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

August 29, 2003

REPORT NO: 03U2199-1

Prepared for

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

Prepared by

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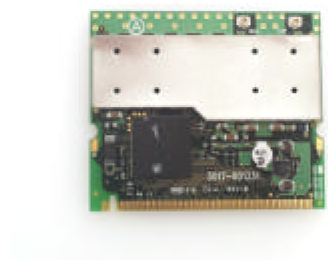
CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Dates of Tests: August 27 - 28, 2003

APPLICANT:	Toshiba Corporation Digital Media Network Company 2-9, Suehiro-cho, Ome 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:	802.11b Direct Sequence Spread Spectrum (DSSS) 802.11g Orthogonal Frequency Division Multiplexing (OFDM)
Tx Frequency:	2412 MHz to 2462 MHz
Max. O/P Power: (Conducted)	802.11b: 15.72 dBm 802.11g: 15.94 dBm
Max. SAR (1g):	802.11b: 0.406 mW/g 802.11b: 0.429 mW/g (Co-location) 802.11g: 0.344 mW/g
Application Type:	Certification
FCC Rule Part(s):	§15.247

Note: This Report is only applicable for 802.11b/g.

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 2-9, Suehiro-cho, Ome Tokyo, 198-8710, Japan
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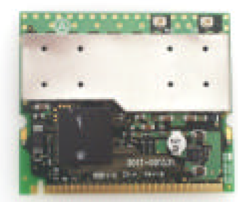

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Host Device (s):

Manufactured	Model Name	Serial Number
Toshiba	PPM20*-*****	--

Bluetooth Module: Toshiba, model PA3232U-1BTM, FCC ID: CJ6UPA3232BT

Antennas: Main/Aux:

1. Dual band film type, model number: HTL008, gain (dBi): 4.8
2. Wide Dual band film type, model number: HTL012, gain (dBi): 4.1 (Alternative)

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.

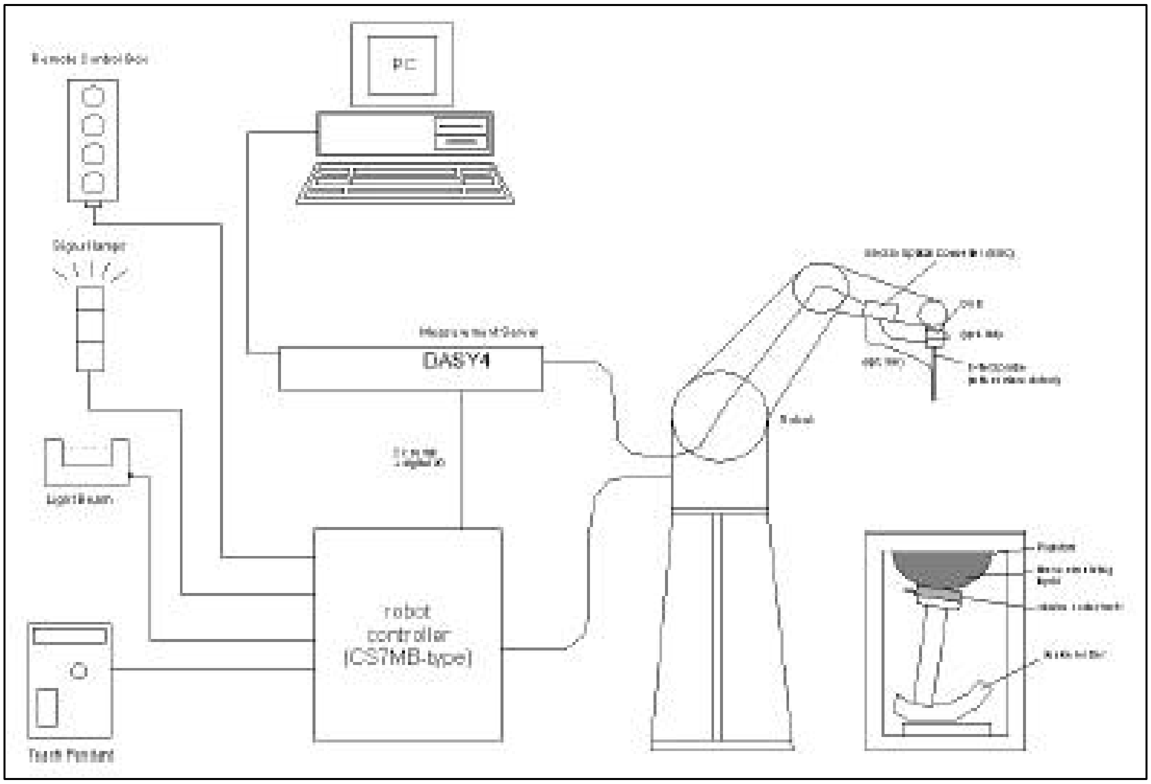
3. DOSIMETRIC ASSESSMENT SYSTEM

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 ET3DV6-SN: 1577 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] 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.

The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

Ingredients (% by weight)	**Frequency (MHz)**									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

3.1. MEASUREMENT SYSTEM DIAGRAM



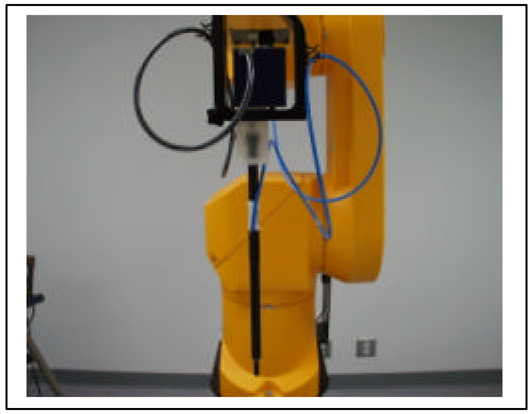
The DASY4 system for performing compliance tests consists of the following items:

- 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

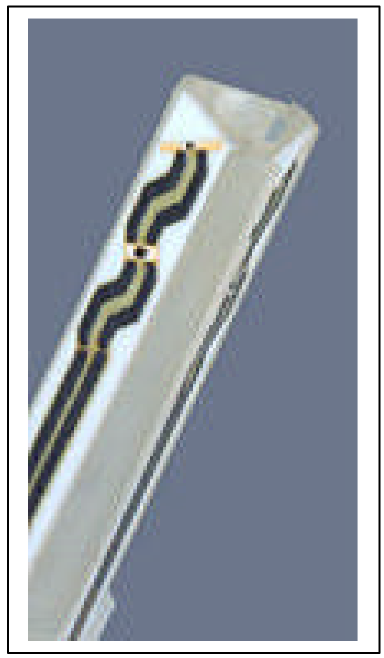
ET3DV6 Probe Specification

Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB
(30 MHz to 3 GHz)
Directivity ± 0.2 dB in brain tissue (rotation around probe axis)
± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic 5 mW/g to > 100 mW/g;
Range Linearity: ± 0.2 dB
Surface ± 0.2 mm repeatability in air and clear liquids
Detection over diffuse reflecting surfaces.
Dimensions Overall length: 330 mm
Tip length: 16 mm
Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms



Photograph of the probe

The SAR measurements were conducted with the dosimetric probe ET3DV6 designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY4 software reads the reflection during a software approach and looks for the maximum using a 2-nd order fitting. The approach is stopped when reaching the maximum.

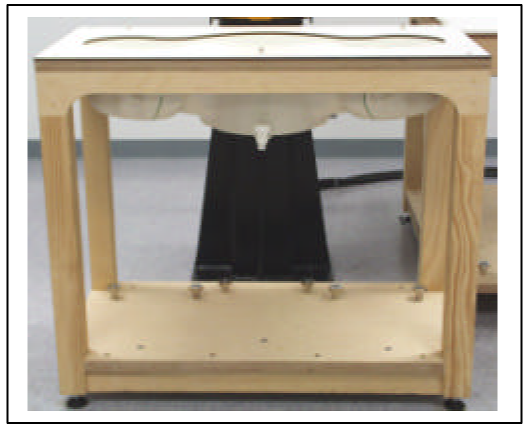


Inside view of
ET3DV6 E-field Probe

SAM Phantom

The SAM Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN50361. The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness: 2 ± 0.2 mm
Filling Volume: Approx. 25 liters
Dimensions (H x L x W): 810 x 1000 x 500 mm

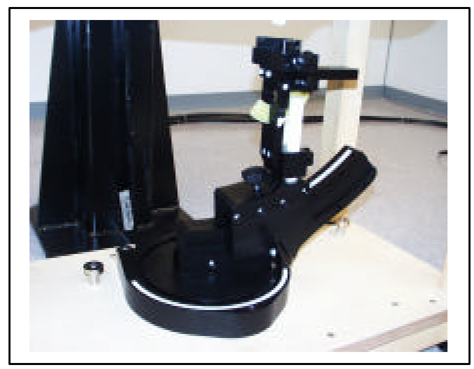


SAM Phantom

Device Holder for Transmitters

In combination with the Generic Twin Phantom V3.0, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations [10]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



Device Holder

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:

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

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 EVALUATION 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 15 mm by 15 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 7 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	±4.8	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	±1.0	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
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	±1.6	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
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						±9.8%	±9.6%	330
Expanded STD Uncertainty						***±19.6%***	***±19.2%***	

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	20.0

(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 of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 Recommended Reference Value

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (Above feed point)	Local SAR at surface (y=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with Head simulating liquid of the following parameters.
- The DASY4 system with an E-fileld probe ET3DV6 SN: 1577 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 dipole input power (forward power) was 250 mW.
- The 1g and 10 g spatial average SAR values normalized to 1 W dipole input power give reference data for comparisons.

SYSTEM PERFORMANCE CHECK RESULTS

Dipole: D2450V2 SN: 706

Date: August 27, 2003

Ambient condition: Temperature 24.5°C; Relative humidity 40%

Head Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
2450 MHz	23.00	15.00	Permitivity:	39.2	39.5663	0.93	± 10
			Conductivity:	1.8	1.8877	4.87	± 5
			1g SAR:	52.4	53.2	1.53	± 10

Date: August 28, 2003

Ambient condition: Temperature 24.5°C; Relative humidity 41%

Head Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
2450 MHz	23.00	15.00	Permitivity:	39.2	39.3783	0.45	± 10
			Conductivity:	1.8	1.885	4.72	± 5
			1g SAR:	52.4	53.2	1.53	± 10

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

IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 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 P1528

Target Frequency	Head		Body	
(MHz)	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	45.3	5.27	48.2	6.00

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

SIMULATING LIQUIDS PARAMETER CHECK RESULTS

Ambient condition: Temperature: 24.5°C; Relative humidity: 40% **Date:** August 27, 2003

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth (cm)					
2450 MHz	23.5	15	Permitivity:	52.7	51.8941	-1.53	± 10
			Conductivity:	1.95	2.0392	4.57	± 5

Ambient condition: Temperature: 24.5°C; Relative humidity: 41% **Date:** August 28, 2003

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth (cm)					
2450 MHz	23.5	15	Permitivity:	52.7	51.9034	-1.51	± 10
			Conductivity:	1.95	1.9743	1.25	± 5

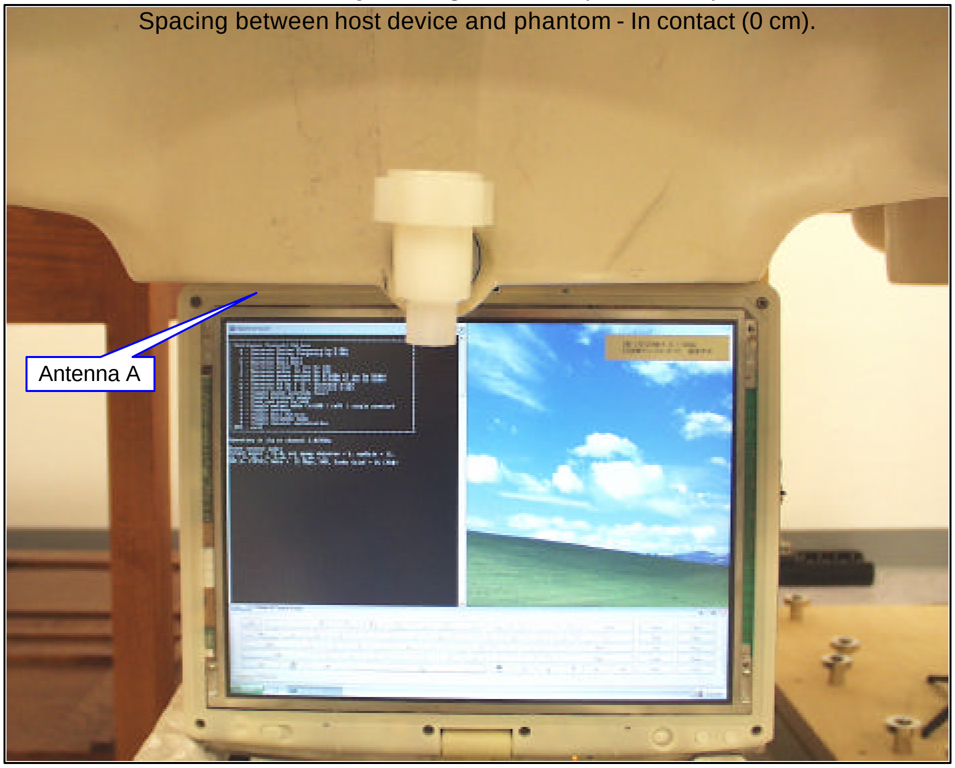
7.3. EUT TUNE-UP PROCEDURES

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

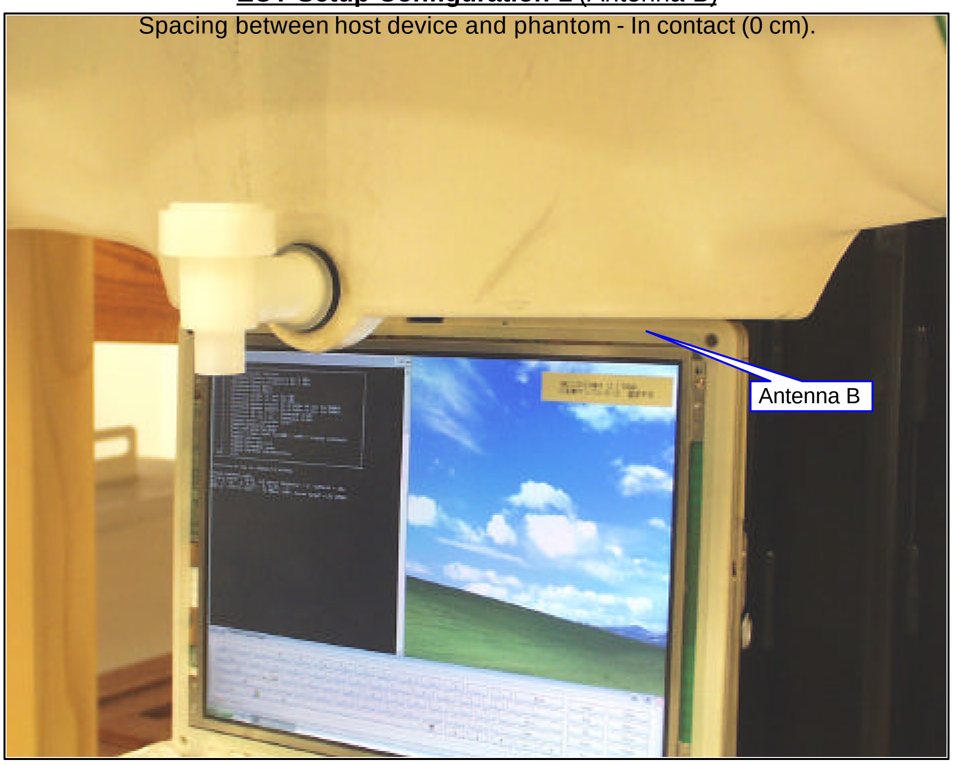
- The client supplied a special driving program (ART Version 2.5 Build 15) to program the EUT to continually transmit the specified maximum power. And also to change the channel frequency.
- The conducted power was measured at the high, middle and low channel frequency before and after the SAR measurement.
- 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.

7.4. EUT SETUP PHOTOS

EUT Setup Configuration 1 (Antenna A)



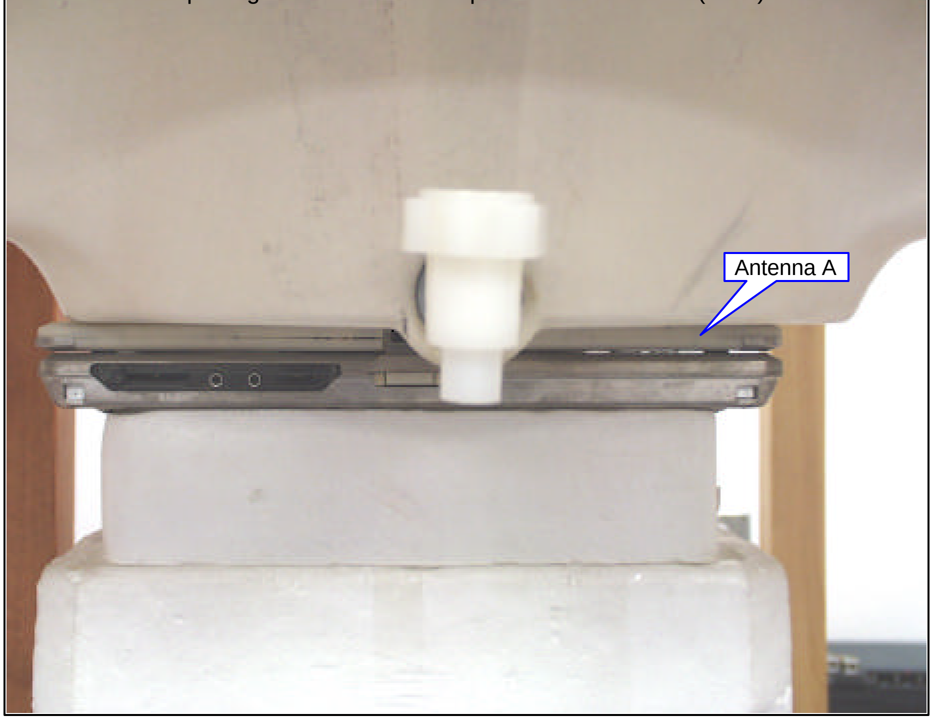
EUT Setup Configuration 1 (Antenna B)



EUT Setup Configuration 2 (Antenna A)

Installation conditions between host device and phantom: Front panel in parallel with flat phantom.

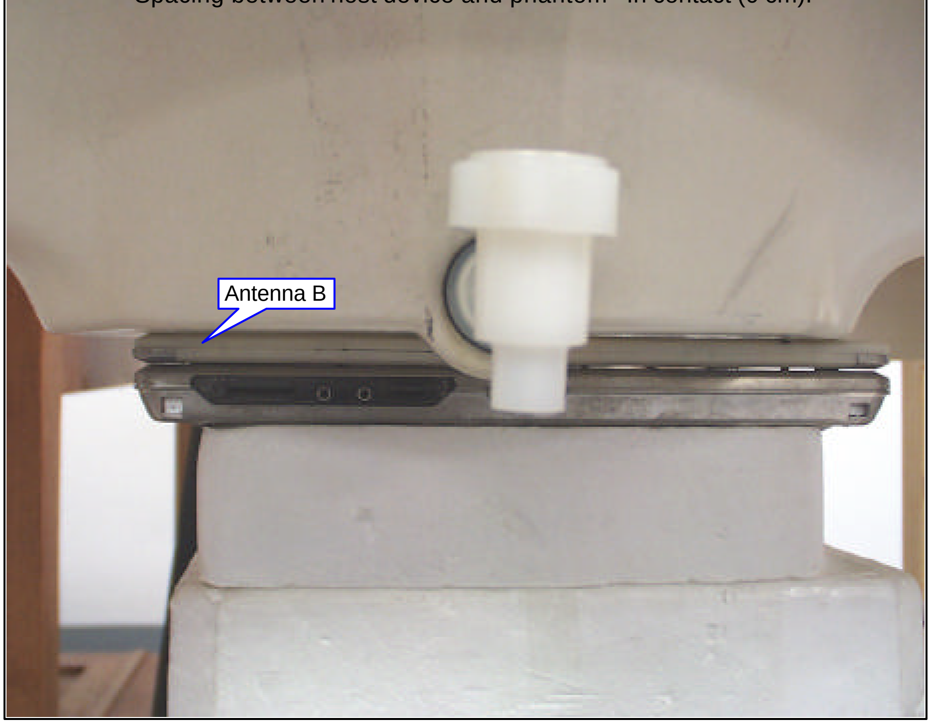
Spacing between EUT and phantom - In contact (0 cm).



EUT Setup Configuration 2 (Antenna B)

Installation conditions between host device and phantom: Front panel in parallel with flat phantom.

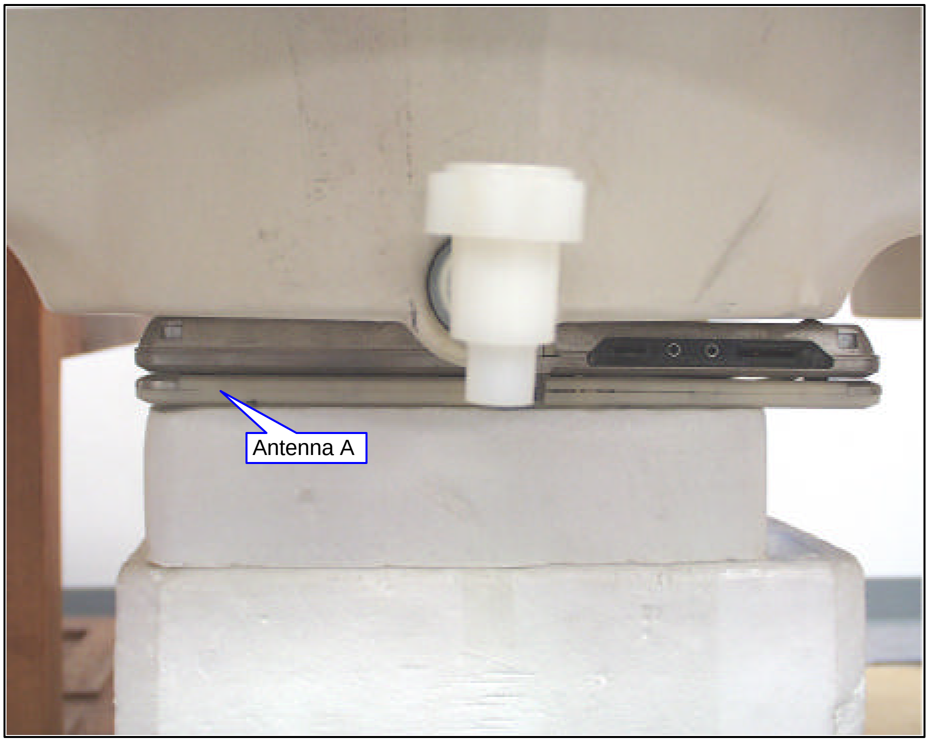
Spacing between host device and phantom - In contact (0 cm).



EUT Setup Configuration 3 (Antenna A)

Installation conditions between host device and phantom: Bottom face in parallel with flat phantom.

Spacing between host device and phantom - In contact (0 cm).



7.5. SAR MEASUREMENTS RESULTS

EUT Setup Configuration 1

- 802.11b (DSSS): *Duty Cycle = 99%, Crest Factor: 1* Depth of liquid: 15.0 cm

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	1	2412	1	15.24	15.20	23.0	0.406	1.6
		6	2437	1	15.40	15.35	23.0	0.404	
		11	2462	1	15.72	15.65	23.0	0.328	
	B (Main)	1	2412	1	15.25	15.20	23.	0.306	
		6	2437	1	15.38	15.34	23.0	0.283	
		11	2462	1	15.70	15.64	23.0	0.255	
Co-location									
0	A (Sub)	1	2412	1	15.24	15.20	23.5	0.429	1.6

- 802.11g (OFDM): *Duty Cycle = 99%, Crest Factor: 1*

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	1	2412	6	15.75	15.71	23.0	0.344	1.6
		6	2437	6	15.88	15.83	23.0	0.343	
		6 (Turbo)	2437	6x2	15.94	15.91	23.0	0.340	
		11	2460	6	15.50	15.42	23.0	0.306	
0	B (Main)	1	2412	6	15.72	15.68	23.0	0.259	1.6
		6	2412	6	15.85	15.80	23.0	0.203	
		6 (Turbo)	2437	6x2	15.92	15.87	23.0	0.178	
		11	2162	6	15.43	15.38	23.0	0.199	

Notes:

1. *: Average power.
2. See attachment for the result presentation in plot format.

SAR MEASUREMENT RESULTS (CONTINUE)

EUT Setup Configuration 2

- 802.11b (DSSS) Depth of liquid: 15.0 cm

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	1	2412	1	15.24	15.20	23.0	0.286	1.6
		1	2437	1	15.40	15.35	23.0	0.292	
		1	2462	1	15.72	15.65	23.0	0.289	
	B (Main)	1	2437	1	15.40	15.35	23.0	0.266	1.6

- 802.11g (OFDM)

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	1	2412	6	15.75	15.71	23.0	0.249	1.6
		6	2437	6	15.88	15.83	23.0	0.247	
		6 (Turbo)	2437	6x2	15.94	15.91	23.0	0.319	
		11	2460	6	15.50	15.42	23.0	0.278	
0	B (Main)	6 (Turbo)	2437	6x2	15.94	15.91	23.0	0.277	1.6

EUT Setup Configuration 3

- 802.11b (DSSS)

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	1	2437	1	15.24	15.20	23.0	0.0108	1.6

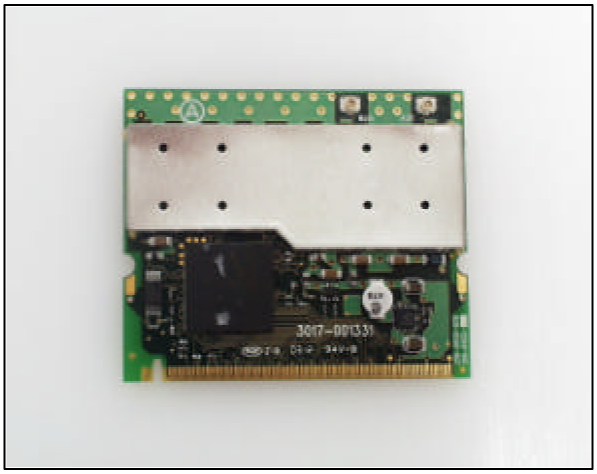
- 802.11g (OFDM)

Sep. [mm]	Antenna	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_dBm		Liquid Temp [°C]	**SAR** (W/kg)	Limit (W/kg)
					Before	After			
0	A (Sub)	6 (Turbo)	2437	6x2	15.94	15.91	23.0	0.00964	1.6

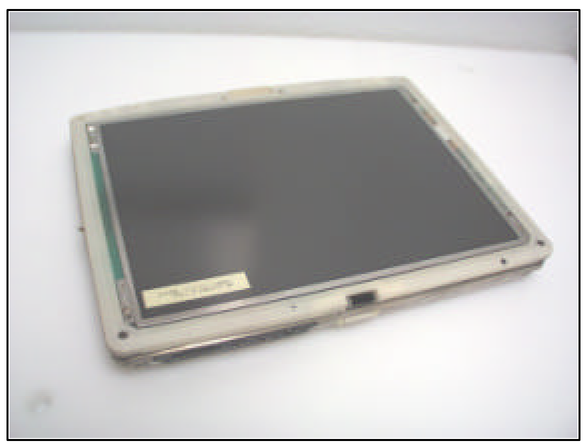
Notes: 1. *: Average power.
2. See attachment for the result presentation in plot format.

8. EUT PHOTOS

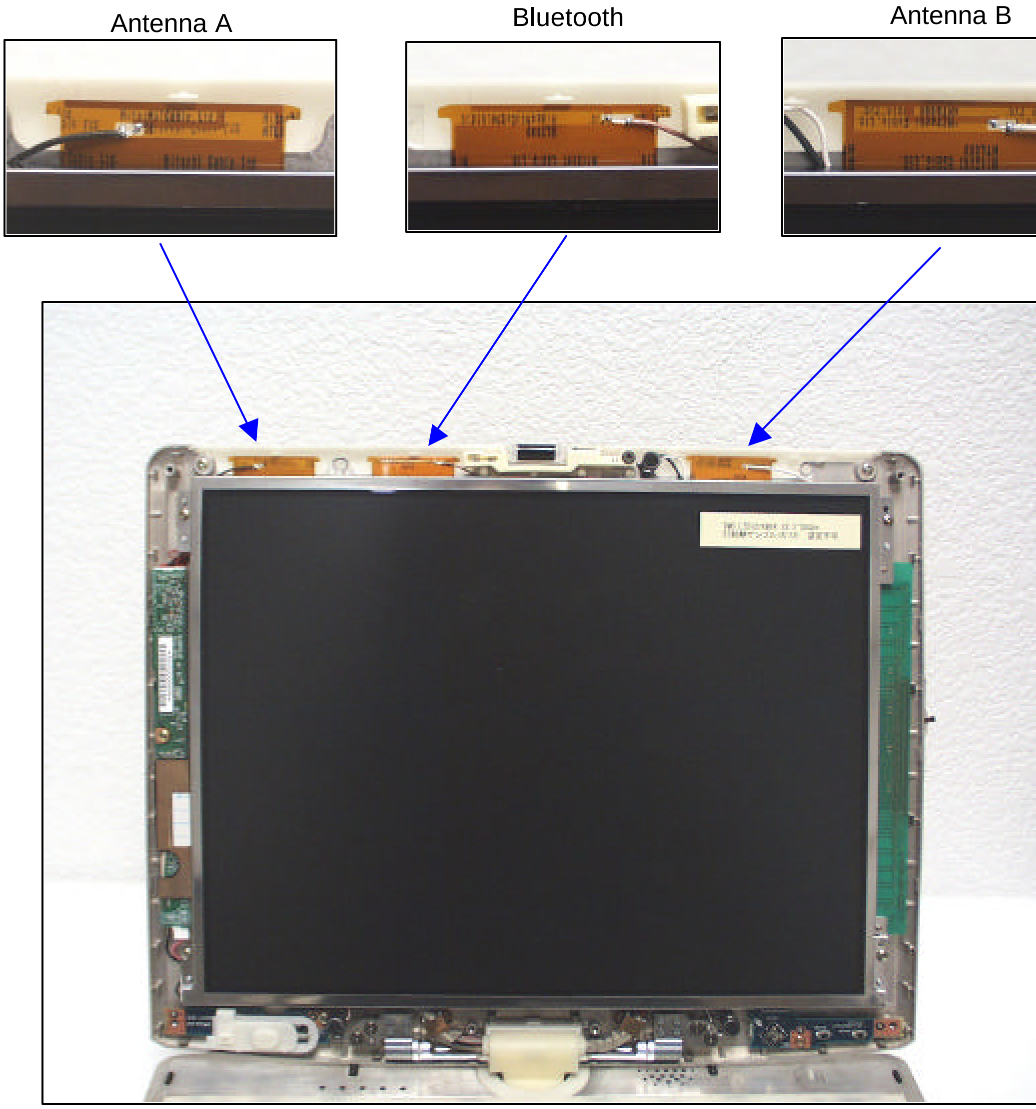
EUT



HOST DEVICES



ANTENNAS LOCATIONS



9. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				last cal.	due date
S-Parameter Network Analyzer	Agilent	8753ES-6	US39173569	8/1/03	8/8/04
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A	N/A
3.5 mm Calibration Kit	Agilent	85033D	3423A07200	8/7/03	8/7/04
Power Meter	Giga-tronics	8651A	8651404	5/12/03	5/12/04
Power Sensor	Giga-tronics	80701A	1834588	2/18/03	2/18/04
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	838114/032	2/14/03	2/14/04
Amplifier	Mini-Circuit	ZHL-42W	D072701-5	N/A	N/A
DC Power generator	Kenwood	PA36-3A	7060074	N/A	N/A
Data Acquisition Electronics (DAE)	SPEAG	DAE3 V1	427	2/4/03	2/4/04
Dosimetric E-Field Probe	SPEAG	ES3DV2	3021	7/29/03	7/29/04
Dosimetric E-Field Probe	SPEAG	ET3DV6	1577	2/7/02	2/7/04
450 MHz System Validation Dipole	SPEAG	D450V2	1003	4/5/02	4/19/04
900 MHz System Validation Dipole	SPEAG	D900V2	108	4/10/03	4/10/05
1800 MHz System Validation Dipole	SPEAG	D1800V2	294	4/09/03	4/19/05
2450 MHz System Validation Dipole	SPEAG	D2450V2	706	6/4/02	6/4/04
Probe Alignment Unit	SPEAG	LB (V2)	261	N/A	N/A
Robot	Staubli	RX90B L	F00/5H31A1/A/01	N/A	N/A
Generic Twin Phantom	SPEAG	N/A	N/A	N/A	N/A
SAM Phantom	SPEAG	N/A	N/A	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A
Head 450 MHz	CCS	H450A	N/A	Daily	N/A
Muscle 450 MHz	CCS	M450A	N/A	Daily	N/A
Head 835 MHz	CCS	H835A	N/A	Daily	N/A
Muscle 835 MHz	CCS	M835A	N/A	Daily	N/A
Head 900 MHz	CCS	H900A	N/A	Daily	N/A
Muscle 900 MHz	CCS	M900A	N/A	Daily	N/A
Head 1800 MHz	CCS	H1800A	N/A	Daily	N/A
Muscle 1800 MHz	CCS	M1800A	N/A	Daily	N/A
Head 1900 MHz	CCS	H1900A	N/A	Daily	N/A
Muscle 1900 MHz	CCS	M1900A	N/A	Daily	N/A
Head 2450 MHz	CCS	H2450A	N/A	Daily	N/A
Muscle 2450 MHz	CCS	M2450A	N/A	Daily	N/A

10. REFERENCES

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11. ATTACHMENTS

No.	Contents	No. of page (s)
1	System Performance Check Plots	4
2	SAR Test Plots	34
3	Dosimetric E-Field Probe - ET3DV6, S/N: 1577	14
4	Validation Dipole - D2450V2, S/N: 706	7

End of Report