SAR Evaluation Report

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

for

802.11b/g Wireless LAN Module Installed in CK 30 Handheld Scanner with Bluetooth Module

Model: 802MIG2 (802.11b/g Wireless LAN Module)

FCC ID: HN2802MIG2

July 9, 2003

REPORT NO: 03U2103-1

Prepared for

Intermec Technologies Corporation
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Everett, WA 98203-9280
USA

Prepared by

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CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

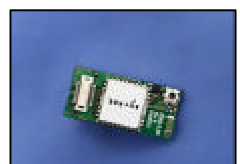
Dates of Tests: July 9, 2003

Report No: 03U2103-1

APPLICANT:	Intermec Technologies Corporation 6001 36th Avenue West Everett, Washington 98203-9280, USA
MODEL:	802MIG2
FCC ID:	HN2802MIG2
DEVICE CATEGORY:	PORTABLE DEVICES
EXPOSURE CATEGORY:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Test Sample is a:	Production unit
Modulation type:	802.11b - DSSS 802.11g - OFDM Bluetooth - FHSS
Tx Frequency:	802.11b/g - 2412 ~ 2462 MHz Bluetooth - 2402 ~ 2480 MHz
Max. O/P Power: (Conducted)	802.11b - 55.7 mW 802.11g - 45.1 mW
Max. SAR (1g):	0.268 mW/g 0.260 mW/g (Co-Location)
Application type:	Certification
FCC Rule part(s):	§ 15.247


Wireless LAN Module


Bluetooth module

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 DESCRIPTIONS

APPLICANT:	Intermec Technologies Corporation 6001 36th Avenue West Everett, Washington 98203-9280, USA
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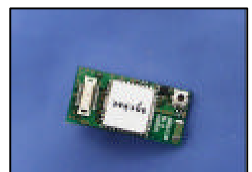
Wireless LAN Module



Bluetooth module

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FCC Rule part(s):	§ 15.247
Bluetooth:	Manufactured by Socket, model BTS069, FCC ID: LUBBTM-1
Host Device:	Handheld Scanner. Manufactured by Intermec, model CK30
Antennas:	1. WLAN - Type: PIFA, P/N 073360, gain: 3.5 dBi 2. Bluetooth - Murata, Type: Multilayer chip, P/N: LAD312G7313F-237, gain: 2.17 dBi

1 *Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).*

2 *IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.*

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.

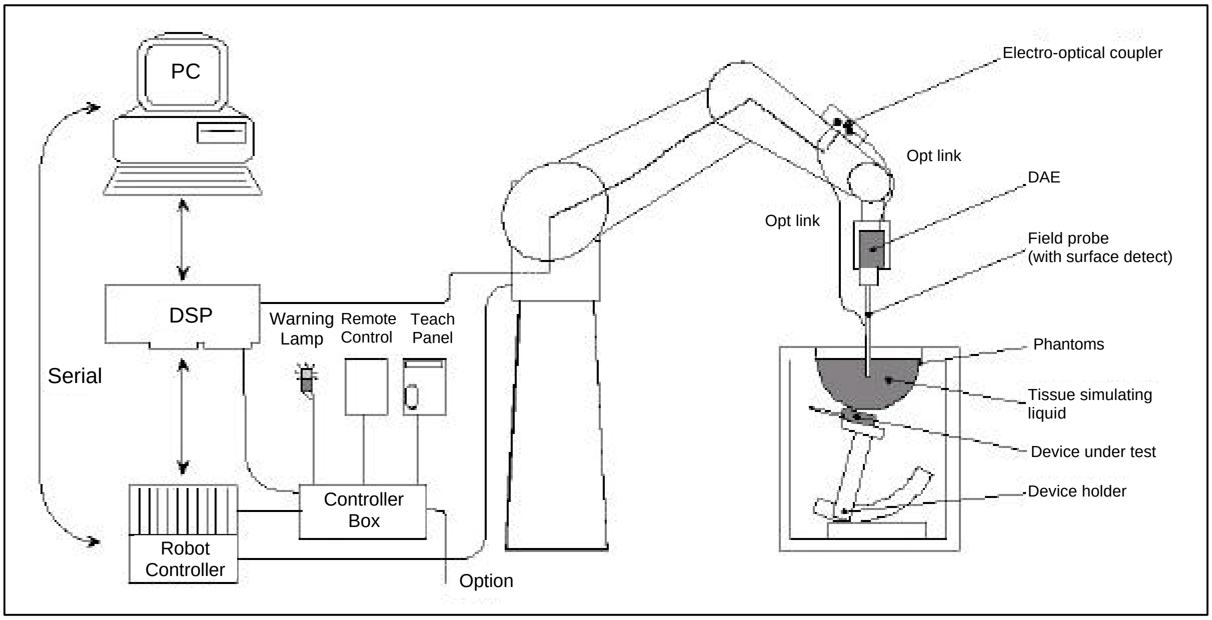
3. DOSIMETRIC ASSESSMENT SYSTEM

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 [3] 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



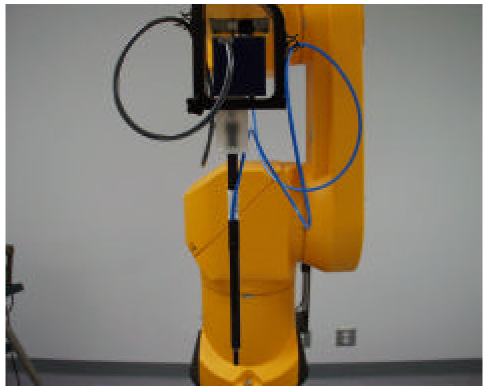
The DASY4 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
2. An arm extension for accommodating the data acquisition electronics (DAE).
3. 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.
4. A data acquisition electronic (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.
5. A unit to operate the optical surface detector, which is connected to the EOC.
6. The Electro-optical coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the PC plug-in card.
7. The functions of the PC plug-in card based on a DSP is to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
8. A computer operating Windows 95 or larger
9. DASY4 software
10. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
11. The SAM phantom enabling testing left-hand and right-hand usage.
12. The device holder for handheld EUT.
13. Tissue simulating liquid mixed according to the given recipes (see Application Note).
14. System validation dipoles to validate 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

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

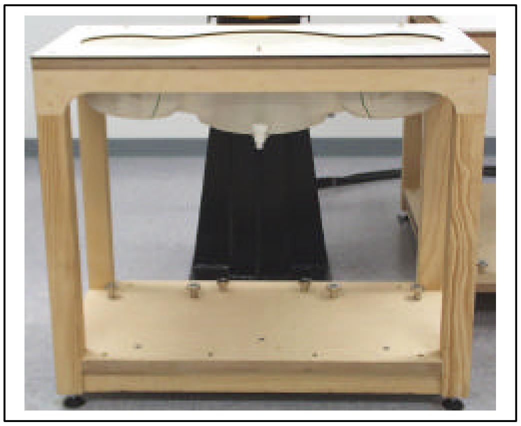
The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the 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, and 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:

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

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) μV/(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 evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the central position was used as a reference value for assessing the power drop.

Step 2: The SAR distribution at the exposed side of the body was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the EUT and the horizontal grid spacing was 10 mm x 10 mm. Based on the data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point, a volume of 32 mm x 32 mm x 34 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm [11]. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
2. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot"-condition (in x, y and z-directions) [11], [12]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

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	3	0.7	0.7	±1.9%	±1.9%	
Hemispherical Isotropy	±9.6	R	3	0.7	0.7	±3.9%	±3.9%	
Boundary Effects	±1.0	R	3	1	1	±0.6%	±0.6%	
Linearity	±4.7	R	3	1	1	±2.7%	±2.7%	
System Detection Limits	±1.0	R	3	1	1	±0.6%	±0.6%	
Readout Electronics	±1.0	N	1	1	1	±1.0%	±1.0%	
Response Time	±0.8	R	3	1	1	±0.5%	±0.5%	
Integration Time	±2.6	R	3	1	1	±1.5%	±1.5%	
RF Ambient Condition	±1.59	R	3	1	1	±0.9%	±0.9%	
Probe Positioner	±1.6	R	3	1	1	±0.2%	±0.2%	
Probe Positioning	±2.9	R	3	1	1	±1.7%	±1.7%	
Max. SAR Eval.	±1.0	R	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	3	1	1	±2.9%	±2.9%	
Phantom and Setup								
Phantom Uncertainty	±4.0	R	3	1	1	±2.3%	±2.3%	
Liquid Conductivity (target)	±5.0	R	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	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 ~ 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

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation 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
2000	41.1	21.1	74.6	6.5
2450	52.4	24.0	104.2	7.7
3000	63.8	25.7	140.2	9.5

SYSTEM PERFORMANCE CHECK RESULTS

Dipole: D2450V2 SN: 706

Date: July 9, 2003

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

Medium			Parameters	Target	Measured	Deviation[%]	Limited[%]
Type	Temp. [°C]	Depth [cm]					
Head 2450 MHz	23.00	15.00	Permitivity:	39.2	38.6633	-1.37	± 10
			Conductivity:	1.8	1.8531	2.95	± 5
			1g SAR:	52.4	53.2	1.53	± 10

7.2. TEST LIQUID CONFIRMATION

SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

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)

LIQUID MEASUREMENT RESULTS

Ambient condition - Temperature: 24.5°C; Relative humidity: 40% **Date:** July 9, 2003

Medium			Parameters	Target	Measured	Deviation[%]	Limited[%]
Type	Temp. [°C]	Depth[cm]					
Muscle 2450 MHz	23	15	Permitivity:	52.7	51.7208	-1.86	± 10
			Conductivity:	1.95	1.9128	-1.91	± 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 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

Spacing between host device (Back side with shoulder holster - P/N: AG1A) and phantom: 0 mm

EUT Setup Configuration 2

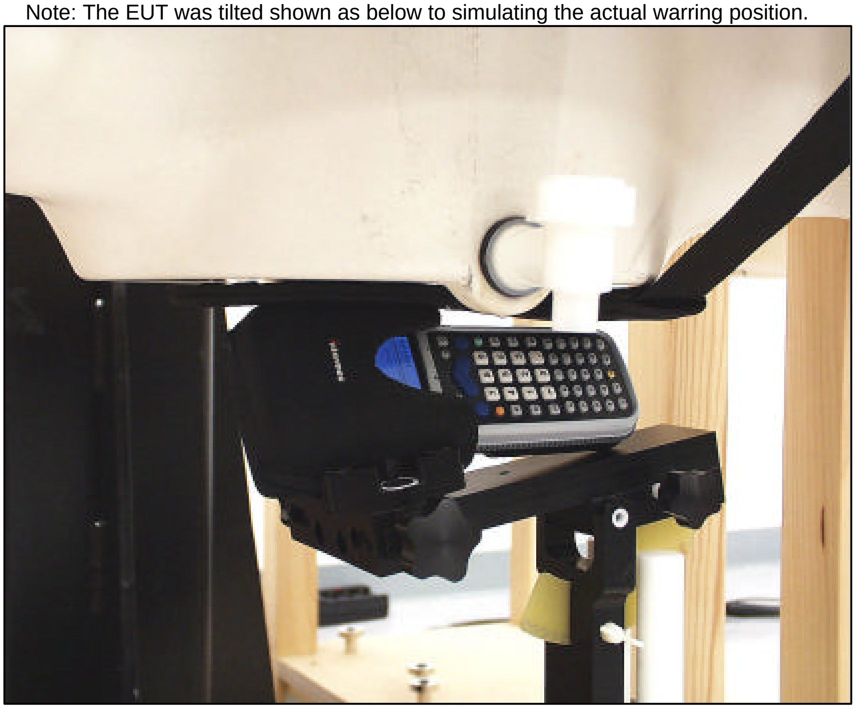
Spacing between host device (Front side with shoulder holster - P/N: AG1A) and phantom: 0 mm

EUT Setup Configuration 3

Spacing between host device (Right side back with hip holster (open bottom) - P/N: AL1A) and phantom: 0 mm
Note: The EUT was tilted shown as below to simulating the actual warring position.

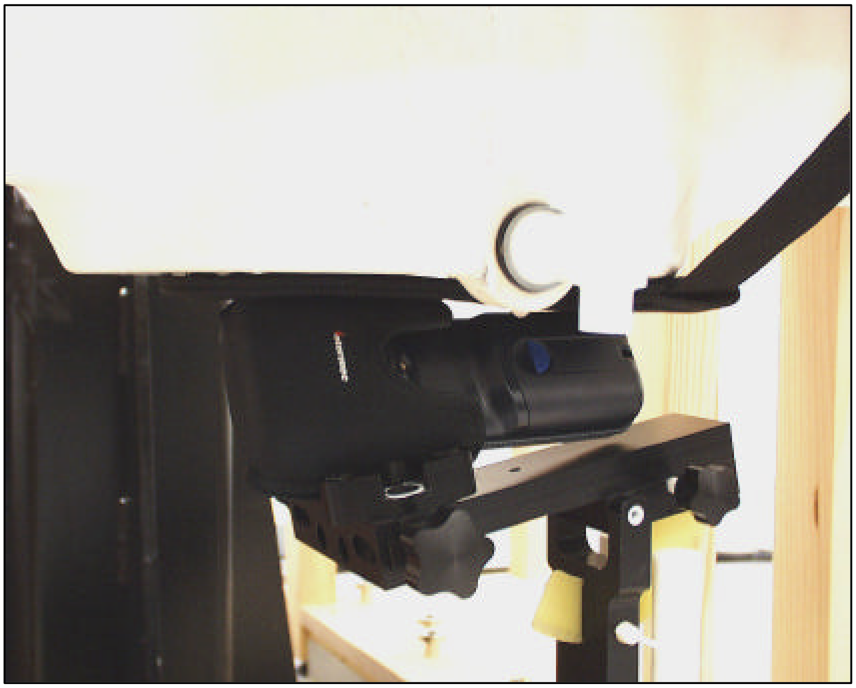
EUT Setup Configuration 4

Spacing between host device (Right side front with hip holster (enclosed) - P/N: AL1A) and phantom: 0 mm
Note: The EUT was tilted shown as below to simulating the actual warring position.



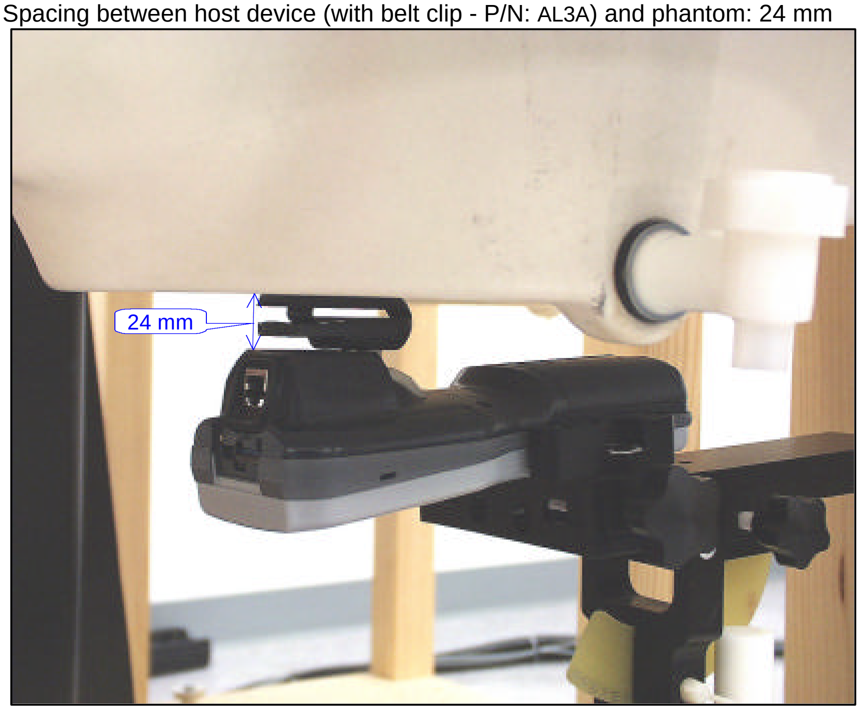
EUT Setup Configuration 5

Spacing between host device (Left side back with hip holster (enclosed) - P/N: AL1A) and phantom: 0 mm
Note: The EUT was tilted shown as below to simulating the actual warring position.



EUT Setup Configuration 6

Spacing between host device (with belt clip - P/N: AL3A) and phantom: 24 mm



7.5. SAR MEASUREMENT RESULTS

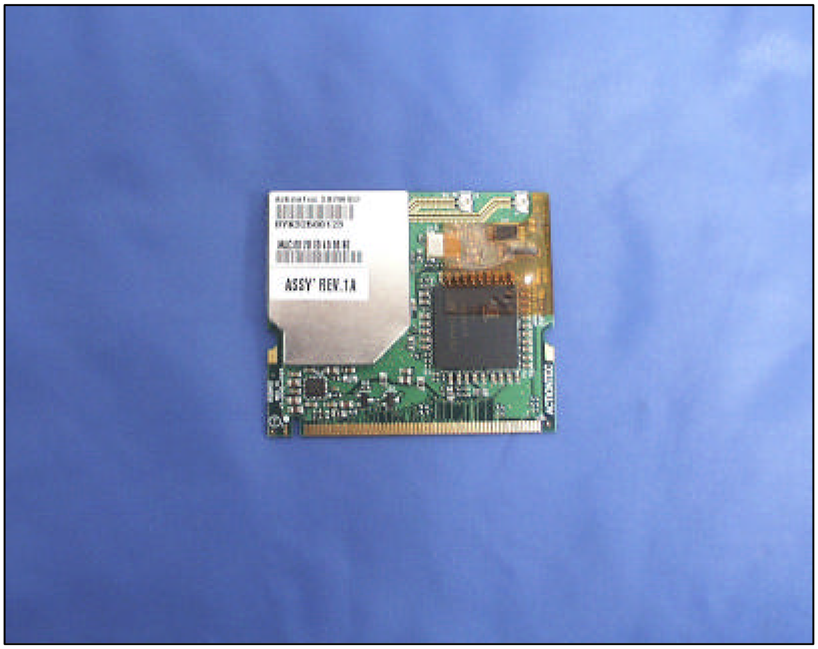
Sep. dist._mm	Channel	Frequency	Rate [Mbps]	*Conducted Pwr_mW		Liquid Temp_°C	**SAR** (W/kg)	Limit (W/kg)
				Before	After			
EUT Setup Configuration 1 (Back side)								
802.11b (DSSS): *Duty Cycle = 100%, Crest Factor: 1*						Depth of liquid: 15.0 cm		
0	1	2412	11	17.6	17.5	23.0	0.0587	1.6
	7	2442	11	55.7	55.5	23.0	**0.243**	
	11	2462	11	13.7	13.5	23.0	0.0783	
802.11g (OFDM)*: Duty Cycle = 100%, Crest Factor: 1*								
0	7	2442	6	45.1	45.0	23.0	0.166	1.6
EUT Setup Configuration 2 *(Front side)* ***802.11b (DSSS)***								
0	7	2442	11	55.7	55.5	23.0	0.0268	1.6
EUT Setup Configuration 3 *(Right side back with holster)*								
0	7	2442	11	55.7	55.5	23.0	0.167	1.6
EUT Setup Configuration 4 *(Right side front with holster)*								
0	7	2442	11	55.7	55.5	23.0	Cube0: 0.0529 Cube1: 0.0346	1.6
EUT Setup Configuration 5 *(Left side back with holster)*								
0	1	2412	11	17.6	17.5	23.0	0.0349	1.6
0	7	2442	11	55.7	55.5	23.0	**0.131**	1.6
0	11	2462	11	13.7	13.5	23.0	0.0327	1.6
EUT Setup Configuration 6 *(With belt-clip)*								
24 (with belt clip)	7	2442	11	55.7	55.5	23.0	***0.268***	1.6
EUT Setup Configuration 6 *(With belt-clip);* ***Co-location***								
24 (with belt clip)	7	2442	11	55.7	55.5	23.0	***0.260***	1.6

Notes:

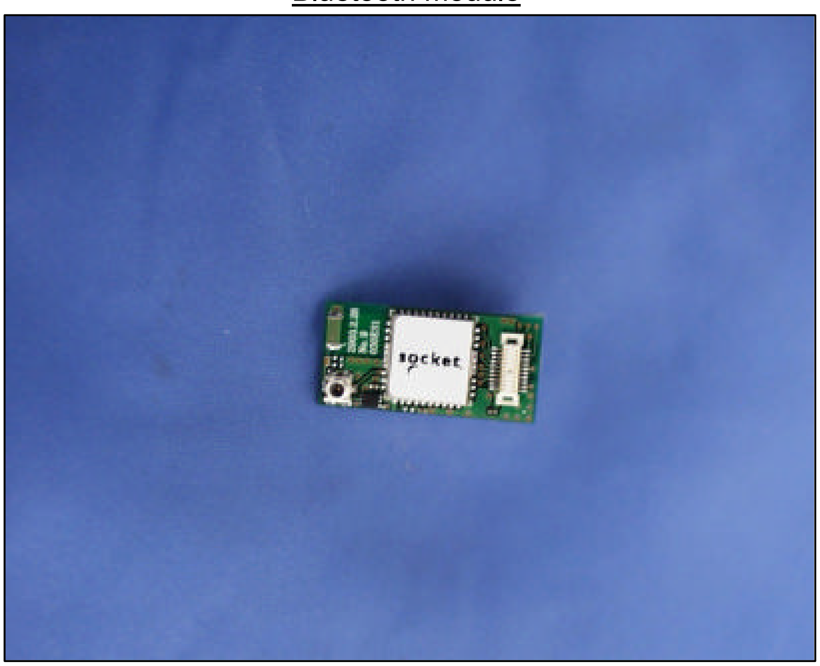
1. *: Average power.
2. See attachment for the result presentation in plot format.
3. Since all of the SAR reading value are 3 dB less than the limit. The low & high channels have been optionally omitted.

8. EUT PHOTOS

EUT (Wireless LAN Module)

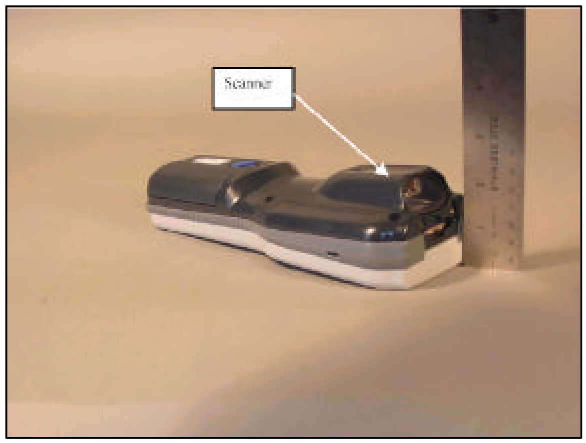


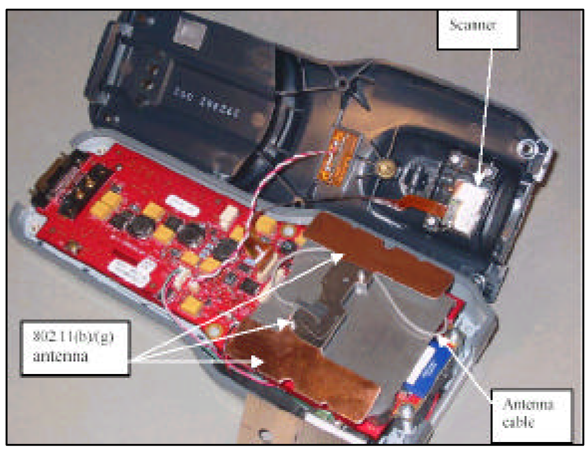
Bluetooth module



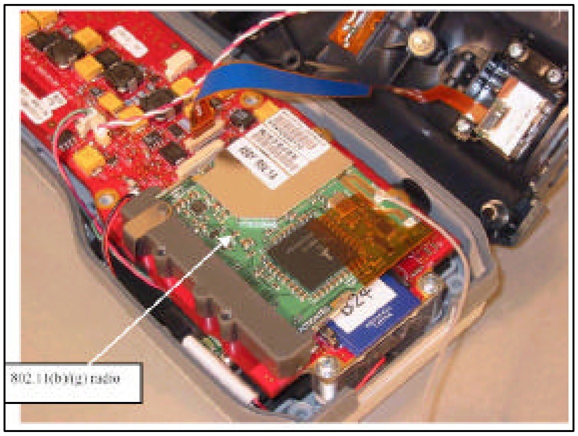
Host Device (Handheld Scanner, model CK 30)

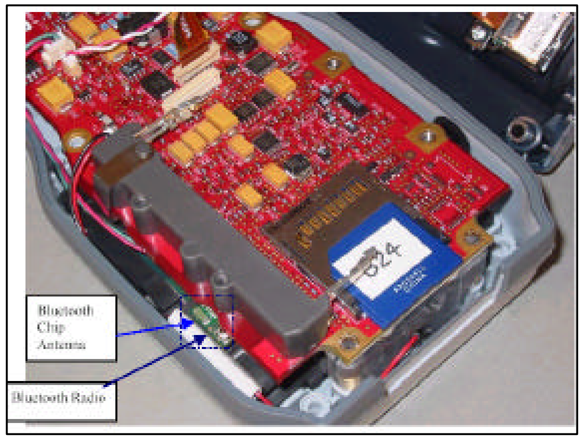


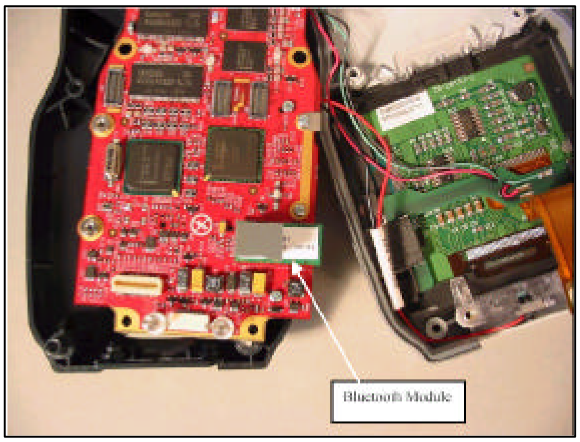



Host Device (Handheld Scanner, model CK 30)







Accessories

Shoulder Holster - P/N: AG1A

Hip Holster (open bottom) - P/N: AL1A

Hip Holster (enclosed) - P/N: AL1A

Belt clip (Long attach.) - P/N: AL3A

9. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				last cal.	due date
S-Parameter Network Analyzer	Agilent	8753ES	MY40001647	8/6/02	8/6/03
Electronic Probe kit	Hewlett Packard	85070C	N/A	N/A	N/A
3.5 mm Calibration Kit	Agilent	85033D	3423A07200	8/6/02	8/6/03
Power Meter	Agilent	E5516A	GB41291160	8/9/02	8/9/03
Power Sensor	Agilent	E9327A	US40440755	9/5/02	9/5/03
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	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

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11. ATTACHMENTS

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

END OF REPORT