SAR TEST REPORT

Dates of Tests: July. 09 ~ 16. 2008
Test Report No.: JP2008-0225
Test Site : KETI in KOREA

FCC ID

APPLICANT

RQKSMARTCOMPACTP

SAMMI information systems Co.,Ltd

EUT Type:	**Industrial PDA**
Model Name	**SmartCompact Plus**
Add Name	**None**
Brand Name	**None**
Test Device Serial No.:	**Identical Prototype**
TX Frequency Range:	**2412 ~ 2462 MHz (WLAN)**
RX Frequency Range:	**2412 ~ 2462 MHz (WLAN)**
Max. SAR Measurement:	**0.481 mW/g 802.11b Body SAR(ch11)**
	0.373 mW/g 802.11g Body SAR(ch6)
Application Type:	**Certification**
Rule Part(s):	**§2.1093; FCC/OET Bulletin Supplement C [July 2001]**
Data of issue:	**July 16, 2008**

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 Bulletin 65 Supplement C (2001) and IEEE Std. 1528-2003.

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.

Tested by : _____
Yong-Sung, Kim(Engineer)

Reviewed by : _____
Seung-Sun, Choi(Team Leader)

The test results and statements relate only to the item(s) tested.

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1. INTROCUCTION

   In 1974, the International Radiation Protection Association (IRPA) formed a working group on non-ionizing radiation (NIR), which examined the problems arising in the field of Protection against the various types of NIR. At the IRPA Congress in Paris in 1977, this working group because the International Non-Ionizing Radiation Committee (INIRC).

   In cooperation with the Environmental Health Division of the World Health Organization (WHO), the IRPA/INIRC developed a number of health criteria documents on NIR as part of WHO'S Environmental Health Criteria Programme, sponsored by the United Nations Environment Programme (UNEP). Each document includes an overview of the physical characteristics, measurement and instrumentation, sources, and applications of NIR, a thorough review of the literature on biological effects, and an evaluation of the health risks of exposure to NIR. These health criteria have provided the scientific database for the subsequent development of exposure limits and codes of practice relating to NIR.

   At the Eighth International Congress of the IRPA (Montreal, 18-22 May 1992), a new, independent scientific organization-the International Commission on Non-Ionizing Radiation Protection (ICNIRP)-was established as a successor to the IRPA/INIRC. The functions of the Commission are to investigate the hazards that may be association with the different forms of NIR, develop international guidelines on NIR exposure to static and extremely-low-frequency (ELF) electric and magnetic field have been reviewed by UNEP/WHO/IRPA (1984, 1987). Those publications and a number of others, including UNEP/WHO/IRPA (1993) and Allen et al. (1991), provided the scientific rationale for these guidelines.

   A glossary of terms appears in the Appendix.

1.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density ( ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1.1).

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho\, dv}\right)$$

Figure 1.1
SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = E^2 / \rho$$

Where:

   σ = conductivity of the tissue-simulant material (S/m)
   ρ = mass density of the tissue-simulant material (kg/m^3)
   E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane. [6]

2. SAR MEASUREMENT SETUP

2.1 Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. The DASY4 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 2.1).

2.2 System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control used to drive the robot motors. The PC consists of the Micron Pentium IV 500 MHz computer with Windows NT system and SAR Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.
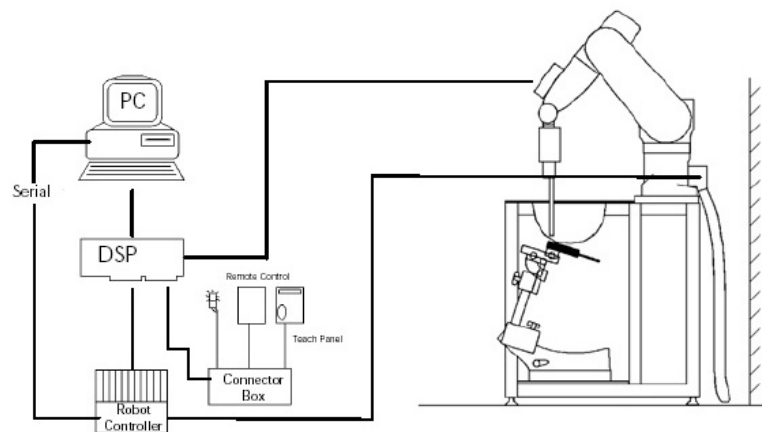
Figure 2.1 SAR Measurement System Setup

2.3 System Electronics

The 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in [7].

3. SAR MEASUREMENT SETUP

3.1 Probe Measurement System

The SAR measurements were conducted with the dosimetric probe ES3DV3, designed in the classical triangular configuration [7] (see Fig. 3.2) 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 multifiber line ending at the front of the probe tip (see Fig. 3.3). 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 2nd order fitting (see Fig.3.1). The approach is stopped at reaching the maximum.

Figure 3.1 DAE System

3.2 Probe Specifications

|	
Calibration:	In air from 10 MHz to 2.5 GHz
	In brain and muscle simulating tissue at
	Frequencies of 450 MHz, 835 MHz, 900 MHz
	1900 MHz and 2450 MHz
Frequency:	10 MHz to 6 GHz
	Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Dynamic:	5 uW/g to > 100 mW/g
Range:	Linearity: ± 0.2 dB
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 dosimetry up to 3 GHz
	Compliance tests of mobile phones
	Fast automatic scanning in arbitrary phantoms
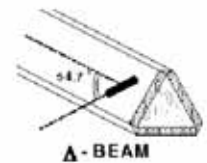
Figure 3.2 Tringular Probe Configuration

Figure 3.3 Probe Thick-Film Technique

4. Probe Calibration Process

4.1 Dosimetric Assessment Procedure

Each probe is calibrated according to a dosimetric assessment procedure described in [8] with accuracy better than +/- 10 %. The spherical isotropy was evaluated with the procedure described in [9] and found to be better than +/- 0.25 dB. The sensitivity parameters (Norm X, Norm Y, Norm Z), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe is tested.

4.2 Free Space Assessment

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz (see Fig. 4.1), 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 at the proper orientation with the field. The probe is then rotated 360 degrees.

4.3 Temperature Assessment

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 a dielectric medium. For temperature correlation calibration a RF transparent thermistor based temperature probe is used in conjunction with the E-field probe (see Fig. 4.2).

$$SAR = C\frac{\Delta T}{\Delta t} \qquad\qquad SAR = \frac{|E|^2 \cdot \sigma}{\rho}$$

where:

Δt = exposure time (30 seconds),

C = heat capacity of tissue (brain or muscle),

ΔT = temperature increase due to RF exposure.

where:

σ = simulated tissue conductivity,

ρ = Tissue density (1.25 g/cm^3 for brain tissue)

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. Now it's possible to quantify the electric field in the simulated tissue by equating the thermally derived SAR to the E- field;
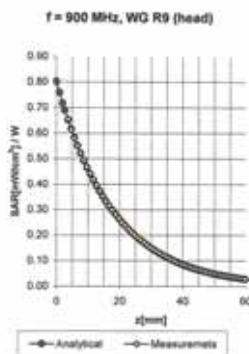

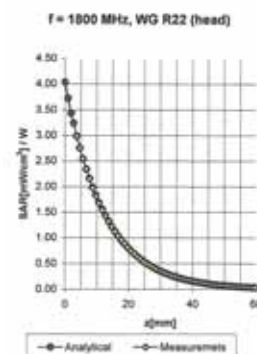**Figure 4.1 E-Field and Temperature Measurements at 900 MHz[7]**

Figure 4.2 E-Field and Temperature Measurements at 1800 MHz[7]

5. PHANTOM & EQUIVALENT TISSUES

5.1 SAM Phantom

Figure 5.1 SAM Twin Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users [11][12]. 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 the evaporation o f 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 (see Fig. 5.1).

5.2 Brain & Muscle Simulating Mixture Characterization

Figure 5.2 Simulated Tissue

The brain and muscle mixtures consist of a viscous gel using hydroxethyl cellullose (HEC) gelling agent and saline solution (see Table 5.1). Preservation with a bacteriacide is added and visual inspection is made to make sure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the desired tissue. The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 have been incorporated in the following table. Other head and body tissue parameters that have not bee specified in P1528 are derived from the issue dielectric parameters computed from he 4-Cole-Cole equations The mixture characterizations used for the brain and muscle tissue simulating liquids are according to the data by C. Gabriel and G. Hartsgrove [13] (see Fig. 5.2).

Table 5.1 Composition of the Brain & Muscle Tissue Equivalent Matter

INGREDIENTS		SIMULATING TISSUE
		2450 MHz Muscle
Mixture Percentage		
WATER		68.64
DGBE		31.37
SUGAR		0.00
SALT		0.00
BACTERICIDE		0.00
HEC		0.00
Dielectric Constant	Target	**52.70**
Conductivity (S/m)	Target	**1.95**

5.3 Device Holder for Transmitters

Figure 5.3 Mounting Device

In combination with the SAM Twin Phantom V4.0, the Mounting Device (see Fig. 5.3) enables the rotation of the mounted transmitter in spherical coordinates where by the rotation point is the ear opening. The devices can be easily, accurately, and repeatably be positioned according to the FCC 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 produce infinite number of configurations [12]. To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

6. TEST SYSTEM SPECIFICATIONS

6.1 Automated Test System Specifications

<u>Positioner</u>

Robot:	Stäubli Unimation Corp. Robot Model: RX60BL
Repeatability:	0.02 mm
No. of axis:	6

<u>Data Acquisition Electronic (DAE) System</u>
<u>Cell Controller</u>

Processor:	Pentium 4 CPU
Clock Speed:	3 GHz
Operating System:	Window 2000
Data Card:	DASY4 PC-Board

Figure 6.1 DASY4 Test System

<u>Data Converter</u>

Features:	Signal, multiplexer, A/D converter & control logic
Software:	DASY4
Connecting Lines :	Optical downlink for data and status info
	Optical uplink for commands and clock

<u>PC Interface Card</u>

Function:	24 bit (64 MHz) DSP for real time processing
	Link to DAE 3 16 bit A/D converter for surface detection system
	serial link to robot direct emergency stop output for robot

<u>E-Field Probes</u>

Model:	ES3DV3 S/N: 3125
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	$\pm$ 0.2 dB(30 MHz to 3 GHz)

<u>Phantom</u>

Phantom:	SAM Twin Phantom (V4.0)
Shell Material :	Vivac Composite
Thickness:	2.0 $\pm$ 0.2 mm

7. DOSIMETRIC ASSESSMENT & PHANTOM SPECS

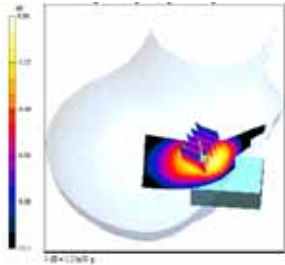### 7.1 Measurement Procedure

Figure 7.1 Sample Sar Area Scan

The evaluation was performed using the following procedure:

1. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.
2. The SAR distribution at the exposed side of the head was measured at a distance of 3.9 mm from the Inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15 mm x 15 mm.
3. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32 mm x 32 mm x 34 mm (fine resolution volume scan, zoom scan) was assessed by measuring 5 x 5 x 7 points. On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see Fig. 7.1):
    a. The data at the surface was 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 [15]. 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.
    b. The maximum interpolated value was searched with a straight-for war dalgorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y and z directions) [15][16]. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
    c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR reference value, at the same location as procedure #1, was re-measured. If the value changed by more than 5 %, the evaluation is repeated.

7.2 Specific Anthropomorphic Mannequin (SAM) Specifications

The phantom for handset SAR assessment testing is a low-loss dielectric shell, with shape and dimensions derived from the anthropometric data of the 90th percentile adult male head dimensions as tabulated by the US Army. The SAM Twin Phantom shell is bisected along the mid-sagittal plane into right and left halves (see Fig. 7.2). The perimeter sidewalls of each phantom halves are extended to allow filling with liquid to a depth that is sufficient to minimized reflections from the upper surface. The liquid depth is maintained at a minimum depth of 15 cm to minimize reflections from the upper surface.

Figure 7.2 SAM Twin Phantom shell

8. DEFINITION OF REFERENCE POINTS
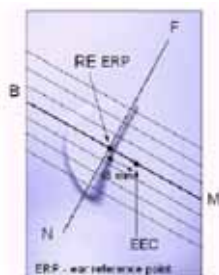
8.1 EAR Reference Point

Figure 8.2 Close-up side view of ERPs

Figure 8.1 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERPs are 15 mm posterior to the entrance to the Ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 8.2. The plane Passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck- Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Fig. 8.2). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5]

Figure 8.1 Front, back and side view of SAM Twin Phantom

8.2 Handset Reference Points

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Fig. 8.3). The "test device reference point" was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at it's top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.
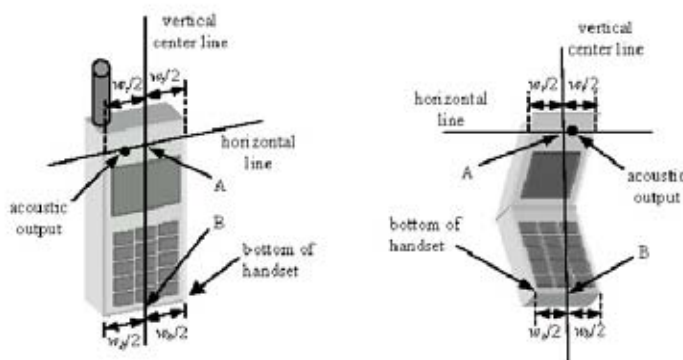

Figure 8.3 Handset Vertical Center & Horizontal Line Reference Points

KETI
Korea Electric Testing Institute

692-8, Keumjung-Dong, Kunpo-City, Kyunggi-Do,
435-862, KOREA
TEL: +82-31-455-7654   FAX: +82-31-455-7657
http://www.keti.or.kr/

9. TEST CONFIGURATION POSITIONS

9.1 Positioning for Cheek/Touch

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Fig. 9.1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

Figure 9.1 Front, Side and Top View of Cheek/Touch Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek) (See Fig. 9.2).
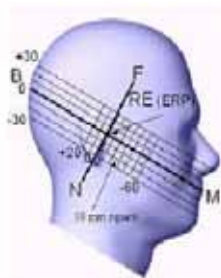

Figure 9.2 Side view w/ relevant markings

9. TEST CONFIGURATION POSITIONS(Continued)

9.2 Positioning for Ear/15° Tilt

With the test device aligned in the "Cheek/Touch Position":

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

2. The phone was then rotated around the horizontal line by 15 degree.

3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Fig. 9.3).

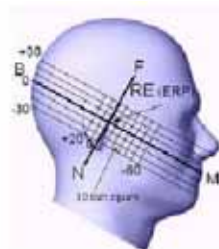Figure 9.3 Front, Side and Top View of Ear/15° Tilt Position

Figure 9.4 Side view w/ relevant markings

9. TEST CONFIGURATION POSITIONS(Continued)

9.3 Body Holster /Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Fig. 9.5). A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are supplied with the device, the device is tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Figure 9.5 Body Belt Clip & Holster Configurations

Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration where a separation distance between the back of the device and the flat phantom is used. All test position spacings are documented.

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing. In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

KETI
Korea Electric Testing Institute

692-8, Keumjung-Dong, Kunpo-City, Kyunggi-Do,
435-862, KOREA
TEL: +82-31-455-7654   FAX: +82-31-455-7657
http://www.keti.or.kr/

10. ICNIRP GUIDELINES RF EXPOSURE LIMITS

10.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

10.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 10.1 Safety Limits for Partial Body Exposure

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
Whole-Body average SAR (W/kg)	0.08	0.40
Localized SAR (head and trunk) (W/kg)	1.60	8.00
Localized SAR (limbs) (W/kg)	4.00	20.00

KETI
Korea Electric Testing Institute

692-8, Keumjung-Dong, Kunpo-City, Kyunggi-Do,
435-862, KOREA
TEL: +82-31-455-7654   FAX: +82-31-455-7657
http://www.keti.or.kr/

11. SAR MEASUREMENT UNCERTAINTIES

Error Description	Uncertainty Value ± %	Probability Distribution	Divisor	(Ci) 1 g	Standard (1 g)	vi 2 or Veff
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8 %	
Axial isotropy	± 4.7	Rectangular	3	0.7	± 1.9 %	
Hemispherical isotropy	± 9.6	Rectangular	3	0.7	± 3.9 %	
Boundary Effects	± 1.0	Rectangular	3	1	± 0.6 %	
Probe Linearity	± 4.7	Rectangular	3	1	± 2.7 %	
Detection limits	± 1.0	Rectangular	3	1	± 0.6 %	
Readout Electronics	± 1.0	Normal	1	1	± 1.0 %	
Response time	± 0.8	Rectangular	3	1	± 0.5 %	
Integration time	± 2.6	Rectangular	3	1	± 1.5 %	
RF Ambient Conditions	± 3.0	Rectangular	3	1	± 1.7 %	
Probe Positioner	± 0.4	Rectangular	3	1	± 0.2 %	
Probe Positioning	± 2.9	Rectangular	3	1	± 1.7 %	
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	3	1	± 0.6 %	
Test Sample Related						
Device Positioning	± 2.9	Normal	1	1	± 2.9 %	145
Device Holder	± 3.6	Normal	1	1	± 3.6 %	5
Power Drift	± 5.0	Rectangular	3	1	± 2.9 %	
Physical Parameters						
Phantom Shell	± 4.0	Rectangular	3	1	± 2.3 %	
Liquid conductivity (Target)	± 5.0	Rectangular	3	0.64	± 1.8 %	
Liquid conductivity (Meas.)	± 2.5	Normal	1	0.64	± 1.6 %	
Liquid permittivity (Target)	± 5.0	Rectangular	3	0.6	± 1.7 %	
Liquid permittivity (Meas.)	± 2.5	Normal	1	0.6	± 1.5 %	
Combined Standard Uncertainty					**± 10.3 %**	330
Expanded Uncertainty (k=2)					**± 20.6 %**	

The above measurement uncertainties are according to IEEE P1528 (2003)

12. SYSTEM VERIFICATION

12.1 Tissue Verification

Table 12.1 Simulated Tissue Verification

MEASURED TISSUE PARAMETERS					
Date(s)	Target Frequency	Dielectric constant: ε		Conductivity: σ	
		Target	Measured	Target	Measured
July. 15, 2008	2450 MHz Body	52.70	53.60	1.95	1.97

12.2 Test System Validation

Prior to assessment, the system is verified to the ± 10 % of the specifications at 2450 MHz by using the system validation kit(s) (Graphic Plots Attached).

Table 12.2 System Validation

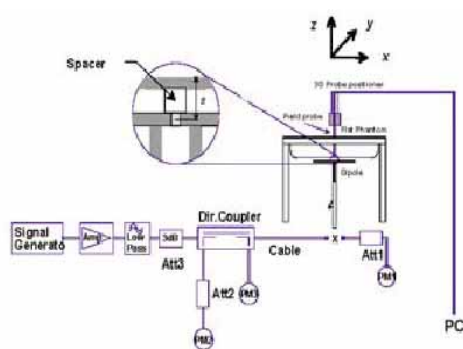| SYSTEM DIPOLE VALIDATION TARGET & MEASURED (2450 MHz values are normalized to a forward power of 1/4 W)					
Date(s)	System Validation Kit:	Target Frequency	Targeted SAR$_{1g}$ (mW/g)	Measured SAR$_{1g}$ (mW/g)	Deviation (%)
July. 15, 2008	D2450V2-SN:794	2450 MHz Head	13.6	14.4	5.88

Figure 12.1 Dipole Validation Test Setup

13. SAR TEST SUMMARY

13.1 See Measurement Result Data Pages

13.2 Procedures Used To Establish Test Signal

The handset was placed into simulated call mode (Wireless LAN) using manufacturers test codes. Such test signals offer a consistent means for testing SAR and are recommended for evaluating SAR [4]. When test modes are not available or inappropriate for testing a handset, the actual transmission is activated through a base station simulator or similar equipment. See data pages for actual procedure used in measurement.

13.3 Device Test Conditions

The handset is battery operated. Each SAR measurement was taken with a fully charged battery.
In order to verify that the device was tested at full power, conducted output power measurements were performed before and after each SAR measurement to confirm the output power. If a conducted power deviation of more than 5 % occurred, the test was repeated.

13.4 EUT Handset Reference Points

Figure 13.1 handset Reference Points

Horizontal Center Line

ERP – Ear Reference Point

Vertical Center Line

14. SAR DATA SUMMARY

Mixture Type : 2450 MHz Body(WLAN)

MEASUREMENT RESULTS					
Option used	Test configuration		SAR, average over 1g (mW/g)		
WLAN (2450 MHz)	Channel		Ch 1 2412 MHz	Ch 6 2437 MHz	Ch 11 2462 MHz
	802.11b	**Power**	13.5	13.9	14.7
		Rear Side	0.020	0.024	0.029
		LCD Side	0.270	0.364	**0.481**
	802.11g	**Power**	11.6	12.5	13.4
		Rear Side	0.077	0.069	0.081
		LCD Side	0.265	**0.373**	0.329
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					Body 1.6 W/kg (mW/g) averaged over 1 gram

NOTE:

1. The test data reported are the worst-case SAR value with the antenna-head position set in a typical configuration. Test procedures used are according to FCC/OET Bulletin 65, Supp. C [July 2001].

2. All modes of operation were investigated, and worst-case results are reported.

3. Prior to testing the conducted output power was measured.

4. The EUT is tested 2nd hot-spot peak, if it is less than 2dB below the highest peak and with a peak SAR value greater than 0.5W/kg.

5. Battery is fully charged for all readings.

6. Test Signal Call Mode   □ Continuous Tx On   ▣ Manu. Test Codes   □ Base Station Simulator

7. Tissue parameters and temperatures are listed on the SAR plots.

8. Liquid tissue depth is 15.0 cm ± 0.1

15. SAR TEST EQUIPMENT

Table 15.1 Test Equipment Calibration

Equipment Name	Model Name	Serial Number	Next Cal. Date
Shield Room	-	NONE	N/A
DASY4 ROBOT	RX60B L	F03/5W18A1/A/01	N/A
DASY4 Controller	CS7MBs&p RX60BL	F03/5W18A1/C/01	N/A
Phantom	SAM Twin Phantom V4.0	TP-1418	N/A
Phantom	SAM Twin Phantom V4.0	TP-1309	N/A
Device Holder	NONE	NONE	N/A
Network Analyzer	8752C	3410A03193	2009.05.08
Signal Generator	8648C	3847U02804	2008.09.17
Power Meter	EPM-442A	GB38270981	2008.09.17
Power Meter	EPM-442A	GB37170391	2008.09.17
Power Sensor	8481A	3318A98329	2008.09.18
Power Sensor	8481A	3318A95115	2008.09.18
Power Sensor	8481A	US37295225	2008.09.18
Power Amplifier	2057-BBS3Q5KCK	1003 D/C 0344	2008.09.17
Dipole Validation Kit	D2450V2	794	2008.11.10
Data Accusition Electronics(DAE)	DAE3	580	2009.03.16
Probe	ES3DV3	3125	2009.01.31
Dual Directional Coupler	778D	17024	2008.09.17
Attenuator	8491B 3dB	50328	2008.09.18
Attenuator	8491B 10dB	50307	2008.09.18
Dielectric Probe Kit	85070D	US01440204	N/A
LP Filter-1.5 GHz	LA-15N	060921-1	2008.09.17
LP Filter-3.0 GHz	LA-30N	060921-2	2008.09.17
Humidity & Temperature Meter	JB913R	03A03	2008.09.19
Electronic Balance	JW-1	JW3014	2008.09.18
Universal Radio Communication Tester	CMU200	112213	2009.02.19

NOTE:
The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Validation measurement is performed by KETI before each test. The brain simulating material is calibrated by KETI using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain-equivalent material.

16. CONCLUSION

16.1 Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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[APPENDIX A] Test Set-Up Photos

[Front Top View of EUT]

[Front Base View of EUT]
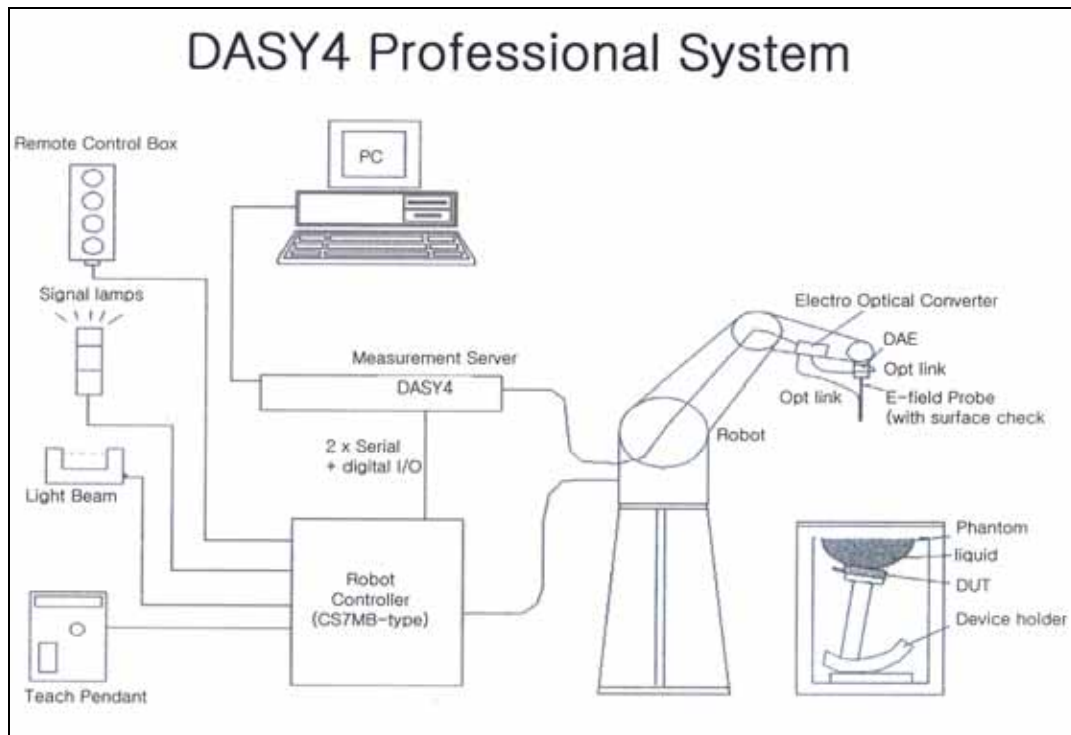
[Rear Top View of EUT]
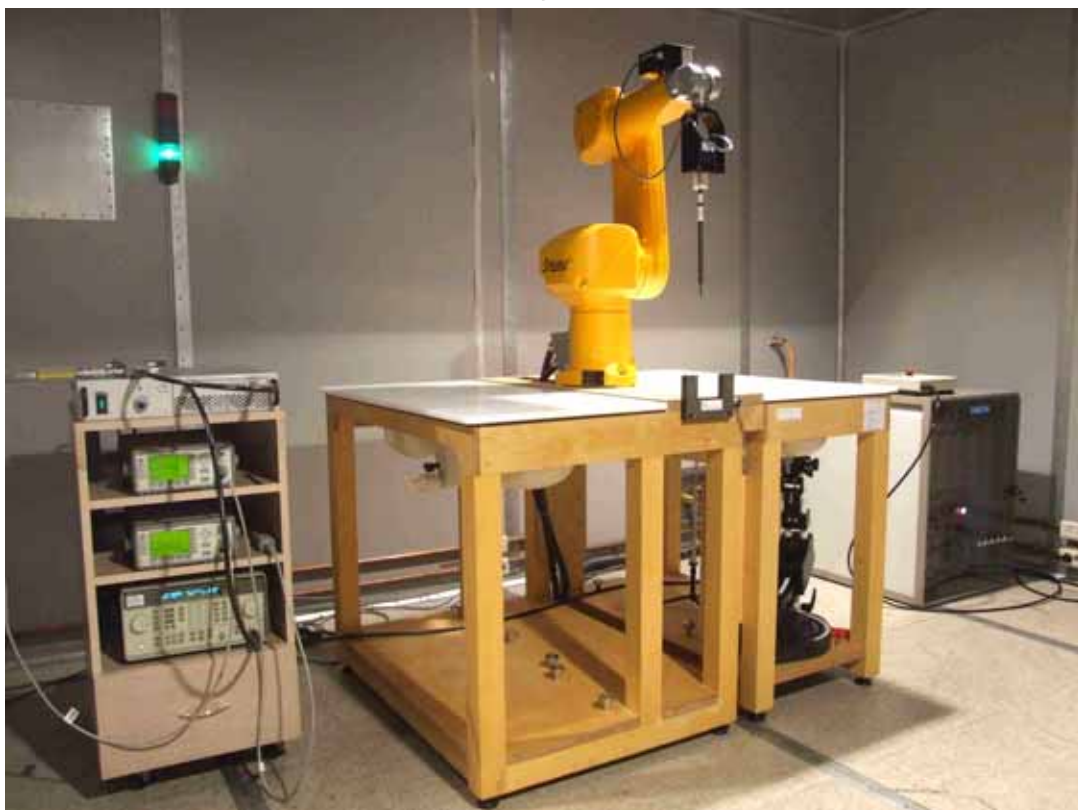

[Rear Base View of EUT]

[Left Side View of EUT]

[Right Side View of EUT]

[System Configuration]

DASY4 Professional System

Remote Control Box

PC

Signal lamps

Electro Optical Converter

DAE

Opt link

Opt link

E-field Probe
(with surface check

Measurement Server

DASY4

Robot

Light Beam

2 x Serial
+ digital I/O

Phantom

liquid

DUT

Robot
Controller
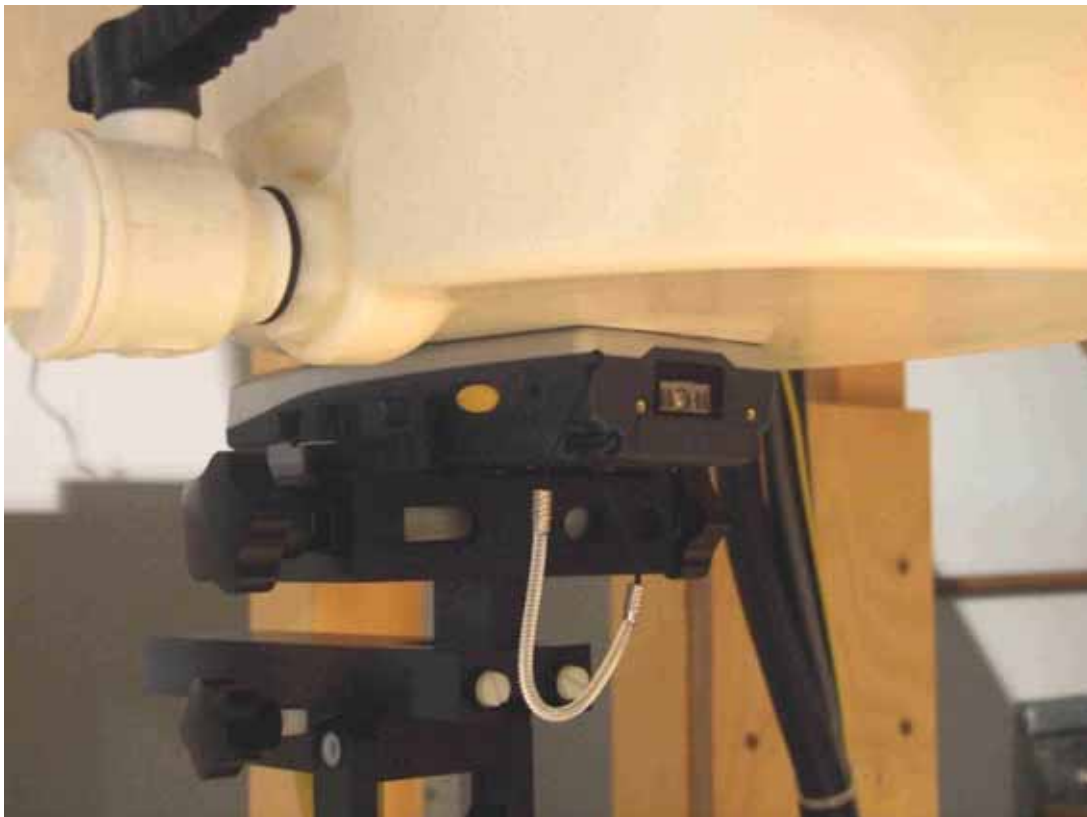(CS7MB-type)

Device holder

Teach Pendant

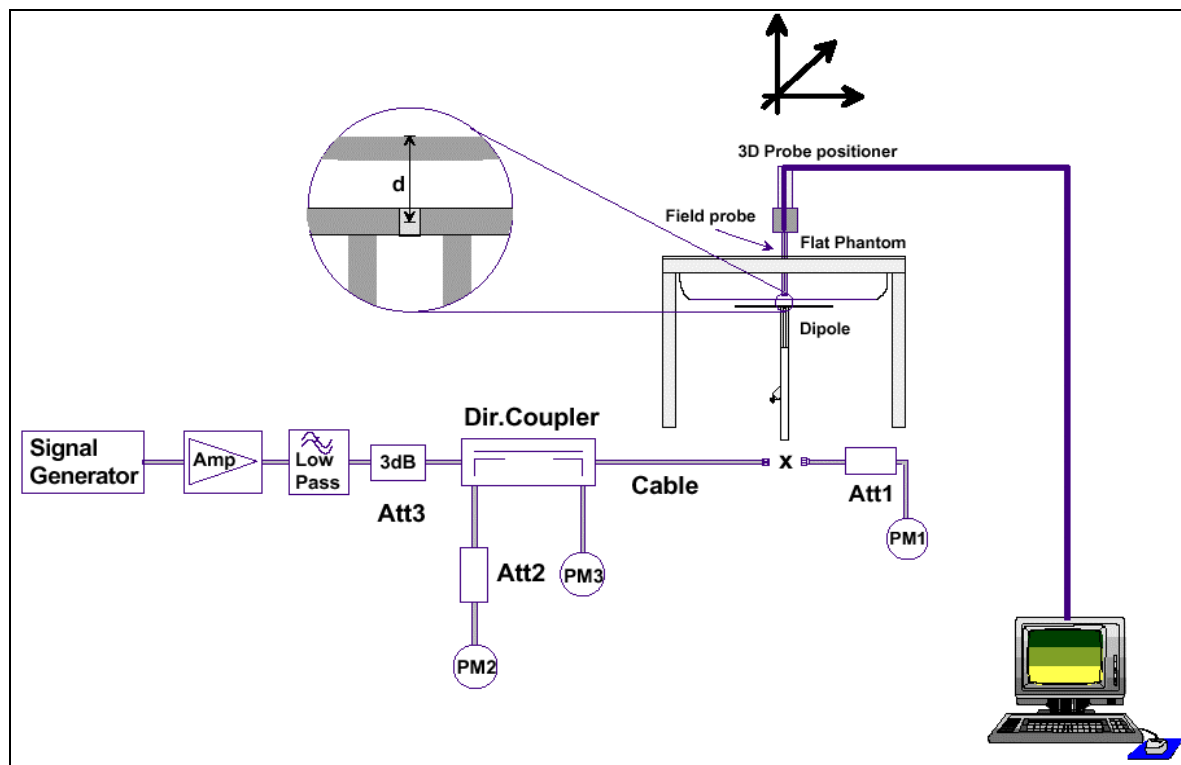# [System Configuration Photo]

[Rear Side]

[LCD Side]

[APPENDIX B] System Validation Checking Scans

[Validation Checking Configuration]

[Validation Checking Photo]