ANSI/IEEE Std. C95.1-1992
In accordance with the requirements of
FCC Report and Order: ET Docket 93-62, and OET Bulletin 65 Supplement C

FCC SAR TEST REPORT

For

TERMINAL

Model: 9600

Trade Name: CIPHERLAB

Issued to

Cipherlab Co., Ltd.
12F, 333 Dunhua S. Rd., Sec.2, Taipei,
Taiwan R.O.C.

Issued by

Compliance Certification Services Inc.
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Testing Laboratory
1309

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1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Applicant Cipherlab Co., Ltd.
12F, 333 Dunhua S. Rd., Sec.2, Taipei,
Taiwan R.O.C.

Equipment Under Test: TERMINAL

Trade Name: CIPHERLAB

Model Number: 9600

Date of Test: September 10~14, 2009

Device Category: PORTABLE DEVICES

Exposure Category: GENERAL POPULATION/UNCONTROLLED EXPOSURE

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC OET 65 Supplement C	No non-compliance noted
Deviation from Applicable Standard	
None	

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C(Edition 01-01). The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Tested by:

Anson Lu
Test Engineer
Compliance Certification Services Inc

2. EUT DESCRIPTION

<table>
<tr><td>Product</td><td colspan="2">TERMINAL</td></tr>
<tr><td>Model Number</td><td colspan="2">9600</td></tr>
<tr><td>Trade Name</td><td colspan="2">CIPHERLAB</td></tr>
<tr><td>Model Discrepancy</td><td colspan="2">N/A</td></tr>
<tr><td>Frequency Range</td><td colspan="2">EGPRS: 850: 824 ~ 849 MHz
EGPRS: 1900: 1850 ~ 1910 MHz
802.11b / g: 2412 ~ 2462 MHz / Bluetooth: 2402 ~ 2483.5 MHz</td></tr>
<tr><td rowspan="2">Transmit Power(Average)</td><td>850 Band:
EGPRS 850: 27.13 dBm</td><td>1900 Band:
EGPRS 1900: 26.02 dBm</td></tr>
<tr><td>2.4GHz:
802.11b: 15.84 dBm
802.11g: 13.22 dBm</td><td>Bluetooth (GFSK): -5.05 dBm</td></tr>
<tr><td>Max. SAR (1g):</td><td colspan="2">850 Band:
EGPRS: 0.153 W/kg (Body position)
1900 Band:
EGPRS: 0.021 W/kg (Body position)
802.11b:
Body: 0.045 W/kg (Body position)
802.11g:
Body: SAR not required, please refer to page 23
Bluetooth:
Body: SAR not required, please refer to page 23</td></tr>
<tr><td>Modulation Technique</td><td colspan="2">EGPES(EDGE): 8PSK
802.11b: Direct Sequence Spread Spectrum (DSSS)
802.11g: Orthogonal Frequency Division Multiplexing (OFDM)
Bluetooth: GFSK for 1Mbps; π/4-DQPSK for 2Mbps; 8DPSK for 3Mbps</td></tr>
<tr><td>Antenna Specification</td><td>Antenna. Type:
EGPRS: Monopole antenna
WLAN: PCB antenna
Bluetooth: PCB antenna</td><td>Antenna. Gain:
EGPRS 850 MHz: -3.75 dBi
EGPRS 1900 MHz: -2.08 dBi
802.11b/g: -1.68dBi
Bluetooth: 0.60dBi</td></tr>
</table>

3. 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. 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. 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.

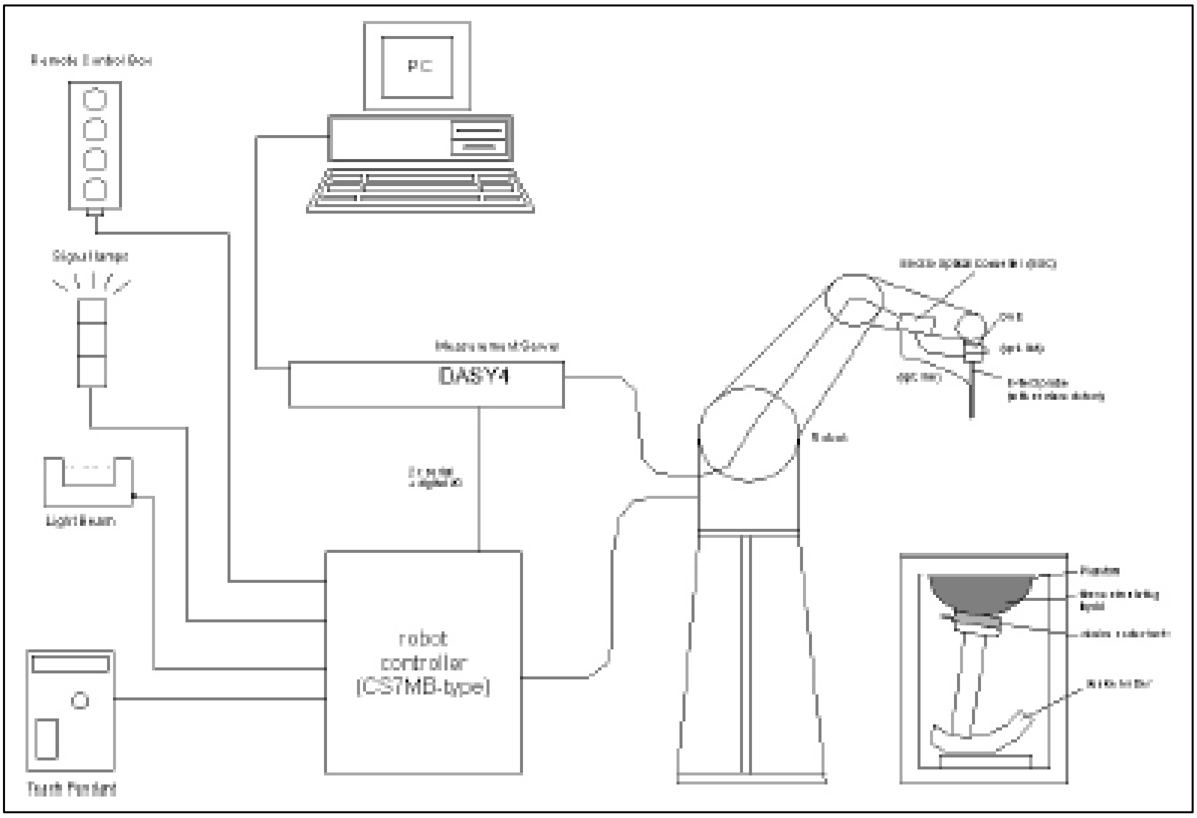
4. DOSIMETRIC ASSESSMENT SETUP

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 EX3DV4-SN:3578 (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, IEE P1528 and CENELEC 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

4.1 MEASUREMENT SYSTEM DIAGRAM



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

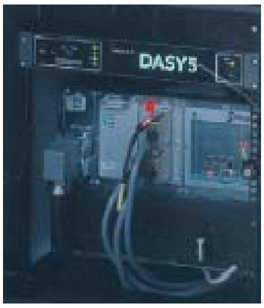
- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. 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.]

4.2 SYSTEM COMPONENTS

DASY4/DASY5 Measurement Server

The DASY4/DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4/DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.



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

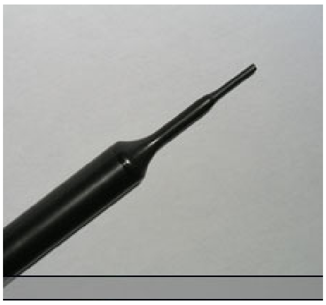
Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

Construction:	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration:	Basic Broad Band Calibration in air: 10-3000 MHz. Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request.
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in HSL (rotation normal to probe axis)
Dynamic Range:	10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)

Dimensions:	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1 mm
Application:	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



Interior of probe

SAM Phantom (V4.0)

Construction:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness:	2 ±0.2 mm
Filling Volume:	Approx. 25 liters
Dimensions:	Height: 810mm; Length: 1000mm; Width: 500mm

SAM Phantom (ELI4) Description

Construction:	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles
Shell Thickness:	2.0 ± 0.2 mm (sagging: <1%)
Filling Volume:	Approx. 25 liters
Dimensions:	Major ellipse axis: 600 mm
Minor axis:	400 mm 500mm

Device Holder for SAM Twin Phantom

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

System Validation Kits for SAM Phantom (V4.0)

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

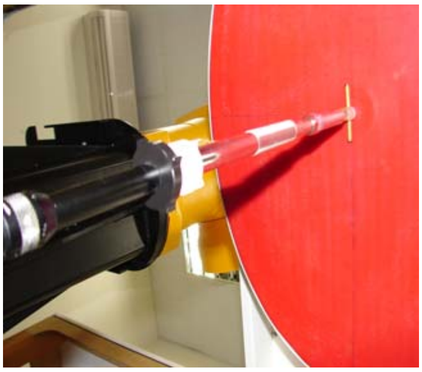
Frequency: 450, 900, 1800, 2450, 5800 MHz

Return loss: > 20 dB at specified validation position

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

Dimensions:
D450V2: dipole length: 270 mm; overall height: 330 mm
D835V2: dipole length: 161 mm; overall height: 340 mm
D900V2: dipole length: 148.5 mm; overall height: 340 mm
D1800V2: dipole length: 72.5 mm; overall height: 300 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D1900V3: dipole length: 67.0 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

System Validation Kits for ELI4 phantom



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D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

5. 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 9 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.

SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY4 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x9 measurement points with 5mm resolution amounting to 441 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a}) cos(\pi \frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes ($a \ll \lambda$), the cos-term can be omitted. Factors *Sb* (parameter Alpha in the DASY4 software) and *a* (parameter Delta in the DASY4 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30_ to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY4 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during postprocessing.

6. MEASUREMENT UNCERTAINTY

UNCERTAINTY BUDGE ACCORDING TO IEEE P1528						
Error Description	**Uncertainty Value ±%**	**Probability distribution**	**Divisor**	**C_1 1g**	**Standard unc.(1g/10g) ±%**	**V_1 or V_{eff}**
Measurement System						
Probe calibration	±4.8	normal	1	1	±4.8	∞
Axial isotropy of probe	±4.6	rectangular	$\sqrt{3}$	$(1\text{-Cp})^{1/2}$	±1.9	∞
Sph. Isotropy of probe	±9.7	rectangular	$\sqrt{3}$	$(\text{Cp})^{1/2}$	±3.9	∞
Probe linearity	±4.5	rectangular	$\sqrt{3}$	1	±2.7	∞
Detection Limit	±0.9	rectangular	$\sqrt{3}$	1	±0.6	∞
Boundary effects	±8.5	rectangular	$\sqrt{3}$	1	±4.8	∞
Readoutelectronics	±1.0	normal	1	1	±1.0	∞
Response time	±0.9	rectangular	$\sqrt{3}$	1	±0.5	∞
Integration time	±1.2	rectangular	$\sqrt{3}$	1	±0.8	∞
Mech Constrains of robot	±0.5	rectangular	$\sqrt{3}$	1	±0.2	∞
Probe positioning	±2.7	rectangular	$\sqrt{3}$	1	±1.7	∞
Extrap. And integration	±4.0	rectangular	$\sqrt{3}$	1	±2.3	∞
RF ambient conditiona	±0.54	rectangular	$\sqrt{3}$	1	±0.43	∞
Test Sample Related						
Device positioning	±2.2	normal	1	1	±2.23	11
Device holder uncertainty	±5	normal	1	1	±5.0	7
Power drift	±5	rectangular	$\sqrt{3}$	1	±2.9	∞
Phantom and Set up						
Phantom uncertainty	±4	rectangular	$\sqrt{3}$	1	±2.3	∞
Liquid conductivity	±5	rectangular	$\sqrt{3}$	0.6	±1.7	∞
Liquid conductivity	±5	rectangular	$\sqrt{3}$	0.6	±3.5/1.7	∞
Liquid permittivity	±5	rectangular	$\sqrt{3}$	0.6	±1.7	∞
Liquid permittivity	±5	rectangular	$\sqrt{3}$	0.6	±1.7	∞
Combined Standard Uncertainty					±12.14/11.76	
Coverage Factor for 95%		kp=2				
Expanded Standard Uncertainty					±24.29/23.51	

Table: Worst-case uncertainty for DASY4 assessed according to IEEE P1528.
The budge is valid for the frequency range 300 MHz to 6G Hz and represents a worst-case analysis.

7. EXPOSURE LIMIT

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

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

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

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

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

Population/Uncontrolled Environments:

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

Occupational/Controlled Environments:

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

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

8. EUT ARRANGEMENT

Please refer to IEEE P1528 illustration below.

8.1 ANTHROPOMORPHIC HEAD PHANTOM

Figure 7-1a shows the front, back and side views of SAM. The point “M” is the reference point for the center of 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 ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 7-1b. The plane passing through the two ear reference points and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 7-1c). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs. Anterior to the N-F line, the ear is truncated as illustrated in Figure 7-1b. The ear truncation is introduced to avoid the handset from touching the ear lobe, which can cause unstable handset positioning at the cheek.

Figure 7-1a
Front, back and side view of SAM (model for the phantom shell)

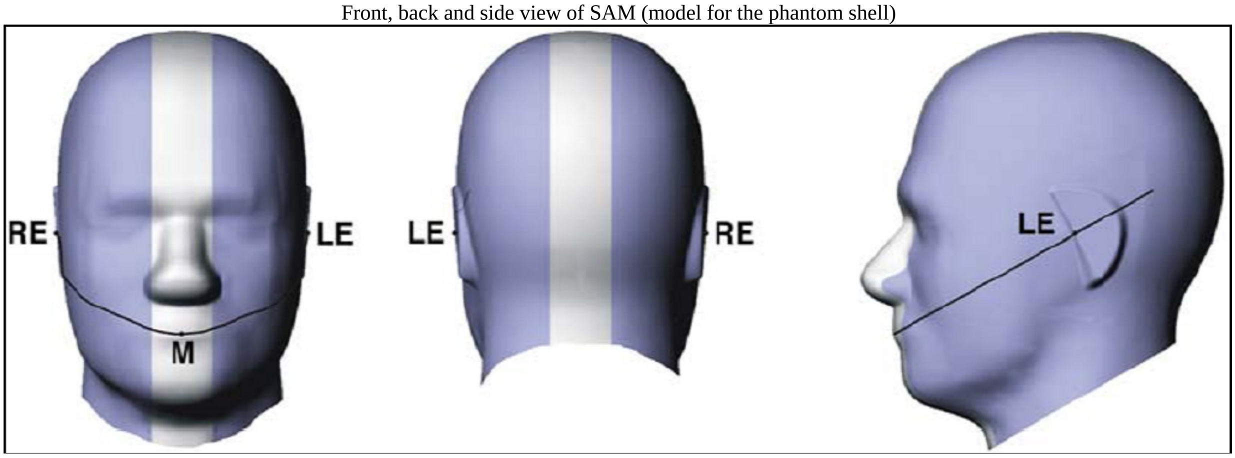
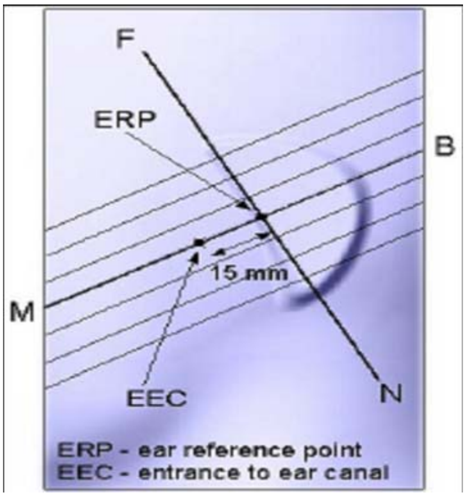


Figure 7-1b
Close up side view of phantom showing the ear region

Figure 7-1c
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations



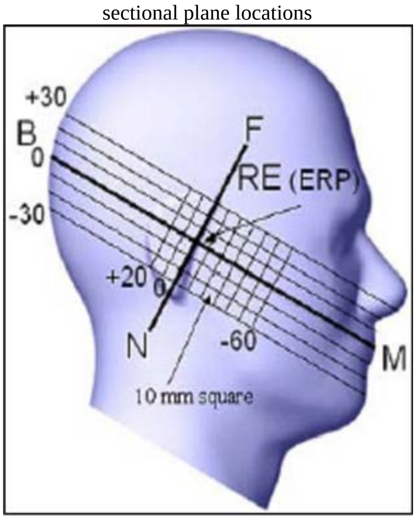


Figure 7-1b
Close up side view of phantom showing the ear region

Figure 7-1c
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations

8.2 DEFINITION OF THE “CHEEK/TOUCH” POSITION

The “cheek” or “touch” position is defined as follows:

a. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover. (If the handset can also be used with the cover closed both configurations must be tested.)

b. Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width wt of the handset at the level of the acoustic output (point A on Figures 7-2a and 7-2b), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 7-2a). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 7-2b), especially for clamshell handsets, handsets with flip pieces, and other irregularly-shaped handsets.

c. Position 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 Figure 7-2c), such that the plane defined by the vertical center line and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

d. Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the pinna.

e. e) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).

f. Rotate the handset around the vertical centerline until the handset (horizontal line) is symmetrical with respect to the line NF.

g. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the handset contact with the pinna, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the pinna (cheek). See Figure 7-2c. The physical angles of rotation should be noted.

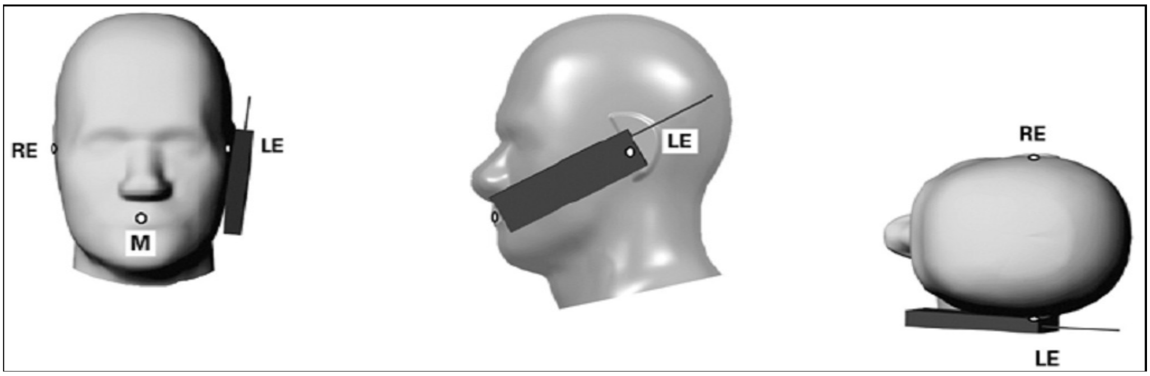


Figure 7.2c
Phone “cheek” or “touch” position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

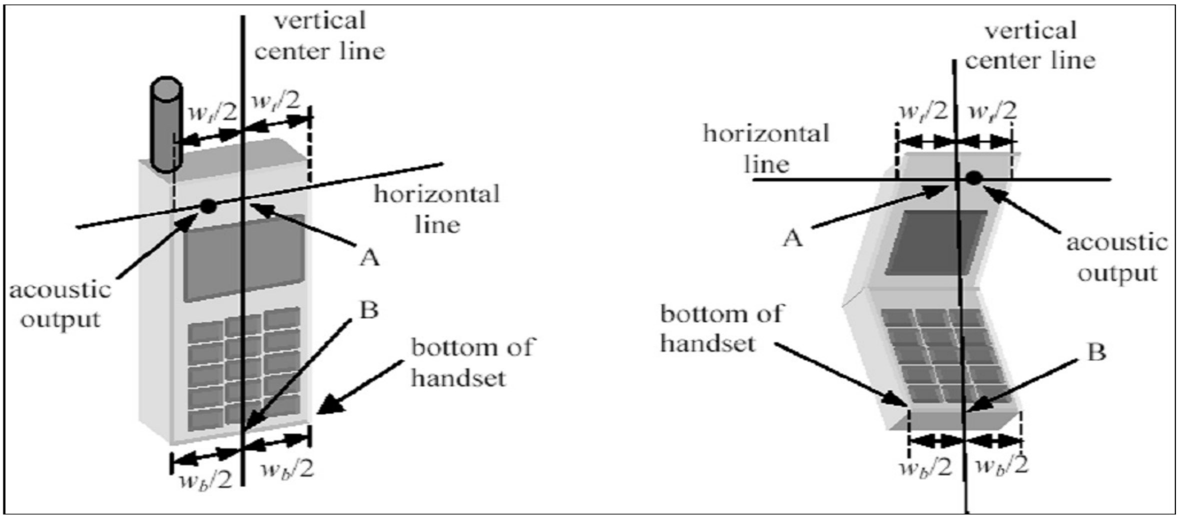


Figure 7.2a Figure 7.2b

8.3 DEFINITION OF THE "TILTED" POSITION

The "tilted" position is defined as follows:

a. Repeat steps (a) – (g) of 7.2 to place the device in the "cheek position."

b. While maintaining the orientation of the handset move the handset away from the pinna along the line passing through RE and LE in order to enable a rotation of the handset by 15 degrees.

c. Rotate the handset around the horizontal line by 15 degrees.

d. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna (e.g., the antenna with the back of the phantom head), the angle of the handset should be reduced. In this case, the tilted position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is contact with the phantom (e.g., the antenna with the back of the head).

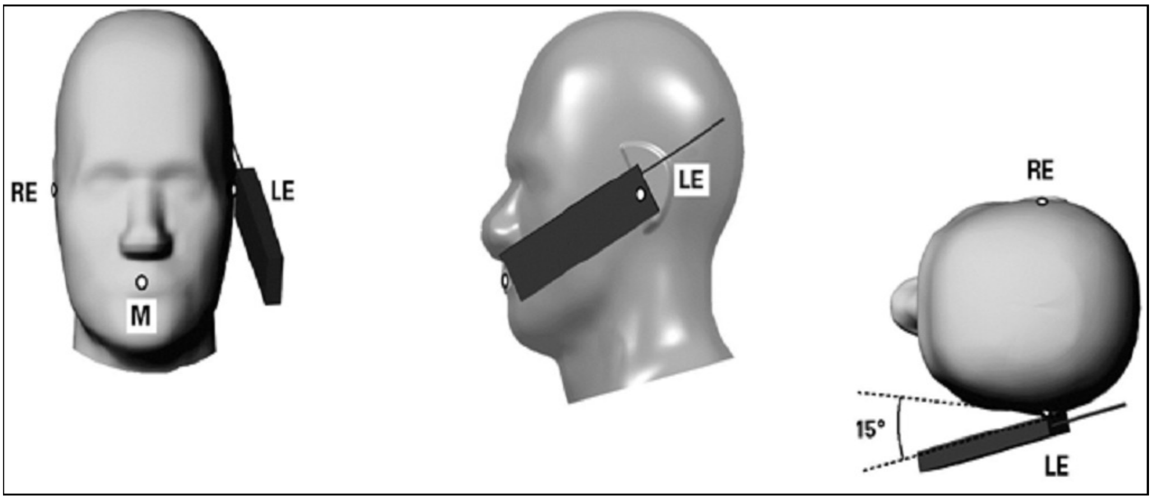


Figure 7-3
Phone "tilted" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

9. MEASUREMENT RESULTS

9.1 TEST LIQUIDS 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 (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	45.3	5.27	48.2	6.00

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

LIQUID MEASUREMENT RESULTS

Date: September 10, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

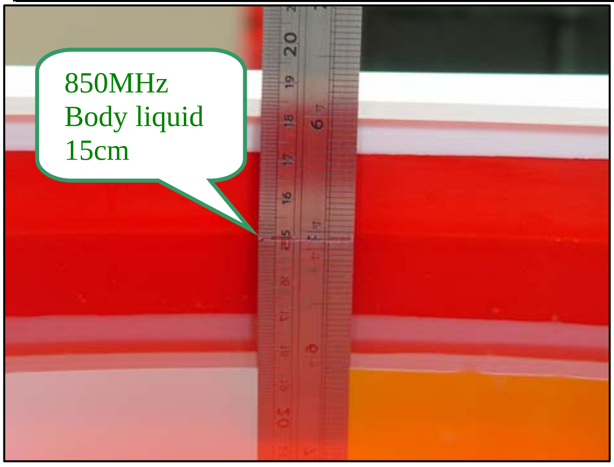
Body Simulatinf Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
835 MHz	23.60	15.00	Permitivity:	55.20	54.20	-1.81	±5
			Conductivity:	0.97	0.961	-0.93	± 5

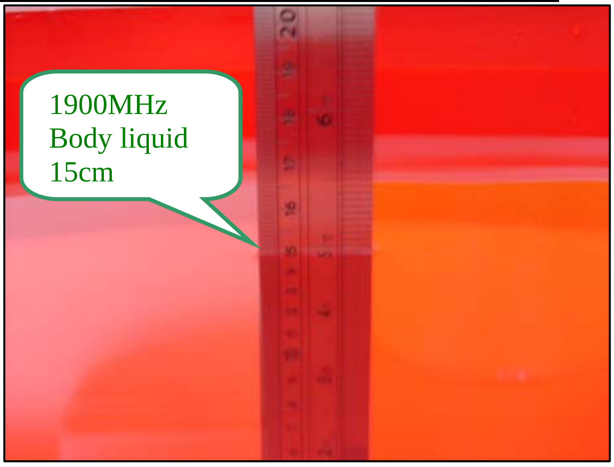
Date: September 11, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

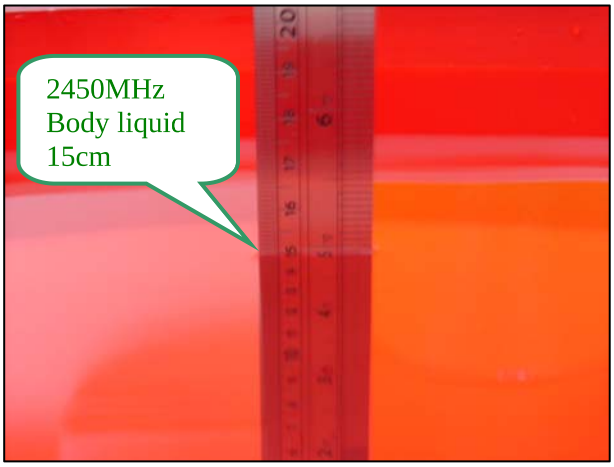
Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth (cm)					
1900 MHz	23.60	15.00	Permitivity:	53.30	51.80	-2.81	± 5
			Conductivity:	1.52	1.49	-1.97	± 5

Date: September 14, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f (MHz)	Temp. [°C]	Depth (cm)					
2450.00	23.60	15.00	Permitivity:	52.70	51.90	-1.52	± 5
			Conductivity:	1.95	1.96	0.51	± 5







9.2 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	38.8	20.4	67.6	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 MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with Head and Body simulating liquid of the following parameters.
- The DASY4 system with an E-fileld probe EX3DV4 SN: 3578 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 15 mm (below 1 GHz) and 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 and it’s equal to 4x(dipole forward power).

SYSTEM PERFORMANCE CHECK RESULTS

Dipole: D835V2-SN: 4d015

Date: September 10, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

Body Simulatinf Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
835.00	23.60	15.00	Permitivity:	55.20	54.20	-1.81	±5
			Conductivity:	0.97	0.961	-0.93	± 5
			1g SAR:	9.62	9.44	-1.87	± 5

ps. 1g SAR is equal 4x2.36(250mW forward power SAR value)

Dipole: D1900V2 SN: 5d056

Date: September 11, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

Body Simulatinf Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
1900.00	23.60	15.00	Permitivity:	53.30	51.80	-2.81	±5
			Conductivity:	1.52	1.49	-1.97	± 5
			1g SAR:	41.60	40.40	-2.88	± 5

ps. 1g SAR is equal 4x10.1(250mW forward power SAR value)

Dipole: D2450V2 SN: 728

Date: September 14, 2009 **Ambient condition:** Temperature 24.6°C; Relative humidity: 53%

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
f(MHz)	Temp. [°C]	Depth [cm]					
2450.00	23.60	15.00	Permitivity:	52.70	51.90	-1.52	± 5
			Conductivity:	1.95	1.96	0.51	± 5
			1g SAR:	51.40	52.40	1.95	± 5

ps. 1g SAR is equal 4x13.1(250mW forward power SAR value)

9.3 EUT TUNE-UP PROCEDURES

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

- To setup the desire channel frequency and the maximum output power. A Radio Communication Tester "Agilent E5515C 8960" was used to program the EUT.

  EGPRS 850 / EGPRS 1900
  Network Support: E*GPRS / EGPRS*
  Main Service: Packet data / Packet data
  Power Setting: *27dBm / 26dBm*
  Class: B; 12 (4 Up / 1 Down) / B; 12 (4 Up / 1 Down)

- Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurement.

EGPRS850/EGPRS1900 Conducted output power (Average)(dBm)

Mode / Channel	**EGPRS** before test	**EGPRS** after test
128	27.02	*N/A ; SAR measurement is not required*
190	***27.13***	27.09
251	26.82	*N/A ; SAR measurement is not required*
512	25.93	*N/A ; SAR measurement is not required*
661	***26.02***	25.98
810	26.01	*N/A ; SAR measurement is not required*

*Ps. (1) Due to 27.13dBm=516.416mW is less than 30.35dBm (1083.93mW), the 850MHz Hand SAR is **not** required according to KDB 447498 4 c) iii) (1).*
*(2) Due to 26.02dBm=399.945mW is less than 28.60dBm (725.476mW), the 1.9GHz Hand SAR is **not** required according to KDB 447498 4 c) iii) (1).*
(3) Due to 27.13dBm=516.416mW is higher than 25.12dBm (325.087mW), the 850MHz Body SAR is required according to KDB 447498 4 c) iii) (3).
(4) Due to 26.02dBm=399.945mW is higher than 23.37dBm (217.643mW), the 1.9GHz Body SAR is required according to KDB 447498 4 c) iii) (3).

802.11b/g output power (Average)(dBm)

Power / Frequency	**1M** before test	**1M** after test	**6M** before test	**6M** after test
1(2412 MHz)	***15.84***	15.81	13.02	*N/A SAR measurement is not required*
7(2442 MHz)	15.82	*N/A SAR measurement is not required*	***13.22***	
13(2472 MHz)	15.65		12.93	

*Ps. (1)15.84dBm=38.371mW is higher than (60/f)=24.5mW, so **802.11b stand-alone SAR is required**.*
*(2)13.22dBm=20.989mW is less than (60/f)=24.5mW, so **802.11g stand-alone SAR is not required**.*
(3)Due to the maximum Peak and Average SAR for the maximum output channel are 0.045 W/kg and 0.021 W/kg respectively, testing of other channels in the default test channels configuration is optional according to KDB 248227.
(4)Due to the maximum average output power of 802.11g channels is less than 1/4 dB higher than that measured on the corresponding 802.11b channels, the SAR for 802.11g channels is not required according to KDB 248227.
(5)There are Main and Aux antenna for this EUT, after verification the maximum output power from Main antenna is 15.84dBm; the maximum output power from Aux antenna is 13.18dBm; so we choose Main antenna was the worst antenna for stand-alone SAR evaluation.

Bluetooth output power (Average)(dBm)

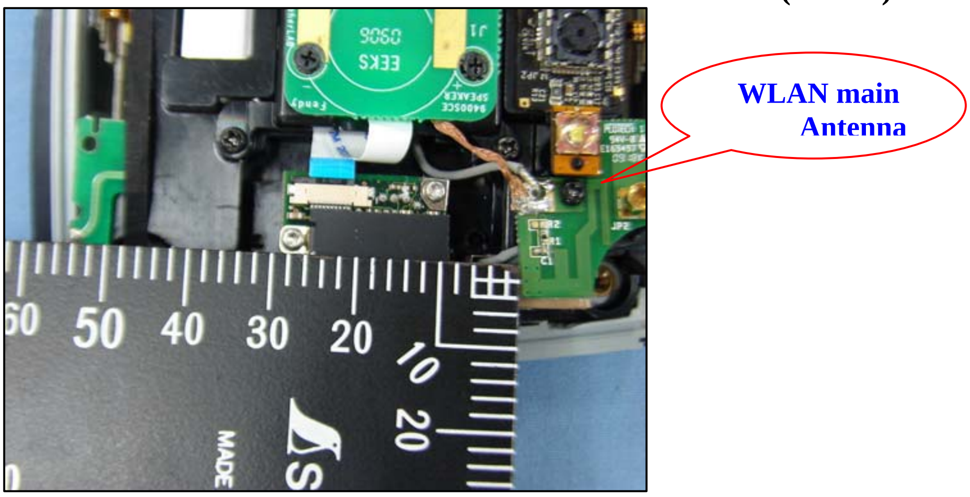
Mode / Frequency	DATA1 1M	
	before test	after test
2402 MHz	-5.27	*N/A SAR measurement is not required*
2441 MHz	***-5.05***	
2480 MHz	-5.06	

Ps. (1) Due to the maximum average output power of Bluetooth is -5.05dBm=0.313mW which is less than 60/f(GHz)= 24.580mW, the SAR for Bluetooth mode is not required according to KDB 447498.

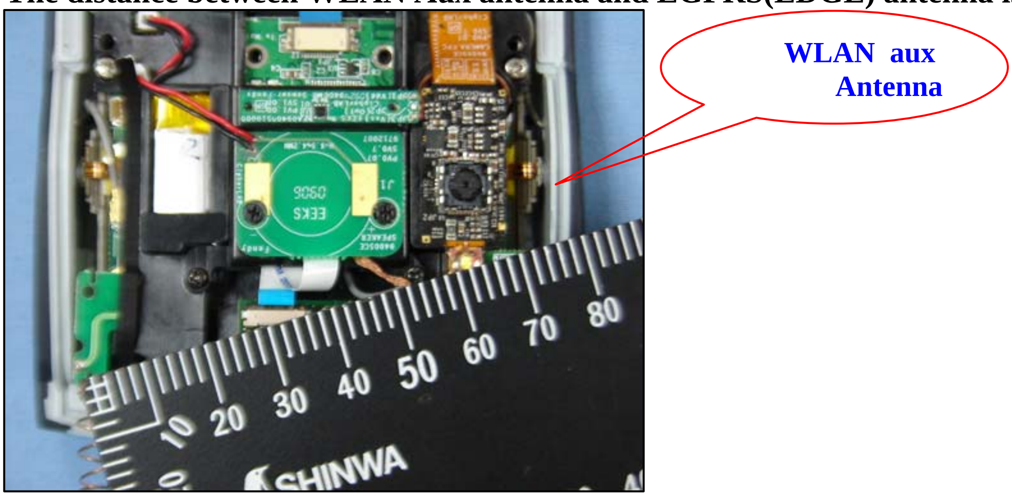
Antenna Location:

antenna1	antenna2	distance(mm)	distance(cm)
EGPRS	**WLAN main**	54	5.4
EGPRS	**WLAN aux**	78	7.8
EGPRS	**Bluetooth**	16.5	1.65

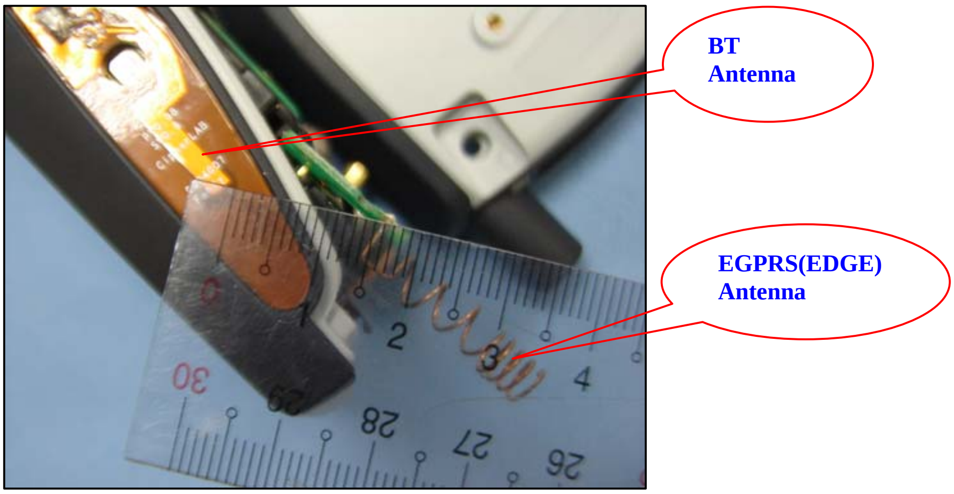
The distance between WLAN Main antenna and EGPRS(EDGE) antenna is 54mm



The distance between WLAN Aux antenna and EGPRS(EDGE) antenna is 78mm



The distance between Bluetooth antenna and EGPRS(EDGE) antenna is 16.5mm



	EGPRS 850 body	EGPRS 1900 body
EGPRS SAR(worst)	0.153	0.021
802.11b SAR(worst)	0.045	0.045
Bluetooth SAR(worst)	0.000	0.000
Σ1g-SAR	0.198	0.066
remark	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)

Simultaneous SAR evaluation:

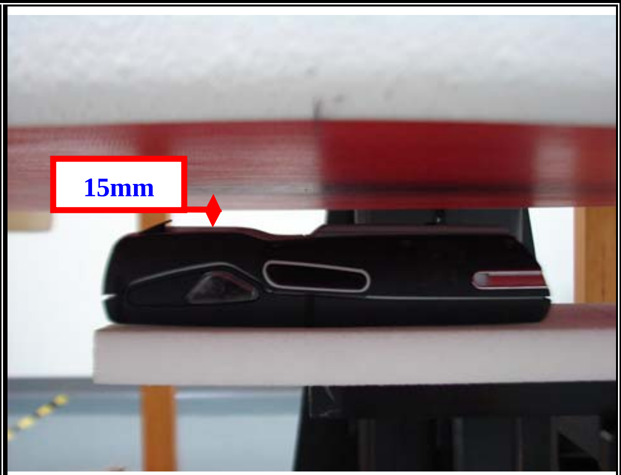
device, mode, f	P, dBm	P, mW	stand-alone SAR(W/kg)
T1, EGPRS 850/1900	27.13	516.416	**Yes**, Please refer page 26
T2, WLAN main, 802.11b/g	15.84	38.371	**Yes**, Please refer page 26
T3, WLAN aux 802.11b/g	13.18	20.797	**No**, < (60/f)mW
T4, Bluetooth, 2480	-5.05	0.313	**No**, < (60/f)mW

(x,y)	d_{xy}, cm	simultaneous Tx SAR	remarks
(T1,T2)	5.4	**No**	d_{xy} > 5cm the Sum of all 1-g SAR < 1.6 W/kg, please refer to page 25~26
(T1,T3)	7.8	**No**	d_{xy} > 5cm the Sum of all 1-g SAR < 1.6 W/kg, please refer to page 25~26
(T1,T4)	1.65	**No**	d_{xy} <2.5cm the 1-g SAR < 1.2 W/kg, please refer to page 25~26

9.4 SAR MEASUREMENT RESULTS

Bottom Flat position

Face up



Face down

Test mode: **EGPRS 835**, Duty Cycle: 50%, Crest Factor: 4 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		Liquid Temp_°C	**SAR** (10g) (W/kg)	Limit (W/kg)
		Channel	MHz			
15mm Face Up	Fixed	190	836.6	23.8	***0.153***	1.6
15mm Face Down	Fixed	190	836.6	23.8	0.120	1.6

Test mode: **EGPRS 1900**, Duty Cycle: 50%, Crest Factor: 4 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		Liquid Temp_°C	**SAR** (10g) (W/kg)	Limit (W/kg)
		Channel	MHz			
15mm Face Up	Fixed	661	1880.0	23.8	***0.021***	1.6
15mm Face Down	Fixed	661	1880.0	23.8	0.014	1.6

Test mode: **802.11b**, Duty Cycle: 100%, Crest Factor: 1 Depth of liquid: 15.0 cm

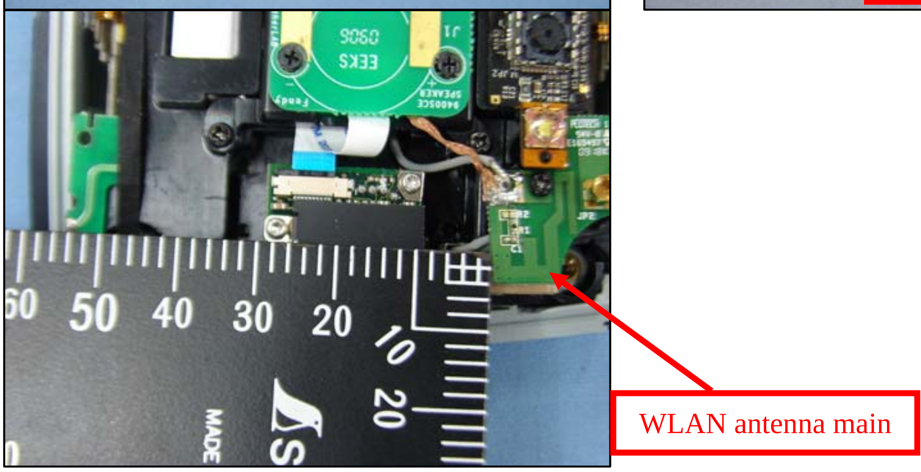
EUT Position	Antenna	Frequency		Liquid Temp_°C	**SAR** (10g) (W/kg)	Limit (W/kg)
		Channel	MHz			
15mm Face Up	Main	1	2412	23.6	0.025	1.6
15mm Face Down	Main	1	2412	23.6	***0.045***	1.6

Notes: 1) Bottom face and bottom in parallel with flat phantom
2) Please refer to attachment for the result presentation in plot format.

10. EUT PHOTO


EDGE antenna
Bluetooth antenna


WLAN antenna aux


WLAN antenna main

11. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(days)	Calibration Due
S-Parameter Network Analyzer	Agilent	E8358A	US40260243	365	07/07/10
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Agilent	E4416A	GB41291611	365	04/02/10
Power Sensor	Agilent	E9327A	US40441097	365	06/28/10
Spectrum Analyzer	Agilent	E4446A	US42510268	365	10/26/09
Wireless Communication Test Set	Agilent	E5515C 8960	MY48363204	365	07/28/10
Wireless Communication Test Set	R&S	CMU200	101245	365	06/10/10
Data Acquisition Electronics (DAE)	SPEAG	DAE4	558	365	07/16/10
Data Acquisition Electronics (DAE)	SPEAG	DAE4	905	365	06/23/10
Dosimetric E-Field Probe	SPEAG	EX3DV4	3578	365	06/25/10
835 MHz System Validation Dipole	SPEAG	D835V2	4d015	730	11/17/10
1900 MHz System Validation Dipole	SPEAG	D1900V2	5d056	730	11/17/10
2450 MHz System Validation Dipole	SPEAG	D2450V2	728	730	04/10/10
Probe Alignment Unit	SPEAG	LB (V2)	348	N/A	N/A
Robot	Staubli	RX90B L	F02/5T69A1/A/01	N/A	N/A
SAM Twin Phantom V4.0	SPEAG	N/A	N/A	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A
Head/ Muscle 835 MHz	CCS	H/M 835A	N/A	N/A	N/A
Head/ Muscle 1900 MHz	CCS	H/M 1900A	N/A	N/A	N/A
Head/ Muscle 2450 MHz	CCS	H/M 2450A	N/A	N/A	N/A

12. FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☒ No. 11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan.

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

13. REFERENCES

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[4] Niels Kuster, Ralph K.astle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.

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14. ATTACHMENTS

Exhibit	Content
1	System Performance Check Plots
2	SAR Test Plots
3	Probe EX3DV4 sn3554
4	Dipole D835V2_sn4d015
5	Dipole D1900V2_sn5d056

END OF REPORT