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

Tri-band mobile phone

Model: CL75

Trade Name: Siemens

Issued to

SIEMENS Limited
8F, No. 19-13, Sanchoung Rd., Nan Gang District,
Taipei, 115 Taiwan, R.O.C.

Issued by

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1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

DATES OF TEST: Feb. 23, 2005

APPLICANT:	SIEMENS Limited 8F, No. 19-13, Sanchoung Rd., Nan Gang District, Taipei, 115 Taiwan, R.O.C.
Model Number / Trade Name:	CL75 / Siemens
Device Category:	PORTABLE DEVICES
EXPOSURE CATEGORY:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Test Sample is a: Production unit

Modulation type: GSM (PCS), GPRS

Operating Mode: Maximum continuous output

Tx Frequency: GSM1900 PCS band: 1850.2 MHz to1909.8 MHz

Max. O/P Power: (Conducted/Average)
GSM1900: 31.14 dBm
GPRS1900: 31.13 dBm

Max. SAR (1g):
Head:
GSM1900:
0.861W/kg (Right head Cheek position)
Body:
GSM1900:
0.188W/kg (Body position Front Panel parallel Phantom)
GPRS1900:
0.306W/kg (Body position Front Panel parallel Phantom)

Application Type: Certification

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.

Approved by:

Harris W. Lai
Executive Vice President
Compliance Certification Services Inc.

Reviewed by:

Chris Hsieh
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTIONS

APPLICANT:	SIEMENS Limited 8F, No. 19-13, Sanchoung Rd., Nan Gang District, Taipei, 115 Taiwan, R.O.C.
Model Number / Trade Name:	CL75 / Siemens
Device Category:	PORTABLE DEVICES
EXPOSURE CATEGORY:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Test Sample is a:	Production unit
Modulation type:	GSM (PCS), GPRS
Operating Mode:	Maximum continuous output
Tx Frequency:	GSM1900 PCS band: 1850.2 MHz to1909.8 MHz
Max. O/P Power: (Conducted/Average)	**GSM1900: 31.14**dBm **GPRS1900: 31.13**dBm
Max. SAR (1g):	**Head:** **GSM1900:0.861**W/kg (Right head Cheek position) **Body:** **GSM1900:** **0.188**W/kg (Body position Front Panel parallel Phantom) **GPRS1900:** **0.306**W/kg (Body position Front Panel parallel Phantom)
Application Type:	Certification
Antenna Type:	**Embedded** Ant.
Battery option:	Only one type/model with EUT

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.

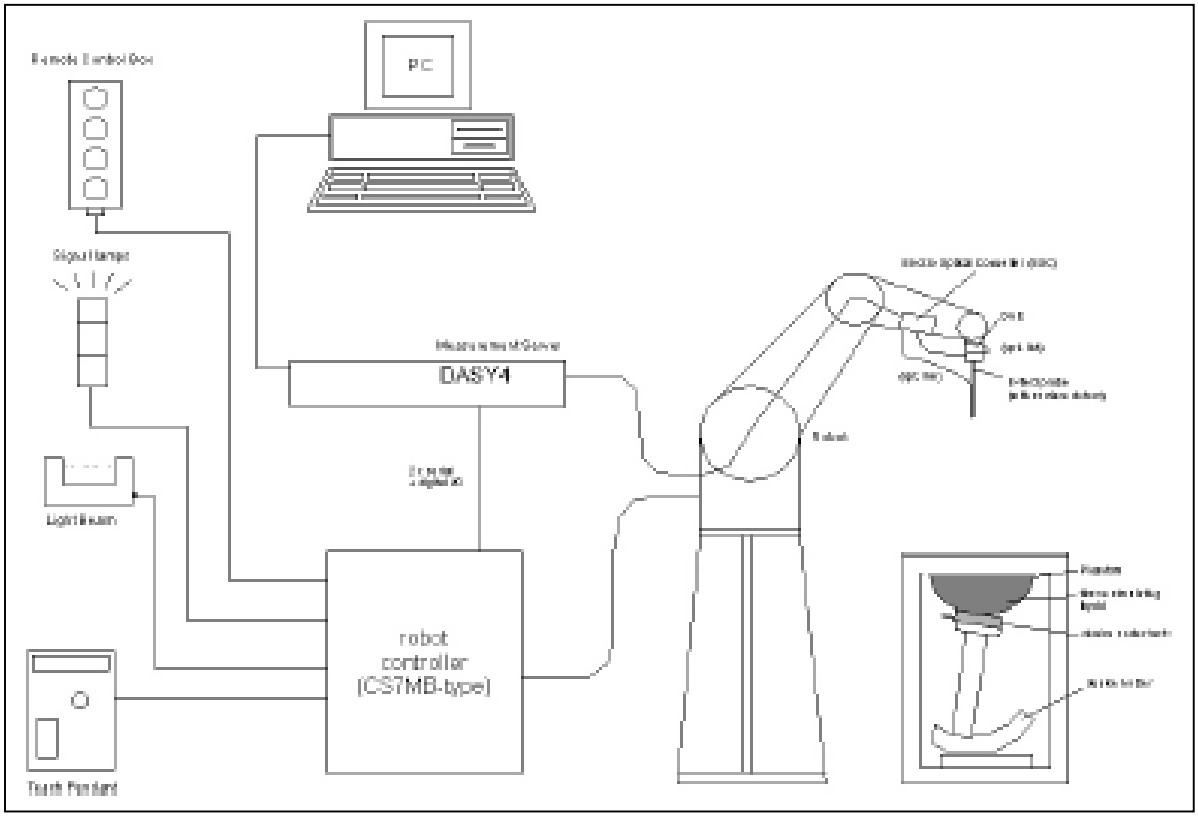
4. DOSIMETRIC ASSESSMENT SETUP

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:3554 (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 Measurement Server

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

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

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

Data Acquisition Electronics (DAE)

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

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

E-Field probe EX3DV4

SAM Phantom (V4.0)

Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

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

Device Holder for SAM Twin Phantom

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

System Validation Kits

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

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

Return loss: > 20 dB at specified validation position

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

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

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 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

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

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 5x5x7 measurement points with 5mm resolution amounting to 343 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) ±%**	**V_1 or V_{eff}**
Measurement System						
Probe calibration	±4.8	normal	1	1	±4.8	∞
Axial isotropy of probe	±4.6	rectangular	√3	$(1-Cp)^{1/2}$	±1.9	∞
Sph. Isotropy of probe	±9.7	rectangular	√3	$(Cp)^{1/2}$	±3.9	∞
Probe linearity	±4.5	rectangular	√3	1	±2.7	∞
Detection Limit	±0.9	rectangular	√3	1	±0.6	∞
Boundary effects	±8.5	rectangular	√3	1	±4.8	∞
Readoutelectronics	±1.0	normal	1	1	±1.0	∞
Response time	±0.9	rectangular	√3	1	±0.5	∞
Integration time	±1.2	rectangular	√3	1	±0.8	∞
Mech Constrains of robot	±0.5	rectangular	√3	1	±0.2	∞
Probe positioning	±2.7	rectangular	√3	1	±1.7	∞
Extrap. And integration	±4.0	rectangular	√3	1	±2.3	∞
RF ambient conditiona	±0.54	rectangular	√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	√3	1	±2.9	∞
Phantom and Set up						
Phantom uncertainty	±4	rectangular	√3	1	±2.3	∞
Liquid conductivity	±5	rectangular	√3	0.6	±1.7	∞
Liquid conductivity	±5	rectangular	√3	0.6	±3.5/1.7	∞
Liquid permittivity	±5	rectangular	√3	0.6	±1.7	∞
Liquid permittivity	±5	rectangular	√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)

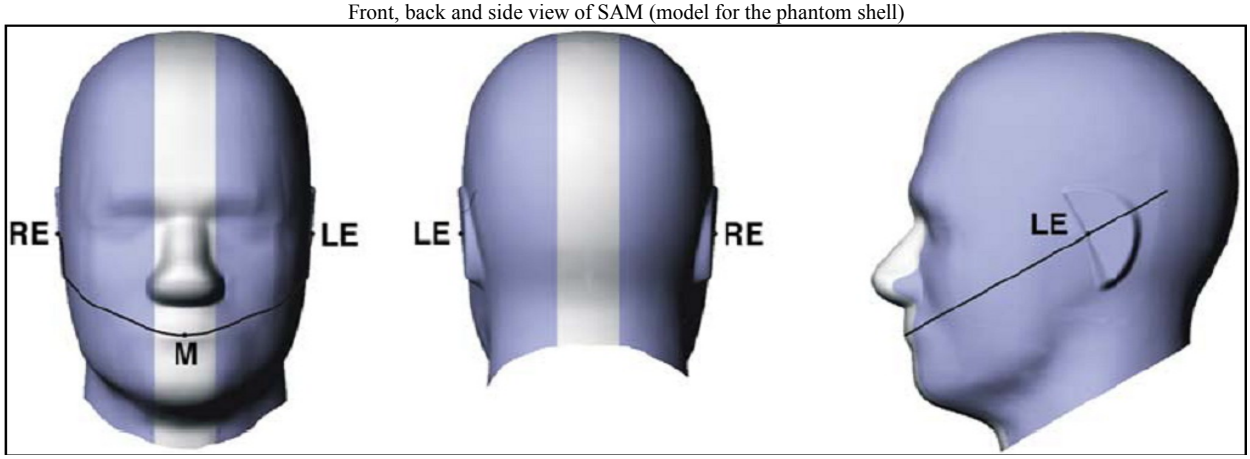


Figure 7-1b
Close up side view of phantom showing the ear region

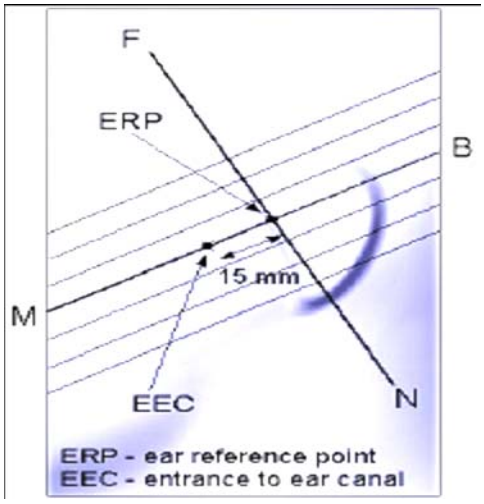


Figure 7-1b
Close up side view of phantom showing the ear region

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

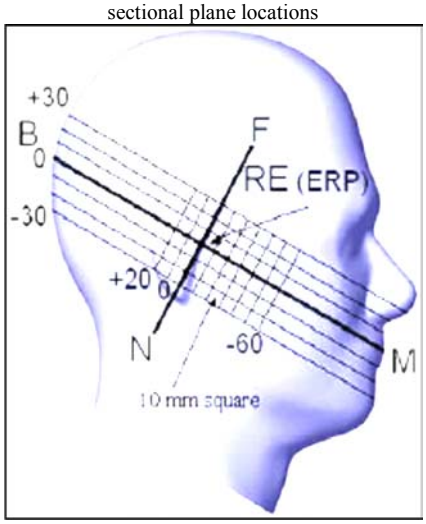


Figure 7-1c
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations

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.

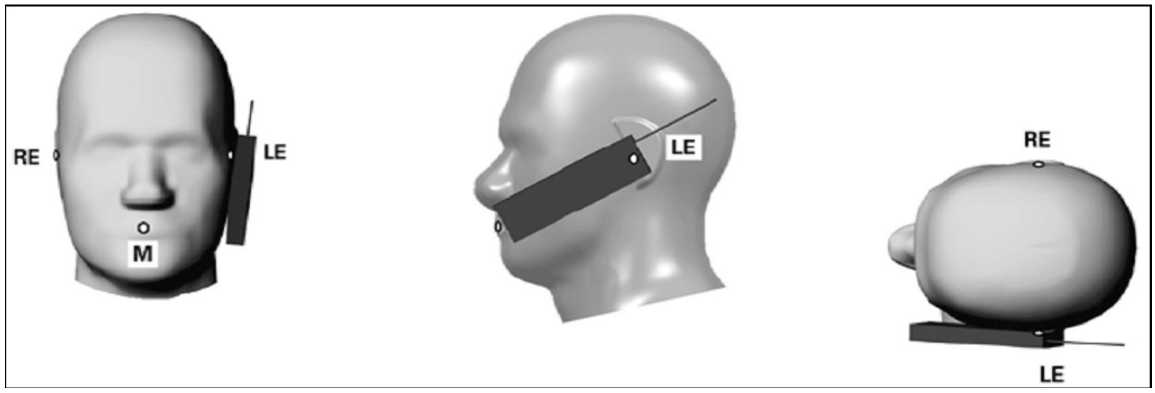


Figure 7.2c
Phone "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

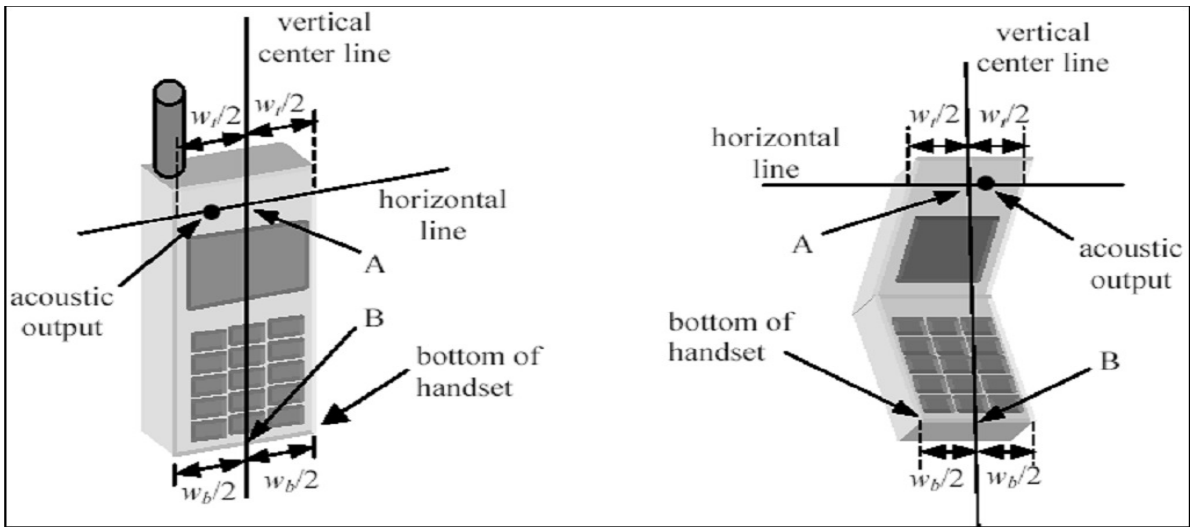


Figure 7.2a Figure 7.2b

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).

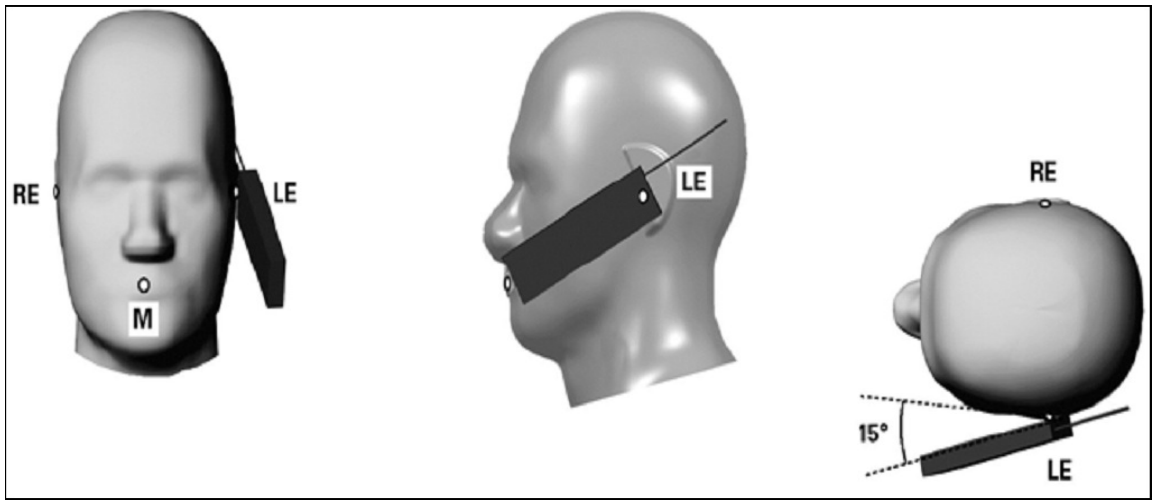


Figure 7-3
Phone "tilted" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

9. MEASUREMENT RESULTS

9.1 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

IEEE P1528 Recommended Reference Value

Frequency (MHz)	1 g SAR	10 g SAR	Local SAR at surface (Above feed point)	Local SAR at surface (y=2cm offset from feed point)
300	3.0	2.0	4.4	2.1
450	4.9	3.3	7.2	3.2
835	9.5	6.2	14.1	4.9
900	10.8	6.9	16.4	5.4
1450	29.0	16.0	50.2	6.5
1800	38.1	19.8	69.5	6.8
1900	39.7	20.5	72.1	6.6
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: 3554 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.

SYSTEM PERFORMANCE CHECK RESULTS

Dipole: D1900V2 SN: 5d056
Date: Feb. 23, 2005
Ambient condition: Temperature 24.8°C; Relative humidity: 58%

Head Simulatinf Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
1900.00	23.80	15.00	Permitivity:	40.00	38.70	-3.25	±5
			Conductivity:	1.40	1.46	4.29	± 5
			1g SAR:	38.84	38.64	-0.51	± 5

Dipole: D1900V2 SN: 5d056
Date: Feb. 23, 2005
Ambient condition: Temperature 24.8°C; Relative humidity: 58%

Body Simulatinf Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth [cm]					
1900.00	23.80	15.00	Permitivity:	53.30	51.60	-3.19	±5
			Conductivity:	1.52	1.59	4.61	± 5
			1g SAR:	40.40	41.60	2.97	± 5

9.2 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	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

Date: Feb. 23, 2005

Ambient condition: Temperature: 24.8°C; Relative humidity: 58%

Head Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth (cm)					
1900 MHz	23.80	15.00	Permitivity:	40.00	38.70	-3.25	± 5
			Conductivity:	1.40	1.46	4.29	± 5

Date: Feb. 23, 2005

Ambient condition: Temperature: 24.8°C; Relative humidity: 58%

Body Simulating Liquid			Parameters	Target	Measured	Deviation[%]	Limited[%]
Frequency	Temp. [°C]	Depth (cm)					
1900 MHz	23.80	15.00	Permitivity:	53.30	51.60	-3.19	± 5
			Conductivity:	1.52	1.59	4.61	± 5

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 "R&S, model CMU 200" was used to program the EUT.

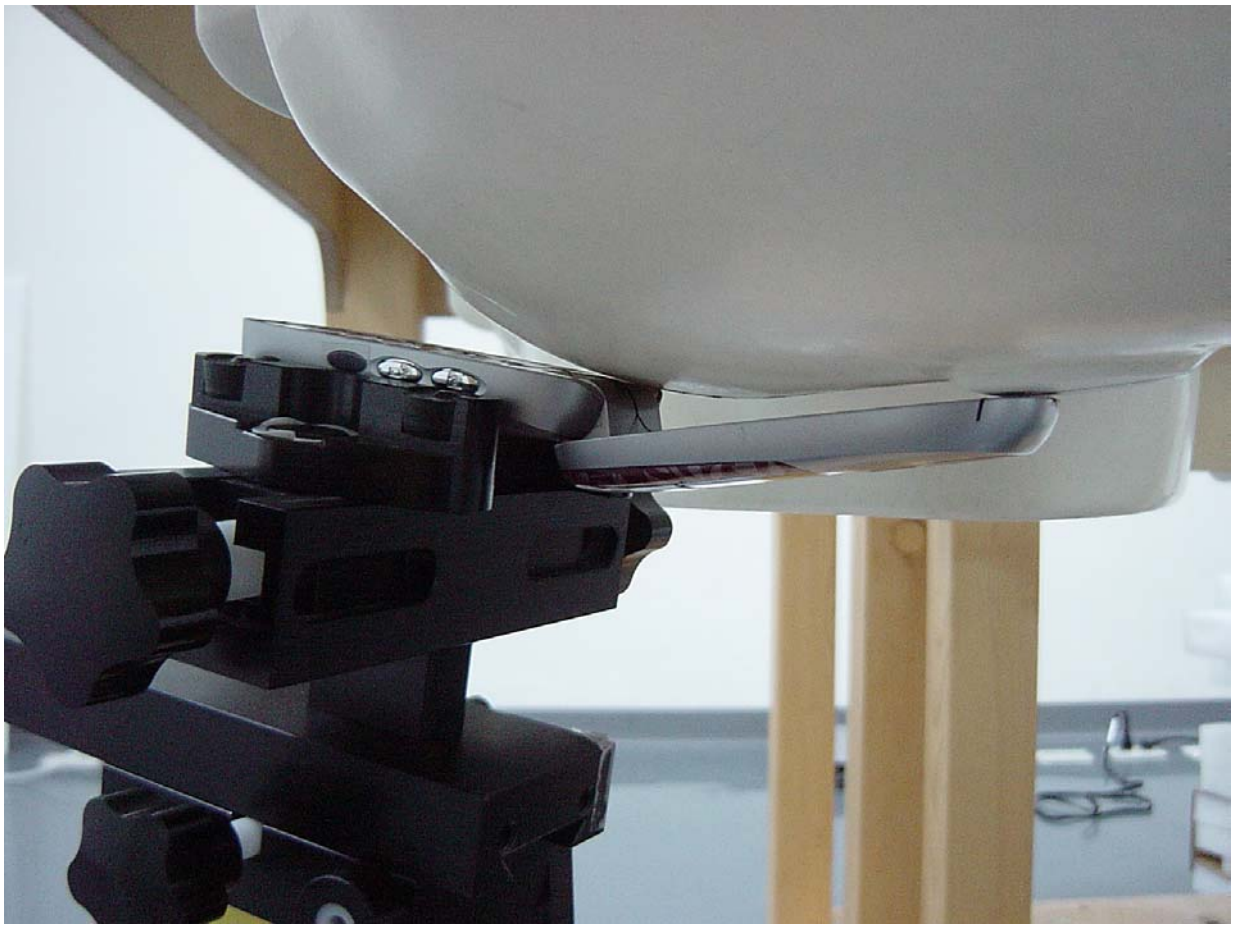
  GSM1900
  Network Support: *GSM only*
  Main Service: *Circuit Switched*
  Power Setting: *PCL: 0 (30dBm)*

  GPRS1900
  Network Support: *GSM + GPRS*
  Main Service: Packet data
  Class: 10

- Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurements, before and after the SAR measurements was done.

9.4 SAR MEASUREMENT RESULTS

Left head Cheek position

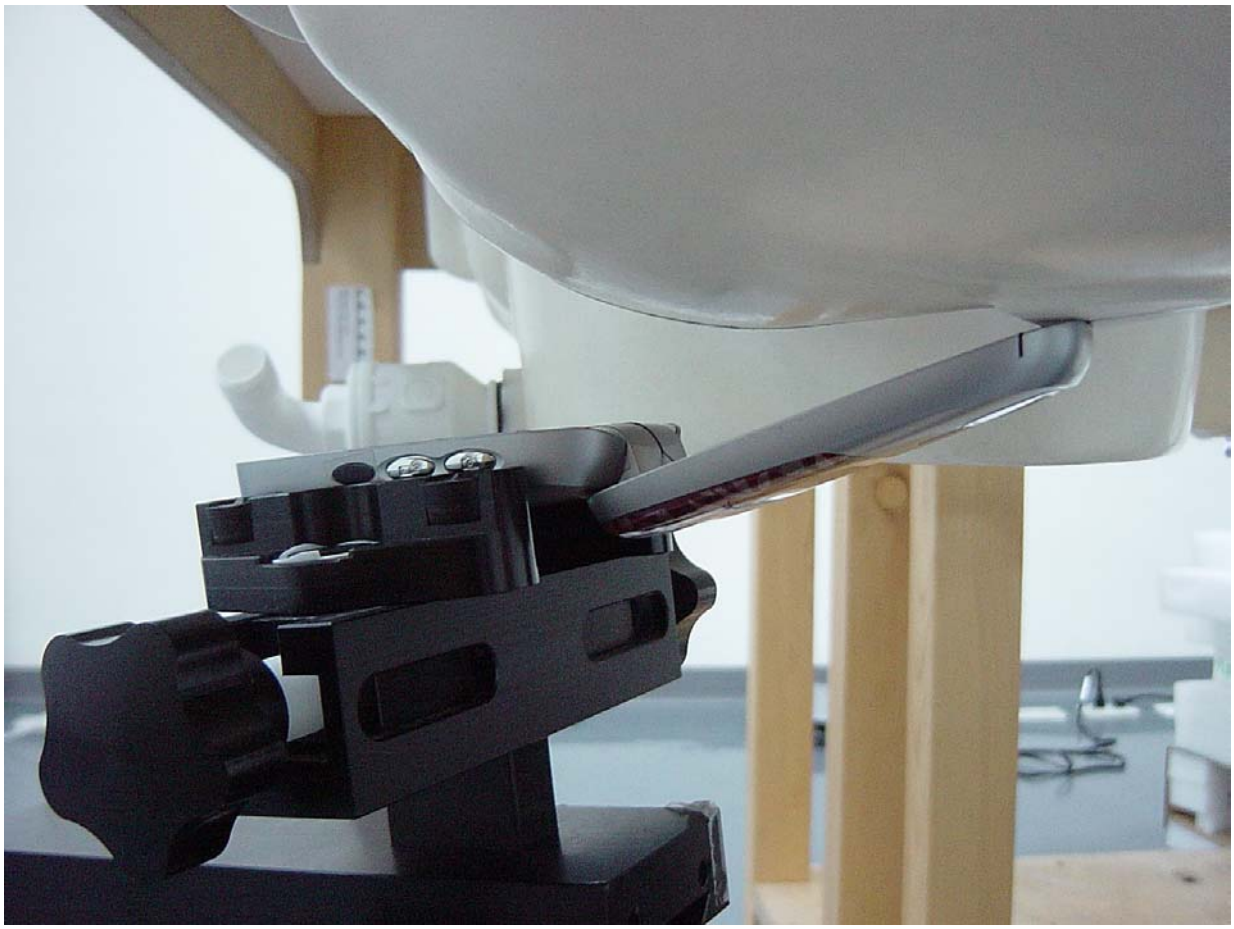


Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Left Cheek	Fixed	512	1850.2	30.82	30.78	23.8	0.719	1.6
		661	1880.0	31.01	30.97	23.8	0.712	
		810	1909.8	31.11	31.07	23.8	0.792	

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

Left head Tilted position



Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Left Tilted	Fixed	512	1850.2	30.81	30.77	23.8	0.583	1.6
		661	1880.0	31.02	30.98	23.8	0.567	
		810	1909.8	31.13	31.09	23.8	0.590	

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

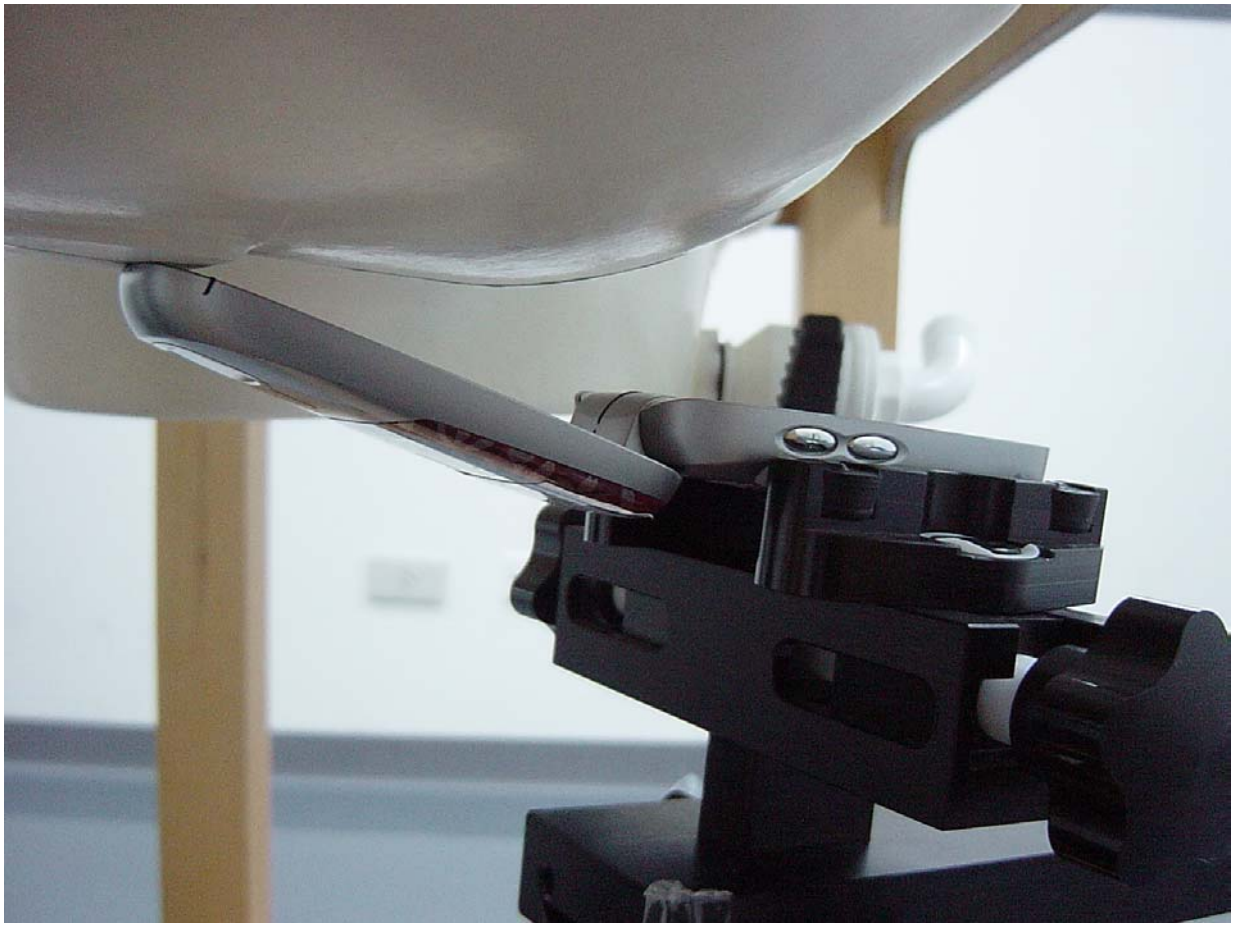
Right head Cheek position

Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Right Cheek	Fixed	512	1850.2	30.83	30.79	23.8	0.767	1.6
		661	1880.0	31.02	30.98	23.8	0.771	
		810	1909.8	**31.14**	31.09	23.8	**0.861**	

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

Right head Tilted position

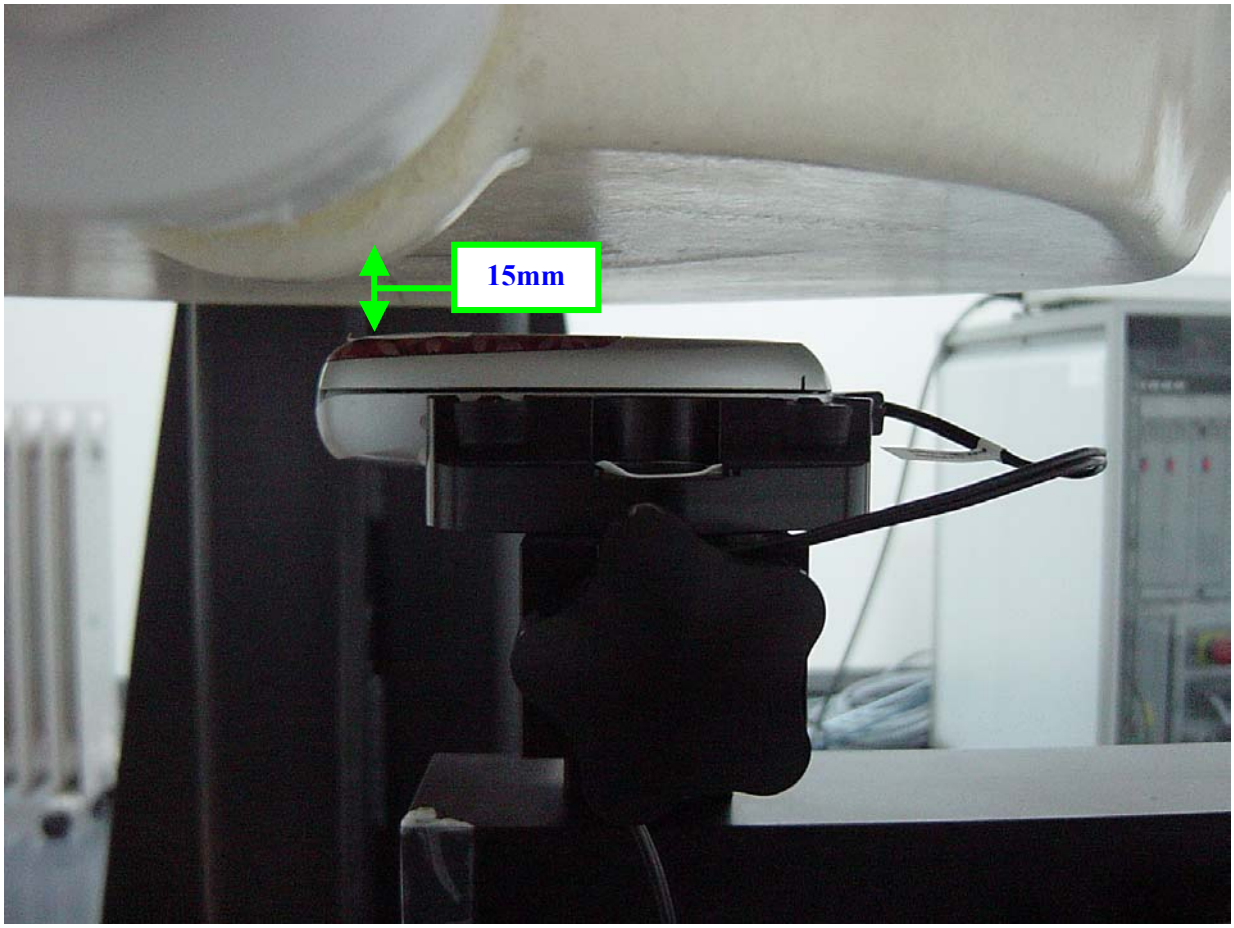


Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Right Tilted	Fixed	512	1850.2	30.82	30.78	23.8	0.619	1.6
		661	1880.0	31.03	30.99	23.8	0.595	
		810	1909.8	31.13	31.09	23.8	0.621	

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

Body position



Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

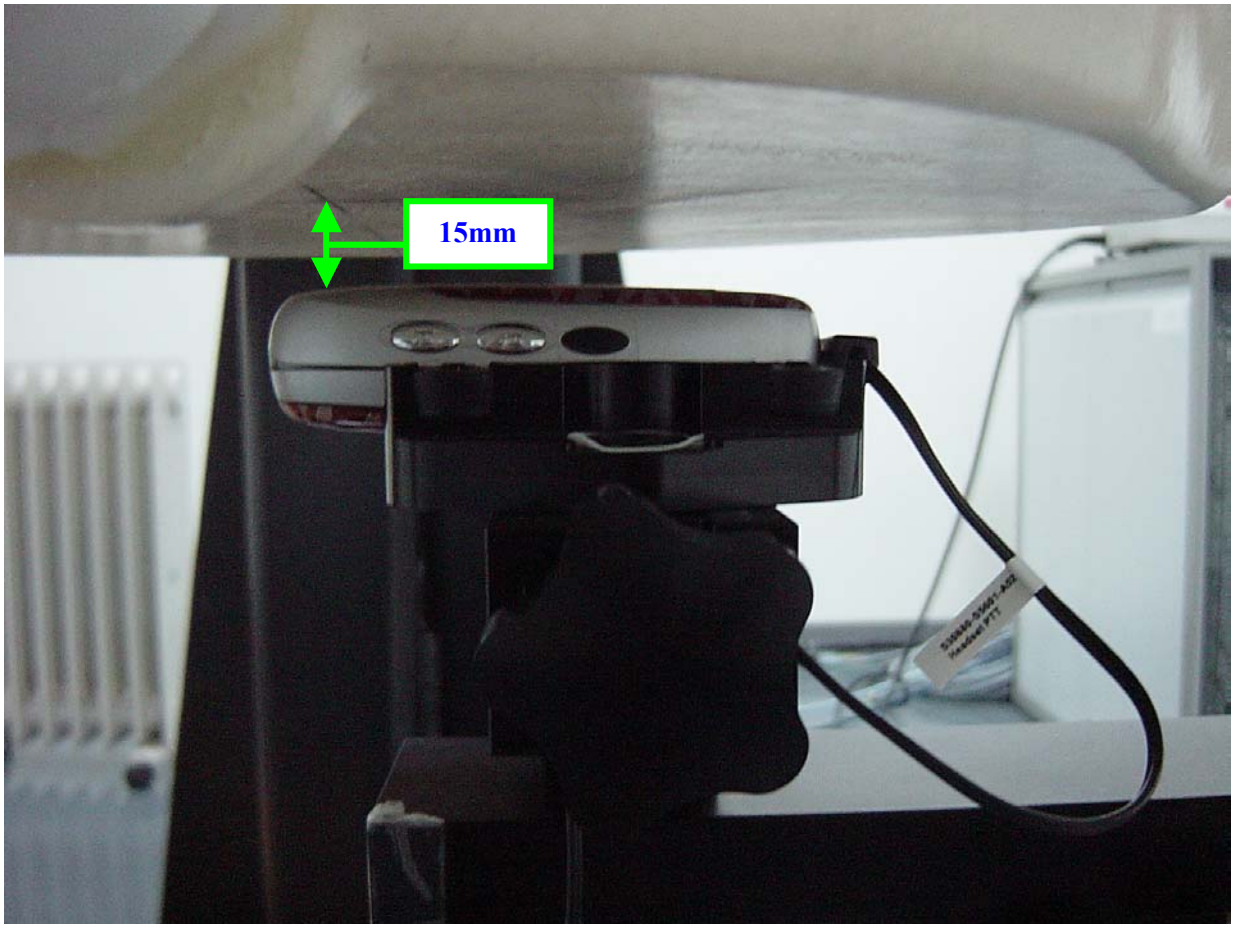
EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Body	Fixed	512	1850.2	30.82	30.78	23.8	0.152	1.6
		661	1880.0	31.01	30.97	23.8	0.155	
		810	1909.8	31.12	31.08	23.8	**0.188**	

Test mode: **GPRS1900**, Duty Cycle: 25%, Crest Factor: 4 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Body	Fixed	512	1850.2	30.81	30.77	23.8	0.238	1.6
		661	1880.0	31.01	30.98	23.8	0.256	
		810	1909.8	**31.13**	31.10	23.8	**0.306**	

Notes: 1. *: Average power
2. Front panel in parallel with flat phantom
3. Please refer to attachment for the result presentation in plot format.

Body position



Test mode: **GSM1900**, Duty Cycle: 12.5%, Crest Factor: 8 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Body	Fixed	512	1850.2	30.81	30.78	23.0	0.039	1.6
		661	1880.0	31.01	30.98	23.0	0.042	
		810	1909.8	31.11	31.09	23.0	0.050	

Test mode: **GPRS1900**, Duty Cycle: 25%, Crest Factor: 4 Depth of liquid: 15.0 cm

EUT Position	Antenna	Frequency		*Conducted Power dBm		Liquid Temp_°C	**SAR** (1g) (W/kg)	Limit (W/kg)
		Channel	MHz	Before	After			
Body	Fixed	512	1850.2	30.80	30.77	23.0	0.037	1.6
		661	1880.0	31.01	30.98	23.0	0.042	
		810	1909.8	31.11	31.09	23.0	0.063	

Notes: 1. *: Peak power
2. Bottom face in parallel with flat phantom
3. Please refer to attachment for the result presentation in plot format.

10. EUT PHOTOS

11. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Due
S-Parameter Network Analyzer	Agilent	E8358A	US40260243	05/24/05
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A
Power Meter	Boonton	4531	13061	07/12/05
Power Sensor	Boonton	56218	2240	07/12/05
Thermometer	Amarell	4046	25060	10/02/14
Thermometer	Amarell	4046	25058	12/03/14
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	1100.0008.02	N/A
Wireless Communication Test Set	Agilent	E5515C	GB44051665	24/05/05
Signal Generator	Agilent	83630B	3844A01022	01/14/05
Signal Generator	Agilent	E8257C	US42340383	08/01/05
Amplifier	Mini-Circuit	ZHL-1724HLN	N/A	N/A
Amplifier	Mini-Circuit	ZVE-8G	N/A	N/A
DC Power generator	ABM	8301HD	N/A	N/A
Data Acquisition Electronics (DAE)	SPEAG	DAE3	427	03/15/05
Data Acquisition Electronics (DAE)	SPEAG	DAE3	558	08/24/05
Dosimetric E-Field Probe	SPEAG	ET3DV6	1763	03/23/05
Dosimetric E-Field Probe	SPEAG	EX3DV4	3554	11/19/05
835 MHz System Validation Dipole	SPEAG	D835V2	4d015	12/09/06
900 MHz System Validation Dipole	SPEAG	D900V2	179	05/12/06
1800 MHz System Validation Dipole	SPEAG	D1800V2	2d062	03/17/06
1900 MHz System Validation Dipole	SPEAG	D1900V2	5d056	12/09/06
2450 MHz System Validation Dipole	SPEAG	D2450V2	728	03/22/06
5GHz System Validation Dipole	SPEAG	D5GHz	1004	10/04/05
Probe Alignment Unit	SPEAG	LB (V2)	348	N/A
Robot	Staubli	RX90B L	F02/5T69A1/A/01	N/A
SAM Twin Phantom V4.0	SPEAG	N/A	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A
Head / Muscle 835 MHz	CCS	H/M 835A	N/A	N/A
Head / Muscle 900 MHz	CCS	H/M 900A	N/A	N/A
Head / Muscle 1800 MHz	CCS	H/M 1800A	N/A	N/A
Head / Muscle 1900 MHz	CCS	H/M 1900A	N/A	N/A
Head / Muscle 2450 MHz	CCS	H/M 2450A	N/A	N/A
Head / Muscle 5800 MHz	CCS	H/M 5800A	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, Wu-Kung 6 Rd, Wu-Ku Hsiang, Wu-Ku Industrial District, Taipei Hsien, (248) Taiwan.

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

13. REFERENCES

[1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environ-mental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.

[2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commision, O_ce of Engineering & Technology, Washington, DC, 1997.

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-_eld scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.

[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.

[5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.

[6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-_eld probes in tissue simulating liquids at mobile communications frequencies", in ICECOM _ 97, Dubrovnik, October 15{17, 1997, pp. 120{124.

[8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-_eld probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172{175.

[9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard K. uhn, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions onMicrowave Theory and Techniques, vol. 44, no. 10, pp. 1865{1873, Oct. 1996.

[10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.

[11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[12] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992..Dosimetric Evaluation of Sample device, month 1998 9

[13] NIS81 NAMAS, \The treatment of uncertainity in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.

[14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

14. ATTACHMENTS

Exhibit	Content
1	System Performance Check Plots
2	SAR Test Plots

END OF REPORT