



**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**

**HSDPA/WCDMA/EDGE/GPRS/GSM 850/900/1800/1900/2100MHz Mobile Phone**

**Model No.: i-mobile i858**

**Trade Name: i-mobile**

**Test Report Number:**

**KS100409B01**

*Prepared for*

**YuHua TelTech (Shanghai) Co.,Ltd.**

4F/2, District B, No. 1000 Jinhai Road, Pudong 201206, Shanghai, P.R.  
China

*Issued by*

**Compliance Certification Services (Kunshan) Inc.**

No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part,  
Kunshan City, Jiangsu Province, P.R.China.

TEL: 86-512-57355888

FAX: 86-512-57370818

<http://www.ccsrf.com>



**Note:** This report shall not be reproduced except in full, without the written approval of  
Compliance Certification Services Inc. This document may be altered or revised by  
Compliance Certification Services Inc. personnel only, and shall be noted in the revision  
section of the document.



## TABLE OF CONTENTS

<b>1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION) .....</b>	<b>3</b>
<b>2. EUT DESCRIPTION .....</b>	<b>4</b>
<b>3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC .....</b>	<b>6</b>
<b>4. TEST METHODOLOGY .....</b>	<b>6</b>
<b>5. Test Configuration .....</b>	<b>6</b>
<b>6. DOSIMETRIC ASSESSMENT SETUP .....</b>	<b>6</b>
6.1 MEASUREMENT SYSTEM DIAGRAM .....	8
6.2 SYSTEM COMPONENTS .....	9
<b>7. EVALUATION PROCEDURES.....</b>	<b>11</b>
<b>8. MEASUREMENT UNCERTAINTY .....</b>	<b>15</b>
<b>9. EXPOSURE LIMIT .....</b>	<b>16</b>
<b>10. EUT ARRANGEMENT.....</b>	<b>17</b>
10.1ANTHROPOMORPHIC HEAD PHANTOM.....	17
10.2DEFINITION OF THE "CHEEK/TOUCH" POSITION.....	18
10.3DEFINITION OF THE "TILTED" POSITION .....	19
<b>11. MEASUREMENT RESULTS.....</b>	<b>20</b>
11.1TEST LIQUIDS CONFIRMATION.....	20
11.2SYSTEM PERFORMANCE CHECK.....	21
11.3EUT TUNE-UP PROCEDURES AND TEST MODE .....	24
11.4RF POWER OUTPUT FOR UMTS REL99 .....	25
11.5RF POWER OUTPUT FOR UMTS REL 5 HSDPA.....	26
11.6RF POWER OUTPUT FOR WI-FI .....	27
11.7KDB 648474 SAR HANDSETS MULTI XMITER ASSESSMENT.....	30
11.8EUT SETUP PHOTOS .....	31
11.9SAR MEASUREMENT RESULTS .....	33
<b>EUT PHOTO .....</b>	<b>42</b>
<b>12. EQUIPMENT LIST &amp; CALIBRATION STATUS.....</b>	<b>47</b>
<b>13. FACILITIES.....</b>	<b>48</b>
<b>14. REFERENCES .....</b>	<b>48</b>
<b>15. ATTACHMENTS.....</b>	<b>49</b>
<b>CONTENT.....</b>	<b>49</b>

**1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)**

<b>Product name:</b>	HSDPA/WCDMA/EDGE/GPRS/GSM850/900/1800/1900/2100MHz Mobile Phone
<b>Model No.:</b>	i-mobile i858
<b>Trade name:</b>	i-mobile
<b>Description:</b>	N/A
<b>Device Category:</b>	PORTABLE DEVICES
<b>Exposure Category:</b>	GENERAL POPULATION/UNCONTROLLED EXPOSURE
<b>Date of Test:</b>	April 16, 2010
<b>Applicant:</b>	YuHua TelTech (Shanghai) Co.,Ltd. 4F/2, District B, No. 1000 Jinhai Road, Pudong 201206, Shanghai, P.R. China
<b>Manufacturer:</b>	YuHua TelTech (Shanghai) Co.,Ltd. 4F/2, District B, No. 1000 Jinhai Road, Pudong 201206, Shanghai, P.R. China
<b>Application Type:</b>	Certification

<b>APPLICABLE STANDARDS AND TEST PROCEDURES</b>	
<b>STANDARDS AND TEST PROCEDURES</b>	<b>TEST RESULT</b>
FCC OET Bulletin 65 Supplement C and the following specific Test Procedures: o KDB 941225 D01 SAR test for 3G devices o KDB 248227 D01 SAR measurement procedures for 802.11 a/b/g transmitters o KDB 648474 D01 SAR evaluation considerations for handsets with multiple transmitters and antennas	Pass
<b>Deviation from Applicable Standard</b>	
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:

Miro Chueh  
EMC Manager  
Compliance Certification Services Inc.

Reviewed by:

Lin Zhang  
EMC Section Manager  
Compliance Certification Services Inc.

**2. EUT DESCRIPTION**

<b>Product</b>	HSDPA/WCDMA/EDGE/GPRS/GSM850/900/1800/1900/2100MHz Mobile Phone
<b>Model Number</b>	i-mobile i858
<b>Trade Name</b>	i-mobile
<b>FCC ID</b>	S2VTN100
<b>Description</b>	Test Sample is a: Production unit
<b>Frequency Range</b>	GSM / GPRS / EGPRS: 850: 824.2 ~ 848.8 MHz GSM / GPRS / EGPRS: 1900: 1850.2 ~ 1909.8 MHz WCDMA / HSDPA band V: 826.4 ~ 846.6 MHz WCDMA / HSDPA band II: 1852.4 ~ 1907.6 MHz 802.11b / g: 2412 ~ 2462 MHz Bluetooth: 2402 ~ 2483.5 MHz
<b>Operating Mode</b>	Maximum continuous output
<b>Transmit Power(Average)</b>	GSM850 Band: GSM 850: 32.82 dBm GPRS 850: 32.92 dBm EDGE850:27.46 dBm GSM1900 Band: GSM 850: 30.71 dBm GPRS 850: 29.22 dBm EDGE850:26.42 dBm WCDMA Band II: WCDMA band II: 24.16 dBm HSDPA band II: 22.30 dBm WCDMA Band V: WCDMA band V: 24.53 dBm HSDPA band V: 22.49 dBm WI-FI IEEE 802.11b:17.48 dBm WI-FI IEEE 802.11g:13.50 dBm Bluetooth:-0.15 dBm
<b>Max. SAR</b>	GSM 850: 0.612 W/kg GSM 1900: 0.913 W/kg WCDMA band V: 0.325 W/kg WCDMA band II: 0.903 W/kg WI-FI IEEE 802.11b:0.221 W/kg
<b>Modulation Technique</b>	GSM / GPRS : GMSK EDGE : 8PSK WCDMA: QPSK HSDPA : QPSK / 16QAM WI-FI 802.11b / 802.11g: WI-FI IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) WI-FI IEEE 802.11g: DSSS (CCK, DQPSK, DBPSK) + OFDM (QPSK, BPSK, 16-QAM, 64-QAM) Bluetooth:FHSS



<b>Accessories</b>	Battery: SKU/model number:BL-84 Li-poltmer 3.7V 1500mAh(5.6Wh)
<b>Antenna Specification</b>	GSM/GPRS / EDGE 850 MHz:1.85dBi GSM/GPRS / EDGE 1900 MHz: 2.99 dBi WCDMA band II: 1.85 dBi WCDMA band V: 2.99 dBi Wifi :1.00 dBi Bluetooth :1.00 dBi
<b>Antenna Type</b>	PIFA Antenna



### **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. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C the following specific FCC Test Procedures.

- o KDB 941225 D01 SAR test for 3G devices
- o KDB 248227 D01 SAR measurement procedures for 802.11 a/b/g transmitters
- o KDB 648474 D01 SAR evaluation considerations for handsets with multiple transmitters and antennas

### **5. TEST CONFIGURATION**

The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

Measurements were performed on the lowest, middle, and highest channel for each testing position.

For SAR testing, EUT is in GSM/GPRS/EDGE or WCDMA/HSDPA link mode. In GSM link mode, its crest factor is 8, In GPRS/EDGE link mode, its crest factor is 2, because EUT is set in GPRS/EDGE multi-slot class 12 with 4 uplink slots. In WCDMA/HSDPA link mode, its crest factor is 1.

### **6. DOSIMETRIC ASSESSMENT SETUP**

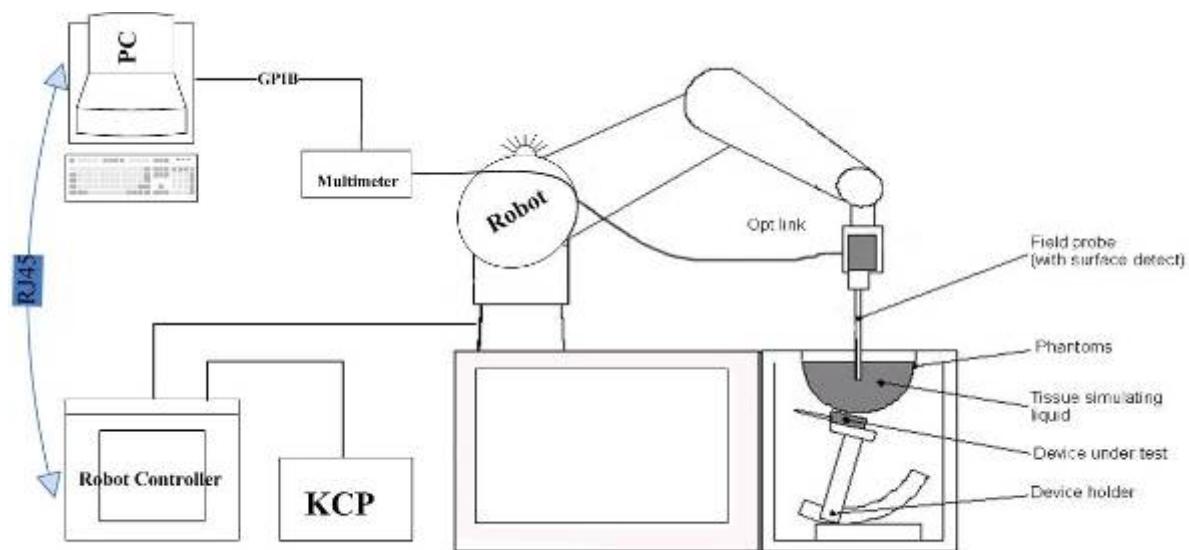
These measurements were performed with the automated near-field scanning system OPENSAR from ATTENNESSA. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than  $\pm 0.02$  mm. Special E- and H-field 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 EP100 1109 (manufactured by SATIMO), 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  $\pm 10\%$ . The spherical isotropy was evaluated with the procedure described in [8] and found to be better than  $\pm 0.25$  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

## 6.1 MEASUREMENT SYSTEM DIAGRAM



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

1. A standard high precision 6-axis robot (KUKA) with controller and software.
2. KUKA Control Panel (KCP).
3. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
4. The functions of the PC plug-in card are to perform the time critical task such as signal filtering, surveillance of the robot operation fast movement interrupts.
5. A computer operating Windows 95.
6. OPENSAR software.
7. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.
8. The SAM phantom enabling testing left-hand right-hand and body usage.
9. The Position device for handheld EUT.
10. Tissue simulating liquid mixed according to the given recipes (see Application Note). System validation dipoles to validate the proper functioning of the system.

## 6.2 SYSTEM COMPONENTS

### SN11/09 EP100 Probe Specification

Construction Symmetrical design with triangular core  
Built-in optical fiber for surface detection System  
Built-in shielding against static charges  
Calibration in air from 100 MHz to 2.5 GHz  
In brain and muscle simulating tissue at frequencies of 835 MHz, 897MHz ,1747 MHz,1880 MHz,1950 MHz and 1.8 GHz (accuracy of  $\pm 8\%$ )  
Frequency 100 MHz to > 30GHz; Linearity:  $\pm 0.25$  dB (100 MHz to 30 GHz)  
Directivity  $\pm 0.25$  dB in brain tissue (rotation around probe axis)  
 $\pm 0.5$  dB in brain tissue (rotation normal probe axis)  
Dynamic 0.001W/kg to > 100 W/kg;  
Range Linearity:  $\pm 0.25$  dB  
Surface  $\pm 0.2$  mm repeatability in air and clear liquids  
Detection over diffuse reflecting surfaces  
Dimensions Overall length: 330 mm  
Tip length: 16 mm  
Body diameter: 8 mm  
Tip diameter: 6.5 mm  
Distance from probe tip to dipole centers: <2.7 mm  
Application General dosimetric up to 3 GHz  
Compliance tests of mobile phones  
Fast automatic scanning in arbitrary phantoms

The SAR measurements were conducted with the dosimetric probe SN11/09 EP100designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique, with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the KRC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The OPENSAR software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.



Inside View of  
SN11/09 EP100 E-field  
Probe

### E-Field Probe Calibration Process

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

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

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

### SAM Phantom

The SAM Phantom SAM29 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC EN62209-1. The phantom enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid.

Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness:  $2 \pm 0.2$  mm

Filling Volume: Approx. 25 liters

Dimensions (H x L x W): 810 x 1000 x 500 mm



SAM Phantom

### Device Holder for Transmitters

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

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



## 7. EVALUATION PROCEDURES

### DATA EVALUATION

The OPENSAR4 post processing software 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	$\sigma$
	- Density	$\rho$

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 OPENSAR 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 (OPENSAR parameter)
	$dcp_i$	= Diode compression point (OPENSAR parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

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

H-field probes:

$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with	$V_i$	= Compensated signal of channel i (i = x, y, z)
	$Norm_i$	= Sensor sensitivity of channel i (i = x, y, z)
		$\mu\text{V}/(\text{V}/\text{m})^2$ for E0field Probes

$ConvF$  = Sensitivity enhancement in solution

$a_{ij}$  = Sensor sensitivity factors for H-field probes

$f$  = Carrier frequency (GHz)

$E_i$  = Electric field strength of channel i in V/m

$H_i$  = 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

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in g/cm<sup>3</sup>

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<sup>2</sup>

$E_{tot}$  = 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 OPENSAR 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 than 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 OPENSAR 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 OPENSAR4 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:

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

Since the decay of the boundary effect dominates for small probes ( $a \ll \lambda$ ), the cos-term can be omitted. Factors  $S_b$  (parameter Alpha in the OPENSAR software) and  $a$  (parameter Delta in the OPENSAR 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 OPENSAR 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 post processing.



## 8. MEASUREMENT UNCERTAINTY

### UNCERTAINTY EVALUATION FOR HANDSET SAR TEST

a	b	c	d	e= f(d,k)	f	g	h= cx <sub>f</sub> /e	i= cx <sub>g</sub> /e	k
Uncertainty Component	Sec.	Tol. (± %)	Prob. Dist.	Div.	c <sub>i</sub> (1 g)	c <sub>i</sub> (10 g)	1 g u <sub>i</sub> (± %)	10 g u <sub>i</sub> (± %)	v <sub>i</sub>
<b>Measurement System</b>									
Probe Calibration	E.2.1.	7	N	1	1	1	7	7	∞
Axial Isotropy	E.2.2.	2,5	R	$\sqrt{3}$	$(1-c_p)^{1/2}$	$(1-c_p)^{1/2}$	1,02062	1,02062	∞
Hemispherical Isotropy	E.2.2.	4	R	$\sqrt{3}$	$\sqrt{c_p}$	$\sqrt{c_p}$	1,63299	1,63299	∞
Boundary Effect	E.2.3.	1	R	$\sqrt{3}$	1	1	0,57735	0,57735	∞
Linearity	E.2.4.	5	R	$\sqrt{3}$	1	1	2,88675	2,88675	∞
System Detection Limits	E.2.5.	1	R	$\sqrt{3}$	1	1	0,57735	0,57735	∞
Readout Electronics	E.2.6.	0,02	N	1	1	1	0,02	0,02	∞
Response Time	E.2.7.	3	R	$\sqrt{3}$	1	1	1,73205	1,73205	∞
Integration Time	E.2.8.	2	R	$\sqrt{3}$	1	1	1,1547	1,1547	∞
RF Ambient Conditions	E.6.1.	3	R	$\sqrt{3}$	1	1	1,73205	1,73205	∞
Probe Positioner Mechanical Tolerance	E.6.2.	2	R	$\sqrt{3}$	1	1	1,1547	1,1547	∞
Probe Positioning with respect to Phantom Shell	E.6.3.	0,05	R	$\sqrt{3}$	1	1	0,02887	0,02887	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E.5.2.	5	R	$\sqrt{3}$	1	1	2,88675	2,88675	∞
<b>Test sample Related</b>									
Test Sample Positioning	E.4.2.1.	0,03	N	1	1	1	0,03	0,03	N-1
Device Holder Uncertainty	E.4.1.1.	5	N	1	1	1	5	5	N-1
Output Power Variation - SAR drift measurement	E.6.2.	3	R	$\sqrt{3}$	1	1	1,73205	1,73205	∞
<b>Phantom and Tissue Parameters</b>									
Phantom Uncertainty (shape and thickness tolerances)	E.3.1.	0,05	R	$\sqrt{3}$	1	1	0,02887	0,02887	∞
Liquid Conductivity - deviation from target values	E.3.2.	5	R	$\sqrt{3}$	0,64	0,43	1,84752	1,2413	∞
Liquid Conductivity - measurement uncertainty	E.3.3.	5	N	1	0,64	0,43	3,2	2,15	M
Liquid Permittivity - deviation from target values	E.3.2.	3	R	$\sqrt{3}$	0,6	0,49	1,03923	0,8487	∞
Liquid Permittivity - measurement uncertainty	E.3.3.	10	N	1	0,6	0,49	6	4,9	M
<b>Combined Standard Uncertainty</b>			RSS				11,1265	10,5799	
<b>Expanded Uncertainty (95% CONFIDENCE INTERVAL)</b>			k=2				21,8079	20,7366	



## 9. EXPOSURE LIMIT

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

Whole-Body	<u>Partial-Body</u>	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

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

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

## 10. EUT ARRANGEMENT

Please refer to IEEE P1528 illustration below.

### 10.1 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

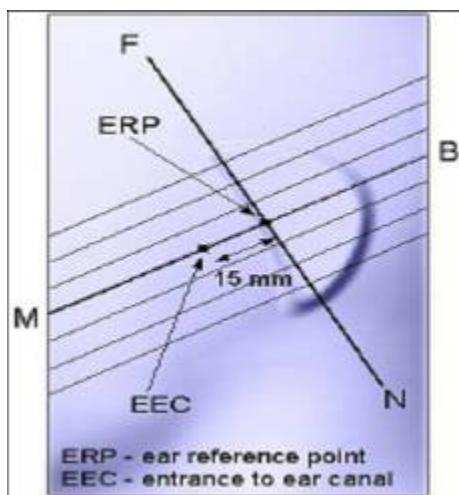


Figure 7-1b  
Close up side view of phantom showing the ear region

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

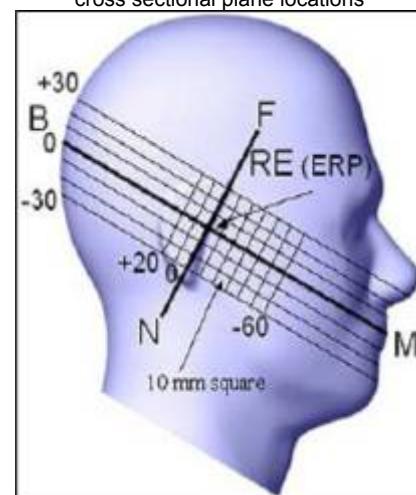


Figure 7-1c  
Side view of the phantom showing relevant markings and the 7 cross sectional plane locations

## 10.2 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. 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.

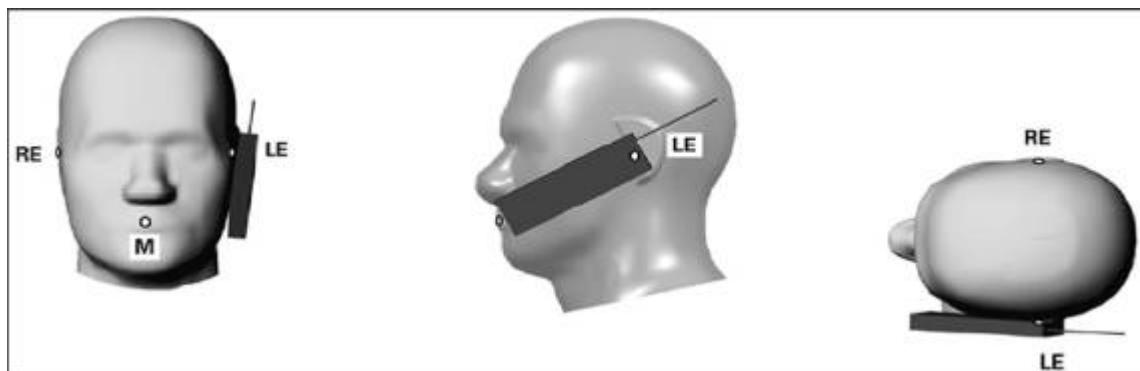


Figure 7.2c

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.

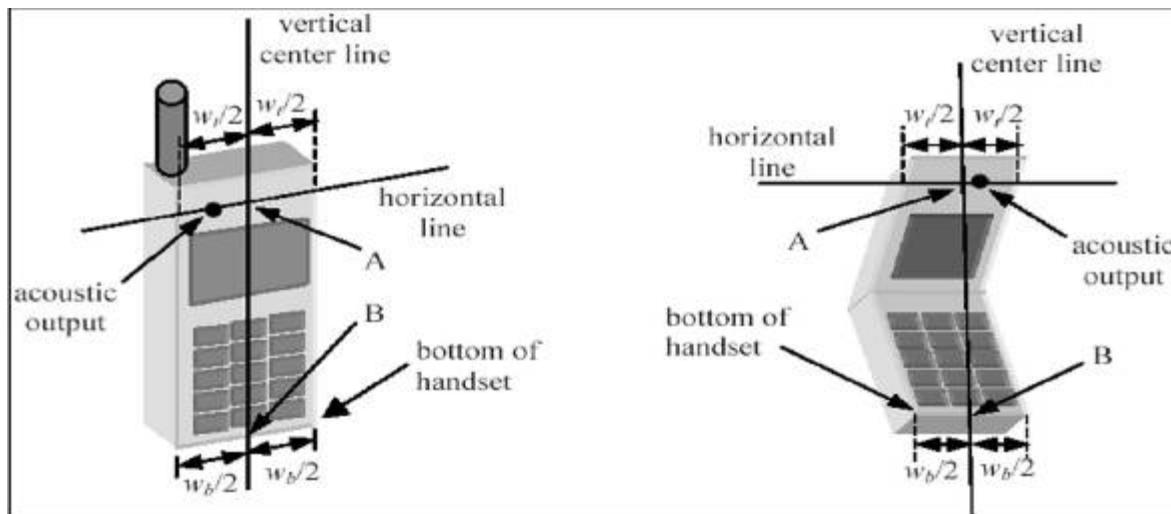


Figure 7.2a

Figure 7.2b

### 10.3 DEFINITION OF THE “TILTED” POSITION

The “tilted” position is defined as follows:

- Repeat steps (a) – (g) of 7.2 to place the device in the “cheek position.”
- 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.
- Rotate the handset around the horizontal line by 15 degrees.
- 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).

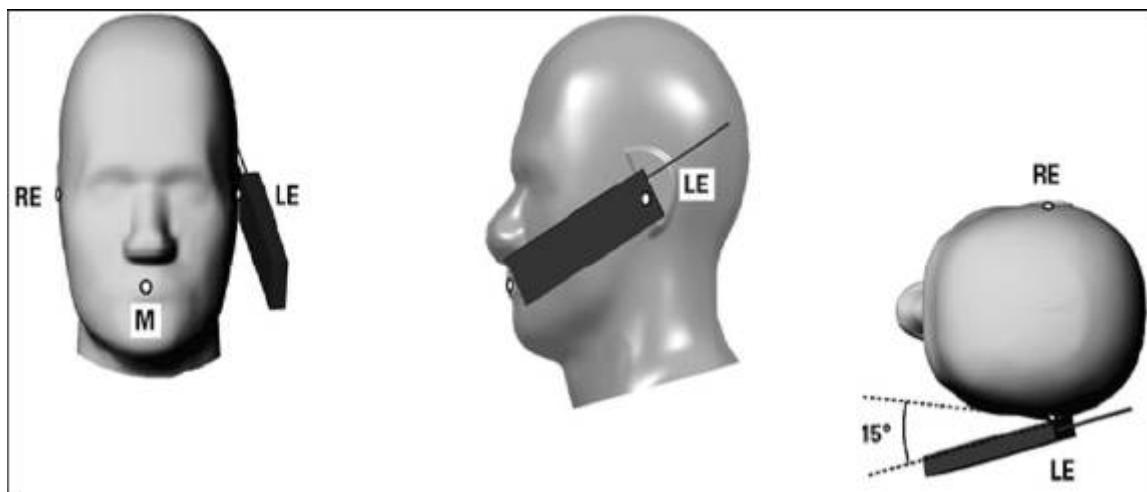


Figure 7-3

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.



## 11. MEASUREMENT RESULTS

### 11.1 TEST LIQUIDS CONFIRMATION

#### SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

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

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

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (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

( $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho = 1000$  kg/m<sup>3</sup>)

#### LIQUID MEASUREMENT RESULTS

Ambient condition: Temperature: 21 °C

Relative humidity: 58%

Liquid Type	Frequency	Temp. [°C]	Depth [cm]	Parameters	Target	Measured	Deviation[%]	Limited[%]	Measured Date
Head850	835 MHz	20	15	Permitivity	41.50	41.46	-0.1	± 5	April 16,2010
		20	15	Conductivity	0.90	0.924	2.67	± 5	April 16,2010
Body850	835 MHz	20	15	Permitivity	55.20	56.51	2.37	± 5	April 16,2010
		20	15	Conductivity	0.97	0.979	0.93	± 5	April 16,2010
Head1900	1950 MHz	20	15	Permitivity	40.00	40.211	0.53	± 5	April 16,2010
		20	15	Conductivity	1.40	1.441	2.71	± 5	April 16,2010
Body1900	1950 MHz	20	15	Permitivity	53.30	52.95	-0.66	± 5	April 16,2010
		20	15	Conductivity	1.52	1.49	-1.97	± 5	April 16,2010
Head2450	2450 MHz	20	15	Permitivity	39.20	40.41	3.09	± 5	April 16,2010
		20	15	Conductivity	1.80	1.86	3.33	± 5	April 16,2010
Body2450	2450 MHz	20	15	Permitivity	52.70	51.52	-2.24	± 5	April 16,2010
		20	15	Conductivity	1.95	1.97	1.03	± 5	April 16,2010



## 11.2 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  $\pm 10\%$ . The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

### 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 OPENSAR system with an E-field probe EP\_100 SN:1109 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 coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration ( $dx= 5$  mm,  $dy= 5$  mm,  $dz= 5$  mm).
- Distance between probe sensors and phantom surface was set to 2.5 mm.
- The dipole input power was  $1W \pm 3\%$ .
- The results are normalized to 1 W input power.

### Reference SAR values

The reference SAR values were using measurement results indicated in the dipole calibration document (see table below)

Frequency (MHz)	1g SAR	10g SAR	Local SAR at Surface (Above Feed Point)	Local SAR at Surface (y = 2cm offset from feed point)
835 Head	9.41	6.27	14.1	4.9
835 Body	9.79	6.63		
1950 Head	41.35	21.39	67.6	6.6
1950 Body	38.95	20.51		
2450 Head	53.49	24.46	104.2	7.7
2450 Body	50.22	23.04		

**SYSTEM PERFORMANCE CHECK RESULTS****Ambient conduction**Temperature: 21 °CRelative humidity: 58 %**System Validation Dipole:** DIPOLE850 SN:SN 48/05 DIPC32 **Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Head 835 MHz	20.00	15.00	1g SAR	9.41	9.55	1.49	± 10
			10g SAR	6.27	6.151	1.90	± 10

Temperature: 21 °CRelative humidity: 58 %**System Validation Dipole:** DIPOLE850SN:SN 48/05 DIPC32 **Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Body 835 MHz	20.00	15.00	1g SAR	9.79	9.683	-1.12	± 10
			10g SAR	6.63	6.545	1.28	± 10

Temperature: 21 °CRelative humidity: 58 %**System Validation Dipole:** DIPOLE1900 SN:SN 48/05 DIPI36 **Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Head 1950 MHz	20.00	15.00	1g SAR	41.35	40.212	2.75	± 10
			10g SAR	21.39	21.435	-0.21	± 10

Temperature: 21 °CRelative humidity: 58 %**System Validation Dipole:** DIPOLE1900 SN: SN 48/05 DIPI36 **Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Body 1950 MHz	20.00	15.00	1g SAR	38.95	38.978	-0.07	± 10
			10g SAR	20.51	20.722	-1.03	± 10

Temperature: 21 °CRelative humidity: 58%**Dipole:** DIPOLE2450 SN:SN 48/05 DIPJ37**Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Head 2450 MHz	20.00	15.00	1g SAR	53.49	51.22	-4.24	± 5
			10g SAR	24.46	23.726	3.00	± 5

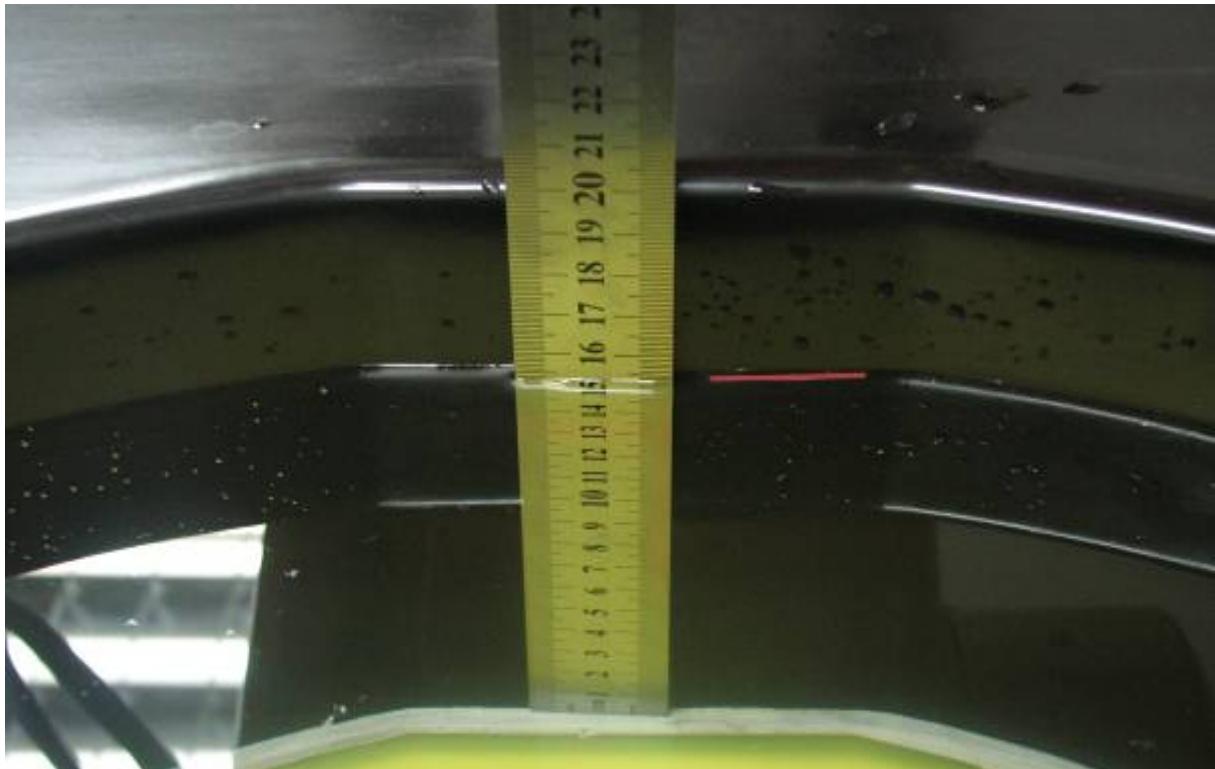
Temperature: 21 °CRelative humidity: 58%**Dipole:** DIPOLE2450 SN:SN 48/05 DIPJ37**Date:** April 16, 2010

Medium			Parameter	Target	Measured	Deviation (%)	Limit (%)
Type	Temp (°C)	Depth (± 0.5 cm)					
Body 2450 MHz	20.00	15.00	1g SAR	50.22	48.80	-2.83	± 5
			10g SAR	23.04	22.564	2.07	± 5

### 11.3 EUT TUNE-UP PROCEDURES AND TEST MODE

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

- o The client supplied a special driver to program the EUT, allowing it to continually transmit the specified maximum power and change the channel frequency.
- o The conducted power was measured at the high, middle and low channel frequency before and after the SAR measurement.
- o During SAR test, the highest output channel per band measured first.
- o the depth of Liquid must above 15cm.





## 11.4 RF POWER OUTPUT FOR UMTS REL99

The following 4 Sub-tests were completed according to procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel99
	Subtest	-
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	HSDPA FRC	Not Applicable
	HSUPA Test	Not Applicable
	Power Control Algorithm	Algorithm2
	$\beta_c$	Not Applicable
	$\beta_d$	Not Applicable
	$\beta_{ec}$	Not Applicable
	$\beta_c/\beta_d$	8/15
	$\beta_{hs}$	Not Applicable
	$\beta_{ed}$	Not Applicable

### Results

#### Rel 99 (12.2kps RMC)

Band	UL Ch	DL Ch	Frequency	Conducted output power (dBm)
				Average
UMTS1900 (Band II)	9262	9662	1852.4	<b>24.53</b>
	9400	9800	1880	23.57
	9538	9938	1907.6	23.96
UMTS850 (Band V)	4132	4357	826.4	23.94
	4182	4407	836.4	23.96
	4233	4458	846.6	<b>24.16</b>



## 11.5 RF POWER OUTPUT FOR UMTS REL 5 HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	Rel5 HSDPA	Rel5 HSDPA	Rel5 HSDPA	Rel5 HSDPA
	Subtest	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	HSUPA Test	Not Applicable			
	Power Control Algorithm	Algorithm 2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	$\beta_{ec}$	-	-	-	-
	$\beta_c/\beta_d$	2/15	12/15	15/8	15/4
HSDPA Specific Settings	$\beta_{hs}$	4/15	24/15	30/15	30/15
	$\beta_{ed}$	Not Applicable			
	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
CQI Feedback (Table 5.2B.4)		4ms			
CQI Repetition Factor (Table 5.2B.4)		2			
$A_{hs} = \beta_{hs}/\beta_c$		30/15			

### Results

#### Rel 5 HSDPA

Band	Subtest	UL Ch	DL Ch	Frequency	Conducted output power (dBm)
					Average
UMTS1900 (Band II)	1	9262	9662	1852.4	<b>24.53</b>
		9400	9800	1880.0	23.57
		9538	9938	1907.6	23.96
	2	9262	9662	1852.4	24.51
		9400	9800	1880.0	23.43
		9538	9938	1907.6	23.85
	3	9262	9662	1852.4	24.33
		9400	9800	1880.0	23.25
		9538	9938	1907.6	23.61
	4	9262	9662	1852.4	24.42
		9400	9800	1880.0	23.31
		9538	9938	1907.6	23.75
UMTS850 (Band V)	1	4132	4357	826.4	23.94
		4182	4407	836.4	23.96
		4233	4458	846.6	<b>24.16</b>
	2	4132	4357	826.4	23.83
		4182	4407	836.4	23.86
		4233	4458	846.6	24.05
	3	4132	4357	826.4	23.66
		4182	4407	836.4	23.78
		4233	4458	846.6	23.95
	4	4132	4357	826.4	23.71
		4182	4407	836.4	23.83
		4233	4458	846.6	23.97

**11.6 RF POWER OUTPUT FOR WI-FI**

The cable assembly insertion loss of 21.5 dB (including 20 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS****802.11b**

Ch. No.	f (MHz)	Average Conducted power (dBm)
1	2412	17.48
6	2437	17.29
11	2462	16.15

**802.11g**

Ch. No.	f (MHz)	Average Conducted power (dBm)
1	2412	13.50
6	2437	13.29
11	2462	12.14



The respectively maximum output powers of each RF modes are as below:

#### Conducted output power (Average)(dBm)

GSM		GSM mode		GPRS mode		EDGE mode	
		before	after	before	after	before	after
GSM850	Ch 128	32.82	32.77	32.92	32.87	27.76	27.72
	Ch 190	32.51	32.47	32.62	32.57	27.46	27.43
	Ch 251	32.41	32.38	32.52	32.48	27.35	27.31
GSM		GSM mode		GPRS mode		EDGE mode	
		before	after	before	after	before	after
GSM1900	Ch 512	30.42	30.38	28.81	28.77	26.02	25.98
	Ch 661	30.62	30.58	29.11	29.07	26.31	26.27
	Ch 810	30.71	29.68	29.22	29.17	26.42	26.38

#### Conducted output power (Average)(dBm)

WCDMA		WCDMA mode		HSDPA mode	
		before	after	before	after
Band V	Ch 4132	24.53	24.49	22.49	22.45
	Ch 4182	23.57	23.53	22.47	22.43
	Ch 4233	23.96	23.92	22.43	22.40
WCDMA		WCDMA mode		HSDPA mode	
		before	After	before	after
Band II	Ch 9262	23.94	23.91	22.04	22.00
	Ch 9400	23.96	23.92	22.09	22.06
	Ch 9538	24.16	24.12	22.30	22.26

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

Mode	802.11b 1M		802.11g 6M	
	before test	after test	before test	after test
1(2412 MHz)	17.48	17.45	13.50	N/A SAR measurement is not required
6(2437 MHz)	17.29	17.25	13.29	
11(2462 MHz)	16.15	16.11	12.14	

Ps. (1)  $17.48 \text{ dBm} = 55.98 \text{ mW}$  is higher than  $24.5 \text{ mW}(60/\text{f})$ , so **802.11b stand-alone SAR is required**.

(2)  $13.50 \text{ dBm} = 22.39 \text{ mW}$  is less than  $24.5 \text{ mW}(60/\text{f})$ , so **802.11g stand-alone SAR is not required**.

#### Bluetooth output power (Average)(dBm)

Mode	DATA1 1M		DATA3 3M	
	before test	after test	before test	after test
2402 MHz	-0.69	N/A SAR measurement is not required	-3.28	N/A SAR measurement is not required
2441 MHz	-0.15		-2.72	
2480 MHz	-1.28		-3.87	

Ps. (1)  $-0.15 \text{ dBm} = 0.97 \text{ mW}$  is less than  $24.58 \text{ mW}(60/\text{f})$ , so **Bluetooth stand-alone SAR is not required**.



**Notice1:** According to KDB 648474, For Bluetooth module transmitter that does not transmit simultaneously with other transmitters and its output is  $\leq 60/f(\text{GHz}) \text{ mW}$  ( $-0.15 \text{ dBm} = 0.97 \text{ mW}$  is less than  $24.58 \text{ mW}(60/f)$ ), 1-g SAR evaluation is not required.

**Notice 2:** According to KDB 648474, For Wi-Fi module transmitter, the 802.11b output power  $> 60/f(17.48 \text{ dBm} = 55.98 \text{ mW}$  is higher than  $24.5 \text{ mW}(60/f)$ ), so 802.11b stand-alone SAR is required. the 802.11g output power  $> 60/f(13.50 \text{ dBm} = 22.39 \text{ mW}$  is less than  $24.5 \text{ mW}(60/f)$ ), so 802.11g stand-alone SAR is required.

	<i>GSM 850 head</i>	<i>GSM 850 body</i>	<i>GPRS 850 body</i>	<i>EDGE 850 body</i>
<b>GSM 850 SAR(worst)</b>	0.275	0.196	0.612	0.469
<b>802.11b SAR(worst)</b>	0.221	0.101	0.101	0.101
<b><math>\Sigma 1g\text{-SAR}</math></b>	0.496	0.297	0.713	0.570
<b>remark</b>	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)

	<i>GSM 1900 head</i>	<i>GSM 1900 body</i>	<i>GPRS 1900 body</i>	<i>EDGE 1900 body</i>
<b>GSM 1900 SAR(worst)</b>	0.913	0.181	0.852	0.643
<b>802.11b SAR(worst)</b>	0.221	0.101	0.101	0.101
<b><math>\Sigma 1g\text{-SAR}</math></b>	1.134	0.282	0.953	0.744
<b>remark</b>	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)

	<i>WCDMA band V head</i>	<i>WCDMA band V body</i>	<i>HSDPA band V body</i>	<i>WCDMA band II head</i>	<i>WCDMA band II body</i>	<i>HSDPA band II body</i>
<b>WCDMA SAR(worst)</b>	0.325	0.201	0.197	0.903	0.189	0.185
<b>802.11b SAR(worst)</b>	0.221	0.101	0.101	0.221	0.101	0.101
<b><math>\Sigma 1g\text{-SAR}</math></b>	0.546	0.302	0.298	1.124	0.290	0.286
<b>remark</b>	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)	Less than 1.6W/kg(limit)

	<i>head</i>	<i>body</i>
<b>Bluetooth SAR(worst)</b>	0.000	0.000

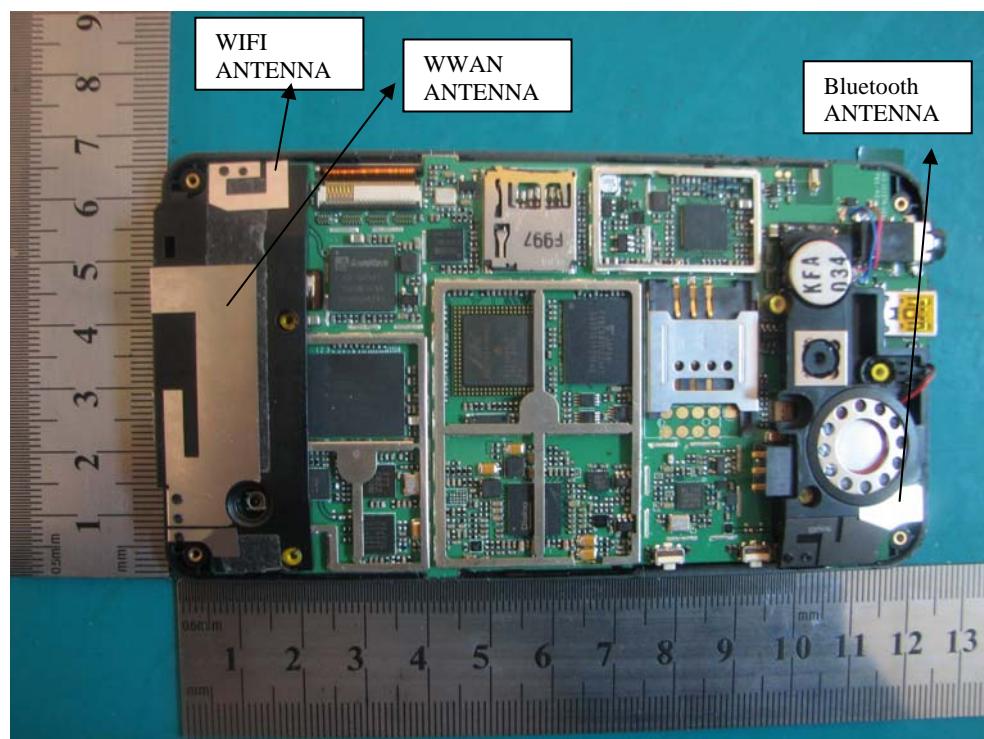
Described above,  $\Sigma 1g\text{-SAR} < 1.6 \text{ W/kg}$  so no Simultaneous Transmission SAR.

## 11.7 KDB 648474 SAR HANDSETS MULTI XMITER ASSESSMENT

EUT Description	(GSM/GPRS/EDGE/WCDMA/HSDPA) with 802.11 b/g and Bluetooth embedded.
Co-located Tx	<ul style="list-style-type: none"><li>WWAN can transmit simultaneously with 802.11g</li><li>WWAN can transmit simultaneously with Bluetooth</li><li>802.11g can transmit simultaneously with Bluetooth</li></ul>
Antenna Separation distances	<ul style="list-style-type: none"><li>8.0 cm - WWAN antenna-to-Bluetooth antenna</li><li>1.0 cm - WWAN antenna-to-WiFi (802.11g)</li><li>10.0 cm - Bluetooth antenna-to-WiFi (802.11g)</li></ul>
Highest 1-g SAR @ Right hand side touch position	<b>WWAN:</b> 0.688 mW/g; WiFi (802.11g): 0.148 mW/g The sum of the 1-g SAR: 0.836 (<1.6 mW/g)
Highest 1-g SAR @ Left hand side touch position	<b>WWAN:</b> 0.913 mW/g; WiFi (802.11g): 0.221 mW/g The sum of the 1-g SAR: 1.134 (<1.6 mW/g) <b>Bluetooth:</b> Conducted average power is below Pref/12mW, stand alone SAR evaluation is not required
Simultaneous TX SAR	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (Measure Simultaneous Transmission SAR with Volume Scans for All Required Antennas)

### CONCLUSION:

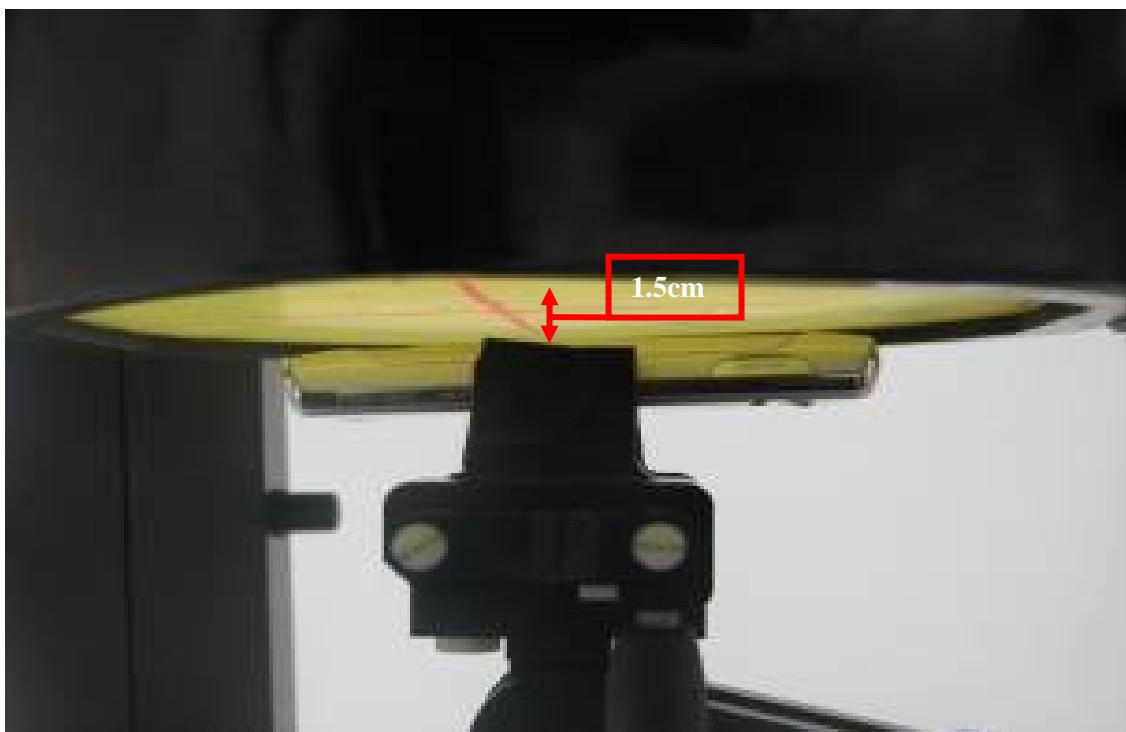
- Based upon KDB 628591 TCB exclusion list, smart phone with embedded 802.11 b/g radio and BT radios is not subject to TCB exclusion list.



## 11.8 EUT SETUP PHOTOS

### EUT Setup Configuration 1

the back side of the EUT in body position with GSM/WCDMA/Wi-Fi



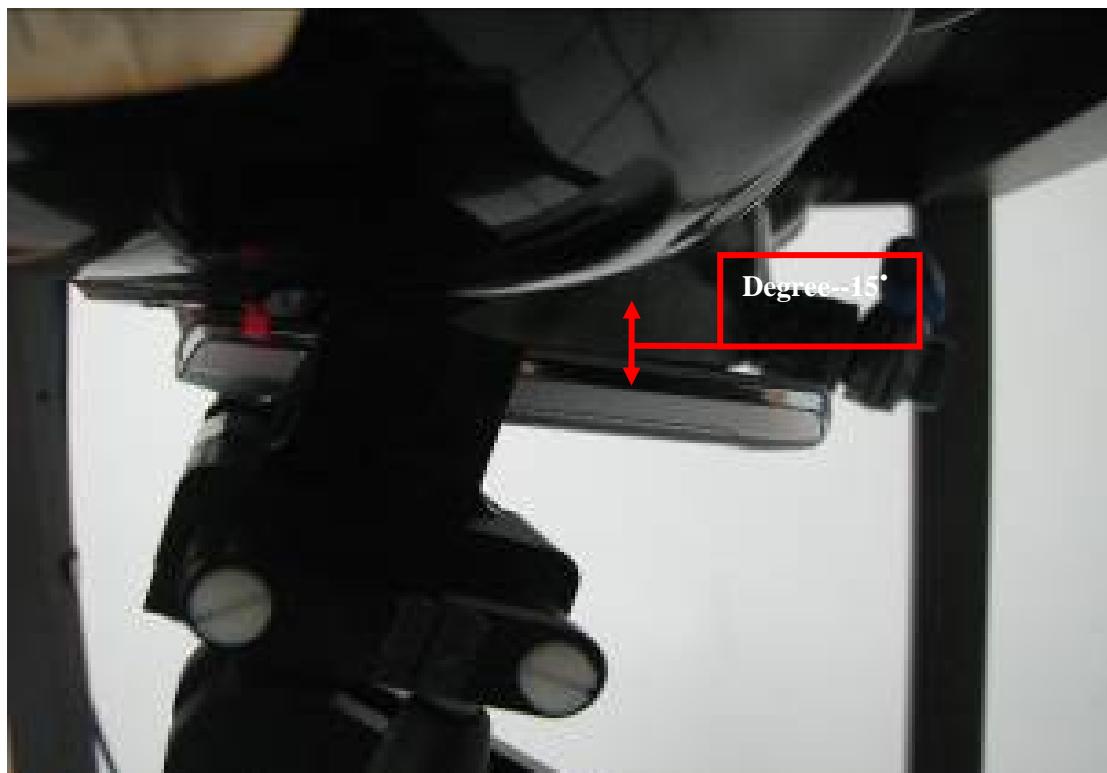
### EUT Setup Configuration 2

Cheek device with head phantom.

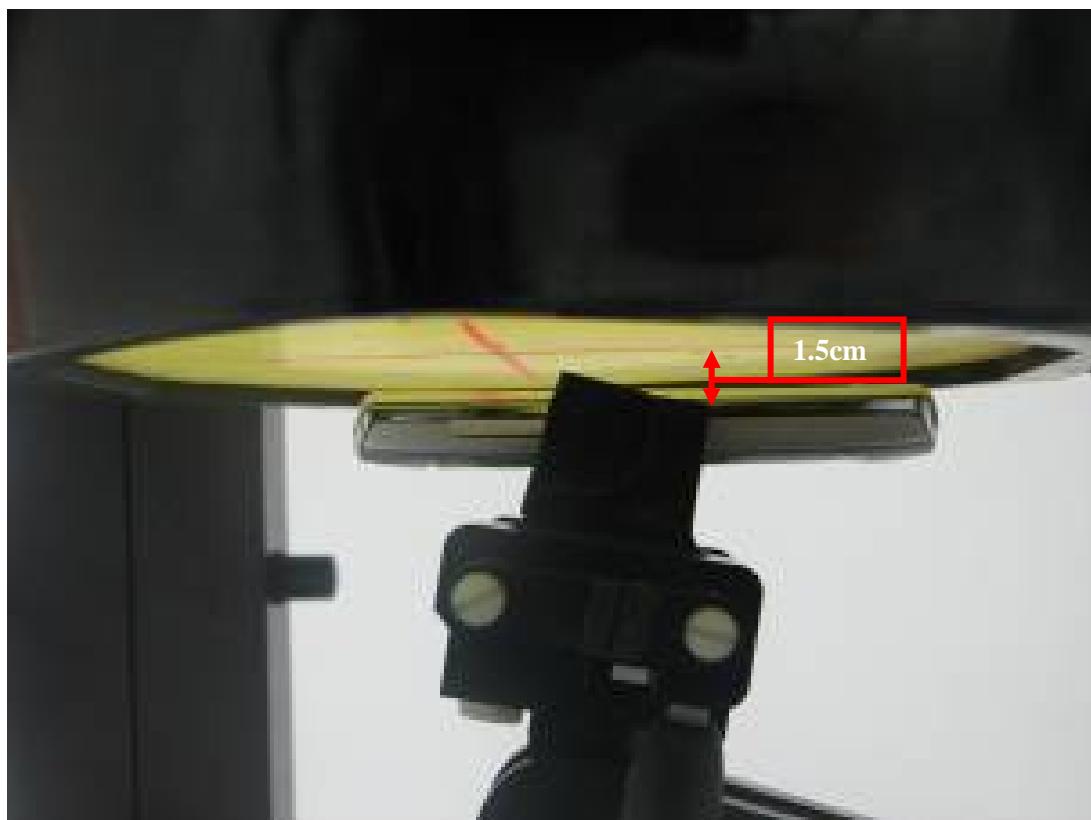


**EUT Setup Configuration 3**

Tilt device with head phantom.

**EUT Setup Configuration 4**

the back side of the EUT in body position with HSDPA/GPRS



**11.9 SAR MEASUREMENT RESULTS**

Date of Measurement: April 16, 2010

SAR Measurement GSM 850									
Crest Factor: <u>8</u> (Duty cycle: <u>12.5%</u> )						Depth of Liquid: <u>15.0</u> cm			
EUT Configuration 1									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
Flat (1.5cm)	Fixed	128	824.2	32.82	32.77	20.0	0.185	0.086	
		180	836.6	32.51	32.47	20.0	0.196	0.103	
		251	848.8	32.41	32.38	20.0	0.188	0.093	
EUT Configuration 2									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
cheek	Right head	Fixed	128	824.2	32.82	32.77	20.0	0.245	
			180	836.6	32.51	32.47	20.0	0.255	
			251	848.8	32.41	32.38	20.0	0.248	
	Left head	Fixed	128	824.2	32.82	32.77	20.0	0.266	
			180	836.6	32.51	32.47	20.0	0.275	
			251	848.8	32.41	32.38	20.0	0.260	
EUT Configuration 3									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
tilt	Right head	Fixed	128	824.2	32.82	32.77	20.0	0.142	
			180	836.6	32.51	32.47	20.0	0.163	
			251	848.8	32.41	32.38	20.0	0.150	
	Left head	Fixed	128	824.2	32.82	32.77	20.0	0.162	
			180	836.6	32.51	32.47	20.0	0.198	
			251	848.8	32.41	32.38	20.0	0.172	

Remarks: For SAR testing, EUT is in GSM link mode. In GSM850 link mode, its crest factor is 8. (Duty cycle: 1:8)



Date of Measurement: April 16, 2010

SAR Measurement GPRS 850 Class 12								
Crest Factor: <u>2</u> (Duty cycle: <u>50%</u> )						Depth of Liquid: <u>15.0</u> cm		
EUT Configuration 4								
EUT Setup Condition	Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before				
Flat (1.5cm)	Fixed	128	824.2	32.92	32.87	20.0	0.532	0.205
		180	836.6	32.62	32.57	20.0	0.612	0.222
		251	848.8	32.52	32.48	20.0	0.587	0.215

Remarks: For SAR testing, EUT is in GPRS link mode. In GPRS850 link mode, its crest factor is 2. (Duty cycle: 1:2)

Date of Measurement: April 16, 2010

SAR Measurement EDGE 850 Class 12								
Crest Factor: <u>2</u> (Duty cycle: <u>50%</u> )						Depth of Liquid: <u>15.0</u> cm		
EUT Configuration 4								
EUT Setup Condition	Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before	After			
Flat (1.5cm)	Fixed	128	824.2	27.76	27.72	20.0	0.456	0.189
		180	836.6	27.46	27.43	20.0	0.469	0.197
		251	848.8	27.35	27.31	20.0	0.461	0.192

Remarks: For SAR testing, EUT is in GPRS link mode. In GPRS850 link mode, its crest factor is 2. (Duty cycle: 1:2)



Date of Measurement: April 16, 2010

## SAR Measurement GSM 1900

Crest Factor: 8 (Duty cycle: 12.5%)Depth of Liquid: 15.0 cm

## EUT Configuration 1

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before	After				
Flat (1.5cm)	Fixed	512	1850.2	30.42	30.38	20.0	0.155	0.096	1.6
		661	1880.0	30.62	30.58	20.0	0.181	0.104	
		810	1910.0	30.71	29.68	20.0	0.170	0.170	

## EUT Configuration 2

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channel	MHz	Before	After					
cheek	Right_head	Fixed	512	1850.2	30.42	30.38	20.0	0.654	0.312	1.6
			661	1880.0	30.62	30.58	20.0	0.680	0.338	
			810	1910.0	30.71	29.68	20.0	0.664	0.320	
	Left_head	Fixed	512	1850.2	30.42	30.38	20.0	0.886	0.524	
			661	1880.0	30.62	30.58	20.0	0.913	0.589	
			810	1910.0	30.71	29.68	20.0	0.894	0.550	

## EUT Configuration 3

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channel	MHz	Before	After					
tilt	Right_head	Fixed	512	1850.2	30.42	30.38	20.0	0.294	0.117	1.6
			661	1880.0	30.62	30.58	20.0	0.299	0.123	
			810	1910.0	30.71	29.68	20.0	0.289	0.108	
	Left_head	Fixed	512	1850.2	30.42	30.38	20.0	0.332	0.104	
			661	1880.0	30.62	30.58	20.0	0.369	0.135	
			810	1910.0	30.71	29.68	20.0	0.345	0.124	

Remarks: For SAR testing, EUT is in GSM link mode. In GSM1900 link mode, its crest factor is 8. (Duty cycle: 1:8)



Date of Measurement: April 16, 2010

SAR Measurement GPRS 1900 Class 12								
Crest Factor: <u>2</u> (Duty cycle: <u>50%</u> )				Depth of Liquid: <u>15.0</u> cm				
<b>EUT Configuration 4</b>								
EUT Setup Condition	Frequency		Conducted Power (dBm)	Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channel	MHz	Before	After			
<b>Flat</b> (1.5cm)	Fixed	512	1850.2	28.81	28.77	20.0	0.832	0.611
		661	1880.0	29.11	29.07	20.0	0.852	0.634
		810	1910.0	29.22	29.17	20.0	0.841	0.621

Remarks: For SAR testing, EUT is in GPRS link mode. In GPRS 1900 link mode, its crest factor is 2. (Duty cycle: 1:2)

Date of Measurement: April 16, 2010

SAR Measurement EDGE 1900 Class 12								
Crest Factor: <u>2</u> (Duty cycle: <u>50%</u> )				Depth of Liquid: <u>15.0</u> cm				
<b>EUT Configuration 4</b>								
EUT Setup Condition	Frequency		Conducted Power (dBm)	Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channel	MHz	Before	After			
<b>Flat</b> (1.5cm)	Fixed	512	1850.2	26.02	25.98	20.0	0.624	0.401
		661	1880.0	26.31	26.27	20.0	0.643	0.425
		810	1910.0	26.42	26.38	20.0	0.635	0.412

Remarks: For SAR testing, EUT is in GPRS link mode. In GPRS 1900 link mode, its crest factor is 2. (Duty cycle: 1:2)



Date of Measurement: April 16, 2010

SAR Measurement WCDMA BAND V									
Crest Factor: <u>1</u> (Duty cycle: <u>100%</u> )					Depth of Liquid: <u>15.0</u> cm				
EUT Configuration 1									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After	20.0	0.186	0.091	
Flat (1.5cm)	Fixed	4132	826.4	24.53	24.49				
		4182	836.4	23.57	23.53				
		4233	846.6	23.96	23.92				
EUT Configuration 2									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After	20.0	0.244	0.112	
cheek	Righthead	Fixed	4132	826.4	24.53	24.49			
			4182	836.4	23.57	23.53			
			4233	846.6	23.96	23.92			
	Left_head	Fixed	4132	826.4	24.53	24.49	20.0	0.271	
			4182	836.4	23.57	23.53			
			4233	846.6	23.96	23.92			
EUT Configuration 3									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Chann el	MHz	Before	After	20.0	0.144	0.081	
tilt	Righthead	Fixed	4132	826.4	24.53	24.49			
			4182	836.4	23.57	23.53			
			4233	846.6	23.96	23.92			
	Left_head	Fixed	4132	826.4	24.53	24.49	20.0	0.164	
			4182	836.4	23.57	23.53			
			4233	846.6	23.96	23.92			

Remarks: For SAR testing, EUT is in GSM link mode. In GSM850 link mode, its crest factor is1. (Duty cycle: 1:1)



Date of Measurement: April 16, 2010

## SAR Measurement HSDPA BAND V

Crest Factor: 1 (Duty cycle: 100%) Depth of Liquid: 15.0 cm

## EUT Configuration 4

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before	After				
<b>Flat (1.5cm)</b>	<b>Fixed</b>	4132	826.4	22.49	22.45	20.0	0.183	0.090	1.6
		4182	836.4	22.47	22.43	20.0	0.197	0.116	
		4233	846.6	22.43	22.40	20.0	0.189	0.094	

Remarks: For SAR testing, EUT is in GSM link mode. In GSM850 link mode, its crest factor is 1. (Duty cycle: 1:1)



Date of Measurement: April 16, 2010

SAR Measurement WCDMA BAND II									
Crest Factor: <u>1</u> (Duty cycle: <u>100%</u> )					Depth of Liquid: <u>15.0</u> cm				
EUT Configuration 1									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
Flat (1.5cm)	Fixed	9262	1852.4	23.94	23.91	20.0	0.161	0.098	
		9400	1880.0	23.96	23.92	20.0	0.189	0.111	
		9538	1907.6	24.16	24.12	20.0	0.179	0.101	
EUT Configuration 2									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
cheek	Righthead	Fixed	9262	1852.4	23.94	23.91	20.0	0.655	
			9400	1880.0	23.96	23.92	20.0	0.686	
			9538	1907.6	24.16	24.12	20.0	0.671	
	Left_head	Fixed	9262	1852.4	23.94	23.91	20.0	0.844	
			9400	1880.0	23.96	23.92	20.0	0.903	
			9538	1907.6	24.16	24.12	20.0	0.864	
EUT Configuration 3									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	
Position	Antenna	Channel	MHz	Before	After				
tilt	Righthead	Fixed	9262	1852.4	23.94	23.91	20.0	0.298	
			9400	1880.0	23.96	23.92	20.0	0.315	
			9538	1907.6	24.16	24.12	20.0	0.277	
	Left_head	Fixed	9262	1852.4	23.94	23.91	20.0	0.333	
			9400	1880.0	23.96	23.92	20.0	0.371	
			9538	1907.6	24.16	24.12	20.0	0.351	

Remarks: For SAR testing, EUT is in GSM link mode. In GSM850 link mode, its crest factor is 1. (Duty cycle: 1:1)



Date of Measurement: April 15, 2010

SAR Measurement	HSDPA BAND II
-----------------	---------------

Crest Factor: <u>1</u> (Duty cycle: <u>100%</u> )	Depth of Liquid: <u>15.0</u> cm
---	---------------------------------

<b>EUT Configuration 4</b>									
EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before	After				

Position	Antenna	Channel	MHz	Before	After	Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
<b>Flat (1.5cm)</b>	<b>Fixed</b>	9262	1852.4	22.04	22.00	20.0	0.158	0.097	1.6
		9400	1880.0	22.09	22.06	20.0	0.185	0.110	
		9538	1907.6	22.30	22.26	20.0	0.169	0.106	

Remarks: For SAR testing, EUT is in GSM link mode. In GSM850 link mode, its crest factor is 1. (Duty cycle: 1:1)



Date of Measurement: April 16, 2010

## SAR Measurement IEEE802.11b (WI-FI)

Crest Factor: 1 (Duty cycle: 100%)Depth of Liquid: 15.0 cm

## EUT Configuration 1

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)
Position	Antenna	Channel	MHz	Before	After				
Flat (1.5cm)	Fixed	1	2412	17.48	17.45	20.0	0.095	0.043	1.6
		6	2437	17.29	17.25	20.0	0.101	0.055	
		11	2462	16.15	16.11	20.0	0.099	0.046	

## EUT Configuration 2

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channe l	MHz	Before	After					
cheek	Righthead	Fixed	1	2412	17.48	17.45	20.0	0.112	0.068	1.6
			6	2437	17.29	17.25	20.0	0.130	0.073	
			11	2462	16.15	16.11	20.0	0.123	0.062	
cheek	Left_head	Fixed	1	2412	17.48	17.45	20.0	0.184	0.104	
			6	2437	17.29	17.25	20.0	0.194	0.112	
			11	2462	16.15	16.11	20.0	0.185	0.106	

## EUT Configuration 3

EUT Setup Condition		Frequency		Conducted Power (dBm)		Liquid Temp [°C]	SAR(1g) (W/kg)	SAR(10g) (W/kg)	Limit (W/kg)	
Position	Antenna	Channe l	MHz	Before	After					
tilt	Righthead	Fixed	1	2412	17.48	17.45	20.0	0.140	0.081	1.6
			6	2437	17.29	17.25	20.0	0.148	0.093	
			11	2462	16.15	16.11	20.0	0.143	0.085	
tilt	Left_head	Fixed	1	2412	17.48	17.45	20.0	0.203	0.111	
			6	2437	17.29	17.25	20.0	0.216	0.120	
			11	2462	16.15	16.11	20.0	0.221	0.124	

Remarks: For SAR testing, EUT is in WIFI link mode. In WIFI link mode, its crest factor is 1. (Duty cycle: 1:1)

**EUT PHOTO**











## 12. EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Due
P C	HP	PV 3.06GHz	375052-AA1	N/A
Signal Generator	Agilent	E8257C	MY43321570	12/11/2010
MultiMeter	Keithley	2000	1015843	05/01/2010
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	08/07/2010
Wireless Communication Test Set	R&S	CMU200	SN:B23-03291	06/17/2010
Power Meter	Agilent	E4416A	QB41292714	07/29/2010
E-field PROBE	ANTENNESSA	EP_100	SN1109	04/16/2010
DIPOLE 835	ANTENNESSA	DIPC32	SN 48/05	12/10/2010
DIPOLE 900	ANTENNESSA	DIPD33	SN 48/05	12/10/2010
DIPOLE 1800	ANTENNESSA	DIPF34	SN 48/05	12/10/2010
DIPOLE 1900	ANTENNESSA	DIPI36	SN 48/05	12/10/2010
DIPOLE 2450	ANTENNESSA	DIPJ37	SN 48/05	12/10/2010
POSITIONING DEVICE	ANTENNESSA	MSH_14	SN 41_05	N/A
DUMMY PROBE	ANTENNESSA	DP_12	SN 39_05	N/A
SAM PHANTOM	ANTENNESSA	SAM29	SN 41_05	N/A
PHANTON WOOD TABLE	ANTENNESSA	N/A	N/A	N/A
6 AXIS ROBOT	KUKA	KR3	846428	N/A
ROBOT KRC	KUKA	KCP2	01436	N/A
CHANNELS SCAN CARD	KEITHLEY	2000	2000-172-01B	N/A
PROBE/ROBOT POSITIONING DEVICE	ANTENNESSA	MSH14	SN 41_05	N/A
LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A

## 13. FACILITIES

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

No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

## 14. REFERENCES

- [1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental 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 Kastle, 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 uncertainty 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



## **15. ATTACHMENTS**

<b>Exhibit</b>	<b>Content</b>
1	System Validation Plots
2	SAR Test Plots
3	Dipole calibration report (850MHz/1900MHz)
4	E-field calibration report

**END OF REPORT**