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 TEST REPORT

For

Rugged Handheld Device

Trade Name: ADLINK TECHNOLOGY INC.

Model: IMX-2000

Issued to

ADLINK TECHNOLOGY INC.
9F, No.166 Jian Yi Road, Zhonghe District
New Taipei City 235,Taiwan

Issued by

Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,

New Taipei City 24891,

Taiwan. (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com.
Issued Date: 2013/01/25

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		2013/01/25		Initial Issue	ALL	Scott
02		2013/02/22		Change Equipment Under Test Name	1,5	Scott

Table of contents

1   Certificate of Compliance (SAR Evaluation)

Applicant	ADLINK TECHNOLOGY INC. 9F, No.166 Jian Yi Road, Zhonghe District New Taipei City 235,Taiwan
Equipment Under Test:	Rugged Handheld Device
Trade Name:	ADLINK TECHNOLOGY INC.
Model Number:	IMX-2000
Date of Test:	January 10 ~ January 18, 2013
Device Category:	PORTABLE DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Applicable Standards	
FCC	• FCC OET 65 Supplement C • IEEE 1528 2003 • KDB 447498 D01 General RF Exposure Guidance v05 • KDB 648474 D01 SAR Handsets Multi Xmiter and Ant v01r05 • KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01 • KDB 941225 D01 SAR Test for 3G Devices 3G-SAR • KDB 248227 D01 SAR measurement for 802 11 a b g v01r02
Limit	
1.6 W/kg	
Test Result	
Pass	

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in EN62311: 2008. 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: *Tested by:*

Alex Wu   Scott Hsu
Section Manager   SAR Engineer
Compliance Certification Services Inc.   Compliance Certification Services Inc.

2   EUT Description

Product	PAD Phone		
Trade Name	ADLINK TECHNOLOGY INC.		
Model Number	IMX-2000		
Transmitters	GSM & WCDMA		
	Wi-Fi & Bluetooth		
	802.11b: Direct Sequence Spread Spectrum(DSSS)		
	802.11g: Orthogonal Frequency Division Multiplexing (OFDM)		
Antenna Specification	WWAN	Brand name	HIGH TRANSFER WAVE Corporation
		Parts Number	AD01117-0100
		WWAN antenna: PIFA antenna	
	WLAN	Brand name	HIGH TRANSFER WAVE Corporation
		Parts Number	AD01117-0301
		WLAN antenna: PIFA antenna	

	Band	Avg. Burst Pwr.	Time Avg. Pwr.
Maximum Output Power	GSM850	32.5 dBm	23.5 dBm
	GPRS850		25.7 dBm
	EGPRS850		23.8 dBm
	GSM1900	30.1 dBm	21.1 dBm
	GPRS 1900		23.1 dBm
	EGPRS1900		22.3 dBm
	WCDMA Band V	22.5 dBm	
	HSDPA Band V	22.4 dBm	
	WCDMA Band II	23.2 dBm	
	HSDPA Band II	23.0 dBm	
	802.11b	11.1 dBm	
	802.11g	9.0 dBm	

FCC Rule Parts	Frequency Range	Highest Reported 1-g SAR
22H	824 - 849 MHz	Head: 0.233 W/kg (Left Cheek)
		Body: 0.296 W/kg (Edge3)
24E	1850 - 1910 MHz	Head: 0.151 W/kg (Right Cheek)
		Body: 1.131 W/kg (Edge3)
15.247	2412 - 2462 MHz	Body: 0.017 W/kg (Edge2)
Rechargeable Li-polymer Battery–alternate	Sample1 Brand: ADLINK Model: BI-AD900-3K9KAX Rating: 3.7V; 3900mAh	Sample2 Brand: ADLINK Model: BI-AD900-3KXKAX Rating: 3.7V; 3000mAh

Remark: *The sample selected for test was prototype that approximated to production product and was provided by manufacturer.*

# 3 Requirements for Compliance Testing Defined

3.1 Requirements for Compliance Testing Defined by the FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/kg for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992 [6]. According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

4 Dosimetric Assessment System

These measurements were performed with the automated near-field scanning system DASY4/DAST5 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: 3665 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE 1528 2003.

4.1 Measurement System Diagram
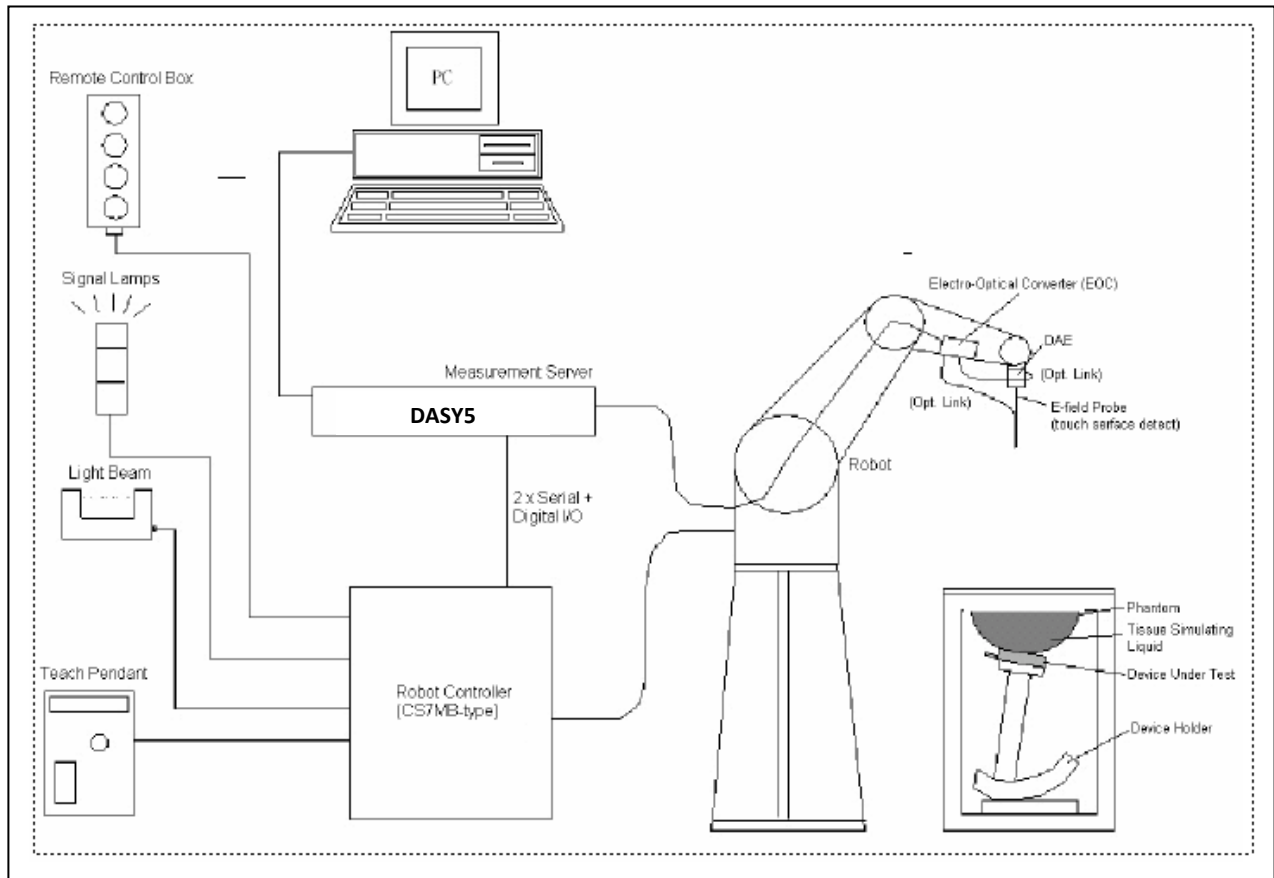
The DASY4/DASY5 system for performing compliance tests consists of the following items:

- 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/DASY5 software.

- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

- The SAM twin phantom enabling testing left-hand and right-hand usage.

- The device holder for handheld mobile phones.

- Tissue simulating liquid mixed according to the given recipes.

- Validation dipole kits allowing validating the proper functioning of the system.

4.2   System Components

DASY4/DASY5 Measurement Server

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

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

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

Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE4) 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 DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

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

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

Interior of probe

SAM Phantom (V4.0)

Construction:	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm
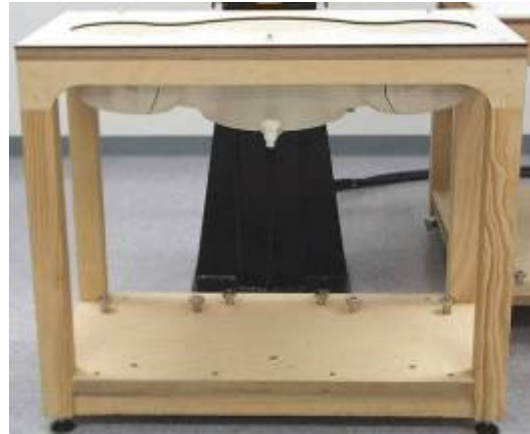
SAM Phantom (ELI4)

Construction:	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters
Dimensions: Major ellipse axis: 600 mm
Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

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

System Validation Kits for SAM Phantom (V4.0)

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

Frequency: 850, 1900, 2450, 5200, 5300, 5500, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)
Dimensions: D835V2: dipole length: 161 mm; overall height: 340 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
D2450V2: dipole length: 51.5 mm; overall height: 290 mm

System Validation Kits for ELI4 phantom

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: 850, 1900, 2450, 5200, 5300, 5500, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)
Dimensions: D835V2: dipole length: 161 mm; overall height: 340 mm
D1900V2: dipole length: 67.7 mm; overall height: 300 mm
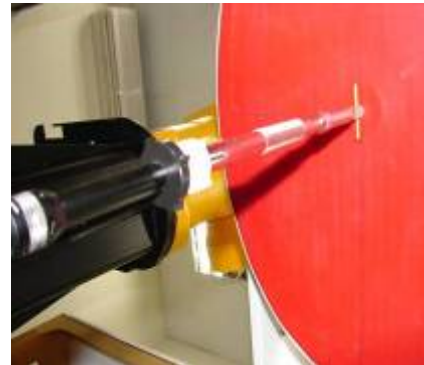D2450V2: dipole length: 51.5 mm; overall height: 290 mm

5   Evaluation Procedures

Data Evaluation

The DASY4/DASY5 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:

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

with
V_i	= Compensated signal of channel i	(i = x, y, z)
$Norm_i$	= Sensor sensitivity of channel i	(i = x, y, z)
	$\mu V/(V/m)^2$ 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 W/kg

       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 Measurement 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/DASY5 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, the grid resolution has to less than 15 mm by 15 mm at frequency ≤2GHz; the grid resolution has to less than 12mm by 12 mm at frequency between 2GHz to 4GHz; grid resolution has to less than 10 mm by 10 mm at frequency between 4GHz to 6GHz. according to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01)

- **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 points in accordance with the frequency can be divided into three parts. (1)The zoom scan volume was set to 5x5x7 points at frequency ≤ 2GHz. (2) The zoom scan volume was set to 7x7x7 points at frequency between 2GHz to 4GHz (3) The zoom scan volume was set to 7x7x12 points at frequency between 4GHz to 6GHz. The measures 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

- **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/DASY5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

    The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1528 2003 standard. It can be conducted for 1 g and 10 g.

The DASY4/DASY5 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.

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<<λ), the cos-term can be omitted. Factors S_b (parameter Alpha in the DASY4/DASY5 software) and a (parameter Delta in the DASY4/DASY5 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/DASY5 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.

6 Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\,(10g)}$	Std. Unc.(1-g)	$v_{i\ or\ Veff}$
Measurement System						
Probe Calibration (k=1)	6.00	Normal	1	1	6.00	∞
Probe Isotropy	7.60	Rectangular	$\sqrt{3}$	0.7	3.07	∞
Boundary Effect	0.65	Rectangular	$\sqrt{3}$	1	0.38	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	∞
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	∞
RF Ambient Conditions	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner Mechanical Tolerance	0.40	Rectangular	$\sqrt{3}$	1	0.23	∞
Probe Positioning with respect to Phantom Shell	2.90	Rectangular	$\sqrt{3}$	1	1.67	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Test sample Related						
Test sample Positioning	3.70	Normal	1	1	3.7	89
Device Holder Uncertainty	3.40	Normal	1	1	3.4	5
Output Power Variation - SAR drift measurement	5.00	Rectangular	$\sqrt{3}$	1	2.89	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	7.50	Rectangular	$\sqrt{3}$	1	4.33	∞
Liquid Conductivity - deviation from target values	4.14	Rectangular	$\sqrt{3}$	0.64	1.53	∞
Liquid Conductivity - measurement uncertainty	-4.02	Normal	1	0.64	-2.57	39
Liquid Permittivity - deviation from target values	3.92	Rectangular	$\sqrt{3}$	0.6	1.36	∞
Liquid Permittivity - measurement uncertainty	-4.99	Normal	1	0.6	-2.99	39
		RSS			11.75	611
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			**23.50%**	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			**1.83dB**	

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 Tissue Dielectric Properties

8.1 Test Liquid 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.

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE 1528 2003 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 IEEE 1528 2003 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE 1528 2003

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

8.2 Typical Composition of Ingredients for Liquid Tissue Phantoms

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

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

alt: 99[+]% Pure Sodium Chloride   Sugar: 98[+]% Pure Sucrose

Water: De-ionized, 16 MΩ[+] resistivity   HEC: Hydroxy thyl Cellulose

DGBE: 99[+]% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra-pure): Polyethylene glycol mono [4-(1, 1, 3, 3-tetramethylbutyl)phenyl]ether

8.3   Simulating Liquids Parameter Check Results

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (εr)	e''	σ	e' (εr)	σ	e' (εr)	σ	±5
2013/1/10	Head 900	824.2	42.47	18.85	0.86	41.56	0.90	2.20%	-4.02%	±5
		836.6	42.34	18.85	0.88	41.50	0.90	2.02%	-2.77%	±5
		848.8	42.17	18.84	0.89	41.50	0.91	1.62%	-2.82%	±5
2013/1/10	Head 900	880.2	41.73	18.82	0.92	41.50	0.95	0.56%	-2.97%	±5
		897.6	41.54	18.80	0.94	41.50	0.97	0.10%	-3.05%	±5
		914.8	41.36	18.79	0.95	41.50	0.98	-0.35%	-2.50%	±5
2013/1/11	Head 1900	1850.2	40.07	13.52	1.39	40.00	1.40	0.19%	-0.74%	±5
		1880.0	39.97	13.57	1.42	40.00	1.40	-0.07%	1.24%	±5
		1909.8	39.90	13.63	1.45	40.00	1.40	-0.26%	3.26%	±5
2013/1/11	Head 1900	1852.4	40.07	13.52	1.39	40.00	1.40	0.19%	-0.63%	±5
		1880.0	39.97	13.57	1.42	40.00	1.40	-0.07%	1.24%	±5
		1907.6	39.90	13.63	1.44	40.00	1.40	-0.26%	3.14%	±5
2013/1/14	Body 900	826.4	53.95	20.54	0.94	55.24	0.97	-2.32%	-2.72%	±5
		836.6	53.85	20.52	0.95	55.20	0.97	-2.45%	-1.78%	±5
		846.6	53.76	20.50	0.96	55.17	0.98	-2.55%	-1.95%	±5
2013/1/15	Body 1900	1850.2	50.79	14.40	1.48	53.30	1.52	-4.72%	-2.62%	±5
		1880.0	50.76	14.50	1.51	53.30	1.52	-4.77%	-0.39%	±5
		1909.8	50.64	14.53	1.54	53.30	1.52	-4.99%	1.43%	±5
2013/1/15	Body 1900	1852.4	50.78	14.41	1.48	53.30	1.52	-4.72%	-2.41%	±5
		1880.0	50.76	14.50	1.51	53.30	1.52	-4.77%	-0.39%	±5
		1907.6	50.65	14.53	1.54	53.30	1.52	-4.97%	1.29%	±5
2013/1/16	Body 900	824.2	54.25	20.65	0.95	55.24	0.97	-1.80%	-2.43%	±5
		836.6	54.16	20.63	0.96	55.20	0.97	-1.89%	-1.30%	±5
		848.8	54.02	20.60	0.97	55.16	0.99	-2.07%	-1.48%	±5
2013/1/16	Body 2450	2412.0	51.81	13.82	1.85	52.75	1.91	-1.78%	-3.21%	±5
		2437.0	51.75	13.93	1.89	52.72	1.94	-1.83%	-2.64%	±5
		2442.0	51.74	13.95	1.89	52.71	1.94	-1.84%	-2.60%	±5
		2462.0	51.70	14.02	1.92	52.68	1.97	-1.88%	-2.50%	±5
		2472.0	51.66	14.06	1.93	52.67	1.98	-1.91%	-2.57%	±5
2013/1/18	Body 1900	1852.4	51.69	14.61	1.50	53.30	1.52	-3.02%	-1.07%	±5
		1880.0	51.61	14.69	1.53	53.30	1.52	-3.18%	0.96%	±5
		1907.6	51.54	14.76	1.56	53.30	1.52	-3.30%	2.90%	±5

9   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. 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 Body simulating liquid of the following parameters.

- The DASY4/DASY5 system with an E-field probe EX3DV4 SN:3665 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=dy= 5 mm, dz= 5 mm).

- Distance between probe sensors and phantom surface was set to 3.0 mm.

- The dipole input power (forward power) was 100 mW±3%.

- The results are normalized to 1 W input power.

Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d015	03/14/2012	835	1g	9.44	9.53
				10g	6.16	6.28
D1900V2	5d056	02/22/2012	1900	1g	39.0	38.3
				10g	20.6	20.2
D2450V2	728	11/20/2012	2450	1g	53.1	51.3
				10g	24.9	24.0

9.1 System Performance Check Results

Date	System Dipole			Parameters	Target	Measured	Deviation[%]	Limited[%]
	Type	Serial No.	Liquid					
2013/1/10	D835V2	4d015	Head	1g SAR:	9.44	9.03	-4.34	± 5
				10g SAR:	6.16	5.95	-3.41	± 5
2013/1/11	D1900V2	5d056	Head	1g SAR:	39.00	38.00	-2.56	± 5
				10g SAR:	20.60	19.60	-4.85	± 5
2013/1/14	D835V2	4d015	Body	1g SAR:	9.53	9.24	-3.04	± 5
				10g SAR:	6.28	6.11	-2.71	± 5
2013/1/15	D1900V2	5d056	Body	1g SAR:	38.30	39.10	2.09	± 5
				10g SAR:	20.20	20.30	0.50	± 5
2013/1/16	D835V2	4d015	Body	1g SAR:	9.53	9.45	-0.84	± 5
				10g SAR:	6.28	6.22	-0.96	± 5
2013/1/16	D2450V2	728	Body	1g SAR:	51.30	52.60	2.53	± 5
				10g SAR:	24.00	24.70	2.92	± 5
2013/1/18	D1900V2	5d056	Body	1g SAR:	38.30	39.30	2.61	± 5
				10g SAR:	20.20	20.40	0.99	± 5

10 Device Under Test

10.1 Simultaneous Transmission

No.	Conditions	Head	Body	Hotspot
1	GPRS850 + WiFi	☐	☒	☒
2	GPRS1900 + WiFi	☐	☒	☒
3	WCDMA Band V + WiFi	☐	☒	☒
4	WCDMA Band II + WiFi	☐	☒	☒
5	GPRS850 + BT	☐	☒	☐
6	GPRS1900 + BT	☐	☒	☐
7	WCDMA Band V + BT	☐	☒	☐
8	WCDMA Band II + BT	☐	☒	☐
9	WiFi + BT	☐	☒	☐

Note(s):

1. WiFi 2.4GHz band and BT can simultaneous transmit.
2. Only WiFi 2.4 GHz Band supports hotspot function.

11 Summary of Test Configurations

11.1 Body Test Exclusion Thresholds

The following SAR test exclusion Thresholds based on KDB 447498 D01 General RF Exposure Guidance v05) 4.3.1)

Band	Test Configurations	Antenna-to-edge/surface	Power Target (dBm)	Power Tolerance (dBm)	Calculate Power (mW)	Test Exclusion Power Threshold(mW)	SAR Required
GPRS850	Edge 3	3mm	23	±1	251	10	Yes
GPRS1900	Edge 3	3mm	21	±1	158	7	Yes
WCDMA Band II	Edge 3	3mm	23	±1	251	7	Yes
WCDMA Band V	Edge 3	3mm	22	±1	200	10	Yes
WiFi 2.4GHz	Edge 2	3.4mm	11	±1	16	7	Yes
Bluetooth	Edge 2	3.4mm	-2	±2	1	7	No

11.2 Body Exposure Conditions for WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Front	13.5 mm	Yes	
Rear	17.0 mm	Yes	
Edge 1	139.0 mm	No	This is not the most conservative antenna-to-user distance at edge mode
Edge 2	13.0 mm	No	This is not the most conservative antenna-to-user distance at edge mode
Edge 3	3.0 mm	Yes	This is most conservative antenna-to-user distance at edge mode
Edge 4	19.0 mm	No	This is not the most conservative antenna-to-user distance at edge mode

11.3 Body Exposure Conditions for WiFi

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Front	13.5 mm	Yes	
Rear	17.0 mm	Yes	
Edge 1	113.0 mm	No	This is not the most conservative antenna-to-user distance at edge mode
Edge 2	3.4 mm	Yes	This is most conservative antenna-to-user distance at edge mode
Edge 3	35.0mm	No	his is not the most conservative antenna-to-user distance at edge mode
Edge 4	65.0 mm	No	This is not the most conservative antenna-to-user distance at edge mode

12 RF Output Power Measurement

12.1 GSM850

Main Service: Circuit Switched
Target Power: 32dBm
Class: B
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
GSM850	128	824.2	32.4	23.4
	190	836.6	32.5	23.5
	251	848.8	32.3	23.3

12.2 GPRS850

GMSK(GPRS) - Coding Scheme: CS1
Target Power:32 dBm(1Slot)
        30 dBm(2Slot,3Slot)
        26 dBm(4Slot)
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Slot	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
GPRS850	1	128	824.2	32.5	23.5
		190	836.6	32.6	23.6
		251	848.8	32.6	23.6
	2	128	824.2	29.9	23.9
		190	836.6	30.1	24.1
		251	848.8	30.1	24.1
	3	128	824.2	29.9	25.6
		190	836.6	30.0	25.7
		251	848.8	30.0	25.7
	4	128	824.2	26.8	23.8
		190	836.6	27.0	24.0
		251	848.8	27.0	24.0

12.3 EGPRS850

8PSK (EGPRS) Mode Coding scheme : MCS-5
Target Power:26 dBm
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Slot	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
EGPRS850	1	128	824.2	26.8	17.8
		190	836.6	26.9	17.8
		251	848.8	26.8	17.7
	2	128	824.2	26.8	20.7
		190	836.6	26.9	20.8
		251	848.8	26.8	20.7
	3	128	824.2	26.7	22.5
		190	836.6	26.8	22.6
		251	848.8	26.7	22.5
	4	128	824.2	26.7	23.7
		190	836.6	26.8	23.8
		251	848.8	26.7	23.6

12.4 GSM1900

Main Service: Circuit Switched
Target Power: 30dBm
Class: B
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
GSM1900	512	824.2	29.8	20.8
	661	836.6	30.1	21.1
	810	848.8	29.9	20.9

12.5 GPRS1900

GMSK(GPRS) - Coding Scheme: CS1
Target Power: 30 dBm(1Slot)
28 dBm(2Slot,3Slot)
24 dBm(4Slot)
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Slot	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
GPRS1900	1	512	824.2	29.9	20.9
		661	836.6	30.1	21.1
		810	848.8	30.0	21.0
	2	512	824.2	28.3	22.3
		661	836.6	28.5	22.5
		810	848.8	28.5	22.5
	3	512	824.2	27.2	22.9
		661	836.6	27.4	23.1
		810	848.8	27.3	23.0
	4	512	824.2	24.2	21.2
		661	836.6	24.5	21.5
		810	848.8	24.4	21.3

12.6 EGPRS1900

8PSK (EGPRS) Mode Coding scheme : MCS-5
Target Power:26 dBm (1Slot,2Slot,3Slot)
             24 dBm(4Slot)
Tune-up Tolerance: -1.0dB / +1.0dB GMSK (GPRS) Mode

Band	Slot	Ch No.	Freq. (MHz)	Avg burst pwr (dBm)	Time Avg. Pwr
EGPRS1900	1	512	824.2	26.4	17.3
		661	836.6	26.6	17.6
		810	848.8	26.5	17.4
	2	512	824.2	26.3	20.3
		661	836.6	26.6	20.6
		810	848.8	26.4	20.4
	3	512	824.2	26.3	22.0
		661	836.6	26.6	22.3
		810	848.8	26.4	22.1
	4	512	824.2	24.2	21.2
		661	836.6	24.5	21.5
		810	848.8	24.4	21.3

12.7 WCDMA Band V

Target Power:22 dBm
Tune-up Tolerance: -1.0dB / +1.0dB

Release 99
The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Sub-test	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control	Algorithm2
	βc/βd	8/15

Output power table

Band	Data Rate or Sub-test	UL/DL Ch No.	Freq. (MHz)	Avg burst pwr (dBm)
WCDMA Band V	---	4132/4357	826.4	22.3
		4182/4407	836.6	22.2
		4233/4458	846.6	22.5

HSDPA

The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Sub-test	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	$\beta c/\beta d$	2/15	12/15	8/15	4/15
	βhs	4/15	24/15	30/15	30/15
	CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =$\beta hs/\beta c$	30/15			

Output power table

Band	Data Rate or Sub-test	UL/DL Ch No.	Freq. (MHz)	Avg. burst power(dBm)
HSDPA V	1	4132/4357	826.4	22.2
		4182/4407	836.6	22.1
		4233/4458	846.6	22.4
	2	4132/4357	826.4	22.1
		4182/4407	836.6	22.1
		4233/4458	846.6	22.3
	3	4132/4357	826.4	21.8
		4182/4407	836.6	21.7
		4233/4458	846.6	22.1
	4	4132/4357	826.4	21.7
		4182/4407	836.6	21.7
		4233/4458	846.6	22.0

12.8 WCDMA Band II

Target Power:23 dBm
Tune-up Tolerance: -1.0dB / +1.0dB
Release 99
The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Sub-test	Rel99
	Loopback Mode	Test Mode 1
WCDMA General Settings	Rel99 RMC	12.2kbps RMC
	Power Control	Algorithm2
	βc/βd	8/15

Band	Data Rate or Sub-test	UL/DL Ch No.	Freq. (MHz)	Avg burst pwr (dBm)
WCDMA Band II	---	9262/9662	1852.4	22.8
		9400/9800	1880.0	23.2
		9538/9983	1907.6	22.8

HSDPA
The following 4 Sub-tests were completed according to Release 6 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Sub-test	1	2	3	4
WCDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	12/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	12/15	8/15	4/15
	βhs	4/15	24/15	30/15	30/15
	CM (dB)	0	1	1.5	1.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs =βhs/βc	30/15			

Output power table

Band	Data Rate or Sub-test	UL/DL Ch No.	Freq. (MHz)	Avg. burst power(dBm)
HSDPA II	1	9262/9662	1852.4	22.6
		9400/9800	1880.0	23.0
		9538/9983	1907.6	22.7
	2	9262/9662	1852.4	22.5
		9400/9800	1880.0	23.0
		9538/9983	1907.6	22.7
	3	9262/9662	1852.4	22.1
		9400/9800	1880.0	22.5
		9538/9983	1907.6	22.3
	4	9262/9662	1852.4	22.1
		9400/9800	1880.0	22.5
		9538/9983	1907.6	22.3

12.9 WiFi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band (GHz)	Freq. (MHz)	Ch #	Default Test Channels	
				802.11b	802.11g
802.11 b/g	2.4	2412	1#	✓	▽
		2437	6	✓	▽
		2462	11#	✓	▽
Notes ✓ = "default test channels" ▽ = possible 802.11g channels with maximum average output ¼ dB the "default test channels" # = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.					

The indicated Wi-Fi target powers in the following table are absolute maximums.

Output power table

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Avg. Pwr (dBm)
2.4	802.11b	1	1	2412	12.0	11.1
			6	2437	12.0	10.3
			11	2462	12.0	10.4
	802.11g	6	1	2412	9.0	9.0
			6	2437	9.0	7.8
			11	2462	9.0	7.7

Note(s):

SAR is not required for 802.11g channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels. As per KDB 248227 D01 SAR measurement for 802 11 a b g v01r02.

12.10 Bluetooth

Target Power:-2 dBm

Tune-up Tolerance: -2.0dB / +2.0dB

Output power table

Band	Mode	Ch #	Freq. (MHz)	Avg burst pwr (dBm)
Bluetooth	DH5	0	2402	-0.6
		39	2441	-2.2
		78	2480	-3.6
	3DH5	0	2402	-2.2
		39	2441	-2.6
		78	2480	-3.3

13 SAR Measurements Results

GSM850:

Band	Test Position	Channel	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
			Tune up limit	Measured			
GSM850	Right Cheek	128	33.0	32.4			1
		190	33.0	32.5	0.141	0.160	
		251	33.0	32.3			1
	Right Titled	128	33.0	32.4			1
		190	33.0	32.5	0.084	0.095	
		251	33.0	32.3			1
	Left Cheek	128	33.0	32.4			1
		190	33.0	32.5	0.205	0.233	
		251	33.0	32.3			1
	Left Titled	128	33.0	32.4			1
		190	33.0	32.5	0.110	0.125	
		251	33.0	32.3			1

GPRS850:

Band	Test Position	Channel	Dist. (mm)	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
				Tune up limit	Measured			
GPRS850 (3Slot)	Front	128	10	26.7	25.6			1
		190	10	26.7	25.7	0.201	0.253	
		251	10	26.7	25.7			1
	Rear	128	10	26.7	25.6			1
		190	10	26.7	25.7	0.175	0.220	
		251	10	26.7	25.7			1
	Edge2	128	10	26.7	25.6			1
		190	10	26.7	25.7	0.216	0.272	
		251	10	26.7	25.7			1
	Edge3	128	10	26.7	25.6			1
		190	10	26.7	25.7	0.235	0.296	
		251	10	26.7	25.7			1

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g SAR for the mid-band or highest output power channel. ≤ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05 section 4.3.3)

GSM 1900:

Band	Test Position	Channel	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
			Tune up limit	Measured			
GSM1900	Right Cheek	512	31.0	29.8			1
		661	31.0	30.1	0.069	0.085	
		810	31.0	29.9			1
	Right Titled	512	31.0	29.8			1
		661	31.0	30.1	0.048	0.059	
		810	31.0	29.9			1
	Left Cheek	512	31.0	29.8			1
		661	31.0	30.1	0.043	0.053	
		810	31.0	29.9			1
	Left Titled	512	31.0	29.8			1
		661	31.0	30.1	0.037	0.046	
		810	31.0	29.9			1

GPRS 1900

Band	Test Position	Channel	Dist. (mm)	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
				Tune up limit	Measured			
GPRS1900 (3Slot)	Front	512	10	24.7	22.9			1
		661	10	24.7	23.1	0.139	0.199	
		810	10	24.7	23.0			1
	Rear	512	10	24.7	22.9			1
		661	10	24.7	23.1	0.511	0.732	
		810	10	24.7	23.0			1
	Edge2	512	10	24.7	22.9			1
		661	10	24.7	23.1	0.302	0.432	
		810	10	24.7	23.0			1
	Edge3	512	10	24.7	22.9	0.754	1.131	
		661	10	24.7	23.1	0.761	1.090	
		810	10	24.7	23.0	0.764	1.120	

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g SAR for the mid-band or highest output power channel. ≤ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05 section 4.3.3)

WCDMA Band V:

Band	Test Position	Channel	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
			Tune up limit	Measured			
WCDMA Band V	Right Cheek	4132	23.0	22.3			1
		4182	23.0	22.2			1
		4233	23.0	22.5	0.088	0.099	
	Right Titled	4132	23.0	22.3			1
		4182	23.0	22.2			1
		4233	23.0	22.5	0.048	0.054	
	Left Cheek	4132	23.0	22.3			1
		4182	23.0	22.2			1
		4233	23.0	22.5	0.111	0.125	
	Left Titled	4132	23.0	22.3			1
		4182	23.0	22.2			1
		4233	23.0	22.5	0.052	0.059	

Band	Test Position	Channel	Dist. (mm)	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
				Tune up limit	Measured			
WCDMA Band V	Front	4132	10	23.0	22.3			1
		4182	10	23.0	22.2			1
		4233	10	23.0	22.5	0.074	0.084	
	Rear	4132	10	23.0	22.3			1
		4182	10	23.0	22.2			1
		4233	10	23.0	22.5	0.061	0.069	
	Edge2	4132	10	23.0	22.3			1
		4182	10	23.0	22.2			1
		4233	10	23.0	22.5	0.049	0.055	
	Edge3	4132	10	23.0	22.3			1
		4182	10	23.0	22.2			1
		4233	10	23.0	22.5	0.104	0.117	

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g SAR for the mid-band or highest output power channel. ≤ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05 section 4.3.3)

WCDMA Band II:

Band	Test Position	Channel	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
			Tune up limit	Measured			
WCDMA Band II	Right Cheek	9262	24.0	22.8			1
		9400	24.0	23.2	0.125	0.151	
		9538	24.0	22.8			1
	Right Titled	9262	24.0	22.8			1
		9400	24.0	23.2	0.088	0.106	
		9538	24.0	22.8			1
	Left Cheek	9262	24.0	22.8			1
		9400	24.0	23.2	0.077	0.093	
		9538	24.0	22.8			1
	Left Titled	9262	24.0	22.8			1
		9400	24.0	23.2	0.073	0.088	
		9538	24.0	22.8			1

Band	Test Position	Channel	Dist. (mm)	Power (dBm)		1g SAR (W/kg)	Reported SAR(W/kg)	Note
				Tune up limit	Measured			
WCDMA Band II	Front	9262	10	24.0	22.8			1
		9400	10	24.0	23.2	0.169	0.204	
		9538	10	24.0	22.8			1
	Rear	9262	10	24.0	22.8			1
		9400	10	24.0	23.2	0.382	0.461	
		9538	10	24.0	22.8			1
	Edge2	9262	10	24.0	22.8			1
		9400	10	24.0	23.2	0.367	0.443	
		9538	10	24.0	22.8			1
	Edge3	9262	10	24.0	22.8	0.830	1.087	
		9400	10	24.0	23.2	0.893	1.079	
		9538	10	24.0	22.8	0.796	1.040	
		9400	10	24.0	23.2	0.924	1.116	2

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g SAR for the mid-band or highest output power channel. ≤ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05 section 4.3.3)

2. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01)

    2.1 Original SAR = 0.893 W/kg, therefore Repeat SAR is required.

    2.2 Repeat SAR = 0.924 W/kg.< 1.45W/kg

    2.3 SAR variation= 3.47% < 20%

    2.4 Second repeat SAR is not required.

Wi-Fi (2.4GHz Band):

Band	Test Position	Channel	Dist. (mm)	Power (dBm) Tune up limit	Power (dBm) Measured	1g SAR (W/kg)	Reported SAR(W/kg)	Note
802.11 b	Front	1	10	12.0	11.1	0.006	0.007	
		6	10	12.0	10.3			1
		11	10	12.0	10.4			1
	Rear	1	10	12.0	11.1	0.008	0.010	
		6	10	12.0	10.3			1
		11	10	12.0	10.4			1
	Edge2	1	10	12.0	11.1	0.014	0.017	
		6	10	12.0	10.3			1
		11	10	12.0	10.4			1

Note(s):

1.Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g SAR for the mid-band or highest output power channel. ≤ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05 section 4.3.3)

Bluetooth:

Band	Freq. (MHz)	Power (dBm) Tune up limit	Power (dBm) Measured	Estimated 1g SAR (W/kg)	Note
Bluetooth	2402	0.0	-0.6	0.061	1
	2441	0.0	-2.2		
	2480	0.0	-3.6		

Note(s):

1.When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following KDB 447498 D01 v05 section 4.3.2
- Maximum power of channel, including tune-up tolerance (mW)=1mW
- Minimum test separation distance (mm) = 3.4 mm
- Estimated SAR= (1mW/3.4mm)[(2.45GHz^0.5)/7.5)]=0.061mW/g

13.1 Summary of Highest SAR Values

Results for highest reported SAR values for each frequency band and mode

Technology/Band	Test configuration	Mode	Highest Reported 1g-SAR (W/kg)
GSM850	Left Cheek		0.233
GPRS850	Edge3	3 slot	0.296
GSM1900	Right Cheek		0.085
GPRS1900	Edge3	3 slot	1.131
WCDMA Band II	Right Cheek		0.151
WCDMA Band II	Edge3	Rel 99 RMC 12.2kbps	1.116
WCDMA band V	Left Cheek		0.125
WCDMA band V	Edge3	Rel 99 RMC 12.2kbps	0.117
WiFi 2.4 GHz	Edge2	802.11b 1Mbps	0.017
Bluetooth	Edge2	DH5	0.061

14 Simultaneous Transmission SAR Analysis

14.1 Sum of the 1g SAR for Body Exposure Condition
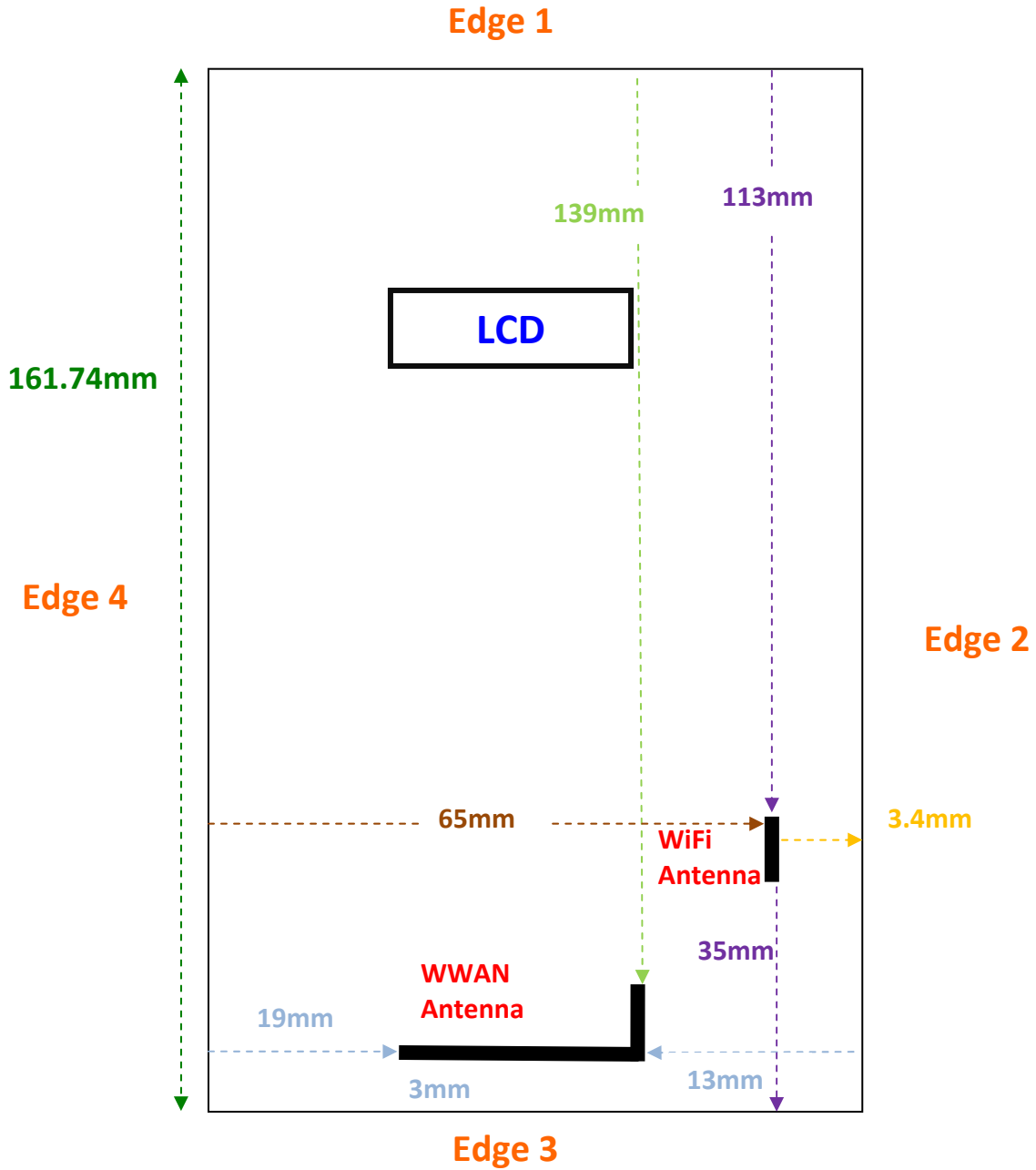
Sum of the SAR with Reported Values

Test Position	GPRS850	GPRS1900	WCDMA Band V	WCDMA Band II	Bluetooth	WiFi 2.4 GHz Band	∑ 1-g SAR (W/kg)
Front	0.253					0.007	0.260
		0.199				0.007	0.206
			0.084			0.007	0.091
				0.204		0.007	0.211
Rear	0.220					0.010	0.230
		0.732				0.010	0.742
			0.069			0.010	0.079
				0.461		0.010	0.471
Edge 2	0.272					0.017	0.289
		0.432				0.017	0.449
			0.055			0.017	0.072
				0.443		0.017	0.460
					0.061	0.017	0.078

Note(s):

1. Simultaneous transmission SAR measurement (Volume Scan) is not required when the ∑ 1-g SAR is < 1.6 mW/g

15 Antenna Locations & Separation Distances

Edge 1

161.74mm

Edge 4

Edge 3

Edge 2

139mm

113mm

LCD

65mm

3.4mm

WiFi
Antenna

35mm

WWAN
Antenna

19mm

3mm

13mm

16 Equipment List & Calibration Status

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(year)	Calibration Due
S-Parameter Network Analyzer	Agilent	E8358A	US40260243	1	07/03/2013
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Anritsu	ML2495A	1012009	1	04/26/2013
Power Sensor	Anritsu	MA2411B	917072	1	04/26/2013
Spectrum Analyzer	Agilent	E4446A	US42510252	1	12/09/2013
Wireless Communication Test Set	Agilent	E5515C 8960	MY48363204	1	09/12/2013
Data Acquisition Electronics (DAE)	SPEAG	DAE4	877	1	03/15/2013
Dosimetric E-Field Probe	SPEAG	EX3DV4	3665	1	4/26/2013
835 MHz System Validation Dipole	SPEAG	D835V2	4d015	1	03/13/2013
1900 MHz System Validation Dipole	SPEAG	D1900V2	5d056	1	02/21/2013
2450 MHz System Validation Dipole	SPEAG	D2450V2	728	1	11/19/2013
Robot	Staubli	RX60L	F02/5T69A1/A/0	N/A	N/A
Amplifier	Mini-Circuit	ZVE-8G	665500309	N/A	N/A
Amplifier	Mini-Circuit	ZHL-1724HLN	D072602#2	N/A	N/A
DC Power generator	ABM	8301HD	N/A	N/A	N/A
Probe Alignment Unit	SPEAG	LB (V2)	348	N/A	N/A
SAM Twin Phantom V4.0	SPEAG	N/A	N/A	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A

17 Facilities

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

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

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

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

18 Reference

[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

19 Attachments

Exhibit	Content
1	System performance check plots
2	SAR test plots for GSM850
3	SAR test plots for GSM1900
4	SAR test plots for WCDMA Band V
5	SAR test plots for WCDMA Band II
6	SAR test plots for 2.4GHz
7	SAR_DAE4_sn877_20120315c
8	SAR_Probe_EX3DV4_sn3665_20120426
9	SAR_Dipole_D835V2_sn4d015_20120313
10	SAR_Dipole_D1900v2_sn5d056_20120221
11	SAR_Dipole_D2450v2_sn728_20121119
12	T121221D03-SF PHOTOs

END OF REPORT