

FCC SAR Test Report

Report No. : SA120608C16A

Applicant : Lenovo (Shanghai) Electronics Technology Co., Ltd.

Address : No. 68 Building, 199 Fenju Road, Wai Gao Qiao FTZ , Shanghai, China

Product : Tablet PC

FCC ID : O57A2107VDF3G

Brand : Vodafone

Model No. : Smart Tab II⁷

Standards : FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1991 / IEEE 1528:2003
FCC OET Bulletin 65 Supplement C (Edition 01-01)
KDB 248227 D01 v01r02 / KDB 447498 D01 v04 / KDB 616217 D03 v01
KDB 941225 D03 v01

Date of Testing : Jul. 06, 2012 ~ Aug. 13, 2012

CERTIFICATION: The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch - Taiwan HwaYa Lab**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

Prepared By :


Ivonne Wu / Senior Specialist

Approved By :


Roy Wu / Manager

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Release Control Record

Issue No.	Reason for Change	Date Issued
R01	Original release	Aug. 14, 2012

1. Summary of Maximum SAR Value

Mode / Band	Test Position	SAR-1g (W/kg)
GSM1900	Body	0.878
WLAN 2.4GHz	Body	0.79
Bluetooth	Body	N/A

Note:

1. The SAR limit (**1.6 W/kg**) for general population/uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1991.
2. Since the Bluetooth maximum power is less than 60/f, the SAR testing for Bluetooth is not required.

2. Description of Equipment Under Test

EUT Type	Tablet PC
FCC ID	O57A2107VDF3G
Brand Name	Vodafone
Model Name	Smart Tab II ⁷
Tx Frequency Bands (Unit: MHz)	GSM1900 : 1850 ~ 1910 WLAN : 2400 ~ 2483.5
Uplink Modulations	802.11b : DSSS 802.11g/n : OFDM
Maximum AVG Conducted Power (Unit: dBm)	GSM1900 : 28.91 802.11b : 14.51 802.11g : 13.88 802.11n HT20 : 14.36 802.11n HT40 : 12.19
Antenna Type	Fixed Internal Antenna
EUT Stage	Identical Prototype

Note:

- The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

List of Accessory:

AC Adapter	Brand Name	Huntkey
	Model Name	HKA00905015-2C
	Power Rating	I/P:100-240Vac, 250mA O/P: 5Vdc, 1500mA
Battery 1	Brand Name	Lenovo
	Model Name	BL195 (ATL cell)
	Power Rating	3.7Vdc, 3550mAh
Battery 2	Type	Li-ion
	Brand Name	Lenovo
	Model Name	BL195 (SDI cell)
USB Cable	Power Rating	3.7Vdc, 3550mAh
	Type	Li-ion
	Brand Name	Lenovo
	Model Name	CD-14
	Signal Line Type	1 meter non-shielded cable without ferrite core

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

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

SAR measurement can be related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4/5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.

3.2.1 Robot

- High precision (repeatability ± 0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)



Fig-3.3 DASY5

3.2.2 Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4	
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μ W/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/g)	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Model	ES3DV3	
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	5 μ W/g to 100 mW/g Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	

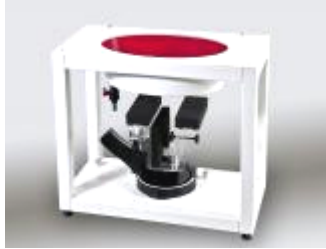
3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
Input Offset Voltage	< 5 μ V (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

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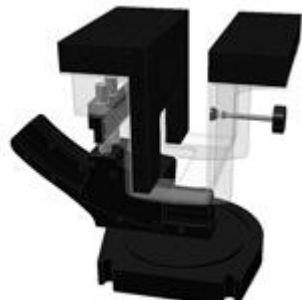
3.2.4 Phantoms

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. 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 teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI 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 compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

3.2.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

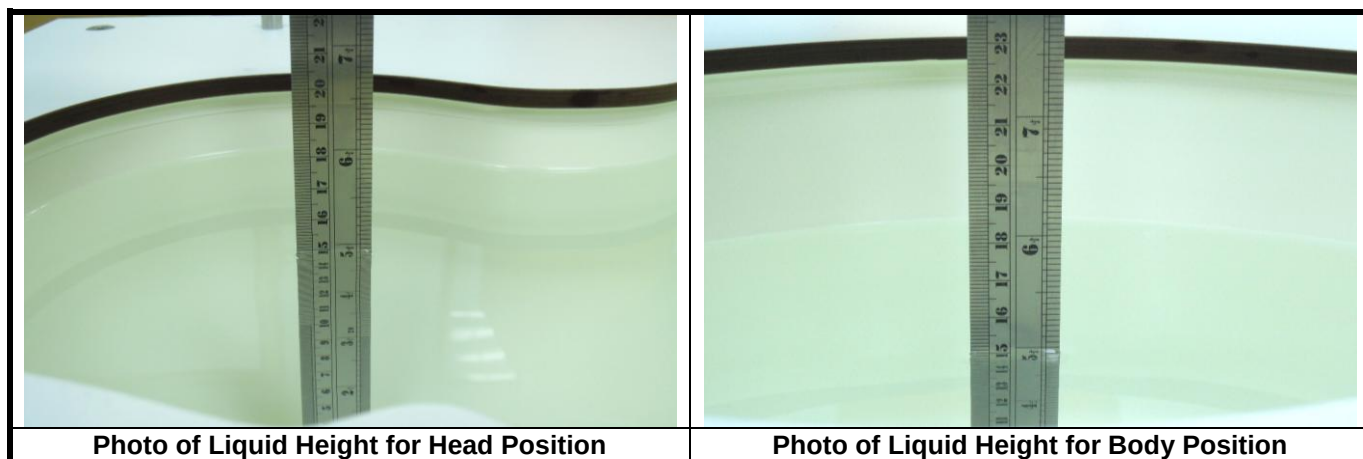
Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.2.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with 1/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

3.2.7 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.



The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528 and FCC OET 65 Supplement C Appendix C. For the body tissue simulating liquids, the dielectric properties are defined in FCC OET 65 Supplement C Appendix C. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of $\pm 5\%$	Target Conductivity	Range of $\pm 5\%$
For Body				
1900	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05

The following table gives the recipes for tissue simulating liquids.

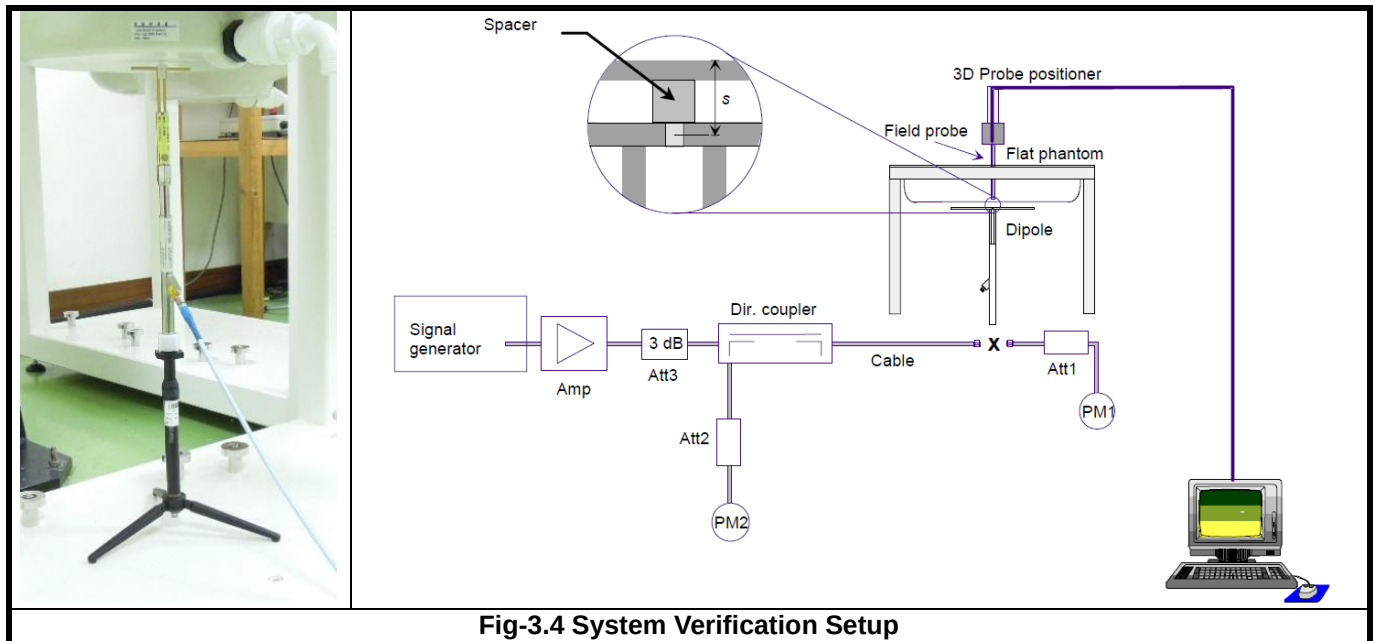
Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
B1900	-	29.5	-	0.3	-	-	70.2	-
B2450	-	31.4	-	0.1	-	-	68.5	-

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3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

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3.4 SAR Measurement Procedure

According to the SAR test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

- (a) Make EUT to transmit maximum output power
- (b) Measure conducted output power through RF cable
- (c) Place the EUT in the specific position of phantom
- (d) Perform SAR testing steps on the DASY system
- (e) Record the SAR value

3.4.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for below 3 GHz, and 7x7x9 points with step size 4, 4 and 2.5 mm for above 5 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

3.4.2 Volume Scan Procedure

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

3.4.3 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

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3.4.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

3.4.5 SAR Averaged Methods

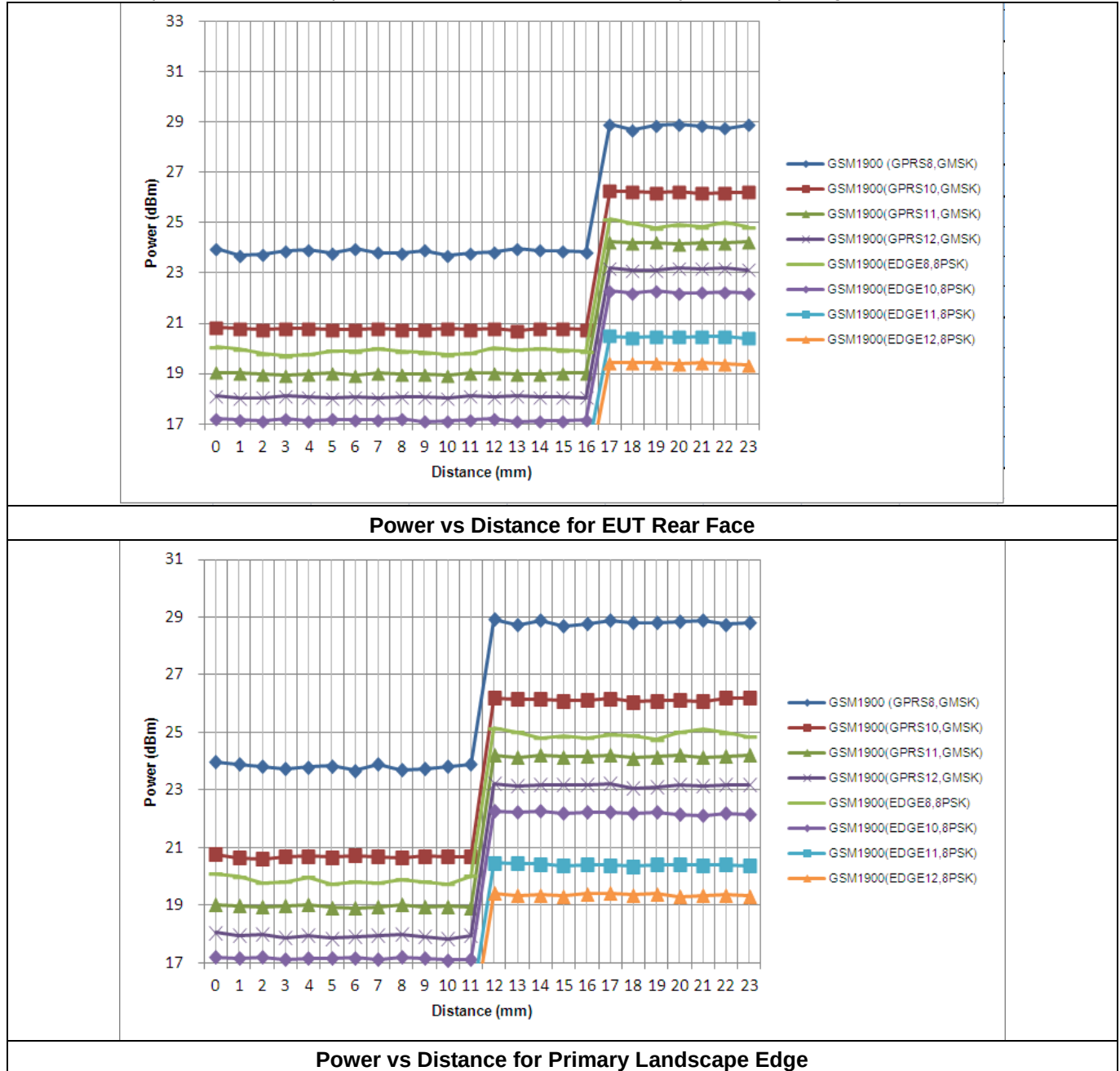
In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

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. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

The device is tablet PC which supports GSM, WLAN and Bluetooth. This tablet PC can be used for four display orientations. It is designed with a proximity sensor which can trigger/not trigger power reduction for GSM1900 on EUT Rear Face and Primary Landscape orientations. The other RF capabilities (WLAN and BT) have no power reduction. The power vs distance plots for EUT Rear Face and Primary Landscape edge are shown as below.



Based on the separation distance for the sensor triggered / not triggered, we test SAR with power reduction at 0 mm,, and test SAR without power reduction at 15 mm for EUT Rear Face, and at 10 mm for Secondary Portrait edge.

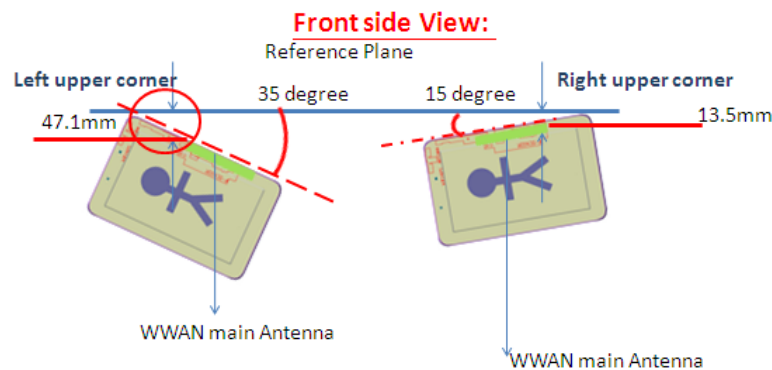
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Since the sensing coverage does not cover the right / left edge contour and the power will resume to normal full power while this tablet is tilted to certain angle, we tilt the tablet and test SAR on the angle with the sensor not triggered. The angle of proximity sensor triggered / not triggered at the corner of Top Left and Top Right is listed as below. Based on the angle, we test SAR without power reduction at 35° for Top Edge/Left Corner, and 15° for Top Edge/Right Corner.

Angle of Top Edge/Left Corner	0° ~ 34°	35°	36°	37°
Proximity Sensor Status	Triggered	Triggered	Not Triggered	Not Triggered

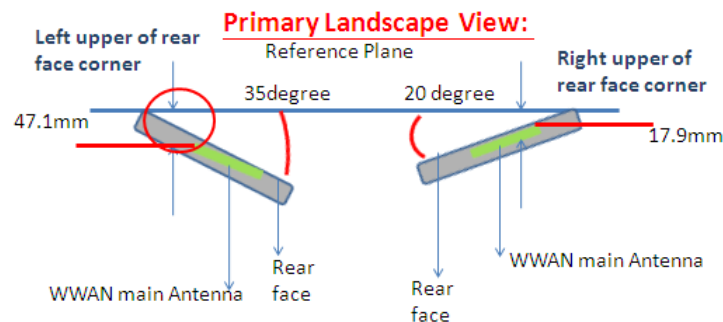
Angle of Top Edge/Right Corner	0° ~ 14°	15°	16°	17°
Proximity Sensor Status	Triggered	Triggered	Not Triggered	Not Triggered



The angle of proximity sensor triggered / not triggered at the corner of EUT Rear Face of Top Left and Top Right is listed as below. Based on the angle, we test SAR without power reduction at 35° for Top Edge/Left Rear Corner, and 20° for Top Edge/Right Rear Corner.

Angle of Top Edge/Left Rear Corner	0° ~ 34°	35°	36°	37°
Proximity Sensor Status	Triggered	Triggered	Not Triggered	Not Triggered

Angle of Top Edge/Right Rear Corner	0° ~ 19°	20°	21°	22°
Proximity Sensor Status	Triggered	Triggered	Not Triggered	Not Triggered



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The simultaneous transmission possibilities are listed as below.

Simultaneous Tx Combination	RF Configuration
1	GSM1900 (Data) + WLAN 2.4G (Data)
2	GSM1900 (Data) + BT (Data)

The power reduction is depends on the proximity sensor input. For a steady SAR test, the power reduction can be enabled manually by RF tool program “adb.exe” during SAR testing. After executing the RF tool program, the power reduction can be enabled by below command.

```
adb shell am start -n com.mediatek.engineermode/com.mediatek.engineermode.EngineerMode
```

For WWAN SAR testing, the EUT was linked and controlled by base station emulator. Communication between the EUT and the emulator was established by air link. The distance between the EUT and the communicating 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 EUT. The EUT was set from the emulator to radiate maximum output power during SAR testing.

The EUT is communicated with base station simulator (Agilent E5515C is used for GSM/WCDMA) by air link. During SAR testing, the base station simulator is set to make the EUT to radiate maximum output power.

For GSM1900, the power control level is set to 0. For GPRS1900 (GMSK, CS1), the power control level is set to 0. For EDGE1900 (GMSK: MCS1, 8PSK:MCS9), the power control level is set to 2. Body SAR is tested under maximum source-based time-average power mode of GPRS/EDGE.

For WLAN SAR testing, the EUT has installed WLAN engineering testing software which can provide continuous transmitting RF signal. This RF signal utilized in SAR measurement has almost 100% duty cycle. The data rates for WLAN SAR testing were set in 1 Mbps for 802.11b due to the highest RF output power.

4.2 EUT Testing Position

The proximity sensor is only active for GSM1900 on EUT Rear Face and Primary Landscape edge. According to KDB 447498, the SAR is required for antenna located within 5 cm from edge. Based on the antenna location shown on Appendix D of this report, SAR testing condition for each antenna is listed as below.

Mode	Testing Position	Power Reduction	Separation Distance (cm)	SAR Testing
GSM 1900	Rear Face	Yes	0	Yes
	Rear Face	No	1.5	Yes
	Primary Portrait	No	0	No
	Secondary Portrait	No	0	No
	Primary Landscape	Yes	0	Yes
	Primary Landscape	No	1.0	Yes
	Secondary Landscape	No	0	No
WLAN 2.4G	Rear Face	No	0	Yes
	Primary Portrait	No	0	No
	Secondary Portrait	No	0	Yes
	Primary Landscape	No	0	Yes
	Secondary Landscape	No	0	No

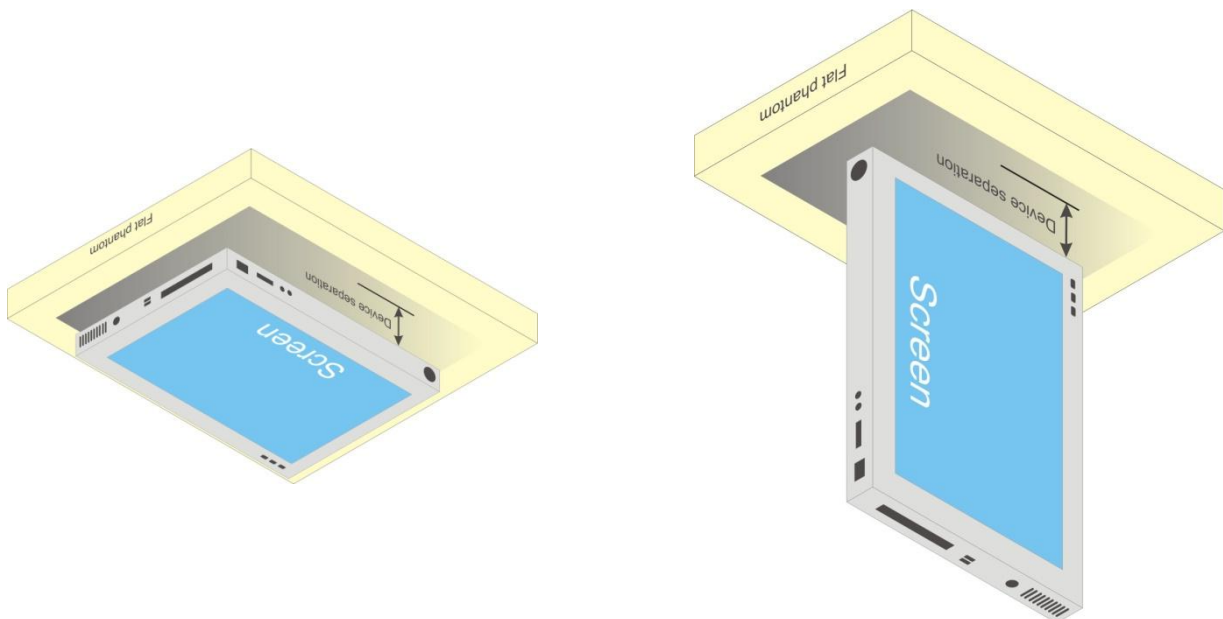


Fig-4.1 Illustration for Tablet Setup

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Measured Conductivity (σ)	Measured Permittivity (ϵ_r)	Target Conductivity (σ)	Target Permittivity (ϵ_r)	Conductivity Deviation (%)	Permittivity Deviation (%)	Test Date
B1900	1900	21.4	1.55	52.8	1.52	53.3	1.97	-0.94	Jul. 16, 2012
B1900	1900	21.1	1.52	53.7	1.52	53.3	0.00	0.75	Aug. 08, 2012
B1900	1900	21.1	1.545	52.799	1.52	53.3	1.64	-0.94	Aug. 10, 2012
B2450	2450	21.0	1.99	54.3	1.95	52.7	2.05	3.04	Jul. 06, 2012
B2450	2450	21.0	2.024	53.364	1.95	52.7	3.79	1.26	Aug. 10, 2012
B2450	2450	20.4	1.999	52.351	1.95	52.7	2.51	-0.66	Aug. 13, 2012

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within $\pm 5\%$ of the target values. Liquid temperature during the SAR testing must be within $\pm 2^\circ\text{C}$.

4.4 System Verification

The measuring results for system check are shown as below.

Test Date	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Jul. 16, 2012	1900	38.90	9.63	38.52	-0.98	5d036	3820	579
Aug. 08, 2012	1900	38.90	9.12	36.48	-6.22	5d036	3650	910
Aug. 10, 2012	1900	38.90	9.62	38.48	-1.08	5d036	3650	910
Jul. 06, 2012	2450	50.00	12.60	50.40	0.80	737	3590	861
Aug. 10, 2012	2450	50.00	12.46	49.84	-0.32	737	3650	910
Aug. 13, 2012	2450	50.00	12.22	48.88	-2.24	737	3650	1277

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.5 Conducted Power Results

The measuring conducted power (Unit: dBm) are shown as below.

Band	GSM1900 (P-Sensor Not Triggered)			Power Reduction (dB)	GSM1900 (P-Sensor Triggered)		
Channel	512	661	810		512	661	810
Frequency (MHz)	1850.2	1880.0	1909.8		1850.2	1880.0	1909.8
Maximum Burst-Averaged Output Power							
GPRS 8 (GMSK, 1 Uplink)	28.91	28.86	28.79	5.0	23.97	23.93	23.87
GPRS 10 (GMSK, 2 Uplink)	26.26	25.97	25.93	5.0	20.82	20.78	20.72
GPRS 11 (GMSK, 3 Uplink)	24.24	24.20	24.14	5.0	19.05	19.01	18.95
GPRS 12 (GMSK, 4 Uplink)	23.21	22.92	22.87	5.0	18.12	17.84	17.78
EDGE 8 (GMSK, 1 Uplink)	28.91	28.86	28.80	5.0	23.97	23.93	23.87
EDGE 10 (GMSK, 2 Uplink)	26.03	25.98	25.92	5.0	20.82	20.78	20.72
EDGE 11 (GMSK, 3 Uplink)	24.25	24.20	24.15	5.0	19.05	19.01	18.95
EDGE 12 (GMSK, 4 Uplink)	23.24	22.94	22.87	5.0	17.88	17.84	17.79
EDGE 8 (8PSK, 1 Uplink)	25.00	25.06	25.14	5.0	19.93	19.98	20.07
EDGE 10 (8PSK, 2 Uplink)	22.14	22.19	22.28	5.0	17.08	17.08	17.21
EDGE 11 (8PSK, 3 Uplink)	20.41	20.45	20.50	5.0	15.52	15.55	15.61
EDGE 12 (8PSK, 4 Uplink)	19.42	19.35	19.45	5.0	14.61	14.49	14.51
Maximum Frame-Averaged Output Power							
GPRS 8 (GMSK, 1 Uplink)	19.91	19.86	19.79	5.0	14.97	14.93	14.87
GPRS 10 (GMSK, 2 Uplink)	20.26	19.97	19.93	5.0	14.82	14.78	14.72
GPRS 11 (GMSK, 3 Uplink)	19.98	19.94	19.88	5.0	14.79	14.75	14.69
GPRS 12 (GMSK, 4 Uplink)	20.21	19.92	19.87	5.0	15.12	14.84	14.78
EDGE 8 (GMSK, 1 Uplink)	19.91	19.86	19.80	5.0	14.97	14.93	14.87
EDGE 10 (GMSK, 2 Uplink)	20.03	19.98	19.92	5.0	14.82	14.78	14.72
EDGE 11 (GMSK, 3 Uplink)	19.99	19.94	19.89	5.0	14.79	14.75	14.69
EDGE 12 (GMSK, 4 Uplink)	20.24	19.94	19.87	5.0	14.88	14.84	14.79
EDGE 8 (8PSK, 1 Uplink)	16.00	16.06	16.14	5.0	10.93	10.98	11.07
EDGE 10 (8PSK, 2 Uplink)	16.14	16.19	16.28	5.0	11.08	11.08	11.21
EDGE 11 (8PSK, 3 Uplink)	16.15	16.19	16.24	5.0	11.26	11.29	11.35
EDGE 12 (8PSK, 4 Uplink)	16.42	16.35	16.45	5.0	11.61	11.49	11.51

Note:

1. The configuration of time slot for GPRS/EDGE is listed as below

Multi-slot Class	Maximum Uplink Slot	Maximum Downlink Slot	Maximum Total Timeslots
8	1	4	5
10	2	4	5
11	3	4	5
12	4	4	5

2. Body SAR testing for GPRS/EDGE was performed on the maximum frame-averaged power mode.

Band	802.11b			802.11g		
Channel	1	6	11	1	6	11
Frequency (MHz)	2412	2437	2462	2412	2437	2462
Average Power	14.21	14.08	14.51	13.74	13.84	13.88

Band	802.11n (HT20)			802.11n (HT40)		
Channel	1	6	11	3	6	9
Frequency (MHz)	2412	2437	2462	2422	2437	2452
Average Power	13.80	13.81	14.36	11.71	11.88	12.19

4.6 SAR Testing Results

4.6.1 SAR Results for Body

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	Battery	P-Sensor Status	Burst Averaged Power	Frame Averaged Power	Power Reduction (dB)	SAR-1g (W/kg)	Power Drift (dB)
1	GSM1900	GPRS 12	Rear Face	0	512	1	Triggered	18.12	15.12	5.0	0.66	0.129
2	GSM1900	GPRS 12	Primary Landscape	0	512	1	Triggered	18.12	15.12	5.0	0.878	-0.175
3	GSM1900	GPRS 12	Primary Landscape	0	661	1	Triggered	17.84	14.84	5.0	0.811	0.095
4	GSM1900	GPRS 12	Primary Landscape	0	810	1	Triggered	17.78	14.78	5.0	0.737	0.165
5	GSM1900	GPRS 12	Primary Landscape	0	512	2	Triggered	18.12	15.12	5.0	0.637	0.19
6	GSM1900	GPRS 10	Rear Face	1.5	512	1	Not Triggered	26.26	20.26	w/o	0.147	0.052
7	GSM1900	GPRS 10	Rear Face (Top Edge/Left Rear Corner at 35°)	0	512	1	Not Triggered	26.26	20.26	w/o	0.136	0.065
8	GSM1900	GPRS 10	Rear Face (Top Edge/Right Rear Corner at 20°)	0	512	1	Not Triggered	26.26	20.26	w/o	0.131	0.102
9	GSM1900	GPRS 10	Primary Landscape	1.0	512	1	Not Triggered	26.26	20.26	w/o	0.304	-0.034
10	GSM1900	GPRS 10	Primary Landscape (Top Edge/Right Corner at 15°)	0	512	1	Not Triggered	26.26	20.26	w/o	0.375	0.013
11	GSM1900	GPRS 10	Primary Landscape (Top Edge/Left Corner at 35°)	0	512	1	Not Triggered	26.26	20.26	w/o	0.059	-0.011

Plot No.	Band	Test Position	Separation Distance (cm)	Channel	Battery	P-Sensor Status	Output Power	Power Reduction (dB)	SAR-1g (W/kg)	Power Drift (dB)
12	802.11b	Rear Face	0	11	1	N/A	14.51	N/A	0.79	0.16
13	802.11b	Secondary Portrait	0	11	1	N/A	14.51	N/A	0.443	-0.096
14	802.11b	Primary Landscape	0	11	1	N/A	14.51	N/A	0.233	0.081
15	802.11b	Rear Face	0	11	2	N/A	14.51	N/A	0.69	0.17

Note:

- According to KDB 248227, the SAR testing for 802.11g/n is not required since the maximum power of 802.11g/n is less 1/4 dB higher than maximum power of 802.11b.

Test Engineer : Match Tsui, and Jerome Chang

4.6.2 Simultaneous Multi-band Transmission Evaluation

No.	Conditions	Position	Gap (cm)	Max. WWAN SAR	Max. WLAN SAR	SAR Summation	SPLSR
1	GSM1900 + WLAN	Rear Face	0	0.66	0.79	1.45	-
		Rear Face	1.5	0.147	0.79	0.937	-
		Primary Portrait	0	0	0	0	-
		Secondary Portrait	0	0	0.443	0.443	-
		Primary Landscape	0	0.878	0.233	1.111	-
		Primary Landscape	1.0	0.304	0.233	0.537	-
		Secondary Landscape	0	0	0	0	-

Note: The maximum SAR summation is calculated based on the same configuration and test position.

Summary:

According to KDB 447498, the simultaneous transmission SAR for WWAN and WLAN was not required because the SAR summation is less than 1.6 W/kg. The Bluetooth standalone SAR and simultaneous transmission SAR for WWAN and Bluetooth were not required, because the output power of Bluetooth is less than 60/f. The WLAN and Bluetooth cannot transmit simultaneously, so there is no co-location test requirement for WLAN and Bluetooth.

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Kit	SPEAG	D1900V2	5d036	Jan. 26, 2012	Annual
System Validation Kit	SPEAG	D2450V2	737	Jan. 24, 2012	Annual
Dosimetric E-Field Probe	SPEAG	EX3DV4	3590	Feb. 23, 2012	Annual
Dosimetric E-Field Probe	SPEAG	EX3DV4	3650	Oct. 26, 2011	Annual
Dosimetric E-Field Probe	SPEAG	EX3DV4	3820	Dec. 16, 2011	Annual
Data Acquisition Electronics	SPEAG	DAE3	579	Apr. 27, 2012	Annual
Data Acquisition Electronics	SPEAG	DAE4	861	Aug. 29, 2011	Annual
Data Acquisition Electronics	SPEAG	DAE4	910	Dec. 07, 2011	Annual
Data Acquisition Electronics	SPEAG	DAE4	1277	Jul. 19, 2012	Annual
ELI Phantom	SPEAG	QDOVA001B	TP-1039	N/A	N/A
SAM Phantom	SPEAG	QD000P40CD	TP-1652	N/A	N/A
SAM Phantom	SPEAG	QD000P40CD	TP-1654	N/A	N/A
ELI Phantom	SPEAG	QDOVA001B	TP-1043	N/A	N/A
Radio Communication Tester	Agilent	E5515C	MY50266628	Sep. 26, 2011	Biennial
ENA Series Network Analyzer	Agilent	E5071C	MY46214281	May 14, 2012	Annual
MXG Analog Signal Generator	Agilent	N5181A	MY50143868	May 06, 2012	Annual
Power Meter	Anritsu	ML2495A	1218009	May 07, 2012	Annual
Power Sensor	Anritsu	MA2411B	1207252	May 07, 2012	Annual
EXA Spectrum Analyzer	Agilent	N9010A	MY52100136	Apr. 23, 2012	Annual
Dielectric Probe Kit	Agilent	85070D	E2-020018	May 14, 2012	Annual
Thermometer	YFE	YF-160A	110600361	Feb. 21, 2012	Annual
Directional Coupler	Woken	0110A05602O-10	11122702	Apr. 19, 2012	Annual
Power Amplifier	AR	5S1G4	0339656	Apr. 23, 2012	Annual
Power Amplifier	Mini-Circuit	ZVE-8G	001000422	Apr. 23, 2012	Annual
Attenuator	Woken	00800A1G01L-03	N/A	Apr. 19, 2012	Annual

6. Measurement Uncertainty

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)	Vi
Measurement System						
Probe Calibration	6.0	Normal	1	1	± 6.0 %	∞
Axial Isotropy	4.7	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	± 3.9 %	∞
Boundary Effects	1.0	Rectangular	√3	1	± 0.6 %	∞
Linearity	4.7	Rectangular	√3	1	± 2.7 %	∞
System Detection Limits	1.0	Rectangular	√3	1	± 0.6 %	∞
Readout Electronics	0.6	Normal	1	1	± 0.6 %	∞
Response Time	0.0	Rectangular	√3	1	± 0.0 %	∞
Integration Time	1.7	Rectangular	√3	1	± 1.0 %	∞
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %	∞
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %	∞
Probe Positioner	0.5	Rectangular	√3	1	± 0.3 %	∞
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %	∞
Max. SAR Eval.	2.3	Rectangular	√3	1	± 1.3 %	∞
Test Sample Related						
Device Positioning	3.9	Normal	1	1	± 3.9 %	31
Device Holder	2.7	Normal	1	1	± 2.7 %	19
Power Drift	5.0	Rectangular	√3	1	± 2.9 %	∞
Phantom and Setup						
Phantom Uncertainty	4.0	Rectangular	√3	1	± 2.3 %	∞
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	± 1.8 %	∞
Liquid Conductivity (Meas.)	5.0	Normal	1	0.64	± 3.2 %	29
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %	∞
Liquid Permittivity (Meas.)	5.0	Normal	1	0.6	± 3.0 %	29
Combined Standard Uncertainty					± 11.7 %	
Expanded Uncertainty (K=2)					± 23.4 %	

Uncertainty budget for frequency range 300 MHz to 3 GHz

7. Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation and authorization certificates of our laboratories obtained from approval agencies can be downloaded from our web site. If you have any comments, please feel free to contact us at the following:

Taiwan HwaYa EMC/RF/Safety/Telecom Lab:

Add: No. 19, Hwa Ya 2nd Rd, Wen Hwa Vil., Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

Tel: 886-3-318-3232

Fax: 886-3-327-0892

Taiwan LinKo EMC/RF Lab:

Add: No. 47, 14th Ling, Chia Pau Vil., Linkou Dist., New Taipei City 244, Taiwan, R.O.C.

Tel: 886-2-2605-2180

Fax: 886-2-2605-1924

Taiwan HsinChu EMC/RF Lab:

Add: No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Vil., Chiung Lin Township, Hsinchu County 307, Taiwan, R.O.C.

Tel: 886-3-593-5343

Fax: 886-3-593-5342

Email: service.adt@tw.bureauveritas.com

Web Site: www.adt.com.tw

The road map of all our labs can be found in our web site also.

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Appendix A. SAR Plots of System Verification

The plots for system verification are shown as follows.



Appendix B. SAR Plots of SAR Measurement

The plots for SAR measurement are shown as follows.



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.



Appendix D. Photographs of EUT and Setup