



A D T

FCC SAR Test Report

Report No. : SA121026C13

Applicant : Brightstar Corporation

Address : 9725 NW 117th Ave.,Miami,Florida,United States

Product : GSM / WCDMA Smartphone

FCC ID : WVBA760X

Brand : Avvio

Model No. : Avvio760S/ Avvio 760

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 648474 D01 v01r05 / KDB 941225 D01 v02
 KDB 941225 D03 v01 / KDB 941225 D06 v01

Date of Testing : Oct. 24, 2012 ~ Nov. 06, 2012

CERTIFICATION: The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., China Branch - Dongguan 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 A2LA or any government agencies.

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Release Control Record

Issue No.	Reason for Change	Date Issued
R01	Original release	Nov. 09, 2012

1. Summary of Maximum SAR Value

Mode / Band	Test Position	SAR-1g (W/kg)
GSM850	Head	0.57
	Body Worn (1 cm Gap)	0.722
	Hotspot Mode (1 cm Gap)	1.07
GSM1900	Head	1.31
	Body Worn (1 cm Gap)	0.582
	Hotspot Mode (1 cm Gap)	0.659
WCDMA Band II	Head	1.42
	Body Worn (1 cm Gap)	0.735
	Hotspot Mode (1 cm Gap)	0.766
WCDMA Band V	Head	0.259
	Body Worn (1 cm Gap)	0.447
	Hotspot Mode (1 cm Gap)	0.645
WLAN 2.4GHz	Head	0.067
	Body Worn (1 cm Gap)	0.059
	Hotspot Mode (1 cm Gap)	0.048
Bluetooth	Head	N/A
	Body Worn (1 cm Gap)	N/A
	Hotspot Mode (1 cm Gap)	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 $2P_{Ref}$, SAR testing for Bluetooth is not required.

2. Description of Equipment Under Test

EUT Type	GSM / WCDMA Smartphone
FCC ID	WVBA760X
Brand Name	Avvio
Model Name	Avvio760S/ Avvio 760
Tx Frequency Bands (Unit: MHz)	GSM850 : 824 ~ 849 GSM1900 : 1850 ~ 1910 WCDMA Band II : 1850 ~ 1910 WCDMA Band V : 824 ~ 849 WLAN : 2400 ~ 2483.5 Bluetooth : 2400 ~ 2483.5
Uplink Modulations	GSM & GPRS : GMSK WCDMA : QPSK 802.11b : DSSS 802.11g/n : OFDM Bluetooth : GFSK
Maximum AVG Conducted Power (Unit: dBm)	GSM850 : 32.43 GSM1900 : 29.26 WCDMA Band II : 22.88 WCDMA Band V : 22.50 802.11b : 15.98 802.11g : 14.40 802.11n HT20 : 14.12 802.11n HT40 : 14.40 Bluetooth : 5.48
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	Avvio
	Model Name	ZT-666-E0500
	Power Rating	I/P:100-240Vac, 50-60Hz, 200mA; O/P: 5Vdc, 500mA
Battery	Brand Name	Avvio
	Model Name	HQ-ZA200
	Power Rating	3.7Vdc, 1400mAh
	Type	Li-ion
Earphone	Brand Name	NA
	Model Name	NA
	Signal Line Type	1.55 meter non-shielded cable without ferrite core
USB Cable	Brand Name	NA
	Model Name	NA
	Signal Line Type	1.0 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:

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

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

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

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

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 DASY5 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.

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Fig-3.1 DASY System Setup

3.2.1 Robot

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- 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-3.2 DASY5

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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 DASY5 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	

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	

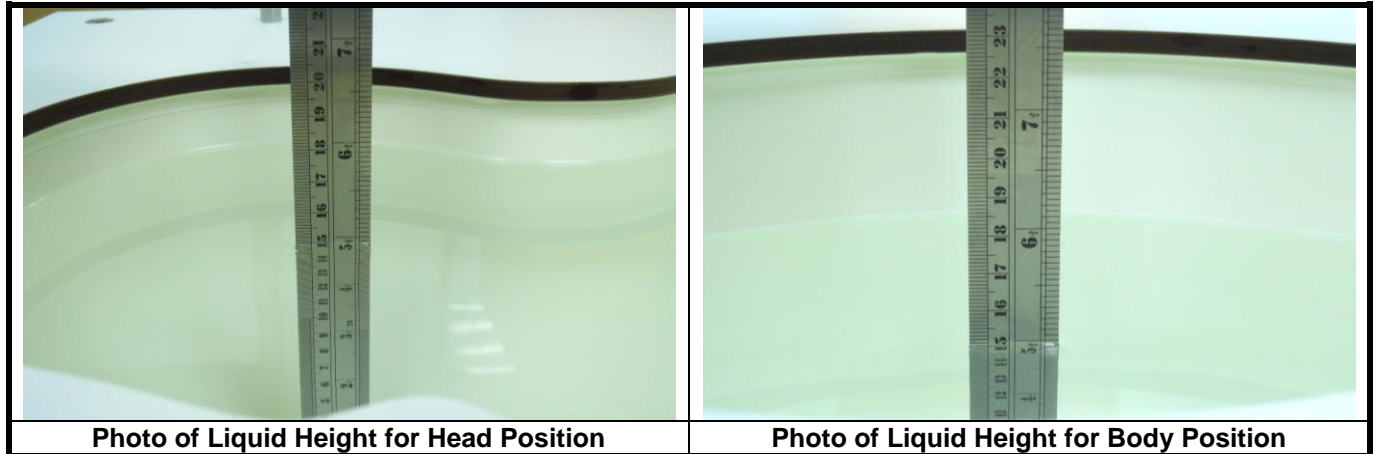
3.2.6 System Validation Dipoles

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)	

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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 SPEAG DAK-3.5 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 Head				
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
For Body				
835	55.2	52.4 ~ 58.0	0.97	0.92 ~ 1.02
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
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2450	-	45.0	-	0.1	-	-	54.9	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2450	-	31.4	-	0.1	-	-	68.5	-

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.

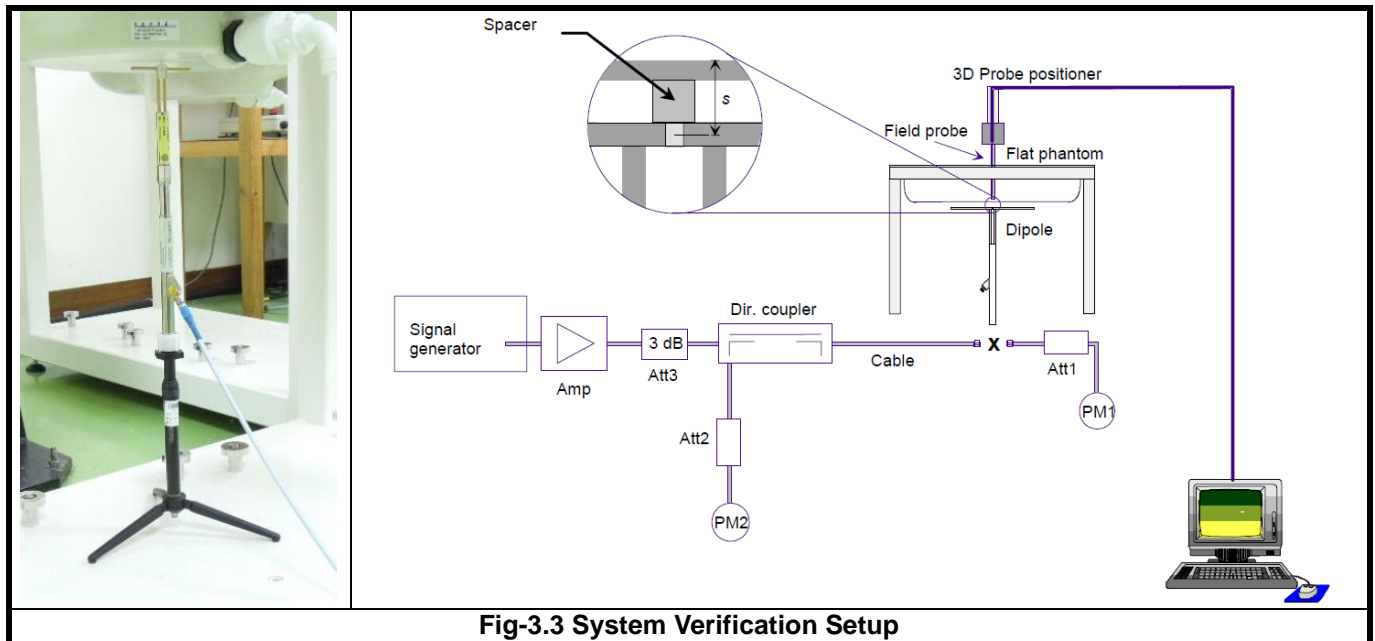


Fig-3.3 System Verification Setup

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 %.

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 DASYS 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 DASYS 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

For WWAN SAR testing, the EUT was linked and controlled by base station emulator (Agilent E5515C). 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.

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.

This device supports WiFi hotspot function, so body SAR was tested under 1 cm for the surfaces / slide edges where a transmitting antenna is within 2.5 cm from the edge. Since the SAR is required for antenna located within 2.5 cm from edge and considers the antenna location shown in appendix D, SAR testing for each antenna is listed as below.

GSM / WCDMA Antenna : Front Face, Rear Face, Left Side, Right Side, Bottom Side

WLAN / BT Antenna : Front Face, Rear Face, Right Side, Top Side

The simultaneous transmission possibilities are listed as below.

Simultaneous TX Combination	Configuration	Head (Voice / VoIP)	Body Worn (Voice / VoIP)	Hotspot (Data)
1	GSM850 (Voice / Data) + WLAN / BT (Data)	Yes	Yes	Yes
2	GSM1900 (Voice / Data) + WLAN / BT (Data)	Yes	Yes	Yes
3	WCDMA V (Voice / Data) + WLAN / BT (Data)	Yes	Yes	Yes
4	WCDMA II (Voice / Data) + WLAN / BT (Data)	Yes	Yes	Yes

The WLAN and BT cannot transmit simultaneously, so there is no co-location test requirement for WLAN and BT.

4.2 EUT Testing Position

This EUT was tested in **Right Cheek, Right Tilted, Left Cheek, Left Tilted, Front Face, Rear Face, Right Side, Left Side, Top Side** and **Bottom Side** positions as illustrated below:

1. Define two imaginary lines on the handset

- (a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.
- (b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.
- (c) 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, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

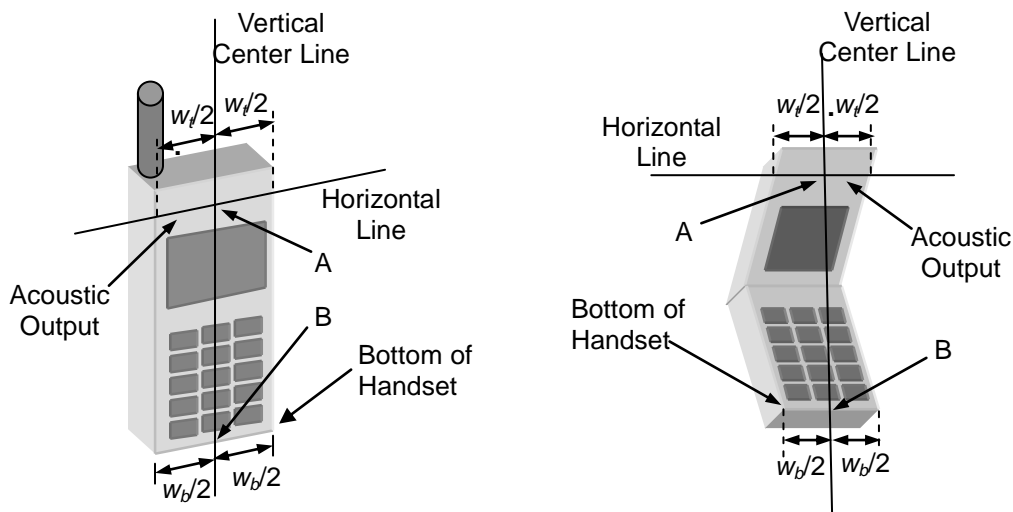


Fig-4.1 Illustration for Handset Vertical and Horizontal Reference Lines

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2. Cheek Position

- (a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.
- (b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig-4.2).

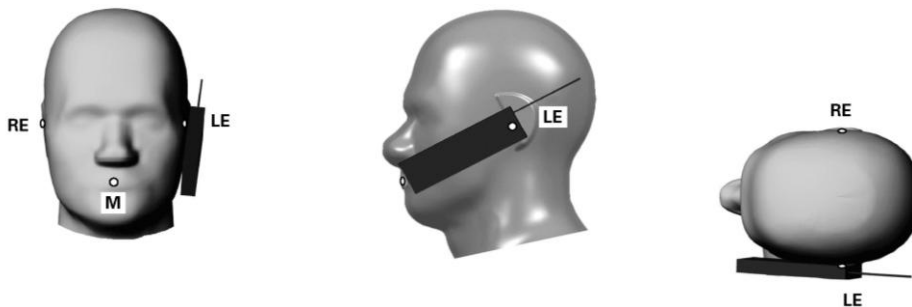


Fig-4.2 Illustration for Cheek Position

3. Tilted Position

- (a) To position the device in the “cheek” position described above.
- (b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig-4.3).

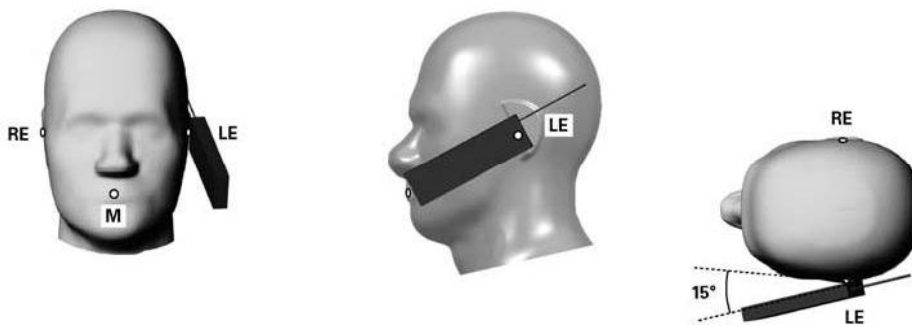
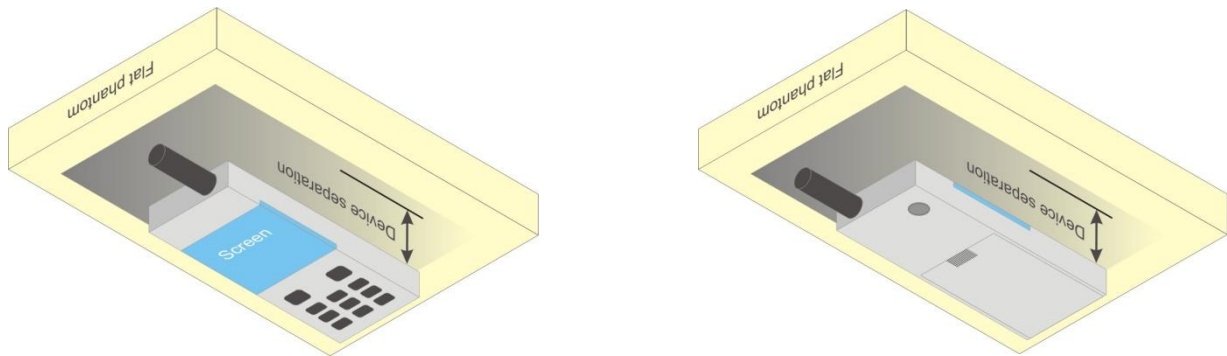


Fig-4.3 Illustration for Tilted Position

4. Body Worn Position

- (a) To position the EUT parallel to the phantom surface.
- (b) To adjust the EUT parallel to the flat phantom.
- (c) To adjust the distance between the EUT surface and the flat phantom to 1.0 cm.

**Fig-4.4 Illustration for Body Worn Position**

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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
H835	835	20.6	0.910	42.116	0.90	41.5	1.11	1.48	Oct. 24, 2012
H835	835	21.1	0.898	40.597	0.90	41.5	-0.22	-2.18	Nov. 06, 2012
H1900	1900	20.9	1.425	41.558	1.40	40.0	1.79	3.90	Oct. 25, 2012
H2450	2450	20.9	1.85	40.901	1.80	39.2	2.78	4.34	Oct. 25, 2012
B835	835	20.8	0.962	53.632	0.97	55.2	-0.82	-2.84	Oct. 27, 2012
B835	835	21.1	1.011	53.581	0.97	55.2	4.23	-2.93	Nov. 06, 2012
B1900	1900	20.7	1.505	53.555	1.52	53.3	-0.99	0.48	Oct. 26, 2012
B2450	2450	20.8	1.910	51.21	1.95	52.7	-2.05	-2.83	Oct. 26, 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	Mode	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
Oct. 24, 2012	Head	835	9.35	2.51	10.04	7.38	4d139	3873	1341
Nov. 06, 2012	Head	835	9.35	2.48	9.92	6.10	4d139	3873	1341
Oct. 25, 2012	Head	1900	39.40	9.66	38.64	-1.93	5d159	3873	1341
Oct. 25, 2012	Head	2450	53.60	12.8	51.20	-4.48	893	3873	1341
Oct. 27, 2012	Body	835	9.50	2.43	9.72	2.32	4d139	3873	1341
Nov. 06, 2012	Body	835	9.50	2.56	10.24	7.79	4d139	3873	1341
Oct. 26, 2012	Body	1900	40.30	10.1	40.40	0.25	5d159	3873	1341
Oct. 26, 2012	Body	2450	51.40	12.9	51.60	0.39	893	3873	1341

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.

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4.5 Conducted Power Results

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

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
Maximum Burst-Averaged Output Power						
GSM (GMSK, 1 Uplink)	32.43	32.43	32.43	28.99	29.26	29.20
GPRS 8 (GMSK, 1 Uplink)	32.43	32.29	32.31	28.99	29.26	29.20
GPRS 10 (GMSK, 2 Uplink)	27.81	27.61	27.60	28.37	28.64	28.58
GPRS 11 (GMSK, 3 Uplink)	27.80	27.60	27.59	26.80	27.06	26.99
GPRS 12 (GMSK, 4 Uplink)	27.78	27.58	27.57	25.76	26.04	25.97
Maximum Frame-Averaged Output Power						
GSM (GMSK, 1 Uplink)	23.43	23.43	23.43	19.99	20.26	20.20
GPRS 8 (GMSK, 1 Uplink)	23.43	23.29	23.31	19.99	20.26	20.20
GPRS 10 (GMSK, 2 Uplink)	21.81	21.61	21.60	22.37	22.64	22.58
GPRS 11 (GMSK, 3 Uplink)	23.54	23.34	23.33	22.54	22.80	22.73
GPRS 12 (GMSK, 4 Uplink)	24.78	24.58	24.57	22.76	23.04	22.97

Note:

- SAR testing for GSM/GPRS/EDGE was performed on the maximum frame-averaged power mode.
- The frame-averaged power is linearly scaled the maximum burst-averaged power based on time slots. The calculated methods are shown as below:
 Frame-averaged power = Burst-averaged power (1 Uplink) – 9 dBm
 Frame-averaged power = Burst averaged power (2 Uplink) – 6 dBm
 Frame-averaged power = Burst averaged power (3 Uplink) – 4.26 dBm
 Frame-averaged power = Burst averaged power (4 Uplink) – 3 dBm

Band	WCDMA Band II			WCDMA Band V		
Channel	9262	9400	9538	4132	4182	4233
Frequency (MHz)	1852.4	1880.0	1907.6	826.4	836.4	846.6
RMC 12.2K	22.72	22.88	22.55	22.49	22.50	22.31
HSDPA Subtest-1	22.68	22.84	22.48	22.39	22.43	22.23
HSDPA Subtest-2	21.69	21.76	21.47	21.41	21.43	21.27
HSDPA Subtest-3	21.20	21.33	21.01	20.92	20.94	20.75
HSDPA Subtest-4	21.18	21.27	20.98	20.89	20.91	20.71
HSUPA Subtest-1	20.71	20.81	20.73	20.46	20.49	20.33
HSUPA Subtest-2	19.69	19.78	19.68	19.45	19.48	19.32
HSUPA Subtest-3	20.17	20.34	20.03	19.95	20.00	19.80
HSUPA Subtest-4	20.71	20.89	20.71	20.49	20.52	20.35
HSUPA Subtest-5	21.24	21.33	21.00	20.96	20.98	20.80

Band	802.11b			802.11g		
Channel	1	6	11	1	6	11
Frequency (MHz)	2412	2437	2462	2412	2437	2462
Average Power	15.98	15.82	15.15	14.20	14.40	13.56

Band	802.11n (HT20)			802.11n (HT40)		
Channel	1	6	11	3	6	9
Frequency (MHz)	2412	2437	2462	2422	2437	2452
Average Power	14.12	13.89	13.54	14.40	14.10	13.65



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4.6 SAR Testing Results

4.6.1 SAR Results for Head

Plot No.	Band	Mode	Test Position	Channel	SAR-1g (W/kg)
1	GSM850	GPRS 12	Right Cheek	128	0.57
2	GSM850	GPRS 12	Right Tilted	128	0.372
3	GSM850	GPRS 12	Left Cheek	128	0.557
4	GSM850	GPRS 12	Left Tilted	128	0.357
5	GSM1900	GPRS 12	Right Cheek	661	0.746
6	GSM1900	GPRS 12	Right Tilted	661	0.267
7	GSM1900	GPRS 12	Left Cheek	661	1.14
8	GSM1900	GPRS 12	Left Tilted	661	0.286
9	GSM1900	GPRS 12	Left Cheek	512	1.31
50	GSM1900	GPRS 12	Left Cheek	810	0.926
14	WCDMA II	RMC 12.2K	Right Cheek	9400	0.74
15	WCDMA II	RMC 12.2K	Right Tilted	9400	0.202
16	WCDMA II	RMC 12.2K	Left Cheek	9400	1.42
17	WCDMA II	RMC 12.2K	Left Tilted	9400	0.233
51	WCDMA II	RMC 12.2K	Left Cheek	9262	1.29
52	WCDMA II	RMC 12.2K	Left Cheek	9538	1.19
10	WCDMA V	RMC 12.2K	Right Cheek	4182	0.252
11	WCDMA V	RMC 12.2K	Right Tilted	4182	0.175
12	WCDMA V	RMC 12.2K	Left Cheek	4182	0.259
13	WCDMA V	RMC 12.2K	Left Tilted	4182	0.193
101	802.11b	-	Right Cheek	1	0.038
102	802.11b	-	Right Tilted	1	0.025
103	802.11b	-	Left Cheek	1	0.067
104	802.11b	-	Left Tilted	1	0.031

Note:

1. SAR is performed on the highest power channel. When the SAR value of highest power channel is less than 0.8 W/kg, SAR testing for optional channel is not required.
2. Since GPRS and WLAN of this device supports VOIP capability through 3rd party apps software, we have evaluated data mode for head SAR.
3. SAR testing for 802.11g/n is not required because its maximum power is less than 1/4 dB higher than 802.11b.



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4.6.2 SAR Results for Body

<Body Worn Mode>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR-1g (W/kg)
23	GSM850	GPRS 12	Front Face	1	128	0.611
24	GSM850	GPRS 12	Rear Face	1	128	0.722
30	GSM1900	GPRS 12	Front Face	1	661	0.582
31	GSM1900	GPRS 12	Rear Face	1	661	0.519
44	WCDMA II	RMC 12.2K	Front Face	1	9400	0.735
45	WCDMA II	RMC 12.2K	Rear Face	1	9400	0.645
37	WCDMA V	RMC 12.2K	Front Face	1	4182	0.3
38	WCDMA V	RMC 12.2K	Rear Face	1	4182	0.447
109	802.11b	-	Front Face	1	1	0.01
110	802.11b	-	Rear Face	1	1	0.059

Note:

1. SAR is performed on the highest power channel. When the SAR value of highest power channel is less than 0.8 W/kg, SAR testing for optional channel is not required.
2. Since GPRS, WCDMA and WLAN of this device support VOIP capability through 3rd party apps software, we have evaluated data mode for body worn mode.
3. SAR testing for 802.11g/n is not required because its maximum power is less than 1/4 dB higher than 802.11b.



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A D T

<Hotspot Mode>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR-1g (W/kg)
18	GSM850	GPRS 12	Front Face	1	128	0.823
19	GSM850	GPRS 12	Rear Face	1	128	1.07
20	GSM850	GPRS 12	Left Side	1	128	0.765
21	GSM850	GPRS 12	Right Side	1	128	0.542
22	GSM850	GPRS 12	Bottom Side	1	128	0.065
46	GSM850	GPRS 12	Front Face	1	189	0.788
47	GSM850	GPRS 12	Front Face	1	251	0.668
48	GSM850	GPRS 12	Rear Face	1	189	0.985
49	GSM850	GPRS 12	Rear Face	1	251	0.808
25	GSM1900	GPRS 12	Front Face	1	661	0.585
26	GSM1900	GPRS 12	Rear Face	1	661	0.506
27	GSM1900	GPRS 12	Left Side	1	661	0.142
28	GSM1900	GPRS 12	Right Side	1	661	0.153
29	GSM1900	GPRS 12	Bottom Side	1	661	0.659
39	WCDMA II	RMC 12.2K	Front Face	1	9400	0.723
40	WCDMA II	RMC 12.2K	Rear Face	1	9400	0.667
41	WCDMA II	RMC 12.2K	Left Side	1	9400	0.182
42	WCDMA II	RMC 12.2K	Right Side	1	9400	0.192
43	WCDMA II	RMC 12.2K	Bottom Side	1	9400	0.766
32	WCDMA V	RMC 12.2K	Front Face	1	4182	0.38
33	WCDMA V	RMC 12.2K	Rear Face	1	4182	0.645
34	WCDMA V	RMC 12.2K	Left Side	1	4182	0.29
35	WCDMA V	RMC 12.2K	Right Side	1	4182	0.297
36	WCDMA V	RMC 12.2K	Bottom Side	1	4182	0.038
105	802.11b	-	Front Face	1	1	0.014
106	802.11b	-	Rear Face	1	1	0.048
107	802.11b	-	Right Side	1	1	0.035
108	802.11b	-	Top Side	1	1	0.0096

Note:

1. SAR is performed on the highest power channel. When the SAR value of highest power channel is less than 0.8 W/kg, SAR testing for optional channel is not required.
2. SAR testing for 802.11g/n is not required because its maximum power is less than 1/4 dB higher than 802.11b.

Test Engineer : Becon Wu

4.6.3 Simultaneous Multi-band Transmission Evaluation

No.	Conditions (SAR1 + SAR2)	Mode	Position	Max. SAR1	Max. SAR2	SAR Summation	SPLSR
1	GSM850 + WLAN 2.4G	Head	Right Cheek	0.57	0.038	0.608	-
			Right Tilted	0.372	0.025	0.397	-
			Left Cheek	0.557	0.067	0.624	-
			Left Tilted	0.357	0.031	0.388	-
		Body-Worn	Front Face	0.611	0.01	0.621	-
			Rear Face	0.722	0.059	0.781	-
		Hotspot	Front Face	0.823	0.014	0.837	-
			Rear Face	1.07	0.048	1.118	-
			Left Side	0.765	0	0.765	-
			Right Side	0.542	0.035	0.577	-
			Top Side	0	0.0096	0.0096	-
			Bottom Side	0.065	0	0.065	-
2	GSM1900 + WLAN 2.4G	Head	Right Cheek	0.746	0.038	0.784	-
			Right Tilted	0.267	0.025	0.292	-
			Left Cheek	1.31	0.067	1.377	-
			Left Tilted	0.286	0.031	0.317	-
		Body-Worn	Front Face	0.582	0.01	0.592	-
			Rear Face	0.519	0.059	0.578	-
		Hotspot	Front Face	0.585	0.014	0.599	-
			Rear Face	0.506	0.048	0.554	-
			Left Side	0.142	0	0.142	-
			Right Side	0.153	0.035	0.188	-
			Top Side	0	0.0096	0.0096	-
			Bottom Side	0.659	0	0.659	-
3	WCDMA II + WLAN 2.4G	Head	Right Cheek	0.74	0.038	0.778	-
			Right Tilted	0.202	0.025	0.227	-
			Left Cheek	1.42	0.067	1.487	-
			Left Tilted	0.233	0.031	0.264	-
		Body-Worn	Front Face	0.735	0.01	0.745	-
			Rear Face	0.645	0.059	0.704	-
		Hotspot	Front Face	0.723	0.014	0.737	-
			Rear Face	0.667	0.048	0.715	-
			Left Side	0.182	0	0.182	-
			Right Side	0.192	0.035	0.227	-
			Top Side	0	0.0096	0.0096	-
			Bottom Side	0.766	0	0.766	-
4	WCDMA V + WLAN 2.4G	Head	Right Cheek	0.252	0.038	0.29	-
			Right Tilted	0.175	0.025	0.2	-
			Left Cheek	0.259	0.067	0.326	-
			Left Tilted	0.193	0.031	0.224	-
		Body-Worn	Front Face	0.3	0.01	0.31	-
			Rear Face	0.447	0.059	0.506	-
		Hotspot	Front Face	0.38	0.014	0.394	-
			Rear Face	0.645	0.048	0.693	-
			Left Side	0.29	0	0.29	-
			Right Side	0.297	0.035	0.332	-
			Top Side	0	0.0096	0.0096	-
			Bottom Side	0.038	0	0.038	-

Note:

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



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Summary:

According to KDB 648474, the simultaneous transmission SAR for WWAN and WLAN was not required, because the SAR summation is less than 1.6 W/kg. The BT standalone SAR and WWAN/BT simultaneous transmission SAR were not required, because the maximum output power of Bluetooth is less than $2P_{Ref}$ and the closest separation distance of these antennas is larger than 5 cm.



5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Kit	SPEAG	D835V2	4d139	Aug. 07, 2012	Annual
System Validation Kit	SPEAG	D1900V2	5d159	Jul. 20, 2012	Annual
System Validation Kit	SPEAG	D2450V2	893	Jul. 24, 2012	Annual
Dosimetric E-Field Probe	SPEAG	EX3DV4	3873	Aug. 06, 2012	Annual
Data Acquisition Electronics	SPEAG	DAE4	1341	Aug. 07, 2012	Annual
SAM Phantom	SPEAG	QD000P40CD	TP-1695	N/A	N/A
SAM Phantom	SPEAG	QD000P40CD	TP-1722	N/A	N/A
Radio Communication Tester	Agilent	E5515C	MY48360810	Feb. 15, 2012	Biennial
ENA Series Network Analyzer	Agilent	E5071C	MY46214638	Jun. 30, 2012	Annual
MXG Analog Signal Generator	Agilent	N5183A	MY50140890	Nov. 07, 2011	Annual
Power Meter	Agilent	N1914A	MY52180044	Aug. 24, 2012	Annual
Power Sensor	Agilent	E9304A	MY52050011	Aug. 23, 2012	Annual
EXA Spectrum Analyzer	Agilent	E7405A	MY45118807	May 14, 2012	Annual
Dielectric Assessment Kit	SPEAG	DAK-3.5	1076	Jul. 30, 2012	Annual
Thermometer	YFE	YF-160A	120100323	Sep. 03, 2012	Annual
Power Amplifier	TESEQ	CBA 1G-150	T44029	Dec. 28, 2011	Annual
Power Amplifier	TESEQ	CBA 3G-100	T44030	Dec. 28, 2011	Annual
Power Amplifier	TESEQ	CBA 6G-50	1041204	Dec. 28, 2011	Annual
Attenuator	Woken	00800A1G01L-03	N/A	Sep. 03, 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., China 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.

If you have any comments, please feel free to contact us at the following:

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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