FCC SAR Test Report

APPLICANT	**:**	**ZTE CORPORATION**
EQUIPMENT	**:**	**V9A and Light Tab 2**
BRAND NAME		**ZTE**
MODEL NAME	**:**	**V9A**
FCC ID	**:**	**Q78-V9A**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)** **IEEE C95.1-1991** **IEEE 1528-2003** **FCC OET Bulletin 65 Supplement C (Edition 01-01)**

The product was received on Mar. 21, 2012 and completely tested on Jun. 12, 2012. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.

Reviewed by:

Jones Tsai

Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL (KUNSHAN) INC.
No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C.

Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA232102	Rev. 01	Initial issue of report	Mar. 18, 2012

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION; DUT: V9A and Light Tab 2; Brand Name: ZTE; Model Name: V9A** are as follows.

Band	Position	SAR_{1g} (W/kg)
GSM850	Body (0 cm)	0.553
GSM1900	Body (0 cm)	0.666
WCDMA Band V	Body (0 cm)	0.278
WCDMA Band II	Body (0 cm)	0.762
802.11 b/g/n	Body (0 cm)	0.661

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1991, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement C (Edition 01-01).

2. Administration Data

2.1 Testing Laboratory

Test Site	SPORTON INTERNATIONAL (KUNSHAN) INC.
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958

2.2 Applicant

Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China

2.3 Manufacturer

Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech, Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P.R.China

2.4 Application Details

Date of Receipt of Application	Mar. 21, 2012
Date of Start during the Test	Mar. 27, 2012
Date of End during the Test	Jun. 12, 2012

3. General Information

3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
DUT Type	V9A and Light Tab 2
Brand Name	ZTE
Model Name	V9A
IMEI Number	861932010054205
FCC ID	Q78-V9A
Tx Frequency	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz 802.11b/g/n: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Rx Frequency	GSM850: 869.2 MHz ~ 893.8 MHz GSM1900: 1930.2 MHz ~ 1989.8 MHz WCDMA Band V: 871.4 MHz ~ 891.6 MHz WCDMA Band II: 1932.4 MHz ~ 1987.6 MHz 802.11b/g/n: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Maximum Average Output Power to Antenna	GSM850: 33.21 dBm GSM1900: 29.89 dBm WCDMA Band V: 23.33 dBm WCDMA Band II: 22.50 dBm 802.11b: 16.71 dBm 802.11g: 10.24 dBm 802.11n (2.4GHz): 8.51 dBm (BW 20MHz) Bluetooth: -3.73 dBm
Antenna Type	WWAN : PIFA Antenna WLAN : PIFA Antenna Bluetooth : PIFA Antenna
Type of Modulation	GSM: GMSK GPRS: GMSK EDGE: GMSK / 8PSK WCDMA: QPSK (uplink) HSDPA: QPSK (uplink) HSUPA: QPSK (uplink) 802.11b: DSSS (BPSK / QPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth (1Mbps): GFSK Bluetooth EDR (2Mbps): π/4-DQPSK Bluetooth EDR (3Mbps): 8-DPSK
DUT Stage	Identical Prototype

Remark:
1. The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. DTM not supported.

3.2 Product Photos

Please refer to Appendix D

3.3 Applied Standards

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- IEEE C95.1-1991
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v04
- FCC KDB 616217 D03 v01
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D03 v01
- FCC KDB 248227 D01 v01r02

3.4 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

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

4. Specific Absorption Rate (SAR)

4.1 Introduction

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.

4.2 SAR Definition

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:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5. SAR Measurement System

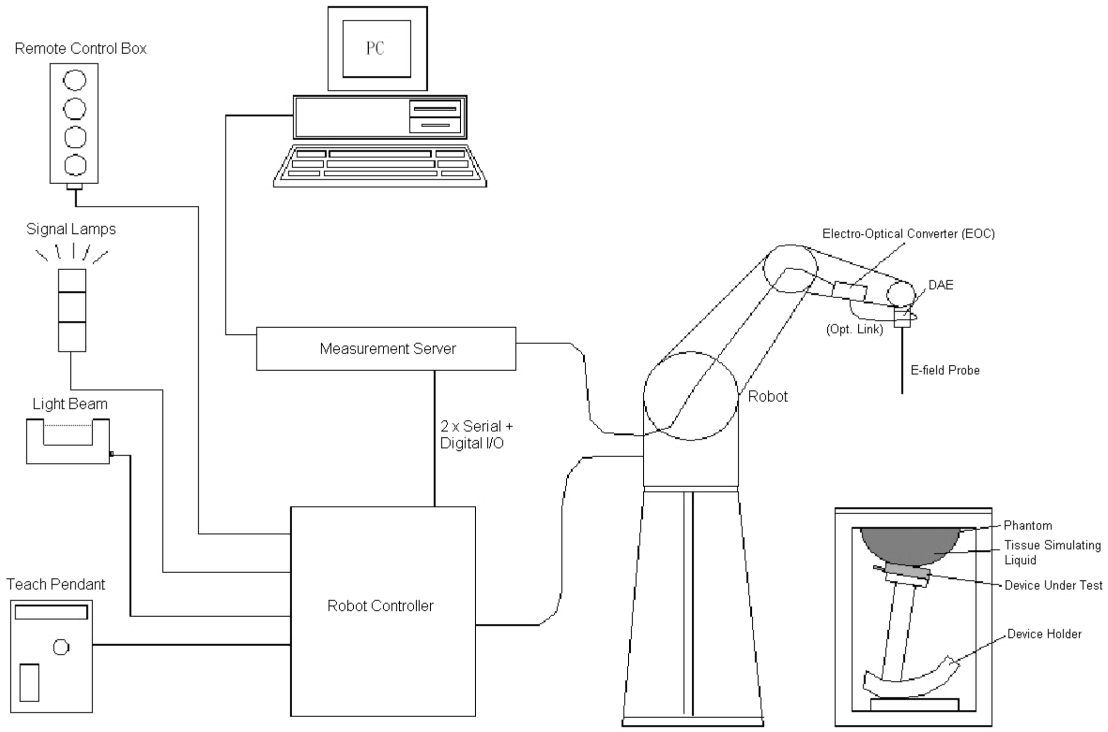


Fig 5.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

5.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).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. This probe has a built in optical surface detection system to prevent from collision with phantom.

5.1.1 E-Field Probe Specification

<EX3DV4 Probe>

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 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) Typical distance from probe tip to dipole centers: 1 mm

Fig 5.2 Photo of EX3DV4

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) 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 input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.3 Photo of DAE

5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) type 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 5.4 Photo of DASY5

5.4 Measurement Server

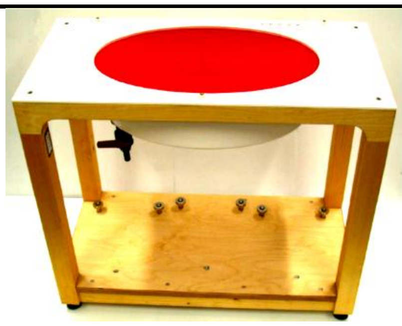
The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

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

Fig 5.5 Photo of Server for DASY5

5.5 Phantom

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	 **Fig 5.6 Photo of ELI4 Phantom**
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI4 phantom is intended 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 standard and all known tissue simulating liquids.

5.6 Device Holder

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

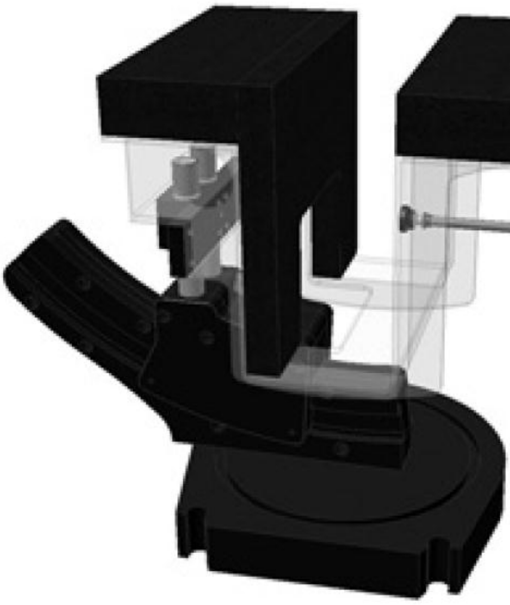


Fig 5.7 Laptop Extension Kit

5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

5.7.2 Data Evaluation

The DASY 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 they can 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：

$$\mathbf{V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}}$$

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

H-field Probes：$\mathbf{H_i = \sqrt{V_i} \cdot \frac{a_{i0}+a_{i1}f+a_{i2}f^2}{f}}$

with V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), $\mu V/(V/m)^2$ for E-field Probes
ConvF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude)：

$$\mathbf{E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}}$$

The primary field data are used to calculate the derived field units.

$$\mathbf{SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5.8 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Sep. 02, 2011	Sep. 01, 2012
SPEAG	Data Acquisition Electronics	DAE4	1210	Nov. 18, 2011	Nov. 17, 2012
SPEAG	835MHz System Validation Kit	D835V2	4d091	Nov. 18, 2011	Nov. 17, 2012
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	Nov. 21, 2011	Nov. 20, 2012
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2012
SPEAG	ELI4 Phantom	QD OVA 001 BB	TP-1079	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201074235	Nov. 30, 2011	Nov. 29, 2012
Agilent	Wireless Communication Test Set	E5515C	GB47050646	Aug. 18, 2011	Aug. 17, 2012
Agilent	Wireless Communication Test Set	E5515C	MY48367160	Oct. 26, 2011	Oct. 25, 2012
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	Apr. 13, 2012	Apr. 14, 2013
Agilent	Dielectric Probe Kit	85070E	MY44300475	NCR	NCR
R&S	Signal Generator	SMR40	100455	Dec. 30, 2011	Dec. 29, 2012
AR	Amplifier	551G4	333096	NCR	NCR
Agilent	Power Meter	E4416A	MY45101555	Aug. 23, 2011	Aug. 22, 2012
Agilent	Power Sensor	E9327A	MY44421198	Aug. 23, 2011	Aug. 22, 2012
ARRA	Power Divider	A3200-2	N/A	NA	NA
MCL	Attenuation	BW-S10W5	N/A	NA	NA
R&S	Spectrum Analyzer	FSP30	101399	Jun. 01, 2012	May 31, 2013

Table 5.1 Test Equipment List

Note: The calibration certificate of DASY can be referred to appendix C of this report.

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. 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, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 6.2.

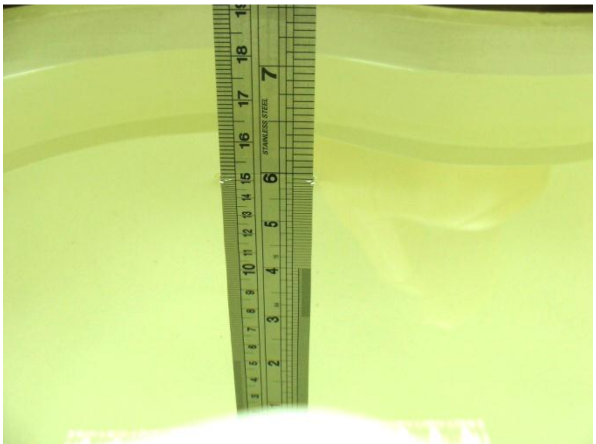


Fig 6.1 Photo of Liquid Height for Head SAR

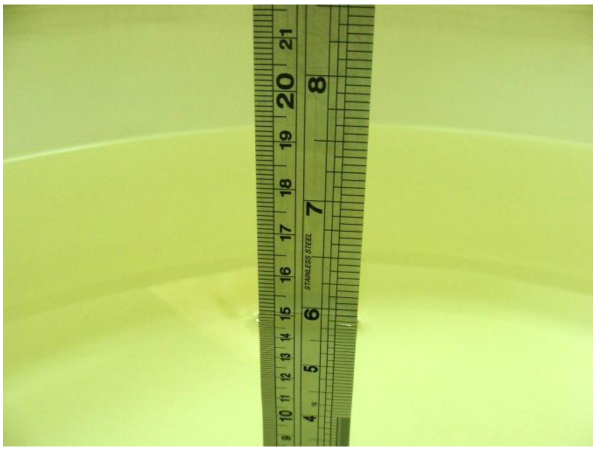


Fig 6.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ε_r)
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Table 6.1 Recipes of Tissue Simulating Liquid

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Freq.	Liquid Type	Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	21.3	0.974	54.252	0.97	55.2	0.41	-1.72	±5	Mar. 27, 2012
1900	Body	21.4	1.519	53.569	1.52	53.3	-0.07	0.50	±5	Mar. 27, 2012
2450	Body	21.3	1.992	54.311	1.95	52.7	2.15	3.06	±5	Jun. 12, 2012

Table 6.2 Measuring Results for Simulating Liquid

7. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 7.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 7.1 Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 7.2.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Standard Uncertainty (1g)
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	0.3	Normal	1	1	± 0.3 %
Response Time	0.8	Rectangular	√3	1	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	± 0.6 %
Test Sample Related					
Device Positioning	2.9	Normal	1	1	± 2.9 %
Device Holder	3.6	Normal	1	1	± 3.6 %
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.)	2.5	Normal	1	0.64	± 1.6 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	± 1.7 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	± 1.5 %
Combined Standard Uncertainty					± 10.99 %
Coverage Factor for 95 %					K = 2
Expanded Uncertainty					**± 21.97 %**

Table 7.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

8. SAR Measurement Evaluation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

8.1 Purpose of System Performance check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

8.2 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

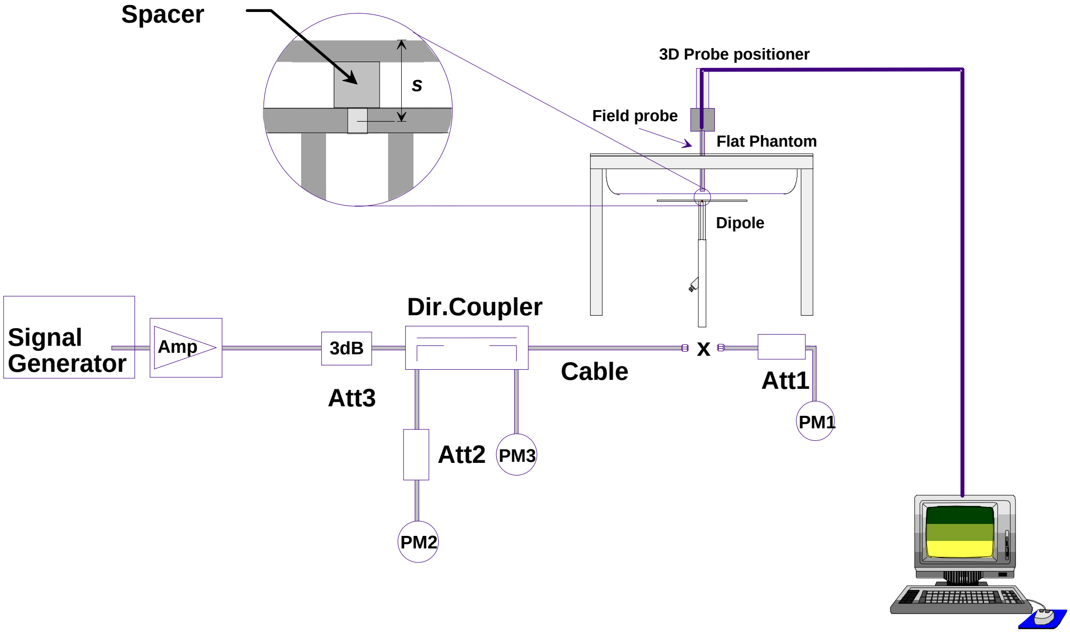


Fig 8.1 System Setup for System Evaluation

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected.

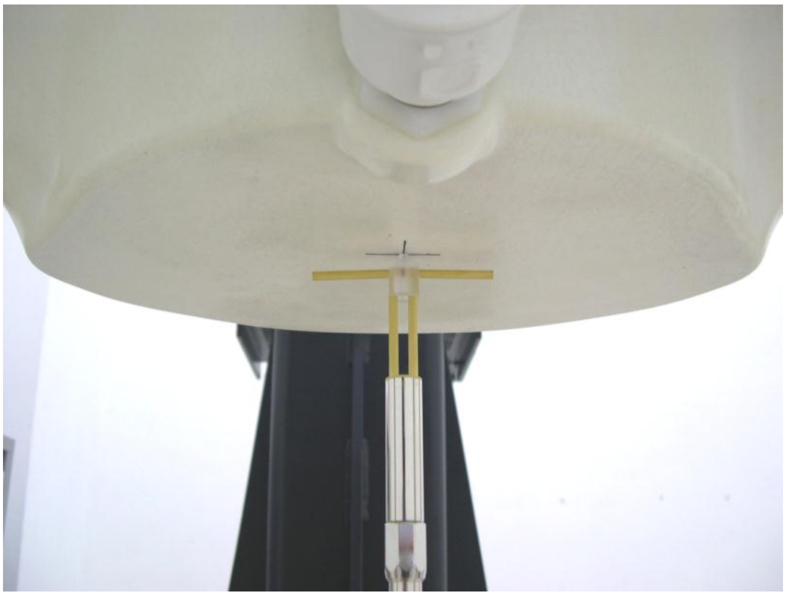


Fig 8.2 Photo of Dipole Setup

8.3 Validation Results

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 8.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Measurement Date	Frequency (MHz)	Liquid Type	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
Mar. 27, 2012	835	Body	9.42	2.51	10.04	6.58
Mar. 27, 2012	1900	Body	41.8	10.2	40.80	-2.39
Jun. 12, 2012	2450	Body	52.3	12.7	50.80	-2.87

Table 8.1 Target and Measurement SAR after Normalized

9. DUT Testing Position

This DUT was tested in four different positions. They are Bottom Face, Secondary Landscape, Primary Portrait, and Secondary Portrait. In these positions, the surface of DUT is touching with phantom 0 cm gap. Please refer to Appendix E for the test setup photos.

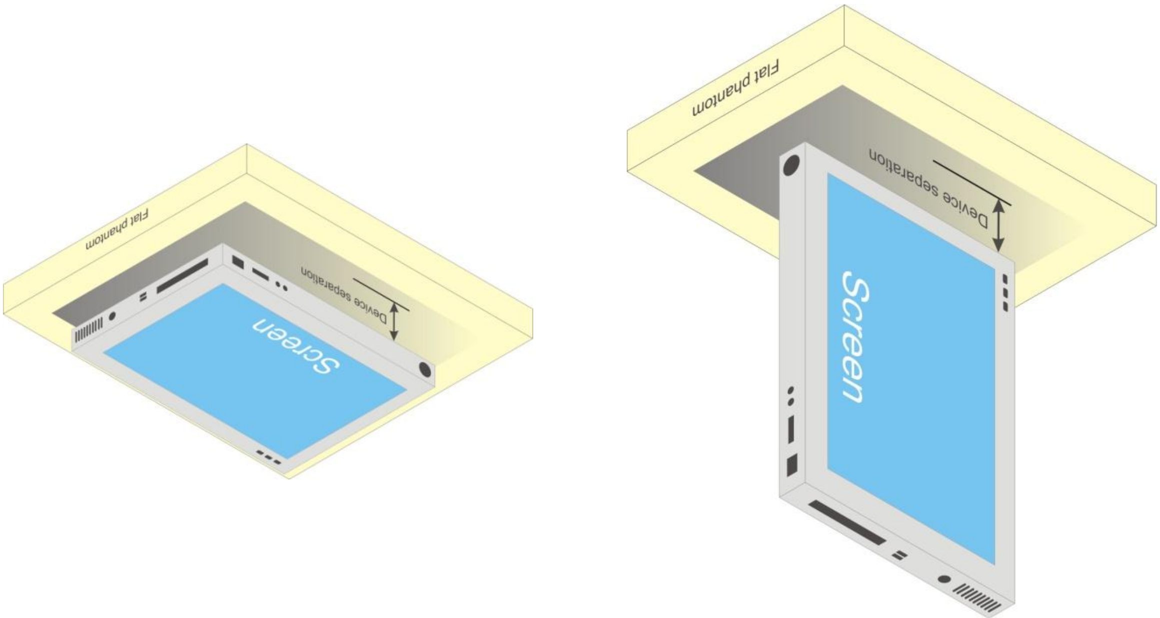


Fig 9.1 Illustration for Lap-touching Position

10. Measurement Procedures

The measurement procedures are as follows:

(a) Use base station or engineering software (if applicable) to transmit RF power continuously (continuous Tx) in the highest power channel Set base station emulator to allow DUT to radiate maximum output power.
(b) Measure output power through RF cable and power meter.
(c) Place the DUT in the positions as Appendix E demonstrates.
(d) Set scan area, grid size and other setting on the DASY software.
(e) Measure SAR results for the highest power channel on each testing position.
(f) Find out the largest SAR result on these testing positions of each band
(g) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the 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

10.1 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 form 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

10.2 Area & Zoom Scan Procedures

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 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

10.3 Volume Scan Procedures

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 DUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

10.4 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.

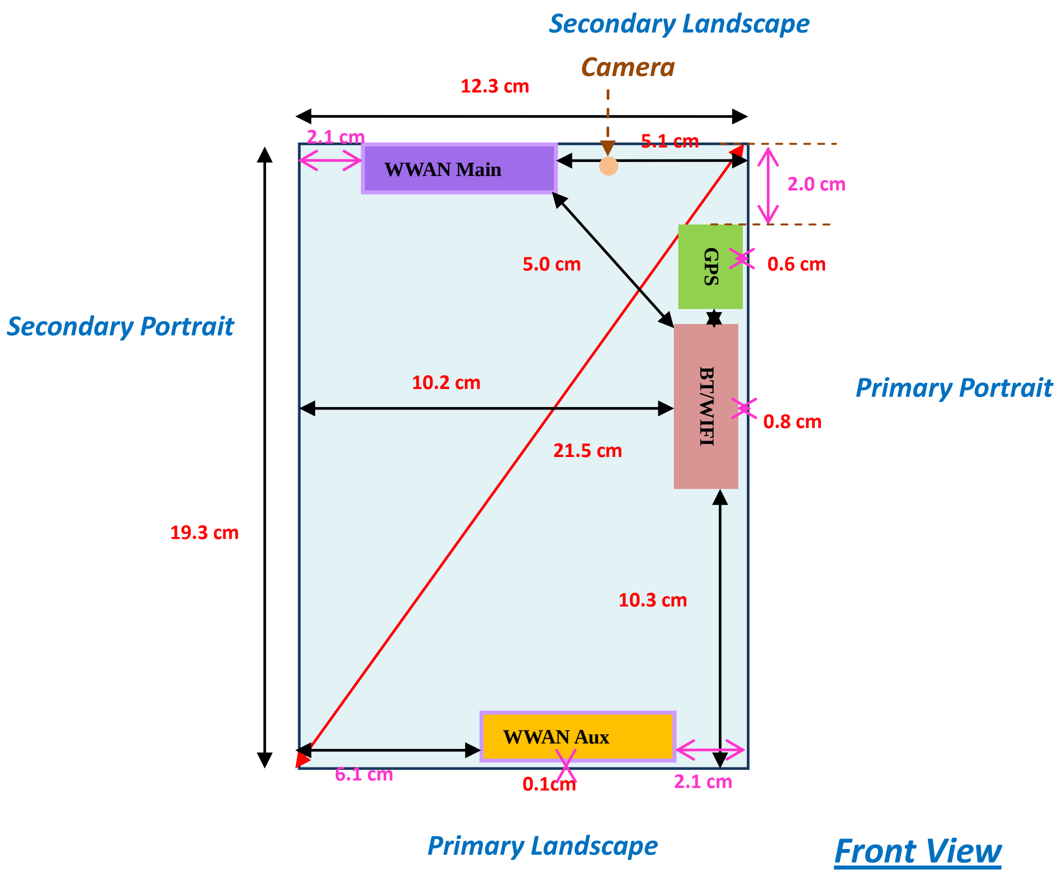
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

10.5 Power Drift Monitoring

All SAR testing is under the DUT 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 DUT 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.

11. SAR Test Configurations

11.1 Exposure Positions Consideration



Antenna	Length	Width
WWAN Antenna	5.1 cm	1.2 cm
WWAN Diversity Antenna	4.1 cm	1.0 cm
BT&WLAN Antenna	3.7 cm	1.3 cm
GPS Antenna (Rx)	3.1 cm	1.2 cm
EUT	19.3 cm	12.3 cm

WWAN Main Antenna <Tx/Rx>	GSM850 / GSM1900 / WCDMA Band II WCDMA Band V
WWAN Diversity Antenna < Rx>	GSM850 / GSM1900 / WCDMA Band II WCDMA Band V
BT/WIFI Antenna <Tx/Rx>	Bluetooth / 802.11 b/g/n
GPS Antenna <Rx>	GPS Antenna receiving only

Sides for SAR tests; Tablet mode						
	Bottom Face	Front Face	Secondary Landscape	Primary Landscape	Secondary Portrait	Primary Portrait
GSM	✓(0 mm)	x	✓(0 mm)	x	✓(0 mm)	X
UMTS	✓(0 mm)	x	✓(0 mm)	x	✓(0 mm)	X
WLAN	✓(0 mm)	x	x	x	x	✓(0 mm)

Note:

1. The DUT diagonal dimension is 215 mm; per KDB 941225 D07, the DUT diagonal > 20 cm and Mini-Tablet procedure is not applied. Therefore, SAR tests follow the Tablet Mode in KDB447498.
2. There is no screen orientation limitation in DUT; that is 4 orientations are supported. The power reduction for SAR compliance is not triggered by the screen orientation.
3. As in (1), the test distance is 0 mm to the flat phantom; SAR evaluation is required for Bottom Face and each applicable Edge with the antenna within 5 cm to the user.

12. SAR Test Results

12.1 Conducted Power (Unit: dBm)

<GSM/GPRS/EDGE>

Burst Average Power						
Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
GSM (1 Uplink)	33.18	33.15	32.96	29.66	29.89	29.53
GPRS 8 (1 Uplink) – CS1	33.21	33.14	32.96	29.68	29.83	29.43
GPRS 10 (2 Uplink) – CS1	30.60	30.76	30.83	27.01	26.85	26.90
GPRS 11 (3 Uplink) – CS1	29.00	28.95	28.79	24.74	24.92	24.93
GPRS 12 (4 Uplink) – CS1	27.84	27.61	27.75	24.71	24.42	24.46
EDGE 8 (GMSK, 1 Uplink) – MCS1	33.19	33.13	32.96	29.53	29.84	29.51
EDGE 10 (GMSK, 2 Uplink) – MCS1	30.55	30.83	30.81	26.87	26.84	26.95
EDGE 11 (GMSK, 3 Uplink) – MCS1	28.97	29.04	28.76	25.17	25.17	25.02
EDGE 12 (GMSK, 4 Uplink) – MCS1	27.73	27.77	27.82	24.62	24.66	24.47
EDGE 8 (8PSK, 1 Uplink) – MCS9	26.93	26.81	26.75	25.19	26.15	25.73
EDGE 10 (8PSK, 2 Uplink) – MCS9	24.25	24.13	24.16	22.72	23.49	23.13
EDGE 11 (8PSK, 3 Uplink) – MCS9	22.42	22.25	22.45	20.77	21.59	21.27
EDGE 12 (8PSK, 4 Uplink) – MCS9	21.53	21.76	21.78	20.90	21.71	21.39

Source-Based Time-Averaged Power						
Band	**GSM850**			**GSM1900**		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**1850.2**	**1880.0**	**1909.8**
GSM (1 Uplink)	24.18	24.15	23.96	20.66	20.89	20.53
GPRS 8 (1 Uplink) – CS1	24.21	24.14	23.96	20.68	20.83	20.43
GPRS 10 (2 Uplink) – CS1	24.60	24.76	24.83	21.01	20.85	20.90
GPRS 11 (3 Uplink) – CS1	24.74	24.69	24.53	20.48	20.66	20.67
GPRS 12 (4 Uplink) – CS1	**24.84**	24.61	24.75	**21.71**	21.42	21.46
EDGE 8 (GMSK, 1 Uplink) – MCS1	24.19	24.13	23.96	20.53	20.84	20.51
EDGE 10 (GMSK, 2 Uplink) – MCS1	24.55	24.83	24.81	20.87	20.84	20.95
EDGE 11 (GMSK, 3 Uplink) – MCS1	24.71	24.78	24.50	20.91	20.91	20.76
EDGE 12 (GMSK, 4 Uplink) – MCS1	24.73	24.77	24.82	21.62	21.66	21.47
EDGE 8 (8PSK, 1 Uplink) – MCS9	17.93	17.81	17.75	16.19	17.15	16.73
EDGE 10 (8PSK, 2 Uplink) – MCS9	18.25	18.13	18.16	16.72	17.49	17.13
EDGE 11 (8PSK, 3 Uplink) – MCS9	18.16	17.99	18.19	16.51	17.33	17.01
EDGE 12 (8PSK, 4 Uplink) – MCS9	18.53	18.76	18.78	17.90	18.71	18.39

Remark: The source-based time-averaged power is linearly scaled the maximum burst averaged power based on time slots. The calculated method are shown as below:
Source based time averaged power = Maximum burst averaged power (1 Uplink) - 9 dB
Source based time averaged power = Maximum burst averaged power (2 Uplink) - 6 dB
Source based time averaged power = Maximum burst averaged power (3 Uplink) - 4.26 dB
Source based time averaged power = Maximum burst averaged power (4 Uplink) - 3 dB

Note:

1. Following KDB 941225 D03, for Body SAR testing, the DUT was set in GPRS 12 for GSM850 and set in GPRS 12 for GSM1900 due to its highest source-based time-average power.
2. Per KDB 447498, the maximum output power channel is used for SAR testing and for further SAR test reduction.
3. EDGE tests with MCS1 setting, GMSK modulation. Burst average power with MCS9 setting 8 PSK modulation, is provided voluntary for reference.

<WCDMA/HSDPA/HSUPA>

Band	WCDMA Band V			WCDMA Band II		
Channel	4132	4182	4233	9262	9400	9538
Frequency (MHz)	826.4	836.4	846.6	1852.4	1880.0	1907.6
RMC 12.2K	23.14	23.33	23.26	22.19	22.50	22.37
HSDPA Subtest-1	21.04	21.27	21.07	21.02	21.32	21.19
HSDPA Subtest-2	21.03	21.23	21.62	21.55	21.31	21.25
HSDPA Subtest-3	21.04	21.24	21.01	21.01	21.34	21.22
HSDPA Subtest-4	21.02	21.28	21.58	21.46	21.27	21.26
HSUPA Subtest-1	21.58	21.27	21.50	21.22	21.62	21.24
HSUPA Subtest-2	21.25	21.57	21.34	21.58	21.33	21.40
HSUPA Subtest-3	21.50	21.32	21.52	21.21	21.58	21.26
HSUPA Subtest-4	21.24	21.51	21.50	21.17	21.55	21.83
HSUPA Subtest-5	21.63	21.41	21.49	21.28	21.62	21.56

MPR (dB)							
3GPP MPR	Subtest	WCDMA Band V			WCDMA Band II		
0	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	HSDPA Subtest-2	0.01	0.04	-0.55	-0.53	0.01	-0.06
≤ 0.5	HSDPA Subtest-3	0.00	0.03	0.06	0.01	-0.02	-0.03
≤ 0.5	HSDPA Subtest-4	0.02	-0.01	-0.51	-0.44	0.05	-0.07
0	HSUPA Subtest-1	0.05	0.14	-0.01	0.06	0.00	0.32
≤ 2	HSUPA Subtest-2	0.38	-0.16	0.15	-0.30	0.29	0.16
≤ 1	HSUPA Subtest-3	0.13	0.09	-0.03	0.07	0.04	0.30
≤ 2	HSUPA Subtest-4	0.39	-0.10	-0.01	0.11	0.07	-0.27
0	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00

Note:

1. For Body SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA subset-1 and HSUPA subset-5 output power is < 1/4 dB higher than RMC, and SAR with RMC 12.2kbps setting is ≦1.2W/kg, HSDPA and HSUPA SAR evaluation can be excluded.
2. EUT is designed to follow the MPR of 3GPP Table 5.2B.1 specification. In production units, MPR result deviation from 3GPP is expected; the implementation and expected deviation is detailed in tune-up procedure exhibit.

<WLAN>

Mode	Channel	Frequency (MHz)	Average power (dBm)			
			Data Rate (bps)			
			1M	2M	5.5M	11M
802.11b	CH 01	2412 MHz	16.13	16.16	16.37	16.39
	CH 06	2437 MHz	16.11	16.19	16.69	**16.71**
	CH 11	2462 MHz	16.14	16.15	16.62	16.65

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			Data Rate (bps)							
			6M	9M	12M	18M	24M	36M	48M	54M
802.11g	CH 01	2412 MHz	9.35	9.42	9.51	9.53	9.67	9.71	9.52	9.74
	CH 06	2437 MHz	9.24	9.27	9.28	9.33	9.43	9.48	9.34	9.39
	CH 11	2462 MHz	10.06	10.03	10.06	10.11	10.15	10.13	10.08	**10.24**

Mode	Channel	Frequency (MHz)	Average power (dBm)							
			Data Rate (bps)							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M	CH 01	2412 MHz	8.35	8.31	8.36	8.23	8.41	8.36	8.29	**8.51**
	CH 06	2437 MHz	8.44	8.27	8.35	8.40	8.45	8.46	8.45	8.50
	CH 11	2462 MHz	8.34	8.08	8.49	8.32	8.21	8.28	8.22	8.49

Note:

1. Per KDB 248227, 11g and 11n output power is less than 1/4 dB higher than 11b mode, thus the SAR can be excluded.
2. Per KDB 248227, choose the highest output power channel to test SAR and determine further SAR exclusion, and CH 6 is chosen here.

<Bluetooth>

Bluetooth	Channel	Frequency (MHz)	Average power (dBm)								
			Data Rate								
			DH1	DH3	DH5	2DH1	2DH3	2DH5	3DH1	3DH3	3DH5
	CH 00	2402 MHz	-5.56	-5.37	-5.38	-6.95	-7.02	-7.05	-7.85	-7.91	-7.94
	CH 39	2441 MHz	-3.91	**-3.73**	-3.75	-5.34	-5.40	-5.43	-6.25	-6.32	-6.35
	CH 78	2480 MHz	-4.90	-4.73	-4.73	-6.34	-6.39	-6.40	-7.25	-7.33	-7.34

12.2 Test Records for Body SAR Test

<2G/3G SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	SAR_{1g} (W/kg)
1	**GSM850**	**GPRS12**	**Bottom Face**	**0**	**128**	**0.553**
2	GSM850	GPRS12	Secondary Portrait	0	128	0.054
3	GSM850	GPRS12	Secondary Landscape	0	128	0.300
4	**GSM1900**	**GPRS12**	**Bottom Face**	**0**	**512**	**0.666**
5	GSM1900	GPRS12	Secondary Portrait	0	512	0.033
6	GSM1900	GPRS12	Secondary Landscape	0	512	0.596
7	**WCDMA V**	**RMC12.K**	**Bottom Face**	**0**	**4182**	**0.278**
8	WCDMA V	RMC12.K	Secondary Portrait	0	4182	0.036
9	WCDMA V	RMC12.K	Secondary Landscape	0	4182	0.150
10	**WCDMA II**	**RMC12.K**	**Bottom Face**	**0**	**9400**	**0.762**
11	WCDMA II	RMC12.K	Secondary Portrait	0	9400	0.038
12	WCDMA II	RMC12.K	Secondary Landscape	0	9400	0.581

Note: Per KDB 447498, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	SAR_{1g} (W/kg)
13	**802.11b**	**-**	**Bottom Face**	**0**	**6**	**0.661**
14	802.11b	-	Primary Portrait	0	6	0.238

Note: Per KDB 248227, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

12.3 Simultaneous Transmission SAR Analysis and Measurements

	Applicable Combination
Simultaneous Transmission	WWAN+WLAN
	WWAN+BT
	WLAN+BT
	WWAN+WLAN+BT

Note:

1. DUT will choose either WCDMA/HSPA or GSM/GPRS/EDGE according to the network signal condition, therefore, WCDMA/HSPA transmission will not exist with GSM/GPRS/EDGE or at the same time.
2. WLAN and Bluetooth share the same antenna and cannot transmit simultaneously.
3. Per KDB 648474 D01, Bluetooth output power (-3.73 dBm) ≤ $2P_{Ref}$ and the distance to WWAN antennas ≥5cm, therefore, stand-alone SAR and simultaneous SAR are not required.
4. According to KDB 648474, simultaneous transmission SAR for WWAN and Bluetooth were not required, because Bluetooth standalone SAR is not required and the maximum WWAN SAR (0.762 W/kg), so the SAR summation is less than 1.6 W/kg.
5. According to KDB 648474, the simultaneous transmission SAR for WWAN and WLAN are not required, because the maximum SAR summation (1.423 W/kg) is less than 1.6 W/kg.
6. The GSM/GPRS/EDGE and WCDMA/HSPA share the same WWAN transmitting antenna, and GSM/GPRS/EDGE will not transmit simultaneously with WCDMA/HSPA.

Position	GSM 850	GSM 1900	WCDMA Band V	WCDMA Band II	802.11b	Max. SAR Summation
Bottom Face	0.553	0.666	0.278	**0.762**	**0.661**	**1.423**
Secondary Portrait	**0.054**	0.033	0.036	0.038	—	**0.054**
Secondary Landscape	0.300	**0.596**	0.150	0.581	—	**0.596**
Primary Portrait	—	—	—	—	**0.238**	**0.238**

Note:

1 The maximum SAR summation is calculated based on the same configuration and test position.
2 For 1g-SAR scalar summation < 1.6W/kg, simultaneous SAR measurement is not necessary

Test Engineer： Fulu Hu

13. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] IEEE Std. C95.1-1991, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, 1991

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] FCC OET Bulletin 65 (Edition 97-01) Supplement C (Edition 01-01), “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields”, June 2001

[5] SPEAG DASY System Handbook

[6] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[7] FCC KDB 447498 D01 v04, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, November 2009

[8] FCC KDB 616217 D03 v01, “SAR Evaluation Considerations for Laptop/Notebook/Netbook and Tablet Computers”, November 2009

[9] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007

[10] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[11] FCC KDB 941225 D04 v01, “Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode”, January 27 2010

[12] FCC KDB 941225 D07 01, "SAR Evaluation Procedure for UMPC Mini-Tablet Devices", April 2011

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.