FCC SAR Test Report

APPLICANT	**:**	**ZTE CORPORATION**
EQUIPMENT	**:**	**LTE Mobile Hotspot**
BRAND NAME	**:**	**ZTE**
MODEL NAME	**:**	**EuFi890**
FCC ID	**:**	**Q78-EUFI890**
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 Dec. 28, 2010 and completely tested on Jun. 14, 2011. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by:

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Testing Laboratory
1190

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Table of Contents

Revision History **3**
1. Statement of Compliance **4**
2. Administration Data **5**
2.1 Testing Laboratory 5
2.2 Applicant 5
2.3 Manufacturer 5
2.4 Application Details 5
3. General Information **6**
3.1 Description of Device Under Test (DUT) 6
3.2 Product Photos 6
3.3 Applied Standards 7
3.4 Device Category and SAR Limits 7
3.5 Test Conditions 7
3.5.1 Ambient Condition 7
3.5.2 Test Configuration 7
3.5.3 LTE operating configurations addressed in KDB 941225 D05 8
4. Specific Absorption Rate (SAR) **9**
4.1 Introduction 9
4.2 SAR Definition 9
5. SAR Measurement System **10**
5.1 E-Field Probe 11
5.1.1 E-Field Probe Specification 11
5.1.2 E-Field Probe Calibration 12
5.2 Data Acquisition Electronics (DAE) 12
5.3 Robot 12
5.4 Measurement Server 13
5.5 Phantom 14
5.6 Device Holder 15
5.7 Data Storage and Evaluation 16
5.7.1 Data Storage 16
5.7.2 Data Evaluation 16
5.8 Test Equipment List 18
6. Tissue Simulating Liquids **19**
7. Uncertainty Assessment **21**
8. SAR Measurement Evaluation **23**
8.1 Purpose of System Performance check 23
8.2 System Setup 23
8.3 Validation Results 24
9. 3G SAR Measurement Procedures **25**
10. Measurement Procedures **27**
10.1 Spatial Peak SAR Evaluation 27
10.2 Area & Zoom Scan Procedures 28
10.3 Volume Scan Procedures 28
10.4 SAR Averaged Methods 28
10.5 Power Drift Monitoring 28
11. SAR Test Configurations **29**
11.1 Exposure Positions Consideration 29
11.2 Simultaneous Transmitting Configurations 30
12. SAR Test Results **31**
12.1 Conducted Power (Unit: dBm) 31
12.2 Test Records for Hot Spot SAR Test 35
12.3 Simultaneous Transmission SAR Analysis and Measurements 38
13. References **39**

Appendix A. Plots of System Performance Check
Appendix B. Plots of SAR Measurement
Appendix C. DASY Calibration Certificate
Appendix D. Product Photos
Appendix E. Test Setup Photos

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA0D2830	Rev.01	Initial issue of report	Jun. 15, 2011
FA0D2830	Rev. 02	Modified the footnote 7 at page 37, and the note for MPR at page 32.	Jun. 24, 2011

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION LTE Mobile Hotspot ZTE EuFi890** are as follows (with expanded uncertainty 21.4 % for 300 MHz to 3 GHz).

Band	Position	SAR_{1g} (W/kg)
GSM850	Hot Spot (1cm Gap)	1.1
GSM1900	Hot Spot (1cm Gap)	0.442
WCDMA Band V	Hot Spot (1cm Gap)	0.917
WCDMA Band II	Hot Spot (1cm Gap)	0.533
CDMA2000 BC0	Hot Spot (1cm Gap)	1.39
CDMA2000 BC1	Hot Spot (1cm Gap)	0.729
LTE Band 13	Hot Spot (1cm Gap)	0.77
802.11b/g/n	Hot Spot (1cm Gap)	0.064

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 INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

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	Dec. 28, 2010
Date of Start during the Test	May 03, 2011
Date of End during the Test	May 14, 2011

3. General Information

3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
DUT Type	LTE Mobile Hotspot
Brand Name	ZTE
Model Name	ZTE EuFi890
FCC ID	Q78-EUFI890
Tx Frequency	GSM850 : 824 MHz ~ 849 MHz GSM1900 : 1850 MHz ~ 1910 MHz WCDMA Band V : 824 MHz ~ 849 MHz WCDMA Band II : 1850 MHz ~ 1910 MHz CDMA2000 BC0 : 824 MHz ~ 849 MHz CDMA2000 BC1 : 1850 MHz ~ 1910 MHz LTE Band 13 : 777 MHz ~ 787 MHz WLAN : 2400 MHz ~ 2483.5 MHz
Rx Frequency	GSM850 : 869 MHz ~ 894 MHz GSM1900 : 1930 MHz ~ 1990 MHz WCDMA Band V : 869 MHz ~ 894 MHz WCDMA Band II : 1930 MHz ~ 1990 MHz CDMA2000 BC0 : 869 MHz ~ 894 MHz CDMA2000 BC1 : 1930 MHz ~ 1990 MHz LTE Band 13 : 746 MHz ~ 756 MHz WLAN : 2400 MHz ~ 2483.5 MHz
Maximum Output Power to Antenna	GSM850 : 32.16 dBm / GSM1900 : 29.68 dBm WCDMA Band V : 23.12 dBm / WCDMA Band II : 22.68 dBm CDMA2000 BC0 : 24.21 dBm / CDMA2000 BC1 : 24.12 dBm LTE Band 13 : 23.00 dBm 802.11b : 11.77 dBm / 802.11g : 11.14 dBm 802.11n (BW 20MHz) : 11.29 dBm
LTE Bandwidth	10MHz
Antenna Type	WWAN : PIFA AntennaWLAN : PCB Antenna
HW Version	NA
SW Version	NA
Type of Modulation	GSM / GPRS : GMSK ; EDGE : 8PSK WCDMA : QPSK ; HSDPA : QPSK / 16QAM HSUPA : QPSK (Release 6) CDMA2000 : QPSK LTE : QPSK, 16QAM 802.11b : DSSS (BPSK / QPSK / CCK) 802.11a/g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
DUT Stage	Identical Prototype

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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 941225 D01 v02
- FCC KDB 941225 D02 v02v01
- FCC KDB 941225 D03 v01
- FCC KDB 941225 D04 v01
- FCC KDB 941225 D05 v01 (SAR for LTE Devices)
- FCC KDB 941225 D06 v01 (Hot Spot SAR)
- 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

EuFi890 is a wireless Hotspot enabling users to access WWAN (GPRS/ EDGE/ Ev-Do/ HSPA/ LTE) through 802.11b/g. The form factor is 88.8mm*88.8mm*18mm (> 9cm*5cm); The device has internal battery, thus referring to KDB 941225 D06, the SAR should be evaluated for all sides and surfaces where the antenna is 2.5cm to that edge or surface, with 10mm test distance to the flat phantom.

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.

During LTE SAR testing, the A-MPR was disabled by setting NS=01 on the R&S CMW500.

3.5.3 LTE operating configurations addressed in KDB 941225 D05

FCC ID: Q78-Eufi890			
1		Operating frequency range of each LTE transmission band used by the device	LTE Band 13 only, 777MHz ~ 787MHz
2		Channel bandwidths used in each frequency band	10MHz only
3		Channel numbers (H, M, L), and frequencies in each LTE frequency band	Only one channel : UL: channel 23230 782MHz, DL: channel 5230@751MHz
4	a.	UE category , and	3
	b.	uplink modulations	QPSK, and 16QAM
5	a.	LTE Tx descriptions, and LTE operates as standalone or shares hardware with other radios,	Please find the separated exhibit, PBA technical document.
	b.	and LTE antenna implementation	1 TX / 2 RX
6	a.	LTE supports configuration - Voice/Data application	Data only ; No voice
	b.	LTE Operating configuration - head/body worn/ Mobile Hot Spot	Supports Mobile Hot Spot ; No head mode, and body worn
	c	Antenna location, info(diversity), and	Please find section 11.1 DUT configuration
	d	DUT configurations (e.g: handset flip-cover, slide positions)	Battery operated standalone personal wireless router
	e	DUT device supports VOIP mode for head SAR	No
7	a.	MPR per 3GPP 36.101	Yes
	b.	A-MPR must be disabled	A-MPR was disabled during SAR testing via R&SCMW500.
8		LTE power table for RBs, modulation, RB allocation	Max power: 23dBm. Please find section 12.1 Max. Power.
9	a.	DUT supports other Radios application in U.S. (e.g:3G,WiFi…)	(i) CDMA/EvDO/EGPRS/ WCDMA/HSPA at 850/1900 band, (ii) WLAN 2.4GHz(11b/g/n)
	b.	and DUT configurations (e.g: handset flip-cover, slide positions)	Portable personal wireless router
10		Max average power table for DUT supports other Radios application in U.S. (e.g:3G,WiFi…)	Please find section 12.1 Max. Power for each radios
11		Simultaneous TX for all supporting radios	Please find the section 11. 3 and 12.3 for Simultaneous Tx configurations.
12		Power Reduction for Sim.-TX in Voice/Data application (e.g: LTE + WiFi , LTE + CDMA1X)	No
13		Test sofware for LTE (E.g: built-in- test firmware)	No special software built in DUT for LTE ; The DUT was linked with R&S CMW500
14		SAR Test Plan (E.g: SAR Tes data, Sim-TX)	Max SAR for LTE is 0.77mW/g, and please find the section 12.2 SAR test results
15		Lab. Concerns	No

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 head 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

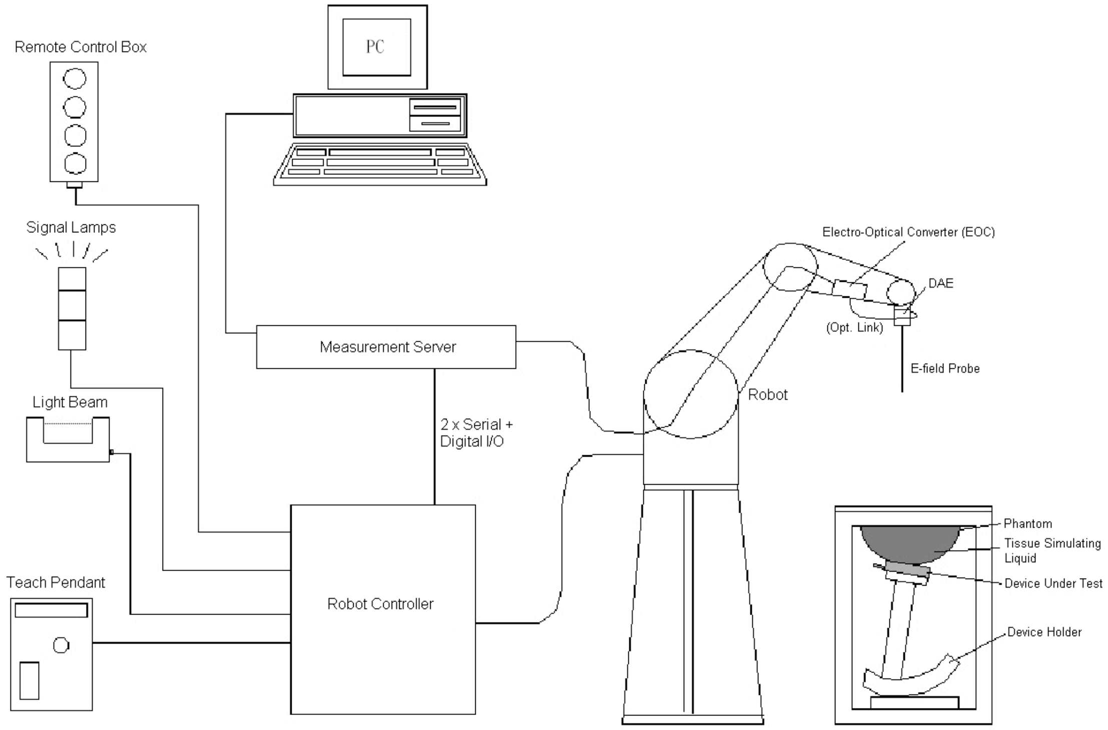


Fig 5.1 SPEAG DASY5 System Configurations

The DASY5 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
- DASY5 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

< ET3DV6 Probe>

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm

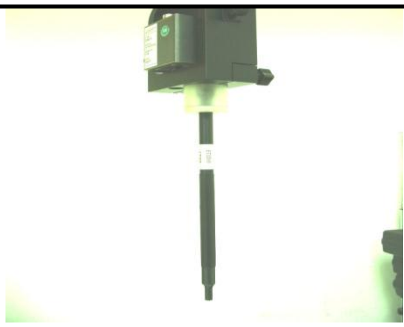


Fig 5.2 Photo of ES3DV3

<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 5.3 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 5.4 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 5.5 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 5.6 Photo of Server for DASY5

5.5 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom

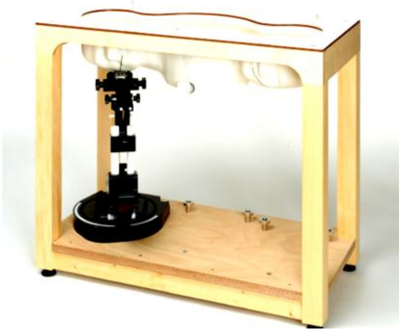


Fig 5.7 Photo of SAM Phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm

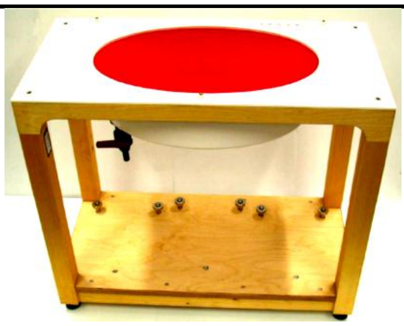


Fig 5.8 Photo of ELI4 Phantom

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

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Fig 5.9 Device Holder

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), μV/(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	ET3DV6	1788	Sep. 21, 2010	Sep. 20, 2011
SPEAG	Dosimetric E-Field Probe	EX3DV4	3731	Sep. 20, 2010	Sep. 19, 2011
SPEAG	Data Acquisition Electronics	DAE3	495	Apr. 28, 2011	Apr. 27, 2012
SPEAG	Data Acquisition Electronics	DAE4	778	Oct. 22, 2010	Oct. 21, 2011
SPEAG	Data Acquisition Electronics	DAE4	1210	Nov. 18, 2010	Nov. 17, 2011
SPEAG	750MHz System Validation Kit	D750V3	1012	Jun. 11, 2010	Jun. 10, 2012
SPEAG	835MHz System Validation Kit	D835V2	4d082	Jul. 20, 2010	Jul. 19, 2012
SPEAG	1900MHz System Validation Kit	D1900V2	5d018	Jun. 15, 2010	Jun. 14, 2012
SPEAG	2450MHz System Validation Kit	D2450V2	735	Jun. 17, 2010	Jun. 16, 2012
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1477	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CB	TP-1479	NCR	NCR
SPEAG	ELI4 Phantom	QD OVA 001 BB	1079	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46106933	Jul. 06, 2010	Jul. 05, 2011
Agilent	Wireless Communication Test Set	E5515C	MY48367160	Feb. 16, 2010	Feb. 15, 2012
R&S	Universal Radio Communication Tester	CMU200	116456	Sep. 11, 2010	Sep. 10, 2011
R&S	Universal Radio Communication Tester	CMW500	102159	Sep. 09, 2010	Sep. 08, 2011
Agilent	Dielectric Probe Kit	85070E	MY44300475	NCR	NCR
AR	Amplifier	551G4	0333096	NCR	NCR
R&S	Signal Generator	SMR40	100455	Jan. 06, 2011	Jan. 05, 2012

Table 5.1 Test Equipment List

Note:

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

2. Referring to KDB 450824, the justification of dipole extended calibration is needed beyond 1 year. Above dipoles used are within one year period during testing.

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.

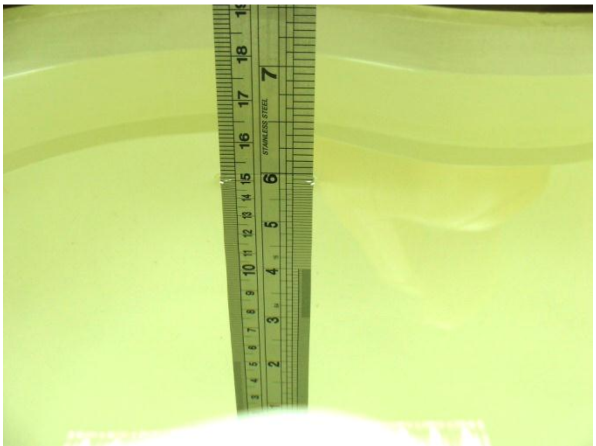


Fig 6.1 Photo of Liquid Height for Head SAR

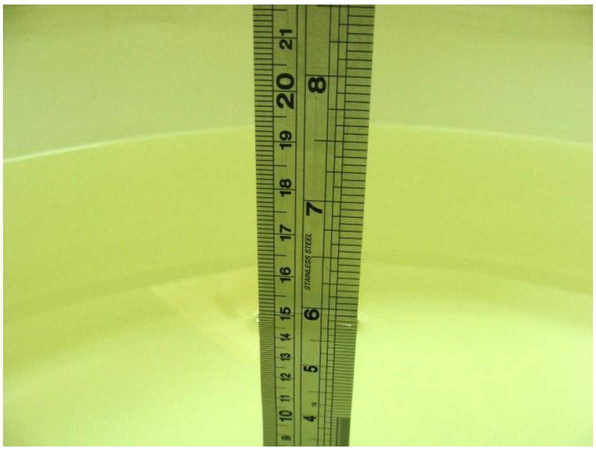


Fig 6.2 Photo of Liquid Height for Body SAR

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								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
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 following table gives the targets for tissue simulating liquid.

Frequency (MHz)	Liquid Type	Conductivity (σ)	±5% Range	Permittivity (ε_r)	±5% Range
750	Body	0.96	0.92 ~ 1.0	55.5	52.8 ~ 58.2
835	Body	0.97	0.92 ~ 1.02	55.2	52.4 ~ 58.0
900	Body	1.05	1.00 ~ 1.10	55.0	52.3 ~ 57.8
1800, 1900, 2000	Body	1.52	1.44 ~ 1.60	53.3	50.6 ~ 56.0
2450	Body	1.95	1.85 ~ 2.05	52.7	50.1 ~ 55.3

Table 6.2 Targets of Tissue Simulating Liquid

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

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Type	Temperature (℃)	Conductivity (σ)	Permittivity (ε_r)	Measurement Date
750	Body	21.4	0.922	54.1	May 13, 2011
750	Body	21.6	0.922	56.1	May 14, 2011
835	Body	21.3	0.977	54.4	May 09, 2011
835	Body	21.3	0.975	54.3	Jun. 14, 2011
1900	Body	21.6	1.54	54.5	May 03, 2011
1900	Body	21.4	1.53	54.6	May 09, 2011
2450	Body	21.5	1.99	54.3	May 05, 2011

Table 6.3 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	5.5	Normal	1	1	± 5.5 %
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					± 10.7 %
Coverage Factor for 95 %					K = 2
Expanded Uncertainty					**± 21.4 %**

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:

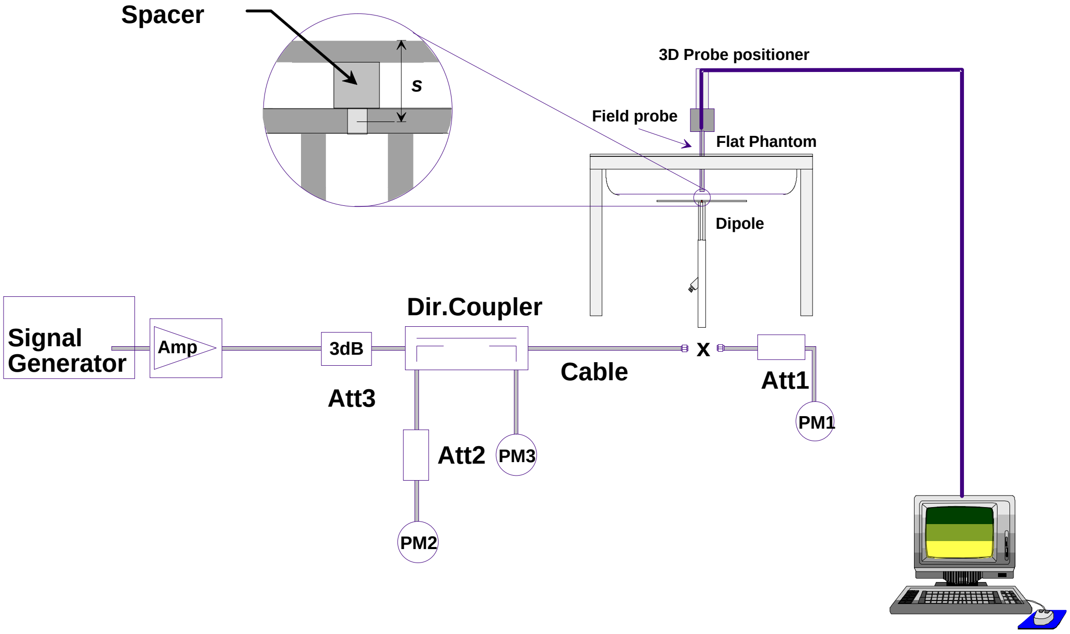


Fig 8.1 System Setup for System Evaluation

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.

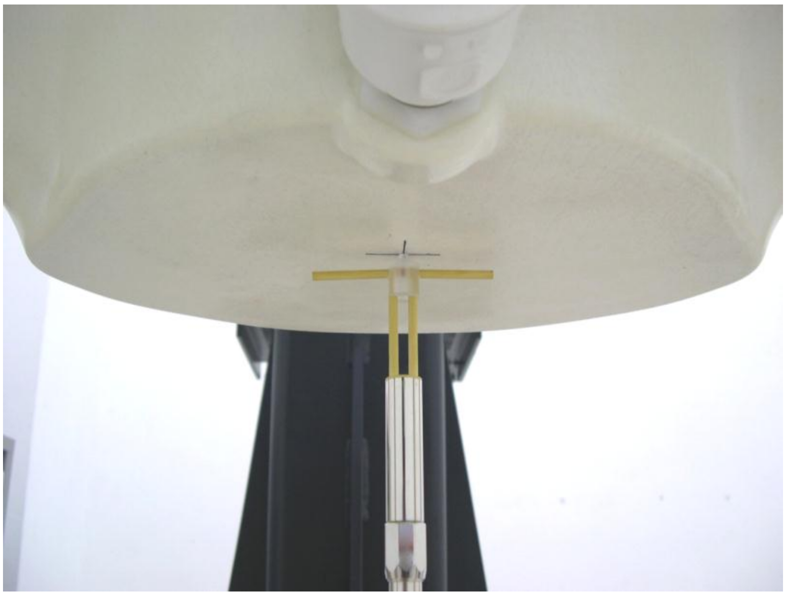


Fig 8.2 Photo of Dipole Setup

8.3 Validation Results

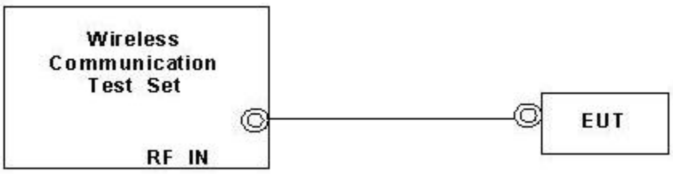
Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 8.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots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

Measurement Date	Frequency (MHz)	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
May 13, 2011	750	8.860	2.310	9.24	4.29
May 14, 2011	750	8.860	2.270	9.08	2.48
May 09, 2011	835	10.000	2.540	10.16	1.60
Jun. 14, 2011	835	10.000	2.620	10.48	4.80
May 03, 2011	1900	40.900	10.600	42.40	3.67
May 09, 2011	1900	40.900	10.800	43.20	5.62
May 05, 2011	2450	53.500	12.800	51.20	-4.30

Table 8.1 Target and Measurement SAR after Normalized

9. 3G SAR Measurement Procedures

The EUT was configured and tested according to the requirements of the FCC 3G procedures/TS 34.121, /KDB941225.



Setup Configuration

WCDMA configuration settings:

a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between DUT and Base Station with following setting
   i. Data rates: Varied from RMC 12.2Kbps.
   ii. RMC Test Loop = Loop Mode 1
   iii. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

HSDPA configuration settings:

a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between DUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each.
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set DeltaACK, DeltaNACK and DeltaCQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

HSPA (HSUPA & HSPDA) configuration settings:

a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between DUT and Test Set with following setting :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

CDMA 2000/ EVDO Rev.0 and A configuration settings:

The DUT was tested according to the requirements of the FCC 3G procedures,

a. The DUT was connected to Wireless Communication Test Set referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between DUT and System Simulator with following setting:
   i. For 1xRTT, set the Radio Configuration and the Service Option
   ii. For 1xEV-DO, set the Protocol Release and Data Rate
   iii. Set the Power Control to All Up Bits
d. The transmitted maximum output power was recorded.

10. Measurement Procedures

The measurement procedures are as follows:

(a) For WWAN function, link DUT with base station emulator in highest power channel
(b) Set base station emulator to allow DUT to radiate maximum output power
(c) Measure output power through RF cable and power meter
(d) Place the DUT in the positions described in the last section
(e) Set scan area, grid size and other setting on the DASY software
(f) Taking data for the middle channel on each testing position
(g) Find out the largest SAR result on these testing positions of each band
(h) 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. 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.

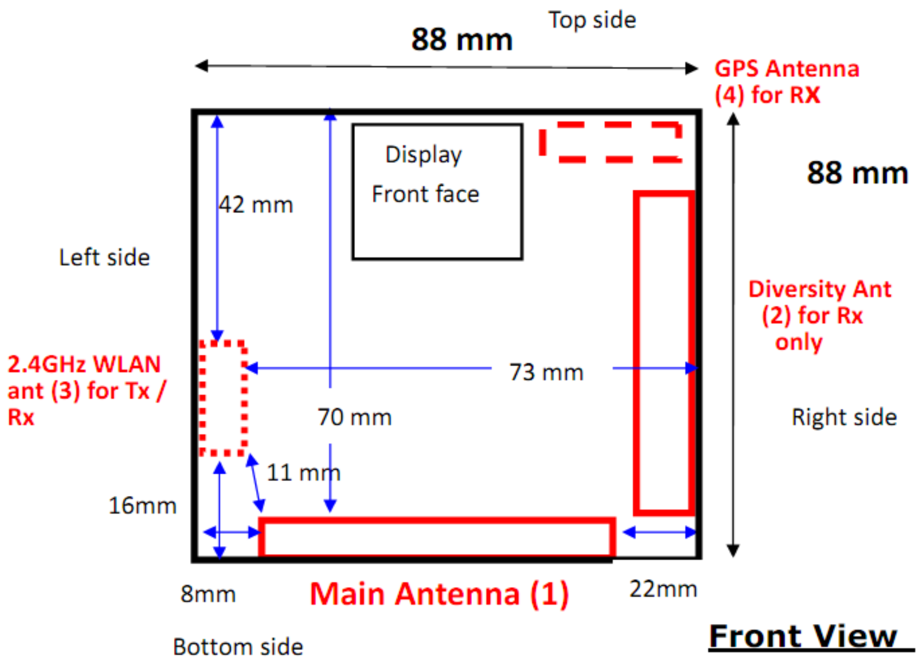
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty 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



Main antenna (1) for LTE Band 13、CDMA/EVDO 850/1900, WCDMA/HSPA 850/1900, and GSM/GPRS/EDGE 850/1900 , TX/RX ; antennas distance between the WLAN 2.4GHz TX/RX antenna (3) and WWAN main antenna (1) is 11mm from the closest metal parts of two antennas. The Antenna (4) is for GPS receive only.

SAR test plan for Hot spot mode :

Sides for SAR tests; Hotspot mode Test distance: 10 mm						
	Front face	Rear face	Top side	Bottom side	Right side	Left side
LTE Band 13 – 700MHz	✓	✓	x	✓	✓	✓
CDMA/EvDo 850/1900	✓	✓	x	✓	✓	✓
WCDMA/HSPA Band850/Band1900	✓	✓	x	✓	✓	✓
GSM/GPRS/EDGE 850/1900	✓	✓	x	✓	✓	✓
WLAN 11b/g/n 2.4GHz	✓	✓	x	✓	x	✓

Referring to KDB 941225 D06, the SAR should be evaluated for all sides and surfaces where the antenna is 2.5cm to that edge or surface, with 10mm test distance to the flat phantom. In this case, the top side is no need due to antenna is larger than 2.5cm from the WWAN, and WLAN transmitter antennas. And the right side (73mm) is no need for WLAN due to antenna to DUT edge is larger than 2.5cm.

11.2 Simultaneous Transmitting Configurations

The device is intention of mobile hot spot feature only, and the simultaneous transmissions are listed below, The device does not support voice feature, and cannot be used against human body, therefore, Head and Body-worn SAR are not required.

	Combinations	Head	Body-worn	Hotspot	Remark
1	CDMA/EVDO 850/1900	x	x	✓	EVDO Rev.0 data application is chosen for SAR test
	WLAN 2.4GHz				
2	LTE Band 13	x	x	✓	
	WLAN 2.4GHz				
3	GSM/GPRS/EDGE 850/1900	x	x	✓	
	WLAN 2.4GHz				
4	WCDMA/HSPA 850/1900	x	x	✓	WCDMA data application is chosen for SAR test
	WLAN 2.4G				
5	GSM/GPRS/EDGE 850/1900	x	x	x	GPRS/EDGE and WCDMA cannot transmit simultaneously
	WCDMA/HSPA 850/1900				
6	GSM/GPRS/EDGE 850/1900	x	x	x	GPRS/EDGE and LTE cannot transmit simultaneously
	LTE Band 13				
7	WCDMA/HSPA 850/1900	x	x	x	WCDMA and LTE cannot transmit simultaneously
	LTE Band 13				

Note: GPRS/EDGE, WCDMA and LTE share the same WWAN transmitting antenna, and GPRS/EDGE, LTE will not transmit simultaneously with WCDMA.

12. SAR Test Results

12.1 Conducted Power (Unit: dBm)

Maximum Conducted Power for GSM/GPRS/EDGE

Average Burst Power

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency	824.2	836.4	848.8	1850.2	1880	1909.8
GSM	32.16	31.96	31.94	29.37	29.68	29.56
GPRS 8-CS1	32.04	31.84	31.82	29.24	29.54	29.38
GPRS 10-CS1	30.22	30.24	30.15	27.94	28.00	27.90
EDGE 8 - MCS1	32.01	31.78	31.78	29.24	29.51	29.30
EDGE 10-MCS1	29.81	30.00	29.91	27.95	27.94	27.79
EDGE 12-MCS1	27.19	27.20	27.16	24.64	24.78	24.26
EDGE 8-MCS9	25.63	25.66	25.67	24.83	24.87	24.84
EDGE 10-MCS9	24.50	24.52	24.54	23.71	23.66	23.60
EDGE 12-MCS9	22.74	22.79	22.84	21.55	21.65	21.59
Source-Based Time-Averaged Power						
Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
GSM	23.16	22.96	22.94	20.37	20.68	20.56
GPRS 8	23.04	22.84	22.82	20.24	20.54	20.38
GPRS 10	24.22	24.24	24.15	21.94	22.00	21.90
EDGE 8 - MCS1	23.01	22.78	22.78	20.24	20.51	20.30
EDGE 10-MCS1	23.81	24.00	23.91	21.95	21.94	21.79
EDGE 12-MCS1	24.19	24.20	24.16	21.64	21.78	21.26
EDGE 8 – MCS9	16.63	16.66	16.67	15.83	15.87	15.84
EDGE 10– MCS9	18.50	18.52	18.54	17.71	17.66	17.60
EDGE 12– MCS9	19.74	19.79	19.84	18.55	18.65	18.59

Note:

1. Referring to KDB 941225 D03, for GPRS/EDGE body SAR testing, the DUT was set in GPRS multi-slot class 10 with 2 uplink slots due to maximum source-based time-averaged output power
2. Referring to KDB 941225 D03, 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 and GSM setting are provided voluntary for reference.

Maximum Conducted Power for WCDMA/HSPA

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	22.70	22.24	23.12	22.53	22.64	22.68
HSDPA Subtest-1	22.30	21.92	23.11	22.10	22.17	22.46
HSDPA Subtest-2	22.16	21.70	22.90	22.21	22.14	22.50
HSDPA Subtest-3	22.35	21.80	23.01	21.91	22.04	22.46
HSDPA Subtest-4	22.17	22.01	22.76	22.01	21.90	22.27
HSUPA Subtest-1	21.76	21.73	22.36	21.97	21.99	22.16
HSUPA Subtest-2	20.45	20.21	20.87	20.34	20.55	20.54
HSUPA Subtest-3	20.92	20.9	21.61	21.03	20.83	21.1
HSUPA Subtest-4	20.21	20.19	20.78	20.34	20.39	20.57
HSUPA Subtest-5	22.01	21.85	22.42	21.94	22.01	22.15

MPR							
MPR level		WCDMA band II			WCDMA band V		
0	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	HSDPA Subtest-2	0.14	0.22	0.21	-0.11	0.03	-0.04
0.5	HSDPA Subtest-3	-0.05	0.12	0.10	0.19	0.13	0.00
0.5	HSDPA Subtest-4	0.13	-0.09	0.35	0.09	0.27	0.19
0	HSUPA Subtest-1	0.25	0.12	0.06	-0.03	0.02	-0.01
2	HSUPA Subtest-2	1.56	1.64	1.55	1.60	1.46	1.61
1	HSUPA Subtest-3	1.09	0.95	0.81	0.91	1.18	1.05
2	HSUPA Subtest-4	1.80	1.66	1.64	1.60	1.62	1.58
0	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00

Note:

1. Referring to KDB 941225 D01, RMC 12.2kbps setting is used for all SAR tests. If HSDPA and HSUPA output power is less than 1/4 dB higher than RMC 12.2kbps, SAR tests for HSDPA and HSUPA can be excluded.
2. DUT is declared to follow the MPR of 3GPP Table 5.2B.1 specification, and the specification will set during the production. Since there is tolerance in measuring 3G output power, the difference between the measured value and the specification is treated as tolerance. According to KDB 941225 D02 v02, 1)b), the MPR implementation information is provided here. Details of MPR information are declared by manufacturer in Tune Up procedure to comply with SAR.

Maximum Conducted Power for CDMA/EVDO(Rev.0/A)

Band	CDMA2000 BC0			CDMA2000 BC1		
Channel	1013	384	777	25	600	1175
Frequency (MHz)	824.70	836.52	848.31	1851.25	1880.00	1908.75
RC1+SO55	23.85	23.55	24.11	23.96	23.86	23.94
RC3+SO55	23.75	23.63	24.10	23.97	23.82	23.87
RC3+SO32(+ F-SCH)	23.77	23.69	24.09	23.95	23.83	23.90
RC3+SO32(+SCH)	23.81	23.44	24.09	23.95	23.85	23.96
Ev-Do Rev.0 (RTAP 153.6)	23.90	23.70	24.21	24.12	23.84	23.98
Ev-Do Rev. A (RETAP 4096)	23.91	23.69	24.20	24.08	23.73	23.98

Note:

1. The EVDO Rev.0 is used to SAR testing due to highest power, and data application.
2. The CDMA 1XRTT settings are provided voluntary for reference, because device does not support voice mode.

Maximum Conducted Power for LTE band 13

Frequency [MHz]	Uplink Channel Number	BW [MHz]	Num. of RB	RB Offset	Mod.	Maximum Average Power [dBm]	Measured MPR (dB)	Declared Max. PWR (dBm)	ZTE MPR Target (dB)	3GPP MPR
782	23230	10	25	13	QPSK	22.15	0.85	23	1	1
782	23230	10	1	49	QPSK	23	0	23	0	0
782	23230	10	1	0	QPSK	22.91	0.09	23	0	0
782	23230	10	50	0	QPSK	22.14	0.86	23	1	1
782	23230	10	25	13	16-QAM	22.11	0.89	23	1	2
782	23230	10	1	49	16-QAM	22.21	0.79	23	1	1
782	23230	10	1	0	16-QAM	22.15	0.85	23	1	1
782	23230	10	50	0	16-QAM	22.12	0.88	23	1	2

Note: Maximum power rated declared by manufacturer is 23dBm (without MPR), and above measured test results demonstrate the expected MPR variation.

MPR implementation:

The device implements maximum power reduction per 3GPP 36.101 requirements where the ZTE MPR target is as below table. The MPR settings are implemented configured into firmware and cannot be disabled by the end user or LTE carrier network.

Modulation	LTE Band 13, Channel Bandwidth = 10MHz, and RB Configurations	ZTE MPR setting (dB)	3GPP 36.101 (dB)
QPSK	> 12	1	<=1
16QAM	<= 12	1	<=1
16QAM	> 12	1	<=2

Maximum Conducted Power for WLAN:

Average Power - 11b

Mode	Channel	Frequency (MHz)	Data Rate 1Mbps	2Mbps	5.5Mbps	11Mbps
802.11b	CH 01	2412	11.35	11.55	11.77	11.65
	CH 06	2437	11.19	11.38	11.66	11.36
	CH 11	2462	11.14	11.16	11.31	11.21

Average Power - 11g

Mode	Channel	Frequency (MHz)	Data Rate 6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
802.11g	CH 01	2412	11.02	11.04	11.09	11.06	11.14	11.08	11.02	10.98
	CH 06	2437	10.85	10.89	10.91	11.03	11.02	10.98	10.82	10.85
	CH 11	2462	10.64	10.71	10.87	10.83	10.85	10.71	10.55	10.45

Average Power - 11g (HT- 20)

Mode	Channel	Frequency (MHz)	Data Rate MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11g	CH 01	2412	11.21	11.27	11.25	11.29	11.17	11.05	11.08	10.98
	CH 06	2437	11.09	11.03	11.02	11.06	10.96	10.86	10.82	10.77
	CH 11	2462	10.71	10.75	10.79	10.67	10.65	10.62	10.61	10.64

Note : Referring to KDB 248227, 11g/11n power is less than 1/4dB higher than 11b, thus SAR tests with 11/b only. Device supports HT-20 only for 11g (n) mode.

12.2 Test Records for Hot Spot SAR Test

Front Face:

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR_{1g} (W/kg)	Target MPR (dB)	LTE output PWR (dBm)
14	GSM850	GPRS 10	Front Face	1	189	0.971	NA	NA
21	GSM850	GPRS 10	Front Face	1	128	0.972	NA	NA
22	GSM850	GPRS 10	Front Face	1	251	0.925	NA	NA
54	GSM850	EDGE 10	Front Face	1	189	0.815	NA	NA
8	GSM1900	GPRS 10	Front Face	1	661	0.396	NA	NA
34	WCDMA band V	RMC 12.2K	Front Face	1	4233	0.764	NA	NA
42	WCDMA band II	RMC 12.2K	Front Face	1	9538	**0.533**	NA	NA
24	CDMA2000 BC0	RTAP 153.6	Front Face	1	777	1.16	NA	NA
31	CDMA2000 BC0	RTAP 153.6	Front Face	1	1013	0.984	NA	NA
32	CDMA2000 BC0	RTAP 153.6	Front Face	1	384	1.1	NA	NA
2	CDMA2000 BC1	RTAP 153.6	Front Face	1	25	**0.729**	NA	NA
13	LTE Band XIII	QPSK(25-13)	Front Face	1	23230	0.66	1	22.15
2	LTE Band XIII	QPSK(1-49)	Front Face	1	23230	0.608	0	23
17	LTE Band XIII	QPSK(1-0)	Front Face	1	23230	0.66	0	22.91
21	LTE Band XIII	16QAM(25-13)	Front Face	1	23230	0.617	1	22.11
30	LTE Band XIII	16QAM(1-49)	Front Face	1	23230	0.618	1	22.21
25	LTE Band XIII	16QAM(1-0)	Front Face	1	23230	0.655	1	22.15
48	802.11b	5.5Mbps	Front Face	1	1	0.028	NA	NA

Rear Face:

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR_{1g} (W/kg)	Target MPR (dB)	LTE output PWR (dBm)
13	GSM850	GPRS 10	Rear Face	1	189	**1.1**	NA	NA
19	GSM850	GPRS 10	Rear Face	1	128	1.08	NA	NA
20	GSM850	GPRS 10	Rear Face	1	251	1.03	NA	NA
53	GSM850	EDGE10	Rear Face	1	189	1.02	NA	NA
7	GSM1900	GPRS 10	Rear Face	1	661	**0.442**	NA	NA
33	WCDMA band V	RMC 12.2K	Rear Face	1	4233	0.902	NA	NA
39	WCDMA band V	RMC 12.2K	Rear Face	1	4132	0.914	NA	NA
40	WCDMA band V	RMC 12.2K	Rear Face	1	4182	**0.917**	NA	NA
41	WCDMA band II	RMC 12.2K	Rear Face	1	9538	0.478	NA	NA
23	CDMA2000 BC0	RTAP 153.6	Rear Face	1	777	**1.39**	NA	NA
29	CDMA2000 BC0	RTAP 153.6	Rear Face	1	1013	1.04	NA	NA
30	CDMA2000 BC0	RTAP 153.6	Rear Face	1	384	1.3	NA	NA
1	CDMA2000 BC1	RTAP 153.6	Rear Face	1	25	0.632	NA	NA
7	LTE Band XIII	QPSK(25-13)	Rear Face	1	23230	0.678	1	22.15
1	LTE Band XIII	QPSK(1-49)	Rear Face	1	23230	**0.77**	0	23
6	LTE Band XIII	QPSK(1-0)	Rear Face	1	23230	0.717	0	22.91
11	LTE Band XIII	16QAM(25-13)	Rear Face	1	23230	0.667	1	22.11
10	LTE Band XIII	16QAM(1-0)	Rear Face	1	23230	0.67	1	22.21
9	LTE Band XIII	16QAM(1-49)	Rear Face	1	23230	0.667	1	22.15
47	802.11b	5.5Mbps	Rear Face	1	1	0.025	NA	NA

Bottom Side:

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR_{1g} (W/kg)	Target MPR (dB)	LTE output PWR (dBm)
18	GSM850	GPRS 10	Bottom Side	1	189	0.132	NA	NA
12	GSM1900	GPRS 10	Bottom Side	1	661	0.209	NA	NA
38	WCDMA band V	RMC 12.2K	Bottom Side	1	4233	0.157	NA	NA
46	WCDMA band II	RMC 12.2K	Bottom Side	1	9538	0.289	NA	NA
28	CDMA2000 BC0	RTAP 153.6	Bottom Side	1	777	0.135	NA	NA
6	CDMA2000 BC1	RTAP 153.6	Bottom Side	1	25	0.406	NA	NA
16	LTE Band XIII	QPSK(25-13)	Bottom Side	1	23230	0.104	1	22.15
5	LTE Band XIII	QPSK(1-49)	Bottom Side	1	23230	0.099	0	23
20	LTE Band XIII	QPSK(1-0)	Bottom Side	1	23230	0.105	0	22.91
24	LTE Band XIII	16QAM(25-13)	Bottom Side	1	23230	0.104	1	22.11
33	LTE Band XIII	16QAM(1-49)	Bottom Side	1	23230	0.101	1	22.21
28	LTE Band XIII	16QAM(1-0)	Bottom Side	1	23230	0.103	1	22.15
52	802.11b	5.5Mbps	Bottom Side	1	1	**0.064**	NA	NA

Right Side:

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR_{1g} (W/kg)	Target MPR (dB)	LTE output PWR (dBm)
16	GSM850	GPRS 10	Right Side	1	189	0.237	NA	NA
10	GSM1900	GPRS 10	Right Side	1	661	0.094	NA	NA
36	WCDMA band V	RMC 12.2K	Right Side	1	4233	0.196	NA	NA
44	WCDMA band II	RMC 12.2K	Right Side	1	9538	0.16	NA	NA
26	CDMA2000 BC0	RTAP 153.6	Right Side	1	777	0.287	NA	NA
4	CDMA2000 BC1	RTAP 153.6	Right Side	1	25	0.192	NA	NA
15	LTE Band XIII	QPSK(25-13)	Right Side	1	23230	0.092	1	22.15
4	LTE Band XIII	QPSK(1-49)	Right Side	1	23230	0.062	0	23
19	LTE Band XIII	QPSK(1-0)	Right Side	1	23230	0.077	0	22.91
23	LTE Band XIII	16QAM(25-13)	Right Side	1	23230	0.087	1	22.11
32	LTE Band XIII	16QAM(1-49)	Right Side	1	23230	0.064	1	22.21
27	LTE Band XIII	16QAM(1-0)	Right Side	1	23230	0.083	1	22.15
50	802.11b	5.5Mbps	Right Side	1	1	0.0096	NA	NA

Left Side:

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Channel	SAR_{1g} (W/kg)	Target MPR (dB)	LTE output PWR (dBm)
15	GSM850	GPRS 10	Left Side	1	189	0.452	NA	NA
9	GSM1900	GPRS 10	Left Side	1	661	0.285	NA	NA
35	WCDMA band V	RMC 12.2K	Left Side	1	4233	0.362	NA	NA
43	WCDMA band II	RMC 12.2K	Left Side	1	9538	0.422	NA	NA
25	CDMA2000 BC0	RTAP 153.6	Left Side	1	777	0.571	NA	NA
3	CDMA2000 BC1	RTAP 153.6	Left Side	1	25	0.583	NA	NA
14	LTE Band XIII	QPSK(25-13)	Left Side	1	23230	0.251	1	22.15
3	LTE Band XIII	QPSK(1-49)	Left Side	1	23230	0.185	0	23
18	LTE Band XIII	QPSK(1-0)	Left Side	1	23230	0.214	0	22.91
22	LTE Band XIII	16QAM(25-13)	Left Side	1	23230	0.237	1	22.11
31	LTE Band XIII	16QAM(1-49)	Left Side	1	23230	0.189	1	22.21
26	LTE Band XIII	16QAM(1-0)	Left Side	1	23230	0.231	1	22.15
49	802.11b	5.5Mbps	Left Side	1	1	0.011	NA	NA

Note:

1. For body SAR testing, the DUT was set in GPRS multi-slot class 10 with 2 uplink slots due to maximum source-based time-averaged output power.
2. Referring the footnote 11 of IEEE 1528-2003 in KDB941225 D03, EDGE mode shall be additionally tested on worst channel, if the SAR of GPRS is higher than 0.8 W/kg; other channels of EDGE SAR are necessary, if EDGE SAR is higher than 85% of 1.6W/kg (1.36W/kg). In case, only one channel of EDGE 10 is needed on Front Face configuration.
3. For LTE, the mode is represented as “modulation (RB-size, RB offset)”. For example, 16QAM (25-13) means “16QAM modulation, 25 RB in the channel, RB start location/ RB-offset =13”.
4. Per KDB 941225 D05, for LTE, if the smaller bandwidth output power is within +/- 0.5dB of the largest bandwidth, and the maximum SAR of the largest bandwidth is < 1.45 W/kg, SAR for smaller bandwidth can be excluded. In this case, device only supports 10MHz bandwidth, and above test results are 10MHz.
5. Per KDB 941225 D05, for LTE, if 50%-RB QPSK/16QAM SAR < 1.45 W/kg, 100%-RB SAR can be excluded.
6. Per KDB 941225 D01, for WCDMA, if RMC 12.2kbps SAR ≦1.2W/kg, HSDPA/HSUPA SAR can be excluded.
7. If the highest output channel SAR for each exposure position is < 0.8 W/kg, other channels SAR tests are not necessary referring to the KDB 447498

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12.3 Simultaneous Transmission SAR Analysis and Measurements

Simultaneous Transmission – Hotspot mode SAR

Hot Spot Mode	LTE Band 13 (700)	GPRS 850 Class 10	GPRS 1900 Class 10	WCDMA Band V	WCDMA Band II	EVDO Rev.0 BC0 (850)	EVDO Rev.0 BC1 (1900)	802.11b/g/n	Max. SAR Summation	Note	SPLSR
Front Face	0.655	0.972	0.396	0.764	0.533	1.16	0.729	0.028	1.19	EVDO 850+ WLAN11b	NA
Rear Face	0.77	1.1	0.442	0.917	0.478	1.39	0.632	0.025	1.42	EVDO 850+ WLAN11b	NA
Right Side	0.092	0.237	0.094	0.196	0.16	0.287	0.192	0 (note2)	0.287	EVDO 850+ WLAN11b	NA
Left Side	0.251	0.452	0.285	0.362	0.422	0.571	0.583	0.011	0.594	EVDO 850+ WLAN11b	NA
Bottom Side	0.105	0.132	0.209	0.157	0.289	0.135	0.406	0.064	0.47	EVDO 850+ WLAN11b	NA
Top Side	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

<Maximum SAR list for DUT, 10mm test distance>

Note:

1. The maximum SAR summation is calculated based on the same configuration and test position.
2. The right side of DUT for WLAN is not applicable, due to the antenna is far away 2.5cm from the edge, and it is supposed “0” for summation.

According to KDB 648474, the simultaneous transmission SAR for WWAN and WLAN was not required, because all summations are less than 1.6 W/kg.

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 447498 D02 v02, “SAR Measurement Procedures for USB Dongle Transmitters”, November 2009

[9] FCC KDB 616217 D01 v01r01, “SAR Evaluation Considerations for Laptop Computers with Antennas Built-in on Display Screens”, November 2009

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

[11] FCC KDB 648474 D01 v01r05, “SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas”, September 2008

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

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

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

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.