FCC SAR Test Report

APPLICANT	**:**	**ZTE CORPORATION**
EQUIPMENT	**:**	**Mobile Hotspot**
BRAND NAME	**:**	**ZTE**
MODEL NAME	**:**	**MF96**
FCC ID	**:**	**Q78-MF96**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2003** **FCC OET Bulletin 65 Supplement C (Edition 01-01)**

The product was completely tested on Dec. 04, 2012. 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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ilac-MRA

TAF
Testing Laboratory
1190

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Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA292704	Rev. 01	Initial issue of report	Dec. 21, 2012

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION Mobile Hotspot, ZTE, MF96** are as follows.

<Highest standalone SAR Summary>

Exposure Position	Frequency Band	Highest Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Hotspot (1cm Gap)	GSM850	**0.40**	PCB	**1.20**
	GSM1900	**0.98**		
	WCDMA Band IV	**0.94**		
	WCDMA Band II	**1.20**		
	LTE Band 4	**1.10**		
	WLAN, 2412 - 2462 MHz	**0.30**	DTS	**0.30**

Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
WCDMA Band II	**PCB**	**1.44**
WLAN, 2412 - 2462 MHz	**DTS**	

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 C95.1-1992, 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 Start during the Test	Nov. 30, 2012
Date of End during the Test	Dec. 04, 2012

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Mobile Hotspot
Brand Name	ZTE
Model Name	MF96
FCC ID	Q78-MF96
Tx Frequency	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz WLAN2.4G: 2412 MHz ~ 2462 MHz
Measure Maximum Average Output Power to Antenna	GSM850: 33.13 dBm GSM1900: 30.39 dBm WCDMA Band II: 22.71 dBm WCDMA Band IV: 22.24 dBm LTE Band 4 : 22.94 dBm 802.11b: 17.84 dBm 802.11g: 18.48 dBm 802.11n-HT20 (2.4GHz) : 17.57 dBm
Antenna Type	WWAN / LTE: PIFA Antenna WLAN: Monopole Antenna
HW Version	xn2C
SW Version	PV_ZTE_MF96_V1.0.0B01
Uplink Modulations	GSM: GMSK GPRS: GMSK EDGE: GMSK / 8PSK WCDMA (Rel 99): QPSK HSDPA (Rel 6): QPSK HSUPA (Rel 6): QPSK HSPA+ (Rel 7): 16QAM LTE: QPSK, 16QAM 802.11b: DSSS (DBPSK / QPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
Dual Transfer Mode (DTM) Category	Class C – EUT can only support either Packet Switched service or Circuit Switched service.
EUT Stage	Identical Prototype
Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.	

3.2 Maximum RF output power among production units

Band	GSM 850	GSM 1900
GPRS/EDGE (GMSK, 1 Tx slot)	33.5	30.5
GPRS/EDGE (GMSK, 2 Tx slots)	30.5	29
GPRS/EDGE (GMSK, 3 Tx slots)	29	27
GPRS/EDGE (GMSK, 4 Tx slots)	28	25.5
EDGE (8PSK, 1 Tx slot)	28.5	27.5
EDGE (8PSK, 2 Tx slots)	26	25.5
EDGE (8PSK, 3 Tx slots)	24	23.5
EDGE (8PSK, 4 Tx slots)	23	22

Band	WCDMA Band II	WCDMA Band IV
RMC 12.2K	23	22.5
HSDPA Subtest-1	23	22.5
HSUPA Subtest-5	23	22.5

IEEE 802.11				
Mode/Band	a	b	g	n
2.4 GHz WiFi		18.5	19	18

	LTE Band 4			
Modulation	**BW (MHz)**	**RB size**	**Target MPR**	**Max. Power**
QPSK	20	≤ 18	**0**	**23.5**
QPSK	20	> 18	**1**	**22.5**
16QAM	20	≤ 18	**1**	**22.5**
16QAM	20	> 18	**2**	**21.5**
QPSK	15	≤ 16	**0**	**23.5**
QPSK	15	> 16	**1**	**22.5**
16QAM	15	≤ 16	**1**	**22.5**
16QAM	15	> 16	**2**	**21.5**
QPSK	10	≤ 12	**0**	**23.5**
QPSK	10	> 12	**1**	**22.5**
16QAM	10	≤ 12	**1**	**22.5**
16QAM	10	> 12	**2**	**21.5**
QPSK	5	≤ 8	**0**	**23.5**
QPSK	5	> 8	**1**	**22.5**
16QAM	5	≤ 8	**1**	**22.5**
16QAM	5	> 8	**2**	**21.5**
QPSK	3	≤ 4	**0**	**23.5**
QPSK	3	> 4	**1**	**22.5**
16QAM	3	≤ 4	**1**	**22.5**
16QAM	3	> 4	**2**	**21.5**
QPSK	1.4	≤ 5	**0**	**23.5**
QPSK	1.4	> 5	**1**	**22.5**
16QAM	1.4	≤ 5	**1**	**22.5**
16QAM	1.4	> 5	**2**	**21.5**

For Band 4:

Modulation	**Channel bandwidth / Transmission bandwidth configuration [RB]**						**MPR Target (dB)**						**3GPP MPR (dB)**
	1.4 MHz	**3 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**1.4 MHz**	**3 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1	1	1	1	1	1	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1	1	1	1	1	1	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2	2	2	2	2	2	≤ 2

Remark:

1. By design, other RB configurations and higher-order modulation RF output power will never exceed maximum output power listed above, detailed information is included in “tune-up procedure” exhibit
2. LTE MPR implementation is the same for normal mode and power reduction mode

The table below summarized necessary items addressed in KDB 941225 D05 v02.

FCC ID	Q78-MF96
EUT	Mobile Hotspot
Operating Frequency Range of each LTE transmission band	Band 4 : Tx: 1710.7 MHz ~ 1754.3 MHz
Channel Bandwidth	Band 4 : 20MHz, 15MHz, 10MHz, 5MHz, 3MHz. 1.4MHz

Transmission (H, M, L) channel numbers and frequencies in each LTE band

Band 4				
	Bandwidth 20 MHz		Bandwidth 15 MHz	
	Channel #	Frequency (MHz)	Channel #	Frequency (MHz)
L	20050	1720	20025	1717.5
M	20175	1732.5	20175	1732.2
H	220300	1745	20325	1747.5

Band 4				
	Bandwidth 10 MHz		Bandwidth 5 MHz	
	Channel #	Frequency (MHz)	Channel #	Frequency (MHz)
L	20000	1715	19975	1712.5
M	20175	1732.5	20175	1732.5
H	20350	1750	20375	1752.5

Band 4				
	Bandwidth 3 MHz		Bandwidth 1.4 MHz	
	Channel #	Frequency (MHz)	Channel #	Frequency (MHz)
L	19965	1711.5	19957	1710.7
M	20175	1732.5	20175	1732.5
H	20385	1753.5	20393	1754.3

UE category, uplink modulations used	Category 3, QPSK, and 16QAM
LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas)	Main Antenna: LTE share the antenna with GSM and WCDMA.
LTE MPR permanently built-in by design	Yes
LTE Voice / Data requirements	Data only
LTE A-MPR	Disabled during SAR testing. NS value is set to NS_01 to disable A-MPR.
LTE Voice / Data requirements	Data only
Base station simulator used for Testing	Anritsu MT8820C
Measured LTE maximum averaged conducted output power	LTE Band 4: 22.94 dBm
Simultaneous transmission configurations	In Section 11.4
Power reduction applied to satisfy SAR compliance	No.

3.3 Applied Standard

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)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v05
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D05 v02
- FCC KDB 941225 D06 v01
- FCC KDB 865664 D01v01
- 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 EUT 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 EUT. The EUT was set from the emulator to radiate maximum output power during all tests.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool,

The EUT was set from the emulator to radiate maximum WWAN 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

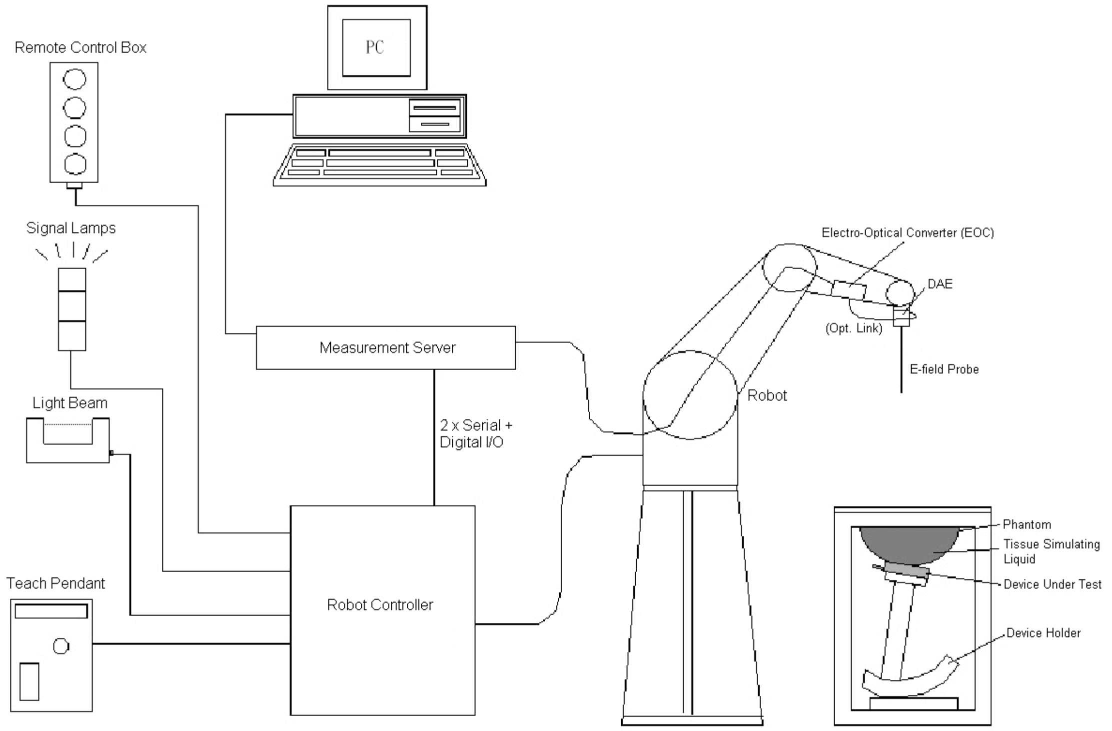


Fig 5.1 SPEAG DASY System Configurations

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 (EOC) 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

Component details are described in 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

<ES3DV3 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: 337 mm (Tip: 10 mm) Tip diameter: 4 mm (Body: 10 mm) Distance from probe tip to dipole centers: 2.0 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 ± 0.25dB. 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 (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; 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)

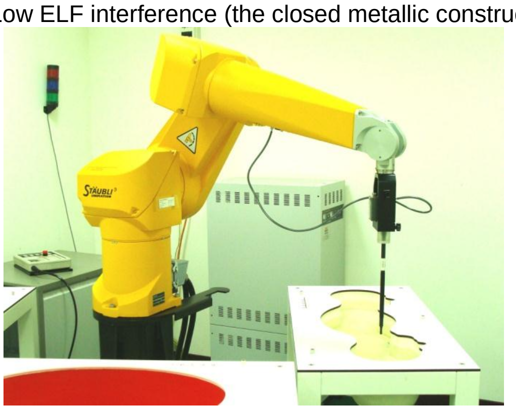


Fig 5.5 Photo of DASY4

Fig 5.6 Photo of DASY5

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, 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 5.7 Photo of Server for DASY4

Fig 5.8 Photo of Server for DASY5

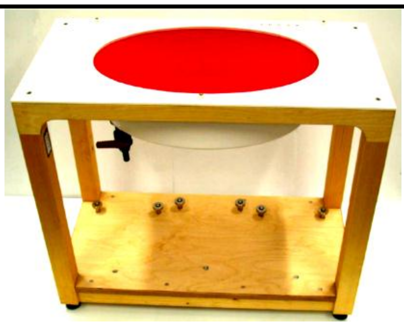
5.5 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 **Fig 5.9 Photo of SAM Phantom**
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat 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%)	 **Fig 5.10 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

<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 (ERP). 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 $\varepsilon = 3$ and loss tangent $\delta = 0.02$. 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 5.11 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.

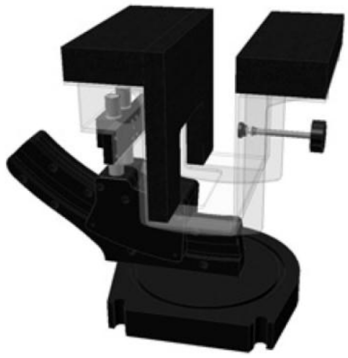


Fig 5.12 Laptop Extension Kit

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	835MHz System Validation Kit	D835V2	499	Mar. 22, 2010	Mar. 21, 2013
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Jun. 20, 2012	Jun. 19, 2013
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 23, 2010	Mar. 22, 2013
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2013
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 27, 2012	Aug. 26, 2013
SPEAG	Data Acquisition Electronics	DAE4	1279	May. 03, 2012	May. 02, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Sep. 28, 2012	Sep. 27, 2013
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 28, 2012	Sep. 27, 2013
Wisewind	Thermometer	ETP-101	TM560	Nov. 13, 2012	Nov. 12, 2013
Wisewind	Thermometer	ETP-101	TM685	Nov. 13, 2012	Nov. 12, 2013
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 CD	TP-1718	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1383	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1477	NCR	NCR
Agilent	Network Analyzer	E5071C	MY46101588	May. 11, 2012	May. 10, 2013
Agilent	ESG Vector Series Signal Generator	E4438C	MY49070755	Oct. 02, 2012	Oct. 01, 2013
Anritsu	Power Meter	ML2495A	1132003	Aug. 14, 2012	Aug. 13, 2013
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 05, 2012	Jan. 04, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 4	
Woken	Attenuator 1	WK0602-XX	N/A	Note 4	
PE	Attenuator 2	PE7005-10	N/A	Note 4	
PE	Attenuator 3	PE7005- 3	N/A	Note 4	
Agilent	Dielectric Probe Kit	85070D	US01440205	Note 5	
AR	Power Amplifier	5S1G4M2	0328767	Note 6	
R&S	Spectrum Analyzer	FSP	101131	Jul. 23, 2012	Jul. 22, 2013

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 D02, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole D835V2, SN: 499, D1900V2, SN: 5d041, and D2450V2, SN: 736 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.
4. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
5. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
6. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have 24dBm to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
7. Attenuator 1 insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.

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 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. 6.1.

Fig 6.1 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)
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. (MHz)	Liquid Type	Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	21.4	0.968	54.6	0.97	55.2	-0.21	-1.09	±5	2012/11/30
1750	Body	21.2	1.479	52.368	1.49	53.4	-0.74	-1.93	±5	2012/11/30
1900	Body	21.3	1.514	54.141	1.52	53.3	-0.39	1.58	±5	2012/11/30
2450	Body	21.4	2.018	52.307	1.95	52.7	3.49	-0.75	±5	2012/12/4

Table 6.2 Measuring Results for Simulating Liquid

7. 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.

7.1 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.

7.2 System Setup

In the simplified setup for system evaluation, the EUT 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:

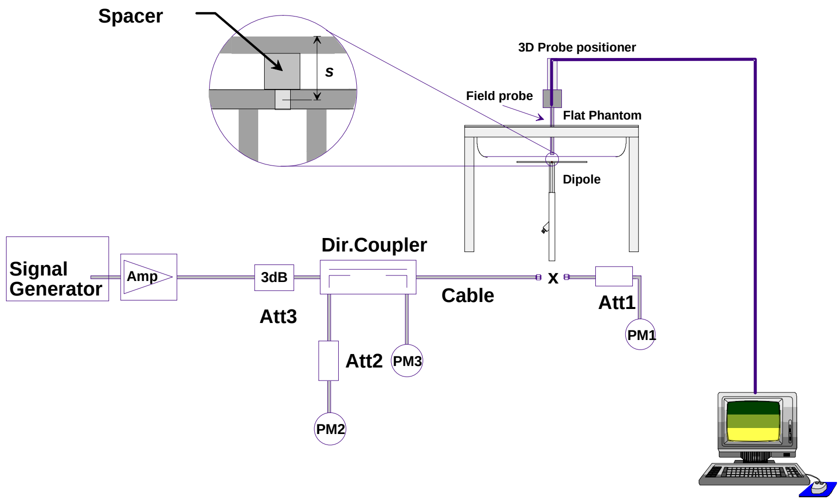


Fig 7.1 System Setup for System Evaluation

Fig 7.2 Photo of Dipole Setup

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

7.3 SAR System Verification Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Table 7.1 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	Power fed onto reference dipole (mW)	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
2012/11/30	835	Body	250	9.82	2.3	9.20	-6.31
2012/11/30	1750	Body	250	36.8	9.13	36.52	-0.76
2012/11/30	1900	Body	250	40	10.1	40.40	1.00
2012/12/4	2450	Body	250	52.3	12.5	50.00	-4.40

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

8.1 Body Position

(a) To position the device parallel to the phantom surface with all sides.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device and the flat phantom to 1.0cm.

<EUT Setup Photos>

Please refer to Appendix E for the test setup photos.

9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix E demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported 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

9.1 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.

9.2 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 is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Area scan and zoom scan resolution setting follows KDB 865664 D01v01 quoted below.

<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

9.3 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 EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.4 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.

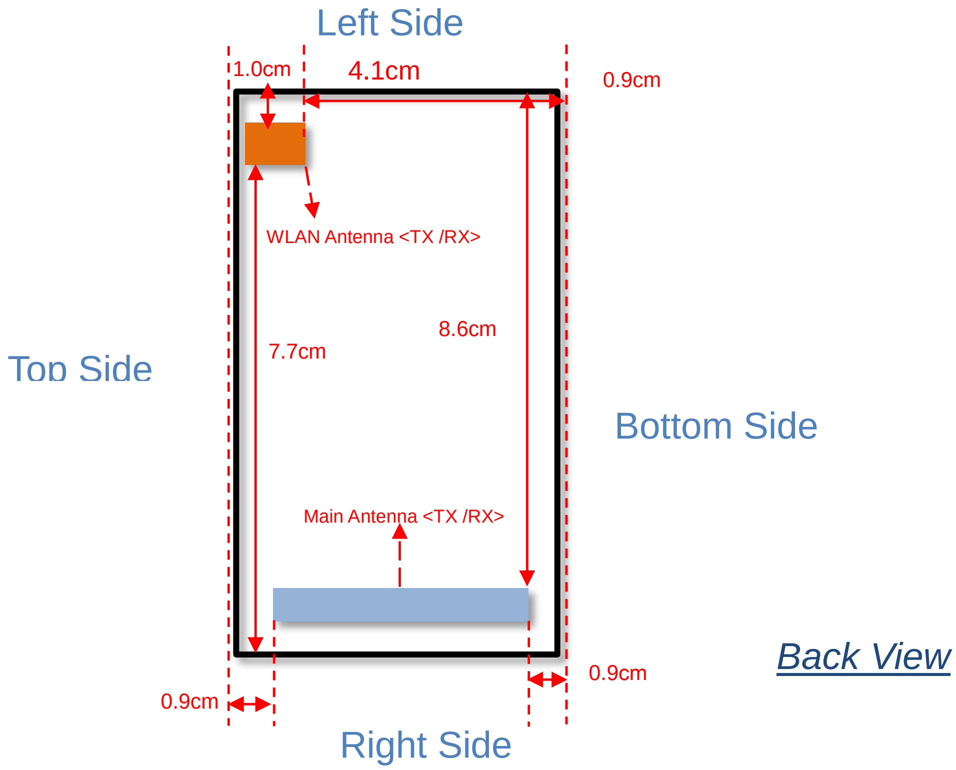
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty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

9.5 Power Drift Monitoring

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

10. SAR Test Configurations

10.1 Exposure Positions Consideration



Antennas	Wireless Interface
WWAN Main Antenna (Tx / Rx)	LTE: band 4 GSM: band 850/1900 WCDMA: band II/IV
WLAN Antenna (Tx / Rx)	WLAN 2.4GHz

Sides for SAR tests; Hotspot mode Test distance: 10 mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
WWAN Main	YES	YES	YES	YES	YES	NO
WLAN	YES	YES	YES	NO	NO	YES

Note:

1. Referring to KDB 941225 D06, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.
2. For WWAN Main antenna, SAR measurements at Left side are not required since the distance between the transmitting antenna and surface of device is > 25mm.
3. For WLAN antenna, SAR measurements Bottom/Right sides are not required since the distance between the transmitting antenna and surface of device is > 25mm.

10.2 Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Band: GSM850	Burst Average Power (dBm)			Frame-Average Power (dBm)		
Channel	**128**	**189**	**251**	**128**	**189**	**251**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**824.2**	**836.4**	**848.8**
GPRS (GMSK, 1 Tx slot) – CS1	33.08	33.10	33.13	24.08	24.10	24.13
GPRS (GMSK, 2 Tx slots) – CS1	30.28	30.31	30.35	24.28	24.31	24.35
GPRS (GMSK, 3 Tx slots) – CS1	28.83	28.62	28.72	24.57	24.36	24.46
GPRS (GMSK, 4 Tx slots) – CS1	27.36	27.46	27.60	24.36	24.46	24.60
EDGE (GMSK, 1 Tx slot) – MCS1	33.07	33.12	33.08	24.07	24.12	24.08
EDGE (GMSK, 2 Tx slots) – MCS1	30.27	30.30	30.33	24.27	24.30	24.33
EDGE (GMSK, 3 Tx slots) – MCS1	28.82	28.60	28.69	24.56	24.34	24.43
EDGE (GMSK, 4 Tx slots) – MCS1	27.33	27.45	27.57	24.33	24.45	24.57
EDGE (8PSK, 1 Tx slot) – MCS5	27.95	27.99	28.04	18.95	18.99	19.04
EDGE (8PSK, 2 Tx slots) – MCS5	25.80	25.85	25.90	19.80	19.85	19.90
EDGE (8PSK, 3 Tx slots) – MCS5	23.74	23.80	23.86	19.48	19.54	19.60
EDGE (8PSK, 4 Tx slots) – MCS5	22.47	22.54	22.60	19.47	19.54	19.60

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

Note:

1. For Body SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 4 Tx slots for GSM850 due to its highest frame-average power.
2. Per KDB 447498 D01v05, the maximum output power channel is used for SAR testing and for further SAR test reduction.
3. The EUT do not support DTM function.

Band: GSM1900	Burst Average Power (dBm)			Frame-Average Power (dBm)		
Channel	**512**	**661**	**810**	**512**	**661**	**810**
Frequency (MHz)	**1850.2**	**1880.0**	**1909.8**	**1850.2**	**1880.0**	**1909.8**
GPRS (GMSK, 1 Tx slot) – CS1	30.09	30.22	30.39	21.09	21.22	21.39
GPRS (GMSK, 2 Tx slots) – CS1	28.00	28.25	28.42	22.00	22.25	22.42
GPRS (GMSK, 3 Tx slots) – CS1	26.14	26.22	26.57	21.88	21.96	22.31
GPRS (GMSK, 4 Tx slots) – CS1	24.80	24.96	25.14	21.80	21.96	22.14
EDGE (GMSK, 1 Tx slot) – MCS1	30.13	30.26	30.35	21.13	21.26	21.35
EDGE (GMSK, 2 Tx slots) – MCS1	28.01	28.29	28.40	22.01	22.29	22.40
EDGE (GMSK, 3 Tx slots) – MCS1	26.16	26.19	26.52	21.90	21.93	22.26
EDGE (GMSK, 4 Tx slots) – MCS1	24.69	24.94	25.10	21.69	21.94	22.10
EDGE (8PSK, 1 Tx slot) – MCS5	27.00	27.12	27.18	18.00	18.12	18.18
EDGE (8PSK, 2 Tx slots) – MCS5	25.00	25.10	25.20	19.00	19.10	19.20
EDGE (8PSK, 3 Tx slots) – MCS5	23.16	23.25	23.32	18.90	18.99	19.06
EDGE (8PSK, 4 Tx slots) – MCS5	21.67	21.82	21.96	18.67	18.82	18.96

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

Note:

1. For Body SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 2 Tx slots for GSM1900 due to its highest frame-average power.
2. Per KDB 447498 D01v05, 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 modulations are provided voluntary for reference.
4. The EUT do not support DTM function.

<WCDMA Conducted Power>

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT 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 RMC 12.2Kbps + 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 Delta ACK, Delta NACK and Delta CQI = 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.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	CM (dB) *(Note 3)*	MPR (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with $\beta_{hs} = 30/15 * \beta_c$, and Δ_{CQI} = 24/15 with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station Agilent E5515C 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.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 5) (Note 6)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM *(dB) (Note 2)*	MPR *(dB) (Note 2)*	*AG Index (Note 6)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 *(Note 4)*	15/15 *(Note 4)*	64	15/15 *(Note 4)*	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.
Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

HSPA+ 3GPP release 7 (uplink category 7) 16QAM, Setup Configuration:

a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station Agilent E5515C with following setting * :
   i. Call Configs = 5.2E:HSPA+:UL with 16QAM
   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, C11.1.4, quoted from the TS 34.121-1 s5.2E
   iii. Set Channel Parms
   iv. Set Cell Power = -86 dBm
   v. Set Channel Type = HSPA
   vi. Set UE Target Power =21 dBm
   vii. Power Ctrl Mode= All Up Bits
   viii. Set Manual Uplink DPCH Bc/Bd = Manual
   ix. Set Manual Uplink DPCH Bc and Bd=15,15(for 34.121-1 v8.10.0 table C11.1.4 sub-test 1)
   x. Set HSPA Conn DL Channel Levels
   xi. Set HS-SCCH Configs
   xii. Set RB Test Mode Setup
   xiii. Set Common HSUPA Parameters
   xiv. Set Serving Grant
   xv. Confirm that E-TFCI is equal to the target E-TFCI of 105 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.4: **β values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM**

Sub-test	β_c (Note3)	β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (2xSF2) (Note 4)	β_{ed} (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	β_{ed}1: 30/15 β_{ed}2: 30/15	β_{ed}3: 24/15 β_{ed}4: 24/15	3.5	2.5	14	105	105

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).
Note 3: DPDCH is not configured, therefore the β_c is set to 1 and β_d = 0 by default.
Note 4: β_{ed} can not be set directly; it is set by Absolute Grant Value.
Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.

Setup Configuration

WCDMA Average power (dBm)							
Band		WCDMA Band II			WCDMA Band IV		
Channel		9262	9400	9538	1312	1413	1513
Frequency (MHz)		1852.4	1880.0	1907.6	1712.4	1732.6	1752.6
3GPP Rel 99	RMC 12.2K	22.60	22.71	22.56	22.24	22.19	22.16
3GPP Rel 6	HSDPA Subtest-1	21.59	21.78	21.67	21.33	21.23	21.22
3GPP Rel 6	HSDPA Subtest-2	21.61	21.77	21.62	21.30	21.20	21.16
3GPP Rel 6	HSDPA Subtest-3	21.15	21.30	21.16	20.74	20.68	20.67
3GPP Rel 6	HSDPA Subtest-4	21.11	21.29	21.10	20.73	20.66	20.63
3GPP Rel 6	HSUPA Subtest-1	21.80	21.50	21.85	21.17	21.44	21.30
3GPP Rel 6	HSUPA Subtest-2	20.61	20.84	20.68	20.46	20.12	20.50
3GPP Rel 6	HSUPA Subtest-3	20.78	20.69	20.82	20.13	20.02	20.39
3GPP Rel 6	HSUPA Subtest-4	20.77	20.70	20.86	21.05	21.00	21.07
3GPP Rel 6	HSUPA Subtest-5	21.88	22.18	22.00	21.62	21.42	21.56
3GPP Rel 7 Category 7	HSPA+ (16QAM) Subtest-1	20.78	20.89	20.79	20.39	20.29	20.31

MPR (dB)								
3GPP MPR	Subtest		WCDMA Band II			WCDMA Band IV		
0	3GPP Rel 6	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	3GPP Rel 6	HSDPA Subtest-2	-0.02	0.01	0.05	0.03	0.03	0.06
≤ 0.5	3GPP Rel 6	HSDPA Subtest-3	0.44	0.48	0.51	0.59	0.55	0.55
≤ 0.5	3GPP Rel 6	HSDPA Subtest-4	0.48	0.49	0.57	0.60	0.57	0.59
0	3GPP Rel 6	HSUPA Subtest-1	0.08	0.68	0.15	0.45	-0.02	0.26
≤ 2	3GPP Rel 6	HSUPA Subtest-2	1.27	1.34	1.32	1.16	1.30	1.06
≤ 1	3GPP Rel 6	HSUPA Subtest-3	1.10	1.49	1.18	1.49	1.40	1.17
≤ 2	3GPP Rel 6	HSUPA Subtest-4	1.11	1.48	1.14	0.57	0.42	0.49
0	3GPP Rel 6	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00
≤ 2.5	3GPP Rel 7	HSPA+ (16QAM) Subtest-1	1.10	1.29	1.21	1.23	1.13	1.25

Note:

1. Applying the subtest setup in Table C.11.1.3 of 3GPP TS 34.121-1 V9.1.0 to Rel. 6 HSPA, and the subtest setup in Table C.11.1.4 to Rel. 7 HSPA+.
2. For Body SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA/HSPA+, output power is < 0.25dB higher than RMC, or SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA/HSPA+ SAR evaluation can be excluded.
3. By design, AMR, HSDPA/HSUPA and RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
4. It is expected by the manufacturer that MPR for some HSDPA/HSUPA, subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

<u><LTE Band 4 Conducted Power ></u>

BW [MHz]	Mod / RB (Size - Offset)	Average Power. (dBm)			3GPP MPR	MPR Result (dB)		
		Low Ch	Mid Ch	High Ch		Low Ch	Mid Ch	High Ch
	Channel	20050	20175	20300		20050	20175	20300
	Frequency (MHz)	1720	1732.5	1745		1720	1732.5	1745
20	QPSK 1-0	22.84	22.69	22.69		0.09	0.25	0.04
20	QPSK 1-49	22.93	22.94	22.73	0	0.00	0.00	0.00
20	QPSK 1-99	22.82	22.78	22.68		0.11	0.16	0.05
20	QPSK 50-0	21.56	21.55	21.61		1.37	1.39	1.12
20	QPSK 50-24	21.54	21.64	21.50	≤ 1	1.39	1.30	1.23
20	QPSK 50-49	21.60	21.59	21.49		1.33	1.35	1.24
20	QPSK100-0	21.50	21.63	21.29		1.43	1.31	1.44
20	16QAM 1-0	21.92	21.90	21.71		1.01	1.04	1.02
20	16QAM 1-49	21.95	21.93	21.54	≤ 1	0.98	1.01	1.19
20	16QAM 1-99	21.89	21.87	21.49		1.04	1.07	1.24
20	16QAM 50-0	20.53	20.54	20.25		2.40	2.40	2.48
20	16QAM 50-24	20.45	20.61	20.23	≤ 2	2.48	2.33	2.50
20	16QAM 50-49	20.50	20.60	20.28		2.43	2.34	2.45
20	16QAM 100-0	20.46	20.63	20.31		2.47	2.31	2.42
	Channel	20025	20175	20325		20025	20175	20325
	Frequency (MHz)	1717.5	1732.5	1747.5		1717.5	1732.5	1747.5
15	QPSK 1-0	22.75	22.63	22.67		0.00	0.05	0.00
15	QPSK 1-37	22.65	22.56	22.65	0	0.10	0.12	0.02
15	QPSK 1-74	22.43	22.68	22.56		0.32	0.00	0.11
15	QPSK 38-0	21.25	21.46	21.31		1.50	1.22	1.36
15	QPSK 38-18	21.40	21.61	21.51	≤ 1	1.35	1.07	1.16
15	QPSK 38-37	21.38	21.57	21.46		1.37	1.11	1.21
15	QPSK 75-0	21.25	21.46	21.18		1.50	1.22	1.49
15	16QAM 1-0	21.87	21.71	21.73		0.88	0.97	0.94
15	16QAM 1-37	21.76	21.65	21.69	≤ 1	0.99	1.03	0.98
15	16QAM 1-74	21.61	21.70	21.51		1.14	0.98	1.16
15	16QAM 38-0	20.40	20.37	20.30		2.35	2.31	2.37
15	16QAM 38-18	20.43	20.67	20.28	≤ 2	2.32	2.01	2.39
15	16QAM 38-37	20.42	20.65	20.35		2.33	2.03	2.32
15	16QAM 75-0	20.29	20.43	20.20		2.46	2.25	2.47
	Channel	20000	20175	20350		20000	20175	20350
	Frequency (MHz)	1715	1732.5	1750		1715	1732.5	1750
10	QPSK 1-0	22.63	22.71	22.55		0.00	0.00	0.11
10	QPSK 1-24	22.42	22.64	22.52	0	0.21	0.07	0.14
10	QPSK 1-49	22.51	22.68	22.66		0.12	0.03	0.00
10	QPSK 25-0	21.70	21.54	21.47		0.93	1.17	1.19
10	QPSK 25-12	21.42	21.48	21.41	≤ 1	1.21	1.23	1.25
10	QPSK 25-24	21.32	21.50	21.32		1.31	1.21	1.34
10	QPSK 50-0	21.17	21.47	21.24		1.46	1.24	1.42
10	16QAM 1-0	21.62	21.75	21.76		1.01	0.96	0.90
10	16QAM 1-24	21.53	21.67	21.67	≤ 1	1.10	1.04	0.99
10	16QAM 1-49	21.56	21.59	21.48		1.07	1.12	1.18
10	16QAM 25-0	20.27	20.55	20.23		2.36	2.16	2.43
10	16QAM 25-12	20.42	20.49	20.32	≤ 2	2.21	2.22	2.34
10	16QAM 25-24	20.19	20.53	20.38		2.44	2.18	2.28
10	16QAM 50-0	20.23	20.49	20.28		2.40	2.22	2.38

BW [MHz]	Mod / RB (Size - Offset)	Average Power. (dBm)			3GPP MPR	MPR Result (dB)		
		Low Ch	Mid Ch	High Ch		Low Ch	Mid Ch	High Ch
	Channel	19975	20175	20375		19975	20175	20375
	Frequency (MHz)	1712.5	1732.5	1752.5		1712.5	1732.5	1752.5
5	QPSK 1-0	22.53	22.61	22.53	0	0.00	0.14	0.05
5	QPSK 1-12	22.47	22.57	22.42		0.06	0.18	0.16
5	QPSK 1-24	22.25	22.75	22.58		0.28	0.00	0.00
5	QPSK 12-0	21.61	21.82	21.62	≤ 1	0.92	0.93	0.96
5	QPSK 12-6	21.55	21.79	21.50		0.98	0.96	1.08
5	QPSK 12-11	21.42	21.49	21.48		1.11	1.26	1.10
5	QPSK 25-0	21.41	21.44	21.40		1.12	1.31	1.18
5	16QAM 1-0	21.65	21.83	21.73	≤ 1	0.88	0.92	0.85
5	16QAM 1-12	21.54	21.62	21.67		0.99	1.13	0.91
5	16QAM 1-24	21.45	21.46	21.56		1.08	1.29	1.02
5	16QAM 12-0	20.71	20.86	20.70	≤ 2	1.82	1.89	1.88
5	16QAM 12-6	20.62	20.65	20.61		1.91	2.10	1.97
5	16QAM 12-11	20.56	20.82	20.55		1.97	1.93	2.03
5	16QAM 25-0	20.49	20.56	20.34		2.04	2.19	2.24
	Channel	19965	20175	20385		19965	20175	20385
	Frequency (MHz)	1711.5	1732.5	1753.5		1711.5	1732.5	1753.5
3	QPSK 1-0	22.55	22.62	22.50	0	0.00	0.04	0.16
3	QPSK 1-7	22.53	22.57	22.43		0.02	0.09	0.23
3	QPSK 1-14	22.45	22.66	22.66		0.10	0.00	0.00
3	QPSK 8-0	21.82	21.75	21.64	≤ 1	0.73	0.91	1.02
3	QPSK 8-4	21.64	21.81	21.53		0.91	0.85	1.13
3	QPSK 8-7	21.50	21.78	21.46		1.05	0.88	1.20
3	QPSK 15-0	21.61	21.62	21.50		0.94	1.04	1.16
3	16QAM 1-0	21.75	21.74	21.44	≤ 1	0.80	0.92	1.22
3	16QAM 1-7	21.64	21.59	21.41		0.91	1.07	1.25
3	16QAM 1-14	21.48	21.66	21.39		1.07	1.00	1.27
3	16QAM 8-0	20.43	20.67	20.57	≤ 2	2.12	1.99	2.09
3	16QAM 8-4	20.76	20.64	20.43		1.79	2.02	2.23
3	16QAM 8-7	20.53	20.56	20.52		2.02	2.10	2.14
3	16QAM 15-0	20.44	20.35	20.46		2.11	2.31	2.20
	Channel	19957	20175	20393		19957	20175	20393
	Frequency (MHz)	1710.7	1732.5	1754.3		1710.7	1732.5	1754.3
1.4	QPSK 1-0	22.62	22.61	22.57	0	0.00	0.10	0.07
1.4	QPSK 1-2	22.54	22.58	22.52		0.08	0.13	0.12
1.4	QPSK 1-5	22.51	22.47	22.62		0.11	0.24	0.02
1.4	QPSK 3-0	22.47	22.61	22.56		0.15	0.10	0.08
1.4	QPSK 3-1	22.40	22.71	22.64		0.22	0.00	0.00
1.4	QPSK 3-2	22.34	22.67	22.56		0.28	0.04	0.08
1.4	QPSK 6-0	21.59	21.69	21.98	≤ 1	1.03	1.02	0.66
1.4	16QAM 1-0	21.54	21.65	21.65	≤ 1	1.08	1.06	0.99
1.4	16QAM 1-2	21.42	21.48	21.58		1.20	1.23	1.06
1.4	16QAM 1-5	21.64	21.45	21.54		0.98	1.26	1.10
1.4	16QAM 3-0	21.57	21.74	21.66		1.05	0.97	0.98
1.4	16QAM 3-1	21.54	21.71	21.77		1.08	1.00	0.87
1.4	16QAM 3-2	21.48	21.56	21.58		1.14	1.15	1.06
1.4	16QAM 6-0	20.79	20.94	20.91	≤ 2	1.83	1.77	1.73

Note:

1. Per KDB 941225 D05v02, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and *required test channel* combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each *required test channel*.
2. Per KDB 941225 D05v02, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
3. 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK
4. Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth

<WLAN 2.4GHz Conducted Power>

WLAN 2.4G 802.11b Average Power (dBm)						
Power vs. Channel			Power vs. Data Rate			
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)		
		1M		2M	5.5M	11M
CH 01	2412	17.78	CH 11	17.82	17.80	17.78
CH 06	2437	17.42				
CH 11	2462	**17.84**				

WLAN 2.4G 802.11g Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)						
		6M		9M	12M	18M	24M	36M	48M	54M
CH 01	2412	**18.48**	CH 01	18.29	18.44	18.42	18.00	18.17	18.40	17.94
CH 06	2437	17.69								
CH 11	2462	17.64								

WLAN 2.4G 802.11n (BW 20MHz) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS0		MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 01	2412	**17.57**	CH 01	17.49	17.37	17.39	17.34	16.26	16.47	15.83
CH 06	2437	17.49								
CH 11	2462	17.22								

Note:

1. Per KDB 248227, choose the highest output power channel to test SAR and determine further SAR exclusion
2. Per KDB 248227, 11g average output power is higher than 0.25dB higher than 11b mode, SAR will be verified.
3. Per KDB 248227, 11n-HT20 output power is less than 1/4 dB higher than 11b mode, thus the SAR can be excluded.
4. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

11. SAR Test Results

11.1 Test Records for Body-worn SAR Test

<General Note>

1. Per KDB 447498 D01v05, for each exposure position, if the highest output channel reported SAR <0.8 other channels SAR testing are not necessary.

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
1	**GSM850**	**GPRS (4 Tx slots)**	**Front**	**1cm**	**251**	**848.8**	**27.60**	**28.00**	**1.096**	**-0.14**	**0.367**	**0.402**
2	GSM850	GPRS (4 Tx slots)	Back	1cm	251	848.8	27.60	28.00	1.096	-0.01	0.309	0.339
3	GSM850	GPRS (4 Tx slots)	Right Side	1cm	251	848.8	27.60	28.00	1.096	-0.128	0.124	0.136
4	GSM850	GPRS (4 Tx slots)	Top Side	1cm	251	848.8	27.60	28.00	1.096	-0.15	0.191	0.209
5	GSM850	GPRS (4 Tx slots)	Bottom Side	1cm	251	848.8	27.60	28.00	1.096	0.01	0.216	0.237
6	GSM1900	GPRS (2 Tx slots)	Front	1cm	810	1909.8	28.42	29.00	1.143	-0.06	0.681	0.778
7	GSM1900	GPRS (2 Tx slots)	Back	1cm	810	1909.8	28.42	29.00	1.143	-0.04	0.521	0.595
8	GSM1900	GPRS (2 Tx slots)	Right Side	1cm	810	1909.8	28.42	29.00	1.143	-0.1	0.837	0.957
21	GSM1900	GPRS (2 Tx slots)	Right Side	1cm	512	1850.2	28.00	29.00	1.259	-0.03	0.769	0.968
22	**GSM1900**	**GPRS (2 Tx slots)**	**Right Side**	**1cm**	**661**	**1880**	**28.25**	**29.00**	**1.189**	**-0.06**	**0.827**	**0.983**
9	GSM1900	GPRS (2 Tx slots)	Top Side	1cm	810	1909.8	28.42	29.00	1.143	-0.05	0.168	0.192
10	GSM1900	GPRS (2 Tx slots)	Bottom Side	1cm	810	1909.8	28.42	29.00	1.143	-0.14	0.3	0.343

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
44	WCDMA IV	RMC12.2K	Front	1cm	1312	1712.4	22.24	22.50	1.062	0	0.811	0.861
45	WCDMA IV	RMC12.2K	Front	1cm	1413	1732.6	22.19	22.50	1.074	-0.01	0.84	0.902
46	**WCDMA IV**	**RMC12.2K**	**Front**	**1cm**	**1513**	**1752.6**	**22.16**	**22.50**	**1.081**	**-0.06**	**0.871**	**0.942**
47	WCDMA IV	RMC12.2K	Back	1cm	1312	1712.4	22.24	22.50	1.062	0.04	0.491	0.521
48	WCDMA IV	RMC12.2K	Right Side	1cm	1312	1712.4	22.24	22.50	1.062	-0.04	0.81	0.860
49	WCDMA IV	RMC12.2K	Right Side	1cm	1413	1732.6	22.19	22.50	1.074	0.04	0.764	0.821
50	WCDMA IV	RMC12.2K	Right Side	1cm	1513	1752.6	22.16	22.50	1.081	0.02	0.843	0.912
51	WCDMA IV	RMC12.2K	Top Side	1cm	1312	1712.4	22.24	22.50	1.062	0.04	0.227	0.241
52	WCDMA IV	RMC12.2K	Bottom Side	1cm	1312	1712.4	22.24	22.50	1.062	0.09	0.261	0.277
11	WCDMA II	RMC12.2K	Front	1cm	9400	1880	22.71	23.00	1.069	0.06	0.816	0.872
12	**WCDMA II**	**RMC12.2K**	**Front**	**1cm**	**9262**	**1852.4**	**22.60**	**23.00**	**1.096**	**-0.06**	**1.09**	**1.195**
13	WCDMA II	RMC12.2K	Front	1cm	9538	1907.6	22.56	23.00	1.107	0.05	0.882	0.976
15	WCDMA II	RMC12.2K	Back	1cm	9400	1880	22.71	23.00	1.069	0.01	0.653	0.698
16	WCDMA II	RMC12.2K	Right Side	1cm	9400	1880	22.71	23.00	1.069	0.01	1.04	1.112
17	WCDMA II	RMC12.2K	Right Side	1cm	9262	1852.4	22.60	23.00	1.096	-0.03	1.02	1.118
18	WCDMA II	RMC12.2K	Right Side	1cm	9538	1907.6	22.56	23.00	1.107	0.08	0.974	1.078
19	WCDMA II	RMC12.2K	Top Side	1cm	9400	1880	22.71	23.00	1.069	0.08	0.204	0.218
20	WCDMA II	RMC12.2K	Bottom Side	1cm	9400	1880	22.71	23.00	1.069	0	0.255	0.273

<LTE SAR>

Plot No.	Band	BW [MHz]	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
23	LTE Band 4	20M	QPSK 1RB 49offset	Front	1cm	20175	1732.5	22.94	23.5	1.138	0.01	0.888	1.010
24	LTE Band 4	20M	QPSK 1RB 49offset	Front	1cm	20050	1720	22.93	23.5	1.140	0.06	0.823	0.938
25	**LTE Band 4**	**20M**	**QPSK 1RB 49offset**	**Front**	**1cm**	**20300**	**1745**	**22.73**	**23.5**	**1.194**	**0.01**	**0.917**	**1.095**
26	LTE Band 4	20M	QPSK 50RB 24offset	Front	1cm	20175	1732.5	21.64	22.5	1.219	-0.05	0.682	0.831
31	LTE Band 4	20M	QPSK 50RB 24offset	Front	1cm	20050	1720	21.54	22.5	1.247	0.08	0.621	0.775
32	LTE Band 4	20M	QPSK 50RB 24offset	Front	1cm	20300	1745	21.5	22.5	1.259	0.01	0.663	0.835
27	LTE Band 4	20M	QPSK 100RB 0offset	Front	1cm	20175	1732.5	21.63	22.5	1.222	0.02	0.655	0.800
28	LTE Band 4	20M	QPSK 1RB 49offset	Back	1cm	20175	1732.5	22.94	23.5	1.138	0.01	0.54	0.614
29	LTE Band 4	20M	QPSK 50RB 24offset	Back	1cm	20175	1732.5	21.64	22.5	1.219	0.01	0.453	0.552
33	LTE Band 4	20M	QPSK 1RB 49offset	Right Side	1cm	20175	1732.5	22.94	23.5	1.138	-0.03	0.813	0.925
34	LTE Band 4	20M	QPSK 1RB 49offset	Right Side	1cm	20050	1720	22.93	23.5	1.140	0	0.787	0.897
35	LTE Band 4	20M	QPSK 1RB 49offset	Right Side	1cm	20300	1745	22.73	23.5	1.194	0.01	0.804	0.960
36	LTE Band 4	20M	QPSK 50RB 24offset	Right Side	1cm	20175	1732.5	21.64	22.5	1.219	-0.09	0.617	0.752
37	LTE Band 4	20M	QPSK 100RB 0offset	Right Side	1cm	20175	1732.5	21.63	22.5	1.222	-0.01	0.619	0.756
38	LTE Band 4	20M	QPSK 1RB 49offset	Top Side	1cm	20175	1732.5	22.94	23.5	1.138	0.05	0.241	0.274
39	LTE Band 4	20M	QPSK 50RB 24offset	Top Side	1cm	20175	1732.5	21.64	22.5	1.219	0.02	0.192	0.234
41	LTE Band 4	20M	QPSK 1RB 49offset	Bottom Side	1cm	20175	1732.5	22.94	23.5	1.138	0	0.315	0.358
42	LTE Band 4	20M	QPSK 50RB 24offset	Bottom Side	1cm	20175	1732.5	21.64	22.5	1.219	0	0.238	0.290

Note:

1. Per KDB 941225 D05v02, when reported SAR of 1RB and 50%RB allocation for QPSK ≤0.8W/kg, and 100%RB with QPSK output power is less than 1RB and 50%RB, 100%RB allocation for QPSK is not required.
2. Per KDB 941225 D05v02, when reported SAR of 1RB and 50%RB allocation for QPSK >0.8W/kg for any exposure position, SAR testing of 100%RB allocation for QPSK is performed at the highest power channel.
3. 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the *reported* SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02, 16QAM SAR testing is not required.
4. Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the *reported* SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02, 16QAM SAR testing is not required.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Scaled SAR_{1g} (W/kg)
53	WLAN2.4G	802.11b	Front	1cm	11	2462	17.84	18.5	1.164	-0.01	0.207	0.241
54	WLAN2.4G	802.11b	Back	1cm	11	2462	17.84	18.5	1.164	-0.135	0.19	0.221
55	WLAN2.4G	802.11b	Left Side	1cm	11	2462	17.84	18.5	1.164	0.15	0.097	0.113
57	**WLAN2.4G**	**802.11b**	**Top Side**	**1cm**	**11**	**2462**	**17.84**	**18.5**	**1.164**	**-0.125**	**0.261**	**0.304**
59	WLAN2.4G	802.11g	Top Side	1cm	1	2412	18.48	19	1.128	-0.124	0.182	0.205

11.2 Repeated SAR Measurement

Plot No.	Band	BW (MHz)	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Tune-up Scaled 1g SAR
8	GSM1900		GPRS (2 Tx slots)	Right Side	1cm	810	1909.8	28.42	29.00	1.143	-0.1	0.837	0.957
60	GSM1900		GPRS (2 Tx slots)	Right Side	1cm	810	1909.8	28.42	29.00	1.143	-0.1	0.836	0.955
46	WCDMA IV		RMC12.2K	Front	1cm	1513	1752.6	22.16	22.50	1.081	-0.06	0.871	0.942
61	WCDMA IV		RMC12.2K	Front	1cm	1513	1752.6	22.16	22.50	1.081	-0.03	0.867	0.938
12	WCDMA II		RMC12.2K	Front	1cm	9262	1852.4	22.60	23.00	1.096	-0.06	1.09	1.195
14	WCDMA II		RMC12.2K	Front	1cm	9262	1852.4	22.60	23.00	1.096	-0.124	1.04	1.140
25	LTE Band 4	20M	QPSK 1RB 49offset	Front	1cm	20300	1745	22.73	23.5	1.194	0.01	0.917	1.095
62	LTE Band 4	20M	QPSK 1RB 49offset	Front	1cm	20300	1745	22.73	23.5	1.194	0.09	0.884	1.055

Note:

1. Per KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01, if the deviation among the repeated measurement is ≤20% and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The deviation is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

11.3 Highest SAR Plot

Plot No.	Band	BW (MHz)	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	SAR_{1g} (W/kg)	Tune-up Scaled 1g SAR
1	GSM850		GPRS (4 Tx slots)	Front	1cm	251	848.8	27.60	28.00	1.096	-0.14	0.367	0.402
22	GSM1900		GPRS (2 Tx slots)	Right Side	1cm	661	1880	28.25	29.00	1.189	-0.06	0.827	0.983
46	WCDMA IV		RMC12.2K	Front	1cm	1513	1752.6	22.16	22.50	1.081	-0.06	0.871	0.942
12	WCDMA II		RMC12.2K	Front	1cm	9262	1852.4	22.60	23.00	1.096	-0.06	1.09	1.195
25	LTE Band 4	20M	QPSK 1RB 49offset	Front	1cm	20300	1745	22.73	23.5	1.194	0.01	0.917	1.095
57	WLAN2.4G		802.11b	Top Side	1cm	11	2462	17.84	18.5	1.164	-0.125	0.261	0.304

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/11/30

#01_GSM850_GPRS (4 Tx slots)_Front_1cm_Ch251

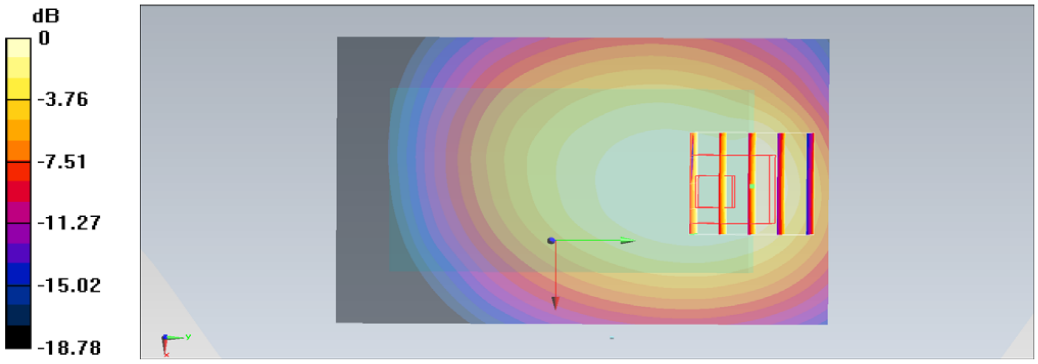
DUT: 292704

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:2
Medium: MSL_850_121130 Medium parameters used: f = 849 MHz; σ = 0.982 mho/m; ε_r = 54.483; ρ = 1000 kg/m^3
Ambient Temperature：22.4 ℃; Liquid Temperature：21.4 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(6.16, 6.16, 6.16); Calibrated: 2012/9/28;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: SAM-Right; Type: QD 000 P40 C; Serial: TP-1383
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch251/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.519 mW/g

Configuration/Ch251/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.887 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.702 mW/g
SAR(1 g) = 0.367 mW/g; SAR(10 g) = 0.236 mW/g
Maximum value of SAR (measured) = 0.457 mW/g



0 dB = 0.457 mW/g = -6.80 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/11/30

#22_GSM1900_GPRS (2 Tx slots)_Right Side_1cm_Ch661

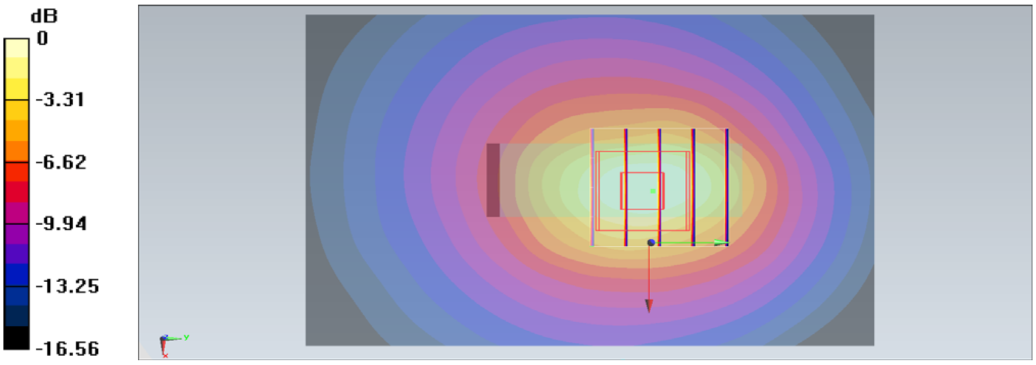
DUT: 292704

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: MSL_1900_121130 Medium parameters used: f = 1880 MHz; $\sigma = 1.49$ mho/m; $\varepsilon_r = 54.234$; $\rho = 1000$ kg/m^3
Ambient Temperature：22.3 ℃; Liquid Temperature：21.3 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(4.67, 4.67, 4.67); Calibrated: 2012/9/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch661/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.14 mW/g

Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.881 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.422 mW/g
SAR(1 g) = 0.827 mW/g; SAR(10 g) = 0.460 mW/g
Maximum value of SAR (measured) = 1.12 mW/g



0 dB = 1.12 mW/g = 0.98 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/11/30

#46_WCDMA IV_RMC12.2K_Front_1cm_Ch1513

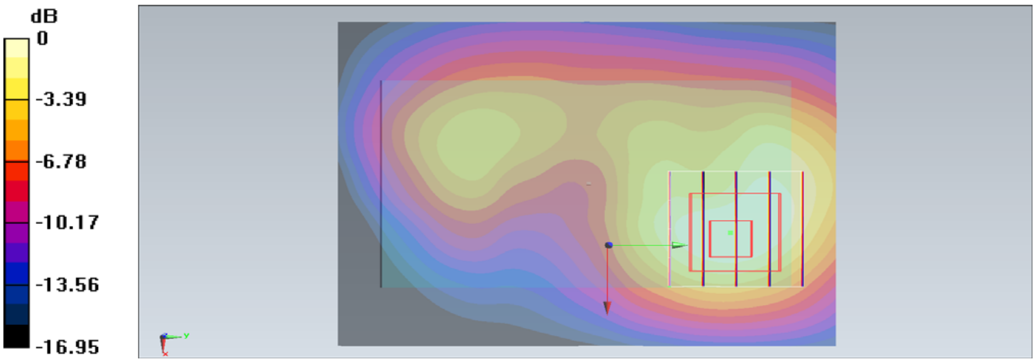
DUT: 292704

Communication System: WCDMA; Frequency: 1752.6 MHz;Duty Cycle: 1:1
Medium: MSL_1750_121130 Medium parameters used: f = 1753 MHz; σ = 1.484 mho/m; ε_r = 52.357; ρ = 1000 kg/m^3
Ambient Temperature：22.2 ℃; Liquid Temperature：21.2 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(4.98, 4.98, 4.98); Calibrated: 2012/9/28;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch1513/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.14 mW/g

Configuration/Ch1513/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.155 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.504 mW/g
SAR(1 g) = 0.871 mW/g; SAR(10 g) = 0.485 mW/g
Maximum value of SAR (measured) = 1.05 mW/g



0 dB = 1.05 mW/g = 0.42 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/11/30

#12_WCDMA II_RMC12.2K_Front_1cm_Ch9262

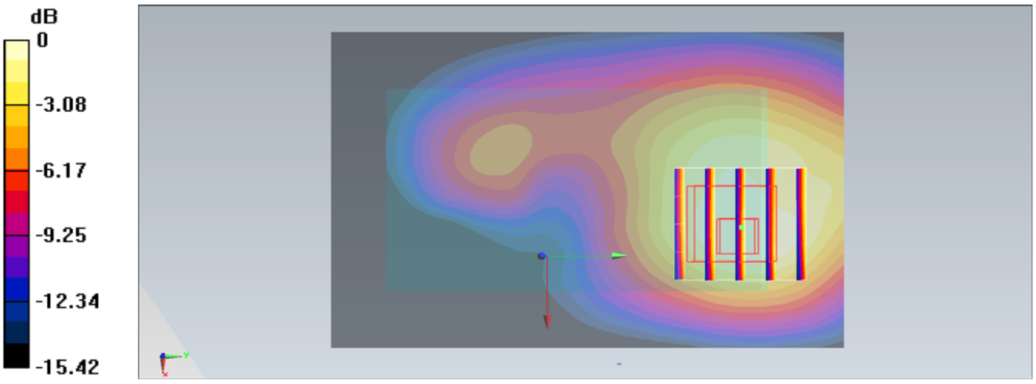
DUT: 292704

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: MSL_1900_121130 Medium parameters used : f = 1852.4 MHz; σ = 1.461 mho/m; ε_r = 54.314; ρ = 1000 kg/m^3
Ambient Temperature：22.3 ℃; Liquid Temperature：21.3 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(4.67, 4.67, 4.67); Calibrated: 2012/9/28;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch9262/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.60 mW/g

Configuration/Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.356 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.977 mW/g
SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.642 mW/g
Maximum value of SAR (measured) = 1.46 mW/g



0 dB = 1.46 mW/g = 3.29 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/11/30

#25_LTE Band 4_20M_QPSK 1RB 49offset_Front_1cm_Ch20300

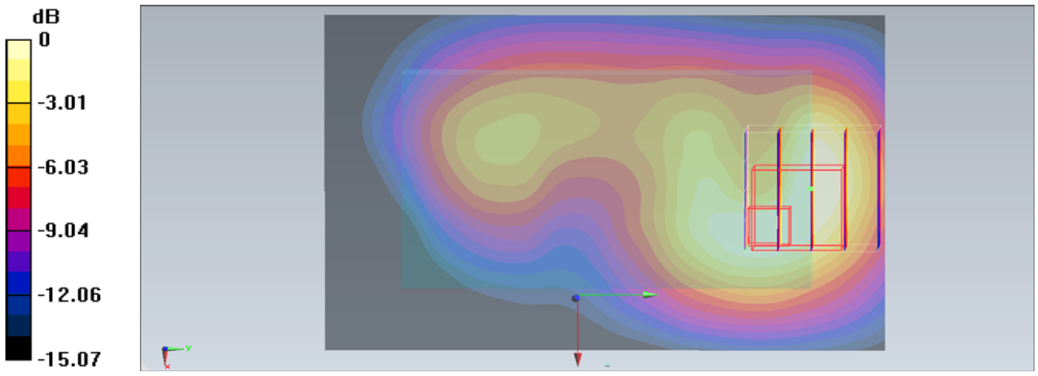
DUT: 292704

Communication System: LTE; Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: MSL_1750_121130 Medium parameters used: f = 1745 MHz; σ = 1.471 mho/m; ε_r = 52.385; ρ = 1000 kg/m^3
Ambient Temperature：22.2 ℃; Liquid Temperature：21.2 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(4.98, 4.98, 4.98); Calibrated: 2012/9/28;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: SAM-Left; Type: QD 000 P40 C; Serial: TP-1477
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch20300/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.16 mW/g

Configuration/Ch20300/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.964 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.538 mW/g
SAR(1 g) = 0.917 mW/g; SAR(10 g) = 0.536 mW/g
Maximum value of SAR (measured) = 1.10 mW/g



0 dB = 1.10 mW/g = 0.83 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2012/12/4

#57_WLAN2.4G_802.11b_Top Side_1cm_Ch11

DUT: 292704

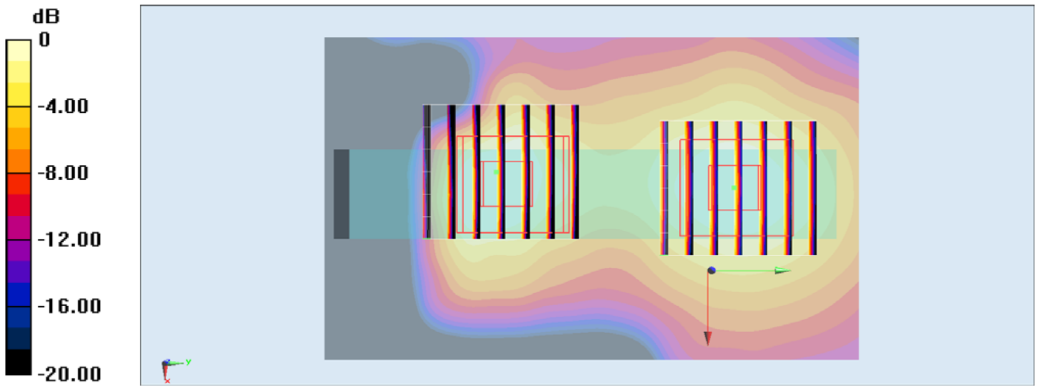
Communication System: 802.11b ; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: MSL_2450_121204 Medium parameters used: f = 2462 MHz; σ = 2.036 mho/m; ε_r = 52.253; ρ = 1000 kg/m^3
Ambient Temperature：22.4 ℃; Liquid Temperature：21.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3697; ConvF(6.57, 6.57, 6.57); Calibrated: 2012/9/28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2012/5/3
- Phantom: SAM LEFT; Type: QD000P40CD; Serial: TP:1718
- Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Configuration/Ch11/Area Scan (61x91x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.459 mW/g

Configuration/Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.656 V/m; Power Drift = -0.125 dB
Peak SAR (extrapolated) = 0.491 mW/g
SAR(1 g) = 0.261 mW/g; SAR(10 g) = 0.136 mW/g
Maximum value of SAR (measured) = 0.376 mW/g

Configuration/Ch11/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.656 V/m; Power Drift = -0.125 dB
Peak SAR (extrapolated) = 0.511 mW/g
SAR(1 g) = 0.248 mW/g; SAR(10 g) = 0.111 mW/g
Maximum value of SAR (measured) = 0.370 mW/g



0 dB = 0.370 mW/g = -8.64 dB mW/g

11.4 Simultaneous Multi-band Transmission Analysis

No.	Applicable Simultaneous Transmission Combination
1.	WLAN2.4G+WWAN

Note:

1. GSM/WCDMA/LTE share the same antenna, and cannot transmit simultaneously.
2. The reported SAR summation is calculated based on the same configuration and test position.
3. If reported 1g-SAR summation < 1.6W/kg, simultaneous SAR measurement is not necessary.

<Hotspot SAR>

	WWAN			WLAN		Reported WWAN + Reported WLAN
Position	WWAN Band	Plot No	Max. Reported WWAN SAR (W/kg)	Plot No	Max. Reported WLAN SAR (W/kg)	
Front	GSM850	1	0.402	53	0.241	**0.64**
	GSM1900	6	0.778	53	0.241	**1.02**
	WCDMA IV	46	0.942	53	0.241	**1.18**
	WCDMA II	12	1.195	53	0.241	**1.44**
	LTE Band 4	25	1.095	53	0.241	**1.34**
Back	GSM850	2	0.339	54	0.221	**0.56**
	GSM1900	7	0.595	54	0.221	**0.82**
	WCDMA IV	47	0.521	54	0.221	**0.74**
	WCDMA II	15	0.698	54	0.221	**0.92**
	LTE Band 4	28	0.614	54	0.221	**0.84**
Left Side	GSM850	-	-	55	0.113	**0.11**
	GSM1900	-	-	55	0.113	**0.11**
	WCDMA IV	-	-	55	0.113	**0.11**
	WCDMA II	-	-	55	0.113	**0.11**
	LTE Band 4	-	-	55	0.113	**0.11**
Right Side	GSM850	3	0.136	-	-	**0.14**
	GSM1900	22	0.983	-	-	**0.98**
	WCDMA IV	50	0.912	-	-	**0.91**
	WCDMA II	17	1.118	-	-	**1.12**
	LTE Band 4	35	0.96	-	-	**0.96**
Top Side	GSM850	4	0.209	57	0.304	**0.51**
	GSM1900	9	0.192	57	0.304	**0.50**
	WCDMA IV	51	0.241	57	0.304	**0.55**
	WCDMA II	19	0.218	57	0.304	**0.52**
	LTE Band 4	38	0.274	57	0.304	**0.58**
Bottom Side	GSM850	5	0.237	-	-	**0.24**
	GSM1900	10	0.343	-	-	**0.34**
	WCDMA IV	52	0.277	-	-	**0.28**
	WCDMA II	20	0.273	-	-	**0.27**
	LTE Band 4	41	0.358	-	-	**0.36**

Test Engineer： Angelo Chang and Michael Yang

12. 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 12.1

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 12.1 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 shown in the following tables.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.0 %**	**± 21.5 %**

Table 12.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz According to IEEE1528-2013

13. References

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

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[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 v05, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, October 2012

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

[9] FCC KDB 941225 D05 v02, “SAR Test Considerations for LTE Handsets and Data Modems”, October .24 .2012

[10] FCC KDB 941225 D06 v01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", 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.

Appendix F. HSPA 16QAM

The plots are shown as follows.