FCC SAR Test Report

APPLICANT	:	**ZTE CORPORATION**
EQUIPMENT	:	**Vodafone Mobile Wi-Fi**
BRAND NAME	:	**ZTE**
MODEL NAME	:	**R212**
FCC ID	:	**Q78-R212**
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 Apr. 25, 2013. We, SPORTON INTERNATIONAL (SHENZHEN) 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 (SHENZHEN) INC., the test report shall not be reproduced except in full.

Eric Huang

Reviewed by: Eric Huang / Deputy Manager

Jones Tsai

Approved by: Jones Tsai / Manager

ilac-MRA

TAF Testing Laboratory 2353

SPORTON INTERNATIONAL (SHENZHEN) INC.

No. 101, Complex Building C, Guanlong Village, Xili Town, Nanshan District, Shenzhen, Guangdong, P.R.C.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA312313	Rev. 01	Initial issue of report	Apr. 26, 2013

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION DUT: Vodafone Mobile Wi-Fi, Brand Name: ZTE, Model Name: R212** are as follows.

<Highest Reported Standalone SAR Summary>

Exposure Position	Frequency Band	Highest Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Body (1cm Gap)	GSM850	1.40	PCB	1.40
	GSM1900	0.87		
	WCDMA Band V	1.17		
	WCDMA Band II	1.16		
	LTE Band 7	0.74		
	WLAN 2.4GHz Band	0.28	DTS	0.30
	WLAN 5.8GHz Band	0.30		
	WLAN 5.2GHz Band	0.77	NII	0.77

<Highest Simultaneous Transmission SAR>

Frequency Band	Equipment Class	Exposure Position	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
GSM850	PCB	Body (1cm Gap)	1.56
WLAN 2.4GHz Band	DTS		

Remark:
The highest simultaneous transmission is scalar summation of reported standalone SAR per FCC KDB 690783 D01 v01r02, and scalar SAR summation of all possible simultaneous transmission scenarios are < 1.6W/kg.

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 (SHENZHEN) INC.
Test Site Location	No. 101, Complex Building C, Guanlong Village, Xili Town, Nanshan District, Shenzhen, Guangdong, P.R.C. TEL: +86-755-8637-9589 FAX: +86-755-8637-9595

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	Mar. 21, 2013
Date of End during the Test	Apr. 25, 2013

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Vodafone Mobile Wi-Fi
Brand Name	ZTE
Model Name	R212
FCC ID	Q78-R212
TX Frequency	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 7: 2506.5 MHz ~ 2534.5 MHz, 2562.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz
Antenna Type	WWAN: Monopole antenna WLAN Ant.1: Monopole antenna WLAN Ant.2: Monopole antenna
HW Version	T3
SW Version	BD_R212V2.0
Type Modulations	GPRS: GMSK EDGE: GMSK / 8PSK WCDMA (Rel 99): QPSK HSDPA (Rel 6)/DC-HSDPA(Rel 8): QPSK HSUPA (Rel 6): QPSK HSPA+(Rel 7): 16QAM (Downlink Only) DC-HSDPA(Rel 8): 64QAM (Downlink Only) LTE: QPSK, 16QAM 802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
DUT 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

Maximum Target Burst Average Power for Production Unit		
Mode / Band	GSM 850	GSM 1900
GPRS (GMSK, 1 Tx slot)	32.5	29.5
GPRS (GMSK, 2 Tx slots)	31.5	28.5
EDGE (GMSK, 1 Tx slot)	32.5	29.5
EDGE (GMSK, 2 Tx slots)	31.5	28.5
EDGE (GMSK, 3 Tx slots)	29	26
EDGE (GMSK, 4 Tx slots)	27.5	24.5
EDGE (8PSK, 1 Tx slot)	26.5	25
EDGE (8PSK, 2 Tx slots)	24	23
EDGE (8PSK, 3 Tx slots)	22	21.5
EDGE (8PSK, 4 Tx slots)	21	20.5

Maximum Target Power for Production Unit		
Mode / Band	WCDMA Band V	WCDMA Band II
RMC 12.2K	23.3	22.5
HSDPA Subtest-1	21	20.5
HSDPA Subtest-2	21	20.5
HSDPA Subtest-3	21	20.5
HSDPA Subtest-4	21	20.5
DC-HSDPA Subtest-1	21	20.5
DC-HSDPA Subtest-2	21	20.5
DC-HSDPA Subtest-3	21	20.5
DC-HSDPA Subtest-4	21	20.5
HSUPA Subtest-1	21	20.5
HSUPA Subtest-2	19	20
HSUPA Subtest-3	20	20
HSUPA Subtest-4	19	19.5
HSUPA Subtest-5	21	21

LTE Band 7				
Modulation	BW (MHz)	RB size	Target MPR	Maximum Power
QPSK	20	≤ 18	0	22
QPSK	20	> 18	1	21
16QAM	20	≤ 18	1	21
16QAM	20	> 18	2	20
QPSK	15	≤ 16	0	22
QPSK	15	> 16	1	21
16QAM	15	≤ 16	1	21
16QAM	15	> 16	2	20
QPSK	10	≤ 12	0	22
QPSK	10	> 12	1	21
16QAM	10	≤ 12	1	21
16QAM	10	> 12	2	20
QPSK	5	≤ 8	0	22
QPSK	5	> 8	1	21
16QAM	5	≤ 8	1	21
16QAM	5	> 8	2	20

Remark:

1. By design, maximum LTE RF power of smaller supported bandwidth does not exceed the RF power of largest supported bandwidth; the information is included in “tune-up procedure” exhibit.
2. LTE MPR implementation is the same for normal mode and power reduction mode.

Maximum Target Average Power for Production Unit					
Mode / Band	IEEE 802.11				
	a	b	g	n-HT20	n-HT40
WLAN 2.4GHz Band Ant.1		16	13		
WLAN 2.4GHz Band Ant.2		17	14		
WLAN 2.4GHz Band MIMO Ant.1+2				13	15
WLAN 5.2GHz Band Ant.1	11				
WLAN 5.2GHz Band Ant.2	10				
WLAN 5.2GHz Band MIMO Ant.1+2				14	13
WLAN 5.8GHz Band Ant.1	9				
WLAN 5.8GHz Band Ant.2	9				
WLAN 5.8GHz Band MIMO Ant.1+2				13	12

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

FCC ID	Q78-R212
EUT	Vodafone Mobile Wi-Fi
Operating Frequency Range of each LTE transmission band	LTE Band 7: 2506.5 MHz ~ 2534.5 MHz, 2562.5 MHz ~ 2567.5 MHz
Channel Bandwidth	5MHz, 10MHz, 15MHz, 20MHz

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

LTE Band 7								
	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20815	2506.5	20840	2509	20865	2511.5	20890	2514
M	21095	2534.5	21070	2532	21045	2529.5	21020	2527
H	21425	2567.5	21400	2565	21375	2562.5	-	-

E category, uplink modulations used	Category 3, QPSK, and 16QAM
LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas)	A primary antenna is used for LTE and other wireless interfaces (GSM/WCDMA) for transmitting and receiving. A 2nd antenna is used for LTE and other wireless interfaces (GSM/CDMA/WCDMA) for receiving only
LTE Voice / Data requirements	Data only
LTE MPR permanently built-in by design	Yes, per 3GPP TS 36.101 v11.0.0

Table 6.2.3.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

LTE A-MPR	In the base simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing.
Base station simulator used for Testing	Anritsu MT8820C

3.3 Product Photos

Please refer to Appendix D.

3.4 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 248227 D01 v01r02
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D03 v01
- FCC KDB 941225 D05 v02
- FCC KDB 941225 D06 v01
- FCC KDB 865664 D01 v01

3.5 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.

3.6 Test Conditions

3.6.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.6.2 Test Configuration

For WWAN SAR testing, 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.

During WLAN SAR testing EUT is configured with the WLAN continuous TX tool, and the transmission duty factor was monitored on the spectrum analyzer with zero-span setting

Duty factor observed as below:

IEEE 802.11 Duty Cycle		
2.4GHz Band	5.2GHz Band	5.8GHz Band
11b - Ant.1, 1Mbps: 100%	11a - Ant.1, 6Mbps: 95.39%	11a – Ant.1, 6Mbps: 95.39%
11b - Ant.2, 1Mbps: 100%	11a - Ant.2, 6Mbps: 95.11%	11a – Ant.2, 6Mbps: 95.39%
11gn HT20 - MIMO Ant.1+2, MCS8: 89.91% 11gn HT40 - MIMO Ant.1+2, MCS8: 83.89%	11an HT20 –MIMO Ant.1+2, MCS8: 83.89%	11an HT20 – MIMO Ant.1+2, MCS8: 90.79%

For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

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

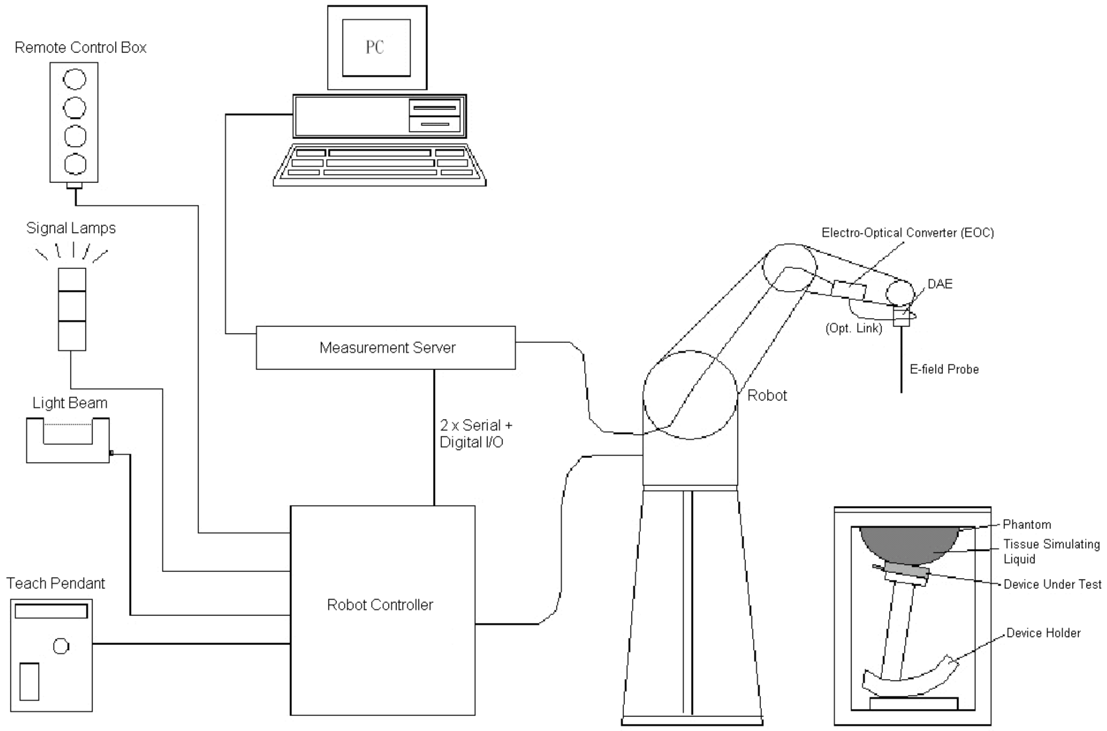


Fig 5.1 SPEAG DASY System Configurations

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

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Fig 5.2 Photo of EX3DV4

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. 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 5.3 Photo of DAE

5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

Fig 5.4 Photo of DASY5

5.4 Measurement Server

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

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

Fig 5.5 Photo of Server for DASY5

5.5 Phantom

<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 5.6 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.

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 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 5.7 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), $\mu V/(V/m)^2$ 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	4d091	Nov. 18, 2011	Nov. 16, 2013
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	Nov. 21, 2011	Nov. 16, 2013
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2013
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Sep. 28, 2011	Sep. 27, 2013
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Dec. 11, 2012	Dec. 10, 2013
SPEAG	Data Acquisition Electronics	DAE4	1303	Nov. 22, 2012	Nov. 21, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3819	Nov. 26, 2012	Nov. 25, 2013
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1670	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1671	NCR	NCR
Anritsu	Radio Communication Analyzer	MT8820C	6201091028	Jun. 10, 2012	Jun. 09, 2013
Agilent	Wireless Communication Test Set	E5515E	MY52112100	Oct. 25, 2012	Oct. 24, 2013
Agilent	Base Station	E5515C	MY50267224	Dec. 29, 2012	Dec. 28, 2013
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	Apr. 13, 2012	Apr. 12, 2013
Anritsu	Power Sensor	MA2411B	1207253	May 08, 2012	May 07, 2013
ARRA	Power Divider	A3200-2	N/A	NA	NA
MCL	Attenuation	BW-S10W5	N/A	NA	NA
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	Dual Directional Coupler	778D	50422	Note 4	
Agilent	Dielectric Probe Kit	85070D	US01440205	Note 5	
AR	Power Amplifier	5S1G4M2	0328767	Note 6	
R&S	Spectrum Analyzer	FSP30	101400	Jun. 01, 2012	May 31, 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 865664 D01v01, 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: 4d091, D1900V2, SN: 5d118, D2450V2, SN: 736 and D2600V2, SN: 1008 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 precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power 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 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 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

Simulating Liquid for 5G, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

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.

Frequency (MHz)	Liquid Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	21.5	0.97	56.499	0.97	55.2	0.00	2.35	±5	Mar. 21, 2013
1900	Body	21.2	1.543	52.519	1.52	53.3	1.51	-1.47	±5	Mar. 21, 2013
1900	Body	21.7	1.528	53.974	1.52	53.3	0.53	1.26	±5	Apr. 09, 2013
2450	Body	21.9	1.949	53.894	1.95	52.7	-0.05	2.27	±5	Apr. 11, 2013
2450	Body	21.7	1.992	52.319	1.95	52.7	2.15	-0.72	±5	Apr. 25, 2013
2600	Body	21.6	2.165	53.823	2.16	52.5	0.23	2.52	±5	Apr. 11, 2013
5200	Body	21.5	5.287	48.755	5.3	49.0	-0.25	-0.50	±5	Apr. 12, 2013
5800	Body	21.5	6.12	47.381	6.0	48.2	2.00	-1.70	±5	Apr. 12, 2013

Table 6.2 Measuring Results for Simulating Liquid

7. SAR System Verification

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:

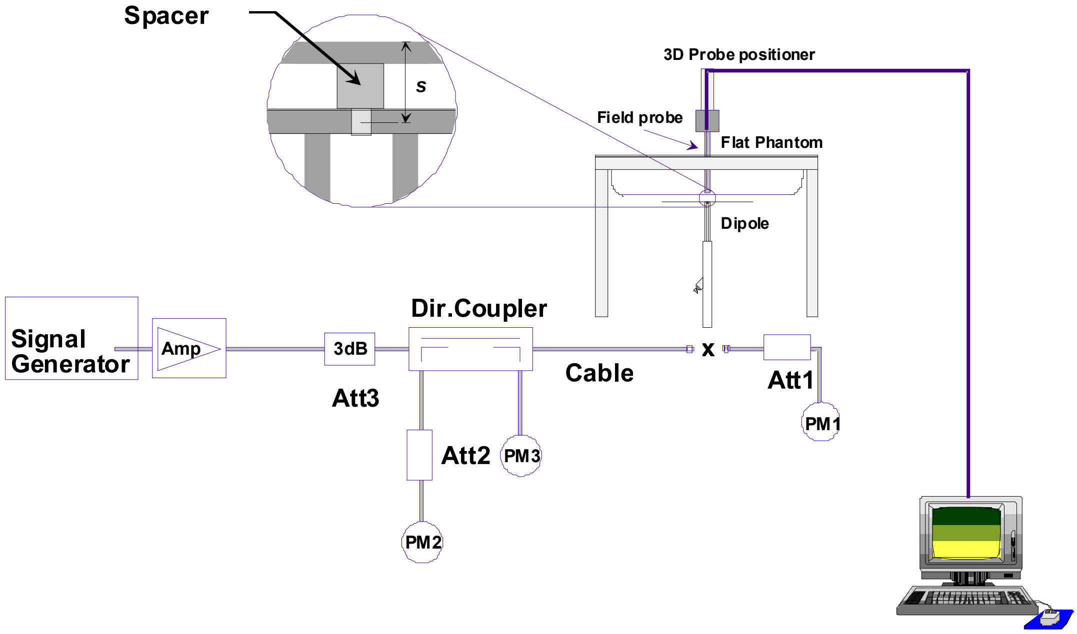


Fig 7.1 System Setup for System Evaluation

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

Fig 7.2 Photo of Dipole Setup

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.

Date	Frequency (MHz)	Liquid Type	Power fed onto reference dipole (mW)	Target SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
Mar. 21, 2013	835	Body	250	9.42	2.45	9.8	4.03
Mar. 21, 2013	1900	Body	250	41.8	10.5	42	0.48
Apr. 09, 2013	1900	Body	250	41.8	10.2	40.8	-2.39
Apr. 11, 2013	2450	Body	250	52.3	13.4	53.6	2.49
Apr. 25, 2013	2450	Body	250	52.3	12.4	49.6	-5.16
Apr. 11, 2013	2600	Body	250	55.9	14.9	59.6	6.62
Apr. 12, 2013	5200	Body	100	71.4	7.53	75.3	5.46
Apr. 12, 2013	5800	Body	100	71.7	7.65	76.5	6.69

8. EUT Testing Position

This EUT was tested in six different positions. They are Front of the EUT with phantom 1 cm gap, Back of the EUT with phantom 1 cm gap, Top Side of the EUT with phantom 1 cm gap, Bottom Side of the EUT with phantom 1 cm gap, Right Side of the EUT with phantom 1 cm gap, and Left Side of the EUT with phantom 1 cm gap. 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 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

9.3 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.

For any secondary peaks found in the area scan which are within 2 dB of the maximum peak and are not within this zoom scan, the zoom scan should be repeated

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></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 reported 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>

9.4 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.

9.5 SAR Averaged Methods

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

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

9.6 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. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v05, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. The DUT do not support DTM function.
3. For Body SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS (2 Tx slots) for GSM850 and GSM1900due to its highest frame-average 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	32.24	32.23	32.23	23.24	23.23	23.23
GPRS (GMSK, 2 Tx slots) – CS1	30.42	30.41	30.40	24.42	24.41	24.40
EDGE (GMSK, 1 Tx slot) – MCS1	32.12	32.14	32.13	23.12	23.14	23.13
EDGE (GMSK, 2 Tx slots) – MCS1	30.15	30.18	30.17	24.15	24.18	24.17
EDGE (GMSK, 3 Tx slots) – MCS1	28.42	28.56	28.64	24.16	24.30	24.38
EDGE (GMSK, 4 Tx slots) – MCS1	27.12	27.22	27.26	24.12	24.22	24.26
EDGE (8PSK, 1 Tx slot) – MCS5	26.15	26.10	26.13	17.15	17.10	17.13
EDGE (8PSK, 2 Tx slots) – MCS5	23.83	23.60	23.68	17.83	17.60	17.68
EDGE (8PSK, 3 Tx slots) – MCS5	21.56	21.45	21.50	17.30	17.19	17.24
EDGE (8PSK, 4 Tx slots) – MCS5	20.96	20.91	20.94	17.96	17.91	17.94

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

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	28.98	29.03	28.91	19.98	20.03	19.91
GPRS (GMSK, 2 Tx slots) – CS1	27.41	27.43	27.37	21.41	21.43	21.37
EDGE (GMSK, 1 Tx slot) – MCS1	28.84	28.86	28.75	19.84	19.86	19.75
EDGE (GMSK, 2 Tx slots) – MCS1	27.33	27.34	27.32	21.33	21.34	21.32
EDGE (GMSK, 3 Tx slots) – MCS1	25.40	25.49	25.45	21.14	21.23	21.19
EDGE (GMSK, 4 Tx slots) – MCS1	24.15	24.16	24.02	21.15	21.16	21.02
EDGE (8PSK, 1 Tx slot) – MCS5	24.80	24.89	24.78	15.80	15.89	15.78
EDGE (8PSK, 2 Tx slots) – MCS5	22.72	22.87	22.77	16.72	16.87	16.77
EDGE (8PSK, 3 Tx slots) – MCS5	20.87	21.02	20.80	16.61	16.76	16.54
EDGE (8PSK, 4 Tx slots) – MCS5	20.22	20.34	20.27	17.22	17.34	17.27

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

<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 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 β_{hs} = 30/15 * β_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 β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_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 Agilent E5515C referred to the 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. 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

DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
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 RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

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:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Proces ses	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

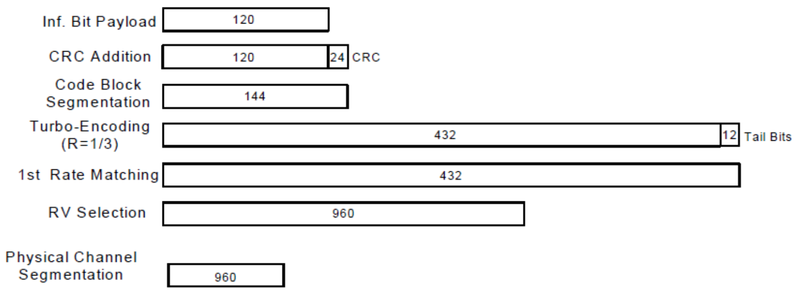


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. By design, HSDPA/DC-HSDPA/HSUPA RF power will not be larger than RMC 12.2kbp, detailed information is included in Tune-up Procure exhibit.
2. It is expected by the manufacturer that MPR for some HSDPA/DC-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.

Average power (dBm)							
Band		WCDMA Band V			WCDMA Band II		
TX Channel		4132	4182	4233	9262	9400	9538
Frequency (MHz)		826.4	836.4	846.6	1852.4	1880	1907.6
3GPP Rel 99	RMC 12.2kbps	22.07	22.20	22.18	21.98	21.80	21.75
3GPP Rel 6	HSDPA Subtest-1	20.51	20.62	20.57	20.47	20.33	20.30
3GPP Rel 6	HSDPA Subtest-2	20.44	20.57	20.48	20.39	20.24	20.19
3GPP Rel 6	HSDPA Subtest-3	20.37	20.52	20.44	20.23	19.99	19.97
3GPP Rel 6	HSDPA Subtest-4	20.28	20.49	20.41	20.14	19.94	19.91
3GPP Rel 8	DC-HSDPA Subtest-1	20.40	20.51	20.46	20.38	20.26	20.24
3GPP Rel 8	DC-HSDPA Subtest-2	20.32	20.44	20.37	20.16	20.10	20.15
3GPP Rel 8	DC-HSDPA Subtest-3	20.36	20.51	20.42	20.37	19.98	19.96
3GPP Rel 8	DC-HSDPA Subtest-4	20.25	20.41	20.39	20.12	19.91	19.89
3GPP Rel 6	HSUPA Subtest-1	20.45	20.66	20.58	20.36	20.21	20.17
3GPP Rel 6	HSUPA Subtest-2	18.64	18.75	18.74	19.21	19.00	18.98
3GPP Rel 6	HSUPA Subtest-3	19.69	19.83	19.84	19.88	19.72	19.64
3GPP Rel 6	HSUPA Subtest-4	18.71	18.84	18.68	19.17	19.06	19.01
3GPP Rel 6	HSUPA Subtest-5	20.32	20.44	20.39	20.39	20.52	20.25
MPR result (dB)							
3GPP MPR specification		WCDMA Band V			WCDMA Band II		
0	HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	HSDPA Subtest-2	0.07	0.05	0.09	0.08	0.09	0.11
≦0.5	HSDPA Subtest-3	0.14	0.10	0.13	0.24	0.34	0.33
≦0.5	HSDPA Subtest-4	0.23	0.13	0.16	0.33	0.39	0.39
0	DC-HSDPA Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00
0	DC-HSDPA Subtest-2	0.08	0.07	0.09	0.22	0.16	0.09
≦0.5	DC-HSDPA Subtest-3	0.04	0.00	0.04	0.01	0.28	0.28
≦0.5	DC-HSDPA Subtest-4	0.15	0.10	0.07	0.26	0.35	0.35
≦0	HSUPA Subtest-1	-0.13	-0.22	-0.19	0.03	0.31	0.08
≦2	HSUPA Subtest-2	1.68	1.69	1.65	1.18	1.52	1.27
≦1	HSUPA Subtest-3	0.63	0.61	0.55	0.51	0.80	0.61
≦2	HSUPA Subtest-4	1.61	1.60	1.71	1.22	1.46	1.24
≦0	HSUPA Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00

<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. 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*.
4. Per KDB 941225 D05v02, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure
5. 16QAM output power for each RB allocation configuration is not > ½ dB higher than the same configuration in QPSK
6. Smaller bandwidth output power for each RB allocation configuration is not > ½ dB higher than the same configuration in the largest supported bandwidth

<u><LTE Conducted Power ></u>

LTE Band 7								
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		20890	21020	-		20890	21020	-
Frequency (MHz)		2514	2527	-		2514	2527	-
20	QPSK 1-0	21.38	21.43	-	0	0.00	0.00	-
20	QPSK 1-49	21.27	21.28	-		0.11	0.15	-
20	QPSK 1-99	21.25	21.36	-		0.13	0.07	-
20	QPSK 50-0	20.15	20.08	-	≤ 1	1.23	1.35	-
20	QPSK 50-24	20.03	20.14	-		1.35	1.29	-
20	QPSK 50-49	20.19	20.08	-		1.19	1.35	-
20	QPSK 100-0	20.20	20.07	-		1.18	1.36	-
20	16QAM 1-0	20.63	20.49	-	≤ 1	0.75	0.94	-
20	16QAM 1-49	20.53	20.47	-		0.85	0.96	-
20	16QAM 1-99	20.51	20.45	-		0.87	0.98	-
20	16QAM 50-0	19.01	18.98	-	≤ 2	2.37	2.45	-
20	16QAM 50-24	19.28	19.10	-		2.10	2.33	-
20	16QAM 50-49	19.17	19.18	-		2.21	2.25	-
20	16QAM 100-0	19.06	19.07	-		2.32	2.36	-
Channel		20865	21045	21375		20865	21045	21375
Frequency (MHz)		2511.5	2529.5	2562.5		2511.5	2529.5	2562.5
15	QPSK 1-0	21.45	21.52	21.57	0	0.00	0.00	0.00
15	QPSK 1-37	21.42	21.39	21.35		0.03	0.13	0.22
15	QPSK 1-74	21.40	21.42	21.49		0.05	0.10	0.08
15	QPSK 36-0	20.32	20.26	20.34	≤ 1	1.13	1.26	1.23
15	QPSK 36-18	20.18	20.29	20.25		1.27	1.23	1.32
15	QPSK 36-37	20.16	20.34	20.23		1.29	1.18	1.34
15	QPSK 75-0	19.96	20.25	20.21		1.49	1.27	1.36
15	16QAM 1-0	20.38	20.77	20.67	≤ 1	1.07	0.75	0.90
15	16QAM 1-37	19.95	20.06	20.19		1.50	1.46	1.38
15	16QAM 1-74	20.05	20.44	20.47		1.40	1.08	1.10
15	QPSK 36-0	19.32	19.20	19.21	≤ 2	2.13	2.32	2.36
15	QPSK 36-18	19.07	19.34	19.16		2.38	2.18	2.41
15	QPSK 36-37	19.34	19.28	19.27		2.11	2.24	2.30
15	16QAM 75-0	19.18	19.28	19.33		2.27	2.24	2.24
Channel		20840	21070	21400		20840	21070	21400
Frequency (MHz)		2509	2532	2565		2509	2532	2565
10	QPSK 1-0	20.46	20.69	20.49	0	0.00	0.00	0.00
10	QPSK 1-24	20.33	20.60	20.46		0.13	0.09	0.03
10	QPSK 1-49	20.40	20.53	20.42		0.06	0.16	0.07
10	QPSK 25-0	19.25	19.40	19.19	≤ 1	1.21	1.29	1.30
10	QPSK 25-12	19.32	19.43	19.24		1.14	1.26	1.25
10	QPSK 25-24	19.30	19.42	19.45		1.16	1.27	1.04
10	QPSK 50-0	19.17	19.23	19.13		1.29	1.46	1.36
10	16QAM 1-0	19.61	19.63	19.55	≤ 1	0.85	1.06	0.94
10	16QAM 1-24	19.39	19.37	19.31		1.07	1.32	1.18
10	16QAM 1-49	19.35	19.54	19.44		1.11	1.15	1.05
10	16QAM 25-0	18.24	18.50	18.29	≤ 2	2.22	2.19	2.20
10	16QAM 25-12	18.43	18.48	18.31		2.03	2.21	2.18
10	16QAM 25-24	18.32	18.36	18.40		2.14	2.33	2.09
10	16QAM 50-0	18.18	18.25	18.19		2.28	2.44	2.30
Channel		20815	21095	21425		20815	21095	21425
Frequency (MHz)		2506.5	2534.5	2567.5		2506.5	2534.5	2567.5
5	QPSK 1-0	21.43	21.49	21.40	0	0.00	0.00	0.00
5	QPSK 1-12	21.36	21.42	21.35		0.07	0.07	0.05
5	QPSK 1-24	21.34	21.42	21.36		0.09	0.07	0.04
5	QPSK 12-0	20.43	20.50	20.42	≤ 1	1.00	0.99	0.98
5	QPSK 12-6	20.46	20.52	20.51		0.97	0.97	0.89
5	QPSK 12-11	20.46	20.51	20.52		0.97	0.98	0.88
5	QPSK 25-0	20.34	20.36	20.31		1.09	1.13	1.09
5	16QAM 1-0	20.64	20.52	20.48	≤ 1	0.79	0.97	0.92
5	16QAM 1-12	20.55	20.43	20.43		0.88	1.06	0.97
5	16QAM 1-24	20.55	20.49	20.44		0.88	1.00	0.96
5	16QAM 12-0	19.50	19.50	19.52	≤ 2	1.93	1.99	1.88
5	16QAM 12-6	19.38	19.60	19.51		2.05	1.89	1.89
5	16QAM 12-11	19.55	19.70	19.53		1.88	1.79	1.87
5	16QAM 25-0	19.26	19.45	19.34		2.17	2.04	2.06

<WLAN 2.4GHz SISO mode Conducted Power>

<Antenna 1>

Channel	Frequency (MHz)	802.11b Average Power (dBm)			
		Data Rate			
		1M bps	2M bps	5.5M bps	11M bps
CH 01	2412	15.23	15.16	15.21	15.27
CH 06	2437	14.89	14.89	14.89	15.00
CH 11	2462	15.74	15.83	15.86	**15.94**

Channel	Frequency (MHz)	802.11g Average Power (dBm)							
		Data Rate							
		6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
CH 01	2412	**12.16**	11.82	11.51	11.81	11.77	11.82	11.92	12.09
CH 06	2437	11.75	11.62	11.39	11.62	11.53	11.68	11.67	11.56
CH 11	2462	12.01	12.05	12.04	12.03	11.94	11.99	11.94	11.93

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.
3. Per KDB 248227 D01 v01r02, 11g output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

<Antenna 2>

Channel	Frequency (MHz)	802.11b Average Power (dBm)			
		Data Rate			
		1M bps	2M bps	5.5M bps	11M bps
CH 01	2412	15.88	15.79	15.70	15.78
CH 06	2437	**16.27**	**16.27**	16.20	16.24
CH 11	2462	16.25	**16.27**	16.23	16.23

Channel	Frequency (MHz)	802.11g Average Power (dBm)							
		Data Rate							
		6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
CH 01	2412	13.07	12.76	12.72	12.73	12.75	12.65	12.73	12.60
CH 06	2437	13.15	13.10	13.15	13.07	13.11	13.05	13.13	12.98
CH 11	2462	**13.18**	13.10	13.08	13.09	13.16	13.12	13.09	13.10

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.
3. Per KDB 248227 D01 v01r02, 11g output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

<WLAN 2.4GHz MIMO mode Conducted Power>

<Antenna 1+2>

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)									
Channel	Frequency (MHz)	MCS Index							
		MCS 8	MCS 9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
CH 01	2412	12.19	11.95	11.75	11.81	11.79	11.96	11.99	11.99
CH 06	2437	11.97	11.77	11.85	11.85	11.79	11.90	11.94	11.91
CH 11	2462	12.16	11.95	12.07	12.11	12.14	12.13	12.12	12.14

WLAN 2.4GHz 802.11n-HT40 Average Power (dBm)									
Channel	Frequency (MHz)	MCS Index							
		MCS 8	MCS 9	MCS 10	MCS 11	MCS 12	MCS 13	MCS 14	MCS 15
CH 03	2422	14.58	14.48	14.47	14.49	14.53	14.53	14.20	14.19
CH 06	2437	14.31	14.30	14.29	14.28	14.14	14.18	14.08	14.10
CH 09	2452	14.48	14.27	14.18	14.30	14.34	14.42	14.37	14.35

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.
3. Per KDB 248227 D01 v01r02, 11n-HT40 average output power is higher than 1/4dB higher than 11n-HT20 mode, these modes SAR will be verified at the highest RF exposure position found in 11n-HT20 SAR testing.

<WLAN 5GHz SISO mode Conducted Power>

<Antenna 1>

Channel	Frequency (MHz)	WLAN 5GHz 802.11a Average Power (dBm) Data Rate 6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
CH 36	5180	9.87	9.92	9.98	9.89	9.90	10.07	10.05	10.03
CH 40	5200	9.52	9.55	9.55	9.60	9.72	9.31	9.65	9.62
CH 44	5220	9.97	9.86	10.01	9.92	9.87	9.68	9.98	9.95
CH 48	5240	10.25	10.15	10.04	9.96	10.08	9.81	10.18	10.44
CH 149	5745	8.45	8.36	8.42	8.28	8.34	8.29	8.44	8.38
CH 153	5765	8.13	8.01	8.01	8.02	8.06	8.06	7.97	7.85
CH 157	5785	7.93	7.91	7.91	7.95	8.00	8.08	8.16	8.12
CH 161	5805	7.69	7.66	7.69	7.68	7.79	7.79	7.87	7.82
CH 165	5825	8.23	8.02	8.03	8.42	8.14	7.98	8.08	8.05

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.

<Antenna 2>

Channel	Frequency (MHz)	WLAN 5GHz 802.11a Average Power (dBm) Data Rate 6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
CH 36	5180	8.88	8.84	8.46	8.95	8.41	8.85	8.92	9.01
CH 40	5200	8.83	8.77	8.55	8.52	8.44	8.97	8.78	8.70
CH 44	5220	9.06	8.70	8.74	8.99	9.00	9.08	9.22	9.18
CH 48	5240	8.89	9.10	9.15	8.98	9.01	9.09	9.15	9.21
CH 149	5745	8.69	8.51	8.02	8.12	8.19	8.47	8.15	8.06
CH 153	5765	7.75	7.45	7.63	7.60	7.66	7.53	7.73	7.68
CH 157	5785	8.45	8.59	8.22	8.16	8.66	8.17	8.14	8.57
CH 161	5805	7.63	7.63	7.52	7.53	7.86	7.90	7.85	7.67
CH 165	5825	8.18	7.95	7.92	8.18	8.02	8.22	8.11	8.37

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.

<WLAN 5GHz MIMO mode Conducted Power>

<Antenna 1+2>

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Channel	Frequency (MHz)	MCS Index							
		MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 36	5180	12.98	13.18	13.40	13.36	13.07	13.18	13.32	13.30
CH 40	5200	12.45	12.54	13.23	13.24	13.16	13.21	13.05	13.27
CH 44	5220	13.35	13.37	13.43	13.21	13.35	13.41	13.44	13.51
CH 48	5240	13.29	13.36	13.40	13.40	13.45	13.44	13.40	13.47
CH 149	5745	12.60	12.38	12.33	12.41	12.37	12.54	12.50	12.35
CH 153	5765	11.92	11.70	11.54	11.75	11.79	11.84	11.87	11.56
CH 157	5785	12.09	12.05	12.10	12.19	12.00	12.16	12.13	12.02
CH 161	5805	11.57	11.53	11.52	11.41	11.52	11.50	11.44	11.44
CH 165	5825	11.92	11.89	11.57	11.72	11.90	12.06	11.91	11.90

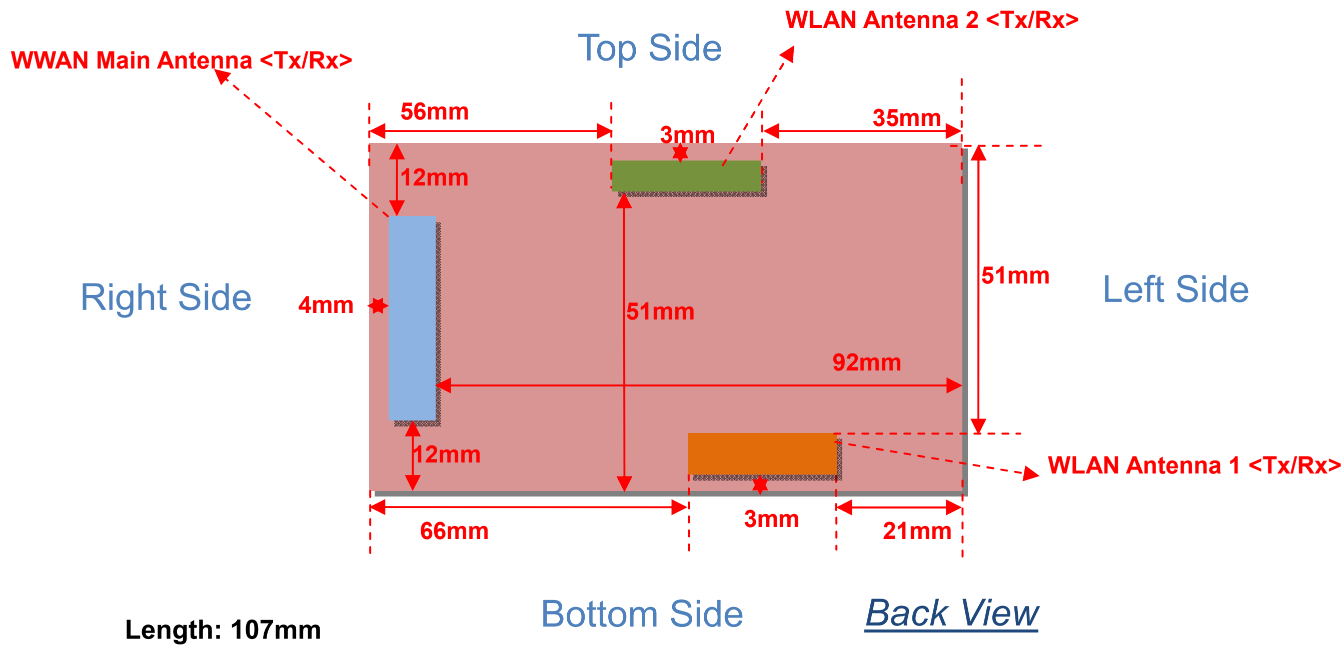
<Antenna 1+2>

WLAN 5GHz 802.11n-HT40 Average Power (dBm)									
Channel	Frequency (MHz)	MCS Index							
		MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 38	5190	12.59	12.28	12.41	12.52	12.24	12.45	12.21	12.42
CH 46	5230	12.52	12.48	12.51	12.50	12.46	12.43	12.44	12.42
CH 151	5755	11.12	11.43	11.45	11.23	11.36	11.36	11.17	11.56
CH 159	5795	11.30	11.09	11.17	11.13	11.03	11.06	11.06	11.33

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
2. 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 1/4dB higher than those measured at the lowest data rate.
3. Per KDB 248227 D01 v01r02, 11n-HT40 output power is less than 11n-HT20 mode, thus the SAR can be excluded.

11. Exposure Positions Consideration



Length: 107mm
Width: 62mm

Antennas	Wireless Interface
WWAN Main Antenna <Tx / Rx>	GSM850 GSM1900 WCDMA Band V WCDMA Band II LTE Band 7
WLAN Antenna 1 <Tx / Rx>	WLAN 2.4GHz Band WLAN 5GHz Band
WLAN Antenna 2 <Tx / Rx>	WLAN 2.4GHz Band WLAN 5GHz Band

<Transmission configuration>

Wireless Interface	SISO Mode		MIMO Mode
	WLAN Antenna 1 <Tx / Rx>	WLAN Antenna 2 <Tx / Rx>	WLAN Antenna 1+ 2 <Tx / Rx>
WLAN 2.4GHz 802.11b/g	yes	yes	
WLAN 2.4GHz 802.11 HT20/HT40			yes
WLAN 5GHz 802.11a	yes	yes	
WLAN 5GHz 802.11 HT20/HT40			yes

Distance of the Antenna to the EUT surface/edge Test distance: 10 mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
WWAN Main	≤ 25mm	≤ 25mm	≤ 25mm	≤ 25mm	≤ 25mm	92mm
WLAN Antenna 1	≤ 25mm	≤ 25mm	51mm	≤ 25mm	66mm	≤ 25mm
WLAN Antenna 2	≤ 25mm	≤ 25mm	≤ 25mm	51mm	56mm	35mm

Positions 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 Antenna 1	Yes	Yes	NO	Yes	NO	Yes
WLAN Antenna 2	Yes	Yes	Yes	NO	NO	NO

Note:

1. Hotspot mode SAR assessments are required.
2. Referring to KDB 941225 D06 v01, 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
3. Per KDB 447498 D01v05, for handsets the *test separation distance* is determined by the smallest distance between the outer surface of the device and the user; which is 10mm for hotspot SAR.

12. SAR Test Results

Note:

1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   Reported SAR(W/kg)= Measured SAR(W/kg) Scaling Factor*
2. Per KDB 447498 D01v05, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing are not necessary.
3. For Hotspot SAR testing, per KDB 941225 D06, for EUT dimension ≥ 9cm*5cm, the test distance is 1cm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.

12.1 Test Records for Hotspot SAR Test

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#01	GSM850	GPRS(2 Tx slots)	Front	1	WWAN Main	128	824.2	30.42	31.5	1.282	-0.09	1.010	1.295
#02	GSM850	GPRS(2 Tx slots)	Back	1	WWAN Main	128	824.2	30.42	31.5	1.282	0.01	0.987	1.266
#03	GSM850	GPRS(2 Tx slots)	Right Side	1	WWAN Main	128	824.2	30.42	31.5	1.282	0.01	0.107	0.137
#04	GSM850	GPRS(2 Tx slots)	Top Side	1	WWAN Main	128	824.2	30.42	31.5	1.282	0.01	0.564	0.723
#05	GSM850	GPRS(2 Tx slots)	Bottom Side	1	WWAN Main	128	824.2	30.42	31.5	1.282	0.05	0.592	0.759
#06	GSM850	GPRS(2 Tx slots)	Front	1	WWAN Main	189	836.4	30.41	31.5	1.285	-0.04	1.050	1.350
#07	GSM850	GPRS(2 Tx slots)	Front	1	WWAN Main	251	848.8	30.40	31.5	1.288	-0.03	0.928	1.195
#08	**GSM850**	**GPRS(2 Tx slots)**	**Back**	**1**	**WWAN Main**	**189**	**836.4**	**30.41**	**31.5**	**1.285**	**-0.02**	**1.090**	**1.401**
#09	GSM850	GPRS(2 Tx slots)	Back	1	WWAN Main	251	848.8	30.40	31.5	1.288	-0.02	0.956	1.232
#45	GSM1900	GPRS(2 Tx slots)	Front	1	WWAN Main	661	1880	27.43	28.5	1.279	-0.02	0.542	0.693
#46	GSM1900	GPRS(2 Tx slots)	Back	1	WWAN Main	661	1880	27.43	28.5	1.279	-0.01	0.670	0.857
#47	GSM1900	GPRS(2 Tx slots)	Right Side	1	WWAN Main	661	1880	27.43	28.5	1.279	0.04	0.665	0.851
#48	GSM1900	GPRS(2 Tx slots)	Top Side	1	WWAN Main	661	1880	27.43	28.5	1.279	-0.1	0.100	0.128
#49	GSM1900	GPRS(2 Tx slots)	Bottom Side	1	WWAN Main	661	1880	27.43	28.5	1.279	0.01	0.209	0.267
#50	GSM1900	GPRS(2 Tx slots)	Back	1	WWAN Main	512	1850.2	27.41	28.5	1.285	-0.06	0.670	0.861
#51	GSM1900	GPRS(2 Tx slots)	Back	1	WWAN Main	810	1909.8	27.37	28.5	1.297	-0.09	0.567	0.736
#52	**GSM1900**	**GPRS(2 Tx slots)**	**Right Side**	**1**	**WWAN Main**	**512**	**1850.2**	**27.41**	**28.5**	**1.285**	**0.05**	**0.678**	**0.871**
#53	GSM1900	GPRS(2 Tx slots)	Right Side	1	WWAN Main	810	1909.8	27.37	28.5	1.297	-0.01	0.576	0.747

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#11	WCDMA Band V	RMC 12.2K	Front	1	WWAN Main	4182	836.4	22.20	23.3	1.288	-0.06	0.859	1.107
#12	WCDMA Band V	RMC 12.2K	Back	1	WWAN Main	4182	836.4	22.20	23.3	1.288	-0.06	0.868	1.118
#13	WCDMA Band V	RMC 12.2K	Right Side	1	WWAN Main	4182	836.4	22.20	23.3	1.288	-0.02	0.086	0.111
#14	WCDMA Band V	RMC 12.2K	Top Side	1	WWAN Main	4182	836.4	22.20	23.3	1.288	-0.04	0.469	0.604
#15	WCDMA Band V	RMC 12.2K	Bottom Side	1	WWAN Main	4182	836.4	22.20	23.3	1.288	-0.07	0.468	0.603
#16	WCDMA Band V	RMC 12.2K	Front	1	WWAN Main	4132	826.4	22.07	23.3	1.327	-0.03	0.856	1.136
#17	WCDMA Band V	RMC 12.2K	Front	1	WWAN Main	4233	846.6	22.18	23.3	1.294	-0.02	0.883	1.143
#18	**WCDMA Band V**	**RMC 12.2K**	**Back**	**1**	**WWAN Main**	**4132**	**826.4**	**22.07**	**23.3**	**1.327**	**0.02**	**0.881**	**1.169**
#19	WCDMA Band V	RMC 12.2K	Back	1	WWAN Main	4233	846.6	22.18	23.3	1.294	-0.02	0.897	1.161
#27	WCDMA Band II	RMC 12.2K	Front	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	0.01	0.691	0.779
#28	WCDMA Band II	RMC 12.2K	Back	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	-0.07	0.874	0.985
#29	**WCDMA Band II**	**RMC 12.2K**	**Right Side**	**1**	**WWAN Main**	**9262**	**1852.4**	**21.98**	**22.5**	**1.127**	**-0.06**	**1.030**	**1.161**
#30	WCDMA Band II	RMC 12.2K	Top Side	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	-0.03	0.125	0.141
#31	WCDMA Band II	RMC 12.2K	Bottom Side	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	-0.03	0.301	0.339
#34	WCDMA Band II	RMC 12.2K	Back	1	WWAN Main	9400	1880	21.80	22.5	1.189	-0.04	0.713	0.838
#35	WCDMA Band II	RMC 12.2K	Back	1	WWAN Main	9538	1907.6	21.75	22.5	1.175	-0.06	0.788	0.937
#36	WCDMA Band II	RMC 12.2K	Right Side	1	WWAN Main	9400	1880	21.80	22.5	1.189	0.01	0.803	0.943
#37	WCDMA Band II	RMC 12.2K	Right Side	1	WWAN Main	9538	1907.6	21.75	22.5	1.175	-0.04	0.823	0.978

Note: Body SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA/DC-HSDPA output power is < 0.25dB higher than RMC, or Reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA/DC-HSDPA SAR evaluation can be excluded.

<LTE SAR>

Plot No.	Band	Mode	BW [MHz]	RB Size	RB Offset	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#54	**LTE Band 7**	**QPSK**	**20M**	**1**	**0**	**Front**	**1**	**WWAN Main**	**21020**	**2527**	**21.43**	**22**	**1.140**	**-0.06**	**0.648**	**0.739**
#55	LTE Band 7	QPSK	20M	1	0	Back	1	WWAN Main	21020	2527	21.43	22	1.140	-0.05	0.501	0.571
#56	LTE Band 7	QPSK	20M	1	0	Right Side	1	WWAN Main	21020	2527	21.43	22	1.140	0.13	0.348	0.397
#57	LTE Band 7	QPSK	20M	1	0	Top Side	1	WWAN Main	21020	2527	21.43	22	1.140	-0.03	0.219	0.250
#58	LTE Band 7	QPSK	20M	1	0	Bottom Side	1	WWAN Main	21020	2527	21.43	22	1.140	-0.01	0.299	0.341
#59	LTE Band 7	QPSK	20M	50	49	Front	1	WWAN Main	20890	2514	20.19	21	1.205	0.05	0.524	0.631
#60	LTE Band 7	QPSK	20M	50	49	Back	1	WWAN Main	20890	2514	20.19	21	1.205	-0.07	0.406	0.489
#61	LTE Band 7	QPSK	20M	50	49	Right Side	1	WWAN Main	20890	2514	20.19	21	1.205	-0.08	0.250	0.301
#62	LTE Band 7	QPSK	20M	50	49	Top Side	1	WWAN Main	20890	2514	20.19	21	1.205	0.11	0.175	0.211
#63	LTE Band 7	QPSK	20M	50	49	Bottom Side	1	WWAN Main	20890	2514	20.19	21	1.205	-0.01	0.199	0.240

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. 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.
3. 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 2.4GHz SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Data Rate	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Duty Cycle %	Duty Cycle Compensate Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#64	WLAN 2.4GHz	802.11b	Front	1	WLAN Ant.1	11	2462	1M	15.74	16	1.062	100	1.000	-0.12	0.071	0.075
#65	**WLAN 2.4GHz**	**802.11b**	**Back**	**1**	**WLAN Ant.1**	**11**	**2462**	**1M**	**15.74**	**16**	**1.062**	**100**	**1.000**	**-0.05**	**0.139**	**0.148**
#66	WLAN 2.4GHz	802.11b	Left Side	1	WLAN Ant.1	11	2462	1M	15.74	16	1.062	100	1.000	0.04	0.027	0.029
#67	WLAN 2.4GHz	802.11b	Bottom Side	1	WLAN Ant.1	11	2462	1M	15.74	16	1.062	100	1.000	0.02	0.106	0.113
#68	WLAN 2.4GHz	802.11b	Front	1	WLAN Ant.2	6	2437	1M	16.27	17	1.183	100	1.000	0.12	0.178	0.211
#69	WLAN 2.4GHz	802.11b	Back	1	WLAN Ant.2	6	2437	1M	16.27	17	1.183	100	1.000	0.06	0.123	0.146
#70	**WLAN 2.4GHz**	**802.11b**	**Top Side**	**1**	**WLAN Ant.2**	**6**	**2437**	**1M**	**16.27**	**17**	**1.183**	**100**	**1.000**	**-0.05**	**0.234**	**0.277**
#101	**WLAN 2.4GHz**	**802.11gn-HT20**	**Front**	**1**	**WLAN Ant.1+2**	**1**	**2412**	**MCS8**	**12.19**	**13**	**1.205**	**89.91**	**1.112**	**0.09**	**0.029**	**0.039**
#102	WLAN 2.4GHz	802.11gn-HT20	Back	1	WLAN Ant.1+2	1	2412	MCS8	12.19	13	1.205	89.91	1.112	0.1	0.021	0.028
#103	WLAN 2.4GHz	802.11gn-HT20	Left Side	1	WLAN Ant.1+2	1	2412	MCS8	12.19	13	1.205	89.91	1.112	0.08	0.0022	0.003
#104	WLAN 2.4GHz	802.11gn-HT20	Top Side	1	WLAN Ant.1+2	1	2412	MCS8	12.19	13	1.205	89.91	1.112	-0.13	0.00462	0.006
#105	WLAN 2.4GHz	802.11gn-HT20	Bottom Side	1	WLAN Ant.1+2	1	2412	MCS8	12.19	13	1.205	89.91	1.112	0.08	0.015	0.020
#71	WLAN 2.4GHz	802.11gn-HT40	Front	1	WLAN Ant.1+2	3	2422	MCS8	14.58	15	1.102	83.89	1.192	-0.09	0.018	0.023

<WLAN 5GHz SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Data Rate	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Duty Cycle %	Duty Cycle Compensate Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#76	WLAN 5.2GHz	802.11a	Front	1	WLAN Ant.1	48	5240	6M	10.25	11	1.189	95.39	1.048	0.05	0.128	0.159
#77	WLAN 5.2GHz	802.11a	Back	1	WLAN Ant.1	48	5240	6M	10.25	11	1.189	95.39	1.048	0.05	0.092	0.114
#78	WLAN 5.2GHz	802.11a	Left Side	1	WLAN Ant.1	48	5240	6M	10.25	11	1.189	95.39	1.048	0.1	0.011	0.014
#79	**WLAN 5.2GHz**	**802.11a**	**Bottom Side**	**1**	**WLAN Ant.1**	**48**	**5240**	**6M**	**10.25**	**11**	**1.189**	**95.39**	**1.048**	**-0.05**	**0.581**	**0.724**
#80	WLAN 5.2GHz	802.11a	Front	1	WLAN Ant.2	44	5220	6M	9.06	10	1.242	95.11	1.051	-0.01	0.045	0.058
#81	WLAN 5.2GHz	802.11a	Back	1	WLAN Ant.2	44	5220	6M	9.06	10	1.242	95.11	1.051	0.01	0.026	0.034
#82	**WLAN 5.2GHz**	**802.11a**	**Top Side**	**1**	**WLAN Ant.2**	**44**	**5220**	**6M**	**9.06**	**10**	**1.242**	**95.11**	**1.051**	**-0.1**	**0.056**	**0.073**
#83	WLAN 5.2GHz	802.11an HT20	Front	1	WLAN Ant.1+2	44	5220	MCS8	13.35	14	1.161	91.67	1.091	-0.04	0.165	0.209
#84	WLAN 5.2GHz	802.11an HT20	Back	1	WLAN Ant.1+2	44	5220	MCS8	13.35	14	1.161	91.67	1.091	0.07	0.119	0.151
#85	WLAN 5.2GHz	802.11an HT20	Left Side	1	WLAN Ant.1+2	44	5220	MCS8	13.35	14	1.161	91.67	1.091	-0.02	0.00791	0.010
#86	**WLAN 5.2GHz**	**802.11an HT20**	**Bottom Side**	**1**	**WLAN Ant.1+2**	**44**	**5220**	**MCS8**	**13.35**	**14**	**1.161**	**91.67**	**1.091**	**0.08**	**0.606**	**0.768**
#87	WLAN 5.2GHz	802.11an HT20	Top Side	1	WLAN Ant.1+2	44	5220	MCS8	13.35	14	1.161	91.67	1.091	0.1	0.069	0.087
#89	WLAN 5.8GHz	802.11a	Front	1	WLAN Ant.1	149	5745	6M	8.45	9	1.135	95.39	1.048	0.01	0.043	0.051
#90	WLAN 5.8GHz	802.11a	Back	1	WLAN Ant.1	149	5745	6M	8.45	9	1.135	95.39	1.048	0.03	0.039	0.047
#91	WLAN 5.8GHz	802.11a	Left Side	1	WLAN Ant.1	149	5745	6M	8.45	9	1.135	95.39	1.048	0.07	0.0019	0.002
#92	**WLAN 5.8GHz**	**802.11a**	**Bottom Side**	**1**	**WLAN Ant.1**	**149**	**5745**	**6M**	**8.45**	**9**	**1.135**	**95.39**	**1.048**	**0.03**	**0.225**	**0.268**
#93	WLAN 5.8GHz	802.11a	Front	1	WLAN Ant.2	149	5745	6M	8.69	9	1.074	95.39	1.048	0.08	0.022	0.025
#94	WLAN 5.8GHz	802.11a	Back	1	WLAN Ant.2	149	5745	6M	8.69	9	1.074	95.39	1.048	0.01	0.00951	0.011
#95	**WLAN 5.8GHz**	**802.11a**	**Top Side**	**1**	**WLAN Ant.2**	**149**	**5745**	**6M**	**8.69**	**9**	**1.074**	**95.39**	**1.048**	**0.01**	**0.025**	**0.028**
#96	WLAN 5.8GHz	802.11an HT20	Front	1	WLAN Ant.1+2	149	5745	MCS8	12.60	13	1.096	90.79	1.101	0.03	0.048	0.058
#97	WLAN 5.8GHz	802.11an HT20	Back	1	WLAN Ant.1+2	149	5745	MCS8	12.60	13	1.096	90.79	1.101	0.06	0.040	0.048
#98	WLAN 5.8GHz	802.11an HT20	Left Side	1	WLAN Ant.1+2	149	5745	MCS8	12.60	13	1.096	90.79	1.101	-0.08	0.017	0.021
#99	**WLAN 5.8GHz**	**802.11an HT20**	**Bottom Side**	**1**	**WLAN Ant.1+2**	**149**	**5745**	**MCS8**	**12.60**	**13**	**1.096**	**90.79**	**1.101**	**0.01**	**0.244**	**0.295**
#100	WLAN 5.8GHz	802.11an HT20	Top Side	1	WLAN Ant.1+2	149	5745	MCS8	12.60	13	1.096	90.79	1.101	0.06	0.061	0.073

12.2 Repeated SAR Measurement

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Ratio	Reported SAR_{1g} (W/kg)
#08	GSM850	GPRS(2 Tx slots)	Back	1	WWAN Main	189	836.4	30.41	31.5	1.285	-0.02	1.090	1	1.401
#10	GSM850	GPRS(2 Tx slots)	Back	1	WWAN Main	189	836.4	30.41	31.5	1.285	-0.01	1.080	1.009	1.388
#29	WCDMA Band II	RMC 12.2K	Right Side	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	-0.06	1.030	1	1.161
#44	WCDMA Band II	RMC 12.2K	Right Side	1	WWAN Main	9262	1852.4	21.98	22.5	1.127	0.09	0.938	1.098	1.057

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.

12.3 Highest SAR Plot

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Data Rate	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
#08	GSM850	GPRS(2 Tx slots)	Back	1	WWAN Main	189	836.4	-	30.41	31.5	1.285	-0.02	1.090	1.401
#52	GSM1900	GPRS(2 Tx slots)	Right Side	1	WWAN Main	512	1850.2	-	27.41	28.5	1.285	0.05	0.678	0.871
#18	WCDMA Band V	RMC 12.2K	Back	1	WWAN Main	4132	826.4	-	22.07	23.3	1.327	0.02	0.881	1.169
#29	WCDMA Band II	RMC 12.2K	Right Side	1	WWAN Main	9262	1852.4	-	21.98	22.5	1.127	-0.06	1.030	1.161
#54	LTE Band 7	QPSK	Front	1	WWAN Main	21020	2527	-	21.43	22	1.140	-0.06	0.648	0.739
#70	WLAN 2.4GHz	802.11b	Top Side	1	WLAN Ant.2	6	2437	1M	16.27	17	1.183	-0.05	0.234	0.277
#86	WLAN 5.2GHz	802.11an HT20	Bottom Side	1	WLAN Ant.1+2	44	5220	MCS8	13.35	14	1.161	0.08	0.606	0.768
#99	WLAN 5.8GHz	802.11an-HT20	Bottom Side	1	WLAN Ant.1+2	149	5745	MCS8	12.6	13	1.096	0.01	0.244	0.295

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 21.03.2013

#08 GSM850_GPRS(2 Tx slots)_Back_1cm_Ch189

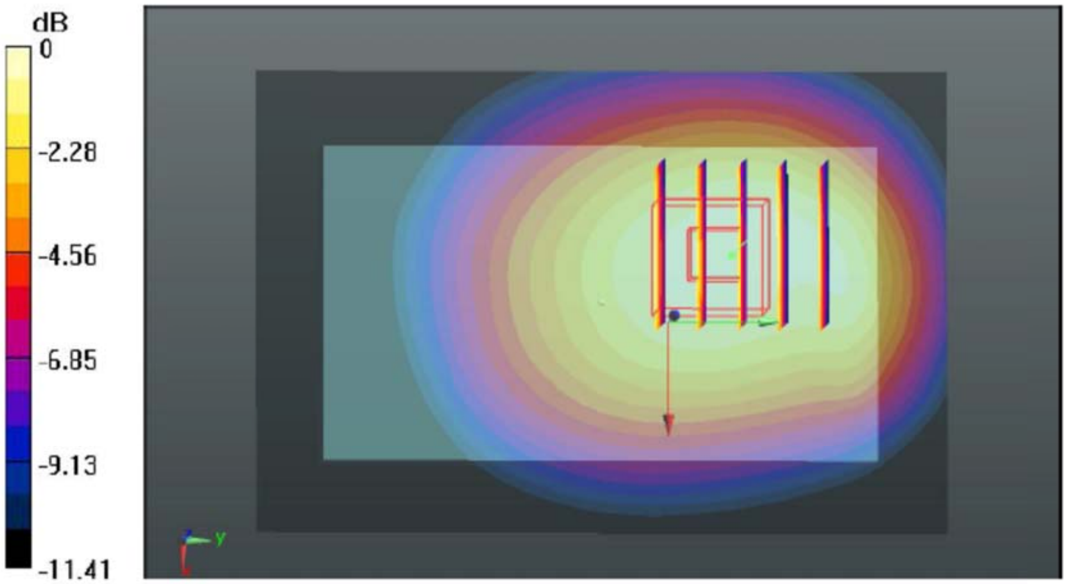
DUT: 312313

Communication System: GPRS/EDGE10; Frequency: 836.4 MHz;Duty Cycle: 1:4
Medium: MSL_835_130321 Medium parameters used: f = 836.4 MHz; σ = 0.972 mho/m; ε_r = 56.486; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.5, 9.5, 9.5); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch189/Area Scan (61x91x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.29 W/kg

Ch189/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.472 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.489 mW/g
SAR(1 g) = 1.090 mW/g; SAR(10 g) = 0.768 mW/g
Maximum value of SAR (measured) = 1.30 W/kg



0 dB = 1.30 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 09.04.2013

#52 GSM1900_GPRS(2 Tx slots)_Right Side_1cm_Ch512

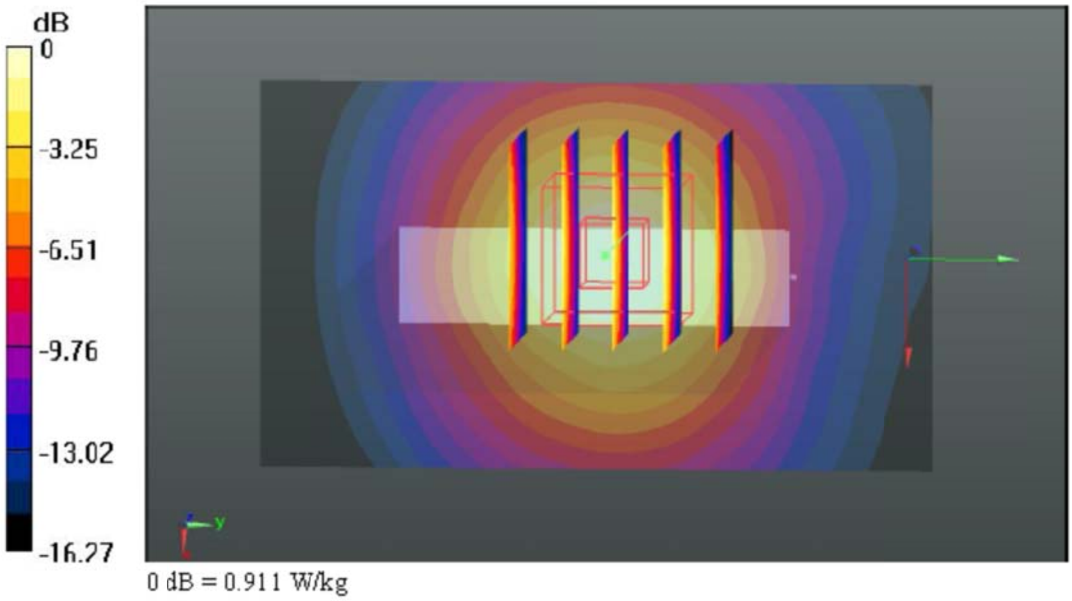
DUT: 312313

Communication System: GPRS/EDGE10; Frequency: 1850.2 MHz;Duty Cycle: 1:4
Medium: MSL_1900_130409 Medium parameters used: f = 1850.2 MHz; σ = 1.469 mho/m; ε_r = 54.083; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.67, 7.67, 7.67); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch512/Area Scan (41x71x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.952 W/kg

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.357 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.112 mW/g
SAR(1 g) = 0.678 mW/g; SAR(10 g) = 0.383 mW/g
Maximum value of SAR (measured) = 0.911 W/kg



0 dB = 0.911 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 21.03.2013

#18 WCDMA Band V_RMC 12.2K_Back_1cm_Ch4132

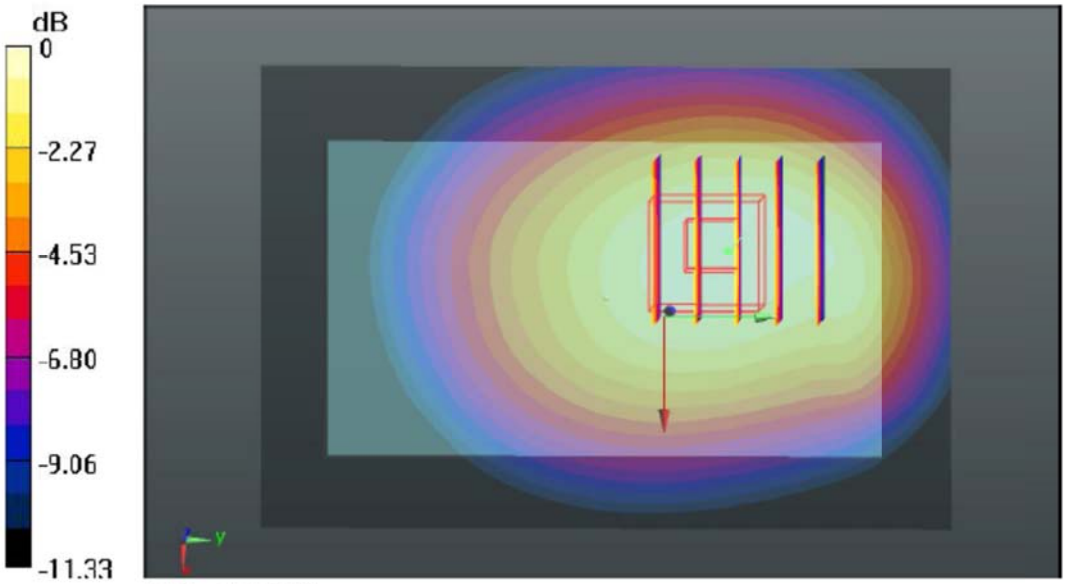
DUT: 312313

Communication System: UMTS; Frequency: 826.4 MHz;Duty Cycle: 1:1
Medium: MSL_835_130321 Medium parameters used: f = 826.4 MHz; $\sigma = 0.962$ mho/m; $\varepsilon_r = 56.57$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.5, 9.5, 9.5); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch4132/Area Scan (61x91x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.05 W/kg

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.907 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.203 mW/g
SAR(1 g) = 0.881 mW/g; SAR(10 g) = 0.629 mW/g
Maximum value of SAR (measured) = 1.05 W/kg



0 dB = 1.05 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 21.03.2013

#29 WCDMA Band II_RMC 12.2K_Right Side_1cm_Ch9262

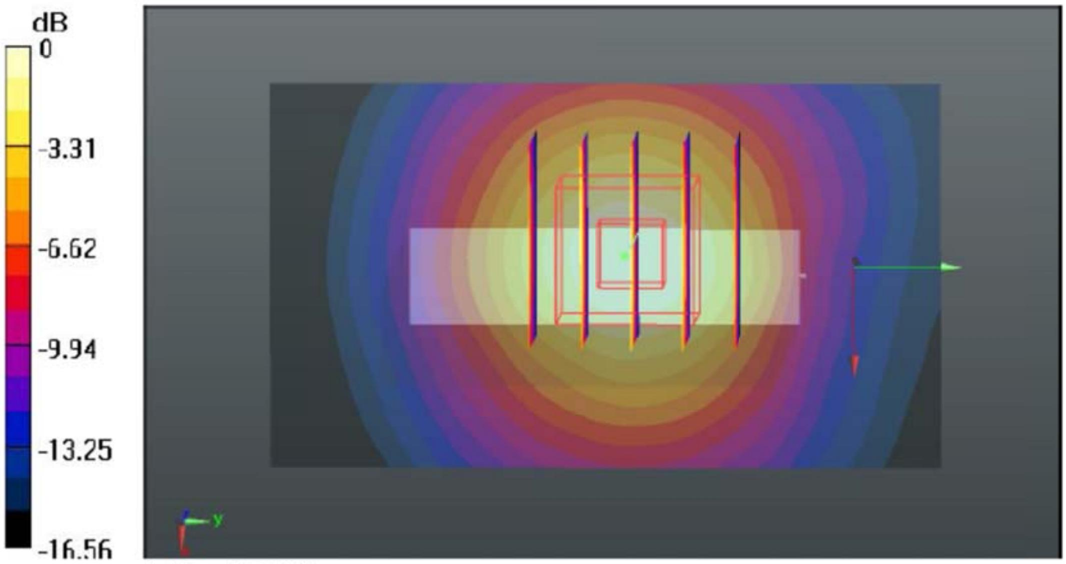
DUT: 312313

Communication System: UMTS; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: MSL_1900_130321 Medium parameters used: f = 1852.4 MHz; σ = 1.489 mho/m; ε_r = 52.679; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.2 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.67, 7.67, 7.67); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch9262/Area Scan (41x71x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.44 W/kg

Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.219 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.700 mW/g
SAR(1 g) = 1.030 mW/g; SAR(10 g) = 0.583 mW/g
Maximum value of SAR (measured) = 1.39 W/kg



0 dB = 1.39 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 11.04.2013

#54 LTE Band 7_20M_QPSK 1RB 0offset_Front_1cm_Ch21020

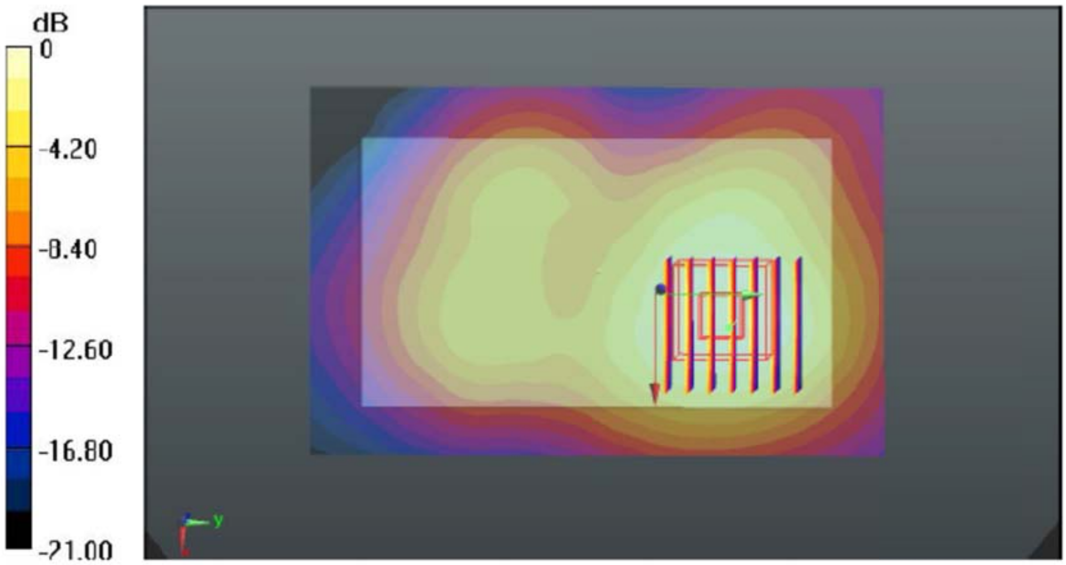
DUT: 312313

Communication System: LTE; Frequency: 2527 MHz; Duty Cycle: 1:1
Medium: MSL_2600_130411 Medium parameters used: f = 2527 MHz; σ = 2.077 mho/m; ε_r = 53.931; ρ = 1000 kg/m^3
Ambient Temperature : 23.6 ℃; Liquid Temperature : 21.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(6.89, 6.89, 6.89); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch21020/Area Scan (71x111x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.926 W/kg

Ch21020/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.979 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.186 mW/g
SAR(1 g) = 0.648 mW/g; SAR(10 g) = 0.363 mW/g
Maximum value of SAR (measured) = 0.892 W/kg



0 dB = 0.892 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 11.04.2013

#70 WLAN2.4GHz_802.11b_WLAN Ant. 2_Top Side_1cm_Ch6

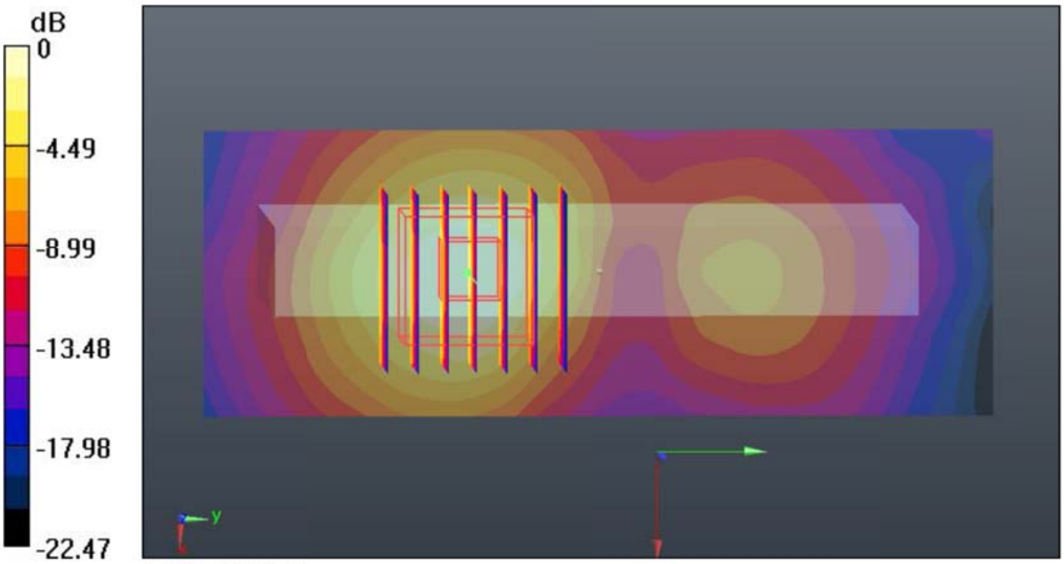
DUT: 312313

Communication System: WIFI; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_130411 Medium parameters used: f = 2437 MHz; σ = 1.922 mho/m; ε_r = 53.921; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(7.21, 7.21, 7.21); Calibrated: 26.11.2012;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch6/Area Scan (41x111x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.411 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.911 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.461 mW/g
SAR(1 g) = 0.234 mW/g; SAR(10 g) = 0.114 mW/g
Maximum value of SAR (measured) = 0.350 W/kg



0 dB = 0.350 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 12.04.2013

#86 WLAN5.2GHz_802.11a_WLAN Ant.1+2_Bottom Side_1cm_Ch44

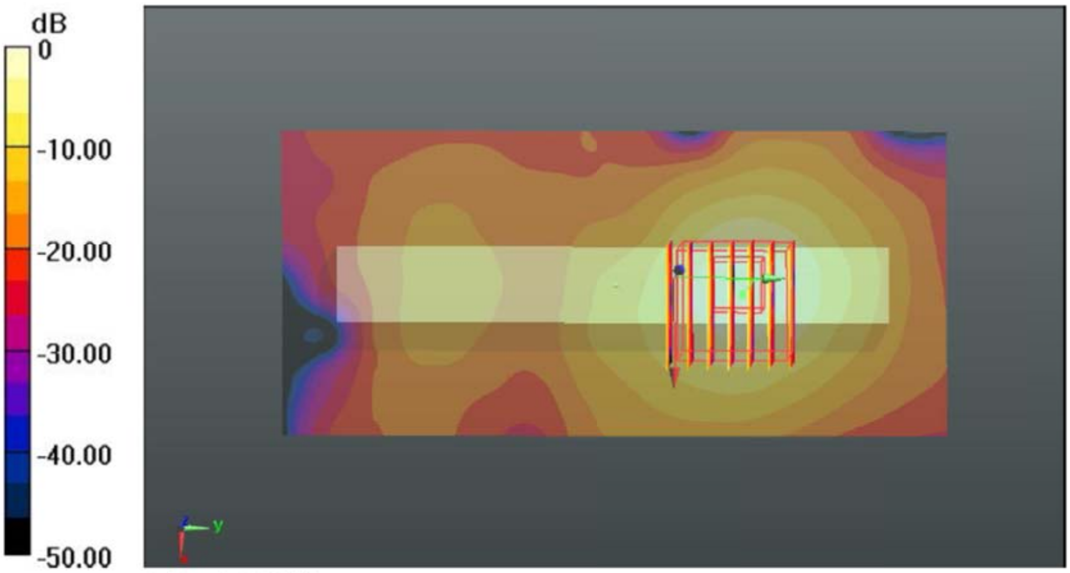
DUT: 312313

Communication System: WIFI; Frequency: 5220 MHz;Duty Cycle: 1:1.1
Medium: MSL_5G_130412 Medium parameters used: f = 5220 MHz; σ = 5.319 mho/m; ε_r = 48.728; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(4.63, 4.63, 4.63); Calibrated: 26.11.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch44/Area Scan (61x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.46 W/kg

Ch44/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 16.582 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 2.551 mW/g
SAR(1 g) = 0.606 mW/g; SAR(10 g) = 0.203 mW/g
Maximum value of SAR (measured) = 1.52 W/kg



0 dB = 1.52 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 12.04.2013

#99 WLAN5.8GHz_802.11a_WLAN Ant.1+2_Bottom Side_1cm_Ch149

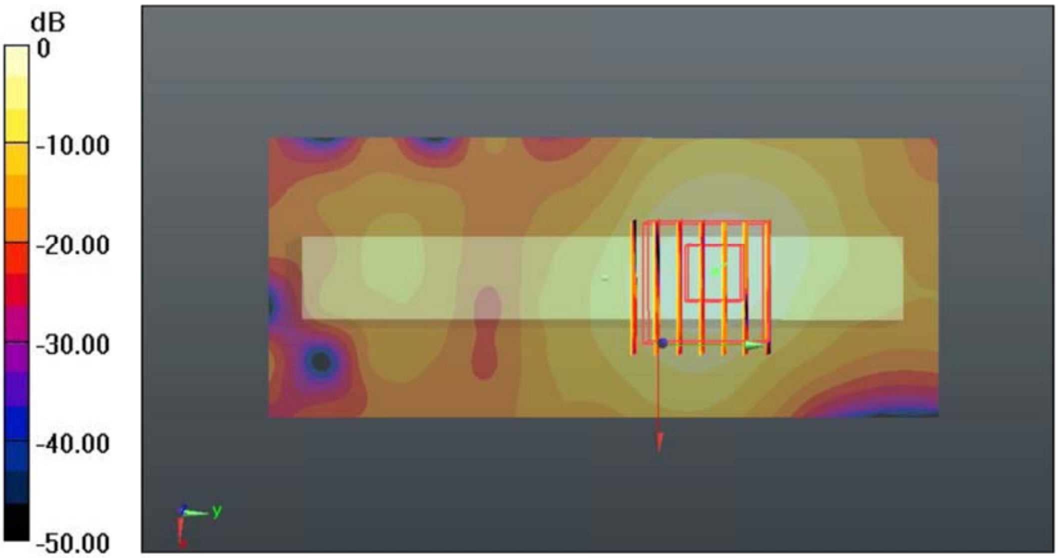
DUT: 312313

Communication System: WIFI; Frequency: 5745 MHz;Duty Cycle: 1:1.1
Medium: MSL_5G_130412 Medium parameters used: f = 5745 MHz; σ = 6.062 mho/m; ε_r = 47.59; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(4.09, 4.09, 4.09); Calibrated: 26.11.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 22.11.2012
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Ch149/Area Scan (51x121x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.606 W/kg

Ch149/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 10.107 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.959 mW/g
SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.078 mW/g
Maximum value of SAR (measured) = 0.606 W/kg



0 dB = 0.606 W/kg

12.4 Simultaneous Multi-band Transmission Analysis

No.	Applicable Simultaneous Transmission Combination
1.	WWAN + WLAN 2.4GHz 802.11b/g (SISO)
2.	WWAN + WLAN 2.4GHz 802.11gn HT20/HT40 (MIMO)
3.	WWAN + WLAN 5.8GHz 802.11a (SISO)
4.	WWAN + WLAN 5.8GHz 802.11an HT20/HT40 (MIMO)

Note:

1. WLAN 2.4GHz and WLAN 5GHz share the same antenna, and cannot transmit simultaneously.
2. GSM/WCDMA/LTE share the same antenna, and cannot transmit simultaneously
3. WWAN and WLAN 5150 MHz band 802.11a cannot be simultaneous transmission, due the 5150 MHz band limited used indoor.
4. The Reported SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v05, simultaneous transmission SAR is compliant if,

(i) Scalar SAR summation < 1.6W/kg.

(ii) SPLSR = (SAR1 + SAR2)1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan

If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary

(iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg

<WWAN PCB + WLAN 2.4GHz DTS>

	WWAN (PCB)			WLAN 2.4GHz (DTS)				Sum (W/kg)	SPLSR ≤ 0.04	Case No
Position	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Mode	Antenna	Plot No	Max. WLAN 2.4GHz SAR (W/kg)			
Front	GSM850	#06	1.350	SISO	Ant.1	#64	0.075	1.43	-	-
	GSM1900	#45	0.693	SISO	Ant.1	#64	0.075	0.77	-	-
	WCDMA Band V	#17	1.143	SISO	Ant.1	#64	0.075	1.22	-	-
	WCDMA Band II	#27	0.779	SISO	Ant.1	#64	0.075	0.85	-	-
	LTE Band 7	#54	0.739	SISO	Ant.1	#64	0.075	0.81	-	-
	GSM850	#06	1.350	SISO	Ant.2	#68	0.211	1.56	-	-
	GSM1900	#45	0.693	SISO	Ant.2	#68	0.211	0.90	-	-
	WCDMA Band V	#17	1.143	SISO	Ant.2	#68	0.211	1.35	-	-
	WCDMA Band II	#27	0.779	SISO	Ant.2	#68	0.211	0.99	-	-
	LTE Band 7	#54	0.739	SISO	Ant.2	#68	0.211	0.95	-	-
	GSM850	#06	1.350	MIMO	Ant.1+2	#101	0.039	1.39	-	-
	GSM1900	#45	0.693	MIMO	Ant.1+2	#101	0.039	0.73	-	-
	WCDMA Band V	#17	1.143	MIMO	Ant.1+2	#101	0.039	1.18	-	-
	WCDMA Band II	#27	0.779	MIMO	Ant.1+2	#101	0.039	0.82	-	-
	LTE Band 7	#54	0.739	MIMO	Ant.1+2	#101	0.039	0.78	-	-
Back	GSM850	#08	1.401	SISO	Ant.1	#65	0.148	1.55	-	-
	GSM1900	#50	0.861	SISO	Ant.1	#65	0.148	1.01	-	-
	WCDMA Band V	#18	1.169	SISO	Ant.1	#65	0.148	1.32	-	-
	WCDMA Band II	#28	0.985	SISO	Ant.1	#65	0.148	1.13	-	-
	LTE Band 7	#55	0.571	SISO	Ant.1	#65	0.148	0.72	-	-
	GSM850	#08	1.401	SISO	Ant.2	#69	0.146	1.55	-	-
	GSM1900	#50	0.861	SISO	Ant.2	#69	0.146	1.01	-	-
	WCDMA Band V	#18	1.169	SISO	Ant.2	#69	0.146	1.32	-	-
	WCDMA Band II	#28	0.985	SISO	Ant.2	#69	0.146	1.13	-	-
	LTE Band 7	#55	0.571	SISO	Ant.2	#69	0.146	0.72	-	-
	GSM850	#08	1.401	MIMO	Ant.1+2	#102	0.028	1.43	-	-
	GSM1900	#50	0.861	MIMO	Ant.1+2	#102	0.028	0.89	-	-
	WCDMA Band V	#18	1.169	MIMO	Ant.1+2	#102	0.028	1.20	-	-
	WCDMA Band II	#28	0.985	MIMO	Ant.1+2	#102	0.028	1.01	-	-
	LTE Band 7	#55	0.571	MIMO	Ant.1+2	#102	0.028	0.60	-	-
Right Side	GSM850	#03	0.137	SISO	Ant.1	-	-	0.14	-	-
	GSM1900	#52	0.871	SISO	Ant.1	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	SISO	Ant.1	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	SISO	Ant.1	-	-	1.16	-	-
	LTE Band 7	#56	0.397	SISO	Ant.1	-	-	0.40	-	-
	GSM850	#03	0.137	SISO	Ant.2	-	-	0.14	-	-
	GSM1900	#52	0.871	SISO	Ant.2	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	SISO	Ant.2	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	SISO	Ant.2	-	-	1.16	-	-
	LTE Band 7	#56	0.397	SISO	Ant.2	-	-	0.40	-	-
	GSM850	#03	0.137	MIMO	Ant.1+2	-	-	0.14	-	-
	GSM1900	#52	0.871	MIMO	Ant.1+2	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	MIMO	Ant.1+2	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	MIMO	Ant.1+2	-	-	1.16	-	-
	LTE Band 7	#56	0.397	MIMO	Ant.1+2	-	-	0.40	-	-

Position	WWAN (PCB)			WLAN 2.4GHz (DTS)				Sum (W/kg)	SPLSR ≤ 0.04	Case No
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Mode	Antenna	Plot No	Max. WLAN 2.4GHz SAR (W/kg)			
Left Side	GSM850	-	-	SISO	Ant.1	#66	0.029	0.03	-	-
	GSM1900	-	-	SISO	Ant.1	#66	0.029	0.03	-	-
	WCDMA Band V	-	-	SISO	Ant.1	#66	0.029	0.03	-	-
	WCDMA Band II	-	-	SISO	Ant.1	#66	0.029	0.03	-	-
	LTE Band 7	-	-	SISO	Ant.1	#66	0.029	0.03	-	-
	GSM850	-	-	SISO	Ant.2	-	-	-	-	-
	GSM1900	-	-	SISO	Ant.2	-	-	-	-	-
	WCDMA Band V	-	-	SISO	Ant.2	-	-	-	-	-
	WCDMA Band II	-	-	SISO	Ant.2	-	-	-	-	-
	LTE Band 7	-	-	SISO	Ant.2	-	-	-	-	-
	GSM850	-	-	MIMO	Ant.1+2	#103	0.003	0.003	-	-
	GSM1900	-	-	MIMO	Ant.1+2	#103	0.003	0.003	-	-
	WCDMA Band V	-	-	MIMO	Ant.1+2	#103	0.003	0.003	-	-
	WCDMA Band II	-	-	MIMO	Ant.1+2	#103	0.003	0.003	-	-
	LTE Band 7	-	-	MIMO	Ant.1+2	#103	0.003	0.003	-	-
Top Side	GSM850	#04	0.723	SISO	Ant.1	-	-	0.72	-	-
	GSM1900	#48	0.128	SISO	Ant.1	-	-	0.13	-	-
	WCDMA Band V	#14	0.604	SISO	Ant.1	-	-	0.60	-	-
	WCDMA Band II	#30	0.141	SISO	Ant.1	-	-	0.14	-	-
	LTE Band 7	#57	0.250	SISO	Ant.1	-	-	0.25	-	-
	GSM850	#04	0.723	SISO	Ant.2	#70	0.277	1.00	-	-
	GSM1900	#48	0.128	SISO	Ant.2	#70	0.277	0.41	-	-
	WCDMA Band V	#14	0.604	SISO	Ant.2	#70	0.277	0.88	-	-
	WCDMA Band II	#30	0.141	SISO	Ant.2	#70	0.277	0.42	-	-
	LTE Band 7	#57	0.250	SISO	Ant.2	#70	0.277	0.53	-	-
	GSM850	#04	0.723	MIMO	Ant.1+2	#104	0.006	0.73	-	-
	GSM1900	#48	0.128	MIMO	Ant.1+2	#104	0.006	0.13	-	-
	WCDMA Band V	#14	0.604	MIMO	Ant.1+2	#104	0.006	0.61	-	-
	WCDMA Band II	#30	0.141	MIMO	Ant.1+2	#104	0.006	0.15	-	-
	LTE Band 7	#57	0.250	MIMO	Ant.1+2	#104	0.006	0.26	-	-
Bottom Side	GSM850	#05	0.759	SISO	Ant.1	#67	0.113	0.87	-	-
	GSM1900	#49	0.267	SISO	Ant.1	#67	0.113	0.38	-	-
	WCDMA Band V	#15	0.603	SISO	Ant.1	#67	0.113	0.72	-	-
	WCDMA Band II	#31	0.339	SISO	Ant.1	#67	0.113	0.45	-	-
	LTE Band 7	#58	0.341	SISO	Ant.1	#67	0.113	0.45	-	-
	GSM850	#05	0.759	SISO	Ant.2	-	-	0.76	-	-
	GSM1900	#49	0.267	SISO	Ant.2	-	-	0.27	-	-
	WCDMA Band V	#15	0.603	SISO	Ant.2	-	-	0.60	-	-
	WCDMA Band II	#31	0.339	SISO	Ant.2	-	-	0.34	-	-
	LTE Band 7	#58	0.341	SISO	Ant.2	-	-	0.34	-	-
	GSM850	#05	0.759	MIMO	Ant.1+2	#105	0.020	0.78	-	-
	GSM1900	#49	0.267	MIMO	Ant.1+2	#105	0.020	0.29	-	-
	WCDMA Band V	#15	0.603	MIMO	Ant.1+2	#105	0.020	0.62	-	-
	WCDMA Band II	#31	0.339	MIMO	Ant.1+2	#105	0.020	0.36	-	-
	LTE Band 7	#58	0.341	MIMO	Ant.1+2	#105	0.020	0.36	-	-

<WWAN PCB + WLAN 5.8GHz DTS>

	WWAN (PCB)			WLAN 5.8GHz (DTS)				Sum (W/kg)	SPLSR ≤ 0.04	Case No
Position	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Mode	Antenna	Plot No	Max. WLAN 5.8GHz SAR (W/kg)			
Front	GSM850	#06	1.350	SISO	Ant.1	#89	0.051	1.40	-	-
	GSM1900	#45	0.693	SISO	Ant.1	#89	0.051	0.74	-	-
	WCDMA Band V	#17	1.143	SISO	Ant.1	#89	0.051	1.19	-	-
	WCDMA Band II	#27	0.779	SISO	Ant.1	#89	0.051	0.83	-	-
	LTE Band 7	#54	0.739	SISO	Ant.1	#89	0.051	0.79	-	-
	GSM850	#06	1.350	SISO	Ant.2	#93	0.025	1.38	-	-
	GSM1900	#45	0.693	SISO	Ant.2	#93	0.025	0.72	-	-
	WCDMA Band V	#17	1.143	SISO	Ant.2	#93	0.025	1.17	-	-
	WCDMA Band II	#27	0.779	SISO	Ant.2	#93	0.025	0.80	-	-
	LTE Band 7	#54	0.739	SISO	Ant.2	#93	0.025	0.76	-	-
	GSM850	#06	1.350	MIMO	Ant.1+2	#96	0.058	1.41	-	-
	GSM1900	#45	0.693	MIMO	Ant.1+2	#96	0.058	0.75	-	-
	WCDMA Band V	#17	1.143	MIMO	Ant.1+2	#96	0.058	1.20	-	-
	WCDMA Band II	#27	0.779	MIMO	Ant.1+2	#96	0.058	0.84	-	-
	LTE Band 7	#54	0.739	MIMO	Ant.1+2	#96	0.058	0.80	-	-
Back	GSM850	#08	1.401	SISO	Ant.1	#90	0.047	1.45	-	-
	GSM1900	#50	0.861	SISO	Ant.1	#90	0.047	0.91	-	-
	WCDMA Band V	#18	1.169	SISO	Ant.1	#90	0.047	1.22	-	-
	WCDMA Band II	#28	0.985	SISO	Ant.1	#90	0.047	1.03	-	-
	LTE Band 7	#55	0.571	SISO	Ant.1	#90	0.047	0.62	-	-
	GSM850	#08	1.401	SISO	Ant.2	#94	0.011	1.41	-	-
	GSM1900	#50	0.861	SISO	Ant.2	#94	0.011	0.87	-	-
	WCDMA Band V	#18	1.169	SISO	Ant.2	#94	0.011	1.18	-	-
	WCDMA Band II	#28	0.985	SISO	Ant.2	#94	0.011	1.00	-	-
	LTE Band 7	#55	0.571	SISO	Ant.2	#94	0.011	0.58	-	-
	GSM850	#08	1.401	MIMO	Ant.1+2	#97	0.048	1.45	-	-
	GSM1900	#50	0.861	MIMO	Ant.1+2	#97	0.048	0.91	-	-
	WCDMA Band V	#18	1.169	MIMO	Ant.1+2	#97	0.048	1.22	-	-
	WCDMA Band II	#28	0.985	MIMO	Ant.1+2	#97	0.048	1.03	-	-
	LTE Band 7	#55	0.571	MIMO	Ant.1+2	#97	0.048	0.62	-	-
Right Side	GSM850	#03	0.137	SISO	Ant.1	-	-	0.14	-	-
	GSM1900	#52	0.871	SISO	Ant.1	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	SISO	Ant.1	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	SISO	Ant.1	-	-	1.16	-	-
	LTE Band 7	#56	0.397	SISO	Ant.1	-	-	0.40	-	-
	GSM850	#03	0.137	SISO	Ant.2	-	-	0.14	-	-
	GSM1900	#52	0.871	SISO	Ant.2	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	SISO	Ant.2	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	SISO	Ant.2	-	-	1.16	-	-
	LTE Band 7	#56	0.397	SISO	Ant.2	-	-	0.40	-	-
	GSM850	#03	0.137	MIMO	Ant.1+2	-	-	0.14	-	-
	GSM1900	#52	0.871	MIMO	Ant.1+2	-	-	0.87	-	-
	WCDMA Band V	#13	0.111	MIMO	Ant.1+2	-	-	0.11	-	-
	WCDMA Band II	#29	1.161	MIMO	Ant.1+2	-	-	1.16	-	-
	LTE Band 7	#56	0.397	MIMO	Ant.1+2	-	-	0.40	-	-

	WWAN (PCB)			WLAN 5.8GHz (DTS)				Sum (W/kg)	SPLSR ≤ 0.04	Case No
Position	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Mode	Antenna	Plot No	Max. WLAN 5.8GHz SAR (W/kg)			
Left Side	GSM850	-	-	SISO	Ant.1	#91	0.002	0.002	-	-
	GSM1900	-	-	SISO	Ant.1	#91	0.002	0.002	-	-
	WCDMA Band V	-	-	SISO	Ant.1	#91	0.002	0.002	-	-
	WCDMA Band II	-	-	SISO	Ant.1	#91	0.002	0.002	-	-
	LTE Band 7	-	-	SISO	Ant.1	#91	0.002	0.002	-	-
	GSM850	-	-	SISO	Ant.2	-	-	-	-	-
	GSM1900	-	-	SISO	Ant.2	-	-	-	-	-
	WCDMA Band V	-	-	SISO	Ant.2	-	-	-	-	-
	WCDMA Band II	-	-	SISO	Ant.2	-	-	-	-	-
	LTE Band 7	-	-	SISO	Ant.2	-	-	-	-	-
	GSM850	-	-	MIMO	Ant.1+2	#98	0.021	0.02	-	-
	GSM1900	-	-	MIMO	Ant.1+2	#98	0.021	0.02	-	-
	WCDMA Band V	-	-	MIMO	Ant.1+2	#98	0.021	0.02	-	-
	WCDMA Band II	-	-	MIMO	Ant.1+2	#98	0.021	0.02	-	-
	LTE Band 7	-	-	MIMO	Ant.1+2	#98	0.021	0.02	-	-
Top Side	GSM850	#04	0.723	SISO	Ant.1	-	-	0.72	-	-
	GSM1900	#48	0.128	SISO	Ant.1	-	-	0.13	-	-
	WCDMA Band V	#14	0.604	SISO	Ant.1	-	-	0.60	-	-
	WCDMA Band II	#30	0.141	SISO	Ant.1	-	-	0.14	-	-
	LTE Band 7	#57	0.250	SISO	Ant.1	-	-	0.25	-	-
	GSM850	#04	0.723	SISO	Ant.2	#95	0.028	0.75	-	-
	GSM1900	#48	0.128	SISO	Ant.2	#95	0.028	0.16	-	-
	WCDMA Band V	#14	0.604	SISO	Ant.2	#95	0.028	0.63	-	-
	WCDMA Band II	#30	0.141	SISO	Ant.2	#95	0.028	0.17	-	-
	LTE Band 7	#57	0.250	SISO	Ant.2	#95	0.028	0.28	-	-
	GSM850	#04	0.723	MIMO	Ant.1+2	#100	0.073	0.80	-	-
	GSM1900	#48	0.128	MIMO	Ant.1+2	#100	0.073	0.20	-	-
	WCDMA Band V	#14	0.604	MIMO	Ant.1+2	#100	0.073	0.68	-	-
	WCDMA Band II	#30	0.141	MIMO	Ant.1+2	#100	0.073	0.21	-	-
	LTE Band 7	#57	0.250	MIMO	Ant.1+2	#100	0.073	0.32	-	-
Bottom Side	GSM850	#05	0.759	SISO	Ant.1	#92	0.268	1.03	-	-
	GSM1900	#49	0.267	SISO	Ant.1	#92	0.268	0.54	-	-
	WCDMA Band V	#15	0.603	SISO	Ant.1	#92	0.268	0.87	-	-
	WCDMA Band II	#31	0.339	SISO	Ant.1	#92	0.268	0.61	-	-
	LTE Band 7	#58	0.341	SISO	Ant.1	#92	0.268	0.61	-	-
	GSM850	#05	0.759	SISO	Ant.2	-	-	0.76	-	-
	GSM1900	#49	0.267	SISO	Ant.2	-	-	0.27	-	-
	WCDMA Band V	#15	0.603	SISO	Ant.2	-	-	0.60	-	-
	WCDMA Band II	#31	0.339	SISO	Ant.2	-	-	0.34	-	-
	LTE Band 7	#58	0.341	SISO	Ant.2	-	-	0.34	-	-
	GSM850	#05	0.759	MIMO	Ant.1+2	#99	0.295	1.05	-	-
	GSM1900	#49	0.267	MIMO	Ant.1+2	#99	0.295	0.56	-	-
	WCDMA Band V	#15	0.603	MIMO	Ant.1+2	#99	0.295	0.90	-	-
	WCDMA Band II	#31	0.339	MIMO	Ant.1+2	#99	0.295	0.63	-	-
	LTE Band 7	#58	0.341	MIMO	Ant.1+2	#99	0.295	0.64	-	-

Test Engineer：Fulu Hu

13. 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 13.1 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 13.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz from IEEE Std 1528™-2003

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
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	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
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	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
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						± 12.8 %	± 12.6 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 25.6 %**	**± 25.2 %**

Table 13.3 Uncertainty Budget of DASY for frequency range 3 GHz to 6 GHz from IEEE Std 1528™-2003

14. References

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[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

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

[10] FCC KDB 941225 D05 v02, “SAR Evaluation Considerations for LTE Devices”

[11] FCC KDB 941225 D06 v01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", April 2011

[12] FCC KDB 865664 D01 v01, “SAR Measurement Requirements for 100MHz to 6 GHz”, October 2012