FCC SAR Test Report

APPLICANT	**:**	**Samsung Electronics Co., Ltd.**
EQUIPMENT	**:**	**Mobile Phone**
BRAND NAME	**:**	**SAMSUNG**
MODEL NAME	**:**	**SCH-I939I**
FCC ID	**:**	**A3LSCHI939I**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2003**

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
FA410307	Rev. 01	Initial issue of report	Feb. 13, 2014

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Samsung Electronics Co., Ltd., Mobile Phone, SCH-I939I** are as follows.

<Highest SAR Summary>

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Head (Separation 0cm)	GSM850	0.28	PCE	0.93
	GSM1900	0.93		
	WCDMA Band V	0.20		
	WCDMA Band II	0.19		
	CDMA 2000 BC0	0.29		
	WLAN 2.4GHz Band	0.04	DTS	
	WLAN 5.8GHz Band	0.01		
	WLAN 5.2GHz Band	0.04	NII	
	WLAN 5.3GHz Band	0.03		
	WLAN 5.5GHz Band	< 0.01		
	Bluetooth	0.02	DSS	
Hotspot (Separation 1cm)	GSM850	0.50	PCE	0.83
	GSM1900	0.83		
	WCDMA Band V	0.34		
	WCDMA Band II	0.79		
	CDMA 2000 BC0	0.60		
	WLAN 2.4GHz Band	0.07	DTS	
	WLAN 5.8GHz Band	0.02		
	Bluetooth	0.02	DSS	
Body-worn (Separation 1cm)	GSM850	0.50	PCE	0.83
	GSM1900	0.83		
	WCDMA Band V	0.34		
	WCDMA Band II	0.79		
	CDMA 2000 BC0	0.60		
	WLAN 2.4GHz Band	0.07	DTS	
	WLAN 5.8GHz Band	0.02		
	WLAN 5.2GHz Band	0.07	NII	
	WLAN 5.3GHz Band	0.04		
	WLAN 5.5GHz Band	0.01		
	Bluetooth	0.02	DSS	

<Highest Simultaneous transmission SAR>

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Head (Separation 0cm)	GSM850 Main antenna	PCE	1.24
	GSM1900 Second antenna	PCE	
	WLAN2.4GHz Band	DTS	

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Head (Separation 0cm)	GSM850 Main antenna	PCE	1.22
	GSM1900 Second antenna	PCE	
	Bluetooth	DSS	

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Head (Separation 0cm)	GSM850 Main antenna	PCE	1.25
	GSM1900 Second antenna	PCE	
	WLAN5.2GHz Band	NII	

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.

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	Samsung Electronics Co., Ltd.
Address	A3 Building, No.185 Kexue Avenue, Science City, Guang Zhou, P.R.C.

2.3 Manufacturer

Company Name	Samsung Electronics Co., Ltd.
Address	129, Samsung-ro, Yeongtong-gu, Suwon-city,Gyeonggi-do, 443-742, Korea

2.4 Application Details

Date of Start during the Test	Jan. 05, 2014
Date of End during the Test	Feb. 07, 2014

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Mobile Phone
Brand Name	SAMSUNG
Model Name	SCH-I939I
FCC ID	A3LSCHI939I
Wireless Technology and Frequency Range	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 CDMA2000 BC0: 824.7 MHz ~ 848.31 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	• GSM/GPRS/EGPRS • RMC/AMR 12.2Kbps Rel 99 • HSDPA Rel 8 Cat24 • HSUPA Rel 6, Cat6 • CDMA2000 : 1xRTT/1xEv-Do(Rel.0)/1xEv-Do(Rev.A)/1x Advanced • 802.11a/b/g/n HT20/HT40 • Bluetooth v3.0+EDR, Bluetooth v4.0 LE • NFC:ASK
HW Version	I939I.02
SW Version	I939IKEUAMK1
EUT Stage	Pre-Production

Remark:
1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. WLAN5GHz operation in 5600 MHz ~ 5650 MHz is notched.
3. 802.11n- HT40 is not supported in 2.4GHz frequency band and supports EGPRS mode multi slot up to class10.
4. This device supported VoIP in GSM, CDMA, WCDMA (e.g. 3rd party VoIP).
5. This device 2.4GHz WLAN supports Hotspot operation, and 2.4GHz / 5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.2GHz / 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
6. This supports dual SIM dual active, the SIM1 for the main antenna supports GSM850 / 1900, CDMA BC0, UMTS Band 2 / 5, the SIM2 for the second antenna supports GSM1900 only, the WWAN radio can simultaneous transmission at the same time.

3.2 Maximum RF output power among production units

<table>
<tr><th rowspan="2">Band / Mode</th><th>GSM Voice(dBm)</th><th colspan="2">Burst Average Power (dBm)</th></tr>
<tr><th>1 Tx Slot</th><th>1 Tx Slot</th><th>2 Tx Slots</th></tr>
<tr><td>GSM850</td><td>33.5</td><td>33.5</td><td>30.5</td></tr>
<tr><td>GSM1900</td><td>30.5</td><td>30.5</td><td>27.5</td></tr>
<tr><th rowspan="2">Band / Mode</th><th colspan="3">8PSK Burst Average Power (dBm)</th></tr>
<tr><th>1 Tx Slot</th><th colspan="2">2 Tx Slots</th></tr>
<tr><td>GSM850</td><td>27.5</td><td colspan="2">27.5</td></tr>
<tr><td>GSM1900</td><td>26.5</td><td colspan="2">26.5</td></tr>
</table>

<table>
<tr><th colspan="3">Band / Mode</th><th>Average Power (dBm)</th></tr>
<tr><td rowspan="8">UMTS</td><td rowspan="4">Band V</td><td>AMR / RCM 12.2Kbps</td><td>23.0</td></tr>
<tr><td>HSDPA</td><td>22.0</td></tr>
<tr><td>DC-HSPDA</td><td>22.0</td></tr>
<tr><td>HSUPA</td><td>21.5</td></tr>
<tr><td rowspan="4">Band II</td><td>AMR / RCM 12.2Kbps</td><td>21.4</td></tr>
<tr><td>HSDPA</td><td>20.5</td></tr>
<tr><td>DC-HSPDA</td><td>20.5</td></tr>
<tr><td>HSUPA</td><td>20.5</td></tr>
<tr><td rowspan="3">CDMA</td><td rowspan="3">BC0</td><td>1x RTT</td><td>25.0</td></tr>
<tr><td>1x EvDO</td><td>24.0</td></tr>
<tr><td>1x Advanced</td><td>24.0</td></tr>
</table>

<table>
<tr><th colspan="3">Mode</th><th>Average Power (dBm)</th></tr>
<tr><td rowspan="3">2.4GHz</td><td colspan="2">802.11b</td><td>15.0</td></tr>
<tr><td colspan="2">802.11g</td><td>12.0</td></tr>
<tr><td colspan="2">802.11n-HT20</td><td>11.0</td></tr>
<tr><td rowspan="6">5GHz</td><td colspan="2">802.11a</td><td>13.0</td></tr>
<tr><td colspan="2">802.11n-HT20</td><td>12.0</td></tr>
<tr><td rowspan="4">802.11n-HT40</td><td>5.2GHz</td><td>11.0</td></tr>
<tr><td>5.3GHz</td><td>11.0</td></tr>
<tr><td>5.5GHz</td><td>11.0</td></tr>
<tr><td>5.8GHz</td><td>9.0</td></tr>
<tr><td colspan="3">Bluetooth v3.0+EDR</td><td>11.5</td></tr>
<tr><td colspan="3">Bluetooth v4.0 LE</td><td>4.0</td></tr>
</table>

3.3 Applied Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r02
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r01
- FCC KDB 648474 D04 Handset SAR v01r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB 941225 D06 Hotspot Mode SAR v01r01
- April 2013 TCB workshop notes (1x Advanced)
- October 2013 TCB workshop notes (GSM/GPRS/EDGE SAR testing criteria)

3.4 Device Category and SAR Limits

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

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

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.

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

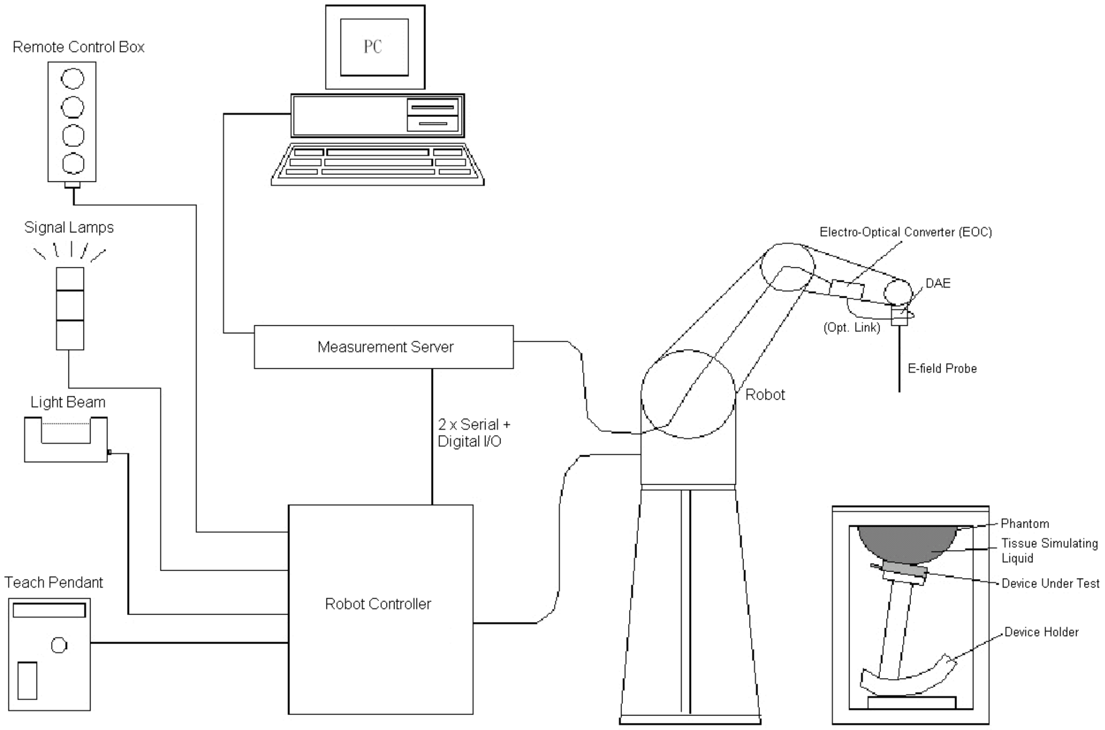


Fig 5.1 SPEAG DASY System Configurations

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 (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

Fig 5.4 Photo of DASY5

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

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

Fig 5.5 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：$\mathbf{E_i} = \sqrt{\frac{\mathbf{V_i}}{\mathbf{Norm_i \cdot ConvF}}}$

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

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)：

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

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. 17, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d118	Nov. 21, 2011	Nov. 20, 2014
SPEAG	2450MHz System Validation Kit	D2450V2	840	Mar. 26. 2013	Mar. 25. 2014
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Sep. 23, 2013	Sep. 22, 2014
SPEAG	Data Acquisition Electronics	DAE4	1303	Nov. 22, 2013	Nov. 21, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3819	Nov. 27, 2013	Nov. 26, 2014
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Mar. 25, 2013	Mar. 24, 2014
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May 06, 2013	May 05, 2014
SPEAG	Device Holder	N/A	N/A	NCR	NCR
R&S	Signal Generator	SMF 100A	101107	May. 27, 2013	May. 26, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 23, 2013	Jul. 22, 2014
R&S	Network Analyzer	ZVB8	100106	Nov.07, 2013	Nov. 06, 2014
Anritsu	Power Meter	ML2495A	1132003	Aug. 28, 2013	Aug. 27, 2014
Anritsu	Power Sensor	MA2411B	1126017	Aug. 27, 2013	Aug. 26, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 4	
Woken	Attenuator 1	WK0602-XX	N/A	Note 4	
PE	Attenuator 2	PE7005-10	N/A	Note 4	
PE	Attenuator 3	PE7005- 3	N/A	Note 4	
AR	Power Amplifier	5S1G4M2	328767	Note 5	
R&S	Spectrum Analyzer	FSP 7	101131	Jul. 09, 2013	Jul. 08, 2014

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 D01v01r02, 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 and D1900V2, SN: 5d118 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. 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
6. 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.

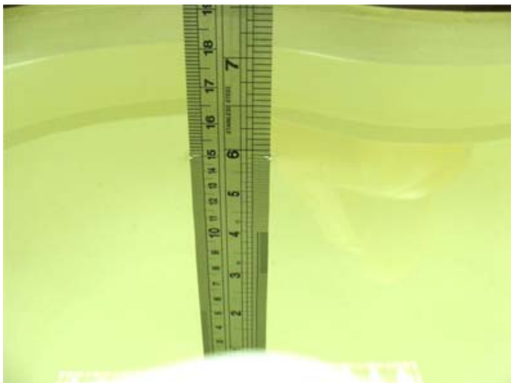


Fig 6.1 Photo of Liquid Height for Head SAR

Fig 6.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ε_r)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Table 6.1 Recipes of Tissue Simulating Liquid

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 a SPEAG DAK-3.5 Dielectric Probe Kit and a R&S ZVB8 Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Head	22.7	0.919	41.524	0.90	41.50	2.11	0.06	±5	2014/1/5
835	Head	22.8	0.918	41.297	0.90	41.50	2.00	-0.49	±5	2014/1/17
1900	Head	22.8	1.447	39.107	1.40	40.00	3.36	-2.23	±5	2014/1/12
2450	Head	22.7	1.878	40.464	1.80	39.20	4.33	3.22	±5	2014/1/27
5200	Head	22.7	4.696	37.048	4.66	36.00	0.77	2.91	±5	2014/1/28
5300	Head	22.7	4.819	36.839	4.76	35.90	1.24	2.62	±5	2014/1/28
5600	Head	22.8	5.199	36.179	5.07	35.50	2.54	1.91	±5	2014/1/28
5800	Head	22.7	5.432	35.732	5.27	35.30	3.07	1.22	±5	2014/1/28
835	Body	22.8	1.011	56.243	0.97	55.20	4.23	1.89	±5	2014/1/11
835	Body	22.7	0.971	56.304	0.97	55.20	0.10	2.00	±5	2014/1/17
1900	Body	22.5	1.533	54.611	1.52	53.30	0.86	2.46	±5	2014/1/9
2450	Body	22.6	1.949	51.667	1.95	52.70	-0.05	-1.96	±5	2014/1/27
5200	Body	22.7	5.137	48.164	5.30	49.00	-3.08	-1.71	±5	2014/2/7
5300	Body	22.6	5.251	47.988	5.42	48.90	-3.12	-1.87	±5	2014/2/7
5600	Body	22.8	5.664	47.452	5.77	48.50	-1.84	-2.16	±5	2014/2/7
5800	Body	22.5	5.868	46.994	6.00	48.20	-2.20	-2.50	±5	2014/2/7

Table 6.2 Measuring Results for Simulating Liquid

7. System Verification Procedures

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:

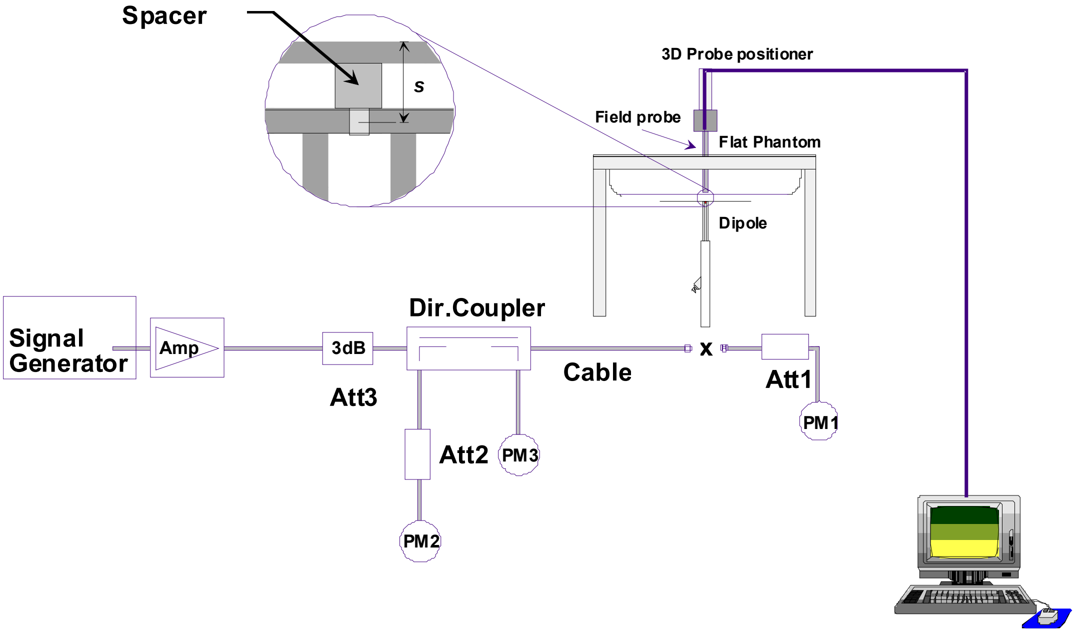


Fig 7.1 System Setup for System Evaluation

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)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
2014/1/5	835	Head	250	4d091	3819	1303	2.50	9.40	10.00	6.38
2014/1/17	835	Head	250	4d091	3819	1303	2.49	9.40	9.96	5.96
2014/1/12	1900	Head	250	5d118	3819	1303	9.69	40.30	38.76	-3.82
2014/1/27	2450	Head	250	840	3819	1303	14.00	53.60	56.00	4.48
2014/1/28	5200	Head	100	1006	3819	1303	7.42	76.60	74.20	-3.13
2014/1/28	5300	Head	100	1006	3819	1303	7.98	80.40	79.80	-0.75
2014/1/28	5600	Head	100	1006	3819	1303	8.14	79.90	81.40	1.88
2014/1/28	5800	Head	100	1006	3819	1303	8.08	76.30	80.80	5.90
2014/1/11	835	Body	250	4d091	3819	1303	2.42	9.42	9.68	2.76
2014/1/17	835	Body	250	4d091	3819	1303	2.28	9.42	9.12	-3.18
2014/1/9	1900	Body	250	5d118	3819	1303	10.60	41.80	42.40	1.44
2014/1/27	2450	Body	250	840	3819	1303	12.20	50.40	48.80	-3.17
2014/2/7	5200	Body	100	1006	3819	1303	7.28	71.50	72.80	1.82
2014/2/7	5300	Body	100	1006	3819	1303	7.81	75.20	78.10	3.86
2014/2/7	5600	Body	100	1006	3819	1303	7.87	77.80	78.70	1.16
2014/2/7	5800	Body	100	1006	3819	1303	7.37	72.30	73.70	1.94

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

8.1 Define two imaginary lines on the handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

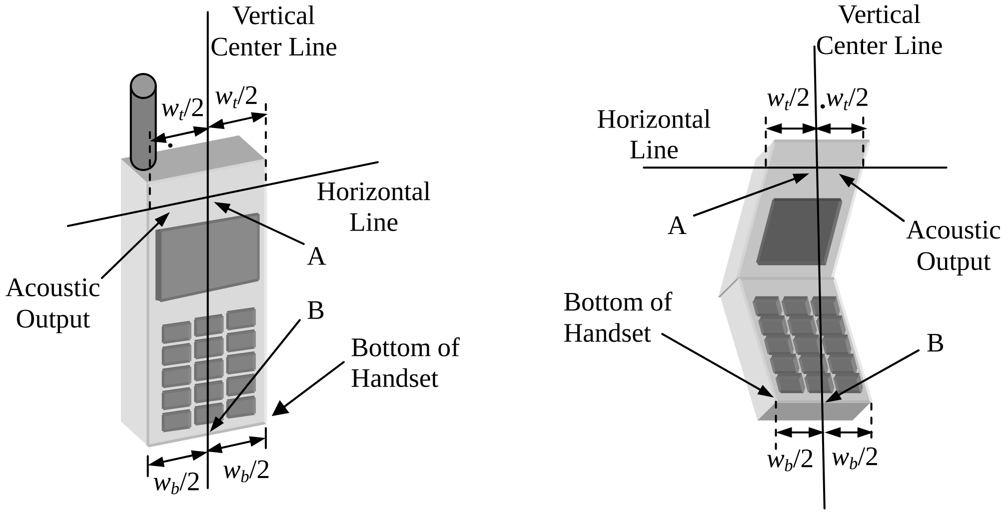


Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines

8.2 Cheek Position

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see Fig. 8.2).

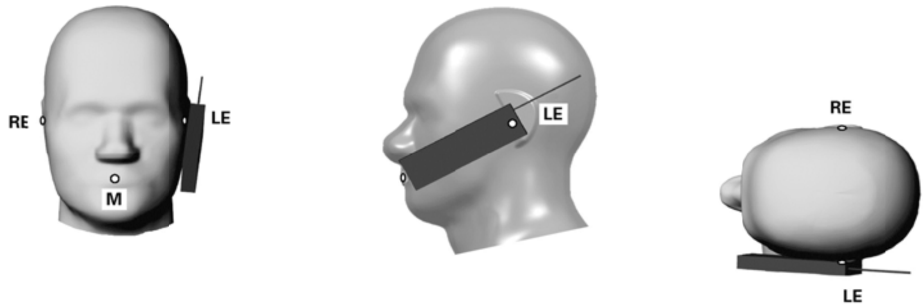


Fig 8.2 Illustration for Cheek Position

8.3 Tilted Position

(a) To position the device in the "cheek" position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 8.3).

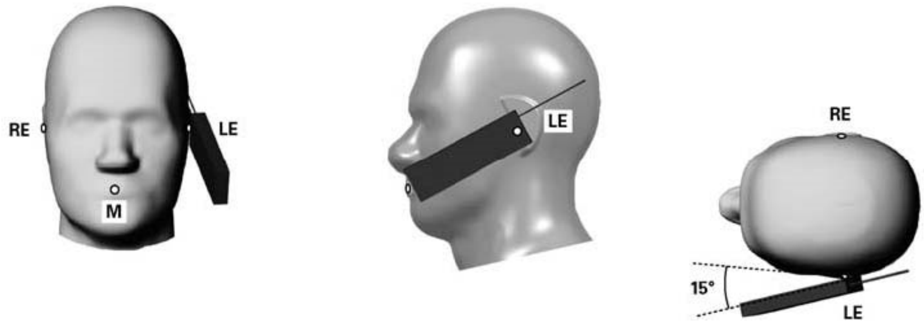


Fig 8.3 Illustration for Tilted Position

8.4 Body Worn Position

(a) To position the device parallel to the phantom surface with either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device surface and the flat phantom to 1 cm.

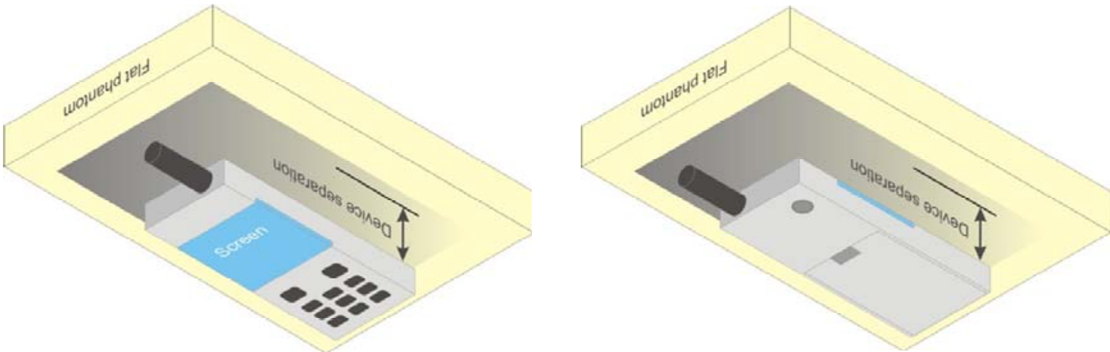


Fig 8.4 Illustration for Body Worn Position

8.5 Hotspot Position

(a) To position the device parallel to the phantom surface with all sides and either keypad up or down.
(b) To adjust the device parallel to the flat phantom.
(c) To adjust the distance between the device and the flat phantom to 1 cm.

<EUT Setup Photos>

Please refer to Appendix E for the test setup photos.

9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D 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 D01v01r02 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

<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>$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>$30° \pm 1°$</td><td>$20° \pm 1°$</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>

Note:

1. Per KDB 447498 D01v05r01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. According to October 2013TCB Workshop, for GSM / GPRS, the number of time slots to test for SAR should correspond to the highest source-based time-averaged maximum output power configuration; When time slots with equivalent maximum average output power specifications, including tolerance, if the measured maximum output power levels are within 0.25 dB of each other, test the configuration with the most number of time slots.
3. For head and body-worn SAR testing, the EUT was set in GPRS (2Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.
4. For hotspot mode SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 2 Tx slots for GSM850/GSM1900 band due to its highest frame-average power.

(Main Antenna)

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)	32.98	32.89	32.70	33.5	23.98	23.89	23.70	24.5
GPRS (GMSK, 1 Tx slot) – CS1	32.97	32.87	32.69	33.5	23.97	23.87	23.69	24.5
GPRS (GMSK, 2 Tx slots) – CS1	30.35	30.28	30.23	30.5	24.35	24.28	24.23	24.5
EDGE (8PSK, 1 Tx slot) – MCS5	26.98	27.02	26.94	27.5	17.98	18.02	17.94	18.5
EDGE (8PSK, 2 Tx slots) – MCS5	26.90	26.97	26.90	27.5	20.90	20.97	20.90	21.5
Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)	29.93	29.70	29.58	30.5	20.93	20.70	20.58	21.5
GPRS (GMSK, 1 Tx slot) – CS1	29.91	29.68	29.57	30.5	20.91	20.68	20.57	21.5
GPRS (GMSK, 2 Tx slots) – CS1	27.16	27.00	26.84	27.5	21.16	21.00	20.84	21.5
EDGE (8PSK, 1 Tx slot) – MCS5	25.66	25.42	25.25	26.5	16.66	16.42	16.25	17.5
EDGE (8PSK, 2 Tx slots) – MCS5	25.52	25.35	25.19	26.5	19.52	19.35	19.19	20.5

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

(Second Antenna)

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)	30.37	29.85	30.10	30.5	21.37	20.85	21.10	21.5
GPRS (GMSK, 1 Tx slot) – CS1	30.31	29.84	30.01	30.5	21.31	20.84	21.01	21.5
GPRS (GMSK, 2 Tx slots) – CS1	27.42	27.04	27.21	27.5	21.42	21.04	21.21	21.5
EDGE (8PSK, 1 Tx slot) – MCS5	26.07	25.56	25.72	26.5	17.07	16.56	16.72	17.5
EDGE (8PSK, 2 Tx slots) – MCS5	25.93	25.43	25.57	26.5	19.93	19.43	19.57	20.5

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

<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	Processes	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.		

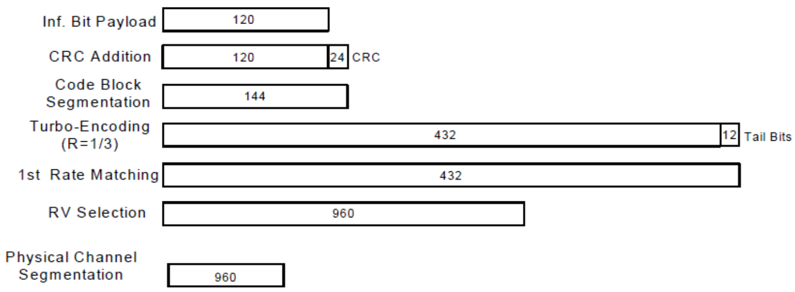


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

Note: Per KDB 941225 D02v02r02, 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.

(Main Antenna)

Band			WCDMA V				WCDMA II			
TX Channel			4132	4182	4233	Tune-up Limit (dBm)	9262	9400	9538	Tune-up Limit (dBm)
Rx Channel			4357	4407	4458		9662	9800	9938	
Frequency (MHz)			826.4	836.4	846.6		1852.4	1880	1907.6	
MPR (dB)	3GPP Rel 99	AMR 12.2Kbps	22.41	22.40	22.37	23.00	21.30	21.27	21.29	21.40
	3GPP Rel 99	RMC 12.2Kbps	22.43	22.42	22.38	23.00	21.32	21.29	21.30	21.40
0	3GPP Rel 6	HSDPA Subtest-1	21.07	21.06	21.14	22.00	19.85	19.68	19.77	20.50
0	3GPP Rel 6	HSDPA Subtest-2	21.04	21.03	21.11	22.00	19.82	19.67	19.75	20.50
0.5	3GPP Rel 6	HSDPA Subtest-3	21.05	20.97	21.11	22.00	19.77	19.61	19.73	20.50
0.5	3GPP Rel 6	HSDPA Subtest-4	21.05	20.95	21.10	22.00	19.56	19.44	19.71	20.50
0	3GPP Rel 8	DC-HSDPA Subtest-1	21.06	21.06	21.12	22.00	19.82	19.66	19.76	20.50
0	3GPP Rel 8	DC-HSDPA Subtest-2	21.04	21.01	21.09	22.00	19.82	19.64	19.75	20.50
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	21.05	20.95	21.08	22.00	19.73	19.58	19.71	20.50
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	21.04	20.95	21.08	22.00	19.55	19.41	19.69	20.50
0	3GPP Rel 6	HSUPA Subtest-1	20.65	21.17	20.78	21.50	20.03	19.69	20.02	20.50
2	3GPP Rel 6	HSUPA Subtest-2	20.57	20.63	20.55	21.50	19.31	19.20	19.25	20.50
1	3GPP Rel 6	HSUPA Subtest-3	19.81	19.98	20.44	21.50	19.18	19.03	19.11	20.50
2	3GPP Rel 6	HSUPA Subtest-4	20.96	20.95	21.15	21.50	19.45	19.31	19.39	20.50
0	3GPP Rel 6	HSUPA Subtest-5	20.96	20.53	20.28	21.50	19.96	19.58	19.79	20.50

<CDMA2000 Conducted Power>

<Measurement procedure for 1x Advanced>

Agilent 8960 base station simulator was used for 1xAdvanced connection, and the measurement setting was followed 2013-April TCB workshop RF exposure update.

a) Protocol Rev: 6 (IS-2000-0)
b) Using SO75 with RC8 on uplink, and RC11 on downlink
c) Smart blanking disabled
d) Reverse power control mode: 400bps
e) Forward power control mode: 000
f) Rvs power control: All up bits

Note:

1. This device additionally supports 1x Advanced. Conducted powers were measured using SO75 with RC8 on the uplink and RC11 on the downlink per KDB 941225D02 v02r02. Smart blanking was disabled for all measurements. The EUT was configured with forward power control Mode 000 and reverse power control at 400 bps. Conducted powers were measured on an Agilent 8960 Series 10 Wireless Communications Test Set, Model E5515C using the CDMA2000 1x Advanced application, Option E1962B-410. Based on the maximum output power measured for 1x Advanced, SAR is required for 1x advanced when if the maximum output for 1x Advanced is more than 0.25 dB higher than the maximum measured for 1x. or the reported SAR in each 1x mode exposure conditions (head, body etc.) is >1.2 W/kg .
2. Per KDB 941225 D01v02, Head SAR for RC1+SO55 is not required because the maximum average output power of RC1 is less than 1/4 dB higher than RC3+SO55.
3. Per KDB 941225 D01v02, in Hotspot mode EUT is treated as data device and SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A (RETAP 4096 bits) power is high than 1/4dB higher than Re v0, SAR tests with those settings are necessary.
4. Per KDB 941225 D01v02, SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only.

(Main Antenna)

Band	CDMA2000 BC0			Tune-up Limit (dBm)
TX Channel	1013	384	777	
Frequency (MHz)	824.7	836.52	848.31	
1xRTT RC1 SO55	24.37	24.03	24.16	25.00
1xRTT RC3 SO55	24.40	24.06	24.26	25.00
1xRTT RC3 SO32(+ F-SCH)	24.37	23.97	24.15	25.00
1xRTT RC3 SO32(+SCH)	24.36	23.87	24.10	25.00
1xEVDO RTAP 153.6Kbps	23.77	23.57	23.56	24.00
1xEVDO RETAP 4096Bits	23.75	23.45	23.44	24.00
1x Advanced	23.71	23.42	23.41	24.00

<WLAN 2.4GHz Conducted Power>

Channel	Frequency (MHz)	802.11b Average Power (dBm) Data Rate (bps)				Tune up Limit (dBm)
		1M bps	2M bps	5.5M bps	11M bps	
CH 01	2412	13.83	13.77	13.92	13.89	15.00
CH 06	2437	13.95	13.86	14.12	14.00	15.00
CH 11	2462	14.48	14.36	14.68	14.63	15.00

Channel	Frequency (MHz)	802.11g Average Power (dBm) Data Rate (bps)								Tune up Limit (dBm)
		6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps	
CH 01	2412	10.66	10.73	10.79	10.70	10.68	10.74	10.74	10.79	12.00
CH 06	2437	11.45	11.38	11.31	11.34	11.35	11.43	11.41	11.42	12.00
CH 11	2462	11.28	11.28	11.34	11.29	11.35	11.44	11.35	11.41	12.00

Channel	Frequency (MHz)	802.11n-HT20 Average Power (dBm) MCS Index								Tune up Limit (dBm)
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
CH 01	2412	9.89	9.82	9.88	9.82	9.85	9.89	9.94	9.88	11.00
CH 06	2437	10.63	10.48	10.60	10.51	10.53	10.57	10.54	10.59	11.00
CH 11	2462	10.42	10.48	10.52	10.49	10.51	10.56	10.54	10.57	11.00

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. Apply the test exclusion rule in KDB 248227 D01 v01r02 11g, 11n-HT20 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

<Bluetooth Conducted Power>

Mode	Channel	Frequency (MHz)	Average power (dBm) v3.0+EDR			Tune up Limit (dBm)
			1Mbps	2Mbps	3Mbps	
Bluetooth	CH 00	2402	10.98	10.08	10.07	11.50
	CH 39	2441	10.50	9.54	9.55	11.50
	CH 78	2480	10.47	9.57	9.59	11.50

Mode	Channel	Frequency (MHz)	Average power (dBm) v4.0 LE	Tune up Limit (dBm)
Bluetooth	CH 00	2402	2.30	4.00
	CH 19	2440	1.80	4.00
	CH 39	2480	1.79	4.00

Note:

1. For Bluetooth SAR testing, the EUT was set in 1Mbps due to its highest average power.
2. The duty factor is selected theoretical 83.3% perform Bluetooth SAR testing.

<WLAN 5GHz Conducted Power>

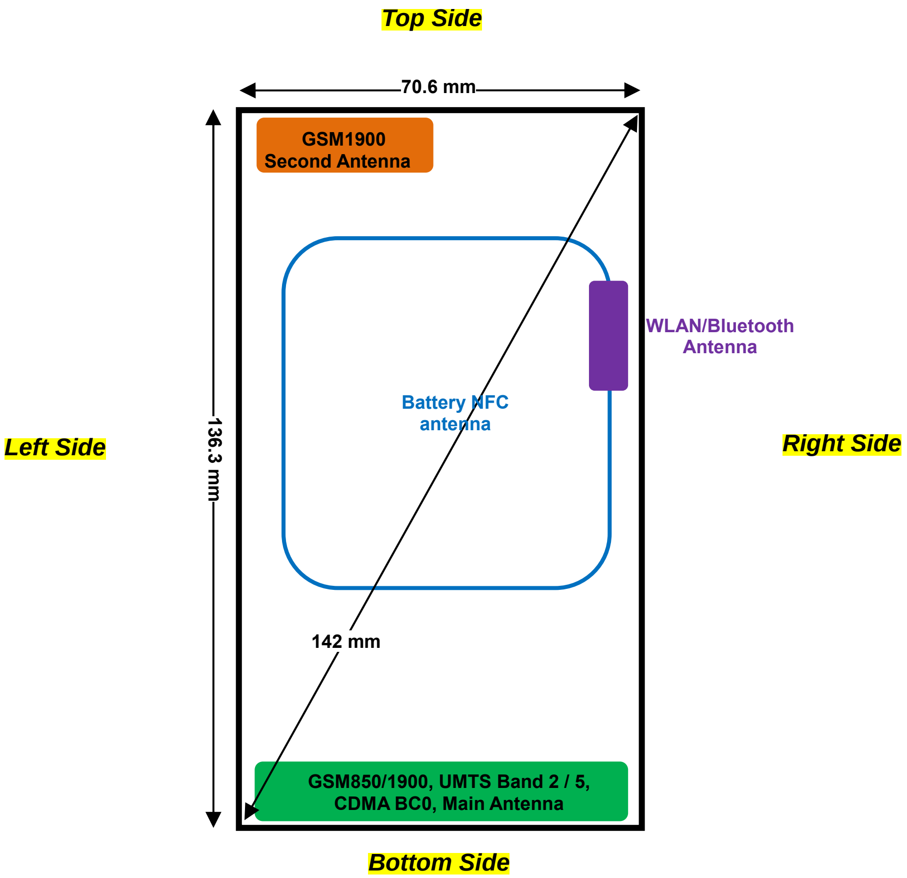
Mode	Channel	Frequency (MHz)	Average Power (dBm)								Tune up Limit (dBm)
			Data Rate								
			6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps	
802.11a	CH 36	5180	12.25	12.23	12.22	12.21	12.21	12.20	12.23	12.21	13.00
	CH 40	5200	12.41	12.39	12.38	12.37	12.37	12.36	12.39	12.37	13.00
	CH 44	5220	12.52	12.50	12.49	12.48	12.48	12.47	12.50	12.48	13.00
	CH 48	5240	12.69	12.67	12.66	12.65	12.65	12.64	12.67	12.65	13.00
	CH 52	5260	11.87	11.85	11.84	11.83	11.83	11.82	11.85	11.83	13.00
	CH 56	5280	11.69	11.67	11.66	11.65	11.65	11.64	11.67	11.65	13.00
	CH 60	5300	12.16	12.14	12.13	12.12	12.12	12.11	12.14	12.12	13.00
	CH 64	5320	12.01	11.99	11.98	11.97	11.97	11.96	11.99	11.97	13.00
	CH 100	5500	12.28	12.26	12.25	12.24	12.24	12.23	12.26	12.24	13.00
	CH 104	5520	12.54	12.52	12.51	12.50	12.50	12.49	12.52	12.50	13.00
	CH 108	5540	12.72	12.70	12.69	12.68	12.68	12.67	12.70	12.68	13.00
	CH 112	5560	12.66	12.64	12.63	12.62	12.62	12.61	12.64	12.62	13.00
	CH 116	5580	12.58	12.56	12.55	12.54	12.54	12.53	12.56	12.54	13.00
	CH 136	5680	12.67	12.65	12.64	12.63	12.63	12.62	12.65	12.63	13.00
	CH 140	5700	12.43	12.41	12.40	12.39	12.39	12.38	12.41	12.39	13.00
	CH 149	5745	10.81	10.79	10.78	10.77	10.77	10.76	10.79	10.77	13.00
	CH 153	5765	12.71	12.45	12.42	12.45	12.50	12.53	12.55	12.55	13.00
	CH 157	5785	12.56	12.51	12.49	12.46	12.49	12.48	12.52	12.48	13.00
	CH 161	5805	11.64	11.56	11.55	11.56	11.58	11.64	11.61	11.67	13.00
	CH 165	5825	12.63	12.58	12.55	12.61	12.56	12.52	12.56	12.55	13.00

Mode	Channel	Frequency (MHz)	Average Power (dBm)								Tune up Limit (dBm)
			MCS Index								
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
802.11n HT20	CH 36	5180	11.10	11.03	11.08	11.06	10.91	10.94	10.93	11.04	12.00
	CH 40	5200	10.29	10.22	10.27	10.25	10.10	10.13	10.12	10.23	12.00
	CH 44	5220	11.41	11.34	11.39	11.37	11.22	11.25	11.24	11.35	12.00
	CH 48	5240	11.33	11.26	11.31	11.29	11.14	11.17	11.16	11.27	12.00
	CH 52	5260	10.31	10.24	10.29	10.27	10.12	10.15	10.14	10.25	12.00
	CH 56	5280	10.24	10.17	10.22	10.20	10.05	10.08	10.07	10.18	12.00
	CH 60	5300	11.39	11.32	11.37	11.35	11.20	11.23	11.22	11.33	12.00
	CH 64	5320	10.88	10.81	10.86	10.84	10.69	10.72	10.71	10.82	12.00
	CH 100	5500	11.19	11.12	11.17	11.15	11.00	11.03	11.02	11.13	12.00
	CH 104	5520	11.52	11.45	11.50	11.48	11.33	11.36	11.35	11.46	12.00
	CH 108	5540	11.24	11.17	11.22	11.20	11.05	11.08	11.07	11.18	12.00
	CH 112	5560	11.83	11.76	11.81	11.79	11.64	11.67	11.66	11.77	12.00
	CH 116	5580	11.58	11.51	11.56	11.54	11.39	11.42	11.41	11.52	12.00
	CH 136	5680	11.69	11.62	11.67	11.65	11.50	11.53	11.52	11.63	12.00
	CH 140	5700	11.92	11.85	11.90	11.88	11.73	11.76	11.75	11.86	12.00
	CH 149	5745	9.91	9.84	9.89	9.87	9.72	9.75	9.74	9.85	12.00
	CH 153	5765	10.85	10.70	10.76	10.73	10.72	10.80	10.80	10.79	12.00
	CH 157	5785	10.68	10.61	10.58	10.53	10.55	10.58	10.54	10.53	12.00
	CH 161	5805	10.00	9.84	9.92	9.84	9.88	9.90	9.92	9.90	12.00
	CH 165	5825	10.72	10.66	10.61	10.68	10.63	10.67	10.63	10.68	12.00

Mode	Channel	Frequency (MHz)	Average Power (dBm)								Tune up Limit (dBm)
			MCS Index								
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
802.11n HT40	CH 38	5190	9.88	9.84	9.85	9.81	9.83	9.86	9.84	9.82	11.00
	CH 46	5230	10.16	10.12	10.13	10.09	10.11	10.14	10.12	10.10	11.00
	CH 54	5270	9.31	9.27	9.28	9.24	9.26	9.29	9.27	9.25	11.00
	CH 62	5310	9.63	9.59	9.60	9.56	9.58	9.61	9.59	9.57	11.00
	CH 102	5510	10.44	10.40	10.41	10.37	10.39	10.42	10.40	10.38	11.00
	CH 110	5550	10.77	10.73	10.74	10.70	10.72	10.75	10.73	10.71	11.00
	CH 134	5670	10.59	10.55	10.56	10.52	10.54	10.57	10.55	10.53	11.00
	CH 151	5755	8.78	8.68	8.71	8.72	8.69	8.74	8.76	8.75	9.00
	CH 159	5795	8.54	8.60	8.59	8.58	8.61	8.68	8.63	8.68	9.00

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. Apply the test exclusion rule in KDB 248227 D01 v01r02, 11n-HT20/HT40 output power is less than 1/4dB higher than 802.11a mode, thus the SAR can be excluded.

11. Antenna Location



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	≤ 25mm	≤ 25mm	124mm	≤ 25mm	≤ 25mm	≤ 25mm
WWAN Second	≤ 25mm	≤ 25mm	≤ 25mm	118mm	≤ 25mm	46mm
BT&WLAN	≤ 25mm	≤ 25mm	26.3mm	86.5mm	≤ 25mm	61mm

Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Main	Yes	Yes	No	Yes	Yes	Yes
WWAN Second	Yes	Yes	Yes	No	Yes	No
BT&WLAN	Yes	Yes	No	No	Yes	No

Note: Referring to KDB 941225 D06 v01r01, 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

12. SAR Test Results

Note:

1. This supports dual SIM dual active, the SIM1 for the main antenna supports GSM850 / 1900, CDMA BC0, UMTS Band 2 / 5, the SIM2 for the second antenna supports GSM1900 only, the WWAN radio can simultaneous transmission at the same time.
2. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
3. Per KDB 447498 D01v05r01, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
4. According to October 2013TCB Workshop, For GSM / EGPRS, the number of time slots to test for SAR should correspond to the highest source-based time-averaged maximum output power configuration, Considering the possibility of e.g. 3rd party VoIP operation for head and body-worn SAR testing, the EUT was set in GPRS (2Tx slots) for GSM850/GSM1900 band due to its highest frame-average power.
5. For hotspot mode SAR testing, GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 2 Tx slots for GSM850/GSM1900 band due to its highest frame-average power.
6. Per KDB 941225 D02v02r02, 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.
7. Per KDB 941225 D01v02, Head SAR for RC1+SO55 is not required because the maximum average output power of RC1 is less than 1/4 dB higher than RC3+SO55.
8. Per KDB 941225 D01v02, in Hotspot mode EUT is treated as data device and SAR is tested with Ev-Do Rev 0 (RTAP 153.6kbps). If 1xRTT and Ev-Do Rev A (RETAP 4096 bits) power is high than 1/4dB higher than Re v0, SAR tests with those settings are necessary.
9. Per KDB 941225 D01v02, SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only and considering the possibility of e.g. 3rd party VoIP was additional Ev-Do Rev A (RETAP 4096 bits) SAR testing performed on TDSO / SO32 worse case.
10. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.

12.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
#01	GSM850	GPRS(2 Tx slots)	Right Cheek	Main	128	824.2	30.35	30.50	1.035	-0.03	0.268	0.277
	GSM850	GPRS(2 Tx slots)	Right Tilted	Main	128	824.2	30.35	30.50	1.035	-0.08	0.222	0.230
	GSM850	GPRS(2 Tx slots)	Left Cheek	Main	128	824.2	30.35	30.50	1.035	-0.07	0.260	0.269
	GSM850	GPRS(2 Tx slots)	Left Tilted	Main	128	824.2	30.35	30.50	1.035	-0.07	0.223	0.231
	GSM1900	GPRS(2 Tx slots)	Right Cheek	Main	512	1850.2	27.16	27.50	1.081	-0.03	0.143	0.155
	GSM1900	GPRS(2 Tx slots)	Right Tilted	Main	512	1850.2	27.16	27.50	1.081	-0.02	0.066	0.071
#02	GSM1900	GPRS(2 Tx slots)	Left Cheek	Main	512	1850.2	27.16	27.50	1.081	0.07	0.186	0.201
	GSM1900	GPRS(2 Tx slots)	Left Tilted	Main	512	1850.2	27.16	27.50	1.081	0.07	0.063	0.068
	GSM1900	GPRS(2 Tx slots)	Right Cheek	Second	512	1850.2	27.42	27.50	1.019	0.07	0.655	0.667
	GSM1900	GPRS(2 Tx slots)	Right Tilted	Second	512	1850.2	27.42	27.50	1.019	0.1	0.694	0.707
#03	GSM1900	GPRS(2 Tx slots)	Left Cheek	Second	512	1850.2	27.42	27.50	1.019	0.02	0.917	0.934
	GSM1900	GPRS(2 Tx slots)	Left Cheek	Second	661	1880	27.04	27.50	1.112	0.01	0.735	0.817
	GSM1900	GPRS(2 Tx slots)	Left Cheek	Second	810	1909.8	27.21	27.50	1.069	-0.09	0.608	0.650
	GSM1900	GPRS(2 Tx slots)	Left Tilted	Second	512	1850.2	27.42	27.50	1.019	-0.02	0.859	0.875
	GSM1900	GPRS(2 Tx slots)	Left Tilted	Second	661	1880	27.04	27.50	1.112	-0.07	0.589	0.655
	GSM1900	GPRS(2 Tx slots)	Left Tilted	Second	810	1909.8	27.21	27.50	1.069	-0.02	0.475	0.508

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Right Cheek	Main	4132	826.4	22.43	23.00	1.140	0.09	0.166	0.189
	WCDMA V	RMC 12.2Kbps	Right Tilted	Main	4132	826.4	22.43	23.00	1.140	0.08	0.114	0.130
#04	WCDMA V	RMC 12.2Kbps	Left Cheek	Main	4132	826.4	22.43	23.00	1.140	-0.04	0.179	0.204
	WCDMA V	RMC 12.2Kbps	Left Tilted	Main	4132	826.4	22.43	23.00	1.140	-0.02	0.098	0.112
	WCDMA II	RMC 12.2Kbps	Right Cheek	Main	9262	1852.4	21.32	21.40	1.019	-0.05	0.128	0.130
	WCDMA II	RMC 12.2Kbps	Right Tilted	Main	9262	1852.4	21.32	21.40	1.019	-0.05	0.061	0.062
#05	WCDMA II	RMC 12.2Kbps	Left Cheek	Main	9262	1852.4	21.32	21.40	1.019	0.11	0.185	0.188
	WCDMA II	RMC 12.2Kbps	Left Tilted	Main	9262	1852.4	21.32	21.40	1.019	-0.09	0.055	0.056

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
#06	CDMA2000 BC0	1xRTT RC3 SO55	Right Cheek	Main	1013	824.7	24.40	25.00	1.148	0.05	0.251	0.288
	CDMA2000 BC0	RETAP 4096 bits	Right Cheek	Main	1013	824.7	23.75	24.00	1.059	0.03	0.222	0.235
	CDMA2000 BC0	1xRTT RC3 SO55	Right Tilted	Main	1013	824.7	24.40	25.00	1.148	-0.05	0.166	0.191
	CDMA2000 BC0	1xRTT RC3 SO55	Left Cheek	Main	1013	824.7	24.40	25.00	1.148	0.02	0.225	0.258
	CDMA2000 BC0	1xRTT RC3 SO55	Left Tilted	Main	1013	824.7	24.40	25.00	1.148	-0.08	0.148	0.170

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 2.4GHz	802.11b 1Mbps	Right Cheek	11	2462	14.48	15.00	1.127	-0.09	0.016	0.018
	WLAN 2.4GHz	802.11b 1Mbps	Right Tilted	11	2462	14.48	15.00	1.127	-0.09	0.00956	0.011
#07	WLAN 2.4GHz	802.11b 1Mbps	Left Cheek	11	2462	14.48	15.00	1.127	-0.03	0.033	**0.037**
	WLAN 2.4GHz	802.11b 1Mbps	Left Tilted	11	2462	14.48	15.00	1.127	-0.05	0.015	0.017
	WLAN 5.8GHz	802.11a 6Mbps	Right Cheek	149	5745	12.71	13.00	1.069	0	< 0.001	< 0.001
	WLAN 5.8GHz	802.11a 6Mbps	Right Tilted	149	5745	12.71	13.00	1.069	-0.09	0.000729	0.001
#08	WLAN 5.8GHz	802.11a 6Mbps	Left Cheek	149	5745	12.71	13.00	1.069	0.01	0.008	**0.009**
	WLAN 5.8GHz	802.11a 6Mbps	Left Tilted	149	5745	12.71	13.00	1.069	0	< 0.001	< 0.001

<WLAN SAR NII>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.2GHz	802.11a 6Mbps	Right Cheek	48	5240	12.69	13.00	1.074	-0.05	0.017	0.018
	WLAN 5.2GHz	802.11a 6Mbps	Right Tilted	48	5240	12.69	13.00	1.074	-0.09	0.021	0.023
#09	WLAN 5.2GHz	802.11a 6Mbps	Left Cheek	48	5240	12.69	13.00	1.074	-0.05	0.039	**0.042**
	WLAN 5.2GHz	802.11a 6Mbps	Left Tilted	48	5240	12.69	13.00	1.074	-0.03	0.015	0.016
	WLAN 5.3GHz	802.11a 6Mbps	Right Cheek	60	5300	12.16	13.00	1.213	0.05	0.00566	0.007
	WLAN 5.3GHz	802.11a 6Mbps	Right Tilted	60	5300	12.16	13.00	1.213	-0.05	0.00862	0.010
#10	WLAN 5.3GHz	802.11a 6Mbps	Left Cheek	60	5300	12.16	13.00	1.213	0.09	0.026	**0.032**
	WLAN 5.3GHz	802.11a 6Mbps	Left Tilted	60	5300	12.16	13.00	1.213	0.01	0.011	0.013
#11	WLAN 5.5GHz	802.11a 6Mbps	Right Cheek	108	5540	12.72	13.00	1.067	0	< 0.001	< 0.001
	WLAN 5.5GHz	802.11a 6Mbps	Right Tilted	108	5540	12.72	13.00	1.067	0	< 0.001	< 0.001
	WLAN 5.5GHz	802.11a 6Mbps	Left Cheek	108	5540	12.72	13.00	1.067	0	< 0.001	< 0.001
	WLAN 5.5GHz	802.11a 6Mbps	Left Tilted	108	5540	12.72	13.00	1.067	0	< 0.001	< 0.001

< Bluetooth SAR DSS >

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps DH5	Right Cheek	0	2402	10.98	11.50	1.127	-0.07	0.00662	0.007
	Bluetooth	1Mbps DH5	Right Tilted	0	2402	10.98	11.50	1.127	0.04	0.00465	0.005
#12	Bluetooth	1Mbps DH5	Left Cheek	0	2402	10.98	11.50	1.127	0.1	0.014	**0.016**
	Bluetooth	1Mbps DH5	Left Tilted	0	2402	10.98	11.50	1.127	0.01	0.00776	0.009

12.2 Hotspot SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS(2 Tx slots)	Front	1	Main	128	824.2	30.35	30.50	1.035	-0.02	0.390	0.404
#13	GSM850	GPRS(2 Tx slots)	Back	1	Main	128	824.2	30.35	30.50	1.035	-0.07	0.484	**0.501**
	GSM850	GPRS(2 Tx slots)	Left Side	1	Main	128	824.2	30.35	30.50	1.035	-0.05	0.383	0.396
	GSM850	GPRS(2 Tx slots)	Right Side	1	Main	128	824.2	30.35	30.50	1.035	-0.04	0.370	0.383
	GSM850	GPRS(2 Tx slots)	Bottom Side	1	Main	128	824.2	30.35	30.50	1.035	0.04	0.022	0.023
	GSM1900	GPRS(2 Tx slots)	Front	1	Main	512	1850.2	27.16	27.50	1.081	-0.08	0.403	0.436
#14	GSM1900	GPRS(2 Tx slots)	Back	1	Main	512	1850.2	27.16	27.50	1.081	-0.14	0.763	**0.825**
	GSM1900	GPRS(2 Tx slots)	Back	1	Main	661	1880	27.00	27.50	1.122	0.03	0.708	0.794
	GSM1900	GPRS(2 Tx slots)	Back	1	Main	810	1909.8	26.84	27.50	1.164	-0.03	0.685	0.797
	GSM1900	GPRS(2 Tx slots)	Left Side	1	Main	512	1850.2	27.16	27.50	1.081	-0.06	0.127	0.137
	GSM1900	GPRS(2 Tx slots)	Right Side	1	Main	512	1850.2	27.16	27.50	1.081	-0.01	0.041	0.044
	GSM1900	GPRS(2 Tx slots)	Bottom Side	1	Main	512	1850.2	27.16	27.50	1.081	-0.1	0.747	0.808
	GSM1900	GPRS(2 Tx slots)	Bottom Side	1	Main	661	1880	27.00	27.50	1.122	-0.05	0.705	0.791
	GSM1900	GPRS(2 Tx slots)	Bottom Side	1	Main	810	1909.8	26.84	27.50	1.164	0.01	0.706	0.822
	GSM1900	GPRS(2 Tx slots)	Front	1	Second	512	1850.2	27.42	27.50	1.019	0.02	0.270	0.275
#15	GSM1900	GPRS(2 Tx slots)	Back	1	Second	512	1850.2	27.42	27.50	1.019	-0.09	0.313	**0.319**
	GSM1900	GPRS(2 Tx slots)	Right Side	1	Second	512	1850.2	27.42	27.50	1.019	-0.06	0.121	0.123
	GSM1900	GPRS(2 Tx slots)	Top Side	1	Second	512	1850.2	27.42	27.50	1.019	-0.11	0.251	0.256

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	1	Main	4132	826.4	22.43	23.00	1.140	-0.06	0.153	0.174
#16	WCDMA V	RMC 12.2Kbps	Back	1	Main	4132	826.4	22.43	23.00	1.140	-0.01	0.298	**0.340**
	WCDMA V	RMC 12.2Kbps	Left Side	1	Main	4132	826.4	22.43	23.00	1.140	0.07	0.228	0.260
	WCDMA V	RMC 12.2Kbps	Right Side	1	Main	4132	826.4	22.43	23.00	1.140	0.11	0.194	0.221
	WCDMA V	RMC 12.2Kbps	Bottom Side	1	Main	4132	826.4	22.43	23.00	1.140	0.03	0.028	0.032
	WCDMA II	RMC 12.2Kbps	Front	1	Main	9262	1852.4	21.32	21.40	1.019	-0.02	0.483	0.492
#17	WCDMA II	RMC 12.2Kbps	Back	1	Main	9262	1852.4	21.32	21.40	1.019	0.01	0.776	**0.790**
	WCDMA II	RMC 12.2Kbps	Left Side	1	Main	9262	1852.4	21.32	21.40	1.019	-0.01	0.118	0.120
	WCDMA II	RMC 12.2Kbps	Right Side	1	Main	9262	1852.4	21.32	21.40	1.019	-0.11	0.043	0.044
	WCDMA II	RMC 12.2Kbps	Bottom Side	1	Main	9262	1852.4	21.32	21.40	1.019	0.02	0.694	0.707

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	CDMA2000 BC0	RTAP 153.6Kbps	Front	1	Main	1013	824.7	23.77	24.00	1.054	0.1	0.274	0.289
	CDMA2000 BC0	RTAP 153.6Kbps	Back	1	Main	1013	824.7	23.77	24.00	1.054	0.04	0.427	0.450
	CDMA2000 BC0	RTAP 153.6Kbps	Left Side	1	Main	1013	824.7	23.77	24.00	1.054	0.04	0.362	0.382
	CDMA2000 BC0	RTAP 153.6Kbps	Right Side	1	Main	1013	824.7	23.77	24.00	1.054	0.02	0.352	0.371
	CDMA2000 BC0	RTAP 153.6Kbps	Bottom Side	1	Main	1013	824.7	23.77	24.00	1.054	0.09	0.030	0.032
	CDMA2000 BC0	1xRTT RC3 SO32	Front	1	Main	1013	824.7	24.37	25.00	1.156	0.09	0.295	0.341
#18	CDMA2000 BC0	1xRTT RC3 SO32	Back	1	Main	1013	824.7	24.37	25.00	1.156	-0.05	0.515	0.595
	CDMA2000 BC0	1xRTT RC3 SO32	Left Side	1	Main	1013	824.7	24.37	25.00	1.156	-0.03	0.372	0.430
	CDMA2000 BC0	1xRTT RC3 SO32	Right Side	1	Main	1013	824.7	24.37	25.00	1.156	0.1	0.376	0.435
	CDMA2000 BC0	1xRTT RC3 SO32	Bottom Side	1	Main	1013	824.7	24.37	25.00	1.156	-0.09	0.033	0.038

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 2.4GHz	802.11b 1Mbps	Front	1	11	2462	14.48	15.00	1.127	-0.08	0.00859	0.010
#19	WLAN 2.4GHz	802.11b 1Mbps	Back	1	11	2462	14.48	15.00	1.127	-0.06	0.058	0.065
	WLAN 2.4GHz	802.11b 1Mbps	Right Side	1	11	2462	14.48	15.00	1.127	-0.04	0.028	0.032
	WLAN 5.8GHz	802.11a 6Mbps	Front	1	149	5745	12.71	13.00	1.069	0.09	0.000507	0.001
#20	WLAN 5.8GHz	802.11a 6Mbps	Back	1	149	5745	12.71	13.00	1.069	0.02	0.017	0.018
	WLAN 5.8GHz	802.11a 6Mbps	Right Side	1	149	5745	12.71	13.00	1.069	0.06	0.014	0.015

<Bluetooth SAR DSS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps DH5	Front	1	0	2402	10.98	11.50	1.127	-0.01	0.00162	0.002
#21	Bluetooth	1Mbps DH5	Back	1	0	2402	10.98	11.50	1.127	-0.01	0.016	0.018
	Bluetooth	1Mbps DH5	Right Side	1	0	2402	10.98	11.50	1.127	-0.07	0.00418	0.005

12.3 Body Worn SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS(2 Tx slots)	Front	1	Main	128	824.2	30.35	30.50	1.035	-0.02	0.390	0.404
#13	GSM850	GPRS(2 Tx slots)	Back	1	Main	128	824.2	30.35	30.50	1.035	-0.07	0.484	0.501
	GSM1900	GPRS(2 Tx slots)	Front	1	Main	512	1850.2	27.16	27.50	1.081	-0.08	0.403	0.436
#14	GSM1900	GPRS(2 Tx slots)	Back	1	Main	512	1850.2	27.16	27.50	1.081	-0.14	0.763	0.825
	GSM1900	GPRS(2 Tx slots)	Back	1	Main	661	1880	27.00	27.50	1.122	0.03	0.708	0.794
	GSM1900	GPRS(2 Tx slots)	Back	1	Main	810	1909.8	26.84	27.50	1.164	-0.03	0.685	0.797
	GSM1900	GPRS(2 Tx slots)	Front	1	Second	512	1850.2	27.42	27.50	1.019	0.02	0.270	0.275
#15	GSM1900	GPRS(2 Tx slots)	Back	1	Second	512	1850.2	27.42	27.50	1.019	-0.09	0.313	0.319

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Front	1	Main	4132	826.4	22.43	23.00	1.140	-0.06	0.153	0.174
#16	WCDMA V	RMC 12.2Kbps	Back	1	Main	4132	826.4	22.43	23.00	1.140	-0.01	0.298	0.340
	WCDMA II	RMC 12.2Kbps	Front	1	Main	9262	1852.4	21.32	21.40	1.019	-0.02	0.483	0.492
#17	WCDMA II	RMC 12.2Kbps	Back	1	Main	9262	1852.4	21.32	21.40	1.019	0.01	0.776	0.790

<CDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	CDMA2000 BC0	1xRTT RC3 SO32	Front	1	Main	1013	824.7	24.37	25.00	1.156	0.09	0.295	0.341
#18	CDMA2000 BC0	1xRTT RC3 SO32	Back	1	Main	1013	824.7	24.37	25.00	1.156	-0.05	0.515	0.595
	CDMA2000 BC0	RETAP 4096 bits	Back	1	Main	1013	824.7	23.75	24.00	1.059	-0.02	0.424	0.449

<WLAN SAR DTS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 2.4GHz	802.11b 1Mbps	Front	1	11	2462	14.48	15.00	1.127	-0.08	0.00859	0.010
#19	WLAN 2.4GHz	802.11b 1Mbps	Back	1	11	2462	14.48	15.00	1.127	-0.06	0.058	0.065
	WLAN 5.8GHz	802.11a 6Mbps	Front	1	149	5745	12.71	13.00	1.069	0.09	0.000507	0.001
#20	WLAN 5.8GHz	802.11a 6Mbps	Back	1	149	5745	12.71	13.00	1.069	0.02	0.017	0.018

<WLAN SAR NII>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.2GHz	802.11a 6Mbps	Front	1	48	5240	12.69	13.00	1.074	0.03	0.00469	0.005
#22	WLAN 5.2GHz	802.11a 6Mbps	Back	1	48	5240	12.69	13.00	1.074	0.05	0.063	0.068
	WLAN 5.3GHz	802.11a 6Mbps	Front	1	60	5300	12.16	13.00	1.213	-0.01	0.00285	0.003
#23	WLAN 5.3GHz	802.11a 6Mbps	Back	1	60	5300	12.16	13.00	1.213	-0.09	0.035	0.042
	WLAN 5.5GHz	802.11a 6Mbps	Front	1	108	5540	12.72	13.00	1.067	-0.09	0.0000809	<0.001
#24	WLAN 5.5GHz	802.11a 6Mbps	Back	1	108	5540	12.72	13.00	1.067	0.05	0.00533	0.006

<Bluetooth SAR DSS>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps DH5	Front	1	0	2402	10.98	11.50	1.127	-0.01	0.00162	0.002
#21	Bluetooth	1Mbps DH5	Back	1	0	2402	10.98	11.50	1.127	-0.01	0.016	0.018

12.4 Repeated SAR Measurement

No.	Band	Mode	Test Position	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
03	GSM1900	GPRS(2 Tx slots)	Left Cheek	Second	512	1850.2	27.42	27.50	1.019	0.02	0.917	-	0.934
2nd	GSM1900	GPRS(2 Tx slots)	Left Cheek	Second	512	1850.2	27.42	27.50	1.019	-0.03	0.916	1.01	0.933

Note:

1. Per KDB 865664 D01v01r02, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r02, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the largest SAR to the smallest SAR among original and repeated measurement.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

13. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Head	Body-worn	Wireless Router
1.	GSM 850 / 1900 Voice + 2.4GHz WLAN	Yes	Yes	
2.	GSM 850 / 1900 Voice + Bluetooth	Yes	Yes	
3.	GSM 850 / 1900 Voice + 5GHz WLAN	Yes	Yes	
4.	GPRS 850 / 1900 data + 2.4GHz WLAN	Yes	Yes	Yes
5.	GPRS 850 / 1900 data + Bluetooth	Yes	Yes	Yes
6.	GPRS 850 / 1900 data + 5.8GHz WLAN	Yes	Yes	Yes
7.	UMTS 850 / 1900 Voice + 2.4GHz WLAN	Yes	Yes	
8.	UMTS 850 / 1900 Voice + Bluetooth	Yes	Yes	
9.	UMTS 850 / 1900 Voice + 5GHz WLAN	Yes	Yes	
10.	UMTS 850 / 1900 data + 2.4GHz WLAN	Yes	Yes	Yes
11.	UMTS 850 / 1900 data + Bluetooth	Yes	Yes	Yes
12.	UMTS 850 / 1900 data + 5.8GHz WLAN	Yes	Yes	Yes
13.	CDMA BC0 Voice + 2.4GHz WLAN	Yes	Yes	
14.	CDMA BC0 Voice + Bluetooth	Yes	Yes	
15.	CDMA BC0 Voice + 5GHz WLAN	Yes	Yes	
16.	CDMA BC0 data + 2.4GHz WLAN	Yes	Yes	Yes
17.	CDMA BC0 data + Bluetooth	Yes	Yes	Yes
18.	CDMA BC0 data + 5.8GHz WLAN	Yes	Yes	Yes
19.	GSM 850 / 1900 Voice + GPRS1900 data	Yes	Yes	
20.	GSM 850 / 1900 Voice + GPRS1900 data + 2.4GHz WLAN	Yes	Yes	
21.	GSM 850 / 1900 Voice + GPRS1900 data + Bluetooth	Yes	Yes	
22.	GSM 850 / 1900 Voice + GPRS1900 data + 5.8GHz WLAN	Yes	Yes	
23.	GPRS 850 / 1900 data + GSM 1900 Voice	Yes	Yes	
24.	GPRS 850 / 1900 data + GSM 1900 Voice + 2.4GHz WLAN	Yes	Yes	
25.	GPRS 850 / 1900 data + GSM 1900 Voice + Bluetooth	Yes	Yes	
26.	GPRS 850 / 1900 data + GSM 1900 Voice + 5.8GHz WLAN	Yes	Yes	
27.	UMTS 850 / 1900 Voice + GPRS1900 data	Yes	Yes	
28.	UMTS 850 / 1900 Voice + GPRS1900 data + 2.4GHz WLAN	Yes	Yes	
29.	UMTS 850 / 1900 Voice + GPRS1900 data + Bluetooth	Yes	Yes	
30.	UMTS 850 / 1900 Voice + GPRS1900 data + 5.8GHz WLAN	Yes	Yes	
31.	UMTS 850 / 1900 data + GSM 1900 Voice	Yes	Yes	
32.	UMTS 850 / 1900 data + GSM 1900 Voice + 2.4GHz WLAN	Yes	Yes	
33.	UMTS 850 / 1900 data + GSM 1900 Voice + Bluetooth	Yes	Yes	
34.	UMTS 850 / 1900 data + GSM 1900 Voice + 5.8GHz WLAN	Yes	Yes	
35.	CDMA BC0 Voice + GPRS1900 data	Yes	Yes	
36.	CDMA BC0 Voice + GPRS1900 data + 2.4GHz WLAN	Yes	Yes	
37.	CDMA BC0 Voice + GPRS1900 data + Bluetooth	Yes	Yes	
38.	CDMA BC0 Voice + GPRS1900 data + 5GHz WLAN	Yes	Yes	
39.	CDMA BC0 data + GSM 1900 Voice	Yes	Yes	
40.	CDMA BC0 data + GSM 1900 Voice + 2.4GHz WLAN	Yes	Yes	
41.	CDMA BC0 data + GSM 1900 Voice + Bluetooth	Yes	Yes	
42.	CDMA BC0 data + GSM 1900 Voice + 5.8GHz WLAN	Yes	Yes	

Note:

1. This device supported VoIP in GSM, CDMA, WCDMA (e.g. 3rd party VoIP).
2. This device 2.4GHz WLAN supports Hotspot operation, and 2.4GHz / 5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.2GHz / 5.3GHz / 5.5GHz supports WiFi Direct (GC only).
3. This supports dual SIM dual active, the SIM1 for the main antenna supports GSM850 / 1900, CDMA BC0, UMTS Band 2 / 5, the SIM2 for the second antenna supports GSM1900 only, the WWAN radio can simultaneous transmission at the same time.
4. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
5. The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WiFi Direct and Hotspot capability. Therefore, for head and body-worn exposure position, the following summations represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.
6. The Scaled SAR summation is calculated based on the same configuration and test position.
7. Per KDB 447498 D01v05r01, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) 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

13.1 Head Exposure Conditions

<WWAN Main + WWAN Second + WLAN DTS>

	WWAN Main		WWAN Second		WLAN DTS		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Right Cheek	GSM850	0.277	GSM1900	0.667	2.4GHz Band	0.018	**0.96**
	GSM1900	0.155	GSM1900	0.667	2.4GHz Band	0.018	**0.84**
	WCDMA V	0.189	GSM1900	0.667	2.4GHz Band	0.018	**0.87**
	WCDMA II	0.130	GSM1900	0.667	2.4GHz Band	0.018	**0.82**
	CDMA2000 BC0	0.288	GSM1900	0.667	2.4GHz Band	0.018	**0.97**
Right Tilted	GSM850	0.230	GSM1900	0.707	2.4GHz Band	0.011	**0.95**
	GSM1900	0.071	GSM1900	0.707	2.4GHz Band	0.011	**0.79**
	WCDMA V	0.130	GSM1900	0.707	2.4GHz Band	0.011	**0.85**
	WCDMA II	0.062	GSM1900	0.707	2.4GHz Band	0.011	**0.78**
	CDMA2000 BC0	0.191	GSM1900	0.707	2.4GHz Band	0.011	**0.91**
Left Cheek	GSM850	0.269	GSM1900	0.934	2.4GHz Band	0.037	**1.24**
	GSM1900	0.201	GSM1900	0.934	2.4GHz Band	0.037	**1.17**
	WCDMA V	0.204	GSM1900	0.934	2.4GHz Band	0.037	**1.18**
	WCDMA II	0.188	GSM1900	0.934	2.4GHz Band	0.037	**1.16**
	CDMA2000 BC0	0.258	GSM1900	0.934	2.4GHz Band	0.037	**1.23**
Left Tilted	GSM850	0.231	GSM1900	0.875	2.4GHz Band	0.017	**1.12**
	GSM1900	0.068	GSM1900	0.875	2.4GHz Band	0.017	**0.96**
	WCDMA V	0.112	GSM1900	0.875	2.4GHz Band	0.017	**1.00**
	WCDMA II	0.056	GSM1900	0.875	2.4GHz Band	0.017	**0.95**
	CDMA2000 BC0	0.170	GSM1900	0.875	2.4GHz Band	0.017	**1.06**

<WWAN Main + WWAN Second + WLAN NII>

	WWAN Main		WWAN Second		WLAN NII		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Right Cheek	GSM850	0.277	GSM1900	0.667	5.2GHz Band	0.018	**0.96**
	GSM1900	0.155	GSM1900	0.667	5.2GHz Band	0.018	**0.84**
	WCDMA V	0.189	GSM1900	0.667	5.2GHz Band	0.018	**0.87**
	WCDMA II	0.130	GSM1900	0.667	5.2GHz Band	0.018	**0.82**
	CDMA2000 BC0	0.288	GSM1900	0.667	5.2GHz Band	0.018	**0.97**
Right Tilted	GSM850	0.230	GSM1900	0.707	5.2GHz Band	0.023	**0.96**
	GSM1900	0.071	GSM1900	0.707	5.2GHz Band	0.023	**0.80**
	WCDMA V	0.130	GSM1900	0.707	5.2GHz Band	0.023	**0.86**
	WCDMA II	0.062	GSM1900	0.707	5.2GHz Band	0.023	**0.79**
	CDMA2000 BC0	0.191	GSM1900	0.707	5.2GHz Band	0.023	**0.92**
Left Cheek	GSM850	0.269	GSM1900	0.934	5.2GHz Band	0.042	**1.25**
	GSM1900	0.201	GSM1900	0.934	5.2GHz Band	0.042	**1.18**
	WCDMA V	0.204	GSM1900	0.934	5.2GHz Band	0.042	**1.18**
	WCDMA II	0.188	GSM1900	0.934	5.2GHz Band	0.042	**1.16**
	CDMA2000 BC0	0.258	GSM1900	0.934	5.2GHz Band	0.042	**1.23**
Left Tilted	GSM850	0.231	GSM1900	0.875	5.2GHz Band	0.016	**1.12**
	GSM1900	0.068	GSM1900	0.875	5.2GHz Band	0.016	**0.96**
	WCDMA V	0.112	GSM1900	0.875	5.2GHz Band	0.016	**1.00**
	WCDMA II	0.056	GSM1900	0.875	5.2GHz Band	0.016	**0.95**
	CDMA2000 BC0	0.170	GSM1900	0.875	5.2GHz Band	0.016	**1.06**

<WWAN Main + WWAN Second + Bluetooth DSS>

	WWAN Main		WWAN Second		2.4GHz Bluetooth	**Summed SAR (W/kg)**
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Right Cheek	GSM850	0.277	GSM1900	0.667	0.007	**0.95**
	GSM1900	0.155	GSM1900	0.667	0.007	**0.83**
	WCDMA V	0.189	GSM1900	0.667	0.007	**0.86**
	WCDMA II	0.130	GSM1900	0.667	0.007	**0.80**
	CDMA2000 BC0	0.288	GSM1900	0.667	0.007	**0.96**
Right Tilted	GSM850	0.230	GSM1900	0.707	0.005	**0.94**
	GSM1900	0.071	GSM1900	0.707	0.005	**0.78**
	WCDMA V	0.130	GSM1900	0.707	0.005	**0.84**
	WCDMA II	0.062	GSM1900	0.707	0.005	**0.77**
	CDMA2000 BC0	0.191	GSM1900	0.707	0.005	**0.90**
Left Cheek	GSM850	0.269	GSM1900	0.934	0.016	**1.22**
	GSM1900	0.201	GSM1900	0.934	0.016	**1.15**
	WCDMA V	0.204	GSM1900	0.934	0.016	**1.15**
	WCDMA II	0.188	GSM1900	0.934	0.016	**1.14**
	CDMA2000 BC0	0.258	GSM1900	0.934	0.016	**1.21**
Left Tilted	GSM850	0.231	GSM1900	0.875	0.009	**1.12**
	GSM1900	0.068	GSM1900	0.875	0.009	**0.95**
	WCDMA V	0.112	GSM1900	0.875	0.009	**1.00**
	WCDMA II	0.056	GSM1900	0.875	0.009	**0.94**
	CDMA2000 BC0	0.170	GSM1900	0.875	0.009	**1.05**

13.2 Hotspot Exposure Conditions

<WWAN Main + WLAN DTS>

	WWAN Main		WLAN DTS		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Front	GSM850	0.404	2.4GHz Band	0.010	**0.41**
	GSM1900	0.436	2.4GHz Band	0.010	**0.45**
	WCDMA V	0.174	2.4GHz Band	0.010	**0.18**
	WCDMA II	0.492	2.4GHz Band	0.010	**0.50**
	CDMA2000 BC0	0.341	2.4GHz Band	0.010	**0.35**
Back	GSM850	0.501	2.4GHz Band	0.065	**0.57**
	GSM1900	0.825	2.4GHz Band	0.065	**0.89**
	WCDMA V	0.340	2.4GHz Band	0.065	**0.41**
	WCDMA II	0.790	2.4GHz Band	0.065	**0.86**
	CDMA2000 BC0	0.595	2.4GHz Band	0.065	**0.66**
Left Side	GSM850	0.396			**0.40**
	GSM1900	0.137			**0.14**
	WCDMA V	0.260			**0.26**
	WCDMA II	0.120			**0.12**
	CDMA2000 BC0	0.430			**0.43**
Right Side	GSM850	0.383	2.4GHz Band	0.032	**0.42**
	GSM1900	0.044	2.4GHz Band	0.032	**0.08**
	WCDMA V	0.221	2.4GHz Band	0.032	**0.25**
	WCDMA II	0.044	2.4GHz Band	0.032	**0.08**
	CDMA2000 BC0	0.435	2.4GHz Band	0.032	**0.47**
Top Side	GSM850				**0.00**
	GSM1900				**0.00**
	WCDMA V				**0.00**
	WCDMA II				**0.00**
	CDMA2000 BC0				**0.00**
Bottom Side	GSM850	0.023			**0.02**
	GSM1900	0.822			**0.82**
	WCDMA V	0.032			**0.03**
	WCDMA II	0.707			**0.71**
	CDMA2000 BC0	0.038			**0.04**

<WWAN Second + WLAN DTS>

	WWAN Second		WLAN DTS		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Front	GSM1900	0.275	2.4GHz Band	0.010	**0.29**
Back	GSM1900	0.319	2.4GHz Band	0.065	**0.38**
Left Side	GSM1900				**0.00**
Right Side	GSM1900	0.123	2.4GHz Band	0.032	**0.16**
Top Side	GSM1900	0.256			**0.26**
Bottom Side	GSM1900				**0.00**

<WWAN Main + Bluetooth DSS>

	WWAN Main		2.4GHz Bluetooth	Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Front	GSM850	0.404	0.002	**0.41**
	GSM1900	0.436	0.002	**0.44**
	WCDMA V	0.174	0.002	**0.18**
	WCDMA II	0.492	0.002	**0.49**
	CDMA2000 BC0	0.341	0.002	**0.34**
Back	GSM850	0.501	0.018	**0.52**
	GSM1900	0.825	0.018	**0.84**
	WCDMA V	0.340	0.018	**0.36**
	WCDMA II	0.790	0.018	**0.81**
	CDMA2000 BC0	0.595	0.018	**0.61**
Left Side	GSM850	0.396		**0.40**
	GSM1900	0.137		**0.14**
	WCDMA V	0.260		**0.26**
	WCDMA II	0.120		**0.12**
	CDMA2000 BC0	0.430		**0.43**
Right Side	GSM850	0.383	0.005	**0.39**
	GSM1900	0.044	0.005	**0.05**
	WCDMA V	0.221	0.005	**0.23**
	WCDMA II	0.044	0.005	**0.05**
	CDMA2000 BC0	0.435	0.005	**0.44**
Top Side	GSM850			**0.00**
	GSM1900			**0.00**
	WCDMA V			**0.00**
	WCDMA II			**0.00**
	CDMA2000 BC0			**0.00**
Bottom Side	GSM850	0.023		**0.02**
	GSM1900	0.822		**0.82**
	WCDMA V	0.032		**0.03**
	WCDMA II	0.707		**0.71**
	CDMA2000 BC0	0.038		**0.04**

<WWAN Second + Bluetooth DSS>

	WWAN Second		2.4GHz Bluetooth	Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Front	GSM1900	0.275	0.002	**0.28**
Back	GSM1900	0.319	0.018	**0.34**
Left Side	GSM1900			**0.00**
Right Side	GSM1900	0.123	0.005	**0.13**
Top Side	GSM1900	0.256		**0.26**
Bottom Side	GSM1900			**0.00**

13.3 Body-Worn Exposure Conditions

<WWAN Main + WWAN Second + WLAN DTS>

	WWAN Master		WWAN Second		WLAN DTS		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Front	GSM850	0.404	GSM1900	0.275	2.4GHz Band	0.010	**0.69**
	GSM1900	0.436	GSM1900	0.275	2.4GHz Band	0.010	**0.72**
	WCDMA V	0.174	GSM1900	0.275	2.4GHz Band	0.010	**0.46**
	WCDMA II	0.492	GSM1900	0.275	2.4GHz Band	0.010	**0.78**
	CDMA2000 BC0	0.341	GSM1900	0.275	2.4GHz Band	0.010	**0.63**
Back	GSM850	0.501	GSM1900	0.319	2.4GHz Band	0.065	**0.89**
	GSM1900	0.825	GSM1900	0.319	2.4GHz Band	0.065	**1.21**
	WCDMA V	0.340	GSM1900	0.319	2.4GHz Band	0.065	**0.72**
	WCDMA II	0.790	GSM1900	0.319	2.4GHz Band	0.065	**1.17**
	CDMA2000 BC0	0.595	GSM1900	0.319	2.4GHz Band	0.065	**0.98**

<WWAN Main + WWAN Second + WLAN NII>

	WWAN Master		WWAN Second		WLAN NII		Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	WLAN Band	SAR (W/kg)	
Front	GSM850	0.404	GSM1900	0.275	5.2GHz Band	0.005	**0.68**
	GSM1900	0.436	GSM1900	0.275	5.2GHz Band	0.005	**0.72**
	WCDMA V	0.174	GSM1900	0.275	5.2GHz Band	0.005	**0.45**
	WCDMA II	0.492	GSM1900	0.275	5.2GHz Band	0.005	**0.77**
	CDMA2000 BC0	0.341	GSM1900	0.275	5.2GHz Band	0.005	**0.62**
Back	GSM850	0.501	GSM1900	0.319	5.2GHz Band	0.068	**0.89**
	GSM1900	0.825	GSM1900	0.319	5.2GHz Band	0.068	**1.21**
	WCDMA V	0.340	GSM1900	0.319	5.2GHz Band	0.068	**0.73**
	WCDMA II	0.790	GSM1900	0.319	5.2GHz Band	0.068	**1.18**
	CDMA2000 BC0	0.595	GSM1900	0.319	5.2GHz Band	0.068	**0.98**

<WWAN Main + WWAN Second + Bluetooth DSS>

	WWAN Master		WWAN Second		2.4GHz Bluetooth	Summed SAR (W/kg)
Position	WWAN Band	SAR (W/kg)	WWAN Band	SAR (W/kg)	SAR (W/kg)	
Front	GSM850	0.404	GSM1900	0.275	0.002	**0.68**
	GSM1900	0.436	GSM1900	0.275	0.002	**0.71**
	WCDMA V	0.174	GSM1900	0.275	0.002	**0.45**
	WCDMA II	0.492	GSM1900	0.275	0.002	**0.77**
	CDMA2000 BC0	0.341	GSM1900	0.275	0.002	**0.62**
Back	GSM850	0.501	GSM1900	0.319	0.018	**0.84**
	GSM1900	0.825	GSM1900	0.319	0.018	**1.16**
	WCDMA V	0.340	GSM1900	0.319	0.018	**0.68**
	WCDMA II	0.790	GSM1900	0.319	0.018	**1.13**
	CDMA2000 BC0	0.595	GSM1900	0.319	0.018	**0.93**

Test Engineer : Luke Lu

14. 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 14.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor(a)	1/k(b)	1/√3	1/√6	1/√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 14.1. 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 14.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

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 14.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

15. References

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

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

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

[4] SPEAG DASY System Handbook

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

[6] FCC KDB 447498 D01 v05r01, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, May 2013

[7] FCC KDB 648474 D04 v01r01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013

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

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

[10] FCC KDB 941225 D02 v02r02, “SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced”, May 2013.

[11] FCC KDB 941225 D06 v01r01, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", May 2013

[12] FCC KDB 865664 D01 v01r02, "SAR Measurement Requirements for 100 MHz to 6 GHz", Dec 2013.

[13] April 2013 TCB workshop notes (1x Advanced)

[14] October 2013 TCB workshop notes (GSM/GPRS/EDGE SAR testing criteria)

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.