FCC SAR Test Report

APPLICANT	**:**	**LG ELECTRONICS MOBILECOMM U.S.A., INC.**
EQUIPMENT	**:**	**GSM/WCDMA TRI-BAND PHONE WITH BT, WLAN, AND NFC**
BRAND NAME	**:**	**LG**
MODEL NAME	**:**	**LG-E960, E960, LGE960**
MARKETING NAME	**:**	**LG-E960**
FCC ID	**:**	**ZNFE960**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2003** **FCC OET Bulletin 65 Supplement C (Edition 01-01)**

The product was completely tested on Sep. 11, 2012. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

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

Reviewed by:

Jones Tsai / Manager

ilac-MRA

TAF Testing Laboratory 1190

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA291007	Rev. 01	Initial issue of report	Sep. 28, 2012
FA291007	Rev. 02	1. 5GHz Hotspot SAR test data removal 2. 10-g SAR test data included.	Sep. 29, 2012

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **LG ELECTRONICS MOBILECOMM U.S.A., INC. GSM/WCDMA TRI-BAND PHONE WITH BT, WLAN, AND NFC LG LG-E960, E960, LGE960 LG-E960** are as follows.

<Standalone SAR>

Band	Position	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
GSM850	Head	0.394	0.308
GSM1900	Head	0.265	0.157
WCDMA Band V	Head	0.316	0.246
WCDMA Band IV	Head	0.561	0.36
WCDMA Band II	Head	0.324	0.195
WLAN 2.4G	Head	0.18	0.086
WLAN 5G	Head	0.175	0.057
GSM850	Hotspot (1 cm Gap)	0.87	0.683
GSM1900	Hotspot (1 cm Gap)	1.1	0.521
WCDMA Band V	Hotspot (1 cm Gap)	0.653	0.509
WCDMA Band IV	Hotspot (1 cm Gap)	0.98	0.58
WCDMA Band II	Hotspot (1 cm Gap)	1.25	0.607
WLAN 2.4G	Hotspot (1 cm Gap)	0.189	0.089
GSM850	Body-worn (1 cm Gap)	0.87	0.683
GSM1900	Body-worn (1 cm Gap)	1.1	0.521
WCDMA Band V	Body-worn (1 cm Gap)	0.653	0.509
WCDMA Band IV	Body-worn (1 cm Gap)	0.98	0.58
WCDMA Band II	Body-worn (1 cm Gap)	1.25	0.607
WLAN 2.4G	Body-worn (1 cm Gap)	0.231	0.109
WLAN 5G	Body-worn (1 cm Gap)	0.234	0.076

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003 and FCC OET Bulletin 65 Supplement C (Edition 01-01).

2. Administration Data

2.1 Testing Laboratory

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

2.2 Applicant

Company Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.
Address	1000 SYLVAN AVENU ENGLEWOOD CLIFFS, NEW JERSEY 07632

2.3 Manufacturer

Company Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.
Address	1000 SYLVAN AVENU ENGLEWOOD CLIFFS, NEW JERSEY 07632

2.4 Application Details

Date of Start during the Test	Sep. 10, 2012
Date of End during the Test	Sep. 11, 2012

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	GSM/WCDMA TRI-BAND PHONE WITH BT, WLAN, AND NFC
Brand Name	LG
Model Name	LG-E960, E960, LGE960
Marketing Name	LG-E960
FCC ID	ZNFE960
IMEI Code	WWAN Main: 353918050011747 WLAN: 353918050011770 & 353918050011796
Tx Frequency	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.5 MHz WLAN2.4G: 2412 MHz ~ 2462 MHz WLAN5G: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz; 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Maximum Average Output Power to Antenna	GSM850: 33.64 dBm GSM1900: 30.18 dBm WCDMA Band V: 23.65 dBm WCDMA Band II: 23.55 dBm WCDMA Band IV: 23.59 dBm 802.11b: 15.77 dBm 802.11g: 12.09 dBm 802.11n-HT20 (2.4GHz) : 11.08 dBm 802.11a: 13.00 dBm 802.11n-HT20 (5GHz) : 11.96 dBm Bluetooth: 7.27 dBm
Antenna Type	WWAN: PIFA Antenna WLAN: FPCB Antenna Bluetooth: FPCB Antenna NFC: FPCB Antenna

Product Feature & Specification	
Uplink Modulations	GSM: GMSK GPRS: GMSK EDGE: GMSK / 8PSK WCDMA (Rel 99): QPSK HSDPA (Rel 5): QPSK HSUPA (Rel 6): QPSK DC-HSDPA (Rel 8): QPSK only 802.11b: DSSS (BPSK / QPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth: GFSK Bluetooth EDR: π/4-DQPSK / 8-DPSK Bluetooth 4.0 LE: GFSK NFC: ASK
Dual Transfer Mode (DTM) Category	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Production Unit
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. 5600 MHz ~ 5650 MHz is notched. 3. The model names (E960, LGE960, LG-E960) are identical on hardware. The only difference is the label of different branding for different customer.	

3.2 Applied Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v04
- FCC KDB 648474 D01 v01r05
- FCC KDB 941225 D01 v02
- FCC KDB 941225 D03 v01
- FCC KDB 941225 D06 v01
- FCC KDB 248227 D01 v01r02

3.3 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.

3.4 Test Conditions

3.4.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.4.2 Test Configuration

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

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

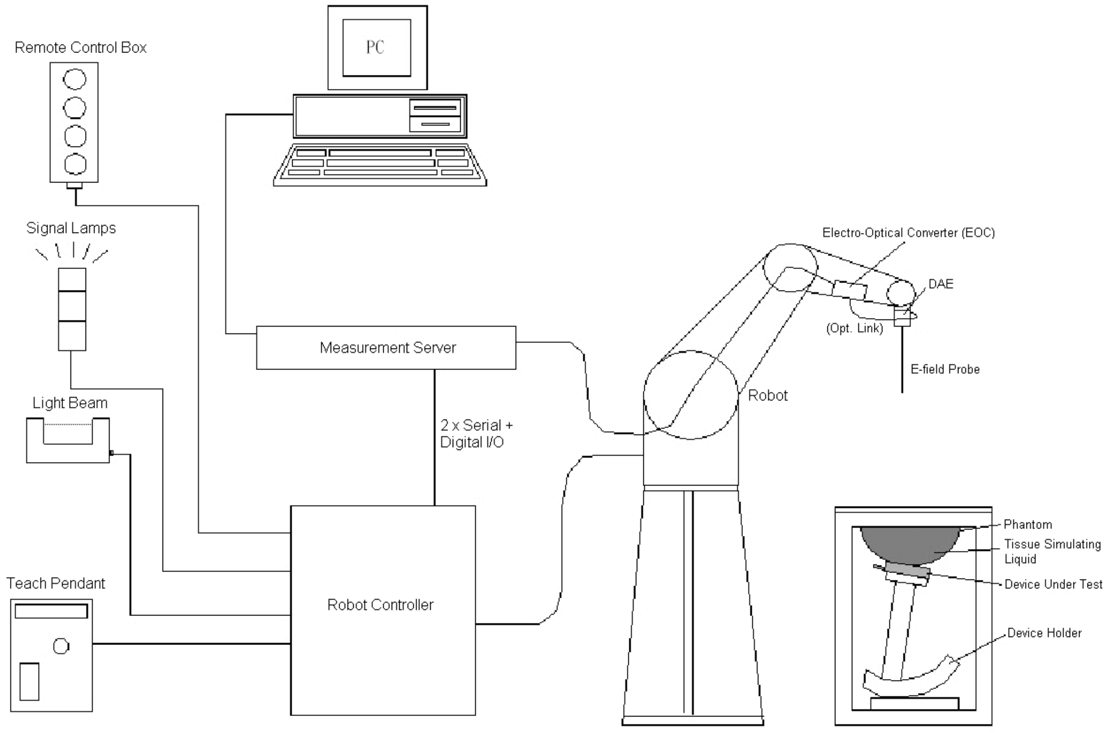


Fig 5.1 SPEAG DASY System Configurations

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

<ET3DV6 / ET3DV6R Probe >

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

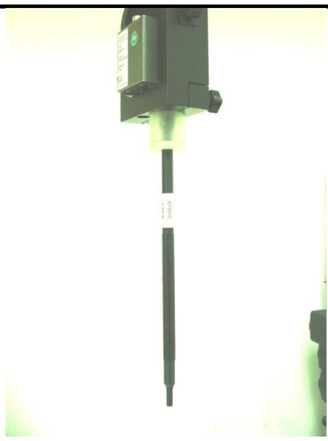


Fig 5.2 Photo of ET3DV6/ET3DV6

<EX3DV4 / ES3DV4 Probe>

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

Fig 5.3 Photo of EX3DV4/ES3DV4

5.1.2 E-Field Probe Calibration

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

5.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.4 Photo of DAE

5.3 Robot

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

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

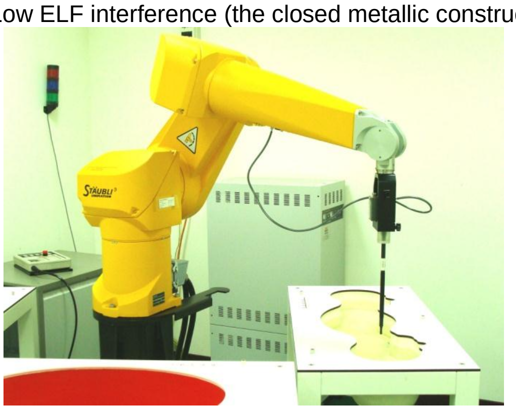


Fig 5.5 Photo of DASY4

Fig 5.6 Photo of DASY5

5.4 Measurement Server

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

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

Fig 5.7 Photo of Server for DASY4

Fig 5.8 Photo of Server for DASY5

5.5 Phantom

<SAM Twin Phantom>

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

Fig 5.9 Photo of SAM Phantom

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

<ELI4 Phantom>

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

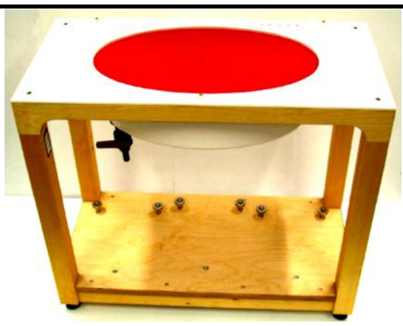


Fig 5.10 Photo of ELI4 Phantom

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

5.6 Device Holder

<Device Holder for SAM Twin Phantom>

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

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (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 5.11 Device Holder

<Laptop Extension Kit>

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

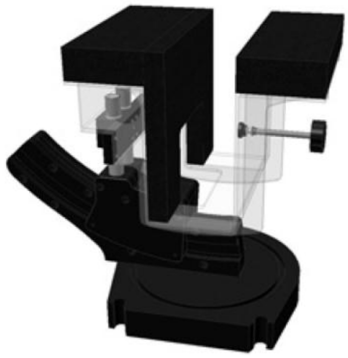


Fig 5.12 Laptop Extension Kit

5.7 Data Storage and Evaluation

5.7.1 Data Storage

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

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

5.7.2 Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software：

Probe parameters：	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters：	- Frequency	f
	- Crest factor	cf
Media parameters：	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as：

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

with V_i = compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated：

E-field Probes：$\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

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

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

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

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

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

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

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

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

5.8 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 22, 2010	Mar. 21, 2013
SPEAG	1750MHz System Validation Kit	D1750V2	1023	Jun. 20, 2012	Jun. 19, 2013
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 23, 2010	Mar. 22, 2013
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2013
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Jan. 18, 2012	Jan. 17, 2013
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 27, 2012	Aug. 26, 2013
SPEAG	Data Acquisition Electronics	DAE3	495	Apr. 23, 2012	Apr. 22, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3792	Jun. 21, 2012	Jun. 20, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3819	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	ETP-101	N/A	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	HTC-1	N/A	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	HTC-1	N/A	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	NA	N/A	Nov. 16, 2011	Nov. 15, 2012
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1303	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1383	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1446	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 C	TP-1478	NCR	NCR
SPEAG	SAM Phantom	QD 000 P41 C	TP-1150	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 CD	TP-1644	NCR	NCR
SPEAG	SAM Phantom	SM 000 T01 DA	TP-1542	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BB	1026	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BA	1029	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 002 AA	TP-1127	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 002 AA	TP-1131	NCR	NCR
Agilent	Network Analyzer	E5071C	MY46101588	May 11, 2012	May 10, 2013
Agilent	ESG Vector Series Signal Generator	E4438C	MY49070755	Oct. 17, 2011	Oct. 16, 2012
Anritsu	Power Meter	ML2495A	1132003	Aug. 14, 2012	Aug. 13, 2013
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Dec. 21, 2011	Dec. 20, 2012
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 05, 2012	Jan. 04, 2014
Agilent	Wireless Communication Test Set	E5515C	GB46311322	Mar. 23, 2011	Mar. 22, 2013
Agilent	Wireless Communication Test Set	E5515C	MY50264370	Apr. 19, 2011	Apr. 18, 2013
Agilent	Wireless Communication Test Set	E5515C	MY50266977	Nov. 13, 2011	Nov. 12, 2013
R&S	Universal Digital Radiocommunication Tester	CMU200	106656	Jun. 28, 2012	Jun. 27, 2013
R&S	Spectrum Analyzer	FSP	101131	Jul. 23, 2012	Jul. 22, 2013

Table 5.1 Test Equipment List

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 450824 D02, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole D835V2, SN: 499, D1900V2, SN: 5d041, and D2450V2, SN: 736 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

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.

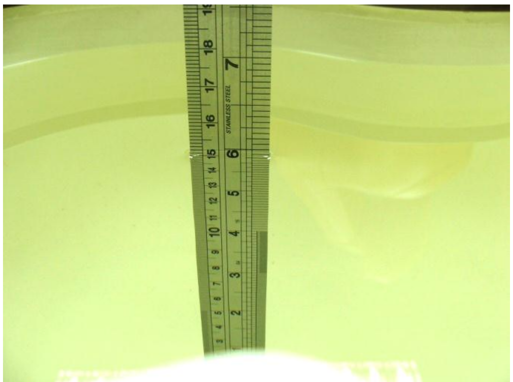


Fig 6.1 Photo of Liquid Height for Head SAR

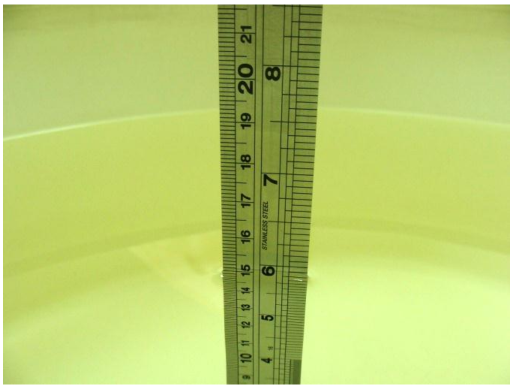


Fig 6.2 Photo of Liquid Height for Body SAR

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								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
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								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Table 6.1 Recipes of Tissue Simulating Liquid

Simulating Liquid for 5G, Manufactured by SPEAG

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

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

The following table shows the measuring results for simulating liquid.

Freq. (MHz)	Liquid Type	Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Head	21.6	0.873	41.054	0.9	41.5	-3.00	-1.07	±5	Sep. 11, 2012
835	Body	21.5	0.963	54.572	0.97	55.2	-0.72	-1.14	±5	Sep. 10, 2012
1750	Head	21.5	1.391	39.773	1.4	40	-0.64	-0.57	±5	Sep. 11, 2012
1750	Body	21.6	1.518	52.095	1.52	53.3	-0.13	-2.26	±5	Sep. 11, 2012
1900	Head	21.5	1.427	39.815	1.4	40	1.93	-0.46	±5	Sep. 11, 2012
1900	Body	21.5	1.523	52.215	1.52	53.3	0.20	-2.04	±5	Sep. 10, 2012
2450	Head	21.5	1.85	39.3	1.80	39.2	2.78	0.26	±5	Sep. 10, 2012
2450	Body	21.5	1.97	53.8	1.95	52.7	1.03	2.09	±5	Sep. 10, 2012
5200	Head	21.7	4.79	35.5	4.66	36.0	2.79	-1.39	±5	Sep. 11, 2012
5200	Body	21.7	5.1	47.5	5.30	49.0	-3.77	-3.06	±5	Sep. 11, 2012
5500	Head	21.7	5.11	35	4.96	35.6	3.02	-1.69	±5	Sep. 11, 2012
5500	Body	21.7	5.47	47	5.65	48.6	-3.19	-3.29	±5	Sep. 11, 2012
5800	Head	21.7	5.39	34.4	5.27	35.3	2.28	-2.55	±5	Sep. 11, 2012
5800	Body	21.7	5.94	46.5	6.00	48.2	-1.00	-3.53	±5	Sep. 11, 2012

Table 6.2 Measuring Results for Simulating Liquid

7. SAR Measurement Evaluation

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

7.1 Purpose of System Performance check

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

7.2 System Setup

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

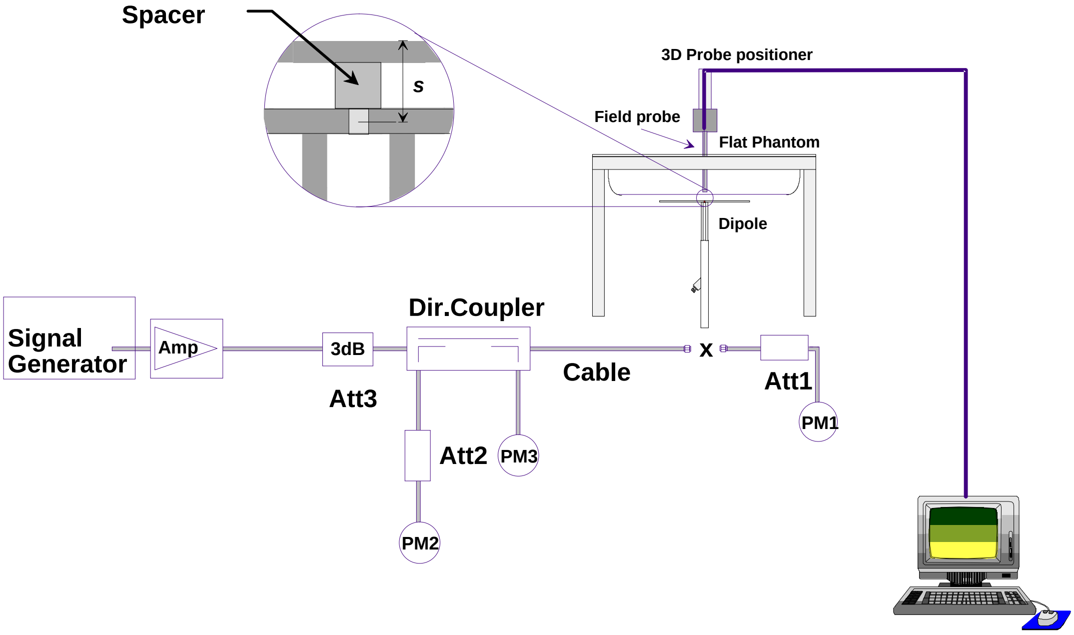


Fig 7.1 System Setup for System Evaluation

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

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

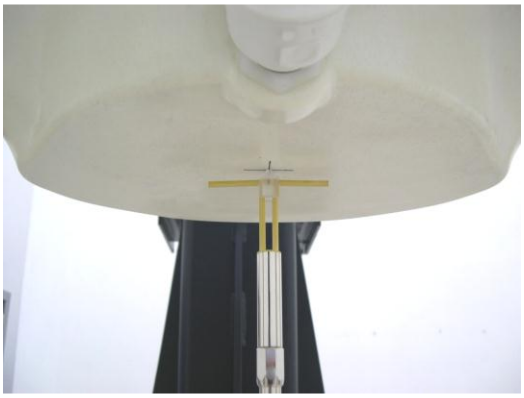


Fig 7.2 Photo of Dipole Setup

7.3 Validation Results

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %. Table 7.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Measurement Date	Frequency (MHz)	Liquid Type	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
Sep. 11, 2012	835	Head	9.71	2.41	9.64	-0.72
Sep. 10, 2012	835	Body	9.82	2.47	9.88	0.61
Sep. 11, 2012	1750	Head	35.8	9.52	38.08	6.37
Sep. 11, 2012	1750	Body	37.00	8.63	34.52	-6.70
Sep. 11, 2012	1900	Head	39.8	9.66	38.64	-2.91
Sep. 10, 2012	1900	Body	40	10.4	41.60	4.00
Sep. 10, 2012	2450	Head	54.8	14.2	56.80	3.65
Sep. 10, 2012	2450	Body	52.3	12.1	48.40	-7.46
Sep. 11, 2012	5200	Head	79.2	21	84.00	6.06
Sep. 11, 2012	5200	Body	72.6	16.9	67.60	-6.89
Sep. 11, 2012	5500	Head	85.2	19.9	79.60	-6.57
Sep. 11, 2012	5500	Body	78.8	18.5	74.00	-6.09
Sep. 11, 2012	5800	Head	79.00	21.2	84.80	7.34
Sep. 11, 2012	5800	Body	73.10	17.3	69.20	-5.34

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

This EUT was tested in ten different positions. They are right cheek, right tilted, left cheek, left tilted, Front of the EUT with phantom 1 cm gap, Back of the EUT with phantom 1 cm gap, Top Side of the EUT with phantom 1 cm gap, Bottom Side of the EUT with phantom 1 cm gap, Right Side of the EUT with phantom 1 cm gap, and Left Side of the EUT with phantom 1 cm gap, as illustrated below:

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.

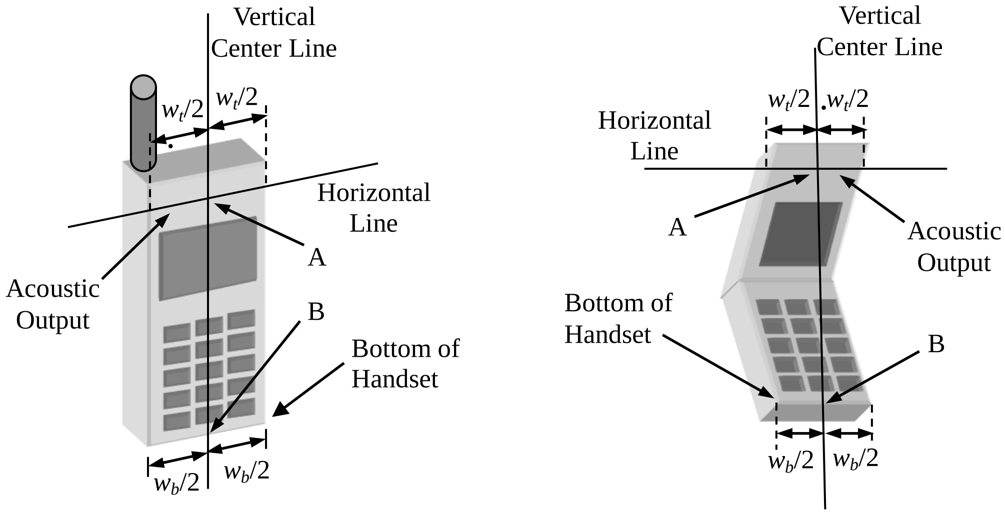


Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines

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. 9.2).

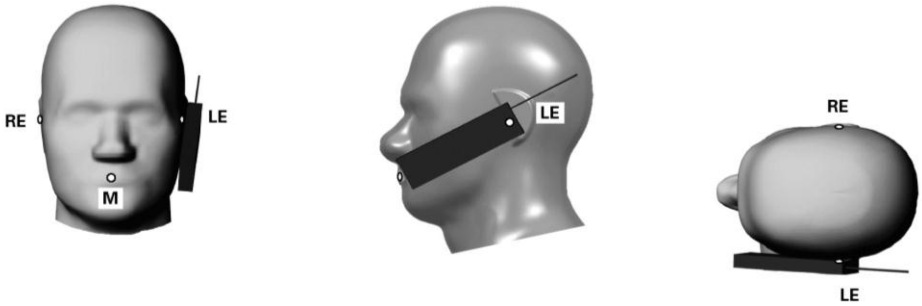


Fig 8.2 Illustration for Cheek Position

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. 9.3).

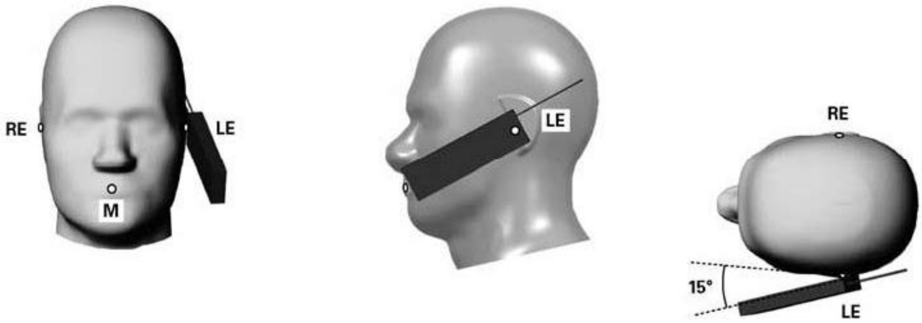


Fig 8.3 Illustration for Tilted Position

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.

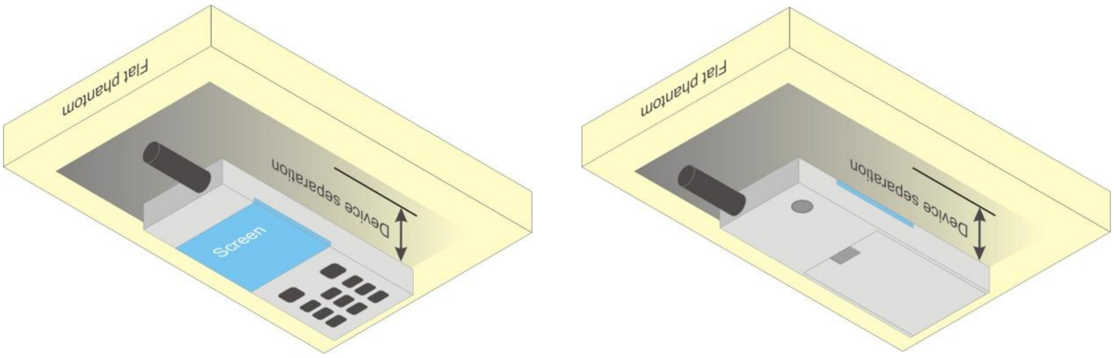


Fig 8.4 Illustration for Body Worn Position

9. Measurement Procedures

The measurement procedures are as follows:

(a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
(b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
(c) Measure output power through RF cable and power meter.
(d) Set scan area, grid size and other setting on the DASY software.
(e) Measure SAR results for the highest power channel on each testing position.
(f) Find out the largest SAR result on these testing positions of each band
(g) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

9.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

9.3 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.4 SAR Averaged Methods

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

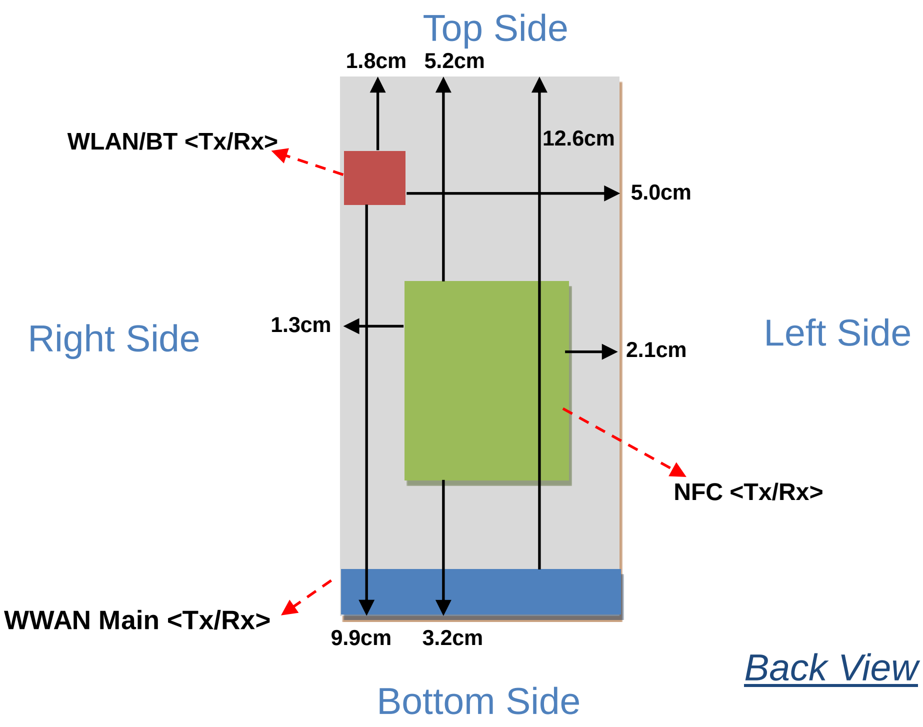
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty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

9.5 Power Drift Monitoring

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

10. SAR Test Configurations

10.1 Exposure Positions Consideration



Antennas	Wireless Interface
WWAN Main Antenna <Tx/Rx>	GSM850/GSM1900 WCDMA Band V WCDMA Band II WCDMA Band IV
BT&WLAN Antenna <Tx/Rx>	WLAN 2.4GHz WLAN 5GHz Bluetooth
NFC <Tx/Rx>	NFC

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

Note:
1. Head/Body-worn/Hotspot mode SAR assessments are required.
2. Referring to KDB 941225 D06, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.
3. For WWAN Main antenna, SAR measurements at Top side is not required since the distance between EUT and flat phantom > 25mm.
4. For BT&WLAN antenna, SAR measurements Bottom and Left side are not required since the distance between EUT and flat phantom > 25mm.

10.2 Conducted RF Output Power (Unit: dBm)

<GSM/GPRS/EDGE>

Burst Average Power						
Band	**GSM850**			**GSM1900**		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**1850.2**	**1880.0**	**1909.8**
GSM (GMSK, 1 Uplink)	33.34	33.51	33.64	30.01	29.87	30.18
GPRS 8 (GMSK, 1 Uplink) – CS1	33.40	33.56	33.58	30.00	29.88	30.17
GPRS 10 (GMSK, 2 Uplink) – CS1	30.75	30.93	30.94	28.08	28.11	28.24
EDGE 8 (8PSK, 1 Uplink) – MCS5	27.52	27.58	27.65	25.42	25.44	25.42
EDGE 10 (8PSK, 2 Uplink) – MCS5	27.44	27.45	27.51	25.25	25.27	25.32

Source-Based Time-Averaged Power						
Band	**GSM850**			**GSM1900**		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
Frequency (MHz)	**824.2**	**836.4**	**848.8**	**1850.2**	**1880.0**	**1909.8**
GSM (GMSK, 1 Uplink)	24.34	24.51	24.64	21.01	20.87	21.18
GPRS 8 (GMSK, 1 Uplink) – CS1	24.40	24.56	24.58	21.00	20.88	21.17
GPRS 10 (GMSK, 2 Uplink) – CS1	24.75	24.93	**24.94**	22.08	22.11	**22.24**
EDGE 8 (8PSK, 1 Uplink) – MCS5	18.52	18.58	18.65	16.42	16.44	16.42
EDGE 10 (8PSK, 2 Uplink) – MCS5	21.44	21.45	21.51	19.25	19.27	19.32

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

Note:

1. Head SAR: GSM Voice mode. Since VOIP is supported, GPRS class 10 Head SAR is also tested
2. Body SAR: GPRS Mode with 2 slots base on highest source base time average power.
3. Per KDB 648474 and 447498, the maximum output power channel is used for SAR testing and for further SAR test reduction.
4. The EUT does not support DTM function.

DC-HSDPA 3GPP Release 8 Setup Configuration

The DC-HSDPA implementation of this device, the uplink parameters are the same as Rel.5 HSDPA. No additional channels and modulations (16QAM, and 64 QAM) are supported in uplink.

The configuration of the fixed reference channels for HSDPA RF tests are described in 3GPP TS34.121, annex C for FDD and 3GPP TS 34.122; fixed reference channel (FRC) H-set 12 with QPSK for DC-HSDPA

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0

Table E.5.0: Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

3GPP TS 34.121 annex C for FDD, describes the configurations of the fixed reference channels for HSDPA RF testing.

C.8.1.12 Fixed Reference Channel Definition H-Set 12

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

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

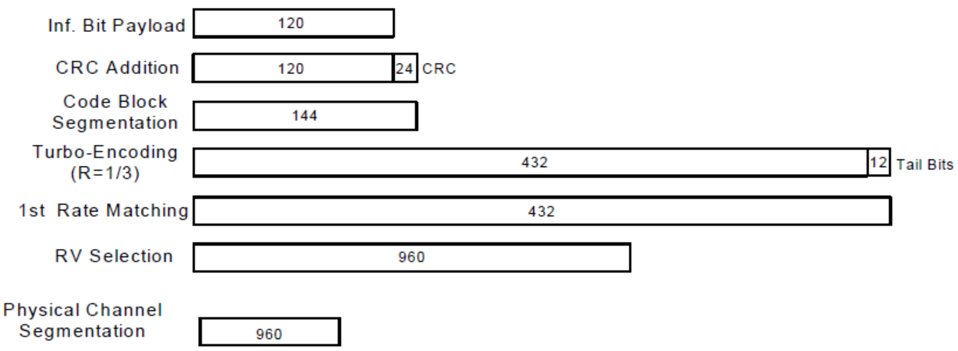


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

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

<WCDMA>

Band		WCDMA Band V			WCDMA Band II			WCDMA Band IV		
Channel		4132	4182	4233	9262	9400	9538	1312	1413	1862
Frequency (MHz)		826.4	836.4	846.6	1852.4	1880.0	1907.6	1712.4	1732.6	1752.5
Rel 99	AMR 12.2K	23.55	23.59	23.49	23.46	23.24	23.27	23.57	23.43	23.50
Rel 99	RMC 12.2K	23.60	23.62	23.65	23.55	23.32	23.29	23.59	23.44	23.55
Rel 5 HSDPA	Subtest-1	23.56	23.64	23.45	23.37	23.26	23.35	23.50	23.44	23.39
Rel 5 HSDPA	Subtest-2	23.61	23.55	23.58	23.39	23.17	23.32	23.42	23.46	23.38
Rel 5 HSDPA	Subtest-3	23.12	23.00	23.01	22.94	22.68	22.71	22.92	22.94	23.05
Rel 5 HSDPA	Subtest-4	23.08	23.04	23.00	22.92	22.55	22.66	22.90	22.92	22.96
Rel 6 HSUPA	Subtest-1	23.40	23.03	22.91	22.75	22.76	23.17	22.85	23.20	22.95
Rel 6 HSUPA	Subtest-2	21.43	21.68	21.66	21.62	21.53	21.18	21.65	21.50	21.67
Rel 6 HSUPA	Subtest-3	22.41	22.50	22.20	22.09	21.78	22.23	22.28	22.23	22.45
Rel 6 HSUPA	Subtest-4	22.29	22.44	22.36	21.22	21.94	21.09	22.37	22.36	22.18
Rel 6 HSUPA	Subtest-5	23.64	23.63	23.56	23.45	23.36	23.39	23.55	23.56	23.54
Rel 8 DC-HSDPA	Subtest-1	23.50	23.53	23.46	23.35	23.15	23.28	23.37	23.49	23.38
Rel 8 DC-HSDPA	Subtest-2	23.48	23.51	23.41	23.31	23.12	23.24	23.25	23.35	23.29
Rel 8 DC-HSDPA	Subtest-3	23.17	23.19	23.04	22.83	22.62	22.72	22.71	22.83	22.73
Rel 8 DC-HSDPA	Subtest-4	23.02	23.06	22.97	22.79	22.57	22.65	22.72	22.82	22.74

MPR (dB)											
3GPP MPR	Subtest		WCDMA Band V			WCDMA Band II			WCDMA Band IV		
0	Rel 5 HSDPA	Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Rel 5 HSDPA	Subtest-2	-0.05	0.09	-0.13	-0.02	0.09	0.03	0.08	-0.02	0.01
≤ 0.5	Rel 5 HSDPA	Subtest-3	0.44	0.64	0.44	0.43	0.58	0.64	0.58	0.50	0.34
≤ 0.5	Rel 5 HSDPA	Subtest-4	0.48	0.60	0.45	0.45	0.71	0.69	0.60	0.52	0.43
0	Rel 6 HSUPA	Subtest-1	0.16	0.57	0.65	0.70	0.60	0.22	0.70	0.36	0.59
≤ 2	Rel 6 HSUPA	Subtest-2	2.13	1.92	1.90	1.83	1.83	2.21	1.90	2.06	1.87
≤ 1	Rel 6 HSUPA	Subtest-3	1.15	1.10	1.36	1.36	1.58	1.16	1.27	1.33	1.09
≤ 2	Rel 6 HSUPA	Subtest-4	1.27	1.16	1.20	1.23	1.42	1.30	1.18	1.20	1.36
0	Rel 6 HSUPA	Subtest-5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Rel 8 DC-HSDPA	Subtest-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	Rel 8 DC-HSDPA	Subtest-2	0.02	0.02	0.05	0.04	0.03	0.04	0.12	0.14	0.09
≤ 0.5	Rel 8 DC-HSDPA	Subtest-3	0.33	0.34	0.42	0.52	0.53	0.56	0.66	0.66	0.65
≤ 0.5	Rel 8 DC-HSDPA	Subtest-4	0.48	0.47	0.49	0.56	0.58	0.63	0.65	0.67	0.64

Note:

1. Applying the subtest setup in Table C.11.1.3 of 3GPP TS 34.121-1 V9.1.0 to Rel. 6 HSPA.
2. For Head SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If AMR 12.2kbps power is < 1/4 dB higher than RMC 12.2kbps, SAR tests with AMR 12.2kbps can be excluded.
3. For Body SAR, per KDB 941225 D01, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 1/4 dB higher than RMC, HSDPA/HSUPA SAR evaluation can be excluded.
4. For devices supporting Rel 8 DC-HSDPA in downlink and Rel 6 HSDPA in uplink , the same test reduction KDB 941225 D01 is followed; if HSDPA output power is < 1/4 dB higher than RMC 12.2kbps, and SAR of RMC 12.2kbps is <1.2W/kg, SAR evaluation of HSDPA is excluded.
5. By design, AMR, HSDPA/HSUPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
6. It is expected by the manufacturer that MPR for some HSDPA/HSUPA subtests may differ from the specification of 3GPP, according to the chipset implementation in this model. The implementation and expected deviation are detailed in tune-up procedure exhibit.

<WLAN 2.4GHz>

Mode	Channel	Frequency (MHz)	Average power (dBm) Data Rate (bps)			
			1M	2M	5.5M	11M
802.11b	CH 01	2412	15.75	15.70	15.77	15.57
	CH 06	2437	15.68	15.68	15.65	15.62
	CH 11	2462	15.64	15.47	15.54	15.33

Mode	Channel	Frequency (MHz)	Average power (dBm) Data Rate (bps)							
			6M	9M	12M	18M	24M	36M	48M	54M
802.11g	CH 01	2412	11.72	12.09	12.01	11.37	11.61	10.84	10.51	10.37
	CH 06	2437	12.00	11.82	11.77	11.86	11.36	11.03	10.67	10.87
	CH 11	2462	11.70	11.89	11.36	11.19	10.97	10.65	10.35	10.22

Mode	Channel	Frequency (MHz)	Average power (dBm) MCS Index							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M	CH 01	2412	10.83	10.36	10.49	9.91	9.67	9.70	9.19	9.12
	CH 06	2437	10.95	10.74	10.59	10.37	10.35	9.75	9.62	9.47
	CH 11	2462	11.08	10.79	10.91	10.42	9.09	9.81	9.62	9.60

Note:

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

<Bluetooth>

Channel	Frequency (MHz)	Average power (dBm)		
		Mode		
		GFSK	π/4-DQPSK	8-DPSK
CH 0	2402	7.27	5.8	6.12
CH 39	2441	5.96	4.46	4.75
CH 78	2480	6.53	5.03	5.35

Channel	Frequency (MHz)	Average power (dBm)
		Mode
		BT 4.0 LE, GFSK
CH 0	2402	3.95
CH 19	2440	2.88
CH 39	2480	3.65

Note: Per KDB 447498, 2.4GHz Bluetooth SAR is excluded due to highest output power ≤ 60/f (GHz) mW, where 60/f (GHz) = 24mW = 13.8dBm.

<WLAN 5GHz>

Mode	Channel	Frequency (MHz)	Average Power (dBm)							
			Data Rate (bps)							
			6M	9M	12M	18M	24M	36M	48M	54M
802.11a	CH 036	5180	13.00	12.73	12.64	12.49	12.33	12.14	11.88	11.75
	CH 040	5200	13.00	13.00	13.00	12.81	12.67	12.05	11.79	11.70
	CH 044	5220	13.00	12.89	12.85	12.37	12.63	12.43	12.12	11.85
	CH 048	5240	13.00	12.70	12.62	12.52	12.37	12.12	11.86	11.77
	CH 052	5260	12.91	12.79	12.72	12.57	12.42	12.15	11.88	11.80
	CH 056	5280	12.70	12.50	12.64	12.29	12.33	11.88	11.35	11.28
	CH 060	5300	12.67	12.50	12.49	12.27	12.17	11.88	11.35	11.18
	CH 064	5320	12.45	12.59	12.44	12.21	11.84	11.47	11.18	11.09
	CH 100	5500	12.93	11.97	11.89	11.71	11.52	11.25	11.00	10.89
	CH 104	5520	12.90	12.50	12.19	12.04	11.57	11.24	11.01	10.83
	CH 108	5540	12.50	12.39	12.50	12.19	11.26	11.00	11.23	11.18
	CH 112	5560	12.50	12.07	12.07	11.97	11.73	11.46	11.23	11.12
	CH 116	5580	12.48	12.40	12.29	12.09	11.57	11.26	11.00	10.88
	CH 132	5660	12.50	12.29	12.40	12.29	11.36	11.20	11.33	11.18
	CH 136	5680	12.50	12.40	12.29	12.19	11.21	11.57	11.10	11.31
	CH 140	5700	12.23	12.19	12.07	11.89	11.73	11.46	11.23	11.11
	CH 149	5745	12.65	12.39	12.30	12.16	12.00	11.69	11.42	11.34
	CH 153	5765	12.50	12.29	12.40	12.07	11.97	11.43	11.36	11.17
	CH 157	5785	12.49	12.42	12.32	12.17	11.99	11.73	11.43	11.37
	CH 161	5805	12.50	12.39	12.30	12.39	11.34	11.16	11.43	11.13
	CH 165	5825	12.78	12.40	12.30	12.16	11.98	11.71	11.45	11.34

Mode	Channel	Frequency (MHz)	Average Power (dBm)							
			MCS Index							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
802.11n 20M	CH 036	5180	11.95	11.61	11.48	11.30	11.08	10.82	10.75	10.65
	CH 040	5200	11.94	11.69	11.51	11.31	11.05	10.80	10.71	10.59
	CH 044	5220	11.83	11.74	11.32	11.31	11.08	10.82	10.49	10.39
	CH 048	5240	11.93	11.64	11.48	11.32	11.08	10.81	10.69	10.57
	CH 052	5260	11.87	11.71	11.55	11.36	11.11	10.88	10.81	10.64
	CH 056	5280	11.87	11.64	11.41	11.32	11.24	10.88	10.70	10.53
	CH 060	5300	11.61	11.46	11.23	11.00	10.55	10.21	10.13	10.03
	CH 064	5320	**11.96**	11.55	10.99	10.79	10.47	10.20	10.13	10.02
	CH 100	5500	11.28	10.88	10.70	10.49	10.22	9.95	9.87	9.77
	CH 104	5520	11.17	11.64	11.41	11.32	11.24	10.88	10.70	10.53
	CH 108	5540	11.01	11.26	11.03	11.24	10.85	10.21	10.23	10.13
	CH 112	5560	11.21	11.14	11.23	11.00	10.55	10.21	10.53	10.05
	CH 116	5580	11.17	10.89	10.71	10.50	10.22	9.95	9.86	9.76
	CH 132	5660	11.10	11.23	11.26	11.03	10.21	10.55	10.13	10.02
	CH 136	5680	11.11	11.41	11.24	11.00	10.13	10.21	10.39	10.29
	CH 140	5700	11.24	11.08	10.90	10.71	10.49	10.19	10.07	9.98
	CH 149	5745	11.61	11.31	11.14	10.95	10.68	10.41	10.32	10.21
	CH 153	5765	11.28	10.88	11.32	10.55	10.53	10.21	10.20	9.96
	CH 157	5785	11.38	11.23	11.08	10.90	10.66	10.39	10.30	10.18
	CH 161	5805	11.01	11.26	10.50	10.55	10.24	10.55	9.96	10.13
	CH 165	5825	11.45	11.36	11.15	10.96	10.65	10.37	10.27	10.22

Note:

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

11. SAR Test Results

11.1 Test Records for Head SAR Test

<GSM SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
49	**GSM850**	**GPRS10**	**Right Cheek**	**251**	**848.8**	**30.94**	**0.16**	**0.394**	**0.308**
50	GSM850	GPRS10	Right Tilted	251	848.8	30.94	0.06	0.277	0.217
51	GSM850	GPRS10	Left Cheek	251	848.8	30.94	0.17	0.369	0.289
52	GSM850	GPRS10	Left Tilted	251	848.8	30.94	0.13	0.277	0.217
69	GSM850	GSM(Voice)	Right Cheek	251	848.8	33.64	0.122	0.392	0.305
70	GSM850	GSM(Voice)	Right Tilted	251	848.8	33.64	-0.09	0.246	0.194
71	GSM850	GSM(Voice)	Left Cheek	251	848.8	33.64	0.154	0.351	0.274
72	GSM850	GSM(Voice)	Left Tilted	251	848.8	33.64	0.123	0.234	0.183
61	GSM1900	GPRS10	Right Cheek	810	1909.8	28.5	0.155	0.155	0.091
62	GSM1900	GPRS10	Right Tilted	810	1909.8	28.5	0.18	0.116	0.063
63	**GSM1900**	**GPRS10**	**Left Cheek**	**810**	**1909.8**	**28.5**	**0.01**	**0.265**	**0.157**
64	GSM1900	GPRS10	Left Tilted	810	1909.8	28.5	-0.14	0.14	0.075
65	GSM1900	GSM(Voice)	Right Cheek	810	1909.8	30.18	0.183	0.096	0.056
66	GSM1900	GSM(Voice)	Right Tilted	810	1909.8	30.18	-0.14	0.078	0.042
67	GSM1900	GSM(Voice)	Left Cheek	810	1909.8	30.18	0.04	0.157	0.092
68	GSM1900	GSM(Voice)	Left Tilted	810	1909.8	30.18	-0.132	0.085	0.046

Note: Per KDB 648474, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
53	**WCDMA V**	**RMC12.2K**	**Right Cheek**	**4233**	**846.6**	**23.65**	**0.12**	**0.316**	**0.246**
54	WCDMA V	RMC12.2K	Right Tilted	4233	846.6	23.65	0.11	0.196	0.153
55	WCDMA V	RMC12.2K	Left Cheek	4233	846.6	23.65	0.12	0.27	0.21
56	WCDMA V	RMC12.2K	Left Tilted	4233	846.6	23.65	0.16	0.2	0.157
57	WCDMA IV	RMC12.2K	Right Cheek	1312	1712.4	23.59	0.04	0.549	0.358
58	WCDMA IV	RMC12.2K	Right Tilted	1312	1712.4	23.59	0.03	0.271	0.163
59	**WCDMA IV**	**RMC12.2K**	**Left Cheek**	**1312**	**1712.4**	**23.59**	**0.18**	**0.561**	**0.36**
60	WCDMA IV	RMC12.2K	Left Tilted	1312	1712.4	23.59	0.16	0.255	0.168
73	WCDMA II	RMC12.2K	Right Cheek	9262	1852.4	23.55	0.129	0.204	0.129
74	WCDMA II	RMC12.2K	Right Tilted	9262	1852.4	23.55	0.13	0.133	0.075
75	**WCDMA II**	**RMC12.2K**	**Left Cheek**	**9262**	**1852.4**	**23.55**	**0.144**	**0.324**	**0.195**
76	WCDMA II	RMC12.2K	Left Tilted	9262	1852.4	23.55	-0.16	0.114	0.064

Note: Per KDB 648474, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
101	WLAN2.4G	802.11b	Right Cheek	1	2412	15.75	0.132	0.064	0.036
102	WLAN2.4G	802.11b	Right Tilted	1	2412	15.75	-0.107	0.057	0.03
103	**WLAN2.4G**	**802.11b**	**Left Cheek**	**1**	**2412**	**15.75**	**0.042**	**0.18**	**0.086**
104	WLAN2.4G	802.11b	Left Tilted	1	2412	15.75	0.096	0.059	0.031
127	WLAN5G	802.11a	Right Cheek	40	5200	13.00	-0.154	0.065	0.019
128	WLAN5G	802.11a	Right Tilted	40	5200	13.00	0.143	0.059	0.017
129	WLAN5G	802.11a	Left Cheek	40	5200	13.00	-0.194	0.134	0.039
130	WLAN5G	802.11a	Left Tilted	40	5200	13.00	0.169	0.054	0.017
123	WLAN5G	802.11a	Right Cheek	52	5260	12.91	0.168	0.068	0.019
124	WLAN5G	802.11a	Right Tilted	52	5260	12.91	-0.123	0.058	0.016
125	WLAN5G	802.11a	Left Cheek	52	5260	12.91	-0.195	0.145	0.04
126	WLAN5G	802.11a	Left Tilted	52	5260	12.91	-0.146	0.053	0.017
119	WLAN5G	802.11a	Right Cheek	100	5500	12.93	-0.072	0.043	0.012
120	WLAN5G	802.11a	Right Tilted	100	5500	12.93	0.043	0.022	0.00595
121	WLAN5G	802.11a	Left Cheek	100	5500	12.93	0.07	0.167	0.054
122	WLAN5G	802.11a	Left Tilted	100	5500	12.93	0.023	0.065	0.018
110	WLAN5G	802.11a	Right Cheek	165	5825	12.78	0.1	0.038	0.015
111	WLAN5G	802.11a	Right Tilted	165	5825	12.78	0.16	0.02	0.00679
112	**WLAN5G**	**802.11a**	**Left Cheek**	**165**	**5825**	**12.78**	**0.036**	**0.175**	**0.057**
113	WLAN5G	802.11a	Left Tilted	165	5825	12.78	0.098	0.043	0.012

Note: Per KDB 648474 and 248227, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

11.2 Test Records for Hotspot SAR Test

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
8	GSM850	GPRS10	Front	1	251	848.8	30.94	0.18	0.598	0.467
9	GSM850	GPRS10	Back	1	128	824.2	30.75	-0.03	0.461	0.359
10	GSM850	GPRS10	Back	1	190	836.6	30.93	0.03	0.693	0.512
11	**GSM850**	**GPRS10**	**Back**	**1**	**251**	**848.8**	**30.94**	**-0.08**	**0.87**	**0.683**
12	GSM850	GPRS10	Left Side	1	251	848.8	30.94	-0.05	0.712	0.488
13	GSM850	GPRS10	Right Side	1	251	848.8	30.94	0.09	0.737	0.507
14	GSM850	GPRS10	Bottom Side	1	251	848.8	30.94	-0.03	0.058	0.035
1	GSM1900	GPRS10	Front	1	810	1909.8	28.24	0.01	0.46	0.238
2	GSM1900	GPRS10	Back	1	512	1850.2	28.08	0.01	0.477	0.253
3	GSM1900	GPRS10	Back	1	661	1880.0	28.11	0.08	0.71	0.334
4	**GSM1900**	**GPRS10**	**Back**	**1**	**810**	**1909.8**	**28.24**	**0.19**	**1.1**	**0.521**
5	GSM1900	GPRS10	Left Side	1	810	1909.8	28.24	-0.04	0.254	0.14
6	GSM1900	GPRS10	Right Side	1	810	1909.8	28.24	0.19	0.053	0.032
7	GSM1900	GPRS10	Bottom Side	1	810	1909.8	28.24	0.14	0.647	0.319

Note:

1. Per KDB 941225 D06, for EUT dimension ≥ 9cm*5cm, the test distance is 1cm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.
2. As in (1), SAR for Front/Back/Bottom Side/Left Side/Right Side is necessary.
3. Per KDB 648474 if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
19	WCDMA V	RMC12.2K	Front	1	4233	846.6	23.65	-0.03	0.458	0.354
20	**WCDMA V**	**RMC12.2K**	**Back**	**1**	**4233**	**846.6**	**23.65**	**0.01**	**0.653**	**0.509**
21	WCDMA V	RMC12.2K	Left Side	1	4233	846.6	23.65	-0.04	0.49	0.337
22	WCDMA V	RMC12.2K	Right Side	1	4233	846.6	23.65	-0.02	0.534	0.369
23	WCDMA V	RMC12.2K	Bottom Side	1	4233	846.6	23.65	0.129	0.041	0.024
25	WCDMA IV	RMC12.2K	Front	1	1312	1712.4	23.59	0.1	0.933	0.541
26	WCDMA IV	RMC12.2K	Front	1	1413	1732.6	23.44	0.07	0.828	0.475
27	WCDMA IV	RMC12.2K	Front	1	1862	1752.5	23.55	0.13	0.726	0.418
28	**WCDMA IV**	**RMC12.2K**	**Back**	**1**	**1312**	**1712.4**	**23.59**	**-0.127**	**0.98**	**0.58**
29	WCDMA IV	RMC12.2K	Back	1	1413	1732.6	23.44	0.05	0.836	0.496
30	WCDMA IV	RMC12.2K	Back	1	1862	1752.5	23.55	0.07	0.744	0.437
31	WCDMA IV	RMC12.2K	Left Side	1	1312	1712.4	23.59	-0.08	0.481	0.286
32	WCDMA IV	RMC12.2K	Right Side	1	1312	1712.4	23.59	0.14	0.263	0.165
33	WCDMA IV	RMC12.2K	Bottom Side	1	1312	1712.4	23.59	-0.02	0.328	0.197
37	WCDMA II	RMC12.2K	Front	1	9262	1852.4	23.55	0.05	0.384	0.208
38	WCDMA II	RMC12.2K	Back	1	9262	1852.4	23.55	-0.01	0.634	0.323
39	WCDMA II	RMC12.2K	Back	1	9400	1880.0	23.32	0.14	0.865	0.409
40	**WCDMA II**	**RMC12.2K**	**Back**	**1**	**9538**	**1907.6**	**23.29**	**-0.16**	**1.25**	**0.607**
41	WCDMA II	RMC12.2K	Left Side	1	9262	1852.4	23.55	0.08	0.214	0.123
42	WCDMA II	RMC12.2K	Right Side	1	9262	1852.4	23.55	0.01	0.095	0.058
43	WCDMA II	RMC12.2K	Bottom Side	1	9262	1852.4	23.55	0.19	0.425	0.219

Note:
1. Per KDB 941225 D06, for EUT dimension ≥ 9cm*5cm, the test distance is 1cm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.
2. As in (1), SAR for Front/Back/Bottom Side/Left Side/Right Side is necessary.
3. Per KDB 648474, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
105	WLAN2.4G	802.11b	Front	1	1	2412	15.75	-0.096	0.036	0.019
106	**WLAN2.4G**	**802.11b**	**Back**	**1**	**1**	**2412**	**15.75**	**-0.055**	**0.189**	**0.089**
107	WLAN2.4G	802.11b	Right Side	1	1	2412	15.75	0.056	0.099	0.047
108	WLAN2.4G	802.11b	Top Side	1	1	2412	15.75	-0.026	0.034	0.019

Note:

1. Per KDB 941225 D06, for EUT dimension ≥ 9cm*5cm, the test distance is 1cm. SAR must be measured for all surfaces and sides with a transmitting antenna located within 2.5cm from that surface or edge.
2. As in (1), SAR for Front/Back/Top Side/Right Side is necessary.
3. Per KDB 248227, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

11.3 Test Records for Body-worn SAR Test

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Headset	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
8	GSM850	GPRS10	Front	1	251	848.8	30.94	-	0.18	0.598	0.467
9	GSM850	GPRS10	Back	1	128	824.2	30.75	-	-0.03	0.461	0.359
10	GSM850	GPRS10	Back	1	190	836.6	30.93	-	0.03	0.693	0.512
11	**GSM850**	**GPRS10**	**Back**	**1**	**251**	**848.8**	**30.94**	**-**	**-0.08**	**0.87**	**0.683**
15	GSM850	GPRS10	Back	1	251	848.8	30.94	v	-0.127	0.759	0.587
78	GSM850	GSM(Voice)	Back	1	251	848.8	33.64	v	-0.17	0.489	0.386
1	GSM1900	GPRS10	Front	1	810	1909.8	28.24	-	0.01	0.46	0.238
2	GSM1900	GPRS10	Back	1	512	1850.2	28.08	-	0.01	0.477	0.253
3	GSM1900	GPRS10	Back	1	661	1880.0	28.11	-	0.08	0.71	0.334
4	**GSM1900**	**GPRS10**	**Back**	**1**	**810**	**1909.8**	**28.24**	**-**	**0.19**	**1.1**	**0.521**
16	GSM1900	GPRS10	Back	1	512	1850.2	28.08	v	0.14	0.491	0.258
17	GSM1900	GPRS10	Back	1	661	1880.0	28.11	v	-0.14	0.699	0.326
18	GSM1900	GPRS10	Back	1	810	1909.8	28.24	v	0.124	1	0.441
77	GSM1900	GSM(Voice)	Back	1	810	1909.8	30.18	v	0.02	0.616	0.281

Note:

1. Per KDB 648474, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. Per KDB 941225 D06, hotspot SAR data in front/back positions can be considered as body-worn accessory SAR test data. GSM voice mode body-worn SAR was repeated at the worst position of hotspot SAR data, back position of this device
3. “V” in the Headset column means the Headset is plugged during SAR testing.

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Headset	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
19	WCDMA V	RMC12.2K	Front	1	4233	846.6	23.65	-	-0.03	0.458	0.354
20	**WCDMA V**	**RMC12.2K**	**Back**	**1**	**4233**	**846.6**	**23.65**	**-**	**0.01**	**0.653**	**0.509**
24	WCDMA V	RMC12.2K	Back	1	4233	846.6	23.65	v	-0.02	0.465	0.366
25	WCDMA IV	RMC12.2K	Front	1	1312	1712.4	23.59	-	0.1	0.933	0.541
26	WCDMA IV	RMC12.2K	Front	1	1413	1732.6	23.44	-	0.07	0.828	0.475
27	WCDMA IV	RMC12.2K	Front	1	1862	1752.5	23.55	-	0.13	0.726	0.418
28	**WCDMA IV**	**RMC12.2K**	**Back**	**1**	**1312**	**1712.4**	**23.59**	**-**	**-0.127**	**0.98**	**0.58**
29	WCDMA IV	RMC12.2K	Back	1	1413	1732.6	23.44	-	0.05	0.836	0.496
30	WCDMA IV	RMC12.2K	Back	1	1862	1752.5	23.55	-	0.07	0.744	0.437
34	WCDMA IV	RMC12.2K	Back	1	1312	1712.4	23.59	v	-0.03	0.879	0.531
35	WCDMA IV	RMC12.2K	Back	1	1413	1732.6	23.44	v	0.08	0.843	0.498
36	WCDMA IV	RMC12.2K	Back	1	1862	1752.5	23.55	v	0.16	0.761	0.448
37	WCDMA II	RMC12.2K	Front	1	9262	1852.4	23.55	-	0.05	0.384	0.208
38	WCDMA II	RMC12.2K	Back	1	9262	1852.4	23.55	-	-0.01	0.634	0.323
39	WCDMA II	RMC12.2K	Back	1	9400	1880.0	23.32	-	0.14	0.865	0.409
40	**WCDMA II**	**RMC12.2K**	**Back**	**1**	**9538**	**1907.6**	**23.29**	**-**	**-0.16**	**1.25**	**0.607**
44	WCDMA II	RMC12.2K	Back	1	9262	1852.4	23.55	v	0.11	0.673	0.342
45	WCDMA II	RMC12.2K	Back	1	9400	1880.0	23.32	v	0.1	0.896	0.435
46	WCDMA II	RMC12.2K	Back	1	9538	1907.6	23.29	v	0.19	1.24	0.581
79	WCDMA II	HSDPA Subtest-1	Back	1	9262	1852.4	23.37	-	-0.04	0.605	0.304
80	WCDMA II	HSDPA Subtest-1	Back	1	9400	1880.0	23.26	-	0.09	0.86	0.395
81	WCDMA II	HSDPA Subtest-1	Back	1	9538	1907.6	23.35	-	-0.132	1.11	0.517
82	WCDMA II	HSUPA Subtest-5	Back	1	9262	1852.4	23.45	-	0.17	0.599	0.3
83	WCDMA II	HSUPA Subtest-5	Back	1	9400	1880.0	23.36	-	0.11	0.854	0.415
84	WCDMA II	HSUPA Subtest-5	Back	1	9538	1907.6	23.39	-	0.01	1.15	0.551

Note:

1. Per KDB 648474 and 447498, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. “V” in the Headset column means the Headset is plugged during SAR testing.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Headset	Power Drift (dB)	SAR_{1g} (W/kg)	SAR_{10g} (W/kg)
105	WLAN2.4G	802.11b	Front	1	1	2412	15.75	-	-0.096	0.036	0.019
106	WLAN2.4G	802.11b	Back	1	1	2412	15.75	-	-0.055	0.189	0.089
109	**WLAN2.4G**	**802.11b**	**Back**	**1**	**1**	**2412**	**15.75**	**v**	**-0.018**	**0.231**	**0.109**
131	WLAN5G	802.11a	Front	1	40	5200	13.00	-	0	0.012	0.00464
132	WLAN5G	802.11a	Back	1	40	5200	13.00	-	0.144	0.14	0.044
135	WLAN5G	802.11a	Back	1	40	5200	13.00	v	0.131	0.143	0.045
136	WLAN5G	802.11a	Front	1	52	5260	12.91	-	0	0.028	0.00904
137	WLAN5G	802.11a	Back	1	52	5260	12.91	-	0.04	0.233	0.075
140	**WLAN5G**	**802.11a**	**Back**	**1**	**52**	**5260**	**12.91**	**v**	**0.037**	**0.234**	**0.076**
141	WLAN5G	802.11a	Front	1	100	5500	12.93	-	0.01	0.026	0.00436
142	WLAN5G	802.11a	Back	1	100	5500	12.93	-	0.09	0.206	0.064
145	WLAN5G	802.11a	Back	1	100	5500	12.93	v	-0.031	0.213	0.066
114	WLAN5G	802.11a	Front	1	165	5825	12.78	-	0.096	0.028	0.011
115	WLAN5G	802.11a	Back	1	165	5825	12.78	-	-0.134	0.127	0.028
118	WLAN5G	802.11a	Back	1	165	5825	12.78	v	0.104	0.096	0.031

Note:

1. Per KDB 248227, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. “V” in the Headset column means the Headset is plugged during SAR testing.

11.4 Simultaneous Multi-band Transmission Analysis

Simultaneous transmission configurations

No	Capable Tx configurations	Head SAR	Body SAR	Power Reduction	Note
1	GSM Voice	O	O	No	Standalone GSM Voice
2	GPRS	O	O	No	Standalone GPRS Class 10
3	EDGE	O	O	No	Standalone EDGE Class 10
4	WCDMA Voice	O	O	No	Standalone WCDMA Voice
5	WCDMA Data	O	O	No	Standalone WCDMA Data
6	WIFI	O	O	No	Standalone WIFI
7	GSM Voice + WIFI 2.4G&WIFI 5G	O	O	No	GSM Voice + WIFI Data
8	GPRS + WIFI 2.4G	O	O	No	GPRS + WIFI hotspot
9	EDGE + WIFI 2.4G	O	O	No	EDGE + WIFI hotspot
10	GPRS + WIFI 5G	X	X	No	GPRS + WIFI hotspot
11	EDGE + WIFI 5G	X	X	No	EDGE + WIFI hotspot
12	WCDMA Voice + WIFI 2.4G&WIFI 5G	O	O	No	WCDMA Voice + WIFI Data
13	WCDMA Data + WIFI2.4G&WIFI 5G	O	O	No	WCDMA Data + WIFI hotspot

O : Supported , X : Not supported
* WiFi 2.4GHz is supported Hotspot, WIFI 5GHz is not supported Hotspot.
* VoIP is supported (e.g. 3rd party VoIP)
* BT and NFC SAR testing is not required

Note:

1. WLAN and BT share the same antenna, and cannot transmit simultaneously.
2. GSM and WCDMA share the same antenna, and cannot transmit simultaneously.
3. EUT will choose either WLAN2.4G or WLAN5G according to the network signal condition; 2.4GHz and 5GHz WLAN will not transmit simultaneously.
4. EUT will choose either GSM or WCDMA according to the network signal condition; therefore, they will not transmit simultaneously.
5. The maximum SAR summation is calculated based on the same configuration and test position.
6. When stand-alone 1-g SAR is not required for a transmitter or antenna, its SAR is considered zero in the 1-g SAR summing process to determine simultaneous transmission SAR evaluation requirements
7. If 1g-SAR scalar summation < 1.6W/kg, simultaneous SAR measurement is not necessary.
8. WLAN 2.4GHz supports Hotspot router mode, WLAN 5G does not support Hotspot router mode.
9. Considering 3rd party VoIP application, VoIP is evaluated.

<Head SAR>

	WWAN (GSM)			Scale WWAN (GSM)				WLAN 2.4G		Scale WLAN 2.4G					Scaled
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	WWAN + Scaled WLAN
Right Cheek	GSM850	69	0.392	33.64	33.7	1.014	0.397	101	0.064	15.75	16	1.059	0.068	0.46	0.47
	GSM1900	65	0.096	30.18	30.2	1.005	0.096	101	0.064	15.75	16	1.059	0.068	0.16	0.16
Right Tilted	GSM850	70	0.246	33.64	33.7	1.014	0.249	102	0.057	15.75	16	1.059	0.060	0.30	0.31
	GSM1900	66	0.078	30.18	30.2	1.005	0.078	102	0.057	15.75	16	1.059	0.060	0.14	0.14
Left Cheek	GSM850	71	0.351	33.64	33.7	1.014	0.356	103	0.18	15.75	16	1.059	0.191	0.53	0.55
	GSM1900	63	0.265	28.24	28.7	1.112	0.295	103	0.18	15.75	16	1.059	0.191	0.45	0.49
Left Tilted	GSM850	72	0.234	33.64	33.7	1.014	0.237	104	0.059	15.75	16	1.059	0.062	0.29	0.30
	GSM1900	68	0.085	30.18	30.2	1.005	0.085	104	0.059	15.75	16	1.059	0.062	0.14	0.15

	WWAN (GSM)			Scale WWAN (GSM)				WLAN 5G		Scale WLAN 5G					Scaled
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	WWAN + Scaled WLAN
Right Cheek	GSM850	69	0.392	33.64	33.7	1.014	0.397	123	0.068	12.91	13	1.021	0.069	0.46	0.47
	GSM1900	65	0.096	30.18	30.2	1.005	0.096	123	0.068	12.91	13	1.021	0.069	0.16	0.17
Right Tilted	GSM850	70	0.246	33.64	33.7	1.014	0.249	128	0.059	13	13	1.000	0.059	0.31	0.31
	GSM1900	66	0.078	30.18	30.2	1.005	0.078	128	0.059	13	13	1.000	0.059	0.14	0.14
Left Cheek	GSM850	71	0.351	33.64	33.7	1.014	0.356	112	0.175	12.78	13	1.052	0.184	0.53	0.54
	GSM1900	63	0.265	28.24	28.7	1.112	0.295	112	0.175	12.78	13	1.052	0.184	0.44	0.48
Left Tilted	GSM850	72	0.234	33.64	33.7	1.014	0.237	122	0.065	12.93	13	1.016	0.066	0.30	0.30
	GSM1900	68	0.085	30.18	30.2	1.005	0.085	122	0.065	12.93	13	1.016	0.066	0.15	0.15

	WWAN (GPRS)			Scale WWAN (GPRS)				WLAN 2.4G		Scale WLAN 2.4G					Scaled
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	WWAN + Scaled WLAN
Right Cheek	GSM850	49	0.394	30.94	31.7	1.191	0.469	101	0.064	15.75	16	1.059	0.068	0.46	0.54
	GSM1900	61	0.155	28.24	28.7	1.112	0.172	101	0.064	15.75	16	1.059	0.068	0.22	0.24
Right Tilted	GSM850	50	0.277	30.94	31.7	1.191	0.330	102	0.057	15.75	16	1.059	0.060	0.33	0.39
	GSM1900	62	0.116	28.24	28.7	1.112	0.129	102	0.057	15.75	16	1.059	0.060	0.17	0.19
Left Cheek	GSM850	51	0.369	30.94	31.7	1.191	0.440	103	0.18	15.75	16	1.059	0.191	0.55	0.63
	GSM1900	63	0.265	28.24	28.7	1.112	0.295	103	0.18	15.75	16	1.059	0.191	0.45	0.49
Left Tilted	GSM850	52	0.277	30.94	31.7	1.191	0.330	104	0.059	15.75	16	1.059	0.062	0.34	0.39
	GSM1900	64	0.14	28.24	28.7	1.112	0.156	104	0.059	15.75	16	1.059	0.062	0.20	0.22

<Head SAR>

	WWAN (WCDMA)			Scale WWAN (WCDMA)				WLAN 2.4G		Scale WLAN 2.4G				WWAN + WLAN	Scaled WWAN + Scaled WLAN
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)		
Right Cheek	WCDMA V	53	0.316	23.65	23.7	1.012	0.320	101	0.064	15.75	16	1.059	0.068	0.38	0.39
	WCDMA IV	57	0.549	23.59	23.7	1.026	0.563	101	0.064	15.75	16	1.059	0.068	0.61	0.63
	WCDMA II	73	0.204	23.55	23.7	1.035	0.211	101	0.064	15.75	16	1.059	0.068	0.27	0.28
Right Tilted	WCDMA V	54	0.196	23.65	23.7	1.012	0.198	102	0.057	15.75	16	1.059	0.060	0.25	0.26
	WCDMA IV	58	0.271	23.59	23.7	1.026	0.278	102	0.057	15.75	16	1.059	0.060	0.33	0.34
	WCDMA II	74	0.133	23.55	23.7	1.035	0.138	102	0.057	15.75	16	1.059	0.060	0.19	0.20
Left Cheek	WCDMA V	55	0.27	23.65	23.7	1.012	0.273	103	0.18	15.75	16	1.059	0.191	0.45	0.46
	WCDMA IV	59	0.561	23.59	23.7	1.026	0.575	103	0.18	15.75	16	1.059	0.191	0.74	0.77
	WCDMA II	75	0.324	23.55	23.7	1.035	0.335	103	0.18	15.75	16	1.059	0.191	0.50	0.53
Left Tilted	WCDMA V	56	0.2	23.65	23.7	1.012	0.202	104	0.059	15.75	16	1.059	0.062	0.26	0.26
	WCDMA IV	60	0.255	23.59	23.7	1.026	0.262	104	0.059	15.75	16	1.059	0.062	0.31	0.32
	WCDMA II	76	0.114	23.55	23.7	1.035	0.118	104	0.059	15.75	16	1.059	0.062	0.17	0.18

	WWAN (WCDMA)			Scale WWAN (WCDMA)				WLAN 5G		Scale WLAN 5G				WWAN + WLAN	Scaled WWAN + Scaled WLAN
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)		
Right Cheek	WCDMA V	53	0.316	23.65	23.7	1.012	0.320	123	0.068	12.91	13	1.021	0.069	0.38	0.39
	WCDMA IV	57	0.549	23.59	23.7	1.026	0.563	123	0.068	12.91	13	1.021	0.069	0.62	0.63
	WCDMA II	73	0.204	23.55	23.7	1.035	0.211	123	0.068	12.91	13	1.021	0.069	0.27	0.28
Right Tilted	WCDMA V	54	0.196	23.65	23.7	1.012	0.198	128	0.059	13	13	1.000	0.059	0.26	0.26
	WCDMA IV	58	0.271	23.59	23.7	1.026	0.278	128	0.059	13	13	1.000	0.059	0.33	0.34
	WCDMA II	74	0.133	23.55	23.7	1.035	0.138	128	0.059	13	13	1.000	0.059	0.19	0.20
Left Cheek	WCDMA V	55	0.27	23.65	23.7	1.012	0.273	112	0.175	12.78	13	1.052	0.184	0.45	0.46
	WCDMA IV	59	0.561	23.59	23.7	1.026	0.575	112	0.175	12.78	13	1.052	0.184	0.74	0.76
	WCDMA II	75	0.324	23.55	23.7	1.035	0.335	112	0.175	12.78	13	1.052	0.184	0.50	0.52
Left Tilted	WCDMA V	56	0.2	23.65	23.7	1.012	0.202	122	0.065	12.93	13	1.016	0.066	0.27	0.27
	WCDMA IV	60	0.255	23.59	23.7	1.026	0.262	122	0.065	12.93	13	1.016	0.066	0.32	0.33
	WCDMA II	76	0.114	23.55	23.7	1.035	0.118	122	0.065	12.93	13	1.016	0.066	0.18	0.18

Note: 5GHz WLAN does not support hotspot mode; the SAR summation only represents WWAN (voice) + WLAN (data) simultaneous transmission scenario.

<Hotspot SAR>

	WWAN			Scale WWAN				WLAN 2.4G		Scale WLAN 2.4G					Scaled
Position	**WWAN Band**	**Plot No**	**WWAN SAR (W/kg)**	**Average Power (dBm)**	**Tune-up Limit (dBm)**	**Scaling Factor**	**Scaled WWAN (W/kg)**	**Plot No**	**WLAN SAR (W/kg)**	**Average Power (dBm)**	**Tune-up Limit (dBm)**	**Scaling Factor**	**Scaled WLAN (W/kg)**	**WWAN + WLAN**	**WWAN + Scaled WLAN**
Front	GSM850	8	0.598	30.94	31.7	1.191	0.712	105	0.036	15.75	16	1.059	0.038	0.63	0.75
	GSM1900	1	0.46	28.24	28.7	1.112	0.511	105	0.036	15.75	16	1.059	0.038	0.50	0.55
	WCDMA V	19	0.458	23.65	23.7	1.012	0.463	105	0.036	15.75	16	1.059	0.038	0.49	0.50
	WCDMA IV	25	0.933	23.59	23.7	1.026	0.957	105	0.036	15.75	16	1.059	0.038	0.97	1.00
	WCDMA II	37	0.384	23.55	23.7	1.035	0.397	105	0.036	15.75	16	1.059	0.038	0.42	0.44
Back	GSM850	11	0.87	30.94	31.7	1.191	1.036	106	0.189	15.75	16	1.059	0.200	1.06	1.24
	GSM1900	4	1.1	28.24	28.7	1.112	1.223	106	0.189	15.75	16	1.059	0.200	1.29	1.42
	WCDMA V	20	0.653	23.65	23.7	1.012	0.661	106	0.189	15.75	16	1.059	0.200	0.84	0.86
	WCDMA IV	28	0.98	23.59	23.7	1.026	1.005	106	0.189	15.75	16	1.059	0.200	1.17	1.21
	WCDMA II	40	1.25	23.29	23.7	1.099	1.374	106	0.189	15.75	16	1.059	0.200	1.44	1.57
Left Side	GSM850	12	0.712	30.94	31.7	1.191	0.848							0.71	0.85
	GSM1900	5	0.254	28.24	28.7	1.112	0.282							0.25	0.28
	WCDMA V	21	0.49	23.65	23.7	1.012	0.496							0.49	0.50
	WCDMA IV	31	0.481	23.59	23.7	1.026	0.493							0.48	0.49
	WCDMA II	41	0.214	23.55	23.7	1.035	0.222							0.21	0.22
Right Side	GSM850	13	0.737	30.94	31.7	1.191	0.878	107	0.099	15.75	16	1.059	0.105	0.84	0.98
	GSM1900	6	0.053	28.24	28.7	1.112	0.059	107	0.099	15.75	16	1.059	0.105	0.15	0.16
	WCDMA V	22	0.534	23.65	23.7	1.012	0.540	107	0.099	15.75	16	1.059	0.105	0.63	0.65
	WCDMA IV	32	0.263	23.59	23.7	1.026	0.270	107	0.099	15.75	16	1.059	0.105	0.36	0.38
	WCDMA II	42	0.095	23.55	23.7	1.035	0.098	107	0.099	15.75	16	1.059	0.105	0.19	0.20
Top Side	GSM850							108	0.034	15.75	16	1.059	0.036	0.03	0.04
	GSM1900							108	0.034	15.75	16	1.059	0.036	0.03	0.04
	WCDMA V							108	0.034	15.75	16	1.059	0.036	0.03	0.04
	WCDMA IV							108	0.034	15.75	16	1.059	0.036	0.03	0.04
	WCDMA II							108	0.034	15.75	16	1.059	0.036	0.03	0.04
Bottom Side	GSM850	14	0.058	30.94	31.7	1.191	0.069							0.06	0.07
	GSM1900	7	0.647	28.24	28.7	1.112	0.719							0.65	0.72
	WCDMA V	23	0.041	23.65	23.7	1.012	0.041							0.04	0.04
	WCDMA IV	33	0.328	23.59	23.7	1.026	0.336							0.33	0.34
	WCDMA II	43	0.425	23.55	23.7	1.035	0.440							0.43	0.44

<Body-worn SAR>

	WWAN (GSM)			Scale WWAN (GSM)				WLAN 2.4G		Scale WLAN 2.4G					
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	Scaled WWAN + Scaled WLAN
Back (w/ Headset)	GSM850	78	0.489	33.64	33.7	1.014	0.496	109	0.231	15.75	16	1.059	0.245	0.72	0.74
	GSM1900	77	0.616	30.18	30.2	1.005	0.619	109	0.231	15.75	16	1.059	0.245	0.85	0.86

	WWAN (GSM)			Scale WWAN (GSM)				WLAN 5G		Scale WLAN 5G					
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	Scaled WWAN + Scaled WLAN
Back (w/ Headset)	GSM850	78	0.489	33.64	33.7	1.014	0.496	140	0.234	12.91	13	1.021	0.239	0.72	0.74
	GSM1900	77	0.616	30.18	30.2	1.005	0.619	140	0.234	12.91	13	1.021	0.239	0.85	0.86

	WWAN (GPRS)			Scale WWAN (GPRS)				WLAN 2.4G		Scale WLAN 2.4G					
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	Scaled WWAN + Scaled WLAN
Back	GSM850	11	0.87	30.94	31.7	1.191	1.036	106	0.189	15.75	16	1.059	0.200	1.06	1.24
	GSM1900	4	1.1	28.24	28.7	1.112	1.223	106	0.189	15.75	16	1.059	0.200	1.29	1.42
Back (w/ Headset)	GSM850	15	0.759	30.94	31.7	1.191	0.904	109	0.231	15.75	16	1.059	0.245	0.99	1.15
	GSM1900	18	1	28.24	28.7	1.112	1.112	109	0.231	15.75	16	1.059	0.245	1.23	1.36

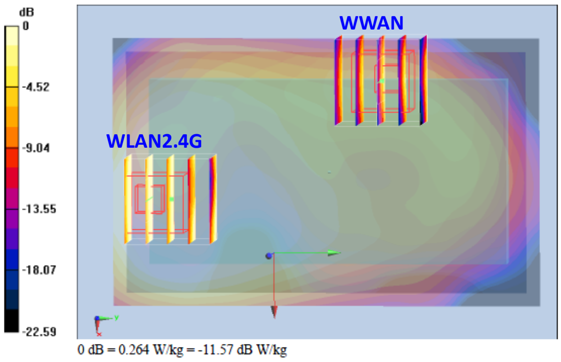
	WWAN (WCDMA)			Scale WWAN (WCDMA)				WLAN 2.4G		Scale WLAN 2.4G					
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	Scaled WWAN + Scaled WLAN
Back	WCDMA V	20	0.653	23.65	23.7	1.012	0.661	106	0.189	15.75	16	1.059	0.200	0.84	0.86
	WCDMA IV	28	0.98	23.59	23.7	1.026	1.005	106	0.189	15.75	16	1.059	0.200	1.17	1.21
	WCDMA II	40	1.25	23.29	23.7	1.099	1.374	106	0.189	15.75	16	1.059	0.200	1.44	1.57
Back (w/ Headset)	WCDMA V	24	0.465	23.65	23.7	1.012	0.470	109	0.231	15.75	16	1.059	0.245	0.70	0.72
	WCDMA IV	34	0.879	23.59	23.7	1.026	0.902	109	0.231	15.75	16	1.059	0.245	1.11	1.15
	WCDMA II	46	1.24	23.29	23.7	1.099	1.363	109	0.231	15.75	16	1.059	0.245	1.47	**1.61**

	WWAN (WCDMA)			Scale WWAN (WCDMA)				WLAN 5G		Scale WLAN 5G					
Position	WWAN Band	Plot No	WWAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WWAN (W/kg)	Plot No	WLAN SAR (W/kg)	Average Power (dBm)	Tune-up Limit (dBm)	Scaling Factor	Scaled WLAN (W/kg)	WWAN + WLAN	Scaled WWAN + Scaled WLAN
Back	WCDMA V	20	0.653	23.65	23.7	1.012	0.661	137	0.233	12.91	13	1.021	0.238	0.89	0.90
	WCDMA IV	28	0.98	23.59	23.7	1.026	1.005	137	0.233	12.91	13	1.021	0.238	1.21	1.24
	WCDMA II	40	1.25	23.29	23.7	1.099	1.374	137	0.233	12.91	13	1.021	0.238	1.48	**1.61**
Back (w/ Headset)	WCDMA V	24	0.465	23.65	23.7	1.012	0.470	140	0.234	12.91	13	1.021	0.239	0.70	0.71
	WCDMA IV	34	0.879	23.59	23.7	1.026	0.902	140	0.234	12.91	13	1.021	0.239	1.11	1.14
	WCDMA II	46	1.24	23.29	23.7	1.099	1.363	140	0.234	12.91	13	1.021	0.239	1.47	**1.60**

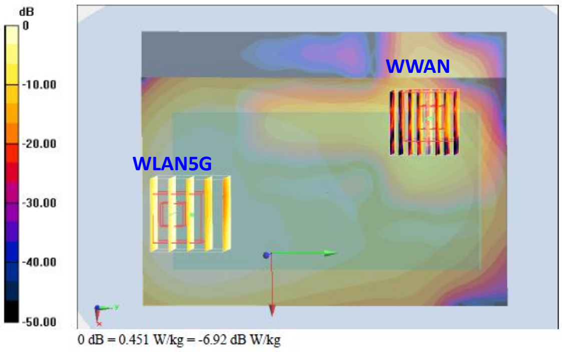
Note: 5GHz WLAN does not support hotspot mode; the SAR summation only represents WWAN (voice)+WLAN (data) simultaneous transmission scenario.

11.5 Simultaneous analysis - SPLSR calculation

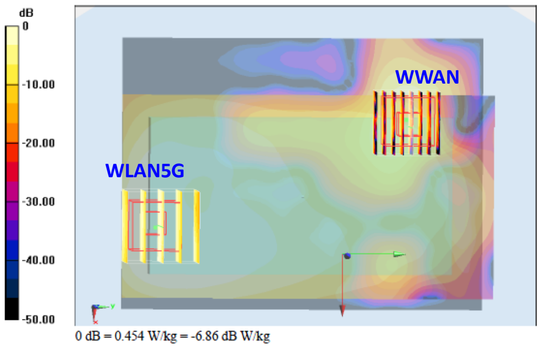
Plot No	Band	Position	Scaled SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (cm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
46	WCDMA II	Back w/ Headset	1.363	1	-0.008	-0.065	-0.202	9.8	1.61	0.16	Not required
109	WLAN 2.4G		0.245	1	-0.0525	0.022	-0.201				



Plot No	Band	Position	Scaled SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (cm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
46	WCDMA II	Back w/ Headset	1.363	1	-0.0045	-0.064	-0.202	12.0	1.60	0.13	Not required
140	WLAN 5G		0.239	1	-0.05	0.047	-0.203				



Plot No	Band	Position	Scaled SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (cm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
40	WCDMA II	Back	1.374	1	-0.0045	-0.064	-0.202	11.9	1.61	0.14	Not required
137	WLAN 5G		0.238	1	-0.048	0.047	-0.203				



Note: Per KDB 447498 and 648474, if SPLSR < 0.3, simultaneous transmission SAR is not necessary.

11.6 Scaled SAR Value to Maximum Tune-up Tolerances

The following measured results were scaled to the maximum tune-up tolerance, according to the output power of the channel tested for the highest measured results in each frequency band.

Test Configuration		Mode	CH	Freq. (MHz)	Power (dBm)		SAR (W/kg)	
					Max tune-up limit	Measured	Measured	Scaled
Body-Worn & Hotspot	Back	GSM 850 (GPRS class 10)	251	848.8	31.7	30.94	0.87	1.036
Body-Worn & Hotspot	Back	GSM 1900 (GPRS class 10)	810	1909.8	28.7	28.24	1.1	1.223
Body-Worn & Hotspot	Back	WCDMA V	4233	846.6	23.7	23.65	0.653	0.661
Body-Worn & Hotspot	Back	WCDMA IV	1312	1712.4	23.7	23.59	0.98	1.005
Body-Worn & Hotspot	Back	WCDMA II	9538	1907.6	23.7	23.29	1.25	1.374
Body-Worn	Back	WLAN2.4G	1	2412	16	15.75	0.231	0.245
Body-Worn	Back	WLAN5G	40	5200	13	13.00	0.143	0.143
Body-Worn	Back	WLAN5G	52	5260	13	12.91	0.234	0.239
Body-Worn	Back	WLAN5G	100	5500	13	12.93	0.213	0.216
Head	Left Cheek	WLAN 5G	165	5825	13	12.78	0.175	0.184

Test Engineer： Bevis Chang, Nick Yu, San Lin, Vic Yang, Ted Sun, and Cona Huang

12. Uncertainty Assessment

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

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

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 12.1

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

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

(b) κ is the coverage factor

Table 12.1 Standard Uncertainty for Assumed Distribution

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

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

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

Table 12.2 Uncertainty Budget of DASY for frequency range 300 MHz to 3 GHz

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 12.3 Uncertainty Budget of DASY for frequency range 3 GHz to 6 GHz

13. References

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

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

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

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

[5] SPEAG DASY System Handbook

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

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

[8] FCC KDB 648474 D01 v01r05, “SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas”, September 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 v02 "3GPP R6 HSPA and R7 HSPA+ SAR Guidance", December 2009.

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

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

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

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.