FCC SAR Test Report

APPLICANT	**:**	**Motorola Solutions, Inc.**
EQUIPMENT	**:**	**Enterprise Digital Assistant (EDA)**
BRAND NAME	**:**	**Motorola**
MODEL NAME	**:**	**MC4597**
FCC ID	**:**	**UZ7MC4597**
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 Nov. 06, 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.

Reviewed by:

Jones Tsai

Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA250901	Rev. 01	Initial issue of report	Dec. 05, 2012

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Motorola Solutions, Inc. Enterprise Digital Assistant (EDA), Motorola, MC4597** are as follows.

Band	Position	SAR_{1g} (W/kg)
GSM850	Head	0.374
GSM1900	Head	0.182
WCDMA Band V	Head	0.384
WCDMA Band II	Head	0.342
WLAN 2.4G	Head	0.124
WLAN 5G	Head	0.142
GSM850	Body-worn (1.5 cm Gap)	0.988
GSM1900	Body-worn (1.5 cm Gap)	0.325
WCDMA Band V	Body-worn (1.5 cm Gap)	0.581
WCDMA Band II	Body-worn (1.5 cm Gap)	0.242
WLAN 2.4G	Body-worn (1.5 cm Gap)	0.053
WLAN 5G	Body-worn (1.5 cm Gap)	0.343
GSM850	Body-worn (0 cm Gap with Holster)	0.658
GSM1900	Body-worn (0 cm Gap with Holster)	0.305
WCDMA Band V	Body-worn (0 cm Gap with Holster)	0.369
WCDMA Band II	Body-worn (0 cm Gap with Holster)	0.171
WLAN 2.4G	Body-worn (0 cm Gap with Holster)	0.021
WLAN 5G	Body-worn (0 cm Gap with Holster)	0.023

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	Motorola Solutions, Inc.
Address	One Motorola Plaza, Holtsville, NY 11742-1300 USA

2.3 Manufacturer

Company Name	Inventec Appliances Corp.
Address	37, Wugong 5th Road, New Taipei industrial Park, Wugu District, New Taipei City, Taiwan 24890

2.4 Application Details

Date of Start during the Test	Oct. 20, 2012
Date of End during the Test	Nov. 06, 2012

3. General Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Enterprise Digital Assistant (EDA)
Brand Name	Motorola
Model Name	MC4597
FCC ID	UZ7MC4597
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 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
Measure Maximum Average Output Power to Antenna	GSM850: 32.94 dBm GSM1900: 29.41 dBm WCDMA Band V: 23.76 dBm WCDMA Band II: 23.32 dBm 802.11b: 13.39 dBm 802.11g: 14.92 dBm 802.11a : 15.14 dBm Bluetooth: 0.28 dBm
Antenna Type	WWAN: PCB Antenna Bluetooth / WLAN: PIFA Antenna
HW Version	DV2.3
SW Version	BSP9.351
Uplink Modulations	GSM: GMSK GPRS: GMSK EDGE: GMSK / 8PSK WCDMA (Rel 99): QPSK HSDPA (Rel 6): QPSK 802.11b: DSSS (BPSK / QPSK / CCK) 802.11a/g: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth : GFSK Bluetooth EDR : π/4-DQPSK, 8-DPSK
Dual Transfer Mode (DTM) Category	Class B– EUT cannot support Packet Switched and Circuit Switched Network simultaneously
EUT Stage	Identical Prototype
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. The battery(03 Rev A) and battery(01 Rev C) spec are the same, only difference is label	

1.	Mobile Computing Terminal	OS Version	BSP9.351
2.		OEM Name	MC45
3.		OEM Version	DVT2.3
4.	Wireless (Fusion)	Part Number	WM-AG-AT-02-C
5.		Version	3.40.0.0.56

3.2 Product Photos

Please refer to Appendix D.

3.3 Applied Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 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

3.4 Device Category and SAR Limits

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

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

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

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

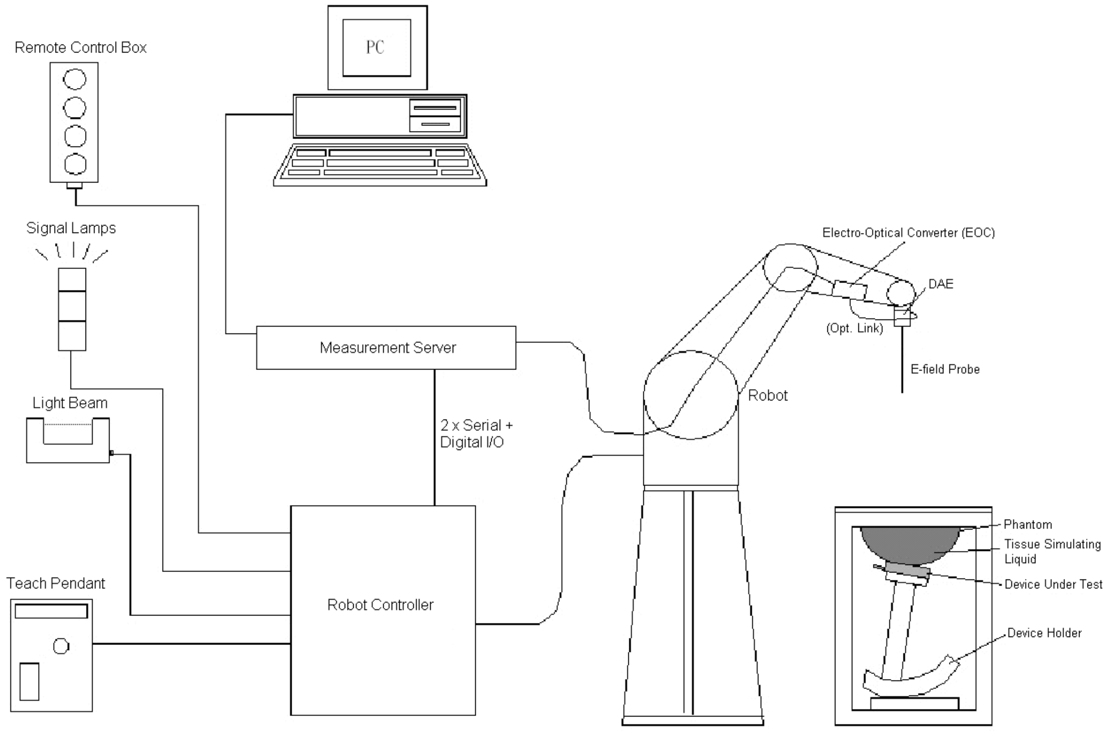


Fig 5.1 SPEAG DASY System Configurations

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

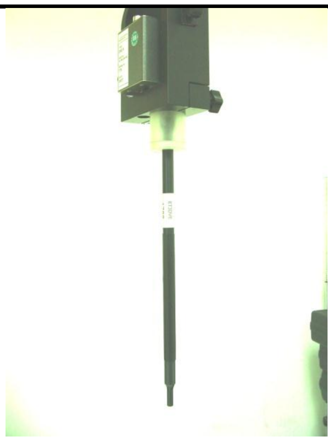


Fig 5.2 Photo of ET3DV6/ET3DV6

<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 ± 0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

5.2 Data Acquisition Electronics (DAE)

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

Fig 5.4 Photo of DAE

5.3 Robot

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

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

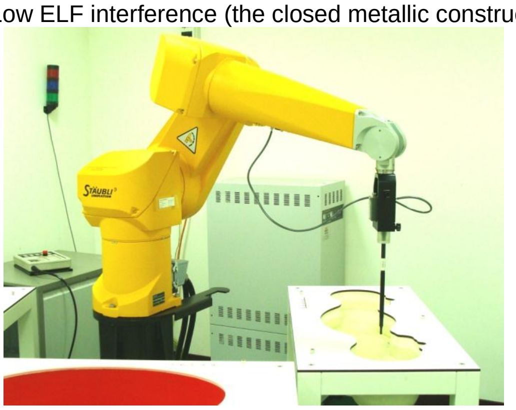


Fig 5.5 Photo of DASY4

Fig 5.6 Photo of DASY5

5.4 Measurement Server

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

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

Fig 5.7 Photo of Server for DASY4

Fig 5.8 Photo of Server for DASY5

5.5 Phantom

<SAM Twin Phantom>

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

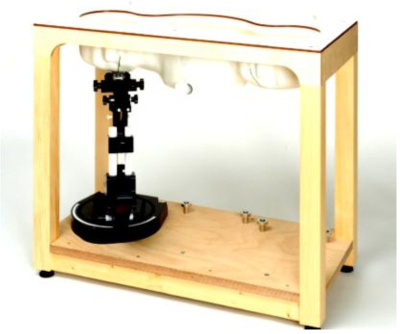


Fig 5.9 Photo of SAM Phantom

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

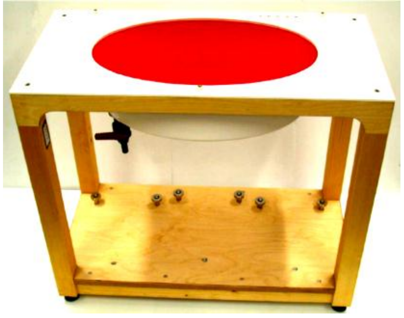


Fig 5.10 Photo of ELI4 Phantom

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.

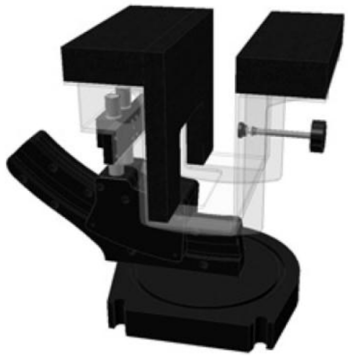


Fig 5.12 Laptop Extension Kit

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	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	DAE3	495	Apr. 23, 2012	Apr. 22, 2013
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 27, 2012	Aug. 26, 2013
SPEAG	Data Acquisition Electronics	DAE3	577	Jun. 06, 2012	Jun. 05, 2013
SPEAG	Data Acquisition Electronics	DAE4	1279	May. 03, 2012	May. 02, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3801	Jun. 22, 2012	Jun. 21, 2013
SPEAG	Dosimetric E-Field Probe	ET3DV6	1787	May. 29, 2012	May. 28, 2013
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 28, 2012	Sep. 27, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3792	Jun. 21, 2012	Jun. 20, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Sep. 28, 2012	Sep. 27, 2013
Wisewind	Thermometer	ETP-101	TM560	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	HTC-1	TM685	Nov. 16, 2011	Nov. 15, 2012
Wisewind	Thermometer	HTC-1	TM659	Nov. 16, 2011	Nov. 15, 2012
H.M.IRIS	Thermometer	TH-08	TM658	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 P41 C	TP-1150	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 CD	TP-1718	NCR	NCR
SPEAG	SAM Phantom	QD 000 P40 CD	TP-1719	NCR	NCR
Agilent	Network Analyzer	E5071C	MY46101588	May. 11, 2012	May. 10, 2013
Agilent	ESG Vector Series Signal Generator	E4438C	MY49070755	Oct. 02, 2012	Oct. 01, 2013
Anritsu	Power Meter	ML2495A	1132003	Aug. 14, 2012	Aug. 13, 2013
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
R&S	Universal Digital Radio communication Tester	CMU200	114256	Jun. 29, 2012	Jun. 28, 2013
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
Woken	Attenuator	WK0602-XX	N/A	NCR	NCR
AR	Power Amplifier	5S1G4M2	0328767	NCR	NCR
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, 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.

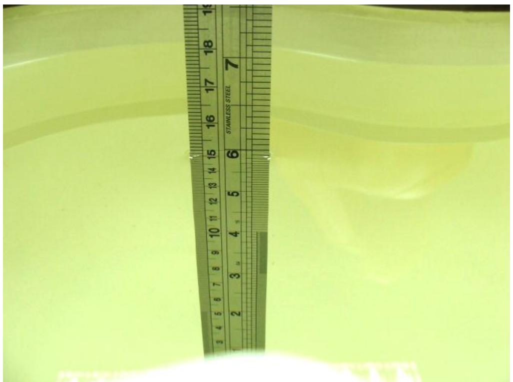


Fig 6.1 Photo of Liquid Height for Head SAR

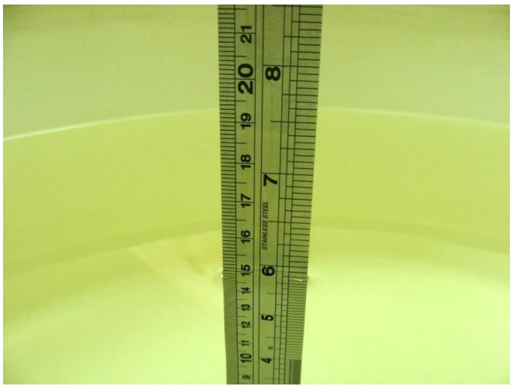


Fig 6.2 Photo of Liquid Height for Body SAR

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								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
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	21.3	0.929	43.117	0.9	41.5	3.22	3.90	±5	2012/10/20
835	Head	21.7	0.886	41.339	0.9	41.5	-1.56	-0.39	±5	2012/10/27
835	Body	21.5	0.996	54.843	0.97	55.2	2.68	-0.65	±5	2012/10/25
1900	Head	21.4	1.432	39.198	1.4	40	2.29	-2.01	±5	2012/10/27
1900	Body	21.4	1.544	51.591	1.52	53.3	1.58	-3.21	±5	2012/10/25
2450	Head	21.5	1.85	39.3	1.8	39.2	2.78	0.26	±5	2012/11/5
2450	Body	21.5	1.93	53.6	1.95	52.7	-1.03	1.71	±5	2012/11/5
5200	Head	21.6	4.81	35.5	4.66	36	3.22	-1.39	±5	2012/11/5
5200	Body	21.4	5.11	47.4	5.3	49	-3.58	-3.27	±5	2012/11/6
5500	Head	21.6	5.14	35	4.96	35.6	3.63	-1.69	±5	2012/11/5
5500	Body	21.4	5.49	47	5.65	48.6	-2.83	-3.29	±5	2012/11/6
5800	Head	21.6	5.42	34.3	5.27	35.3	2.85	-2.83	±5	2012/11/5
5800	Body	21.4	5.96	46.5	6	48.2	-0.67	-3.53	±5	2012/11/6

Table 6.2 Measuring Results for Simulating Liquid

7. SAR Measurement Evaluation

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

7.1 Purpose of System Performance check

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

7.2 System Setup

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

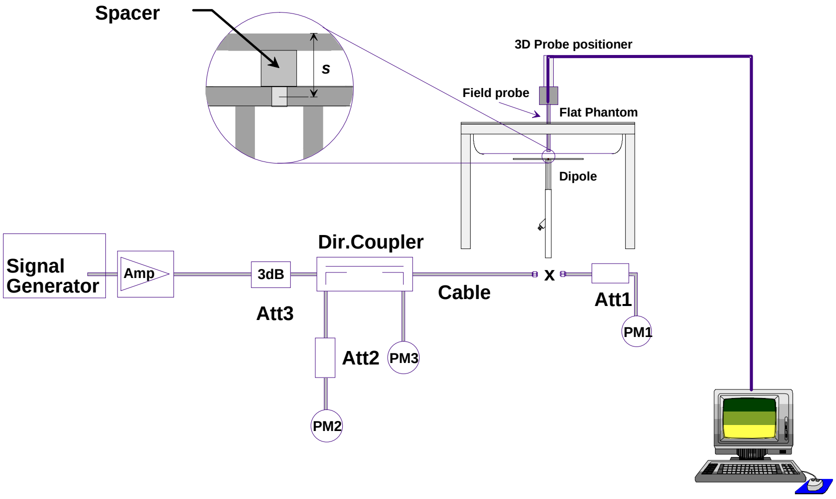


Fig 7.1 System Setup for System Evaluation

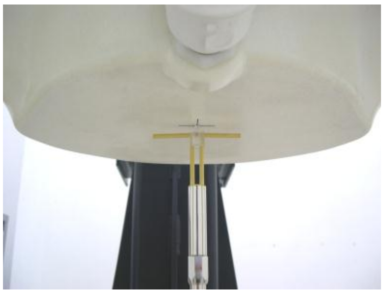


Fig 7.2 Photo of Dipole Setup

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

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

7.3 SAR System Verification Results

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

Measurement Date	Frequency (MHz)	Liquid Type	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
2012/10/20	835	Head	9.71	2.27	9.08	-6.49
2012/10/27	835	Head	9.71	2.35	9.40	-3.19
2012/10/25	835	Body	9.82	2.54	10.16	3.46
2012/10/27	1900	Head	39.8	9.99	39.96	0.40
2012/10/25	1900	Body	40	10.6	42.40	6.00
2012/11/5	2450	Head	54.8	14	56.00	2.19
2012/11/5	2450	Body	52.3	12.8	51.20	-2.10
2012/11/5	5200	Head	79.2	21.1	84.40	6.57
2012/11/6	5200	Body	72.6	19.1	76.40	5.23
2012/11/5	5500	Head	85.2	21.8	87.20	2.35
2012/11/6	5500	Body	78.8	18.3	73.20	-7.11
2012/11/5	5800	Head	79	19	76.00	-3.80
2012/11/6	5800	Body	73.1	18	72.00	-1.50

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

8.1 Define two imaginary lines on the handset

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

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

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

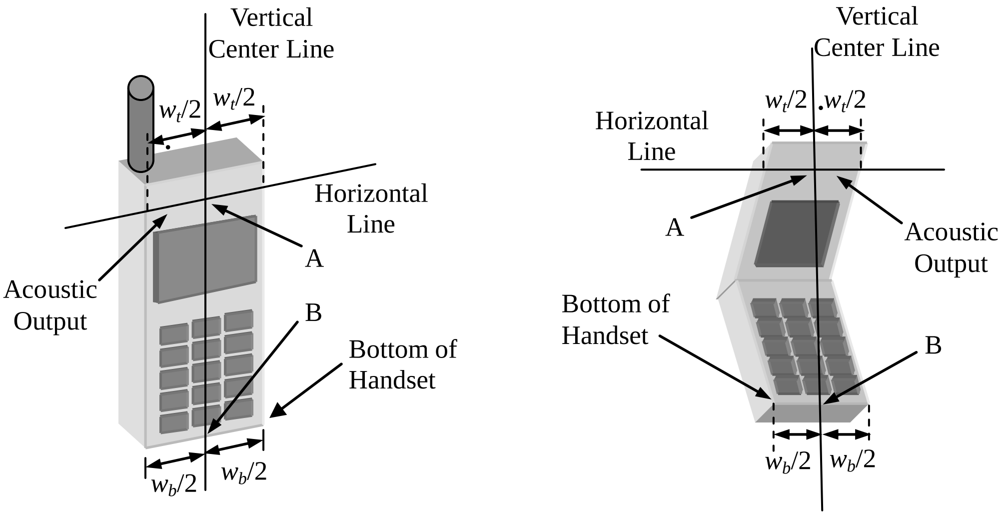


Fig 8.1 Illustration for Handset Vertical and Horizontal Reference Lines

8.2 Cheek Position

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

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

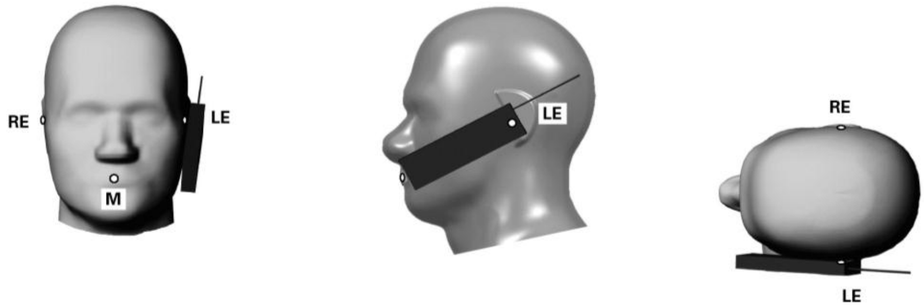


Fig 8.2 Illustration for Cheek Position

8.3 Tilted Position

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

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

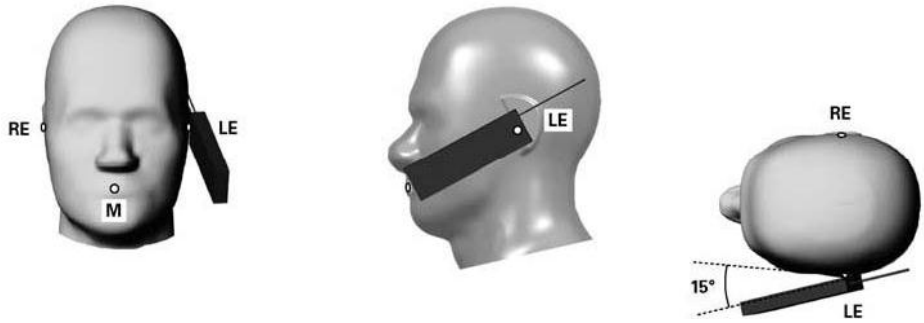


Fig 8.3 Illustration for Tilted Position

8.4 Body Worn Position

(a) To position the device parallel to the phantom surface with either keypad up or down.

(b) To adjust the device parallel to the flat phantom.

(c) To adjust the distance between the device surface and the flat phantom to 1.5 cm or holster surface and the flat phantom to 0 cm.

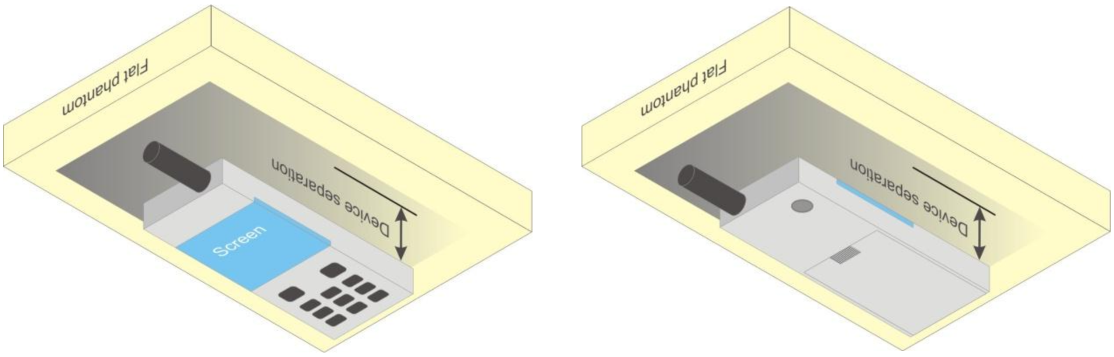


Fig 8.4 Illustration for Body Worn Position

<EUT Setup Photos>

Please refer to Appendix E for the test setup photos.

9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

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

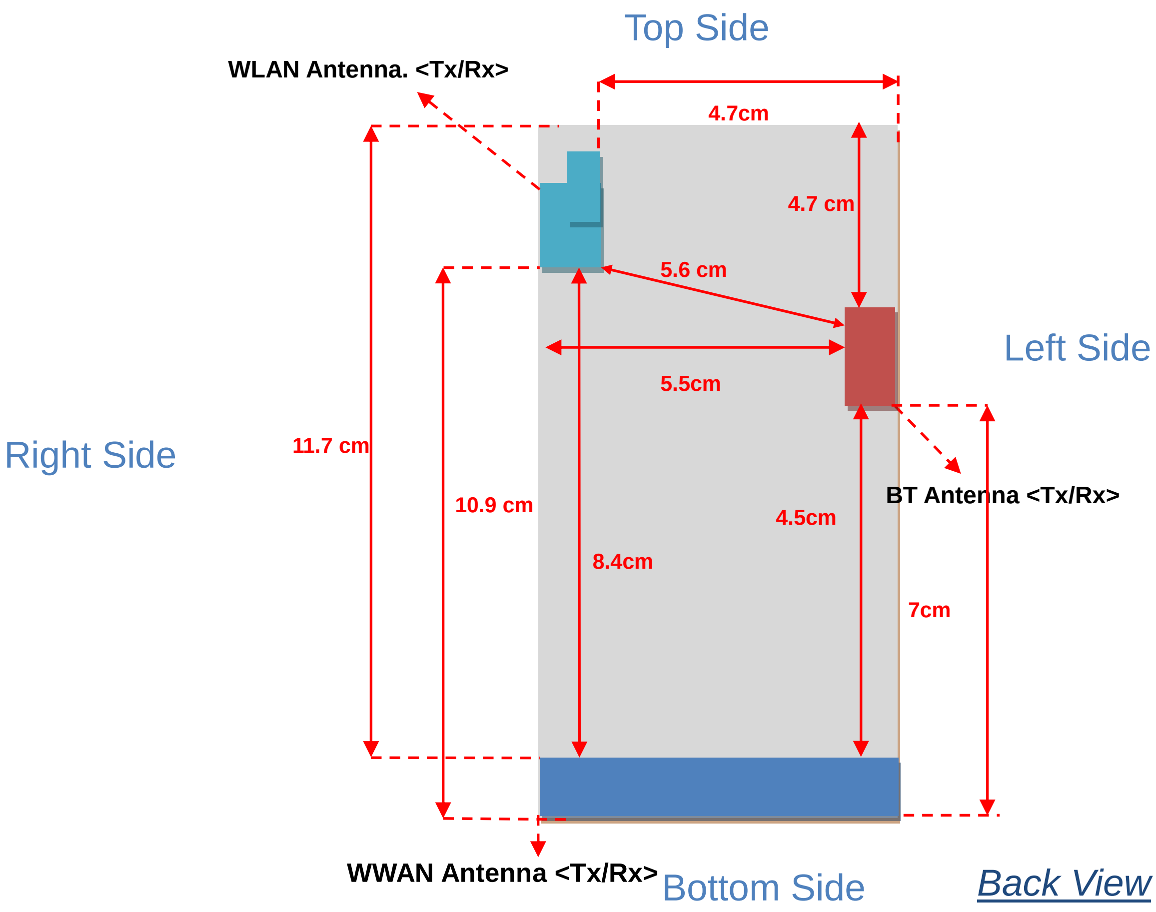
Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty 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 drifts more than 5%, the SAR will be retested.

10. SAR Test Configurations

10.1 Exposure Positions Consideration



Antennas	Wireless Interface
WWAN Antenna (Tx / Rx)	GSM 850 GSM 1900 WCDMA Band V WCDMA Band II
WLAN Antenna (Tx / Rx)	WLAN 2.4G WCDMA 5G
BT Antenna (Tx / Rx)	Bluetooth

Note:

1. Head/Body-worn mode SAR assessments are required.
2. Per KDB 648474 D01, Bluetooth output power ≤ 2*P_{Ref} and the distance to WLAN antennas ≥ 5cm, therefore, stand-alone SAR is not required.
3. Per KDB 648474 D01, Bluetooth output power ≤ P_{Ref} and the distance to WWAN antennas ≥ 2.5cm, therefore stand-alone SAR is not required.

10.2 Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Band: GSM850	Burst Average Power (dBm)			Frame-Average Power (dBm)		
Channel	128	189	251	128	189	251
Frequency (MHz)	824.2	836.4	848.8	824.2	836.4	848.8
GSM (GMSK, 1 Tx slot)	32.68	32.86	32.94	23.68	23.86	23.94
GPRS (GMSK, 1 Tx slot) – CS1	32.67	32.85	32.93	23.67	23.85	23.93
GPRS (GMSK, 2 Tx slots) – CS1	29.60	29.78	29.88	23.60	23.78	23.88
GPRS (GMSK, 3 Tx slots) – CS1	29.51	29.66	29.74	25.25	25.40	25.48
GPRS (GMSK, 4 Tx slots) – CS1	29.33	29.52	29.64	26.33	26.52	26.64
EDGE (GMSK, 1 Tx slot) – MCS1	32.62	32.80	32.88	23.62	23.80	23.88
EDGE (GMSK, 2 Tx slots) – MCS1	29.56	29.73	29.84	23.56	23.73	23.84
EDGE (GMSK, 3 Tx slots) – MCS1	29.49	29.64	29.71	25.23	25.38	25.45
EDGE (GMSK, 4 Tx slots) – MCS1	29.32	29.51	29.63	26.32	26.51	26.63
EDGE (8PSK, 1 Tx slot) – MCS5	26.60	26.77	26.87	17.60	17.77	17.87
EDGE (8PSK, 2 Tx slots) – MCS5	26.58	26.74	26.85	20.58	20.74	20.85
EDGE (8PSK, 3 Tx slots) – MCS5	26.52	26.68	26.77	22.26	22.42	22.51
EDGE (8PSK, 4 Tx slots) – MCS5	25.95	26.11	26.22	22.95	23.11	23.22

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

Note:

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

Band: GSM1900	Burst Average Power (dBm)			Frame-Average Power (dBm)		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
GSM (GMSK, 1 Tx slot)	29.41	29.26	29.30	20.41	20.26	20.30
GPRS (GMSK, 1 Tx slot) – CS1	29.40	29.25	29.28	20.40	20.25	20.28
GPRS (GMSK, 2 Tx slots) – CS1	29.39	29.23	29.27	23.39	23.23	23.27
GPRS (GMSK, 3 Tx slots) – CS1	29.35	29.20	29.25	25.09	24.94	24.99
GPRS (GMSK, 4 Tx slots) – CS1	28.32	28.16	28.19	25.32	25.16	25.19
EDGE (GMSK, 1 Tx slot) – MCS1	29.39	29.26	29.30	20.39	20.26	20.30
EDGE (GMSK, 2 Tx slots) – MCS1	29.38	29.24	29.28	23.38	23.24	23.28
EDGE (GMSK, 3 Tx slots) – MCS1	29.34	29.19	29.23	25.08	24.93	24.97
EDGE (GMSK, 4 Tx slots) – MCS1	28.30	28.15	28.18	25.30	25.15	25.18
EDGE (8PSK, 1 Tx slot) – MCS5	25.89	25.76	25.78	16.89	16.76	16.78
EDGE (8PSK, 2 Tx slots) – MCS5	25.88	25.75	25.77	19.88	19.75	19.77
EDGE (8PSK, 3 Tx slots) – MCS5	25.87	25.74	25.76	21.61	21.48	21.50
EDGE (8PSK, 4 Tx slots) – MCS5	24.88	24.73	24.75	21.88	21.73	21.75

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

Note:

1. For Head SAR testing, GSM should be evaluated, therefore the EUT was set in GSM Voice for GSM1900 due to its highest frame-average power.
2. For Body SAR testing, GSM,GPRS and EDGE should be evaluated, therefore the EUT was set in GPRS 4 Tx slots for GSM1900 due to its highest frame-average power.
3. Per KDB 447498, the maximum output power channel is used for SAR testing and for further SAR test reduction.
4. The EUT do not support DTM function.

<WCDMA Conducted Power>

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

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station referred to the drawing of Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

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

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

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

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

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

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

Setup Configuration

WCDMA Average power (dBm)							
Band		**WCDMA Band V**			**WCDMA Band II**		
Channel		**4132**	**4182**	**4233**	**9262**	**9400**	**9538**
Frequency (MHz)		**826.4**	**836.4**	**846.6**	**1852.4**	**1880.0**	**1907.6**
3GPP Rel 99	**AMR 12.2K**	23.46	23.73	23.72	23.10	23.28	23.04
3GPP Rel 99	**RMC 12.2K**	23.48	**23.76**	23.73	23.13	**23.32**	23.05
3GPP Rel 6	**HSDPA Subtest-1**	23.35	23.65	23.57	23.01	23.20	22.91
3GPP Rel 6	**HSDPA Subtest-2**	23.31	23.54	23.51	23.00	23.18	22.88
3GPP Rel 6	**HSDPA Subtest-3**	22.81	23.13	23.02	22.61	22.84	22.50
3GPP Rel 6	**HSDPA Subtest-4**	22.77	23.07	22.98	22.60	22.80	22.43

MPR (dB)								
3GPP MPR	**Subtest**		**WCDMA Band V**			**WCDMA Band II**		
0	**3GPP Rel 6**	**HSDPA Subtest-1**	0.00	0.00	0.00	0.00	0.00	0.00
0	**3GPP Rel 6**	**HSDPA Subtest-2**	0.04	0.11	0.06	0.01	0.02	0.03
≤ 0.5	**3GPP Rel 6**	**HSDPA Subtest-3**	0.54	0.52	0.55	0.40	0.36	0.41
≤ 0.5	**3GPP Rel 6**	**HSDPA Subtest-4**	0.58	0.58	0.59	0.41	0.40	0.48

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 < 0.25dB 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 output power is < 0.25dB higher than RMC, or SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA SAR evaluation can be excluded.
4. By design, AMR, HSDPA RF power will not be larger than RMC 12.2kbps, detailed information is included in Tune-up Procure exhibit.
5. It is expected by the manufacturer that MPR for some HSDPA, 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 Conducted Power>

WLAN 2.4G 802.11b Average Power (dBm)					
Channel	Frequency (MHz)	Data Rate (bps)			
		1M	2M	5.5M	11M
CH 01	2412	12.45	12.32	12.15	12.22
CH 06	2437	13.07	12.98	13.06	12.90
CH 11	2462	13.39	13.29	13.11	13.15
CH 12	2467	9.90	9.86	9.85	9.89

WLAN 2.4G 802.11g Average Power (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		6M	9M	12M	18M	24M	36M	48M	54M
CH 01	2412	10.85	10.79	10.84	10.83	10.71	10.59	10.51	10.60
CH 06	2437	14.92	14.85	14.90	14.87	14.84	14.88	13.69	12.11
CH 11	2462	12.65	12.62	12.57	12.46	12.45	12.46	12.46	12.52
CH 12	2467	6.10	6.07	6.06	6.06	6.04	6.01	6.02	6.05

Note:

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

<Bluetooth Conducted Power>

Channel	Frequency (MHz)	Average power (dBm)		
		Mode		
		GFSK	π/4-DQPSK	8-DPSK
CH 0	2402	-1.14	-1.13	-1.41
CH 39	2441	0.24	0.28	-0.04
CH 78	2480	-0.92	-0.90	-1.19

<WLAN 5GHz Conducted Power>

WLAN 5G 802.11a Average Power (dBm)									
Channel	Frequency (MHz)	Average Power (dBm) Data Rate (bps)							
		6M	9M	12M	18M	24M	36M	48M	54M
CH 036	5180	12.21	11.92	11.80	12.01	11.89	11.96	12.03	10.93
CH 040	5200	12.64	12.62	12.50	12.59	12.47	12.49	12.56	11.41
CH 044	5220	**14.91**	14.57	14.55	14.72	14.57	12.72	11.72	10.70
CH 048	5240	14.59	14.36	14.35	14.52	14.46	12.56	11.62	10.69
CH 052	5260	**15.14**	15.12	15.10	14.95	15.06	13.31	12.47	11.17
CH 056	5280	15.06	14.97	14.91	14.87	14.74	13.53	12.49	11.40
CH 060	5300	15.07	15.06	14.94	14.98	14.98	13.47	12.40	11.34
CH 064	5320	13.43	13.39	13.34	13.36	13.33	13.41	12.39	11.19
CH 100	5500	12.42	12.29	12.19	12.29	12.21	12.31	12.22	11.15
CH 104	5520	12.61	12.54	12.47	12.56	12.54	12.52	12.56	11.41
CH 108	5540	12.55	12.32	12.31	12.42	12.31	12.30	12.25	11.28
CH 112	5560	12.22	12.17	12.09	12.12	12.03	12.07	12.06	11.09
CH 116	5580	**14.91**	14.88	14.84	14.86	14.86	13.01	12.04	10.94
CH 132	5660	10.75	10.65	10.64	10.63	10.54	10.56	10.56	10.53
CH 136	5680	10.65	10.57	10.47	10.53	10.49	10.51	10.47	10.40
CH 140	5700	10.56	10.46	10.30	10.51	10.47	10.48	10.44	10.40
CH 149	5745	14.97	14.86	14.93	14.80	14.92	13.26	12.34	11.53
CH 153	5765	14.74	14.56	14.59	14.71	14.47	12.50	11.53	10.47
CH 157	5785	**15.12**	14.96	14.87	14.98	14.94	12.98	12.26	11.36
CH 161	5805	14.97	14.84	14.75	14.96	14.80	12.48	11.59	10.64
CH 165	5825	14.94	14.93	14.98	15.08	15.09	13.06	12.33	11.42

Note:

1. Per KDB 248227, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB 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)
1	**GSM850**	**GSM Voice**	**Right Cheek**	**251**	**848.8**	**32.94**	**0.019**	**0.374**
2	GSM850	GSM Voice	Right Tilted	251	848.8	32.94	0.09	0.214
3	GSM850	GSM Voice	Left Cheek	251	848.8	32.94	-0.14	0.352
4	GSM850	GSM Voice	Left Tilted	251	848.8	32.94	0.04	0.223
27	GSM1900	GSM Voice	Right Cheek	512	1850.2	29.41	0.05	0.134
28	GSM1900	GSM Voice	Right Tilted	512	1850.2	29.41	0.17	0.077
29	**GSM1900**	**GSM Voice**	**Left Cheek**	**512**	**1850.2**	**29.41**	**0.16**	**0.182**
30	GSM1900	GSM Voice	Left Tilted	512	1850.2	29.41	-0.11	0.115

Note: Per KDB 648474 and KDB 447498, 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)
31	**WCDMA V**	**RMC12.2K**	**Right Cheek**	**4182**	**836.4**	**23.76**	**0.01**	**0.384**
32	WCDMA V	RMC12.2K	Right Tilted	4182	836.4	23.76	-0.04	0.254
33	WCDMA V	RMC12.2K	Left Cheek	4182	836.4	23.76	0.15	0.347
34	WCDMA V	RMC12.2K	Left Tilted	4182	836.4	23.76	-0.14	0.267
23	WCDMA II	RMC12.2K	Right Cheek	9400	1880	23.32	0.03	0.341
24	WCDMA II	RMC12.2K	Right Tilted	9400	1880	23.32	0.09	0.181
25	**WCDMA II**	**RMC12.2K**	**Left Cheek**	**9400**	**1880**	**23.32**	**-0.12**	**0.342**
26	WCDMA II	RMC12.2K	Left Tilted	9400	1880	23.32	-0.17	0.239

Note: Per KDB 648474 and KDB 447498, 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)	Duty Cycle %	Duty Cycle Compensate Factor	SAR_{1g} (W/kg)	Duty Cycle Compensated 1g SAR
35	WLAN2.4G	802.11b	Right Cheek	11	2462	13.39	0.14	100	1.000	0.07	0.070
36	WLAN2.4G	802.11b	Right Tilted	11	2462	13.39	0.049	100	1.000	0.073	0.073
37	WLAN2.4G	802.11b	Left Cheek	11	2462	13.39	0.161	100	1.000	0.064	0.064
38	WLAN2.4G	802.11b	Left Tilted	11	2462	13.39	0.027	100	1.000	0.064	0.064
39	**WLAN2.4G**	**802.11g**	**Right Tilted**	**6**	**2437**	**14.92**	**0.129**	94.28	**1.061**	**0.117**	**0.124**
44	WLAN5G	802.11a	Right Cheek	44	5220	14.91	0.165	92.5	1.081	0.085	0.092
45	WLAN5G	802.11a	Right Tilted	44	5220	14.91	0.183	92.5	1.081	0.095	0.103
46	WLAN5G	802.11a	Left Cheek	44	5220	14.91	-0.123	92.5	1.081	0.124	0.134
47	WLAN5G	802.11a	Left Tilted	44	5220	14.91	0.17	92.5	1.081	0.102	0.110
48	WLAN5G	802.11a	Right Cheek	52	5260	15.14	0.168	92.5	1.081	0.099	0.107
49	WLAN5G	802.11a	Right Tilted	52	5260	15.14	0.13	92.5	1.081	0.115	0.124
50	**WLAN5G**	**802.11a**	**Left Cheek**	**52**	**5260**	**15.14**	**0.03**	**92.5**	**1.081**	**0.131**	**0.142**
51	WLAN5G	802.11a	Left Tilted	52	5260	15.14	0.01	92.5	1.081	0.103	0.111
52	WLAN5G	802.11a	Right Cheek	116	5580	14.91	0.153	92.5	1.081	0.106	0.115
53	WLAN5G	802.11a	Right Tilted	116	5580	14.91	-0.178	92.5	1.081	0.128	0.138
54	WLAN5G	802.11a	Left Cheek	116	5580	14.91	0.14	92.5	1.081	0.109	0.118
55	WLAN5G	802.11a	Left Tilted	116	5580	14.91	0.159	92.5	1.081	0.091	0.098
56	WLAN5G	802.11a	Right Cheek	157	5785	15.12	0.192	100	1.000	0.061	0.061
57	WLAN5G	802.11a	Right Tilted	157	5785	15.12	0.158	100	1.000	0.08	0.080
58	WLAN5G	802.11a	Left Cheek	157	5785	15.12	0.02	100	1.000	0.085	0.085
59	WLAN5G	802.11a	Left Tilted	157	5785	15.12	-0.172	100	1.000	0.071	0.071

Note: Per KDB 648474 and KDB 447498, 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 Body-worn SAR Test

<u><GSM SAR></u>

Plot No.	Band	Mode	Test Position	Gap (cm)	Holster	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)
5	GSM850	GPRS (4 Tx slots)	Front	1.5cm		251	848.8	29.64	-0.13	0.799
6	GSM850	GPRS (4 Tx slots)	Back	1.5cm		251	848.8	29.64	-0.03	0.984
7	GSM850	GPRS (4 Tx slots)	Back	1.5cm		128	824.2	29.33	-0.08	0.933
8	**GSM850**	**GPRS (4 Tx slots)**	**Back**	**1.5cm**		**189**	**836.4**	**29.52**	**-0.12**	**0.988**
9	GSM850	GPRS (4 Tx slots)	Front	0cm	v	251	848.8	29.64	0.04	0.658
17	**GSM1900**	**GPRS (4 Tx slots)**	**Front**	**1.5cm**		**512**	**1850.2**	**28.32**	**-0.18**	**0.325**
18	GSM1900	GPRS (4 Tx slots)	Back	1.5cm		512	1850.2	28.32	-0.03	0.297
19	GSM1900	GPRS (4 Tx slots)	Front	0cm	v	512	1850.2	28.32	0.01	0.305

Note:
1. Per KDB 648474 and KDB 447498, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. When EUT be placed into the holster and only the EUT positive toward the human body.
3. “V” in the Headset column means the Headset is plugged during SAR testing.

<u><WCDMA SAR></u>

Plot No.	Band	Mode	Test Position	Gap (cm)	Holster	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	SAR_{1g} (W/kg)
12	WCDMA V	RMC12.2K	Front	1.5cm		4182	836.4	23.76	-0.16	0.453
13	**WCDMA V**	**RMC12.2K**	**Back**	**1.5cm**		**4182**	**836.4**	**23.76**	**-0.02**	**0.581**
14	WCDMA V	RMC12.2K	Front	0cm	v	4182	836.4	23.76	-0.04	0.369
20	WCDMA II	RMC12.2K	Front	1.5cm		9400	1880	23.32	-0.07	0.221
21	**WCDMA II**	**RMC12.2K**	**Back**	**1.5cm**		**9400**	**1880**	**23.32**	**-0.02**	**0.242**
22	WCDMA II	RMC12.2K	Front	0cm	v	9400	1880	23.32	0.02	0.171

Note:
1. Per KDB 648474 and KDB 447498, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. When EUT be placed into the holster and only the EUT positive toward the human body.
3. “V” in the Headset column means the Headset is plugged during SAR testing.

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Holster	Ch.	Freq. (MHz)	Average Power (dBm)	Power Drift (dB)	Duty Cycle %	Duty Cycle Compensate Factor	SAR_{1g} (W/kg)	Duty Cycle Compensated 1g SAR
40	WLAN2.4G	802.11b	Front	1.5cm		11	2462	13.39	0.193	100	1.000	0.016	0.016
41	WLAN2.4G	802.11b	Back	1.5cm		11	2462	13.39	0.191	100	1.000	0.032	0.032
42	**WLAN2.4G**	**802.11g**	**Back**	**1.5cm**		**6**	**2437**	**14.92**	**0.107**	**94.28**	**1.061**	**0.05**	**0.053**
43	WLAN2.4G	802.11g	Front	0cm	v	6	2437	14.92	0.101	94.28	1.061	0.02	0.021
60	WLAN5G	802.11a	Front	1.5cm		44	5220	14.91	0.168	92.5	1.081	0.027	0.029
61	WLAN5G	802.11a	Back	1.5cm		44	5220	14.91	0.142	92.5	1.081	0.236	0.255
62	WLAN5G	802.11a	Front	0cm	v	44	5220	14.91	0.1	92.5	1.081	0.021	0.023
63	WLAN5G	802.11a	Front	1.5cm		52	5260	15.14	0.19	92.5	1.081	0.024	0.026
64	WLAN5G	802.11a	Back	1.5cm		52	5260	15.14	0.125	92.5	1.081	0.244	0.264
65	WLAN5G	802.11a	Front	0cm	v	52	5260	15.14	0.145	92.5	1.081	0.019	0.021
66	WLAN5G	802.11a	Front	1.5cm		116	5580	14.91	0.124	92.5	1.081	0.017	0.018
67	**WLAN5G**	**802.11a**	**Back**	**1.5cm**		**116**	**5580**	**14.91**	**0.173**	**92.5**	**1.081**	**0.317**	**0.343**
68	WLAN5G	802.11a	Front	0cm	v	116	5580	14.91	0.144	92.5	1.081	0.00317	0.003
69	WLAN5G	802.11a	Back	1.5cm		157	5785	15.12	0.109	100	1.000	0.015	0.015
70	WLAN5G	802.11a	Back	1.5cm		157	5785	15.12	0.133	100	1.000	0.191	0.191
71	WLAN5G	802.11a	Front	0cm	v	157	5785	15.12	0.121	100	1.000	0.00721	0.007

Note:

1. Per KDB 648474 and KDB 248227, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.
2. When EUT be placed into the holster and only the EUT positive toward the human body.
3. “V” in the Headset column means the Headset is plugged during SAR testing.

11.3 Simultaneous Multi-band Transmission Analysis

No.	Applicable Simultaneous Transmission Combination
1.	WWAN + BT
2.	WWAN + WLAN

Note:

1. GSM/WCDMA share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either WLAN2.4G or WLAN5G according to the network signal condition; therefore, they will not transmit simultaneously.
3. EUT will choose either GSM/WCDMA according to the network signal condition; therefore, they will not transmit simultaneously.
4. The maximum SAR summation is calculated based on the same configuration and test position.
5. 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
6. If 1g-SAR scalar summation < 1.6W/kg, simultaneous SAR measurement is not necessary.

<Head SAR>

Position	WWAN			WLAN		WWAN + WLAN
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Plot No	Max. WLAN SAR (W/kg)	
Right Cheek	GSM850	1	0.374	35	0.07	**0.44**
	GSM1900	27	0.134	35	0.07	**0.20**
	WCDMA V	31	0.384	35	0.07	**0.45**
	WCDMA II	23	0.341	35	0.07	**0.41**
Right Tilted	GSM850	2	0.214	39	0.124	**0.34**
	GSM1900	28	0.077	39	0.124	**0.20**
	WCDMA V	32	0.254	39	0.124	**0.38**
	WCDMA II	24	0.181	39	0.124	**0.31**
Left Cheek	GSM850	3	0.352	37	0.064	**0.42**
	GSM1900	29	0.182	37	0.064	**0.25**
	WCDMA V	33	0.347	37	0.064	**0.41**
	WCDMA II	25	0.342	37	0.064	**0.41**
Left Tilted	GSM850	4	0.223	38	0.064	**0.29**
	GSM1900	30	0.115	38	0.064	**0.18**
	WCDMA V	34	0.267	38	0.064	**0.33**
	WCDMA II	26	0.239	38	0.064	**0.30**

<Head SAR>

Position	WWAN			WLAN		WWAN + WLAN
	WWAN Band	Plot No	Max. WWAN SAR (W/kg)	Plot No	Max. WLAN SAR (W/kg)	
Right Cheek	GSM850	1	0.374	52	0.115	**0.49**
	GSM1900	27	0.134	52	0.115	**0.25**
	WCDMA V	31	0.384	52	0.115	**0.50**
	WCDMA II	23	0.341	52	0.115	**0.46**
Right Tilted	GSM850	2	0.214	53	0.138	**0.35**
	GSM1900	28	0.077	53	0.138	**0.22**
	WCDMA V	32	0.254	53	0.138	**0.39**
	WCDMA II	24	0.181	53	0.138	**0.32**
Left Cheek	GSM850	3	0.352	50	0.142	**0.49**
	GSM1900	29	0.182	50	0.142	**0.32**
	WCDMA V	33	0.347	50	0.142	**0.49**
	WCDMA II	25	0.342	50	0.142	**0.48**
Left Tilted	GSM850	4	0.223	51	0.111	**0.33**
	GSM1900	30	0.115	51	0.111	**0.23**
	WCDMA V	34	0.267	51	0.111	**0.38**
	WCDMA II	26	0.239	51	0.111	**0.35**

<Body-worn SAR>

Position	WWAN Band	WWAN Plot No	Max. WWAN SAR (W/kg)	WLAN Plot No	Max. WLAN SAR (W/kg)	WWAN + WLAN
Front	GSM850	5	0.799	40	0.016	**0.82**
	GSM1900	17	0.325	40	0.016	**0.34**
	WCDMA V	12	0.453	40	0.016	**0.47**
	WCDMA II	20	0.221	40	0.016	**0.24**
Back	GSM850	8	0.988	42	0.053	**1.04**
	GSM1900	18	0.297	42	0.053	**0.35**
	WCDMA V	13	0.581	42	0.053	**0.63**
	WCDMA II	21	0.242	42	0.053	**0.30**
Front (w/ Holster	GSM850	9	0.658	43	0.021	**0.68**
	GSM1900	19	0.305	43	0.021	**0.33**
	WCDMA V	14	0.369	43	0.021	**0.39**
	WCDMA II	22	0.171	43	0.021	**0.19**

<Body-worn SAR>

Position	WWAN Band	WWAN Plot No	Max. WWAN SAR (W/kg)	WLAN Plot No	Max. WLAN SAR (W/kg)	WWAN + WLAN
Front	GSM850	5	0.799	60	0.029	**0.83**
	GSM1900	17	0.325	60	0.029	**0.35**
	WCDMA V	12	0.453	60	0.029	**0.48**
	WCDMA II	20	0.221	60	0.029	**0.25**
Back	GSM850	8	0.988	67	0.343	**1.33**
	GSM1900	18	0.297	67	0.343	**0.64**
	WCDMA V	13	0.581	67	0.343	**0.92**
	WCDMA II	21	0.242	67	0.343	**0.59**
Front (w/ Holster	GSM850	9	0.658	62	0.023	**0.68**
	GSM1900	19	0.305	62	0.023	**0.33**
	WCDMA V	14	0.369	62	0.023	**0.39**
	WCDMA II	22	0.171	62	0.023	**0.19**

Test Engineer : Ken Li and Angelo Chang

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 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

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.