FCC SAR Test Report

APPLICANT	:	**Hewlett-Packard Company**
EQUIPMENT	:	**Tablet PC**
BRAND NAME	:	**hp**
MODEL NAME	:	**HSTNN-C78C**
FCC ID	:	**B94HNC78CHWWR**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)**
		ANSI/IEEE C95.1-1992
		IEEE 1528-2003

The product was testing completed on Nov. 13, 2013. 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.
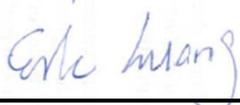
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Reviewed by: Eric Huang / Deputy Manager

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Approved by: Jones Tsai / Manager

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
FA392719-03	Rev. 01	Initial issue of report	Dec. 09, 2013

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1. _Statement of Compliance_

The maximum results of Specific Absorption Rate (SAR) found during testing for **Hewlett-Packard Company Tablet PC, HSTNN-C78C** are as follows.

<Highest SAR Summary>

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Body	GPRS850	1.34	PCB	1.49
	GPRS1900	1.36		
	WCDMA Band V	1.20		
	WCDMA Band IV	1.49		
	WCDMA Band II	1.48		

<Highest Simultaneous transmission SAR>

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Body	GSM850	PCB	1.59
	WLAN 2.4GHz Band	DTS	

Exposure Position	Frequency Band	Equipment Class	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
Body	WCDMA Band IV	PCB	1.58
	Bluetooth	DSS	

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.

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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	Hewlett-Packard Company
Address	3000 Hanover Street, Palo Alto, California 94304, USA

2.3 Manufacturer

Company Name	COMPAL ELECTRONICS, INC.
Address	No. 581, Ruiguang Rd., Neihu District, Taipei City 11492, Taiwan (R. O. C.)

2.4 Application Details

Date of Start during the Test	Nov. 05, 2013
Date of End during the Test	Nov. 13, 2013

3. Underline Information

3.1 Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT	Tablet PC
Brand Name	hp
Model Name	HSTNN-C78C
FCC ID	B94HNC78CHWWR
Integrated Module	WWAN Module: Band Name: Huawei Model Name: MU736 WLAN Module: Brand Name: Mitsumi Model Name: DWM-W095A
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC: 13.56 MHz
Mode	・GPRS/EGPRS ・RMC 12.2Kbps Rel 99 ・HSDPA Rel 7, Cat14 ・HSUPA Rel 6, Cat6 ・802.11a/b/g/n HT20/HT40 ・Bluetooth v2.1+EDR，Bluetooth v4.0+LE ・NFC: ASK
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. This EUT has another variant version with WWAN module removal, and WLAN/Bluetooth SAR assessment was addressed in the Sporton SAR report (report no. FA392719-01 Rev.02) for FCC ID: B94HNC78CBRPR. The WLAN/Bluetooth module and the antenna is exactly identical between 2 versions, and the WLAN/Bluetooth antenna is >5cm away from WWAN antenna, the WLAN/Bluetooth SAR test results in the B94HNC78CBRPR SAR report is representative of WLAN/Bluetooth SAR performance in this EUT and will be submitted in this application.

3.2 Maximum RF output power among production units

Mode	Burst average power (dBm)			
	GSM 850		GSM 1900	
Output Power Status	Full power mode	Reduced Power mode	Full power mode	Reduced Power mode
GPRS (GMSK, 1 Tx slot)	33.5	29.0	30.5	26.0
GPRS (GMSK, 2 Tx slots)	31.0	26.5	28.0	23.0
EDGE (8PSK, 1 Tx slot)	28.0	28.0	27.0	26.0
EDGE (8PSK, 2 Tx slots)	25.5	25.5	24.5	23.0
EDGE (8PSK, 3 Tx slot)	24.0	24.0	23.0	21.0
EDGE (8PSK, 4 Tx slots)	22.5	22.5	21.5	20.0

Mode	Average Power (dBm)					
	WCDMA Band V		WCDMA Band II		WCDMA Band IV	
Output Power Status	Full power mode	Reduced Power mode	Full power mode	Reduced Power mode	Full power mode	Reduced Power mode
RMC 12.2K	24.5	19	24.5	17.5	24.5	18
HSDPA Subtest-1	24.5	19	24.5	17.5	24.5	18
HSUPA Subtest-5	24.5	19	24.5	17.5	24.5	18

3.3 Applied Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:
- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r01
- FCC KDB 616217 D04 SAR for laptop and tablets v01r01
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE v01

3.4 Device Category and SAR Limits

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

3.5 Test Conditions

3.5.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 Test Configuration

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT.

Target Power reduction applied for each wireless mode and orientation

Exposure Position / wireless mode	Bottom Face[1]	Edge 1[1]	Edge 2	Edge 3	Edge 4
GSM850 GPRS (GMSK 1 Tx slot)	4.5 dB	4.5 dB	0 dB	0 dB	0 dB
GSM850 GPRS (GMSK 2 Tx slots)	4.5 dB	4.5 dB	0 dB	0 dB	0 dB
GSM850 EDGE (8PSK 1 Tx slot)	0.0 dB	0.0 dB	0 dB	0 dB	0 dB
GSM850 EDGE (8PSK 2 Tx slots)	0.0 dB	0.0 dB	0 dB	0 dB	0 dB
GSM850 EDGE (8PSK 3 Tx slots)	0.0 dB	0.0 dB	0 dB	0 dB	0 dB
GSM850 EDGE (8PSK 4 Tx slots)	0.0 dB	0.0 dB	0 dB	0 dB	0 dB
GSM1900 GPRS (GMSK 1 Tx slot)	4.5 dB	4.5 dB	0 dB	0 dB	0 dB
GSM1900 GPRS (GMSK 2 Tx slots)	5.0 dB	5.0 dB	0 dB	0 dB	0 dB
GSM1900 EDGE (8PSK 1 Tx slot)	1.0 dB	1.0 dB	0 dB	0 dB	0 dB
GSM1900 EDGE (8PSK 2 Tx slots)	1.5 dB	1.5 dB	0 dB	0 dB	0 dB
GSM1900 EDGE (8PSK 3 Tx slots)	2.0 dB	2.0 dB	0 dB	0 dB	0 dB
GSM1900 EDGE (8PSK 4 Tx slots)	1.5 dB	1.5 dB	0 dB	0 dB	0 dB
WCDMA Band V	5.5 dB	5.5 dB	0 dB	0 dB	0 dB
WCDMA Band IV	6.5 dB	6.5 dB	0 dB	0 dB	0 dB
WCDMA Band II	7.0 dB	7.0 dB	0 dB	0 dB	0 dB

Remark:
1. [1]: Reduced maximum limit applied by activation of proximity sensor.

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Measurement on EUT:

Band/Mode	Ch #	Measured power reduction (dBm)		Reduction Levels
		w/o power back-off	w/ power back-off	(dB)
GSM850 GPRS (GMSK 2 Tx slot)	189	30.62	26.34	4.28
GSM1900 GPRS (GMSK 2 Tx slot)	661	27.45	22.96	4.49
WCDMA Band V (RMC 12.2Kbps)	4182	24.10	18.83	5.27
WCDMA Band IV (RMC 12.2Kbps)	1413	23.82	17.91	5.91
WCDMA Band II (RMC 12.2Kbps)	9400	23.83	17.49	6.34

Proximity Sensor for Bottom Face detection

Bottom Face

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Proximity Sensor for Edge 1 detection

Edge 1

Legend:
- GSM850 (GMSK 2 Tx slot)
- GSM1900 (GMSK 2 Tx slot)
- WCDMA Band V
- WCDMA Band IV
- WCDMA Band II

(X-axis: Gap (mm); Y-axis: Power [dBm])

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4. _Specific Absorption Rate (SAR)_

4.1 _Introduction_

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

4.2 _SAR Definition_

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

5. SAR Measurement System
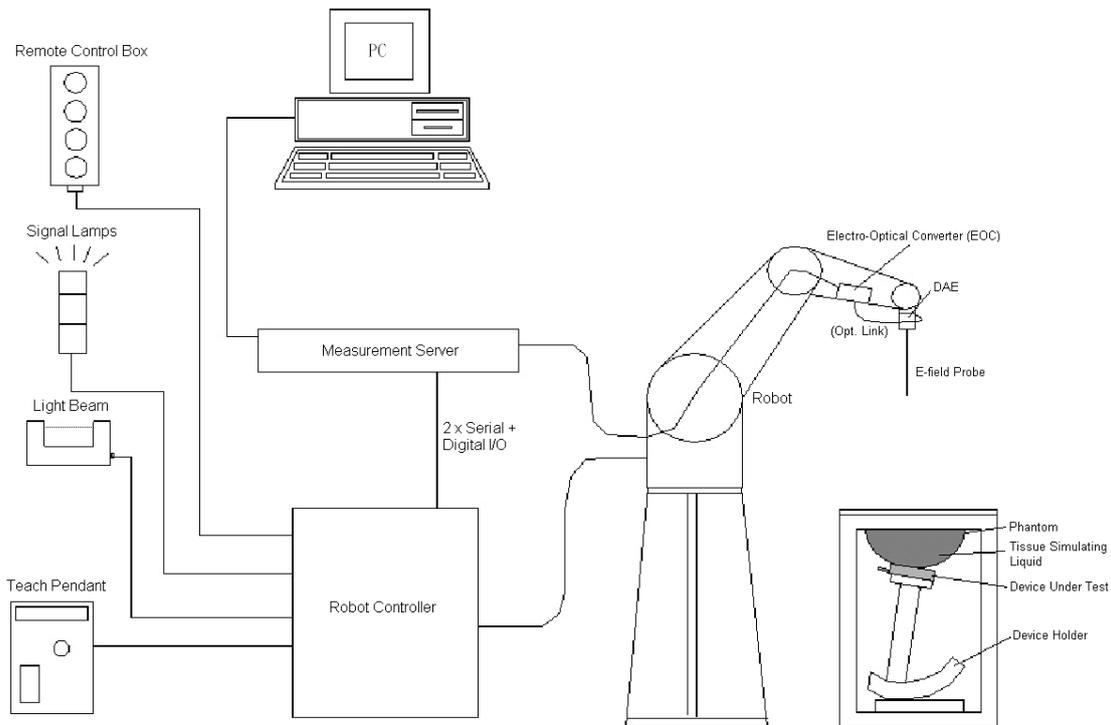
Fig 5.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

> ➢ A standard high precision 6-axis robot with controller, a teach pendant and software
> ➢ A data acquisition electronic (DAE) attached to the robot arm extension
> ➢ A dosimetric probe equipped with an optical surface detector system
> ➢ The electro-optical converter (EOC) performs the conversion between optical and electrical signals
> ➢ A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
> ➢ A probe alignment unit which improves the accuracy of the probe positioning
> ➢ A computer operating Windows XP
> ➢ DASY software
> ➢ Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
> ➢ The SAM twin phantom
> ➢ A device holder
> ➢ Tissue simulating liquid
> ➢ Dipole for evaluating the proper functioning of the system

Component details are described in in the following sub-sections.

5.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

5.1.1   E-Field Probe Specification

<ES3DV3 Probe >

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)	
Dynamic Range	5 µW/g to 100 mW/g; Linearity: ± 0.2 dB	
Dimensions	Overall length: 337 mm (Tip: 10 mm) Tip diameter: 4 mm (Body: 10 mm) Distance from probe tip to dipole centers: 3 mm	**Fig 5.2 Photo of ES3DV3**

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	**Fig 5.3 Photo of EX3DV4/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**
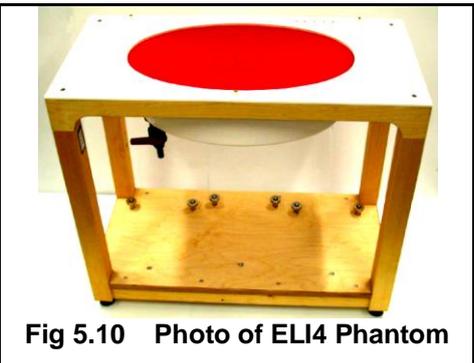
The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

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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.
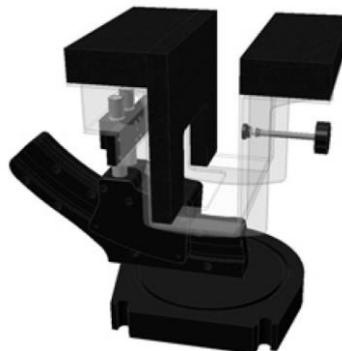

Fig 5.12   Laptop Extension Kit

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：

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

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：

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

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

with V_i = compensated signal of channel i, (i = x, y, z)
           $Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(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)：

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

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

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

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.

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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. 18, 2013	Mar. 17, 2014
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Jun. 20, 2012	Jun. 19, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 20, 2013	Mar. 19, 2014
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 21, 2013	Aug. 20, 2014
SPEAG	Data Acquisition Electronics	DAE4	1279	Jan. 28, 2013	Jan. 27, 2014
SPEAG	Data Acquisition Electronics	DAE4	913	Jan. 17, 2013	Jan. 16, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3697	Oct. 15, 2013	Oct. 14, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3801	Jun. 20, 2013	Jun. 19, 2014
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 24, 2013	Sep. 23, 2014
Wisewind	Thermometer	ETP-101	TM685	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	HTC-1	TM642	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	ETP-101	TM685	Oct. 22, 2013	Oct. 21, 2014
Agilent	Wireless Communication Test Set	E5515C	MY50264370	Apr. 29, 2013	Apr. 28, 2015
Agilent	Wireless Communication Test Set	E5515E	MY52112077	Apr. 28, 2012	Apr. 27, 2014
SPEAG	Device Holder	N/A	N/A	NCR	NCR
R&S	Signal Generator	SMF 100A	101107	May. 27, 2013	May. 26, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 23, 2013	Jul. 22, 2014
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 07, 2013	Feb. 06, 2014
Anritsu	Power Meter	ML2495A	1132003	Aug. 28, 2013	Aug. 27, 2014
Anritsu	Power Sensor	MA2411B	1126017	Aug. 27, 2013	Aug. 26, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 4	
Woken	Attenuator 1	WK0602-XX	N/A	Note 4	
PE	Attenuator 2	PE7005-10	N/A	Note 4	
PE	Attenuator 3	PE7005- 3	N/A	Note 4	
AR	Power Amplifier	5S1G4M2	328767	Note 5	
R&S	Spectrum Analyzer	FSP 7	101131	Jul. 09, 2013	Jul. 08, 2014

Table 5.1 Test Equipment List

Note:
1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01r01, 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 D1750V2, SN: 1068 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.
4. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
6. Attenuator 1 insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.

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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.
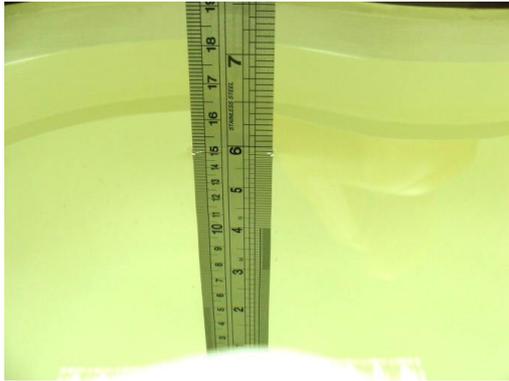
Fig 6.1 Photo of Liquid Height for Head SAR

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%

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The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SPEAG DAK-3.5 Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target (σ)	Permittivity Target (εr)	Delta (σ) (%)	Delta (εr) (%)	Limit (%)	Date
835	Body	22.3	0.963	54.541	0.97	55.20	-0.72	-1.19	±5	2013/11/13
835	Body	22.3	0.963	54.541	0.97	55.20	-0.72	-1.19	±5	2013/11/13
1750	Body	22.6	1.510	52.005	1.52	53.30	-0.66	-2.43	±5	2013/11/5
1750	Body	22.4	1.546	51.742	1.52	53.30	1.71	-2.92	±5	2013/11/8
1750	Body	22.3	1.545	51.726	1.52	53.30	1.64	-2.95	±5	2013/11/13
1900	Body	22.6	1.534	51.986	1.52	53.30	0.92	-2.47	±5	2013/11/5
1900	Body	22.4	1.569	51.586	1.52	53.30	3.22	-3.22	±5	2013/11/8

Table 6.2 Measuring Results for Simulating Liquid

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7. *System Verification Procedures*

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

7.1 *Purpose of System Performance check*

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

7.2 *System Setup*

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:
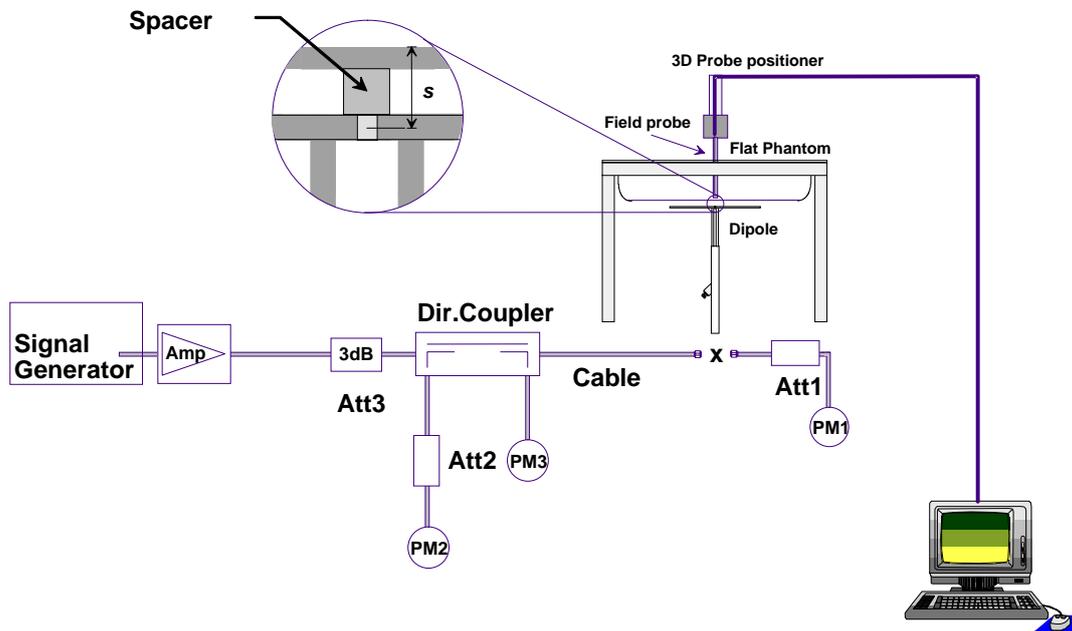
Fig 7.1 System Setup for System Evaluation

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

Fig 7.2 Photo of Dipole Setup

7.3 SAR System Verification Results

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

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
2013/11/13	835	Body	250	D835V2-SN:499	3801	913	2.54	9.63	10.16	5.50
2013/11/13	835	Body	250	D835V2-SN:499	3270	778	2.45	9.63	9.8	1.77
2013/11/5	1750	Body	250	D1750V2-SN:1068	3697	1279	9.25	36.80	37	0.54
2013/11/8	1750	Body	250	D1750V2-SN:1068	3697	1279	9.46	36.80	37.84	2.83
2013/11/13	1750	Body	250	D1750V2-SN:1068	3801	913	9.78	36.80	39.12	6.30
2013/11/5	1900	Body	250	D1900V2-SN:5d041	3697	1279	9.49	40.80	37.96	-6.96
2013/11/8	1900	Body	250	D1900V2-SN:5d041	3697	1279	9.70	40.80	38.8	-4.90

Table 7.1 Target and Measurement SAR after Normalized

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8. _EUT Testing Position_

Please refer to Appendix D for the test setup photos.

9. _Measurement Procedures_

The measurement procedures are as follows:

<u><Conducted power measurement></u>
(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

<u><SAR measurement></u>
(a)   Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b)   Place the EUT in the positions as Appendix D demonstrates.
(c)   Set scan area, grid size and other setting on the DASY software.
(d)   Measure SAR results for the highest power channel on each testing position.
(e)   Find out the largest SAR result on these testing positions of each band
(f)   Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

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

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

9.1 _Spatial Peak SAR Evaluation_

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

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

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

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

9.2 Power Reference Measurement

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

9.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r01 quoted below.

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

		≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		$30° \pm 1°$	$20° \pm 1°$
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}		≤ 2 GHz: ≤ 15 mm $2 – 3$ GHz: ≤ 12 mm	$3 – 4$ GHz: ≤ 12 mm $4 – 6$ GHz: ≤ 10 mm
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}		≤ 2 GHz: ≤ 8 mm $2 – 3$ GHz: ≤ 5 mm[*]	$3 – 4$ GHz: ≤ 5 mm[*] $4 – 6$ GHz: ≤ 4 mm[*]
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	$3 – 4$ GHz: ≤ 4 mm $4 – 5$ GHz: ≤ 3 mm $5 – 6$ GHz: ≤ 2 mm
	graded grid: $\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	$3 – 4$ GHz: ≤ 3 mm $4 – 5$ GHz: ≤ 2.5 mm $5 – 6$ GHz: ≤ 2 mm
	$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	$3 – 4$ GHz: ≥ 28 mm $4 – 5$ GHz: ≥ 25 mm $5 – 6$ GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

[*] When zoom scan is required and the _reported_ SAR from the area scan based _1-g SAR estimation_ procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

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9.4 *Volume Scan Procedures*

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

9.5 *SAR Averaged Methods*

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

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

9.6 *Power Drift Monitoring*

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

10. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

Note:
1. Per KDB 447498 D01v05r01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. According to KDB 941225 D03v01, for Body SAR testing, the EUT operating without power back-off was set in GPRS (2 Tx slots) and the EUT operating with power back-off was set in GPRS (2 Tx slots) due to its highest frame-average power.

Full Power mode (Proximity Sensor Inactive)

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GPRS (GMSK, 1 Tx slot)	32.90	32.89	32.91	33.50	23.90	23.89	23.91	24.50
GPRS (GMSK, 2 Tx slots)	30.70	30.62	30.61	31.00	24.70	24.62	24.61	25.00
EDGE (8PSK, 1 Tx slot)	26.99	26.89	26.84	28.00	17.99	17.89	17.84	19.00
EDGE (8PSK, 2 Tx slots)	24.56	24.41	24.39	25.50	18.56	18.41	18.39	19.50
EDGE (8PSK, 3 Tx slots)	23.01	22.88	22.88	24.00	18.75	18.62	18.62	19.74
EDGE (8PSK, 4 Tx slots)	21.43	21.45	21.33	22.50	18.43	18.45	18.33	19.50

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

Reduced Power Mode (Proximity Sensor active)

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GPRS (GMSK, 1 Tx slot)	28.98	28.89	28.95	29.00	19.98	19.89	19.95	20.00
GPRS (GMSK, 2 Tx slots)	26.40	26.34	26.30	26.50	20.40	20.34	20.30	20.50
EDGE (8PSK, 1 Tx slot)	26.99	26.89	26.84	28.00	17.99	17.89	17.84	19.00
EDGE (8PSK, 2 Tx slots)	24.56	24.41	24.39	25.50	18.56	18.41	18.39	19.50
EDGE (8PSK, 3 Tx slots)	23.01	22.88	22.88	24.00	18.75	18.62	18.62	19.74
EDGE (8PSK, 4 Tx slots)	21.43	21.45	21.33	22.50	18.43	18.45	18.33	19.50

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

Full Power mode (Proximity Sensor Inactive)

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GPRS (GMSK, 1 Tx slot)	30.13	30.22	30.23	30.50	21.13	21.22	21.23	21.50
GPRS (GMSK, 2 Tx slots)	27.36	27.45	27.47	28.00	21.36	21.45	21.47	22.00
EDGE (8PSK, 1 Tx slot)	25.62	25.68	25.74	27.00	16.62	16.68	16.74	18.00
EDGE (8PSK, 2 Tx slots)	23.43	23.46	23.38	24.50	17.43	17.46	17.38	18.50
EDGE (8PSK, 3 Tx slots)	21.90	21.81	21.87	23.00	17.64	17.55	17.61	18.74
EDGE (8PSK, 4 Tx slots)	20.44	20.64	20.43	21.50	17.44	17.64	17.43	18.50

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

Reduced Power Mode (Proximity Sensor active)

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GPRS (GMSK, 1 Tx slot)	25.59	25.66	25.67	26.00	16.59	16.66	16.67	17.00
GPRS (GMSK, 2 Tx slots)	22.81	22.96	22.95	23.00	16.81	16.96	16.95	17.00
EDGE (8PSK, 1 Tx slot)	25.16	25.19	25.18	26.00	16.16	16.19	16.18	17.00
EDGE (8PSK, 2 Tx slots)	22.40	22.42	22.41	23.00	16.40	16.42	16.41	17.00
EDGE (8PSK, 3 Tx slots)	20.38	20.45	20.50	21.00	16.12	16.19	16.24	16.74
EDGE (8PSK, 4 Tx slots)	19.43	19.61	19.62	20.00	16.43	16.61	16.62	17.00

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

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<WCDMA Conducted Power>

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

A summary of these settings are illustrated below:

HSDPA Setup Configuration:
     a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
     b. The RF path losses were compensated into the measurements.
     c. A call was established between EUT and Base Station with following setting:
         i. Set Gain Factors (β_c and β_d) and parameters were set according to each
         ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
         iii. Set RMC 12.2Kbps + HSDPA mode.
         iv. Set Cell Power = -86 dBm
         v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
         vi. Select HSDPA Uplink Parameters
         vii. Set Delta ACK, Delta NACK and Delta CQI = 8
         viii. Set Ack-Nack Repetition Factor to 3
         ix. Set CQI Feedback Cycle (k) to 4 ms
         x. Set CQI Repetition Factor to 2
         xi. Power Ctrl Mode = All Up bits
     d. The transmitted maximum output power was recorded.

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

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

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

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

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

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

Setup Configuration

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HSUPA Setup Configuration:

    a.   The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.

    b.   The RF path losses were compensated into the measurements.

    c.   A call was established between EUT and Base Station with following setting * :

        i.   Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK

        ii.   Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121

        iii.   Set Cell Power = -86 dBm

        iv.   Set Channel Type = 12.2k + HSPA

        v.   Set UE Target Power

        vi.   Power Ctrl Mode= Alternating bits

        vii.   Set and observe the E-TFCI

        viii.   Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI

    d.   The transmitted maximum output power was recorded.

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

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

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

Note 2:   CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3:   For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4:   For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5:   In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

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<WCDMA Conducted Power>

Note:
1. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA SAR evaluation can be excluded..
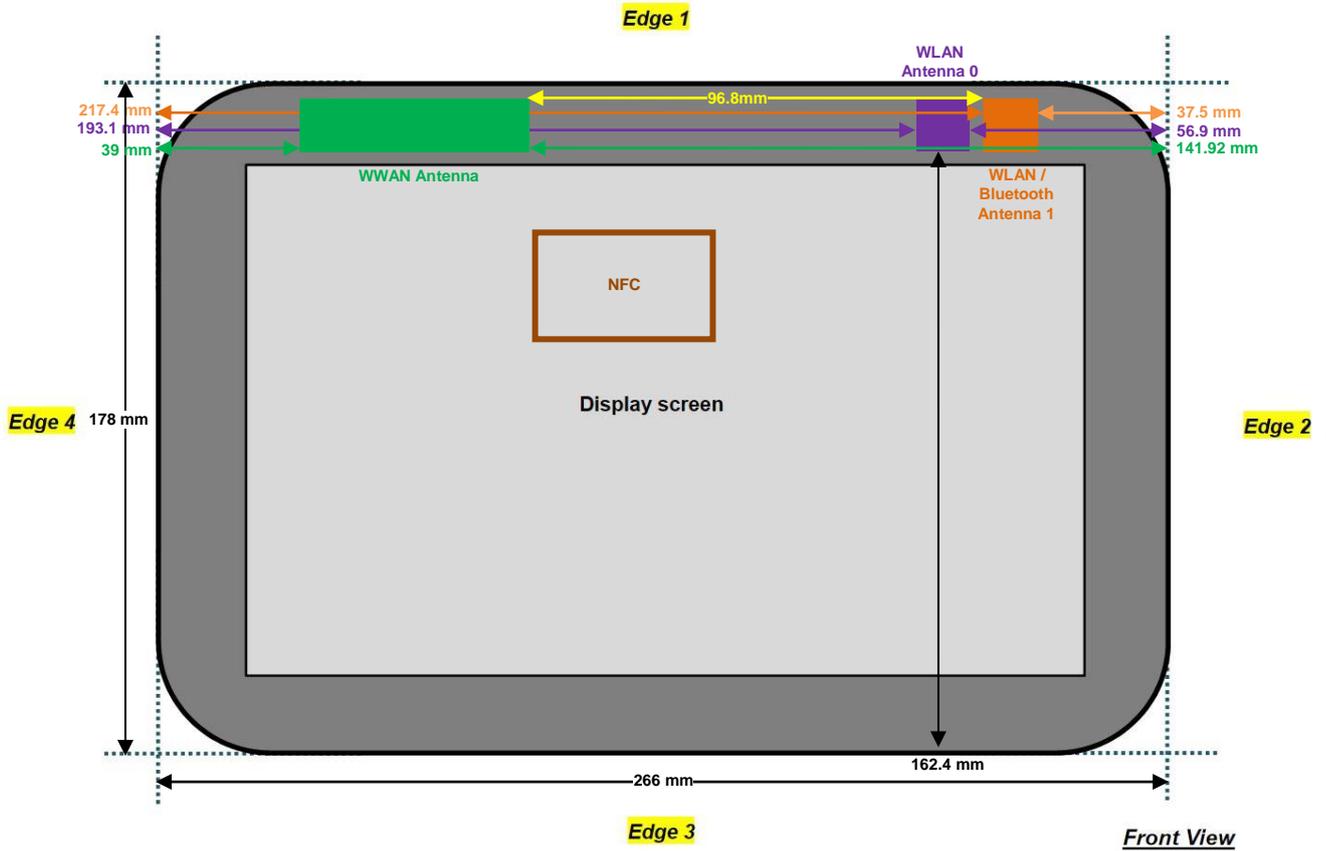
Full Power mode (Proximity Sensor Inactive)

Band			WCDMA V			Tune-up Limit (dBm)	WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)
TX Channel			4132	4182	4233		9262	9400	9538		1312	1413	1513	
Frequency (MHz)			826.4	836.4	846.6		1852.4	1880	1907.6		1712.4	1732.6	1752.6	
MPR	3GPP Rel 99	RMC 12.2Kbps	24.30	24.10	24.11	24.50	23.80	23.83	23.72	24.50	23.98	23.82	23.87	24.50
0	3GPP Rel 6	HSDPA Subtest-1	24.08	23.91	23.92	24.50	23.58	23.65	23.33	24.50	23.67	23.52	23.59	24.50
0	3GPP Rel 6	HSDPA Subtest-2	23.04	22.86	22.88	24.50	22.53	22.59	22.57	24.50	22.68	22.50	22.61	24.50
0.5	3GPP Rel 6	HSDPA Subtest-3	22.75	22.60	22.61	23.50	22.29	22.37	22.13	23.50	22.44	22.28	22.32	23.50
0.5	3GPP Rel 6	HSDPA Subtest-4	22.48	22.30	22.31	23.50	21.99	22.09	21.88	23.50	22.15	22.03	22.05	23.50
0	3GPP Rel 6	HSUPA Subtest-1	23.02	22.82	22.85	24.50	22.48	22.57	22.34	24.50	22.67	22.57	22.59	24.50
2	3GPP Rel 6	HSUPA Subtest-2	20.90	20.75	20.78	22.50	20.54	20.55	20.38	22.50	20.64	20.55	20.58	22.50
1	3GPP Rel 6	HSUPA Subtest-3	21.73	21.56	21.58	23.50	21.28	21.29	21.09	23.50	21.40	21.33	21.37	23.50
2	3GPP Rel 6	HSUPA Subtest-4	21.24	21.07	21.09	22.50	20.81	20.90	20.65	22.50	21.01	20.97	20.98	22.50
0	3GPP Rel 6	HSUPA Subtest-5	23.11	22.88	22.89	24.50	22.57	22.64	22.41	24.50	22.74	22.34	22.43	24.50

Reduced Power Mode (Proximity Sensor active)

Band			WCDMA V			Tune-up Limit (dBm)	WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)
TX Channel			4132	4182	4233		9262	9400	9538		1312	1413	1513	
Frequency (MHz)			826.4	836.4	846.6		1852.4	1880	1907.6		1712.4	1732.6	1752.6	
MPR	3GPP Rel 99	RMC 12.2Kbps	18.89	18.83	18.84	19.00	17.46	17.49	17.44	17.50	17.94	17.91	17.89	18.00
0	3GPP Rel 6	HSDPA Subtest-1	18.65	18.58	18.61	19.00	17.23	17.34	17.21	17.50	17.40	17.34	17.24	18.00
0	3GPP Rel 6	HSDPA Subtest-2	18.63	18.53	18.55	19.00	17.22	17.33	17.20	17.50	17.39	17.33	17.23	18.00
0.5	3GPP Rel 6	HSDPA Subtest-3	18.61	18.52	18.54	19.00	17.21	17.32	17.19	17.50	17.38	17.32	17.22	18.00
0.5	3GPP Rel 6	HSDPA Subtest-4	18.60	18.48	18.53	19.00	17.20	17.31	17.18	17.50	17.37	17.31	17.21	18.00
0	3GPP Rel 6	HSUPA Subtest-1	18.34	18.32	18.33	19.00	17.03	17.09	17.01	17.50	17.17	17.10	17.05	18.00
2	3GPP Rel 6	HSUPA Subtest-2	18.41	18.30	18.34	19.00	16.75	16.81	16.72	17.50	16.96	16.88	16.84	18.00
1	3GPP Rel 6	HSUPA Subtest-3	18.25	18.16	18.24	19.00	16.90	17.01	16.88	17.50	17.11	17.06	17.02	18.00
2	3GPP Rel 6	HSUPA Subtest-4	18.33	18.25	18.27	19.00	16.99	17.05	16.93	17.50	17.10	17.07	17.04	18.00
0	3GPP Rel 6	HSUPA Subtest-5	18.75	18.62	18.65	19.00	17.34	17.44	17.31	17.50	17.60	17.37	17.36	18.00

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11. Antenna Location

<Tablet PC>

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\<SAR test exclusion table\>

Exposure Position	Wireless Interface	GPRS850 Class 10	GPRS1900 Class 10	WCDMA Band V	WCDMA Band IV	WCDMA Band II
	Tune-up Maximum power	25	22	24.5	24.5	24.5
	Tune-up Maximum rated power(mW)	316.00	158.00	282.00	282.00	282.00
Bottom Face	Antenna to user (mm)	5				
	SAR exclusion threshold (Ratio)	58.20	43.66	51.88	74.61	77.89
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 1	Antenna to user (mm)	5				
	SAR exclusion threshold (Ratio)	58.20	43.66	51.88	74.61	77.89
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 2	Antenna to user (mm)	141.92				
	SAR exclusion threshold (mW)	682.54	1027.76	681.51	1032.59	1027.82
	SAR testing required?	**No**	**No**	**No**	**No**	**No**
Edge 3	Antenna to user (mm)	162.4				
	SAR exclusion threshold (mW)	798.32	1232.56	797.02	1237.39	1232.62
	SAR testing required?	**No**	**No**	**No**	**No**	**No**
Edge 4	Antenna to user (mm)	39				
	SAR exclusion threshold (Ratio)	7.46	5.6	6.65	9.57	9.99
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Note:
1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
2. Per KDB 447498 D01v05r01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01v05r01, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01v05r01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

    [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
    - f(GHz) is the RF channel transmit frequency in GHz
    - Power and distance are rounded to the nearest mW and mm before calculation
    - The result is rounded to one decimal place for comparison
5. Per KDB 447498 D01v05r01, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
    a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
    b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

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12. SAR Test Results

Note:
1. Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
2. For the exposure positions that proximity sensor power reduction is applied for SAR compliance, additional SAR testing with EUT transmitting full power in normal mode was performed; 1.1cm for bottom face, 0.7cm for edge 1.
3. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA output power is < 0.25dB higher than RMC12.2Kbps, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA SAR evaluation can be excluded.

12.1 Body SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	(Sensor) Power Back-off	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
135	GSM850	GPRS (2 Tx slots)	Bottom Face	1.1cm	128	824.2	OFF	30.7	31	1.072	-0.03	0.931	0.998
136	GSM850	GPRS (2 Tx slots)	Bottom Face	1.1cm	189	836.4	OFF	30.62	31	1.091	-0.01	0.882	0.963
137	GSM850	GPRS (2 Tx slots)	Bottom Face	1.1cm	251	848.8	OFF	30.61	31	1.094	-0.01	0.813	0.889
138	GSM850	GPRS (2 Tx slots)	Edge 1	0.7cm	128	824.2	OFF	30.7	31	1.072	-0.05	0.791	0.848
139	GSM850	GPRS (2 Tx slots)	Edge 1	0.7cm	189	836.4	OFF	30.62	31	1.091	-0.05	0.732	0.799
140	GSM850	GPRS (2 Tx slots)	Edge 1	0.7cm	251	848.8	OFF	30.61	31	1.094	-0.07	0.705	0.771
141	GSM850	GPRS (2 Tx slots)	Edge 4	0cm	128	824.2	OFF	30.7	31	1.072	-0.04	0.267	0.286
142	GSM850	GPRS (2 Tx slots)	Bottom Face	0cm	128	824.2	ON	26.4	26.5	1.023	0.15	1.310	**1.341**
143	GSM850	GPRS (2 Tx slots)	Bottom Face	0cm	189	836.4	ON	26.34	26.5	1.038	-0.11	1.180	1.224
144	GSM850	GPRS (2 Tx slots)	Bottom Face	0cm	251	848.8	ON	26.3	26.5	1.047	-0.03	1.090	1.141
146	GSM850	GPRS (2 Tx slots)	Edge 1	0cm	128	824.2	ON	26.4	26.5	1.023	-0.13	0.622	0.636
101	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	810	1909.8	OFF	27.47	28	1.130	0	0.731	0.826
104	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	512	1850.2	OFF	27.36	28	1.159	0.01	0.671	0.778
105	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	661	1880	OFF	27.45	28	1.135	-0.01	0.712	0.808
102	GSM1900	GPRS (2 Tx slots)	Edge1	0.7cm	810	1909.8	OFF	27.47	28	1.130	-0.06	0.441	0.498
103	GSM1900	GPRS (2 Tx slots)	Edge 4	0cm	810	1909.8	OFF	27.47	28	1.130	0.16	0.358	0.404
106	GSM1900	GPRS (2 Tx slots)	Bottom Face	0cm	661	1880	ON	22.96	23	1.009	-0.04	1.350	**1.362**
107	GSM1900	GPRS (2 Tx slots)	Bottom Face	0cm	512	1850.2	ON	22.81	23	1.045	0	1.280	1.337
108	GSM1900	GPRS (2 Tx slots)	Bottom Face	0cm	810	1909.8	ON	22.95	23	1.012	-0.02	1.300	1.315
109	GSM1900	GPRS (2 Tx slots)	Edge1	0cm	661	1880	ON	22.96	23	1.009	-0.09	0.477	0.481

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<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	(Sensor) Power Back-off	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
128	WCDMA V	RMC 12.2Kbps	Bottom Face	1.1cm	4132	826.4	OFF	24.3	24.5	1.047	0.08	0.879	0.920
129	WCDMA V	RMC 12.2Kbps	Bottom Face	1.1cm	4182	836.4	OFF	24.1	24.5	1.096	0.04	0.822	0.901
130	WCDMA V	RMC 12.2Kbps	Bottom Face	1.1cm	4233	846.6	OFF	24.11	24.5	1.094	0.07	0.809	0.885
125	WCDMA V	RMC 12.2Kbps	Edge 1	0.7cm	4132	826.4	OFF	24.3	24.5	1.047	0.08	0.893	0.935
126	WCDMA V	RMC 12.2Kbps	Edge 1	0.7cm	4182	836.4	OFF	24.1	24.5	1.096	0.14	0.885	0.970
127	WCDMA V	RMC 12.2Kbps	Edge 1	0.7cm	4233	846.6	OFF	24.11	24.5	1.094	0.08	0.899	0.983
124	WCDMA V	RMC 12.2Kbps	Edge 4	0cm	4132	826.4	OFF	24.3	24.5	1.047	0.12	0.191	0.200
131	WCDMA V	RMC 12.2Kbps	Bottom Face	0cm	4132	826.4	ON	18.89	19	1.026	0.09	1.100	1.128
132	WCDMA V	RMC 12.2Kbps	Bottom Face	0cm	4182	836.4	ON	18.83	19	1.040	-0.03	1.150	**1.196**
133	WCDMA V	RMC 12.2Kbps	Bottom Face	0cm	4233	846.6	ON	18.84	19	1.038	-0.05	1.040	1.079
134	WCDMA V	RMC 12.2Kbps	Edge 1	0cm	4132	826.4	ON	18.89	19	1.026	-0.03	0.656	0.673
19	WCDMA IV	RMC 12.2Kbps	Bottom Face	1.1cm	1312	1712.4	OFF	23.98	24.5	1.127	0.01	0.911	1.027
20	WCDMA IV	RMC 12.2Kbps	Bottom Face	1.1cm	1413	1732.6	OFF	23.82	24.5	1.169	-0.02	1.030	1.205
21	WCDMA IV	RMC 12.2Kbps	Bottom Face	1.1cm	1513	1752.6	OFF	23.87	24.5	1.156	0	1.020	1.179
22	WCDMA IV	RMC 12.2Kbps	Edge 1	0.7cm	1312	1712.4	OFF	23.98	24.5	1.127	-0.13	1.200	1.353
115	WCDMA IV	RMC 12.2Kbps	Edge 1	0.7cm	1413	1732.6	OFF	23.82	24.5	1.169	0.12	1.220	1.427
116	WCDMA IV	RMC 12.2Kbps	Edge 1	0.7cm	1513	1732.6	OFF	23.87	24.5	1.156	0.09	1.220	1.410
117	WCDMA IV	RMC 12.2Kbps	Edge 4	0cm	1312	1712.4	OFF	23.98	24.5	1.127	0.15	0.264	0.298
118	WCDMA IV	RMC 12.2Kbps	Bottom Face	0cm	1312	1712.4	ON	17.94	18	1.014	-0.07	1.420	1.440
120	WCDMA IV	RMC 12.2Kbps	Bottom Face	0cm	1413	1732.6	ON	17.91	18	1.021	0.03	1.400	1.429
121	WCDMA IV	RMC 12.2Kbps	Bottom Face	0cm	1513	1752.6	ON	17.89	18	1.026	0.02	1.450	**1.487**
119	WCDMA IV	RMC 12.2Kbps	Edge 1	0cm	1312	1712.4	ON	17.94	18	1.014	-0.02	0.478	0.485
8	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	9400	1880	OFF	23.83	24.5	1.167	0.06	1.110	1.295
9	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	9262	1852.4	OFF	23.8	24.5	1.175	-0.09	1.260	1.480
10	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	9538	1907.6	OFF	23.72	24.5	1.197	0.02	1.140	1.364
11	WCDMA II	RMC 12.2Kbps	Edge 1	0.7cm	9400	1880	OFF	23.83	24.5	1.167	-0.07	1.060	1.237
12	WCDMA II	RMC 12.2Kbps	Edge 1	0.7cm	9262	1852.4	OFF	23.8	24.5	1.175	0.08	0.991	1.164
13	WCDMA II	RMC 12.2Kbps	Edge 1	0.7cm	9538	1907.6	OFF	23.72	24.5	1.197	-0.06	0.965	1.155
110	WCDMA II	RMC 12.2Kbps	Edge 4	0cm	9400	1880	OFF	23.83	24.5	1.167	0.12	0.594	0.693
111	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	9400	1880	ON	17.49	17.5	1.002	-0.03	1.460	1.463
112	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	9262	1852.4	ON	17.46	17.5	1.009	-0.02	1.470	**1.484**
113	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	9538	1907.6	ON	17.44	17.5	1.014	0.01	1.400	1.419
114	WCDMA II	RMC 12.2Kbps	Edge 1	0cm	9400	1880	ON	17.49	17.5	1.002	-0.09	0.702	0.704

12.2 Repeated SAR Measurement

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	(Sensor) Power Back-off	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
142	GSM850	GPRS (2 Tx slots)	Bottom Face	0cm	128	824.2	ON	26.4	26.5	1.023	0.15	1.310	-	1.341
145	GSM850	GPRS (2 Tx slots)	Bottom Face	0cm	128	824.2	ON	26.4	26.5	1.023	-0.17	1.300	1.01	1.330
121	WCDMA IV	RMC 12.2Kbps	Bottom Face	0cm	1513	1752.6	ON	17.89	18	1.026	0.02	1.450	-	1.487
123	WCDMA IV	RMC 12.2Kbps	Bottom Face	0cm	1513	1752.6	ON	17.89	18	1.026	0.05	1.430	1.01	1.467
112	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	9262	1852.4	ON	17.46	17.5	1.009	-0.02	1.470	-	1.484
122	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	9262	1852.4	ON	17.46	17.5	1.009	-0.02	1.410	1.04	1.423

Note:

1. Per KDB 865664 D01v01r01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg

2. Per KDB 865664 D01v01r01, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.

3. The ratio is the largest SAR to the smallest SAR among original and repeated measurement.

4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

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12.3 *Highest SAR Plot*

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2013/11/13
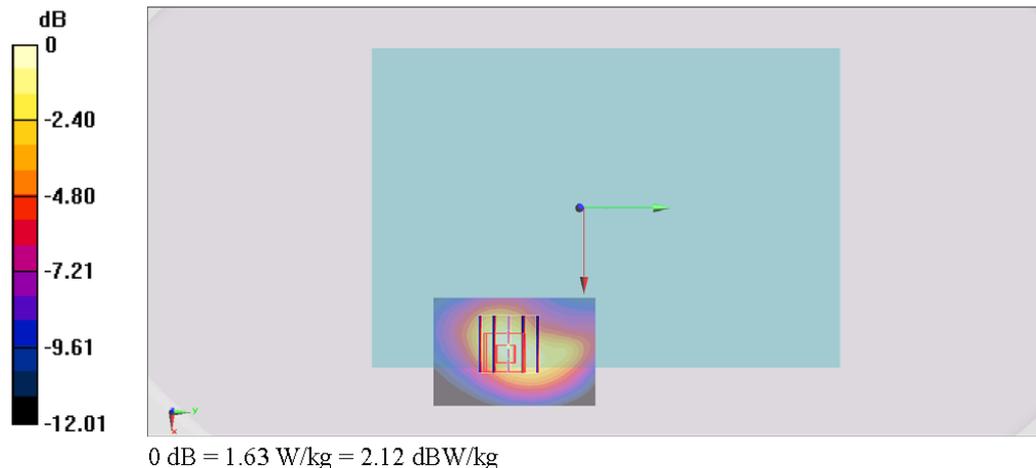
#142_GSM850_GPRS (2 Tx slots)_Bottom Face_0cm_Ch128

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:4.15
Medium: MSL_850_131113 Medium parameters used: f = 824.2 MHz; σ = 0.952 S/m; ε_r = 54.662; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.3 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(6.08, 6.08, 6.08); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch128/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.62 W/kg

Configuration/Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.120 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 2.36 W/kg
SAR(1 g) = 1.31 W/kg; SAR(10 g) = 0.752 W/kg
Maximum value of SAR (measured) = 1.63 W/kg

0 dB = 1.63 W/kg = 2.12 dBW/kg

Test Laboratory : Sporton International Inc. SAR/HAC Testing Lab   Date: 2013/11/8

#106_GSM1900_GPRS (2 Tx slots)_Bottom Face_0cm_Ch661

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:4.15
Medium: MSL_1900_131108 Medium parameters used: f = 1880 MHz; σ = 1.546 S/m; ε_r = 51.643; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3697; ConvF(7.19, 7.19, 7.19); Calibrated: 2013/10/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2013/1/28
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch661/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.04 W/kg

Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 36.588 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 2.60 W/kg
SAR(1 g) = 1.35 W/kg; SAR(10 g) = 0.674 W/kg
Maximum value of SAR (measured) = 1.99 W/kg

0 dB = 1.99 W/kg = 2.99 dBW/kg
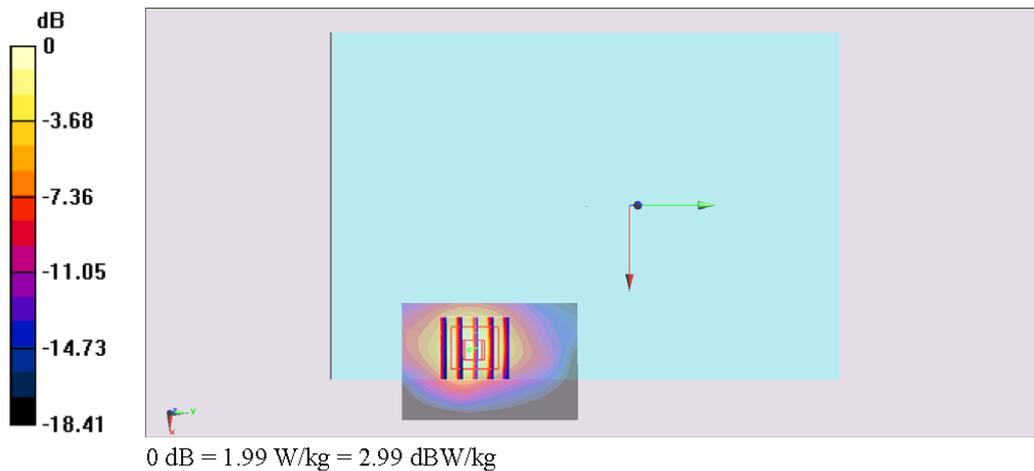
Test Laboratory : Sporton International Inc. SAR/HAC Testing Lab   Date: 2013/11/8
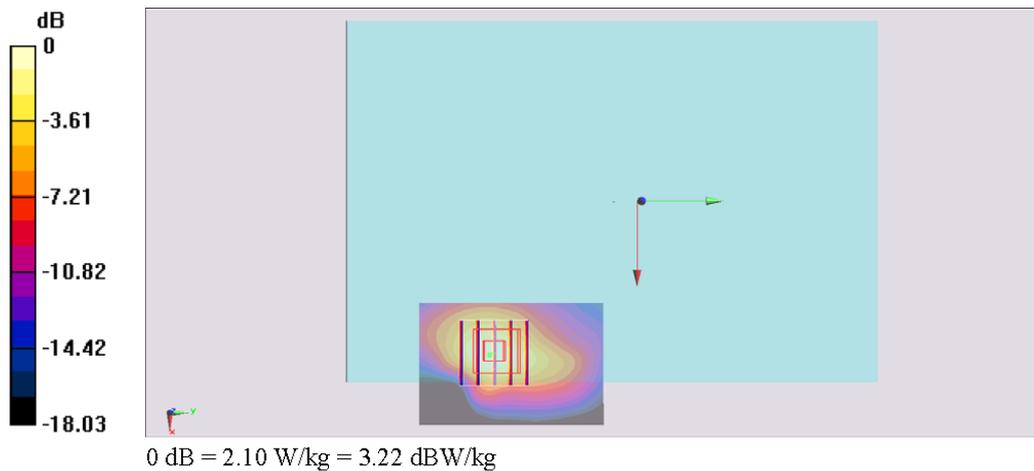
#121_WCDMA IV_RMC 12.2Kbps_Bottom Face_0cm_Ch1513

Communication System: WCDMA; Frequency: 1752.6 MHz;Duty Cycle: 1:1
Medium: MSL_1750_131108 Medium parameters used: f = 1753 MHz; σ = 1.55 S/m; ε_r = 51.733; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3697; ConvF(7.51, 7.51, 7.51); Calibrated: 2013/10/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2013/1/28
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch1513/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.34 W/kg

Configuration/Ch1513/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.105 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 2.68 W/kg
SAR(1 g) = 1.45 W/kg; SAR(10 g) = 0.764 W/kg
Maximum value of SAR (measured) = 2.10 W/kg

0 dB = 2.10 W/kg = 3.22 dBW/kg

Test Laboratory : Sporton International Inc. SAR/HAC Testing Lab   Date: 2013/11/8

#112_WCDMA II_RMC 12.2Kbps_Bottom Face_0cm_Ch9262

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: MSL_1900_131108 Medium parameters used : f = 1852.4 MHz; σ = 1.514 S/m; ε_r = 51.747;
ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3697; ConvF(7.19, 7.19, 7.19); Calibrated: 2013/10/15;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2013/1/28
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch9262/Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.53 W/kg

Configuration/Ch9262/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm,
dz=5mm
Reference Value = 42.347 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.79 W/kg
SAR(1 g) = 1.47 W/kg; SAR(10 g) = 0.748 W/kg
Maximum value of SAR (measured) = 2.08 W/kg

0 dB = 2.08 W/kg = 3.18 dBW/kg
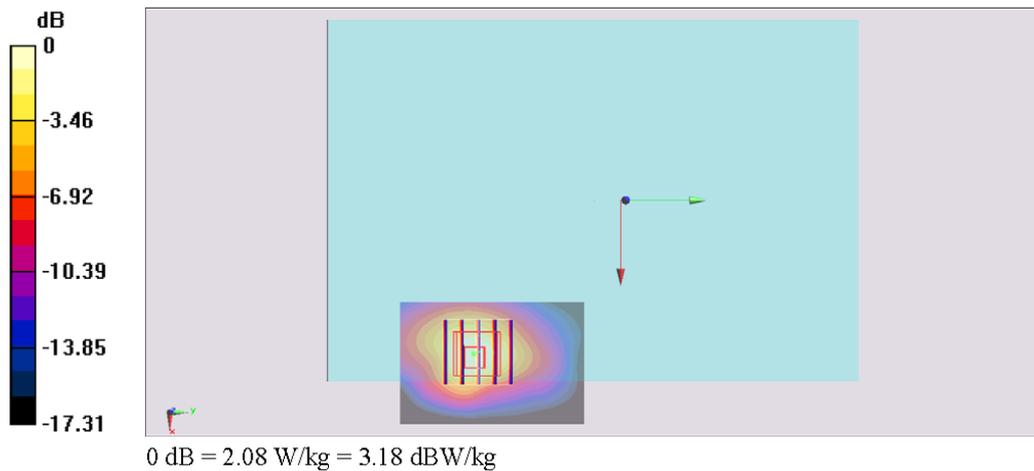
13. *Simultaneous Transmission Analysis*

NO.	Simultaneous Transmission Configurations	Portable Tablet Body	Note
1.	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes	2.4GHz Hotspot
2.	WCDMA(Data) + WLAN2.4GHz(data)	Yes	2.4GHz Hotspot
3.	GPRS/EDGE(Data) + Bluetooth(data)	Yes	
4.	WCDMA(Data) + Bluetooth(data)	Yes	
5.	GPRS/EDGE(data) + WLAN5GHz(data)	No	
6.	WCDMA(data) + WLAN5GHz(data)	No	

Note:
1. WLAN SAR test result and Bluetooth maximum power in the Sporton SAR report FCC ID: B94HNC78CBRPR (report no. FA392719-01 Rev.02) are used for simultaneous transmission analysis.
2. For simultaneous transmission analysis for exposure position of bottom face 1.1cm and Edge1 0.7cm, WLAN SAR tested at 0mm separation testing results are used for conservative SAR summation.
3. For co-location analysis:
   i) For WWAN SAR testing was performed on bottom face, Edge1 and Edge4, according to KDB 447498 D01v05r01 exclusion thresholds which can be referred to page33.
   ii) The WLAN SAR testing was performed on bottom face, Edge1 and Edge2, according to KDB 447498 D01v05r01 exclusion thresholds which can be referred to Sporton FCC SAR Report, FCC ID: B94HNC78CBRPR, Report No: FA392719-01 Rev.01 page34.
   iii) For co-location analysis was performed at the same exposure positions, which are bottom face and Edge1, where both WWAN standalone SAR and WLAN standalone SAR was assessed.
4. Per KDB 447498 D01v05r01, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) $SPLSR = (SAR_1 + SAR_2)^{1.5} /$ (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
      If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary
   iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg
5. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r01 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f(GHz)}/x$] W/kg for *test separation distances* $\leq$ 50 mm; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
   ii) When the minimum test separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.
   iv) Bluetooth estimated SAR is conservatively determined by 5mm separation, for all applicable exposure positions.

Bluetooth Max Power	Exposure Position	All Positions
9.5 dBm	Estimated SAR (W/kg)	0.378 W/kg

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13.1 Body Exposure Conditions

<WWAN + WLAN Antenna 0>

Position	WWAN		WLAN Ant 0	Summed SAR (W/kg)	SPLSR	Case No
	WWAN Band	SAR (W/kg)	SAR (W/kg)			
Bottom Face At 1.1 cm	GSM850	0.998	1.161	**2.16**	0.02	Case 1
	GSM1900	0.826	1.161	**1.99**	0.02	Case 2
	WCDMA V	0.920	1.161	**2.08**	0.02	Case 3
	WCDMA IV	1.205	1.161	**2.37**	0.03	Case 4
	WCDMA II	1.480	1.161	**2.64**	0.03	Case 5
Edge1 At 0.7 cm	GSM850	0.848	0.237	**1.09**		
	GSM1900	0.498	0.237	**0.74**		
	WCDMA V	0.983	0.237	**1.22**		
	WCDMA IV	1.445	0.237	**1.68**	0.02	Case 6
	WCDMA II	1.237	0.237	**1.47**		
Bottom Face At 0cm	GSM850	1.341	1.161	**2.50**	0.03	Case 7
	GSM1900	1.362	1.161	**2.52**	0.03	Case 8
	WCDMA V	1.196	1.161	**2.36**	0.03	Case 9
	WCDMA IV	1.487	1.161	**2.65**	0.03	Case 10
	WCDMA II	1.484	1.161	**2.65**	0.03	Case 11
Edge1 At 0cm	GSM850	0.636	0.237	**0.87**		
	GSM1900	0.481	0.237	**0.72**		
	WCDMA V	0.673	0.237	**0.91**		
	WCDMA IV	0.485	0.237	**0.72**		
	WCDMA II	0.704	0.237	**0.94**		

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<WWAN + WLAN Antenna 1>

Position	WWAN		WLAN Ant 1	Summed SAR (W/kg)	SPLSR	Case No
	WWAN Band	SAR (W/kg)	SAR (W/kg)			
Bottom Face At 1.1 cm	GSM850	0.998	0.595	**1.59**		
	GSM1900	0.826	0.595	**1.42**		
	WCDMA V	0.920	0.595	**1.52**		
	WCDMA IV	1.205	0.595	**1.80**	0.02	Case 12
	WCDMA II	1.480	0.595	**2.08**	0.02	Case 13
Edge1 At 0.7 cm	GSM850	0.848	0.152	**1.00**		
	GSM1900	0.498	0.152	**0.65**		
	WCDMA V	0.983	0.152	**1.14**		
	WCDMA IV	1.445	0.152	**1.60**		
	WCDMA II	1.237	0.152	**1.39**		
Bottom Face At 0cm	GSM850	1.341	0.595	**1.94**	0.02	Case 14
	GSM1900	1.362	0.595	**1.96**	0.02	Case 15
	WCDMA V	1.196	0.595	**1.79**	0.02	Case 16
	WCDMA IV	1.487	0.595	**2.08**	0.02	Case 17
	WCDMA II	1.484	0.595	**2.08**	0.02	Case 18
Edge1 At 0cm	GSM850	0.636	0.152	**0.79**		
	GSM1900	0.481	0.152	**0.63**		
	WCDMA V	0.673	0.152	**0.83**		
	WCDMA IV	0.485	0.152	**0.64**		
	WCDMA II	0.704	0.152	**0.86**		

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<WWAN + WLAN Antenna 0+1>

Position	WWAN Band	WWAN SAR (W/kg)	WLAN Ant 0+1 SAR (W/kg)	Summed SAR (W/kg)	SPLSR	Case No
Bottom Face At 1.1 cm	GSM850	0.998	1.226	**2.22**	0.02	Case 19
	GSM1900	0.826	1.226	**2.05**	0.02	Case 20
	WCDMA V	0.920	1.226	**2.15**	0.02	Case 21
	WCDMA IV	1.205	1.226	**2.43**	0.03	Case 22
	WCDMA II	1.480	1.226	**2.71**	0.03	Case 23
Edge1 At 0.7 cm	GSM850	0.848	0.257	**1.11**		
	GSM1900	0.498	0.257	**0.76**		
	WCDMA V	0.983	0.257	**1.24**		
	WCDMA IV	1.445	0.257	**1.70**	0.02	Case 24
	WCDMA II	1.237	0.257	**1.49**		
Bottom Face At 0cm	GSM850	1.341	1.226	**2.57**	0.03	Case 25
	GSM1900	1.362	1.226	**2.59**	0.03	Case 26
	WCDMA V	1.196	1.226	**2.42**	0.03	Case 27
	WCDMA IV	1.487	1.226	**2.71**	0.03	Case 28
	WCDMA II	1.484	1.226	**2.71**	0.03	Case 29
Edge1 At 0cm	GSM850	0.636	0.257	**0.89**		
	GSM1900	0.481	0.257	**0.74**		
	WCDMA V	0.673	0.257	**0.93**		
	WCDMA IV	0.485	0.257	**0.74**		
	WCDMA II	0.704	0.257	**0.96**		

<WWAN + Bluetooth Antenna 1>

Position	WWAN Band	WWAN SAR (W/kg)	Bluetooth Estimated SAR (W/kg)	Summed SAR (W/kg)	SPLSR	Case No
Bottom Face At 1.1 cm	GSM850	0.998	0.378	**1.38**		
	GSM1900	0.826	0.378	**1.20**		
	WCDMA V	0.920	0.378	**1.30**		
	WCDMA IV	1.205	0.378	**1.58**		
	WCDMA II	1.480	0.378	**1.86**	0.03	Case 30
Edge1 At 0.7 cm	GSM850	0.848	0.378	**1.23**		
	GSM1900	0.498	0.378	**0.88**		
	WCDMA V	0.983	0.378	**1.36**		
	WCDMA IV	1.445	0.378	**1.82**	0.03	Case 31
	WCDMA II	1.237	0.378	**1.62**	0.02	Case 32
Bottom Face At 0cm	GSM850	1.341	0.378	**1.72**	0.02	Case 33
	GSM1900	1.362	0.378	**1.74**	0.02	Case 34
	WCDMA V	1.196	0.378	**1.57**		
	WCDMA IV	1.487	0.378	**1.87**	0.03	Case 35
	WCDMA II	1.484	0.378	**1.86**	0.03	Case 36
Edge1 At 0cm	GSM850	0.636	0.378	**1.01**		
	GSM1900	0.481	0.378	**0.86**		
	WCDMA V	0.673	0.378	**1.05**		
	WCDMA IV	0.485	0.378	**0.86**		
	WCDMA II	0.704	0.378	**1.08**		

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13.2 SPLSR Evaluation and Analysis

Case 1	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR Result	Simultaneous SAR
					X	Y	Z				
	GSM850	Bottom Face	0.998	1.1	0.082	-0.06	-0.179	130.8	2.16	0.02	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
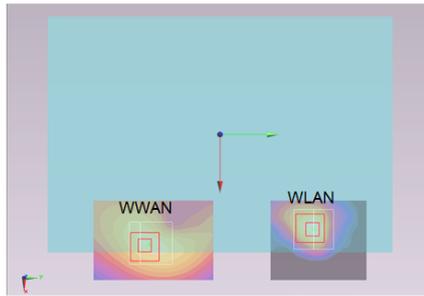
Case 2	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM1900	Bottom Face	0.826	1.1	0.0775	-0.0565	-0.18	127.1	1.99	0.02	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
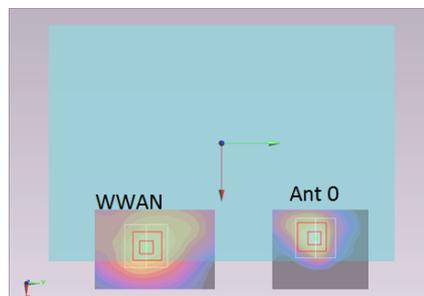
Case 3	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Bottom Face	0.92	1.1	0.0845	-0.0525	-0.18	123.6	2.08	0.02	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				

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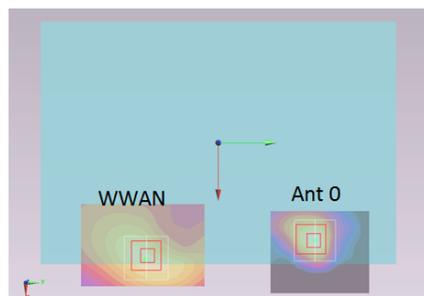
Case 4	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA IV	Bottom Face	1.205	1.1	0.079	-0.055	-0.179	125.6	2.37	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
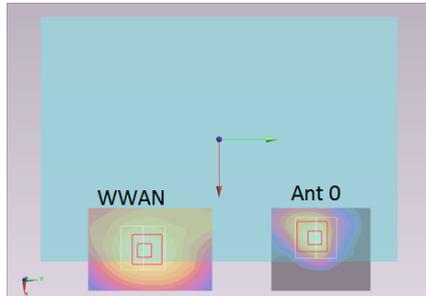
Case 5	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.48	1.1	0.079	-0.055	-0.179	125.6	2.64	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
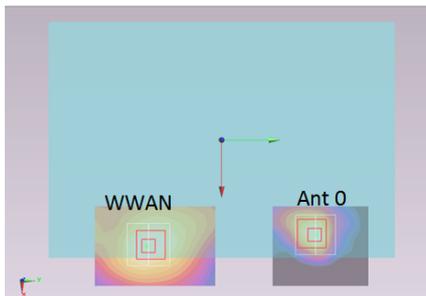
Case 6	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA IV	Edge 1	1.41	0.7	0.0035	-0.052	-0.18	124.9	1.65	0.02	Not required
	WLAN2.4GHz		0.237	0	-0.0012	0.0728	-0.179				

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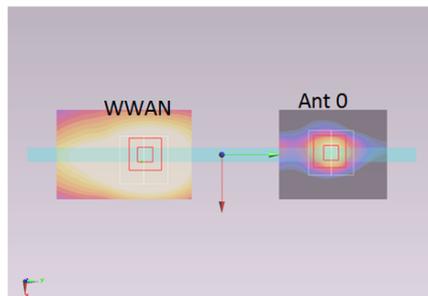
Case 7	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM850	Bottom Face	1.341	0	0.084	-0.052	-0.178	123.0	2.50	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
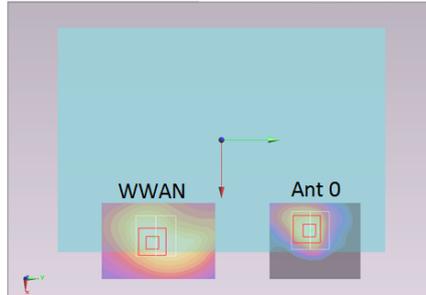
Case 8	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM1900	Bottom Face	1.362	0	0.073	-0.0595	-0.179	129.9	2.52	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
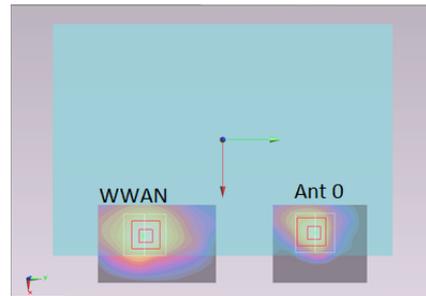
Case 9	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Bottom Face	1.196	0	0.085	-0.046	-0.178	117.2	2.36	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				

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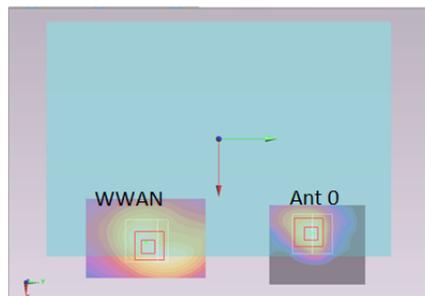
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					X	Y	Z				
	WCDMA IV	Bottom Face	1.487	0	0.0745	-0.0595	-0.18	130.0	2.65	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
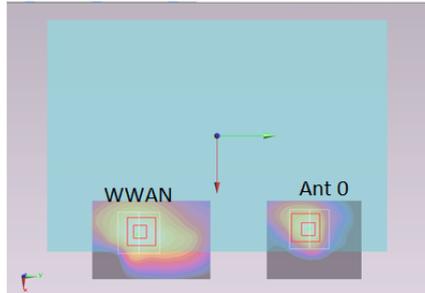
Case 11	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.484	0	0.0745	-0.058	-0.18	128.5	2.65	0.03	Not required
	WLAN2.4GHz		1.161	0	0.0716	0.0704	-0.177				
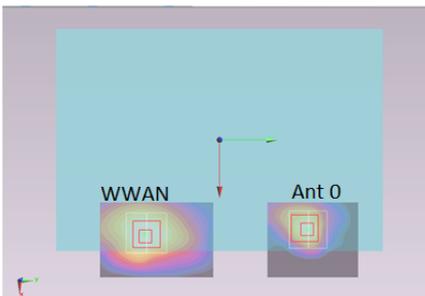
Case 12	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA IV	Bottom Face	1.205	1.1	0.079	-0.055	-0.179	142.3	1.80	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				

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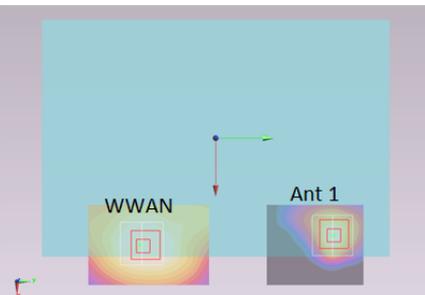
Case 13	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.48	1.1	0.079	-0.055	-0.179	142.3	2.08	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				
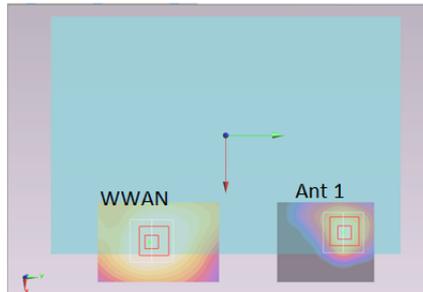
Case 14	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM850	Bottom Face	1.341	0	0.084	-0.052	-0.178	139.7	1.94	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				
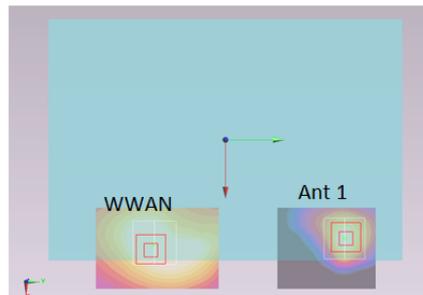
Case 15	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM1900	Bottom Face	1.362	0	0.073	-0.0595	-0.179	146.7	1.96	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				

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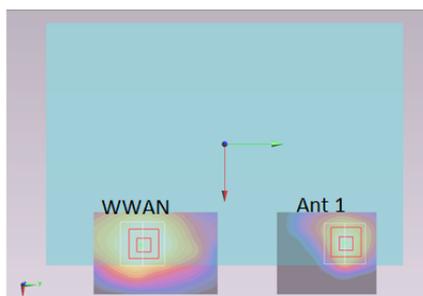
Case 16	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Bottom Face	1.196	0	0.085	-0.046	-0.178	133.8	1.79	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				
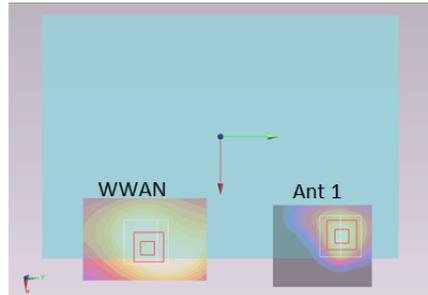
Case 17	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA VI	Bottom Face	1.487	0	0.0745	-0.0595	-0.18	146.7	2.08	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				
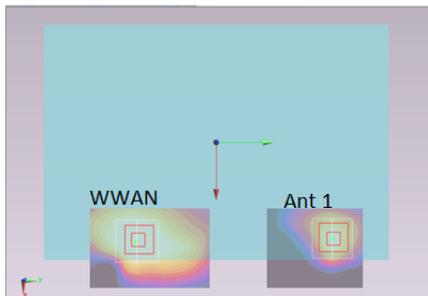
Case 18	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.484	0	0.0745	-0.058	-0.18	145.2	2.08	0.02	Not required
	WLAN2.4GHz		0.595	0	0.0728	0.0872	-0.177				

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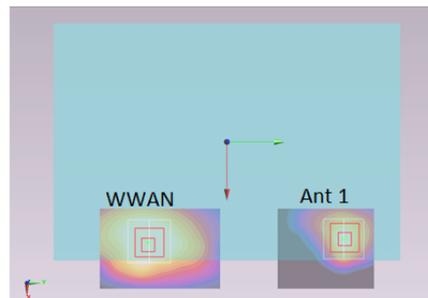
Case 19	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM850	Bottom Face	0.998	1.1	0.082	-0.06	-0.179	134.2	2.22	0.02	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
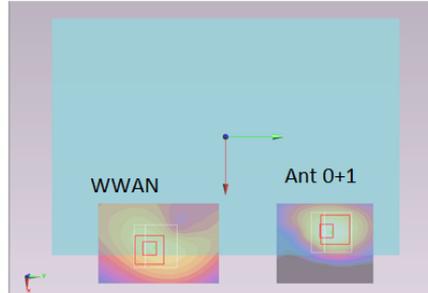
Case 20	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM1900	Bottom Face	0.826	1.1	0.0775	-0.0565	-0.18	130.5	2.05	0.02	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
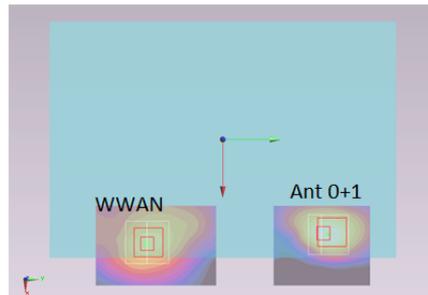
Case 21	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Bottom Face	0.92	1.1	0.0845	-0.0525	-0.18	127.0	2.15	0.02	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				

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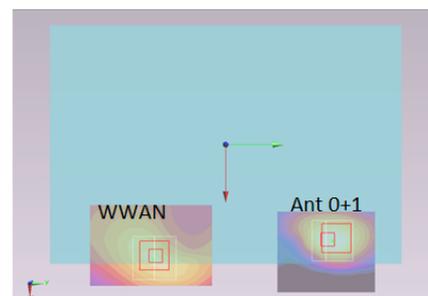
Case 22	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA VI	Bottom Face	1.205	1.1	0.079	-0.055	-0.179	129.0	2.43	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
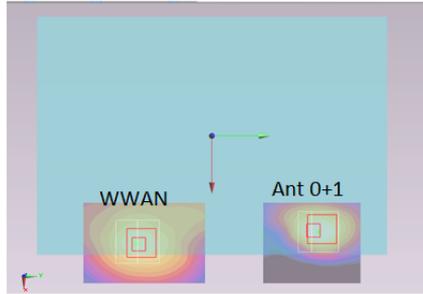
Case 23	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.48	1.1	0.079	-0.055	-0.179	129.0	2.71	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
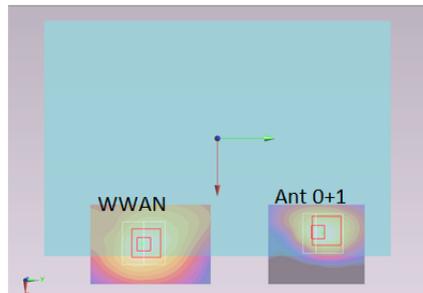
Case 24	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA IV	Edge 1	1.41	0.7	0.0035	-0.052	-0.18	129.3	1.67	0.02	Not required
	WLAN2.4GHz		0.257	0	-0.0024	0.0772	-0.18				

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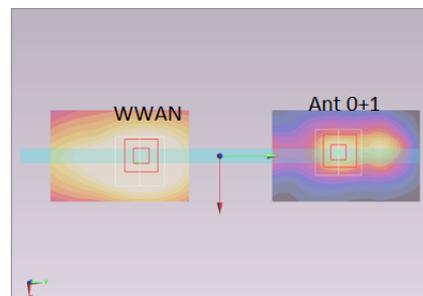
Case 25	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM850	Bottom Face	1.341	0	0.084	-0.052	-0.178	126.4	2.57	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
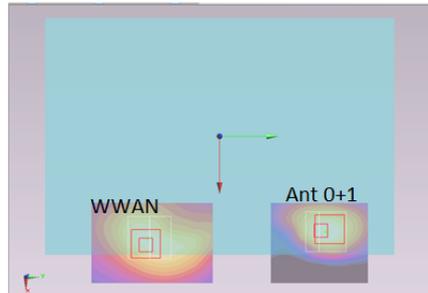
Case 26	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	GSM1900	Bottom Face	1.362	0	0.073	-0.0595	-0.179	133.3	2.59	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
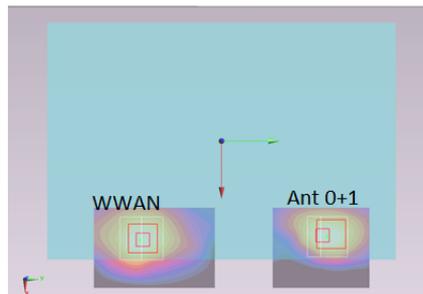
Case 27	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA V	Bottom Face	1.196	0	0.085	-0.046	-0.178	120.6	2.42	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				

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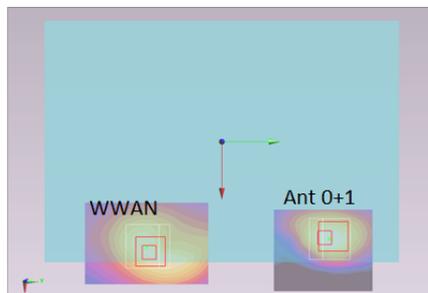
Case 28	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA IV	Bottom Face	1.487	0	0.0745	-0.0595	-0.18	133.4	2.71	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				
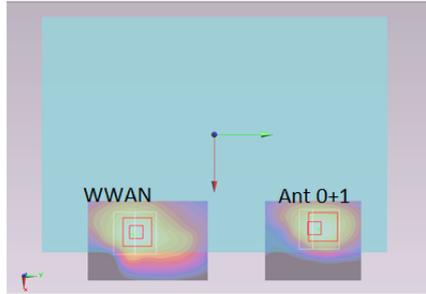
Case 29	Band	Position	SAR (W/kg)	Gap (cm)	SAR peak location (m)			3D distance (mm)	Pair SAR sum (W/kg)	SPLSR	Simultaneous SAR
					X	Y	Z				
	WCDMA II	Bottom Face	1.484	0	0.0745	-0.058	-0.18	131.9	2.71	0.03	Not required
	WLAN2.4GHz		1.226	0	0.0716	0.0738	-0.177				

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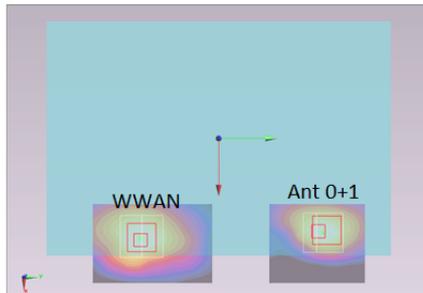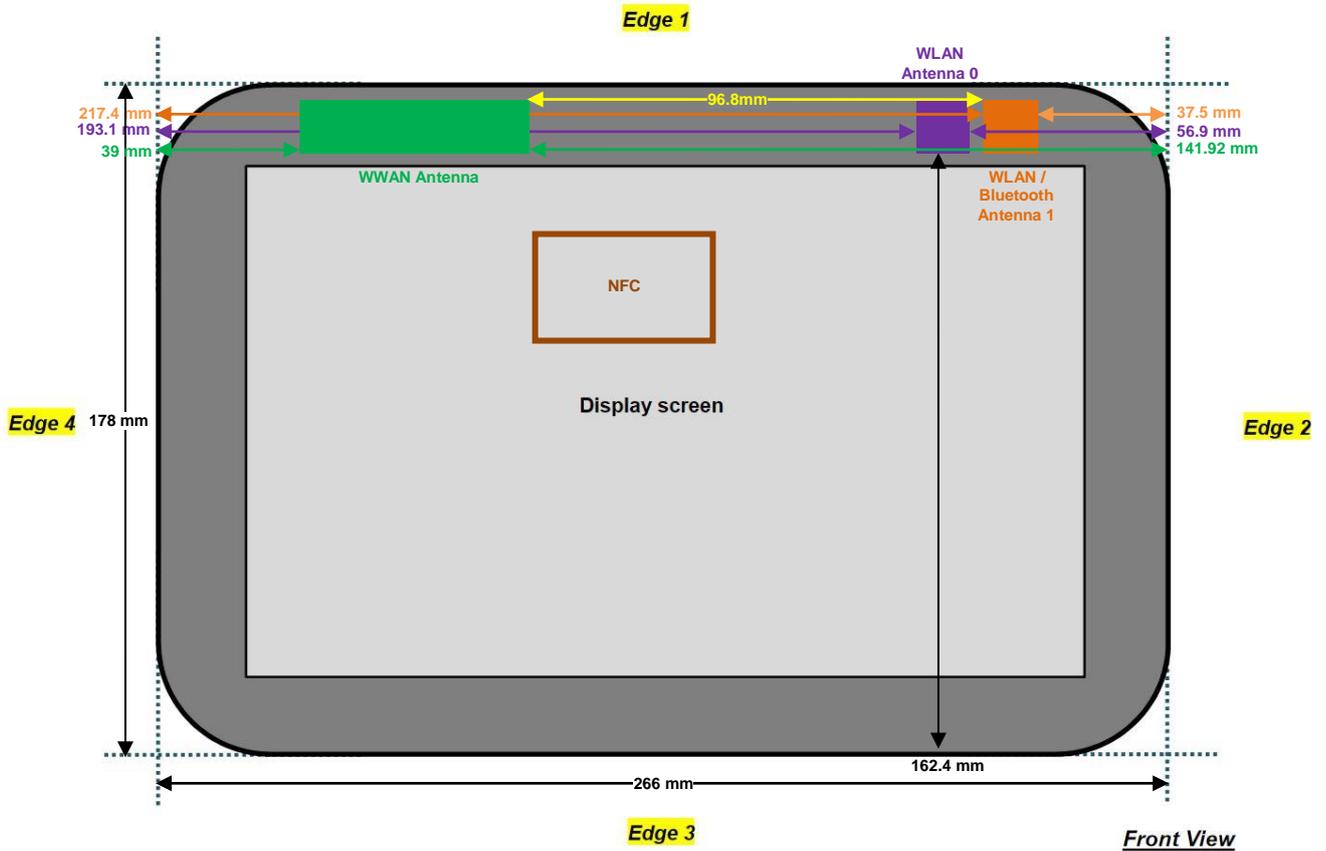
Note:
1. For Bluetooth SPLSR analysis, The minimum distance of "WWAN to Bluetooth antenna1" is used for conservative SPLSR calculation.
2. SPLSR = (SAR1 + SAR2)1.5 / (min. separation distance, mm). If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

Case 30	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	WCDMA II	Bottom Face	1.48	1.1	96.8	1.86	0.03	Not required
	BT		0.378	0				

Case 31	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	WCDMA IV	Edge 1	1.445	0.7	96.8	1.82	0.03	Not required
	BT		0.378	0				

Case 32	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	WCDMA II	Edge 1	1.237	0.7	96.8	1.62	0.02	Not required
	BT		0.378	0				

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Case 33	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	GSM850	Bottom Face	1.341	0	96.8	1.72	0.02	Not required
	BT		0.378	0				

Case 34	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	GSM1900	Bottom Face	1.362	0	96.8	1.74	0.02	Not required
	BT		0.378	0				

Case 35	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	WCDMA VI	Bottom Face	1.487	0	96.8	1.87	0.03	Not required
	BT		0.378	0				

Case 36	Band	Position	SAR (W/kg)	Gap (cm)	Minimum distance (mm)	Summed SAR (W/kg)	SPLSR Result	Simultaneous SAR
	WCDMA II	Bottom Face	1.484	0	96.8	1.86	0.03	Not required
	BT		0.378	0				

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14. *Uncertainty Assessment*

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

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

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 14.1

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

(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 15.1. 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 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

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