FCC SAR Test Report

APPLICANT	:	DT Research Inc.
EQUIPMENT	:	WLAN Module
BRAND NAME	:	DT Research Inc.
MODEL NAME	:	600B
FCC ID	:	YE3600B
STANDARD	:	FCC 47 CFR Part 2 (2.1093)
		ANSI/IEEE C95.1-1992
		IEEE 1528-2003
		FCC OET Bulletin 65 Supplement C (Edition 01-01)

The product was installed into Tablet PC (Brand Name: DT Research Inc., Model Name: DT395, FCC ID: YE3800A) during test.

The product was completely tested on Dec. 28, 2012. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

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

Reviewed by:

Jones Tsai / Manager

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

SPORTON INTERNATIONAL INC.
TEL : 886-3-327-3456
FAX : 886-3-328-4978
FCC ID : YE3600B

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA2D0508-01	Rev. 01	Initial issue of report	Jan. 28, 2013

1. *Statement of Compliance*

The maximum results of Specific Absorption Rate (SAR) found during testing for **DT Research Inc., 600B,** are as follows.

<Highest Reported SAR>

Exposure Position	Frequency Band	Highest Reported 1g-SAR (W/kg)	Equipment Class	Highest Reported 1g-SAR (W/kg)
Body (0 cm Gap)	WLAN 5.2GHz Band	**0.50**	NII	**0.79**
	WLAN 5.3GHz Band	**0.79**		
	WLAN 5.5GHz Band	**0.47**		
	WLAN 5.8GHz Band	**0.96**	DTS	**0.96**
	WLAN 2.4GHz Band	**0.19**		

<Highest Simultaneous transmission SAR>

Frequency Band	Equipment Class	Exposure Position	Highest Reported Simultaneous Transmission 1g-SAR (W/kg)
CDMA BC0	PCB	Bottom Face (0 cm Gap)	0.79
Bluetooth	DSS		

Remark:

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

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

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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	DT Research Inc.
Address	6F, NO. 1, NingPo E. St., Taipei, 100 Taiwan, R.O.C.

2.3 *Manufacturer*

Company Name	DT Research Inc.
Address	6F, NO. 1, NingPo E. St., Taipei, 100 Taiwan, R.O.C.

2.4 *Application Details*

Date of Start during the Test	Dec. 25, 2012
Date of End during the Test	Dec. 28, 2012

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3. *General Information*

3.1 *Description of Equipment Under Test (EUT)*

Product Feature & Specification	
EUT	WLAN Module
Brand Name	DT Research Inc.
Model Name	600B
FCC ID	YE3600B
Tx Frequency	Bluetooth: 2402 MHz ~ 2480 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
Antenna Type	WLAN: PIFA Antenna Bluetooth: PIFA Antenna
Uplink Modulations	802.11b: DSSS (BPSK / QPSK / CCK) 802.11a/g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth: GFSK Bluetooth EDR: π/4-DQPSK / 8-DPSK Bluetooth 4.0 LE: GFSK
EUT Stage	Production Unit
Remark: 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. 2. 5600 MHz ~ 5650 MHz is notched.	

The product was installed into Tablet PC (Brand Name: DT Research Inc., Model Name: DT395, FCC ID: YE3800A) during test, and this Tablet specification is listed below.

Product Feature & Specification	
Host	WLAN Module
Brand Name	DT Research Inc.
Model Name	600B
FCC ID	YE3800A
Tx Frequency	CDMA2000 BC0: 824.70 MHz ~ 848.31 MHz CDMA2000 BC1: 1851.25 MHz ~ 1908.75 MHz
Antenna Type	WWAN: PIFA Antenna
Uplink Modulations	CDMA2000: QPSK
EUT Stage	Production Unit
Remark: 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description. 2. Voice call is not supported. 3. For co-location analysis, Bluetooth SAR was tested with the WWAN module installed	

3.2 Maximum RF output power among production units

WLAN 2.4GHz Band	IEEE 802.11 Ant 1(Main antenna) average power(dBm)		
	Ch1	Ch6	Ch11
802.11b	17	17	17
802.11g	13	16	13
802.11n_20M	12	16	12
802.11n_40M	Ch3	Ch6	CH9
	9.5	12.5	8.5

WLAN 2.4GHz Band	IEEE 802.11 Ant 2(Aux antenna) average power(dBm)		
	Ch1	Ch6	Ch11
802.11b	16	14.5	15.5
802.11g	12	15	12
802.11n_20M	11	15.5	11
802.11n_40M	Ch3	Ch6	CH9
	8	11.5	9

WLAN 2.4GHz Band	IEEE 802.11 Ant 1+2(MIMO antenna) average power(dBm)		
	Ch1	Ch6	Ch11
802.11n_20M	14.5	16	13.5
802.11n_40M	Ch3	Ch6	CH9
	10	15.5	9.5

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WLAN 5GHz Band	IEEE 802.11 Ant 1(Main antenna) average power(dBm)							
	WLAN 5.2GHz Band		WLAN 5.3GHz Band		WLAN 5.5GHz Band			WLAN 5.8GHz Band
802.11a	16.5		16.5		16.5			14.5
802.11n_20M	17		17		17			14.5
802.11n_40M	Ch38	Ch46	CH54	Ch62	Ch102	Ch110	Ch134	
	13	16.5	16.5	12	15	16.5	16.5	20

WLAN 5GHz WIFI	IEEE 802.11 Ant 2(Aux antenna) average power(dBm)					
	WLAN 5.2GHz Band		WLAN 5.3GHz Band		WLAN 5.5GHz Band	WLAN 5.8GHz Band
802.11a	16		16		16	16
802.11n_20M	16		16		16	16
802.11n_40M	Ch38	Ch46	CH54	Ch62		
	13	16	15.5	12.5	16	20.5

WLAN 5GHz WIFI	IEEE 802.11 Ant 1+2 (MIMO antenna) average power(dBm)				
	WLAN 5.2GHz Band		WLAN 5.3GHz Band	WLAN 5.5GHz Band	WLAN 5.8GHz Band
802.11n_20M	16.5		16.5	16.5	17
802.11n_40M	Ch38	Ch46			
	13.5	16.5	16	16.5	16.5

Mode / Band	Bluetooth average power(dBm)			
	1Mbps (GMSK)	2Mbps (π/4-DQPSK)	3Mbps (8-DPSK)	BT4.0-LE (GMSK)
2.4 GHz Bluetooth	6	3	3	4

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3.3 *Product Photos*

Please refer to Appendix D.

3.4 *Applied Standard*

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:
- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC OET Bulletin 65 Supplement C (Edition 01-01)
- FCC KDB 447498 D01 v05
- FCC KDB 616217 D04 v01
- FCC KDB 248227 D01 v01r02
- FCC KDB 941225 D01 v02

3.5 *Device Category and SAR Limits*

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

3.6 *Test Conditions*

3.6.1 Ambient Condition

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.6.2 Test Configuration

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

Duty factor observed as below:

802.11b, 1Mbps: 100%

802.11a, 6Mbps: 100%

802.11n-HT20, 6.5Mbps: 100%

802.11n-HT40, 13.5Mbps: 100%

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

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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:

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

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

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

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

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

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

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.

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5. *SAR Measurement System*
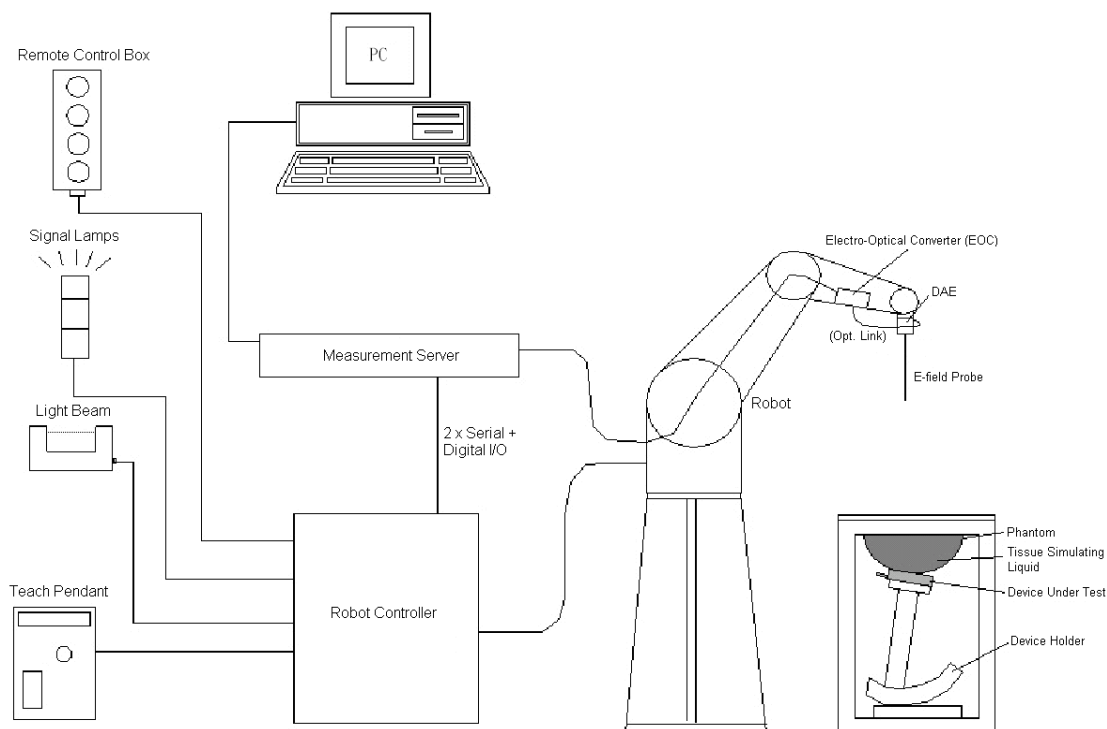
Fig 5.1 SPEAG DASY System Configurations

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

Some of the components are described in details in the following sub-sections.

5.1 _E-Field Probe_

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

5.1.1 E-Field Probe Specification

<EX3DV4 / ES3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	**Fig 5.2 Photo of EX3DV4/ES3DV4**

5.1.2 E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure. The calibration data can be referred to appendix C of this report.

5.2 _Data Acquisition Electronics (DAE)_

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.
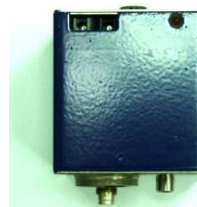
Fig 5.3 Photo of DAE

5.3 Robot

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

➢ High precision (repeatability ±0.035 mm)
➢ High reliability (industrial design)
➢ Jerk-free straight movements
➢ Low ELF interference (the closed metallic construction shields against motor control fields)
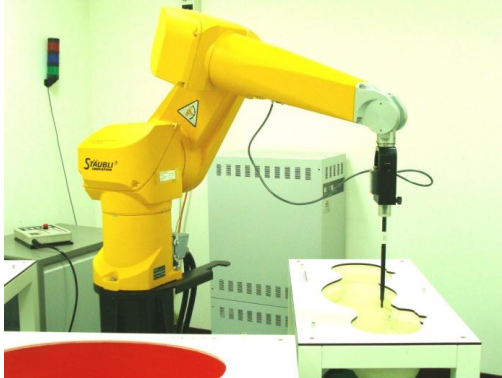
Fig 5.4 Photo of DASY4   **Fig 5.5 Photo of DASY5**

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 5.6 Photo of Server for DASY4   **Fig 5.7 Photo of Server for DASY5**

5.5 *Phantom*

\<SAM Twin Phantom\>
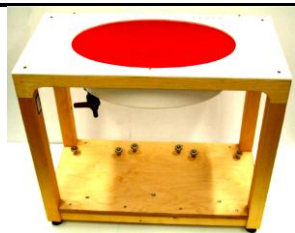
Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	**Fig 5.8 Photo of SAM Phantom**

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 5.9 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 5.10 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.
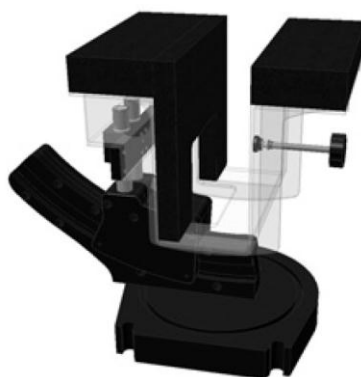
Fig 5.11 Laptop Extension Kit

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.

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

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

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

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.

5.8 *Test Equipment List*

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	**Due Date**
SPEAG	2450MHz System Validation Kit	D2450V2	736	Jul. 25, 2011	Jul. 24, 2013
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Dec. 11, 2012	Dec. 10, 2013
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 27, 2012	Aug. 26, 2013
SPEAG	Data Acquisition Electronics	DAE4	1338	Jun. 12, 2012	Jun. 11, 2013
SPEAG	Dosimetric E-Field Probe	EX3DV4	3792	Jun. 21, 2012	Jun. 20, 2013
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 28, 2012	Sep. 27, 2013
Wisewind	Thermometer	ETP-101	TM560	Nov. 13, 2012	Nov. 12, 2013
Wisewind	Thermometer	ETP-101	TM685	Nov. 13, 2012	Nov. 12, 2013
SPEAG	Device Holder	N/A	N/A	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BB	1026	NCR	NCR
SPEAG	ELI4 Phantom	QD 0VA 001 BA	1029	NCR	NCR
Agilent	Network Analyzer	E5071C	MY46101588	May. 11, 2012	May. 10, 2013
Agilent	ESG Vector Series Signal Generator	E4438C	MY49070755	Oct. 02, 2012	Oct. 01, 2013
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Dec. 11, 2012	Dec. 10, 2014
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Jan. 05, 2012	Jan. 04, 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	
Agilent	Dielectric Probe Kit	85070D	US01440205	Note 5	
AR	Power Amplifier	5S1G4M2	0328767	Note 6	
R&S	Spectrum Analyzer	FSP	101131	Jul. 23, 2012	Jul. 22, 2013

Table 5.1 Test Equipment List

Note:
1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole D2450V2, SN: 736 can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.
4. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
5. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
6. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have 24dBm to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it
7. Attenuator 1 insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.

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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 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. 6.1.

Fig 6.1   Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
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 Agilent 85070D Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Freq. (MHz)	Liquid Type	Temp. (℃)	Conductivity (σ)	Permittivity (εᵣ)	Conductivity Target (σ)	Permittivity Target (εᵣ)	Delta (σ) (%)	Delta (εᵣ) (%)	Limit (%)	Date
2450	Body	21.5	1.965	51.537	1.95	52.7	0.77	-2.21	±5	Dec. 25, 2012
5200	Body	21.5	5.244	47.499	5.3	49	-1.06	-3.06	±5	Dec. 27, 2012
5300	Body	21.5	5.38	47.244	5.3	49	1.51	-3.58	±5	Dec. 27, 2012
5600	Body	21.4	5.79	46.784	5.65	48.6	2.48	-3.74	±5	Dec. 28, 2012
5800	Body	21.4	6.144	46.492	6.00	48.2	2.40	-3.54	±5	Dec. 28, 2012

Table 6.2 Measuring Results for Simulating Liquid

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7. *SAR System Validation*

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

7.1 *Purpose of System Performance check*

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

7.2 *System Setup*

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:
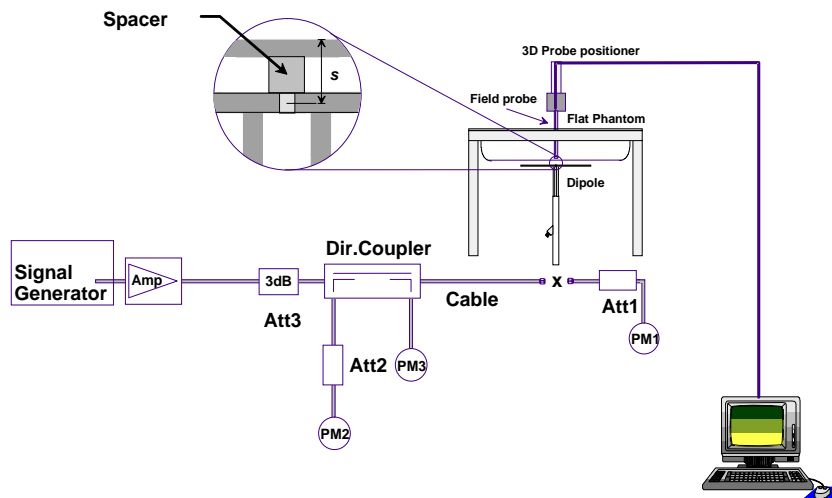
Fig 7.1 System Setup for System Evaluation   **Fig 7.2 Photo of Dipole Setup**

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

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7.3 SAR System Verification Results

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

Measurement Date	Frequency (MHz)	Liquid Type	Input power fed to dipole (mW)	Targeted SAR_{1g} (W/kg)	Measured SAR_{1g} (W/kg)	Normalized SAR_{1g} (W/kg)	Deviation (%)
Dec. 25, 2012	2450	Body	250	52.3	12.9	51.60	-1.34
Dec. 27, 2012	5200	Body	100	71.4	7.23	72.30	1.26
Dec. 27, 2012	5300	Body	100	73.5	7.46	74.60	1.50
Dec. 28, 2012	5600	Body	100	76.8	7.41	74.10	-3.52
Dec. 28, 2012	5800	Body	100	71.7	7.65	76.50	6.69

Table 7.1 Target and Measurement SAR after Normalized

8. EUT Testing Position

This EUT was tested in four positions. They are bottom-face, edge1, edge2 and edge4 of tablet PC. In these positions, the surface of EUT is touching with phantom 0 cm. Please refer to Appendix E for the test setup photos.

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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 E demonstrates.
(c)   Set scan area, grid size and other setting on the DASY software.
(d)   Measure SAR results for the highest power channel on each testing position.
(e)   Find out the largest SAR result on these testing positions of each band
(f)   Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

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

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

9.1 *Spatial Peak SAR Evaluation*

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

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

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

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

9.2 Area & Zoom Scan Procedures

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

Area scan and zoom scan resolution setting follows KDB 865664 D01v01 quoted below.

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

		≤ 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 ≤ 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
	graded grid — $\Delta z_{Zoom}(n>1)$: 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.

9.3 *Volume Scan Procedures*

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

9.4 *SAR Averaged Methods*

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

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

9.5 *Power Drift Monitoring*

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

10. *Exposure Positions Consideration*

<Tablet PC>
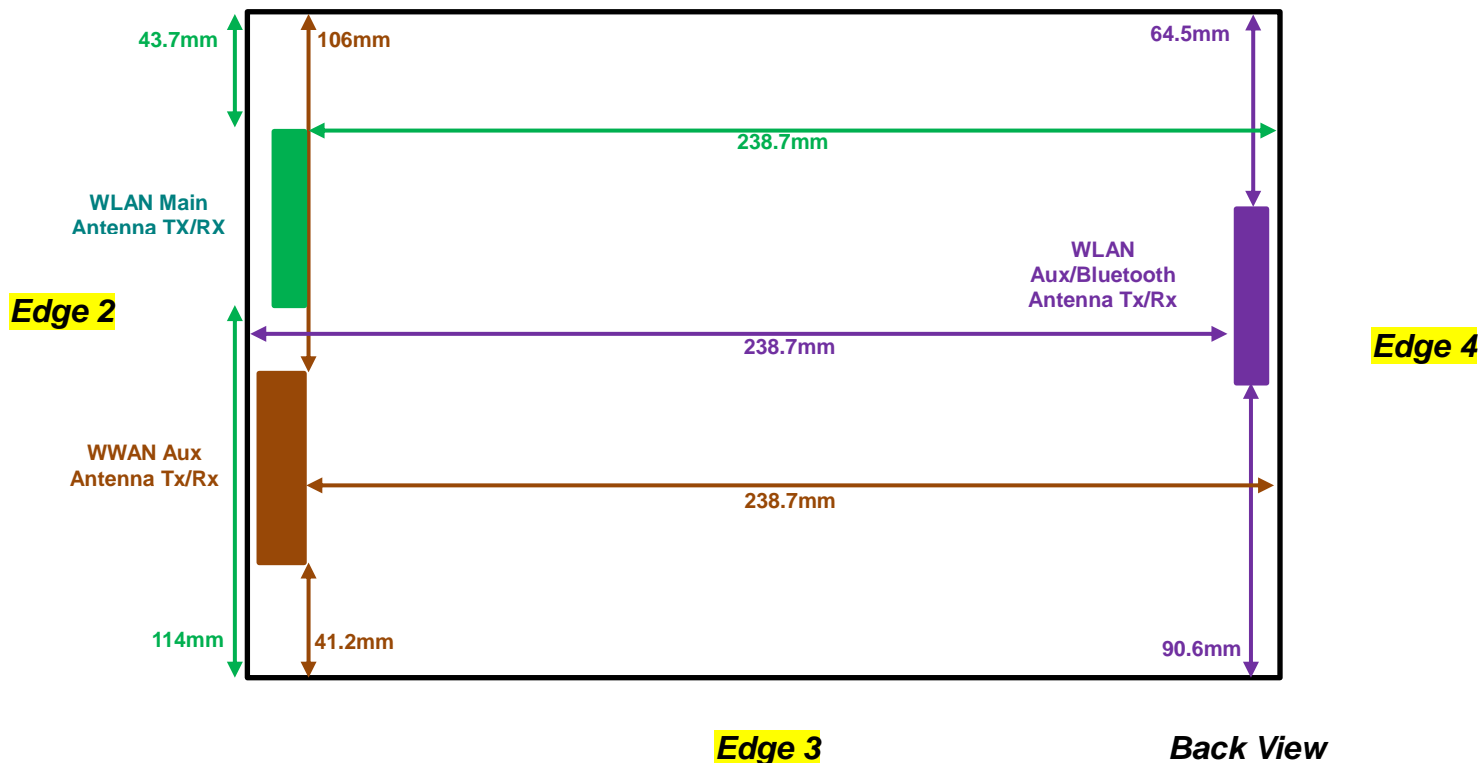
Antennas	Wireless Interface
WLAN Main Antenna Ant 1(Tx/Rx)	WLAN 5GHz WLAN 2.4GHz
WLAN Aux &Bluetooth Antenna Ant 2(Tx/Rx)	WLAN 5GHz WLAN 2.4GHz Bluetooth 2.4GHz

Antenna Band	Ant 1	Ant 2	Ant1+2
Bluetooth	No	Yes	No
2.4GHz 802.11b/g	Yes	Yes	No
2.4GHz 802.11n	Yes	Yes	Yes
5GHz 802.11a	Yes	Yes	No
5GHz 802.11n	Yes	Yes	Yes

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Exposure Position	Wireless Interface	802.11b Ant 1	802.11b Ant 2	802.11n-HT 20 Ant 1+2	802.11n-HT 40 Ant 1	802.11n-HT 40 Ant 2	802.11n-HT 20 Ant 1+2	Bluetooth Ant2
	Tune-up Maximum power (dBm)	17	16	16	20	20.5	17	6
	Tune-up Maximum rated power (mW)	50.12	39.81	39.81	100.00	112.20	50.12	3.98
Bottom Face	Antenna to user (mm)	5	5	5	5	5	5	5
	SAR exclusion threshold (mW)	10	10	10	6	6	6	10
	SAR testing required?	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**NO**
Edge 1	Antenna to user (mm)	43	65	65	43	65	43	65
	SAR exclusion threshold (mW)	82	246	246	53	212	53	245
	SAR testing required?	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**NO**
Edge 2	Antenna to user (mm)	5	239	239	5	239	5	239
	SAR exclusion threshold (mW)	10	1986	1986	6	1952	6	1985
	SAR testing required?	**YES**	**NO**	**NO**	**YES**	**NO**	**YES**	**NO**
Edge 3	Antenna to user (mm)	114	91	91	114	91	91	91
	SAR exclusion threshold (mW)	736	506	506	702	472	472	505
	SAR testing required?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Edge 4	Antenna to user (mm)	239	5	5	239	5	5	5
	SAR exclusion threshold (mW)	1986	10	10	1952	6	6	10
	SAR testing required?	**NO**	**YES**	**YES**	**NO**	**YES**	**YES**	**NO**

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 D01v05, for larger devices, the test separation distance is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01v05, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01v05, 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 D01v05, 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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11. *Conducted RF Output Power (Unit: dBm)*

<WLAN 2.4GHz Conducted Power>

WLAN Main Antenna--<Ant 1>

WLAN 2.4G 802.11b Average Power (dBm)						
Power vs. Channel			**Power vs. Data Rate**			
Channel	**Frequency (MHz)**	**Data Rate (bps)**	**Channel**	**Data Rate (bps)**		
		1M		**2M**	**5.5M**	**11M**
CH 01	2412	16.64	CH 6	16.59	16.56	16.55
CH 06	2437	**16.69**				
CH 11	2462	16.62				

WLAN 2.4G 802.11g Average Power (dBm)									
Power vs. Channel			**Power vs. Data Rate**						
Channel	**Frequency (MHz)**	**Data Rate (bps)**	**Channel**	**Data Rate (bps)**					
		6M		**9M**	**12M**	**18M**	**24M**	**36M**	**48M**	**54M**
CH 01	2412	12.64	CH 6	15.21	15.16	15.39	15.22	15.28	15.28	15.27
CH 06	2437	**15.57**							
CH 11	2462	12.78							

WLAN 2.4G 802.11n (BW 20MHz) Average Power (dBm)									
Power vs. Channel			**Power vs. Data Rate**						
Channel	**Frequency (MHz)**	**MCS Index**	**Channel**	**MCS Index**					
		MCS8		**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
CH 01	2412	11.97	CH 6	15.17	15.09	15.21	14.90	15.18	15.10	15.02
CH 06	2437	**15.47**							
CH 11	2462	11.60							

WLAN 2.4G 802.11n (BW 40MHz) Average Power (dBm)									
Power vs. Channel			**Power vs. Data Rate**						
Channel	**Frequency (MHz)**	**MCS Index**	**Channel**	**MCS Index**					
		MCS8		**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
CH 03	2422	9.20	CH 6	11.96	11.85	12.01	12.10	11.97	11.93	11.81
CH 06	2437	**12.15**							
CH 09	2452	8.42							

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. Per KDB 248227 D01 v01r02, 11g, 11n-HT20 and 11n-HT40 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.
3. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

WLAN Aux antenna----<Ant 2>

WLAN 2.4G 802.11b Average Power (dBm)						
Power vs. Channel			Power vs. Data Rate			
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)		
		1M		2M	5.5M	11M
CH 01	2412	15.57	CH 1	15.30	15.31	15.30
CH 06	2437	14.00				
CH 11	2462	15.27				

WLAN 2.4G 802.11g Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)					
		6M		9M	12M	18M	24M	36M	48M	54M
CH 01	2412	11.94	CH 6	14.94	14.62	14.63	14.89	14.95	14.89	14.82
CH 06	2437	14.96								
CH 11	2462	11.78								

WLAN 2.4G 802.11n (BW 20MHz) Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index					
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 01	2412	10.48	CH 6	14.77	14.67	14.86	14.75	14.90	14.84	14.82
CH 06	2437	15.02								
CH 11	2462	10.48								

WLAN 2.4G 802.11n (BW 40MHz) Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index					
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 03	2422	7.76	CH 6	11.27	10.97	11.10	10.98	10.93	10.97	11.10
CH 06	2437	11.38								
CH 09	2452	8.57								

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion

2. Per KDB 248227 D01 v01r02, 11g, 11n-HT20 and 11n-HT40 output power is less than 1/4dB higher than 11b mode, thus the SAR can be excluded.

3. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

WLAN MIMO antenna----<Ant 1+2>

WLAN 2.4G 802.11n (BW 20MHz) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 01	2412	14.36	CH 6	15.69	15.48	15.39	15.42	15.56	15.53	15.48
CH 06	2437	**15.82**								
CH 11	2462	13.37								

WLAN 2.4G 802.11n (BW 40MHz) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 03	2422	9.90	CH 6	15.17	15.22	15.12	15.20	15.14	15.19	14.98
CH 06	2437	**15.27**								
CH 09	2452	9.41								

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion

2. Per KDB 248227 D01 v01r02, 11n-HT40 output power is less than 1/4dB higher than 11n-HT20 mode, thus the SAR can be excluded.

3. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

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<WLAN 5GHz Conducted Power>

WLAN Main Antenna----<Ant 1>

WLAN 5G 802.11a Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)						
		6M		9M	12M	18M	24M	36M	48M	54M
CH 36	5180	**16.15**	CH 36	16.12	16.09	16.07	16.02	16.00	16.02	15.99
CH 40	5200	16.10								
CH 44	5220	16.11								
CH 48	5240	15.82								
CH 52	5260	15.77	CH 64	16.26	16.18	16.16	16.18	16.17	16.18	16.17
CH 56	5280	16.26								
CH 60	5300	16.27								
CH 64	5320	**16.30**								
CH 100	5500	16.32	CH 116	16.43	16.41	16.38	16.36	16.34	16.35	16.31
CH 104	5520	16.41								
CH 108	5540	16.11								
CH 112	5560	16.37								
CH 116	5580	==16.46==								
CH 132	5660	16.17								
CH 136	5680	16.38								
CH 140	5700	16.41								
CH 149	5745	**14.26**	CH 149	14.16	14.14	14.24	13.95	14.12	13.96	13.75
CH 153	5765	14.21								
CH 157	5785	14.09								
CH 161	5805	14.22								
CH 165	5825	13.99								

WLAN 5G 802.11n (BW 20M) Average Power (dBm)										
Power vs. Channel			**Power vs. Data Rate**							
Channel	**Frequency (MHz)**	**MCS Index**	**Channel**	**MCS Index**						
		MCS8		**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
CH 36	5180	15.87	CH 44	16.39	16.35	16.44	16.45	16.46	16.44	16.40
CH 40	5200	16.37								
CH 44	5220	**16.48**								
CH 48	5240	16.35								
CH 52	5260	16.03	CH 64	16.56	16.51	16.50	16.49	16.50	16.48	16.46
CH 56	5280	16.27								
CH 60	5300	16.53								
CH 64	5320	<mark>**16.57**</mark>								
CH 100	5500	**16.50**	CH 100	16.49	16.49	16.43	16.44	16.38	16.35	16.33
CH 104	5520	16.27								
CH 108	5540	16.30								
CH 112	5560	16.39								
CH 116	5580	16.39								
CH 132	5660	16.15								
CH 136	5680	16.41								
CH 140	5700	15.15								
CH 149	5745	**14.43**	CH 149	14.40	14.22	14.07	14.38	14.38	14.36	14.09
CH 153	5765	14.37								
CH 157	5785	14.21								
CH 161	5805	14.26								
CH 165	5825	13.96								

WLAN 5G 802.11n (BW 40M) Average Power (dBm)										
Power vs. Channel			**Power vs. Data Rate**							
Channel	**Frequency (MHz)**	**MCS Index**	**Channel**	**MCS Index**						
		MCS8		**MCS9**	**MCS10**	**MCS11**	**MCS12**	**MCS13**	**MCS14**	**MCS15**
CH 38	5190	12.77	CH 46	16.28	16.25	16.18	16.29	16.21	16.20	16.17
CH 46	5230	**16.32**								
CH 54	5270	**16.02**	CH 54	16.00	15.97	15.98	15.98	15.97	15.97	15.90
CH 62	5310	11.46								
CH 102	5510	14.46	CH 110	16.46	15.44	16.37	16.32	16.27	16.24	16.21
CH 110	5550	**16.47**								
CH 134	5670	16.40								
CH 151	5755	<mark>**19.73**</mark>	CH 151	19.72	19.68	19.63	19.60	19.56	19.55	19.53
CH 159	5795	19.55								

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion

2. Per KDB 248227 D01 v01r02, 11n-HT20 5180 MHz ~ 5240MHz power is 1/4dB higher than 802.11a mode, 11n-HT20 SAR will be verified at the highest RF exposure position found in 802.11a SAR testing.

3. Per KDB 248227 D01 v01r02, 11n-HT20 5260 MHz ~ 5320MHz power is 1/4dB higher than 802.11a mode, 11n-HT20 SAR will be verified at the highest RF exposure position found in 802.11a SAR testing.

4. Per KDB 248227 D01 v01r02, 11n-HT20 & 11n-HT40 5500 MHz ~ 5700MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded

5. Per KDB 248227 D01 v01r02, 11n-HT40 5755 MHz ~ 5795MHz power is 1/4dB higher than 802.11a mode, 11n-HT40 SAR will be verified at the highest RF exposure position found in 802.11a SAR testing..

6. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

WLAN Aux Antenna----<Ant 2>

WLAN 5G 802.11a Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate (bps)	Channel	Data Rate (bps)						
		6M		9M	12M	18M	24M	36M	48M	54M
CH 36	5180	**15.88**	CH 36	15.83	15.84	15.84	15.80	15.75	15.79	15.71
CH 40	5200	15.85								
CH 44	5220	15.76								
CH 48	5240	15.65								
CH 52	5260	15.28	CH 64	15.88	15.85	15.81	15.80	15.84	15.83	15.82
CH 56	5280	15.85								
CH 60	5300	15.33								
CH 64	5320	<mark>**15.90**</mark>								
CH 100	5500	15.52	CH 116	15.59	15.52	15.48	15.44	15.61	15.61	15.56
CH 104	5520	**15.65**								
CH 108	5540	15.60								
CH 112	5560	15.61								
CH 116	5580	15.67								
CH 132	5660	15.55								
CH 136	5680	15.57								
CH 140	5700	15.44								
CH 149	5745	**15.79**	CH 149	15.40	15.44	15.41	15.44	15.53	15.70	15.46
CH 153	5765	15.71								
CH 157	5785	15.66								
CH 161	5805	15.75								
CH 165	5825	15.54								

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WLAN 5G 802.11n (BW 20M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 36	5180	15.98	CH 36	15.94	15.93	15.92	15.89	15.93	15.89	15.88
CH 40	5200	15.96								
CH 44	5220	15.96								
CH 48	5240	15.90								
CH 52	5260	15.38	CH 64	15.63	15.61	15.59	15.58	15.56	15.52	15.52
CH 56	5280	15.62								
CH 60	5300	15.24								
CH 64	5320	15.65								
CH 100	5500	15.58	CH 116	15.67	15.65	15.63	15.62	15.60	15.57	15.57
CH 104	5520	15.65								
CH 108	5540	15.61								
CH 112	5560	15.59								
CH 116	5580	15.69								
CH 132	5660	15.54								
CH 136	5680	15.50								
CH 140	5700	15.43								
CH 149	5745	15.79	CH 149	15.59	15.10	15.45	15.55	15.45	15.16	15.25
CH 153	5765	15.71								
CH 157	5785	15.61								
CH 161	5805	15.70								
CH 165	5825	15.51								

WLAN 5G 802.11n (BW 40M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 38	5190	12.69	CH 46	15.66	15.60	15.58	15.56	15.53	15.50	15.48
CH 46	5230	15.68								
CH 54	5270	15.16	CH 54	15.14	15.10	15.08	15.05	15.03	15.01	14.96
CH 62	5310	12.36								
CH 102	5510	14.76	CH 110	15.77	15.75	15.72	15.70	15.68	15.67	15.62
CH 110	5550	15.78								
CH 134	5670	15.57								
CH 151	5755	20.10	CH 151	20.04	19.97	19.96	19.94	19.90	19.86	19.81
CH 159	5795	20.04								

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. Per KDB 248227 D01 v01r02, 11n-HT20 & 11n-HT40 5180 MHz ~ 5240MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
3. Per KDB 248227 D01 v01r02, 11n-HT20 & 11n-HT40 5260 MHz ~ 5320MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
4. Per KDB 248227 D01 v01r02, 11n-HT20 & 11n-HT40 5500 MHz ~ 5700MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
5. Since 11n-HT40 5755 MHz ~ 5795MHz power is 1/4dB higher than 802.11a mode, 11n-HT40 SAR will be verified at the highest RF exposure position found in 802.11a SAR testing.
6. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

WLAN MIMO Antenna----<Ant 1+2>

WLAN 5G 802.11n (BW 20M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 36	5180	**16.26**	CH 36	16.21	16.18	16.15	16.15	16.17	16.09	16.05
CH 40	5200	16.20								
CH 44	5220	16.18								
CH 48	5240	15.96								
CH 52	5260	15.59	CH 64	15.94	15.93	15.88	15.88	15.91	15.84	15.83
CH 56	5280	15.91								
CH 60	5300	15.89								
CH 64	5320	**15.97**								
CH 100	5500	15.87	CH 116	15.88	15.85	15.82	15.78	15.75	15.73	15.75
CH 104	5520	15.64								
CH 108	5540	15.86								
CH 112	5560	15.67								
CH 116	5580	**15.92**								
CH 132	5660	15.77								
CH 136	5680	15.65								
CH 140	5700	15.36								
CH 149	5745	**16.52**	CH 149	16.41	16.33	16.12	16.33	16.09	15.93	16.16
CH 153	5765	16.50								
CH 157	5785	16.45								
CH 161	5805	16.49								
CH 165	5825	16.25								

WLAN 5G 802.11n (BW 40M) Average Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	MCS Index	Channel	MCS Index						
		MCS8		MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
CH 38	5190	13.40	CH 46	16.31	16.28	16.26	16.25	16.21	16.19	16.17
CH 46	5230	**16.33**								
CH 54	5270	**15.51**	CH 54	15.48	15.45	15.41	15.39	15.36	15.37	15.36
CH 62	5310	15.33								
CH 102	5510	15.18	CH 110	16.17	16.17	16.12	16.09	16.07	16.04	16.00
CH 110	5550	**16.19**								
CH 134	5670	15.68								
CH 151	5755	16.29	CH 159	16.37	16.38	16.36	16.33	16.28	16.29	16.25
CH 159	5795	**16.41**								

Note:

1. Per KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. Per KDB 248227 D01 v01r02, 11n-HT40 5190 MHz ~ 5230MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
3. Per KDB 248227 D01 v01r02, 11n-HT40 5270 MHz ~ 5310MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
4. Since 11n-HT40 5510 MHz ~ 5670MHz power is 1/4dB higher than 11n-HT20 5500MHz ~ 5700MHz , 11n-HT40 SAR will be verified at the highest RF exposure position found in 802.11a SAR testing.
5. Per KDB 248227 D01 v01r02, 11n-HT40 5755 MHz ~ 5795MHz output power is less than 1/4 dB higher than 802.11a mode, thus the SAR can be excluded
6. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 0.25dB higher than those measured at the lowest data rate.

12. SAR Test Results

<Note>

1. Per KDB 447498 D01v05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
    Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
    Reported SAR(W/kg)= Measured SAR(W/kg) Scaling Factor*
2. Per KDB 447498 D01v05, for each exposure position, if the highest output channel reported SAR <0.8W/kg, other channels SAR testing are not necessary

12.1 Test Records for Body SAR Test

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR₁g (W/kg)	Scaled SAR₁g (W/kg)
1	WLAN2.4GHz	802.11b	Bottom Face	0cm	Ant 1	6	2437	16.69	17	1.075	0.17	0.138	0.148
2	WLAN2.4GHz	802.11b	Edge2	0cm	Ant 1	6	2437	16.69	17	1.075	0.04	0.176	**0.189**
4	WLAN2.4GHz	802.11b	Bottom Face	0cm	Ant 2	1	2412	15.57	16	1.105	-0.14	0.056	0.062
7	WLAN2.4GHz	802.11b	Edge4	0cm	Ant 2	1	2412	15.57	16	1.105	-0.04	0.112	0.124
8	WLAN2.4GHz	802.11n-HT20	Bottom Face	0cm	Ant 1+2	6	2437	15.82	16	1.042	0.08	0.043	0.045
10	WLAN2.4GHz	802.11n-HT20	Edge2	0cm	Ant 1+2	6	2437	15.82	16	1.042	0.03	0.056	0.058
12	WLAN2.4GHz	802.11n-HT20	Edge4	0cm	Ant 1+2	6	2437	15.82	16	1.042	-0.04	0.047	0.049
21	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 1	36	5180	16.15	16.5	1.083	-0.06	0.059	0.064
22	WLAN5GHz	802.11a	Edge1	0cm	Ant 1	36	5180	16.15	16.5	1.083	0.08	0.034	0.037
23	WLAN5GHz	802.11a	Edge2	0cm	Ant 1	36	5180	16.15	16.5	1.083	0.14	0.274	0.297
24	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1	44	5220	16.48	17	1.128	0.025	0.441	**0.497**
36	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 2	36	5180	15.88	16	1.028	0.11	0.225	0.231
38	WLAN5GHz	802.11a	Edge4	0cm	Ant 2	36	5180	15.88	16	1.028	0.11	0.251	0.258
49	WLAN5GHz	802.11n-HT20	Bottom Face	0cm	Ant 1+2	36	5180	16.26	16.5	1.056	0.17	0.099	0.105
51	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1+2	36	5180	16.26	16.5	1.056	0.06	0.092	0.097
52	WLAN5GHz	802.11n-HT20	Edge4	0cm	Ant 1+2	36	5180	16.26	16.5	1.056	-0.06	0.091	0.096
25	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 1	64	5320	16.30	16.5	1.046	-0.02	0.128	0.134
26	WLAN5GHz	802.11a	Edge1	0cm	Ant 1	64	5320	16.30	16.5	1.046	-0.03	0.093	0.097
27	WLAN5GHz	802.11a	Edge2	0cm	Ant 1	64	5320	16.30	16.5	1.046	0.13	0.649	0.679
28	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1	64	5320	16.57	17	1.105	0.04	0.711	**0.786**
39	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 2	64	5320	15.90	16	1.023	-0.12	0.227	0.232
41	WLAN5GHz	802.11a	Edge4	0cm	Ant 2	64	5320	15.90	16	1.023	0.1	0.281	0.287
53	WLAN5GHz	802.11n-HT20	Bottom Face	0cm	Ant 1+2	64	5320	15.97	16.5	1.130	0.17	0.068	0.077
55	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1+2	64	5320	15.97	16.5	1.130	0.02	0.203	0.229
56	WLAN5GHz	802.11n-HT20	Edge4	0cm	Ant 1+2	64	5320	15.97	16.5	1.130	0.023	0.095	0.107
29	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 1	116	5580	16.46	16.5	1.009	0.04	0.043	0.043
30	WLAN5GHz	802.11a	Edge1	0cm	Ant 1	116	5580	16.46	16.5	1.009	0.01	0.127	0.128
31	WLAN5GHz	802.11a	Edge2	0cm	Ant 1	116	5580	16.46	16.5	1.009	0.03	0.469	**0.473**
42	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 2	116	5580	15.67	16	1.078	-0.13	0.318	0.343
44	WLAN5GHz	802.11a	Edge4	0cm	Ant 2	116	5580	15.67	16	1.078	-0.04	0.276	0.298
57	WLAN5GHz	802.11n-HT20	Bottom Face	0cm	Ant 1+2	116	5580	15.92	16.5	1.143	0.19	0.193	0.221
59	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1+2	116	5580	15.92	16.5	1.143	0.08	0.148	0.169
60	WLAN5GHz	802.11n-HT20	Edge4	0cm	Ant 1+2	116	5580	15.92	16.5	1.143	-0.03	0.097	0.111
61	WLAN5GHz	802.11n-HT40	Bottom Face	0cm	Ant 1+2	110	5580	16.19	16.5	1.074	-0.19	0.111	0.119

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Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	SAR$_{1g}$ (W/kg)	Scaled SAR$_{1g}$ (W/kg)
32	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 1	149	5745	14.26	14.5	1.056	0.1	0.223	0.236
33	WLAN5GHz	802.11a	Edge1	0cm	Ant 1	149	5745	14.26	14.5	1.056	0.02	0.101	0.107
34	WLAN5GHz	802.11a	Edge2	0cm	Ant 1	149	5745	14.26	14.5	1.056	0.04	0.285	0.301
67	WLAN5GHz	802.11n-HT40	Edge2	0cm	Ant 1	151	5755	19.73	20	1.063	0.02	0.899	0.956
66	WLAN5GHz	802.11n-HT40	Edge2	0cm	Ant 1	159	5795	19.55	20	1.108	-0.04	0.809	0.897
45	WLAN5GHz	802.11a	Bottom Face	0cm	Ant 2	149	5745	15.79	16	1.049	-0.02	0.326	0.342
47	WLAN5GHz	802.11a	Edge4	0cm	Ant 2	149	5745	15.79	16	1.049	0.01	0.273	0.286
48	WLAN5GHz	802.11n-HT40	Edge4	0cm	Ant 2	151	5755	20.10	20.5	1.095	-0.14	0.544	0.596
62	WLAN5GHz	802.11n-HT20	Bottom Face	0cm	Ant 1+2	149	5745	16.52	17	1.118	0.15	0.09	0.101
64	WLAN5GHz	802.11n-HT20	Edge2	0cm	Ant 1+2	149	5745	16.52	17	1.118	0.02	0.202	0.226
65	WLAN5GHz	802.11n-HT20	Edge4	0cm	Ant 1+2	149	5745	16.52	17	1.118	0.04	0.116	0.130

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12.2 Repeated SAR Measurement

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	SAR1g (W/kg)	Scaled SAR1g (W/kg)
67	WLAN5GHz	802.11n-HT40	Edge2	0cm	Ant 1	151	5755	19.73	20	1.063	0.02	0.899	0.956
35	WLAN5GHz	802.11n-HT40	Edge2	0cm	Ant 1	151	5755	19.73	20	1.063	0	0.862	0.917

Note:

1. Per KDB 865664 D01v01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/kg
2. Per KDB 865664 D01v01, if the deviation among the repeated measurement is ≤ 20% and the measured SAR < 1.45 W/kg, only one repeated measurement is required.
3. The deviation is the difference in percentage between original and repeated *measured SAR.*
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

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12.3 *Highest SAR Plot*

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	SAR1g (W/kg)	Scaled SAR1g (W/kg)
2	WLAN2.4GHz	802.11b	Edge2	0cm	Ant 1	6	2437	16.69	17	1.075	0.04	0.176	0.189
67	WLAN5GHz	802.11n-HT40	Edge2	0cm	Ant 1	151	5755	19.73	20	1.063	0.02	0.899	0.956

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Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2012/12/25

#02_WLAN2.4G_802.11b_Edge2_0cm_Ch6;Ant 1

DUT: 2D0508-01

Communication System: 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_121225 Medium parameters used: f = 2437 MHz; σ = 1.946 mho/m; ε_r = 51.582; ρ
= 1000 kg/m^3
Ambient Temperature：22.5 ℃；Liquid Temperature：21.5 ℃

DASY5 Configuration:
- Probe: ES3DV3 - SN3270; ConvF(4.17, 4.17, 4.17); Calibrated: 2012/9/28;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2012/8/27
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1026
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6477)

Configuration/Ch6/Area Scan (51x181x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.229 mW/g

Configuration/Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,
dz=5mm
Reference Value = 11.136 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.380 mW/g
SAR(1 g) = 0.176 mW/g; SAR(10 g) = 0.083 mW/g
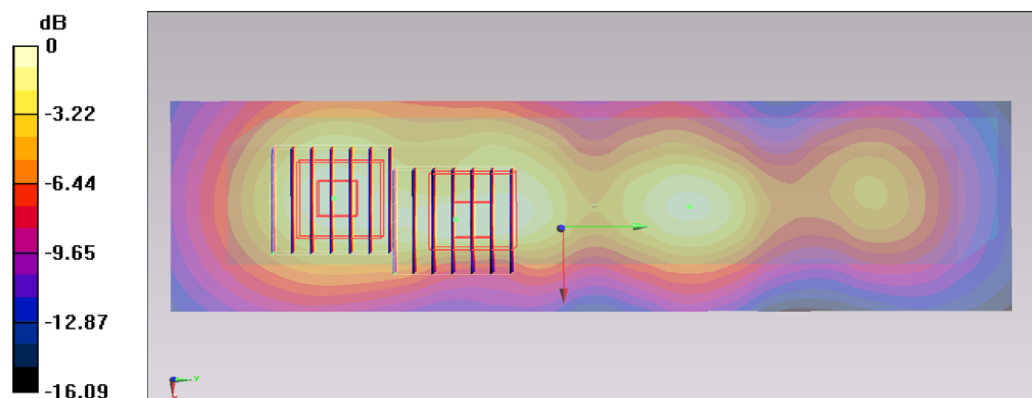Maximum value of SAR (measured) = 0.236 mW/g

Configuration/Ch6/Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm,
dz=5mm
Reference Value = 11.136 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.300 mW/g
SAR(1 g) = 0.158 mW/g; SAR(10 g) = 0.087 mW/g
Maximum value of SAR (measured) = 0.196 mW/g

0 dB = 0.196 mW/g = -14.15 dB mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2012/12/28

#67_WLAN5G_802.11n-HT40_Edge2_0cm_Ch151;Ant 1

DUT: 2D0508-01

Communication System: 802.11n; Frequency: 5755 MHz;Duty Cycle: 1:1
Medium: MSL_5G_121228 Medium parameters used: f = 5755 MHz; σ = 6.103 mho/m; ε_r = 46.684; ρ = 1000 kg/m^3
Ambient Temperature：22.4 ℃；Liquid Temperature：21.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3792; ConvF(3.89, 3.89, 3.89); Calibrated: 2012/6/21;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2012/6/12
- Phantom: ELI 4.0_Front; Type: QDOVA001BB; Serial: 1029
- Measurement SW: DASY52, Version 52.8 (3);SEMCAD X Version 14.6.5 (6469)

Configuration/Ch151/Area Scan (61x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.18 mW/g
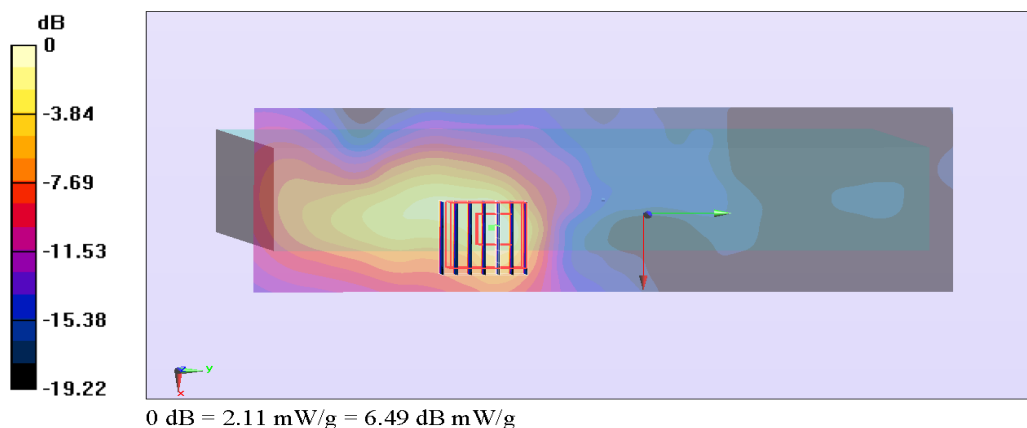
Configuration/Ch151/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 21.872 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.356 mW/g
SAR(1 g) = 0.899 mW/g; SAR(10 g) = 0.318 mW/g
Maximum value of SAR (measured) = 2.11 mW/g

0 dB = 2.11 mW/g = 6.49 dB mW/g

Test Engineer： Vic Yang, Ted Sun, and Angelo Chang

12.4 *Simultaneous Multi-band Transmission Analysis*

No.	Applicable Simultaneous Transmission Combination
1.	WWAN(data) + BT

Note:
1. WLAN Main and Bluetooth cannot transmit simultaneously.
2. WLAN Aux and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. By design, WLAN 2.4Ghz and 5GHz frequency band does not support mobile hotspot operation
4. EUT will choose either WLAN2.4G or WLAN5G according to the network signal condition; therefore, they will not transmit simultaneously.
5. WWAN module FCC ID: YE3800A is also integrated into this host, WWAN power and SAR test data is referred to Sporton FCC SAR Report, Report No: FA2D0508.
6. For simultaneous transmission analysis, SAR is estimated per KDB 447498 D01v05 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* ≤ 50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
   ii) 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.
7. Per KDB 447498 D01v05, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan
      If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   iii) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg

Mode	Max Power	Exposure Position	Bottom Face	Edge 2	Edge 3
		Test separation	0 mm	0 mm	0 mm
Bluetooth	6 dBm	Antenna to user distance	5 mm	238.7 mm	90.6 mm
		Estimated SAR (W/kg)	0.167W/kg	0.4 W/kg	0.4 W/kg

Position	WWAN			Bluetooth-DSS	WWAN + Bluetooth
	WWAN Band	Plot No	Max. Reported SAR (W/kg)	Estimated SAR (W/kg)	
Bottom Face At 0cm	CDMA BC0	16	0.099	0.167	**0.27**
	CDMA BC1	**13**	0.274	0.167	**0.44**
Edge2 At 0cm	CDMA BC0	17	0.299	0.4	**0.70**
	CDMA BC1	**14**	0.388	0.4	**0.79**
Edge3 At 0cm	CDMA BC0	18	0.011	0.4	**0.41**
	CDMA BC1	**15**	0.041	0.4	**0.44**

Test Engineer： Vic Yang, Ted Sun, San Lin, Aaron Chen, and Nick Yu

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13. *Uncertainty Assessment*

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

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

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

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

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

(b) κ is the coverage factor

Table 12.1 Standard Uncertainty for Assumed Distribution

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

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

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

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

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Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 12.8 %	± 12.6 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 25.6 %**	**± 25.2 %**

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

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14. *References*

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

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

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

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

[5]   SPEAG DASY System Handbook

[6]   FCC KDB 447498 D01 v05, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", October 2012

[7]   FCC KDB 616217 D04 v01, "SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers", October 2012

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

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

Appendix A.   *Plots of System Performance Check*

The plots are shown as follows.

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Appendix B.   Plots of SAR Measurement

The plots are shown as follows.

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Appendix C.   *DASY Calibration Certificate*

The DASY calibration certificates are shown as follows.

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