Certificate No.: CB10304014

FCC SAR Test Report

Equipment	**: Lytro Light Field Camera**
Brand Name	**: Lytro**
Model No.	**: B5**
FCC ID	**: ZMQB5**
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)**
Applicant	**: Lytro, Inc.** **1300 Terra Bella Avenue, Mountain View, CA 94043 USA**
Manufacturer	**: Qisda Corporation** **157 Shan-Ying Road, Gueishan Taoyuan 333, Taiwan**

The product sample received on Feb. 28, 2014 and completely tested on Mar. 27, 2014. We, SPORTON, 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.

Jordan Hsiao

Jordan Hsiao
SPORTON INTERNATIONAL INC.

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SUMMARY OF TEST RESULT

The maximum results of Specific Absorption Rate (SAR) found during testing as follows.

Exposure Position	Frequency Band	Reported 1g-SAR (W/kg)	Highest Reported 1g-SAR (W/kg)
Body (Separation 0cm)	WLAN 5 GHz Band 1	0.810	1.036
	WLAN 5 GHz Band 2	0.999	
	WLAN 5 GHz Band 3	1.036	
	WLAN 5 GHz Band 4	1.497	1.497
	WLAN 2.4GHz Band	0.219	

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,FCC OET Bulletin 65 Supplement C (Edition 01-01).

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA422631	Rev. 01	Initial issue of report	Apr. 14, 2014

1 General Description

1.1 Information

1.1.1 RF General Information

Items	Description
Power Type	From host system or li-ion battery
Product Type	802.11abgn/ac HT20/HT40/VHT20/VHT40/VHT80: WLAN (1TX, 1RX) Bluetooth BR/EDR/LE GPS
Frequency Range	WLAN 2.4 GHz Band: 2412 MHz ~ 2462 MHz WLAN 5 GHz Band 1: 5180 MHz ~ 5240 MHz WLAN 5 GHz Band 2: 5260 MHz ~ 5320 MHz WLAN 5 GHz Band 3: 5500 MHz ~ 5700 MHz WLAN 5 GHz Band 4: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz GPS: 1570 MHz ~ 1620 MHz
EUT Stage	Identical Prototype
Note: 2.4G only 20MHz for WLAN	

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		Remark
1	INPAQ	GPS (ACD3216)	PCB Antenna	I-PEX	-2.18		GPS Ant.
2	INPAQ	Wi-Fi Antenna(ACM3 5036)	PCB Antenna	I-PEX	2.4GHz	2.17	WLAN/Bluetooth Ant.
					5GHz	4.35	

1.1.3 Maximum RF output power among production units

WLAN Average Power (dBm)					
Mode	**Frequency (MHz)**	**Channel**	**802.11b**	**802.11g**	**802.11n (HT20)**
2.4GHz	**2412**	**CH1**	20.5	12.5	12
	2437	**CH6**	21.5	20	20
	2462	**CH11**	19	14.5	14

WLAN Average Power (dBm)								
Mode	**Frequency (MHz)**	**Channel**	**802.11a**	**802.11n (HT20)**	**802.11n (HT40)**	**802.11ac (VHT20)**	**802.11ac (VHT40)**	**802.11ac (VHT80)**
5GHz Band1	**5180**	**CH36**	14	15		15		
	5190	**CH38**			14		15	
	5200	**CH40**	15	15		15		
	5210	**CH42**						15.5
	5220	**CH44**	15	15		15		
	5230	**CH46**			17		17	
	5240	**CH48**	14.5	14.5		15		
5GHz Band2	**5260**	**CH52**	18	18		18		
	5270	**CH54**			19		19	
	5280	**CH56**	18.5	18.5		18.5		
	5290	**CH58**						15
	5300	**CH60**	19	19		19		
	5310	**CH62**			14		15	
	5320	**CH64**	18.5	18.5		18		
5GHz Band3	**5500**	**CH100**	18	18.5		18.5		
	5510	**CH102**			17		17	
	5520	**CH104**	18.5	18.5		18.5		
	5530	**CH106**						17
	5540	**CH108**	18.5	18.5		18.5		
	5550	**CH110**			18.5		18.5	
	5560	**CH112**	18.5	18.5		18.5		
	5580	**CH116**	18.5	18.5		18.5		
	5660	**CH132**	18.5	18.5		18.5		
	5670	**CH134**			15.5		17.5	
	5680	**CH136**	18.5	18.5		18.5		
	5700	**CH140**	15	14		14		
5GHz Band4	**5745**	**CH149**	17.5	17.5		17.5		
	5755	**CH151**			17		17	
	5765	**CH153**	17.5	17.5		17.5		
	5775	**CH155**						16.9
	5785	**CH157**	16.8	16.8		16.8		
	5795	**CH159**			17.5		17.5	
	5805	**CH161**	17.5	17.5		17.5		
	5825	**CH165**	17	17		17		

Bluetooth Average Power (dBm)				
Mode	**1Mbps (GFSK)**	**2Mbps (π/4-DQPSK)**	**3Mbps (8-DPSK)**	**BT4.0-LE (GFSK)**
Bluetooth	9	8	8	2

1.2 Accessories

Accessories				
No.	**Equipment Name**	**Brand Name**	**Model Name**	**Rating**
1	Li-ion Battery	LYTRO	A3	3.7Vdc, 3760mAh
Others				
USB Cable: 0.6m, Shielded				

1.3 Testing Applied Standards

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 v01r01
FCC KDB 447498 D01 v05r01
FCC KDB 248227 D01 v01r02
FCC KDB 644545 D01 v01r01
FCC OET Bulletin 65 Supplement C (Edition 01-01)

1.4 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.

1.5 Testing Location

Testing Location							
☐	HWA YA	ADD	:	No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.			
		TEL	:	886-3-327-3456	FAX	:	886-3-327-0973
☒	JHUBEI	ADD	:	No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.			
		TEL	:	886-3-656-9065	FAX	:	886-3-656-9085

Test Condition	Test Site No.	Test Environment	Test Engineer
Radiated Emission	SAR01-CB	22°C / 54%	Benson Peng

2 Specific Absorption Rate (SAR)

2.1 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.

2.2 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:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by

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

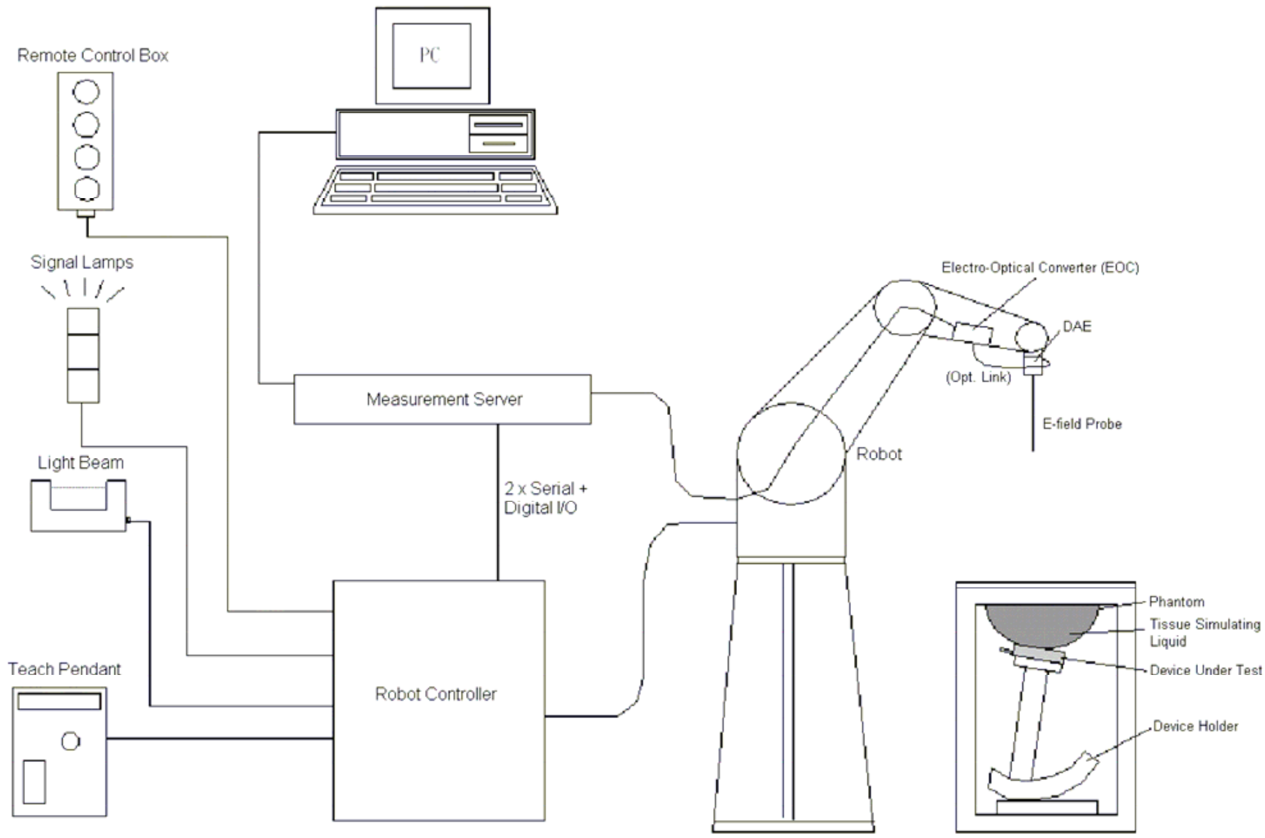
Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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.

3 SAR Measurement System

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 flat 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.

3.1 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.

3.1.1 E-Field Probe Specification

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

3.1.2 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 D of this report.

3.2 Data Acquisition Electronics (DAE)

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.
Photo of DAE


3.3 Robot

Robot
The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (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)
Photo of DASY5


3.4 Measurement Server

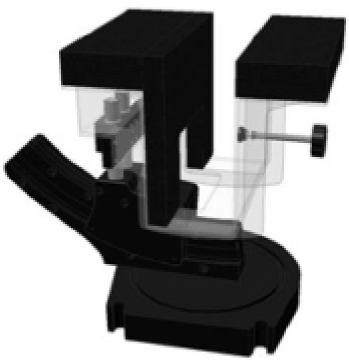
Measurement Server
The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital 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.
Photo of Server for DASY5


3.5 Phantom

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	**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.		

3.6 Device Holder

Device Holder for flat 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.
Photo of 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 ELI phantoms.
Photo of Laptop Extension Kit


3.7 Data Storage and Evaluation

3.7.1 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.

3.7.2 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：

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

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.

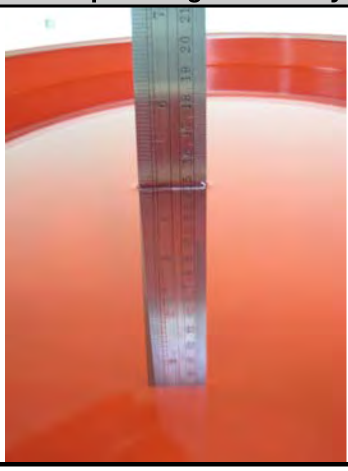
$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

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.

4 Tissue Simulating Liquids

Tissue Simulating Liquids
For the measurement of the field distribution inside the 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 Photo of Liquid Height for Body SAR.
Photo of Liquid Height for Body SAR



Recipes of Tissue Simulating Liquid								
Frequency (MHz)	**Water (%)**	**Sugar (%)**	**Cellulose (%)**	**Salt (%)**	**Preventol (%)**	**DGBE (%)**	**Conductivity (σ)**	**Permittivity (ε_r)**
For Body								
2450	68.6	0	0	0	0	31.4	1.95	52.7

Simulating Liquid for 5G, Manufactured by SPEAG	
Ingredients	**(% by weight)**
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an Agilent Network Analyzer.

Measuring Results for Simulating Liquid										
Frequency (MHz)	Liquid Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Cal. Date
2450	Body	22	1.97	51.47	1.95	52.70	1.18	-2.33	±5	2014/3/24
5200	Body	22	5.32	47.85	5.30	49.00	0.38	-2.35	±5	2014/3/24
5300	Body	22	5.45	47.71	5.42	48.87	0.46	-2.37	±5	2014/3/24
5600	Body	22	5.85	47.23	5.80	48.50	0.79	-2.62	±5	2014/3/24
5800	Body	22	6.11	46.90	6.00	48.20	1.83	-2.70	±5	2014/3/24

Measuring Results for Simulating Liquid										
Frequency (MHz)	Liquid Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Cal. Date
2450	Body	22	1.92	51.19	1.95	52.70	-1.44	-2.87	±5	2014/3/27
5200	Body	22	5.31	47.71	5.30	49.00	0.23	-2.63	±5	2014/3/27
5300	Body	22	5.45	47.58	5.42	48.87	0.63	-2.64	±5	2014/3/27
5600	Body	22	5.84	47.09	5.80	48.50	0.64	-2.91	±5	2014/3/27
5800	Body	22	6.11	46.77	6.00	48.20	1.85	-2.97	±5	2014/3/27

5 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.

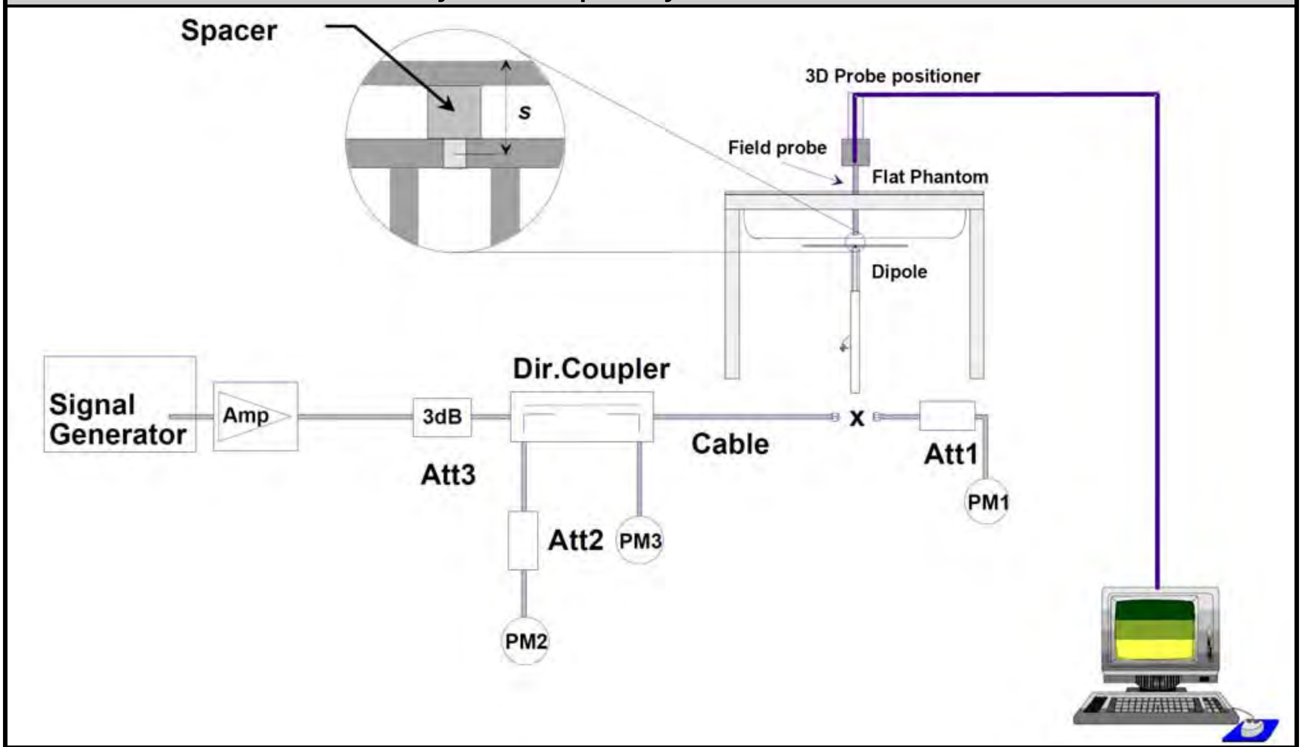
5.1 Purpose of System Performance check

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.

5.2 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 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:

System Setup for System Evaluation



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

5.3 SAR System Verification Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. The table below 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 B of this report.

Target and Measurement SAR after Normalized

Frequency (MHz)	Liquid Type	Power fed onto reference dipole (mW)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)	Limit (%)	Date
2450	Body	250	50.2	12.8	51.2	1.99	±10	2014/3/27
5200	Body	100	73.6	7.17	71.7	-2.58	±10	2014/3/25
5300	Body	100	75.8	7.49	74.9	-1.19	±10	2014/3/25
5600	Body	100	80.0	8.38	83.8	4.75	±10	2014/3/25
5800	Body	100	74.1	7.09	70.9	-4.32	±10	2014/3/25

6 EUT Testing Position

Please refer to Appendix A for the test setup photos.

7 Measurement Procedures

Measurement Procedures
Conducted power measurement
(a) 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 (b) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power
SAR measurement
(a) Use 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 A 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
Peak spatial-average SAR value
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

7.1 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

7.2 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.

7.3 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 FCC KDB 865664 D01 v01r01 quoted below.

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

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 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.</td></tr>
</table>

7.4 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.

7.5 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.

7.6 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.

8 Conducted RF Output Power

Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Antenna	Average Power (dBm)
WLAN 2.4GHz Band	802.11b	CH 1	2412	1	2	20.26
		CH 6	2437			21.08
		CH 11	2462			18.98
	802.11g	CH 1	2412	6	2	12.47
		CH 6	2437			19.62
		CH 11	2462			14.33
	802.11n (HT20)	CH 1	2412	MCS0	2	11.96
		CH 6	2437			19.63
		CH 11	2462			13.96

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

Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Antenna	Average Power (dBm)
WLAN 5 GHz Band 1	802.11a	CH36	5180	6	2	13.92
		CH40	5200			14.70
		CH44	5220			14.51
		CH48	5240			14.40
	802.11n (HT20)	CH36	5180	MCS0	2	14.91
		CH40	5200			14.79
		CH44	5220			14.59
		CH48	5240			14.48
	802.11n (HT40)	CH38	5190	MCS0	2	13.90
		CH46	5230			16.81
	802.11ac (VHT20)	CH36	5180	MCS0/Nss1	2	14.83
		CH40	5200			14.80
		CH44	5220			14.55
		CH48	5240			14.50
	802.11ac (VHT40)	CH38	5190	MCS0/Nss1	2	14.84
		CH46	5230			16.78
	802.11ac (VHT80)	CH42	5210	MCS0/Nss1	2	15.03

Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Antenna	Average Power (dBm)
WLAN 5 GHz Band 2	802.11a	CH52	5260	6	2	17.81
		CH56	5280			18.26
		CH60	5300			18.58
		CH64	5320			18.23
	802.11n (HT20)	CH52	5260	MCS0	2	17.78
		CH56	5280			18.08
		CH60	5300			18.62
		CH64	5320			18.22
	802.11n (HT40)	CH54	5270	MCS0	2	18.65
		CH62	5310			13.65
	802.11ac (VHT20)	CH52	5260	MCS0/Nss1	2	17.82
		CH56	5280			18.31
		CH60	5300			18.60
		CH64	5320			17.72
	802.11ac (VHT40)	CH54	5270	MCS0/Nss1	2	18.60
		CH62	5310			14.62
	802.11ac (VHT80)	CH58	5290	MCS0/Nss1	2	14.75

Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Antenna	Average Power (dBm)
WLAN 5 GHz Band 3	802.11a	CH100	5500	6	2	17.96
		CH104	5520			18.12
		CH108	5540			18.02
		CH112	5560			18.07
		CH116	5580			18.23
		CH132	5660			18.07
		CH136	5680			18.09
		CH140	5700			14.96
	802.11n (HT20)	CH100	5500	MCS0	2	18.01
		CH104	5520			18.06
		CH108	5540			18.01
		CH112	5560			18.07
		CH116	5580			18.32
		CH132	5660			18.13
		CH136	5680			18.02
		CH140	5700			13.90
	802.11n (HT40)	CH102	5510	MCS0	2	16.61
		CH110	5550			18.38
		CH134	5670			15.20
	802.11ac (VHT20)	CH100	5500	MCS0/Nss1	2	18.02
		CH104	5520			18.09
		CH108	5540			18.02
		CH112	5560			18.12
		CH116	5580			18.30
		CH132	5660			18.15
		CH136	5680			18.06
		CH140	5700			13.89
	802.11ac (VHT40)	CH102	5510	MCS0/Nss1	2	16.59
		CH110	5550			18.34
		CH134	5670			17.37
	802.11ac (VHT80)	CH106	5530	MCS0/Nss1	2	16.72

Band	Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Antenna	Average Power (dBm)
WLAN 5 GHz Band 4	802.11a	CH149	5745	6	2	17.35
		CH153	5765			17.34
		CH157	5785			16.51
		CH161	5805			17.26
		CH165	5825			16.81
	802.11n (HT20)	CH149	5745	MCS0	2	17.28
		CH153	5765			17.33
		CH157	5785			16.58
		CH161	5805			17.28
		CH165	5825			16.73
	802.11n (HT40)	CH151	5755	MCS0	2	16.71
		CH159	5795			17.29
	802.11ac (VHT20)	CH149	5745	MCS0/Nss1	2	17.35
		CH153	5765			17.36
		CH157	5785			16.41
		CH161	5805			17.31
		CH165	5825			16.72
	802.11ac (VHT40)	CH151	5755	MCS0/Nss1	2	16.72
		CH159	5795			17.21
	802.11ac (VHT80)	CH155	5775	MCS0/Nss1	2	16.72

Note:
1. Per FCC KDB 248227 D01 v01r02, choose the highest output power channel to test SAR and determine further SAR exclusion
2. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate.
3. Per FCC KDB 248227 D01 v01r02, 11n/ac-HT20/HT40/VHT20/VHT40 output power is less than 1/4dB higher than 11a mode, thus the SAR can be excluded.
4. For 802.11ac SAR evaluation for each frequency band, 802.11ac VHT80 will verified at the worst case found in 802.11a SAR testing.

Bluetooth – Burst Average Power (dBm)				
Channel	Frequency (MHz)	Mode		
		GFSK	π /4-DQPSK	8-DPSK
CH 0	2402	8.61	7.28	7.15
CH 39	2441	9.62	8.17	8.17
CH 78	2480	7.46	5.82	6.01

Bluetooth – Source-base time-Average Power (dBm)				
Channel	Frequency (MHz)	Mode		
		GFSK	π /4-DQPSK	8-DPSK
CH 0	2402	7.82	6.49	6.36
CH 39	2441	8.83	7.38	7.38
CH 78	2480	6.67	5.03	5.22

Bluetooth Average Power (dBm)		
Channel	Frequency (MHz)	Mode
		BT v4.0 LE, GFSK
CH 0	2402	0.67
CH 19	2440	1.51
CH 39	2480	-0.6

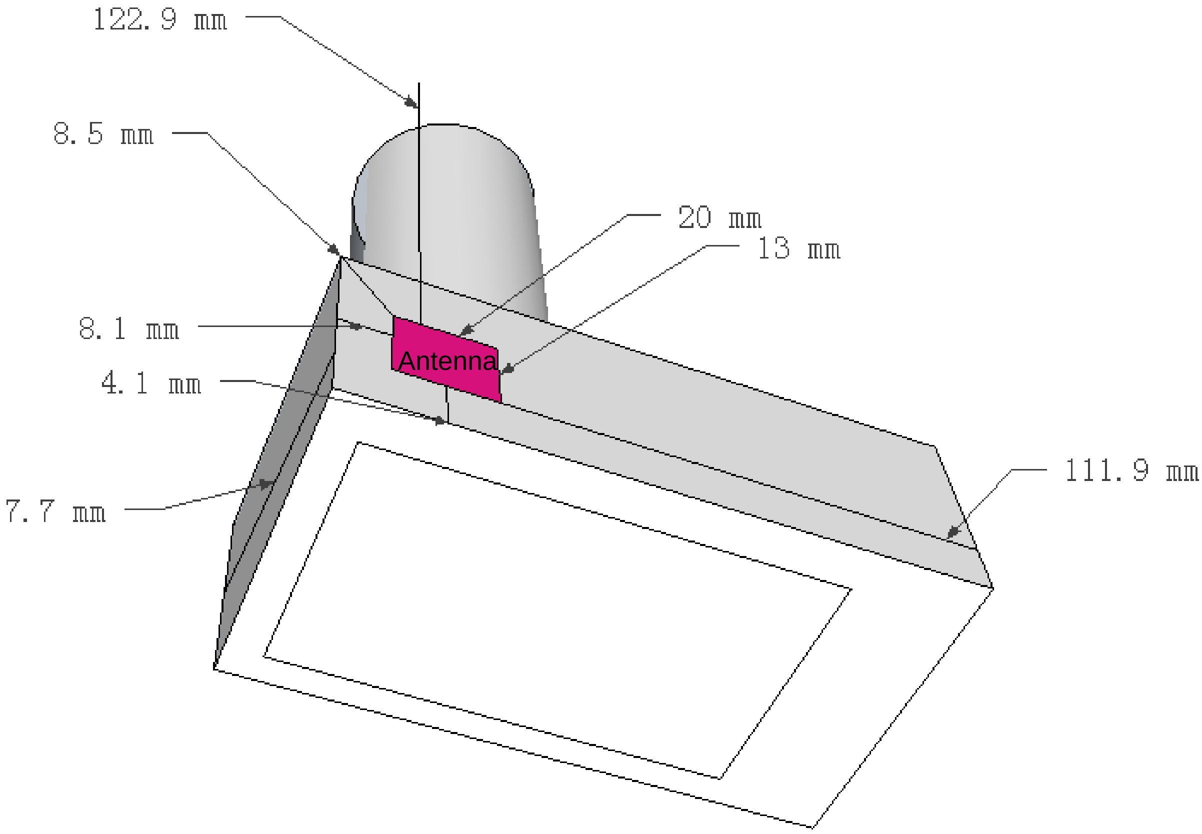
Note:

1. The data above is the average power level during the “ON” burst of Bluetooth transmitter
2. The duty factor of DH5/2DH5/3DH5 is applied to determine source-base time-average power and time-average power = burst average power * duty factor.
3. Duty factor used for DH5/2DH5/3DH5 is the theoretical maximum of 83.3%.
4. Per FCC KDB 447498 D01 v05r01, 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

Bluetooth Max Power (dBm)	mW	Test Distance (mm)	Frequency (GHz)	Exclusion Thresholds
8.83	7.63	5	2.441	2.38

5. Per FCC KDB 447498 D01 v05r01 exclusion thresholds is 2.38 < 3, RF exposure evaluation is not required.

9 Antenna Location



EUT's dimension is 140mm*77mm*113mm.

The form factor is big enough so that it can't put inside the pocket (9cm*5cm).

Only front site can contact body when normally use.

10 SAR Test Results

1. Per FCC KDB 447498 D01 v05r01, 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 WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Tune-up scaling factor.
2. Per FCC KDB 447498 D01 v05r01, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

10.1 Test Records for Body SAR Test

WLAN SAR DTS													
Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Ant.	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured SAR 1g (W/kg)	Scaled SAR 1g (W/kg)
19	WLAN 2.4GHz	802.11b 1Mbps	Front	0	CH6	2412	2	21.08	21.50	1.102	0.00	0.199	0.219
4	WLAN 5GHz	802.11a 6Mbps	Front	0	CH149	5745	2	17.35	17.50	1.035	-0.06	1.410	1.460
10	WLAN 5GHz	802.11a 6Mbps	Front	0	CH157	5785	2	16.51	16.80	1.069	-0.07	1.400	1.497
11	WLAN 5GHz	802.11a 6Mbps	Front	0	CH165	5825	2	16.81	17.00	1.045	-0.05	1.420	1.484
8	WLAN 5GHz	802.11ac (VHT80) MCS0/Nss1	Front	0	CH155	5775	2	16.72	16.90	1.042	-0.06	1.410	1.470

WLAN SAR NII													
Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Ant.	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured SAR 1g (W/kg)	Scaled SAR 1g (W/kg)
1	WLAN 5GHz	802.11a 6Mbps	Front	0	CH40	5200	2	14.70	15.00	1.072	-0.20	0.394	0.422
15	WLAN 5GHz	802.11n (HT40) MCS0	Front	0	CH46	5230	2	16.81	17.00	1.045	-0.12	0.775	0.810
12	WLAN 5GHz	802.11ac (VHT80) MCS0/Nss1	Front	0	CH42	5210	2	15.03	15.50	1.114	0.19	0.509	0.567
5	WLAN 5GHz	802.11a 6Mbps	Front	0	CH52	5260	2	17.81	18.00	1.045	-0.06	0.817	0.854
2	WLAN 5GHz	802.11a 6Mbps	Front	0	CH60	5300	2	18.58	19.00	1.102	-0.10	0.907	0.999
6	WLAN 5GHz	802.11a 6Mbps	Front	0	CH64	5320	2	18.23	18.50	1.064	0.00	0.716	0.762
13	WLAN 5GHz	802.11ac (VHT80) MCS0/Nss1	Front	0	CH58	5290	2	14.75	15.00	1.059	-0.04	0.452	0.479
7	WLAN 5GHz	802.11a 6Mbps	Front	0	CH104	5520	2	18.12	18.50	1.091	-0.12	0.696	0.760
3	WLAN 5GHz	802.11a 6Mbps	Front	0	CH116	5580	2	18.23	18.50	1.064	0.01	0.974	1.036
9	WLAN 5GHz	802.11a 6Mbps	Front	0	CH136	5680	2	18.09	18.50	1.099	-0.10	0.884	0.972
14	WLAN 5GHz	802.11ac (VHT80) MCS0/Nss1	Front	0	CH106	5530	2	16.72	17.00	1.067	-0.05	0.704	0.751

10.2 Repeated SAR Measurement

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured SAR 1g (W/kg)	Scaled SAR 1g (W/kg)
2	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH60	5300	18.58	19.00	1.102	-0.1	0.907	0.999
18	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH60	5300	18.58	19.00	1.102	-0.06	1.08	1.190
3	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH116	5580	18.23	18.50	1.064	0.01	0.974	1.036
17	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH116	5580	18.23	18.50	1.064	-0.09	1.15	1.224
11	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH165	5825	16.81	17.00	1.045	-0.05	1.42	1.484
16	WLAN 5GHz	802.11a 6Mbps	Fornt	0	CH165	5825	16.81	17.00	1.045	-0.11	1.38	1.442

Note:
1. Per FCC KDB 865664 D01 v01r01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per FCC KDB 865664 D01 v01r01, 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 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.

10.3 Simultaneous Transmission Analysis

No.	Simultaneous Transmission Configurations	Support
1	WLAN+Bluetooth	No

Note:
1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, they will not transmit simultaneously.

10.4 Highest SAR Plot

WLAN 2.4GHz

Test Laboratory :Sporton International Inc. SAR Testing Lab Date: 2014/03/27

P-19_WLAN2.4GHz_802.11b_1Mbps_front_0cm_CH6;Ant B

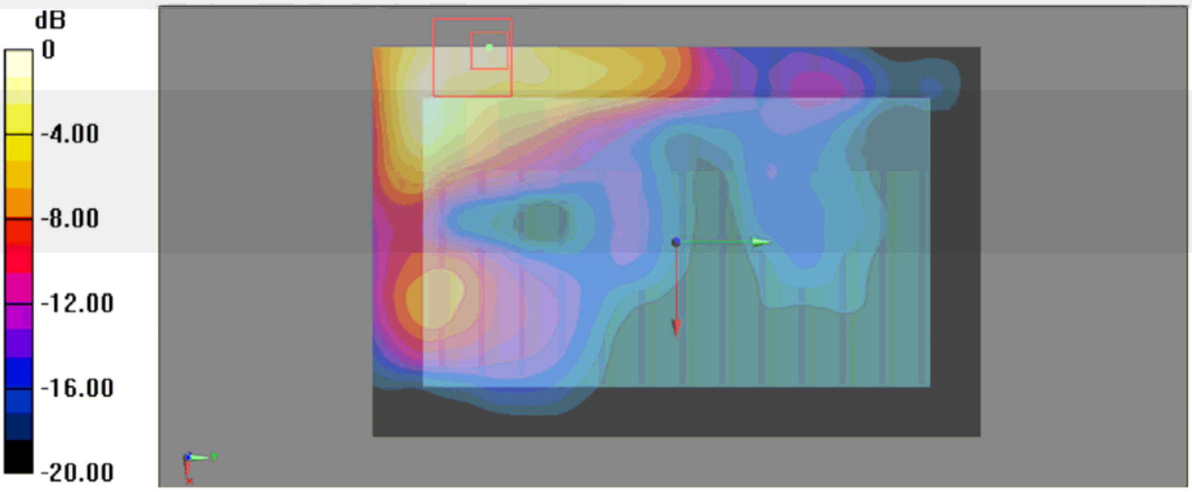
Communication System: WLAN 2.4GHz_802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1
Medium: MSL_2.4G; Medium parameters used: f = 2437 MHz; σ = 1.904 S/m; ε_r = 51.229; ρ = 1000 kg/m^3

DASY5 Configuration:

- Probe: EX3DV4 - SN3958; ConvF(7.6, 7.6, 7.6); Calibrated: 2013/12/09;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1386; Calibrated: 2013/12/02
- Phantom: ELI v4.0 right; Type: QDOVA001BB; Serial: TP:1232
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10(7164)

Configuration/CH6/Area Scan (91x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.294 W/kg

Configuration/CH6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.272 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.408 W/kg
SAR(1 g) = 0.199 W/kg; SAR(10 g) = 0.105 W/kg
Maximum value of SAR (measured) = 0.299 W/kg



0 dB = 0.299 W/kg = -5.24 dBW/kg

WLAN 5GHz Band4

Test Laboratory :Sporton International Inc. SAR Testing Lab Date: 2014/03/27

P-10_WLAN5GHz_802.11a_6Mbps_front_0cm_CH157;Ant B

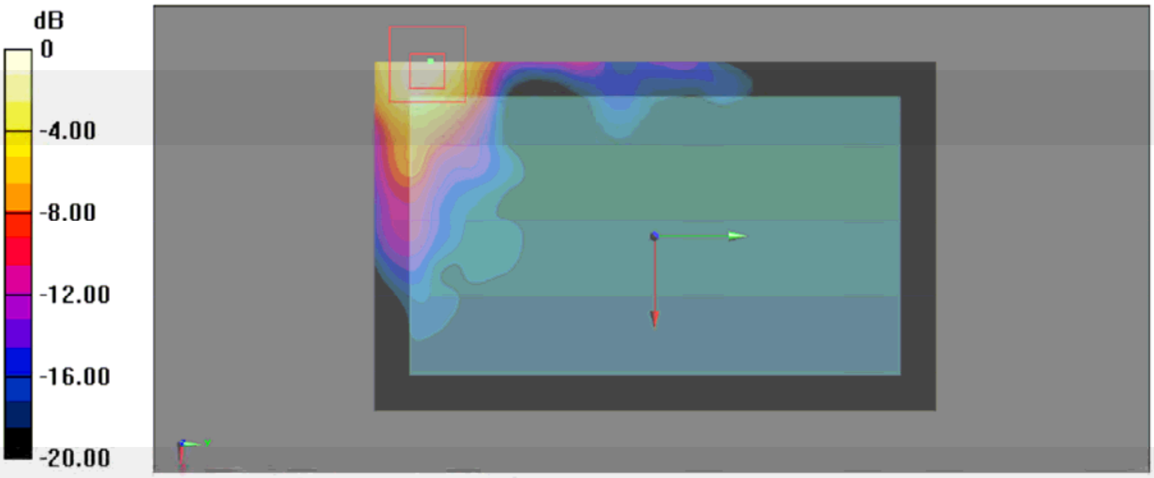
Communication System: WLAN 5GHz_802.11a ; Frequency: 5785 MHz ; Duty Cycle: 1:1
Medium: MSL_5G; Medium parameters used: f = 5785 MHz; σ = 6.087 S/m; ε_r = 46.794; ρ = 1000 kg/m^3

DASY5 Configuration:

- Probe: EX3DV4 - SN3958; ConvF(4.15, 4.15, 4.15); Calibrated: 2013/12/09;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1386; Calibrated: 2013/12/02
- Phantom: ELI v4.0 front; Type: QDOVA001BB; Serial: TP:1233
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10(7164)

Configuration/CH157/Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.17 W/kg

Configuration/CH157/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 26.001 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 6.24 W/kg
SAR(1 g) = 1.4 W/kg; SAR(10 g) = 0.485 W/kg
Maximum value of SAR (measured) = 3.44 W/kg



0 dB = 3.44 W/kg = 5.37 dBW/kg

WLAN 5GHz Band1

Test Laboratory :Sporton International Inc. SAR Testing Lab Date: 2014/03/27

P-15_WLAN5GHz_802.11n-HT40_MCS0_front_0cm_CH46;Ant B

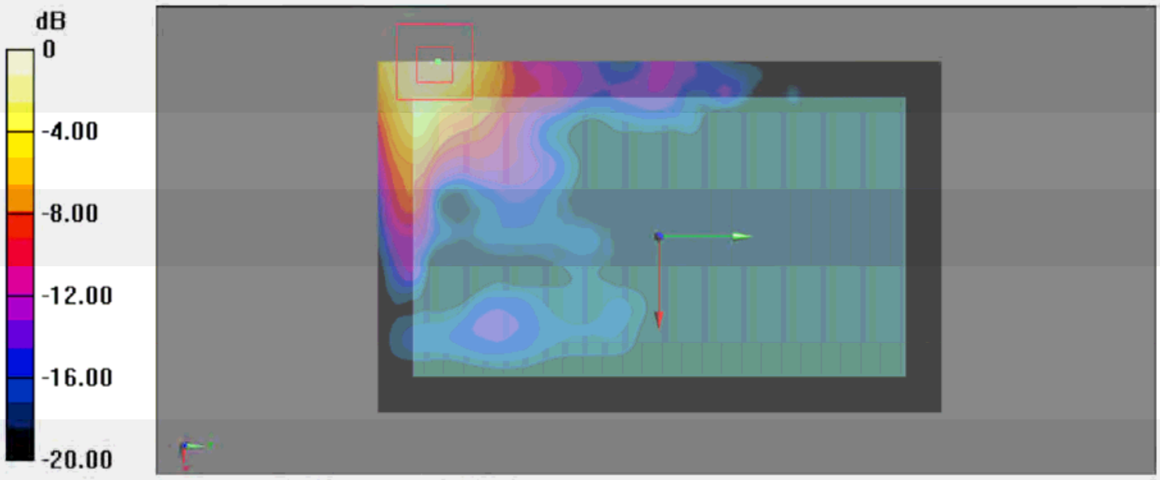
Communication System: WLAN 5GHz_802.11n ; Frequency: 5230 MHz ; Duty Cycle: 1:1
Medium: MSL_5G; Medium parameters used: f = 5230 MHz; σ = 5.342 S/m; ε_r = 47.63; ρ = 1000 kg/m^3

DASY5 Configuration:

- Probe: EX3DV4 - SN3958; ConvF(4.55, 4.55, 4.55); Calibrated: 2013/12/09;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1386; Calibrated: 2013/12/02
- Phantom: ELI v4.0 front; Type: QDOVA001BB; Serial: TP:1233
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10(7164)

Configuration/CH46/Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.80 W/kg

Configuration/CH46/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 20.104 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 3.16 W/kg
SAR(1 g) = 0.775 W/kg; SAR(10 g) = 0.290 W/kg
Maximum value of SAR (measured) = 1.78 W/kg



0 dB = 1.78 W/kg = 2.50 dBW/kg

WLAN 5GHz Band2

Test Laboratory :Sporton International Inc. SAR Testing Lab Date: 2014/03/25

P-02_WLAN5GHz_802.11a_6Mbps_front_0cm_CH60;Ant B

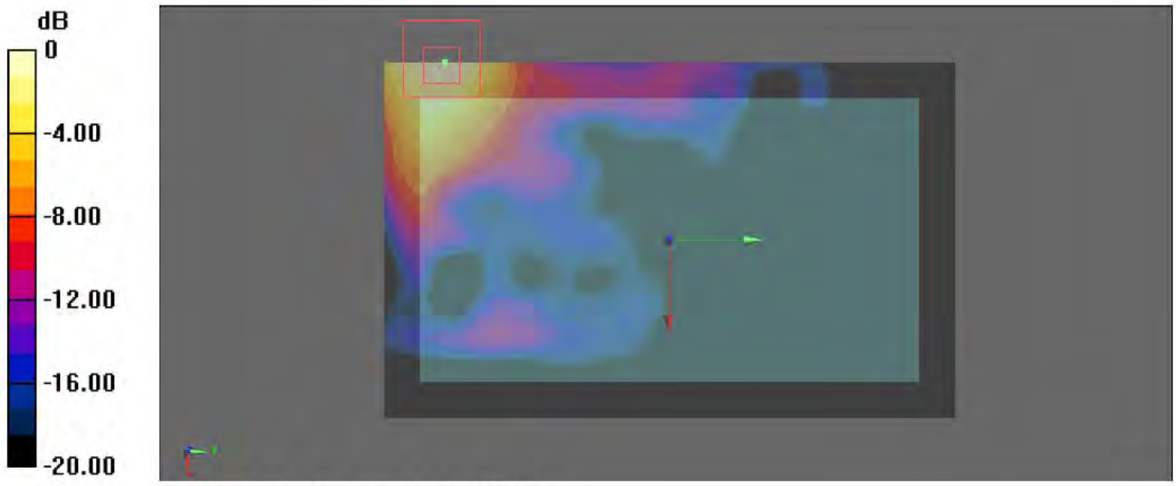
Communication System: WLAN 5GHz_802.11a ; Frequency: 5300 MHz ; Duty Cycle: 1:1
Medium: MSL_5G; Medium parameters used: f = 5300 MHz; σ = 5.445 S/m; ε_r = 47.715; ρ = 1000 kg/m^3

DASY5 Configuration:

- Probe: EX3DV4 - SN3958; ConvF(4.55, 4.55, 4.55); Calibrated: 2013/12/09;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1386; Calibrated: 2013/12/02
- Phantom: ELI v4.0 front; Type: QDOVA001BB; Serial: TP:1233
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10(7164)

Configuration/CH60/Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.08 W/kg

Configuration/CH60/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 21.547 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 3.64 W/kg
SAR(1 g) = 0.907 W/kg; SAR(10 g) = 0.349 W/kg
Maximum value of SAR (measured) = 2.07 W/kg



0 dB = 2.07 W/kg = 3.16 dBW/kg

WLAN 5GHz Band3

Test Laboratory :Sporton International Inc. SAR Testing Lab   Date: 2014/03/26

P-03_WLAN5GHz_802.11a_6Mbps_front_0cm_CH116;Ant B

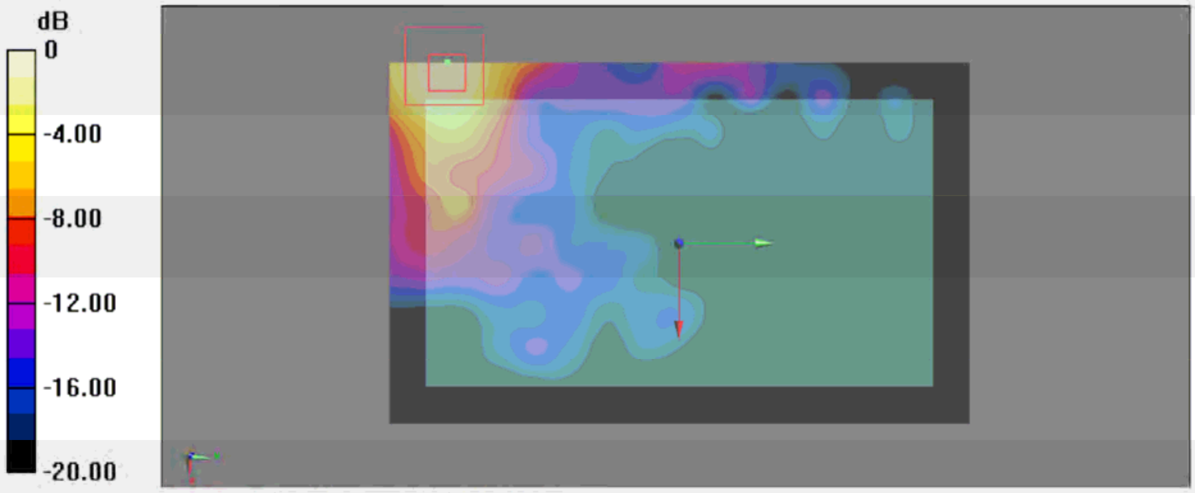
Communication System: WLAN 5GHz_802.11a ; Frequency: 5580 MHz ; Duty Cycle: 1:1
Medium: MSL_5G; Medium parameters used: f = 5580 MHz; σ = 5.817 S/m; ε_r = 47.244; ρ = 1000 kg/m^3

DASY5 Configuration:

- Probe: EX3DV4 - SN3958; ConvF(3.91, 3.91, 3.91); Calibrated: 2013/12/09;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1386; Calibrated: 2013/12/02
- Phantom: ELI v4.0 front; Type: QDOVA001BB; Serial: TP:1233
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10(7164)

Configuration/CH116/Area Scan (101x161x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.15 W/kg

Configuration/CH116/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 21.222 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 4.15 W/kg
SAR(1 g) = 0.974 W/kg; SAR(10 g) = 0.364 W/kg
Maximum value of SAR (measured) = 2.32 W/kg



0 dB = 2.32 W/kg = 3.65 dBW/kg

11 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
2450MHz System Validation Kit	SPEAG	D2450V2	926	300MHz~3GHz	Dec. 3, 2013	SAR01-CB
5GHz System Validation Kit	SPEAG	D5GHzV2	1023	3GHz~6GHz	Jan. 30, 2014	SAR01-CB
Data Acquisition Electronics	SPEAG	DAE4	1386	-	Dec. 2, 2013	SAR01-CB
Dosimetric E-Field Probe	SPEAG	EX3DV4	3958	30MHz~6GHz	Dec. 9, 2013	SAR01-CB
Device Holder	SPEAG	N/A	N/A	N/A	N.C.R.	SAR01-CB
Dielectric Probe Kit	SPEAG	DAK-3.5	1144	200MHz~20GHz	Dec. 3, 2013	SAR01-CB
Dual Directional Coupler	Woken	SMA 30W	DOM3BDW1A3	500MHz~6GHz	Note 1	SAR01-CB
Network Analyzers	Agilent	E5071C	MY46418863	9kHz~6GHz	Oct. 30, 2013	SAR01-CB
Power Meter	Agilent	E4416A	GB41991199	50MHz~18GHz	Dec. 02, 2013	SAR01-CB
Power Sensor	Agilent	E9327A	US40442088	50MHz~18GHz	Dec. 02, 2013	SAR01-CB
Thermometer	HTC-1	HTC-1	TM-1	-50℃~70℃	Jan. 16, 2014	SAR01-CB
Mini-Circuits	Power Amplifier	ZVE-8G	N/A	2GHz~8GHz	Dec. 02, 2013	SAR01-CB
Attenuator 1	Woken	WATT-218FS-03	N/A	1GHz~18GHz	Note 1	SAR01-CB
Attenuator 2	Woken	WATT-218FS-03	N/A	1GHz~18GHz	Note 1	SAR01-CB

Note:
1. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
2. The calibration certificate of DASY can be referred to appendix D of this report.
3. 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.
4. Calibration Interval of instruments listed above is one year.
5. NCR means Non-Calibration required.

12 Uncertainty Assessment

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

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

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

Standard Uncertainty for Assumed Distribution				
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

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)
Uncertainty Budget for frequency range 0.3 MHz to 3 GHz							
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 %
Modulation Response	2.4	Rectangular	$\sqrt{3}$	1	1	± 1.4 %	± 1.4 %
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.	2.0	Rectangular	$\sqrt{3}$	1	1	± 1.2 %	± 1.2 %
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 %
Power Scaling	0	Rectangular	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %
Phantom and Setup							
Phantom Uncertainty	6.1	Rectangular	$\sqrt{3}$	1	1	± 3.5 %	± 3.5 %
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	0.84	± 1.1 %	± 0.9 %
Liquid Conductivity (Mea.)	2.5	Rectangular	$\sqrt{3}$	0.78	0.71	± 1.1 %	± 1.0 %
Liquid Permittivity (Mea.)	2.5	Rectangular	$\sqrt{3}$	0.26	0.26	± 0.3 %	± 0.4 %
Temp. unc. – Conductivity	3.4	Rectangular	$\sqrt{3}$	0.78	0.71	± 1.5 %	± 1.4 %
Temp. unc. – Permittivity	0.4	Rectangular	$\sqrt{3}$	0.23	0.26	± 0.1 %	± 0.1 %
Combined Standard Uncertainty						± 11.2 %	± 11.1 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.3 %**	**± 22.2 %**

Uncertainty Budget for frequency range 3 GHz to 6 GHz							
Error Description	**Uncertainty Value (±%)**	**Probability Distribution**	**Divisor**	**Ci (1g)**	**Ci (10g)**	**Standard Uncertainty (1g)**	**Standard Uncertainty (10g)**
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	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	2.0	Rectangular	$\sqrt{3}$	1	1	± 1.2 %	± 1.2 %
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 %
Modulation Response	2.4	Rectangular	$\sqrt{3}$	1	1	± 1.4 %	± 1.4 %
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	0.8	Rectangular	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %
Probe Positioning	6.7	Rectangular	$\sqrt{3}$	1	1	± 3.9 %	± 3.9 %
Max. SAR Eval.	4.0	Rectangular	$\sqrt{3}$	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	$\sqrt{3}$	1	1	± 2.9 %	± 2.9 %
Power Scaling	0	Rectangular	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %
Phantom and Setup							
Phantom Uncertainty	6.6	Rectangular	$\sqrt{3}$	1	1	± 3.8 %	± 3.8 %
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	0.84	± 1.1 %	± 0.9 %
Liquid Conductivity (Mea.)	2.5	Rectangular	$\sqrt{3}$	0.78	0.71	± 1.1 %	± 1.0 %
Liquid Permittivity (Mea.)	2.5	Rectangular	$\sqrt{3}$	0.26	0.26	± 0.3 %	± 0.4 %
Temp. unc. – Conductivity	3.4	Rectangular	$\sqrt{3}$	0.78	0.71	± 1.5 %	± 1.4 %
Temp. unc. – Permittivity	0.4	Rectangular	$\sqrt{3}$	0.23	0.26	± 0.1 %	± 0.1 %
Combined Standard Uncertainty						± 12.3 %	± 12.2 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 24.6 %**	**± 24.5 %**

13 References

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

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

[4] SPEAG DASY System Handbook

[5] FCC FCC KDB 865664 D01 v01r01, "SAR Measurement Requirements for 100 MHz to 6 GHz", May 2013.

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

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