

**In accordance with the requirements of SAR Report and Order:
FCC 47 CFR Part 2 (2.1093)
RSS102 issue 5**

SAR TEST REPORT

For

Product Name: 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card

Brand name: Qualcomm Atheros

Model No.: QCNFA364A

Series Model: N/A

FCCID: PPD-QCNFA364AH

IC: 4104A-QCNFA364A

Test Report Number:

C160127R02-B-SF

Issued for

Qualcomm Atheros, Inc.

1700 Technology Drive, San Jose, CA 95110

Issued by

Compliance Certification Services Inc.

Kun shan Laboratory

**No.10 Weiye Rd., Innovation park, Eco&Tec,
Development Zone, Kunshan City, Jiangsu, China**

TEL: 86-512-57355888

FAX: 86-512-57370818



TESTING CERT #2541.01

Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document. The client should not use it to claim product endorsement by A2LA or any government agencies. The test results in the report only apply to the tested sample.

Revision History

Revision	REPORT NO.	Date	Page Revised	Contents
Original	C160127R02-B-SF	January 29, 2016	N/A	N/A
01	C160127R02-B-SF	April 11, 2016	All Report	Update EUT TURN-UP Table and add IEEE802.11n40 5GHz test data.
02	C160127R02-B-SF	May 17, 2016	All Report	Add U-NII-3 test data.
03	C160127R02-B-SF	May 19, 2016	All Report	Update EUT TURN-UP Table and retest IEEE802.11n40 5GHz frequency band.

TABLE OF CONTENTS

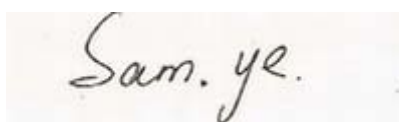
1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)	4
2. EUT DESCRIPTION	5
2.1 TARGET RF OUTPUT POWER WITH TEST CHANNEL	6
2.2 STATEMENT OF COMPLIANCE	8
3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC	9
4. TEST METHODOLOGY	9
5. TEST CONFIGURATION	9
6. DOSIMETRIC ASSESSMENT SETUP	10
6.1 MEASUREMENT SYSTEM DIAGRAM	11
6.2 SYSTEM COMPONENTS	12
7. EVALUATION PROCEDURES	15
8. MEASUREMENT UNCERTAINTY	19
9. EXPOSURE LIMIT	21
10. MEASUREMENT RESULTS	22
10.1 TEST LIQUIDS CONFIRMATION	22
10.2 LIQUID MEASUREMENT RESULTS	23
10.3 SYSTEM PERFORMANCE CHECK	24
10.4 EUT TUNE-UP PROCEDURES AND TEST MODE	26
10.5 STANDALONE SAR TEST EXCLUSION	34
10.6 SAR TEST CONFIGURATIONS	35
10.7 ANTENNA LOCATION	36
10.8 SAR MEASUREMENT RESULTS	38
10.9 REPEATED SAR MEASUREMENT	40
10.10 SAR MULTI XMITER ASSESSMENT	41
EQUIPMENT LIST & CALIBRATION STATUS	43
11. FACILITIES	44
12. REFERENCES	44
Appendix A: DUT AND SAR SETUP Photo	45
Appendix B: Plots of Performance Check	45
Appendix C: DASY Calibration Certificate	52
Appendix D: Plots of SAR Test Result	52

1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

Product Name:	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
Brand name:	Qualcomm Atheros
Model Name.:	QCNFA364A
Series Model:	N/A
Device Category:	PORTABLE DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE
Date of Test:	December 26, 2015 & May 19, 2016
Applicant:	Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110
Manufacturer:	Qualcomm Atheros, Inc. 1700 Technology Drive, San Jose, CA 95110
Application Type:	Certification
APPLICABLE STANDARDS AND TEST PROCEDURES	
STANDARDS AND TEST PROCEDURES	TEST RESULT
FCC 47 CFR Part 2 (2.1093) IEEE 1528-2013 KDB 248227 KDB 865664 KDB 447498 KDB 616217 RSS102 issue 5 IEC 62209-2:2010	No non-compliance noted
Deviation from Applicable Standard	
None	
The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in KDB 865664 ; RSS102 issue 5. The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.	

Approved by:

Jeff.fang
RF Manager
Compliance Certification Services Inc.

Tested by:

Sam.ye
Test Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product Name:	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
Brand name:	Qualcomm Atheros
Model Name.:	QCNFA364A
Series Model:	N/A
FCC ID:	PPD-QCNFA364AH
IC:	4104A-QCNFA364A
Power reduction:	NO
DTM Description:	N/A
Device Category:	Production unit
Frequency Range:	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Modulation Technique:	802.11a/b/g/n HT20/HT40/VHT20/VHT40/VHT80 Bluetooth:3.0 + EDR, 8-DPSK Bluetooth:4.0
Operating Mode:	Maximum continuous output

Tested System Details

Product	Manufacturer	Model No.
Notebook Computer	Lenovo	Lenovo ideapad Y900-17ISKxxxxxx, 80Q1xxxxxx (The"x" in model name can be 0 to 9,A to Z,a to z,"-"or blank,for marketing use only,with no impact on EMC and safety compliance of the product)

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

2.1 TARGET RF OUTPUT POWER WITH TEST CHANNEL

Band / Mode	Target Power(dBm)		
	V3.0 + EDR, GFSK	V3.0 + EDR, $\pi/4$ -DQPSK	V3.0 + EDR, 8-DPSK
Bluetooth	7	7	7

Band / Mode	Target Power(dBm)
	BLE4.0, GFSK
Bluetooth	4.5

Band / Mode	Channel	SISO Target Power (dBm)
802.11b	1	18.5
	6	19
	11	18.5
802.11g	1	15.5
	6	18
	11	14.5
802.11n 20MHz	1	15.5
	6	18
	11	14.5
802.11n 40MHz	3	11.5
	6	17
	9	10.5
802.11 a U-NII-1	36-48	13
802.11 a U-NII-2A	52-60	17
	64	15
802.11 a U-NII-2C	100	15
	104-136	17
	140	14.5
	144	17
802.11 a U-NII-3	149	15
802.11 a U-NII-3	165	17
802.11 n20 U-NII-1	36-48	13
802.11 n20 U-NII-2A	52-60	17
	64	15
802.11 n20 U-NII-2C	100	15
	104-136	17
	140	14.5
	144	17
802.11 n20 U-NII-3	149	15
802.11 n20 U-NII-3	165	17
802.11 n40 U-NII-1	38-46	13
802.11 n40 U-NII-2A	54	17
	62	15
802.11 n40 U-NII-2C	102	15
	110-142	17
802.11 n40 U-NII-3	151	12.5
802.11 n40 U-NII-3	159	17
802.11 ac80 U-NII-1	42	13
802.11 ac80 U-NII-2A	58	12
802.11 ac80 U-NII-2C	106	12.5



	122-138	16
802.11 ac80 U-NII-3	155	12

2.2 STATEMENT OF COMPLIANCE

The maximum results of Specific Absorption Rate (SAR) found during testing for **Qualcomm Atheros, 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card, QCNFA364A**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary	
		Body 1g SAR (W/kg)	Simultaneous Transmission 1g SAR (W/kg)
DTS	2.4GHz WLAN	0.430	0.449
NII	5.2GHz WLAN	--	0.646
	5.3GHz WLAN	0.707	
	5.5GHz WLAN	0.868	
	5.8GHz WLAN	0.627	
DSSS(BT)	2.4GHz	0.019	0.646

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 RSS 102 issue5 2015, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/Kg for an uncontrolled environment and 8.0 W/Kg for an occupational/controlled environment as recommended by the FCC 47 CFR part 2 (2.1093); RSS-102 issue 5: 2015.

4. TEST METHODOLOGY

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)
- ☒ IEEE 1528-2013
- ☒ IEC 62209-2:2010
- ☒ RSS-102 issue 5: 2015
- ☒ KDB 447498 D01v06 General RF Exposure Guidance
- ☒ KDB 865664 D01v01r04 Measurement 100 MHz to 6 GHz
- ☒ KDB 865664 D02 v01r02 RF Exposure Reporting
- ☒ KDB 248227 D01v02r02 802 11 Wi-Fi SAR
- ☒ KDB 616217 D04v01r02 SAR for laptop and tablets

5. 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

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

Duty cycle Form

Band	Mode	Duty cycle(100%)
2.4GHz	Bluetooth	63.1
	802.11b	99
	802.11g	99
	802.11n 20MHz	99
	802.11n 40MHz	98
5GHz	802.11a	99
	802.11 20MHz	99
	802.11 40MHz	99
	802.11 ac80	98

6. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from SPEAG. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than $\pm 10\%$. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ± 0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEE P1528 and CENELEC IEC 62209.

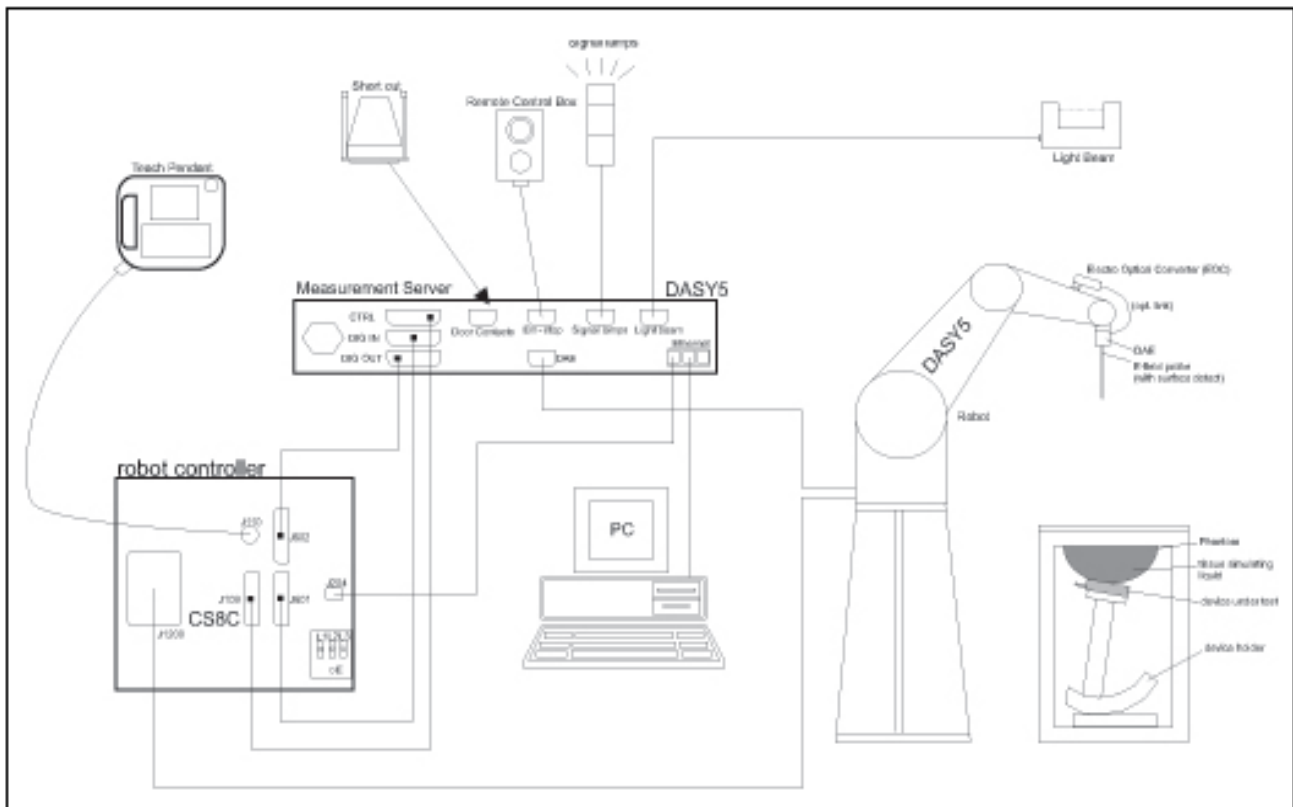
The following table gives the recipes for tissue simulating liquids.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

6.1 MEASUREMENT SYSTEM DIAGRAM



The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

6.2 SYSTEM COMPONENTS



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

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



The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)



The data acquisition electronics (DAE4) 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 mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements



Construction: Symmetrical design with triangular core

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.

Conversion Factors (CF) for HSL 900 and HSL 1800
CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
 ± 0.5 dB in HSL (rotation normal to probe axis)

Dynamic Range: 10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 μ W/g)

Dimensions: Overall length: 337 mm (Tip: 9 mm)
 Tip diameter: 2.5 mm (Body: 10 mm)
 Distance from probe tip to dipole centers:
 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



Interior of probe

SAM Twin Phantom

Construction:

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.



Shell Thickness: 2 ± 0.2 mm

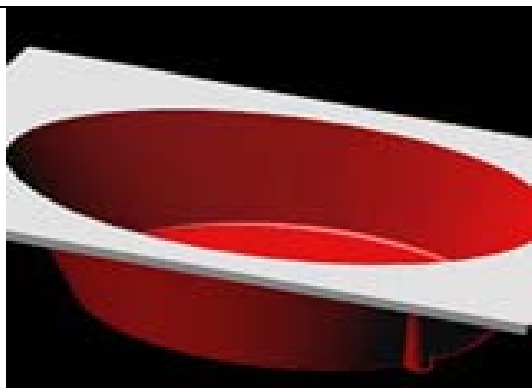
Filling Volume: Approx. 25 liters

Dimensions: Height: 850mm; Length: 1000mm; Width: 750mm

SAM Phantom (ELI4 v4.0)

Description Construction:

Phantom 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 the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles



Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm

Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

**System Validation Kits for SAM Twin Phantom**

Construction: Symmetrical dipole with 1/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900, 1800, 2450, 5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm

D1800V2: dipole length: 72.5 mm; overall height: 300 mm

D1900V2: dipole length: 67.7 mm; overall height: 300 mm

D2450V2: dipole length: 51.5 mm; overall height: 290 mm

D5GHzV2: dipole length: 20.6 mm; overall height: 300mm

**System Validation Kits for ELI4 phantom**

Construction: Symmetrical dipole with 1/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 900, 1800, 2450, 5800 MHz

ReTune loss: > 20 dB at specified validation position

Power capability: > 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm

D1800V2: dipole length: 72.5 mm; overall height: 300 mm

D1900V2: dipole length: 67.7 mm; overall height: 300 mm

D2450V2: dipole length: 51.5 mm; overall height: 290 mm

D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm



7. EVALUATION PROCEDURES

DATA EVALUATION

The DASY 5 post processing software 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 be imported into the software from the configuration files issued for the DASY 5 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 5 parameter)
	dcp_i	= Diode compression point (DASY 5 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 E0field 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/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm²

E_{tot} = total electric field strength in V/m

H_{tot} = total magnetic field strength in A/m

SAR EVALUATION PROCEDURES

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

- **Power Reference Measurement**

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more than one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

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. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b \exp\left(-\frac{z}{a}\right) \cos\left(\pi \frac{z}{\lambda}\right)$$

Since the decay of the boundary effect dominates for small probes ($a \ll \lambda$), the cos-term can be omitted. Factors S_b (parameter Alpha in the DASY 5 software) and a (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30° to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

8. MEASUREMENT UNCERTAINTY

Measurement uncertainty for 30 MHz to 3 GHz averaged over 1 gram						
Uncertainty Component	Uncertainty	Prob.	Div.	C_i (1g)	Std. Unc. (1-g)	V_i or V_{eff}
Measurement System						
Probe Calibration ($k=1$)	6.00	Normal	1	1	6.00	∞
Probe Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	1.90	∞
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	3.88	∞
Boundary Effect	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	∞
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner	0.40	Rectangular	$\sqrt{3}$	1	0.23	∞
Probe Positioning	2.90	Rectangular	$\sqrt{3}$	1	1.67	∞
Max. SAR Evaluation	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Test sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Power drift	5	Rectangular	$\sqrt{3}$	1	2.89	∞
Power Scaling	0	Rectangular	$\sqrt{3}$	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	6.1	Rectangular	$\sqrt{3}$	1	3.52	∞
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	$\sqrt{3}$	0.64	1.85	∞
Liquid Conductivity (meas)	-3.16	Rectangular	$\sqrt{3}$	0.78	-1.42	∞
Liquid Permittivity (target)	5	Rectangular	$\sqrt{3}$	0.6	1.73	∞
Liquid Permittivity (meas)	-2.1	Rectangular	$\sqrt{3}$	0.26	-0.32	∞
Temp. unc. - Conductivity	3.4	Rectangular	$\sqrt{3}$	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	$\sqrt{3}$	0.23	0.05	∞
Combined Std. Uncertainty		RSS			11.51	361
Expanded STD Uncertainty		$k=2$			23.03%	

Measurement uncertainty for 3 GHz to 6 GHz averaged over 1 gram

Uncertainty Component	Uncertainty	Prob.	Div.	$C_i(1g)$	Std. Unc. (1-g)	V_i or V_{eff}
Measurement System						
Probe Calibration ($k=1$)	6.55	Normal	1	1	6.55	∞
Probe Isotropy	4.70	Rectangular	$\sqrt{3}$	0.7	1.90	∞
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	$\sqrt{3}$	0.7	3.88	∞
Boundary Effect	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	∞
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Probe Positioning	6.70	Rectangular	$\sqrt{3}$	1	3.87	∞
Max. SAR Evaluation	4.00	Rectangular	$\sqrt{3}$	1	2.31	∞
Test sample Related						
Test sample Positioning	2.9	Normal	1	1	2.9	145
Device Holder Uncertainty	3.6	Normal	1	1	3.6	5
Power drift	5	Rectangular	$\sqrt{3}$	1	2.89	∞
Power Scaling	0	Rectangular	$\sqrt{3}$	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	6.6	Rectangular	$\sqrt{3}$	1	3.81	∞
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	$\sqrt{3}$	0.64	1.85	∞
Liquid Conductivity (meas)	-3.13	Rectangular	$\sqrt{3}$	0.78	-1.41	∞
Liquid Permittivity (target)	5	Rectangular	$\sqrt{3}$	0.6	1.73	∞
Liquid Permittivity (meas)	0.32	Rectangular	$\sqrt{3}$	0.26	0.05	∞
Temp. unc. - Conductivity	3.4	Rectangular	$\sqrt{3}$	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	$\sqrt{3}$	0.23	0.05	∞
Combined Std. Uncertainty		RSS			12.56	748
Expanded STD Uncertainty		$k=2$			25.12%	
Expanded STD Uncertainty		$k=2$			1.95dB	

9. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B). Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Note: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Population/Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
1.6 W/kg

10. MEASUREMENT RESULTS

10.1 TEST LIQUIDS CONFIRMATION

SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the SPEAG DAK3.5 dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

(ϵ_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m³)

10.2 LIQUID MEASUREMENT RESULTS

The following table show the measuring results for simulating liquid:

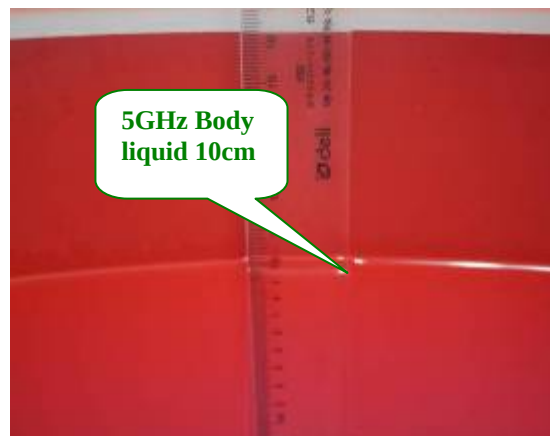
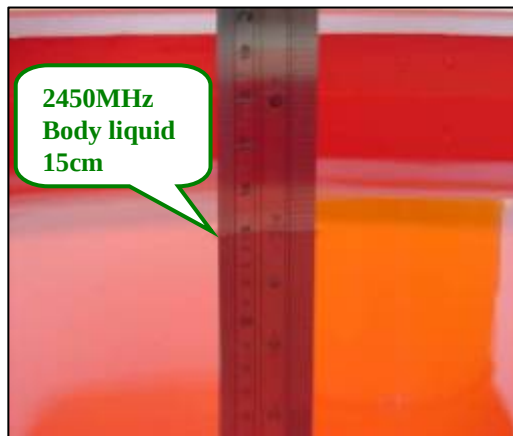
Liquid Type	Liquid Temp. (°C)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body2437	21.5	Permittivity(ϵ)	52.72	51.69	-1.95	± 5	2015-12-26
		Conductivity(σ)	1.93	1.88	-2.74	± 5	
Body2480	21.5	Permittivity(ϵ)	52.66	51.56	-2.10	± 5	2015-12-26
		Conductivity(σ)	1.99	1.93	-3.16	± 5	
Body5270	21.5	Permittivity(ϵ)	48.94	49.08	0.29	± 5	2016-5-19
		Conductivity(σ)	5.43	5.26	-3.13	± 5	
Body5590	21.5	Permittivity(ϵ)	48.49	48.64	0.31	± 5	2016-5-19
		Conductivity(σ)	5.78	5.64	-2.34	± 5	
Body5630	21.5	Permittivity(ϵ)	48.44	48.59	0.32	± 5	2016-5-19
		Conductivity(σ)	5.82	5.68	-2.40	± 5	
Body5795	21.5	Permittivity(ϵ)	48.21	48.32	0.23	± 5	2016-5-19
		Conductivity(σ)	5.99	5.85	-2.43	± 5	

10.3 SYSTEM PERFORMANCE CHECK

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of $\pm 10\%$. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system with an E-field probe EX3DV4 SN: 3798 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration ($dx=5$ mm, $dy=5$ mm, $dz=5$ mm).
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole less than 3G input power was $250\text{mW} \pm 3\%$.
- The dipole above than 3G input power was $100\text{mW} \pm 3\%$.
- The results are normalized to 1 W input power.



- Note: For SAR testing, less than 3G the liquid depth is 15cm shown above
- Note: For SAR testing, above than 3G the liquid depth is 10cm shown above

SYSTEM PERFORMANCE CHECK RESULTS

Liquid Type	Ambient Temp. (°C)	Liquid Temp. (°C)	Input Power (W)	Measured SAR _{1g} (W/Kg)	1W Target SAR _{1g} (W/Kg)	1W Normalized SAR _{1g} (W/Kg)	Deviation (%)	Limited (%)	Date
Body2450	22	21.5	0.25	12.20	49.20	48.80	-0.81	± 10	2015-12-26
Body5200	22	21.5	0.1	7.31	74.60	73.1	-2.01	± 10	2016-5-19
Body5300	22	21.5	0.1	7.83	76.00	78.3	3.03	± 10	2016-5-19
Body5500	22	21.5	0.1	7.92	79.10	79.2	0.13	± 10	2016-5-19
Body5600	22	21.5	0.1	7.66	77.80	76.6	-1.54	± 10	2016-5-19
Body5800	22	21.5	0.1	7.37	75.00	73.7	-1.73	± 10	2016-5-19

10.4 EUT TUNE-UP PROCEDURES AND TEST MODE

Conducted output power(dBm):

General Note:

- 1 Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.
- 2 Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.
 - 1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
 - 2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.
- 3 For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.
- 4 Apply the default power measurement procedures to measure maximum output power for each standalone and aggregated frequency band.
 - a) When band gap channels between U-NII-2C band and U-NII-3 band or §15.247 5.8 GHz band are supported and the bands are aggregated for SAR testing according to KDB 248227D01 sections 2.3 and 3.3, apply the following to determine high, middle and low channels for power measurement and SAR test reduction.
 - i) channels in U-NII-2C band below 5.65 GHz are considered as one band
 - ii) channels above 5.65 GHz, together with channels in 5.8 GHz U-NII-3 or §15.247 band, are considered as a separate band
 - b) The maximum output power of band gap channels is limited to the lowest maximum output power certified for the adjacent bands regardless of whether band aggregation is applied for SAR testing.
 - c) The measured maximum output power results are used to reduce the number of channels that need testing.

WLAN 2.4G Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 b	1	2412	18.5	±1.5	20	18.36
	6	2437	19	±1.5	20.5	18.99
	11	2462	18.5	±1.5	20	18.56
802.11 g	1	2412	15.5	±1.5	17	Not require
	6	2437	18	±1.5	19.5	
	11	2462	14.5	±1.5	16	
802.11 n 20MHz	1	2412	15.5	±1.5	17	
	6	2437	18	±1.5	19.5	
	11	2462	14.5	±1.5	16	
802.11 n 40MHz	3	2422	11.5	±1.5	13	
	6	2437	17	±1.5	18.5	
	9	2452	10.5	±1.5	12	

WLAN 2.4G Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 b	1	2412	18.5	±1.5	20	18.35
	6	2437	19	±1.5	20.5	19
	11	2462	18.5	±1.5	20	18.38
802.11 g	1	2412	15.5	±1.5	17	Not require
	6	2437	18	±1.5	19.5	
	11	2462	14.5	±1.5	16	
802.11 n 20MHz	1	2412	15.5	±1.5	17	
	6	2437	18	±1.5	19.5	
	11	2462	14.5	±1.5	16	
802.11 n 40MHz	3	2422	11.5	±1.5	13	
	6	2437	17	±1.5	18.5	
	9	2452	10.5	±1.5	12	

WLAN Conducted output power(dBm):

U-NII-1 Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	36	5180	13	±2	15	Not require
	40	5200	13	±2	15	
	44	5220	13	±2	15	
	48	5240	13	±2	15	
802.11 n 20MHz	36	5180	13	±2	15	
	40	5200	13	±2	15	
	44	5220	13	±2	15	
	48	5240	13	±2	15	
802.11 n 40MHz	38	5180	13	±2	15	
	46	5230	13	±2	15	
802.11 ac80	42	5210	13	±2	15	13.05

U-NII-1 Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	36	5180	13	±2	15	Not require
	40	5200	13	±2	15	
	44	5220	13	±2	15	
	48	5240	13	±2	15	
802.11 n 20MHz	36	5180	13	±2	15	
	40	5200	13	±2	15	
	44	5220	13	±2	15	
	48	5240	13	±2	15	
802.11 n 40MHz	38	5180	13	±2	15	
	46	5230	13	±2	15	
802.11 ac80	42	5210	13	±2	15	13.02

U-NII-2A Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	52	5260	17	±2	19	Not require
	56	5280	17	±2	19	
	60	5300	17	±2	19	
	64	5320	15	±2	17	
802.11 n 20MHz	52	5260	17	±2	19	
	56	5280	17	±2	19	
	60	5300	17	±2	19	
	64	5320	15	±2	17	
802.11 n 40MHz	54	5270	17	±2	19	17.02
	62	5310	15	±2	17	15.10
802.11 ac80	58	5290	12	±2	14	Not require

U-NII-2A Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	52	5260	17	±2	19	Not require
	56	5280	17	±2	19	
	60	5300	17	±2	19	
	64	5320	15	±2	17	
802.11 n 20MHz	52	5260	17	±2	19	
	56	5280	17	±2	19	
	60	5300	17	±2	19	
	64	5320	15	±2	17	
802.11 n 40MHz	54	5270	17	±2	19	17.05
	62	5310	15	±2	17	15.02
802.11 ac80	58	5290	12	±2	14	Not require

U-NII-2C Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	100	5500	15	±2	17	Not require
	112	5560	17	±2	19	
	116	5580	17	±2	19	
	124	5620	17	±2	19	
	128	5640	17	±2	19	
	140	5700	14.5	±2	16.5	
802.11 n 20MHz	100	5500	15	±2	17	
	112	5560	17	±2	19	
	116	5580	17	±2	19	
	124	5620	17	±2	19	
	128	5640	17	±2	19	
	140	5700	14	±2	16	
802.11 n 40MHz	102	5510	15	±2	17	15.04
	110	5550	17	±2	19	17.01
	118	5590	17	±2	19	17.12
	126	5630	17	±2	19	17.03
	134	5670	17	±2	19	17.01
802.11 ac80	106	5530	12.5	±2	14.5	Not require
	122	5610	16	±2	18	
	138	5690	16	±2	18	

U-NII-2C Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average Power (dBm)
802.11 a	100	5500	15	±2	17	Not require
	112	5560	17	±2	19	
	116	5580	17	±2	19	
	124	5620	17	±2	19	
	128	5640	17	±2	19	
	140	5700	14.5	±2	16.5	
802.11 n 20MHz	100	5500	15	±2	17	
	112	5560	17	±2	19	
	116	5580	17	±2	19	
	124	5620	17	±2	19	
	128	5640	17	±2	19	
	140	5700	14	±2	16	
802.11 n 40MHz	102	5510	15	±2	17	15.06
	110	5550	17	±2	19	17.02
	118	5590	17	±2	19	17.14
	126	5630	17	±2	19	17.09
	134	5670	17	±2	19	17.07



802.11 ac80	106	5530	12.5	±2	14.5	Not require
	122	5610	16	±2	18	
	138	5690	16	±2	18	

U-NII-3 Chain0

Mode	Channel	Frequency	Chain0 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	149	5745	15	±2	17	Not require
	157	5785	17	±2	19	
	165	5825	17	±2	19	
802.11 n 20MHz	149	5745	15	±2	17	
	157	5785	17	±2	19	
	165	5825	17	±2	19	
802.11 n 40MHz	151	5755	12.5	±2	14.5	12.56
	159	5795	17	±2	19	17.06
802.11 ac80	155	5755	12	±2	14	Not require

U-NII-3 Chain1

Mode	Channel	Frequency	Chain1 Target power(dBm)	Turn up tolerance (dBm)	Maximum Turn up power (dBm)	Average power (dBm)
802.11 a	149	5745	15	±2	17	Not require
	157	5785	17	±2	19	
	165	5825	17	±2	19	
802.11 n 20MHz	149	5745	15	±2	17	
	157	5785	17	±2	19	
	165	5825	17	±2	19	
802.11 n 40MHz	151	5755	12.5	±2	14.5	12.57
	159	5795	17	±2	19	17.08
802.11 ac80	155	5775	12	±2	14	Not require

Bluetooth

Band	Mode	Channel	Frequency	Averaged Power (dBm)
2.4 GHz	Bluetooth BR (GFSK)	0	2402	6.74
		39	2441	6.73
		78	2480	7
	Bluetooth EDR2 ($\pi/4$ -DQPSK)	0	2402	Not required
		39	2441	
		78	2480	
	Bluetooth EDR3 (8-DPSK)	0	2402	
		39	2441	
		78	2480	
	Bluetooth LE	0	2402	
		39	2441	
		78	2480	

10.5 STANDALONE SAR TEST EXCLUSION

According to KDB447498 D01: 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:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,²⁴ where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation²⁵
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below
- If the test separation distance (antenna-user) is < 5 mm, 5 mm is used for excluded SAR calculation

	Wireless Interface	Bluetooth
	Tune-up Maximum power (dBm)	7
	Tune-up Maximum rated power (mW)	5.012
Body	Antenna to user (mm)	5
	Frequency (GHz)	2480
	SAR exclusion threshold	1.579

Per KDB 447498 D01 exclusion thresholds is $1.579 < 3$, Bluetooth RF exposure evaluation is not required.

According to RSS102-2015 :

SAR evaluation for this device was performed with a separation distance of 5 mm. Observing the SAR evaluation exemption limit table (Table 1, see below) found in § 2.5.1 of RSS102:2015, it was determined that the SAR exemption limit for this device is 4 mW for 2.4 GHz transmission. No Wi-Fi mode qualified for test exemption as all power levels were above the stated thresholds. On the contrary, Bluetooth, with a frequency of 2480 MHz and a maximum output power of 5.012 mW (7 dBm, tune-up tolerance accounted for), is High than the exemption threshold and therefore exempt from SAR evaluation for either the intended user or bystanders. So Bluetooth RF exposure evaluation is required

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

10.6 SAR TEST CONFIGURATIONS

According to KDB 616217 D04, SAR testing for laptop PC is required for bottom surface. This EUT was tested in the base of EUT directly against the flat phantom.

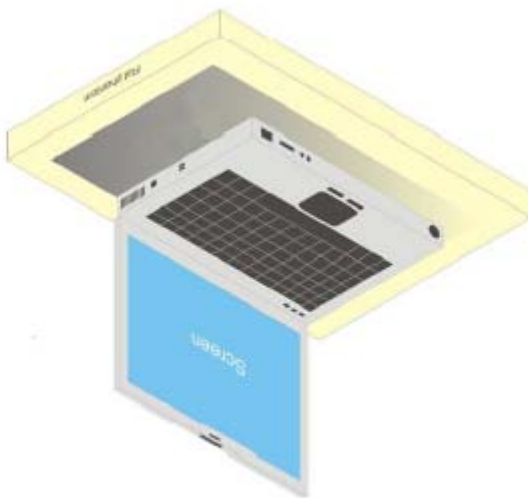
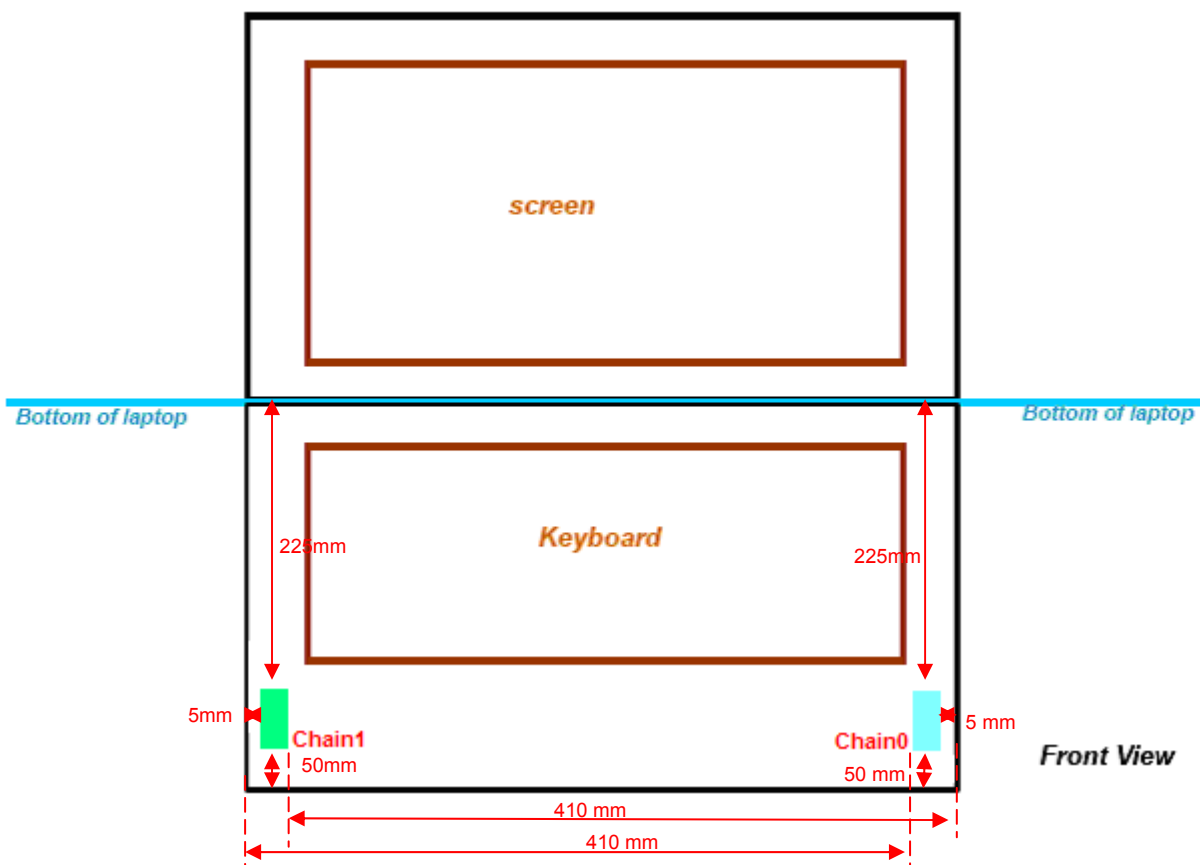


Fig Illustration for Laptop Setup

Note: The distance between EUT bottom surface and Antenna position is 10 mm

10.7 ANTENNA LOCATION

<Notebook>



Note: The distance between EUT bottom surface and Antenna position is 10 mm

Device dimensions (H x W): 425 x 315 mm

Antennas	Wireless Interface
Bluetooth & WLAN Antenna	WLAN 2.4GHz WLAN 5.2GHz WLAN 5.3GHz WLAN 5.5GHz WLAN 5.8GHz Bluetooth
Main Antenna	WLAN
Aux Antenna	WLAN+ Bluetooth

Test Mode

IEEE 802.11	Data transmission mode(802.11n40;b; Bluetooth GFSK)
-------------	---

10.8 SAR MEASUREMENT RESULTS

Note:

- Per KDB 447498 D01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - 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.
 - For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
- Per KDB 447498 D01, for each exposure position, if the highest output channel reported SAR ≤ 0.8 W/kg, other channels SAR testing is not necessary.
- Per KDB 447498 D01, 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

SAR Results for Test Records

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Chain	measured Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)
WLAN 2.4GHz	802.11b	NB	Bottom	0	2437	0	18.99	20.5	1.416	-0.09	1.01	0.301	0.430
WLAN 2.4GHz	802.11b	NB	Bottom	0	2437	1	19	20.5	1.413	0.08	1.01	0.181	0.258
2.4GHz	BT GFSK	NB	Bottom	0	2480	1	7	7	1.000	0.00	1.59	0.012	0.019

Remark: SAR is not required for the following 2.4 GHz OFDM conditions.

- When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is $0.481 \leq 1.2$ W/kg. So 2.4 GHz OFDM mode is not require.

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Chain	measured Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)
U-NII-2A	802.11 n40	NB	Bottom	0	5270	0	17.02	19	1.578	0.05	1.01	0.132	0.210
U-NII-2C	802.11 n40	NB	Bottom	0	5590	0	17.12	19	1.542	0.10	1.01	0.079	0.123
U-NII-3	802.11 n40	NB	Bottom	0	5795	0	17.06	19	1.563	0.12	1.01	0.397	0.627
U-NII-2A	802.11 n40	NB	Bottom	0	5270	1	17.05	19	1.567	0.06	1.01	0.447	0.707
U-NII-2C	802.11 n40	NB	Bottom	0	5590	1	17.14	19	1.535	0.14	1.01	0.560	0.868
U-NII-2C	802.11 n40	NB	Bottom	0	5630	1	17.09	19	1.552	0.09	1.01	0.483	0.757
U-NII-3	802.11 n40	NB	Bottom	0	5795	1	17.08	19	1.556	0.10	1.01	0.324	0.509

Remark: For devices that operate in both U-NII-1 and U-NII-2A bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

The highest reported SAR for U-NII is adjusted by the ratio of U-NII-1 to U-NII-2A specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg. So U-NII-1 mode is not require.



Repeated SAR Test Records 5GHz U-NII-2C

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Chain	measured Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)
U-NII-2C	802.11 n40	NB	Bottom	0	5590	1	17.14	19	1.535	0.07	1.01	0.536	0.831

10.9 REPEATED SAR MEASUREMENT

Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is $\geq 0.8\text{W/Kg}$
2. Per KDB 865664 D01v01r04, if the ratio of largest to smallest SAR for the original and first repeated measurement is ≤ 1.2 and the measured SAR $< 1.45\text{W/Kg}$, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated measured SAR.

Band	Mode	Configure	Test Position	Freq (MHZ)	Original Measured SAR1g (mW/g)	1st Repeated SAR1g (mW/g)	Ratio	Original Measured SAR1g (mW/g)	2nd Repeated SAR1g (mW/g)	Ratio
U-NII-2C	802.11 n40	NB	Bottom	5590	0.560	0.536	1.045	--	--	--

10.10 SAR MULTI XMITER ASSESSMENT

	Position	Applicable Combination
Simultaneous Transmission	Body	Main Antenna + Aux Antenna

Note:

- Aux Antenna 2.4GHz WLAN and BT share the same antenna, and cannot transmit simultaneously. The DUT does not support chain0 and chain1 WLAN simultaneous transmission
- The reported SAR summation is calculated based on the same configuration and test position.
- Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - Scalar SAR summation $< 1.6\text{W/kg}$.
 - $\text{SPLSR} = (\text{SAR1} + \text{SAR2})1.5 / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where $(x1, y1, z1)$ and $(x2, y2, z2)$ are the coordinates of the extrapolated peak SAR locations in the zoom scan
If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR is compliant
 - Simultaneously transmission SAR measurement, and the reported multi-band SAR $< 1.6\text{W/kg}$

Result of SUM Σ SAR_{1g} for Body worn

SUM Σ SAR _{1g} Chain0 WLAN 2.4G + Chain1 WLAN 2.4G /Bluetooth						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	
	[mm]	Main Antenna WLAN 2.4G	Aux Antenna WLAN 2.4G	Aux Antenna Bluetooth	Main ant 2.4G+ Aux ant 2.4G	Main ant WLAN 2.4+ Aux ant BT
Bottom	0	0.430	0.258	0.019	0.688	0.449

SUM Σ SAR _{1g} Chain0 WLAN U-NII-2A + Chain1 WLAN U-NII-2A / Bluetooth						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	
	[mm]	Main Antenna WLAN 5.3G	Aux Antenna WLAN 5.3G	Aux Antenna Bluetooth	Main ant 5.3G+ Aux ant 5.3G	Main ant WLAN 5.3+ Aux ant BT
Bottom	0	0.210	0.707	0.019	0.917	0.229

SUM Σ SAR1g Chain0 WLAN U-NII-2C + Chain1 WLAN U-NII-2C/ Bluetooth						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	
	[mm]	Main Antenna WLAN 5.5G	Aux Antenna WLAN 5.5G	Aux Antenna Bluetooth	Main ant 5.5G+ Aux ant 5.5G	Main ant WLAN 5.5+ Aux ant BT
Bottom	0	0.123	0.868	0.019	0.991	0.142

SUM Σ SAR1g Chain0 WLAN U-NII-3 + Chain1 WLAN U-NII-3/ Bluetooth						
Position	Distance	Stand alone SAR(1g) [W/kg]			SUM SAR(1g)[W/kg]	
	[mm]	Main Antenna WLAN 5.8G	Aux Antenna WLAN 5.8G	Aux Antenna Bluetooth	Main ant 5.8G+ Aux ant 5.8G	Main ant WLAN 5.8+ Aux ant BT
Bottom	0	0.627	0.509	0.019	1.136	0.646

EQUIPMENT LIST & CALIBRATION STATUS

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Calibration	Calibration Due
P C	HP	Core(rm)3.16G	CZCO48171H	N/A	N/A
Signal Generator	Agilent	E8257C	MY43321570	11/20/2015	11/19/2016
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	03/02/2016	03/01/2017
Power Meter	Agilent	E4416A	GB41292714	03/02/2016	03/01/2017
Peak & Average sensor	Agilent	E9327A	us40441788	03/02/2016	03/01/2017
Power meter	Anritsu	ML2495A	1445010	03/02/2016	03/01/2017
Power sensor	Anritsu	MA2411B	1339220	03/02/2016	03/01/2017
E-field PROBE	SPEAG	EX3DV4	3798	07/24/2015	07/23/2016
DAE	SPEAG	DEA4	1245	07/22/2015	07/21/2016
DIPOLE 2450MHZ ANTENNA	SPEAG	D2450V2	817	07/31/2013	07/28/2016
DIPOLE 5GHZ ANTENNA	SPEAG	D5GHzV2	1095	05/31/2013	05/28/2016
DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
SAM PHANTOM (ELI4 v4.0)	SPEAG	QDOVA001BB	1102	N/A	N/A
Twin SAM Phantom	SPEAG	QD000P40CD	1609	N/A	N/A
ROBOT	SPEAG	TX60	F10/5E6AA1/A101	N/A	N/A
ROBOT KRC	SPEAG	CS8C	F10/5E6AA1/C101	N/A	N/A
LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A	N/A

11. FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

12. REFERENCES

- [1] Federal Communications Commission, "Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.
- [2] David L. Means Kwok Chan, Robert F. Cleveland, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, Office of Engineering & Technology, Washington, DC, 1997.
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105-113, Jan. 1996.
- [4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEEE Transactions on Communications, vol. E80-B, no. 5, pp. 645-652, May 1997.
- [5] CENELEC, "Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz – 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.
- [6] ANSI, ANSI/IEEE C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
- [7] Katja Pokovic, Thomas Schmid, and Niels Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM '97, Dubrovnik, October 15-17, 1997, pp. 120-124.
- [8] Katja Pokovic, Thomas Schmid, and Niels Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp. 172-175.
- [9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kuhn, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.
- [10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.
- [11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [12] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992. Dosimetric Evaluation of Sample device, month 1998 9
- [13] NIS81 NAMAS, "The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.
- [14] Barry N. Taylor and Christ E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10

APPENDIX A: DUT AND SAR SETUP PHOTO**APPENDIX B: PLOTS OF PERFORMANCE CHECK**

The plots are showing as followings.

Test Laboratory: Compliance Certification Services Inc.

Date: 12/26/2015

System Performance Check-Body D2450**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 817**

Communication System: UID 0, CW; Communication System Band: D2450 (2450.0 MHz);

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.896$ S/m; $\epsilon_r = 51.664$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.08, 7.08, 7.08); Calibrated: 7/24/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm**(EX-Probe)/Area Scan (9x9x1):** Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 14.3 W/kg

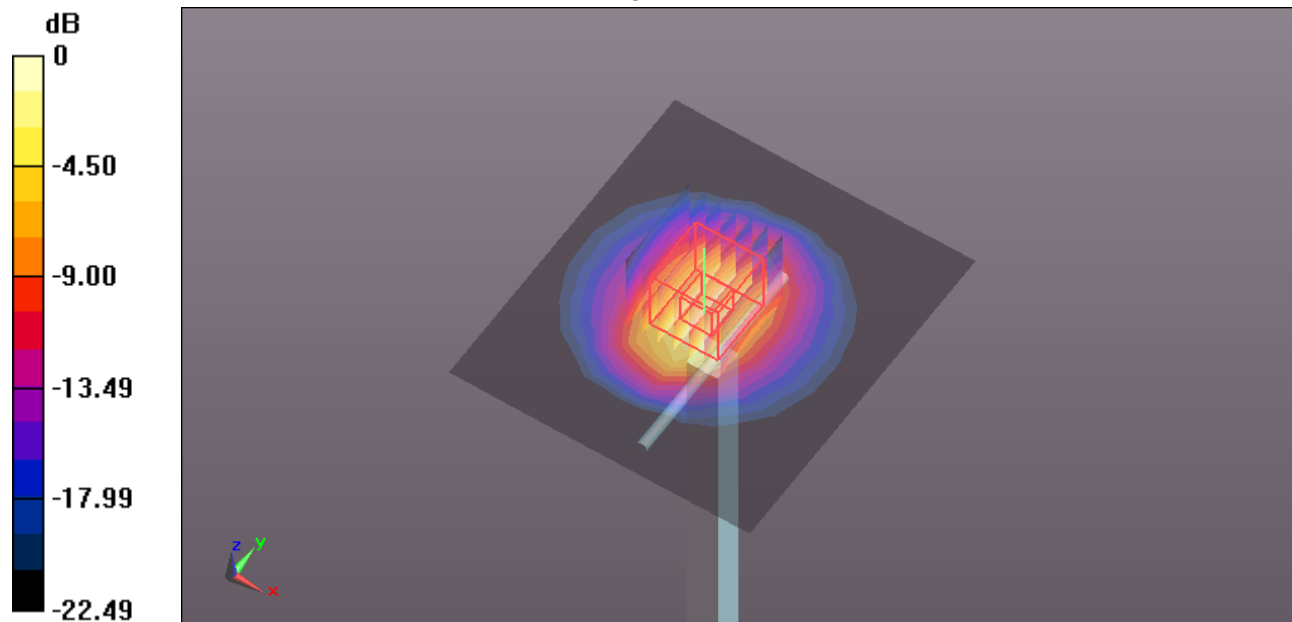
System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=2.0mm**(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.39 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 21.0 W/kg

SAR(1 g) = 12.2 W/kg; SAR(10 g) = 6.15 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

Date: 5/19/2016

SystemPerformanceCheck-D5200**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.195$ S/m; $\epsilon_r = 49.185$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.64, 4.64, 4.64); Calibrated: 7/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5200 MHz 20/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 14.1 W/kg

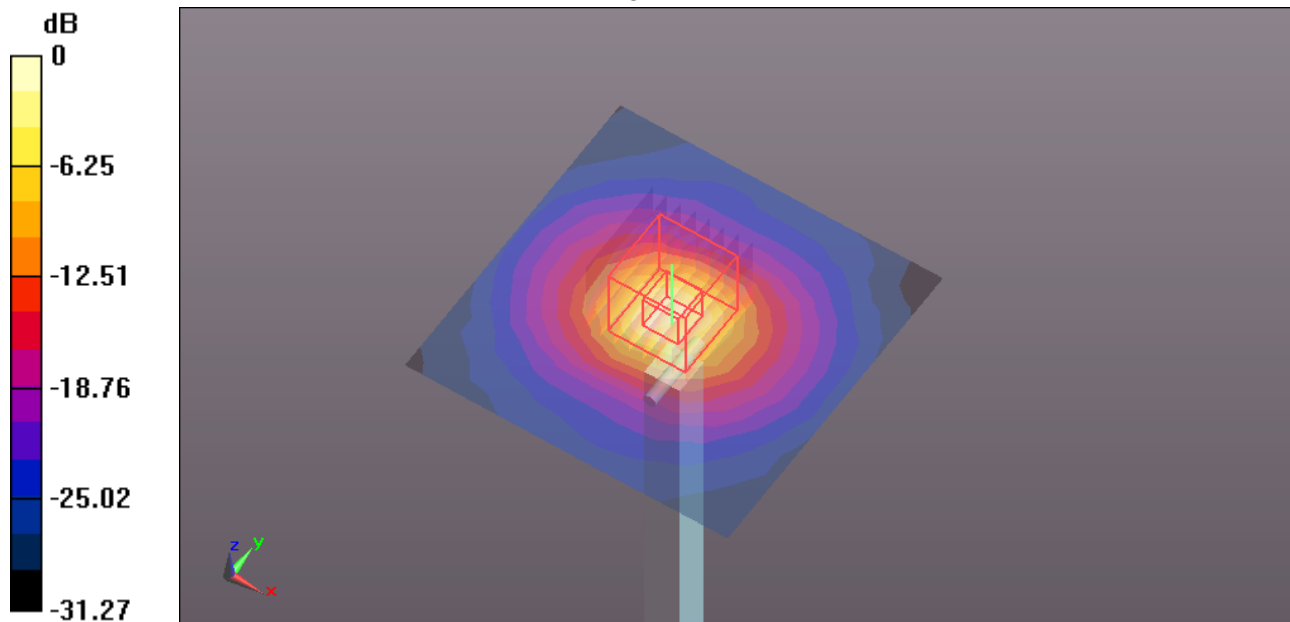
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5200 MHz 20/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.17 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 7.31 W/kg; SAR(10 g) = 2.01 W/kg

Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

Date: 5/19/2016

SystemPerformanceCheck-D5300**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5300$ MHz; $\sigma = 5.315$ S/m; $\epsilon_r = 49.046$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.42, 4.42, 4.42); Calibrated: 7/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5300 MHz 19.6/Area Scan (9x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 17.2 W/kg

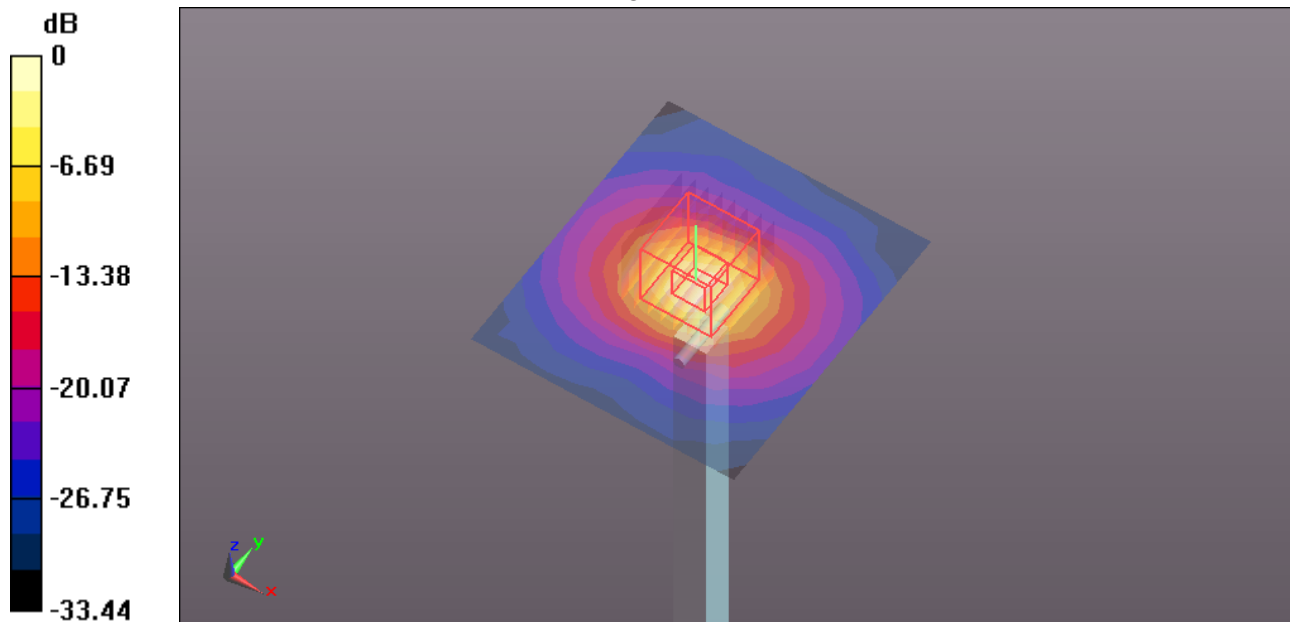
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5300 MHz 19.6/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 67.84 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 35.1 W/kg

SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 19.5 W/kg



0 dB = 19.5 W/kg = 12.90 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

Date: 5/19/2016

System Performance Check-D5500**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5500 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.518$ S/m; $\epsilon_r = 48.799$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.01, 4.01, 4.01); Calibrated: 7/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5500 MHz/Area Scan (9x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 16.9 W/kg

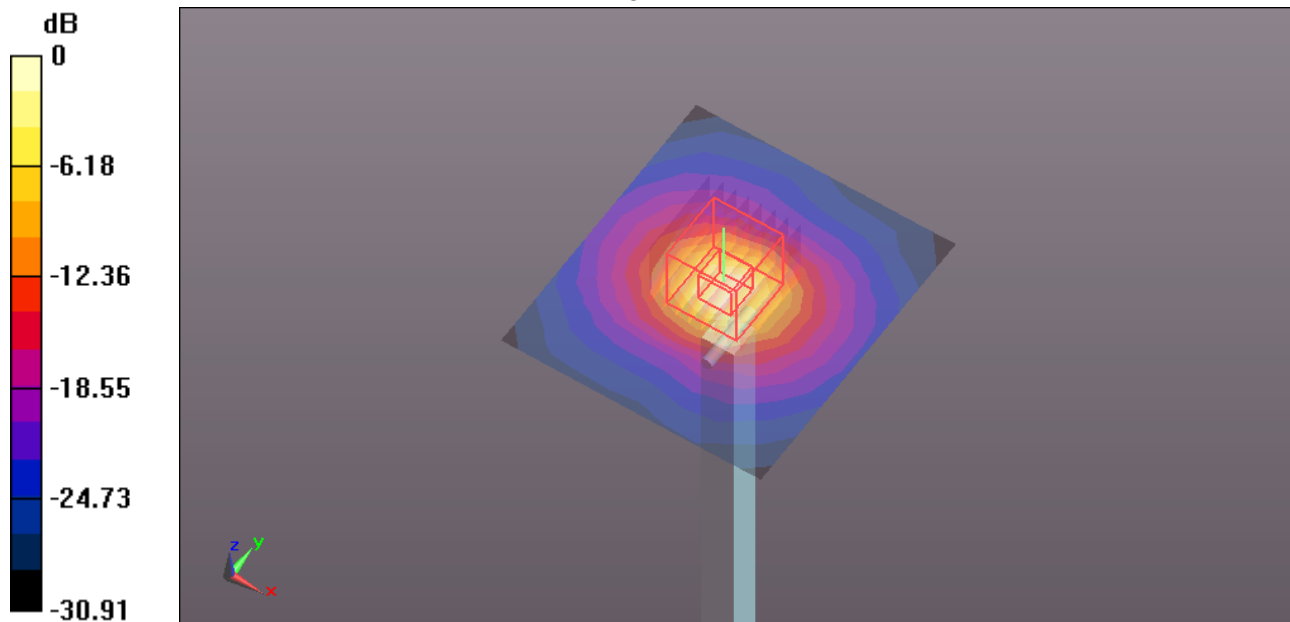
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.94 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 34.3 W/kg

SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg = 12.81 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

Date: 5/19/2016

System Performance Check-D5600**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.657$ S/m; $\epsilon_r = 48.642$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(3.9, 3.9, 3.9); Calibrated: 7/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (9x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.7 W/kg

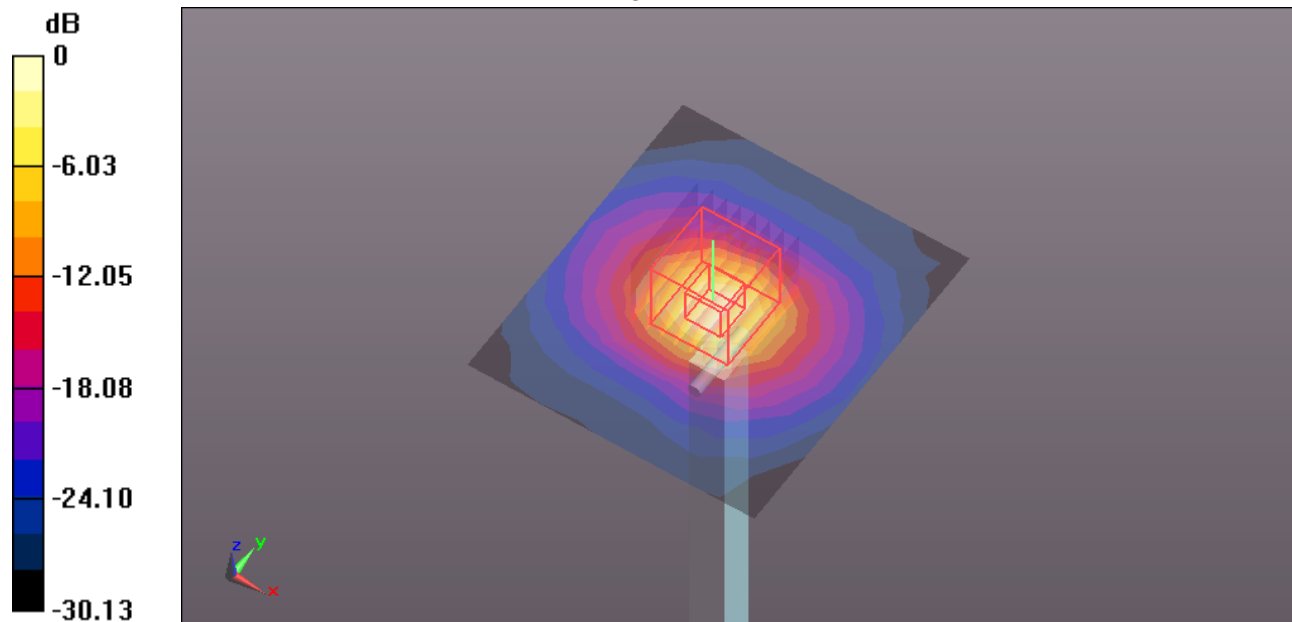
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 69.14 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 35.8 W/kg

SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 20.8 W/kg



0 dB = 20.8 W/kg = 13.18 dBW/kg

Test Laboratory: Compliance Certification Services Inc.

Date: 5/19/2016

SystemPerformanceCheck-D5800**DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095**

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.861$ S/m; $\epsilon_r = 48.332$; $\rho = 1000$ kg/m³

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.16, 4.16, 4.16); Calibrated: 7/24/2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/22/2015
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Area Scan (9x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 18.6 W/kg

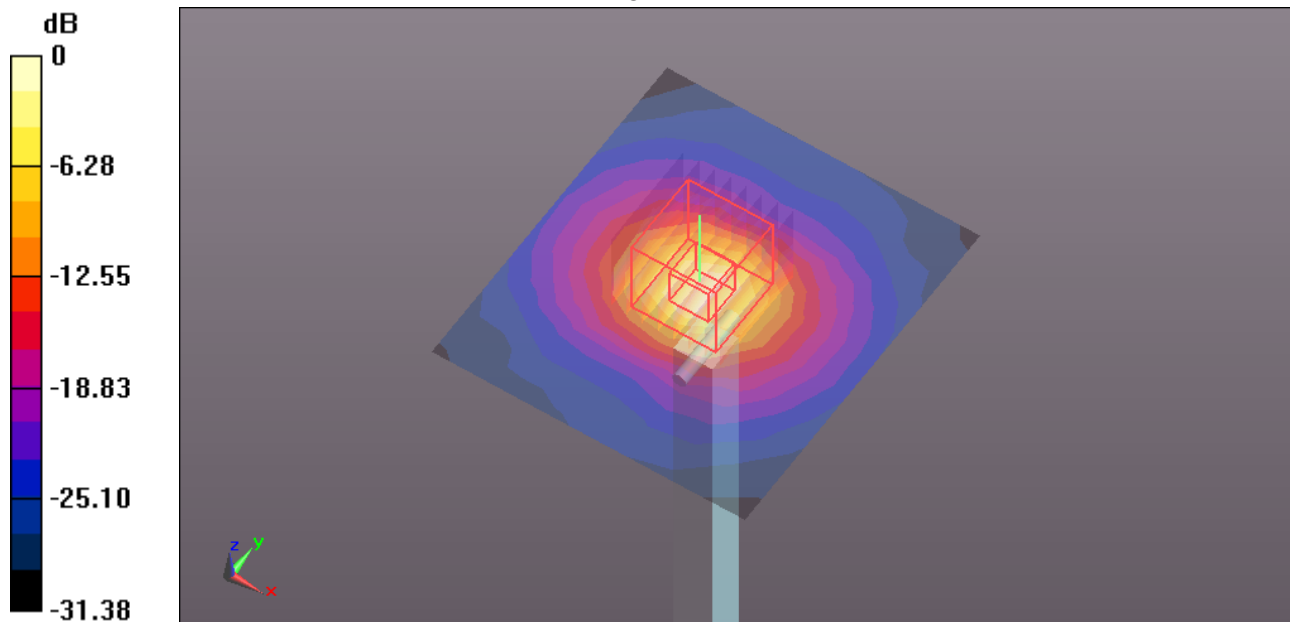
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.49 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.95 dBW/kg

APPENDIX C: DASY CALIBRATION CERTIFICATE

The DASY Calibration Certificates are showing in the file named Appendix C DASY Calibration Certificate.

APPENDIX D: PLOTS OF SAR TEST RESULT

The plots are showing in the file named Appendix D Plots of SAR Test Result

END REPORT