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SAR TEST REPORT

Application No.:	SZEM1802001346CR
Applicant:	Realtek Semiconductor Corp.
Address of Applicant:	No.2,Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan
Manufacturer:	Realtek Semiconductor Corp.
Address of Manufacturer:	No.2,Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan
Equipment Under Test (EUT):	
EUT Name:	802.11a/b/g/n/ac RTL8821CE Combo module
Brand name:	REALTEK
Model No.:	RTL8821CE
FCC ID:	TX2-RTL8821CE
IC:	6317A-RTL8821CE
Standard(s) :	FCC 47 CFR Part 2 (2.1093) IEEE 1528-2013 KDB 248227 KDB 865664 KDB 447498 KDB 616217 RSS102 issue 5
Date of Receipt:	January 11, 2018
Date of Test:	February 6, 2018 & February 7, 2018
Date of Issue:	February 8, 2018
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

Revision Record				
Version	***Chapter***	***Date***	***Modifier***	***Remark***
01		*2018-02-08*		*Original*

Authorized for issue by:				
		Bill Chen		
		Bill Chen /Project Engineer		
		Eric Fu		
		Eric Fu /Reviewer		

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1. EUT DESCRIPTION

<table>
<tr><td>Product Name:</td><td colspan="5">802.11a/b/g/n/ac RTL8821CE Combo module</td></tr>
<tr><td>Brand name:</td><td colspan="5">REALTEK</td></tr>
<tr><td>Model Name.:</td><td colspan="5">RTL8821CE</td></tr>
<tr><td>Series Model:</td><td colspan="5">N/A</td></tr>
<tr><td>FCC ID:</td><td colspan="5">TX2-RTL8821CE</td></tr>
<tr><td>IC:</td><td colspan="5">6317A-RTL8821CE</td></tr>
<tr><td>Power reduction:</td><td colspan="5">YES</td></tr>
<tr><td>DTM Description:</td><td colspan="5">N/A</td></tr>
<tr><td>Device Category:</td><td colspan="5">Production unit</td></tr>
<tr><td>Exposure Category:</td><td colspan="5">GENERAL POPULATION/UNCONTROLLED EXPOSURE</td></tr>
<tr><td>Frequency Range:</td><td colspan="5">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 ~ 5720 MHz
WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz
Bluetooth: 2402 MHz ~ 2480 MHz</td></tr>
<tr><td>Modulation Technique:</td><td colspan="5">802.11a/b/g/n HT20/HT40/VHT20/VHT40/VHT80
Bluetooth:2.1 + EDR, 8-DPSK
Bluetooth:4.2</td></tr>
<tr><td>Operating Mode:</td><td colspan="5">Maximum continuous output</td></tr>
<tr><td rowspan="8">Antenna Specification:</td><td rowspan="3">Brand</td><td colspan="4">Gain(dBi)</td></tr>
<tr><td>2.4GHz</td><td>5GHz</td><td>2.4GHz</td><td>5GHz</td></tr>
<tr><td>ANT1</td><td>ANT1</td><td>ANT2</td><td>ANT2</td></tr>
<tr><td>South Star</td><td>1.35</td><td>1.78</td><td>1.64</td><td>1.67</td></tr>
<tr><td>Part No.</td><td colspan="2">64451204800040</td><td colspan="2">64451204800020</td></tr>
<tr><td>INPAQ</td><td>-0.9</td><td>-1.3</td><td>-2.6</td><td>0.1</td></tr>
<tr><td>Part No.</td><td colspan="2">L01RF118-NB-H</td><td colspan="2">L01RF117-NB-H</td></tr>
<tr><td colspan="5">Note: ANT1 is Main Antenna; ANT2 is Aux Antenna.</td></tr>
</table>

Tested System Details

Product	Manufacturer	Model No.
Notebook Computer	Lenovo	Model Name.: Lenovo V530s-14IKB;81EX

Note:

Model discrepancy only for market segment

1.1 Maximum RF output power with test channel

Band / Mode	Target Power(dBm)		
	V2.1 + EDR, GFSK	V2.1+ EDR, π/4-DQPSK	V2.1 + EDR, 8-DPSK
Bluetooth	5	5	5

Band / Mode	Target Power(dBm)
	BLE4.0, GFSK
Bluetooth	5

Band / Mode	Channel	SISO Tune up Target Power (dBm)
802.11b	1-11	16
802.11g	1-11	16
802.11n 20MHz	1-11	16
802.11n 40MHz	3-9	15
802.11 a U-NII-1	36-48	13
802.11 a U-NII-2A	52-64	13
802.11 a U-NII-2C	100-144	13
802.11 a U-NII-3	149-165	13
802.11 n20 U-NII-1	36-48	12.5
802.11 n20 U-NII-2A	52-64	12.5
802.11 n20 U-NII-2C	100-144	12.5
802.11 n20 U-NII-3	149-165	12.5
802.11 n40 U-NII-1	38-46	12.5
802.11 n40 U-NII-2A	54-62	12.5
802.11 n40 U-NII-2C	102-142	12.5
802.11 n40 U-NII-3	151-159	12.5
802.11 ac80 U-NII-1	42	11
802.11 ac80 U-NII-2A	58	12
802.11 ac80 U-NII-2C	106-138	12.5
802.11 ac80 U-NII-3	155	12.5

1.2 STATEMENT OF COMPLIANCE

The maximum results of Specific Absorption Rate (SAR) found during testing for **REALTEK, 802.11a/b/g/n/ac RTL8821CE Combo module, RTL8821CE,** are as follows.

Equipment Class	Frequency Band	Highest SAR Summary Body 1g SAR (W/kg)
DTS	2.4GHz WLAN	1.11
NII	5.2GHz WLAN	--
	5.3GHz WLAN	0.905
	5.5GHz WLAN	1.12
	5.8GHz WLAN	0.803
DSSS(BT)	2.4GHz	0.079
Highest Simultaneous Transmission SAR		Body 1g SAR (W/kg)
NII+DSSS		1.199

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 1528-2013.

2. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC OR ISED

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones.

RSS-102 issue 5: 2015: Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands).

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 ANSI/IEEE standard C95.1-1992; ; RSS-102 issue 5: 2015.

3. 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)
☒ ANSI/IEEE C95.1-1992
☒ IEEE 1528-2013
☒ 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

4. 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	100
	802.11b	100
	802.11g	100
	802.11n 20MHz	100
	802.11n 40MHz	100
5GHz	802.11a	100
	802.11 20MHz	100
	802.11 40MHz	100
	802.11 ac80	100

5. 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 ±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, IEEE P1528 and CENELEC EN 62209.

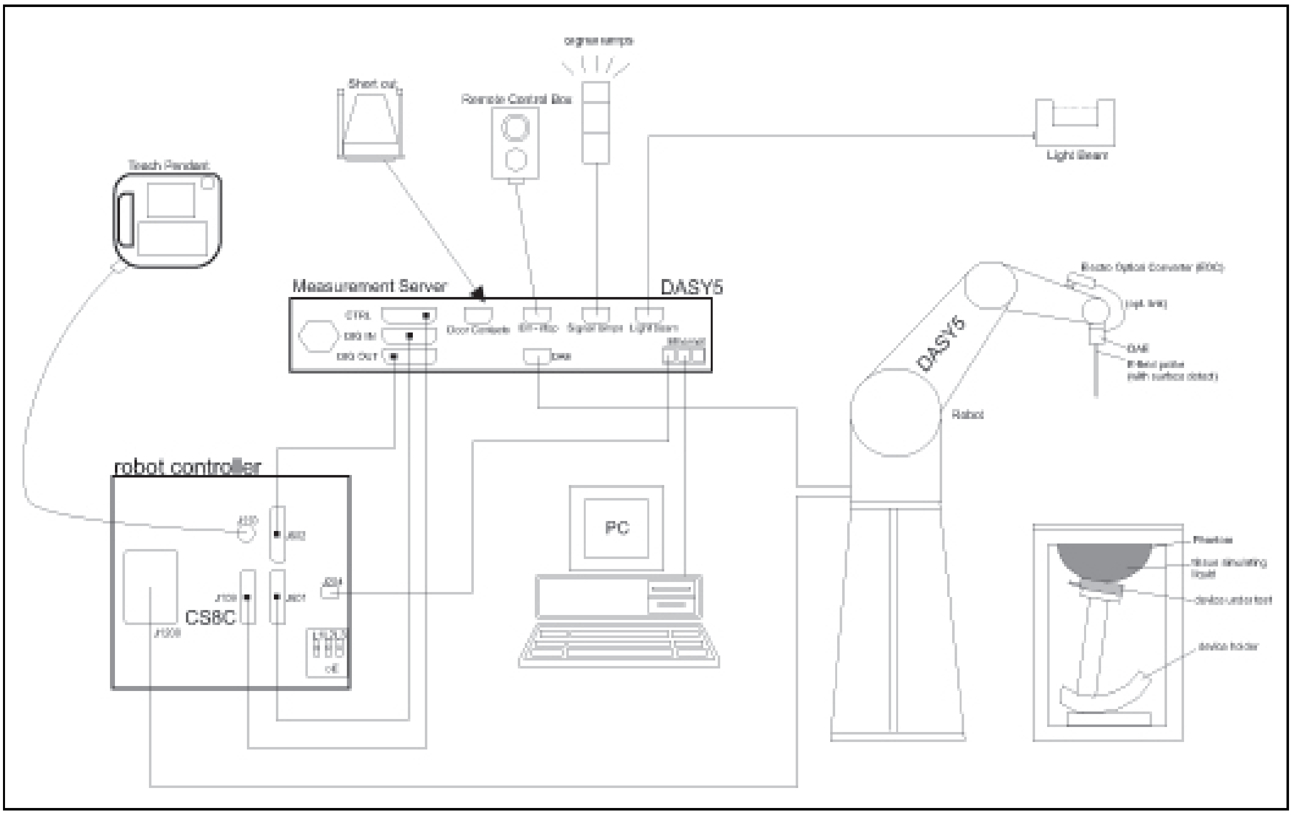
The following table gives the recipes for tissue simulating liquids.

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

5.1 MEASUREMENT SYSTEM DIAGRAM



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

- A standard high precision 6-axis robot (St¨aubli 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.

5.2 SYSTEM COMPONENTS

<table>
<tr><td>
</td><td>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.</td></tr>
<tr><td>
</td><td>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.</td></tr>
<tr><td colspan="2">Data Acquisition Electronics (DAE)</td></tr>
<tr><td>
</td><td>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.</td></tr>
</table>

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 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 µW/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 l/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 < 1GHz); > 40 W (f > 1GHz)

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 l/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 < 1GHz); > 40 W (f > 1GHz)

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

6. 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:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with V_i = Compensated signal of channel i(i = x, y, z)

$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)

μV/(V/m)² for E0field Probes

ConvF = Sensitivity enhancement in solution

aij = Sensor sensitivity factors for H-field probes

f = Carrier frequency (GHz)

Ei = Electric field strength of channel i in V/m

Hi = 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.

$$SAR=E_{tot}^2\cdot\frac{\sigma}{\rho\cdot1000}$$

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 then 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:

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

Since the decay of the boundary effect dominates for small probes (a<<λ), the cos-term can be omitted. Factors *Sb* (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.

7. 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)	5.50	Normal	1	1	5.50	∞
Probe Isotropy	4.70	Rectangular	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.88	∞
Boundary Effect	1.00	Rectangular	√3	1	0.58	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.73	∞
Probe Positioner	0.40	Rectangular	√3	1	0.23	∞
Probe Positioning	2.90	Rectangular	√3	1	1.67	∞
Max. SAR Evaluation	2.00	Rectangular	√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	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	6.1	Rectangular	√3	1	3.52	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	√3	0.64	1.85	∞
Liquid Conductivity (meas)	2.75	Rectangular	√3	0.78	1.24	∞
Liquid Permittivity (target)	5	Rectangular	√3	0.6	1.73	∞
Liquid Permittivity (meas)	-1.87	Rectangular	√3	0.26	-0.28	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.05	∞
Combined Std. Uncertainty		RSS			11.19	361
Expanded STD Uncertainty		*k*=2			22.39%	

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	√3	0.7	1.90	∞
Modulation Response	2.40	Rectangular	√3	1	1.39	∞
Hemispherical Isotropy	9.60	Rectangular	√3	0.7	3.88	∞
Boundary Effect	2.00	Rectangular	√3	1	1.15	∞
Linearity	4.70	Rectangular	√3	1	2.71	∞
System Detection Limit	1.00	Rectangular	√3	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	√3	1	0.46	∞
Integration Time	2.60	Rectangular	√3	1	1.50	∞
RF Ambient Noise	3.00	Rectangular	√3	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	√3	1	1.73	∞
Probe Positioner	0.80	Rectangular	√3	1	0.46	∞
Probe Positioning	6.70	Rectangular	√3	1	3.87	∞
Max. SAR Evaluation	4.00	Rectangular	√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	√3	1	2.89	∞
Power Scaling	0	Rectangular	√3	1	0.00	∞
Phantom and Tissue Parameters						
Phantom Uncertainty	4	Rectangular	√3	1	2.31	∞
SAR correction	1.9	Rectangular	√3	1	1.10	∞
Liquid Conductivity (target)	5	Rectangular	√3	0.64	1.85	∞
Liquid Conductivity (meas)	-2.87	Rectangular	√3	0.78	-1.29	∞
Liquid Permittivity (target)	5	Rectangular	√3	0.6	1.73	∞
Liquid Permittivity (meas)	-1.70	Rectangular	√3	0.26	-0.26	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	1.53	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.05	∞
Combined Std. Uncertainty		RSS			12.18	748
Expanded STD Uncertainty		*k*=2			24.36%	
Expanded STD Uncertainty		*k*=2			1.89dB	

8. 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

9. MEASUREMENT RESULTS

9.1 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/m^3)

9.2 LIQUID MEASUREMENT RESULTS

The following table show the measuring results for simulating liquid:

Liquid Type	Liquid Temp. (℃)	Parameters	Target	Measured	Deviation (%)	Limited (%)	Measured Date
Body2402	21.5	Permitivity(ε)	52.76	51.91	-1.61	± 5	2018-2-6
		Conductivity(σ)	1.89	1.86	-1.33	± 5	
Body2412	21.5	Permitivity(ε)	52.75	51.89	-1.63	± 5	2018-2-6
		Conductivity(σ)	1.90	1.89	-0.73	± 5	
Body2437	21.5	Permitivity(ε)	52.72	51.74	-1.86	± 5	2018-2-6
		Conductivity(σ)	1.93	1.94	0.57	± 5	
Body2441	21.5	Permitivity(ε)	52.71	51.73	-1.87	± 5	2018-2-6
		Conductivity(σ)	1.94	1.96	0.87	± 5	
Body2462	21.5	Permitivity(ε)	52.68	51.77	-1.74	± 5	2018-2-6
		Conductivity(σ)	1.97	2.01	2.09	± 5	
Body2480	21.5	Permitivity(ε)	52.66	51.86	-1.52	± 5	2018-2-6
		Conductivity(σ)	1.99	2.05	2.75	± 5	
Body5260	21.5	Permitivity(ε)	48.95	48.26	-1.41	± 5	2018-2-7
		Conductivity(σ)	5.42	5.27	-2.87	± 5	
Body5280	21.5	Permitivity(ε)	48.92	48.39	-1.09	± 5	2018-2-7
		Conductivity(σ)	5.44	5.34	-1.85	± 5	
Body5300	21.5	Permitivity(ε)	48.90	48.49	-0.84	± 5	2018-2-7
		Conductivity(σ)	5.46	5.39	-1.42	± 5	
Body5320	21.5	Permitivity(ε)	48.87	48.42	-0.92	± 5	2018-2-7
		Conductivity(σ)	5.49	5.40	-1.56	± 5	
Body5500	21.5	Permitivity(ε)	48.62	48.29	-0.67	± 5	2018-2-7
		Conductivity(σ)	5.68	5.54	-2.55	± 5	
Body5560	21.5	Permitivity(ε)	48.54	47.77	-1.58	± 5	2018-2-7
		Conductivity(σ)	5.75	5.78	0.50	± 5	
Body5660	21.5	Permitivity(ε)	48.40	47.59	-1.66	± 5	2018-2-7
		Conductivity(σ)	5.85	5.82	-0.65	± 5	
Body5720	21.5	Permitivity(ε)	48.31	47.81	-1.04	± 5	2018-2-7
		Conductivity(σ)	5.92	5.86	-0.98	± 5	
Body5745	21.5	Permitivity(ε)	48.28	47.46	-1.70	± 5	2018-2-7
		Conductivity(σ)	5.94	5.88	-1.03	± 5	
Body5785	21.5	Permitivity(ε)	48.22	47.55	-1.39	± 5	2018-2-7
		Conductivity(σ)	5.98	6.06	1.26	± 5	
Body5825	21.5	Permitivity(ε)	47.99	48.05	0.14	± 5	2018-2-7
		Conductivity(σ)	6.03	6.01	-0.35	± 5	

Note: 1. Since the maximum deviation of dielectric properties of the tissue simulating liquid is within 5%, SAR correction is evaluated in the measurement uncertainty shown on section 8 of this report.

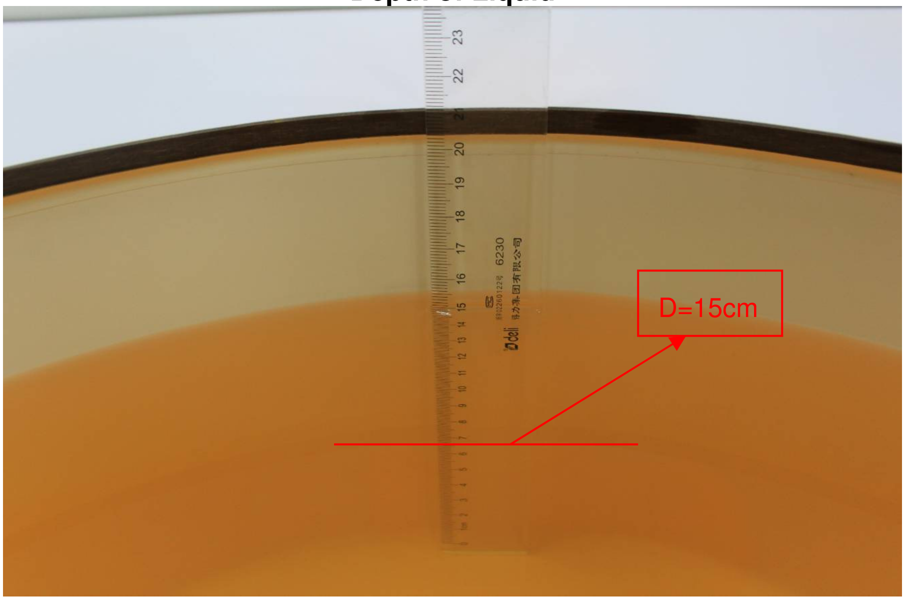
9.3 SYSTEM PERFORMANCE CHECK

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 ±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 withan E-fileld 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 from dipole center to the simulating liquid surface.
- he 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 250mW±3%.
- The dipole above than 3G input power was 100mW±3%.
- The results are normalized to 1 W input power.

Depth of Liquid



- Note: For SAR testing, the liquid depth is 15cm shown above

SYSTEM PERFORMANCE CHECK RESULTS

Liquid Type	Ambient Temp. (°C)	Liquid Temp. (℃)	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	12.80	51.50	51.20	-0.58	± 10	2018-2-6
Body5200	22	21.5	0.1	7.53	74.50	75.3	1.07	± 10	2018-2-7
Body5300	22	21.5	0.1	7.80	77.20	78	1.04	± 10	2018-2-7
Body5500	22	21.5	0.1	7.87	81.10	78.7	-2.96	± 10	2018-2-7
Body5600	22	21.5	0.1	7.91	79.80	79.1	-0.88	± 10	2018-2-7
Body5800	22	21.5	0.1	7.69	77.20	76.9	-0.39	± 10	2018-2-7

9.4 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)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average power (dBm)
802.11 b	1	2412	15	±1	16	15.93
	6	2437	15	±1	16	15.85
	11	2462	15	±1	16	16.00
802.11 g	1	2412	15	±1	16	Not required
	6	2437	15	±1	16	
	11	2462	15	±1	16	
802.11 n HT20	1	2412	15	±1	16	
	6	2437	15	±1	16	
	11	2462	15	±1	16	
802.11 n HT40	3	2422	14	±1	15	
	6	2437	14	±1	15	
	9	2452	14	±1	15	

WLAN 2.4G Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average power (dBm)
802.11 b	1	2412	15	±1	16	15.97
	6	2437	15	±1	16	15.99
	11	2462	15	±1	16	15.92
802.11 g	1	2412	15	±1	16	Not required
	6	2437	15	±1	16	
	11	2462	15	±1	16	
802.11 n HT20	1	2412	15	±1	16	
	6	2437	15	±1	16	
	11	2462	15	±1	16	
802.11 n HT40	3	2422	14	±1	15	
	6	2437	14	±1	15	
	9	2452	14	±1	15	

WLAN Conducted output power(dBm):

U-NII-1 Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	36	5180	12	±1	13	12.77
	40	5200	12	±1	13	12.66
	44	5220	12	±1	13	12.85
	48	5240	12	±1	13	12.58
802.11 n HT20	36	5180	11.5	±1	12.5	Not required
	40	5200	11.5	±1	12.5	
	44	5220	11.5	±1	12.5	
	48	5240	11.5	±1	12.5	
802.11 n HT40	38	5190	11.5	±1	12.5	
	46	5230	11.5	±1	12.5	
802.11 ac80	42	5210	10	±1	11	

U-NII-1 Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	36	5180	12	±1	13	12.73
	40	5200	12	±1	13	12.85
	44	5220	12	±1	13	12.79
	48	5240	12	±1	13	12.86
802.11 n HT20	36	5180	11.5	±1	12.5	Not required
	40	5200	11.5	±1	12.5	
	44	5220	11.5	±1	12.5	
	48	5240	11.5	±1	12.5	
802.11 n HT40	38	5190	11.5	±1	12.5	
	46	5230	11.5	±1	12.5	
802.11 ac80	42	5210	10	±1	11	

U-NII-2A Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	52	5260	12	±1	13	13.00
	56	5280	12	±1	13	12.81
	60	5300	12	±1	13	12.94
	64	5320	12	±1	13	12.67
802.11 n HT20	52	5260	11.5	±1	12.5	Not required
	56	5280	11.5	±1	12.5	
	60	5300	11.5	±1	12.5	
	64	5320	11.5	±1	12.5	
802.11 n HT40	54	5270	11.5	±1	12.5	
	62	5310	11.5	±1	12.5	
802.11 ac80	58	5290	11	±1	12	

U-NII-2A Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	52	5260	12	±1	13	12.95
	56	5280	12	±1	13	13.00
	60	5300	12	±1	13	12.80
	64	5320	12	±1	13	13.00
802.11 n HT20	52	5260	11.5	±1	12.5	Not required
	56	5280	11.5	±1	12.5	
	60	5300	11.5	±1	12.5	
	64	5320	11.5	±1	12.5	
802.11 n HT40	54	5270	11.5	±1	12.5	
	62	5310	11.5	±1	12.5	
802.11 ac80	58	5290	11	±1	12	

U-NII-2C Chain0

Mode	Channel	Frequency (MHZ)	Chain0 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	100	5500	12	±1	13	12.84
	112	5560	12	±1	13	12.95
	116	5580	12	±1	13	12.86
	128	5640	12	±1	13	12.92
	132	5660	12	±1	13	12.85
	136	5680	12	±1	13	12.58
	140	5700	12	±1	13	12.91
	144	5720	12	±1	13	12.87
802.11 n HT20	100	5500	11.5	±1	12.5	Not required
	112	5560	11.5	±1	12.5	
	116	5580	11.5	±1	12.5	
	128	5640	11.5	±1	12.5	
	132	5660	11.5	±1	12.5	
	136	5680	11.5	±1	12.5	
	140	5700	11.5	±1	12.5	
	144	5720	11.5	±1	12.5	
802.11 n HT40	102	5510	11.5	±1	12.5	
	110	5550	11.5	±1	12.5	
	118	5590	11.5	±1	12.5	
	126	5630	11.5	±1	12.5	
	134	5670	11.5	±1	12.5	
	142	5710	11.5	±1	12.5	
802.11 ac80	106	5530	11.5	±1	12.5	
	122	5610	11.5	±1	12.5	
	138	5690	11.5	±1	12.5	

U-NII-2C Chain1

Mode	Channel	Frequency (MHZ)	Chain1 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average Power (dBm)
802.11 a	100	5500	12	±1	13	12.89
	112	5560	12	±1	13	12.97
	116	5580	12	±1	13	12.81
	128	5640	12	±1	13	12.81
	132	5660	12	±1	13	13.00
	136	5680	12	±1	13	12.97
	140	5700	12	±1	13	12.97
	144	5720	12	±1	13	12.95
802.11 n HT20	100	5500	11.5	±1	12.5	Not required
	112	5560	11.5	±1	12.5	
	116	5580	11.5	±1	12.5	
	128	5640	11.5	±1	12.5	
	132	5660	11.5	±1	12.5	
	136	5680	11.5	±1	12.5	
	140	5700	11.5	±1	12.5	
	144	5720	11.5	±1	12.5	
802.11 n HT40	102	5510	11.5	±1	12.5	
	110	5550	11.5	±1	12.5	
	118	5590	11.5	±1	12.5	
	126	5630	11.5	±1	12.5	
	134	5670	11.5	±1	12.5	
	142	5710	11.5	±1	12.5	
802.11 ac80	106	5530	11.5	±1	12.5	
	122	5610	11.5	±1	12.5	
	138	5690	11.5	±1	12.5	

U-NII-3 Chain0

Mode	Channel	Frequency	Chain0 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average power (dBm)
802.11 a	149	5745	12	±1	13	12.89
	157	5785	12	±1	13	12.88
	165	5825	12	±1	13	12.94
802.11 n HT20	149	5745	11.5	±1	12.5	Not required
	157	5785	11.5	±1	12.5	
	165	5825	11.5	±1	12.5	
802.11 n HT40	151	5755	11.5	±1	12.5	
	159	5795	11.5	±1	12.5	
802.11 ac80	155	5775	11.5	±1	12.5	

U-NII-3 Chain1

Mode	Channel	Frequency	Chain1 Target power(dBm)	Tune up tolerance (dBm)	Maximum Tune up power (dBm)	Average power (dBm)
802.11 a	149	5745	12	±1	13	12.93
	157	5785	12	±1	13	13.00
	165	5825	12	±1	13	12.99
802.11 n HT20	149	5745	11.5	±1	12.5	Not required
	157	5785	11.5	±1	12.5	
	165	5825	11.5	±1	12.5	
802.11 n HT40	151	5755	11.5	±1	12.5	
	159	5795	11.5	±1	12.5	
802.11 ac80	155	5775	11.5	±1	12.5	

Bluetooth

Band	Mode	Channel	Frequency	Chian0 Average Power (dBm)	Chain1 Average Power (dBm)
2.4 GHz	Bluetooth BR (GFSK)	0	2402	4.46	4.51
		39	2441	3.92	4.02
		78	2480	3.59	3.65
	Bluetooth EDR2 (π/4-DQPSK)	0	2402	3.88	3.78
		39	2441	3.40	3.34
		78	2480	3.12	3.08
	Bluetooth EDR3 (8-DPSK)	0	2402	3.58	3.46
		39	2441	3.21	3.34
		78	2480	3.00	2.95
	Bluetooth LE	0	2402	4.08	4.12
		19	2440	3.69	3.85
		39	2480	3.28	3.52

9.5 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:

[(*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,[24] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[25]
- 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 < 5mm, 5mm is used for excluded SAR calculation

	Wireless Interface	Bluetooth
Tune-up Maximum power (dBm)		5
Tune-up Maximum rated power (mW)		3.162
Body	Antenna to user (mm)	5
	Frequency(GHz)	2402
	SAR exclusion threshold	0.980

Per KDB 447498 D01 exclusion thresholds is 0.980 < 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 2.4GHz 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 4.61 mW (6.64 dBm, tune-up tolerance accounted for), is Higher 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

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

9.6 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.

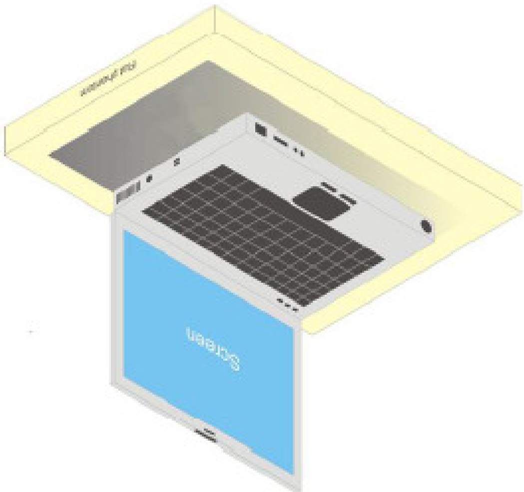
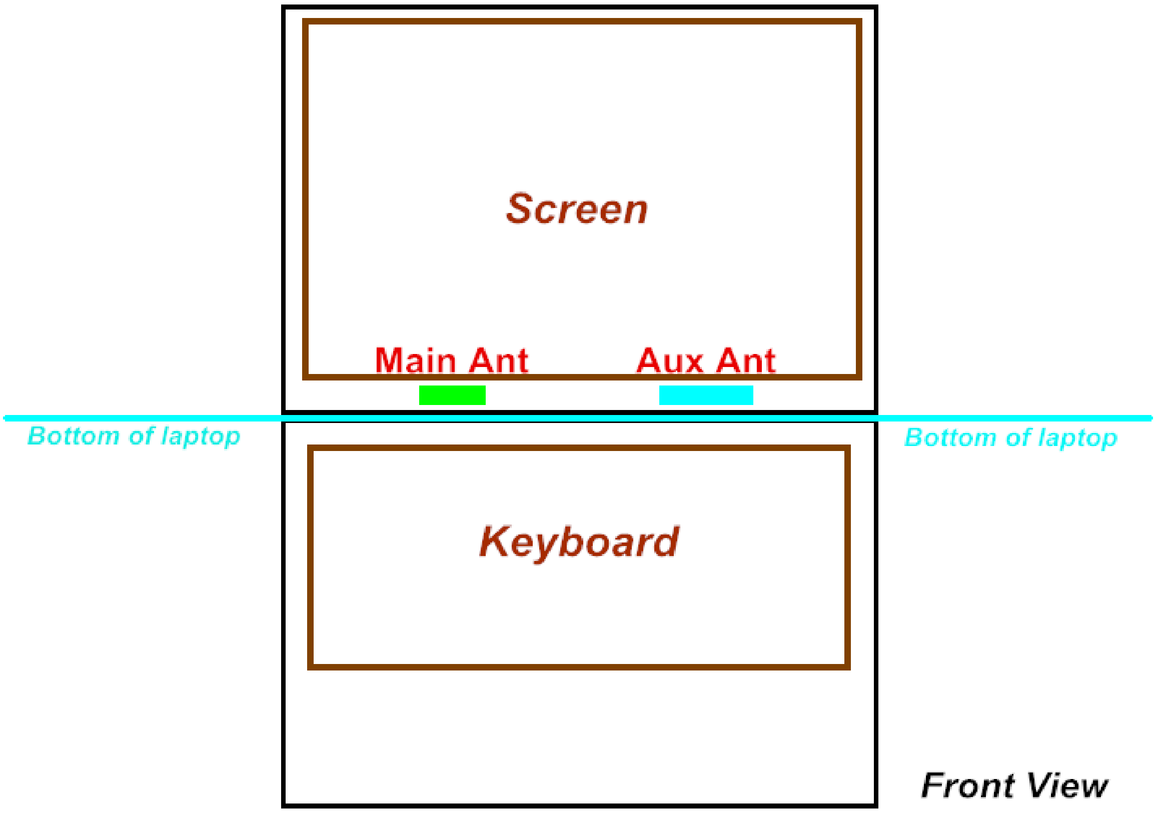


Fig Illustration for Laptop Setup

Note： The distance between EUT bottom surface and Antenna position is 4.00 mm

9.7 ANTENNA LOCATION



Device dimensions for Tablet mode (H x W): 325 x 230 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 TX/RX 2.4GHz/5GHz+ Bluetooth
Aux Antenna	WLAN TX/RX 2.4GHz/5GHz+ Bluetooth

Test Mode

IEEE 802.11	Data transmission mode(802.11a;802.11b; Bluetooth GFSK)

Note:

Chain0 is Main Antenna

Chain1 is Aux Antenna.

9.8 SAR MEASUREMENT RESULTS

Note:

1. Per KDB 447498 D01, 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)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01, for each exposure position, if the highest output channel reported SAR ≤0.8W/kg, other channels SAR testing is not necessary.
3. 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

2.4GHz SAR Results for Test Records

South Star Antenna

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
WLAN 2.4Ghz	802.11b	NB	Bottom	0	2412	Main	15.93	16.00	1.016	0.10	1	0.967	0.983	3
		NB	Bottom	0	2437	Main	15.85	16.00	1.035	0.17	1	0.998	1.033	4
		NB	Bottom	0	2462	Main	16.00	16.00	1.000	0.10	1	1.11	1.110	5
		NB	Bottom	0	2412	Aux	15.97	16.00	1.007	0.02	1	1.06	1.067	6
		NB	Bottom	0	2437	Aux	15.99	16.00	1.002	0.09	1	0.981	0.983	7
		NB	Bottom	0	2462	Aux	15.92	16.00	1.019	0.13	1	0.997	1.016	8
2.4Ghz	BT GFSK	NB	Bottom	0	2402	Main	4.46	5	1.132	0.04	1	0.048	0.054	13
		NB	Bottom	0	2441	Main	3.92	5	1.282	0.15	1	0.049	0.063	14
		NB	Bottom	0	2480	Main	3.59	5	1.384	0.13	1	0.057	0.079	15
		NB	Bottom	0	2402	Aux	4.51	5	1.119	0.07	1	0.045	0.050	16
		NB	Bottom	0	2441	Aux	4.02	5	1.253	0.06	1	0.045	0.056	17
		NB	Bottom	0	2480	Aux	3.65	5	1.365	0.10	1	0.039	0.053	18

Luxshare Antenna - Worst case

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
WLAN 2.4Ghz	802.11b	NB	Bottom	0	2462	Main	16.00	16.00	1.000	0.17	1	1.05	1.050	11
WLAN 2.4Ghz	802.11b	NB	Bottom	0	2412	Aux	15.97	16.00	1.007	0.08	1	0.754	0.759	12
2.4Ghz	BT GFSK	NB	Bottom	0	2480	Main	3.59	5	1.384	0.02	1	0.047	0.065	19
2.4Ghz	BT GFSK	NB	Bottom	0	2441	Aux	4.02	5	1.253	0.07	1	0.026	0.033	20

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

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.

2) 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 ≤ 1.2 W/kg. So 2.4 GHz OFDM mode is not required.

Repeated SAR Test Records for 2.4GHz

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
WLAN 2.4Ghz	802.11b	NB	Bottom	0	2462	Main	16.00	16.00	1.000	0.08	1	1.09	1.090	9
WLAN 2.4Ghz	802.11b	NB	Bottom	0	2412	Aux	15.97	16.00	1.007	0.07	1	1.08	1.087	10

5GHz SAR Results for Test Records

South Star Antenna

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2A	802.11a	NB	Bottom	0	5260	Main	13.00	13.00	1.000	-0.18	1	0.741	0.741	21
U-NII-2A		NB	Bottom	0	5300	Main	12.94	13.00	1.014	0.10	1	0.670	0.679	22
U-NII-2A		NB	Bottom	0	5320	Main	12.67	13.00	1.079	-0.01	1	0.591	0.638	23
U-NII-2C		NB	Bottom	0	5500	Main	12.84	13.00	1.038	0.06	1	0.868	0.901	24
U-NII-2C		NB	Bottom	0	5560	Main	12.95	13.00	1.012	0.16	1	1.10	1.113	25
U-NII-2C		NB	Bottom	0	5720	Main	12.87	13.00	1.030	0.17	1	0.896	0.923	26
U-NII-3		NB	Bottom	0	5745	Main	12.89	13.00	1.026	0.07	1	0.749	0.768	27
U-NII-3		NB	Bottom	0	5785	Main	12.88	13.00	1.028	0.10	1	0.755	0.776	28
U-NII-3		NB	Bottom	0	5825	Main	12.94	13.00	1.014	0.09	1	0.666	0.675	29

Luxshare Antenna

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2A	802.11a	NB	Bottom	0	5260	Aux	12.95	13.00	1.012	0.06	1	0.875	0.885	31
U-NII-2A		NB	Bottom	0	5280	Aux	13.00	13.00	1.000	-0.16	1	0.905	0.905	32
U-NII-2A		NB	Bottom	0	5320	Aux	13.00	13.00	1.000	0.11	1	0.836	0.836	33
U-NII-2C		NB	Bottom	0	5500	Aux	12.89	13.00	1.026	-0.01	1	0.745	0.764	34
U-NII-2C		NB	Bottom	0	5660	Aux	13.00	13.00	1.000	0.10	1	1.12	1.120	35
U-NII-2C		NB	Bottom	0	5720	Aux	12.95	13.00	1.012	0.07	1	0.875	0.885	36
U-NII-3		NB	Bottom	0	5745	Aux	12.93	13.00	1.016	0.03	1	0.784	0.797	37
U-NII-3		NB	Bottom	0	5785	Aux	13.00	13.00	1.000	0.07	1	0.803	0.803	38
U-NII-3		NB	Bottom	0	5825	Aux	12.99	13.00	1.002	0.12	1	0.765	0.767	39

Luxshare Antenna- Worst case

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2C	802.11a	NB	Bottom	0	5560	Main	12.95	13.00	1.012	-0.07	1	0.797	0.806	43

South Star Antenna- Worst case

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2C	802.11a	NB	Bottom	0	5660	Aux	13.00	13.00	1.000	0.05	1	1.01	1.01	44

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 Main Antenna 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 Main Antenna U-NII-1 mode is not required.

Repeated SAR Test Records for 5GHz

South Star Antenna

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2C	802.11a	NB	Bottom	0	5560	Main	12.95	13.00	1.012	0.14	1	1.09	1.103	30

Luxshare Antenna

Band	Mode	Configure	Test Position	Dist. (mm)	Freq. (MHZ)	Ant	max Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Duty Cycle Scaling Factor	SAR1g (mW/g)	Scaled SAR1g (mW/g)	Plot page
U-NII-2A	802.11a	NB	Bottom	0	5280	Aux	13.00	13.00	1.000	0.06	1	0.895	0.895	40
U-NII-2C	802.11a	NB	Bottom	0	5660	Aux	13.00	13.00	1.000	0.09	1	1.11	1.11	41
U-NII-3	802.11a	NB	Bottom	0	5785	Aux	13.00	13.00	1.000	0.05	1	0.792	0.792	42

9.9 REPEATED SAR MEASUREMENT

Note:

1. Per KDB 865664 D01v01,for each frequency band, repeated SAR measurement is required only when the measured SAR is ⩾ 0.8W/Kg
2. Per KDB 865664 D01v01,if the ratio of largest to smallest SAR for the original and first 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.

Band	Mode	Test Position	Ant	Freq (MHZ)	Original Measured SAR1g (mW/g)	1st Repeated SAR1g (mW/g)	Ratio	Original Measured SAR1g (mW/g)	2nd Repeated SAR1g (mW/g)	Ratio
WLAN 2.4Ghz	802.11b	Bottom	Main	2462	1.11	1.09	1.018	--	--	--
WLAN 2.4Ghz	802.11b	Bottom	Aux	2412	1.06	1.08	1.019	--	--	--
U-NII-2A	802.11a	Bottom	Aux	5280	0.905	0.895	1.011	--	--	--
U-NII-2C	802.11a	Bottom	Main	5560	1.10	1.09	1.009	--	--	--
U-NII-2C	802.11a	Bottom	Aux	5660	1.12	1.11	1.009	--	--	--
U-NII-3	802.11a	Bottom	Aux	5785	0.803	0.792	1.014	--	--	--

9.10 SAR TABLET/CONVERTIBLE COMPUTER MULTI XMITER ASSESSMENT

	Position	Applicable Combination
Simultaneous Transmission	Body	WLAN 5GHz+ Bluetooth

Note:

1. The EUT supports the Main antenna with TX/RX diversity function for WLAN and Bluetooth, the Auxiliary antenna with TX/RX diversity function for WLAN and Bluetooth.
2. WLAN 2.4GHz and Bluetooth will not be transmitting at same time.
3. WLAN 2.4GHz and WLAN 5GHz will not be transmitting at same time.
4. The reported SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,

   1) Scalar SAR summation < 1.6W/kg.

   2) SPLSR = (SAR1 + SAR2)1.5 / (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 SPLSR ≤ 0.04, simultaneously transmission SAR is compliant

3) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg

Sum of SAR for worst case standalone measurements

SUM ∑SAR1g Chain0 WLAN 5GHz + Chain0 Bluetooth				
Position	Distance [mm]	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
		Main Antenna WLAN 5G	Main Antenna Bluetooth	Main ant 5G+ Main ant BT
Bottom	0	1.113	0.079	1.192

SUM ∑SAR1g Chain1 WLAN 5GHz + Chain1 Bluetooth				
Position	Distance [mm]	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
		Aux Antenna WLAN 5G	Aux Antenna Bluetooth	Aux ant 5G+ Aux ant BT
Bottom	0	1.12	0.056	1.176

SUM ∑SAR1g Chain0 WLAN 5GHz + Chain1 Bluetooth				
Position	Distance [mm]	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
		Main Antenna WLAN 5G	Aux Antenna Bluetooth	Main ant 5G+ Aux ant BT
Bottom	0	1.113	0.056	1.169

SUM ∑SAR1g Chain1 WLAN 5GHz + Chain0 Bluetooth				
Position	Distance [mm]	Stand alone SAR(1g) [W/kg]		SUM SAR(1g)[W/kg]
		Aux Antenna WLAN 5G	Main Antenna Bluetooth	Aux ant 5G+ Main ant BT
Bottom	0	1.12	0.079	1.199

10. 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	US37101915	02/28/2017	02/27/2018
S-Parameter Network Analyzer	Agilent	E5071B	MY42301382	02/28/2017	02/27/2018
Power meter	Anritsu	ML2495A	1445010	04/26/2017	04/25/2018
Power sensor	Anritsu	MA2411B	1339220	04/26/2017	04/25/2018
Electro Thermometer	DTM	DTM3000	3030	12/26/2017	12/25/2018
E-field PROBE	SPEAG	EX3DV4	3798	07/26/2017	07/25/2018
DAE	SPEAG	DEA4	1245	07/20/2017	07/19/2018
DIPOLE 2450MHZ ANTENNA	SPEAG	D2450V2	817	05/30/2017	05/29/2018
DIPOLE 5GHZ ANTENNA	SPEAG	D5GHzV2	1095	05/23/2017	05/22/2018
3db ATTENUATOR	MINI	MCL BW-S3W5	0533	N/A	N/A
DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
Dual Directional Coupler	Woken	20W couple	DOM2BHW1A1	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. TEST LOCATION

All tests were sub-contracted to:

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

12. 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.

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14. LABORATORY ACCREDITATIONS AND LISTING

FCC –Designation Number: CN1172.

Compliance Certification Services Inc. Kun shan Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Designation Number: CN1172.

In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, 2324E for SAR chamber.

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: 2/6/2018

SystemPerformanceCheck-Body D2450

DUT: Dipole 2450 MHz D2450V2; 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; σ = 1.978 S/m; ε_r = 51.708; ρ = 1000 kg/m^3

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(7.32, 7.32, 7.32); Calibrated: 7/26/2017;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (9x10x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 16.7 W/kg

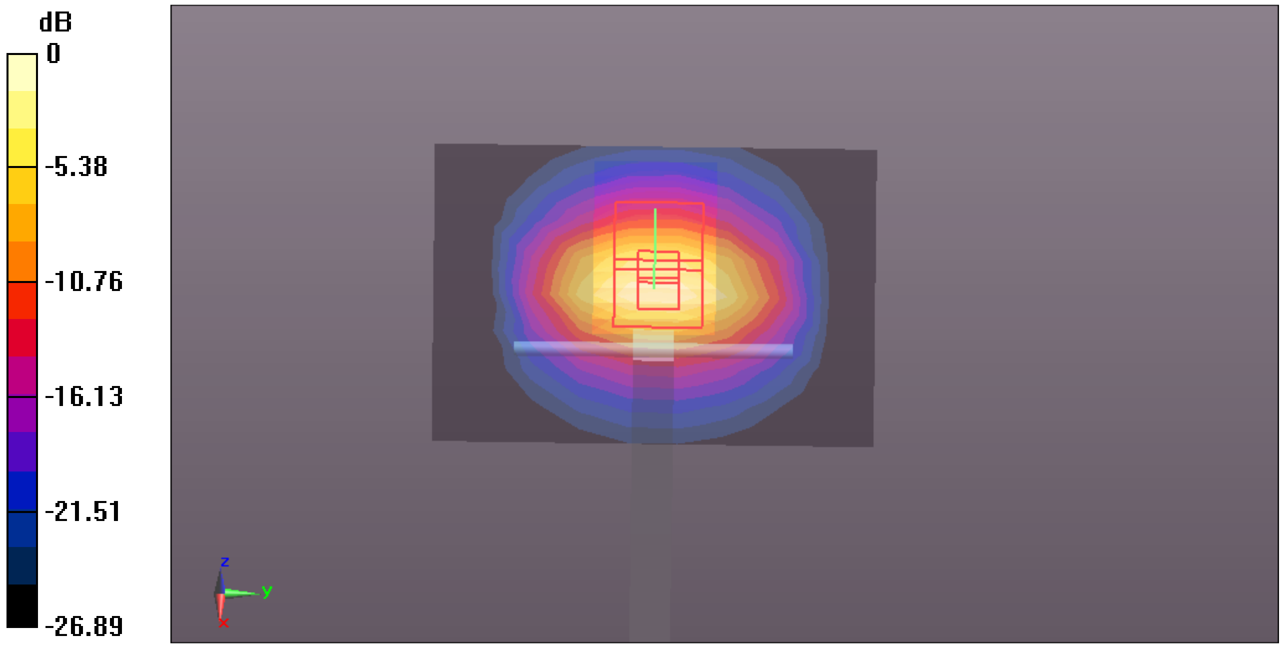
System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.23 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 6.05 W/kg

Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/7/2018

SystemPerformanceCheck-Body D5200

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial:1095

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

Medium parameters used: f = 5200 MHz; σ = 5.233 S/m; ε_r = 48.75; ρ = 1000 kg/m^3

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(4.81, 4.81, 4.81); Calibrated: 7/26/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- 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/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 16.1 W/kg

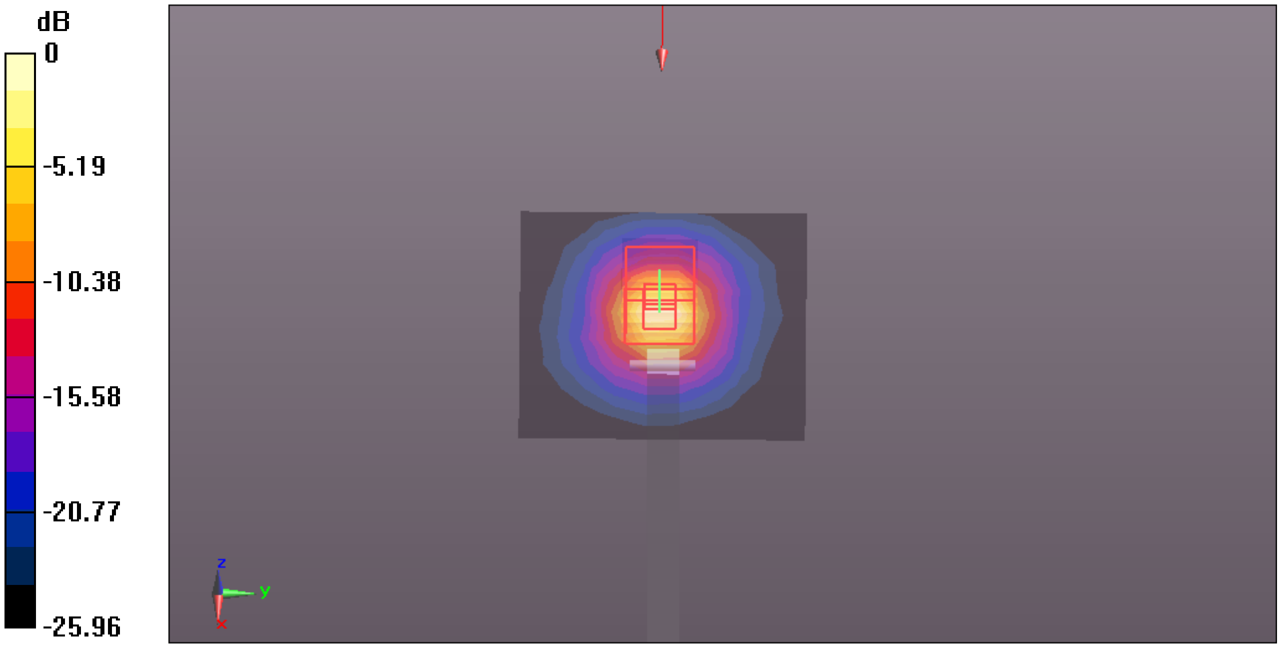
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 58.64 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 33.2 W/kg

SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.24 W/kg

Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/7/2018

SystemPerformanceCheck-Body D5300

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial:1095

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

Medium parameters used: f = 5300 MHz; σ = 5.387 S/m; ε_r = 48.486; ρ = 1000 kg/m^3

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(4.67, 4.67, 4.67); Calibrated: 7/26/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- 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 2/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

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

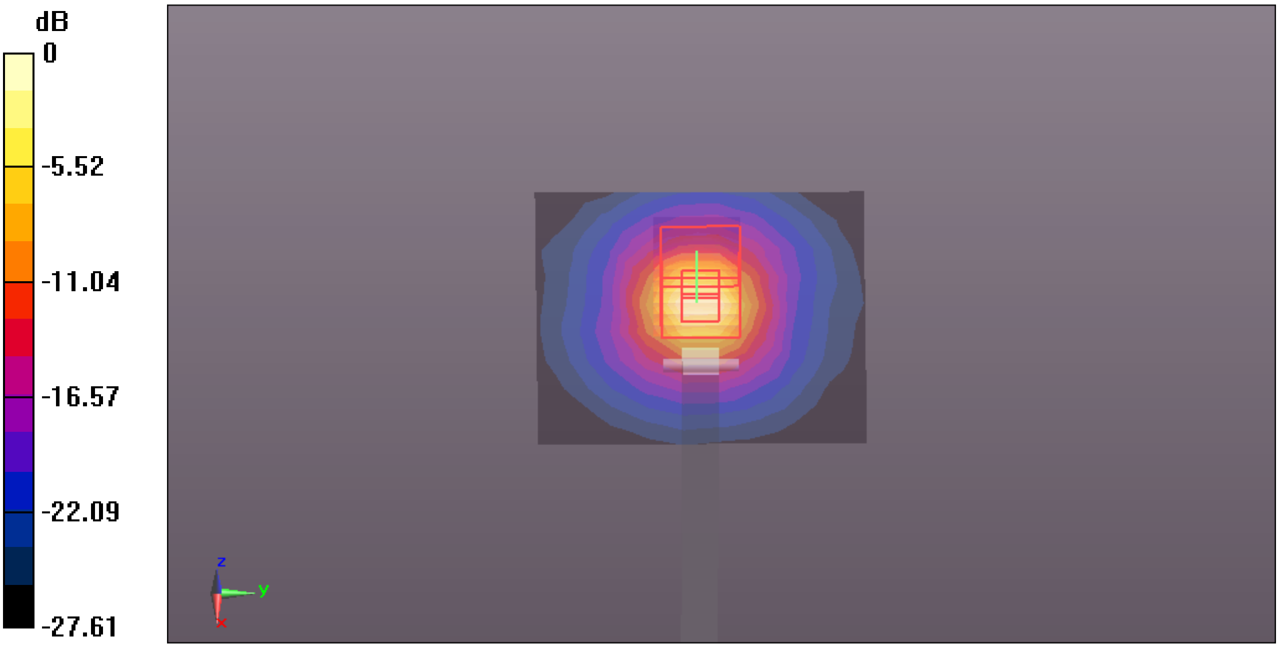
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5300 MHz 2/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 61.58 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 34.2 W/kg

SAR(1 g) = 7.80 W/kg; SAR(10 g) = 2.34 W/kg

Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/7/2018

SystemPerformanceCheck-Body D5500

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095

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

Medium parameters used: f = 5500 MHz; σ = 5.537 S/m; ε_r = 48.292; ρ = 1000 kg/m^3

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(4.26, 4.26, 4.26); Calibrated: 7/26/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- 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 2/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 17.6 W/kg

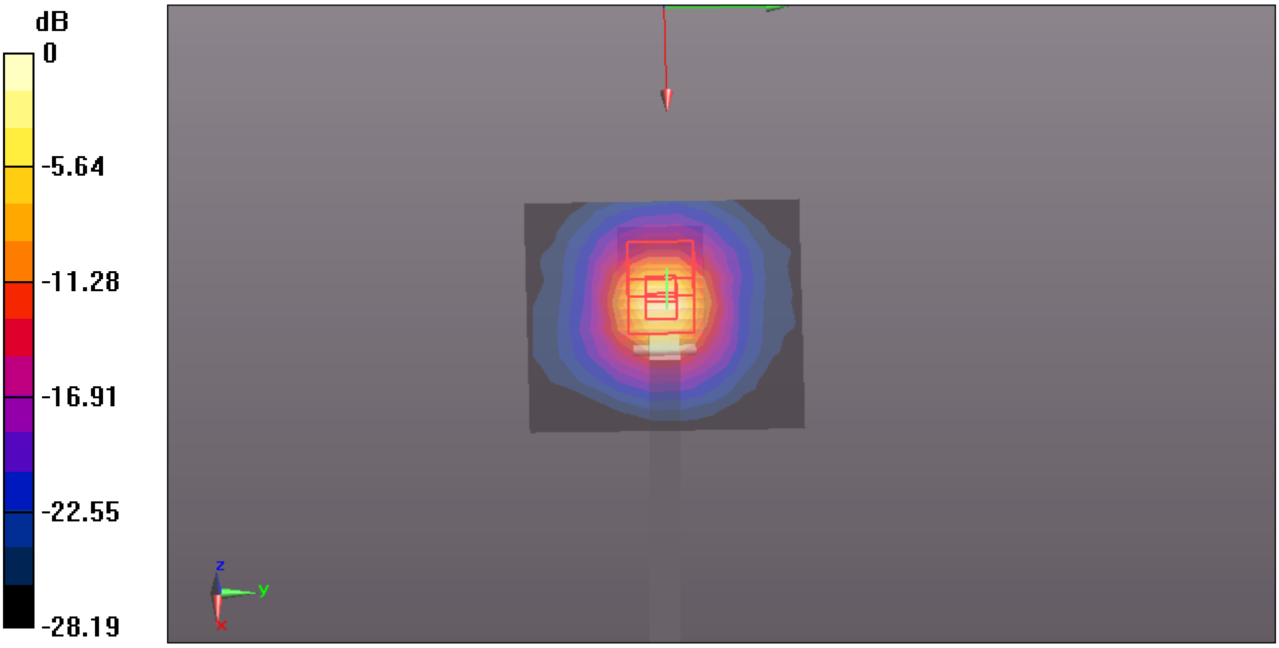
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5500 MHz 2/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.06 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 33.6 W/kg

SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.27 W/kg

Maximum value of SAR (measured) = 18.0W/kg



0 dB = 18.0 W/kg = 12.55 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/7/2018

SystemPerformanceCheck-Body D5600

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: 1095

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

Medium parameters used: f = 5600 MHz; σ = 5.736 S/m; ε_r = 48.176; ρ = 1000 kg/m^3

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

Phantom section: Flat Section

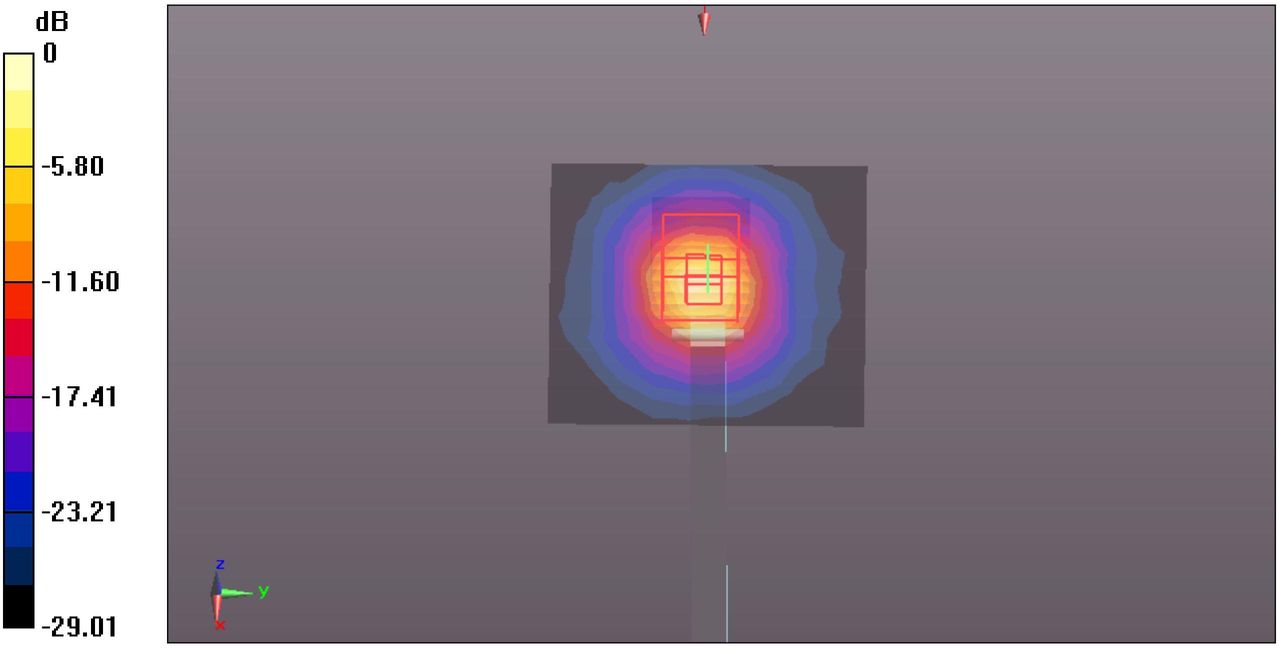
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(4.18, 4.18, 4.18); Calibrated: 7/26/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- 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 (10x10x1): 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=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.14 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 34.9 W/kg
SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 17.9 W/kg



0 dB = 17.9 W/kg = 12.53 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 2/7/2018

SystemPerformanceCheck-Body D5800

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1095

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

Medium parameters used: f = 5800 MHz; σ = 6.117 S/m; ε_r = 47.901; ρ = 1000 kg/m^3

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(4.45, 4.45, 4.45); Calibrated: 7/26/2017;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1102
- 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 (10x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 16.2 W/kg

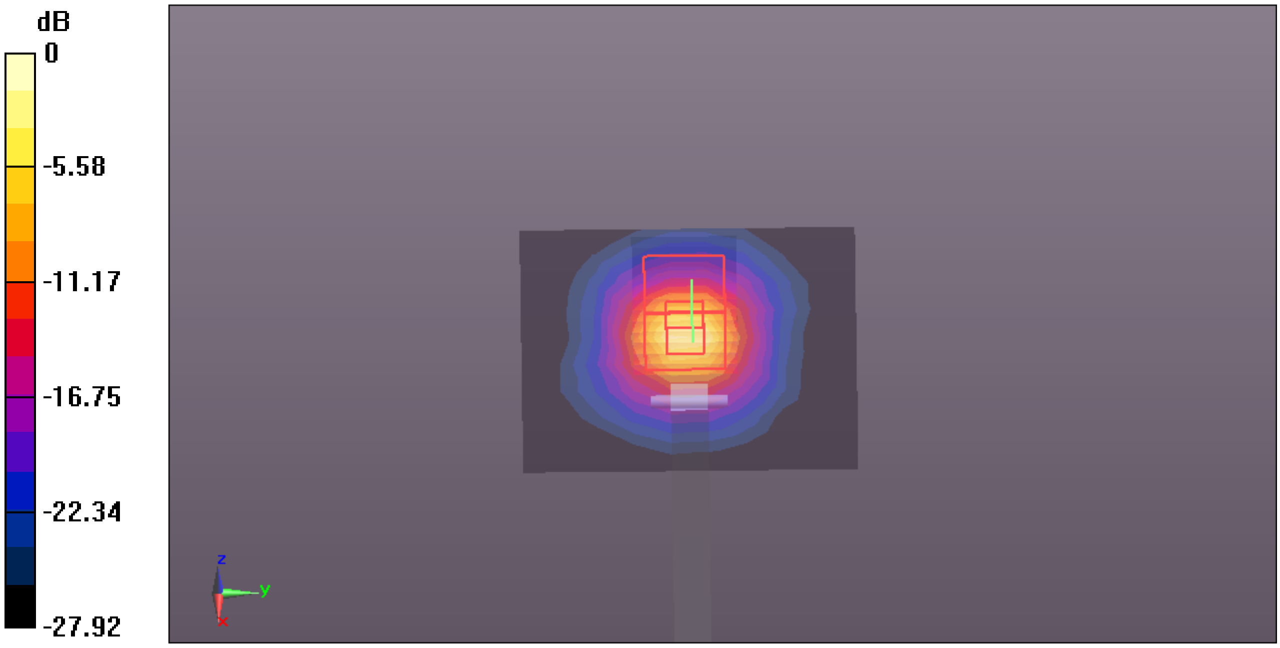
System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.66 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 34.6 W/kg

SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.30 W/kg

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



0 dB = 18.3 W/kg = 12.62 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 of the Report -