FCC SAR Report

Report No.	**:**	**SESF1506018**
Client/Manufacturer	**:**	**Broadcom Corporation**
Address	**:**	**190 Mathilda Place Sunnyvale CA 94086 U.S.A.**
Product	**:**	**Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card**
Brand	**:**	**Broadcom**
Model	**:**	**BCM943162ZP**
FCC ID	**:**	**QDS-BRCM1075**
Standards	**:**	**FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:2005 / IEEE 1528-2013 / KDB 865664 D01 v01r04 / KDB 248227 D01 v02r01 / KDB 447498 D01 v05r02 / KDB 616217 D04 v01r01**
Test Date	**:**	**August 12th, 2015~ August 15th, 2015**

Statement of Compliance:

The SAR values measured for the test sample are below the maximum recommended level of 1.6W/kg averaged over any 1g tissue according to FCC Acknowledge Data Base/ FCC 47CFR Part 2 (2.1093) / IEEE Std.1528-2013.

The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.

Prepared By: Leo Chen

Leo Chen

Approved By: Miro Chueh

Miro Chueh

Testing Laboratory
2877

Release Version

Report No.	Issue Date	Description
SESF1506018	2015-08-26	Initial release

Contents

1. Summary of Maximum SAR Value

Equipment Class	Highest Reported SAR_{1-g}(W/kg)
DTS	0.186
U-NII	1.27
DSS	N/A
Equipment Class	**Highest Simultaneous SAR(W/kg)**
DTS+DSS	0.8
UNII+DSS	1.56

2. Description of Equipment under Test

Product Name	Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card
Model No.	BCM943162ZP
Brand Name	Broadcom
Product Type	WLAN (1TX, 1RX)
Antenna Type	PIFA
Antenna Peak Gain	LUXSHARE-ICT: 2400- 2500MHz: 1.87dBi, 5150- 5850MHz: 1.56dBi
	HongLin: 2400- 2500MHz: 0.95dBi, 5150- 5850MHz: 1.55dBi
Device Category	Portable
RF Exposure Environment	Uncontrolled
Bluetooth	
Bluetooth Frequency	2402~2480MHz
Channel separation	1MHz
Modulation technology	BT-LE (GFSK) for DTS
Wi-Fi	
Tx Rate	802.11b: up to 11Mbps, 802.11a/g: up to 54Mbps 802.11n : up to 400Mbps, 802.11ac: up to 866.7Mbps
Wi-Fi Frequency	**For 15.247:** 2.4GHz: 2.412 ~ 2.462GHz, 5GHz: 5.745 ~ 5.825GHz
	For 15.407: 802.11a: 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.5~5.72GHz
Channel Separation	**For 15.247(2.4GHz):** 11 for 802.11b, 802.11g, 802.11n (HT20) / 7 for 802.11n (HT40)
	For 15.247(5GHz): 5 for 802.11a, 802.11n (HT20)/ 2 for 802.11n (HT40)/ 1 for 802.11ac (VHT80)
	For 15.407: 20 for 802.11a, 802.11n (HT20)/ 10 for 802.11n (HT40)/ 5 for 802.11ac (VHT80)

Additional Information

1. Antenna information

Ant Type	Manufacturer	Part Number
1	LUXSHARE-ICT	Main Antenna: DC33001D900 / Aux Antenna: DC33001D910
2	HongLin Electronics Co., Ltd	Main Antenna: DC33001DB00 / Aux Antenna: DC33001DB10

2. WIFI

For IEEE 802.11a/b/g/n/ac mode (1TX/1RX), the EUT supports the antenna with TX/RX diversity function. Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna, but only one antenna can be used as transmitting/receiving antenna at the same time.

3. Bluetooth

For Bluetooth mode (1TX/1RX), Only Chain 1 can be used as transmitting/receiving antenna.

3. General Information

Host Details,

Host Manufacture	Host Type	Host Model
Lenovo	Notebook Computer	Lenovo YOGA 700-14ISK

Our Lab,

Test Site	Cerpass Technology (Suzhou) Co., Ltd.
Test Site Location	No.66,Tangzhuang Road, Suzhou Industrial Park, Jiangsu 215006, China

4. Basic restrictions and Standards

4.1. Test Standards

1. IEEE 1528-2013
2. FCC KDB Publication 447498 D01 General RF Exposure Guidance v05r02
3. FCC KDB Publication 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
4. FCC KDB Publication 616217 D04 SAR for laptop and tablets v01r01
5. FCC KDB Publication 248227 D01 802.11 Wi-Fi SAR v02r01

4.2. Environment Condition

Item	Target	Measured
Ambient Temperature(℃)	18~25	21.5±2
Temperature of Simulant(℃)	20~22	21±2
Relative Humidity(%RH)	30~70	52

4.3. RF Exposure Limits

Human Exposure	Basic restrictions for electric, magnetic and electromagnetic fields. (Unit in mW/g or W/kg)
Spatial Peak SAR[1](Head and Body)	1.60
Spatial Average SAR[2](Whole Body)	0.08
Spatial Peak SAR[3](Arms and Legs)	4.00

Notes:

1. The Spatial Peak value of the SAR averaged over any 1gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

2. The Spatial Average value of the SAR averaged over the whole body.

3. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over appropriate averaging time.

5. DASY5 Measurement System

DASY5 Measurement System

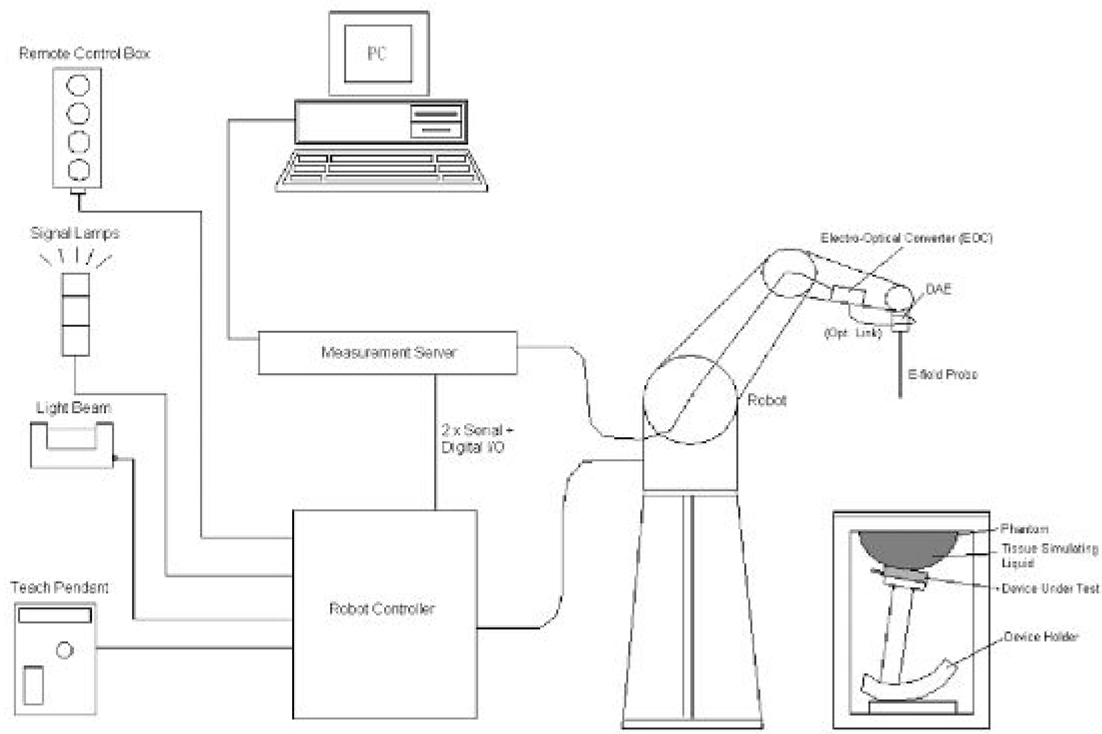


Figure 2.1 SPEAG DASY5 System Configurations

The DASY5 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic(DAE)attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter(ECO)performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows 7
- DASY5 software
- Remove control with teach pendant additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

5.1. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}}\cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$

$$f_2(x,y,z) = Ae^{-\frac{z}{a}}\frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

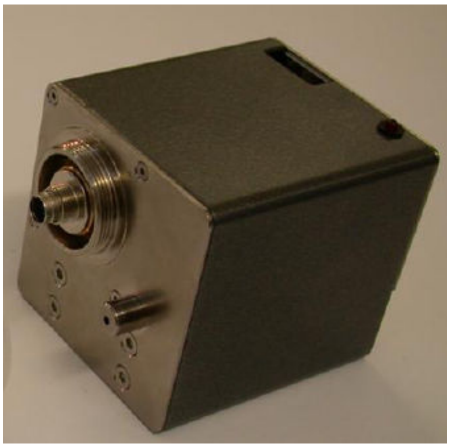
5.2. DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.
SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D.

Model	EX3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	
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%.	

5.3. Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit.
Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



5.4. Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.
The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

5.5. Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

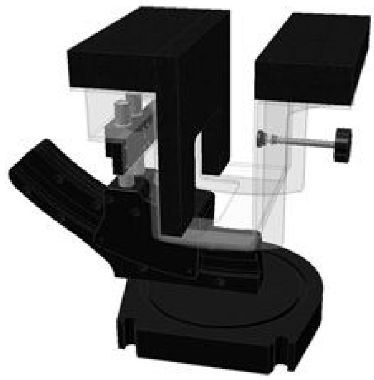
5.6. Measurement Server

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics 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.	

5.7. SAM Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas: ■ Left head ■ Right head ■ Flat phantom	
The ELI4 Phantom also is a fiberglass shell phantom with 2mm shell thickness. It has 30 liters filling volume, and with a dimension of 600mm for major ellipse axis, 400mm for minor axis. It is intended for compliance testing of handheld and body-mounted wireless devices in frequency range of 30 MHz to 6GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.	
The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.	

5.8. Device Holder

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).Thus the device needs no repositioning when changing the angles. The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.	
The laptop extension is lightweight and made of POM, acrylic glass and foam. It fits easily on upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.	

5.9. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Cali. Due Date
Stäubli Robot TX60L	Stäubli	TX60L	5P6VA1/A/01	only once
Robot Controller	Stäubli	CS8C	5P6VA1/C/01	only once
Dipole Validation Kits	Speag	D2450V2	914	2017.05.18
Dipole Validation Kits	Speag	D5GHzV2	1156	2017.05.21
SAM ELI Phantom	Speag	SAM	1211	N/A
Laptop Holder	Speag	SM LH1 001CD	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1379	2016.05.19
E-Field Probe	Speag	EX3DV4	3927	2016.05.26
SAR Software	Speag	DASY5	V5.2 Build 162	N/A
Power Amplifier	Mini-Circuit	ZVA-183W-S+	MN136701248	2016.09.02
Directional Coupler	Agilent	772D	MY52180104	2016.09.02
Spectrum Analyzer	R&S	FSP40	100324	2016.03.22
Vector Network	Agilent	E5071C	MY4631693	2016.01.14
Signal Generator	R&S	SML	103287	2016.03.08
Power Meter	BONN	BLWA0830-160/100/40D	76659	2015.11.10
AUG Power Sensor	R&S	NRP-Z91	100384	2016.03.08

6. The SAR Measurement Procedure

6.1. System Performance Check

6.1.1 Purpose

1. To verify the simulating liquids are valid for testing.
2. To verify the performance of testing system is valid for testing.

6.1.2 Tissue Dielectric Parameters for Head and Body Phantoms

Target Frequency	Head		Body	
(MHz)	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
850	41.5	0.92	55.2	0.99
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
5200	36.0	4.66	**49.0**	**5.30**
5300	35.87	4.76	48.88	5.42
5600	35.5	5.07	**48.5**	**5.77**
5800	35.3	5.27	**48.2**	**6.00**

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

6.1.3 Tissue Calibration Result

■ The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY5 Diel -ectric Assessment Kit and Agilent Vector Network Analyzer E5071C.

Tissue parameter for body							
Fre. <MHz>	Permittivity	Conductivity	Target Permittivity	Target Conductivity	Delta Permittivity%	Delta Conductivity %	Tissue Temperature℃
12-08-2015							
2450	52.47	1.96	52.70	1.95	0.00	0.01	21.0
2412	52.561	1.928	52.70	1.90	0.00	0.01	21.0
2437	52.511	1.945	52.70	1.93	0.00	0.01	21.0
2462	52.443	1.993	52.70	1.97	0.00	0.01	21.0
13-08-2015							
5200	49.17	5.31	49.00	5.30	0.00	0.00	21.0
5180	49.191	5.297	49.00	5.30	0.00	0.00	21.0
5210	48.998	5.316	49.00	5.30	0.00	0.00	21.0
5240	49.091	5.334	49.00	5.30	0.00	0.01	21.0
5260	48.946	5.379	48.88	5.42	0.00	-0.01	21.0
5290	48.894	5.410	48.88	5.42	0.00	0.00	21.0
5300	48.89	5.42	48.88	5.42	0.00	0.00	21.0
14-08-2015							
5600	48.46	5.77	48.47	5.77	0.00	0.00	21.0
5500	48.62	5.66	48.61	5.71	0.00	-0.01	21.0
5610	48.456	5.778	48.47	5.77	0.00	0.00	21.0
5700	48.36	5.86	48.34	5.88	0.00	0.00	21.0
15-08-2015							
5800	48.42	5.97	48.20	6.00	0.00	-0.01	21.0
5745	48.442	5.957	48.20	6.00	0.01	-0.01	21.0
5775	48.435	5.968	48.20	6.00	0.00	-0.01	21.0
5785	48.431	5.969	48.20	6.00	0.00	-0.01	21.0
5825	48.411	5.976	48.20	6.00	0.00	0.00	21.0

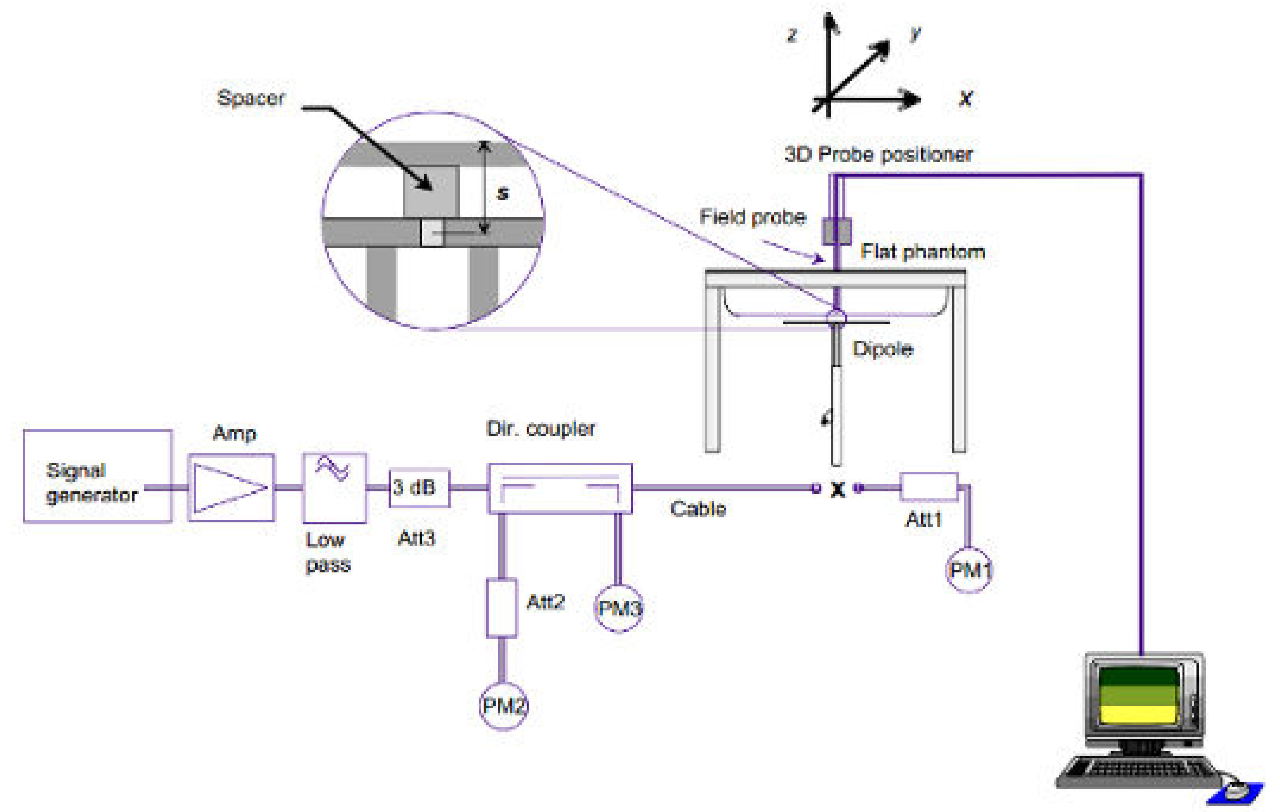
■ Refer to KDB 865664 D01 v01r04, The depth of body tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz.

6.1.4 System Performance Check Procedure

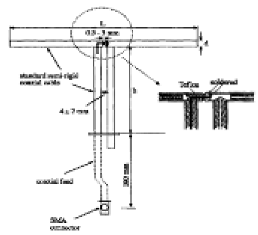
The DASY5 installation includes predefined files with recommended procedures for measurements and the system performance check. They are read-only document files and destined as fully defined but unmeasured masks, so the finished system performance check must be saved under a different name. The system performance check document requires the SAM Twin Phantom or ELI4 Phantom, so the phantom must be properly installed in your system. (User defined measurement procedures can be created by opening a new document or editing an existing document file). Before you start the system performance check, you need only to tell the system with which components (probe, medium, and device) you are performing the system performance check; the system will take care of all parameters.

- **The Power Reference Measurement and Power Drift Measurement** jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the Dipole output power. If it is too high (above ±0.2 dB), the system performance check should be repeated;
- **The Surface Check** job tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ±0.1mm). In that case it is better to abort the system performance check and stir the liquid;
- **The Area Scan** job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable;
- **The Zoom Scan** job measures the field in a volume around the peak SAR value assessed in the previous Area Scan job (for more information see the application note on SAR evaluation). If the system performance check gives reasonable results. The dipole input power(forward power) was 250mW, 1 g and 10 g spatial average SAR values normalized to 1W dipole input power give reference data for comparisons and it's equal to 10x(dipole forward power). The next sections analyze the expected uncertainties of these values, as well as additional checks for further information or troubleshooting.

6.1.5 System Performance Check Setup



6.1.6 Validation Dipoles

The dipoles use is based on the IEEE Std.1528-2013 and FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03standard, and is complied with mechanical and electrical specifications in line with the requirements of both EN62209-1 and EN62209-2. The table below provides details for the mechanical and electrical specifications for the dipoles.	

6.1.7 Result of System Performance Check: Valid Result

System Performance Check at 2450MHz, 5200MHz, 5600MHz and 5800MHz for Body.

Validation Dipole: D2450V2-SN 914

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
2450 MHz	Reference result ± 10% window	52.5 47.25 to 57.75	24.6 22.14 to 27.06	21.0
	12-08-2015	53.6	24.24	

Validation Dipole: D5GHzV2-SN1156

Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5200MHz	Reference result ± 10% window	75.0 67.5 to 82.5	21.0 18.9 to 23.1	21.0
	13-08-2015	77.2	21.5	
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5600MHz	Reference result ± 10% window	79.5 71.55 to 87.45	22.0 19.8 to 24.2	21.0
	14-08-2015	81.8	22.8	
Frequency [MHz]	Description	SAR [w/kg] 1g	SAR [w/kg] 10g	Tissue Temp. [°C]
5800MHz	Reference result ± 10% window	76.6 68.94 to 84.26	21.1 18.99 to 23.21	21.0
	15-08-2015	80.9	22.4	

Note: All SAR values are normalized to 1W forward power.

6.2. Test Requirements

6.2.1 Test Procedures

Step 1 Setup a Connection

First, engineer should record the conducted power before the test. Then establish a call in handset at the maximum power level with a base station simulator via air interface, or make the EUT estimate by itself in testing band. Place the EUT to the specific test location. After the testing, must export SAR test data by SEMCAD. Then writing down the conducted power of the EUT into the report, also the SAR values tested.

Step 2 Power Reference Measurements

To measure the local E-field value at a fixed location which value will be taken as a reference value for calculating a possible power drift.

Step 3 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 fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01v01r04

<table>
<tr><th></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>$\leq$ 2 GHz: $\leq$ 15 mm
2 – 3 GHz: $\leq$ 12 mm</td><td>3 – 4 GHz: $\leq$ 12 mm
4 – 6 GHz: $\leq$ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

Step 4 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 Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 v01r04

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Step 5 Power Drift Measurements

Repetition of the E-field measurement at the fixed location mentioned in Step 1 to make sure the two results differ by less than ± 0.2 dB.

6.2.2 Test Channel

Per KDB248227 D01 v02r01, channel selection procedures below apply to both the initial test configu -ration and subsequent test configureation(s):

1) 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

2) The largest channel bandwidth configuration is selected among the multiple configurations in a freq -uency band with the same specified maximum output power.

3) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is sele -cted.

4) If multiple configurations have the same specified maximum output power, largest channel band -width and lowest order modulation, the lowest data rate configuration among these configurations is seleced.

5) The same procedures also apply to subsequent highest output power channel(s) selection.

a> The channel closest to mid-band frequency is selected for SAR measurement.

b> For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

7. Wi-Fi/Bluetooth SAR Exclusion and Results

7.1. Maximum Tune-up Conducted Average Power

<BCM943162ZP_1T1R Main> (Unit: dBm)

Ch.	Freq(MHz)	11b	11g	HT20	HT40
1	2412	15.4	15.4	15.4	--
3	2422	--	--	--	15.0
6	2437	15.4	15.4	15.4	15.4
9	2452	--	--	--	15.4
11	2462	15.4	15.4	15.4	--

Ch.	Freq(MHz)	11a	HT20
36	5180	15.5	15.5
38	5200	15.5	15.5
44	5220	15.5	15.5
48	5240	15.5	15.5
52	5260	15.5	15.5
56	5280	15.5	15.5
60	5300	15.5	15.5
64	5320	15.5	15.5
100	5500	13.7	13.7
104	5520	13.7	13.7
108	5540	13.7	13.7
112	5560	13.7	13.7
116	5580	13.7	13.7
120	5600	13.7	13.7
124	5620	13.7	13.7
128	5640	13.7	13.7
132	5660	13.7	13.7
136	5680	13.7	13.7
140	5700	13.7	13.7
144	5720	13.7	13.7
149	5745	15.0	15.0
153	5765	15.0	15.0
157	5785	15.0	15.0
161	5805	15.0	15.0
165	5825	15.0	15.0

Ch.	Freq(MHz)	HT40
38	5190	14.5
46	5230	15.5
54	5270	15.5
62	5310	15.5
102	5510	13.7
110	5550	13.7
118	5590	13.7
126	5630	13.7
134	5670	13.7
142	5710	13.7
151	5755	15.0
159	5795	15.0

Ch.	Freq(MHz)	VHT80
42	5210	15.5
58	5290	15.5
106	5530	13.7
122	5610	13.7
138	5690	13.7
155	5775	15.0

Bluetooth Max. Tune-up power
8.5dBm

7.2. Measured Conducted Average Power

<BCM943162ZP_1T1R Main> (Unit: dBm)

<table>
<tr><td rowspan="2">Configurations</td><td colspan="12">Mode</td></tr>
<tr><td colspan="12">Channel / Frequency (MHz)</td></tr>
<tr><td rowspan="12">2.4GHz WLAN Average Power (Main)</td><td colspan="12">802.11b</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.33</td><td colspan="4">15.25</td><td colspan="4">15.22</td></tr>
<tr><td colspan="12">802.11g</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.27</td><td colspan="4">15.19</td><td colspan="4">15.13</td></tr>
<tr><td colspan="12">802.11n(HT20)</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.24</td><td colspan="4">15.17</td><td colspan="4">15.11</td></tr>
<tr><td colspan="12">802.11n(HT40)</td></tr>
<tr><td colspan="4">3/2422</td><td colspan="4">6/2437</td><td colspan="4">9/2452</td></tr>
<tr><td colspan="4">14.89</td><td colspan="4">15.22</td><td colspan="4">15.17</td></tr>
<tr><td rowspan="12">5.2GHz WLAN Average Power (Main)</td><td colspan="12">802.11a</td></tr>
<tr><td colspan="3">36/5180</td><td colspan="3">40/5200</td><td colspan="3">44/5220</td><td colspan="3">48/5240</td></tr>
<tr><td colspan="3">15.24</td><td colspan="3">15.31</td><td colspan="3">15.28</td><td colspan="3">15.31</td></tr>
<tr><td colspan="12">802.11n(HT20)</td></tr>
<tr><td colspan="3">36/5180</td><td colspan="3">40/5200</td><td colspan="3">44/5220</td><td colspan="3">48/5240</td></tr>
<tr><td colspan="3">15.25</td><td colspan="3">15.30</td><td colspan="3">15.27</td><td colspan="3">15.2</td></tr>
<tr><td colspan="12">802.11n(HT40)</td></tr>
<tr><td colspan="6">38/5190</td><td colspan="6">46/5230</td></tr>
<tr><td colspan="6">14.47</td><td colspan="6">15.27</td></tr>
<tr><td colspan="12">802.11ac(VHT80)</td></tr>
<tr><td colspan="12">42/5210</td></tr>
<tr><td colspan="12">15.33</td></tr>
</table>

Configurations	Mode / Channel / Frequency (MHz)						
5.3GHz WLAN Average Power (Main)	802.11a						
	52/5260	56/5280	60/5300	64/5320			
	15.39	15.43	15.30	15.37			
	802.11n(HT20)						
	52/5260	56/5280	60/5300	64/5320			
	15.41	15.37	15.40	15.39			
	802.11n(HT40)						
	54/5270	62/5310					
	15.39	15.41					
	802.11ac(VHT80)						
	58/5290						
	15.41						
5.6GHz WLAN Average Power (Main)	802.11a						
	100/5500	104/5520	116/5580	120/5600	124/5620	136/5680	140/5700
	13.45	13.51	13.59	13.58	13.61	13.54	13.51
	802.11n(HT20)						
	100/5500	104/5520	116/5580	120/5600	124/5620	136/5680	140/5700
	13.41	13.49	13.54	13.52	13.55	13.50	13.48
	802.11n(HT40)						
	102/5510	110/5550	134/5670	142/5710			
	13.47	13.49	13.52	13.47			
	802.11ac(VHT80)						
	106/5530	124/5610	138/5690				
	13.48	13.63	13.35				
5.8GHz WLAN Average Power (Main)	802.11a						
	149/5745	153/5765	157/5785	161/5805	165/5825		
	14.71	14.74	14.78	14.79	14.72		
	802.11n(HT20)						
	149/5745	153/5765	157/5785	161/5805	165/5825		
	14.69	14.73	14.77	14.74	14.70		
	802.11n(HT40)						
	151/5755	159/5795					
	14.81	14.80					
	802.11ac(VHT80)						
	155/5775						
	14.81						

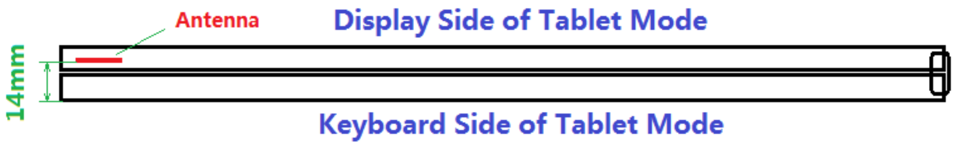
<BCM943162ZP_1T1R Main> (Unit: dBm)

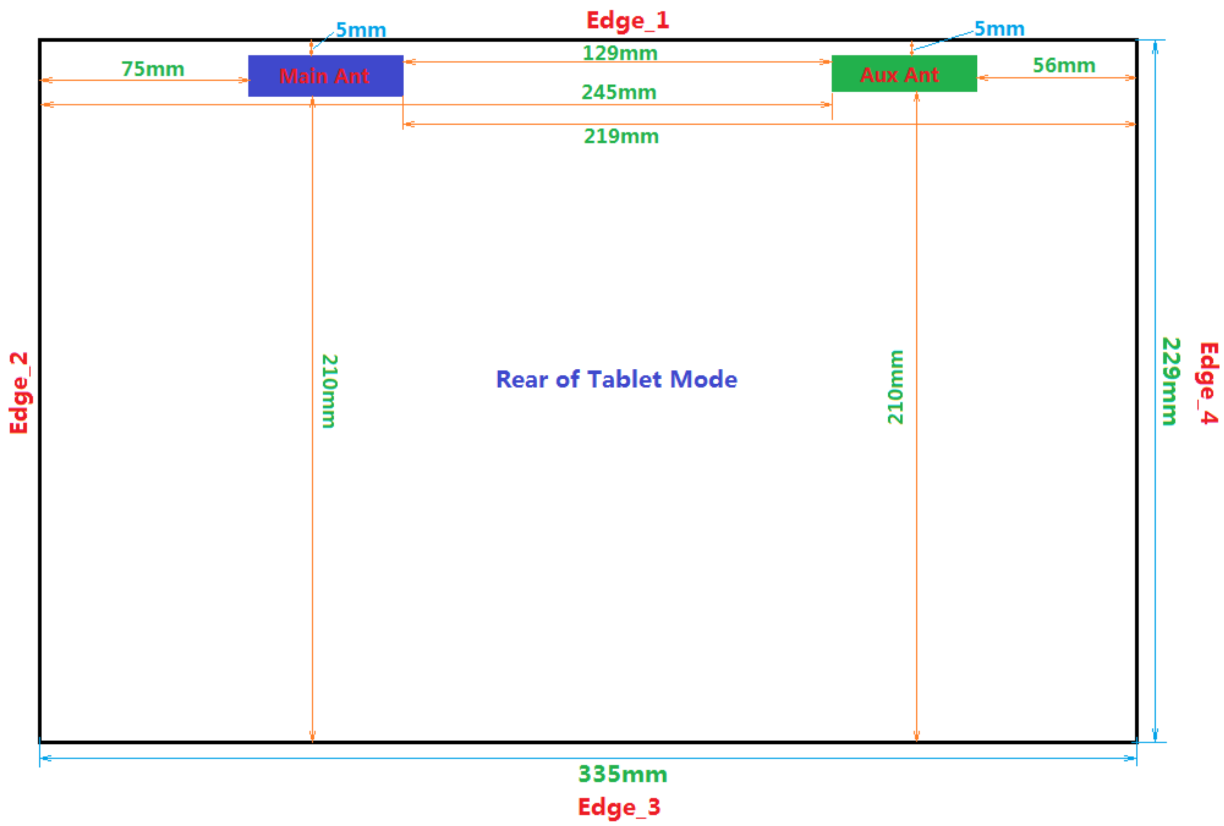
<table>
<tr><td rowspan="2">Configurations</td><td colspan="12">Mode</td></tr>
<tr><td colspan="12">Channel / Frequency (MHz)</td></tr>
<tr><td rowspan="12">2.4GHz WLAN Average Power (Aux)</td><td colspan="12">802.11b</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.43</td><td colspan="4">15.34</td><td colspan="4">15.23</td></tr>
<tr><td colspan="12">802.11g</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.31</td><td colspan="4">15.29</td><td colspan="4">15.16</td></tr>
<tr><td colspan="12">802.11n(HT20)</td></tr>
<tr><td colspan="4">1/2412</td><td colspan="4">6/2437</td><td colspan="4">11/2462</td></tr>
<tr><td colspan="4">15.29</td><td colspan="4">15.26</td><td colspan="4">15.14</td></tr>
<tr><td colspan="12">802.11n(HT40)</td></tr>
<tr><td colspan="4">3/2422</td><td colspan="4">6/2437</td><td colspan="4">9/2452</td></tr>
<tr><td colspan="4">14.92</td><td colspan="4">15.15</td><td colspan="4">15.14</td></tr>
<tr><td rowspan="12">5.2GHz WLAN Average Power (Aux)</td><td colspan="12">802.11a</td></tr>
<tr><td colspan="3">36/5180</td><td colspan="3">40/5200</td><td colspan="3">44/5220</td><td colspan="3">48/5240</td></tr>
<tr><td colspan="3">15.33</td><td colspan="3">15.34</td><td colspan="3">15.37</td><td colspan="3">15.35</td></tr>
<tr><td colspan="12">802.11n(HT20)</td></tr>
<tr><td colspan="3">36/5180</td><td colspan="3">40/5200</td><td colspan="3">44/5220</td><td colspan="3">48/5240</td></tr>
<tr><td colspan="3">15.31</td><td colspan="3">15.33</td><td colspan="3">15.29</td><td colspan="3">15.27</td></tr>
<tr><td colspan="12">802.11n(HT40)</td></tr>
<tr><td colspan="6">38/5190</td><td colspan="6">46/5230</td></tr>
<tr><td colspan="6">14.37</td><td colspan="6">15.34</td></tr>
<tr><td colspan="12">802.11ac(VHT80)</td></tr>
<tr><td colspan="12">42/5210</td></tr>
<tr><td colspan="12">15.38</td></tr>
</table>

<table>
<tr><th rowspan="2">Configurations</th><th colspan="60">Mode</th></tr>
<tr><th colspan="60">Channel / Frequency (MHz)</th></tr>
<tr><td rowspan="12">5.3GHz WLAN Average Power (Aux)</td><td colspan="60">802.11a</td></tr>
<tr><td colspan="15">52/5260</td><td colspan="15">56/5280</td><td colspan="15">60/5300</td><td colspan="15">64/5320</td></tr>
<tr><td colspan="15">15.28</td><td colspan="15">15.27</td><td colspan="15">15.31</td><td colspan="15">15.35</td></tr>
<tr><td colspan="60">802.11n(HT20)</td></tr>
<tr><td colspan="15">52/5260</td><td colspan="15">56/5280</td><td colspan="15">60/5300</td><td colspan="15">64/5320</td></tr>
<tr><td colspan="15">15.29</td><td colspan="15">15.34</td><td colspan="15">15.37</td><td colspan="15">15.36</td></tr>
<tr><td colspan="60">802.11n(HT40)</td></tr>
<tr><td colspan="30">54/5270</td><td colspan="30">62/5310</td></tr>
<tr><td colspan="30">15.31</td><td colspan="30">15.33</td></tr>
<tr><td colspan="60">802.11ac(VHT80)</td></tr>
<tr><td colspan="60">58/5290</td></tr>
<tr><td colspan="60">15.38</td></tr>
<tr><td rowspan="12">5.6GHz WLAN Average Power (Aux)</td><td colspan="60">802.11a</td></tr>
<tr><td colspan="9">100/5500</td><td colspan="9">104/5520</td><td colspan="9">116/5580</td><td colspan="9">120/5600</td><td colspan="8">124/5620</td><td colspan="8">136/5680</td><td colspan="8">140/5700</td></tr>
<tr><td colspan="9">13.41</td><td colspan="9">13.47</td><td colspan="9">13.51</td><td colspan="9">13.50</td><td colspan="8">13.49</td><td colspan="8">13.46</td><td colspan="8">13.44</td></tr>
<tr><td colspan="60">802.11n(HT20)</td></tr>
<tr><td colspan="9">100/5500</td><td colspan="9">104/5520</td><td colspan="9">116/5580</td><td colspan="9">120/5600</td><td colspan="8">124/5620</td><td colspan="8">136/5680</td><td colspan="8">140/5700</td></tr>
<tr><td colspan="9">13.44</td><td colspan="9">13.44</td><td colspan="9">13.42</td><td colspan="9">13.51</td><td colspan="8">13.53</td><td colspan="8">13.47</td><td colspan="8">13.45</td></tr>
<tr><td colspan="60">802.11n(HT40)</td></tr>
<tr><td colspan="15">102/5510</td><td colspan="15">110/5550</td><td colspan="15">134/5670</td><td colspan="15">142/5710</td></tr>
<tr><td colspan="15">13.47</td><td colspan="15">13.49</td><td colspan="15">13.52</td><td colspan="15">13.50</td></tr>
<tr><td colspan="60">802.11ac(VHT80)</td></tr>
<tr><td colspan="20">106/5530</td><td colspan="20">124/5610</td><td colspan="20">138/5690</td></tr>
<tr><td colspan="20">13.53</td><td colspan="20">13.58</td><td colspan="20">13.55</td></tr>
<tr><td rowspan="12">5.8GHz WLAN Average Power (Aux)</td><td colspan="60">802.11a</td></tr>
<tr><td colspan="12">149/5745</td><td colspan="12">153/5765</td><td colspan="12">157/5785</td><td colspan="12">161/5805</td><td colspan="12">165/5825</td></tr>
<tr><td colspan="12">14.68</td><td colspan="12">14.71</td><td colspan="12">14.72</td><td colspan="12">14.70</td><td colspan="12">14.69</td></tr>
<tr><td colspan="60">802.11n(HT20)</td></tr>
<tr><td colspan="12">149/5745</td><td colspan="12">153/5765</td><td colspan="12">157/5785</td><td colspan="12">161/5805</td><td colspan="12">165/5825</td></tr>
<tr><td colspan="12">14.69</td><td colspan="12">14.67</td><td colspan="12">14.68</td><td colspan="12">14.69</td><td colspan="12">14.66</td></tr>
<tr><td colspan="60">802.11n(HT40)</td></tr>
<tr><td colspan="30">151/5755</td><td colspan="30">159/5795</td></tr>
<tr><td colspan="30">14.67</td><td colspan="30">14.71</td></tr>
<tr><td colspan="60">802.11ac(VHT80)</td></tr>
<tr><td colspan="60">155/5775</td></tr>
<tr><td colspan="60">14.75</td></tr>
</table>

Note: Per KDB248227 D01 v02r01 Section4 2) b), 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.

7.3. Antenna Location





Antenna	Antenna Distance to Edges(mm)				
	Back	Edge_1	Edge_2	Edge_3	Edge_4
Main(Tx1)	14	5	75	210	219
Aux(Tx2)	14	5	245	210	56

7.4. SAR exclusion

Per FCC KDB 447498 D01v05r02 for 100MHz~6GHz:

1) The 1g-SAR exclusion threshold for distances<50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ \ Channel(mW)}{Test\ Separation\ Distance(mm)} \times \sqrt{Frequency(GHz)} \leq 3.0$$

5mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	5	10	8.5	7	N
802.11b	2437	5	10	15.4	35	Y
802.11g	2437	5	10	15.4	35	Y
802.11n(HT20)	2437	5	10	15.4	35	Y
802.11n(HT40)	2437	5	10	15.4	35	Y
802.11a	5220	5	7	15.5	35	Y
802.11n(HT20)	5220	5	7	15.5	35	Y
802.11n(HT40)	5230	5	7	15.5	35	Y
802.11ac(VHT80)	5210	5	7	15.5	35	Y
802.11a	5300	5	7	15.5	35	Y
802.11n(HT20)	5300	5	7	15.5	35	Y
802.11n(HT40)	5310	5	7	15.5	35	Y
802.11ac(VHT80)	5290	5	7	15.5	35	Y
802.11a	5540	5	6	13.7	23	Y
802.11n(HT20)	5540	5	6	13.7	23	Y
802.11n(HT40)	5550	5	6	13.7	23	Y
802.11ac(VHT80)	5530	5	6	13.7	23	Y
802.11a	5785	5	6	15	32	Y
802.11n(HT20)	5785	5	6	15	32	Y
802.11n(HT40)	5795	5	6	15	32	Y
802.11ac(VHT80)	5775	5	6	15	32	Y

14mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	14	27	8.5	7	N
802.11b	2437	14	27	15.4	35	Y
802.11g	2437	14	27	15.4	35	Y
802.11n(HT20)	2437	14	27	15.4	35	Y
802.11n(HT40)	2437	14	27	15.4	35	Y
802.11a	5220	14	18	15.5	35	Y
802.11n(HT20)	5220	14	18	15.5	35	Y
802.11n(HT40)	5230	14	18	15.5	35	Y
802.11ac(VHT80)	5210	14	18	15.5	35	Y
802.11a	5300	14	18	15.5	35	Y
802.11n(HT20)	5300	14	18	15.5	35	Y
802.11n(HT40)	5310	14	18	15.5	35	Y
802.11ac(VHT80)	5290	14	18	15.5	35	Y
802.11a	5540	14	18	13.7	23	Y
802.11n(HT20)	5540	14	18	13.7	23	Y
802.11n(HT40)	5550	14	18	13.7	23	Y
802.11ac(VHT80)	5530	14	18	13.7	23	Y
802.11a	5785	14	17	15	32	Y
802.11n(HT20)	5785	14	17	15	32	Y
802.11n(HT40)	5795	14	17	15	32	Y
802.11ac(VHT80)	5775	14	17	15	32	Y

2) At test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

a. [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50mm)·(f (MHz)/150)] mW, at 100 MHz to 1500 MHz

b. [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

56mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	56	156	8.5	7	N
802.11b	2437	56	156	15.4	35	N
802.11g	2437	56	156	15.4	35	N
802.11n(HT20)	2437	56	156	15.4	35	N
802.11n(HT40)	2437	56	156	15.4	35	N
802.11a	5220	56	126	15.5	35	N
802.11n(HT20)	5220	56	126	15.5	35	N
802.11n(HT40)	5230	56	126	15.5	35	N
802.11ac(VHT80)	5210	56	126	15.5	35	N
802.11a	5300	56	125	15.5	35	N
802.11n(HT20)	5300	56	125	15.5	35	N
802.11n(HT40)	5310	56	125	15.5	35	N
802.11ac(VHT80)	5290	56	125	15.5	35	N
802.11a	5540	56	124	13.7	23	N
802.11n(HT20)	5540	56	124	13.7	23	N
802.11n(HT40)	5550	56	124	13.7	23	N
802.11ac(VHT80)	5530	56	124	13.7	23	N
802.11a	5785	56	122	15	32	N
802.11n(HT20)	5785	56	122	15	32	N
802.11n(HT40)	5795	56	122	15	32	N
802.11ac(VHT80)	5775	56	122	15	32	N

75mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	75	346	8.5	7	N
802.11b	2437	75	346	15.4	35	N
802.11g	2437	75	346	15.4	35	N
802.11n(HT20)	2437	75	346	15.4	35	N
802.11n(HT40)	2437	75	346	15.4	35	N
802.11a	5220	75	316	15.5	35	N
802.11n(HT20)	5220	75	316	15.5	35	N
802.11n(HT40)	5230	75	316	15.5	35	N
802.11ac(VHT80)	5210	75	316	15.5	35	N
802.11a	5300	75	315	15.5	35	N
802.11n(HT20)	5300	75	315	15.5	35	N
802.11n(HT40)	5310	75	315	15.5	35	N
802.11ac(VHT80)	5290	75	315	15.5	35	N
802.11a	5540	75	314	13.7	23	N
802.11n(HT20)	5540	75	314	13.7	23	N
802.11n(HT40)	5550	75	314	13.7	23	N
802.11ac(VHT80)	5530	75	314	13.7	23	N
802.11a	5785	75	312	15	32	N
802.11n(HT20)	5785	75	312	15	32	N
802.11n(HT40)	5795	75	312	15	32	N
802.11ac(VHT80)	5775	75	312	15	32	N

210mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	210	1696	8.5	7	N
802.11b	2437	210	1696	15.4	35	N
802.11g	2437	210	1696	15.4	35	N
802.11n(HT20)	2437	210	1696	15.4	35	N
802.11n(HT40)	2437	210	1696	15.4	35	N
802.11a	5220	210	1666	15.5	35	N
802.11n(HT20)	5220	210	1666	15.5	35	N
802.11n(HT40)	5230	210	1666	15.5	35	N
802.11ac(VHT80)	5210	210	1666	15.5	35	N
802.11a	5300	210	1665	15.5	35	N
802.11n(HT20)	5300	210	1665	15.5	35	N
802.11n(HT40)	5310	210	1665	15.5	35	N
802.11ac(VHT80)	5290	210	1665	15.5	35	N
802.11a	5540	210	1664	13.7	23	N
802.11n(HT20)	5540	210	1664	13.7	23	N
802.11n(HT40)	5550	210	1664	13.7	23	N
802.11ac(VHT80)	5530	210	1664	13.7	23	N
802.11a	5785	210	1662	15	32	N
802.11n(HT20)	5785	210	1662	15	32	N
802.11n(HT40)	5795	210	1662	15	32	N
802.11ac(VHT80)	5775	210	1662	15	32	N

219mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	219	1786	8.5	7	N
802.11b	2437	219	1786	15.4	35	N
802.11g	2437	219	1786	15.4	35	N
802.11n(HT20)	2437	219	1786	15.4	35	N
802.11n(HT40)	2437	219	1786	15.4	35	N
802.11a	5220	219	1756	15.5	35	N
802.11n(HT20)	5220	219	1756	15.5	35	N
802.11n(HT40)	5230	219	1756	15.5	35	N
802.11ac(VHT80)	5210	219	1756	15.5	35	N
802.11a	5300	219	1755	15.5	35	N
802.11n(HT20)	5300	219	1755	15.5	35	N
802.11n(HT40)	5310	219	1755	15.5	35	N
802.11ac(VHT80)	5290	219	1755	15.5	35	N
802.11a	5540	219	1754	13.7	23	N
802.11n(HT20)	5540	219	1754	13.7	23	N
802.11n(HT40)	5550	219	1754	13.7	23	N
802.11ac(VHT80)	5530	219	1754	13.7	23	N
802.11a	5785	219	1752	15	32	N
802.11n(HT20)	5785	219	1752	15	32	N
802.11n(HT40)	5795	219	1752	15	32	N
802.11ac(VHT80)	5775	219	1752	15	32	N

245mm Test Separation

Test Mode	Frq.(MHz)	Test Separations	Thresholds (mW)	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	SAR Test(Y/N
Bluetooth	2441	245	2046	8.5	7	N
802.11b	2437	245	2046	15.4	35	N
802.11g	2437	245	2046	15.4	35	N
802.11n(HT20)	2437	245	2046	15.4	35	N
802.11n(HT40)	2437	245	2046	15.4	35	N
802.11a	5220	245	2016	15.5	35	N
802.11n(HT20)	5220	245	2016	15.5	35	N
802.11n(HT40)	5230	245	2016	15.5	35	N
802.11ac(VHT80)	5210	245	2016	15.5	35	N
802.11a	5300	245	2015	15.5	35	N
802.11n(HT20)	5300	245	2015	15.5	35	N
802.11n(HT40)	5310	245	2015	15.5	35	N
802.11ac(VHT80)	5290	245	2015	15.5	35	N
802.11a	5540	245	2014	13.7	23	N
802.11n(HT20)	5540	245	2014	13.7	23	N
802.11n(HT40)	5550	245	2014	13.7	23	N
802.11ac(VHT80)	5530	245	2014	13.7	23	N
802.11a	5785	245	2012	15	32	N
802.11n(HT20)	5785	245	2012	15	32	N
802.11n(HT40)	5795	245	2012	15	32	N
802.11ac(VHT80)	5775	245	2012	15	32	N

7.5. Required Edges for SAR Testing

Test Mode	Main Antenna					Aux Antenna				
	Back	Edge_1	Edge_2	Edge_3	Edge_4	Back	Edge_1	Edge_2	Edge_3	Edge_4
BT(GFSK)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
802.11b	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11g	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT20)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT40)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11a	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT20)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT40)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11ac(VHT	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11a	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT20)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT40)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11ac(VHT	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11a	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT20)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT40)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11ac(VHT	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11a	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT20)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11n(HT40)	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO
802.11ac(VHT	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO

Note: According to KDB 248227 D01 v02r01, SAR configuration may be reduced.

7.6. Estimated SAR

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05r02, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is≤1.6W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05r02 4.3.2 2, the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$Estimated\ SAR = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(Max\ Power\ of\ channel, mW)}{Min.\ Separation, mm}$$

WIFI/ Bluetooth

Test Position	Test Mode	Frq.(MHz)	Test Separations	Max. Tune-up Power(dBm)	Max. Tune-up Power(mW)	Estimated SAR(W/kg)
Edge_1	Bluetooth	2440	5	8.5	7	0.29
Back	Bluetooth	2440	14	8.5	7	0.11

Note: An estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR for test separate on distances >50mm per 447498 D01v05r02.

7.7. SAR Test Results Summary

■ **Tablet Mode- DTS_WLAN 2.4GHz**

Plot No.	Ant Type	Ant Port	Band	Mode	Test Position	Dist. mm	Ch.	Fre.	Max. Tune-up Power(dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift(dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
	1	main	802.11b	CCK	Edge_1	0	1	2412	15.4	15.33	1.00	0.16	0.0999	0.100
	1	main	802.11b	CCK	Back	0	1	2412	15.4	15.33	1.00	0.01	0.0013	0.001
	1	aux	802.11b	CCK	Edge_1	0	1	2412	15.4	15.43	1.00	0.01	0.0935	0.093
	1	aux	802.11b	CCK	Back	0	1	2412	15.4	15.43	1.00	0.12	0.0011	0.001
01	2	main	802.11b	CCK	Edge_1	0	1	2412	15.4	15.33	1.00	0.01	0.185	**0.186**
	2	main	802.11b	CCK	Back	0	1	2412	15.4	15.33	1.00	-0.15	0.0047	0.005
	2	aux	802.11b	CCK	Edge_1	0	1	2412	15.4	15.43	1.00	0.01	0.0758	0.076
	2	aux	802.11b	CCK	Back	0	1	2412	15.4	15.43	1.00	0.12	0.0017	0.002

Note:

1. **When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration, per KDB248227 D01 v02r01 section 5.2.1 1).**
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, 802.11g/n OFDM SAR is not required, per KDB248227 D01 v02r01 section 5.2.2 2).**

■ Tablet Mode- U-NII-2A _WLAN 5.3GHz

Plot No.	Ant Type	Ant Port	Band	Mode	Test Position	Dist. mm	Ch.	Fre.	Max.Tune-up Power(dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift(dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
Initial Test configuration of LUXSHARE-ICT Main&Aux Antenna														
	1	main	802.11ac	VHT80	Edge_1	0	58	5290	15.5	15.41	1.01	0.00	0.302	0.304
	1	main	802.11ac	VHT80	Back	0	58	5290	15.5	15.41	1.01	0.00	0.043	0.043
	1	aux	802.11ac	VHT80	Edge_1	0	58	5290	15.5	15.38	1.01	0.00	0.316	0.318
	1	aux	802.11ac	VHT80	Back	0	58	5290	15.5	15.38	1.01	0.00	0.051	0.051
Initial Test configuration of Honglin Main&Aux Antenna														
02	2	main	802.11ac	VHT80	Edge_1	0	58	5290	15.5	15.41	1.01	0.00	1.26	**1.27**
	2	main	802.11ac	VHT80	Edge_1*	0	58	5290	15.5	15.41	1.01	0.00	1.25	1.26
	2	main	802.11ac	VHT80	Back	0	58	5290	15.5	15.41	1.01	0.00	0.104	0.105
	2	aux	802.11ac	VHT80	Edge_1	0	58	5290	15.5	15.38	1.01	0.00	0.961	0.968
	2	aux	802.11ac	VHT80	Back	0	58	5290	15.5	15.38	1.01	0.00	0.0874	0.0881
Subsequent Test configuration of Honglin Main Antenna														
	2	main	802.11a	OFDM	Edge_1	0	56	5280	15.5	15.43	1.00	0.00	1.02	1.02
	2	main	802.11a	OFDM	Edge_1	0	60	5300	15.5	15.3	1.01	0.00	0.951	0.96

Note:

1. **When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the largest channel bandwidth configuration is selected for initial test.**
2. **Subsequent test configurations is required for "Ant Type 2 (Honglin)" main antenna, due the adjusted SAR is >1.2W/kg.**
3. **"*", repeated SAR is required, per KDB865664 D01 r01v04.**

■ Tablet Mode- U-NII-1_WLAN 5.2GHz

Plot No.	Ant Type	Ant Port	Band	Mode	Test Position	Dist. mm	Ch.	Fre.	Max.Tune-up Power(dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift(dB)	Measured SAR-1g(W/kg)	Scaled SAR-1g(W/kg)
Initial Test configurations of Honglin Main Antenna														
03	2	main	802.11a	VHT80	Edge_1	0	42	5210	15.5	15.33	1.01	0.00	1.10	**1.11**
	2	main	802.11a	VHT80	Edge_1*	0	42	5210	15.5	15.33	1.01	0.00	1.08	1.09
	2	main	802.11a	VHT80	Back	0	42	5210	15.5	15.33	1.01	0.00	0.074	0.075

Note:

1. **Due to U-NII-1 and U-NII-2A have the same maximum power output, also the adjusted SAR of U-NII-1 and U-NII-2A is >1.2W/kg for Honglin main antenna, therefore U-NII-1 SAR is required, per KDB 248227 D01 v02r01.**
2. **When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the largest channel bandwidth configuration is selected for initial test.**
3. **"*", repeated SAR is required, per KDB865664 D01 r01v04.**

■ Tablet Mode- U-NII-2C_ WLAN 5.6GHz

Plot No.	Ant Type	Ant Port	Band	Mode	Test Position	Dist. mm	Ch.	Fre.	Max. Tune-up Power(dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift(dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
Initial Test configuration of LUXSHARE-ICT Main&Aux Antenna														
	1	main	802.11ac	VHT80	Edge_1	0	122	5610	13.7	13.63	1.01	0.00	0.307	0.309
	1	main	802.11ac	VHT80	Back	0	122	5610	13.7	13.63	1.01	0.00	0.0247	0.0248
	1	aux	802.11ac	VHT80	Edge_1	0	122	5610	13.7	13.58	1.01	0.00	0.334	0.337
	1	aux	802.11ac	VHT80	Back	0	122	5610	13.7	13.58	1.01	0.00	0.0259	0.03
Initial Test configuration of Honglin Main&Aux Antenna														
04	2	main	802.11ac	VHT80	Edge_1	0	122	5610	13.7	13.63	1.01	0.00	0.765	**0.769**
	2	main	802.11ac	VHT80	Back	0	122	5610	13.7	13.63	1.01	0.00	0.0533	0.0536
	2	aux	802.11ac	VHT80	Edge_1	0	122	5610	13.7	13.58	1.01	0.00	0.415	0.419
	2	aux	802.11ac	VHT80	Back	0	122	5610	13.7	13.58	1.01	0.00	0.0216	0.0218

Note:

1. **When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the largest channel bandwidth configuration is selected for initial test.**
2. **Subsequent test configurations is not required, due the adjusted SAR is ≤1.2W/kg.**

■ Tablet Mode- U-NII-3_ WLAN 5.8GHz

Plot No.	Ant Type	Ant Port	Band	Mode	Test Position	Dist. mm	Ch.	Fre.	Max. Tune-up Power(dBm)	Measured Conducted Power (dBm)	Scaling Factor	Power Drift(dB)	Measured SAR-1g (W/kg)	Scaled SAR-1g (W/kg)
Initial Test configuration of LUXSHARE-ICT Main&Aux Antenna														
	1	main	802.11ac	VHT80	Edge_1	0	155	5775	15.0	14.81	1.01	0.00	0.35	0.35
	1	main	802.11ac	VHT80	Back	0	155	5775	15.0	14.81	1.01	0.00	0.0341	0.0345
	1	Aux	802.11ac	VHT80	Edge_1	0	155	5775	15.0	14.75	1.02	0.00	0.376	0.382
	1	Aux	802.11ac	VHT80	Back	0	155	5775	15.0	14.75	1.02	0.00	0.0403	0.0410
Initial Test configuration of Honglin Main&Aux Antenna														
05	2	main	802.11ac	VHT80	Edge_1	0	155	5775	15.0	14.81	1.01	0.00	0.927	**0.939**
	2	main	802.11ac	VHT80	Edge_1*	0	155	5775	15.0	14.81	1.01	0.00	0.922	0.934
	2	main	802.11ac	VHT80	Back	0	155	5775	15.0	14.81	1.01	0.00	0.0763	0.0773
	2	Aux	802.11ac	VHT80	Edge_1	0	155	5775	15.0	14.75	1.02	0.00	0.552	0.56
	2	Aux	802.11ac	VHT80	Back	0	155	5775	15.0	14.75	1.02	0.00	0.0414	0.0421

Note:

1. **When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the largest channel bandwidth configuration is selected for initial test.**
2. **"*", repeated SAR is required, per KDB865664 D01 r01v04.**

8. Simultaneous Transmission Analysis

8.1. Max. Simultaneous SAR

■**WLAN+ Bluetooth**

LUXSHARE-ICT Antenna

Configurations	Test Position	WLAN SAR(W/kg)	BT SAR(W/kg)	∑ SAR(W/kg)
WLAN(DTS) + BT(DSS)	Body-Back	0.001	0.11	0.111
	Body-Edge_1	0.100	0.29	0.39
	Body-Edge_2	0.4	0.4	0.8
	Body-Edge_3	0.4	0.4	0.8
	Body-Edge_4	0.4	0.4	0.8
WLAN(UNII) + BT(DSS)	Body-Back	0.043	0.11	0.153
	Body-Edge_1	0.382	0.29	0.672
	Body-Edge_2	0.4	0.4	0.8
	Body-Edge_3	0.4	0.4	0.8
	Body-Edge_4	0.4	0.4	0.8

Honglin Antenna

Configurations	Test Position	WLAN SAR(W/kg)	BT SAR(W/kg)	∑ SAR(W/kg)
WLAN(DTS) + BT(DSS)	Body-Back	0.005	0.11	0.115
	Body-Edge_1	0.186	0.29	0.476
	Body-Edge_2	0.4	0.4	0.8
	Body-Edge_3	0.4	0.4	0.8
	Body-Edge_4	0.4	0.4	0.8
WLAN(UNII) + BT(DSS)	Body-Back	0.105	0.11	0.215
	Body-Edge_1	1.27	0.29	**1.56**
	Body-Edge_2	0.4	0.4	0.8
	Body-Edge_3	0.4	0.4	0.8
	Body-Edge_4	0.4	0.4	0.8

Note: An estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR for test separate-on distances >50mm per 447498 D01v05r02.

8.2. Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05r02.

9. Measurement Uncertainty

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std.Unc. (1g)	Std. nc. (10g)	(vi) veff
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Modulation Response	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max.SAR Eval.	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Power Scalingp	±0%	R	$\sqrt{3}$	0	0	±0%	±0%	∞
Phantom and Setup								
Phantom Uncertainty	±6.1%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%	∞
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)DAK	±2.5%	R	$\sqrt{3}$	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (mea.)DAK	±2.5%	R	$\sqrt{3}$	0.26	0.26	±0.3%	±0.4%	∞
Temp. unc. –ConductivityBB	±3.4%	R	$\sqrt{3}$	0.78	0.71	±1.5%	±1.4%	∞
Temp. unc. – PermittivityBB	±0.4%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%	∞
Combined Std. Uncertainty						±11.2%	±11.1%	361
Expanded STD Uncertainty(k=2)						**±22.3%**	**±22.2%**	

DASY5 Uncertainty Budget, according to IEEE 1528/2011 and IEC 62209-1/2011(0.3-3GHz)

Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std.Unc. (1g)	Std. nc. (10g)	(vi) veff
Measurement System								
Probe Calibration	±6.55%	N	1	0	0			
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Modulation Response[m]	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Probe Positioning	±6.7%	R	$\sqrt{3}$	1	1	±3.9%	±3.9%	∞
Max.SAR Eval.	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Power Scaling[p]	±0%	R	$\sqrt{3}$	0	0	±0%	±0%	∞
Phantom and Setup								
Phantom Uncertainty	±6.6%	R	$\sqrt{3}$	1	1	±3.8%	±3.8%	∞
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)[DAK]	±2.5%	R	$\sqrt{3}$	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (mea.)[DAK]	±2.5%	R	$\sqrt{3}$	0.26	0.26	±0.3%	±0.4%	∞
Temp. unc. –Conductivity[BB]	±3.4%	R	$\sqrt{3}$	0.78	0.71	±1.5%	±1.4%	∞
Temp. unc. – Permittivity[BB]	±0.4%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%	∞
Combined Std. Uncertainty						±12.3%	±12.2%	748
Expanded STD Uncertainty(Coverage factor=2)						**±24.6%**	**±24.5%**	

DASY5 Uncertainty Budget, according to IEEE 1528/2011 and IEC 62209-1/2011(3-6GHz)

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