

# FCC SAR Test Report

## FCC ID: HFSQTA-TP00126A

**Report No.** : BTL-FCC-1-2006T132  
**Equipment** : Notebook Computer  
**Model Name** : TP00126A  
**Series Model** : Lenovo ThinkPad C13 Yoga Gen 1 Chromebook\*\*\*\*\*  
(x=0~9, A~z, "-" or blank)  
**Brand Name** : Lenovo  
**Applicant** : Lenovo Japan LLC  
**Address** : Minatomirai Center Building 21F 3-6-1 Minatomirai, Nishi-ku,  
Yokohama-shi Kanagawa 220-0012  
**Date of Receipt** : July. 6, 2020  
**Date of Test** : July. 7, 2020 ~ July 9, 2020, September. 11, 2020  
**Issued Date** : September. 14, 2020

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL In

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The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

**Limitation**

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

<b>Table of Contents</b>	<b>Page</b>
<b>1 . GENERAL INFORMATION</b>	<b>6</b>
1.1 GENERAL DESCRIPTION OF EUT	6
<b>2 RF EMISSIONS MEASUREMENT</b>	<b>7</b>
2.1 TEST FACILITY	7
2.2 MEASUREMENT UNCERTAINTY	7
2.3 WLAN ANTENNA INFORMATION:	9
2.4 THE MAXIMUM SAR 1G VALUES	10
2.5 LABORATORY ENVIRONMENT	10
2.6 MAIN TEST INSTRUMENTS	11
<b>3 SAR MEASUREMENTS SYSTEM CONFIGURATION</b>	<b>12</b>
3.1 SAR MEASUREMENT SET-UP	12
3.1.1 TEST SETUP LAYOUT	12
3.2 DASY5 E-FIELD PROBE SYSTEM	13
3.2.1 EX3DV4 PROBE SPECIFICATION	13
3.2.2 E-FIELD PROBE CALIBRATION	14
3.2.3 OTHER TEST EQUIPMENT	15
3.2.4 SCANNING PROCEDURE	16
3.2.5 DATA STORAGE AND EVALUATION	17
3.2.6 DATA EVALUATION BY SEMCAD	18
<b>4 TISSUE-EQUIVALENT LIQUID</b>	<b>20</b>
4.1 TISSUE-EQUIVALENT LIQUID INGREDIENTS	20
4.2 TISSUE-EQUIVALENT LIQUID PROPERTIES	20
<b>5 SYSTEM CHECK</b>	<b>21</b>
5.1 DESCRIPTION OF SYSTEM CHECK	21
5.2 DESCRIPTION OF SYSTEM CHECK	22
<b>6 OPERATIONAL CONDITIONS DURING TEST</b>	<b>23</b>
6.1 GENERAL DESCRIPTION OF TEST PROCEDURES	23
6.2 TEST POSITION OF PORTABLE DEVICES	23
6.3 TEST POSITION ANTENNA LOCATION	23
6.4 TEST POSITION	25
6.4.1 BODY TEST CONFIGURATION	25
6.5 SAR EXCLUSION CALCULATIONS FOR WI-FI ANTENNA < 50MM FROM THE USER	26
6.6 SAR EXCLUSION CALCULATIONS FOR WI-FI ANTENNA > 50MM FROM THE USER	27
<b>7 SAR MEASUREMENT VARIABILITY AND UNCERTAINTY</b>	<b>28</b>
7.1 SAR MEASUREMENT VARIABILITY	28
7.2 TEST CONFIGURATION	29
7.2.1 WIFI TEST CONFIGURATION	29
7.2.2 WLAN2.4G SAR TEST REQUIREMENTS	29
7.2.3 WLAN5G SAR TEST REQUIREMENTS	30
7.2.4 OFDM TRANSMISSION MODE AND SAR TEST CHANNEL SELECTION	30

<b>Table of Contents</b>	<b>Page</b>
7.2.5 INITIAL TEST CONFIGURATION PROCEDURE	30
<b>8 CONDUCTED POWER RESULTS</b>	<b>31</b>
8.1 CONDUCTED POWER MEASUREMENT RESULTS OF BT	31
8.2 CONDUCTED POWER MEASUREMENT RESULTS OF 2.4G BAND	32
8.3 CONDUCTED POWER MEASUREMENTS OF UNI_1	33
8.4 CONDUCTED POWER MEASUREMENTS OF UNII_2A	34
8.5 CONDUCTED POWER MEASUREMENTS OF WIFI UNII_2C	35
8.6 CONDUCTED POWER MEASUREMENTS OF WIFI UNII_3	37
8.7 SARTEST RESULTS	38
<b>9 SAR TEST RESULTS</b>	<b>39</b>
9.1 BODY SAR TEST RESULTS	39
<b>10. SIMULTANEOUS TRANSMISSION CONDITIONS</b>	<b>41</b>
10.1 STAND-ALONE SAR TEST EXCLUSION	41
10.3 ESTIMATED SAR FOR SIMULTANEOUS TRANSMISSION SAR ANALYSIS	43
10.3.1 ESTIMATED SAR FOR BLUETOOTH	43
10.2 SIMULTANEOUS TRANSMISSION CONDITIONS	44
<b>11. TEST LAYOUT</b>	<b>45</b>

**REPORT ISSUED HISTORY**

Report Version	Description	Issued Date
R00	Original Issue.	2020/7/23
R01	1.Add Wi-Fi 2.4G channel 12 & 13 test result for page 40. 2.Add Wi-Fi 2.4G channel 12 & 13 conducted power for page 32.	2020/9/14

## 1.. GENERAL INFORMATION

### 1.1. GENERAL DESCRIPTION OF EUT

<b>Equipment</b>	Notebook Computer	
<b>Brand Name</b>	Lenovo	
<b>Model Name</b>	TP00126A	
<b>Series Model</b>	Lenovo ThinkPad C13 Yoga Gen 1 Chromebook***** (x=0~9, A~z, "-" or blank)	
<b>Model Name Difference</b>	Market segmentation	
<b>Battery Information</b>	Band: Lonovo Model: L19L4PG2 Rating: 8.8V/6368mAh	
<b>Frequency Range</b>	WLAN 2.4 GHz Band:	2400 MHz ~ 2483.5 MHz
	RLAN 5 GHz Band:	5150 MHz ~ 5250 MHz 5250 MHz ~ 5350 MHz 5470 MHz ~ 5725 MHz 5725 MHz ~ 5850 MHz
	Bluetooth:	2400 MHz ~ 2483.5 MHz
<b>Operation Frequency</b>	WLAN 2.4 GHz Band:	2412 MHz ~ 2472 MHz
	RLAN 5 GHz Band:	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5700 MHz 5745 MHz ~ 5825 MHz
	Bluetooth:	2402 MHz ~ 2480 MHz
<b>Standard(s)</b>	<b>ANSI Std C95.1:2019</b> Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.( IEEE Std C95.1-2019)  <b>IEEE Std 1528:2013</b> Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques  <b>KDB447498 D01</b> General RF Exposure Guidance v06 <b>KDB248227 D01</b> 802. 11 Wi-Fi SAR v02r02 <b>KDB865664 D01</b> SAR measurement 100 MHz to 6 GHz v01r04 <b>KDB865664 D02</b> SAR Reporting v01r02 <b>KDB616217 D04</b> SAR for laptop and tablets v01r02	

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC-SAR-1-2006T132) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).

## 2. RF EMISSIONS MEASUREMENT

### 2.1. TEST FACILITY

The test facilities used to collect the test data in this report is **SAR Test room** at the location of No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan.

### 2.2. MEASUREMENT UNCERTAINTY

Uncertainty Budget for Frequency range of 300 MHz to 3 GHz

Error Description	Uncertainty Value ( $\pm$ %)		Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)	Vi V <sub>eff</sub>
<b>Measurement System</b>									
Probe Calibration	6.05		Normal	1	1	1	$\pm 6.05$ %	$\pm 6.05$ %	$\infty$
Axial Isotropy	4.7		Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9$ %	$\pm 1.9$ %	$\infty$
Hemispherical Isotropy	9.6		Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.9$ %	$\pm 3.9$ %	$\infty$
Boundary Effects	1		Rectangular	$\sqrt{3}$	1	1	$\pm 0.6$ %	$\pm 0.6$ %	$\infty$
Linearity	4.7		Rectangular	$\sqrt{3}$	1	1	$\pm 2.7$ %	$\pm 2.7$ %	$\infty$
Detection Limits	1		Rectangular	$\sqrt{3}$	1	1	$\pm 0.6$ %	$\pm 0.6$ %	$\infty$
Modulation response	2.4		Rectangular	$\sqrt{3}$	1	1	$\pm 1.4$ %	$\pm 1.4$ %	$\infty$
Readout Electronics	0.3		Normal	1	1	1	$\pm 0.3$ %	$\pm 0.3$ %	$\infty$
Response Time	0.8		Rectangular	$\sqrt{3}$	1	1	$\pm 0.5$ %	$\pm 0.5$ %	$\infty$
Integration Time	2.6		Rectangular	$\sqrt{3}$	1	1	$\pm 1.5$ %	$\pm 1.5$ %	$\infty$
RF Ambient – Noise	3		Rectangular	$\sqrt{3}$	1	1	$\pm 1.7$ %	$\pm 1.7$ %	$\infty$
RF Ambient– Reflections	3		Rectangular	$\sqrt{3}$	1	1	$\pm 1.7$ %	$\pm 1.7$ %	$\infty$
Probe Positioner	0.4		Rectangular	$\sqrt{3}$	1	1	$\pm 0.2$ %	$\pm 0.2$ %	$\infty$
Probe Positioning	2.9		Rectangular	$\sqrt{3}$	1	1	$\pm 1.7$ %	$\pm 1.7$ %	$\infty$
Max.SAR Evaluation	2		Rectangular	$\sqrt{3}$	1	1	$\pm 1.15$ %	$\pm 1.15$ %	$\infty$
<b>Test Sample Related</b>									
Device Positioning	1.6	1.8	Normal	1	1	1	$\pm 1.6$ %	$\pm 1.8$ %	145
Device Holder	1.5	1.7	Normal	1	1	1	$\pm 1.5$ %	$\pm 1.7$ %	5
Power Drift	5.0		Rectangular	$\sqrt{3}$	1	1	$\pm 2.9$ %	$\pm 2.9$ %	$\infty$
<b>Phantom and Setup</b>									
Phantom Production Tolerances	6.1		Rectangular	$\sqrt{3}$	1	1	3.52	3.52	$\infty$
SAR correction	1.9		Rectangular	$\sqrt{3}$	1	0.84	1.10	1.10	
Liquid Conductivity (mea.)	2.4		Rectangular	$\sqrt{3}$	0.78	0.71	1.08	1.08	$\infty$
Liquid Permittivity (mea.)	2.4		Rectangular	$\sqrt{3}$	0.26	0.26	0.36	0.36	$\infty$
Temp. unc. - Conductivity	3.4		Rectangular	$\sqrt{3}$	0.78	0.71	1.53	1.53	$\infty$
Temp. unc. - Permittivity	0.4		Rectangular	$\sqrt{3}$	0.23	0.26	0.05	0.05	$\infty$
<b>Combined Standard Uncertainty (K = 1)</b>							$\pm 10.42$ %	$\pm 10.48$ %	361
<b>Expanded Uncertainty (K = 2)</b>							$\pm 20.84$ %	$\pm 20.97$ %	

## Uncertainty Budget for Frequency range of 3 GHz to 6 GHz

Error Description	Uncertainty Value ( $\pm$ %)		Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)	$V_i V_{eff}$
<b>Measurement System</b>									
Probe Calibration	6.65		Normal	1	1	1	$\pm 6.65$ %	$\pm 6.65$ %	$\infty$
Axial Isotropy	4.7		Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 1.9$ %	$\pm 1.9$ %	$\infty$
Hemispherical Isotropy	9.6		Rectangular	$\sqrt{3}$	0.7	0.7	$\pm 3.9$ %	$\pm 3.9$ %	$\infty$
Boundary Effects	2		Rectangular	$\sqrt{3}$	1	1	$\pm 1.2$ %	$\pm 1.2$ %	$\infty$
Linearity	4.7		Rectangular	$\sqrt{3}$	1	1	$\pm 2.7$ %	$\pm 2.7$ %	$\infty$
Detection Limits	1		Rectangular	$\sqrt{3}$	1	1	$\pm 0.6$ %	$\pm 0.6$ %	$\infty$
Modulation response	2.4		Rectangular	$\sqrt{3}$	1	1	$\pm 1.4$ %	$\pm 1.4$ %	$\infty$
Readout Electronics	0.3		Normal	1	1	1	$\pm 0.3$ %	$\pm 0.3$ %	$\infty$
Response Time	0.8		Rectangular	$\sqrt{3}$	1	1	$\pm 0.5$ %	$\pm 0.5$ %	$\infty$
Integration Time	2.6		Rectangular	$\sqrt{3}$	1	1	$\pm 1.5$ %	$\pm 1.5$ %	$\infty$
RF Ambient – Noise	3		Rectangular	$\sqrt{3}$	1	1	$\pm 1.7$ %	$\pm 1.7$ %	$\infty$
RF Ambient– Reflections	3		Rectangular	$\sqrt{3}$	1	1	$\pm 1.7$ %	$\pm 1.7$ %	$\infty$
Probe Positioner	0.4		Rectangular	$\sqrt{3}$	1	1	$\pm 0.2$ %	$\pm 0.2$ %	$\infty$
Probe Positioning	6.7		Rectangular	$\sqrt{3}$	1	1	$\pm 3.9$ %	$\pm 3.9$ %	$\infty$
Max.SAR Evaluation	4		Rectangular	$\sqrt{3}$	1	1	$\pm 2.3$ %	$\pm 2.3$ %	$\infty$
<b>Test Sample Related</b>									
Device Positioning	1.6	1.8	Normal	1	1	1	$\pm 1.6$ %	$\pm 1.8$ %	145
Device Holder	1.5	1.7	Normal	1	1	1	$\pm 1.5$ %	$\pm 1.7$ %	5
Power Drift	5.0		Rectangular	$\sqrt{3}$	1	1	$\pm 2.9$ %	$\pm 2.9$ %	$\infty$
<b>Phantom and Setup</b>									
Phantom Production Tolerances	6.6		Rectangular	$\sqrt{3}$	1	1	3.81	3.81	$\infty$
SAR correction	1.9		Rectangular	$\sqrt{3}$	1	0.84	1.10	0.92	
Liquid Conductivity (mea.)	2.4		Rectangular	$\sqrt{3}$	0.78	0.71	1.08	0.98	$\infty$
Liquid Permittivity (mea.)	2.4		Rectangular	$\sqrt{3}$	0.26	0.26	0.36	0.36	$\infty$
Temp. unc. - Conductivity	3.4		Rectangular	$\sqrt{3}$	0.78	0.71	1.53	1.39	$\infty$
Temp. unc. - Permittivity	0.4		Rectangular	$\sqrt{3}$	0.23	0.26	0.05	0.06	$\infty$
<b>Combined Standard Uncertainty (K = 1)</b>							$\pm 11.65$ %	$\pm 11.66$ %	361
<b>Expanded Uncertainty (K = 2)</b>							$\pm 23.29$ %	$\pm 23.33$ %	



## 2.3 WLAN Antenna Information:

### Tablet Mode

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	ICT	SA30Z18922	PIFA Antenna	2400-2500	-2.6
				5150-5350	-0.9
				5740-5725	-2.5
				5725-5875	-2.5
Aux	ICT	SA30Z18923	PIFA Antenna	2400-2500	-1.1
				5150-5350	-2.6
				5740-5725	-3.6
				5725-5875	-5.7

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	AWAN	SA30Z18927	PIFA Antenna	2400-2500	-0.39
				5150-5350	0.21
				5740-5725	-1.28
				5725-5875	-0.64
Aux	AWAN	SA30Z18928	PIFA Antenna	2400-2500	-1.48
				5150-5350	-0.25
				5740-5725	-1.22
				5725-5875	-1.22

### NB Mode

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	ICT	SA30Z18922	PIFA Antenna	2400-2500	-2.3
				5150-5350	1.6
				5740-5725	1.9
				5725-5875	1.9
Aux	ICT	SA30Z18923	PIFA Antenna	2400-2500	-2.3
				5150-5350	1.1
				5740-5725	1.2
				5725-5875	2.0

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	AWAN	SA30Z18927	PIFA Antenna	2400-2500	-2.11
				5150-5350	1.94
				5740-5725	1.61
				5725-5875	1.47
Aux	AWAN	SA30Z18928	PIFA Antenna	2400-2500	-1.73
				5150-5350	1.78
				5740-5725	0.71
				5725-5875	0.52

## 2.4 The Maximum SAR 1g Values

Ant	Mode	Highest Body Reported SAR-1g(W/kg)
FHSS	Bluetooth_DH5	0.146
DTS	WLAN 2.4G	1.047
UNII	UNII_1	1.175
	UNII_2a	1.320
	UNII_2c	1.483
	UNII_3	1.125

Note:

- 1) The device is in compliance with Specific Absorption Rate(SAR)for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:2019/IEEE C95.1:2019, the NCRP Report Number 86 for uncontrolled environment and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 .

## 2.5 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25°C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

## 2.6 Main Test Instruments

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1486	June. 04, 2020	1 Year
2	E-field Probe	Speag	EX3DV4	7369	May. 29, 2020	1 Year
3	System Validation Dipole	Speag	D2450V2	973	Sep. 21, 2018	3 Year
4	System Validation Dipole	Speag	D5GHzV2	1221	Sep. 28, 2018	3 Year
5	ELI4 Phantom	Speag	ELI4 Phantom V5.0	1240	N/A	N/A
6	ENA Network Analyzer	Agilent	E5071C	MY46524658	Apr. 07, 2020	1 Year
7	EXG Vector Signal Generator	Agilent	N5172B	MY53051229	Jun. 20, 2020	1 Year
8	Spectrum Analyzer	Keysight	N9010A	MY54200240	Jun. 11, 2020	1 Year
9	Power Meter	Anritsu	ML2495A	1128008	Jun. 11, 2020	1 Year
10	Power Sensor	Anritsu	MA2411B	1126001	Jun. 11, 2020	1 Year
11	Dielectric Probe Kit	Agilent	85070E	2593	N/A	N/A
12	Low pass filter	Mini-Circuits	SLP-2950+	M108294	N/A	N/A
13	Power Amplifier	Mini-Circuits	ZVE-2W-272+	N650001538	N/A	N/A
14	Power Amplifier	Mini-Circuits	ZVE-8G+	N628801631	N/A	N/A

Remark: "N/A" denotes no model name, serial No. or calibration specified.

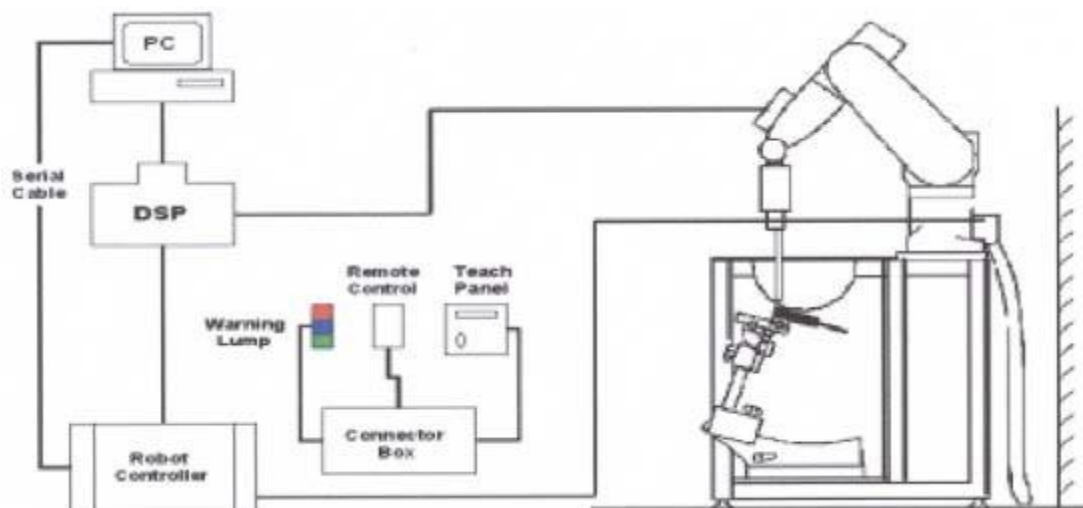
### 3. SAR MEASUREMENTS SYSTEM CONFIGURATION

#### 3.1. SAR Measurement Set-up

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

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. 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.
3. A data acquisition electronic (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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows.
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

##### 3.1.1. TEST SETUP LAYOUT

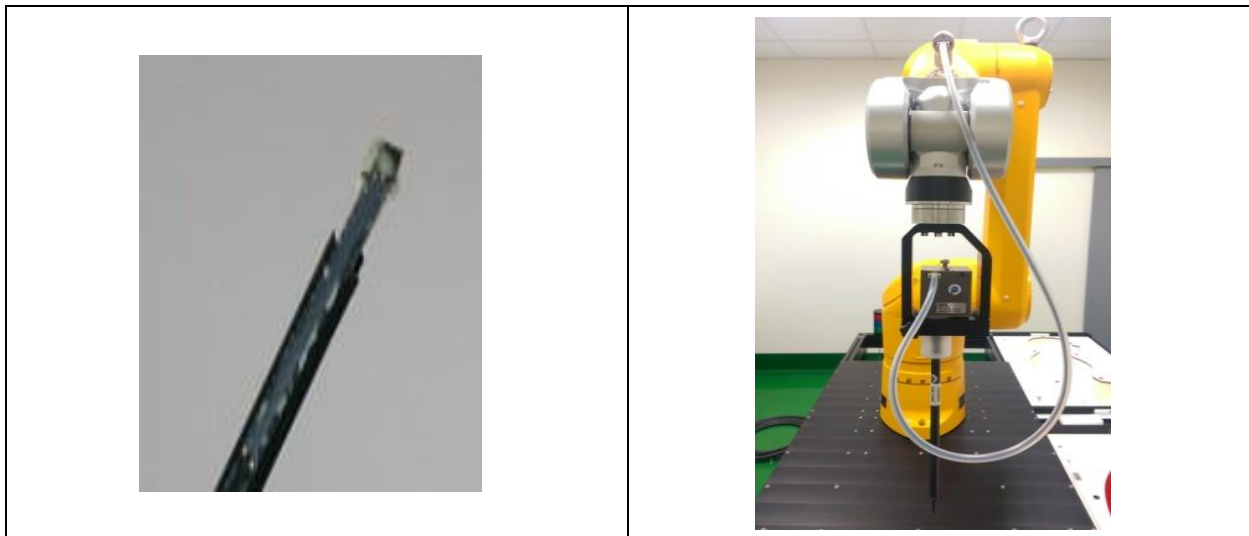


### 3.2. DASYS E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### 3.2.1. EX3DV4 PROBE SPECIFICATION

<b>Construction</b>	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
<b>Calibration</b>	ISO/IEC 17025 calibration service available
<b>Frequency</b>	10 MHz to 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
<b>Directivity</b>	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
<b>Dynamic Range</b>	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB
<b>Dimensions</b>	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



EX3DV4 E-field Probe

### 3.2.2. E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$\text{SAR} = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

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

Where:  $\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).


### 3.2.3. OTHER TEST EQUIPMENT


#### 3.2.3.1. Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extensor is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

**Material:** POM, Acrylic glass, Foam

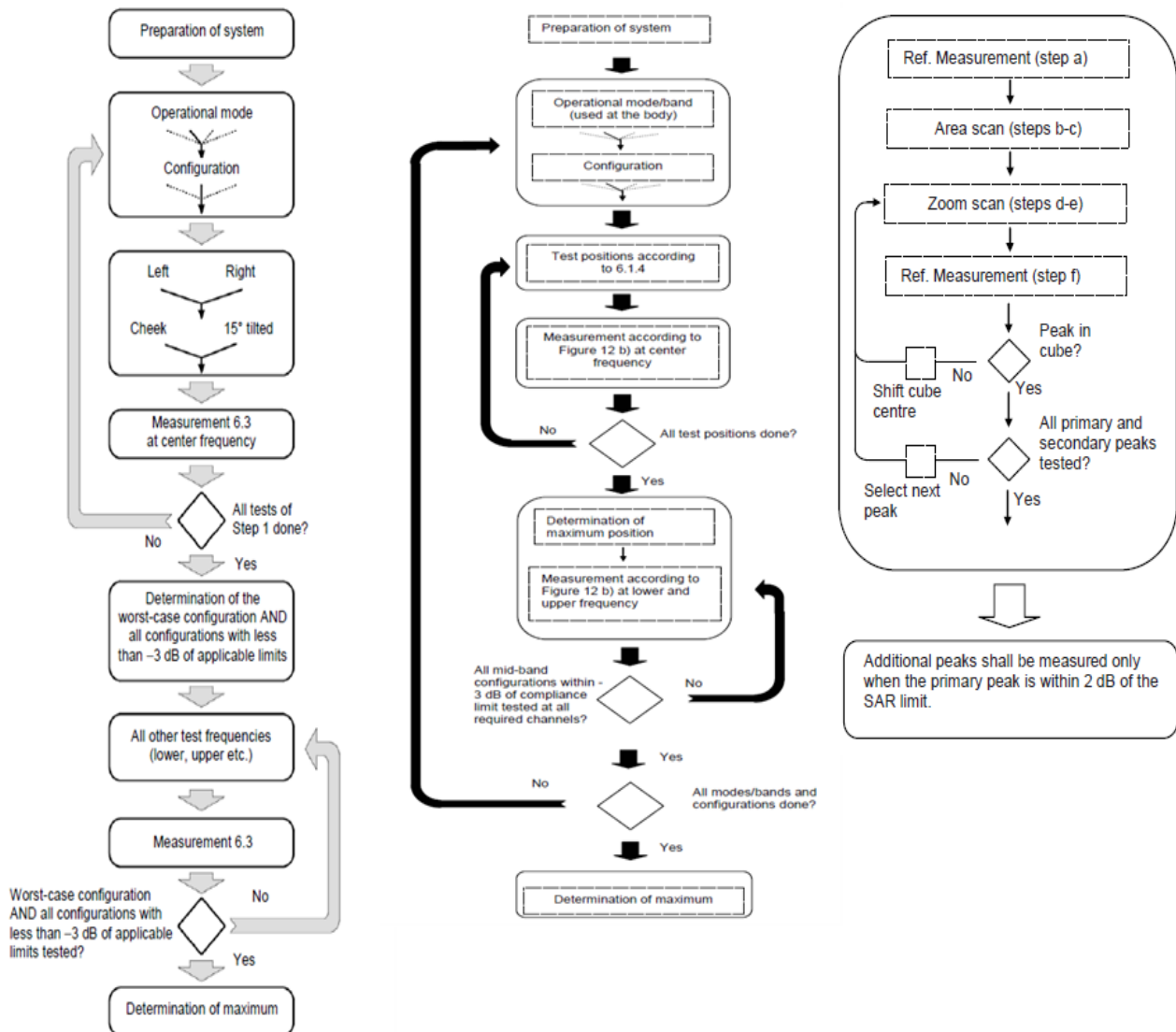
#### 3.2.3.2 Phantom

Model	ELI4 Phantom	
<b>Construction</b>	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI 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 compatible with all SPEAG dosimetric probes and dipoles.	
<b>Shell Thickness</b>	2±0.1 mm	
<b>Filling Volume</b>	Approx. 30 liters	
<b>Dimensions</b>	Length: 600 mm ; Width: 190mm Height: adjustable feet	
<b>Available</b>	Special	

Model	Twin SAM	
<b>Construction</b>	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. 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 teaching three points with the robot.	
<b>Shell Thickness</b>	2 ± 0.2 mm	
<b>Filling Volume</b>	Approx. 25 liters	
<b>Dimensions</b>	Length:1000mm; Width: 500mm Height: adjustable feet	
<b>Available</b>	Special	

### 3.2.4. SCANNING PROCEDURE

The SAR test against the head and body-worn phantom was carried out as follow:



After an area scan has been done at a fixed distance of 1.4mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

Above is the scanning procedure flow chart and table from the IEEE1528 standard.

This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behavior are tested.



### **3.2.5. DATA STORAGE AND EVALUATION**

#### **3.2.5.1 Data Storage**

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension "DAE4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### 3.2.6. DATA EVALUATION BY SEMCAD

The SEMCAD 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	Normi, a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub>
	Conversion factor	ConvF <sub>i</sub>
	Diode compression point	Dcp <sub>i</sub>
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter 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:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With	V <sub>i</sub> = compensated signal of channel i	(i = x, y, z)
	U <sub>i</sub> = input signal of channel i	(i = x, y, z)
	cf = crest factor of exciting field	(DASY parameter)
	dcp <sub>i</sub> = diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E-field probes: } E_i = ( V_i / \text{Norm}_i \cdot \text{ConvF} )^{1/2}$$

$$\text{H-field probes: } H_i = ( V_i )^{1/2} \cdot ( a_{i0} + a_{i1} f + a_{i2} f^2 ) / f$$

With  $V_i$  = compensated signal of channel i ( i = x, y, z )

$\text{Norm}_i$  = sensor sensitivity of channel i ( i = x, y, z )  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$\text{ConvF}$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel i in V/m

$H_i$  = magnetic field strength of channel i in A/m

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

$$E_{\text{tot}} = ( E_X^2 + E_Y^2 + E_Z^2 )^{1/2}$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = ( E_{\text{tot}} )^2 \cdot \sigma / ( \rho \cdot 1000 )$$

With  $\text{SAR}$  = local specific absorption rate in mW/g

$E_{\text{tot}}$  = total field strength in V/m  
= conductivity in [mho/m] or [Siemens/m]  
= equivalent tissue density in g/cm<sup>3</sup>

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 to be a free space field.

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

With  $P_{\text{pwe}}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{\text{tot}}$  = total field strength in V/m

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

## 4. TISSUE-EQUIVALENT LIQUID

### 4.1. Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt and Glycol, Sugar, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The measured conductivity and relative permittivity should be within  $\pm 5\%$  of the target values. The below table shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEC 62209.

#### Composition of the Tissue Equivalent Matter

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Head 2450	-	45.0	-	0.1	-	-	54.9	-
Head 5G	-	-	-	-	-	17.2	65.5	17.3

### 4.2. Tissue-equivalent Liquid Properties

#### Dielectric Performance of Tissue Simulating Liquid

Tissue Verification									
Date	Tissue Type	Frequency (MHz)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Targeted Conductivity ( $\sigma$ )	Targeted Permittivity ( $\epsilon_r$ )	Deviation Conductivity ( $\sigma$ ) (%)	Deviation Permittivity ( $\epsilon_r$ ) (%)	Limit (%) $\pm 5$
2020/7/8	Head	2450	1.79	39.10	1.80	39.20	-0.44	-0.26	$\pm 5$
2020/7/9	Head	5200	4.66	35.99	4.66	36.00	-0.11	-0.04	$\pm 5$
2020/7/9	Head	5300	4.76	35.87	4.76	35.90	-0.06	-0.08	$\pm 5$
2020/7/9	Head	5600	5.07	35.53	5.07	35.50	-0.10	0.08	$\pm 5$
2020/7/9	Head	5800	5.27	35.30	5.27	35.30	0.08	0.00	$\pm 5$
2020/9/11	Head	2450	1.87	38.29	1.80	39.20	3.94	-2.32	$\pm 5$

Note:

- 1)The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
- 2)KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
- 3)The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.
- 4) According to FCC TCB workshop April, 2019 RF Exposure Procedures Update(Effective February 19,2019, FCC has permitted the use of single head-tissue simulating liquid specified in IEEE 62209-1- for all SAR tests.

## 5. SYSTEM CHECK

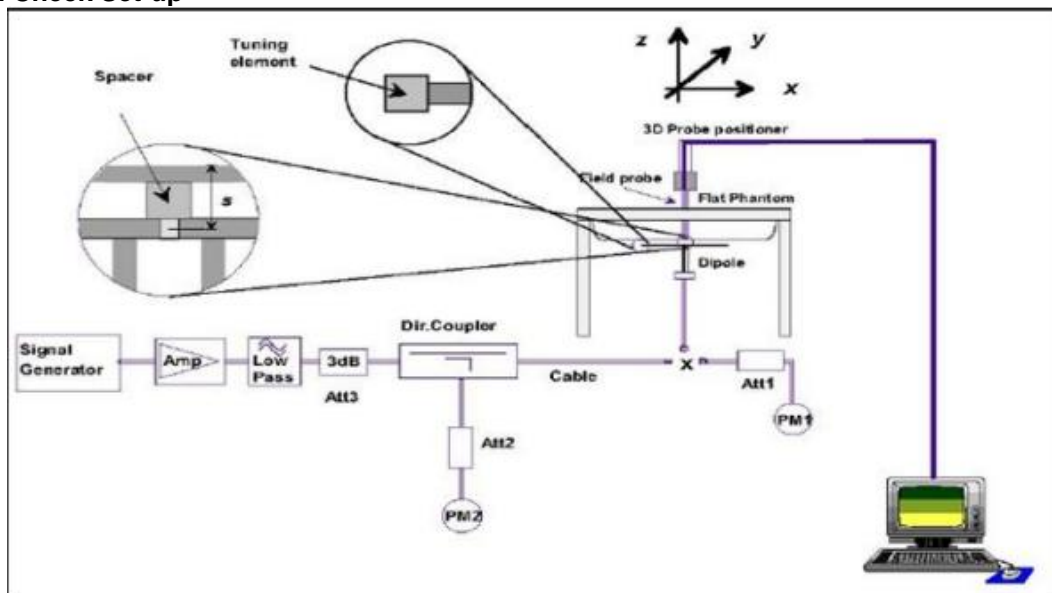
### 5.1. Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW (below 3GHz) or 100mW (3-6GHz), which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

#### System Check Set-up



## 5.2. Description of System Check

### System Check in Tissue Simulating Liquid

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

Date	System Dipole			Parameters	Target [W/kg]	Measured [W/kg]	Deviation [%]	Limited [%]
	Type	Serial No.	Liquid					
2020/7/8	D2450V2	973	Head	1g SAR	51.9	49.2	-5.20	± 10
2020/7/9	D5GHzV2 (5.2GHz)	1221	Head	1g SAR	76.8	72.8	-5.21	± 10
2020/7/9	D5GHzV2 (5.3GHz)	1221	Head	1g SAR	79.0	78.5	-0.63	± 10
2020/7/9	D5GHzV2 (5.6GHz)	1221	Head	1g SAR	80.3	74.9	-6.72	± 10
2020/7/9	D5GHzV2 (5.8GHz)	1221	Head	1g SAR	76.9	74.7	-2.86	± 10
2020/9/11	D2450V2	973	Head	1g SAR	51.9	49.2	-5.20	± 10

## 6. OPERATIONAL CONDITIONS DURING TEST

### 6.1. General Description of Test Procedures

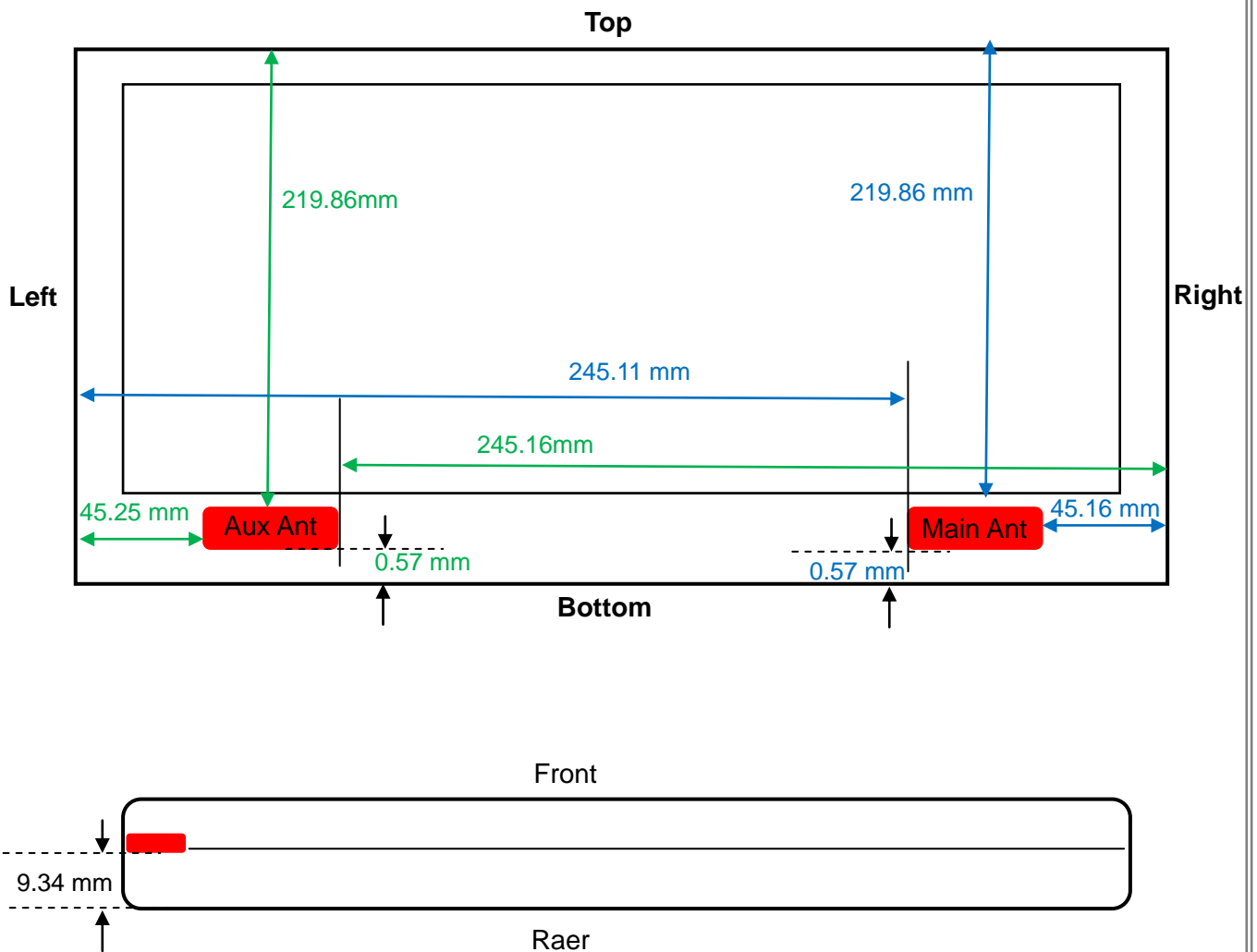
Connection to the EUT is established via air interface with base station An, and the EUT is Set to maximum output power by base station. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30dB.

### 6.2. Test Position of Portable Devices

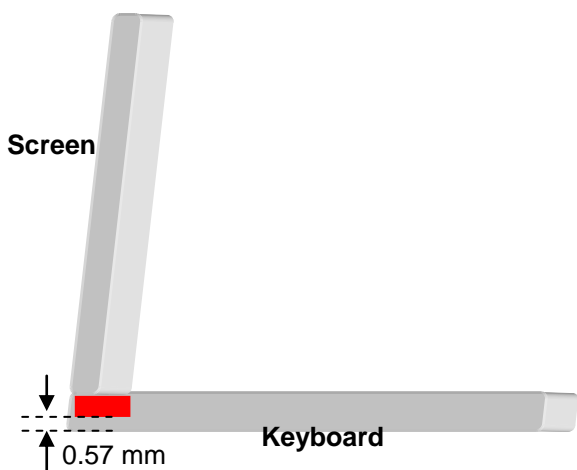
This DUT was tested in 1 different positions. They are bottom as illustrated below, which recommended by EN62209-2:

### 6.3. Test position Antenna Location

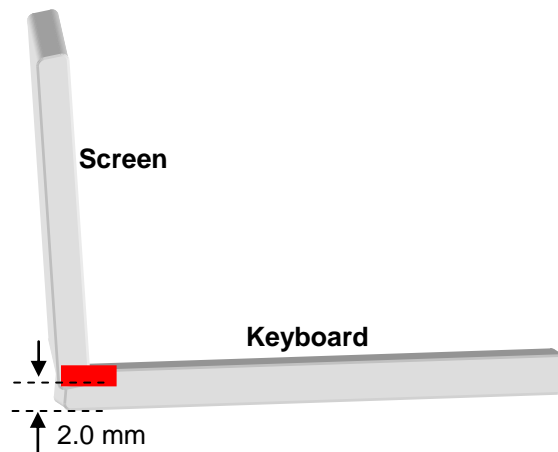
Tablet Mode



### Stand Mode



### NB Mode



Minimum Separation Distance_Tablet Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Rear	9.34	Yes
	Top	219.86	No
	Bottom	0.57	Yes
	Left	245.11	No
	Right	45.16	No
WLAN-Aux & BT	Rear	9.34	Yes
	Top	219.86	No
	Bottom	0.57	Yes
	Left	45.25	No
	Right	245.16	No

Minimum Separation Distance_NB Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Bottom	0.57	Yes
WLAN-Aux & BT	Bottom	0.57	Yes

Minimum Separation Distance_Stand Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Stand	0.57	Yes
WLAN-Aux & BT	Stand	0.57	Yes



## 6.4. Test position

### 6.4.1. Body test configuration

The SAR Exclusion Threshold in KDB 447498 D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an EUT edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned adjacent the phantom and the edge containing the antenna positioned perpendicular to the phantom.

#### SAR test reduction and exclusion guidance

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

$$\frac{(\text{max. power of channel, including tune-up tolerance, mW})}{(\text{min. test separation distance, mm})} \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

(2) The SAR exclusion threshold for distances > 50 mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

a) at 100 MHz to 1500 MHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f_{\text{(MHz)}}/150)] \text{ mW}$$

b) at > 1500 MHz and  $\leq 6$  GHz

$$[\text{Power allowed at numeric Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$$

## 6.5 SAR Exclusion Calculations for Wi-Fi Antenna < 50mm from the User

### NB Mode & Stand Mode

According to KDB 447498 v06 in section 4.3.1, if the calculated threshold value is > 3 then SAR testing is required.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)		Calculated Threshold Value	
			dBm	mW	NB Bottom	Stand	Rear	Right
Wi-Fi Main	2.4GHz	2437	15.00	32.00	2.00	2.00	24.98	24.98
	5.2GHz	5210	13.50	22.00	2.00	2.00	25.11	25.11
	5.3GHz	5290	13.50	22.00	2.00	2.00	25.30	25.30
	5.5GHz	5530	13.50	22.00	2.00	2.00	25.87	25.87
	5.8GHz	5775	13.50	22.00	2.00	2.00	26.43	26.43
Wi-Fi Aux	2.4GHz	2437	15.00	32.00	2.00	2.00	24.98	24.98
	5.2GHz	5210	13.50	22.00	2.00	2.00	25.11	25.11
	5.3GHz	5290	13.50	22.00	2.00	2.00	25.30	25.30
	5.5GHz	5530	13.50	22.00	2.00	2.00	25.87	25.87
	5.8GHz	5775	13.50	22.00	2.00	2.00	26.43	26.43
Bluetooth	Bluetooth	2440	10.50	11.00	2.00	2.00	8.59	8.59

### Tablet Mode

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Top	Right	Left	Bottom	Rear	Top	Right	Left	Bottom
Wi-Fi Main	2.4GHz	2437	15.00	32.00	9.34	<b>219.86</b>	45.16	<b>245.11</b>	2.00	5.35	>200mm	1.11	>200mm	24.98
	5.2GHz	5210	13.50	22.00	9.34	<b>219.86</b>	45.16	<b>245.11</b>	2.00	5.38	>200mm	1.11	>200mm	25.11
	5.3GHz	5290	13.50	22.00	9.34	<b>219.86</b>	45.16	<b>245.11</b>	2.00	5.42	>200mm	1.12	>200mm	25.30
	5.5GHz	5530	13.50	22.00	9.34	<b>219.86</b>	45.16	<b>245.11</b>	2.00	5.54	>200mm	1.15	>200mm	25.87
	5.8GHz	5775	13.50	22.00	9.34	<b>219.86</b>	45.16	<b>245.11</b>	2.00	5.66	>200mm	1.17	>200mm	26.43
Wi-Fi Aux	2.4GHz	2437	15.00	32.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	5.35	>200mm	>200mm	1.10	24.98
	5.2GHz	5210	13.50	22.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	5.38	>200mm	>200mm	1.11	25.11
	5.3GHz	5290	13.50	22.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	5.42	>200mm	>200mm	1.12	25.30
	5.5GHz	5530	13.50	22.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	5.54	>200mm	>200mm	1.14	25.87
	5.8GHz	5775	13.50	22.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	5.66	>200mm	>200mm	1.17	26.43
Bluetooth	Bluetooth	2440	10.50	11.00	9.34	<b>219.86</b>	<b>245.16</b>	45.25	2.00	1.84	>200mm	>200mm	0.38	8.59

## 6.6 SAR Exclusion Calculations for Wi-Fi Antenna > 50mm from the User

### NB Mode & Stand Mode

According to KDB 447498 v06, if the calculated Power threshold is less than the output power then SAR testing is required.

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)		Calculated Threshold Value	
			dBm	mW	NB Bottom	Stand	Rear	Bottom
Wi-Fi Main	2.4GHz	2437	15.0	32	2.00	0.57	<50mm	<50mm
	5.2GHz	5210	13.5	22	2.00	0.57	<50mm	<50mm
	5.3GHz	5290	13.5	22	2.00	0.57	<50mm	<50mm
	5.5GHz	5530	13.5	22	2.00	0.57	<50mm	<50mm
	5.8GHz	5775	13.5	22	2.00	0.57	<50mm	<50mm
Wi-Fi Aux	2.4GHz	2437	13.5	22	2.00	0.57	<50mm	<50mm
	5.2GHz	5210	13.5	22	2.00	0.57	<50mm	<50mm
	5.3GHz	5290	13.5	22	2.00	0.57	<50mm	<50mm
	5.5GHz	5530	13.5	22	2.00	0.57	<50mm	<50mm
	5.8GHz	5775	13.5	22	2.00	0.57	<50mm	<50mm
Bluetooth	Bluetooth	2440	10.5	11	2.00	0.57	<50mm	<50mm

### Tablet Mode

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Top	Right	Left	Bottom	Rear	Top	Right	Left	Bottom
Wi-Fi Main	2.4GHz	2437	15.0	32	9.34	219.86	45.16	245.11	2.00	<50mm	>200mm	<50mm	>200mm	<50mm
	5.2GHz	5210	13.5	22	9.34	219.86	45.16	245.11	2.00	<50mm	>200mm	<50mm	>200mm	<50mm
	5.3GHz	5290	13.5	22	9.34	219.86	45.16	245.11	2.00	<50mm	>200mm	<50mm	>200mm	<50mm
	5.5GHz	5530	13.5	22	9.34	219.86	45.16	245.11	2.00	<50mm	>200mm	<50mm	>200mm	<50mm
	5.8GHz	5775	13.5	22	9.34	219.86	45.16	245.11	2.00	<50mm	>200mm	<50mm	>200mm	<50mm
Wi-Fi Aux	2.4GHz	2437	13.5	22	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm
	5.2GHz	5210	13.5	22	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm
	5.3GHz	5290	13.5	22	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm
	5.5GHz	5530	13.5	22	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm
	5.8GHz	5775	13.5	22	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm
Bluetooth	Bluetooth	2440	10.5	11	9.34	219.86	245.16	45.25	2.00	<50mm	>200mm	>200mm	<50mm	<50mm

## 7. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

### 7.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg (~ 10% from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 8.2.

## 7.2. Test CONFIGURATION

### 7.2.1. WIFI TEST CONFIGURATION

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

#### WLAN 2.4G

Mode	802.11b	802.11g	802.11n HT20	802.11n HT40	802.11 ax20	802.11 ax40
Duty cycle	100%					
Crest factor	1					

#### WLAN 5G

Mode	802.11a	802.11n HT20	802.11n HT40	802.11 ac20	802.11 ac40	802.11 ac80	802.11 ac160
	802.11 ax20	802.11 ax40	802.11 ax80	802.11 ax160	/	/	/
Duty cycle	100%						
Crest factor	1						

For WiFi SAR testing, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 are applied.

### 7.2.2 WLAN2.4G SAR TEST REQUIREMENTS

#### 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is  $> 0.8$  W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.

#### 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. 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  $\leq 1.2$  W/kg.

### SAR Test Requirements for OFDM configurations

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

## 7.2.3 WLAN5G SAR TEST REQUIREMENTS

### ✧ U-NII-1 and U-NII-2A Band

For devices that operate in both U-NII-1 and U-NII-2A bands, 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  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR. 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  $\leq 1.2$  W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.

### ✧ U-NII-2C, U-NII-3 Bands

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification. Unless band gap channels are permanently disabled, they must be considered for SAR testing. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

## 7.2.4 OFDM TRANSMISSION MODE AND SAR TEST CHANNEL SELECTION

For the 2.4GHz and 5GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations (for example 802.11a, 802.11n and 802.11ac, or 802.11g and 802.11n, with the same channel bandwidth, modulation, and data rate, etc.), the lower order 802.11 mode (i.e. 802.11a then 802.11n and 802.11ac, or 802.11g then 802.11n) is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

## 7.2.5 INITIAL TEST CONFIGURATION PROCEDURE

For OFDM, in both 2.4G and 5GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output powers is the initial test channel. Otherwise, the channel of the transmission mode with the highest average RF output power will be the initial test configuration.

When the reported SAR is  $\leq 0.8$  W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is  $\leq 1.2$  W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurement.

## 8. CONDUCTED POWER RESULTS

### 8.1. Conducted power measurement results of BT

Band	Mode	Channel	Frequency (MHz)	Max Power (dBm)	AVG Power (dBm)
BR	DH5	0	2402	10.50	10.25
		39	2441	10.50	9.92
		78	2480	10.50	10.27
EDR	2DH5	0	2402	9.00	8.83
		39	2441	9.00	8.51
		78	2480	9.00	8.92
	3DH5	0	2402	9.00	8.85
		39	2441	9.00	8.44
		78	2480	9.00	8.94
BLE	1M	0	2402	9.00	8.71
		19	2440	9.00	7.87
		39	2480	9.00	8.07
	2M	0	2402	9.00	8.74
		19	2440	9.00	7.91
		39	2480	9.00	8.10

### 8.2. Conducted power measurement results of 2.4G Band

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)			
						Main	Aux	Main+Aux MIMO	
2.4G	802.11b	1	2412	1	15.00	14.93			
		6	2437		15.00	14.93			
		11	2462		15.00	14.87			
		12	2467		15.00	14.89			
		13	2472		15.00	14.90			
		1	2412		15.00		14.69		
		6	2437		15.00		14.84		
		11	2462		15.00		14.86		
		12	2467		15.00		14.84		
		13	2472		15.00		14.85		
		1	2412		15.00			14.96	
		6	2437		15.00			14.93	
	11	2462	15.00			14.95			
	12	2467	15.00			13.46			
	13	2472	11.00			10.65			
	1	2412	15.00				14.94		
	6	2437	15.00				14.98		
	11	2462	15.00				14.92		
	12	2467	15.00				13.44		
	13	2472	11.00				10.65		
	802.11 n20	1	2412	HTO	15.00	14.71			
		6	2437		15.00	14.93			
		11	2462		15.00	14.87			
		12	2467		15.00	13.41			
		13	2472		10.50	10.37			
		1	2412		15.00		14.76		
		6	2437		15.00		14.75		
		11	2462		15.00		14.77		
		12	2467		15.00		13.11		
		13	2472		10.50		10.13		
		1	2412		15.00	HT8	11.94	11.79	14.88
		6	2437		15.00	HT8	11.93	11.79	14.87
	11	2462	15.00	HT8	11.74	12.05	14.91		
	12	2467	13.00	HT8	10.01	9.74	12.89		
	13	2472	8.00	HT8	4.94	4.44	7.71		
	802.11 n40	3	2422	HTO	15.00	14.94			
		6	2437		15.00	14.92			
		9	2452		15.00	14.88			
		3	2422		15.00		14.89		
		6	2437		15.00		14.93		
		9	2452		15.00		14.77		
		3	2422	15.00	HT8	11.94	11.91	14.94	
		6	2437	15.00	HT8	12.01	11.83	14.93	
		9	2452	15.00	HT8	10.12	10.33	13.24	
		1	2412	15.00	EHO	14.76			
		6	2437	15.00		14.79			
		11	2462	15.00		14.77			
	12	2467	15.00	13.37					
	13	2472	10.50	10.22					
	1	2412	15.00			14.84			
	6	2437	15.00		14.86				
	11	2462	15.00		14.92				
	12	2467	15.00		13.47				
	13	2472	10.50		10.48				
	802.11 ax20	1	2412	EHO	15.00	11.89	11.97	14.94	
		6	2437		15.00	11.84	11.79	14.83	
		11	2462		15.00	11.91	11.81	14.87	
		12	2467		13.00	10.17	9.13	12.69	
		13	2472		8.00	4.88	4.45	7.68	
		3	2422		15.00	14.99			
6		2437	15.00	14.98					
9		2452	15.00	15.00					
3		2422	15.00		14.93				
6		2437	15.00		14.89				
9		2452	15.00		14.87				
3		2422	15.00	EH8	11.98	11.87	14.94		
6	2437	15.00	EH8	12.03	11.84	14.95			
9	2452	13.50	EH8	10.03	10.19	13.12			

**Note:**

Per KDB248227 D01, for WiFi 2.4GHz Main, the highest measured maximum output power Channel for DSSS modes(802.11b Mode)was selected for SAR measurement. SAR for OFDM modes(2.4GHz 802.11g/n/ax Mode) was not required When the highest reported SAR for DSSS is adjusted by the ratio of OFDM modes(802.11g/n)to DSSS modes(802.11b)specified maximum output power and the adjusted SAR is > 1.2 W/kg.



**8.3. Conducted power measurements of UNI\_1**

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
						Main	Aux	Main+Aux MIMO
UNII_1	802.11a	36	5180	6	13.50	13.44		
		40	5200		13.50	13.45		
		44	5220		13.50	13.42		
		48	5240		13.50	13.38		
		36	5180		13.50		13.33	
		40	5200		13.50		13.38	
		44	5220		13.50		13.35	
		48	5240		13.50		13.37	
	802.11 n20	36	5180	HT0	13.50	13.36		
		40	5200		13.50	13.41		
		44	5220		13.50	13.44		
		48	5240		13.50	13.50		
		36	5180	HT0	13.50		13.33	
		40	5200		13.50		13.46	
		44	5220		13.50		13.37	
		48	5240		13.50		13.48	
		36	5180	HT8	13.50	10.44	10.49	13.48
		40	5200		13.50	10.33	10.43	13.39
		44	5220		13.50	10.56	10.21	13.40
		48	5240		13.50	10.13	10.33	13.24
	802.11 n40	38	5190	HT0	13.50	13.47		
		46	5230		13.50	13.46		
		38	5190		13.50		13.42	
		46	5230	13.50		13.41		
		38	5190	HT8	13.50	10.36	10.41	13.40
		46	5230		13.50	10.31	10.48	13.41
	802.11 ac80	42	5210	VHT0	13.50	13.43		
		42	5210		13.50		13.39	
		42	5210	VHT8	13.50	10.33	10.47	13.41
	802.11 ax20	36	5180	EH0	13.50	13.37		
		40	5200		13.50	13.39		
		44	5220		13.50	13.37		
		48	5240		13.50	13.37		
		36	5180		13.50		13.41	
		40	5200		13.50		13.41	
		44	5220		13.50		13.39	
		48	5240		13.50		13.42	
		36	5180	EH8	13.50	10.28	10.54	13.42
		40	5200		13.50	10.23	10.46	13.36
		44	5220		13.50	10.56	10.32	13.45
		48	5240		13.50	10.32	10.56	13.45
	802.11 ax40	38	5190	EH0	13.50	13.45		
		46	5230		13.50	13.44		
		38	5190		13.50		13.49	
		46	5230	13.50		13.47		
		38	5190	EH8	13.50	10.57	10.12	13.36
		46	5230		13.50	10.49	10.18	13.35
	802.11 ax80	42	5210	EH0	13.50	13.46		
42		5210	13.50			13.48		
42		5210	13.50		10.41	10.47	13.45	

**8.4. Conducted power measurements of UNII\_2a**

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)			
						Main	Aux	Main+Aux MIMO	
UNII_2a	802.11a	52	5260	6	13.50	13.46			
		56	5280		13.50	13.41			
		60	5300		13.50	13.45			
		64	5320		13.50	13.42			
		52	5260		13.50		13.44		
		56	5280		13.50		13.43		
		60	5300		13.50		13.42		
		64	5320		13.50		13.41		
	802.11 n20	52	5260	HT0	13.50	13.42			
		56	5280		13.50	13.43			
		60	5300		13.50	13.41			
		64	5320		13.50	13.45			
		52	5260	HT8	13.50		13.44		
		56	5280		13.50		13.42		
		60	5300		13.50		13.41		
		64	5320		13.50		13.41		
		802.11 n40	52	5260	HT0	13.50	10.44	10.51	13.49
			56	5280		13.50	10.41	10.52	13.48
			60	5300	HT8	13.50	10.30	10.35	13.34
			64	5320		13.50	10.21	10.56	13.40
	802.11 ac80		54	5270	HT0	13.50	13.42		
			62	5310		13.50	13.45		
		54	5270	HT8	13.50		13.43		
		62	5310		13.50		13.49		
	802.11 ac160	54	5270	VHT0	13.50	10.45	10.50	13.49	
		62	5310		13.50	10.28	10.33	13.32	
	802.11 ax20	58	5290	VHT8	13.50	13.44			
		58	5290		13.50		13.42		
		58	5290	EH0	13.50	10.37	10.49	13.44	
		58	5290		13.50	13.49			
		802.11 ax40	50	5250	EH0	13.50		13.50	
			50			EH8	13.50	10.23	10.59
			52	EH0	13.50	13.39			
			56		13.50	13.41			
			60		13.50	13.41			
			64		13.50	13.45			
			52	EH8	13.50		13.44		
			56		13.50		13.43		
		60	13.50			13.42			
		64	13.50			13.44			
		52	EH8	13.50	10.23	10.51	13.38		
		56		13.50	10.25	10.49	13.38		
	60	13.50		10.20	10.61	13.42			
	64	13.50		10.26	10.62	13.45			
	802.11 ax80	54	EH0	13.50	13.39				
		62		13.50	13.44				
		54	EH8	13.50		13.43			
		62		13.50		13.46			
	802.11 ax160	54	EH0	13.50	10.35	10.41	13.39		
		62		13.50	10.02	10.60	13.33		
	802.11 ax160	58	5290	EH0	13.50	13.48			
		58			13.50		13.49		
802.11 ax160	58	5290	EH8	13.50	10.37	10.51	13.45		
	58			13.50	13.45				
802.11 ax160	50	5250	EH0	13.50		13.46			
	50			EH8	13.50	10.13	10.47	13.31	

**8.5. Conducted power measurements of wifi UNII\_2c**

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)				
						Main	Aux	Main+Aux MIMO		
UNII_2c	802.11a	100	5500	6	13.50	13.44				
		104	5520		13.50	13.47				
		108	5540		13.50	13.45				
		112	5560		13.50	13.44				
		116	5580		13.50	13.45				
		120	5600		13.50	13.42				
		124	5620		13.50	13.44				
		128	5640		13.50	13.43				
		100	5500		13.50		13.44			
		104	5520		13.50		13.42			
		108	5540		13.50		13.42			
		112	5560		13.50		13.44			
		116	5580		13.50		13.42			
		120	5600		13.50		13.44			
		124	5620		13.50		13.46			
		128	5640		13.50		13.47			
		802.11 n20	100		5500	HT0	13.50	13.39		
			104		5520		13.50	13.38		
			108		5540		13.50	13.38		
			112		5560		13.50	13.39		
			116		5580		13.50	13.39		
			120		5600		13.50	13.40		
			124		5620		13.50	13.38		
			128		5640		13.50	13.39		
	100		5500	13.50			13.37			
	104		5520	13.50			13.33			
	108		5540	13.50			13.39			
	112		5560	13.50			13.37			
	116		5580	13.50			13.37			
	120		5600	13.50			13.39			
	124		5620	13.50			13.40			
	128		5640	13.50			13.37			
	802.11 n40		100	5500	HT0		13.50	10.41	10.29	13.36
			104	5520			13.50	10.44	10.29	13.38
			108	5540			13.50	13.42	13.30	16.37
			112	5560			13.50	10.44	10.39	13.43
			116	5580			13.50	10.78	10.11	13.47
			120	5600			13.50	10.37	10.15	13.27
			124	5620			13.50	10.39	10.33	13.37
			128	5640			13.50	10.42	10.40	13.42
		102	5510	HT0		13.50	13.50			
		110	5550			13.50	13.44			
		118	5590			13.50	13.43			
		126	5630			13.50	13.43			
	102	5510	13.50			13.42				
	110	5550	13.50			13.44				
	118	5590	13.50			13.48				
	126	5630	13.50			13.45				
	102	5510	HT8		13.50	10.42	10.27	13.36		
	110	5550			13.50	10.37	10.20	13.30		
	118	5590			13.50	10.39	10.25	13.33		
	126	5630			13.50	10.37	10.29	13.34		
	802.11 ac80	106	5530	VHT0	13.50	13.47				
		122	5610		13.50	13.48				
		106	5530		13.50		13.48			
		122	5610		13.50		13.48			
		106	5530		VHT8	13.50	10.32	10.51	13.43	
	122	5610	13.50	10.37		10.39	13.39			
	802.11 ac160	114	5570	EH0	13.50	13.50				
					13.50		13.49			
				EH8	13.50	10.49	10.27	13.39		

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
						Main	Aux	Main+Aux MIMO
UNII_2c	802.11 ax20	100	5500	HT0	13.50	13.36		
		104	5520		13.50	13.38		
		108	5540		13.50	13.38		
		112	5560		13.50	13.33		
		116	5580		13.50	13.37		
		120	5600		13.50	13.35		
		124	5620		13.50	13.34		
		128	5640		13.50	13.31		
		100	5500		13.50		13.34	
		104	5520		13.50		13.35	
		108	5540		13.50		13.37	
		112	5560		13.50		13.35	
		116	5580		13.50		13.36	
		120	5600		13.50		13.34	
		124	5620		13.50		13.35	
		128	5640		13.50		13.38	
		100	5500		13.50		10.59	13.49
		104	5520		13.50		10.33	10.60
		108	5540		13.50		10.39	10.51
		112	5560		13.50		10.35	10.49
		116	5580		13.50		10.37	10.44
		120	5600		13.50		10.29	10.41
		124	5620		13.50		10.33	10.49
		128	5640		13.50		10.37	10.46
	102	5510	13.50		13.50			
	110	5550	13.50		13.44			
	118	5590	13.50		13.43			
	126	5630	13.50		13.43			
	102	5510	13.50			13.44		
	110	5550	13.50			13.42		
	118	5590	13.50			13.41		
	126	5630	13.50			13.40		
	102	5510	13.50		10.31	10.51		
	110	5550	13.50		10.53	10.40		
	118	5590	13.50		10.49	10.21		
	126	5630	13.50		10.33	10.37		
	106	5530	13.50		13.47			
	122	5610	13.50		13.45			
	106	5530	13.50			13.44		
	122	5610	13.50			13.49		
	106	5530	13.50		10.27	10.39		
	122	5610	13.50		10.39	10.37		
106	5530	13.50		13.42				
122	5610	13.50			13.41			
802.11 ax160	114	5570		EH0	13.50			
				EH8	13.50	10.46	10.38	13.43

**8.6. Conducted power measurements of wifi UNII\_3**

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)			
						Main	Aux	Main+Aux MIMO	
UNII_3	802.11a	132	5660	6	13.50	13.46			
		136	5680		13.50	13.45			
		140	5700		13.50	13.48			
		149	5745		13.50	13.47			
		153	5765		13.50	13.43			
		157	5785		13.50	13.39			
		161	5805		13.50	13.39			
		165	5825		13.50	13.37			
		132	5660		13.50		13.46		
		136	5680		13.50		13.45		
		140	5700		13.50		13.47		
		149	5745		13.50		13.42		
		153	5765		13.50		13.42		
		157	5785		13.50		13.39		
		161	5805		13.50		13.39		
		165	5825		13.50		13.38		
	802.11 n20	132	5660	HT0	13.50	13.47			
		136	5680		13.50	13.45			
		140	5700		13.50	13.45			
		149	5745		13.50	13.46			
		153	5765		13.50	13.41			
		157	5785		13.50	13.37			
		161	5805		13.50	13.35			
		165	5825		13.50	13.35			
		132	5660		13.50		13.46		
		136	5680		13.50		13.45		
		140	5700		13.50		13.44		
		149	5745		13.50		13.41		
		153	5765		13.50		13.41		
		157	5785		13.50		13.37		
		161	5805		13.50		13.35		
		165	5825		13.50		13.33		
	802.11 n40	132	5660	HT8	13.50	10.53	10.10	13.33	
		136	5680		13.50	10.51	10.14	13.34	
		140	5700		13.50	10.57	10.02	13.31	
		149	5745		13.50	10.79	10.08	13.46	
		153	5765		13.50	10.49	10.21	13.36	
		157	5785		13.50	10.81	9.97	13.42	
		161	5805		13.50	10.53	10.36	13.46	
		165	5825		13.50	10.55	10.34	13.46	
		134	5670		HT0	13.50	13.47		
		142	5710			13.50	13.46		
	151	5755	13.50	13.46					
	159	5795	13.50	13.44					
	134	5670	13.50			13.45			
	142	5710	13.50			13.43			
	151	5755	13.50			13.45			
	159	5795	13.50			13.10			
134	5670	HT8	13.50	10.26		10.22	13.25		
142	5710		13.50	10.28		10.29	13.30		
151	5755		13.50	10.51	9.94	13.24			
159	5795		13.50	10.49	10.10	13.31			
802.11 ac80	138	5690	VHT0	13.50	13.48				
	155	5775		13.50	13.49				
	138	5690	VHT8	13.50		13.48			
	155	5775		13.50		13.50			
	138	5690		13.50	10.52	10.24	13.39		
155	5775	13.50	10.57	10.17	13.38				

## 8.7. SARTEST RESULTS

### General Notes:

1. Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
2. Per KDB447498 D01, 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:  $\leq 0.8$  W/kg or  $2.0$  W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz. When the maximum output power variation across the required test channels is  $> \frac{1}{2}$  dB, instead of the middle channel, the highest output power channel must be used.
3. Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$  W/kg; if the deviation among the repeated measurement is  $\leq 20\%$ , and the measured SAR  $< 1.45$  W/kg, only one repeated measurement is required.

### WLAN Notes:

1. For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other (remaining) test positions. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 for 2.4GHz WIFI single transmission chain operations, the highest measured maximum output power Channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.1.4 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 for 5GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed power. Other transmission mode was not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2W/kg. See Section 7.1.4 for more information.

## 9. SAR TEST RESULTS

### 9.1. Body SAR test results

SAR test results of Bluetooth \_separation distance=0cm

Mode	Channel	Test Position	Ant Vendor	Ant	Max une-up (dBm)	AVG Power (dBm)	SAR 1g	Reported SAR 1g	Note
DH5	78	NB Bottom	AWAN	Aux	10.50	10.27	0.092	0.097	
		Tablet Bottom			10.50	10.27	0.138	<b>0.146</b>	
		Stand			10.50	10.27	0.107	0.113	
		Tablet Bottom	ICT		10.50	10.27	0.137	0.144	

SAR test results of 2.4G WiFi \_separation distance=0cm

Mode	Channel	Test Position	Ant Vendor	Ant	Max une-up (dBm)	AVG Power (dBm)	SAR 1g	Reported SAR 1g	Note	
802.11b	6	NB Bottom	AWAN	Main	15.00	14.93	0.422	0.429		
	12	NB Bottom			15.00	14.89	0.408	0.418		
	13	NB Bottom			15.00	14.90	0.359	0.367		
	6	Tablet Bottom			15.00	14.93	0.861	0.875		
	12	Tablet Bottom			15.00	14.89	0.724	0.743		
	13	Tablet Bottom			15.00	14.90	0.829	0.848		
	6	Tablet Rear			15.00	14.93	0.635	0.645		
	12	Tablet Rear			15.00	14.89	0.572	0.587		
	13	Tablet Rear			15.00	14.90	0.642	0.657		
	6	Stand			15.00	14.93	0.698	0.709		
	12	Stand			15.00	14.89	0.596	0.611		
	13	Stand			15.00	14.90	0.581	0.595		
	1	Tablet Bottom		15.00	14.93	1.030	<b>1.047</b>	1		
	6	NB Bottom		Aux	15.00	14.86	0.582	0.601		
	12	NB Bottom			15.00	14.84	0.644	0.668		
	13	NB Bottom			15.00	14.85	0.549	0.568		
	6	Tablet Bottom			15.00	14.86	0.435	0.449		
	12	Tablet Bottom			15.00	14.84	0.433	0.449		
	13	Tablet Bottom			15.00	14.85	0.433	0.448		
	6	Tablet Rear			15.00	14.86	0.149	0.154		
	12	Tablet Rear			15.00	14.84	0.113	0.117		
	13	Tablet Rear			15.00	14.85	0.111	0.115		
	6	Stand			15.00	14.86	0.413	0.427		
	12	Stand			15.00	14.84	0.559	0.580		
	13	Stand	15.00		14.85	0.492	0.509			
	1	Tablet Bottom	ICT		Main	15.00	14.93	1.020	1.037	
	1	Tablet Bottom	AWAN		Main	15.00	14.93	0.922	0.937	2

Note:

- Highest reported SAR is > 0.8 W/kg. Added second highest power channel for this test position
- Repeated measurements are required only when the measured SAR is  $\geq 0.80$  W/kg. If the measured SAR values are < 1.45 W/kg with  $\leq 20\%$  variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)  
Original SAR = 1.030 W/kg, therefore second times repeat SAR is required.  
Repeat SAR = 0.922 W/kg < 1.45W/kg  
SAR variation= -10.49% < 20%

SAR test results of 5G WiFi\_separation distance=0cm

Band	Mode	Channel	Test Position	Ant Vendor	Ant	Max une-up (dBm)	AVG Power (dBm)	SAR 1g	Reported SAR 1g	Note	
5G UNII 1 & 2a	802.11 ac 160	50	NB Bottom	AWAN	Main	13.50	13.49	0.242	0.243		
			Tablet Bottom			13.50	13.49	0.769	0.771		
			Tablet Rear			13.50	13.49	0.160	0.160		
			Stand			13.50	13.49	0.169	0.169		
			NB Bottom			13.50	13.50	0.195	0.195		
			Tablet Bottom		13.50	13.50	1.320	<b>1.320</b>			
			Tablet Rear		13.50	13.50	0.264	0.264			
			Stand		13.50	13.50	0.173	0.173			
			802.11 ac 80		58	Tablet Bottom	13.50	13.49	1.090	1.093	1
			42		13.50		13.48	1.170	1.175	1	
5G UNII 2c	802.11 ac 160	114	NB Bottom	AWAN	Main	13.50	13.50	0.277	0.277		
			Tablet Bottom			13.50	13.50	0.565	0.565		
			Tablet Rear			13.50	13.50	0.167	0.167		
			Stand			13.50	13.50	0.193	0.193		
	802.11 ac 160	114	NB Bottom		Aux	13.50	13.49	0.192	0.192		
			Tablet Bottom			13.50	13.49	1.480	<b>1.483</b>		
			Tablet Rear			13.50	13.49	0.271	0.272		
			Stand			13.50	13.49	0.162	0.162		
	802.11 ac 80	122	Tablet Bottom		13.50	13.48	1.150	1.155	1		
		106			13.50	13.48	1.130	1.135	1		
5G UNII 3	802.11 ac 80	155	NB Bottom	AWAN	Main	13.50	13.49	0.492	0.493		
			Tablet Bottom			13.50	13.49	0.595	0.596		
			Tablet Rear			13.50	13.49	0.833	0.835		
			Stand			13.50	13.49	0.406	0.407		
		138	Tablet Rear		13.50	13.48	0.779	0.783	1		
		155	NB Bottom		Aux	13.50	13.50	0.210	0.210		
			Tablet Bottom			13.50	13.50	1.080	1.080		
			Tablet Rear			13.50	13.50	0.223	0.223		
			Stand			13.50	13.50	0.346	0.346		
		138	Tablet Bottom		13.50	13.48	1.120	1.125	1		
5G UNII 2c	802.11 ac 160	114	Tablet Bottom	ICT	Aux	13.50	13.49	1.340	1.343		
				AWAN		13.50	13.49	1.350	1.353	2	

Note:

- Highest reported SAR is > 0.8 W/kg. Added second highest power channel for this test position
- Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04)  
Original SAR = 1.480 W/kg, therefore second times repeat SAR is required.  
Repeat SAR = 1.350 W/kg < 1.45W/kg  
SAR variation= -8.78% < 20%



## 10. SIMULTANEOUS TRANSMISSION CONDITIONS

### 10.1 Stand-alone SAR test exclusion

SAR compliance for simultaneous transmission must be considered when the maximum duration of overlapping transmissions, including network hand-offs, is greater than 30 seconds. This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis.

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration
1	WLAN 2.4G(Main)+BT
2	RLAN 5G(Main)+BT
3	WLAN 2.4G(Main)+ WLAN 2.4G(Aux)
4	RLAN 5G(Main)+ RLAN 5G(Aux)
5	RLAN 5G(Main)+ RLAN 5G(Aux) +BT

## 10.2 Simultaneous transmission conditions

KDB 447498 D01 General RF Exposure Guidance v06, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / R_i$$

Where:

**SAR<sub>1</sub>** is the highest Reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

**SAR<sub>2</sub>** is the highest Reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

**R<sub>i</sub>** is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

A new threshold of 0.04 is also introduced in the KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / R_i \leq 0.04$$

### 10.3 Estimated SAR for Simultaneous Transmission SAR Analysis

#### Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
  - When the separation distance from the antenna to an adjacent edge is  $\leq 5$  mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
  - When the separation distance from the antenna to an adjacent edge is  $> 5$  mm but  $\leq 50$  mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
  - When the minimum test separation distance is  $> 50$  mm, the estimated SAR value is 0.4 W/kg

#### 10.3.1 Estimated SAR for Bluetooth

According to section 9, the Bluetooth must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f_{\text{(GHz)}}/x}]$  W/kg for test separation distances  $\leq 50$  mm; where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is  $> 50$  mm.

#### NB Mode & Stand Mode

Band	Frequency (MHz)	Output Power		Separation Distances(mm)		Estimated 1-g SAR (W/Kg)	
		dBm	mW	NB Bottom	Stand	NB Bottom	Stand
2.4GHz	2480	10.50	11.00	2.00	0.57	<b>Test</b>	<b>Test</b>

#### Tablet Mode

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Estimated 1-g SAR (W/Kg)				
			dBm	mW	Rear	Top	Right	Left	Bottom	Rear	Top	Right	Left	Bottom
Bluetooth	2.4GHz	2480	10.50	11.00	9.34	<b>245.16</b>	<b>245.16</b>	45.25	2.00	0.247	<b>&gt;200mm</b>	<b>&gt;200mm</b>	0.051	<b>Test</b>

## 10.2 Simultaneous transmission conditions

Test Position SAR1g(W/kg)	NB Bottom	Tablet Bottom	Tablet Rear	Stand Mode
WLAN 2.4G WiFi_Main	<b>0.429</b>	<b>1.047</b>	<b>0.645</b>	<b>0.709</b>
WLAN 2.4G WiFi_Aux	<b>0.597</b>	<b>0.446</b>	<b>0.153</b>	<b>0.424</b>
UNII_1 WiFi_Main				
UNII_1 WiFi_Aux		1.175		
UNII_2a WiFi_Main	0.243	<b>0.771</b>	0.160	0.169
UNII_2a WiFi_Aux	0.195	1.320	0.264	0.173
UNII_2c WiFi_Main	0.277	0.565	<b>1.182</b>	0.193
UNII_2c WiFi_Aux	0.192	<b>1.483</b>	<b>0.272</b>	0.162
UNII_3 WiFi_Main	<b>0.493</b>	0.596	0.835	<b>0.407</b>
UNII_3 WiFi_Aux	<b>0.211</b>	1.125	0.224	<b>0.348</b>
Bluetooth_DH5	0.097	0.146		0.113
WLAN 2.4G_Main+WLAN 2.4G_Aux MAX $\Sigma$ SAR1g	1.026	1.475	0.808	1.137
WLAN 2.4G+BT MAX $\Sigma$ SAR1g	0.438	0.893	0.659	0.724
RLAN 5G_Main+ RLAN 5G_Aux MAX $\Sigma$ SAR1g	0.705	2.254	1.107	0.756
RLAN 5G_Main+ RLAN 5G_Aux+BT MAX $\Sigma$ SAR1g	0.917	<b>2.400</b>	1.332	1.003

Note: As the Sum of the SAR is less than 1.6W/Kg, so SPLSR is not required.

## 11. Test Layout

### Specific Absorption Rate Test Layout

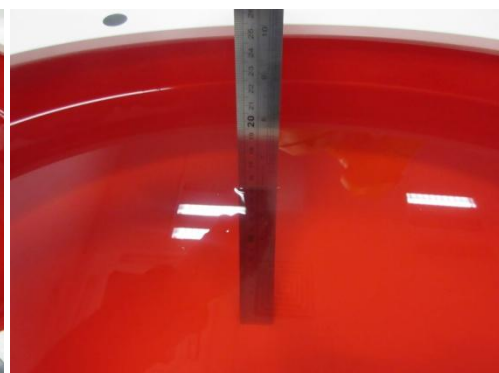


#### Liquid depth in the flat Phantom ( $\geq 15\text{cm}$ depth)

HSL(2450MHz)



HSL(5GHz)



**Appendix A. SAR Plots of System Verification**

(Pls See BTL-FCC SAR-1-2006T132\_Appendix A.)

**Appendix B. SAR Plots of SAR Measurement**

(Pls See BTL-FCC SAR-1-2006T132\_Appendix B.)

**Appendix C. Calibration Certificate**

(Pls See BTL-FCC SAR-1-2006T132\_Appendix C.)

**Appendix D. Photographs of the Test Set-Up**

(Pls See BTL-FCC SAR-1-2006T132\_Appendix D.)

**Appendix E. SAR SPLSR**

(Pls See BTL-FCC SAR-1-2006T132\_Appendix E.)

**End of Test Report**