FCC SAR Test Report

FCC ID: O57-AX200NGW

Report No.	:	BTL-FCC-5-2007T046
Equipment	:	Notebook Computer
Model Name	:	Yoga 6 13ARE05
Series Model		Yoga 6 13ARE05******** (*=0~9, A~z, "_" or blank)
Brand Name	:	Lenovo
Applicant	:	Lenovo (Shanghai) Electronics Technology Co., Ltd.
Address	:	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong, P.R.China
Date of Receipt	:	July. 14, 2020
Date of Test	:	July. 28, 2020 ~ July. 30, 2020
Issued Date	:	September. 4, 2020

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

Prepared by :

Peter Chen, Engineer

Approved by :

Scott Hsu, Manager

BTL Inc.
No.3, Jinshagang 1st Road, Shixia, Dalang Town,Dongguan, Guangdong, China.
Tel: +86-769-8318-3000
Web: www.newbtl.com

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

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.

Table of Contents Page

Table of Contents Page

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	2020/8/11
R01	Page 6 Add P-Sensor Type and Note Page 10 Add Test Distance Page 33 Modify P-Sensor Trigger Distance Page 34 Add P-Sensor Tilt Trigger Distance	2020/9/4

1. GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

Equipment	Notebook Computer	
Brand Name	Lenovo	
Model Name	Yoga 6 13ARE05	
Series Model	Yoga 6 13ARE05******** (*=0~9, A~z, "_" or blank)	
WLAN Module	Brand Name: Intel Model Name: AX200NGW	
Battery Information	Band: Lonovo Model: ADLX45YCC3D Rating: 20V / 2.25A	
P-Sensor Type	Capacitive Proximity Sensor	
Frequency Range	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
Operation Frequency	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
Standard(s)	**ANSI Std C95.1:2019** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-2019) **IEEE Std 1528:2013** Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques **KDB447498 D01** General RF Exposure Guidance v06 **KDB248227 D01** 802. 11 Wi-Fi SAR v02r02 **KDB865664 D01** SAR measurement 100 MHz to 6 GHz v01r04 **KDB865664 D02** SAR Reporting v01r02 **KDB616217 D04** SAR for laptop and tablets v01r02	

Note:
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-1-2007T046) 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).
The device will automatically detect the status of P-sensor . If the P-sensor fail , it will automatically reduce power by a fix maximum power reduction amplitude to ensure SAR compliance.

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

Uncertainty Budget for Frequency range of 3 GHz to 6 GHz

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

2.3 WLAN Antenna Information:

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	ICT	SA30Z18922	PIFA Antenna	2400-2500	0.6
				5150-5350	-1.5
				5740-5725	-1.2
				5725-5875	-1.7
Aux	ICT	SA30Z18923	PIFA Antenna	2400-2500	-1.6
				5150-5350	-0.6
				5740-5725	-1.7
				5725-5875	-1.8

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Main	AWAN	SA30Z18927	PIFA Antenna	2400-2500	1.14
				5150-5350	-1.73
				5740-5725	-3.61
				5725-5875	-2.83
Aux	AWAN	SA30Z18928	PIFA Antenna	2400-2500	-1.53
				5150-5350	-2.43
				5740-5725	-2.91
				5725-5875	-1.54

2.4 The Maximum SAR 1g Values

P-Sensor On

Ant	Test Distance (mm)	Mode	Highest Body Reported SAR-1g(W/kg)
DTS	0	WLAN 2.4G	1.067
UNII		UNII_1	1.123
		UNII_2a	1.175
		UNII_2c	1.135
		UNII_3	1.233

P-Sensor Off

Ant	Test Distance (mm)	Mode	Highest Body Reported SAR-1g(W/kg)
FHSS	19	Bluetooth_DH5	0.323
DTS		WLAN 2.4G	0.259
UNII		UNII_1	0.586
		UNII_2c	0.561
		UNII_3	0.684

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. = 18ºC, Max. = 25ºC
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.

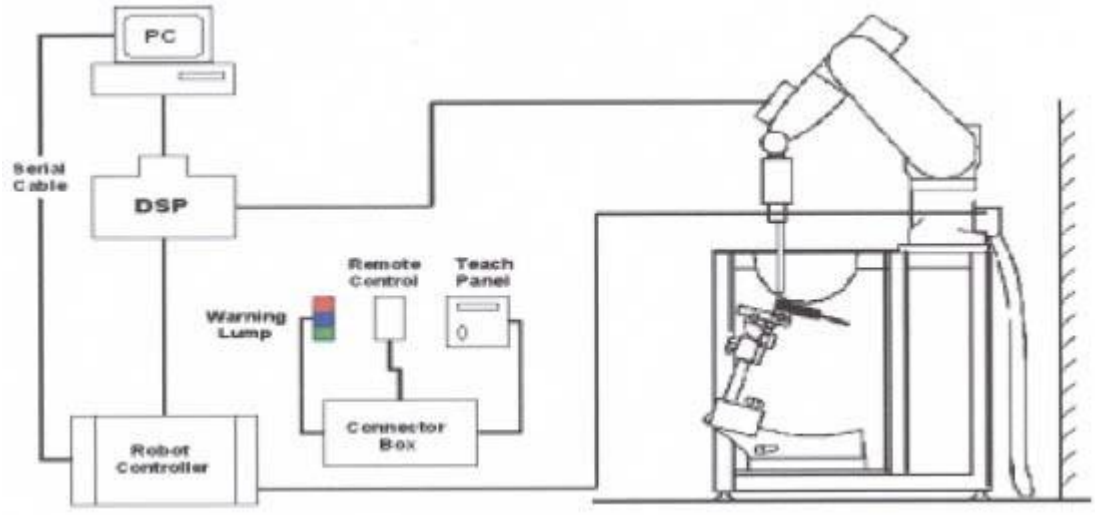
3 SAR MEASUREMENTS SYSTEM CONFIGURATION

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

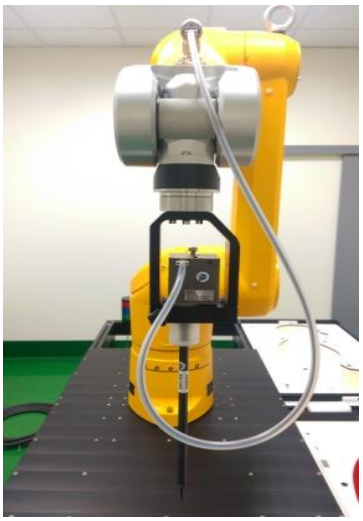


3.2 DASY5 E-field Probe System

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

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
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: ± 0.2dB
Dimensions	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 ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. 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 bellow 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.

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

Where: Δt = Exposure time (30 seconds),

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

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

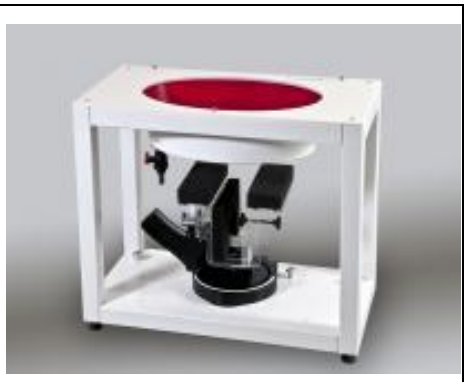
ρ = Tissue density (kg/m3).

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 extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.
Material: POM, Acrylic glass, Foam

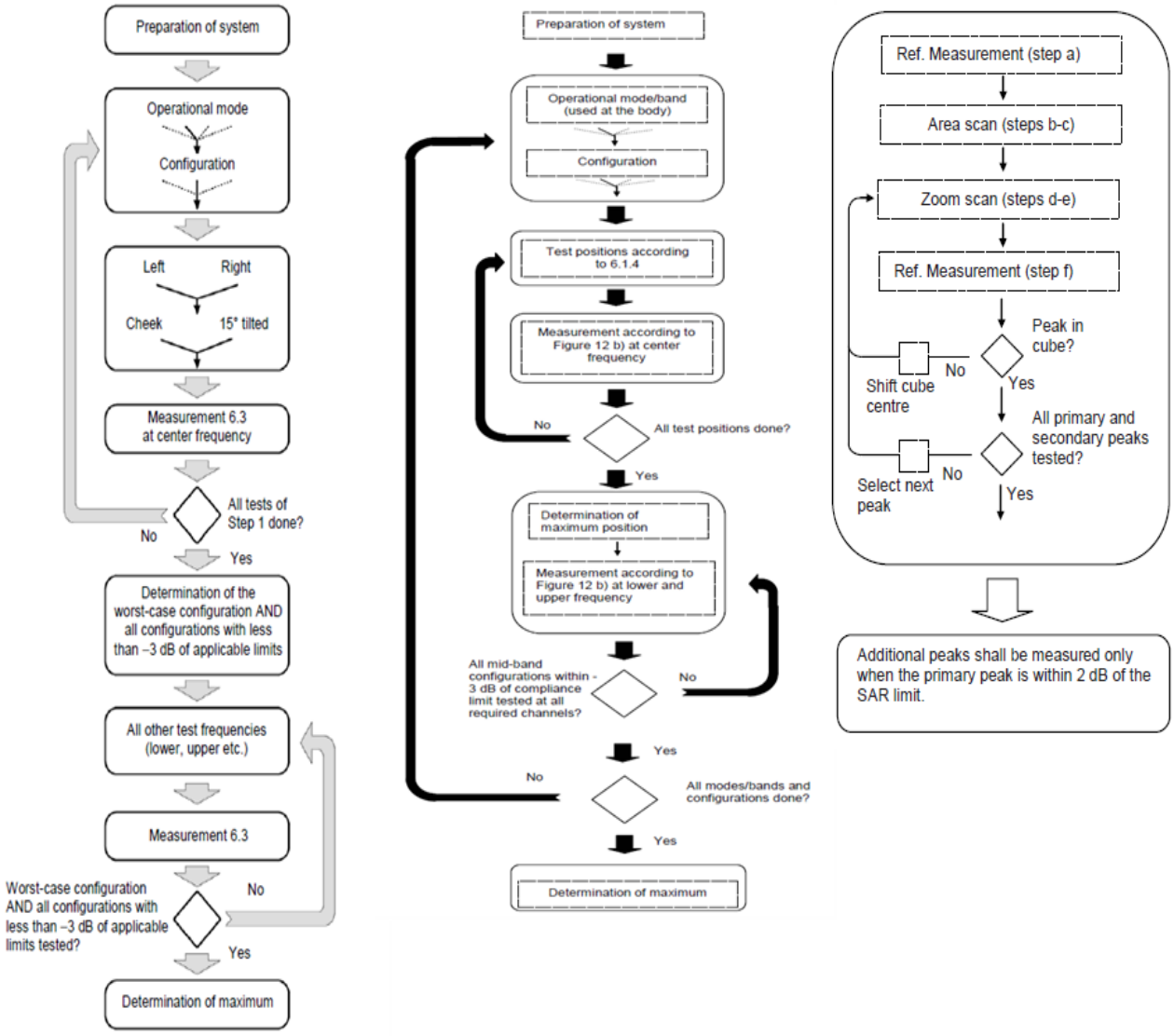
3.2.3.2 Phantom

Model	ELI4 Phantom	
Construction	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.	
Shell Thickness	2±0.1 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Length: 600 mm ; Width: 190mm Height: adjustable feet	
Aailable	Special	

Model	Twin SAM	
Construction	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.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length:1000mm; Width: 500mm Height: adjustable feet	
Aailable	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/cm²], [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_{i0}, a_{i1}, a_{i2}
	Conversion factor	$ConvF_i$
	Diode compression point	Dcp_i
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_i = compensated signal of channel i (i = x, y, z)
U_i = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

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

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

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)

$Norm_i$ = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)^2] for E-field Probes

$ConvF$ = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

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

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

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

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

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

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

With SAR = local specific absorption rate in mW/g

E_{tot} = total field strength in V/m
= conductivity in [mho/m] or [Siemens/m]
= equivalent tissue density in g/cm^3

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.

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

With P_{pwe} = equivalent power density of a plane wave in mW/cm^2

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

H_{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 ±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 (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Limit (%) ±5
2020/7/28	Head	5200	4.45	35.97	4.66	35.99	-4.50	-0.05	±5
2020/7/28	Head	5300	4.56	35.74	4.76	35.87	-4.09	-0.38	±5
2020/7/28	Head	5600	4.90	34.98	5.07	35.53	-3.24	-1.54	±5
2020/7/28	Head	5800	5.14	34.59	5.27	35.30	-2.52	-2.02	±5
2020/7/29	Head	5200	4.45	35.32	4.66	35.99	-4.45	-1.86	±5
2020/7/29	Head	5300	4.56	35.08	4.76	35.87	-4.08	-2.22	±5
2020/7/29	Head	5600	4.90	34.38	5.07	35.53	-3.26	-3.24	±5
2020/7/29	Head	5800	5.13	33.98	5.27	35.30	-2.63	-3.74	±5
2020/7/30	Head	2450	1.89	37.58	1.80	39.20	4.78	-4.14	±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

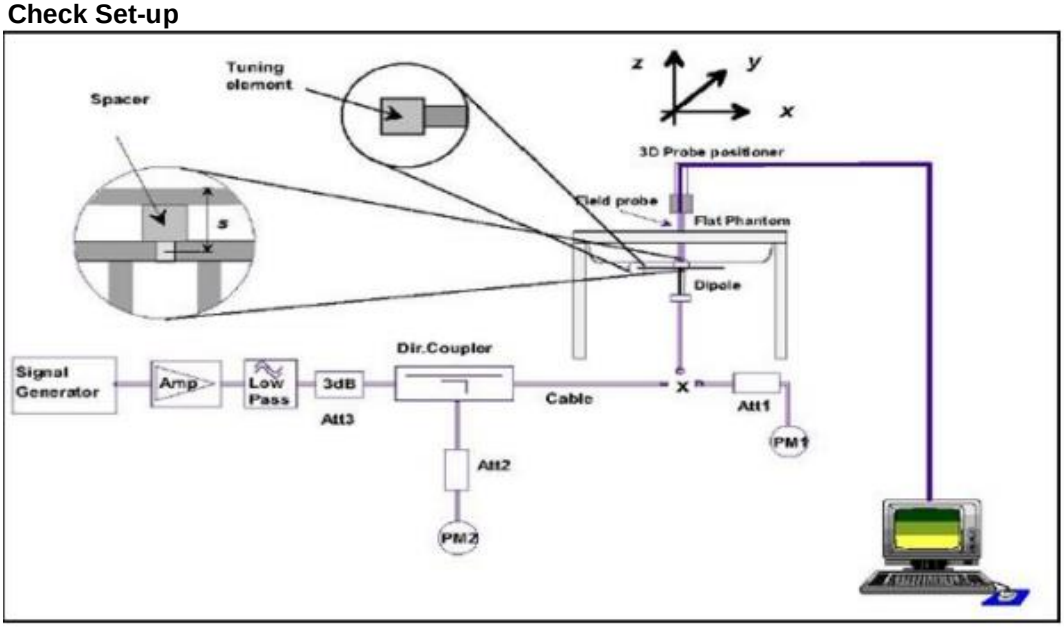
5.1 Description of System Check

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 (±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					
2020/7/28	D5GHzV2 (5.2GHz)	1221	Head	1g SAR	76.8	73.3	-4.56	± 10
2020/7/28	D5GHzV2 (5.3GHz)	1221	Head	1g SAR	79.0	74.0	-6.33	± 10
2020/7/28	D5GHzV2 (5.6GHz)	1221	Head	1g SAR	80.3	80.7	0.50	± 10
2020/7/28	D5GHzV2 (5.8GHz)	1221	Head	1g SAR	76.9	79.6	3.51	± 10
2020/7/29	D5GHzV2 (5.2GHz)	1221	Head	1g SAR	76.8	73.3	-4.56	± 10
2020/7/29	D5GHzV2 (5.3GHz)	1221	Head	1g SAR	79.0	74.0	-6.33	± 10
2020/7/29	D5GHzV2 (5.6GHz)	1221	Head	1g SAR	80.3	79.5	-1.00	± 10
2020/7/29	D5GHzV2 (5.8GHz)	1221	Head	1g SAR	76.9	80.6	4.81	± 10
2020/7/30	D2450V2	973	Head	1g SAR:	51.9	49.6	-4.43	± 10

6 OPERATIONAL CONDITIONS DURING TEST

6.1 General Description of Test Procedures

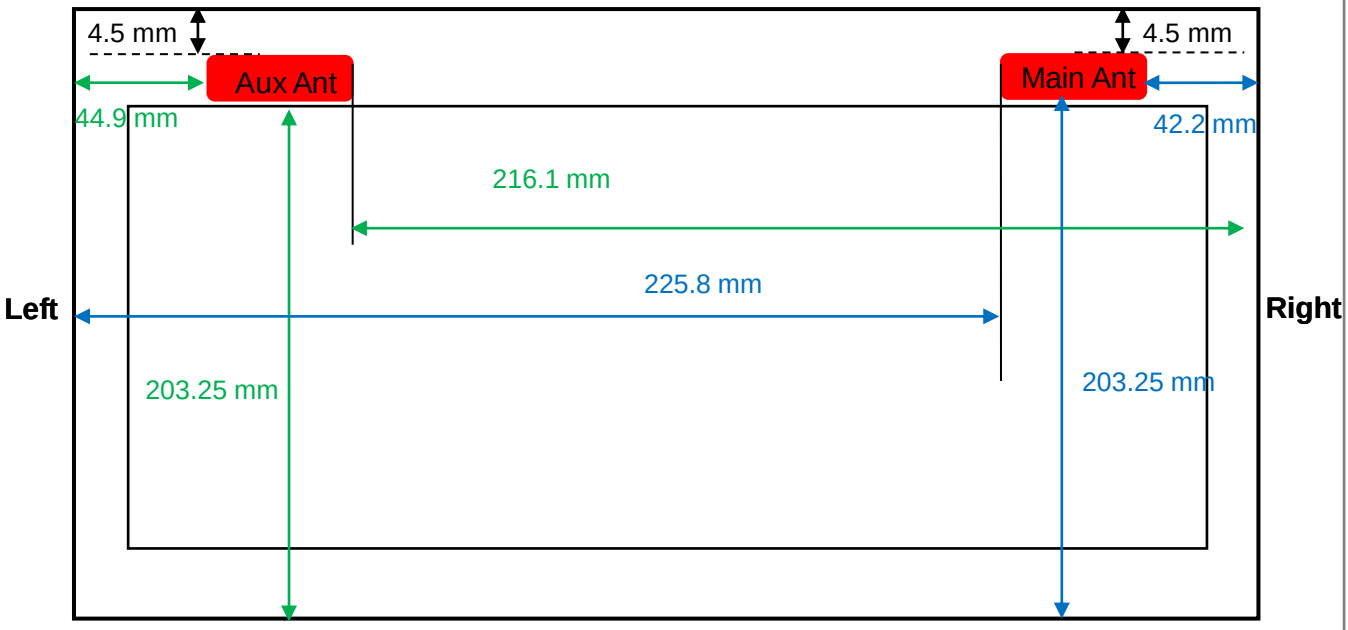
Connection to the EUT is established via air interface with base station An, and the EUT is Set to maximum output power by base station. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. The antenna connected to the output of the base station 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.

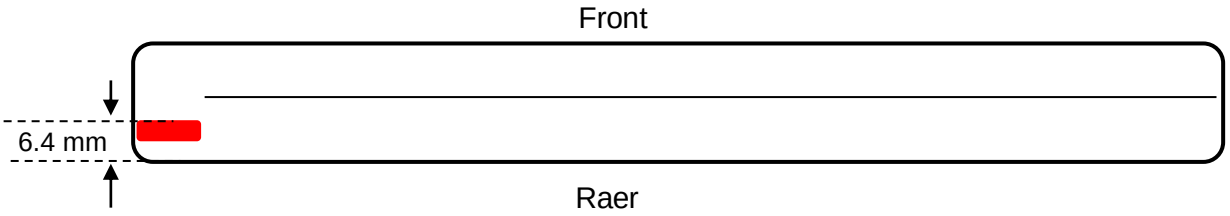
6.2 Test Position of Portable Devices

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

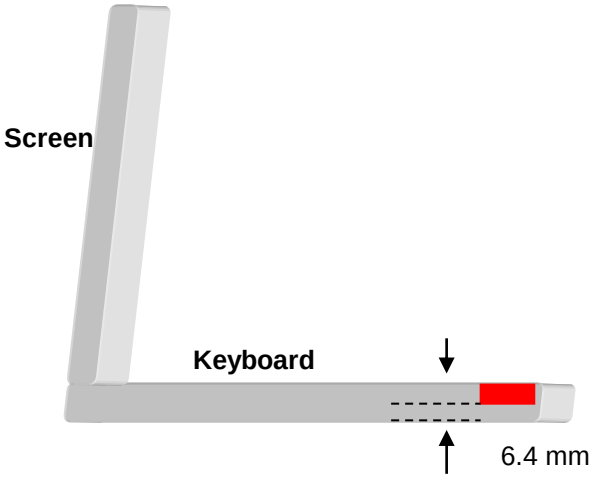
6.3 Test position Antenna Location

Tablet Mode

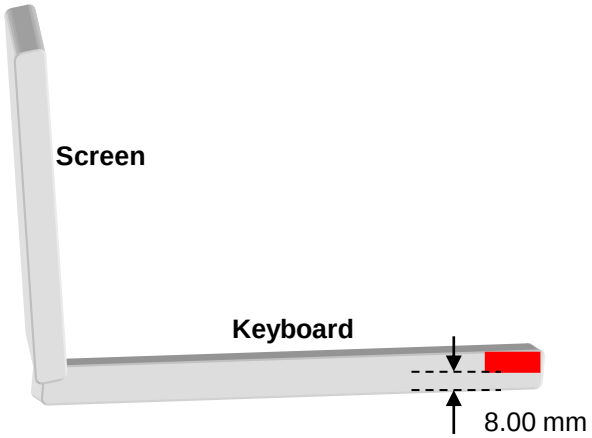




Stand Mode



NB Mode



Minimum Separation Distance_Tablet Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Rear	6.40	Yes
	Top	4.50	Yes
	Bottom	203.25	No
	Left	225.8	No
	Right	42.20	Yes
WLAN-Aux & BT	Rear	6.40	Yes
	Top	4.50	Yes
	Bottom	203.25	No
	Left	44.90	Yes
	Right	216.10	No

Minimum Separation Distance_NB Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Bottom	8.00	No
WLAN-Aux & BT	Bottom	8.00	No

Minimum Separation Distance_Stand Mode			
Antenna	Position	Distance (mm)	Evaluation Test
WLAN-Main	Stand	6.40	Yes
WLAN-Aux & BT	Stand	6.40	Yes

6.4 Test position

6.4.1BODY TEST CONFIGURATION

The SAR Exclusion Threshold in KDB 447498 D01can 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<50mm is defined by the following equation:

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

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

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

a) at 100 MHz to1500 MHz

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

b) at >1500MHz and ≤6GHz

[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm) ·10] 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	NB Bottom	Stand
Wi-Fi Main	2.4GHz	2437	21.00	126.00	8.00	6.40	24.59	30.73
	5.2GHz	5210	21.00	126.00	8.00	6.40	35.95	44.94
	5.3GHz	5290	21.00	126.00	8.00	6.40	36.23	45.28
	5.5GHz	5530	21.00	126.00	8.00	6.40	37.04	46.30
	5.8GHz	5775	21.00	126.00	8.00	6.40	37.85	47.31
Wi-Fi Aux	2.4GHz	2437	21.00	126.00	8.00	6.40	24.59	30.73
	5.2GHz	5210	21.00	126.00	8.00	6.40	35.95	44.94
	5.3GHz	5290	21.00	126.00	8.00	6.40	36.23	45.28
	5.5GHz	5530	21.00	126.00	8.00	6.40	37.04	46.30
	5.8GHz	5775	21.00	126.00	8.00	6.40	37.85	47.31
Bluetooth	Bluetooth	2440	11.00	13.00	8.00	6.40	2.54	3.17

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	21.00	126.00	6.40	**4.50**	42.20	**225.80**	203.25	30.73	43.71	4.66	**>200mm**	**>200mm**
	5.2GHz	5210	21.00	126.00	6.40	**4.50**	42.20	**225.80**	203.25	44.94	63.91	6.82	**>200mm**	**>200mm**
	5.3GHz	5290	21.00	126.00	6.40	**4.50**	42.20	**225.80**	203.25	45.28	64.40	6.87	**>200mm**	**>200mm**
	5.5GHz	5530	21.00	126.00	6.40	**4.50**	42.20	**225.80**	203.25	46.30	65.84	7.02	**>200mm**	**>200mm**
	5.8GHz	5775	21.00	126.00	6.40	**4.50**	42.20	**225.80**	203.25	47.31	67.29	7.18	**>200mm**	**>200mm**
Wi-Fi Aux	2.4GHz	2437	21.00	126.00	6.40	**4.50**	**216.10**	44.90	203.25	30.73	43.71	**>200mm**	4.38	**>200mm**
	5.2GHz	5210	21.00	126.00	6.40	**4.50**	**216.10**	44.90	203.25	44.94	63.91	**>200mm**	6.41	**>200mm**
	5.3GHz	5290	21.00	126.00	6.40	**4.50**	**216.10**	44.90	203.25	45.28	64.40	**>200mm**	6.45	**>200mm**
	5.5GHz	5530	21.00	126.00	6.40	**4.50**	**216.10**	44.90	203.25	46.30	65.84	**>200mm**	6.60	**>200mm**
	5.8GHz	5775	21.00	126.00	6.40	**4.50**	**216.10**	44.90	203.25	47.31	67.29	**>200mm**	6.74	**>200mm**
Bluetooth	Bluetooth	2440	11.00	13.00	6.40	**4.50**	**216.10**	44.90	203.25	3.17	4.51	**>200mm**	0.45	**>200mm**

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	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.2GHz	5210	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.3GHz	5290	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.5GHz	5530	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.8GHz	5775	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
Wi-Fi Aux	2.4GHz	2437	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.2GHz	5210	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.3GHz	5290	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.5GHz	5530	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
	5.8GHz	5775	21.0	126	**8.00**	**6.40**	**<50mm**	**<50mm**
Bluetooth	Bluetooth	2480	11.0	13	**8.00**	**6.40**	**<50mm**	**<50mm**

Tablet Mode

Antenna	Band	Frequency (MHz)	Output		Separation Distances(mm)					Calculated Threshold Value				
			dBm	mW	Rear	Top	Right	Left	Bottom	Rear	Top	Right	Left	Bottom
Wi-Fi Main	2.4GHz	2437	21.0	126	**6.40**	**4.50**	**42.20**	**225.80**	**203.25**	**<50mm**	**<50mm**	**<50mm**	**>200mm**	**>200mm**
	5.2GHz	5210	21.0	126	**6.40**	**4.50**	**42.20**	**225.80**	**203.25**	**<50mm**	**<50mm**	**<50mm**	**>200mm**	**>200mm**
	5.3GHz	5290	21.0	126	**6.40**	**4.50**	**42.20**	**225.80**	**203.25**	**<50mm**	**<50mm**	**<50mm**	**>200mm**	**>200mm**
	5.5GHz	5530	21.0	126	**6.40**	**4.50**	**42.20**	**225.80**	**203.25**	**<50mm**	**<50mm**	**<50mm**	**>200mm**	**>200mm**
	5.8GHz	5775	21.0	126	**6.40**	**4.50**	**42.20**	**225.80**	**203.25**	**<50mm**	**<50mm**	**<50mm**	**>200mm**	**>200mm**
Wi-Fi Aux	2.4GHz	2437	21.0	126	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**
	5.2GHz	5210	21.0	126	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**
	5.3GHz	5290	21.0	126	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**
	5.5GHz	5530	21.0	126	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**
	5.8GHz	5775	21.0	126	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**
Bluetooth	Bluetooth	2440	11.0	13	**6.40**	**4.50**	**216.10**	**44.90**	**203.25**	**<50mm**	**<50mm**	**>200mm**	**<50mm**	**>200mm**

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 ≥ 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≥ 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 ≥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					

RLAN 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 ≤ 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 ≤ 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 ≤ 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 ≤ 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.11 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 ≤ 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 ≤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 POWER REDUCTION BY PROXIMITY SENSING

A proximity sensor for power reduction is implemented in this device to address RF exposure compliance when the cellular antenna is positioned close to the user's body. The sensor's mechanical structure is designed to fit within the enclosure design used in this device and also extended around the edge and top of the antenna element in order to optimize sensitivity in these orientations. This design combines the antenna printed directly on a plastic part and proximity sensor FPC (Flexible Printed Circuit) bonded together into one piece. According to KDB 616217 D04 SAR for laptop and tablets v01r02)

8.1 procedures for detrmining proximity sensor triggering distances

The following procedures should be applied to determine proximity sensor triggering distances for the back surface and individual edges of a tablet. Conducted power is monitored qualitatively to identify the general triggering characteristics and recorded quantitatively, versus spacing, as required by the procedures. Unless there is built-in test software that reports the triggering conditions and enables the power levels to be confirmed separately, monitoring of conducted power during the triggering tests typically requires internal access to the antenna ports inside the tablet, which may interfere with the triggering tests.

1. The relevant transmitter should be set to operate at its normal maximum output power.

2. The entire back surface or edge of the tablet is positioned below a flat phantom filled with the required tissue-equivalent medium, and positioned at least 20 mm further than the distance that triggers power reduction.

3. It should be ensured that the cables required for power measurements are not interfering with the proximity sensor. Cable losses should be properly compensated to report the measured power results.

4. The back surface or edge is moved toward the phantom in 3 mm steps until the sensor triggers.

5. The back surface or edge is then moved back (further away) from the phantom by at least 5 mm or until maximum output power is returned to the normal maximum level.

6. The back surface or edge is again moved toward the phantom, but in 1 mm steps, until it is at least 5 mm past the triggering point or touching the phantom. If 1 mm resolution is not suitable for the sensor triggering sensitivity, a KDB inquiry should be submitted to determine alternative test configurations.

7. If the tablet is not touching the phantom, it is moved in 3 mm steps until it touches the phantom to confirm that the sensor remains triggered and the maximum power stays reduced.

8. The process is then reversed by moving the tablet away from the phantom according to steps 4) to 7), to determine triggering release, until it is at least 10 mm beyond the point that triggers the return of normal maximum power.

9. The measured output power within ± 5 mm of the triggering points, or until the tablet is touching the phantom, for movements to and from the phantom should be tabulated in the SAR report.

10. If the sensor design and implementation allow additional variations for triggering distance tolerances, multiple samples should be tested to determine the most conservative distance required for SAR evaluation.

11. To ensure all production units are compliant, it is generally necessary to reduce the triggering distance determined from the triggering tests by 1 mm, or more if it is necessary, and use the smallest distance for movements to and from the phantom, minus 1 mm, as the sensor triggering distance for determining the SAR measurement distance.

8.2 procedures for detrmining antenna and proximity sensor coverage

The sensing regions are usually limited to areas near the sensor element. If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. The following are used to determine if additional SAR measurements may be necessary due to sensor and antenna offset. 25 These procedures do not apply and are not required for configurations where the antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

1. The back surface or edge of the tablet is positioned at a test separation distance less than or equal to the distance required for back surface or edge triggering, with both the antenna and sensor pad located at least 20 mm laterally outside the edge (boundary) of the phantom, along the direction of maximum antenna and sensor offset. For the back surface, if the direction of maximum offset is not aligned with the tablet coordinates (physical edges) the tablet test position would not be aligned with the phantom coordinates (orientations). Each applicable tablet edge should be positioned perpendicularly to the phantom to determine sensor coverage. For antennas and/or sensors located near the corner of a tablet, both adjacent edges must be considered.

2. The similar sequence of steps applied to determine sensor triggering distance in section 6.2 are used to verify back surface and edge sensor coverage by moving the tablet (sensor and antenna) horizontally toward the phantom while maintaining the same vertical separation between the back surface or edge and the phantom.

3. After the exact location where triggering of power reduction is determined, with respect to the sensor and antenna, the tablet movement should be continued, in 3 mm increments, until both the sensor and antenna(s) are fully under the phantom and at least 20 mm inside the phantom edge.

4. The process is then repeated from the opposite direction, starting at the other end of the maximum antenna and sensor offset, by rotating the tablet 180° along the vertical axis.

5. The triggering points should be documented graphically, with the antenna and sensor clearly identified, along with all relevant dimensions.

If the subsequently measured peak SAR location for the antenna is not between the triggering points, established by the sensor coverage tests from opposite ends of the antenna and sensor, additional SAR tests may be required for conditions where only part of the back surface or edge of a tablet corresponding to the antenna is in proximity to the user and the sensor may not be triggering as desired. A KDB inquiry must be submitted by the test lab to determine if additional tests are required and the proper test configurations to use for testing. This may include situations where the sensor coverage region is too small for the antenna, the sensor is located too far away from the antenna, the sensor location is insufficient to cover multiple antennas or the antenna is at the corner of a tablet etc.

8.3 proximity sensor status table of trigger distance

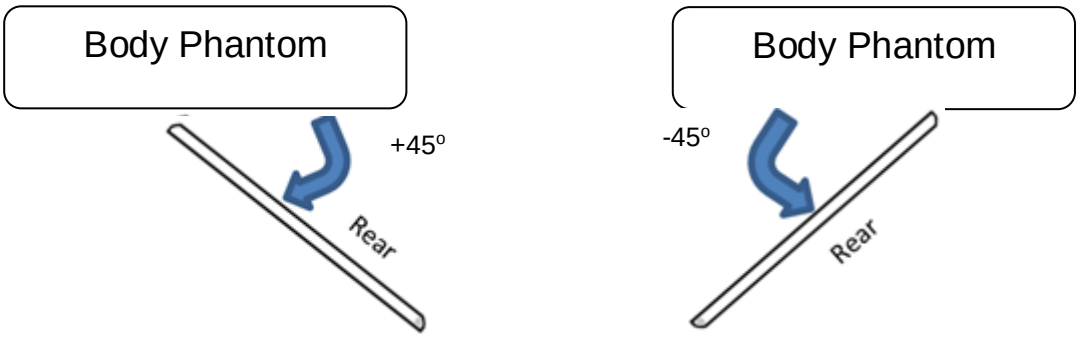
As per the KDB 616217 D04 SAR for laptop and tablets v01r02, section 6.2, the following procedure is used to determine the triggering distances.

Proximity Sensor Status Table when DUT is moving towards the phantom

Distance to the DUT (mm)	Proximity Sensor Status – Tablet Rear	Proximity Sensor Status – Tablet Top	Proximity Sensor Status – Stand
30	OFF	OFF	OFF
27	OFF	OFF	OFF
25	OFF	OFF	OFF
24	OFF	OFF	OFF
23	OFF	OFF	OFF
22	OFF	OFF	OFF
21	OFF	OFF	OFF
20	OFF	OFF	OFF
19	ON	ON	ON
18	ON	ON	ON
17	ON	ON	ON
16	ON	ON	ON
15	ON	ON	ON
14	ON	ON	ON
13	ON	ON	ON
12	ON	ON	ON
11	ON	ON	ON
10	ON	ON	ON
9	ON	ON	ON
8	ON	ON	ON
7	ON	ON	ON
6	ON	ON	ON
5	ON	ON	ON
4	ON	ON	ON
3	ON	ON	ON
2	ON	ON	ON
1	ON	ON	ON
0	ON	ON	ON

8.4 Tilt angle influences to proximity sensor triggering

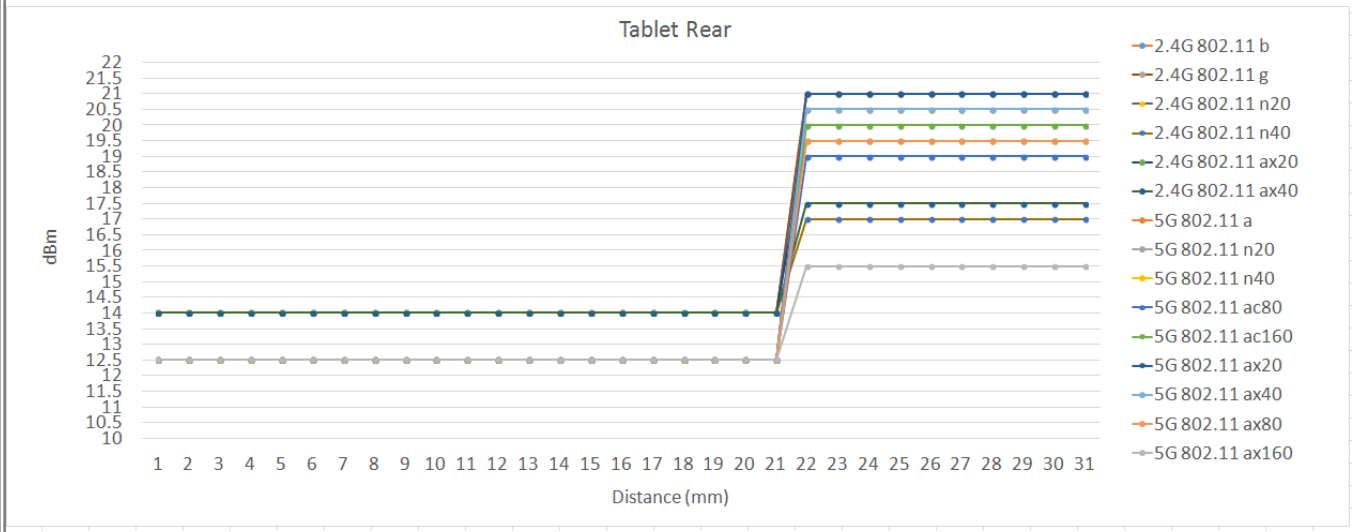
As per the KDB 616217 D04 SAR for laptop and tablets v01r02, section 6.4, the following procedure is used to determine the tilt angle influences to proximity sensor triggering.

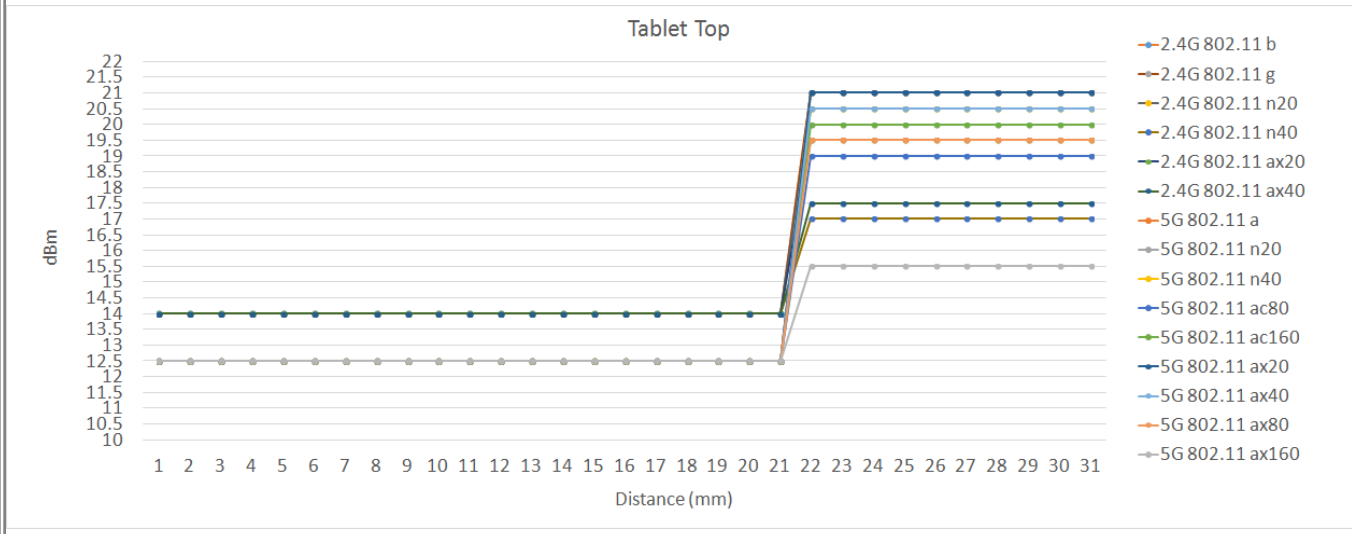


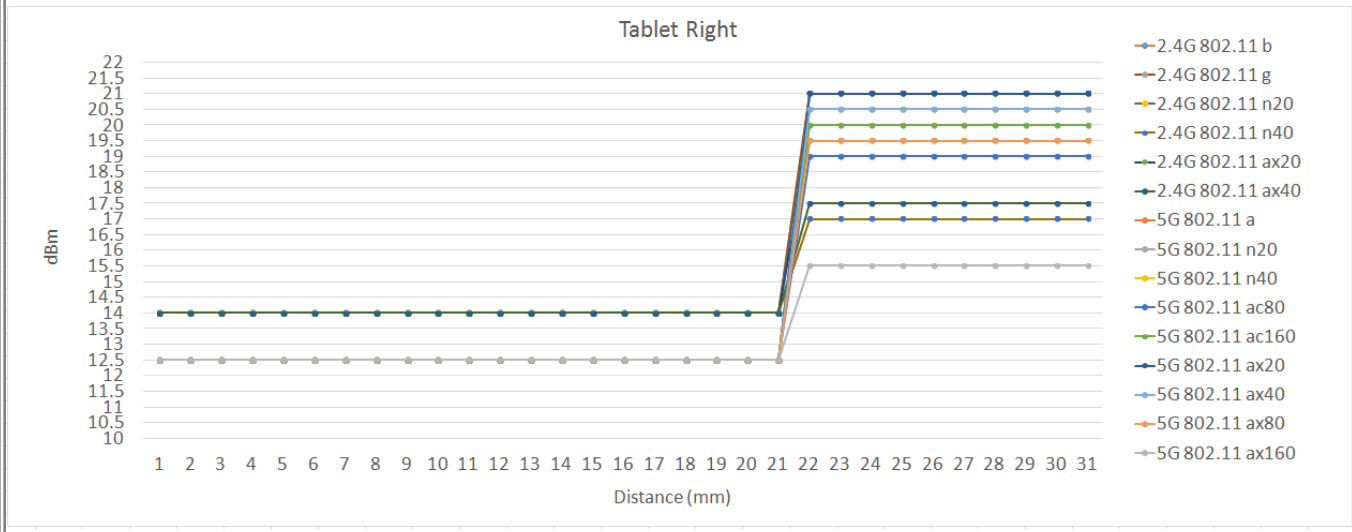
Distance to the DUT (mm)	Proximity Sensor Status 0° to +45°	Proximity Sensor Status 0° to +45°
19	ON	ON
18	ON	ON
17	ON	ON
16	ON	ON
15	ON	ON
14	ON	ON
13	ON	ON
12	ON	ON
11	ON	ON
10	ON	ON
9	ON	ON
8	ON	ON
7	ON	ON
6	ON	ON
5	ON	ON
4	ON	ON
3	ON	ON
2	ON	ON
1	ON	ON
0	ON	ON

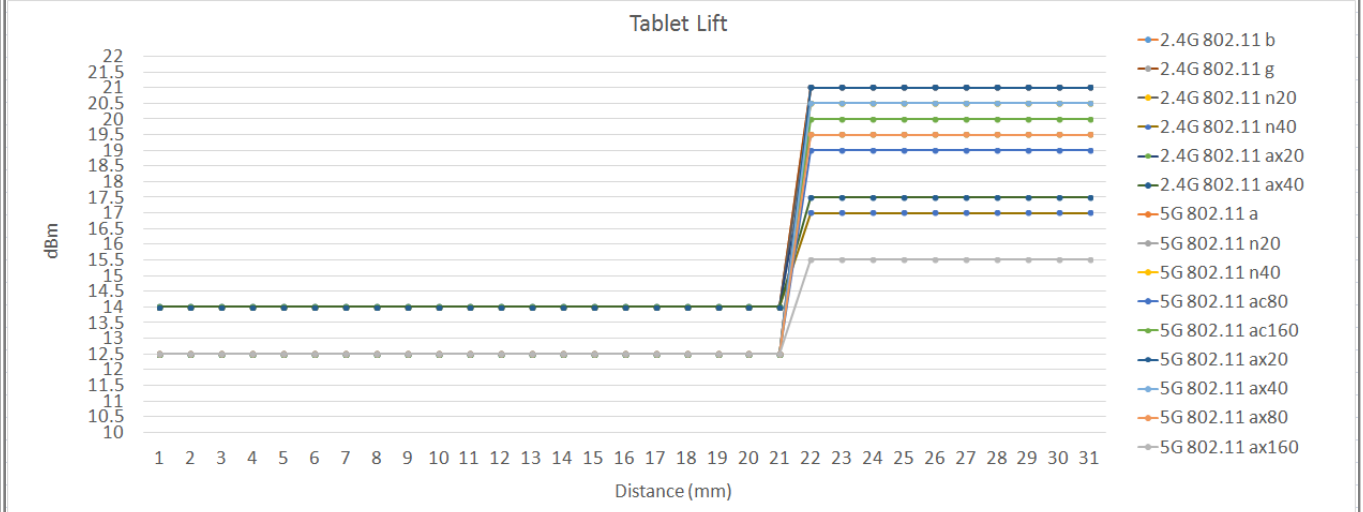
8.5 power reduction per air-interface

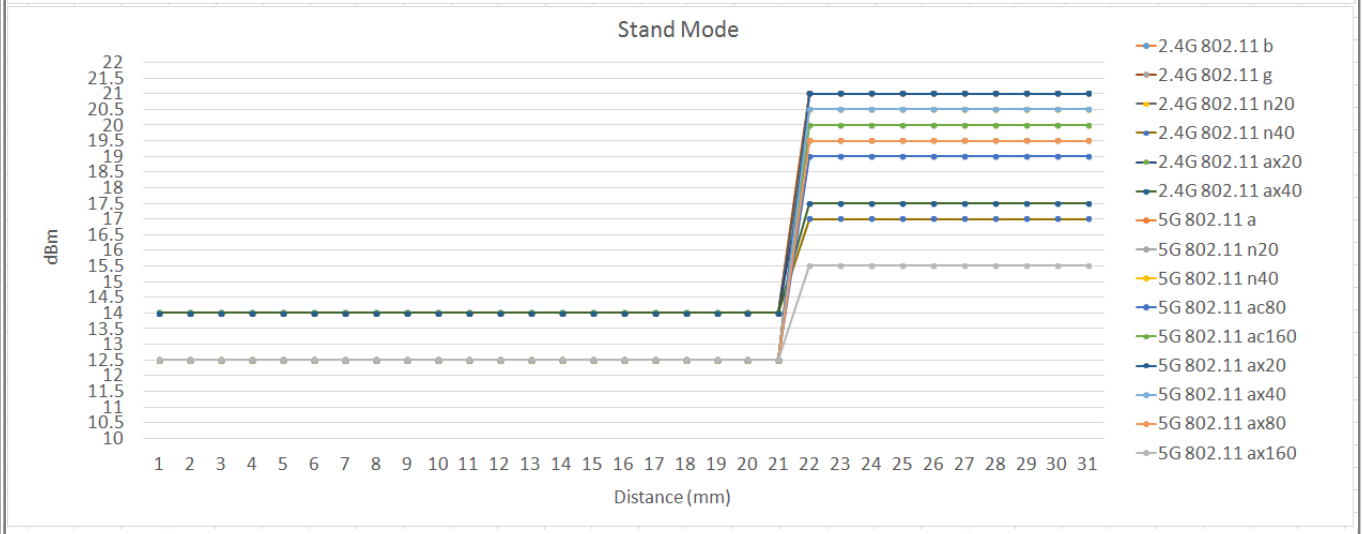
The following graphs show the power level and the distance from the DUT to the flat phantom for the Tablet Rear /Tablet Top / Tablet Tight / Tablet Lift / Stand Mode Surface.








Tablet Lift
dBm
Distance (mm)
2.4G 802.11 b
2.4G 802.11 g
2.4G 802.11 n20
2.4G 802.11 n40
2.4G 802.11 ax20
2.4G 802.11 ax40
5G 802.11 a
5G 802.11 n20
5G 802.11 n40
5G 802.11 ac80
5G 802.11 ac160
5G 802.11 ax20
5G 802.11 ax40
5G 802.11 ax80
5G 802.11 ax160


Stand Mode
dBm
Distance (mm)
2.4G 802.11 b
2.4G 802.11 g
2.4G 802.11 n20
2.4G 802.11 n40
2.4G 802.11 ax20
2.4G 802.11 ax40
5G 802.11 a
5G 802.11 n20
5G 802.11 n40
5G 802.11 ac80
5G 802.11 ac160
5G 802.11 ax20
5G 802.11 ax40
5G 802.11 ax80
5G 802.11 ax160

9 CONDUCTED POWER RESULTS

9.1 Conducted power measurement results of Bluetooth

Band	Mode	Channel	Frequency (MHz)	Max Power (dBm)	AVG Power (dBm)
BR	DH5	0	2402	11.00	10.92
		39	2441	11.00	10.96
		78	2480	11.00	10.98
EDR	2DH5	0	2402	10.50	Not Required
		39	2441	10.50	
		78	2480	10.50	
	3DH5	0	2402	10.50	
		39	2441	10.50	
		78	2480	10.50	
BLE		0	2402	6.00	
		19	2440	6.00	
		39	2480	6.00	

9.2 Conducted power measurement results of 2.4G Band

P-Senser_On

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	14.00	13.96		
		6	2437		14.00	13.98		
		11	2462		14.00	13.97		
		1	2412		14.00		13.96	
		6	2437		14.00		13.97	
		11	2462		14.00		13.96	
	802.11g	1	2412	6	14.00	Not Required		
		6	2437		14.00			
		11	2462		14.00			
		1	2412		14.00			
		6	2437		14.00			
		11	2462		14.00			
	802.11 n20	1	2412	HT0	14.00	Not Required		
		6	2437		14.00			
		11	2462		14.00			
		1	2412		14.00			
		6	2437		14.00			
		11	2462		14.00			
		1	2412	HT8	14.00	Not Required		
		6	2437		14.00			
		11	2462		14.00			
	802.11 n40	3	2422	HT0	10.50	Not Required		
		6	2437		14.00			
		9	2452		10.50			
		3	2422		10.50			
		6	2437		14.00			
		9	2452		10.50			
		3	2422	HT8	10.50	Not Required		
		6	2437		14.00			
		9	2452		10.50			
	802.11 ax20	1	2412	EH0	14.00	Not Required		
		6	2437		14.00			
		11	2462		14.00			
		1	2412		14.00			
		6	2437		14.00			
		11	2462		14.00			
		1	2412	EH8	14.00	Not Required		
		6	2437		14.00			
		11	2462		14.00			
	802.11 ax40	3	2422	EH0	10.50	Not Required		
		6	2437		14.00			
		9	2452		10.50			
		3	2422		10.50			
		6	2437		14.00			
		9	2452		10.50			
		3	2422	EH8	10.50	Not Required		
		6	2437		14.00			
		9	2452		10.50			

Note:
1. Output Power and SAR is not required for 802.11 g/n HT20/n HT40 channels 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.

P-Senser_Off

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	21.00	20.84		
		6	2437		21.00	20.86		
		11	2462		21.00	20.85		
		1	2412		21.00		20.99	
		6	2437		21.00		20.99	
		11	2462		21.00		20.97	
	802.11g	1	2412	6	20.50	Not Required		
		6	2437		20.50			
		11	2462		20.50			
		1	2412		21.00			
		6	2437		21.00			
		11	2462		21.00			
	802.11 n20	1	2412	HT0	20.50	Not Required		
		6	2437		20.50			
		11	2462		20.50			
		1	2412		20.50			
		6	2437		20.50			
		11	2462		20.50			
		1	2412	HT8	20.50	Not Required		
		6	2437		20.50			
		11	2462		20.50			
	802.11 n40	3	2422	HT0	17.00	Not Required		
		6	2437		17.00			
		9	2452		17.00			
		3	2422		17.00			
		6	2437		17.00			
		9	2452		17.00			
		3	2422	HT8	17.00	Not Required		
		6	2437		17.00			
		9	2452		17.00			
	802.11 ax20	1	2412	EH0	19.50	Not Required		
		6	2437		19.50			
		11	2462		19.50			
		1	2412		19.50			
		6	2437		19.50			
		11	2462		19.50			
		1	2412	EH8	19.50	Not Required		
		6	2437		19.50			
		11	2462		19.50			
	802.11 ax40	3	2422	EH0	17.50	Not Required		
		6	2437		17.50			
		9	2452		17.50			
		3	2422		17.50			
		6	2437		17.50			
		9	2452		17.50			
		3	2422	EH8	17.50	Not Required		
		6	2437		17.50			
		9	2452		17.50			

Note:

1. Output Power and SAR is not required for 802.11 g/n HT20/n HT40 channels 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.

9.3 Conducted power measurements of UNIi_1

P-sensor On/Off	Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
							Main	Aux	Main+Aux MIMO
On	5.2 UNII_1	802.11a	36	5180	6	12.50	12.46		
			40	5200		12.50	12.50		
			44	5220		12.50	12.48		
			48	5240		12.50	12.46		
			36	5180		12.50		12.46	
			40	5200		12.50		12.49	
			44	5220		12.50		12.46	
			48	5240		12.50		12.47	
		802.11 n20	36-48	5180-5240	HT0	12.50	Not Required		
					HT8	12.50			
		802.11 n40	38-46	5190-5230	HT0	12.50			
					HT8	12.50			
		802.11 ac80	42	5210	VHT0	12.50			
					VHT8	12.50			
		802.11 ax20	36-48	5180-5240	HT0	12.50			
					HT8	12.50			
		802.11 ax40	38-46	5190-5230	HT0	12.50			
					HT8	12.50			
		802.11 ax80	42	5210	VHT0	12.50			
					VHT8	12.50			
Off	5.2 UNII_1	802.11a	36	5180	6	21.00	20.93		
			40	5200		21.00	20.99		
			44	5220		21.00	20.97		
			48	5240		21.00	20.95		
			36	5180		21.00		20.94	
			40	5200		21.00		21.00	
			44	5220		21.00		20.96	
			48	5240		21.00		20.94	
		802.11 n20	36-48	5180-5240	HT0	21.00	Not Required		
					HT8	21.00			
		802.11 n40	38-46	5190-5230	HT0	20.50			
					HT8	20.50			
		802.11 ac80	42	5210	VHT0	19.00			
					VHT8	19.00			
		802.11 ax20	36-48	5180-5240	HT0	21.00			
					HT8	21.00			
		802.11 ax40	38-46	5190-5230	HT0	20.50			
					HT8	20.50			
		802.11 ax80	42	5210	VHT0	19.00			
					VHT8	19.00			

Note:

1. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
   ≤ 1.2 W/kg, SAR is not required for UNII band I.
   > 1.2 W/kg, both bands should be tested independently for SAR.
2. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11a .

9.4 Conducted power measurements of UNII_2a

P-sensor On/Off	Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
							Main	Aux	Main+Aux MIMO
On	5.3 UNII_2a	802.11a	52	5260	6	12.50	12.47		
			56	5280		12.50	12.47		
			60	5300		12.50	12.49		
			64	5320		12.50	12.49		
			52	5260		12.50		12.47	
			56	5280		12.50		12.48	
			60	5300		12.50		12.49	
			64	5320		12.50		12.47	
		802.11 n20	52-64	5260-5320	HT0	12.50	Not Required		
					HT8	12.50			
		802.11 n40	54-62	5270-5310	HT0	12.50			
					HT8	12.50			
		802.11 ac80	58	5290	VHT0	12.50			
					VHT8	12.50			
		802.11 ac160	50	5250	VHT0	12.50			
					VHT8	12.50			
		802.11 ax20	52-64	5260-5320	HT0	12.50			
					HT8	12.50			
		802.11 ax40	54-62	5270-5310	HT0	12.50			
					HT8	12.50			
		802.11 ax80	58	5290	VHT0	12.50			
					VHT8	12.50			
		802.11 ax160	50	5250	VHT0	12.50			
					VHT8	12.50			
Off	5.3 UNII_2a	802.11a	52	5260	6	21.00	21.94		
			56	5280		21.00	21.95		
			60	5300		21.00	21.96		
			64	5320		21.00	21.95		
			52	5260		21.00		21.96	
			56	5280		21.00		21.94	
			60	5300		21.00		21.94	
			64	5320		21.00		21.94	
		802.11 n20	52-64	5260-5320	HT0	21.00	Not Required		
					HT8	21.00			
		802.11 n40	54-62	5270-5310	HT0	20.50			
					HT8	20.50			
		802.11 ac80	58	5290	VHT0	18.50			
					VHT8	18.50			
		802.11 ac160	50	5250	VHT0	14.50			
					VHT8	14.50			
		802.11 ax20	52-64	5260-5320	HT0	21.00			
					HT8	21.00			
		802.11 ax40	54-62	5270-5310	HT0	20.50			
					HT8	20.50			
		802.11 ax80	58	5290	VHT0	18.50			
					VHT8	18.50			
		802.11 ax160	50	5250	VHT0	15.00			
					VHT8	15.00			

Note:

1. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
   ≤ 1.2 W/kg, SAR is not required for UNII band I.
   > 1.2 W/kg, both bands should be tested independently for SAR.
2. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11a .

9.5 Conducted power measurements of wifi UNII_2c

P-sensor On/Off	Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
							Main	Aux	Main+Aux MIMO
On	5.5 UNII_2c	802.11a	100-128	5500-5640	6	12.50	Not Required		
		802.11 n20	100-128	5500-5640	HT0	12.50			
					HT8	12.50			
		802.11 n40	102	5510	HT0	12.50	12.45		
			110	5550		12.50	12.48		
			118	5590		12.50	12.49		
			126	5630		12.50	12.46		
			102	5510		12.50		12.46	
			110	5550		12.50		12.48	
			118	5590		12.50		12.48	
			126	5630		12.50		12.47	
			102-126	5510-5630	HT8	12.50	Not Required		
		802.11 ac80	106-122	5530-5610	VHT0	12.50			
					VHT8	12.50			
		802.11 ac160	114	5570	VHT0	12.50			
					VHT8	12.50			
		802.11 ax20	100-128	5500-5640	HT0	12.50			
					HT8	12.50			
		802.11 ax40	102-126	5510-5630	HT0	12.50			
					HT8	12.50			
		802.11 ax80	106-122	5530-5610	VHT0	12.50			
					VHT8	12.50			
		802.11 ax160	114	5570	VHT0	12.50			
					VHT8	12.50			
Off	5.5 UNII_2c	802.11a	100-128	5500-5640	6	21.00	Not Required		
		802.11 n20	100-128	5500-5640	HT0	21.00			
					HT8	21.00			
		802.11 n40	102	5510	HT0	21.00	12.94		
			110	5550		21.00	12.95		
			118	5590		21.00	12.96		
			126	5630		21.00	12.95		
			102	5510		21.00		12.93	
			110	5550		21.00		12.95	
			118	5590		21.00		12.96	
			126	5630		21.00		12.95	
			102-126	5510-5630	HT8	21.00	Not Required		
		802.11 ac80	106-122	5530-5610	VHT0	20.00			
					VHT8	20.00			
		802.11 ac160	114	5570	VHT0	15.50			
					VHT8	15.50			
		802.11 ax20	100-128	5500-5640	HT0	21.00			
					HT8	21.00			
		802.11 ax40	102-126	5510-5630	HT0	21.00			
					HT8	21.00			
		802.11 ax80	106-122	5530-5610	VHT0	19.50			
					VHT8	19.50			
		802.11 ax160	114	5570	VHT0	15.50			
					VHT8	15.50			

Note:

1. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11n HT20/HT40/802.11ac and the measured SAR is ≤ 1.2 W/Kg.
2. Output Power and SAR measurement is not required for / 802.11n HT20/n HT40 /802.11ac channels when the specified maximum tune-up powers are less or same with 802.11 a.

9.6Conducted power measurements of wifi UNII_3

P-sensor On/Off	Band	Mode	Channel	Frequency (MHz)	Data Rate	Max Tune-Up Power (dBm)	AVG Power (dBm)		
							Main	Aux	Main+Aux MIMO
On	5.8 UNII_3	802.11a	132-165	5660-5825	6	12.50	Not Required		
		802.11 n20	132-165	5660-5825	HT0	12.50			
					HT8	12.50			
		802.11 n40	134-159	5670-5795	HT0	12.50			
					HT8	12.50			
		802.11 ac80	138	5690	VHT0	12.50	12.44		
			155	5775		12.50	12.45		
			138	5690		12.50		12.48	
			155	5775		12.50		12.49	
			138-155	5690-5775	VHT8	12.50	Not Required		
		802.11 ax20	132-165	5660-5825	HT0	12.50			
					HT8	12.50			
		802.11 ax40	134-159	5670-5795	HT0	12.50			
					HT8	12.50			
		802.11 ax80	138-155	5690-5775	VHT0	12.50			
					VHT8	12.50			
Off	5.5 UNII_2c	802.11a	132-165	5660-5825	6	21.00	Not Required		
		802.11 n20	132-165	5660-5825	HT0	21.00			
					HT8	21.00			
		802.11 n40	134-159	5670-5795	HT0	21.00			
					HT8	21.00			
		802.11 ac80	138	5690	VHT0	21.00	20.96		
			155	5775		21.00	20.98		
			138	5690		21.00		20.95	
			155	5775		21.00		20.97	
			138-155	5690-5775	VHT8	21.00	Not Required		
		802.11 ax20	132-165	5660-5825	HT0	21.00			
					HT8	21.00			
		802.11 ax40	134-159	5670-5795	HT0	21.00			
					HT8	21.00			
		802.11 ax80	138-155	5690-5775	VHT0	21.00			
					VHT8	21.00			

Note:

1. Output Power and SAR measurement is not required for 802.11n HT20/n HT40/802.11ac channels when the specified maximum tune-up powers are less or same with 802.11n HT20/HT40/802.11ac and the measured SAR is ≤ 1.2 W/Kg.
2. Output Power and SAR measurement is not required for / 802.11n HT20/n HT40 /802.11ac channels when the specified maximum tune-up powers are less or same with 802.11 a.

9.7 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:≤0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is≤100 MHz. When the maximum output power variation across the required test channels is > ½ 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 ≥0.8W/kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/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 ≤ 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 ≤ 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 Section7.1.4 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 than1.2W/kg. See Section 7.1.4 for more information.

10 SAR TEST RESULTS

10.1 Body SAR test results

SAR test results of Bluetooth

Mode	Channel	Test Position	Ant Vendor	Ant	Dist (mm)	Max une-up (dBm)	AVG Power (dBm)	Area SAR 1g	Zoom SAR 1g	Reported SAR 1g	Note
Bluetooth	78	Tablet Top	AWAN	Aux	0	11.00	10.98	0.030		0.030	
		Tablet Rear			0	11.00	10.98	0.107		0.107	
		Stane			0	11.00	10.98	0.351	0.322	**0.323**	
		Stane	ICT		0	11.00	10.98	0.295	0.272	0.273	

SAR test results of 2.4G WiFi

P-sense On/Off	Mode	Channel	Test Position	Ant Vendor	Ant	Dist (mm)	Max une-up (dBm)	AVG Power (dBm)	Area SAR 1g	Zoom SAR 1g	Reported SAR 1g	Note
on	802.11b	6	Tablet Top	AWAN	Main	0	14.00	13.98	0.126		0.127	
			Tablet Rear			0	14.00	13.98	0.505	0.503	0.505	
			Stand			0	14.00	13.98	0.917	0.889	**0.893**	
			Tablet Right			0	14.00	13.98	0.024		0.024	
		1	Stand			0	14.00	13.96	0.995	0.841	0.849	
		6	Tablet Top		Aux	0	14.00	13.97	0.266		0.268	
			Tablet Rear			0	14.00	13.97	0.431	0.432	0.435	
			Stand			0	14.00	13.97	1.130	1.060	**1.067**	
			Tablet Left			0	14.00	13.97	0.025		0.025	
		1	Stand			0	14.00	13.96	0.982	0.919	0.928	
		6	Stand	ICT	Aux	0	14.00	13.97	1.050	0.957	0.964	
		6	Stand	AWAN	Aux	0	14.00	13.97	1.100	1.030	1.037	
Off	802.11b	6	Tablet Top	AWAN	Main	19	21.00	20.86	0.099		0.102	
			Tablet Rear			19	21.00	20.86	0.192		0.198	
			Stand			19	21.00	20.86	0.251	0.242	**0.250**	
			Tablet Right			19	21.00	20.86	0.010		0.010	
			Tablet Top		Aux	19	21.00	20.99	0.048		0.048	
			Tablet Rear			19	21.00	20.99	0.203		0.203	
			Stand			19	21.00	20.99	0.270	0.258	**0.259**	
			Tablet Left			19	21.00	20.99	0.014		0.014	
			Stand	ICT	Aux	19	21.00	20.99	0.251	0.244	0.245	

Note:

1. Highest reported SAR is > 0.8 W/kg. Added second highest power channel for this test position
2. 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 = 1.067 W/kg, therefore second times repeat SAR is required.
   Repeat SAR = 1.037 W/kg < 1.45W/kg
   SAR variation= -2.81% < 20%

SAR test results of 5G WiFi

P-sense On/Off	Band	Mode	Channel	Test Position	Ant Vendor	Ant	Dist (mm)	Max une-up (dBm)	AVG Power (dBm)	Area SAR 1g	Zoom SAR 1g	Reported SAR 1g	Note
On	5G_UNII 1 & 2a	802.11a	40	Tablet Top	AWAN	Main	0	12.50	12.50	0.221		0.221	
				Tablet Rear			0	12.50	12.50	0.517	0.649	0.649	
				Tablet Right			0	12.50	12.50	0.083		0.083	
				Stand			0	12.50	12.50	0.914	0.858	0.858	
			60	Stand			0	12.50	12.49	1.070	0.988	0.990	1
			40	Tablet Top		Aux	0	12.50	12.49	0.275		0.276	
				Tablet Rear			0	12.50	12.49	0.561	0.741	0.743	
				Tablet Lift			0	12.50	12.49	0.066		0.066	
				Stand			0	12.50	12.49	0.983	1.120	1.123	
			60	Stand			0	12.50	12.48	0.908	1.170	**1.175**	1
	5G_UNII 2c	802.11 n40	118	Tablet Top		Main	0	12.50	12.49	0.281		0.282	
				Tablet Rear			0	12.50	12.49	0.826	0.829	0.831	
				Tablet Right			0	12.50	12.49	0.136		0.136	
				Stand			0	12.50	12.49	1.040	0.974	1.042	
			110	Stand			0	12.50	12.48	0.102	0.972	0.976	1
			118	Tablet Top		Aux	0	12.50	12.48	0.256		0.257	
				Tablet Rear			0	12.50	12.48	0.492	0.584	0.587	
				Tablet Lift			0	12.50	12.48	0.021		0.021	
				Stand			0	12.50	12.48	0.931	1.130	**1.135**	
			110	Stand			0	12.50	12.48	0.828	0.987	0.992	1
	5G_UNII 3	802.11 ac80	155	Tablet Top		Main	0	12.50	12.45	0.261		0.264	
				Tablet Rear			0	12.50	12.45	0.573	0.582	0.589	
				Tablet Right			0	12.50	12.45	0.086		0.087	
				Stand			0	12.50	12.45	0.806	0.878	0.888	
			138	Stand			0	12.50	12.44	0.720	0.842	0.854	
			155	Tablet Top		Aux	0	12.50	12.49	0.205		0.205	
				Tablet Rear			0	12.50	12.49	0.623	0.743	0.745	
				Tablet Lift			0	12.50	12.49	0.077		0.077	
				Stand			0	12.50	12.49	1.020	1.230	**1.233**	
			138	Stand			0	12.50	12.48	1.130	1.130	1.135	1
			155	Stand	ICT		0	12.50	12.49	1.020	1.010	1.012	
				Stand	AWAN		0	12.50	12.49	1.010	1.180	1.183	2
Off	5G_UNII 1 & 2a	802.11a	40	Tablet Top	AWAN	Main	19	21.00	20.99	0.191		0.191	
				Tablet Rear			19	21.00	20.99	0.124		0.124	
				Tablet Right			19	21.00	20.99	0.014		0.014	
				Stand			19	21.00	20.99	0.404	0.429	0.405	
				Tablet Top		Aux	19	21.00	21.00	0.484	0.497	0.497	
				Tablet Rear			19	21.00	21.00	0.226		0.226	
				Tablet Lift			19	21.00	21.00	0.022		0.022	
				Stand			19	21.00	21.00	0.552	0.586	**0.586**	
	5G_UNII 2c	802.11 n40	118	Tablet Top		Main	19	21.00	20.96	0.322		0.325	
				Tablet Rear			19	21.00	20.96	0.365	0.386	0.390	
				Tablet Right			19	21.00	20.96	0.029		0.029	
				Stand			19	21.00	20.96	0.592	0.660	0.666	
				Tablet Top		Aux	19	21.00	20.96	0.222		0.224	
				Tablet Rear			19	21.00	20.96	0.450	0.474	0.478	
				Tablet Lift			19	21.00	20.96	0.012		0.012	
				Stand			19	21.00	20.96	0.530	0.556	**0.561**	
	5G_UNII 3	802.11 ac80	155	Tablet Top		Main	19	21.00	20.98	0.362		0.364	
				Tablet Rear			19	21.00	20.98	0.412	0.438	0.440	
				Tablet Right			19	21.00	20.98	0.019		0.019	
				Stand			19	21.00	20.98	0.641	0.681	**0.684**	
				Tablet Top		Aux	19	21.00	20.97	0.303		0.305	
				Tablet Rear			19	21.00	20.97	0.538	0.552	0.556	
				Tablet Lift			19	21.00	20.97	0.021		0.022	
				Stand			19	21.00	20.97	0.599	0.620	0.624	
Off	5G_UNII 3	802.11 ac80	155	Stand	ICT	Main	19	21.00	20.98	0.579	0.619	0.622	

Note:

1. Highest reported SAR is > 0.8 W/kg. Added second highest power channel for this test position
2. 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 = 1.233 W/kg, therefore second times repeat SAR is required.
   Repeat SAR = 1.183 W/kg < 1.45W/kg
   SAR variation= -4.05% < 20%

11. SIMULTANEOUS TRANSMISSION CONDITIONS

11.1 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

11.2 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:

SAR₁ 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

SAR₂ 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

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

11.3 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 ≤ 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 ≤ 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

11.3.1 Estimated SAR for Bluetooth

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

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/x]* W/kg for test separation distances ≤ 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	11.00	13.00	8.00	6.40	0.341	**Test**

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	11.00	13.00	6.40	**4.50**	**216.10**	44.90	203.25	**Test**	**Test**	**>200mm**	0.061	**>200mm**

11.5 Simultaneous transmission conditions

P-Sensor On

Test Position / SAR1g(W/kg)	Tablet Top	Tablet Rear	Tablet Lift	Tablet Right	Stand Mode
WLAN 2.4G WiFi_Main	**0.127**	**0.505**		0.024	**0.896**
WLAN 2.4G WiFi_Aux	**0.268**	**0.435**	0.025		**1.067**
UNII_1 WiFi_Main	0.221	0.649		0.083	0.858
UNII_1 WiFi_Aux	**0.276**	0.743	0.066		1.123
UNII_2a WiFi_Main					0.990
UNII_2a WiFi_Aux					1.175
UNII_2c WiFi_Main	**0.282**	**0.831**		0.136	**1.042**
UNII_2c WiFi_Aux	0.256	0.492	0.021		1.135
UNII_3 WiFi_Main	0.264	0.589		0.087	0.888
UNII_3 WiFi_Aux	0.205	**0.745**	0.077		**1.233**
Bluetooth_DH5	0.030	0.107	0.061		0.322
WLAN 2.4G_Main+WLAN 2.4G_Aux MAX∑SAR1g	0.395	0.940			1.963
WLAN 2.4G+BT MAX∑SAR1g	0.425	1.047			**2.285**
RLAN 5G_Main+ RLAN 5G_Aux MAX∑SAR1g	0.558	1.576			2.275
RLAN 5G_Main+ RLAN 5G_Aux+BT MAX∑SAR1g	0.588	1.683			**2.597**

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

P-Sensor Off

Test Position / SAR1g(W/kg)	Tablet Top	Tablet Rear	Tablet Lift	Tablet Right	Stand Mode
WLAN 2.4G WiFi_Main	**0.102**	**0.198**		0.010	**0.250**
WLAN 2.4G WiFi_Aux	**0.048**	**0.203**	0.014		**0.259**
UNII_1 WiFi_Main	0.191	0.124		0.014	0.405
UNII_1 WiFi_Aux	**0.497**	0.226	0.022		0.586
UNII_2a WiFi_Main					
UNII_2a WiFi_Aux					
UNII_2c WiFi_Main	0.325	0.390		0.029	0.666
UNII_2c WiFi_Aux	0.224	0.478	0.012		0.561
UNII_3 WiFi_Main	**0.364**	**0.440**		0.019	**0.684**
UNII_3 WiFi_Aux	0.305	**0.556**	0.022		**0.624**
Bluetooth_DH5	0.030	0.107	0.061		0.322
WLAN 2.4G_Main+WLAN 2.4G_Aux MAX∑SAR1g	0.150	0.401			0.509
WLAN 2.4G+BT MAX∑SAR1g	0.180	0.508			**0.831**
RLAN 5G_Main+ RLAN 5G_Aux MAX∑SAR1g	0.861	0.996			1.308
RLAN 5G_Main+ RLAN 5G_Aux+BT MAX∑SAR1g	0.891	1.103			**1.630**

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

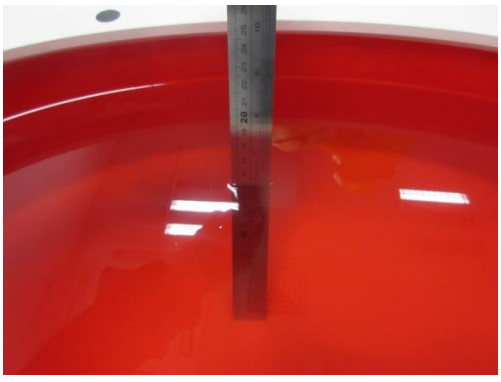
12. Test Layout

Specific Absorption Rate Test Layout

Liquid depth in the flat Phantom (≥15cm depth)

HSL(2450MHz)

HSL(5GHz)



Appendix A. SAR Plots of System Verification

(Pls See BTL-FCC SAR-1-2007T046_Appendix A.)

Appendix B. SAR Plots of SAR Measurement

(Pls See BTL-FCC SAR-1-2007T046_Appendix B.)

Appendix C. Calibration Certificate

(Pls See BTL-FCC SAR-1-2007T046_Appendix C.)

Appendix D. Photographs of the Test Set-Up

(Pls See BTL-FCC SAR-1-2007T046_Appendix D.)

Appendix E. SPLSR

(Pls See BTL-FCC SAR-1-2007T046_Appendix E.)

End of Test Report