FCC SAR Test Report

APPLICANT	:	Lenovo (Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT	:	Portable Tablet Computer
BRAND NAME	:	Lenovo
MODEL NAME	:	TB305FU
FCC ID	:	O57TB305FU
STANDARD	:	FCC 47 CFR Part 2 (2.1093)

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ilac-MRA

A2LA ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA4N0501	Rev. 01	Initial issue of report	Dec. 20, 2024

1. *Statement of Compliance*

The maximum results of Specific Absorption Rate (SAR) found during testing for **Lenovo (Shanghai) Electronics Technology Co., Ltd., Portable Tablet Computer, TB305FU,** are as follows.

Highest 1g SAR Summary				
Equipment Class	Frequency Band		Head (Separation 0mm) 1g SAR (W/kg)	Body (Separation 0mm) 1g SAR (W/kg)
DTS	WLAN	2.4GHz WLAN	**1.05**	1.00
NII		5GHz WLAN	0.61	**1.07**
DSS	Bluetooth	2.4GHz Bluetooth	0.11	0.23
Date of Testing:			2024/11/9 ~ 2024/12/2	

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR03-KS SAR04-KS	CN1257	314309

Applicant	
Company Name	Lenovo (Shanghai) Electronics Technology Co., Ltd.
Address	Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone

Manufacturer	
Company Name	Lenovo PC HK Limited
Address	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong, China

3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02

4. Equipment Under Test (EUT) Information

4.1 General Information

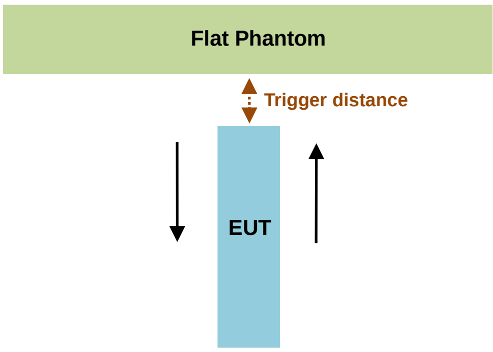
Product Feature & Specification	
Equipment Name	Portable Tablet Computer
Brand Name	Lenovo
Model Name	TB305FU
FCC ID	O57TB305FU
S/N Code	Sample 1: SN:HA238AG9 Sample 2: SN:HA236XHR
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	TB305FU
SW Version	TB305FU_RF01_241207
EUT Stage	Identical Prototype

Remark:
1. This device support voice function.
2. The device employs proximity sensors that detect the presence of the user's body also a finger or hand near the bottom face, edge 1 and edge 2 of the device, reduced power will be active for all WLAN bands. (P-sensor can't work at detecting presence of the user's body at other edges of the device.)
3. There are four samples. The difference between them could be referred to the TB305FU_Operational Description of Product Equality Declaration which is exhibited separately. According to the differences, we choose sample 1 to perform full test, and the sample 2 are verified the difference with the sample 1. For sample 3/4, the differences do not affect the test, so sample 3/4 are not tested.

5. Proximity Sensor Triggering Test

<Proximity Sensor Triggering Distance (KDB 616217 D04 section 6.2)>:

1. Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed and the tissue-equivalent medium for highest frequency 5825MHz and lowest 2412MHz frequency was used for proximity sensor triggering testing.
2. Capacitive proximity sensor placed coincident with antenna elements at the Bottom Face, Edge 1 and Edge 2 of the device are utilized to determine when the device comes in proximity of the user's body at the Bottom Face, Edge 1 and Edge 2 of the device. There is no need to do sensor coverage testing for the proximity sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the proximity sensor entirely covers the antenna.
3. When the sensor is active, all WLAN bands reduced power will be active.
4. The sensors used to detect the proximity of the user's body at the Bottom Face, Edge 1 and Edge 2 side of the device use a detection threshold distance. The data shown in the sections below shows the distance(s).



Proximity Sensor Triggering Distance (mm)						
Position	Bottom Face		Edge 1		Edge 2	
	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
Minimum	16	19	12	15	5	8

<Proximity Sensor Triggering Coverage (KDB 616217 D04 section 6.3)>:

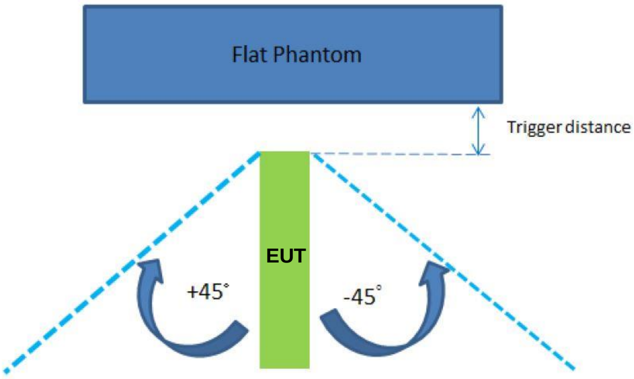
If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For p-sensor coverage testing, the device is moved and "along the direction of maximum antenna and sensor offset".

Illustrated in the internal photo exhibit, although the senor is spatially offset, there is no trigger condition where the antenna is next to the user but the sensor is laterally further away, therefore proximity sensor coverage testing is not required.

This procedure is not required because antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.

<Tablet Tilt angle influences to proximity sensor triggering (KDB 616217 D04 section 6.4)>:

The influence of table tilt angles to proximity sensor triggering was determined by positioning each tablet edge that contains a transmitting antenna, perpendicular to the flat phantom, the detail please refers to following tables. Rotating the tablet around the edge next to the phantom in ≤ 10° increments until the tablet is ± 45° from the vertical position at 0°, and the maximum output power remains in the reduced mode.



The Sensor Trigger Distance (mm)		
Position	Edge 1	Edge 2
Minimum	12	5

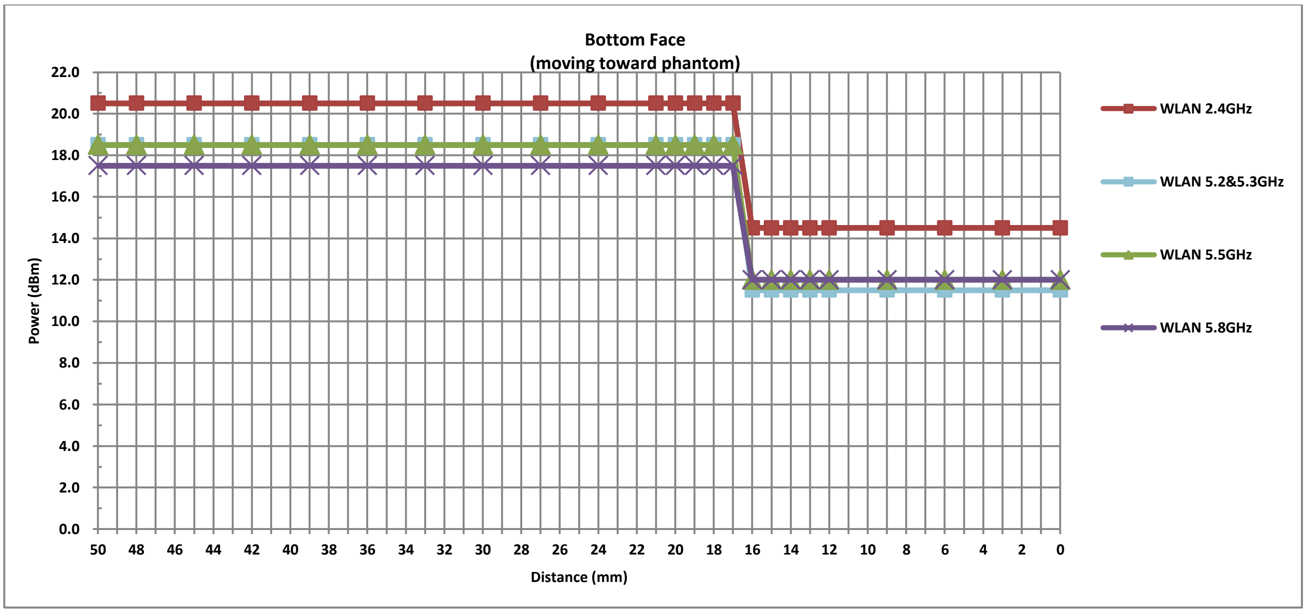
Proximity sensor power reduction

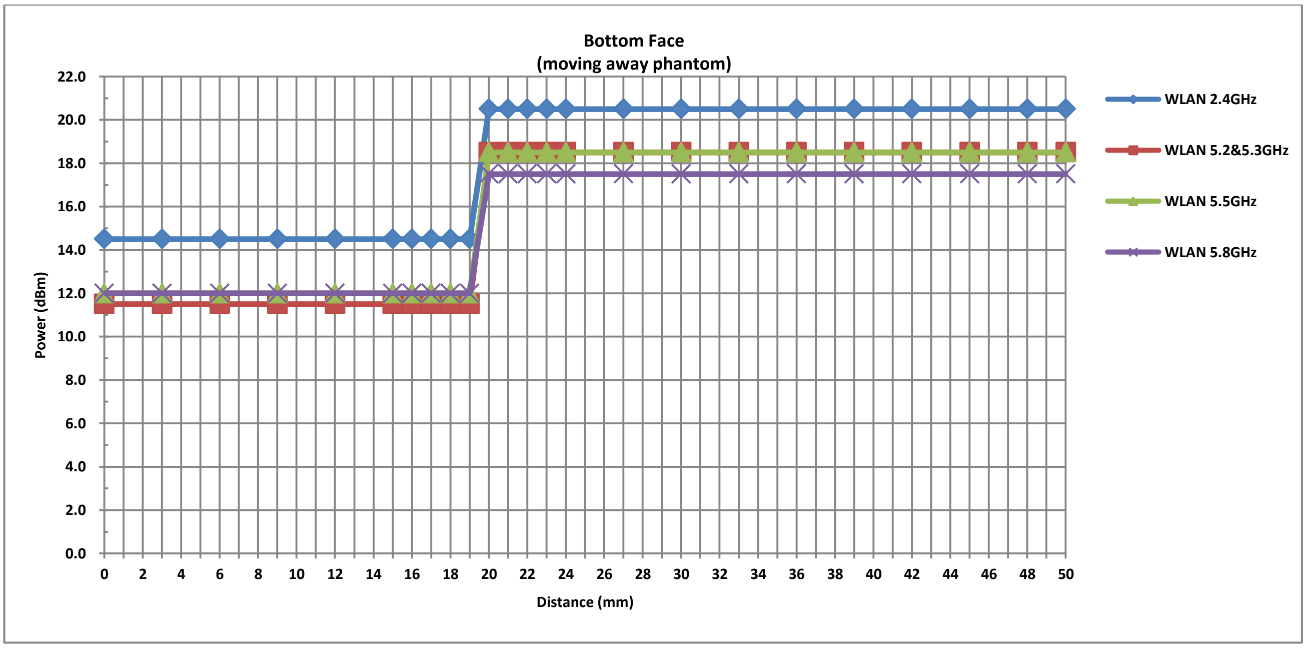
Exposure Position / wireless mode	Bottom Face[(1)]	Edge 1[(1)]	Edge 2[(1)]	Edge 3	Edge 4
WLAN 2.4GHz	6.0 dB	6.0 dB	6.0 dB	0 dB	0 dB
WLAN 5.2GHz	7.0 dB	7.0 dB	7.0 dB	0 dB	0 dB
WLAN 5.3GHz	7.0 dB	7.0 dB	7.0 dB	0 dB	0 dB
WLAN 5.5GHz	6.5 dB	6.5 dB	6.5 dB	0 dB	0 dB
WLAN 5.8GHz	5.5 dB	5.5 dB	5.5 dB	0 dB	0 dB

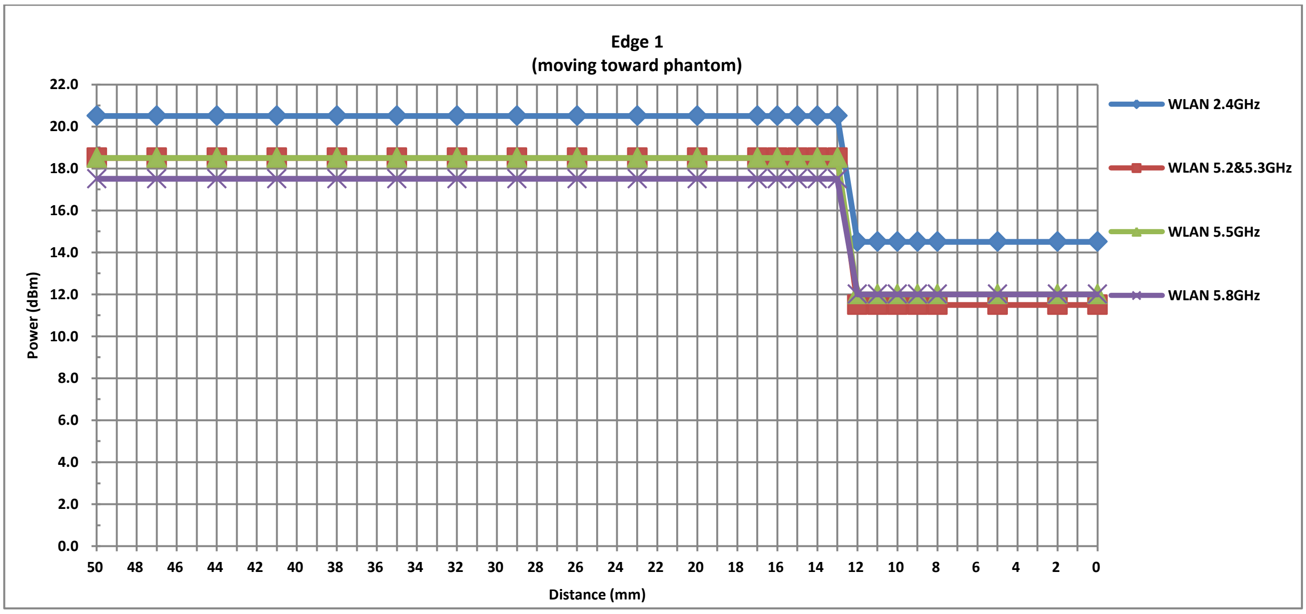
Remark:
1. [(1)]: Reduced maximum limit applied by activation of proximity sensor.
2. Power reduction is not applicable for Bluetooth.
3. Tests were performed in accordance with KDB 616217 D04 section 6.1, 6.2, 6.3, 6.4 and 6.5 and compliant results are shown and described in exhibit “P-Sensor operational description
4. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed:
   For WLAN:
   - Bottom Face: 15 mm
   - Edge 1: 11 mm
   - Edge 2: 4 mm

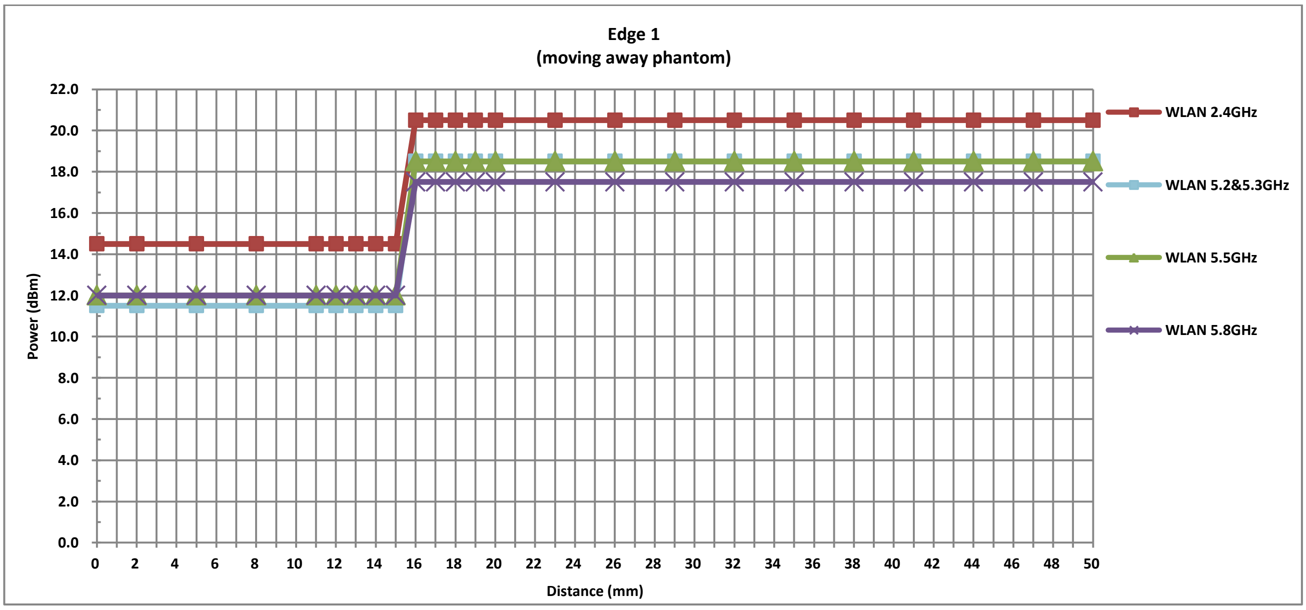
Power Measurement during Sensor Trigger distance testing

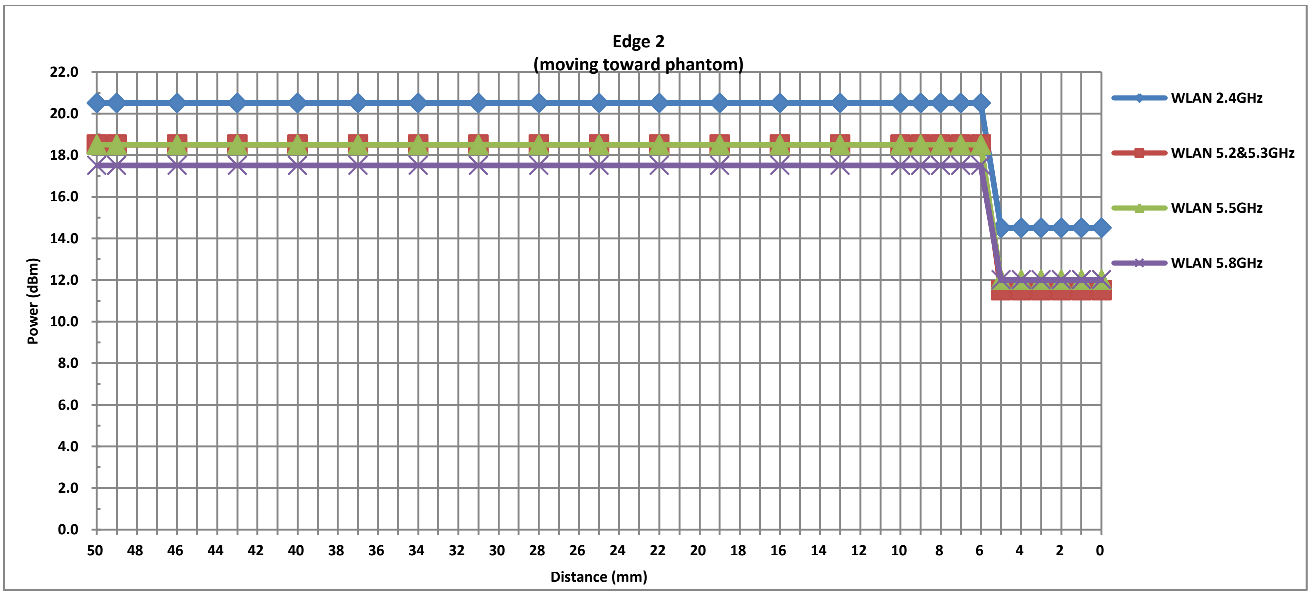
Band/Mode	Measured power reduction (dBm)		Reduction Levels
	w/o power back-off	w/ power back-off	(dB)
WLAN 2.4GHz	20.50	14.50	6.0
WLAN 5.2GHz	18.50	11.50	7.0
WLAN 5.3GHz	18.50	11.50	7.0
WLAN 5.5GHz	18.50	12.00	6.5
WLAN 5.8GHz	17.50	12.00	5.5

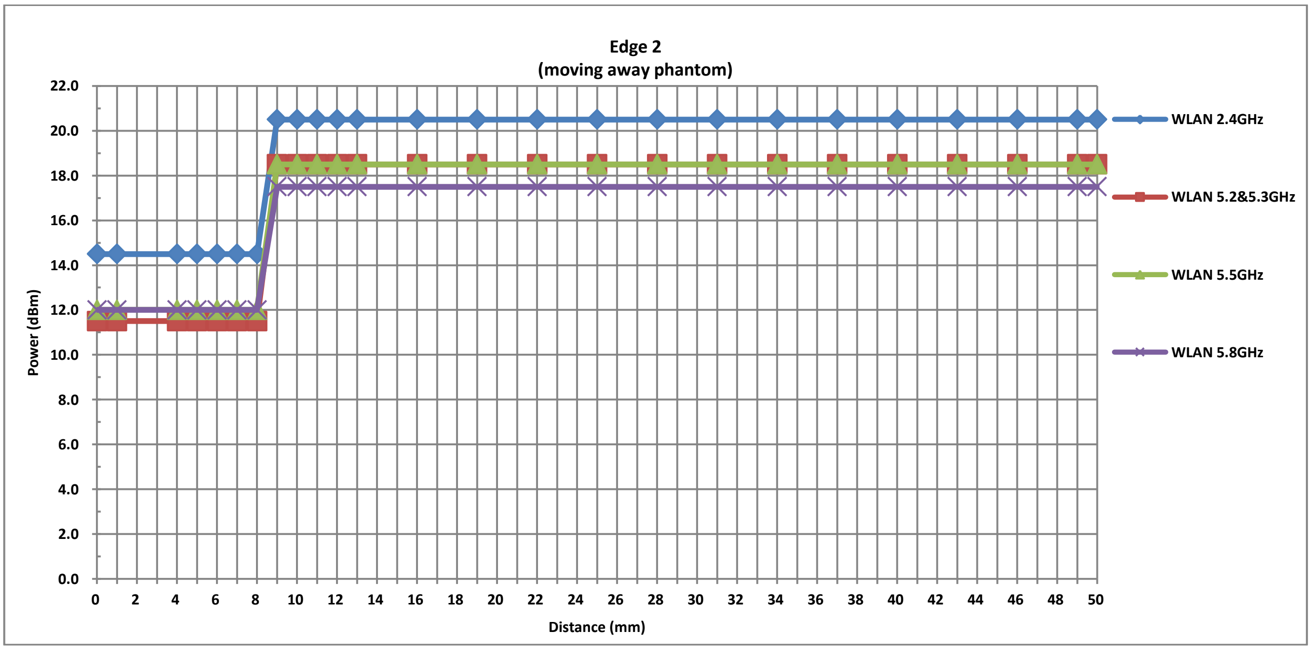





Edge 1
(moving toward phantom)
Power (dBm)
Distance (mm)
WLAN 2.4GHz
WLAN 5.2&5.3GHz
WLAN 5.5GHz
WLAN 5.8GHz


Edge 1
(moving away phantom)
Power (dBm)
Distance (mm)
WLAN 2.4GHz
WLAN 5.2&5.3GHz
WLAN 5.5GHz
WLAN 5.8GHz


Edge 2
(moving toward phantom)
Power (dBm)
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
Distance (mm)
WLAN 2.4GHz
WLAN 5.2&5.3GHz
WLAN 5.5GHz
WLAN 5.8GHz


Edge 2
(moving away phantom)
Power (dBm)
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50
Distance (mm)
WLAN 2.4GHz
WLAN 5.2&5.3GHz
WLAN 5.5GHz
WLAN 5.8GHz

6. RF Exposure Limits

6.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

6.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

7. Specific Absorption Rate (SAR)

7.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

7.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

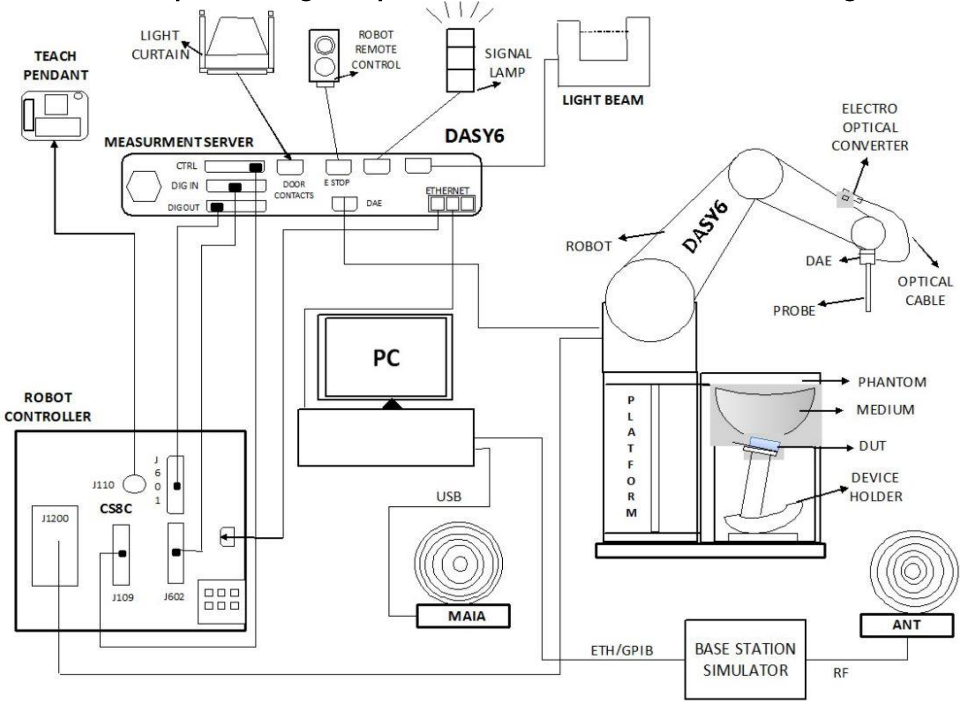
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

8. System Description and Setup

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 or Win10 and the DASY5 or DASY6 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

8.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	4 MHz – 10 GHz Linearity: ±0.2 dB (30 MHz – 10 GHz)	
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)	
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

8.2 Data Acquisition Electronics (DAE)

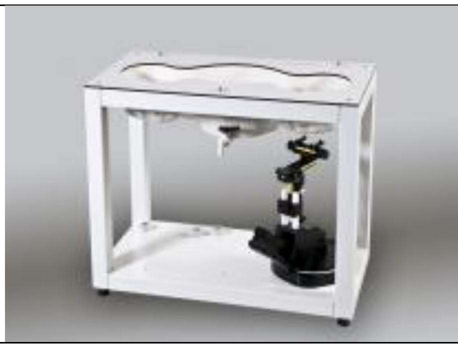
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Photo of DAE

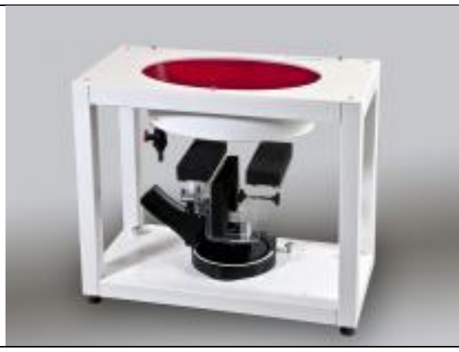
8.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm	

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices or for evaluating transmitters operating at low frequencies. ELI is fully compatible with standard and all known tissue simulating liquids.

8.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

9.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

9.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

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

9.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

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

9.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

10. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	1095	2024/2/8	2025/2/7
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	2022/9/23	2025/9/21
SPEAG	Data Acquisition Electronics	DAE4	1338	2024/3/18	2025/3/17
SPEAG	Data Acquisition Electronics	DAE4	1358	2024/5/23	2025/5/22
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	2024/1/22	2025/1/21
SPEAG	Dosimetric E-Field Probe	EX3DV4	7764	2024/9/2	2025/9/1
SPEAG	SAM Twin Phantom	SAM Twin	TP-1697	NCR	NCR
SPEAG	ELI Phantom	ELI4	TP-2134	NCR	NCR
Testo	Thermo-Hygrometer	HTC-1	55011	2024/1/4	2025/1/3
CHIGO	Thermo-Hygrometer	HTC-1	55009	2024/1/4	2025/1/3
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46112129	2024/7/4	2025/7/3
SPEAG	Dielectric Probe Kit	DAK-3.5	1071	2024/2/19	2025/2/18
SPEAG	Dielectric Probe Kit	DAK-3.5	1144	2024/8/20	2025/8/19
Anritsu	Vector Signal Generator	MG3710A	6201682672	2024/1/2	2025/1/1
Rohde & Schwarz	Power Meter	NRVD	102081	2024/7/4	2025/7/3
Rohde & Schwarz	Power Sensor	NRV-Z5	100538	2024/7/4	2025/7/3
Rohde & Schwarz	Power Sensor	NRV-Z5	100539	2024/7/4	2025/7/3
Rohde & Schwarz	Spectrum Analyzer	FSV7	101631	2024/10/11	2025/10/10
TES	DIGITAC THERMOMETER	TYPE-K	220305411	2024/1/4	2025/1/3
R&S	BLUETOOTH TESTER	CBT	101246	2024/7/4	2025/7/3
ARRA	Power Divider	A3200-2	N/A	Note 1	
MCL	Attenuation1	BW-S10W5+	N/A	Note 1	
MCL	Attenuation2	BW-S10W5+	N/A	Note 1	
MCL	Attenuation3	BW-S10W5+	N/A	Note 1	
BONN	POWER AMPLIFIER	BLMA 0830-3	087193A	Note 1	
BONN	POWER AMPLIFIER	BLMA 2060-2	087193B	Note 1	
Agilent	Dual Directional Coupler	778D	20500	Note 1	
Agilent	Dual Directional Coupler	11691D	MY48151020	Note 1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. The dipole calibration interval can be extended to 3 years with justification according to KDB 865664 D01. The dipoles are also not physically damaged, or repaired during the interval. The justification data in appendix C can be found which the return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration for each dipole.

11. System Verification

11.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

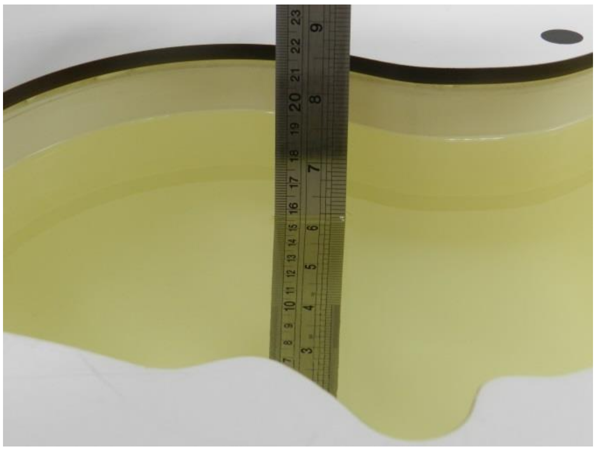


Fig 10.1Photo of Liquid Height for Head SAR

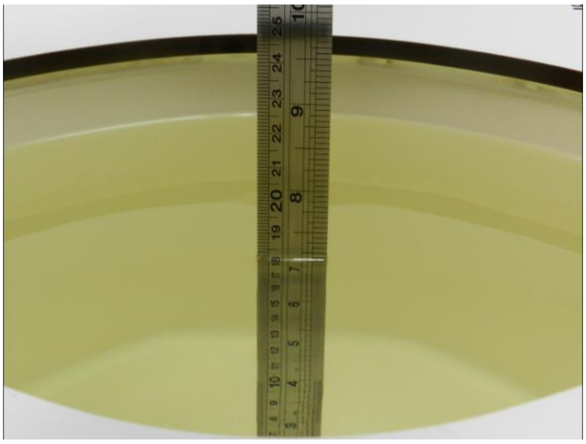


Fig 10.2 Photo of Liquid Height for Body SAR

11.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
2450	55.0	0	0	0	0	45.0	1.80	39.2

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
2450	Head	22.9	1.867	38.912	1.80	39.20	3.72	-0.73	±5	2024/11/29
5250	Head	22.6	4.573	35.719	4.71	35.90	-2.91	-0.50	±5	2024/11/30
5600	Head	22.6	4.946	35.100	5.07	35.50	-2.45	-1.13	±5	2024/12/1
5750	Head	22.7	5.106	34.868	5.22	35.40	-2.18	-1.50	±5	2024/12/2
2450	Head	22.7	1.850	39.100	1.80	39.20	2.78	-0.26	±5	2024/11/9
5250	Head	22.7	4.560	35.000	4.71	35.90	-3.18	-2.51	±5	2024/11/11
5600	Head	22.7	4.950	34.400	5.07	35.50	-2.37	-3.10	±5	2024/11/12
5750	Head	22.8	5.120	34.100	5.22	35.40	-1.92	-3.67	±5	2024/11/13

11.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2024/11/29	2450	Head	50	1095	3857	1338	2.530	52.60	50.6	-3.80
2024/11/30	5250	Head	50	1113	3857	1338	3.810	81.50	76.2	-6.50
2024/12/1	5600	Head	50	1113	3857	1338	4.020	82.60	80.4	-2.66
2024/12/2	5750	Head	50	1113	3857	1338	3.880	80.80	77.6	-3.96
2024/11/9	2450	Head	50	1095	7764	1358	2.670	52.60	53.4	1.52
2024/11/11	5250	Head	50	1113	7764	1358	4.350	81.50	87	6.75
2024/11/12	5600	Head	50	1113	7764	1358	4.430	82.60	88.6	7.26
2024/11/13	5750	Head	50	1113	7764	1358	4.280	80.80	85.6	5.94

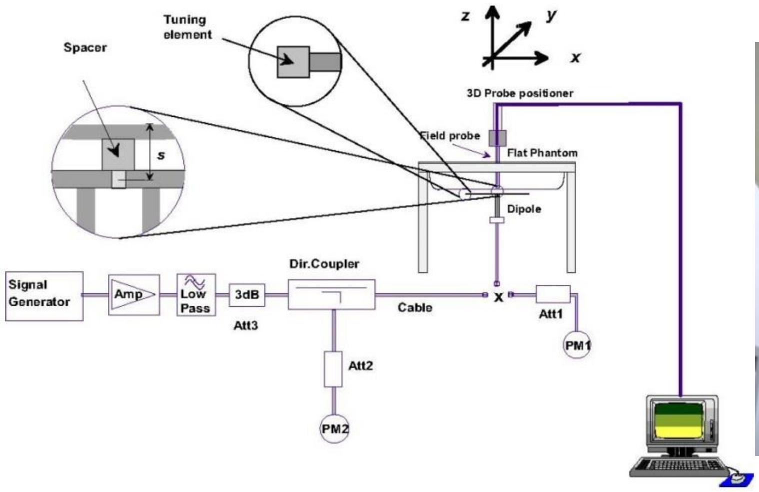


Fig 10.3.1 System Performance Check Setup

Fig 10.3.2 Setup Photo

12. RF Exposure Positions

12.1 Ear and handset reference point

Figure 12.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 12.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 12.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 12.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

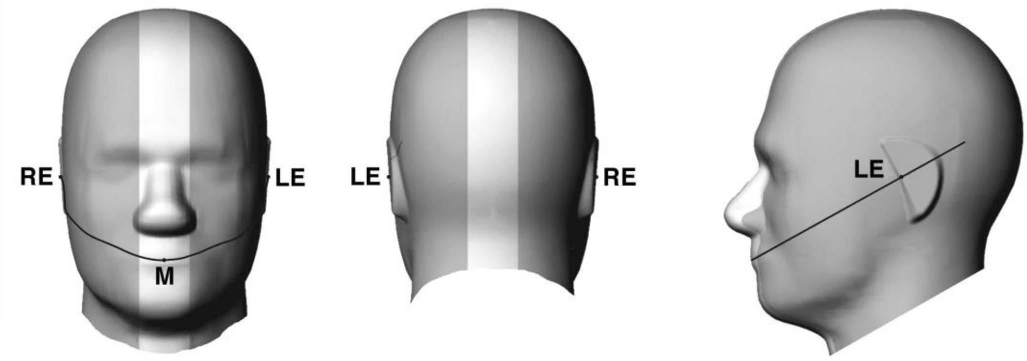
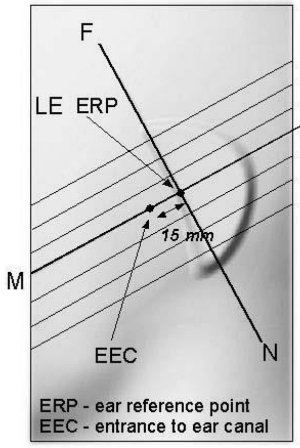


Fig 12.1.1 Front, back, and side views of SAM twin phantom



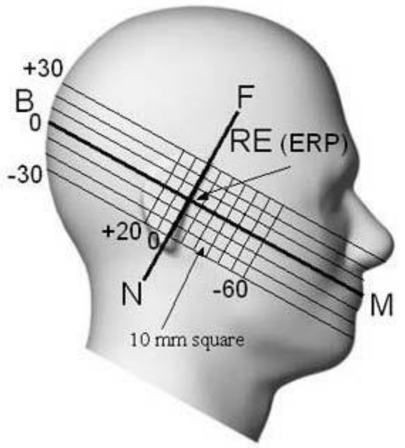


Fig 12.1.2 Close-up side view of phantom showing the ear region.

Fig 12.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

12.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 12.2.1 and Figure 12.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 12.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 12.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 12.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 12.2.3. The actual rotation angles should be documented in the test report.

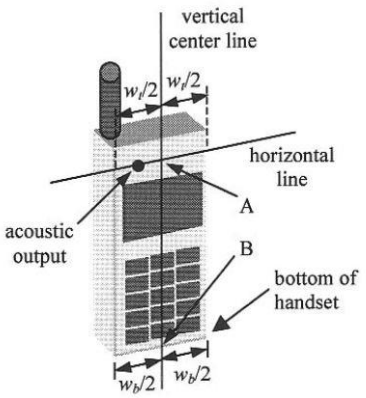


Fig 12.2.1 Handset vertical and horizontal reference lines—"fixed case

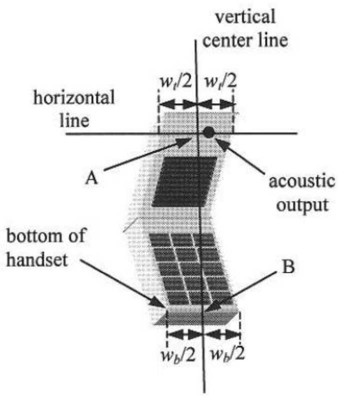


Fig 12.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

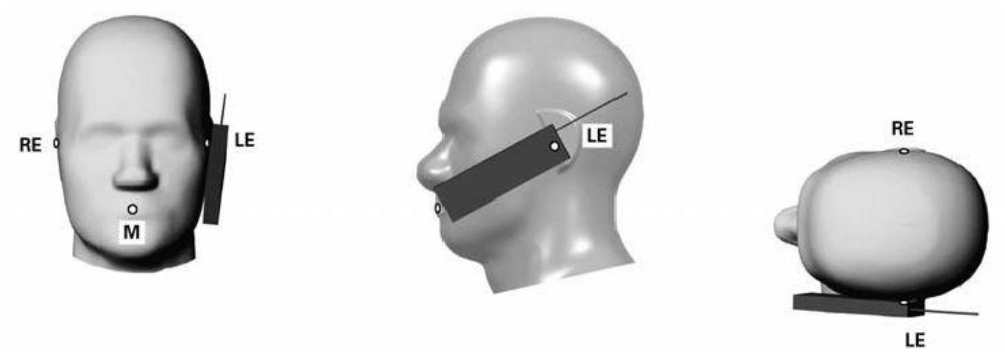


Fig 12.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

12.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 12.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

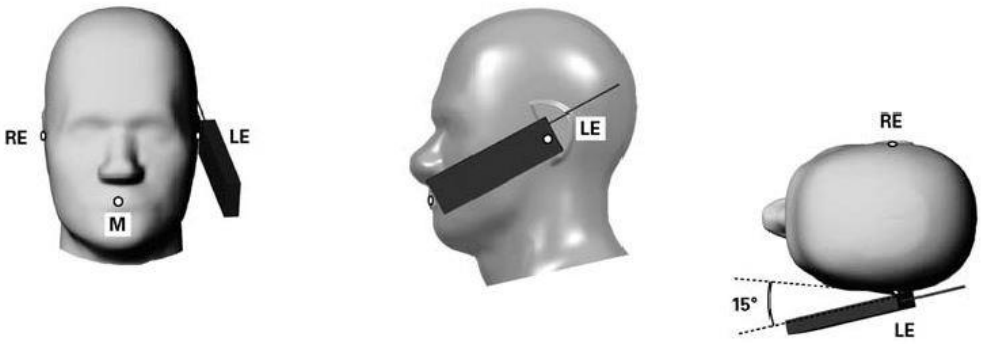


Fig 12.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

12.4 SAR Testing for Tablet

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

<EUT Setup Photos>

Please refer to Appendix D for the test setup photos.

13. Conducted RF Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix E.

<WLAN Conducted Power>

General Note:

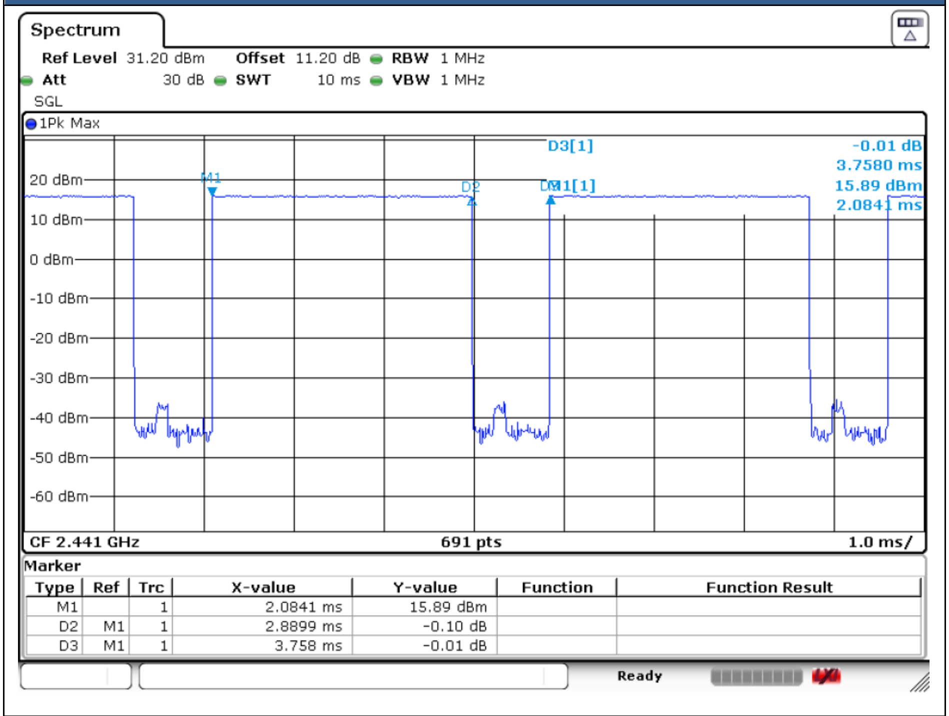
1. The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For "Not required", SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration. Additional output power measurements were not necessary.
2. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
3. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
4. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
5. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

<u><2.4GHz Bluetooth></u>

General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle are 76.9% as following figure, Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation.

Bluetooth time-domain plot



14. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

<SAR test exclusion table>

General Note:

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison
6. Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
   a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

Exposure Position	Wireless Interface	BT	2.4GHz WLAN	5GHz WLAN
	Calculated Frequency (MHz)	2480	2462	5825
	Maximum power (dBm)	11.5	20.5	18.5
	Maximum rated power(mW)	14.13	112.20	70.79
Bottom Face	Separation distance(mm)	5.0	5.0	5.0
	exclusion threshold	4.5	35.2	34.2
	Testing required?	**Yes**	**Yes**	**Yes**
Edge 1	Separation distance(mm)	5.0	5.0	5.0
	exclusion threshold	4.5	35.2	34.2
	Testing required?	**Yes**	**Yes**	**Yes**
Edge 2	Separation distance(mm)	5.0	5.0	5.0
	exclusion threshold	4.5	35.2	34.2
	Testing required?	**Yes**	**Yes**	**Yes**
Edge 3	Separation distance(mm)	185.8	185.8	185.8
	exclusion threshold	1453.0	1454.0	1420.0
	Testing required?	**No**	**No**	**No**
Edge 4	Separation distance(mm)	103.6	103.6	103.6
	exclusion threshold	631.0	632.0	598.0
	Testing required?	**No**	**No**	**No**

15. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For SAR testing of Bluetooth signal with 83.3% theoretical duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle) *83.3%".
   d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   · ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   · ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   · ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. The device employs proximity sensors that detect the presence of the user's body also a finger or hand near the bottom face, edge 1 and edge 2 of the device, reduced power will be active for all WLAN bands. (P-sensor can't work at detecting presence of the user's body at other edges of the device.)

WLAN/Bluetooth Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

15.1 Head SAR

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Right Cheek	0mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.18	0.175	0.251
	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	0mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.14	0.141	0.202
01	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.03	0.728	**1.045**
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 1	Full Power	1	2412	2	18.93	20.50	1.435	100	1.000	0.11	0.703	1.009
	WLAN2.4GHz	802.11b 1Mbps	Left Tilted	0mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	-0.17	0.458	0.657
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 1	Full Power	11	2462	1	17.28	19.00	1.486	100	1.000	0.02	0.696	1.034
	WLAN2.4GHz	802.11b 1Mbps	Left Cheek	0mm	Ant 1	Full Power	6	2437	1	14.11	16.00	1.545	100	1.000	-0.05	0.509	0.787
	Bluetooth	1Mbps	Right Cheek	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	-0.17	0.000	0.000
	Bluetooth	1Mbps	Right Tilted	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	-0.03	0.000	0.000
02	Bluetooth	1Mbps	Left Cheek	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	-0.01	0.084	**0.110**
	Bluetooth	1Mbps	Left Tilted	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	0.14	0.047	0.062
	Bluetooth	1Mbps	Left Cheek	0mm	Ant 1	Full Power	0	2402	1	10.46	11.50	1.271	76.9	1.083	0.11	0.064	0.088
	Bluetooth	1Mbps	Left Cheek	0mm	Ant 1	Full Power	78	2480	1	10.50	11.50	1.259	76.9	1.083	-0.05	0.069	0.094
	WLAN5.3GHz	802.11a 6Mbps	Right Cheek	0mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	-0.08	0.049	0.072
	WLAN5.3GHz	802.11a 6Mbps	Right Tilted	0mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	0.05	0.047	0.069
	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	-0.08	0.206	0.303
	WLAN5.3GHz	802.11a 6Mbps	Left Tilted	0mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	0.06	0.137	0.202
	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	52	5260	1	16.94	18.50	1.432	96.98	1.031	-0.09	0.362	0.535
03	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	60	5300	1	16.91	18.50	1.442	96.98	1.031	0.03	0.408	**0.607**
	WLAN5.3GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	64	5320	1	15.96	17.50	1.425	96.98	1.031	0.13	0.330	0.485
	WLAN5.5GHz	802.11a 6Mbps	Right Cheek	0mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	-0.15	0.056	0.084
	WLAN5.5GHz	802.11a 6Mbps	Right Tilted	0mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	0.11	0.064	0.096
04	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	0.01	0.120	**0.180**
	WLAN5.5GHz	802.11a 6Mbps	Left Tilted	0mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	-0.08	0.084	0.126
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	100	5500	1	16.25	18.00	1.496	96.98	1.031	-0.17	0.079	0.122
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	116	5580	1	16.37	18.00	1.455	96.98	1.031	-0.08	0.102	0.153
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	124	5620	1	16.54	18.50	1.570	96.98	1.031	-0.04	0.088	0.142
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	140	5700	1	15.74	17.50	1.499	96.98	1.031	-0.08	0.070	0.108
	WLAN5.5GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	132	5660	1	16.51	18.50	1.581	96.98	1.031	0.17	0.076	0.124
	WLAN5.8GHz	802.11a 6Mbps	Right Cheek	0mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	0.19	0.044	0.065
	WLAN5.8GHz	802.11a 6Mbps	Right Tilted	0mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	0.07	0.073	0.108
	WLAN5.8GHz	802.11a 6Mbps	Left Cheek	0mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	-0.18	0.058	0.086
05	WLAN5.8GHz	802.11a 6Mbps	Left Tilted	0mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	0.09	0.079	**0.117**
	WLAN5.8GHz	802.11a 6Mbps	Left Tilted	0mm	Ant 1	Full Power	149	5745	1	15.91	17.50	1.442	96.98	1.031	0.03	0.074	0.110
	WLAN5.8GHz	802.11a 6Mbps	Left Tilted	0mm	Ant 1	Full Power	157	5785	1	15.86	17.50	1.459	96.98	1.031	-0.15	0.068	0.102

15.2 Body SAR

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	Sensor on	11	2462	1	12.86	14.50	1.459	100	1.000	0.08	0.548	0.799
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	Sensor on	1	2412	1	12.81	14.50	1.476	100	1.000	0.01	0.566	0.835
06	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	Sensor on	6	2437	1	12.56	14.50	1.563	100	1.000	0.03	0.638	**0.997**
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	0mm	Ant 1	Sensor on	11	2462	1	12.86	14.50	1.459	100	1.000	0.03	0.368	0.537
	WLAN2.4GHz	802.11b 1Mbps	Edge 2	0mm	Ant 1	Sensor on	11	2462	1	12.86	14.50	1.459	100	1.000	0.1	0.235	0.343
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	15mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.08	0.134	0.192
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	11mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.01	0.146	0.210
	WLAN2.4GHz	802.11b 1Mbps	Edge 2	4mm	Ant 1	Full Power	1	2412	1	18.93	20.50	1.435	100	1.000	0.03	0.211	0.303
07	Bluetooth	1Mbps	Bottom Face	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	0.03	0.172	**0.226**
	Bluetooth	1Mbps	Bottom Face	0mm	Ant 1	Full Power	0	2402	1	10.46	11.50	1.271	76.9	1.083	0.08	0.161	0.222
	Bluetooth	1Mbps	Bottom Face	0mm	Ant 1	Full Power	78	2480	1	10.50	11.50	1.259	76.9	1.083	0.01	0.158	0.215
	Bluetooth	1Mbps	Edge 1	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	0.08	0.074	0.097
	Bluetooth	1Mbps	Edge 2	0mm	Ant 1	Full Power	39	2441	1	10.66	11.50	1.213	76.9	1.083	0.01	0.099	0.130
08	WLAN5.3GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	58	5290	1	10.11	11.50	1.377	88.14	1.135	0.02	0.685	**1.071**
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	58	5290	2	10.11	11.50	1.377	88.14	1.135	-0.02	0.613	0.958
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 1	Sensor on	58	5290	1	10.11	11.50	1.377	88.14	1.135	0.12	0.456	0.713
	WLAN5.3GHz	802.11ac-VHT80 MCS0	Edge 2	0mm	Ant 1	Sensor on	58	5290	1	10.11	11.50	1.377	88.14	1.135	0.08	0.156	0.244
	WLAN5.3GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	-0.08	0.190	0.280
	WLAN5.3GHz	802.11a 6Mbps	Edge 1	11mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	-0.08	0.222	0.327
	WLAN5.3GHz	802.11a 6Mbps	Edge 2	4mm	Ant 1	Full Power	56	5280	1	16.95	18.50	1.429	96.98	1.031	0.1	0.138	0.203
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	122	5610	1	10.66	12.00	1.361	88.14	1.135	-0.17	0.517	0.799
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	106	5530	1	10.31	12.00	1.476	88.14	1.135	-0.03	0.499	0.836
09	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	138	5690	1	10.60	12.00	1.380	88.14	1.135	-0.15	0.581	**0.910**
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	138	5690	2	10.60	12.00	1.380	88.14	1.135	0.01	0.525	0.823
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 1	Sensor on	122	5610	1	10.66	12.00	1.361	88.14	1.135	0.14	0.260	0.402
	WLAN5.5GHz	802.11ac-VHT80 MCS0	Edge 2	0mm	Ant 1	Sensor on	122	5610	1	10.66	12.00	1.361	88.14	1.135	0.18	0.114	0.176
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	-0.18	0.331	0.498
	WLAN5.5GHz	802.11a 6Mbps	Edge 1	11mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	0.1	0.200	0.301
	WLAN5.5GHz	802.11a 6Mbps	Edge 2	4mm	Ant 1	Full Power	144	5720	1	16.86	18.50	1.459	96.98	1.031	0.12	0.177	0.266
10	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	155	5775	1	10.76	12.00	1.330	88.14	1.135	0.02	0.615	**0.929**
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Bottom Face	0mm	Ant 1	Sensor on	155	5775	2	10.76	12.00	1.330	88.14	1.135	0.03	0.588	0.888
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Edge 1	0mm	Ant 1	Sensor on	155	5775	1	10.76	12.00	1.330	88.14	1.135	0.14	0.260	0.393
	WLAN5.8GHz	802.11ac-VHT80 MCS0	Edge 2	0mm	Ant 1	Sensor on	155	5775	1	10.76	12.00	1.330	88.14	1.135	-0.05	0.138	0.208
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	15mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	0.08	0.327	0.483
	WLAN5.8GHz	802.11a 6Mbps	Edge 1	11mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	-0.17	0.222	0.328
	WLAN5.8GHz	802.11a 6Mbps	Edge 2	4mm	Ant 1	Full Power	165	5825	1	15.94	17.50	1.432	96.98	1.031	-0.03	0.488	0.721

16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations
1.	None

General Note:

1. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment though they have independent antenna.
2. WLAN 2.4GHz and Bluetooth share the same antenna so can't transmit simultaneously.
3. According to the EUT characteristic, WLAN 5GHz and Bluetooth can't transmit simultaneously.

Test Engineer : Martin Li, Varus Wang, Light Wang, Ricky Gu

17. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg and highest measured 10-g SAR is less 3.75W/kg. Therefore, the measurement uncertainty table is not required in this report.

18. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[6] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[7] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[8] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

[9] FCC KDB 616217 D04 v01r02, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, Oct 2015

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