



# SAR TEST REPORT

For

Shenzhen Moorechip Technologies Co.,Ltd

Retro Handheld Game Console

Test Model: Retroid Pocket Flip 2

Prepared for : Shenzhen Moorechip Technologies Co.,Ltd  
Address : 5th Floor, Education Industry Building, Zone 71, Xingdong Community, Xin' an Street, Bao' an District, Shenzhen

Prepared by : Shenzhen LCS Compliance Testing Laboratory Ltd.  
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Date of receipt of test sample : May 08, 2025  
Number of tested samples : 1  
Sample number : A250506030-1  
Serial number : Prototype  
Date of Test : May 08, 2025 ~ May 14, 2025  
Date of Report : May 15, 2025



**SAR TEST REPORT**

Report Reference No.....: LCSA04305029EB

Date Of Issue .....: May 15, 2025

**Testing Laboratory Name.....: Shenzhen LCS Compliance Testing Laboratory Ltd.**

Address .....: 101, 201 Bldg A &amp; 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China

Testing Location/ Procedure .....: Full application of Harmonised standards ☒  
Partial application of Harmonised standards ☐  
Other standard testing method ☐**Applicant's Name .....: Shenzhen Moorechip Technologies Co.,Ltd**

Address .....: 5th Floor, Education Industry Building, Zone 71, Xingdong Community, Xin' an Street, Bao' an District, Shenzhen

**Test Specification:**Standard.....: FCC 47CFR §2.1093  
ANSI/IEEE C95.1-2019  
IEEE 1528-2013

Test Report Form No.....: TRF-4-E-102 A/0

TRF Originator.....: Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF .....: Dated 2014-09

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**Test Item Description. ....: Retro Handheld Game Console**

Trade Mark .....: Retroid Pocket

Model/Type Reference .....: Retroid Pocket Flip 2

Ratings .....: Input: 9V $\overline{\text{---}}$ 3A  
Battery: 5000mAh 3.85V 19.25Wh**Result .....: Positive****Compiled by:**

Jay zhan

**Supervised by:**

Jack Liu

**Approved by:**

Gavin Liang

Jay Zhan/ File administrators

Jack Liu/ Technique principal

Gavin Liang/ Manager



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## SAR -- TEST REPORT

<b>Test Report No. :</b>	LCSA04305029EB	<b>May 15, 2025</b> Date of issue
EUT.....	: Retro Handheld Game Console	
Type/Model .....	: Retroid Pocket Flip 2	
<b>Applicant.....</b>	<b>: Shenzhen Moorechip Technologies Co.,Ltd</b>	
Address.....	: 5th Floor, Education Industry Building, Zone 71, Xingdong Community, Xin' an Street, Bao' an District, Shenzhen	
Telephone.....	: /	
Fax.....	: /	
<b>Manufacturer.....</b>	<b>: Shenzhen Moorechip Technologies Co.,Ltd</b>	
Address.....	: 5th Floor, Education Industry Building, Zone 71, Xingdong Community, Xin' an Street, Bao' an District, Shenzhen	
Telephone.....	: /	
Fax.....	: /	
<b>Factory.....</b>	<b>: Dongguan Chijing Electronics Co., Ltd</b>	
Address.....	: Room 401, Building 2, No. 2 Anyue Road, Chashan Town, Dongguan City, Guangdong Province	
Telephone.....	: /	
Fax.....	: /	

<b>Test Result</b>	<b>Positive</b>
--------------------	-----------------

The test report merely corresponds to the test sample.  
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.





Revision History

Revision	Issue Date	Revision Content	Revised By
000	May 15, 2025	Initial Issue	---





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## 1. TEST STANDARDS AND TEST DESCRIPTION

### 1.1. Statement of Compliance

The maximum of results of SAR found during testing for Retroid Pocket Flip 2 are follows:

#### <Highest Reported standalone SAR Summary>

Classment Class	Frequency Band	Body-worn (Report SAR1-g (W/kg)
		(Separation Distance 0mm)
DTS	WIFI2.4G ANT0	0.635
	WIFI2.4G ANT1	0.651

#### Note

1) This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2019, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

#### <Highest Reported simultaneous SAR Summary>

Exposure Position	Classment Class	Body (Report SAR1-g (W/kg)	Highest Reported Simultaneous Transmission SAR1-g (W/kg)
Body	DTS	0.635	1.286
	DTS	0.651	



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## 1.2. Test Location

Company: Shenzhen LCS Compliance Testing Laboratory Ltd.  
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### 1.3. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Site Description  
SAR Lab.

: NVLAP Accreditation Code is 600167-0.  
FCC Designation Number is CN5024.  
CAB identifier is CN0071.  
CNAS Registration Number is L4595.  
Test Firm Registration Number: 254912.



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## 1.4. Test Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 $\Omega$
Atmospheric pressure:	950-1050mbar
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.	





## 1.5. Product Description

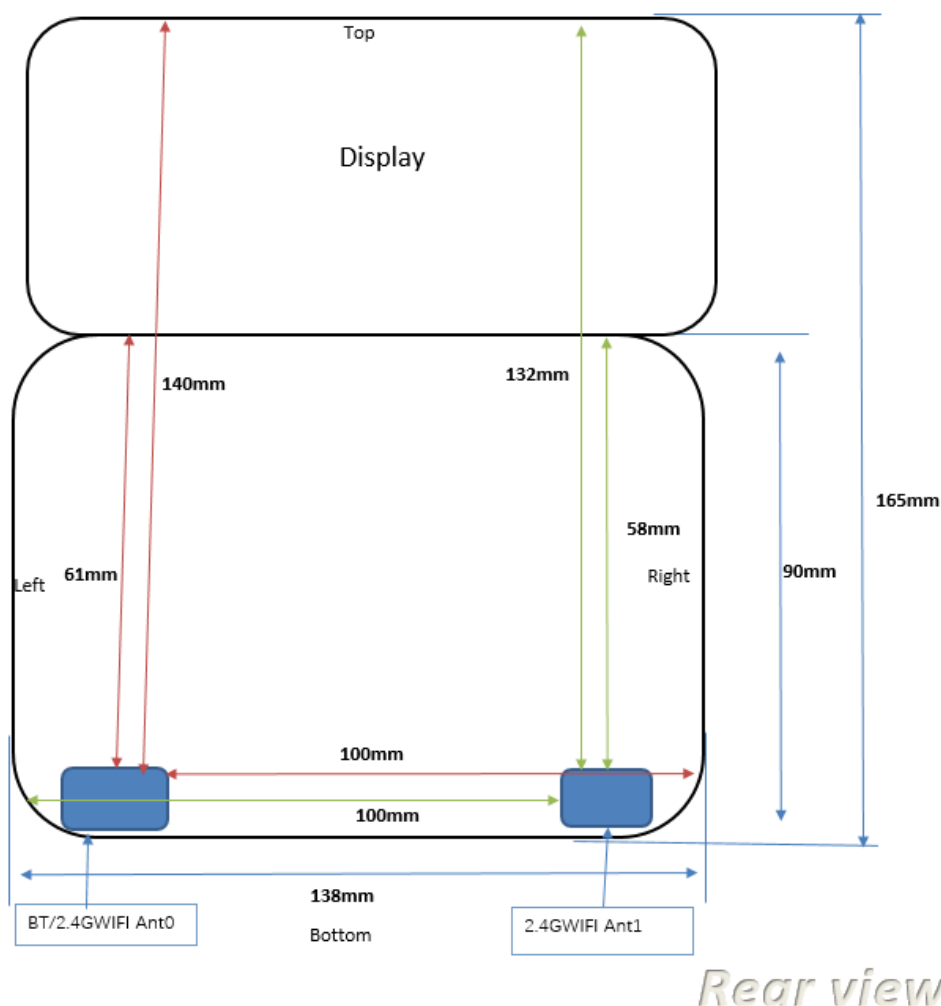
The **Shenzhen Moorechip Technologies Co.,Ltd**'s Model: Retroid Pocket Flip 2 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

EUT	: Retro Handheld Game Console
Test Model	: Retroid Pocket Flip 2
Ratings	: Input: 9V $\overline{=}$ 3A Battery: 5000mAh 3.85V 19.25Wh
Hardware Version	: V1.2
Software Version	: V1.0.0.51
Bluetooth	:
Frequency Range	: 2402MHz~2480MHz
Channel Number	: 79 channels for Bluetooth V5.1 (DSS) 40 channels for Bluetooth V5.1 (DTS)
Channel Spacing	: 1MHz for Bluetooth V5.1 (DSS) 2MHz for Bluetooth V5.1 (DTS)
Modulation Type	: GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.1 (DSS) GFSK for Bluetooth V5.1 (DTS)
Bluetooth Version	: V5.1
Antenna Description	: FPC Antenna, 1.40dBi(Max.)
WIFI(2.4G Band)	:
Frequency Range	: 2412MHz~2462MHz
Channel Spacing	: 5MHz
Channel Number	: 11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz)
Modulation Type	: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ax: OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: Ant0: FPC Antenna, 1.40dBi(Max.) Ant1: FPC Antenna, 1.43dBi(Max.)

Note: For a more detailed antenna description, please refer to the antenna specifications or the antenna report provided by the customer.



## 1.6. DUT Antenna Locations



Note :

1) WIFI Antenna: WIFI 2.4G/BT

Distance from the antenna to the EUT edge(mm) Open						
Mode	Front	Back	Left	Right	Top	Bottom
BT/WIFI Antenna 0	5	5	5	100	140	5
WIFI Antenna 1	5	5	100	5	132	5

Distance from the antenna to the EUT edge(mm) Close						
Mode	Front	Back	Left	Right	Top	Bottom
BT/WIFI Antenna 0	5	5	5	100	61	5
WIFI Antenna 1	5	5	100	5	58	5





## 1.7. Test Specification

Identity	Document Title
FCC 47CFR §2.1093	Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI/IEEE C95.1-2019	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB 248227 D01	SAR Guidance for IEEE 802.11 Wi-Fi SAR v02r02
KDB 447498 D01	General RF Exposure Guidance v06
KDB 865664 D01	SAR Measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02	RF Exposure Reporting v01r02



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## 1.8. SAR basic restrictions limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
<b>Spatial Peak SAR*</b> (Brain*Trunk)	<b>1.60 mW/g</b>	8.00 mW/g
<b>Spatial Average SAR**</b> (Whole Body)	0.08 mW/g	0.40 mW/g
<b>Spatial Peak SAR***</b> (Hands/Feet/Ankle/Wrist)	<b>4.00 mW/g</b>	20.00 mW/g

### Notes:

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

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

\*\*\* The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

**Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**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.)



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## 1.9. Equipment list

Test Platform		SPEAG DASY5 Professional				
Description		SAR Test System (Frequency range 300MHz-6GHz)				
Software Reference		DASY52; SEMCAD X				
Hardware Reference						
Equipment		Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration
<input checked="" type="checkbox"/>	PC	Lenovo	NA	NA	NA <sup>1</sup>	NA <sup>1</sup>
<input checked="" type="checkbox"/>	Twin Phantom	SPEAG	SAM V5.0	1850	NA <sup>1</sup>	NA <sup>1</sup>
<input checked="" type="checkbox"/>	ELI Phantom	SPEAG	ELI V6.0	2010	NA <sup>1</sup>	NA <sup>1</sup>
<input checked="" type="checkbox"/>	DAE	SPEAG	DAE3	373	2025/2/17	2026/2/16
<input checked="" type="checkbox"/>	E-Field Probe	SPEAG	EX3DV4	3805	2025/2/25	2026/2/24
<input checked="" type="checkbox"/>	Validation Kits	SPEAG	D2450V2	808	2023/10/23	2026/10/22
<input checked="" type="checkbox"/>	Agilent Network Analyzer	Agilent	8753E	SU38432944	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	Dielectric Probe Kit	SPEAG	DAK3.5	1425	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	Universal Radio Communication Tester	R&S	CMW500	42115	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Directional Coupler	MCLI/USA	4426-20	03746	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	Power meter	Agilent	E4419B	MY45104493	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Power meter	Agilent	E4419B	MY45100308	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Power sensor	Agilent	E9301H	MY41495616	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Power sensor	Agilent	E9301H	MY41495234	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Signal Generator	Agilent	E4438C	MY49072627	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	3dB Attenuator	NA	2N-3dB	NA	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	3dB Attenuator	NA	2N-3dB	NA	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	3dB Attenuator	NA	2N-3dB	NA	2024/10/8	2025/10/7
<input checked="" type="checkbox"/>	Broadband Preamplifier	/	BP-01M18G	P190501	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	DC POWER SUPPLY	I-SHENG	SP-504	NA	2024/6/6	2025/6/5
<input checked="" type="checkbox"/>	Speed reading thermometer	HTC-1	NA	LCS-E-138	2024/6/6	2025/6/5

Note: All the equipments are within the valid period when the tests are performed.

“1” : NA as this is not measurement equipment.

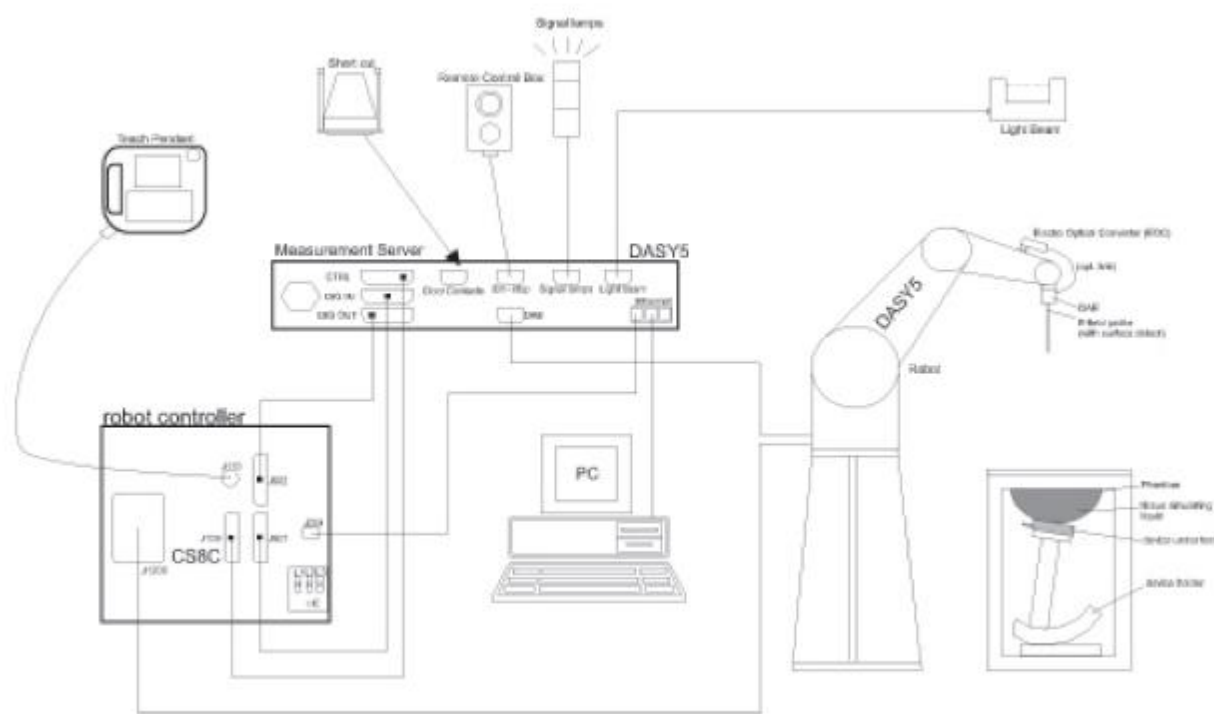


## 2.1. SAR Measurement System

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

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.

The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.



### F-1. SAR Measurement System Configuration







- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and Body Worn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validating the proper functioning of the system.



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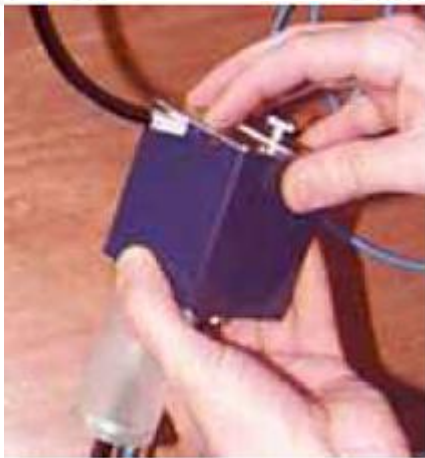


## 2.2. Isotropic E-field Probe EX3DV4


	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 <a href="#">calibration service</a> available.
Frequency	10 MHz to > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in TSL (rotation around probe axis) $\pm 0.5$ dB in TSL (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/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
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI



## 2.3. Data Acquisition Electronics (DAE)

<b>Model</b>	DAE	
<b>Construction</b>	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
<b>Measurement Range</b>	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
<b>Input Offset Voltage</b>	< 5μV (with auto zero)	
<b>Input Bias Current</b>	< 50 f A	
<b>Dimensions</b>	60 x 60 x 68 mm	

## 2.4. SAM Twin Phantom

<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)	
<b>Liquid Compatibility</b>	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)	
<b>Shell Thickness</b>	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
<b>Dimensions (incl. Wooden Support)</b>	Length: 1000 mm Width: 500 mm Height: adjustable feet	
<b>Filling Volume</b>	approx. 25 liters	
<b>Wooden Support</b>	SPEAG standard phantom table	


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.

Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.





## 2.5. ELI Phantom

<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)	
<b>Liquid Compatibility</b>	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)	
<b>Shell Thickness</b>	2.0 ± 0.2 mm (bottom plate)	
<b>Dimensions</b>	Major axis: 600 mm Minor axis: 400 mm	
<b>Filling Volume</b>	approx. 30 liters	
<b>Wooden Support</b>	SPEAG standard phantom table	

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.

ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.



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## 2.6. Device Holder for Transmitters



F-2. Device Holder for Transmitters

- The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon=3$  and loss tangent  $\delta=0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.





## 2.7. Measurement procedure

### 2.7.1. Scanning procedure

#### **Step 1: Power reference measurement**

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure.

#### **Step 2: Area scan**

The SAR distribution at the exposed side of the head was measured at a distance of 4mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm\*15mm or 12mm\*12mm or 10mm\*10mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

#### **Step 3: Zoom scan**

Around this point, a volume of 32mm\*32mm\*30mm ( $f \leq 2\text{GHz}$ ), 30mm\*30mm\*30mm ( $f$  for 2-3GHz) and 24mm\*24mm\*22mm ( $f$  for 5-6GHz) was assessed by measuring 5x5x7 points ( $f \leq 2\text{GHz}$ ), 7x7x7 points ( $f$  for 2-3GHz) and 7x7x12 points ( $f$  for 5-6GHz). On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the centre of the dipoles is 2.0mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification). The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One thousand points were interpolated to calculate the average. All neighbouring volumes were evaluated until no neighboring volume with a higher average value was found.

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std. 1528-2013.







		$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		$5 \pm 1$ mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$		$\leq 2$ GHz: $\leq 15$ mm 2 – 3 GHz: $\leq 12$ mm	3 – 4 GHz: $\leq 12$ mm 4 – 6 GHz: $\leq 10$ 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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm*	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$
Minimum zoom scan volume	x, y, z		3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm

#### Step 4: Power reference measurement (drift)

The Power Drift Measurement job measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The indicated drift is mainly the variation of the DUT's output power and should vary max.  $\pm 5\%$

#### 2.7.2. Data Storage

The DASY 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], [m W/g], [m W/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.







### 2.7.3. 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, ai0, ai1, ai2
- Conversion factor	ConvFi	
- Diode compression point	Dcpi	
Device parameters:	- Frequency	f
- Crest factor	cf	
Media parameters:	- Conductivity	$\epsilon$
- Density	$\rho$	

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 DASY 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)<sup>2</sup>] for E-field Probes

ConvF = sensitivity enhancement in solution

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

$f$  = carrier frequency [GHz]

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

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

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

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

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

with SAR = local specific absorption rate in mW/g

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

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\epsilon$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

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

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

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

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



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### 3. SAR measurement variability and uncertainty

#### 3.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

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

#### 3.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is  $< 1.5$  W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.



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## 4. Description of Test Position

### 4.1. Body Exposure Condition

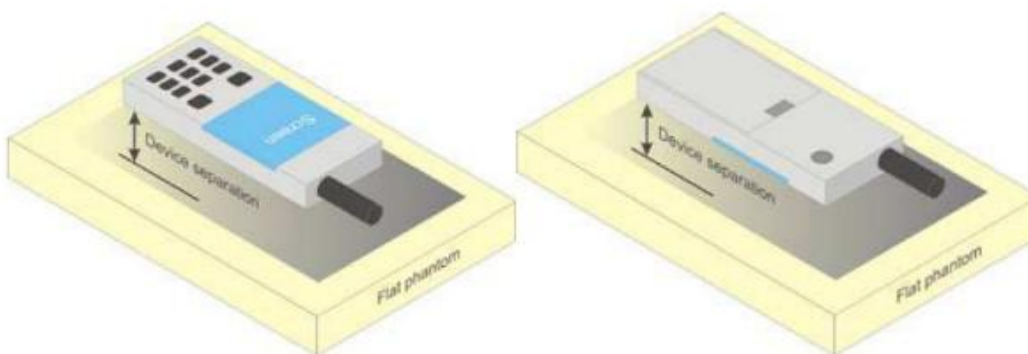
#### 4.1.1. Body-worn accessory exposure conditions

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB Publication 648474 D04, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.



F-1. Test positions for body-worn devices





#### 4.1.2. Wireless Router exposure conditions

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. For devices with form factors smaller than 9 cm x 5 cm, a test separation distance of 5 mm is required.

### 4.2. Extremity exposure conditions

Per FCC KDB 648474D04, for smart phones with a display diagonal dimension  $> 15.0 \text{ cm}$  or an overall diagonal dimension  $> 16.0 \text{ cm}$  that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, the device is marketed as "Phablet".

The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at  $\leq 25 \text{ mm}$  from that surface or edge, in direct contact with a flat phantom, for Product Specific 10-g SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, Product Specific 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR  $> 1.2 \text{ W/kg}$ ; however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for phablet modes to compare with the 1.2 W/kg SAR test reduction threshold.

Due to the SAR result, the Main antenna frequency bands are not required to test with 0mm for the Product Specific 10 g SAR.



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## 5. SAR System Verification Procedure

### 5.1. Tissue Simulate Liquid

#### 5.1.1. Recipes for Tissue Simulate Liquid

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands:

Ingredients (% by weight)	Frequency (MHz)				
	450	700-900	1750-2000	2300-2500	2500-2700
Water	38.56	40.30	55.24	55.00	54.92
Salt (NaCl)	3.95	1.38	0.31	0.2	0.23
Sucrose	56.32	57.90	0	0	0
HEC	0.98	0.24	0	0	0
Bactericide	0.19	0.18	0	0	0
Tween	0	0	44.45	44.80	44.85
Salt: 99 <sup>+</sup> % Pure Sodium Chloride Water: De-ionized, 16 MΩ <sup>+</sup> resistivity Tween: Polyoxyethylene (20) sorbitan monolaurate Sucrose: 98 <sup>+</sup> % Pure Sucrose HEC: Hydroxyethyl Cellulose					
HSL5GHz is composed of the following ingredients: Water: 50-65% Mineral oil: 10-30% Emulsifiers: 8-25% Sodium salt: 0-1.5%					

Table 1: Recipe of Tissue Simulate Liquid



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5.1.2. Measurement for Tissue Simulate Liquid

The dielectric properties for this Tissue Simulate Liquids were measured by using the DAKS. The Conductivity ( $\sigma$ ) and Permittivity ( $\rho$ ) are listed in bellow table. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was  $22\pm2^{\circ}\text{C}$ .

Tissue Type	Measured Frequency (MHz)	Target Tissue ( $\pm 5\%$ )		Measured Tissue		Liquid Temp. ( $^{\circ}\text{C}$ )	Measured Date
		$\epsilon_r$	$\sigma(\text{S/m})$	$\epsilon_r$	$\sigma(\text{S/m})$		
2450 Head	2450	39.2 (37.24~41.16)	1.8 (1.71~1.89)	38.525	1.854	20.1	May 12, 2025

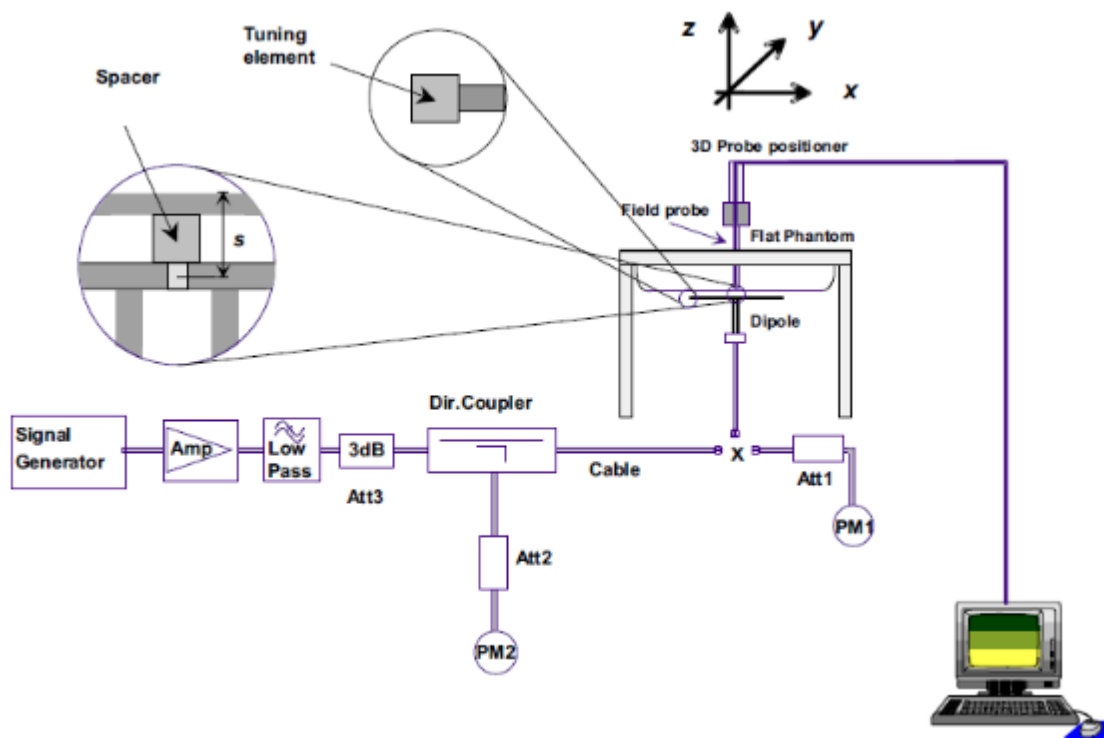
Table 2: Measurement result of Tissue electric parameters





## 5.2. SAR System Check

The microwave circuit arrangement for system Check is sketched in F-1. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within  $\pm 10\%$  from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the following table (A power level of 100mW (below 3GHz) or 100mW (3-6GHz) was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range  $22\pm 2^{\circ}\text{C}$ , the relative humidity was in the range 60% and the liquid depth above the ear reference points was above  $15\pm 0.5\text{ cm}$  in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-1. the microwave circuit arrangement used for SAR system check





### 5.2.1. Justification for Extended SAR Dipole Calibrations

1) Referring to KDB865664 D01 requirements for dipole calibration, instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

- There is no physical damage on the dipole;
- System check with specific dipole is within 10% of calibrated value;
- Return-loss is within 20% of calibrated measurement;
- Impedance is within  $5\Omega$  from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

D2450V2 SN 808 Extend Dipole Calibrations

Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2023-10-23	-26.3		51.4		4.73	
2024-10-22	-26.27	-0.11	51.2	-0.2	4.70	-0.03

### 5.2.2. Summary System Check Result(s)

Validation Kit		Measured SAR 100mW	Measured SAR 100mW	Measured SAR (normalized to 1W)	Measured SAR (normalized to 1W)	Target SAR (normalized to 1W) ( $\pm 10\%$ )	Target SAR (normalized to 1W) ( $\pm 10\%$ )	Liquid Temp. ( $^{\circ}\text{C}$ )	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D2450V2	Head	5.11	2.41	51.10	24.10	53.5 (48.15~58.85)	24.8 (22.32~27.28)	20.1	May 12, 2025

Table 3: Please see the Appendix A



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## 6. SAR measurement procedure

The measurement procedures are as follows:

### 6.1. WIFI Test Configuration

The SAR measurement and test reduction procedures are structured according to either the DSSS or OFDM transmission mode configurations used in each standalone frequency band and aggregated band. For devices that operate in exposure configurations that require multiple test positions, additional SAR test reduction may be applied. The maximum output power specified for production units, including tune-up tolerance, are used to determine initial SAR test requirements for the 802.11 transmission modes in a frequency band. SAR is measured using the highest measured maximum output power channel for the initial test configuration. SAR measurement and test reduction for the remaining 802.11 modes and test channels are determined according to measured or specified maximum output power and reported SAR of the initial measurements. The general test reduction and SAR measurement approaches are summarized in the following:

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.
2. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, an “initial test configuration” is first determined for each standalone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units.
  - a. 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, for each frequency band.
  - b. SAR is measured for OFDM configurations using the initial test configuration procedures. Additional frequency band specific SAR test reduction may be considered for individual frequency bands
  - c. Depending on the reported SAR of the highest maximum output power channel tested in the initial test configuration, SAR test reduction may apply to subsequent highest output channels in the initial test configuration to reduce the number of SAR measurements.
3. The Initial test configuration does not apply to DSSS. The 2.4 GHz band SAR test requirements and 802.11b DSSS procedures are used to establish the transmission configurations required for SAR measurement.
4. An “initial test position” is applied to further reduce the number of SAR tests for devices operating in next to the ear, UMPC mini-tablet or hotspot mode exposure configurations that require multiple test positions .
  - a. SAR is measured for 802.11b according to the 2.4 GHz DSSS procedure using the exposure condition established by the initial test position.
  - b. SAR is measured for 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration. 802.11b/g/n operating modes are tested independently according to the service requirements in each frequency band. 802.11b/g/n modes are tested on the maximum average output channel.
5. The Initial test position does not apply to devices that require a fixed exposure test position. SAR is measured in a fixed exposure test position for these devices in 802.11b according to the 2.4 GHz DSSS procedure or in 2.4 GHz and 5 GHz OFDM configurations using the initial test configuration procedures .
6. The “subsequent test configuration” procedures are applied to determine if additional SAR measurements are required for the remaining OFDM transmission modes that have not been tested in the initial test configuration. SAR test exclusion is determined according to reported SAR in the initial test configuration and maximum output power specified or measured for these other OFDM configurations.

#### 2.4 GHz and 5GHz SAR Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are described in section 5.2.2.

##### 1. 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:

- a. When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.





- b. When the reported SAR is  $> 0.8 \text{ W/kg}$ , SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2 \text{ W/kg}$ , SAR is required for the third channel; i.e., all channels require testing.

1. 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 (section 5.3). SAR is not required for the following 2.4 GHz OFDM conditions.

- a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration  
b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2 \text{ W/kg}$ .

2. SAR Test Requirements for OFDM Configurations

When SAR measurement is required for 802.11 a/g/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements.<sup>20</sup> 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.

3. OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements

The initial test configuration for 2.4 GHz and 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures (section 4). When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

- a. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.  
b. If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.  
c. If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.  
d. When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n.

After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.

- a. Channels with measured maximum output power within  $\frac{1}{4} \text{ dB}$  of each other are considered to have the same maximum output.  
b. When there are multiple test channels with the same measured maximum output power, the channel closest to mid-band frequency is selected for SAR measurement.  
c. When there are multiple test channels with the same measured maximum output power and equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration. For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode.<sup>23</sup> For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration. When the reported SAR of the initial test configuration is  $> 0.8 \text{ W/kg}$ , SAR measurement is required







for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested.

#### 4. Subsequent Test Configuration Procedures

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. The initial test position procedure is applied to next to the ear, UMPC mini-tablet and hotspot mode configurations. When the same maximum output power is specified for multiple transmission modes, the procedures in section 5.3.2 are applied to determine the test configuration. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. The subsequent test configuration and SAR measurement procedures are described in the following.

- a. When SAR test exclusion provisions of KDB Publication 447498 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.
- b. When the highest reported SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for that subsequent test configuration.
- c. The number of channels in the initial test configuration and subsequent test configuration can be different due to differences in channel bandwidth. When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel. This step requires additional power measurement to identify the highest maximum output power channel in the subsequent test configuration to determine SAR test reduction.
  - 1). SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.
  - 2). SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the reported SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is  $> 1.2$  W/kg or until all required channels are tested.
    - a) For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.
    - d. SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration (highest maximum output) or subsequent test configuration(s) (subsequent next highest maximum output power) is determined by applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:
      - 1) replace "subsequent test configuration" with "next subsequent test configuration" (i.e., subsequent next highest specified maximum output power configuration)
      - 2) replace "initial test configuration" with "all tested higher output power configurations."

## 6.2. Power Reduction

The product without any power reduction.

## 6.3. Power Drift

To control the output power stability during the SAR test, SAR system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. This ensures that the power drift during one measurement is within  $\pm 0.2$ dB .



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## 7. TEST CONDITIONS AND RESULTS

### 7.1. Conducted Power Results

According KDB 447498 D01 General RF Exposure Guidance v06 Section 4.1 2) states that “Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged ERP applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as FRS and certain Part 15 transmitters with built-in integral antennas, the maximum output power allowed for production units should be used to determine RF exposure test exclusion and compliance.”

#### 7.1.1. Conducted Power Measurement Results(WIFI 2.4G)

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Tune Up (dBm)
NVNT	b	2412	Ant0	15.2	16.00
NVNT	b	2437	Ant0	14.68	15.00
NVNT	b	2462	Ant0	14.49	15.00
NVNT	g	2412	Ant0	14.33	15.00
NVNT	g	2437	Ant0	14.69	15.00
NVNT	g	2462	Ant0	14.58	15.00
NVNT	n20	2412	Ant0	13.46	14.00
NVNT	n20	2437	Ant0	14.02	15.00
NVNT	n20	2462	Ant0	13.58	14.00
NVNT	n40	2422	Ant0	12.05	13.00
NVNT	n40	2437	Ant0	12.79	13.00
NVNT	n40	2452	Ant0	12.69	13.00
NVNT	ax20	2412	Ant0	13.29	14.00
NVNT	ax20	2437	Ant0	13.58	14.00
NVNT	ax20	2462	Ant0	13.55	14.00
NVNT	ax40	2422	Ant0	12.99	13.00
NVNT	ax40	2437	Ant0	12.81	13.00
NVNT	ax40	2452	Ant0	12.6	13.00

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Tune Up (dBm)
NVNT	b	2412	Ant1	15.24	16.00
NVNT	b	2437	Ant1	14.63	15.00
NVNT	b	2462	Ant1	14.56	15.00
NVNT	g	2412	Ant1	14.34	15.00
NVNT	g	2437	Ant1	14.66	15.00
NVNT	g	2462	Ant1	14.62	15.00
NVNT	n20	2412	Ant1	14.52	15.00
NVNT	n20	2437	Ant1	13.86	14.00
NVNT	n20	2462	Ant1	13.61	14.00
NVNT	n40	2422	Ant1	12.76	13.00
NVNT	n40	2437	Ant1	12.81	13.00
NVNT	n40	2452	Ant1	13.66	14.00
NVNT	ax20	2412	Ant1	14.34	15.00
NVNT	ax20	2437	Ant1	13.58	14.00
NVNT	ax20	2462	Ant1	13.6	14.00
NVNT	ax40	2422	Ant1	13.92	14.00
NVNT	ax40	2437	Ant1	13.56	14.00
NVNT	ax40	2452	Ant1	13.6	14.00

#### MIMO

Condition	Mode	Frequency (MHz)	Total Power (dBm)		
			Ant0	Ant1	Ant0+Ant1



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NVNT	n20	2412	13.46	14.52	17.03
NVNT	n20	2437	14.02	13.86	16.95
NVNT	n20	2462	13.58	13.61	16.61
NVNT	n40	2422	12.05	12.76	15.43
NVNT	n40	2437	12.79	12.81	15.81
NVNT	n40	2452	12.69	13.66	16.21
NVNT	ax20	2412	13.29	14.34	16.86
NVNT	ax20	2437	13.58	13.58	16.59
NVNT	ax20	2462	13.55	13.6	16.59
NVNT	ax40	2422	12.99	13.92	16.49
NVNT	ax40	2437	12.81	13.56	16.21
NVNT	ax40	2452	12.6	13.6	16.14

**Note:**

a) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.

b) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.

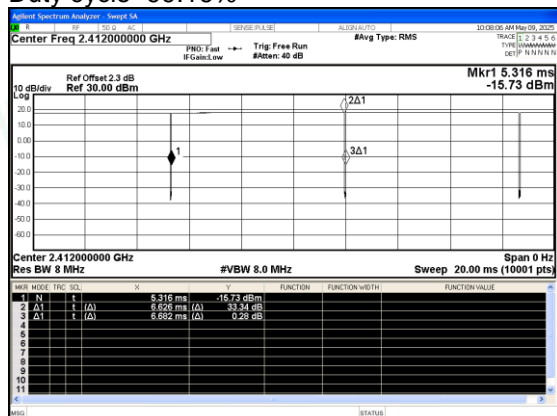
1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.

2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

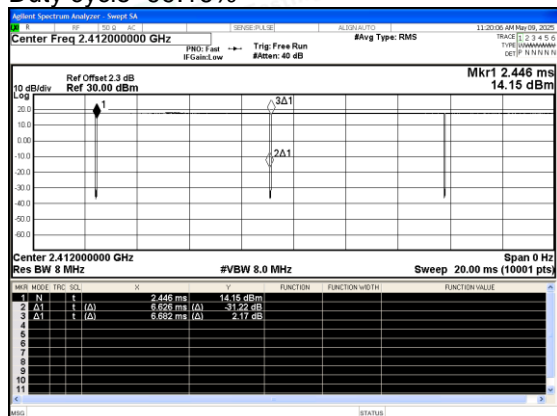
c) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

**ANT0:WIFI 2.4G (802.11b):**

Duty cycle=99.16%

**ANT1:WIFI 2.4G (802.11b):**

Duty cycle=99.16%



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**7.1.2. Conducted Power Measurement Results(Bluetooth)**

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Conducted Output Power (dBm)	
				ANT1	Tune Up (dBm)
GFSK	SISO	2402	DH5	-1.82	-1.00
		2441	DH5	-1.85	-1.00
		2480	DH5	-2.36	-2.00
Pi/4DQPSK	SISO	2402	2DH5	-0.95	0.00
		2441	2DH5	-1.04	-1.00
		2480	2DH5	-1.50	-1.00
8DPSK	SISO	2402	3DH5	-0.53	0.00
		2441	3DH5	-0.61	0.00
		2480	3DH5	-1.08	-1.00

Mode	TX Type	Frequency (MHz)	Maximum Conducted Output Power (dBm)	
			ANT1	Tune Up (dBm)
1M	SISO	2402	-1.33	-1.00
		2440	-1.29	-1.00
		2480	-1.50	-1.00
2M	SISO	2402	-1.29	-1.00
		2440	-1.20	-1.00
		2480	-1.36	-1.00





## 7.2. Stand-alone SAR test evaluation

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and Product specific 10g SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

**SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and  $\leq 50$  mm**

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	
MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.



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The test exclusions are applicable only when the minimum test separation distance is > 50 mm and for transmission frequencies between 100 MHz and 6 GHz.

### SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	mW
150	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527	
300	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554	
450	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	
835	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943	
900	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998	
1500	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522	
1900	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509	
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	
3600	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479	
5200	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466	
5400	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465	
5800	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462	

According to the table above, Standalone SAR exclusion calculation for this device are as below:

Open:

ANT0	Freq. Band	Frequency (MHz)	Position	Test Separation (mm)	Max Power (dBm)	Max Power (mW)	Exclusion Threshold (mW)	Exclusion (Yes/No)
	BT	2441	Front side	5	0.00	1.00	10	Yes
		2441	Rear side	5	0.00	1.00	10	Yes
		2441	Left side	5	0.00	1.00	10	Yes
		2441	Right side	100	0.00	1.00	596	Yes
		2441	Top side	140	0.00	1.00	996	Yes
		2441	Bottom side	5	0.00	1.00	10	Yes
	Wi-Fi 2.4G	2412	Front side	5	16.00	39.81	10	No
		2412	Rear side	5	16.00	39.81	10	No
		2412	Left side	5	16.00	39.81	10	No
		2412	Right side	100	16.00	39.81	596	Yes
		2412	Top side	140	16.00	39.81	996	Yes
		2412	Bottom side	5	16.00	39.81	10	No

ANT1	Freq. Band	Frequency (MHz)	Position	Test Separation (mm)	Max Power (dBm)	Max Power (mW)	Exclusion Threshold (mW)	Exclusion (Yes/No)
	Wi-Fi 2.4G	2412	Front side	5	16.00	39.81	10	No
		2412	Rear side	5	16.00	39.81	10	No
		2412	Left side	100	16.00	39.81	596	Yes
		2412	Right side	5	16.00	39.81	10	No
		2412	Top side	132	16.00	39.81	916	Yes



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	2412	Bottom side	5	16.00	39.81	10	No
--	------	-------------	---	-------	-------	----	----

Close:

ANT0	Freq. Band	Frequency (MHz)	Position	Test Separation (mm)	Max Power (dBm)	Max Power (mW)	Exclusion Threshold (mW)	Exclusion (Yes/No)
	BT	2441	Front side	5	0.00	1.00	10	Yes
		2441	Rear side	5	0.00	1.00	10	Yes
		2441	Left side	5	0.00	1.00	10	Yes
		2441	Right side	100	0.00	1.00	596	Yes
		2441	Top side	61	0.00	1.00	206	Yes
		2441	Bottom side	5	0.00	1.00	10	Yes
	Wi-Fi 2.4G	2412	Front side	5	16.00	39.81	10	No
		2412	Rear side	5	16.00	39.81	10	No
		2412	Left side	5	16.00	39.81	10	No
		2412	Right side	100	16.00	39.81	596	Yes
		2412	Top side	61	16.00	39.81	206	Yes
		2412	Bottom side	5	16.00	39.81	10	No

ANT1	Freq. Band	Frequency (MHz)	Position	Test Separation (mm)	Max Power (dBm)	Max Power (mW)	Exclusion Threshold (mW)	Exclusion (Yes/No)
	Wi-Fi 2.4G	2412	Front side	5	16.00	39.81	10	No
		2412	Rear side	5	16.00	39.81	10	No
		2412	Left side	100	16.00	39.81	596	Yes
		2412	Right side	5	16.00	39.81	10	No
		2412	Top side	58	16.00	39.81	176	Yes
		2412	Bottom side	5	16.00	39.81	10	No

From what is shown in the table above, we can draw the conclusion that:

Open:

ANT0	EUT Sides for SAR Testing							
	Mode	Exposure Condition	Front	Back	Left	Right	Top	Bottom
	Bluetooth	Body	No	No	No	No	No	No
	WIFI 2.4G	Body	Yes	Yes	Yes	No	No	Yes

ANT1	EUT Sides for SAR Testing							
	Mode	Exposure Condition	Front	Back	Left	Right	Top	Bottom
	WIFI 2.4G	Body	Yes	Yes	No	Yes	No	Yes

Close:

ANT0	EUT Sides for SAR Testing							
	Mode	Exposure Condition	Front	Back	Left	Right	Top	Bottom
	Bluetooth	Body	No	No	No	No	No	No
	WIFI 2.4G	Body	Yes	Yes	Yes	No	No	Yes

ANT1	EUT Sides for SAR Testing							
	Mode	Exposure Condition	Front	Back	Left	Right	Top	Bottom
	WIFI 2.4G	Body	Yes	Yes	No	Yes	No	Yes

EUT Sides for SAR Testing.



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### 7.3. SAR Measurement Results

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} * 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Scaling factor} = 10^{(P_{\text{target}} - P_{\text{measured}})/10}$$

$$\text{Reported SAR} = \text{Measured SAR} * \text{Scaling factor}$$

Where

$P_{\text{target}}$  is the power of manufacturing upper limit;

$P_{\text{measured}}$  is the measured power;

Measured SAR is measured SAR at measured power which including power drift)

Reported SAR which including Power Drift and Scaling factor

#### 7.3.1. SAR Results [WIFI 2.4G]

SAR Values [WIFI 2.4G] ANT0									
Ch/ Freq. (MHz)	Channel Type	Test Position	Duty Cycle	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (dB)	Scaling Factor	SAR <sub>1-g</sub> results(W/kg)	
								Measured	Reported
measured / reported SAR numbers - Body (Test data distance 0mm)(Open)									
1/2412	802.11b	Front side	1.008	15.20	16.00	-0.01	1.202	0.492	0.597
1/2412	802.11b	Rear side	1.008	15.20	16.00	0.14	1.202	0.518	0.628
1/2412	802.11b	Left side	1.008	15.20	16.00	-0.11	1.202	0.450	0.546
1/2412	802.11b	Bottom side	1.008	15.20	16.00	-0.14	1.202	0.477	0.578
measured / reported SAR numbers - Body (Test data distance 0mm)(Close)									
1/2412	802.11b	Front side	1.008	15.20	16.00	-0.13	1.202	0.500	0.606
1/2412	802.11b	Rear side	1.008	15.20	16.00	0.02	1.202	<b>0.524</b>	<b>0.635</b>
1/2412	802.11b	Left side	1.008	15.20	16.00	0.18	1.202	0.455	0.552
1/2412	802.11b	Bottom side	1.008	15.20	16.00	0.14	1.202	0.485	0.588

SAR Values [WIFI 2.4G] ANT1									
Ch/ Freq. (MHz)	Channel Type	Test Position	Duty Cycle	Conducted Power (dBm)	Maximum Allowed Power (dBm)	Power Drift (dB)	Scaling Factor	SAR <sub>1-g</sub> results(W/kg)	
								Measured	Reported
measured / reported SAR numbers - Body (Test data distance 0mm)(Open)									
1/2412	802.11b	Front side	1.008	15.24	16.00	0.03	1.191	0.522	0.627
1/2412	802.11b	Rear side	1.008	15.24	16.00	-0.15	1.191	0.537	0.645
1/2412	802.11b	Right side	1.008	15.24	16.00	0.01	1.191	0.466	0.560
1/2412	802.11b	Bottom side	1.008	15.24	16.00	-0.09	1.191	0.491	0.590
measured / reported SAR numbers - Body (Test data distance 0mm)(Close)									
1/2412	802.11b	Front side	1.008	15.24	16.00	-0.01	1.191	0.533	0.640
1/2412	802.11b	Rear side	1.008	15.24	16.00	-0.03	1.191	<b>0.542</b>	<b>0.651</b>
1/2412	802.11b	Right side	1.008	15.24	16.00	0.05	1.191	0.477	0.573
1/2412	802.11b	Bottom side	1.008	15.24	16.00	-0.07	1.191	0.509	0.611

Note:

- 1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.
- 2) When the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg, SAR test for the other 802.11 modes are not required.



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## 7.4. Multiple Transmitter Evaluation

### 7.4.1. Simultaneous SAR test evaluation

#### 2) Simultaneous Transmission Possibilities

NO.	Simultaneous Tx Combination	Body
10	WiFi 2.4G ANT0 + WiFi 2.4G ANT1	Yes
12	WiFi 2.4G ANT1 + BT ANT0	Yes

Note:

- 1) Wi-Fi ANT0 and Bluetooth ANT0 share the same Tx antenna and can't transmit simultaneously.
- 2) The device does not support DTM function.



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## 7.4.2. Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:

- $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$  for test separation distances  $\leq 50 \text{ mm}$ ;

Where  $x = 7.5$  for 1-g SAR, and  $x = 18.75$  for 10-g SAR.

When the minimum test separation distance is  $< 5 \text{ mm}$ , a distance of  $5 \text{ mm}$  is applied to determine SAR test exclusion.

### Estimated SAR Result

Freq. Band	Frequency (GHz)	Test Position	max. power (dBm)	max. power (mw)	Test Separation (mm)	Estimated
						1g SAR (W/kg)
Bluetooth	2.48	Body	0.00	1.00	5	0.042

## 7.4.3. Simultaneous Transmission SAR Summation Scenario

Open:

Test position		WiFi Antenna SARmax (W/kg)		
		WLAN 2.4G ANT0	BT ANT0	WLAN 2.4G ANT1
		1	2	3
Body	Front side	0.597	0.042	0.627
	Back side	0.628	0.042	0.645
	Left side	0.546	0.042	/
	Right side	/	/	0.560
	Top side	/	/	/
	Bottom side	0.578	0.042	0.590

Test position		Summed 1g SARmax (W/kg)	
		1+3	2+3
Body	Front side	1.224	0.669
	Back side	1.273	0.687
	Left side	0.546	0.042
	Right side	0.560	0.560
	Top side	/	/
	Bottom side	1.168	0.632



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Scan code to check authenticity



Close:

Test position		WiFi Antenna SARmax (W/kg)		
		WLAN 2.4G ANT0	BT ANT0	WLAN 2.4G ANT1
		1	2	3
Body	Front side	0.606	0.042	0.640
	Back side	0.635	0.042	0.651
	Left side	0.552	0.042	/
	Right side	/	/	0.573
	Top side	/	/	/
	Bottom side	0.588	0.042	0.611

Test position		Summed 1g SARmax (W/kg)	
		1+3	2+3
Body	Front side	1.246	0.682
	Back side	1.286	0.693
	Left side	0.552	0.042
	Right side	0.573	0.573
	Top side	/	/
	Bottom side	1.199	0.653





## Appendix A: Detailed System Check Results

## Appendix B: Detailed Test Results

## Appendix C: Calibration certificate

## Appendix D: Photographs

.....**The End of Test Report**.....

