



**Version**

Version No.	Date	Description
V1.0	December 18, 2020	Original

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China  
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: [info@uttlab.com](mailto:info@uttlab.com) [Http://www.uttlab.com](http://www.uttlab.com)  
UTTR-SAR-IEEE Std 1528-2013-V1.0

## Contents

	Page
<b>1 GENERAL INFORMATION .....</b>	<b>4</b>
<b>1.1 STATEMENT OF COMPLIANCE.....</b>	<b>4</b>
<b>1.2 EUT DESCRIPTION.....</b>	<b>5</b>
1.2.1 General Description.....	5
1.2.2 Wireless Technologies.....	5
1.2.3 List of Accessory.....	5
<b>1.3 MAXIMUM CONDUCTED POWER .....</b>	<b>5</b>
<b>1.4 OTHER INFORMATION.....</b>	<b>5</b>
<b>1.5 TESTING LOCATION .....</b>	<b>5</b>
<b>1.6 TEST FACILITY .....</b>	<b>6</b>
<b>1.7 GUIDANCE STANDARD .....</b>	<b>7</b>
<b>2 SPECIFIC ABSORPTION RATE (SAR).....</b>	<b>8</b>
<b>2.1 INTRODUCTION .....</b>	<b>8</b>
<b>2.2 SAR DEFINITION.....</b>	<b>8</b>
<b>2.3 SAR LIMITS .....</b>	<b>8</b>
<b>3 SAR MEASUREMENT SYSTEM .....</b>	<b>9</b>
<b>3.1 SPEAG DASY SYSTEM .....</b>	<b>9</b>
3.1.1 Robot.....	9
3.1.2 Probe.....	10
3.1.3 Data Acquisition Electronics (DAE).....	10
3.1.4 Phantom.....	11
3.1.5 Device Holder.....	12
3.1.6 System Validation Dipoles.....	12
<b>3.2 SAR SCAN PROCEDURE.....</b>	<b>13</b>
3.2.1 SAR Reference Measurement (drift).....	13
3.2.2 Area Scan.....	13
3.2.3 Zoom Scan.....	13
3.2.4 SAR Drift Measurement.....	14
<b>3.3 TEST EQUIPMENT .....</b>	<b>15</b>
<b>3.4 MEASUREMENT UNCERTAINTY.....</b>	<b>16</b>
<b>3.5 TISSUE DIELECTRIC PARAMETER MEASUREMENT &amp; SYSTEM VERIFICATION.....</b>	<b>17</b>
3.5.1 Tissue Simulating Liquids.....	17
3.5.2 System Check Description.....	19
3.5.3 Tissue Verification.....	20
3.5.4 System Verification.....	20
<b>4 SAR MEASUREMENT EVALUATION.....</b>	<b>22</b>
<b>4.1 EUT CONFIGURATION AND SETTING.....</b>	<b>22</b>
4.1.1 WLAN Configuration and Testing.....	22
4.1.2 Antenna Config.....	23
<b>4.2 EUT TESTING POSITION.....</b>	<b>24</b>
4.2.1 Body Exposure Conditions.....	24
<b>4.3 MEASURED CONDUCTED POWER RESULT.....</b>	<b>25</b>
4.3.1 Conducted Power of 2.4G.....	25
<b>4.4 SAR TESTING RESULTS.....</b>	<b>26</b>
4.4.1 SAR Results for Body Exposure Condition (Separation Distance is 0 cm).....	26

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

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

**Appendix C. Calibration Certificate for Probe and Dipole**

**Appendix D. Photographs of EUT and Setup**

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

[Http://www.uttlab.com](http://www.uttlab.com)

UTTR-SAR-IEEE Std 1528-2013-V1.0

# 1 General Information

## 1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Mode	Highest Reported Body SAR <sub>1g</sub> (0 cm Gap) (W/kg)
WIFI 2.4G	0.146

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

## 1.2 EUT Description

### 1.2.1 General Description

Product Name	Sentia
Trade mark	N/A
Model No.(EUT)	A0295
Add. Model No.:	N/A
FCC ID	2AXRY-UBSENTIA
Tx Frequency Bands (Unit: MHz)	2.4G: 2400-2483.5
Antenna Type	Fixed Internal Antenna
EUT Stage	Identical Prototype

### 1.2.2 Wireless Technologies

2.4G	802.11b 802.11g 802.11n (HT20)
------	--------------------------------------

### 1.2.3 List of Accessory

Battery	Model No.:	PL804048
	Battery Type:	Lithium-ion Polymer Rechargeable Battery
	Power Rating	3.7Vdc, 1850mAh
	Manufacturer	ChangHong Grand-Pro Tech Co., Ltd

## 1.3 Maximum Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Mode	2.4G WLAN
802.11b	13.11
802.11g	13.45
802.11n HT20	13.31

## 1.4 Other Information

Sample Received Date:	October 14, 2020
Sample tested Date:	October 26, 2020 to October 26, 2020

## 1.5 Testing Location

Shenzhen UnionTrust Quality and Technology Co., Ltd.	
Address: Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China	
Telephone: +86-755-28230888	Fax: +86-755-28230886
Mail: <a href="mailto:info@uttlab.com">info@uttlab.com</a>	Website: <a href="http://www.uttlab.com">Http://www.uttlab.com</a>

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China  
 Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: [info@uttlab.com](mailto:info@uttlab.com) [Http://www.uttlab.com](http://www.uttlab.com)  
 UTR-SAR-IEEC Std 1528-2013-V1.0

## 1.6 Test Facility

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

### **CNAS-Lab Code: L9069**

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

### **FCC Accredited Lab.**

**Designation Number: CN1194**

**Test Firm Registration Number: 259480**

### **A2LA-Lab Certificate No.: 4312.01**

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

### **ISED Wireless Device Testing Laboratories**

CAB identifier: CN0032

## **Shenzhen UnionTrust Quality and Technology Co., Ltd.**

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China  
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: [info@uttlab.com](mailto:info@uttlab.com) [Http://www.uttlab.com](http://www.uttlab.com)  
UTTR-SAR-IEEE Std 1528-2013-V1.0

## 1.7 Guidance Standard

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2 §2.1093, IEEE Std 1528-2013, IEEE Std C95.1-2005 + A1:2010, the following FCC Published RF exposure KDB procedures:

KDB 865664 D01 v01r04

KDB 865664 D02 v01r02

KDB 447498 D01 v06

KDB 941225 D07 v01r02

KDB 248227 D01 v02r02

## 2 Specific Absorption Rate (SAR)

### 2.1 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, by appropriate techniques, to produce specific absorption rates (SARs) as averaged over the whole-body, any 1 g or any 10 g of tissue (defined as a tissue volume in the shape of a cube). All SAR values are to be averaged over any six-minute period. When portable device was used within 20 cm of the user's body, SAR evaluation of the device will be required. The SAR limit in chapter 2.3.

### 2.2 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 ( $\rho$ ). The equation description is as below:

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

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

SAR measurement can be related to the electrical field in the tissue by

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

Where:  $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and E is the RMS electrical field strength.

### 2.3 SAR Limits

(A) Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

**Note:**

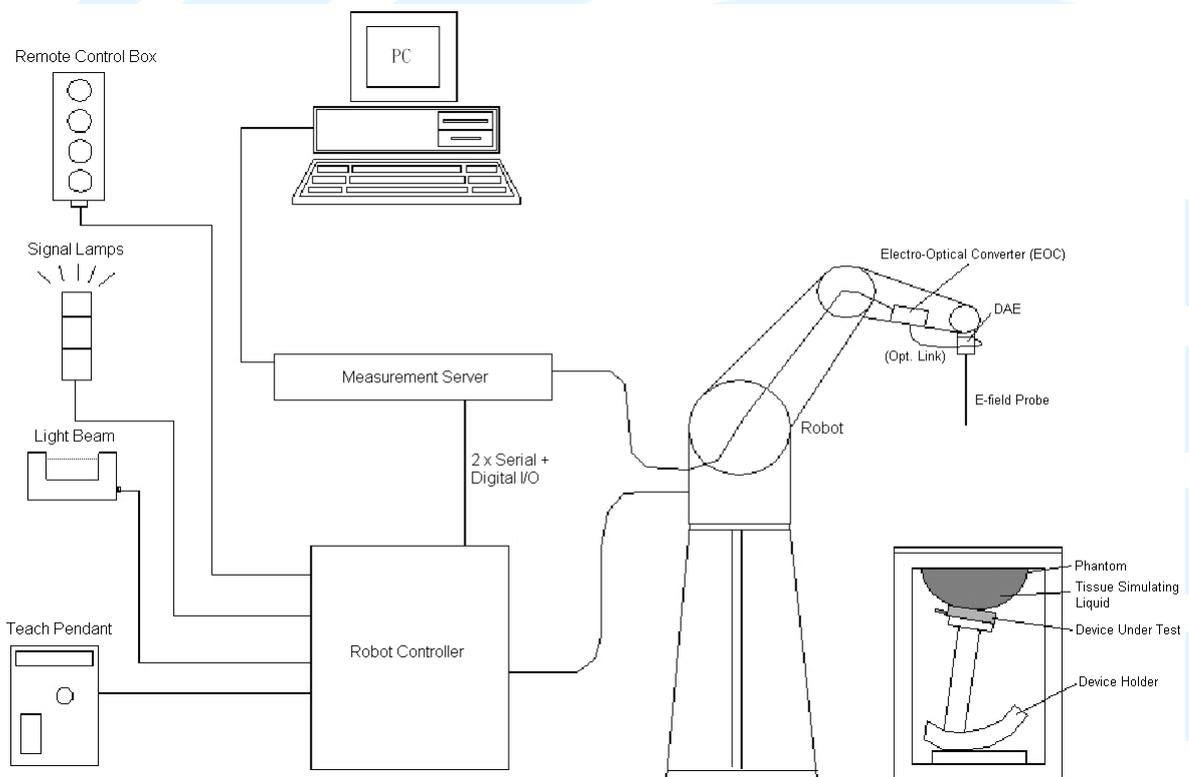
1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.
2. At frequencies above 6.0 GHz, SAR limits are not applicable and MPE limits for power density should be applied at 5 cm or more from the transmitting device.
3. The SAR limit is specified in FCC 47 CFR Part 2 §2.1093, IEEE Std C95.1-2005 + A1:2010.

#### Shenzhen UnionTrust Quality and Technology Co., Ltd.

## 3 SAR Measurement System

### 3.1 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC.



DASY Measurement System

#### 3.1.1 Robot

The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

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

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China  
Tel: +86-755-28230888 Fax: +86-755-28230886 E-mail: info@uttlab.com [Http://www.uttlab.com](http://www.uttlab.com)  
UTTR-SAR-IEEE Std 1528-2013-V1.0

### 3.1.2 Probe

The SAR measurement is conducted with the dosimetric probe. 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.

<b>Model</b>	EX3DV4	
<b>Construction</b>	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
<b>Frequency</b>	10 MHz to 6 GHz Linearity: $\pm 0.2$ dB	
<b>Directivity</b>	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)	
<b>Dynamic Range</b>	10 $\mu$ W/g to 100 mW/g Linearity: $\pm 0.2$ dB (noise: typically $< 1$ $\mu$ W/g)	
<b>Dimensions</b>	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	

<b>Model</b>	ES3DV3	
<b>Construction</b>	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
<b>Frequency</b>	10 MHz to 4 GHz Linearity: $\pm 0.2$ dB	
<b>Directivity</b>	$\pm 0.2$ dB in HSL (rotation around probe axis) $\pm 0.3$ dB in tissue material (rotation normal to probe axis)	
<b>Dynamic Range</b>	5 $\mu$ W/g to 100 mW/g Linearity: $\pm 0.2$ dB	
<b>Dimensions</b>	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm	

### 3.1.3 Data Acquisition Electronics (DAE)

<b>Model</b>	DAE3, DAE4	
<b>Construction</b>	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY 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>	$< 5\mu$ V (with auto zero)	
<b>Input Bias Current</b>	$< 50$ fA	
<b>Dimensions</b>	60 x 60 x 68 mm	

## Shenzhen UnionTrust Quality and Technology Co., Ltd.

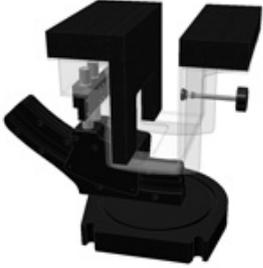
### 3.1.4 Phantom

<b>Model</b>	Twin SAM	
<b>Construction</b>	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)	
<b>Shell Thickness</b>	$2 \pm 0.2$ mm ( $6 \pm 0.2$ mm at ear point)	
<b>Dimensions</b>	Length: 1000 mm Width: 500 mm Height: adjustable feet	
<b>Filling Volume</b>	approx. 25 liters	

<b>Model</b>	ELI	
<b>Construction</b>	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)	
<b>Shell Thickness</b>	$2.0 \pm 0.2$ mm (bottom plate)	
<b>Dimensions</b>	Major axis: 600 mm Minor axis: 400 mm	
<b>Filling Volume</b>	approx. 30 liters	

### 3.1.5 Device Holder

<b>Model</b>	Mounting Device	
<b>Construction</b>	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
<b>Material</b>	POM	

<b>Model</b>	Laptop Extensions Kit	
<b>Construction</b>	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
<b>Material</b>	POM, Acrylic glass, Foam	

### 3.1.6 System Validation Dipoles

<b>Model</b>	D-Serial	
<b>Construction</b>	Symmetrical dipole with 1/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
<b>Frequency</b>	750 MHz to 5800 MHz	
<b>Return Loss</b>	> 20 dB	
<b>Power Capability</b>	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

## Shenzhen UnionTrust Quality and Technology Co., Ltd.

### 3.2 SAR Scan Procedure

#### 3.2.1 SAR Reference Measurement (drift)

Prior to the SAR test, local SAR shall be measured at a stationary reference point where the SAR exceeds the lower detection limit of the measurement system.

#### 3.2.2 Area Scan

Measurement procedures for evaluating the SAR of wireless device start with a coarse measurement grid to determine the approximate location of the local peak SAR values. This is known as the area-scan procedure. All antennas and radiating structures that may contribute to the measured SAR or influence the SAR distribution must be included in the area scan. The area scan measurement resolution must enable the extrapolation algorithms of the SAR system to correctly identify the peak SAR location(s) for subsequent zoom scan measurements to correctly determine the 1-g SAR. Area scans are performed at a constant distance from the phantom surface, determined by the measurement frequencies. When a measured peak is closer than 1/2 the zoom scan volume dimension (x, y) from the edge of the area scan region, unless the entire peak and gram-averaging volume are both captured within the zoom scan volume, the area scan must be repeated by shifting and expanding the area scan region to ensure all peaks are away from the area scan boundary. The area scan resolutions specified in the table below must be applied to the SAR measurements.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 mm ± 1 mm	1/2 · δ · ln(2) mm ± 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: Δ <sub>xArea</sub> , Δ <sub>yArea</sub>	≤ 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.	

#### 3.2.3 Zoom Scan

To evaluate the peak spatial-average SAR values with respect to 1 g or 10 g cubes, fine resolution volume scans, called zoom scans, are performed at the peak SAR locations identified during the area scan. If the cube volume within the zoom scan chosen to calculate the peak spatial-average SAR touches any boundary of the zoom-scan volume, the zoom scan shall be repeated with the center of the zoom-scan volume shifted to the new maximum SAR location. For any secondary peaks found in the area scan that are within 2 dB of the maximum peak and are not within this zoom scan, the zoom scan shall be performed for such peaks, unless the peak spatial-average SAR at the location of the maximum peak is more than 2 dB below the applicable SAR limit (i.e., 1 W/kg for a 1.6 W/kg 1 g limit, or 1.26 W/kg for a 2 W/kg 10 g limit). The zoom scan resolutions specified in the table below must be applied to the SAR measurements.

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

			$\leq 3$ GHz	$> 3$ GHz
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: $\Delta Z_{Zoom}(n)$		$\leq 5$ mm	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	$\leq 4$ mm
	$\Delta Z_{Zoom}(n>1)$ : between subsequent points		$\leq 1.5 \cdot \Delta Z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm
<p>Note: <math>\delta</math> is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.</p> <p>* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is <math>\leq 1.4</math> W/kg, <math>\leq 8</math> mm, <math>\leq 7</math> mm and <math>\leq 5</math> 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.</p>				

### 3.2.4 SAR Drift Measurement

The local SAR (or conducted power) shall be measured at exactly the same location as in 3.2.1 section. The absolute value of the measurement drift (the difference between the SAR measured in 3.2.1 and 3.2.4 section) shall be recorded. The SAR drift shall be kept within  $\pm 5\%$ .

### 3.3 Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D2450V2	883	Sep. 20, 2019	3 Year
Dosimetric E-Field Probe	SPEAG	ES3DV3	3090	May. 09, 2020	1 Year
Data Acquisition Electronics	SPEAG	DAE4	662	May. 06, 2020	1 Year
ENA Series Network Analyzer	Agilent	8753ES	US39170317	Nov. 24, 2019	1 Year
Dielectric Assessment Kit	SPEAG	DAK-3.5	1056	N/A	N/A
USB/GPIB Interface	Agilent	82357B	N10149	N/A	N/A
Signal Generator	R&S	SMB100A	103718	May. 14, 2020	1 Year
POWER METER	R&S	NRP	101293	Nov. 24, 2019	1 Year
Thermometer	Lisheng	HTC-1	/	Nov. 25, 2019	1 Year
Coupler	REBES	TC-05180-10 S	161221001	N/A	N/A
Amplifier	Mini-Circuit	ZHL42	QA1252001	N/A	N/A
DC Source	Agilent	66319B	MY43000795	N/A	N/A

### 3.4 Measurement Uncertainty

Per KDB 865664 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.



### 3.5 Tissue Dielectric Parameter Measurement & System Verification

#### 3.5.1 Tissue Simulating Liquids

The temperature of the tissue-equivalent medium used during measurement must also be within 18 °C to 25 °C and within ± 2 °C of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 - 4 days of use; or earlier if the dielectric parameters can become out of tolerance.

The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.



Photo of Liquid Height

Table-3.1 Tissue Dielectric Parameters for Head and Body

Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
750	41.9	0.89	55.5	0.96
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
1450	40.5	1.20	54.0	1.30
1640	40.3	1.29	53.8	1.40
1750	40.1	1.37	53.4	1.49
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2300	39.5	1.67	52.9	1.81
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16
3500	37.9	2.91	51.3	3.31
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5800	35.3	5.27	48.2	6.00

( $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho = 1000 \text{ kg/m}^3$ )

The following table gives the recipes for tissue simulating liquids.

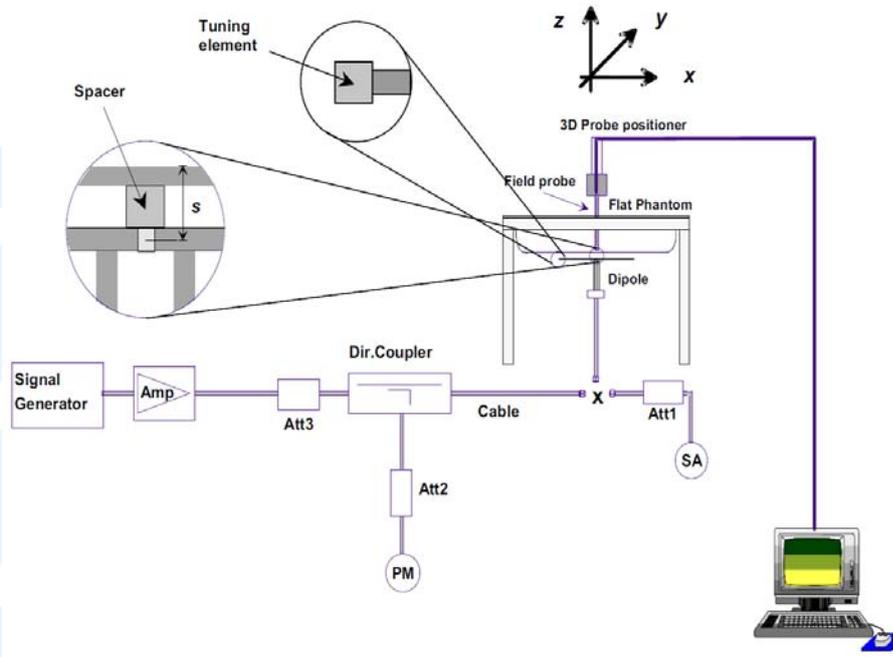
Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.4	57.0	-	41.1	-
H835	0.1	-	1.0	1.4	57.0	-	40.5	-
H900	0.1	-	1.0	1.5	56.5	-	40.9	-
H1450	-	45.5	-	0.7	-	-	53.8	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	44.5	-	0.3	-	-	55.2	-
H1800	-	44.9	-	0.2	-	-	54.9	-
H1900	-	44.9	-	0.2	-	-	54.9	-
H2000	-	50	-	-	-	-	50	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.52	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	29.4	-	0.4	-	-	70.2	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

### 3.5.2 System Check Description

The system check procedure provides a simple, fast, and reliable test method that can be performed daily or before every SAR measurement. The objective here is to ascertain that the measurement system has acceptable accuracy and repeatability. This test requires a flat phantom and a radiating source. The system verification setup is shown as below.



System Verification Setup

### 3.5.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Measured Conductivity ( $\sigma$ )	Measured Permittivity ( $\epsilon_r$ )	Target Conductivity ( $\sigma$ )	Target Permittivity ( $\epsilon_r$ )	Conductivity Deviation (%)	Permittivity Deviation (%)
Oct. 26, 2020	Head	2450	22.0	1.777	40.200	1.80	39.20	-1.28	2.55

**Note:**

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within  $\pm 5\%$  of the target values. The variation of the liquid temperature must be within  $\pm 2^\circ\text{C}$  during the test.

### 3.5.4 System Verification

The measuring result for system verification is tabulated as below. Dipole input signal is 10 mw in the System check.

Test Date	Tissue Type	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Oct. 26, 2020	Head	2450	52.60	0.482	48.20	-8.37	883	3090	662

**Note:**

Comparing to the reference SAR value, the validation data should be within its specification of 10%. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Per KDB 865664, SAR system validation status should be documented to confirm measurement accuracy. SAR measurement systems are validated according to procedures in KDB 865664. The validation status is documented according to the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters. When multiple SAR system is used, the validation status of each SAR system is needed to be documented separately according to the associated system components.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probe and tissue dielectric parameters are shown as below.

Date	Probe S/N	Tested Freq. (MHz)	Tissue Type	Perm	Cond	CW Validation			Mod. Validation		
						Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	Peak to average power ratio
Jun. 30, 2020	3090	750	Head	41.04	0.874	PASS	PASS	PASS	N/A	N/A	N/A
Jun. 30, 2020	3090	835	Head	40.69	0.921	PASS	PASS	PASS	GMSK	PASS	N/A
Jun. 30, 2020	3090	900	Head	42.28	0.930	PASS	PASS	PASS	GMSK	PASS	N/A
Jun. 30, 2020	3090	1750	Head	38.87	1.313	PASS	PASS	PASS	N/A	N/A	N/A
Jun. 30, 2020	3090	1900	Head	38.67	1.410	PASS	PASS	PASS	GMSK	PASS	N/A
Jun. 30, 2020	3090	2000	Head	38.51	1.469	PASS	PASS	PASS	N/A	N/A	N/A
Jun. 30, 2020	3090	2300	Head	38.11	1.672	PASS	PASS	PASS	TDD	PASS	N/A
Jun. 30, 2020	3090	2450	Head	40.15	1.792	PASS	PASS	PASS	OFDM/GFSK	PASS	PASS
Jun. 30, 2020	3090	2600	Head	37.75	1.905	PASS	PASS	PASS	TDD	PASS	N/A

**Shenzhen UnionTrust Quality and Technology Co., Ltd.**

## 4 SAR Measurement Evaluation

### 4.1 EUT Configuration and Setting

#### 4.1.1 WLAN Configuration and Testing

In general, various vendor specific external test software and chipset based internal test modes are typically used for SAR measurement. These chipset based test mode utilities are generally hardware and manufacturer dependent, and often include substantial flexibility to reconfigure or reprogram a device. A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current generation SAR systems to measure SAR correctly. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

According to KDB 248227 D01, this device has installed WLAN engineering testing software which can provide continuous transmitting RF signal. During WLAN SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

#### Initial Test Configuration

An initial test configuration is determined for OFDM transmission modes in 2.4 GHz and 5 GHz bands 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. 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.

#### Subsequent Test Configuration

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. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. When the highest reported SAR for the initial test configuration 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.

#### SAR Test Configuration and Channel Selection

When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is using largest channel bandwidth, lowest order modulation, lowest data rate,

#### Shenzhen UnionTrust Quality and Technology Co., Ltd.

and lowest order 802.11 mode (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.

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

#### 4.1.2 Antenna Config

The device support Tx antenna for WLAN 2.4G band.

(Refer to the Antenna location picture in the appendix D for details).

**SAR test procedure is as below:**

During the SAR test, the Tx Antenna is set to the MAX transmit power level and test the SAR respectively in all applicable RF exposure conditions. Some commands or test scripts are supplied to fix the operation state so that only one TX antenna is chosen and tested at a time. The Tx antenna is completely covered by the appropriate SAR measurements.

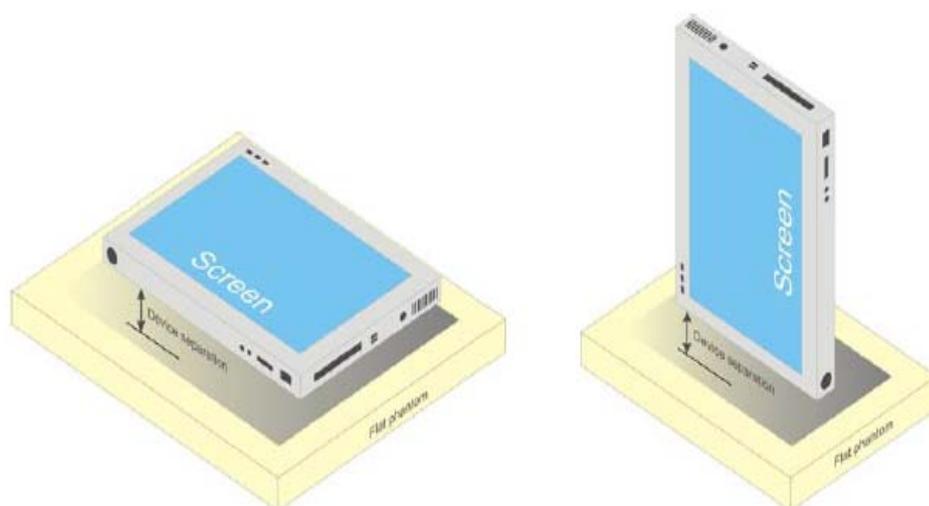
## 4.2 EUT Testing Position

### 4.2.1 Body Exposure Conditions

RF Exposure Conditions	Test Position	Separation Distance	SAR test exclusion
Body	Front Face	0 cm	Note
	Rear Face		
	Left Side		
	Right Side		
	Top Side		
	Bottom Side		

Note:

- 1) The monitor is overall diagonal dimension < 20 cm, This device is typically operated like a mini-tablet and are usually designed with certain UMPC features and operating characteristics



### 4.3 Measured Conducted Power Result

#### 4.3.1 Conducted Power of 2.4G

The following table summarized the data of the conduction power:

Mode		Channel	Frequency (MHz)	Average Power (dBm)
2.4G	802.11b	1	2412	12.56
		6	2437	12.90
		11	2462	13.11
	802.11g	1	2412	12.89
		6	2437	13.17
		11	2462	13.45
	802.11n (HT20)	1	2412	13.05
		6	2437	13.31
		11	2462	13.30

Note:

1) Per KDB 447498, the tested device was within the specified tune-up tolerances range, but not more than 2dB lower than the maximum tune-up tolerance limit.

## 4.4 SAR Testing Results

### KDB 447498 D01 General RF Exposure Guidance

Testing of other required channels within the operating mode of a frequency band is not required when the reported SAR for the mid-band or highest output power channel is:

- a)  $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
- b)  $\leq 0.6$  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
- c)  $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz

### KDB 248227 D01 Wi-Fi SAR

- a) For handsets operating next to ear, hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is  $\leq 0.4$  W/kg, SAR testing for remaining test positions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.
- b) For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is  $\leq 0.8$  W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is  $\leq 1.2$  W/kg.

### 4.4.1 SAR Results for Body Exposure Condition (Separation Distance is 0 cm)

Band	Mode	Test Position	Separation Distance (cm)	Ch.	Duty Cycle	Power setting	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Measured SAR-1g (W/kg)	Scaling Factor	Scaled 1g SAR
2.4G WLAN	802.11b	Front Face	0	11	100	17	14.0	13.11	0.060	1.23	0.074
2.4G WLAN	802.11b	Rear Face	0	11	100	17	14.0	13.11	0.075	1.23	0.092
2.4G WLAN	802.11b	Left Side	0	11	100	17	14.0	13.11	0.034	1.23	0.042
2.4G WLAN	802.11b	Right Side	0	11	100	17	14.0	13.11	0.025	1.23	0.031
2.4G WLAN	802.11b	Top Side	0	11	100	17	14.0	13.11	0.010	1.23	0.012
2.4G WLAN	802.11b	Bottom Side	0	11	100	17	14.0	13.11	0.023	1.23	0.028
2.4G WLAN	802.11b	Rear Face	0	6	100	17	14.0	12.90	0.091	1.29	0.117
2.4G WLAN	802.11b	Rear Face	0	1	100	17	14.0	12.56	<b>0.105</b>	1.39	<b>0.146</b>

### Shenzhen UnionTrust Quality and Technology Co., Ltd.

\*\*\* End of Report \*\*\*

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.



## Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.



## Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.



## **Appendix C. Calibration Certificate for Probe and Dipole**

The calibration certificates are shown as follows.



## **Appendix D. Photographs of EUT and Setup**

The Photographs of EUT and Setup are shown as follows.

