# SAR Test Report

| | | |
|---|---|---|
| **FCC Rule Part** | : | **CFR §2.1093** |
| **Standards** | : | **IEEE Std 1528:2013, KDB 865664 D01 v01r04, KDB 865664 D02 v01r02, KDB 447498 D01 v06, KDB 248227 D01 v02r02, KDB 616217 D04 v01r02** |
| **Report No.** | : | **SFBEMI-WTW-P25060631** |
| **Applicant** | : | **NETRONIX, INC.** |
| **Address** | : | **No. 945, Boai St., Jubei City, Hsin-Chu, 30265, Taiwan** |
| **Factory:** | : | **(1) NETRONIX, INC.**<br>**(2) NTX Electronics YANGZHOU CO., LTD.** |
| **Address:** | : | **(1) No. 945, Boai St., Jubei City, Hsin-Chu, 30265, Taiwan**<br>**(2) No. 8, Wuzhou West Road, Economic and technological Development Zone, Yangzhou, Jiangsu Province, 225009, China** |
| **Product** | : | **Electronic Display Device** |
| **FCC ID** | : | **NOIKBN428B** |
| **Brand** | : | **Rakuten kobo** |
| **Model No.** | : | **N428B** |
| **Sample Received Date** | : | **Jun. 30, 2025** |
| **Date of Testing** | : | **Jul. 16, 2025** |
| **Lab Address** | : | **No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan** |
| **Test Location** | : | **No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City, Taiwan** |
| **FCC Accredited No.** | : | **TW0003** |

**CERTIFICATION:** The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch–Lin Kou Laboratories**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by TAF or any government agencies.

**Prepared By :** Vera Huang

Vera Huang / Specialist

**Approved By :** Gordon Lin

Gordon Lin / Manager

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

# Table of Contents

**Release Control Record** ..... **3**
**1. Test Reference Guidance** ..... **4**
**2. Summary of Maximum SAR Value** ..... **4**
**3. Description of Equipment Under Test** ..... **5**
**4. SAR Measurement System** ..... **6**
4.1 Definition of Specific Absorption Rate (SAR) ..... 6
4.2 SPEAG DASY6 System ..... 6
4.2.1 Robot ..... 7
4.2.2 Probes ..... 8
4.2.3 Data Acquisition Electronics (DAE) ..... 8
4.2.4 Phantoms ..... 8
4.2.5 Device Holder ..... 9
4.2.6 System Validation Dipoles ..... 10
4.2.7 Power Source ..... 10
4.2.8 Tissue Simulating Liquids ..... 11
4.3 SAR System Verification ..... 13
4.4 SAR Measurement Procedure ..... 15
4.4.1 Area Scan and Zoom Scan Procedure ..... 15
4.4.2 Volume Scan Procedure ..... 16
4.4.3 Power Drift Monitoring ..... 17
4.4.4 Spatial Peak SAR Evaluation ..... 17
4.4.5 SAR Averaged Methods ..... 17
**5. SAR Measurement Evaluation** ..... **18**
5.1 EUT Configuration and Setting ..... 18
5.2 EUT Testing Position ..... 20
5.2.1 Body Exposure Conditions ..... 20
5.3 Tissue Verification ..... 21
5.4 System Validation ..... 21
5.5 System Verification ..... 21
5.6 Maximum Output Power ..... 21
5.6.1 Maximum Target Conducted Power ..... 21
5.6.2 Measured Conducted Power Result ..... 21
5.7 SAR Testing Results ..... 22
5.7.1 SAR Test Reduction Considerations ..... 22
5.7.2 SAR Results for Body Exposure Condition (Test Separation Distance is 0 mm) ..... 23
5.7.3 SAR Measurement Variability ..... 23
5.7.4 Simultaneous Multi-band Transmission Evaluation ..... 24
**6. Calibration of Test Equipment** ..... **25**
**7. Measurement Uncertainty** ..... **26**
**8. Information of the Testing Laboratories** ..... **28**

**Appendix A. Plots of SAR System Verification**
**Appendix B. Plots of SAR Measurement**
**Appendix C. Tissue & System Verification**
**Appendix D. Maximum Target Conducted Power**
**Appendix E. Measured Conducted Power Result**
**Appendix F. SAR Test Result**
**Appendix G. SAR Measurement Variability**
**Appendix H. Analysis of Simultaneous Transmission SAR**
**Appendix J. Calibration of Test Equipment List**
**Appendix K. Considerations Related to Bluetooth for Setup and Testing**
**Appendix Z. Calibration Certificate for Probe and Dipole**

# Release Control Record

| Report No. | Reason for Change | Date Issued |
|---|---|---|
| SFBEMI-WTW-P25060631 | Initial release | Sep. 18, 2025 |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# 1. Test Reference Guidance

| | | |
|---|---|---|
| **FCC Rule Part** | : | **CFR §2.1093** |
| **Standards** | : | **IEEE Std 1528:2013, KDB 865664 D01 v01r04, KDB 865664 D02 v01r02, KDB 447498 D01 v06, KDB 248227 D01 v02r02, KDB 616217 D04 v01r02** |

# 2. Summary of Maximum SAR Value

| Equipment Class | Mode | Highest $SAR_{1g}$ Body Tested at 0 mm (W/kg) |
|---|---|---|
| DTS | 2.4G WLAN | 1.19 |
| NII | 5.2G WLAN | 1.18 |
| | 5.8G WLAN | 0.87 |
| DSS | Bluetooth | 0.09 |

| Highest Simultaneous Transmission SAR | Highest $SAR_{1g}$ Body Tested at 0 mm (W/kg) |
|---|---|
| | 1.28 |

**Note:**

1. The SAR criteria **(Head & Body: SAR-1g1.6 W/kg, and Extremity: SAR-10g 4.0 W/kg)** for general population/uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

**Test Reference Guidance:** IEEE C95.1:1992

# 3. Description of Equipment Under Test

| | |
|---|---|
| **EUT Type** | Electronic Display Device |
| **FCC ID** | NOIKBN428B |
| **Brand Name** | Rakuten kobo |
| **Model Name** | N428B |
| **Tx Frequency Bands (Unit: MHz)** | WLAN : 2412 ~ 2462, 5180 ~ 5240, 5745 ~ 5825<br>Bluetooth : 2402 ~ 2480 |
| **Uplink Modulations** | 802.11b : DSSS<br>802.11a/g/n/ac : OFDM<br>Bluetooth : GFSK, π/4-DQPSK, 8-DPSK |
| **Antenna Type** | Chip Antenna<br>(Peak Antenna Gain : 3.91 dBi for 2.4GHz, 3.41 dBi for 5GHz) |
| **EUT Stage** | Engineering Sample |

**Note:**

1. The EUT uses following accessories.

| Item | Brand | Model | Supplier Model | Color | Specification | Material | TID number |
|---|---|---|---|---|---|---|---|
| 1st source USB Cable | Yih Fone | SH-0846 | YF-USB2-A-C-1M(K) | Black | Signal Line : Shielded: Y, 1.0M, Core: N/A | TPE | 12574 |
| | | SH-0837 | YF-USB2-A-C-1M-WH(K) | White | Signal Line : Shielded: Y, 1.0M, Core: N/A | TPE | 12575 |
| 2nd source USB Cable | LUXSHARE-ICT | LB93US005-1H | - | Black | Signal Line : Shielded: Y, 1.0M, Core: N/A | TPE | - |
| | | LB93US006-1H | - | White | Signal Line : Shielded: Y, 1.0M, Core: N/A | TPE | - |

2. The EUT will be supported with the following eMMC and DRAM sources.

| Item | Brand | Model |
|---|---|---|
| 1st source eMMC | PHISON | PTE7A0YJ-32GE |
| 2nd source eMMC | MK FOUNDER | MKEMF032GT1E-C |
| 3rd source eMMC | FORESEE | FEMDNN032G-C9A55 |
| 1st source DRAM | MICRON | MT53D512M16D1DS-046 WT:D |
| 2nd source DRAM | KINGSTON | D0811PM2FDGUK |

3. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

# 4. SAR Measurement System

## 4.1 Definition of Specific Absorption Rate (SAR)

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

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

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

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

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

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

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

## 4.2 SPEAG DASY6 System

DASY6 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 DASY6 software defined. The DASY6 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 (EOC). The EOC performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

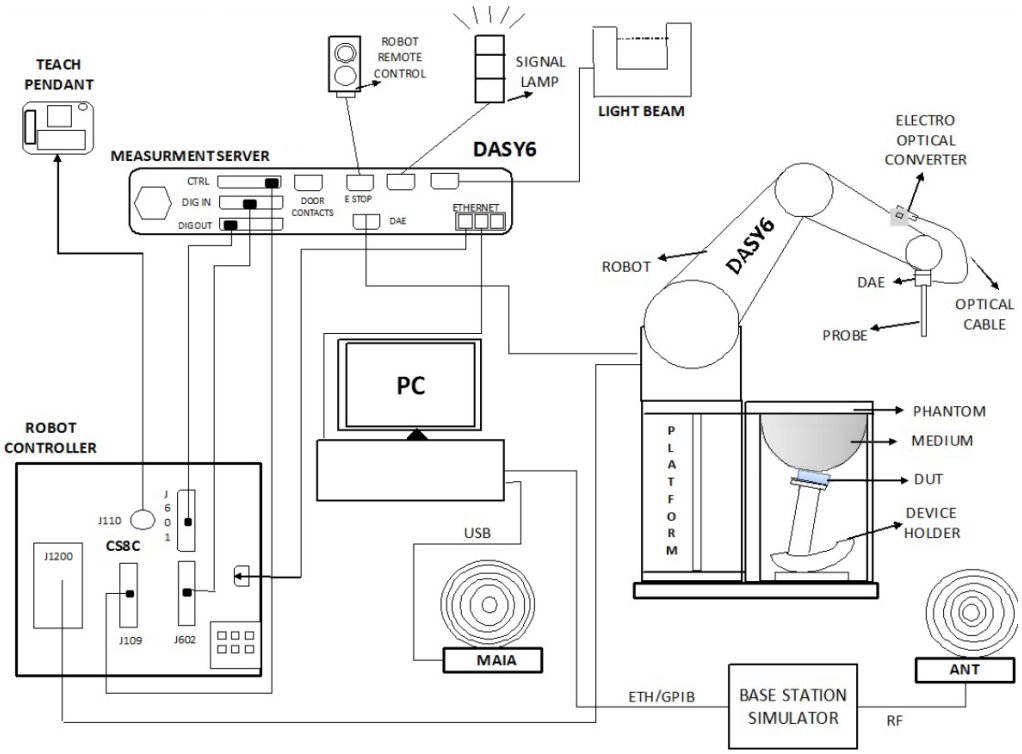



**Fig-4.1 SPEAG DASY6 System Setup**

### 4.2.1 Robot

The DASY6 systems use the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version of CS8c from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

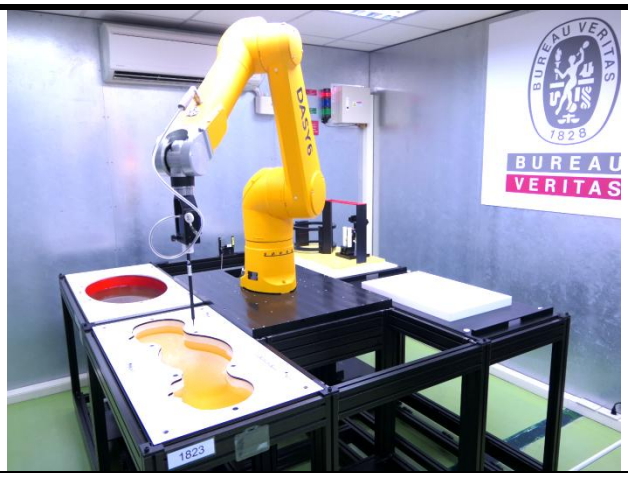


**Fig-4.2 SPEAG DASY6 System**

### 4.2.2 Probes

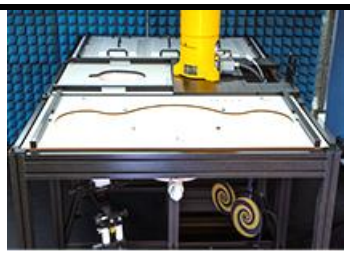
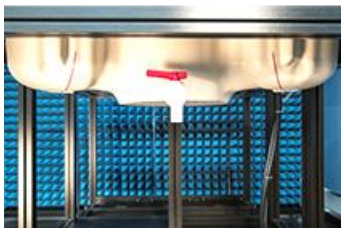
The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

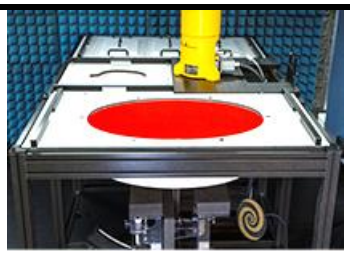
| | | |
|---|---|---|
| **Model** | EX3DV4 | |
| **Construction** | Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE). | |
| **Frequency** | 4 MHz to 10 GHz<br>Linearity: ± 0.2 dB | |
| **Directivity** | ± 0.1 dB in TSL (rotation around probe axis)<br>± 0.3 dB in TSL (rotation normal to probe axis) | |
| **Dynamic Range** | 10 μW/g to 100 mW/g<br>Linearity: ± 0.2 dB (noise: typically < 1 μW/g) | |
| **Dimensions** | Overall length: 337 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |

### 4.2.3 Data Acquisition Electronics (DAE)

| | | |
|---|---|---|
| **Model** | DAE3, DAE4 | |
| **Construction** | 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. | |
| **Measurement Range** | -100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV) | |
| **Input Offset Voltage** | < 5μV (with auto zero) | |
| **Input Bias Current** | < 50 fA | |
| **Dimensions** | 60 x 60 x 68 mm | |

### 4.2.4 Phantoms

| | | |
|---|---|---|
| **Model** | SAM-Twin Phantom |  <br>  |
| **Construction** | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE Std 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. | |
| **Material** | Vinylester, fiberglass reinforced (VE-GF) | |
| **Shell Thickness** | 2 ± 0.2 mm (6 ± 0.2 mm at ear point) | |
| **Dimensions** | Length: 1000 mm<br>Width: 500 mm<br>Height: adjustable feet | |
| **Filling Volume** | approx. 25 liters | |

| | | |
|---|---|---|
| **Model** | ELI |  |
| **Construction** | The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices. 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. | |
| **Material** | Vinylester, fiberglass reinforced (VE-GF) | |
| **Shell Thickness** | 2.0 ± 0.2 mm (bottom plate) | |
| **Dimensions** | Major axis: 600 mm<br>Minor axis: 400 mm | |
| **Filling Volume** | approx. 30 liters | |

### 4.2.5 Device Holder

| | | |
|---|---|---|
| **Model** | MD4HHTV5 - Mounting Device for Hand-Held Transmitters | |
| **Construction** | In combination with the Twin SAM or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). | |
| **Material** | Polyoxymethylene (POM) | |

| | | |
|---|---|---|
| **Model** | MDA4WTV5 - Mounting Device Adaptor for Ultra Wide Transmitters | |
| **Construction** | An upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm. | |
| **Material** | Polyoxymethylene (POM) | |

| | | |
|---|---|---|
| **Model** | MDA4SPV6 - Mounting Device Adaptor for Smart Phones | |
| **Construction** | The solid low-density MDA4SPV6 adaptor assuring no impact on the DUT radiation performance and is conform with any DUT design and shape. | |
| **Material** | ROHACELL | |

| | | |
|---|---|---|
| **Model** | MD4LAPV5 - Mounting Device for Laptops and other Body-Worn Transmitters | |
| **Construction** | In combination with the Twin SAM or ELI phantoms, the Mounting Device (Body-Worn) enables testing of transmitter devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at a flat phantom section. | |
| **Material** | Polyoxymethylene (POM), PET-G, Foam | |

### 4.2.6 System Validation Dipoles

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

### 4.2.7 Power Source

| | | |
|---|---|---|
| **Model** | Powersource1 | |
| **Signal Type** | Continuous Wave | |
| **Operating Frequencies** | 600 MHz to 5850 MHz | |
| **Output Power** | -5.0 dBm to +17.0 dBm | |
| **Power Supply** | 5V DC, via USB jack | |
| **Power Consumption** | <3 W | |
| **Applications** | System performance check and validation with a CW signal. | |

### 4.2.8 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 10 % are listed in Table-4.1.

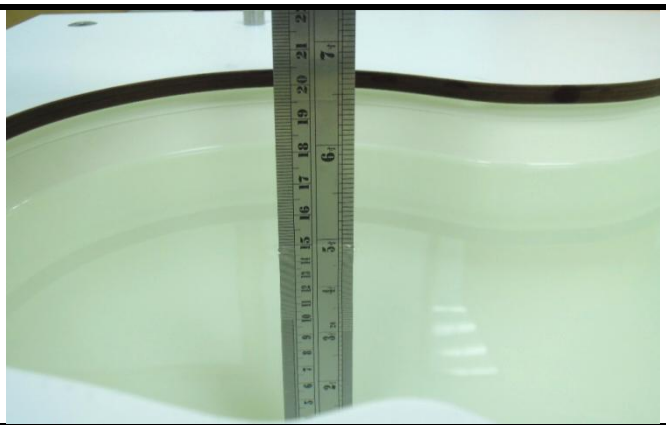


**Photo of Liquid Height for Head Position**

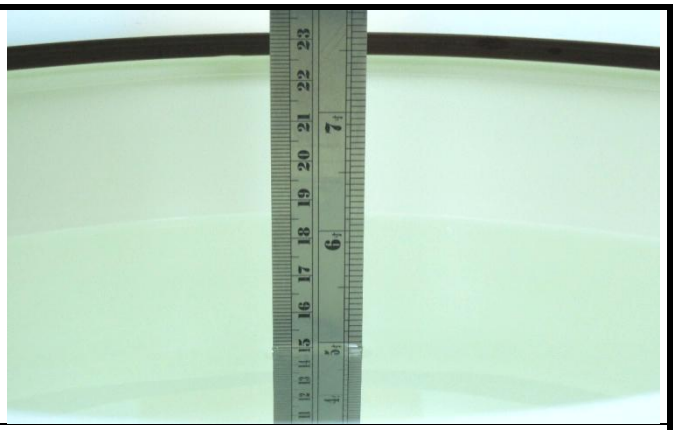


**Photo of Liquid Height for Body Position**

**Table-4.1 Targets of Tissue Simulating Liquid**

| Frequency (MHz) | Target Permittivity | Range of ±10 % | Target Conductivity | Range of ±10 % |
|---|---|---|---|---|
| 450 | 43.5 | 39.2 ~ 47.9 | 0.87 | 0.78 ~ 0.96 |
| 750 | 41.9 | 37.7 ~ 46.1 | 0.89 | 0.80 ~ 0.98 |
| 835 | 41.5 | 37.4 ~ 45.7 | 0.90 | 0.81 ~ 0.99 |
| 900 | 41.5 | 37.4 ~ 45.7 | 0.97 | 0.87 ~ 1.07 |
| 1450 | 40.5 | 36.5 ~ 44.6 | 1.20 | 1.08 ~ 1.32 |
| 1500 | 40.4 | 36.4 ~ 44.4 | 1.23 | 1.11 ~ 1.35 |
| 1640 | 40.2 | 36.2 ~ 44.2 | 1.31 | 1.18 ~ 1.44 |
| 1750 | 40.1 | 36.1 ~ 44.1 | 1.37 | 1.23 ~ 1.51 |
| 1800 | 40.0 | 36.0 ~ 44.0 | 1.40 | 1.26 ~ 1.54 |
| 1900 | 40.0 | 36.0 ~ 44.0 | 1.40 | 1.26 ~ 1.54 |
| 2000 | 40.0 | 36.0 ~ 44.0 | 1.40 | 1.26 ~ 1.54 |
| 2100 | 39.8 | 35.8 ~ 43.8 | 1.49 | 1.34 ~ 1.64 |
| 2300 | 39.5 | 35.6 ~ 43.5 | 1.67 | 1.50 ~ 1.84 |
| 2450 | 39.2 | 35.3 ~ 43.1 | 1.80 | 1.62 ~ 1.98 |
| 2600 | 39.0 | 35.1 ~ 42.9 | 1.96 | 1.76 ~ 2.16 |
| 3000 | 38.5 | 34.7 ~ 42.4 | 2.40 | 2.16 ~ 2.64 |
| 3500 | 37.9 | 34.1 ~ 41.7 | 2.91 | 2.62 ~ 3.20 |
| 4000 | 37.4 | 33.7 ~ 41.1 | 3.43 | 3.09 ~ 3.77 |
| 4500 | 36.8 | 33.1 ~ 40.5 | 3.94 | 3.55 ~ 4.33 |
| 5000 | 36.2 | 32.6 ~ 39.8 | 4.45 | 4.01 ~ 4.90 |
| 5200 | 36.0 | 32.4 ~ 39.6 | 4.66 | 4.19 ~ 5.13 |
| 5400 | 35.8 | 32.2 ~ 39.4 | 4.86 | 4.37 ~ 5.35 |
| 5600 | 35.5 | 32.0 ~ 39.1 | 5.07 | 4.56 ~ 5.58 |
| 5800 | 35.3 | 31.8 ~ 38.8 | 5.27 | 4.74 ~ 5.80 |
| 6000 | 35.1 | 31.6 ~ 38.6 | 5.48 | 4.93 ~ 6.03 |
| 6500 | 34.5 | 31.1 ~ 38.0 | 6.07 | 5.46 ~ 6.68 |

The dielectric properties of the tissue simulating liquids are defined in IEC 62209-1 and IEC 62209-2. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit and a network analyzer.

Since the range of ±10 % of the required target values is used to measure relative permittivity and conductivity, the SAR correction procedure is applied to correct measured SAR for the deviations in permittivity and conductivity. Only positive correction has been used to scale up the measured SAR, and SAR result would not be corrected if the correction △SAR has a negative sign.

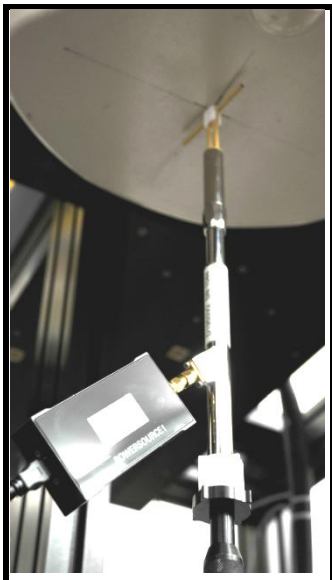
The following table gives the recipes for tissue simulating liquids.

**Table-4.2 Recipes of Tissue Simulating Liquid**

| Tissue Type | Bactericide | DGBE | HEC | NaCl | Sucrose | Triton X-100 | Water | Diethylene Glycol Mono-hexylether | Oxidized Mineral Oil |
|---|---|---|---|---|---|---|---|---|---|
| H750 | 0.2 | - | 0.2 | 1.5 | 56.0 | - | 42.1 | - | - |
| H835 | 0.2 | - | 0.2 | 1.5 | 57.0 | - | 41.1 | - | - |
| H900 | 0.2 | - | 0.2 | 1.4 | 58.0 | - | 40.2 | - | - |
| H1450 | - | 43.3 | - | 0.6 | - | - | 56.1 | - | - |
| H1640 | - | 45.8 | - | 0.5 | - | - | 53.7 | - | - |
| H1750 | - | 47.0 | - | 0.4 | - | - | 52.6 | - | - |
| H1800 | - | 44.5 | - | 0.3 | - | - | 55.2 | - | - |
| H1900 | - | 44.5 | - | 0.2 | - | - | 55.3 | - | - |
| H2000 | - | 44.5 | - | 0.1 | - | - | 55.4 | - | - |
| 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 | 65.5 | 17.3 | - |
| H6G | - | - | - | - | - | - | 56.0 | - | 44.0 |

## 4.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



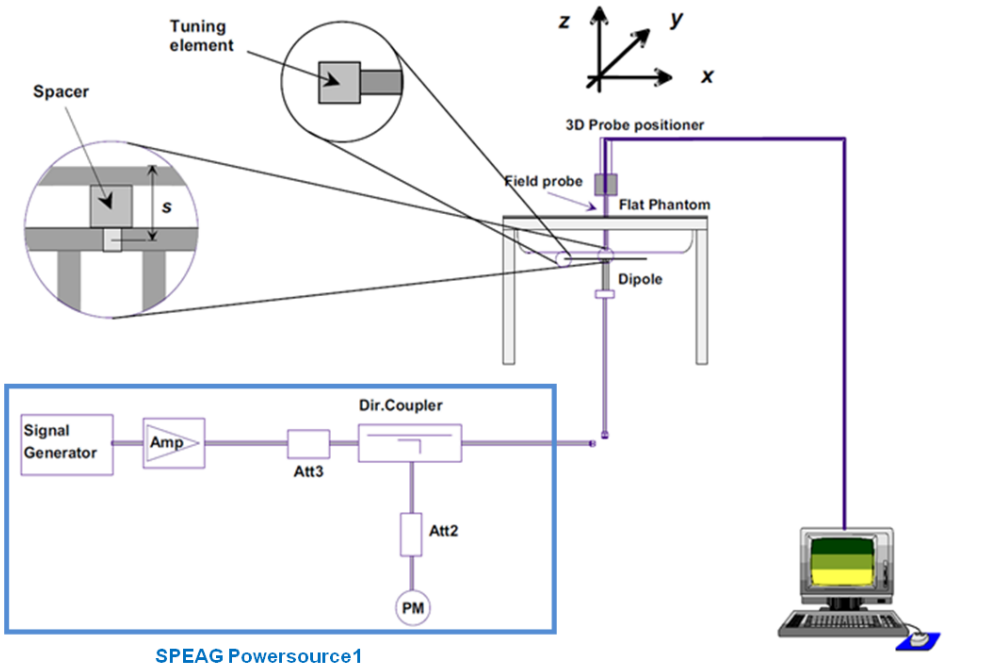



**Fig-4.3a System Verification Setup for Frequency <= 6 GHz**

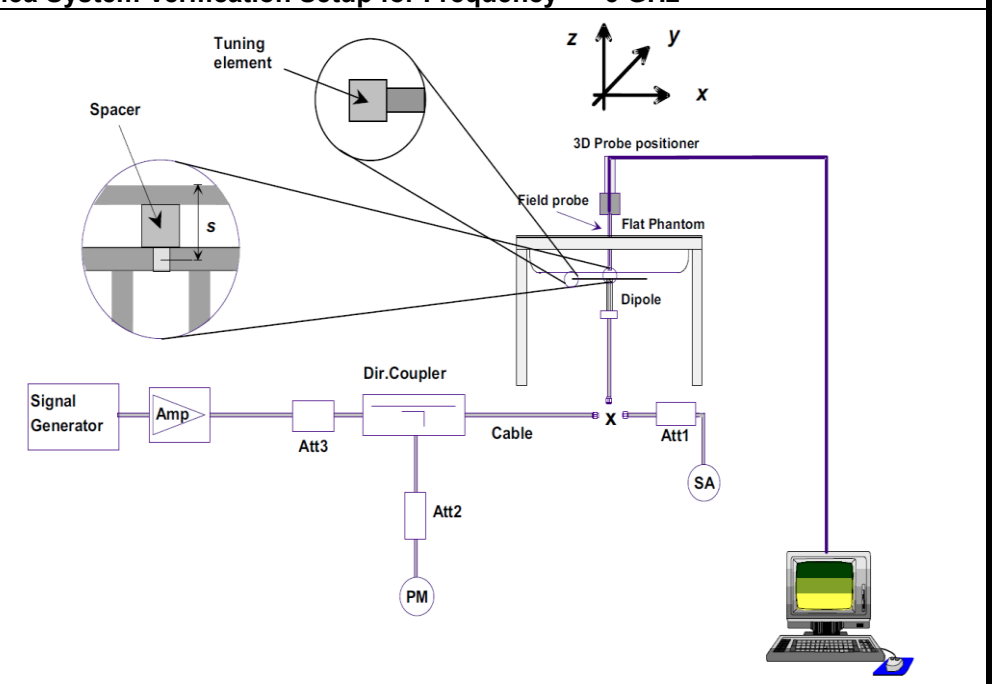



**Fig-4.3b System Verification Setup for Frequency > 6 GHz**

For frequency <= 6 GHz, the SPEAG Powersource1 is a portable and very stable RF source providing a continuous wave (CW) signal. It is designed for conducting SAR system checks and SAR system validation of DASY and is compatible with IEC/IEEE 62209-1528:2020 and IEEE Std 1528 standards. The Powersource1 has been calibrated by SPEAG's ISO/IEC 17025-accredited calibration center. When using Powersource1, the setup can be simplified, as shown in Fig-4.3a. The signal purity is warranted by design. Since the Powersource1 is calibrated, no additional equipment is needed and the Powersource1 can directly be connected to the SMA connector of the dipole without a cable as all separate components (signal generator, amplifier, coupler and power meter) are built into the unit.

For frequency > 6 GHz, the setup is shown in Fig-4.3b. The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power as 100 mW at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The Powersource1 is adjusted for the desired forward power of 17 dBm or 20 dBm will be set for > 6 GHz at the dipole connector and the RF output power would be turned on. After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

## 4.4 SAR Measurement Procedure

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

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

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

### 4.4.1 Area Scan and Zoom Scan Procedure

First area scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an area scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, zoom scan is required. The zoom scan is performed around the highest E-field value to determine the averaged SAR-distribution.

Measure the local SAR at a test point at 1.4 mm of the inner surface of the phantom recommended by SEPAG. The area scan (two-dimensional SAR distribution) is performed cover at least an area larger than the projection of the EUT or antenna. The measurement resolution and spatial resolution for interpolation shall be chosen to allow identification of the local peak locations to within one-half of the linear dimension of the corresponding side of the zoom scan volume. Following table provides the measurement parameters required for the area scan.

| Parameter | $f \leqq$ 3 GHz | 3 GHz < $f \leqq$ 6 GHz |
|---|---|---|
| Maximum distance from closest measurement point to phantom surface | 5 ± 1 | $\delta$ ln(2)/2 ±0.5 |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ±1° | 20° ±1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≦2 GHz: ≦15 mm<br>2 – 3 GHz: ≦12 mm | 3 – 4 GHz: ≦12 mm<br>4 – 6 GHz: ≦10 mm |

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks. Additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g. 1 W/kg for 1.6 W/kg, 1 g limit; or 1.26 W/kg for 2 W/kg, 10 g limit).

The zoom scan (three-dimensional SAR distribution) is performed at the local maxima locations identified in previous area scan procedure. The zoom scan volume must be larger than the required minimum dimensions. When graded grids are used, which only applies in the direction normal to the phantom surface, the initial grid separation closest to the phantom surface and subsequent graded grid increment ratios must satisfy the required protocols. The 1-g SAR averaging volume must be fully contained within the zoom scan measurement volume boundaries; otherwise, the measurement must be repeated by shifting or expanding the zoom scan volume. The similar requirements also apply to 10-g SAR measurements. Following table provides the measurement parameters required for the zoom scan.

| Parameter | | $f \leqq$ 3 GHz | 3 GHz < $f \leqq$ 6 GHz |
|---|---|---|---|
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | ≦2 GHz: ≦8 mm<br>2 – 3 GHz: ≦5 mm | 3 – 4 GHz: ≦5 mm<br>4 – 6 GHz: ≦4 mm |
| Maximum zoom scan spatial resolution, normal to phantom surface | *uniform grid:* $\Delta z_{Zoom}(n)$ | ≦5 mm | 3 – 4 GHz: ≦4 mm<br>4 – 5 GHz: ≦3 mm<br>5 – 6 GHz: ≦2 mm |
| | *graded grids:* $\Delta z_{Zoom}(1)$ | ≦4 mm | 3 – 4 GHz: ≦3.0 mm<br>4 – 5 GHz: ≦2.5 mm<br>5 – 6 GHz: ≦2.0 mm |
| | $\Delta z_{Zoom}(n>1)$ | ≦1.5·$\Delta z_{Zoom}(n-1)$ mm | |
| Minimum zoom scan volume (x, y, z) | | ≥30 mm | 3 – 4 GHz: ≥28 mm<br>4 – 5 GHz: ≥25 mm<br>5 – 6 GHz: ≥22 mm |

Per IEC 62209-2 AMD1, the successively higher resolution zoom scan is required if the zoom scan measured as defined above complies with both of the following criteria, or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed:

(1) The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x and y directions (Δx, Δy). This shall be checked for the measured zoom scan plane conformal to the phantom at the distance zM1.

(2) The ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum SAR value shall be at least 30 %.

If one or both of the above criteria are not met, the zoom scan measurement shall be repeated using a finer resolution. New horizontal and vertical grid steps shall be determined from the measured SAR distribution so that the above criteria are met. Compliance with the above two criteria shall be demonstrated for the new measured zoom scan.

### 4.4.2 Volume Scan Procedure

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

### 4.4.3 Power Drift Monitoring

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

### 4.4.4 Spatial Peak SAR Evaluation

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

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

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

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

### 4.4.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard’s method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

# 5. SAR Measurement Evaluation

## 5.1 EUT Configuration and Setting

**<Considerations Related to WLAN for Setup 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 ≤ 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, 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.

**<Considerations Related to Bluetooth for Setup and Testing>**

This device has installed Bluetooth engineering testing software which can provide continuous transmitting RF signal. During Bluetooth 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.

The Bluetooth call box has been used during SAR measurement and the EUT was set to DH5 mode at the maximum output power. Its duty factor was calculated as below and the measured SAR for Bluetooth would be scaled to the 100% transmission duty factor to determine compliance.

Refer to Appendix K for the duty factor of Bluetooth signal.

## 5.2 EUT Testing Position

### 5.2.1 Body Exposure Conditions

For full-size tablet, according to KDB 616217 D04, SAR evaluation is required for back surface and edges of the devices. The back surface and edges of the tablet are tested with the tablet touching the phantom. Exposures from antennas through the front surface of the display section of a tablet are generally limited to the user's hands. Exposures to hands for typical consumer transmitters used in tablets are not expected to exceed the extremity SAR limit; therefore, SAR evaluation for the front surface of tablet display screens are generally not necessary. When voice mode is supported on a tablet and it is limited to speaker mode or headset operations only, additional SAR testing for this type of voice use is not required.

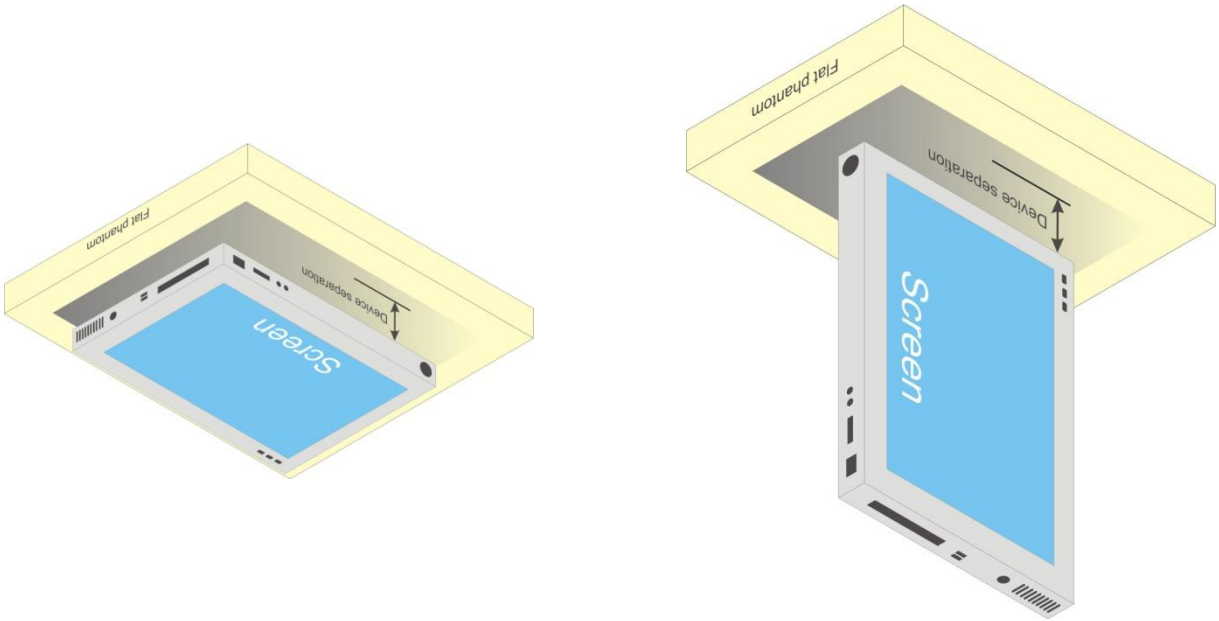



**Fig-5.1 Illustration for Tablet Setup**

## 5.3 Tissue Verification

Refer to Appendix C.

## 5.4 System Validation

Refer to Appendix C.

## 5.5 System Verification

Refer to Appendix C.

## 5.6 Maximum Output Power

### 5.6.1 Maximum Target Conducted Power

Refer to Appendix D.

### 5.6.2 Measured Conducted Power Result

Refer to Appendix E.

## 5.7 SAR Testing Results

### 5.7.1 SAR Test Reduction Considerations

**<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:

(1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

(2) ≤ 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

(3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

When SAR is not measured at the maximum power level allowed for production units, the measured SAR will be scaled to the maximum tune-up tolerance limit to determine compliance. The scaling factor for the tune-up power is defined as maximum tune-up limit (mW) / measured conducted power (mW). The reported SAR would be calculated by measured SAR x tune-up power scaling factor.

The SAR has been measured with highest transmission duty factor supported by the test mode tools for WLAN and/or Bluetooth. When the transmission duty factor could not achieve 100%, the reported SAR will be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up power. The scaling factor for the duty factor is defined as 100% / transmission duty cycle (%). The reported SAR would be calculated by measured SAR x tune-up power scaling factor x duty cycle scaling factor.

**<KDB 248227 D01, SAR Guidance for Wi-Fi Transmitters>**

(1) 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 <= 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 <= 0.8 W/kg or all test positions are measured.

(2) For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 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 <= 1.2 W/kg.

(3) For WLAN 5GHz, the initial test configuration was selected according to the transmission mode with the highest maximum output power. When the reported SAR of initial test configuration is > 0.8 W/kg, SAR is required for the subsequent highest measured output power channel until the reported SAR result is <=1.2 W/kg or all required channels are measured. For other transmission modes, SAR is not required when the highest reported SAR for initial test configuration is adjusted by the ratio of subsequent test configuration to initial test configuration specified maximum output power and it is <= 1.2 W/kg.

(4) For WLAN MIMO mode, the power-based standalone SAR test exclusion or the sum of SAR provision in KDB 447498to determine simultaneous transmission SAR test exclusion should be applied. Otherwise, SAR for MIMO mode will be measured with all applicable antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

### 5.7.2 SAR Results for Body Exposure Condition (Test Separation Distance is 0 mm)

Refer to Appendix F.

### 5.7.3 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium maybe used to perform the repeated measurement. These 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.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. If the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20, or when the original or repeated measurement is >= 1.45 W/kg, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

Refer to Appendix G for SAR Measurement Variability.

### 5.7.4 Simultaneous Multi-band Transmission Evaluation

**<SAR Summation Analysis>**

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of $SAR_{1g}$ of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit($SAR_{1g}$ 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of $SAR_{1g}$ is greater than the SAR limit ($SAR_{1g}$ 1.6 W/kg), SAR test exclusion is determined by the SPLSR.

Refer to Appendix H for the Simultaneous transmission SAR analysis.

**<SAR to Peak Location Separation Ratio Analysis>**

The simultaneous transmitting antennas in each operating mode and exposure condition combination are considered one pair at a time to determine the SPLSR. When SAR is measured for both antennas in the pair, the peak location separation distance is computed by the following formula.

$$\text{Peak Location Separation Distance} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

Where ($x_1$, $y_1$, $z_1$) and ($x_2$, $y_2$, $z_2$) are the coordinates of the extrapolated peak SAR locations in the area or zoom scans.

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna. Due to curvatures on the SAM phantom, when SAR is estimated for one of the antennas in an antenna pair, the measured peak SAR location will be translated onto the test device to determine the peak location separation for the antenna pair.

The SPLSR is determined by the following formula.

$$\text{SPLSR} = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

Where $SAR_1$ and $SAR_2$ are the highest reported or estimated SAR for each antenna in the pair, and $R_i$ is the separation distance between the peak SAR locations for the antenna pair in mm.

When the SPLSR is <= 0.04, the simultaneous transmission SAR is not required. Otherwise, the enlarged zoom scan and volume scan post-processing procedures will be performed.

Since sum of simultaneous transmission SAR is less than the SAR limit for Body : SAR1g 1.6 W/kg .
There is no requirement for SAR to Peak Location Separation Ratio Analysis.

**Test Engineer：** Ainsley Yang

# 6. Calibration of Test Equipment

Refer to Appendix J.

# 7. Measurement Uncertainty

| Source of Uncertainty | Uncertainty (± %) | Probability Distribution | Divisor | Ci (1g) | Ci (10g) | Standard Uncertainty (± %, 1g) | Standard Uncertainty (± %, 10g) | Vi |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| Probe Calibration | 6.0 | Normal | 1 | 1 | 1 | 6.0 | 6.0 | ∞ |
| Axial Isotropy | 4.7 | Rectangular | √3 | √0.5 | √0.5 | 1.9 | 1.9 | ∞ |
| Hemispherical Isotropy | 9.6 | Rectangular | √3 | √0.5 | √0.5 | 3.9 | 3.9 | ∞ |
| Boundary Effect | 1.0 | Rectangular | √3 | 1 | 1 | 0.6 | 0.6 | ∞ |
| Linearity | 4.7 | Rectangular | √3 | 1 | 1 | 2.7 | 2.7 | ∞ |
| Detection Limits | 0.25 | Rectangular | √3 | 1 | 1 | 0.14 | 0.14 | ∞ |
| Probe Modulation Response | 4.8 | Rectangular | √3 | 1 | 1 | 2.8 | 2.8 | ∞ |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 1 | 0.3 | 0.3 | ∞ |
| Response Time | 0.0 | Rectangular | √3 | 1 | 1 | 0.0 | 0.0 | ∞ |
| Integration Time | 1.7 | Rectangular | √3 | 1 | 1 | 1.0 | 1.0 | ∞ |
| RF Ambient Conditions – Noise | 3.0 | Rectangular | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| RF Ambient Conditions – Reflections | 3.0 | Rectangular | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| Probe Positioner Mechanical Tolerance | 0.02 | Rectangular | √3 | 1 | 1 | 0.01 | 0.01 | ∞ |
| Probe Positioning with Respect to Phantom | 0.4 | Rectangular | √3 | 1 | 1 | 0.2 | 0.2 | ∞ |
| Post-processing | 2.0 | Rectangular | √3 | 1 | 1 | 1.2 | 1.2 | ∞ |
| **Test Sample Related** | | | | | | | | |
| Test Sample Positioning | 3.68 / 1.73 | Normal | 1 | 1 | 1 | 3.7 | 1.7 | 29 |
| Device Holder Uncertainty | 2.55 / 2.76 | Normal | 1 | 1 | 1 | 2.6 | 2.8 | 7 |
| Power Drift of Measurement | 5.0 | Rectangular | √3 | 1 | 1 | 2.9 | 2.9 | ∞ |
| PowerScaling | 0.0 | Rectangular | √3 | 1 | 1 | 0.0 | 0.0 | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 7.2 | Rectangular | √3 | 1 | 1 | 4.2 | 4.2 | ∞ |
| Liquid Conductivity (Temperature Uncertainty) | 2.58 | Rectangular | √3 | 0.78 | 0.71 | 1.2 | 1.1 | ∞ |
| Liquid Conductivity (Measured) | 2.95 | Normal | 1 | 0.78 | 0.71 | 2.3 | 2.1 | 61 |
| Liquid Permittivity (Temperature Uncertainty) | 1.97 | Rectangular | √3 | 0.23 | 0.26 | 0.3 | 0.3 | ∞ |
| Liquid Permittivity (Measured) | 3.04 | Normal | 1 | 0.23 | 0.26 | 0.7 | 0.8 | 47 |
| **Combined Standard Uncertainty** | | | | | | ± 11.5 % | ± 11.0 % | |
| **Expanded Uncertainty (K=2)** | | | | | | **± 23.0 %** | **± 22.0 %** | |

**Body SAR Uncertainty Budget for Frequency Range of 300 MHz to 3 GHz**

| Source of Uncertainty | Uncertainty (± %) | Probability Distribution | Divisor | Ci (1g) | Ci (10g) | Standard Uncertainty (± %, 1g) | Standard Uncertainty (± %, 10g) | Vi |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| Probe Calibration | 6.55 | Normal | 1 | 1 | 1 | 6.55 | 6.55 | ∞ |
| Axial Isotropy | 4.7 | Rectangular | √3 | 0.7 | 0.7 | 1.9 | 1.9 | ∞ |
| Hemispherical Isotropy | 9.6 | Rectangular | √3 | 0.7 | 0.7 | 3.9 | 3.9 | ∞ |
| Boundary Effect | 2.0 | Rectangular | √3 | 1 | 1 | 1.2 | 1.2 | ∞ |
| Linearity | 4.7 | Rectangular | √3 | 1 | 1 | 2.7 | 2.7 | ∞ |
| Detection Limits | 0.25 | Rectangular | √3 | 1 | 1 | 0.14 | 0.14 | ∞ |
| Probe Modulation Response | 4.8 | Rectangular | √3 | 1 | 1 | 2.8 | 2.8 | ∞ |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 1 | 0.3 | 0.3 | ∞ |
| Response Time | 0.0 | Rectangular | √3 | 1 | 1 | 0.0 | 0.0 | ∞ |
| Integration Time | 1.7 | Rectangular | √3 | 1 | 1 | 1.0 | 1.0 | ∞ |
| RF Ambient Conditions – Noise | 3.0 | Rectangular | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| RF Ambient Conditions – Reflections | 3.0 | Rectangular | √3 | 1 | 1 | 1.7 | 1.7 | ∞ |
| Probe Positioner Mechanical Tolerance | 0.04 | Rectangular | √3 | 1 | 1 | 0.02 | 0.02 | ∞ |
| Probe Positioning with Respect to Phantom | 0.8 | Rectangular | √3 | 1 | 1 | 0.5 | 0.5 | ∞ |
| Post-processing | 4.0 | Rectangular | √3 | 1 | 1 | 2.3 | 2.3 | ∞ |
| **Test Sample Related** | | | | | | | | |
| Test Sample Positioning | 3.68 / 1.73 | Normal | 1 | 1 | 1 | 3.7 | 1.7 | 29 |
| Device Holder Uncertainty | 2.55 / 2.76 | Normal | 1 | 1 | 1 | 2.6 | 2.8 | 7 |
| Power Drift of Measurement | 5.0 | Rectangular | √3 | 1 | 1 | 2.9 | 2.9 | ∞ |
| PowerScaling | 0.0 | Rectangular | √3 | 1 | 1 | 0.0 | 0.0 | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty (Shape and Thickness Tolerances) | 7.6 | Rectangular | √3 | 1 | 1 | 4.4 | 4.4 | ∞ |
| Liquid Conductivity (Temperature Uncertainty) | 2.58 | Rectangular | √3 | 0.78 | 0.71 | 1.2 | 1.1 | ∞ |
| Liquid Conductivity (Measured) | 2.95 | Normal | 1 | 0.78 | 0.71 | 2.3 | 2.1 | 61 |
| Liquid Permittivity (Temperature Uncertainty) | 1.97 | Rectangular | √3 | 0.23 | 0.26 | 0.3 | 0.3 | ∞ |
| Liquid Permittivity (Measured) | 3.04 | Normal | 1 | 0.23 | 0.26 | 0.7 | 0.8 | 47 |
| **Combined Standard Uncertainty** | | | | | | ± 12.1 % | ± 11.6 % | |
| **Expanded Uncertainty (K=2)** | | | | | | **± 24.2 %** | **± 23.2 %** | |

**Body SAR Uncertainty Budget for Frequency Range of 3 GHz to 6 GHz**

# 8. Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Lin Kou EMC/RF Lab**
Tel: 886-2-26052180
Fax: 886-2-26051924

**Hsin Chu EMC/RF/Telecom Lab**
Tel: 886-3-6668565
Fax: 886-3-6668323

**Hwa Ya EMC/RF/Safety/SAR Lab**
Tel: 886-3-3183232
Fax: 886-3-3270892

**Email:** service.adt@bureauveritas.com
**Web Site:** http://ee.bureauveritas.com.tw

The address and road map of all our labs can be found in our web site also.

**--- END ---**