



**中认信通**  
CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)



## SAR TEST REPORT

**Applicant:** SINORISE TECHNOLOGY(SHENZHEN)CO.,LTD

**Address:** 6 floor, Bld. 6, No.49, Jiao yu North road Gaoqiao Com., Pingdi Str.,  
Longgang Dist Shenzhen, China

**FCC ID:** 2A9S3SR-622

**Product Name:** SR-622 multi-purpose helmet

**Model Number:** SR-622

**Standard(s):** 47 CFR Part 2(2.1093)

The above equipment has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

**Report Number:** CR231166666-20

**Date Of Issue:** 2024-01-09

**Reviewed By:** Karl Gong

*Karl Gong*

**Title:** SAR Engineer

**Test Laboratory:** China Certification ICT Co., Ltd (Dongguan)

No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China  
Tel: +86-769-82016888

**SAR TEST RESULTS SUMMARY**

| Operation Frequency Bands             | Highest Reported 1g SAR<br>(W/kg) |                        | Limits<br>(W/kg) |
|---------------------------------------|-----------------------------------|------------------------|------------------|
|                                       | Head<br>(Gap 20mm)                | Body-Worn<br>(Gap 0mm) |                  |
| PTT(462.5500-467.7125MHz)             | 0.95                              | /                      | 1.6              |
| Maximum Simultaneous Transmission SAR |                                   |                        |                  |
| Items                                 | Head<br>(Gap 20mm)                | Body-Worn<br>(Gap 0mm) | Limits           |
| Sum SAR(W/kg)                         | N/A                               | N/A                    | 1.6              |
| SPLSR                                 | N/A                               | N/A                    | 0.04             |
| EUT Received Date:                    | 2023/11/14                        |                        |                  |
| Tested Date:                          | 2024/01/04                        |                        |                  |
| Tested Result:                        | Pass                              |                        |                  |

**Test Facility**

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 442868, the FCC Designation No. : CN1314.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0123.

**Declarations**

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

This report cannot be reproduced except in full, without prior written approval of the Company.

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

## CONTENTS

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>DOCUMENT REVISION HISTORY .....</b>                       | <b>5</b>  |
| <b>1. GENERAL INFORMATION .....</b>                          | <b>6</b>  |
| 1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) ..... | 6         |
| 1.2 TEST SPECIFICATION, METHODS AND PROCEDURES .....         | 7         |
| 1.3 SAR LIMITS.....                                          | 8         |
| 1.4 FACILITIES.....                                          | 9         |
| <b>2. SAR MEASUREMENT SYSTEM .....</b>                       | <b>10</b> |
| <b>3. EQUIPMENT LIST AND CALIBRATION .....</b>               | <b>19</b> |
| 3.1 EQUIPMENTS LIST & CALIBRATION INFORMATION .....          | 19        |
| <b>4. SAR MEASUREMENT SYSTEM VERIFICATION .....</b>          | <b>20</b> |
| 4.1 LIQUID VERIFICATION .....                                | 20        |
| 4.2 SYSTEM ACCURACY VERIFICATION .....                       | 21        |
| 4.3 SAR SYSTEM VALIDATION DATA.....                          | 22        |
| <b>5. EUT TEST STRATEGY AND METHODOLOGY .....</b>            | <b>23</b> |
| 5.1 TEST POSITIONS FOR HEAD-WORN CONFIGURATIONS .....        | 23        |
| 5.2 TEST DISTANCE FOR SAR EVALUATION.....                    | 23        |
| 5.3 SAR EVALUATION PROCEDURE .....                           | 24        |
| <b>6. CONDUCTED OUTPUT POWER MEASUREMENT .....</b>           | <b>25</b> |
| 6.1 TEST PROCEDURE .....                                     | 25        |
| 6.2 MAXIMUM TARGET OUTPUT POWER.....                         | 25        |
| 6.3 TEST RESULTS: .....                                      | 25        |
| <b>7. SAR MEASUREMENT RESULTS .....</b>                      | <b>27</b> |
| 7.1 SAR TEST DATA .....                                      | 27        |
| <b>8. SAR PLOTS .....</b>                                    | <b>28</b> |
| <b>APPENDIX A MEASUREMENT UNCERTAINTY .....</b>              | <b>30</b> |
| <b>APPENDIX B EUT TEST POSITION PHOTOS.....</b>              | <b>31</b> |
| <b>APPENDIX C CALIBRATION CERTIFICATES .....</b>             | <b>33</b> |

## DOCUMENT REVISION HISTORY

| Revision Number | Report Number  | Description of Revision | Data of Revision |
|-----------------|----------------|-------------------------|------------------|
| 1.0             | CR231166666-20 | Original Report         | 2024-01-09       |

## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment under Test (EUT)

|                               |                                                                                     |
|-------------------------------|-------------------------------------------------------------------------------------|
| <b>Device Type:</b>           | Portable                                                                            |
| <b>Exposure Category:</b>     | General Population/Uncontrolled Exposure                                            |
| <b>Antenna Type(s):</b>       | Integral Antenna                                                                    |
| <b>Body-Worn Accessories:</b> | None                                                                                |
| <b>Face-Head Accessories:</b> | None                                                                                |
| <b>Operation Mode:</b>        | PTT_FM                                                                              |
| <b>Frequency Band:</b>        | 462MHz(462.5500-462.7250MHz)<br>467MHz(467.5625-467.7125 MHz)                       |
| <b>RF Output Power(ERP):</b>  | 462MHz(462.5500-462.7250MHz): 31.41 dBm<br>467MHz(467.5625-467.7125 MHz): 26.78 dBm |
| <b>Power Source:</b>          | DC 7.4V from Rechargeable Battery                                                   |
| <b>Serial Number:</b>         | 2DJ9-1                                                                              |
| <b>Normal Operation:</b>      | Head-worn                                                                           |

## **1.2 Test Specification, Methods and Procedures**

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE 1528-2013, the following FCC Published RF exposure KDB procedures:

KDB 447498 D01 General RF Exposure Guidance v06  
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04  
KDB 865664 D02 RF Exposure Reporting v01r02  
KDB 643646 D01 SAR Test for PTT Radios v01r03

TCB Workshop April 2019: RF Exposure Procedures

### 1.3 SAR Limits

#### FCC Limit

| EXPOSURE LIMITS                                                  | SAR (W/kg)                                                     |                                                        |
|------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------|
|                                                                  | (General Population /<br>Uncontrolled Exposure<br>Environment) | (Occupational /<br>Controlled Exposure<br>Environment) |
| Spatial Average<br>(averaged over the whole body)                | 0.08                                                           | 0.4                                                    |
| Spatial Peak<br>(averaged over any 1 g of tissue)                | <b>1.60</b>                                                    | 8.0                                                    |
| Spatial Peak<br>(hands/wrists/feet/ankles<br>averaged over 10 g) | 4.0                                                            | 20.0                                                   |

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

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

Population/Uncontrolled Environments Spatial Peak limit 1.6W/kg for 1g SAR applied to the EUT.

## 1.4 FACILITIES

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

The test sites and measurement facilities used to collect data are located at:

|                                    |                                               |
|------------------------------------|-----------------------------------------------|
| <input type="checkbox"/> SAR Lab 1 | <input checked="" type="checkbox"/> SAR Lab 2 |
|------------------------------------|-----------------------------------------------|

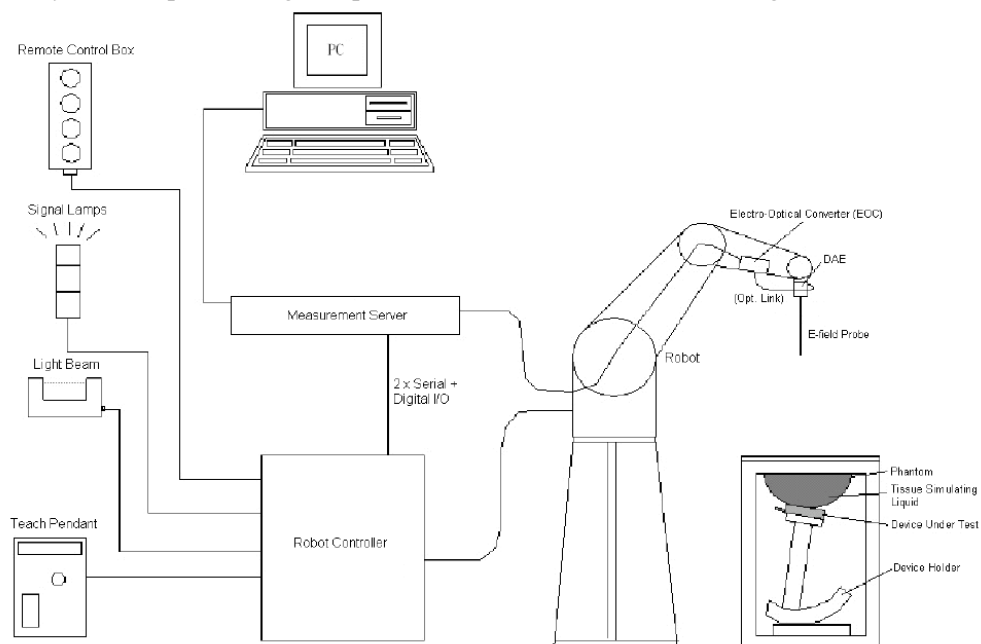
## 2. SAR MEASUREMENT SYSTEM

These measurements were performed with the automated near-field scanning system DASY5 from Schmid & Partner Engineering AG (SPEAG) which is the Fifth generation of the system shown in the figure hereinafter:



### DASY5 System Description

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal application, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 professional operating system and the DASY52 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

### **DASY5 Measurement Server**

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz Intel ULV Celeron, 128MB chip-disk and 128MB RAM. The necessary circuits for communication with the DAE4 (or DAE3) electronics box, as well as the 16 bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.



The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized point out, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.

### **Data Acquisition Electronics**

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of both the DAE4 as well as of the DAE3 box is 200M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**EX3DV4 E-Field Probes**

|                      |                                                                                                                                                                                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency</b>     | 4 MHz - 10 GHz<br>Linearity: $\pm 0.2$ dB (30 MHz to 10 GHz)                                                                                                                                                  |
| <b>Directivity</b>   | $\pm 0.1$ dB in TSL (rotation around probe axis)<br>$\pm 0.3$ dB in TSL (rotation normal to probe axis)                                                                                                       |
| <b>Dynamic Range</b> | 10 $\mu$ W/g to $> 100$ mW/g<br>Linearity: $\pm 0.2$ dB (noise: typically $< 1$ $\mu$ W/g)                                                                                                                    |
| <b>Dimensions</b>    | 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                                                                          |
| <b>Application</b>   | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |
| <b>Compatibility</b> | DASY3, DASY4, DASY52, DASY6, DASY8 SAR, EASY6, EASY4/MRI                                                                                                                                                      |

**Calibration Frequency Points for EX3DV4 E-Field Probes SN: 3801Calibrated: 2023/6/23**

| Calibration Frequency Point(MHz) | Frequency Range(MHz) |      | Conversion Factor |       |       |
|----------------------------------|----------------------|------|-------------------|-------|-------|
|                                  | From                 | To   | X                 | Y     | Z     |
| 150 Head                         | 100                  | 200  | 11.02             | 11.02 | 11.02 |
| 450 Head                         | 350                  | 550  | 10.11             | 10.11 | 10.11 |
| 750 Head                         | 650                  | 810  | 9.49              | 9.49  | 9.49  |
| 835 Head                         | 810                  | 860  | 9.17              | 9.17  | 9.17  |
| 900 Head                         | 860                  | 1000 | 9.08              | 9.08  | 9.08  |
| 1450 Head                        | 1350                 | 1550 | 8.32              | 8.32  | 8.32  |
| 1750 Head                        | 1650                 | 1850 | 8.22              | 8.22  | 8.22  |
| 1900 Head                        | 1850                 | 2000 | 7.93              | 7.93  | 7.93  |
| 2100 Head                        | 2000                 | 2200 | 7.87              | 7.87  | 7.87  |
| 2300 Head                        | 2200                 | 2399 | 7.62              | 7.62  | 7.62  |
| 2450 Head                        | 2399                 | 2500 | 7.38              | 7.38  | 7.38  |
| 2600 Head                        | 2500                 | 2700 | 7.16              | 7.16  | 7.16  |
| 3300 Head                        | 3200                 | 3400 | 6.52              | 6.52  | 6.52  |
| 3500 Head                        | 3400                 | 3600 | 6.46              | 6.46  | 6.46  |
| 3700 Head                        | 3600                 | 3800 | 4.40              | 4.40  | 4.40  |
| 3900 Head                        | 3800                 | 4000 | 6.33              | 6.33  | 6.33  |
| 4100 Head                        | 4000                 | 4150 | 5.98              | 5.98  | 5.98  |
| 4200 Head                        | 4150                 | 4300 | 5.95              | 5.95  | 5.95  |
| 4400 Head                        | 4300                 | 4500 | 5.74              | 5.74  | 5.74  |
| 4600 Head                        | 4500                 | 4700 | 5.73              | 5.73  | 5.73  |
| 4800 Head                        | 4700                 | 4870 | 5.72              | 5.72  | 5.72  |
| 4950 Head                        | 4870                 | 5060 | 5.38              | 5.38  | 5.38  |
| 5250 Head                        | 5140                 | 5360 | 5.19              | 5.19  | 5.19  |
| 5600 Head                        | 5490                 | 5675 | 4.60              | 4.60  | 4.60  |
| 5750 Head                        | 5675                 | 5860 | 4.69              | 4.69  | 4.69  |

### **SAM Twin Phantom**

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6 mm). The phantom has three measurement areas:

- \_ Left Head
- \_ Right Head
- \_ Flat phantom

The phantom table for the DASY systems based on the robots have the size of 100 x 50 x 85 cm (L x W x H). For easy dislocation these tables have fork lift cut outs at the bottom.

The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different liquids)



A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on top of this phantom cover are possible. Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.

### **Robots**

The DASY5 system uses the high precision industrial robot. The robot offers the same features important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchrony motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

The above mentioned robots are controlled by the Staubli CS8c robot controllers. All information regarding the use and maintenance of the robot arm and the robot controller is contained on the CDs delivered along with the robot. Paper manuals are available upon request direct from Staubli.

## SAR Scan Procedures

### Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 1.4 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

### Step 2: Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 15mm 2 step integral, with 1.5mm interpolation used to locate the peak SAR area used for zoom scan assessments.

Where the system identifies multiple SAR peaks (which are within 25% of peak value) the system will provide the user with the option of assessing each peak location individually for zoom scan averaging.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

|                                                                                                        | $\leq 3$ GHz                                                                                                                                                                                                                                                           | $> 3$ GHz                                               |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 mm $\pm$ 1 mm                                                                                                                                                                                                                                                        | $\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm $\pm$ 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location              | $30^\circ \pm 1^\circ$                                                                                                                                                                                                                                                 | $20^\circ \pm 1^\circ$                                  |
| Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$                            | $\leq 2$ GHz: $\leq 15$ mm<br>2 – 3 GHz: $\leq 12$ mm                                                                                                                                                                                                                  | 3 – 4 GHz: $\leq 12$ mm<br>4 – 6 GHz: $\leq 10$ mm      |
|                                                                                                        | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |                                                         |

### Step 3: Zoom Scan (Cube Scan Averaging)

The averaging zoom scan volume utilized in the DASY5 software is in the shape of a cube and the side dimension of a 1 g or 10 g mass is dependent on the density of the liquid representing the simulated tissue. A density of 1000 kg/m<sup>3</sup> is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10g cube is 21.5mm.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

|                                                                                                                                                                                                                                                                                                                                                           |                                           |                                                                                             | ≤ 3 GHz                                                                             | > 3 GHz                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$                                                                                                                                                                                                                                                                    |                                           |                                                                                             | $\leq 2 \text{ GHz}: \leq 8 \text{ mm}$<br>$2 - 3 \text{ GHz}: \leq 5 \text{ mm}^*$ | $3 - 4 \text{ GHz}: \leq 5 \text{ mm}^*$<br>$4 - 6 \text{ GHz}: \leq 4 \text{ mm}^*$                                          |
| Maximum zoom scan spatial resolution, normal to phantom surface                                                                                                                                                                                                                                                                                           | uniform grid: $\Delta z_{\text{Zoom}}(n)$ |                                                                                             | $\leq 5 \text{ mm}$                                                                 | $3 - 4 \text{ GHz}: \leq 4 \text{ mm}$<br>$4 - 5 \text{ GHz}: \leq 3 \text{ mm}$<br>$5 - 6 \text{ GHz}: \leq 2 \text{ mm}$    |
|                                                                                                                                                                                                                                                                                                                                                           | graded grid                               | $\Delta z_{\text{Zoom}}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface | $\leq 4 \text{ mm}$                                                                 | $3 - 4 \text{ GHz}: \leq 3 \text{ mm}$<br>$4 - 5 \text{ GHz}: \leq 2.5 \text{ mm}$<br>$5 - 6 \text{ GHz}: \leq 2 \text{ mm}$  |
|                                                                                                                                                                                                                                                                                                                                                           |                                           | $\Delta z_{\text{Zoom}}(n>1)$ : between subsequent points                                   | $\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1) \text{ mm}$                             |                                                                                                                               |
| Minimum zoom scan volume                                                                                                                                                                                                                                                                                                                                  | x, y, z                                   |                                                                                             | $\geq 30 \text{ mm}$                                                                | $3 - 4 \text{ GHz}: \geq 28 \text{ mm}$<br>$4 - 5 \text{ GHz}: \geq 25 \text{ mm}$<br>$5 - 6 \text{ GHz}: \geq 22 \text{ mm}$ |
| Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.                                                                                                                                                                                                                     |                                           |                                                                                             |                                                                                     |                                                                                                                               |
| * When zoom scan is required and the <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is $\leq 1.4 \text{ W/kg}$ , $\leq 8 \text{ mm}$ , $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. |                                           |                                                                                             |                                                                                     |                                                                                                                               |

### Step 4: Power Drift Measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

When the cube intersects with the surface of the phantom, it is oriented so that 3 vertices touch the surface of the shell or the center of a face is tangent to the surface. The face of the cube closest to the surface is modified in order to conform to the tangent surface.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications (including FCC) utilize a physical step of 7 x 7 x 7 (5mmx5mmx5mm) providing a volume of 30 mm in the X & Y & Z axis.

## Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1:2016

### Recommended Tissue Dielectric Parameters for Head liquid

**Table A.3 – Dielectric properties of the head tissue-equivalent liquid**

| Frequency<br>MHz | Relative permittivity<br>$\epsilon_r$ | Conductivity ( $\sigma$ )<br>S/m |
|------------------|---------------------------------------|----------------------------------|
| 300              | 45,3                                  | 0,87                             |
| 450              | 43,5                                  | 0,87                             |
| <i>750</i>       | <i>41,9</i>                           | <i>0,89</i>                      |
| 835              | 41,5                                  | 0,90                             |
| 900              | 41,5                                  | 0,97                             |
| 1 450            | 40,5                                  | 1,20                             |
| <i>1 500</i>     | <i>40,4</i>                           | <i>1,23</i>                      |
| <i>1 640</i>     | <i>40,2</i>                           | <i>1,31</i>                      |
| <i>1 750</i>     | <i>40,1</i>                           | <i>1,37</i>                      |
| 1 800            | 40,0                                  | 1,40                             |
| 1 900            | 40,0                                  | 1,40                             |
| 2 000            | 40,0                                  | 1,40                             |
| <i>2 100</i>     | <i>39,8</i>                           | <i>1,49</i>                      |
| <i>2 300</i>     | <i>39,5</i>                           | <i>1,67</i>                      |
| 2 450            | 39,2                                  | 1,80                             |
| <i>2 600</i>     | <i>39,0</i>                           | <i>1,96</i>                      |
| 3 000            | 38,5                                  | 2,40                             |
| <i>3 500</i>     | <i>37,9</i>                           | <i>2,91</i>                      |
| <i>4 000</i>     | <i>37,4</i>                           | <i>3,43</i>                      |
| <i>4 500</i>     | <i>36,8</i>                           | <i>3,94</i>                      |
| <i>5 000</i>     | <i>36,2</i>                           | <i>4,45</i>                      |
| <i>5 200</i>     | <i>36,0</i>                           | <i>4,66</i>                      |
| <i>5 400</i>     | <i>35,8</i>                           | <i>4,86</i>                      |
| <i>5 600</i>     | <i>35,5</i>                           | <i>5,07</i>                      |
| <i>5 800</i>     | <i>35,3</i>                           | <i>5,27</i>                      |
| <i>6 000</i>     | <i>35,1</i>                           | <i>5,48</i>                      |

NOTE For convenience, permittivity and conductivity values at those frequencies which are not part of the original data provided by Drossos et al. [33] or the extension to 5 800 MHz are provided (i.e. the values shown *in italics*). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6 000 MHz that were linearly extrapolated from the values at 3 000 MHz and 5 800 MHz.

**EN 62209-2:2010/A1:2019 Recommended Body Tissue Dielectric Parameters .****Table 1 – Dielectric properties of the tissue-equivalent liquid material**

| Frequency<br>MHz | Real part of the<br>complex relative<br>permittivity, $\varepsilon'_r$ | Conductivity, $\sigma$<br>S/m |
|------------------|------------------------------------------------------------------------|-------------------------------|
| 30               | 55,0                                                                   | 0,75                          |
| 150              | 52,3                                                                   | 0,76                          |
| 300              | 45,3                                                                   | 0,87                          |
| 450              | 43,5                                                                   | 0,87                          |
| 750              | 41,9                                                                   | 0,89                          |
| 835              | 41,5                                                                   | 0,90                          |
| 900              | 41,5                                                                   | 0,97                          |
| 1 450            | 40,5                                                                   | 1,20                          |
| 1 800            | 40,0                                                                   | 1,40                          |
| 1 900            | 40,0                                                                   | 1,40                          |
| 1 950            | 40,0                                                                   | 1,40                          |
| 2 000            | 40,0                                                                   | 1,40                          |
| 2 100            | 39,8                                                                   | 1,49                          |
| 2 450            | 39,2                                                                   | 1,80                          |
| 2 600            | 39,0                                                                   | 1,96                          |
| 3 000            | 38,5                                                                   | 2,40                          |
| 3 500            | 37,9                                                                   | 2,91                          |
| 4 000            | 37,4                                                                   | 3,43                          |
| 4 500            | 36,8                                                                   | 3,94                          |
| 5 000            | 36,2                                                                   | 4,45                          |
| 5 200            | 36,0                                                                   | 4,66                          |
| 5 400            | 35,8                                                                   | 4,86                          |
| 5 600            | 35,5                                                                   | 5,07                          |
| 5 800            | 35,3                                                                   | 5,27                          |
| 6 000            | 35,1                                                                   | 5,48                          |

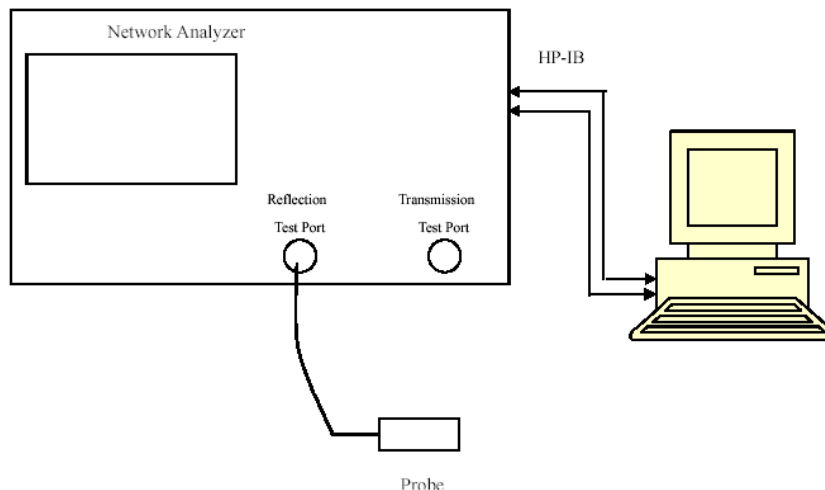
### 3. EQUIPMENT LIST AND CALIBRATION

#### 3.1 Equipments List & Calibration Information

| Equipment                     | Model         | S/N           | Calibration Date | Calibration Due Date |
|-------------------------------|---------------|---------------|------------------|----------------------|
| DASY5 Test Software           | DASY52.8      | N/A           | NCR              | NCR                  |
| DASY5 Measurement Server      | DASY5 5.0.28  | 1123          | NCR              | NCR                  |
| Data Acquisition Electronics  | DAE4          | 1354          | 2023/11/17       | 2024/11/16           |
| E-Field Probe                 | EX3DV4        | 3801          | 2023/6/23        | 2024/6/22            |
| Mounting Device               | MD4HHTV5      | BJPCTC0152    | NCR              | NCR                  |
| Oval Flat Phantom             | ELI V5.0      | 1078          | NCR              | NCR                  |
| Dipole, 450MHz                | D450V3        | 1096          | 2022/11/17       | 2025/11/16           |
| Simulated Tissue 450 MHz Head | TS-450 Head   | 2109045001    | Each Time        | /                    |
| Network Analyzer              | 8753B         | 2828A00170    | 2023/10/17       | 2024/10/16           |
| Dielectric assessment kit     | 1319          | SM DAK 040 CA | NCR              | NCR                  |
| MXG Vector Signal Generator   | N5182B        | MY51350144    | 2023/3/31        | 2024/3/30            |
| Power Meter                   | ML2495A       | 1106009       | 2023/8/4         | 2024/8/3             |
| Power Amplifier               | ZHL-5W-202-S+ | 416402204     | NCR              | NCR                  |
| Directional Coupler           | 441493        | 520Z          | NCR              | NCR                  |
| Attenuator                    | 20dB, 100W    | LN749         | NCR              | NCR                  |
| Attenuator                    | 6dB, 150W     | 2754          | NCR              | NCR                  |
| Thermometer                   | DTM3000       | 3892          | 2023/3/31        | 2024/3/30            |
| Spectrum Analyzer             | FSU26         | 100147        | 2023/3/31        | 2024/3/30            |

## 4. SAR MEASUREMENT SYSTEM VERIFICATION

### 4.1 Liquid Verification



Liquid Verification Setup Block Diagram

### Liquid Verification Results

| Frequency (MHz) | Liquid Type                   | Liquid Parameter |                | Target Value |                | Delta (%)          |                      | Tolerance (%) |
|-----------------|-------------------------------|------------------|----------------|--------------|----------------|--------------------|----------------------|---------------|
|                 |                               | $\epsilon_r$     | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) | $\Delta\epsilon_r$ | $\Delta\sigma$ (S/m) |               |
| 450             | Simulated Tissue 450 MHz Head | 43.116           | 0.855          | 43.5         | 0.87           | -0.88              | -1.72                | $\pm 5$       |
| 462.6375        | Simulated Tissue 450 MHz Head | 42.735           | 0.872          | 43.43        | 0.87           | -1.6               | 0.23                 | $\pm 5$       |
| 467.6375        | Simulated Tissue 450 MHz Head | 42.476           | 0.884          | 43.41        | 0.87           | -2.15              | 1.61                 | $\pm 5$       |

\*Liquid Verification above was performed on 2024/01/04.

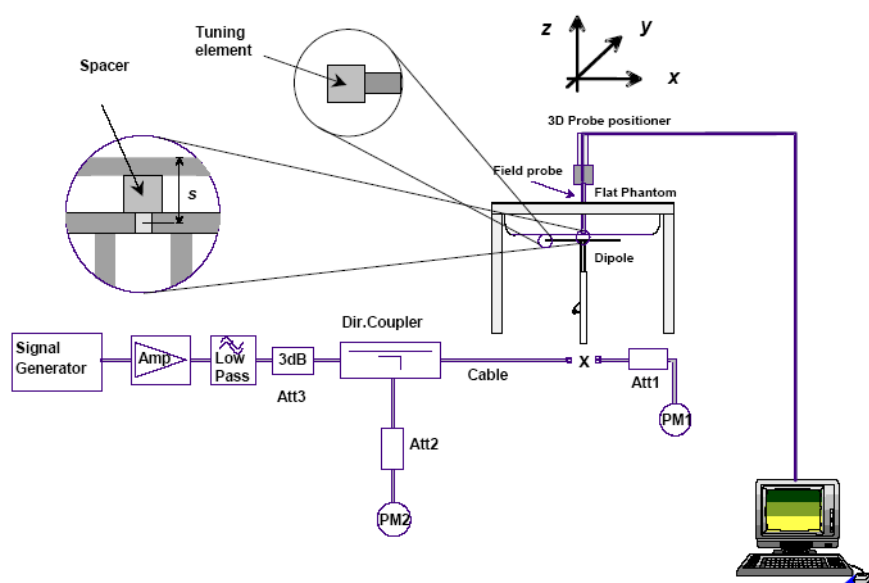
## 4.2 System Accuracy Verification

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of  $\pm 10\%$ . The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The spacing distances in the **System Verification Setup Block Diagram** is given by the following:

- $s = 15 \text{ mm} \pm 0,2 \text{ mm}$  for  $300 \text{ MHz} \leq f \leq 1\,000 \text{ MHz}$ ;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$  for  $1\,000 \text{ MHz} < f \leq 3\,000 \text{ MHz}$ ;
- $s = 10 \text{ mm} \pm 0,2 \text{ mm}$  for  $3\,000 \text{ MHz} < f \leq 6\,000 \text{ MHz}$ .

### System Verification Setup Block Diagram



### System Accuracy Check Results

| Date       | Frequency Band | Liquid Type                      | Input Power (W) | Measured SAR (W/kg) |      | Target Value (W/kg) | Delta (%) | Tolerance (%) |
|------------|----------------|----------------------------------|-----------------|---------------------|------|---------------------|-----------|---------------|
| 2024/01/04 | 450 MHz        | Simulated Tissue<br>450 MHz Head | 1               | 1g                  | 4.34 | 4.56                | -4.82     | $\pm 10$      |

### 4.3 SAR SYSTEM VALIDATION DATA

#### System Performance 450 MHz Head (Liquid Temperature: 20.4-20.5 °C)

**DUT: Dipole 450 MHz; Type: D450V3; Serial: 1096**

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 450$  MHz;  $\sigma = 0.855$  S/m;  $\epsilon_r = 43.116$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(10.11, 10.11, 10.11) @ 450 MHz; Calibrated: 2023/6/23
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1354; Calibrated: 2023/11/17
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1078
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.12 (7164)

**Area Scan (8x21x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 4.49 W/kg

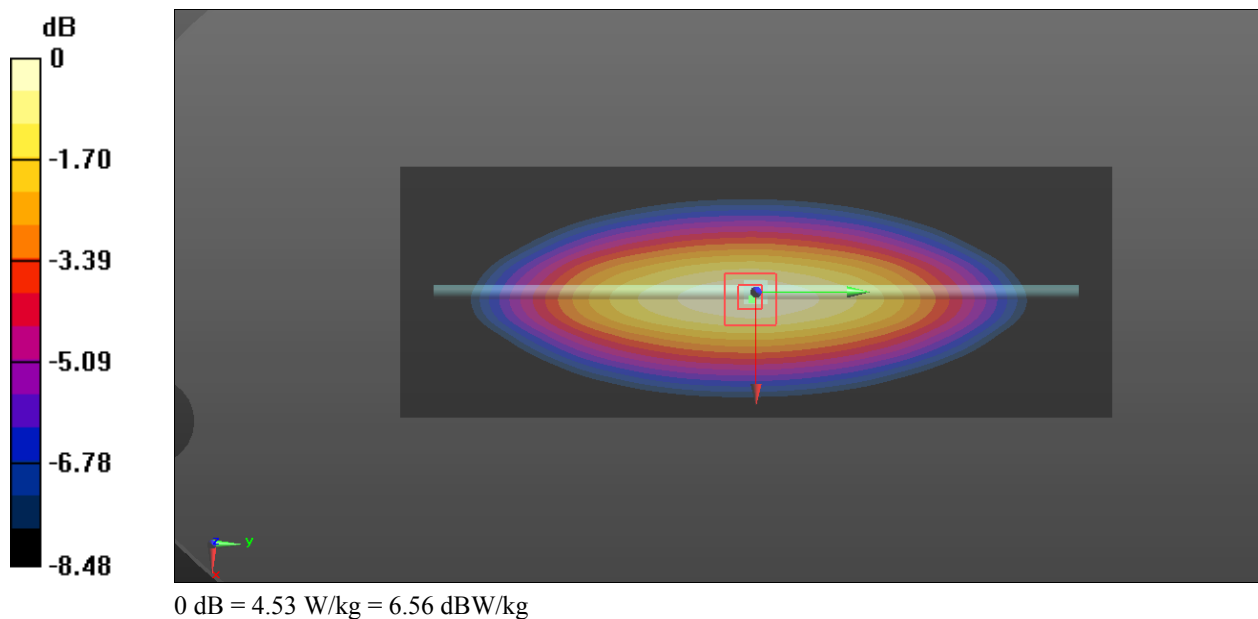
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 63.52 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 6.28 W/kg

**SAR(1 g) = 4.34 W/kg; SAR(10 g) = 2.91 W/kg**

Maximum value of SAR (measured) = 4.53 W/kg

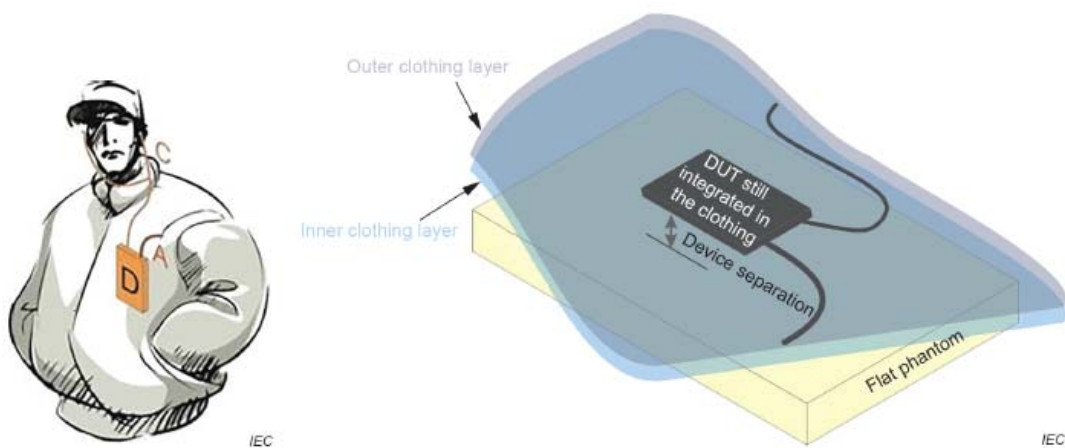


## 5. EUT TEST STRATEGY AND METHODOLOGY

### 5.1 Test positions for head-worn configurations

A typical example of a clothing-integrated device is a wireless communication device integrated into a jacket to provide voice communications through an embedded speaker and microphone. This category also includes head-mounted devices with integrated wireless communication devices.

All wireless or RF transmitting components shall be positioned against the flat phantom (or specific phantoms) that correspond to the intended use conditions when they are integrated into the clothing. Devices integrated in head-mounted devices may be tested using the SAM phantom (if appropriate) or specific phantoms.



### 5.2 Test Distance for SAR Evaluation

In this case the DUT (Device Under Test) is set the test distance is 20mm for Head mode.

### 5.3 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or radiating structures of the EUT, the horizontal grid spacing was 15 mm x 15 mm, and the SAR distribution was determined by integrated grid of 1.5mm x 1.5mm. Based on these data, the area of the maximum absorption was determined by spline interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7x 7 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

- 1) The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

- 2) The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the "Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

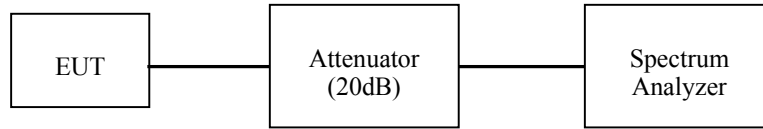
All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

## 6. CONDUCTED OUTPUT POWER MEASUREMENT

### 6.1 Test Procedure

The RF output of the transmitter was connected to the input of the Spectrum Analyzer through sufficient attenuation.



PTT

The Spectrum Analyzer setting:

| RBW     | VBW     |
|---------|---------|
| 100 kHz | 300 kHz |

### 6.2 Maximum Target Output Power

| Frequency Band                | Max. ERP(with tolerance) for Production Unit (dBm) |
|-------------------------------|----------------------------------------------------|
| 462MHz(462.5500-462.7250MHz)  | 32                                                 |
| 467MHz(467.5625-467.7125 MHz) | 27                                                 |

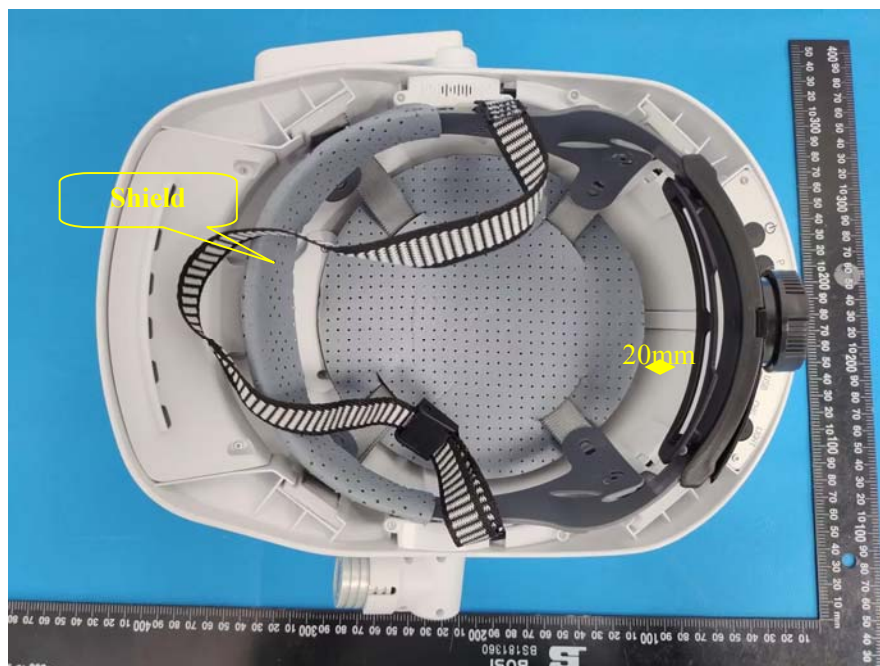
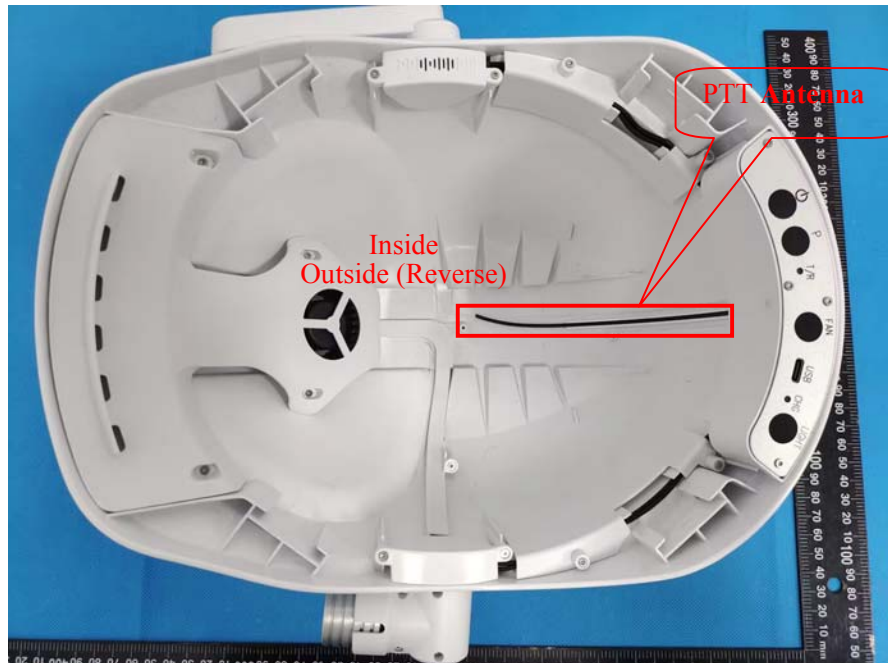
### 6.3 Test Results:

| Mode                          | Frequency (MHz) | Conducted Output power (dBm) | Antenna Gain (dBi) | ERP (dBm) |
|-------------------------------|-----------------|------------------------------|--------------------|-----------|
| 462MHz(462.5500-462.7250MHz)  | 462.6375        | 33.56                        | -2.15              | 31.41     |
| 467MHz(467.5625-467.7125 MHz) | 467.6375        | 28.93                        | -2.15              | 26.78     |

**Note:**

Per IEEE1528:2013, the width of the transmit frequency band,  $\Delta f = f_{\text{high}} - f_{\text{low}}$  (where  $f_{\text{high}}$  is the highest frequency in the band and  $f_{\text{low}}$  is the lowest) does not exceeds 1% of its center frequency  $f_c$ . then only **center frequency** need be tested.

**Antennas Location:**



## 7. SAR MEASUREMENT RESULTS

This page summarizes the results of the performed dosimetric evaluation.

### 7.1 SAR Test Data

#### Environmental Conditions

|                    |              |
|--------------------|--------------|
| Temperature:       | 21.7-22.4 °C |
| Relative Humidity: | 51 %         |
| ATM Pressure:      | 101.5 kPa    |
| Test Date:         | 2024/01/04   |

Testing was performed by Aixlee Li.

#### Test Results:

| Test Mode    | Frequency (MHz) | Worn accessories | Max. Meas. Power (dBm) | Max. Rated Power (dBm) | 1 g SAR Value(W/kg) |           |                |            |      |
|--------------|-----------------|------------------|------------------------|------------------------|---------------------|-----------|----------------|------------|------|
|              |                 |                  |                        |                        | Power Scaled Factor | Meas. SAR | PTT 50% Factor | Scaled SAR | Plot |
| Head (20 mm) | 462.6375        | None             | 31.41                  | 32                     | 1.146               | 1.65      | 0.825          | 0.95       | 1#   |
|              | 467.6375        | None             | 26.78                  | 27                     | 1.052               | 1.05      | 0.525          | 0.55       | 2#   |

#### Note:

1. For a PTT, only simplex communication technology was supported, so the SAR value need to be corrected by Multiplying 50%.
2. Passive body-worn and audio accessories generally do not apply to the head SAR of PTT radios.
3. The whole antenna and radiating structures that may contribute to the measured SAR or influence the SAR distribution has been included in the area scan.

## 8. SAR PLOTS

Plot 1#:462.6375MHz\_Head

DUT: SR-622 multi-purpose helmet; Type: SR-622; Serial: 2DJ9-1

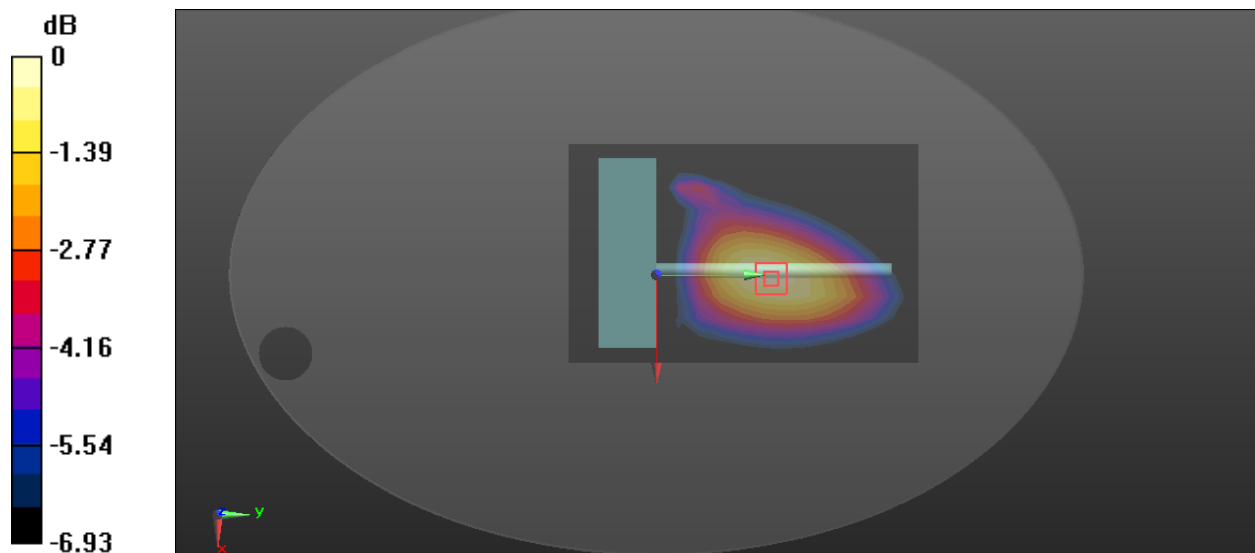
Communication System: FM; Frequency: 462.6375 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 462.6375$  MHz;  $\sigma = 0.872$  S/m;  $\epsilon_r = 42.735$ ;  $\rho = 1000$  kg/  
m<sup>3</sup> Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(10.11, 10.11, 10.11) @ 462.6375 MHz; Calibrated: 2023/6/23
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1354; Calibrated: 2023/11/17
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1078
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.12 (7164)

**Area Scan (11x17x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 1.65 W/kg

**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 13.96 V/m; Power Drift = 0.13 dB  
Peak SAR (extrapolated) = 2.03 W/kg  
**SAR(1 g) = 1.65 W/kg; SAR(10 g) = 1.12 W/kg**  
Maximum value of SAR (measured) = 1.67 W/kg



**Plot 2#:467.6375MHz\_Head****DUT: SR-622 multi-purpose helmet; Type: SR-622; Serial: 2DJ9-1**

Communication System: FM; Frequency: 467.637 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 467.637 \text{ MHz}$ ;  $\sigma = 0.884 \text{ S/m}$ ;  $\epsilon_r = 42.476$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3801; ConvF(10.11, 10.11, 10.11) @ 467.637 MHz; Calibrated: 2023/6/23
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1354; Calibrated: 2023/11/17
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1078
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.12 (7164)

**Area Scan (7x10x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$ 

Maximum value of SAR (measured) = 1.13 W/kg

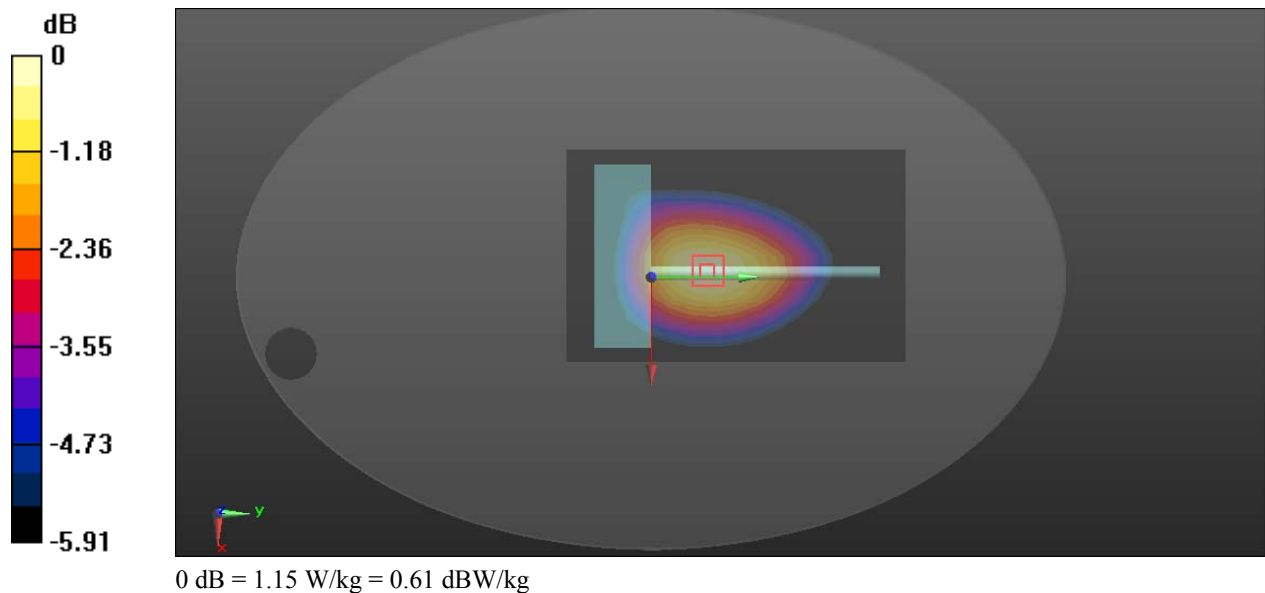
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 30.17 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.34 W/kg

**SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.818 W/kg**

Maximum value of SAR (measured) = 1.15 W/kg



## APPENDIX A MEASUREMENT UNCERTAINTY

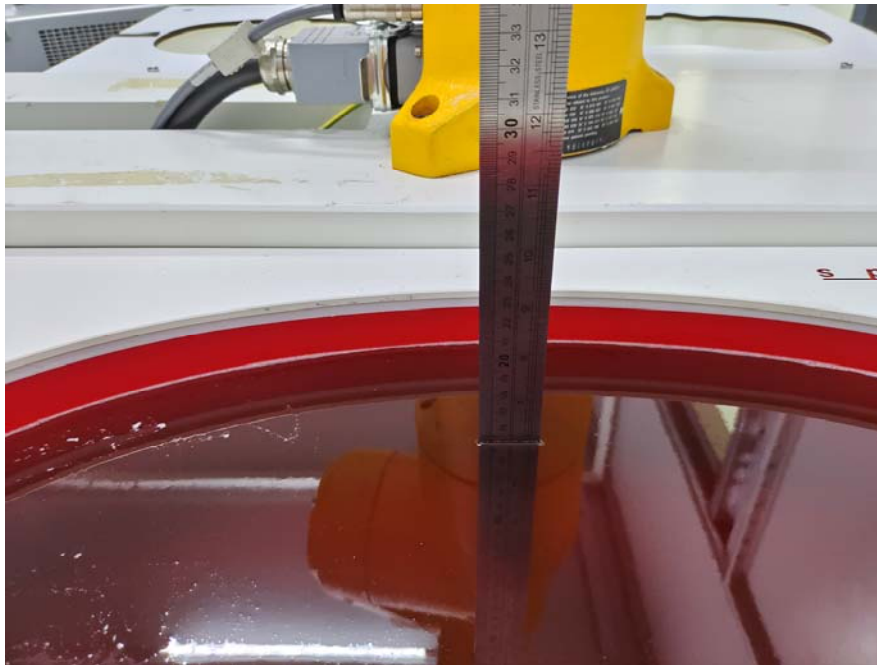
The uncertainty budget has been determined for the measurement system and is given in the following Table.

### Measurement uncertainty evaluation for IEEE1528-2013 SAR test

| Source of uncertainty                                | Tolerance/<br>uncertainty<br>± % | Probability<br>distribution | Divisor    | ci<br>(1 g) | ci<br>(10 g) | Standard<br>uncertainty<br>± %, (1 g) | Standard<br>uncertainty<br>± %, (10 g) |
|------------------------------------------------------|----------------------------------|-----------------------------|------------|-------------|--------------|---------------------------------------|----------------------------------------|
| <b>Measurement system</b>                            |                                  |                             |            |             |              |                                       |                                        |
| Probe calibration                                    | 6.55                             | N                           | 1          | 1           | 1            | 6.3                                   | 6.3                                    |
| Axial Isotropy                                       | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Hemispherical Isotropy                               | 9.6                              | R                           | $\sqrt{3}$ | 0           | 0            | 0.0                                   | 0.0                                    |
| Boundary effect                                      | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Linearity                                            | 4.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.7                                   | 2.7                                    |
| Detection limits                                     | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Readout electronics                                  | 0.3                              | N                           | 1          | 1           | 1            | 0.3                                   | 0.3                                    |
| Response time                                        | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| Integration time                                     | 0.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.0                                   | 0.0                                    |
| RF ambient conditions – noise                        | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| RF ambient conditions– reflections                   | 1.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.6                                   | 0.6                                    |
| Probe positioner mech. Restrictions                  | 0.8                              | R                           | $\sqrt{3}$ | 1           | 1            | 0.5                                   | 0.5                                    |
| Probe positioning with respect to phantom shell      | 6.7                              | R                           | $\sqrt{3}$ | 1           | 1            | 3.9                                   | 3.9                                    |
| Post-processing                                      | 2.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 1.2                                   | 1.2                                    |
| <b>Test sample related</b>                           |                                  |                             |            |             |              |                                       |                                        |
| Test sample positioning                              | 2.8                              | N                           | 1          | 1           | 1            | 2.8                                   | 2.8                                    |
| Device holder uncertainty                            | 6.3                              | N                           | 1          | 1           | 1            | 6.3                                   | 6.3                                    |
| Drift of output power                                | 5.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.9                                   | 2.9                                    |
| <b>Phantom and set-up</b>                            |                                  |                             |            |             |              |                                       |                                        |
| Phantom uncertainty (shape and thickness tolerances) | 4.0                              | R                           | $\sqrt{3}$ | 1           | 1            | 2.3                                   | 2.3                                    |
| Liquid conductivity target)                          | 5.0                              | R                           | $\sqrt{3}$ | 0.64        | 0.43         | 1.8                                   | 1.2                                    |
| Liquid conductivity meas.)                           | 2.5                              | N                           | 1          | 0.64        | 0.43         | 1.6                                   | 1.1                                    |
| Liquid permittivity target)                          | 5.0                              | R                           | $\sqrt{3}$ | 0.6         | 0.49         | 1.7                                   | 1.4                                    |
| Liquid permittivity meas.)                           | 2.5                              | N                           | 1          | 0.6         | 0.49         | 1.5                                   | 1.2                                    |
| Combined standard uncertainty                        |                                  | RSS                         |            |             |              | 12.2                                  | 12.0                                   |
| Expanded uncertainty 95 % confidence interval)       |                                  |                             |            |             |              | 24.1                                  | 23.7                                   |

## APPENDIX B EUT TEST POSITION PHOTOS

**Liquid depth  $\geq 15\text{cm}$**



**Head Setup Photo (20mm)**



## **APPENDIX C CALIBRATION CERTIFICATES**

---

**Please Refer to the Attachment.**

**\*\*\*\*\* END OF REPORT \*\*\*\*\***