



# SAR TEST REPORT

For

Hunan GM Innovation Technology Co., Ltd

Allcomm Full-Duplex Intercom System

Test Model: 290-0010

Additional Model No.: 290-0014,290-0015,290-0016,290-0017,290-0025,  
290-0026,290-0027

Prepared for : Hunan GM Innovation Technology Co., Ltd  
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China

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Date of receipt of test sample : September 16, 2026  
Number of tested samples : 1  
Sample number : C260625002-1  
Serial number : Prototype  
Date of Test : September 16, 2026 ~ September 18, 2026  
Date of Report : September 18, 2026

**SAR TEST REPORT**

Report Reference No.....: LCSA05196104E

Date Of Issue .....: September 18, 2026

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

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

Testing Location/ Procedure .....: Full application of Harmonised standards ☒  
Partial application of Harmonised standards ☐  
Other standard testing method ☐**Applicant's Name .....: Hunan GM Innovation Technology Co., Ltd**

Address .....: 2601 26th Floor, Building 10, Zone B, Greenland V Island, Yuehu Street, kaifu District, Changsha city. Hunan Province, China

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

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

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

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**Test Item Description. ....: Allcomm Full-Duplex Intercom System**

Trade Mark .....: N/A

Model/Type Reference .....: 290-0010

Ratings .....: Please Refer to Page 10

**Result .....: Positive****Compiled by:**

Jay zhan

Jay Zhan/ Administrator

**Supervised by:**

Kevin Huang

Kevin Huang/ RF Manager

**Approved by:**

Gavin Liang

Gavin Liang/ Manager



## SAR -- TEST REPORT

|                                                                                                                                                                                                                                                         |                      |                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------|
| <b>Test Report No. :</b>                                                                                                                                                                                                                                | <b>LCSA05196104E</b> | September 18, 2026<br>Date of issue |
| EUT..... : Allcomm Full-Duplex Intercom System                                                                                                                                                                                                          |                      |                                     |
| Type/Model ..... : 290-0010                                                                                                                                                                                                                             |                      |                                     |
| <b>Applicant..... : Hunan GM Innovation Technology Co., Ltd</b><br>Address..... : 2601 26th Floor, Building 10, Zone B, Greenland V Island, Yuehu Street, kaifu District, Changsha city. Hunan Province, China<br>Telephone..... : /<br>Fax..... : /    |                      |                                     |
| <b>Manufacturer..... : Hunan GM Innovation Technology Co., Ltd</b><br>Address..... : 2601 26th Floor, Building 10, Zone B, Greenland V Island, Yuehu Street, kaifu District, Changsha city. Hunan Province, China<br>Telephone..... : /<br>Fax..... : / |                      |                                     |
| <b>Factory..... : Hunan GM Innovation Technology Co., Ltd</b><br>Address..... : 2601 26th Floor, Building 10, Zone B, Greenland V Island, Yuehu Street, kaifu District, Changsha city. Hunan Province, China<br>Telephone..... : /<br>Fax..... : /      |                      |                                     |

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

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



Revision History

| Revision | Issue Date         | Revision Content | Revised By |
|----------|--------------------|------------------|------------|
| 000      | September 18, 2026 | Initial Issue    | ---        |
|          |                    |                  |            |
|          |                    |                  |            |
|          |                    |                  |            |



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1. TEST STANDARDS AND TEST DESCRIPTION

1.1. Statement of Compliance

The maximum of results of SAR found during testing for 290-0010 are follows:

<Highest Reported standalone SAR Summary>

| Frequency Band | Head<br>(Report SAR1-g (W/kg) |
|----------------|-------------------------------|
|                | (Separation Distance 0mm)     |
| 2.4G           | 0.603                         |

Note

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



## 1.2. Test Location

Company: Shenzhen LCS Compliance Testing Laboratory Ltd.  
Address: 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China  
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### 1.3. Test Facility

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

Site Description  
SAR Lab.

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



1.4. Test Laboratory Environment

|                                                                                                                                                                                                 |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Temperature                                                                                                                                                                                     | Min. = 18°C, Max. = 25 °C |
| Relative humidity                                                                                                                                                                               | Min. = 30%, Max. = 70%    |
| Ground system resistance                                                                                                                                                                        | < 0.5 Ω                   |
| Atmospheric pressure:                                                                                                                                                                           | 950-1050mbar              |
| Ambient noise is checked and found very low and in compliance with requirement of standards.<br>Reflection of surrounding objects is minimized and in compliance with requirement of standards. |                           |



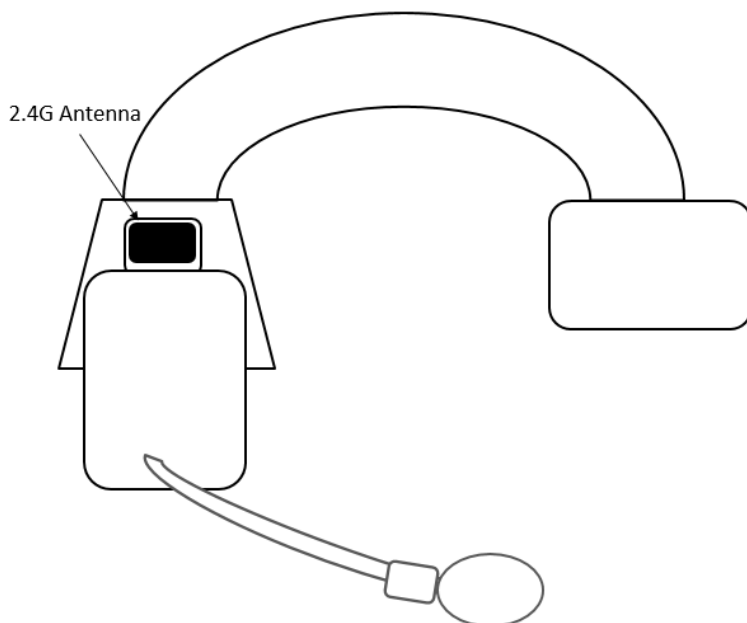
## 1.5. Product Description

The **Hunan GM Innovation Technology Co., Ltd**'s Model: **290-0010** or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

|                      |                                                                                                         |
|----------------------|---------------------------------------------------------------------------------------------------------|
| EUT                  | : Allcomm Full-Duplex Intercom System                                                                   |
| Test Model           | : 290-0010                                                                                              |
| Additional Model No. | : 290-0014,290-0015,290-0016,290-0017,290-0025,290-0026,290-0027                                        |
| Model Declaration    | : PCB board, structure and internal of these model(s) are the same, So no additional models were tested |
| Ratings              | : Input: DC 5V, 2000mA<br>Battery: DC 3.85V, 1800mAh                                                    |
| Hardware Version     | : v1.0                                                                                                  |
| Software Version     | : v1.0                                                                                                  |
| 2.4G                 | :                                                                                                       |
| Frequency Range      | : 2401.575MHz~2476.575MHz                                                                               |
| Channel Number       | : 79 channels for 2.4G                                                                                  |
| Channel Spacing      | : 0.9MHz for 2.4G                                                                                       |
| Modulation Type      | : MSK for 2.4G                                                                                          |
| Antenna Description  | : Internal Antenna, 5.58dBi(Max.)                                                                       |

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

## 1.6. DUT Antenna Locations





## 1.7. Test Specification

| Identity          | Document Title                                                                                                                                                              |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC 47CFR §2.1093 | Radiofrequency Radiation Exposure Evaluation: Portable Devices                                                                                                              |
| IEEE C95.1-2019   | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.                                                  |
| IEEE 1528-2013    | Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques |
| KDB 248227 D01    | SAR Guidance for IEEE 802.11 Wi-Fi SAR v02r02                                                                                                                               |
| KDB 447498 D01    | General RF Exposure Guidance v06                                                                                                                                            |
| KDB 865664 D01    | SAR Measurement 100 MHz to 6 GHz v01r04                                                                                                                                     |
| KDB 865664 D02    | RF Exposure Reporting v01r02                                                                                                                                                |
| KDB 690783 D01    | SAR Listings on Grants v01r03                                                                                                                                               |
| KDB 775926 V01    | SPECIFIC ABSORPTION RATE (SAR) TESTING FOR IRREGULAR SHAPED DEVICES                                                                                                         |



## 1.8. RF exposure limits

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

**Notes:**

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

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

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

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

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



## 1.9. Equipment list

| Test Platform                       |                                      | SPEAG DASY5 Professional                      |           |               |                  |                         |
|-------------------------------------|--------------------------------------|-----------------------------------------------|-----------|---------------|------------------|-------------------------|
| Description                         |                                      | SAR Test System (Frequency range 300MHz-6GHz) |           |               |                  |                         |
| Software Reference                  |                                      | DASY52; SEMCAD X                              |           |               |                  |                         |
| Hardware Reference                  |                                      |                                               |           |               |                  |                         |
| Equipment                           |                                      | Manufacturer                                  | Model     | Serial Number | Calibration Date | Due date of calibration |
| <input checked="" type="checkbox"/> | PC                                   | Lenovo                                        | NA        | NA            | NA <sup>1</sup>  | NA <sup>1</sup>         |
| <input checked="" type="checkbox"/> | Twin Phantom                         | SPEAG                                         | SAM V5.0  | 1850          | NA <sup>1</sup>  | NA <sup>1</sup>         |
| <input checked="" type="checkbox"/> | ELI Phantom                          | SPEAG                                         | ELI V6.0  | 2010          | NA <sup>1</sup>  | NA <sup>1</sup>         |
| <input checked="" type="checkbox"/> | DAE                                  | SPEAG                                         | DAE3      | 373           | 2026/3/2         | 2027/3/1                |
| <input checked="" type="checkbox"/> | E-Field Probe                        | SPEAG                                         | EX3DV4    | 3805          | 2026/3/2         | 2027/3/1                |
| <input checked="" type="checkbox"/> | Validation Kits                      | SPEAG                                         | D2450V2   | 808           | 2026/8/19        | 2029/8/18               |
| <input checked="" type="checkbox"/> | Agilent Network Analyzer             | Agilent                                       | 8753E     | SU38432944    | 2026/4/21        | 2027/4/20               |
| <input checked="" type="checkbox"/> | Dielectric Probe Kit                 | SPEAG                                         | DAKS3.5   | 1157          | 2026/7/27        | 2027/7/26               |
| <input checked="" type="checkbox"/> | Universal Radio Communication Tester | R&S                                           | CMW500    | 42115         | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Directional Coupler                  | MCLI/USA                                      | 4426-20   | 3746          | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Power meter                          | Agilent                                       | E4419B    | MY45104493    | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Power meter                          | Agilent                                       | E4419B    | MY45100308    | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Power sensor                         | Agilent                                       | E9301H    | MY41495616    | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Power sensor                         | Agilent                                       | E9301H    | MY41495234    | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | 3dB Attenuator                       | NA                                            | 2N-3dB    | NA            | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | 3dB Attenuator                       | NA                                            | 2N-3dB    | NA            | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | 3dB Attenuator                       | NA                                            | 2N-3dB    | NA            | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Signal Generator                     | Agilent                                       | E4438C    | MY49072627    | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Broadband Preamplifier               | /                                             | BP-01M18G | P190501       | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | DC POWER SUPPLY                      | I-SHENG                                       | SP-504    | NA            | 2025/9/27        | 2026/9/26               |
| <input checked="" type="checkbox"/> | Speed reading thermometer            | HTC-1                                         | NA        | LCS-E-138     | 2025/9/27        | 2026/9/26               |

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

"1" : NA as this is not measurement equipment.



## 2.1. SAR Measurement System

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





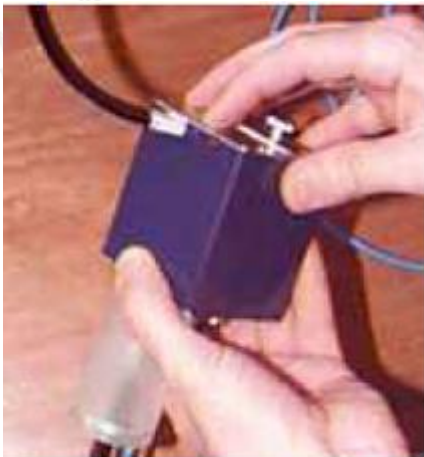
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.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



## 2.2. Isotropic E-field Probe EX3DV4

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

## 2.3. Data Acquisition Electronics (DAE)

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

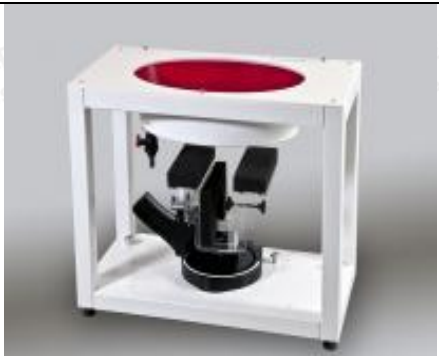
## 2.4. SAM Twin Phantom

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

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

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

## 2.5. ELI Phantom

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

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

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

## 2.6. Device Holder for Transmitters



F-2. Device Holder for Transmitters

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



## 2.7. Measurement procedure

### 2.7.1. Scanning procedure

#### Step 1: Power reference measurement

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

#### Step 2: Area scan

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

#### Step 3: Zoom scan

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

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

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



|                                                                                                        |                                    |                                                                                      |                                                                                                                                                                                                                                                                        |                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                        |                                    |                                                                                      | $\leq 3 \text{ GHz}$                                                                                                                                                                                                                                                   | $> 3 \text{ GHz}$                                                                                                                |
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface |                                    |                                                                                      | $5 \pm 1 \text{ mm}$                                                                                                                                                                                                                                                   | $\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$                                                                       |
| 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: $\Delta x_{Area}$ , $\Delta y_{Area}$                            |                                    |                                                                                      | $\leq 2 \text{ GHz: } \leq 15 \text{ mm}$<br>$2 - 3 \text{ GHz: } \leq 12 \text{ mm}$                                                                                                                                                                                  | $3 - 4 \text{ GHz: } \leq 12 \text{ mm}$<br>$4 - 6 \text{ GHz: } \leq 10 \text{ mm}$                                             |
|                                                                                                        |                                    |                                                                                      | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device. |                                                                                                                                  |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$                            |                                    |                                                                                      | $\leq 2 \text{ GHz: } \leq 8 \text{ mm}$<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: $\Delta z_{Zoom}(n)$ |                                                                                      | $\leq 5 \text{ mm}$                                                                                                                                                                                                                                                    | $3 - 4 \text{ GHz: } \leq 4 \text{ mm}$<br>$4 - 5 \text{ GHz: } \leq 3 \text{ mm}$<br>$5 - 6 \text{ GHz: } \leq 2 \text{ mm}$    |
|                                                                                                        | graded grid                        | $\Delta z_{Zoom}(1)$ : 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>$5 - 6 \text{ GHz: } \leq 2 \text{ mm}$  |
|                                                                                                        |                                    | $\Delta z_{Zoom}(n>1)$ : between subsequent points                                   | $\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$                                                                                                                                                                                                                                  |                                                                                                                                  |
| 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>$5 - 6 \text{ GHz: } \geq 22 \text{ mm}$ |

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

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

#### 2.7.2. Data Storage

The DASY software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated. The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.



### 2.7.3. Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

|                           |                |                      |
|---------------------------|----------------|----------------------|
| Probe parameters:         | - Sensitivity  | Normi, ai0, ai1, ai2 |
| - Conversion factor       | ConvFi         |                      |
| - Diode compression point | Dcpi           |                      |
| Device parameters:        | - Frequency    | f                    |
| - Crest factor            | cf             |                      |
| Media parameters:         | - Conductivity | $\epsilon$           |
| - Density                 | $\rho$         |                      |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcpi$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$U_i$  = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcpi = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:

$$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$



H-field probes:

$$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2) / f$$

With  $V_i$  = compensated signal of channel  $i$  ( $i = x, y, z$ )

Normi = sensor sensitivity of channel  $i$  ( $i = x, y, z$ )

[mV/(V/m)<sup>2</sup>] for E-field Probes

ConvF = sensitivity enhancement in solution

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

$f$  = carrier frequency [GHz]

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

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

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

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

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

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

with SAR = local specific absorption rate in mW/g

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

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

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

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

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

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

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

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



### 3. SAR measurement variability and uncertainty

#### 3.1. SAR measurement variability

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

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

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

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

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

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

#### 3.2. SAR measurement uncertainty

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

## 4. Description of Test Position

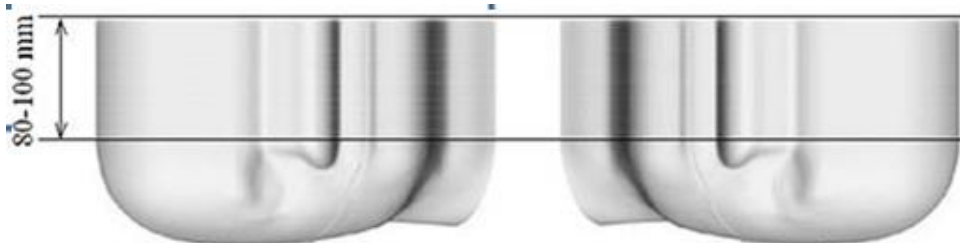
### 4.1. Head Exposure Condition

#### 4.1.1. SAM Phantom Shape

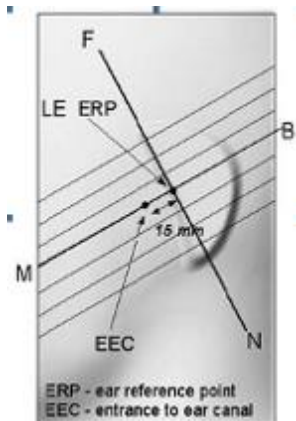


F-3. Front, back, and side views of SAM (model for the phantom shell). Full-head model is for illustration purposes only-procedures in this recommended practice are intended primarily for the phantom setup.

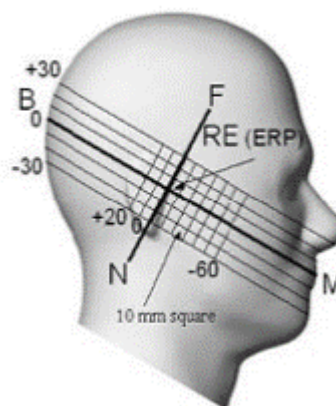
Note: The centre strip including the nose region has a different thickness tolerance.



F-4. Sagittally bisected phantom with extended perimeter (shown placed on its side as used for SAR measurements)

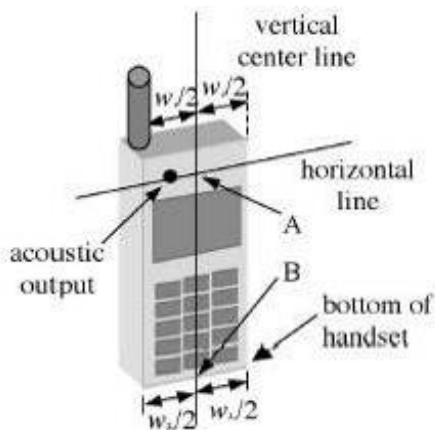


F-5. Close-up side view of phantom, showing the ear region, N-F and B-M lines, and seven cross-sectional plane locations

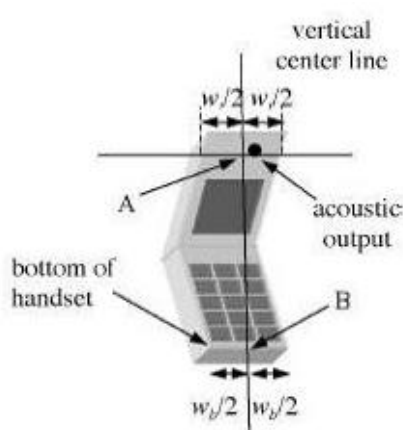


F-6. Side view of the phantom showing relevant markings and seven cross-sectional plane locations

### 4.1.2. EUT constructions



F-1. Handset vertical and horizontal reference lines-“fixed case”



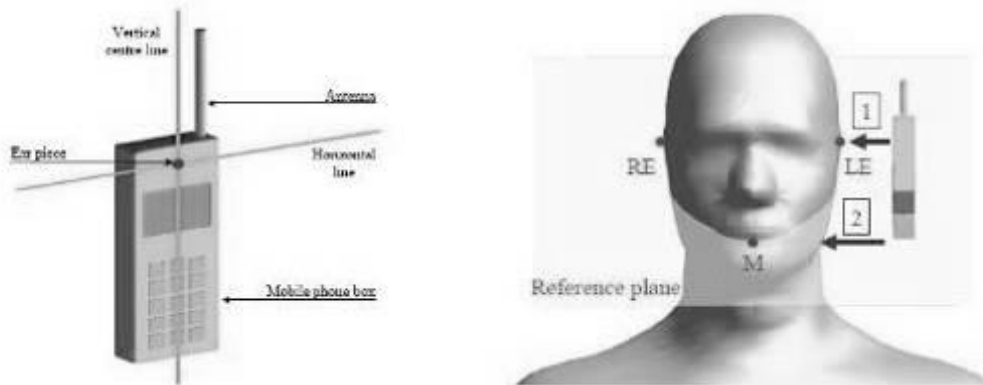
F-2. Handset vertical and horizontal reference lines-“clam-shell case”

### 4.1.3. Definition of the “cheek” position

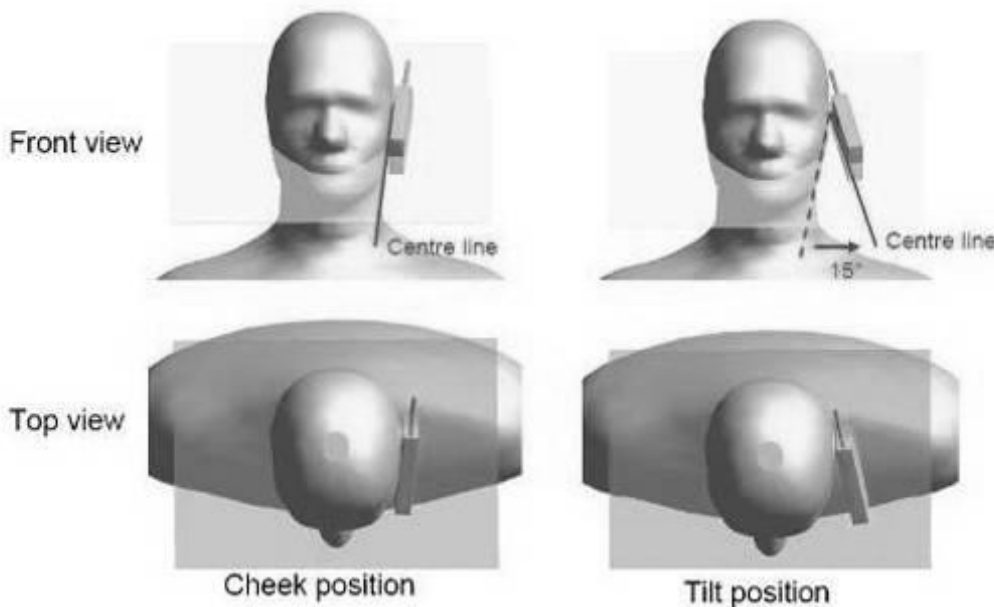
- Position the device with the vertical centre line of the body of the device and the horizontal line crossing the centre of the ear piece in a plane parallel to the sagittal plane of the phantom (“initial position”). While maintaining the device in this plane, align the vertical centre line with the reference plane containing the three ear and mouth reference points (M, RE and LE) and align the centre of the ear piece with the line RE-LE.
- Translate the mobile phone box towards the phantom with the ear piece aligned with the line LE-RE until telephone touches the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the box until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.

#### 4.1.4. Definition of the “tilted” position

- Position the device in the “cheek” position described above;
- While maintaining the device in the reference plane described above and pivoting against the ear, move it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost.



F-1. Definition of the reference lines and points, on the phone and on the phantom and initial position



F-2. “Cheek” and “tilt” positions of the mobile phone on the left side

## 4.2. Body Exposure Condition

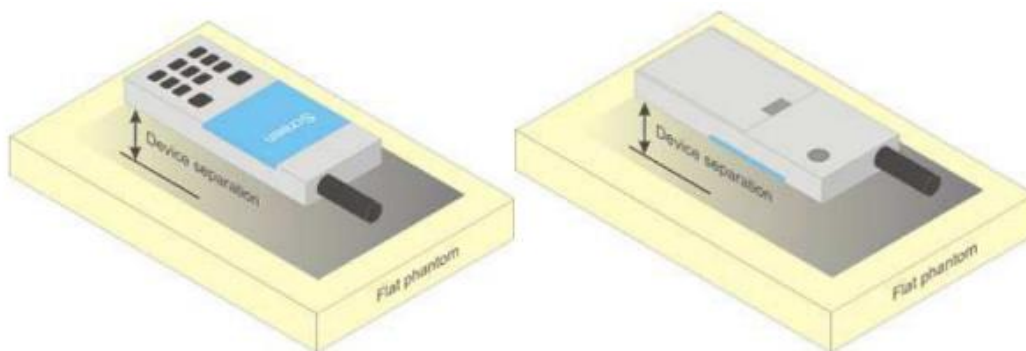
### 4.2.1. Body-worn accessory exposure conditions

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

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

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

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



F-1. Test positions for body-worn devices



#### 4.2.2. Wireless Router exposure conditions

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

#### 4.3. Extremity exposure conditions

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

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

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

#### 4.4. Head-worn devices (helmets, VR headsets, glasses, and goggles)

A variety of head-worn devices are now equipped with transmitter systems to facilitate communications. Some examples of common head-worn devices include helmets, augmented reality visors, and virtual reality headsets. Head-worn devices typically come in several sizes and include adjustable straps which are sometimes rigid or elastic and often include user interface controls directly on the device. These devices are required to comply with the head RF exposure conditions (i.e., 1g-SAR) and may also require extremity SAR considerations. Furthermore, most head-worn devices are form-fitting, so placement against the flat phantom is often impractical.

In some instances, the radio transmitter is removable from the head-worn device. For example, it is common for transmitters to be removable from motorcycle helmets to make charging or replacing batteries easier. In the case where the transmitter is removable, SAR may be tested with the transmitter removed from the helmet and tested at a distance that is representative of the distance from the head.

In the ideal case, the side of the device closest to the head should be tested. However, when transmitters are located away from the head, as is the case in many VR headsets, the side containing the transmitter may be tested at a conservative distance from antenna to head. For example, if the transmit antenna is located 8 mm from the head with a 1 mm device thickness, then the front surface of the device may be tested at 7 mm. While this is possible in some cases, some antennas will be closer to the head and therefore the inside of the device will need to be tested.

Removal of components or partially modifying a device such that the field characteristics are not significantly impacted is sometimes necessary and is permitted as stated in section 2. For example, straps, glasses' temples, etc., which are rigid, made of plastic or other non-conductive material, but do not contain critical components (e.g., cables, antennas, etc.) may be removed or altered. Likewise, for VR headsets and other devices that are equipped with foam or rubber pads that can compress, it is required to remove these pads for a conservative worst-case test separation distance. The side of the head worn device closest to the head is then placed against the phantom. When straps, temples, etc.



contain critical components then the straps may still be removed and suspended below the phantom out of the way.

Form-fitting goggles, VR headsets, etc., may be placed on the neck of the SAM phantom so long as the curvature of the neck and head-worn device are similar and thus allow for a conservative separation distance to be maintained.

The use of a face-down or headstand phantom is permitted when head-worn device does not properly fit against the neck or when the strap cannot be physically removed due to design constraints. If a nonstandard phantom is used to demonstrate compliance, then a PAG needs to be submitted in accordance with KDB Publication 388624 D02.

For head-worn devices that contain physical controls and/or buttons, extremity SAR needs to be evaluated on the exterior of the device. SAR testing should be performed with the exterior (i.e., side facing away from the user's face/head) of the DUT placed underneath the flat phantom.



## 5. SAR System Verification Procedure

### 5.1. Tissue Simulate Liquid

#### 5.1.1. Recipes for Tissue Simulate Liquid

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

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

Table 1: Recipe of Tissue Simulate Liquid



5.1.2. Measurement for Tissue Simulate Liquid

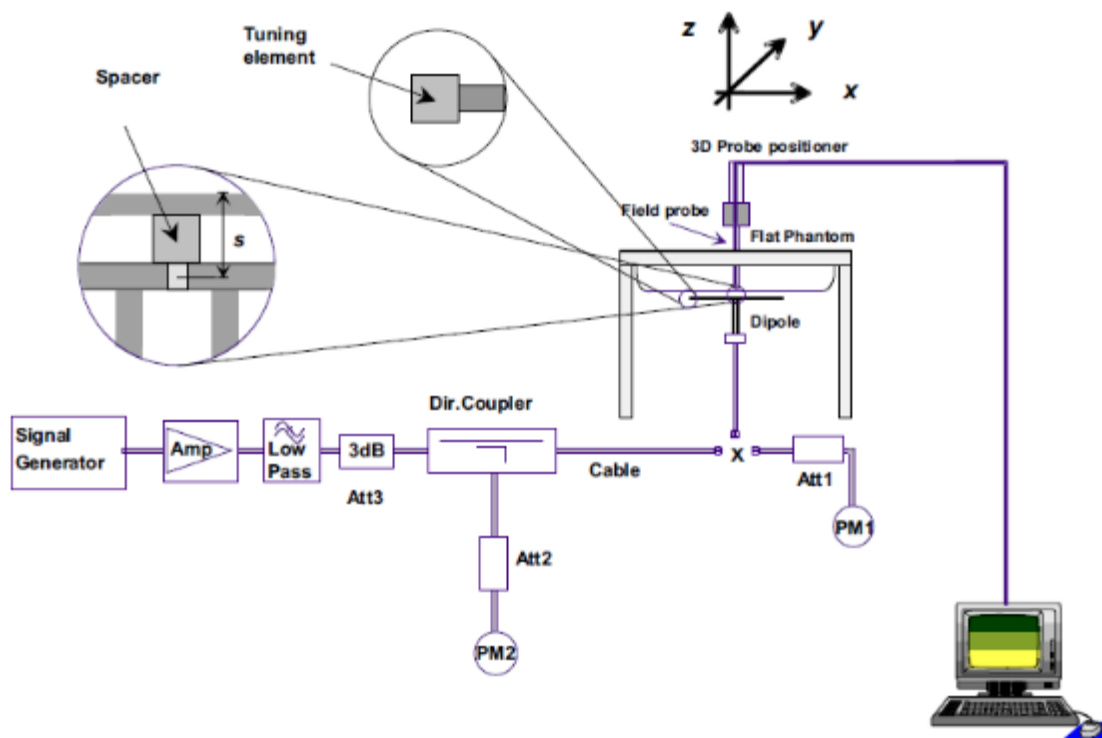
The dielectric properties for this Tissue Simulate Liquids were measured by using the DAKS. The Conductivity ( $\sigma$ ) and Permittivity ( $\rho$ ) are listed in bellow table. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was  $22\pm2^{\circ}\text{C}$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

| Tissue Type | Measured Frequency (MHz) | Target Tissue ( $\pm 5\%$ ) |                      | Measured Tissue |                      | Liquid Temp. ( $^{\circ}\text{C}$ ) | Measured Date      |
|-------------|--------------------------|-----------------------------|----------------------|-----------------|----------------------|-------------------------------------|--------------------|
|             |                          | $\epsilon_r$                | $\sigma(\text{S/m})$ | $\epsilon_r$    | $\sigma(\text{S/m})$ |                                     |                    |
| 2450 Head   | 2450                     | 39.2<br>(37.24~41.16)       | 1.8<br>(1.71~1.89)   | 40.454          | 1.754                | 22.6                                | September 17, 2026 |

Table 2: Measurement result of Tissue electric parameters

## 5.2. SAR System Check

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



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

### 5.2.1. Justification for Extended SAR Dipole Calibrations

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

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

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

D2450V2 SN 808 Extend Dipole Calibrations

| Date of Measurement | Return-Loss (dB) | Delta (%) | Real Impedance (ohm) | Delta (ohm) | Imaginary Impedance (ohm) | Delta (ohm) |
|---------------------|------------------|-----------|----------------------|-------------|---------------------------|-------------|
| 2026-08-19          | -25.6            |           | 52.6                 |             | 4.71                      |             |



5.2.2. Summary System Check Result(s)

| Validation Kit |      | Measured SAR 100mW | Measured SAR 100mW | Measured SAR (normalized to 1W) | Measured SAR (normalized to 1W) | Target SAR (normalized to 1W) (±10%) | Target SAR (normalized to 1W) (±10%) | Liquid Temp. (°C) | Measured Date      |
|----------------|------|--------------------|--------------------|---------------------------------|---------------------------------|--------------------------------------|--------------------------------------|-------------------|--------------------|
|                |      | 1g (W/kg)          | 10g (W/kg)         | 1g (W/kg)                       | 10g (W/kg)                      | 1-g(W/kg)                            | 10-g(W/kg)                           |                   |                    |
| D2450V2        | Head | 5.36               | 2.35               | 53.60                           | 23.50                           | 52.8 (47.52~58.08)                   | 25.0 (22.50~27.50)                   | 22.6              | September 17, 2026 |

Table 3: Please see the Appendix A



## 6. SAR measurement procedure

The measurement procedures are as follows:

### 6.1. Conducted power measurement

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

### 6.2. WIFI Test Configuration

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

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

#### 2.4 GHz and 5GHz SAR Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is



required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are described in section 5.2.2.

#### 1. 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- a. When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- b. When the reported SAR is  $> 0.8$  W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.

#### 1. 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3). SAR is not required for the following 2.4 GHz OFDM conditions.

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

#### 2. SAR Test Requirements for OFDM Configurations

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

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

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

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

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

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

#### Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in



each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration. For next to the ear, hotspot mode and UMC mini-table exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode.<sup>23</sup> For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration. When the reported SAR of the initial test configuration is  $> 0.8 \text{ W/kg}$ , SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is  $\leq 1.2 \text{ W/kg}$  or all required channels are tested.

#### 4. Subsequent Test Configuration Procedures

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

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

## 6.3. Power Reduction

The product without any power reduction.

## 6.4. Power Drift

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



## 7. TEST CONDITIONS AND RESULTS

### 7.1. Conducted Power Results

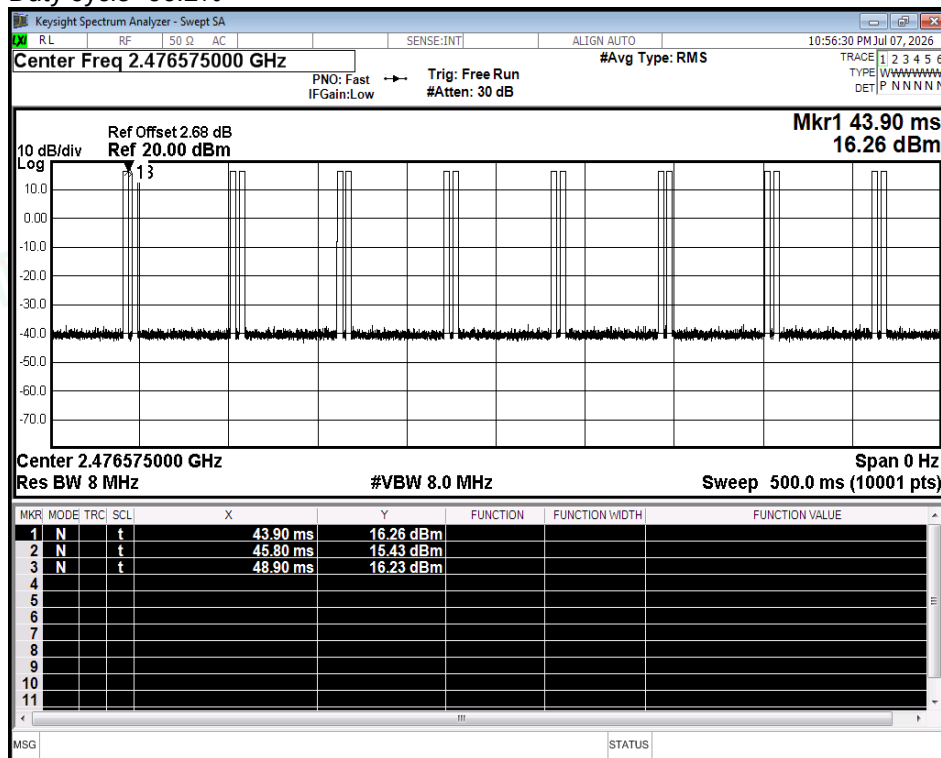
According KDB 447498 D01 General RF Exposure Guidance v06 Section 4.1 2) states that “Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies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

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

| Condition | Mode | Frequency (MHz) | Antenna | Conducted Power (dBm) | Tune Up (dBm) |
|-----------|------|-----------------|---------|-----------------------|---------------|
| NVNT      | 2.4G | 2402            | Ant1    | 14.07                 | 16.00         |
| NVNT      | 2.4G | 2441            | Ant1    | 14.17                 | 16.00         |
| NVNT      | 2.4G | 2480            | Ant1    | 15.01                 | 16.00         |

#### 2.4G:

Duty cycle=66.2%





## 7.2. SAR Measurement Results

The calculated SAR is obtained by the following formula:

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

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

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

+Where

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

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

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

Reported SAR which including Power Drift and Scaling factor

### 7.2.1. SAR Results [2.4G]

| SAR Values [2.4G]                      |              |                  |            |                             |                                      |                        |                   |                                  |          |
|----------------------------------------|--------------|------------------|------------|-----------------------------|--------------------------------------|------------------------|-------------------|----------------------------------|----------|
| Ch/<br>Freq. (MHz)                     | Test<br>Mode | Test<br>Position | Duty Cycle | Conducted<br>Power<br>(dBm) | Maximum<br>Allowed<br>Power<br>(dBm) | Power<br>Drift<br>(dB) | Scaling<br>Factor | SAR <sub>1-g</sub> results(W/kg) |          |
|                                        |              |                  |            |                             |                                      |                        |                   | Measured                         | Reported |
| measured / reported SAR numbers – Head |              |                  |            |                             |                                      |                        |                   |                                  |          |
| 78/2480                                | MSK          | Head             | 1.511      | 15.01                       | 16.00                                | 0.08                   | 1.256             | 0.318                            | 0.603    |

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.



Appendix A: Detailed System Check Results

Appendix B: Detailed Test Results

Appendix C: Calibration certificate

Appendix D: Photographs

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