



## **SAR EVALUATION REPORT**

**FCC 47 CFR § 2.1093  
IEEE Std. 1528-2013  
RSS-102 Issue 5  
IEC/IEEE 62209-1528:2020**

**For  
Portable Bluetooth Speaker**

**FCC ID: APIGOED  
IC: 6132A-GOED**

**Model: GO ESSENTIALD**

**Report Number: 4790911486-SAR-1**

**Issue Date: Jun. 29, 2023**

**Prepared for  
Harman International Industries, Inc.  
8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES**

**Prepared by  
UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch  
Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech  
Development Zone Dongguan, People's Republic of China**

**Tel: +86 769 22038881  
Fax: +86 769 33244054  
Website: [www.ul.com](http://www.ul.com)**



### Revision History

| Rev. | Date         | Revisions     | Revised By |
|------|--------------|---------------|------------|
| V1.0 | Jun 29, 2023 | Initial Issue | \          |
|      |              |               |            |
|      |              |               |            |

1. The Measurement result for the sample received is<Pass> according to < IEEE Std. 1528-2013> < RSS-102 Issue 5> when <Accuracy Method> decision rule is applied.
2. This report is only published to and used by the applicant, and it is not for evidence purpose in China.



## Table of Contents

|                                                 |                                                                      |           |
|-------------------------------------------------|----------------------------------------------------------------------|-----------|
| <b>1.</b>                                       | <b>Attestation of Test Results .....</b>                             | <b>4</b>  |
| <b>2.</b>                                       | <b>Test Specification, Methods and Procedures.....</b>               | <b>5</b>  |
| <b>3.</b>                                       | <b>Facilities and Accreditation .....</b>                            | <b>6</b>  |
| <b>4.</b>                                       | <b>SAR Measurement System &amp; Test Equipment .....</b>             | <b>7</b>  |
| 4.1.                                            | SAR Measurement System .....                                         | 7         |
| 4.2.                                            | SAR Scan Procedures .....                                            | 8         |
| 4.3.                                            | Test Equipment.....                                                  | 10        |
| <b>5.</b>                                       | <b>Measurement Uncertainty.....</b>                                  | <b>11</b> |
| 5.1.                                            | Uncertainty budget list (4MHz to 10GHz).....                         | 11        |
| <b>6.</b>                                       | <b>Device Under Test (DUT) Information .....</b>                     | <b>12</b> |
| 6.1.                                            | DUT Description .....                                                | 12        |
| 6.2.                                            | Wireless Technology.....                                             | 12        |
| 6.3.                                            | Antenna Gain.....                                                    | 12        |
| <b>7.</b>                                       | <b>Conducted Output Power Measurement and tune-up tolerance.....</b> | <b>13</b> |
| 7.1.                                            | Power measurement result Bluetooth .....                             | 13        |
| 7.2.                                            | Duty cycle .....                                                     | 14        |
| <b>8.</b>                                       | <b>Exemption Limits for Routine Evaluation for FCC .....</b>         | <b>15</b> |
| 8.1.                                            | SAR test exclusion analysis .....                                    | 15        |
| <b>9.</b>                                       | <b>Exemption Limits for Routine Evaluation for ISSED .....</b>       | <b>16</b> |
| 9.1.                                            | SAR test exclusion analysis .....                                    | 16        |
| <b>10.</b>                                      | <b>RF Exposure Conditions.....</b>                                   | <b>17</b> |
| <b>11.</b>                                      | <b>SAR Test Configuration .....</b>                                  | <b>18</b> |
| <b>12.</b>                                      | <b>Dielectric Property Measurements &amp; System Check .....</b>     | <b>19</b> |
| 12.1.                                           | Dielectric Property Measurements.....                                | 19        |
| 12.2.                                           | System Check .....                                                   | 20        |
| <b>13.</b>                                      | <b>Measured and Reported (Scaled) SAR Results.....</b>               | <b>21</b> |
| 13.1.                                           | SAR Test Results of Bluetooth .....                                  | 21        |
| <b>14.</b>                                      | <b>Simultaneous Transmission SAR Analysis.....</b>                   | <b>22</b> |
| <b>Appendixes .....</b>                         | <b>23</b>                                                            |           |
| 4790911486-SAR-1 App A Photo .....              | 23                                                                   |           |
| 4790911486-SAR-1 App B Highest Test Plots ..... | 23                                                                   |           |
| 4790911486-SAR-1 App C System Check Plots ..... | 23                                                                   |           |
| 4790911486-SAR-1 App D Cal. Certificates.....   | 23                                                                   |           |



## 1. Attestation of Test Results

|                                                                  |                                                                                                              |                                                                         |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Applicant Name                                                   | Harman International Industries, Inc.                                                                        |                                                                         |
| Address                                                          | 8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES                                                   |                                                                         |
| Manufacturer                                                     | Harman International Industries, Inc.                                                                        |                                                                         |
| Address                                                          | 8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES                                                   |                                                                         |
| EUT Name                                                         | Portable Bluetooth Speaker                                                                                   |                                                                         |
| Model                                                            | GO ESSENTIALD                                                                                                |                                                                         |
| Sample Status                                                    | Normal                                                                                                       |                                                                         |
| Sample Received Date                                             | Jun 10, 2023                                                                                                 |                                                                         |
| Date of Tested                                                   | Jun 25, 2023                                                                                                 |                                                                         |
| Applicable Standards                                             | FCC 47 CFR § 2.1093<br>IEEE Std. 1528-2013<br>KDB publication<br>RSS-102 Issue 5<br>IEC/IEEE 62209-1528:2020 |                                                                         |
| <b>SAR Limits (W/Kg)</b>                                         |                                                                                                              |                                                                         |
| Exposure Category                                                | Peak spatial-average<br>(1g of tissue)                                                                       | Extremities (hands, wrists, ankles, etc.)<br>(10g of tissue)            |
| General population /<br>Uncontrolled exposure                    | 1.6                                                                                                          | 4                                                                       |
| <b>The Highest Reported SAR (W/kg)</b>                           |                                                                                                              |                                                                         |
| <b>RF Exposure Conditions</b>                                    | <b>Equipment Class</b>                                                                                       |                                                                         |
|                                                                  | <b>DSS</b>                                                                                                   |                                                                         |
| Body(1-g)                                                        | 0.036                                                                                                        |                                                                         |
| Simultaneous Transmission                                        | /                                                                                                            |                                                                         |
| Test Results                                                     | Pass                                                                                                         |                                                                         |
| Prepared By:<br><i>Burt Hu</i><br>Burt Hu<br>Laboratory Engineer | Reviewed By:<br><i>Denny Huang</i><br>Denny Huang<br>Senior Project Engineer                                 | Approved By:<br><i>Stephen Guo</i><br>Stephen Guo<br>Laboratory Manager |



## 2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with IEEE Std.1528-2013, RSS-102 Issue 5, the following FCC Published RF exposure KDB procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02



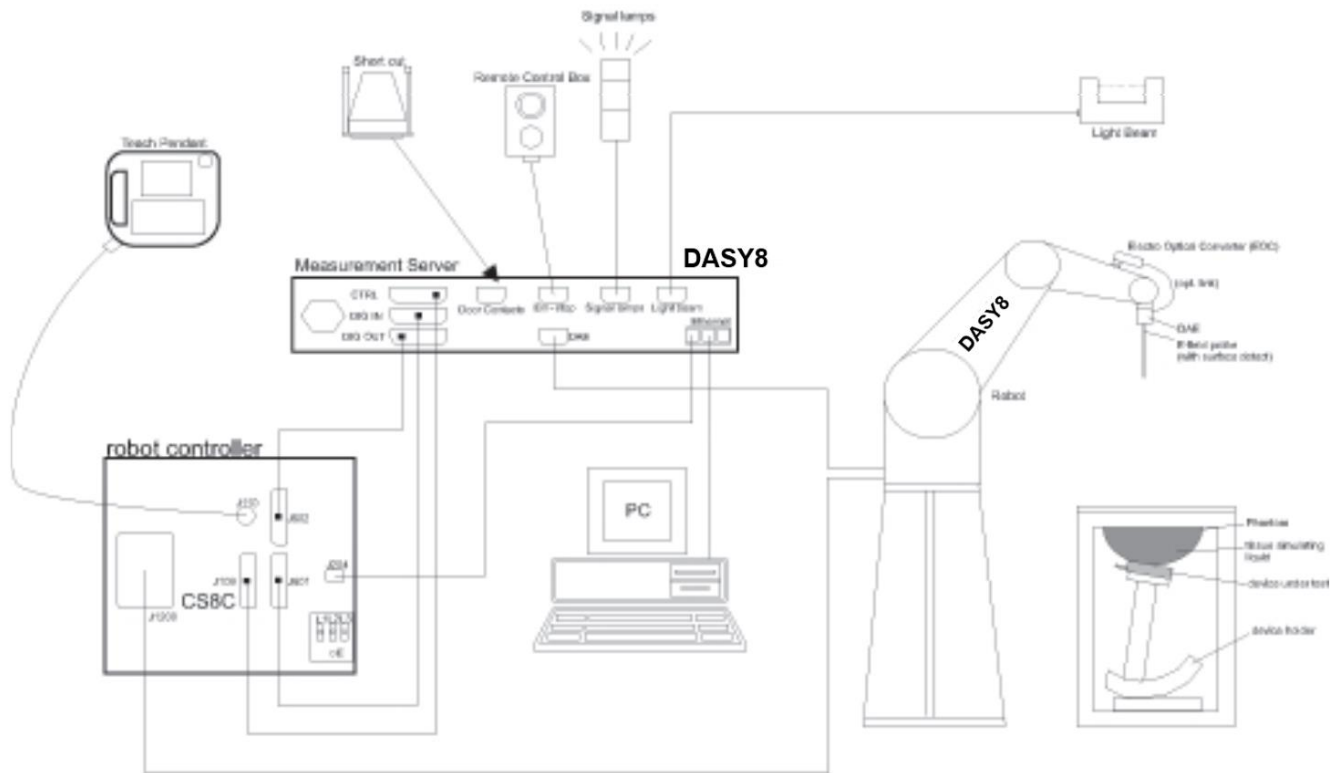
### 3. Facilities and Accreditation

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Location             | UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Address                   | Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Accreditation Certificate | <p><b>A2LA (Certificate No.: 4102.01)</b><br/>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with A2LA.</p> <p><b>FCC (FCC Recognized No.: CN1187)</b><br/>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p><b>IC(Company No.: 21320)</b><br/>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p> <p><b>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)</b><br/>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.<br/>Facility Name:<br/>Chamber D, the VCCI registration No. is G-20019 and R-20004<br/>Shielding Room B , the VCCI registration No. is C-20012 and T-20011</p> |
| Description               | All measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## 4. SAR Measurement System & Test Equipment

### 4.1. SAR Measurement System

The DASY8 system used 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 amplification, 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 Win10 and the DASY8 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.



## 4.2. 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 2.1 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 Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

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° $\pm$ 1°                                                                                                                                                                                                                                                           | 20° $\pm$ 1°                                            |
| Maximum area scan spatial resolution: $\Delta x_{\text{Area}}$ , $\Delta y_{\text{Area}}$              | $\leq 2$ 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**

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 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>$5 - 6 \text{ GHz}: \geq 22 \text{ mm}$ |

**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.

**Step 5: Z-Scan (FCC only)**

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.



### 4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

| Name of equipment             | Manufacturer         | Type/Model             | Serial No. | Cal. Due Date |
|-------------------------------|----------------------|------------------------|------------|---------------|
| ENA Network Analyzer          | Keysight             | E5080A                 | MY55100583 | 2023.10.16    |
| Dielectric Probe kit          | SPEAG                | SM DAK 040 SA          | 1155       | 2025.02.27    |
| DC power supply               | Keysight             | E36103A                | MY55350020 | 2023.10.16    |
| Signal Generator              | Rohde & Schwarz      | SME06                  | 837633\001 | 2023.08.14    |
| BI-Directional Coupler        | KRYTAR               | 1850                   | 54733      | 2023.10.16    |
| Peak and Average Power Sensor | Keysight             | E9325A                 | MY62220002 | 2023.10.25    |
| Peak and Average Power Sensor | Keysight             | E9325A                 | MY62220003 | 2023.10.25    |
| Dual Channel PK Power Meter   | Keysight             | N1912A                 | MY55416024 | 2023.10.16    |
| Amplifier                     | CORAD TECHNOLOGY LTD | AMF-4D-00400600-50-30P | 1983561    | NCR           |
| Dosimetric E-Field Probe      | SPEAG                | EX3DV4                 | 7733       | 2023.08.01    |
| Data Acquisition Electronic   | SPEAG                | DAE4                   | 1739       | 2023.07.28    |
| Dipole Kit 2450 MHz           | SPEAG                | D2450V2                | 977        | 2024.12.16    |
| Software                      | SPEAG                | DASY8                  | N/A        | NCR           |
| ELI Phantom                   | SPEAG                | ELI V8.0               | 2178       | NCR           |
| Thermometer                   | /                    | GX-138                 | 150709653  | 2023.10.21    |
| Thermometer                   | VICTOR               | ITHX-SD-5              | 18470005   | 2023.10.21    |

**Note:**

1) Per KDB865664D01 v01r04 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. 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;
- The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
- The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

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



## 5. Measurement Uncertainty

### 5.1. Uncertainty budget list (4MHz to 10GHz).

| Symbol                                                | Input quantity $X_i$<br>(source of uncertainty)                          | Unc.<br>( $\pm$ ) | Prob.<br>Dist.<br>$PDF_i$ | Unc.<br>$a(x_i)$ | $C_i$<br>(1g) | $C_i$<br>(10g) | $U_i$<br>(1g)<br>(%) | $U_i$<br>(10g)<br>(%) |
|-------------------------------------------------------|--------------------------------------------------------------------------|-------------------|---------------------------|------------------|---------------|----------------|----------------------|-----------------------|
| Measurement system errors                             |                                                                          |                   |                           |                  |               |                |                      |                       |
| $CF$                                                  | Probe calibration                                                        | 18.6              | N<br>( $k = 2$ )          | 2                | 1             | 1              | 9.3                  | 9.3                   |
| $CF_{drift}$                                          | Probe calibration drift                                                  | 1.7               | R                         | $\sqrt{3}$       | 1             | 1              | 1.0                  | 1.0                   |
| $LIN$                                                 | Probe linearity and detection limit                                      | 0.6               | R                         | $\sqrt{3}$       | 1             | 1              | 0.3                  | 0.3                   |
| $BBS$                                                 | Broadband signal                                                         | 0.5               | R                         | $\sqrt{3}$       | 1             | 1              | 0.3                  | 0.3                   |
| $ISO$                                                 | Probe isotropy                                                           | 0.5               | R                         | $\sqrt{3}$       | 1             | 1              | 0.3                  | 0.3                   |
| $DAE$                                                 | Other probe and data acquisition errors                                  | 2.4               | N                         | 1                | 1             | 1              | 2.4                  | 2.4                   |
| $AMB$                                                 | RF ambient and noise                                                     | 3.0               | R                         | $\sqrt{3}$       | 1             | 1              | 1.7                  | 1.7                   |
| $\Delta_{xyz}$                                        | Probe positioning errors                                                 | 0.5               | N                         | 1                | 0.33          | 0.33           | 0.2                  | 0.2                   |
| $DAT$                                                 | Data processing errors                                                   | 4.0               | R                         | $\sqrt{3}$       | 1             | 1              | 2.3                  | 2.3                   |
| Phantom and device (DUT or validation antenna) errors |                                                                          |                   |                           |                  |               |                |                      |                       |
| $LIQ(\sigma)$                                         | Measurement of phantom conductivity( $\sigma$ )                          | 2.5               | N                         | 1                | 0.78          | 0.71           | 2.0                  | 1.8                   |
| $LIQ(T_c)$                                            | Temperature effects (medium)                                             | 2.7               | R                         | $\sqrt{3}$       | 0.78          | 0.71           | 1.2                  | 1.1                   |
| $EPS$                                                 | Shell permittivity                                                       | 14.0              | R                         | $\sqrt{3}$       | 0.5           | 0.5            | 4.0                  | 4.0                   |
| $DIS$                                                 | Distance between the radiating element of the DUT and the phantom medium | 2.0               | N                         | 1                | 2             | 2              | 4.0                  | 4.0                   |
| $D_{xyz}$                                             | Repeatability of positioning the DUT or source against the phantom       | 2.9               | N                         | 1                | 1             | 1              | 2.9                  | 2.9                   |
| $H$                                                   | Device holder effects                                                    | 3.6               | N                         | 1                | 1             | 1              | 3.6                  | 3.6                   |
| $MOD$                                                 | Effect of operating mode on probe sensitivity                            | 2.4               | R                         | $\sqrt{3}$       | 1             | 1              | 1.4                  | 1.4                   |
| $TAS$                                                 | Time-average SAR                                                         | 0.0               | R                         | $\sqrt{3}$       | 1             | 1              | 0.0                  | 0.0                   |
| $RF_{drift}$                                          | Variation in SAR due to drift in output of DUT                           | 2.5               | N                         | 1                | 1             | 1              | 2.5                  | 2.5                   |
| $VAL$                                                 | Validation antenna uncertainty (validation measurement only)             | 0.0               | N                         | 1                | 1             | 1              | 0.0                  | 0.0                   |
| $P_{in}$                                              | Uncertainty in accepted power (validation measurement only)              | 0.0               | N                         | 1                | 1             | 1              | 0.0                  | 0.0                   |
| Corrections to the SAR result (if applied)            |                                                                          |                   |                           |                  |               |                |                      |                       |
| $C(\epsilon', \sigma)$                                | Phantom deviation from target ( $\epsilon', \sigma$ )                    | 1.9               | N                         | 1                | 1             | 0.84           | 1.9                  | 1.6                   |
| $C(R)$                                                | SAR scaling                                                              | 0.0               | R                         | $\sqrt{3}$       | 1             | 1              | 0.0                  | 0.0                   |
| $u(\Delta SAR)$                                       | Combined uncertainty                                                     | \                 |                           |                  |               |                | 14.36                | 14.26                 |
| $U$                                                   | Expanded uncertainty and effective degrees of freedom ( $k = 2$ )        | \                 |                           |                  |               |                | 28.73                | 28.53                 |



## 6. Device Under Test (DUT) Information

### 6.1. DUT Description

|                                                                  |                                                               |
|------------------------------------------------------------------|---------------------------------------------------------------|
| EUT is a portable speaker with BT/BLE 2.4GHz wireless technology |                                                               |
| Dimension                                                        | Overall (Length x Width x Height): 85.8 mm x 71.2mm x 28.5 mm |
| Accessory                                                        | None                                                          |

### 6.2. Wireless Technology

| Wireless technology | Frequency band |
|---------------------|----------------|
| BT                  | 2.4 GHz        |
| BLE                 | 2.4 GHz        |

### 6.3. Antenna Gain

| Antenna type | Band    | Gain(dBi) |
|--------------|---------|-----------|
| PCB          | 2.4 GHz | 2.58      |

## 7. Conducted Output Power Measurement and tune-up tolerance

### 7.1. Power measurement result Bluetooth

| Test Mode | Channel/<br>frequency | Average Conducted Power (dBm) | Tune-up(dBm) | Duty Cycle (%) |
|-----------|-----------------------|-------------------------------|--------------|----------------|
| DH5       | 0/2402                | 3.03                          | 3.5          | /              |
|           | 39/2441               | 2.94                          | 3.5          |                |
|           | 78/2480               | 3.37                          | 3.5          |                |
| 2DH5      | 0/2402                | 3.11                          | 4.0          | /              |
|           | 39/2441               | 3.59                          | 4.0          |                |
|           | 78/2480               | 3.74                          | 4.0          |                |
| 3DH5      | 0/2402                | 3.26                          | 5.0          | 77.07          |
|           | 39/2441               | 3.82                          | 5.0          |                |
|           | 78/2480               | 4.14                          | 5.0          |                |
| BLE 1M    | 0/2402                | 1.69                          | 2.0          | /              |
|           | 19/2440               | 2.96                          | 4.0          |                |
|           | 39/2480               | 3.68                          | 4.0          |                |

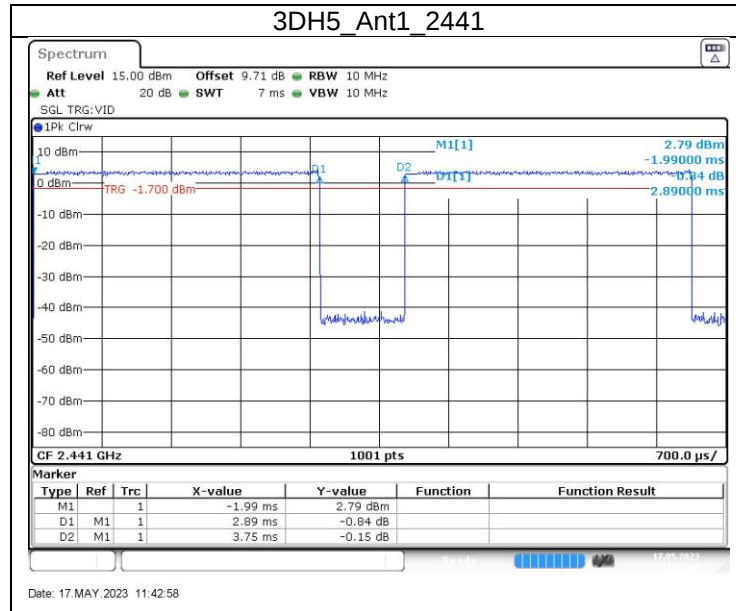
Note:

- 1) The output power of the device was set to transmit at maximum power for all tests.
- 2) The maximum output power mode 3DH5 was selected as the primary mode to test SAR for Bluetooth mode. SAR measurement is not required for the other modes, when the secondary mode is  $\leq 0.25$  dB higher than the primary mode.
- 3) As per KDB 447498 D04 sec.4.1.d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.



## 7.2. Duty cycle

| Test Mode | On Time (msec) | Period (msec) | Duty Cycle x (Linear) | Duty Cycle (%) |
|-----------|----------------|---------------|-----------------------|----------------|
| 3DH5      | 2.89           | 3.75          | 0.7707                | 77.07          |





## 8. Exemption Limits for Routine Evaluation for FCC

According to KDB 447498 D04 V01, at separation distance of  $\leq 5\text{mm}$ , the corresponding exemption limit for 2450MHz is: 3 mW, so the SAR evaluation for Bluetooth is required.

Table B.2—Example Power Thresholds (mW)

| Frequency (MHz) | Distance (mm) |    |    |    |     |     |     |     |     |     |     |
|-----------------|---------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|
|                 |               | 5  | 10 | 15 | 20  | 25  | 30  | 35  | 40  | 45  | 50  |
|                 | 300           | 39 | 65 | 88 | 110 | 129 | 148 | 166 | 184 | 201 | 217 |
|                 | 450           | 22 | 44 | 67 | 89  | 112 | 135 | 158 | 180 | 203 | 226 |
|                 | 835           | 9  | 25 | 44 | 66  | 90  | 116 | 145 | 175 | 207 | 240 |
|                 | 1900          | 3  | 12 | 26 | 44  | 66  | 92  | 122 | 157 | 195 | 236 |
|                 | 2450          | 3  | 10 | 22 | 38  | 59  | 83  | 111 | 143 | 179 | 219 |
|                 | 3600          | 2  | 8  | 18 | 32  | 49  | 71  | 96  | 125 | 158 | 195 |
|                 | 5800          | 1  | 6  | 14 | 25  | 40  | 58  | 80  | 106 | 136 | 169 |

### 8.1. SAR test exclusion analysis

| Test Mode | Frequency (MHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Threshold | SAR Test |
|-----------|-----------------|-------------|------------|--------------------------|-----------|----------|
| BT 3DH5   | 2480            | 5           | 3.16       | 5.00                     | 3.0       | Required |

## 9. Exemption Limits for Routine Evaluation for ISED

| Frequency (MHz) | Exemption Limits (mW)                 |                                 |                                 |                                 |                                 |
|-----------------|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                 | At separation distance of $\leq 5$ mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| $\leq 300$      | 71 mW                                 | 101 mW                          | 132 mW                          | 162 mW                          | 193 mW                          |
| 450             | 52 mW                                 | 70 mW                           | 88 mW                           | 106 mW                          | 123 mW                          |
| 835             | 17 mW                                 | 30 mW                           | 42 mW                           | 55 mW                           | 67 mW                           |
| 1900            | 7 mW                                  | 10 mW                           | 18 mW                           | 34 mW                           | 60 mW                           |
| 2450            | 4 mW                                  | 7 mW                            | 15 mW                           | 30 mW                           | 52 mW                           |
| 3500            | 2 mW                                  | 6 mW                            | 16 mW                           | 32 mW                           | 55 mW                           |
| 5800            | 1 mW                                  | 6 mW                            | 15 mW                           | 27 mW                           | 41 mW                           |

| Frequency (MHz) | Exemption Limits (mW)           |                                 |                                 |                                 |                                        |
|-----------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------------------------------|
|                 | At separation distance of 30 mm | At separation distance of 35 mm | At separation distance of 40 mm | At separation distance of 45 mm | At separation distance of $\geq 50$ mm |
| $\leq 300$      | 223 mW                          | 254 mW                          | 284 mW                          | 315 mW                          | 345 mW                                 |
| 450             | 141 mW                          | 159 mW                          | 177 mW                          | 195 mW                          | 213 mW                                 |
| 835             | 80 mW                           | 92 mW                           | 105 mW                          | 117 mW                          | 130 mW                                 |
| 1900            | 99 mW                           | 153 mW                          | 225 mW                          | 316 mW                          | 431 mW                                 |
| 2450            | 83 mW                           | 123 mW                          | 173 mW                          | 235 mW                          | 309 mW                                 |
| 3500            | 86 mW                           | 124 mW                          | 170 mW                          | 225 mW                          | 290 mW                                 |
| 5800            | 56 mW                           | 71 mW                           | 85 mW                           | 97 mW                           | 106 mW                                 |

### 9.1. SAR test exclusion analysis

According to RSS-102 issue 5, at separation distance of  $\leq 5$ mm, the corresponding exemption limit for 2450MHz is: 4 mW, so the SAR evaluation for Bluetooth is required.

| Test Mode | Frequency (MHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Threshold | SAR Test |
|-----------|-----------------|-------------|------------|--------------------------|-----------|----------|
| BT 3DH5   | 2480            | 7.58        | 5.73       | 5.00                     | 4.0       | Required |

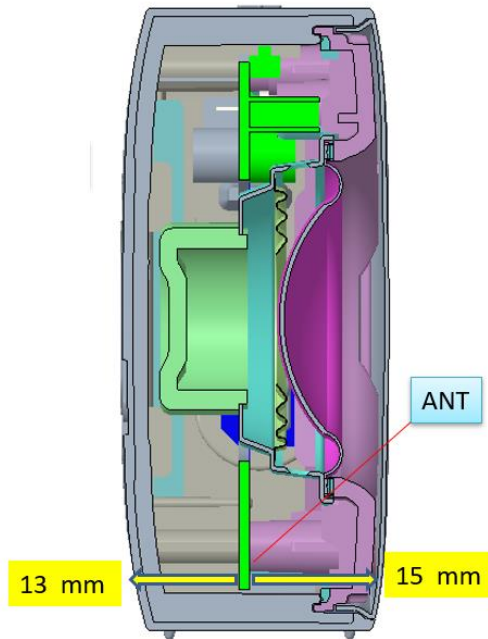
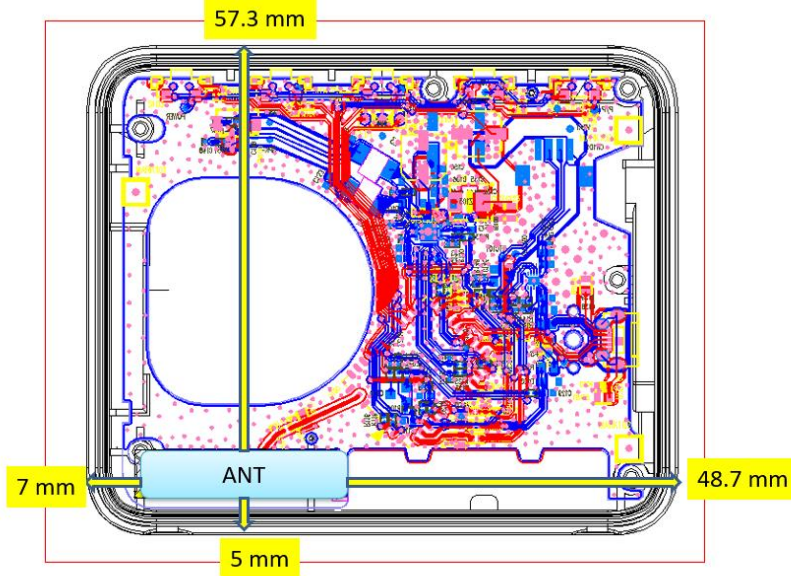
Note:

- As per RSS-102 issue 5, output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

## 10. RF Exposure Conditions

Distance from the antenna to the edge of the product

**Antenna location diagram**





## 11. SAR Test Configuration

EUT is a portable speaker that may be very close to the body when used, so it is necessary to consider a 1g body SAR (5mm) assessment.



## 12. Dielectric Property Measurements & System Check

### 12.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within  $\pm 2^\circ\text{C}$  of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

#### Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

| Target Frequency (MHz) | Head         |                | Body         |                |
|------------------------|--------------|----------------|--------------|----------------|
|                        | $\epsilon_r$ | $\sigma$ (S/m) | $\epsilon_r$ | $\sigma$ (S/m) |
| 150                    | 52.3         | 0.76           | 61.9         | 0.80           |
| 300                    | 45.3         | 0.87           | 58.2         | 0.92           |
| 450                    | 43.5         | 0.87           | 56.7         | 0.94           |
| 835                    | 41.5         | 0.90           | 55.2         | 0.97           |
| 900                    | 41.5         | 0.97           | 55.0         | 1.05           |
| 915                    | 41.5         | 0.98           | 55.0         | 1.06           |
| 1450                   | 40.5         | 1.20           | 54.0         | 1.30           |
| 1610                   | 40.3         | 1.29           | 53.8         | 1.40           |
| 1800 – 2000            | 40.0         | 1.40           | 53.3         | 1.52           |
| 2450                   | 39.2         | 1.80           | 52.7         | 1.95           |
| 3000                   | 38.5         | 2.40           | 52.0         | 2.73           |
| 5000                   | 36.2         | 4.45           | 49.3         | 5.07           |
| 5100                   | 36.1         | 4.55           | 49.1         | 5.18           |
| 5200                   | 36.0         | 4.66           | 49.0         | 5.30           |
| 5300                   | 35.9         | 4.76           | 48.9         | 5.42           |
| 5400                   | 35.8         | 4.86           | 48.7         | 5.53           |
| 5500                   | 35.6         | 4.96           | 48.6         | 5.65           |
| 5600                   | 35.5         | 5.07           | 48.5         | 5.77           |
| 5700                   | 35.4         | 5.17           | 48.3         | 5.88           |
| 5800                   | 35.3         | 5.27           | 48.2         | 6.00           |

#### IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

#### Dielectric Property Measurements Results:

| Liquid    | Freq. | Liquid Parameters |      |                |      | Delta(%)       |      | Limit (%) | Temp. (°C) | Test Date |
|-----------|-------|-------------------|------|----------------|------|----------------|------|-----------|------------|-----------|
|           |       | Measured          |      | Target         |      |                |      |           |            |           |
|           |       | ϵ <sub>r</sub>    | σ    | ϵ <sub>r</sub> | σ    | ϵ <sub>r</sub> | σ    |           |            |           |
| Head 2450 | 2360  | 40.40             | 1.72 | 39.36          | 1.72 | 2.64           | 0.00 | ±5        | 21.6       | 2023.6.25 |
|           | 2450  | 40.30             | 1.83 | 39.20          | 1.80 | 2.81           | 1.67 |           |            |           |
|           | 2540  | 39.80             | 1.93 | 39.09          | 1.90 | 1.82           | 1.58 |           |            |           |



## 12.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be conEdgered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

### System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness:  $2.0 \pm 0.2$  mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be  $\geq 15.0$  cm for SAR measurements  $\leq 3$  GHz and  $\geq 10.0$  cm for measurements  $> 3$  GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long Edge of the phantom). The standard measuring distance was 10mm (above 1GHz) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension( $\leq 2$ GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan,  $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}} \leq 2$ GHz -  $\leq 8$ mm, 2-4GHz -  $\leq 5$  mm and 4-6 GHz- $\leq 4$ mm;  $\Delta z_{\text{zoom}} \leq 3$ GHz -  $\leq 5$  mm, 3-4 GHz-  $\leq 4$ mm and 4-6GHz- $\leq 2$ mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- The results are normalized to 1 W input power.

### System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

| T.S. Liquid |      | Measured Results    |                           | Target<br>(Ref. value) | Delta<br>(%) | Limit<br>(%) | Temp.<br>(°C) | Test Date |
|-------------|------|---------------------|---------------------------|------------------------|--------------|--------------|---------------|-----------|
|             |      | Zoom Scan<br>(W/Kg) | Normalize to<br>1W (W/Kg) |                        |              |              |               |           |
| Head 2450   | 1-g  | 12.700              | 50.80                     | 53.20                  | -4.51        | $\pm 10$     | 21.6          | 2023.6.25 |
|             | 10-g | 5.940               | 23.76                     | 24.20                  | -1.82        | $\pm 10$     |               |           |



### 13. Measured and Reported (Scaled) SAR Results

#### 13.1. SAR Test Results of Bluetooth

| Scenario and Distance<br>(Body 5mm) | Test Mode | Channel/<br>Frequency | Power (dBm) |       | SAR Value     | Power<br>Drift | Duty<br>Factor<br>(%) | Scaled<br>(W/Kg) |
|-------------------------------------|-----------|-----------------------|-------------|-------|---------------|----------------|-----------------------|------------------|
|                                     |           |                       | Tune-up     | Meas. | 1-g<br>(W/Kg) |                |                       |                  |
| Front surface                       | BT 3DH5   | 2480                  | 5.0         | 4.14  | <0.01         | 0.00           | 77.07                 | <0.01            |
| Back surface                        | BT 3DH5   | 2480                  | 5.0         | 4.14  | <0.01         | 0.00           | 77.07                 | <0.01            |
| Left Edge                           | BT 3DH5   | 2480                  | 5.0         | 4.14  | 0.016         | 0.07           | 77.07                 | 0.025            |
| Right Edge                          | BT 3DH5   | 2480                  | 5.0         | 4.14  | <0.01         | 0.00           | 77.07                 | <0.01            |
| Top Edge                            | BT 3DH5   | 2480                  | 5.0         | 4.14  | <0.01         | 0.00           | 77.07                 | <0.01            |
| Bottom Edge                         | BT 3DH5   | 2480                  | 5.0         | 4.14  | <0.01         | 0.00           | 77.07                 | <0.01            |
| Left Edge                           | BT 3DH5   | 2402                  | 5.0         | 3.26  | 0.011         | 0.16           | 77.07                 | 0.021            |
| Left Edge                           | BT 3DH5   | 2441                  | 5.0         | 3.82  | 0.021         | -0.07          | 77.07                 | 0.036            |



#### **14. Simultaneous Transmission SAR Analysis**

Per KDB 447498 D04, SAR compliance for simultaneous transmission must be configured when the maximum duration of overlapping transmissions, including network hand-offs, is greater than 30 seconds. This device could not contain multiple transmitters that may operate simultaneously, and therefore no requires a simultaneous transmission analysis.



## Appendixes

Refer to separated files for the following appendixes.

4790911486-SAR-1 App A Photo

4790911486-SAR-1 App B Highest Test Plots

4790911486-SAR-1 App C System Check Plots

4790911486-SAR-1 App D Cal. Certificates

-----End of Report-----