# SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093**
**IEC/IEEE 62209-1528:2020**

*For*
**Wireless Charger**

**FCC ID: 2ADNG-YND1800**
**Model Name: YND-1800**

**Report Number: R15339687-S1**
**Issue Date: 2024-08-15**

*Prepared for*
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ACCREDITED
CERT #0751.06

**Revision History**

| Rev. | Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 2024-07-03 | Initial Issue | -- |
| V2 | 2024-08-15 | Updated §1 equipment class to DTS. | Lindsay Ryan |
| | | | |
| | | | |

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# 1. Attestation of Test Results

| | | |
|---|---|---|
| Applicant Name | Energous Corporation | |
| FCC ID | 2ADNG-YND1800 | |
| Model Name | YND-1800 | |
| Applicable Standards | Published RF exposure KDB procedures<br>IEC/IEEE 62209-1528:2020 | |
| Exposure Category | SAR Limits (W/Kg) | |
| | Peak spatial-average<br>(1g of tissue) | |
| General population / Uncontrolled exposure | 1.6 | |
| RF Exposure Conditions | Equipment Class - Highest Reported SAR (W/kg) | |
| | 8CC | DTS |
| Body-worn | 1.023 | 0.528 |
| Simultaneous TX | 1.551 | 1.551 |
| Date Tested | 2024-06-10 to 2024-06-12 | |
| Test Results | Pass | |

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the U.S. Government.

| Approved & Released By: | Prepared By: |
|---|---|
| Richard Jankovics | Lindsay Ryan |
| Operations Leader<br>UL LLC | Engineer<br>UL LLC |

# 2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEC/IEEE 62209-1528:2020, the following FCC Published RF exposure KDB procedures:

- 447498 D01 General RF Exposure Guidance v06
- 447498 D03 Supplement C Cross-Reference v01
- 680106 D01 RF Exposure Wireless Charging Apps v04
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

In addition to the above, the following information was used:

- TCB Workshop October 2016; RF Exposure Procedures (DUT Holder Perturbations)
- TCB Workshop April 2019; RF Exposure Procedures (Tissue Simulating Liquids (TSL))

# 3. Facilities and Accreditation

UL LLC is accredited by A2LA, cert. # 0751.06 for all testing performed within the scope of this report. Testing was performed at the locations noted below.

The test sites and measurement facilities used to collect data are located at 2800 Perimeter Park Dr, Morrisville, NC, USA.

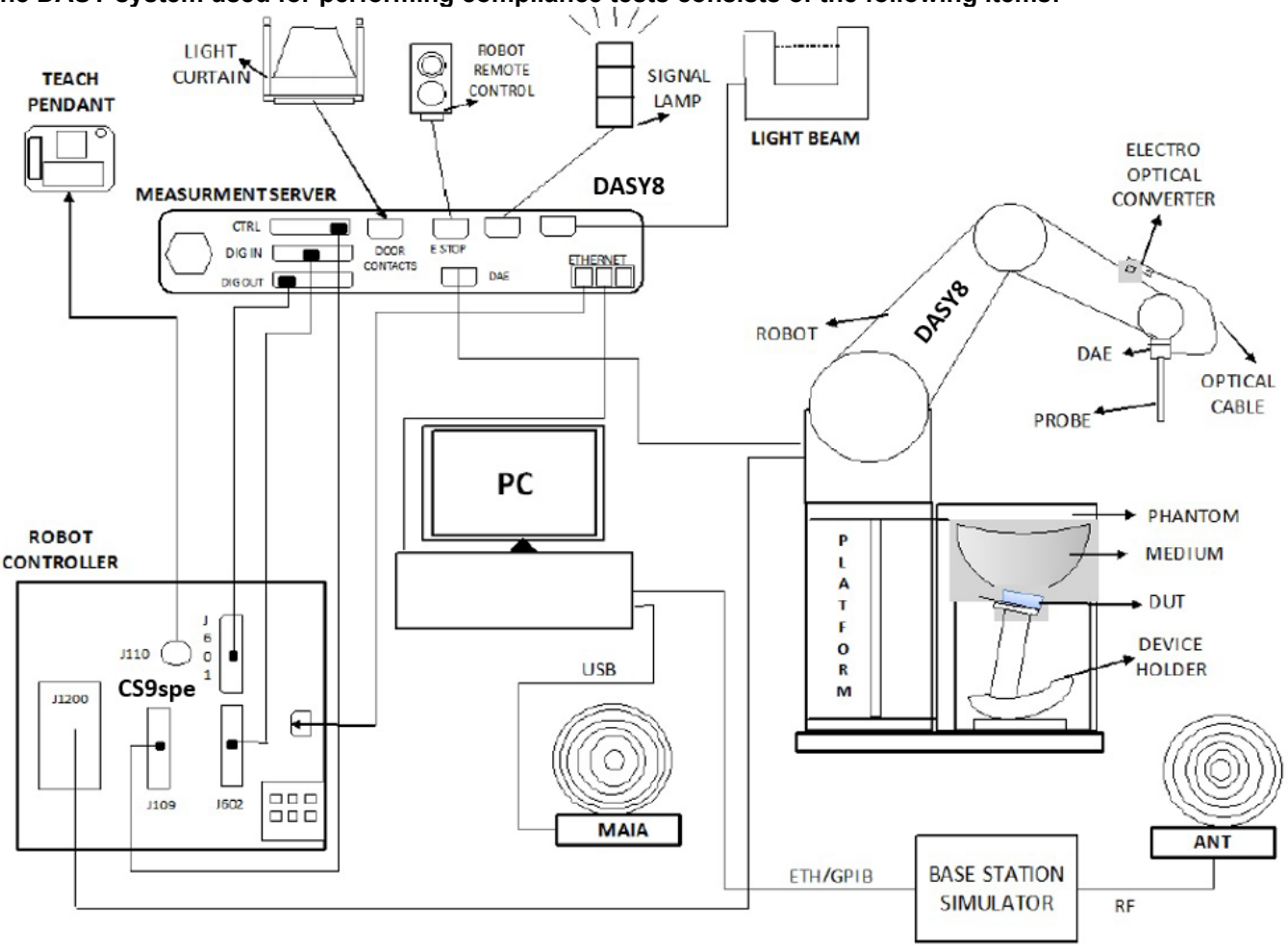
- SAR Lab 2A

| | Address | ISED CABID | ISED Company Number | FCC Registration |
|---|---|---|---|---|
| ☐ | Building:<br>12 Laboratory Dr<br>RTP, NC 27709, U.S.A | US0067 | 2180C | 825374 |
| ☒ | Building:<br>2800 Perimeter Park Dr. Suite B<br>Morrisville, NC 27560, U.S.A | US0067 | 27265 | 825374 |

# 4. SAR Measurement System & Test Equipment

## 4.1. SAR Measurement System

**The DASY 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[1] 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.

[1] DASY8 software used: DASY16.2.4.2524 and older generations.

## 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 IEC/IEEE 62209-1528, 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

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 ± 1 mm | ½·δ·ln(2) ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |

**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

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$</td><td>≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.<br>* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

**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.

## 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.

**Dielectric Property Measurements**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| Network Analyzer | Keysight | E5063A | MY54100681 | 2023-08-04 | 2024-08-04 |
| Dielectric Probe | SPEAG | DAKS-3.5 | 1051 | 2023-10-25 | 2024-10-25 |
| Shorting Block | SPEAG | DAK-3.5 Short | SM DAK 200 DA | 2023-10-25 | 2024-10-25 |
| Thermometer | Fisher Scientific | 15-078-181 | 1817705017 | 2024-03-29 | 2026-03-29 |

**System Check**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| Signal Generator | Keysight | N5181A | MY50140788 | 2023-08-03 | 2024-08-03 |
| RF Power Meter | Keysight | N1912A | MY55136012 | 2023-08-04 | 2024-08-04 |
| RF Power Sensor | Keysight | N1921A | MY55090025 | 2023-08-21 | 2024-08-21 |
| RF Power Sensor | Keysight | N1921A | MY55090030 | 2023-06-26 | 2024-06-26 |
| Amplifier | Mini-Circuits | ZVA-183WA-S+ | S C484802241 | N/A | N/A |
| Directional Coupler | Mini-Circuits | ZUDC10-183+ | 2214 | NA | NA |
| Dual Directional Coupler | Werlatone | C5100-10 | 92249 | N/A | N/A |
| DC Power Supply | Miteq | PS 15V1 | 1990186 | N/A | N/A |

**Lab Equipment**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| E-Field Probe | SPEAG | EX3DV4 | 7711 | 2024-03-15 | 2025-03-15 |
| Data Acquisition Electronics | SPEAG | DAE4 | 1716 | 2024-03-13 | 2025-03-13 |
| System Validation Dipole | SPEAG | D900V2 | 1d180 | 2023-10-19 | 2024-10-19 |
| System Validation Dipole | SPEAG | D2450V2 | 963 | 2023-10-20 | 2024-10-20 |
| Environmental Indicator | Fisher Scientific | Traceable | 240072459 | 2024-01-24 | 2026-01-24 |

**Other**

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| 3-Path Diode Power Sensor | Rohde & Schwarz | NRP8S | 112236 | 2023-06-03 | 2024-06-30 |
| 3-Path Diode Power Sensor | Rohde & Schwarz | NRP8S | 112237 | 2023-06-03 | 2024-06-30 |

# 5. Measurement Uncertainty

Measurement uncertainty for 300 MHz to 3 GHz

| Uncertainty component | Uncertainty Value (±%) | Prob. Dist. | Div. | *ci* (1 g) | *ci* (10 g) | Std. Unc. 1 g (± %) | Std. Unc. 10 g (± %) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | 12.00 | Normal | 2 | 1 | 1 | 6.00 | 6.00 |
| Probe Calibration Drift | 1.70 | Rectangular | 1.732 | 1 | 1 | 1.0 | 1.0 |
| Probe Linearity | 4.70 | Rectangular | 1.732 | 1 | 1 | 2.7 | 2.7 |
| Boradband Signal | 3.00 | Rectangular | 1.732 | 1 | 1 | 1.7 | 1.7 |
| Probe Isotropy | 7.60 | Rectangular | 1.732 | 1 | 1 | 4.4 | 4.4 |
| Other Probe+Electronic | 0.70 | Normal | 1 | 1 | 1 | 0.7 | 0.7 |
| RF Ambient | 1.80 | Normal | 1 | 1 | 1 | 1.8 | 1.8 |
| Probe Positioning | 0.60 | Normal | 1 | 0.14 | 0.14 | 0.1 | 0.1 |
| Data Processing | 1.20 | Normal | 1 | 1 | 1 | 1.2 | 1.2 |
| **Phantom and Device Errors** | | | | | | | |
| Conductivity (meas.)$^{DAK}$ | 2.50 | Normal | 1 | 0.78 | 0.71 | 2.0 | 1.8 |
| Conductivity (temp.)$^{BB}$ | 3.30 | Rectangular | 1.732 | 0.78 | 0.71 | 1.5 | 1.4 |
| Phantom Permittivity | 14.00 | Rectangular | 1.732 | 0 | 0 | 0.0 | 0.0 |
| Distance DUT - TSL | 2.00 | Normal | 1 | 2 | 2 | 4.0 | 4.0 |
| Device Positioning | 1.00 | Normal | 1 | 1 | 1 | 1.0 | 1.0 |
| Device Holder | 3.60 | Normal | 1 | 1 | 1 | 3.6 | 3.6 |
| DUT Modulation$^{m}$ | 2.40 | Rectangular | 1.732 | 1 | 1 | 1.4 | 1.4 |
| Time-average SAR | 1.70 | Rectangular | 1.732 | 1 | 1 | 1.0 | 1.0 |
| DUT Drift | 2.50 | Normal | 1 | 1 | 1 | 2.5 | 2.5 |
| Val Antenna Unc.$^{val}$ | 0.00 | Normal | 1 | 1 | 1 | 0.0 | 0.0 |
| Unc. Input Power$^{val}$ | 0.00 | Normal | 1 | 1 | 1 | 0.0 | 0.0 |
| **Correction to the SAR results** | | | | | | | |
| Uncertainty in SAR Correction for Deviations in Permittivity and Conductivity | 1.90 | Normal | 1 | 1 | 0.84 | 1.9 | 1.6 |
| SAR scaling$^{p}$ | 0.00 | Rectangular | 1.732 | 1 | 1 | 0.0 | 0.0 |
| Liquid Conductivity - measurement | **-4.70** | Normal | 1 | 0.78 | 0.71 | -3.7 | -3.3 |
| Combined Standard Uncertainty Uc(y) = | | RSS | | | | 11.6 | 11.4 |
| Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence = | | | | | | 23.2 | 22.8 |

# 6. Device Under Test (DUT) Information

## 6.1. DUT Description

| | |
|---|---|
| Device Dimension | Overall (Length x Width): 187 mm x 188 mm x 50 mm |
| Test sample information | **S/N** — **Notes**<br>Yondu 040A — WPT/BLE Radiated<br>Yondu 5022 — WPT/BLE Radiated<br>Inplay-I2C — Receiver |
| Hardware Version | nrf5x_yondu |
| Software Version | 6.0.1.19_2200_sdk_17, direct_test_mode_pca100.hex |

## 6.2. Wireless Technologies

| Wireless technologies | Frequency bands | Operating mode | Duty Cycle used for SAR testing |
|---|---|---|---|
| CW | 900 MHz | WPT | 30%[1] |
| Bluetooth | 2.4 GHz | LE | 62.82%[2] |

1. 30% is the real-world duty cycle for WPT.
2. 62.82% duty cycle for Bluetooth LE was achievable by the test tool, however the real-world duty cycle is limited to 18%.

# 7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

## 7.1. Required Test Configurations

The table below identifies the standalone test configurations required for this device:

| Test Configurations | Front | Edge Top | Edge Right | Edge Bottom | Edge Left | Back[2] |
|---|---|---|---|---|---|---|
| WPT | Yes | Yes | Yes | Yes | Yes | No |
| BLE | Yes | Yes | Yes | Yes | Yes | No |

**Note(s):**

1. Yes = Testing is required.
   No = Testing is not required.
2. This is a wall mounted device; therefore, the rear surface exposure condition is physically inaccessible.

# 8. Dielectric Property Measurements & System Check

## 8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; 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.
The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

**Tissue Dielectric Parameters**

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

| Target Frequency (MHz) | Head | | Body | |
|---|---|---|---|---|
| | $\varepsilon_r$ | σ (S/m) | $\varepsilon_r$ | σ (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 |

**Dielectric Property Measurements Results:**

| SAR Lab | Date | Band (MHz) | Tissue Type | Frequency (MHz) | Relative Permittivity (εr) | | | Conductivity (σ) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Measured | Target | Delta (%) | Measured | Target | Delta (%) |
| 2A | 2024-06-10 | 900 | Head | 900 | 40.3 | 41.5 | -2.94 | 0.93 | 0.97 | -4.63 |
| | | | | 880 | 40.4 | 41.5 | -2.72 | 0.92 | 0.95 | -2.85 |
| | | | | 930 | 40.3 | 41.5 | -2.92 | 0.94 | 0.99 | -4.70 |
| 2A | 2024-06-10 | 2450 | Head | 2450 | 37.8 | 39.2 | -3.52 | 1.76 | 1.80 | -2.00 |
| | | | | 2400 | 37.9 | 39.3 | -3.50 | 1.73 | 1.75 | -1.46 |
| | | | | 2500 | 37.8 | 39.1 | -3.54 | 1.80 | 1.85 | -3.02 |

## 8.2. 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 considered 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 ±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 ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 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 side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
- The dipole input power (forward power) was recorded and 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. Refer to Appendix B for the SAR System Check Plots.

| SAR Lab | Date | Tissue Type | Dipole Type_Serial # | Dipole Cal. Due Data | Dipole Power (dBm) | Measured Results for 1g SAR | | | | Measured Results for 10g SAR | | | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Zoom Scan | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | Zoom Scan | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | |
| 2A | 2024-06-10 | Head | D900V2 SN: 1d180 | 2024-10-19 | 17.00 | 0.530 | 10.57 | 11.10 | -4.73 | 0.340 | 6.78 | 7.11 | -4.59 | 1 |
| 2A | 2024-06-10 | Head | D2450V2 SN: 963 | 2024-10-20 | 17.00 | 2.700 | 53.87 | 53.30 | 1.07 | 1.260 | 25.14 | 25.10 | 0.16 | 2 |

# 9. Conducted Output Power Measurements

Tune-Up Power Limits provided by the manufacturer are used to scale measured SAR values.

## 9.1. Charging Signal

**Maximum Output Power (Tune-up Limit) for WPT**

| Band | Frequency (MHz) | Tune-up PowerLimit (dBm) | |
|---|---|---|---|
| | | Chain 0 | Chain 1 |
| CW | 911.68 | 30.0 | 30.0 |
| | 913.50 | 30.0 | 30.0 |
| | 915.50 | 30.0 | 30.0 |

**WPT Measured Results**

| Band | Freq. (MHz) | Chain 0 Average Power (dBm) | | | Chain 1 Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|
| | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| CW | 911.68 | 29.7 | 30.0 | Yes | 30.0 | 30.0 | Yes |
| | 913.50 | 29.7 | 30.0 | | 30.0 | 30.0 | |
| | 915.50 | 29.8 | 30.0 | | 30.0 | 30.0 | |

## 9.2. Bluetooth

**Maximum Output Power (Tune-up Limit) for Bluetooth**

| Band | Mode | Channel | Frequency (MHz) | Tune-up PowerLimit (dBm) | |
|---|---|---|---|---|---|
| | | | | Chain 0 | Chain 1 |
| Bluetooth 2.4 GHz | LE | 0 | 2402 | 17.2 | 17.2 |
| | | 19 | 2440 | 17.6 | 17.6 |
| | | 39 | 2480 | 13.8 | 13.8 |

**Bluetooth Measured Results**

| Band | Mode | Ch # | Freq. (MHz) | Chain 0 Average Power (dBm) | | | Chain 1 Average Power (dBm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Meas Pwr | Tune-up | SAR Test (Yes/No) | Meas Pwr | Tune-up | SAR Test (Yes/No) |
| Bluetooth 2.4 GHz | LE, GFSK | 0 | 2402 | 16.6 | 17.2 | Yes | 17.2 | 17.2 | Yes |
| | | 19 | 2440 | 17.1 | 17.6 | | 17.6 | 17.6 | |
| | | 39 | 2480 | 13.2 | 13.8 | | 13.8 | 13.8 | |

**Duty Factor Measured Results**

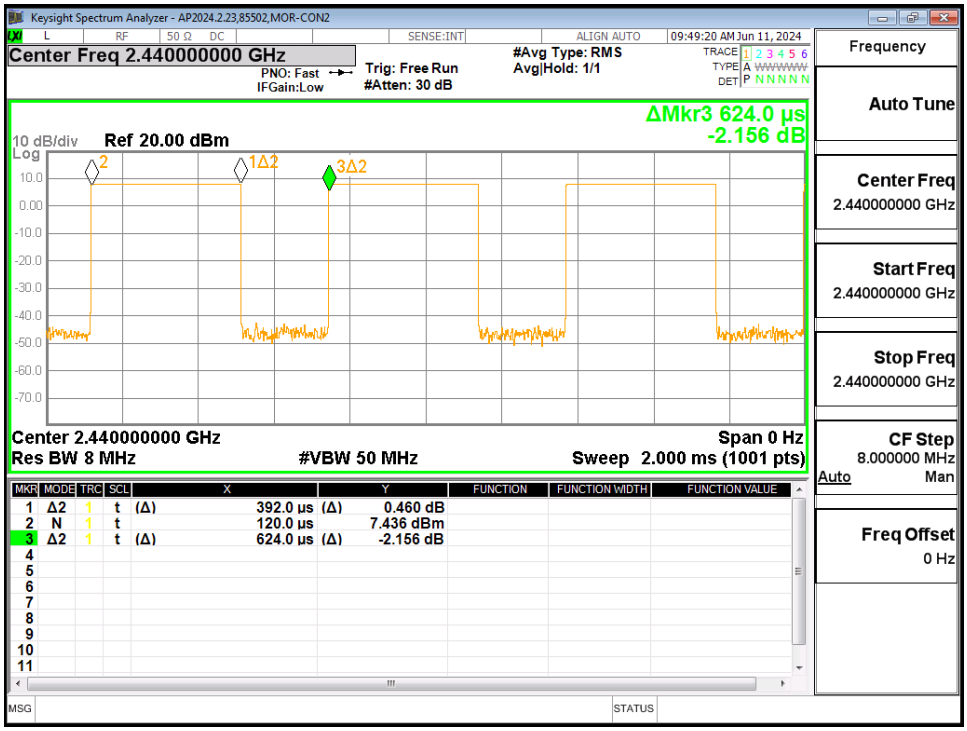
| Mode | T on (ms) | Period (ms) | Duty Cycle | Crest Factor (1/duty cycle) |
|---|---|---|---|---|
| GFSK | 0.392 | 0.624 | 62.82% | 1.59 |

**Note(s):**

Duty Cycle = (T on / period) * 100%

# Duty Cycle plots

GFSK



# 10. Measured and Reported (Scaled) SAR Results

**SAR Test Reduction criteria are as follows:**

- Reported SAR(W/kg) for Bluetooth = Measured SAR * Tune-up scaling factor * Duty Cycle scaling factor
- Duty Cycle scaling factor = Real-World Duty Cycle / Duty Cycle During Measurement (%)

**Note:** The real-world Bluetooth duty cycle is protocol limited to 18%.

**KDB 447498 D01 General RF Exposure Guidance:**

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

## 10.1. WPT

| RF Exposure Conditions | Mode | Antenna | Dist. (mm) | Test Position | Freq. (MHz) | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Body-Worn | CW | MIMO | 0 | Front | 911.7 | 30.0 | 29.9 | 0.847 | 0.867 | |
| | | | | | 913.5 | 30.0 | 29.9 | 0.914 | 0.935 | |
| | | | | | 915.5 | 30.0 | 29.9 | 1.000 | **1.023** | 1 |
| | | | | Edge Top | 913.5 | 30.0 | 29.9 | 0.097 | 0.099 | |
| | | | | Edge Right | 913.5 | 30.0 | 29.9 | 0.057 | 0.058 | |
| | | | | Edge Bottom | 913.5 | 30.0 | 29.9 | 0.075 | 0.077 | |
| | | | | Edge Left | 913.5 | 30.0 | 29.9 | 0.076 | 0.078 | |

**Note:**

1. The two antennas are always transmitting in MIMO mode simultaneously; therefore, the mean of the two chain's measured output power was used since the emissions are overlapping between the two antennas.

## 10.2. Bluetooth

| RF Exposure Conditions | Mode | Antenna | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle Scaling Factor | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Body-Worn | BLE GFSK | MIMO | 0 | Front | 19 | 2440.0 | 0.287 | 17.6 | 17.4 | 1.760 | **0.528** | 2 |
| | | | | Edge Top | 19 | 2440.0 | 0.287 | 17.6 | 17.4 | 0.026 | 0.008 | |
| | | | | Edge Right | 19 | 2440.0 | 0.287 | 17.6 | 17.4 | 0.021 | 0.006 | |
| | | | | Edge Bottom | 19 | 2440.0 | 0.287 | 17.6 | 17.4 | 0.029 | 0.009 | |
| | | | | Edge Left | 19 | 2440.0 | 0.287 | 17.6 | 17.4 | 0.016 | 0.005 | |

**Note:**

1. The two antennas are always transmitting in MIMO mode simultaneously; therefore, the mean of the two chain's measured output power was used since the emissions are overlapping between the two antennas.

# 11. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 or 2 W/kg (1-g or 10-g respectively), 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 ≥ 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
4) Perform a third repeated measurement only if the original, first, or second repeated measurement is ≥ 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

| Frequency Band (MHz) | Air Interface | RF Exposure Conditions | Test Position | Repeated SAR (Yes/No) | Highest Measured SAR (W/kg) | First Repeated | | Second Repeated | | Third Repeated |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Measured SAR (W/kg) | Largest to Smallest SAR Ratio | Measured SAR (W/kg) | Largest to Smallest SAR Ratio | Measured SAR (W/kg) |
| 900 | CW | Body | Front | Yes | 0.914 | 0.914 | 1.00 | N/A | N/A | N/A |
| 2450 | BLE | Body | Front | Yes | 1.760 | 1.720 | 1.02 | N/A | N/A | N/A |

# 12. Simultaneous Transmission Conditions

| RF Exposure Condition | Item | Capable Transmit Configurations | | |
|---|---|---|---|---|
| Body-Worn | 1 | WPT | + | BLE |

## 12.1. Simultaneous transmission SAR test exclusion considerations

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

**Sum of SAR**

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

## 12.2. Sum of the SAR for WPT & BLE

| RF Exposure conditions | Test Position | Body-Worn SAR (W/kg) | | ∑ 1-g SAR (W/kg) |
|---|---|---|---|---|
| | | 1 | 2 | 1+2 |
| | | CW (WPT) | BLE | |
| Body-Worn | Front | 1.023 | 0.528 | **1.551** |

# Appendixes

**Refer to separated files for the following appendixes.**

**Appendix A: SAR Setup Photos**

**Appendix B: SAR System Check Plots**

**Appendix C: SAR Highest Test Plots**

**Appendix D: SAR Tissue Ingredients**

**Appendix E: SAR Probe Certificates**

**Appendix F: SAR Dipole Certificates**

**END OF REPORT**