# TEST REPORT

**Report Number: 105786504MPK-002**
**Project Numbers: G105786504**
**June 25, 2024**

**Testing performed on the**
**Rechargeable Toothbrush Handle**
**Model Number: HX742A**

**to**

**FCC Part 15 Subpart C (15.225)**
**Industry Canada RSS-210 Issue 10**

**for**

**Philips Oral Healthcare LLC**

| Test Performed by: | Test Authorized by: |
|---|---|
| Intertek | Philips Oral Healthcare LLC |
| 1365 Adams Court | 22100 Bothell Everett Highway |
| Menlo Park, CA 94025 USA | Bothell, WA 98021 USA |

Prepared by: _____ **Date:** June 25, 2024
Erica Chan

Reviewed by: _____ **Date:** June 25, 2024
Anderson Soungpanya

| Report No. 105786504MPK-002 | |
|---|---|
| **Equipment Under Test:** | Rechargeable Toothbrush Handle |
| **Model Number:** | HX742A |
| **Applicant:** | Philips Oral Healthcare LLC |
| **Contact:** | David Rodriguez |
| **Address:** | Philips Oral Healthcare LLC<br>22100 Bothell Everett Highway<br>Bothell, WA 98021 USA |
| **Country:** | USA |
| **Tel. Number:** | (425) 487-7000 |
| **Email:** | david.rodriguez@philips.com |
| **Applicable Regulation:** | FCC Part 15 Subpart C (15.225)<br>Industry Canada RSS-210 Issue 10 |
| **Date of Test:** | May 9, 2024 – June 24, 2024 |

***We attest to the accuracy of this report:***

Erica Chan
EMC Project Engineer

Anderson Soungpanya
EMC Team Leader

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## 1.0 Summary of Tests

| TEST | REFERENCE FCC 15.225 | REFERENCE RSS-210 | RESULTS |
|---|---|---|---|
| Field Strength of Fundamental | 15.225(a) | B.6 | Complies |
| Radiated Emissions Outside the band | 15.225(b), 15.225(c), 15.225(d), 15.209 | B.6 | Complies |
| Frequency Tolerance of the Carrier | 15.225(e) | B.6 | Complies |
| Line Conducted Emissions | 15.207 | RSS-GEN | Complies |
| Occupied Bandwidth | 15.215 | RSS-GEN | Complies |
| Antenna requirement | 15.203 | RSS-GEN | Complies[1] |

[1] The EUT utilizes an internal Antenna.

**EUT receive date:** April 15, 2024

**EUT receive condition:** The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

**Test start date:** May 9, 2024

**Test completion date:** June 24, 2024

The test results in this report pertain only to the item tested.

## 2.0 General Description

### 2.1 Product Description

Philips Oral Healthcare LLC supplied the following description of the EUT:

The Philips HX742A is a rechargeable electric toothbrush that is inductively charged. Bluetooth connectivity allows the toothbrush to be connected to an app which provides real-time guidance on pressure, motion, position, duration and frequency of brushing. The toothbrush also tracks the brush head usage through RFID to alert the user when the heads need to be replaced.

**Overview of the EUT**

| | |
|---|---|
| **Applicant name & address** | Philips Oral Healthcare LLC<br>22100 Bothell Everett Highway<br>Bothell, WA 98021 USA |
| **Contact info / Email** | David Rodriguez / david.rodriguez@philips.com |
| **Model** | HX742A |
| **Operating Frequency** | 13.56 MHz |
| **Number of Channels** | 1 |
| **Type of Modulation** | ASK |
| **Antenna Type** | Internal Antenna |

## 2.2 Related Submittal(s) Grants

None

## 2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4: 2014. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7, ANSI C63.10: 2013, ANSI C63.4-2014 & RSS-GEN Issue 5.

## 2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

## 2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and does not take into account the measurement uncertainty.

Estimated Measurement Uncertainty

| Measurement | Expanded Uncertainty (k=2) | | |
|---|---|---|---|
| | 0.15 MHz – 1 GHz | 1 GHz – 2.5 GHz | > 2.5 GHz |
| RF Power and Power Density – antenna conducted | - | 0.7 dB | - |
| Unwanted emissions - antenna conducted | 1.1 dB | 1.3 dB | 1.9 dB |
| Bandwidth – antenna conducted | - | 30 Hz | - |

| Measurement | Expanded Uncertainty (k=2) | | |
|---|---|---|---|
| | 0.15 MHz – 30MHz | 30 MHz – 1 GHz | 1 GHz – 18 GHz |
| Radiated emissions | - | 4.6 | 5.0 dB |
| AC mains conducted emissions | 2.1 dB | - | - |

## 3.0 System Test Configuration

### 3.1 Equipment Under Test (EUT) and Support Equipment

| Equipment Under Test | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** |
| Rechargeable Toothbrush Handle | Philips Oral Healthcare LLC | HX742A | EMC-001, EMC-002 |

| Support Equipment | | |
|---|---|---|
| **Description** | **Manufacturer** | **Model** |
| Toothbrush Head | Philips Oral Healthcare LLC | C3 |

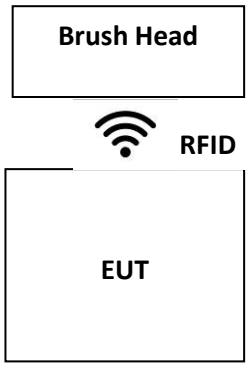
## 3.2 Variant Models

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

| Description | Model | Remarks |
|---|---|---|
| **Full Set product type reference** | HX710n, HX711n, HX740n, HX741n, HX742n | Full Set is identified by type reference HX710n, HX711n, HX740n, HX741n, HX742n<br>Where the last character n, is an alphanumeric character which differences are only for marketing purposes. |
| **Power Toothbrush Handles Codes** | HX710x, HX711x, HX740x, HX741x, HX742x | Handle HX742A is the representative model for testing.<br>Toothbrush handles HX710x, HX711x, HX740x, HX741x, HX742x, Where x, is an alphanumeric character which differences are only for the handle color. |
| **Toothbrush Base Charger** | HX6100 ABA1 | HX6100 ABA1 is the representative model for testing for:<br>HX6100 AFA1, HX6100 AFA2 models.<br>Where F can be B or C or blank, which are for different factory purposes.<br>When B is for factory Bao Hui Science & Technology Co., Ltd.<br>When C is for factory PI ELECTRONICS (VIETNAM) COMPANY LIMITED<br>When blank is for factory PI Electronics (China Plant) |
| **Toothbrush Base DC Charger** | HX6110 ABA3 | Model HX6110 ABA3 is representative model of testing for: HX6110 AFA3 models.<br>Model of HX6110 AFA3 explanation, where F can be B or C or blank are not safety or EMC relevant, they are for different factories.<br>When F = B is for factory of Bao Hui Science & Technology Co., Ltd.<br>When F= C is for factory of PI ELECTRONICS (VIETNAM) COMPANY LIMITED<br>When F = blank is for factory of PI Electronics (China Plant) |
| **Toothbrush Base DC Charger** | HX6110 ADB3 | Model ADB3 is representative model of testing for: HX6110 AFB3.<br>Model HX6110 AFB3, where F can be D or E are not safety or EMC relevant, they are the for different manufacturing locations:<br>When F = D. Dongguan Aohai Technology Co.,Ltd<br>Jiaoyitang No 2 Yinyuan Road, No 2 Yinyuan Road, Dongguan, Guangdong Sheng, 523723, China<br>When F = E. Pt Aohai Technology Indonesia<br>Kawasan Industri Tunas 1 No.C, Belian Batam Kota, Kota Batam Kepulauan Riau, Kepulauan Riau, Indonesia |
| **Toothbrush Travel Charger** | HYTC02 | HYTC02 is the representative model for testing for: HYTC01. HYTC01 is electrically and mechanically identical the only difference is the color:<br>01 = white<br>02 = Black |
| **Wall Adaptor** | WAA2001 | Model WAA2001 is the representative model for testing.<br>Model WAA1001 (SSW-2924xx-WH), WAA2001 (SSW-2924xx-BK).<br>The xx can be EU, UK2, UK3, AU, US, JP, TW, CN which represents different plug portion.<br>All models are identical to WWA1001 (SSW-29254EU-WH) except for the differences of plug portion and PCB layout version. |

## 3.3 Block Diagram of Test Setup

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.




**EUT Photo**

### 3.4 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit. As declared by the manufacturer, the highest clock frequency used is 148.5 MHz.

### 3.5 Software Exercise Program

The EUT exercise program used during testing was provided by Philips Oral Healthcare LLC

### 3.6 Mode of Operation during test

The EUT was constantly broadcasting a 13.56 MHz signal while reading an RFID tag embedded into a wrist band.

### 3.7 Modifications required for Compliance

No modifications were made by the manufacturer to bring the EUT into compliance.

### 3.8 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

## 4.0 Measurement Results

### 4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

#### 4.1.1 Requirements

FCC Rules 15.225

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data reported is in the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

Where FS = Field Strength in dB (μV/m)

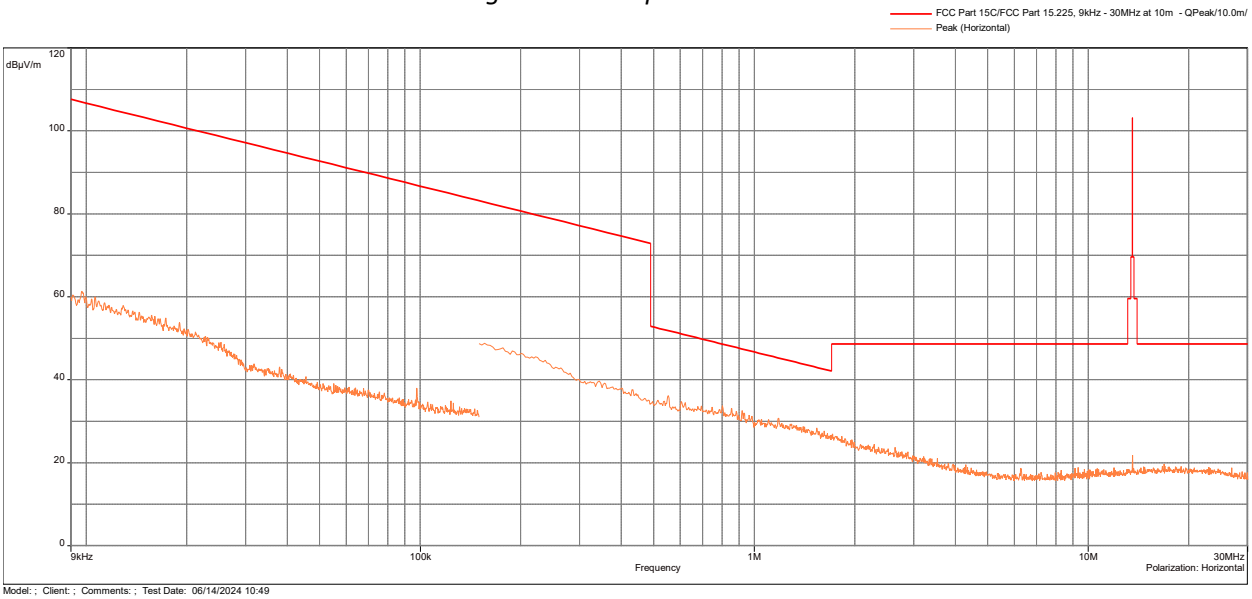
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

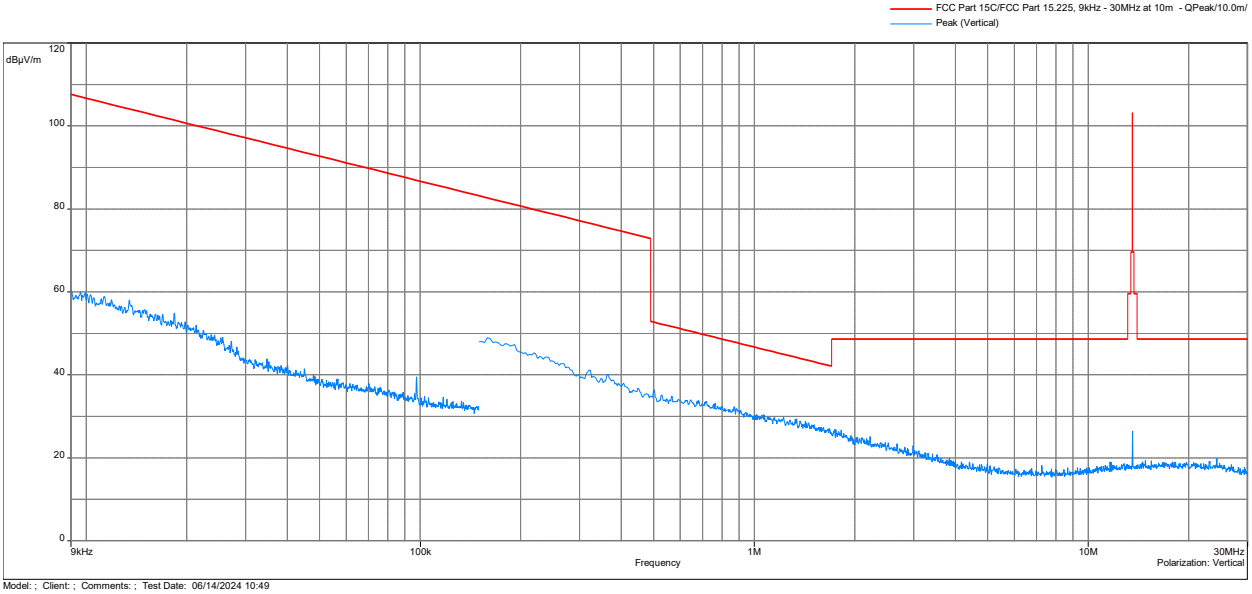
### 4.1.3 Test Result 15.225 (a)(b)(c)

***Radiated Spurious Emissions from 9kHz to 30MHz***

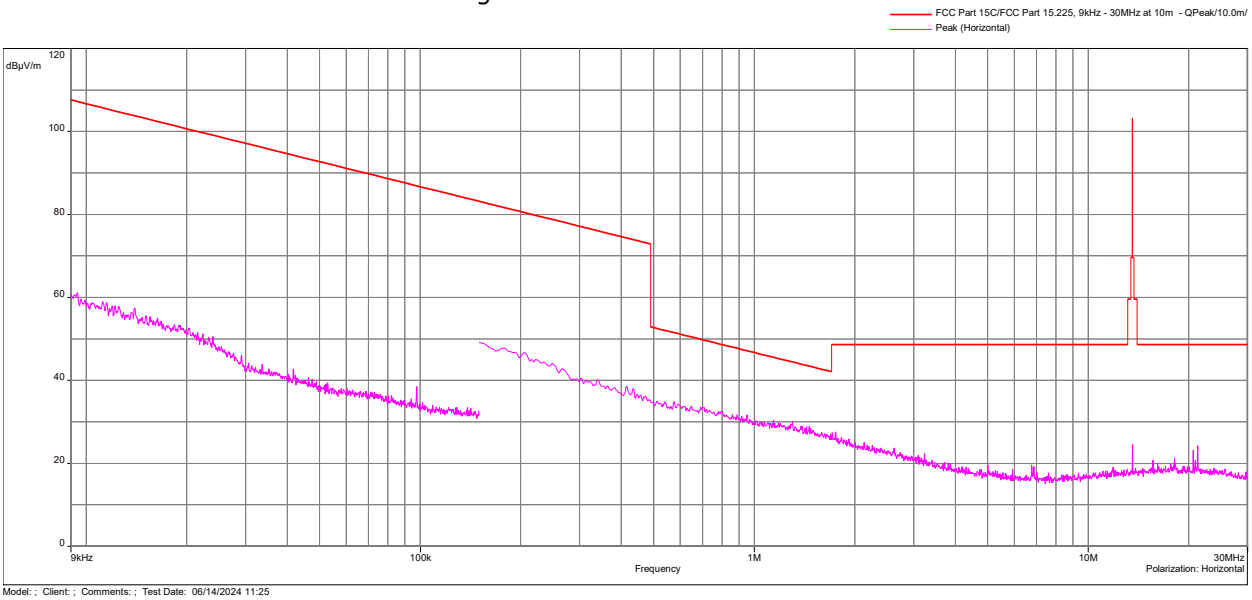
*Receiving Antenna Coplanar Orientation*



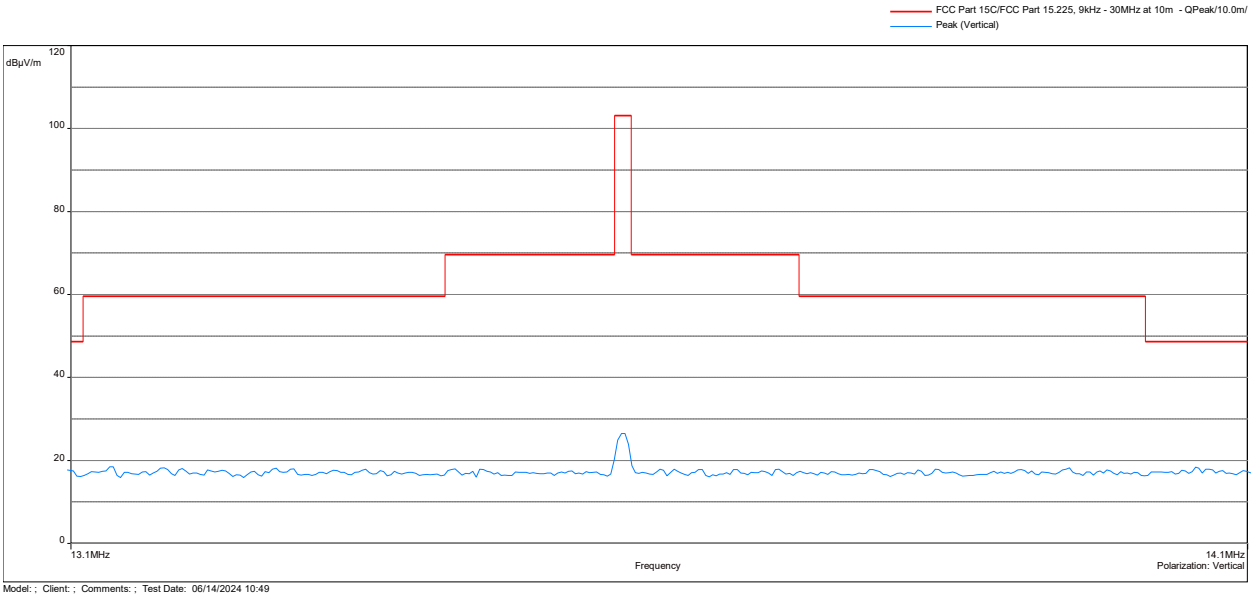

*Receiving Antenna Coaxial Orientation*



*Receiving Antenna Horizontal Orientation*




*Test Result 15.225 (a)(b)(c) Radiated Spurious Emissions Mask*

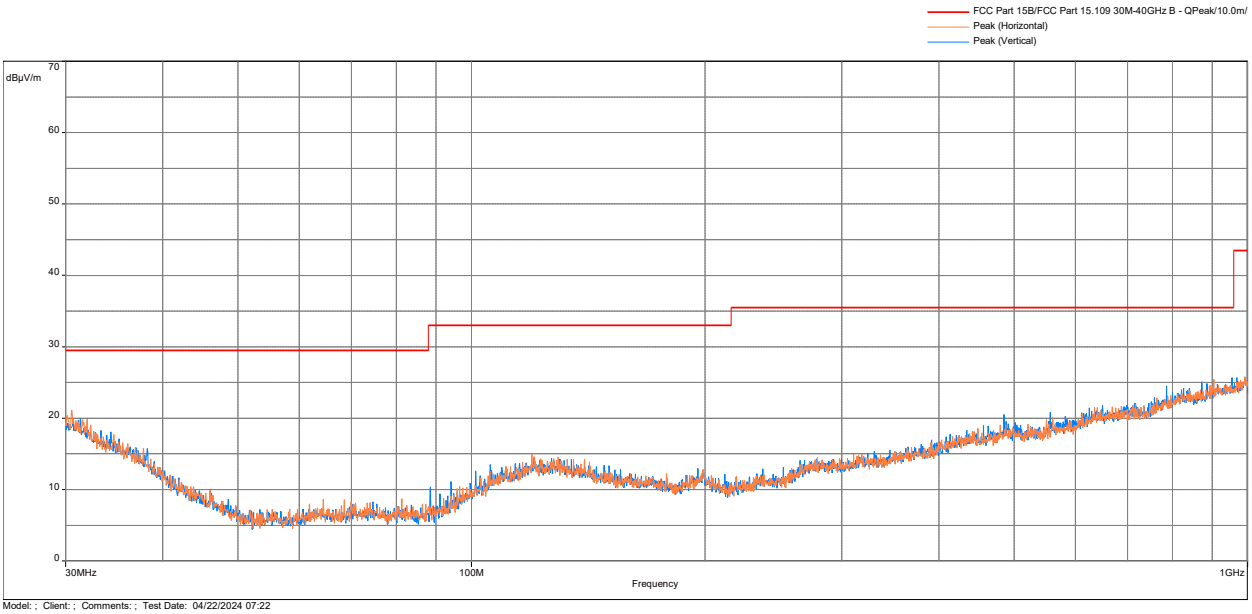



| Frequency | Peak FS@10m | Limit@10m | Margin | Comment | Correction |
|---|---|---|---|---|---|
| (MHz) | dB(uV/m) | dB(uV/m) | dB | | dB |
| 13.56 | 26.48 | 103.1 | -76.62 | Coplanar | 2.61 |

Note: Correction = AF+CF–AG- distance correction factor
Distance correction factor=40*log$_{10}$(limit distance/measured distance)

### 4.1.4 Test Result: 15.225 (d) and 15.209

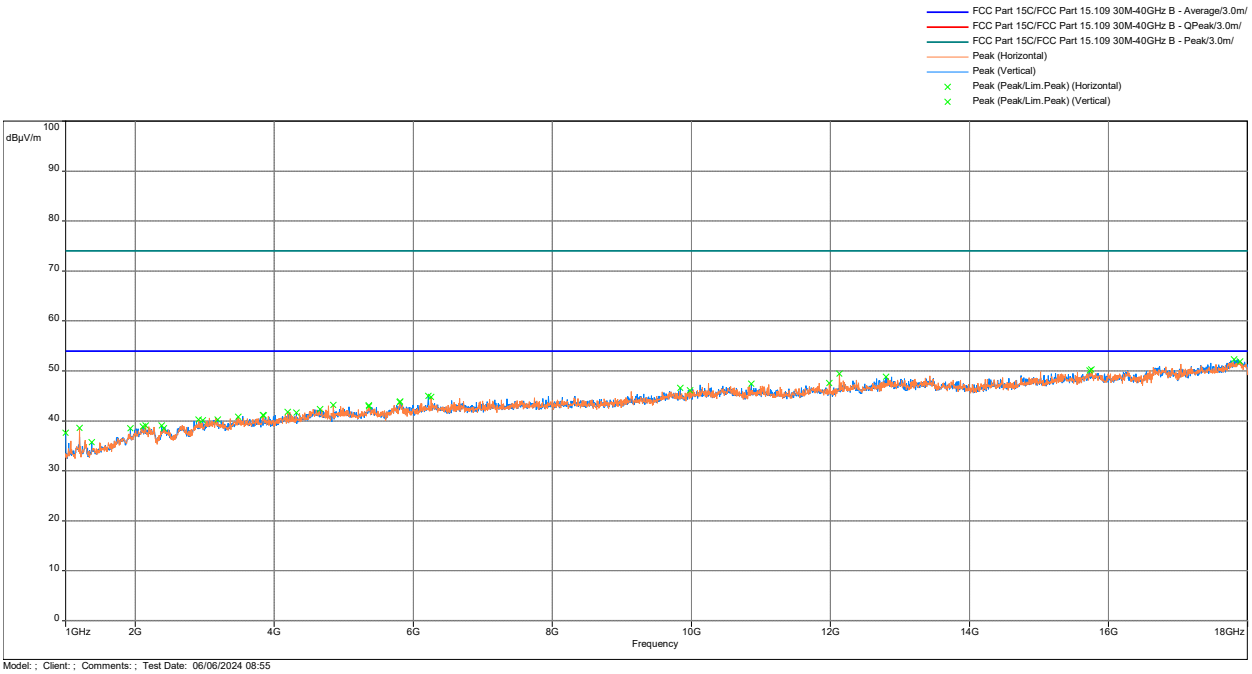
***Radiated Spurious Emissions from 30 MHz to 1000 MHz***




| Freq (MHz) | Peak FS@10m dB(uV/m) | Limit@10m dB(uV/m) | Margin (dB) | Azimuth (Deg) | Height (m) | Polarity | Correction (dB) |
|---|---|---|---|---|---|---|---|
| 30.550 | 21.1 | 29.5 | -8.4 | 1 | 222.25 | Horizontal | -6.73 |
| 954.248 | 25.67 | 35.5 | -9.83 | 3 | 65.75 | Vertical | 0.35 |
| 785.889 | 24.54 | 35.5 | -10.96 | 4 | 40.75 | Vertical | -2.59 |
| 81.345 | 8.71 | 29.5 | -20.79 | 4 | 357.75 | Horizontal | -19.45 |
| 64.435 | 8.63 | 29.5 | -20.87 | 2 | 326 | Horizontal | -19.4 |
| 94.117 | 11.12 | 33 | -21.88 | 2 | 301.5 | Vertical | -18.26 |

Note: Correction = AF + CF – Preamp

***Radiated Spurious Emissions from 1 to 18 GHz, Peak Scan vs Avg and Peak Limits***

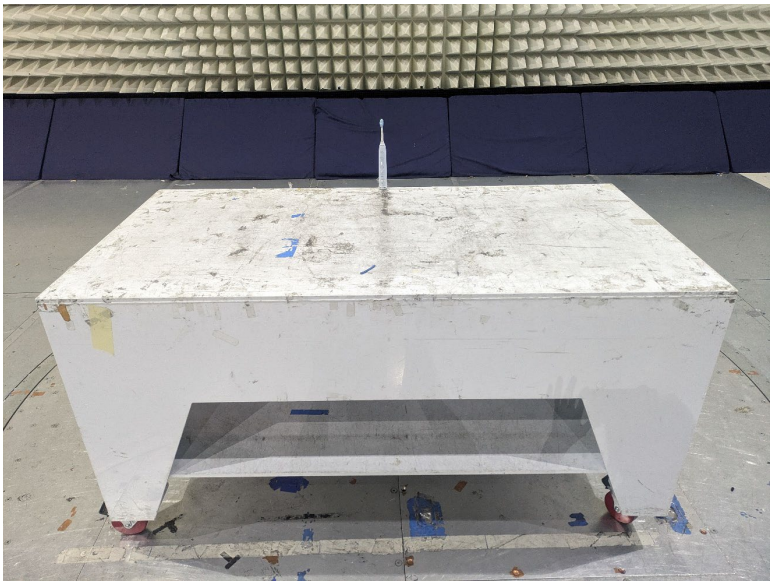



| Freq (MHz) | Peak FS@10m dB(uV/m) | Limit@10m dB(uV/m) | Margin (dB) | Azimuth (Deg) | Height (m) | Polarity | Correction (dB) |
|---|---|---|---|---|---|---|---|
| 17805.067 | 52.28 | 54 | -1.72 | 1.01 | 188.25 | Vertical | 8.21 |
| 15753.167 | 50.28 | 54 | -3.72 | 2.01 | 108.25 | Horizontal | 3 |
| 12129.333 | 49.45 | 54 | -4.55 | 2.01 | 358.75 | Horizontal | -0.13 |
| 6217.867 | 45.02 | 54 | -8.98 | 1.01 | 1.25 | Vertical | -4.54 |
| 5813.267 | 43.85 | 54 | -10.15 | 3.99 | 25.25 | Vertical | -5.28 |
| 4848.233 | 43.19 | 54 | -10.81 | 2.01 | 108.25 | Horizontal | -7.08 |

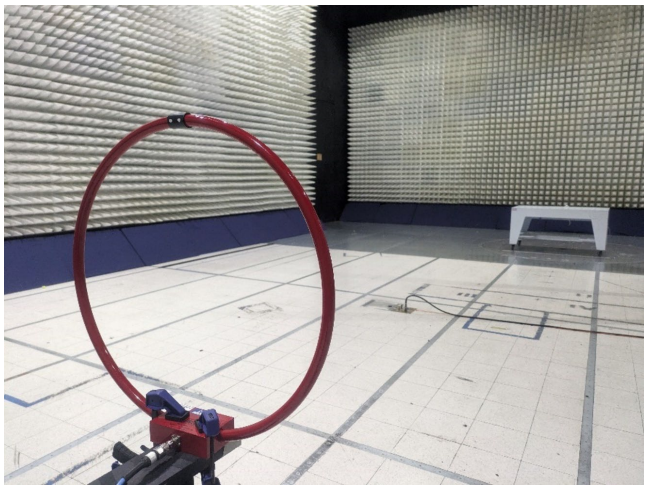
| **Result** | **Complies** by 1.72 dB |
|---|---|

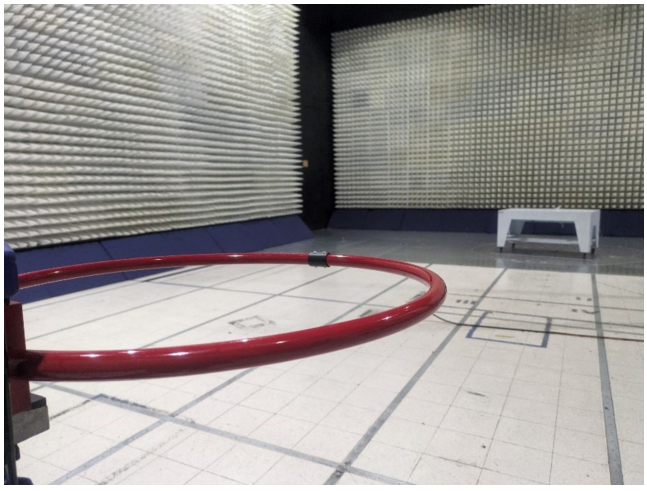
### 4.1.5 Test Configuration Photographs

**The following photographs show the testing configurations used.**

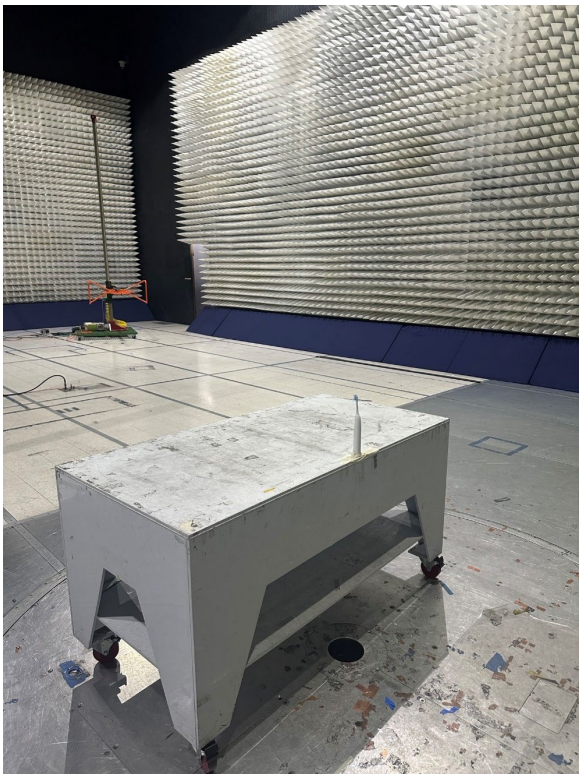


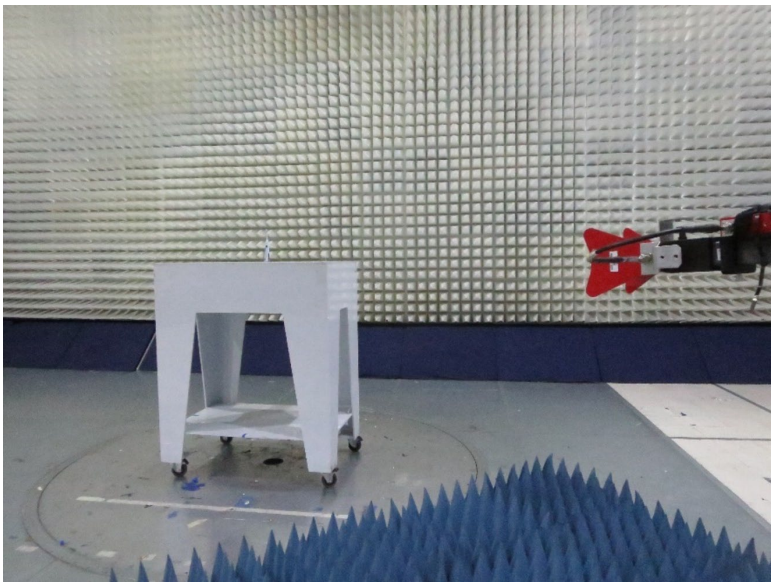
### 4.1.5 Test Configuration Photographs (Continued)





### 4.1.5 Test Configuration Photographs (Continued)





## 4.2 Frequency Tolerance

### 4.2.1 Requirements

FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded.

### 4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13560000 Hz

| Voltage (AC) | Temperature ( C ) | Measured Frequency (Hz) | Δ ppm | Deviation from Reference (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| Battery | -20 | 13559721.07 | 20.57 | -278.926 | -0.00206% |
| Battery | -10 | 13559771.49 | 16.85 | -228.509 | -0.00169% |
| Battery | 0 | 13559790.36 | 15.46 | -209.642 | -0.00155% |
| Battery | 10 | 13559788.27 | 15.61 | -211.726 | -0.00156% |
| Battery | 20 | 13559777.76 | 16.39 | -222.242 | -0.00164% |
| Battery | 30 | 13559765.14 | 17.32 | -234.859 | -0.00173% |
| Battery | 40 | 13559754.64 | 18.09 | -245.359 | -0.00181% |
| Battery | 50 | 13559760.92 | 17.63 | -239.076 | -0.00176% |

## 4.3 Occupied Bandwidth
FCC 15.215

### 4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

### 4.3.2 Procedure

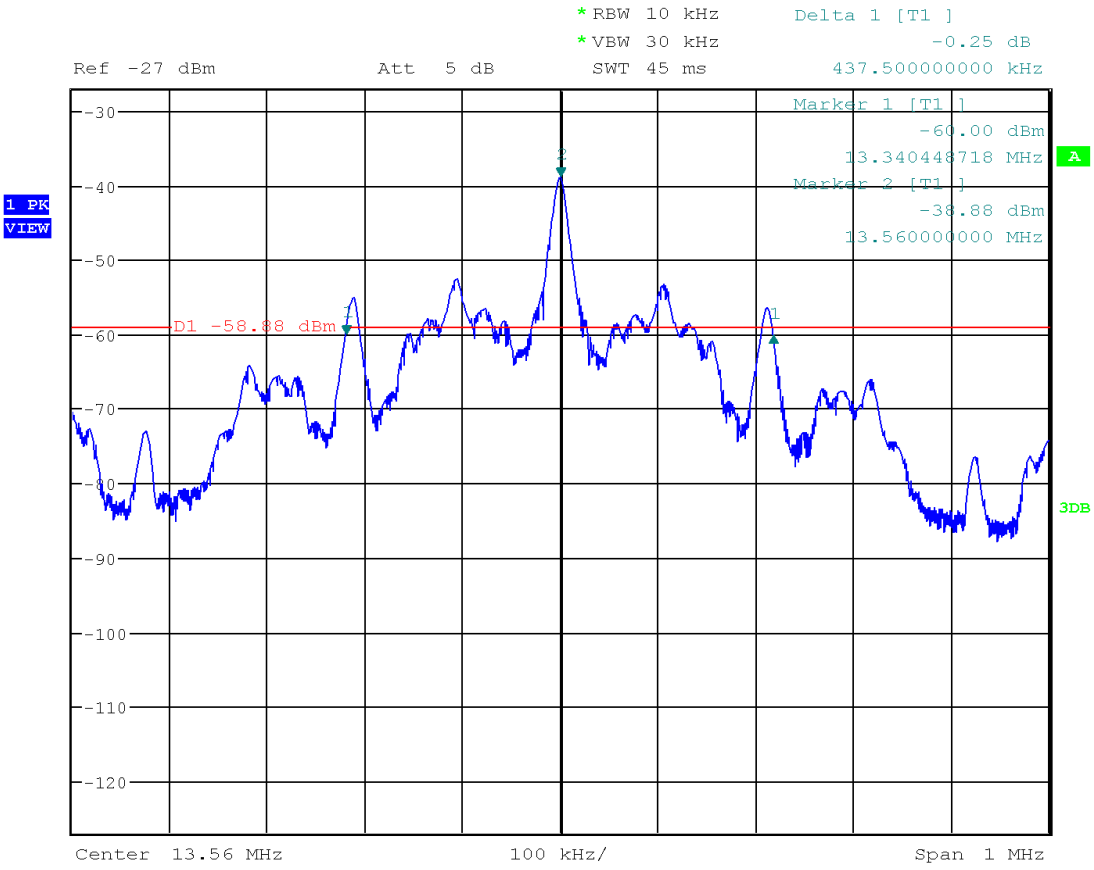
The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10: 2013, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

### 4.3.3 Test Results

| Frequency (MHz) | -20 dB Channel Bandwidth (kHz) | 99% Channel Bandwidth (kHz) |
|---|---|---|
| 13.56 | 437.500 | 567.700 |

-20 dB Channel Bandwidth Plot

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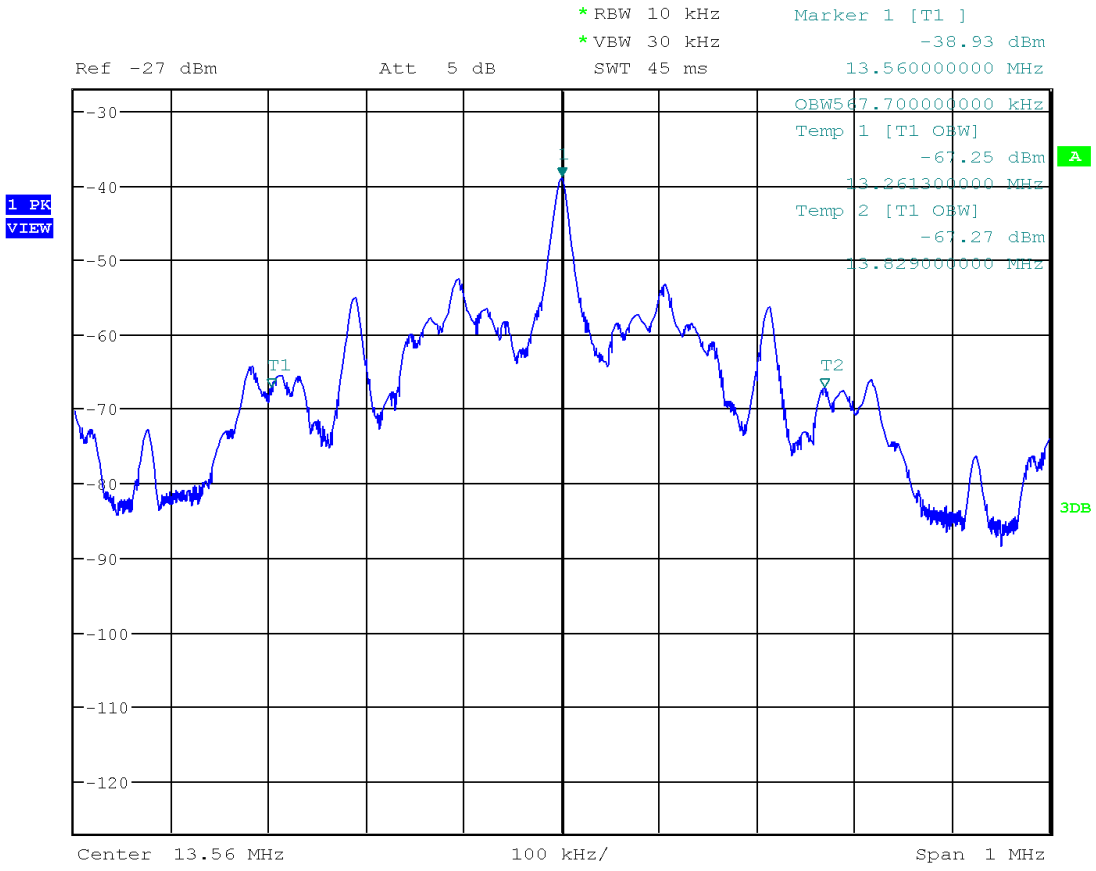
99% Channel Bandwidth Plot

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## 4.4 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

### 4.4.1 Requirement

| Frequency Band MHz | Class B Limit dB(μV) | | Class A Limit dB(μV) | |
|---|---|---|---|---|
| | Quasi-Peak | Average | Quasi-Peak | Average |
| 0.15-0.50 | 66 to 56 * | 56 to 46 * | 79 | 66 |
| 0.50-5.00 | 56 | 46 | 73 | 60 |
| 5.00-30.00 | 60 | 50 | 73 | 60 |

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

### 4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207. After, the EUT RF was powered off and was measured to show compliance with the 15.107 limits.

### 4.4.3 Test Result

Not applicable. The EUT is battery powered.

## 5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

| Asset # | Manufacturer | Model/Type | Asset # | Cal Int (months) | Cal Due |
|---|---|---|---|---|---|
| 01607 | EMI Test Receiver | Rohde & Schwarz | ESR7 | 12 | 10/18/2024 |
| 00942 | 9kHz to 1GHz Amplifier | Sonoma Instrument | 310 | 12 | 04/20/2025 |
| 01577 | 30MHz-2GHz Bi-Log Antenna | SunAR RF Motion | JB1 | 12 | 02/28/2025 |
| 01325 | 1-18GHz Horn Antenna | ETS Lindgren | 3117-PA | 12 | 11/26/2024 |
| 00961 | EMI Test Receiver 40GHz | Rohde & Schwarz | ESU40 | 12 | 04/26/2025 |
| 01573 | 9kHz-30MHz Loop Antenna (Passive) | ETS Lindgren | 6512 | 12 | 11/30/2024 |
| 01436 | Humidity Temperature Test Chamber | ESPEC | BTX-475 | 12 | 10/23/2024 |
| 01936 | 20Hz-26.5GHz Spectrum Analyzer | Rohde & Schwarz | FSU | 12 | 03/16/2025 |
| 001608 | Loop Sensor | Solar Electronics | 7334-1 | 12 | 11/21/2024 |
| 00984 | Radio Frequency Shielded System | Panashield | 10 Meter Chamber | 36 | 09/22/2025 |

Software used for emission compliance testing utilized the following:

| Name | Manufacturer | Version | Template/Profile |
|---|---|---|---|
| BAT-EMC | Nexio | 3.20.0.23 | Activate Games - 02-22-24.bpp |
| RS Commander | Rohde Schwarz | 1.6.4 | Not Applicable (Screen Grabber) |

## 6.0 Document History

| Revision/ Job Number | Writer Initials | Reviewer Initials | Date | Change |
|---|---|---|---|---|
| 1.0 / G105786504 | EC | AS | June 25, 2024 | Original document |

# END OF TEST REPORT