

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:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

Test Authorized by:

Philips Oral Healthcare LLC

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Prepared by:



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Date: June 25, 2024

Reviewed by:



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Date: June 25, 2024

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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 22100 Bothell Everett Highway 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) 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



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TABLE OF CONTENTS

1.0	Summary of Tests	4
2.0	General Description	5
2.1	Product Description	5
2.2	Related Submittal(s) Grants.....	6
2.3	Test Methodology.....	6
2.4	Test Facility	6
2.5	Measurement Uncertainty	6
3.0	System Test Configuration.....	7
3.1	Equipment Under Test (EUT) and Support Equipment.....	7
3.2	Variant Models.....	8
3.3	Block Diagram of Test Setup	9
3.5	Justification	10
3.6	Software Exercise Program	10
3.7	Mode of Operation during test.....	10
3.8	Modifications required for Compliance.....	10
3.9	Additions, deviations and exclusions from standards	10
4.0	Measurement Results	11
4.1	Field Strength of Fundamental and Radiated Emissions Outside the band	11
4.2	Frequency Tolerance	20
4.3	Occupied Bandwidth.....	22
4.4	AC Line Conducted Emission.....	25
5.0	List of test equipment	27
6.0	Document History	28

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 22100 Bothell Everett Highway 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

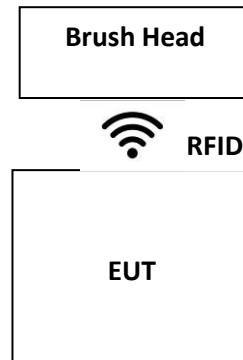
3.2 Variant Models

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 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. 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: HX6100 AFA1, HX6100 AFA2 models. Where F can be B or C or blank, which are for different factory purposes. When B is for factory Bao Hui Science & Technology Co., Ltd. When C is for factory PI ELECTRONICS (VIETNAM) COMPANY LIMITED 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. 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. When F = B is for factory of Bao Hui Science & Technology Co., Ltd. When F = C is for factory of PI ELECTRONICS (VIETNAM) COMPANY LIMITED 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. Model HX6110 AFB3, where F can be D or E are not safety or EMC relevant, they are the for different manufacturing locations: When F = D. Dongguan Aohai Technology Co.,Ltd Jiaoyitang No 2 Yinyuan Road, No 2 Yinyuan Road, Dongguan, Guangdong Sheng, 523723, China When F = E. Pt Aohai Technology Indonesia 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: 01 = white 02 = Black
Wall Adaptor	WAA2001	Model WAA2001 is the representative model for testing. Model WAA1001 (SSW-2924xx-WH), WAA2001 (SSW-2924xx-BK). The xx can be EU, UK2, UK3, AU, US, JP, TW, CN which represents different plug portion. 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 ($\mu\text{V}/\text{m}$)

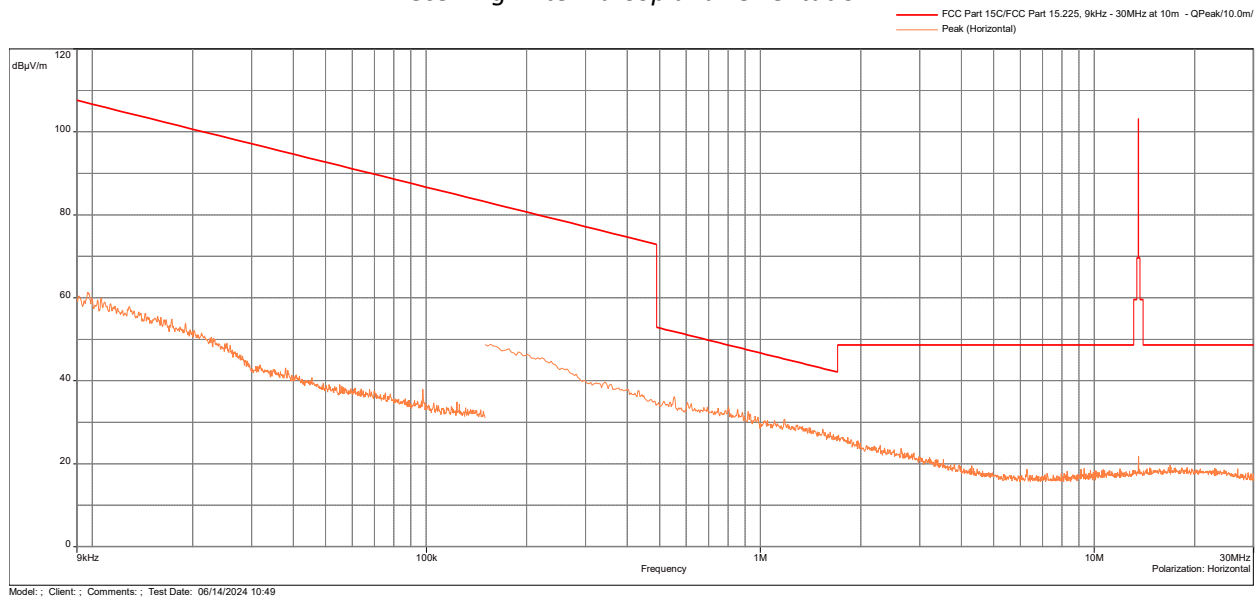
RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

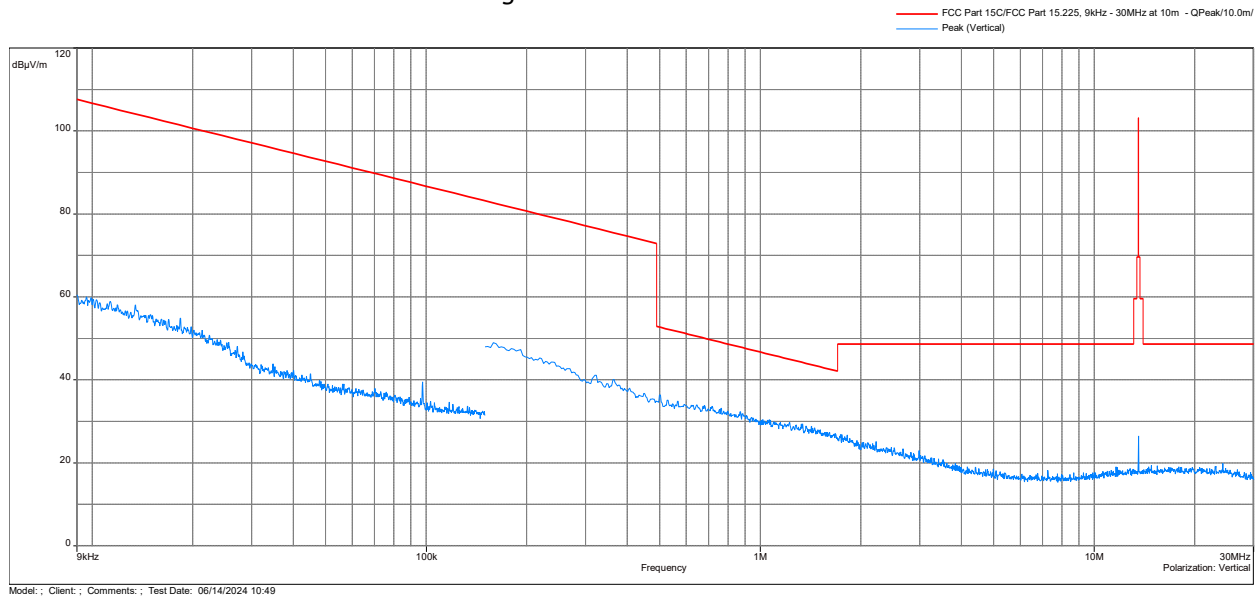
4.1.3 Test Result 15.225 (a)(b)(c)

Radiated Spurious Emissions from 9kHz to 30MHz

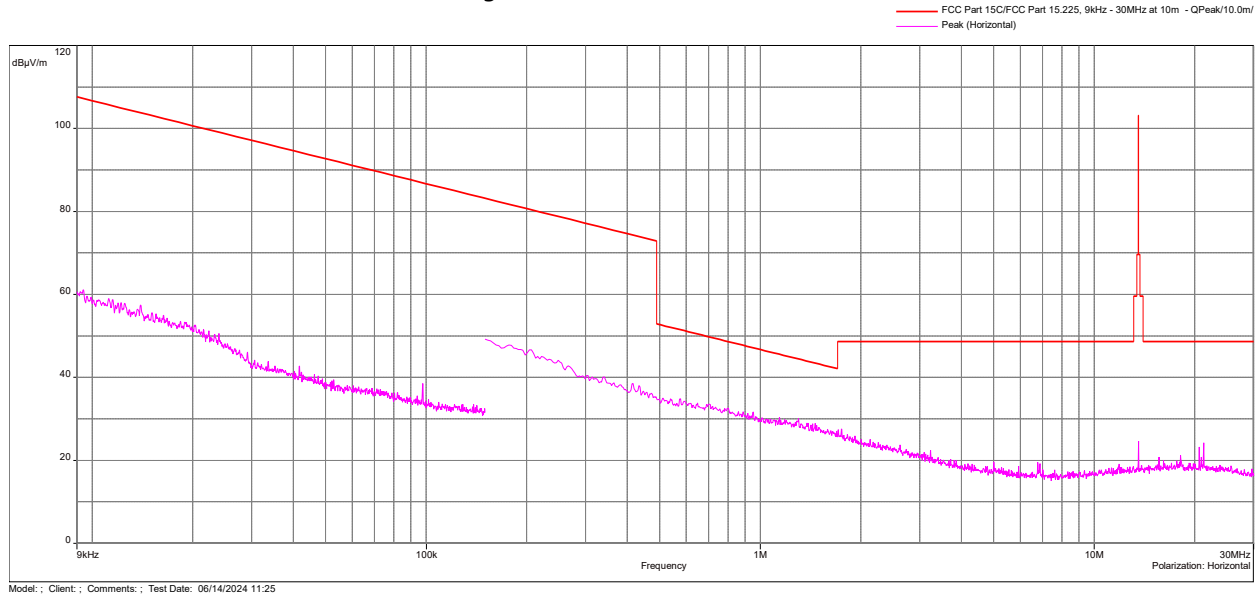
Receiving Antenna Coplanar Orientation



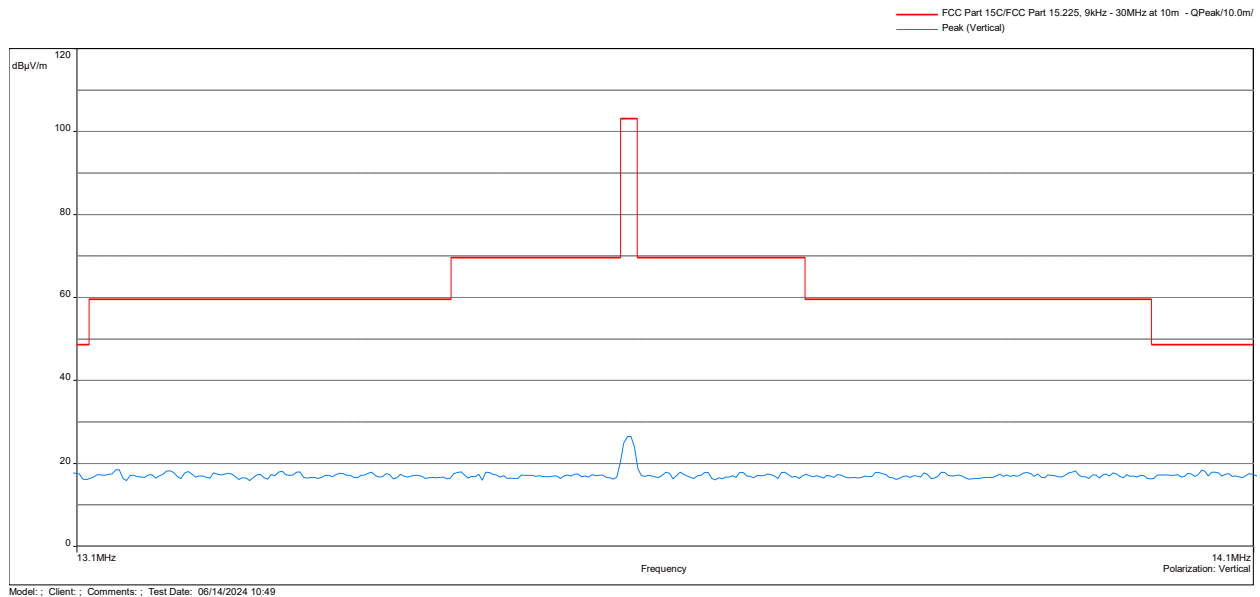
Receiving Antenna Coaxial Orientation



Receiving Antenna Horizontal Orientation



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

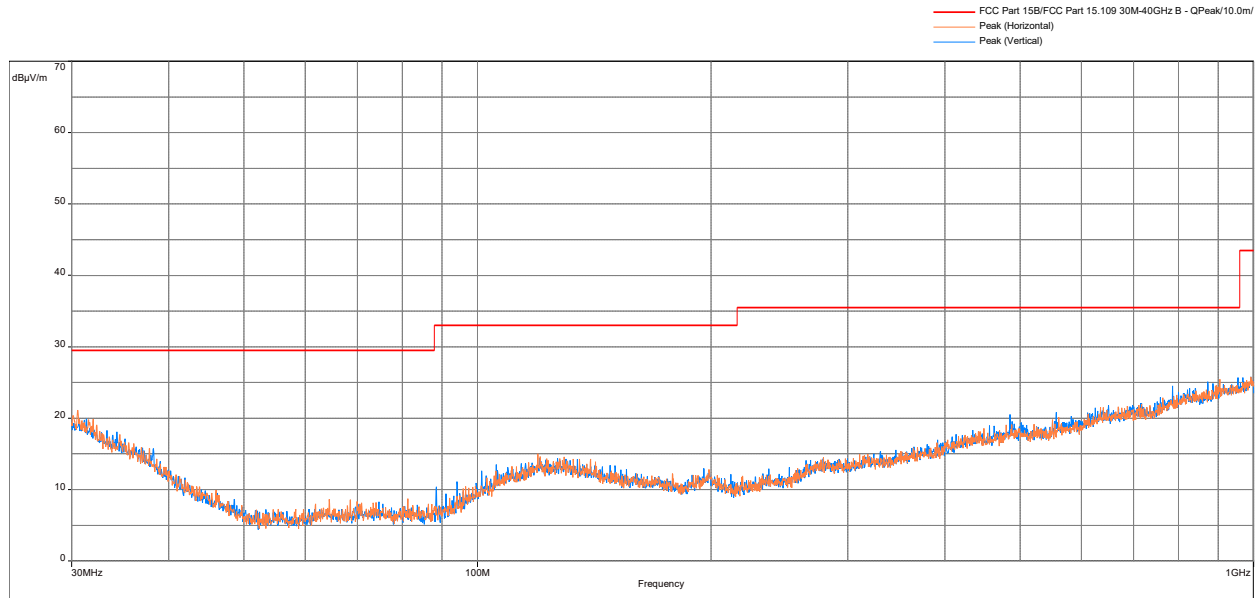


Frequency (MHz)	Peak FS@10m dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	Comment	Correction dB
13.56	26.48	103.1	-76.62	Coplanar	2.61

Note: Correction = AF+CF-AG- distance correction factor
Distance correction factor= $40 \cdot \log_{10}(\text{limit distance}/\text{measured distance})$

4.1.4 Test Result: 15.225 (d) and 15.209

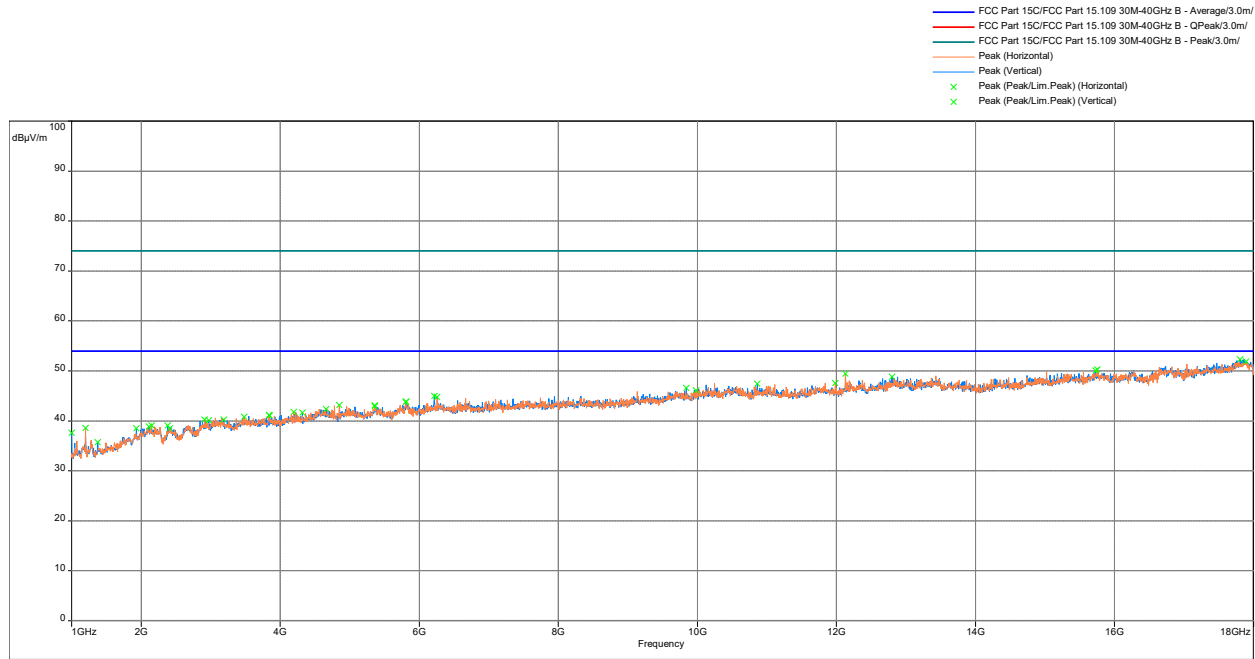
Radiated Spurious Emissions from 30 MHz to 1000 MHz



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 – Preampl

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

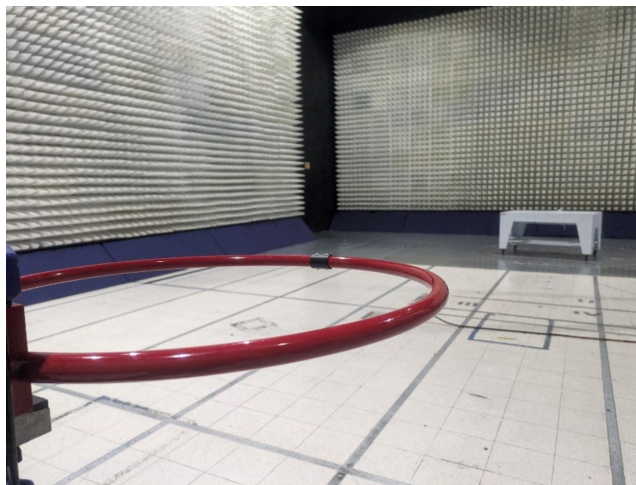
Result Complies by 1.72 dB

4.1.5 Test Configuration Photographs

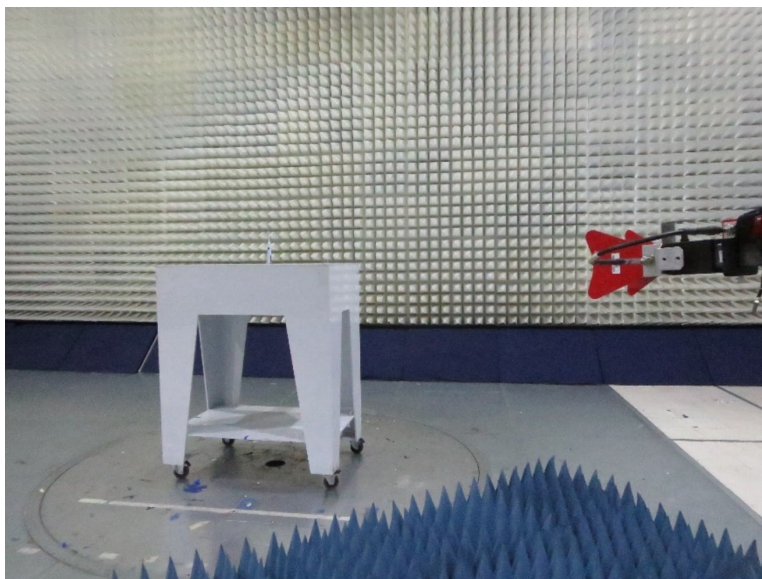
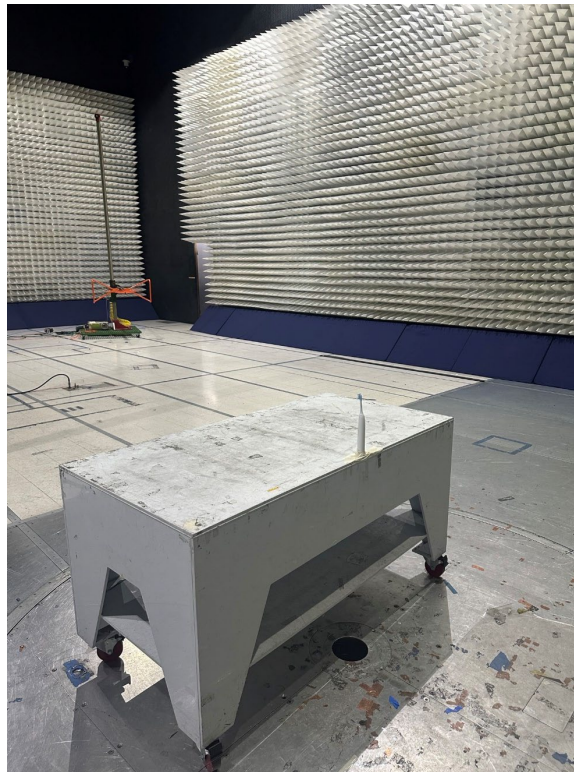
The following photographs show the testing configurations used.



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 $\pm 0.01\%$ 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

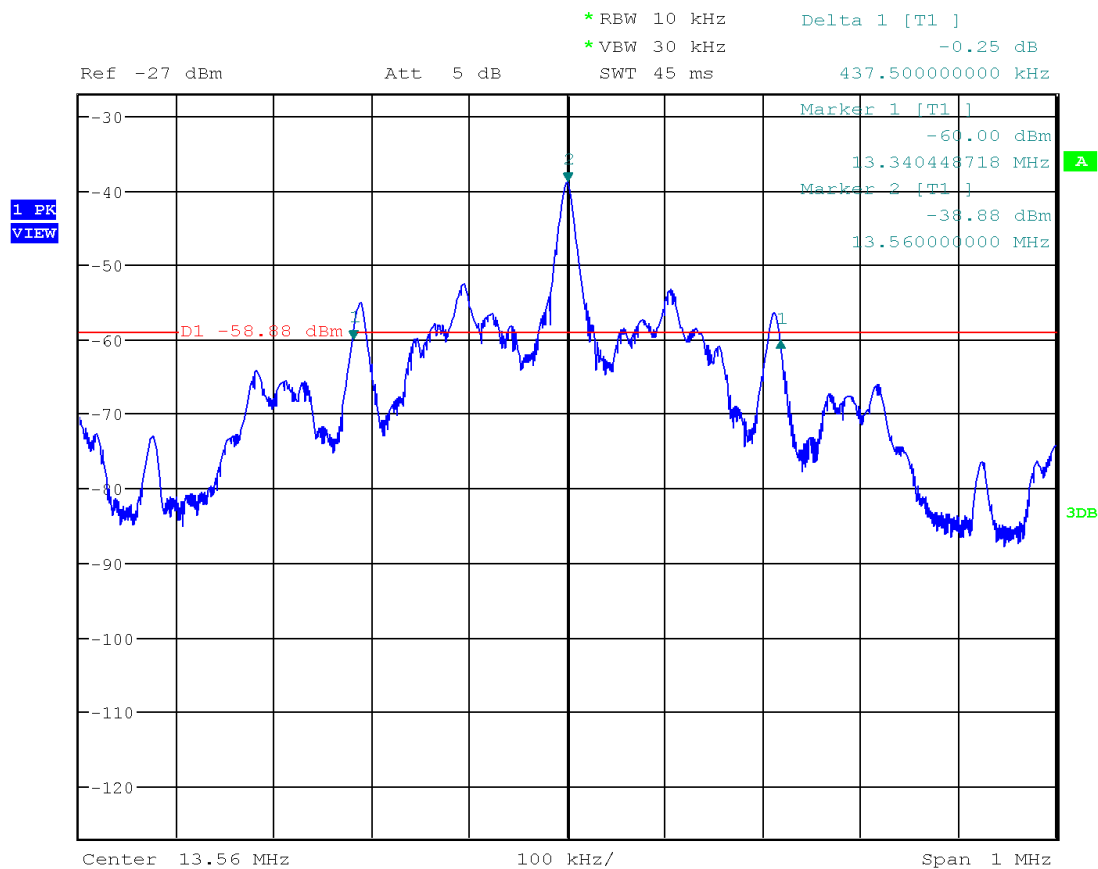
The EUT was setup to transmit in normal operating condition.

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

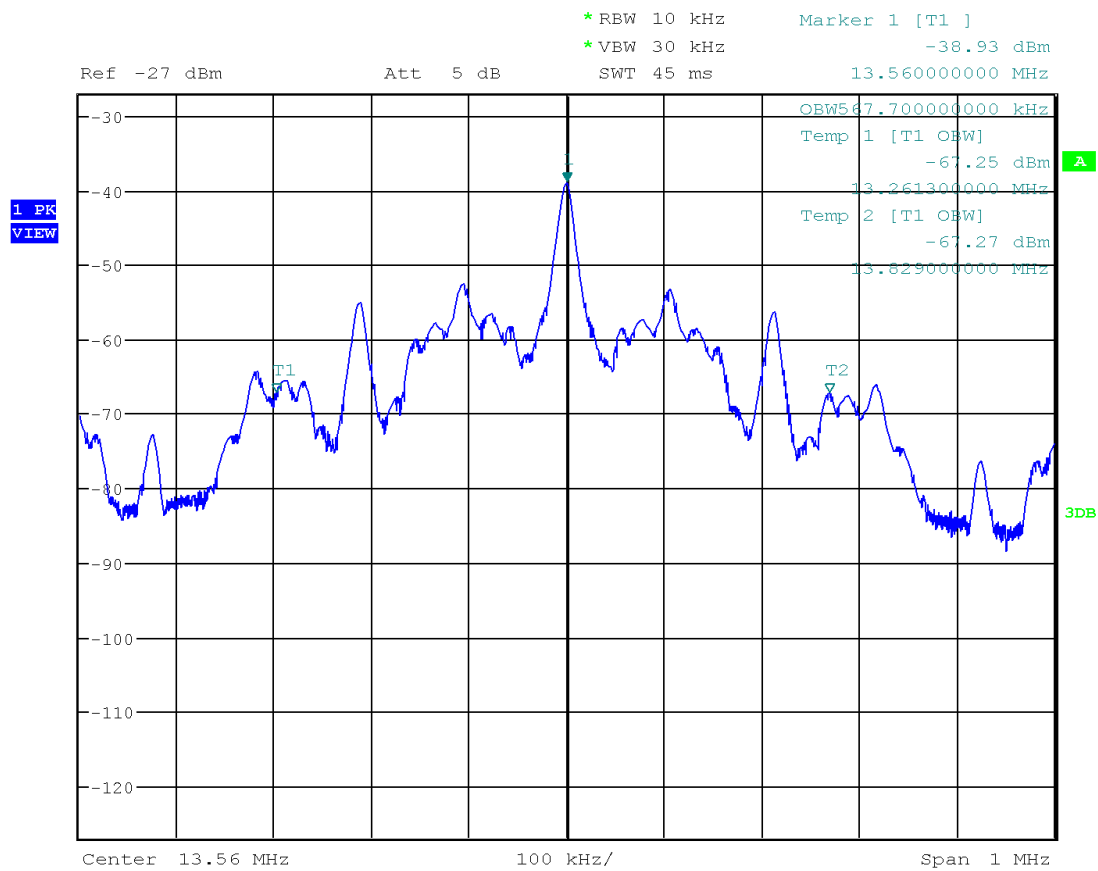
Frequency (MHz)	-20 dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
13.56	437.500	567.700

-20 dB Channel Bandwidth Plot



Date: 24.JUN.2024 20:53:22

99% Channel Bandwidth Plot



Date: 24.JUN.2024 21:42:29

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