313 West 12800 South, Suite 311
Draper, UT 84020
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Test Report

Certification

FCC ID	2BA2Z-PURAMINIV1
Equipment Under Test	810-00029
Test Report Serial No	V074308_01
Dates of Test	January 31 and February 1, 2024
Report Issue Date	May 30, 2024

Test Specifications:	Applicant:
FCC Part 15, Subpart C	Pura Scents, Inc. 2100 Pleasant Grove Blvd #600 Pleasant Grove, Utah 84062 U.S.A.

NVLAP TESTING
NVLAP LAB CODE 100272-0

Certification of Engineering Report

This report has been prepared by VPI Laboratories, Inc. to document compliance of the device described below with the requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

Applicant	Pura Scents, Inc.
Manufacturer	Pura
Brand Name	Pura Mini
Model Number	810-00029
FCC ID	2BA2Z-PURAMINIV1

On this 30th day of May 2024, I, individually and for VPI Laboratories, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the VPI Laboratories, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

VPI Laboratories, Inc.

Tested by: Benjamin N. Antczak

Reviewed by: Jason Stewart

Revision History		
Revision	**Description**	**Date**
01	Original Report Release	May 30, 2024

Table of Contents

1 Client Information

1.1 Applicant

Company Name	Pura Scents, Inc. 2100 Pleasant Grove Blvd #600 Pleasant Grove, Utah 84062 U.S.A.
Contact Name	Clint Cook
Title	Electrical Engineering Manager

1.2 Manufacturer

Company Name	Pura Scents, Inc. 2100 Pleasant Grove Blvd #600 Pleasant Grove, Utah 84062 U.S.A.
Contact Name	Clint Cook
Title	Electrical Engineering Manager

2 Equipment Under Test (EUT)

2.1 Identification of EUT

Brand Name	Pura Mini
Model Number	810-00029
Serial Numbers	Constant Transmit Unit: ENG Unit Dummy Load Unit: ENG Unit Normal Operation Unit: ENG Unit
Dimensions (cm)	6.0 x 9.0 x 5.0

2.2 Description of EUT

The 810-00029 is a scent diffuser for use in homes and commercial spaces. It contains an NFC reader that operates at 13.56MHz and interfaces with passive tags on scent bottles. EUT was tested with and without tags present. The EUT also contains a certified BLE Module operating in the 2400 MHz to 2483.5MHz ISM Band containing FCCID 2AC7Z-ESP32WROVERE. Because EUT contains liquid scents, there is only a single orientation for use. EUT is powered directly by AC Mains.

This report covers the transmitter circuitry of the devices subject to FCC Part 15, Subpart C, §15.225.

2.3 EUT and Support Equipment

The EUT and support equipment used during the test are listed below.

Brand Name **Model Number** **Serial Number**	**Description**	**Name of Interface Ports / Interface Cables**
BN: Pura MN: 810-00029 (Note 1) SN: See Section 2.1 Above	Scent Diffuser with NFC	See Section 2.4
BN: Pura MN: N/A SN: N/A	Scent Bottle with NFC Tag	Wireless NFC Interface

Notes: (1) EUT

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT

There are no interface ports on the EUT.

2.5 Modification Incorporated/Special Accessories on EUT

The following modifications were made to the EUT by the Client during testing to comply with the specification. This report is not complete without an accompanying signed attestation, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

- A shield is placed over the NFC transmitter circuity.

2.6 Deviation from Test Standard

There were no deviations from the test specification.

3 Test Specification, Methods and Procedures

3.1 Test Specification

Title	FCC PART 15, Subpart C (47 CFR 15) 15.203, 15.207, and 15.225 KDB174176 D01 Line Conducted FAQ v01r01
Purpose of Test	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures

3.2.1 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 Conducted Limits

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.50*	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Table 1: Limits for conducted emissions at mains ports of Class B ITE.

3.2.3 KDB174176 AC Mains Conducted Procedure for Devices Operating Below 30MHz

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:

(1) perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;

(2) retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band.

For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band.

3.2.4 §15.225 Operation Within the Band 13.110 – 14.010

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

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.

f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.3 Test Procedure

VPI Laboratories, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2024. VPI Laboratories, Inc. carries FCC Accreditation Designation Number US5263. VPI Laboratories main office is located at 313 W 12800 S, Suite 311, Draper, UT 84020. The testing was performed according to the procedures in ANSI C63.10-2013, KDB 558074, and 47 CFR Part 15.

4 Operation of EUT During Testing

4.1 Operating Environment

Power Supply	120 VAC
AC Mains Frequency	60 Hz

4.2 Operating Modes

Since EUT contains liquids and is only to be used in single orientation, the transmitter was tested in that orientation while in a constant transmit mode at 13.56MHz. Tests were repeated while transmitting continuously with and without tags. No changes were detected above 30MHz with the presence of tags. The BLE transmitter was active and transmitting in the 2400-2483.5MHz band. Worst case emissions were observed while the EUT was transmitting at 13.56 MHz without a tag present.

AC Mains Conducted Emissions were tested twice, with a dummy load for comparison to general limits, and again with the antennas to ensure NFC frequency band-edge compliance according to KDB 174176.

The AC mains voltage to the AC adapter was varied as required by §15.31(e) with no change seen in the voltage supplied to the transmitter or in transmitter characteristics.

4.3 EUT Exercise Software

Engineering firmware was used to activate the 13.56MHz transmitter in normal mode or continuous transmission mode.

5 Summary of Test Results

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.225(a)	Field Strength	13.11 – 14.01	Complied
15.225(b)	Field Strength	13.11 – 14.01	Complied
15.225(c)	Field Strength	13.11 – 14.01	Complied
15.225(d)	Field Strength	13.11 – 14.01	Complied
15.225(e)	Frequency Stability	13.11 – 14.01	Complied
---	Emission Bandwidth	13.56	Reported

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

6 Measurements, Examinations and Derived Results

6.1 General Comments

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Section 7 of this report.

When calculations in this report require EUT antenna gains, those values have been provided by the manufacturer unless otherwise noted.

6.2 Test Results

6.2.1 §15.203 Antenna Requirements

The EUT uses a Molex 1462360151 antenna to transmit at 13.56MHz.

Result

The EUT complied with the specification.

6.2.2 Conducted Emissions at Mains Ports Data with Dummy Loads

Hot Lead

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.16	Peak (Note 1)	33.5	13.2	46.7	55.5	-8.8
0.24	Peak (Note 1)	30.8	12.2	42.9	52.2	-9.3
0.35	Peak (Note 1)	28.6	11.6	40.2	49.0	-8.8
0.81	Peak (Note 1)	27.0	10.7	37.7	46.0	-8.3
1.1	Peak (Note 1)	29.4	10.4	39.8	46.0	-6.2
1.2	Quasi-Peak (Note 2)	34.9	10.4	45.3	56.0	-10.7
1.2	Average (Note 2)	28.6	10.4	39.0	46.0	-7.0
2.5	Peak (Note 1)	27.2	10.2	37.3	46.0	-8.7
13.6	Quasi-Peak (Note 2)	20.5	10.6	31.1	60.0	-28.9
13.6	Average (Note 2)	16.3	10.6	26.9	50.0	-23.1

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Neutral Lead

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.15	Peak (Note 1)	34.7	13.5	48.2	56.0	-7.8
0.22	Peak (Note 1)	33.0	12.4	45.4	52.9	-7.5

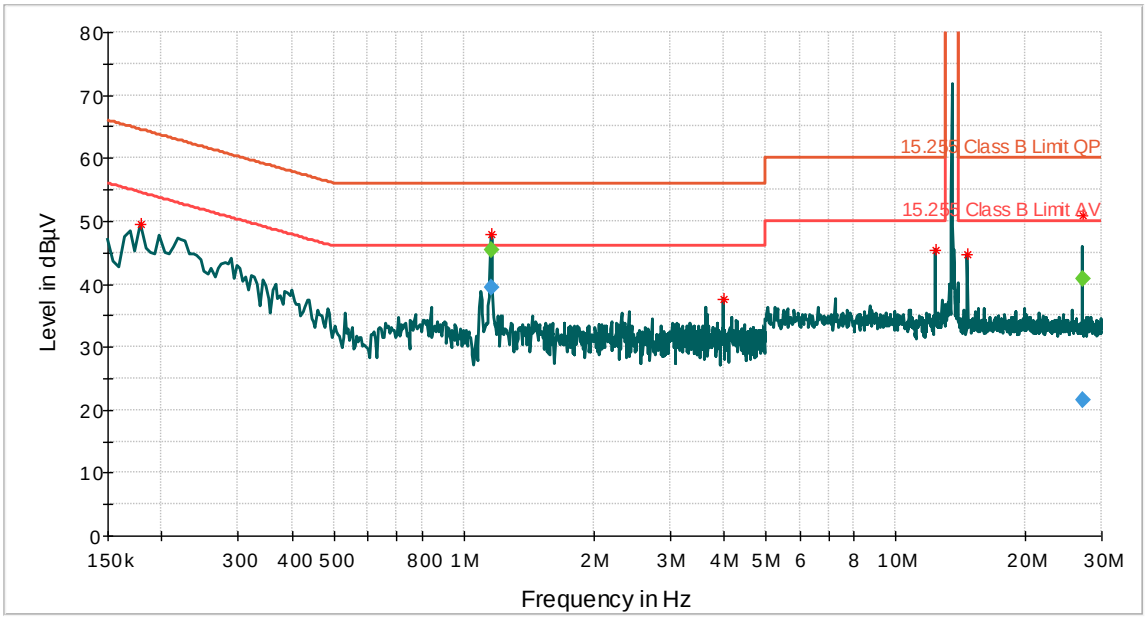
Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.27	Peak (Note 1)	31.4	12.0	43.4	51.1	-7.7
0.35	Peak (Note 1)	29.5	11.6	41.1	49.0	-7.9
1.1	Peak (Note 1)	26.1	10.4	36.5	46.0	-9.5
1.2	Quasi-Peak (Note 2)	31.5	10.4	41.9	56.0	-14.1
1.2	Average (Note 2)	26.6	10.4	37.0	46.0	-9.0
4.4	Peak (Note 1)	25.7	10.2	35.9	46.0	-10.1
13.6	Quasi-Peak (Note 2)	19.6	10.6	30.2	60.0	-29.8
13.6	Average (Note 2)	14.3	10.6	24.8	50.0	-25.2

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

6.2.3 Conducted Emissions at Mains Ports Data with Antenna Transmitting (Hot Lead)

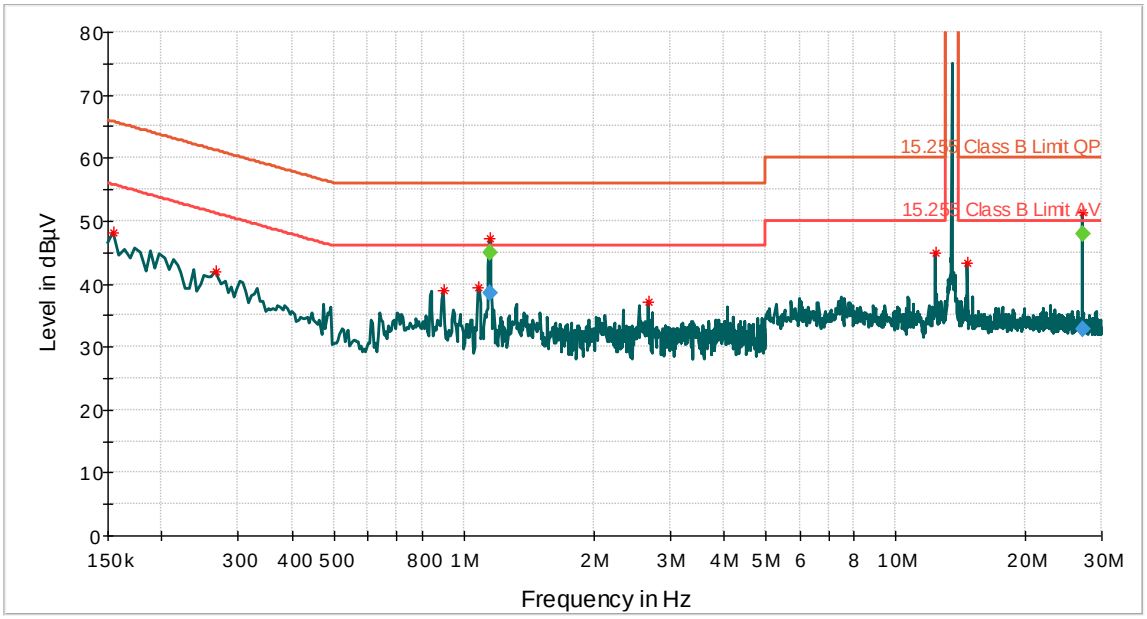
No conducted AC mains emissions were detected exceeding Section 15.207 limits outside the transmitter's fundamental emission band while transmitting with an antenna at 13.56MHz.

Transmitting with Tag



Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.18	Peak	36.6	12.9	49.6	54.5	-5.0
1.2	Quasi-Peak	35.0	10.4	45.4	56.0	-10.6
1.2	Average	29.0	10.4	39.5	46.0	-6.5
4.0	Peak	27.3	10.2	37.5	46.0	-8.5
12.4	Peak	34.9	10.5	45.4	50.0	-4.6
14.7	Peak	34.1	10.6	44.7	50.0	-5.3
27.1	Quasi-Peak	29.8	11.0	40.9	60.0	-19.2
27.1	Average	10.6	11.0	21.6	50.0	-28.4

Transmitting without Tag



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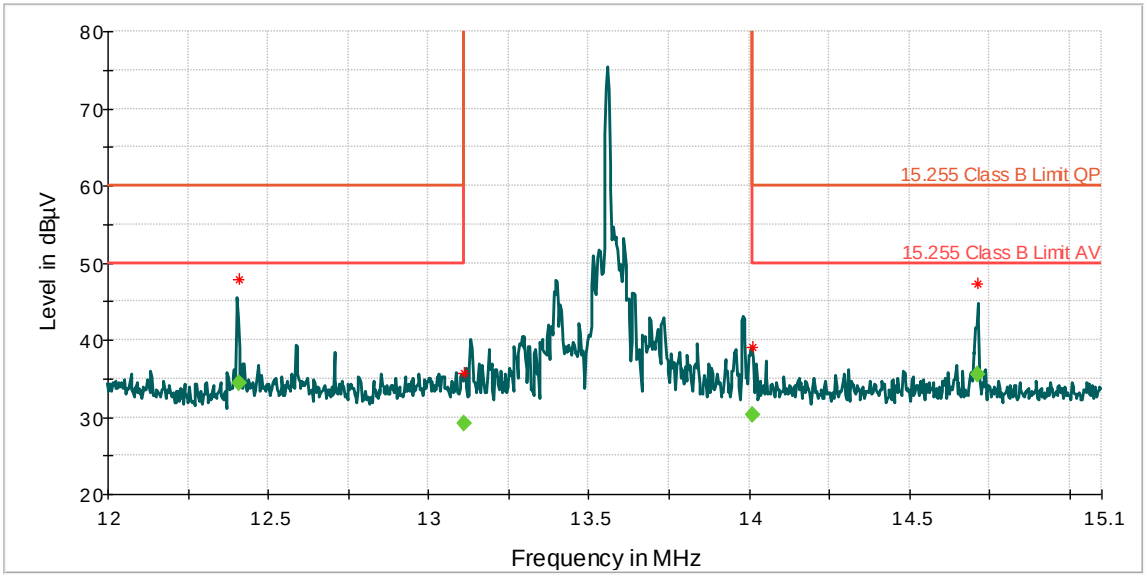
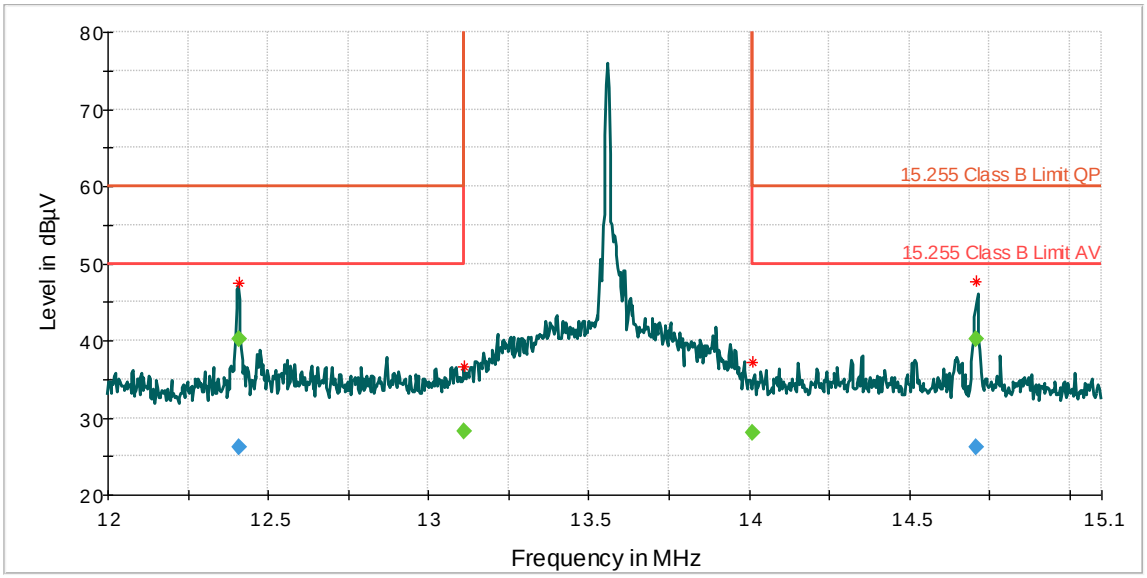
Critical_Freqs PK+ [Critical_Freqs.Result:4]
15.255 Class B Limit AV [..\Wanship Conducted 150k-30M\]
15.255 Class B Limit QP [..\Wanship Conducted 150k-30M\]
Final_Result AVG [Final_Result.Result:4]
Final_Result QPK [Final_Result.Result:5]

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.15	Peak	34.9	13.4	48.3	55.7	-7.5
0.27	Peak	29.9	12.0	41.9	51.2	-9.3
0.90	Peak	28.2	10.6	38.9	46.0	-7.1
1.1	Peak	28.9	10.5	39.3	46.0	-6.7
1.2	Quasi-Peak	34.5	10.4	44.9	56.0	-11.1
1.2	Average	28.2	10.4	38.6	46.0	-7.4
2.7	Peak	27.1	10.1	37.2	46.0	-8.8
12.4	Peak	34.4	10.5	44.9	50.0	-5.1
14.7	Peak	32.7	10.6	43.3	50.0	-6.7
27.1	Quasi-Peak	36.8	11.0	47.8	60.0	-12.2
27.1	Average	21.8	11.0	32.8	50.0	-17.2



Graph 1: Hot Lead Fundamental Emission Band Edges with Tags

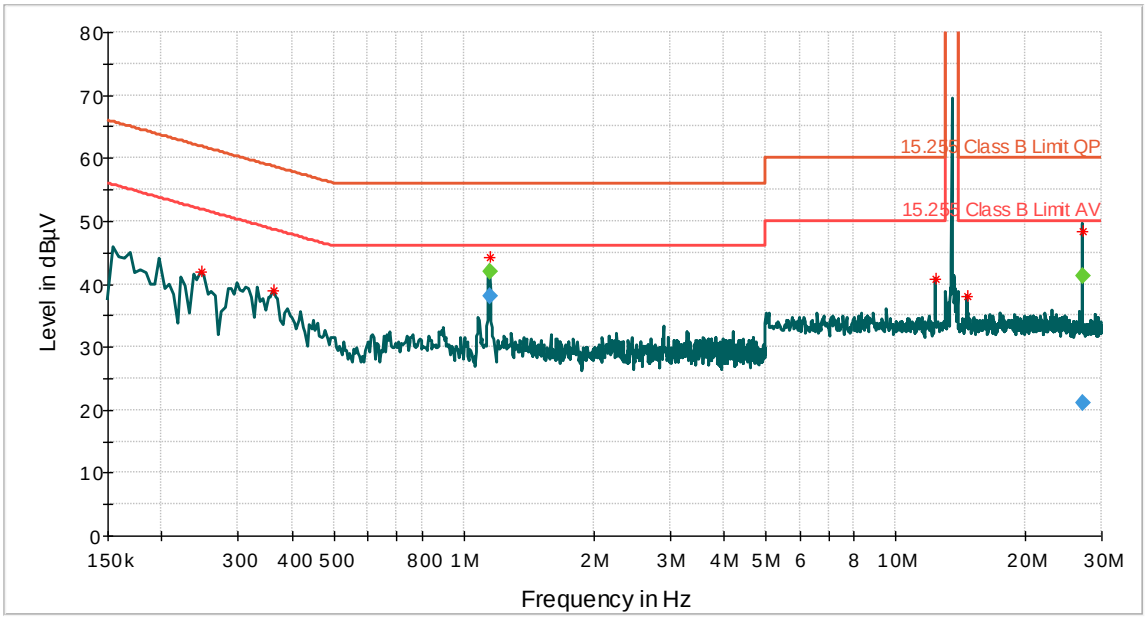


Graph 2: Hot Lead Emission Band Edges without Tags

6.2.4 Conducted Emissions at Mains Ports Data with Antenna Transmitting (Neutral Lead)

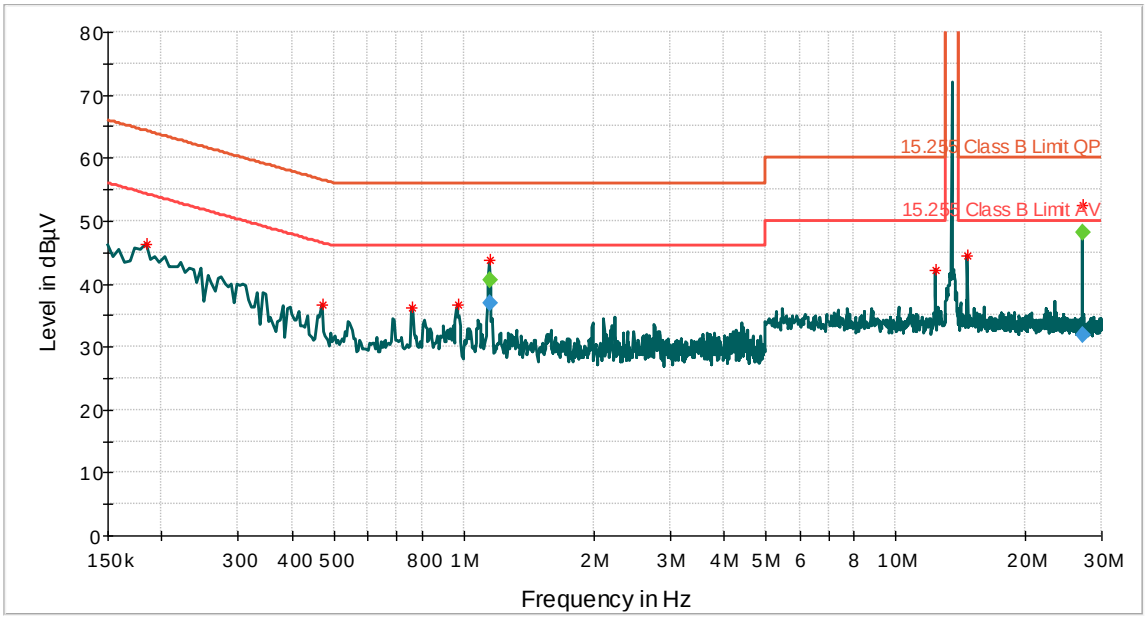
No conducted AC mains emissions were detected exceeding Section 15.207 limits outside the transmitter's fundamental emission band while transmitting with an antenna at 13.56MHz.

Transmitting with Tag



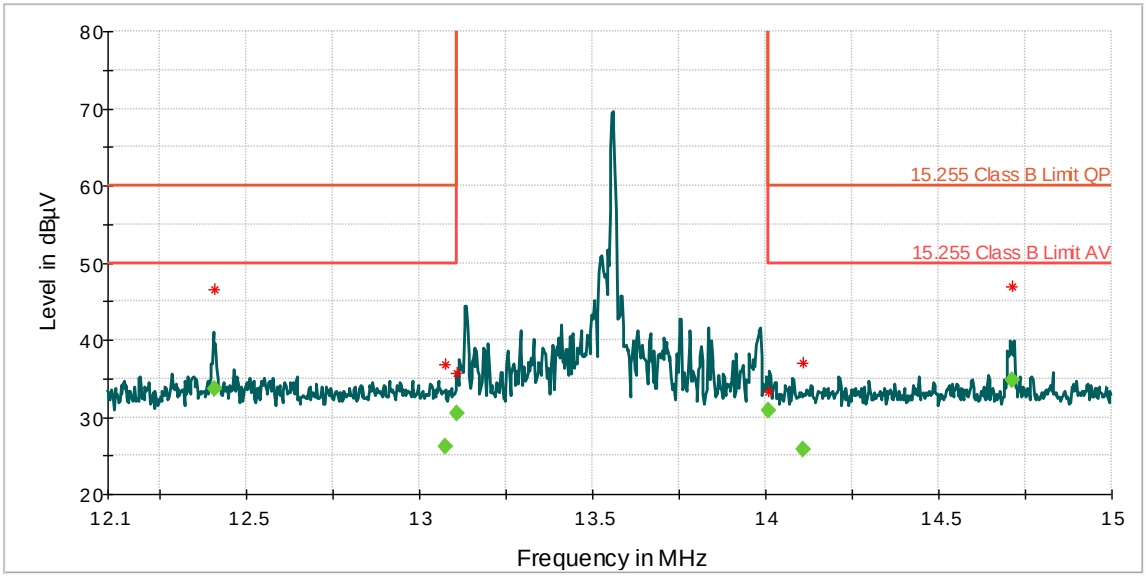
Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.25	Peak	29.9	12.2	42.1	51.9	-9.8
0.36	Peak	27.5	11.5	39.0	48.7	-9.6
1.2	Quasi-Peak	31.4	10.4	41.9	56.0	-14.1
1.2	Average	27.5	10.4	37.9	46.0	-8.1
12.4	Peak	30.4	10.5	40.9	50.0	-9.1
14.7	Peak	27.4	10.6	37.9	50.0	-12.1
27.1	Quasi-Peak	30.4	10.9	41.3	60.0	-18.7
27.1	Average	10.2	10.9	21.1	50.0	-28.9

Transmitting without Tag

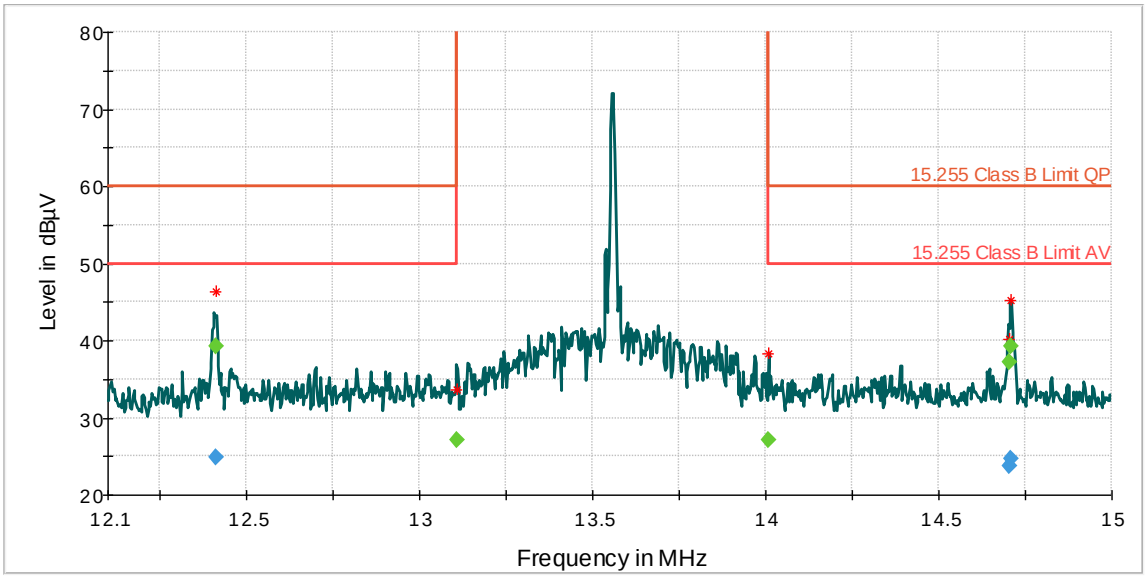


Preview Result 1-PK+ [Preview Result 1.Result:1]
Critical_Freqs PK+ [Critical_Freqs.Result:4]
15.255 Class B Limit AV [..\Wanship Conducted 150k-30M\]
15.255 Class B Limit QP [..\Wanship Conducted 150k-30M\]
Final_Result AVG [Final_Result.Result:4]
Final_Result QPK [Final_Result.Result:5]

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB)	Measured Level (dBµV)	Class B Limit (dBµV)	Margin (dB)
0.18	Peak	33.4	12.9	46.2	54.3	-8.1
0.47	Peak	25.4	11.2	36.6	46.5	-9.9
0.76	Peak	25.4	10.7	36.2	46.0	-9.8
1.0	Peak	26.1	10.5	36.6	46.0	-9.4
1.1	Quasi-Peak	30.2	10.4	40.6	56.0	-15.4
1.1	Average	26.4	10.4	36.8	46.0	-9.2
12.4	Peak	31.7	10.5	42.2	50.0	-7.8
14.7	Peak	33.9	10.6	44.5	50.0	-5.5
27.1	Quasi-Peak	37.2	10.9	48.1	60.0	-11.9
27.1	Average	20.9	10.9	31.8	50.0	-18.2



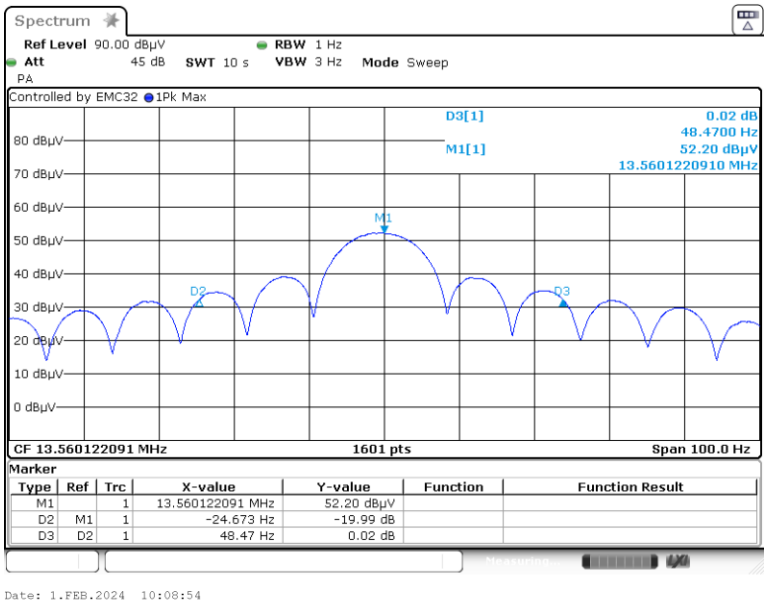
Graph 3: Neutral Lead Fundamental Emission Band Edges with Tags



Graph 4: Neutral Lead Emission Band Edges without Tags

6.2.5 20dB Emissions Bandwidth

Mode	Frequency (MHz)	Emissions 20dB Bandwidth (Hz)
Transmitting with Tag	13.56	48.5



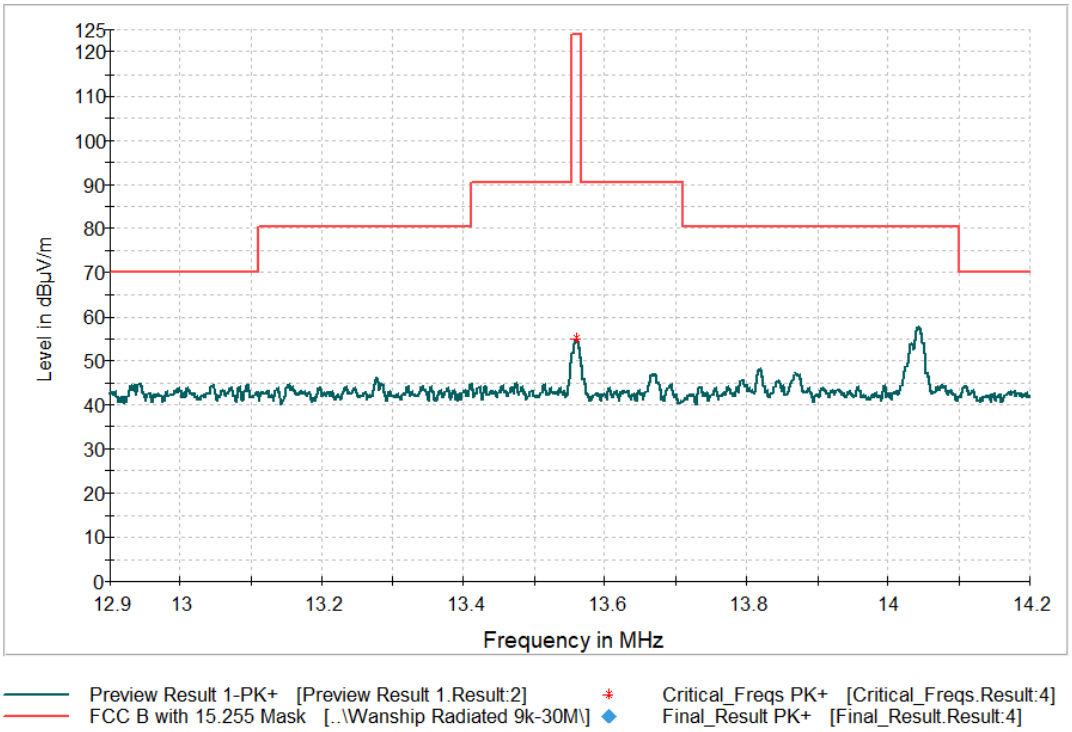
Graph 5: 20dB Bandwidth

6.2.6 §15.255(a)-(c) In-Band Radiated Disturbance Data (13.110 MHz – 14.010 MHz)

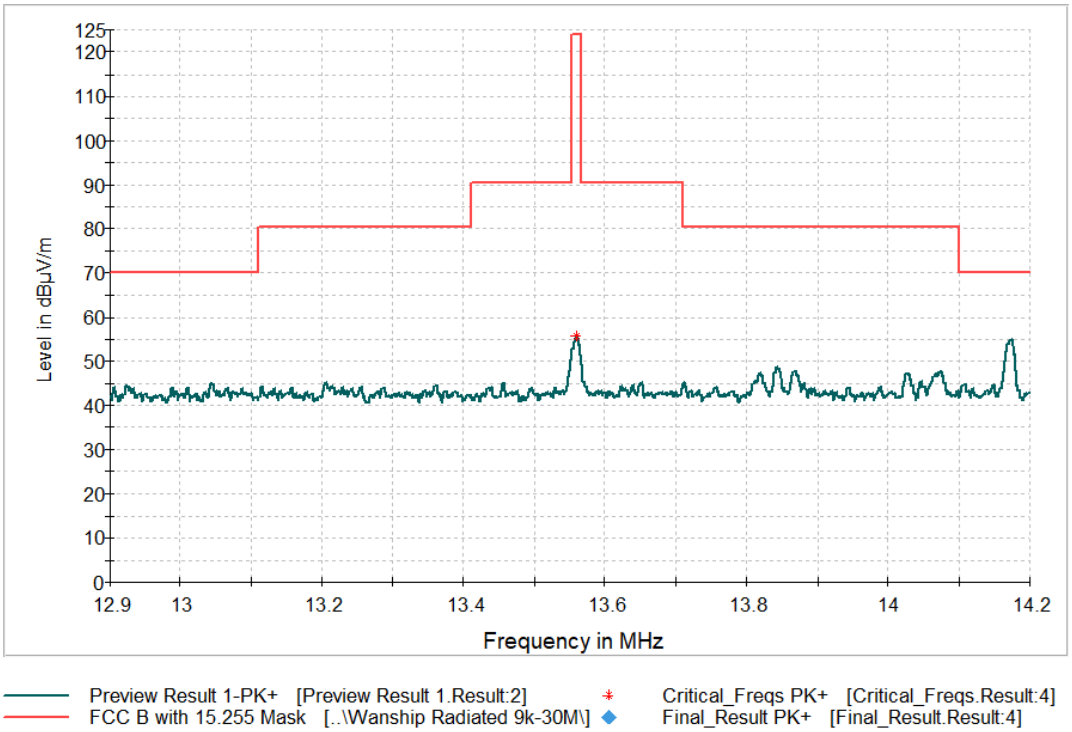
The maximum field strength shall not exceed 15,848.0 µV/m at 30 meters. Test data was taken at 3 meters and extrapolated to the limit distance according to ANSI C63.10.

Mode	Frequency (MHz)	Measured Peak Power (dBµV/m)	Measured Peak Power (µV/m)
Transmitting with Tag	13.56	55.0	562.3
Transmitting without Tag	13.56	55.5	595.7

The plots below show compliance with the full band compared to the limits of 47 CFR §15.255(a)-(c).



Graph 6: Transmitting with Tag



Graph 7: Transmitting without Tag

6.2.7 §15.225 (d) Radiated Disturbance Data (0.009 – 12500 MHz, excluding the range 13.110 – 14.010 MHz)

Worst-case emissions were detected with the EUT transmitting from the Right antenna with a Tag in place. Emissions below 30MHz were tested with a Loop antenna. Due to the low power of the device's transmission, it was evaluated at three meters to keep the signal above the noise-floor, and then extrapolated to the limit distance according to ANSI C63.10.

Radiated Emissions Data –Vertical Polarity

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
0.01	Peak (Notes 1 & 2)	70.9	18.0	88.9	299.5	-210.6
0.02	Peak (Notes 1 & 2)	57.3	13.3	70.6	177.4	-106.9
0.15	Peak (Notes 1 & 2)	57.9	9.7	67.6	96.8	-29.2
13.6	Peak (Notes 1 & 2)	43.9	10.6	54.5	124.0	-69.5
27.1	Peak (Notes 1 & 2)	37.8	9.7	47.4	70.0	-22.6
40.6	Peak (Note 1)	35.2	1.6	36.8	40.0	-3.2
40.7	Peak (Note 1)	33.2	1.6	34.9	40.0	-5.2
44.7	Peak (Note 1)	36.1	-1.0	35.2	40.0	-4.8
45.7	Peak (Note 1)	36.1	-1.0	35.1	40.0	-4.9
47.0	Peak (Note 1)	36.0	-1.2	34.8	40.0	-5.2
50.0	Quasi-Peak (Note 1)	30.5	-2.3	28.2	40.0	-11.8
51.2	Quasi-Peak (Note 1)	31.7	-2.3	29.4	40.0	-10.6
53.5	Peak (Note 1)	36.1	-2.8	33.3	40.0	-6.7
54.1	Peak (Note 1)	35.6	-2.5	33.0	40.0	-7.0
67.8	Peak (Note 1)	24.7	-2.2	22.5	40.0	-17.5
81.4	Peak (Note 1)	19.8	-2.3	17.5	40.0	-22.5
95.0	Peak (Note 1)	20.6	-1.2	19.4	43.5	-24.1
108.5	Peak (Note 1)	16.9	-0.3	16.7	43.5	-26.8
122.1	Peak (Note 1)	19.5	-1.2	18.3	43.5	-25.2
135.6	Peak (Note 1)	24.3	0.1	24.4	43.5	-19.1
147.0	Peak (Note 1)	29.2	0.7	29.9	43.5	-13.6
476.2	Peak (Note 1)	25.1	12.7	37.8	46.0	-8.2

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.
Note 2: Emissions below 30MHz were tested with a Loop antenna. Due to the low power of the device's transmission power, it was evaluated at three meters to keep the signal above the noise-floor, and then extrapolated to the limit distance according to ANSI C63.10.

Result

The EUT complied with the specification limit by a margin of 3.2 dB.

Radiated Emissions Data –Horizontal Polarity

Frequency (MHz)	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30.4	Peak (Note 1)	14.7	7.3	22.1	40.0	-17.9
40.6	Peak (Notes 1)	20.2	1.6	21.9	40.0	-18.1
45.1	Peak (Note 1)	19.0	-0.7	18.2	40.0	-21.8
54.4	Peak (Note 1)	21.2	-2.6	18.6	40.0	-21.4
68.0	Peak (Note 1)	18.6	-2.2	16.4	40.0	-23.6
81.3	Peak (Note 1)	18.5	-2.2	16.2	40.0	-23.8
108.3	Peak (Note 1)	18.3	-0.2	18.1	43.5	-25.4
122.4	Peak (Note 1)	18.2	-1.2	17.0	43.5	-26.5
135.5	Peak (Note 1)	19.0	0.1	19.1	43.5	-24.4
149.8	Peak (Note 1)	19.6	1.2	20.8	43.5	-22.7
216.9	Peak (Note 1)	19.2	3.5	22.7	46.0	-23.3
339.5	Peak (Note 1)	22.7	8.1	30.8	46.0	-15.2
367.9	Peak (Note 1)	21.6	9.7	31.4	46.0	-14.7
5799.5	Peak (Note 1)	32.1	7.5	39.6	54.0	-14.4
5799.5	Peak (Note 1)	40.4	7.5	47.9	74.0	-26.1
Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.						

Result

The EUT complied with the specification limit by a margin of 14.4 dB.

6.2.8 §15.225(e) Frequency Stability

The EUT was tested for frequency stability as specified in RSS-210 B.6. The 13.56 MHz module has its own voltage regulation. The transmitter transmits at 13560135 Hz. The transmitter is allowed a deviation of 0.01% or 1356.0 Hz. Varying the voltage ±15% does not change the transmitter fundamental frequency.

(ºC)	Frequency (Hz) over Time (Minutes)				Deviation (Hz)			
	Startup	2 min	5 min	10 min	Min Freq	Deviation	Max Freq	Deviation
50	13560074	13560088	13560074	13560077	13560074	-61	13560088	-47
40	13560085	13560083	13560077	13560083	13560077	-58	13560085	-50
30	13560111	13560109	13560106	13560109	13560106	-29	13560111	-24
20	13560135	13560135	13560135	13560135	13560135	0	13560135	0
10	13560152	13560150	13560152	13560152	13560150	15	13560152	17

(ºC)	Frequency (Hz) over Time (Minutes)				Deviation (Hz)			
	Startup	2 min	5 min	10 min	Min Freq	Deviation	Max Freq	Deviation
0	13560143	13560143	13560149	13560149	13560143	8	13560149	14
-10	13560106	13560111	13560114	13560120	13560106	-29	13560120	-15
-20	13560033	13560048	13560056	13560059	13560033	-102	13560059	-76

Result

The EUT complied with the specification as the fundamental frequency was maintained with ± 0.01% of the operating frequency through the tests.

6.3 Sample Measurement Calculations

6.3.1 Field Strength Calculations

The field strength is calculated by adding the *Correction Factor* (*Antenna Factor* + *Cable Factor*), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. The basic equation with a sample calculation is shown below:

$$Receiver\ Amplitude\ Reading = Receiver\ Reading - Amplifier\ Gain$$
$$Correction\ Factor = Antenna\ Factor\ +\ Cable\ Factor$$
$$Field\ Strength = Receiver\ Amplitude\ Reading\ +\ Correction\ Factor$$

Example

Assuming a *Receiver Reading* of 42.5 dBµV is obtained from the receiver, the *Amplifier Gain* is 26.5 dB the *Antenna Factor* is 4.5 dB, and the *Cable Factor* is 4.0 dB. The *Field Strength* is calculated by subtracting the *Amplifier Gain* and adding the *Correction Factor*, giving a *Field Strength* of 24.5 dBµV/m.

$$Receiver\ Amplitude\ Reading\ =\ 42.5 - 26.5\ =\ 16.0\ \text{dBµV/m}$$
$$Correction\ Factor\ =\ 4.5 + 4.0\ =\ 8.5\ \text{dB}$$
$$Field\ Strength\ =\ 16.0 + 8.5\ =\ 24.5\ \text{dBµV/m}$$

6.3.2 Conducted Measurement Value Calculations

A conducted emission value is calculated by adding the *Correction Factor* (*LISN Transducer Factor* + *Cable Factor*) to the measured value from the receiver. The LISN contains an internal 10dB (nominal) attenuation accounted for in the LISN Transducer Factor. Amplifiers are not utilized for this measurement. The basic equation with a sample calculation is shown below:

$$Correction\ Factor\ =\ LISN\ Transducer\ Factor\ +\ Cable\ Factor$$
$$Conducted\ Emission\ Value\ =\ Receiver\ Amplitude\ Reading\ +\ Correction\ Factor$$

Example

Assuming a *Receiver Reading* of 20.8 dBµV is obtained from the receiver, *LISN Transducer Factor* is 10.1 dB, and the *Cable Factor* is 0.3 dB. The *Conducted Emissions Value* is calculated by adding the *Correction Factor*, giving a *Conducted Emissions Value* of 31.2 dBµV.

$$Receiver\ Amplitude\ Reading\ =\ 20.8\ \text{dBµV}$$
$$Correction\ Factor\ =\ 10.1 + 0.3\ =\ 10.4\ \text{dB}$$
$$Conducted\ Emissions\ Value\ =\ 20.8 + 10.4\ =\ 31.2\ \text{dBµV}$$

7 Test Procedures and Test Equipment

7.1 Conducted Emissions at Mains Ports

The conducted emissions at mains and telecommunications ports from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted emissions at mains ports measurements are performed in a screen room using a (50 Ω/50 µH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of devices with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

- Each power cord, which is terminated in a mains supply plug, shall be tested separately.
- Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
- Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
- Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
- When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

For testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	V033119	08/20/2023	08/20/2024
Spectrum Analyzer/ Signal Analyzer	Rohde & Schwarz	FSV40	V044352	03/08/2022	03/08/2024
LISN	Teseq	NNB 51	V045406	12/05/2023	12/05/2024
Conductance Cable Wanship Upper Site	VPI Labs	Cable J	V034832	12/28/2023	12/28/2024
EMC32 Test Software	Rohde & Schwarz	10.60.20	N/A	N/A	N/A

Table 2: List of equipment used for conducted emissions testing at mains ports.

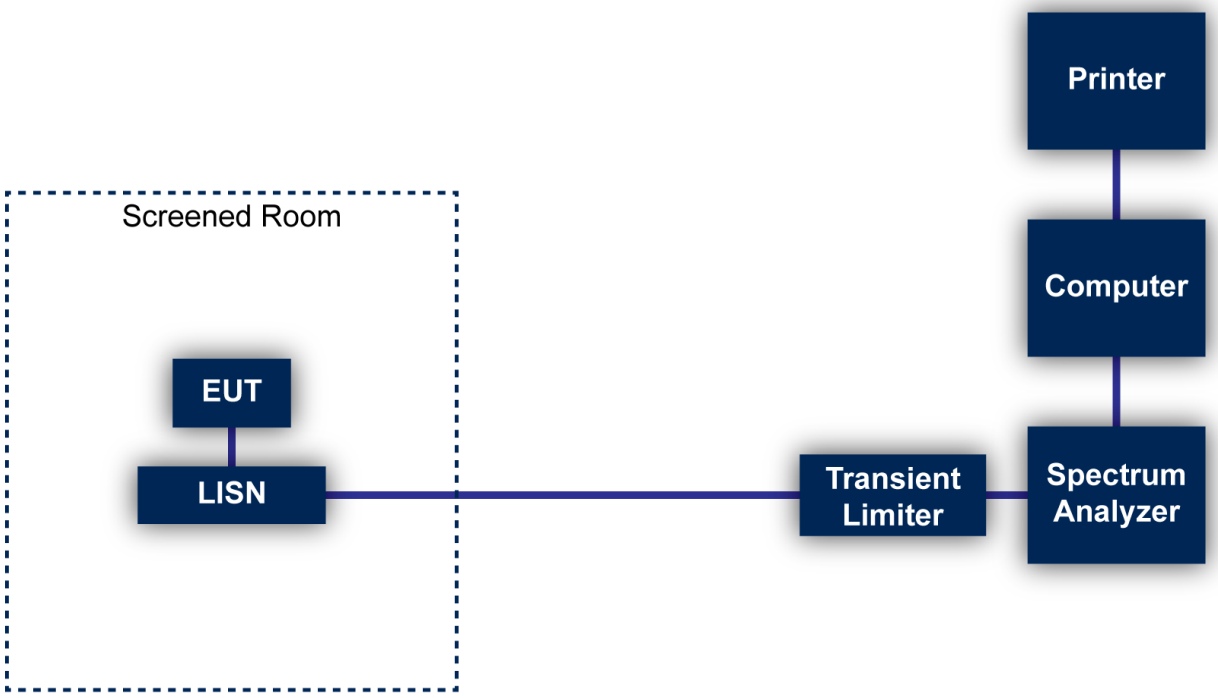


Figure 1: Conducted Emissions Test

7.1.1 Test Configuration Block Diagram

Figure 2: Direct Connection at the Antenna Port Test

7.2 Radiated Emissions

The radiated emissions from the EUT were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A preamplifier with a fixed gain of 51 dB was used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For frequencies below 30 MHz, a 9 kHz resolution Bandwidth was used.

A loop antenna was used to measure frequencies below 30 MHz. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated emissions. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. For frequencies above 1000 MHz, the EUT is placed on a table 1.5 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emissions testing that is performed at distances closer than the specified distance; an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

Type of Equipment	Manufacturer	Model Number	Asset Number	Date of Last Calibration	Due Date of Calibration
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	V033119	08/20/2023	08/20/2024
Spectrum Analyzer/ Signal Analyzer	Rohde & Schwarz	FSV40	V044352	03/08/2022	03/08/2024
Loop Antenna	EMCO	6502	V034216	04/27/2023	04/27/2024
Biconilog Antenna	EMCO	3142E	V057461	06/06/2023	06/06/2025
Power Amplifier	HP	8447E	V067767	12/28/2023	12/28/2024
Double Ridged Guide Antenna	EMCO	3115	V034413	01/25/2023	01/25/2025
Standard Gain Horn	ETS-Lindgren	3160-09	V034223	ICO	ICO
High Frequency Amplifier	Miteq	AFS4-001018000-35-10P-4	V033997	12/28/2023	12/28/2024
900 MHz High Pass Filter	Micro-Tronics	HPM50108-03	V034185	12/28/2023	12/28/2024
2.4 GHz High Pass Filter	Micro-Tronics	HPM50111-03	V034183	12/28/2023	12/28/2024
2.4 GHz Notch Filter	Micro-Tronics	BRM50702-03	V034213	12/28/2023	12/28/2024
6’ High Frequency Cable	Microcoax	UFB197C-0-0720-000000	V033638	12/28/2023	12/28/2024
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	V033979	12/28/2023	12/28/2024
3 Meter Radiated Emissions Cable Wanship Upper Site	Microcoax	UFB205A-0-4700-000000	V033639	12/28/2023	12/28/2024
EMC32 Test Software	Rohde & Schwarz	10.60.20	N/A	N/A	N/A

Table 3: List of equipment used for radiated emissions testing.

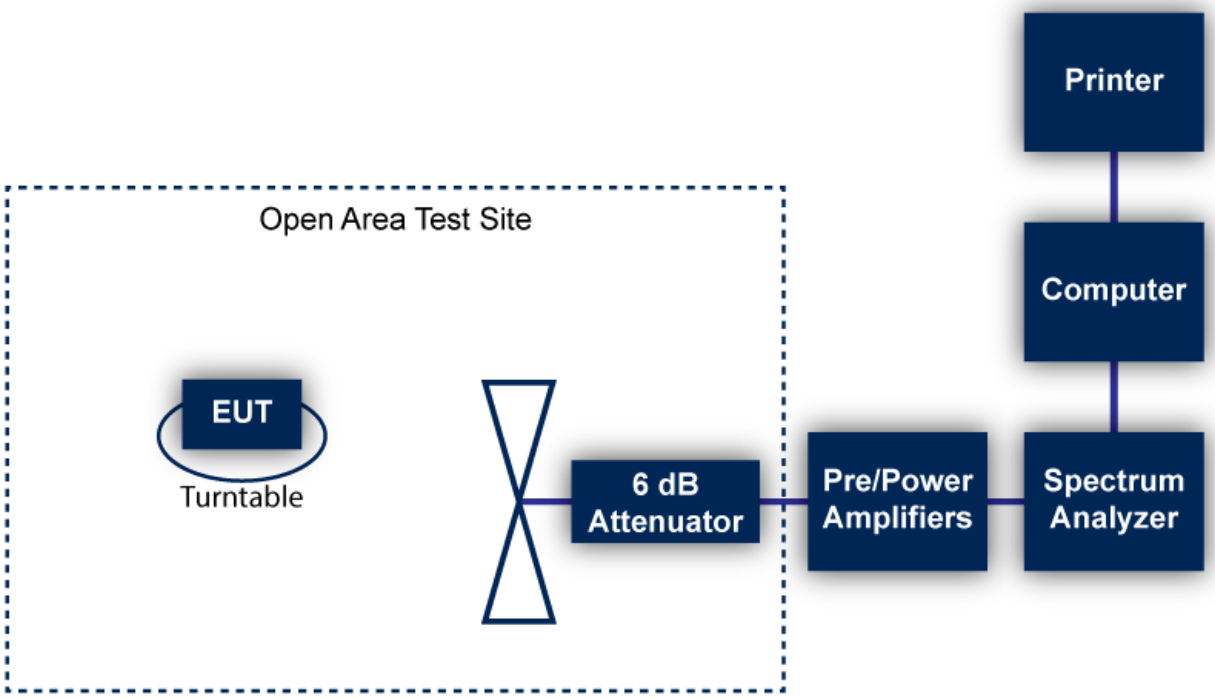


Figure 3: Radiated Emissions Test

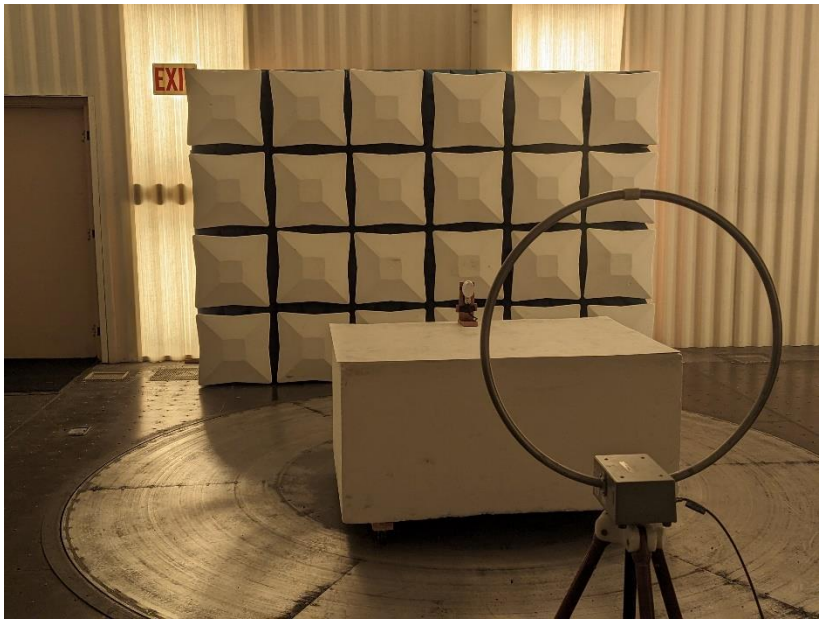
7.3 Equipment Calibration

All applicable equipment is calibrated using either an independent calibration laboratory or VPI Laboratories, Inc. personnel at intervals defined in ANSI C63.4:2014 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

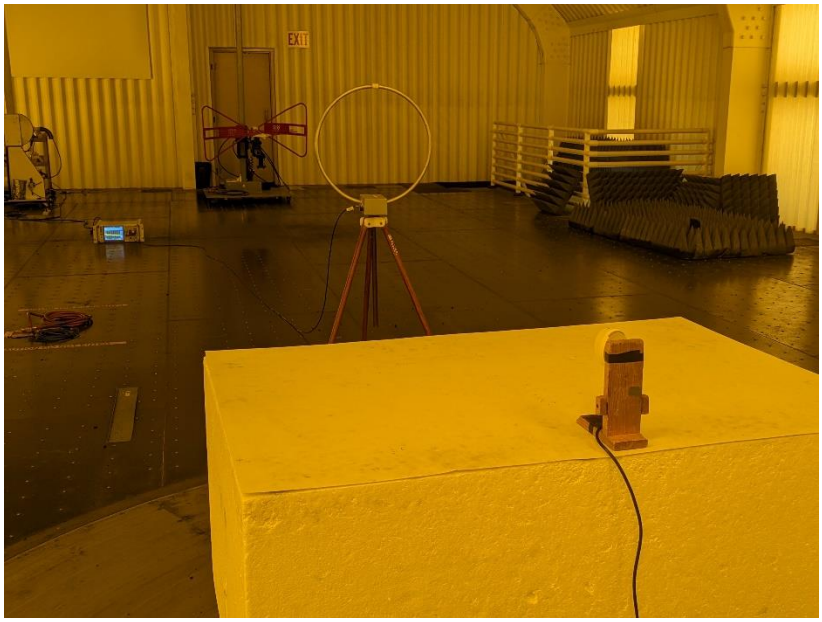
7.4 Measurement Uncertainty

Test	Uncertainty (±dB)	Confidence (%)
Conducted Emissions	2.8	95
Radiated Emission (9 kHz to 30 MHz)	3.3	95
Radiated Emissions (30 MHz to 1 GHz)	3.4	95
Radiated Emissions (1 GHz to 18 GHz)	5.0	95
Radiated Emissions (18 GHz to 40 GHz)	4.1	95

8 Photographs

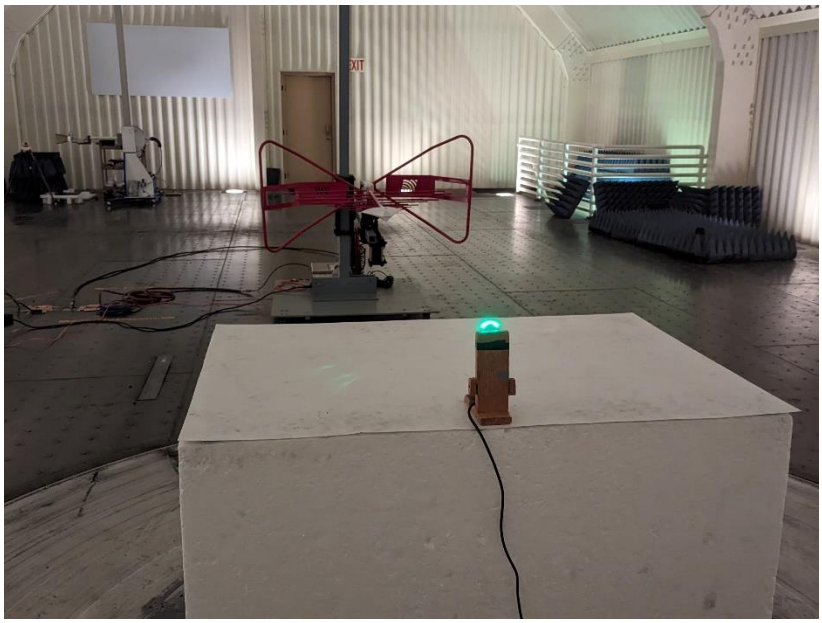


Photograph 1: Front View Radiated Emissions Worst-Case Configuration – Frequencies Below 30MHz

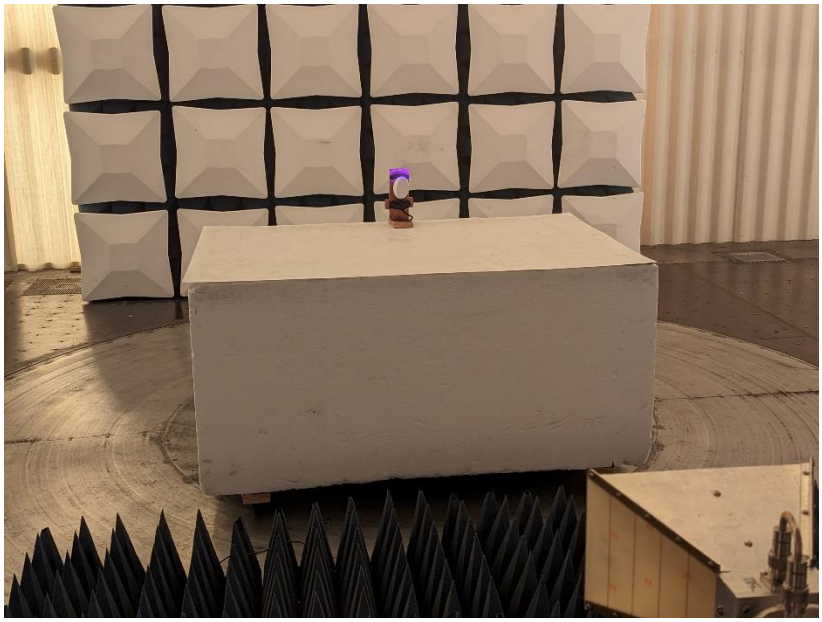


Photograph 2: Back View Radiated Emissions Worst-Case Configuration – Frequencies Below 30MHz

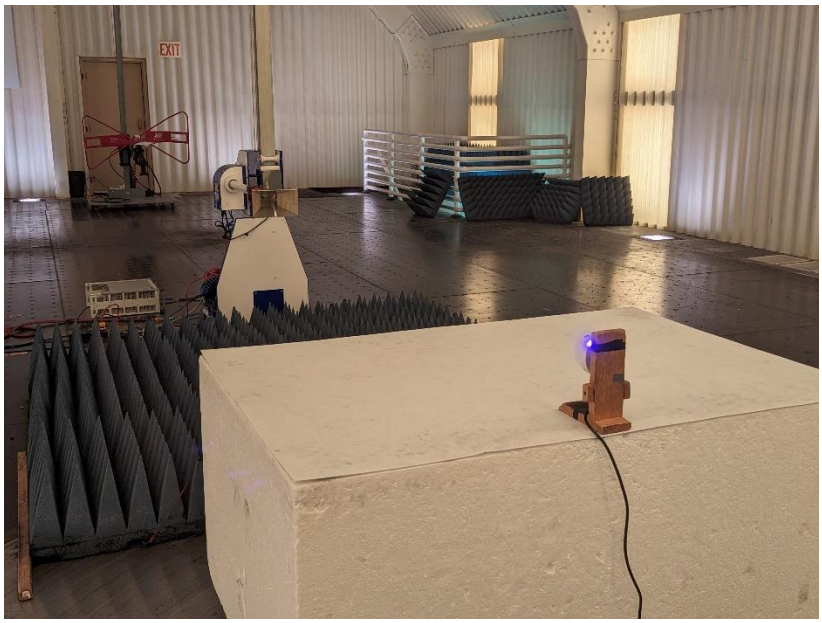
Photograph 3: Front View Radiated Emissions Worst-Case Configuration – Frequencies 30-1000MHz



Photograph 4: Back View Radiated Emissions Worst-Case Configuration – Frequencies 30-1000MHz



Photograph 5: Front View Radiated Emissions Worst-Case Configuration – Frequencies Above 1000MHz



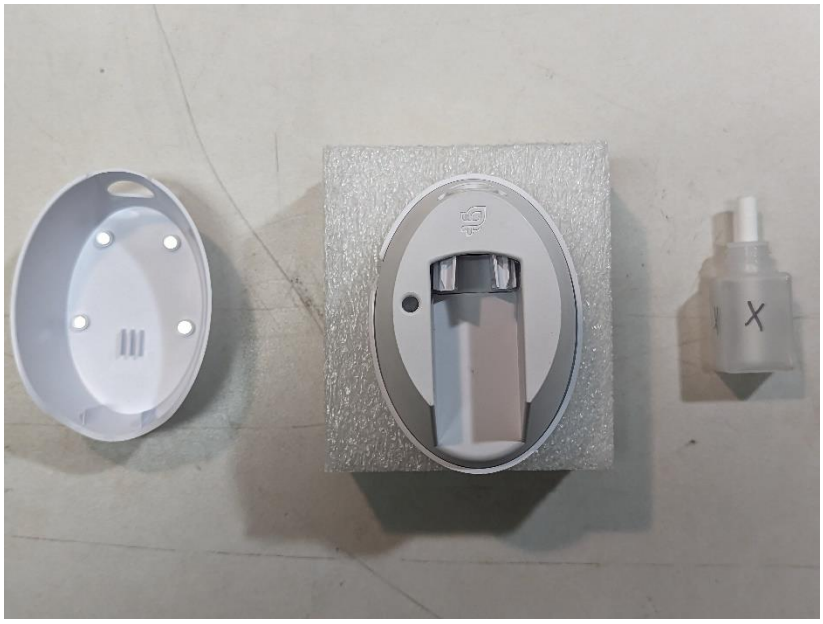
Photograph 6: Back View Radiated Emissions Worst-Case Configuration – Frequencies Above 1000MHz

Photograph 7: Front View Conducted Emissions Worst-Case Configuration

Photograph 8: Back View Conducted Emissions Worst-Case Configuration

Photograph 9: Front View of the EUT with Cover In Place

Photograph 10: Front View of the EUT with Cover Removed and Tag In Place



Photograph 11: Front View of the EUT with Cover and Tag Removed

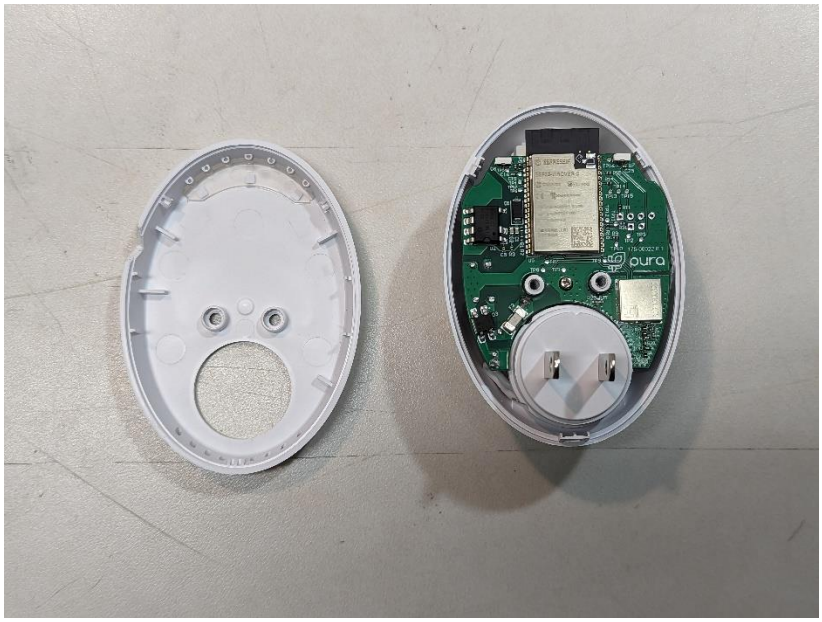
Photograph 12: Scent Bottles with Tag

Photograph 13: Back View of the EUT

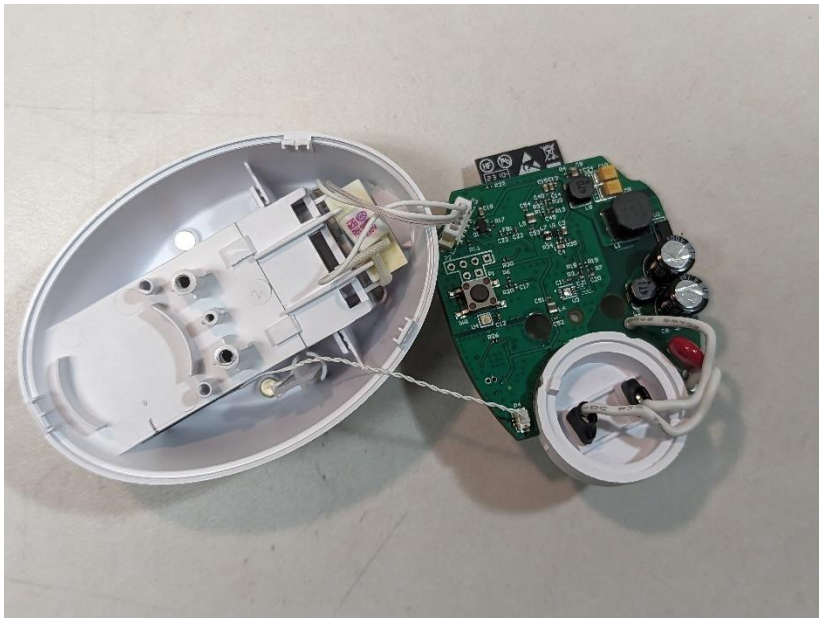
Photograph 14: Side View of the EUT

Photograph 15: Bottom View of the EUT

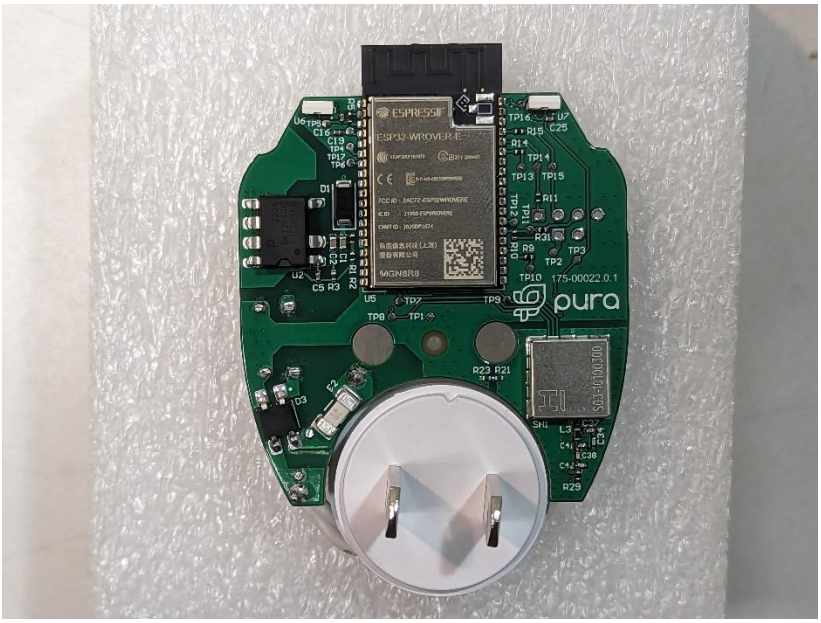
Photograph 16: Top View of the EUT



Photograph 17: Opened Enclosure PCB Placement

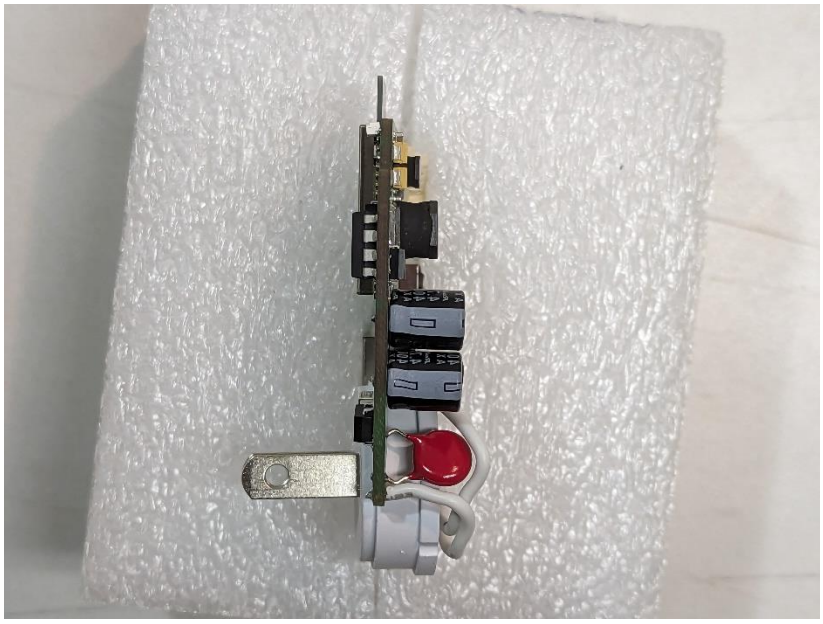


Photograph 18: Placement of PCB Removed from Enclosure Showing Antenna Connection



Photograph 19: Top View of PCB Removed from Enclosure

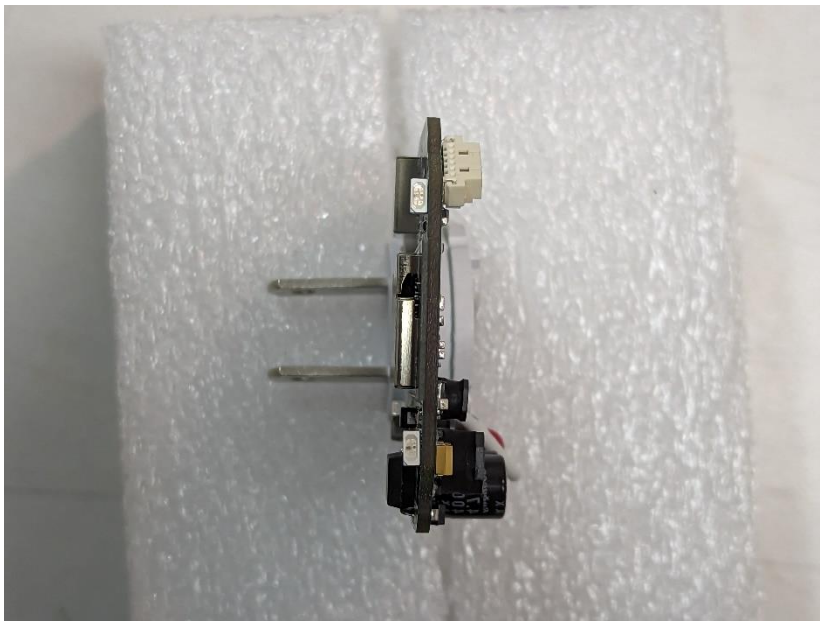
Photograph 20: Bottom View of PCB Removed from Enclosure



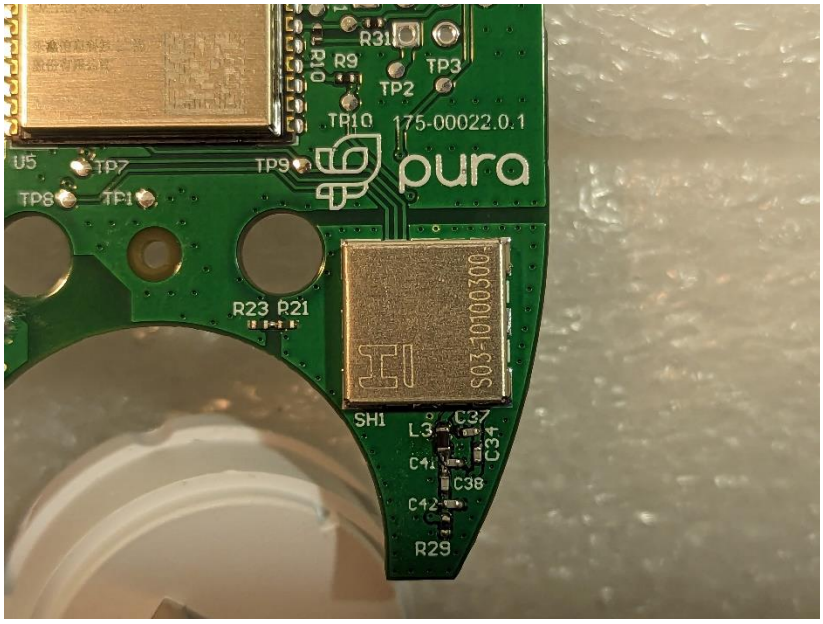
Photograph 21: Edge 1 View PCB Removed from Enclosure

Photograph 22: Edge 2 View PCB Removed from Enclosure

Photograph 23: Edge 3 View PCB Removed from Enclosure

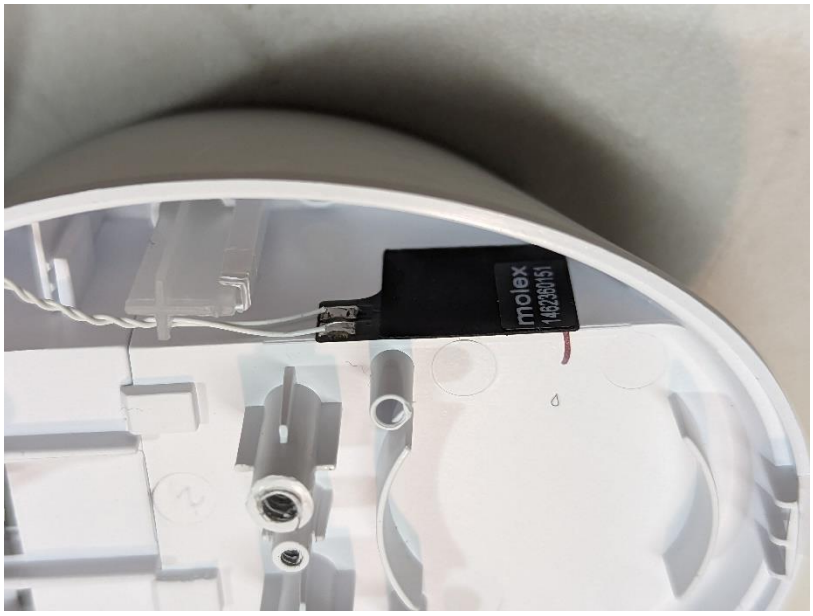


Photograph 24: Edge 4 View PCB Removed from Enclosure



Photograph 25: Bottom View of PCB Removed from Enclosure with NFC Shield

Photograph 26: Close-up View of PCB Section Under NFC Shield



Photograph 27: View of NFC Antenna on Enclosure

--- End of Report ---