

Test Report

Prepared for: Luna Products LLC

Model: LP.KEY03.345.1

Description: 3-Button Keyfob

Serial Number: NA

FCC ID: 2ATK4LPKEY033451

To

FCC Part 15.231

And

RSS-210

Test Result: PASS

Date of Issue: July 10, 2024

On the behalf of the applicant:

Luna Products LLC
3145 Tiger Run CT. STE 110
Carlsbad, CA 92010
United States

Attention of:

Robert Reichert, Sr. Regulatory Engineer
Ph: 833-586-2776
E-mail: rreichert@lunaproducts.com

Prepared by
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p2460006



Project Test Engineer
John Michalowicz

This report may not be reproduced, except in full, without written permission from Compliance Testing.
All results contained herein relate only to the sample tested.

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.231(a),(e)	Fundamental Field Strength	Pass	
15.231(d)	Out of Band Spurious Emissions	Pass	
15.231(c), RSS-210	99% Occupied Bandwidth	Pass	

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	July 10, 2024	John Michalowicz	Original Document

Table of Contents

<u>Description</u>	<u>Page</u>
TEST RESULTS SUMMARY	2
STANDARD TEST CONDITIONS ENGINEERING PRACTICES	7
FUNDAMENTAL FIELD STRENGTH	9
RADIATED SPURIOUS EMISSIONS	12
99% OCCUPIED BANDWIDTH	17
TEST EQUIPMENT UTILIZED	18

ANAB

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.



FCC Site Reg. #349717

IC Site Reg. #2044A-2

The applicant has been cautioned as to the following

15.21: Information to User

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator the responsible part may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing:

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (Mbar)
26.1 – 27.2	31 - 41	967.8 – 969.7

EUT Description

Model: LP.KEY03.345.1

Description: 3-Button Keyfob

Firmware: N/A

Software: 0

Serial Number: NA

Highest Clock Frequency: 345 MHz (Transmitter)

Additional Information: The EUT is a battery powered Key fob with wireless capability. The EUT transmits on 345 MHz with a button press.

EUT Operation during Tests

The EUT was powered with a CR2032 battery and placed in a constant transmit mode during testing unless otherwise stated.

Accessories: NA

Cables: NA

Modifications: NA

Fundamental Field Strength

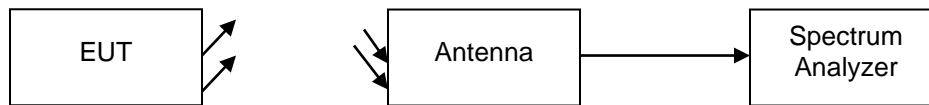
Engineer: John Michalowicz

Test Date: 7/03/24

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meters from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Fundamental Field Strength.

Test Setup



Spectrum Analyzer Settings

Detector Settings	RBW	VBW	Span
peak	300 kHz	2.0 MHz	As Necessary

Sample Calculations:

Correction Factors include Antenna and cable insertion loss.

Measured Level includes correction factors that were entered into the spectrum analyzer before recording test data.

All following limits were converted to dBuV/m by the calculation stated below:

$20 \cdot \text{LOG}(\mu\text{V/m})$

Fundamental Frequency (MHz)	Field Strength of Fundamental ($\mu\text{V/m}$)	Field Strength of Spurious Emissions ($\mu\text{V/m}$)
260 - 470	3750 to 12500	375 to 1250

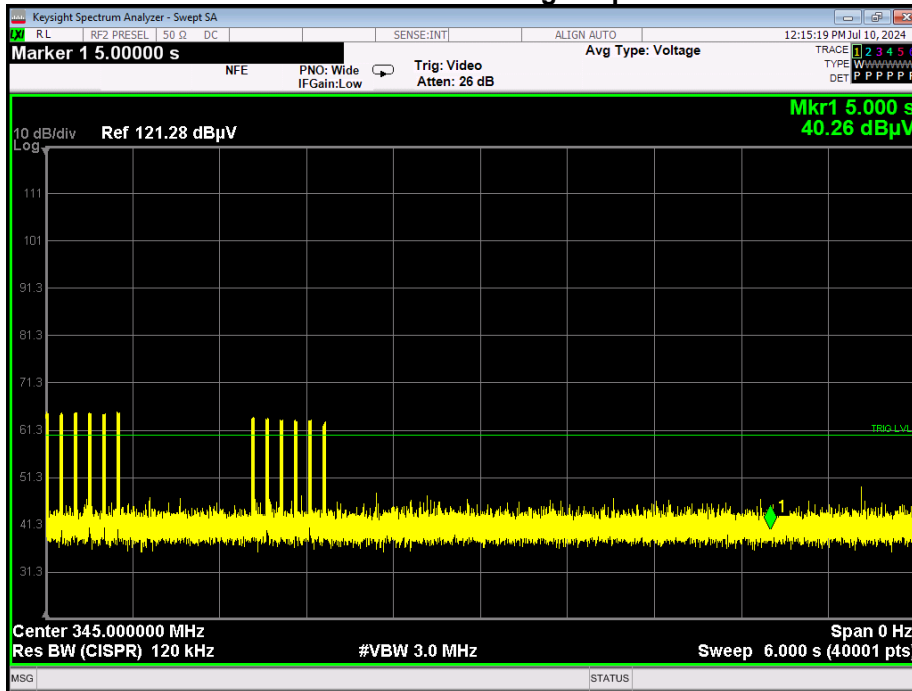
*Linear interpolations

Fundamental Field Strength

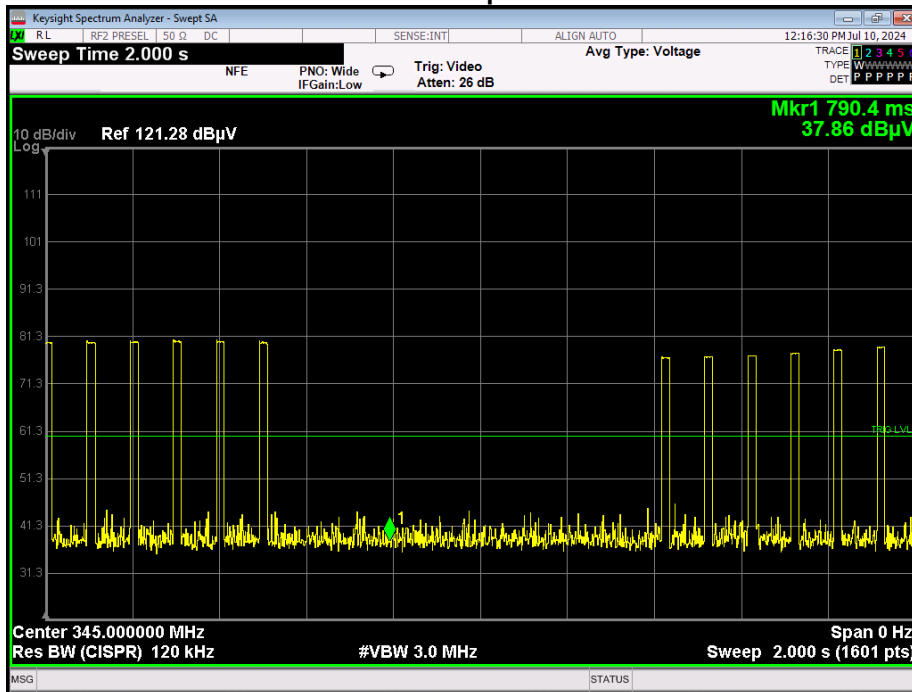
Tuned Frequency (MHz)	Peak Measured Level (dBuV/m)	Peak. Limit (dBuV/m)	Avg. Measured Level (dBuV/m)	Avg. Limit (dBuV/m)	Result
345	84.49	97.26	65.1	77.26	Pass

Duty cycle correction = -19.39 dB

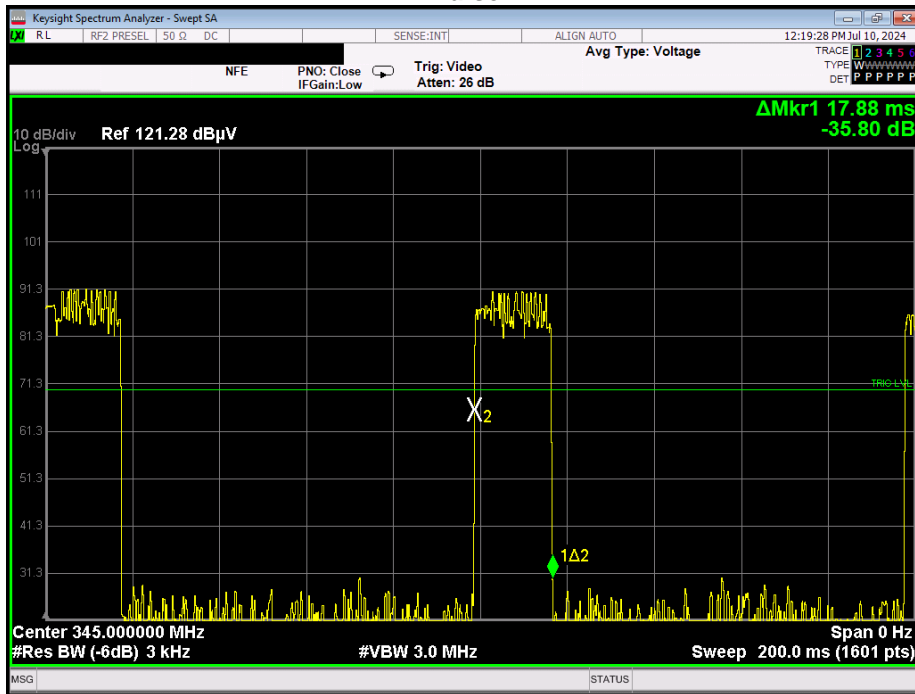
5 second Period while holding the pushbutton



2 second period



Pulse



Pulse 1	Pulse 1	Summation	Duty Cycle
ms	count	ms	dB
17.88	12	214.56	-19.39

Radiated Spurious Emissions

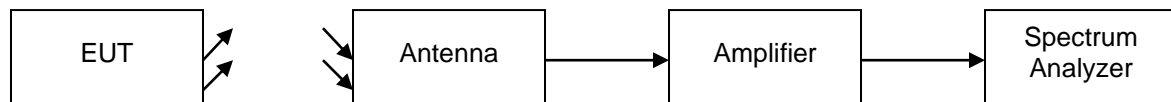
Engineer: John Michalowicz

Test Date: 7/3/24

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the limits for Radiated Spurious Emissions. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording data. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup



Analyzer Settings

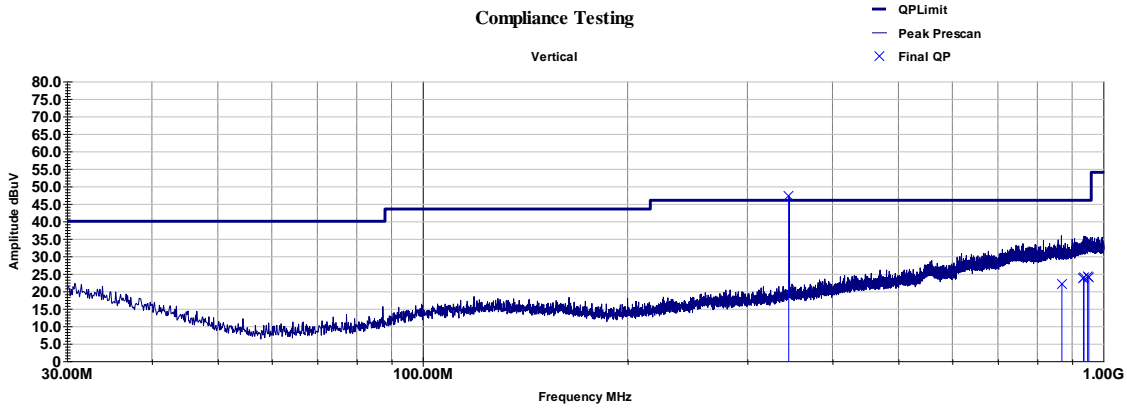
Detector Settings	RBW (MHz)	VBW (MHz)	Span
Peak	1	3	As Necessary
Average	1	3	As Necessary

Sample Calculations:

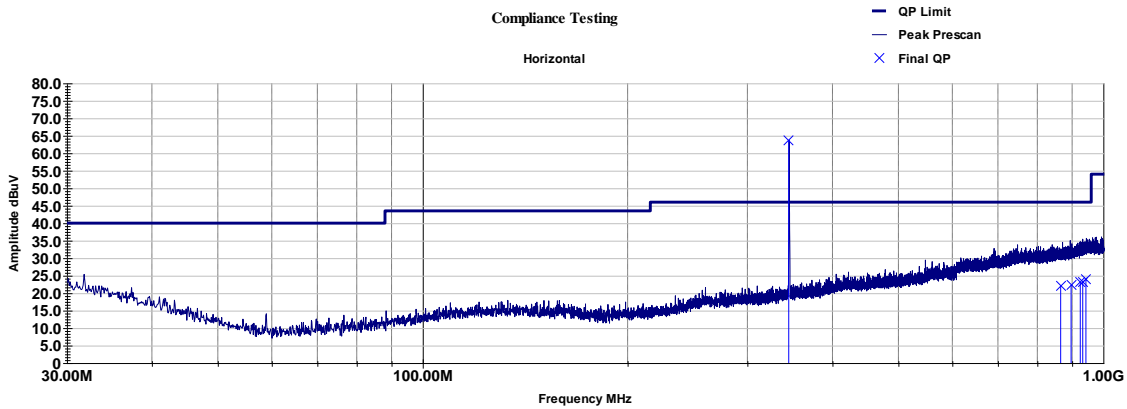
Correction Factors include Antenna and cable insertion loss correction factors.

Measured Level includes correction factors that were input to the spectrum analyzer before recording test data

30 - 1000 MHz

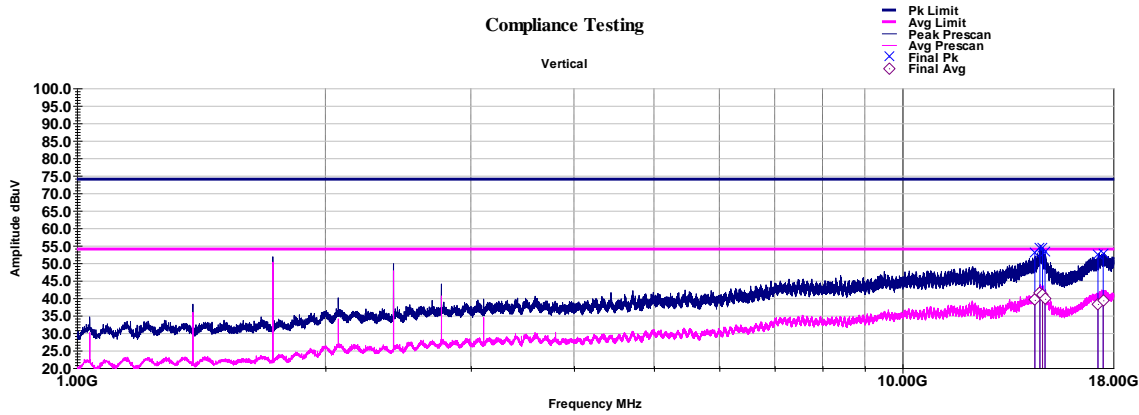


Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
344.995	51.00	260.00	NA	NA	NA	NA	NA
869.176	145.00	322.00	25.77	-3.79	22.00	46.00	-24.00
935.063	352.00	335.00	25.56	-1.89	23.70	46.00	-22.30
936.961	64.00	325.00	25.61	-1.69	23.90	46.00	-22.10
948.348	72.00	352.00	25.53	-1.40	24.10	46.00	-21.90
952.257	255.00	281.00	25.54	-1.47	24.10	46.00	-21.90
Final = Raw + Path Loss							
Margin = Final - Limit							

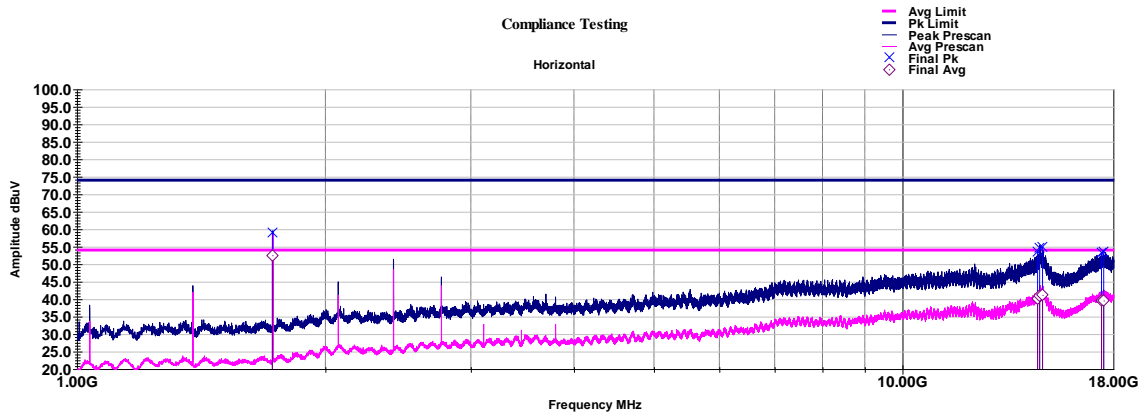


Frequency	Azimuth	Height	Raw QP	Correction	Final QP	Limit	QP Margin
MHz	deg	cm	dBuV	dB	dBuV/m	dBuV/m	dB
345.001	299.00	100.00	NA	NA	NA	NA	NA
865.76	353.00	325.00	25.90	-3.78	22.10	46.00	-23.90
896.697	199.00	325.00	25.75	-3.40	22.40	46.00	-23.60
924.953	331.00	325.00	25.63	-2.56	23.10	46.00	-22.90
932.607	253.00	148.00	25.62	-2.41	23.20	46.00	-22.80
942.815	359.00	325.00	25.58	-1.74	23.80	46.00	-22.20
Final = Raw + Path Loss							
Margin = Final - Limit							

1 - 18 GHz



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
14463978250	76.00	395.00	48.61	35.10	4.35	52.97	74.00	-21.03	39.45	54	-14.55
14668485000	0.00	121.00	47.95	34.96	6.54	54.49	74.00	-19.51	41.50	54	-12.50
14777740250	165.00	325.00	48.39	34.83	6.08	54.47	74.00	-19.53	40.91	54	-13.09
14881629750	316.00	170.00	48.44	35.07	4.71	53.14	74.00	-20.86	39.77	54	-14.23
17245752500	110.00	100.00	45.72	31.47	6.83	52.55	74.00	-21.45	38.30	54	-15.70
17501974000	340.00	322.00	44.68	31.27	8.09	52.77	74.00	-21.24	39.36	54	-14.64
Final = Raw + Path Loss											
Margin = Final - Limit											



Frequency	Azimuth	Height	Raw Pk	Raw Avg	Correction	Final Pk	Pk Limit	Pk Margin	Final Avg	Avg Limit	Avg Margin
MHz	deg	cm	dBuV	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	dBuV/m	dB
1724943750	106.00	100.00	75.02	68.42	-15.89	59.13	74.00	-14.87	52.53	54	-1.47
14571080750	312.00	121.00	48.02	34.56	5.50	53.52	74.00	-20.48	40.06	54	-13.94
14656053750	312.00	124.00	48.09	34.47	6.49	54.57	74.00	-19.43	40.96	54	-13.04
14774732000	198.00	197.00	48.87	35.06	6.12	54.98	74.00	-19.02	41.17	54	-12.83
17417591000	77.00	100.00	45.43	31.67	7.83	53.26	74.00	-20.74	39.50	54	-14.50
17523483500	3.00	185.00	45.50	31.51	8.09	53.58	74.00	-20.42	39.60	54	-14.40
Final = Raw + Path Loss											
Margin = Final - Limit											

99% Occupied Bandwidth

Engineer: John Michalowicz

Test Date: 7/3/24

Test Procedure

The EUT was tested in a semi-anechoic chamber at a distance of 3 meter from the receiving antenna. The Span was set wide enough to capture the entire transmit spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold while the 99% bandwidth was measured.

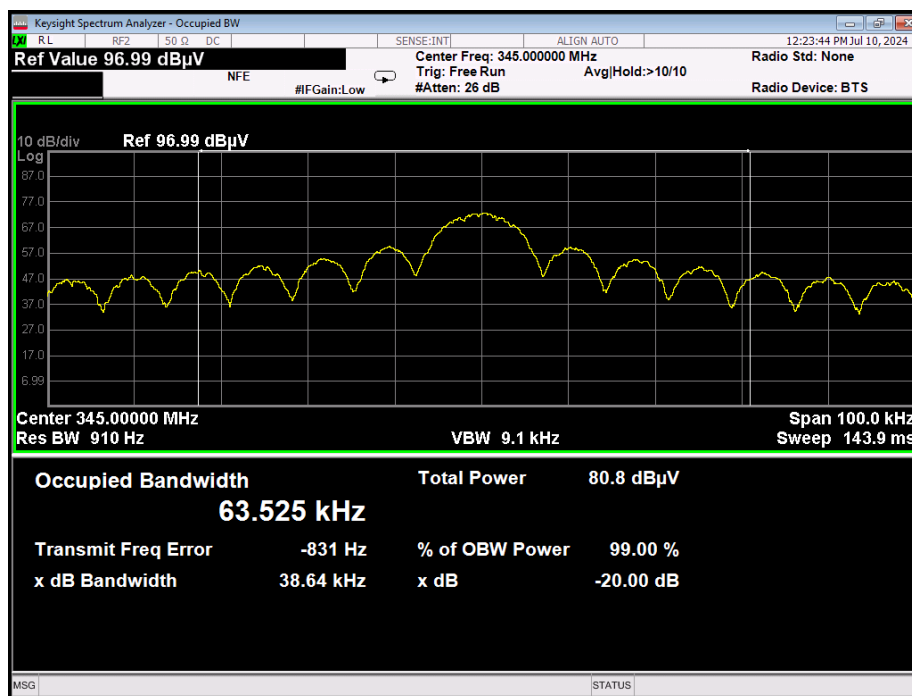
Test Setup



Occupied Bandwidth Summary

Frequency (MHz)	Recorded Measurement (kHz)	Result
345	63.5	Pass

99% Bandwidth



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	8/11/22	8/11/24
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	2/7/23	2/7/25
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/13/23	7/13/26
MXE EMI receiver	Keysight	N9038A	i00552	3/1/24	3/1/25
Temp./humidity/pressure monitor (rad. immunity)	Omega Engineering	iBTHX-W-5	i00629	1/25/24	1/25/25

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

Measurement Uncertainty

Measurement Uncertainty (U_{lab}) for Compliance Testing is listed in the table below.

Measurement	U_{lab}
Radio Frequency	$\pm 3.3 \times 10^{-8}$
RF Power, conducted	± 1.5 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 1.8 dB
Radiated Emissions	± 4.5 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty $\pm U_{lab}$ (dB) has been estimated at a 95% confidence level ($k=2$)

U_{lab} is less than or equal to U_{ETSI} therefore

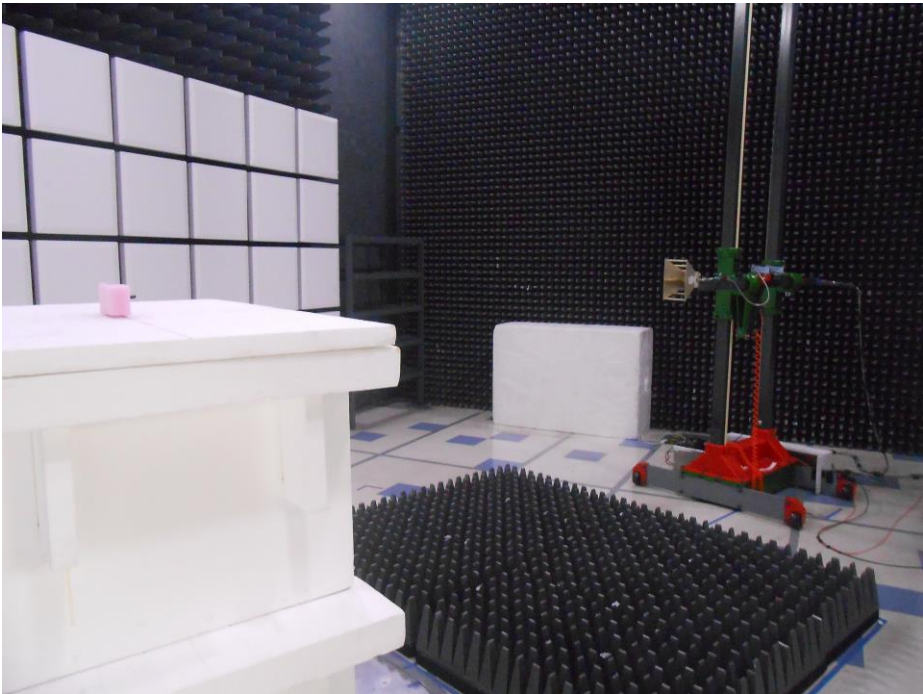
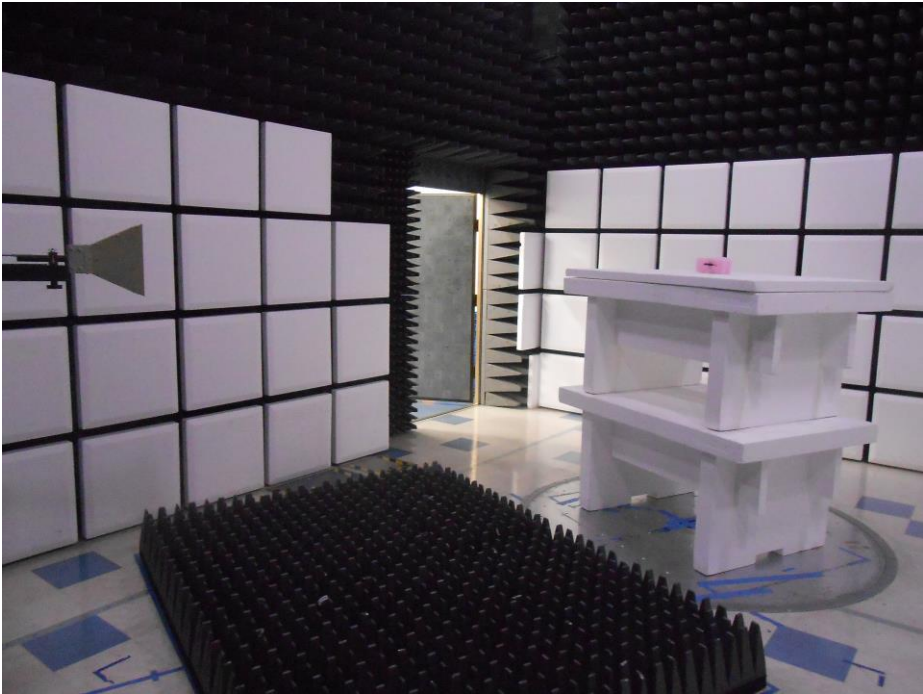
- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit
- Non-Compliance is deemed to occur if any measured disturbance exceeds the disturbance limit

END OF TEST REPORT



Test Setup Photos

FCC ID: 2ATK4LPKEY033451





Test Setup Photos
FCC ID: 2ATK4LPKEY033451

