Test Report

Prepared for: Icom Incorporated

Model: IP-M60

Description: Marine Radio

Serial Number: 000000000023

FCC ID: AFJ446700
ISED ID: 202D-446700

To

FCC Part 80
RSS-182 Issue 6 (June 2021)

Date of Issue: December 20, 2023

On the behalf of the applicant:	**Icom Incorporated** **1-1-32 Kamiminami Hirano-ku** **Osaka 547-0003** **Japan**
Attention of:	**Atsushi Tomiyama, General Manager of QA Department** **Ph: +81 6 6793 8424** **E-Mail: world_support@icom.co.jp**

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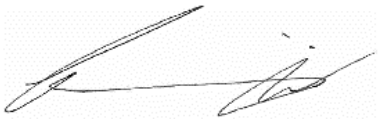
Project No: p23b0001



John Michalowicz

Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	December 20, 2023	John Michalowicz	Original Document

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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

Non-accredited tests contained in this report:

N/A

Standard Test Conditions Engineering Practices

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

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts: FCC Part 80, ANSI C63.26-2015, and ISED RSS-182, RSS-GEN.

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

Environmental Conditions		
Temperature (ºC)	**Humidity (%)**	**Pressure (mbar)**
17.9 – 23.9	26.0 – 35.3	961.1 – 981

EUT Description
Model: IP-M60
Description: Marine Radio
Serial Number: 000000000023
HVIN: 446700-01

Additional Information
The EUT is a 5W Marine Radio operating between 156 and 162 MHz
The push to talk radio operates from a rechargeable Li-ion battery 7.35 – 7.6 volts DC.
Type of emission = G3E

The manufacturer supplied the following antenna information.

Type	Gain	Model
	dBi	
Herical	-4.5	FA-SC55V-1
Herical	-13.4	FA-SC59V

EUT Operation during Tests
The EUT was tested at 7.4 vdc under normal operation. The transmitter was set to 100% duty cycle for all tests.

Test Results Summary

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ISED			
2.1047 80.213(a)	RSS-182 Section 5.4	Modulation Requirements	Pass	
2.1046 80.215 (a)	RSS-182 Section 5.6	Output Power (Conducted)	Pass	
2.1051 80.211(f)	RSS-182 Section 5.9	Conducted Spurious Emissions	Pass	
2.1053 80.211(f)	RSS-182 Section 5.9	Radiated Spurious Emissions	Pass	
2.1049 80.205	RSS-182 Section 5.9	Emission Mask	Pass	
2.1049 80.205	RSS-Gen	Occupied Bandwidth	Pass	
2.1055 80.209(b)	RSS-182 Section 5.5	Frequency Stability (Temperature Variation)	Pass	
2.1055, 80.209(b)	RSS-182 Section 5.5	Frequency Stability (Voltage Variation)	Pass	

Statements of conformity

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*.

Modulation Requirements

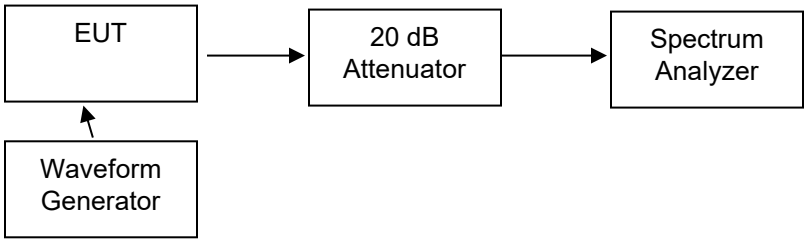
Engineer: John Michalowicz

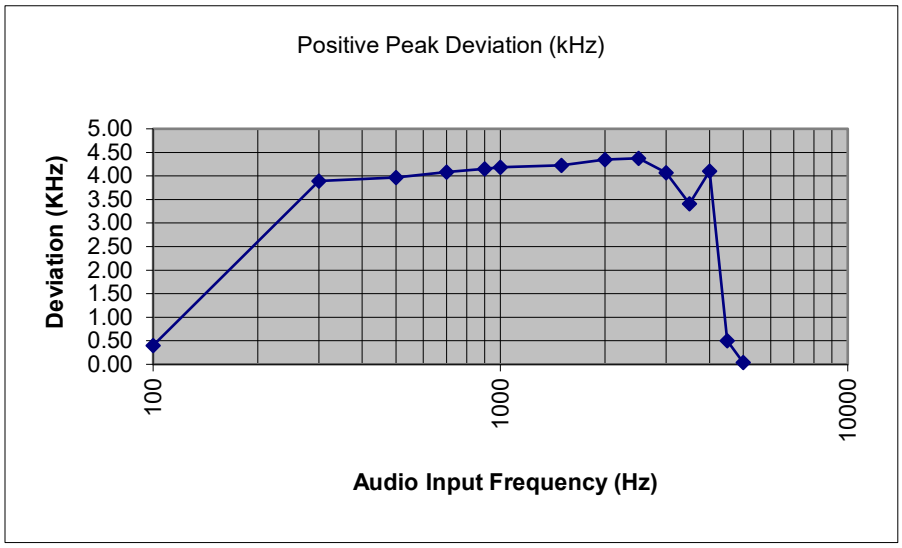
Test Date: 12/05/23

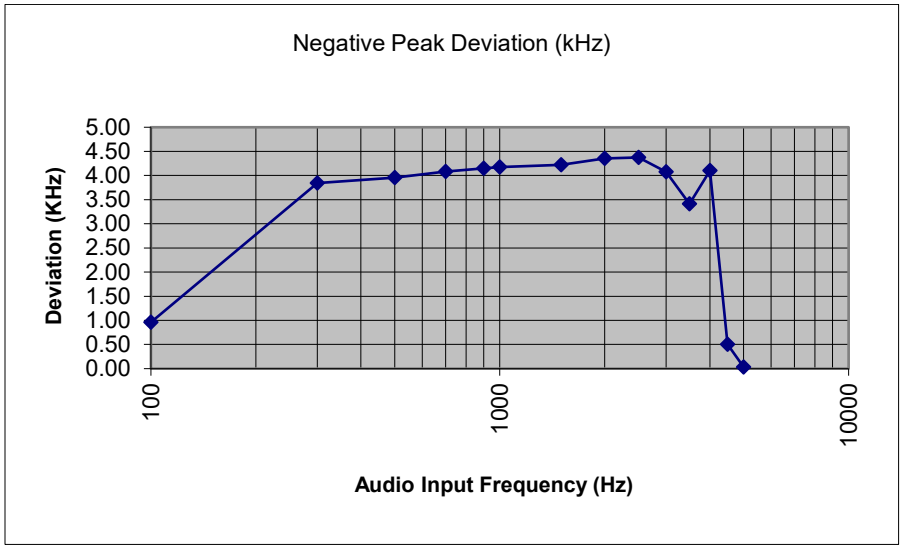
Test Procedure

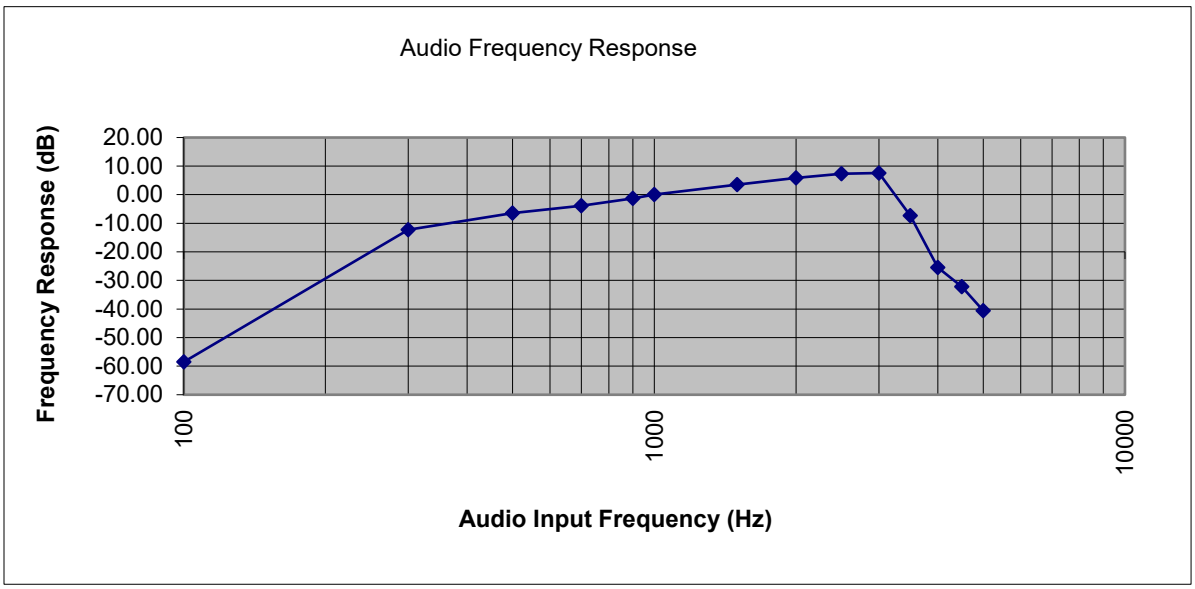
The EUT was setup as shown.

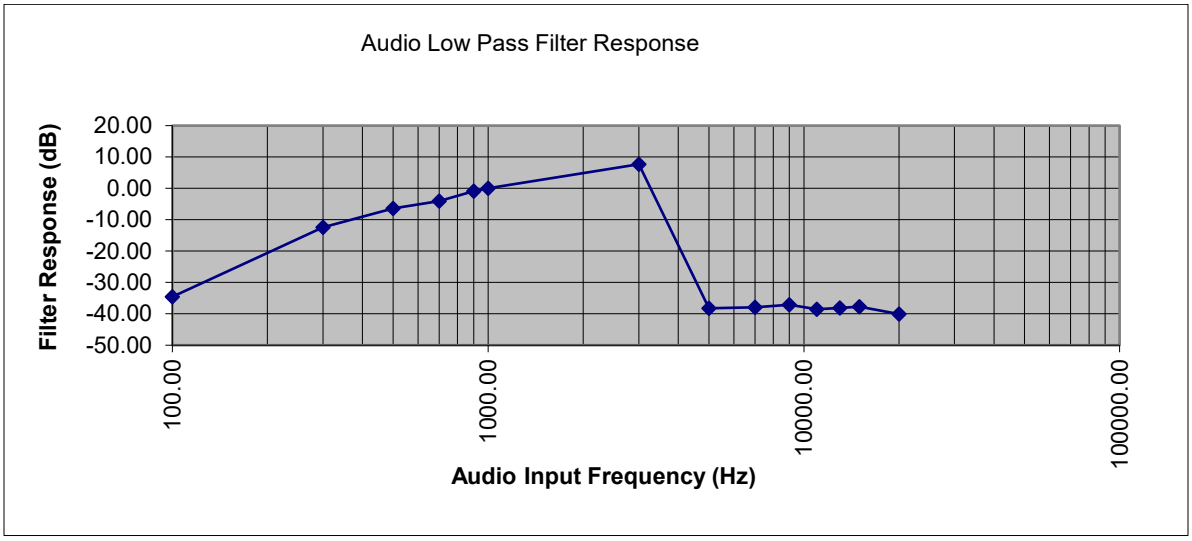
Test Setup








Audio Frequency Response
Frequency Response (dB)
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
100
1000
10000
Audio Input Frequency (Hz)


Audio Low Pass Filter Response
Filter Response (dB)
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
100.00
1000.00
10000.00
100000.00
Audio Input Frequency (Hz)

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Output Power (Conducted)

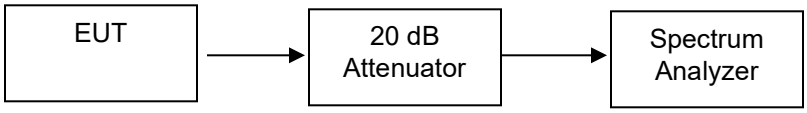
Engineer: John Michalowicz

Test Date: 12/05/23

Test Procedure

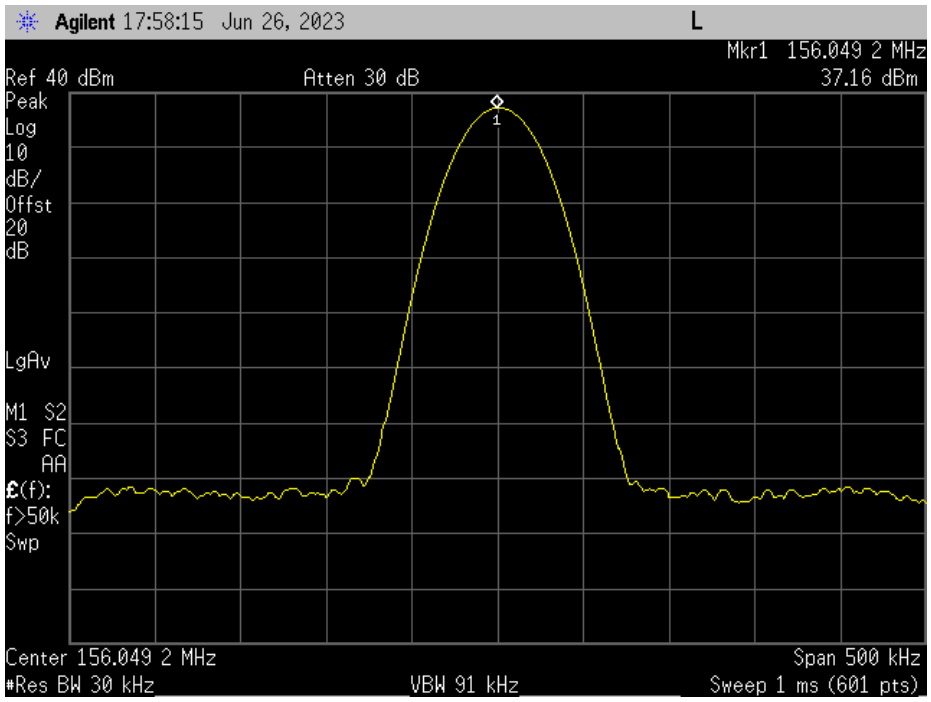
The output power was measured with a 100% duty cycle carrier wave without modulation.

Test Setup

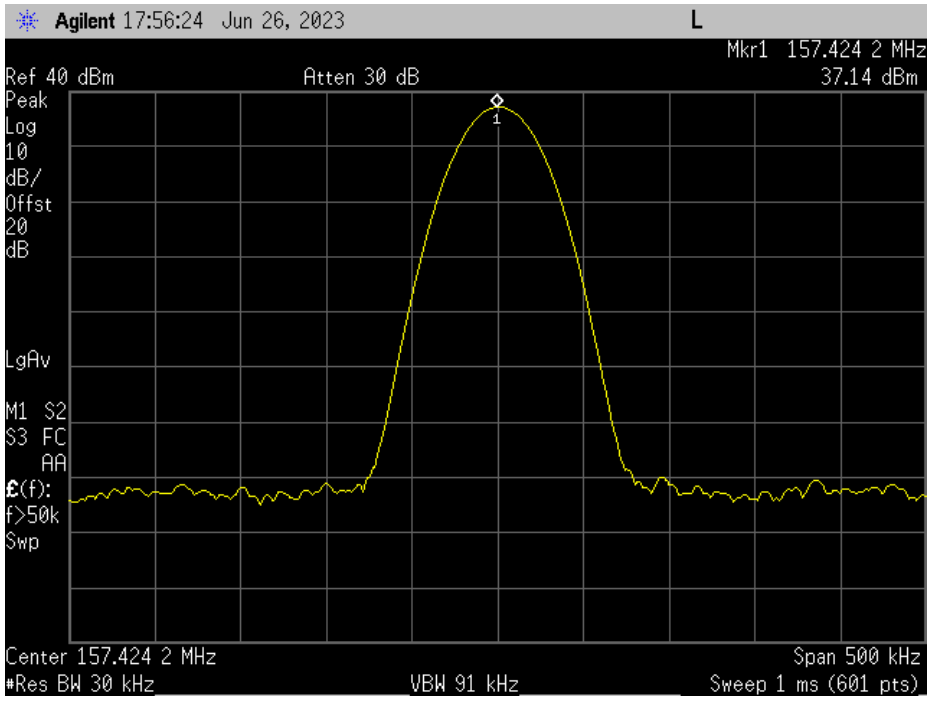


Transmit Frequency MHz	Low Power dBm	High Power dBm	Antenna Gain dBi
156.05	29.09	37.16	-4.5
157.425	29.0	37.14	-4.5

Low Channel High Output Power



High Channel High Output Power



Conducted Spurious Emissions

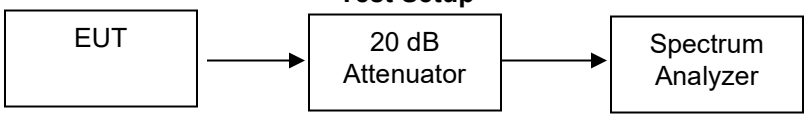
Engineer: John Michalowicz

Test Date: 12/5/2023

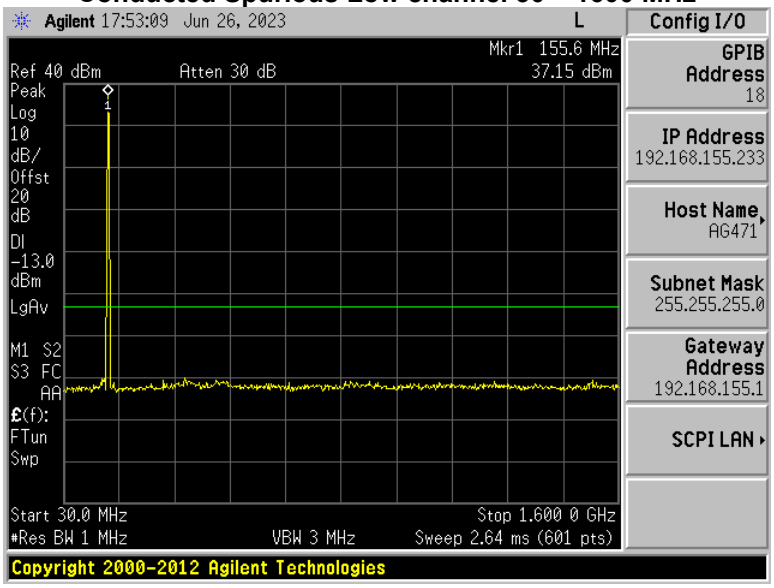
Test Procedure

Conducted spurious emissions were measured at the RF output as follows.
RBW below 1 GHz = 100 kHz
RBW above 1 GHz = 1 MHz

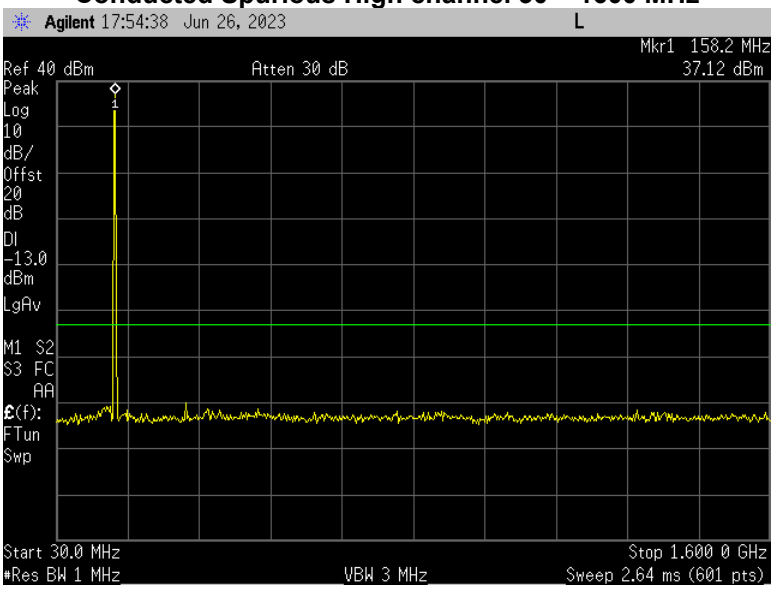
Test Setup



Conducted Spurious Low channel 30 – 1600 MHz



Conducted Spurious High channel 30 – 1600 MHz



All spurious emissions were below the -13 dBm limit.

No other spurious emissions were observed.

Radiated Spurious Emissions
Engineer: John Michalowicz
Test Date: 12/09/2023

Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna.
A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions.
The EUT was tested by rotating it 360 degrees with the antenna in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure that the signal levels were maximized. The EUT was terminated into a 50 ohm load and the transmission was set to 100%

Per 80.211(f), the spurious emissions are referenced to the mean (avg) power.

The peak emissions were measured and the average emission was calculated and compared to the limit.
If a peak value was near the limit an average measurement was performed

The following formula was used for calculating the limits:

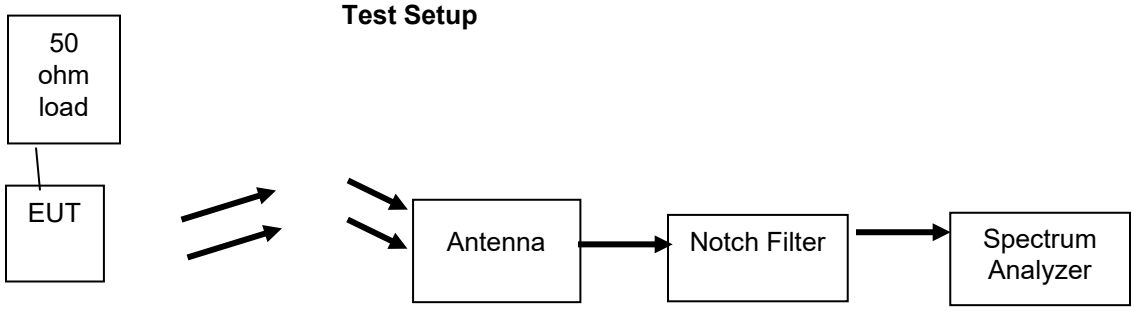
Final Spurious emissions (avg) = Measured Spurious (Peak) + Antenna Corr Factor + Cable Corr Factor

Radiated Spurious Emissions Limit
Wideband = P1 – (43+ 10Log(P2)) = -13dBm
P1 = power in dBm
P2 = power in Watts

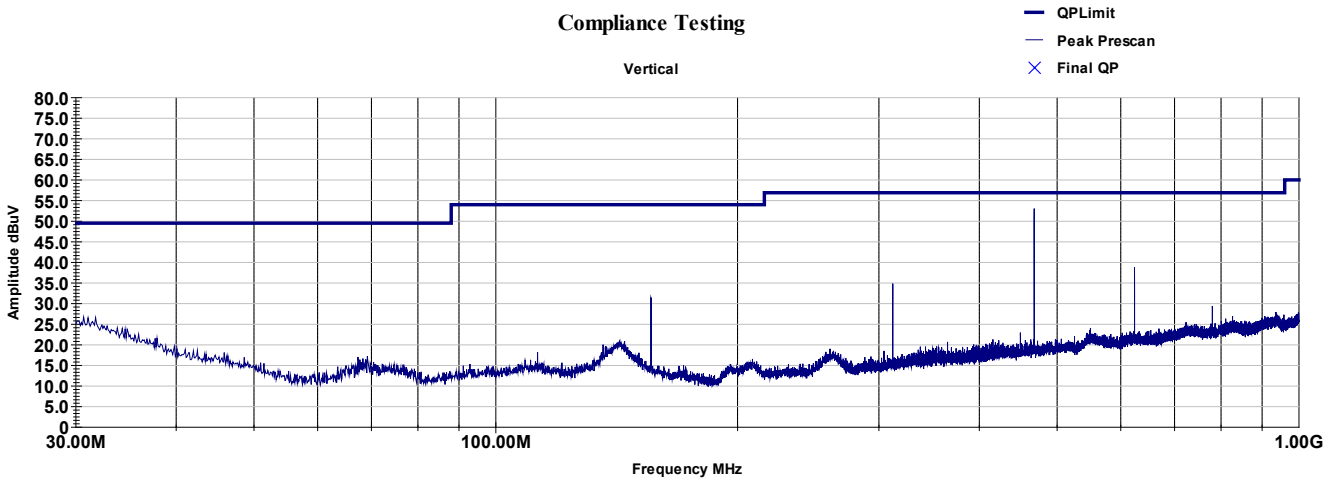
The -13 dBm limit is less stringent than the 15.209 Class A limits below. All peak measurements abide by the average limits.

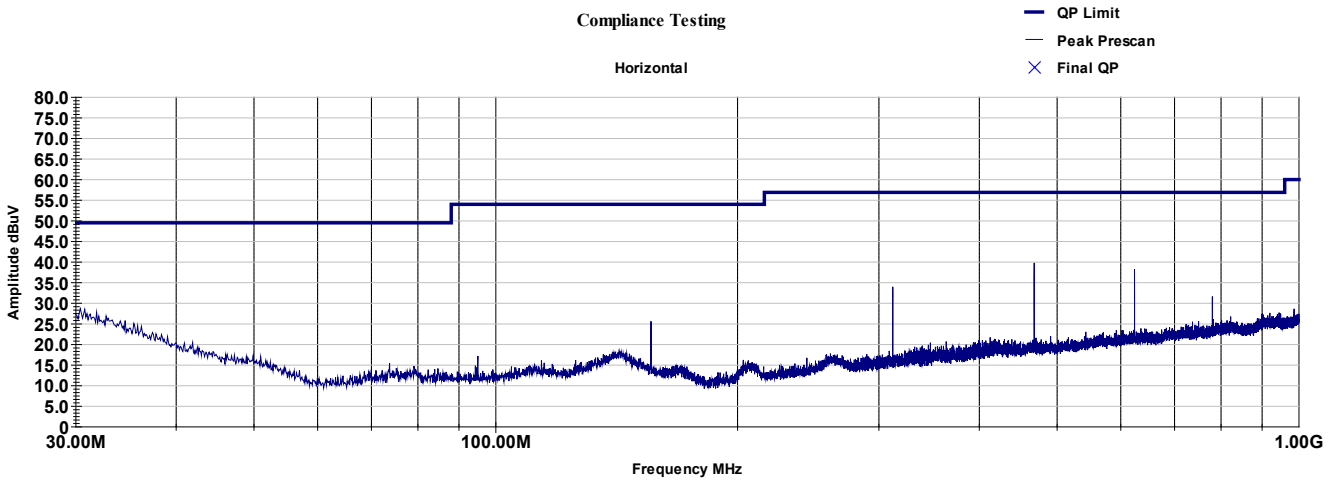
The RBW was set to 100 kHz for measurements below 1 GHz and 1 MHz for measurements above 1 GHz.
The VBW was set to 3 times the RBW.

Test Setup



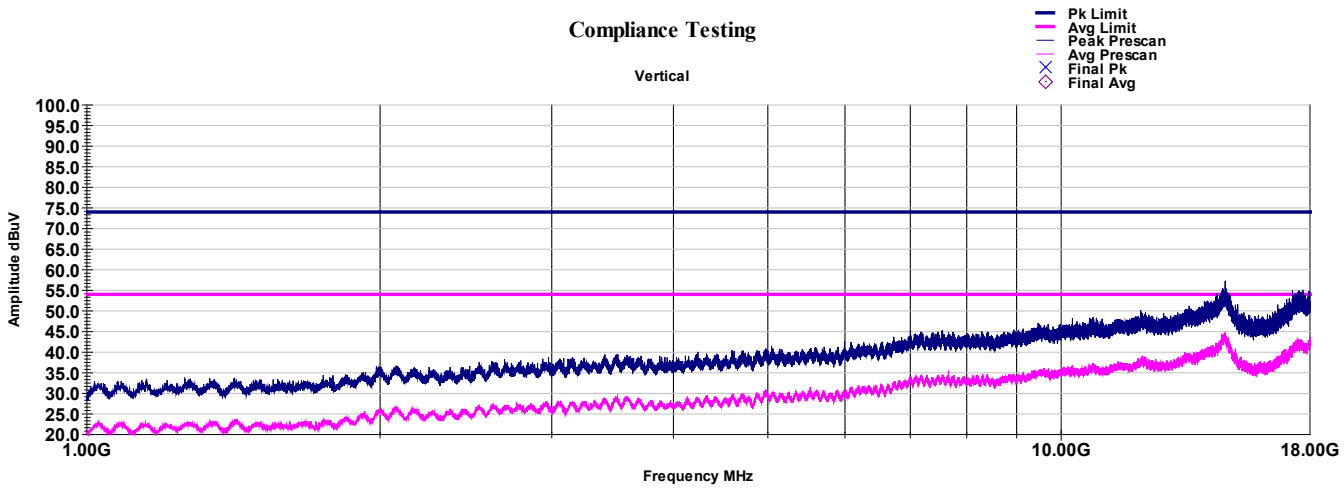
Low channel

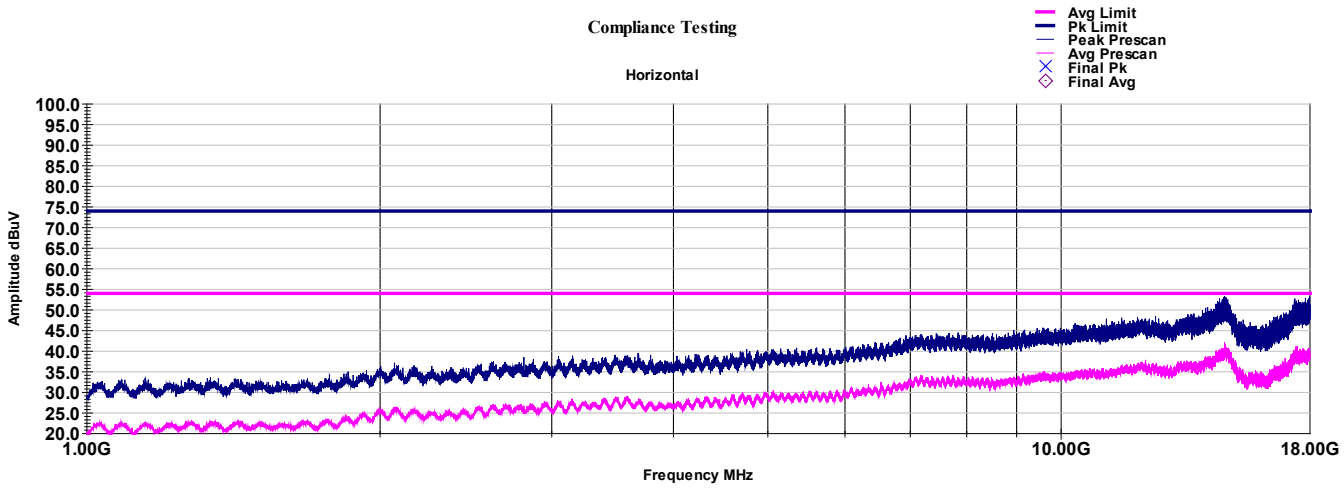




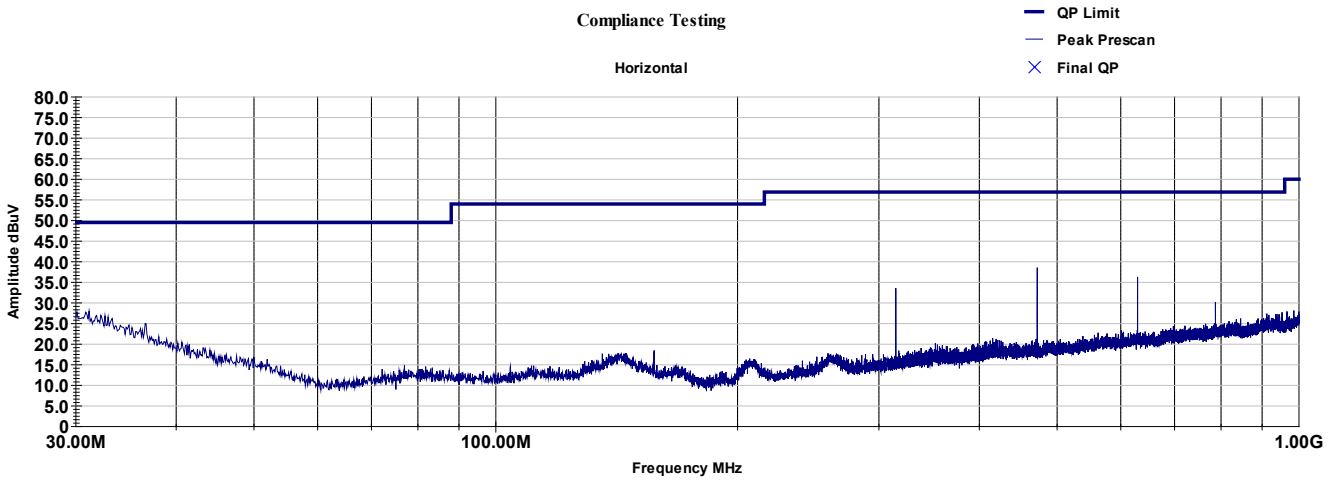
Worst Case measurements

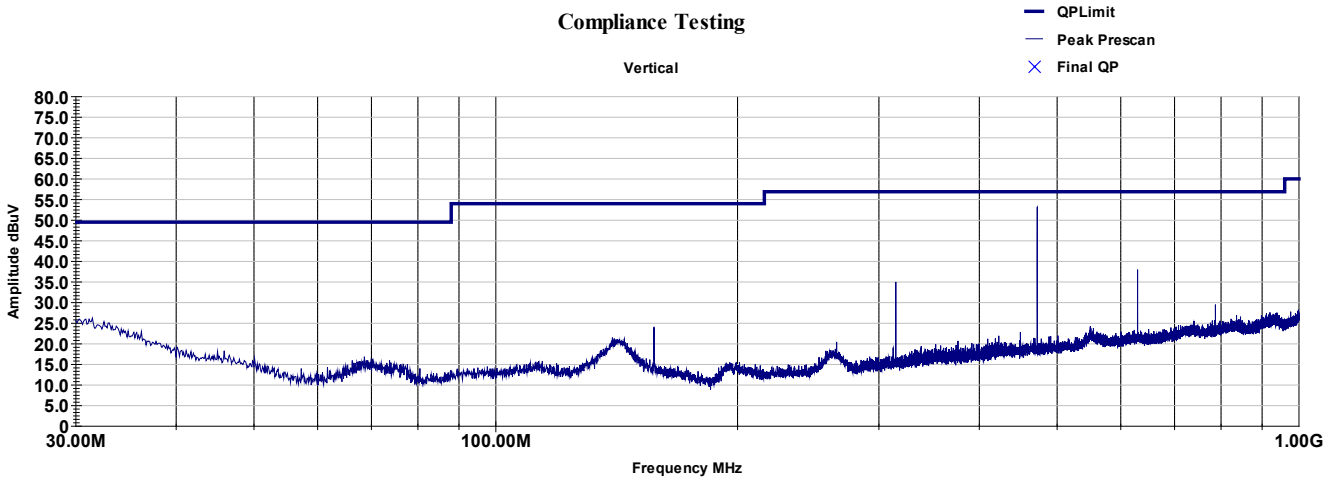
Frequency MHz	Peak measurement (dBuV)	Height cm	Turntable degrees	Class A limits (dBuV)	Margin (dB)
30.68	26.731	395	159	49.5	-22.769
156.00	31.47	100	316	54	-22.53
312.08	34.844	100	128	56.9	-22.056
468.15	53.053	100	175	56.9	-3.847
624.22	38.782	100	175	56.9	-18.118
780.20	29.362	100	18	56.9	-27.538


Compliance Testing
Vertical
Pk Limit
Avg Limit
Peak Prescan
Avg Prescan
Final Pk
Final Avg
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
Amplitude dBuV
1.00G
10.00G
18.00G
Frequency MHz

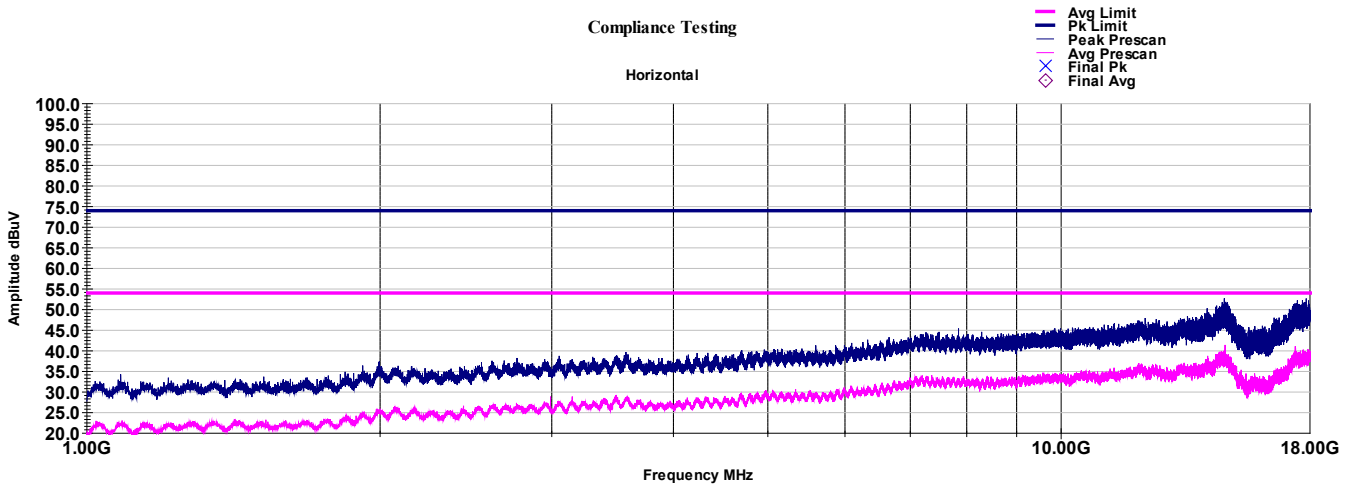

Compliance Testing
Horizontal
Avg Limit
Pk Limit
Peak Prescan
Avg Prescan
Final Pk
Final Avg
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
Amplitude dBuV
1.00G
10.00G
18.00G
Frequency MHz

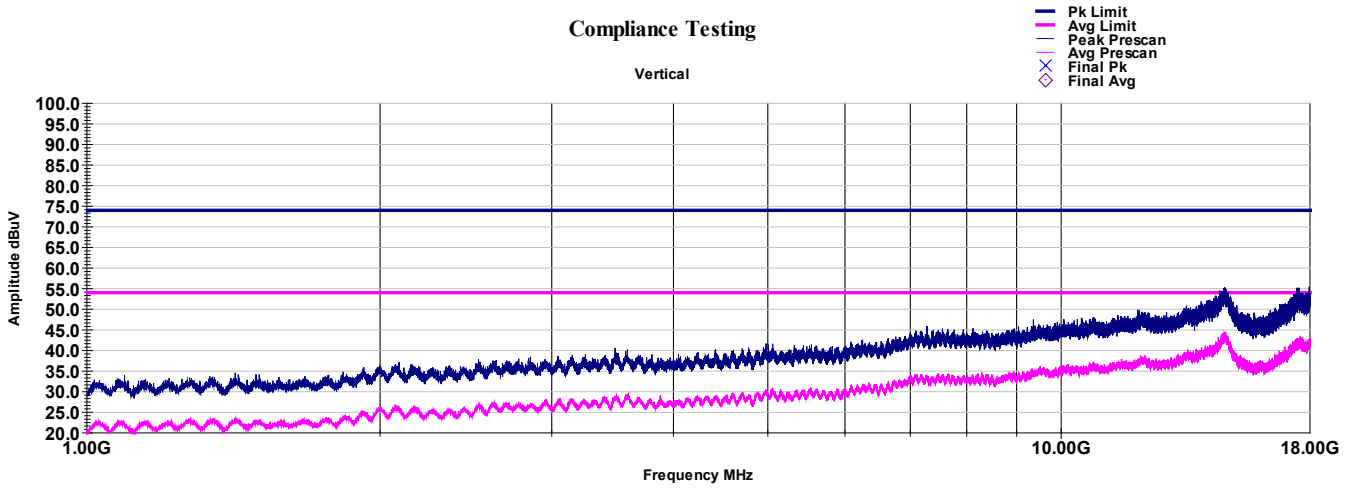
High Channel





Frequency MHz	Peak measurement (dBuV)	Height cm	Turntable degrees	Class A limits (dBuV)	Margin (dB)
31.455	26.217	100	332	49.5	-23.283
314.889	34.994	100	222	54	-21.906
472.32	53.165	100	285	56.9	-3.735
629.654	37.993	100	301	56.9	-18.907
787.182	29.512	100	112	56.9	-27.388
920.363	27.618	395	301	56.9	-29.282





The antenna and cable correction factors were added to the peak measurement in the test results table.

All spurious emissions were below the -13 dBm limit and the more stringent 15.209 Class A limits.

No other spurious emissions were observed.

Emission Mask

Engineer: John Michalowicz

Test Date: 12/05/2023

Test Procedure

The EUT was setup as shown.
The spurious emissions is referenced to the mean power per 80.211(f)

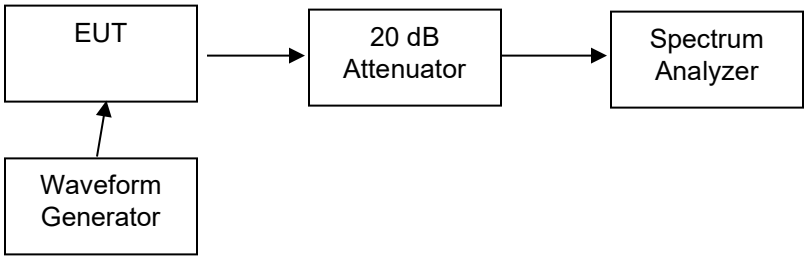
The reference level was set to the channel power so the mask could be displayed using a peak detector.

The 20 dB attenuator and RF cable insertion loss correction factors was input to the spectrum analyzer as correction factors or reference level offsets before recording the emission mask data.

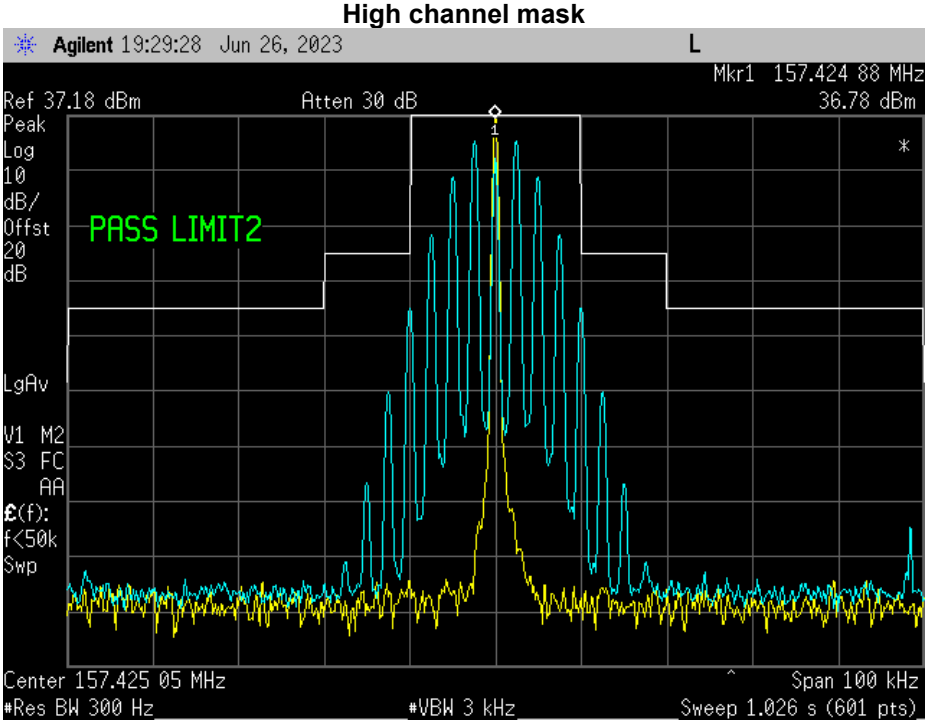
The RBW was set between 1 – 5% of the occupied bandwidth.

An input signal of 2.5 kHz was used to modulated the signal.

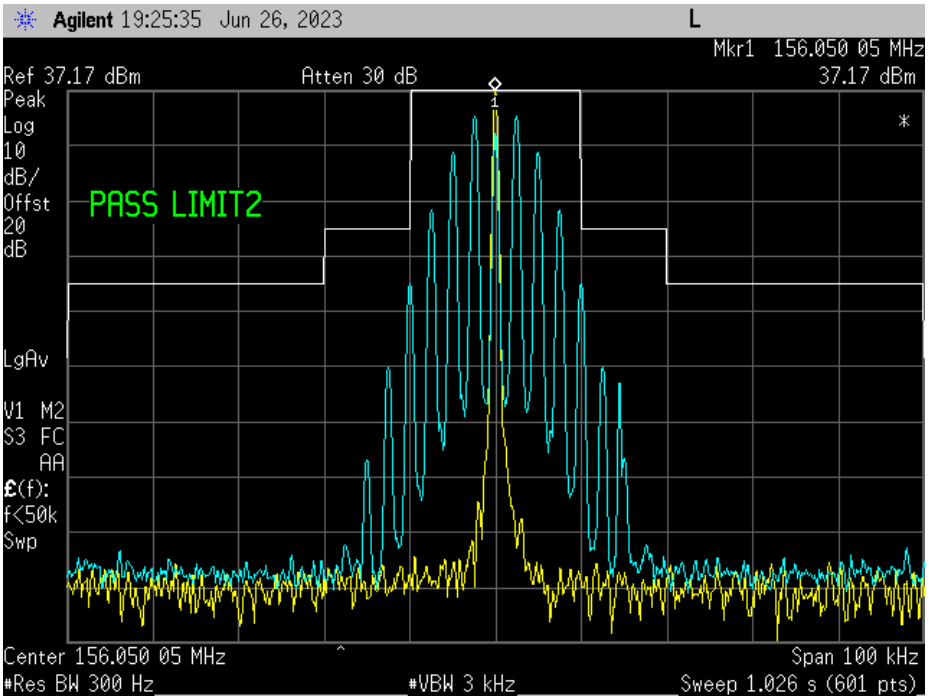
Test Setup



High channel mask



Low channel mask



Occupied Bandwidth

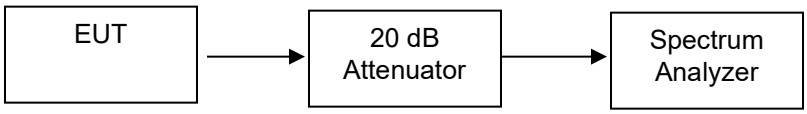
Engineer: John Michalowicz

Test Date: 12/07/2023

Test Procedure

The EUT was setup as shown. Th 99% occupied bandwidth was recorded
The 20 dB attenuator and RF cable insertion loss correction factors was input to the spectrum analyzer as correction factors or reference level offsets before recording the occupied bandwidth data.

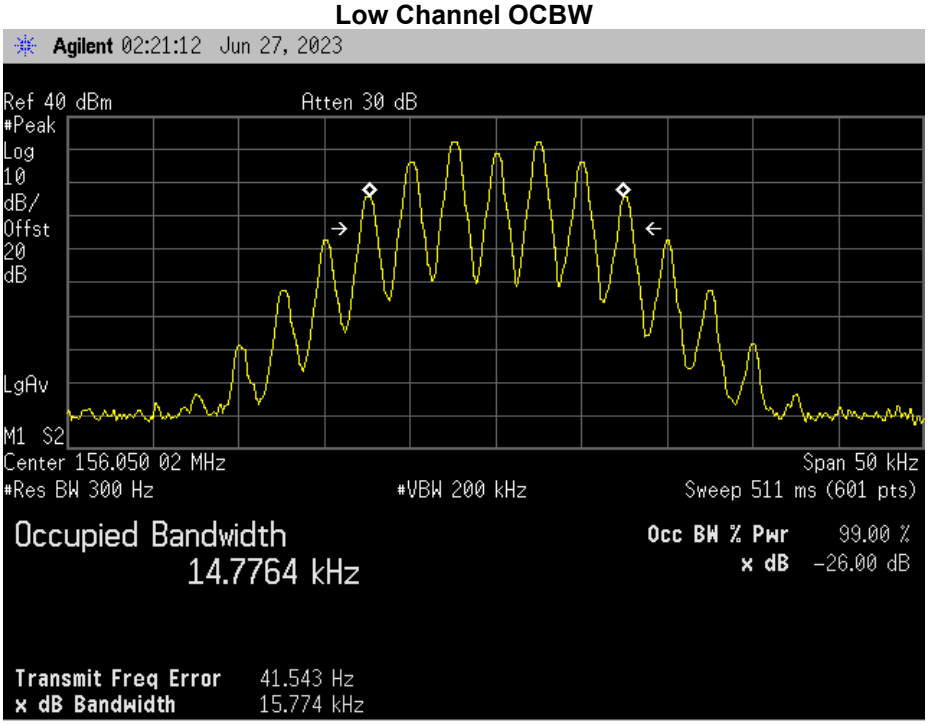
Test Setup



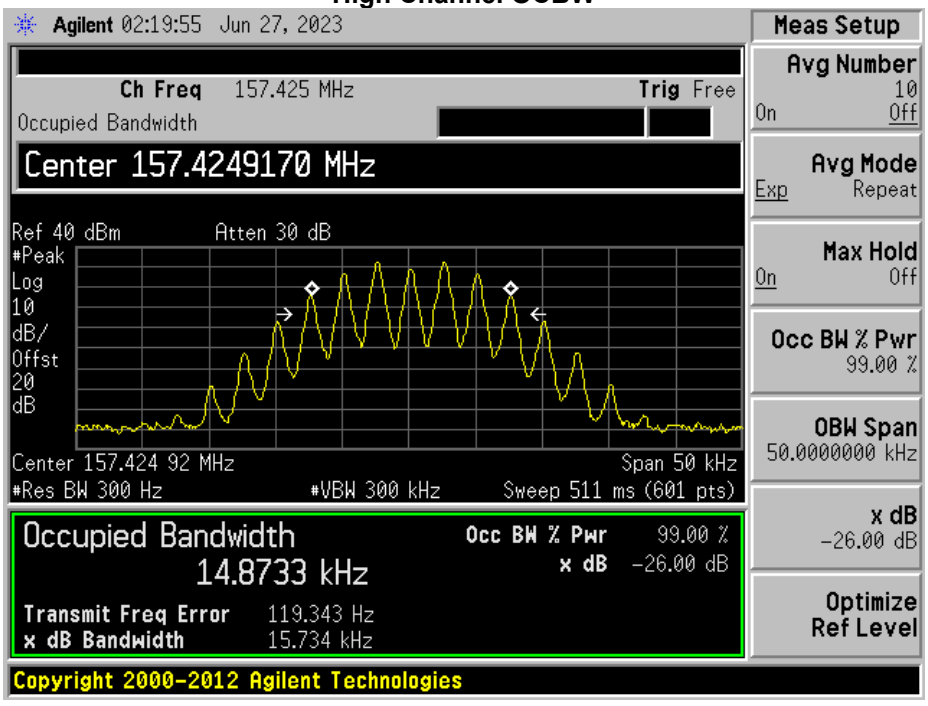
Occupied Bandwidth Test Summary Table

Channel	99% Bandwidth
	kHz
156.05	14.776
157.425	14.875

Low Channel OCBW



High Channel OCBW



Frequency Stability (Temperature Variation)

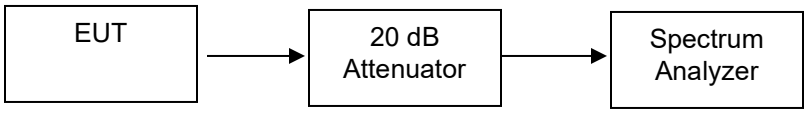
Engineer: John Michalowicz

Test Date: 12/09/2023

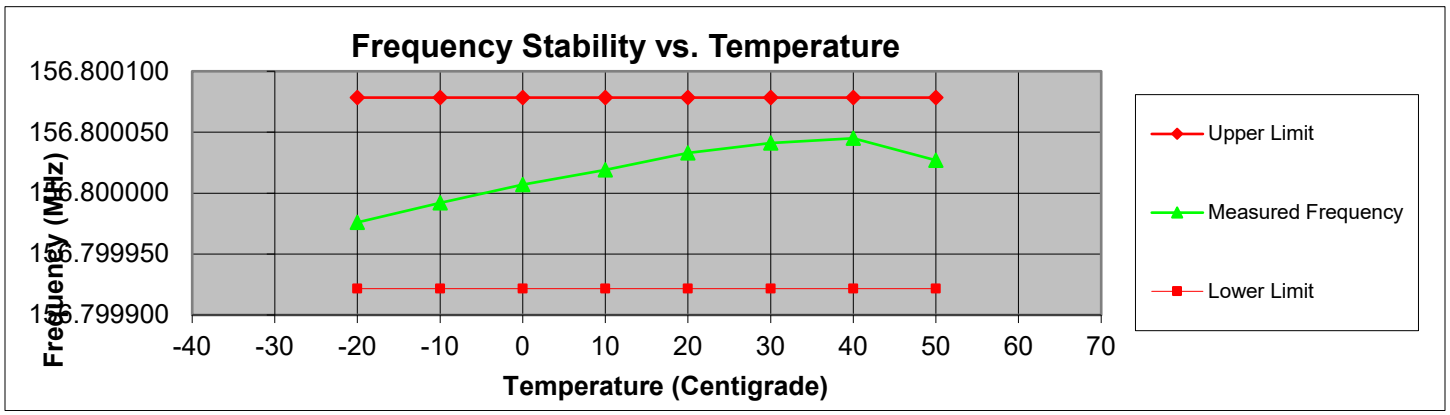
Test Procedure

The EUT was placed in an environmental test chamber and the RF output was connected directly to a spectrum analyzer
The temperature was varied from -20ºC to 50ºC in 10ºC increments.
After a sufficient time for temperature stabilization the RF output frequency was measured.

Test Setup



Frequency Stability (Temperature Variation) Measurement Results



Frequency Stability (Voltage Variation)

Engineer: John Michalowicz

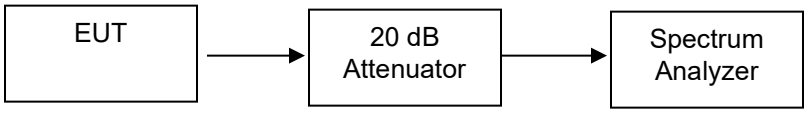
Test Date: 12/9/2023

Test Procedure

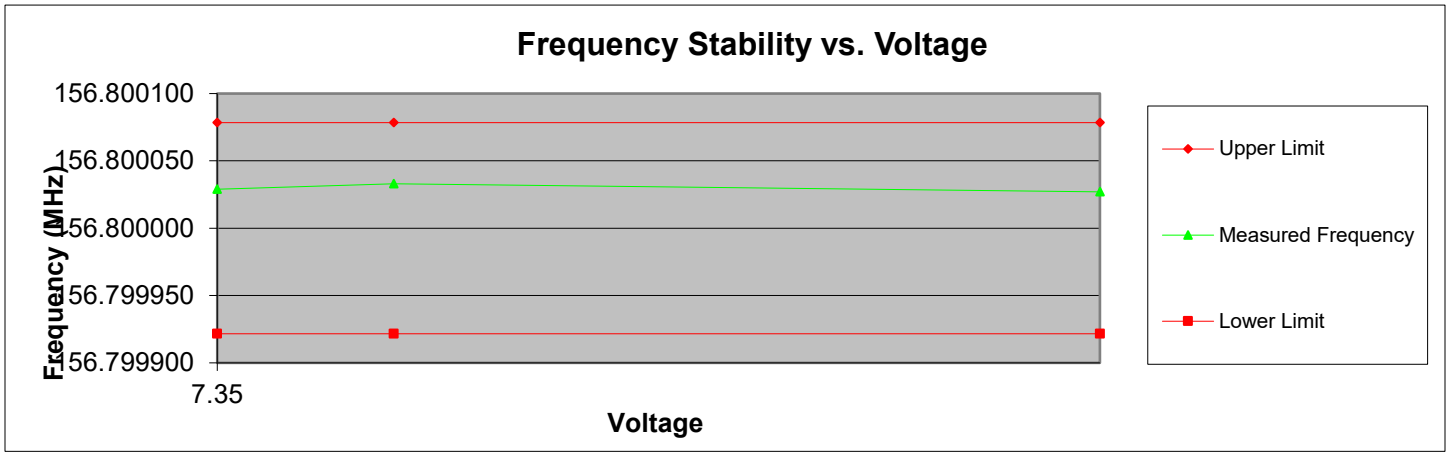
The EUT was placed in a temperature chamber at 20± 0.5°C and connected directly to a spectrum analyzer. The power supply voltage to the EUT was varied from 7.2 to 7.6 vdc and the RF output was measured.

The operating voltage range for the EUT is 7.2 – 7.6 vdc.

Test Setup



Frequency Stability (Voltage Variation) Measurement Results



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bilog Antenna 0.030-1.0GHz	Schaffner	CBL6111C	I00349	02/07/23	02/06/25
RF Amplifier 10MHz-50GHz, 40dB gain amp.	Eravant	SBB-0115034018-2F2F-E3	I00646	Verified on 07/28/23	Next Verification 07/28/24
9kHz-44GHz CISPR comp. receiver	Keysight/Agilent	N9038A	i00552	02/23/23	02/23/24
1-18GHz Horn Antenna	Antenna Research	DRG-118/A	I00271	08/11/22	08/10/24
temperature/humidity/pressure probe	Omega Engineering, Inc.	iBTHX-W	i00686	01/05/23	01/05/24
3.4GHz high pass filter	Trilithic	23042	I00177	NCR	
low pass filter 1GHz	K&L Microwave	4L120-1100-OP/00	I00699	NCR	

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.

END OF TEST REPORT