Test Report

Prepared for: Etherstack, Inc

Model: XBR5100P5VI

Description: XBR Base Station Transceiver

FCC ID:2ADAKXBR5100P5VI

ISED ID: 9487A-XBR5100P5VI

Serial Number: 241100135

Project No: p2540016.7

Test Results: Pass

To

FCC_ Part 22, 74, 80, 90

ISED RSS-119 (issue 12)

Date of Issue: June 2, 2025

On the behalf of the applicant:	**Etherstack Inc** **16 Madison Square W. FL12 Suite 1200** **New York, NY 10010**
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Greg Corbin
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	6/2/2025	Greg Corbin	Original Document

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Test Result Summary

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ISED			
2.1046 22.565 (a) 74.461 80.215 (f)(l) 90.205(s)	RSS-119 (5.4)	Carrier Output Power (Conducted)	Pass	
2.1051 22.359 (a) 74.462(C) 80.211 (f) 90.210(b)(d)	RSS-119 (5.8)	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053 22.359 (a) 74.462(C) 80.211 (f) 90.210(b)(d)	RSS-119 (5.8)	Field Strength of Spurious Radiation	Pass	
2.1049(c) 74.462(C) 80.211 (f) 90.210(b)(d)	RSS-119 (5.5)	Emission Masks (Occupied Bandwidth)	Pass	
2.1047(a)	N/A	Audio Low Pass Filter (Voice Input)	Pass	
2.1047(a)	N/A	Audio Frequency Response	Pass	
2.1047(b) 74.463(c)	N/A	Modulation Limiting	Pass	
2.1055 22.355 74.464 80.209 (a)(7) 90.213(a)	RSS-119 (5.3)	Frequency Stability (Temperature Variation)	Pass	
2.1055 90.213(a) 22.355 80.209 (a)(7) 74.464	RSS-119 (5.3)	Frequency Stability (Voltage Variation)	Pass	
90.214	RSS-119 (5.9)	Transient Frequency Behavior	Pass	
2.202 (g)	TRC-43 (issue 3)	Necessary Bandwidth Calculation	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*.

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. #750616

IC Site Reg. #2044A-2

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II, Part 2, Subpart J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, ANSI C63.26-2015, FCC Part 22, 74, 80, 90_RSS-GEN, RSS-119.

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/TIA 603C, 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.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
25.7 – 30.3	19.2 – 36.7	963.3 – 972.3

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

EUT Description

Model:	XBR5100P5VI
Serial:	241100135
Firmware:	0.2.04_1
Software:	N/A
HVIN	XBR5100P5VI
PMN	XBR5100
UPN	XBR5100P5VI
FVIN	ES2202_RL10
Description:	XBR Base Station Transceiver
Additional Information:	The EUT is a 100-watt base station transceiver using FM and C4FM modulation operating in the UHF band as noted in Table 1.
Power	13.8 vdc
Receipt of Sample(s):	5/13/2025
EUT Condition:	**Visual Damage** No **State of Development** Production/Production Equivalent

EUT Operation during Tests

The transmitter is powered by 13.8 vdc.

The base station transceiver operates with NB (12.5 kHz Channel), C4FM, and WB (25 kHz) were allowed.

For output power, the minimum (1 watt) and maximum (100 watts) was recorded.

The output power was set to 100 watts for all other tests.

Table 1 Frequency Allocation

Frequency Range (440 - 512 MHz)							
Rule Part	**Frequency Range (MHz)**	**Sub-Bands (MHz)**			**Extended Frequency**		**Emission Designator**
FCC Part 90 Narrowband	450 - 512	450 – 512	N/A	N/A	N/A	512 - 520	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E
FCC Part 90 Wideband	450 - 512	470 - 512	N/A	N/A	N/A	512 - 520	16K0F3E
FCC Part 22	454 - 460	454 - 455	459 - 460	N/A	N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
FCC Part 74	450 - 456	450 - 454	455 - 456	N/A	N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
FCC Part 80	454 - 470	454 - 455	456 - 460	462.7375 - 470	N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
RSS 119	450 - 470	450 - 470	N/A	N/A	N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E

Table 2 - FCC Test Frequencies

Test Frequency (MHz)	FCC Rule Part
450.1025	74, 90, RSS-119
459.9875	22, 80, 90, RSS-119
469.9875	80, 90, RSS-119
511.9875	90

Accessories:

Qty	Description	Length	Model	S/N
1	Ethernet cable from transmitter to PC	3m	N/A	N/A
1	2 wire power cable from transmitter to power supply	2m	N/A	N/A
1	Multi-pin connector to 3 BNC cables from transmitter Audio input and output	1m	N/A	N/A

Modifications: None

Carrier Output Power (Conducted)

Engineer: Greg Corbin

Test Date: 5/20/2025

Measurement Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB Power attenuator.

All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained.

For narrowband and wideband signals, a CW signal and peak detector was used for performing output power measurements.

For digital signals a C4FM signal and average detector was used for performing output power measurements Output power was recorded for both the lowest and highest power setting

The output power limits are as follows for each FCC rule part.

Manufacturer Rated Power = 100 watts (50 dBm)

Part 22: 22.565(a) = 150 watts

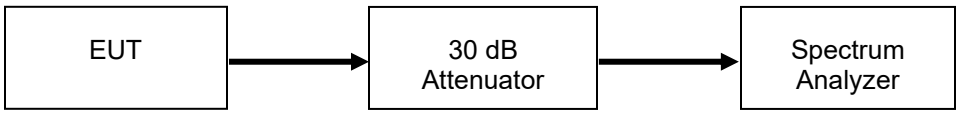
Part 74: 74.461 = 100 watts

Part 80: 80.215(l)_For operational fixed stations using frequencies in the 72-76 MHz band and for other classes of stations operating above 162.025 MHz, the transmitter power must be specified in the station authorization.

Part 90: 90.205(h)_450-470 MHz. (1) The maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2 in part 90.205(h).

90.205(s)_FCC Output Power Limit = 120 w (20% of manufacturer rated power)

Test Setup



Transmitter Peak Output Power_ CW - Narrowband

Tuned Frequency	Power Level Setting	Output Power		Result
MHz	watts	dBm	watts	
450.1025	1	31.74	1.493	Pass
459.9875	1	31.59	1.442	Pass
469.9875	1	31.51	1.416	Pass
511.9875	1	31.47	1.403	Pass
450.1025	100	49.65	92.257	Pass
459.9875	100	49.74	94.189	Pass
469.9875	100	49.74	94.189	Pass
511.9875	100	49.50	89.125	Pass

Transmitter Peak Output Power_ CW - Wideband

Tuned Frequency	Power Level Setting	Output Power		Result
MHz	watts	dBm	watts	
450.1025	1	31.62	1.452	Pass
459.9875	1	31.54	1.426	Pass
469.9875	1	31.50	1.413	Pass
511.9875	1	31.48	1.406	Pass
450.1025	100	49.62	91.622	Pass
459.9875	100	49.72	93.756	Pass
469.9875	100	49.86	96.828	Pass
511.9875	100	49.53	89.743	Pass

Transmitter Peak Output Power_ C4FM

Tuned Frequency	Power Level Setting	Output Power		Result
MHz	watts	dBm	watts	
450.1025	1	31.69	1.476	Pass
459.9875	1	31.66	1.466	Pass
469.9875	1	31.64	1.459	Pass
511.9875	1	31.49	1.409	Pass
450.1025	100	49.68	92.897	Pass
459.9875	100	49.82	95.940	Pass
469.9875	100	49.84	96.383	Pass
511.9875	100	49.52	89.536	Pass

Conducted Spurious Emissions

Engineer: Greg Corbin

Test Date: 5/21/2025

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions.

The resolution bandwidth was set for 100 kHz or 1 MHz as required per the rule section and the reference level was adjusted to ensure the system had sufficient dynamic range to measure spurious emissions.

A tunable notch filter was utilized for 30 MHz to 1 GHz to ensure the fundamental did not put the spectrum analyzer into compression.

The notch filter was replaced with a 1 GHz highpass filter that was used for measurements above 1 GHz.

The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed and plotted.

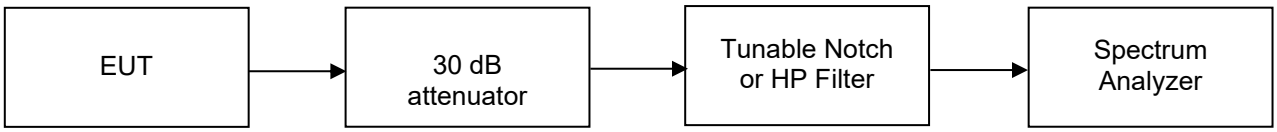
The conducted spurious emissions were recorded using CW and C4FM modulation.

The specification limit was set for -20 dBm for comparison to the emission mask “D” limit.

Note: A marker was placed on the fundamental frequency and the highest spurious emission. Only the fundamental TX signal exceeded the limit as shown in the spectrum analyzer screenshots.

The output power was set to 100 watts for all conducted spurious measurements.

Test Setup



Conducted Spurious Emissions Summary Test Table_ CW - Narrowband

Frequency Span	Tuned Frequency	Conducted Spurious		Limit	Margin	Result
		Frequency	Level			
MHz	MHz	MHz	dBm	dBm	dB	
30 - 1000	450.1025	33.379	-42.4	-20	-22.4	Pass
30 - 1000	459.9875	78.348	-44.4	-20	-24.4	Pass
30 - 1000	469.9875	939.996	-42.3	-20	-22.3	Pass
30 - 1000	511.9875	539.992	-42.2	-20	-22.2	Pass
1000 - 6000	450.1025	5913.359	-36.7	-20	-16.7	Pass
1000 - 6000	459.9875	5914.140	-37.2	-20	-17.2	Pass
1000 - 6000	469.9875	5639.843	-35.7	-20	-15.7	Pass
1000 - 6000	511.9875	5120.078	-36.4	-20	-16.4	Pass

Conducted Spurious Emissions Summary Test Table_ CW – Wideband

Frequency Span	Tuned Frequency	Conducted Spurious		Limit	Margin	Result
		Frequency	Level			
MHz	MHz	MHz	dBm	dBm	dB	
30 - 1000	450.1025	32.000	-43.2	-20	-23.2	Pass
30 - 1000	459.9875	53.431	-44.1	-20	-24.1	Pass
30 - 1000	469.9875	939.981	-43.1	-20	-23.1	Pass
30 - 1000	511.9875	539.977	-42.0	-20	-22	Pass
1000 - 6000	450.1025	5950	-36.3	-20	-16.3	Pass
1000 - 6000	459.9875	5059.843	-36.8	-20	-16.8	Pass
1000 - 6000	469.9875	5640.000	-34.1	-20	-14.1	Pass
1000 - 6000	511.9875	5887.968	-36.9	-20	-16.9	Pass

Conducted Spurious Emissions Summary Test Table_ C4FM

Frequency Span	Tuned Frequency	Conducted Spurious		Limit	Margin	Result
		Frequency	Level			
MHz	MHz	MHz	dBm	dBm	dB	
30 - 1000	450.1025	85.684	-42.5	-20	-22.5	Pass
30 - 1000	459.9875	52.037	-42.5	-20	-22.5	Pass
30 - 1000	469.9875	39.942	-43.0	-20	-23	Pass
30 - 1000	511.9875	539.992	-42.6	-20	-22.6	Pass
1000 - 6000	450.1025	5963.046	-37.1	-20	-17.1	Pass
1000 - 6000	459.9875	5060.156	-36.5	-20	-16.5	Pass
1000 - 6000	469.9875	5639.765	-36.7	-20	-16.7	Pass
1000 - 6000	511.9875	5759.062	-37.6	-20	-17.6	Pass

Annex A Conducted Spurious Emission

Refer to Annex A for Conducted Spurious Emission plots.

Field Strength of Spurious Radiation

Engineer: Greg Corbin

Test Date: 6/3/2025

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.

All cable and antenna correction factors were input into the spectrum analyzer ensuring an accurate measurement in ERP/EIRP with the resultant power in dBm.

The EUT was set to transmit at maximum power with the RF output terminated with a 150-watt 50 ohm load.

Radiated spurious emissions were recorded with the EUT using FM modulation.

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

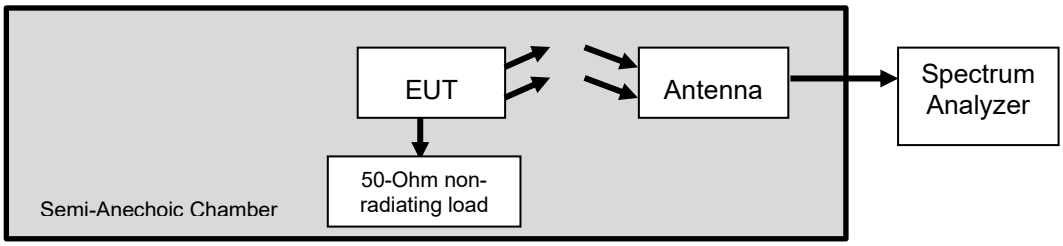
The VBW was set to 3 times the RBW.

The following formula was used for calculating the limits:

The worst case radiated spurious limit = P1 – (50+ 10Log(P2)) = -20dBm

On the 30 – 1000 MHz plots, marker 1 is the fundamental transmit frequency and is not subject to the -20 dBm limit.

Test Setup



Radiated Spurious Emissions Summary Test Table_ FM

Frequency Span	Tuned Frequency	Radiated Spurious		Limit	Margin	Result
		Frequency	Level			
MHz	MHz	MHz	dBm	dBm	dB	
30 - 1000	450.1025	900.18	-48.4	-20	-28.4	Pass
30 - 1000	459.9875	919.97	-41.4	-20	-21.4	Pass
30 - 1000	469.9875	939.95	-45.8	-20	-25.8	Pass
30 - 1000	511.9875	373.12	-55.2	-20	-35.2	Pass
1000 - 6000	450.1025	2700.59	-33.4	-20	-13.4	Pass
1000 - 6000	459.9875	2299.81	-27.4	-20	-7.4	Pass
1000 - 6000	469.9875	2819.84	-37.2	-20	-17.2	Pass
1000 - 6000	511.9875	5631.73	-35.5	-20	-15.5	Pass

Annex B Radiated Spurious Emission

Refer to Annex B for Radiated Spurious Emission plots with C4FM modulation.

Emission Masks

Engineer: Greg Corbin

Test Date: 5/21/2025

Measurement Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask.

The reference level was set to the maximum power recorded previously.

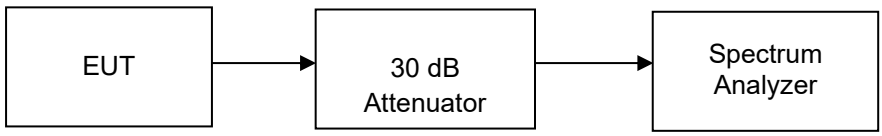
Mask B was used for wideband FM.

Mask D was used for narrowband FM and C4FM

For FM modulation, the transmitter was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

For C4FM modulation the internal C4FM standard test pattern was used.

Test Setup



Annex C Emission Mask

Refer to Annex C for Emission Mask plots.

Occupied Bandwidth

Engineer: Greg Corbin

Test Date: 5/20/2025

Measurement Procedure

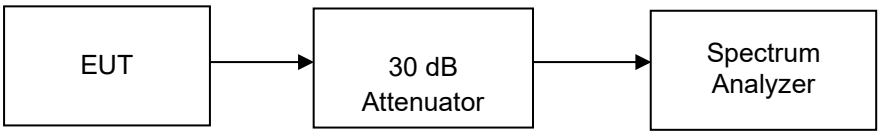
The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required occupied bandwidth.

The internal occupied bandwidth tool built into the spectrum analyzer was used to record the -26 dB and 99% occupied bandwidth.

For FM modulation, the transmitter was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

For C4FM modulation the internal C4FM standard test pattern was used.

Test Setup



Occupied Bandwidth Summary Table

Tuned Frequency	Modulation	99%	-26 dB
MHz	NB, WB, C4FM	kHz	kHz
450.1025	NB	9.78	10.50
459.9875	NB	9.71	10.40
469.9875	NB	9.77	10.50
511.9875	NB	9.77	10.40
450.1025	WB	14.60	15.60
459.9875	WB	14.60	15.60
469.9875	WB	14.80	15.60
511.9875	WB	14.80	15.60
450.1025	C4FM	8.00	9.53
459.9875	C4FM	8.03	9.63
469.9875	C4FM	8.11	9.61
511.9875	C4FM	8.10	9.56

Annex D Occupied Bandwidth

Refer to Annex D for Occupied Bandwidth plots.

Transient Frequency Behavior

Engineer: Greg Corbin
Test Date: 6/2/2025

Measurement Procedure

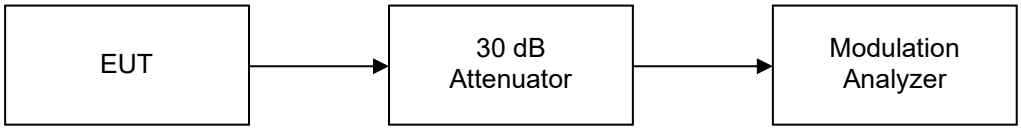
The EUT was connected directly to a modulation analyzer through a 30 dB attenuator to verify that the EUT meets the required Transient Frequency Behavior response per the specification. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.
The turn on and turn off transient timing was measured and recorded.

Part 90.214 transient frequency behavior requirements.

Time Intervals [1,2]	Maximum Frequency Difference[3]	All Equipment	
		150 – 174 MHz	421 – 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1[4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3[4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1[4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3[4]	±6.25 kHz	5.0 ms	10.0 ms

[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t_1 is the time period immediately following t_{on}.
t_2 is the time period immediately following t_1.
t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
t_{off} is the instant when the 1 kHz test signal starts to rise.
[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.
[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.
[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

Test Setup



Transient Frequency Test Results

Tuned Frequency = 459.9875 MHz				Tuned Frequency = 459.9875 MHz			
Channel Bandwidth = 12.5 kHz				Channel Bandwidth = 25 kHz			
Time Interval	Frequency Error (kHz)	Limit (kHz)	Pass / Fail	Time Interval	Frequency Error (kHz)	Limit (kHz)	Pass / Fail
t1	3.564	± 12.5	Pass	t1	2.754	± 25	Pass
t2	1.403	± 6.25	Pass	t2	2.663	± 12.5	Pass
t3	-1.471	± 12.5	Pass	t3	4.776	± 25	Pass

Annex E Transient Frequency Behavior

Refer to Annex E for Transient Frequency Behavior plots.

Audio Low Pass Filter (Voice Input)

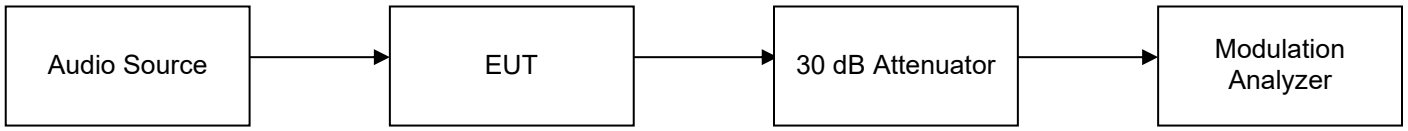
Engineer: Greg Corbin

Test Date: 5/29/2025

Measurement Procedure

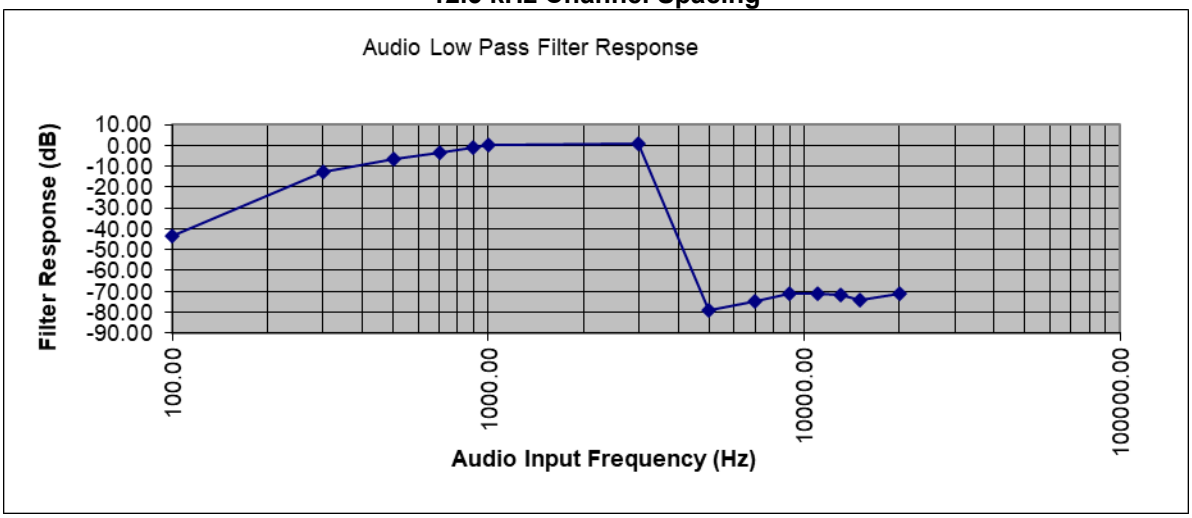
The EUT was connected directly to a modulation analyzer through an attenuator.
Set the audio frequency generator to 1 kHz and adjust the level for 60% deviation per manufacturer's specifications.
The audio source was tuned from 100 Hz to 20 kHz and the audio frequency response was measured and plotted.
The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.
The Audio Low Pass Filter test data was recorded for 12.5 kHz and 25 kHz channel spacing.

Test Setup

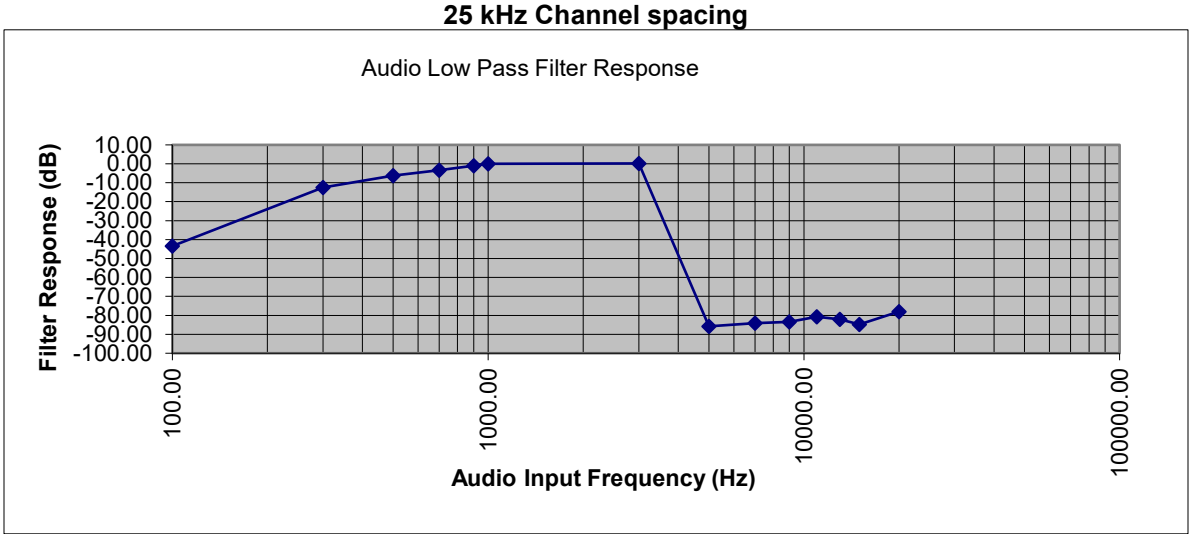


Test Results

12.5 kHz Channel Spacing



25 kHz Channel spacing



Audio Frequency Response

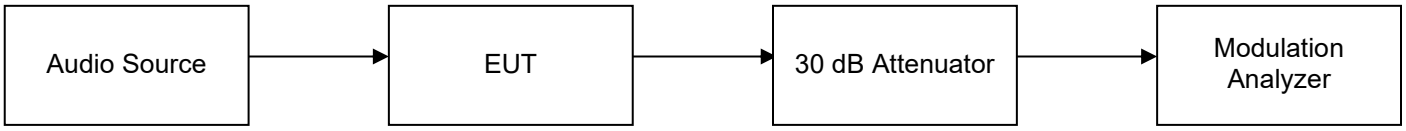
Engineer: Greg Corbin

Test Date: 5/29/2025

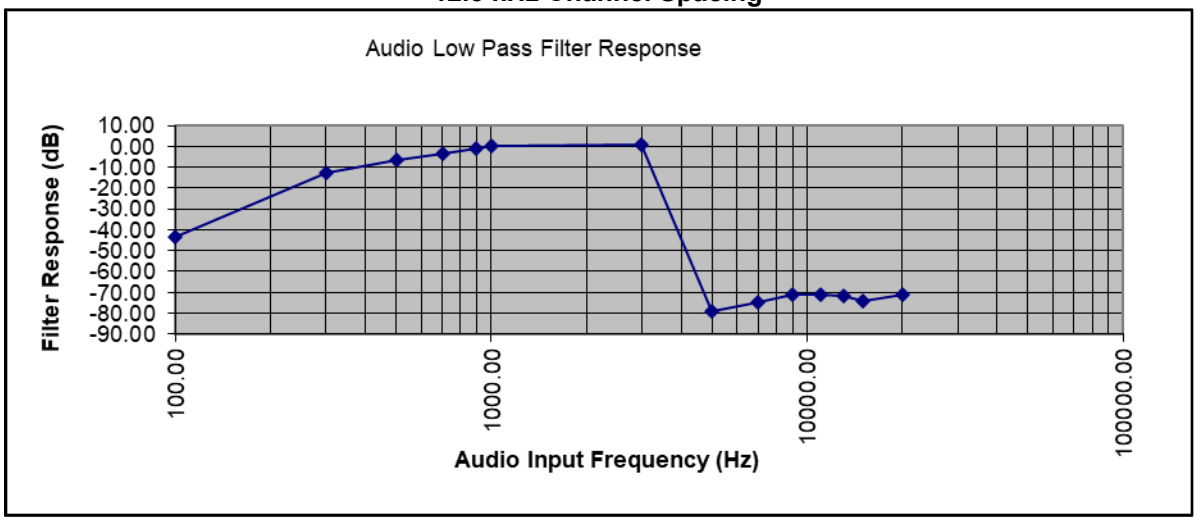
Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator.
The audio frequency was set to 1 kHz and the level was adjusted for 20% deviation according to the manufacturer's instructions.
The audio source was tuned from 100 Hz to 5000 Hz and the audio frequency response was measured and plotted.
The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.
The Audio Frequency Response test data was recorded for 12.5 kHz and 25 kHz channel spacing.

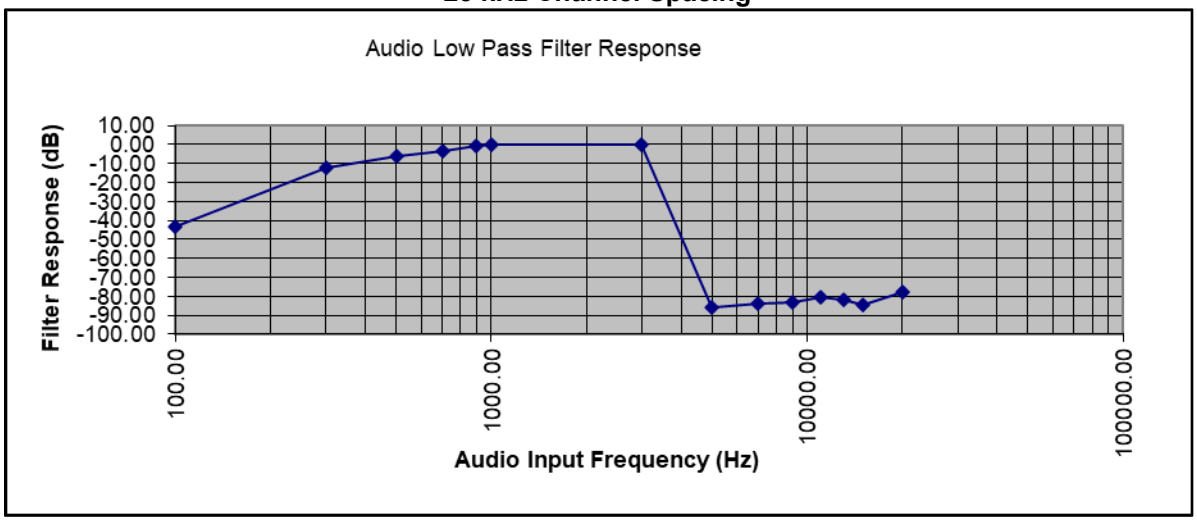
Test Setup



12.5 kHz Channel Spacing



25 kHz Channel Spacing



Modulation Limiting

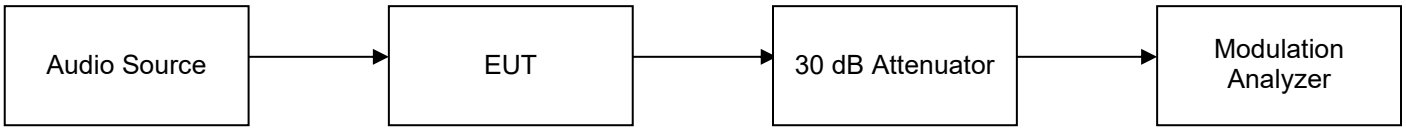
Engineer: Greg Corbin

Test Date: 5/29/2025

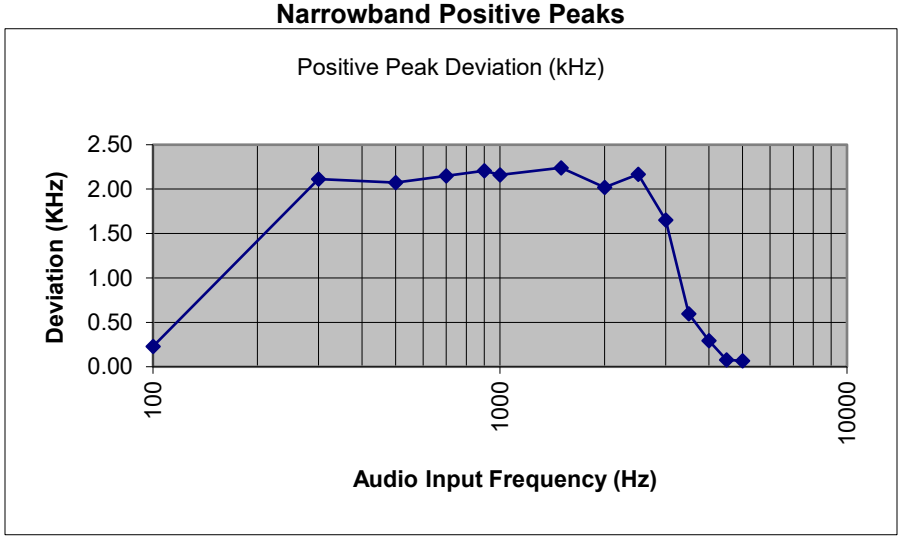
Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator.
The audio frequency was set to 1 kHz and the level was adjusted for 60% deviation according to the manufacturer's instructions. The input level was then set to 16 dB above the level used for 50 % modulation.
The audio source was tuned from 100 Hz to 5000 Hz and the audio frequency response was measured and plotted.
The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.
The Modulation Limiting test data was recorded for 12.5 kHz and 25 kHz channel spacing.

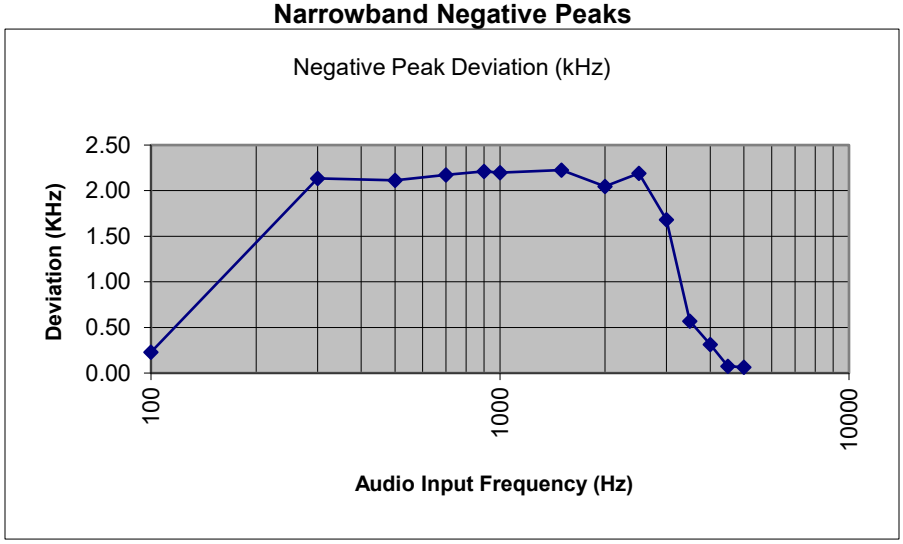
Test Setup



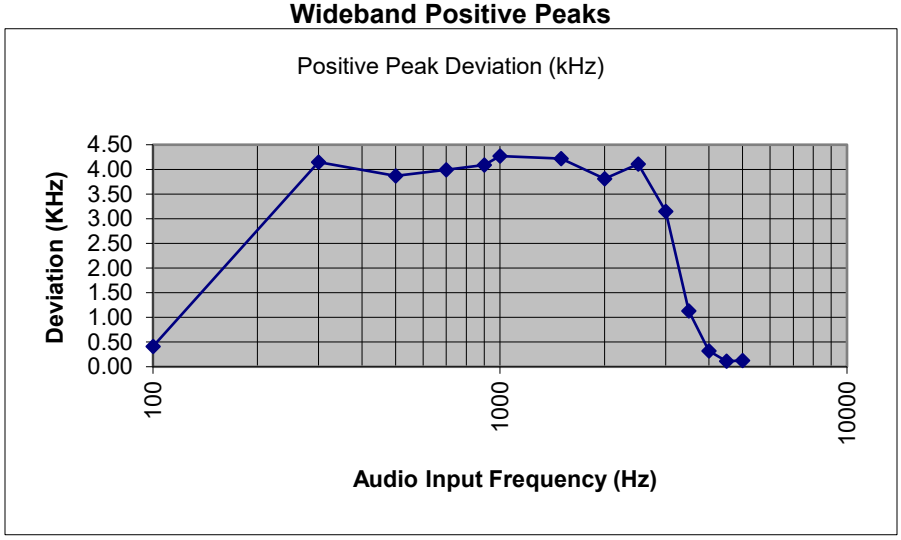
Narrowband Positive Peaks



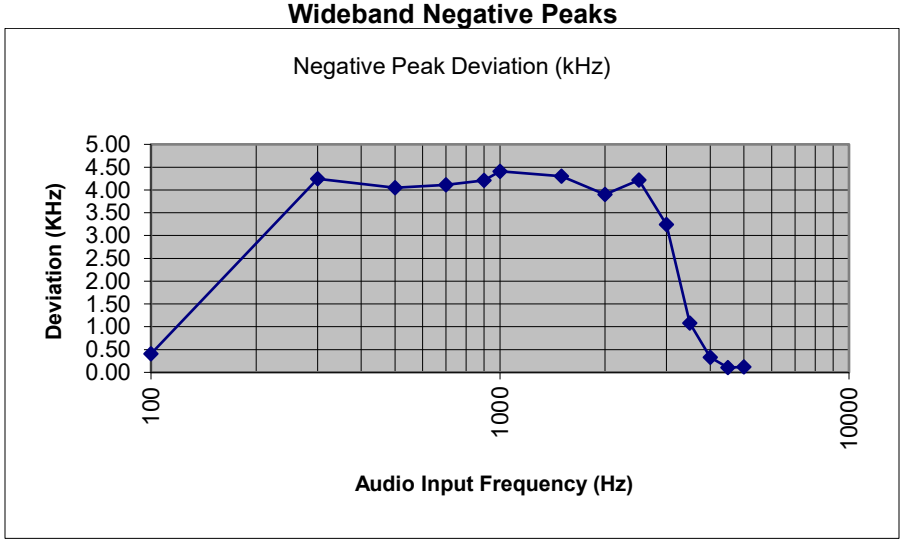
Narrowband Negative Peaks



Wideband Positive Peaks



Wideband Negative Peaks



Frequency Stability (Temperature Variation)

Engineer: Greg Corbin

Test Date:5/30/2025

Measurement Procedure

The EUT was placed in an environmental test chamber and the RF output was connected directly to a spectrum analyzer.

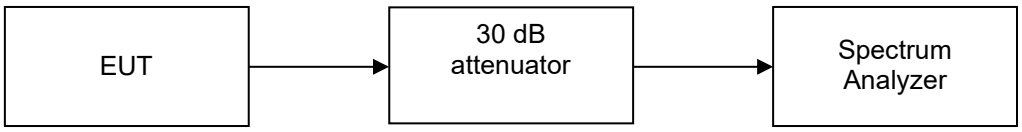
The temperature was varied from -30°C to 50°C in 10°C increments.

After a sufficient time for temperature stabilization the RF output frequency was measured.

At 20°C the power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured.

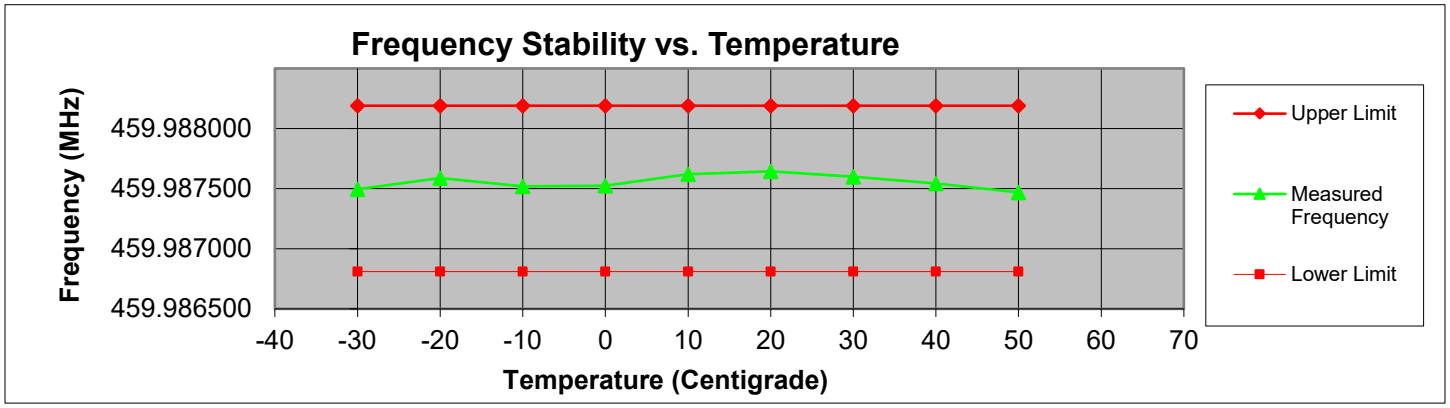
The transmitter DC input = 13.8 vdc.

Measurement Setup



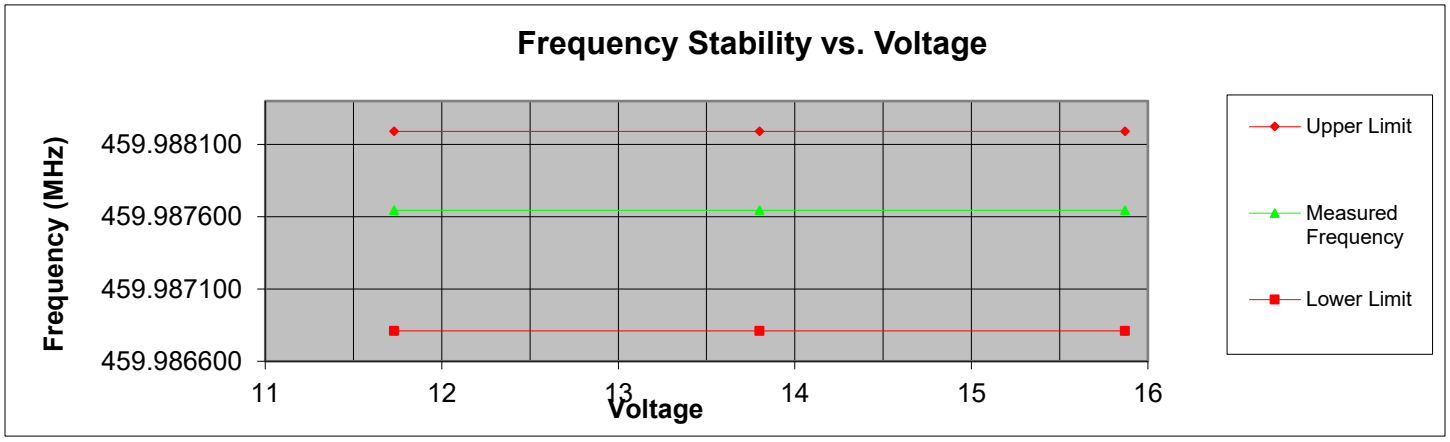
Frequency Stability vs Temperature

Tuned Frequency	Temperature	Tolerance	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(deg C)	(PPM)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
459.9875	-30	1.5	459.987494	459.988190	459.986810	-0.000696	0.000684
459.9875	-20	1.5	459.987587	459.988190	459.986810	-0.000603	0.000777
459.9875	-10	1.5	459.987519	459.988190	459.986810	-0.000671	0.000709
459.9875	0	1.5	459.987525	459.988190	459.986810	-0.000665	0.000715
459.9875	10	1.5	459.987619	459.988190	459.986810	-0.000571	0.000809
459.9875	20	1.5	459.987644	459.988190	459.986810	-0.000546	0.000834
459.9875	30	1.5	459.987600	459.988190	459.986810	-0.000590	0.000790
459.9875	40	1.5	459.987544	459.988190	459.986810	-0.000646	0.000734
459.9875	50	1.5	459.987469	459.988190	459.986810	-0.000721	0.000659



Frequency Stability vs Voltage

Tuned Frequency	Tolerance	Voltage	Measured Frequency	Upper Limit	Lower Limit	Upper Margin	Lower Margin
(MHz)	(PPM)	(PPM)	(MHz)	(MHz)	(MHz)	(MHz)	(MHz)
459.9875	1.5	11.73	459.987644	459.988190	459.986810	-0.000546	0.000834
459.9875	1.5	13.80	459.987644	459.988190	459.986810	-0.000546	0.000834
459.9875	1.5	15.87	459.987644	459.988190	459.986810	-0.000546	0.000834



Necessary Bandwidth Calculations

Engineer: Greg Corbin

Test Date: 10/5/2023

Modulation = 11K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	3
Maximum Deviation (D), kHz	=	2.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	11.0

Modulation = 16K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M) kHz	=	3
Maximum Deviation (D), kHz	=	5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	16.0

Modulation = 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 8K10F1D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	9.6
Maximum Deviation (D), kHz	=	3.111
Signaling States	=	4
Constant Factor (K)	=	0.531
Necessary Bandwidth (B_N), kHz	=	($R/\log_2 S$)+2DK
	=	8.1

Measurement Uncertainty

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

Measurement	U_{lab}
Radio Frequency	± 3.3 x 10^{-8}
RF Power, conducted	± .54 dB
RF Power Density, conducted	± 1.0 dB
Conducted Emissions	± 0.94 dB
Radiated Emissions 9kHz-30MHz	± 2.76 dB
Radiated Emissions 30MHz-1000MHz	± 4.25 dB
Radiated Emissions – 1GHz-18GHz	± 4..49 dB
Temperature	± 1.5 deg C
Humidity	± 4.3 %
DC voltage	± 0.20 VDC
AC Voltage	± 1.2 VAC

The reported expanded uncertainty +/- 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

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Function Generator	HP	33120A	i00118	Verified on: 5/21/25	
Tunable Notch Filter	Eagle	TNF-1-(250-850MHz)	i00124	Verified on: 5/20/25	
Horn Antenna	ARA	DRG-118/A	i00271	8/9/2024	8/9/2026
Temp./humidity/pressure monitor (Main Lab)	Omega Engineering	iBTHX-W-5	i00686	1/25/2025	1/25/2026
Data Logger	Fluke	Hydra Data Bucket	i00343	6/19/2024	6/19/2025
Attenuator, 30 dB, 150W	Narda	769-30	i00347	Verified on: 5/20/25	
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	2/27/25	2/27/27
Spectrum Analyzer	Textronix	RSA5126A	i00424	6/25/2024	6/25/2025
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/13/23	7/13/26
Highpass Filter (1 GHz)	K&L	7IH40-980/T6000-O/O	i00432	Verified on: 5/20/25	
Voltmeter	Fluke	179	i00488	6/19/2024	6/19/2025
MXE EMI receiver	Keysight	N9038A	i00552	3/17/2025	3/17/2026
Temperature Chamber	Thermotron	SE-1000-3-3	i00557	Verified on: 5/30/25	
DC Power Supply	Keysight	N7973A	i00565	Verified on: 5/20/25	
Preamplifier	Eravant	SBB-0115034018-2F2F-E3	i00646	Verified on: 12/4/24	

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