



Compliance Testing, LLC

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Test Report

Prepared for: Etherstack

Model: SFFR6V2

Description: Small Form Factor Repeater

Serial Number: 17050006

FCC ID: 2ADAKSFFR6V2

IC: 9487A-SFFR6V2

To

FCC Part 22, 74, 80, 90

and

IC RSS-119 (Issue 12)

Date of Issue: February 12, 2019

On the behalf of the applicant:

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Attention of:

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Greg Corbin
Project Test Engineer

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All results contained herein relate only to the sample tested.



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	October 16, 2017	Greg Corbin	Original Document
2.0	November 28, 2017	Greg Corbin	Corrected attenuator value on page 13. Added Table 2 on page 7 listing FCC test frequencies used. Added power limits to page 9. Added ppm specification to page 21. Added ANSI C63.26 reference to page 6.
3.0	December 17, 2017	Greg Corbin	Updated Model and Description, manufacturer address. Added emission designators 8K10F7D, 8K10F7E, 8K10F1W, 8K10F7W. Removed emission designator 20k0F3E. Updated test modulation description on pages 11,13,14,16,18,20. Updated the following test data, emission masks, occupied bandwidth, audio low pass filter, audio frequency response, modulation limiting, updated frequency stability limit and added frequency stability for DC voltage
4.0	June 8, 2018	Greg Corbin	Updated FCC and IC IDs, Removed all references to internal duplexer and associated losses, Updated Output power tables
5.0	June 21, 2018	Greg Corbin	Added 8K10F1E to page 6, Updated notes on pages 11, 12. Corrected label for graph on page 8 in Annex B, Updated channel bandwidth for C4FM in table on page 13 Updated FM narrowband and FM wideband plots in Annex D Removed 8K10F1E from necessary BW calculation page 24 Added 8K10F1E,8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W to necessary BW calculations Added audio source to test setup on page 11 and 14. Replaced repeater with basestation Replaced channel spacing with channel bandwidth
6.0	October 2, 2018	Greg Corbin	Changed description back to Small Form Factor Repeater Added Part 74 frequencies to Table 1 page 6.
7.0	October 25, 2018	Greg Corbin	Added emission designators to table 1 on page 7.
8.0	January 18, 2019	Greg Corbin	Updated extended frequencies in Table 1.
9.0	February 11, 2019	Greg Corbin	Removed the extended frequency range for the 16K0F3E emission from Table 1 on page 7.



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ILAC / A2LA

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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.

Testing Certificate Number: **2152.01**



FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The Applicant has been cautioned as to the following:

15.21: Information to the 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 party 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.

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, and the following individual Parts: FCC Part 22, 80, 90, and ANSI C63.26.

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 603E, 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 (°C)	Humidity (%)	Pressure (mbar)
26.3 – 30.0	33.6 – 46.2	963.8 – 965.3

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

EUT Description

Model: SFFR6V2

Description: Small Form Factor Repeater

Firmware: 2.04.000

Software: N/A

Serial Number: 17060006

Additional Information:

The EUT is a VHF small form factor repeater operating from 136 – 174 MHz per Table 1 below.

The EUT is AC or DC powered, with 2 battery packs for battery power.

EUT Operation during Tests

Throughout the test report, there are references to narrowband, wideband, and digital signals.

Narrowband (NB) utilizes analog FM test signals with 12.5 kHz channel bandwidth.

Wideband (WB) utilizes analog FM test signals with 25 kHz channel bandwidth.

Digital utilizes C4FM test signals.



Table 1 - Frequency Allocation

Frequency Range (136 – 174 MHz)								
Rule Part	Frequency Range (MHz)	Sub-Bands (MHz)				Extended Frequency (MHz)		Emission Designators
FCC Part 90	150.8 – 173.4	150.8 – 156.2475	157.1875 – 161.575	161.775 – 161.9625	162.0375 – 173.4	136 – 150.8	173.4 – 174	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E
FCC Part 22	150.8 – 161.775	150.8 – 152.885		157.45 – 161.775		N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
FCC Part 74	150.885 – 173.2	152.8625 – 153.3575	160.860 – 161.400	161.625 – 161.775	166.25 , 170.15	Per the attestation letter, any frequency within the frequency range that is not listed in the sub-band section		8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
FCC Part 80	154 – 162.02375	154 – 161.625		161.775 – 162.0375		N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E
RSS 119	138 - 174	138 – 144	148 – 148.9	150.05 - 174		N/A	N/A	8K10F1D, 8K10F1E, 8K10F1W, 8K10F7D, 8K10F7E, 8K10F7W, 11K0F3E, 16K0F3E

Table 2 - FCC and IC Test Frequencies

Test Frequency (MHz)	FCC and IC Rule Part
138.0125	RSS-119
150.8125	22, 90, RSS-119
161.5625	22, 80, 90, RSS-119
173.3875	90, RSS-119



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Audio breakout box	Etherstack	N/A	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	AC Power cord	1	N	N	N/A
1	DC Power cord	1	N	N	N/A

Modifications: None



Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
2.1046 RSS-119 (5.4) 22.565 (a) 80.215 (f)(g)	Conducted Output Power	Pass	
2.1051 RSS-119 (5.8) 22.359 (a) 80.211 (f)	Conducted Spurious Emissions	Pass	
2.1053 Rss-119 (5.8) 22.359 (a) 80.211 (f)	Radiated Spurious Emissions	Pass	
90.210 2.1049 RSS-119 (5.5) 80.211 (f)	Emission Masks	Pass	
2.1049	Occupied Bandwidth	Pass	
2.1047	Audio Low Pass Filter (Voice Input)	Pass	
2.1047	Audio Frequency Response	Pass	
2.1047(a)	Modulation Limiting	Pass	
90.213 RSS-119 (5.3) 22.355 80.209 (a)(5)	Frequency Stability (Temperature Variation)	Pass	
90.213 RSS-119 (5.3) 22.355 80.209 (a)(5)	Frequency Stability (Voltage Variation)	Pass	
90.214 RSS-119 (5.9)	Transient Frequency Behavior	Pass	
2.202 (g)	Necessary Bandwidth Calculation	Pass	

Conducted Output Power

Engineer: Greg Corbin

Test Date: 8/28/17

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.

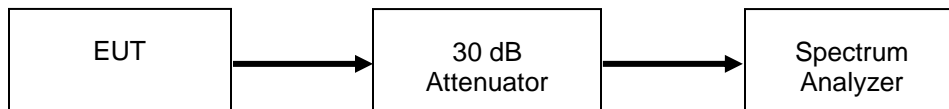
The output power limits are as follows for each FCC rule part.

Part 22: 22.565(a)_150 watts

Part 80: 80.215(a)_50 watts

Part 90: 90.205 (d) 150-174 MHz. (1) The maximum allowable station ERP is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 1 in part 90.205(a).

Test Setup



Peak Output Power – Narrowband - Low Power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	32.4	1.738	Pass
150.8125	32.4	1.738	Pass
161.5625	32.4	1.738	Pass
173.3875	32.5	1.778	Pass

Peak Output Power – Narrowband - High power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	44.2	26.303	Pass
150.8125	44.2	26.303	Pass
161.5625	44.2	26.303	Pass
173.3875	44.3	26.915	Pass



Peak Output Power – Wideband - Low Power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	32.4	1.738	Pass
150.8125	32.4	1.738	Pass
161.5625	32.4	1.738	Pass
173.3875	32.5	1.778	Pass

Peak Output Power – Wideband - High power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	44.2	26.303	Pass
150.8125	44.2	26.303	Pass
161.5625	44.2	26.303	Pass
173.3875	44.3	26.915	Pass

Peak Output Power – Digital - Low Power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	32.4	1.738	Pass
150.8125	32.4	1.738	Pass
161.5625	32.4	1.738	Pass
173.3875	32.5	1.778	Pass

Peak Output Power – Digital - High power setting

Tuned Frequency (MHz)	Measured Output Power		Result
	(dBm)	(watts)	
138.0125	44.2	26.303	Pass
150.8125	44.2	26.303	Pass
161.5625	44.2	26.303	Pass
173.3875	44.3	26.915	Pass



Conducted Spurious Emissions

Engineer: Greg Corbin

Test Date: 9/5/17

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. A tunable notch filter was utilized to ensure the fundamental did not put the spectrum analyzer into compression. The resolution bandwidth set for 100 kHz and the reference level was adjusted to ensure the system had sufficient dynamic range to measure spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed and plotted

The EUT was tested in 3 modes of operation, Wideband (WB), Narrowband (NB), and Digital.

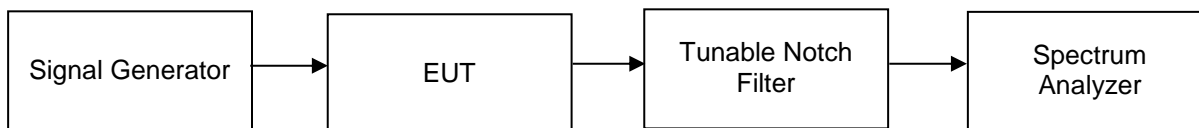
The high power output was used for all conducted spurious tests.

For analog modulation, a 2.5 kHz tone was used, set to 50% modulation (NB 50% of 2.5 kHz = 1.125 kHz, WB 50% of 5 kHz is 2.5 kHz).

The input level was then set to 16 dB above the level used for 50 % modulation.

For digital modulation, the EUT internal C4FM modulation was used.

Test Setup



Refer to Annex A for Conducted Spurious Emission test data.

Notes:

The limit line on the graphs is set to -13dBm.

The test limit for 25 kHz channels is -13dBm.

The test limit is for 12.5 kHz channels is -20dBm.

All spurious measurements were below -20 dBm.



Radiated Spurious Emissions

Engineer: Greg Corbin

Test Date: 9/6/2017

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. A signal generator was used to provide a modulated signal as required. The EUT output was terminated into a 50 Ohm non-radiating load.

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:

Radiated Spurious Emissions Limit

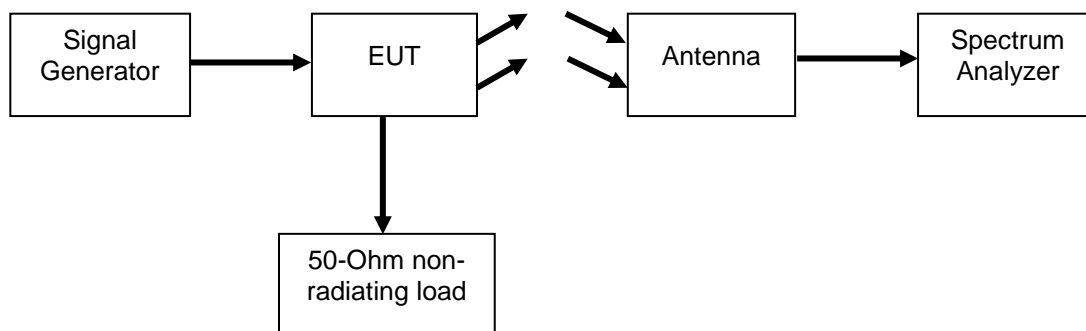
Wideband = $P1 - (43 + 10\log(P2)) = -13\text{dBm}$

Narrowband = $P1 - (50 + 10\log(P2)) = -20\text{dBm}$

P1 = power in dBm

P2 = power in Watts

Test Setup



Refer to Annex B for the Radiated Spurious Emissions test data.

Notes:

The limit line on the graphs is set to -13dBm.

The test limit for 25 kHz channels is -13dBm.

The test limit is for 12.5 kHz channels is -20dBm.

All spurious measurements were below -20 dBm.

No other emissions were detected.



Emission Masks

Engineer: Greg Corbin

Test Date: 8/29/2017

Test Procedure

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

A reference level plot is provided to verify that the peak power was established prior to testing the mask.

The modulation settings are listed in the table below.

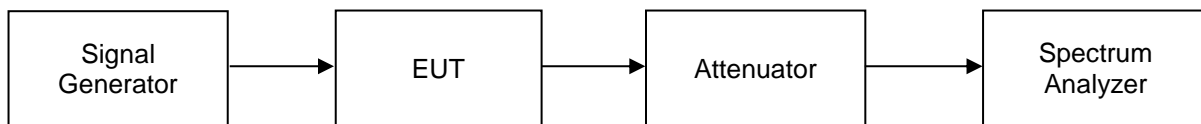
For analog modulation, a 2.5 kHz tone was used, set to 50% modulation (NB 50% of 2.5 kHz = 1.125 kHz, WB 50% of 5 kHz is 2.5 kHz).

The input level was then set to 16 dB above the level used for 50 % modulation.

For digital modulation, the EUT internal C4FM modulation was used.

Channel Bandwidth (kHz)	Emission Mask	Emission Bandwidth	Type of Modulation	Audio Frequency (kHz)	Deviation (kHz)	RBW (Hz)
25	B	16k0	FM	2.5	50%	300
12.5	D	11k0	FM	2.5	50%	100
12.5	D	8k10	C4FM	N/A	N/A	100

Test Setup



Refer to Annex C for Emission Mask test data.



Occupied Bandwidth

Engineer: Greg Corbin

Test Date: 8/28/17

Test Procedure

The EUT was connected directly to a spectrum analyzer. 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 Occupied Bandwidth tool on the spectrum analyzer was used to measure the -26 dB (99%) occupied bandwidth.

For analog modulation, a 2.5 kHz tone was used, set to 50% modulation.

The input level was then set to 16 dB above the level used for 50 % modulation.

For digital modulation, the EUT internal C4FM modulation was used.

Test Setup



Refer to Annex D for Occupied Bandwidth test data.



Transient Frequency Behavior

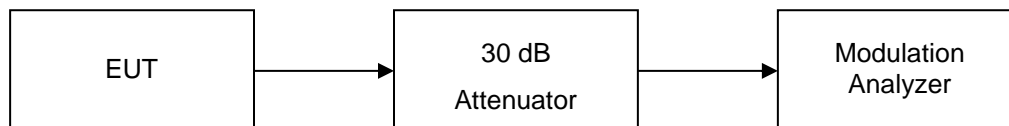
Engineer: Greg Corbin

Test Date: 8/29/2017

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.

Test Setup



Refer to Annex E for Transient Frequency Behaviour test data.



Audio Low Pass Filter (Voice Input)

Engineer: Greg Corbin

Test Date: 12/11/2017

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator.

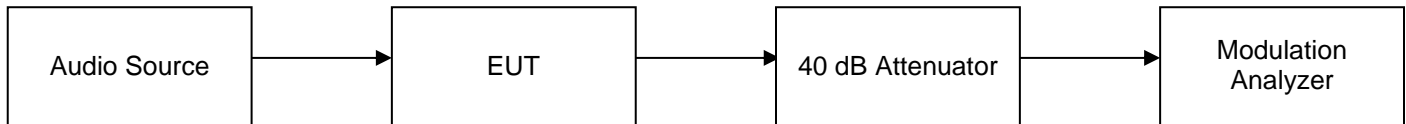
Set the audio frequency generator to 1 kHz and adjust the level per manufacturer's specifications.

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.

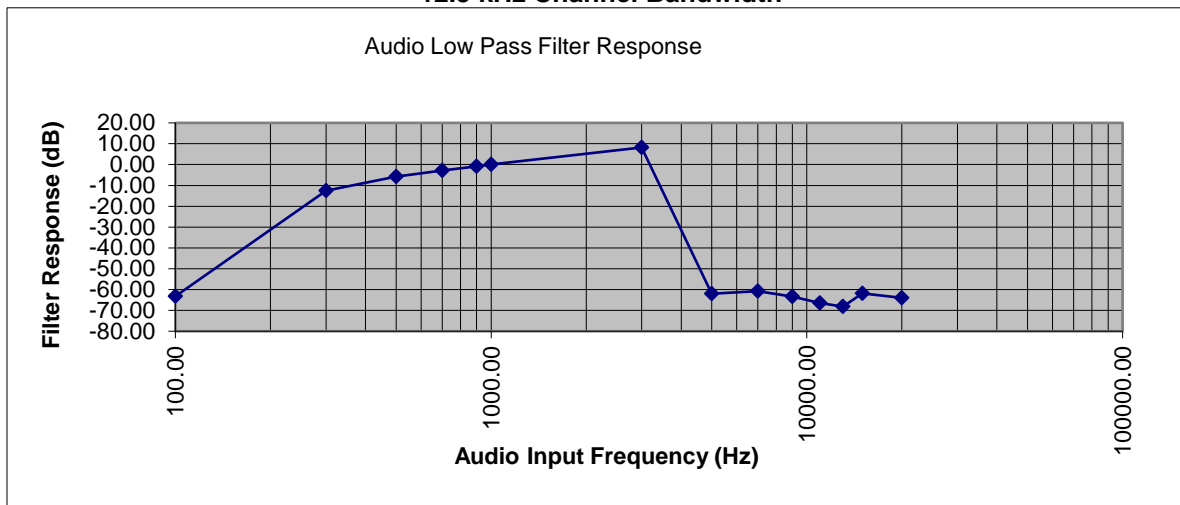
The Audio Low Pass Filter test data was recorded for 12.5 kHz and 25 kHz channel bandwidth.

Test Setup

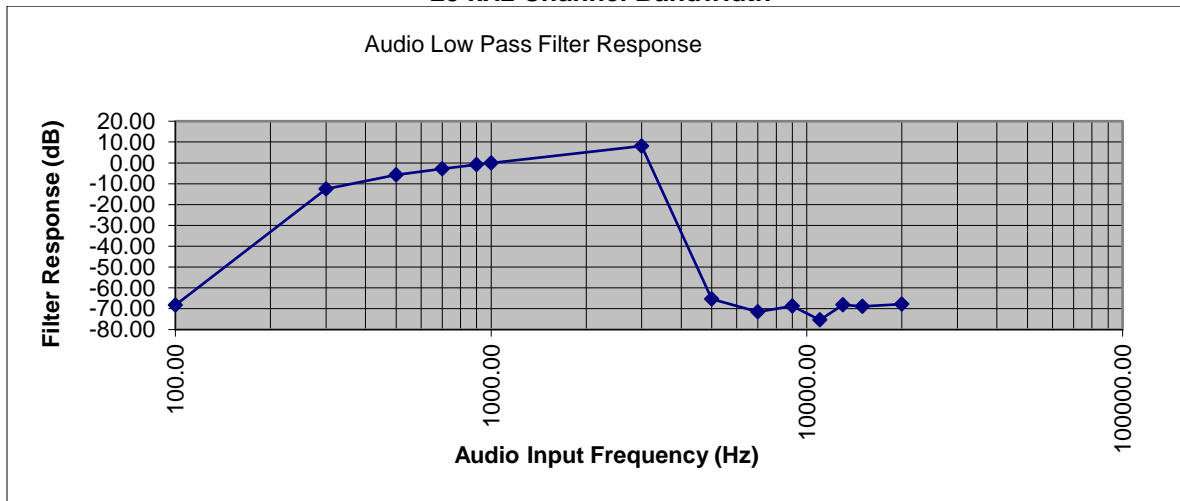


Test Results

12.5 kHz Channel Bandwidth



25 kHz Channel Bandwidth





Audio Frequency Response

Engineer: Greg Corbin

Test Date: 12/11/2017

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator.

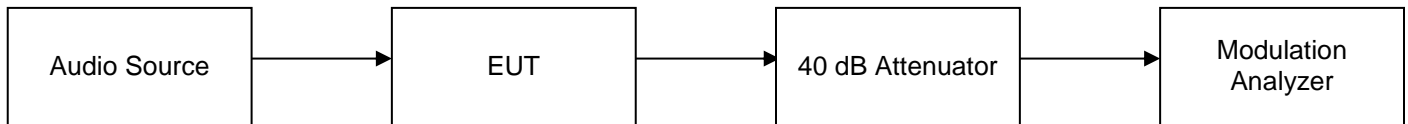
The audio frequency was set to 1 kHz and the level was adjusted for 20% deviation according to the manufacturer's instructions.

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.

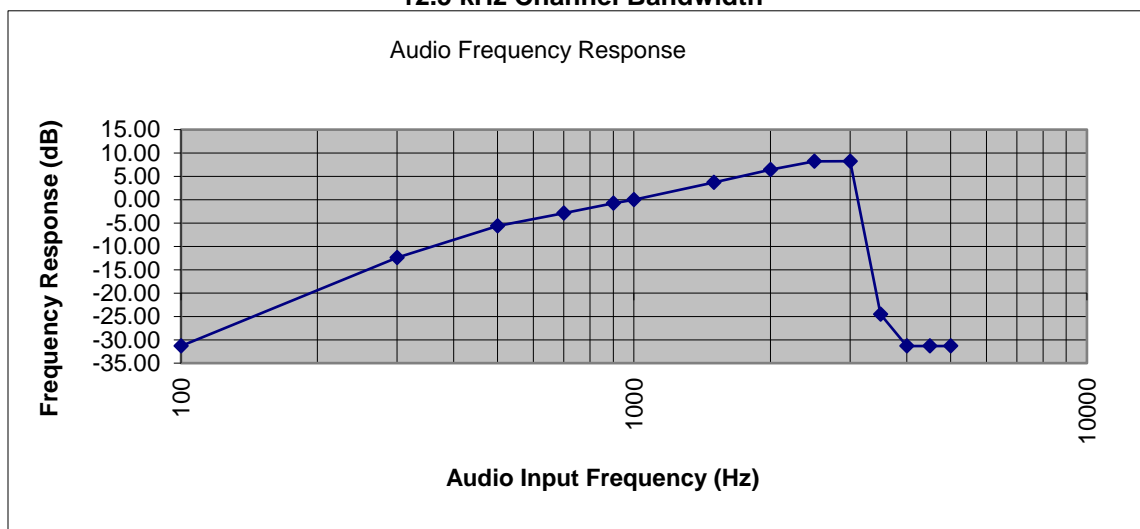
The Audio Frequency Response test data was recorded for 12.5 kHz and 25 kHz channel bandwidth.

Test Setup

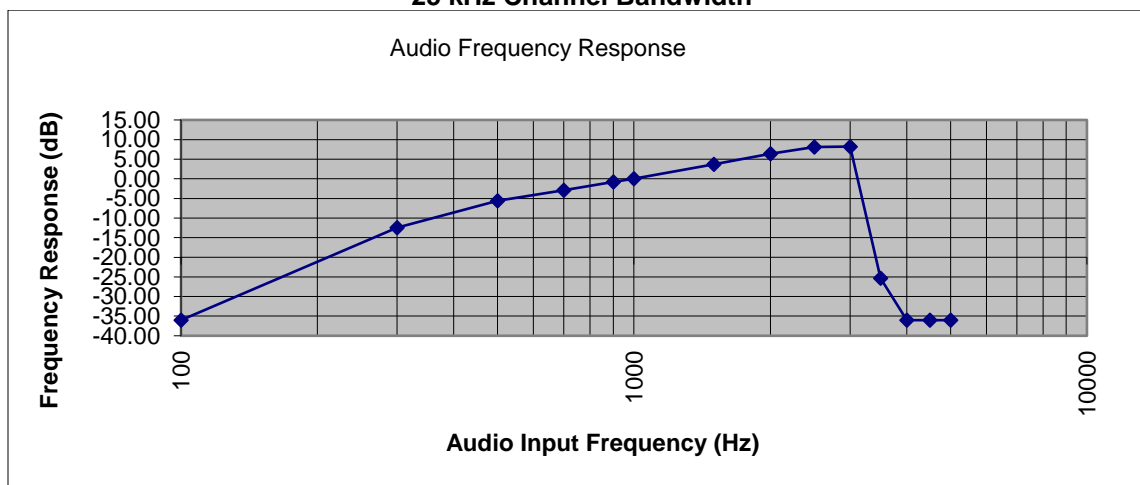


Test Results

12.5 kHz Channel Bandwidth



25 kHz Channel Bandwidth





Modulation Limiting

Engineer: Greg Corbin

Test Date: 12/11/2017

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator.

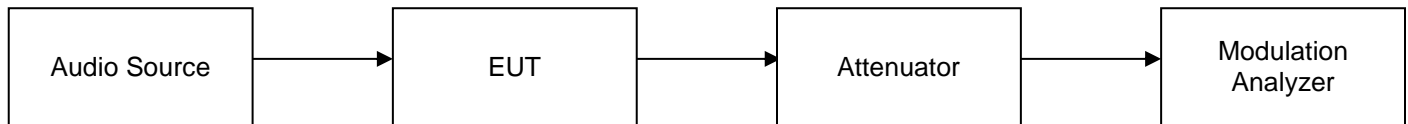
The audio frequency was set to 1 kHz and the level was adjusted for 60% deviation according to the manufacturer's instructions. The input level was then set to 16 dB above the level used for 50 % modulation.

The audio source was tuned from 100 Hz to 5000 Hz and the audio frequency response was measured and plotted.

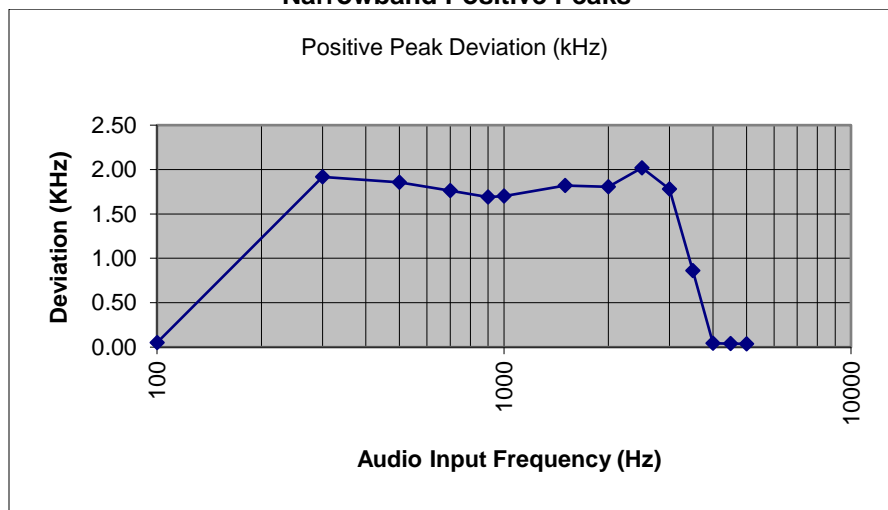
The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

The Modulation Limiting test data was recorded for 12.5 kHz and 25 kHz channel bandwidth.

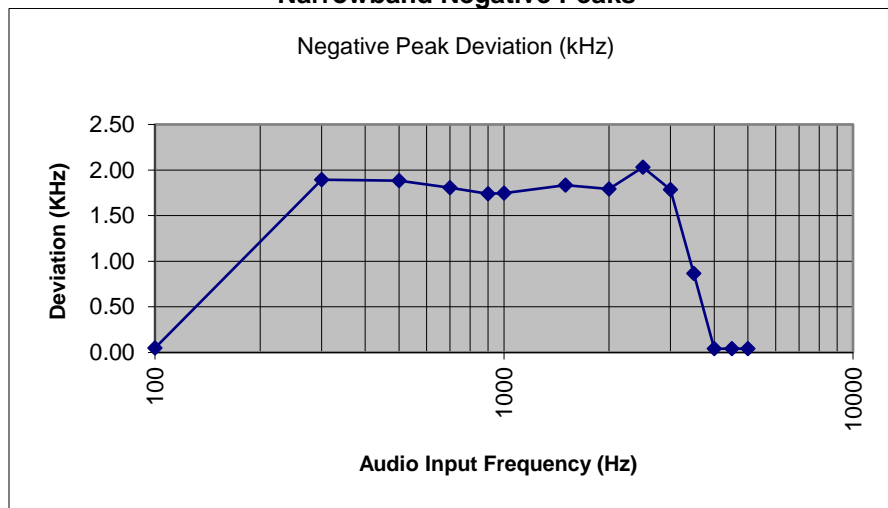
Test Setup



Narrowband Positive Peaks

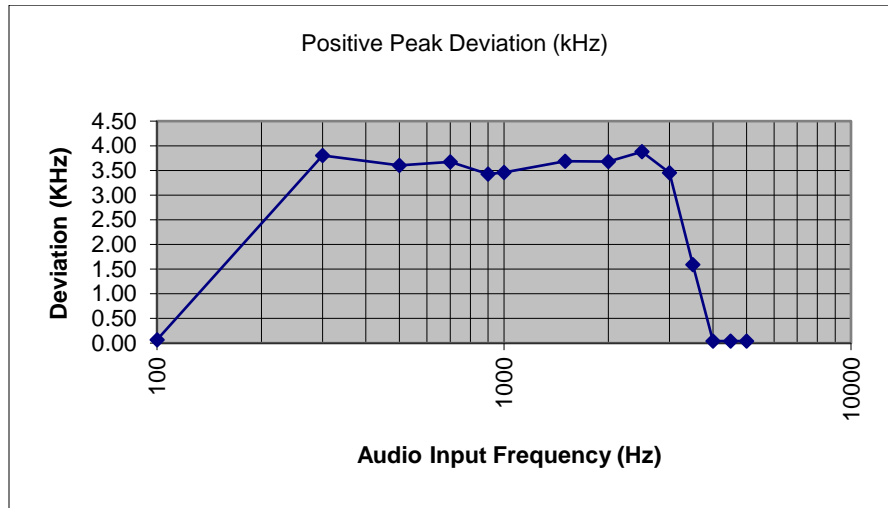


Narrowband Negative Peaks

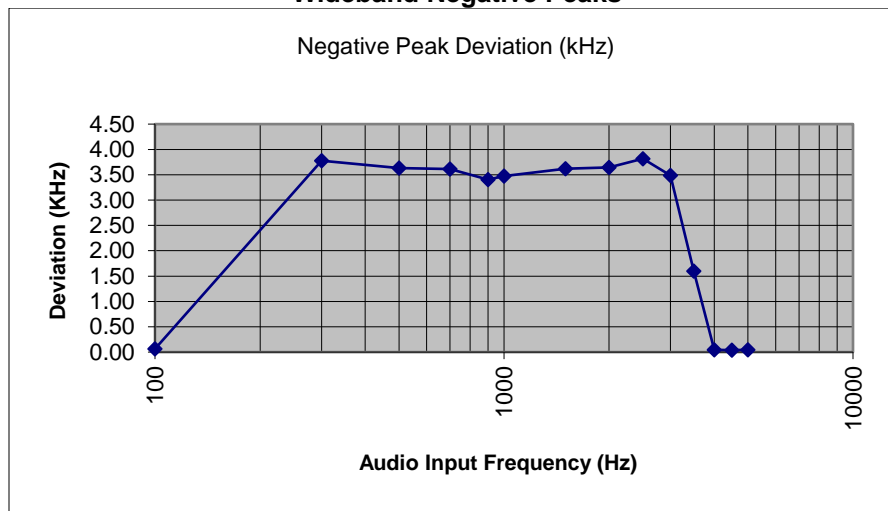




Wideband Positive Peaks



Wideband Negative Peaks





Frequency Stability (Temperature Variation)

Engineer: Greg Corbin

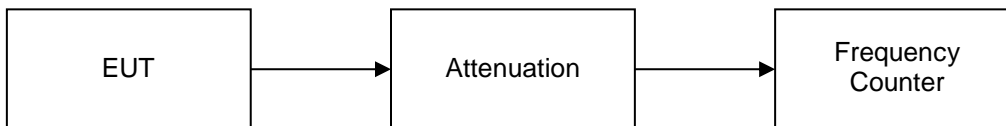
Test Date: 12/17/2017

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.

Tests were performed for both 120 VAC and +12 VDC supply voltages.

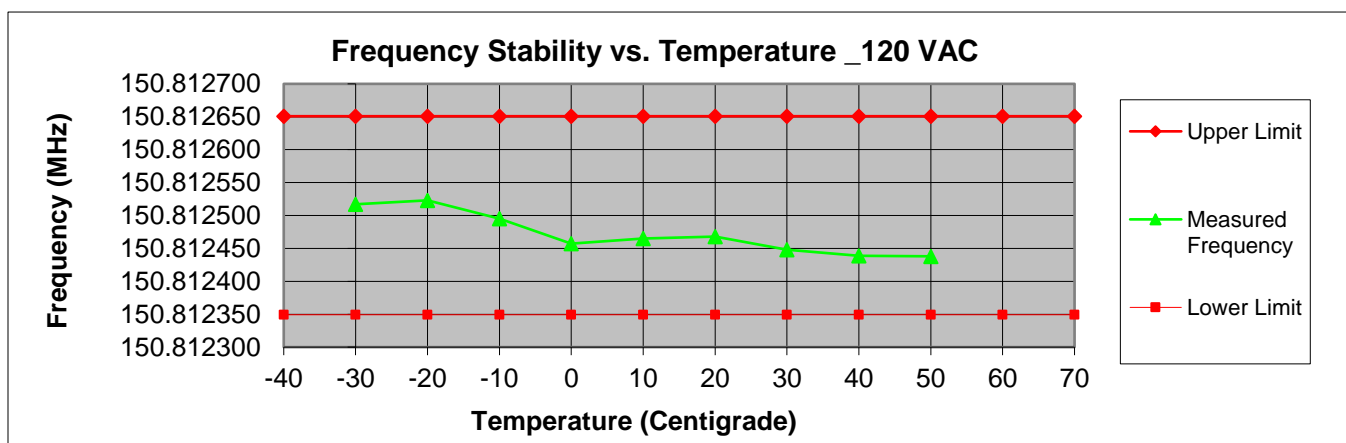
Measurement Setup



Measurement Results

Frequency Stability vs. Temperature _120 VAC

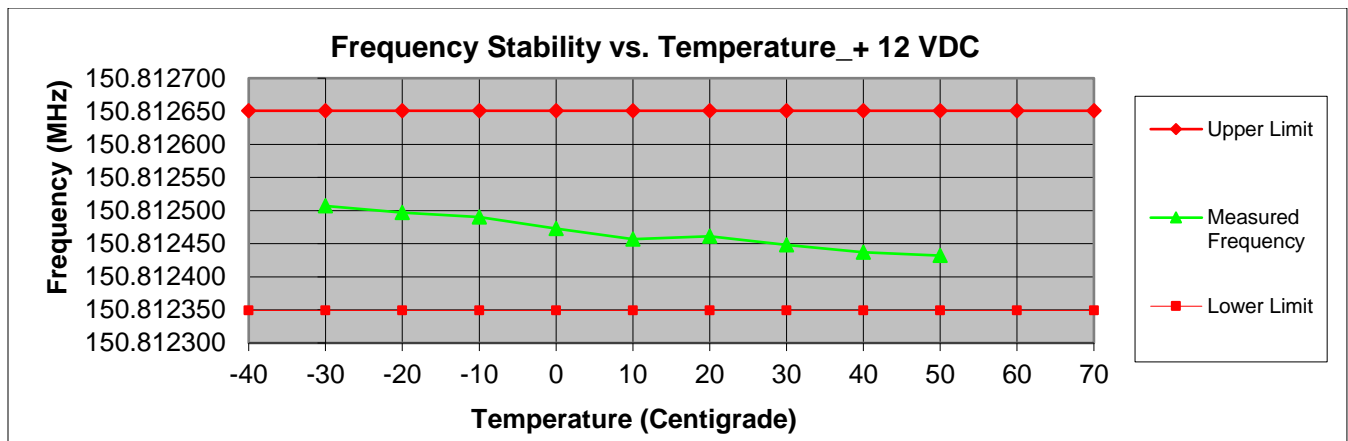
Tuned Frequency (MHz)	Frequency Tolerance (PPM)	Temperature (centigrade)	Measured Frequency (MHz)	Upper Limit (MHz)	Lower Limit (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
150.8125	1.0	-30	150.812517	150.812651	150.812349	-0.000134	0.000168
150.8125	1.0	-20	150.812523	150.812651	150.812349	-0.000128	0.000174
150.8125	1.0	-10	150.812495	150.812651	150.812349	-0.000156	0.000146
150.8125	1.0	0	150.812457	150.812651	150.812349	-0.000194	0.000108
150.8125	1.0	10	150.812465	150.812651	150.812349	-0.000186	0.000116
150.8125	1.0	20	150.812468	150.812651	150.812349	-0.000183	0.000119
150.8125	1.0	30	150.812448	150.812651	150.812349	-0.000203	0.000099
150.8125	1.0	40	150.812439	150.812651	150.812349	-0.000212	0.000090
150.8125	1.0	50	150.812438	150.812651	150.812349	-0.000213	0.000089





Frequency Stability vs. Temperature_+ 12 VDC

Tuned Frequency (MHz)	Frequency Tolerance (PPM)	Temperature centigrade	Measured Frequency (MHz)	Upper Limit (MHz)	Lower Limit (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
150.8125	1.0	-30	150.812507	150.812651	150.812349	-0.000144	0.000158
150.8125	1.0	-20	150.812497	150.812651	150.812349	-0.000154	0.000148
150.8125	1.0	-10	150.812490	150.812651	150.812349	-0.000161	0.000141
150.8125	1.0	0	150.812473	150.812651	150.812349	-0.000178	0.000124
150.8125	1.0	10	150.812457	150.812651	150.812349	-0.000194	0.000108
150.8125	1.0	20	150.812461	150.812651	150.812349	-0.000190	0.000112
150.8125	1.0	30	150.812448	150.812651	150.812349	-0.000203	0.000099
150.8125	1.0	40	150.812437	150.812651	150.812349	-0.000214	0.000088
150.8125	1.0	50	150.812432	150.812651	150.812349	-0.000219	0.000083





Frequency Stability (Voltage Variation)

Engineer: Greg Corbin

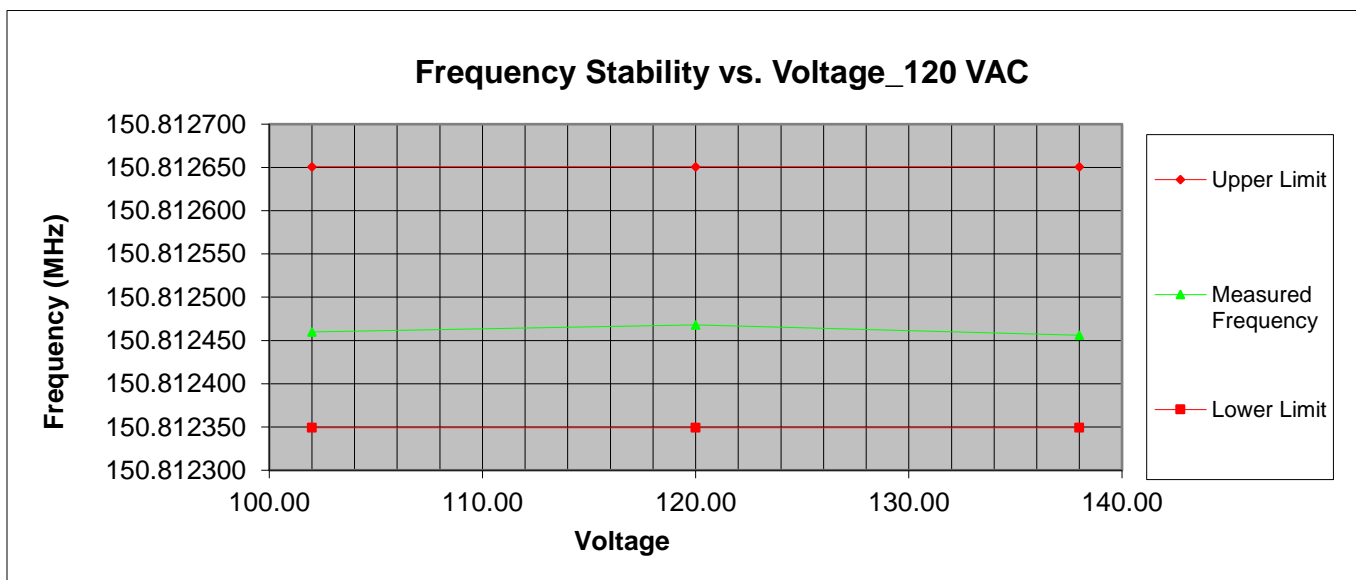
Test Date: 12/17/2017

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

Tests were performed for both 120 VAC and +12 VDC supply voltages.

Frequency Stability vs. Voltage_120 VAC

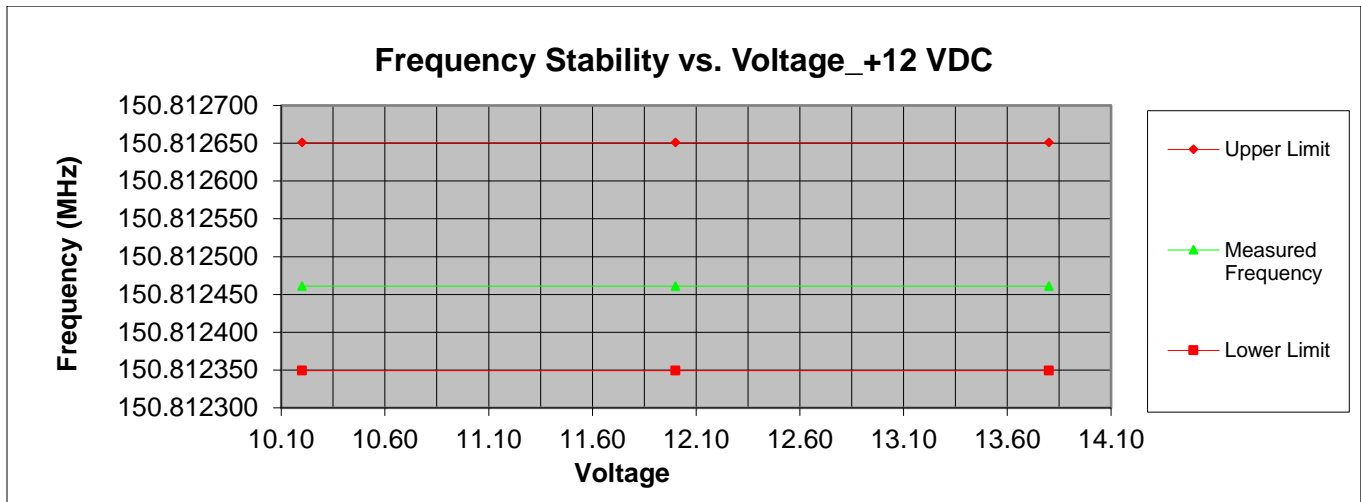
Tuned Frequency (MHz)	Frequency Tolerance (PPM)	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltage	Measured Voltage	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
150.8125	1.0	150.812651	150.812349	120.00	102.00	150.812460	-0.000191	0.000111
150.8125	1.0	150.812651	150.812349	120.00	120.00	150.812468	-0.000183	0.000119
150.8125	1.0	150.812651	150.812349	120.00	138.00	150.812456	-0.000195	0.000107





Frequency Stability vs. Voltage_+12 VDC

Tuned Frequency (MHz)	Frequency Tolerance (PPM)	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltage	Measured Voltage	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
150.8125	1.0	150.812651	150.812349	12.00	10.20	150.812461	-0.000190	0.000112
150.8125	1.0	150.812651	150.812349	12.00	12.00	150.812461	-0.000190	0.000112
150.8125	1.0	150.812651	150.812349	12.00	13.80	150.812461	-0.000190	0.000112





Necessary Bandwidth Calculations

Engineer: Greg Corbin

Test Date: 10/10/2017

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



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/9/17	6/9/18
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/22/17	2/22/18
Signal Generator	Rohde & Schwarz	SMU200A	i00405	5/5/17	5/5/18
Spectrum Analyzer	Textronix	RSA5126A	i00424	5/3/17	5/3/18
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
Signal Generator	Agilent	E4438C	i00457	10/19/16	10/19/18
Preamplifier for 1-18GHz horn antenna	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A

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