

Test Report

Prepared for: BK Technologies, Inc

Model: BKR9000

Description: Multi-Band Portable Radio VHF/UHF/700/800

FCC ID:K95BKR9000-2
ISED ID: 2116A-BKR9000-2

To

FCC_ Part 22, 74, 80, 90
ISED_RSS-119 issue 12 (May 2015)

Date of Issue: March 8, 2023

On the behalf of the applicant:

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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	3/29/2023	Greg Corbin	Original Document
2.0	5/15/2023	Greg Corbin	Removed reference to b/g modes for UNII bands 1, 2A, 2C in the modulation table on page 6.
3.0	5/25/2023	Greg Corbin	Removed references to UNII bands 2A and 2C from test report on page 6.

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Test Result Summary

Specification		Test Name	Pass, Fail, N/A	Comments
FCC	ISED			
2.1046 90.205(s) 22.565(a) 74.461 80.215	RSS-119_5.4	Carrier Output Power (Conducted)	Pass	
2.1051 90.210 22.359(a) 74.462(c) 80.211(f)(3)	RSS-119_5.8.3	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1051 90.210 22.359(a) 74.462(c) 80.211(f)(3)	RSS-119_5.8.3	Field Strength of Spurious Radiation	Pass	
2.1049 90.210(b)(d) 74.462(c) 80.211(f)	RSS-119_5.5	Emission Masks	Pass	
2.1049(c)(1) 22.359(b) 74.462(c) 80.211(f)	RSS-GEN_6.7	Occupied Bandwidth	Pass	
90.543(a)	RSS-119_5.8.9.1	Adjacent Channel Power	Pass	
2.1047(a) 74.463(c) 80.213(e)	N/A	Audio Low Pass Filter (Voice Input)	Pass	
2.1047(a)	N/A	Audio Frequency Response	Pass	
2.1047(a) 74.463(a)(c) 80.213(a)	N/A	Modulation Limiting	Pass	
2.1055 90.213 90.539(c) 22.355 74.464 80.209(a)	RSS-119_5.3	Frequency Stability (Temperature Variation)	Pass	
2.1055 90.213 90.539(c) 22.355 74.464 80.209(a)	RSS-119_5.3	Frequency Stability (Voltage Variation)	Pass	
90.214 74.462(c)	RSS-119_5.9	Transient Frequency Behavior	Pass	
2.202	N/A	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. #349717

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, Part 74, Part 80, Part 90, RSS-119 and RSS-GEN.

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 (°C)	Humidity (%)	Pressure (mbar)
19.1 – 25.4	17.9 – 43.3	956.7 - 984

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

EUT Description

Model: BKR-9000

Description: Multi-Band Portable Radio VHF/UHF/700/800

Firmware: 6.5.8.81

Software: 5.8.82f

DSP: 5.8.54

Serial Number: 01, 07

PMN: BKR9000-2

HVIN: BKR9000-2

Additional Information:

The EUT is a portable land mobile radio operating in the VHF, UHF, 700, 800 MHz bands as noted in Table 1. The EUT contains the following pre-certified module.

Manufacturer	Module	FCC ID	ISED ID
Texas Instruments	WIFI and BT Module WL18DBMOD	Z64-WL18DBMOD	451I-WL18DBMOD

This module contains 2.4 GHz and 5 GHz WIFI bands and 2.4 GHz Bluetooth as noted below.

Band	Frequency Range (MHz)	Modulation
2.4 GHz WIFI	2412 - 2462	802.11b : DSSS 802.11 g/n : OFDM
2.4 GHz Bluetooth	2402 - 2480	Bluetooth BR (1Mbps: GFSK) Bluetooth EDR (2 Mbps: $\pi/4$ -DQPSK)
2.4 GHz BT LE	2402 - 2480	Bluetooth LE (GFSK)
UNII-1	5150 - 5250	WLAN 11a/n HT20/HT40
UNII-3	5725 - 5850	802.11a/n: OFDM

EUT Operation during Tests

The EUT is battery powered with the nominal voltage set to 7.2 vdc.
The output power was set to maximum for all tests.

The test frequencies are listed in Table 1 and identified as to whether the frequency is FCC/IC only or common to FCC and IC.

The low, mid, high frequency for each FCC and ISSED band was tested as well as 1 frequency in each band for FCC Part 22, 74, 80.

Table 1 – Frequency Range, Modulation Type and Emission Designators

Frequency Band (MHz)	FCC Rule Section	FCC, ISSED	Test Frequency (MHz)	12.5k FM	P25 Phase 1 C4FM	P25 Phase 2 H-CPM
FCC (Part 90) 150.8 -174 (Part 22) 152.03 – 158.07 (Part 74) 161.625 – 161.775 (Part 80) 157.2 – 157.425 (Part 80) 161.8 – 162.025 ISSED 138 – 174	90 EF	FCC (EF), ISSED	138.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISSED	150.8125	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	22, 90	FCC, ISSED	158.07	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	74, 90	FCC, ISSED	161.625	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	80, 90	FCC, ISSED	161.80	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISSED	173.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
FCC (Part 90) 406.1 – 430 (Part 90) 450 – 470 (Part 90) 470- 512 (Part 90 EF) 380 - 406 (Part 90 EF) 512 – 520 (Part 22) 454.025 – 459.650 (Part 74) 450 – 451 (Part 74) 455 – 456 (Part 74) 470 – 488 (Part 80) 457.5375 – 467.825 ISSED 406.1 – 430 450 - 470	90 EF	FCC (EF)	380.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISSED	406.2	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISSED	420	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISSED	429.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	74, 90	FCC, ISSED	450.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	22, 90	FCC, ISSED	459.65	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	80, 90	FCC, ISSED	467.825	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	80, 90	FCC, ISSED	469.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC	511.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90 EF	FCC (EF)	519.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W

FCC (Part 90) 769 - 775 (Part 90) 799 – 805 ISED 768 - 776 798 - 806	N/A	ISED	768.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	769.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	774.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	N/A	ISED	775.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	N/A	ISED	798.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	799.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	804.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	N/A	ISED	805.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
FCC (FCC) 806 - 815 (FCC) 851 – 860 ISED 806 – 824 851 - 869	90	FCC, ISED	806.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	810.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	814.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	N/A	ISED	823.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	851.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	855.025	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	90	FCC, ISED	859.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W
	N/A	ISED	868.975	11K0F3E	8K10F1E 8K10F1D	8K10F1W

Antenna Gain

Model	Frequency Range (MHz)		Gain (dBi)
BKR0813	VHF	136 – 174	-6 to -4
BKR0892	VHF	136 – 174	0
	700 / 800 Band	769 - 870	2
BKR0893-148-E	VHF	136 – 174	-8 to -4
	UHF	380 - 520	-5 to 0
	700 / 800 Band	763 - 870	-1 to 1
BKR0893-148-E20	VHF	136 – 174	-9 to -5
	UHF	380 - 520	-5 to 0
	700 / 800 Band	763 - 870	-1 to 1

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Battery, Li-ion Rechargeable	BK	BKR0102	N/A
1	Battery Charger	BK	BKR0300	N/A
1	ITE Power Supply for BKR0300	Leader Electronics	MU12B8120100-A1	N/A
1	Battery Eliminator	BK	N/A	N/A
1	PTT Microphone	BK	BKR0204	N/A
1	Antenna	BK	BKR0813	N/A
1	Antenna	BK	BKR0892-180	N/A
1	Antenna	BK	BKR0893-148-E	N/A
1	Antenna	BK	BKR0893-148-E20	N/A

Cables: None

Modifications: None

Carrier Output Power (Conducted)

Engineer: Greg Corbin

Test Date: 1/5/2023

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.

Output power was recorded in CW, C4FM, TDMA modes of operation.

CW was measured with peak detector with max hold.

C4FM was measured using the Channel Power integration tool in the spectrum analyzer.

and TDMA was measured using a average detector with max hold per ANSI C63.25-2015 section 5.2.4.3.3.

Manufacturer Rated Power =VHF= 6 watts (37.782 dBm)

Manufacturer Rated Power =UHF= 5 watts (36.99 dBm)

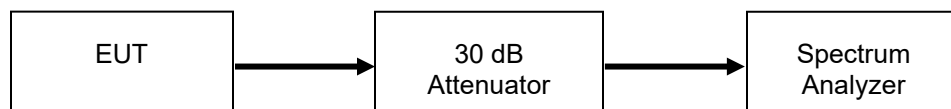
Manufacturer Rated Power =700 band= 3 watts (34.771 dBm)

Manufacturer Rated Power =800 band= 3 watts (34.771 dBm)

ISED RSS-119 Output Power Limit = ± 1 dB of manufacturer rated power.

FCC Output Power Limit = 7.2 w (20% of manufacturer rated power)

Test Setup



Transmitter Peak Output Power_ CW

FCC ISED	Tuned Frequency	Output Power	Output Power	Result
	MHz	(dBm)	(watts)	
FCC (EF), ISED	138.0250	37.93	6.209	Pass
FCC, ISED	150.8125	37.93	6.209	Pass
FCC, ISED	158.0700	38.06	6.397	Pass
FCC, ISED	161.6250	38.02	6.339	Pass
FCC, ISED	161.8000	38.01	6.324	Pass
FCC, ISED	173.9750	38.01	6.324	Pass
FCC, ISED	380.0250	36.82	4.808	Pass
FCC, ISED	406.2000	36.97	4.977	Pass
FCC, ISED	420.0000	36.87	4.864	Pass
FCC, ISED	429.9750	37.41	5.508	Pass
FCC, ISED	450.0250	37.31	5.383	Pass
FCC, ISED	459.6500	37.29	5.358	Pass
FCC, ISED	467.8250	37.37	5.458	Pass
FCC, ISED	469.9750	37.27	5.333	Pass
FCC only	511.9750	37.32	5.395	Pass
FCC (EF) only	519.9750	37.3	5.370	Pass
ISED Only	768.0250	34.68	2.938	Pass
FCC, ISED	769.0250	34.23	2.649	Pass
FCC, ISED	774.9750	34.1	2.570	Pass
ISED Only	775.9750	34.75	2.985	Pass
ISED Only	798.0250	34.52	2.831	Pass
FCC, ISED	799.0250	34.03	2.529	Pass
FCC, ISED	804.9750	34.11	2.576	Pass
ISED Only	805.9750	34.53	2.838	Pass
FCC, ISED	806.0250	34.12	2.582	Pass
FCC, ISED	810.0250	34.12	2.582	Pass
FCC, ISED	814.9750	34.19	2.624	Pass
ISED Only	823.9750	34.45	2.786	Pass
FCC, ISED	851.0250	34.4	2.754	Pass
FCC, ISED	855.0250	34.49	2.812	Pass
FCC, ISED	859.9750	34.49	2.812	Pass
ISED Only	868.9750	34.05	2.541	Pass

Transmitter Peak Output Power_ C4FM

FCC ISED	Tuned Frequency	Output Power	Output Power	Result
	MHz	(dBm)	(watts)	
FCC (EF), ISED	138.0250	36.96	4.966	Pass
FCC, ISED	150.8125	37.52	5.649	Pass
FCC, ISED	158.0700	37.79	6.012	Pass
FCC, ISED	161.6250	37.76	5.970	Pass
FCC, ISED	161.8000	37.76	5.970	Pass
FCC, ISED	173.9750	37.78	5.998	Pass
FCC, ISED	380.0250	36.69	4.667	Pass
FCC, ISED	406.2000	36.6	4.571	Pass
FCC, ISED	420.0000	36.47	4.436	Pass
FCC, ISED	429.9750	36.95	4.955	Pass
FCC, ISED	450.0250	36.8	4.786	Pass
FCC, ISED	459.6500	36.76	4.742	Pass
FCC, ISED	467.8250	36.79	4.775	Pass
FCC, ISED	469.9750	36.87	4.864	Pass
FCC only	511.9750	36.8	4.786	Pass
FCC (EF) only	519.9750	36.77	4.753	Pass
ISED Only	768.0250	34.63	2.904	Pass
FCC, ISED	769.0250	34.11	2.576	Pass
FCC, ISED	774.9750	34.05	2.541	Pass
ISED Only	775.9750	34.65	2.917	Pass
ISED Only	798.0250	34.45	2.786	Pass
FCC, ISED	799.0250	34.01	2.518	Pass
FCC, ISED	804.9750	34.15	2.600	Pass
ISED Only	805.9750	34.48	2.805	Pass
FCC, ISED	806.0250	34.13	2.588	Pass
FCC, ISED	810.0250	34.09	2.564	Pass
FCC, ISED	814.9750	34.16	2.606	Pass
ISED Only	823.9750	34.35	2.723	Pass
FCC, ISED	851.0250	34.4	2.754	Pass
FCC, ISED	855.0250	34.5	2.818	Pass
FCC, ISED	859.9750	34.49	2.812	Pass
ISED Only	868.9750	33.98	2.500	Pass

Transmitter Peak Output Power_ TDMA

FCC ISED	Tuned Frequency	Output Power	Output Power	Result
	MHz	(dBm)	(watts)	
FCC (EF), ISED	138.0250	37.77	5.984	Pass
FCC, ISED	150.8125	37.75	5.957	Pass
FCC, ISED	158.0700	37.88	6.138	Pass
FCC, ISED	161.6250	37.72	5.916	Pass
FCC, ISED	161.8000	37.67	5.848	Pass
FCC, ISED	173.9750	37.81	6.039	Pass
FCC, ISED	380.0250	36.26	4.227	Pass
FCC, ISED	406.2000	36.93	4.932	Pass
FCC, ISED	420.0000	36.64	4.613	Pass
FCC, ISED	429.9750	36.98	4.989	Pass
FCC, ISED	450.0250	36.78	4.764	Pass
FCC, ISED	459.6500	36.76	4.742	Pass
FCC, ISED	467.8250	36.69	4.667	Pass
FCC, ISED	469.9750	36.76	4.742	Pass
FCC only	511.9750	36.69	4.667	Pass
FCC (EF) only	519.9750	36.72	4.699	Pass
ISED Only	768.0250	33.28	2.128	Pass
FCC, ISED	769.0250	33.26	2.118	Pass
FCC, ISED	774.9750	33.33	2.153	Pass
ISED Only	775.9750	33.35	2.163	Pass
ISED Only	798.0250	33.47	2.223	Pass
FCC, ISED	799.0250	33.43	2.203	Pass
FCC, ISED	804.9750	33.51	2.244	Pass
ISED Only	805.9750	33.49	2.234	Pass
FCC, ISED	806.0250	33.49	2.234	Pass
FCC, ISED	810.0250	33.49	2.234	Pass
FCC, ISED	814.9750	33.26	2.118	Pass
ISED Only	823.9750	33.07	2.028	Pass
FCC, ISED	851.0250	33.73	2.360	Pass
FCC, ISED	855.0250	33.85	2.427	Pass
FCC, ISED	859.9750	33.83	2.415	Pass
ISED Only	868.9750	33.83	2.415	Pass

Conducted Spurious Emissions

Engineer: Greg Corbin

Test Date: 3/7/2023

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. A tunable notch filter was utilized as required to ensure the fundamental did not put the spectrum analyzer into compression. The resolution bandwidth 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.

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

The conducted spurious emissions was recorded for FM, C4FM, TDMA modes of operation.

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

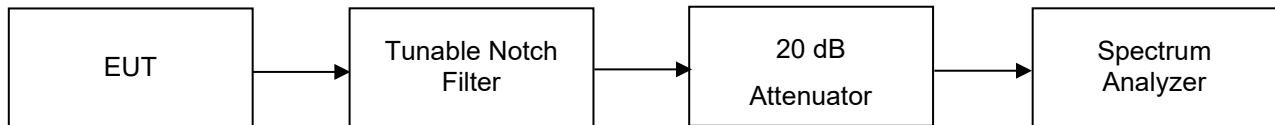
Note: A marker was placed on the fundamental frequency. Only the fundamental TX signal exceeded the limit as shown in the spectrum analyzer screenshots.

Conducted spurious test data was also recorded for FCC part 90.543 (f) requirements.

90.543(f)_

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

Test Setup



Conducted Spurious Emissions Summary Test Table_ FM

FCC ISED	Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
FCC (EF), ISED	138.0250	276.08	-32.3	-20	Pass
FCC, ISED	150.8125	301.66	-33.1	-20	Pass
FCC, ISED	158.0700	316.11	-32.5	-20	Pass
FCC, ISED	161.6250	323.21	-31.8	-20	Pass
FCC, ISED	161.8000	323.57	-32.1	-20	Pass
FCC, ISED	173.9750	347.96	-31.0	-20	Pass
FCC, ISED	380.0250	257.61	-36.9	-20	Pass
FCC, ISED	406.2000	812.42	-33.2	-20	Pass
FCC, ISED	420.0000	840.01	-33.0	-20	Pass
FCC, ISED	429.9750	859.91	-34.7	-20	Pass
FCC, ISED	450.0250	151.26	-38.9	-20	Pass
FCC, ISED	459.6500	834.21	-39.1	-20	Pass
FCC, ISED	467.8250	110.05	-39.1	-20	Pass
FCC, ISED	469.9750	114.44	-39.2	-20	Pass
FCC only	511.9750	121.54	-37.3	-20	Pass
FCC (EF) only	519.9750	383.97	-37.3	-20	Pass
ISED Only	768.0250	268.86	-31.7	-20	Pass
FCC, ISED	769.0250	268.86	-37.1	-20	Pass
FCC, ISED	774.9750	186.79	-37.0	-20	Pass
ISED Only	775.9750	625.67	-36.8	-20	Pass
ISED Only	798.0250	606.01	-33.0	-20	Pass
FCC, ISED	799.0250	602.57	-33.0	-20	Pass
FCC, ISED	804.9750	268.74	-33.7	-20	Pass
ISED Only	805.9750	210.36	-33.2	-20	Pass
FCC, ISED	806.0250	537.20	-35.3	-20	Pass
FCC, ISED	810.0250	230.37	-34.7	-20	Pass
FCC, ISED	814.9750	622.94	-35.2	-20	Pass
ISED Only	823.9750	593.57	-35.5	-20	Pass
FCC, ISED	851.0250	223.62	-34.6	-20	Pass
FCC, ISED	855.0250	268.86	-34.8	-20	Pass
FCC, ISED	859.9750	268.74	-33.5	-20	Pass
ISED Only	868.9750	825.56	-37.9	-20	Pass

Conducted Spurious Emissions Summary Test Table_ C4FM

FCC ISED	Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
FCC (EF), ISED	138.0250	276.08	-31.9	-20	Pass
FCC, ISED	150.8125	301.66	-33.2	-20	Pass
FCC, ISED	158.0700	316.11	-31.7	-20	Pass
FCC, ISED	161.6250	323.21	-31.9	-20	Pass
FCC, ISED	161.8000	323.57	-32.1	-20	Pass
FCC, ISED	173.9750	347.96	-31.1	-20	Pass
FCC, ISED	380.0250	760.08	-37.2	-20	Pass
FCC, ISED	406.2000	812.42	-33.2	-20	Pass
FCC, ISED	420.0000	840.01	-33.4	-20	Pass
FCC, ISED	429.9750	859.91	-34.3	-20	Pass
FCC, ISED	450.0250	132.08	-39.0	-20	Pass
FCC, ISED	459.6500	151.26	-39.5	-20	Pass
FCC, ISED	467.8250	935.70	-40.1	-20	Pass
FCC, ISED	469.9750	939.96	-39.3	-20	Pass
FCC only	511.9750	102.36	-36.2	-20	Pass
FCC (EF) only	519.9750	1560.4	-37.1	-20	Pass
ISED Only	768.0250	307.23	-33.2	-20	Pass
FCC, ISED	769.0250	577.11	-36.5	-20	Pass
FCC, ISED	774.9750	583.03	-36.4	-20	Pass
ISED Only	775.9750	587.30	-36.3	-20	Pass
ISED Only	798.0250	606.01	-33.8	-20	Pass
FCC, ISED	799.0250	268.86	-33.6	-20	Pass
FCC, ISED	804.9750	268.74	-33.3	-20	Pass
ISED Only	805.9750	268.96	-33.9	-20	Pass
FCC, ISED	806.0250	595.59	-35.2	-20	Pass
FCC, ISED	810.0250	617.97	-35.5	-20	Pass
FCC, ISED	814.9750	305.21	-35.6	-20	Pass
ISED Only	823.9750	555.20	-35.3	-20	Pass
FCC, ISED	851.0250	281.77	-34.9	-20	Pass
FCC, ISED	855.0250	345.60	-35.3	-20	Pass
FCC, ISED	859.9750	164.76	-35.4	-20	Pass
ISED Only	868.9750	268.86	-36.0	-20	Pass

Conducted Spurious Emissions Summary Test Table_ TDMA

FCC ISED	Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
FCC (EF), ISED	138.0250	276.08	-32.4	-20	Pass
FCC, ISED	150.8125	301.66	-33.3	-20	Pass
FCC, ISED	158.0700	316.11	-32.9	-20	Pass
FCC, ISED	161.6250	323.11	-32.6	-20	Pass
FCC, ISED	161.8000	323.57	-32.6	-20	Pass
FCC, ISED	173.9750	347.96	-33.0	-20	Pass
FCC, ISED	380.0250	502.51	-37.4	-20	Pass
FCC, ISED	406.2000	812.42	-34.2	-20	Pass
FCC, ISED	420.0000	840.01	-35.4	-20	Pass
FCC, ISED	429.9750	859.91	-34.7	-20	Pass
FCC, ISED	450.0250	132.08	-39.5	-20	Pass
FCC, ISED	459.6500	384.08	-40.2	-20	Pass
FCC, ISED	467.8250	739.35	-40.6	-20	Pass
FCC, ISED	469.9750	114.32	-39.8	-20	Pass
FCC only	511.9750	70.50	-37.4	-20	Pass
FCC (EF) only	519.9750	1560.4	-36.7	-20	Pass
ISED Only	768.0250	499.19	-32.9	-20	Pass
FCC, ISED	769.0250	268.86	-38.0	-20	Pass
FCC, ISED	774.9750	230.07	-37.8	-20	Pass
ISED Only	775.9750	265.54	-37.5	-20	Pass
ISED Only	798.0250	567.64	-34.0	-20	Pass
FCC, ISED	799.0250	268.86	-34.2	-20	Pass
FCC, ISED	804.9750	267.74	-34.0	-20	Pass
ISED Only	805.9750	230.37	-34.5	-20	Pass
FCC, ISED	806.0250	268.86	-36.7	-20	Pass
FCC, ISED	810.0250	230.37	-36.6	-20	Pass
FCC, ISED	814.9750	266.73	-36.1	-20	Pass
ISED Only	823.9750	593.57	-35.9	-20	Pass
FCC, ISED	851.0250	268.74	-34.0	-20	Pass
FCC, ISED	855.0250	268.74	-33.1	-20	Pass
FCC, ISED	859.9750	164.76	-33.2	-20	Pass
ISED Only	868.9750	259.50	-32.8	-20	Pass

Annex A1 thru A3 Conducted Spurious Emission

Refer to Annex A1 for Conducted Spurious Emission plots with FM modulation

Refer to Annex A2 for Conducted Spurious Emission plots with C4FM modulation

Refer to Annex A3 for Conducted Spurious Emission plots with TDMA modulation

Conducted Spurious Emissions (1559 – 1610 MHz)

Engineer: Greg Corbin

Test Date: 2/14/2023

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. A tunable notch filter was utilized as required to ensure the fundamental did not put the spectrum analyzer into compression. The resolution bandwidth set for 700 Hz 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.

Conducted spurious test data was also recorded for FCC part 90.543 (f) requirements.

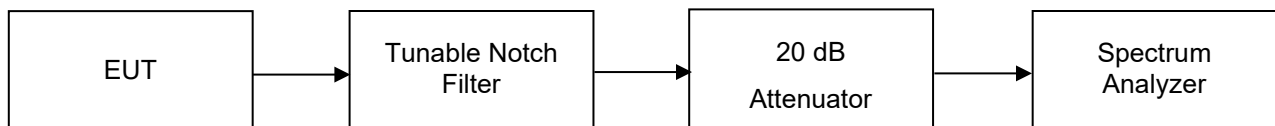
90.543(f)_

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

Of the 4 antennas provided by the manufacturer (refer to page 8 for the antenna specifications), the BKR0892 antenna had the highest gain (2.0 dBi).

This antenna gain was used in the EIRP calculation for the Final value listed in the test results table.

Test Setup



768 - 776 MHz Band Narrowband Test Results

Spurious Frequency Range (MHz)	Tuned Frequency (MHz)	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Gain/Loss from Antenna Kitting Information (dBi)	Final Value EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
1559 – 1610 (NB)	768.025	FM	1579.9	-101.9	2	-99.9	-50	-49.9
1559 – 1610 (NB)	768.025	C4FM	1603.5	-102.2	2	-100.2	-50	-50.2
1559 – 1610 (NB)	768.025	TDMA	1606.7	-101.1	2	-99.1	-50	-49.1
1559 – 1610 (NB)	769.025	FM	1601.5	-101.9	2	-99.9	-50	-49.9
1559 – 1610 (NB)	769.025	C4FM	1568.3	-102.5	2	-100.5	-50	-50.5
1559 – 1610 (NB)	769.025	TDMA	1593.4	-102.4	2	-100.4	-50	-50.4
1559 – 1610 (NB)	774.975	FM	1600.2	-101.3	2	-99.3	-50	-49.3
1559 – 1610 (NB)	774.975	C4FM	1586.6	-102.1	2	-100.1	-50	-50.1
1559 – 1610 (NB)	774.975	TDMA	1577.4	-101.7	2	-99.7	-50	-49.7
1559 – 1610 (NB)	775.975	FM	1575.0	-102.2	2	-100.2	-50	-50.2
1559 – 1610 (NB)	775.975	C4FM	1604.5	-101.7	2	-99.7	-50	-49.7
1559 – 1610 (NB)	775.975	TDMA	1572.0	-102.4	2	-100.4	-50	-50.4

768 - 776 MHz Band Wideband Test Results

Spurious Frequency Range (MHz)	Tuned Frequency (MHz)	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Gain/Loss from Antenna Kitting Information (dBi)	Final Value EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
1559 – 1610 (WB)	768.025	FM	1585.31	-65.8	2	-63.8	-40	-23.8
1559 – 1610 (WB)	768.025	C4FM	1594.29	-66.6	2	-64.6	-40	-24.6
1559 – 1610 (WB)	768.025	TDMA	1565.89	-66.3	2	-64.3	-40	-24.3
1559 – 1610 (WB)	769.025	FM	1574.35	-66.6	2	-64.6	-40	-24.6
1559 – 1610 (WB)	769.025	C4FM	1562.93	-66.6	2	-64.6	-40	-24.6
1559 – 1610 (WB)	769.025	TDMA	1575.67	-66.2	2	-64.2	-40	-24.2
1559 – 1610 (WB)	774.975	FM	1578.44	-65.9	2	-63.9	-40	-23.9
1559 – 1610 (WB)	774.975	C4FM	1565.04	-65.7	2	-63.7	-40	-23.7
1559 – 1610 (WB)	774.975	TDMA	1602.34	-66.4	2	-64.4	-40	-24.4
1559 – 1610 (WB)	775.975	FM	1583.83	-66.5	2	-64.5	-40	-24.5
1559 – 1610 (WB)	775.975	C4FM	1570.78	-65.7	2	-63.7	-40	-23.7
1559 – 1610 (WB)	775.975	TDMA	1569.34	-65.1	2	-63.1	-40	-23.1

798 - 806 MHz Band_ Narrowband Test Results

Spurious Frequency Range (MHz)	Tuned Frequency (MHz)	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Gain/Loss from Antenna Kitting Information (dBi)	Final Value EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
1559 – 1610 (NB)	798.025	FM	1596.05	-81.2	2	-79.2	-50	-29.2
1559 – 1610 (NB)	798.025	C4FM	1596.05	-82.2	2	-80.2	-50	-30.2
1559 – 1610 (NB)	798.025	TDMA	1596.05	-80.1	2	-78.1	-50	-28.1
1559 – 1610 (NB)	799.025	FM	1598.05	-81.8	2	-79.8	-50	-29.8
1559 – 1610 (NB)	799.025	C4FM	1598.05	-83.1	2	-81.1	-50	-31.1
1559 – 1610 (NB)	799.025	TDMA	1598.05	-80.1	2	-78.1	-50	-28.1
1559 – 1610 (NB)	804.975	FM	1609.95	-77.4	2	-75.4	-50	-25.4
1559 – 1610 (NB)	804.975	C4FM	1609.95	-79.4	2	-77.4	-50	-27.4
1559 – 1610 (NB)	804.975	TDMA	1609.95	-77.5	2	-75.5	-50	-25.5
1559 – 1610 (NB)	805.975	FM	1575.15	-102.3	2	-100.3	-50	-50.3
1559 – 1610 (NB)	805.975	C4FM	1580.69	-102.7	2	-100.7	-50	-50.7
1559 – 1610 (NB)	805.975	TDMA	1592.54	-102.3	2	-100.3	-50	-50.3

798 - 806 MHz Band_ Wideband Test Results

Spurious Frequency Range (MHz)	Tuned Frequency (MHz)	Modulation	Measured Frequency (MHz)	Measured Value (dBm)	Gain/Loss from Antenna Kitting Information (dBi)	Final Value EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
1559 – 1610 (WB)	798.025	FM	1596.25	-66.5	2	-64.5	-40	-24.5
1559 – 1610 (WB)	798.025	C4FM	1585.44	-65.5	2	-63.5	-40	-23.5
1559 – 1610 (WB)	798.025	TDMA	1565.75	-65.4	2	-63.4	-40	-23.4
1559 – 1610 (WB)	799.025	FM	1559.16	-66.4	2	-64.4	-40	-24.4
1559 – 1610 (WB)	799.025	C4FM	1609.67	-66.1	2	-64.1	-40	-24.1
1559 – 1610 (WB)	799.025	TDMA	1585.44	-66.0	2	-64	-40	-24
1559 – 1610 (WB)	804.975	FM	1608.76	-65.1	2	-63.1	-40	-23.1
1559 – 1610 (WB)	804.975	C4FM	1559.61	-66.2	2	-64.2	-40	-24.2
1559 – 1610 (WB)	804.975	TDMA	1574.68	-64.9	2	-62.9	-40	-22.9
1559 – 1610 (WB)	805.975	FM	1593.83	-65.7	2	-63.7	-40	-23.7
1559 – 1610 (WB)	805.975	C4FM	1593.35	-65.8	2	-63.8	-40	-23.8
1559 – 1610 (WB)	805.975	TDMA	1567.15	-65.7	2	-63.7	-40	-23.7

Annex B Conducted Spurious Emission (1559 – 1610 MHz)

Refer to Annex B for Conducted Spurious Emission (1559 – 1610 MHz) plots.

Field Strength of Spurious Radiation

Engineer: Greg Corbin

Test Date: 2/21/2023

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. 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 the BKR0892-180 antenna.

Radiated spurious emissions was recorded with the EUT in CW mode and C4FM.

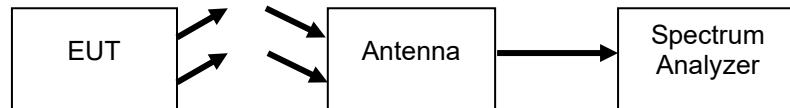
The receive path pre-amplifier was bypassed for this test.

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:

For the VHF, UHF, 800 MHz band the radiated spurious limit = $P_1 - (50 + 10\log(P_2)) = -20\text{dBm}$

Test Setup



Radiated Spurious Emissions Summary Test Table_ CW

FCC ISED	Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
FCC (EF), ISED	138.0250	954.28	-29.7	-20	Pass
FCC, ISED	150.8125	982.58	-29.3	-20	Pass
FCC, ISED	158.0700	972.87	-30.7	-20	Pass
FCC, ISED	161.6250	943.26	-28.4	-20	Pass
FCC, ISED	161.8000	955.26	-27.7	-20	Pass
FCC, ISED	173.9750	918.43	-27.8	-20	Pass
FCC, ISED	380.0250	952.66	-27.5	-20	Pass
FCC, ISED	406.2000	984.51	-27.5	-20	Pass
FCC, ISED	420.0000	976.22	-29.2	-20	Pass
FCC, ISED	429.9750	972.20	-28.4	-20	Pass
FCC, ISED	450.0250	959.53	-29.3	-20	Pass
FCC, ISED	459.6500	955.14	-28.7	-20	Pass
FCC, ISED	467.8250	986.65	-29.9	-20	Pass
FCC, ISED	469.9750	956.33	-30.2	-20	Pass
FCC only	511.9750	994.58	-29.4	-20	Pass
FCC (EF) only	519.9750	945.79	-29.7	-20	Pass
ISED Only	768.0250	959.41	-25.6	-20	Pass
FCC, ISED	769.0250	946.74	-25.8	-20	Pass
FCC, ISED	774.9750	943.89	-23.4	-20	Pass
ISED Only	775.9750	945.55	-24.4	-20	Pass
ISED Only	798.0250	944.49	-24.9	-20	Pass
FCC, ISED	799.0250	968.05	-23.7	-20	Pass
FCC, ISED	804.9750	976.34	-23.5	-20	Pass
ISED Only	805.9750	946.86	-23.3	-20	Pass
FCC, ISED	806.0250	976.34	-23.5	-20	Pass
FCC, ISED	814.9750	957.39	-24.8	-20	Pass
ISED Only	823.9750	970.78	-23.7	-20	Pass
FCC, ISED	851.0250	986.29	-22.8	-20	Pass
FCC, ISED	859.9750	992.68	-23.2	-20	Pass
ISED Only	868.9750	945.32	-23.4	-20	Pass

Radiated Spurious Emissions Summary Test Table_ C4FM

FCC ISED	Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
FCC (EF), ISED	138.0250	988.54	-26.6	-20	Pass
FCC, ISED	150.8125	934.78	-27.3	-20	Pass
FCC, ISED	158.0700	996.71	-26.6	-20	Pass
FCC, ISED	161.6250	975.51	-29.3	-20	Pass
FCC, ISED	161.8000	957.51	-26.8	-20	Pass
FCC, ISED	173.9750	968.29	-28.0	-20	Pass
FCC, ISED	380.0250	944.49	-27.5	-20	Pass
FCC, ISED	406.2000	971.61	-27.3	-20	Pass
FCC, ISED	420.0000	951.71	-28.0	-20	Pass
FCC, ISED	429.9750	955.26	-27.4	-20	Pass
FCC, ISED	450.0250	958.70	-27.4	-20	Pass
FCC, ISED	459.6500	978.24	-27.4	-20	Pass
FCC, ISED	467.8250	929.92	-27.7	-20	Pass
FCC, ISED	469.9750	954.43	-27.2	-20	Pass
FCC only	511.9750	991.74	-27.9	-20	Pass
FCC (EF) only	519.9750	948.04	-28.0	-20	Pass
ISED Only	768.0250	988.78	-23.5	-20	Pass
FCC, ISED	769.0250	939.63	-23.4	-20	Pass
FCC, ISED	774.9750	989.13	-22.9	-20	Pass
ISED Only	775.9750	931.22	-24.8	-20	Pass
ISED Only	798.0250	981.67	-24.2	-20	Pass
FCC, ISED	799.0250	979.54	-25.3	-20	Pass
FCC, ISED	804.9750	965.80	-23.2	-20	Pass
ISED Only	805.9750	948.63	-23.1	-20	Pass
FCC, ISED	806.0250	937.14	-23.3	-20	Pass
FCC, ISED	814.9750	943.18	-23.3	-20	Pass
ISED Only	823.9750	969.00	-23.3	-20	Pass
FCC, ISED	851.0250	946.14	-23.4	-20	Pass
FCC, ISED	859.9750	910.03	-23.7	-20	Pass
ISED Only	868.9750	958.34	-23.1	-20	Pass

Annex C1 thru C2 Radiated Spurious Emission

Refer to Annex C1 for Radiated Spurious Emission plots with CW

Refer to Annex C2 for Radiated Spurious Emission plots with C4FM modulation

Emission Masks (Occupied Bandwidth)

Engineer: Greg Corbin

Test Date: 2/15/2023

Measurement 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.

For FM modulation the transmitter was modulated with a 2.5 kHz tone at a level 16 dB higher than that required to produce 50% of the maximum frequency deviation.

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

For TDMA modulation, the internal TDMA standard test pattern was used.

The 99% and -26 dB Occupied Bandwidth was recorded for each frequency with FM, C4FM, and TDMA modulation.

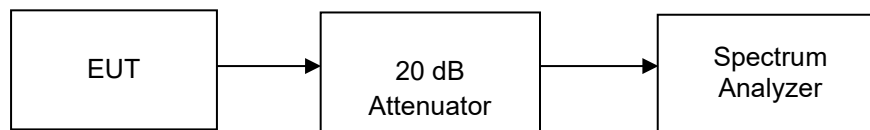
Mask D was used for the VHF, UHF band.

Mask B and D was used for the 800 band.

Mask per FCC Part 90.691 was also recorded for the 800 band.

For the 700 band, the adjacent channel power was recorded. Refer to a separate section of the test report for Adjacent Channel Power data.

Test Setup



Annex D Occupied Bandwidth

Refer to Annex D for Occupied Bandwidth plots.

Annex E Emission Mask

Refer to Annex E for Emission Mask plots.

Adjacent Channel power

Engineer: Greg Corbin

Test Date: 2/14/2023

Measurement Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required Adjacent Channel Power requirements for FCC Part 90.543 and ISSED RSS-119 section 5.8.9.

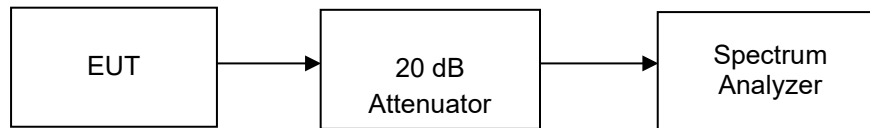
For FM modulation the transmitter was modulated per ANSI C63.26-2015 section 6.5.2.4(e).

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

For TDMA modulation, the internal TDMA symmetric test pattern was used.

For the portion of the test (In the paired receive band) , a notch filter was used in order to achieve the 100 dB dynamic range required in the paired receive band.

Test Setup



Annex F1 thru F3 Adjacent Channel Power

Refer to Annex F1 for Adjacent Channel Power plots with FM modulation

Refer to Annex F2 for Adjacent Channel Power plots with C4FM modulation

Refer to Annex F3 for Adjacent Channel Power plots with TDMA modulation

Transient Frequency Behavior

Engineer: Greg Corbin

Test Date: 1/19/2023

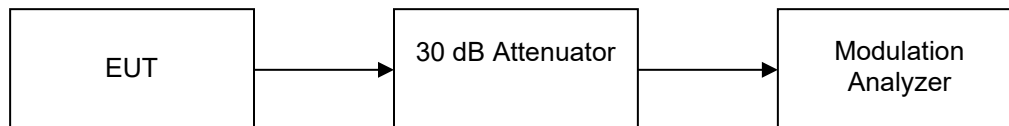
Measurement Procedure

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.

Transient Frequency Behavior was recorded for the VHF and UHF bands.

Test Setup



Transient Frequency Behavior Summary Table – VHF_ 161.625 MHz

12.5 kHz CH spacing - VHF – 161.625 MHz				
Time reference	time - referenced from t_{on}	Measured value	Limit	Pass / Fail
	(ms)	(kHz)	(kHz)	
t_1	5	2.4690	± 12.5	Pass
		-1.009		
t_2	20	0.0115	± 6.5	Pass
		0.1866		
t_3	5	0.0624	± 12.5	Pass
		-0.1864		

Transient Frequency Behavior Summary Table – UHF_ 420 MHz

12.5 kHz CH spacing - UHF – 420 MHz				
Time reference	time - referenced from t _{on}	Measured value	Limit	Pass / Fail
	(ms)	(kHz)	(kHz)	
t ₁	5	2.9730	± 12.5	Pass
		-3.7500		
t ₂	20	-0.0474	± 6.5	Pass
		-0.3337		
t ₃	5	0.3023	± 12.5	Pass
		-0.0912		

Transient Frequency Behavior Summary Table – UHF_ 459.65 MHz

12.5 kHz CH spacing - UHF – 459.65 MHz				
Time reference	time - referenced from t _{on}	Measured value	Limit	Pass / Fail
	(ms)	(kHz)	(kHz)	
t ₁	5	0.0132	± 12.5	Pass
		-3.7380		
t ₂	20	0.0132	± 6.5	Pass
		-1.472		
t ₃	5	0.1022	± 12.5	Pass
		-0.2835		

**Per 90.214 (note 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.

Annex G Transient Frequency Behavior

Refer to Annex G for Transient Frequency Behavior plots.

Audio Low Pass Filter (Voice Input)

Engineer: Greg Corbin

Test Date: 1/17/2023

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range and the audio low pass filter response was measured and plotted. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

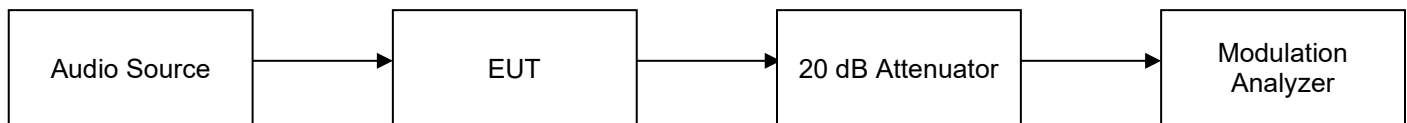
Use the Modulation Analyzer Audio Spectrum screen to measure the amplitude of the audio signal.

Set the audio frequency and measure the audio spectrum level using the marker function. This is performed by setting the marker equal to the audio input frequency.

Record the spectrum level for 100 Hz to 20 kHz and plot the results.

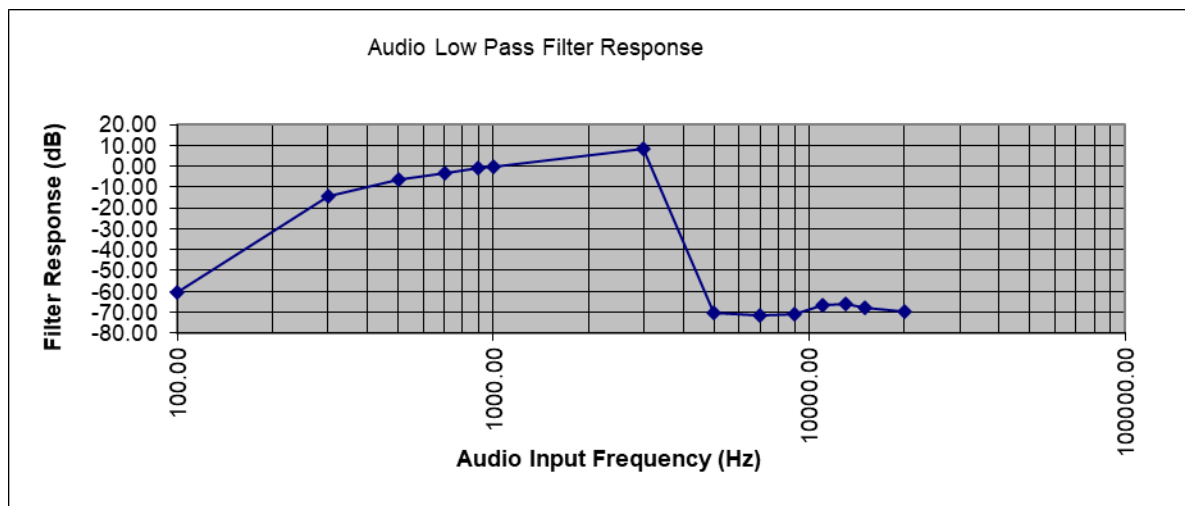
The Audio Low pass filter was measured for each band of operation, VHF, UHF, 700 and 800 bands.

Test Setup

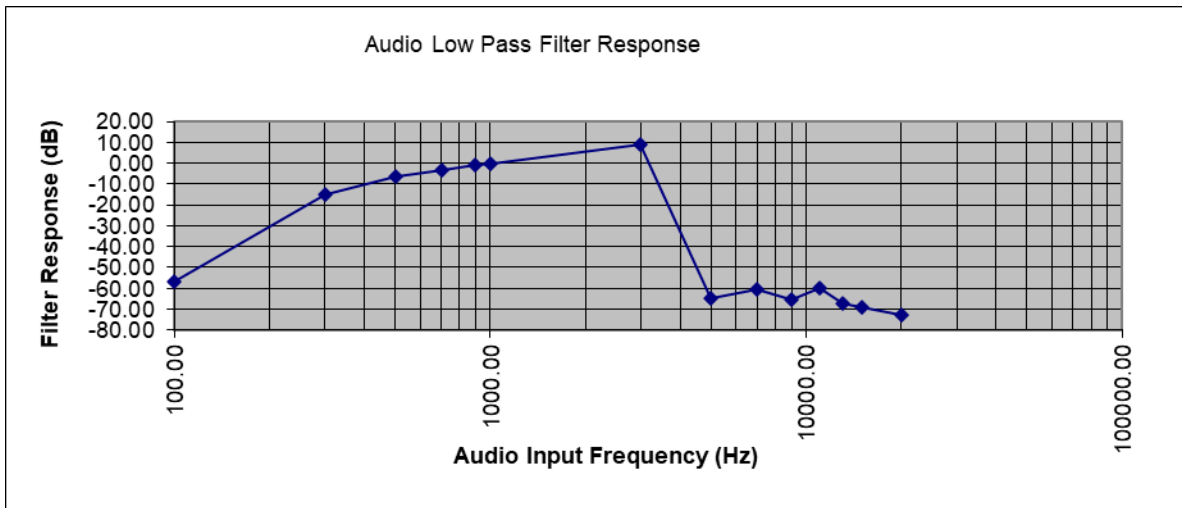


Audio Low Pass Filter Test Results

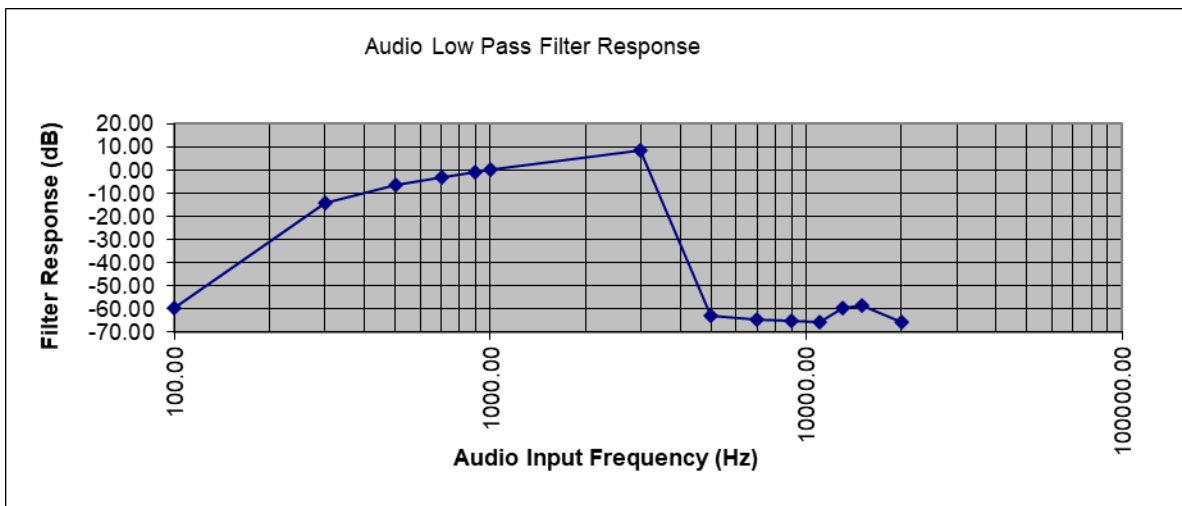
161.625 MHz



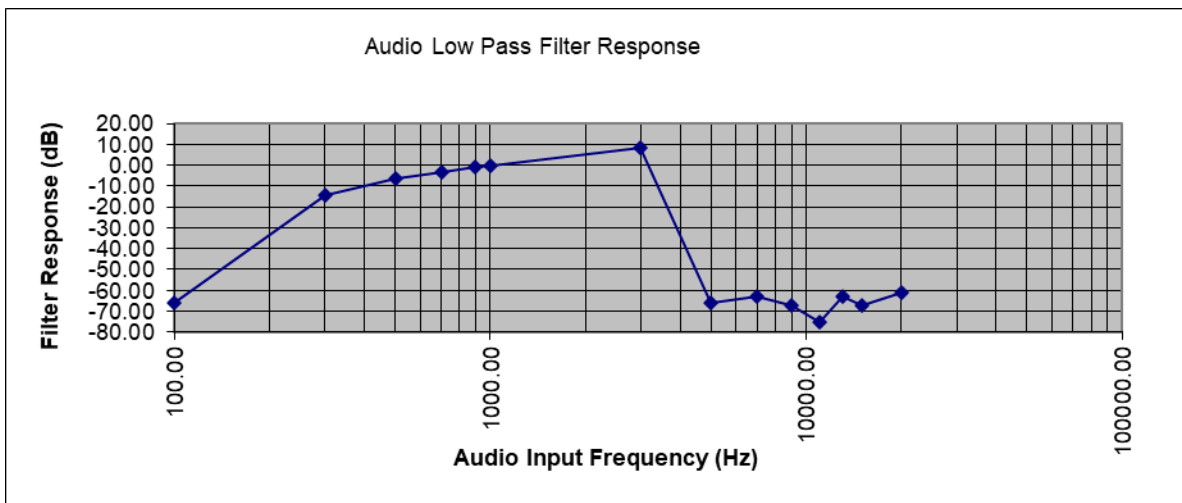
459.65 MHz



774.975 MHz



810.025 MHz



Audio Frequency Response

Engineer: Greg Corbin

Test Date: 1/17/2023

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range 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.

Set the audio frequency for 1 kHz and adjust the level for 20% deviation according to the manufacturer's instructions.

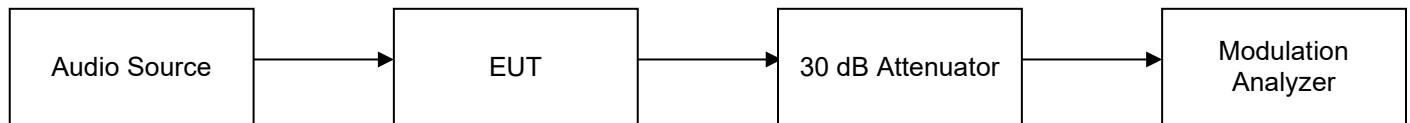
Use the Modulation Analyzer Audio Summary screen to measure RMS deviation.

Set the audio input frequency to the frequencies specified and measure the RMS deviation.

Record the audio spectrum level for 100 Hz to 5 kHz and plot the results.

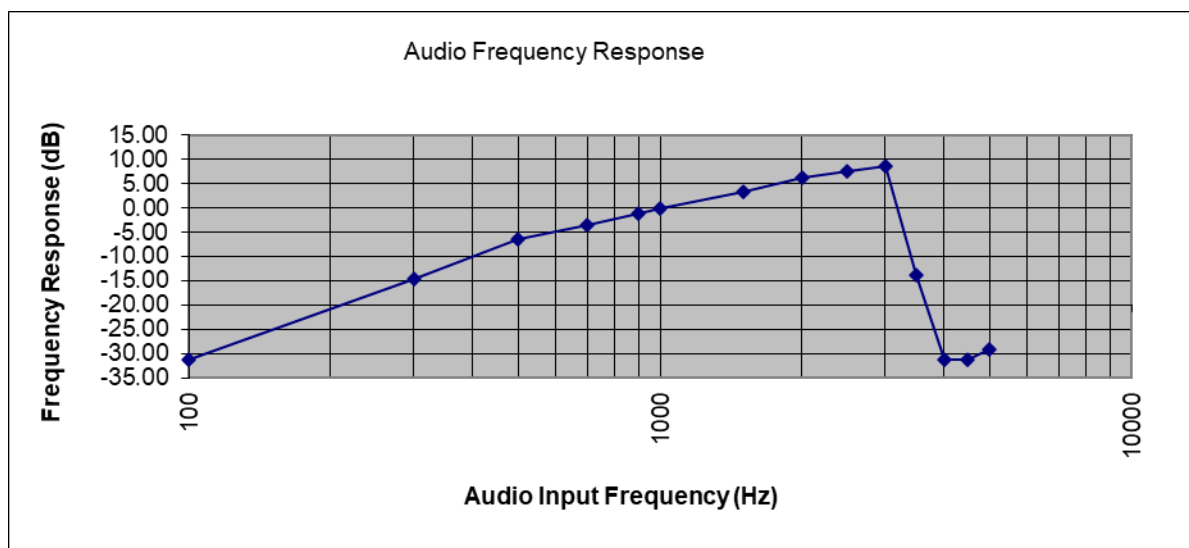
The Audio Frequency Response was measured for each band of operation, VHF, UHF, 700 and 800 bands.

Test Setup

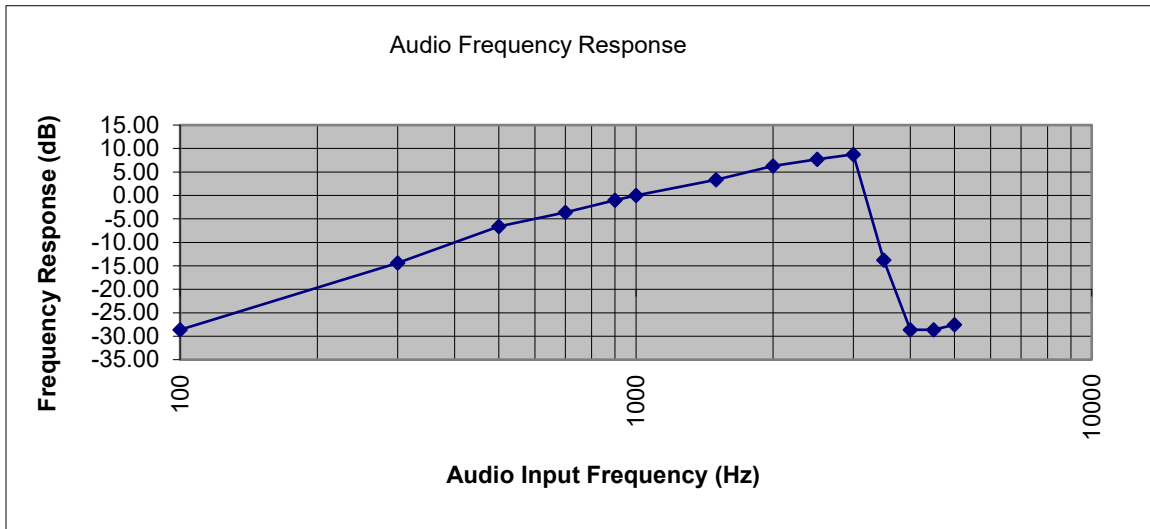


Audio Frequency Response Test Results

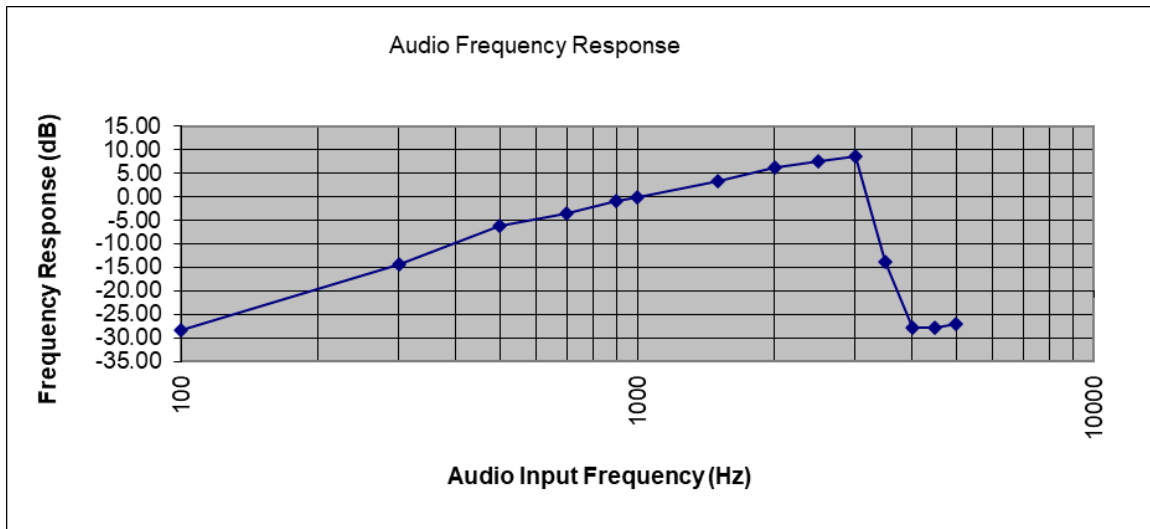
161.625 MHz



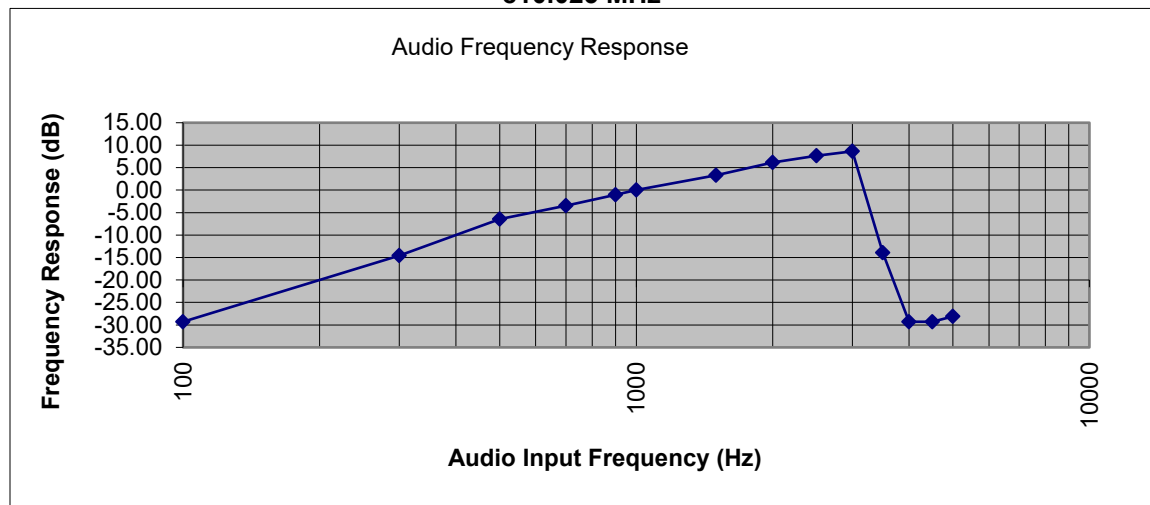
459.65 MHz



774.975 MHz



810.025 MHz



Modulation Limiting

Engineer: Greg Corbin

Test Date: 1/17/2023

Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator. The audio source was tuned across the required audio frequency range and the modulation limiting response was measured and plotted. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.

Set the audio input to 1 kHz and adjust the level for 60% deviation as per the manufacturer's instruction.

Increase the deviation by 20 dB. Use the peak / -peak readings for this setting.

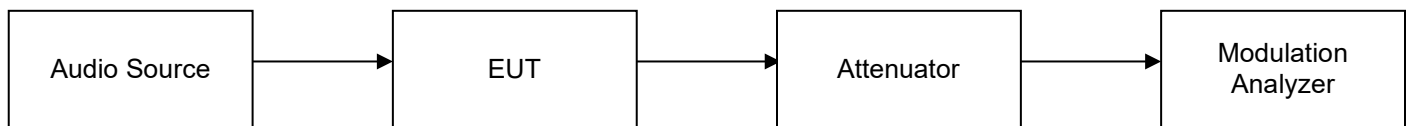
Use the Modulation Analyzer Audio Summary screen to measure + pk / - pk deviation.

Set the audio input frequency to the frequencies specified and measure the positive and negative peak deviation.

Record the positive and negative peak deviation for 100 Hz to 5 kHz and plot the results.

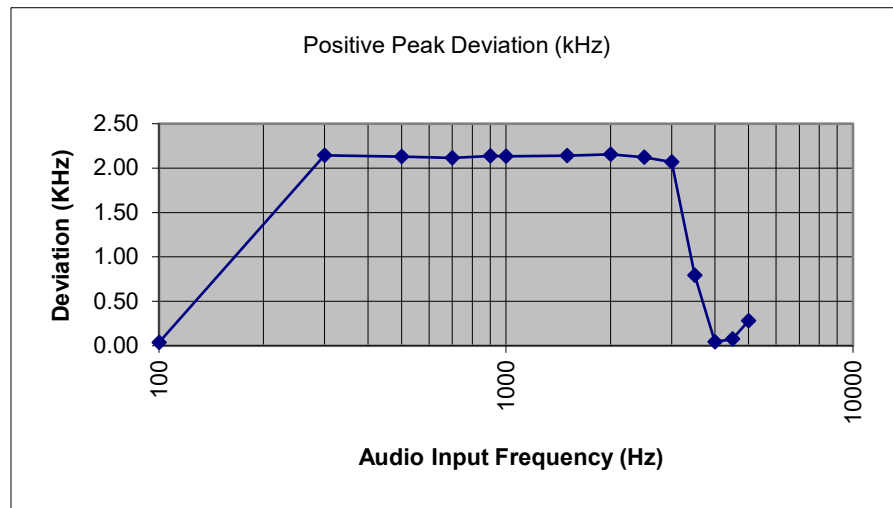
The Modulation Limiting was measured for each band of operation, VHF, UHF, 700 and 800 bands.

Test Setup

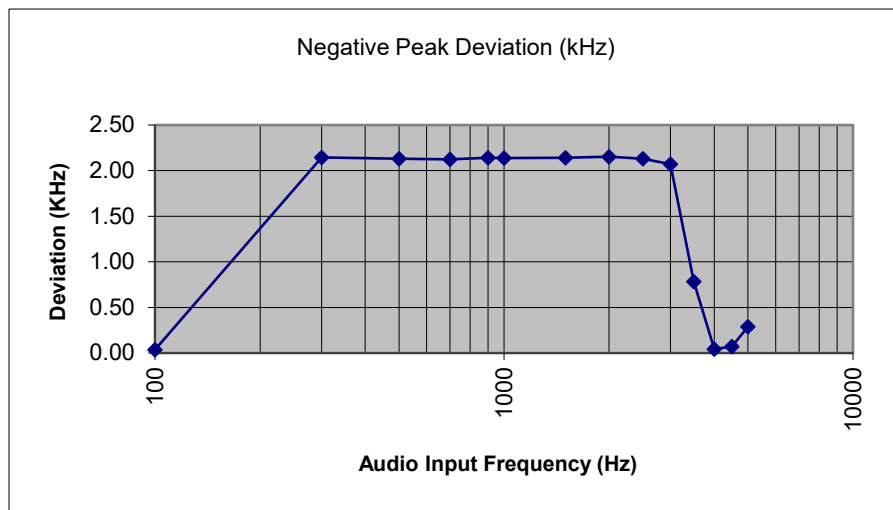


Modulation Limiting Test Results

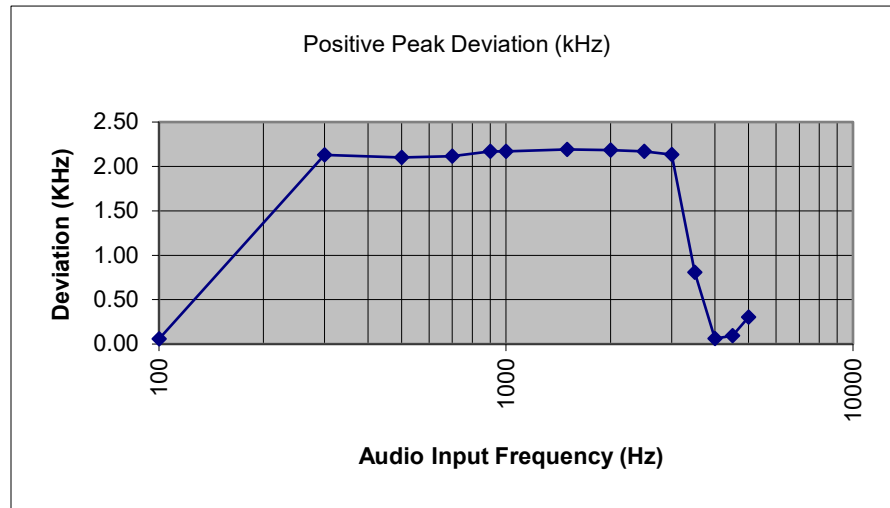
161.625 MHz_ Positive Peaks



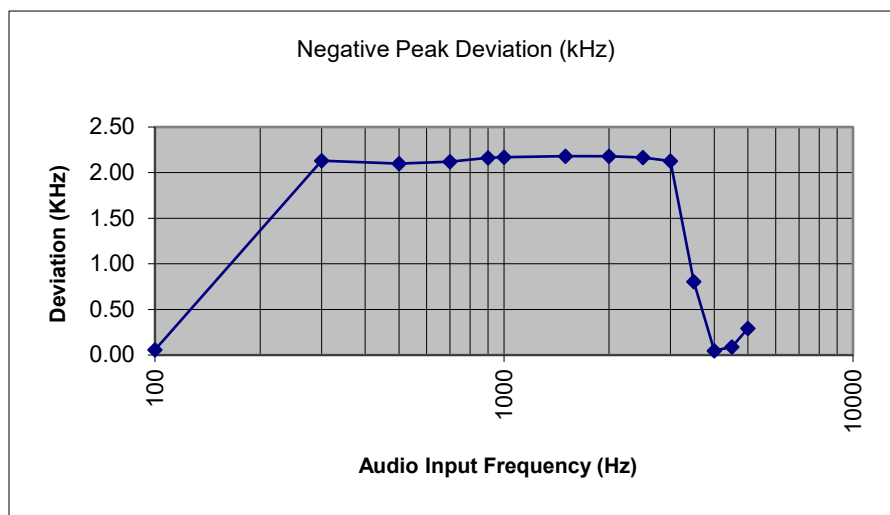
161.625 MHz_ Negative Peaks



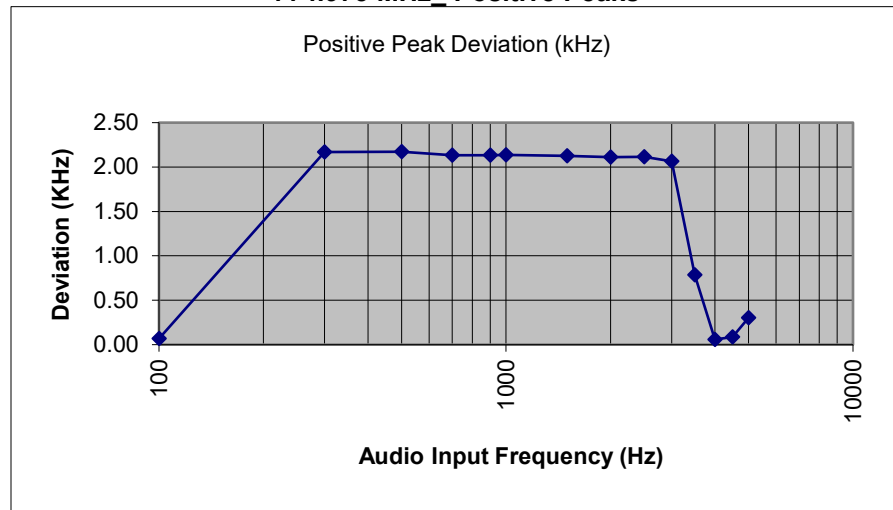
459.65 MHz_ Positive Peaks



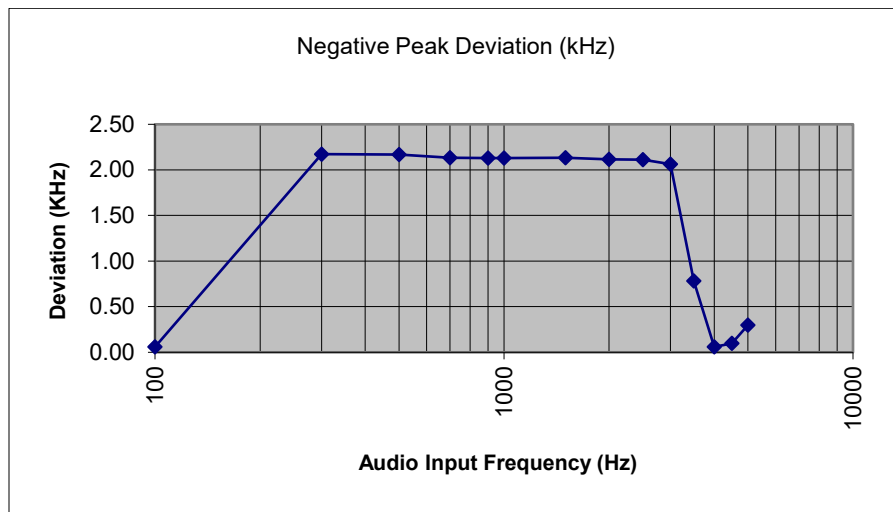
459.65 MHz_ Negative Peaks



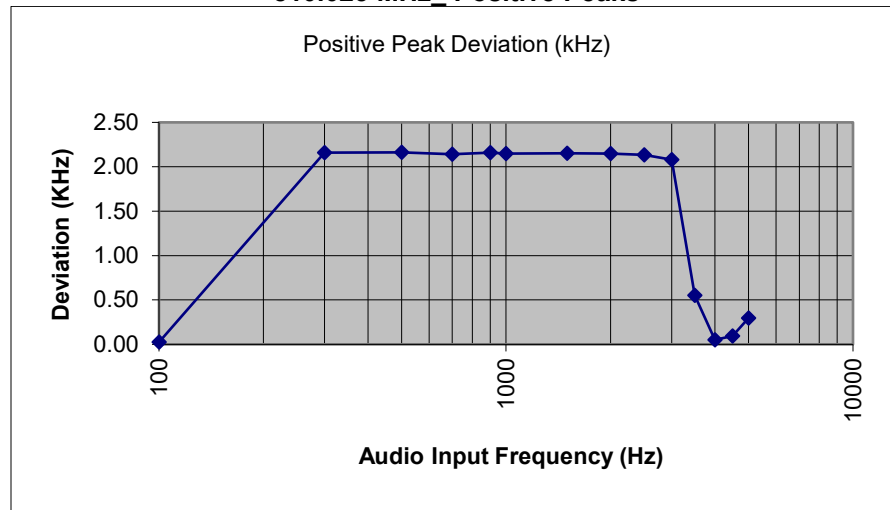
774.975 MHz_ Positive Peaks



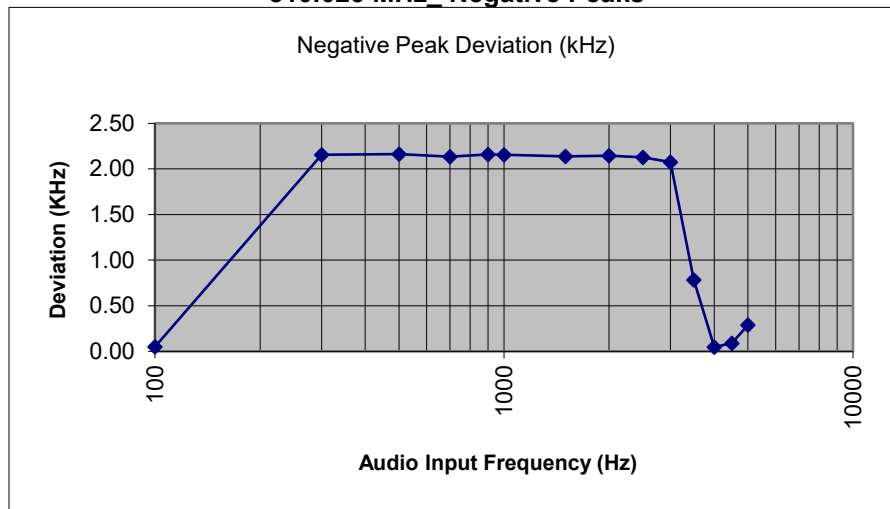
774.975 MHz_ Negative Peaks



810.025 MHz_ Positive Peaks



810.025 MHz_ Negative Peaks



Frequency Stability (Temperature Variation)

Engineer: Greg Corbin

Test Date: 2/24/2023

Measurement Procedure

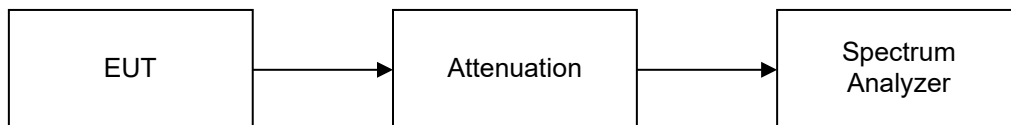
The EUT was placed in an environmental test chamber and the RF output was connected directly to a spectrum analyzer. The temperature was varied from -30°C to 50°C in 10°C increments.

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.

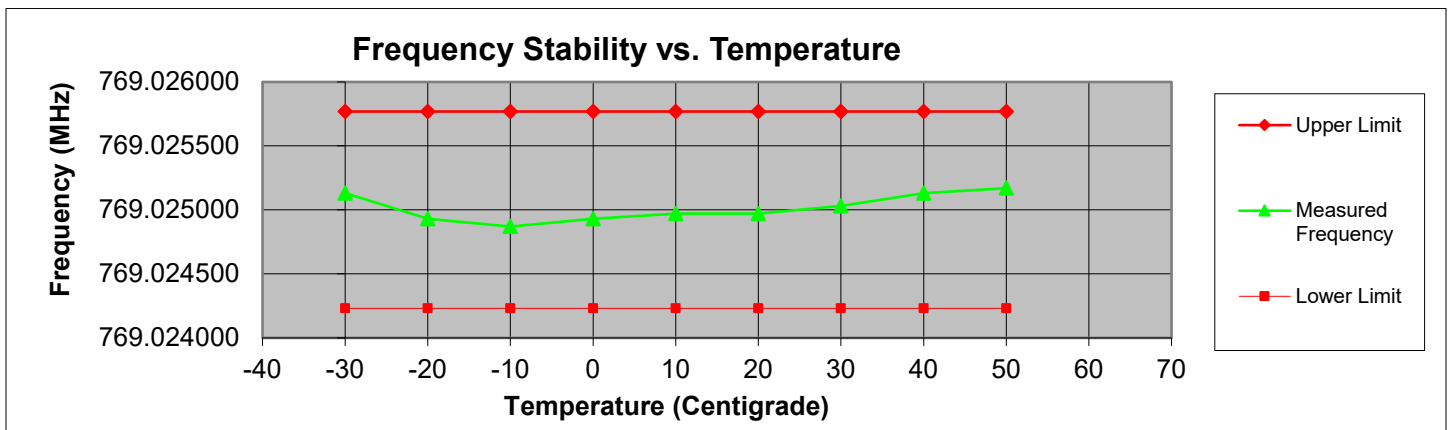
The frequency determining circuitry is common to all 4 bands of operation so the temperature stability was only measured for 1 frequency 769.025 MHz.

Measurement Setup



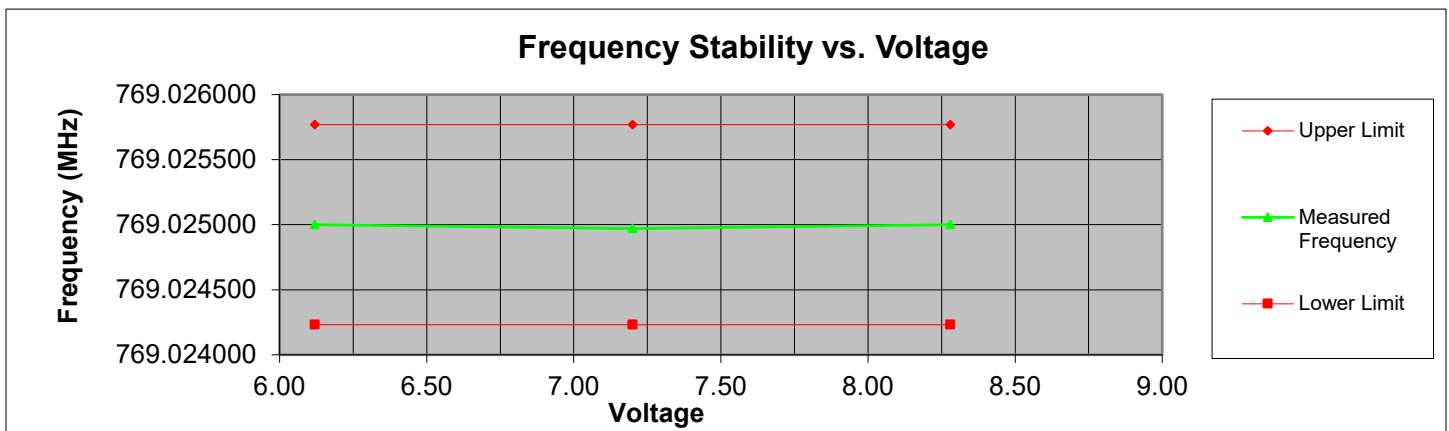
Frequency Stability vs Temperature

Tuned (MHz)	Temperature (deg C)	Tolerance (PPM)	Measured (MHz)	Upper (MHz)	Lower (MHz)	Upper (MHz)	Lower (MHz)
769.025	-30	1.0	769.025130	769.025769	769.024231	-0.000639	0.000899
769.025	-20	1.0	769.024930	769.025769	769.024231	-0.000839	0.000699
769.025	-10	1.0	769.024870	769.025769	769.024231	-0.000899	0.000639
769.025	0	1.0	769.024930	769.025769	769.024231	-0.000839	0.000699
769.025	10	1.0	769.024970	769.025769	769.024231	-0.000799	0.000739
769.025	20	1.0	769.024970	769.025769	769.024231	-0.000799	0.000739
769.025	30	1.0	769.025030	769.025769	769.024231	-0.000739	0.000799
769.025	40	1.0	769.025130	769.025769	769.024231	-0.000639	0.000899
769.025	50	1.0	769.025170	769.025769	769.024231	-0.000599	0.000939



Frequency Stability vs Voltage

Tuned Frequency (MHz)	Tolerance (PPM)	Voltage (PPM)	Measured Frequency (MHz)	Upper Limit (MHz)	Lower Limit (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
769.025	1.0	6.12	769.025000	769.025769	769.024231	-0.000769	0.000769
769.025	1.0	7.20	769.024970	769.025769	769.024231	-0.000799	0.000739
769.025	1.0	8.28	769.025000	769.025769	769.024231	-0.000769	0.000769



Necessary Bandwidth Calculations

Engineer: Greg Corbin

Test Date: 3/15/2023

Modulation = 11K0F3E	
Necessary Bandwidth Calculation:	
Maximum Modulation (M), kHz	= 3
Maximum Deviation (D), kHz	= 2.5
Constant Factor (K)	= 1
Necessary Bandwidth (BN), kHz	= $(2 \times M) + (2 \times D \times K)$
	= 11.0

Modulation = 8K10F1E	
Necessary Bandwidth Calculation:	
Maximum Modulation (M), kHz	= 1.55
Maximum Deviation (D), kHz	= 2.5
Constant Factor (K)	= 1
Necessary Bandwidth (BN), kHz	= $(2 \times M) + (2 \times D \times K)$
	= 8.3

Modulation = 8K10F1D / 8K10F1W	
Necessary Bandwidth Calculation:	
Data Rate (R) Kbps	= 2.35
Maximum Deviation (D), kHz	= 2.5
Necessary Bandwidth (BN), kHz	= $2.4D + 1.0R$
	= 8.3

Measurement Uncertainty

Measurement Uncertainty for Compliance Testing is listed in the table below.

The reported expanded uncertainty has been estimated at a 95% confidence level (k=2)

Measurement Type	Expanded Uncertainty
Conducted Emissions, AC Powerline	± 3.28 dB
Radiated Emissions_30 – 1000 MHz	± 4.82 dB
Radiated Emissions_1 – 18 GHz	± 5.73 dB
Frequency Error	± 22 Hz
Conducted RF Power	± 0.98 dB
Conducted Spurious Emission	± 2.49 dB
AC Voltage	± 2.3 %
DC Voltage	± 0.12 %
Temperature	± 1.0 deg C
Humidity	± 4.32 %

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	EMCO	3116	i00085	2/22/21	2/22/23
Horn Antenna	EMCO	3115	i00103	2/15/23	2/15/25
Tunable Notch Filter	Eagle	TNF-1-(250-850MHz)	i00124	Verified on: 2/23/23	
Bi-Log Antenna	Chase	CBL6111C	i00267	8/10/22	8/10/24
Horn Antenna	ARA	DRG-118/A	i00271	8/11/22	8/11/24
Temp./humidity/pressure monitor	Omega Engineering	iBTHX-W-5	i00686	1/5/23	1/5/24
Temperature Chamber	Tenney	Tenney II Benchmaster	i00287	Verified on: 2/24/23	
Data Logger	Fluke	Hydra Data Bucket	i00343	6/23/22	6/23/23
Vector Signal Generator	Agilent	E4438C	i00348	6/14/22	6/14/23
Spectrum Analyzer	Textronix	RSA5126A	i00424	10/11/22	10/11/23
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/17/20	7/17/23
Highpass Filter (1 GHz)	K&L	7IH40-980/T6000-O/O	i00432	Verified on: 2/23/23	
Voltmeter	Fluke	179	i00488	6/8/22	6/8/23
MXE EMI receiver	Keysight	N9038A	i00552	2/23/23	2/23/24
Attenuator, 20 dB, 50W	Mini-Circuits	BW- N20W50+	i00611	Verified on: 1/5/23	
Preamplifier	Eravant	SBB-0115034018-2F2F-E3	i00650	Verified on: 2/8/23	
Spectrum Analyzer	Agilent	PSA E4448A	i00688	11/9/22	11/9/23
Tunable Band Reject Filter	Telonic Berkeley	TTR 190-3EE	S/N: 970276-5	Verified on: 2/8/23	
Tunable Band Reject Filter	Wainwright	WRCT946.1/946.1-943.6/951.6-30/5SS	SN 19	Verified on: 1/12/23	

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