ncee labs
Product Compliance Solutions
4740 Discovery Drive | Lincoln, NE 68521
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info@nceelabs.com | http://nceelabs.com

FCC/ISED TEST REPORT

Prepared for:	**Aerostar International**
Address:	**3901 W 59th Street, Sioux Falls, SD 57108**
Product:	**HiPointer 150**
Test Report No:	**R240129-01-E2A**
Approved By:	

Fox Lane,
EMC Test Engineer

DATE:	**August 15, 2024**
Total Pages:	**38**

ilac-MRA A2LA ACCREDITED TESTING LABORATORY CERTIFICATE NO. 1953.01

REVISION PAGE

Rev. No.	Date	Description
0	12 August 2024	Issued by FLane Reviewed by KVepuri Prepared by FLane
A	15 August 2024	Updated Address - FL

CONTENTS

1.0 SUMMARY OF TEST RESULTS

The worst-case measurements were reported in this report. The EUT has been tested according to the following specifications:

FCC Part 90 requirements **Test Method:** IEEE ANSI C63.26-2015, TIA-603-D		**Result**
Test	**FCC Rule Part**	
RF Output Power	Part 90.205(r)	Pass
Occupied bandwidth	Part 90.209	Pass
Spurious emissions at antenna terminals	Part 90.210 (c), 90.215	Pass
Field strength of spurious emission	Part 90.210 (c), 90.215	Pass
Frequency Stability Tested in temperature chamber set to high and low of mfg specs	Part 90.213	Pass

See Section 4 for details on the test methods used for each test.

2.0 EUT DESCRIPTION

2.1 EQUIPMENT UNDER TEST

Model	HiPointer 150
EUT Received	16 February 2024
EUT Tested	16 February 2024- 21 February 2024
Serial No.	NCEETEST1 (Assigned by the test lab)
Operating Band	9410 MHz – 9460 MHz
Device Type	Licensed Radio
Power Supply	24VDC battery (2 X 12V Marine batteries)

NOTE: For more detailed features description, please refer to the manufacturer's specifications or user's manual.

2.2 DESCRIPTION OF TEST MODES

The EUT operates on, and was tested at the frequencies below:

Mode	CHANNEL FREQUENCY (MHz)
A	9410.000000
B	9460.000000
C	9410.000000
D	9460.000000

See the operational description for a list of all channel frequency and designations.

This EUT was set to transmit in a worst-case scenario. The manufacturer modified the unit to transmit continuously on four different modes.

2.3 DESCRIPTION OF SUPPORT UNITS

NA

3.0 LABORATORY DESCRIPTION

3.1 LABORATORY DESCRIPTION

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number:	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests:
Relative humidity of 35 ± 4%
Temperature of 22 ± 3° Celsius

3.2 TEST PERSONNEL

All testing was performed by Fox Lane of NCEE Labs. The results were reviewed by Karthik Vepuri.

3.3 TEST EQUIPMENT

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Keysight MXE Signal Analyzer (44GHz)	N9038A	MY59050109	July 17, 2023	July 17, 2025
Keysight MXE Signal Analyzer (26.5GHz)	N9038A	MY56400083	July 17, 2023	July 17, 2025
SunAR RF Motion	JB1	A091418	July 27, 2023	July 26, 2024
ETS-Lindgren Red Horn Antenna	3115	218576	July 31, 2023	July 30, 2024
ETS Red Preamplifier (Orange)*	3115-PA	00218576	January 22, 2024	January 22, 2026
RF Cable (preamplifier to antenna)*	MFR-57500	01-07-002	June 5, 2023	June 5, 2025
Trilithic High Pass Filter*	6HC330	23042	June 5, 2023	June 5, 2025
Keysight, External Harmonic Mixer, 75-110G	M1971W	MY56390145	April 12, 2019	April 11, 2025
Sage Standard Gain Horn Antenna, 75-110G	SAZ-2410-10-S1	16434-01	CNR	CNR
Cable to M1971W, 75-110G	SLU18-SMNM-01.00M	121108	April 12, 2019	April 11, 2025
Cable to M1970V-002, 75-110G	SLU18-SMNM-01.00M	121099	April 13, 2019	April 12, 2025
Keysight, External Harmonic Mixer, 50-80G	M1970V-002	MY51391050	April 13, 2019	April 12, 2025
Pasternack Standard Gain Horn Antenna, 50-80G	PE9881-24	32/2016	CNR	CNR
ETS – Lindgren- VSWR on 10m Chamber	10m Semi-anechoic chamber-VSWR	4740 Discovery Drive	May 15, 2024	May 15, 2027
NCEE Labs-NSA on 10m Chamber*	10m Semi-anechoic chamber-NSA	NCEE-001	May 22, 2024	May 22, 2026
RF Cable (antenna to 10m chamber bulkhead)*	FSCM 64639	01E3872	June 5, 2023	June 5, 2025
RF Cable (10m chamber bulkhead to control room bulkhead)*	FSCM 64639	01E3874	June 5, 2023	June 5, 2025
RF Cable (control room bulkhead to test receiver)*	FSCM 64639	01F1206	June 5, 2023	June 5, 2025
N connector bulkhead (10m chamber)*	PE9128	NCEEBH1	June 5, 2023	June 5, 2025
N connector bulkhead (control room)*	PE9128	NCEEBH2	June 5, 2023	June 5, 2025

*Internal Characterization

4.0 DETAILED RESULTS

4.1 UNWANTED EMISSIONS & FIELD STRENGTH OF EMISSIONS

Test Method: ANSI C63.26:2015:
Section 5.5, “Radiated Emissions Testing”

Limits for field strength of emissions measurements:
47 CFR 90.205(r) & 47 CFR 90.210 (C) :
All other frequency bands. Requested transmitter power will be considered and authorized on a case-by-case basis.

Emission Mask C. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz, but not more than 10 kHz: At least 83 log (fd/5) dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least 29 log (fd2/11) dB or 50 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test procedures:
The EUT was connected directly to a spectrum analyzer using attenuators to protect the test equipment. Analyzer measurement settings can be found in the plots below along with the corresponding power levels.

All Radiated Emissions were performed at 3m test distance.

Deviations from test standard:
No deviation.

Test setup:

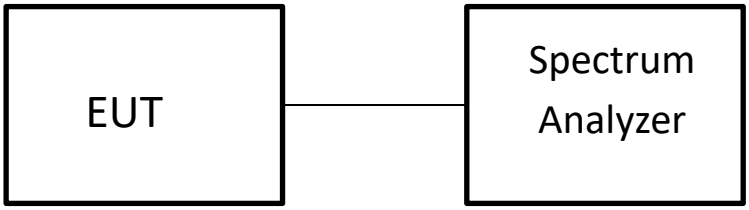

Figure 1 - Conducted Spurious Test Setup

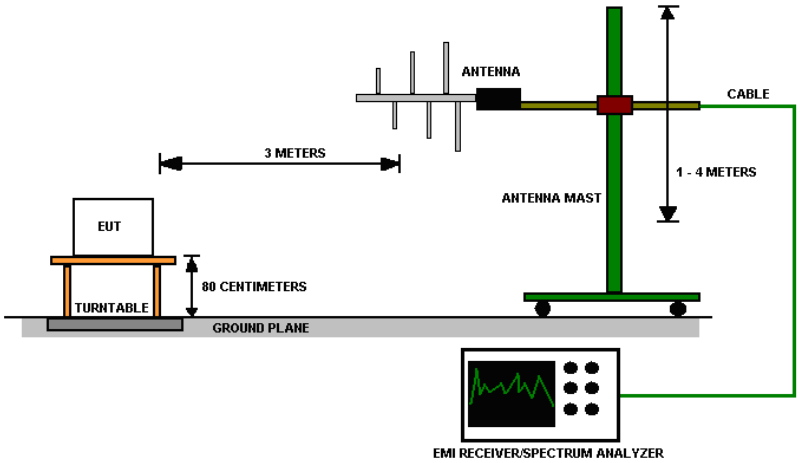

Figure 2 - Radiated Emissions Test Setup

EUT operating conditions
See Section 2.1 & 2.2

Test results:

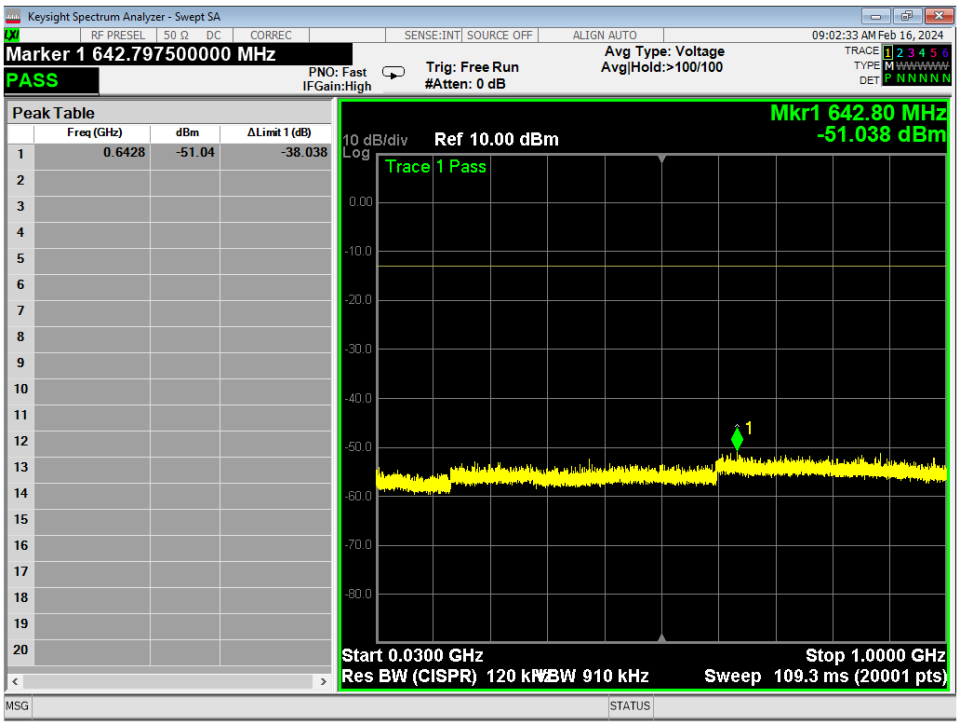

Figure 3 - Conducted Unwanted Emissions Plot, 30MHz-1GHz, Mode A

*Limit is -13dBm – Pass

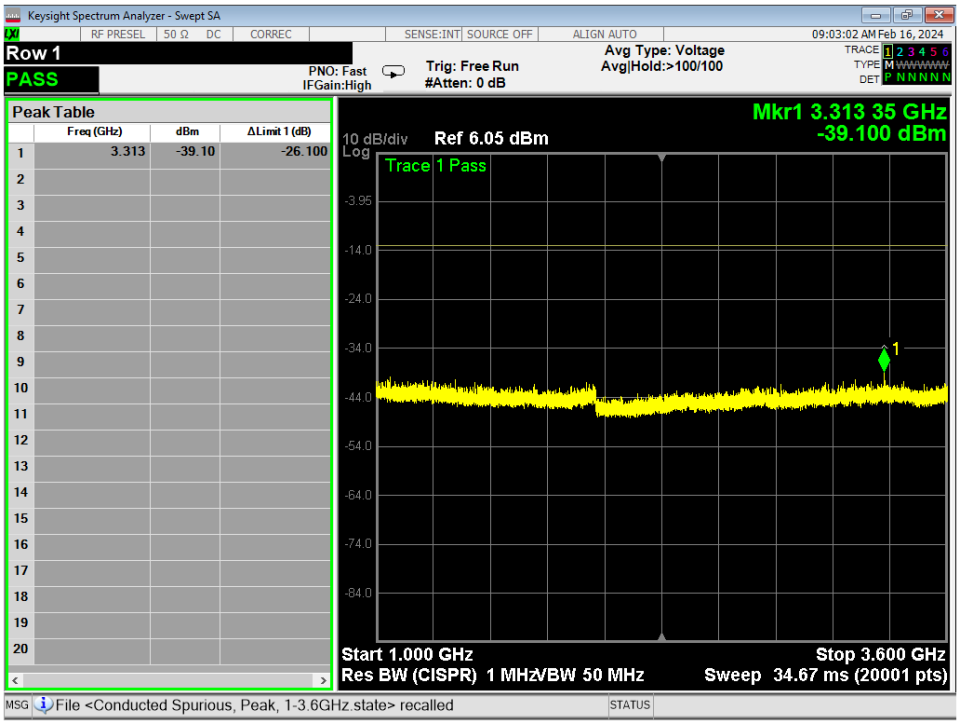

Figure 4 - Conducted Unwanted Emissions Plot, 1GHz-3.6GHz, Mode A

*Limit is -13dBm – Pass

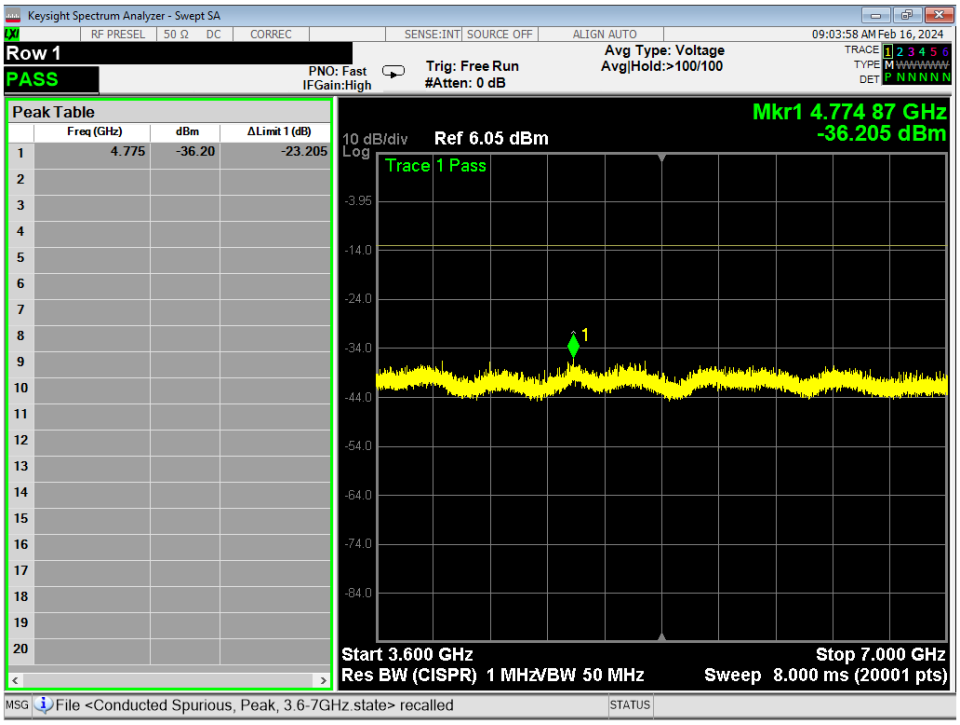

Figure 5 - Conducted Unwanted Emissions Plot, 3.6GHz-7GHz, Mode A

*Limit is -13dBm – Pass

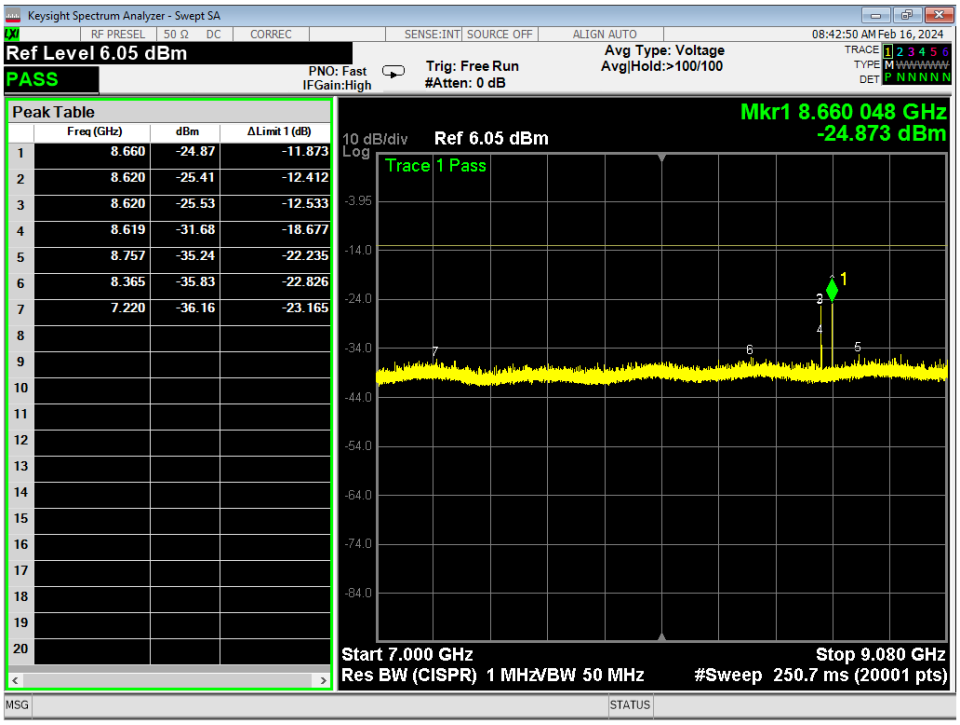

Figure 6 - Conducted Unwanted Emissions Plot, 7GHz-9.08GHz, Mode A

*Limit is -13dBm – Pass

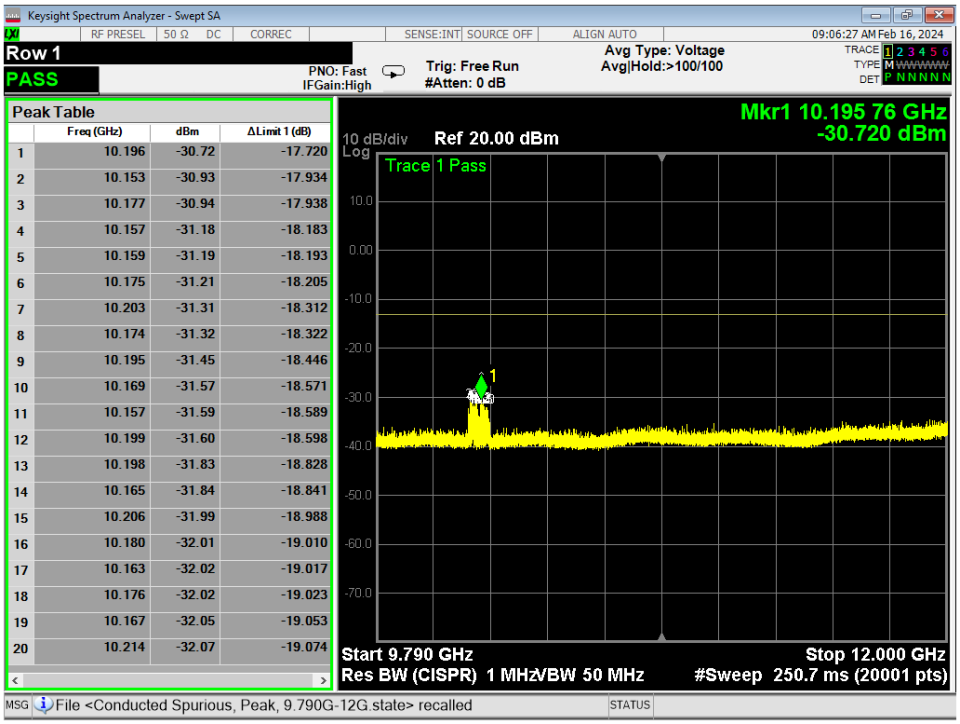

Figure 7 - Conducted Unwanted Emissions Plot, 9.79GHz-12GHz, Mode A

*Limit is -13dBm – Pass

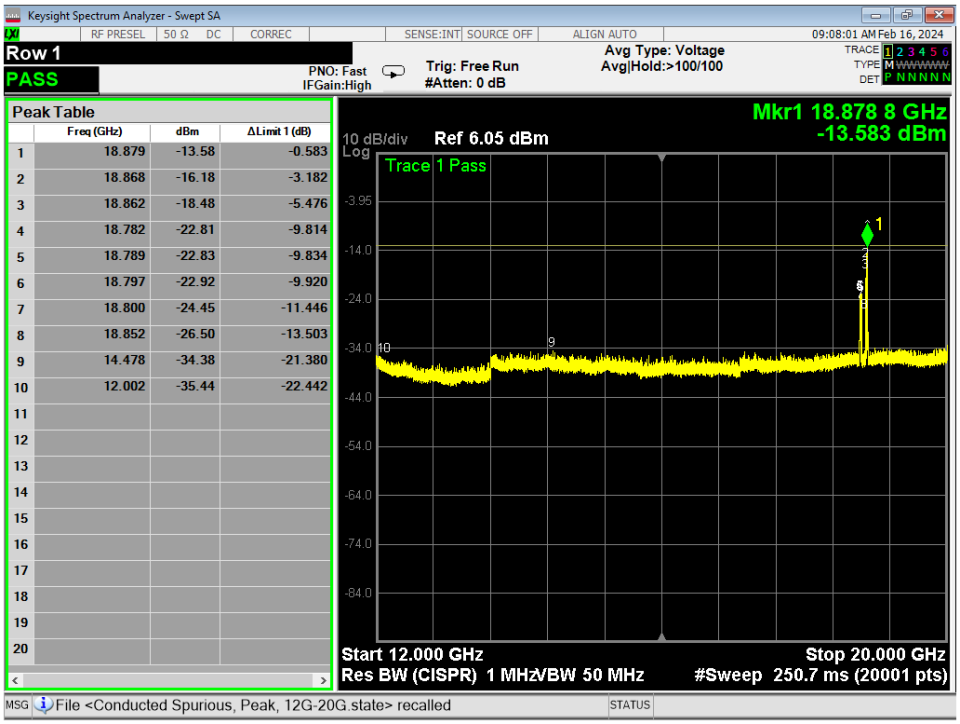

Figure 8 - Conducted Unwanted Emissions Plot, 12GHz-20GHz, Mode A

*Limit is -13dBm – Pass

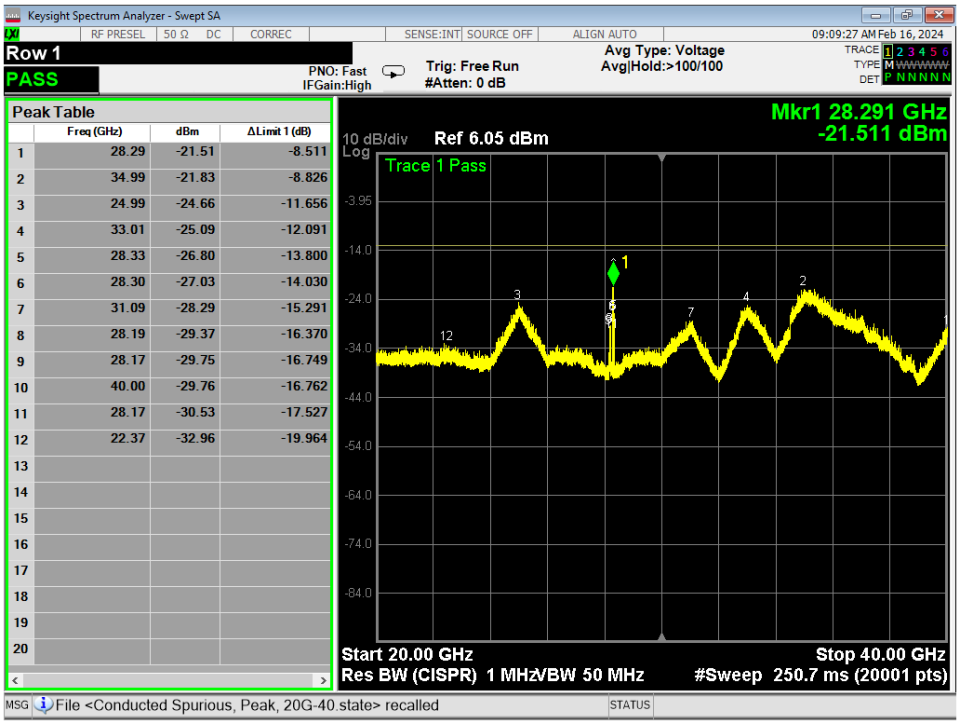

Figure 9 - Conducted Unwanted Emissions Plot, 20GHz-40GHz, Mode A

*Limit is -13dB – Pass

All other measurements including above 40 GHz were investigated and found to be below the laboratory noise floor and at least 6 dB below the limits.

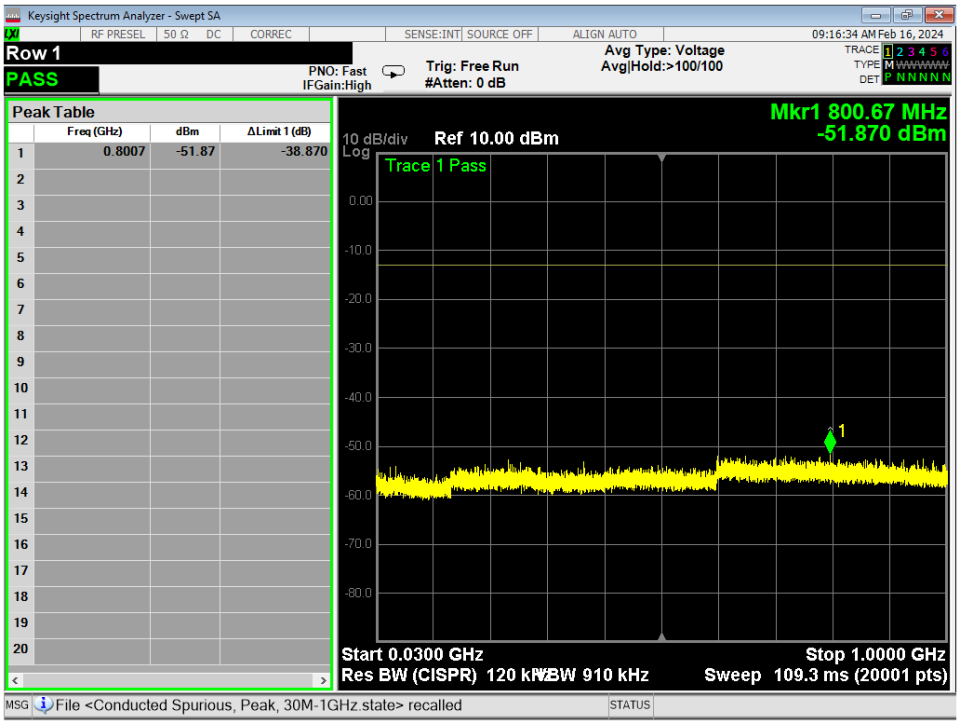

Figure 10 - Conducted Unwanted Emissions Plot, 30MHz-1GHz, Mode B

*Limit is -13dBm – Pass

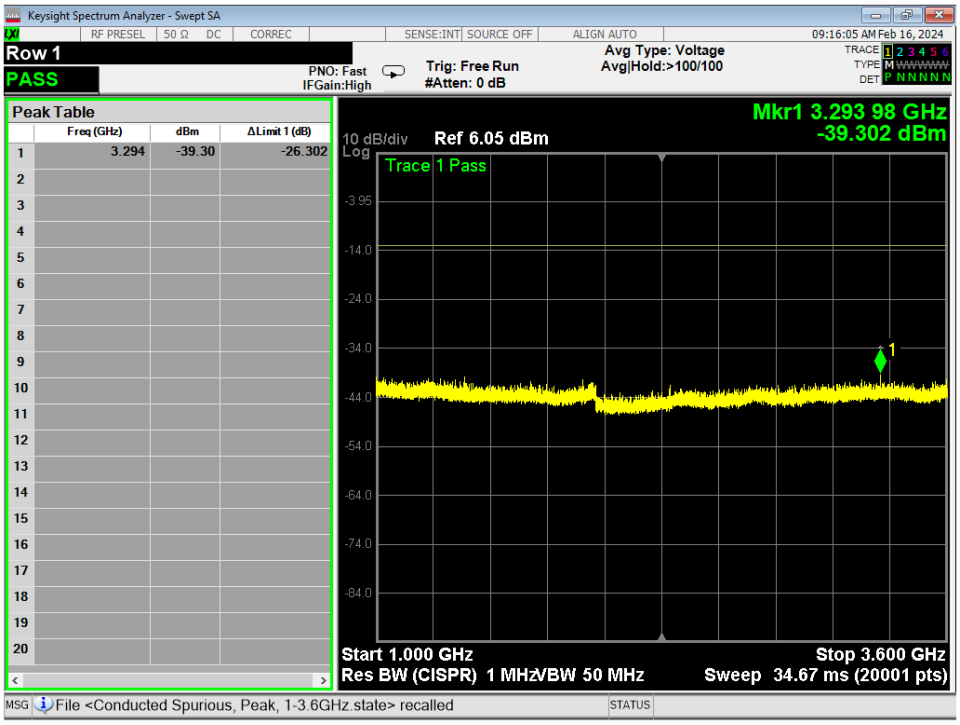

Figure 11 - Conducted Unwanted Emissions Plot, 1GHz-3.6GHz, Mode B

*Limit is -13dBm – Pass

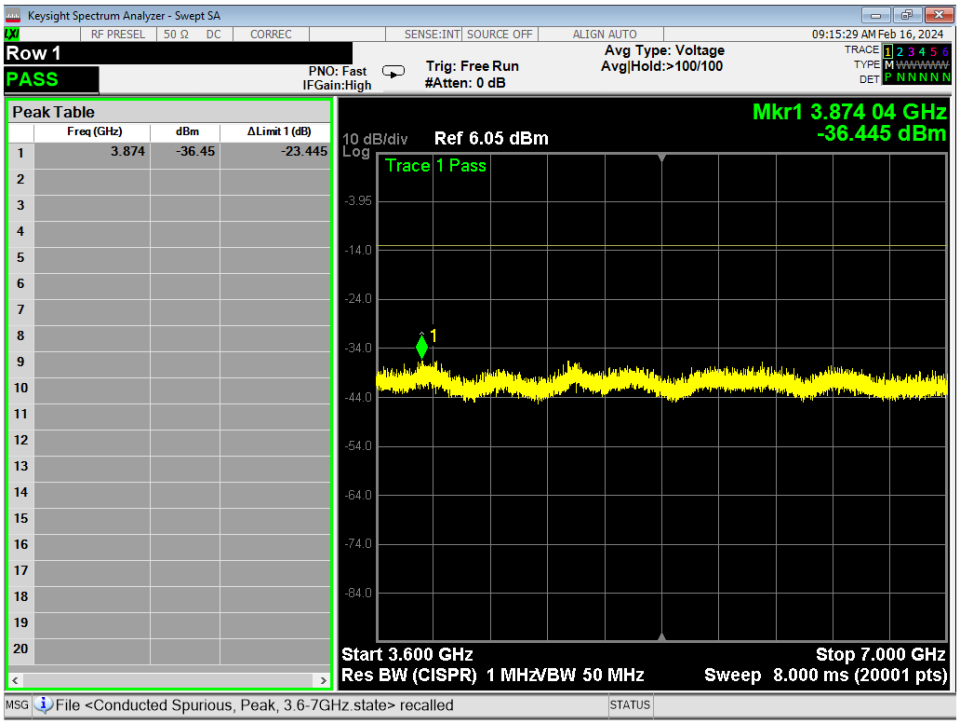

Figure 12 - Conducted Unwanted Emissions Plot, 3.6GHz-7GHz, Mode B

*Limit is -13dBm – Pass

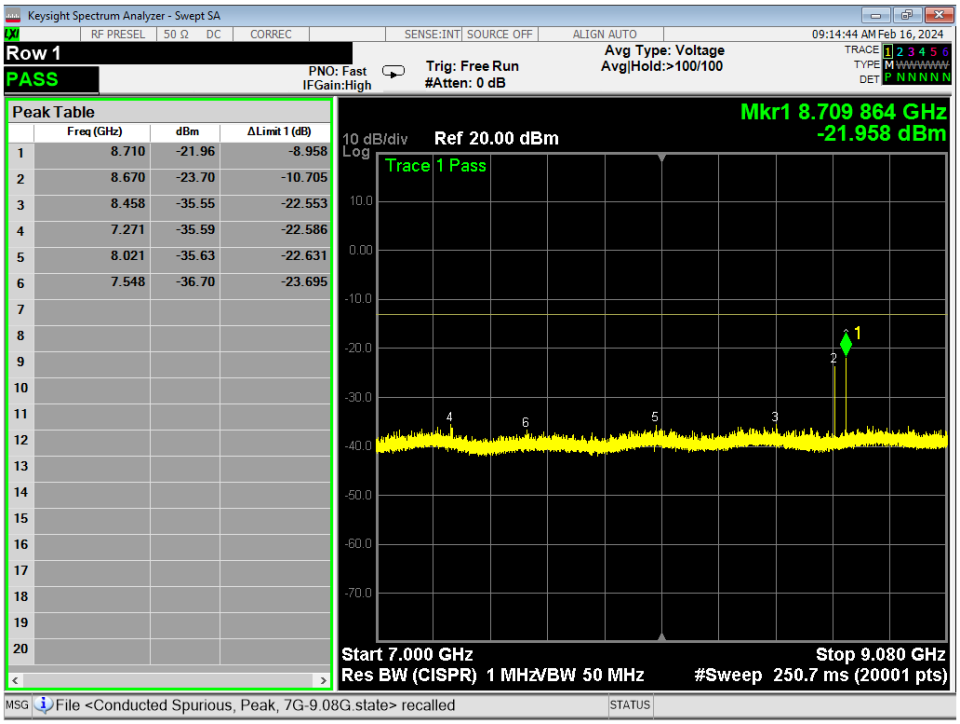

Figure 13 - Conducted Unwanted Emissions Plot, 7GHz-9.08GHz, Mode B

*Limit is -13dBm – Pass

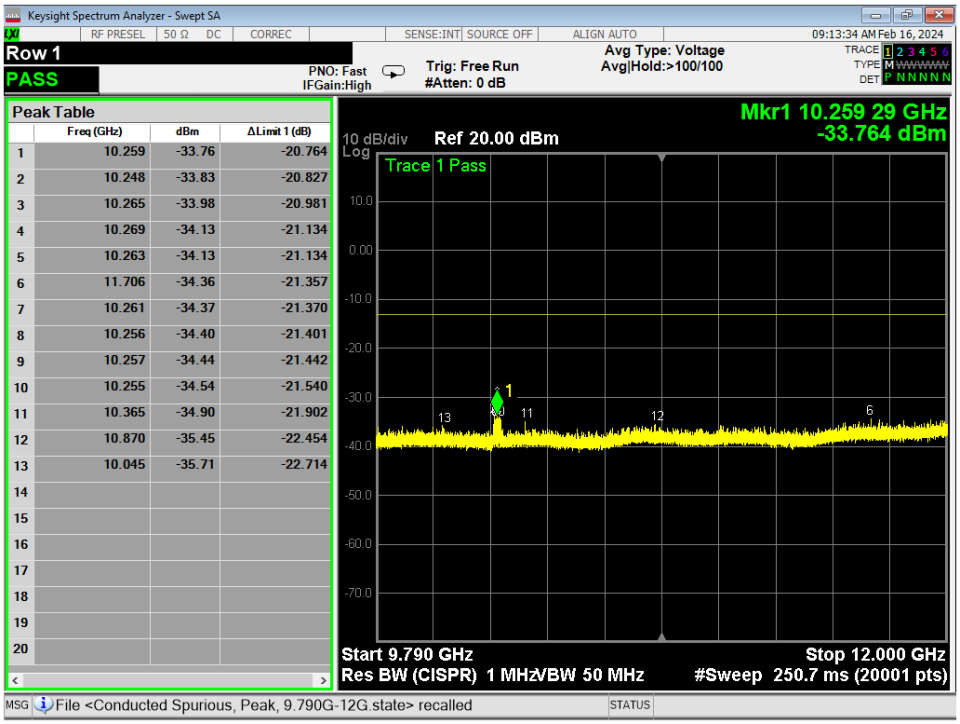

Figure 14 - Conducted Unwanted Emissions Plot, 9.79GHz-12GHz, Mode B

*Limit is -13dBm – Pass

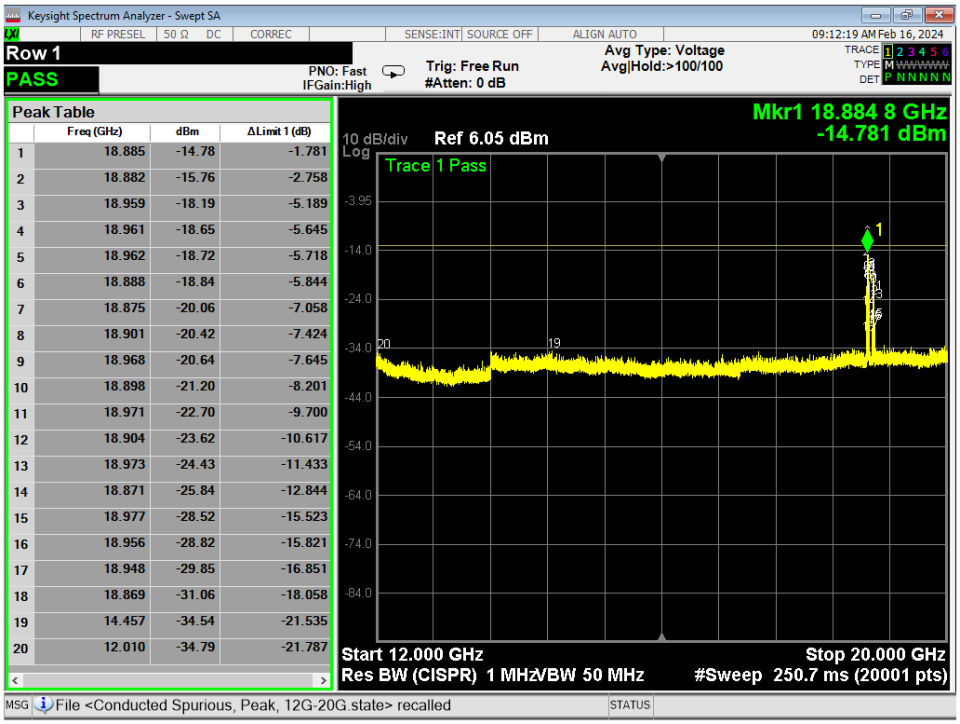

Figure 15 - Conducted Unwanted Emissions Plot, 12GHz-20GHz, Mode B

*Limit is -13dBm – Pass

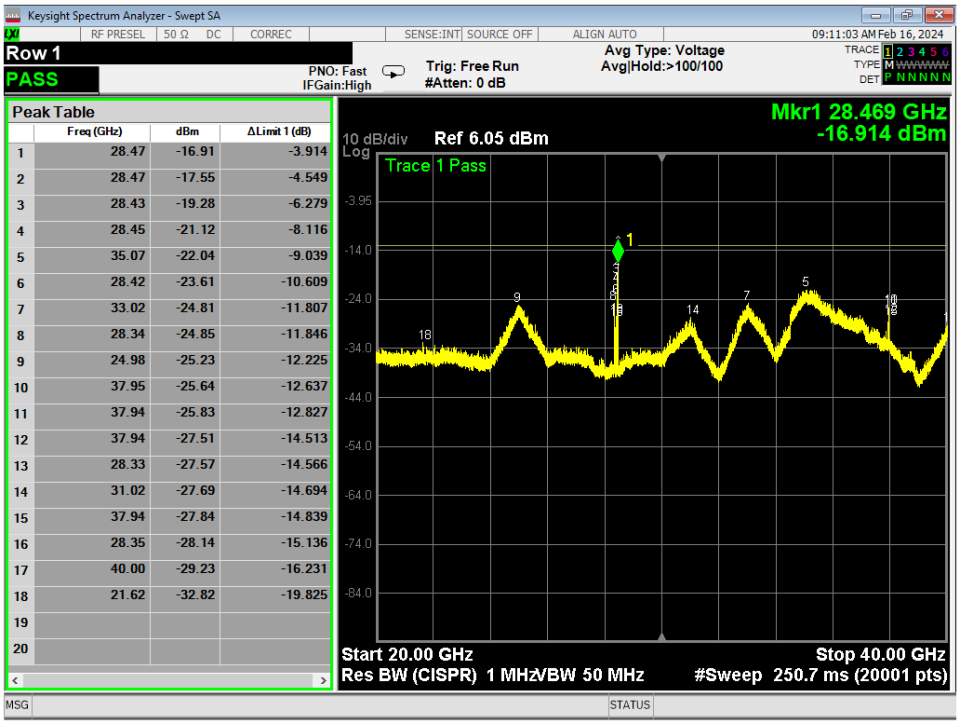

Figure 16 - Conducted Unwanted Emissions Plot, 20GHz-40GHz, Mode B

*Limit is -13dB – Pass

All other measurements including above 40 GHz were investigated and found to be below the laboratory noise floor and at least 6 dB below the limits.

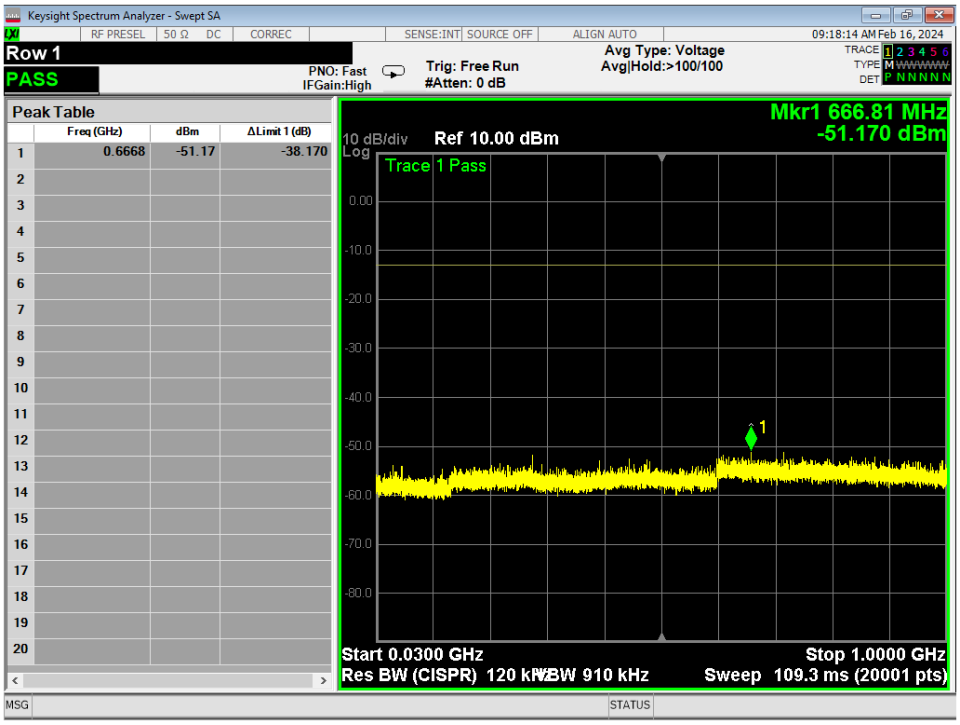

Figure 17 - Conducted Unwanted Emissions Plot, 30MHz-1GHz, Mode C

*Limit is -13dBm – Pass

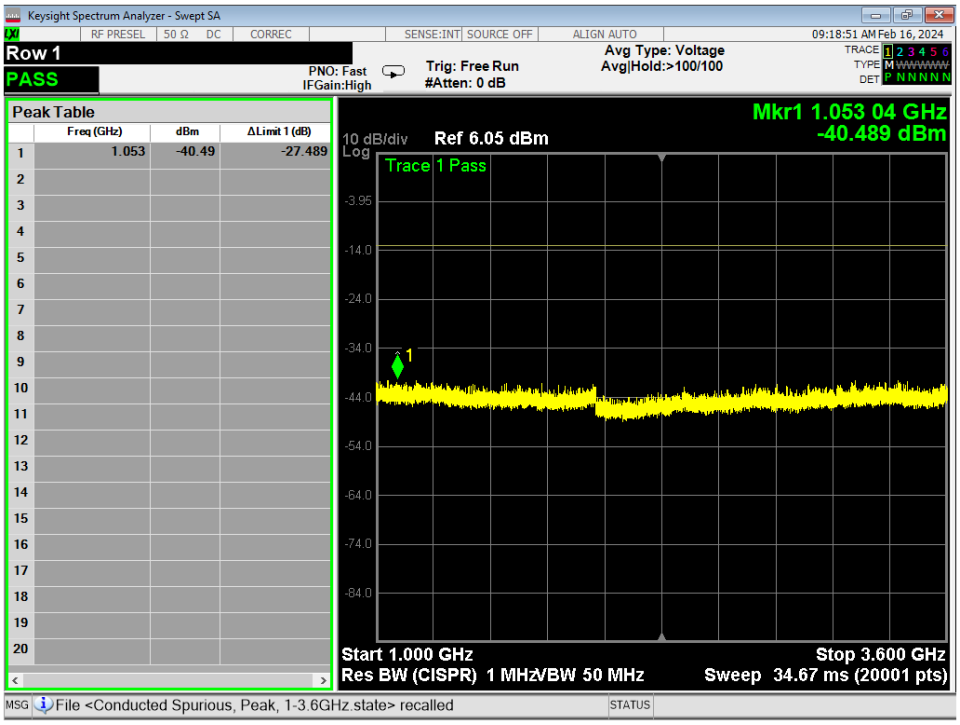

Figure 18 - Conducted Unwanted Emissions Plot, 1GHz-3.6GHz, Mode C

*Limit is -13dBm – Pass

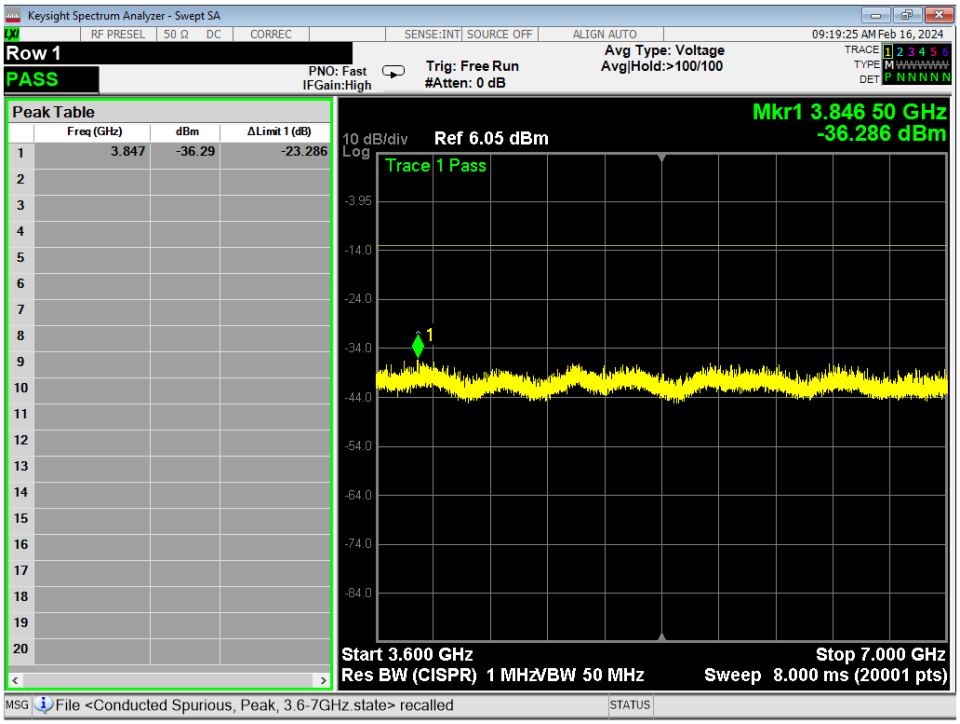

Figure 19 - Conducted Unwanted Emissions Plot, 3.6GHz-7GHz, Mode C

*Limit is -13dBm – Pass

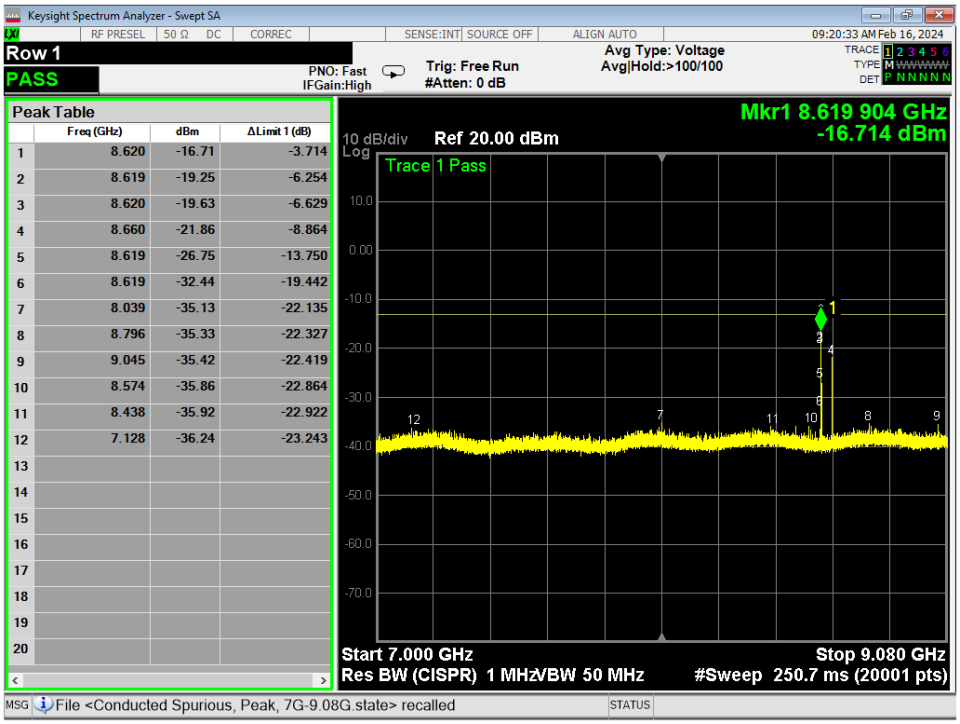

Figure 20 - Conducted Unwanted Emissions Plot, 7GHz-9.08GHz, Mode C

*Limit is -13dBm – Pass

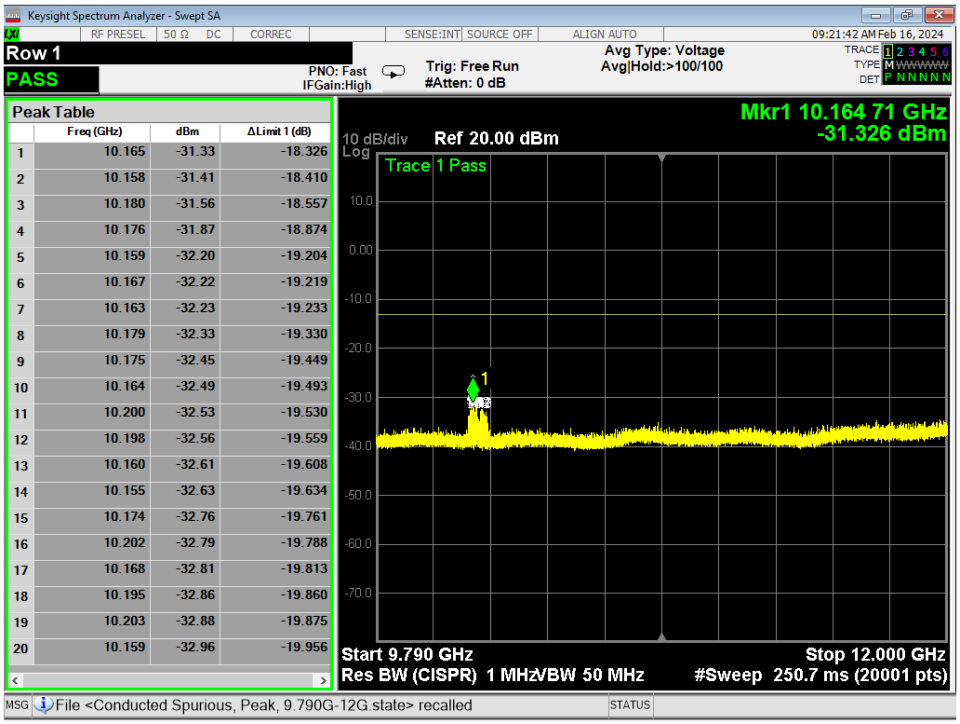

Figure 21 - Conducted Unwanted Emissions Plot, 9.79GHz-12GHz, Mode C

*Limit is -13dBm – Pass

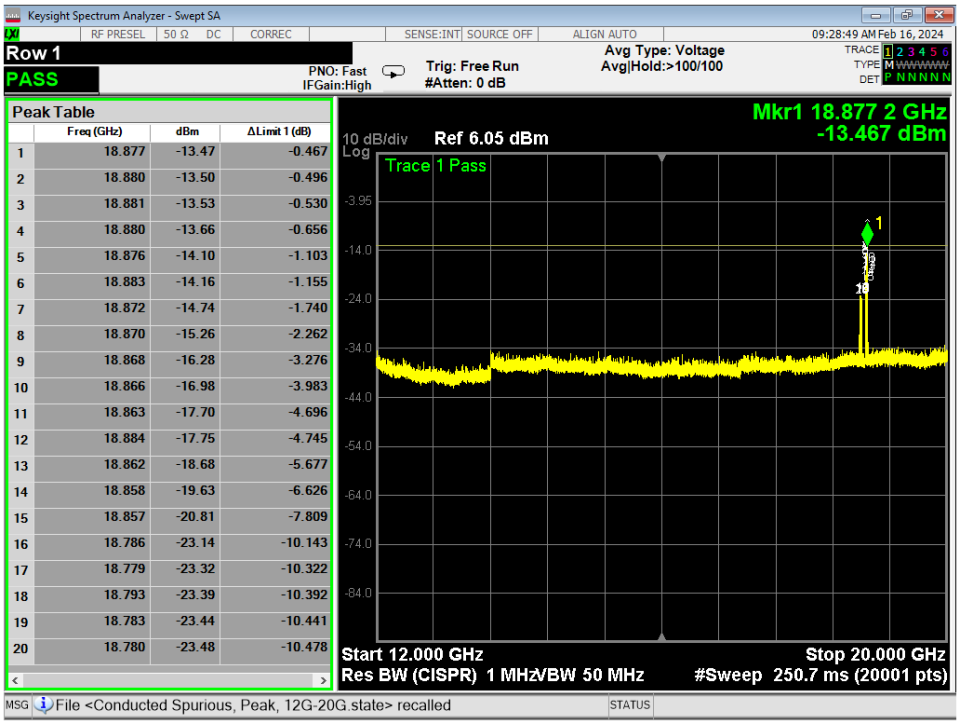

Figure 22 - Conducted Unwanted Emissions Plot, 9.79GHz-12GHz, Mode C

*Limit is -13dBm – Pass

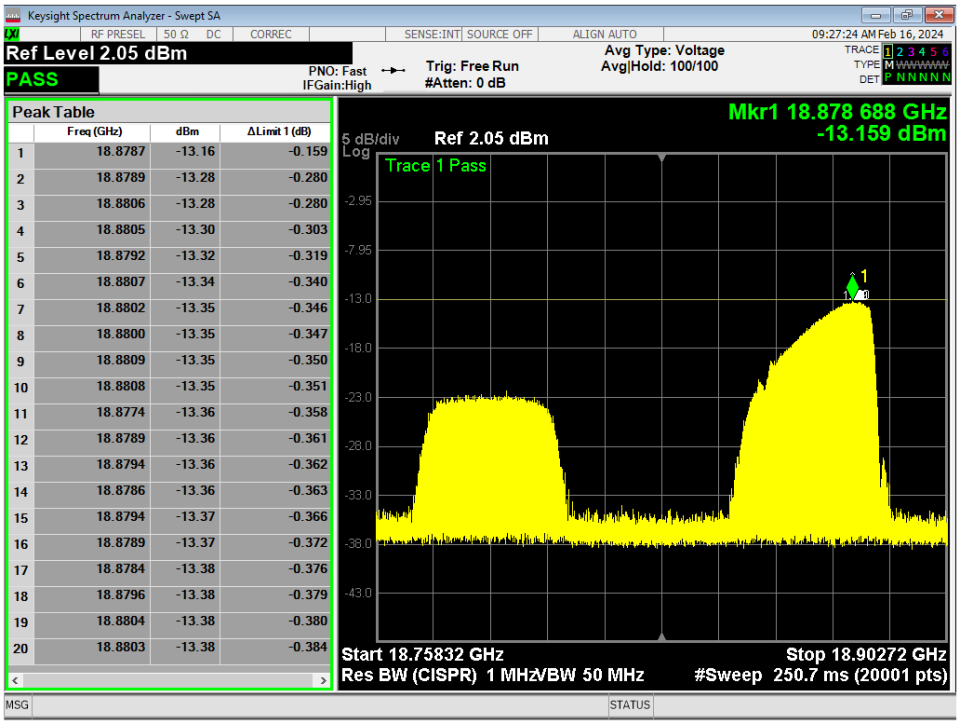

Figure 23 - Conducted Unwanted Emissions Plot, 18.75832GHz-18.90272GHz, Mode C

*Limit is -13dBm – Pass

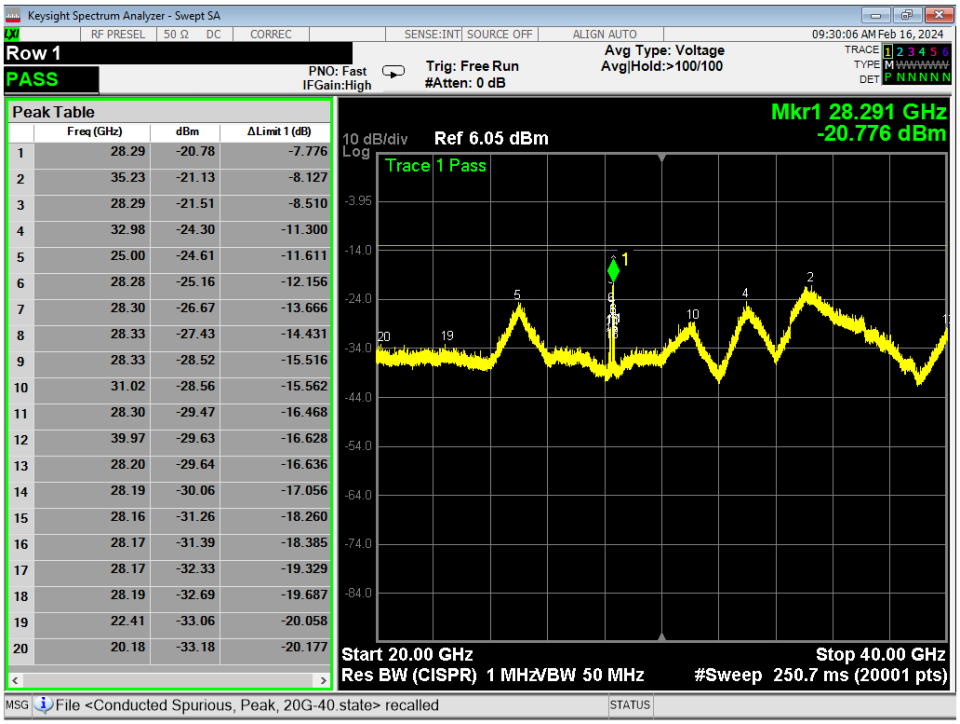

Figure 24 - Conducted Unwanted Emissions Plot, 20GHz-40GHz, Mode C

*Limit is -13dB – Pass

All other measurements including above 40 GHz were investigated and found to be below the laboratory noise floor and at least 6 dB below the limits.

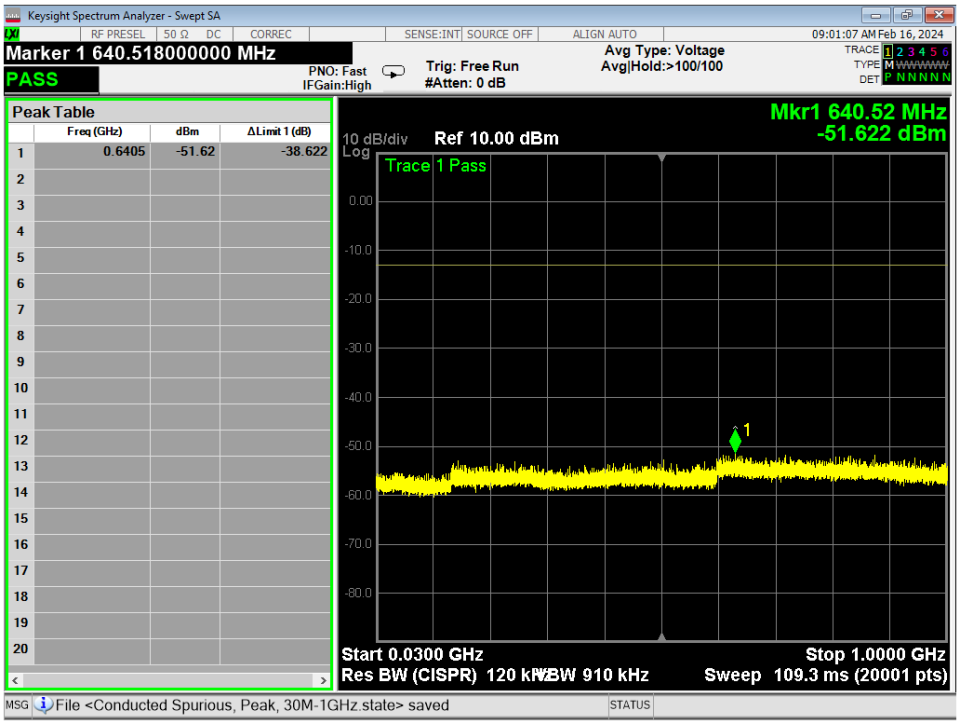

Figure 25 - Conducted Unwanted Emissions Plot, 30MHz-1GHz, Mode D

*Limit is -13dBm – Pass

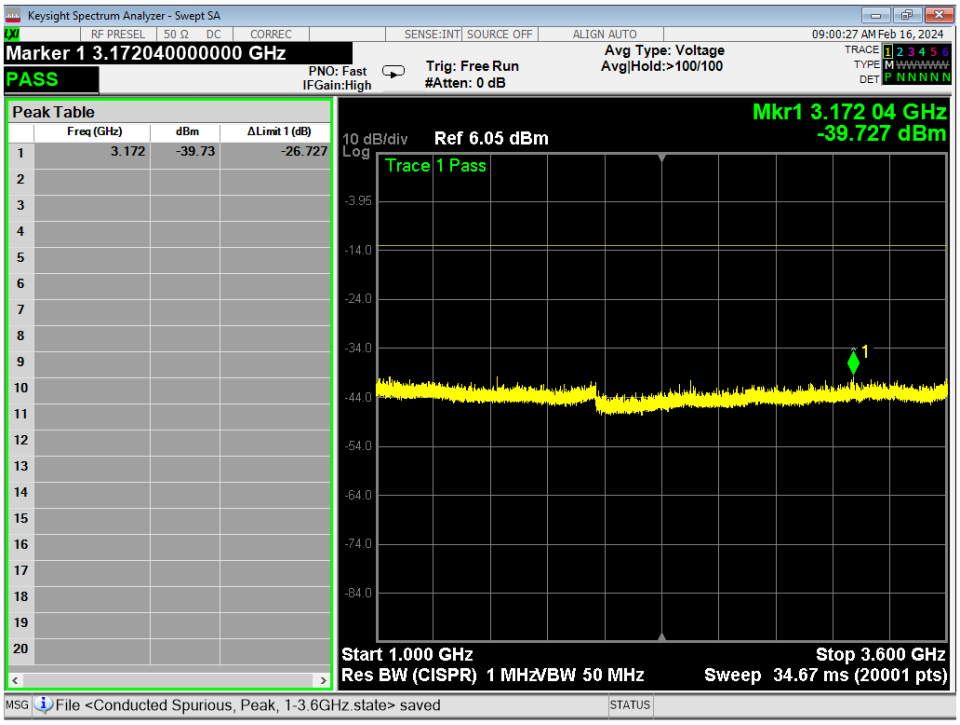

Figure 26 - Conducted Unwanted Emissions Plot, 1GHz-3.6GHz, Mode D

*Limit is -13dBm – Pass

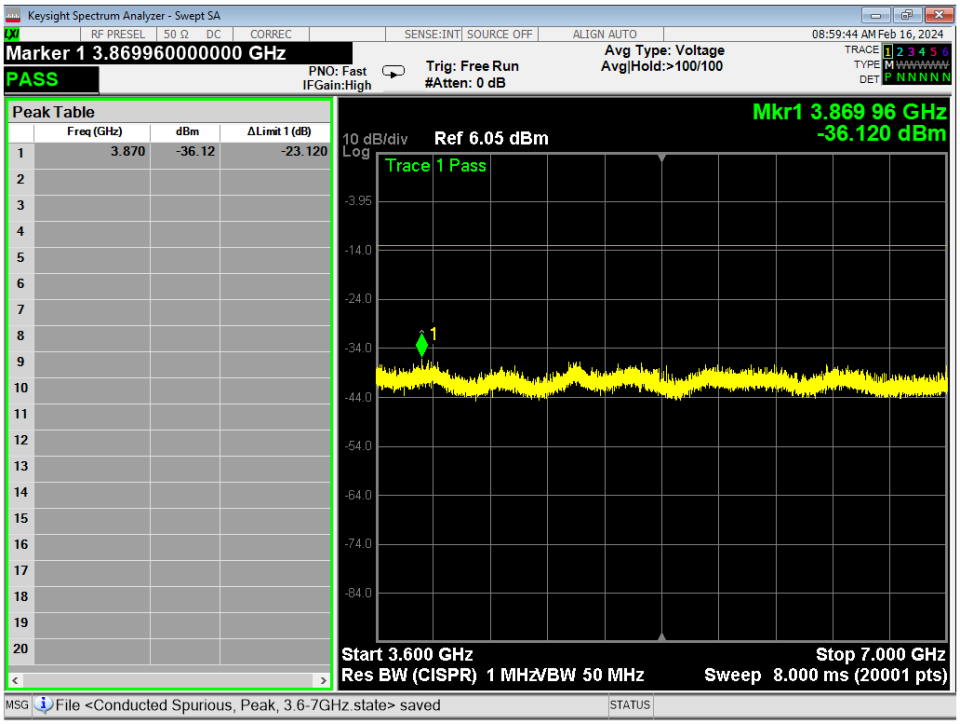

Figure 27 - Conducted Unwanted Emissions Plot, 3.6GHz-7GHz, Mode D

*Limit is -13dBm – Pass

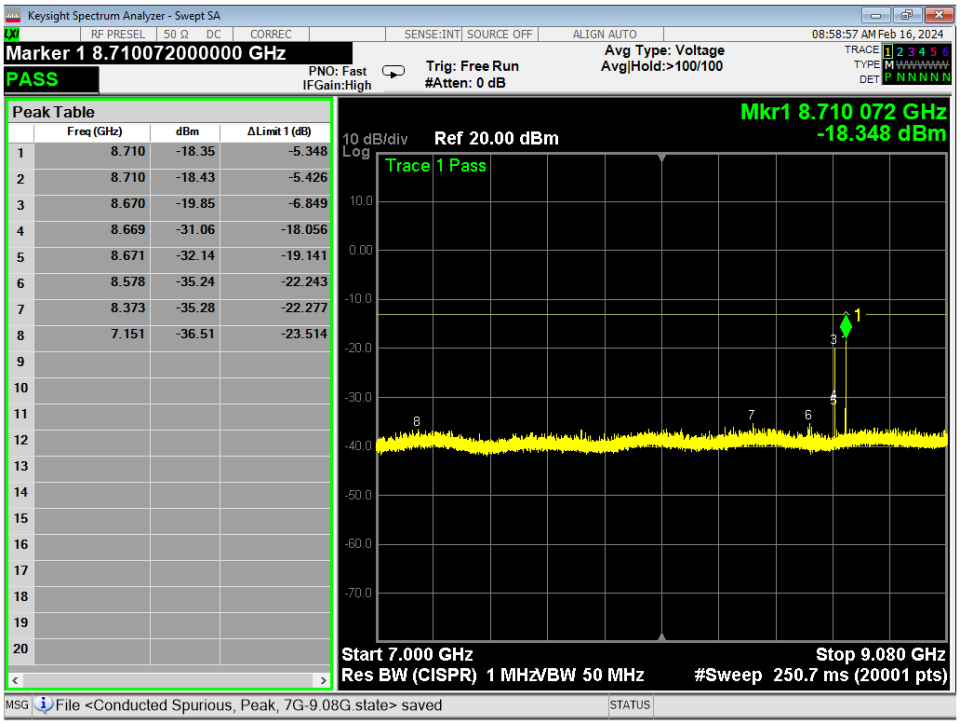

Figure 28 - Conducted Unwanted Emissions Plot, 7GHz-9.08GHz, Mode D

*Limit is -13dBm – Pass

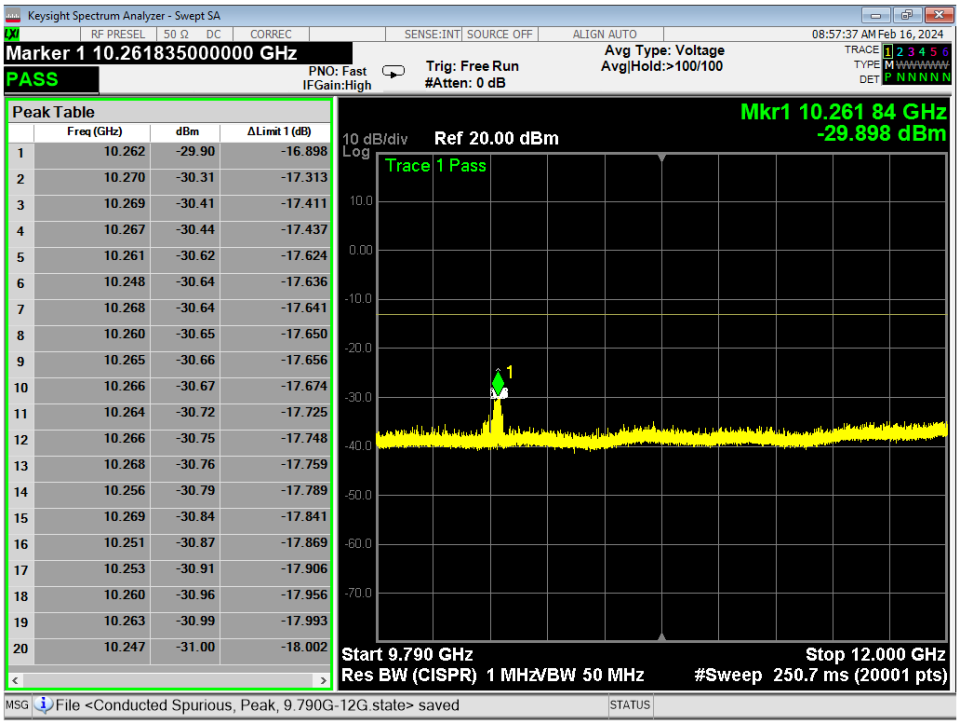

Figure 29 - Conducted Unwanted Emissions Plot, 9.79GHz-12GHz, Mode D

*Limit is -13dBm – Pass

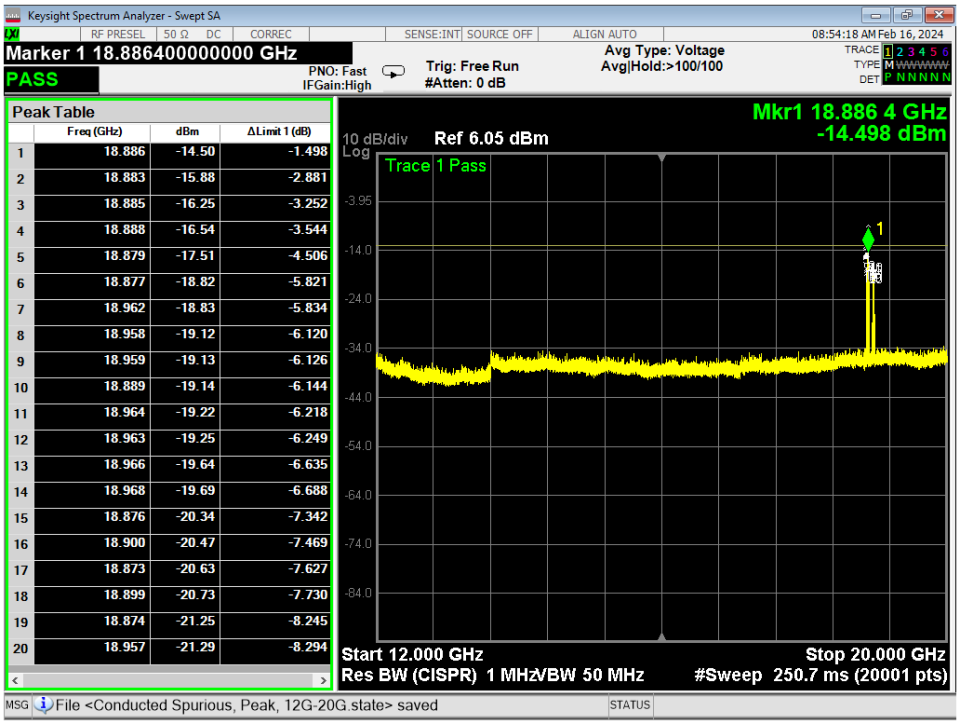

Figure 30 - Conducted Unwanted Emissions Plot, 12GHz-20GHz, Mode D

*Limit is -13dBm – Pass

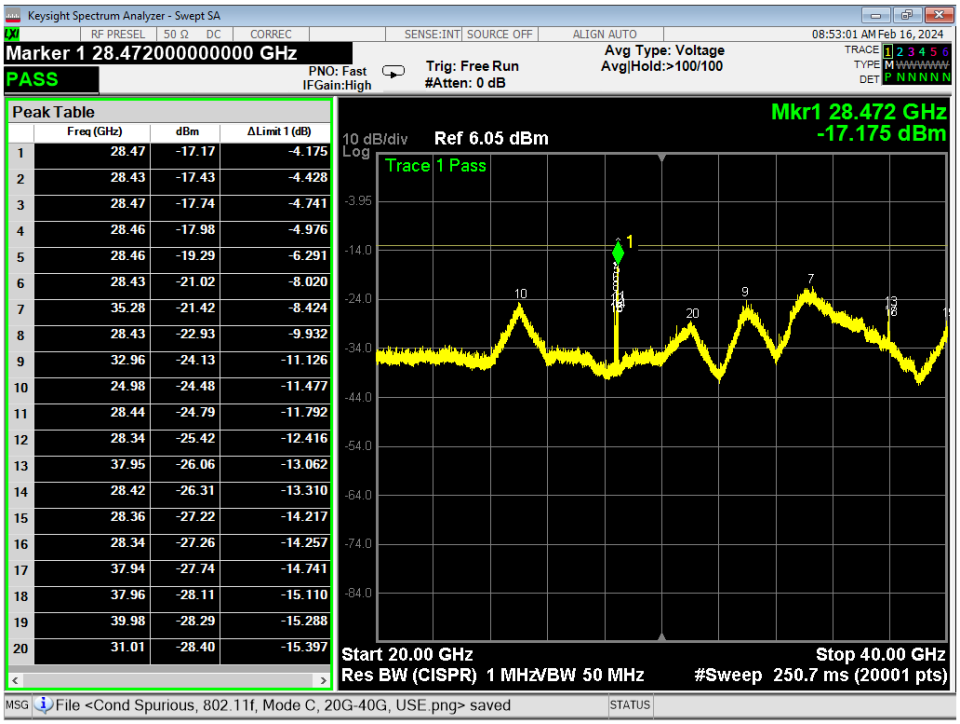

Figure 31 - Conducted Unwanted Emissions Plot, 20GHz-40GHz, Mode D

*Limit is -13dB – Pass

All other measurements including above 40 GHz were investigated and found to be below the laboratory noise floor and at least 6 dB below the limits.

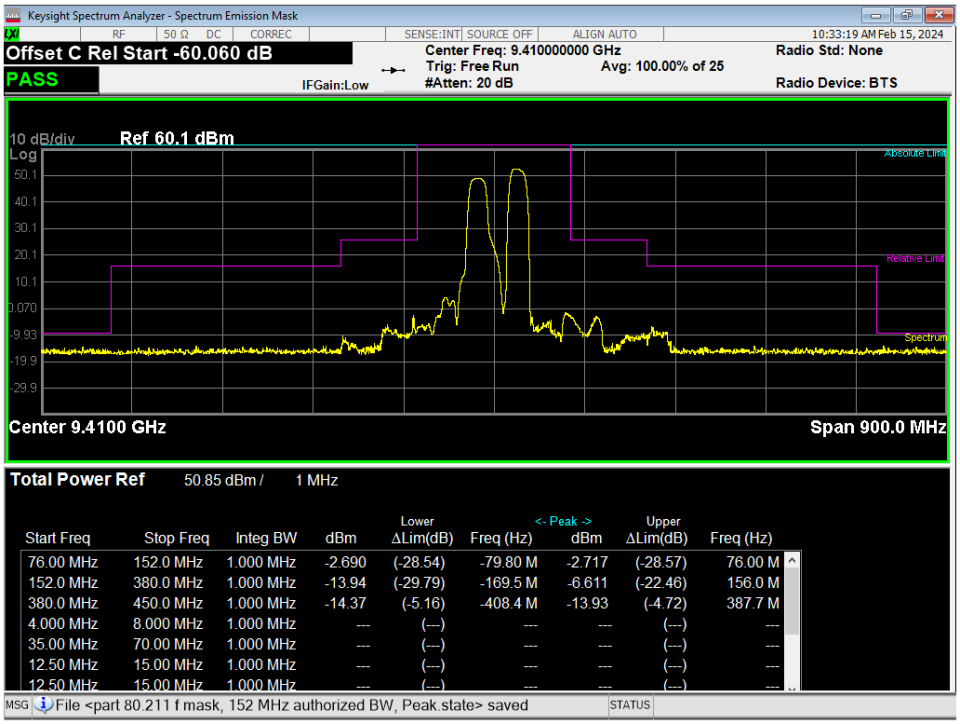

Figure 32 – Emissions Mask, Mode A, 152 MHz Authorized BW

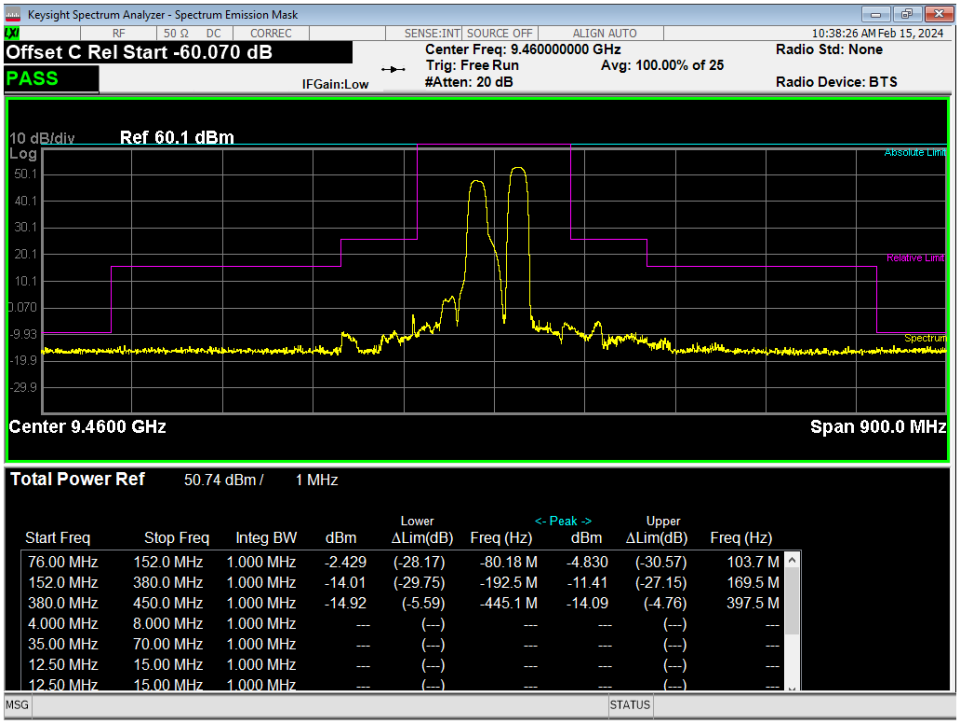

Figure 33 – Emissions Mask, Mode B, 152 MHz Authorized BW

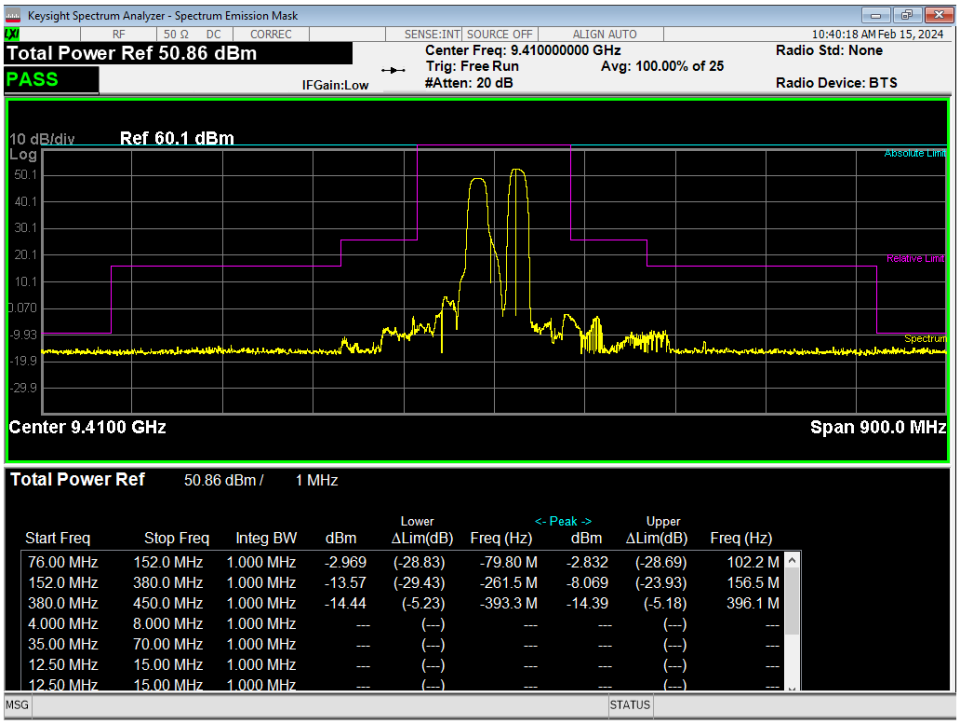

Figure 34 – Emissions Mask, Mode C, 152 MHz Authorized BW

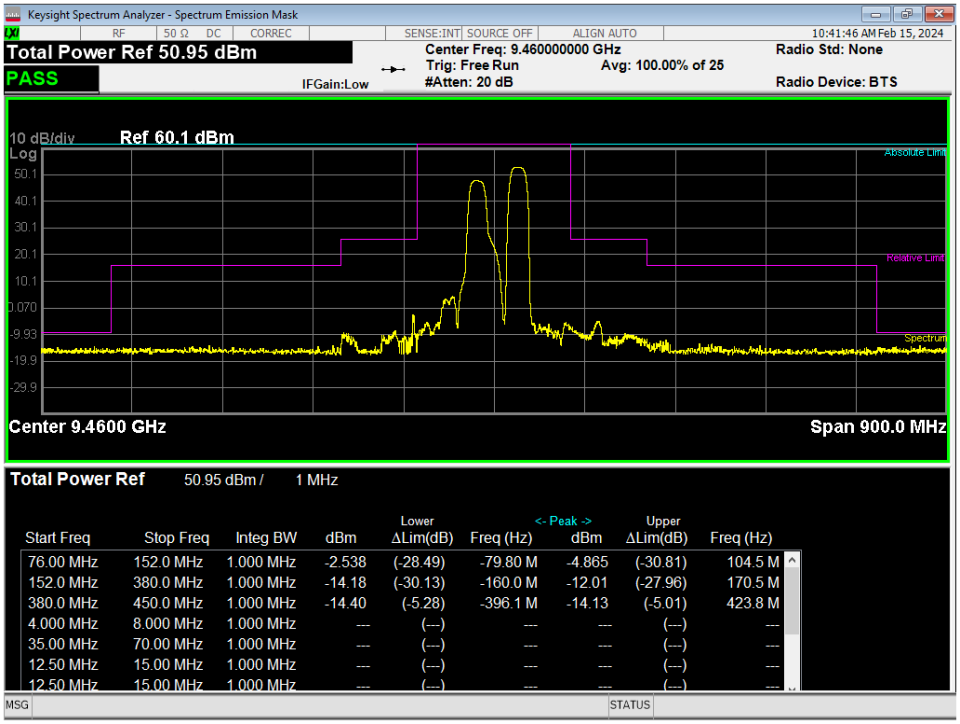

Figure 35 – Emissions Mask, Mode D, 152 MHz Authorized BW

4.2 OUTPUT POWER

Test Method: ANSI C63.26:
Section(s) 5.2.4.4.2

Limits of power measurements:

The transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms: For PON and F3N emission: Mean power

Test procedures:
All the measurements were done with RBW greater than OBW of the signal.

Deviations from test standard:
No deviation.

Test setup:

Figure 36 – Output Power Measurements Test Setup

EUT operating conditions:
See Section 2.1 & 2.2

Test results:

Output Power

Mode	CHANNEL FREQUENCY (MHz)	Duty Cycle Correction Factor (DCCF)	Raw Avg uncorrected level (dBm)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	Method	RESULT
A-4% Duty Cycle	9410.000000	13.9794	36.87	50.85	121.6	Conducted	PASS
B-2% Duty Cycle	9410.000000	16.9897	33.87	50.86	118.6	Conducted	PASS
C-4% Duty Cycle	9460.000000	13.9794	36.76	50.74	121.9	Conducted	PASS
D-2% Duty Cycle	9460.000000	16.9897	33.96	50.95	124.4	Conducted	PASS
Duty cycle is declared by the manufacturer. Corrected Output Power = DCCF + Raw uncorrected level. Limit-50 dBm/100 W							

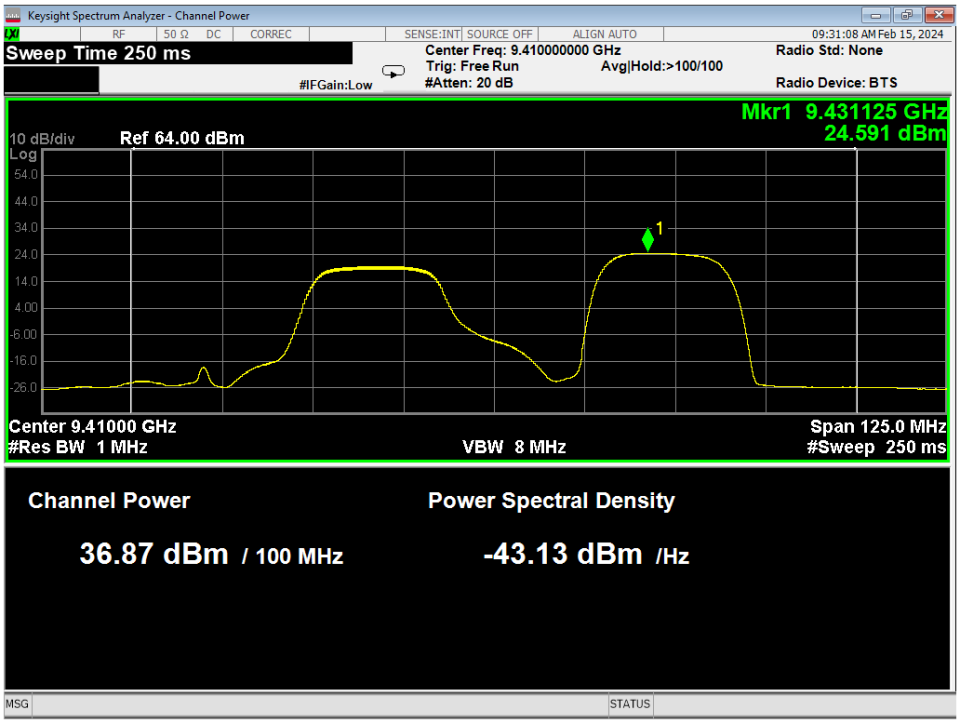

Figure 37 – Average Power, Mode A

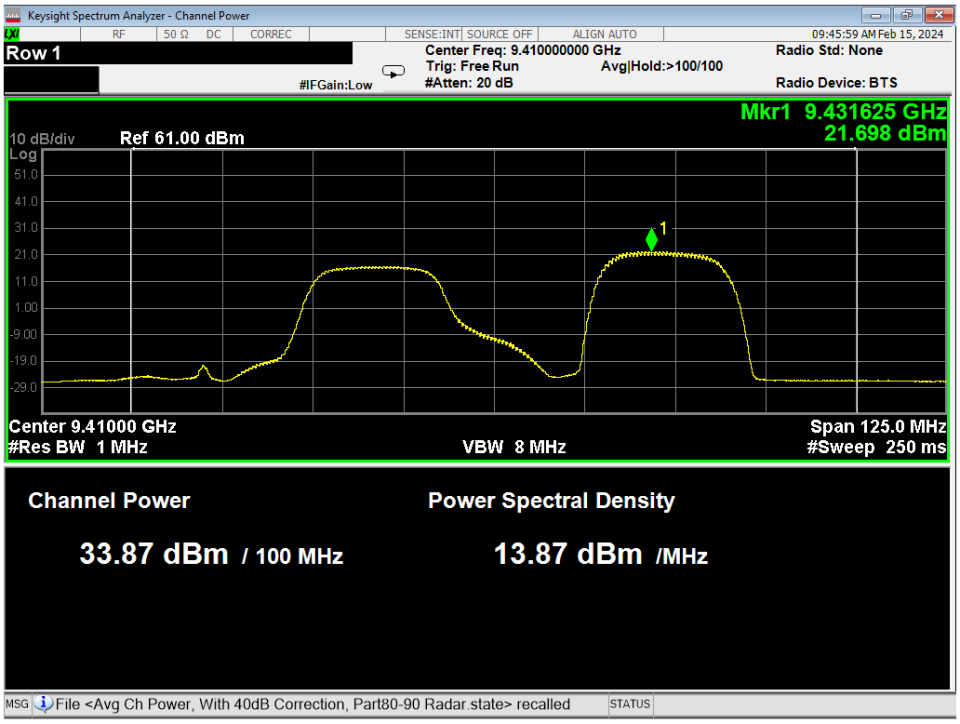

Figure 38 – Average Power, Mode B

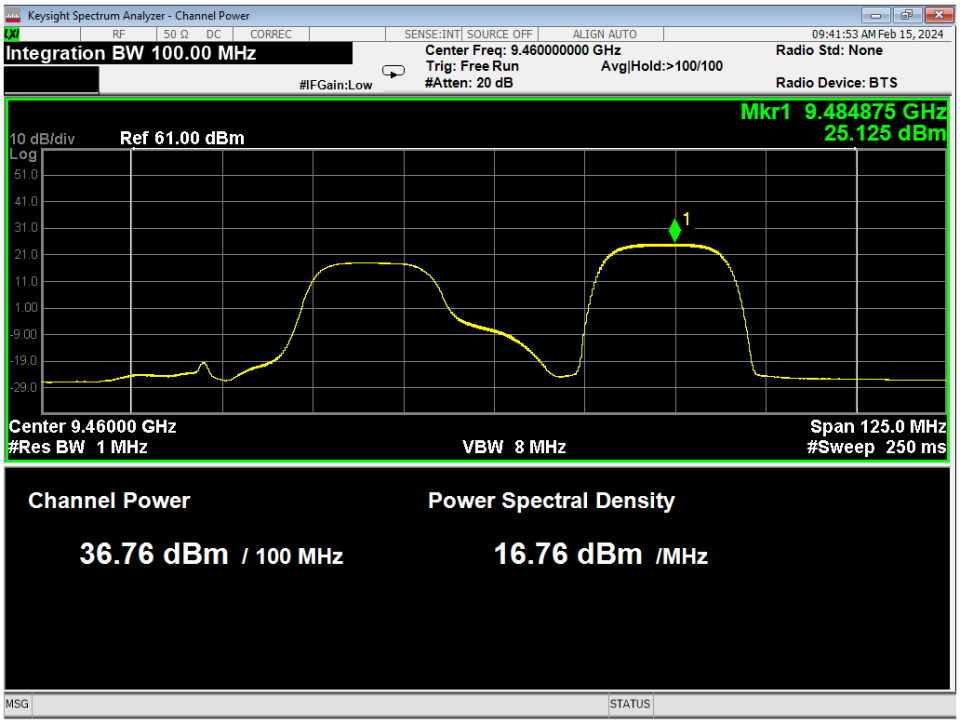

Figure 39 – Average Power, Mode C

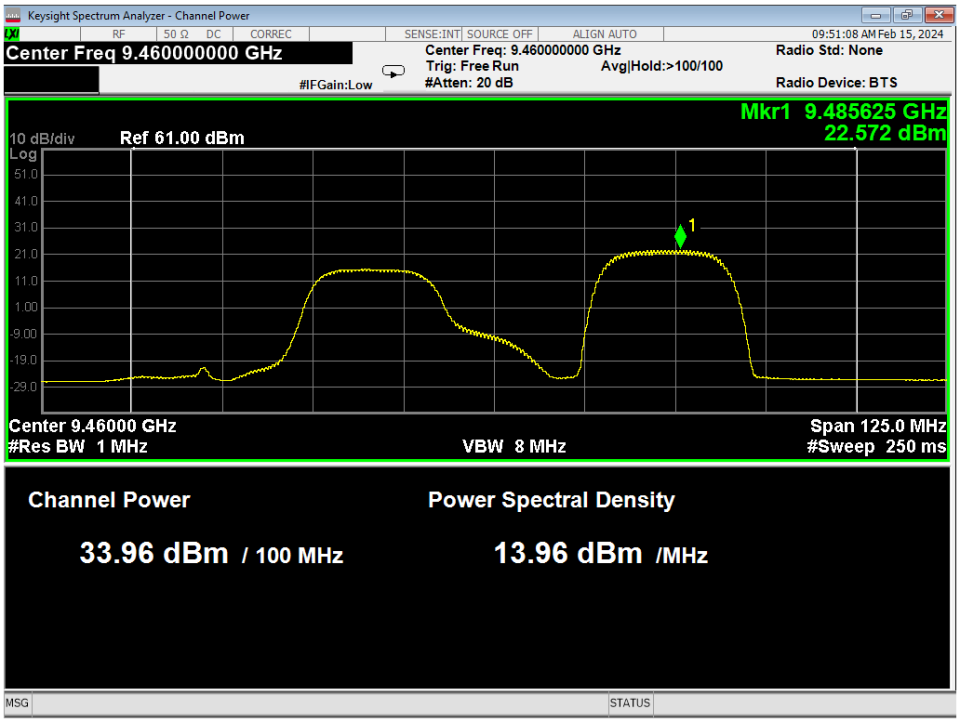

Figure 40 – Average Power, Mode D

4.3 BANDWIDTH AND MODULATION CHARACTERISTICS

Test Method: ANSI C63.26,
Section(s) 5.4.3, 5.4.4

Limits of bandwidth measurements:
Authorized Bandwidth is 152 MHz. Operating Range is 9410 MHz – 9460 MHz.

Limits for Modulation Characteristics:
Bandwidths for radiolocation stations in the 420-450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis. – 47 CFR 90.209(b)(5)

Test procedures:
The EUT was connected to the spectrum analyzer directly with a low-loss shielded coaxial cable and an attenuator to protect measurement equipment. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1 MHz RBW and 8 MHz VBW. The bandwidth measurements were done using the automatic bandwidth measurement.

Deviations from test standard:
No deviation

Test setup:

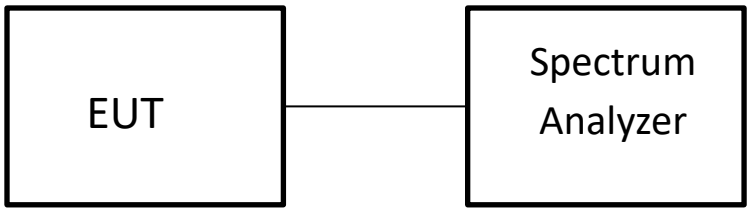

Figure 41 –Measurements Test Setup

EUT operating conditions:
See Section 2.1 & 2.2

Test results:

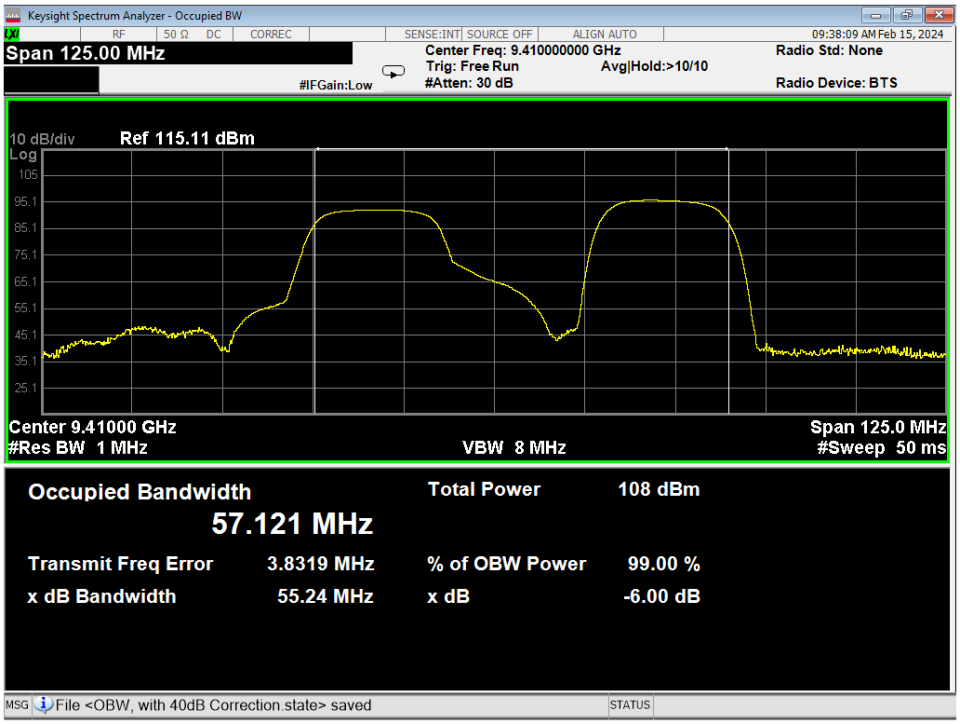

Figure 42 - 99% Occupied Bandwidth, Mode A

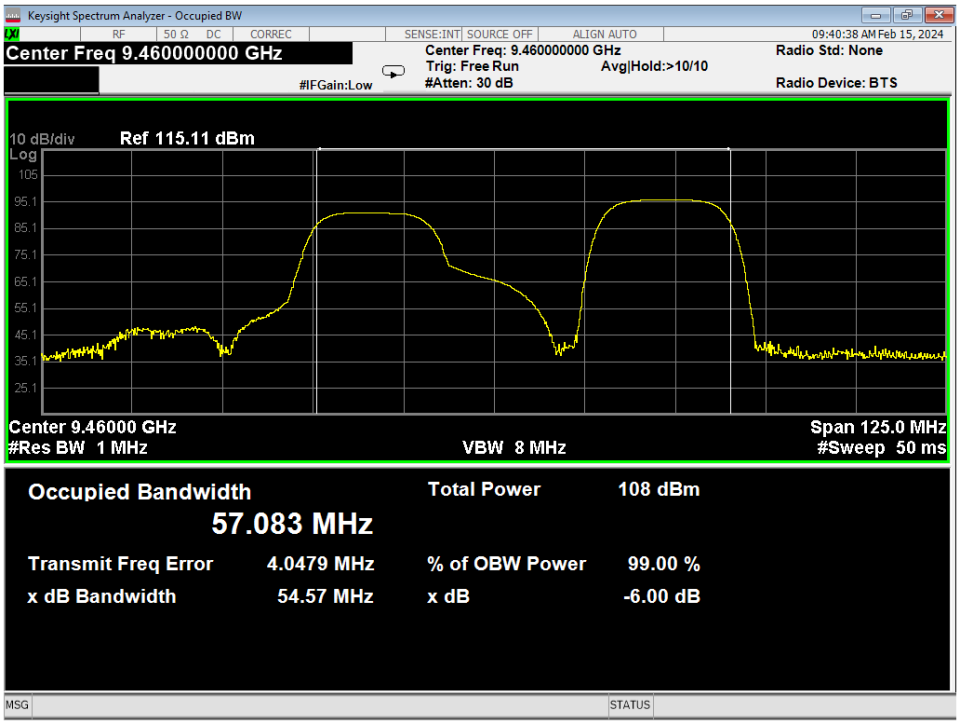

Figure 43 - 99% Occupied Bandwidth, Mode B

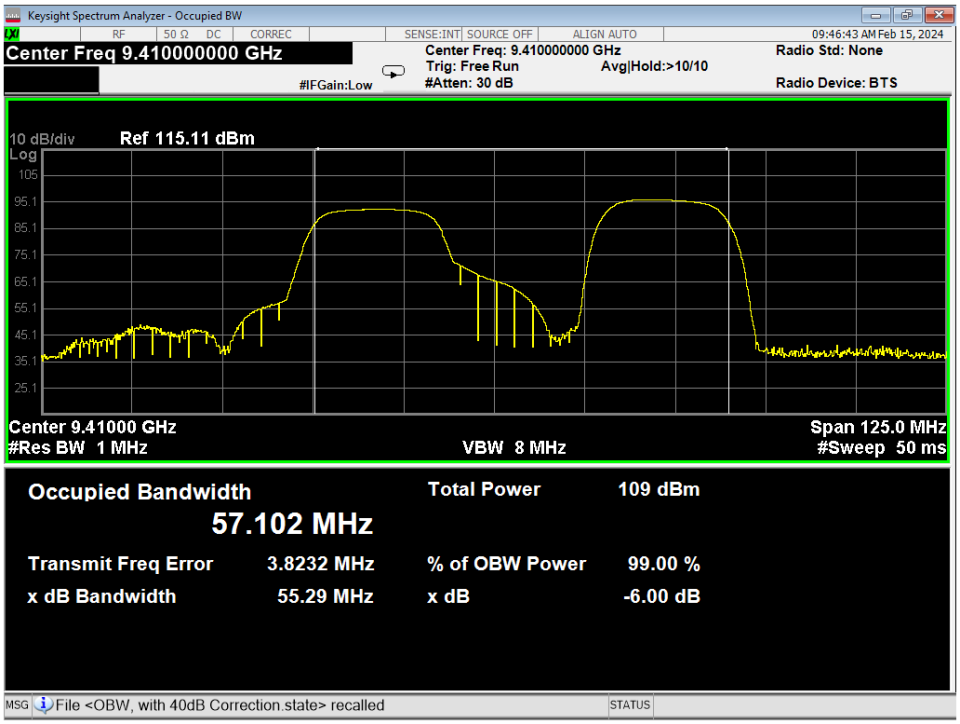

Figure 44 - 99% Occupied Bandwidth, Mode C

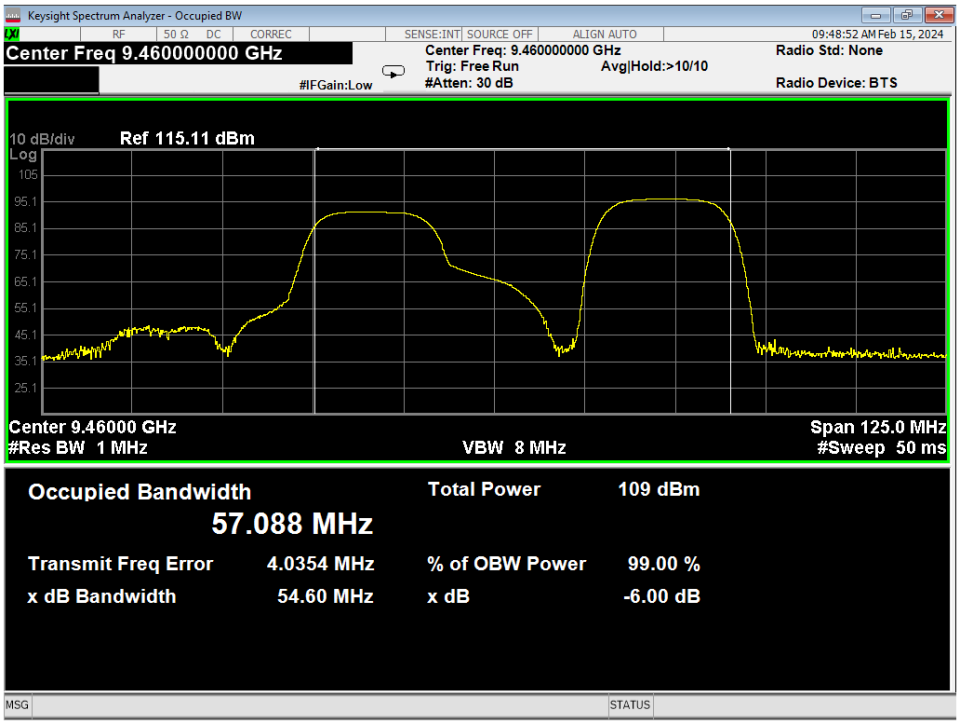

Figure 45 - 99% Occupied Bandwidth, Mode D

4.4 FREQUENCY STABILITY MEASUREMENTS

Test Method: ANSI C63.26,
Section(s) 5.6.3 “Procedures for frequency stability testing”

Limits:
47 CFR 90.213
Frequency stability is to be specified in the station authorization.

Test procedures:
Radiated power was measured on a spectrum analyzer with resolution bandwidth and video bandwidth set to 1 MHz and 8 MHz respectively. The frequency error functionality on the receiver was used. The temperature was varied from -30°C to +55°C.

Deviations from test standard:
No deviation

Test setup:

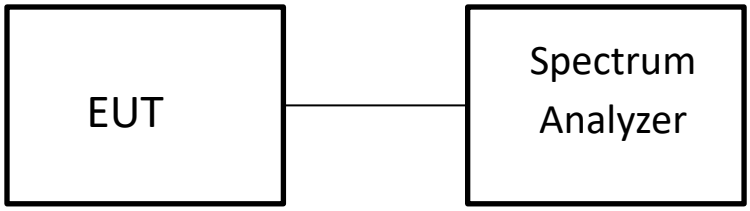

Figure 46 –Measurements Test Setup

EUT operating conditions:
See Section 2.1 & 2.2

Test results: Complies

Reference Freq (MHz)			9410
Frequency error versus temperature and supply voltage			
Temperature (°C)	**Frequency Error (MHz)**	**Error in ppm**	
55	3.86	407.90	
40	3.72	393.11	
30	3.73	394.17	
20	3.82	403.68	
10	3.91	413.19	
0	3.92	414.24	
-10	4.02	424.81	
-20	4.03	425.87	
-30	3.97	419.53	
85% of nominal voltage	4.0219	425.01	
115% of nominal voltage	4.0159	424.38	
Nominal voltage (28VDC)	4.0082	423.57	

Mode A

Reference Freq (MHz)		9410
Cold Start from first ability to activate transmission (-30C)		
power on to ability to transmit due to software (Seconds)		182
Minutes after ability to Transmit	**Frequency Error (MHz)**	**Error in ppm**
0 Min(s)	3.95	417.42
1 Min(s)	3.96	418.47
2 Min(s)	3.96	418.47
3 Min(s)	3.97	419.53
4 Min(s)	3.97	419.53
5 Min(s)	3.97	419.53

Reference Freq (MHz)			9460
Frequency error versus temperature and supply voltage			
Temperature (°C)	**Frequency Error (MHz)**	**Error in ppm**	
55	4.22	445.95	
40	4.21	444.89	
30	4.24	448.06	
20	4.25	449.12	
10	4.24	448.06	
0	4.29	453.34	
-10	4.31	455.46	
-20	4.36	460.74	
-30	4.46	471.31	
85% of nominal voltage	4.1513	438.69	
115% of nominal voltage	4.1417	437.67	
Nominal voltage (28VDC)	4.1433	437.84	

Mode B

Reference Freq (MHz)		9460
Cold Start from first ability to activate transmission (-30C)		
power on to ability to transmit due to software (Seconds)		182
Minutes after ability to Transmit	**Frequency Error (kHz)**	**Error in ppm**
0 Min(s)	4.63	489.27
1 Min(s)	4.61	487.16
2 Min(s)	4.62	488.22
3 Min(s)	4.6	486.10
4 Min(s)	4.6	486.10
5 Min(s)	4.61	487.16

APPENDIX A: SAMPLE CALCULATION

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.
Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m
AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations
In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

EIRP (Watts) = [Field Strength (V/m) x antenna distance (m)]^2 / 30
Power (watts) = 10^[Power (dBm)/10] / 1000
Voltage (dBμV) = Power (dBm) + 107 (for 50Ω measurement systems)
Field Strength (V/m) = 10^[Field Strength (dBμV/m) / 20] / 10^6
Gain = 1 (numeric gain for isotropic radiator)
Conversion from 3m field strength to EIRP (d=3):

EIRP = [FS(V/m) x d^2]/30 = FS [0.3] for d = 3
EIRP(dBm) = FS(dBμV/m) – 10(log 10^9)+ 10log[0.3] = FS(dBμV/m) - 95.23
10log(10^9) is the conversion from micro to milli

APPENDIX B – MEASUREMENT UNCERTAINTY

NCEE Labs does not add uncertainty to levels
Where relevant, the following measurement uncertainty levels have been for tests performed in this test report:

Test	Frequency Range	Uncertainty Value (dB)
Radiated Emissions, 3m	30MHz - 1GHz	±4.31
Radiated Emissions, 3m	1GHz - 18GHz	±5.08

Expanded uncertainty values are calculated to a confidence level of 95%.

REPORT END