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**16740 Peters Road**  
**Middlefield, Ohio 44062**  
**United States of America**  
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## **CERTIFICATION TEST REPORT**

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**Manufacturer:** Runwise, Inc.  
104 West 27<sup>th</sup> Street, Floor 3  
New York, New York 10001 USA

**Applicant:** Same as Above

**Product Name:** Gen2 Wireless Network Module

**Product Description:** Serial UART to RF network interface, 900 MHz Radio

**Operating Voltage/Freq. of EUT During Testing:** Module is DC powered at 3.3VDC nominal

**Model:** V3.1

**FCC ID:** 2AQX2-G2RWMOD

**Testing Commenced:** 2024-01-10

**Testing Ended:** 2024-04-26

**Summary of Test Results:** **In Compliance**

The EUT complies with the EMC requirements when manufactured identically as the unit tested in this report, including any required modifications and/or manufacturer's statement. Any changes to the design or build of this unit subsequent to this testing may deem it non-compliant.

**Rules:**

- **FCC Part 15 Subpart C, Section 15.247**
- **FCC15.207 - Conducted Limits**
- **FCC Part 15.31(e)**
- **ANSI C63.10:2013**



**Evaluation Conducted by:**

Julius Chiller, Senior Wireless Project Engineer

**Report Reviewed by:**

Ken Littell, Vice President of Operations

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## 1 ADMINISTRATIVE INFORMATION

### 1.1 Measurement Location:

F2 Labs in Middlefield, Ohio. Site description and attenuation data are on file with the FCC's Sampling and Measurement Branch at the FCC Laboratory in Columbia, MD.

### 1.2 Measurement Procedure:

All measurements were performed according to ANSI C63.10 and recommended FCC procedure of measurement under Section 15.247 and in KDB558074. A list of the measurement equipment can be found in Section 6.

### 1.3 Uncertainty Budget:

The uncertainty in EMC measurements arises from several factors which affect the results, some associated with environmental conditions in the measurement room, the test equipment being used, and the measurement techniques adopted.

The measurement uncertainty budgets detailed below are calculated from the test and calibration data and are expressed with a 95% confidence factor. Note: Only measurements listed below which relate to tests included in this Test Report are applicable to it.

Measurement Range	Expanded Uncertainty	Combined Uncertainty
Radiated Emissions <1 GHz @ 3m	±5.07dB	±2.54
Radiated Emissions <1 GHz @10m	±5.09dB	±2.55
Radiated Emissions 1 GHz to 2.7 GHz	±3.62dB	±1.81
Radiated Emissions 2.7 GHz to 18 GHz	±3.10dB	±1.55
AC Power Line Conducted Emissions, 150kHz to 30 MHz	±2.76dB	±1.38

This Uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 1.4 Document History

Document Number	Description	Issue Date	Approved By
F2P30751A-C2-01E	First Issue	2024-04-26	K. Littell

**2 SUMMARY OF TEST RESULTS**

Test Name	Standard(s)	Results
Occupied Bandwidth	CFR 47 Part 15.247(a)(2) / KDB558074	Complies
Conducted Output Power	CFR 47 Part 15.247(b)(2) / KDB558074	Complies
Voltage Variations	CFR 47 Part 15.31(e)	Complies
Conducted Spurious Emissions	CFR 47 Part 15.247(d) / Part 15.207 / KDB558074	Complies
Radiated Spurious Emission with 3.9dBi Gain Whip Antenna	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	N/A
Frequency Separation	ANSI 63.10 2013 (7.8.2)	Complies
Number of Hopping Frequencies	ANSI 63.10 2013 (7.8.3)	Complies
Dwell Time	ANSI 63.10 2013 (7.8.4)	Complies
Conducted Emissions	CFR 47 Part 15.207(a)	Complies

Modifications Made to the Equipment
None



### 3 TABLE OF MEASURED RESULTS

Test		Low Channel 902.4 MHz	Mid Channel 914.1 MHz	High Channel 927.6 MHz
Conducted Output Power		269.2mW / 24.3dBm	234.4mW / 23.7dBm	213.8mW / 23.3dBm
Conducted Output Power Limit		1 Watt / 30dBm	1 Watt / 30dBm	1 Watt / 30dBm
E.I.R.P. with 3.9dBi Monopole Antenna		660.7mW / 28.2dBm	575.4mW / 27.6dBm	524.8mW 27.2dBm
E.I.R.P. Limit		4 Watts / 36.02dBm	4 Watts / 36.02dBm	4 Watts / 36.02dBm
-20dB Occupied Bandwidth		268.5 MHz	256.9 MHz	259.6 MHz
99% Occupied Bandwidth		204.5kHz	210.3kHz	210.3kHz
Occupied Bandwidth Limit		<500kHz	<500kHz	<500kHz
Voltage Variations*	Nominal 3.3VDC	23.68dBm	--	--
	-15% 2.7VDC	19.2dBm	--	--
	+15% 3.8VDC	24.3dBm	--	--
Limit		1W 30dBm	1W 30dBm	1W 30dBm

*\*To meet the requirements of 15.31 the maximum voltage used is the manufacturer's specified limit. The minimum voltage of 2.7VDC is 0.1VDC above turn off.*



#### **4 ENGINEERING STATEMENT**

This report has been prepared on behalf of Runwise, Inc. to provide documentation for the testing described herein. This equipment has been tested and found to comply with Part 15.247 of the FCC Rules using ANSI C63.10 and KDB558074 standards. The test results found in this test report relate only to the items tested.



## 5 EUT INFORMATION AND DATA

### 5.1 Equipment Under Test:

Product: Gen2 Wireless Network Module - 900 MHz Radio

Model: V3.1

Serial No.: 120

Firmware: V1.0

Hardware: V3.1

FCC ID: 2AQX2-G2RWMOD

### 5.2 Trade Name:

Runwise, Inc.

### 5.3 Power Supply:

Module is DC powered at 3.3VDC nominal

### 5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

### 5.5 Equipment Category:

Radio Transmitter-FHSS

### 5.6 Antenna:

3.9dBi Monopole

2.5dBi Dipole

### 5.7 Accessories:

Device	Manufacturer	Model Number	Serial Number
Test Fixture	Texas Instruments	CC1350	Rev1.3.0
Accessory Software Version:		FW Rev:1.0	

### 5.8 Test Item Condition:

The equipment to be tested was received in good condition.

### 5.9 Testing Algorithm:

EUT was tested on low, mid and high channels in the 902-928 MHz band. EUT was set for 100% Duty Cycle. FHSS parameters were measured in the Hopping mode. The highest emissions were recorded in the data tables.



**6 LIST OF MEASUREMENT INSTRUMENTATION**

Equipment Type	Asset Number	Manufacturer	Model	Serial Number	Calibration Due Date
Shielded Chamber	CL166	AlbatrossProjects	B83117-DF435-T261	US140023	2024-11-15
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2025-04-09
Low Loss Cable Set	CL315 / CL318	Fairview Microwave	FMC0202914-72/FMC0202914-240	None Spec.	2024-04-14
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2024-09-25
Horn Antenna	CL098	Emco	3115	9809-5580	2025-01-02
Amplifier w/Monopole & 18"	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2024-12-14
Pre-Amplifier	CL153	Agilent	83006-69007	MY57280115	2024-11-14
Preamplifier	CL284	A.H. Systems, Inc.	PAM-1001	131	2025-04-10
Software:	EMC 32, Version 8.53.0 Software Verified: 2024-01-11				
Temp/Hum Rec	CL293	Thermpro	TP50	1	2025-05-31
Spectrum Analyzer	0141	Hewlett Packard	8591E	3520A04145	2024-04-11
Transient Limiter	0202	Hewlett Packard	11947A	3107A00729	2024-04-11
LISN	CL184	Com-Power	LI-125A	191213	2026-11-02
LISN	CL185	Com-Power	LI-125A	191214	2026-11-02
Temp/Hum Rec	CL294	Thermpro	TP50	2	2024-04-27



## **7 OCCUPIED BANDWIDTH**

### **7.1 Requirements:**

The 20dB bandwidth shall be less than 500 kHz.

-20 dB Bandwidth measurements were made at the low, mid and high frequencies with the resolution Bandwidth set at 30 kHz (video bandwidth set at 100 kHz) while the span was set at 3 MHz. The bandwidth was measured using the analyzer's marker function.

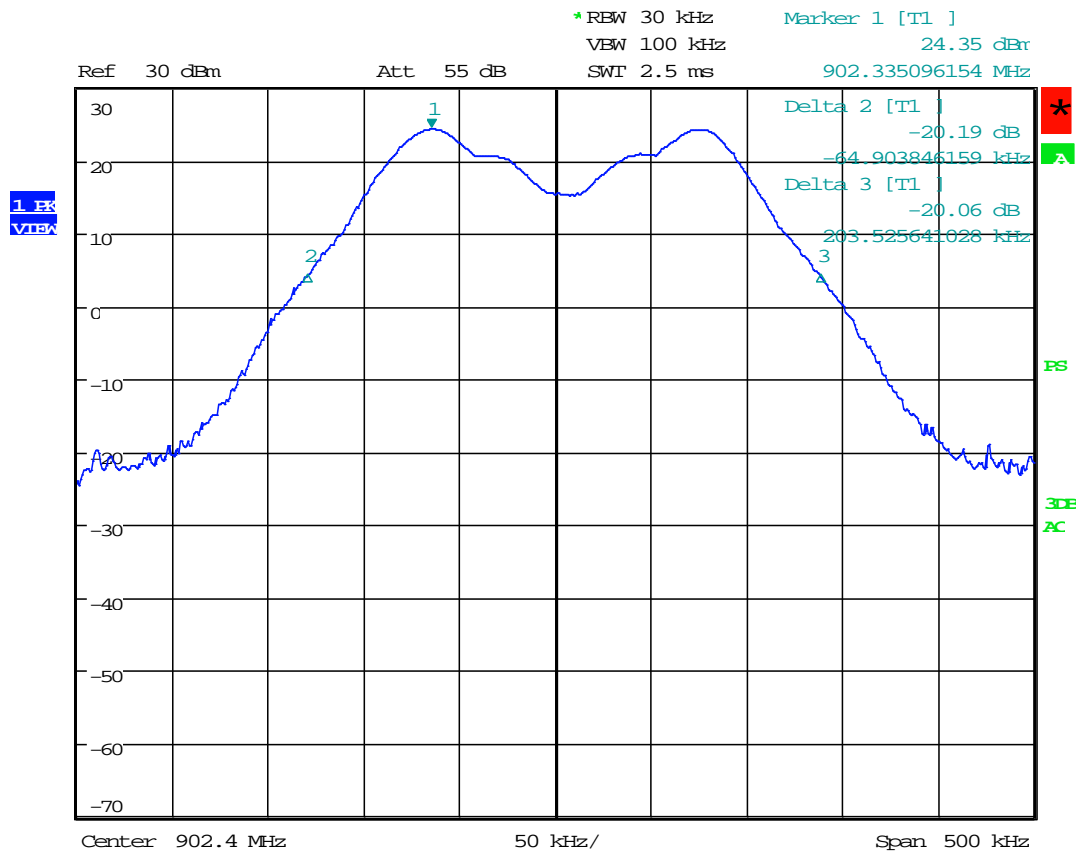
99% Bandwidth measurements were made with the resolution bandwidth set to 5 kHz.



## 7.2 Occupied Bandwidth Test Data

Test Date:	2024-01-11; 2024-04-26	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	21.3°C
		Relative Humidity:	37%

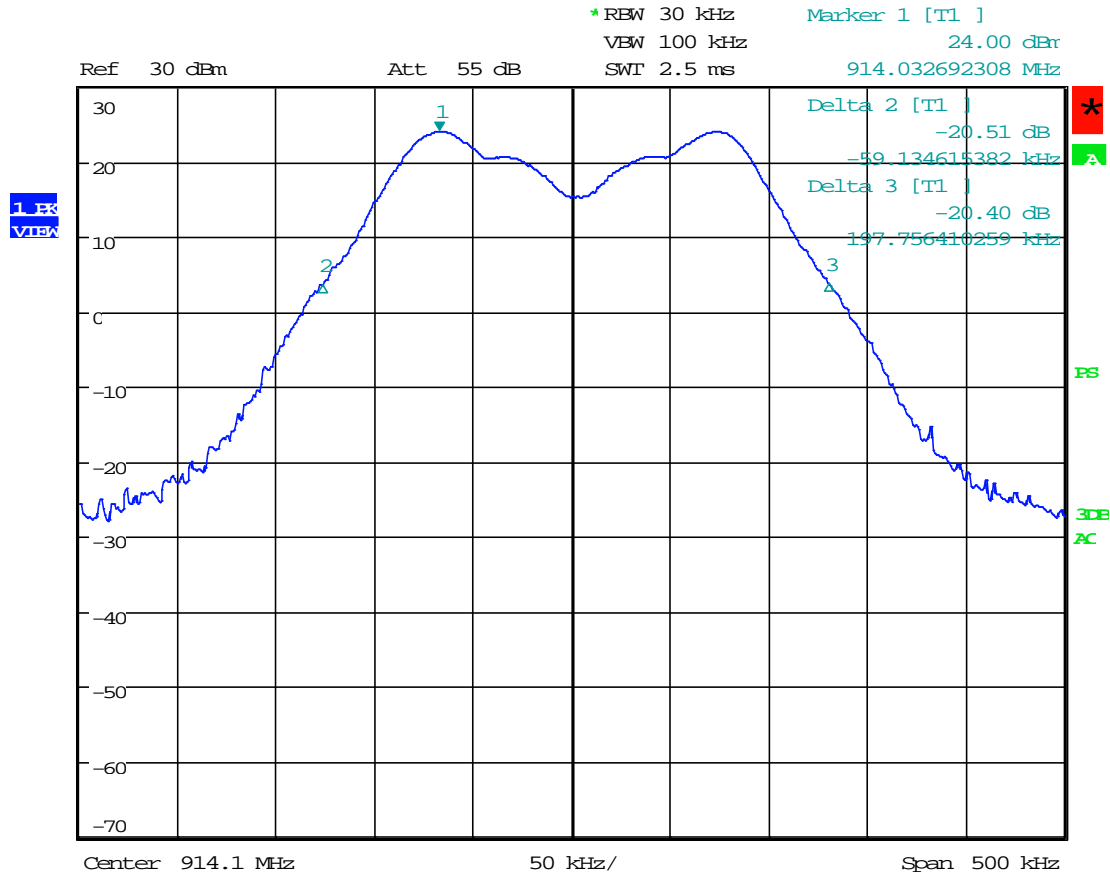
### -20dB: Low Channel



Date: 11.JAN.2024 13:50:34



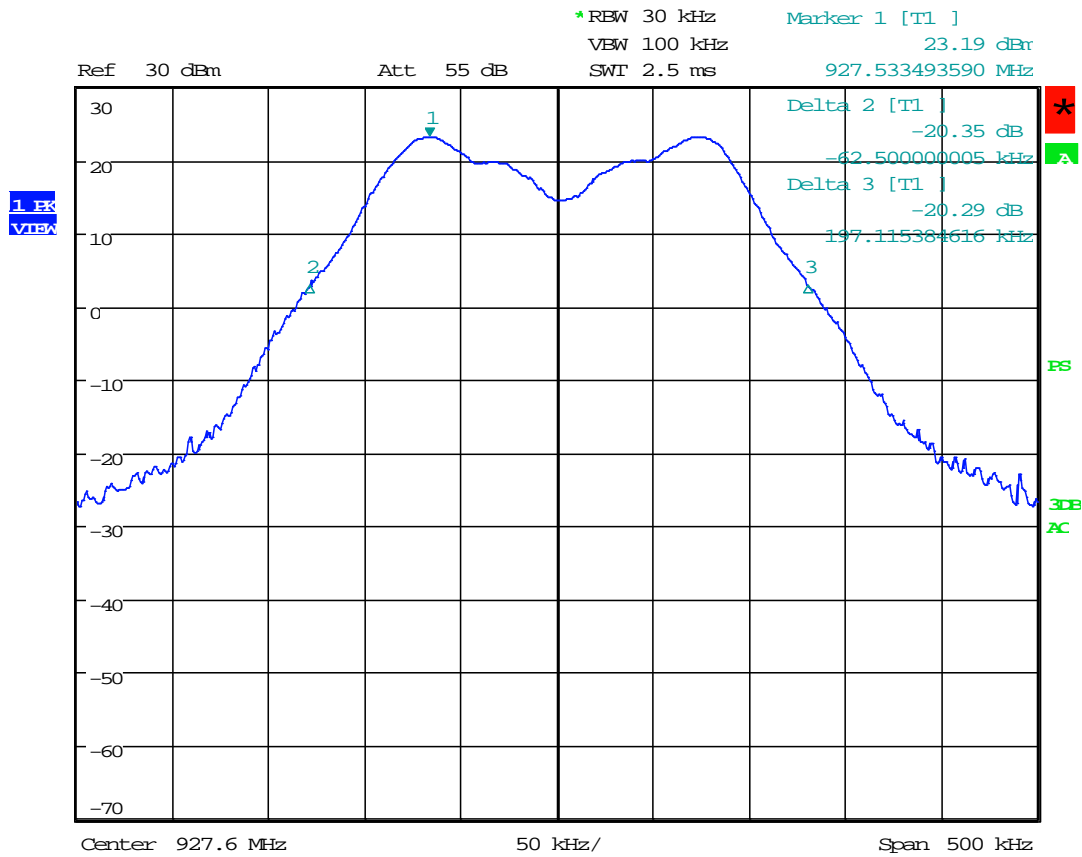
### -20dB: Mid Channel



Date: 11.JAN.2024 13:56:31



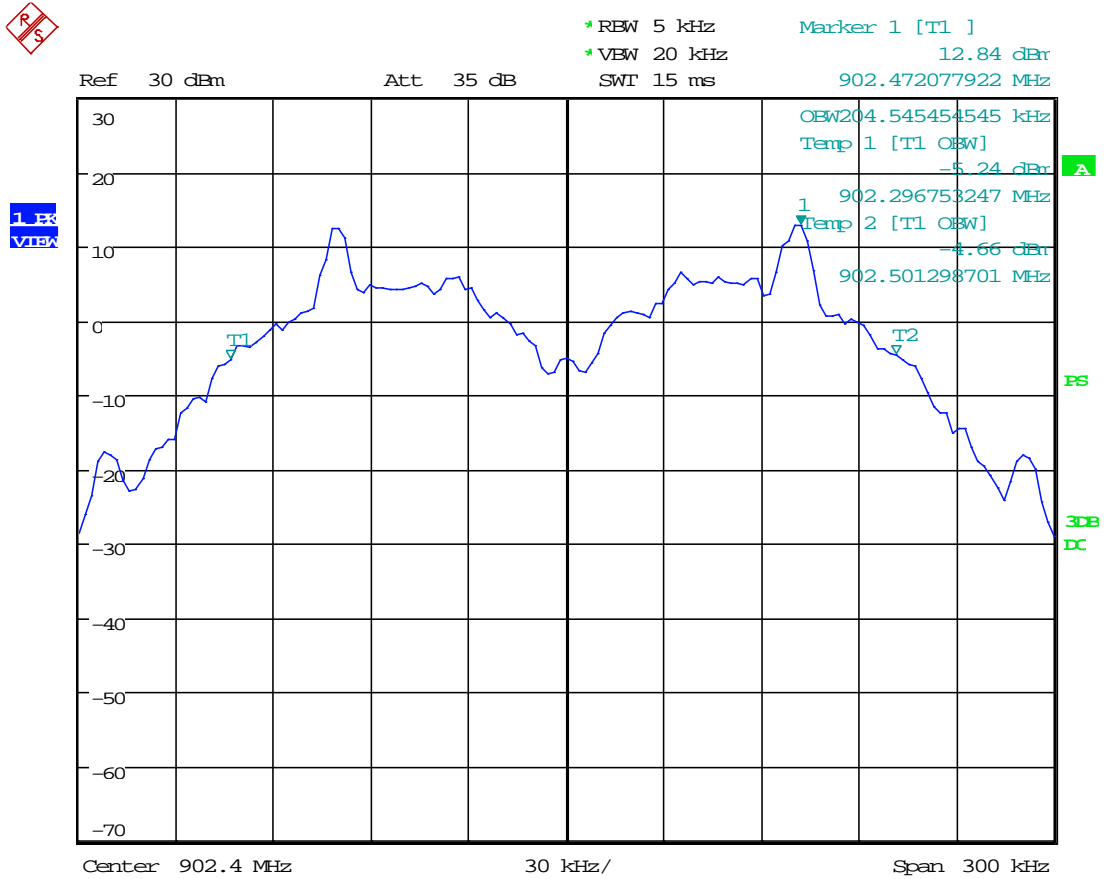
### -20dB: High Channel



Date: 11.JAN.2024 13:59:46



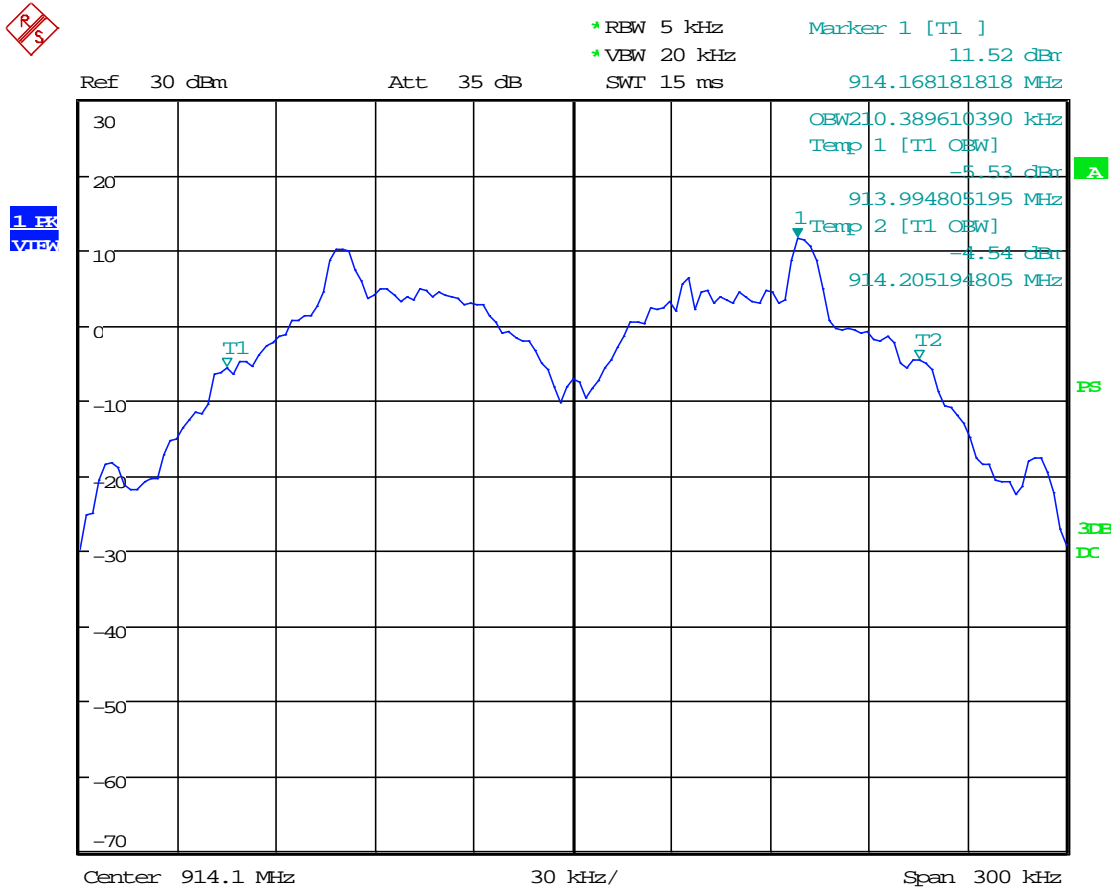
### 99%: Low Channel



Date: 26.APR.2024 10:22:27



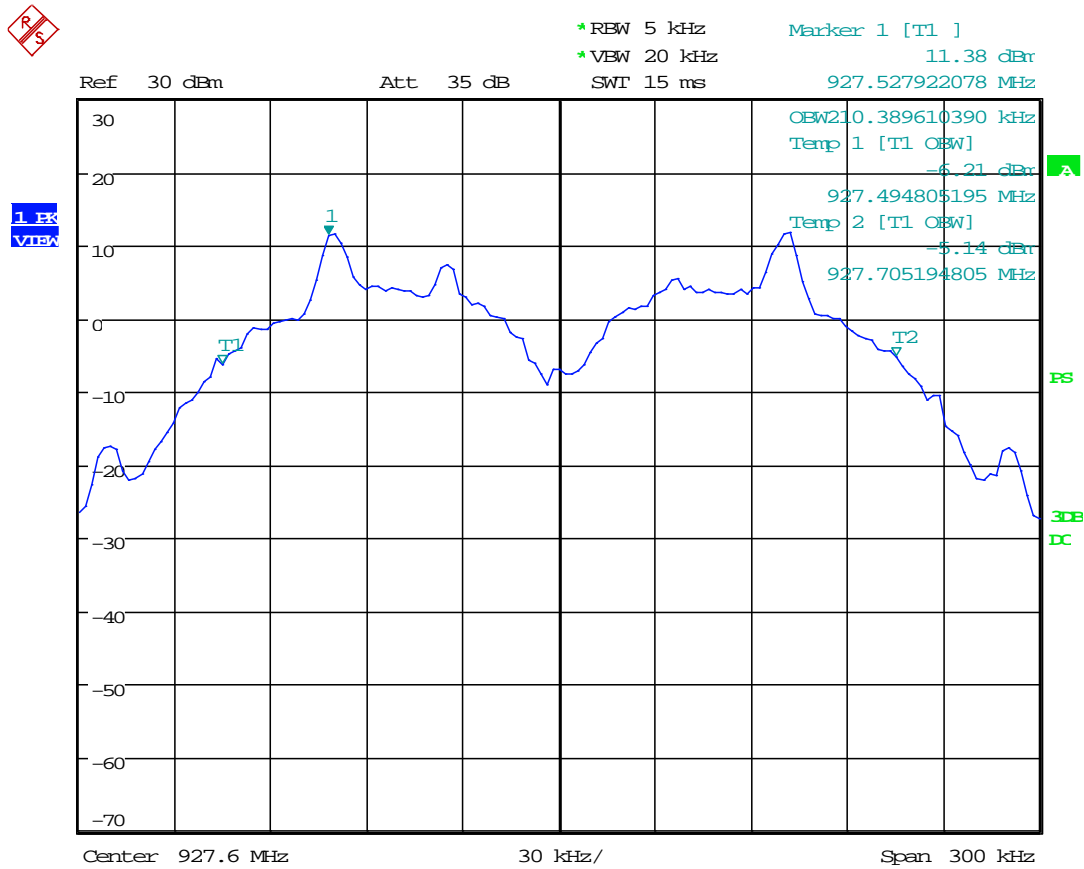
99%: Mid Channel



Date: 26.APR.2024 10:23:52



### 99%: High Channel



Date: 26.APR.2024 10:28:51





## **8 CONDUCTED OUTPUT POWER**

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the receiver. The peak power output was measured.

### **8.1 Requirements:**

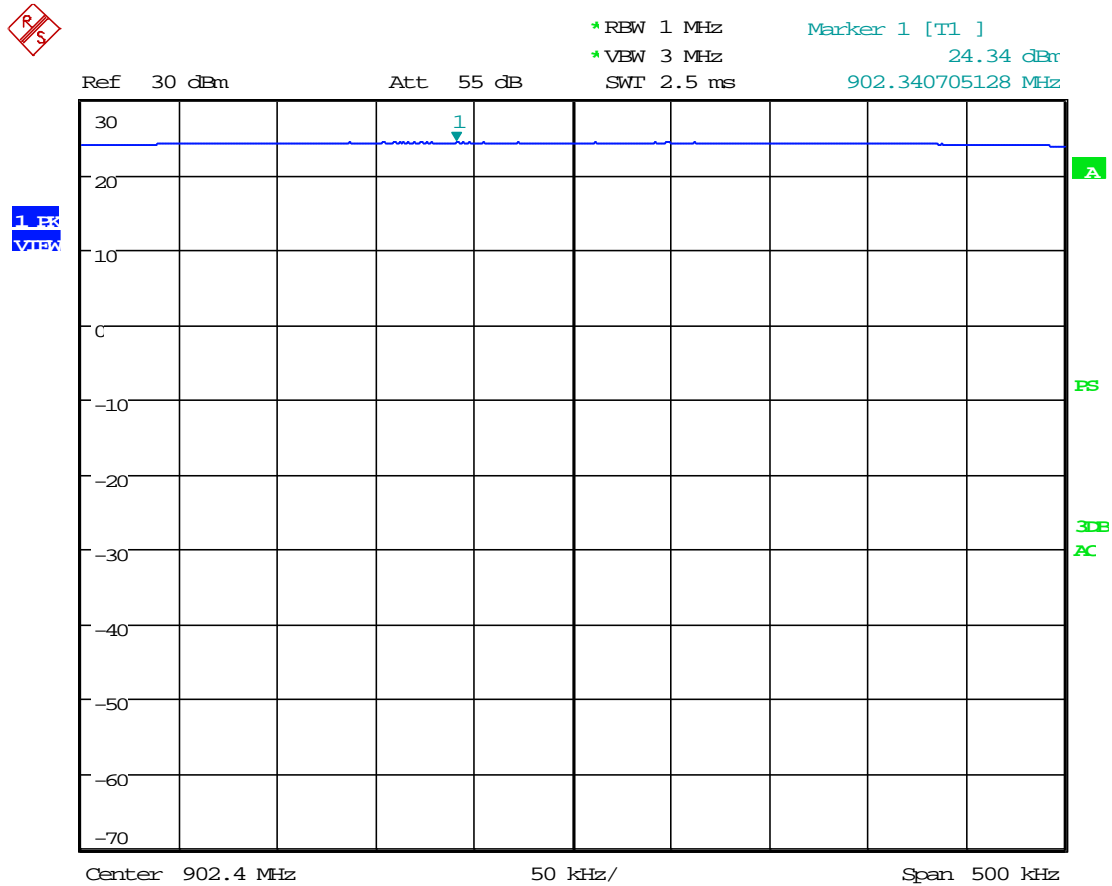
The peak power output shall be 1 watt (30 dBm) or less when using an antenna with a gain of less than 6dBi. For antennas having a gain of more than 6dBi, the limit is reduced by 1dB for every dB the antenna gain is over 6dBi.



## 8.2 Conducted Output Power Test Data

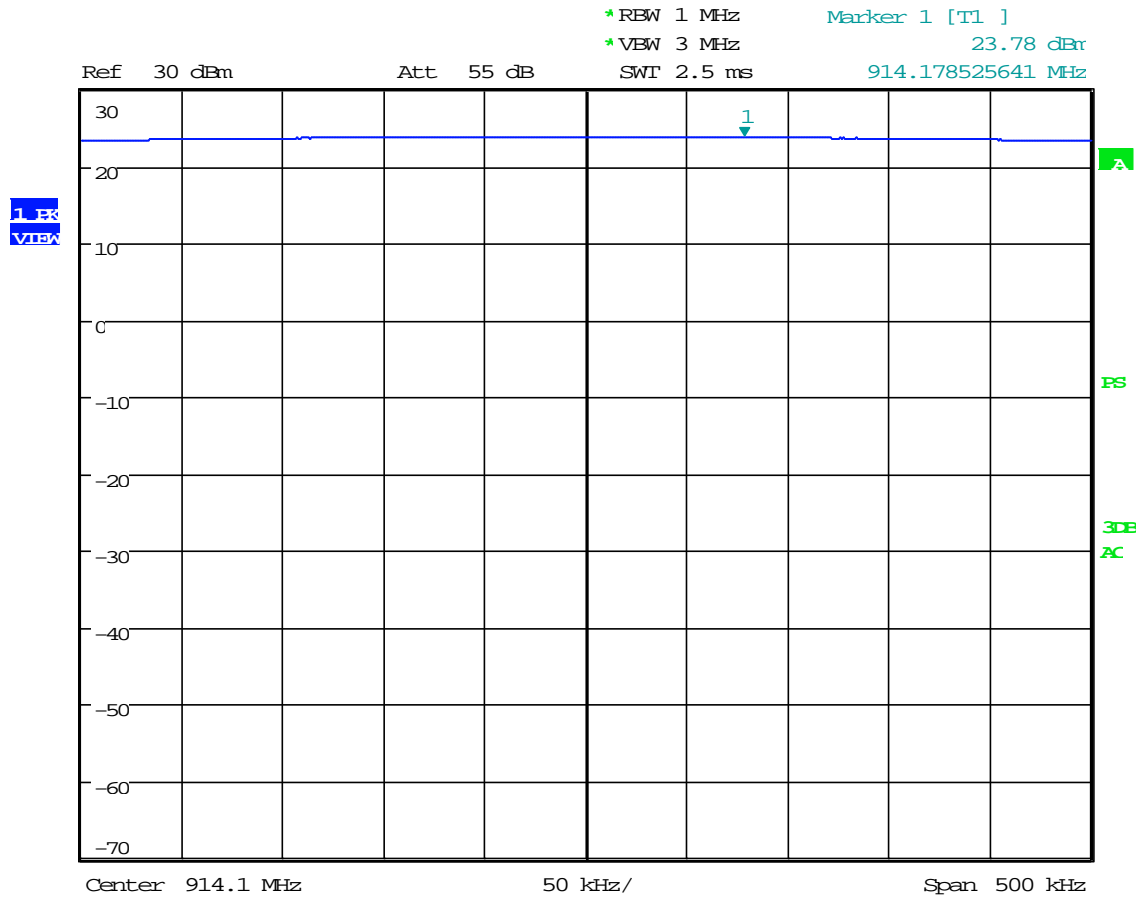
Test Date:	2024-01-24	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	Air Temperature:	21.3°C
		Relative Humidity:	37%

### Low Channel





### Mid Channel



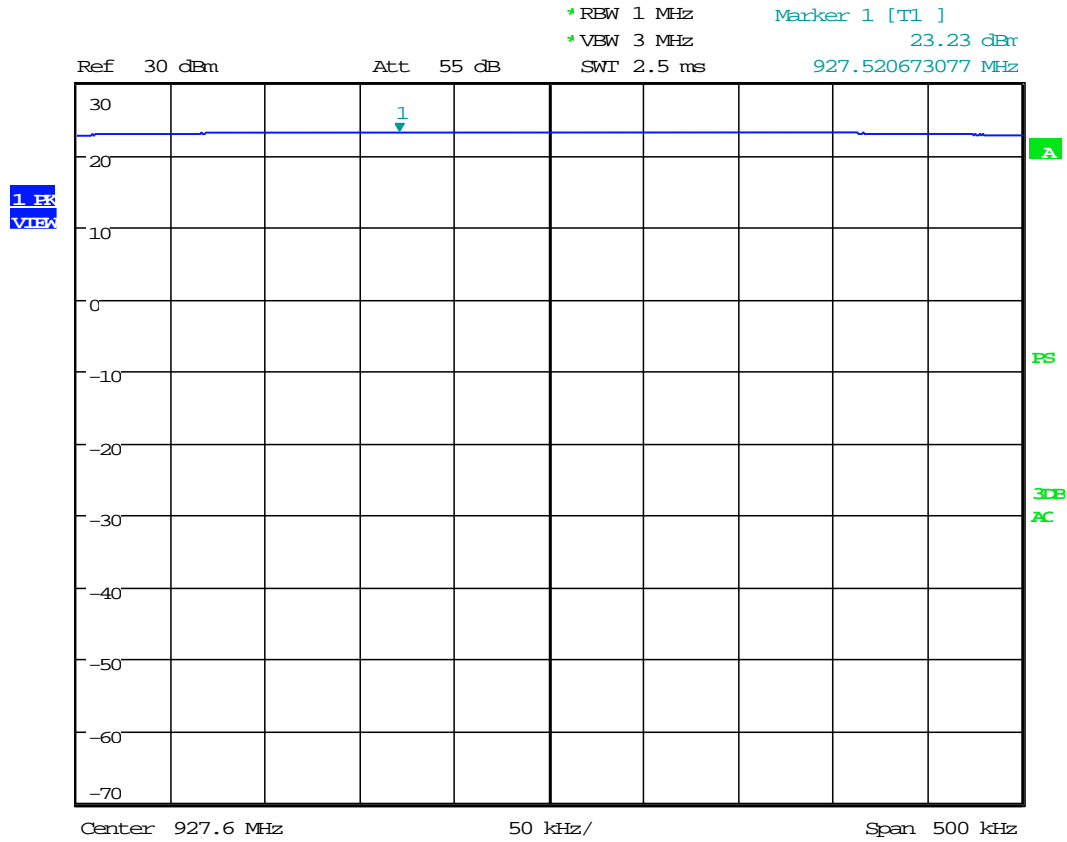
Date: 11.JAN.2024 14:10:39



Order No(s): F2P30751A-C2

Applicant: Runwise, Inc.  
Model: V3.1

## High Channel



Date: 11.JAN.2024 14:07:15



## **9 VOLTAGE VARIATIONS**

### **9.1 Requirements**

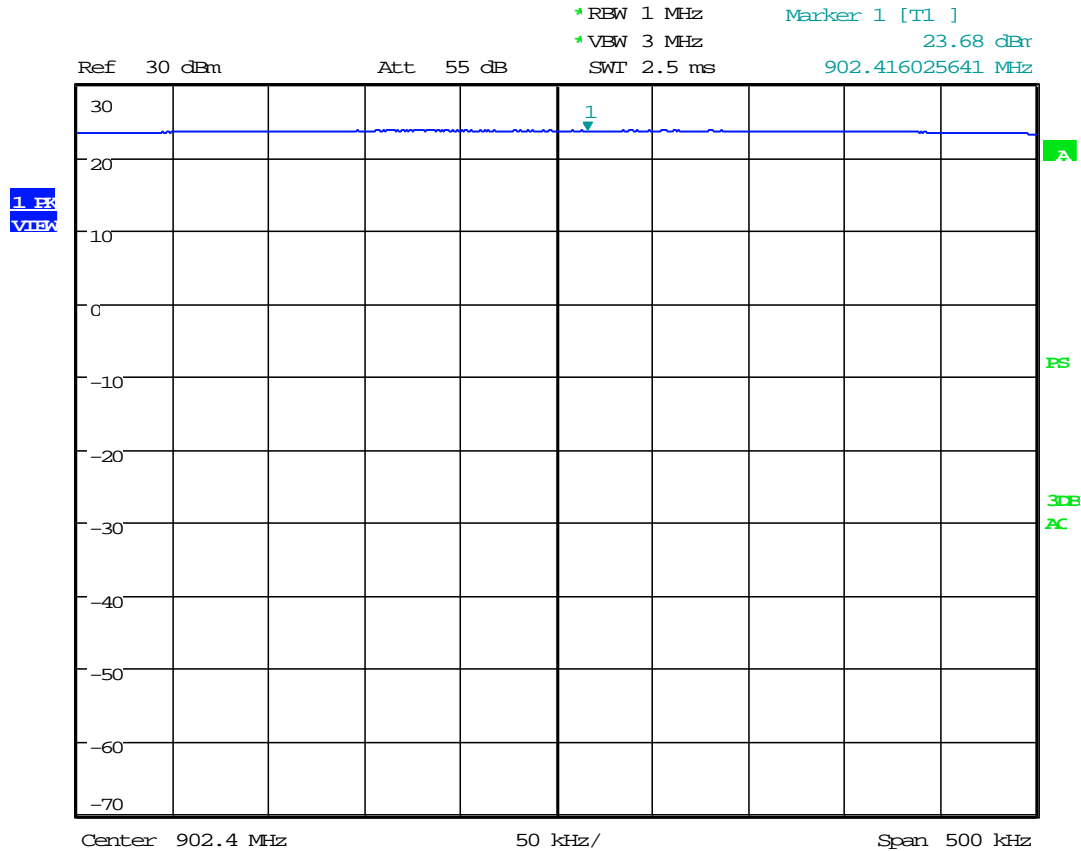
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.



## 9.2 Voltage Variations Test Data

Test Date(s):	2024-01-11	Test Engineer:	J. Chiller
Rule:	15.31(e)	Air Temperature:	21.5° C
Test Results:	Complies	Relative Humidity:	37%

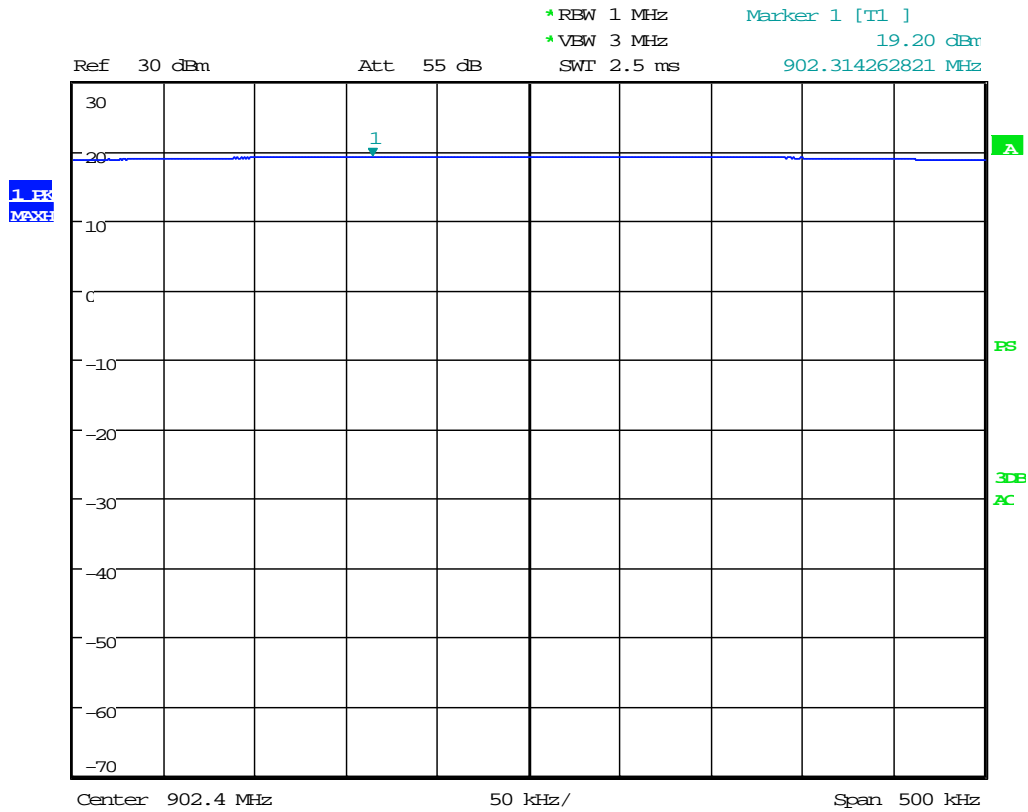
Nominal Voltage: 3.3VDC



Date: 11.JAN.2024 14:22:45



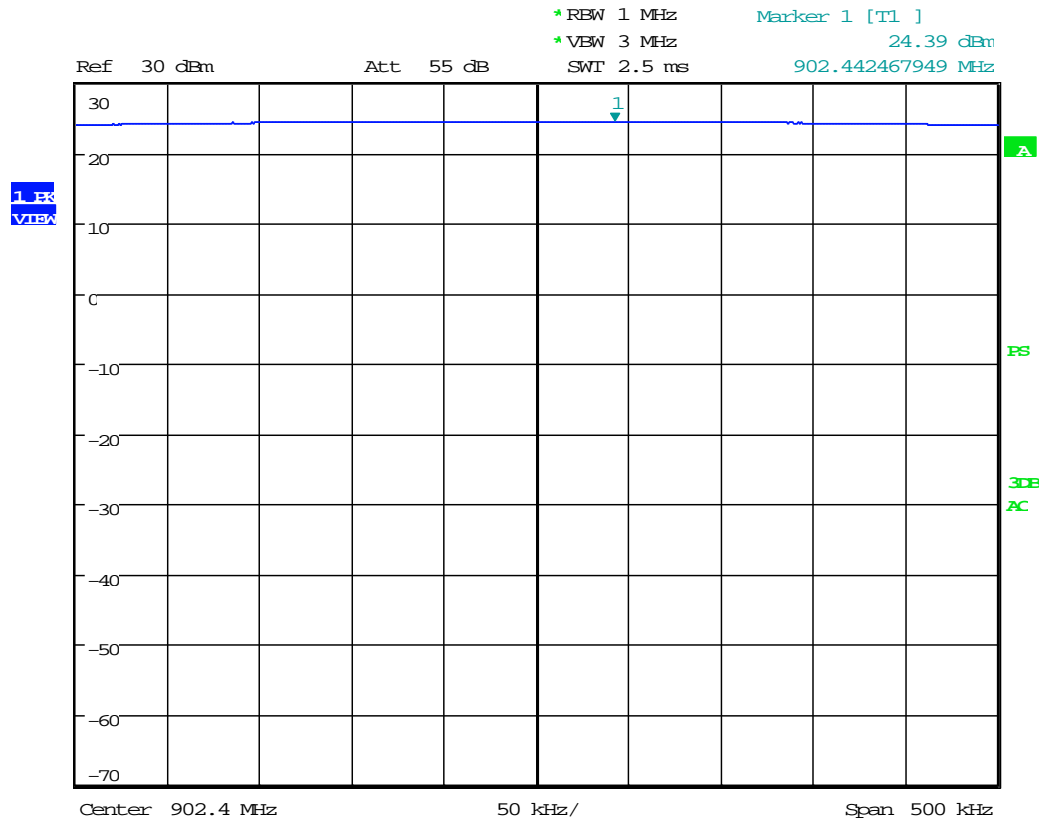
-15%: 2.7VDC



Date: 11.JAN.2024 14:24:54



+15%: 3.8VDC



Date: 11.JAN.2024 14:25:49





## 10 CONDUCTED SPURIOUS EMISSIONS

The following tests were performed to demonstrate compliance.

### RF Antenna Conducted Test

The EUT antenna port was fitted with an SMA connector and directly connected to the input of the spectrum analyzer.

#### 10.1 Requirements:

All Spurious Emissions must be at least 20dB down from the highest emission level measured within the authorized band up through the tenth harmonic.

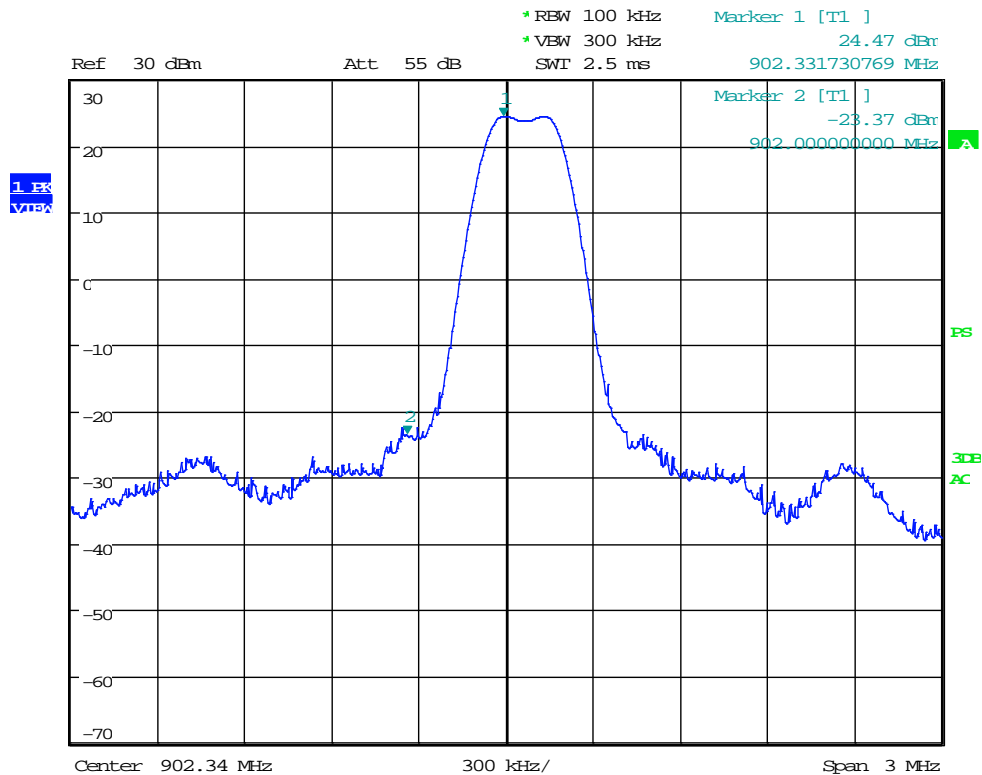
Spurious emissions measurements were made at the low, mid, and upper channels with the appropriate spectrum analyzer impulse bandwidth. Additionally, 20dB down points were measured for the low and high channels to verify band edge compliance.



## 10.2 Conducted Spurious Emissions Test Data

Test Date:	2024-01-11	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(d) / Part 15.207 KDB558074	Air Temperature:	21.5°C
Results:	Complies	Relative Humidity:	37%

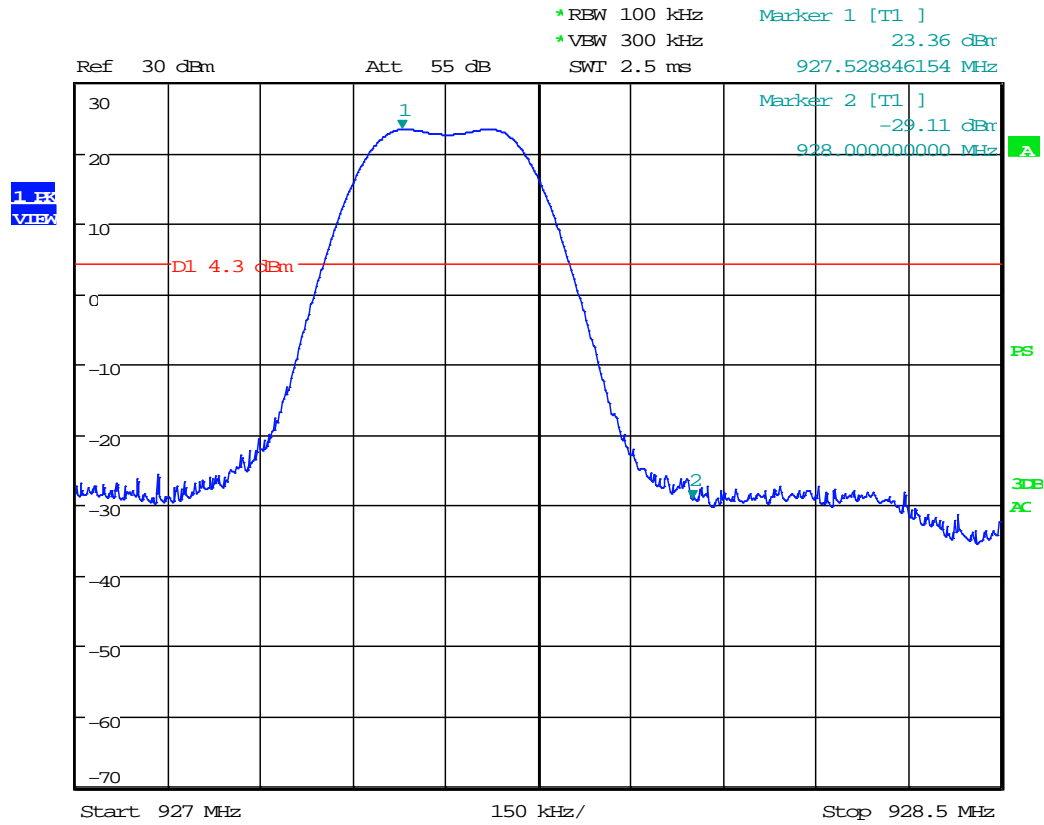
### Low Band Edge



Date: 11.JAN.2024 14:36:50



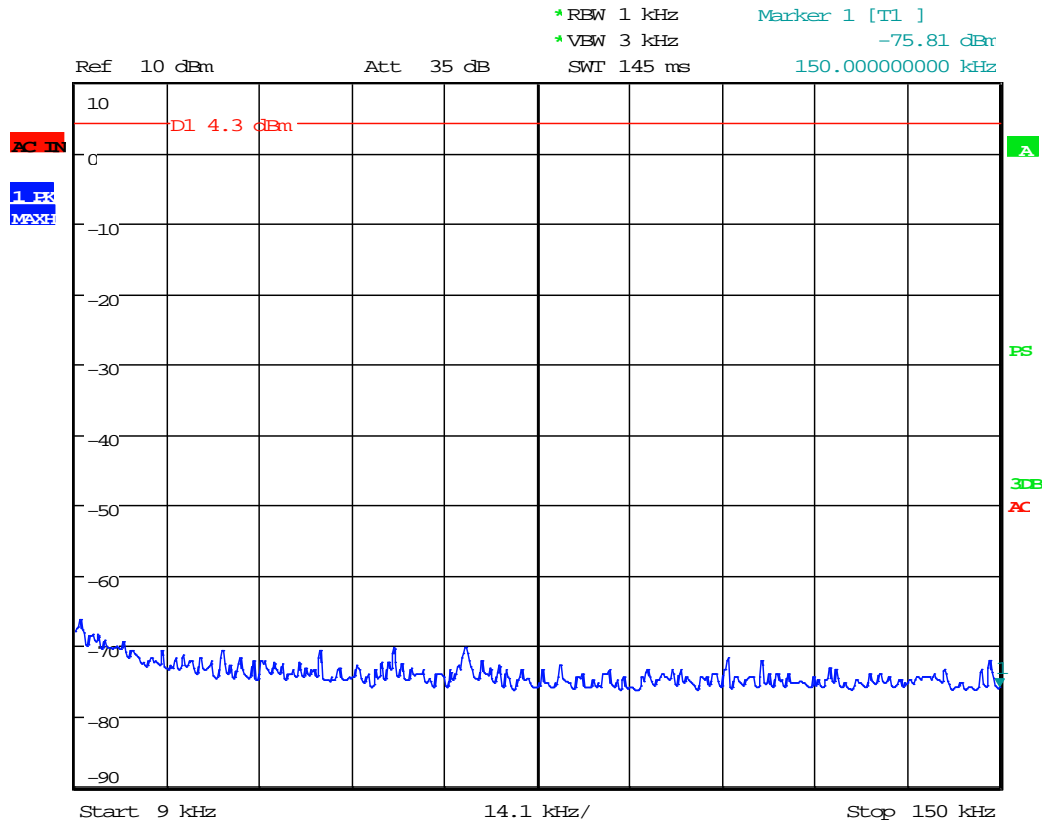
## Upper Band Edge



Date: 11.JAN.2024 14:48:41



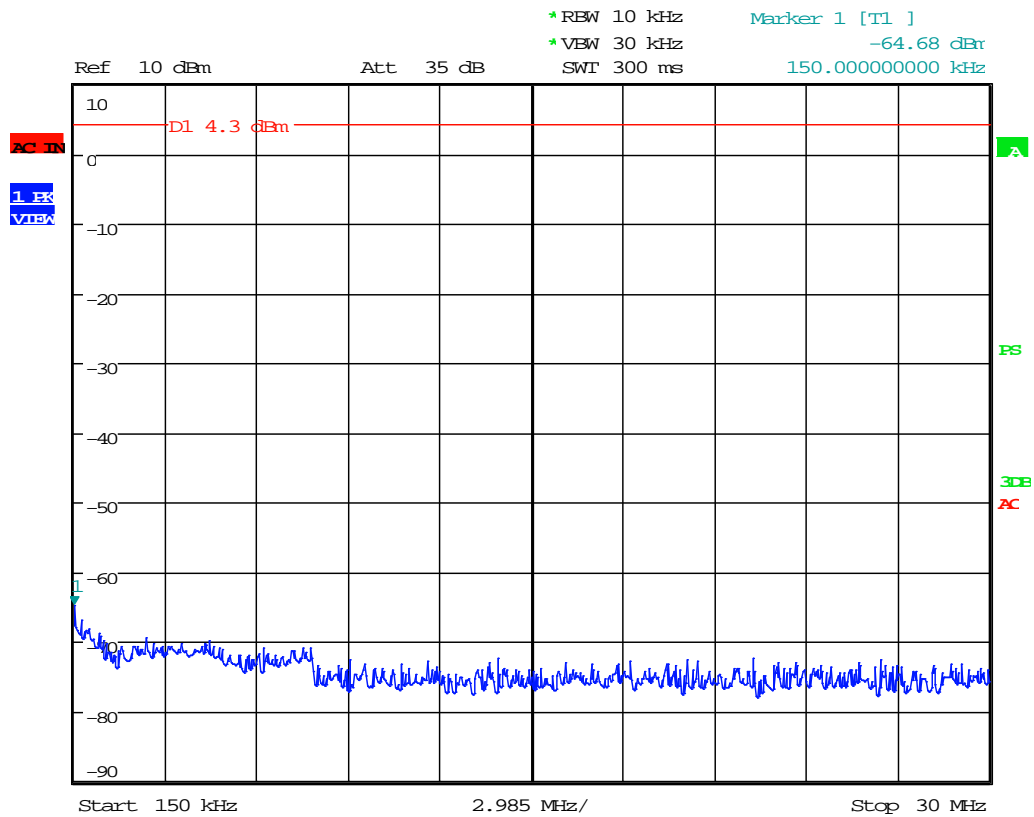
Low Channel: 0.009 MHz to 0.15 MHz



Date: 11.JAN.2024 14:31:29



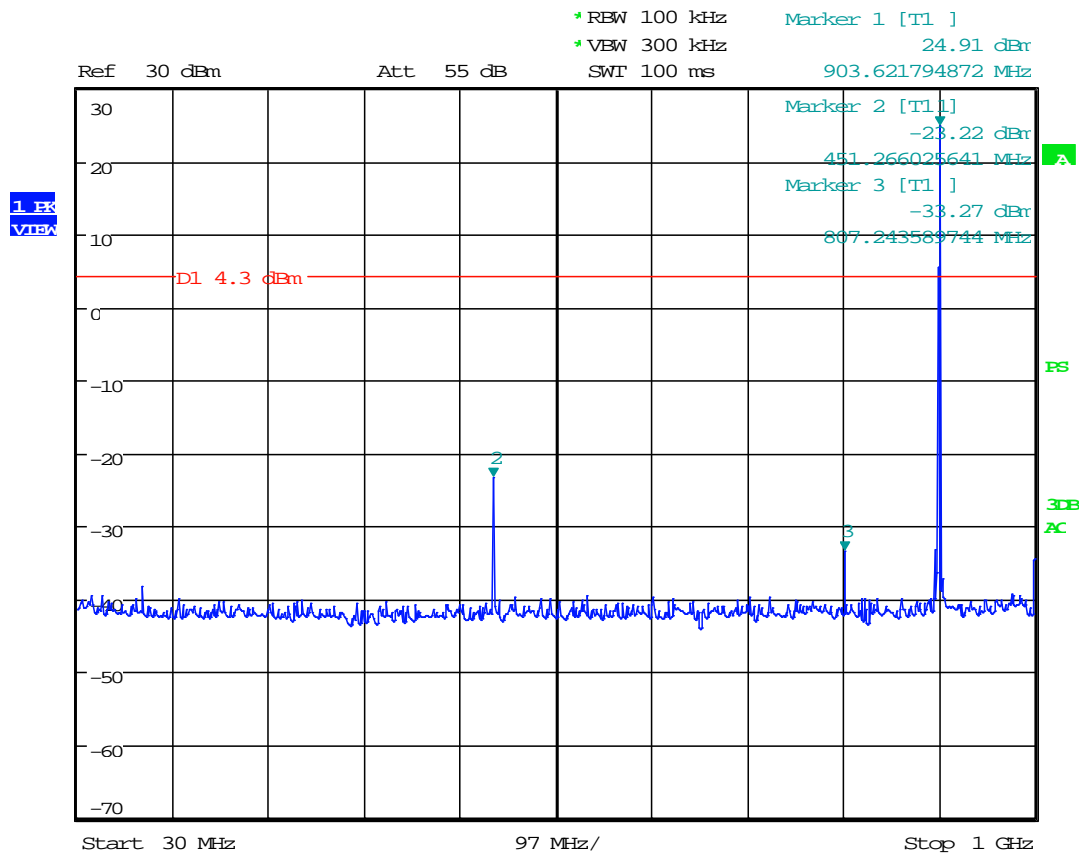
### Low Channel: 0.15 MHz to 30 MHz



Date: 11.JAN.2024 14:32:01



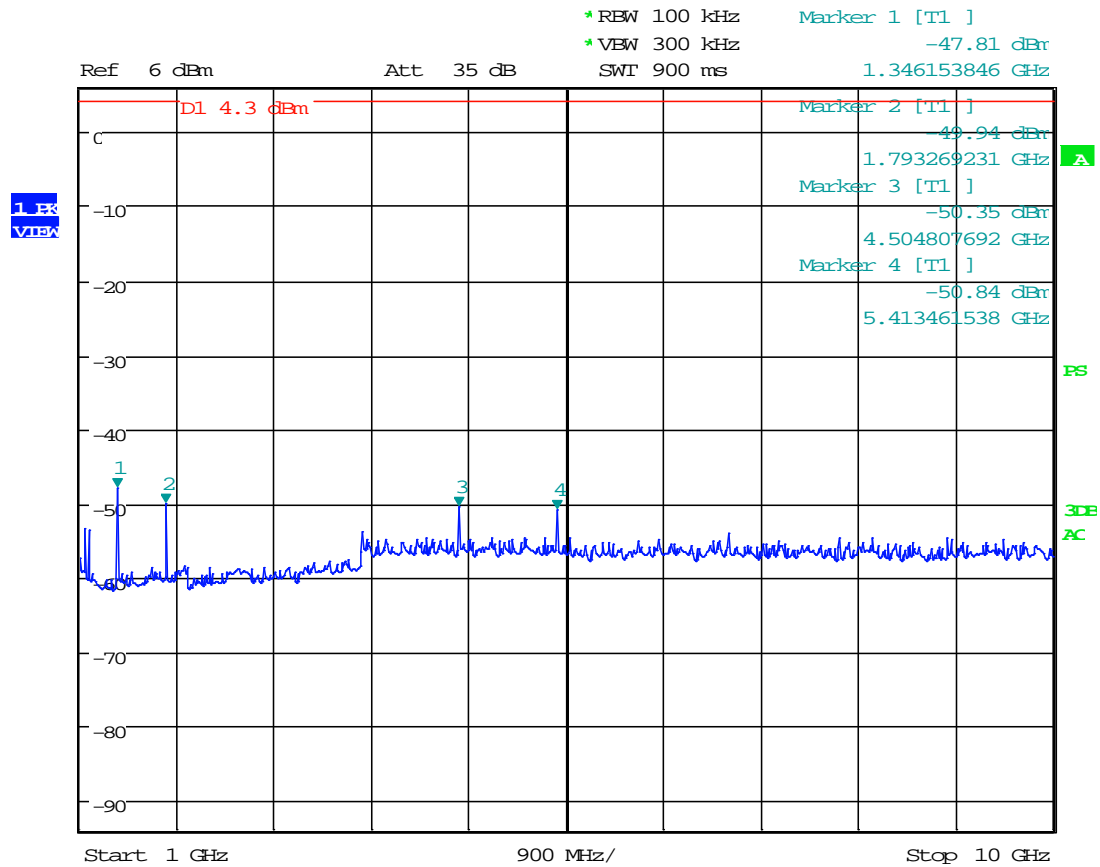
### Low Channel: 30 MHz to 1000 MHz



Date: 11.JAN.2024 14:33:15



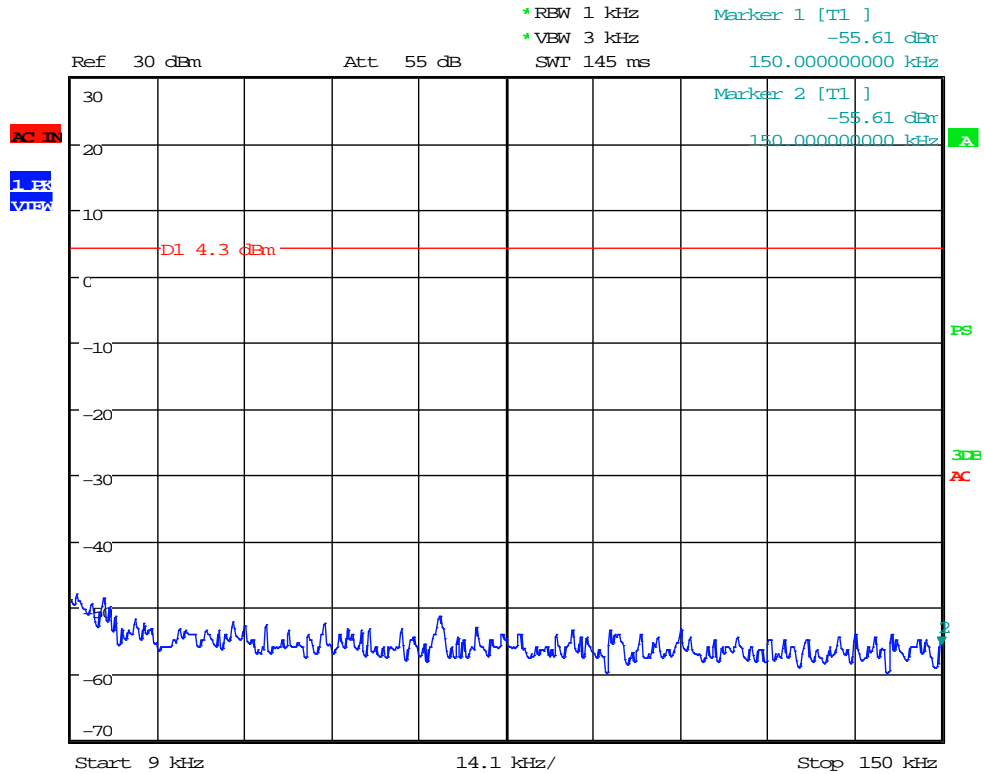
### Low Channel: 1 GHz to 10 GHz



Date: 11.JAN.2024 14:34:35



### Mid Channel: 0.009 MHz to 0.15 MHz

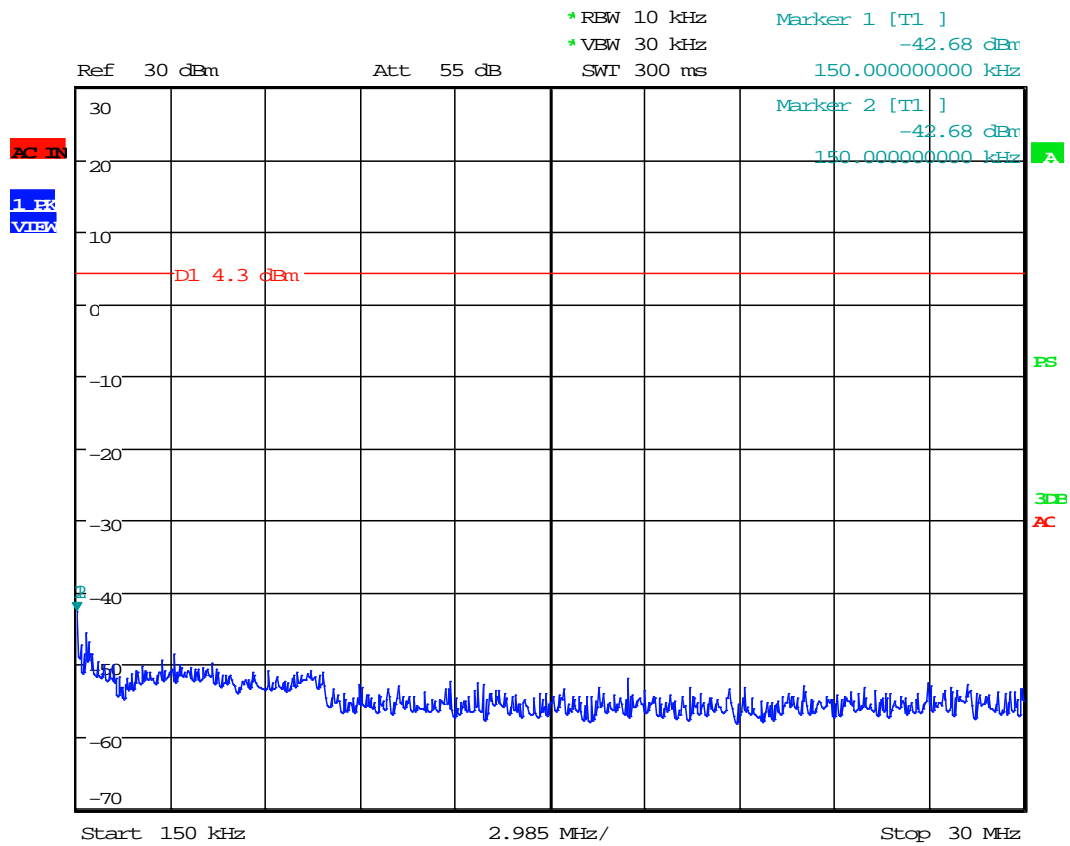


Date: 11.JAN.2024 14:38:38





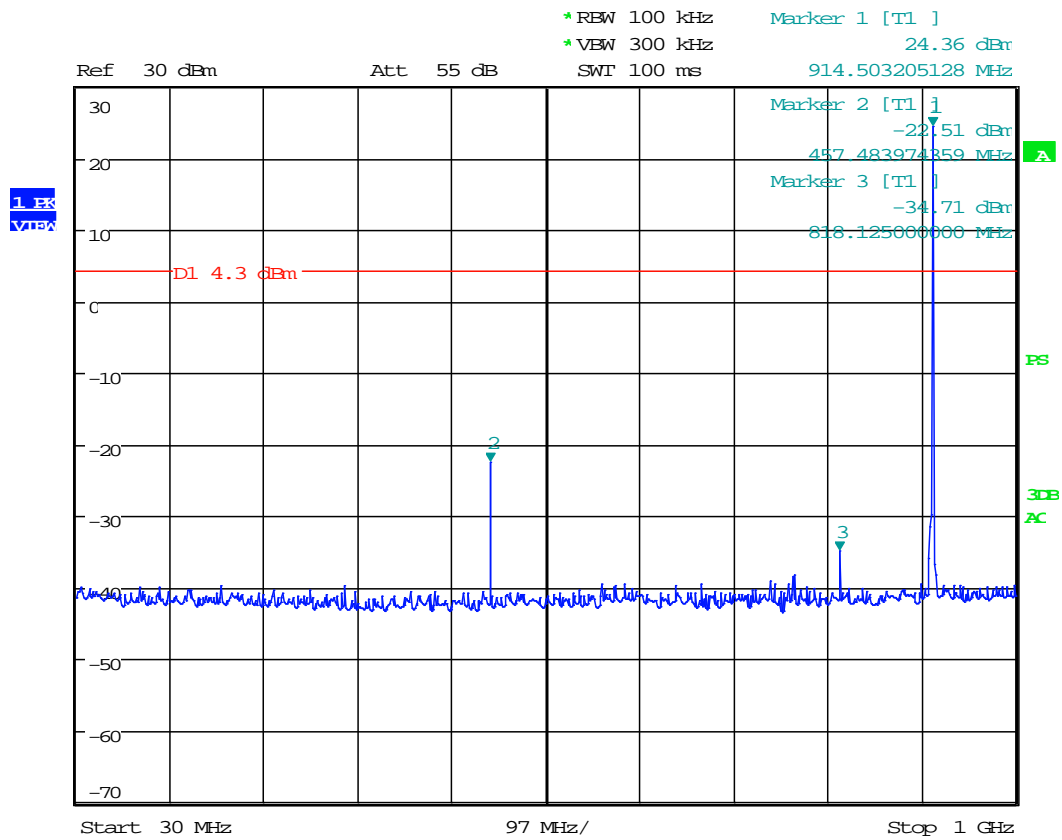
Mid Channel: 0.15 MHz to 30 MHz



Date: 11.JAN.2024 14:39:12



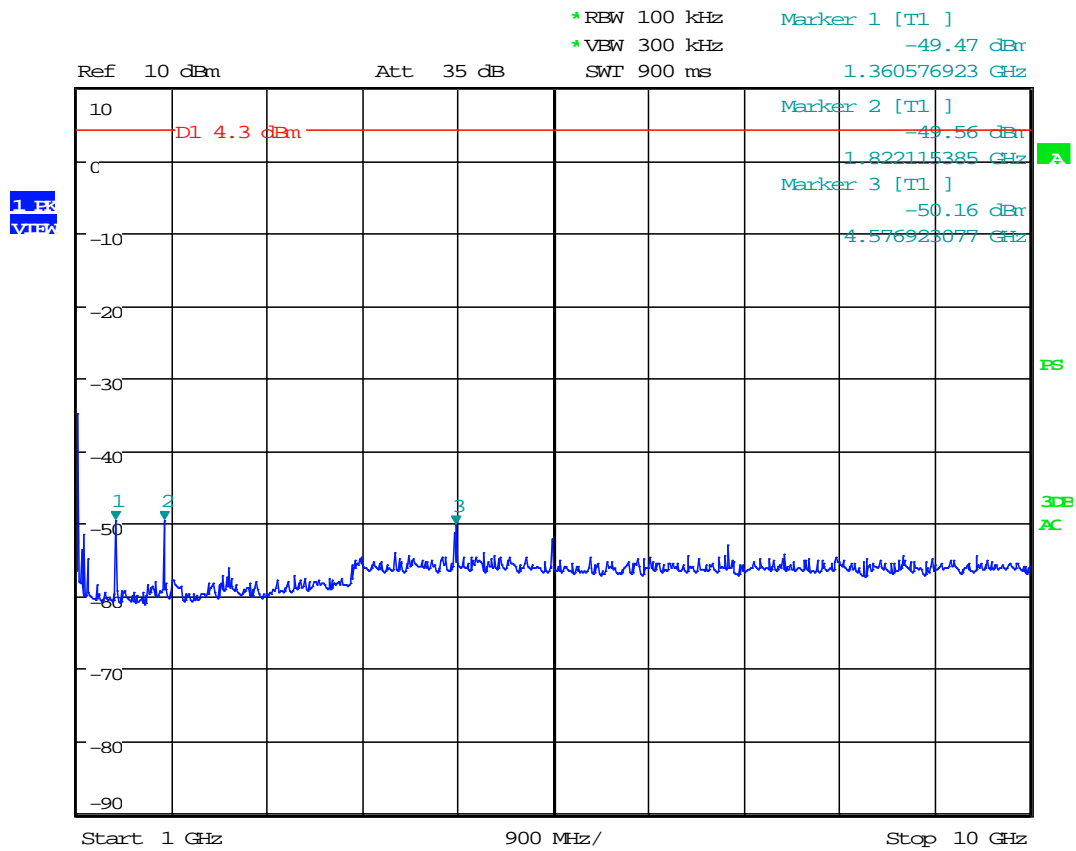
### Mid Channel: 30 MHz to 1000 MHz



Date: 11.JAN.2024 14:40:12



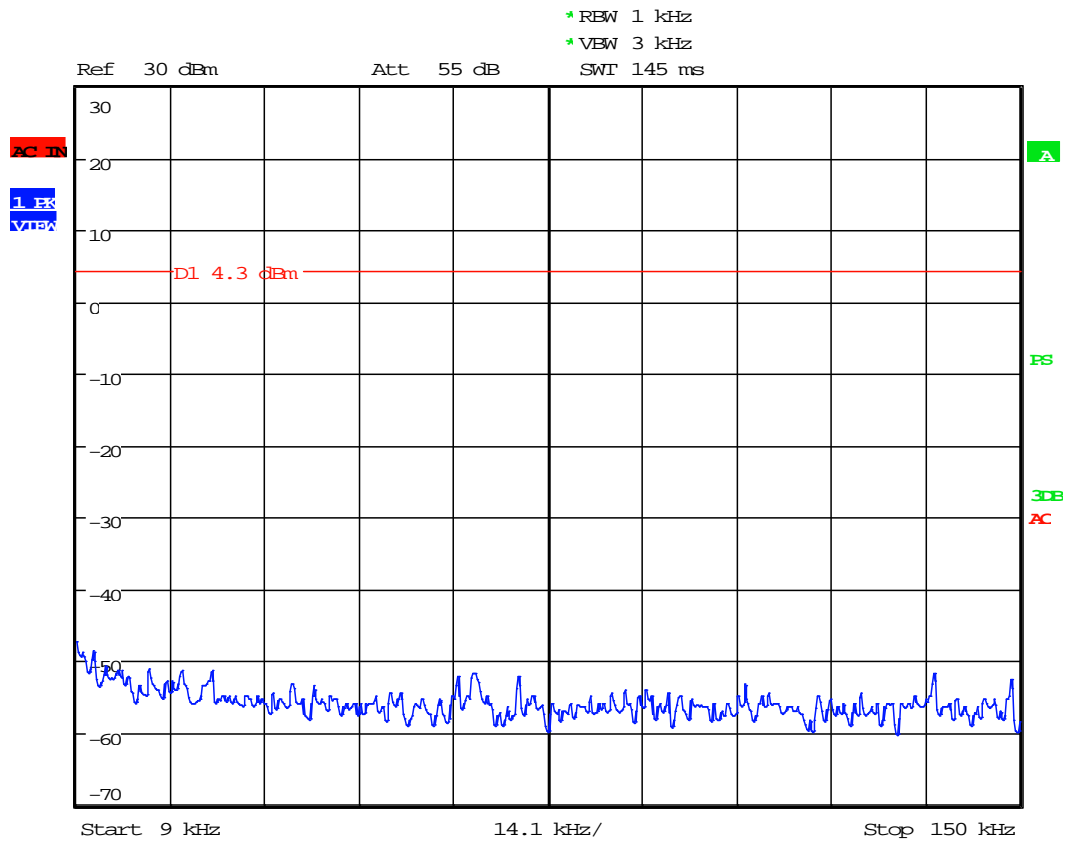
### Mid Channel: 1 GHz to 10 GHz



Date: 11.JAN.2024 14:41:31



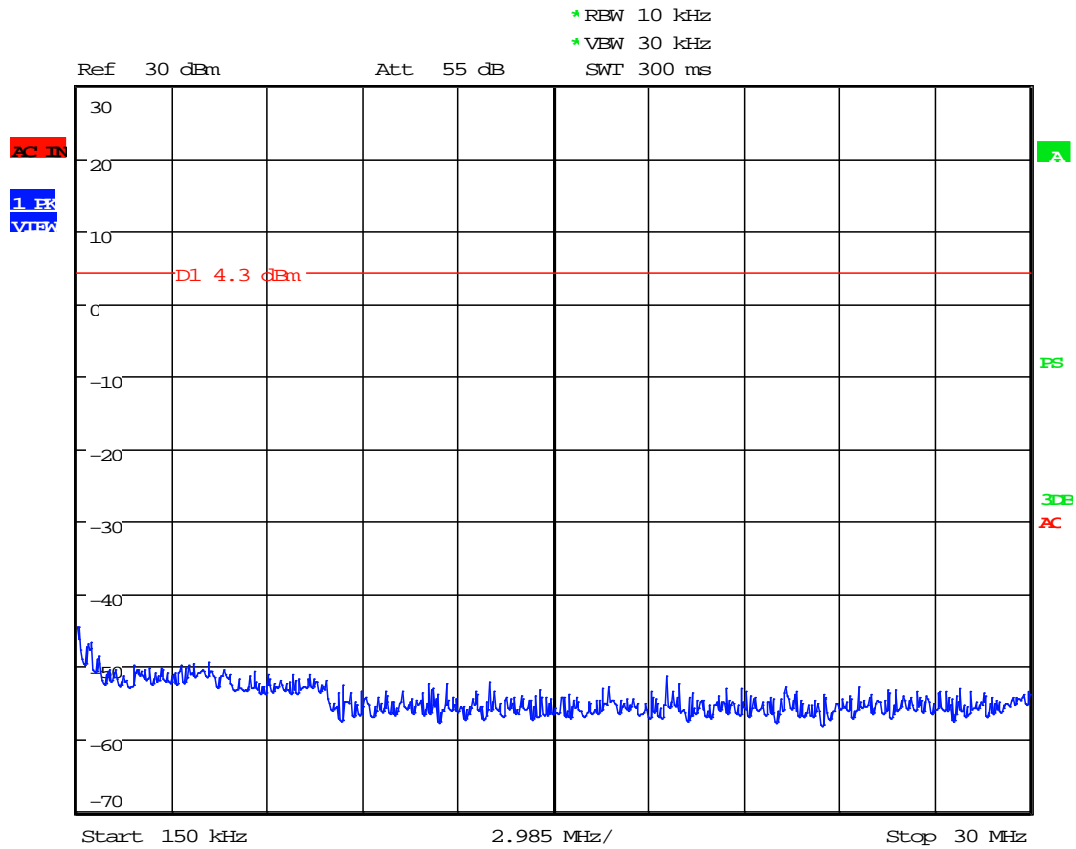
### High Channel: 0.009 MHz to 0.15 MHz



Date: 11.JAN.2024 14:44:35



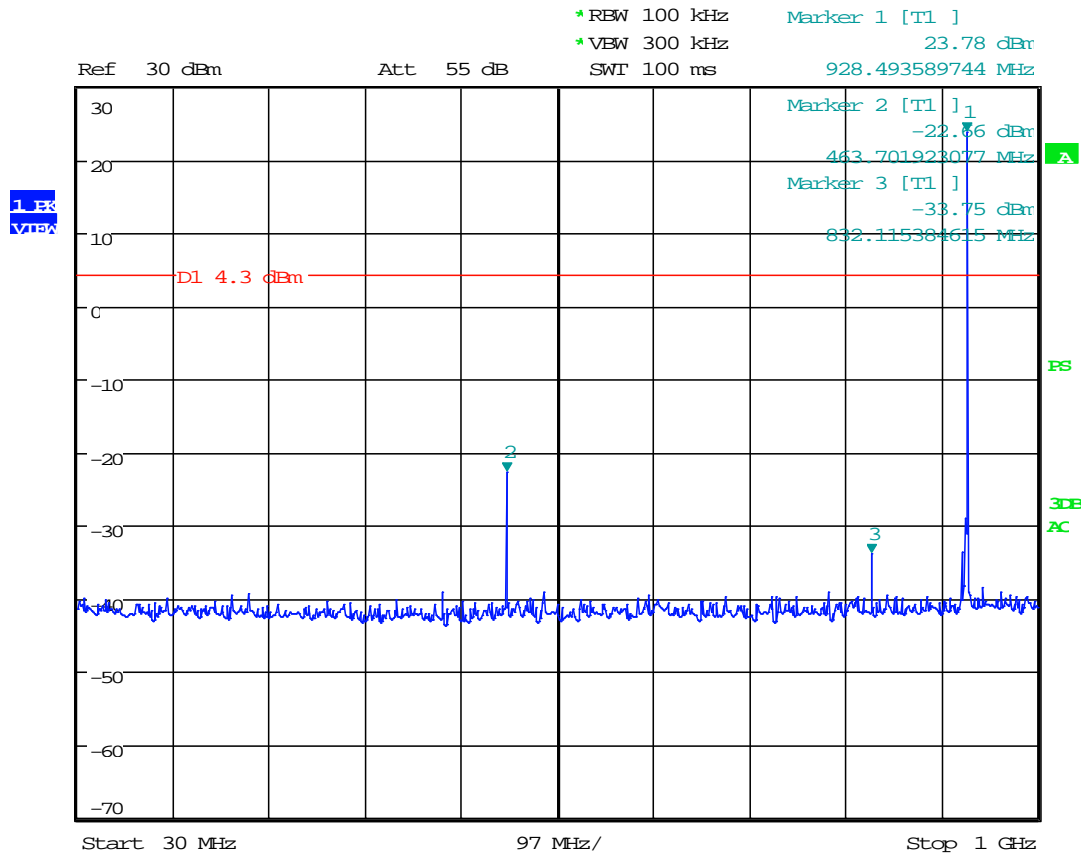
### High Channel: 0.15 MHz to 30 MHz



Date: 11.JAN.2024 14:45:16



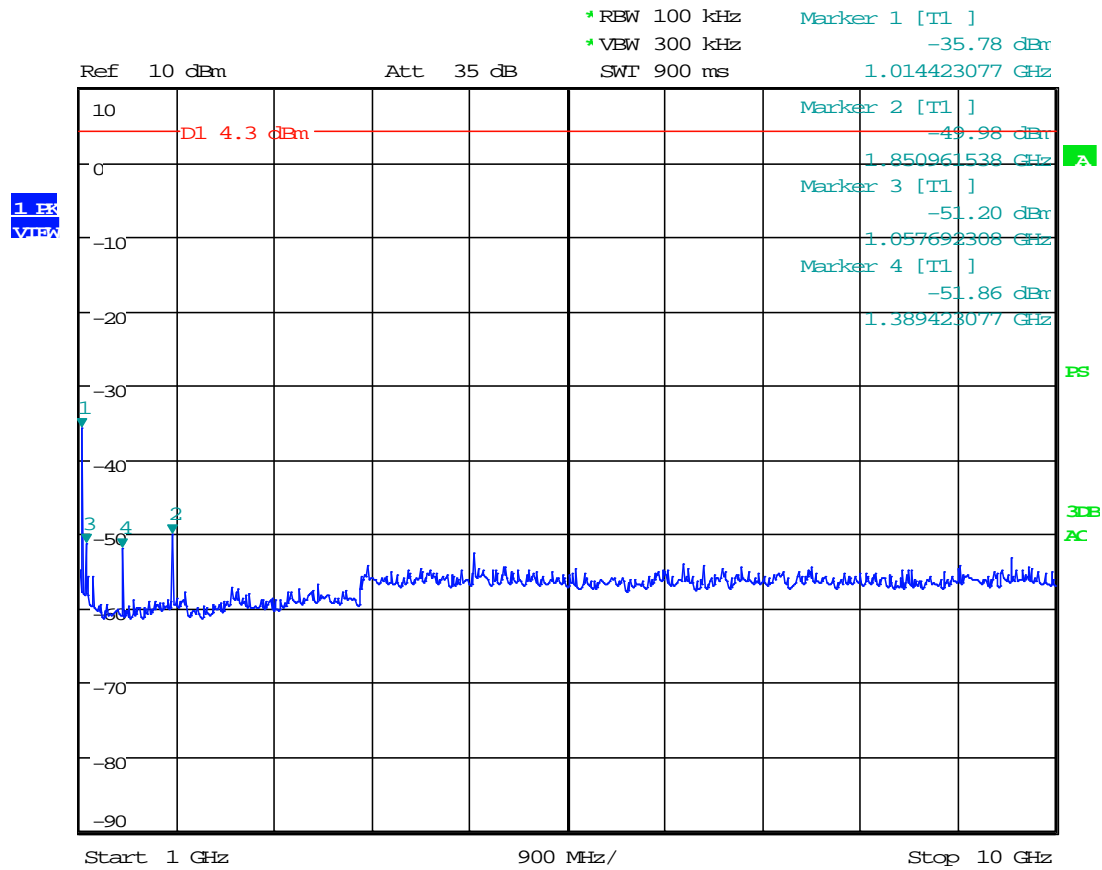
### High Channel: 30 MHz to 1000 MHz



Date: 11.JAN.2024 14:46:10



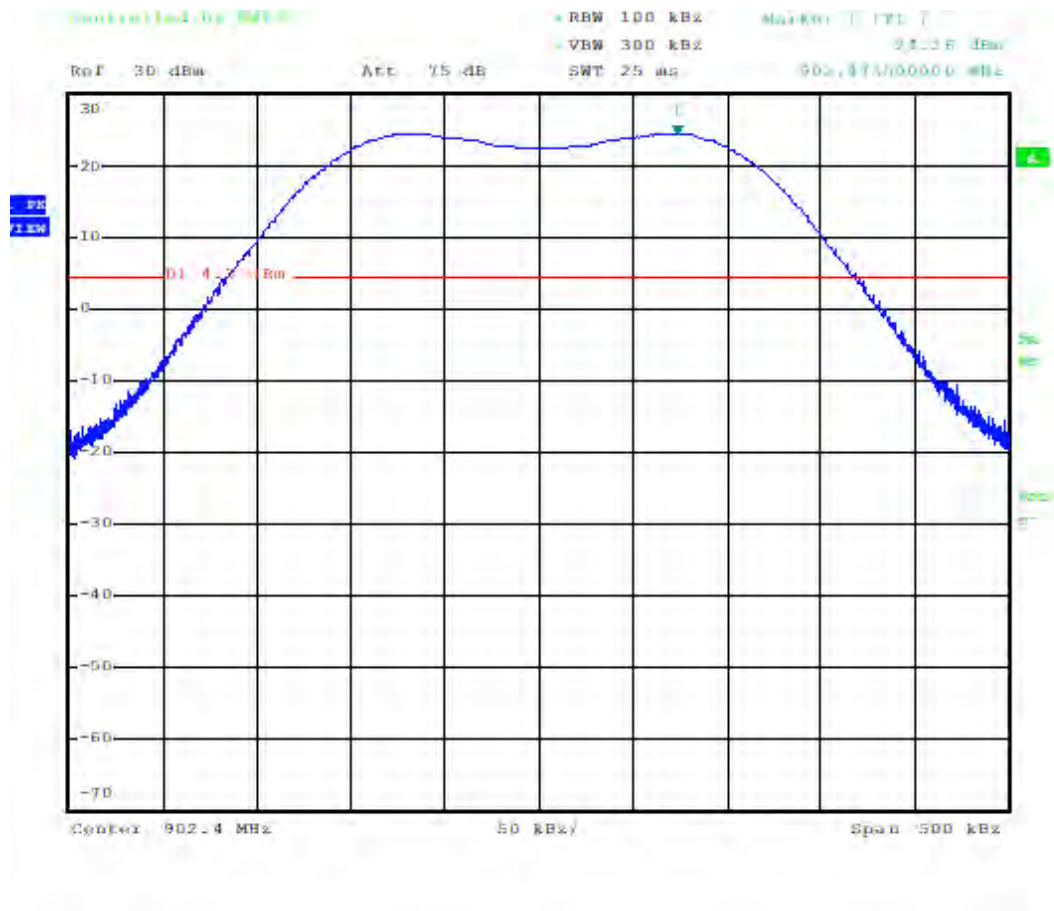
### High Channel: 1 GHz to 10 GHz



Date: 11.JAN.2024 14:47:27



### Spur Reference – 20 dBc







## 11 RADIATED SPURIOUS EMISSIONS

The EUT antenna port was fitted with its 3.9dBi gain Monopole Antenna. Radiated emissions were measured in a Semi-Anechoic Chamber. All emissions generated that fall in the restricted bands per FCC Part 15.205 were examined.

### 11.1 Requirements:

All emissions that fall in the restricted bands defined in FCC Part 15.205 shall not exceed the maximum field strength listed in FCC Part 15.209(a).

Scans were performed from 9kHz to 10 GHz at the low, mid, and high channels and the mid channel was determined to be the worst case. The tables of measured results follow in data presented and include measurements from all channels.



## 11.2 Radiated Spurious Emissions Test Data

<b>Test Date(s):</b>	2024-01-11	<b>Test Engineer:</b>	J. Chiller
<b>Standards:</b>	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	<b>Air Temperature:</b>	20.0°C
		<b>Relative Humidity:</b>	36%

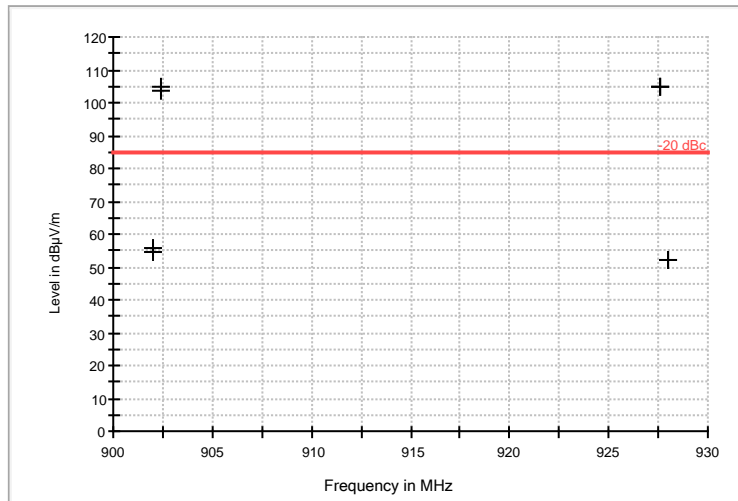
Notes: Plots are peak, max hold prescan data included only to determine what frequencies to investigate and measure. The EUT was initially placed in a semi-anechoic chamber, and rotated in all three orthogonal positions to maximize the emissions. Characterization measurements were then performed to determine at which frequencies significant emissions occurred. These graphs are shown below.

The equipment was fully exercised with all cabling attached to the EUT and was positioned on the Semi-Anechoic Chamber for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable was adjusted 360 degrees to determine the maximum field strength. The tables of measured results can be found below.

In the following plots, the black trace is the active trace and the green trace is the Max Hold amplitude during rotation. Emissions to be found by the EUT were measured and listed in tables. The plots are for reference only and the limit lines are not actual limit lines but merely a guide.

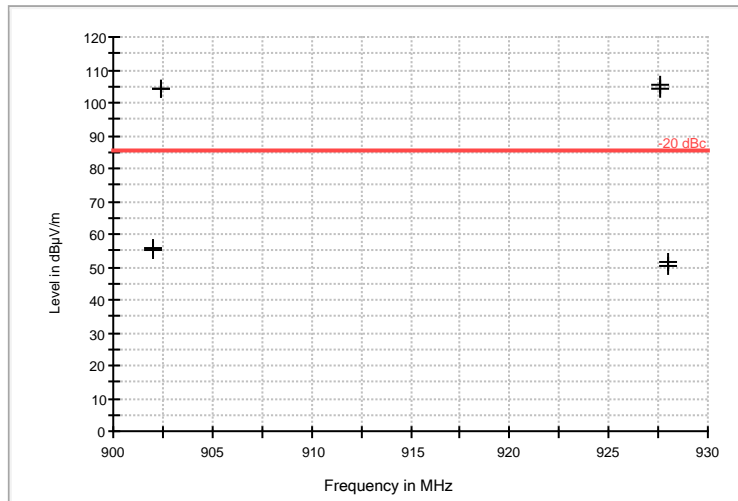
**Measurements: Band Edges – Dipole Antenna**

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
902.000000	55.7	120.000	100.0	V	0.0	-13.9	1.2	56.9
902.000000	54.7	120.000	268.0	H	280.0	-13.9	2.2	56.9
902.400000	104.6	120.000	100.0	V	0.0	-13.9	-47.7	56.9
902.400000	103.9	120.000	268.0	H	280.0	-13.9	-47.0	56.9
927.600000	105.1	120.000	251.0	V	0.0	-13.2	-48.2	56.9
927.600000	104.6	120.000	100.0	H	34.0	-13.2	-47.7	56.9
928.000000	52.4	120.000	251.0	V	0.0	-13.2	4.5	56.9
928.000000	52.1	120.000	100.0	H	34.0	-13.2	4.8	56.9



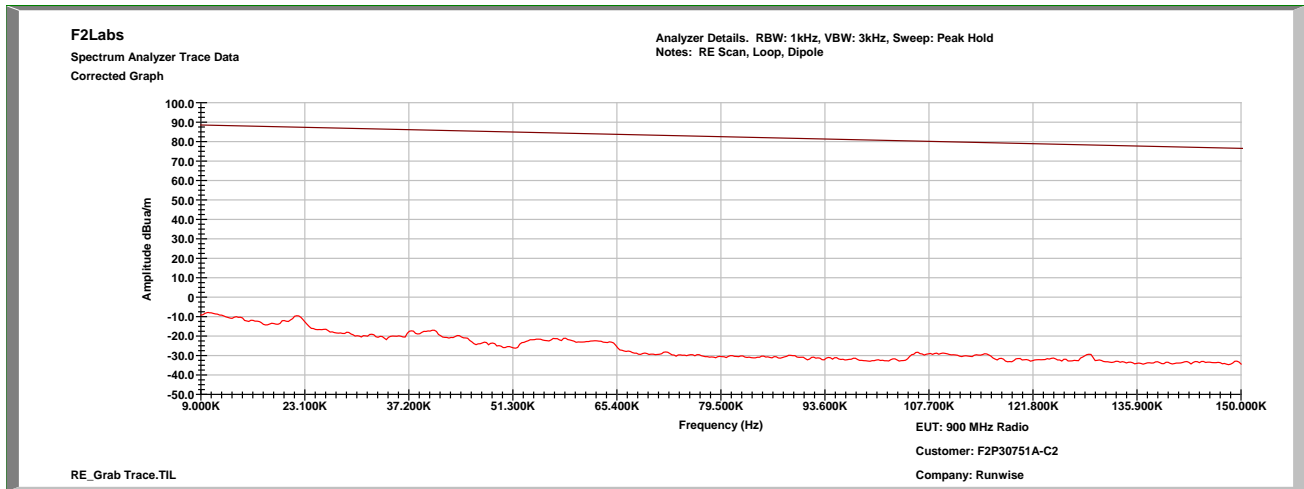
**Measurements: Band Edges – Monopole Antenna**

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
902.000000	55.6	120.000	100.0	V	0.0	-13.9	1.3	56.9
902.000000	55.0	120.000	100.0	H	190.0	-13.9	1.9	56.9
902.400000	104.0	120.000	100.0	H	190.0	-13.9	-47.1	56.9
902.400000	104.5	120.000	100.0	V	0.0	-13.9	-47.6	56.9
927.600000	104.0	120.000	100.0	H	286.0	-13.2	-47.1	56.9
927.600000	105.5	120.000	100.0	V	0.0	-13.2	-48.6	56.9
928.000000	50.3	120.000	100.0	H	286.0	-13.2	6.6	56.9
928.000000	51.7	120.000	100.0	V	0.0	-13.2	5.2	56.9

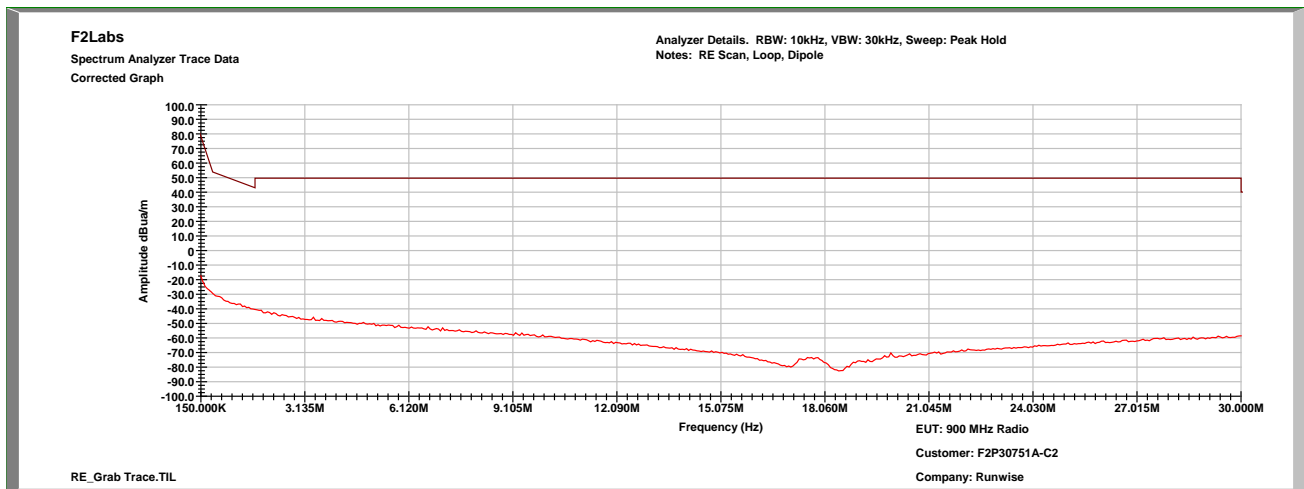




## Radiated Spurious Emissions: 0.009 MHz to 0.15 MHz – Dipole Antenna

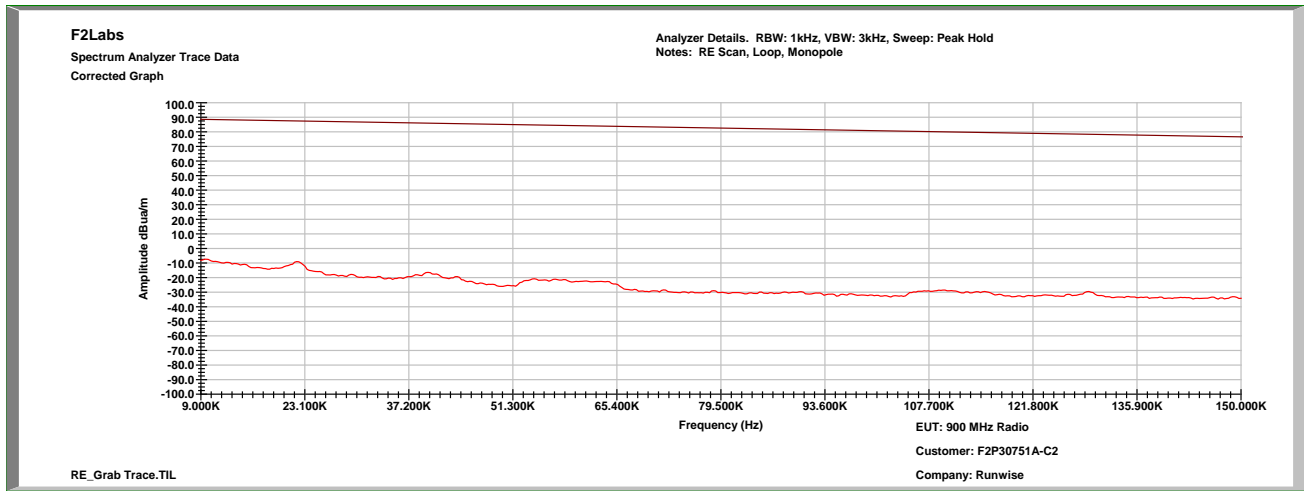


## Radiated Spurious Emissions: 0.15 MHz to 30 MHz – Dipole Antenna

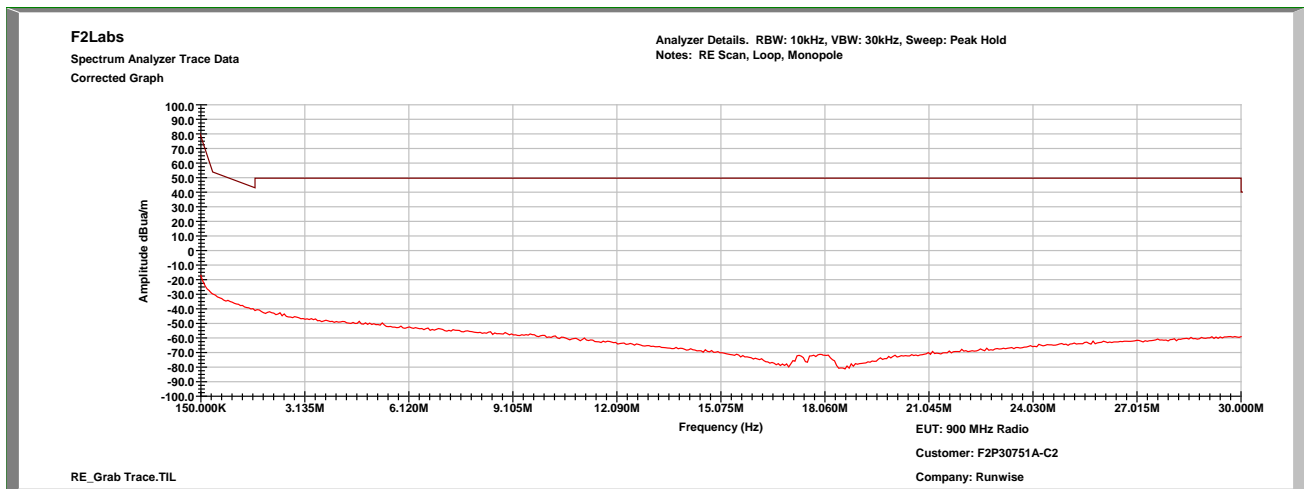




## Radiated Spurious Emissions: 0.009 MHz to 0.15 MHz – Monopole Antenna

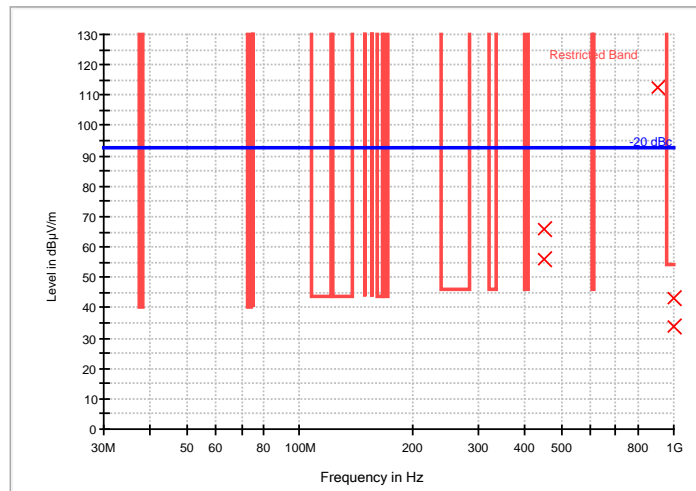


## Radiated Spurious Emissions: 0.15 MHz to 30 MHz – Monopole Antenna



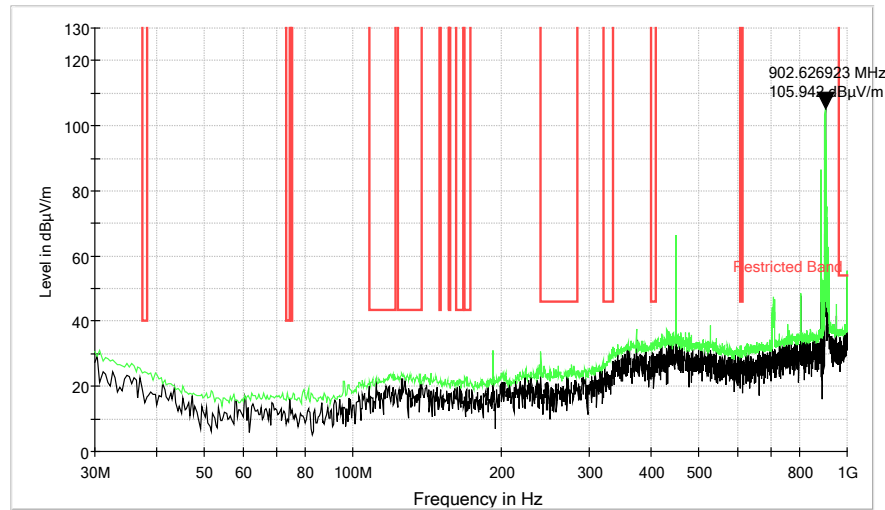
### Measurements: 30 MHz to 1000 MHz – Dipole Antenna

Frequency (MHz)	QuasiPeak (dBμV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBμV/m)
451.200000	55.7	120.000	100.0	H	0.0	9.5	124.3	180.0
451.200000	65.8	120.000	100.0	V	0.0	9.5	114.2	180.0
902.400000	112.5	120.000	100.0	V	0.0	17.3	67.5	180.0
998.520000	43.1	120.000	100.0	H	0.0	19.3	10.9	54.0
998.880000	33.7	120.000	100.0	V	0.0	19.3	20.3	54.0

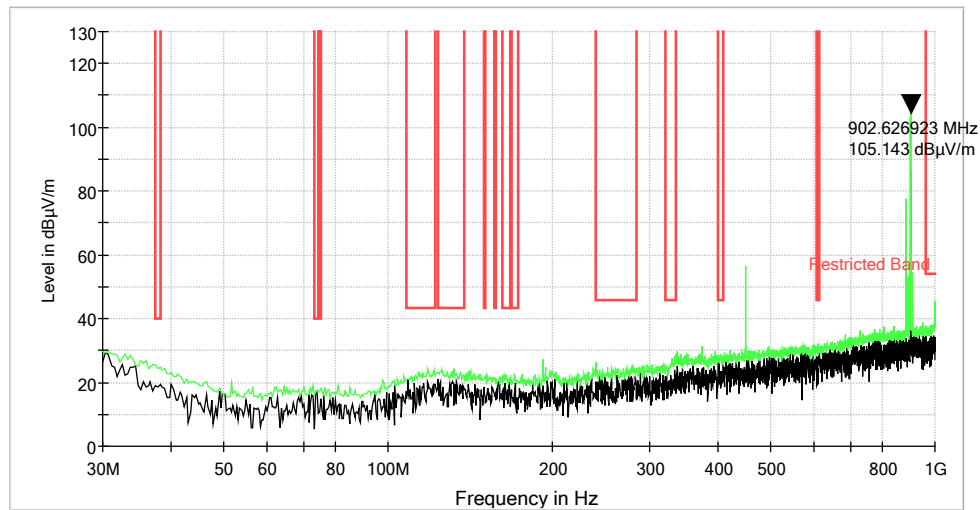




### Radiated Spurious Emissions: 30 MHz to 1000 MHz - Vertical – Dipole Antenna



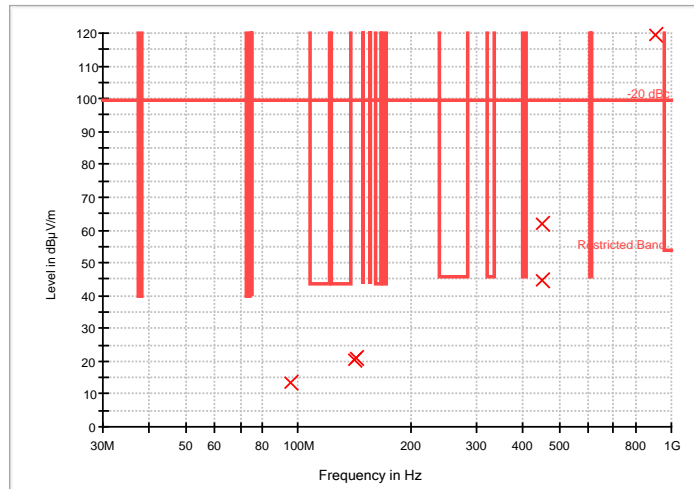
### Radiated Spurious Emissions: 30 MHz to 1000 MHz - Horizontal – Dipole Antenna





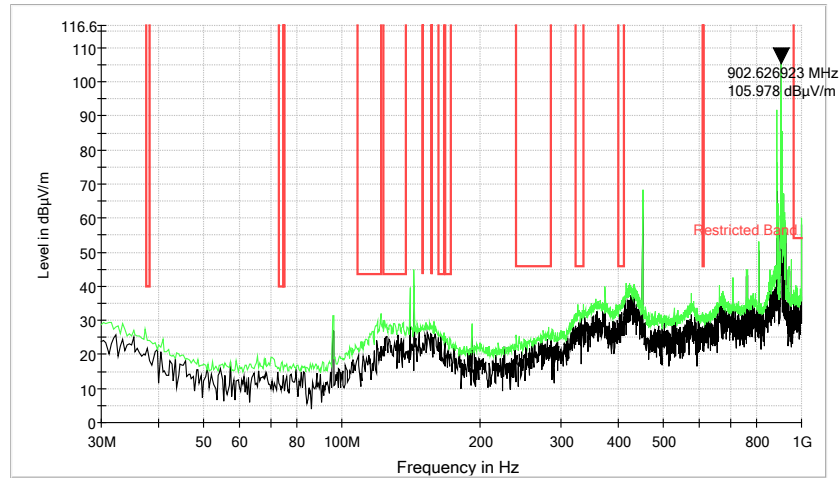
**Measurements: 30 MHz to 1000 MHz – Monopole Antenna**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dB $\mu$ V/m)
95.680000	13.7	120.000	100.0	V	0.0	-0.2	29.8	43.5
140.800000	20.7	120.000	100.0	V	0.0	4.1	22.8	43.5
143.800000	21.2	120.000	100.0	V	0.0	3.8	22.3	43.5
451.200000	44.6	120.000	100.0	H	0.0	9.5	1.4	46.0
451.200000	61.7	120.000	100.0	V	0.0	9.5	-15.7	46.0
902.400000	119.6	120.000	100.0	V	0.0	17.3	-73.6	46.0

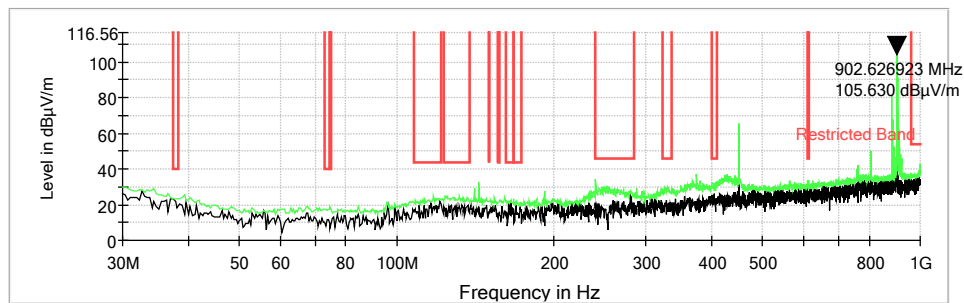




### Radiated Spurious Emissions: 30 MHz to 1000 MHz - Vertical – Monopole Antenna



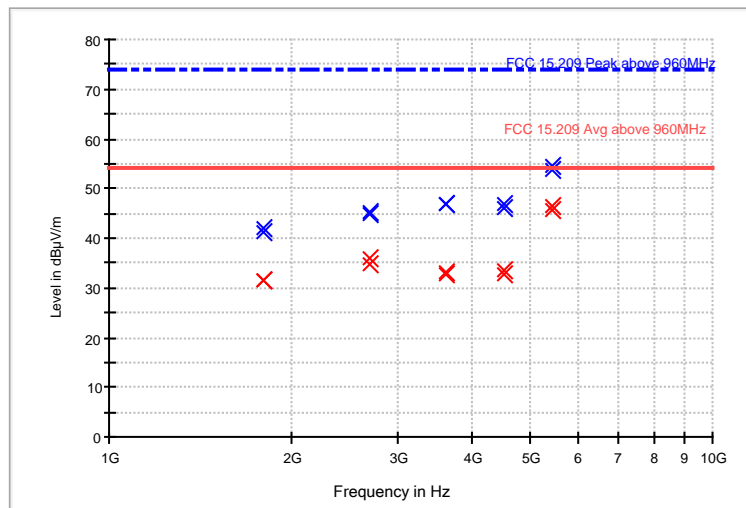
### Radiated Spurious Emissions: 30 MHz to 1000 MHz - Horizontal – Monopole Antenna





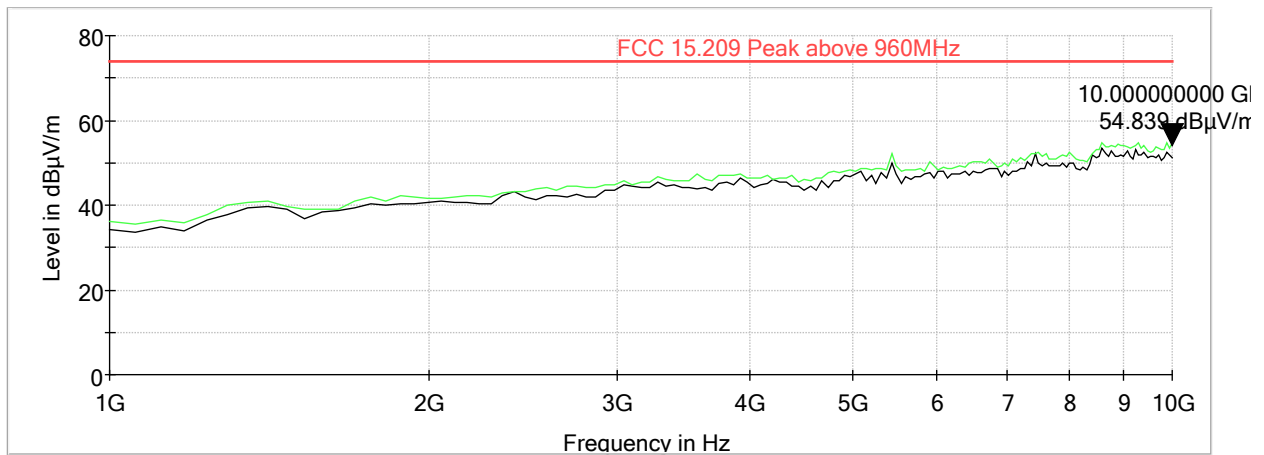
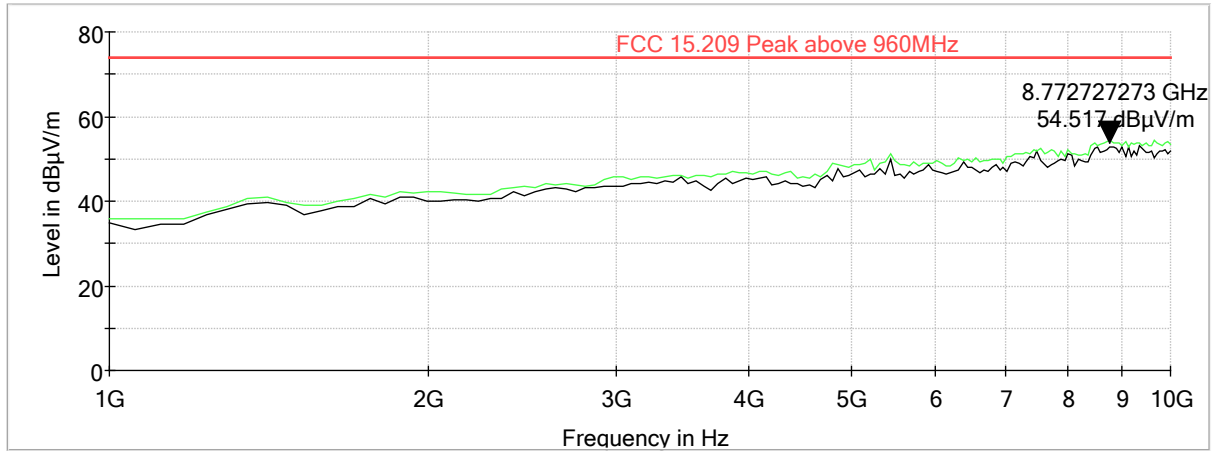
## Measurements: Greater Than 1 GHz – Dipole Antenna

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBμV/m)	Comment
1804.800000	41.3	31.4	1000.0	1000.000	150.0	H	0.0	3.9	22.6	54.0	
1805.000000	42.2	31.4	1000.0	1000.000	150.0	V	0.0	3.9	22.6	54.0	
2707.200000	45.3	35.9	1000.0	1000.000	150.0	H	3.0	7.6	18.1	54.0	
2707.200000	44.7	34.9	1000.0	1000.000	150.0	V	0.0	7.6	19.1	54.0	
3609.600000	47.0	32.7	1000.0	1000.000	150.0	H	0.0	9.5	21.3	54.0	
3609.600000	47.0	33.1	1000.0	1000.000	150.0	V	3.0	9.5	21.0	54.0	
4512.000000	46.2	32.9	1000.0	1000.000	150.0	H	4.0	10.6	21.1	54.0	
4512.000000	46.7	33.5	1000.0	1000.000	150.0	H	15.0	10.6	20.5	54.0	
5414.400000	53.7	45.7	1000.0	1000.000	150.0	V	0.0	13.2	8.3	54.0	
5414.400000	54.7	46.6	1000.0	1000.000	150.0	H	359.0	13.2	7.4	54.0	
***	***	***	***	***	***		***	***	***	***	



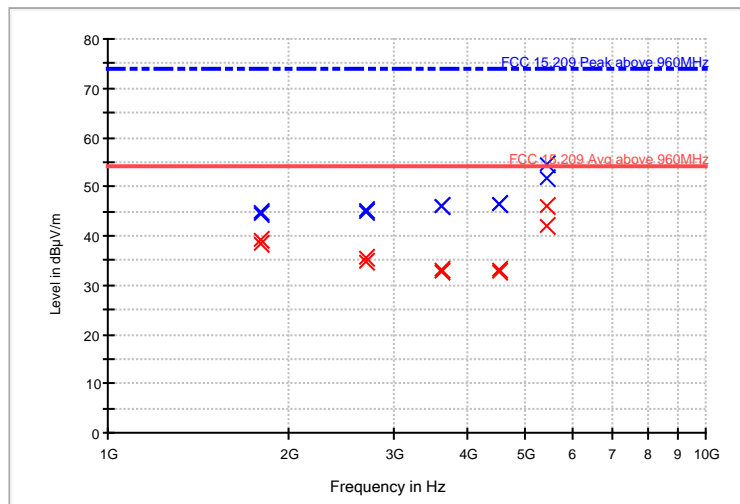


## Radiated Spurious Emissions: 1 GHz to 10 GHz – Vertical – Dipole Antenna



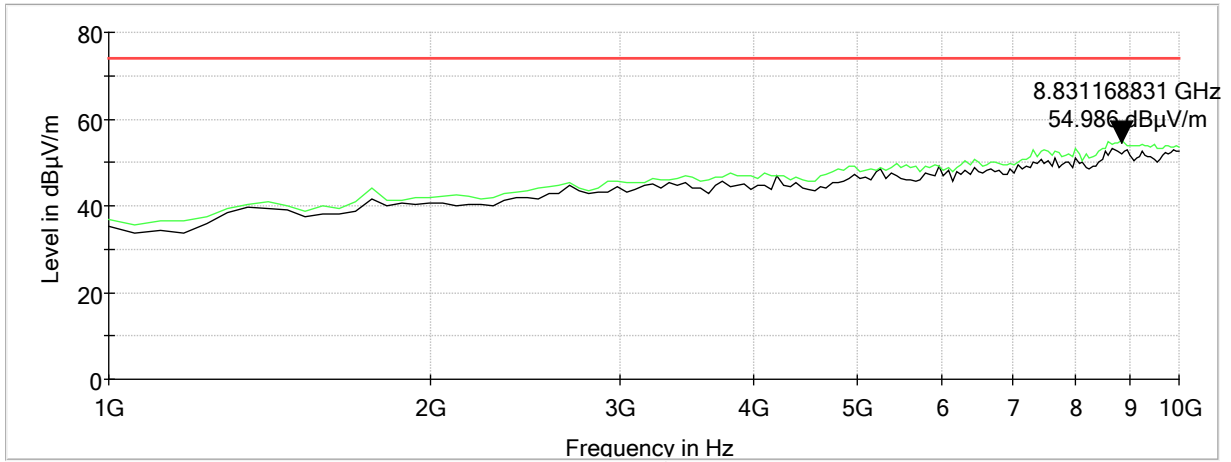
**Measurements: Greater Than 1 GHz – Monopole Antenna**

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBμV/m)	Comment
1804.800000	44.6	38.2	1000.0	1000.000	150.0	V	0.0	3.9	15.8	54.0	
1804.800000	44.8	39.2	1000.0	1000.000	150.0	H	4.0	3.9	14.8	54.0	
2707.200000	44.9	34.6	1000.0	1000.000	150.0	H	193.0	7.6	19.4	54.0	
2707.200000	45.2	35.7	1000.0	1000.000	150.0	V	2.0	7.6	18.3	54.0	
3609.600000	46.0	33.0	1000.0	1000.000	150.0	H	31.0	9.5	21.0	54.0	
3609.600000	46.1	32.6	1000.0	1000.000	150.0	V	0.0	9.5	21.4	54.0	
4512.000000	46.3	33.1	1000.0	1000.000	150.0	H	355.0	10.6	20.9	54.0	
4512.000000	46.5	32.9	1000.0	1000.000	150.0	V	5.0	10.6	21.1	54.0	
5414.400000	51.8	42.2	1000.0	1000.000	150.0	V	217.0	13.2	11.8	54.0	
5414.400000	54.4	46.0	1000.0	1000.000	150.0	H	41.0	13.2	8.0	54.0	
***	***	***	***	***	***		***	***	***	***	

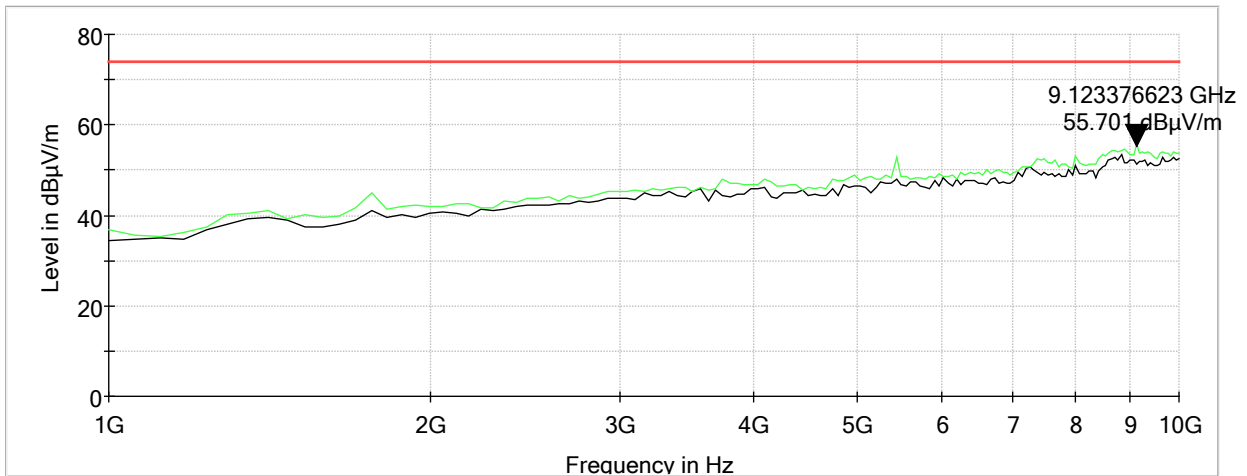




### Radiated Spurious Emissions: 1 GHz to 10 GHz – Vertical – Monopole Antenna

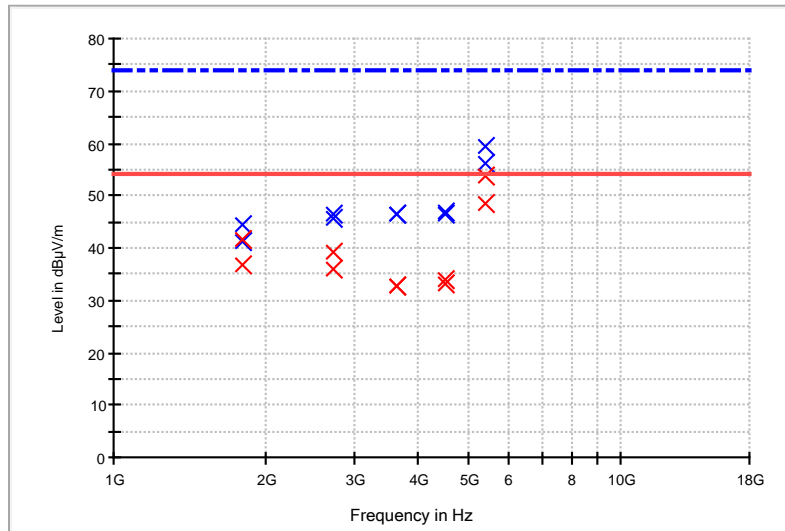


### Radiated Spurious Emissions: 1 GHz to 10 GHz – Horizontal – Monopole Antenna



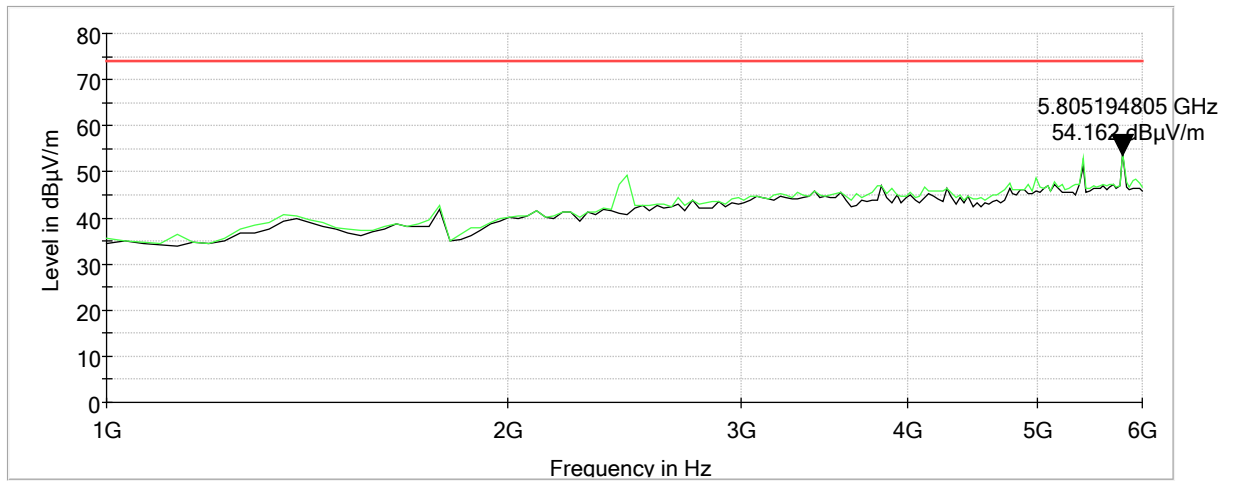
**Measurements: Greater Than 1 GHz – Monopole Antenna**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Average (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dB $\mu$ V/m)	Comment
1804.800000	44.6	41.5	1000.0	1000.000	150.0	V	356.0	3.9	12.5	54.0	
1804.800000	41.3	36.9	1000.0	1000.000	150.0	H	355.0	3.9	17.2	54.0	
2707.200000	46.3	39.0	1000.0	1000.000	150.0	H	344.0	7.6	15.0	54.0	
2707.200000	45.7	35.8	1000.0	1000.000	150.0	V	11.0	7.6	18.2	54.0	
3609.000000	46.5	32.6	1000.0	1000.000	150.0	H	8.0	9.5	21.4	54.0	
3609.000000	46.4	32.7	1000.0	1000.000	150.0	V	355.0	9.5	21.3	54.0	
4512.000000	46.5	33.3	1000.0	1000.000	150.0	H	0.0	10.6	20.7	54.0	
4512.000000	46.7	34.0	1000.0	1000.000	150.0	V	2.0	10.6	20.0	54.0	
5414.400000	56.0	48.3	1000.0	1000.000	150.0	H	0.0	13.2	5.7	54.0	
5414.400000	59.3	53.7	1000.0	1000.000	150.0	V	196.0	13.2	0.3	54.0	

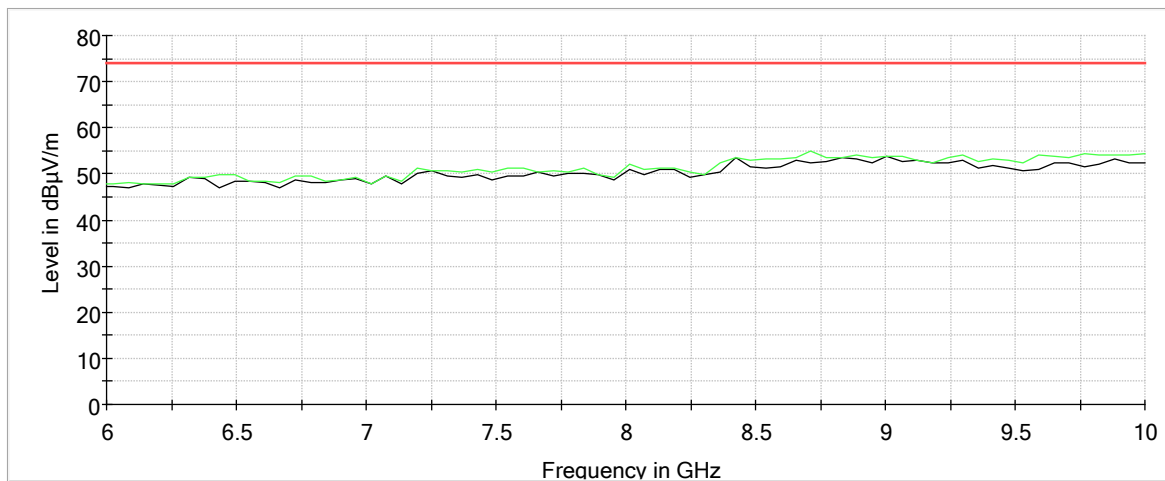




### Monopole Antenna - Lower Band Edge – Vertical



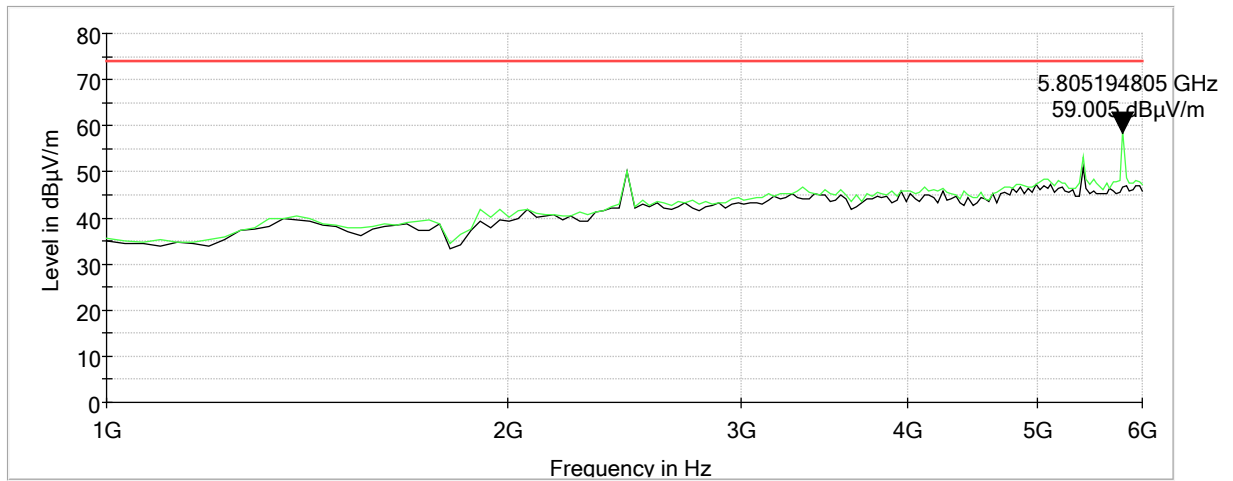
### Monopole Antenna - Upper Band Edge – Vertical



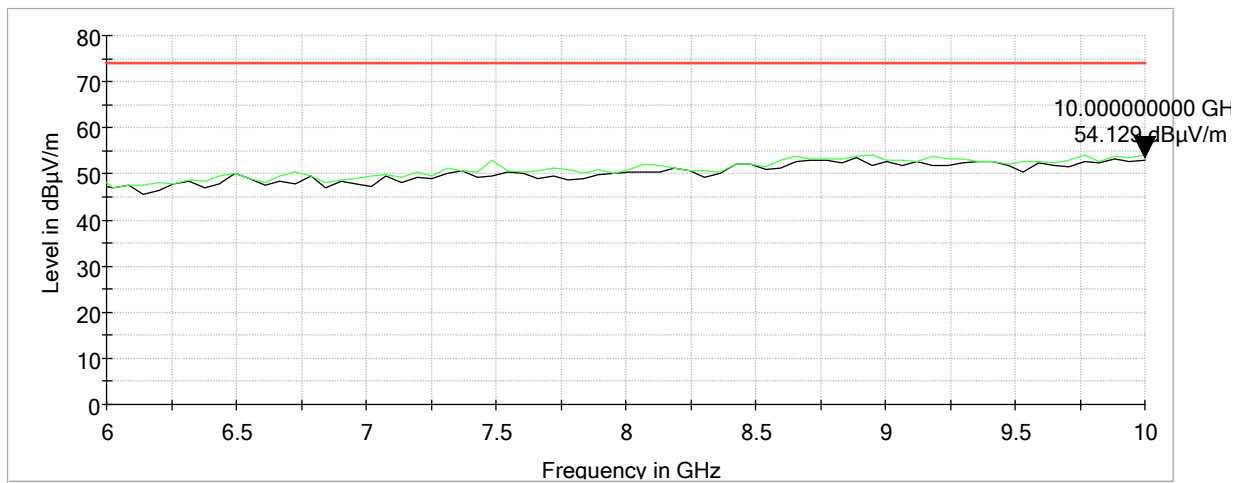




### Monopole Antenna - Lower Band Edge – Horizontal



### Monopole Antenna - Upper Band Edge – Horizontal





## 12 NUMBER OF HOPPING FREQUENCIES

The EUT was directly connected to the measurement device through a SMA connector. With the hopping enabled, the EUT was checked to ensure all of the hopping channels were present.

### 12.1 Requirements:

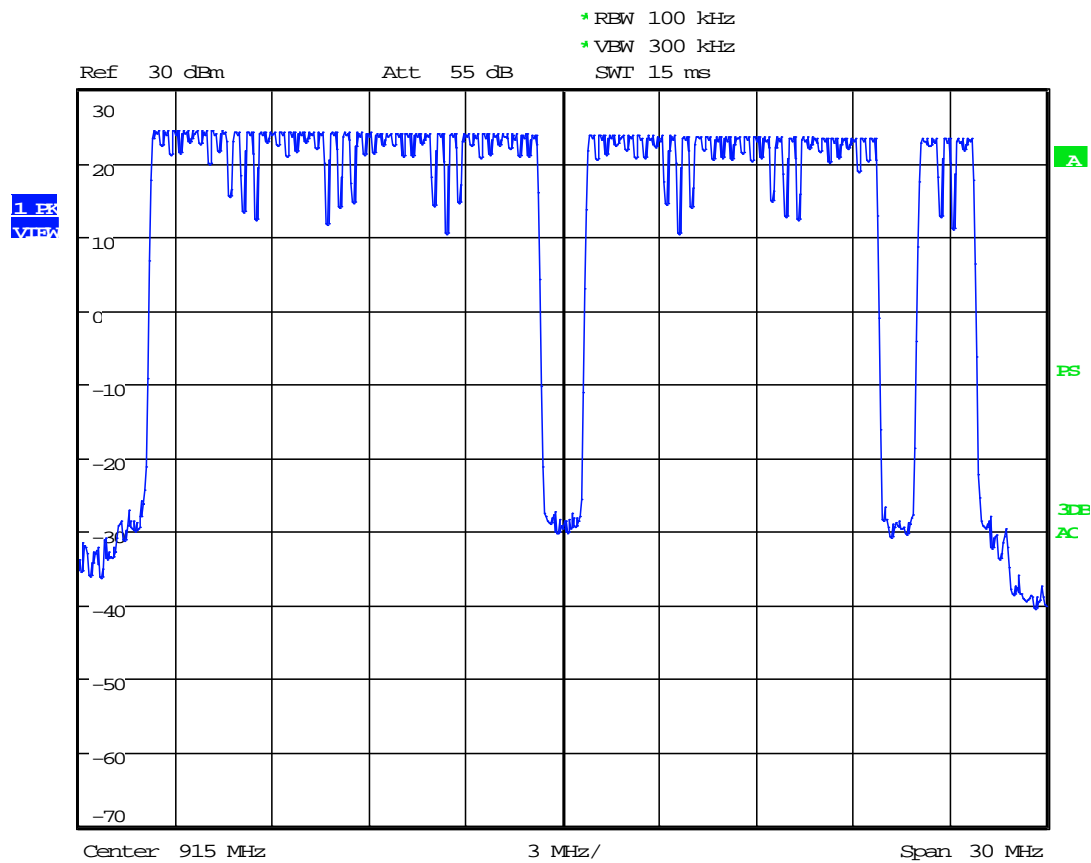
Verify that all channels are present.



## 12.2 Number of Hopping Frequencies Test Data

Test Date(s):	2024-01-11; 2024-04-29	Test Engineer:	J. Chiller
Standard(s):	ANSI 63.10 7.8.3	Air Temperature:	21.5°C
		Relative Humidity:	37%

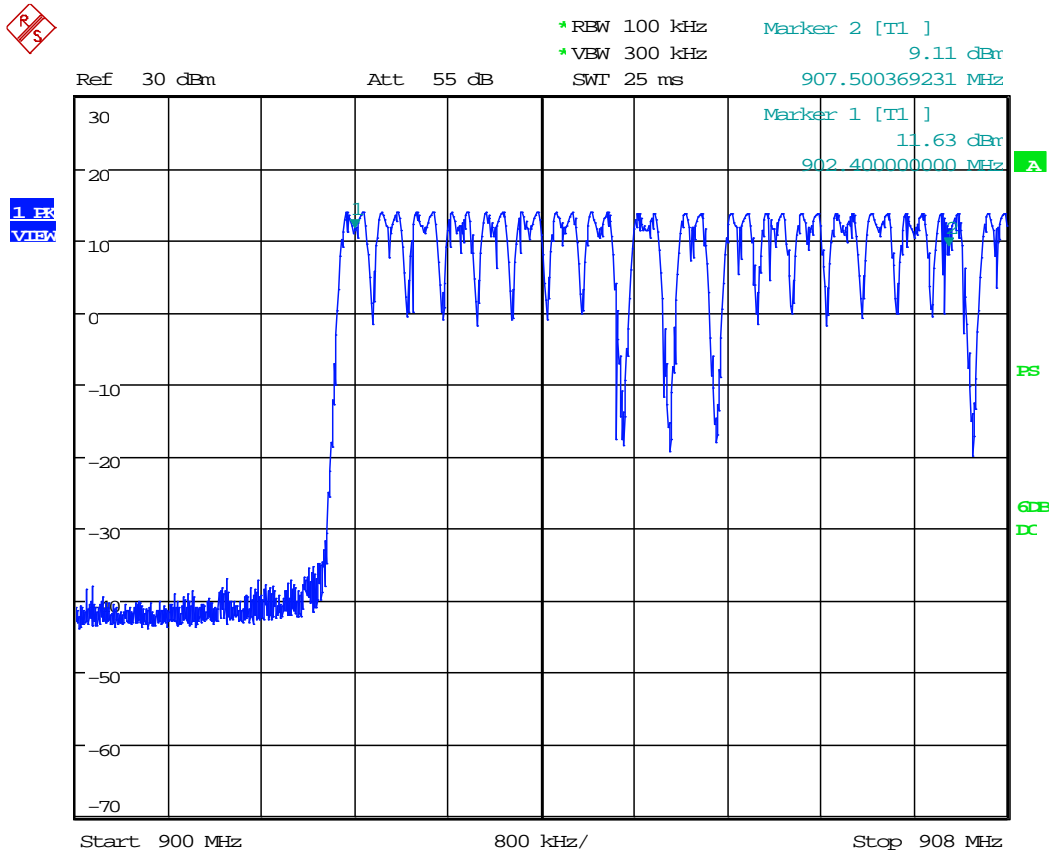
EUT showed 70 channels, confirming manufacturer's specifications.



Date: 11.JAN.2024 15:01:50



## 17 Channels



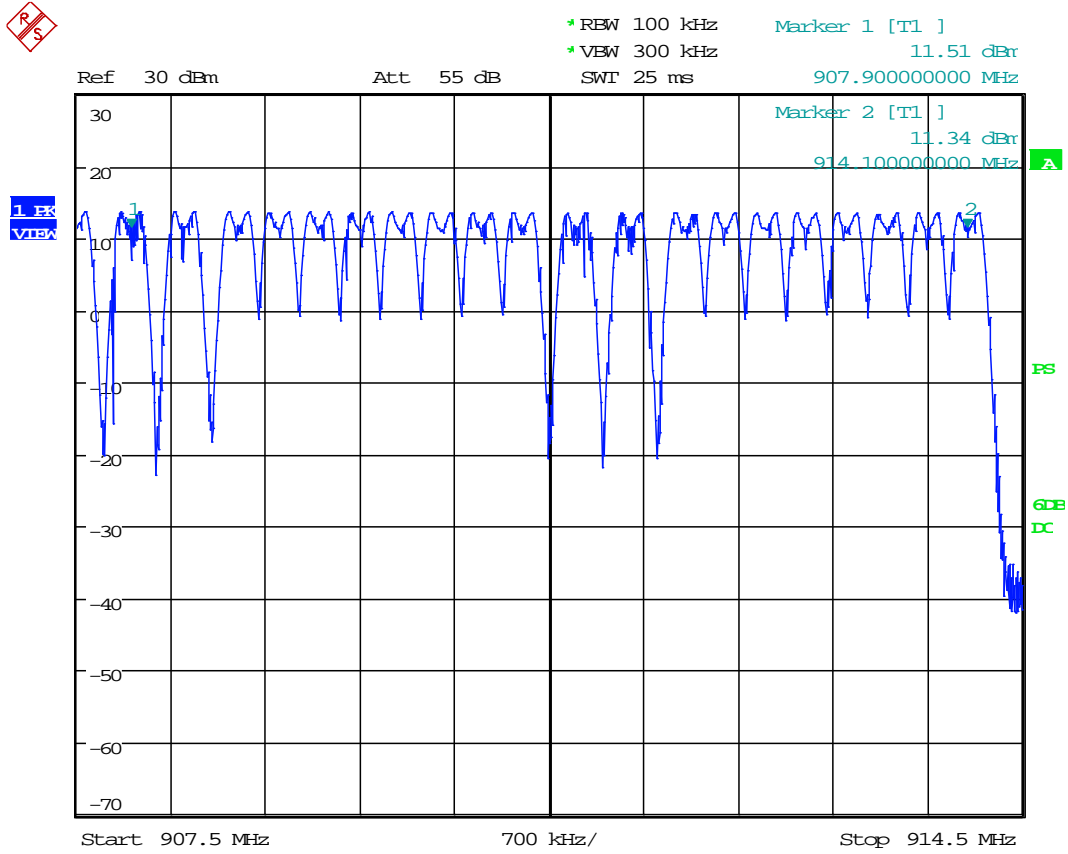
Date: 29.APR.2024 10:15:13



Order No(s): F2P30751A-C2

Applicant: Runwise, Inc.  
Model: V3.1

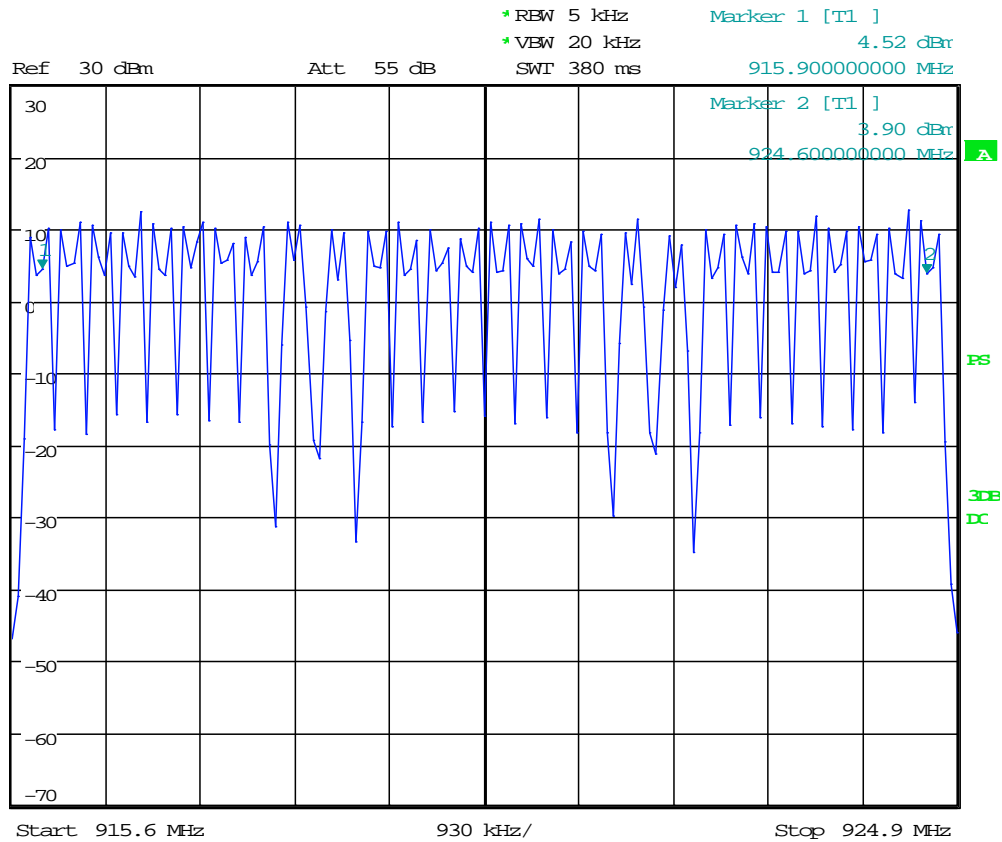
## 20 Channels



Date: 29.APR.2024 10:23:02



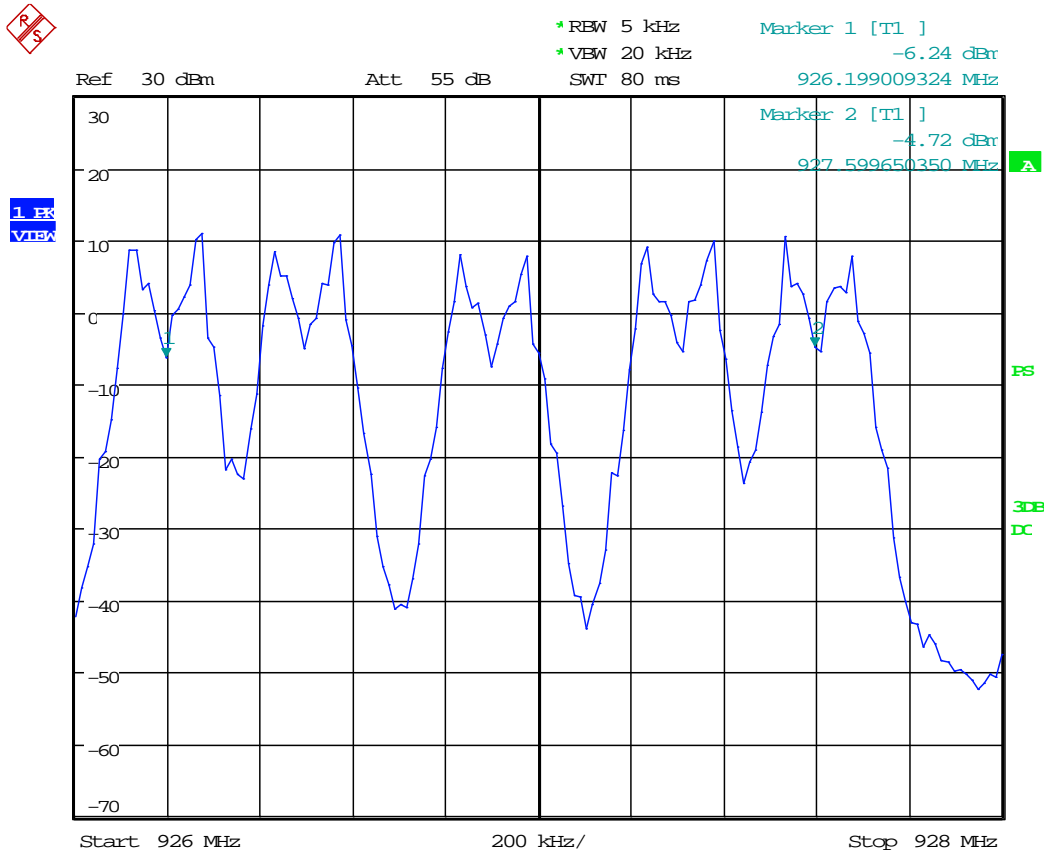
## 28 Channels



Date: 26.APR.2024 11:02:52



## 5 Channels



Date: 26.APR.2024 11:05:09



### 13 DWELL TIME

Test was to verify the dwell time on any channel while Hopping was on. EUT was directly connected to analyzer. The plots on the following page show how long a transmission is, and the transmissions in ten seconds.

#### 13.1 Requirements:

Limit of 0.4 seconds in a 10-second period.

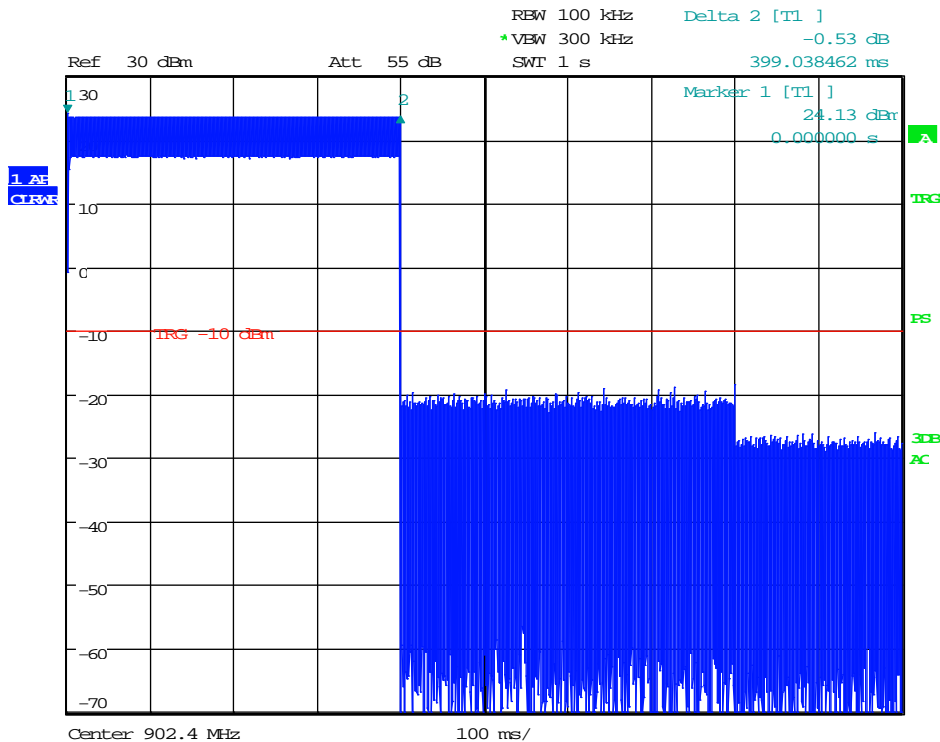




## 13.2 Dwell Time Test Data

Test Date(s):	2024-01-11	Test Engineer:	J. Chiller
Standard(s):	ANSI 63.10 7.8.4	Air Temperature:	21.5°C
Results:	Complies	Relative Humidity:	37%

## Length of Transmission



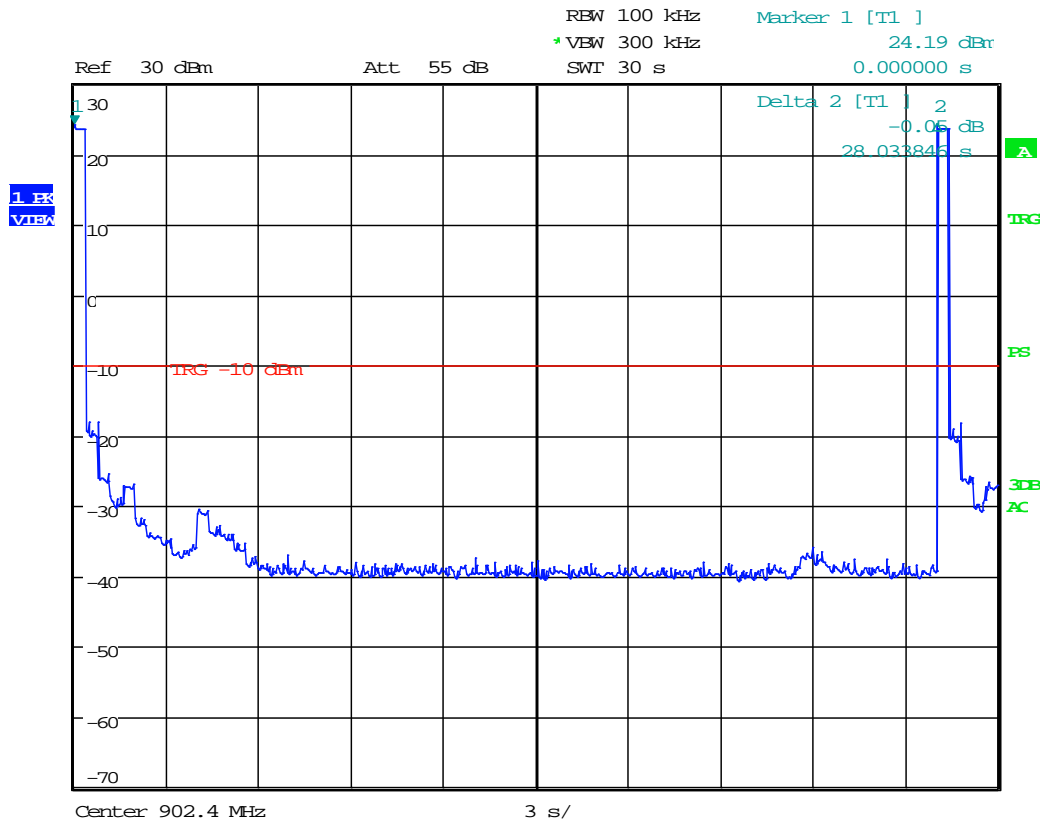
Date: 11.JAN.2024 14:55:00

Transmission Duration:	399.03mS
Transmissions in 20s:	1
Time Between Transmissions	28s

Limit: 400mS in 10-second period.



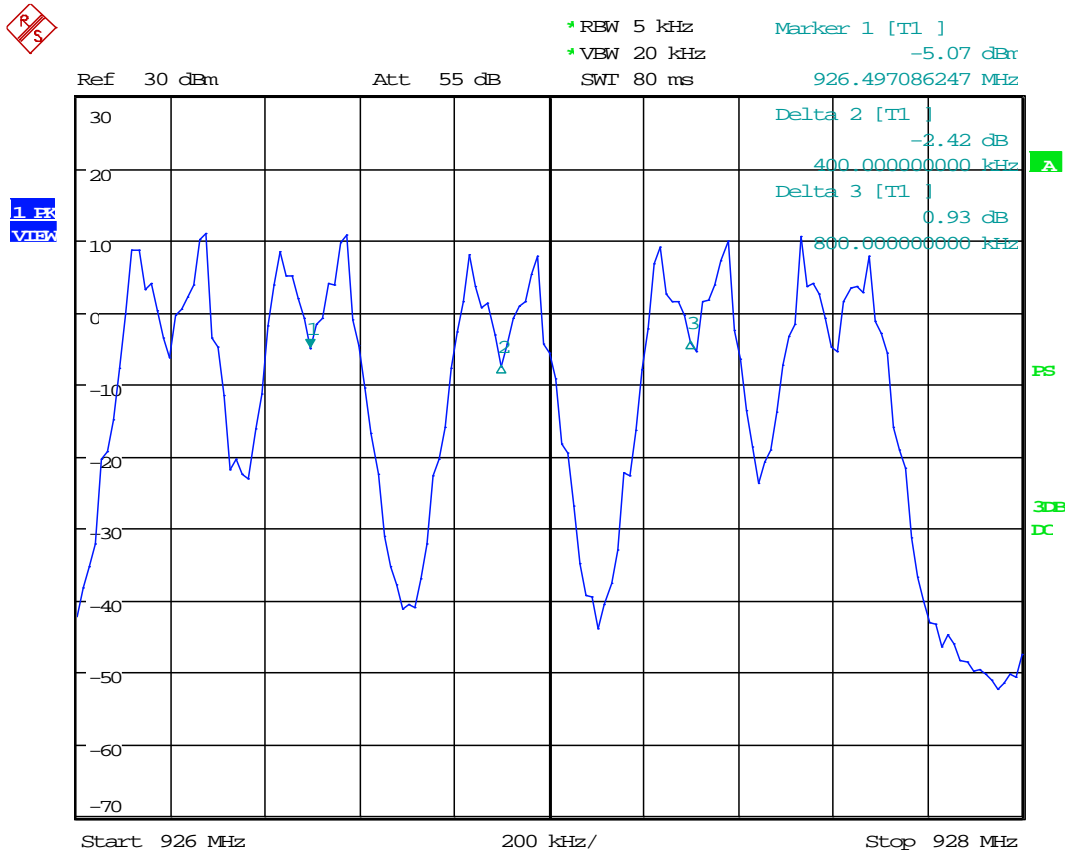
## Transmission Time on Channel



Date: 11.JAN.2024 14:57:35



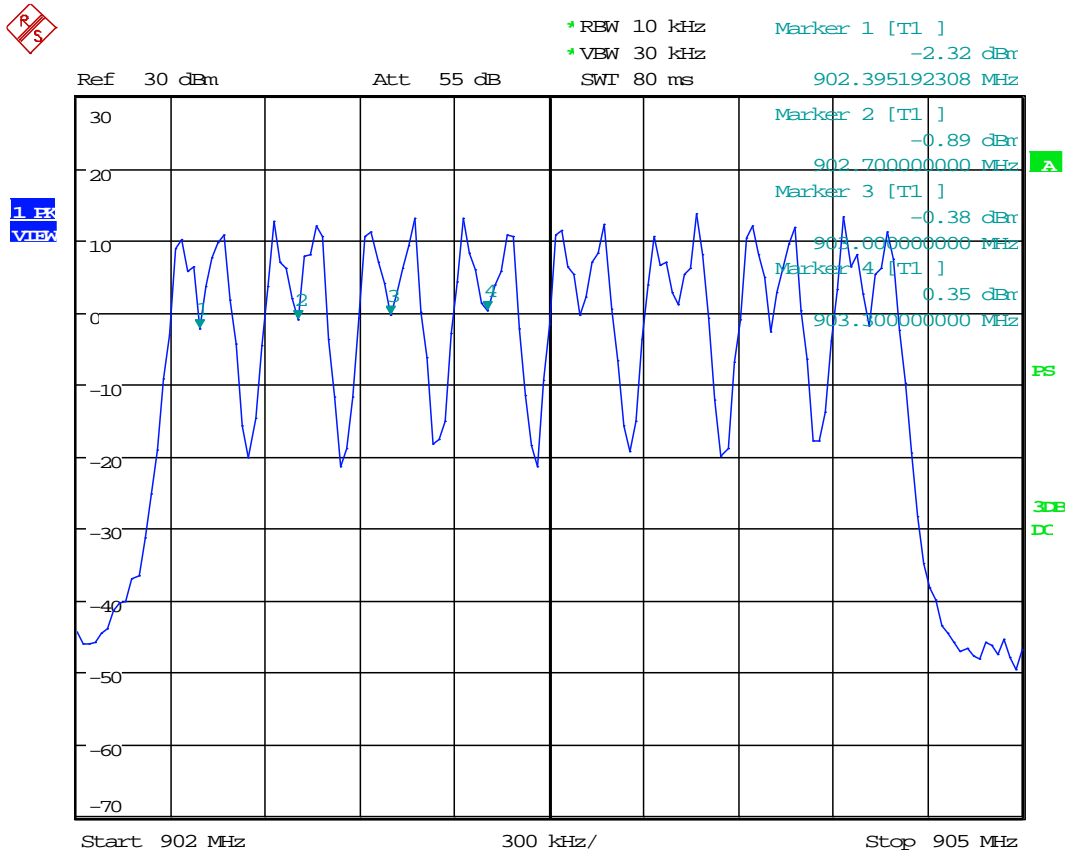
## Broadcast Channel Spacing 400kHz



Date: 26.APR.2024 11:06:13



### Data Channel Spacing 300kHz



Date: 26.APR.2024 10:15:33

**Note: All channel spacing is greater than 268 kHz (20dB OBW).**



## 14 CONDUCTED EMISSIONS

### 14.1 Requirements

In accordance with FCC CFR 47 Part 15.207(a), "Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### 14.2 Procedure

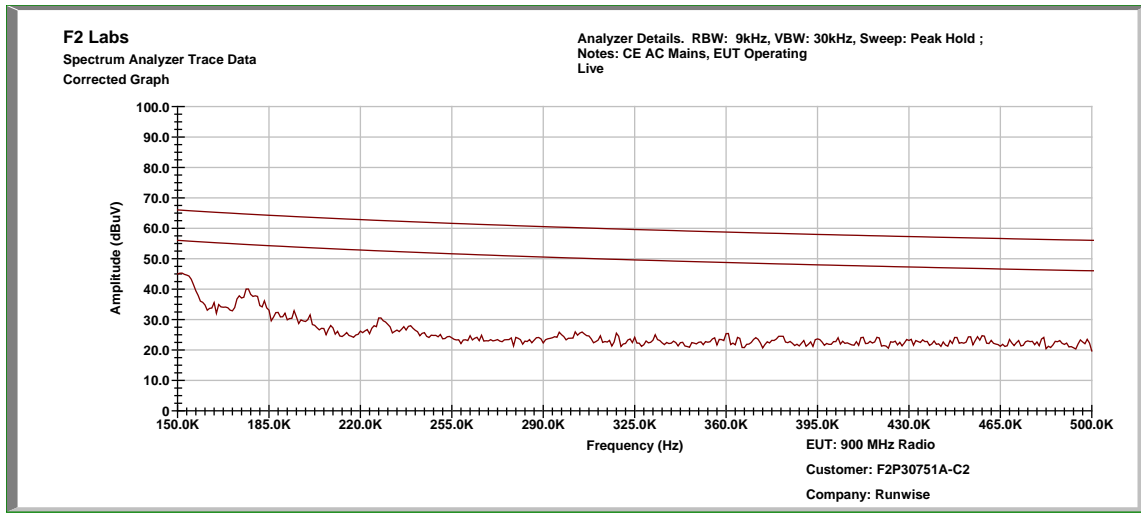
The EUT was placed on a 1.0 x 1.5 meter non-conductive table, 0.8 meter above a horizontal ground plane and 0.4 meter from a vertical ground plane. Power was provided to the EUT through a LISN bonded to a 3 x 2 meter ground plane. The LISN and peripherals were supplied power through a filtered AC power source. The output of the LISN was connected to the input of the receiver via a transient limiter, and emissions in the range 150 kHz to 30 MHz were measured. The measurements were recorded using the quasi-peak and average detectors as directed by the standard, and the resolution bandwidth during testing was 9 kHz. The raw measurements were corrected to allow for attenuation from the LISN, transient limiter and cables.



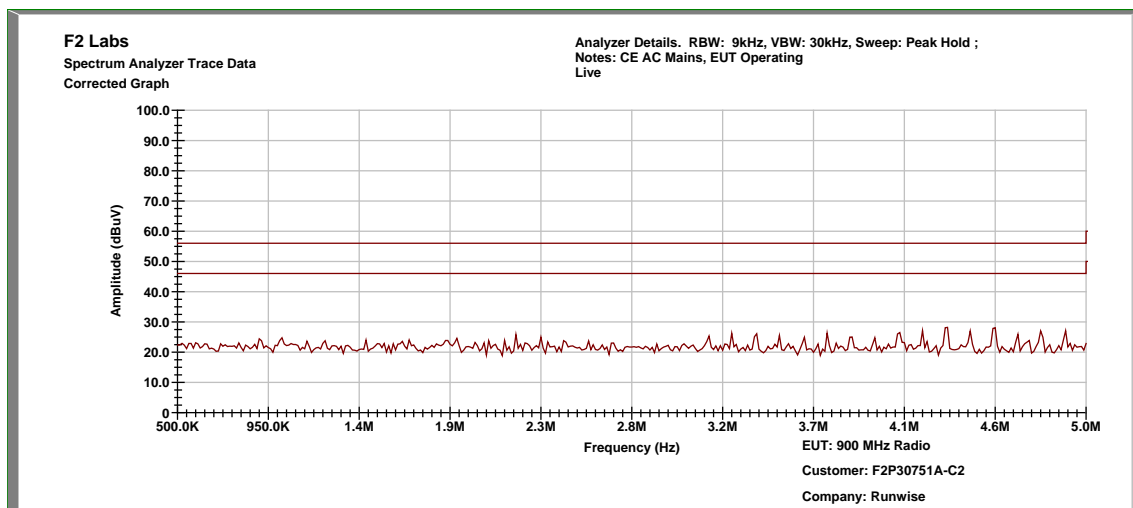
### 14.3 Conducted Emissions Test Data

Test Date(s):	2024-01-11	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	21.3° C
Test Results:	Complies	Relative Humidity:	41%

#### Conducted Test – Live: 0.15 MHz to 0.5 MHz

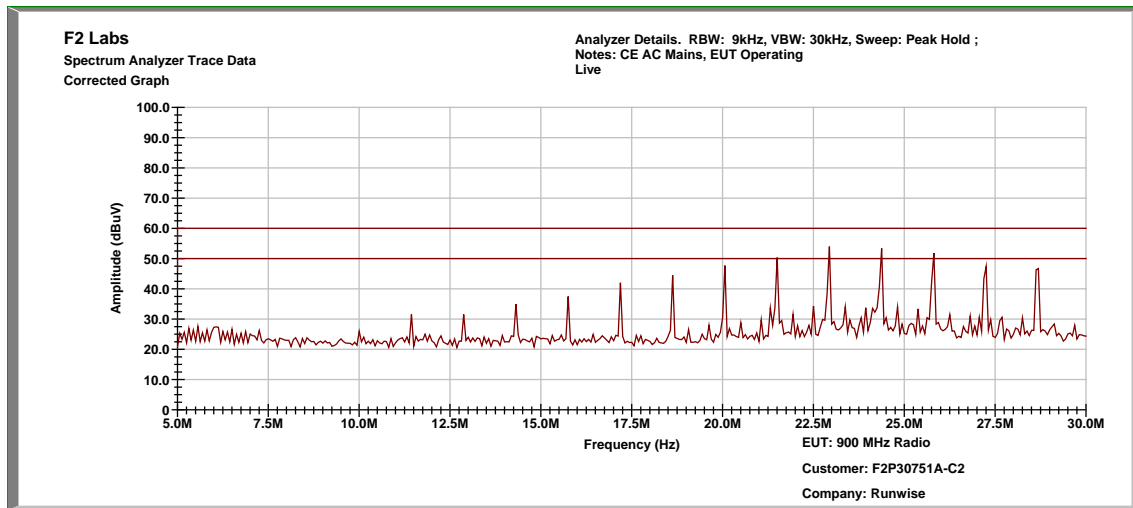


#### Conducted Test – Live: 0.5 MHz to 5.0 MHz





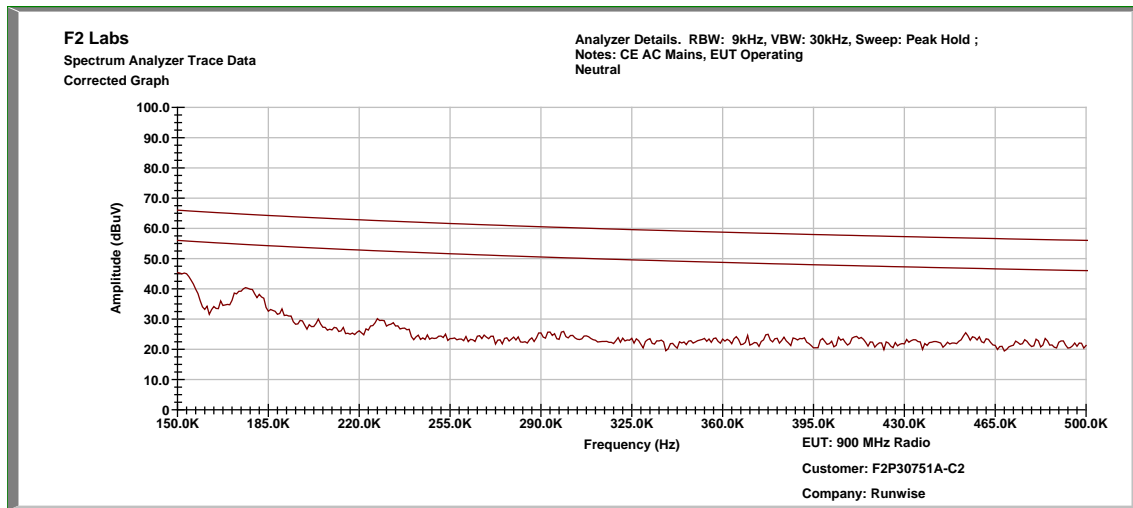
## Conducted Test – Live: 5.0 MHz to 30.0 MHz



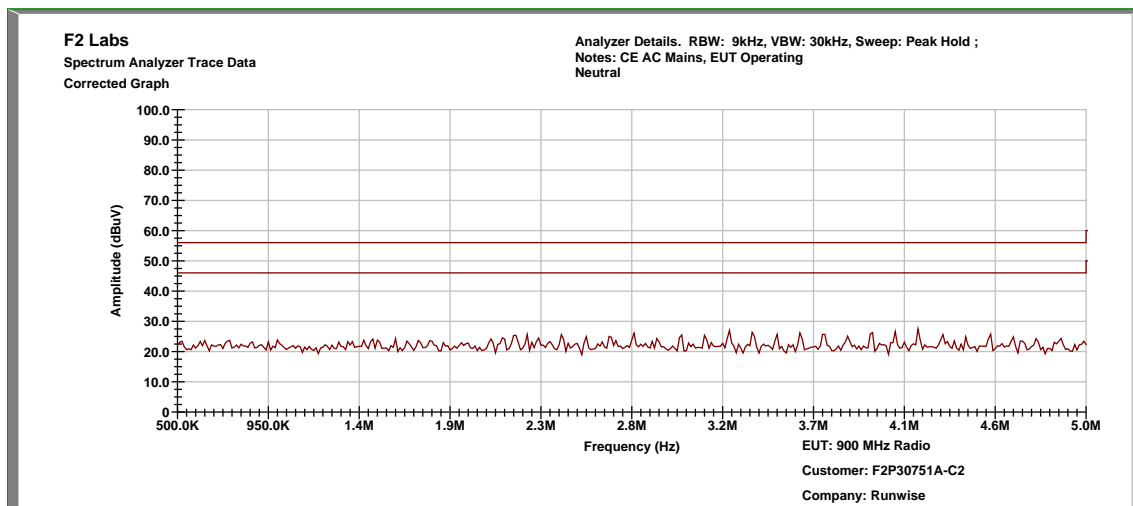
Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Line 1	20.06	Quasi-Peak	35.51	10.896	46.41	60.0	-13.6
			Average	33.86	10.896	44.76	50.0	-5.2
2	Line 1	21.5	Quasi-Peak	37.18	11.025	48.21	60.0	-11.8
			Average	34.71	11.025	45.74	50.0	-4.3
3	Line 1	22.9	Quasi-Peak	40.8	11.092	51.89	60.0	-8.1
			Average	37.78	11.092	48.87	50.0	-1.1
4	Line 1	24.3	Quasi-Peak	40.69	11.125	51.82	60.0	-8.2
			Average	37.56	11.125	48.69	50.0	-1.3
5	Line 1	25.8	Quasi-Peak	38.05	11.286	49.34	60.0	-10.7
			Average	34.51	11.286	45.80	50.0	-4.2



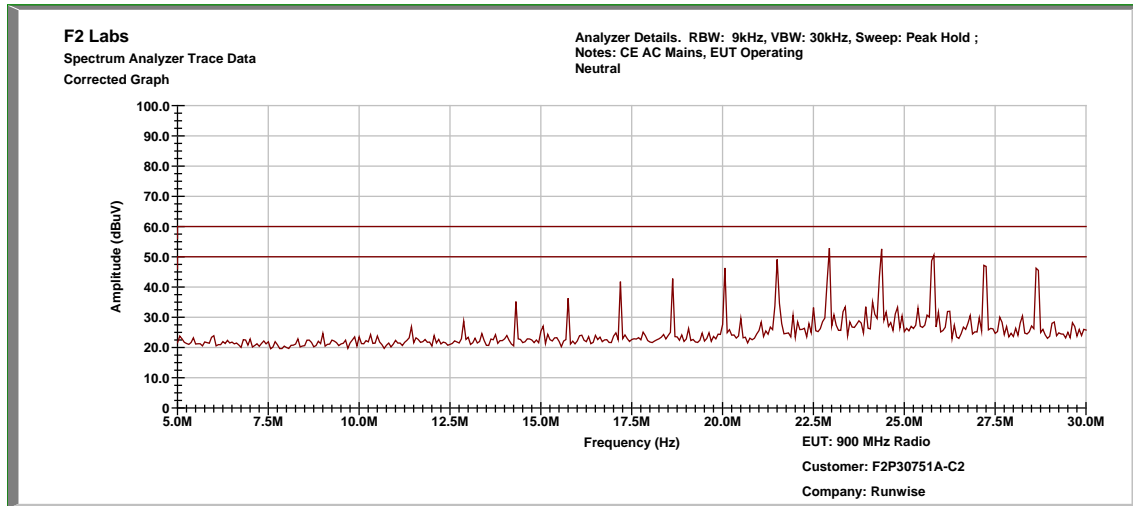
### Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



### Conducted Test – Neutral: 0.5 MHz to 5.0 MHz





**Conducted Test – Neutral: 5.0 MHz to 30.0 MHz**

Top Discrete Measurements								
No.	Conductor	Frequency (MHz)	Detector	Level (dBμV)	Adjustment (dB)	Results (dBμV)	Limit (dBμV)	Margin (dB)
1	Neutral	21.5	Quasi-Peak	36.57	10.983	47.55	60.00	-12.4
			Average	33.49	10.983	44.47	50.00	-5.5
2	Neutral	22.93	Quasi-Peak	40.30	11.042	51.34	60.00	-8.7
			Average	36.88	11.042	47.92	50.00	-2.1
3	Neutral	24.37	Quasi-Peak	40.05	11.161	51.21	60.00	-8.8
			Average	37.02	11.161	48.18	50.00	-1.8
4	Neutral	25.81	Quasi-Peak	38.01	11.196	49.21	60.00	-10.8
			Average	35.58	11.196	46.78	50.00	-3.2



## 15 TEST SETUP PHOTOGRAPH(S)

**Radiated Spurious Emission: 0.009 MHz to 30 MHz**

**Dipole**



**Monopole**





## Radiated Spurious Emission: 30 MHz to 1000 MHz

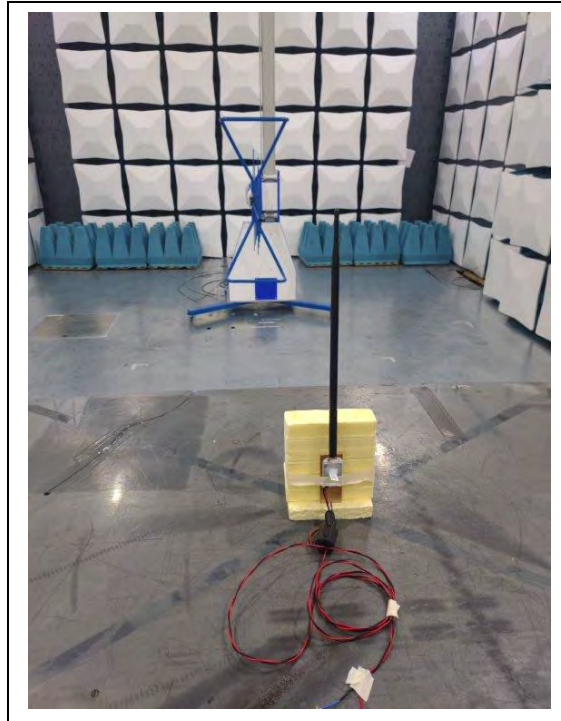




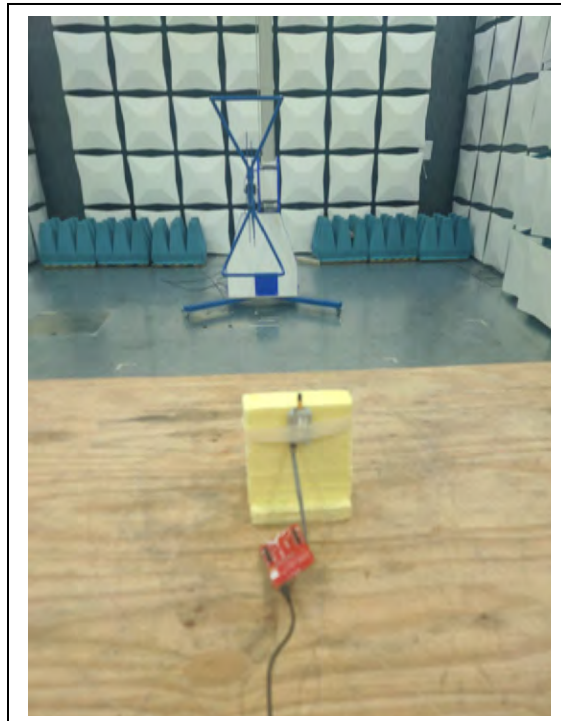
**Radiated Spurious Emission: 30 MHz to 1000 MHz, cont'd**



### Radiated Spurious Emission: 30 MHz to 1000 MHz – Dipole Antenna

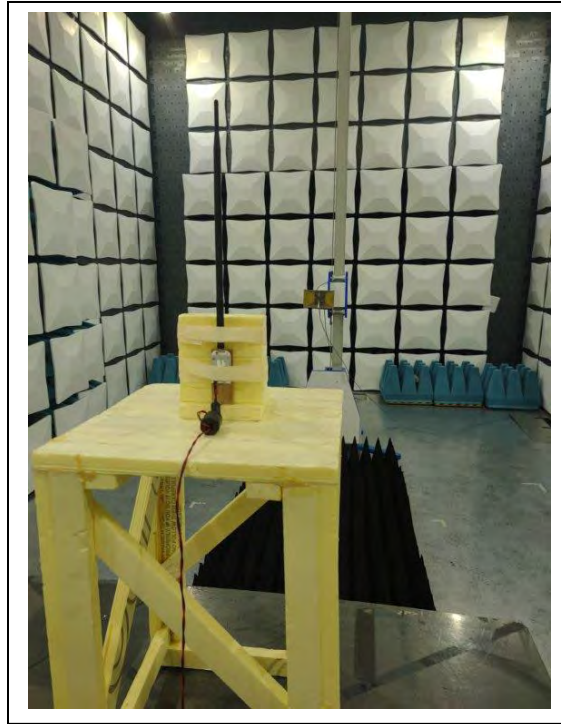


### Radiated Spurious Emission: 30 MHz to 1000 MHz – Monopole Antenna





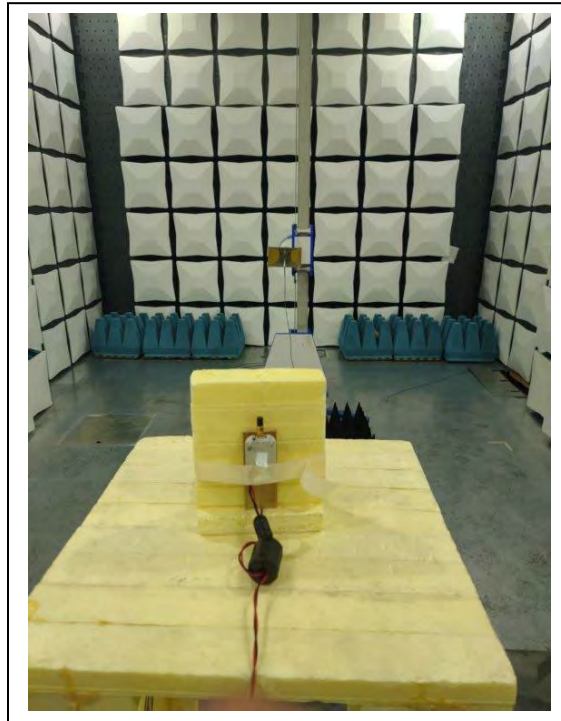
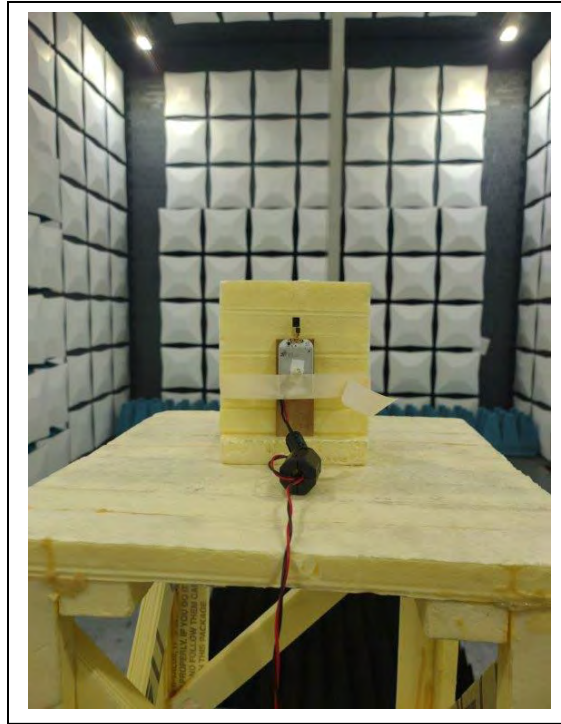
## Radiated Spurious Emission: Greater than 1 GHz – Dipole Antenna





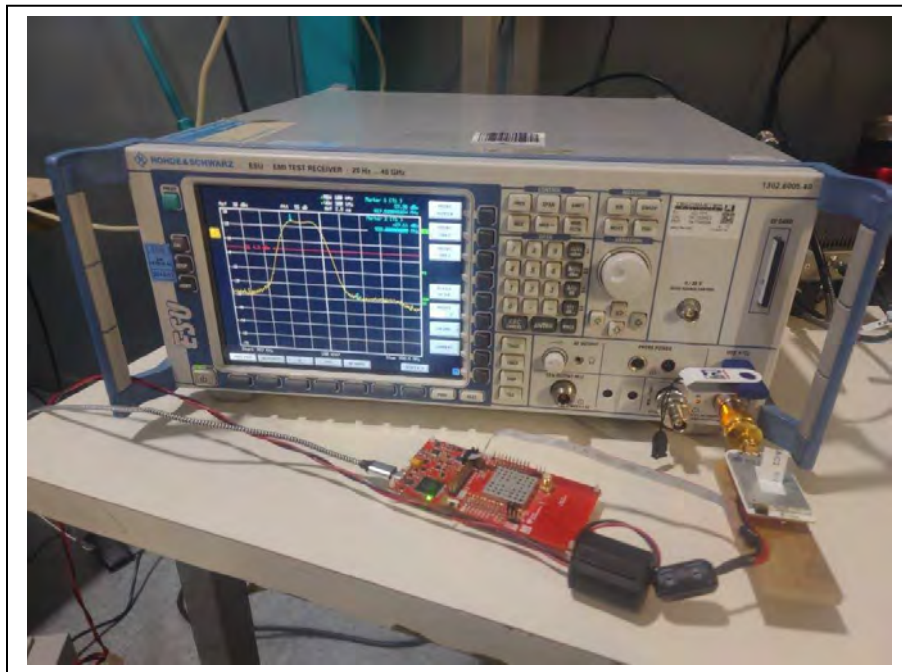


### Monopole Above 1 GHz





## Conducted Output Power, Occupied Bandwidth, and Conducted Spurious Emissions







## Conducted Emissions

