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Middlefield, Ohio 44062
United States of America
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CERTIFICATION TEST REPORT

Manufacturer:	**Runwise, Inc.** **104 West 27th 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 3.7VDC nominal
Model:	**V4.0**
FCC ID:	**2AQX2-G2RWHPMOD**
Testing Commenced:	2024-01-11
Testing Ended:	2025-01-28
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

Erik Tobin, EMC 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 Uncertainly
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-R1-01E	First Issue	2025-01-28	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 Emissions	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

**Not required for FHSS devices.*

Modifications Made to the Equipment
None

3 TABLE OF MEASURED RESULTS

Test		Low Channel 902.4 MHz	Mid Channel 915.9 MHz	High Channel 927.6 MHz
Conducted Output Power with 2.5dBi Dipole Antenna		542mW / 27.34dBm	448.8mW / 26.52dBm	481.9mW / 26.83dBm
Conducted Output Power with 6dBi Omni Antenna		542mW / 27.34dBm	448.8mW / 26.52dBm	481.9mW / 26.83dBm
Conducted Output Power Limit		1 Watt / 30dBm	1 Watt / 30dBm	1 Watt / 30dBm
Conducted Output Power with 8dBi Yagi Antenna		542mW / 27.34dBm	448.8mW / 26.52dBm	481.9mW / 26.83dBm
Conducted Output Power Limit		0.6165 Watt / 27.9 dBm	0.6165 Watt / 27.9 dBm	0.6165 Watt / 27.9 dBm
E.I.R.P. with 2.5dBi Dipole Antenna		963.8mW / 29.84dBm	798mW / 29.02dBm	857mW / 29.33dBm
E.I.R.P. with 6dBi Omni Antenna		2157mW / 33.34dBm	17.86mW / 32.52dBm	1919mW / 32.83dBm
E.I.R.P. with 8dBi Yagi Antenna		3499mW / 35.44dBm	2897mW / 34.62dBm	3112mW / 34.93dBm
E.I.R.P. Limit		4 Watts / 36dBm	4 Watts / 36dBm	4 Watts / 36dBm
-20dB Occupied Bandwidth		215.54kHz	205.12kHz	206.72kHz
99% Occupied Bandwidth		205.93kHz	198.72kHz	197.12kHz
Occupied Bandwidth Limit		<500kHz	<500kHz	<500kHz
Voltage Variations*	3.3VDC	26.39dBm	26.08dBm	25.94dBm
	-15% 2.8VDC	22.09dBm	21.72dBm	21.86dBm
	+15% 3.8VDC	27.34dBm	26.52dBm	26.83dBm
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: V4.0
Serial No.: 412
Firmware: V4.0
Hardware: V1.0.3
FCC ID: **G2RWHPMOD**

5.2 Trade Name:

Runwise, Inc.

5.3 Power Supply:

Module is DC powered at 3.7VDC nominal

5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

5.5 Equipment Category:

Radio Transmitter-FHSS

5.6 Antenna(s):

2.5dBi Dipole
6dBi Omni Antenna
8dBi Yagi Antenna

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	2025-01-31
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2025-04-09
Low Loss Cable Set	CL315 / CL318	Fairview Microwave	FMC0202914-72/FMC0202914-240	None Spec.	2025-04-09, 2025-04-10
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2025-09-18
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	CL250	Com-Power	PAM-118A	18040011	2025-04-11
Preamplifier	CL284	A.H. Systems, Inc.	PAM-1001	131	2025-04-10
Software:	EMC 32, Version 8.53.0		Software Verified: 2024-11-20 to 2024-11-21		
Temp/Hum Rec	CL293	Thermpro	TP50	1	2025-05-31
Spectrum Analyzer	0141	Hewlett Packard	8591E	3520A04145	2025-04-09
Software:	Tile Version 3.4.B.3.		Software Verified: 2024-11-21		
Spectrum Analyzer	CL147	Agilent	E7402A	MY45101241	2025-04-10
LISN	CL181	Com-Power	LI-125A	191226	2026-11-20
LISN	CL182	Com-Power	LI-125A	191225	2026-11-21
Temp/Hum Rec	CL294	Thermpro	TP50	2	2026-04-27

7 OCCUPIED BANDWIDTH

7.1 Requirements:

The 20dB bandwidth shall be less than 500 kHz.

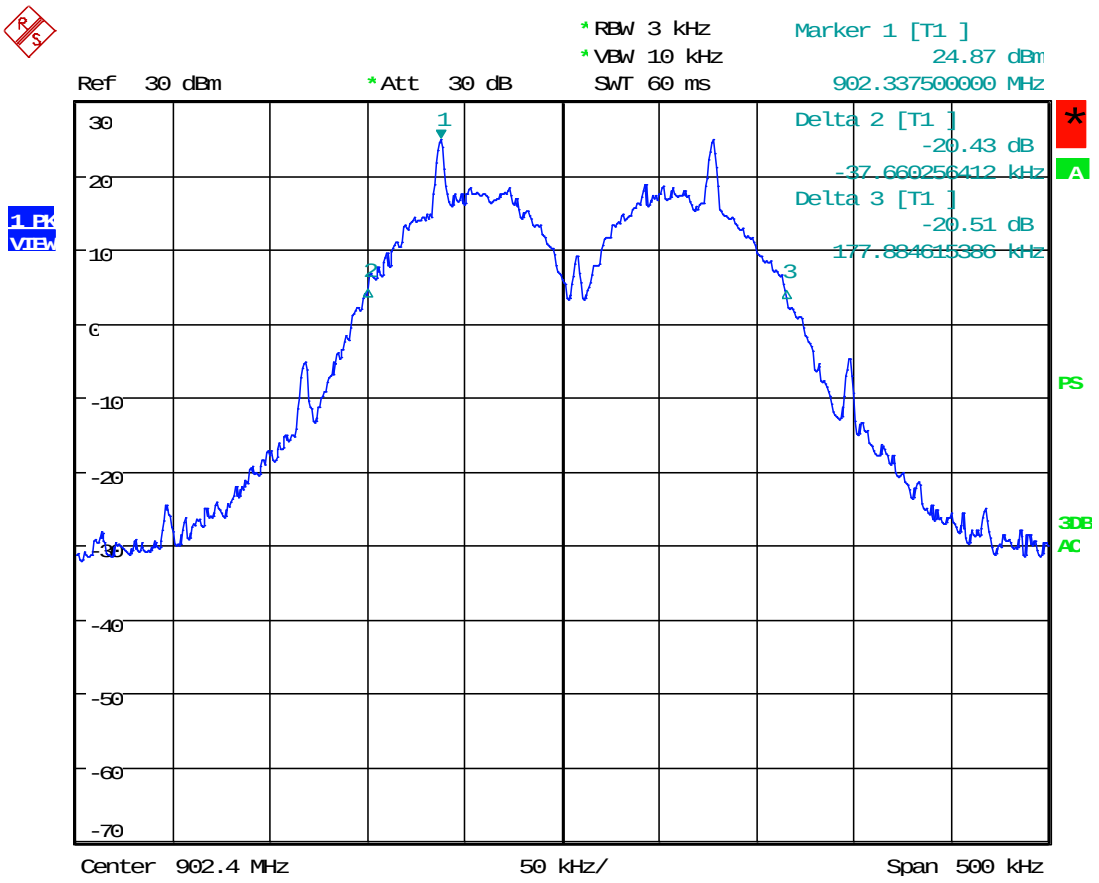
-20 dB Bandwidth measurements were made at the low, mid and high frequencies. The bandwidth was measured using the analyzer's marker function.

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

7.2 Occupied Bandwidth Test Data

Test Date:	2025-01-27 to 2025-01-28	**Test Engineer(s):**	E. Tobin
Standards:	CFR 47 Part 15.247(a)(2); KDB558074	**Air Temperature:**	21.3ºC
		Relative Humidity:	37%

-20dB: Low Channel



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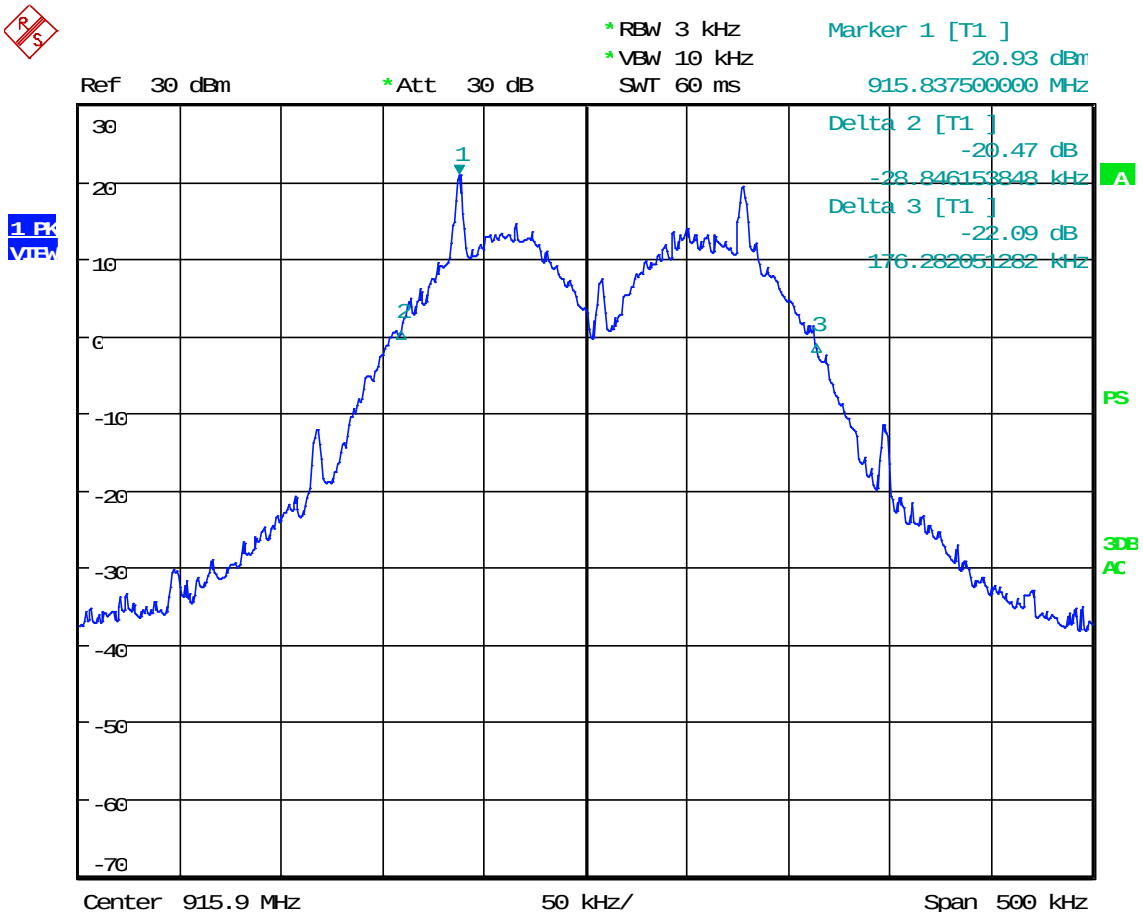
-20dB: Mid Channel



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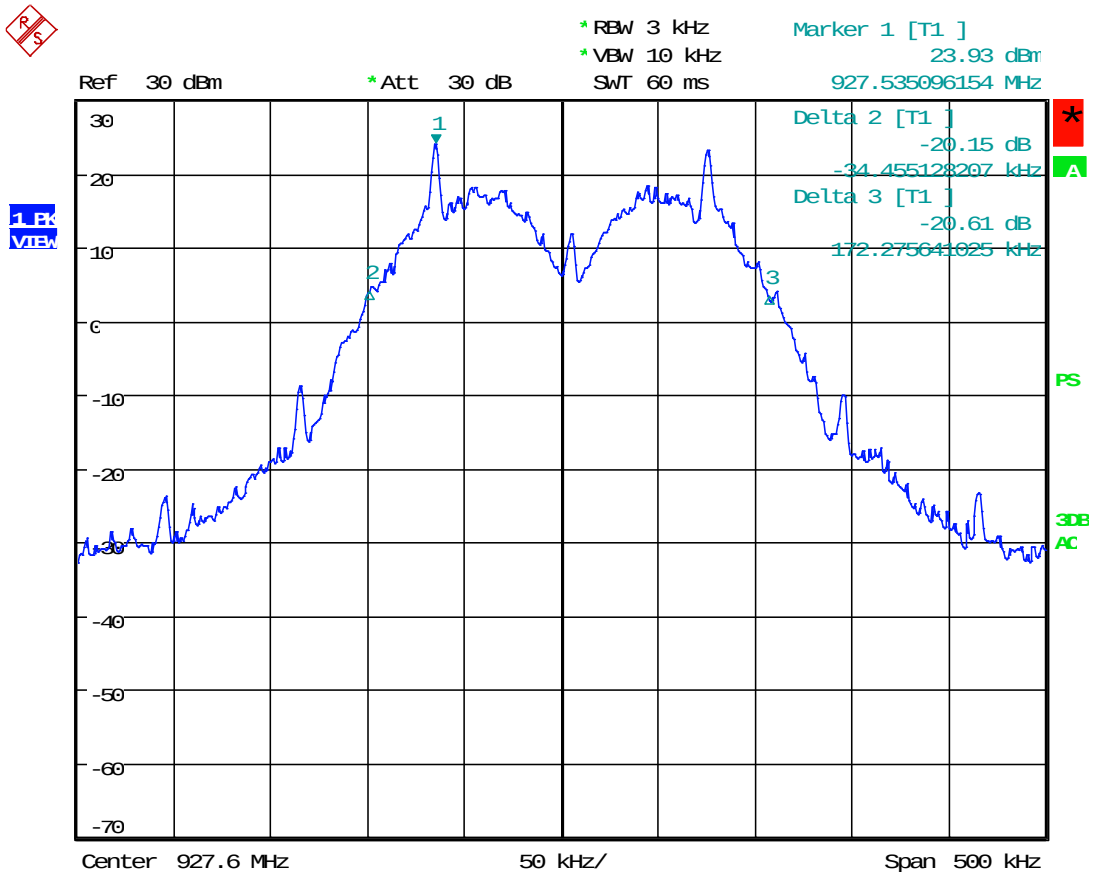
-20dB: High Channel



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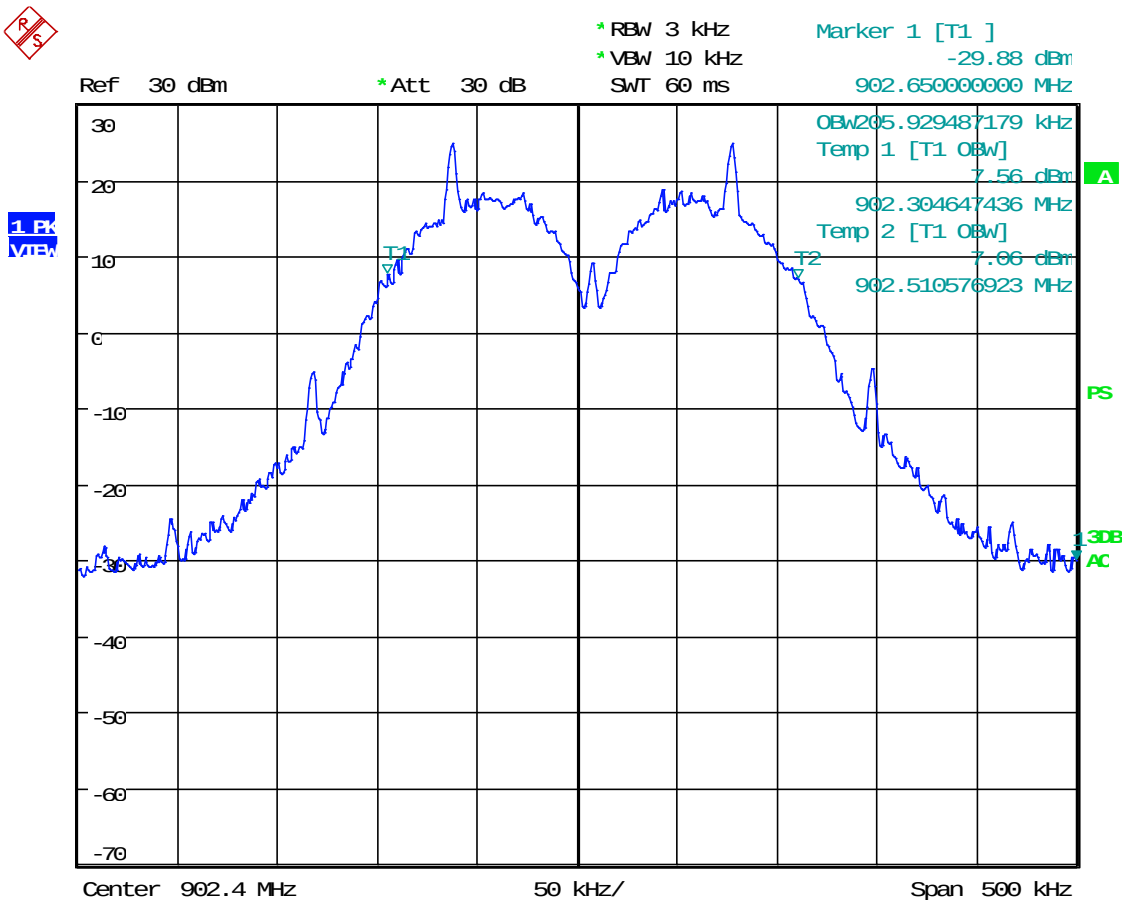
99%: Low Channel



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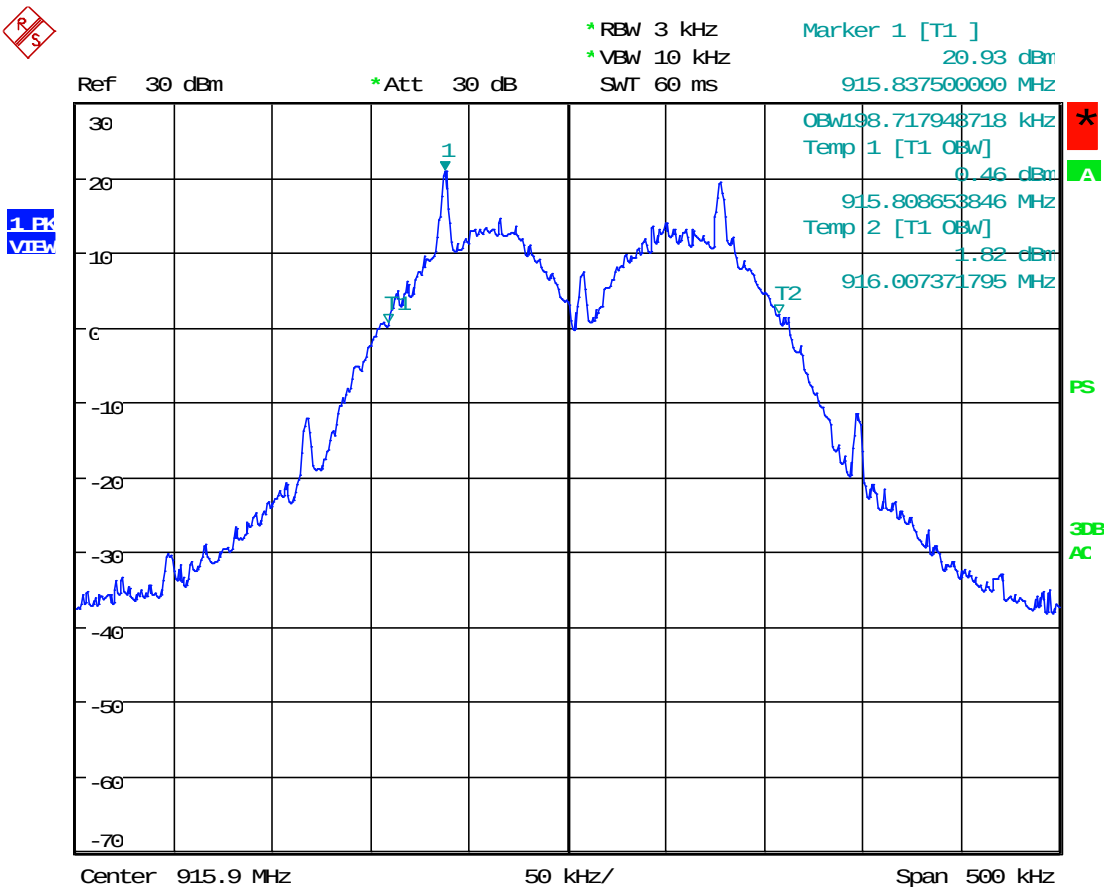
99%: Mid Channel



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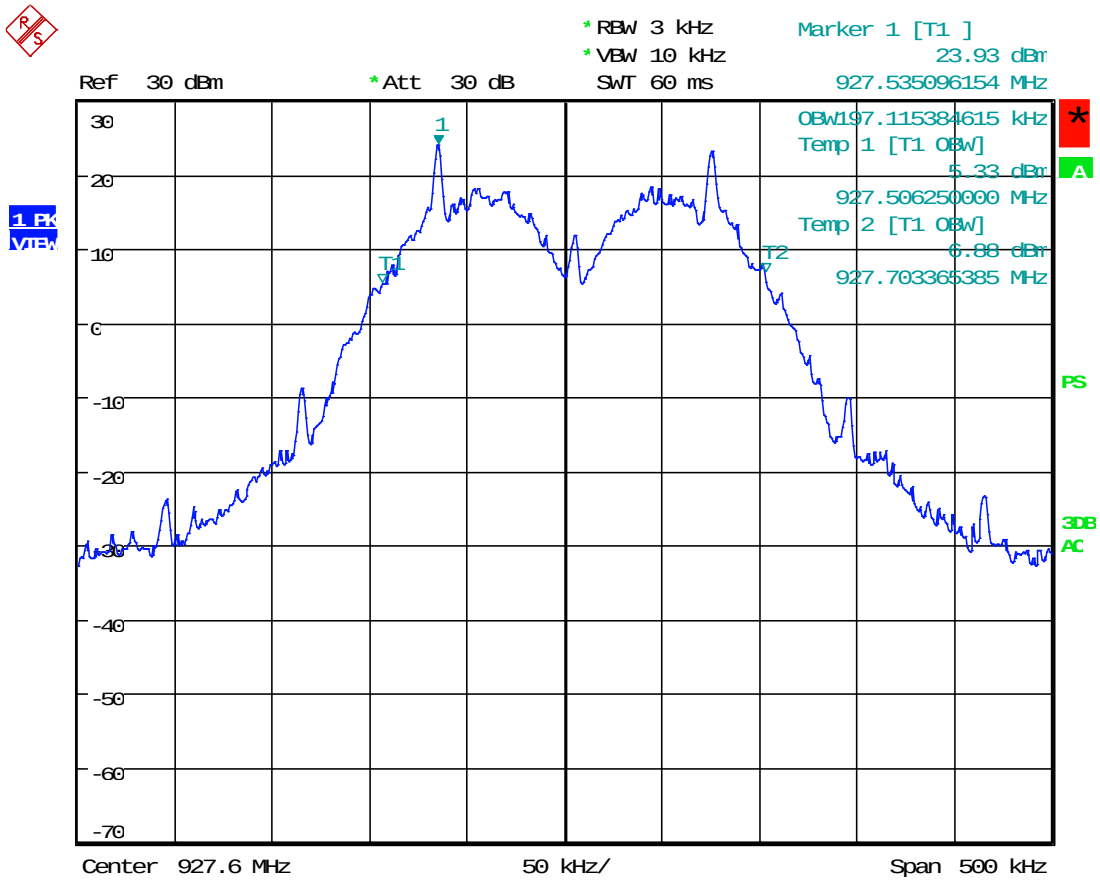
99%: High Channel



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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.

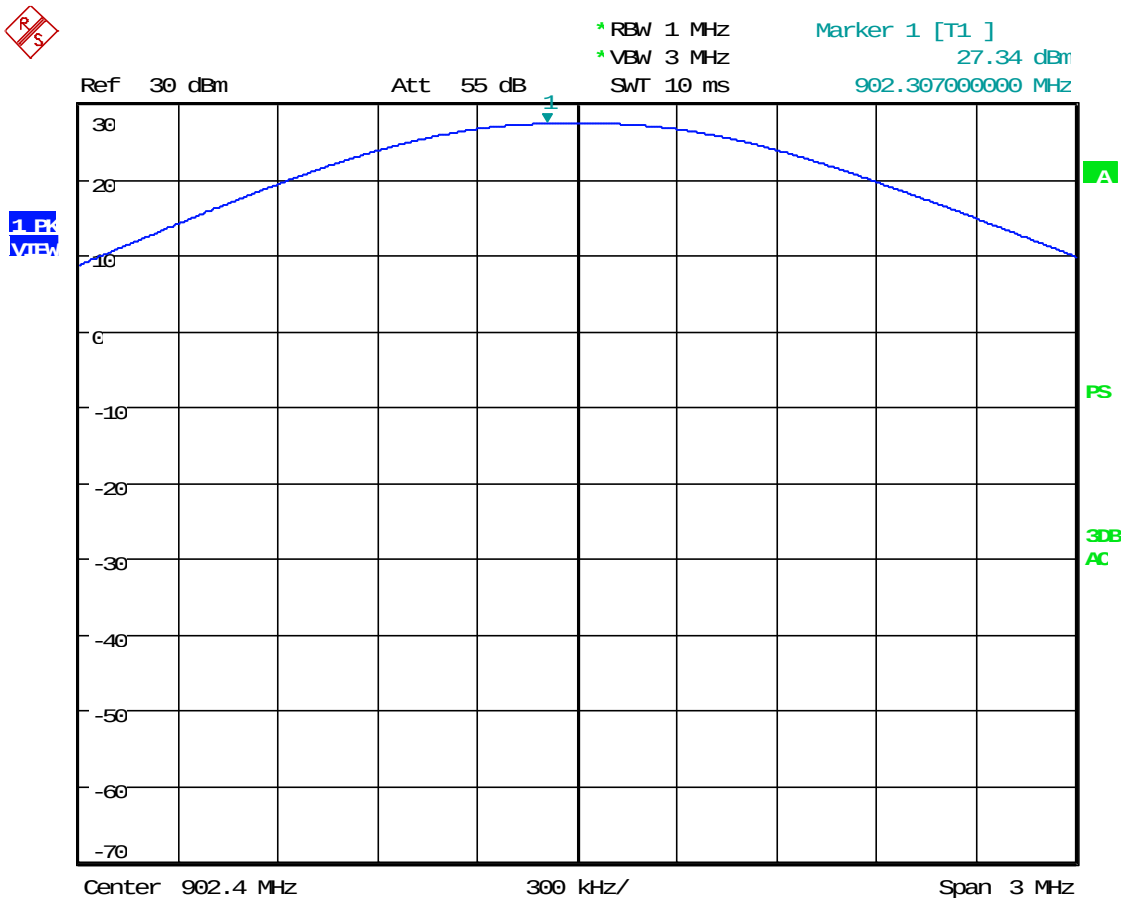
8.1 Requirements:

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:	2024-11-20	Test Engineer:	J. Chiller
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	Air Temperature:	22.1ºC
		Relative Humidity:	39%

Low Channel



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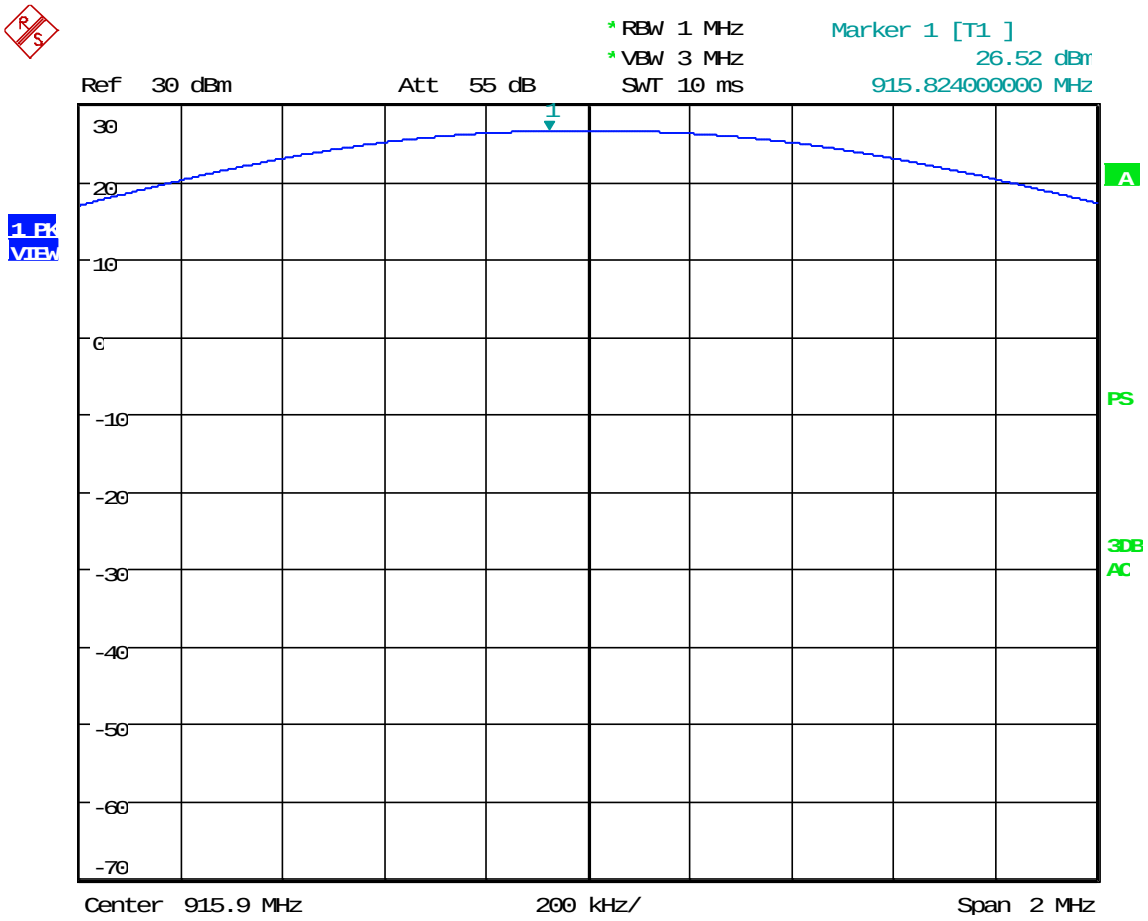
Mid Channel



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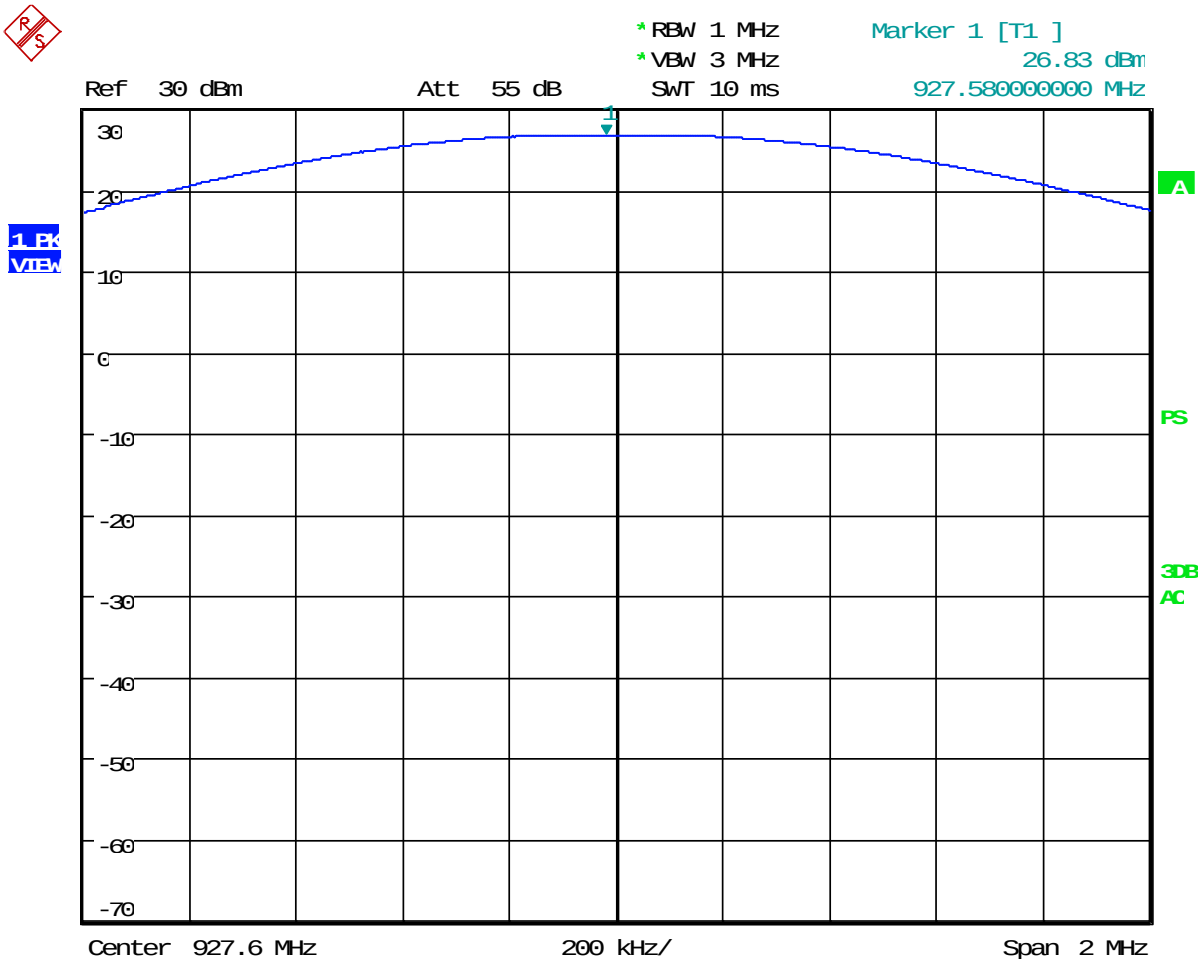
High Channel



Date: 20.NOV.2024 15:13:43

9 VOLTAGE VARIATIONS

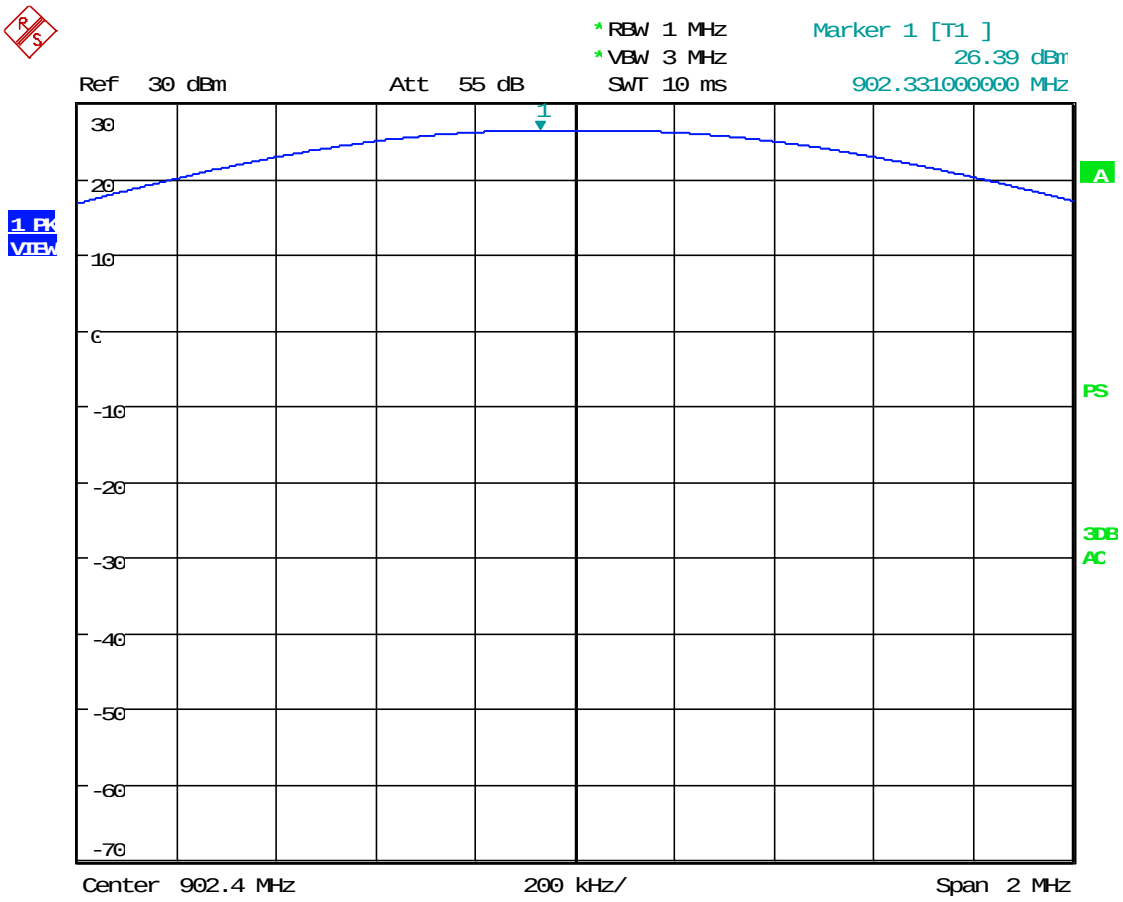
9.1 Requirements

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):	2024-11-20	**Test Engineer:**	J. Chiller
Rule:	15.31(e)	**Air Temperature:**	21.4º C
Test Results:	Complies	**Relative Humidity:**	41%

Low Channel: 3.3VDC



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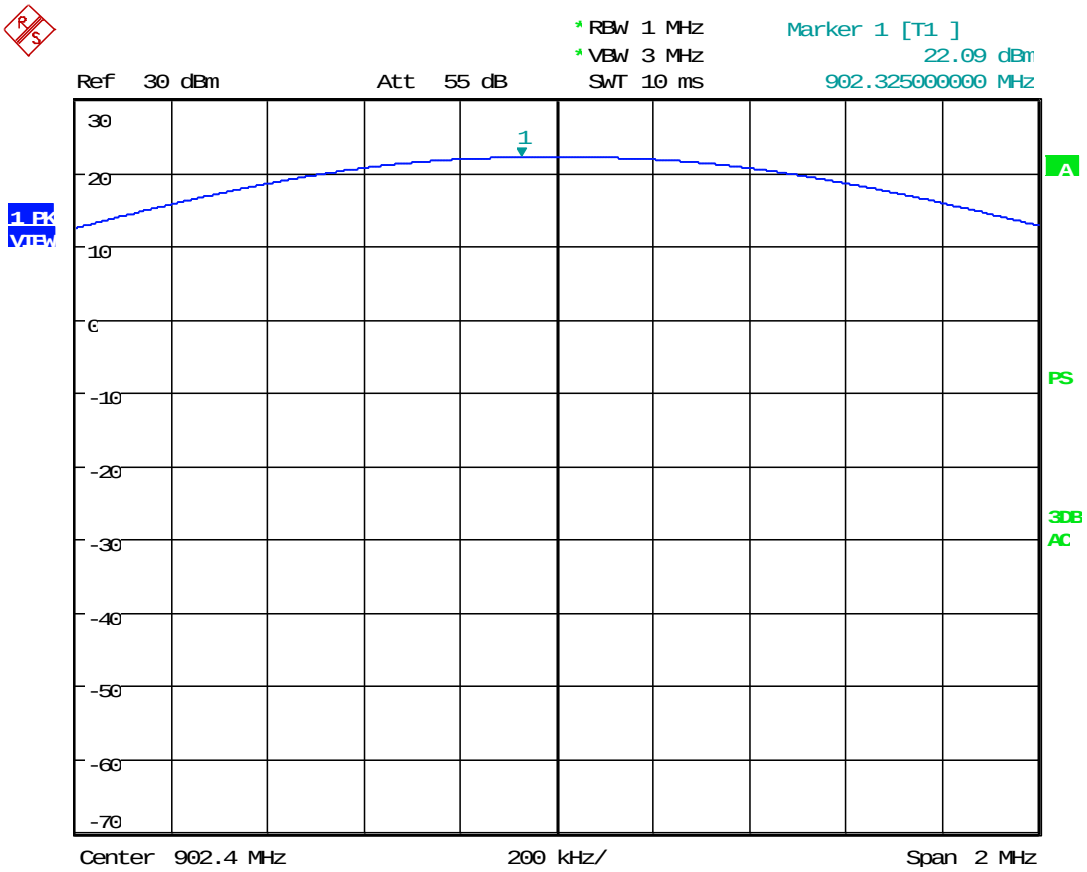
Low Channel: 2.8VDC (-15%)



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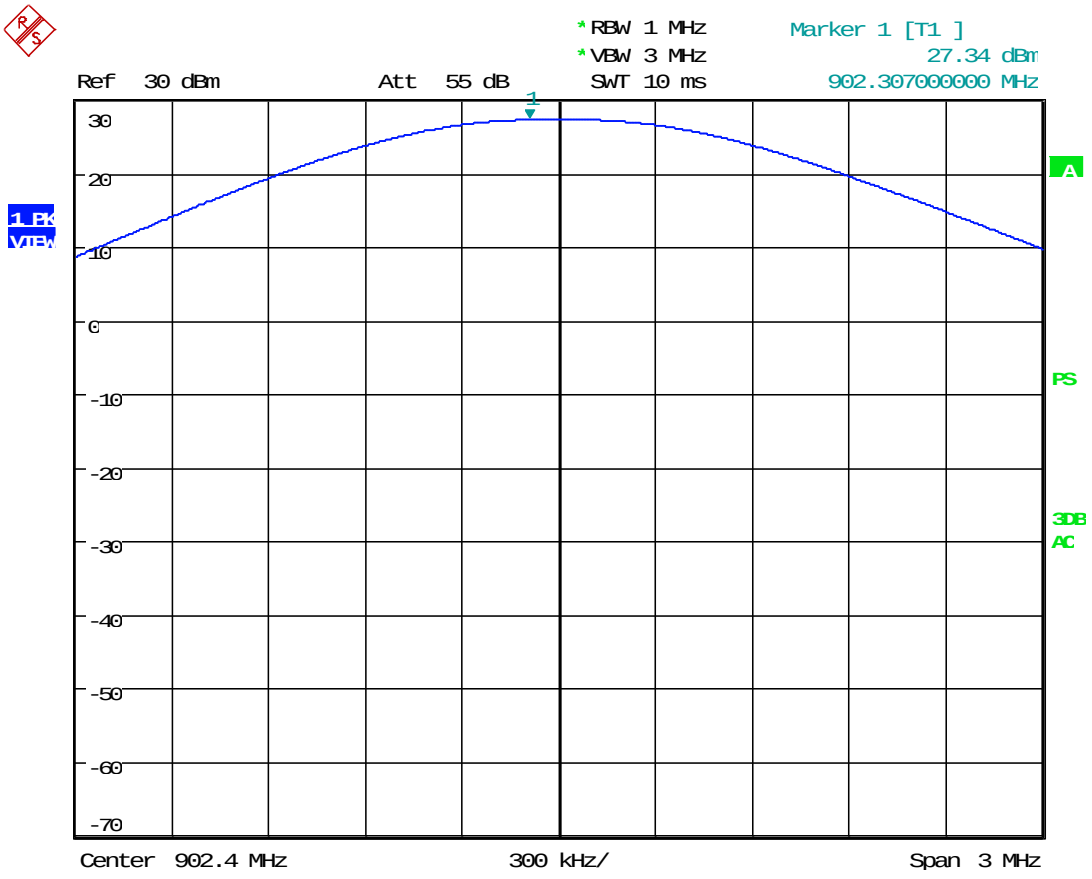
Low Channel: 3.8VDC (+15%)



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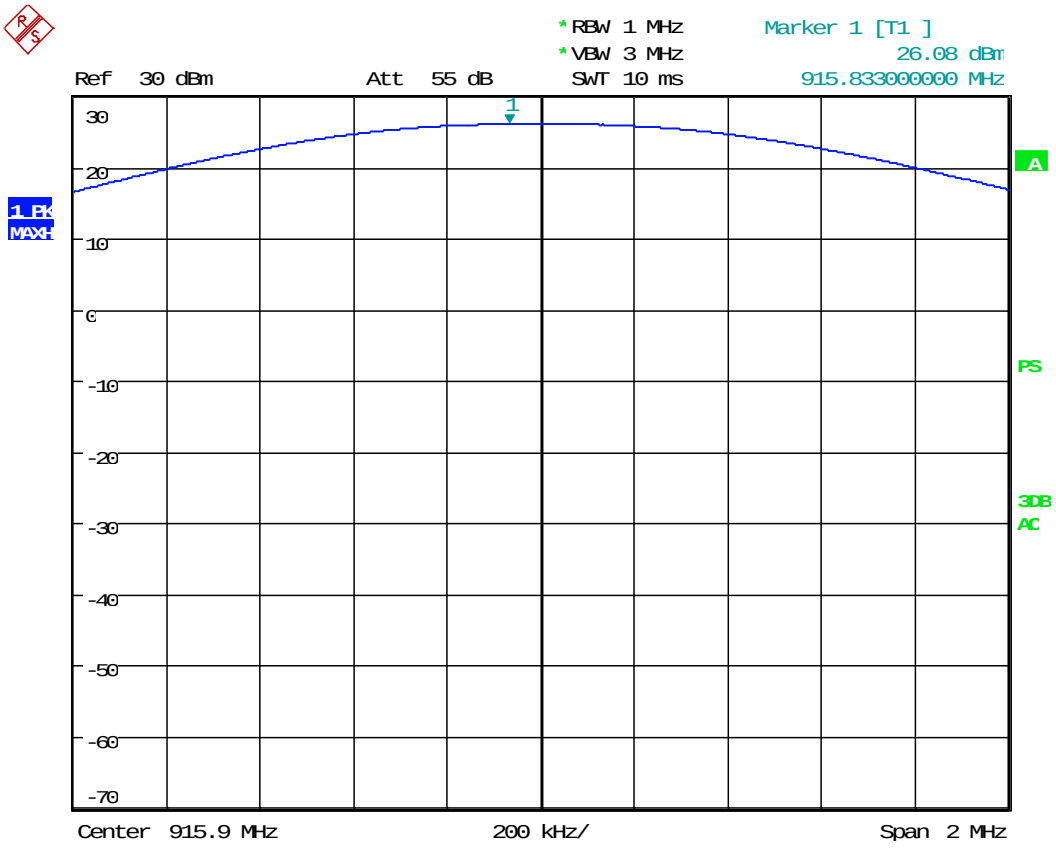
Mid Channel: 3.3VDC (Nominal)



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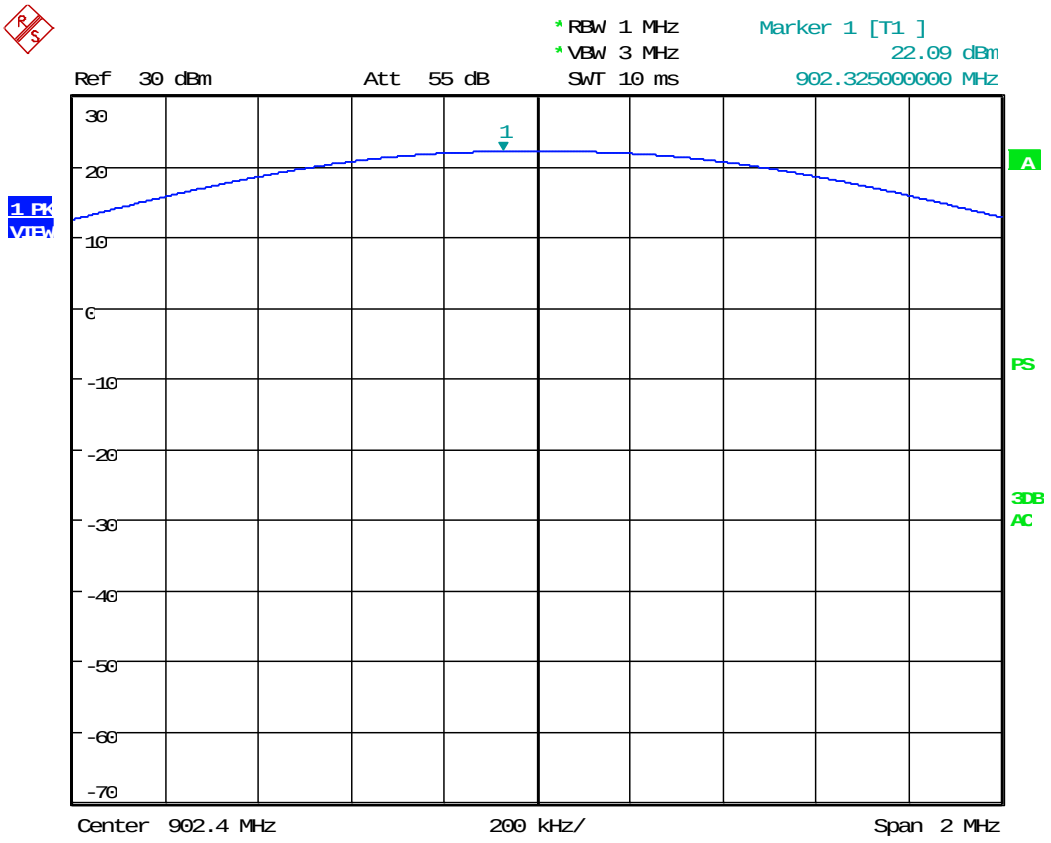
Mid Channel: 3.8VDC (+15%)



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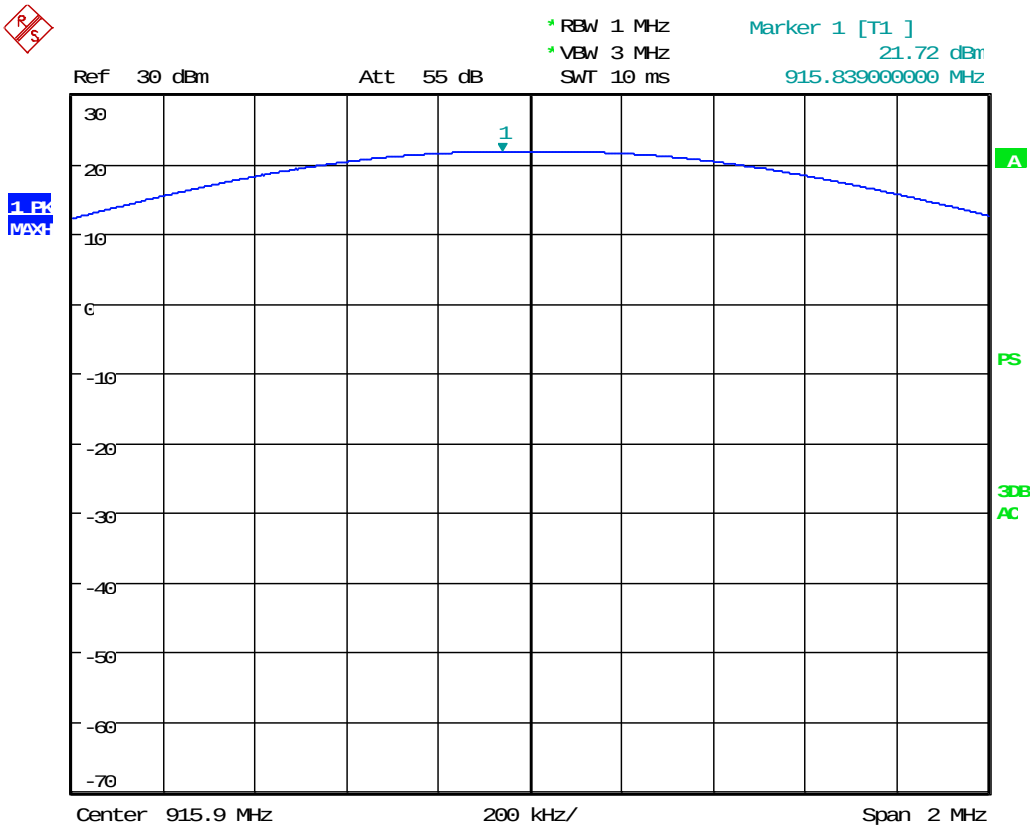
Mid Channel: 2.8VDC (-15%)



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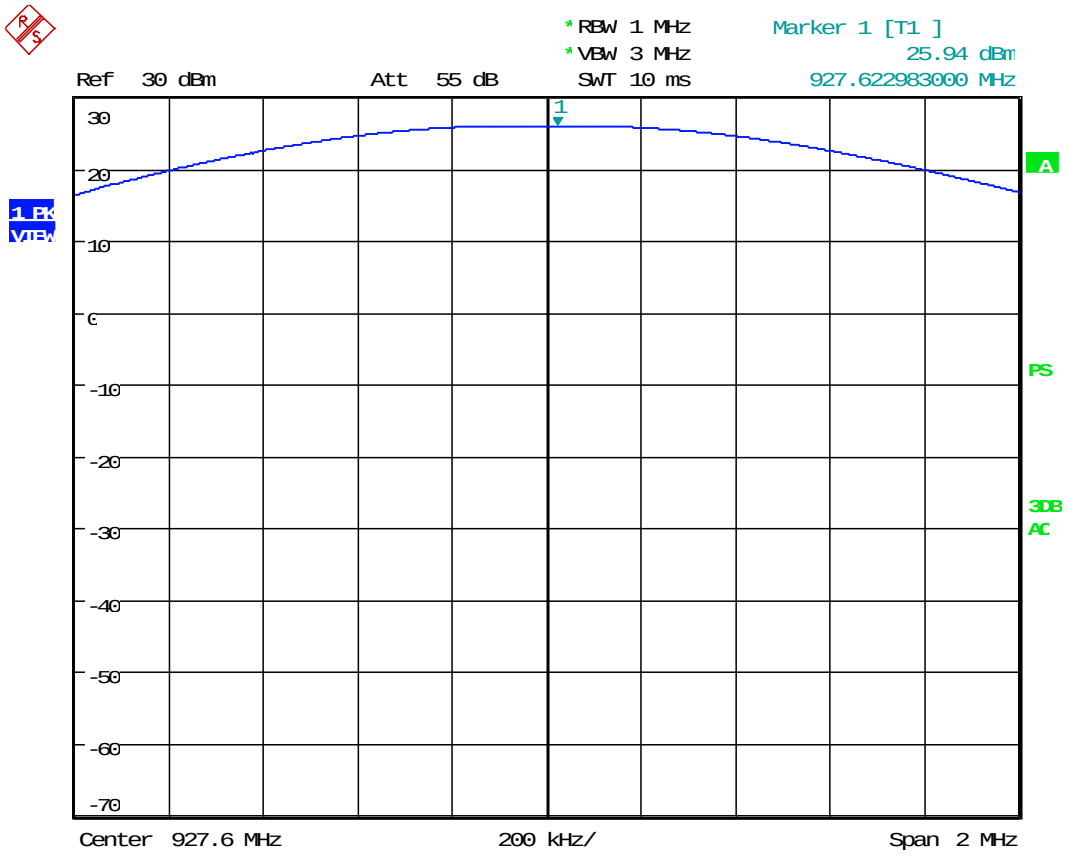
High Channel: 3.3VDC (Nominal)



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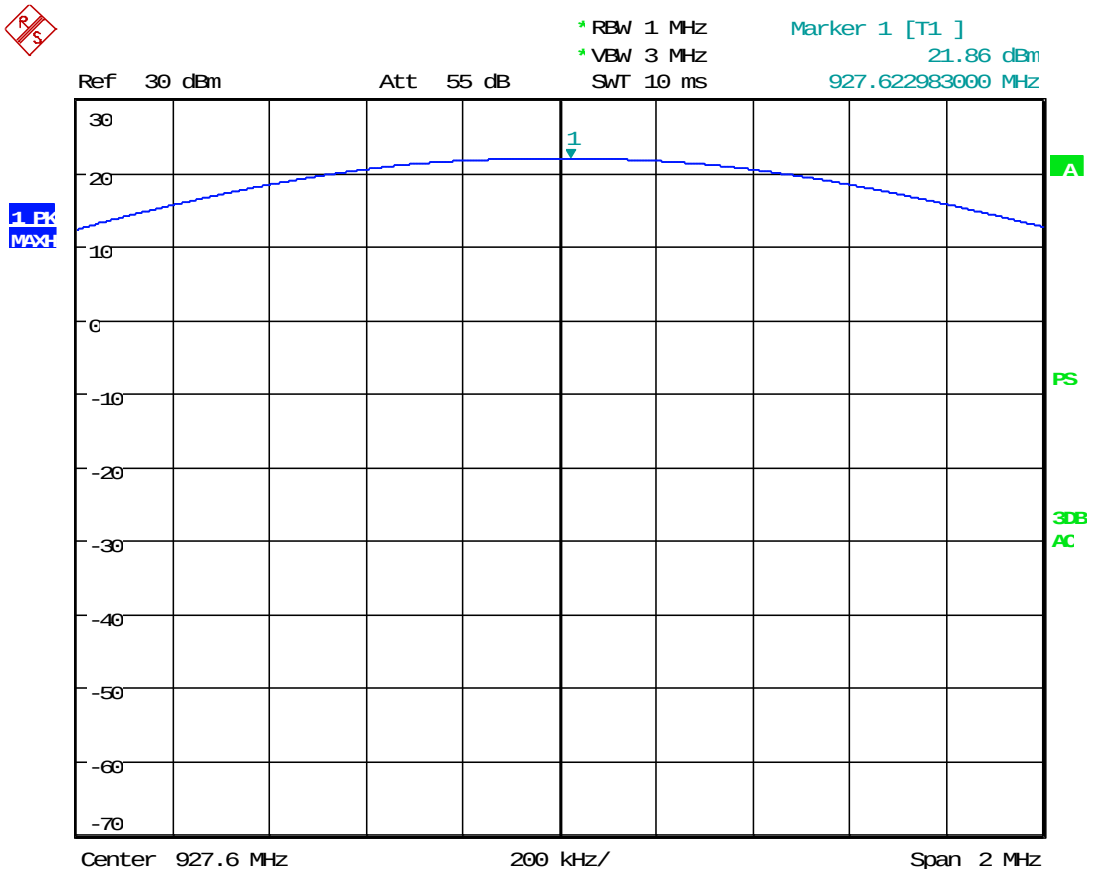
High Channel: 2.8VDC (-15%)



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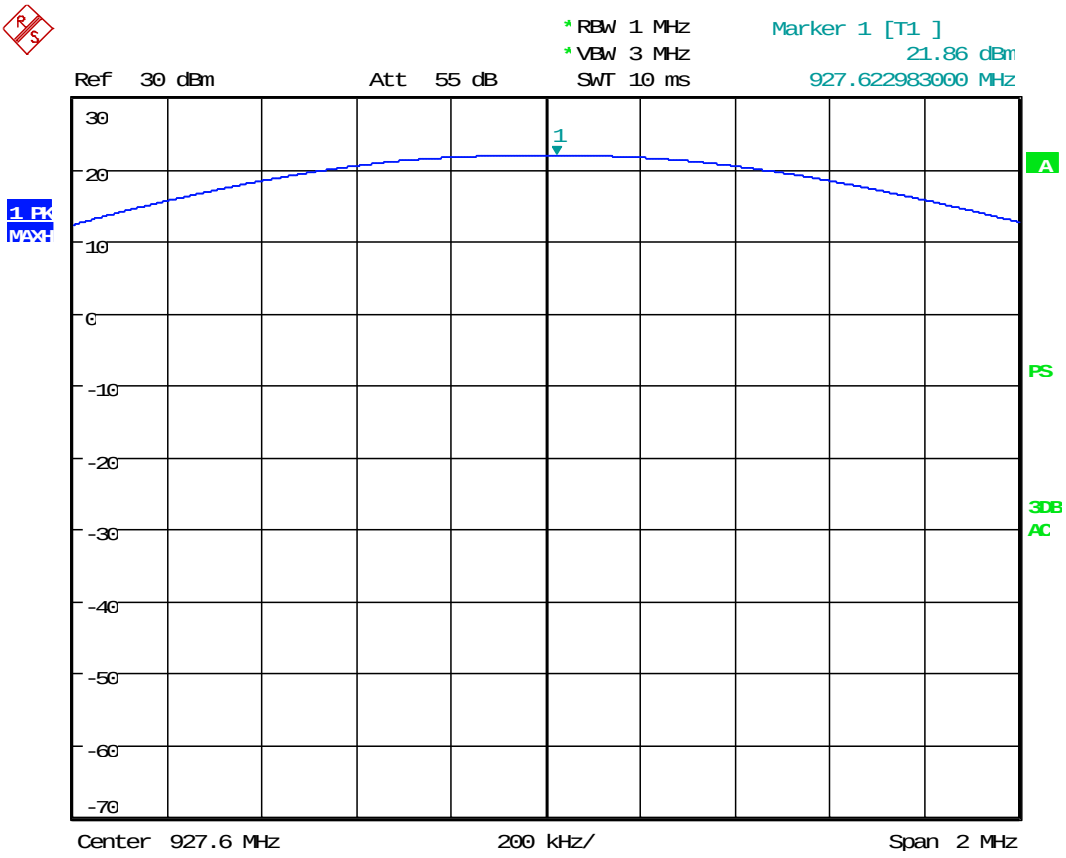
High Channel: 3.8VDC (+15%)



Date: 20.NOV.2024 15:25:57

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, a -30dBc limit was used, and no emissions were closer than 20dB to that limit; therefore, none were closer than 30dB to the -20dBc limit.

10.2 Conducted Spurious Emissions Test Data

Test Date:	2024-11-20	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(d) / Part 15.207 KDB558074	**Air Temperature:**	21.6ºC
		Relative Humidity:	39%
Results:	Complies		

Low Channel: 0.009 MHz to 0.15 MHz

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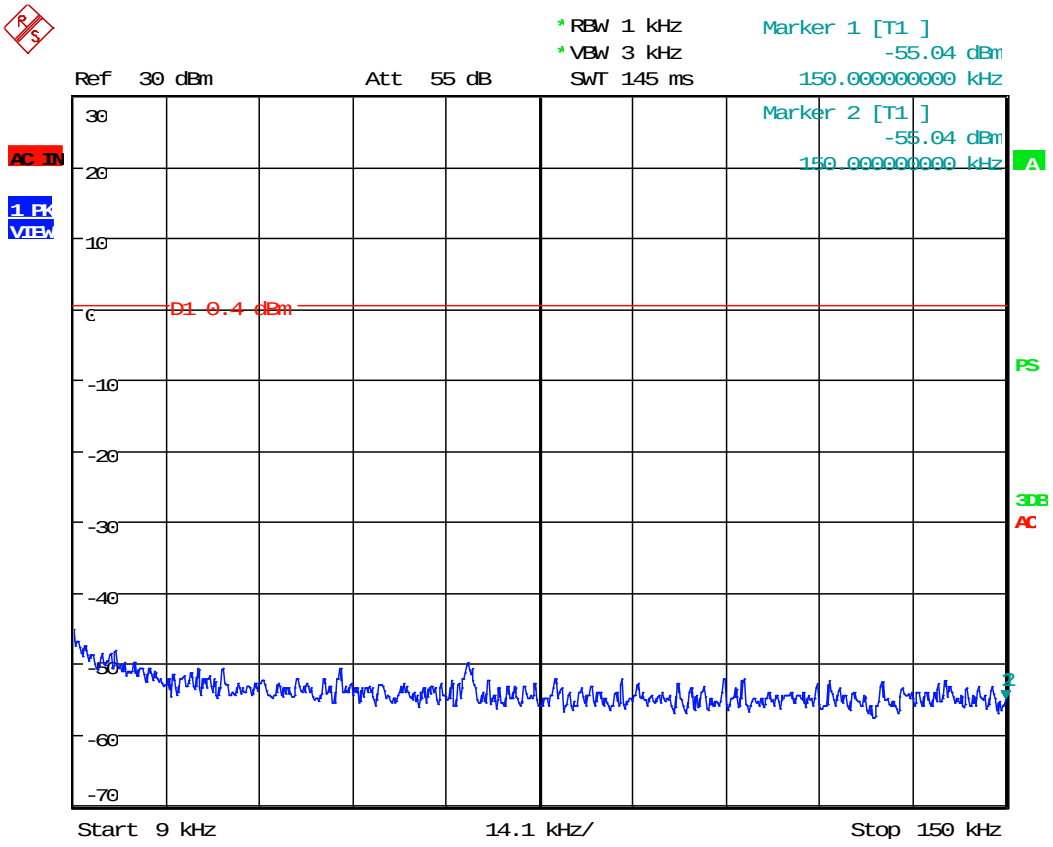

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Low Channel: 0.15 MHz to 30 MHz

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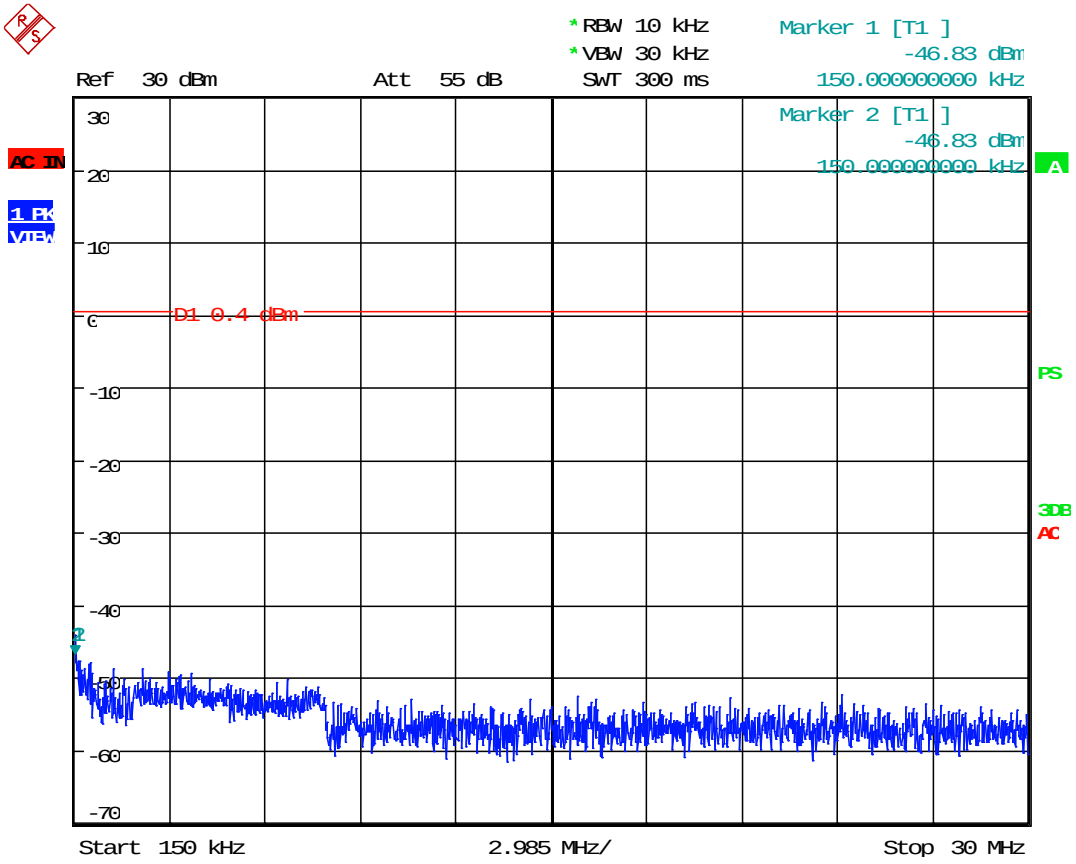

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Low Channel: 30 MHz to 1000 MHz

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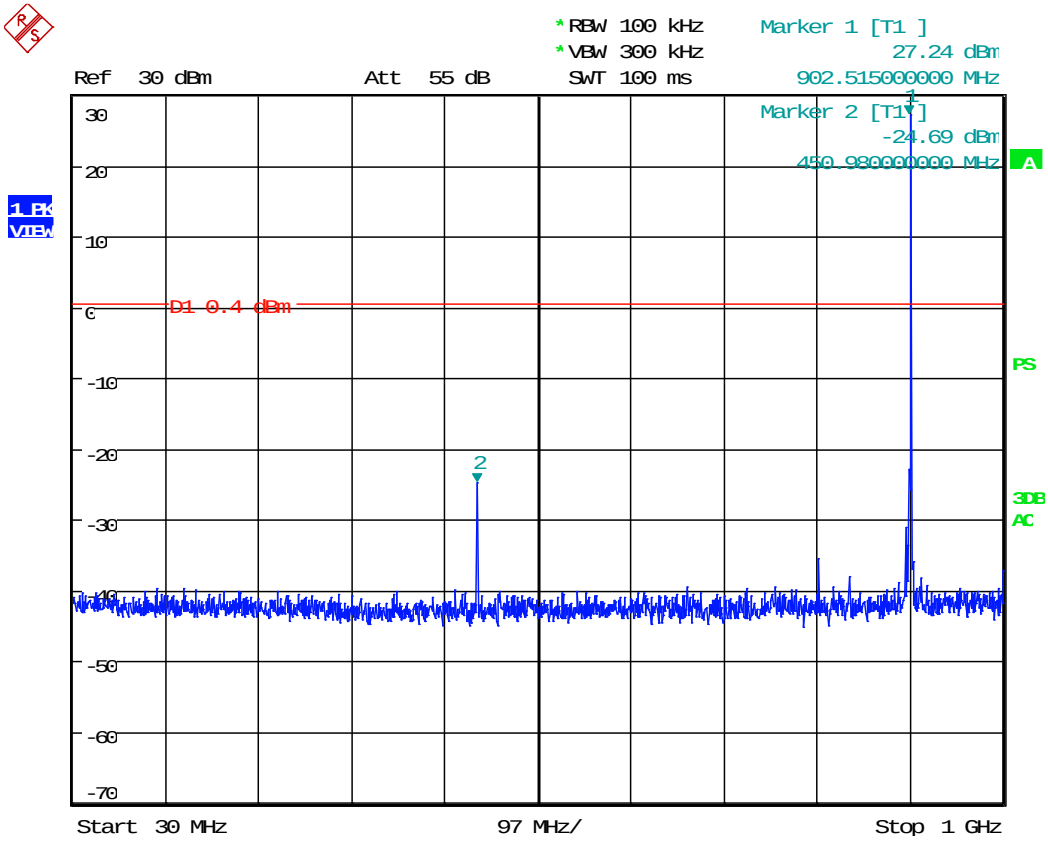

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Low Channel: 1 GHz to 10 GHz

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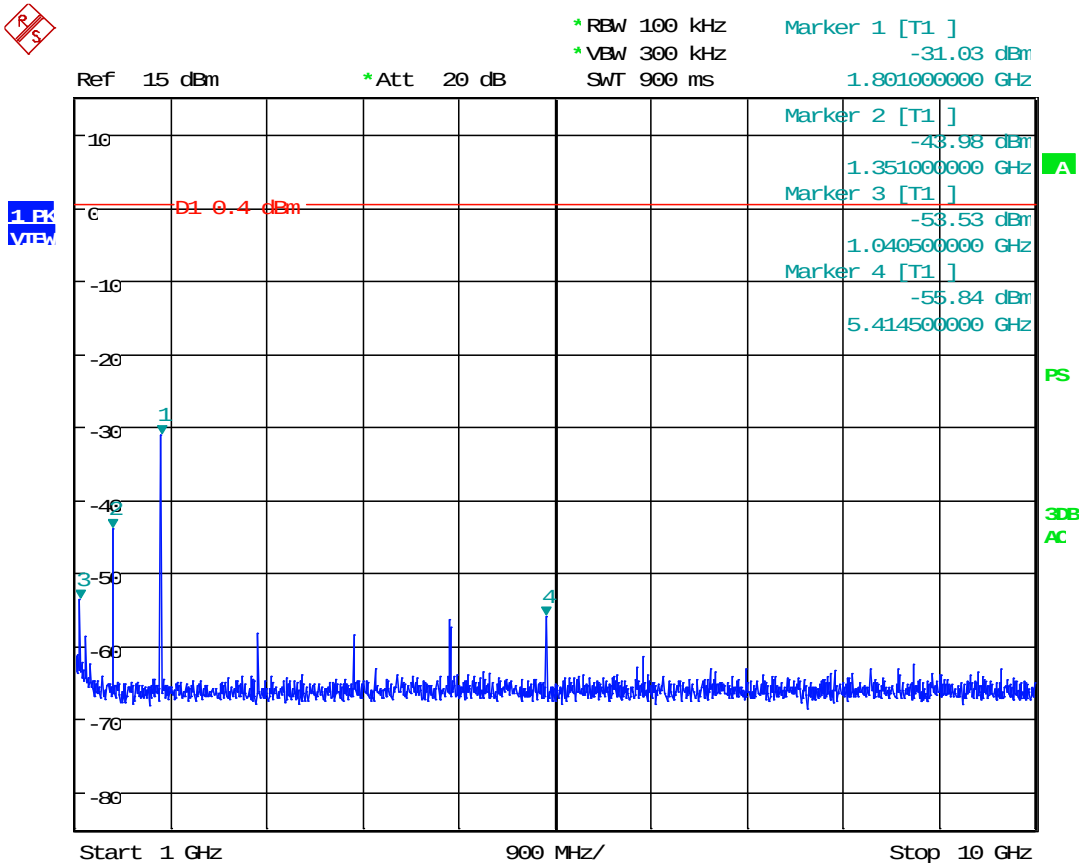

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Mid Channel: 0.009 MHz to 0.15 MHz

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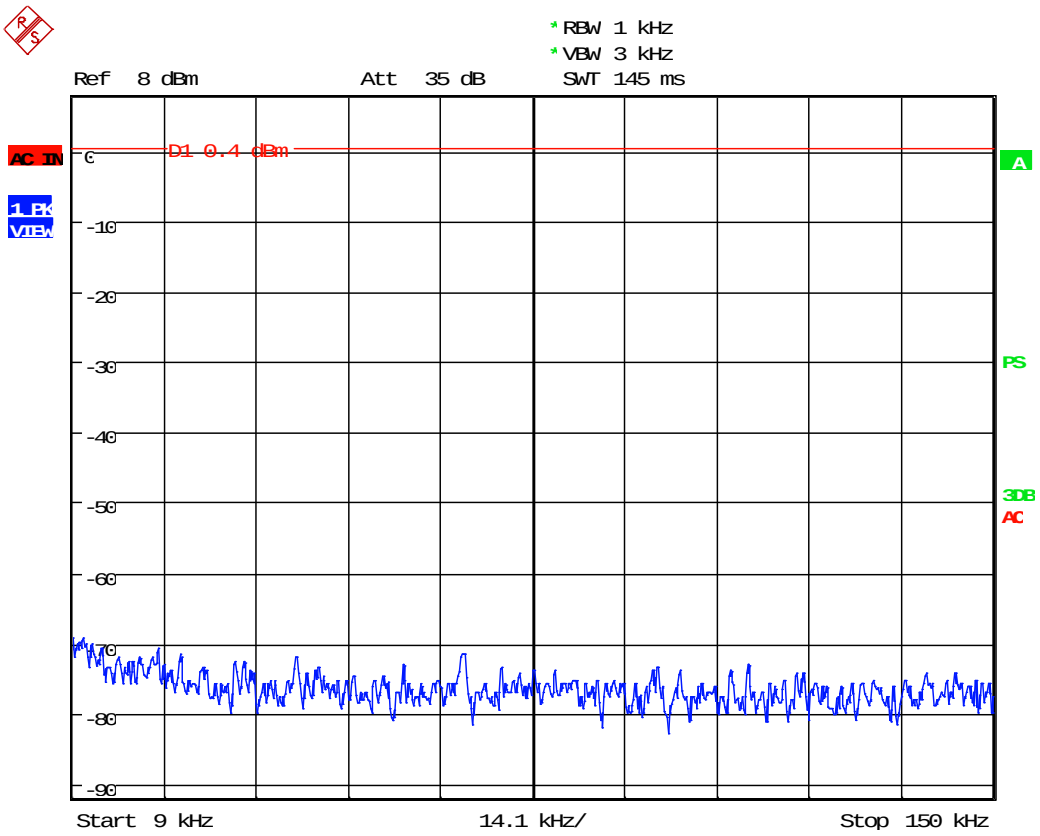

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Mid Channel: 0.15 MHz to 30 MHz

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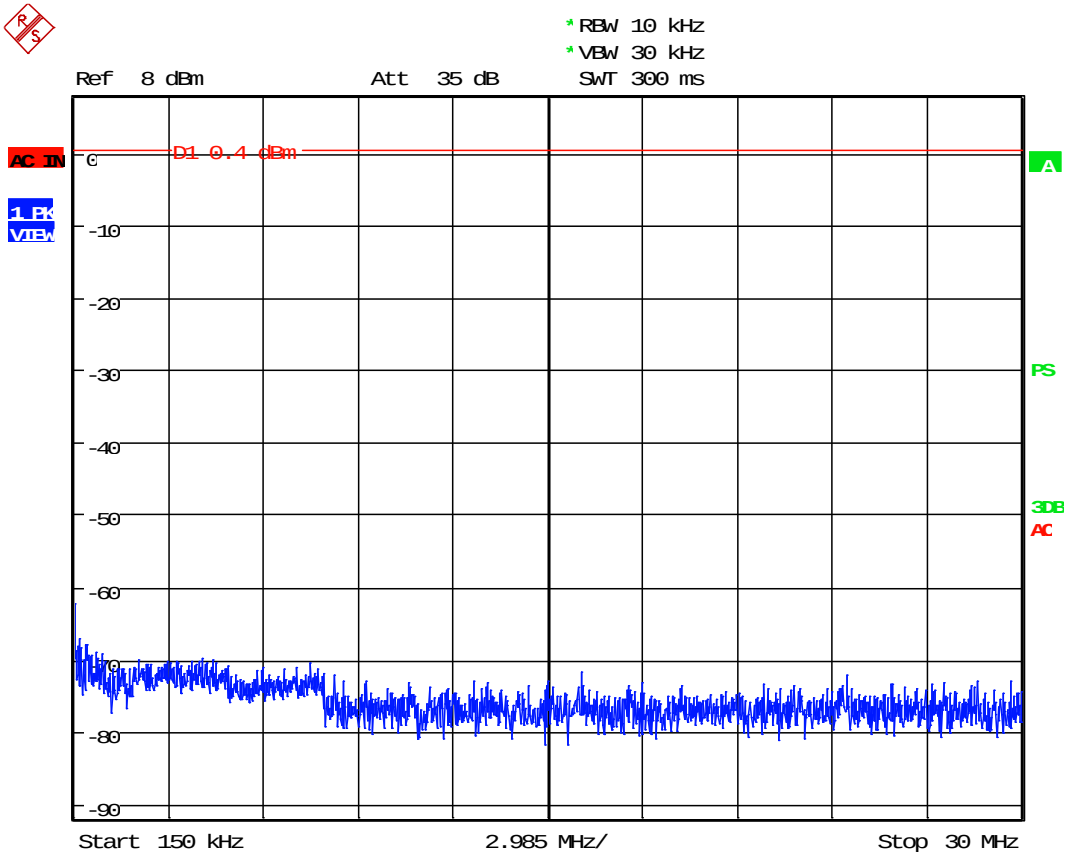

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Mid Channel: 30 MHz to 1000 MHz

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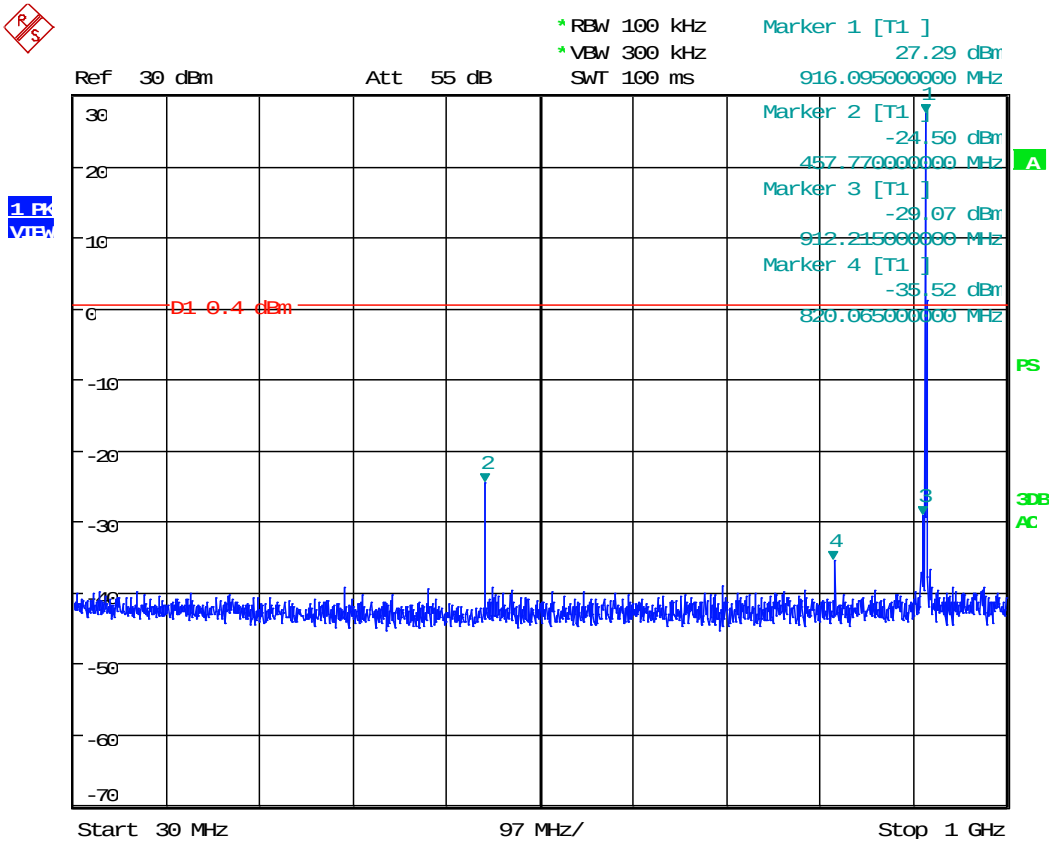

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Mid Channel: 1 GHz to 10 GHz

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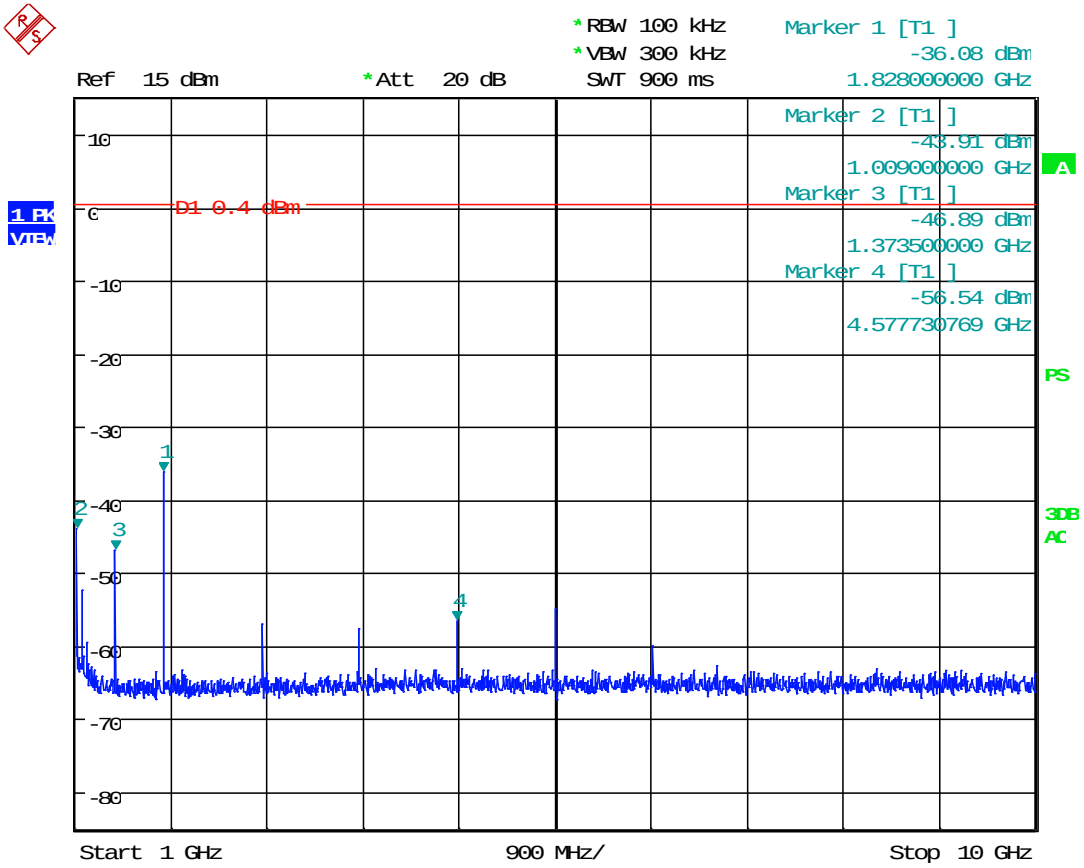

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High Channel: 0.009 MHz to 0.15 MHz

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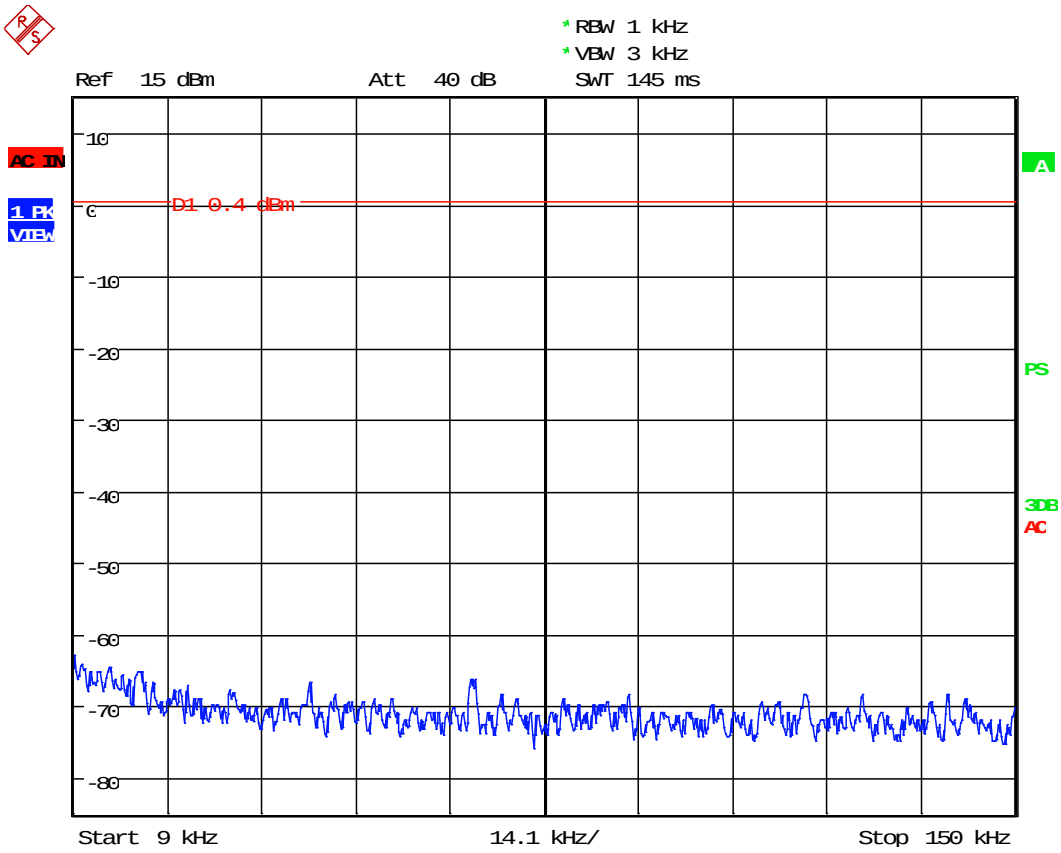

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High Channel: 0.15 MHz to 30 MHz

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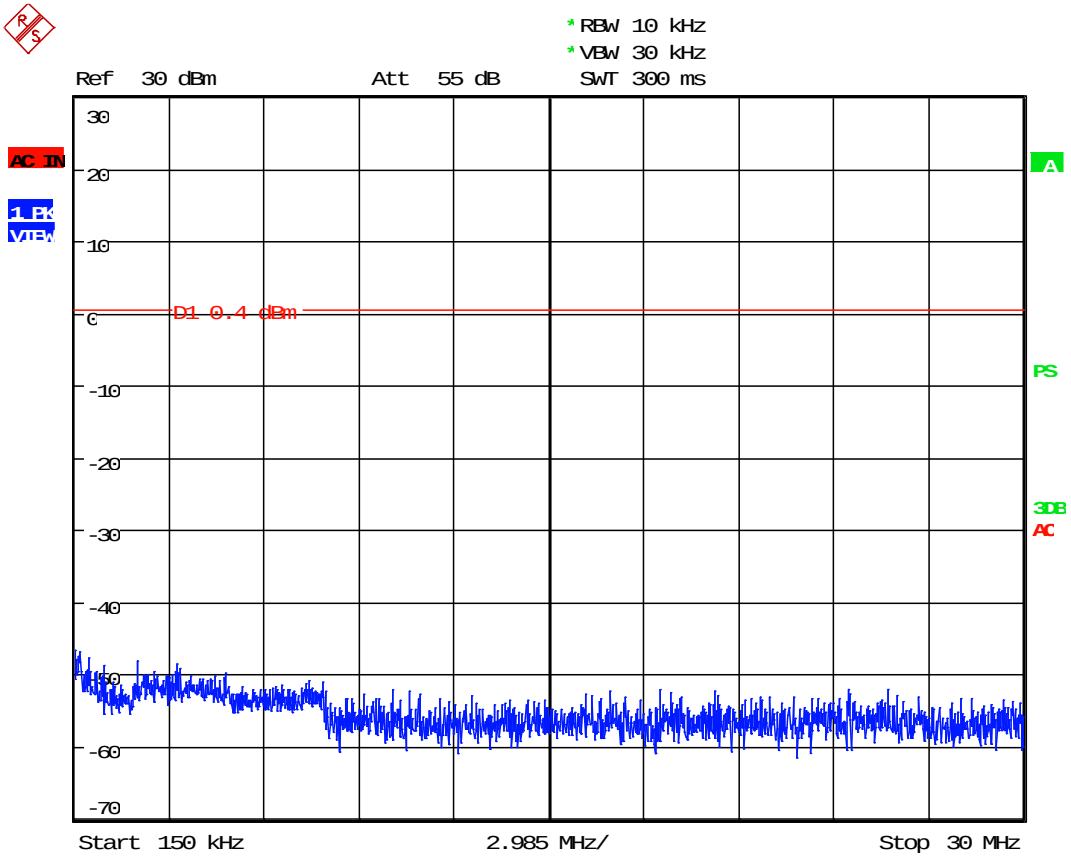

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High Channel: 30 MHz to 1000 MHz

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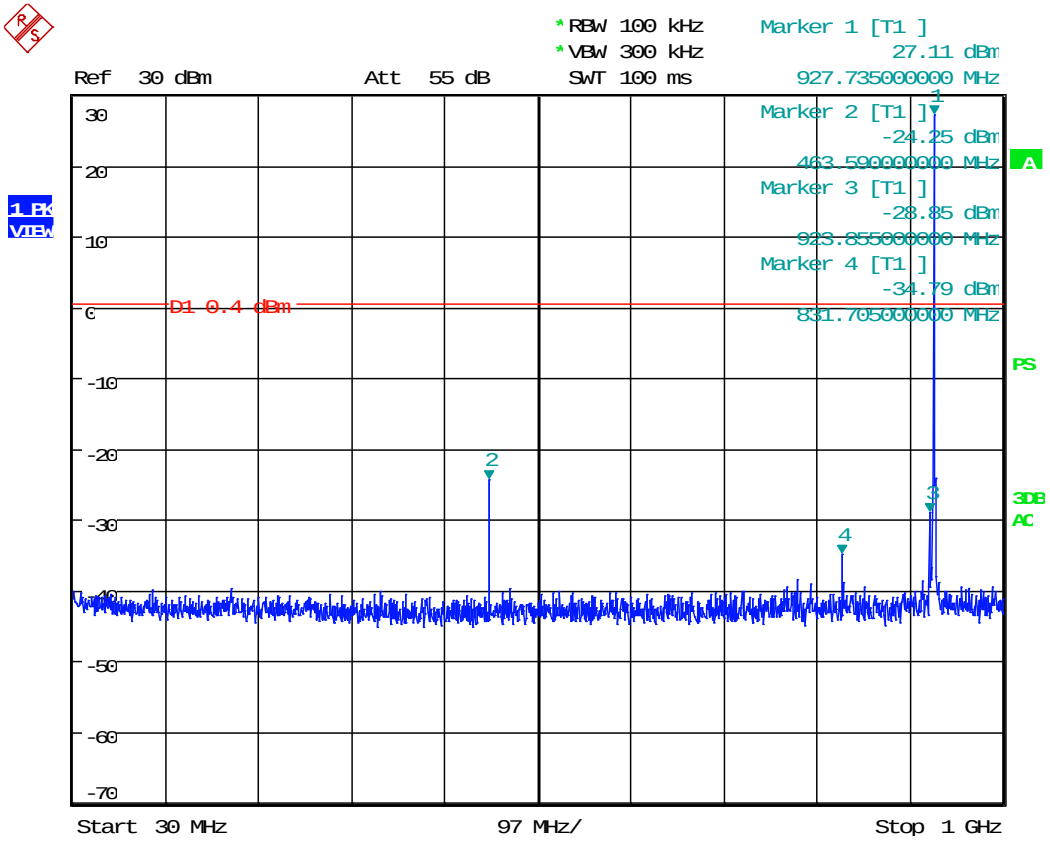

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High Channel: 1 GHz to 10 GHz

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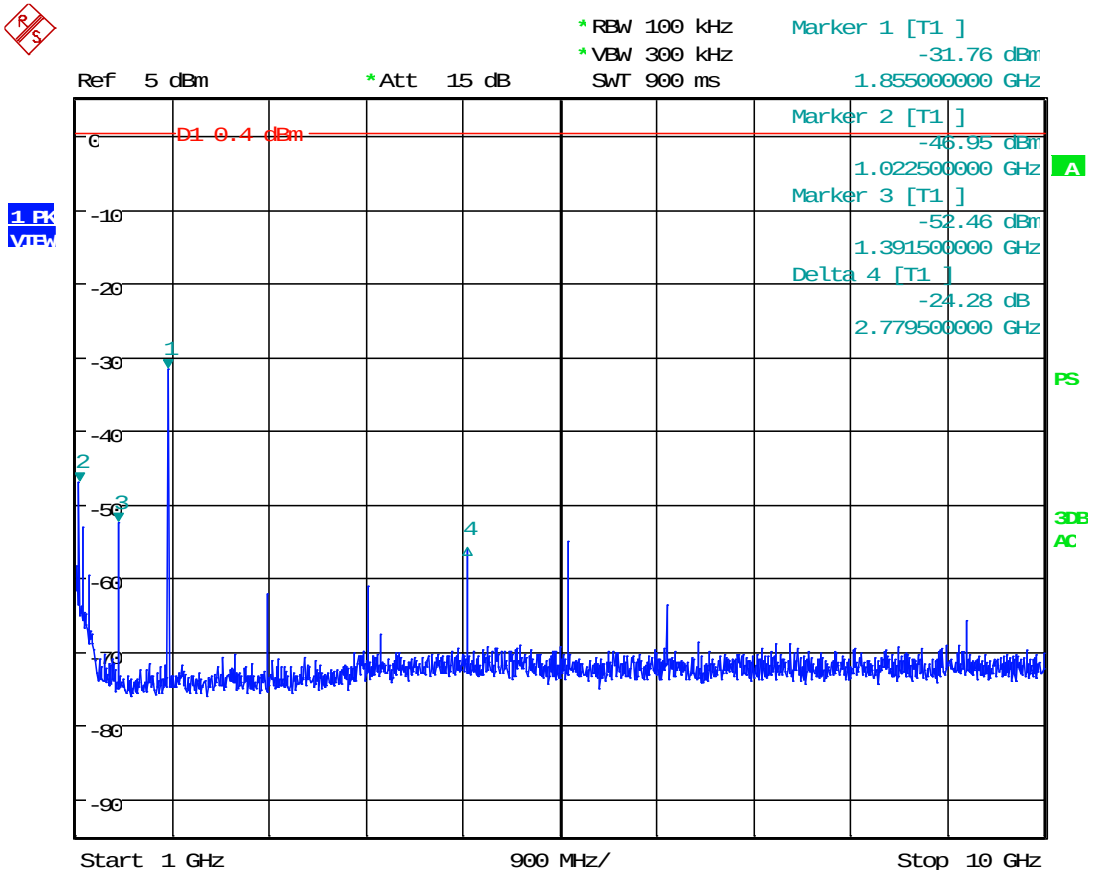


Date: 20.NOV.2024 15:15:55

11 RADIATED SPURIOUS EMISSIONS

The EUT antenna port was fitted with its Dipole, Omni or Yagi 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

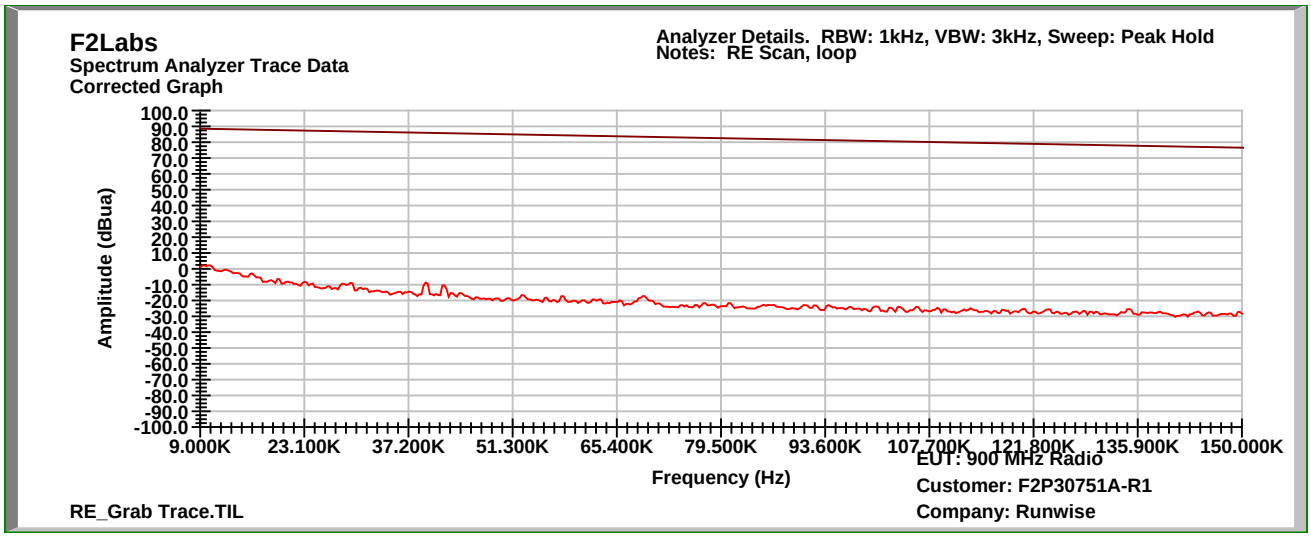
Test Date(s):	2024-11-20	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	21.1ºC
		Relative Humidity:	40%

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.

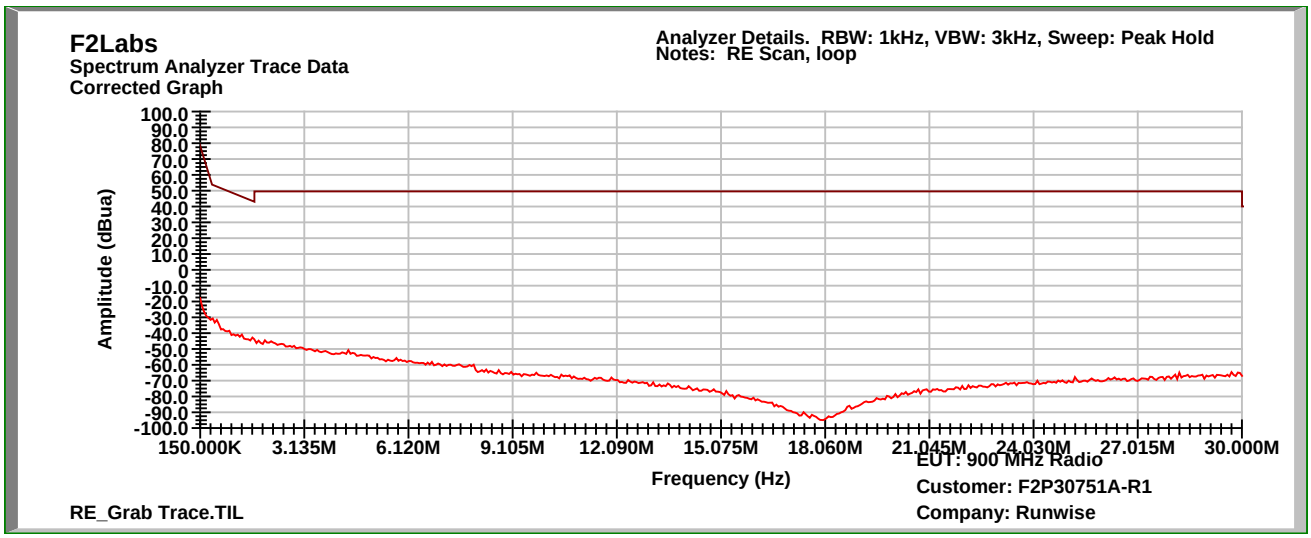
The equipment was fully exercised with all cabling attached to the EUT and was positioned on the Semi-Anechoic Chamber for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable 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 race 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.

Characterization Scan, 0.009 MHz to 0.15 MHz – Loop Antenna

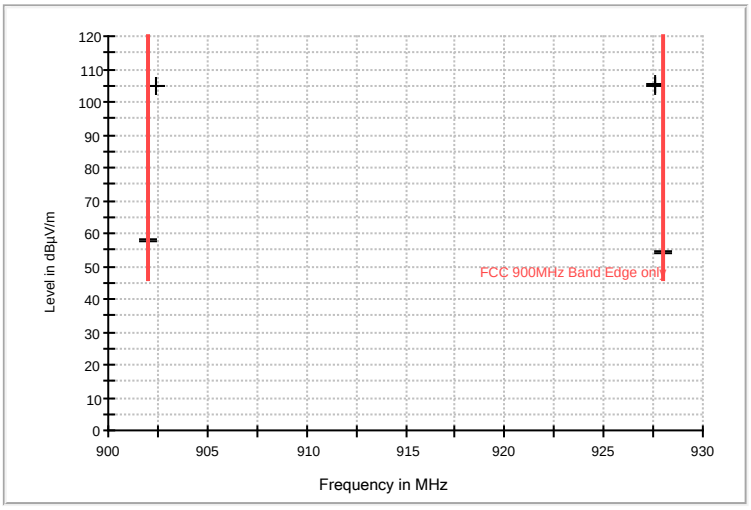


Characterization Scan, 0.15 MHz to 30 MHz – Loop Antenna

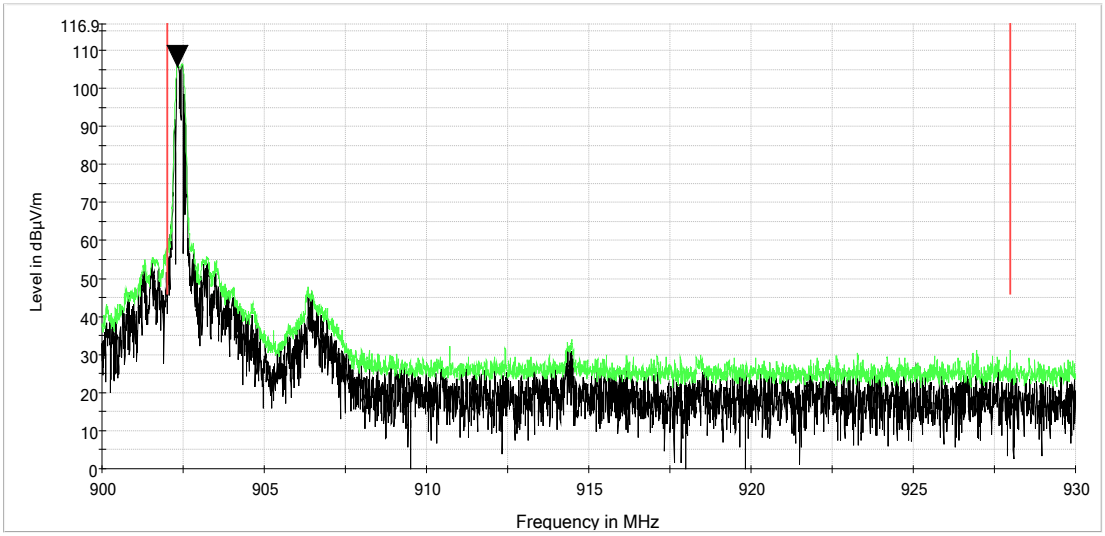


Measurements: Band Edges – Dipole Antenna

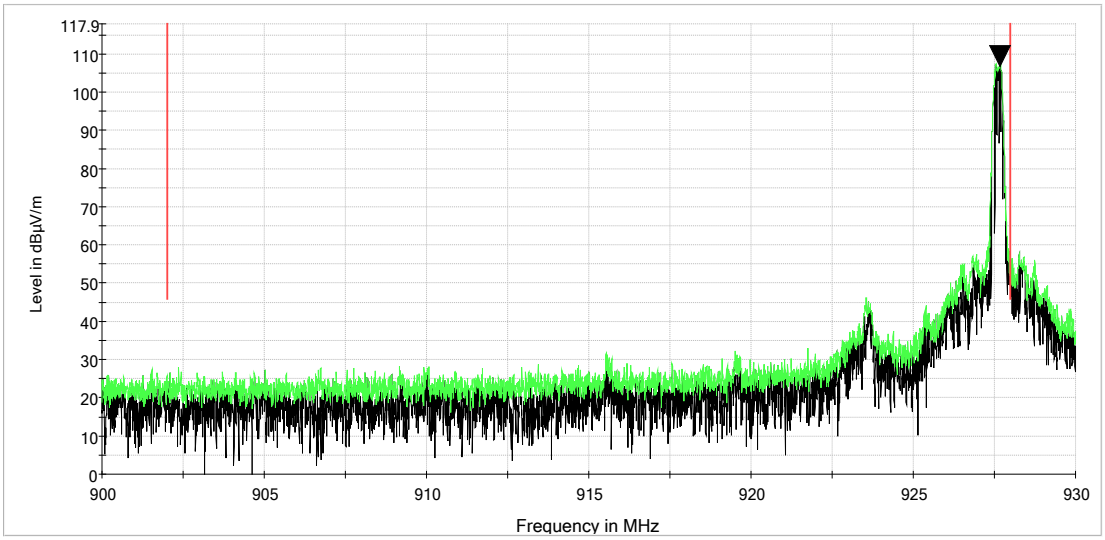
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	58.0	120.000	100.0	H	259.0	-13.6	27.4	85.4
902.000000	57.8	120.000	145.0	V	0.0	-13.6	27.6	85.4
902.400000	104.6	120.000	100.0	H	259.0	-13.6	-----	-----
902.400000	104.7	120.000	145.0	V	0.0	-13.6	-----	-----
927.600000	105.4	120.000	173.0	V	0.0	-12.9	-----	-----
927.600000	104.6	120.000	173.0	H	285.0	-12.9	-----	-----
928.000000	54.7	120.000	173.0	V	0.0	-12.9	30.7	85.4
928.000000	53.9	120.000	173.0	H	285.0	-12.9	31.5	85.4



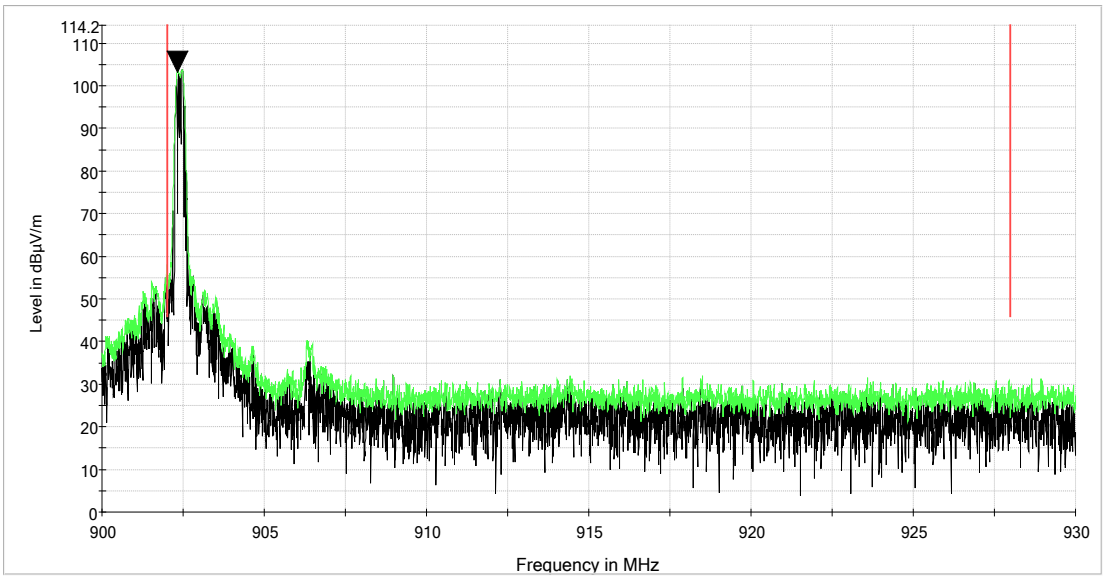
Dipole Antenna: Lower Band Edge – Vertical



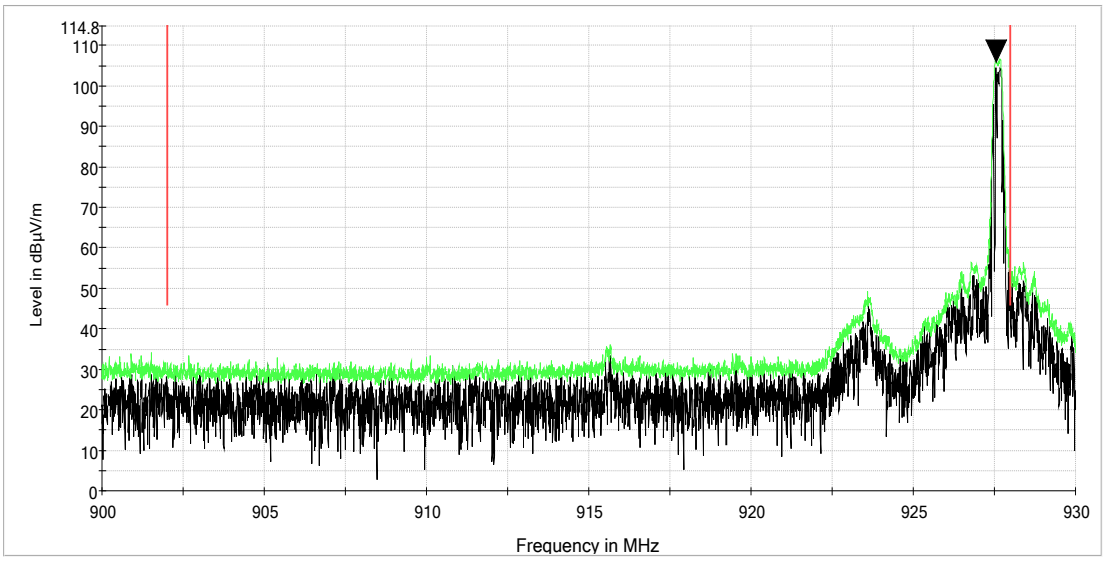
Dipole Antenna: Upper Band Edge – Vertical



Dipole Antenna: Lower Band Edge – Horizontal

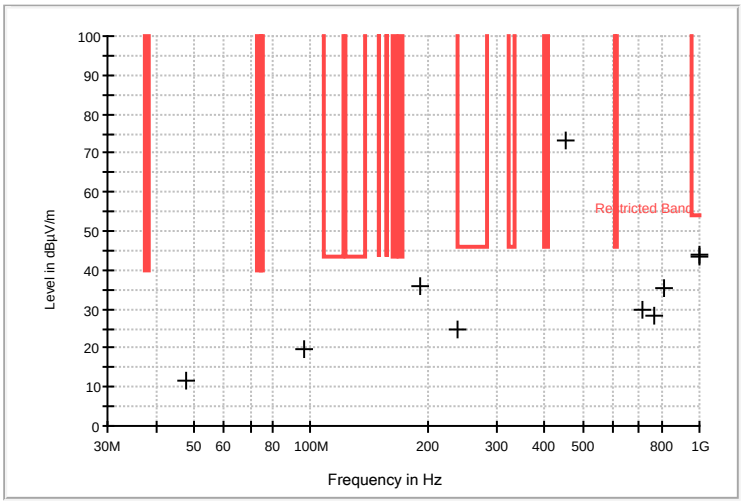


Dipole Antenna: Upper Band Edge – Horizontal

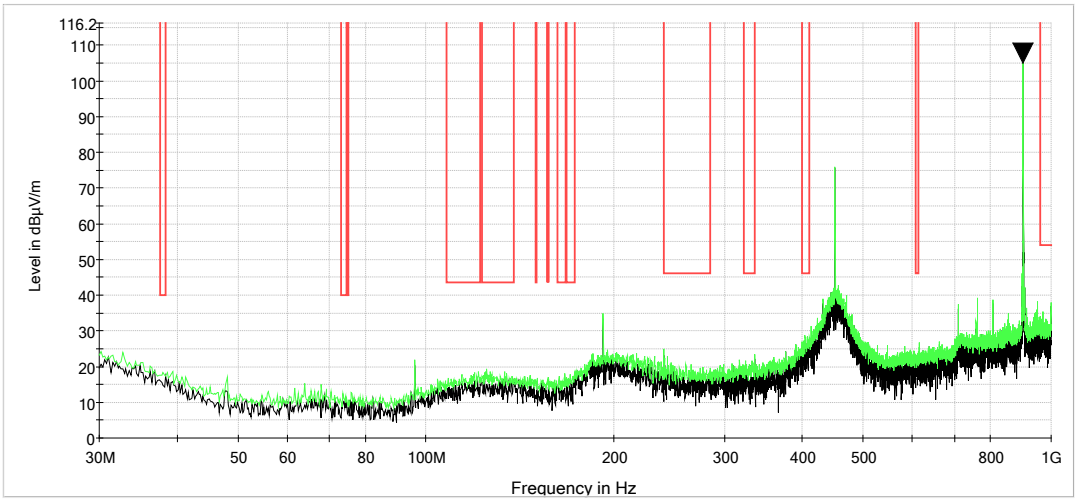


Dipole Antenna, Measurements: 30 MHz to 1000 MHz

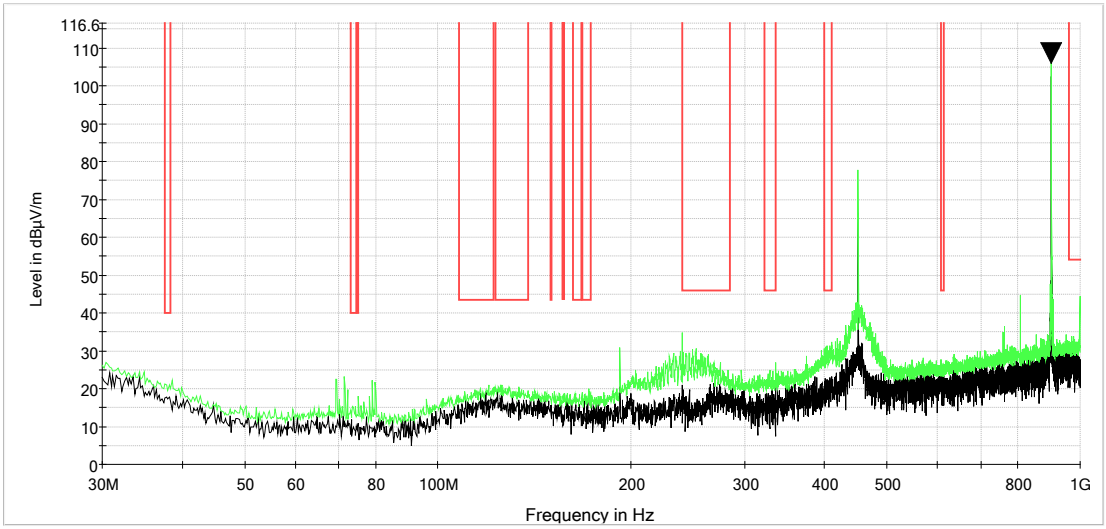
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
48.040000	11.5	120.000	100.0	V	0.0	-31.2	73.9	85.4
95.960000	19.6	120.000	100.0	V	29.0	-30.8	65.8	85.4
191.990000	36.1	120.000	100.0	V	317.0	-27.4	49.3	85.4
239.910000	24.8	120.000	100.0	H	147.0	-26.8	60.6	85.4
451.170000	73.3	120.000	100.0	H	266.0	-21.7	12.1	85.4
710.550000	30.0	120.000	100.0	V	257.0	-17.3	55.4	85.4
761.570000	28.4	120.000	100.0	V	323.0	-16.3	57.0	85.4
806.390000	35.5	120.000	100.0	V	0.0	-15.4	49.9	85.4
998.450000	44.2	120.000	100.0	H	0.0	-11.3	9.8	54.0
998.450000	43.3	120.000	100.0	H	0.0	-11.3	10.7	54.0



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

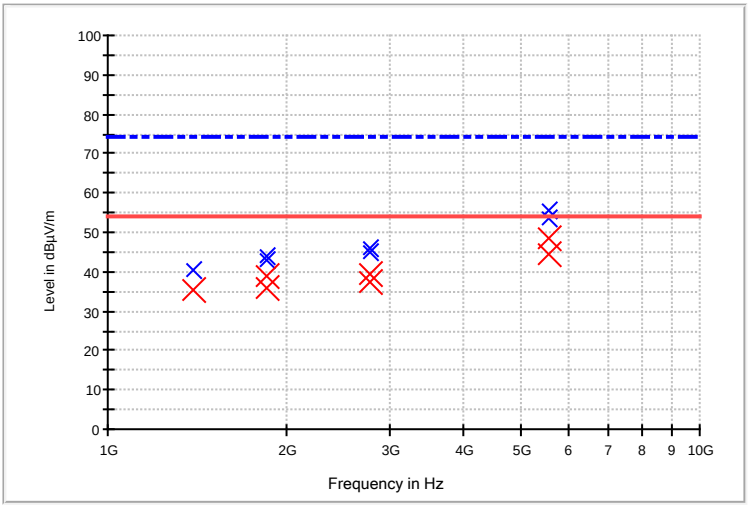


Dipole Antenna, Radiated Spurious Emissions: 30 MHz to 1000 MHz - Horizontal

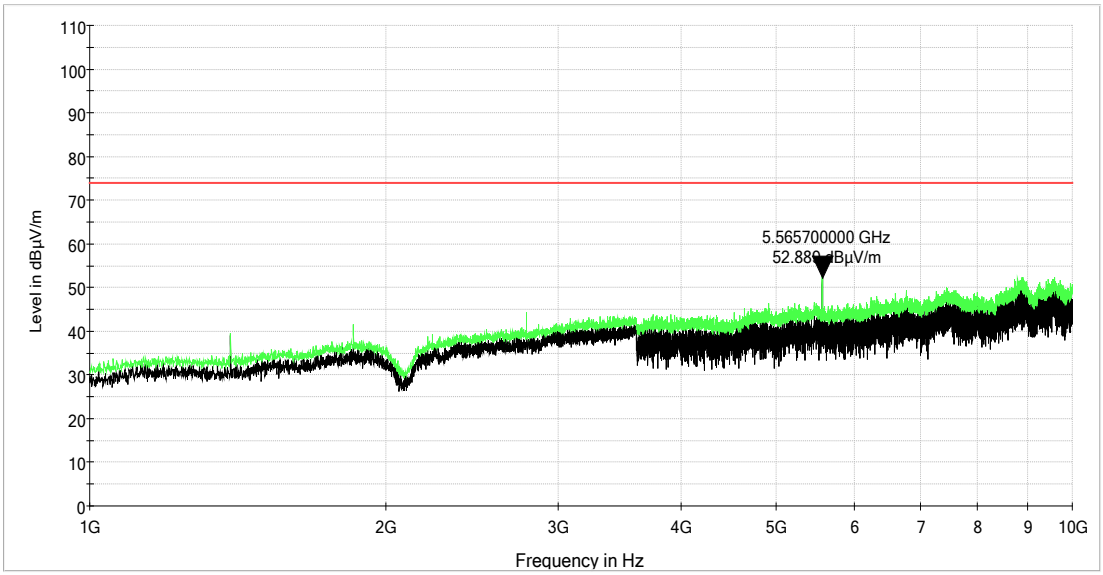


Dipole Antenna, Measurements: Greater Than 1 GHz

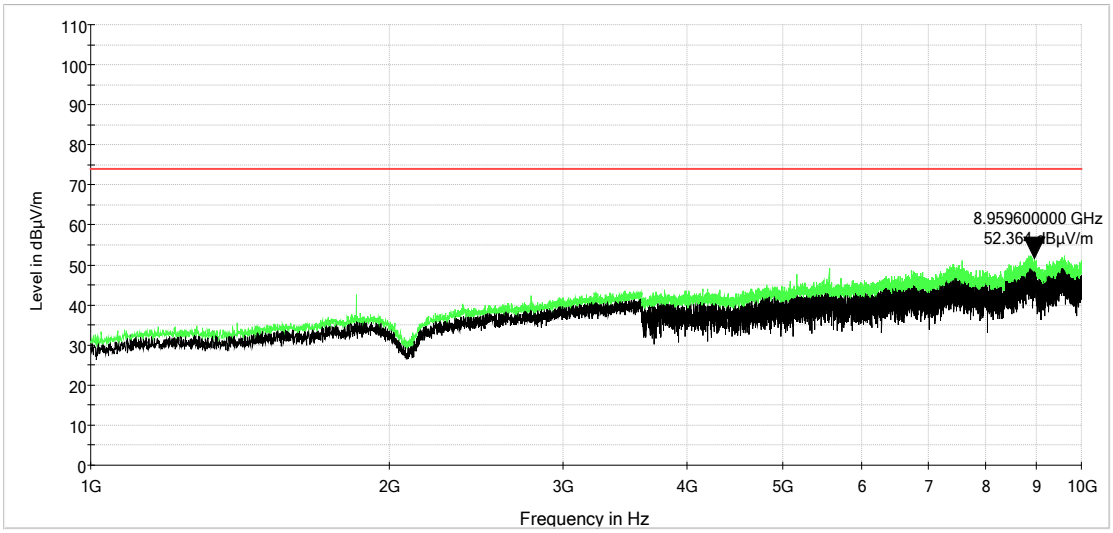
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1391.400000	40.7	35.2	1000.0	1000.000	150.0	V	353.0	-10.2	18.8	54.0
1855.200000	44.0	38.7	1000.0	1000.000	150.0	H	0.0	-8.4	15.3	54.0
1855.200000	42.9	35.9	1000.0	1000.000	150.0	V	235.0	-8.4	18.1	54.0
2782.800000	44.8	37.4	1000.0	1000.000	150.0	H	340.0	-6.7	16.6	54.0
2782.800000	46.0	39.2	1000.0	1000.000	183.0	V	206.0	-6.7	14.8	54.0
5565.700000	53.4	44.5	1000.0	1000.000	150.0	H	220.0	1.9	9.5	54.0
5565.700000	55.7	48.5	1000.0	1000.000	150.0	V	54.0	1.9	5.5	54.0



Dipole Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical

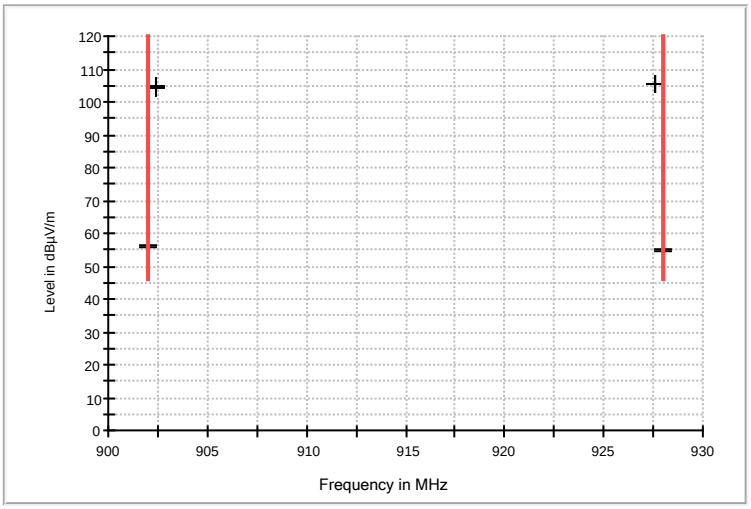


Dipole Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz – Horizontal

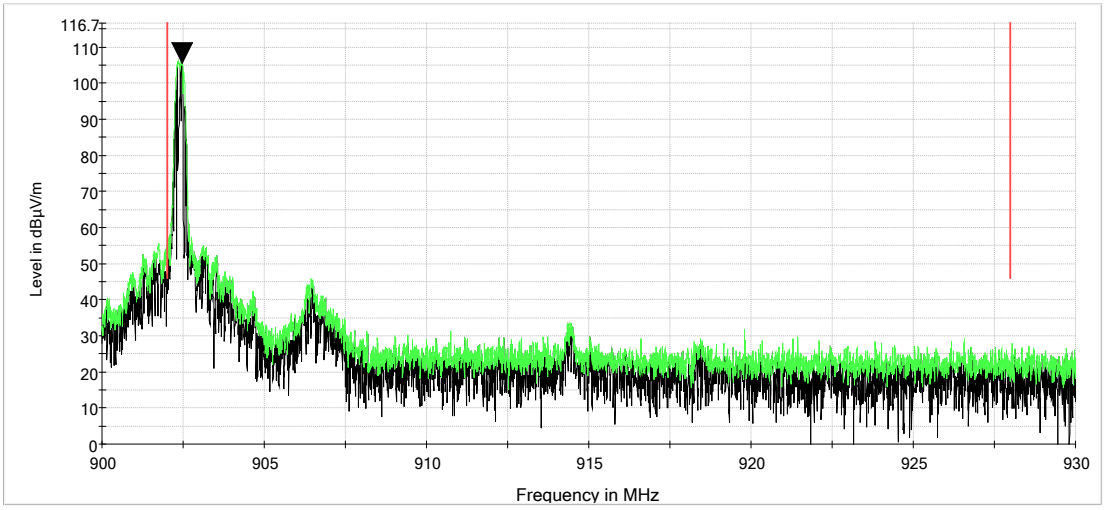


Omni Antenna, Measurements: Band Edges

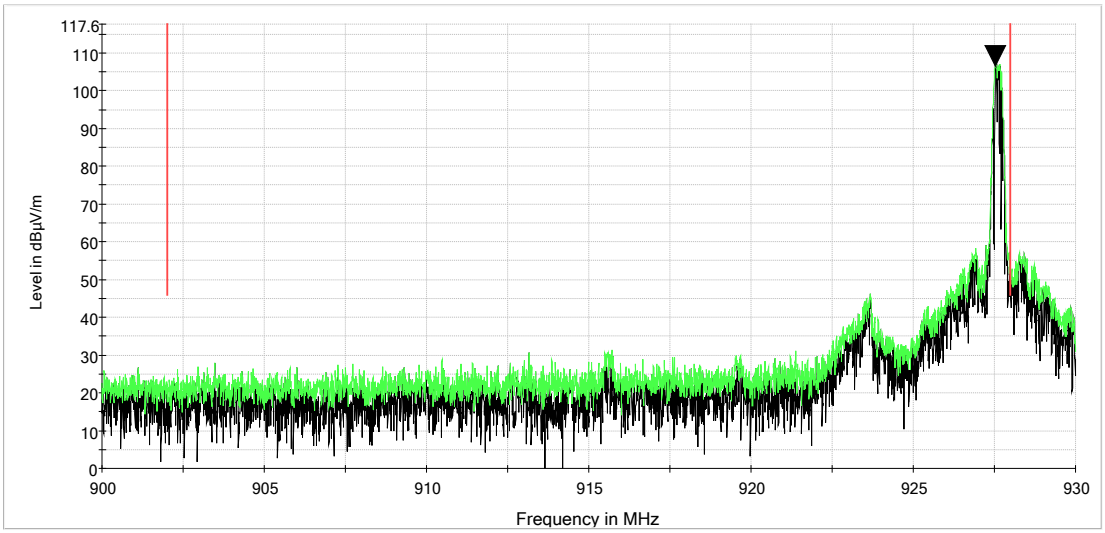
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	55.9	120.000	100.0	H	293.0	-13.6	29.4	85.3
902.000000	56.6	120.000	206.0	V	118.0	-13.6	28.7	85.3
902.400000	104.6	120.000	206.0	V	118.0	-13.6	-----	-----
902.400000	104.2	120.000	100.0	H	293.0	-13.6	-----	-----
927.600000	105.2	120.000	100.0	V	0.0	-12.9	-----	-----
927.600000	105.3	120.000	100.0	H	230.0	-12.9	-----	-----
928.000000	55.4	120.000	100.0	V	0.0	-12.9	29.9	85.3
928.000000	54.3	120.000	100.0	H	230.0	-12.9	31.0	85.3



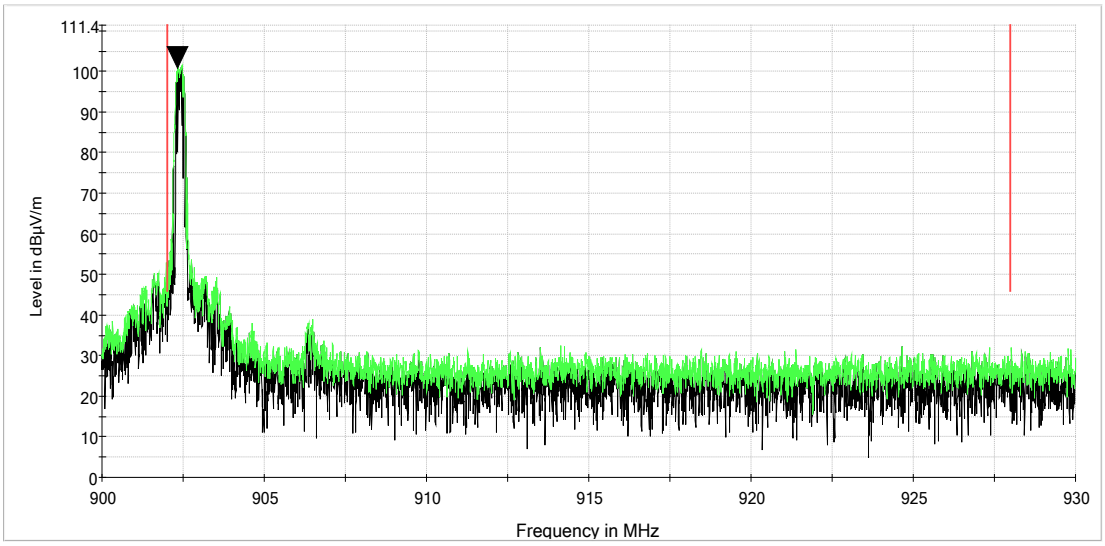
Omni Antenna: Lower Band Edge – Vertical



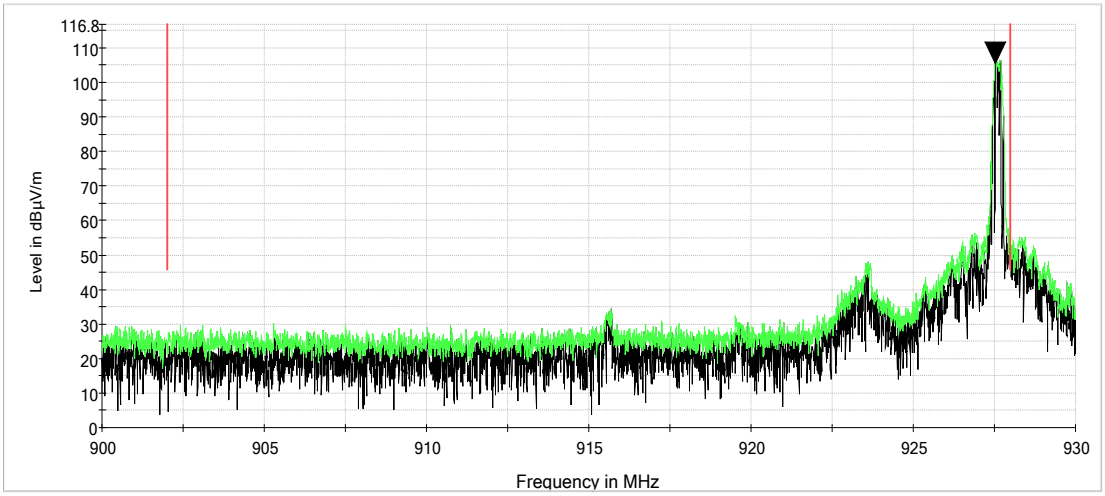
Omni Antenna: Upper Band Edge – Vertical



Omni Antenna: Lower Band Edge – Horizontal

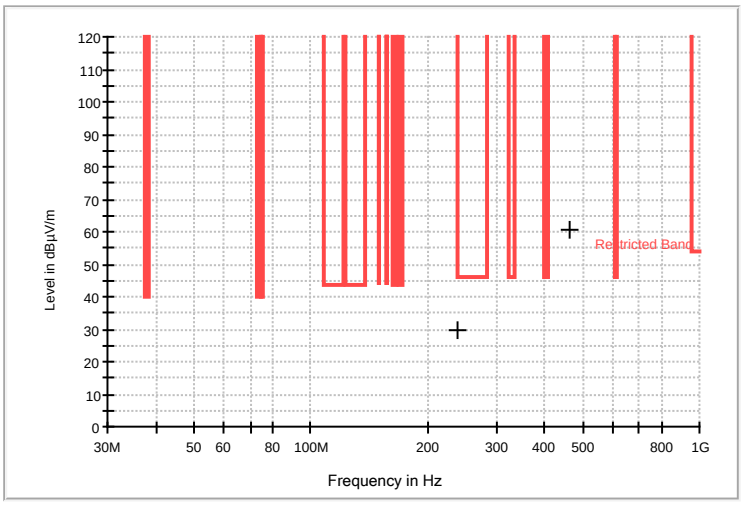


Omni Antenna: Upper Band Edge – Horizontal

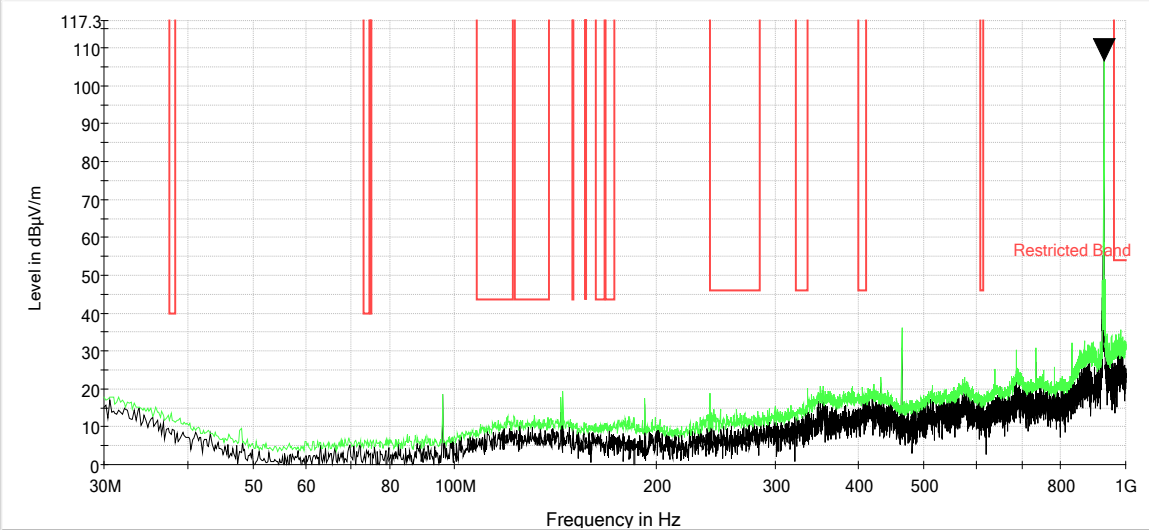


Omni Antenna: Measurements: 30 MHz to 1000 MHz

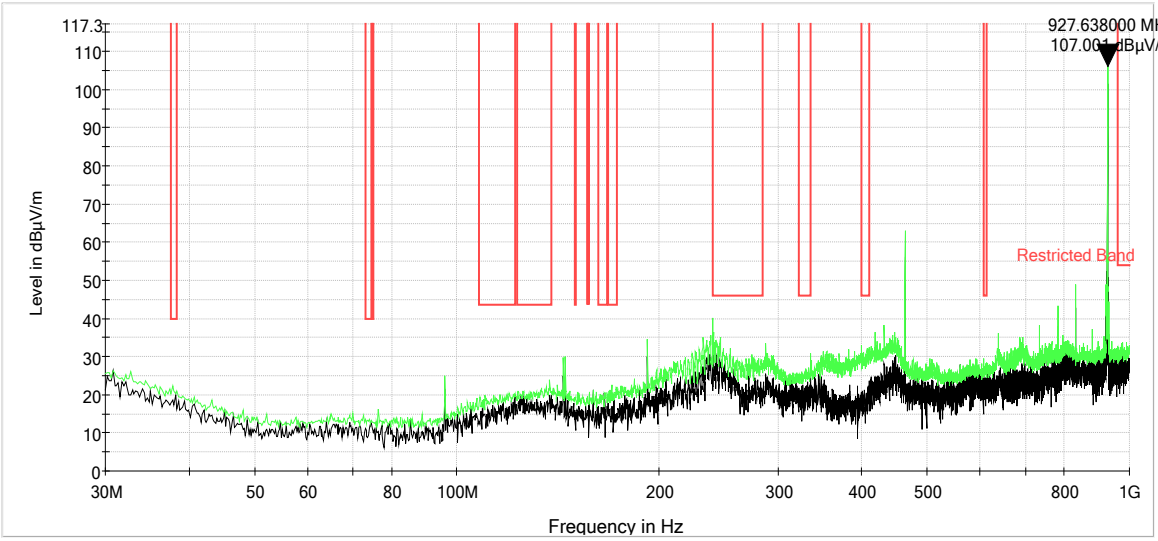
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
239.910000	29.8	120.000	100.0	H	7.0	-26.8	16.2	46.0
463.780000	60.5	120.000	100.0	H	33.0	-21.3	24.9	85.4



Omni Antenna: Radiated Spurious Emissions: 30 MHz to 1000 MHz - Vertical

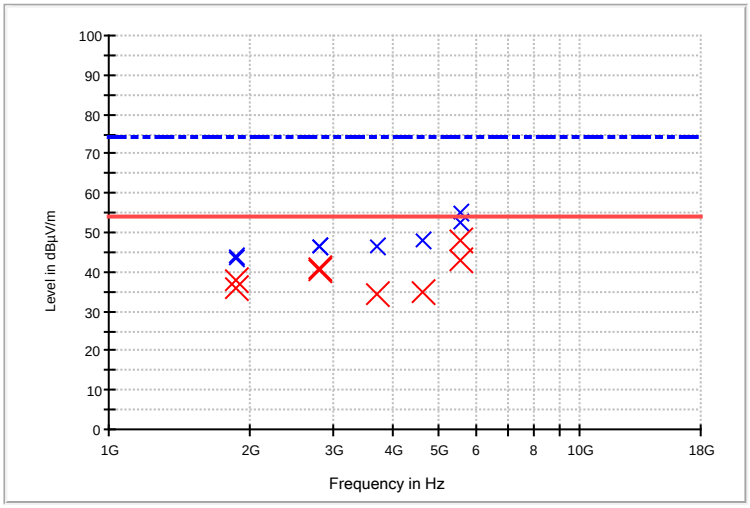


Omni Radiated Spurious Emissions: 30 MHz to 1000 MHz - Horizontal

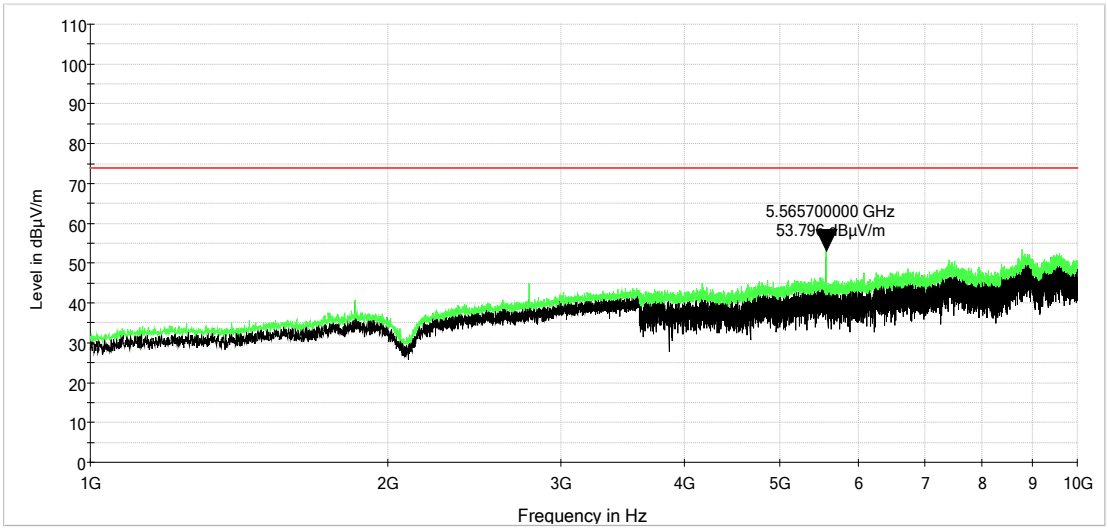


Omni Antenna: Measurements: Greater Than 1 GHz

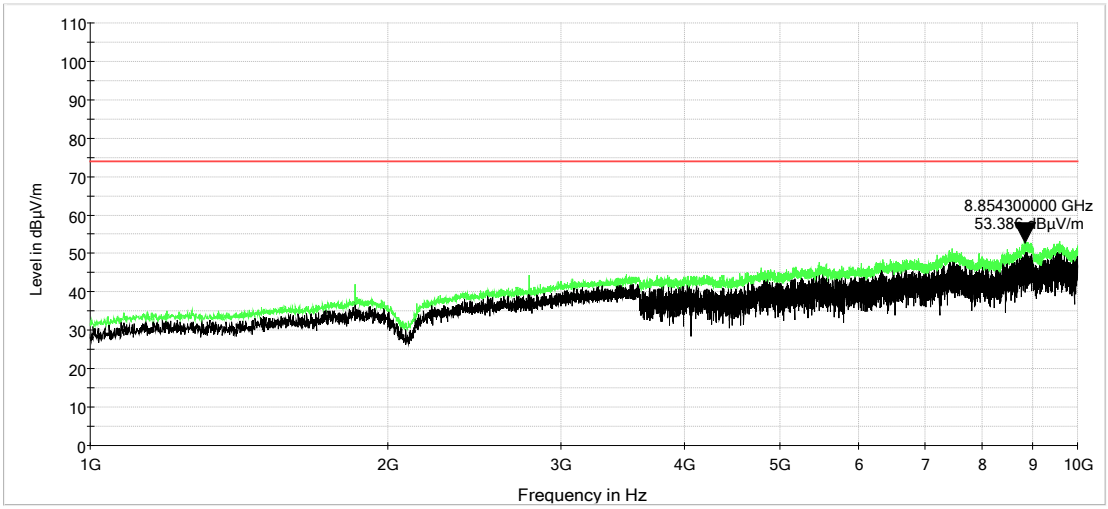
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1855.200000	43.8	37.8	1000.0	1000.000	150.0	H	218.0	-8.4	16.2	54.0
1855.200000	43.4	35.9	1000.0	1000.000	271.0	V	224.0	-8.4	18.1	54.0
2782.800000	46.3	40.2	1000.0	1000.000	150.0	H	252.0	-6.7	13.8	54.0
2782.800000	46.6	41.1	1000.0	1000.000	163.0	V	154.0	-6.7	12.9	54.0
3710.400000	46.5	34.4	1000.0	1000.000	150.0	V	96.0	-3.2	19.6	54.0
4638.000000	48.0	34.9	1000.0	1000.000	150.0	V	0.0	-1.3	19.1	54.0
5565.700000	52.3	42.8	1000.0	1000.000	168.0	H	194.0	1.9	11.2	54.0
5565.700000	55.0	47.8	1000.0	1000.000	159.0	V	0.0	1.9	6.2	54.0



Omni Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical

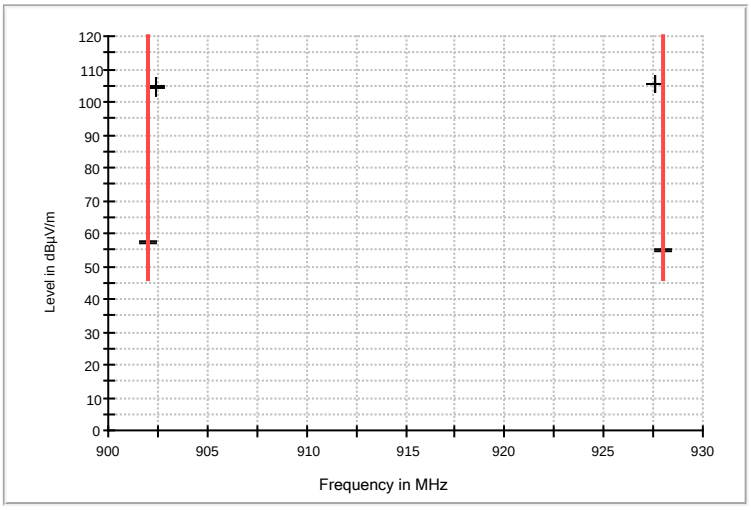


Omni Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz – Horizontal

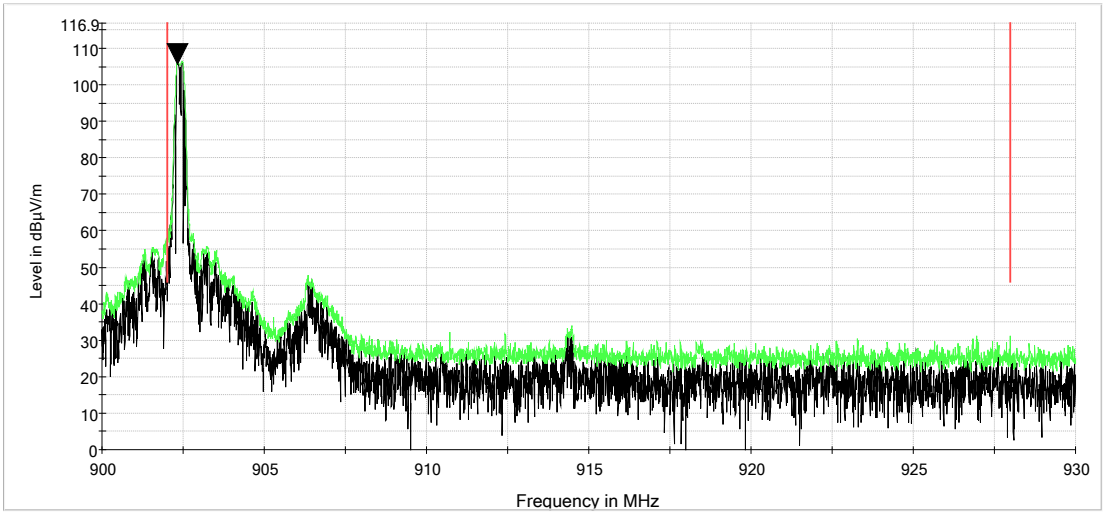


Yagi Antenna, Measurements: Band Edges

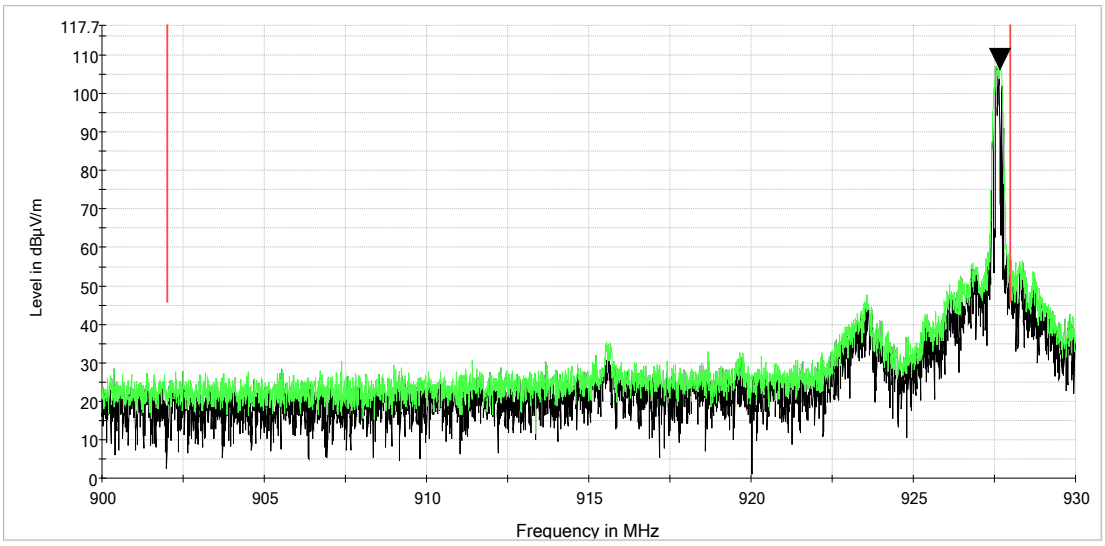
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	57.3	120.000	100.0	V	12.0	-13.6	28.1	85.4
902.000000	57.1	120.000	156.0	H	231.0	-13.6	28.3	85.4
902.400000	104.3	120.000	100.0	V	13.0	-13.6	-----	-----
902.400000	104.6	120.000	156.0	H	231.0	-13.6	-----	-----
927.600000	105.4	120.000	100.0	V	31.0	-12.9	-----	-----
927.600000	105.2	120.000	100.0	H	266.0	-12.9	-----	-----
928.000000	54.4	120.000	100.0	V	24.0	-12.9	31	85.4
928.000000	55.0	120.000	100.0	H	266.0	-12.9	30.4	85.4



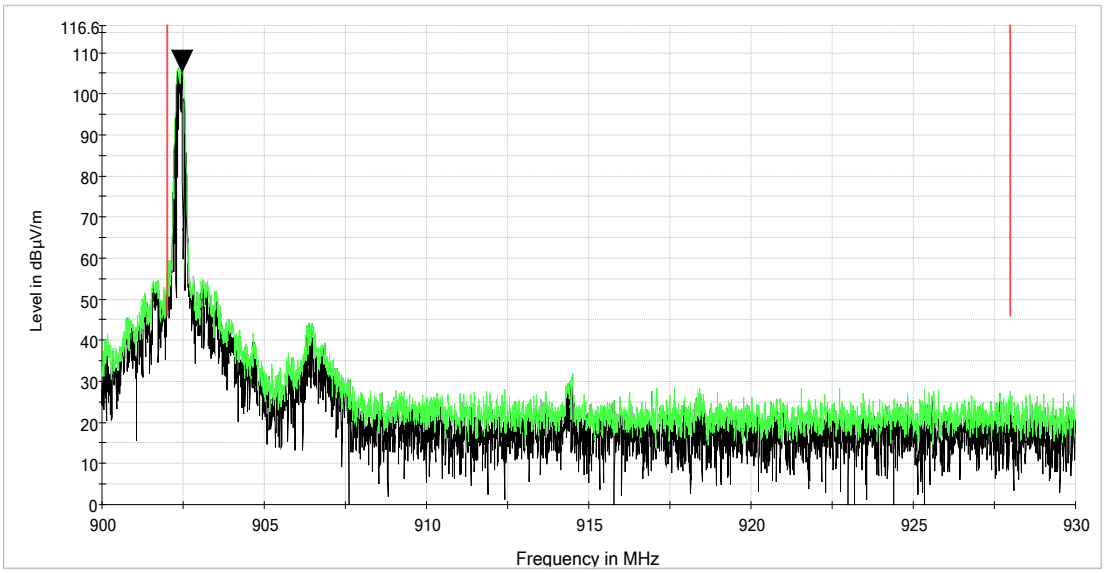
Yagi Antenna: Lower Band Edge – Vertical



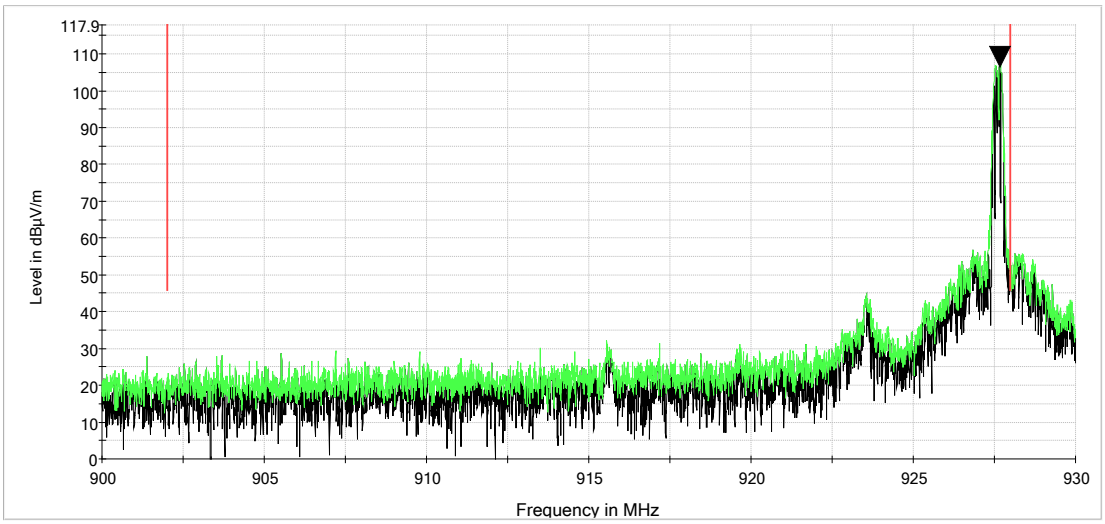
Yagi Antenna: Upper Band Edge – Vertical



Yagi Antenna: Lower Band Edge – Horizontal

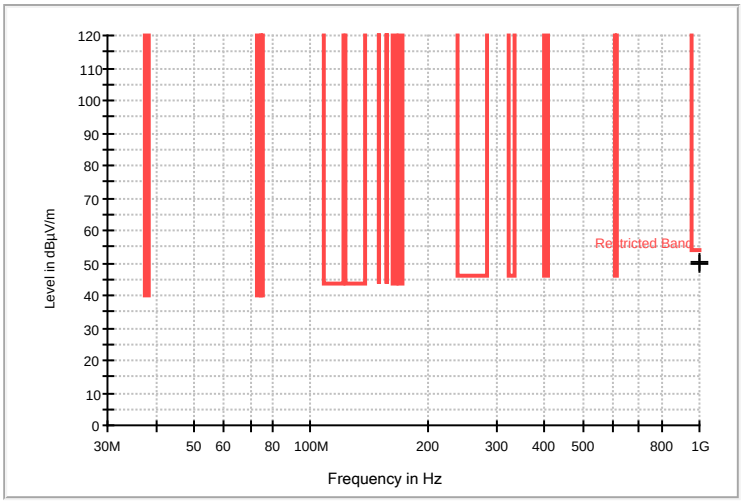


Yagi Antenna: Upper Band Edge – Horizontal

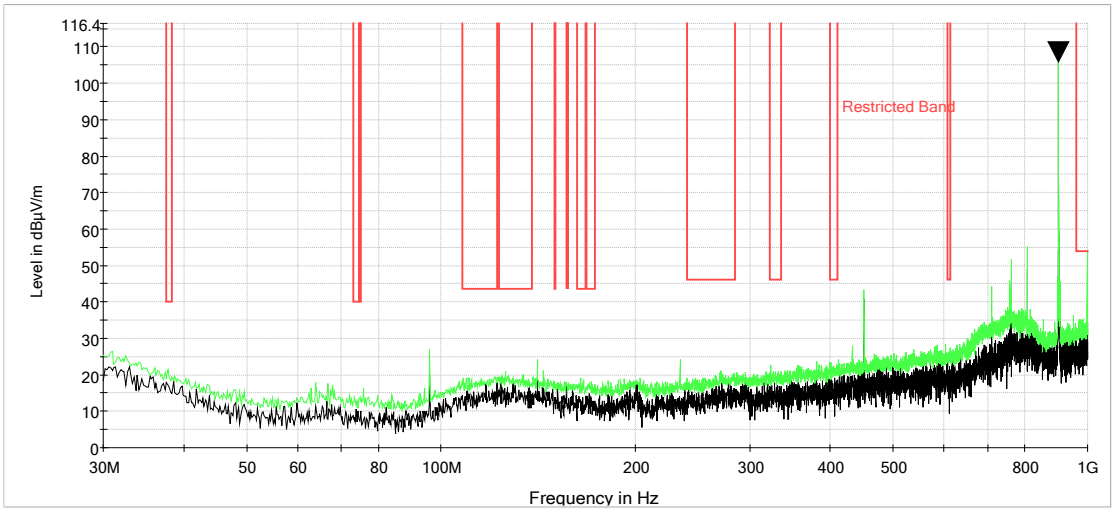


Yagi Antenna: Measurements: 30 MHz to 1000 MHz

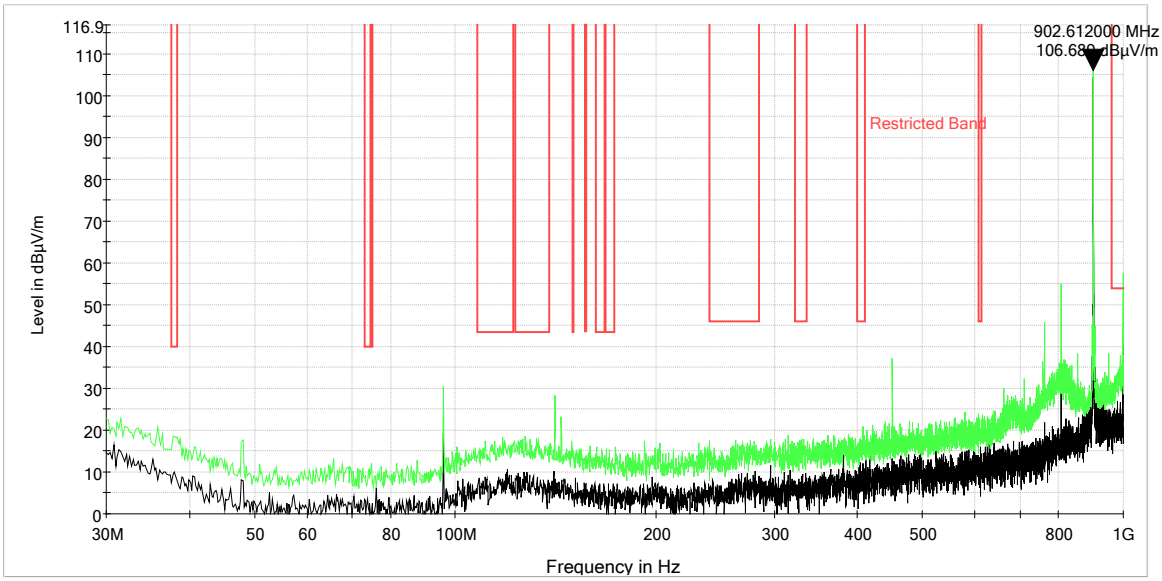
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
998.448000	49.5	120.000	100.0	H	28.0	-11.3	4.5	54.0
998.448000	50.3	120.000	100.0	V	96.0	-11.3	3.7	54.0



Yagi Antenna: Radiated Spurious Emissions: 30 MHz to 1000 MHz - Vertical

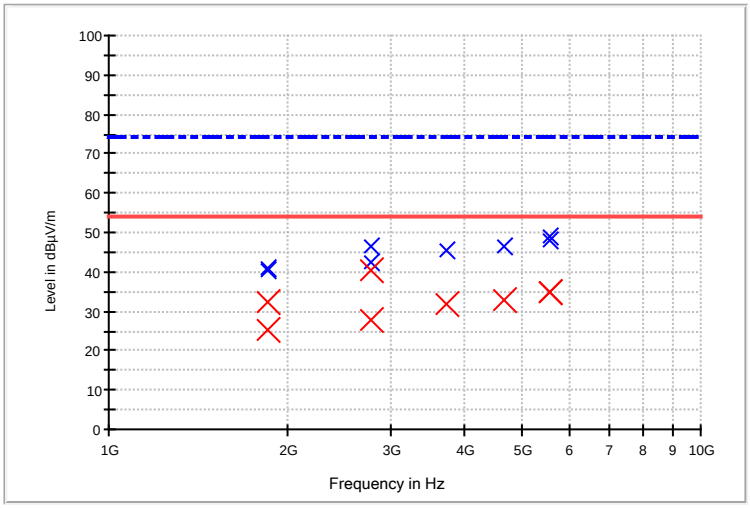


Yagi Radiated Spurious Emissions: 30 MHz to 1000 MHz - Horizontal

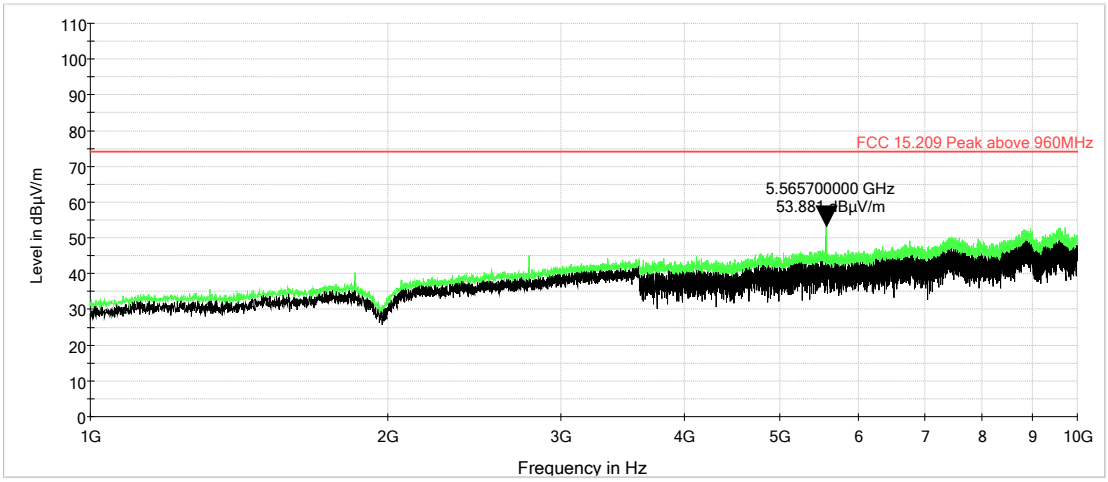


Yagi Antenna: Measurements: Greater Than 1 GHz

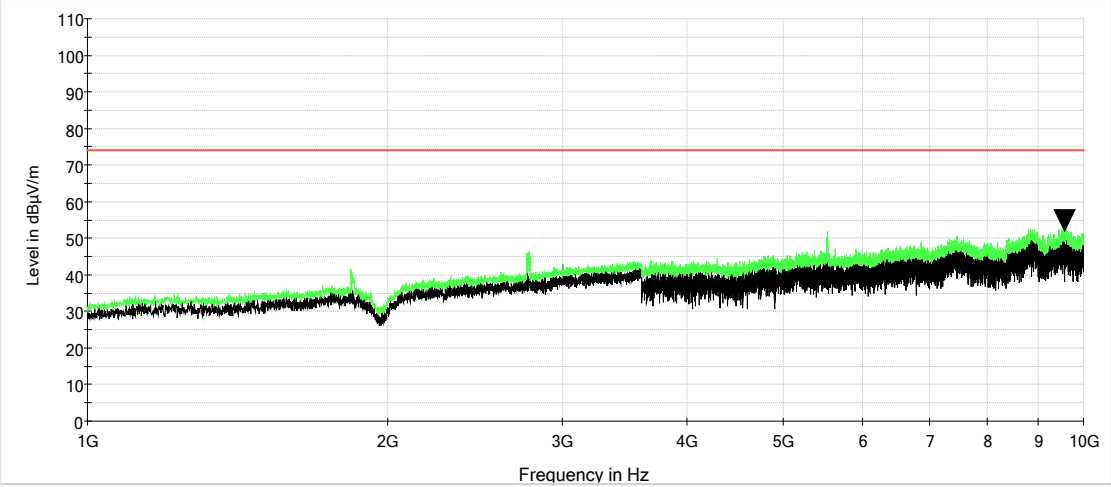
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1855.200000	40.9	25.4	1000.0	1000.000	224.0	H	314.0	-8.4	28.6	54.0
1855.200000	40.7	32.1	1000.0	1000.000	150.0	V	0.0	-8.4	21.9	54.0
2782.800000	42.2	27.9	1000.0	1000.000	150.0	H	4.0	-6.7	26.1	54.0
2782.800000	46.6	40.5	1000.0	1000.000	167.0	V	129.0	-6.7	13.5	54.0
3710.400000	45.6	31.8	1000.0	1000.000	259.0	V	185.0	-3.2	22.2	54.0
4638.000000	46.4	33.0	1000.0	1000.000	150.0	V	302.0	-1.3	21.0	54.0
5565.700000	48.2	34.9	1000.0	1000.000	150.0	H	342.0	1.9	19.1	54.0
5565.700000	49.2	35.0	1000.0	1000.000	150.0	V	61.0	1.9	19.0	54.0



Yagi Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical



Yagi Antenna, Radiated Spurious Emissions: 1 GHz to 10 GHz – Horizontal



12 NUMBER OF HOPPING FREQUENCIES

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

12.1 Requirements:

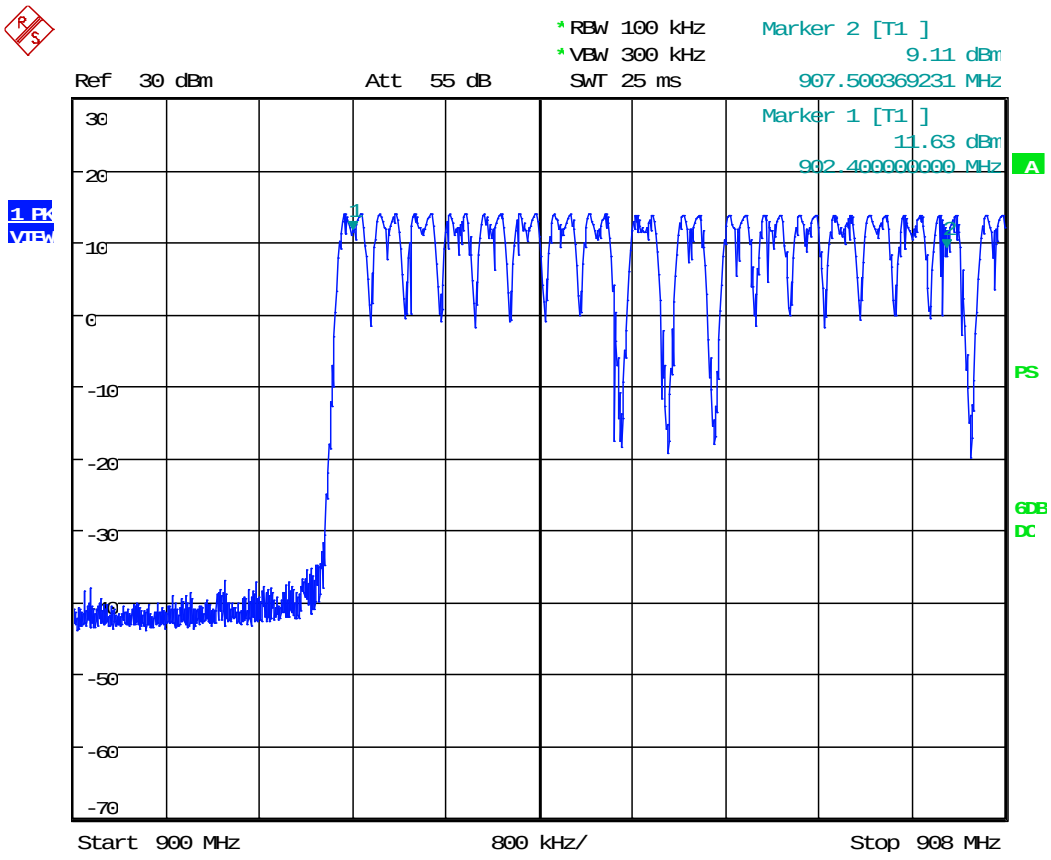
Verify that all channels are present

12.2 Number of Hopping Frequencies Test Data

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

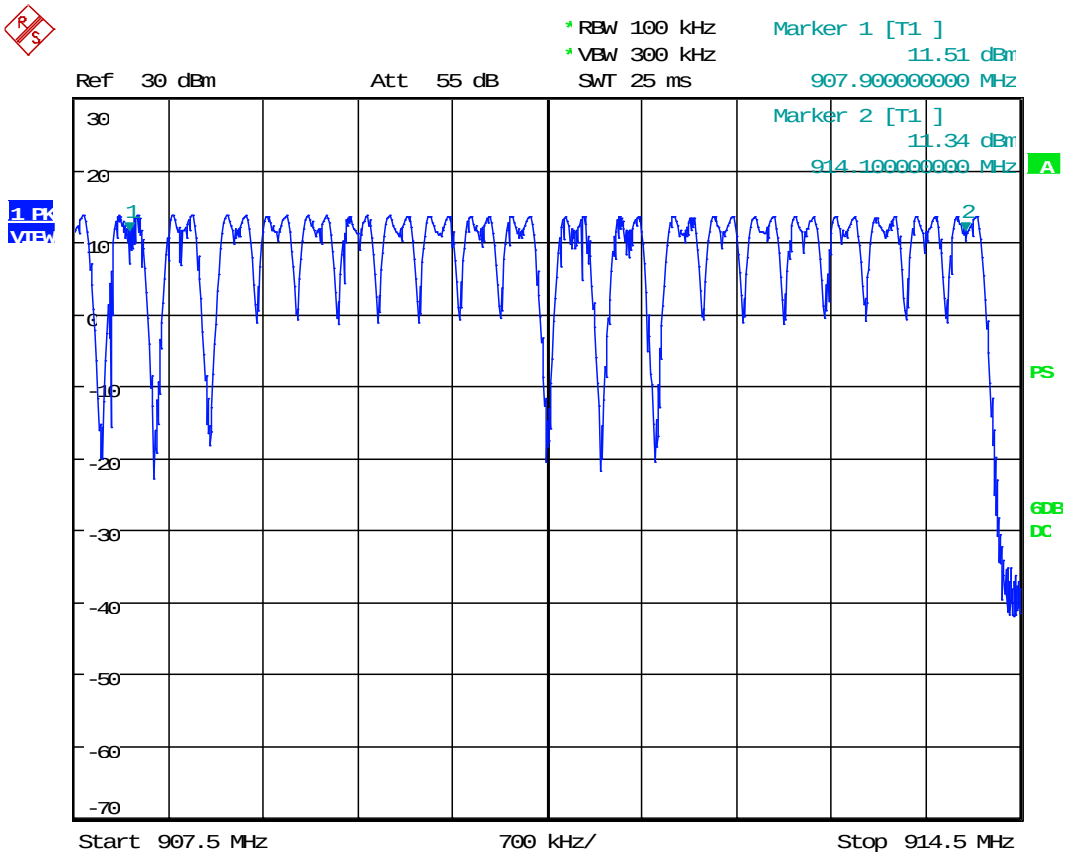
EUT showed 70 channels, confirming manufacturer's specifications.

17 Channels



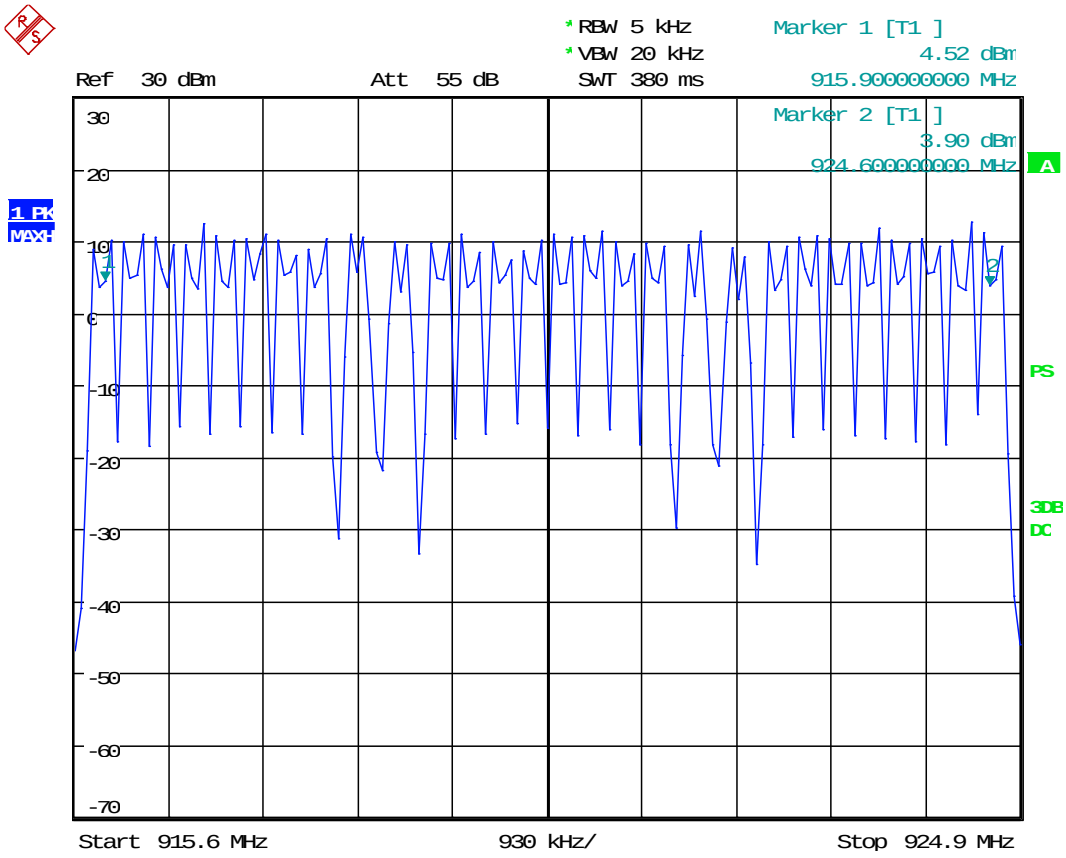
Date: 29.APR.2024 10:15:13

20 Channels



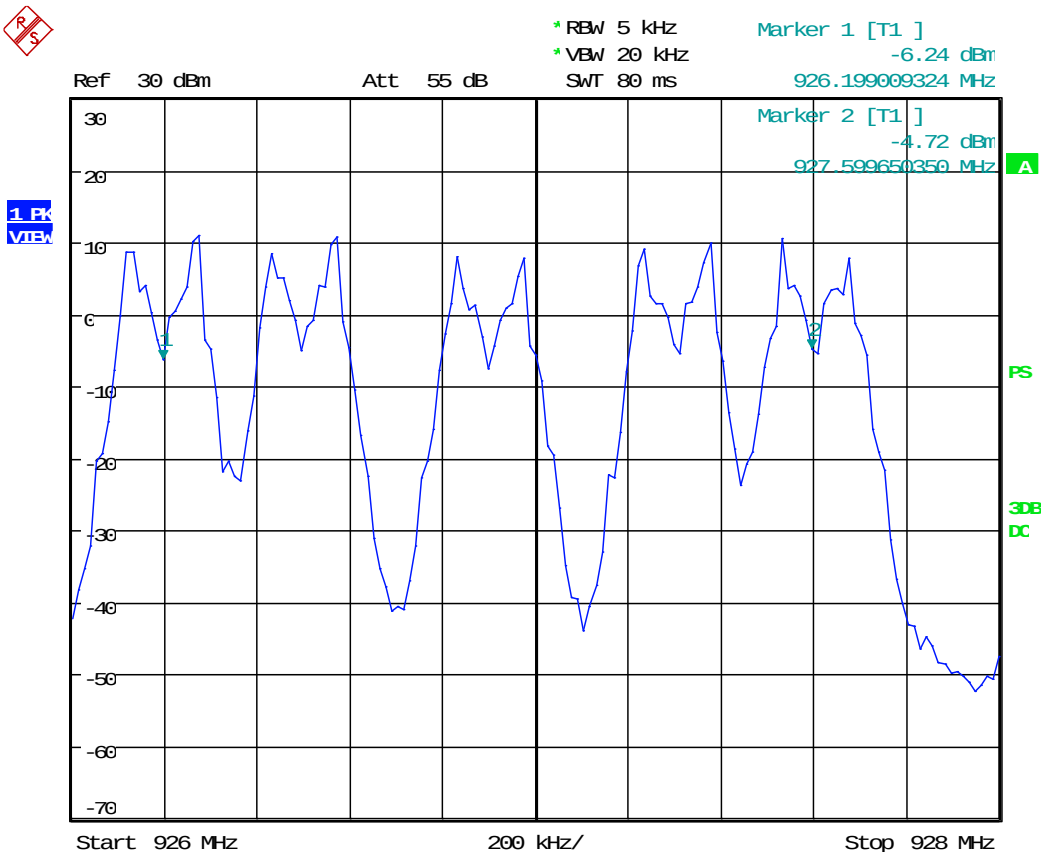
Date: 29.APR.2024 10:23:02

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 twenty seconds.

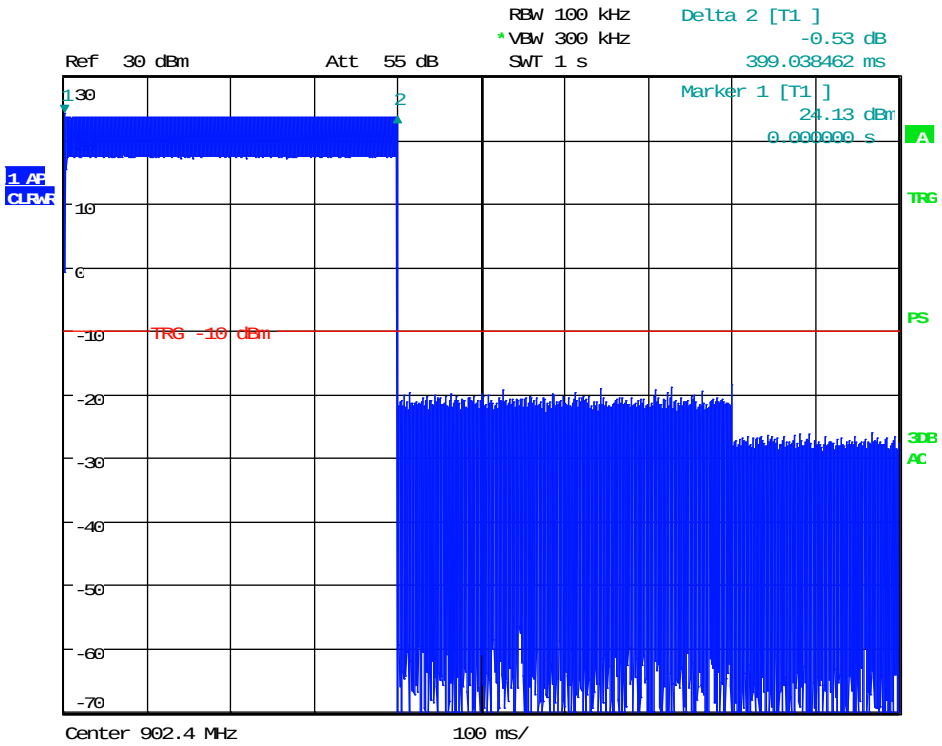
13.1 Requirements:

Limit of 0.4 seconds in a 20-second period.

13.2 Dwell Time Test Data

Test Date(s):	2024-01-11; 2024-04-29	**Test Engineer:**	J. Chiller
Standard(s):	ANSI 63.10 7.8.4	**Air Temperature:**	21.5ºC
		Relative Humidity:	37%
Results:	Complies		

Length of Transmission

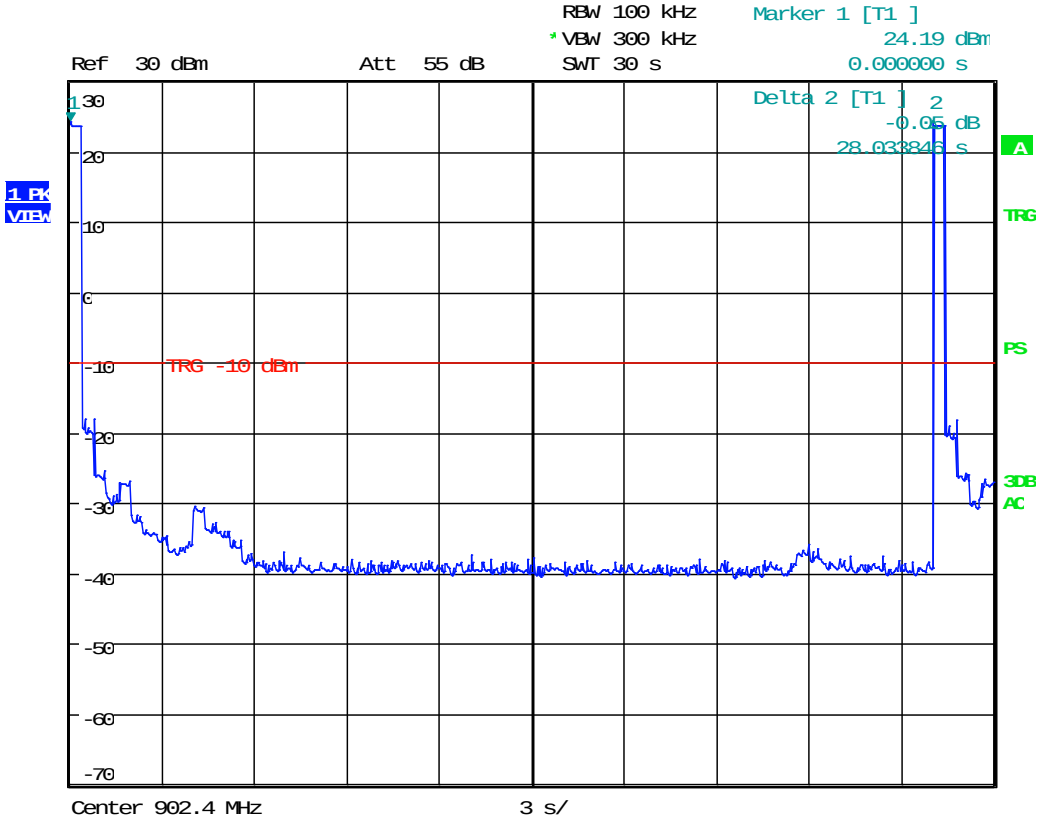


Date: 11.JAN.2024 14:55:00

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

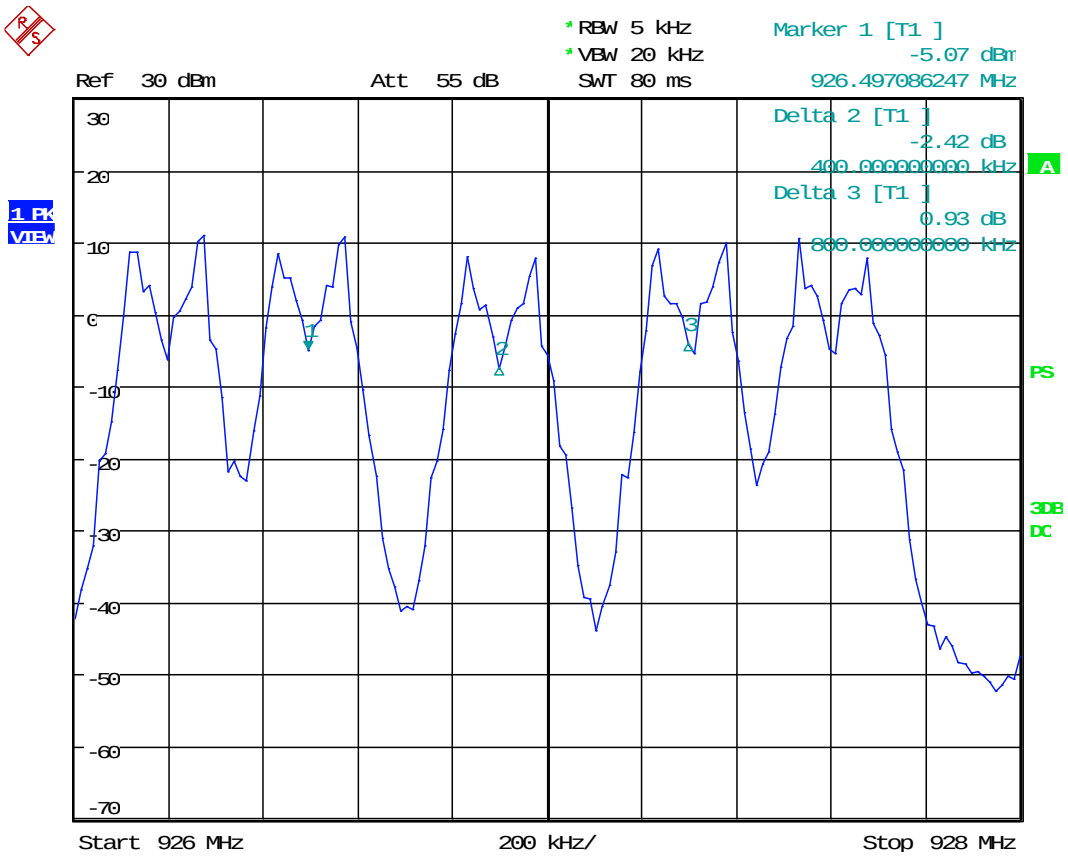
Limit: 400mS in 20-second period.

Time Between Transmission



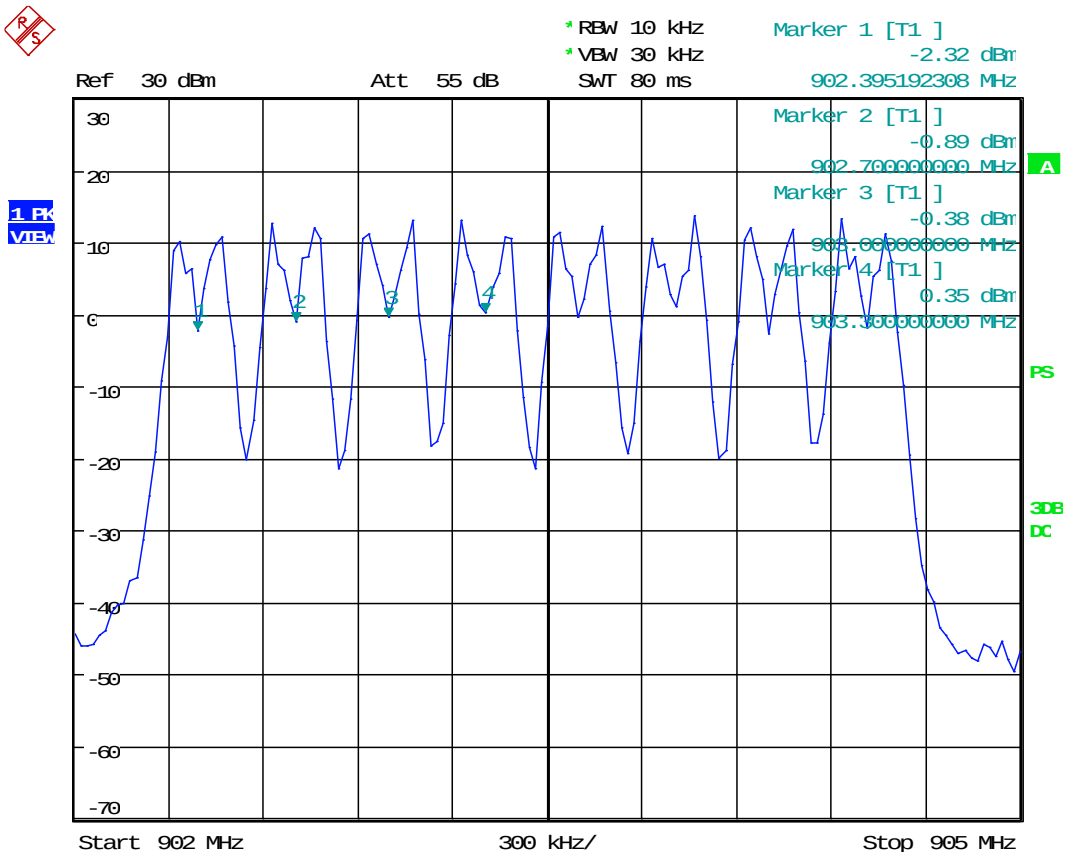
Date: 11.JAN.2024 14:57:35

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 μH/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 (dBμV)	
	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.

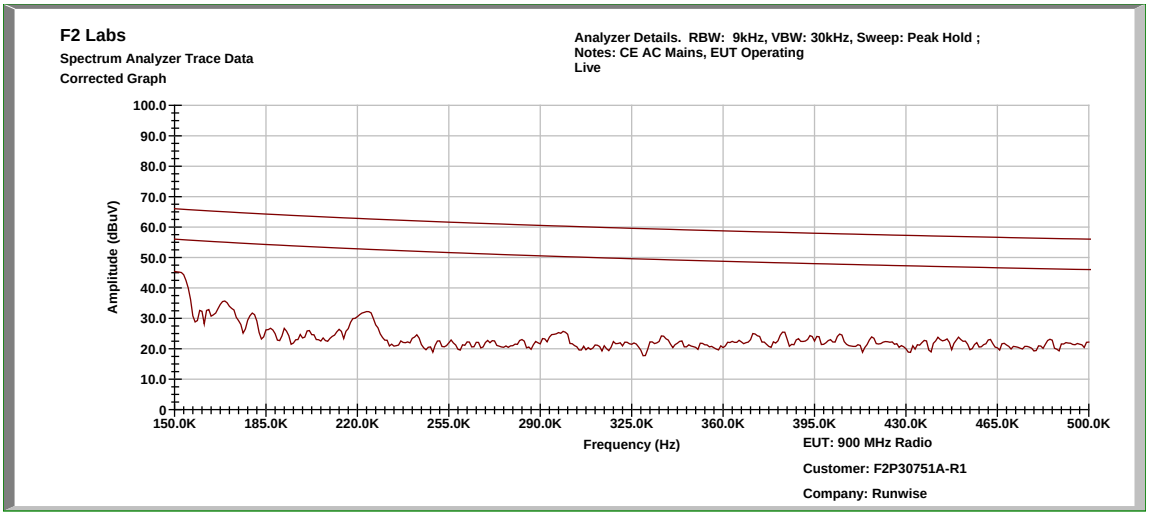
14.2 Procedure

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.

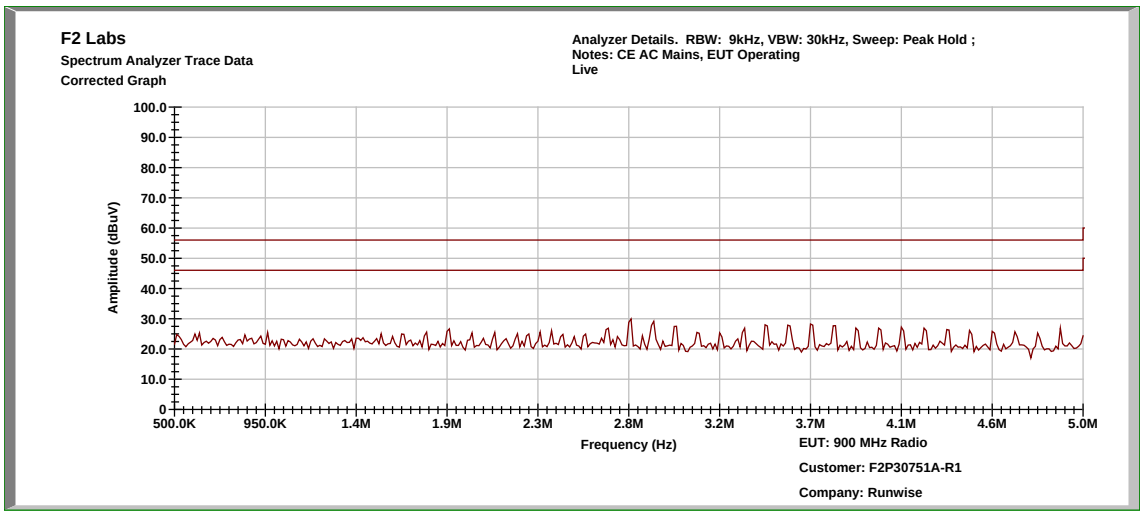
14.3 Conducted Emissions Test Data

Test Date(s):	2024-11-21	**Test Engineer:**	J. Chiller
Rule:	15.207	**Air Temperature:**	17.7º C
Test Results:	Complies	**Relative Humidity:**	42%

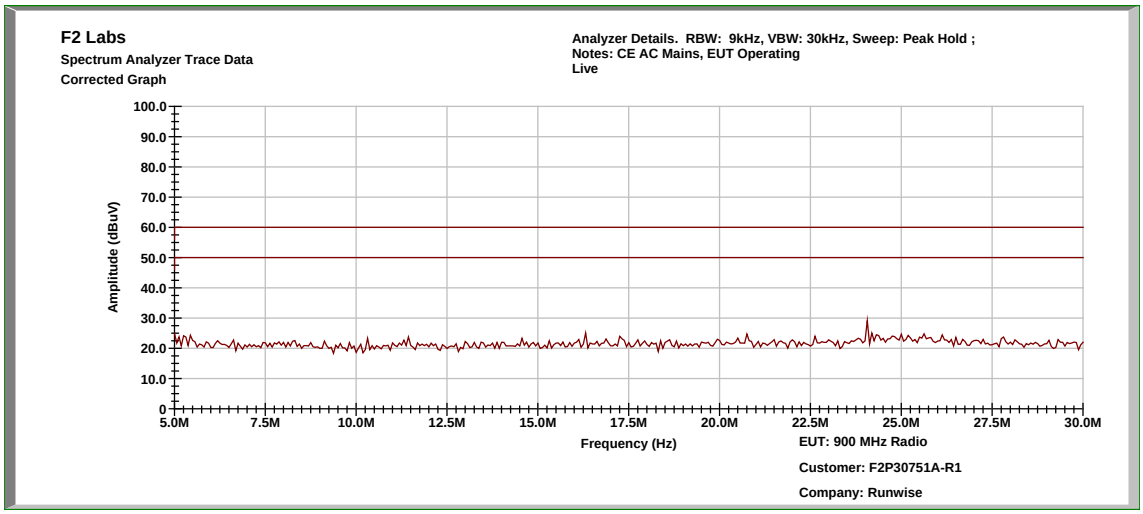
Conducted Test – Live: 0.15 MHz to 0.5 MHz



Conducted Test – Live: 0.5 MHz to 5.0 MHz

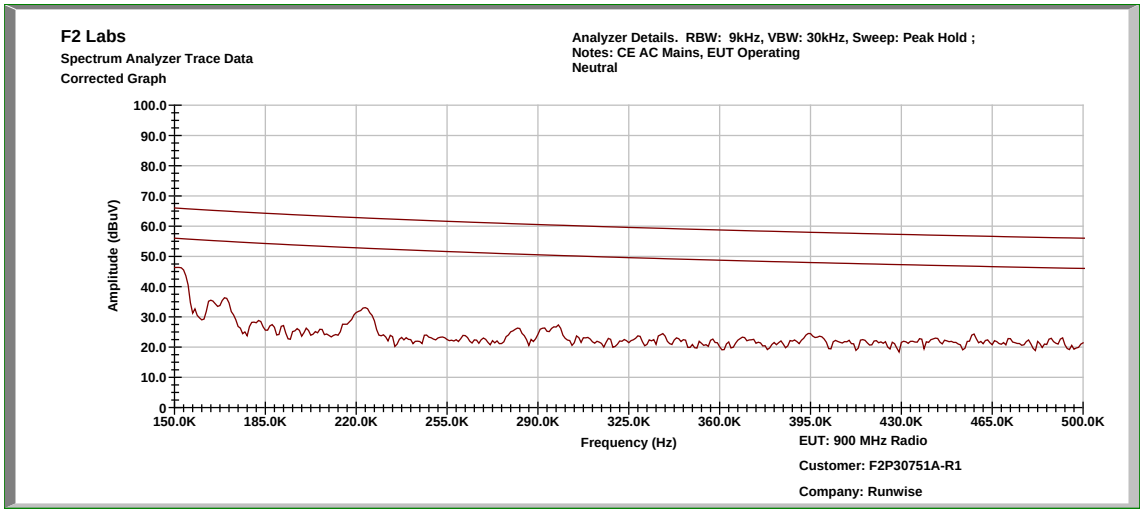


Conducted Test – Live: 5.0 MHz to 30.0 MHz

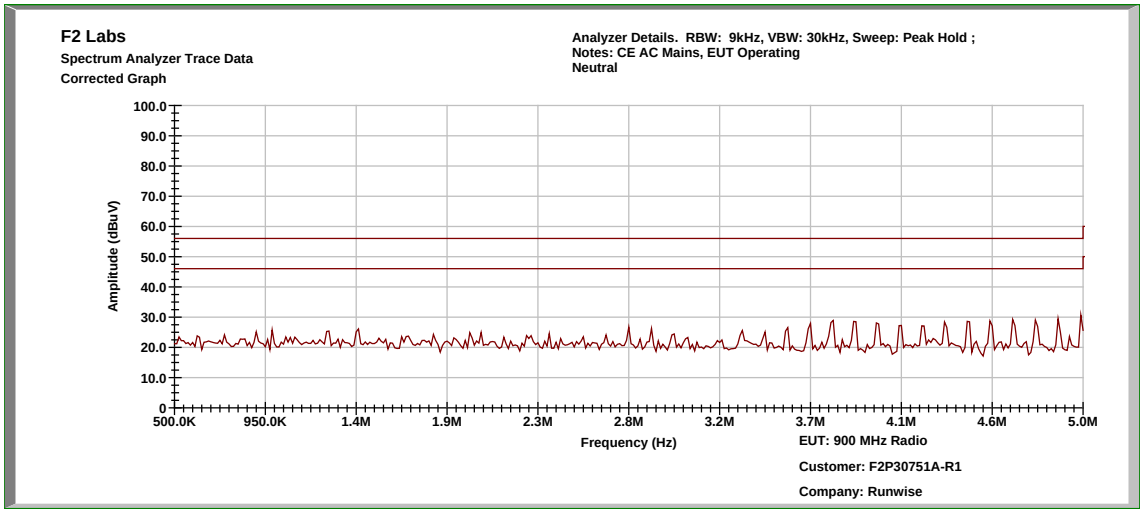


Note: Peak scans below AVG limit.

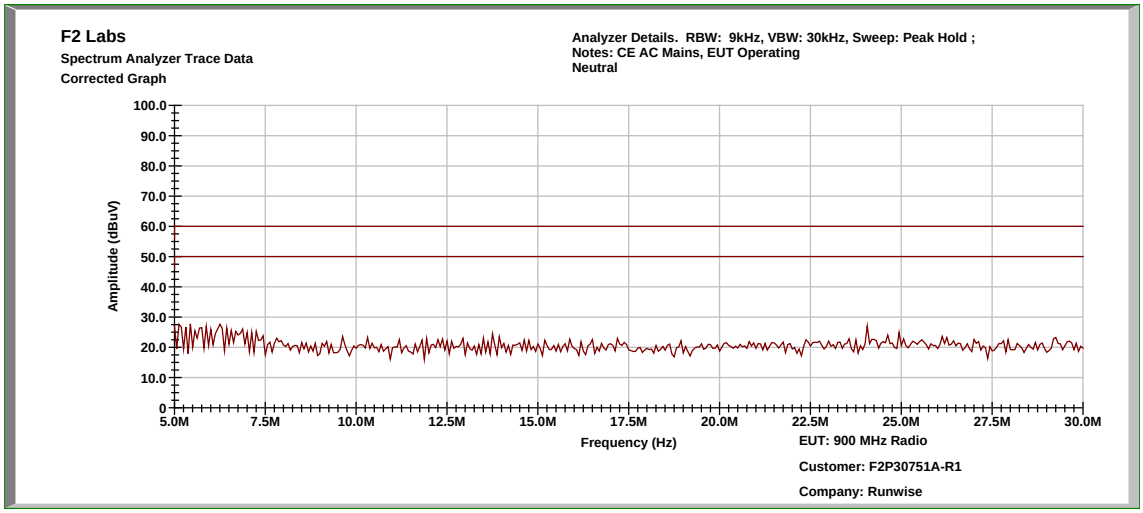
Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



Conducted Test – Neutral: 0.5 MHz to 5.0 MHz



Conducted Test – Neutral: 5.0 MHz to 30.0 MHz



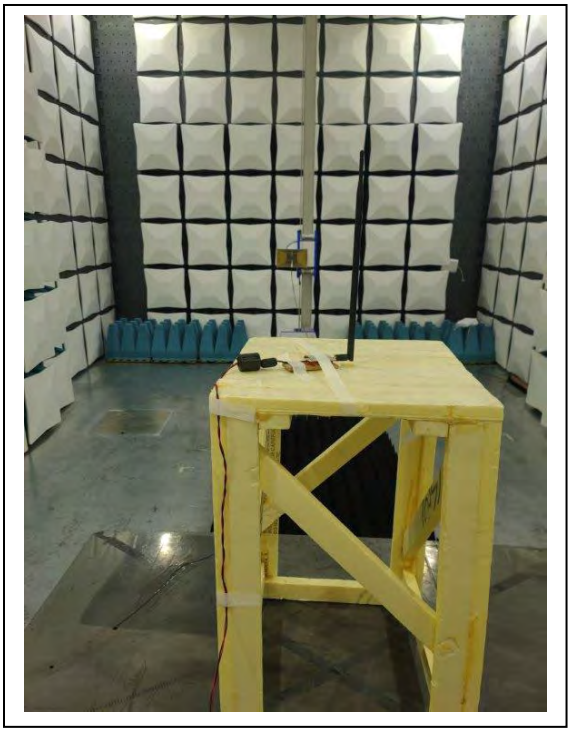
Note: Peak scans below AVG limit.

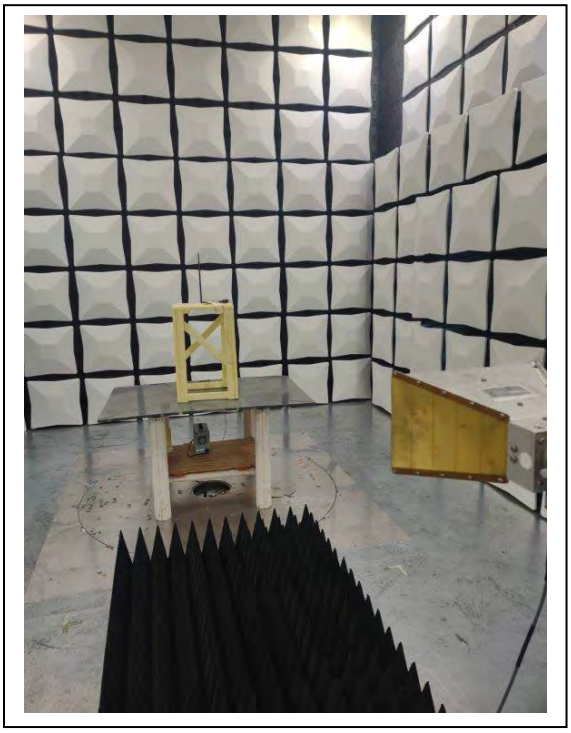
15 TEST SETUP PHOTOGRAPH(S)

Radiated Spurious Emission: 0.009 MHz to 30 MHz (Loop Antenna)

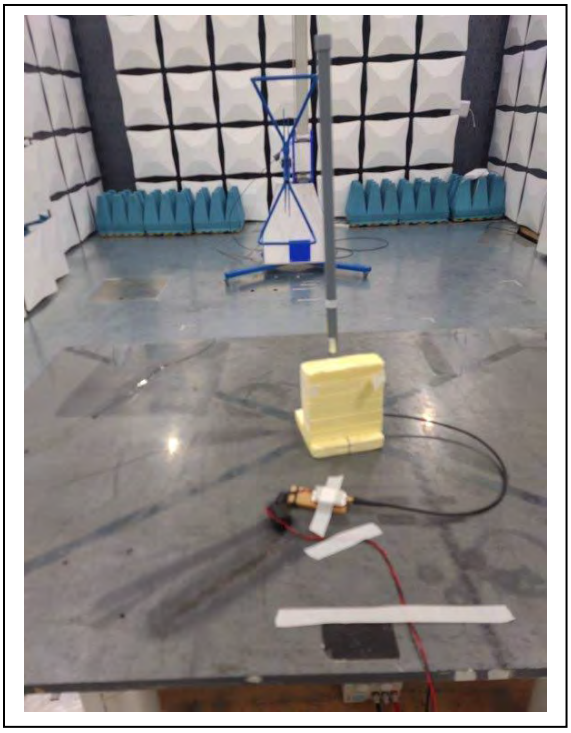
Dipole Antenna, Radiated Spurious Emission: 30 MHz to 1000 MHz

Dipole Antenna, Radiated Spurious Emission: 1 GHz to 10 GHz

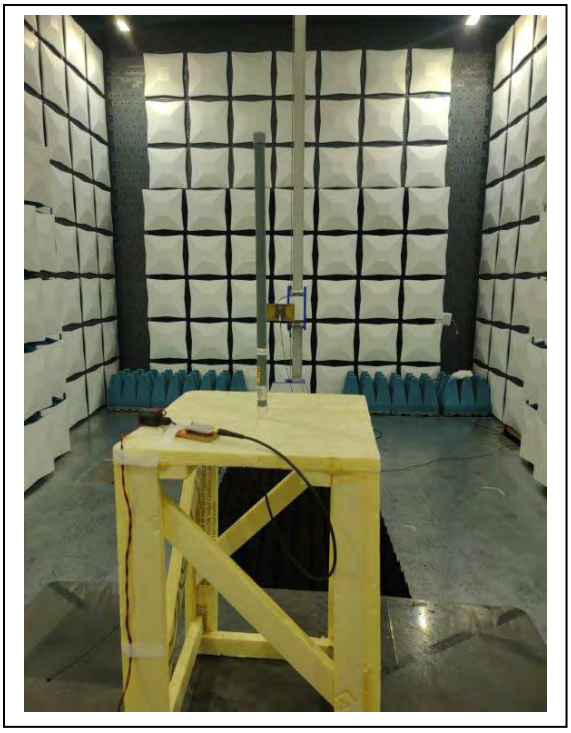




Omni Antenna, Radiated Spurious Emission: 30 MHz to 1000 MHz

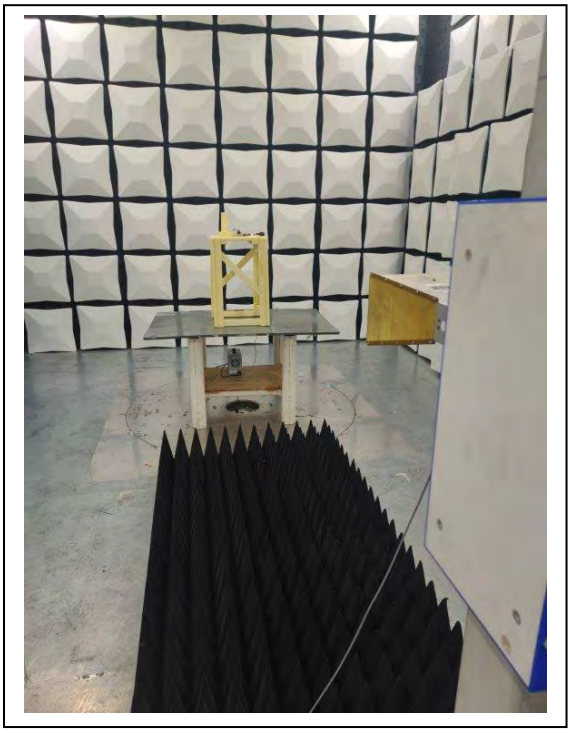


Omni Antenna, Radiated Spurious Emission: 1 GHz to 10 GHz

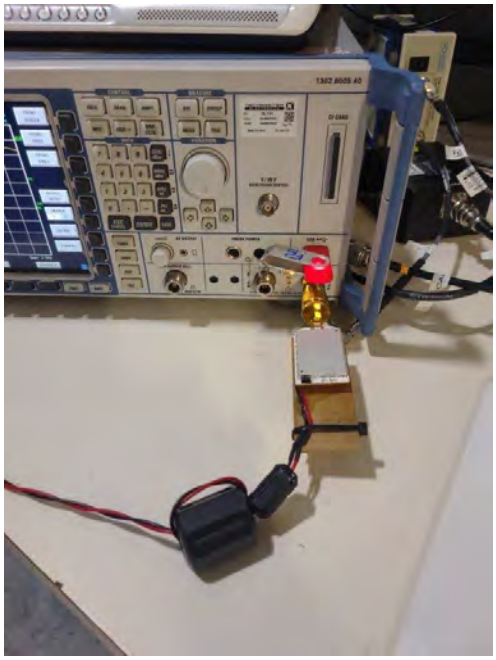


Yagi Antenna, Radiated Spurious Emission: 30 MHz to 1000 MHz

Yagi Antenna, Radiated Spurious Emission: 1 GHz to 10 GHz



Conducted Measurements



Conducted Emissions