F2 Labs
16740 Peters Road
Middlefield, Ohio 44062
United States of America
www.f2labs.com

CERTIFICATION TEST REPORT

Manufacturer:	**Marjamaa Engineering Inc.** **395 County Road** **Mount, Minnesota 55364 USA**
Applicant:	**TAPCO (Traffic and Parking Control Co., Inc.)** **5100 West Brown Deer Road** **Milwaukee, Wisconsin 53223 USA**
Product Name:	**Radio 154450**
Product Description:	25dBm 900 MHz Radio
Operating Voltage/Freq. of EUT During Testing:	3.7V from lab supply. EUT is battery only in use.
Model:	**154450**
FCC ID:	**2ANWN-RM154450**
Testing Commenced:	2024-11-01
Testing Ended:	2025-02-26
Summary of Test Results:	**In Compliance, with Modifications** 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**
- **FCC Part 15.31(e)**
- **ANSI C63.10:2013**
- **FCC15.207 - Conducted Limits**

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

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
F2P33484-01E	First Issue	2025-02-26	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	CFR 47 Part 15.247(d) / Part 15.209 / KDB558074	Complies
Peak Power Spectral Density	CFR 47 Part 15.247(e) / KDB558074	Complies
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

***To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.*

Modifications Made to the Equipment
Power settings were changed to meet PSD and E.I.R.P. requirements as follows: Low Channel, Set 10; Mid Channel, Set 9; High Channel, Set 10.

3 TABLE OF MEASURED RESULTS

Note: Power limits in the following charts have been reduced by 4.65 dBm due to antenna gain over 6dB.

Test		Low Channel 902.575	Mid Channel 915.00	High Channel 927.425
DTS, 500kHz:				
Conducted Output Power		319.9mW / 25.05dBm	334.2mW / 25.24dBm	323.6mW / 25.1dBm
Conducted Output Power Limit		563 mW / 25.35dBm	563 mW / 25.35dBm	563 mW / 25.35dBm
E.I.R.P.		3715.4mW / 35.7dBm	3881.5mW / 35.89dBm	3758.4mW / 35.75dBm
E.I.R.P. Limit		4 Watts / 36dBm	4 Watts / 36dBm	4 Watts / 36dBm
Peak Power Spectral Density		6.58dBm (power set to 10)	4.65dBm (power set to 9)	4.84dBm (power set to 10)
Peak Power Spectral Density Limit		8dBm	8dBm	8dBm
-6dB Occupied Bandwidth (kHz)		665	663	663
99% Occupied Bandwidth (kHz)		660	660	659
Occupied Bandwidth Limit		≥ 500KHz	≥ 500KHz	≥ 500KHz
Voltage Variations*	Nominal	4VDC	--	--
	-15%	25.03dBm / 318.42mW	24.28dBm / 267.917mW	24.45dBm / 278.612mW
	+15%	25.02dBm / 317.687mW	24.23dBm / 264.85mW	24.45dBm / 278.612mW
Limit		1W / 30dBm	1W / 30dBm	1W / 30dBm

***To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.*

Test		Low Channel 902.25 MHz	Mid Channel 915.00 MHz	High Channel 927.75 MHz
FHSS, 120kHz:				
Conducted Output Power		103.03mW / 20.13dBm	62.80mW / 17.98dBm	67mW / 18.26dBm
Conducted Output Power Limit		563 mW / 25.35dBm	563 mW / 25.35dBm	563 mW / 25.35dBm
E.I.R.P.		1196.7mW / 30.78dBm	729.45mW /28.63dBm	778.03mW / 28.91dBm
E.I.R.P. Limit		4 Watts / 36.02dBm	4 Watts / 36.02dBm	4 Watts / 36.02dBm
-20dB Occupied Bandwidth (kHz)		209	203	203
99% Occupied Bandwidth (kHz)		223	223	221
Occupied Bandwidth Limit		<250kHz	<250kHz	<250kHz
Voltage Variations*	Nominal	4VDC	--	--
	-15%	19.86dBm / 96.828mW	17.62dBm / 57.816mW	17.88dBm / 61.376mW
	+15%	19.87dBm / 97.051mW	17.6dBm / 57.544mW	17.90dBm / 61.66mW
Limit		1W / 30dBm	1W / 30dBm	1W / 30dBm

***To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.*

Test		Low Channel 902.25 MHz	Mid Channel 915.00 MHz	High Channel 927.75 MHz
FHSS, 200kHz:				
Conducted Output Power		101.85mW / 20.08dBm	62.37mW / 17.95dBm	67.20mW / 18.28dBm
Conducted Output Power Limit		563 mW / 25.35dBm	563 mW / 25.35dBm	563 mW / 25.35dBm
E.I.R.P.		1183.04mW / 30.73dBm	724.40mW /28.60dBm	781.62mW / 28.93dBm
E.I.R.P. Limit		4 Watts / 36.02dBm	4 Watts / 36.02dBm	4 Watts / 36.02dBm
-20dB Occupied Bandwidth (kHz)		233	241	237
99% Occupied Bandwidth (kHz)		210	211	210
Occupied Bandwidth Limit		<250kHz	<250kHz	<250kHz
Voltage Variations*	Nominal	3.3VDC	--	--
	-15%	19.79dBm / 95.28mW	17.62dBm / 57.81mW	17.85dBm / 60.954mW
	+15%	19.79dBm / 95.28mW	17.63dBm / 57.943mW	17.84dBm / 60.814mW
Limit		1W / 30dBm	1W / 30dBm	1W / 30dBm

***To meet the requirements of 15.31, voltage was varied by ±15% of the nominal voltage. All tests were then performed at the highest output power voltage setting.*

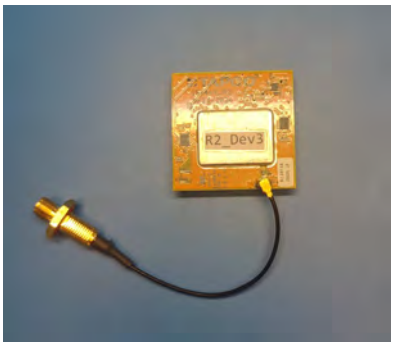
4 ENGINEERING STATEMENT

This report has been prepared on behalf of TAPCO (Traffic and Parking Control Co., 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 standards and KDB558074 procedures. 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: 900 MHz Radio
Model(s): 154450
Serial No.: R2_Dev3
FCC ID: 2ANWN-RM154450



5.2 Trade Name:

TAPCO (Traffic and Parking Control Co., Inc.)

5.3 Power Supply:

3.7V Battery

5.4 Applicable Rules:

CFR 47, Part 15.247, subpart C

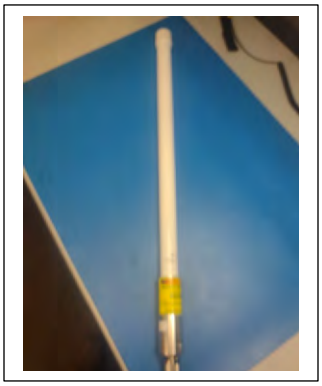
5.5 Equipment Category:

Radio Transmitter-DTS
Radio Transmitter-FHSS

5.6 Accessories:

Device	Manufacturer	Type	Model	Gain (dBi)	Serial Number
Antenna	Linx Technology	Monopole	ANT-916-CW-QW	1.8	None Specified
Antenna	Laird	Yagi	PC906	10.65	None Specified
Antenna	PCTel	Monopole	MFB9153	5.15	None Specified
Antenna	Pulse Larsen	Dipole	W1063	1.2	None Specified
Antenna	WP Wireless	Puck	WPANT30026-S5A	4	None Specified

PCTEL MONOPOLE



YAGI

DIPOLE

PUCK

LINX MONOPOLE

5.7 Test Item Condition:

The equipment to be tested was received in good condition.

5.8 Testing Algorithm:

EUT was set to transmit continuous GFSK modulations with 120kHz, 200kHz BW in the FHSS mode and 500kHz BW in DTS mode. EUT was tested with four antenna types – Dipole, Monopole, Puck and Yagi. 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-E	Albatross Projects	B83117-DF435-T261	US140023	2025-03-31
Spectrum Analyzer	CL138	Agilent Technologies	E4407B	US41192779	2025-04-11
Receiver	CL151	Rohde & Schwarz	ESU40	100319	2025-04-09
Receiver	CL204	Rohde & Schwarz	ESR7	101714	2025-04-10
Antenna, JB3 Combination	CL175	Sunol Sciences	JB3	A030315	2025-09-18
Low Loss Cable Set	--	Pasternack	PE3C0666-252 / PE3C066-50CM	None Spec.	2025-04-09
Horn Antenna	CL098	Emco	3115	9809-5580	2025-01-02
Pre-Amplifier	CL153	Keysight Tech.	83006A	MY39500791	2025-12-04
Preamplifier	CL284	AH Systems, Inc.	PAM-0101	131	2025-04-10
Active 18” Loop Antenna	CL163-Loop	A.H. Systems, Inc.	EHA-52B	100	2025-02-15
Temp/Hum Rec	CL293	Thermpro	TP50	1	2025-05-31
Temp/Hum Rec	CL294	Thermpro	TP50	2	2026-04-27
Software:	Tile Version 3.4.B.3		Software Verified: 2024-11-01 to 2024-11-07		
Software:	EMC 32, Version 8.53.0		Software Verified: 2024-11-01 to 2024-11-07		
Transient Limiter	CL102	Hewlett Packard	11947A	3107A03325	2025-04-08
Software:	Tile Version 3.4.B.3.		Software Verified: 2024-12-17		
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:

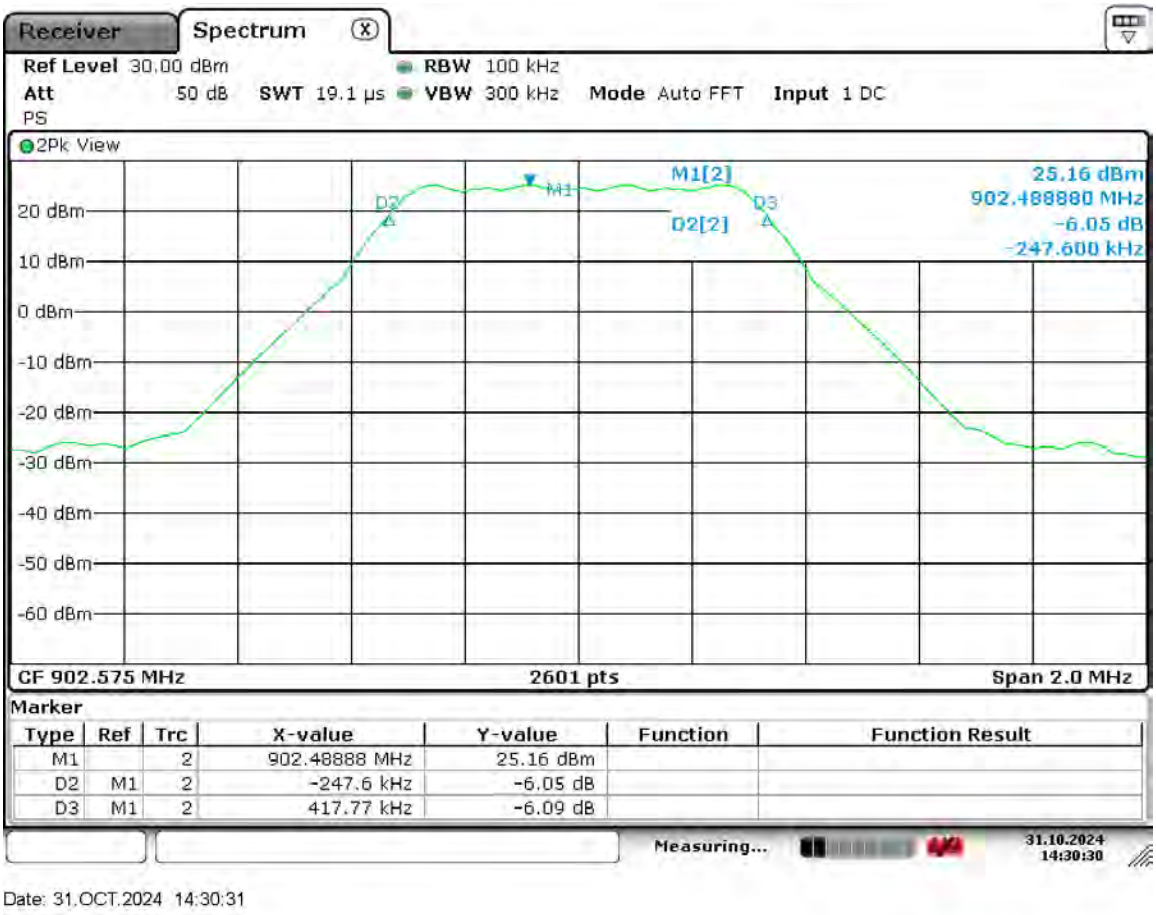
The DTS 6dB bandwidth shall be greater than 500 kHz.
The FHSS -20 dB bandwidth shall be less than 250 kHz.

Bandwidth measurements were made at the low, mid and high frequencies with the Resolution Bandwidth set between 1%-5% OBW for the 99%, and 100kHz Resolution Bandwidth and 300kHz Video Bandwidth for the 6dB OBW. The DTS bandwidth was measured using the marker delta method and the 99% measurements were made using the analyzer's measurement function set to 99%.

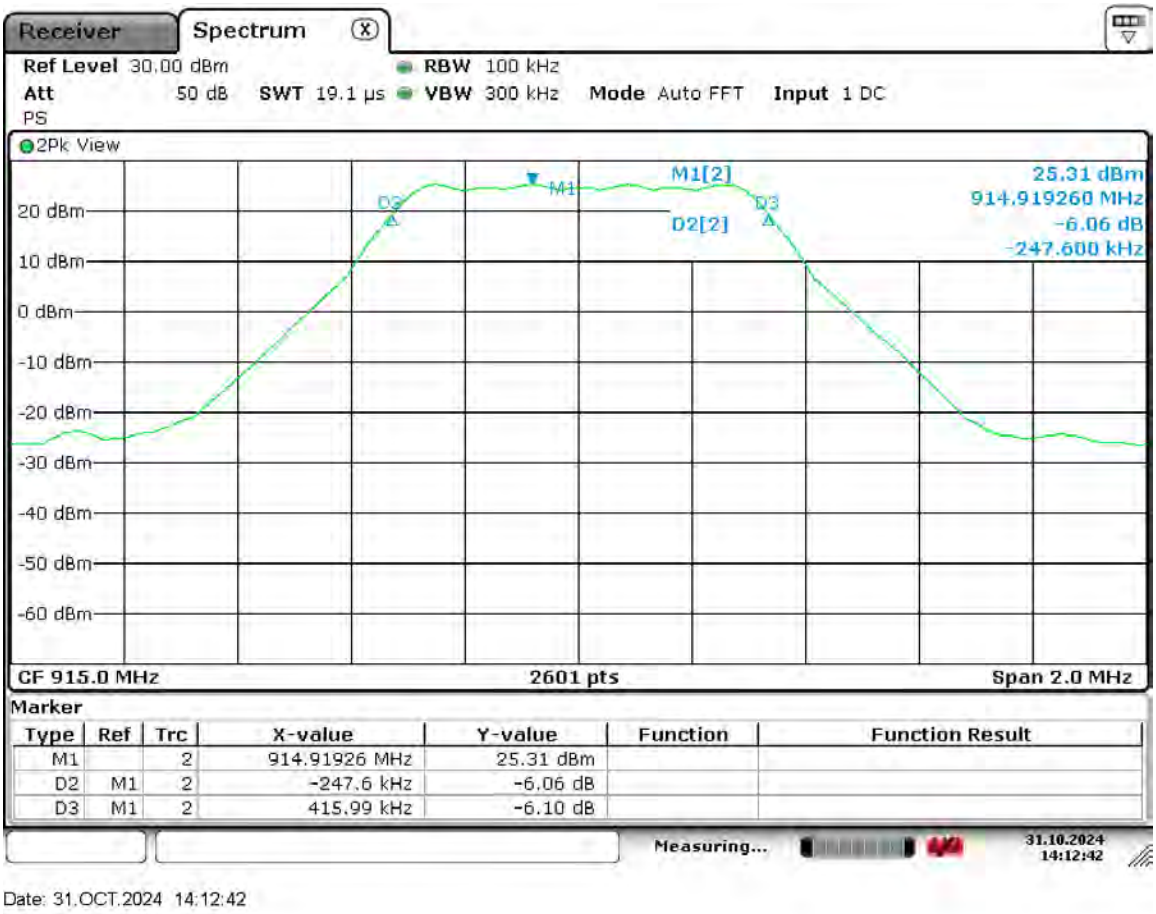
7.2 Occupied Bandwidth Test Data

Test Date:	2024-10-31	Test Engineer:	J. Chiller
Standard(s):	CFR 47 Part 15.247(a)(2); KDB558074	Air Temperature:	23.1ºC
		Relative Humidity:	43%

DTS, 500kHz, -6dB: Low Channel



DTS, 500kHz, -6dB: Mid Channel



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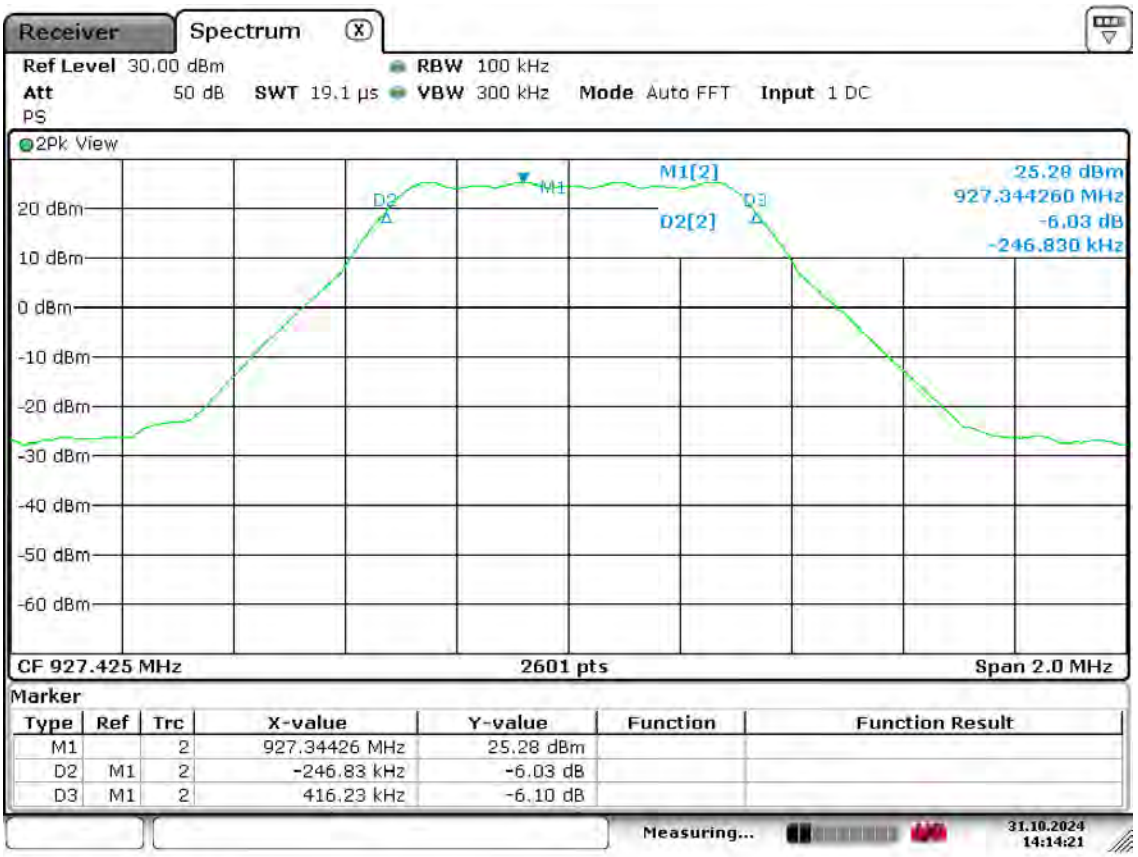
DTS, 500kHz, -6dB: High Channel



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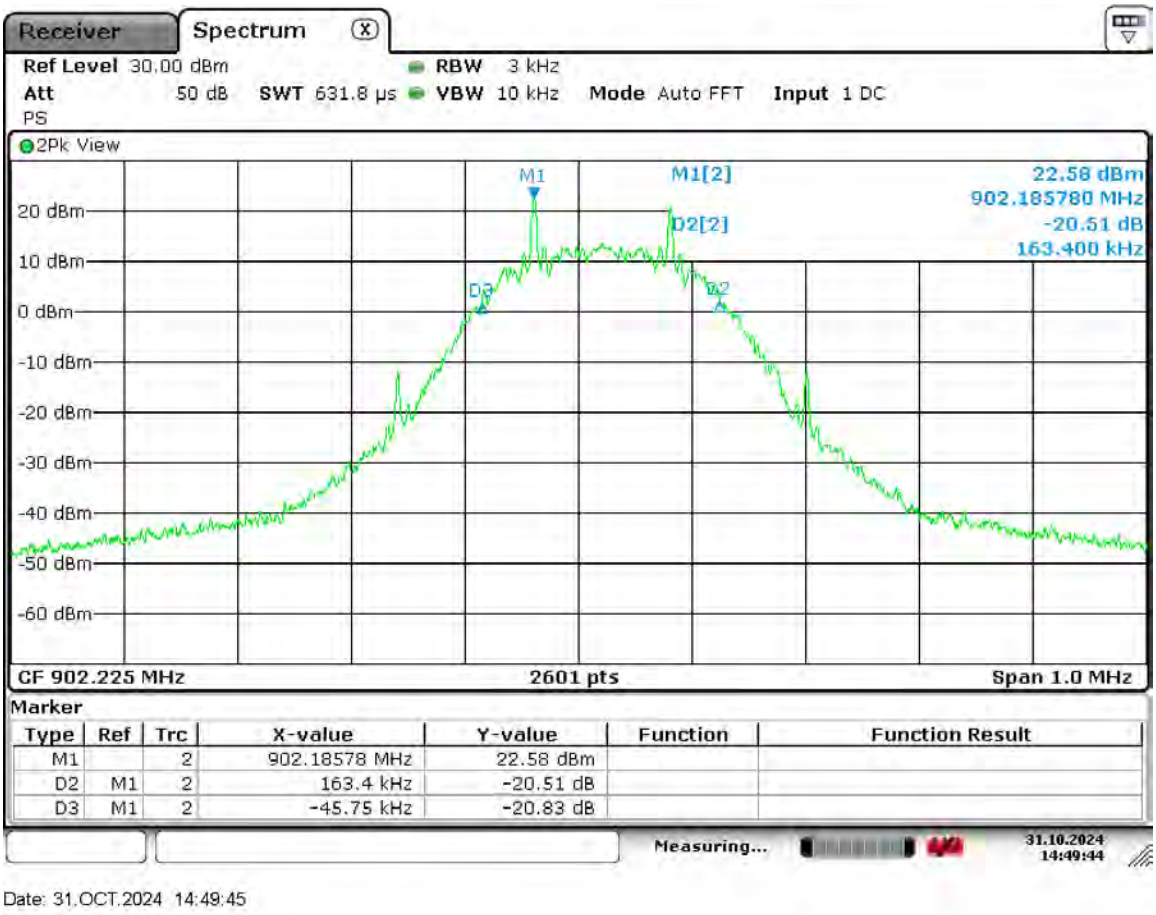
DTS, 500kHz, 99%: Low Channel

DTS, 500kHz, 99%: Mid Channel

DTS, 500kHz, 99%: High Channel

FHSS, 120kHz, -20dB: Low Channel



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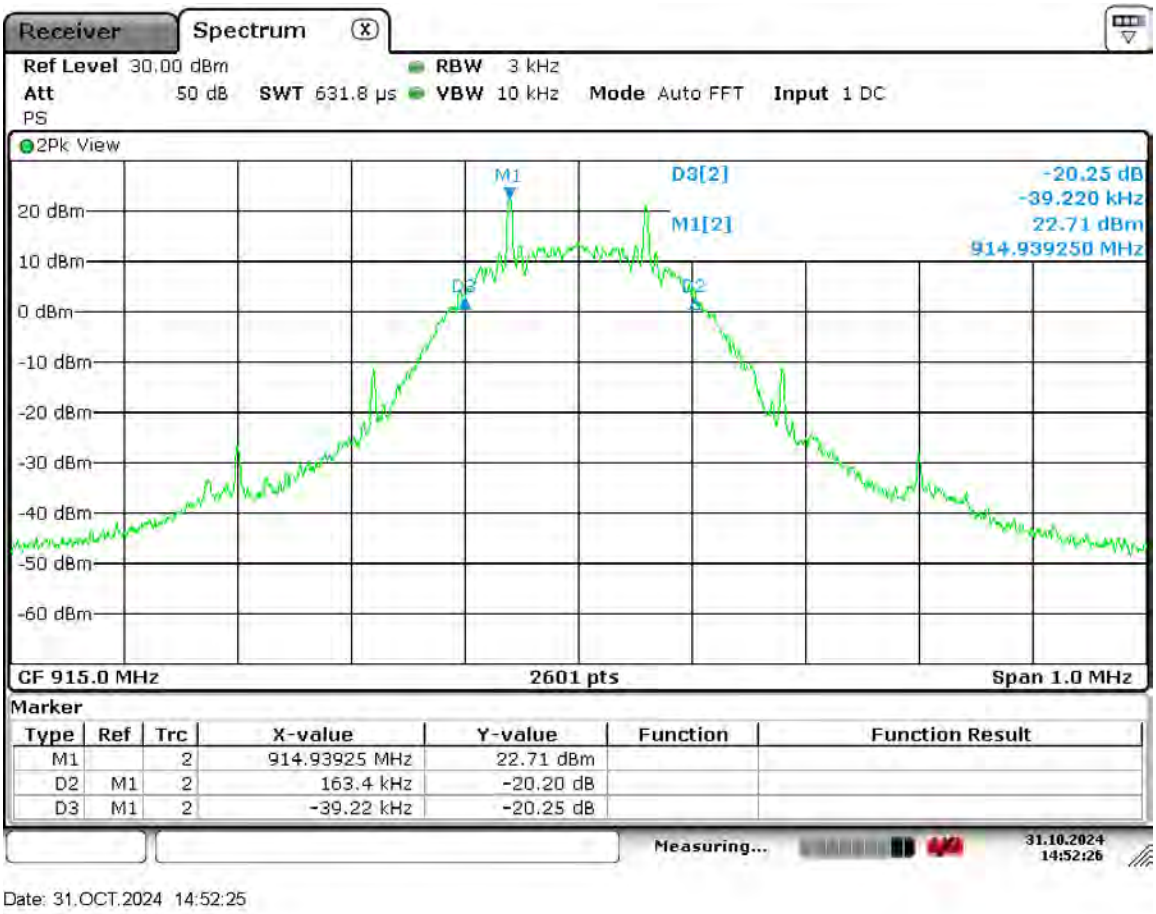
FHSS, 120kHz, -20dB: Mid Channel



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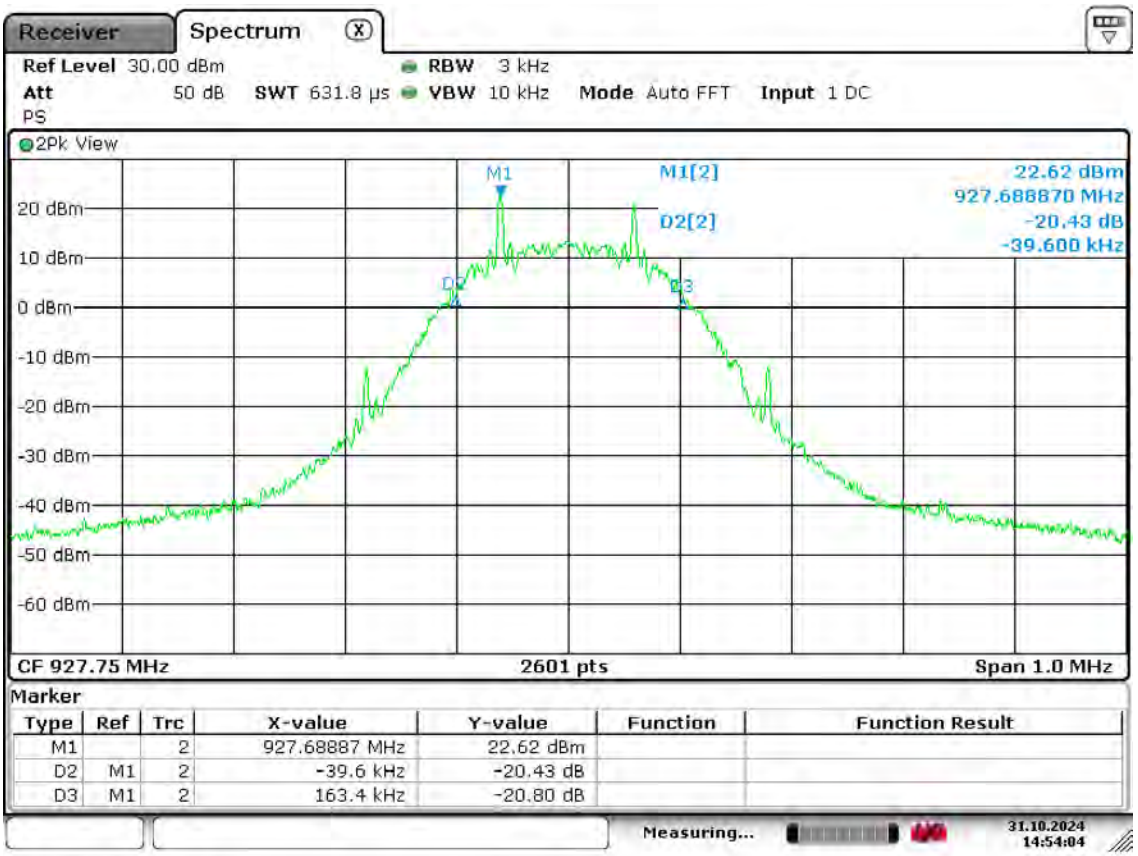
FHSS, 120kHz, -20dB: High Channel



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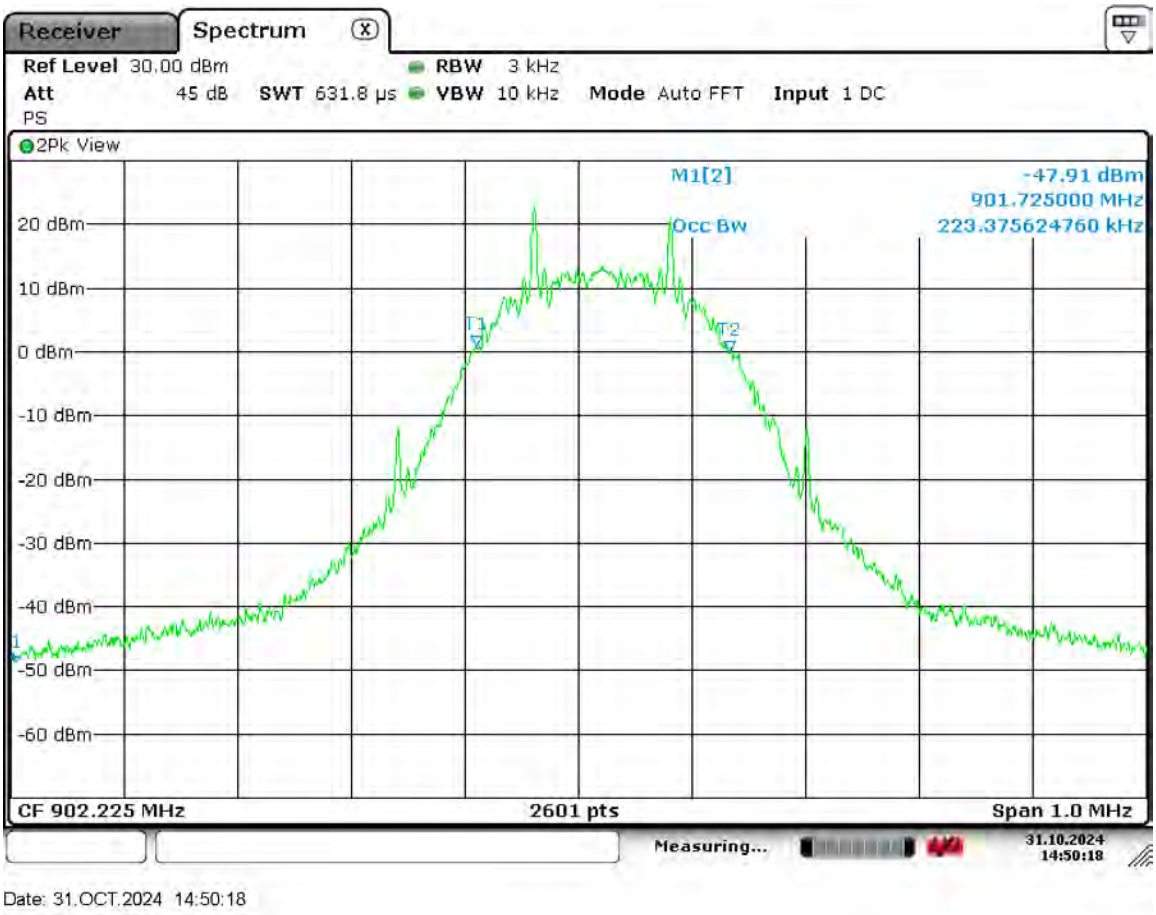
FHSS, 120kHz, 99%: Low Channel



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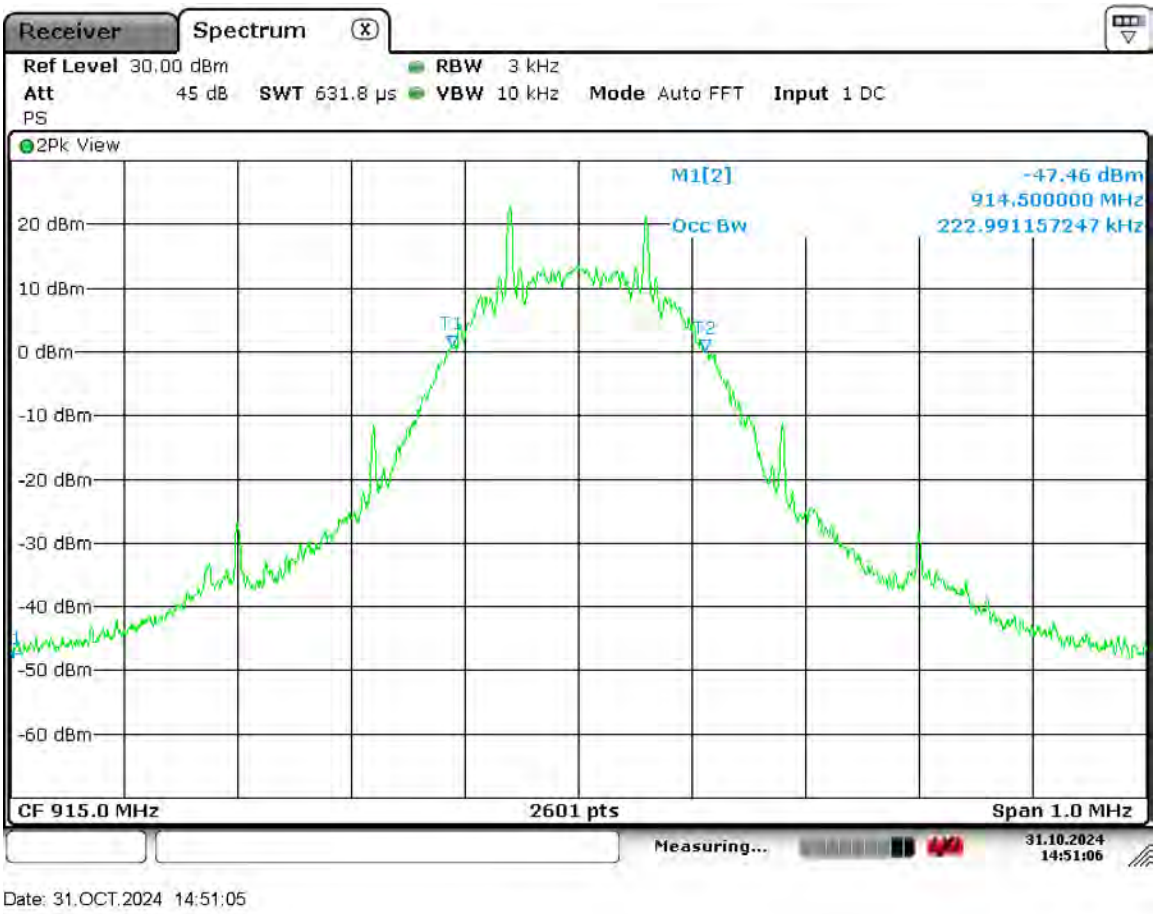
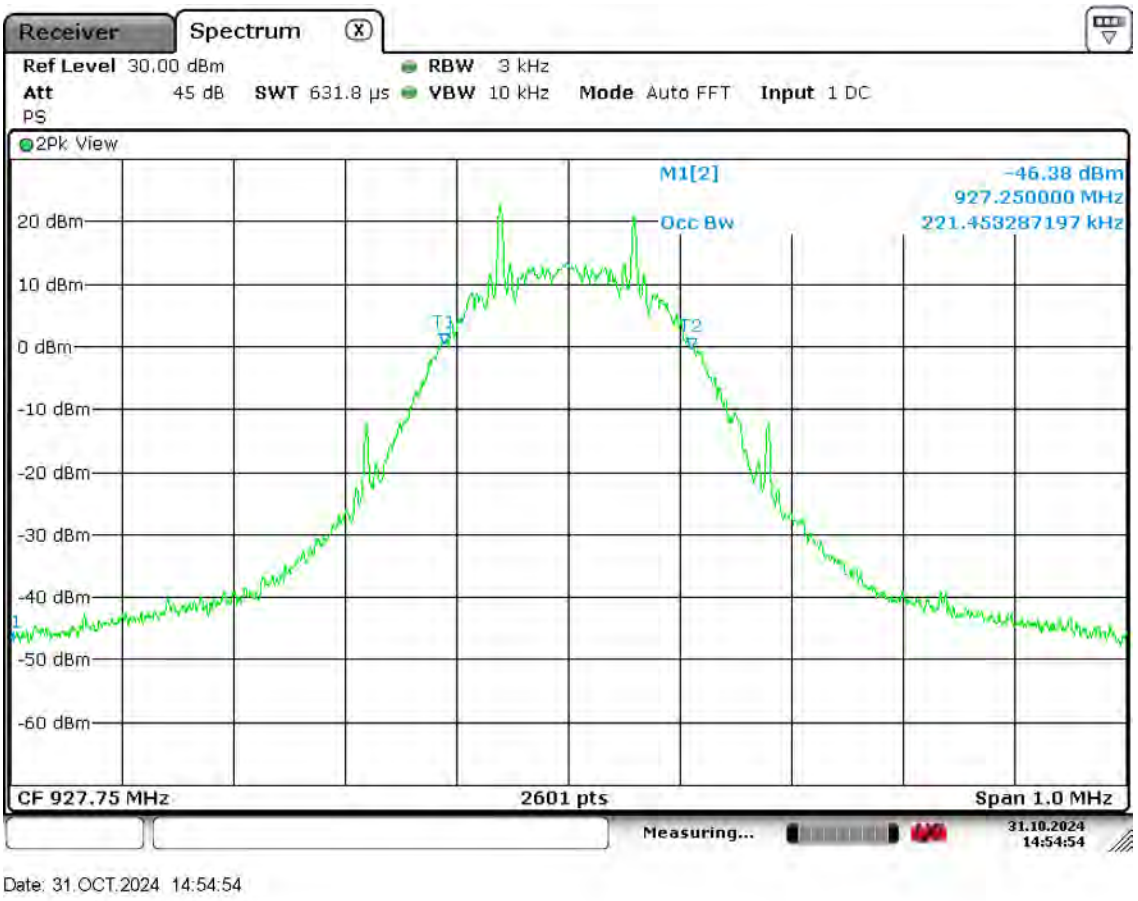
FHSS, 120kHz, 99%: Mid Channel



FHSS, 120kHz, 99%: High Channel



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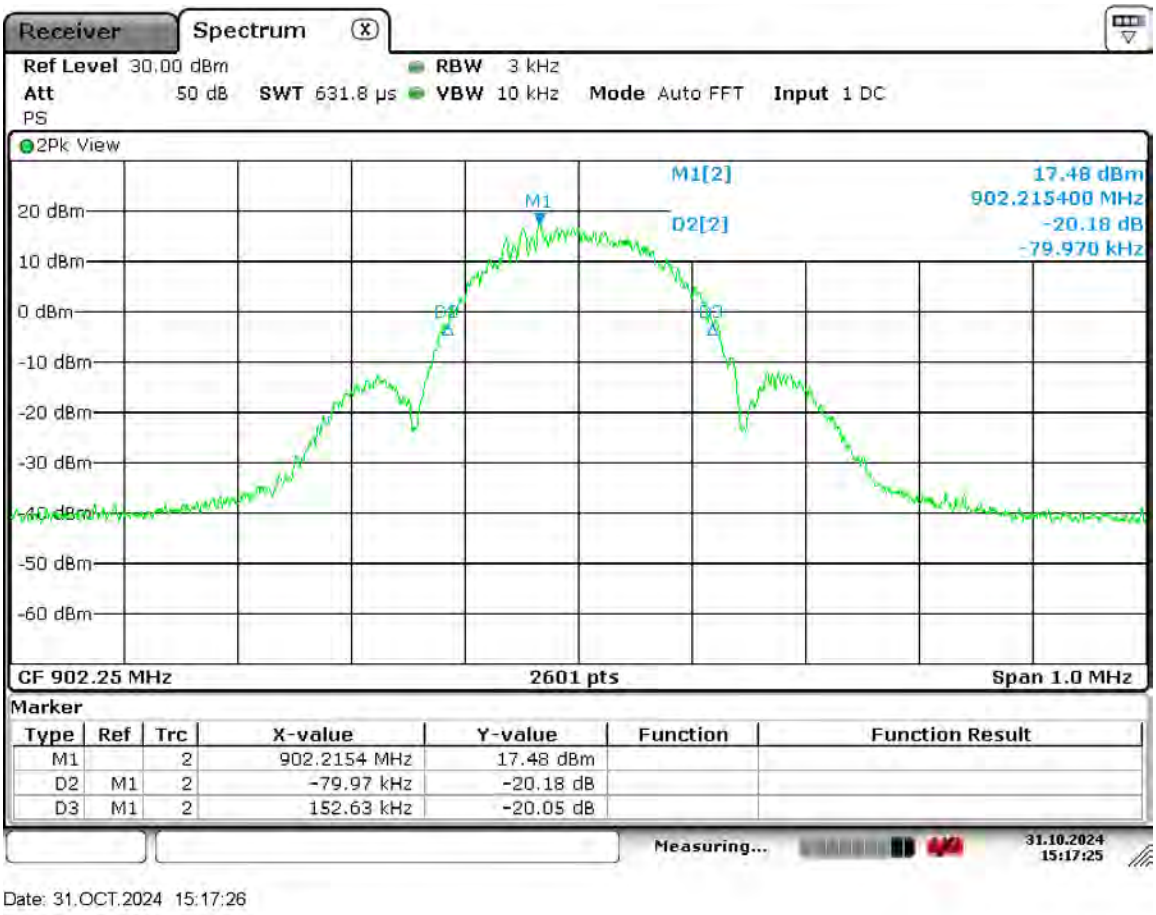
FHSS, 200kHz, -20dB: Low Channel



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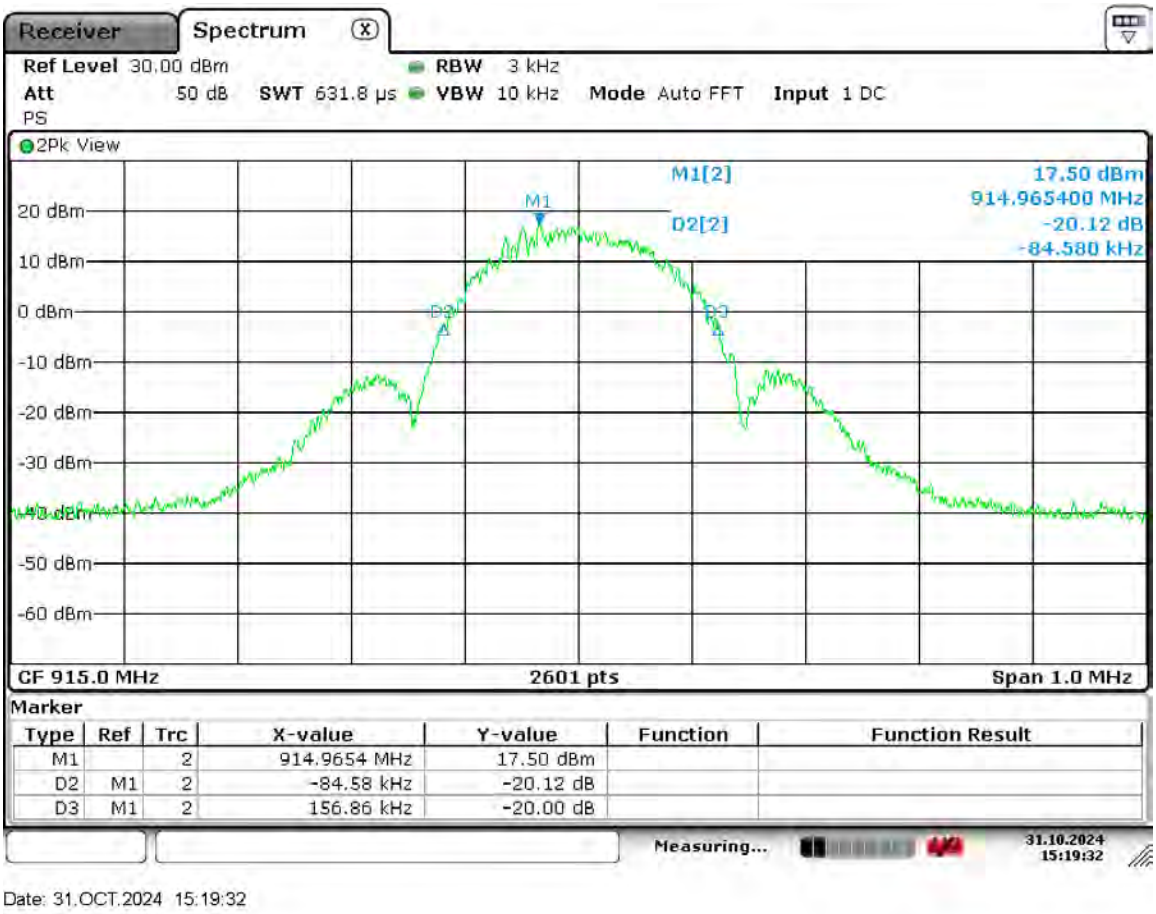
FHSS, 200kHz, -20dB: Mid Channel



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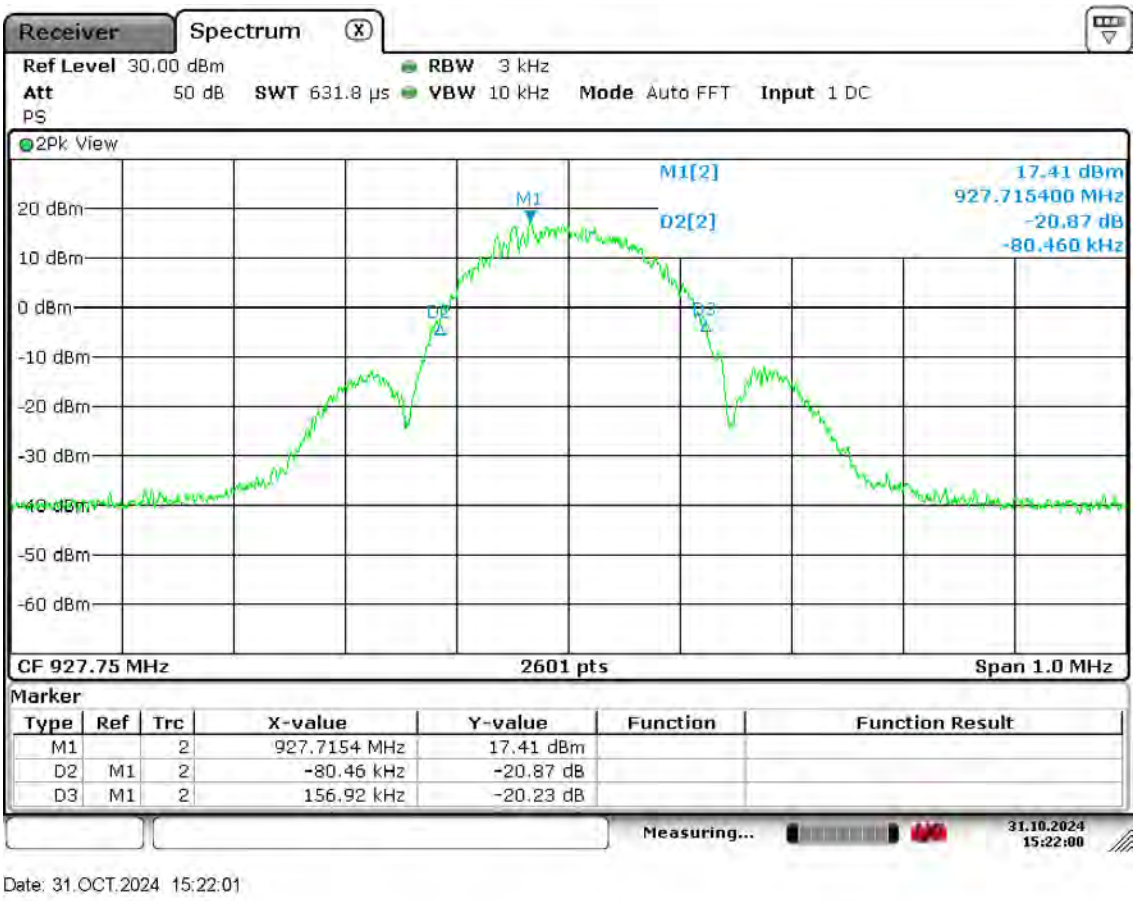
FHSS, 200kHz, -20B: High Channel



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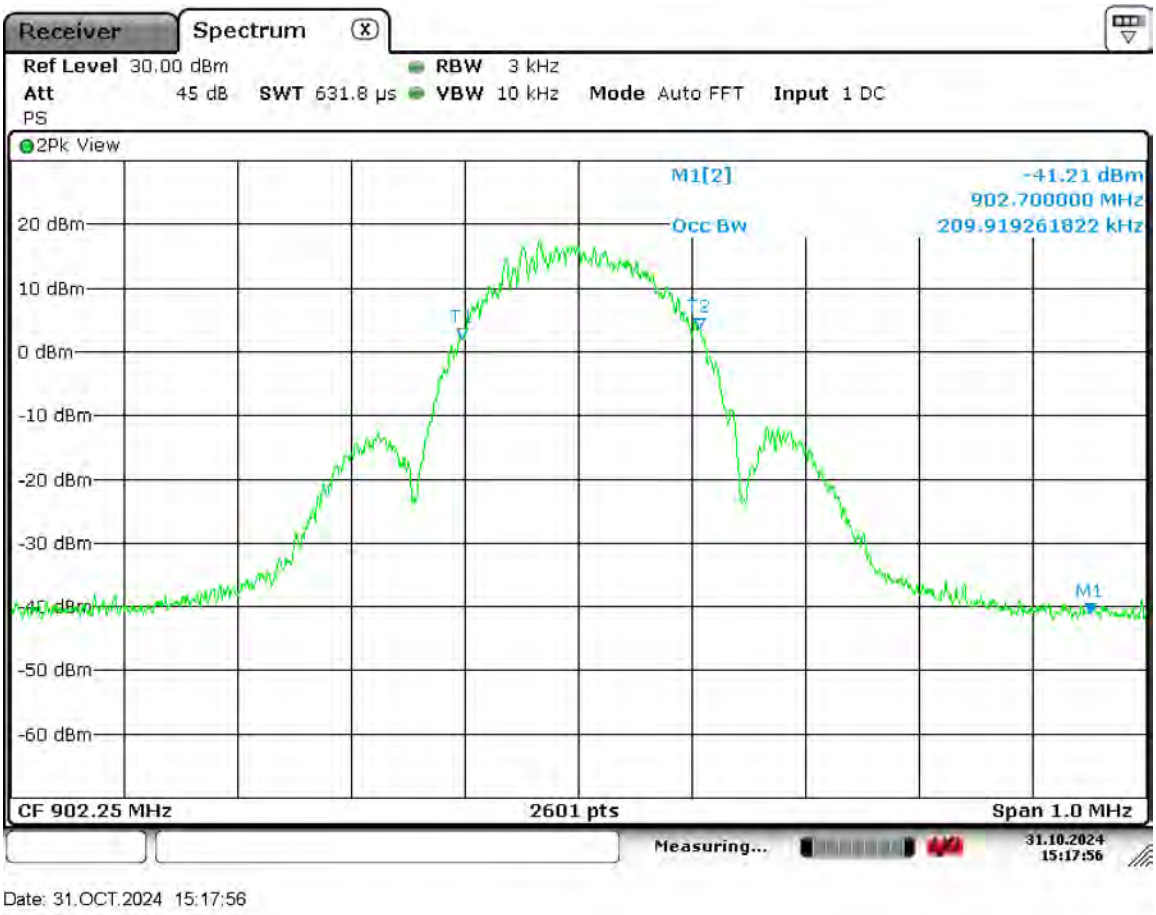
FHSS, 200kHz, 99%: Low Channel



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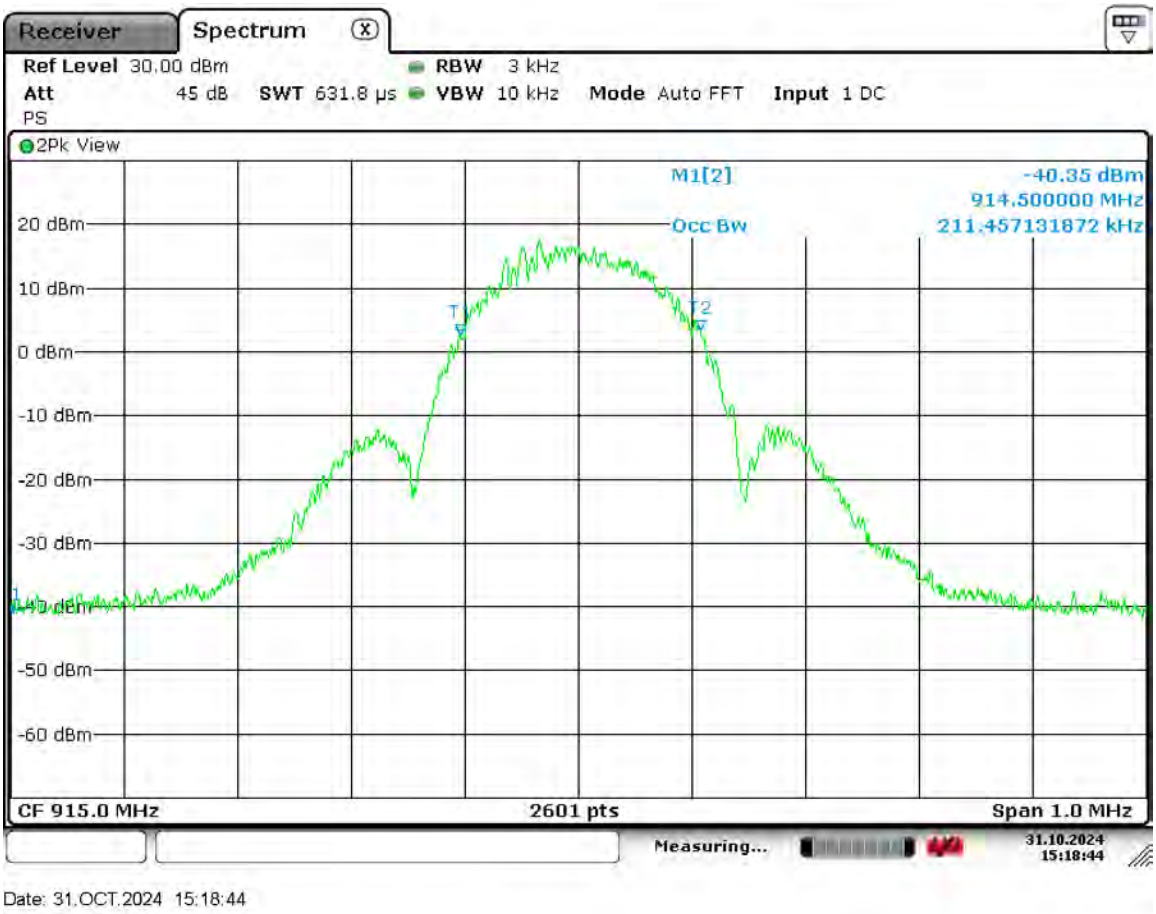
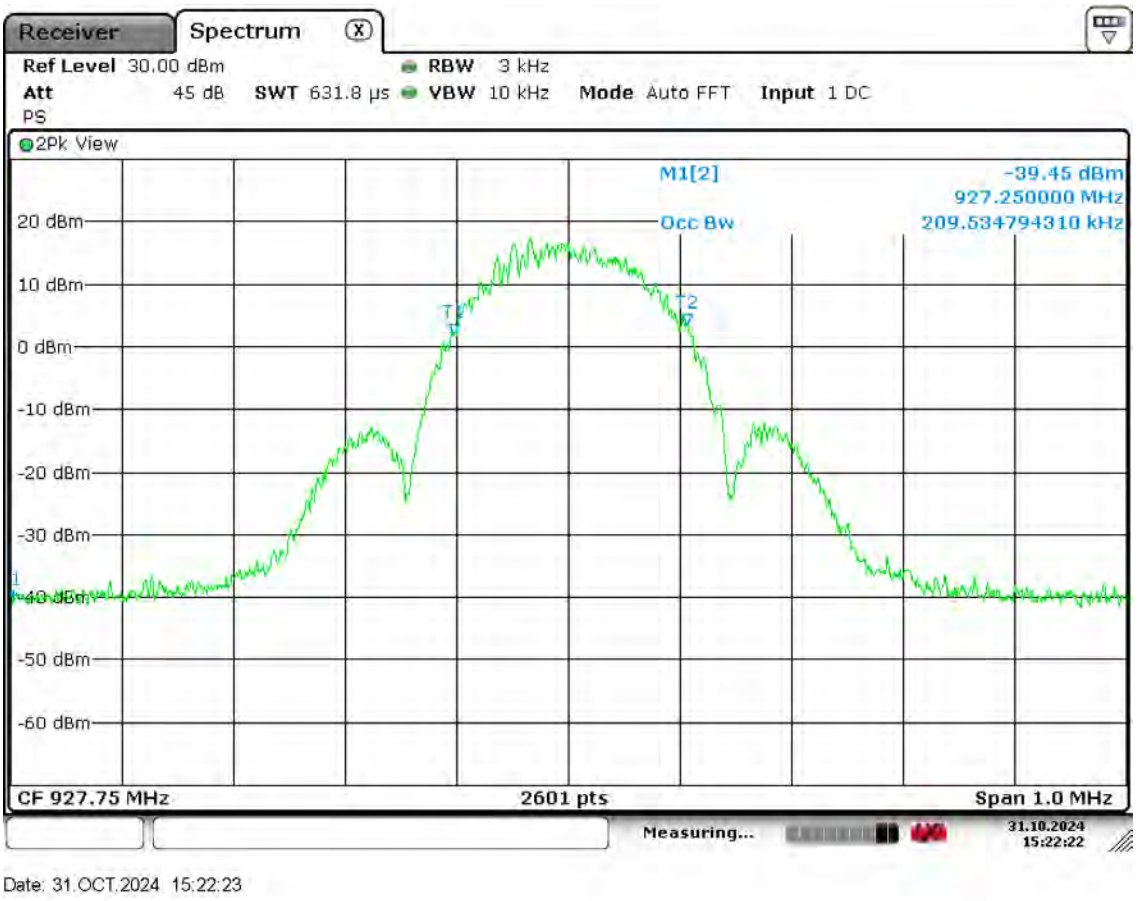
FHSS, 200kHz, 99%: Mid Channel



FHSS, 200kHz, 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.

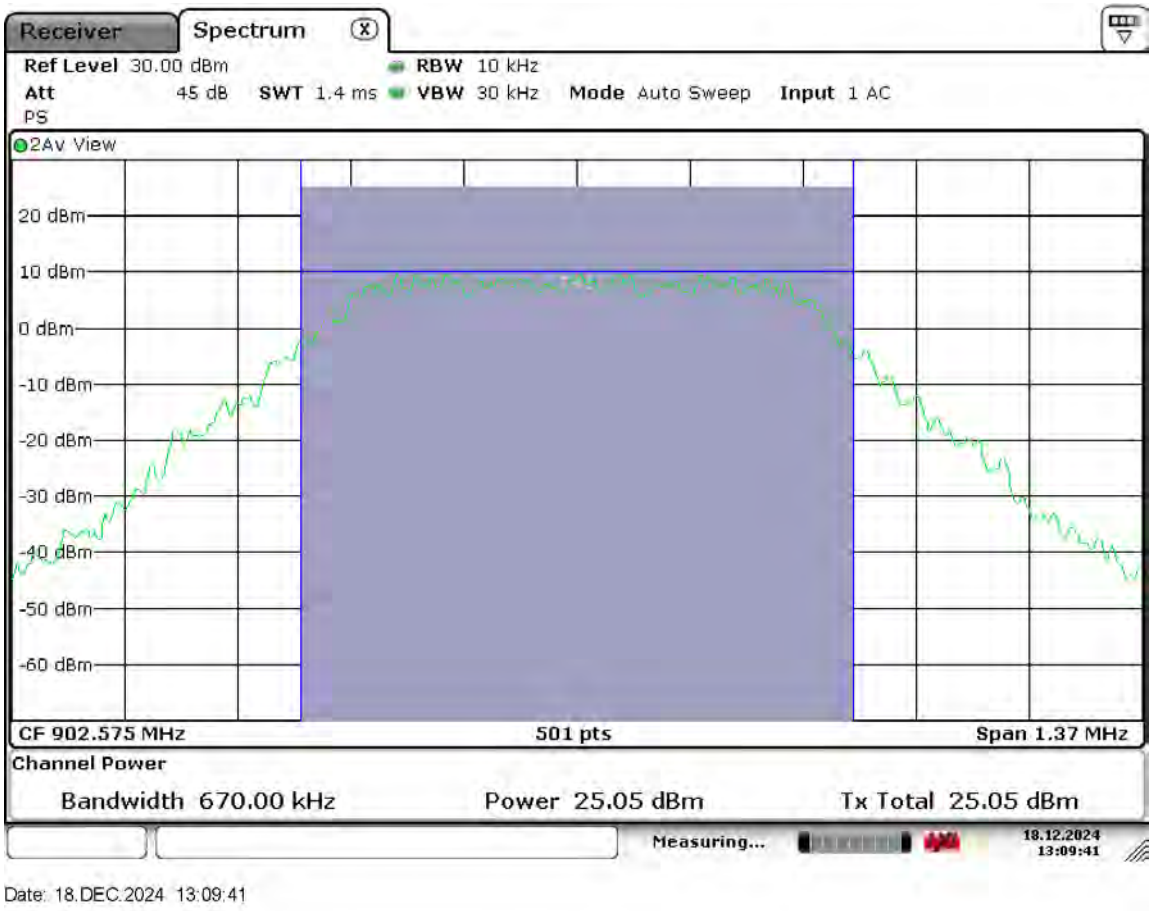
8.1 Requirements:

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

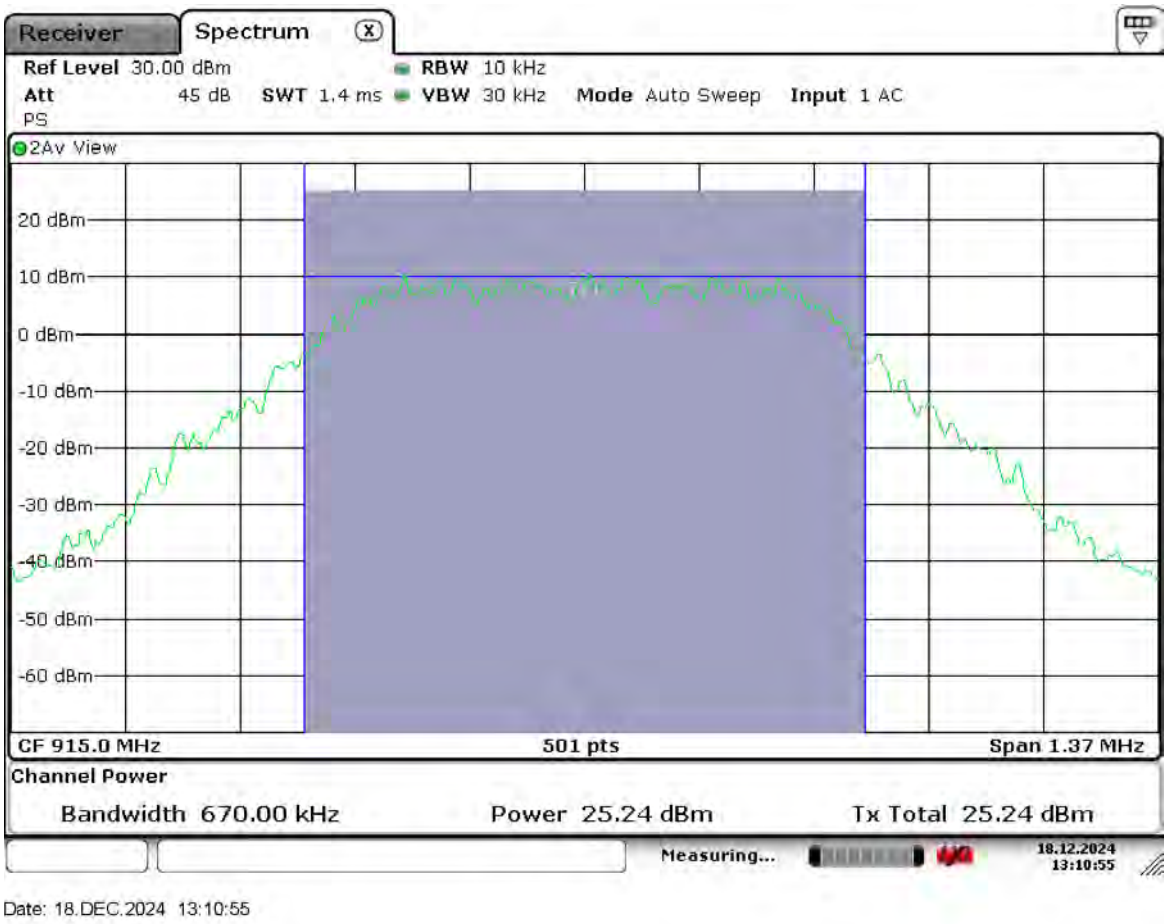
8.2 Conducted Output Power Test Data

Test Date:	2024-12-18	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(b)(3); KDB558074	**Air Temperature:**	21.2ºC
		Relative Humidity:	38%

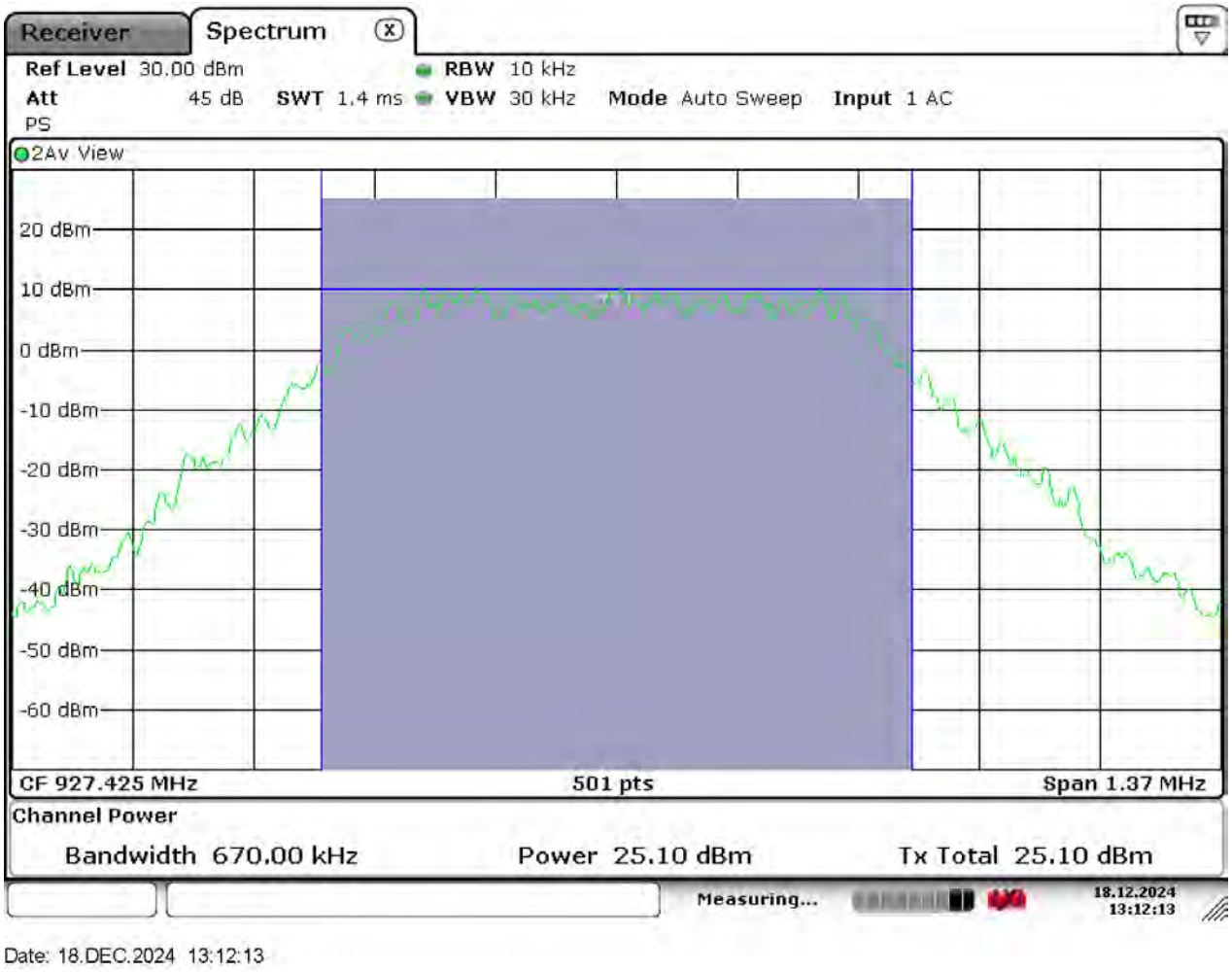
DTS, 500kHz: Low Channel



DTS, 500kHz: Mid Channel



DTS, 500kHz: High Channel



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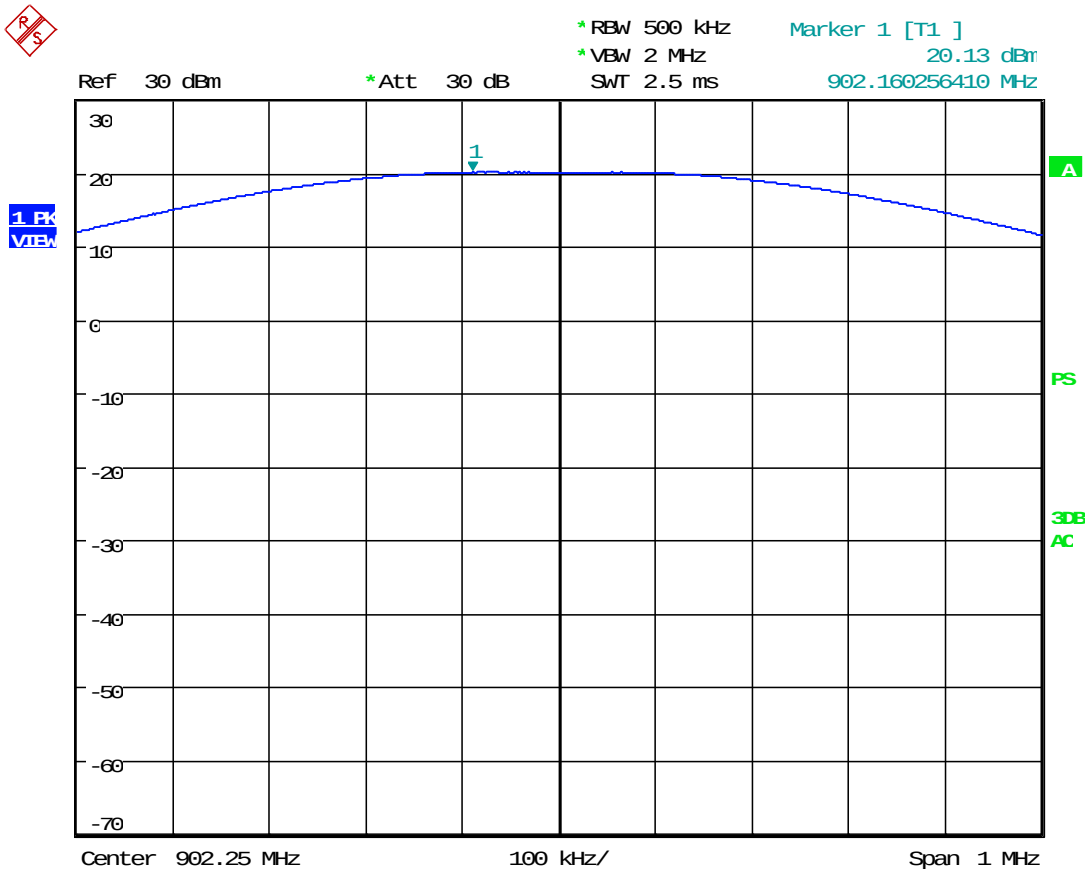
FHSS, 120kHz: Low Channel



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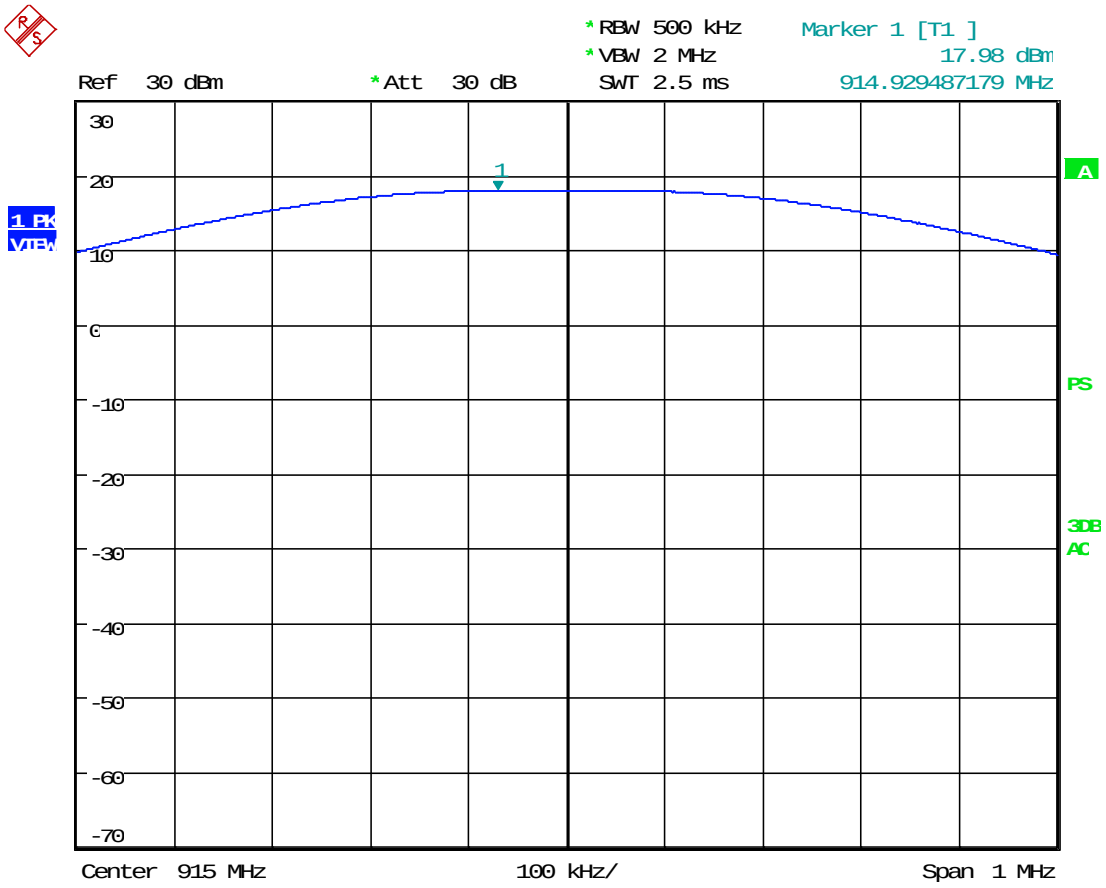
FHSS, 120kHz: Mid Channel



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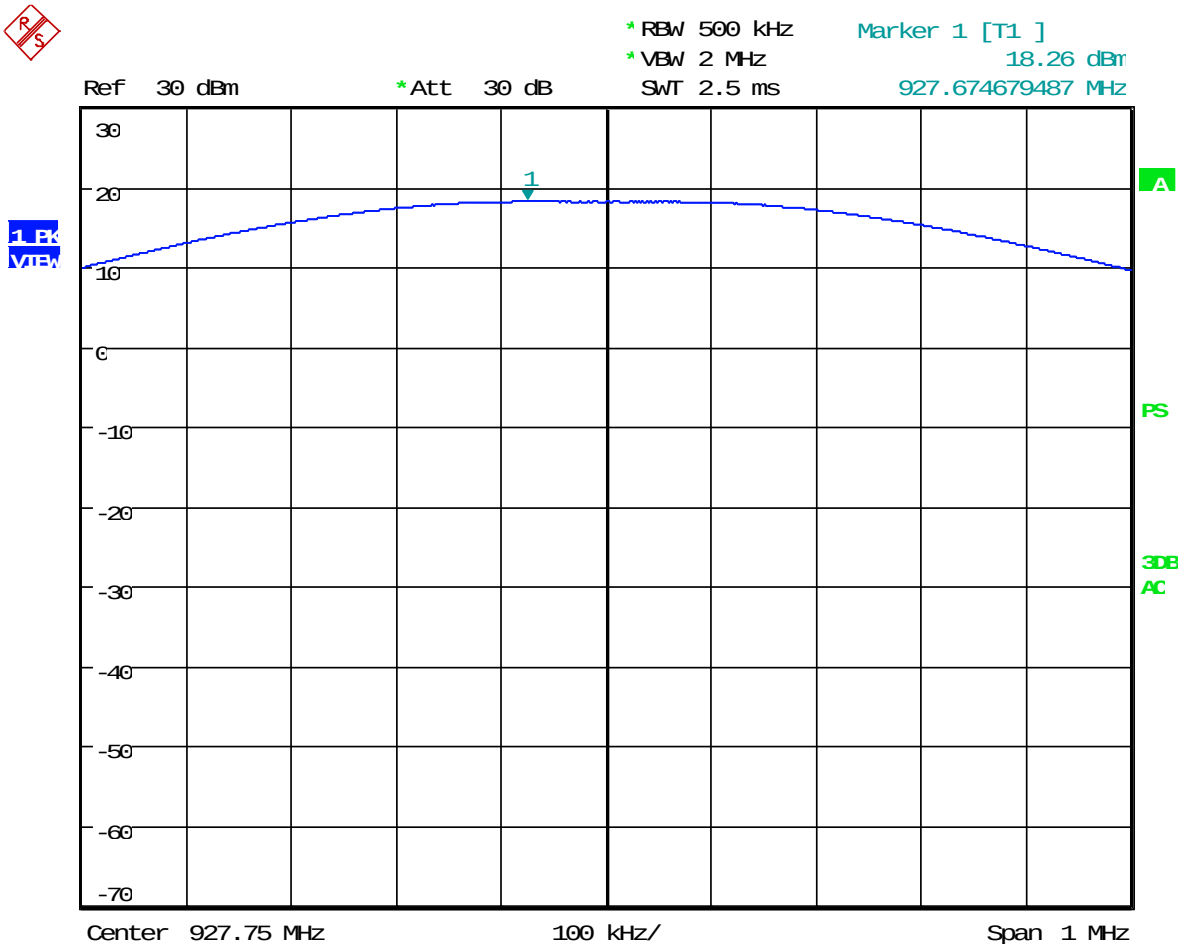
FHSS, 120kHz: High Channel



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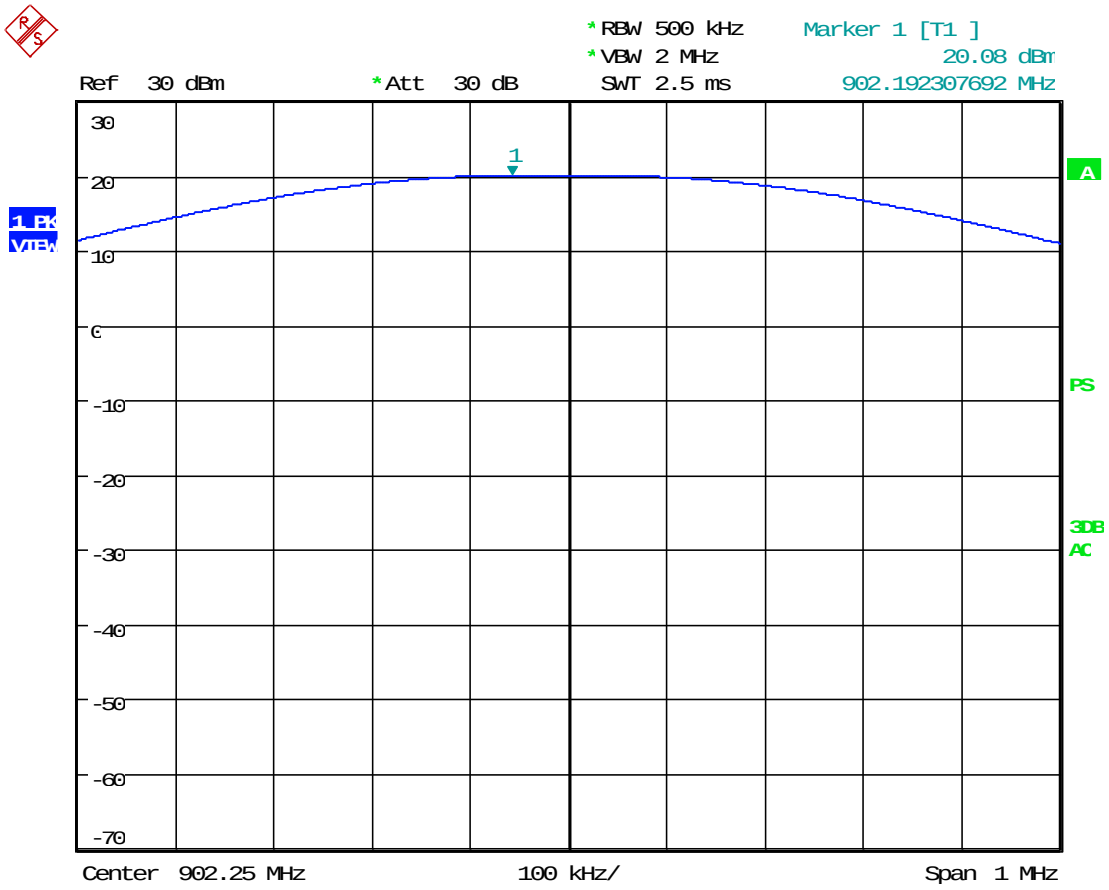
FHSS, 200kHz: Low Channel



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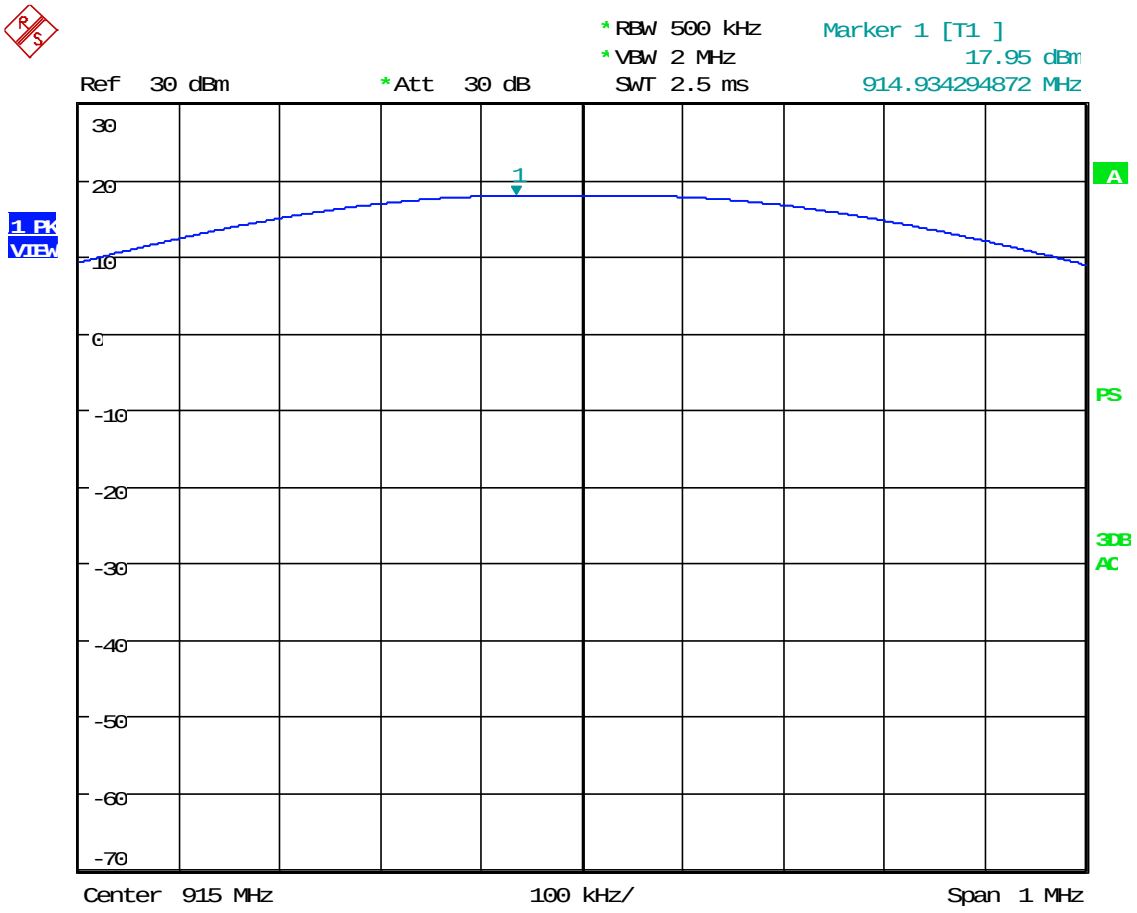
FHSS, 200kHz: Mid Channel



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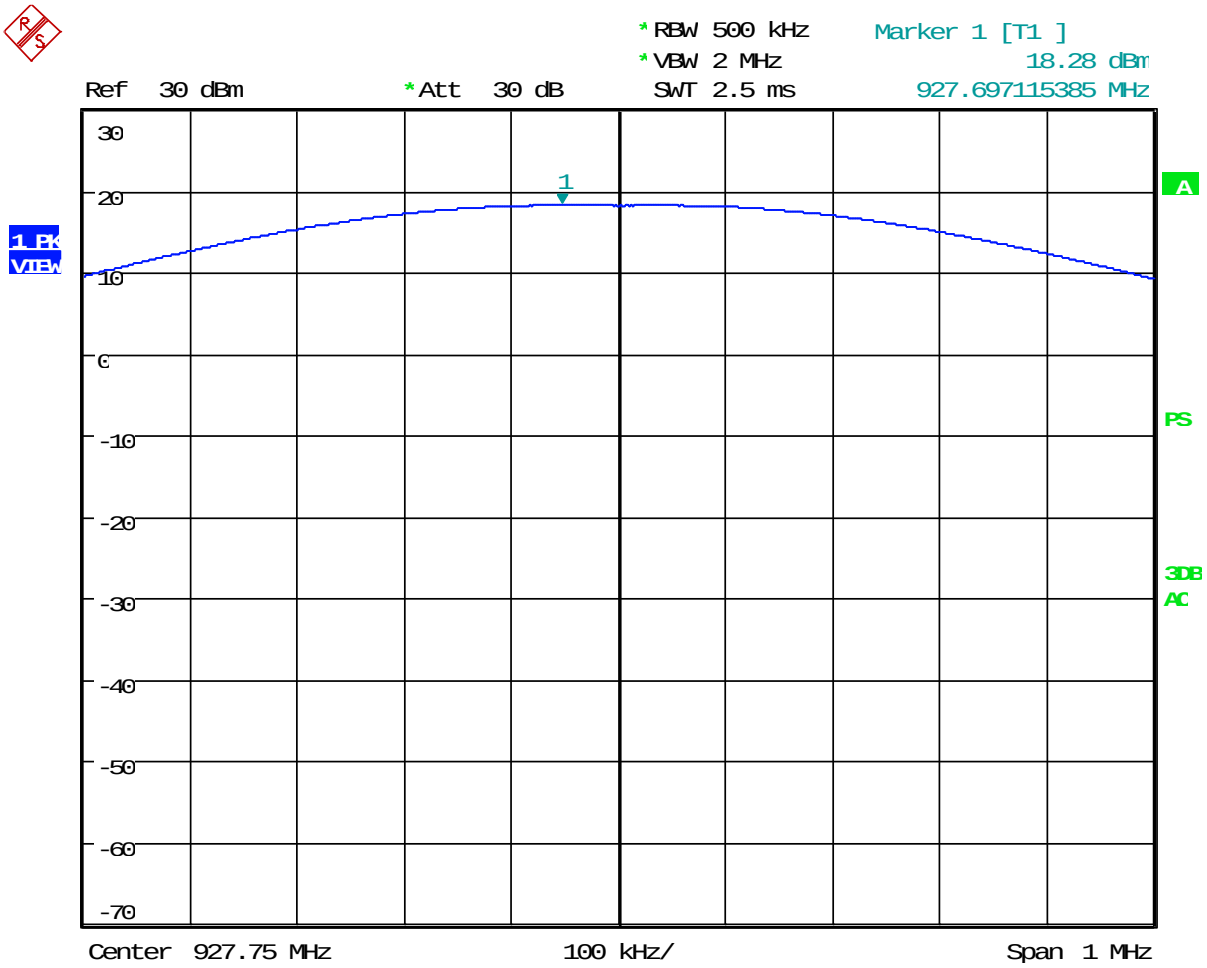
FHSS, 200kHz: High Channel



Date: 7.FEB.2025 11:05:46

9 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.

9.1 Requirements:

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

The 30 dBc limits shown apply to the DTS mode due to power measurements using an average detector. Since the FHSS mode meets the 30dBc requirement, then, by default, the product complies with the 20dBc FHSS requirement.

9.2 Conducted Spurious Emissions Test Data

Test Date:	2024-12-18	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(d) / Part 15.207 KDB558074	**Air Temperature:**	21.3ºC
Results:	Complies	**Relative Humidity:**	38%

DTS, 500kHz: Lower Band Edge

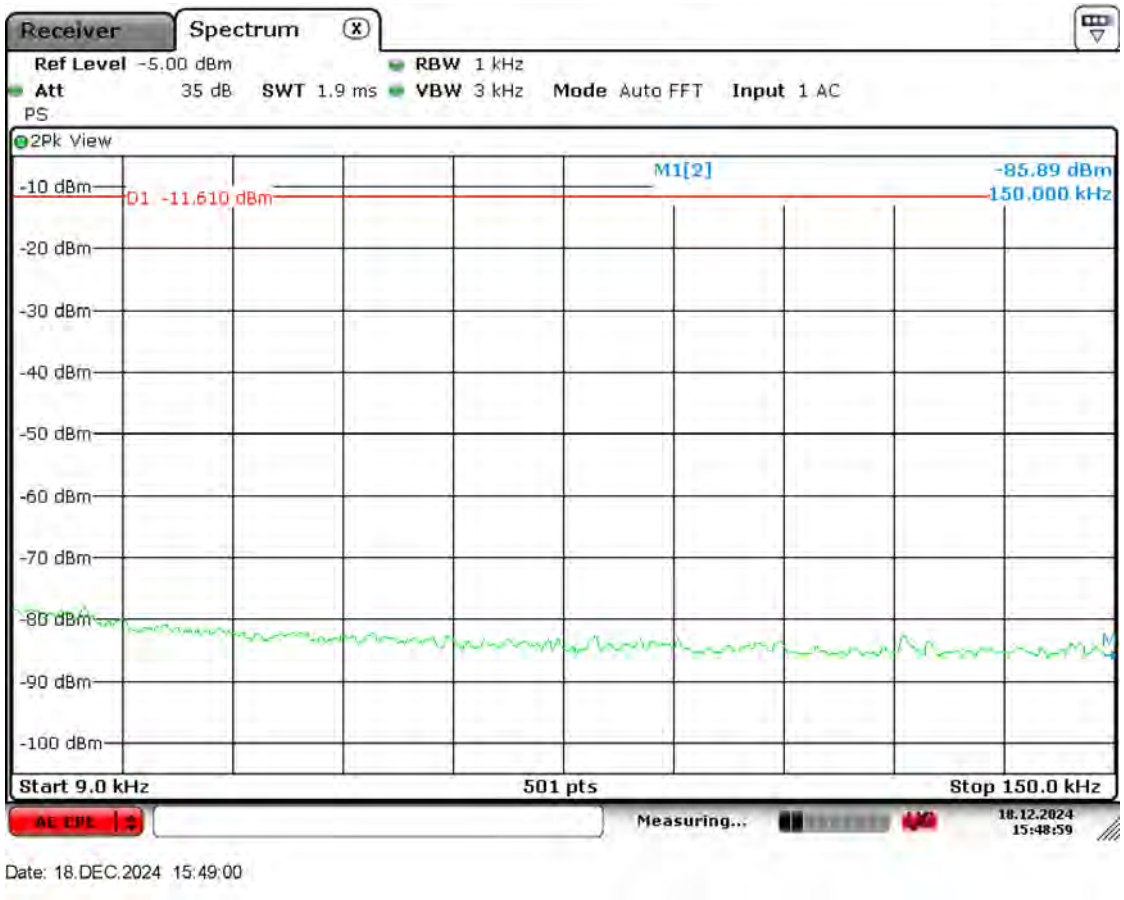
.

DTS, 500kHz: Upper Band Edge

.

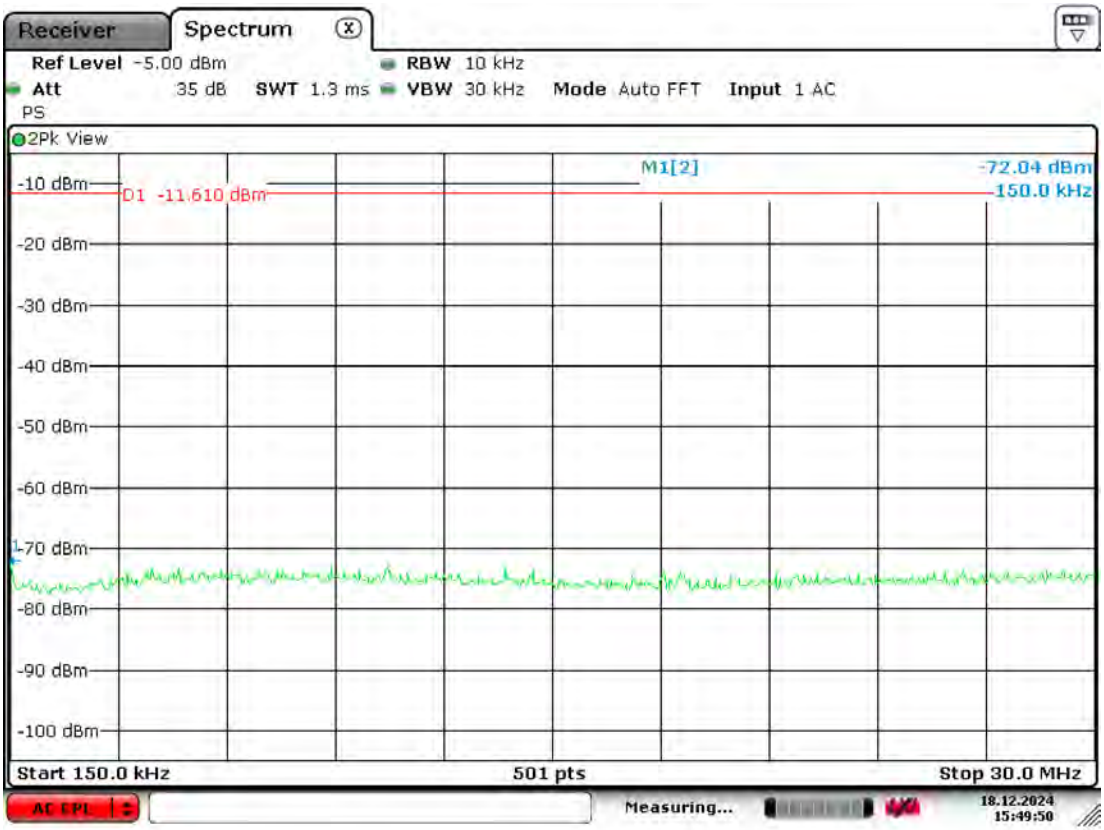
DTS, 500kHz, Low Channel: 0.009 MHz to 0.15 MHz

.



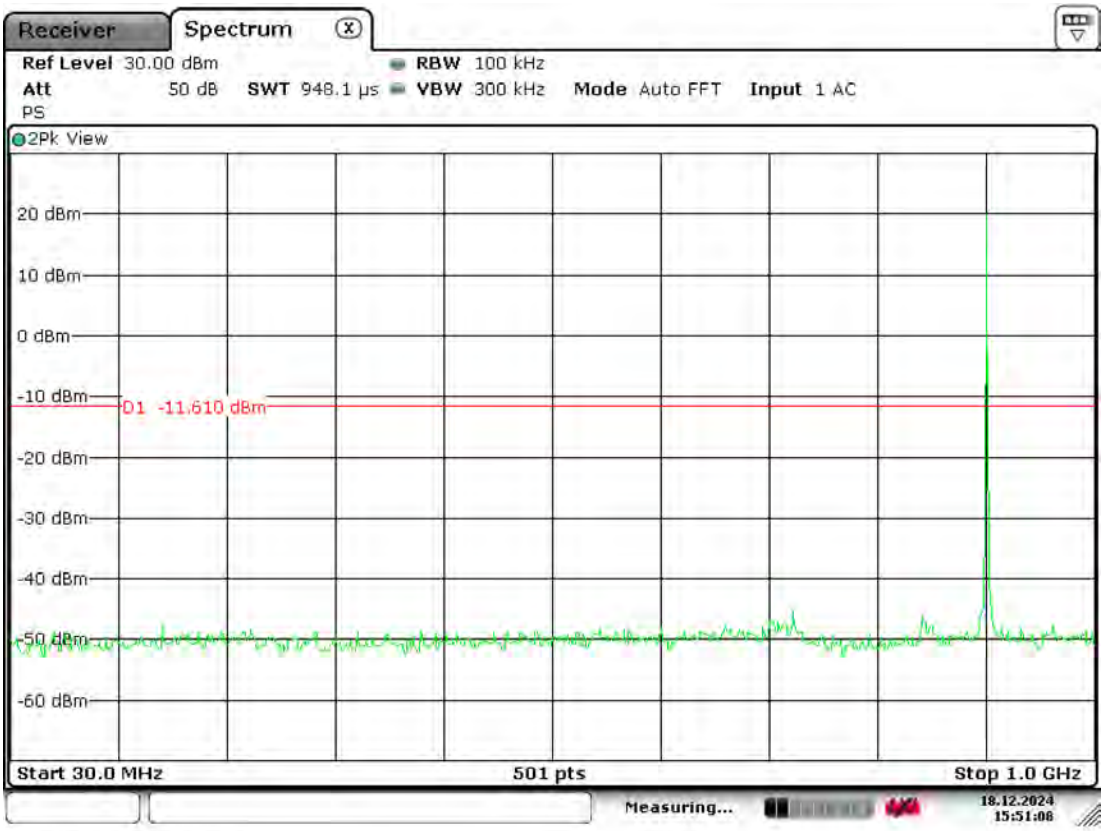
DTS, 500kHz, Low Channel: 0.15 MHz to 30 MHz

.



DTS, 500kHz, Low Channel: 30 MHz to 1000 MHz

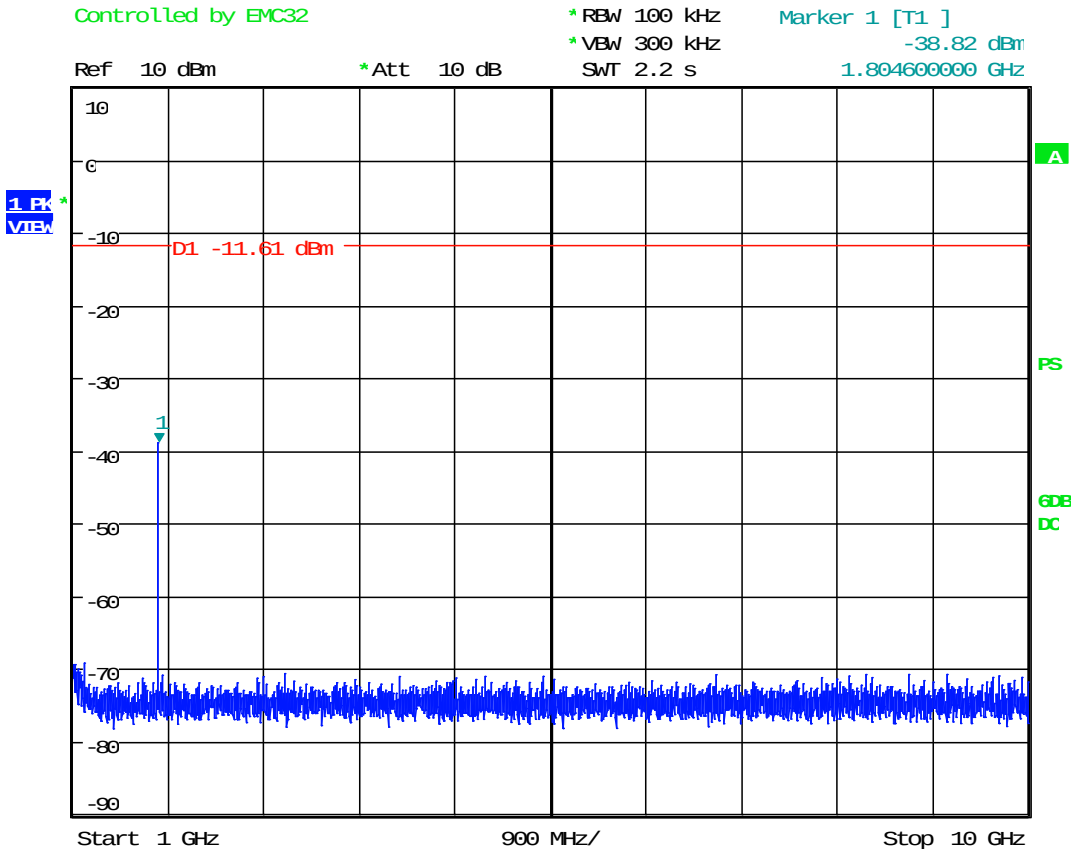
.



Date: 18.DEC.2024 15:51:08

DTS, 500kHz, Low Channel: 1 GHz to 10 GHz

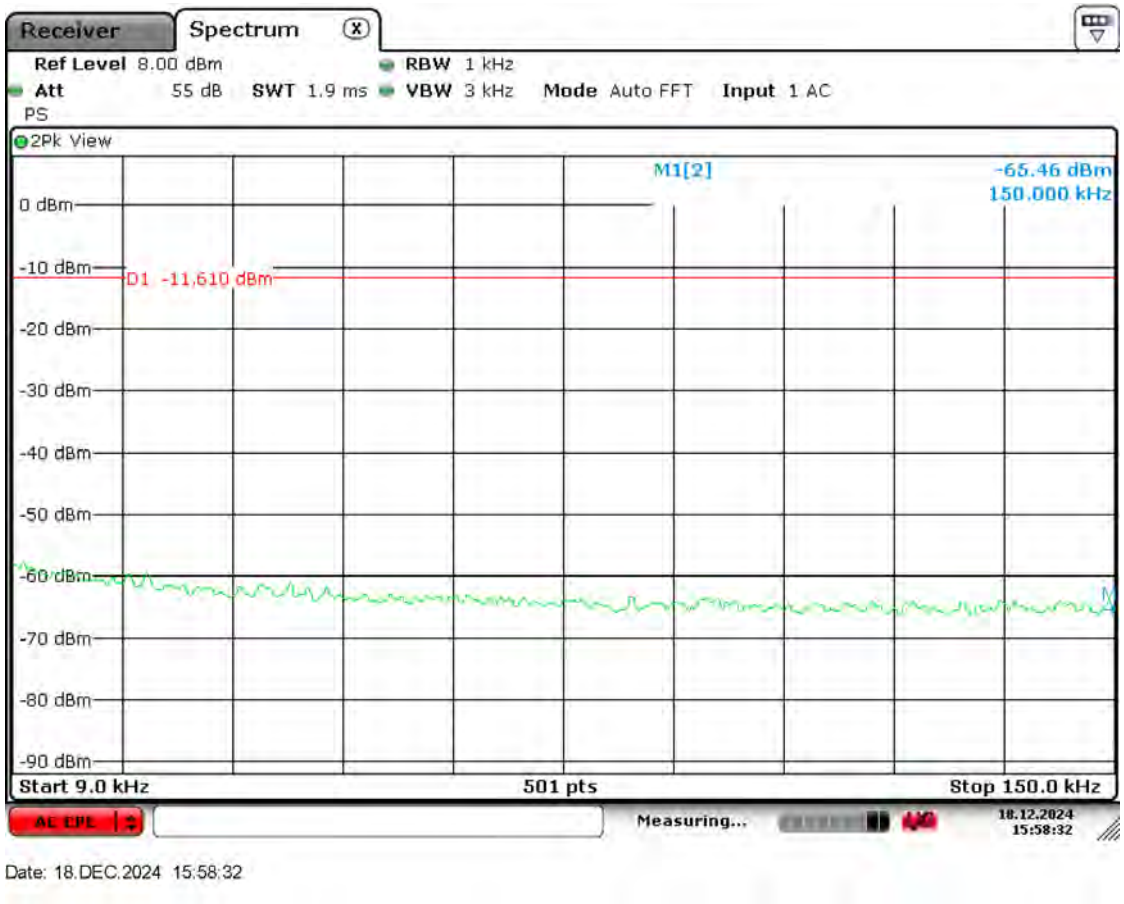
.



Date: 19.DEC.2024 09:53:10

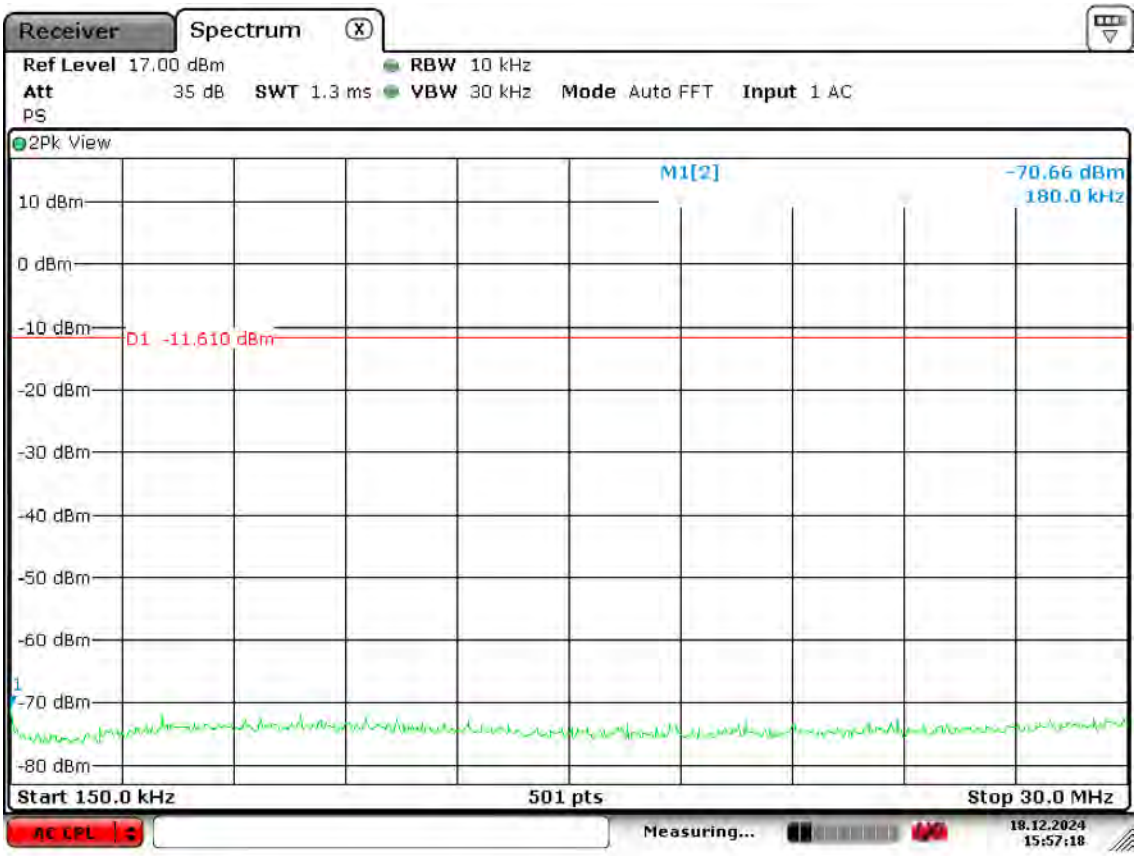
DTS, 500kHz, Mid Channel: 0.009 MHz to 0.15 MHz

.



DTS, 500kHz, Mid Channel: 0.15 MHz to 30 MHz

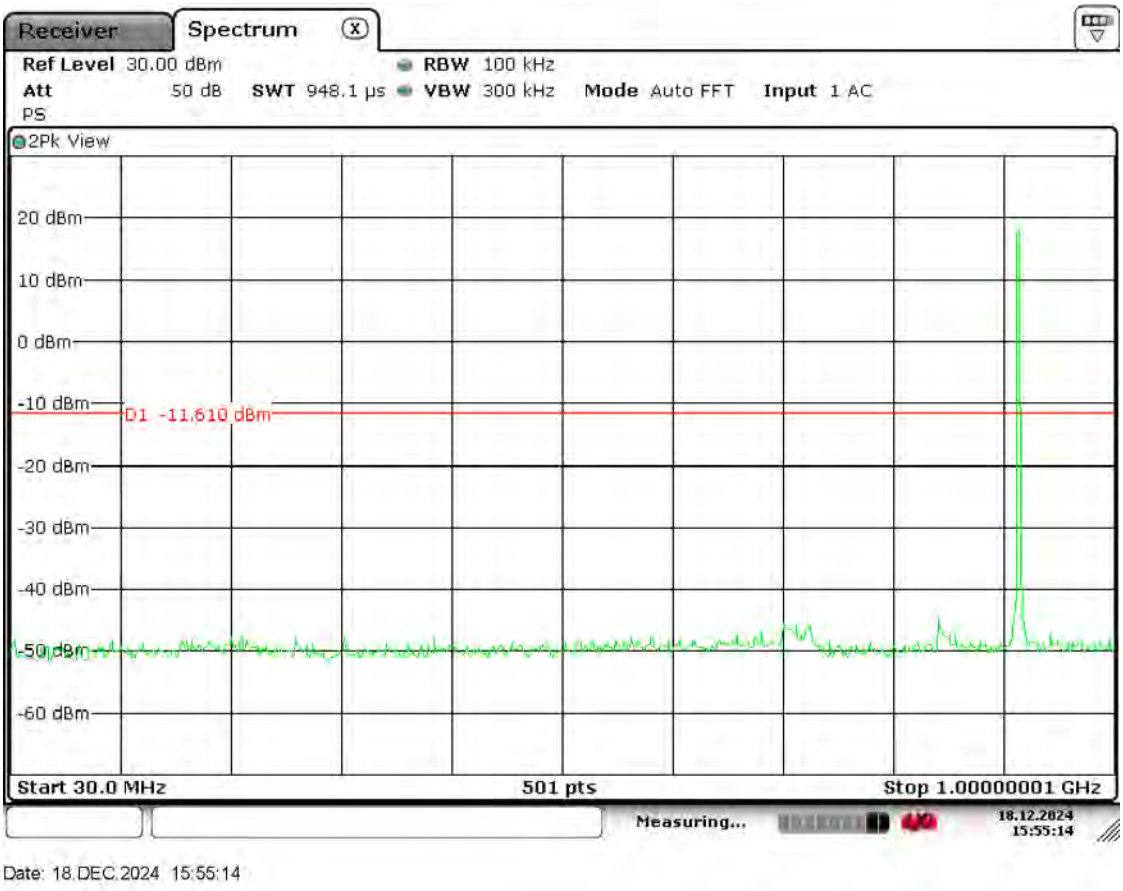
.



Date: 18.DEC.2024 15:57:18

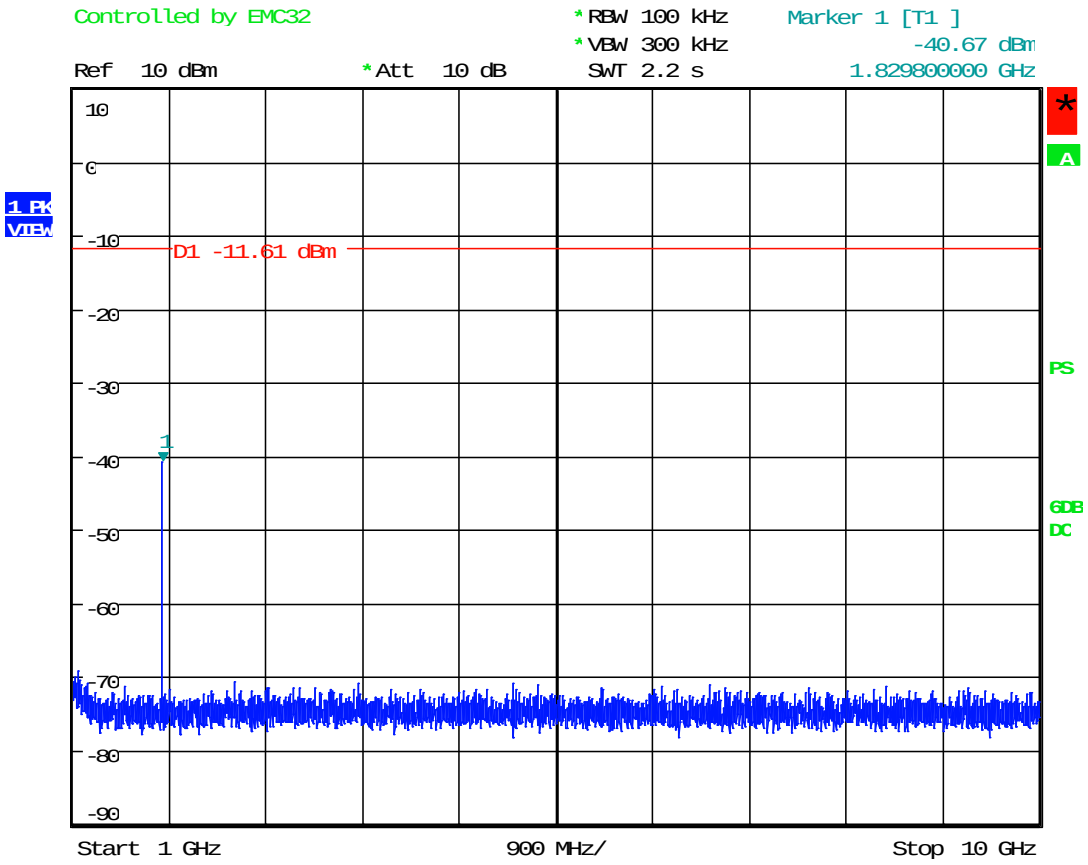
DTS, 500kHz, Mid Channel: 30 MHz to 1000 MHz

.



DTS, 500kHz, Mid Channel: 1 GHz to 10 GHz

.



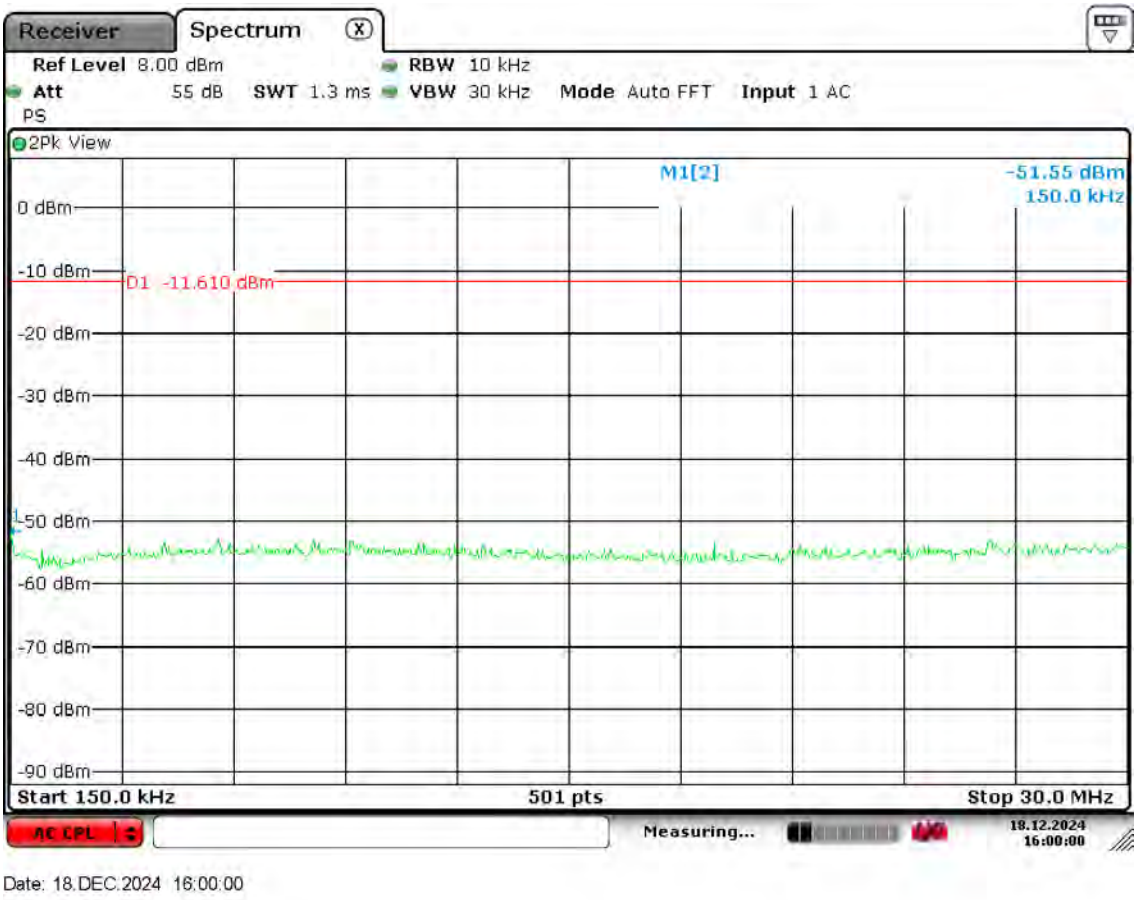
Date: 19.DEC.2024 09:53:35

DTS, 500kHz, High Channel: 0.009 MHz to 0.15 MHz

.

DTS, 500kHz, High Channel: 0.15 MHz to 30 MHz

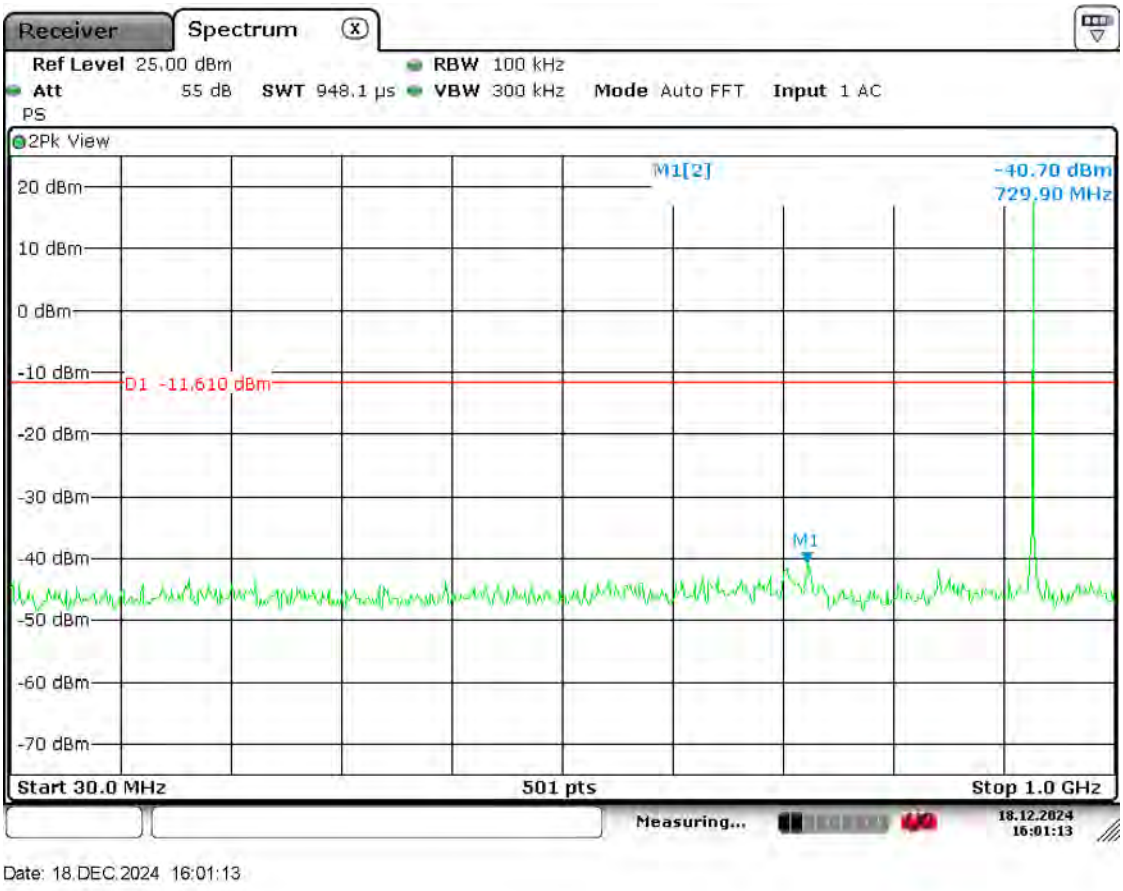
.



Date: 18.DEC.2024 16:00:00

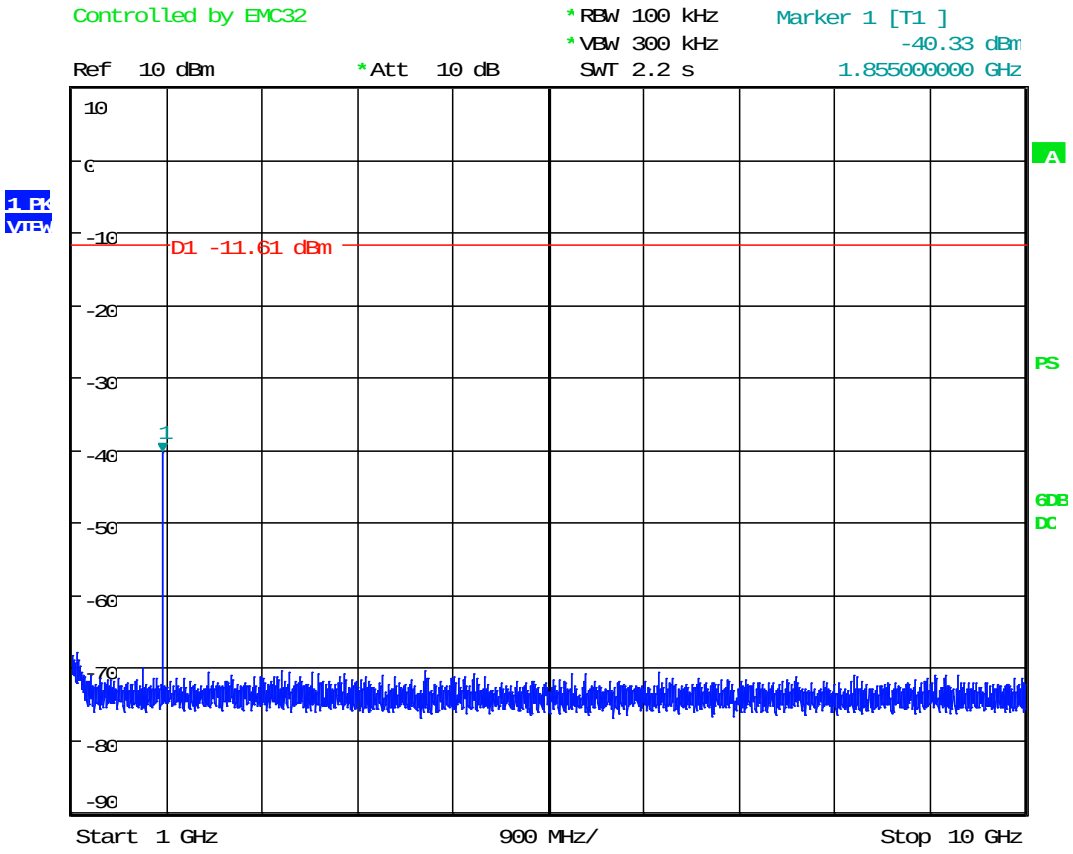
DTS, 500kHz, High Channel: 30 MHz to 1000 MHz

.



DTS, 500kHz, High Channel: 1 GHz to 10 GHz

.



Date: 19.DEC.2024 09:54:09

DTS, 500kHz: Spur Reference

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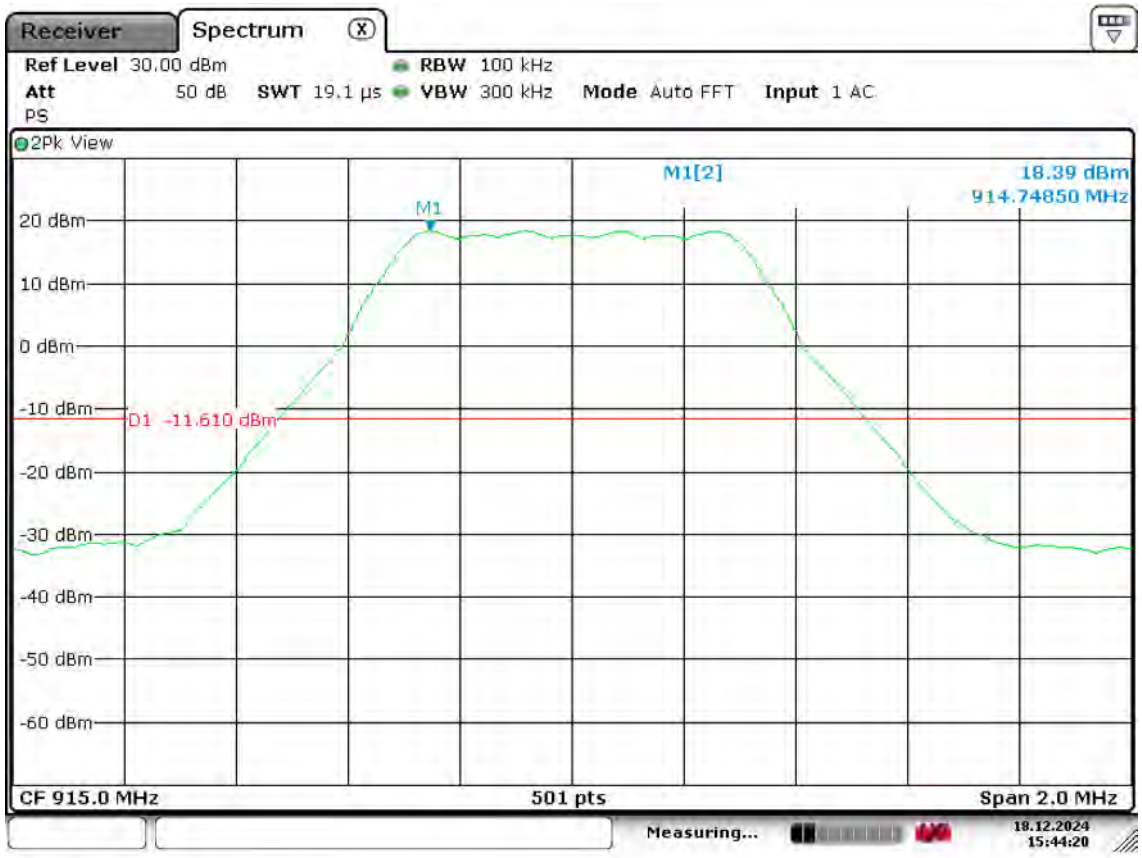
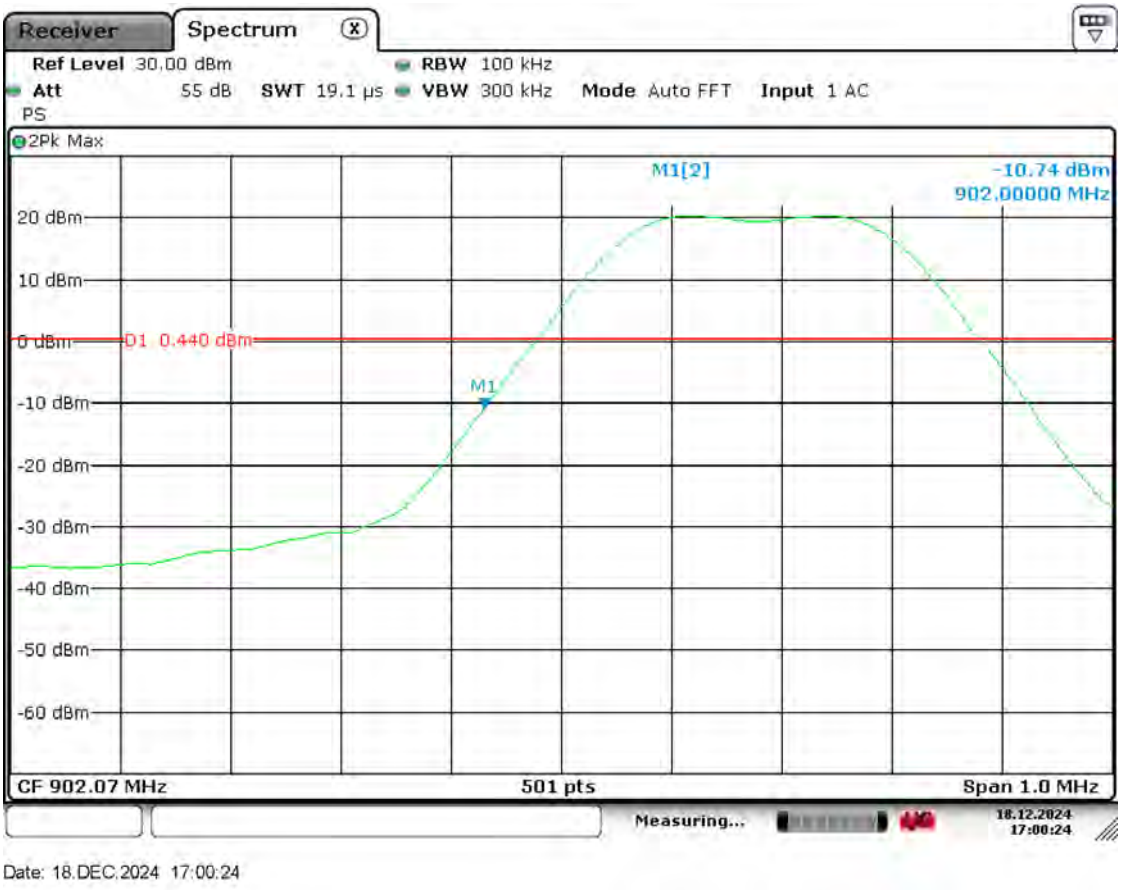


FHSS, 120kHz: Lower Band Edge

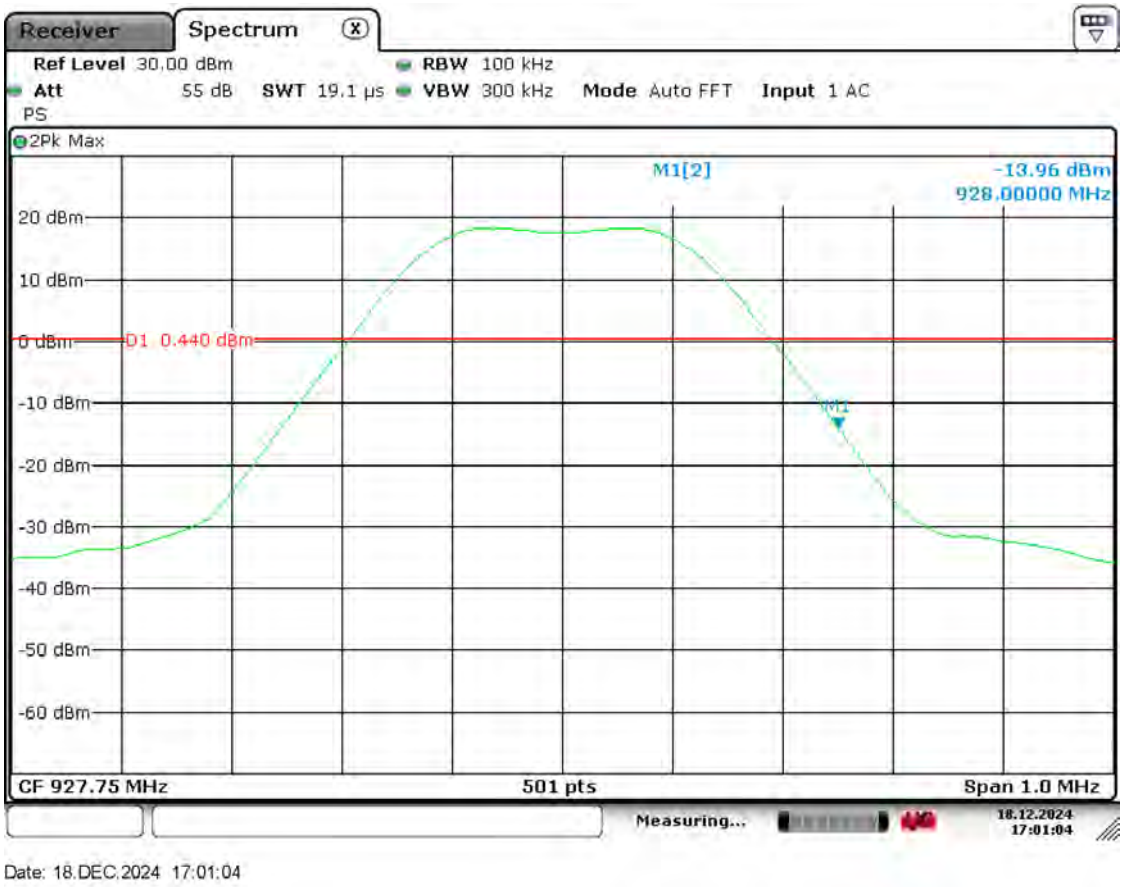
.



Date: 18.DEC.2024 17:00:24

FHSS, 120kHz: Upper Band Edge

.



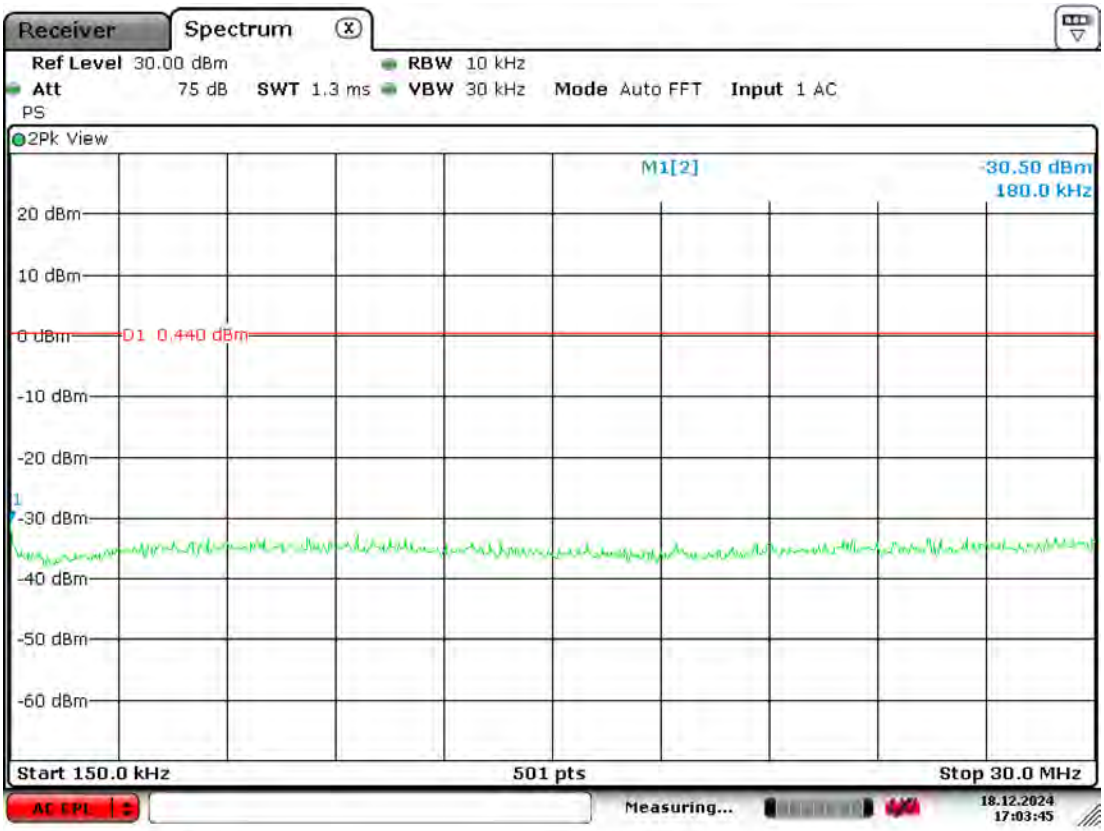
Date: 18.DEC.2024 17:01:04

FHSS, 120kHz, Low Channel: 0.009 MHz to 0.15 MHz

.

FHSS, 120kHz, Low Channel: 0.15 MHz to 30 MHz

.



Date: 18.DEC.2024 17:03:45

FHSS, 120kHz, Low Channel: 30 MHz to 1000 MHz

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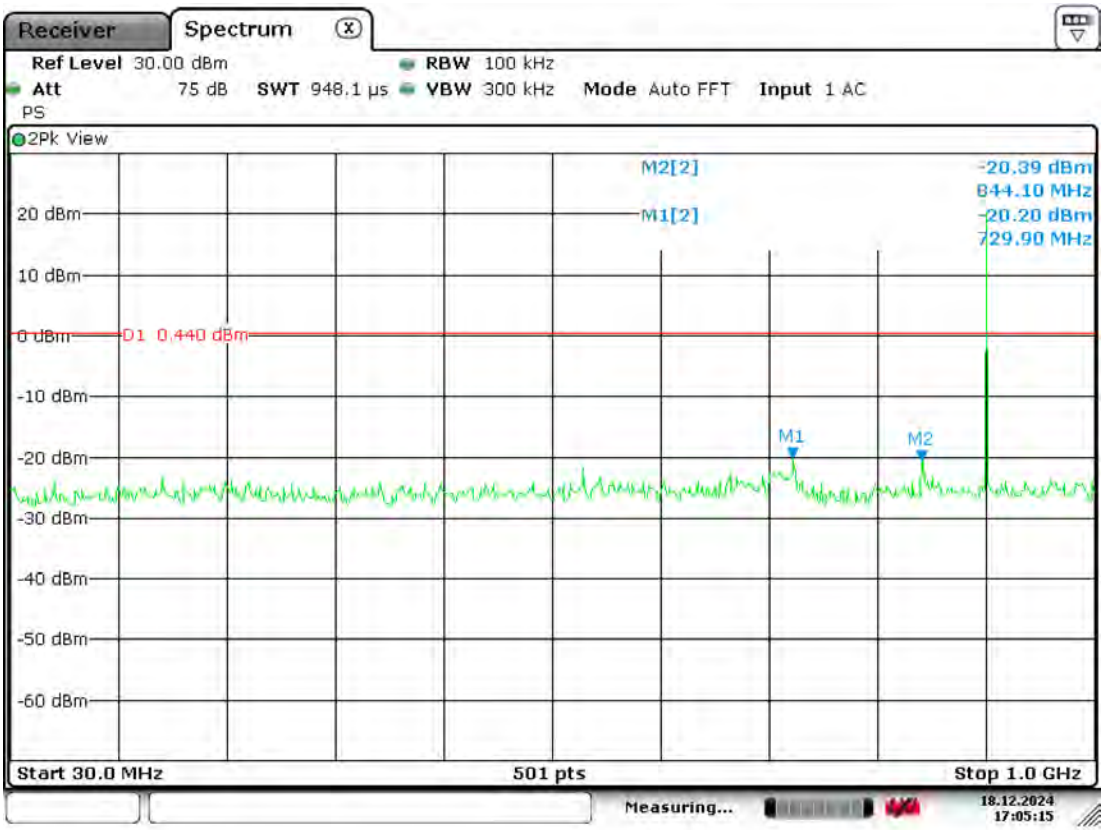

Date: 18.DEC.2024 17:05:16

FHSS, 120kHz, Low Channel: 1 GHz to 10 GHz

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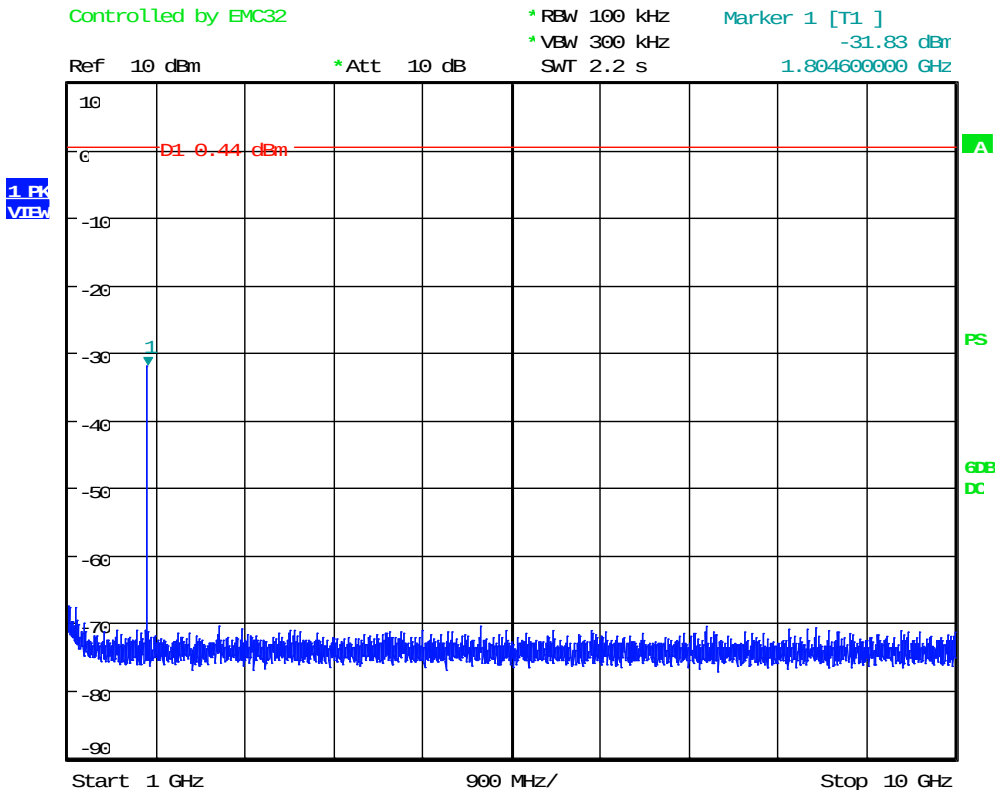

Date: 19.DEC.2024 09:55:49

FHSS, 120kHz, Mid Channel: 0.009 MHz to 0.15 MHz

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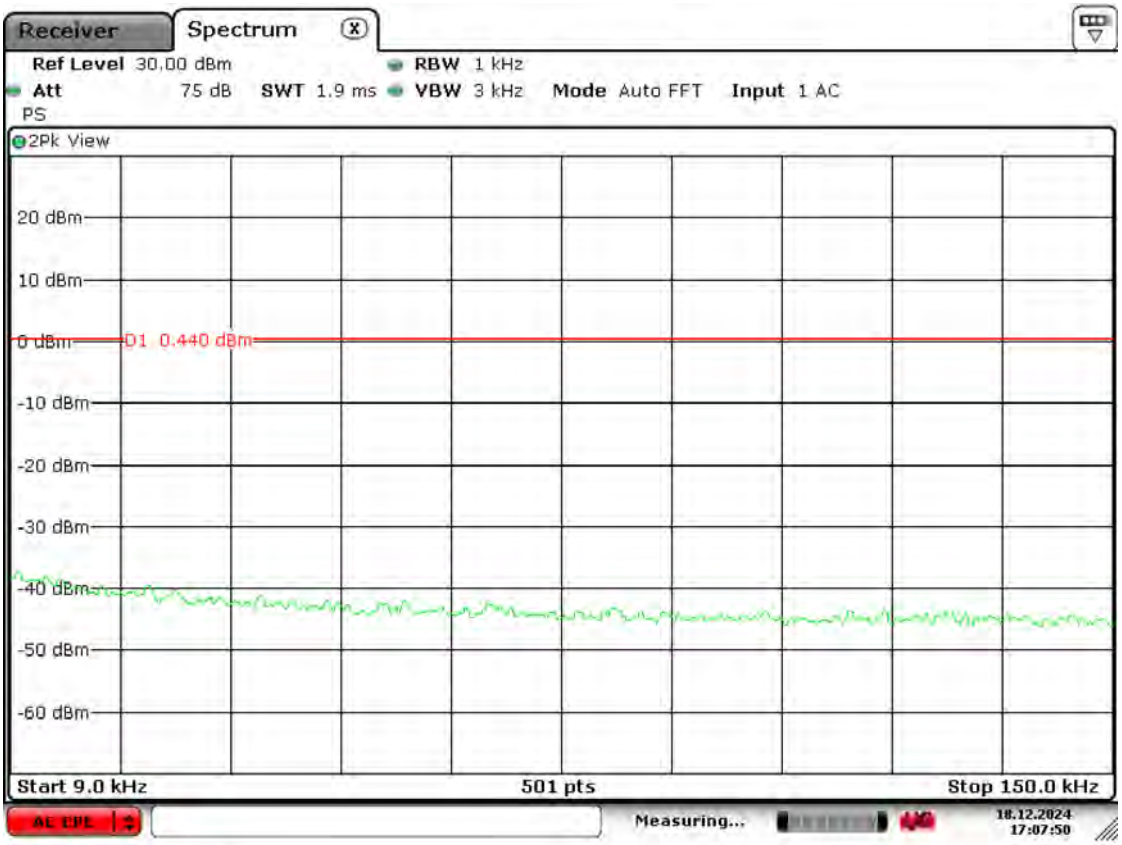
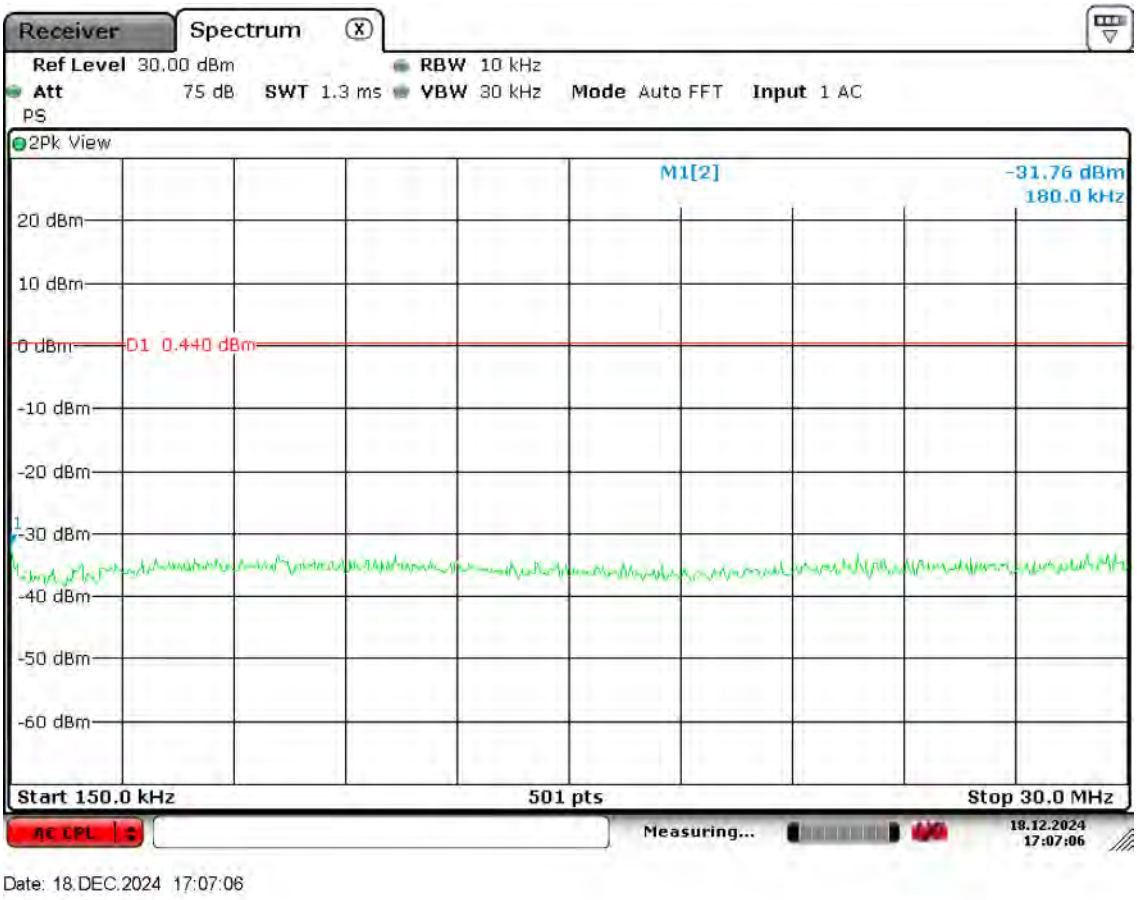


Date: 18.DEC.2024 17:07:49

FHSS, 120kHz, Mid Channel: 0.15 MHz to 30 MHz

.



Date: 18.DEC.2024 17:07:06

FHSS, 120kHz, Mid Channel: 30 MHz to 1000 MHz

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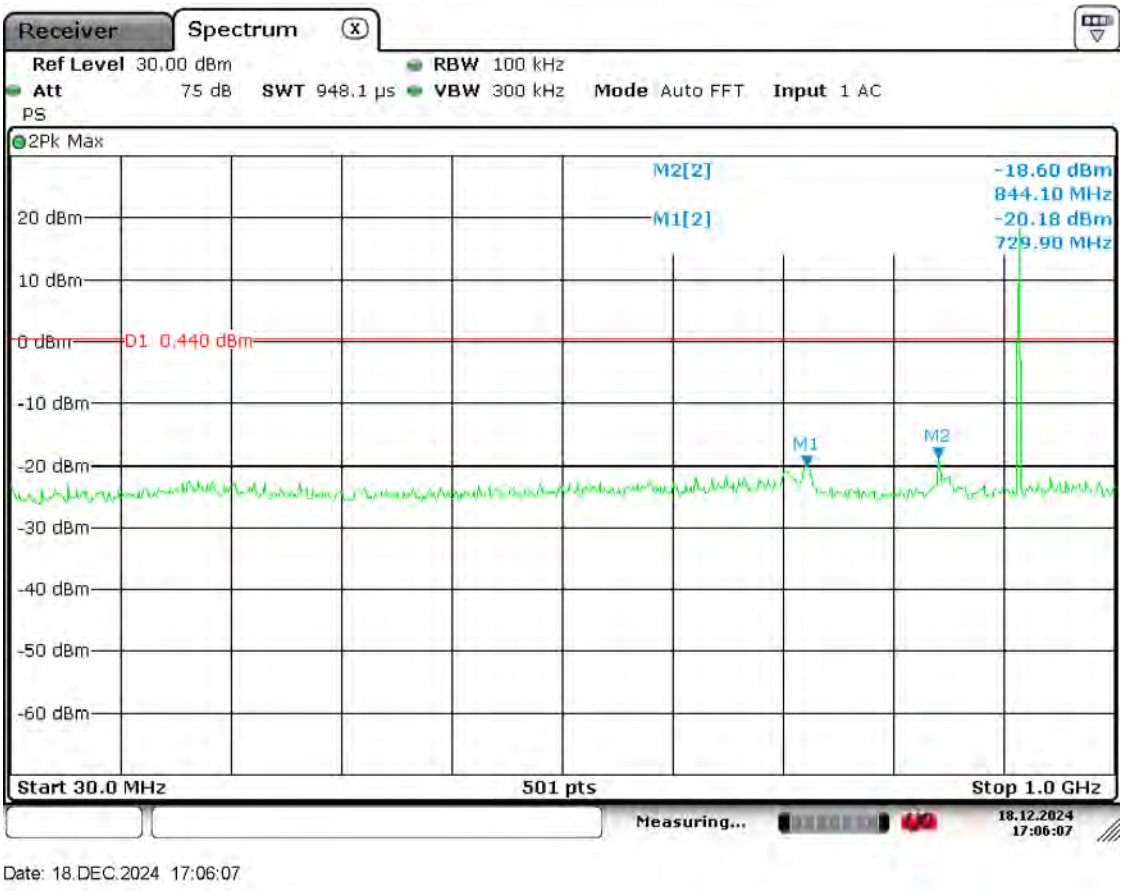

Date: 18.DEC.2024 17:06:07

FHSS, 120kHz, Mid Channel: 1 GHz to 10 GHz

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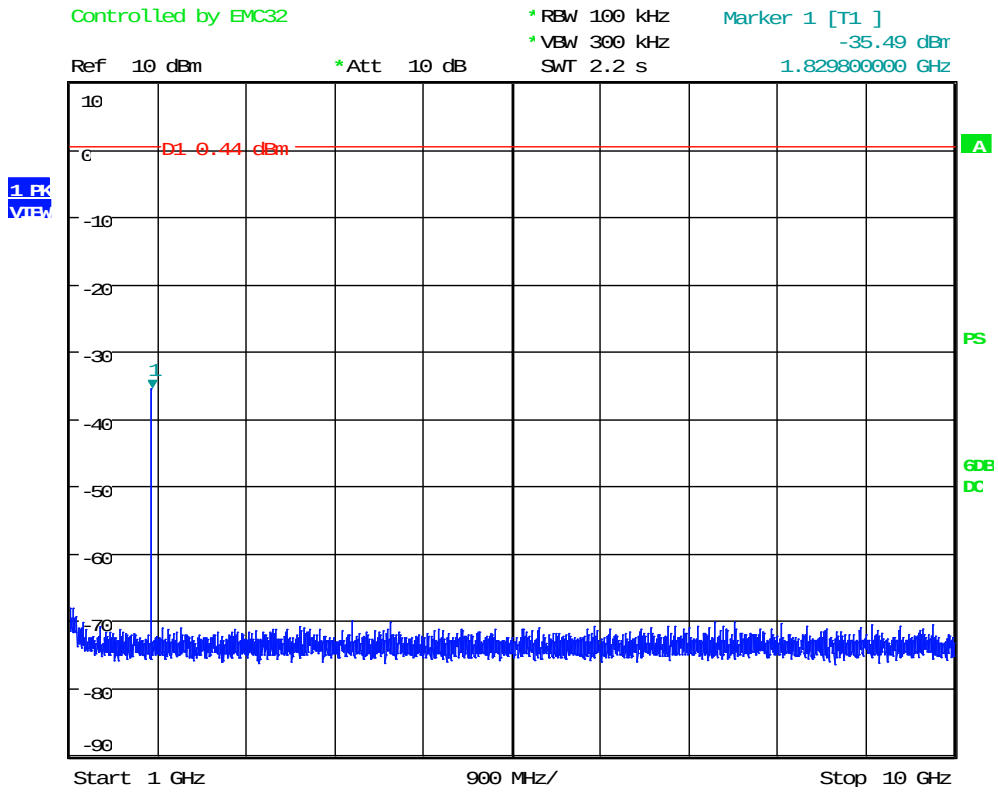

Date: 19.DEC.2024 09:56:18

FHSS, 120kHz, High Channel: 0.009 MHz to 0.15 MHz

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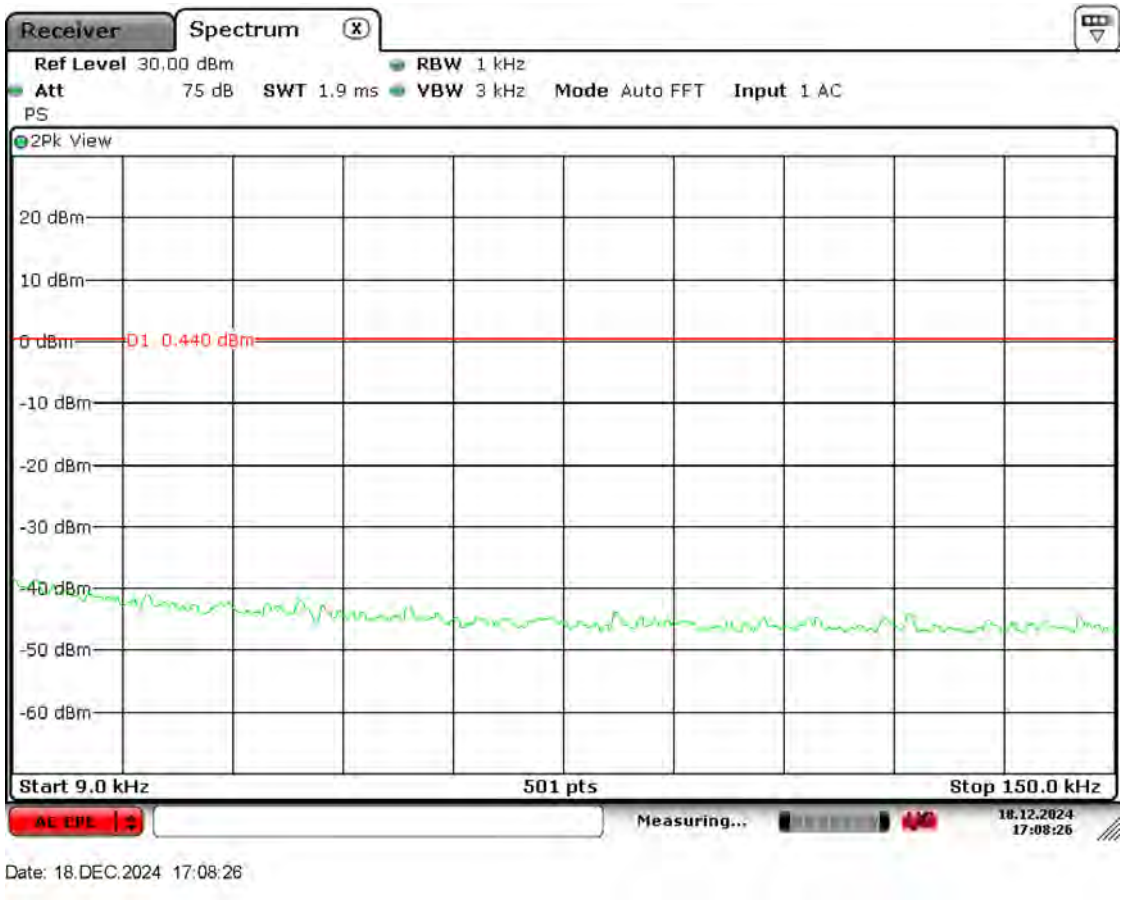

FHSS, 120kHz, High Channel: 0.15 MHz to 30 MHz

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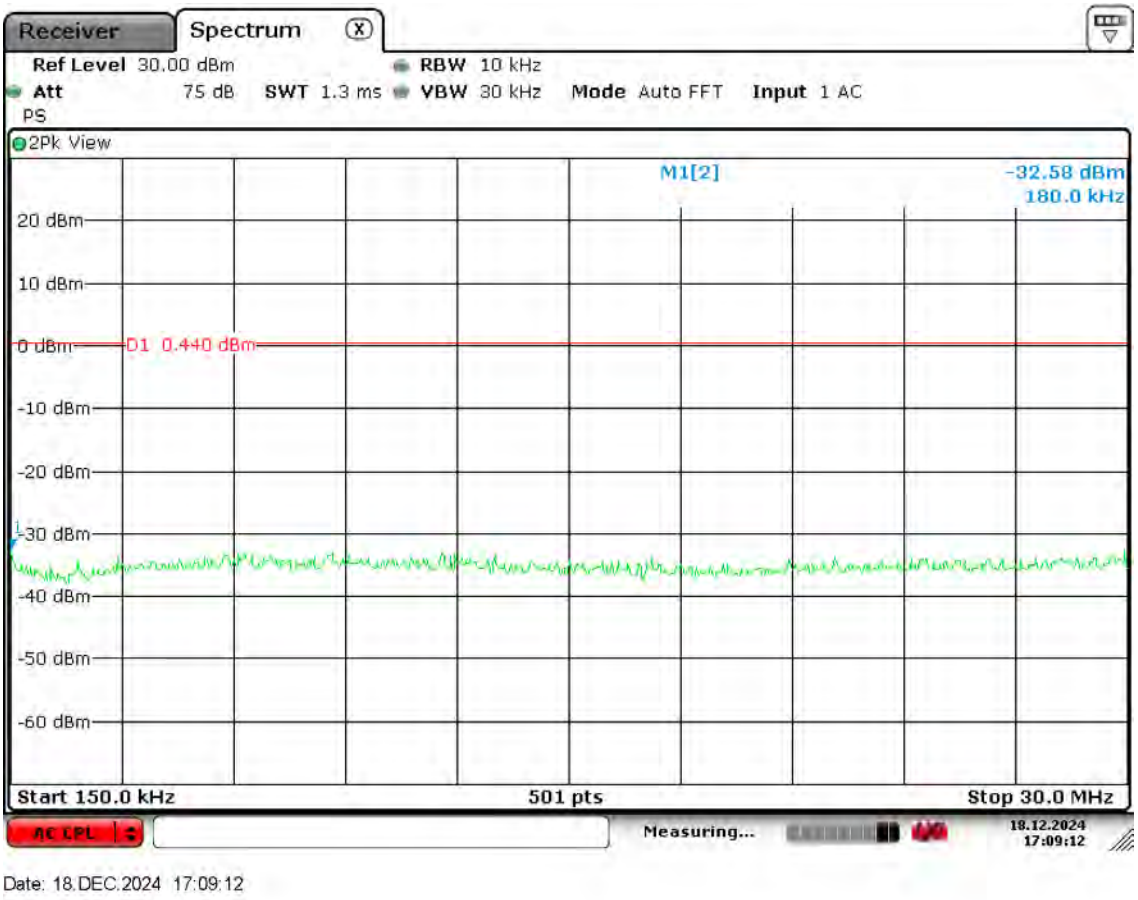

Date: 18.DEC.2024 17:09:12

FHSS, 120kHz, High Channel: 30 MHz to 1000 MHz

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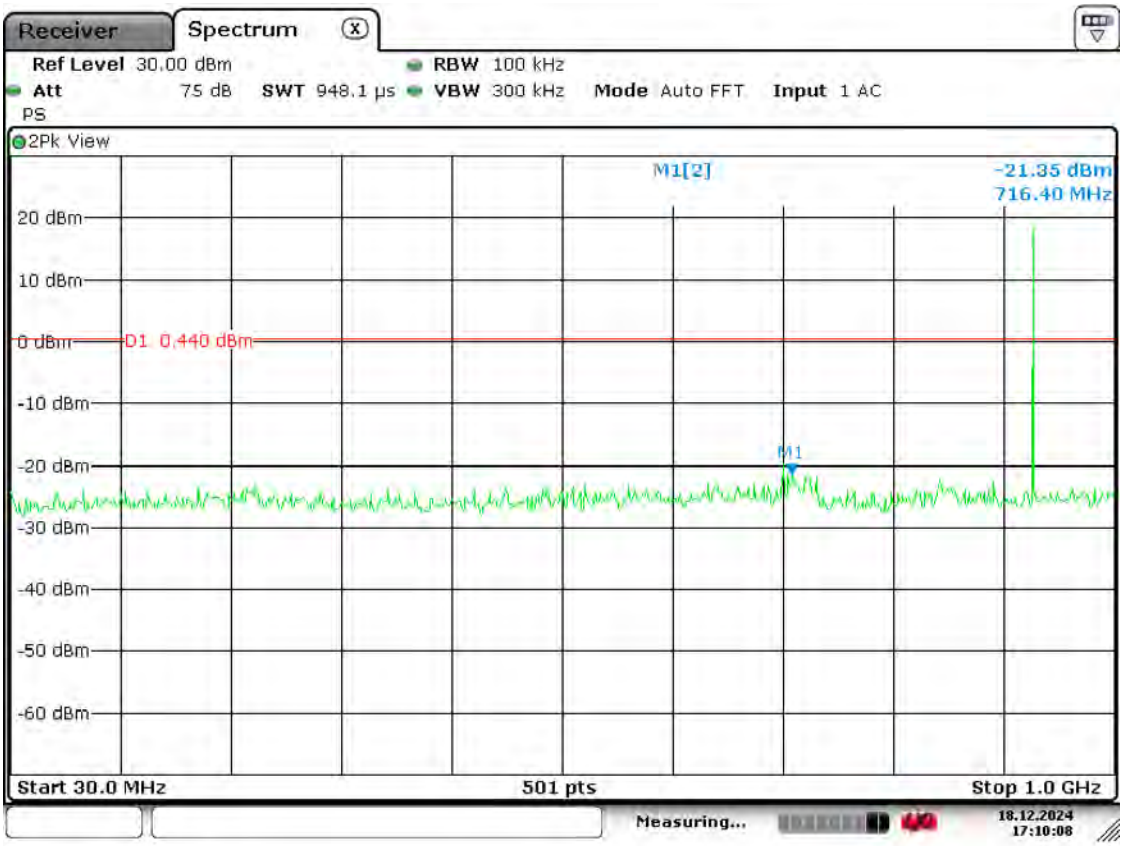

Date: 18.DEC.2024 17:10:08

FHSS, 120kHz, High Channel: 1 GHz to 10 GHz

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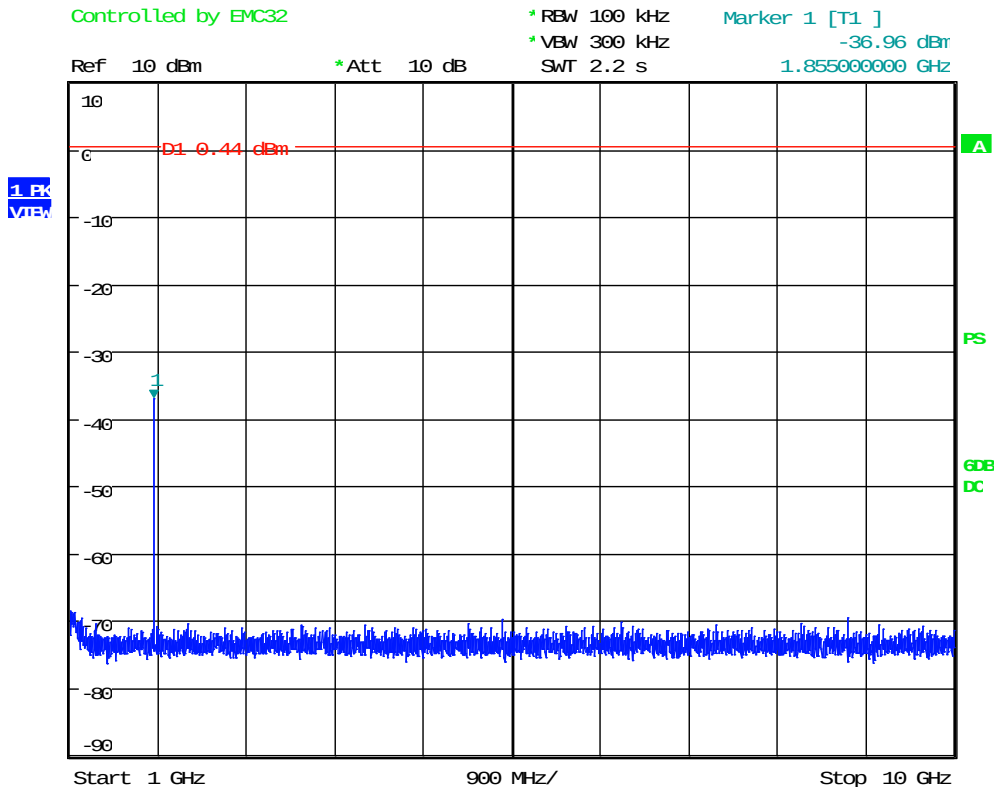

Date: 19.DEC.2024 09:56:42

FHSS, 120kHz: Spur Reference

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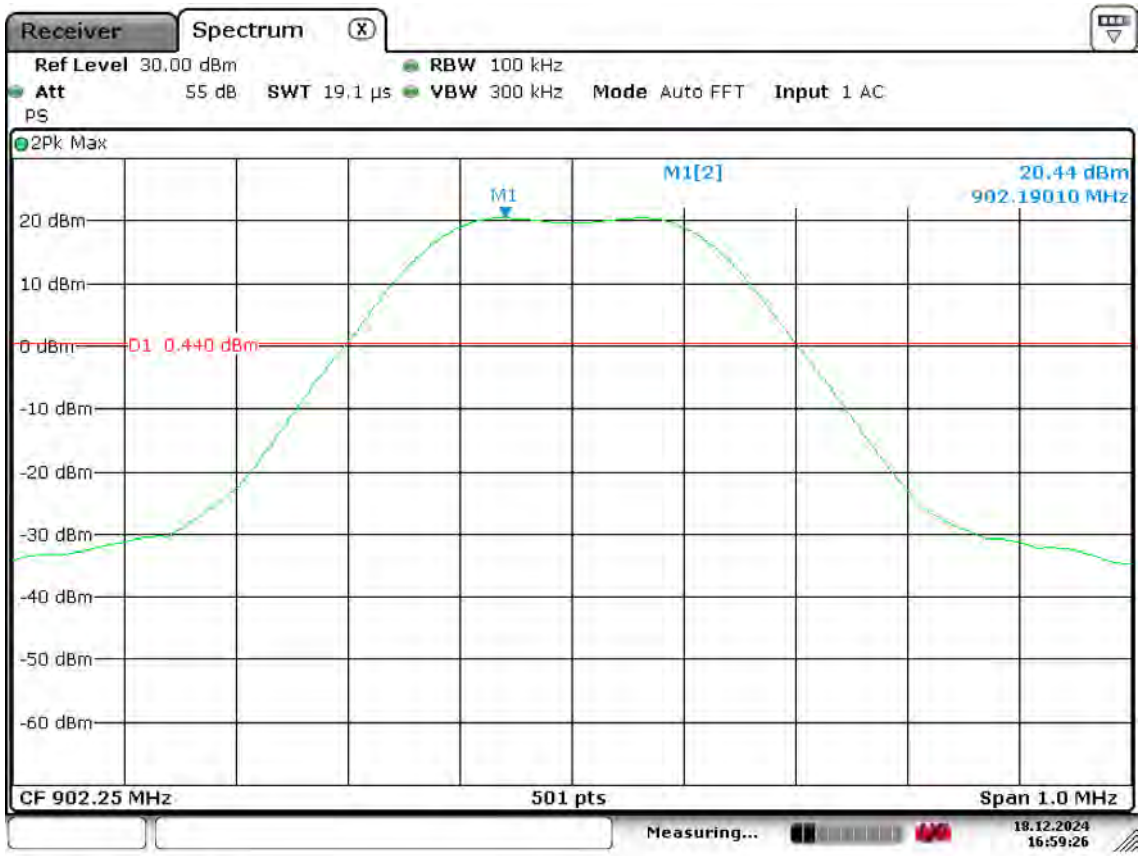
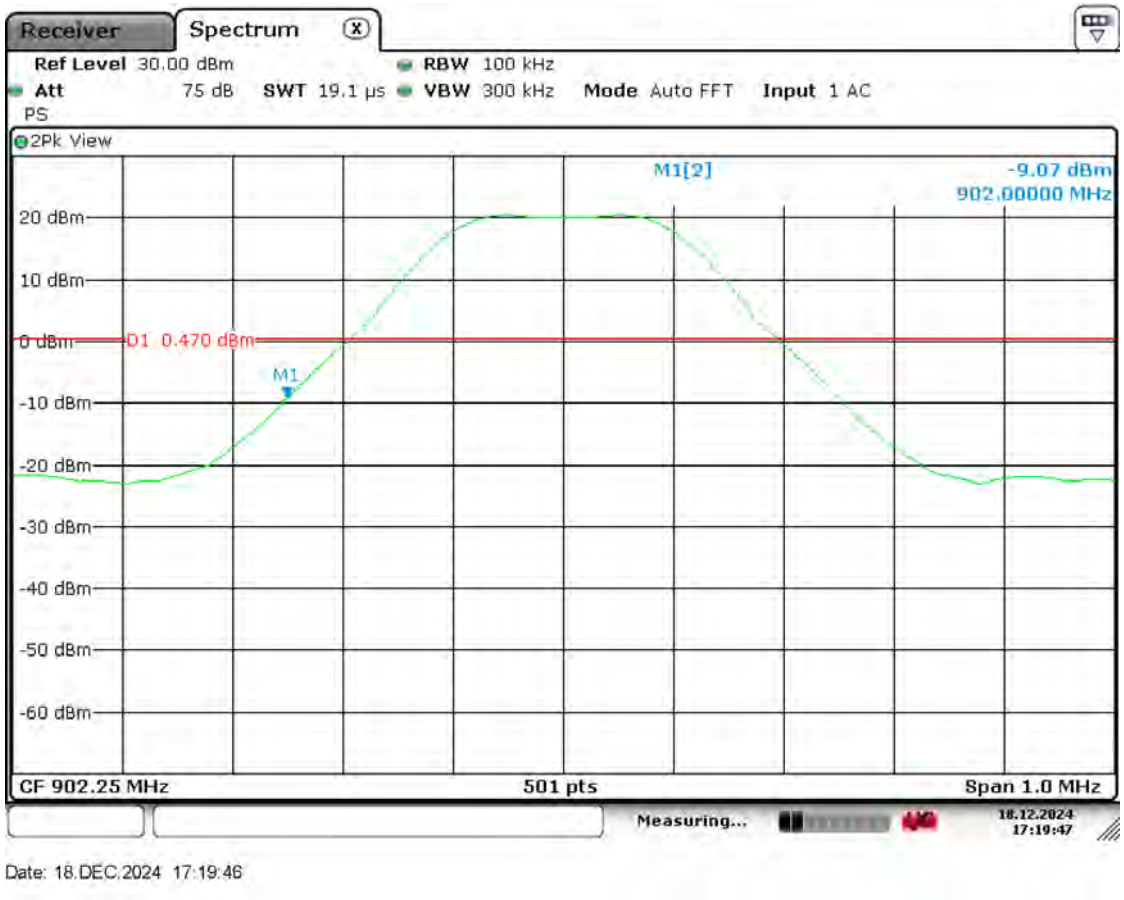


FHSS, 200kHz: Lower Band Edge

.



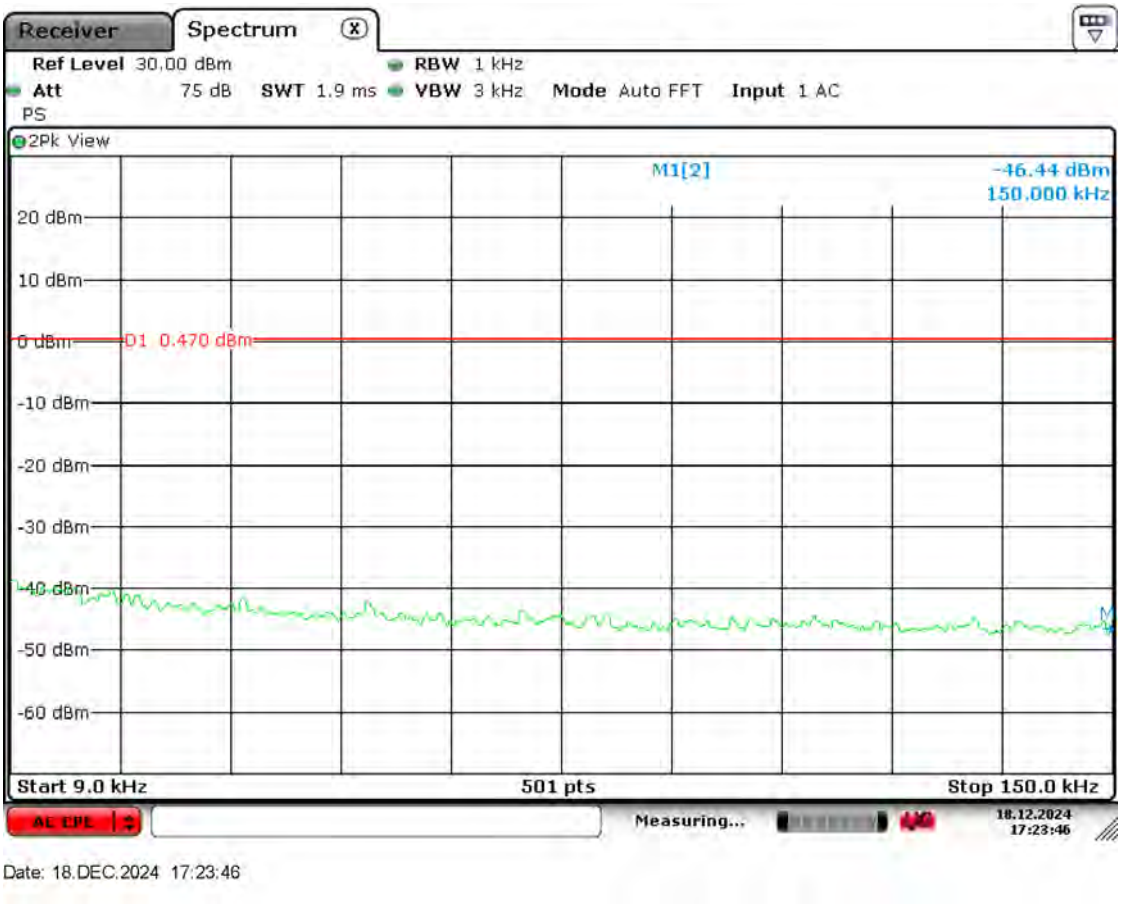
FHSS, 200kHz: Upper Band Edge

.

Date: 18.DEC.2024 17:20:49

FHSS, 200kHz, Low Channel: 0.009 MHz to 0.15 MHz

.



FHSS, 200kHz, Low Channel: 0.15 MHz to 30 MHz

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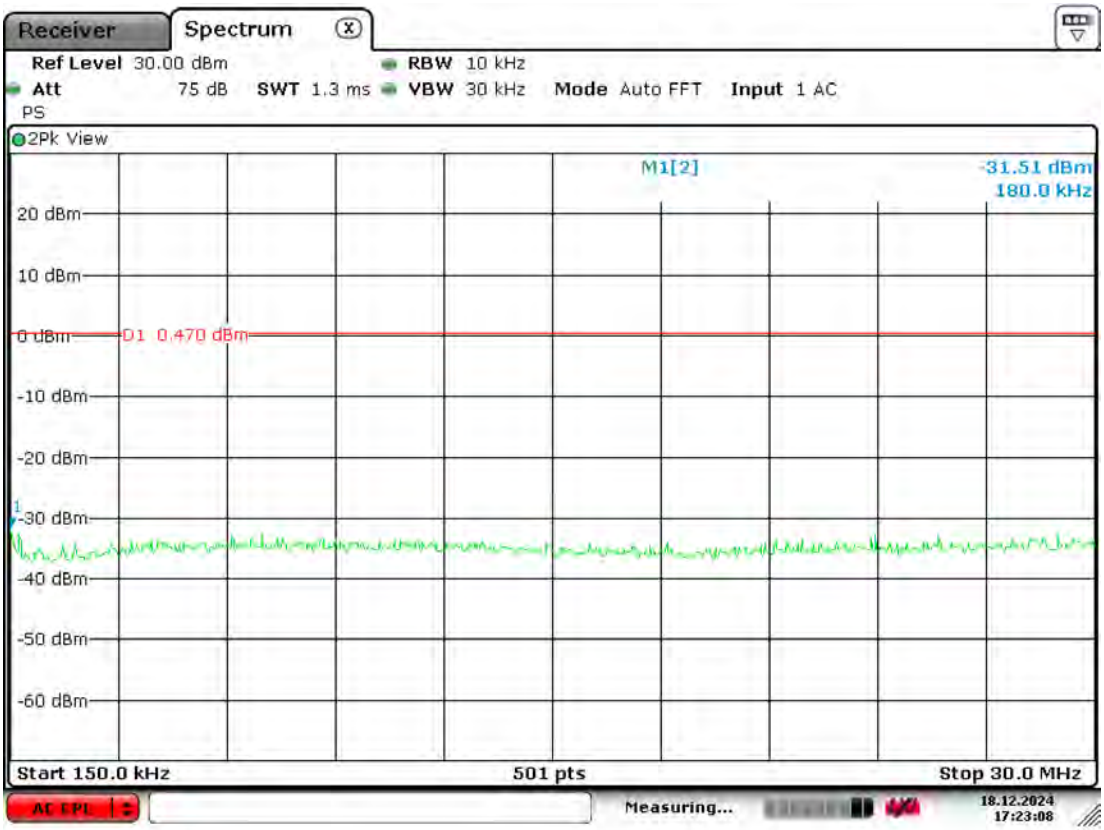

Date: 18.DEC.2024 17:23:08

FHSS, 200kHz, Low Channel: 30 MHz to 1000 MHz

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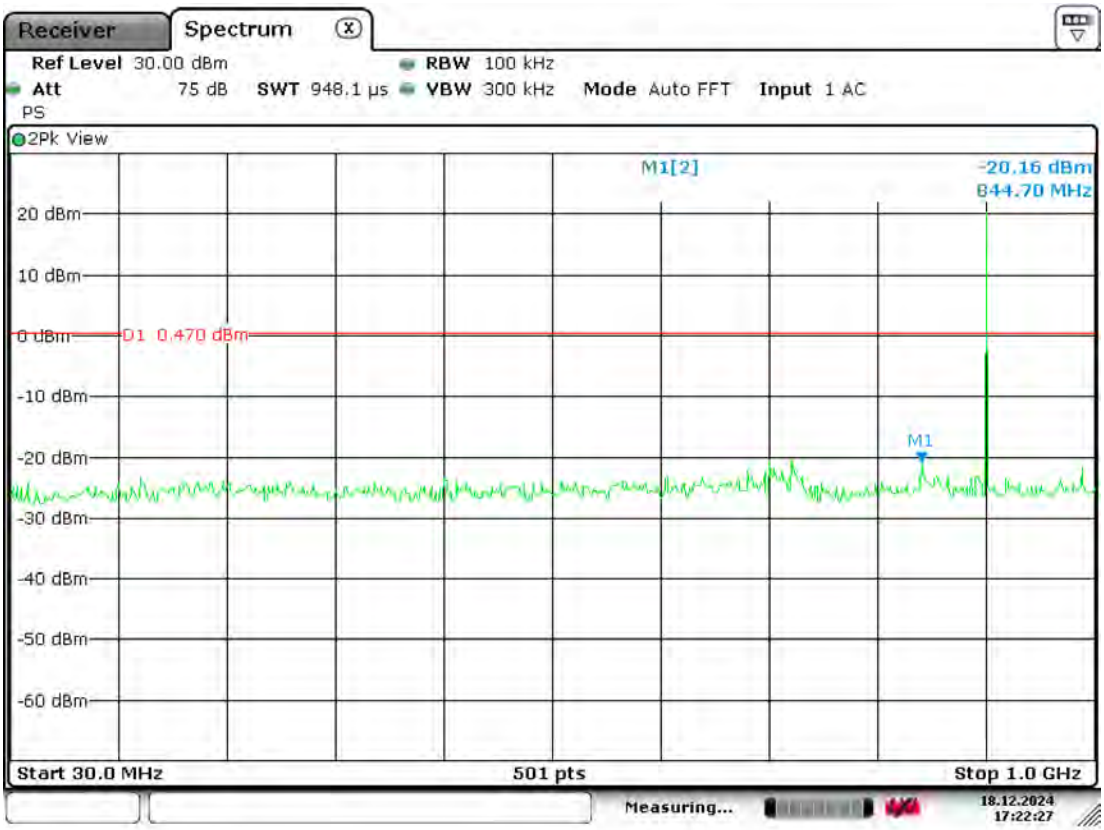

Date: 18.DEC.2024 17:22:26

FHSS, 200kHz, Low Channel: 1 GHz to 10 GHz

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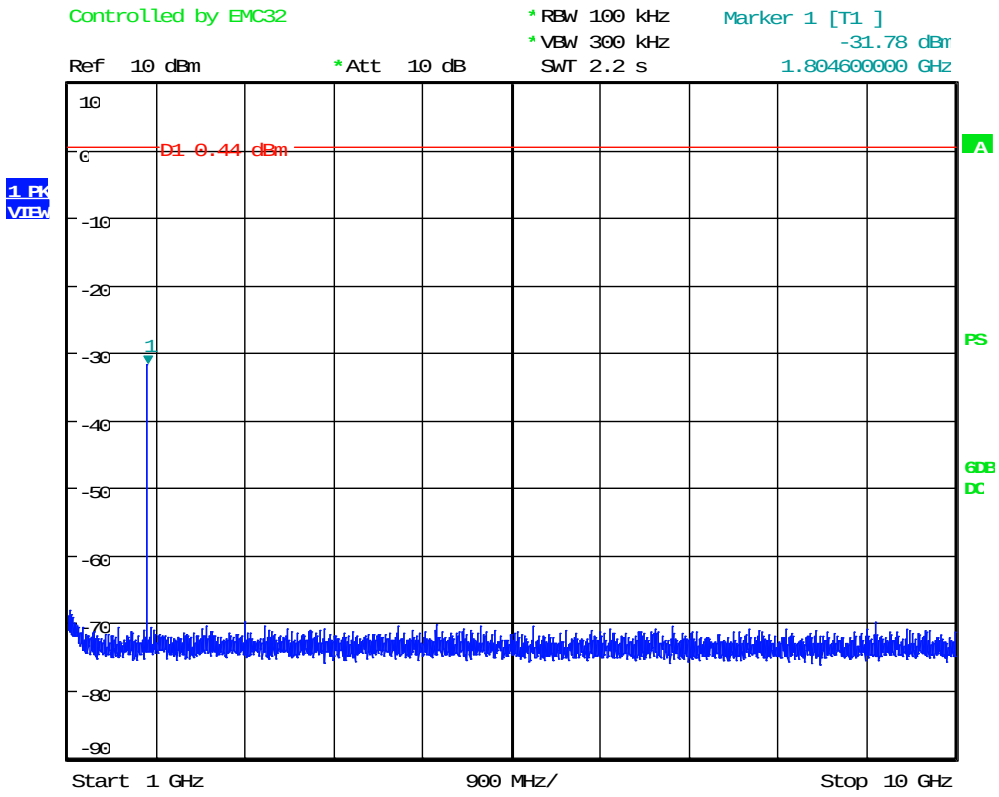

Date: 19.DEC.2024 09:57:48

FHSS, 200kHz, Mid Channel: 0.009 MHz to 0.15 MHz

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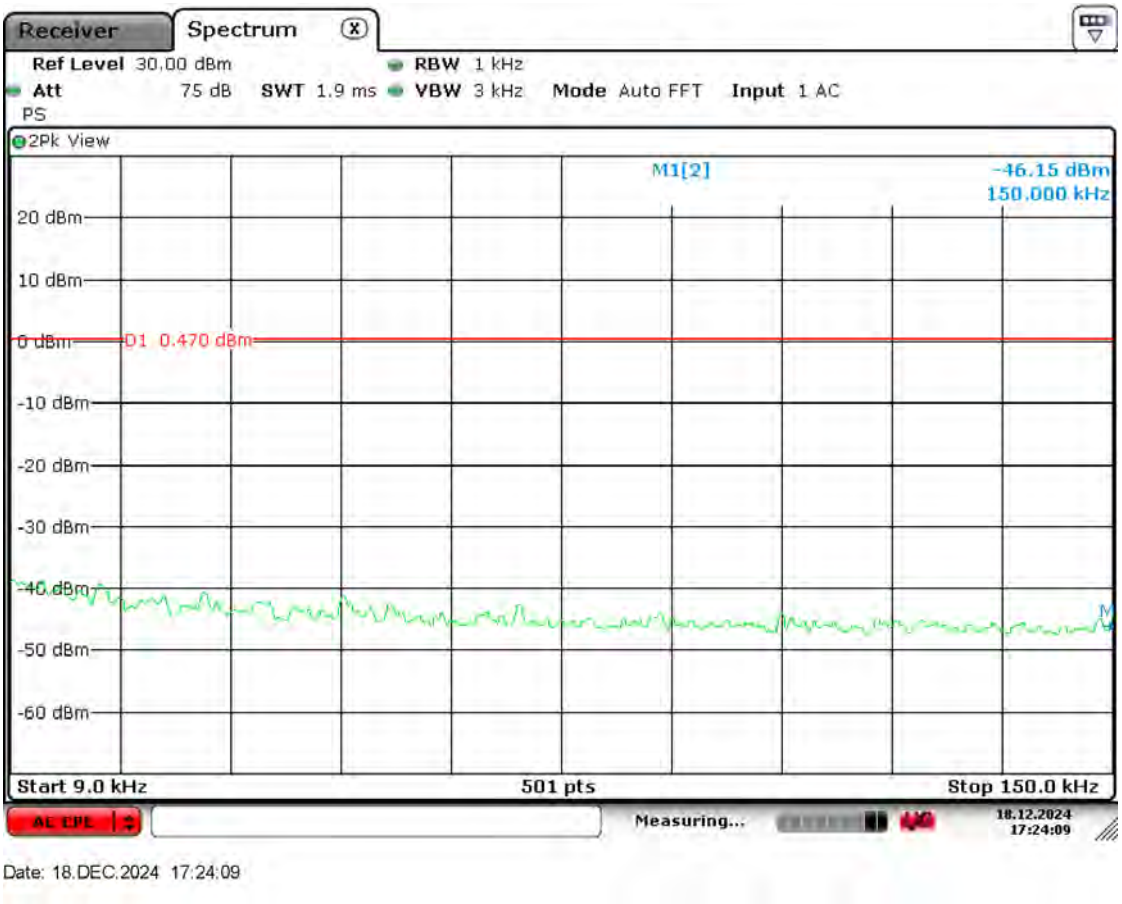

FHSS, 200kHz, Mid Channel: 0.15 MHz to 30 MHz

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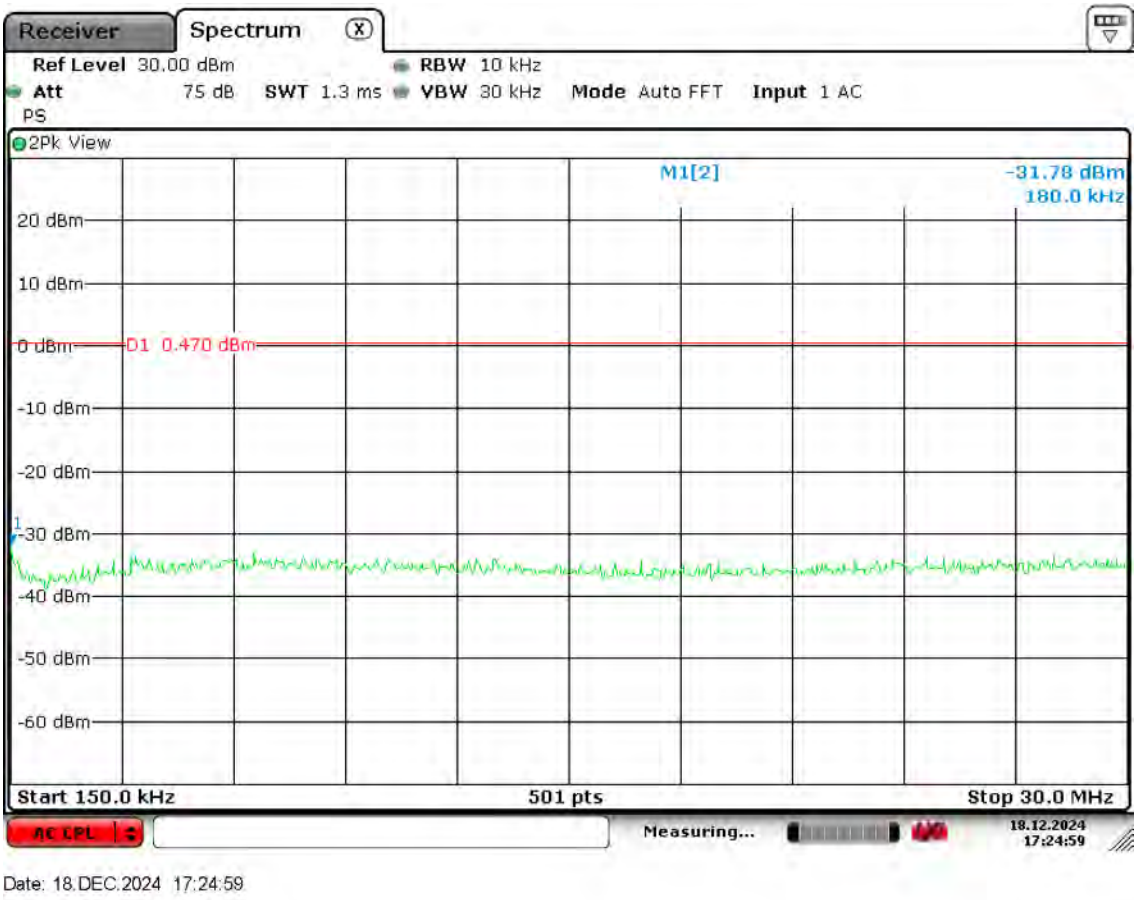

Date: 18.DEC.2024 17:24:59

FHSS, 200kHz, Mid Channel: 30 MHz to 1000 MHz

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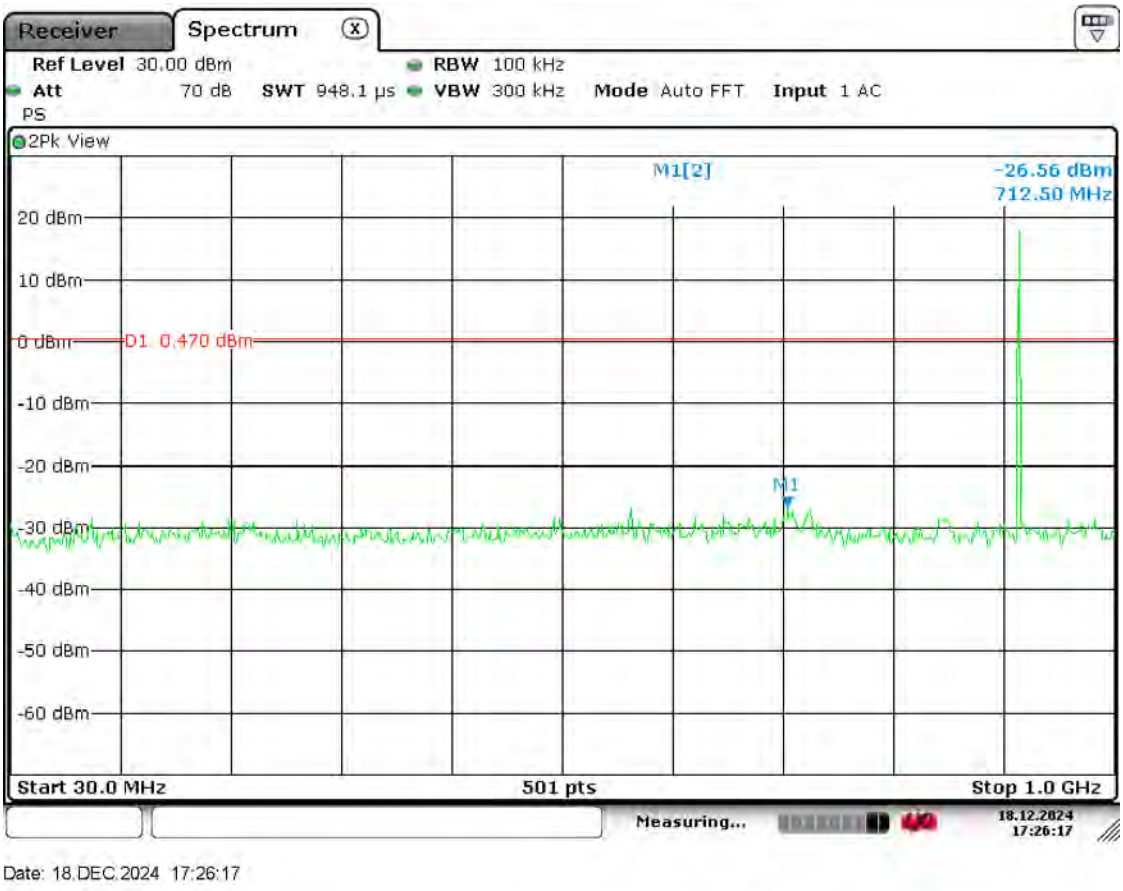

Date: 18.DEC.2024 17:26:17

FHSS, 200kHz, Mid Channel: 1 GHz to 10 GHz

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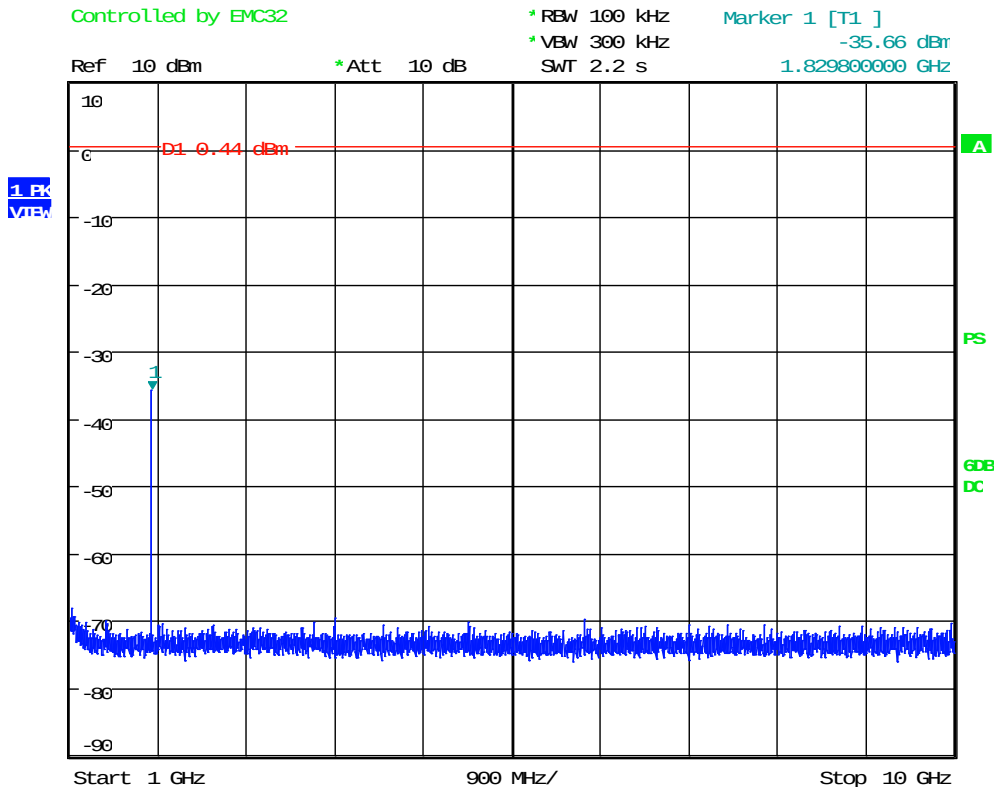
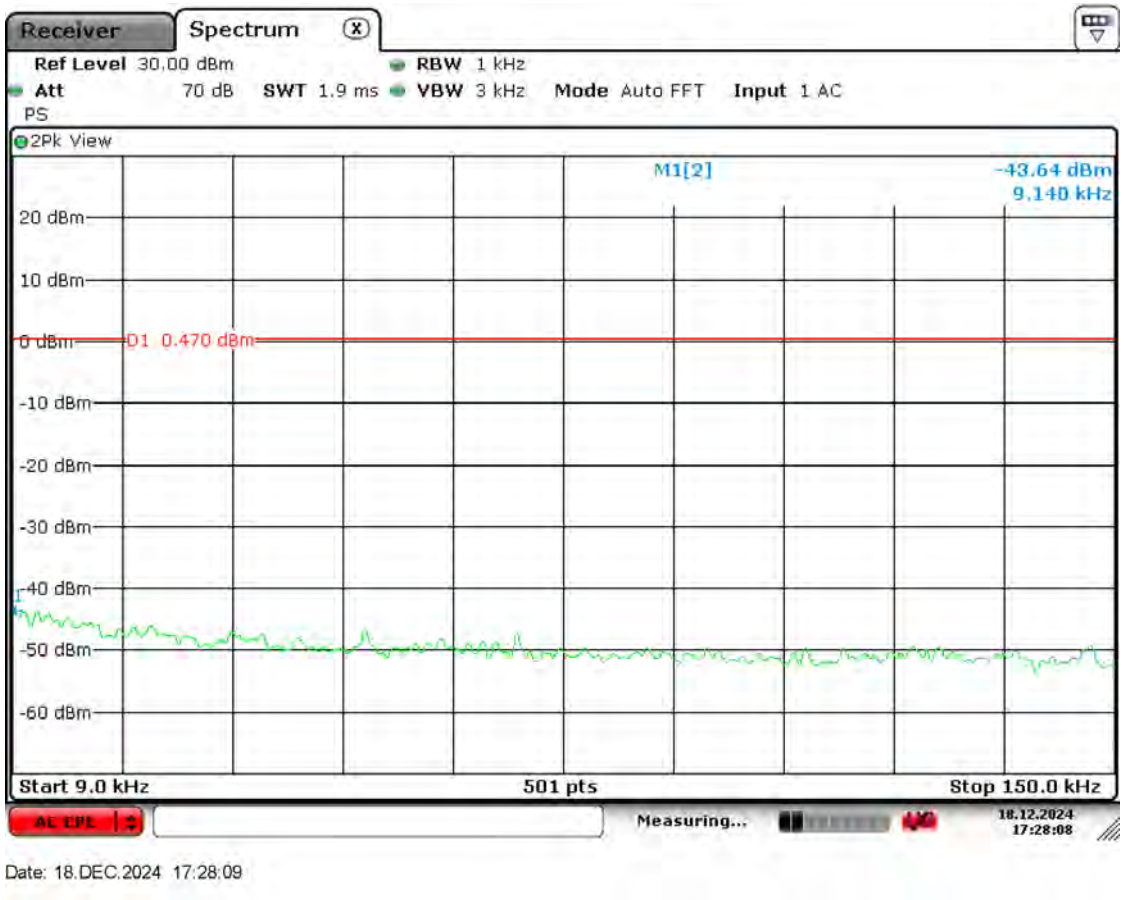


Date: 19.DEC.2024 09:58:14

FHSS, 200kHz, High Channel: 0.009 MHz to 0.15 MHz

.



FHSS, 200kHz, High Channel: 0.15 MHz to 30 MHz

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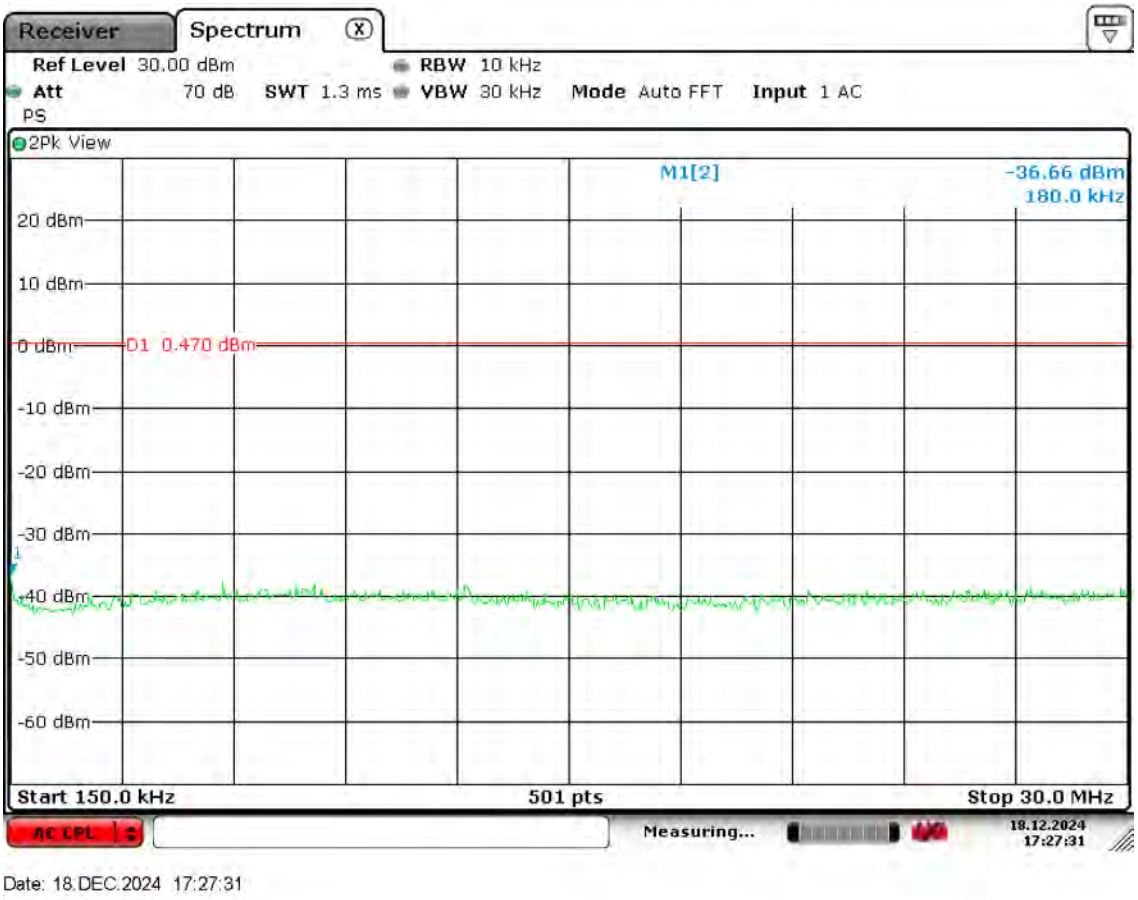

Date: 18.DEC.2024 17:27:31

FHSS, 200kHz, High Channel: 30 MHz to 1000 MHz

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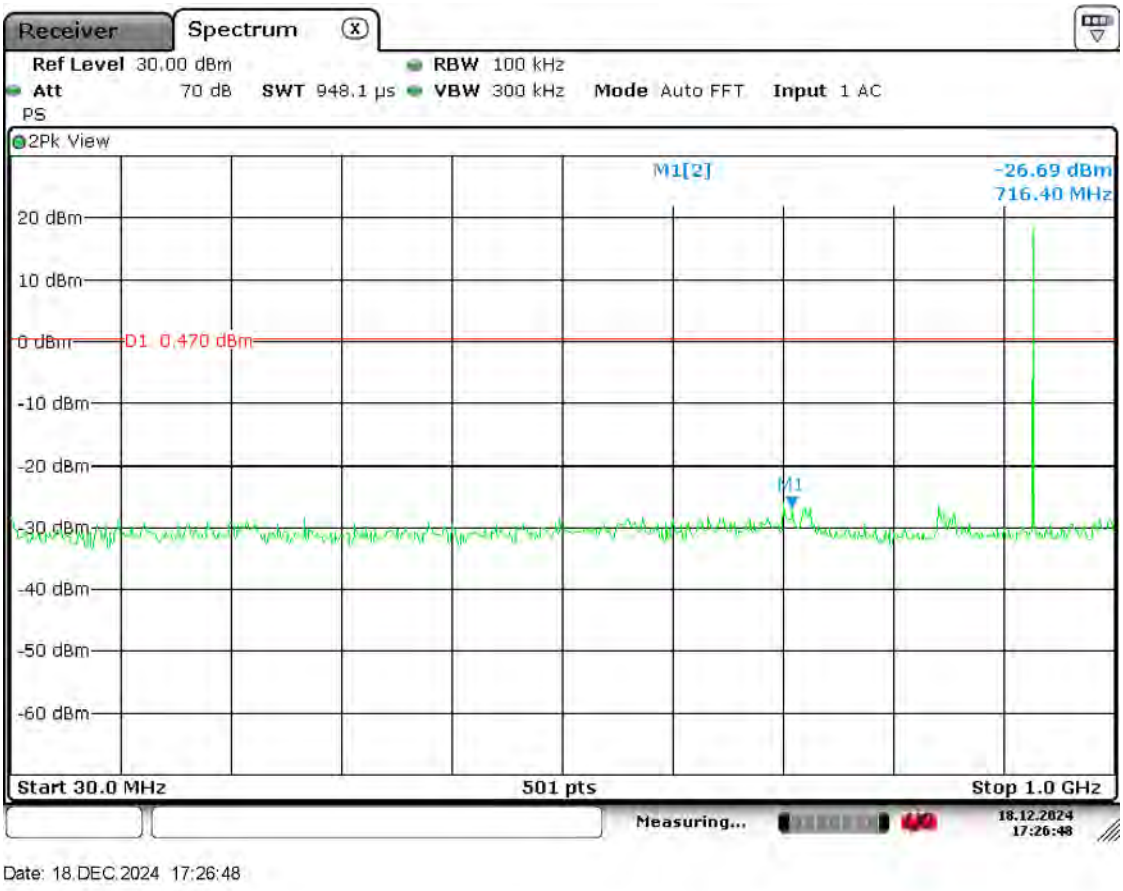
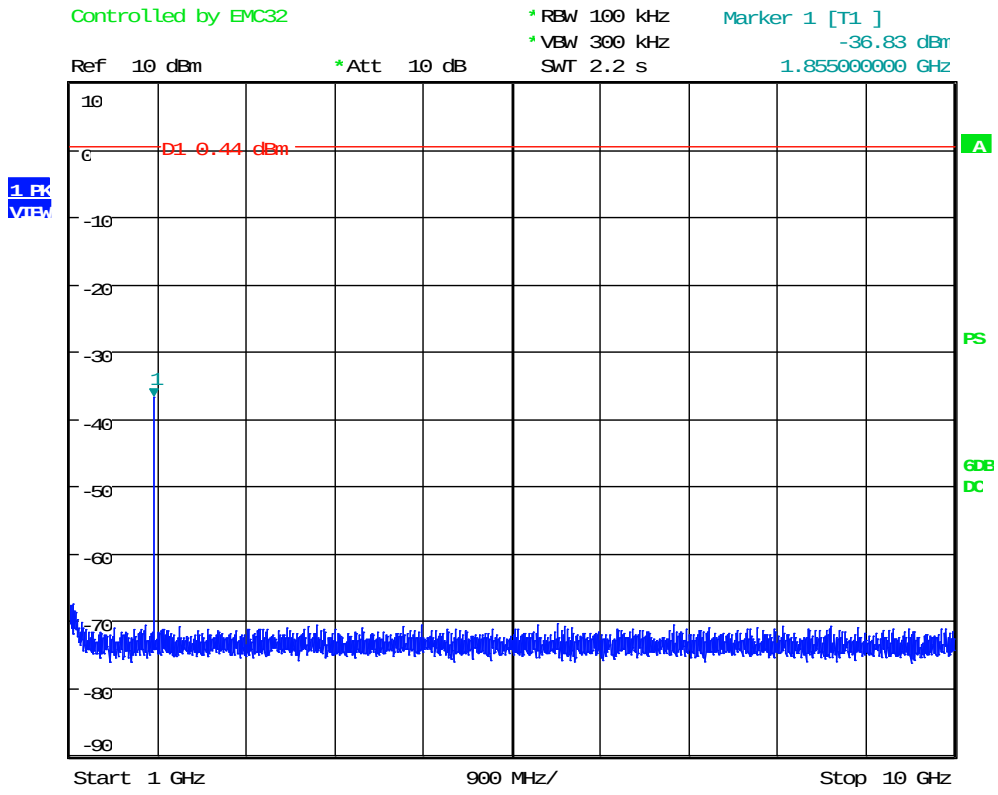


Date: 18.DEC.2024 17:26:48

FHSS, 200kHz, High Channel: 1 GHz to 10 GHz

.



Date: 19.DEC.2024 09:58:43

FHSS, 200kHz: Spur Reference

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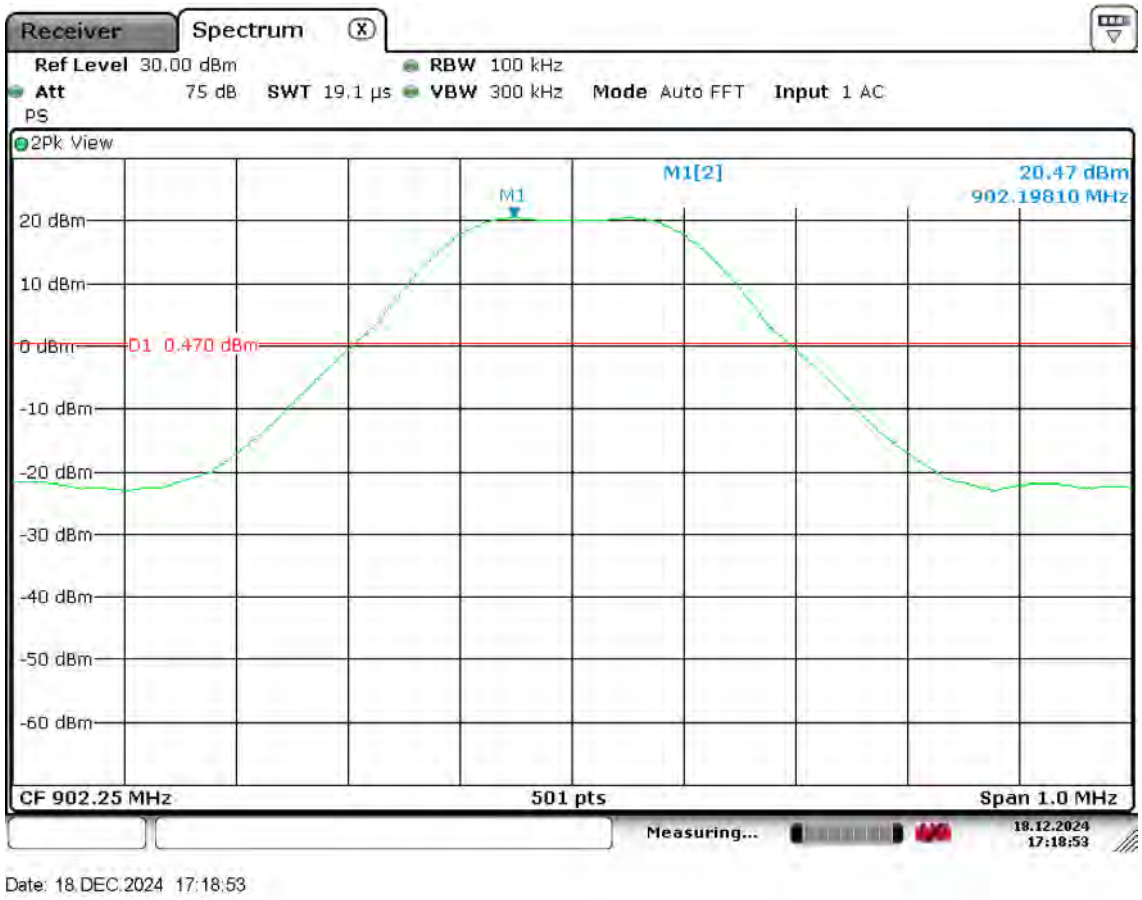


Date: 18.DEC.2024 17:18:53

10 RADIATED SPURIOUS EMISSIONS

The EUT antenna port was fitted with the highest gain antenna from each antenna type. 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.

10.1 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 Low Channel was determined to be the worst case. The tables of measured results follow in data presented and include measurements from all channels.

10.2 Radiated Spurious Emissions Test Data

Test Date(s):	2024-12-19	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(d); Part 15.209 / KDB558074	**Air Temperature:**	21.3ºC
		Relative Humidity:	38%

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.

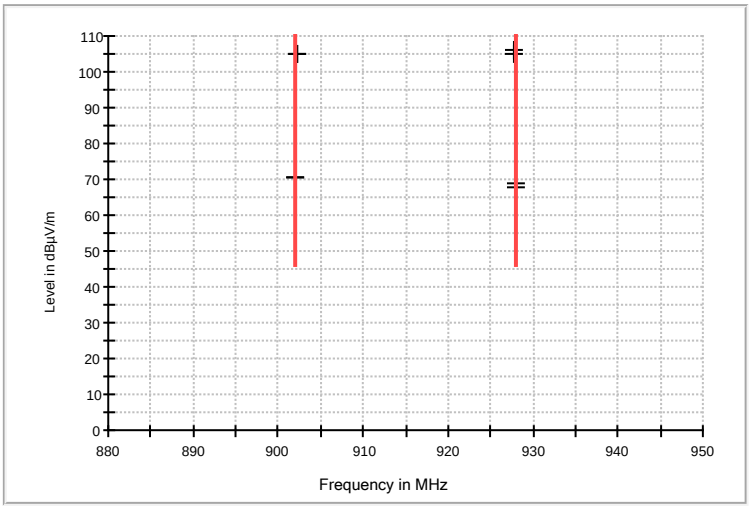
The equipment was fully exercised with all cabling attached to the EUT and was positioned on the Semi-Anechoic Chamber for maximum emissions. While the equipment was energized, the receiving antenna was scanned from 1.0 meter to 4.0 meters in both vertical and horizontal polarities while the turntable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

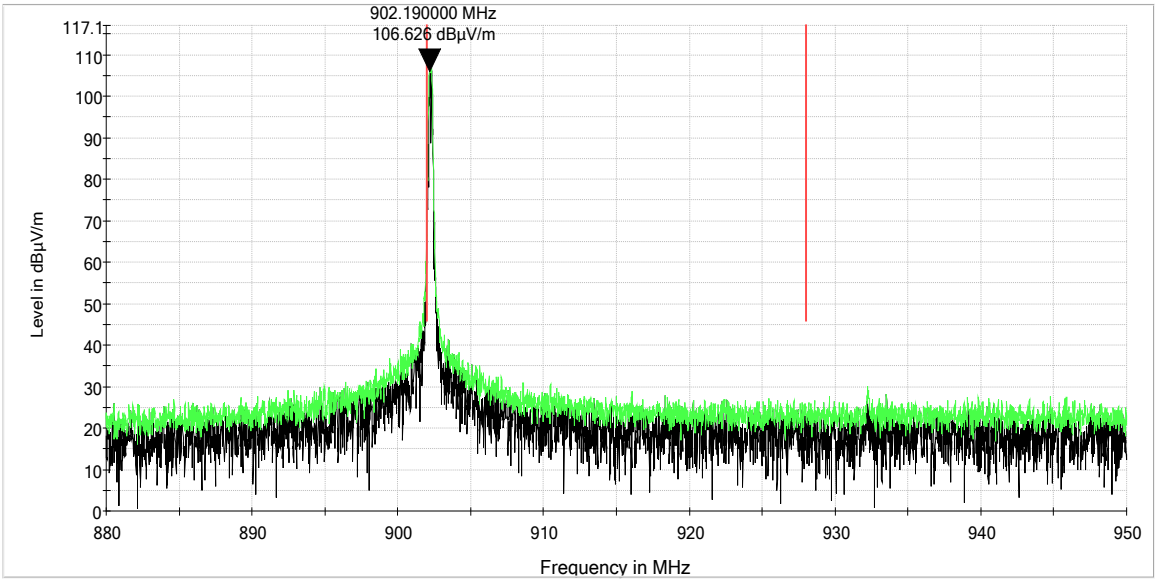
DTS mode at 660kHz OBW was found to be the worst-case emissions.

Yagi 200kHz FHSS, Measurements: Band Edges

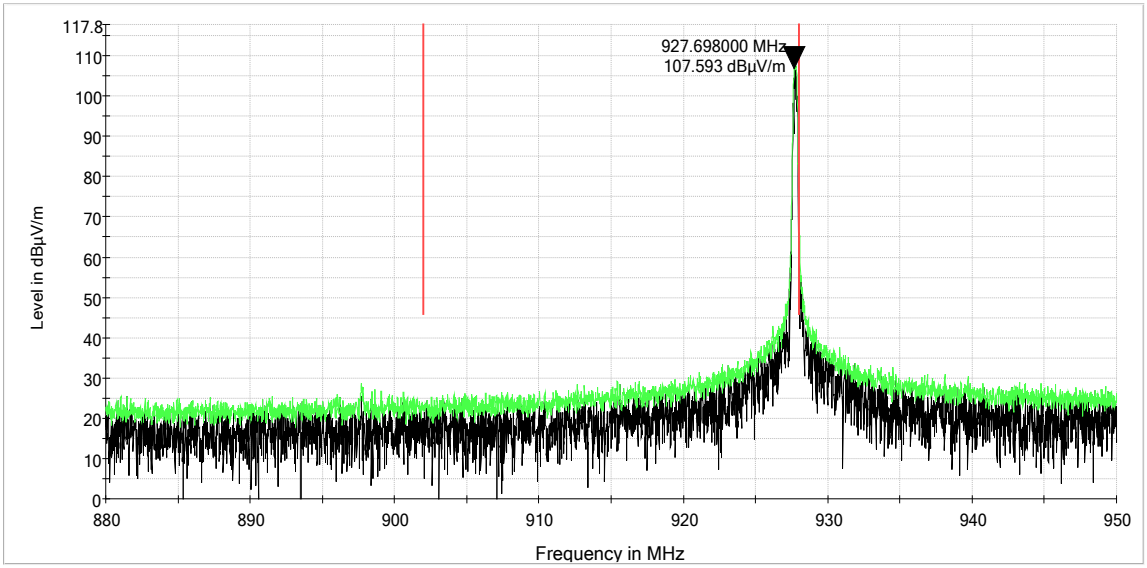
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	70.5	120.000	100.0	H	211.0	-13.6	15.6	86.1
902.000000	70.5	120.000	172.0	V	354.0	-13.6	15.6	86.1
902.250000	105.2	120.000	172.0	V	354.0	-13.6	------	------
902.250000	105.1	120.000	100.0	H	211.0	-13.6	------	------
927.750000	106.1	120.000	224.0	V	35.0	-12.9	------	------
927.750000	105.1	120.000	100.0	H	168.0	-12.9	------	------
928.000000	68.7	120.000	224.0	V	35.0	-12.9	17.4	86.1
928.000000	67.6	120.000	100.0	H	168.0	-12.9	18.5	86.1



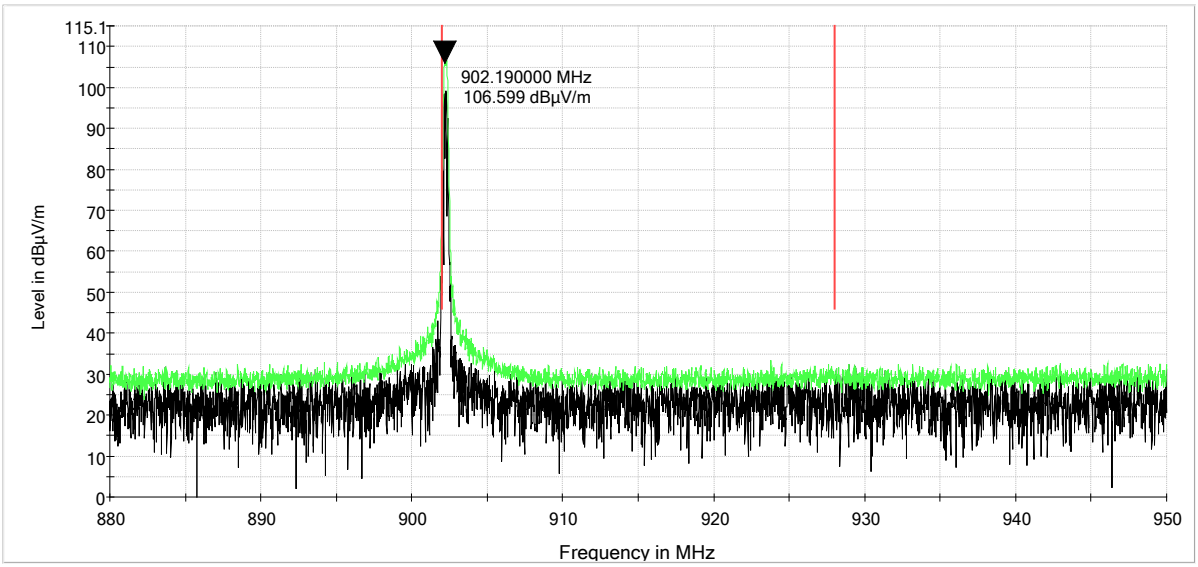
Yagi 200kHz FHSS, Lower Band Edge – Vertical



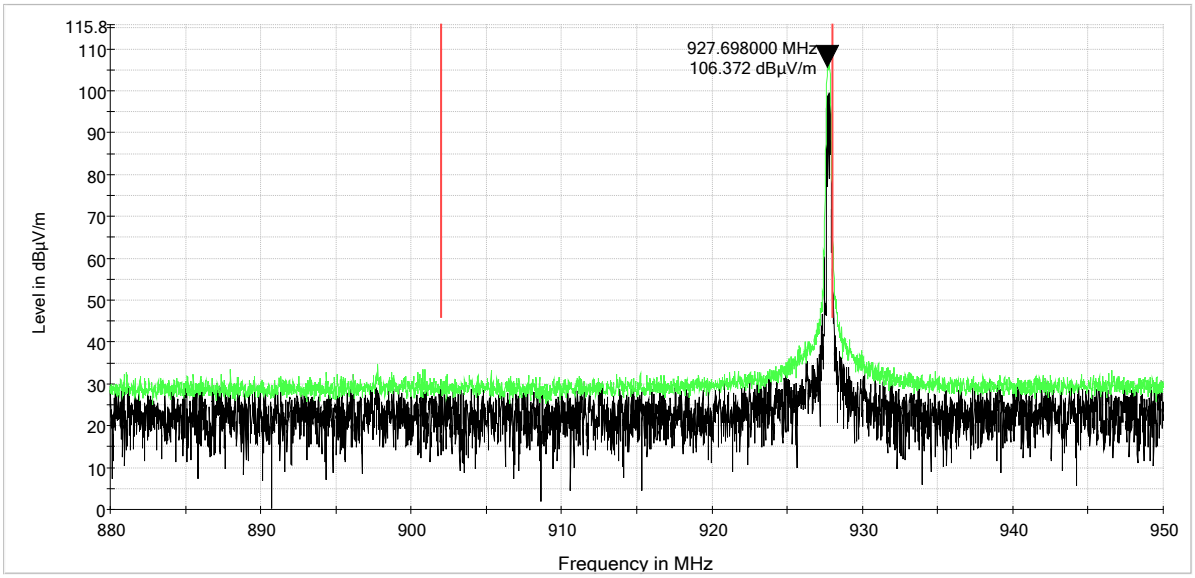
Yagi 200kHz FHSS, Upper Band Edge – Vertical



Yagi 200kHz FHSS, Lower Band Edge – Horizontal

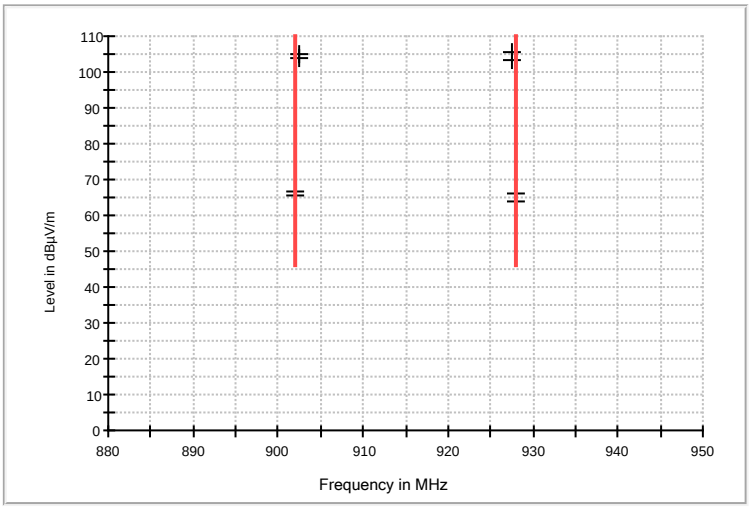


Yagi 200kHz FHSS, Upper Band Edge – Horizontal

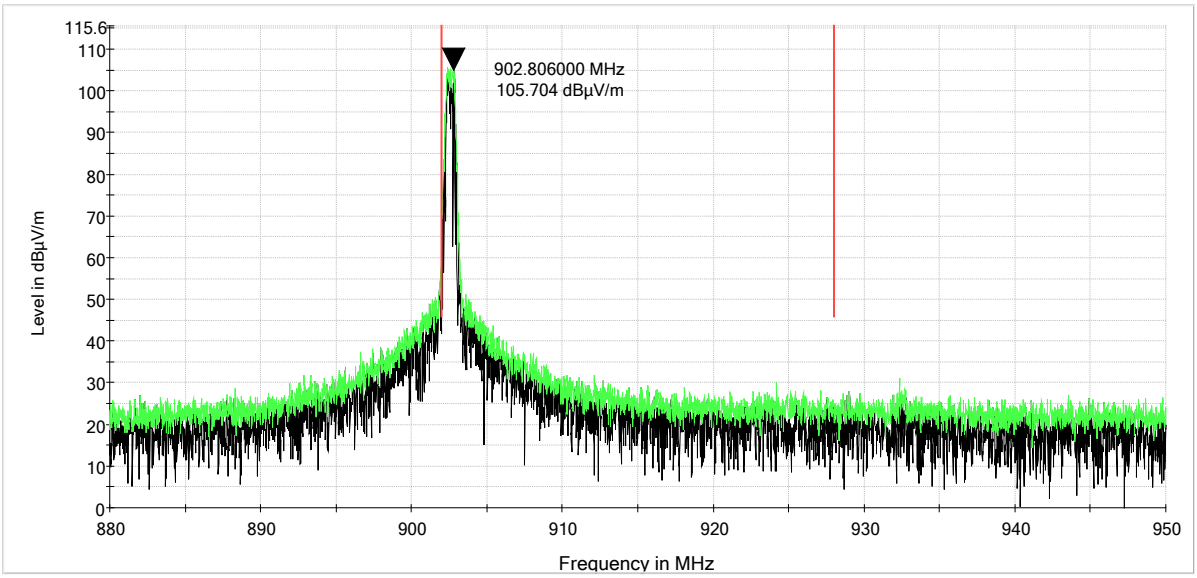


Dipole, Measurements: Band Edges

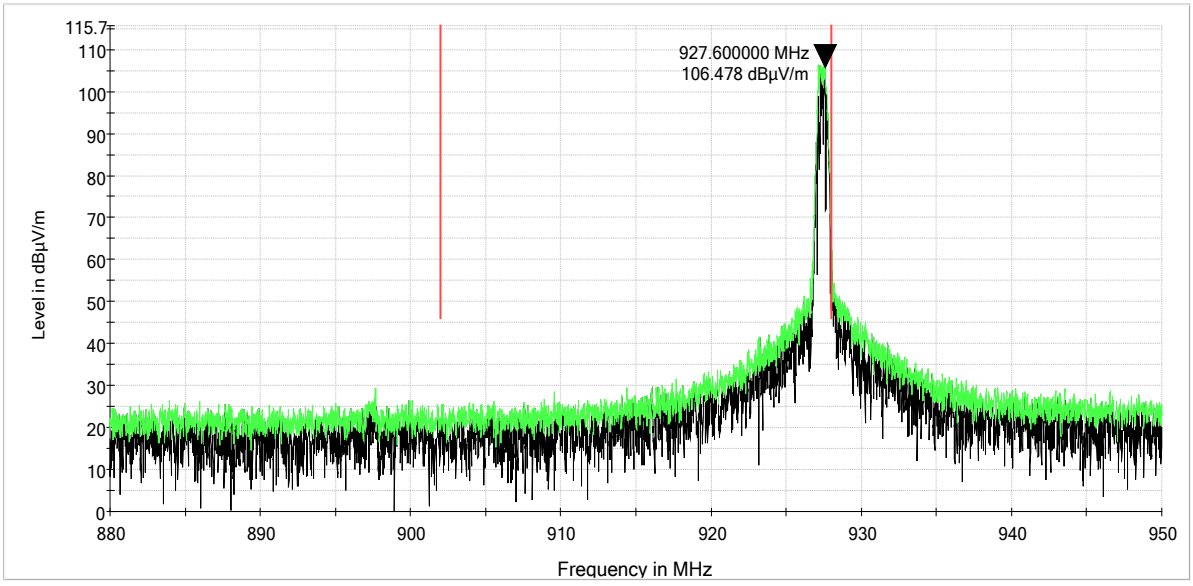
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	65.4	120.000	100.0	H	134.0	-13.6	20.4	85.8
902.000000	66.4	120.000	186.0	V	0.0	-13.6	19.4	85.8
902.575000	104.9	120.000	186.0	V	0.0	-13.6	------	------
902.575000	103.7	120.000	100.0	H	134.0	-13.6	------	------
927.425000	105.8	120.000	100.0	V	238.0	-12.9	------	------
927.425000	103.4	120.000	100.0	H	75.0	-12.9	------	------
928.000000	66.4	120.000	100.0	V	238.0	-12.9	19.4	85.8
928.000000	64.0	120.000	100.0	H	75.0	-12.9	21.8	85.8



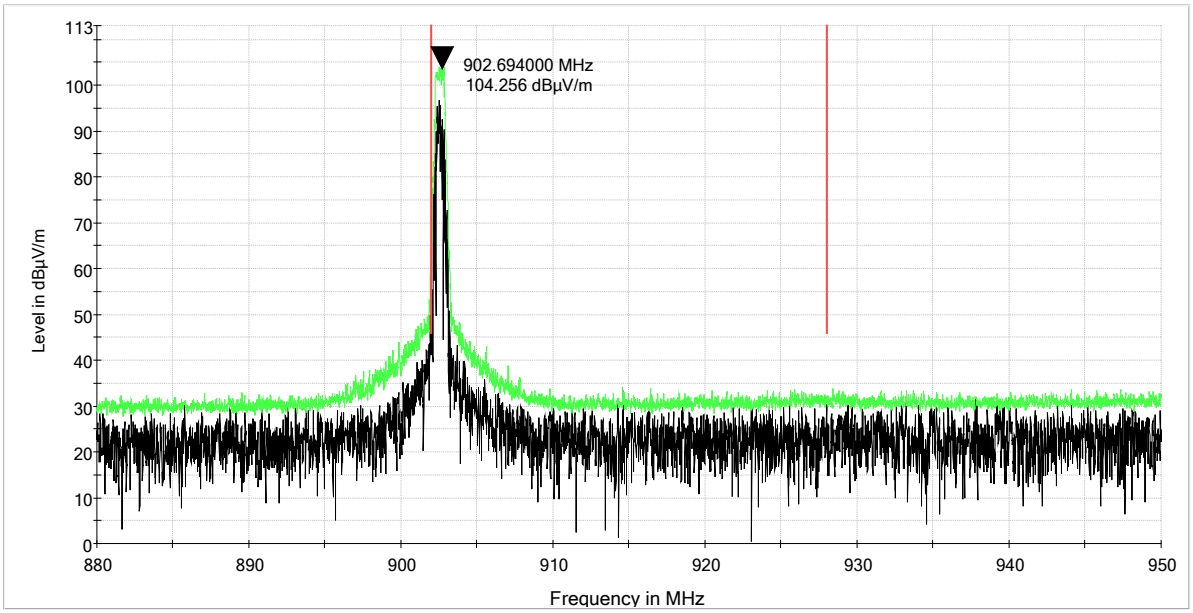
Dipole, Lower Band Edge – Vertical



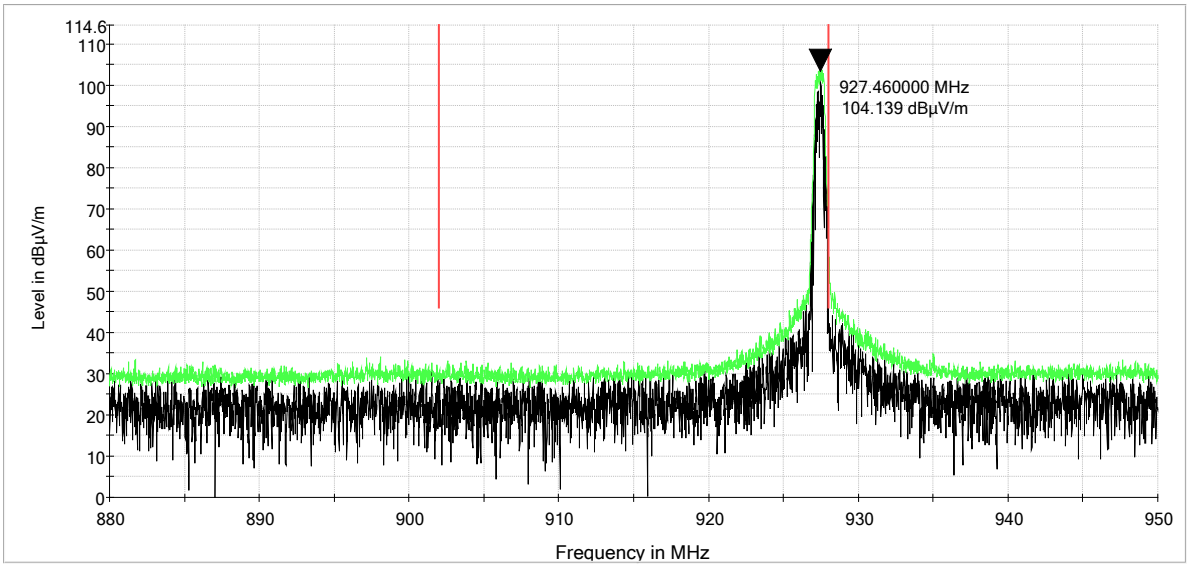
Dipole, Upper Band Edge – Vertical



Dipole, Lower Band Edge – Horizontal

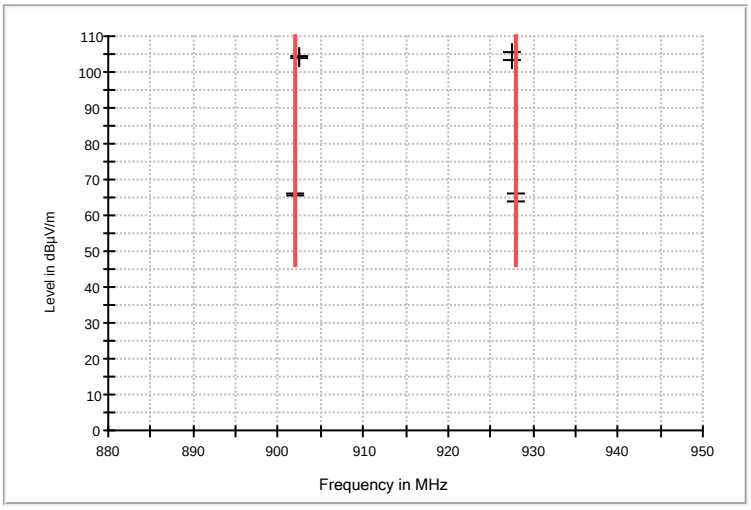


Dipole, Upper Band Edge – Horizontal

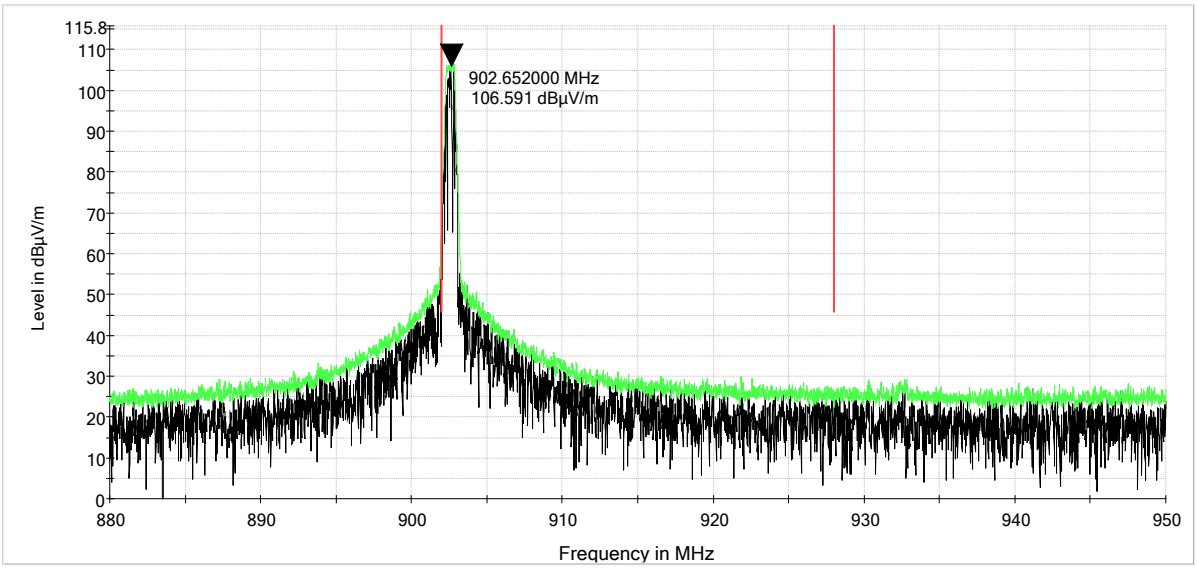


Puck, Measurements: Band Edges

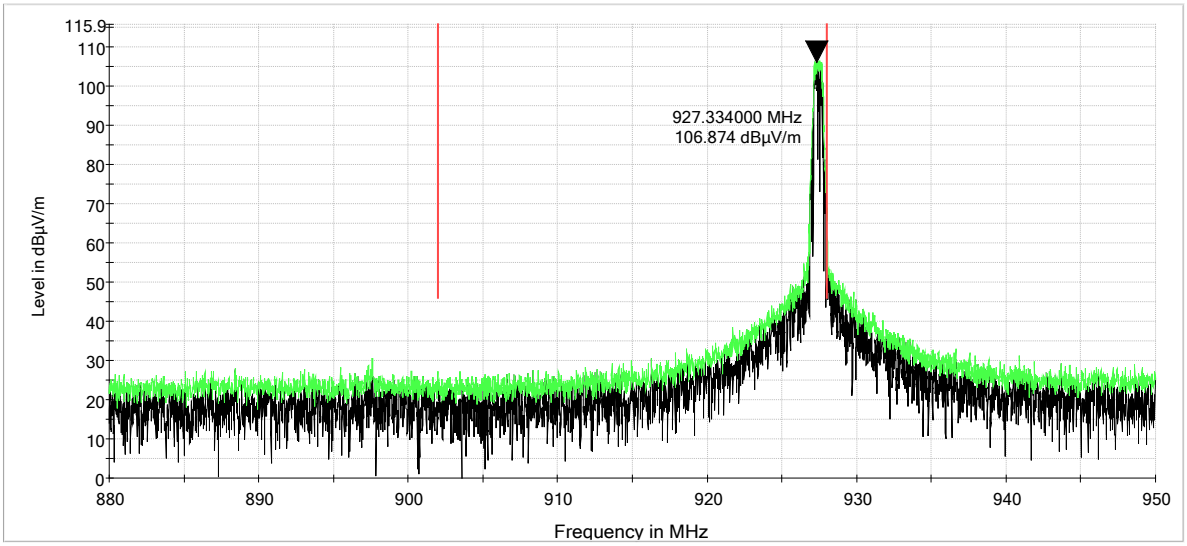
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	65.6	120.000	210.0	H	73.0	-13.6	20.0	85.6
902.000000	66.2	120.000	203.0	V	0.0	-13.6	19.4	85.6
902.575000	104.7	120.000	203.0	V	0.0	-13.6	-----	-----
902.575000	104.0	120.000	210.0	H	73.0	-13.6	-----	-----
927.425000	103.5	120.000	100.0	H	242.0	-12.9	-----	-----
927.575000	105.6	120.000	100.0	V	0.0	-12.9	-----	-----
928.000000	66.2	120.000	100.0	V	0.0	-12.9	19.4	85.6
928.000000	63.7	120.000	100.0	H	242.0	-12.9	21.9	85.6



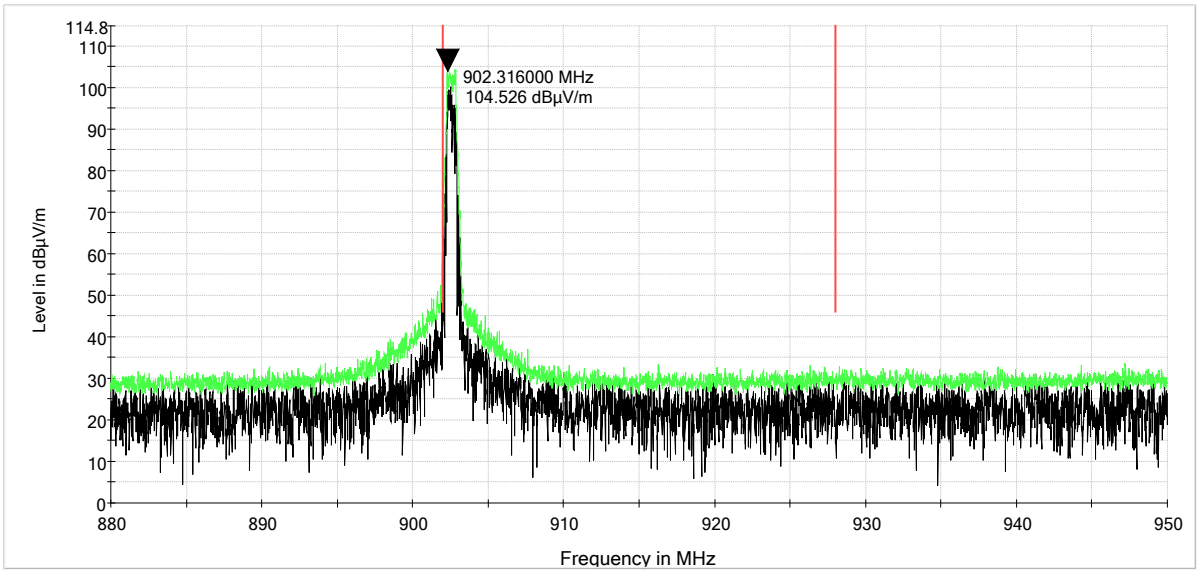
Puck, Lower Band Edge – Vertical



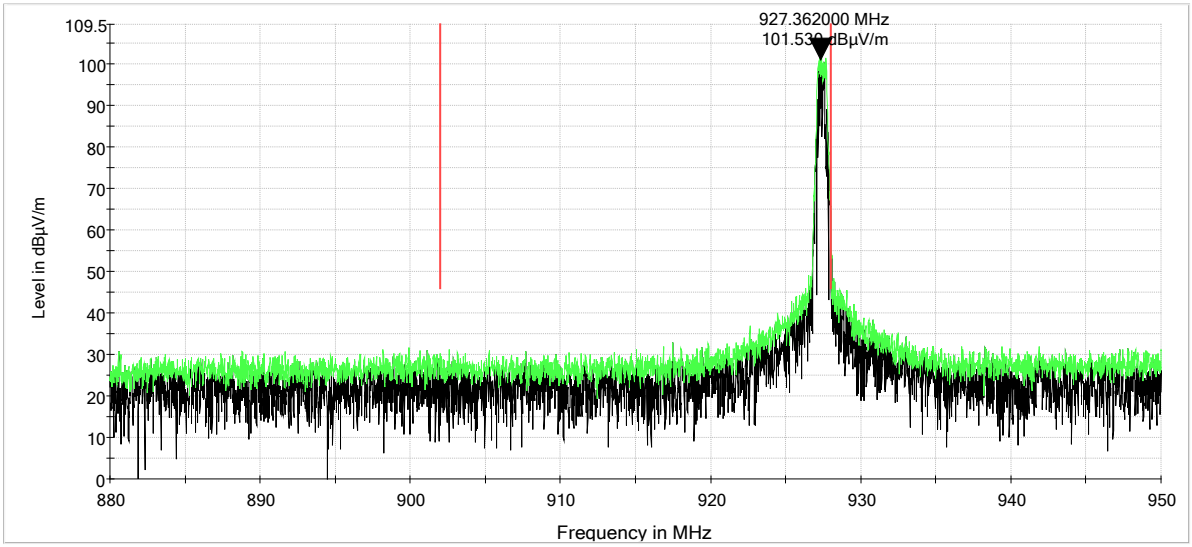
Puck, Upper Band Edge – Vertical



Puck, Lower Band Edge – Horizontal

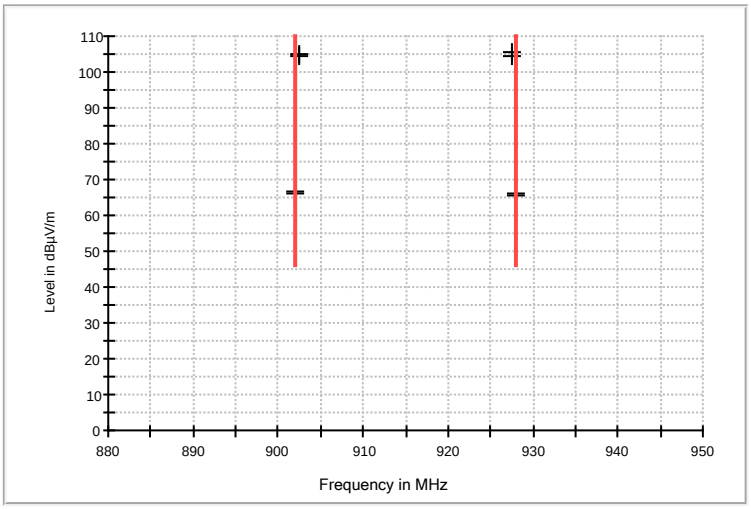


Puck, Upper Band Edge – Horizontal

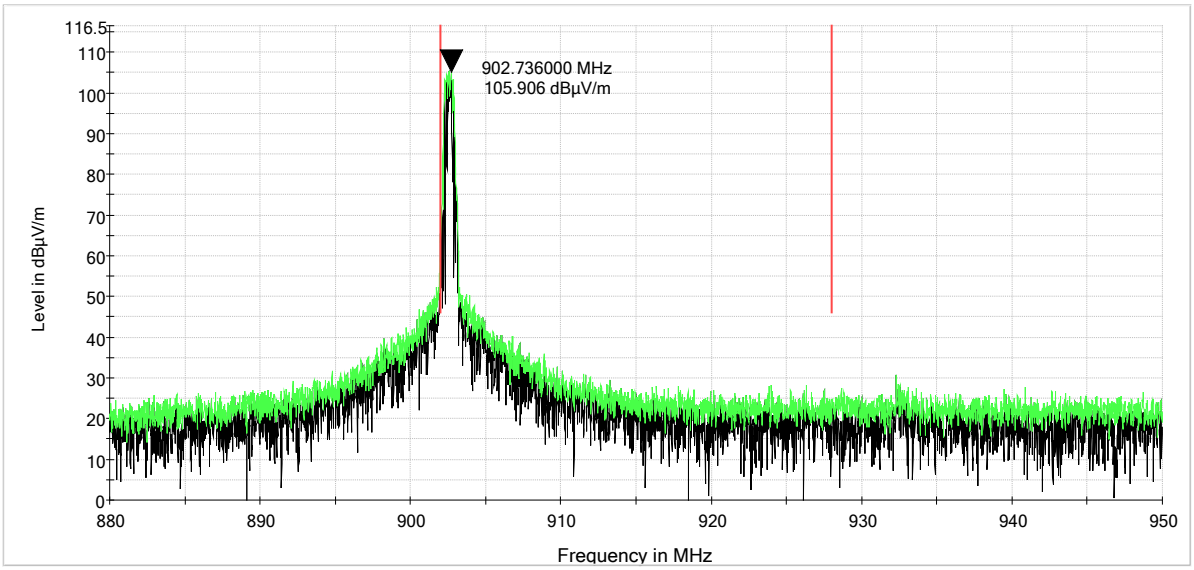


PCTel Monopole, Measurements: Band Edges

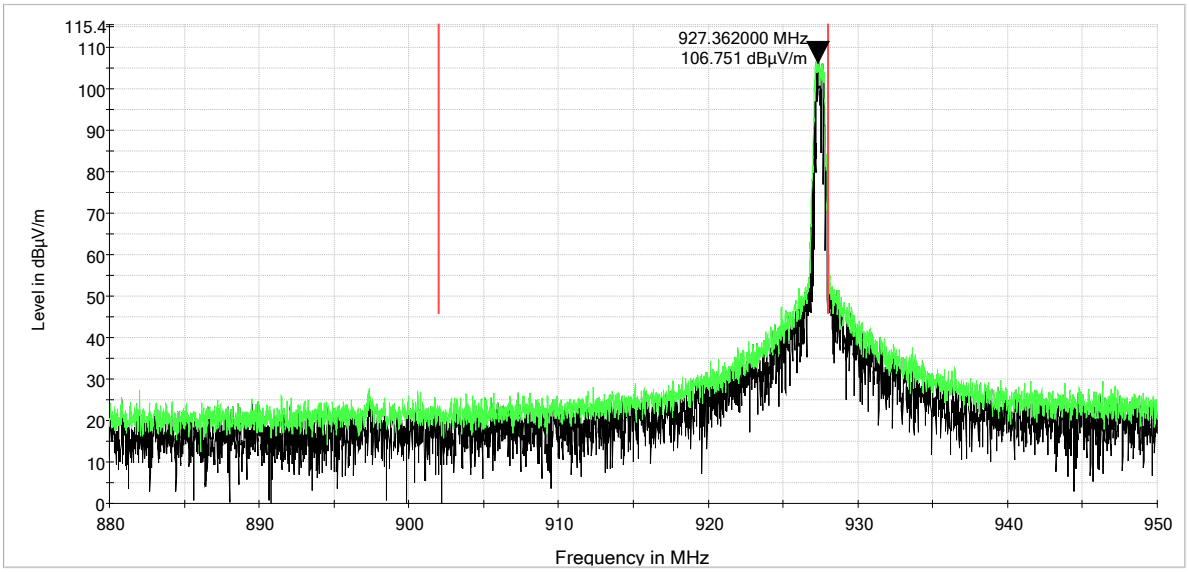
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m
902.000000	66.3	120.000	100.0	H	237.0	-13.6	19.4	85.7
902.000000	66.6	120.000	217.0	V	79.0	-13.6	19.1	85.7
902.575000	104.9	120.000	217.0	V	79.0	-13.6	-------	-------
902.575000	104.5	120.000	100.0	H	237.0	-13.6	-------	-------
927.425000	104.7	120.000	100.0	H	51.0	-12.9	-------	-------
927.425000	105.7	120.000	100.0	V	182.0	-12.9	-------	-------
928.000000	65.3	120.000	100.0	H	51.0	-12.9	20.4	85.7
928.000000	66.3	120.000	100.0	V	180.0	-12.9	19.4	85.7



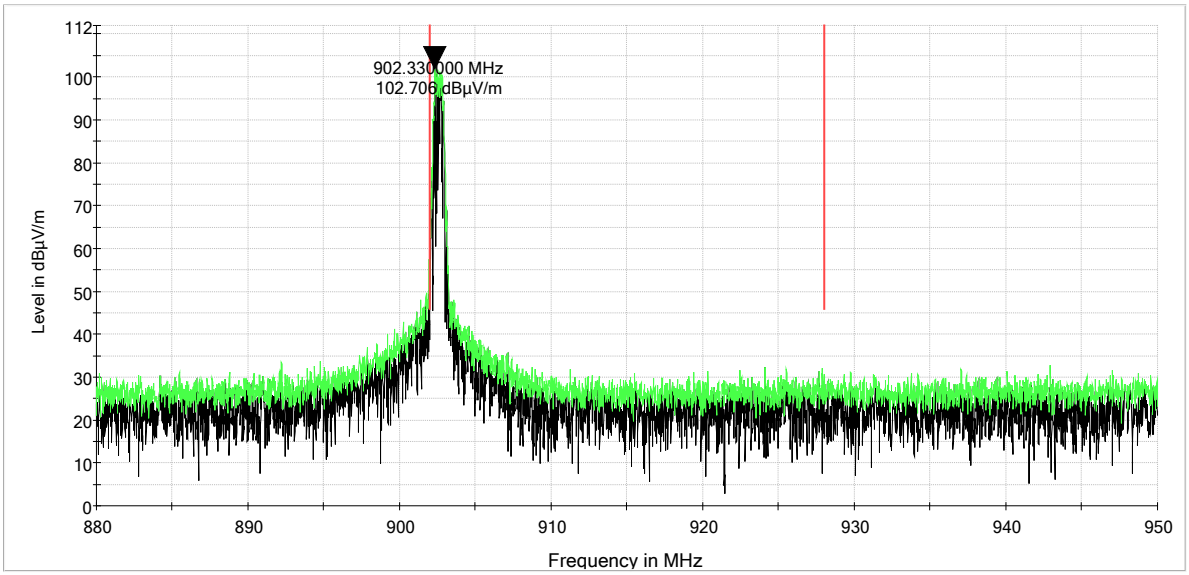
PCTel Monopole, Lower Band Edge – Vertical



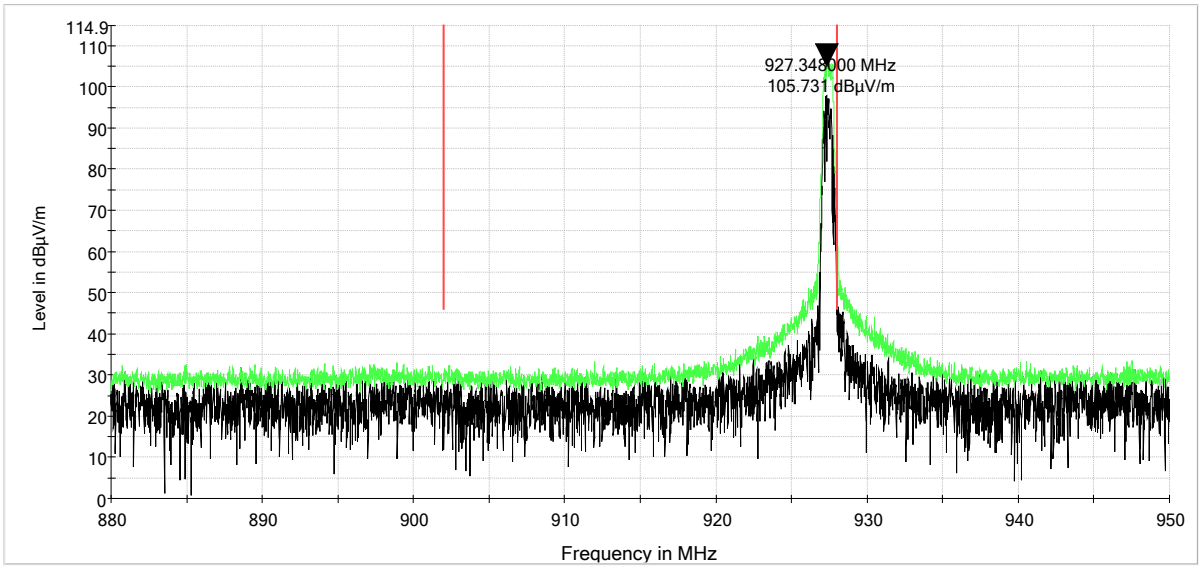
PCTel Monopole, Upper Band Edge – Vertical



PCTel Monopole, Lower Band Edge – Horizontal

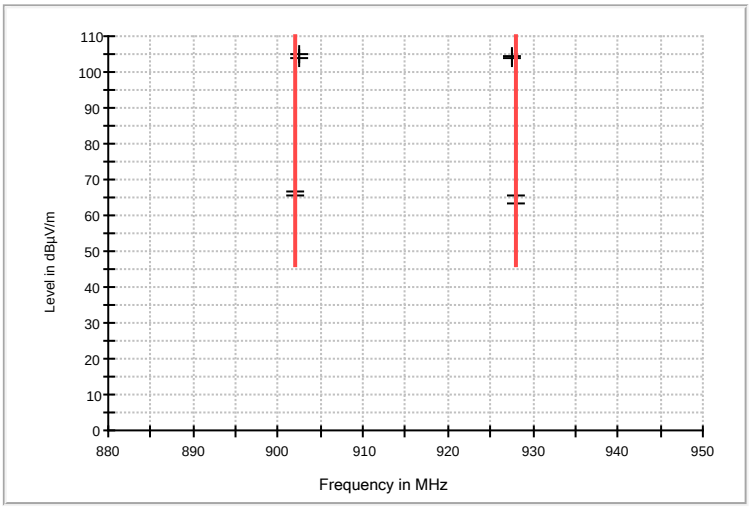


PCTel Monopole, Upper Band Edge – Horizontal

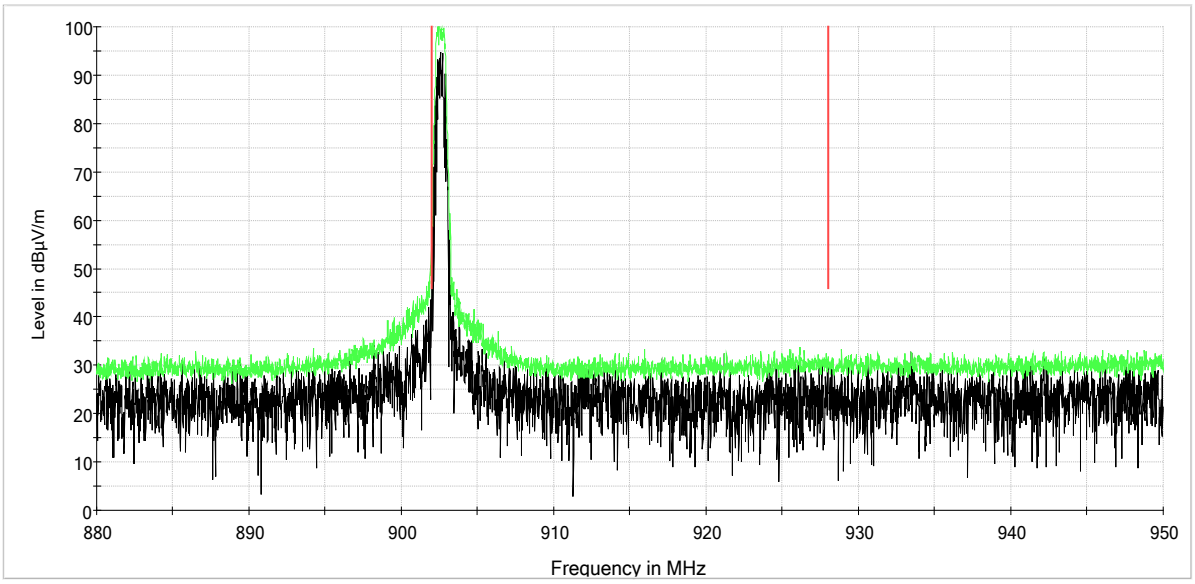


Linx Monopole, Measurements: Band Edges

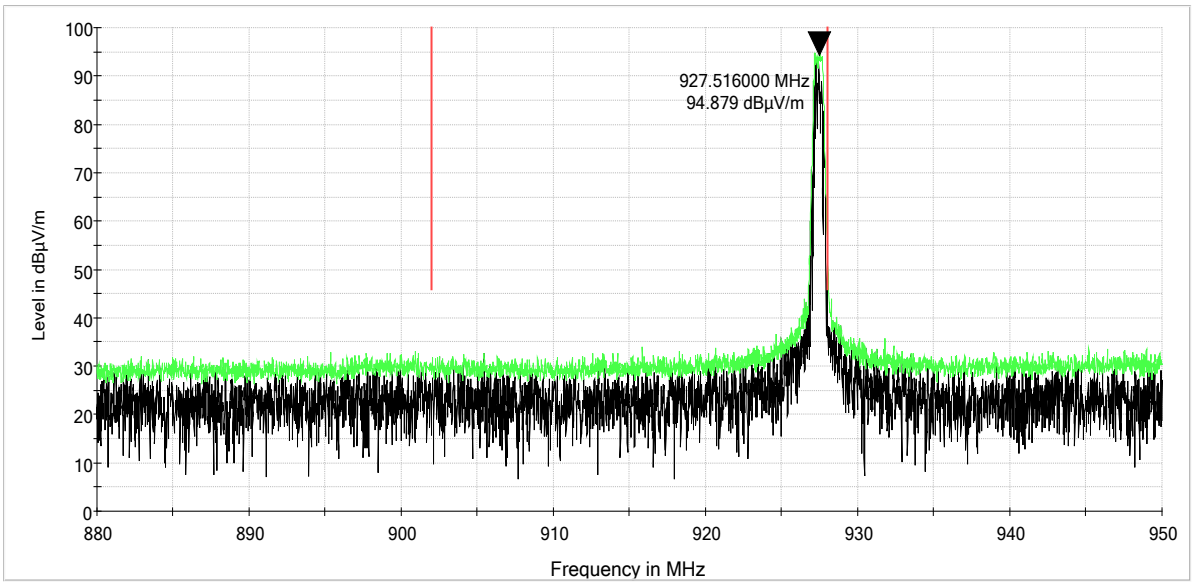
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
902.000000	66.5	120.000	257.0	H	13.0	-13.6	18.4	84.9
902.000000	65.5	120.000	173.0	V	66.0	-13.6	19.4	84.9
902.575000	104.9	120.000	257.0	H	13.0	-13.6	------	------
902.580000	104.0	120.000	173.0	V	66.0	-13.6	------	------
927.425000	103.9	120.000	179.0	V	9.0	-12.9	------	------
927.425000	104.7	120.000	100.0	H	44.0	-12.9	------	------
928.000000	63.8	120.000	179.0	V	9.0	-12.9	21.1	84.9
928.000000	65.3	120.000	100.0	H	44.0	-12.9	19.6	84.9



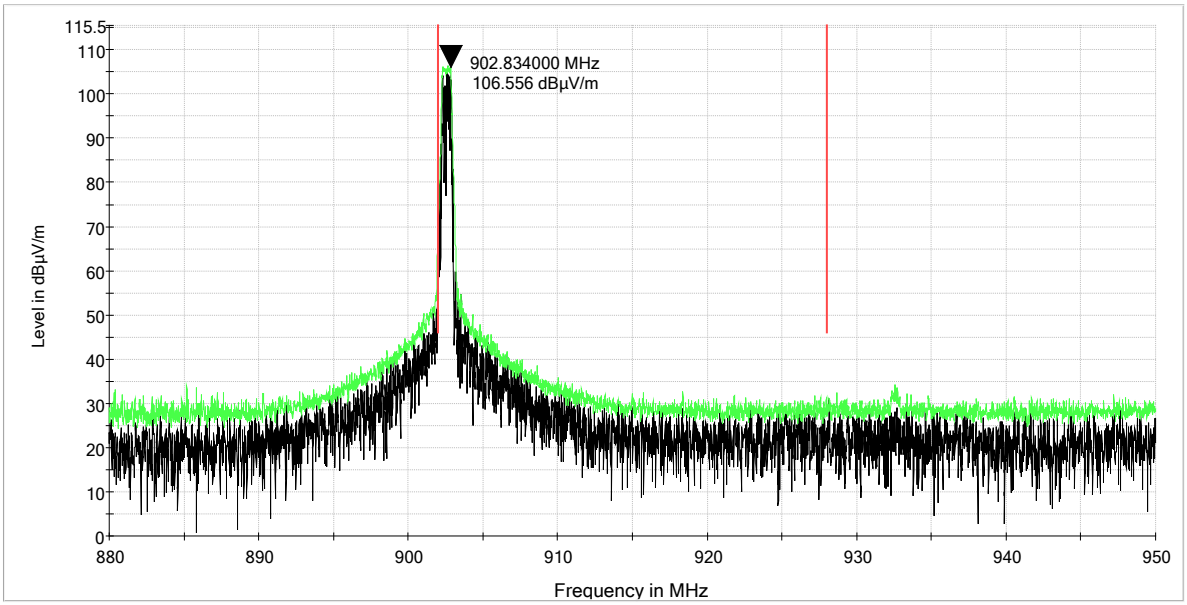
Linx Monopole, Lower Band Edge – Vertical



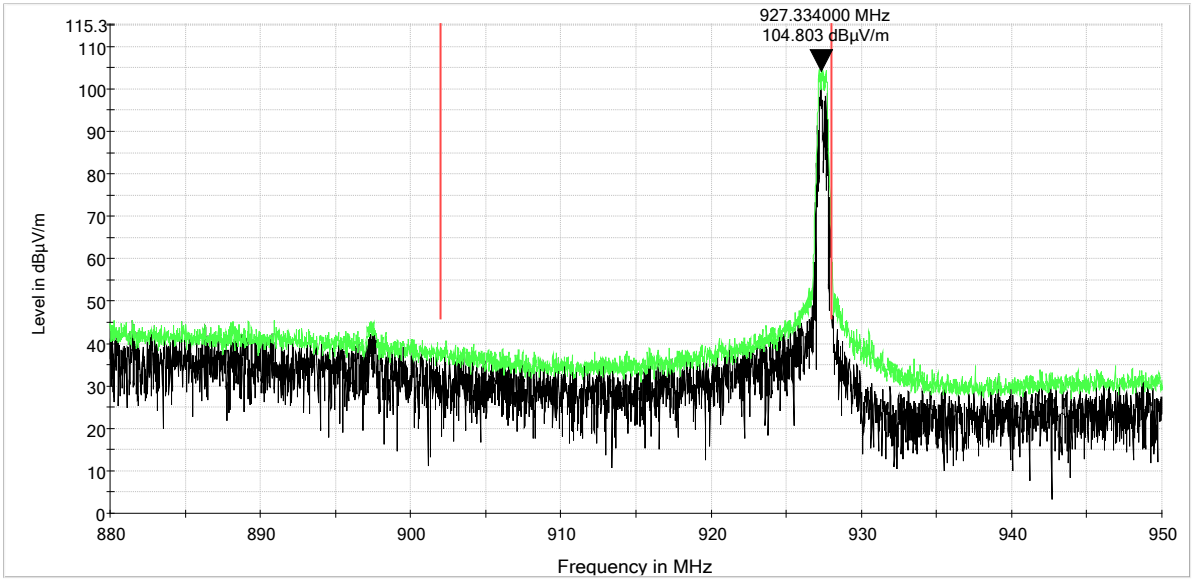
Linx Monopole, Upper Band Edge – Vertical



Linx Monopole, Lower Band Edge – Horizontal



Linx Monopole, Upper Band Edge – Horizontal

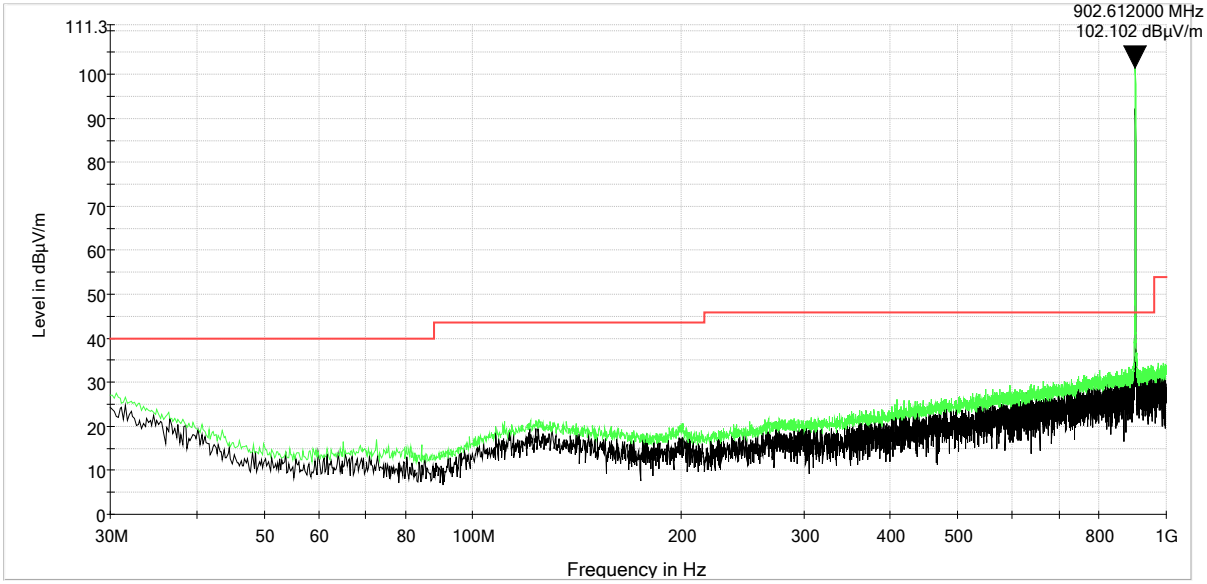


DTS Yagi, Measurements*: 30 MHz to 1000 MHz

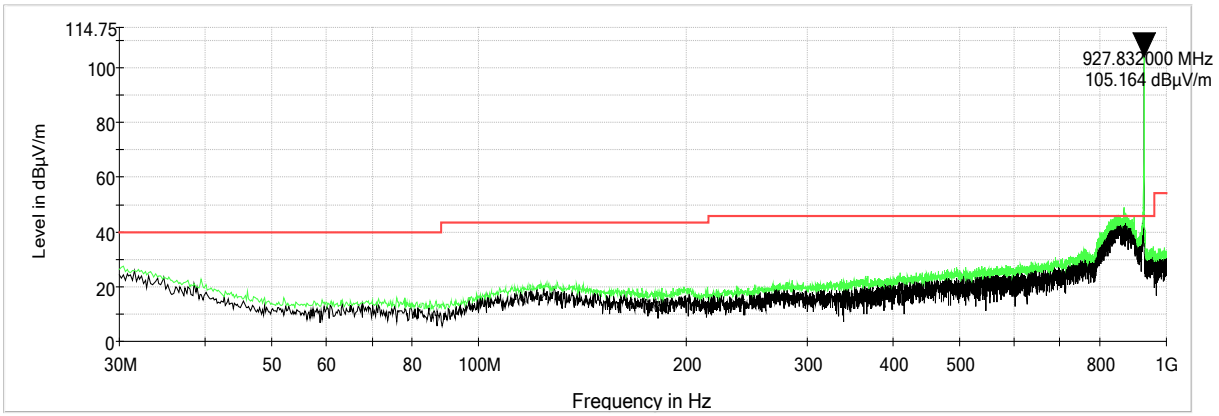
Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.580000	22.1	120.000	100.0	V	0.0	-19.5	17.9	40.0
32.520000	20.9	120.000	100.0	H	80.0	-20.9	19.1	40.0
35.040000	17.4	120.000	100.0	H	358.0	-22.8	22.6	40.0
39.510000	16.0	120.000	100.0	V	352.0	-26.2	24.0	40.0
50.760000	9.6	120.000	100.0	V	0.0	-32.1	30.4	40.0
54.440000	9.2	120.000	100.0	H	274.0	-32.6	30.8	40.0
60.070000	9.7	120.000	100.0	H	0.0	-32.4	30.3	40.0
69.770000	10.3	120.000	100.0	V	2.0	-31.5	29.7	40.0
80.440000	9.5	120.000	100.0	H	354.0	-32.0	30.5	40.0
100.620000	12.4	120.000	100.0	H	0.0	-29.2	31.1	43.5
105.850000	13.9	120.000	100.0	V	0.0	-27.8	29.6	43.5
130.490000	16.1	120.000	100.0	V	354.0	-25.6	27.4	43.5
136.700000	15.5	120.000	100.0	V	0.0	-26.0	28.0	43.5
156.290000	14.4	120.000	100.0	H	0.0	-26.8	29.1	43.5
156.290000	9.2	120.000	100.0	H	0.0	-26.8	34.3	43.5
198.000000	8.8	120.000	100.0	H	0.0	-26.3	34.7	43.5
198.970000	15.6	120.000	100.0	H	0.0	-26.1	27.9	43.5
201.110000	15.5	120.000	100.0	V	0.0	-26.2	28.0	43.5
300.050000	16.9	120.000	100.0	V	0.0	-25.1	29.1	46.0
404.030000	19.5	120.000	100.0	V	0.0	-22.4	26.5	46.0
405.000000	19.7	120.000	100.0	H	0.0	-22.4	26.3	46.0
604.050000	23.0	120.000	100.0	V	0.0	-19.3	23.0	46.0
618.400000	23.5	120.000	100.0	V	0.0	-19.1	22.5	46.0
756.920000	26.0	120.000	100.0	H	5.0	-16.3	20.0	46.0
782.530000	26.4	120.000	100.0	V	356.0	-15.9	19.6	46.0
837.230000	41.7	120.000	100.0	H	0.0	-14.9	4.4	46.0
854.890000	39.5	120.000	100.0	H	32.0	-14.6	6.5	46.0
867.690000	44.2	120.000	100.0	H	0.0	-14.3	1.8	46.0
884.960000	38.1	120.000	100.0	H	18.0	-14.0	7.9	46.0
897.370000	43.4	120.000	100.0	H	0.0	-13.5	2.6	46.0

**Deemed worst case due to Bandwidth.*

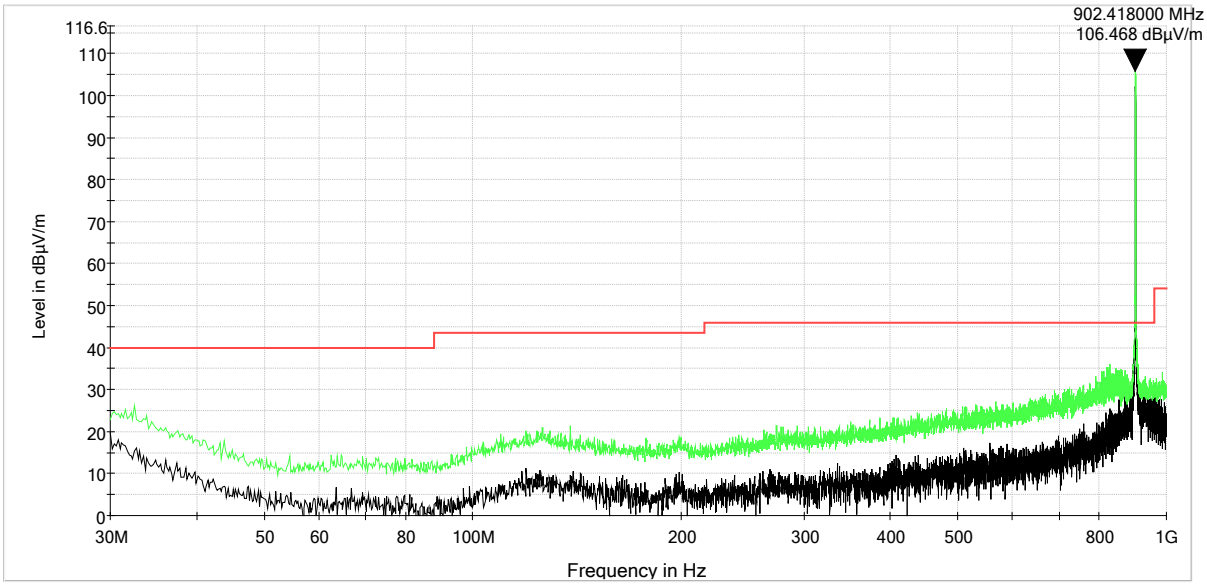
Yagi Radiated Spurious Emissions: 30 MHz to 1000 MHz – Vertical – Low Channel



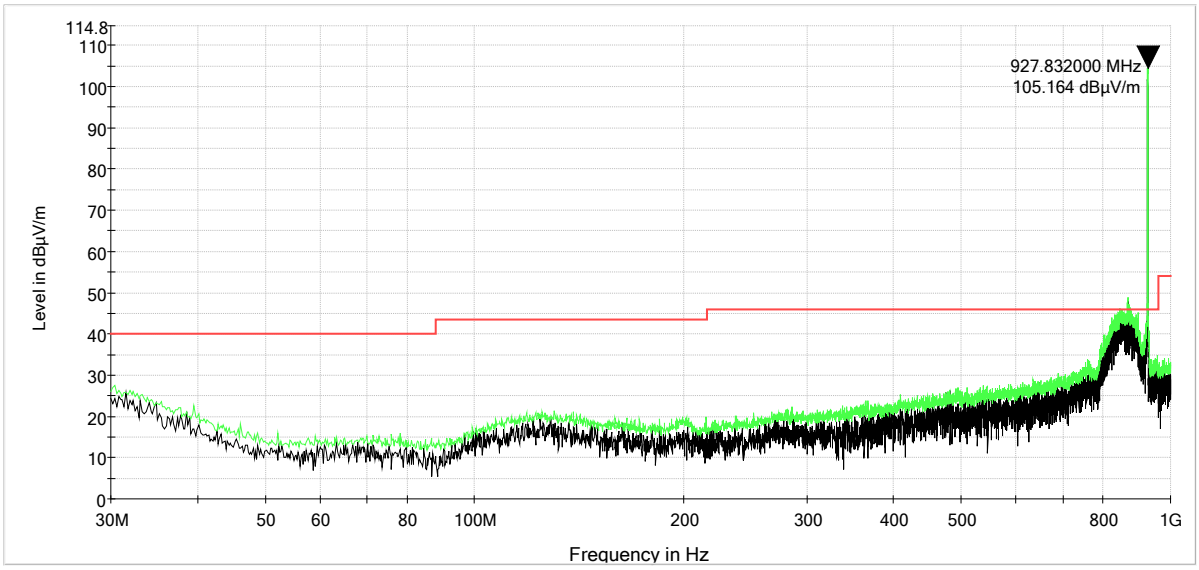
Yagi Radiated Spurious Emissions: 30 MHz to 1000 MHz – Vertical – High Channel



Yagi Radiated Spurious Emissions: 30 MHz to 1000 MHz – Horizontal – Low Channel

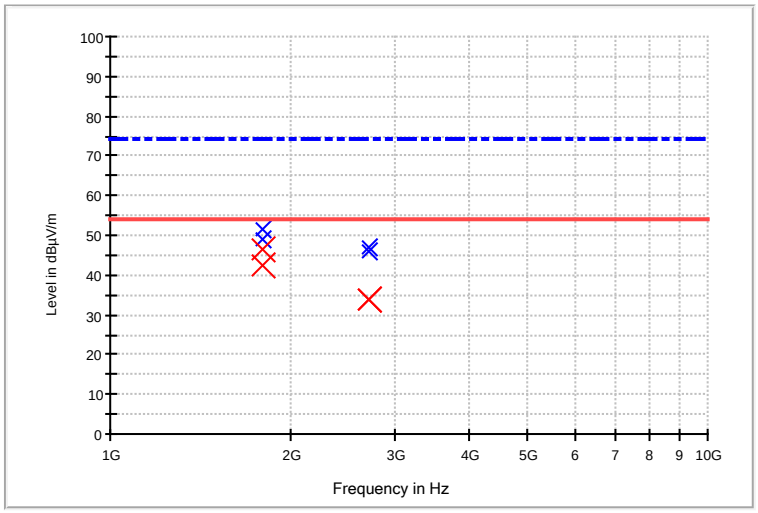


Yagi Radiated Spurious Emissions: 30 MHz to 1000 MHz – Horizontal – High Channel

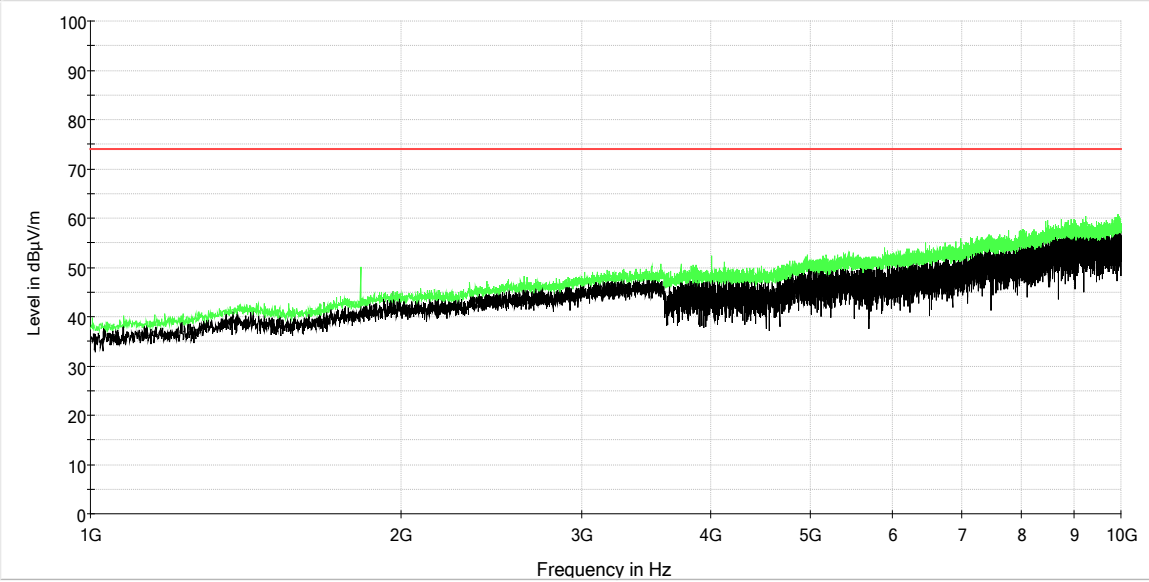


Yagi, Measurements: Greater Than 1 GHz

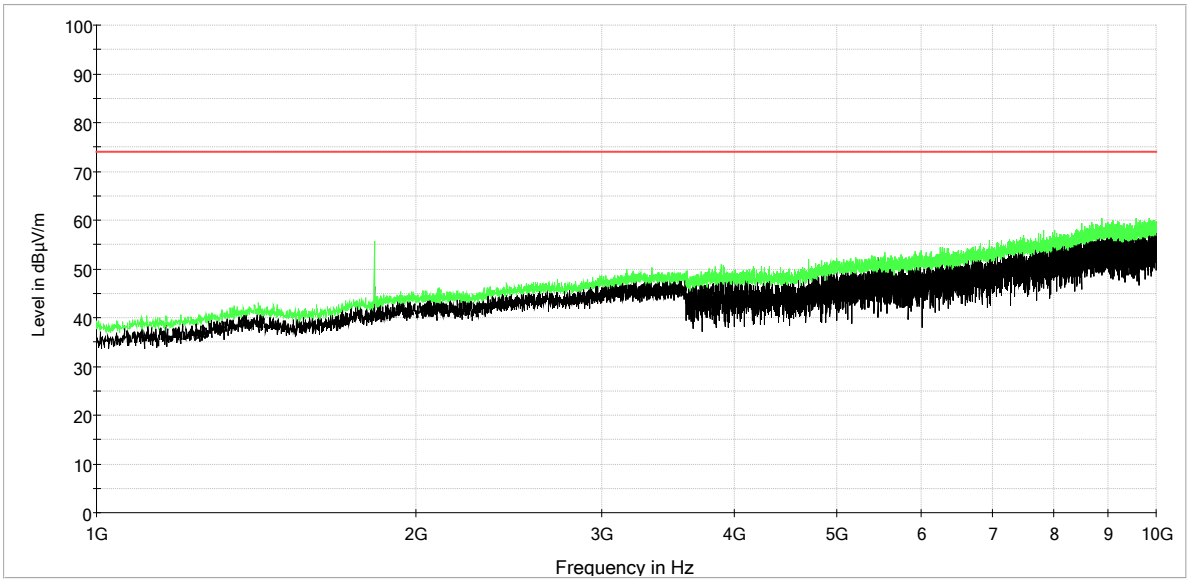
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
1805.150000	51.7	46.3	1000.0	1000.000	200.0	H	155.0	5.1	28.4	74.7	-30 dBc
1805.150000	49.2	42.5	1000.0	1000.000	251.0	V	239.0	5.1	32.2	74.7	-30 dBc
2707.725000	47.0	33.7	1000.0	1000.000	150.0	H	328.0	9.0	20.3	54.0	restricted
2707.725000	46.2	33.7	1000.0	1000.000	150.0	V	4.0	9.0	20.3	54.0	restricted



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



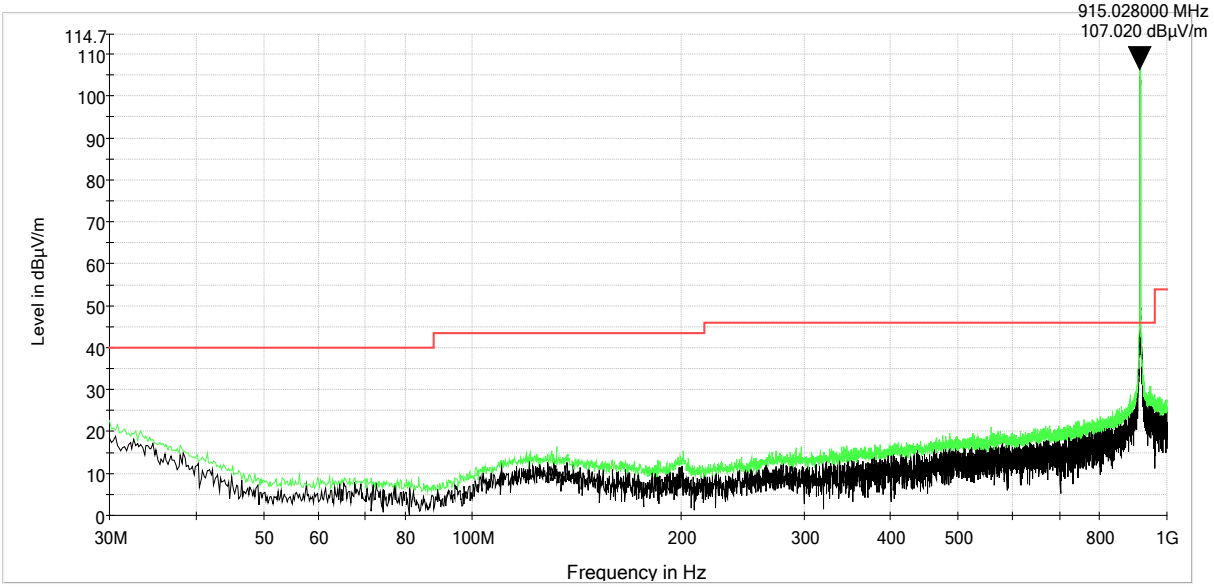
Yagi, Radiated Spurious Emissions: 1 GHz to 10 GHz - Horizontal



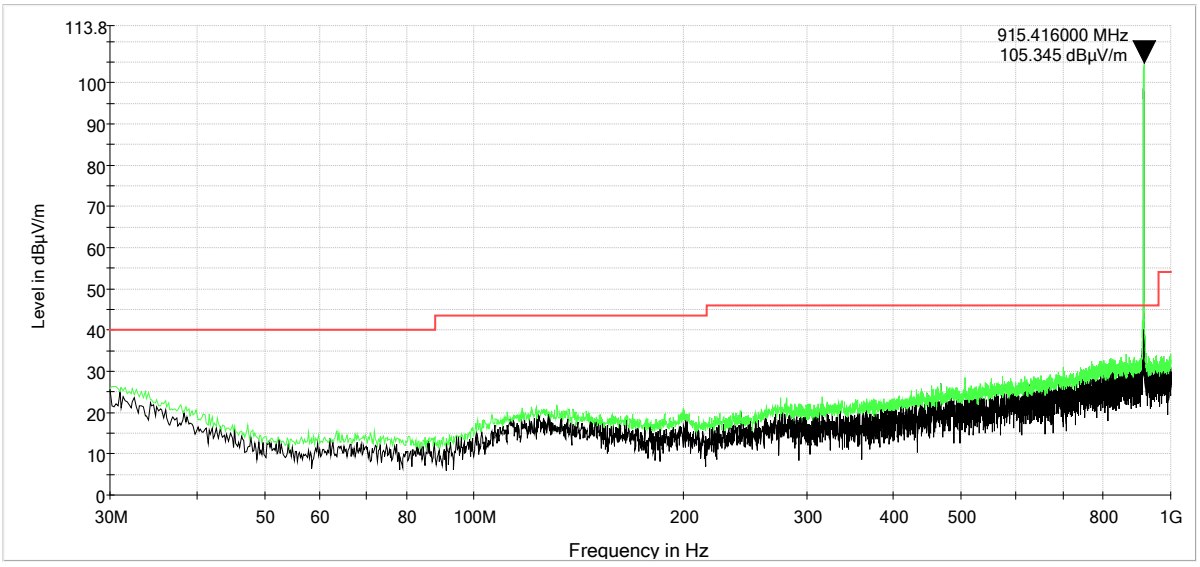
DTS Dipole, Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
33.100000	13.0	120.000	100.0	V	0.0	-21.3	27.0	40.0
39.890000	15.4	120.000	100.0	H	0.0	-26.4	24.6	40.0
50.370000	1.8	120.000	100.0	V	0.0	-32.0	38.2	40.0
68.220000	9.9	120.000	100.0	H	0.0	-31.7	30.1	40.0
101.000000	4.0	120.000	100.0	V	0.0	-29.1	39.5	43.5
101.200000	12.7	120.000	100.0	H	0.0	-29.0	30.8	43.5
132.240000	7.0	120.000	100.0	V	0.0	-25.7	36.5	43.5
133.790000	15.7	120.000	100.0	H	0.0	-25.8	27.8	43.5
199.560000	15.7	120.000	100.0	H	0.0	-26.1	27.8	43.5
201.300000	6.8	120.000	100.0	V	0.0	-26.3	36.7	43.5
302.960000	17.1	120.000	100.0	H	0.0	-25.0	28.9	46.0
398.410000	19.1	120.000	100.0	H	0.0	-22.8	26.9	46.0
404.610000	9.8	120.000	100.0	V	0.0	-22.4	36.2	46.0
507.240000	21.8	120.000	100.0	H	0.0	-20.6	24.2	46.0
597.450000	11.7	120.000	100.0	V	0.0	-19.5	34.3	46.0
610.060000	23.2	120.000	100.0	H	0.0	-19.2	22.8	46.0
703.570000	24.8	120.000	100.0	H	0.0	-17.5	21.2	46.0
817.830000	27.3	120.000	100.0	H	0.0	-15.1	18.7	46.0
945.100000	27.8	120.000	100.0	V	0.0	-12.4	18.2	46.0
954.410000	28.6	120.000	100.0	H	0.0	-12.2	17.4	46.0

DTS Dipole, Characterization Scan, 30 MHz to 1000 MHz – Vertical

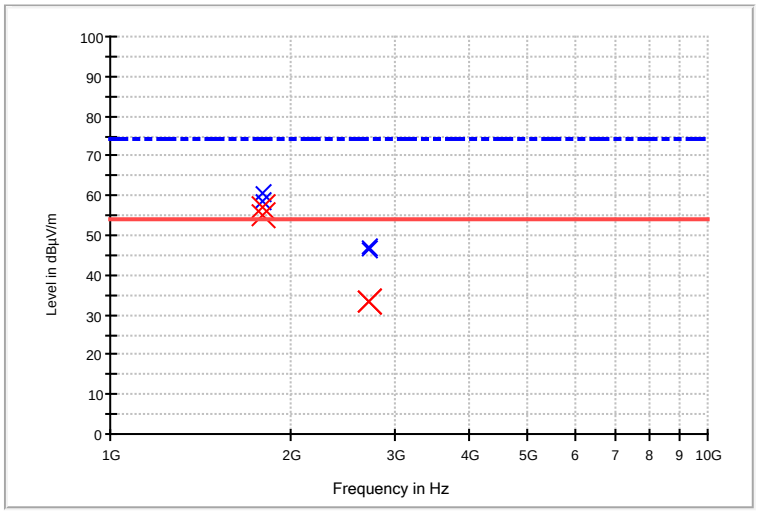


DTS Dipole, Characterization Scan, 30 MHz to 1000 MHz – Horizontal

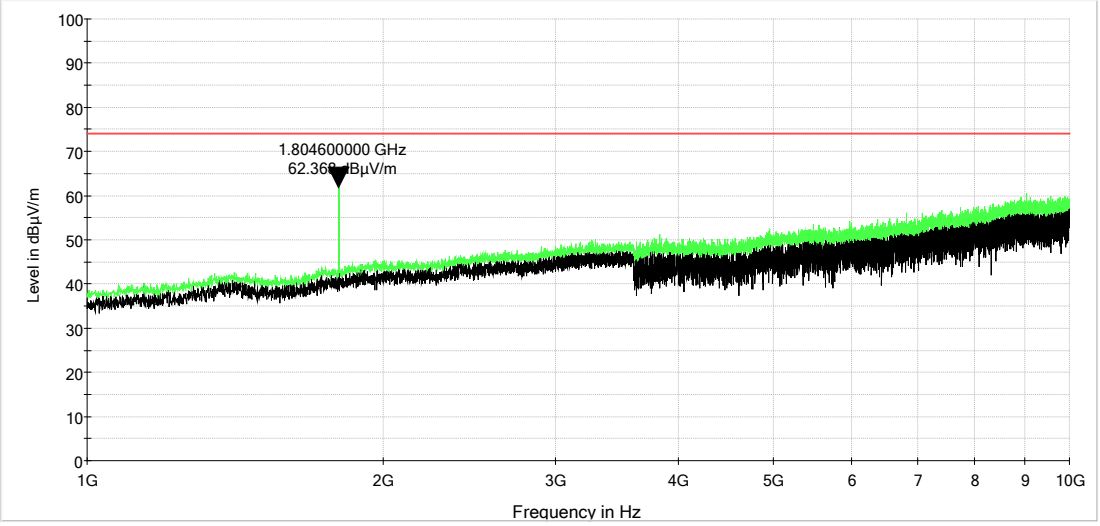


DTS Dipole Measurements: Greater Than 1 GHz

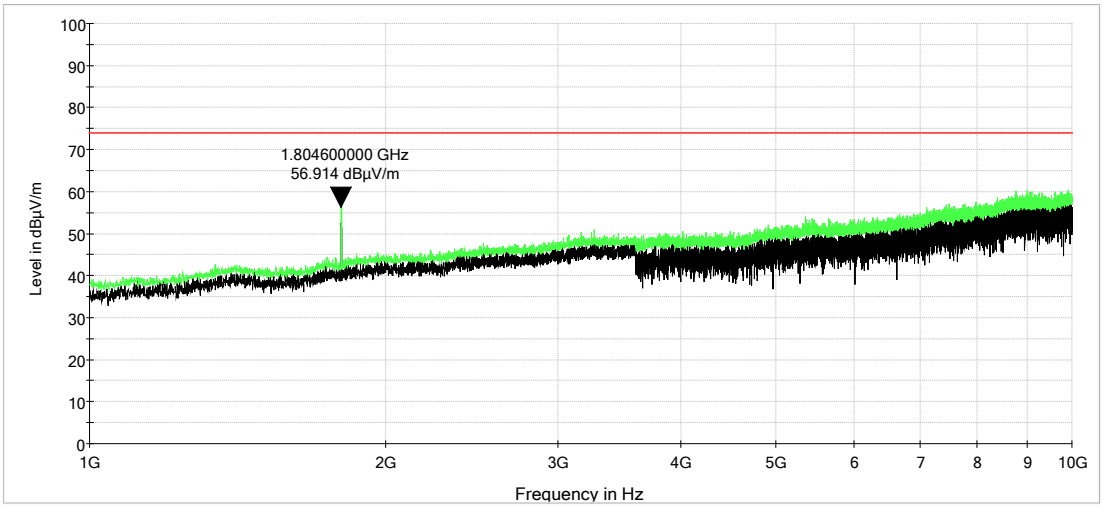
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
1805.150000	58.4	54.9	1000.0	1000.000	161.0	H	41.0	5.1	20.8	75.7	-30 dBc
1805.150000	60.6	56.8	1000.0	1000.000	150.0	V	123.0	5.1	18.9	75.7	-30 dBc
2707.725000	47.0	33.5	1000.0	1000.000	150.0	H	168.0	9.0	20.5	54.0	restricted
2707.725000	46.7	33.5	1000.0	1000.000	150.0	V	178.0	9.0	20.5	54.0	restricted



DTS Dipole Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical



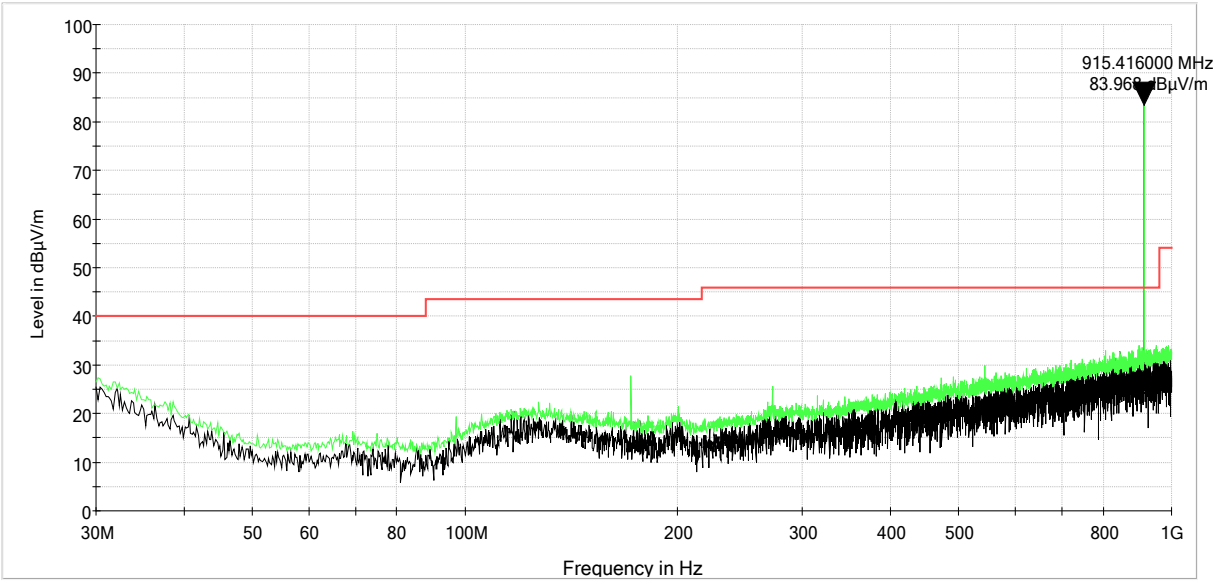
DTS Dipole, Radiated Spurious Emissions: 1 GHz to 10 GHz - Horizontal



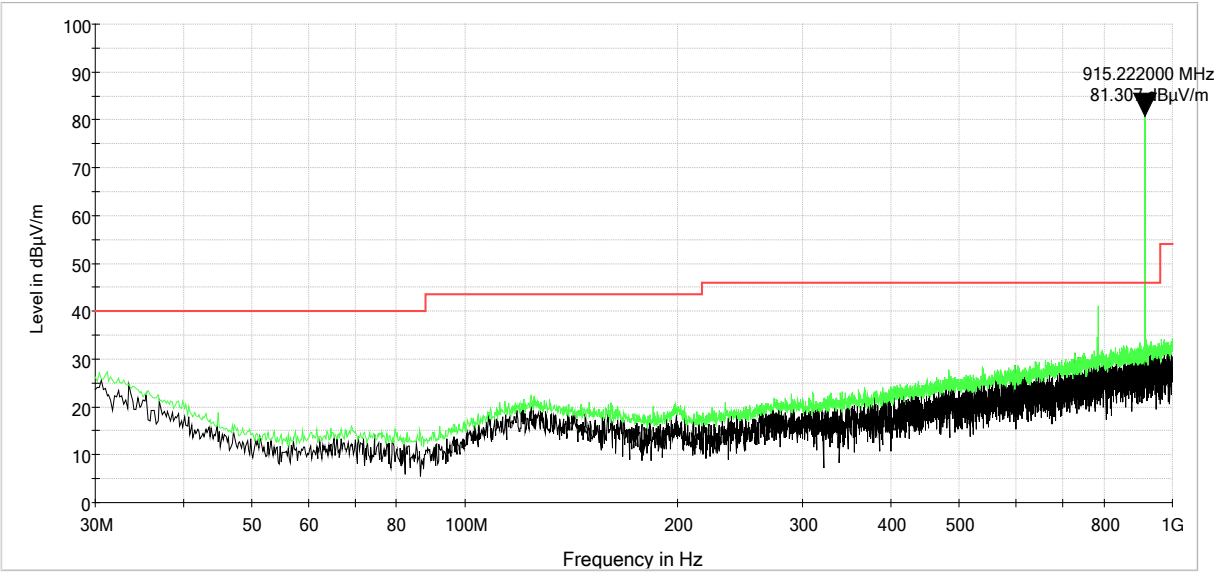
DTS Puck, Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
31.940000	21.4	120.000	100.0	V	0.0	-20.5	18.6	40.0
39.890000	15.6	120.000	100.0	H	0.0	-26.4	24.4	40.0
69.380000	10.2	120.000	100.0	V	0.0	-31.6	29.8	40.0
96.930000	11.7	120.000	100.0	V	314.0	-30.4	31.8	43.5
123.900000	17.1	120.000	100.0	H	160.0	-25.5	26.4	43.5
160.950000	19.2	120.000	100.0	H	349.0	-26.9	24.3	43.5
171.620000	15.2	120.000	100.0	V	129.0	-27.6	28.3	43.5
197.420000	15.5	120.000	100.0	H	239.0	-26.4	28.0	43.5
200.140000	15.8	120.000	100.0	V	0.0	-26.1	27.7	43.5
272.110000	16.7	120.000	100.0	V	262.0	-25.2	29.3	46.0
399.380000	19.3	120.000	100.0	H	32.0	-22.7	26.7	46.0
543.520000	22.6	120.000	100.0	V	30.0	-20.0	23.4	46.0
785.050000	27.9	120.000	100.0	H	308.0	-15.8	18.1	46.0

DTS Puck, Characterization Scan, 30 MHz to 1000 MHz – Vertical

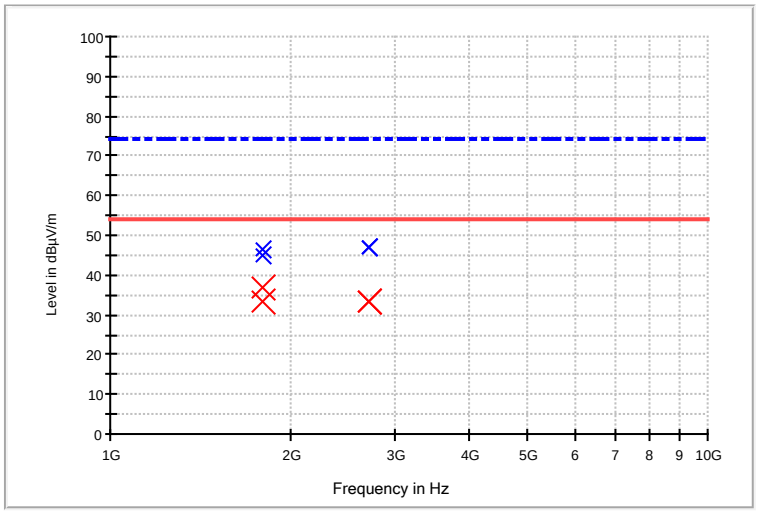


DTS Puck, Characterization Scan, 30 MHz to 1000 MHz – Horizontal

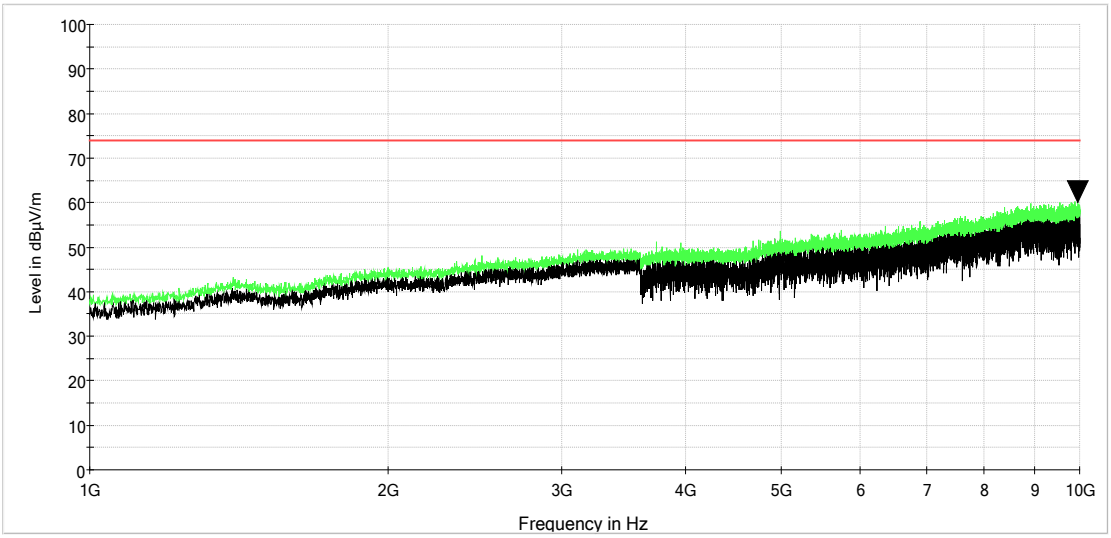


DTS Puck, Measurements: Greater Than 1 GHz

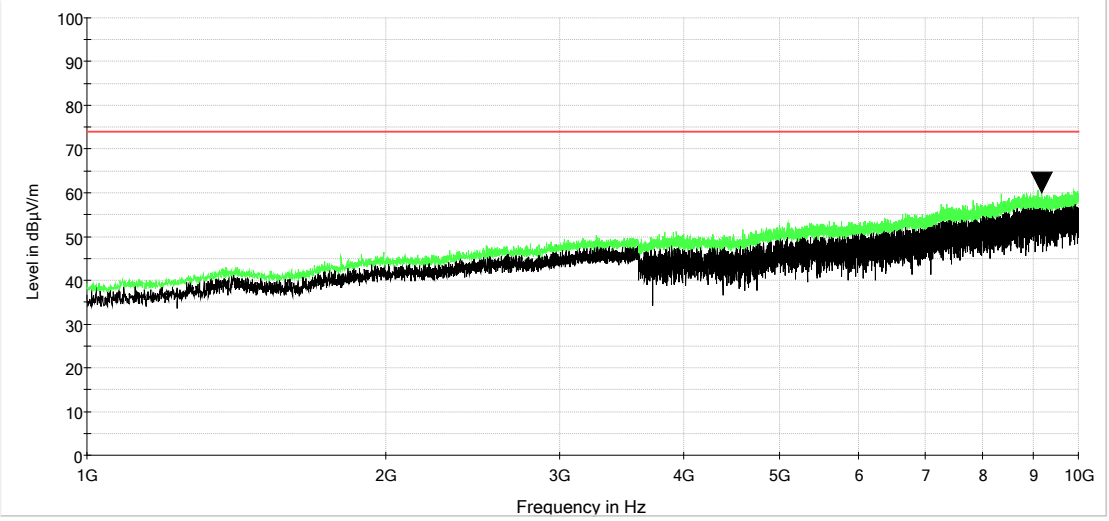
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
1805.150000	44.9	33.4	1000.0	1000.000	173.0	H	78.0	5.1	42.2	75.6	-30 dBc
1805.150000	46.6	36.7	1000.0	1000.000	150.0	V	212.0	5.1	38.9	75.6	-30 dBc
2707.725000	47.2	33.5	1000.0	1000.000	150.0	H	324.0	9.0	20.5	54.0	restricted
2707.725000	47.2	33.6	1000.0	1000.000	150.0	V	10.0	9.0	20.4	54.0	restricted



DTS Puck, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical



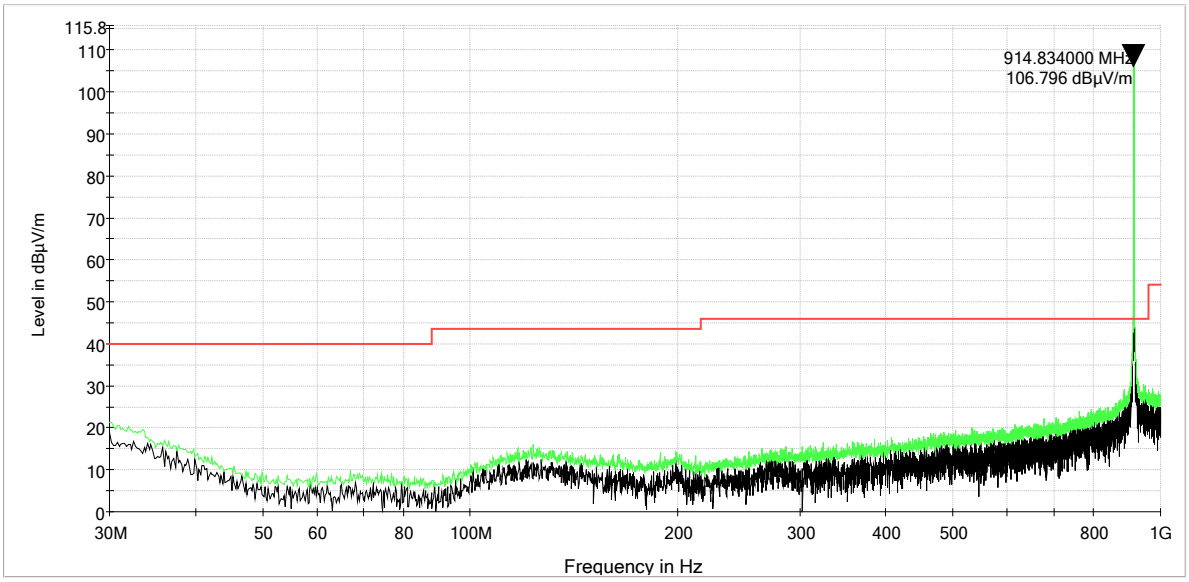
DTS Puck, Radiated Spurious Emissions: 1 GHz to 10 GHz - Horizontal



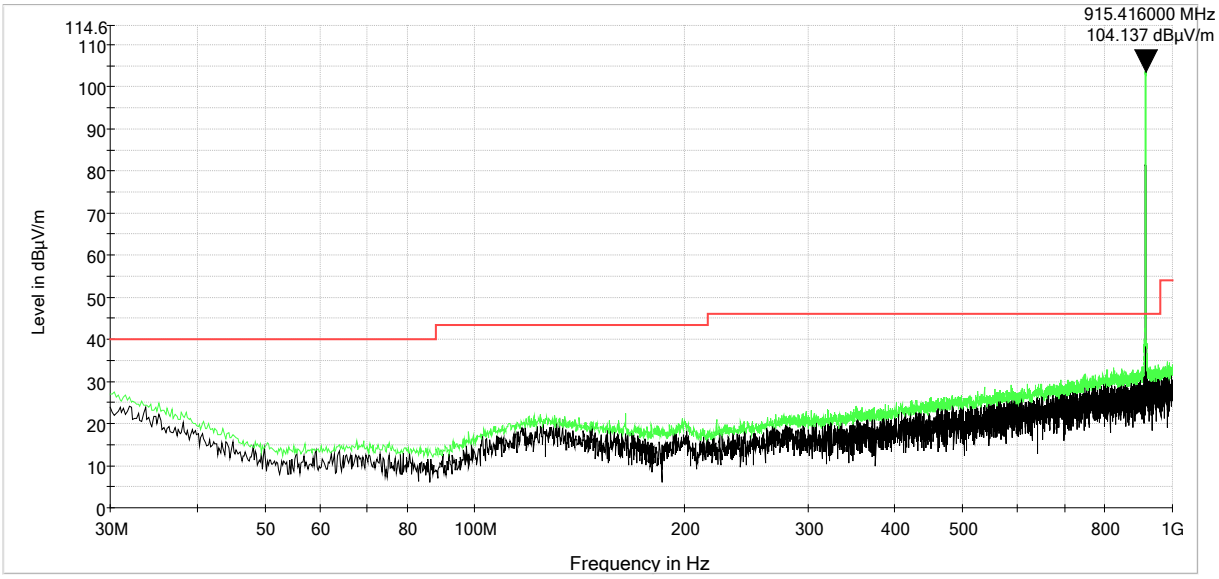
PCTEL Monopole (worst-case Monopole), Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
32.330000	20.9	120.000	145.0	H	0.0	-20.8	19.1	40.0
33.490000	12.0	120.000	100.0	V	0.0	-21.6	28.0	40.0
50.370000	9.6	120.000	145.0	H	0.0	-32.0	30.4	40.0
59.880000	0.9	120.000	100.0	V	0.0	-32.4	39.1	40.0
80.250000	9.4	120.000	145.0	H	0.0	-32.0	30.6	40.0
121.570000	15.9	120.000	145.0	H	0.0	-25.6	27.6	43.5
122.340000	7.3	120.000	100.0	V	0.0	-25.6	36.2	43.5
164.050000	5.4	120.000	100.0	V	0.0	-27.0	38.1	43.5
164.440000	17.3	120.000	145.0	H	0.0	-27.1	26.2	43.5
198.200000	15.5	120.000	145.0	H	0.0	-26.3	28.0	43.5
201.110000	6.5	120.000	100.0	V	0.0	-26.2	37.0	43.5
303.730000	17.0	120.000	145.0	H	0.0	-24.9	29.0	46.0
402.670000	9.1	120.000	100.0	V	0.0	-22.5	36.9	46.0
589.300000	23.2	120.000	145.0	H	0.0	-19.5	22.8	46.0
806.970000	26.1	120.000	145.0	H	0.0	-15.3	19.9	46.0
984.090000	28.6	120.000	145.0	H	0.0	-11.6	25.4	54.0

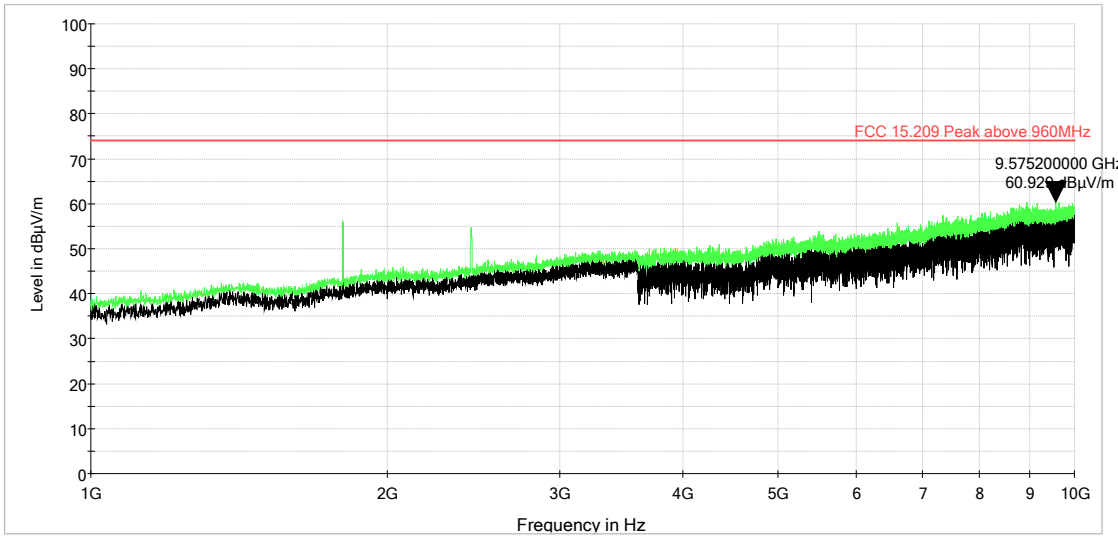
PCTEL Monopole (worst-case Monopole), Characterization Scan, 30 MHz to 1000 MHz – Vertical



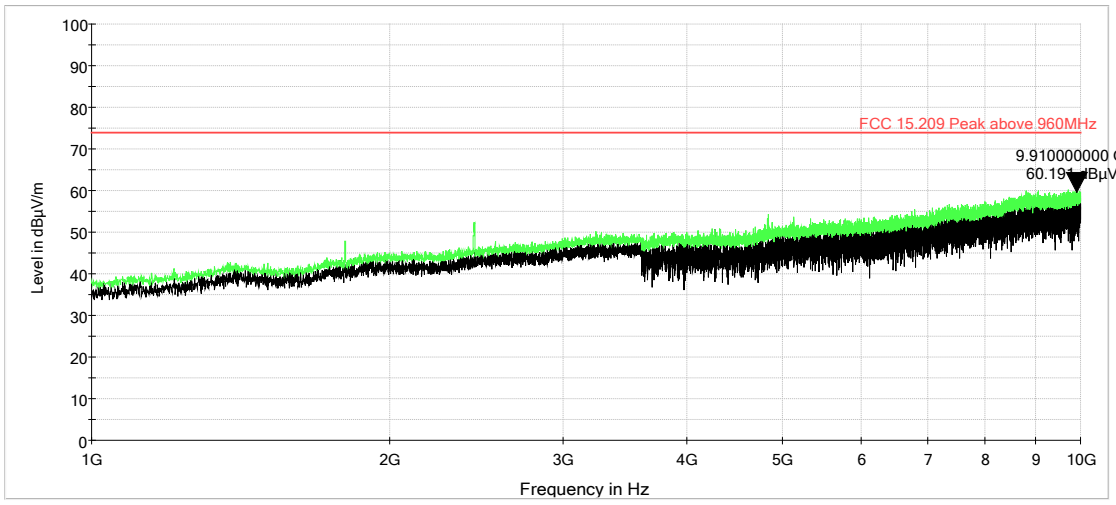
PCTEL Monopole (worst-case Monopole), Characterization Scan, 30 MHz to 1000 MHz – Horizontal



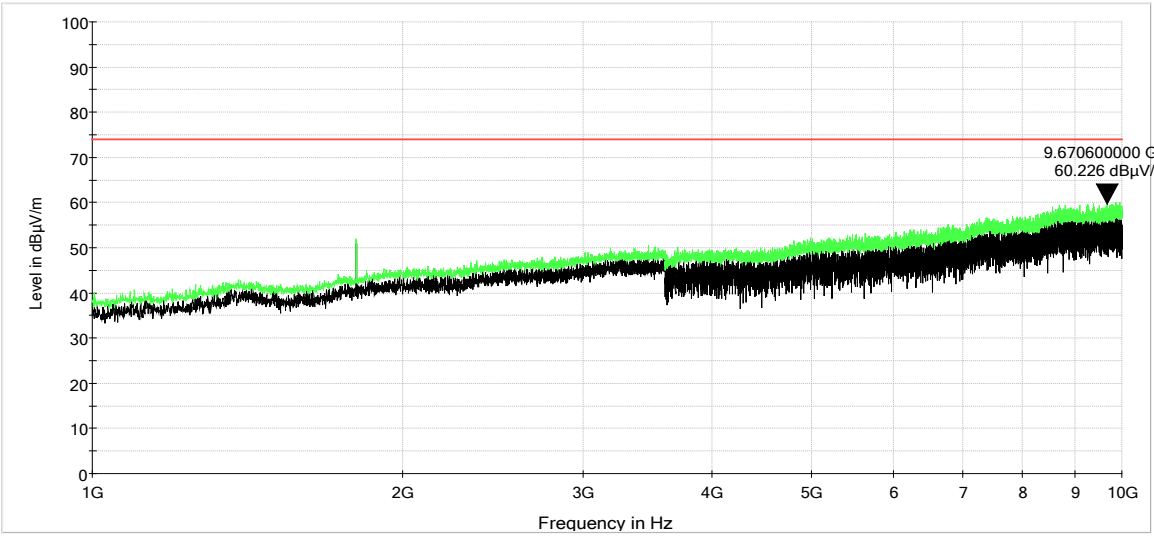
Linx Monopole, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical



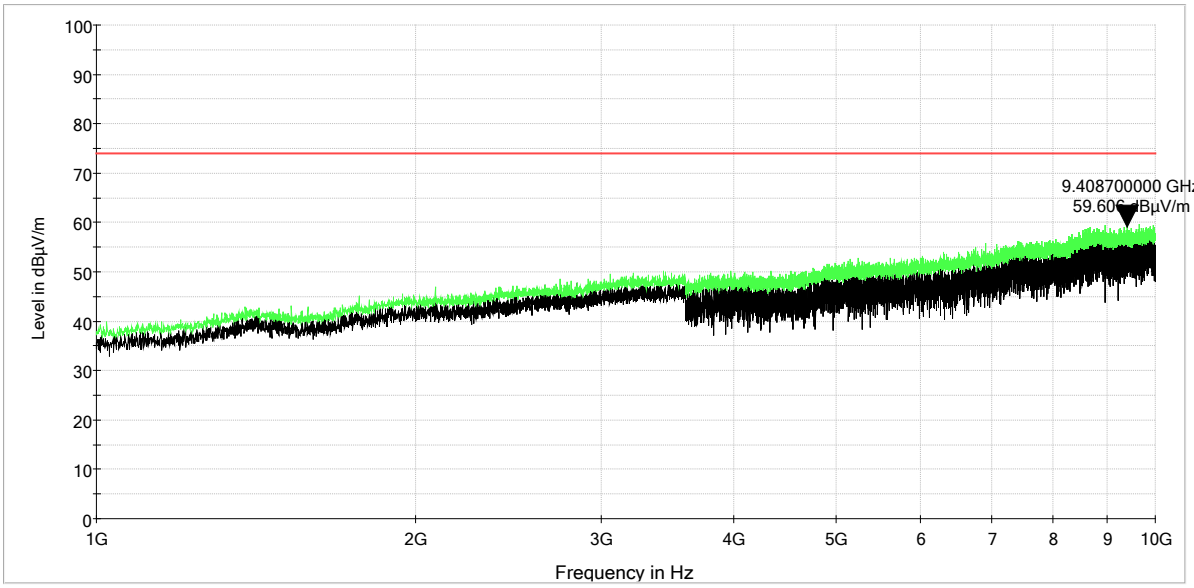
Linx Monopole, Radiated Spurious Emissions: 1 GHz to 10 GHz - Horizontal



PCTel Monopole, Radiated Spurious Emissions: 1 GHz to 10 GHz - Vertical



PCTel Monopole, Radiated Spurious Emissions: 1 GHz to 10 GHz - Horizontal



PCTel Monopole (worst-case Monopole), 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)	Comment
1805.150000	48.7	40.8	1000.0	1000.000	155.0	H	0.0	5.1	34.9	85.7	-30 dBc
1805.150000	55.9	52.1	1000.0	1000.000	155.0	V	355.0	5.1	23.6	85.7	-30 dBc
2707.725000	47.5	33.6	1000.0	1000.000	150.0	H	0.0	9.0	20.4	54.0	restricted
2707.725000	47.1	33.6	1000.0	1000.000	155.0	V	2.0	9.0	20.4	54.0	restricted
4834.900000	55.1	41.3	1000.0	1000.000	150.0	H	50.0	13.6	12.7	54.0	restricted
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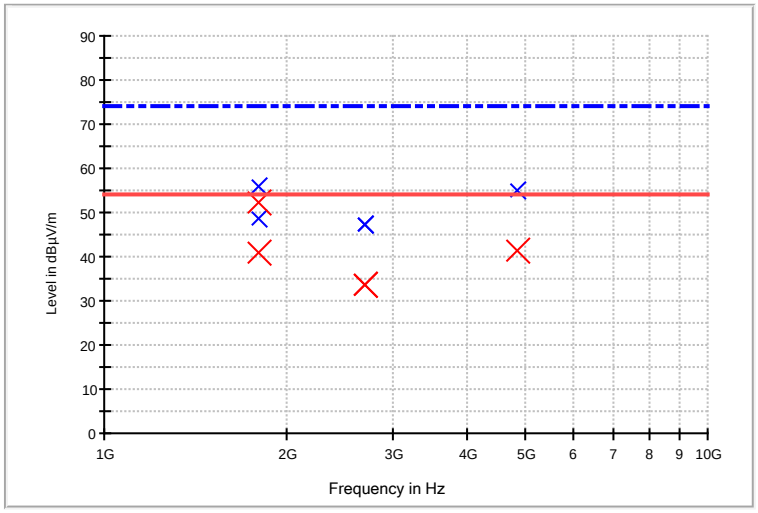
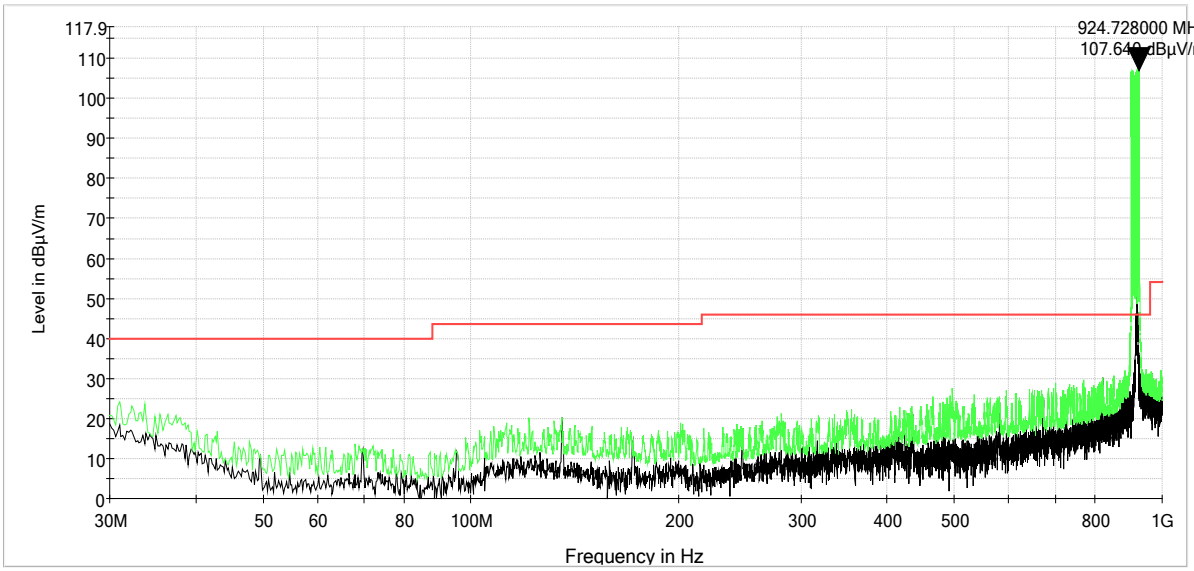


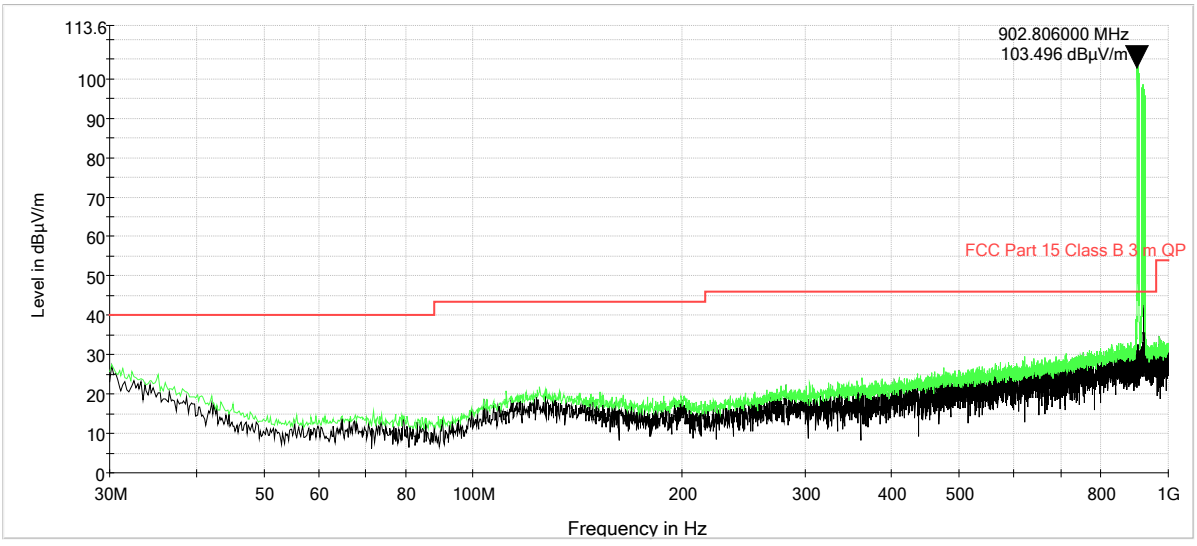
FHSS Dipole, Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.970000	16.5	120.000	100.0	V	237.0	-19.9	23.5	40.0
35.240000	18.6	120.000	100.0	H	0.0	-22.9	21.4	40.0
50.560000	9.5	120.000	100.0	H	0.0	-32.1	30.5	40.0
71.900000	9.8	120.000	100.0	H	0.0	-31.5	30.2	40.0
111.670000	14.8	120.000	100.0	H	0.0	-26.7	28.7	43.5
121.370000	11.1	120.000	100.0	V	303.0	-25.6	32.4	43.5
199.360000	15.3	120.000	100.0	H	0.0	-26.1	28.2	43.5
200.910000	10.9	120.000	100.0	V	207.0	-26.2	32.6	43.5
304.900000	17.2	120.000	100.0	H	0.0	-24.9	28.8	46.0
417.220000	14.9	120.000	100.0	V	4.0	-22.0	31.1	46.0
497.350000	16.6	120.000	100.0	V	205.0	-20.7	29.4	46.0
500.450000	20.9	120.000	100.0	H	0.0	-20.7	25.1	46.0
713.660000	25.0	120.000	100.0	H	0.0	-17.3	21.0	46.0
849.650000	22.1	120.000	100.0	V	204.0	-14.7	23.9	46.0
855.280000	27.9	120.000	100.0	H	0.0	-14.6	18.1	46.0
971.870000	28.3	120.000	100.0	H	0.0	-11.9	25.7	54.0
996.700000	24.1	120.000	100.0	V	230.0	-11.3	29.9	54.0

FHSS Dipole, Characterization Scan, 30 MHz to 1000 MHz – Vertical



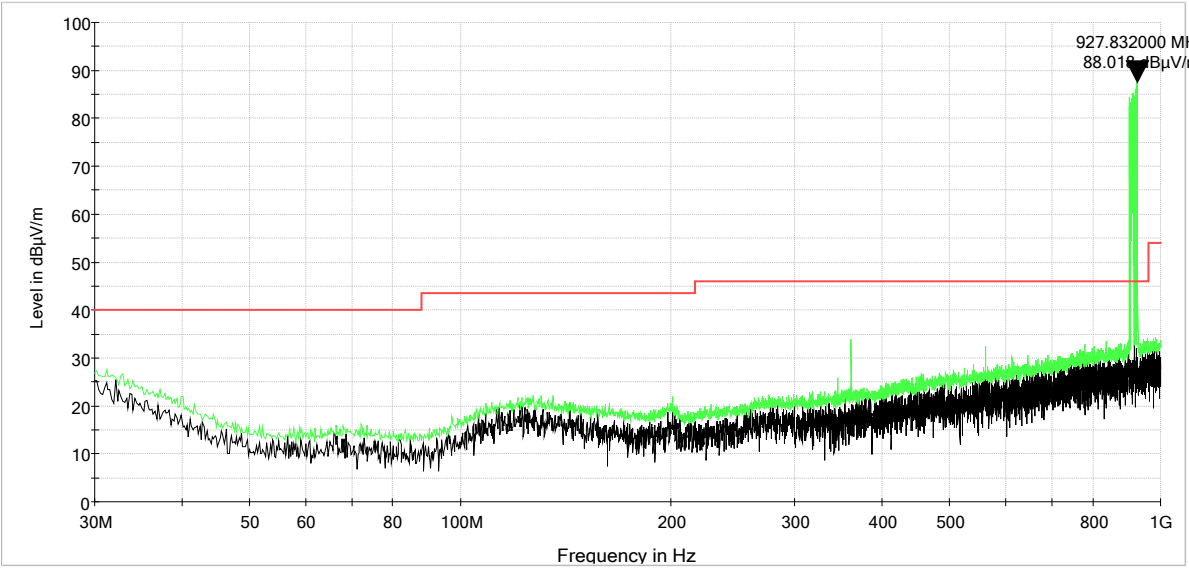
FHSS Dipole, Characterization Scan, 30 MHz to 1000 MHz – Horizontal



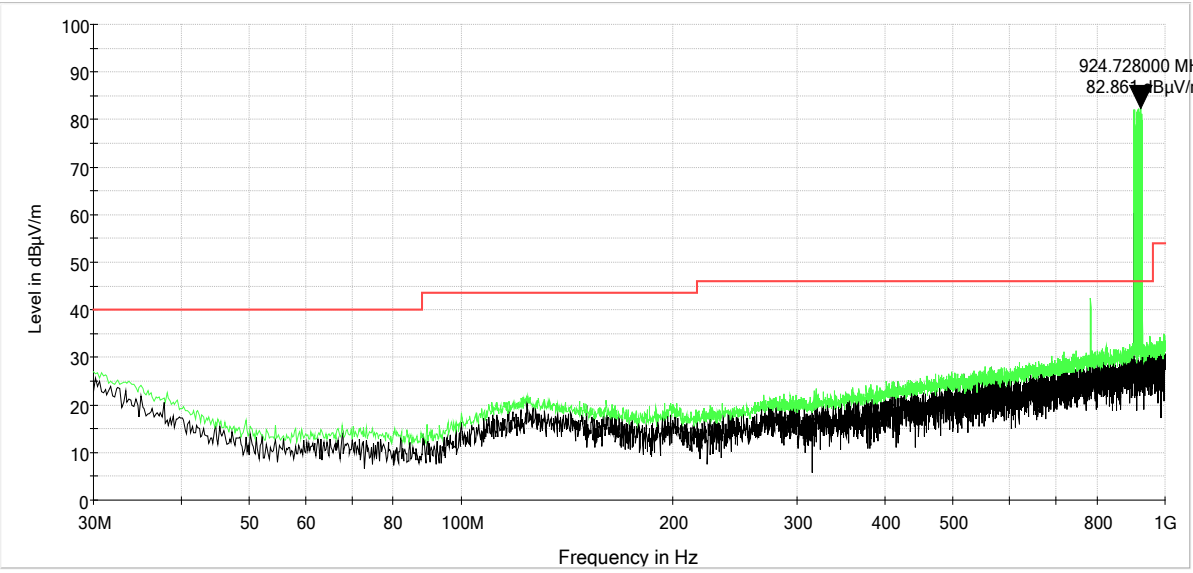
FHSS Puck, Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.780000	22.1	120.000	100.0	H	359.0	-19.7	17.9	40.0
32.910000	20.8	120.000	100.0	V	358.0	-21.2	19.2	40.0
49.400000	10.2	120.000	100.0	H	359.0	-31.7	29.8	40.0
89.360000	9.7	120.000	100.0	H	359.0	-32.3	33.8	43.5
123.900000	17.0	120.000	100.0	H	359.0	-25.5	26.5	43.5
124.670000	16.6	120.000	100.0	V	185.0	-25.5	26.9	43.5
200.720000	15.7	120.000	100.0	V	38.0	-26.1	27.8	43.5
319.060000	17.4	120.000	100.0	H	359.0	-24.5	28.6	46.0
361.550000	18.7	120.000	100.0	V	296.0	-23.4	27.3	46.0
561.750000	23.2	120.000	100.0	V	168.0	-19.7	22.8	46.0
784.080000	35.7	120.000	100.0	H	346.0	-15.8	10.3	46.0

FHSS Puck, Characterization Scan, 30 MHz to 1000 MHz – Vertical



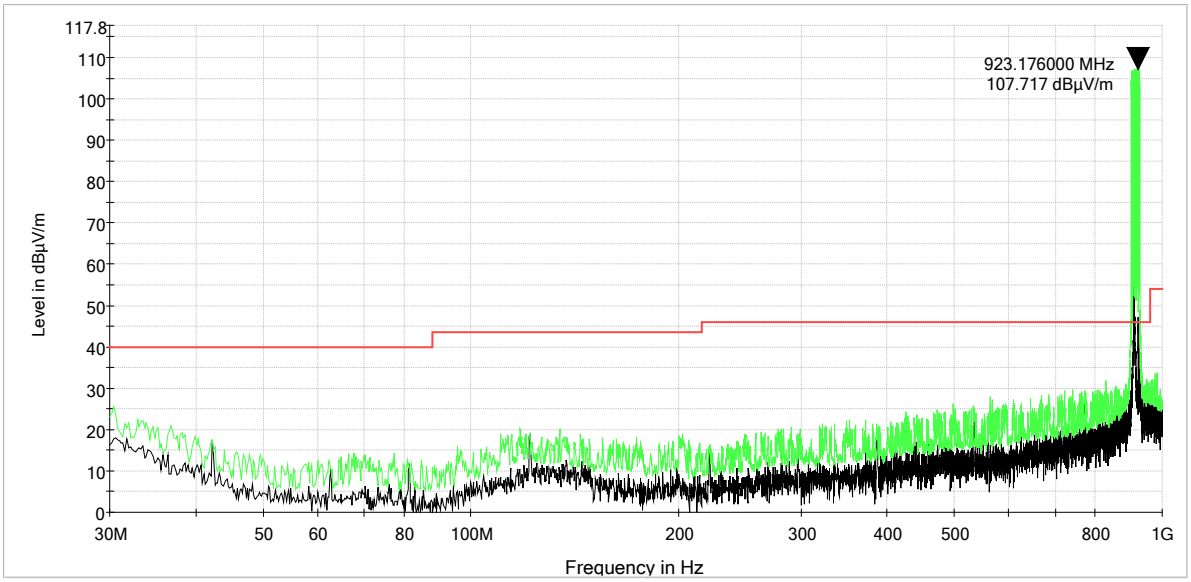
FHSS Puck, Characterization Scan, 30 MHz to 1000 MHz – Horizontal



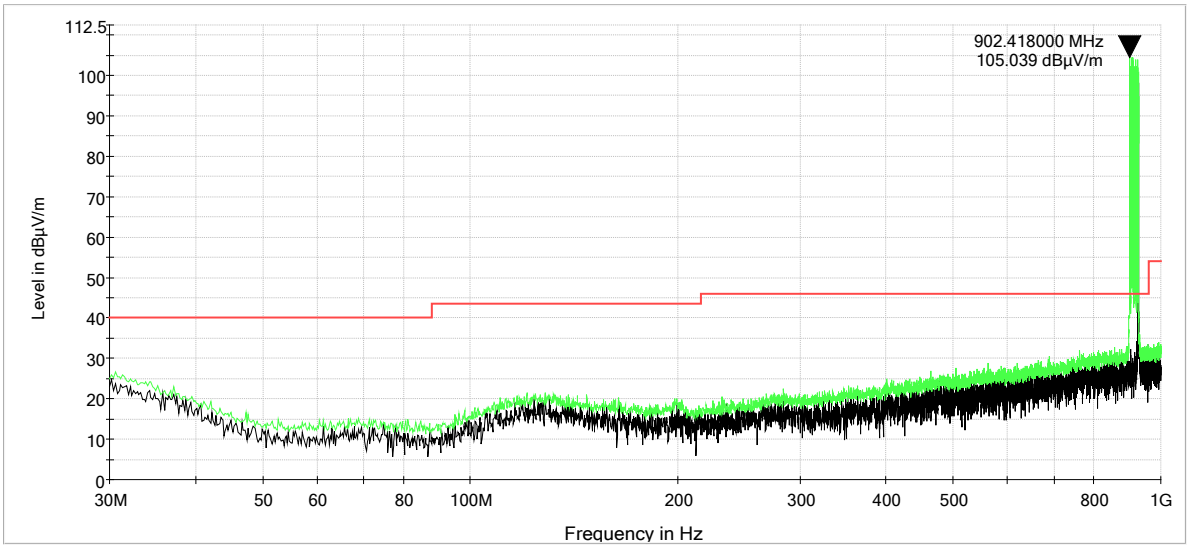
FHSS PCTel Monopole (worst-case Monopole), Measurements: 30 MHz to 1000 MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)
30.390000	17.1	120.000	100.0	V	0.0	-19.4	22.9	40.0
37.180000	17.3	120.000	100.0	H	4.0	-24.4	22.7	40.0
52.700000	9.1	120.000	100.0	H	4.0	-32.5	30.9	40.0
67.640000	5.1	120.000	100.0	V	0.0	-31.7	34.9	40.0
80.630000	9.4	120.000	100.0	H	4.0	-32.1	30.6	40.0
117.690000	12.4	120.000	100.0	V	48.0	-26.0	31.1	43.5
132.820000	15.6	120.000	100.0	H	4.0	-25.7	27.9	43.5
197.420000	15.2	120.000	100.0	H	4.0	-26.4	28.3	43.5
202.080000	10.5	120.000	100.0	V	254.0	-26.6	33.0	43.5
284.330000	16.5	120.000	100.0	H	4.0	-25.2	29.5	46.0
325.660000	12.6	120.000	100.0	V	339.0	-24.4	33.4	46.0
401.320000	19.1	120.000	100.0	H	4.0	-22.6	26.9	46.0
563.110000	18.2	120.000	100.0	V	110.0	-19.7	27.8	46.0
690.380000	24.9	120.000	100.0	H	4.0	-17.8	21.1	46.0
723.360000	20.2	120.000	100.0	V	100.0	-17.1	25.8	46.0
766.620000	26.0	120.000	100.0	H	4.0	-16.3	20.0	46.0
828.120000	22.3	120.000	100.0	V	140.0	-14.9	23.7	46.0
982.930000	24.1	120.000	100.0	V	315.0	-11.8	29.9	54.0
986.030000	28.5	120.000	100.0	H	4.0	-11.6	25.5	54.0

FHSS PCTel Monopole (worst-case Monopole), Characterization Scan, 30 MHz to 1000 MHz – Vertical



FHSS PCTel Monopole (worst-case Monopole), Characterization Scan, 30 MHz to 1000 MHz – Horizontal



11 PEAK POWER SPECTRAL DENSITY (PSD)

Peak power spectral density measurements were performed.

11.1 Requirements:

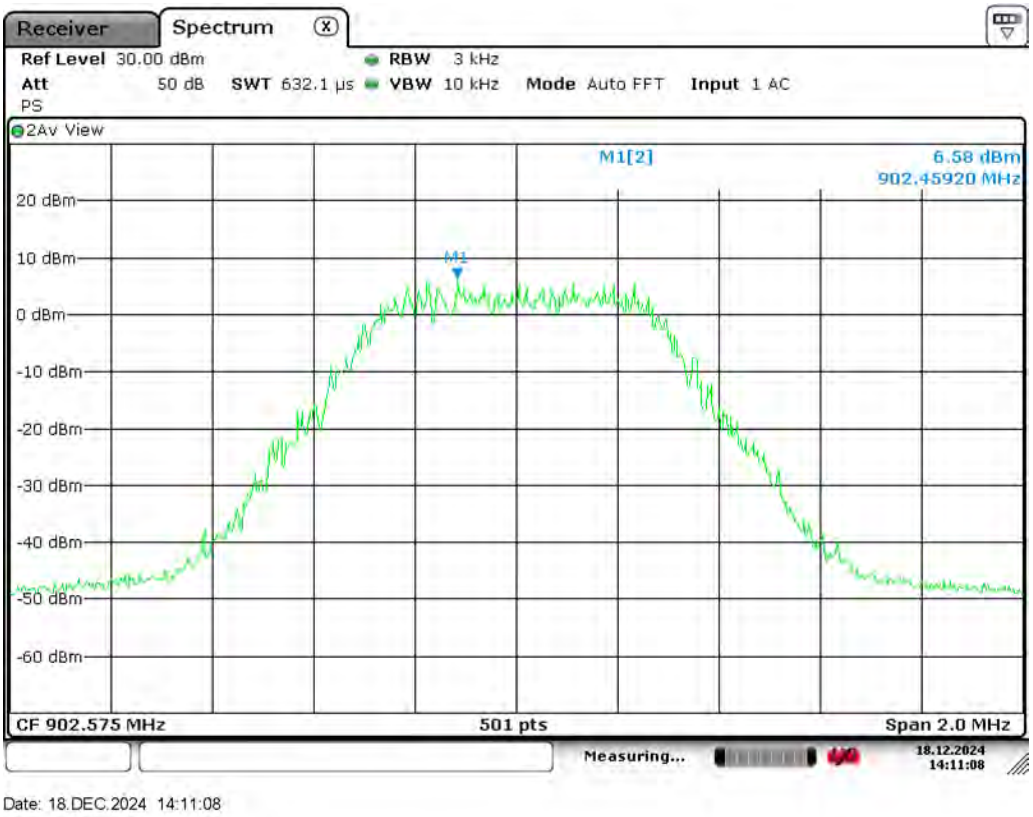
The peak power spectral density shall not exceed +8dBm in any 3 kHz band during any time interval of continuous transmission.

Power spectral density measurements were performed with an Average detector at a resolution bandwidth of 3 kHz (video bandwidth set at 10kHz). The peak spectral densities were measured at the low, mid, and upper channels.

11.2 Peak Power Spectral Density Test Data

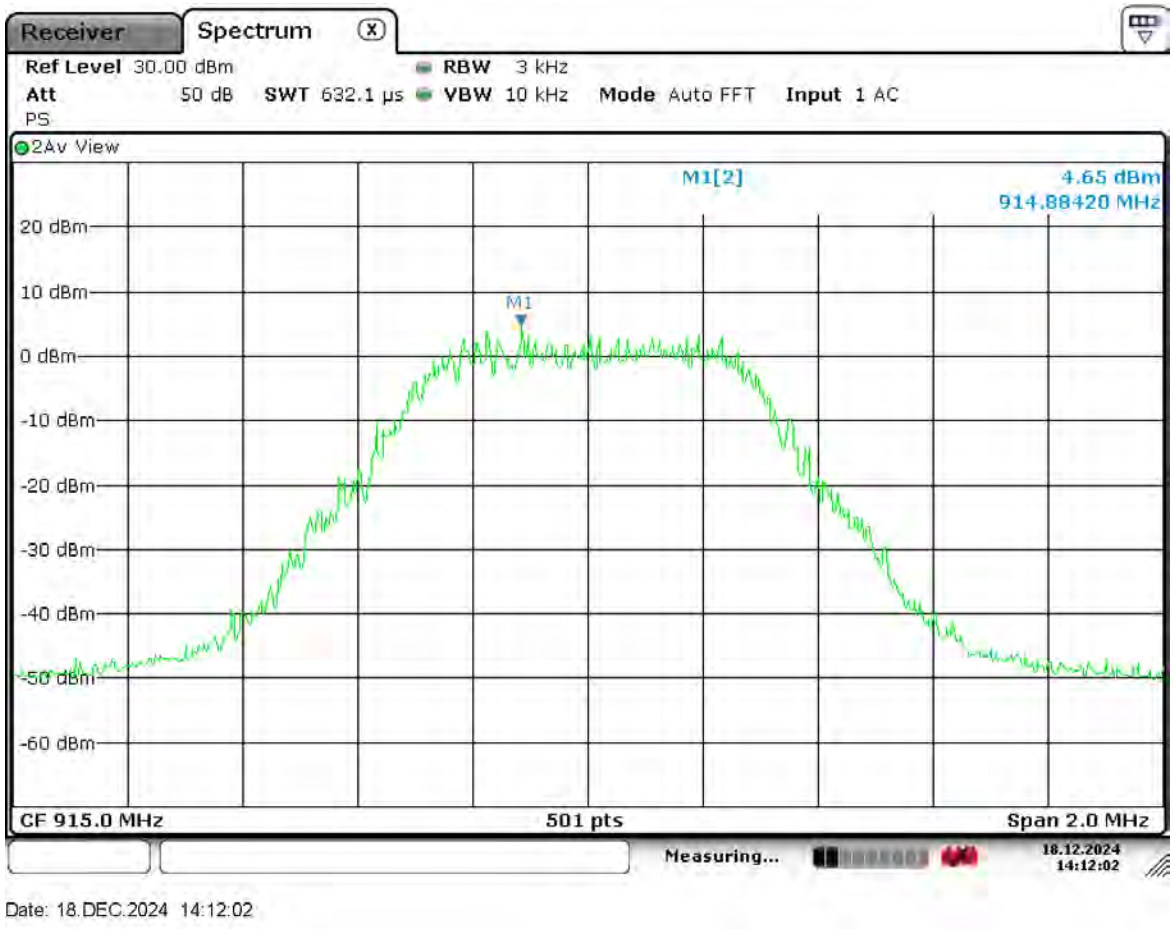
Test Date(s):	2024-12-18	**Test Engineer:**	J. Chiller
Standards:	CFR 47 Part 15.247(e); KDB558074	**Air Temperature:**	21.2ºC
		Relative Humidity:	38%

DTS, Low Channel

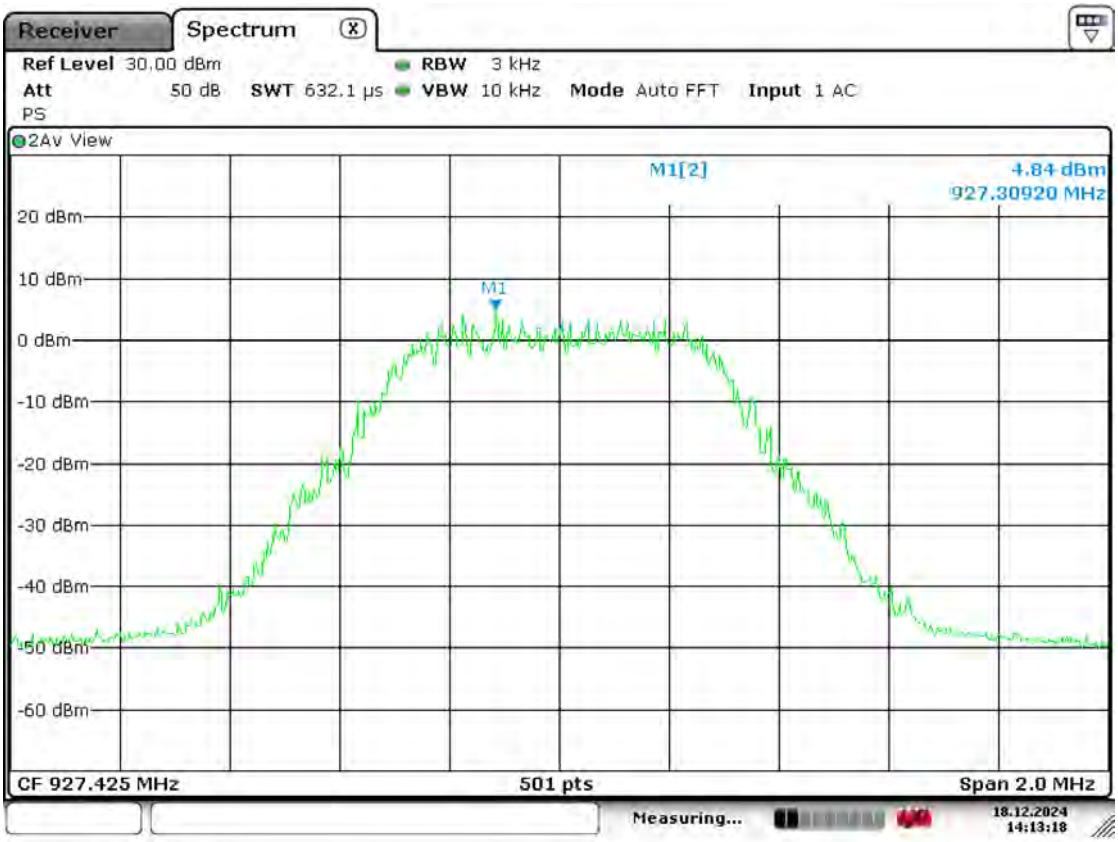


Date: 18.DEC.2024 14:11:08

DTS, Mid Channel



DTS, High Channel



Date: 18.DEC.2024 14:13:18

12 FREQUENCY SEPARATION

EUT was directly connected to the analyzer with the Hopping function on.

12.1 Requirements:

Frequency separation must be greater than 25kHz or 20dB bandwidth of the Hopping Channel, whichever is greater.

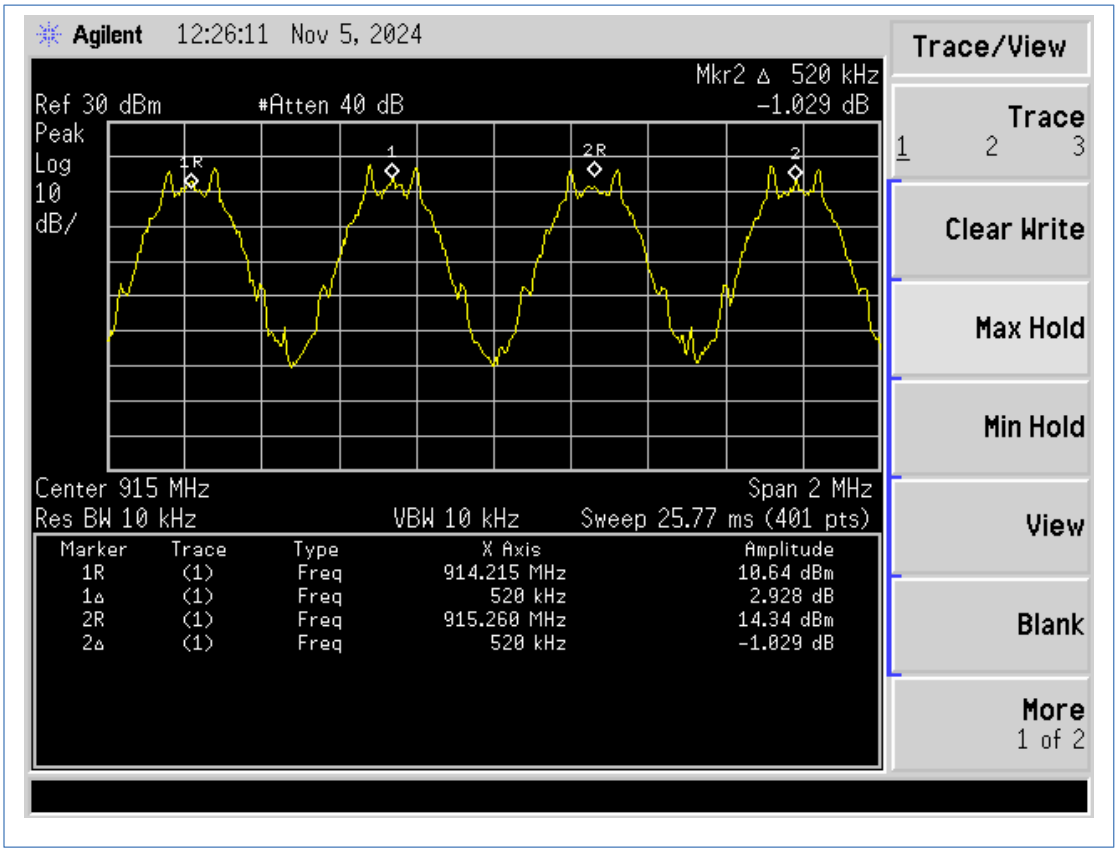
12.2 Frequency Separation Test Data

Test Date(s):	2024-11-05	Test Engineer:	J. Chiller
Standard(s):	FCC Part 15.247 (a)(1)	Air Temperature:	21.3ºC
		Relative Humidity:	36%
Results:	Complies		

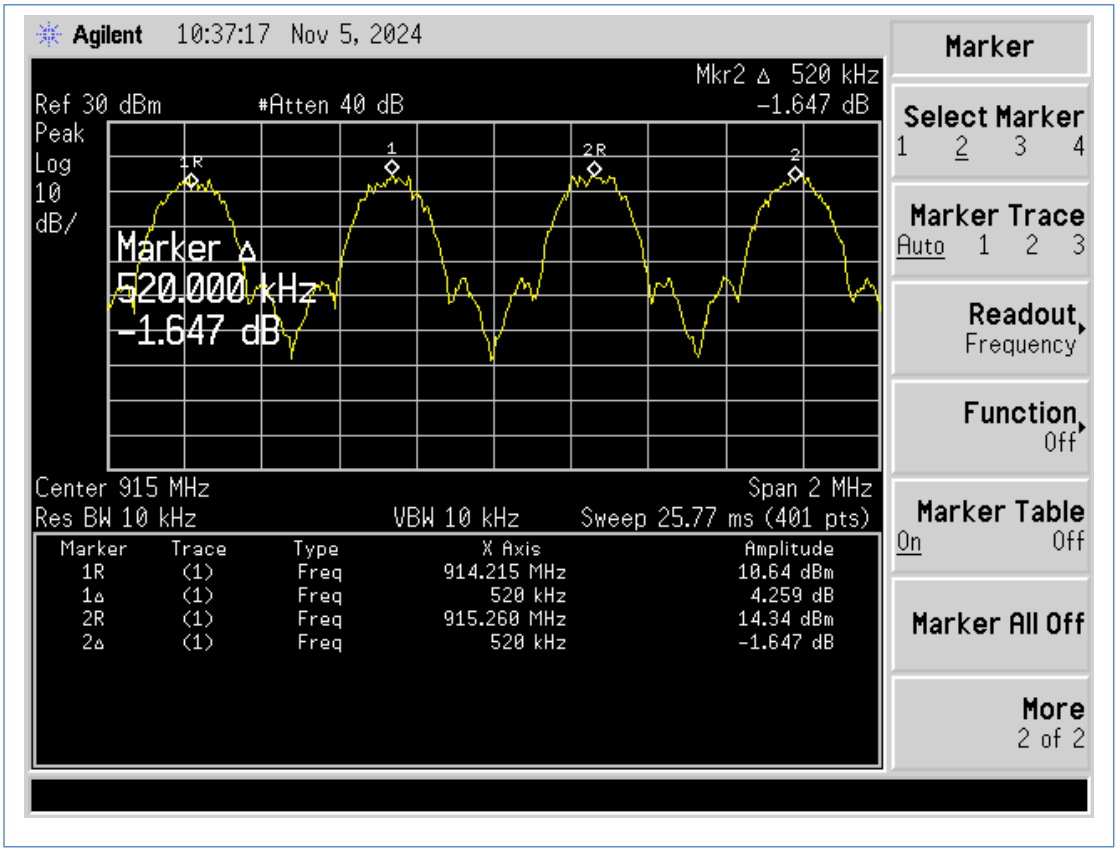
Limit: >214kHz OBW

Verified all modulations had the frequency separation claimed by manufacturer. All modulations had 520kHz separation.

120kHz



200kHz


Agilent 10:37:17 Nov 5, 2024
Mkr2 Δ 520 kHz
Ref 30 dBm #Atten 40 dB -1.647 dB
Peak
Log
10
dB/
1R
1
2R
2
Marker Δ
520.000 kHz
-1.647 dB
Center 915 MHz Span 2 MHz
Res BW 10 kHz VBW 10 kHz Sweep 25.77 ms (401 pts)
Marker Trace Type X Axis Amplitude
1R (1) Freq 914.215 MHz 10.64 dBm
1Δ (1) Freq 520 kHz 4.259 dB
2R (1) Freq 915.260 MHz 14.34 dBm
2Δ (1) Freq 520 kHz -1.647 dB
Marker
Select Marker
1 2 3 4
Marker Trace
Auto 1 2 3
Readout
Frequency
Function
Off
Marker Table
On Off
Marker All Off
More
2 of 2

13 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.

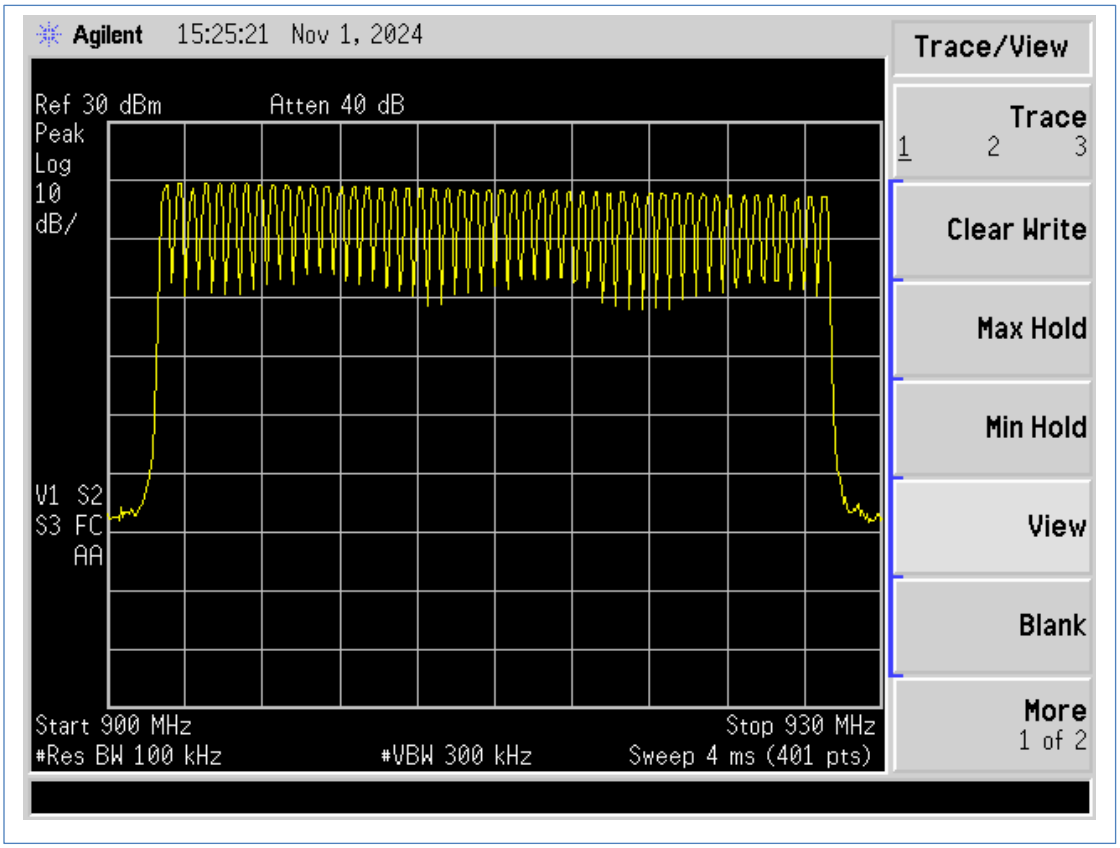
13.1 Requirements:

Verify that all 50 channels are present.

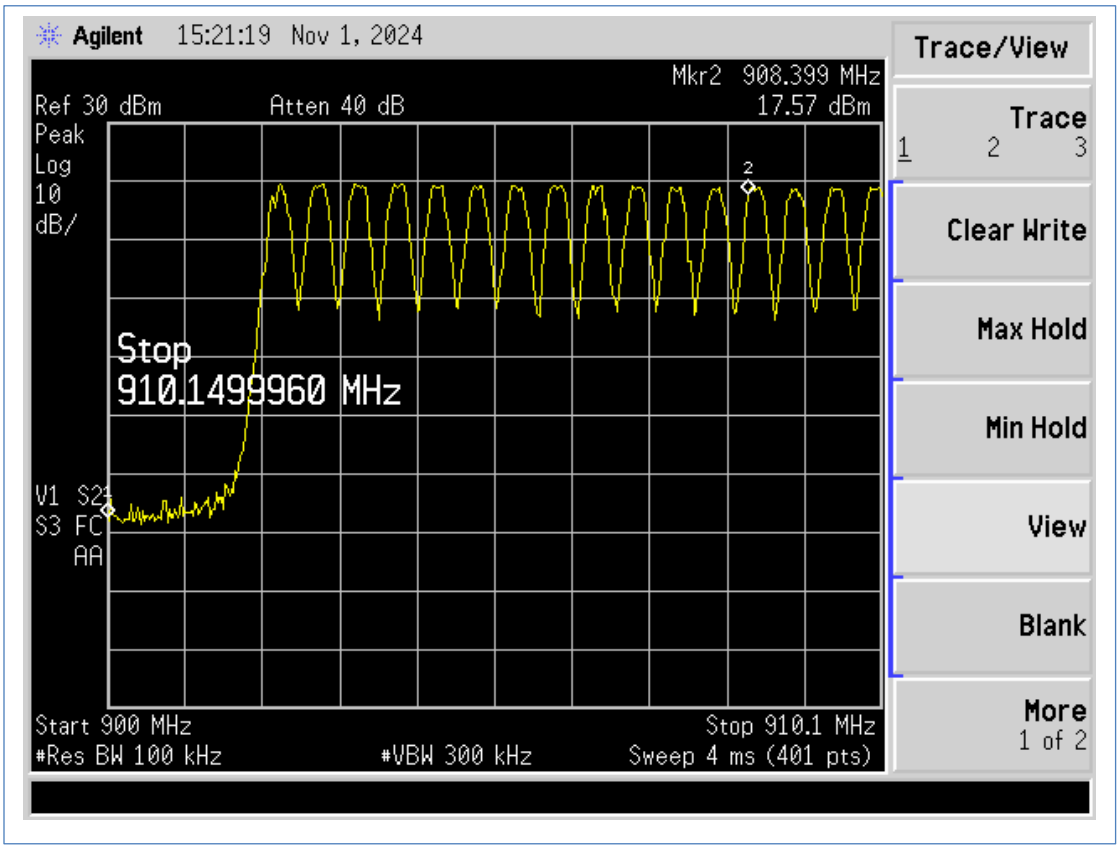
13.2 Number of Hopping Frequencies Test Data

Test Date(s):	2024-11-01	Test Engineer:	J. Chiller
Standard(s):	FCC Part 15.247 (a)(1)(i)	Air Temperature:	22.3ºC
		Relative Humidity:	33%

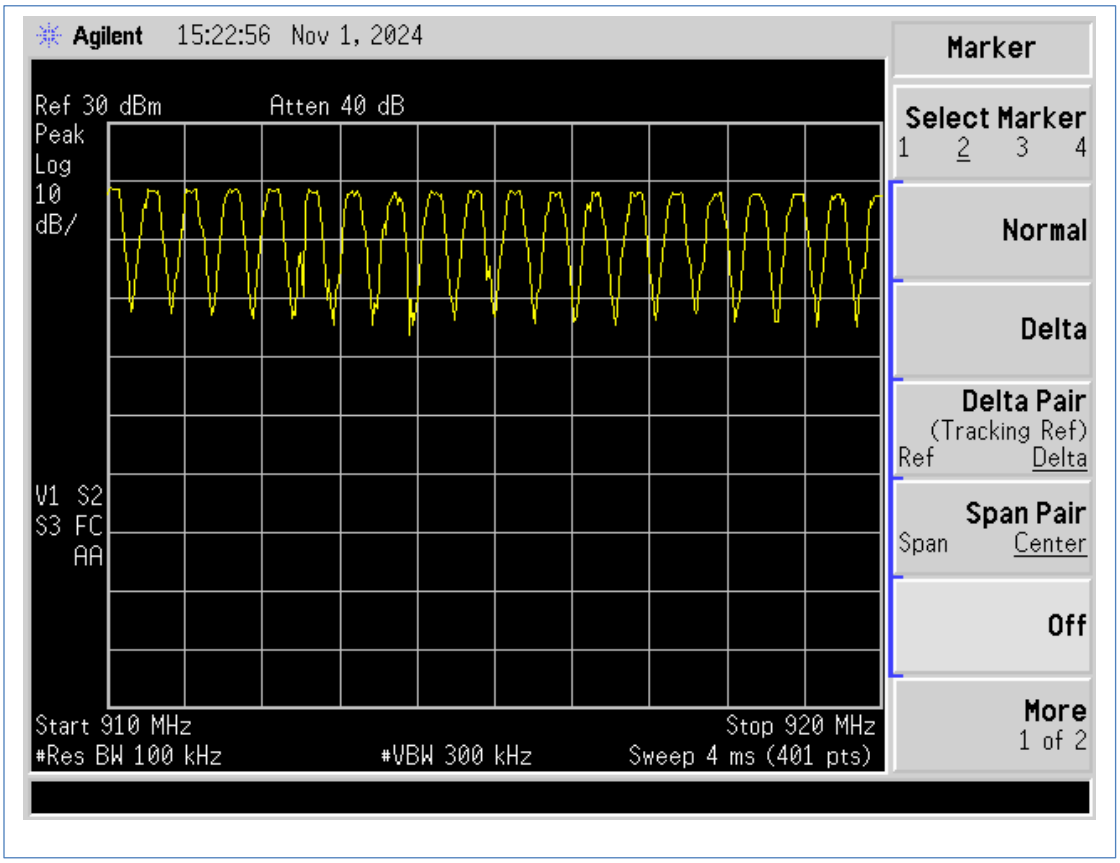
EUT showed 50 channels, confirming manufacturer's specifications.



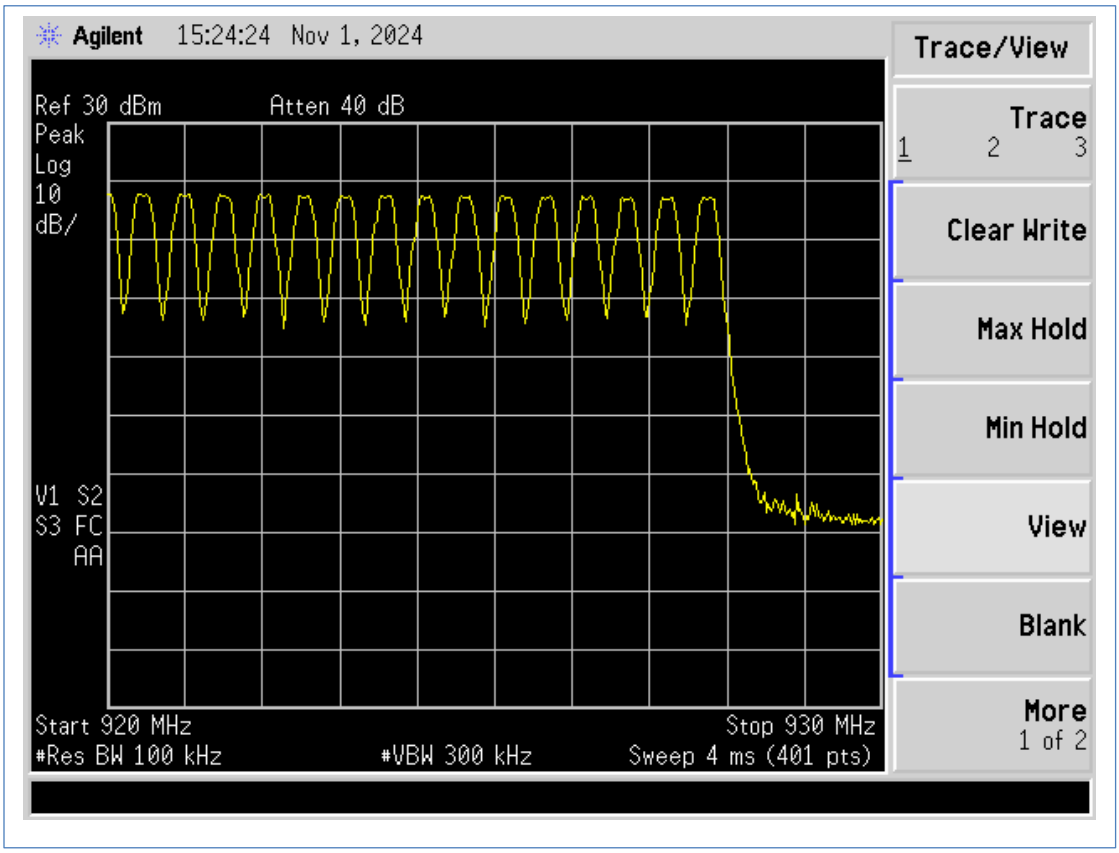
900 MHz to 910 MHz, 15 Channels



910 MHz to 920 MHz, 19 Channels



920 MHz to 930 MHz, 16 Channels



14 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.

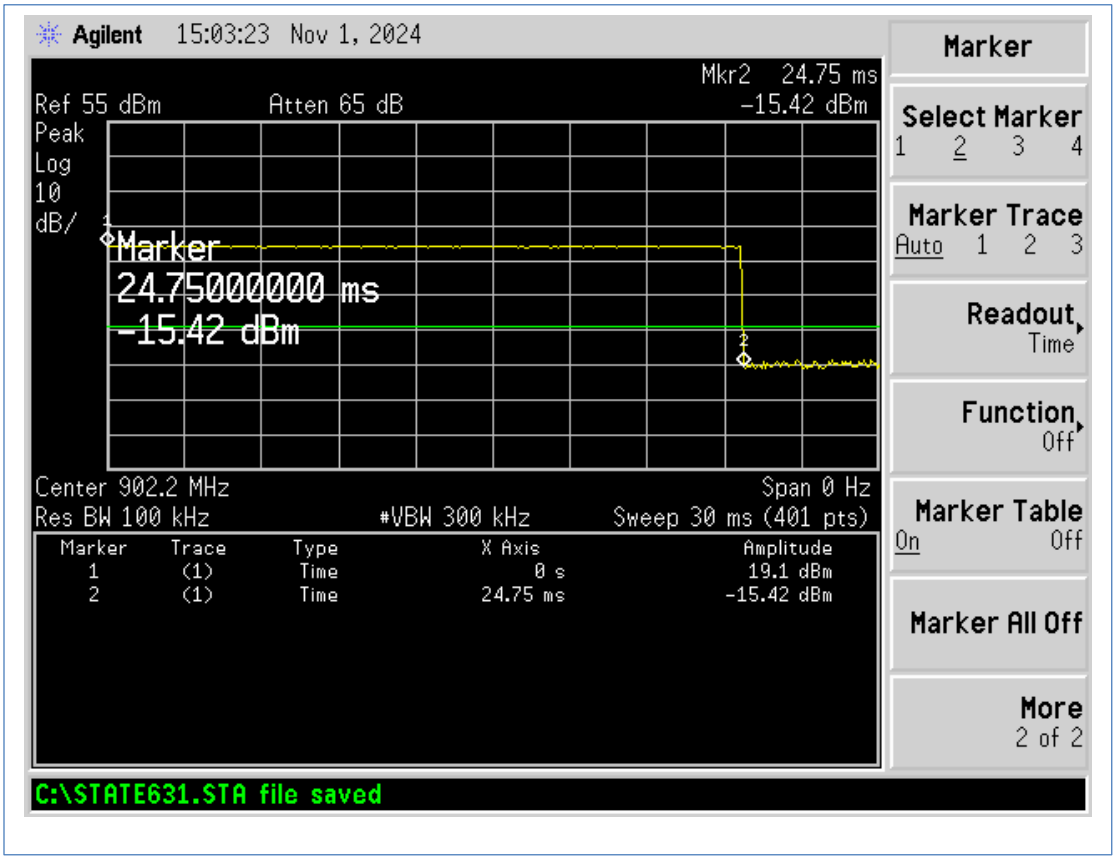
14.1 Requirements:

Limit of 400mS in a 20-second period.

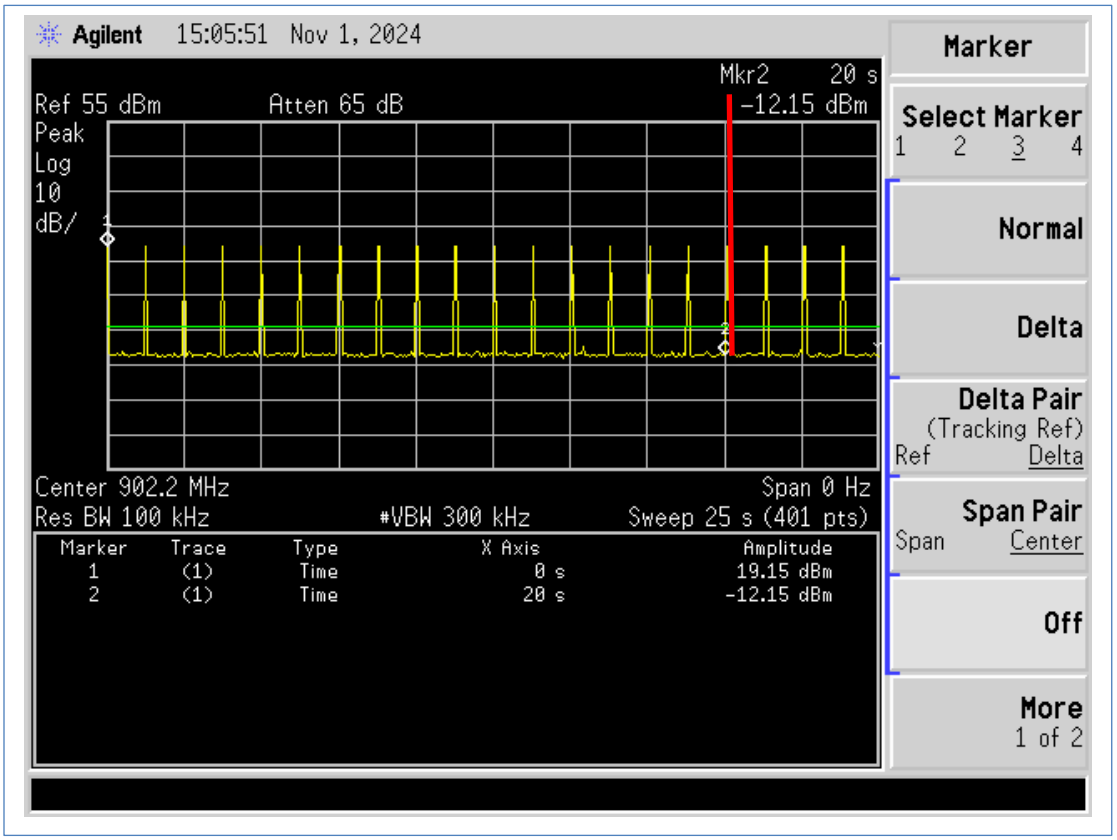
14.2 Dwell Time Test Data

Test Date(s):	2024-11-01	**Test Engineer:**	J. Chiller
Standard(s):	ANSI 63.10 7.8.4	**Air Temperature:**	22.3ºC
		Relative Humidity:	33%
Results:	Complies		

Length of Transmission



Number of Transmissions in 20 Seconds



Pulse Duration: 24.75mS
Pulses in 20s: 16

Limit: 400mS in 20-second period.
396mS on channel with 16 transmissions in 20 seconds.

15 VOLTAGE VARIATIONS

15.1 Requirements

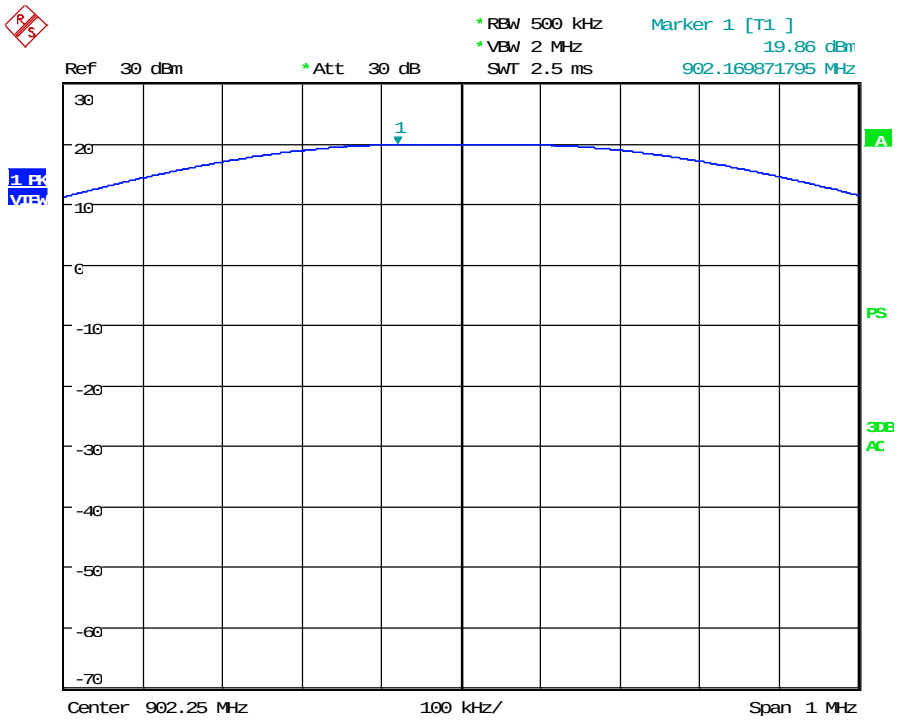
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated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

15.2 Voltage Variations Test Data

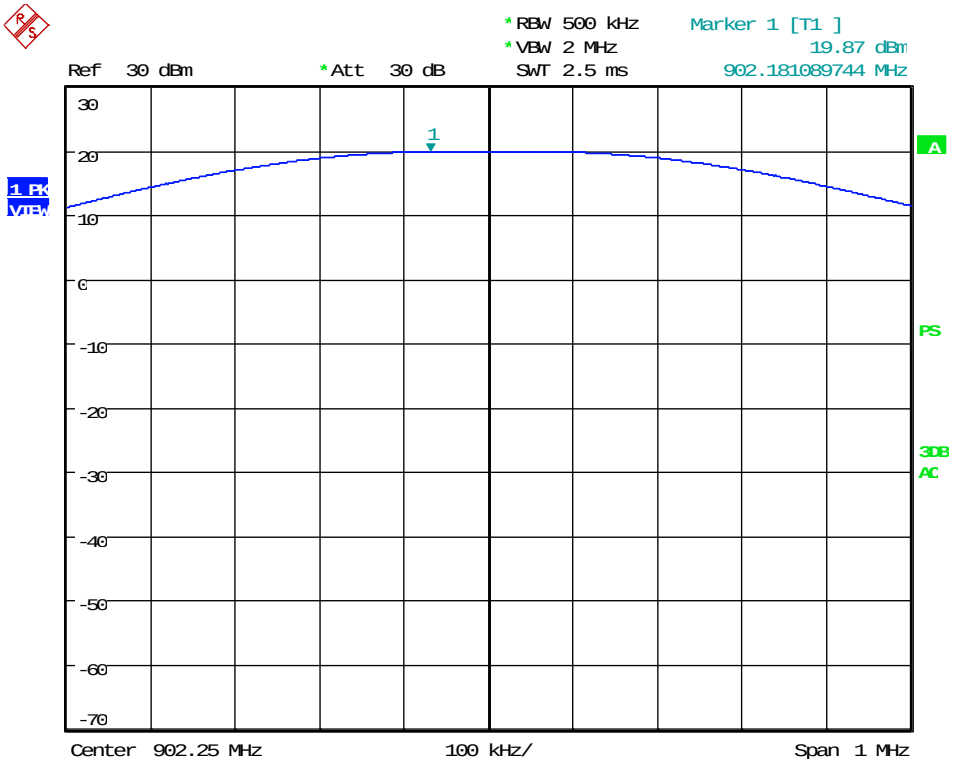
Test Date(s):	2025-02-26	**Test Engineer:**	E. Tobin
Rule:	15.31(e)	**Air Temperature:**	21.0º C
Test Results:	Complies	**Relative Humidity:**	31%

Nominal Voltage: 4VDC

120kHz, Low Channel: -15%

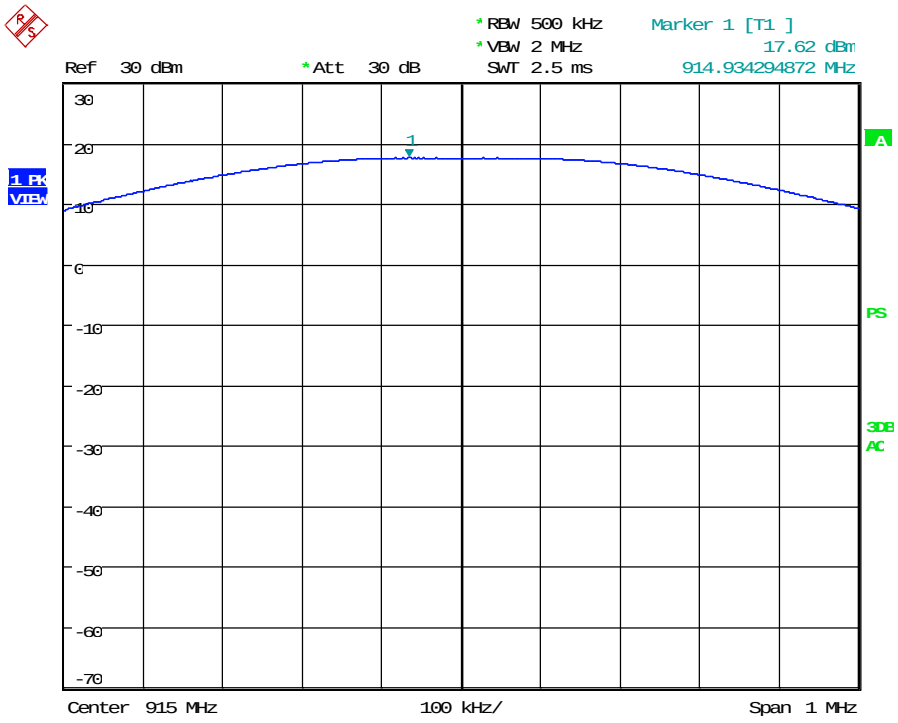


120kHz, Low Channel: +15%



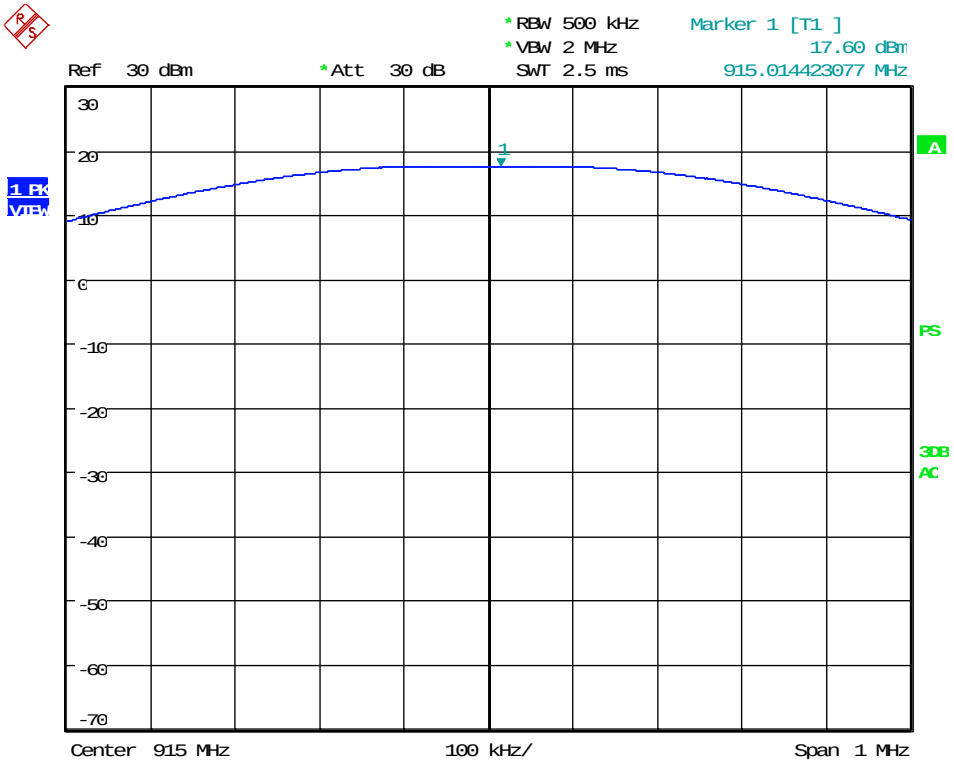
Date: 25.FEB.2025 16:17:56

120kHz, Mid Channel: -15%



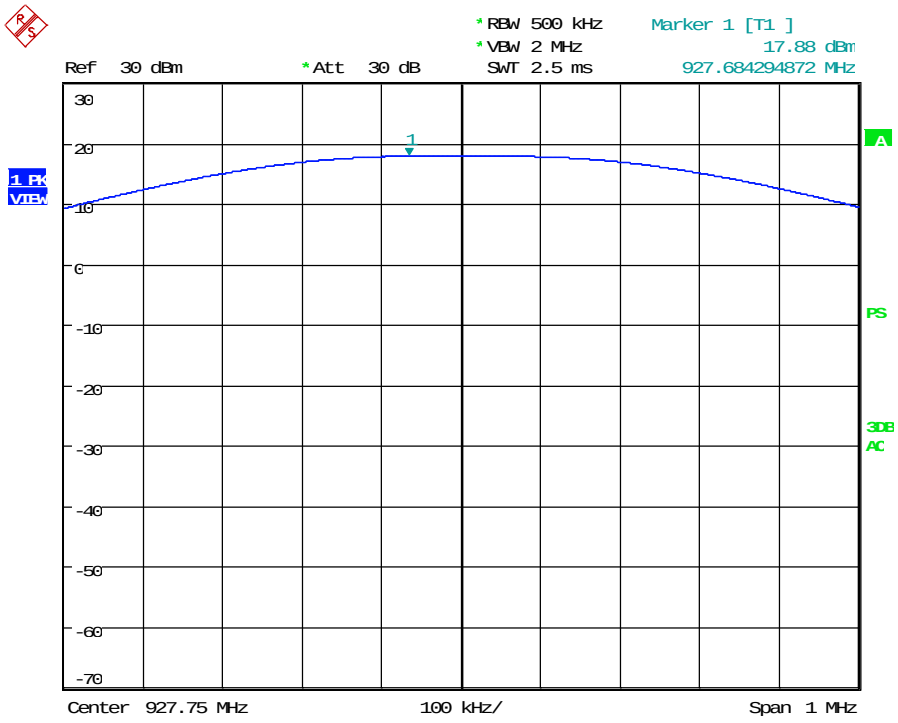
Date: 25.FEB.2025 16:19:29

120kHz, Mid Channel: +15%



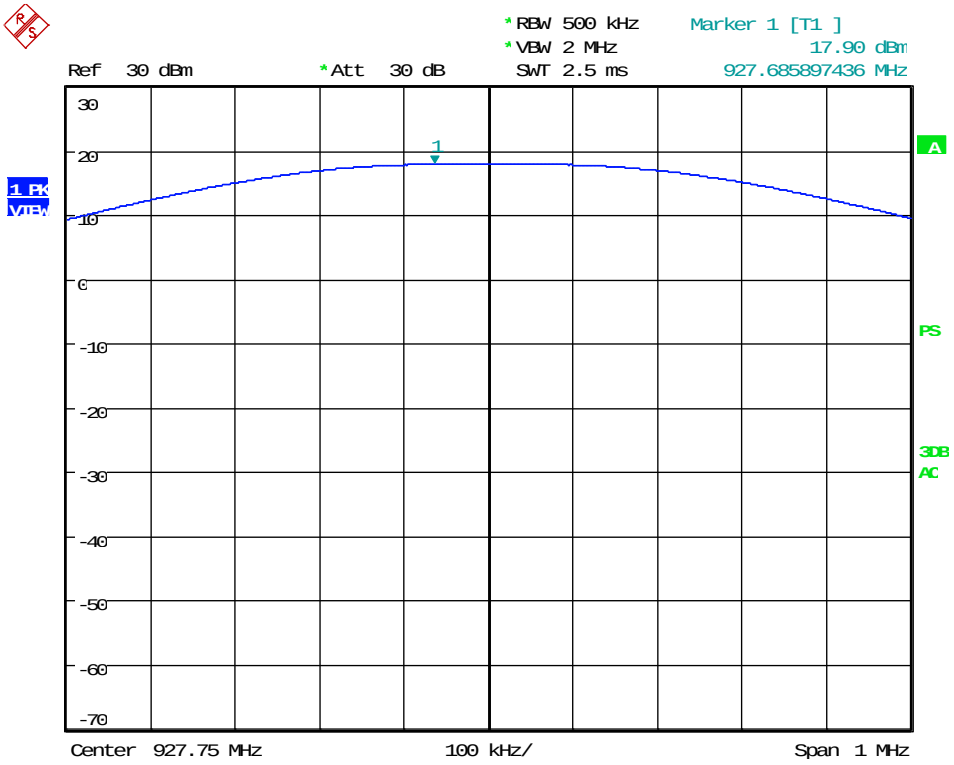
Date: 25.FEB.2025 16:19:10

120kHz, High Channel: -15%



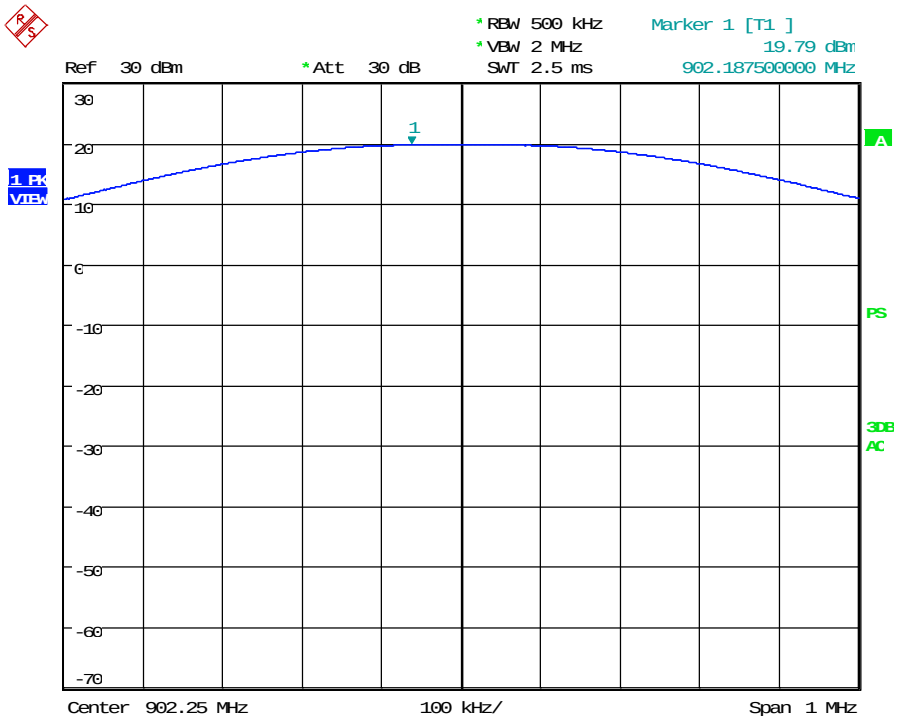
Date: 25.FEB.2025 16:20:37

120kHz, High Channel: +15%



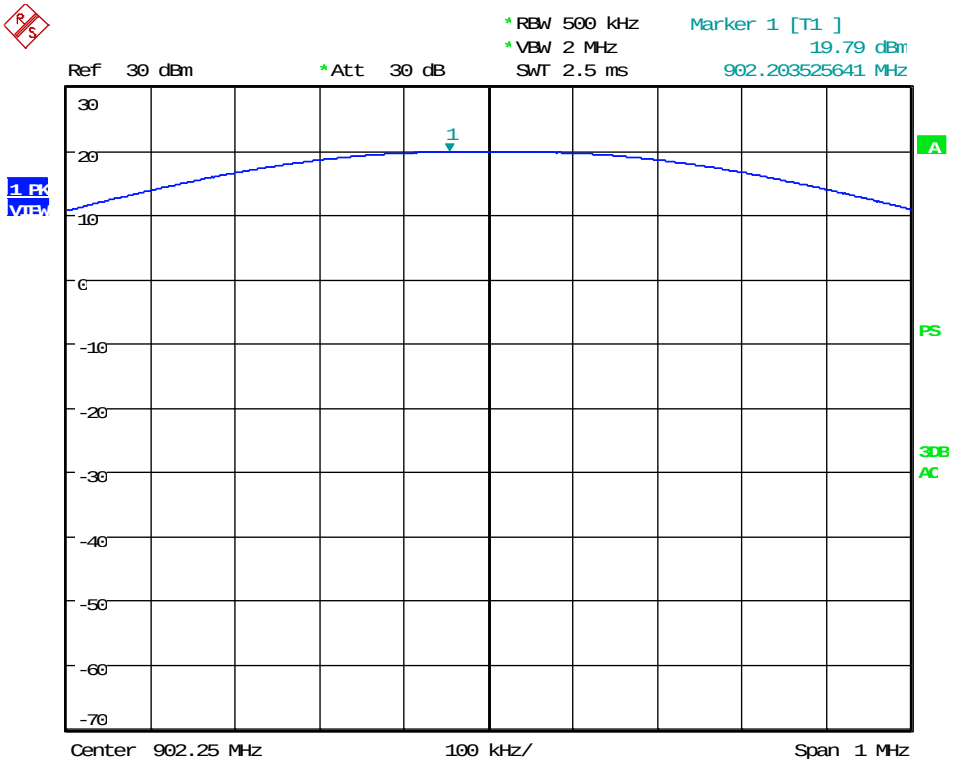
Date: 25.FEB.2025 16:20:59

200kHz, Low Channel: -15%



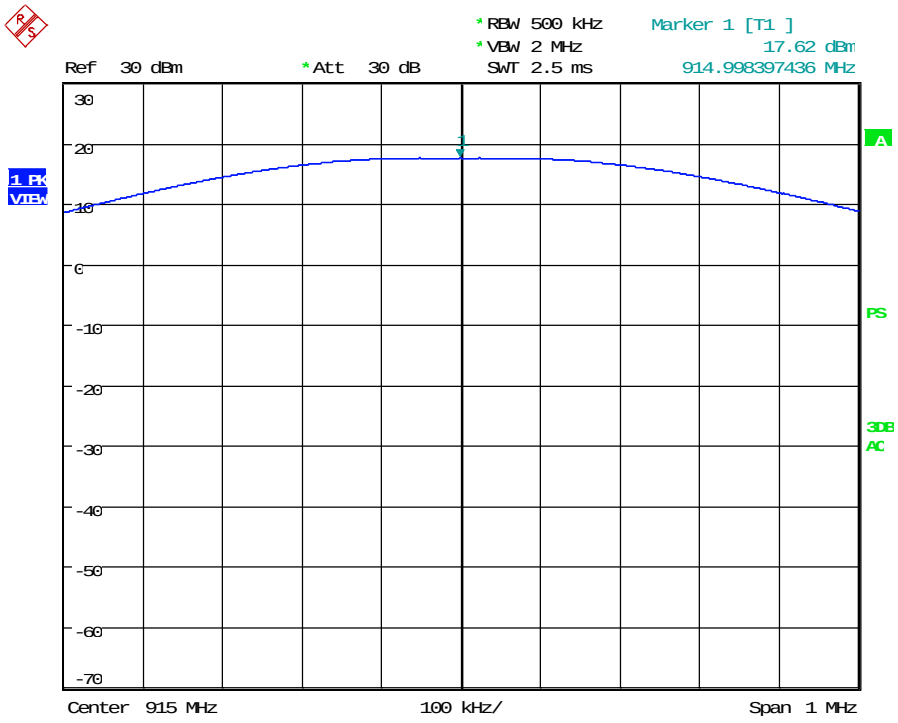
Date: 25.FEB.2025 16:23:35

200kHz, Low Channel: +15%



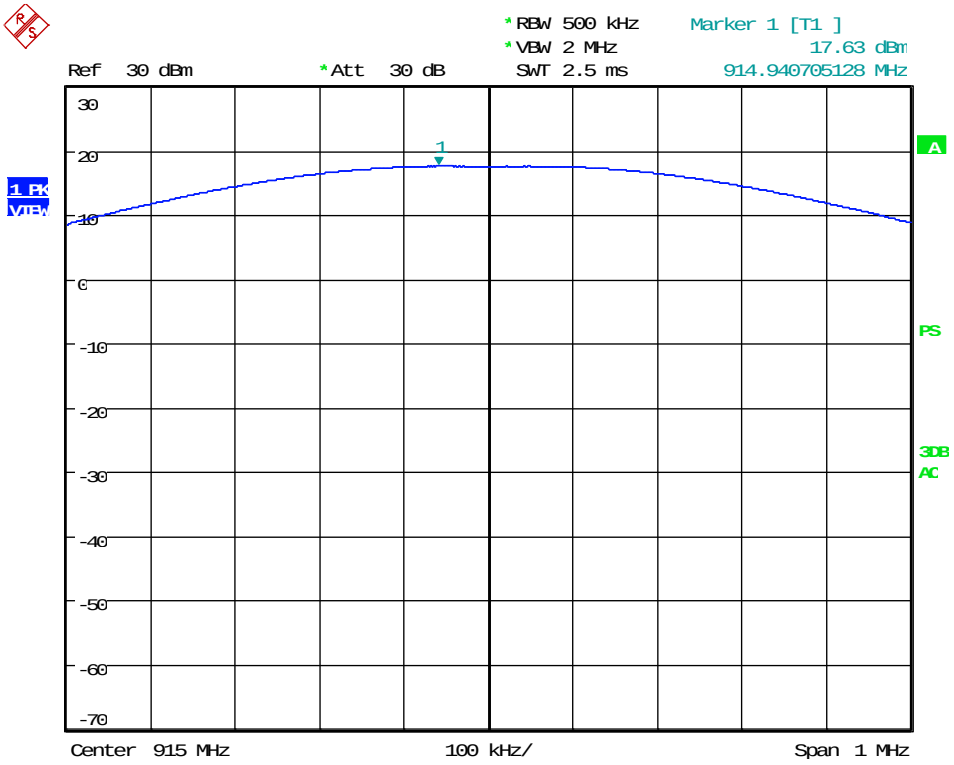
Date: 25.FEB.2025 16:23:10

200kHz, Mid Channel: -15%



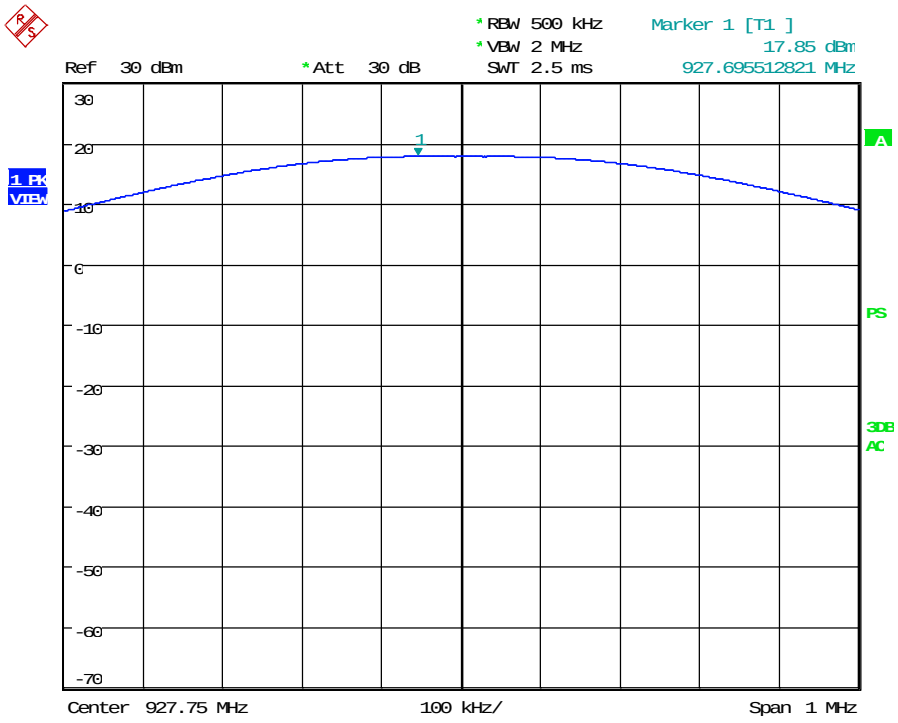
Date: 25.FEB.2025 16:24:12

200kHz, Mid Channel: +15%



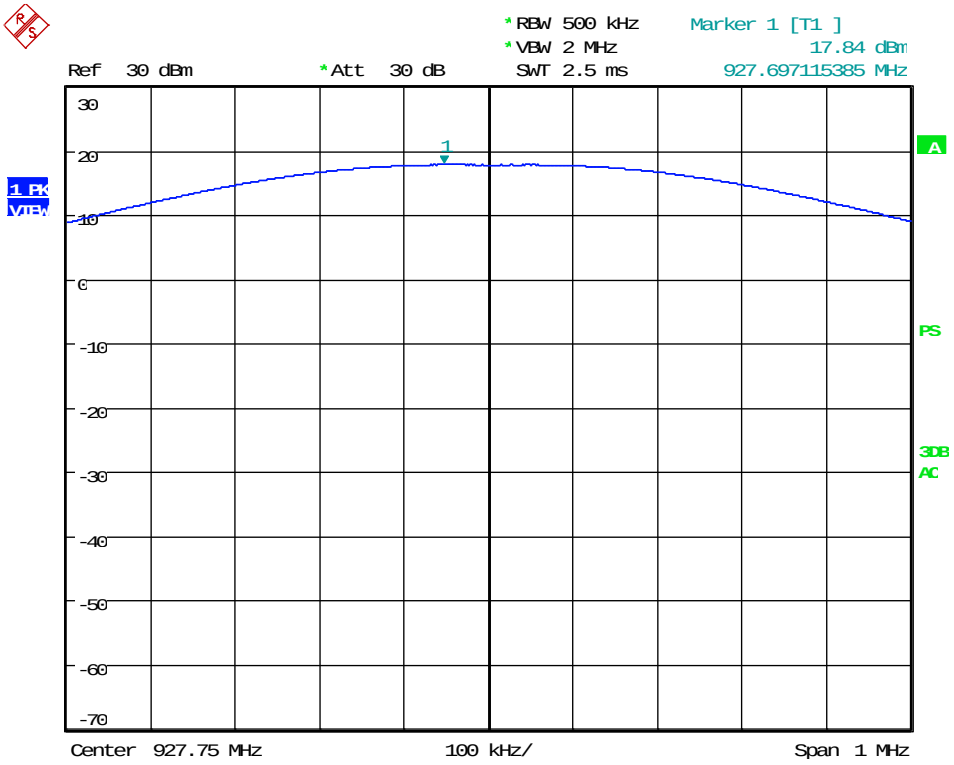
Date: 25.FEB.2025 16:24:32

200kHz, High Channel: -15%



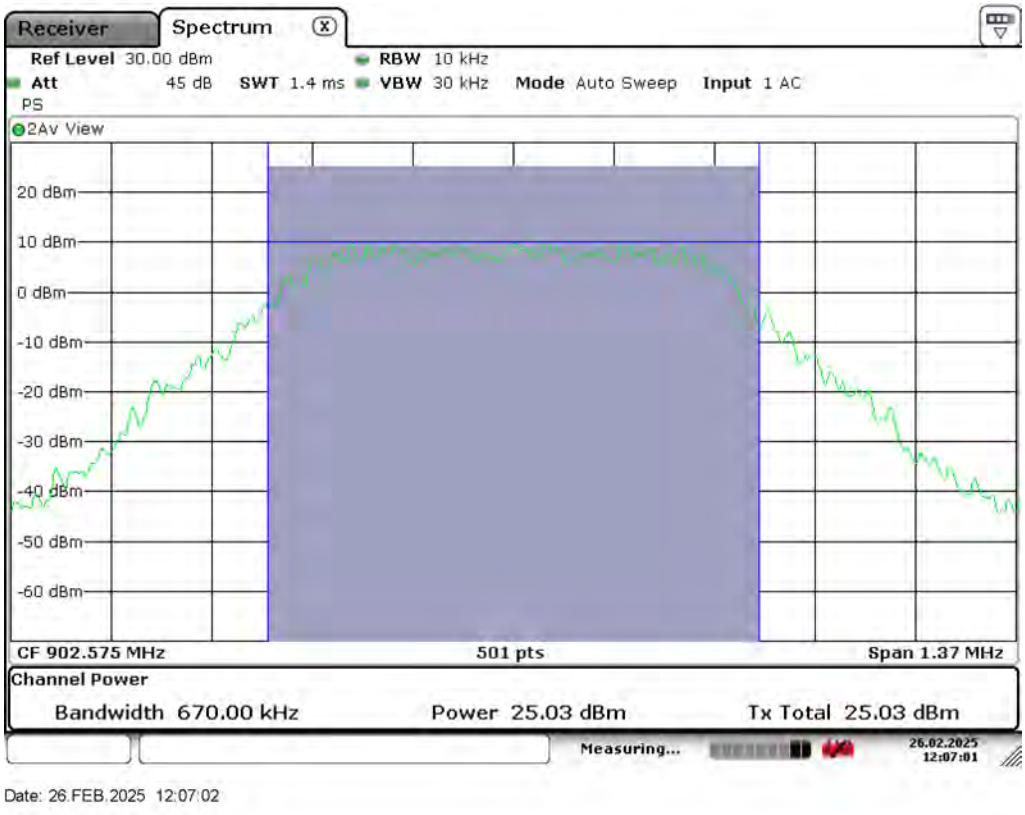
Date: 25.FEB.2025 16:25:39

200kHz, High Channel: +15%

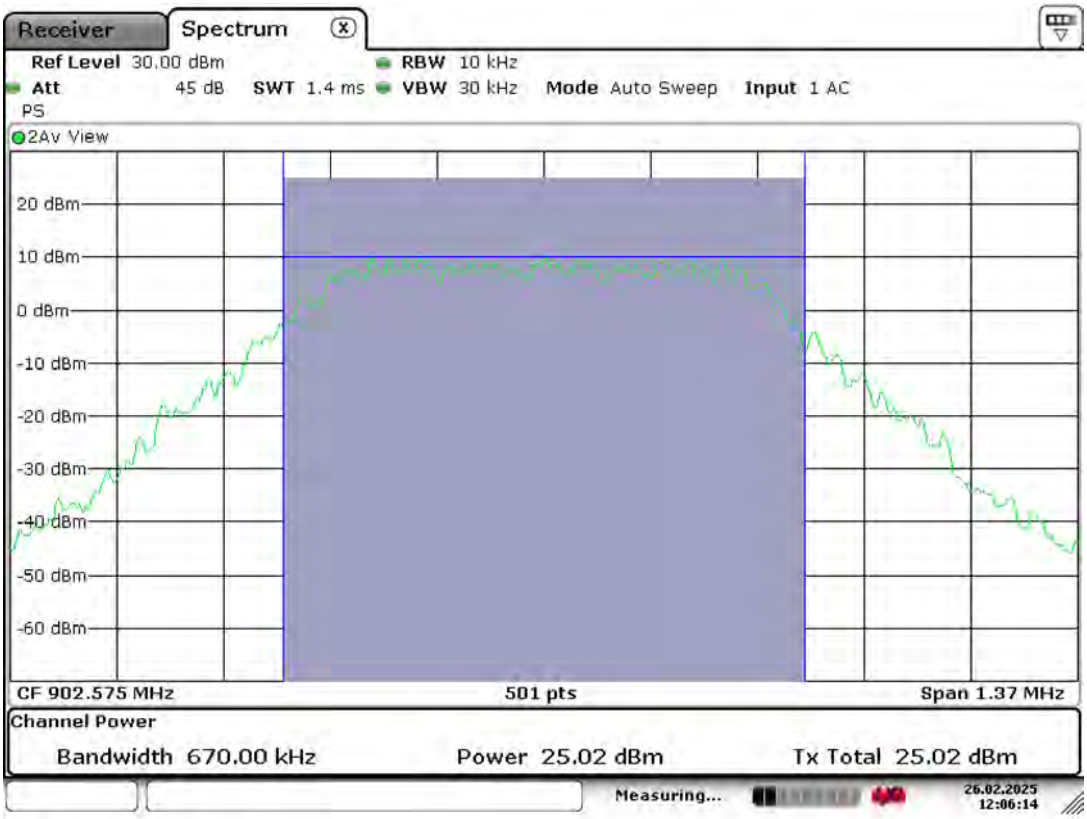


Date: 25.FEB.2025 16:25:16

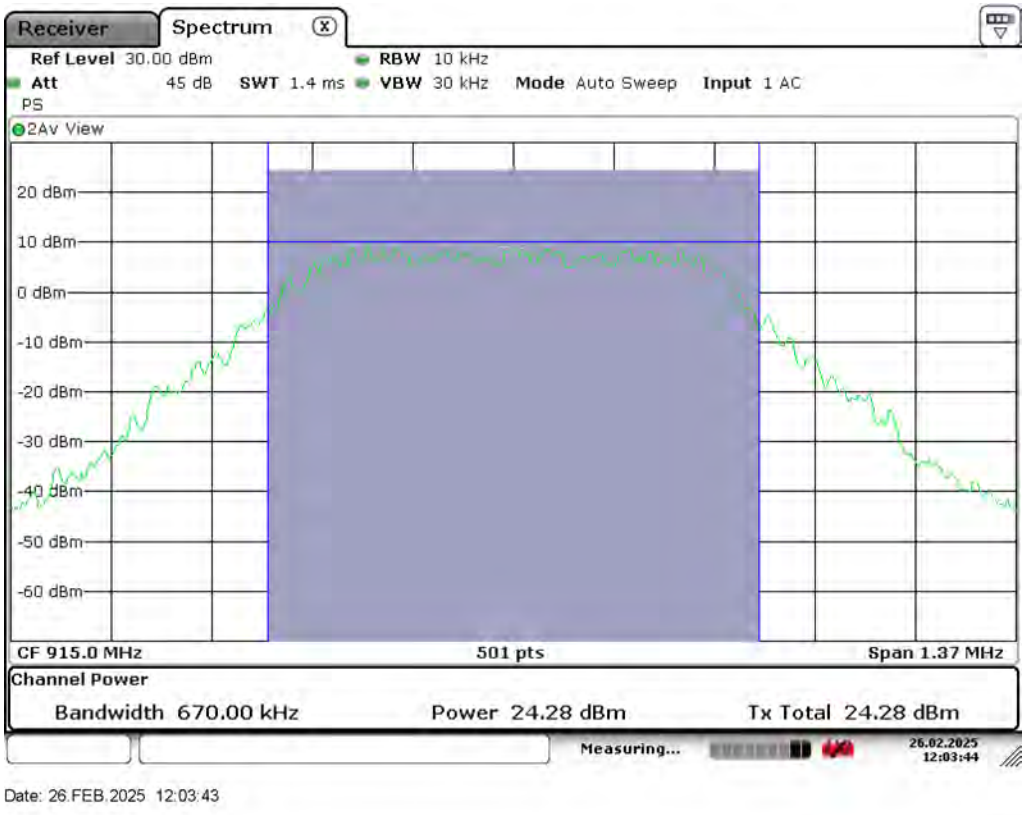
500kHz, Low Channel: -15%



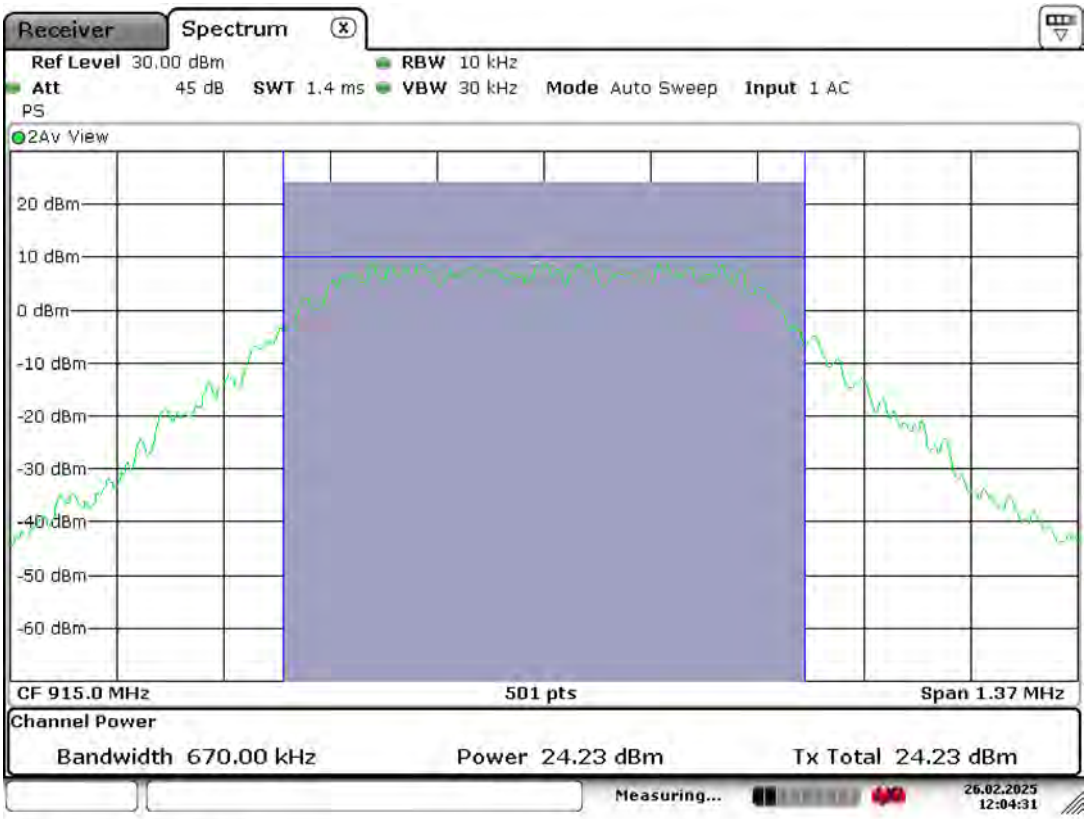
500kHz, Low Channel: +15%



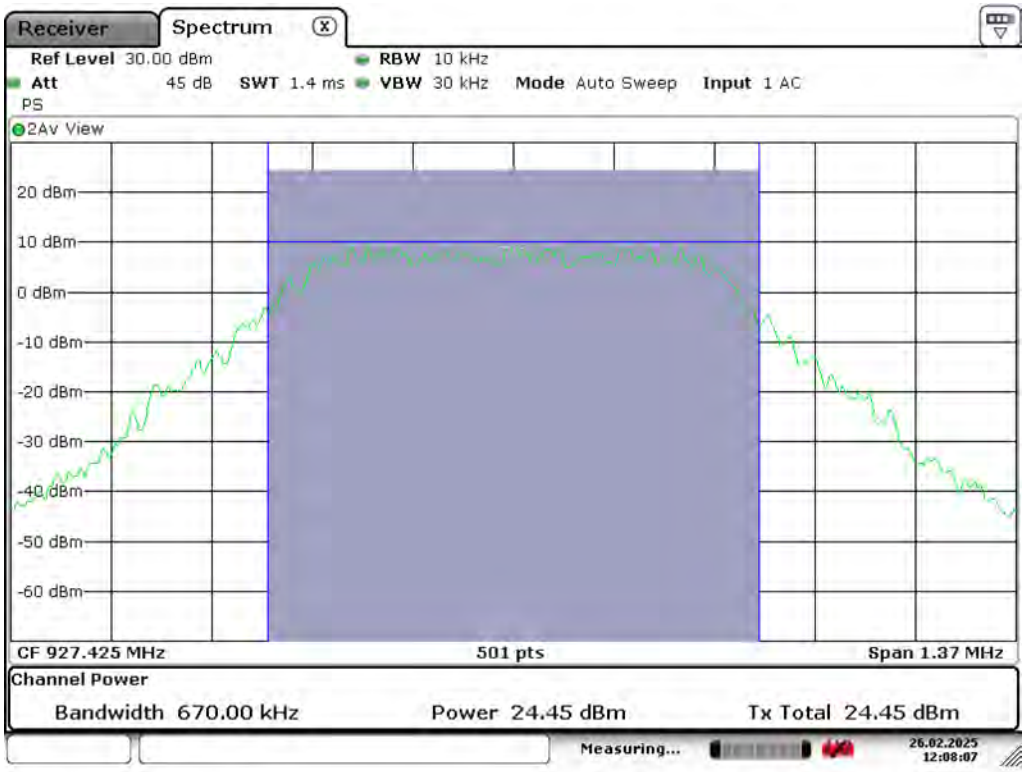
500kHz, Mid Channel: -15%



500kHz, Mid Channel: +15%

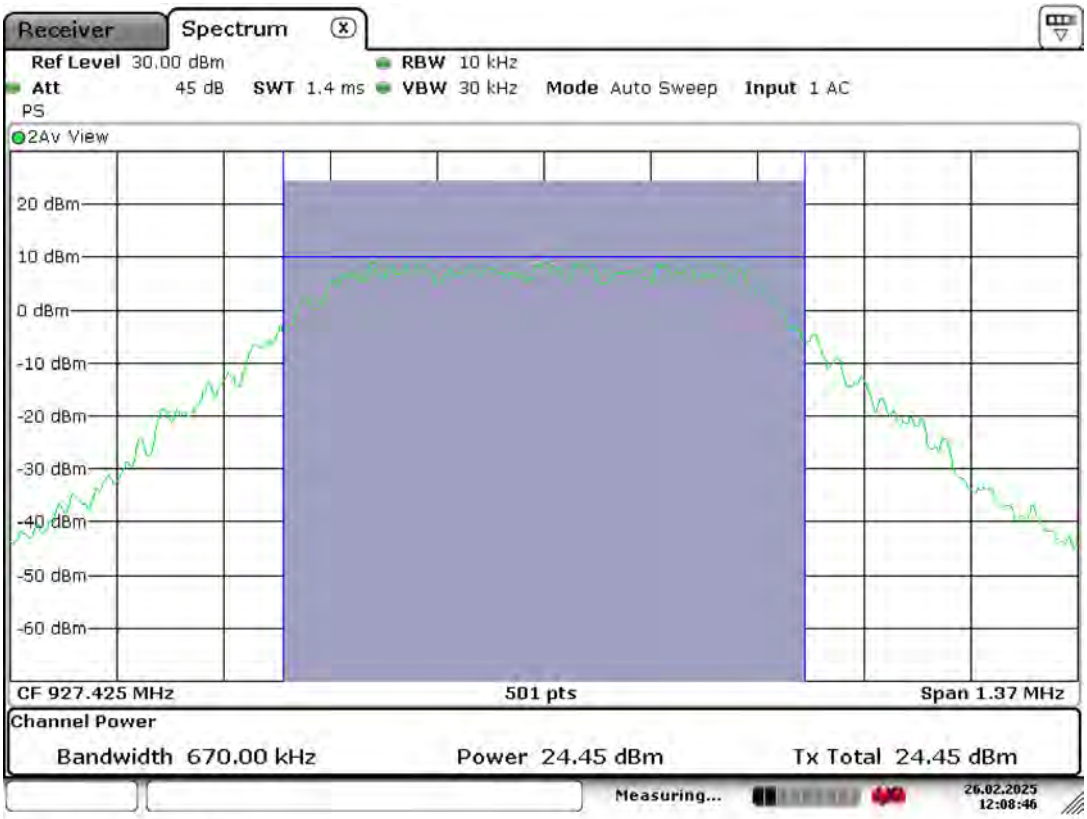


500kHz, High Channel: -15%



Date: 26.FEB.2025 12:08:07

500kHz, High Channel: +15%



16 CONDUCTED EMISSIONS

16.1 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.

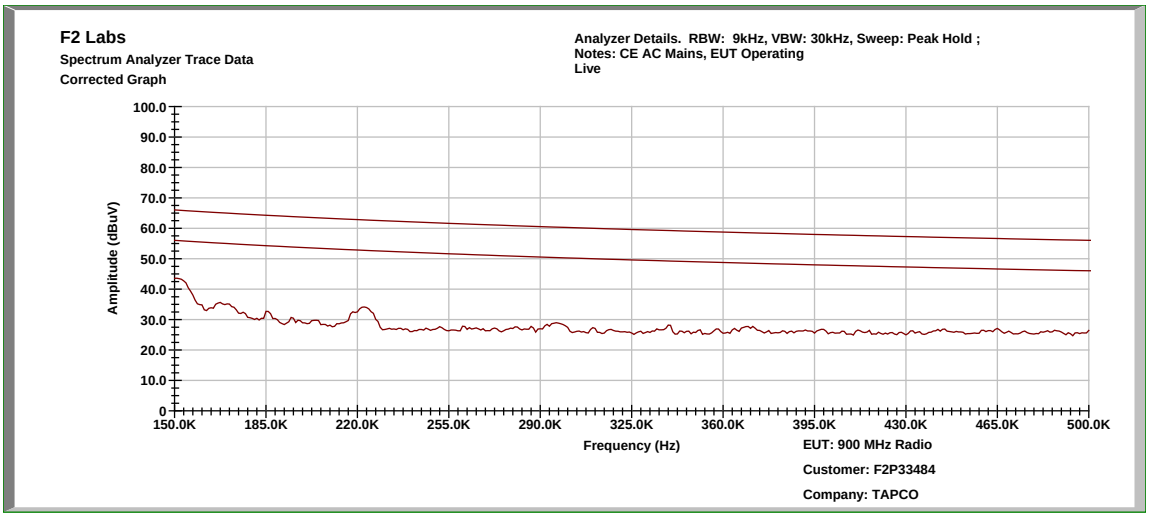
16.2 Procedure

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.

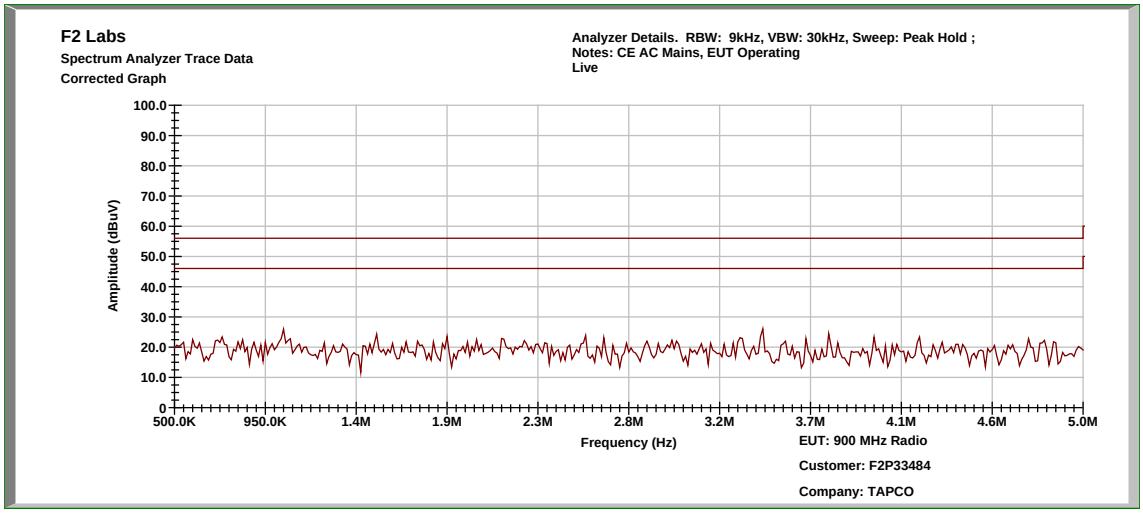
16.3 Conducted Emissions Test Data

Test Date(s):	2024-12-17	Test Engineer:	J. Chiller
Rule:	15.207	Air Temperature:	21.1º C
Test Results:	Complies	Relative Humidity:	40%

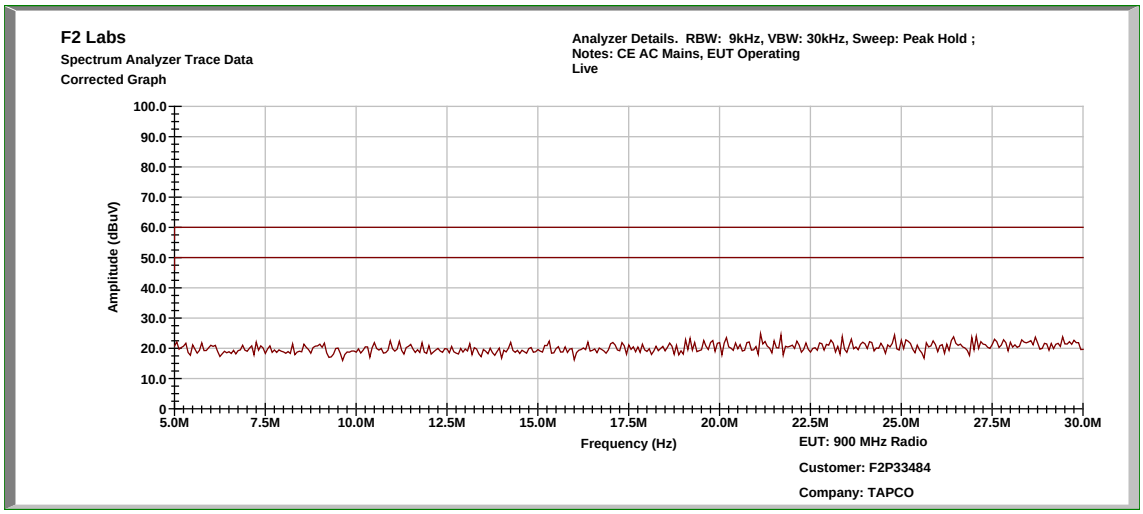
Conducted Test – Live: 0.15 MHz to 0.5 MHz



Conducted Test – Live: 0.5 MHz to 5.0 MHz

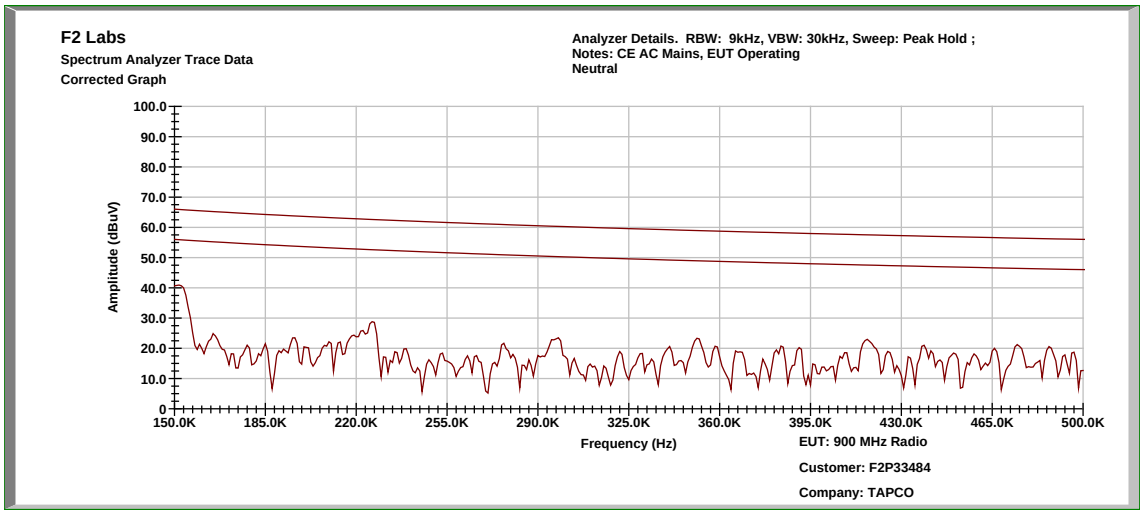


Conducted Test – Live: 5.0 MHz to 30.0 MHz

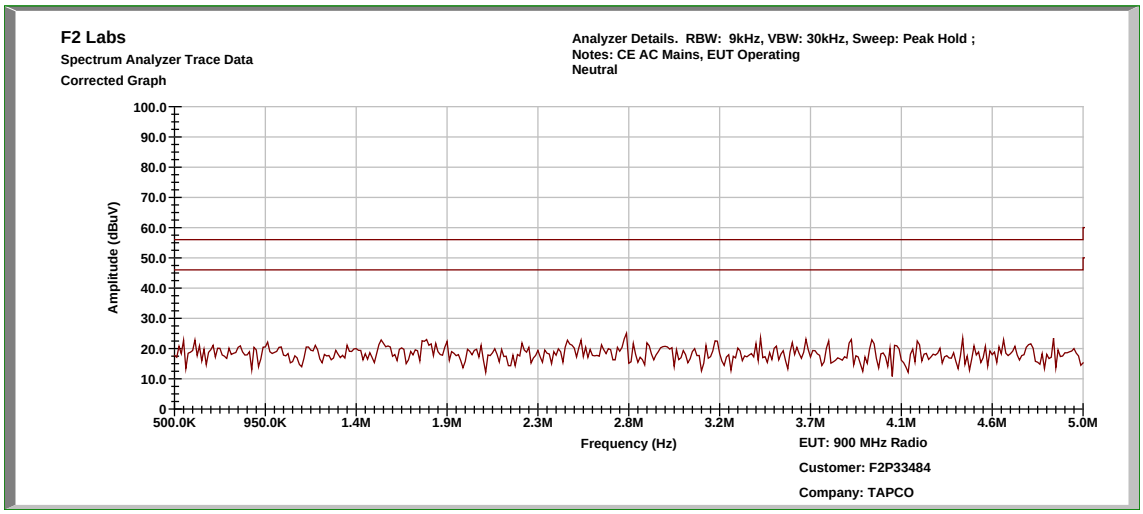


Note: Peak scans below AVG limit.

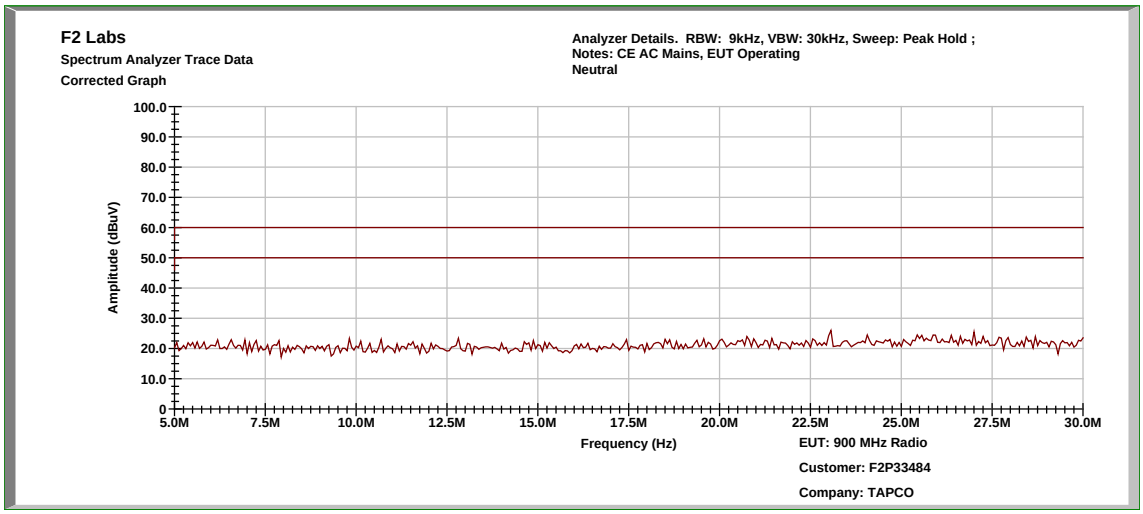
Conducted Test – Neutral: 0.15 MHz to 0.5 MHz



Conducted Test – Neutral: 0.5 MHz to 5.0 MHz



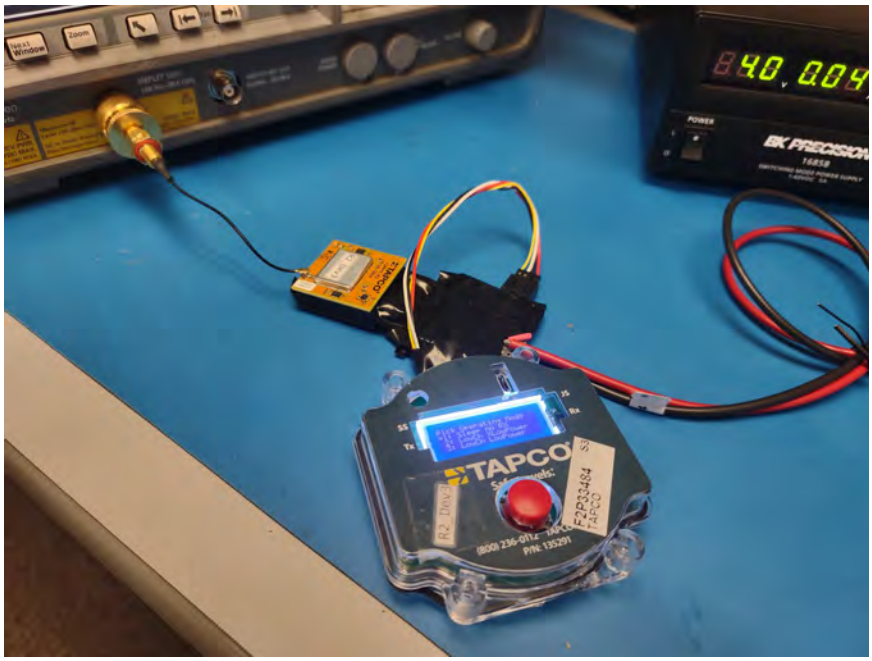
Conducted Test – Neutral: 5.0 MHz to 30.0 MHz



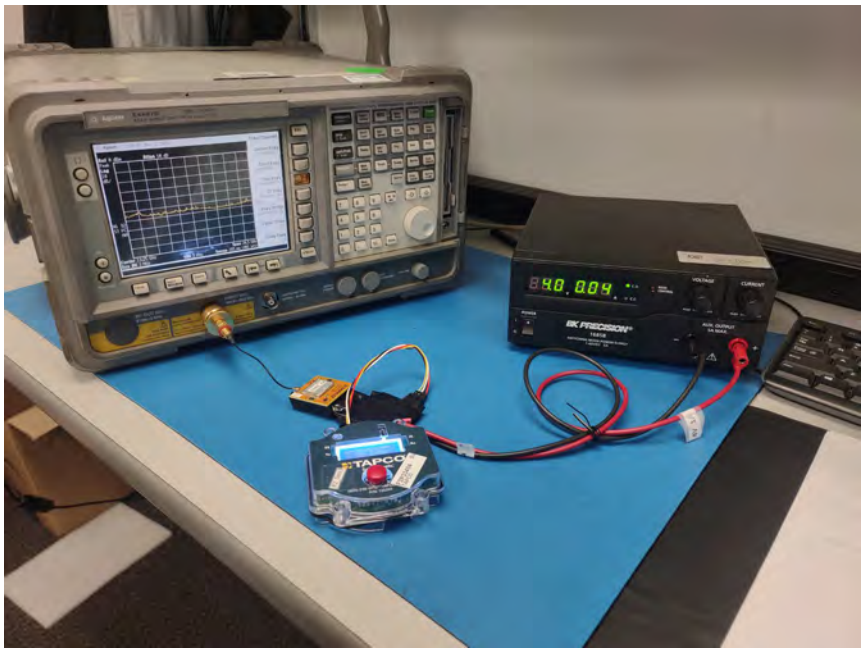
Note: Peak scans below AVG limit.

17 TEST SETUP PHOTOGRAPH(S)

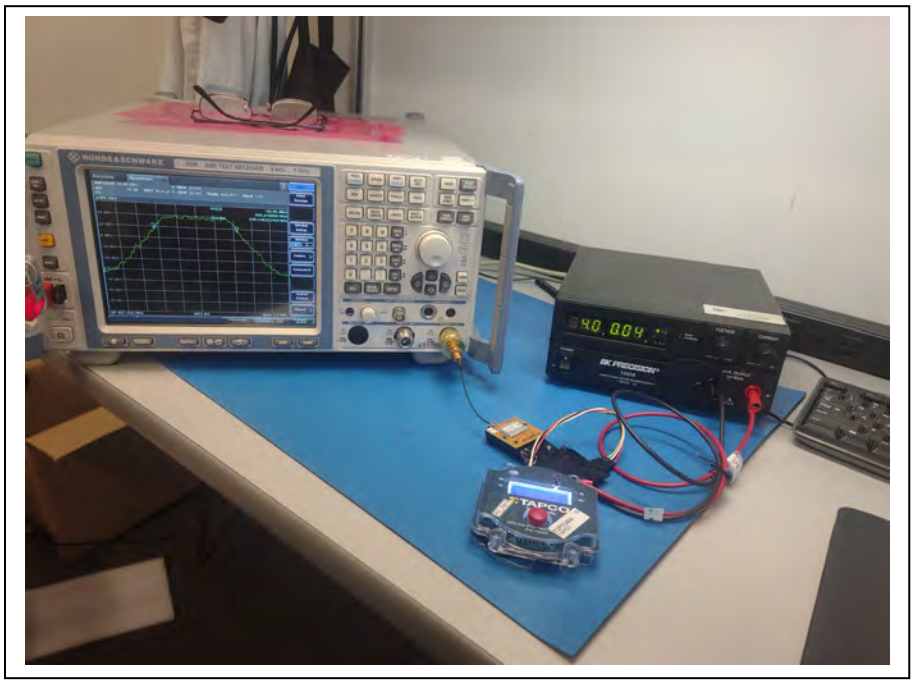
Radio Setup



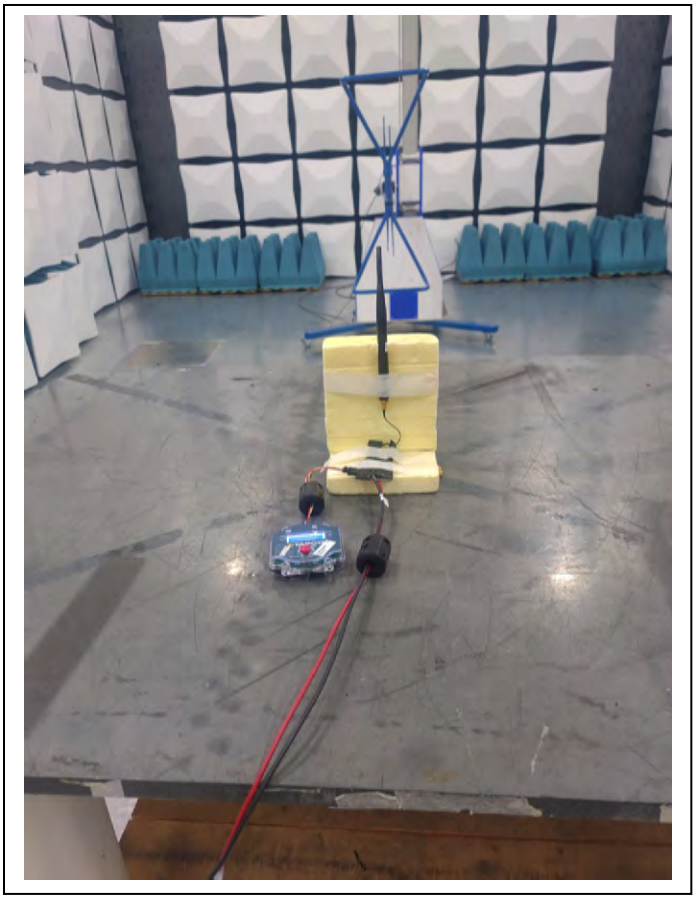
Conducted – Agilent



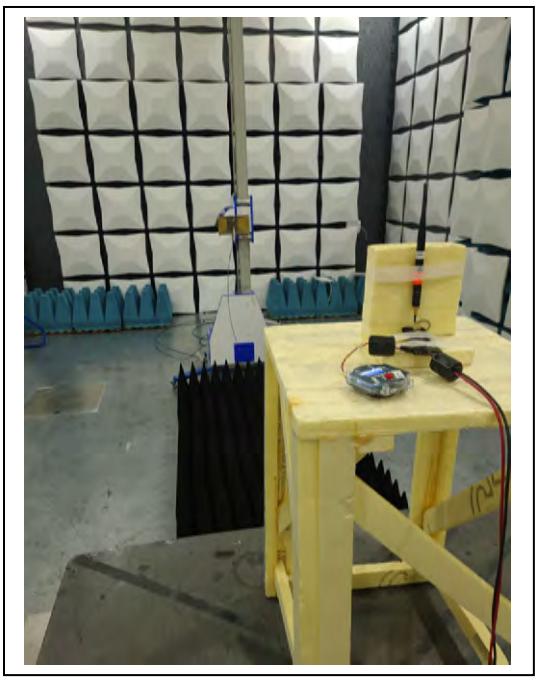
Conducted – ESR 7

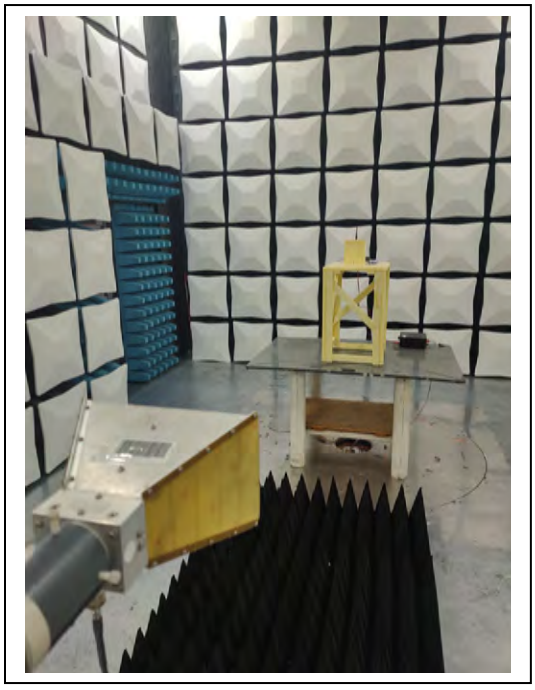


Radiated – Dipole: Less Than 1 GHz

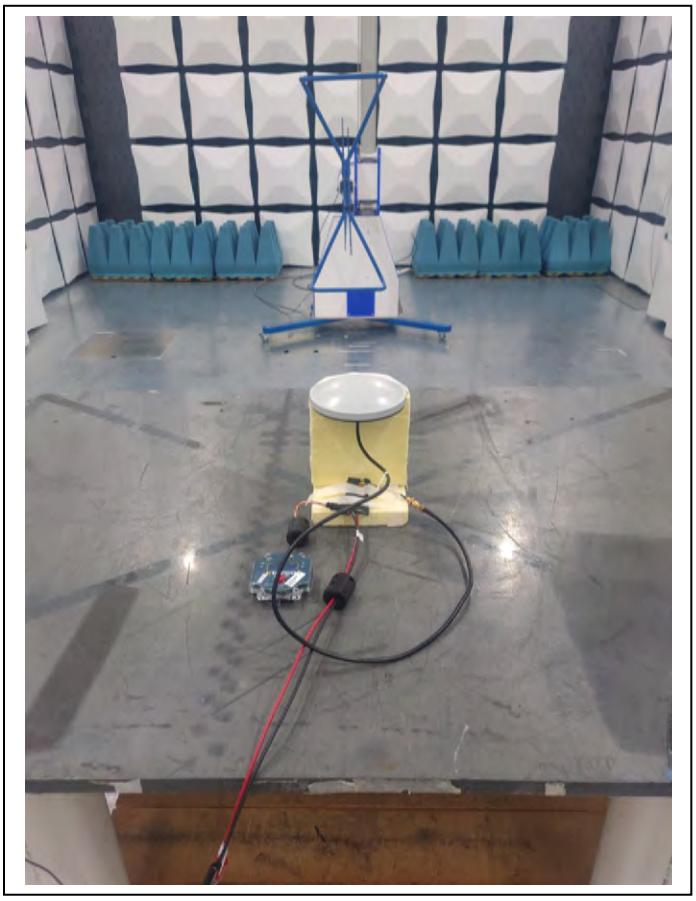


Radiated – Dipole: Greater Than 1 GHz

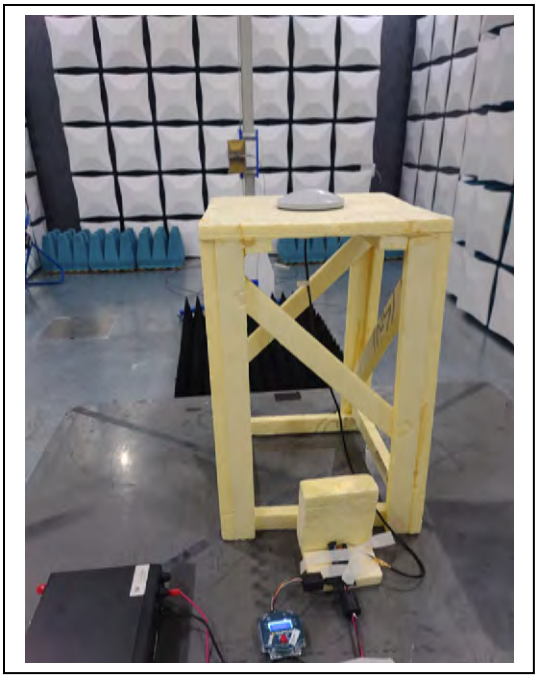


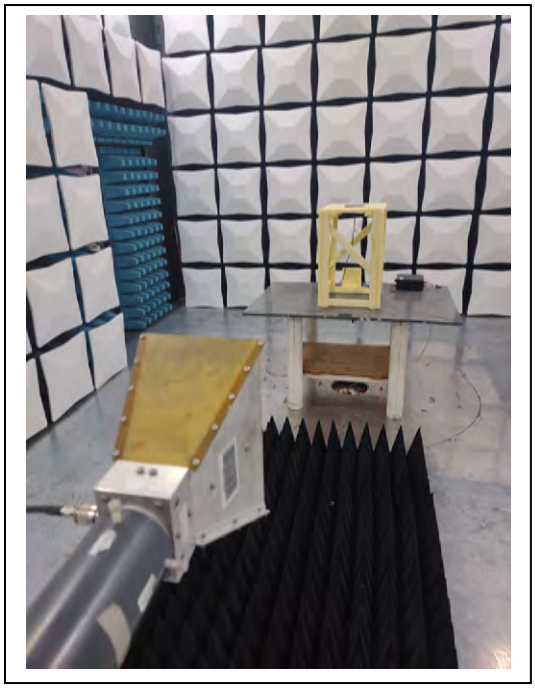


Radiated – Puck: Less Than 1 GHz

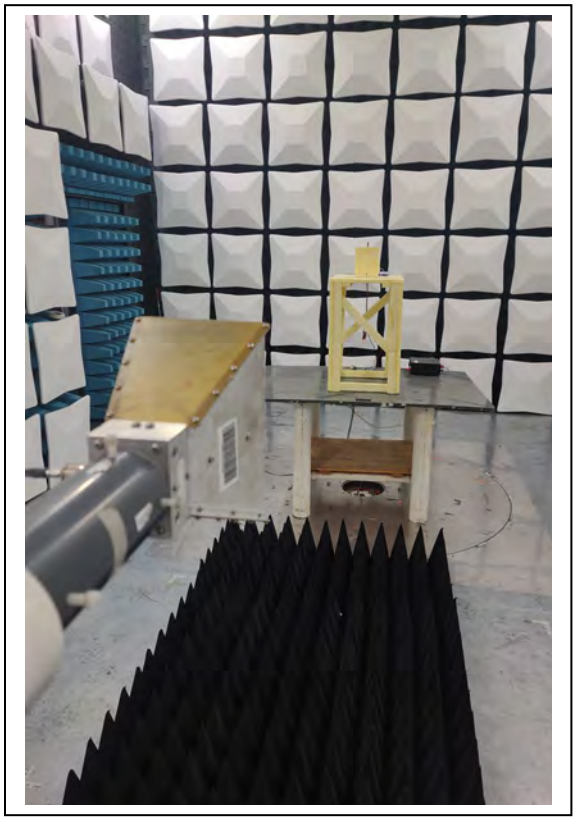


Radiated – Puck: Greater Than 1 GHz

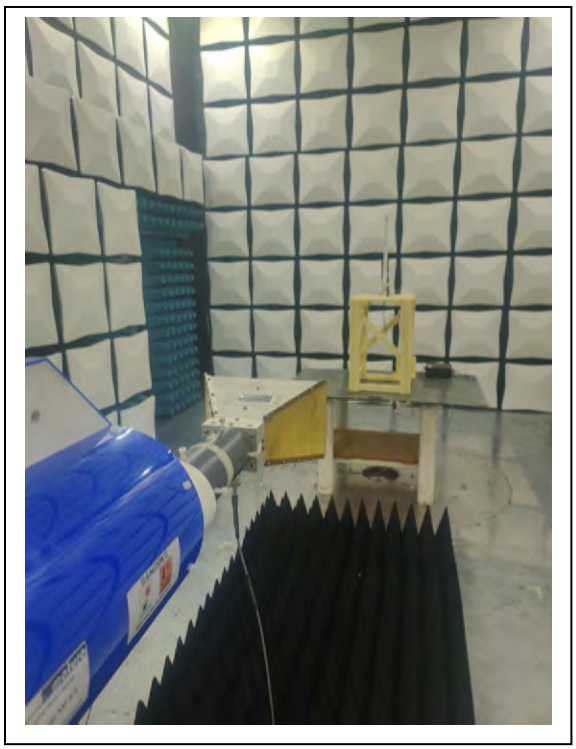


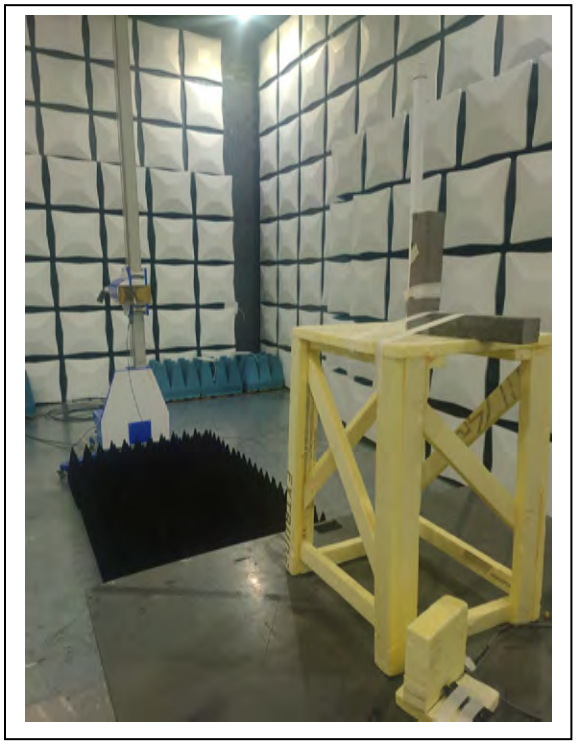


Radiated – Linx Monopole (1.8dB): Greater than 1 GHz

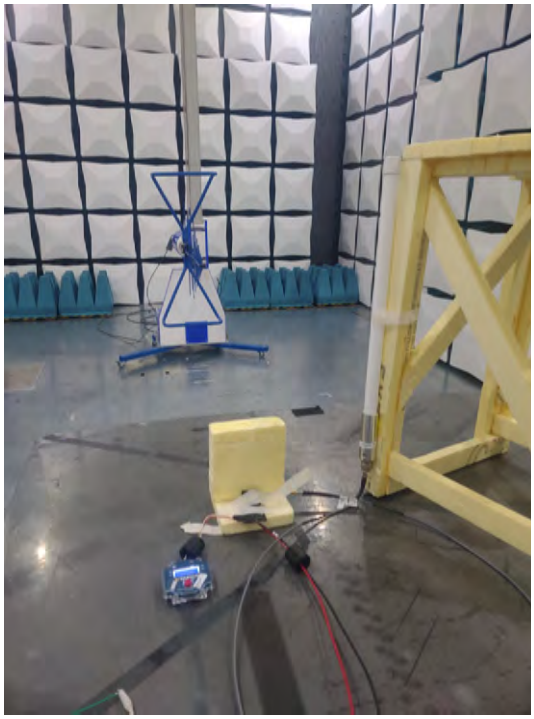


Radiated – PCTel Monopole (5.15dBi): Greater than 1 GHz

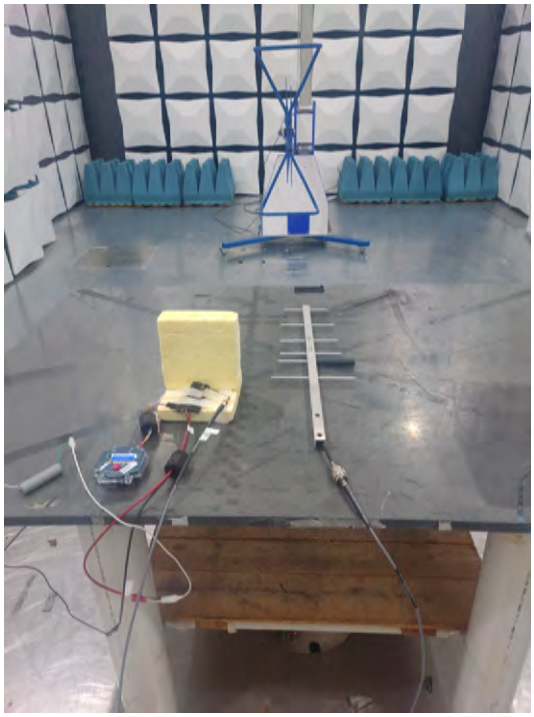




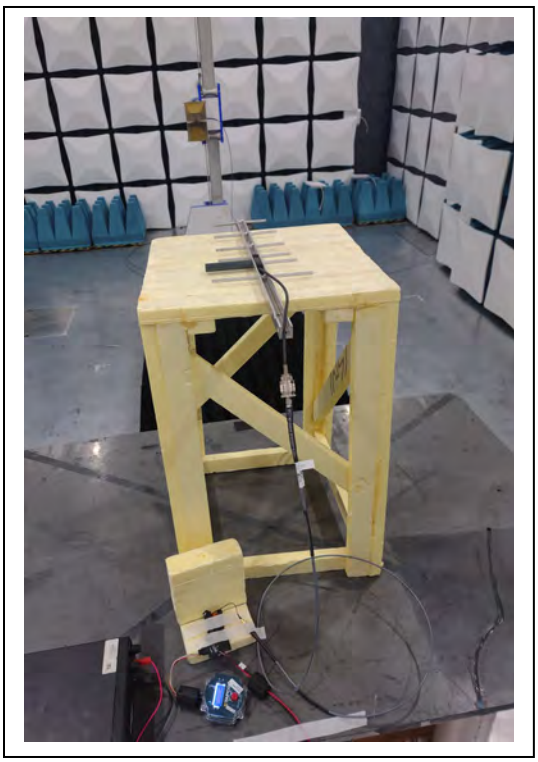
Radiated – PCTel Monopole: Less Than 1 GHz

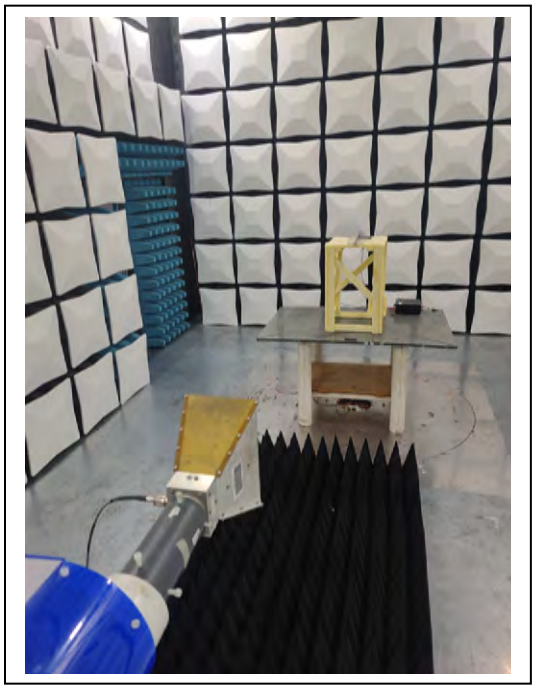


Radiated – Yagi: Less Than 1 GHz



Radiated – Yagi: Greater Than 1 GHz





Conducted Emissions