FCC PART 15.247
TEST REPORT

On Behalf of

Zhiwei Robotics Corp.

Room 603, 2 Boyun Road, Pudong, Shanghai P.R.China

FCC ID: 2AIDMLPDF1091
Model: DFR1080, DFR1081, DFR1090, DFR1091

November 2, 2024

This Report Concerns:	**Equipment Type:**
☒ Original Report	LattePanda Sigma

Test Engineer:	LBi Li / LBi Li
Report Number:	**QCT24JR-0163E-03**
Test Date:	October 18, 2024 ~ November 2, 2024
Reviewed By:	Vincent Yang / Vincent Yang
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Revision History of This Test Report

Report Number	Description	Issued Date
QCT24JR-0163E-03	Initial Issue	2024-11-02

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1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Description	LattePanda Sigma
Model No.	DFR1080, DFR1081, DFR1090, DFR1091
Model Difference:	all the models are electrical identical including the same software parameter and hardware design (i.e., circuit design, PCB Layout, RF module/circuit, antenna type(s) and antenna location, components on PCB, etc.,), same mechanical structure and design (including product enclosure, materials, etc.,), the only differences are capacity of Memory and SSD. All tests were conducted on the models (DFR1091) and the test result was passed. Difference testing was performed on the model (DFR1081), testing Conducted Emission and spurious emission (30MHz - 1GHz).
Tested Model	DFR1091, DFR1081
Sample(s) Status	Engineer sample
Operation Frequency:	802.11b/802.11g/802.11n(HT20)/802.11ax(HE20): 2412MHz~2462MHz 802.11n(HT40)/802.11ax(HE40):: 2422MHz~2452MHz
Channel numbers:	802.11b/802.11g /802.11n(HT20)/802.11ax(HE20): 11 802.11n(HT40)/802.11ax(HE40):7
Channel separation:	5MHz
Modulation type:	802.11b: BPSK, QPSK, CCK 802.11g/802.11n(HT20)/802.11n(HT40): BPSK, QPSK, 16-QAM, 64-QAM 802.11ax20/802.11ax40: BPSK, QPSK, 16-QAM, 64-QAM/256-QAM/ 1024-QAM
Antenna Type:	Internal Antenna
Antenna gain*1:	1.56dBi max for 2.4GHz Ant1 1.56dBi max for 2.4GHz Ant2 Note: Antenna 1 and Antenna 2 support MIMO mode, so directional gain value as below: Directional Gain=$10*\log[(10^{1.56/20}+10^{1.56/20})^2/2]$=4.57dBi
Power supply:	DC 19V/4.7A (Powered by adapter)
Accessories:	Adapter Model: ADP-90MD H Input:100-240V~, 1.5A, 50-60Hz Output:19V/4.7A, 90.1W Manufacturer: DELTA ELECTRONICS, INC.
Trade Mark:	N/A
Applicant:	Zhiwei Robotics Corp.
Address:	Room 603, 2 Boyun Road, Pudong, Shanghai P.R.China

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Manufacturer:	Zhiwei Robotics Corp.
Address:	Room 603, 2 Boyun Road, Pudong, Shanghai P.R.China
Sample No.:	Y24J0163E01WC(DFR1091), Y24J0163E02WC(DFR1081)

Note: *1This information provided by Manufacturer, SZ QC Lab is not responsible for the accuracy of this information.

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1.2 System Test Configuration

1.2.1 Channel List

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Test channel	Frequency (MHz)	
	802.11b/802.11g/802.11n(HT20) /802.11ax(HE20)	802.11n(HT40) /802.11ax(HE40)
Lowest channel	2412MHz	2422MHz
Middle channel	2437MHz	2437MHz
Highest channel	2462MHz	2452MHz

1.2.2 EUT Exercise Software

The device was tested with the worst case was performed as below:

Test Mode	Data Rate	Power Level
802.11b	1Mbps	Default
802.11g	6Mbps	Default
802.11n(HT20)	HT0	Default
802.11n(HT40)	HT0	Default
802.11ax(HE20)	HE0	Default
802.11ax(HE40)	HE0	Default

" DRTU" exercise software was made to the EUT tested, The software and power level was provided by the applicant.

1.2.3 Test mode

1. Transmitting mode: Keep the EUT in continuously transmitting.
2. 802.11ax mode only support Full RU.
3. The built-in test software can control the single antenna transmission, and can also control the double antenna transmission together.

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1.2.4 Support Equipment

Manufacturer	Description	Model	Serial Number
Keyboard	HP	6CB78PA# AB2	1.5m，un-shielding， No Core
Mouse	DELL	CN-049PRO	1.5m，un-shielding， No Core
Flat Panel Monitor	DELL	S2721QS	Input: 100-240V~, 50/60Hz, 1.5A

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1.3 Test Facility

Test Firm : Shenzhen QC Testing Laboratory Co., Ltd.

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS – Registration No.: L8464

The EMC Laboratory has been accredited by CNAS, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

A2LA Certificate Number: 6759.01

The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 561109

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 29628

CAB identifier: CN0141

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

1.4 Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±1.42 x10^{-4}%
RF output power, conducted	±1.06dB
Power Spectral Density, conducted	±1.06dB
Unwanted Emissions, conducted	±2.51dB
AC Power Line Conducted Emission	±1.80dB
Radiated Spurious Emission test (9kHz-30MHz)	±2.66dB
Radiated Spurious Emission test (30MHz-1000MHz)	±4.04dB
Radiated Spurious Emission test (1000MHz-18000MHz)	±4.70 dB
Radiated Spurious Emission test (18GHz-40GHz)	±4.80dB
Temperature	±0.8℃
Humidity	±3.2%
DC and low frequency voltages	±0.1%
Time	±5%
Duty cycle	±5%

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

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2. Summary of Test Results

Test Item	Section	Result
Antenna Requirement	FCC part 15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	FCC part 15.207	Pass
Conducted Peak Output Power	FCC part 15.247 (b)(3)	Pass
Channel Bandwidth & 99% Occupied Bandwidth	FCC part 15.247 (a)(2)	Pass
Power Spectral Density	FCC part 15.247 (e)	Pass
Band Edge	FCC part 15.247(d)	Pass
Spurious Emissions	FCC part 15.247(d)/15.205/15.209	Pass

Note: 1. Pass: The EUT complies with the essential requirements in the standard.

2.Test according to ANSI C63.10:2013, KDB662911 D01 v02r01，

3.. All indications of Pass/Fail in this report are opinions expressed by Shenzhen QC Testing Laboratory Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.

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3. List of Test and Measurement Instruments

3.1 Conducted Emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	EMI Test Receiver	Rohde&Schwarz	ESIB 7	2277573376	2024.03.14	2025.03.13
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	101820	2024.08.06	2025.08.05
3	Artificial Mains Network	SCHWARZBECK	NSLK8126	8126200	2024.08.06	2025.08.05
4	PULSE LIMITER	Rohde&Schwarz	ESH3-Z2	100058	2024.03.14	2025.03.13
Conducted Emission Measurement Software: TS+ JS32-CE Ver 5.0.0						

3.2 Radiated Emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1.	EMI Test Receiver	R&S	ESIB 7	2277573376	2024.03.14	2025.03.13
2.	EMI Test Receiver	ESPI3	ESPI3	101131	2024.03.14	2025.03.13
3.	Spectrum Analyzer	Rohde&Schwarz	FSV 40	101458	2024.03.14	2025.03.13
4.	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9168	VULB9168-588	2023.04.01	2025.03.31
5.	Loop Antenna	EMCO	6502	2133	2023.03.18	2025.03.17
6.	horn antenna	SCHWARZBECK	BBHA9120D	2069	2023.04.01	2025.03.31
7.	Horn Antenna	COM-MW	ZLB7-18-40G-950	12221225	2023.01.12	2025.01.09
8.	Pre-amplifier	MITEQ	TTA0001-18	2063645	2024.03.27	2025.03.26
9.	Pre-amplifier	COM-MW	DLAN-18000-40000-02	10229104	2024.03.14	2025.03.13
10.	966 Camber	ZhongYU	9*6*6	/	2023.05.08	2026.05.07
Radiated Emission Measurement Software: EZ_EMC Ver QCT03A2 RE+						

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3.3 RF Conducted test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1.	Wideband Radio Communication Tester	Rohde & Schwarz	CW500	151583	2024.03.14	2025.03.13
2.	Spectrum Analyzer	ROHDE& SCHWARZ	FSV 40	101458	2024.03.14	2025.03.13
3.	Signal Generator	Agilent	N5182A	MY50141563	2024.03.14	2025.03.13
4.	RF Automatic Test System	MW	MW100-RFCB/ MW100-PSB	MW2007004	2024.03.14	2025.03.13
RF Conducted Measurement Software: MTS 8310 Ver 2.0.0.0						

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4. Antenna requirement

Standard requirement: FCC Part15 C Section 15.203 /247(c)

15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

EUT Antenna: The EUT uses an Internal Integrated Metal Antenna, which gain is 1.56dBi max for 2.4GHz Ant1,1.56dBi max for 2.4GHz Ant2, In accordance to FCC Part15 C Section 15.203, it is considered sufficiently to comply with the provisions of this section. reference to the Internal photo for details.

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5. Conducted Emissions

5.1 Applicable Standard

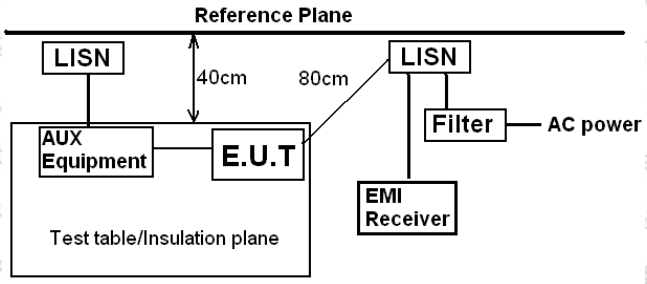
FCC Part15 C Section 15.207

5.2 Limit

Frequency range (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Note *: The level decreases linearly with the logarithm of the frequency.

5.3 Test setup



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

5.4 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.
RBW=9 kHz, VBW=30 kHz, Sweep time=auto

5.5 Test procedure

1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

5.6 Test Data

Temperature	23 ℃	Humidity	52%
ATM Pressure	101.1kPa	Antenna Gain	Ant1: 1.56dBi Ant2: 1.56dBi
Test by	LBi Li	Test result	PASS

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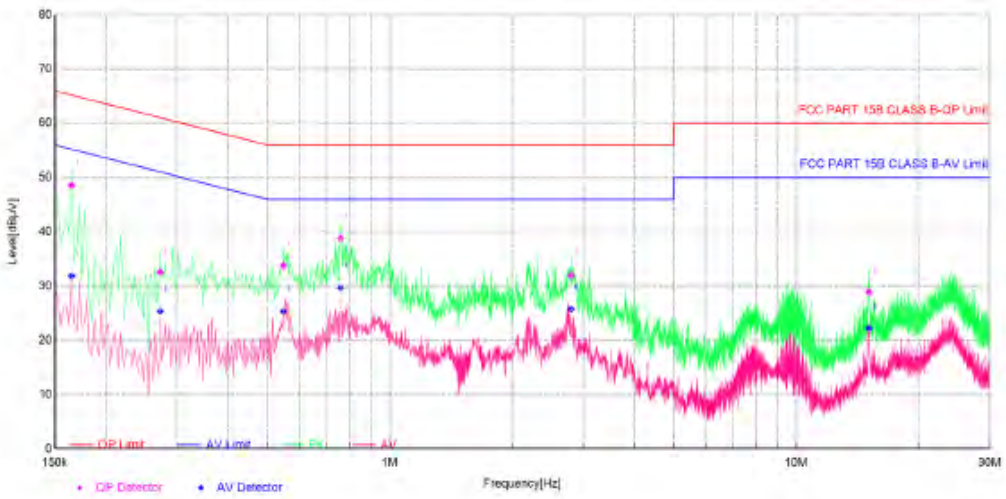
Model: DFR1091

Measurement data:

Pre-scan all test modes, found worst case at 802.11b mode 2412MHz, and so only show the test result of 802.11b mode 2412MHz

Line:



Final Data List

NO.	Freq. [MHz]	Factor[dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict
1	0.165	10.60	48.59	65.21	16.62	31.87	55.21	23.34	L	PASS
2	0.2725	10.69	32.54	61.04	28.50	25.38	51.04	25.66	L	PASS
3	0.5475	10.74	33.70	56.00	22.30	25.38	46.00	20.62	L	PASS
4	0.7575	10.75	38.82	56.00	17.18	29.65	46.00	16.35	L	PASS
5	2.7965	10.70	31.99	56.00	24.01	25.76	46.00	20.24	L	PASS
6	15.158	11.01	28.88	60.00	31.12	22.25	50.00	27.75	L	PASS

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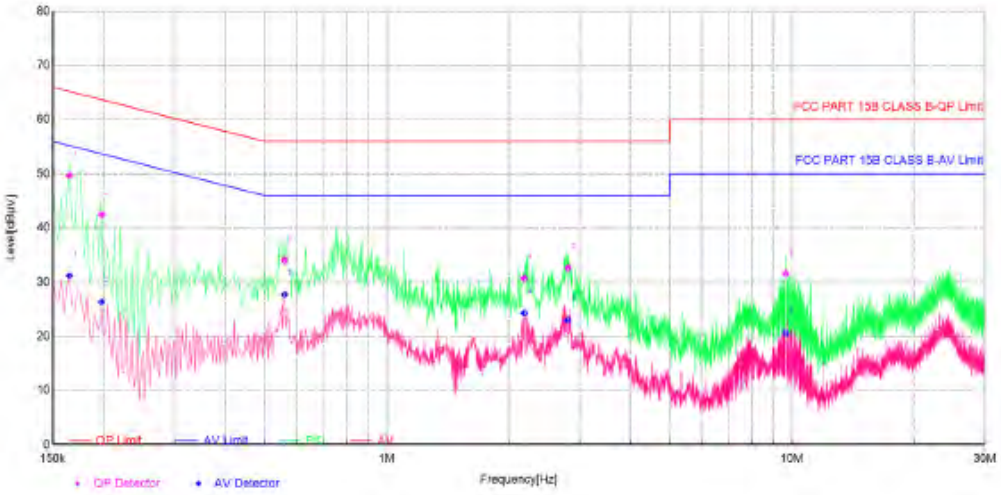
Neutral:



Final Data List										
NO.	Freq. [MHz]	Factor[dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict
1	0.165	10.48	49.64	65.21	15.57	31.18	55.21	24.03	N	PASS
2	0.1975	10.49	42.46	63.72	21.26	26.37	53.72	27.35	N	PASS
3	0.56	10.64	34.05	56.00	21.95	27.76	46.00	18.24	N	PASS
4	2.189	10.66	30.74	56.00	25.26	24.27	46.00	21.73	N	PASS
5	2.8055	10.66	32.61	56.00	23.39	23.00	46.00	23.00	N	PASS
6	9.6725	10.73	31.59	60.00	28.41	20.56	50.00	29.44	N	PASS

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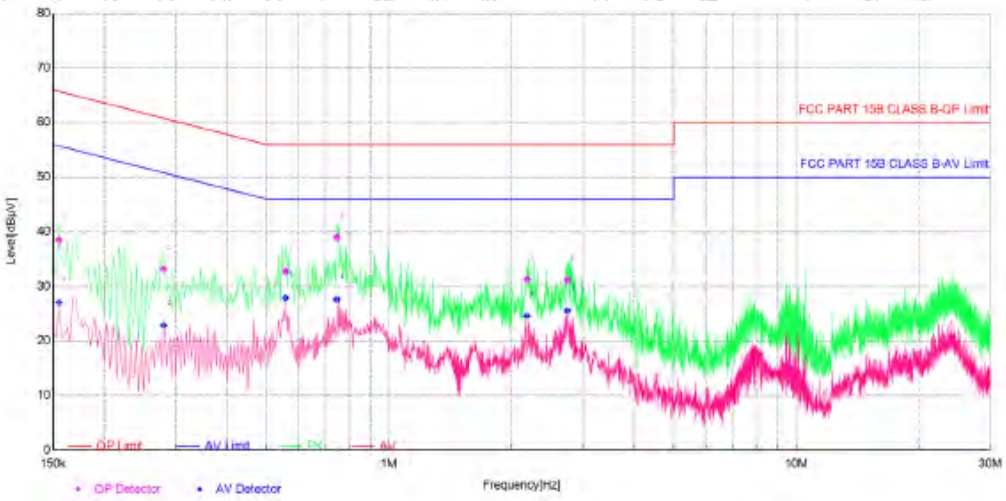
Model: DFR1081

Measurement data:

Pre-scan all test modes, found worst case at 802.11b mode 2412MHz, and so only show the test result of 802.11b mode 2412MHz

Line:



Final Data List

NO.	Freq. [MHz]	Factor[dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict
1	0.155	10.58	38.48	65.73	27.25	27.09	55.73	28.64	L	PASS
2	0.28	10.69	33.11	60.82	27.71	22.85	50.82	27.97	L	PASS
3	0.5575	10.74	32.71	56.00	23.29	27.87	46.00	18.13	L	PASS
4	0.745	10.75	38.95	56.00	17.05	27.63	46.00	18.37	L	PASS
5	2.18	10.69	31.27	56.00	24.73	24.55	46.00	21.45	L	PASS
6	2.7425	10.70	31.15	56.00	24.85	25.57	46.00	20.43	L	PASS

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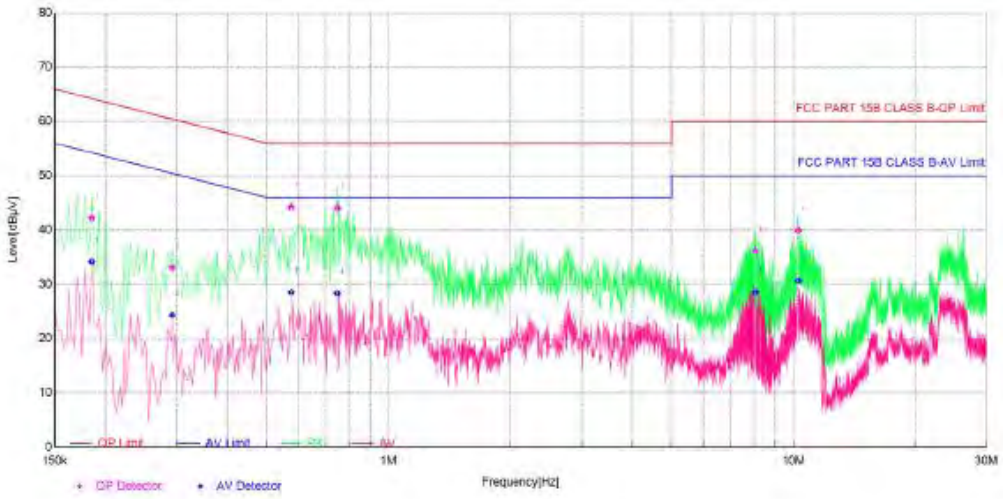
Neutral:



Final Data List										
NO.	Freq. [MHz]	Factor[dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Phase	Verdict
1	0.185	10.49	42.18	64.26	22.08	34.16	54.26	20.10	N	PASS
2	0.2925	10.83	33.11	60.45	27.34	24.35	50.45	26.10	N	PASS
3	0.575	10.66	44.20	56.00	11.80	28.53	46.00	17.47	N	PASS
4	0.7475	10.74	44.03	56.00	11.97	28.37	46.00	17.63	N	PASS
5	8.0615	10.54	36.10	60.00	23.90	28.58	50.00	21.42	N	PASS
6	10.28	10.78	39.89	60.00	20.11	30.63	50.00	19.37	N	PASS

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

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6. Conducted Peak Output Power

6.1 Applicable Standard

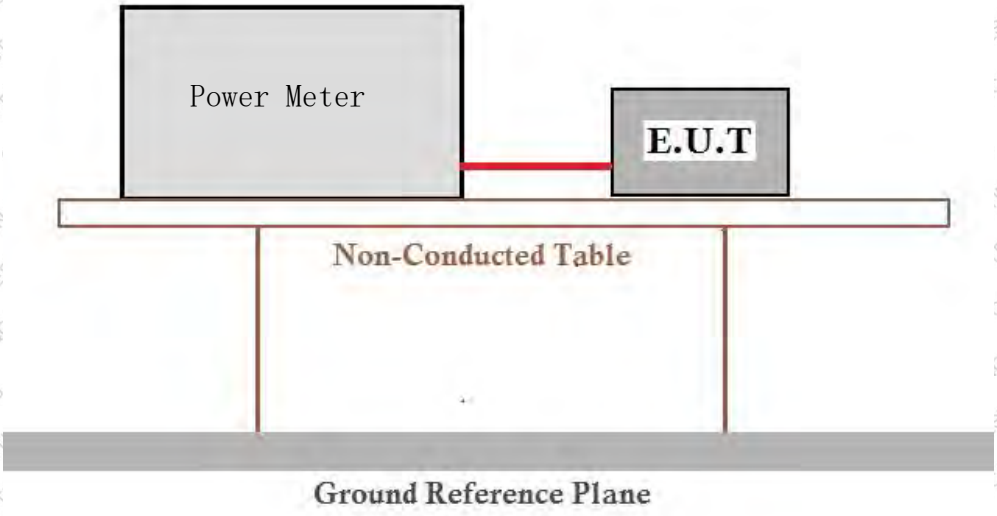
FCC Part15 C Section 15.247 (b)(3)

6.2 Limit

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

6.3 Test setup



6.4 Test Data

Temperature	23 ℃	Humidity	52 %
ATM Pressure	101.1kPa	Antenna Gain	Ant1: 1.56dBi Ant2: 1.56dBi
Test by	LBi Li	Test result	PASS

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Test result as below table

802.11b_SISO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Limit (dBm)	Result
	Ant 1	Ant 2		
Low channel 2412MHz	16.57	16.3	≤30	Pass
Middle channel 2437MHz	16.73	16.31	≤30	Pass
High channel 2462MHz	16.68	16.18	≤30	Pass

802.11g_SISO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Limit (dBm)	Result
	Ant 1	Ant 2		
Low channel 2412MHz	16.3	16.09	≤30	Pass
Middle channel 2437MHz	16.28	15.93	≤30	Pass
High channel 2462MHz	16.25	15.91	≤30	Pass

802.11n20_SISO, 802.11n20_MIMO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Conducted power (dBm)			Limit (dBm)	Result
	Ant 1	Ant 2	Ant1	Ant2	Sum		
Low channel 2412MHz	16.25	15.92	13.38	12.81	16.11	≤30	Pass
Middle channel 2437MHz	16.3	15.81	13.19	12.44	15.84	≤30	Pass
High channel 2462MHz	16.32	15.76	13.25	12.28	15.8	≤30	Pass

802.11n40_SISO, 802.11n40_MIMO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Conducted power (dBm)			Limit (dBm)	Result
	Ant 1	Ant 2	Ant1	Ant2	Sum		
Low channel 2422MHz	16.53	15.94	13.52	12.57	16.08	≤30	Pass
Middle channel 2437MHz	16.6	15.72	13.42	12.25	15.88	≤30	Pass
High channel 2452MHz	16.45	15.63	13.31	12.1	15.76	≤30	Pass

802.11ax20_SISO, 802.11ax20_MIMO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Conducted power (dBm)			Limit (dBm)	Result
	Ant 1	Ant 2	Ant1	Ant2	Sum		
Low channel 2412MHz	16.14	15.84	13.44	11.69	15.66	≤30	Pass
Middle channel 2437MHz	15.98	15.7	13.34	12.11	15.78	≤30	Pass
High channel 2462MHz	16.05	15.67	13.37	12.12	15.8	≤30	Pass

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802.11ax40_SISO, 802.11ax40_MIMO modulation Test Result

Frequency (MHz)	Conducted power (dBm)	Conducted power (dBm)	Conducted power (dBm)			Limit (dBm)	Result
	Ant 1	Ant 2	Ant1	Ant2	Sum		
Low channel 2422MHz	15.79	15.68	13.06	12.41	15.76	≤30	Pass
Middle channel 2437MHz	15.79	15.45	13.04	12.37	15.73	≤30	Pass
High channel 2452MHz	15.76	15.41	12.85	12.02	15.47	≤30	Pass

Remark:

1. $Power^{SUM}= 10*Log(10^{*(PowerANT1/10)} +10^{*(PowerANT2/10)})$
2. The built-in test software can control the single antenna transmission, and can also control the double antenna transmission together
3. For MIMO devices refer to KDB Publication 662911 D01.

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7. Channel Bandwidth & 99% Occupied Bandwidth

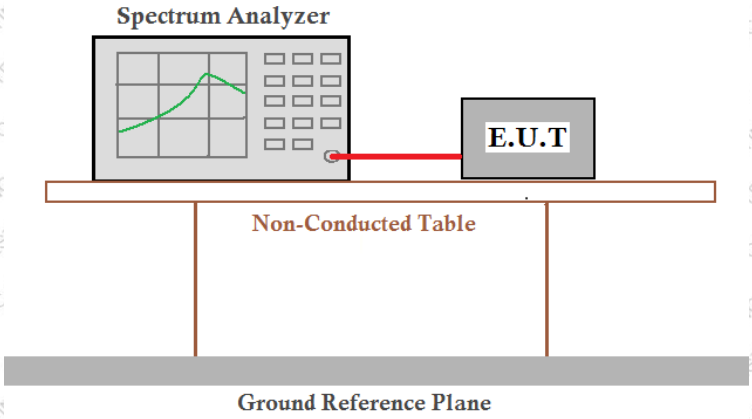
7.1 Applicable Standard

FCC Part15 C Section 15.247 (a)(2)

7.2 Limit

The minimum 6 dB bandwidth shall be 500 kHz.

7.3 Test setup



7.4 Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

7.5 Test Data

Temperature	23 ℃	Humidity	52 %
ATM Pressure	101.1kPa	Antenna Gain	Ant1: 1.56dBi Ant2: 1.56dBi
Test by	LBi Li	Test result	PASS

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Please refer to following table and plots.

DTS Bandwidth:

Modulation	CH No.	Frequency (MHz)	ANT	DTS Bandwidth (MHz)	Limit (MHz)	Verdict
802.11b	01	2412	1	10.089	≥0.5	PASS
			2	10.086	≥0.5	PASS
	06	2437	1	10.074	≥0.5	PASS
			2	10.089	≥0.5	PASS
	11	2462	1	10.086	≥0.5	PASS
			2	10.068	≥0.5	PASS
802.11g	01	2412	1	15.114	≥0.5	PASS
			2	15.12	≥0.5	PASS
	06	2437	1	15.114	≥0.5	PASS
			2	15.12	≥0.5	PASS
	11	2462	1	15.117	≥0.5	PASS
			2	15.117	≥0.5	PASS
802.11n (HT20)	01	2412	1	15.105	≥0.5	PASS
			2	15.126	≥0.5	PASS
	06	2437	1	15.123	≥0.5	PASS
			2	15.105	≥0.5	PASS
	11	2462	1	15.123	≥0.5	PASS
			2	15.114	≥0.5	PASS
802.11n (HT40)	03	2422	1	35.094	≥0.5	PASS
			2	35.052	≥0.5	PASS
	06	2437	1	35.088	≥0.5	PASS
			2	35.07	≥0.5	PASS
	09	2452	1	35.082	≥0.5	PASS
			2	35.088	≥0.5	PASS
802.11ax (HEW20)	01	2412	1	16.374	≥0.5	PASS
			2	17.352	≥0.5	PASS
	06	2437	1	16.374	≥0.5	PASS
			2	16.35	≥0.5	PASS
	11	2462	1	16.368	≥0.5	PASS
			2	16.38	≥0.5	PASS
802.11ax (HEW40)	03	2422	1	35.082	≥0.5	PASS
			2	35.088	≥0.5	PASS
	06	2437	1	35.094	≥0.5	PASS
			2	35.076	≥0.5	PASS
	09	2452	1	35.4	≥0.5	PASS
			2	35.082	≥0.5	PASS

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99% Occupied Bandwidth:

Modulation	CH No.	Frequency (MHz)	ANT	99% Bandwidth (MHz)	Limit (MHz)	Verdict
802.11b	01	2412	1	13.421	/	PASS
			2	13.43	/	PASS
	06	2437	1	13.4	/	PASS
			2	13.361	/	PASS
	11	2462	1	13.358	/	PASS
			2	13.4	/	PASS
802.11g	01	2412	1	16.567	/	PASS
			2	16.576	/	PASS
	06	2437	1	16.552	/	PASS
			2	16.51	/	PASS
	11	2462	1	16.528	/	PASS
			2	16.543	/	PASS
802.11n (HT20)	01	2412	1	17.671	/	PASS
			2	17.68	/	PASS
	06	2437	1	17.668	/	PASS
			2	17.626	/	PASS
	11	2462	1	17.632	/	PASS
			2	17.65	/	PASS
802.11n (HT40)	03	2422	1	35.948	/	PASS
			2	36.032	/	PASS
	06	2437	1	35.942	/	PASS
			2	35.954	/	PASS
	09	2452	1	35.93	/	PASS
			2	36.026	/	PASS
802.11ax (HEW20)	01	2412	1	18.826	/	PASS
			2	18.835	/	PASS
	06	2437	1	18.847	/	PASS
			2	18.808	/	PASS
	11	2462	1	18.826	/	PASS
			2	18.841	/	PASS
802.11ax (HEW40)	03	2422	1	37.4	/	PASS
			2	37.496	/	PASS
	06	2437	1	37.424	/	PASS
			2	37.37	/	PASS
	09	2452	1	37.424	/	PASS
			2	37.46	/	PASS

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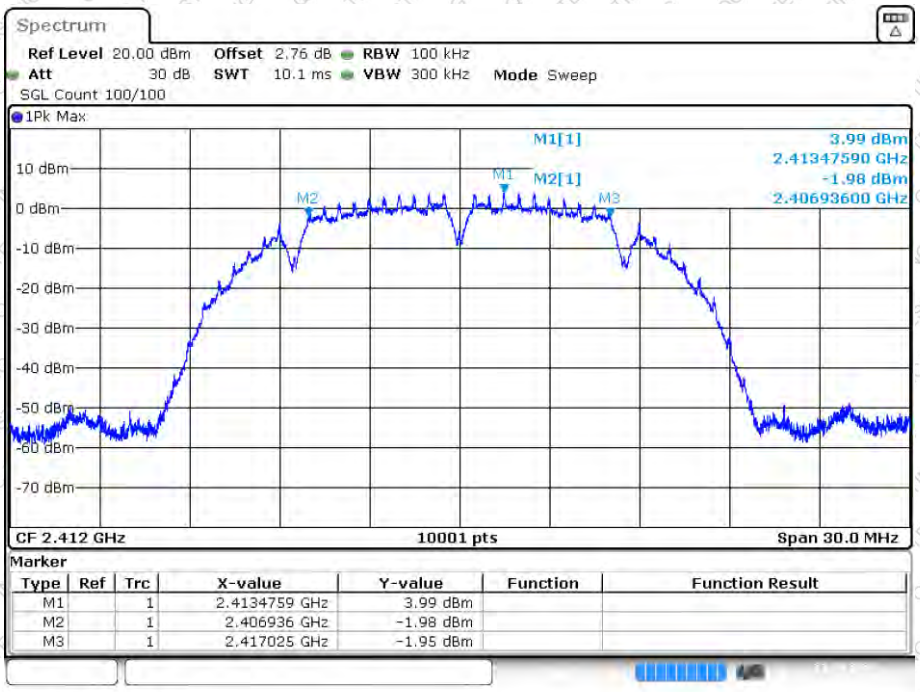
-6dB Bandwidth NVNT b 2412MHz Ant1



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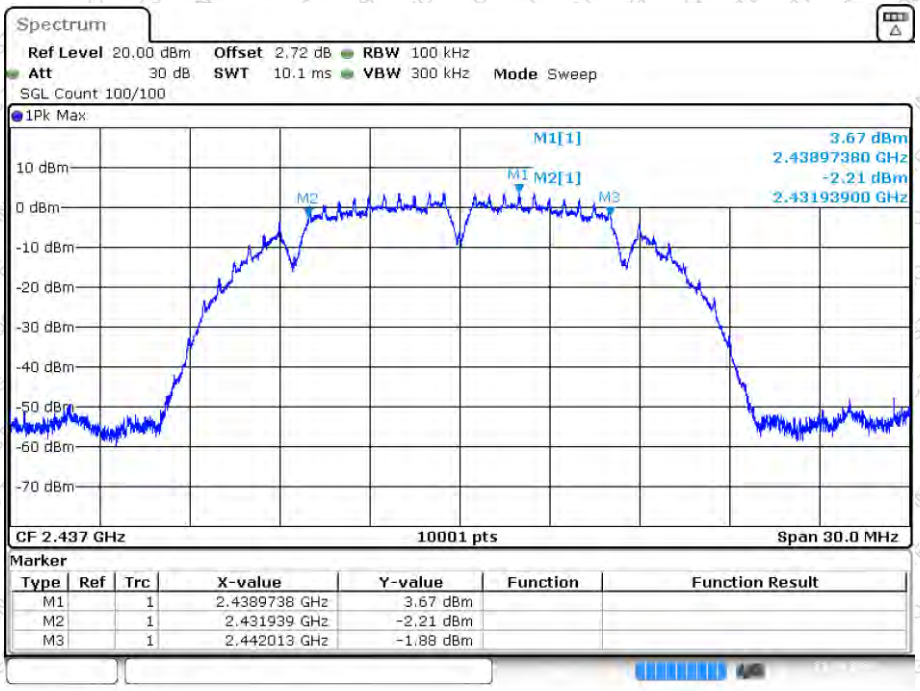

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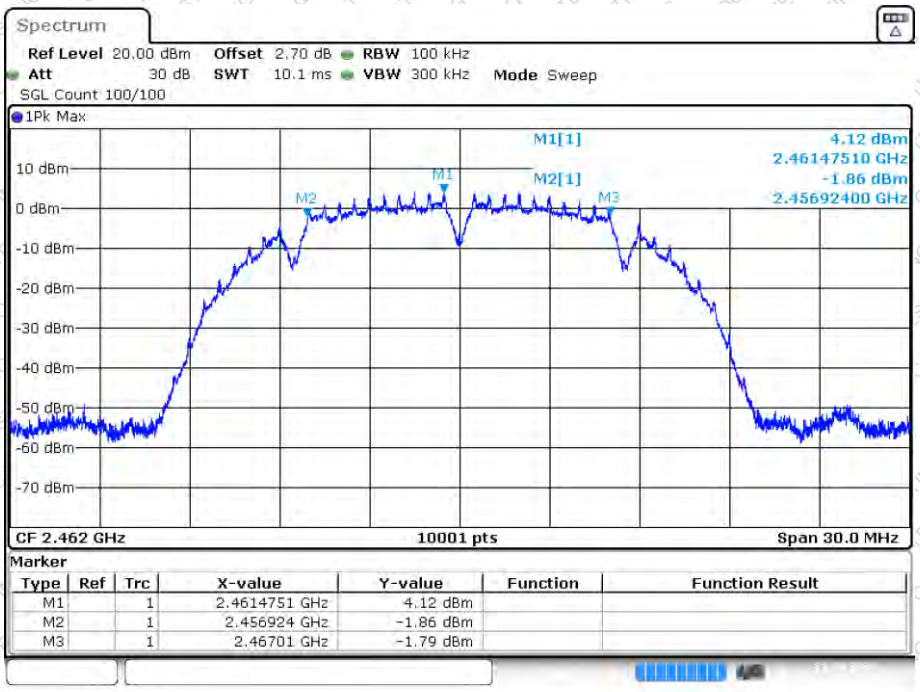
-6dB Bandwidth NVNT b 2462MHz Ant1



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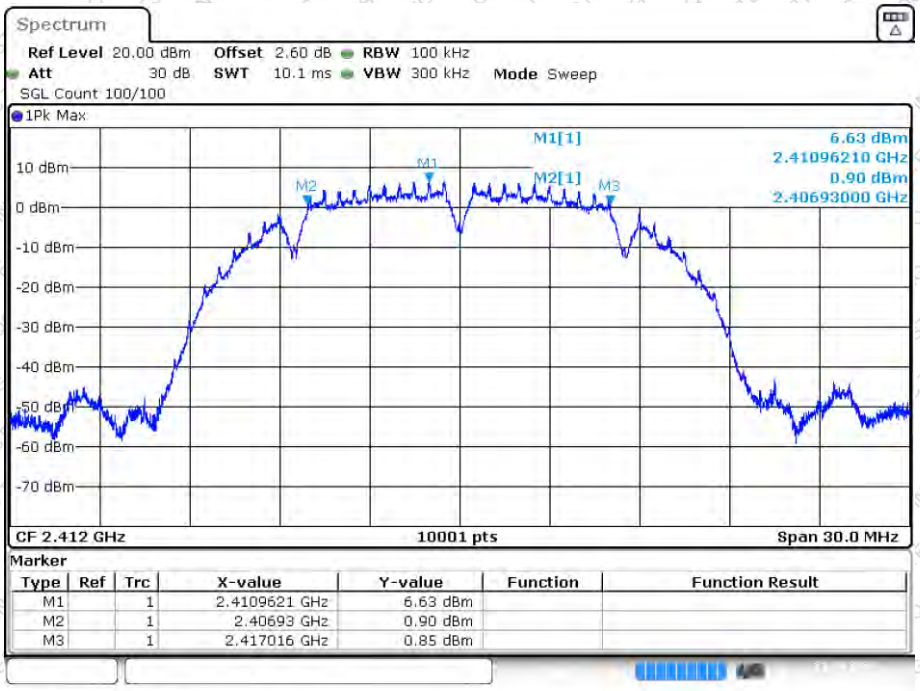

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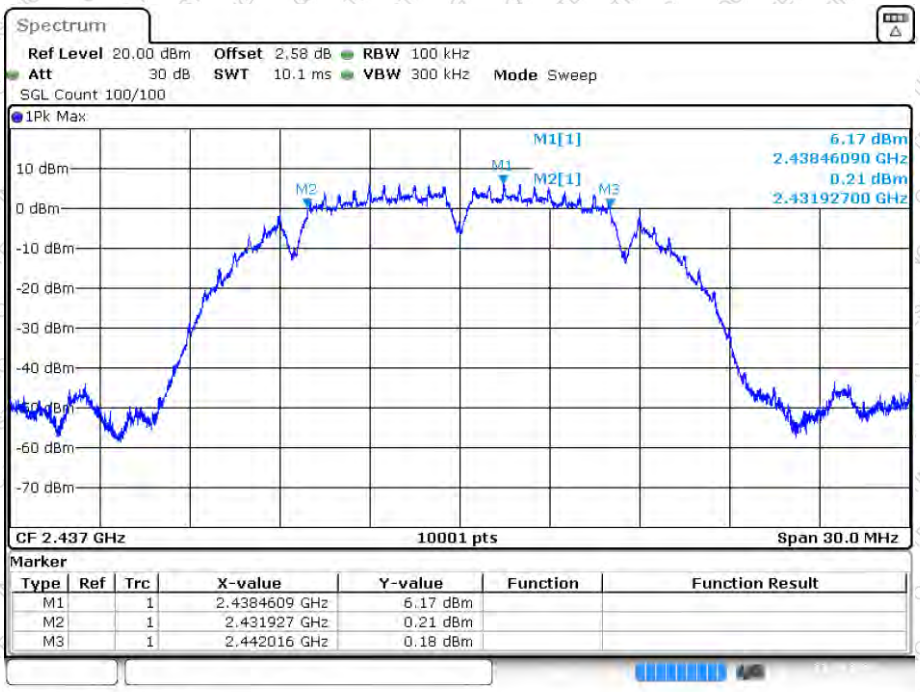
-6dB Bandwidth NVNT b 2437MHz Ant2



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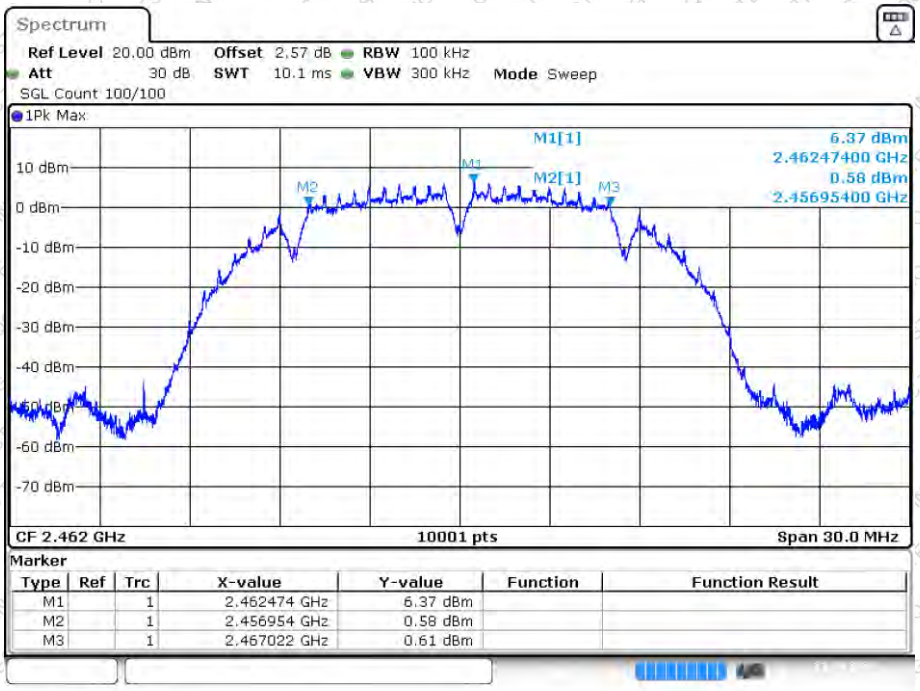

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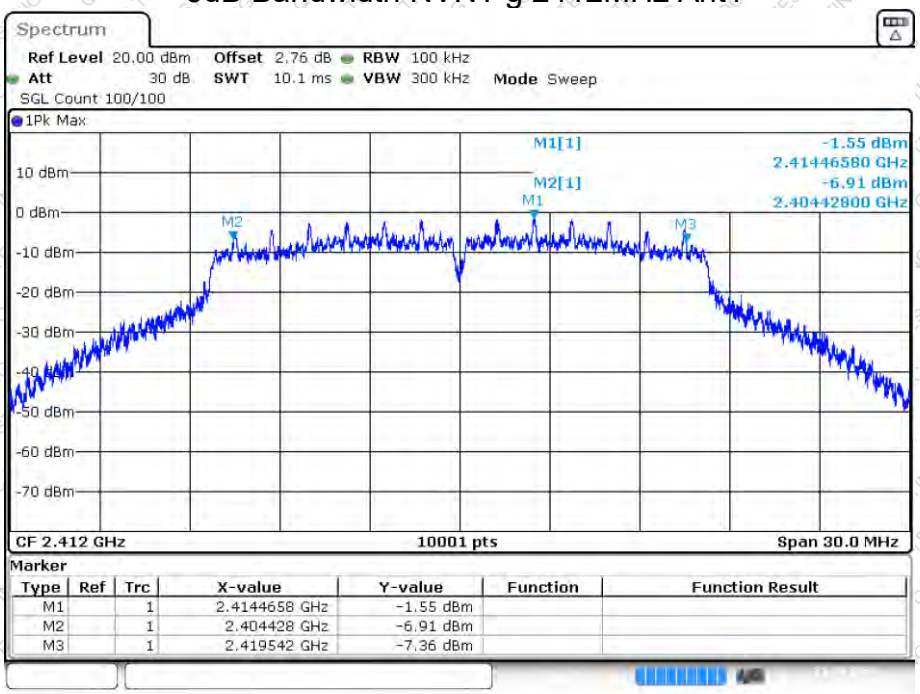
-6dB Bandwidth NVNT g 2412MHz Ant1



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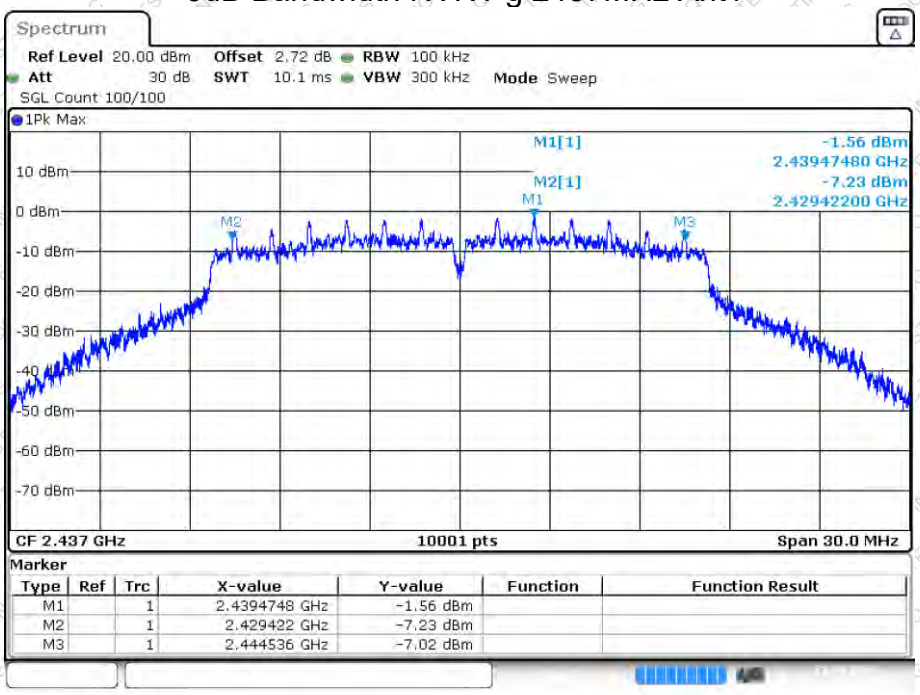

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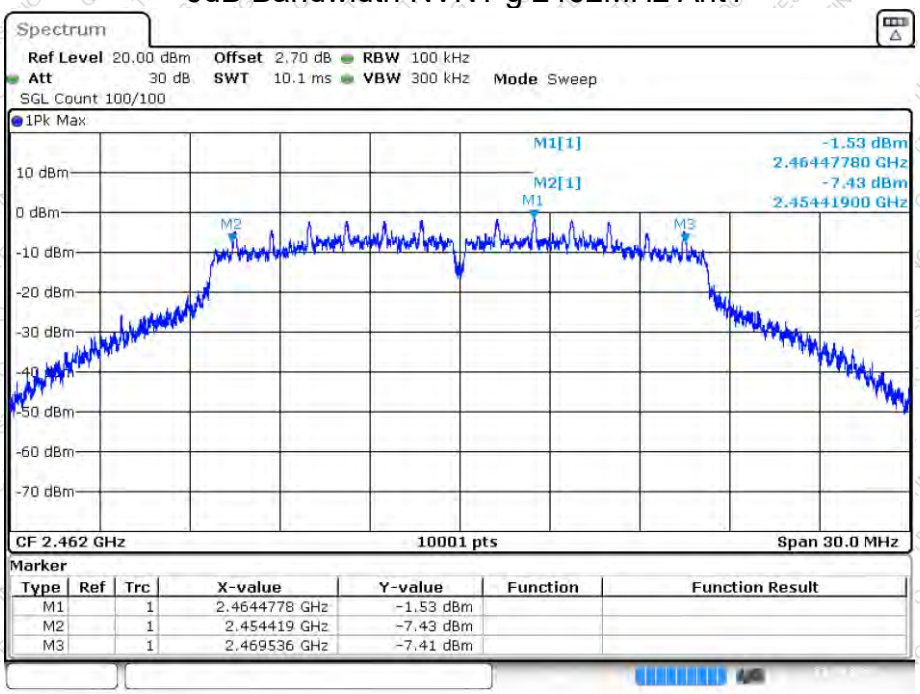
-6dB Bandwidth NVNT g 2462MHz Ant1



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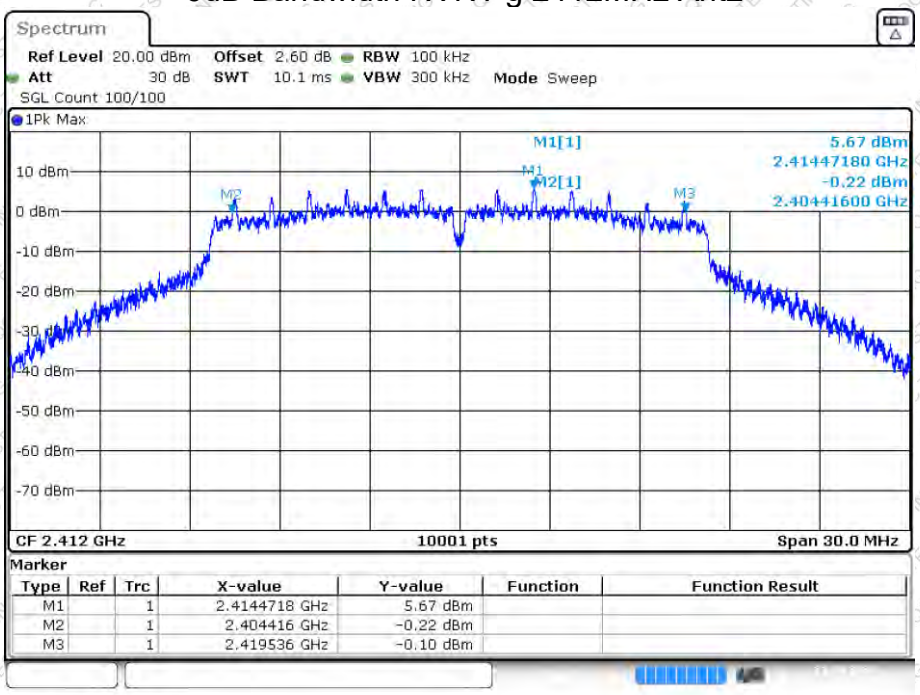
-6dB Bandwidth NVNT g 2412MHz Ant2



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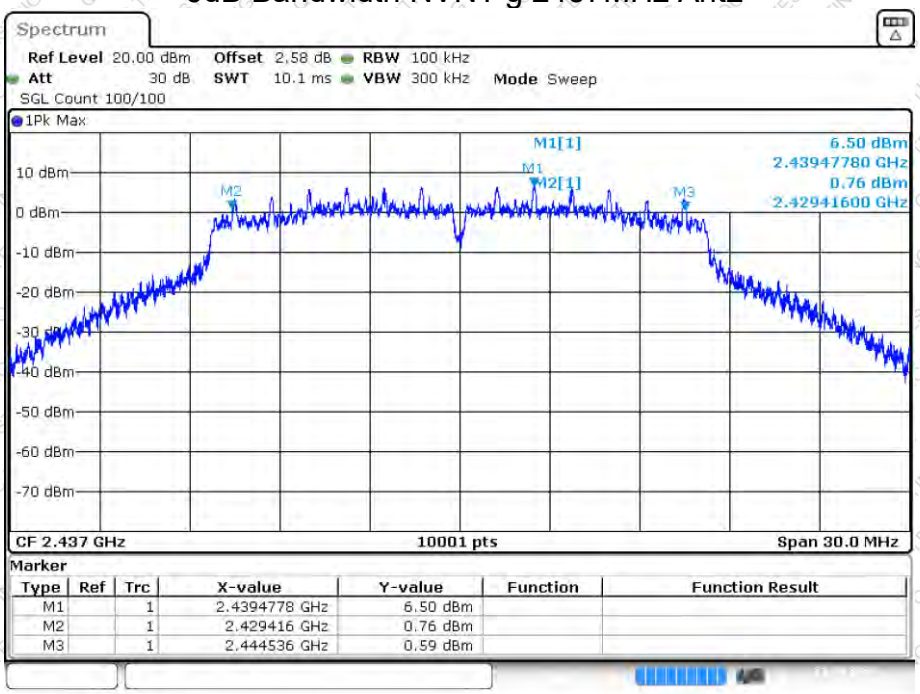
-6dB Bandwidth NVNT g 2437MHz Ant2



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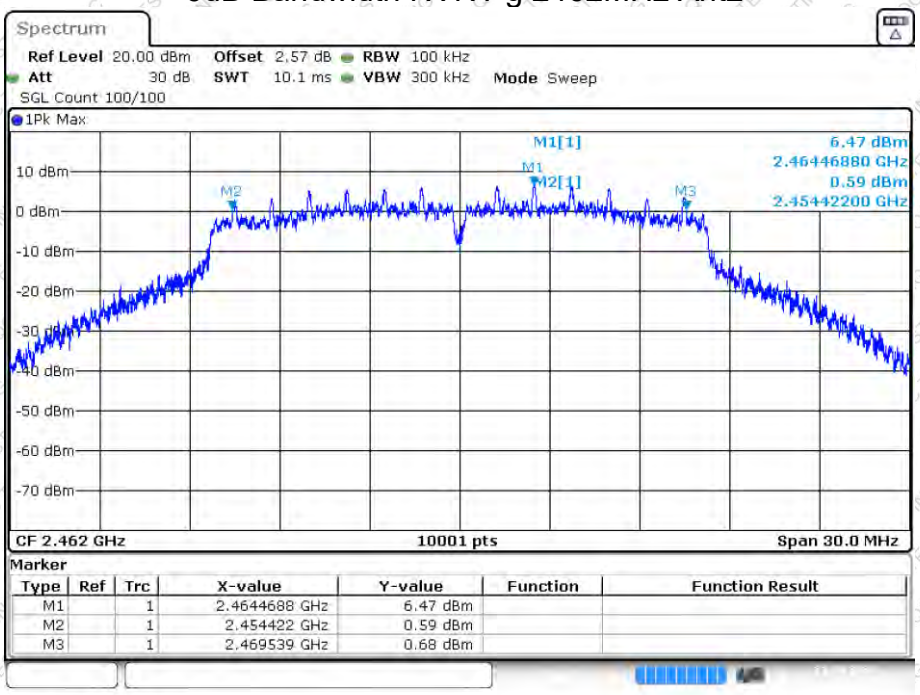
-6dB Bandwidth NVNT g 2462MHz Ant2



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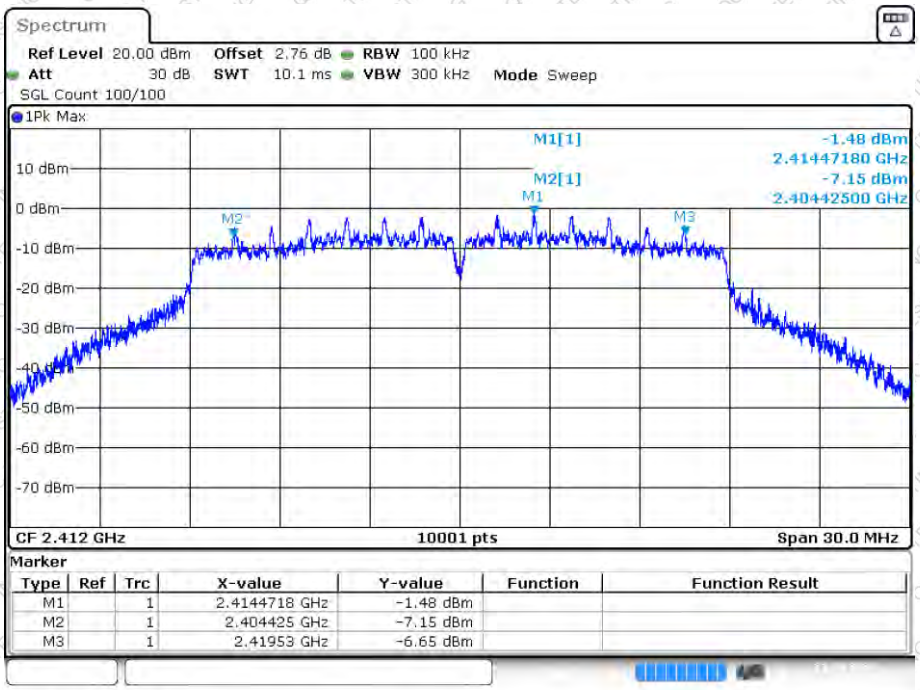
-6dB Bandwidth NVNT n20 2412MHz Ant1



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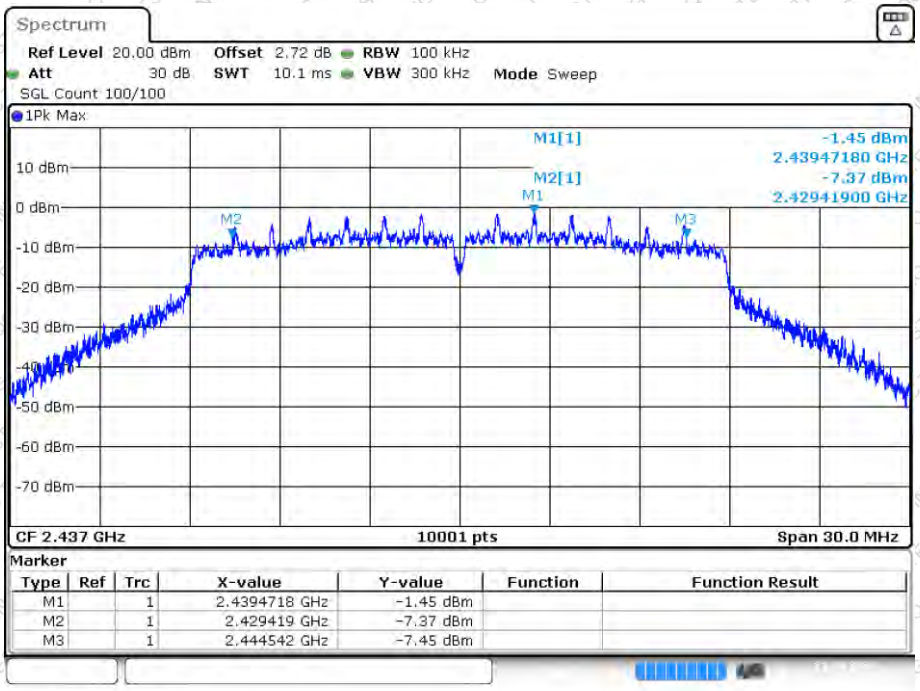
-6dB Bandwidth NVNT n20 2437MHz Ant1



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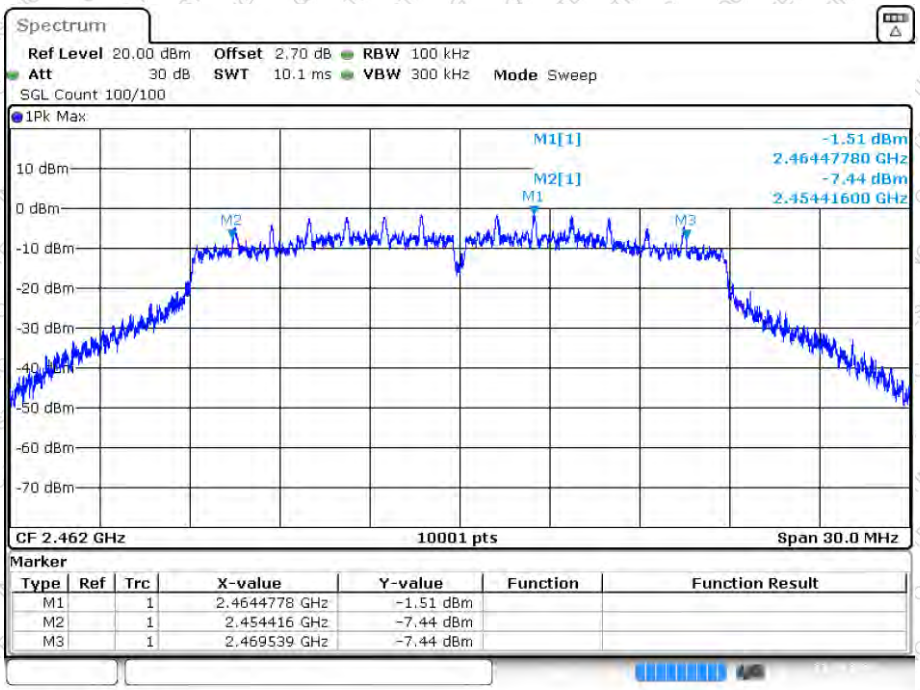
-6dB Bandwidth NVNT n20 2462MHz Ant1



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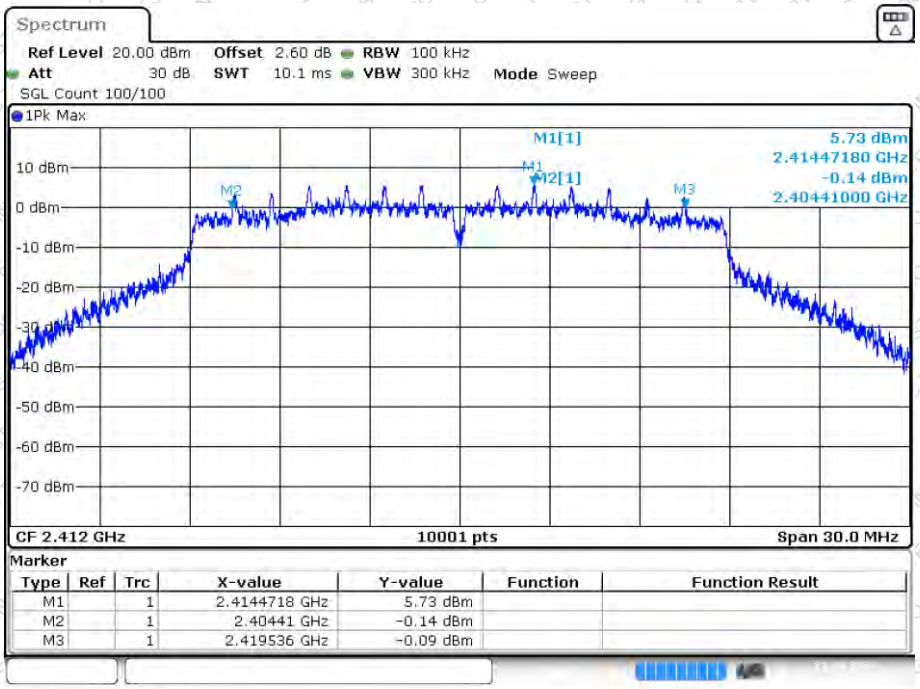
-6dB Bandwidth NVNT n20 2412MHz Ant2



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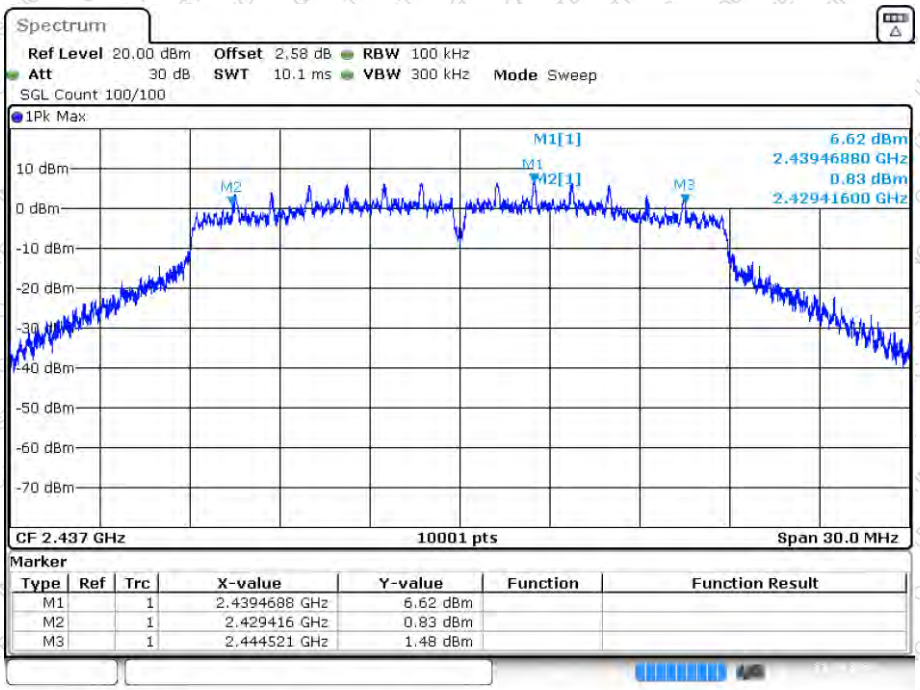
-6dB Bandwidth NVNT n20 2437MHz Ant2



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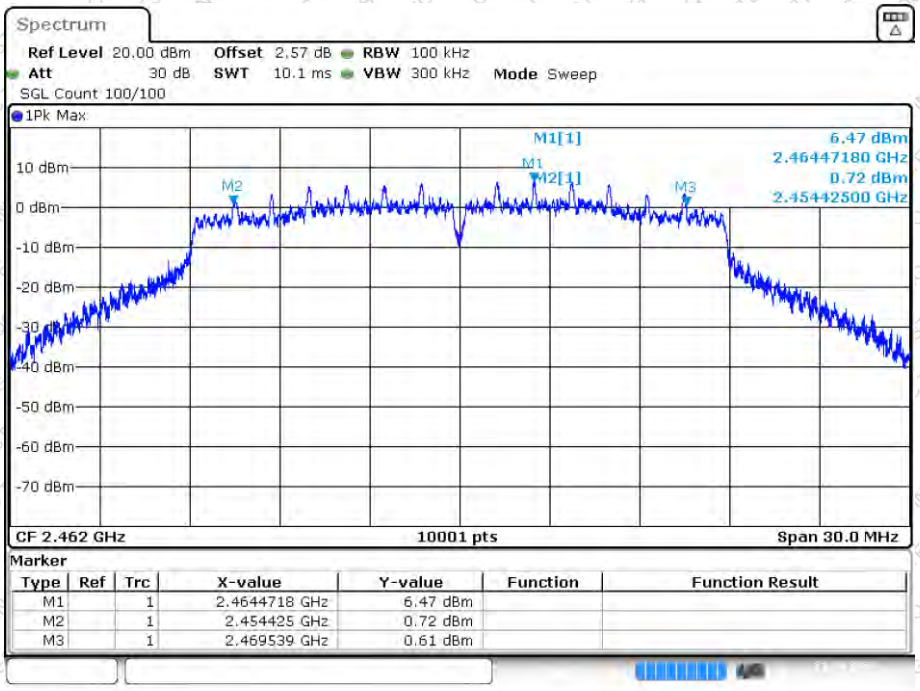
-6dB Bandwidth NVNT n20 2462MHz Ant2



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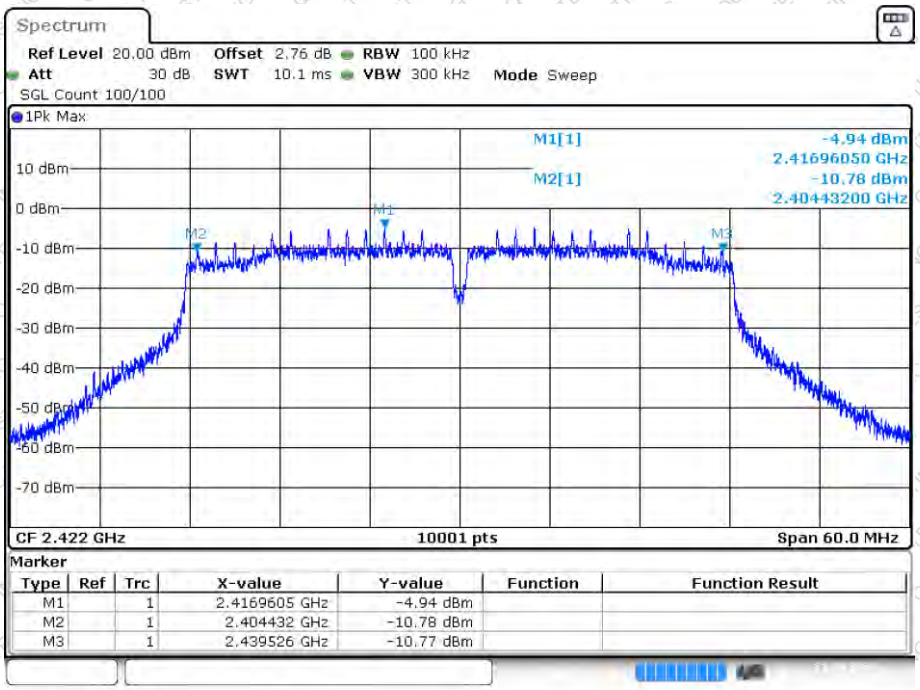
-6dB Bandwidth NVNT n40 2422MHz Ant1



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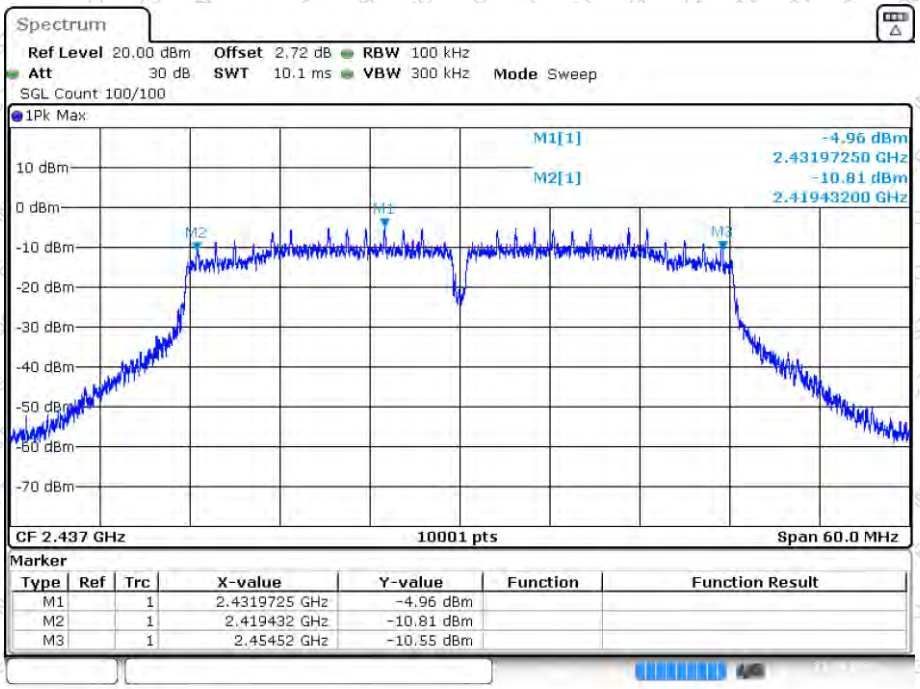
-6dB Bandwidth NVNT n40 2437MHz Ant1



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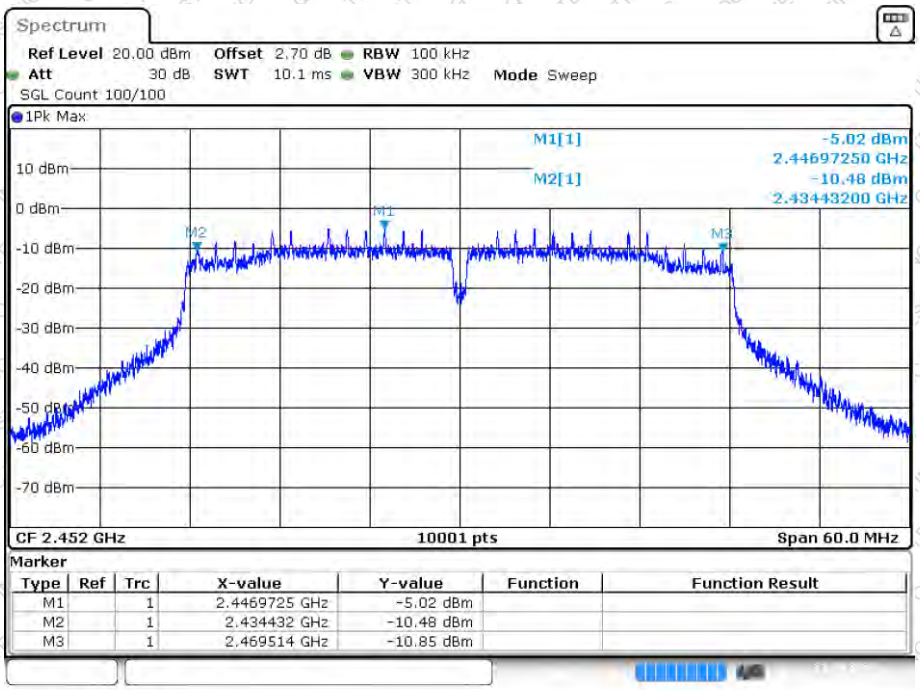
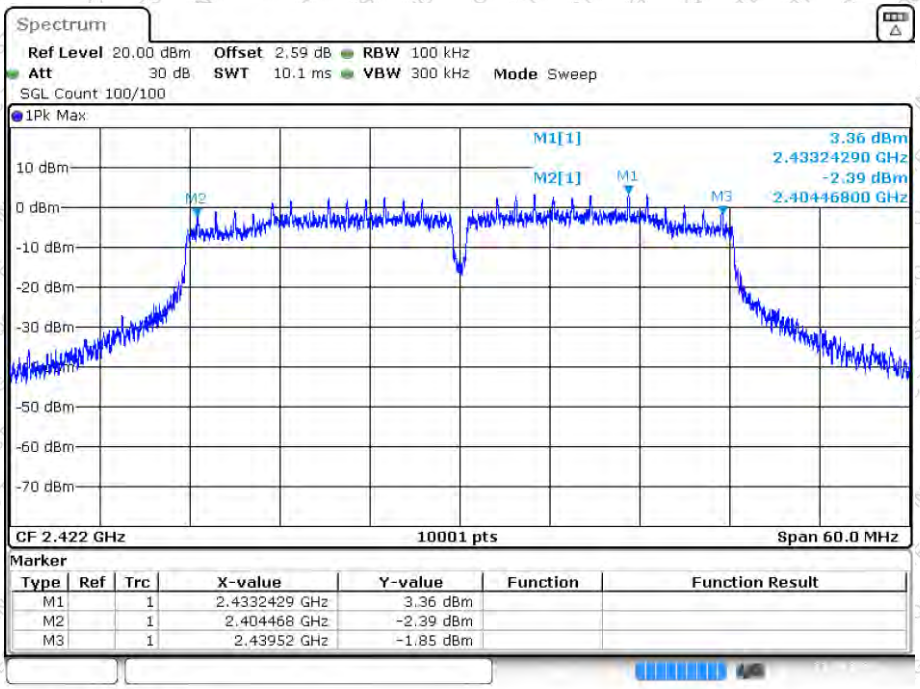
-6dB Bandwidth NVNT n40 2452MHz Ant1



Date: 21.OCT.2024 10:28:43

-6dB Bandwidth NVNT n40 2422MHz Ant2



Date: 21.OCT.2024 11:36:45

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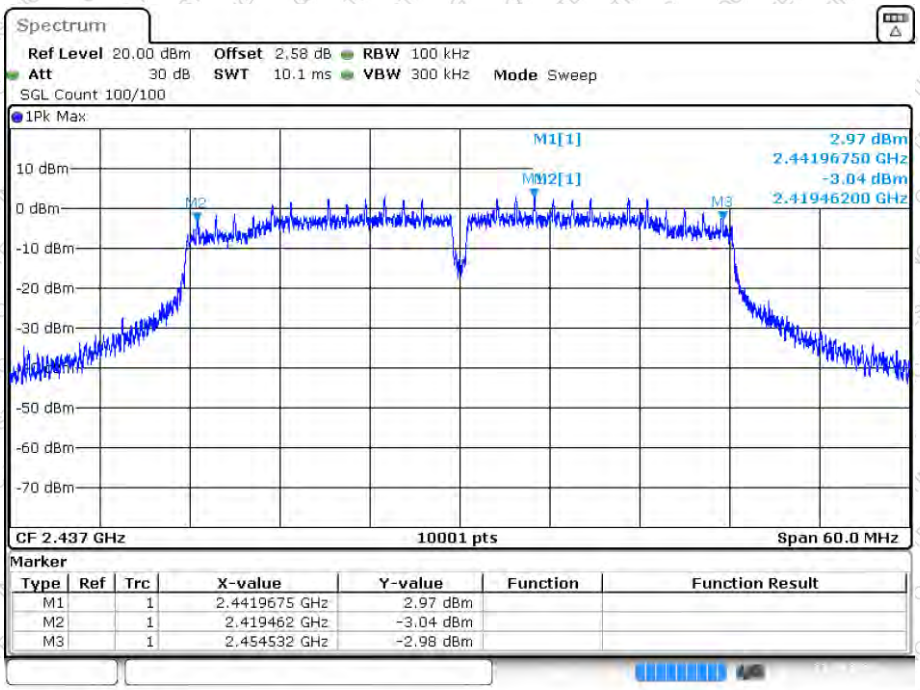
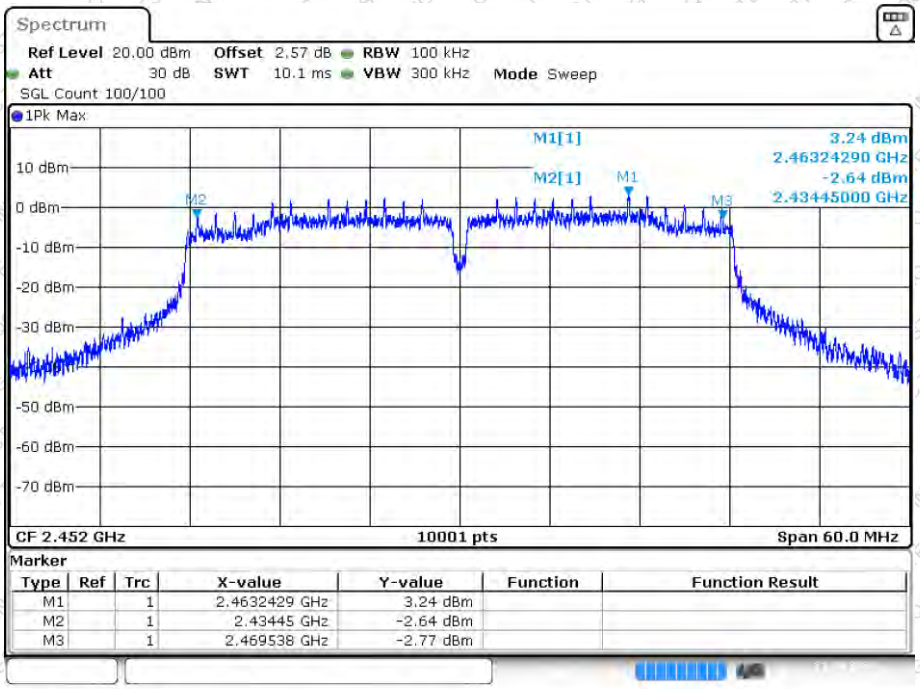
-6dB Bandwidth NVNT n40 2437MHz Ant2



Date: 21.OCT.2024 11:38:12

-6dB Bandwidth NVNT n40 2452MHz Ant2



Date: 21.OCT.2024 11:41:08

Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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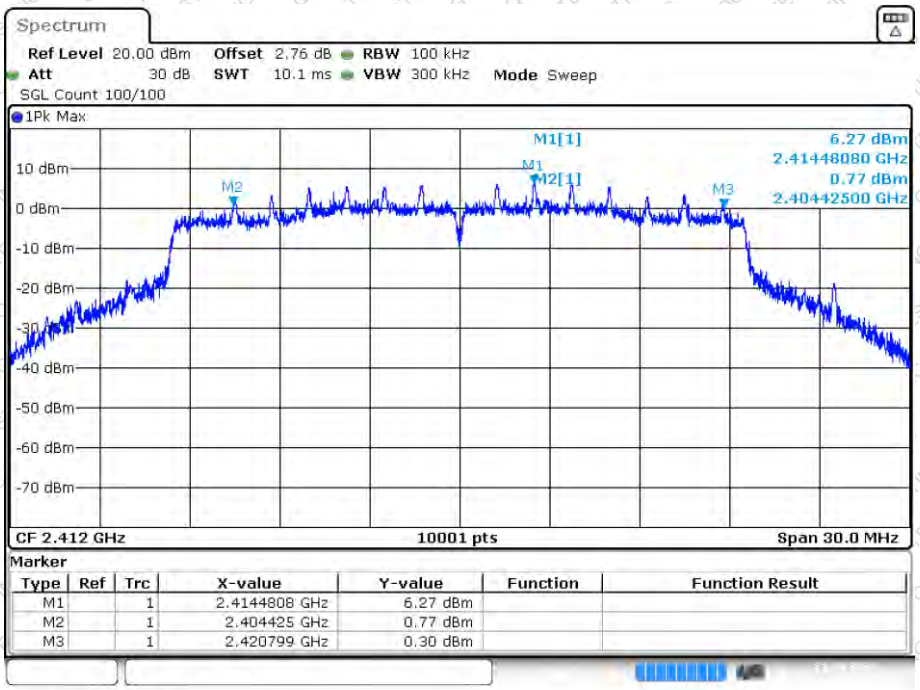
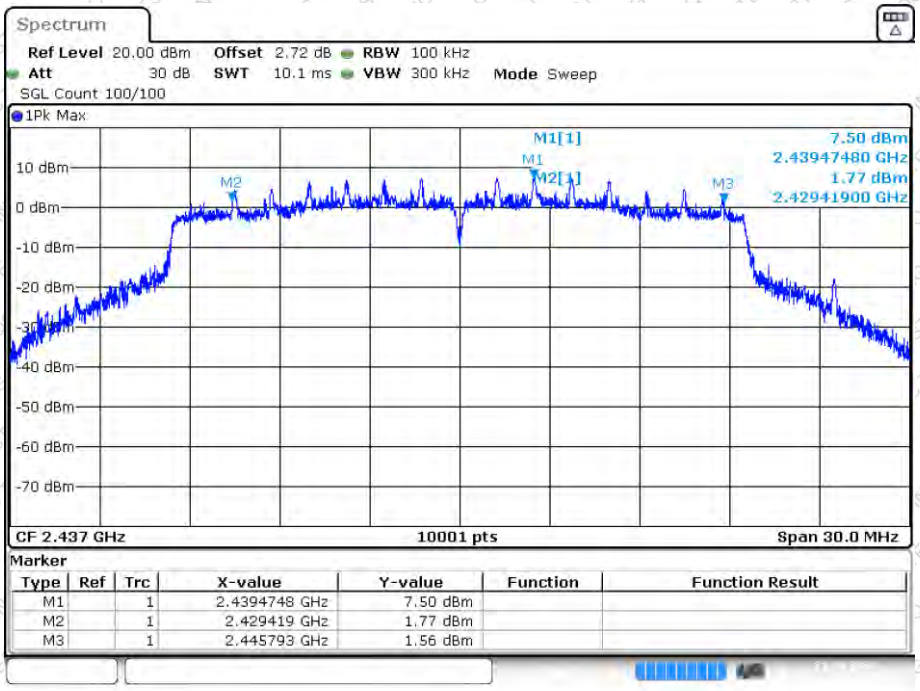
-6dB Bandwidth NVNT ax20 2412MHz Ant1



Date: 21.OCT.2024 10:45:35

-6dB Bandwidth NVNT ax20 2437MHz Ant1



Date: 21.OCT.2024 10:50:12

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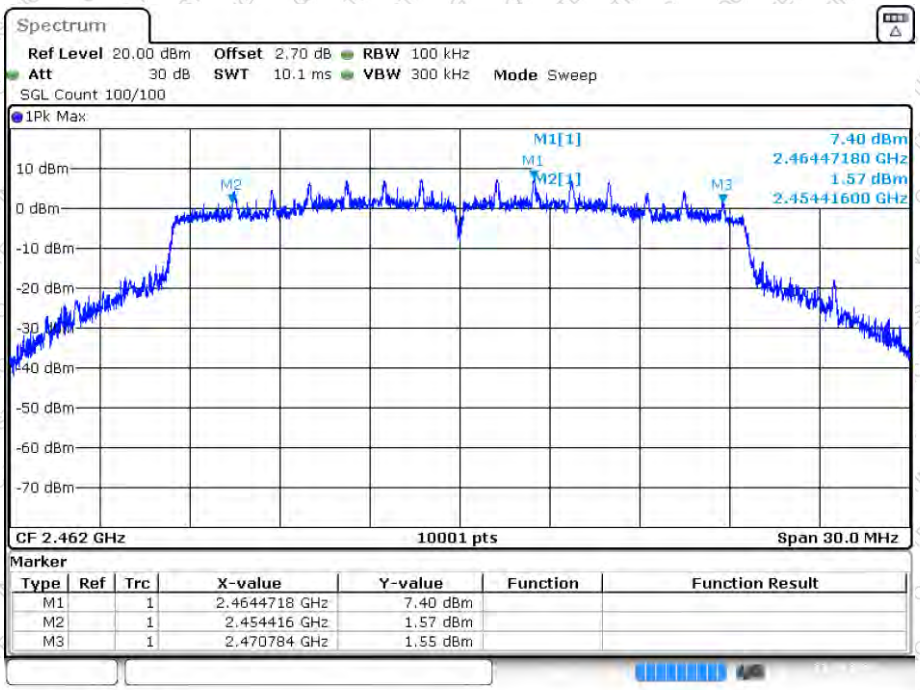
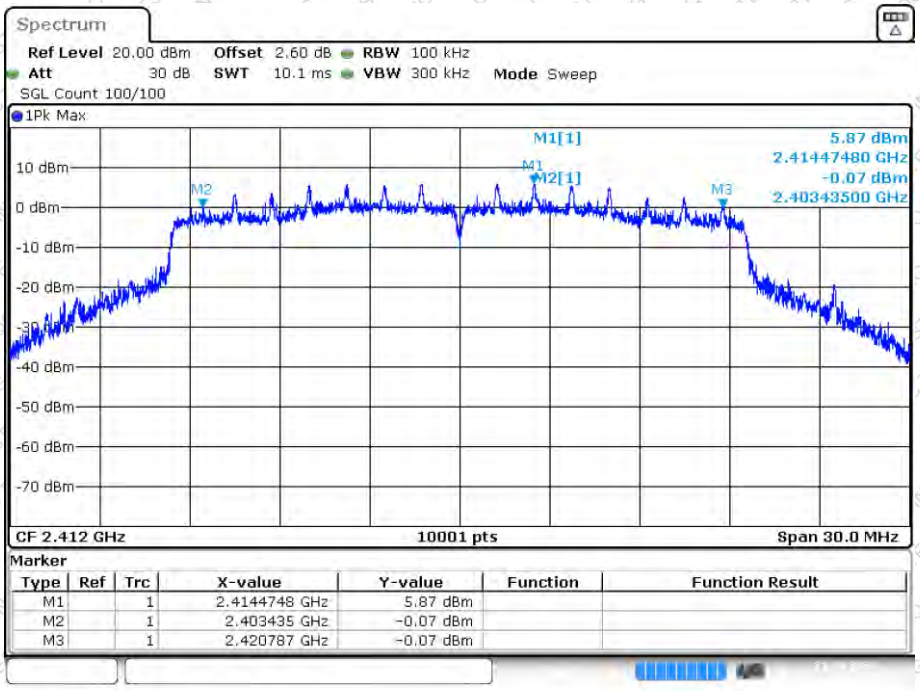
-6dB Bandwidth NVNT ax20 2462MHz Ant1



Date: 21.OCT.2024 10:51:42

-6dB Bandwidth NVNT ax20 2412MHz Ant2



Date: 21.OCT.2024 13:49:54

Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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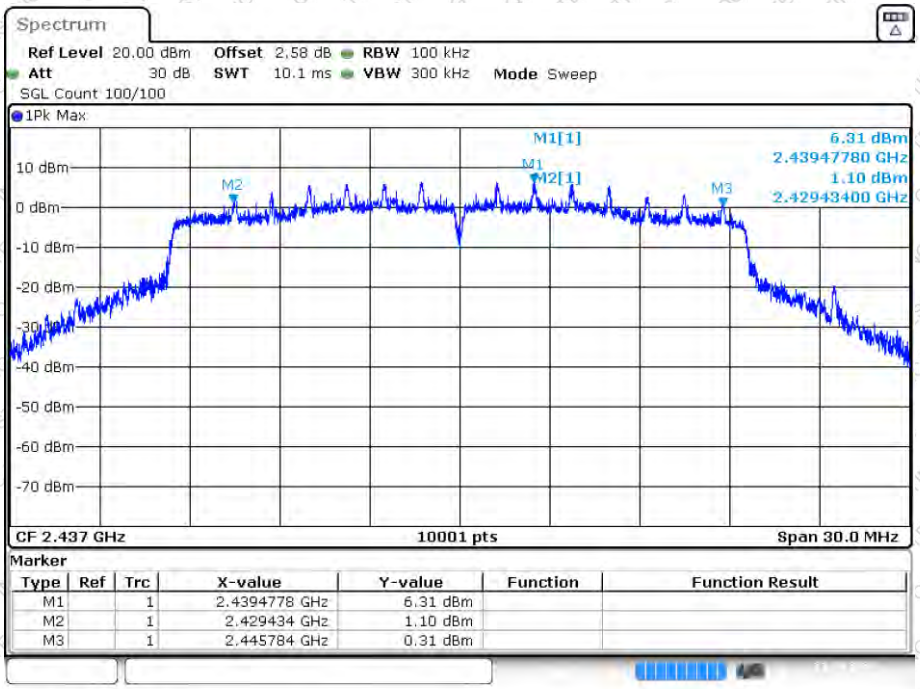
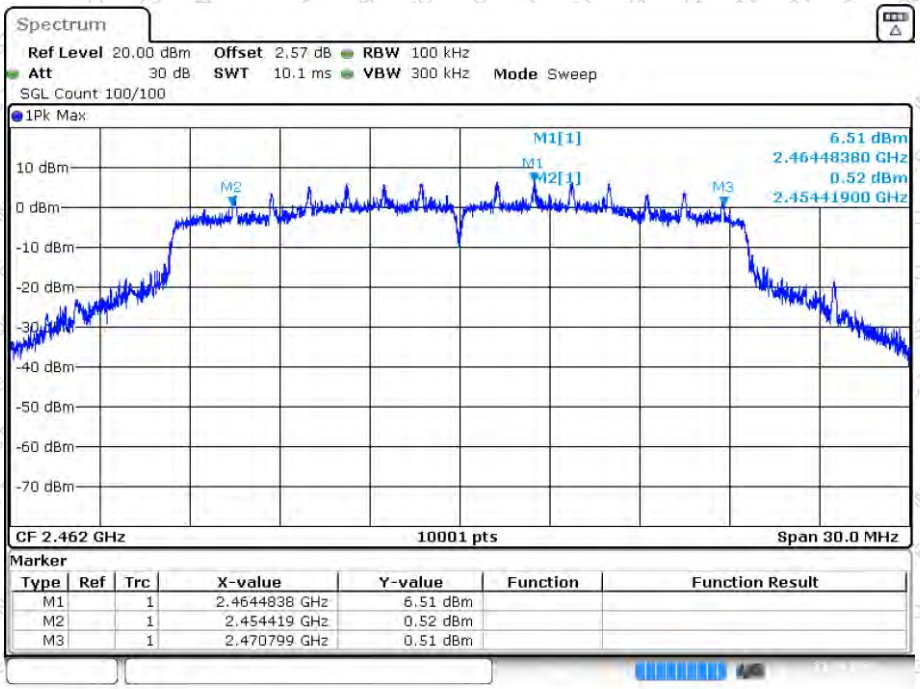
-6dB Bandwidth NVNT ax20 2437MHz Ant2



Date: 21.OCT.2024 13:51:27

-6dB Bandwidth NVNT ax20 2462MHz Ant2



Date: 21.OCT.2024 13:56:53

Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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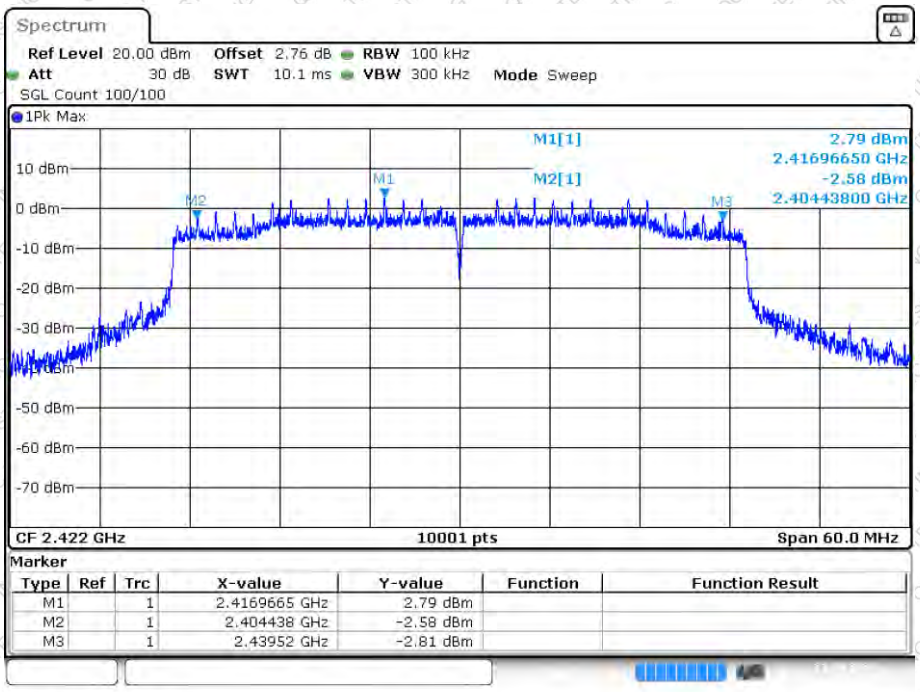
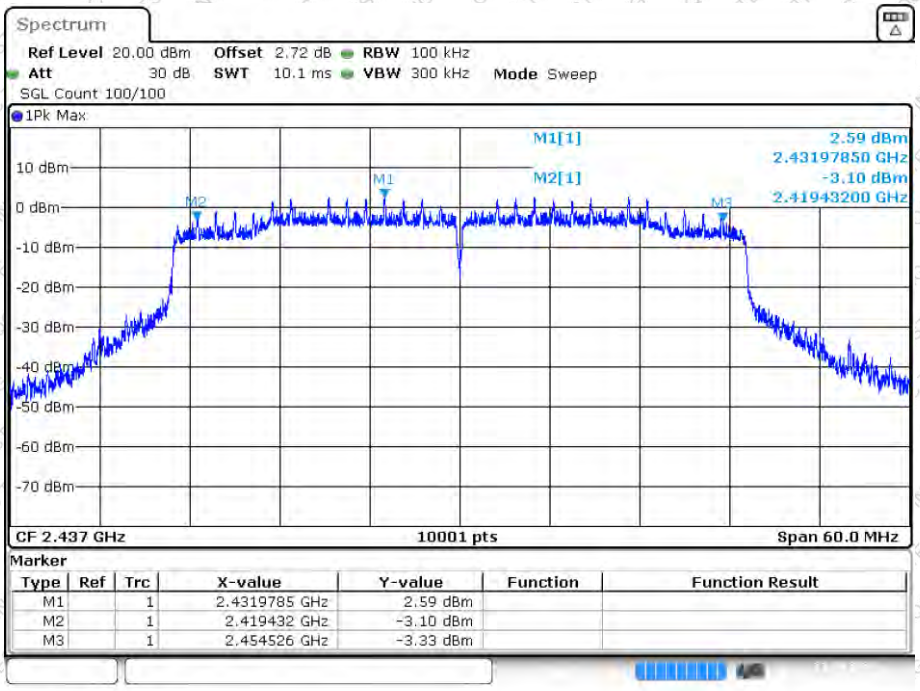
-6dB Bandwidth NVNT ax40 2422MHz Ant1



Date: 21.OCT.2024 10:56:32

-6dB Bandwidth NVNT ax40 2437MHz Ant1



Date: 21.OCT.2024 10:59:06

Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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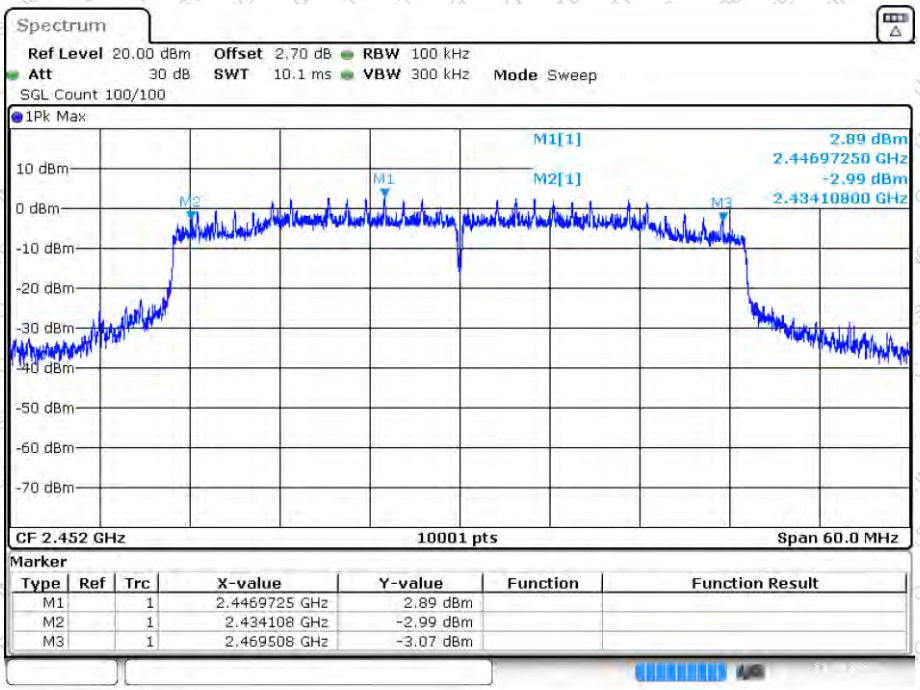
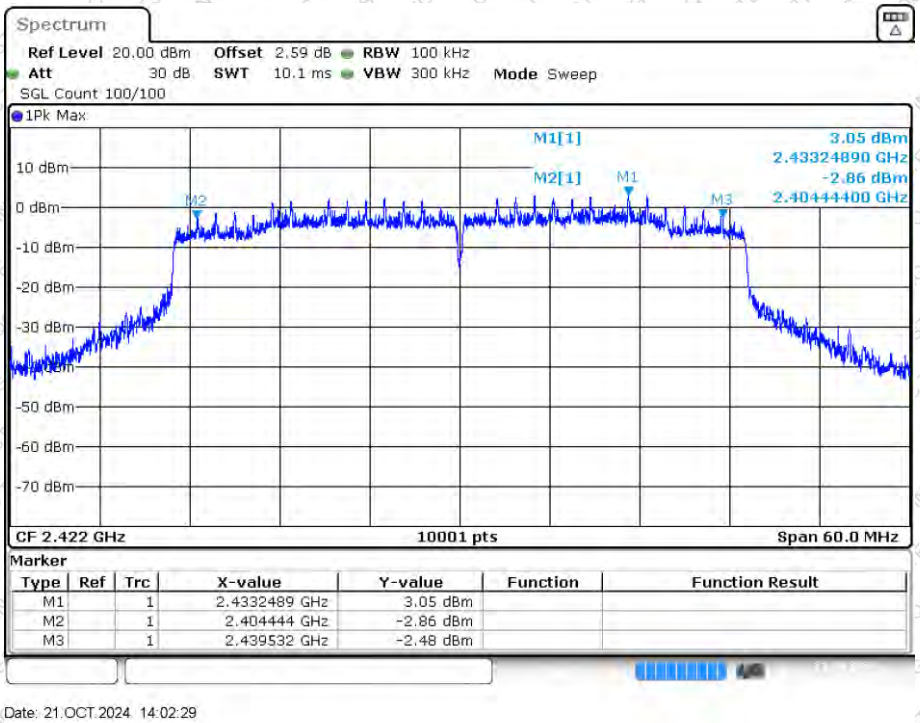
-6dB Bandwidth NVNT ax40 2452MHz Ant1



-6dB Bandwidth NVNT ax40 2422MHz Ant2



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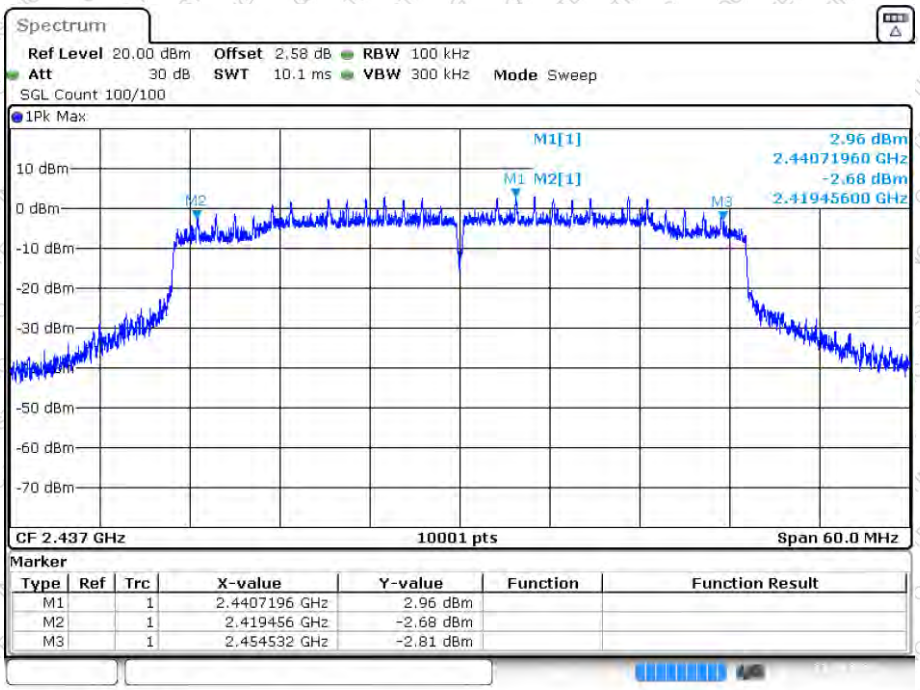
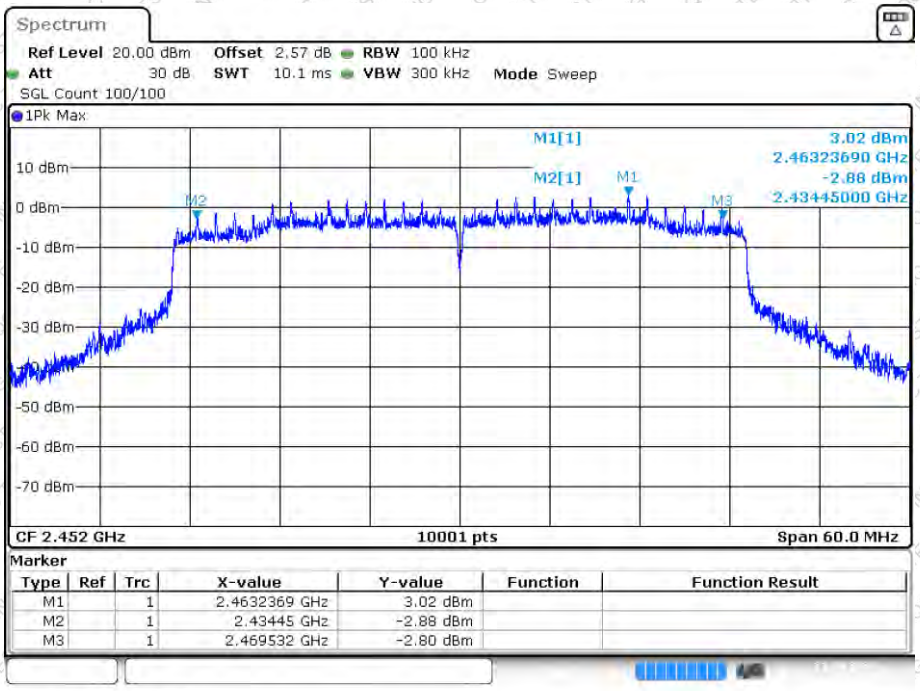
-6dB Bandwidth NVNT ax40 2437MHz Ant2



Date: 21.OCT.2024 14:05:00

-6dB Bandwidth NVNT ax40 2452MHz Ant2



Date: 21.OCT.2024 14:08:48

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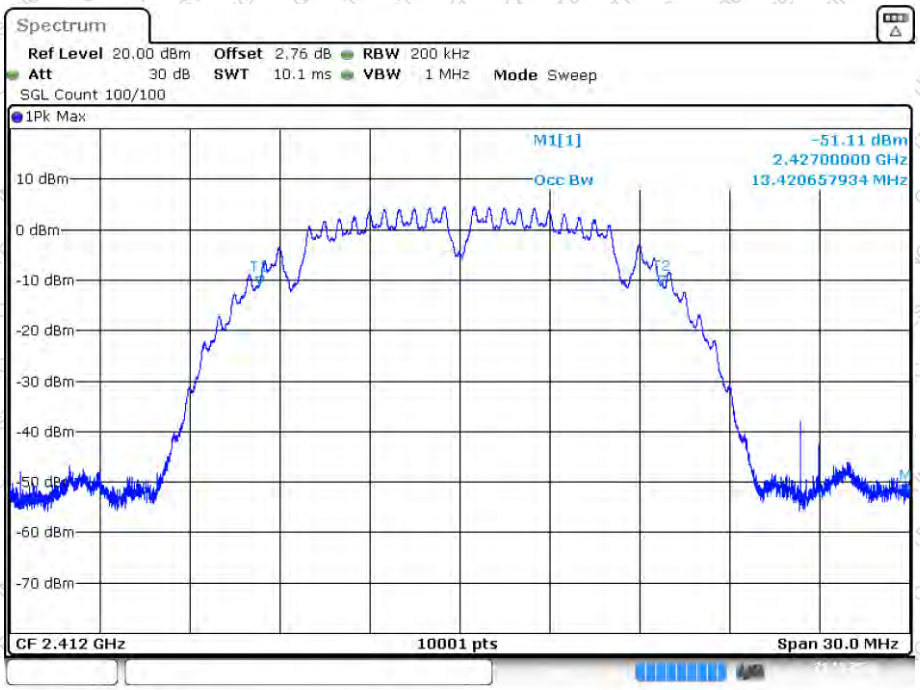
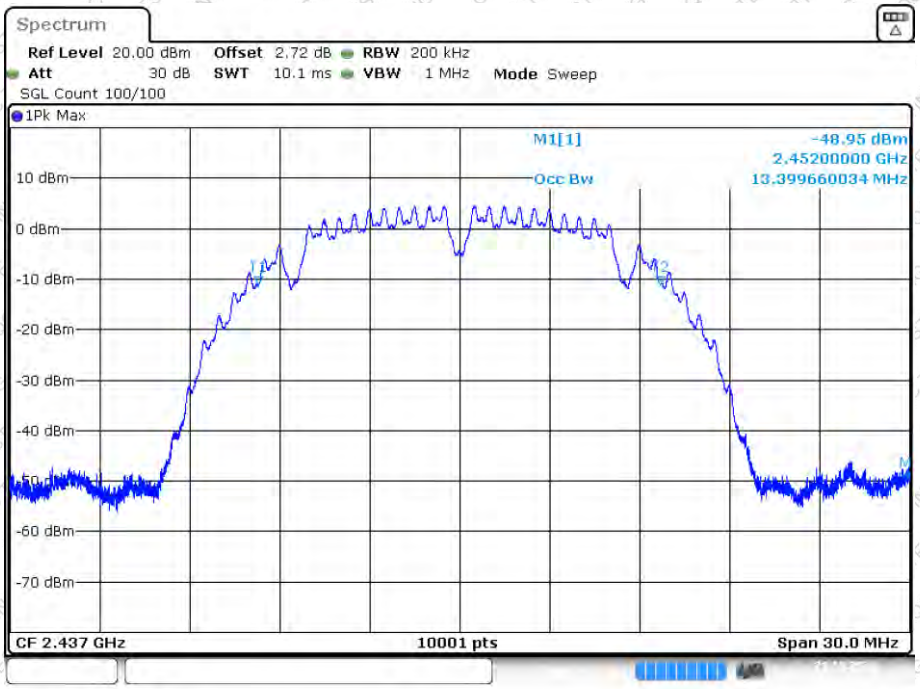
OBW NVNT b 2412MHz Ant1



Date: 21.OCT.2024 09:38:39

OBW NVNT b 2437MHz Ant1



Date: 21.OCT.2024 09:40:53

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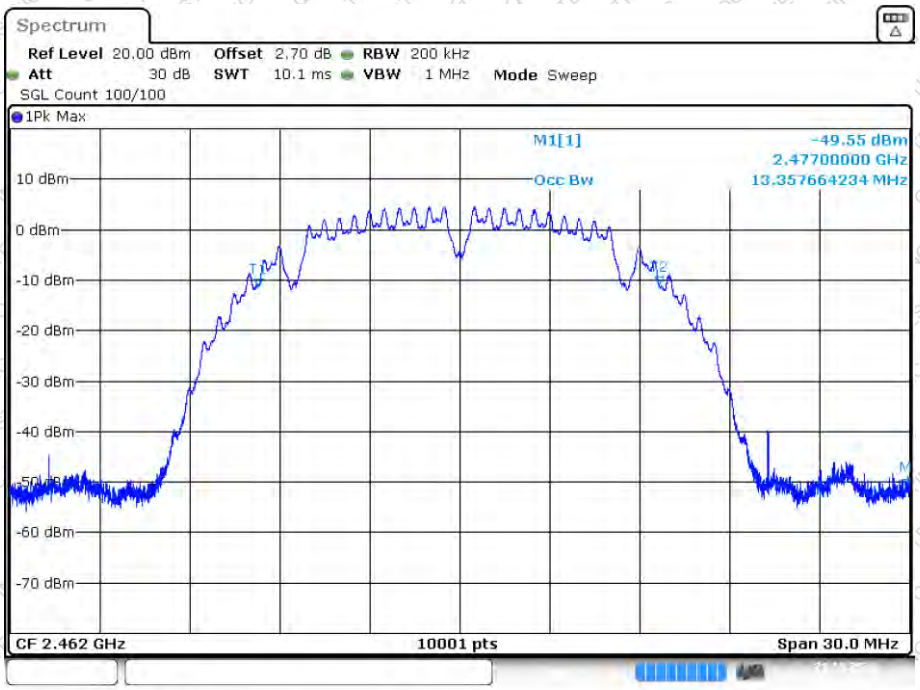
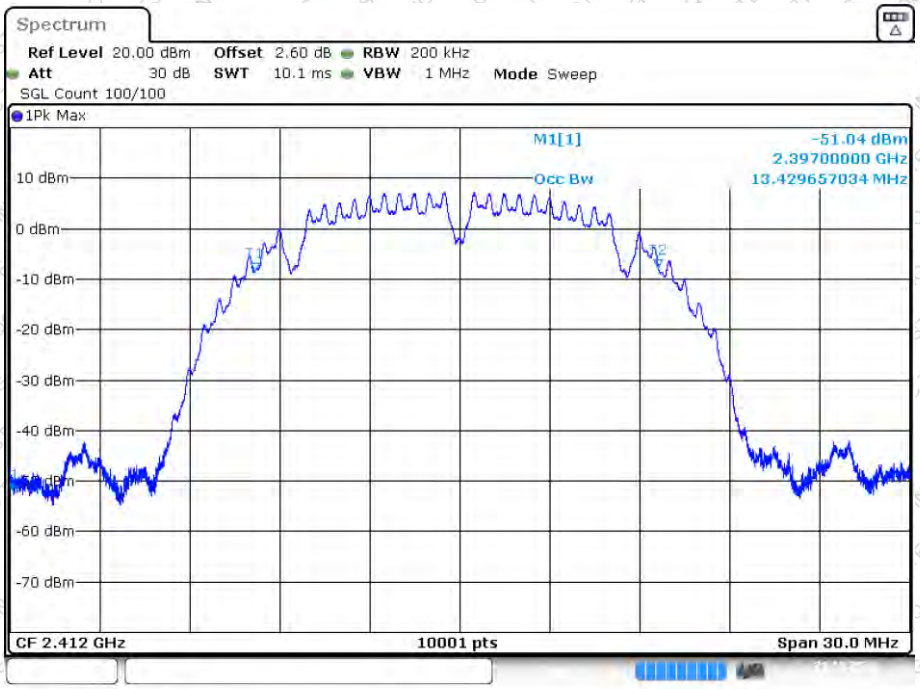
OBW NVNT b 2462MHz Ant1



Date: 21.OCT.2024 09:44:38

OBW NVNT b 2412MHz Ant2



Date: 21.OCT.2024 11:08:09

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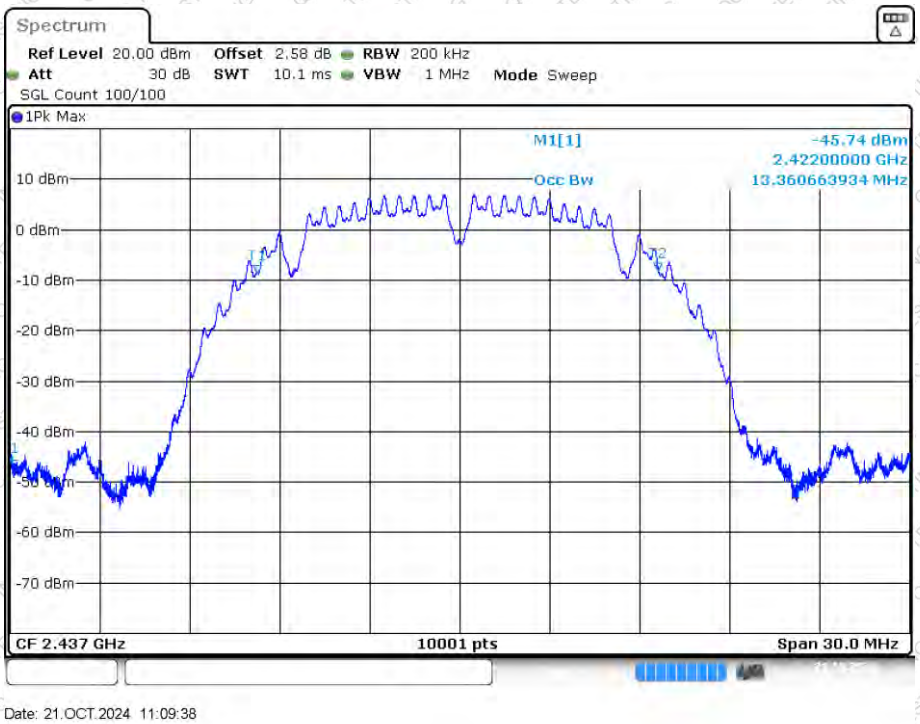
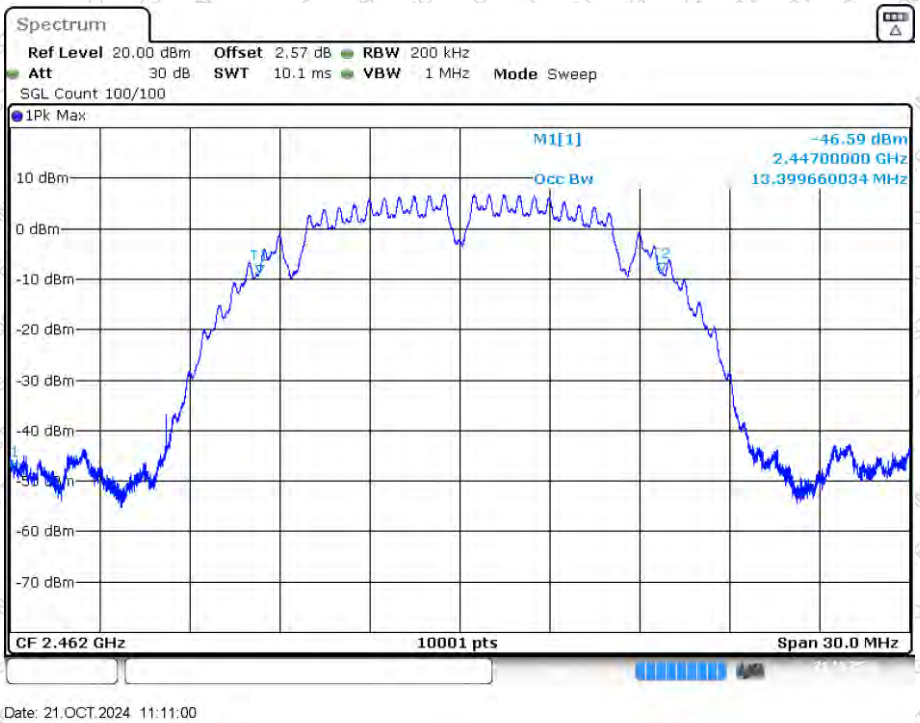
OBW NVNT b 2437MHz Ant2



Date: 21.OCT.2024 11:09:38

OBW NVNT b 2462MHz Ant2



Date: 21.OCT.2024 11:11:00

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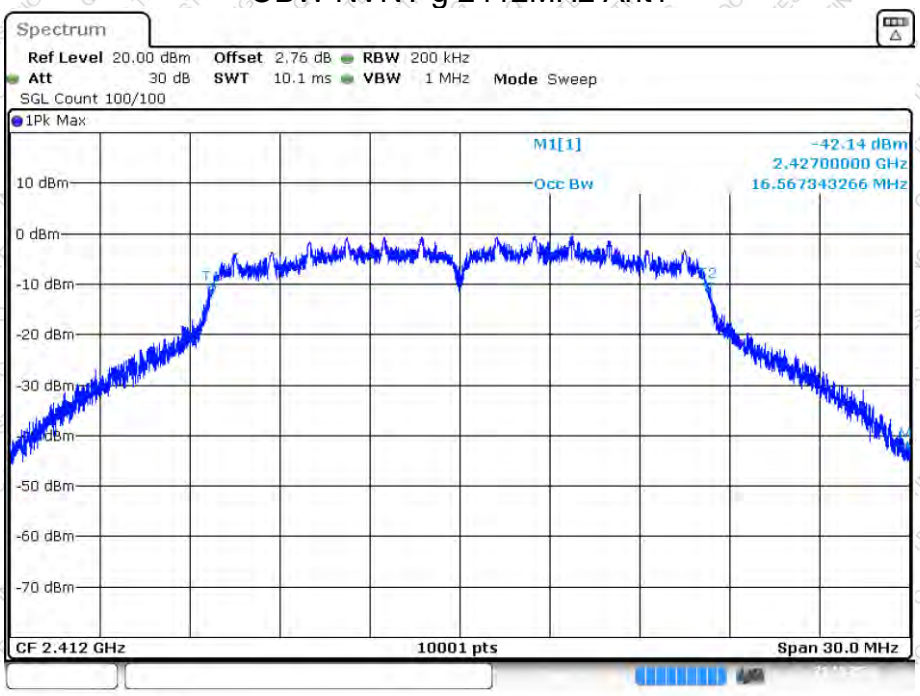
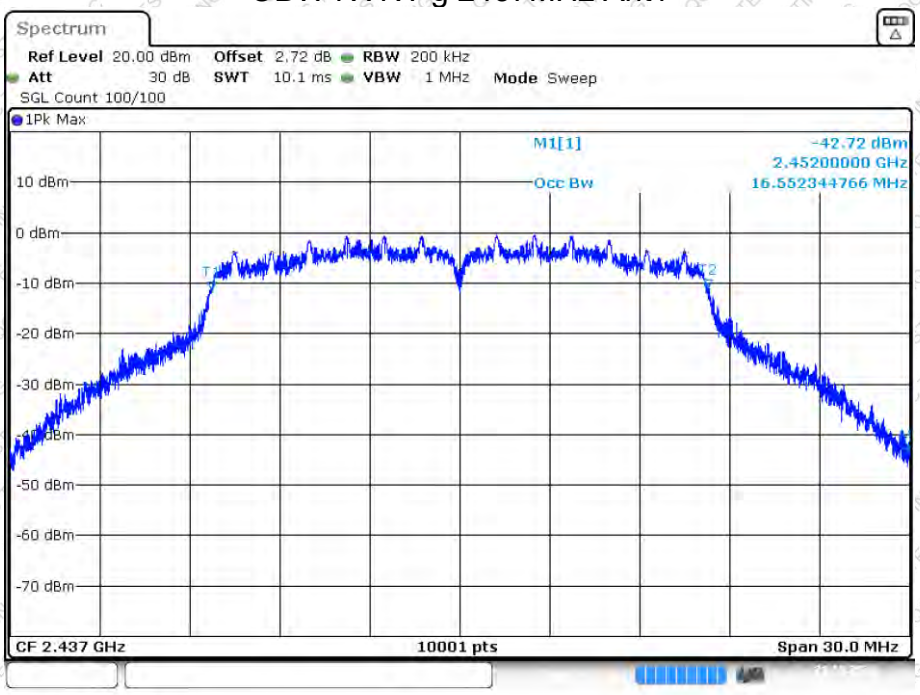
OBW NVNT g 2412MHz Ant1



Date: 21.OCT.2024 09:52:42

OBW NVNT g 2437MHz Ant1



Date: 21.OCT.2024 10:02:50

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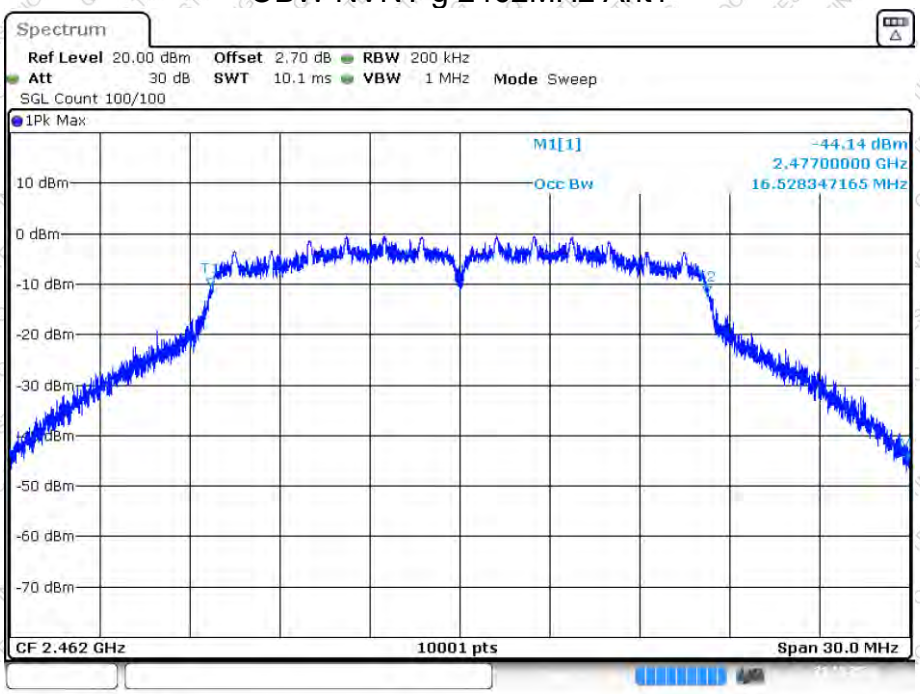
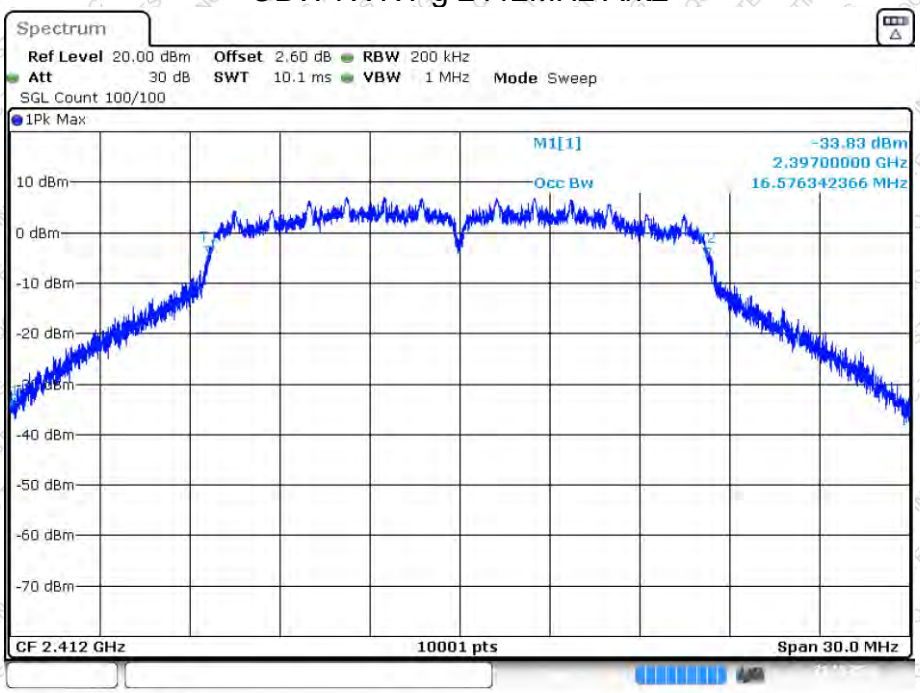
OBW NVNT g 2462MHz Ant1



Date: 21.OCT.2024 10:00:33

OBW NVNT g 2412MHz Ant2



Date: 21.OCT.2024 11:16:26

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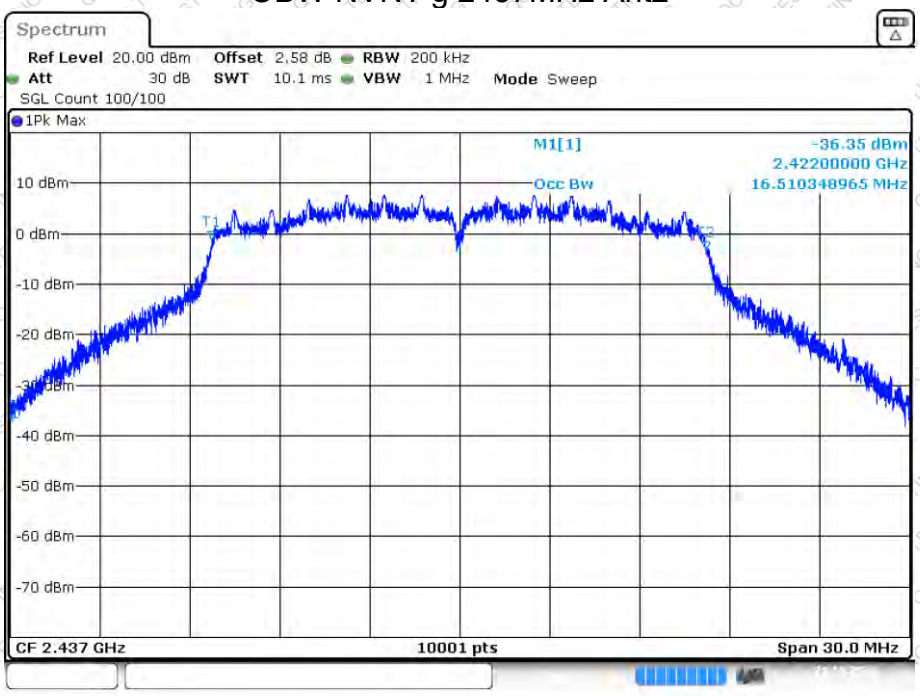
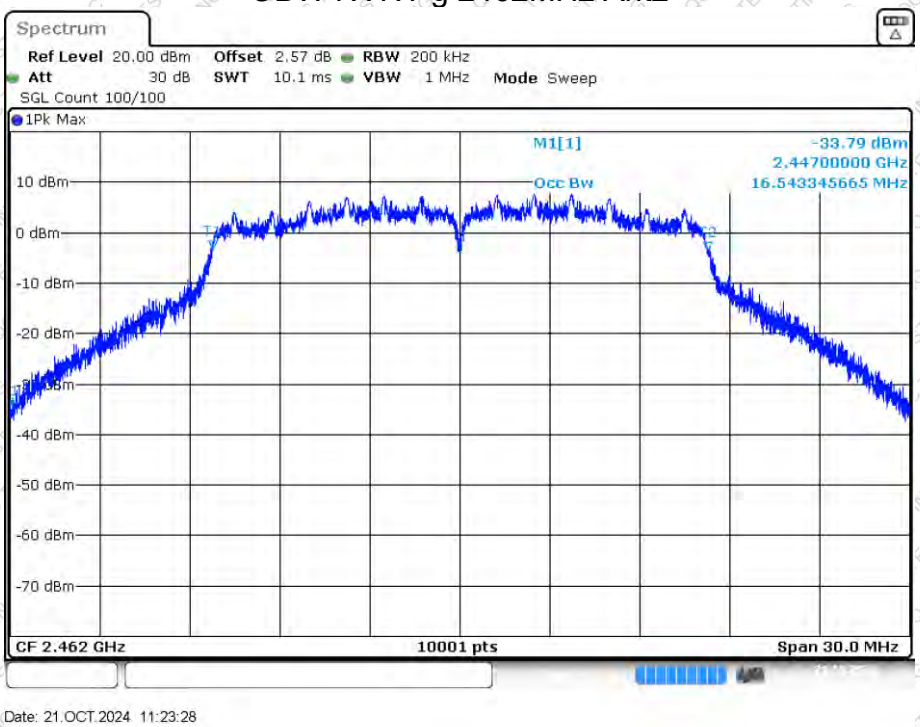
OBW NVNT g 2437MHz Ant2



OBW NVNT g 2462MHz Ant2



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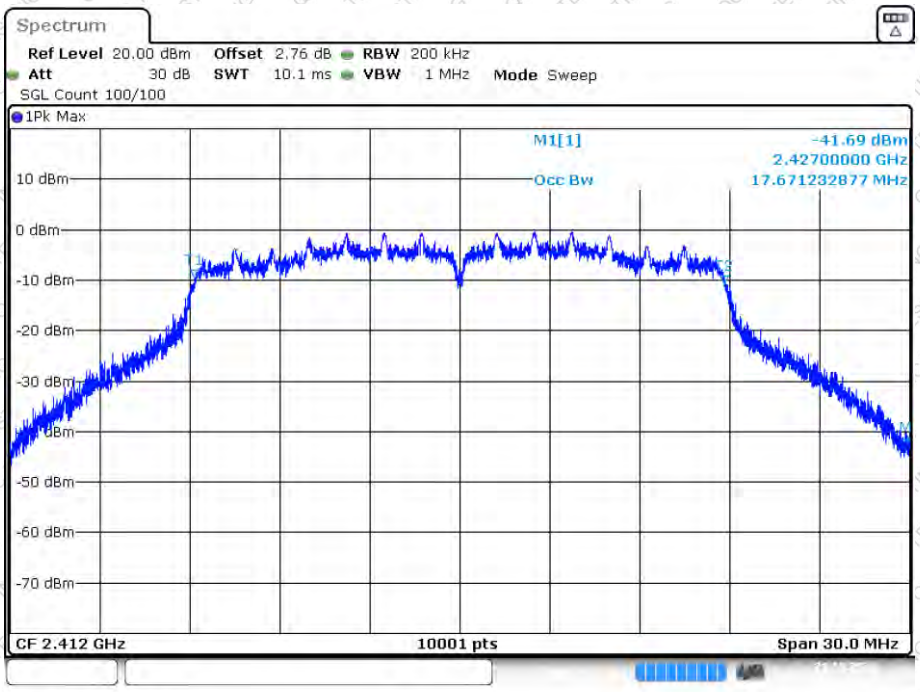
OBW NVNT n20 2412MHz Ant1



Date: 21.OCT.2024 10:05:51

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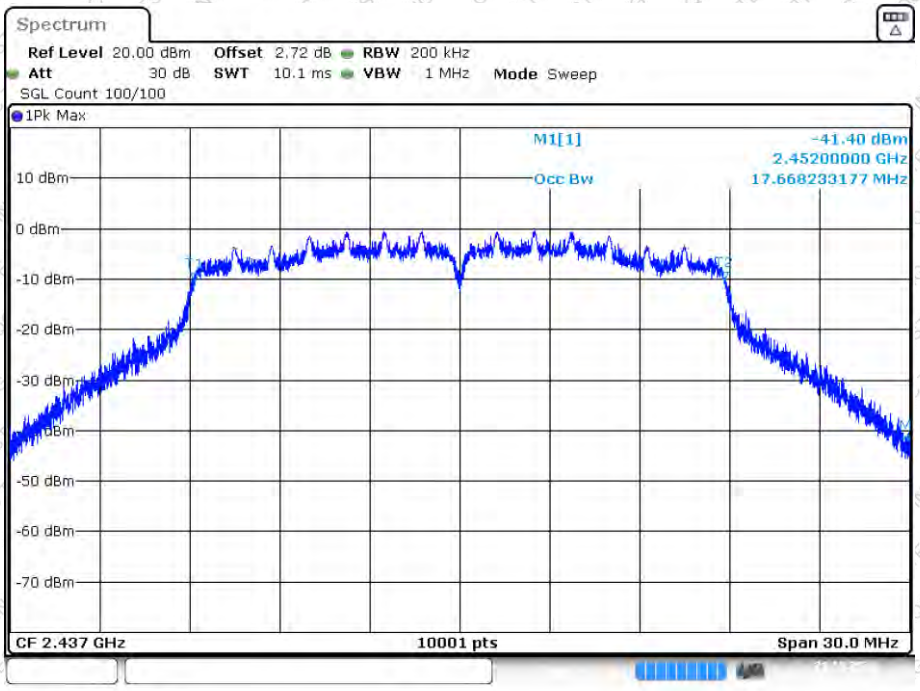

Date: 21.OCT.2024 10:08:59

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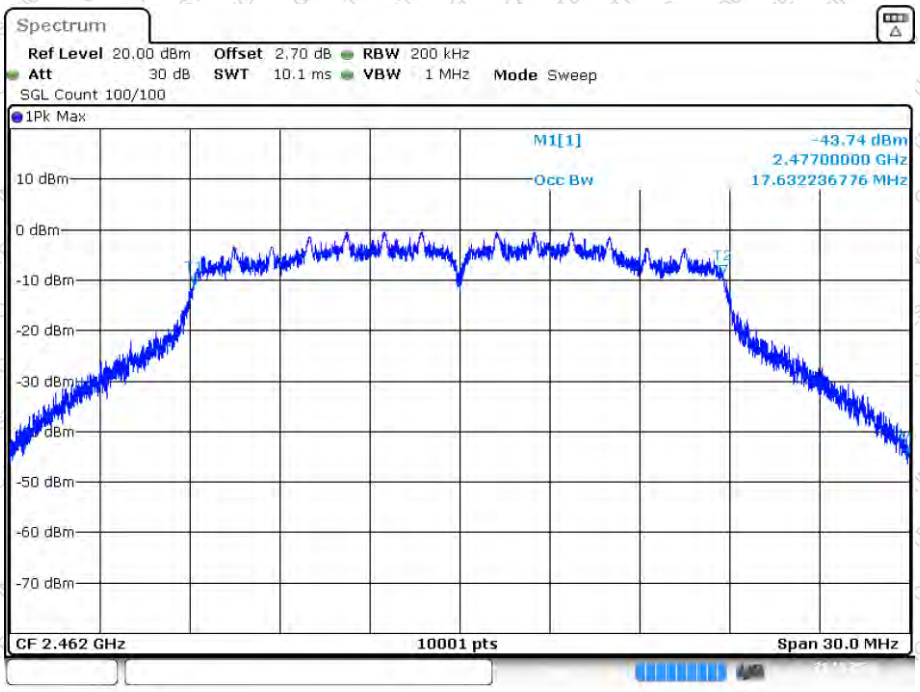
OBW NVNT n20 2462MHz Ant1



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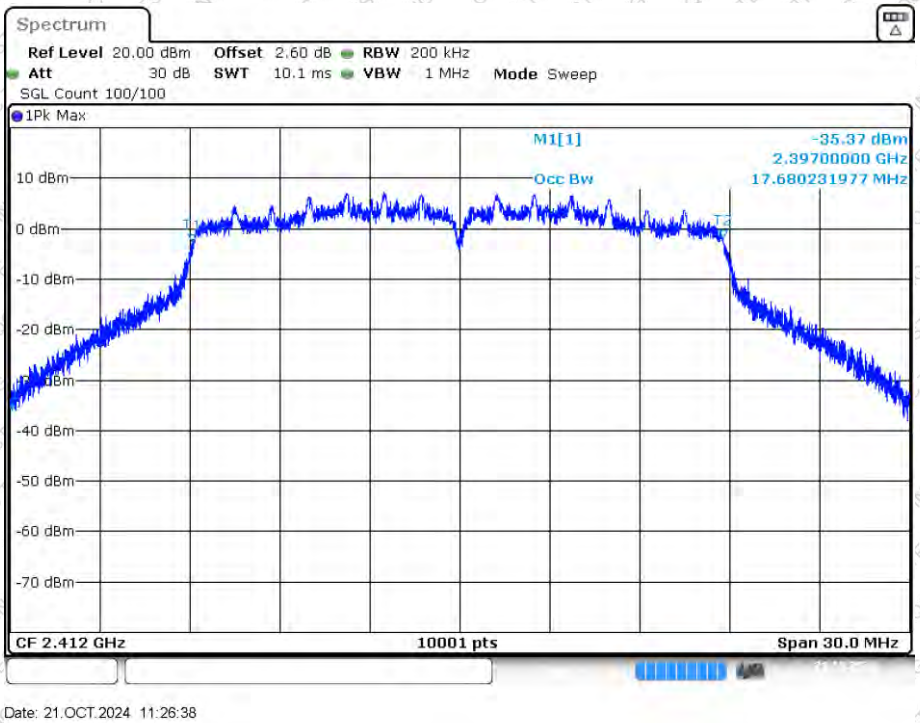

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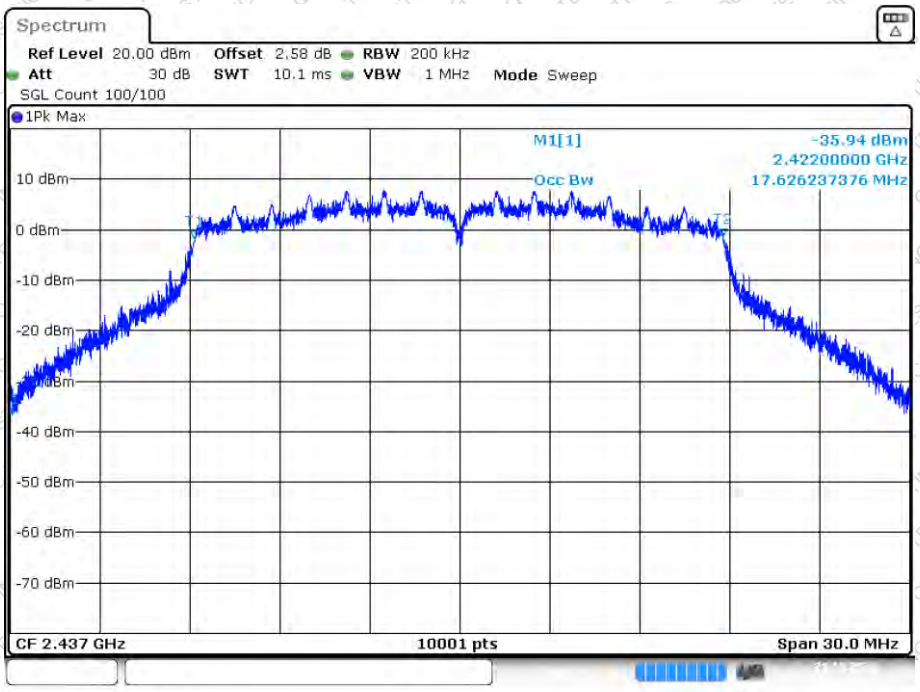
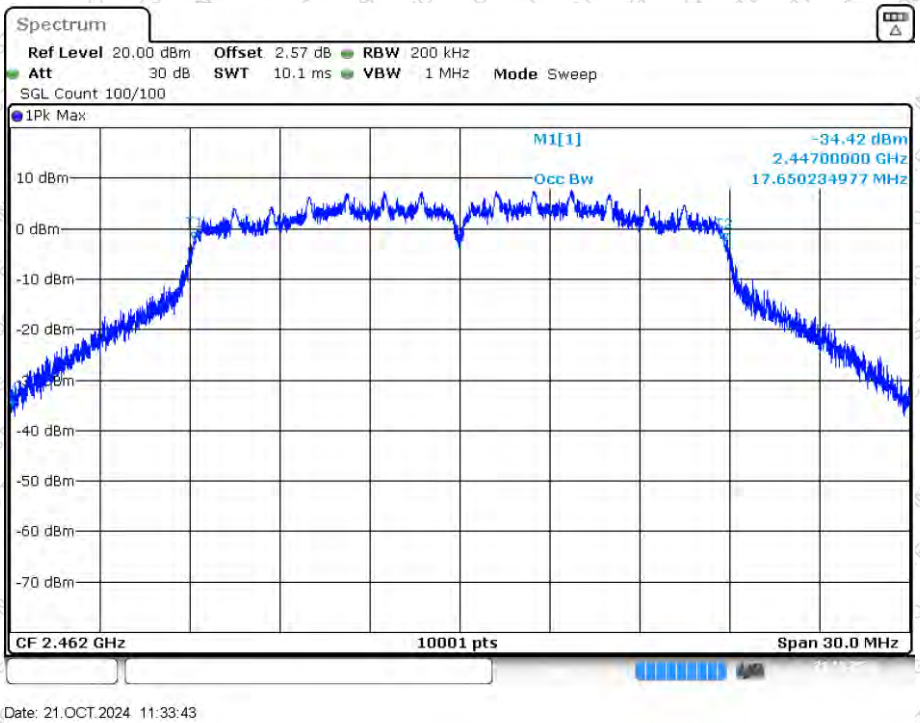
OBW NVNT n20 2437MHz Ant2



OBW NVNT n20 2462MHz Ant2



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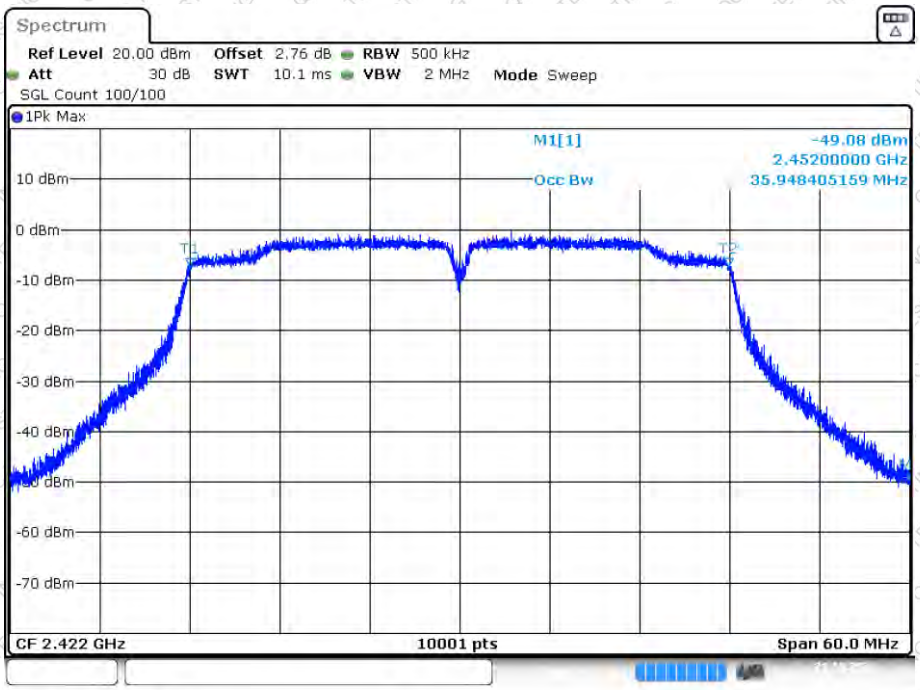
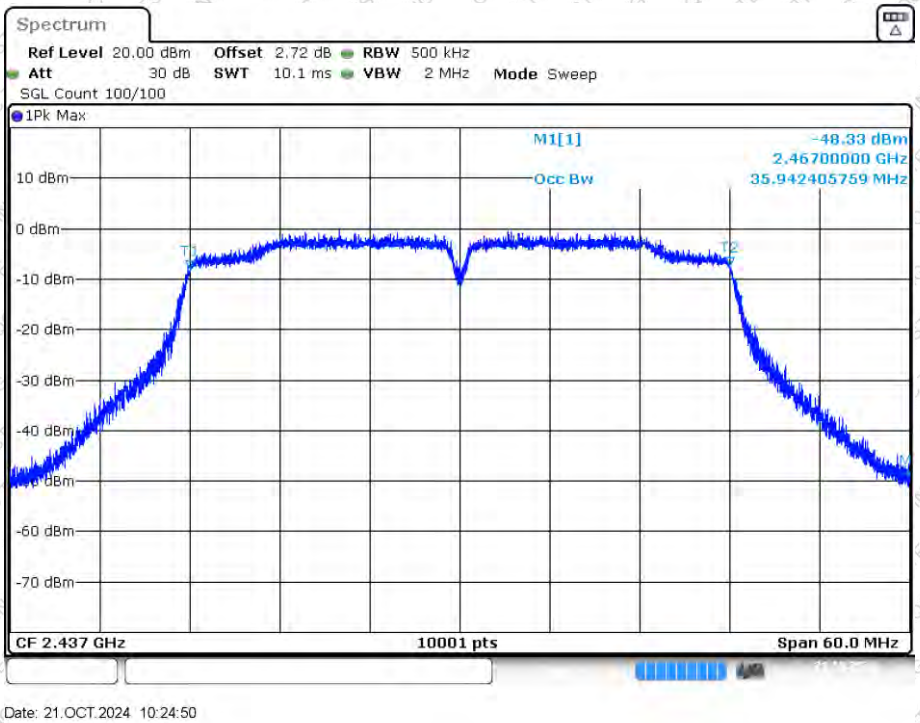
OBW NVNT n40 2422MHz Ant1



OBW NVNT n40 2437MHz Ant1



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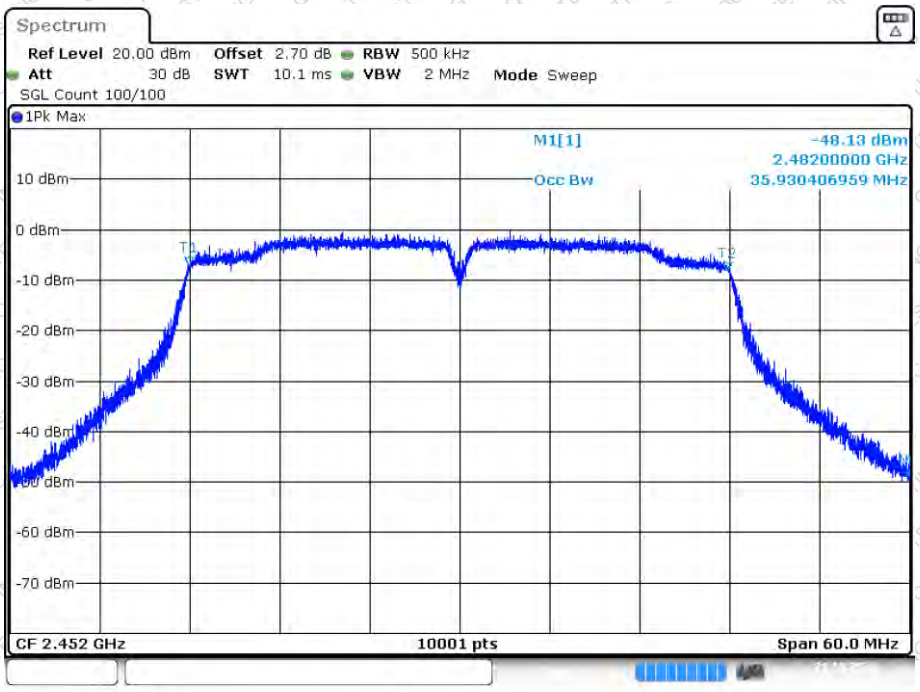
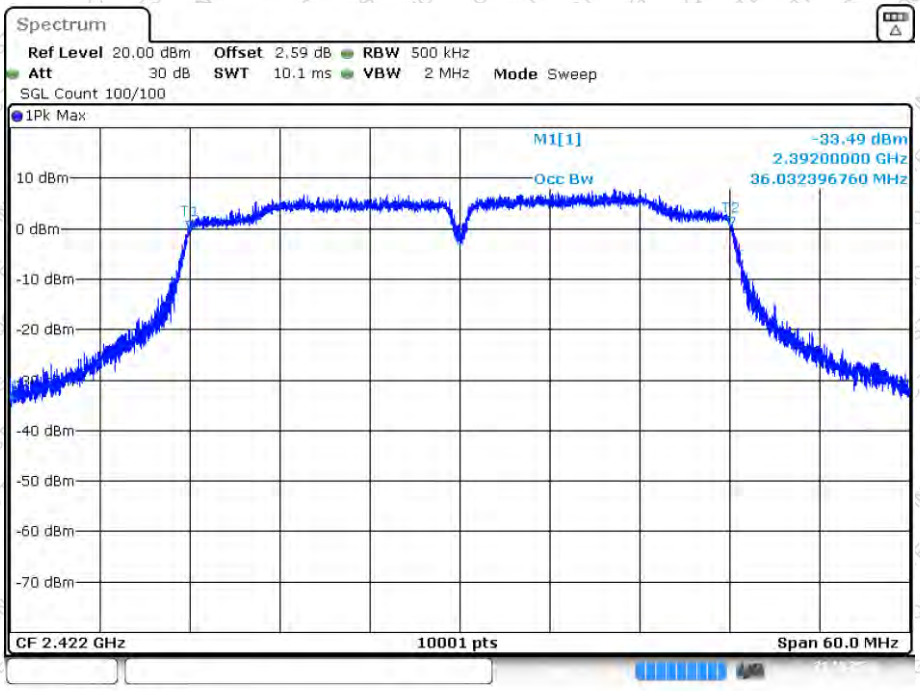
OBW NVNT n40 2452MHz Ant1



Date: 21.OCT.2024 10:28:34

OBW NVNT n40 2422MHz Ant2



Date: 21.OCT.2024 11:36:36

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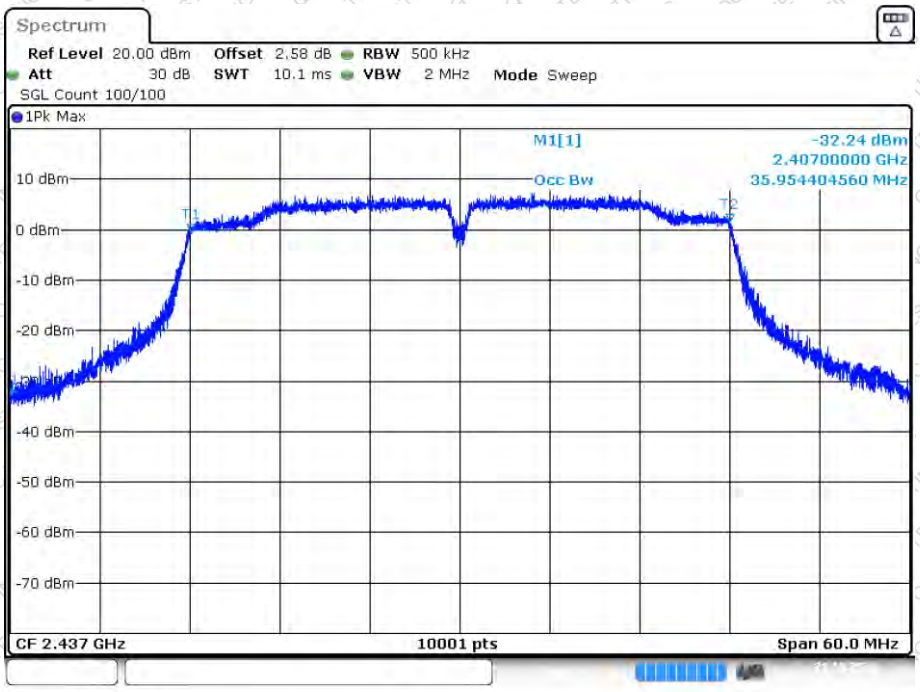
OBW NVNT n40 2437MHz Ant2



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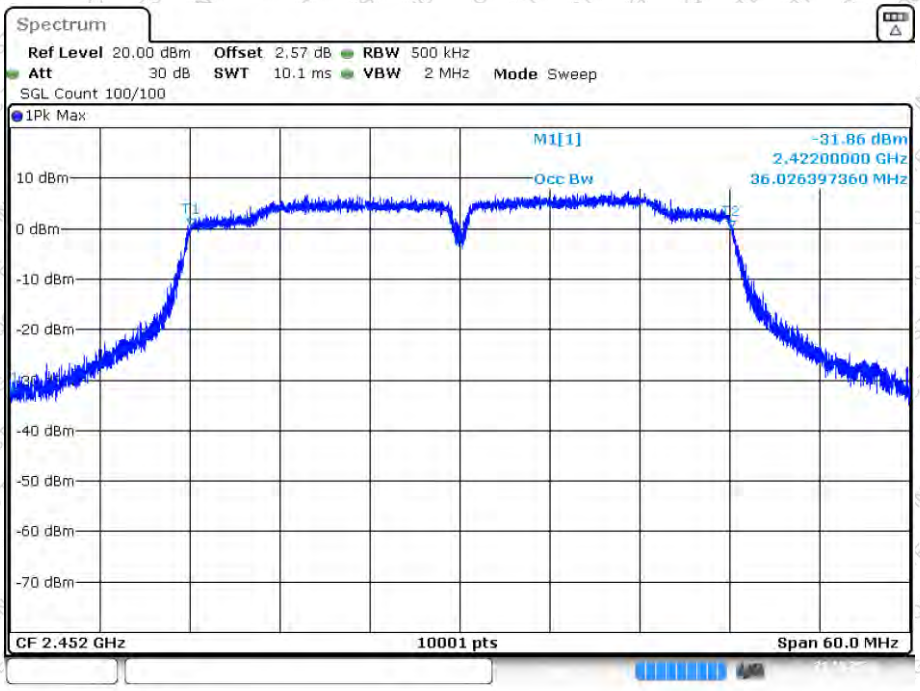
OBW NVNT n40 2452MHz Ant2



Date: 21.OCT.2024 11:40:59

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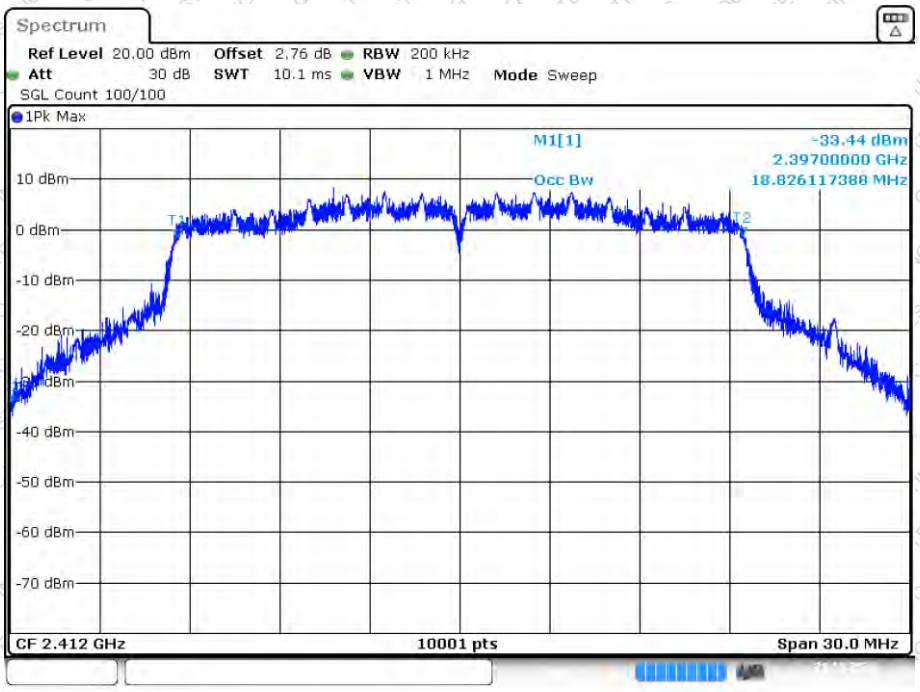
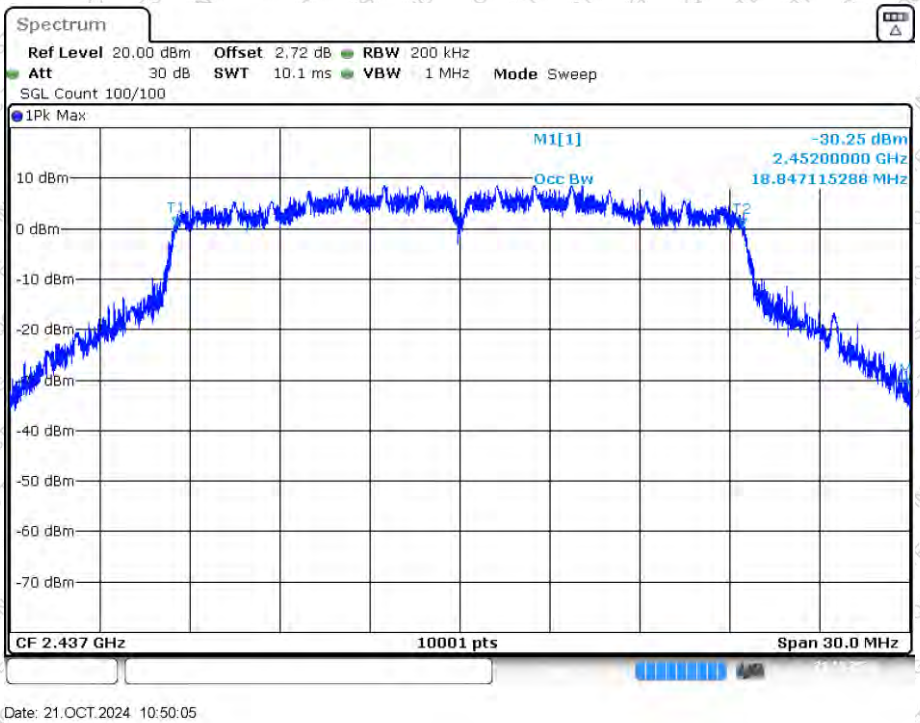
OBW NVNT ax20 2412MHz Ant1



OBW NVNT ax20 2437MHz Ant1



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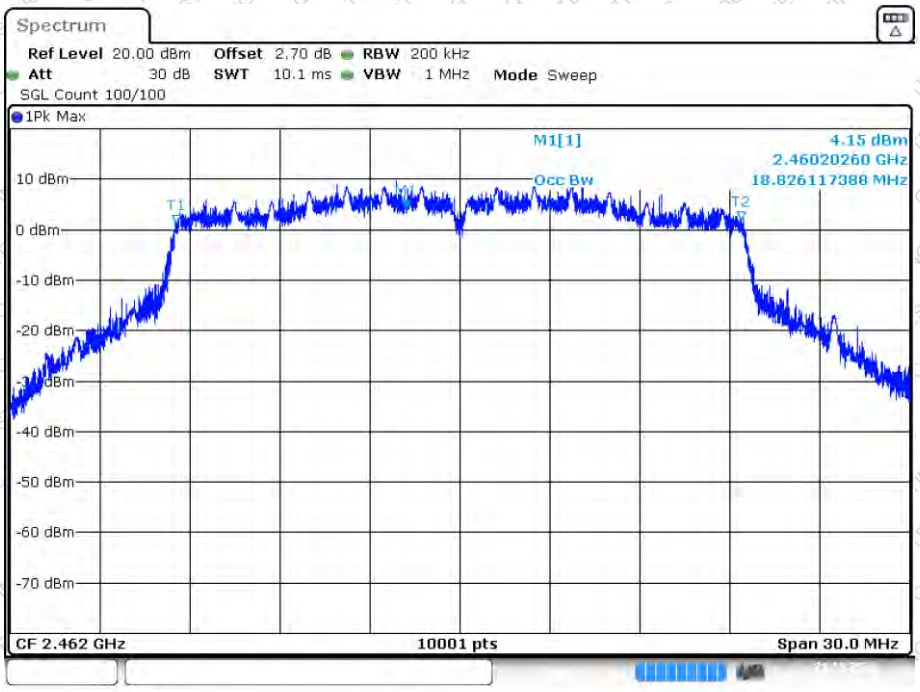
OBW NVNT ax20 2462MHz Ant1



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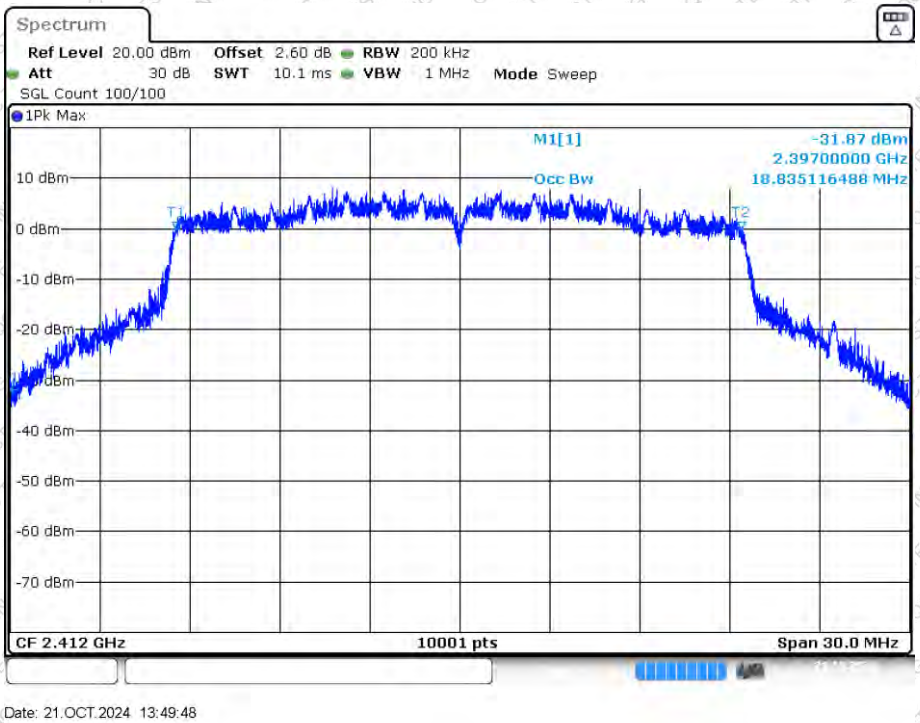

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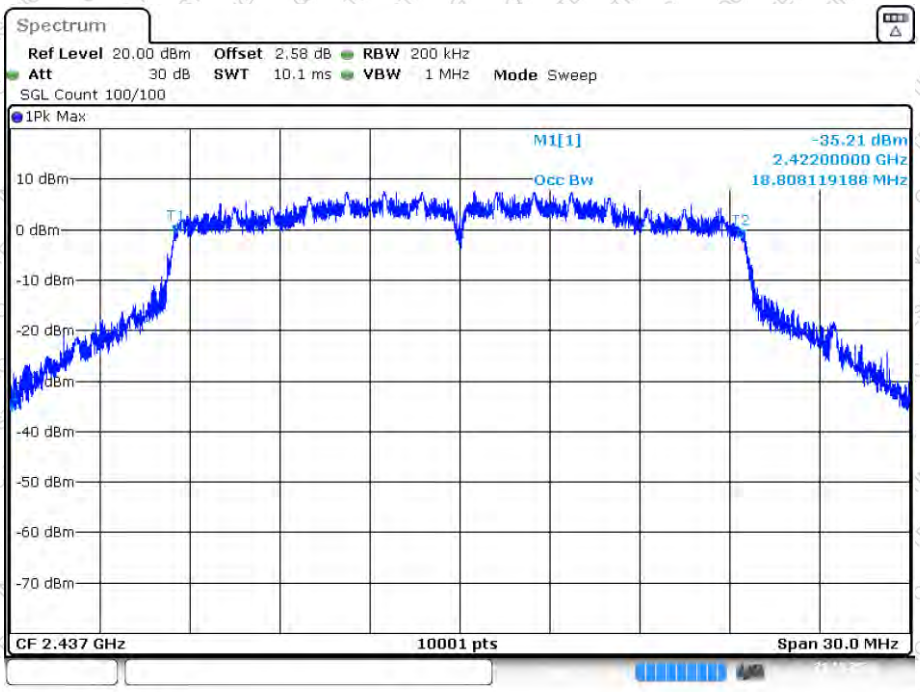
OBW NVNT ax20 2437MHz Ant2



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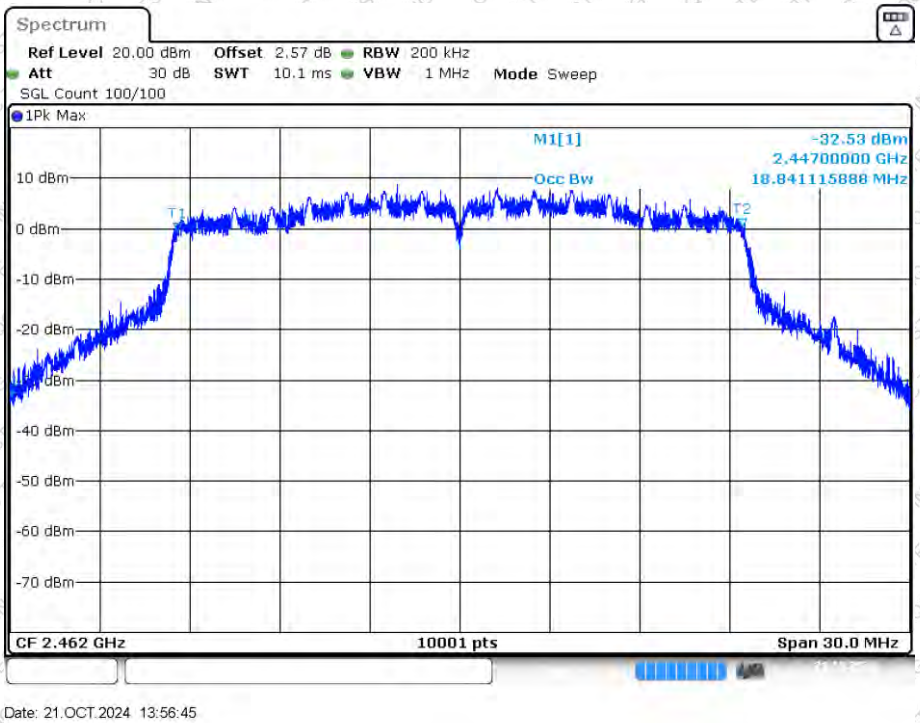

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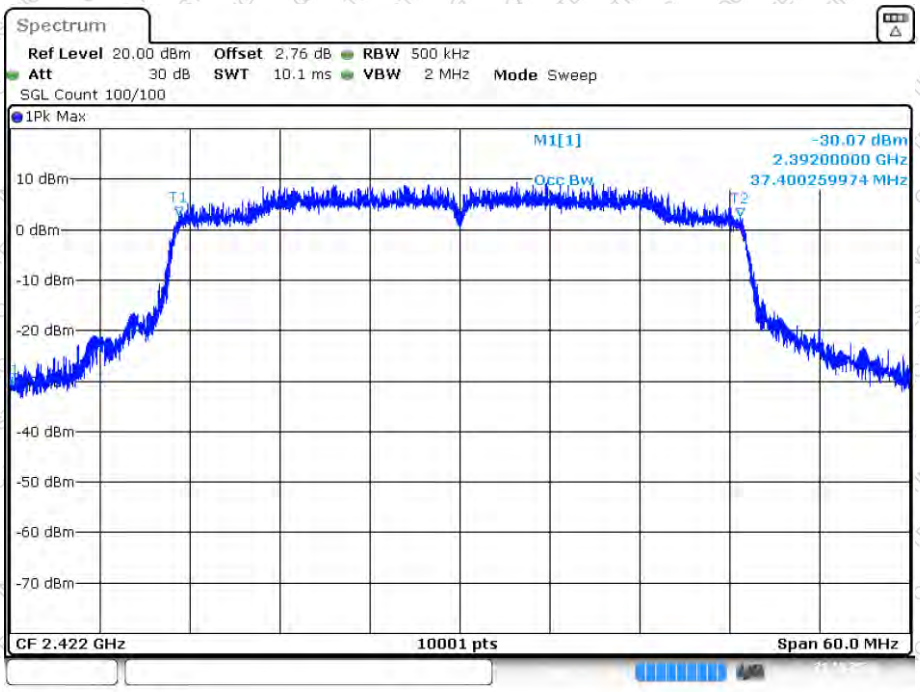
OBW NVNT ax40 2422MHz Ant1



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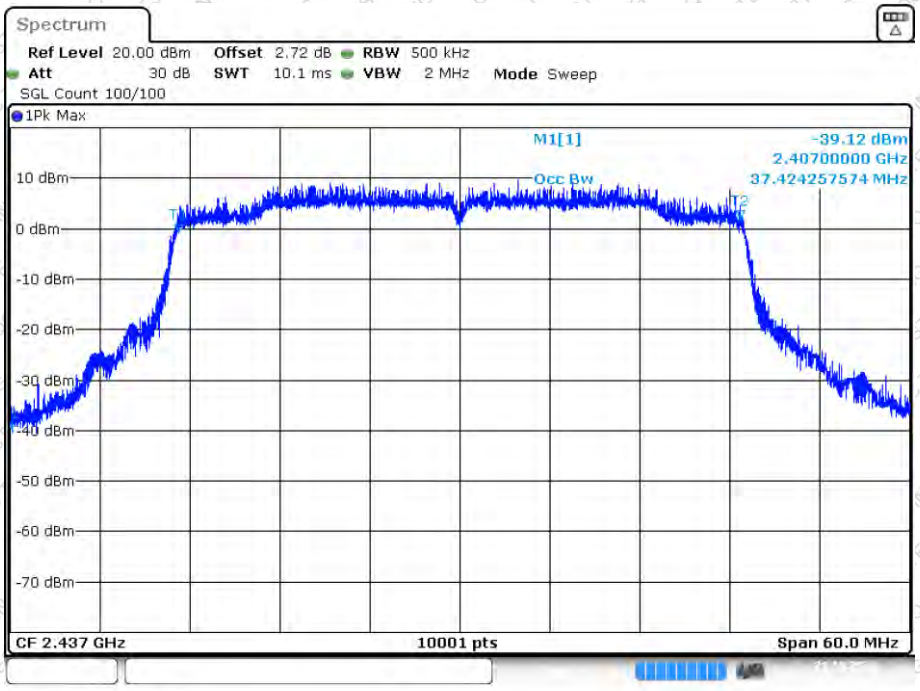

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Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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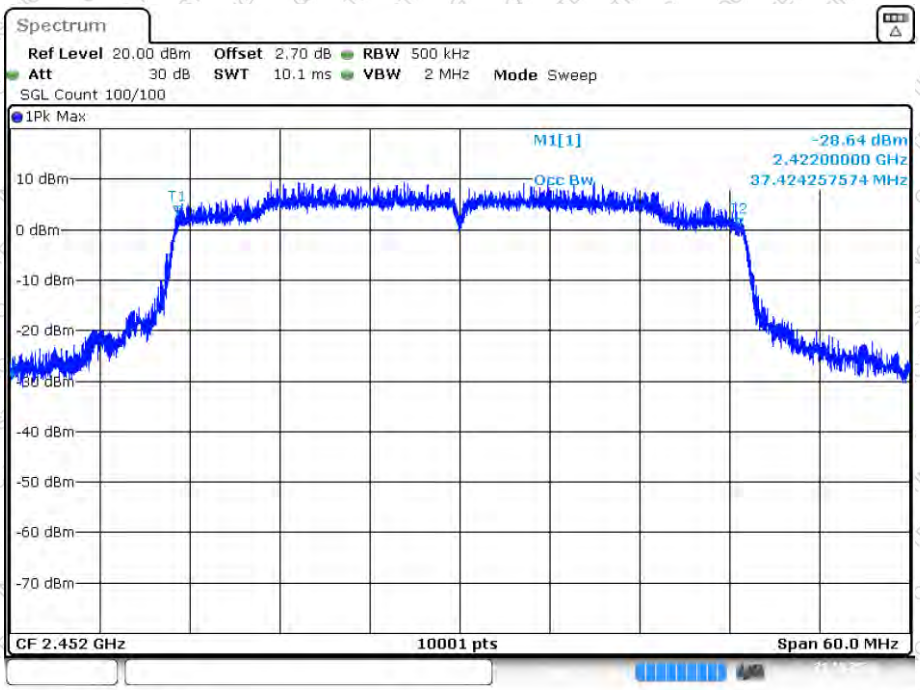
OBW NVNT ax40 2452MHz Ant1



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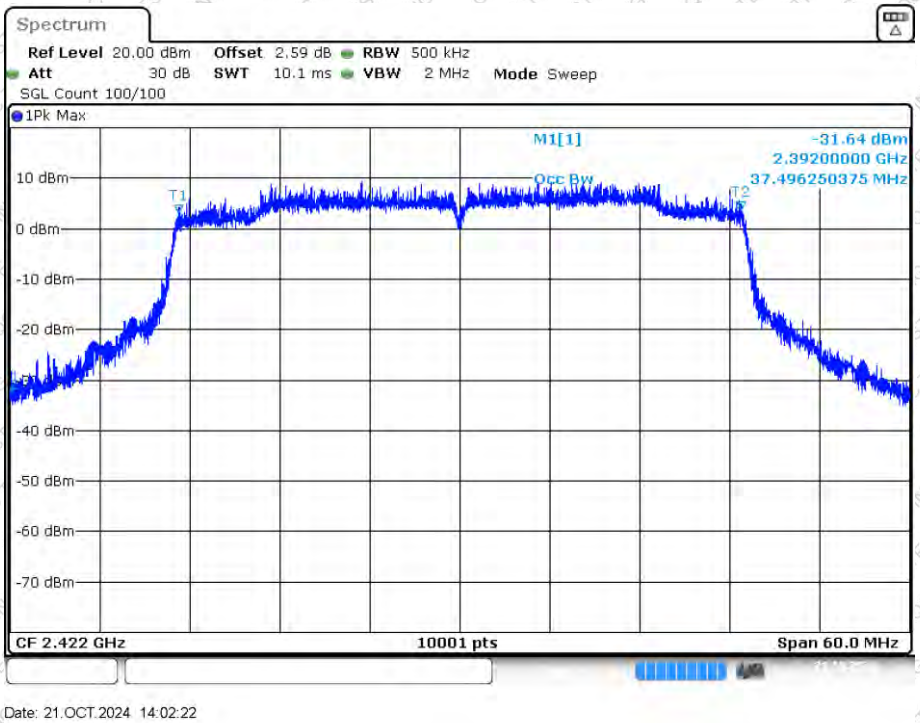

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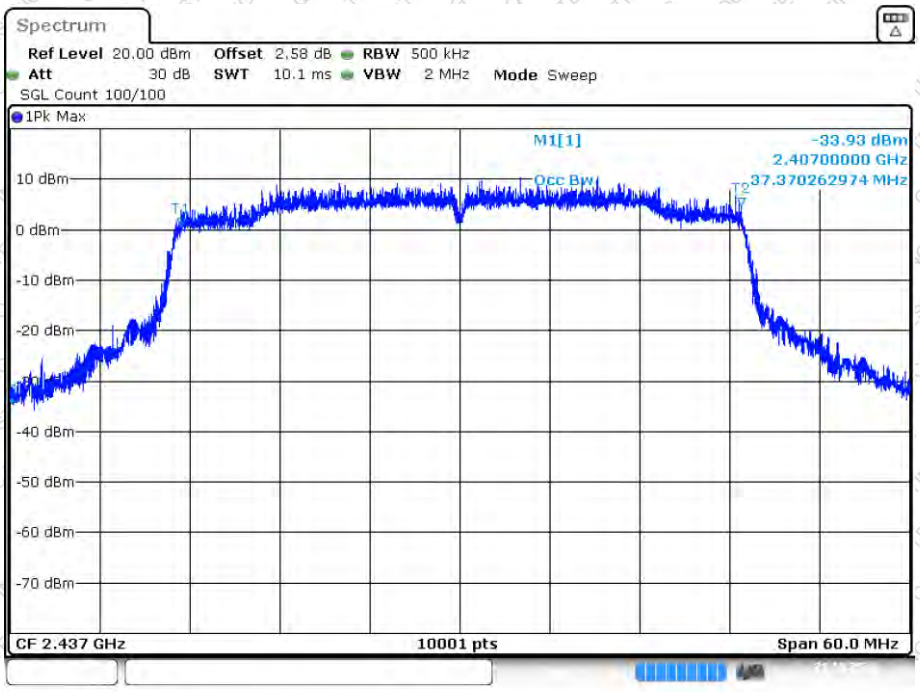
Tel: 0755-23008269 Fax: 0755-23726780 www.qctest.com.cn

OBW NVNT ax40 2437MHz Ant2



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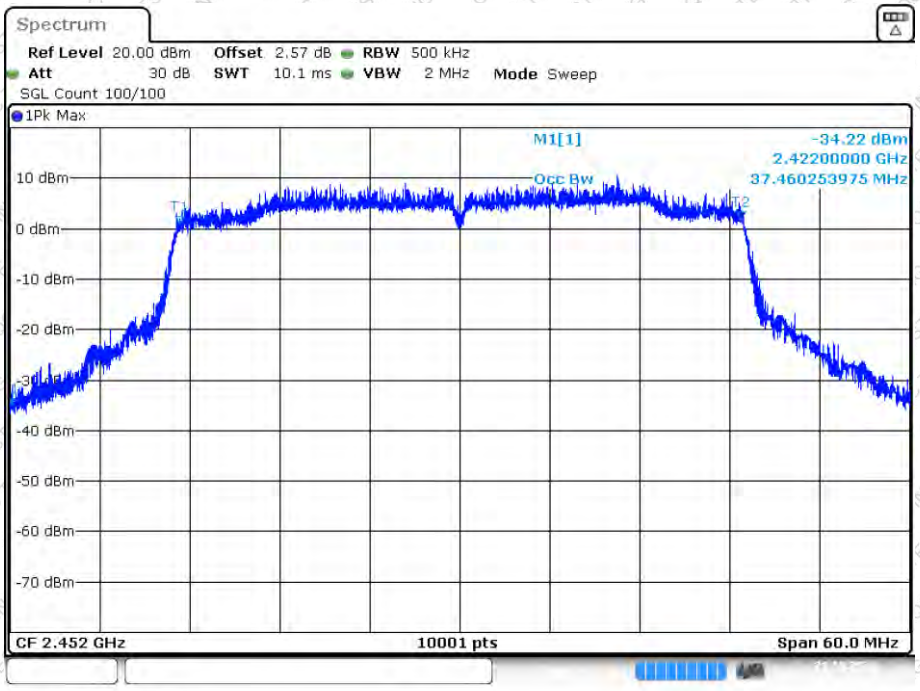

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8. Power Spectral Density

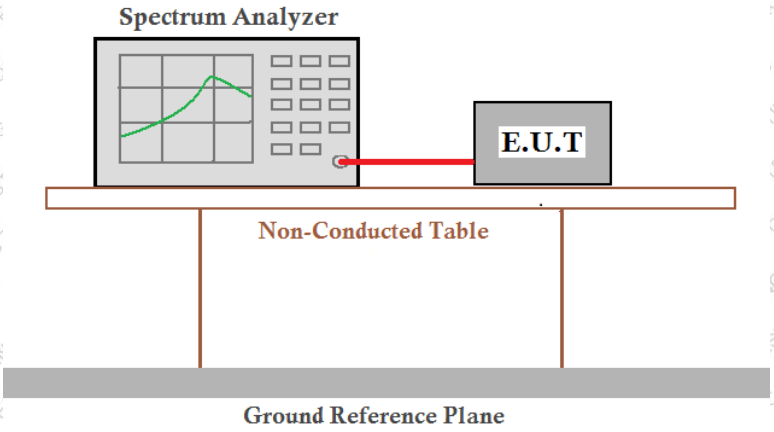
8.1 Applicable Standard

FCC Part15 C Section 15.247 (e)

8.2 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.3 Test setup



8.4 Test Procedure

Refer to KDB558074 D01 15.247 Meas Guidance v05r02

8.5 Test Data

Temperature	23 ℃	Humidity	52 %
ATM Pressure	101.1kPa	Antenna Gain	Ant1: 1.56dBi Ant2: 1.56dBi
Test by	LBi Li	Test result	PASS

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Please refer to following table and plots.

Modulation	Frequency (MHz)	Max PSD (dBm/3kHz)	Max PSD (dBm/3kHz)	Max PSD (dBm/3kHz)			Limit (dBm/3kHz)	Verdict
		ANT1	ANT2	ANT1	ANT2	Sum		
802.11b	2412	-9.55	3.06	/	/	/	≤8	Pass
	2437	-9.58	3.51	/	/	/	≤8	Pass
	2462	-9.5	2.87	/	/	/	≤8	Pass
802.11g	2412	-16.61	-1.32	/	/	/	≤8	Pass
	2437	-15.98	-1.08	/	/	/	≤8	Pass
	2462	-15.9	-1.21	/	/	/	≤8	Pass
802.11n (HT20)	2412	-16.2	-1.31	-3.99	-4.36	-1.16	≤8	Pass
	2437	-16.02	-1.14	-4.7	-5.3	-1.98	≤8	Pass
	2462	-15.05	-1.12	-4.03	-5.36	-1.63	≤8	Pass
802.11n (HT40)	2422	-18.32	-4.43	-7	-8.15	-4.53	≤8	Pass
	2437	-18.33	-4.55	-6.17	-8.27	-4.08	≤8	Pass
	2452	-18.37	-5	-6.72	-8.71	-4.59	≤8	Pass
802.11ax (HEW20)	2412	-2.4	-1.59	-4.24	-5.99	-2.02	≤8	Pass
	2437	-1.34	-1.78	-4.18	-5.17	-1.64	≤8	Pass
	2462	-1.37	-1.87	-4.41	-5.82	-2.05	≤8	Pass
802.11ax (HEW40)	2422	-5.56	-5.57	-8.08	-9	-5.51	≤8	Pass
	2437	-5.39	-5.45	-8.48	-8.98	-5.71	≤8	Pass
	2452	-5.43	-5.49	-7.7	-9.07	-5.32	≤8	Pass

Remark:

1. $PSD^{SUM}= 10*Log(10^{*(PSDANT1/10)} +10^{*(PSDANT2/10)})$
2. The built-in test software can control the single antenna transmission, and can also control the double antenna transmission together
3. Line loss and duty factor have been added to the map
4. For MIMO devices refer to KDB Publication 662911 D01.

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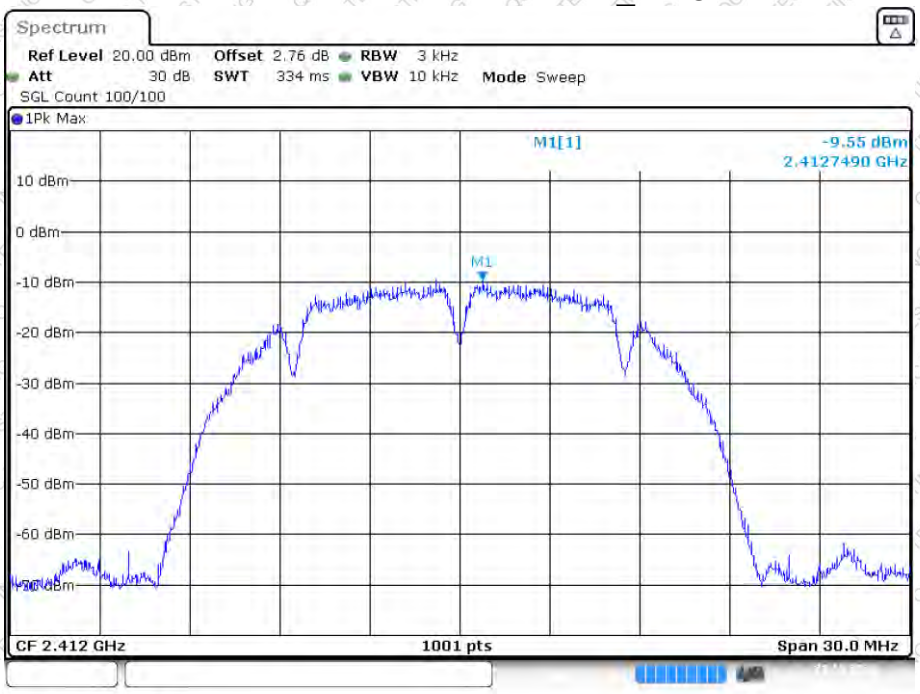
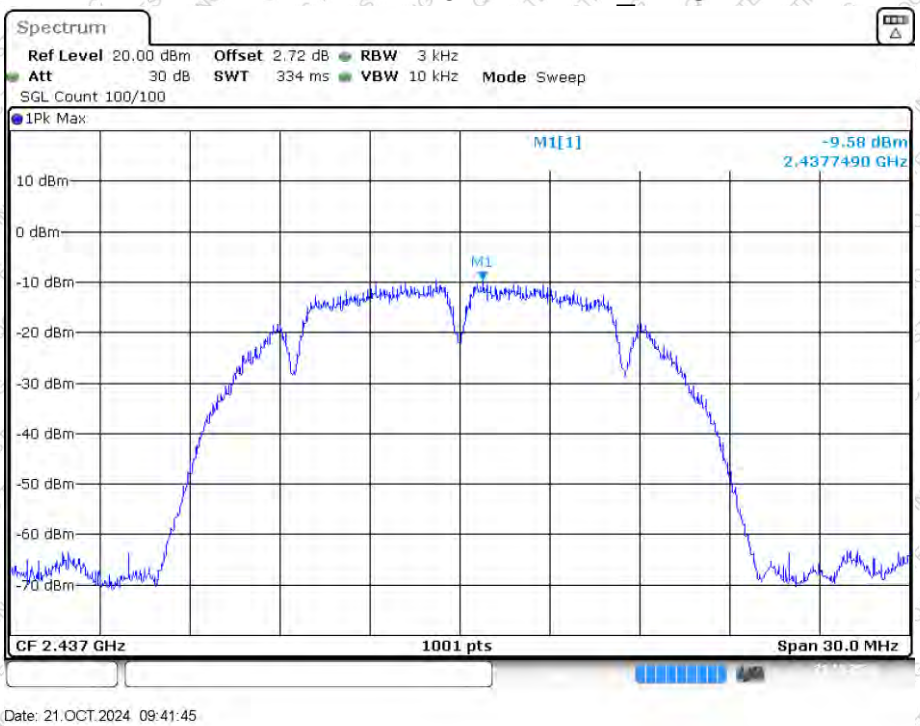
PSD NVNT b 2412MHz Ant1_SISO



PSD NVNT b 2437MHz Ant1_SISO



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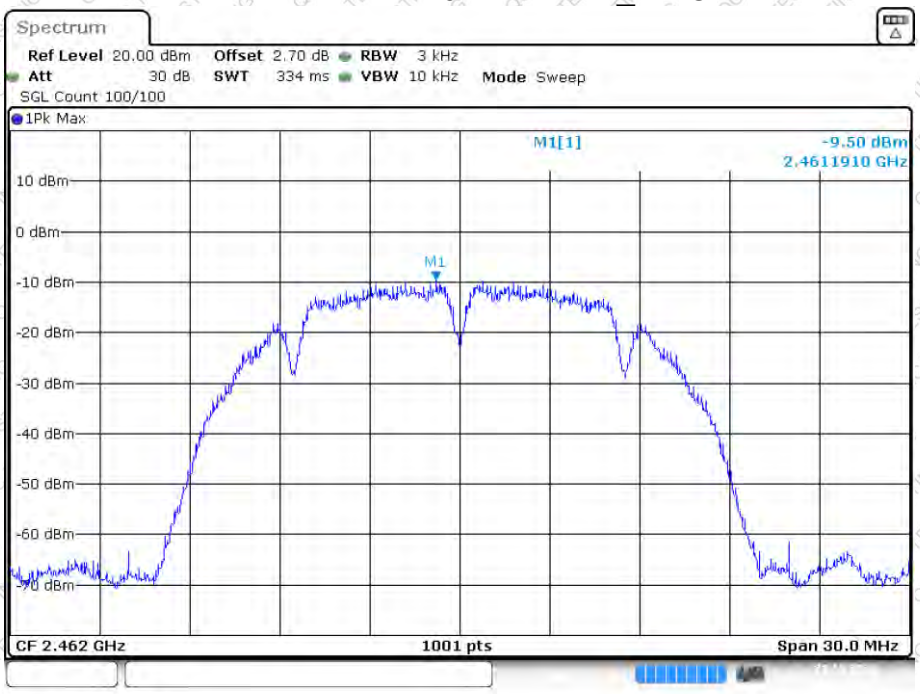
PSD NVNT b 2462MHz Ant1_SISO



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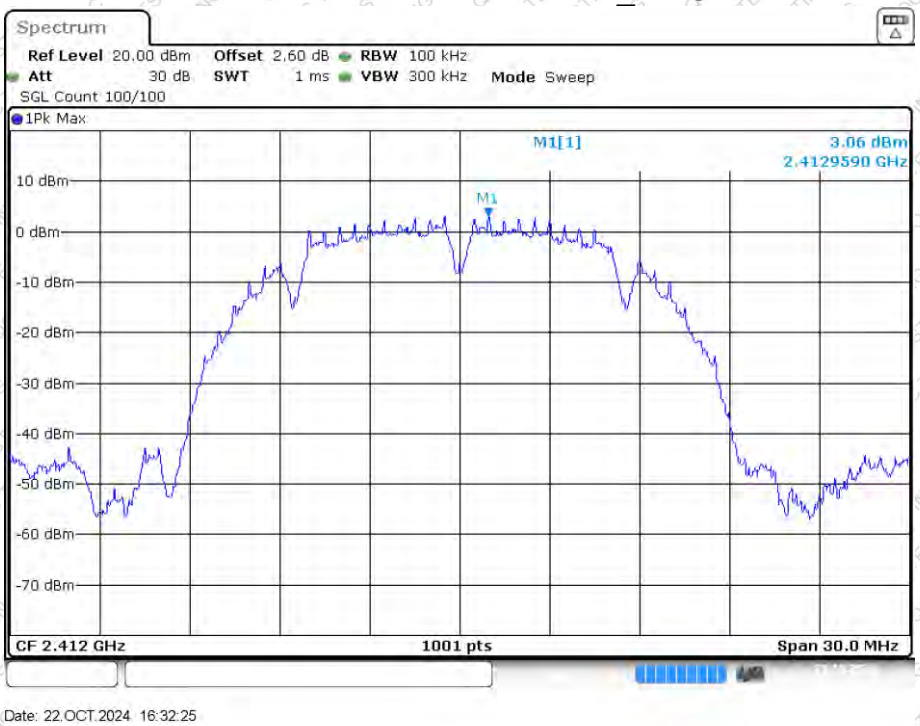

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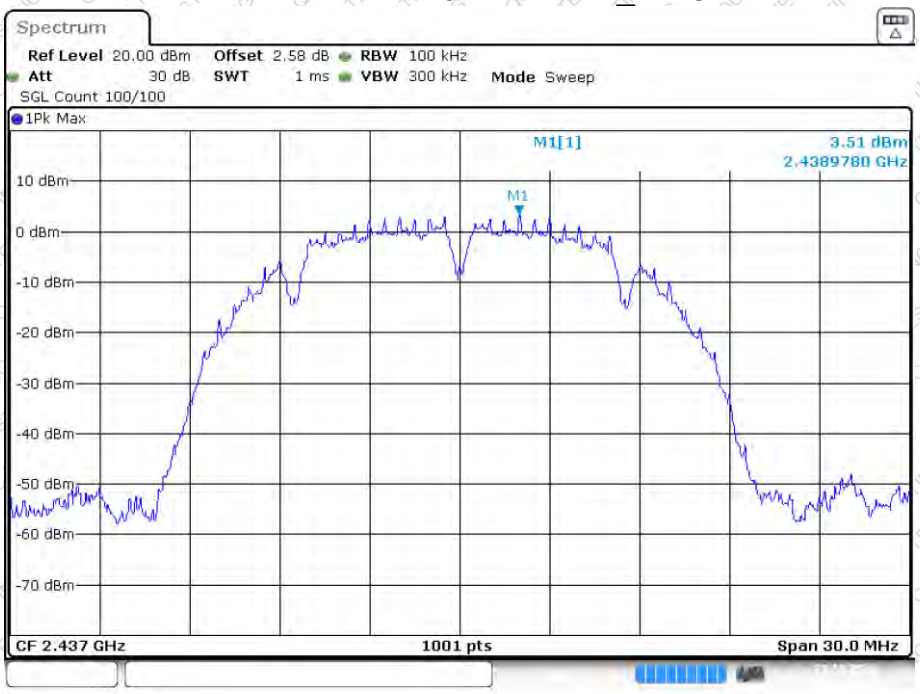

PSD NVNT b 2462MHz Ant2_SISO

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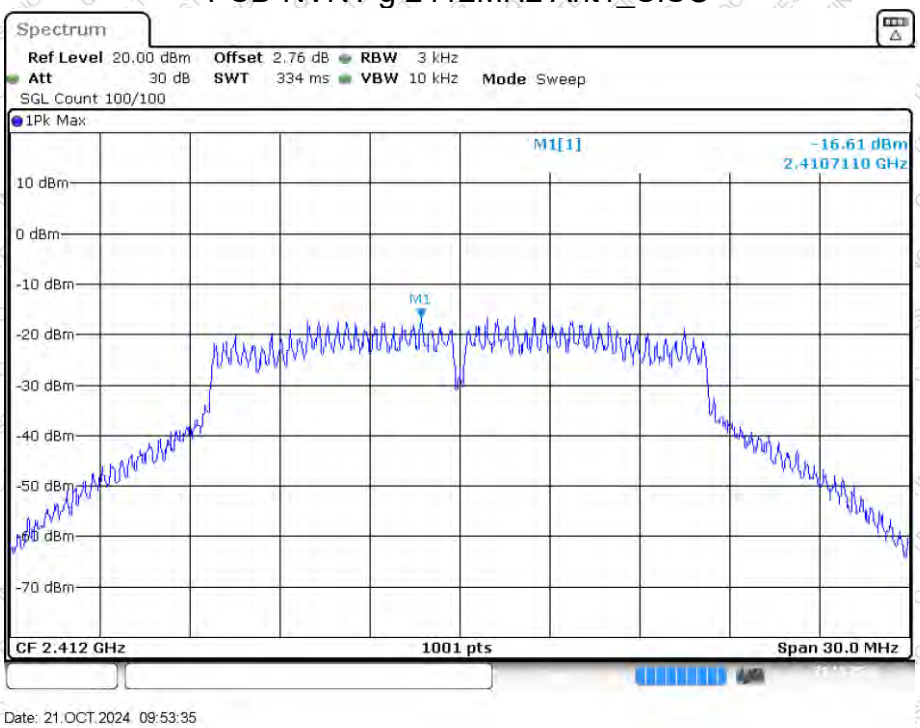
PSD NVNT g 2412MHz Ant1_SISO



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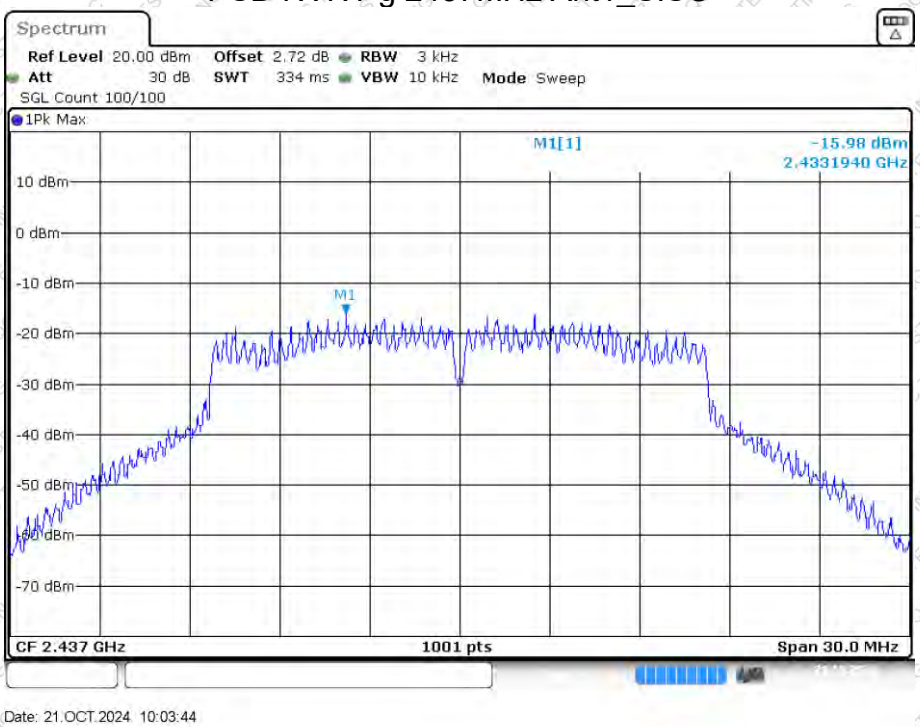

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Tel: 0755-23008269 Fax: 0755-23726780 www.qctest.com.cn

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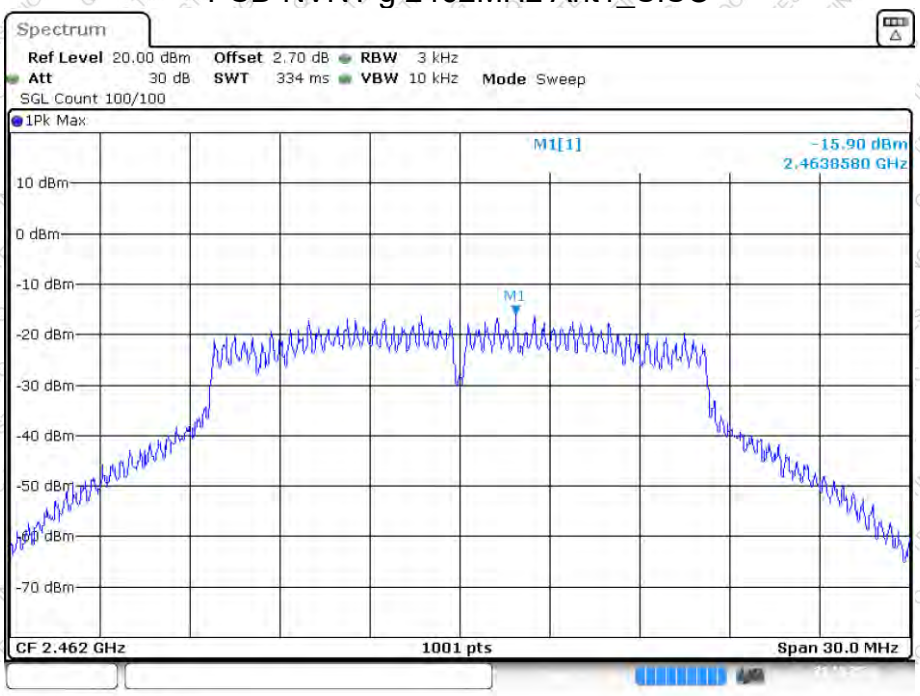

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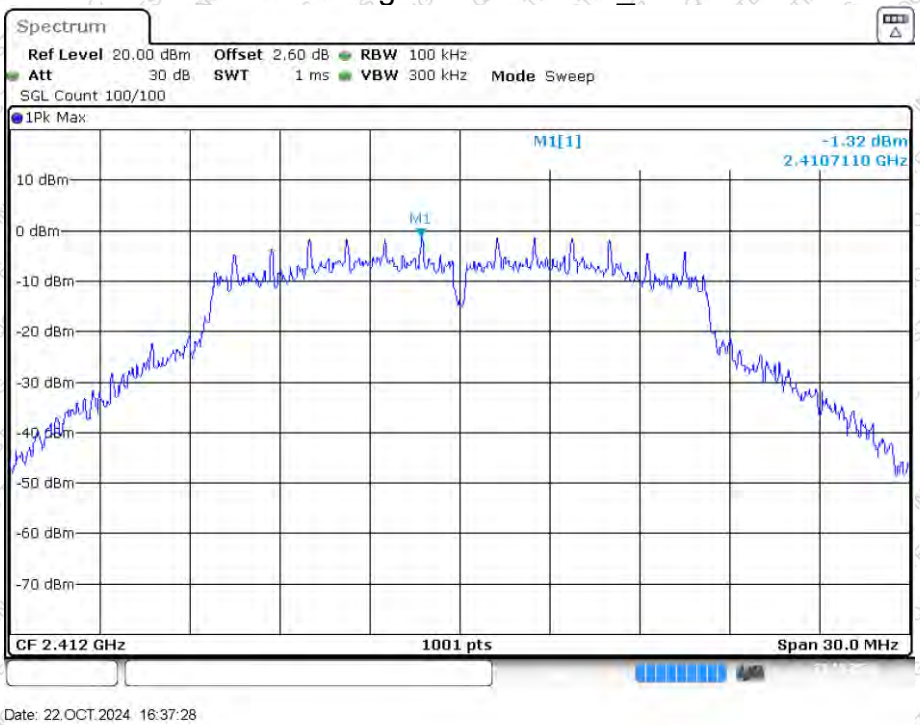

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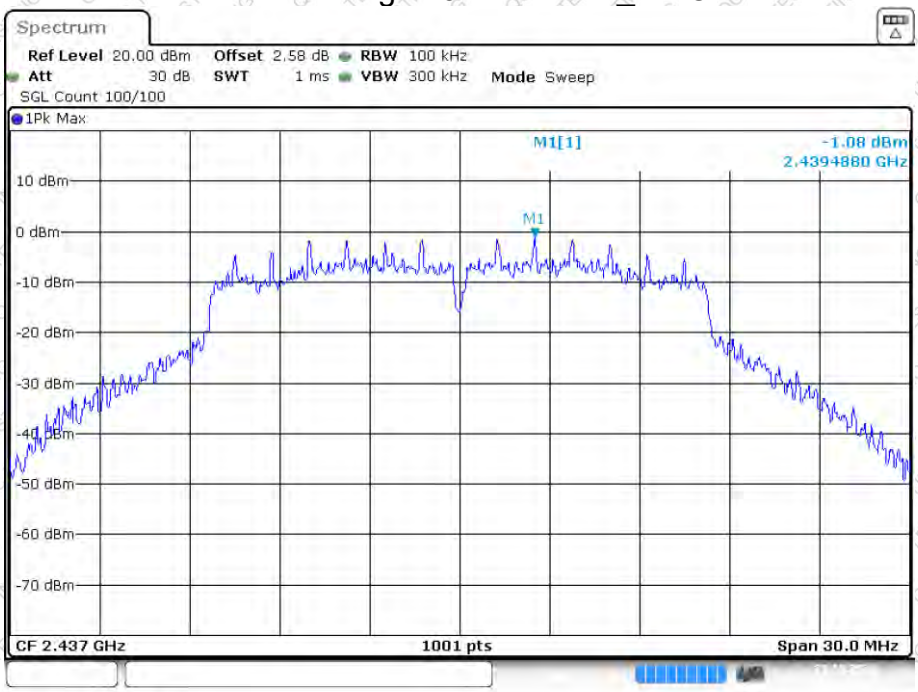

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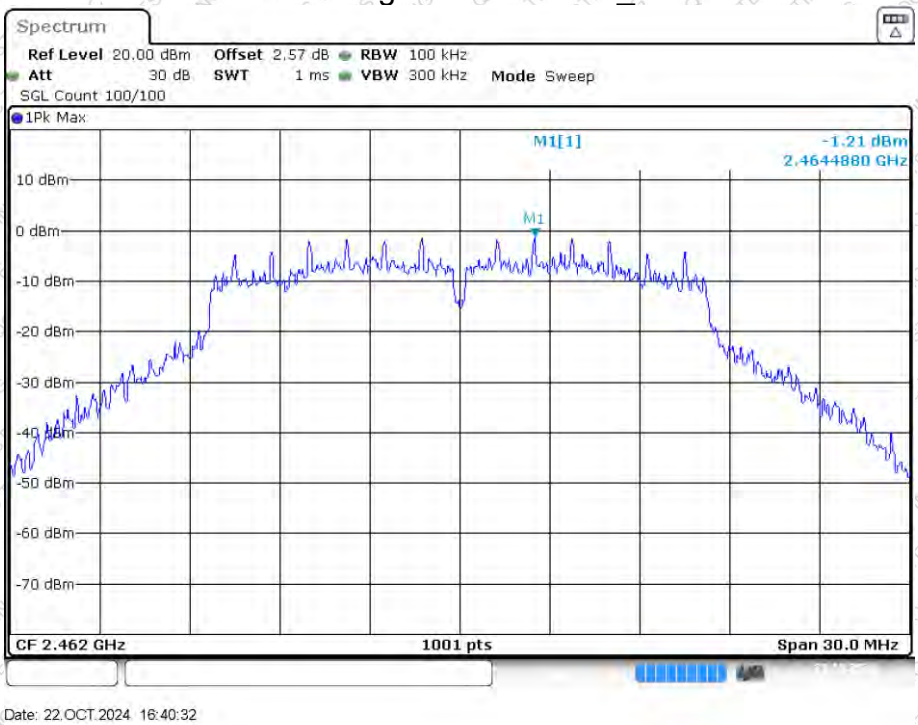

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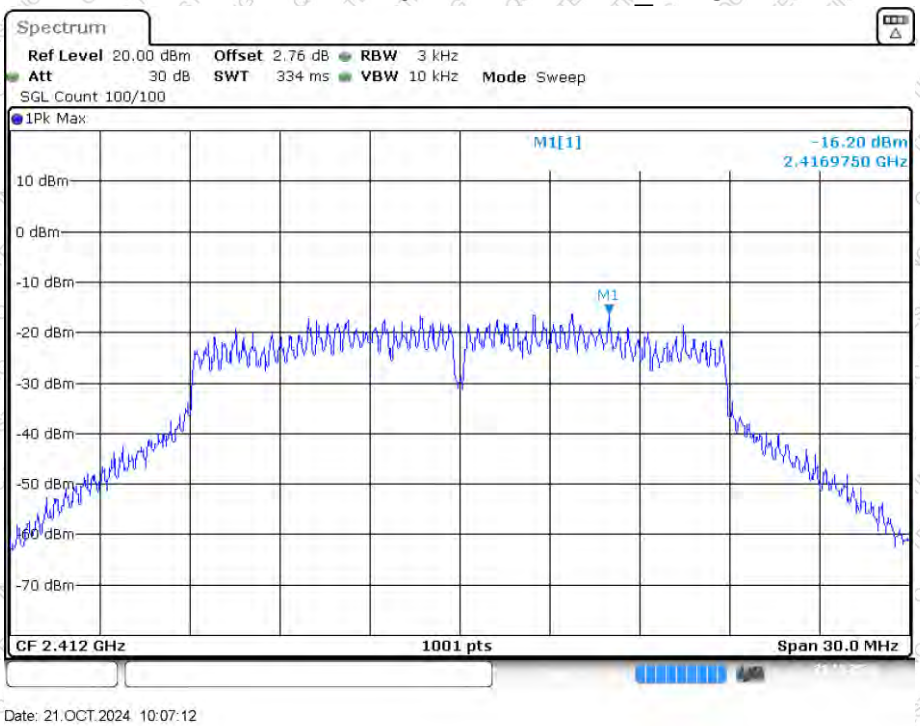
PSD NVNT n20 2412MHz Ant1_SISO



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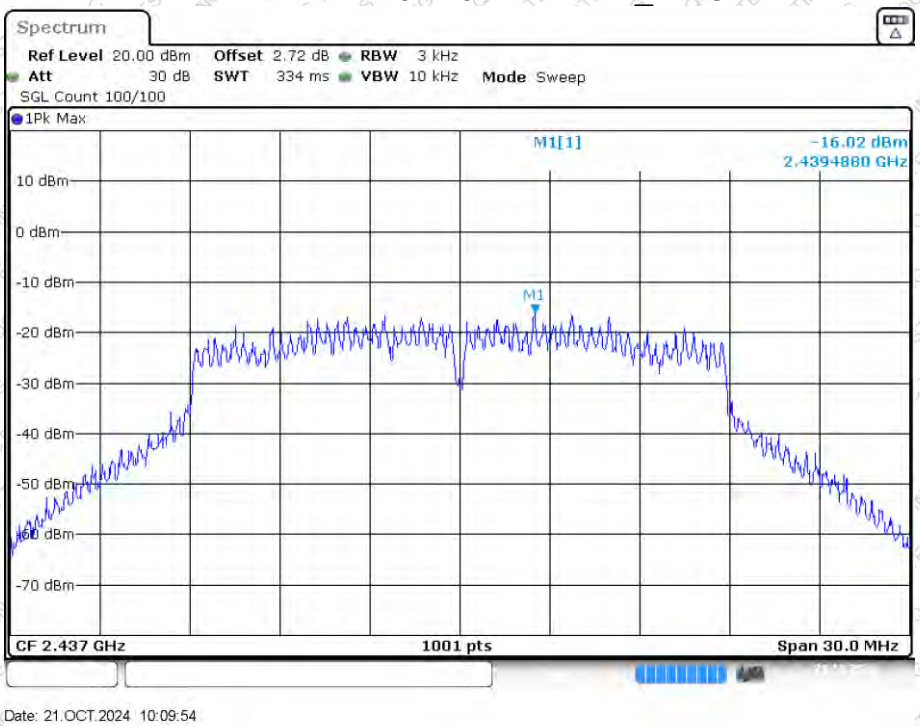

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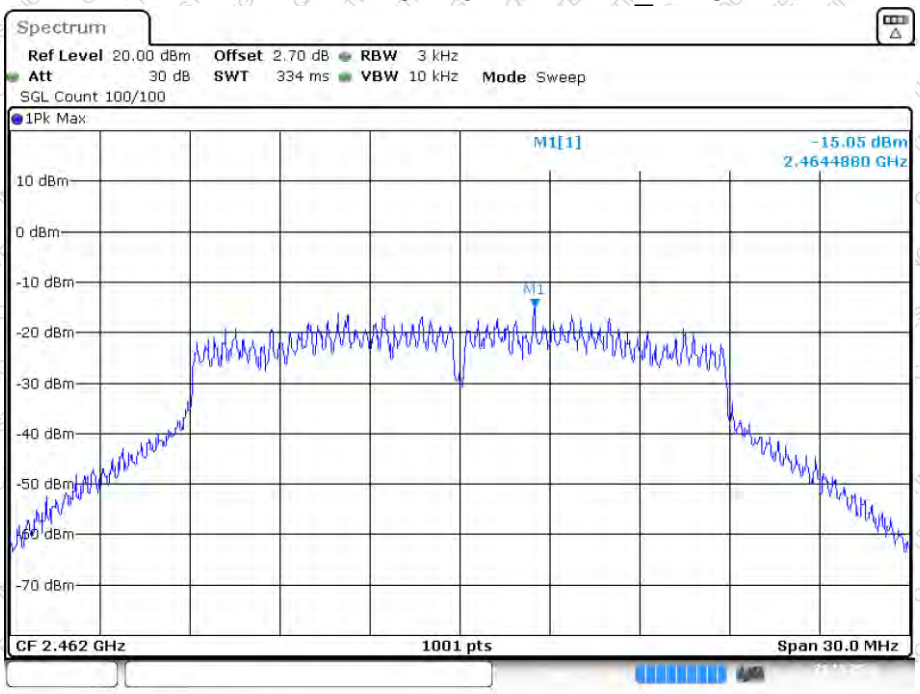

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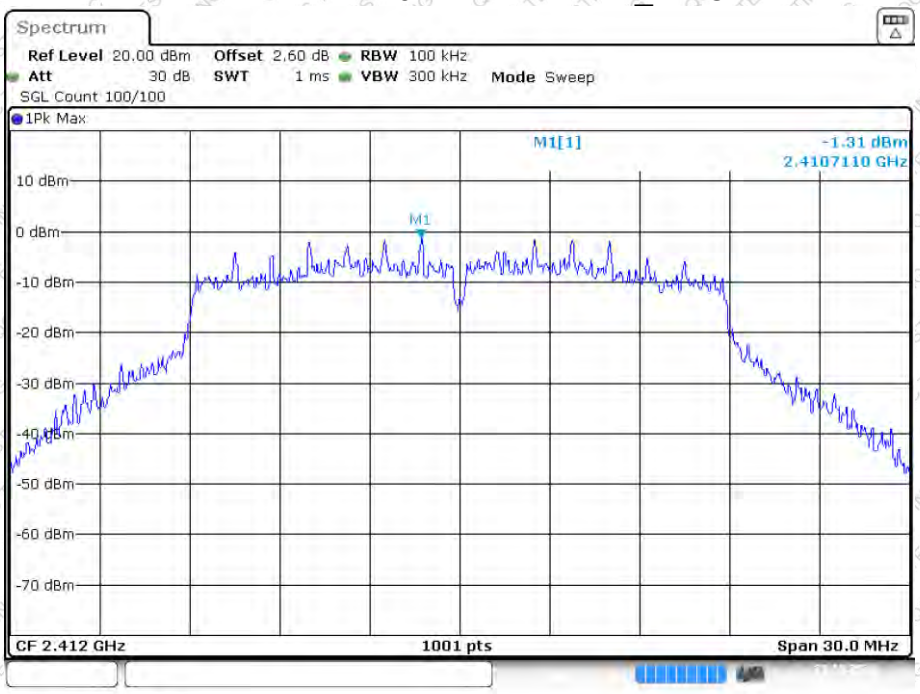

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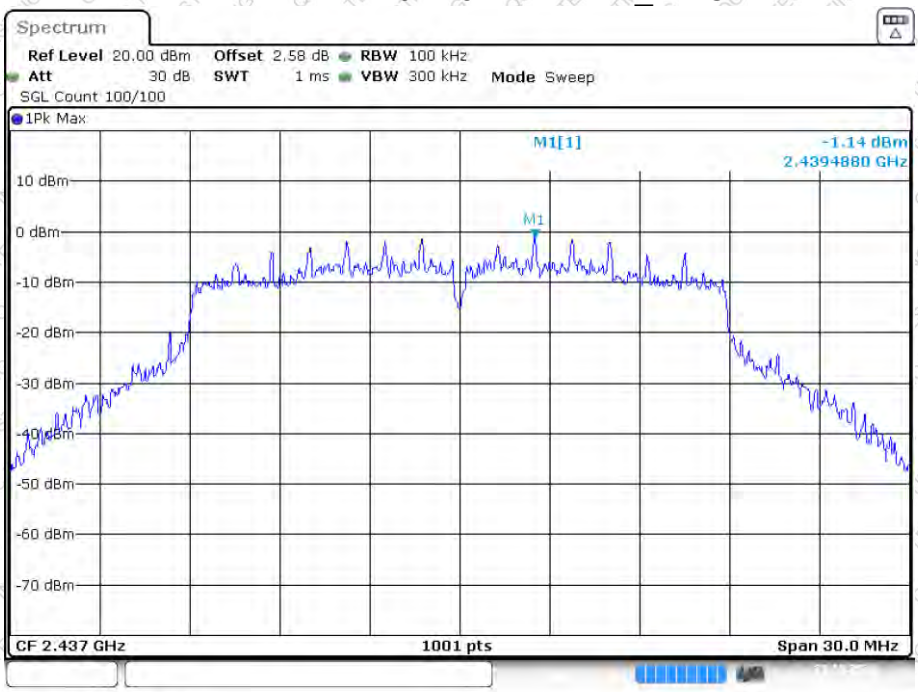

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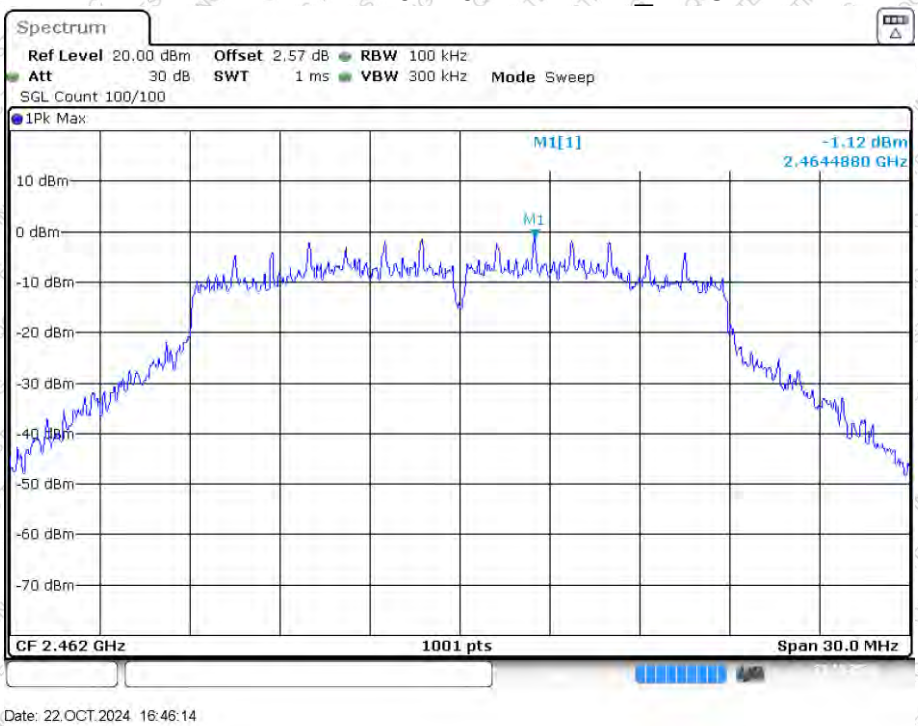

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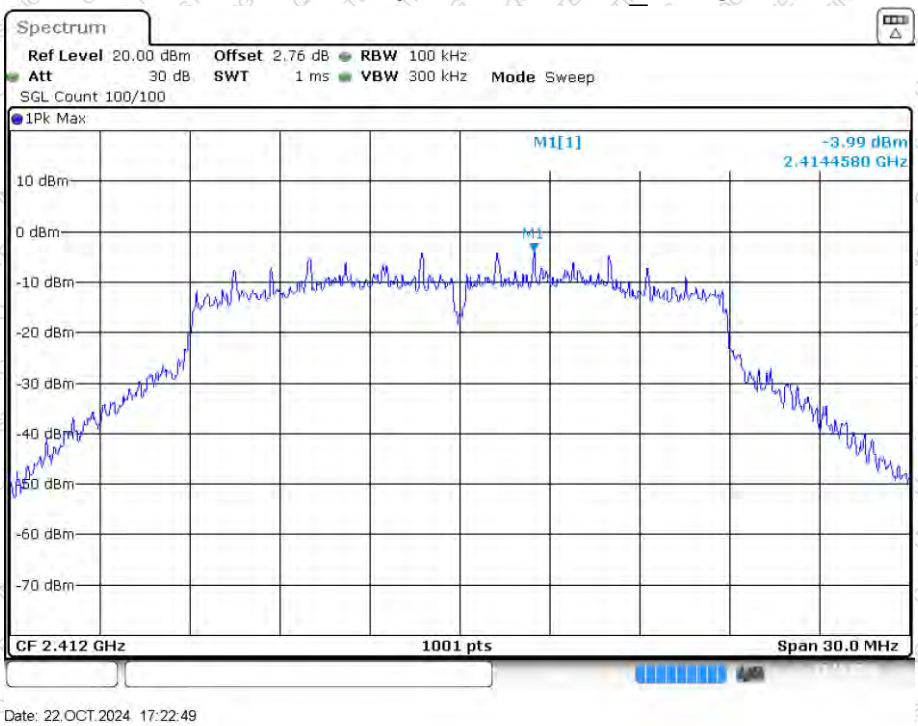
PSD NVNT n20 2412MHz Ant1_MIMO



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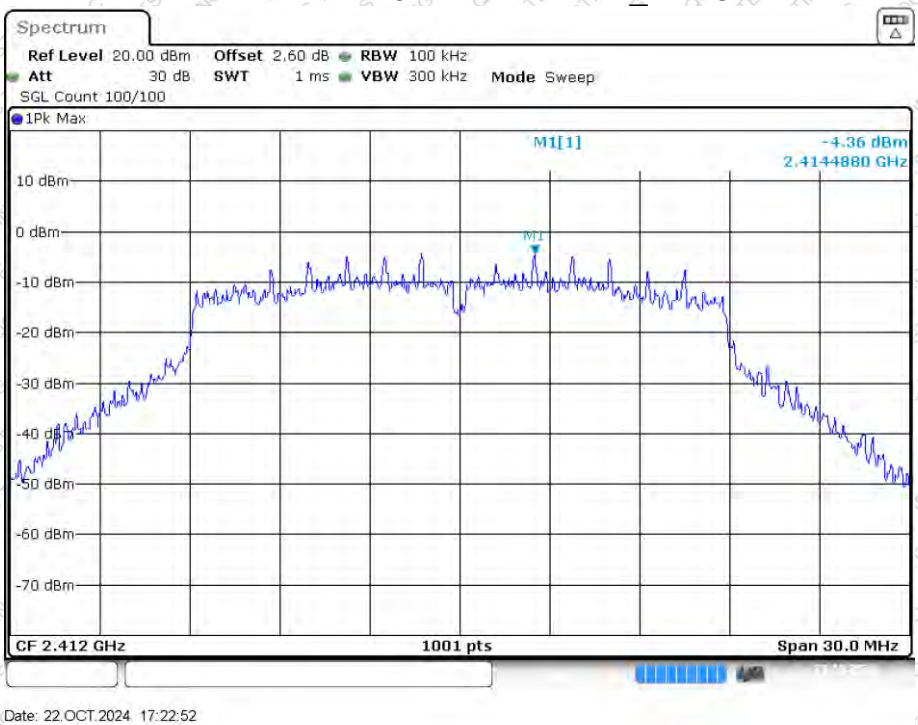

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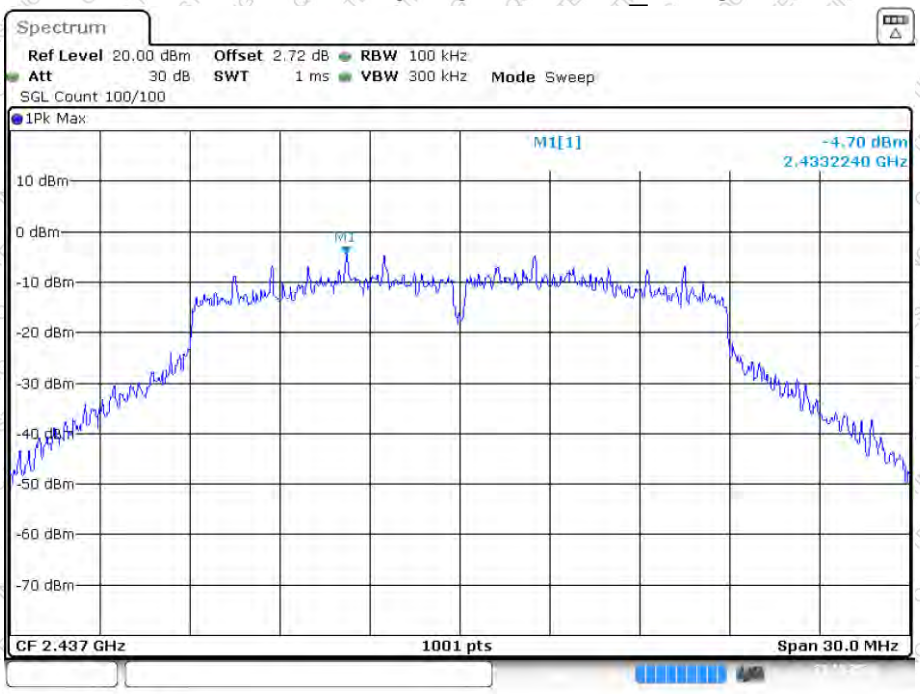
PSD NVNT n20 2437MHz Ant1_MIMO



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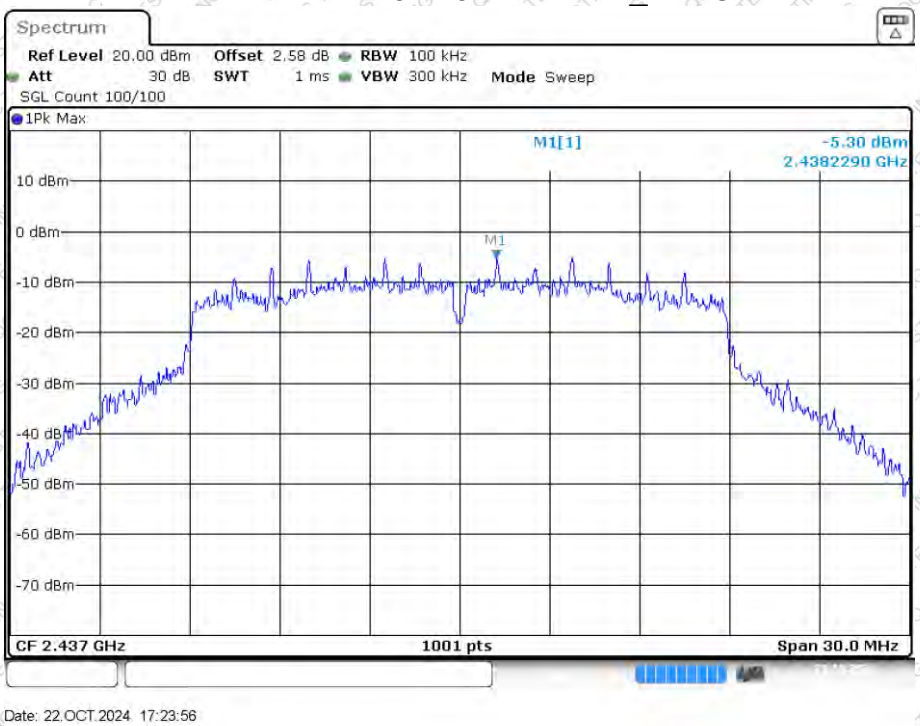

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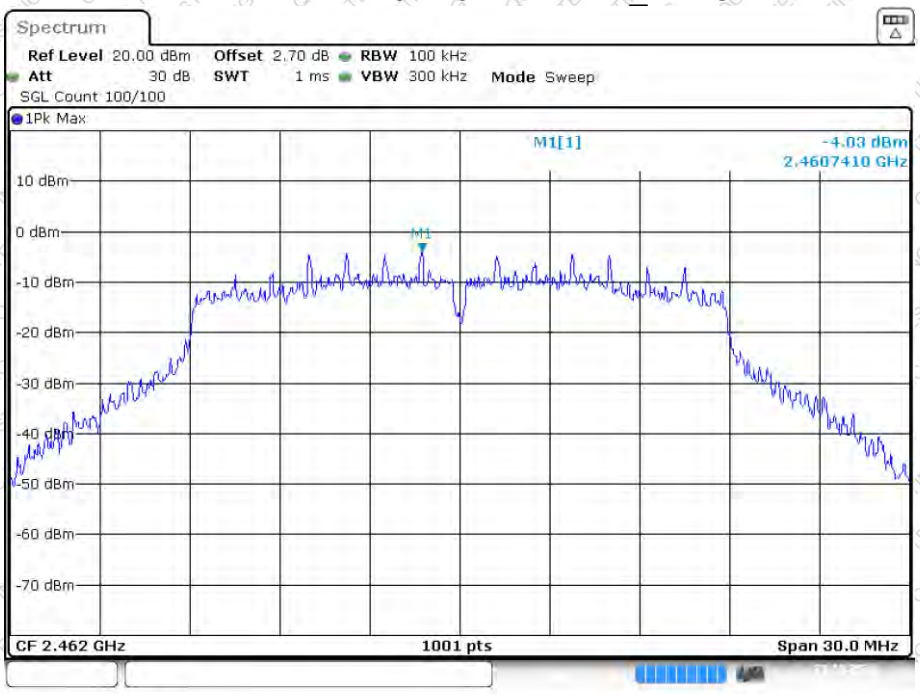
PSD NVNT n20 2462MHz Ant1_MIMO



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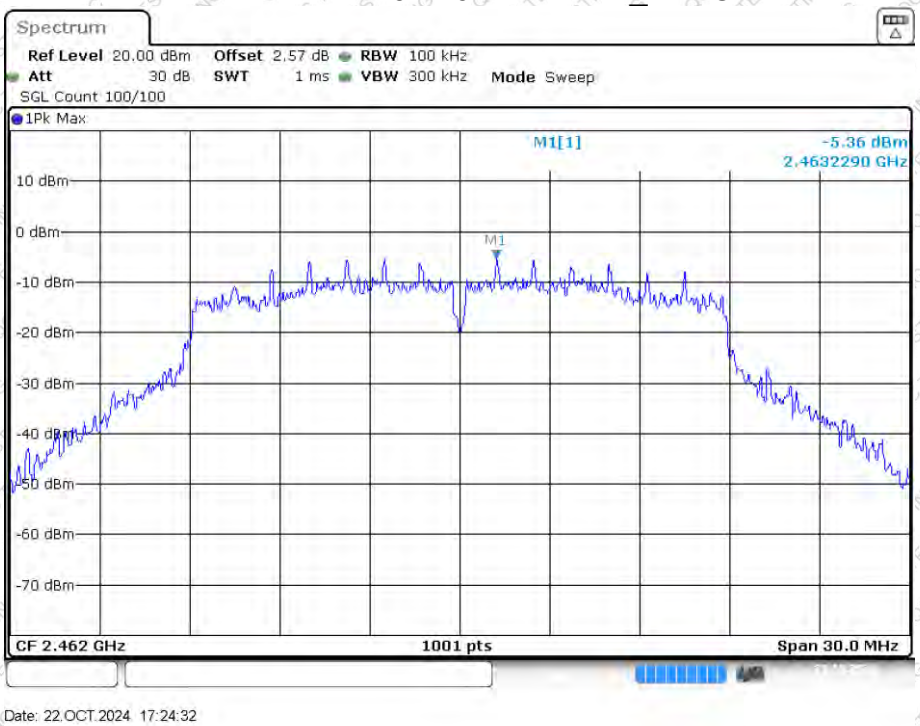

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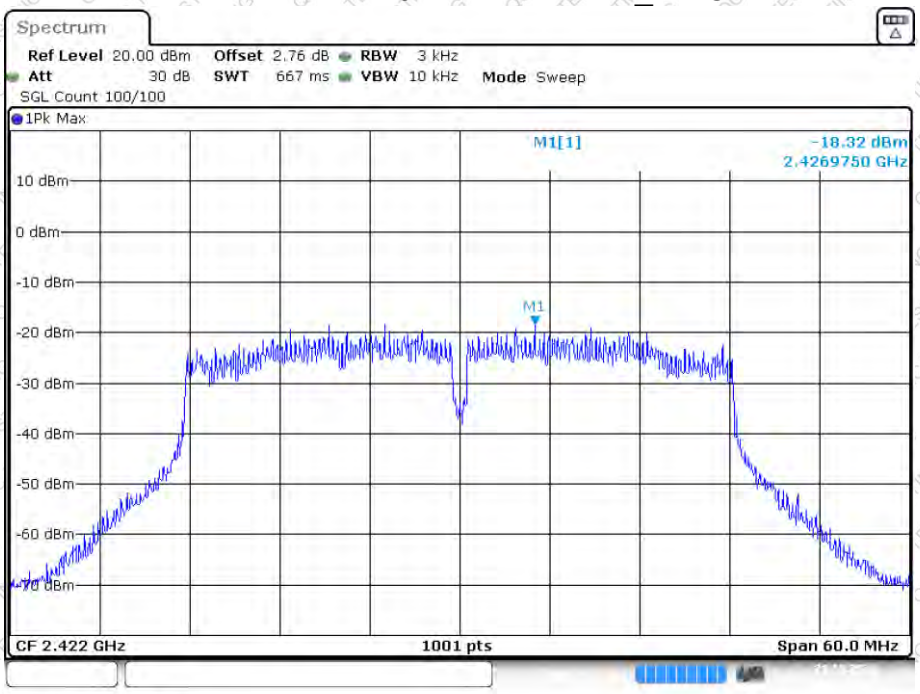
PSD NVNT n40 2422MHz Ant1_SISO



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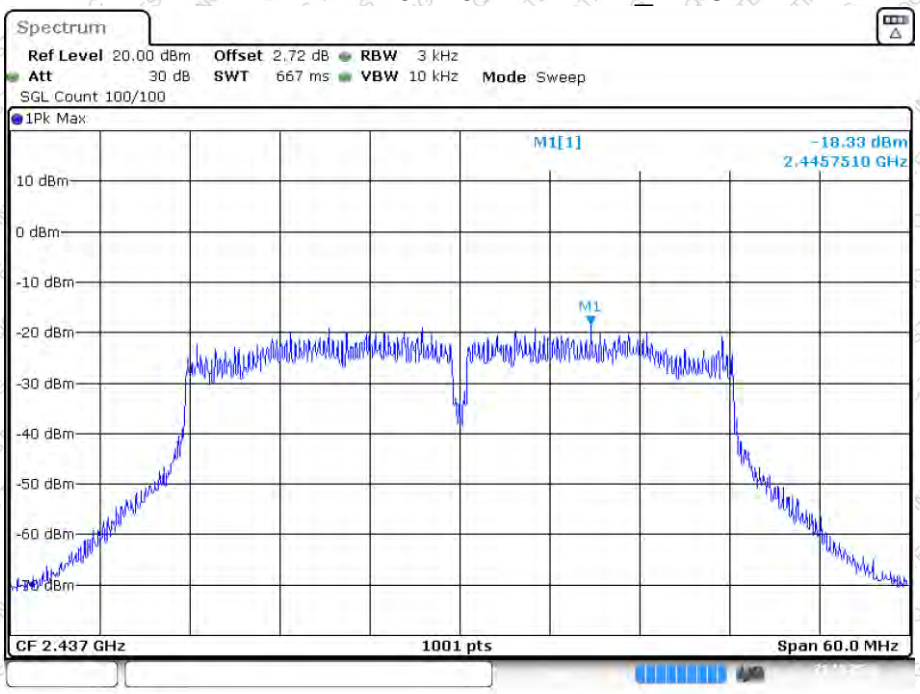
PSD NVNT n40 2437MHz Ant1_SISO



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Address: East of 1/F., Building E, Xinghong Science Park, No.111, Shuiku Road, Fenghuanggang, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
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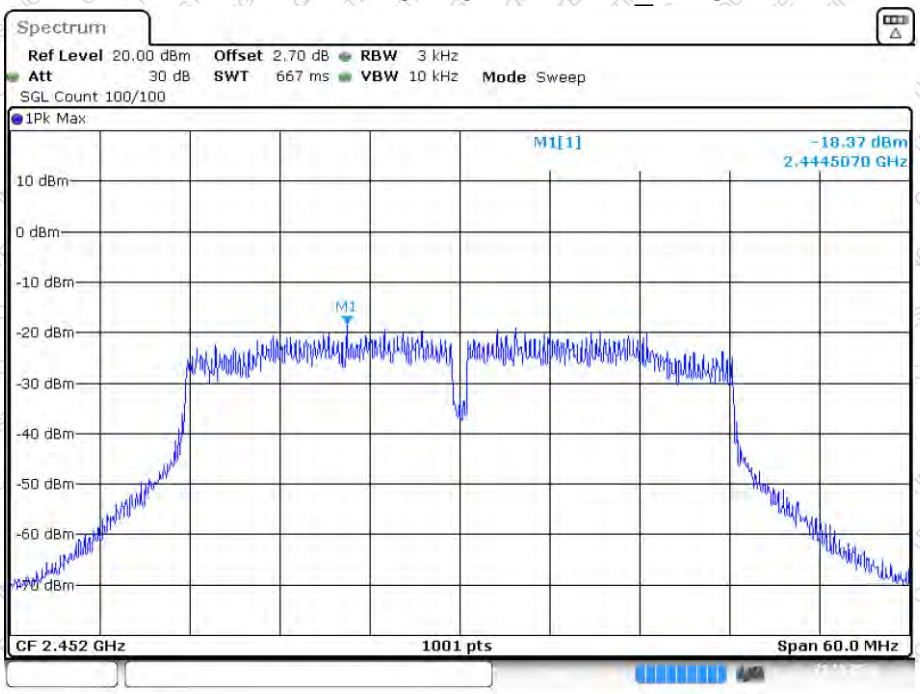
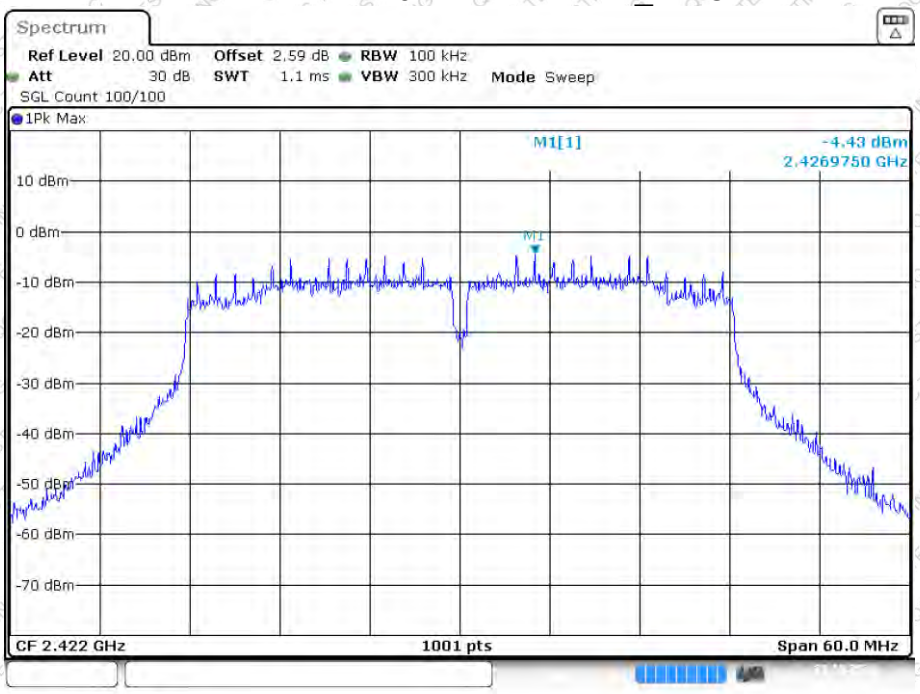
PSD NVNT n40 2452MHz Ant1_SISO



Date: 21.OCT.2024 10:30:11

PSD NVNT n40 2422MHz Ant2_SISO



Date: 22.OCT.2024 16:59:09

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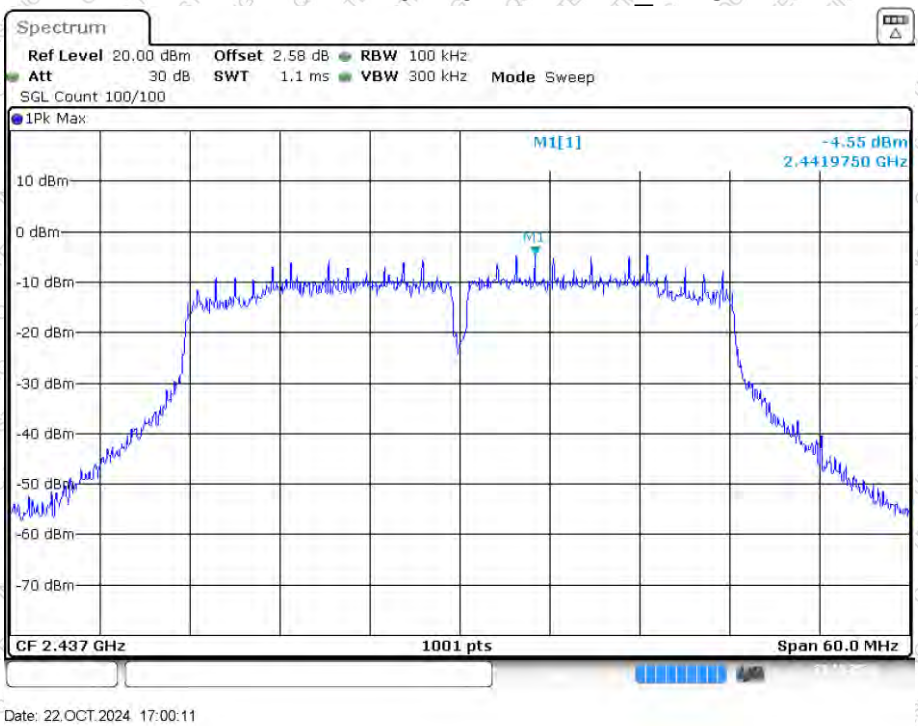
PSD NVNT n40 2437MHz Ant2_SISO



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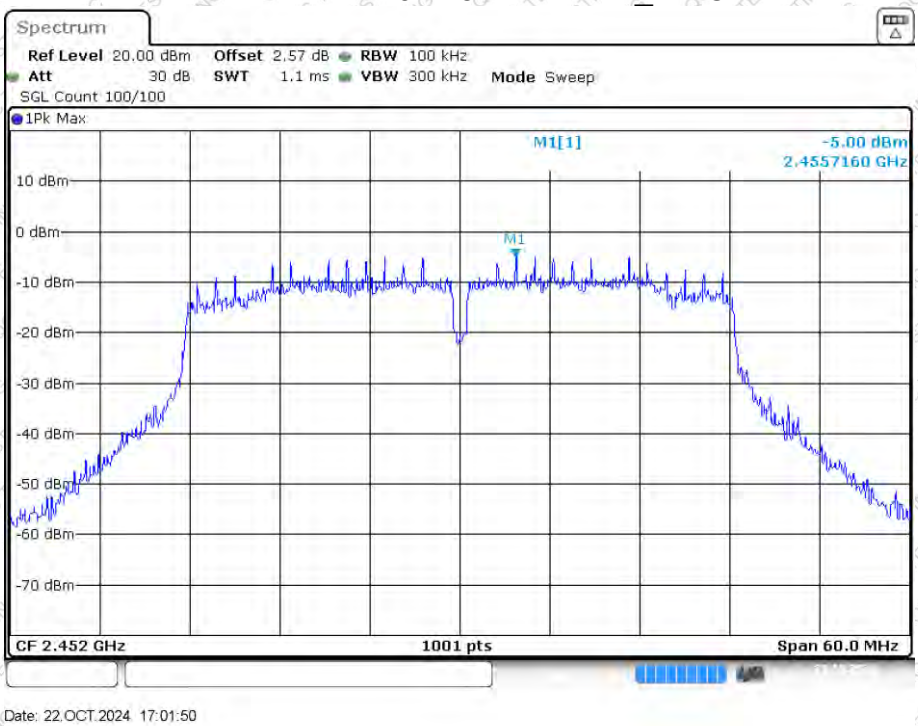

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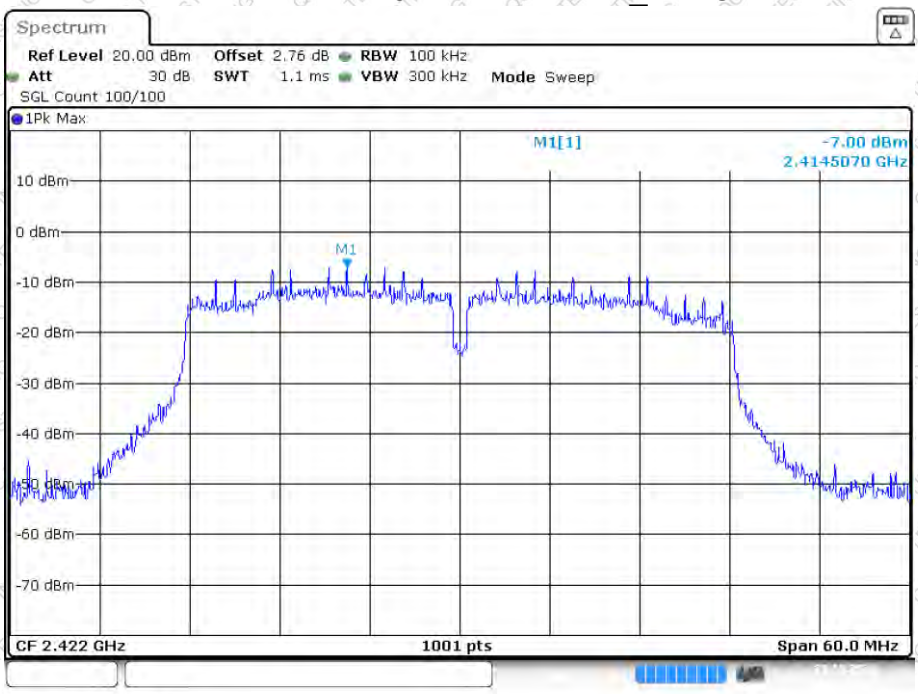
PSD NVNT n40 2422MHz Ant1_MIMO



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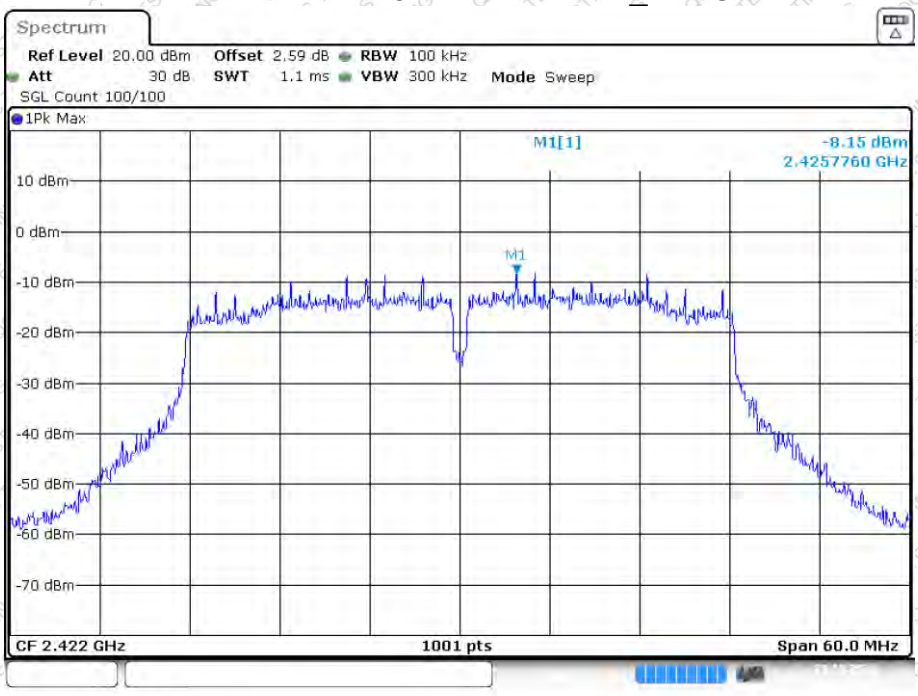

Date: 22.OCT.2024 17:30:57

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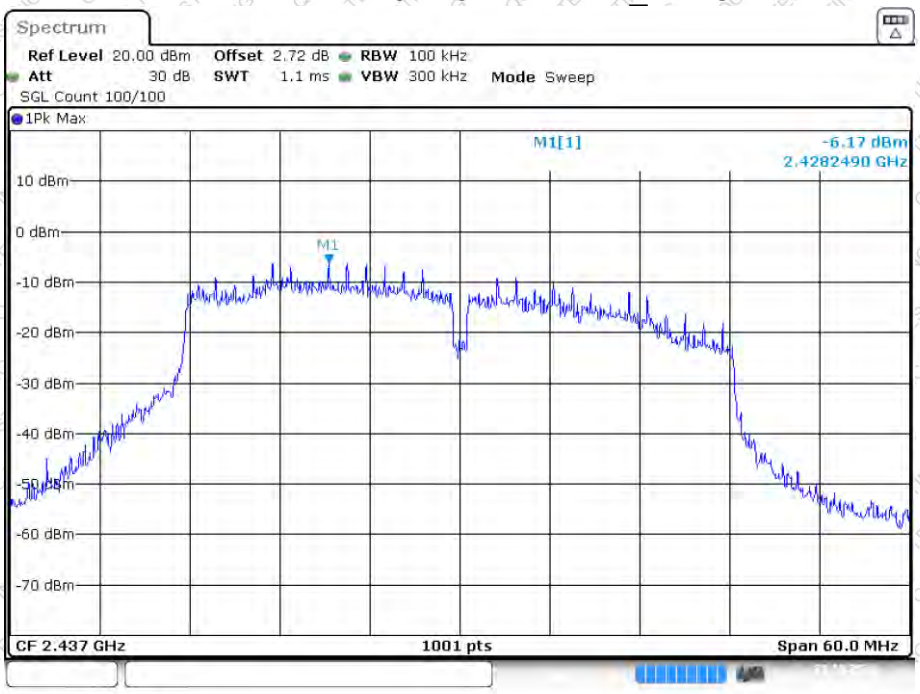
PSD NVNT n40 2437MHz Ant1_MIMO



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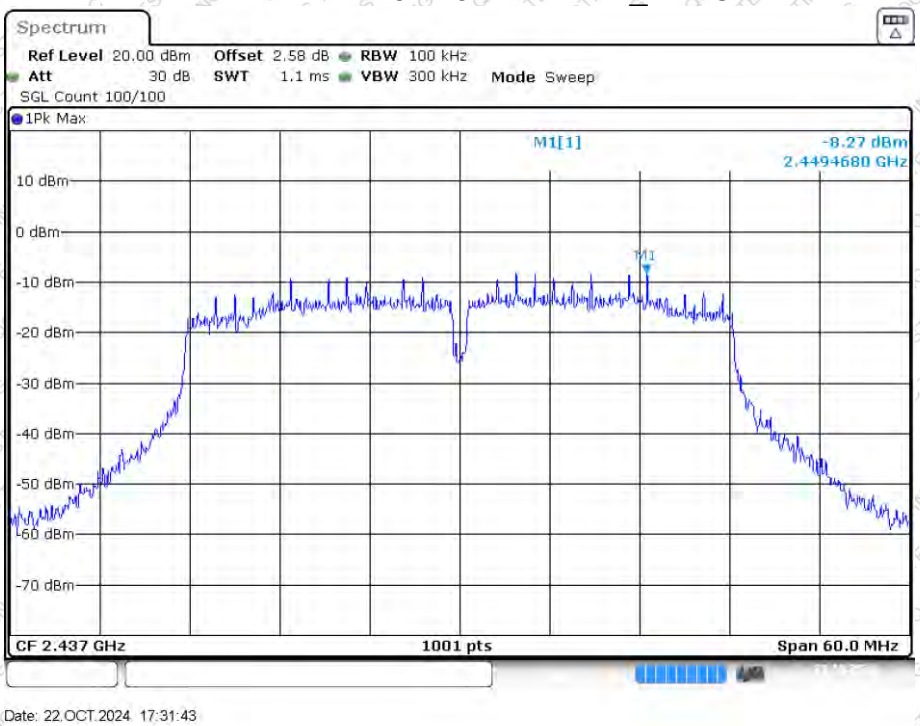

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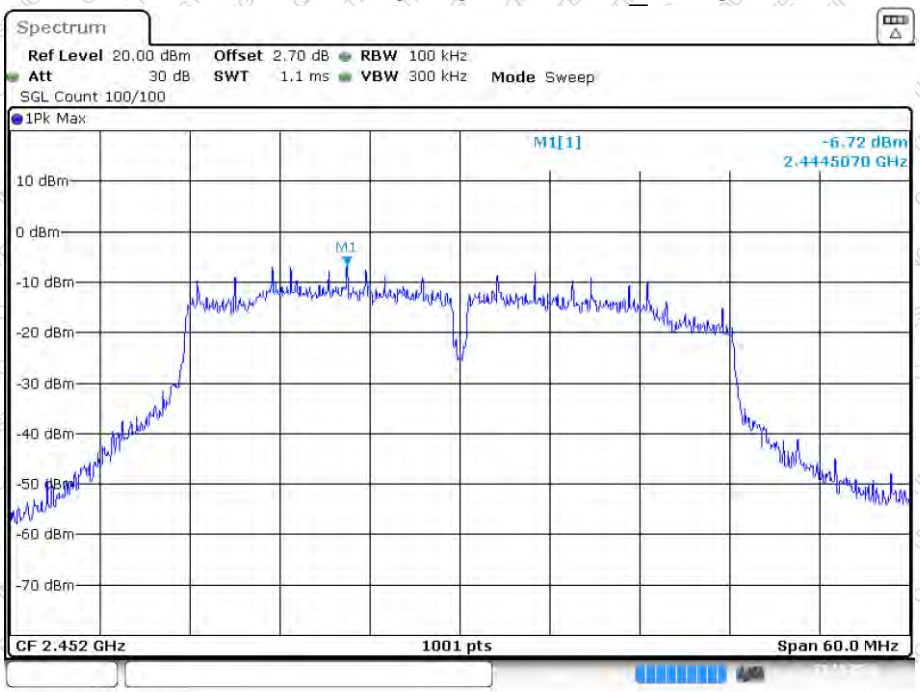
PSD NVNT n40 2452MHz Ant1_MIMO



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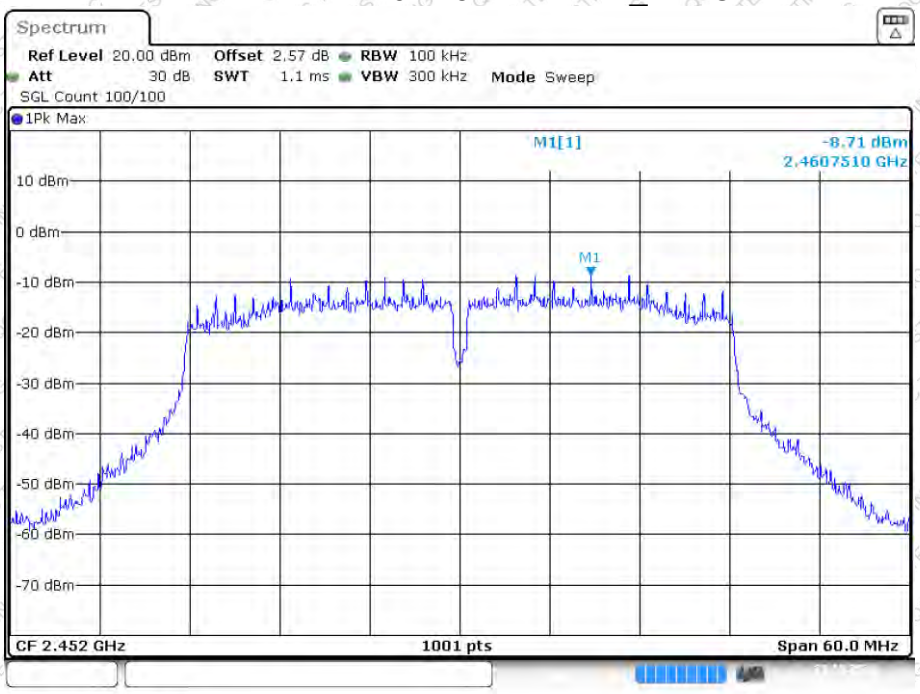

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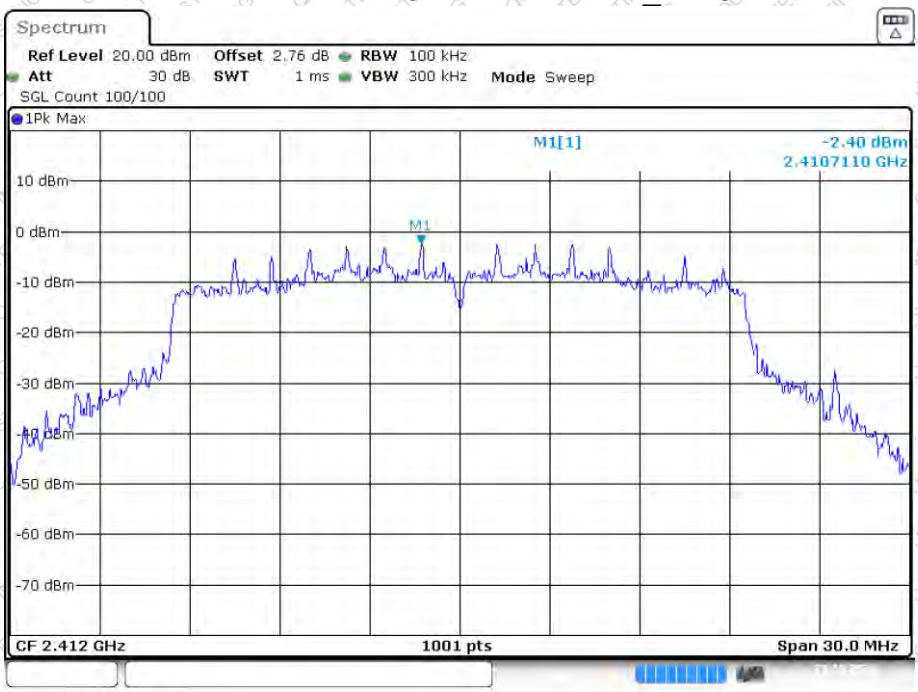
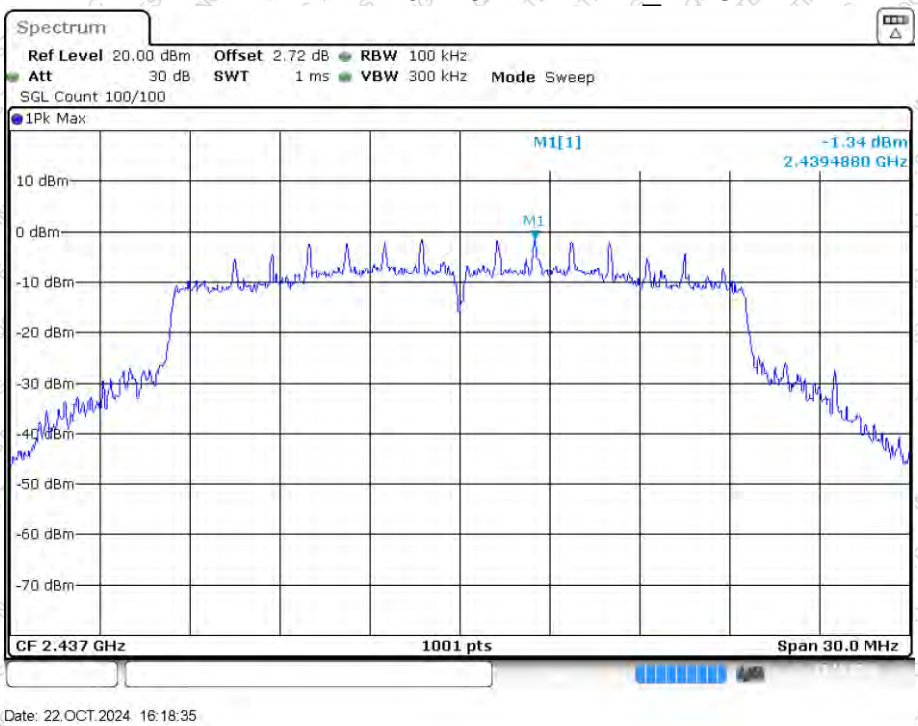
PSD NVNT ax20 2412MHz Ant1_SISO



PSD NVNT ax20 2437MHz Ant1_SISO



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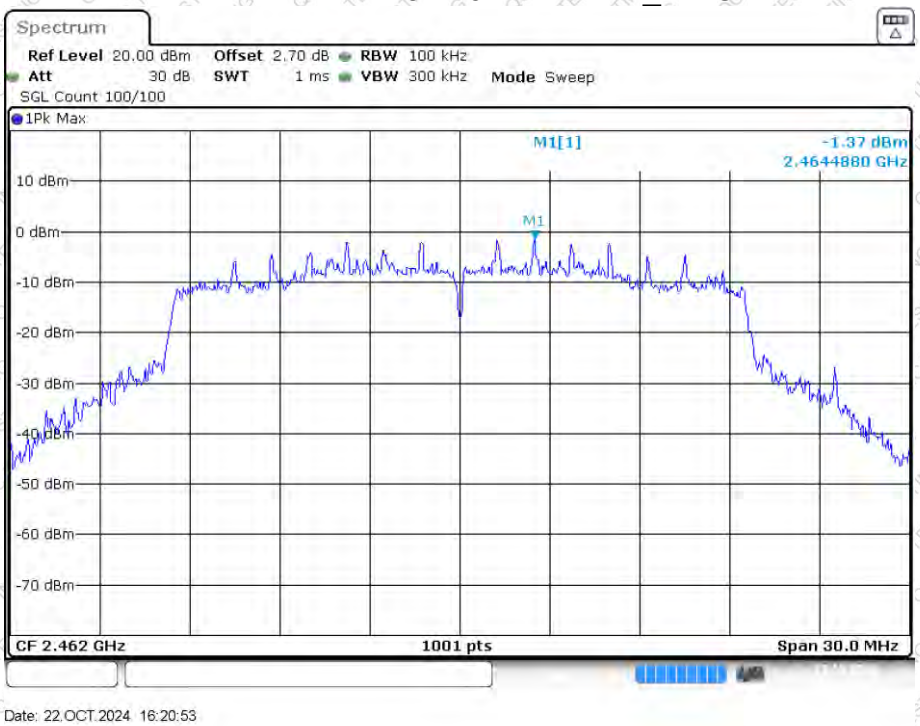
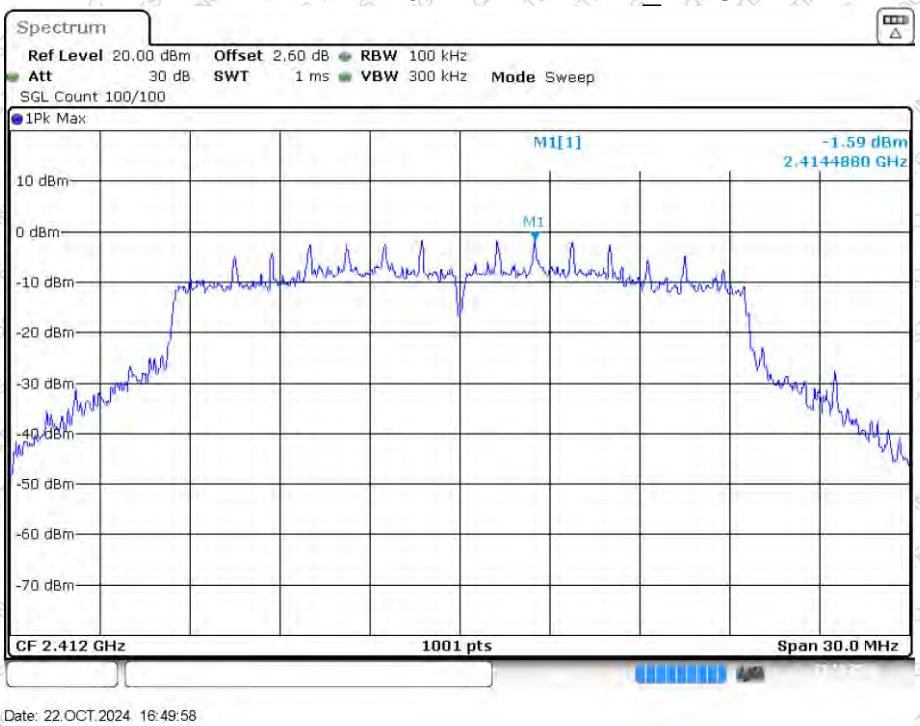
PSD NVNT ax20 2462MHz Ant1_SISO



PSD NVNT ax20 2412MHz Ant2_SISO



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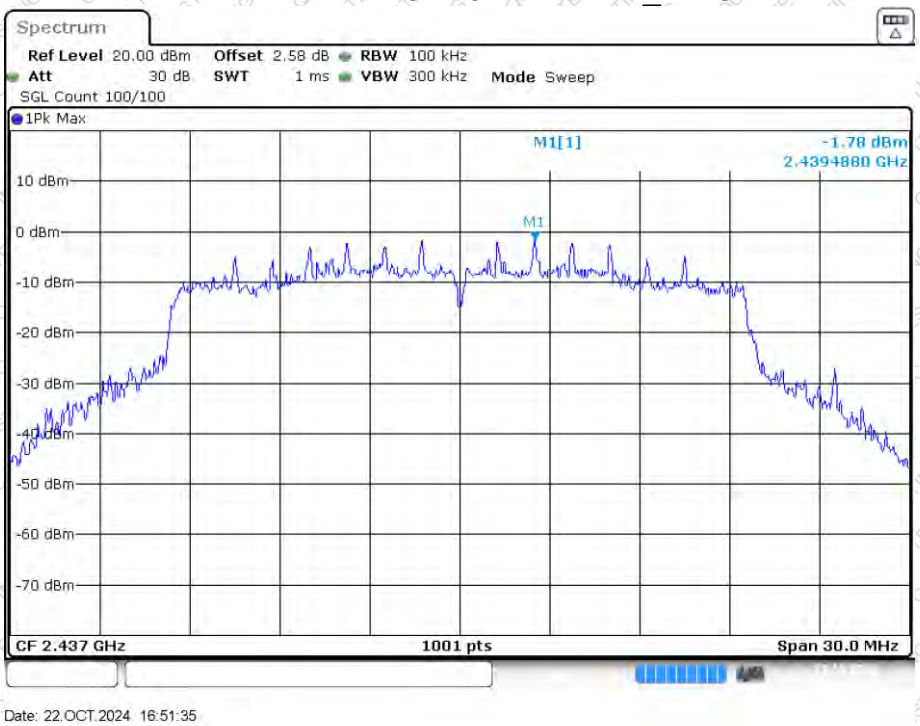
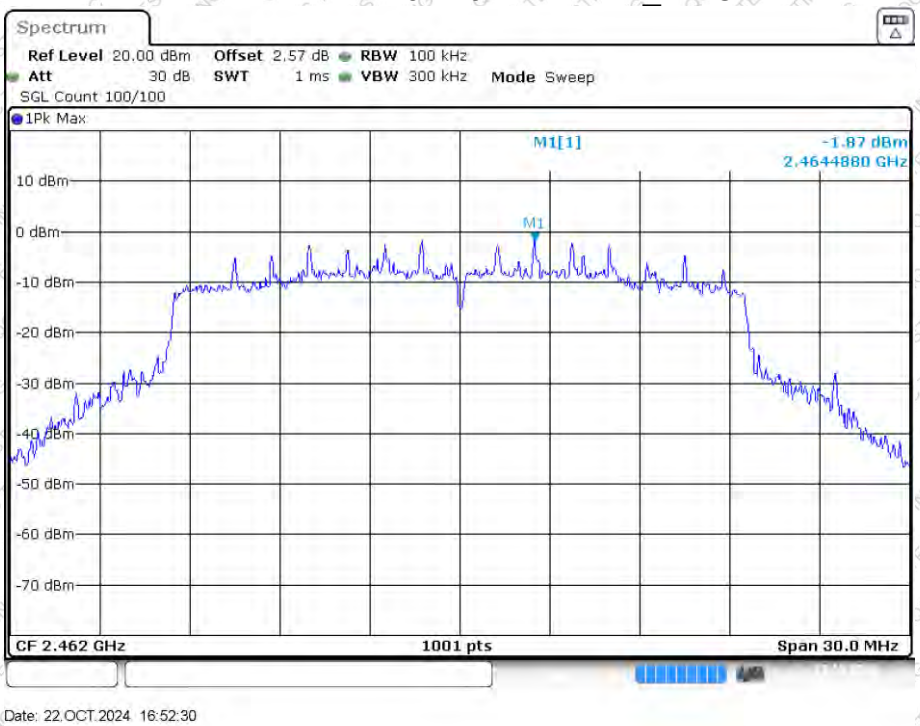
PSD NVNT ax20 2437MHz Ant2_SISO



PSD NVNT ax20 2462MHz Ant2_SISO



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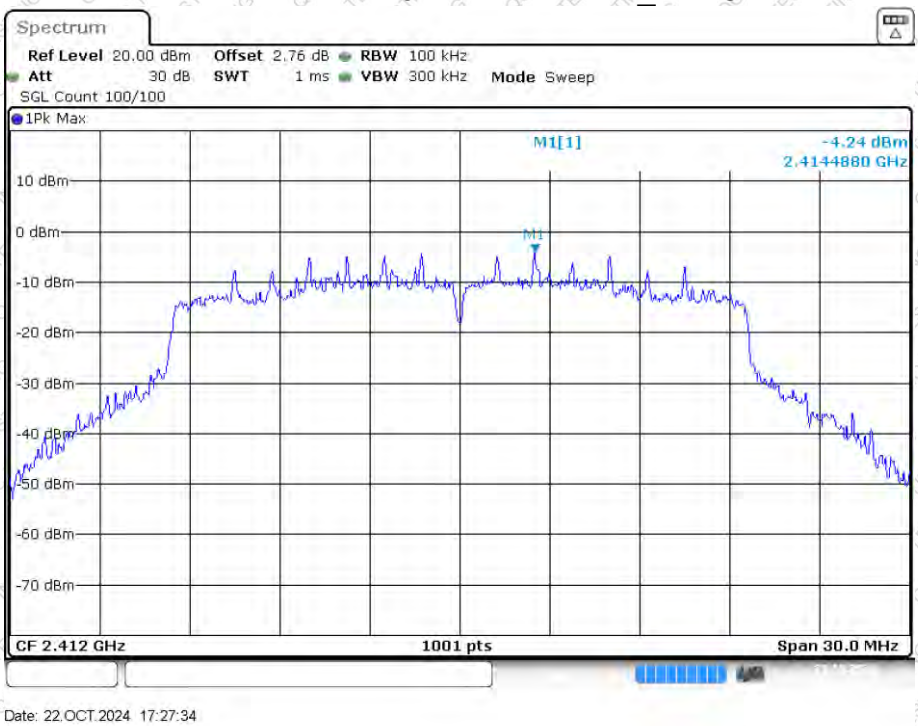
PSD NVNT ax20 2412MHz Ant1_MIMO



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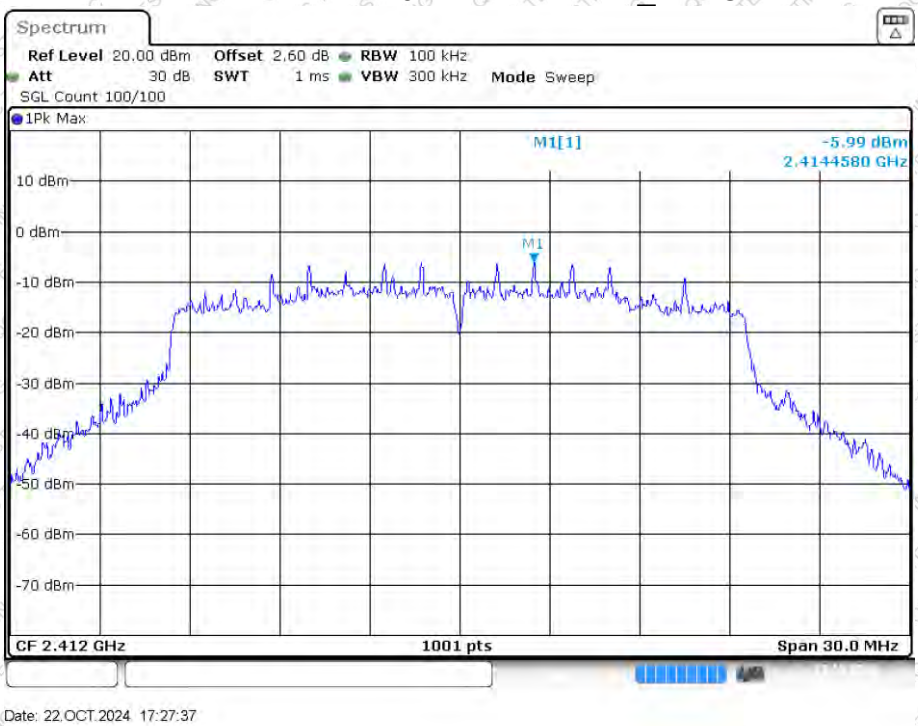

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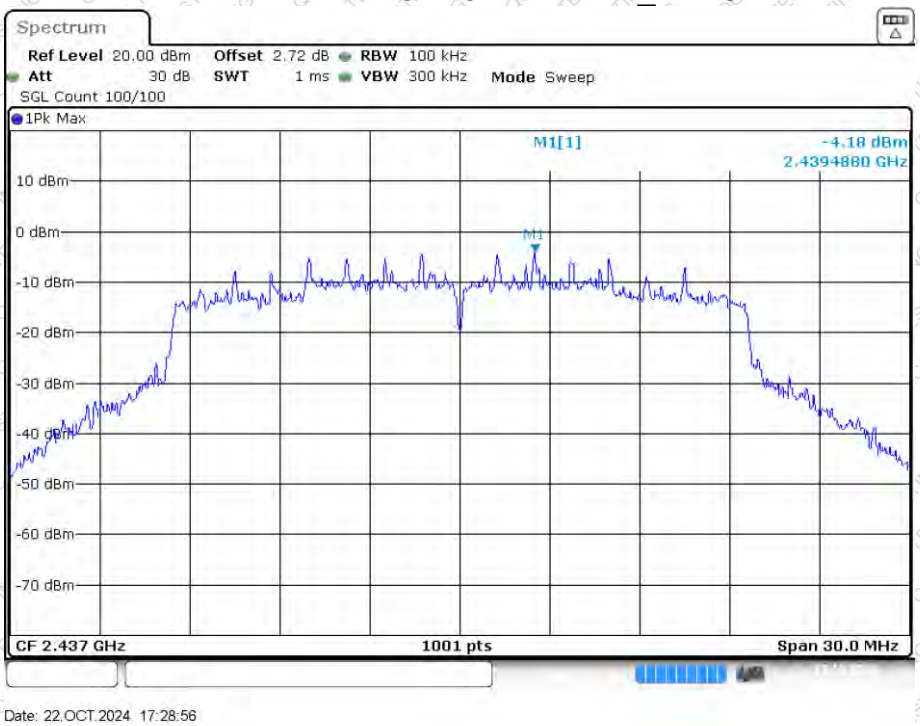
PSD NVNT ax20 2437MHz Ant1_MIMO



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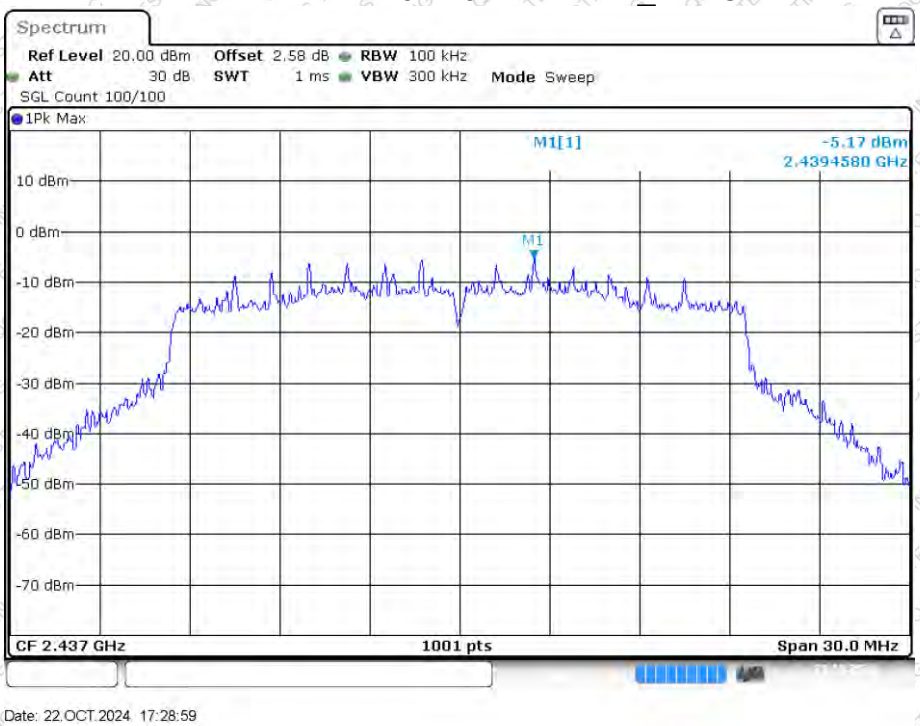

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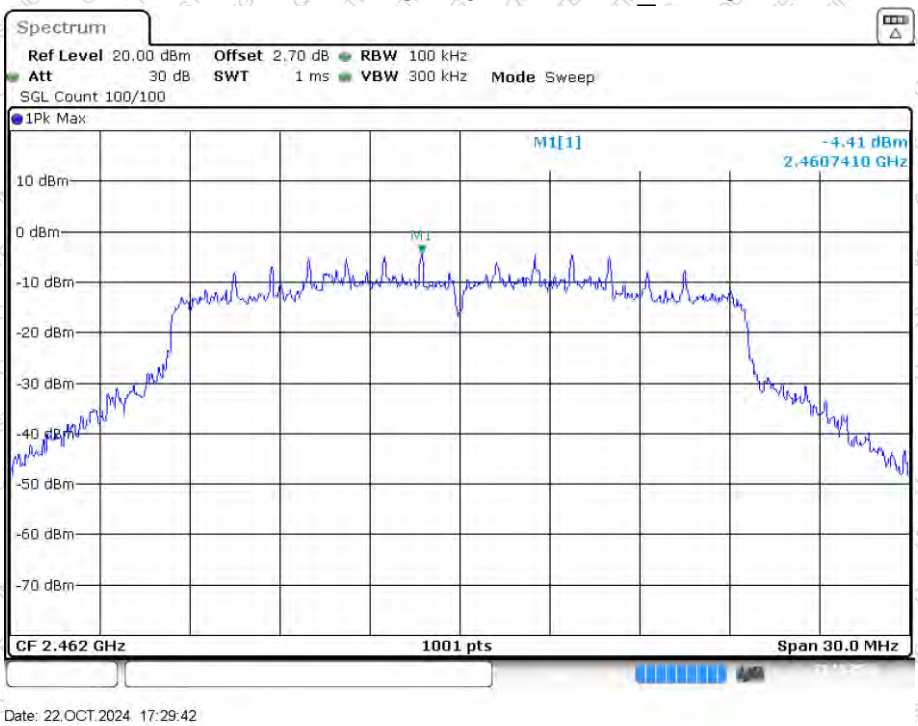
PSD NVNT ax20 2462MHz Ant1_MIMO



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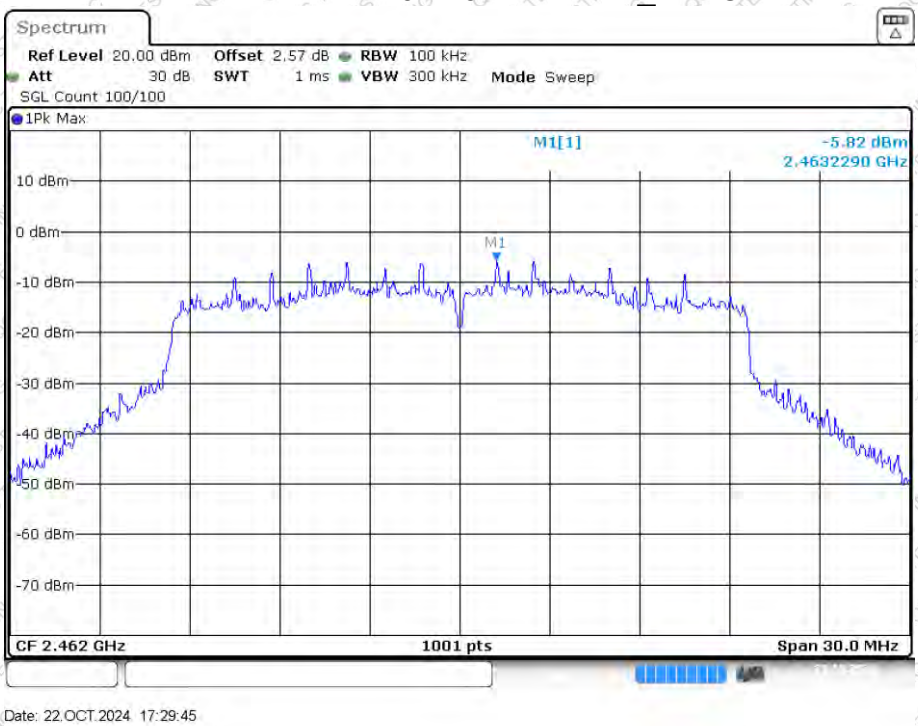

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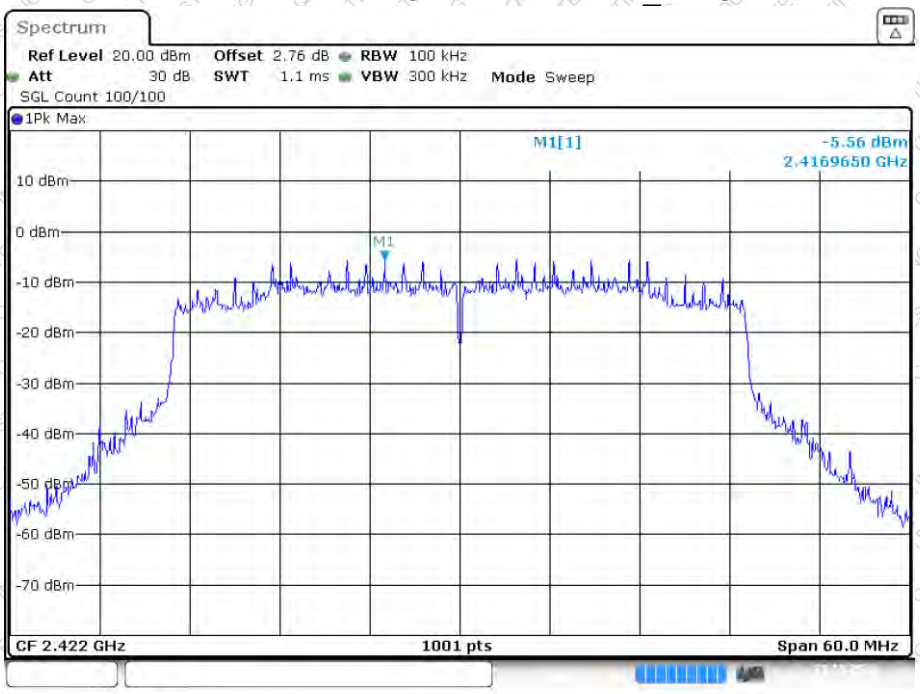
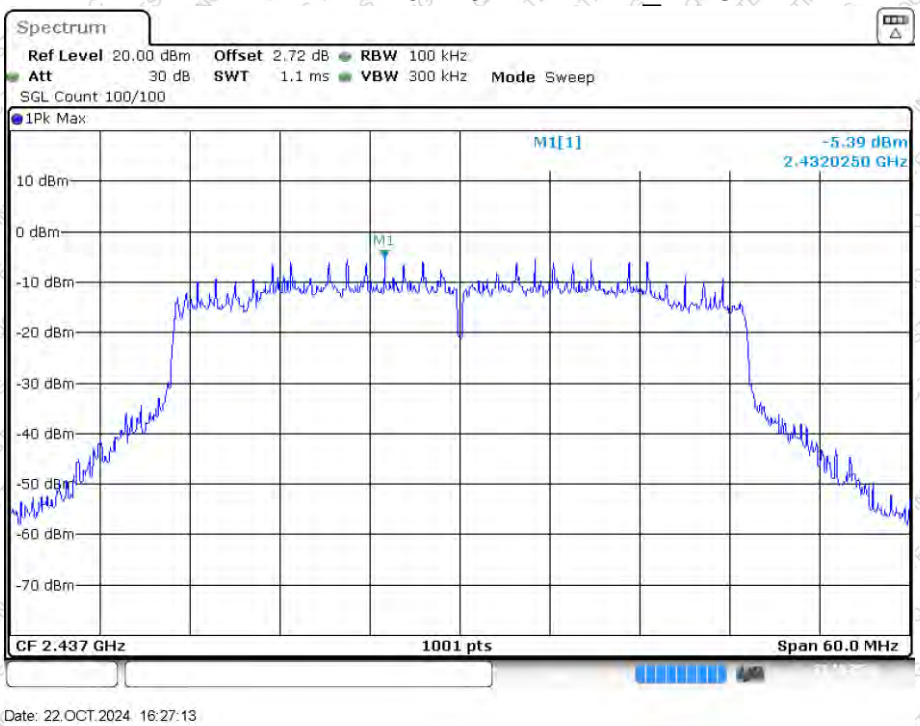
PSD NVNT ax40 2422MHz Ant1_SISO



PSD NVNT ax40 2437MHz Ant1_SISO



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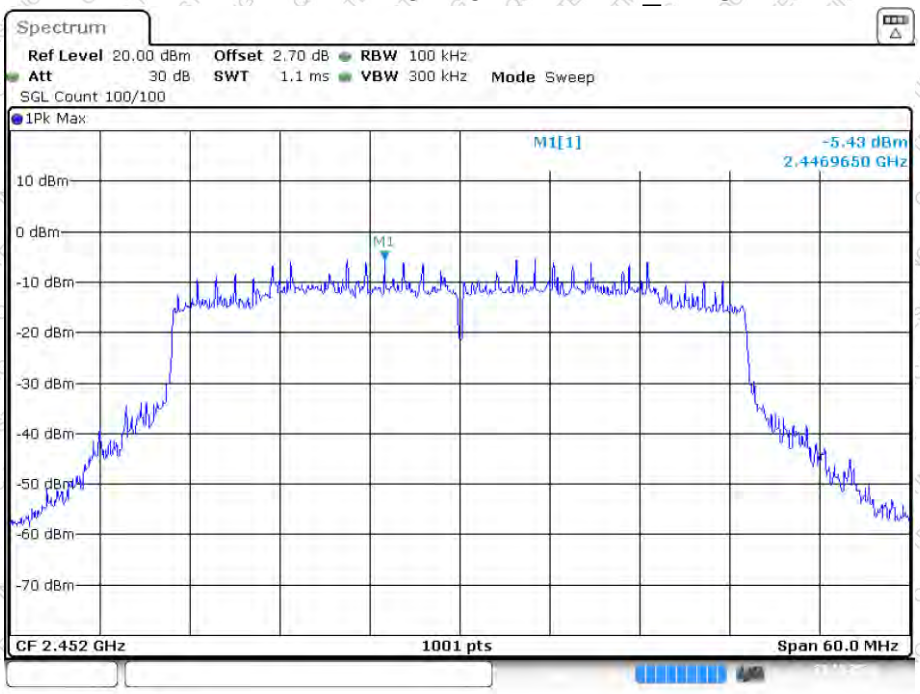
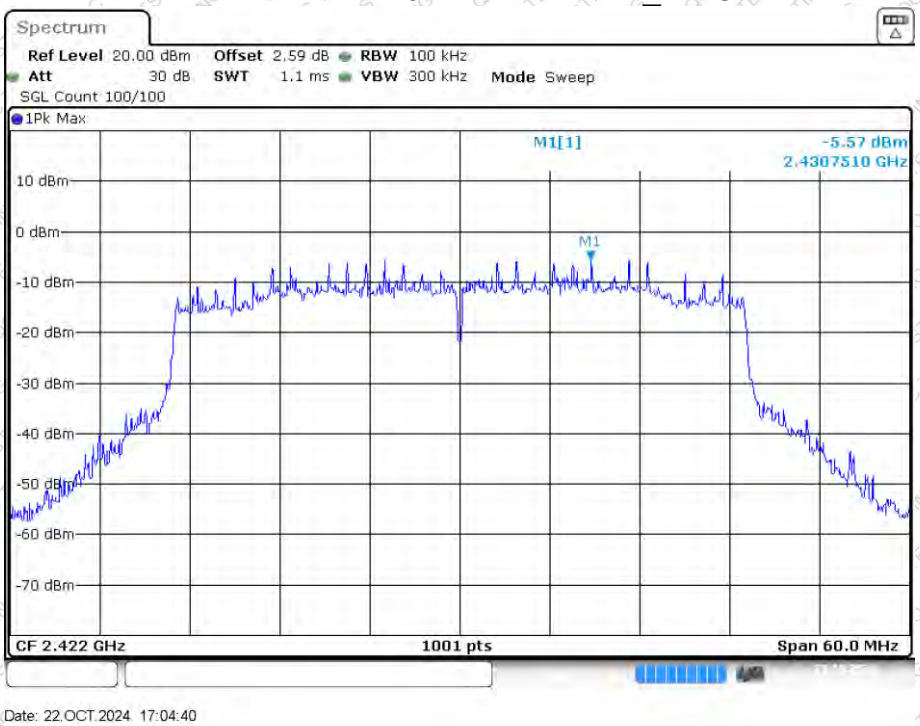
PSD NVNT ax40 2452MHz Ant1_SISO



PSD NVNT ax40 2422MHz Ant2_SISO



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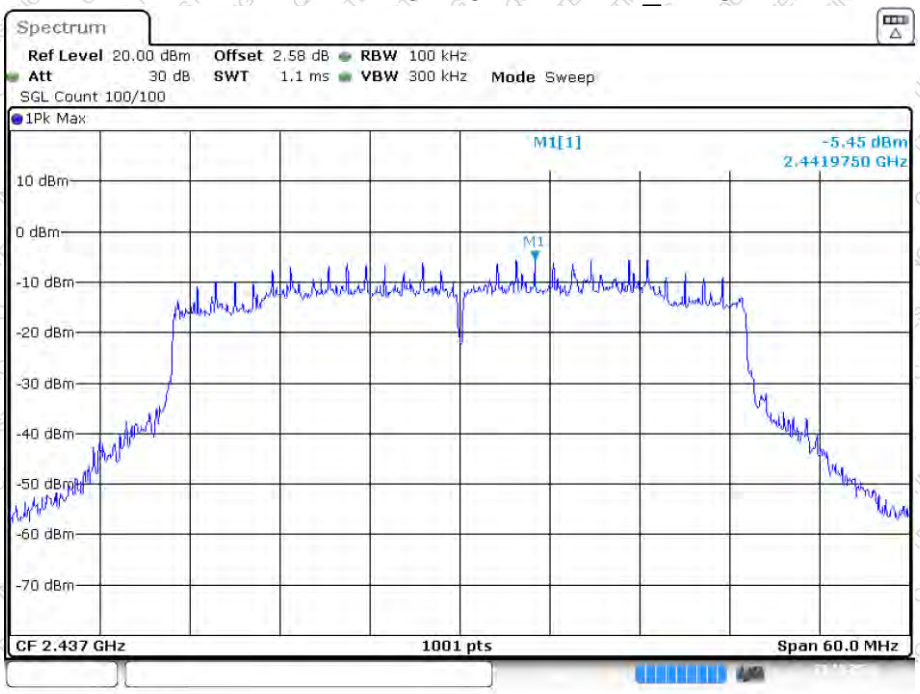
PSD NVNT ax40 2437MHz Ant2_SISO



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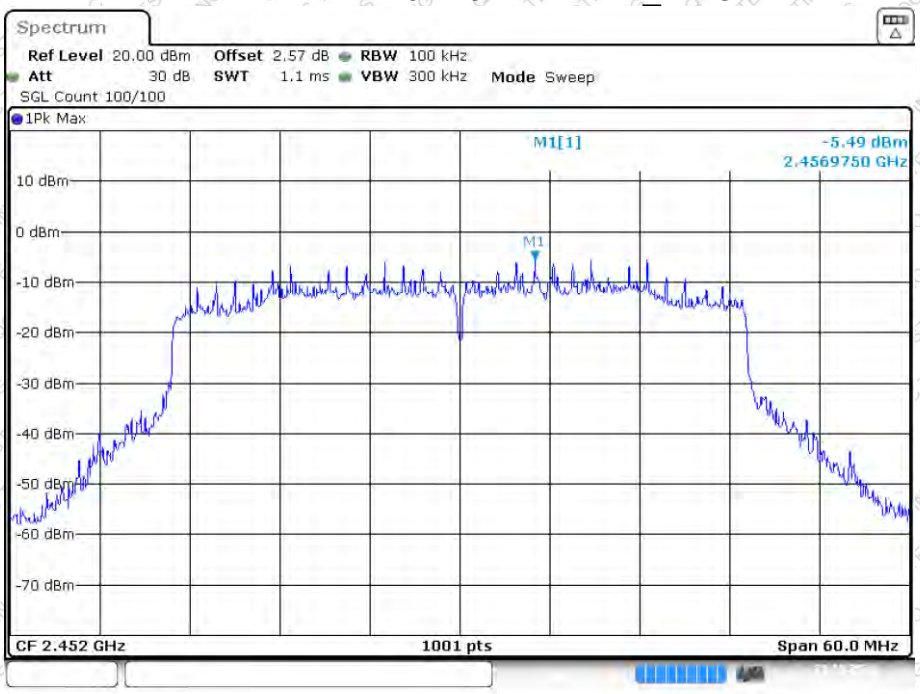
PSD NVNT ax40 2452MHz Ant2_SISO



Date: 22.OCT.2024 17:06:26

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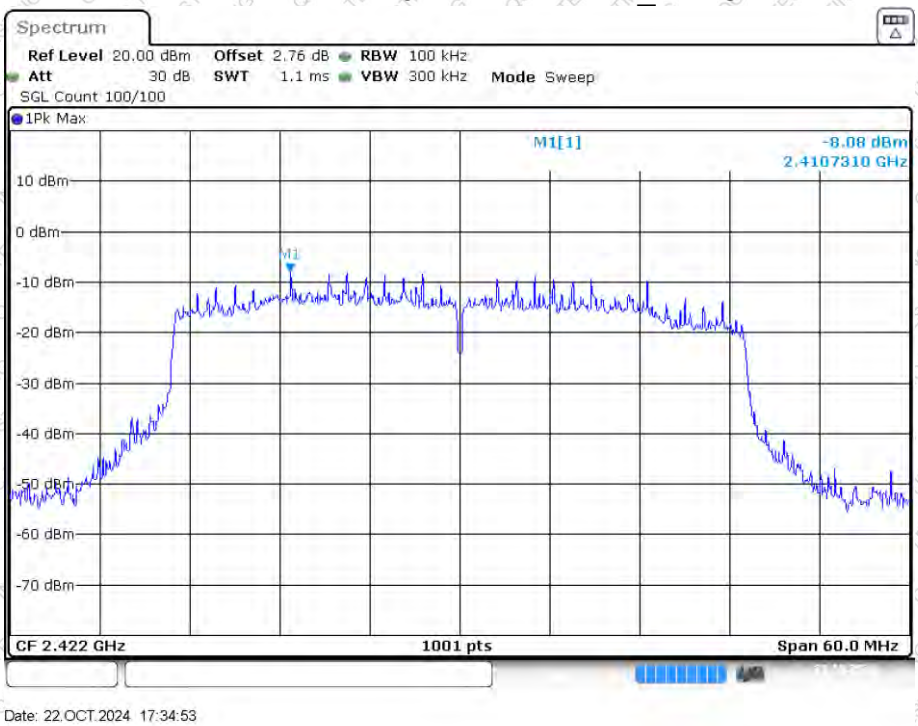
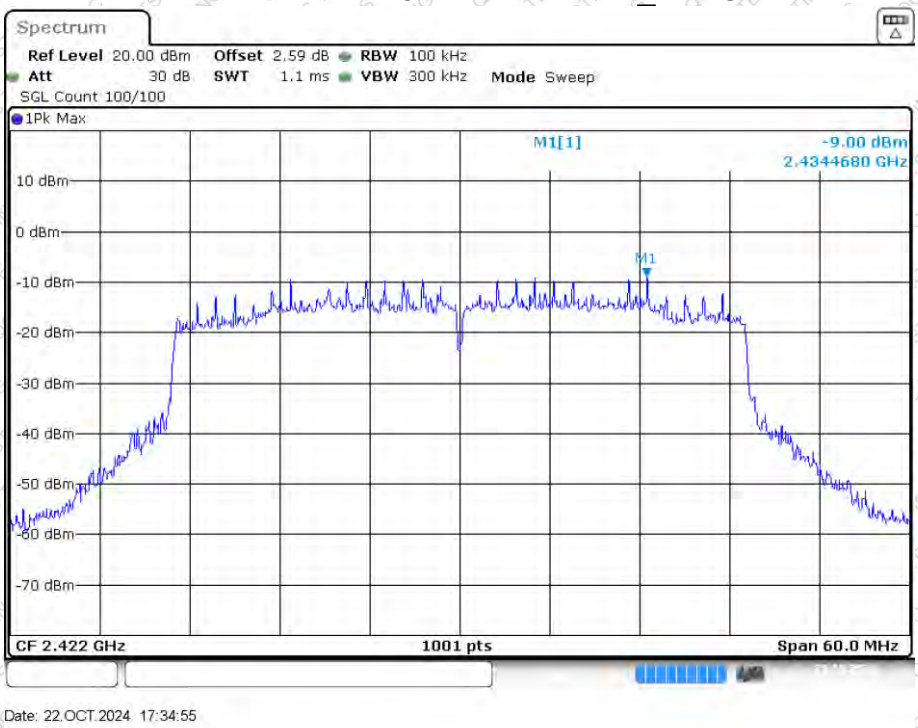
PSD NVNT ax40 2422MHz Ant1_MIMO



PSD NVNT ax40 2422MHz Ant2_MIMO



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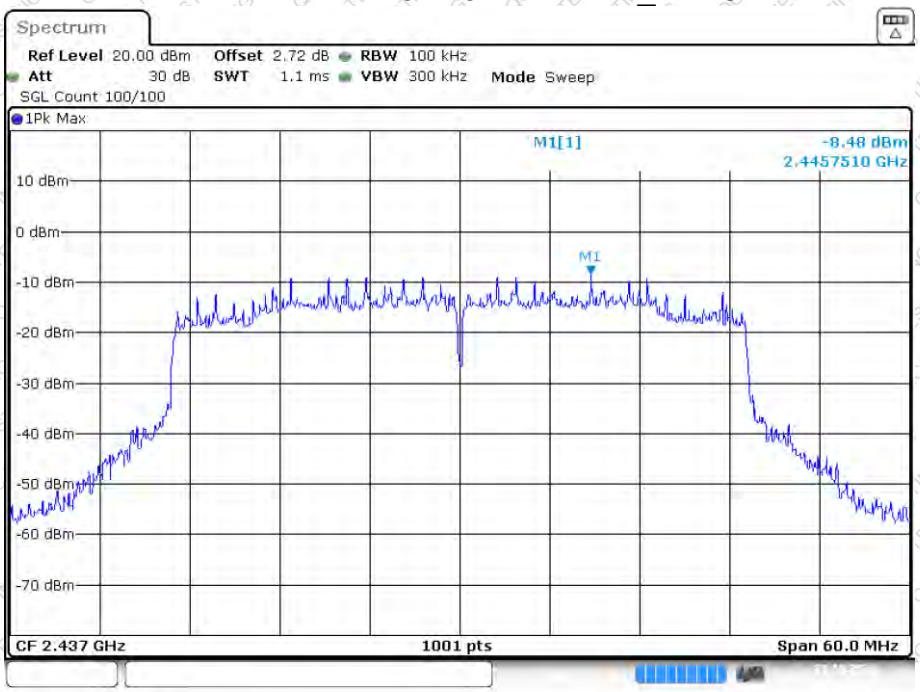
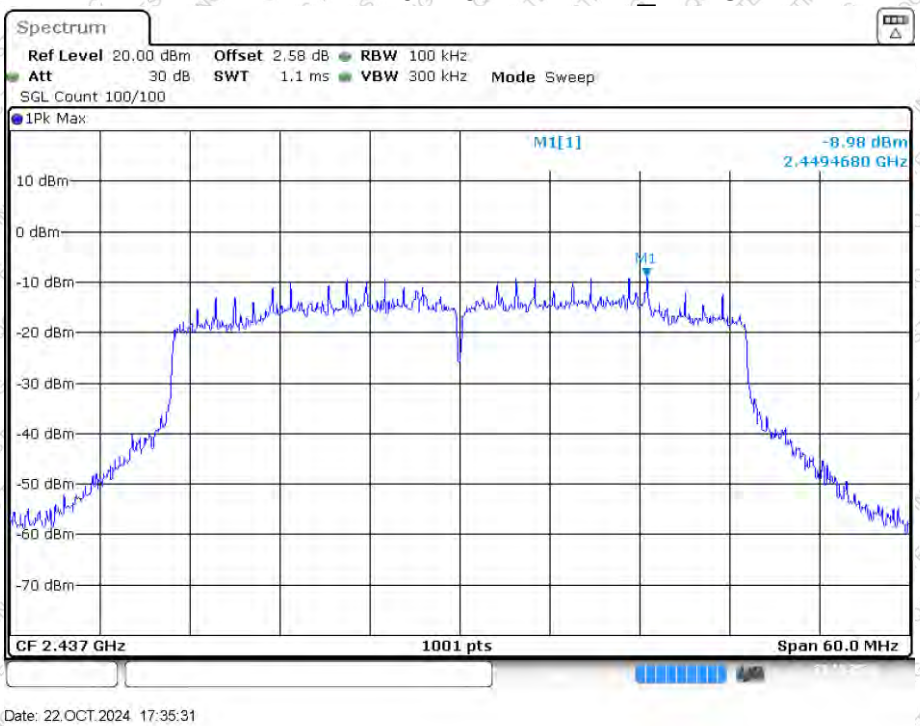
PSD NVNT ax40 2437MHz Ant1_MIMO



PSD NVNT ax40 2437MHz Ant2_MIMO



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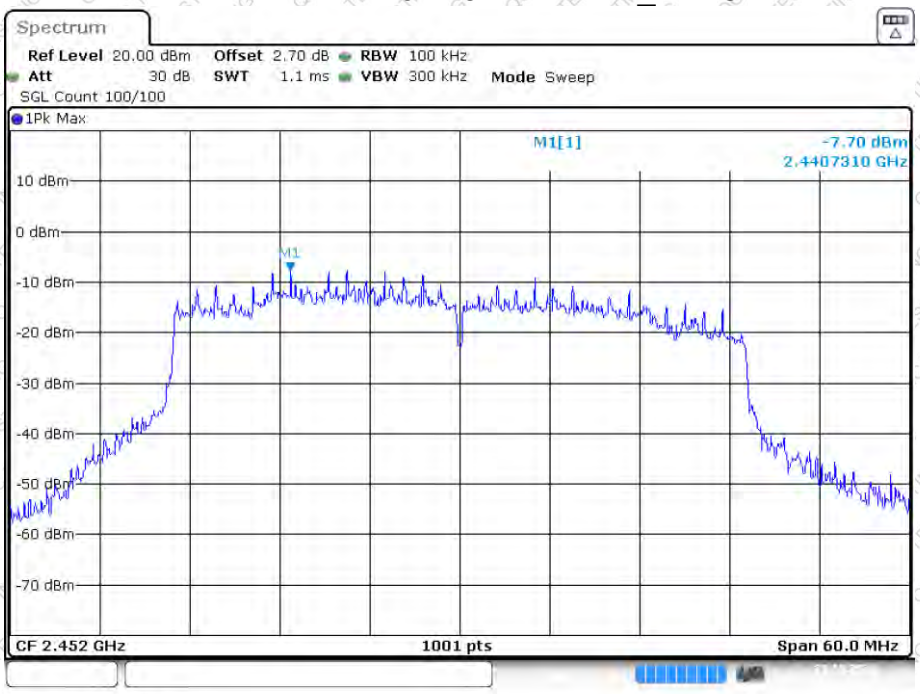
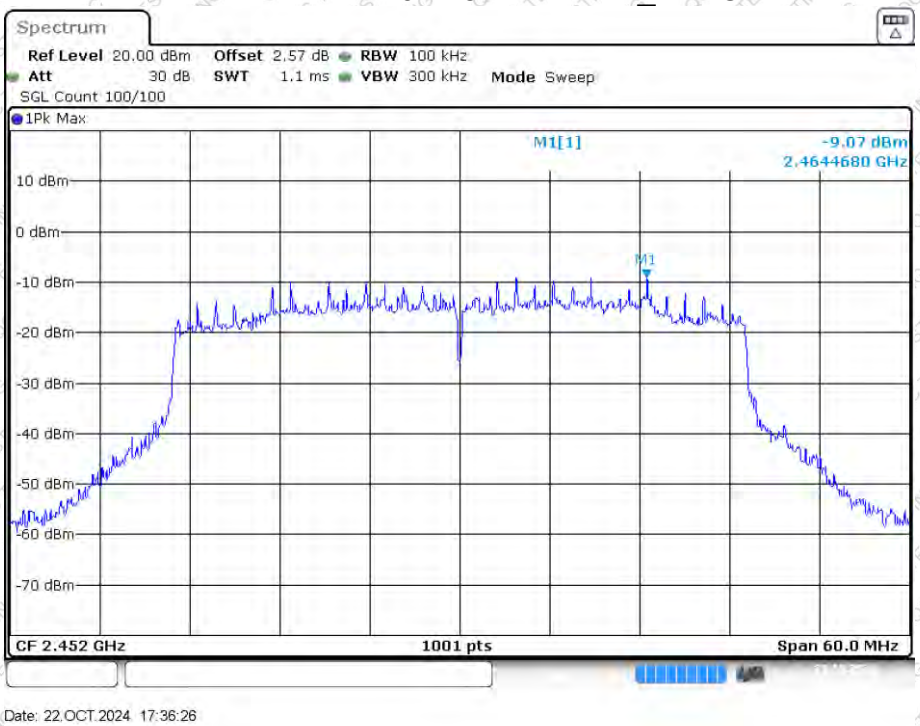
PSD NVNT ax40 2452MHz Ant1_MIMO



PSD NVNT ax40 2452MHz Ant2_MIMO



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