FCC PART 15.247

TEST REPORT

For

Shenzhen Huafurui Technology Co., Ltd

Unit 1401 14/F, Jin qi zhi gu mansion Liu xian street, Xili, Nan shan district, Shenzhen, China

FCC ID: 2AHZ5SW10

Report Type:	**Product Type:**
Original Report	Projector

Report Number: SZ1210918-48944E-00B

Report Date: 2021-11-02

Reviewed By: Candy Li, RF Engineer

Prepared By: Shenzhen Accurate Technology Co., Ltd.
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Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Projector
Trademark	SUREWHEEL
Tested Model	SW10
Frequency Range	Wi-Fi: 2412-2462MHz
Maximum Conducted Peak Output Power	Wi-Fi: 18.75dBm(802.11b), 19.08dBm(802.11g), 18.97dBm(802.11n20), 18.88dBm(802.11n40)
Modulation Technique	Wi-Fi: DSSS, OFDM
Antenna Specification*	Internal Antenna 0&1: -0.76dBi(provided by the applicant)
Voltage Range	AC 100-240V, 50-60Hz
Date of Test	2021-10-13 to 2021-10-31
Sample serial number	SZ1210918-48944E-RF-S1 (Assigned by ATC)
Received date	2021-09-18
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 mode, total 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

802.11b, 802.11g and 802.11n-HT20 mode was tested with Channel 1, 6 and 11.
802.11n-HT40 mode was tested with Channel 3, 6 and 9.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"REALTEK"* software was used to test and power level as below:

Ant 0:

Mode	Data rate	Power Level*		
		Low Channel	Middle Channel	High Channel
802.11b	1 Mbps	55	55	55
802.11g	6 Mbps	45	45	45
802.11n-HT20	MCS0	45	45	45
802.11n-HT40	MCS0	45	45	45

Ant 1:

Mode	Data rate	Power Level*		
		Low Channel	Middle Channel	High Channel
802.11b	1 Mbps	75	75	75
802.11g	6 Mbps	60	60	60
802.11n-HT20	MCS0	60	60	60
802.11n-HT40	MCS0	60	60	60

The worst-case data rates are determined to be as above for each mode based upon investigations by measuring the average power and PSD across all data rates, bandwidths and modulations. The device supports SISO and MIMO 2T2R in all modes. Per pretest, 2TX mode was the worst mode and recorded in this report.

Duty cycle

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

Support Equipment List and Details

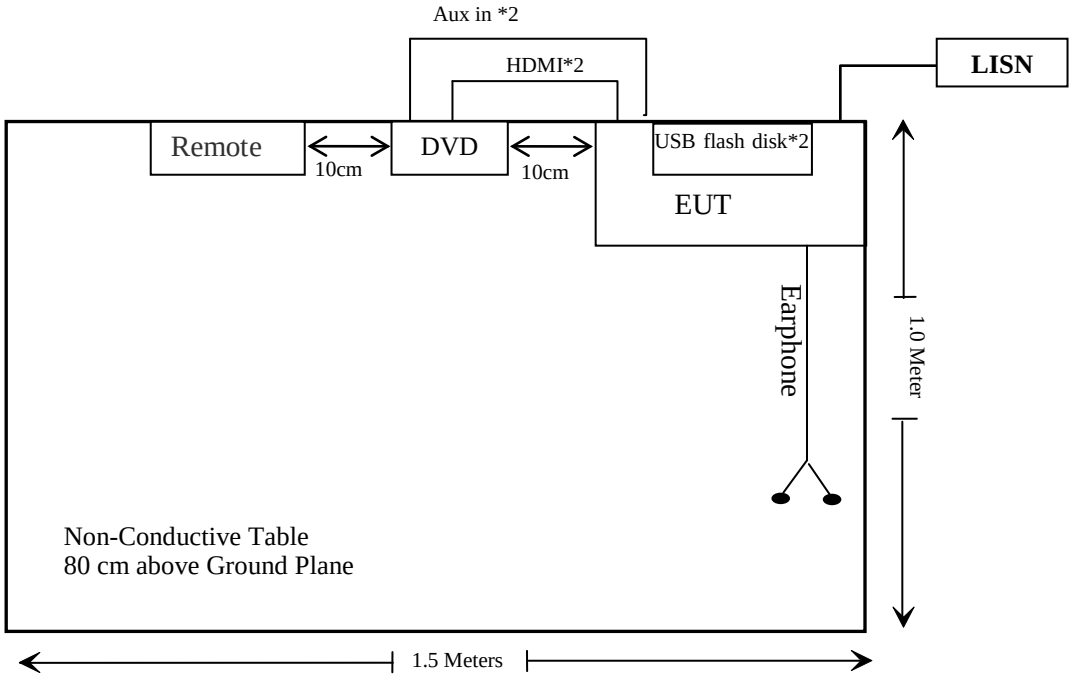
Manufacturer	Description	Model	Serial Number
GIEC	DVD	BDP-G4308	Unknown
HUAWEI	Earphone	Unknown	Unknown
Unknown	USB flash disk*2	Unknown	Unknown

External I/O Cable

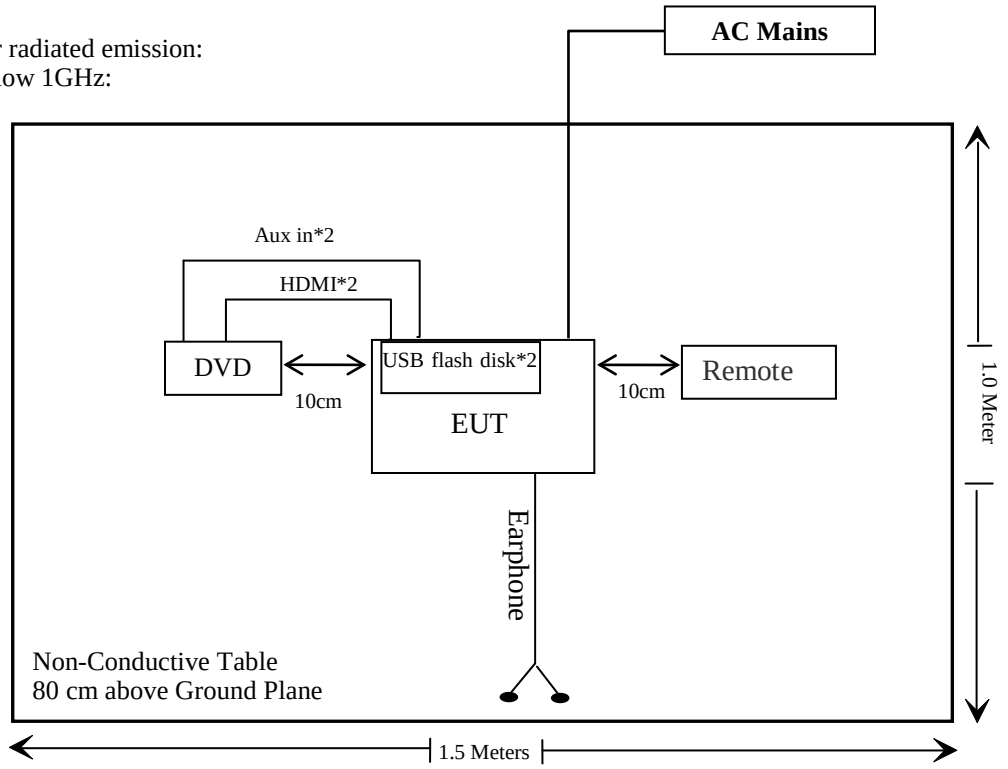
Cable Description	Length (m)	From/Port	To
Un-Shielding Detachable AC power Cable	1.5	EUT	LISN
Un-Shielding Detachable AUX IN Cable 1	0.2	EUT	AUX IN Cable 2
Un-Shielding Detachable AUX IN Cable 2	1.0	AUX IN Cable 1	DVD
Un-Shielding Detachable Earphone Cable	0.75	EUT	Earphone
Un-Shielding Detachable HDMI Cable*2	1.45	EUT	DVD

Block Diagram of Test Setup

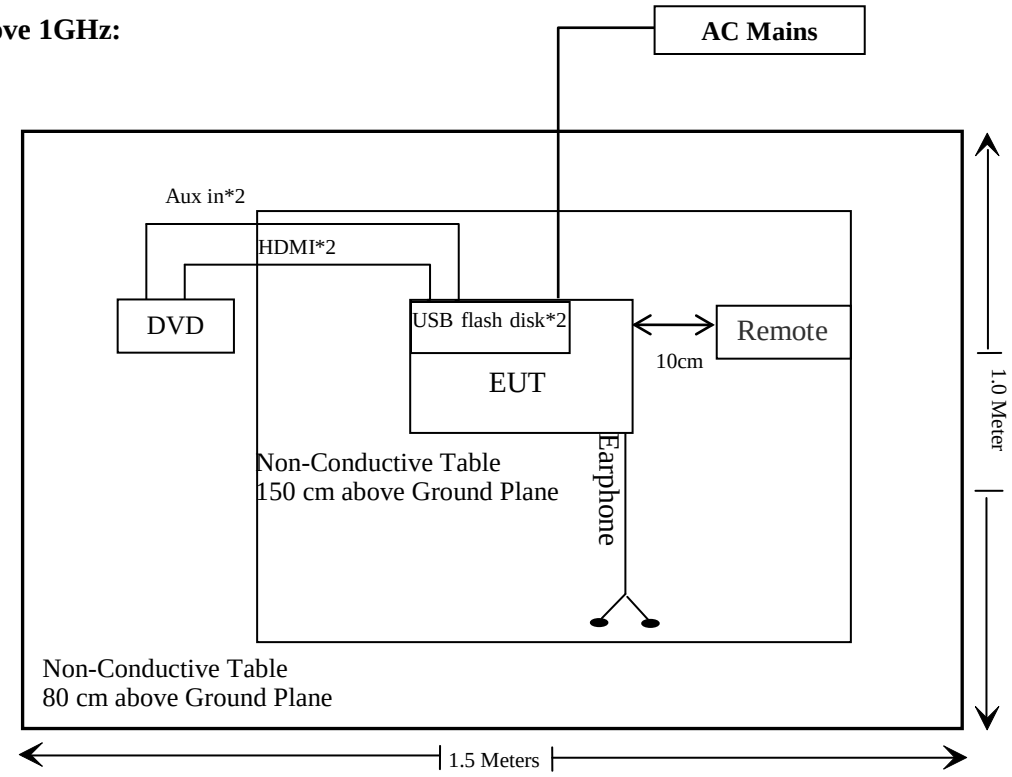
For conducted emission:



For radiated emission:
Below 1GHz:



Above 1GHz:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (I), §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth & Occupied Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Conducted Emission Test Software: e3 19821b(V9)					
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
Wainwright	High Pass Filter	WHKX3.6/18G-10SS	5	2020/12/25	2021/12/24
Radiated Emission Test Software: EZ_EMC V 1.1.4.2 & e3 19821b(V9)					
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
Rohde & Schwarz	Open Switch and Control Unit	OSP120 +OSP-B157	101244 + 100866	2020/12/24	2021/12/23
OREGON SCIENTIFIC	Temperature & Humidity Meter	JB913R	GZ-WS004	2020/01/02	2023/01/01

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

For worst case:

Mode	**Frequency Range (MHz)**	**Antenna Gain**		**Tune-up Output Power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
		(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2.4G Wi-Fi	2412-2462	-0.76	0.84	19.5	89.13	20	0.015	1.0

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, 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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has two internal antennas used arrangement for Wi-Fi, which was permanently attached and the antenna gain is -0.76dBi, fulfill the requirement of this section. Please refer to the EUT photos.

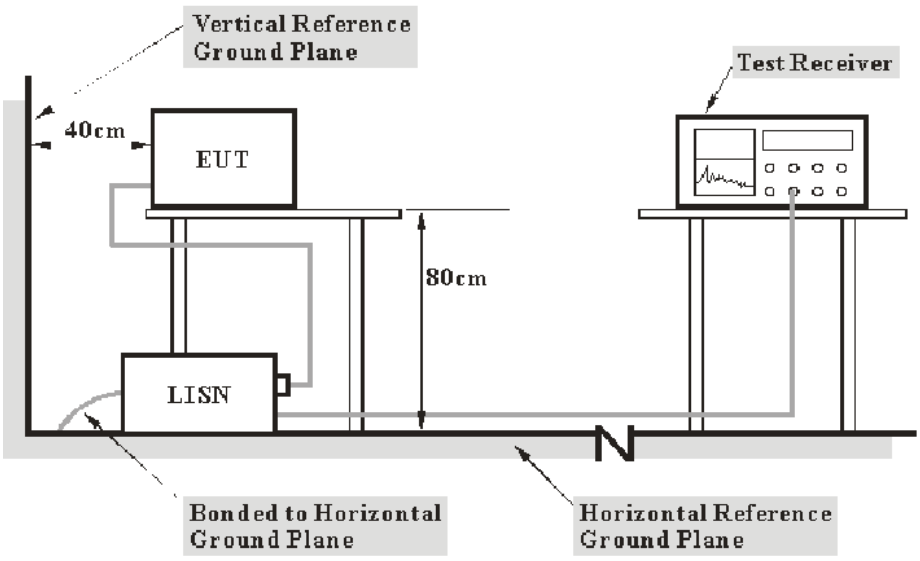
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the device was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correct Factor = LISN VDF + Cable Loss

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Over Limit = Result – Limit
Result= Reading + Correct Factor

Test Data

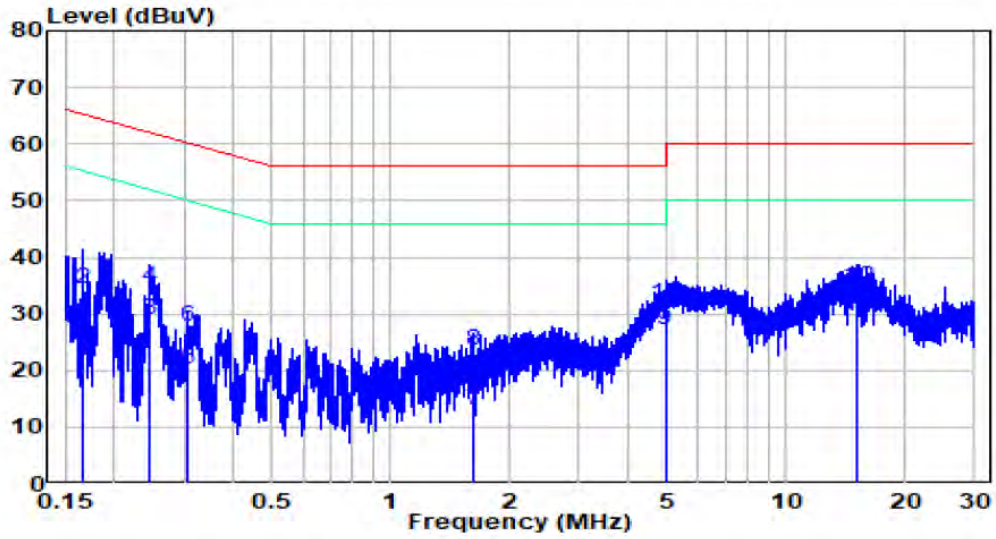
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-10-29.

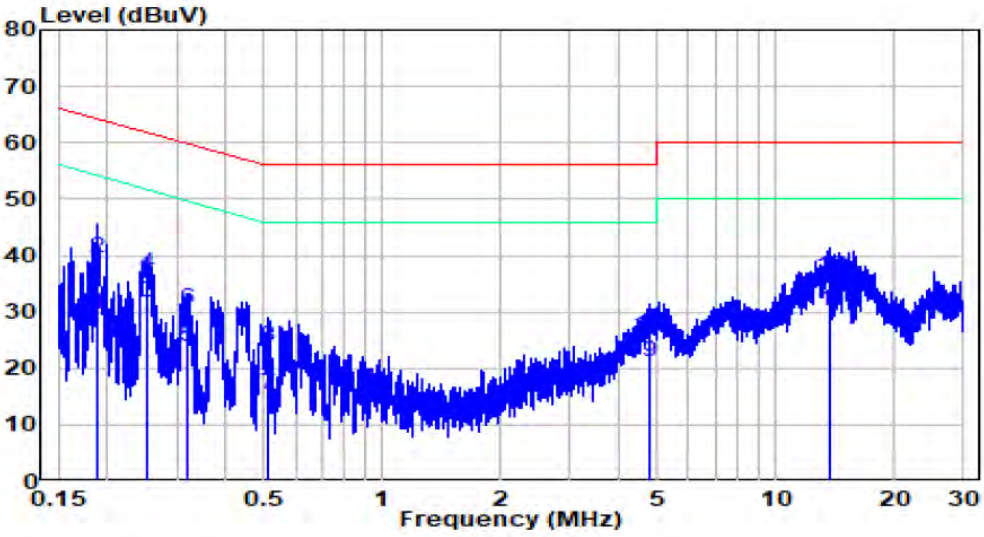
EUT operation mode: 2.4G Wi-Fi Transmitting (Worst case as below)

AC 120V/60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)		
1	0.166	11.97	9.87	21.84	55.14	-33.3	Average	Line
2	0.166	24.64	9.87	34.51	65.14	-30.63	QP	Line
3	0.246	19.05	9.8	28.85	51.89	-23.04	Average	Line
4	0.246	25.02	9.8	34.82	61.89	-27.07	QP	Line
5	0.306	10.41	9.8	20.21	50.08	-29.87	Average	Line
6	0.306	17.96	9.8	27.76	60.08	-32.32	QP	Line
7	1.625	3.12	9.89	13.01	46	-32.99	Average	Line
8	1.625	13.66	9.89	23.55	56	-32.45	QP	Line
9	4.949	17.13	9.99	27.12	46	-18.88	Average	Line
10	4.949	21.63	9.99	31.62	56	-24.38	QP	Line
11	15.056	19.44	10.05	29.49	50	-20.51	Average	Line
12	15.056	24.59	10.05	34.64	60	-25.36	QP	Line

AC 120V/60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)		
1	0.189	19.71	9.98	29.69	54.1	-24.41	Average	Neutral
2	0.189	29.62	9.98	39.6	64.1	-24.5	QP	Neutral
3	0.253	21.71	9.98	31.69	51.65	-19.96	Average	Neutral
4	0.253	26.8	9.98	36.78	61.65	-24.87	QP	Neutral
5	0.319	14.02	9.95	23.97	49.75	-25.78	Average	Neutral
6	0.319	20.58	9.95	30.53	59.75	-29.22	QP	Neutral
7	0.515	5.43	9.91	15.34	46	-30.66	Average	Neutral
8	0.515	13.95	9.91	23.86	56	-32.14	QP	Neutral
9	4.750	11.21	10.05	21.26	46	-24.74	Average	Neutral
10	4.750	15.53	10.05	25.58	56	-30.42	QP	Neutral
11	13.759	20.06	10.06	30.12	50	-19.88	Average	Neutral
12	13.759	26.13	10.06	36.19	60	-23.81	QP	Neutral

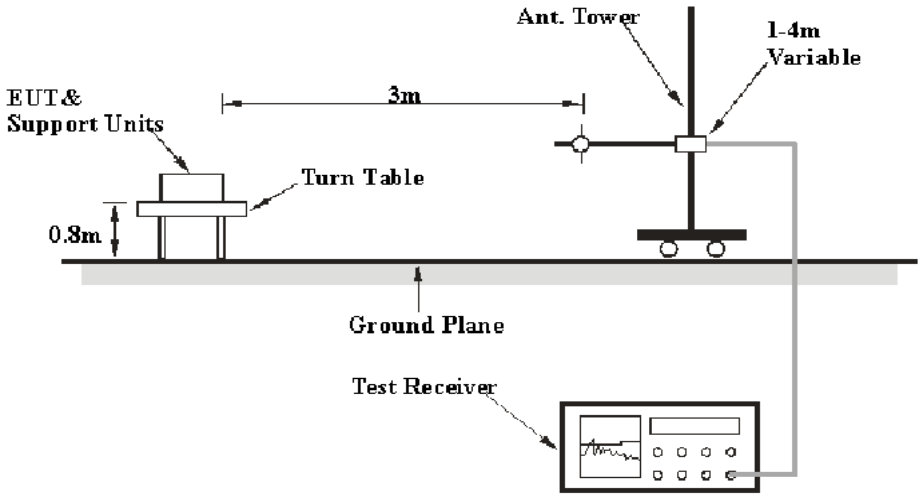
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

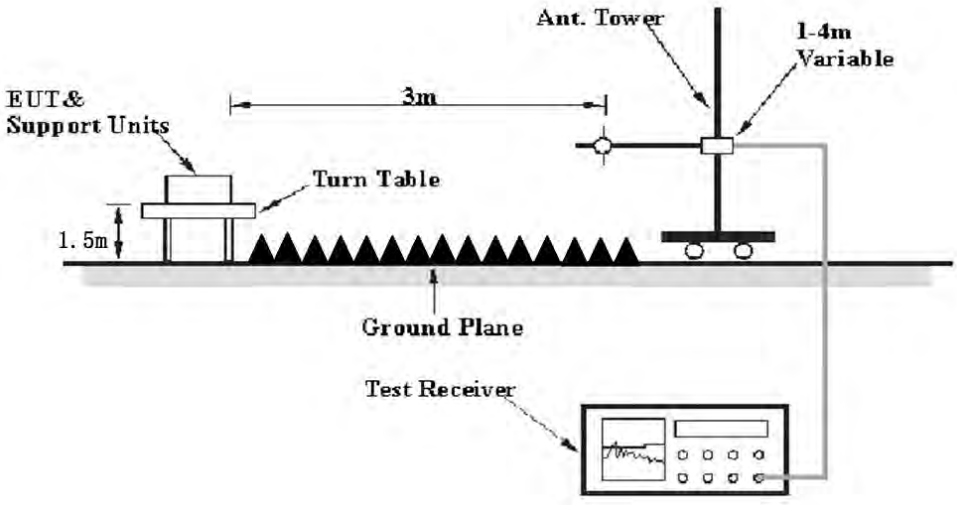
FCC §15.247 (d); §15.209; §15.205;

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Factor & Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Result / Corrected Amplitude - Limit
Result / Corrected Amplitude = Reading + Factor

Test Data

Environmental Conditions

Temperature:	23-25 ℃
Relative Humidity:	48-52 %
ATM Pressure:	101.0 kPa

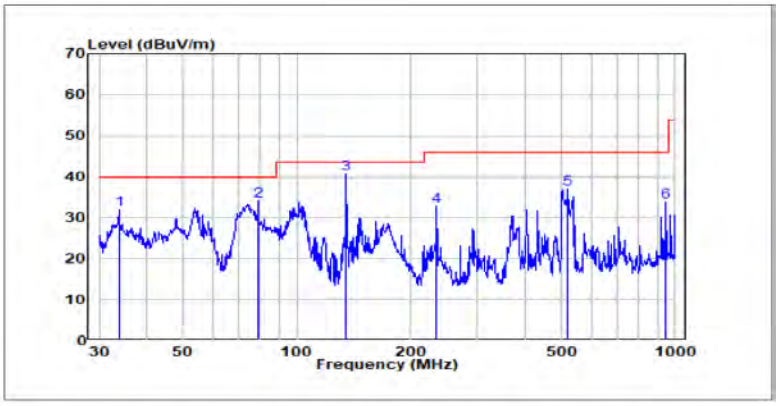
The testing was performed by Fan Yang on 2021-10-31 for below 1GHz and 2021-10-13 for above 1GHz..

EUT operation mode: Transmitting

30MHz-1GHz: (Worst case)

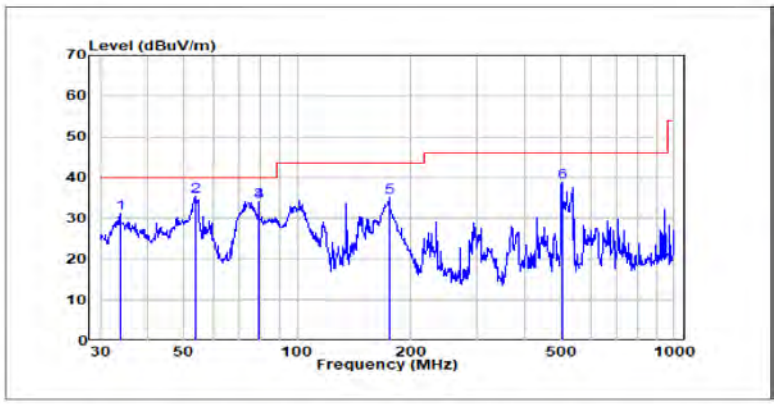
Wi-Fi: 802.11B mode, MIMO, low Channel

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Detector	Phase
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1	33.799	51.61	-19.71	31.90	40.00	-8.10	QP	HORIZONTAL
2	78.965	57.13	-23.07	34.06	40.00	-5.94	QP	HORIZONTAL
3	135.032	63.10	-22.49	40.61	43.50	-2.89	QP	HORIZONTAL
4	234.168	51.63	-18.79	32.84	46.00	-13.16	QP	HORIZONTAL
5	519.065	50.96	-13.94	37.02	46.00	-8.98	QP	HORIZONTAL
6	945.440	41.90	-8.01	33.89	46.00	-12.11	QP	HORIZONTAL

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Detector	Phase
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1	33.799	50.92	-19.71	31.21	40.00	-8.79	QP	VERTICAL
2	53.505	53.37	-18.04	35.33	40.00	-4.67	QP	VERTICAL
3	78.965	57.14	-23.07	34.07	40.00	-5.93	QP	VERTICAL
4	78.965	57.14	-23.07	34.07	40.00	-5.93	QP	VERTICAL
5	175.037	56.21	-21.17	35.04	43.50	-8.46	QP	VERTICAL
6	502.940	52.93	-14.14	38.79	46.00	-7.21	QP	VERTICAL

2TX Mode (Worst case)

1-25 GHz:

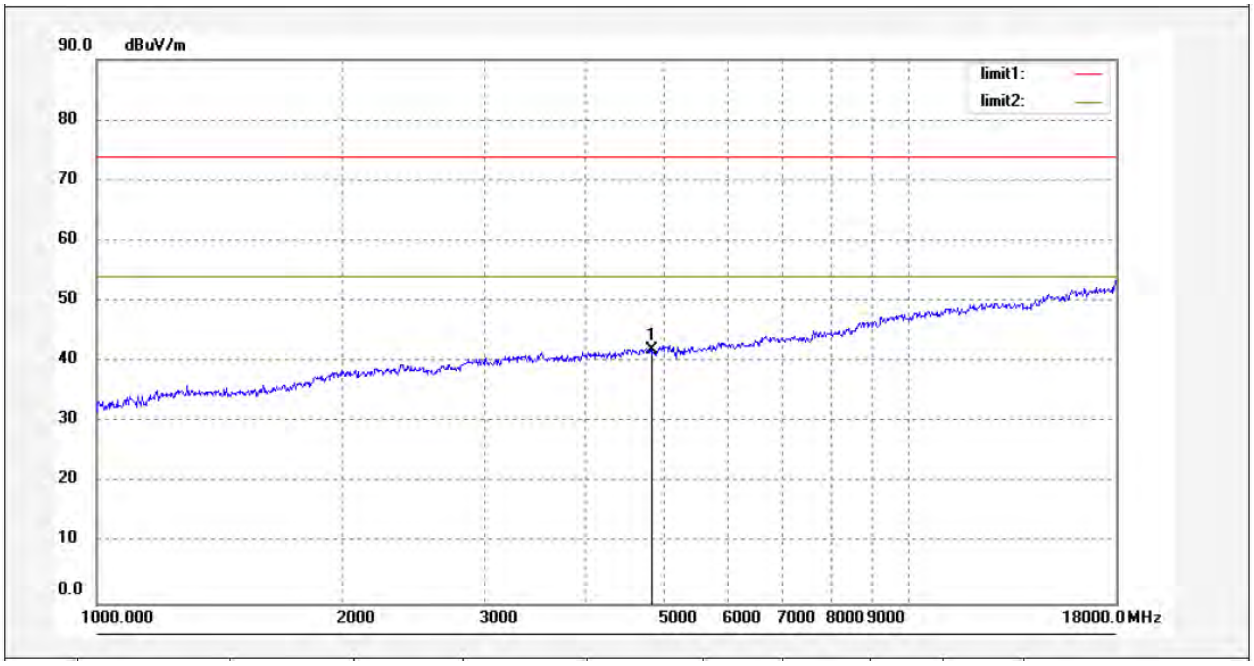
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	46.61	PK	334	1.1	H	-6.84	39.77	74	-34.23
2310	45.07	PK	267	1.6	V	-6.84	38.23	74	-35.77
2390	47.27	PK	34	1.9	H	-6.44	40.83	74	-33.17
2390	46.57	PK	327	1.5	V	-6.44	40.13	74	-33.87
4824	39.03	PK	294	2.2	H	2.87	41.9	74	-32.1
4824	40.27	PK	59	2.1	V	2.87	43.14	74	-30.86
802.11B, Middle Channel									
4874	38.58	PK	222	1.1	H	3.01	41.59	74	-32.41
4874	39.84	PK	85	1.2	V	3.01	42.85	74	-31.15
802.11B, High Channel									
2483.5	45.05	PK	108	1.5	H	-5.96	39.09	74	-34.91
2483.5	43.74	PK	238	1.7	V	-5.96	37.78	74	-36.22
2500	46.41	PK	185	1.8	H	-5.88	40.53	74	-33.47
2500	45.51	PK	297	1.8	V	-5.88	39.63	74	-34.37
4924	37.97	PK	240	1.3	H	3.17	41.14	74	-32.86
4924	39.04	PK	346	1.5	V	3.17	42.21	74	-31.79
802.11G, Low Channel									
2310	45.05	PK	255	1.9	H	-6.84	38.21	74	-35.79
2310	44.78	PK	333	1.9	V	-6.84	37.94	74	-36.06
2390	46.3	PK	74	1.9	H	-6.44	39.86	74	-34.14
2390	45.55	PK	176	1.4	V	-6.44	39.11	74	-34.89
4824	38.41	PK	256	1.8	H	2.87	41.28	74	-32.72
4824	39.53	PK	92	2.2	V	2.87	42.4	74	-31.6
802.11G, Middle Channel									
4874	38.43	PK	197	1.2	H	3.01	41.44	74	-32.56
4874	40	PK	349	2.1	V	3.01	43.01	74	-30.99
802.11G, High Channel									
2483.5	44.74	PK	94	1.4	H	-5.96	38.78	74	-35.22
2483.5	44.83	PK	306	1.7	V	-5.96	38.87	74	-35.13
2500	46.61	PK	145	1.2	H	-5.88	40.73	74	-33.27
2500	45.87	PK	125	1.4	V	-5.88	39.99	74	-34.01
4924	38.4	PK	308	1.9	H	3.17	41.57	74	-32.43
4924	39.93	PK	317	1.1	V	3.17	43.1	74	-30.9
802.11N20, Low Channel									
2310	45.49	PK	47	2.1	H	-6.84	38.65	74	-35.35
2310	44.83	PK	326	1.5	V	-6.84	37.99	74	-36.01
2390	45.73	PK	298	2	H	-6.44	39.29	74	-34.71
2390	44.68	PK	251	1.7	V	-6.44	38.24	74	-35.76
4824	38.68	PK	152	1	H	2.87	41.55	74	-32.45
4824	39.7	PK	118	2.1	V	2.87	42.57	74	-31.43
802.11N20, Middle Channel									
4874	38.29	PK	236	2.1	H	3.01	41.3	74	-32.7
4874	40.07	PK	16	1.1	V	3.01	43.08	74	-30.92
802.11N20, High Channel									

2483.5	44.45	PK	343	1.4	H	-5.96	38.49	74	-35.51
2483.5	43.08	PK	49	1.6	V	-5.96	37.12	74	-36.88
2500	44.51	PK	242	1.6	H	-5.88	38.63	74	-35.37
2500	43.3	PK	213	1.5	V	-5.88	37.42	74	-36.58
4924	37.82	PK	55	1.3	H	3.17	40.99	74	-33.01
4924	39.19	PK	120	1.4	V	3.17	42.36	74	-31.64
802.11N40, Low Channel									
2310	45.46	PK	303	1	H	-6.84	38.62	74	-35.38
2310	44.27	PK	90	1.1	V	-6.84	37.43	74	-36.57
2390	45.16	PK	156	1.2	H	-6.44	38.72	74	-35.28
2390	43.7	PK	53	2.1	V	-6.44	37.26	74	-36.74
4844	38.11	PK	28	1.9	H	2.92	41.03	74	-32.97
4844	39.75	PK	344	1.9	V	2.92	42.67	74	-31.33
802.11N40, Middle Channel									
4874	38.61	PK	205	2	H	3.01	41.62	74	-32.38
4874	39.14	PK	185	1.6	V	3.01	42.15	74	-31.85
802.11N40, High Channel									
2483.5	44.95	PK	57	1.1	H	-5.96	38.99	74	-35.01
2483.5	43.8	PK	154	2.2	V	-5.96	37.84	74	-36.16
2500	46.52	PK	31	1.6	H	-5.88	40.64	74	-33.36
2500	45.46	PK	349	1.5	V	-5.88	39.58	74	-34.42
4904	38.16	PK	276	1	H	3.11	41.27	74	-32.73
4904	39.82	PK	265	1.4	V	3.11	42.93	74	-31.07

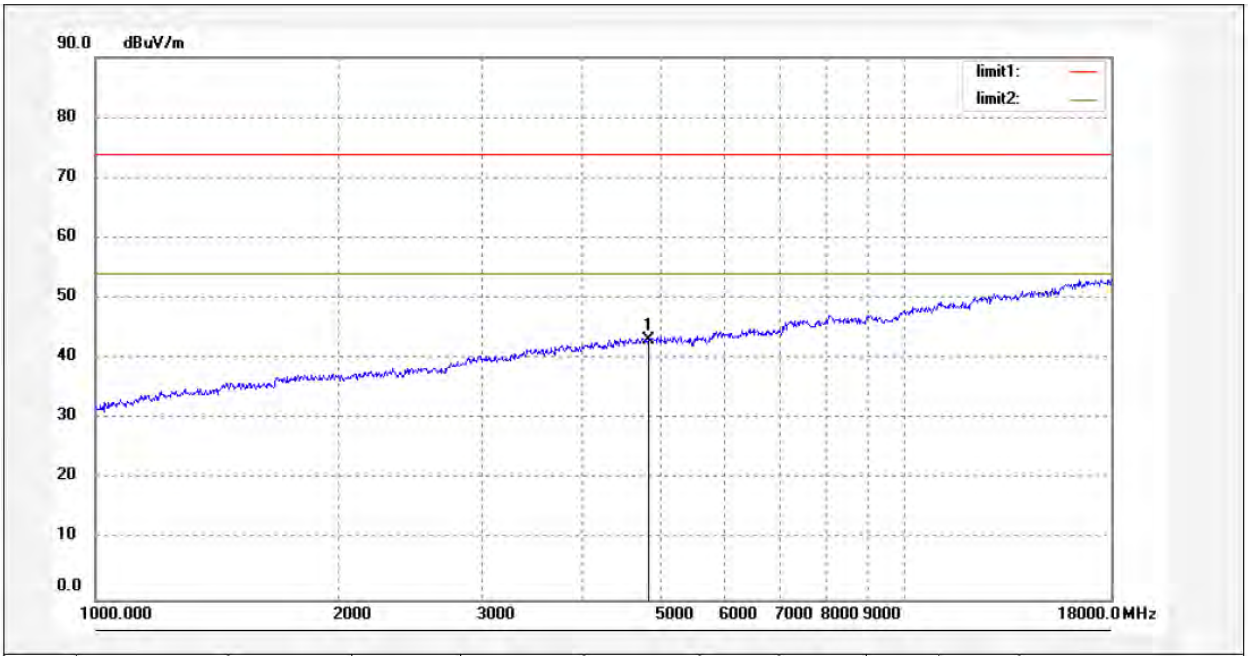
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB below to the limit was not recorded.
The test result of peak was less than the limit of average, so just peak values were recorded.

1-18 GHz:

Pre-scan for Peak
802.11 b Low Channel
Horizontal

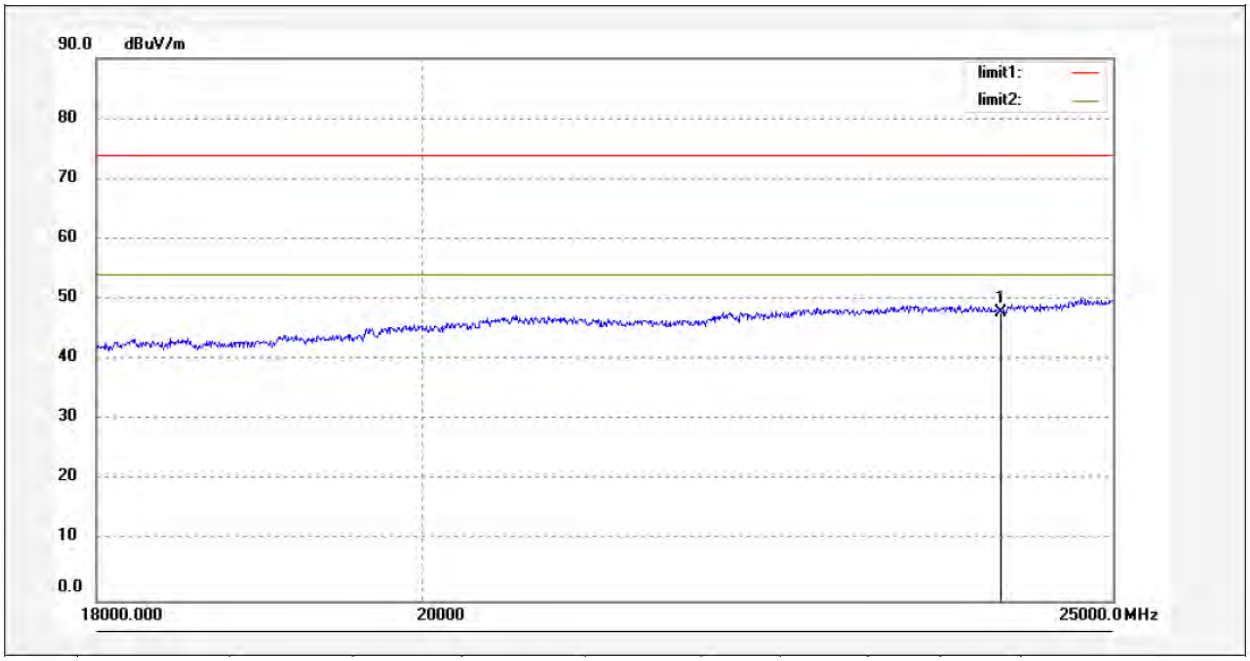


Vertical

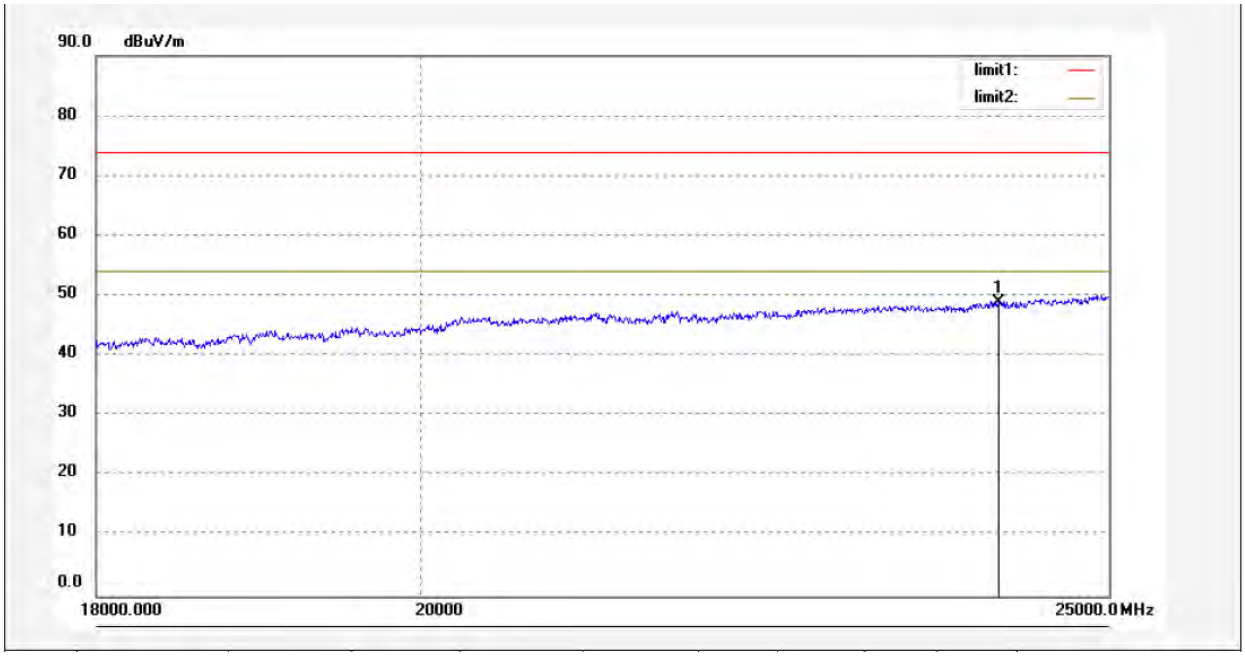


18 -25GHz:

Pre-scan for Peak
802.11 b Low Channel
Horizontal



Vertical



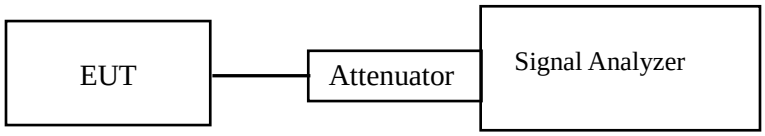
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang from 2021-10-09 to 2021-10-11

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

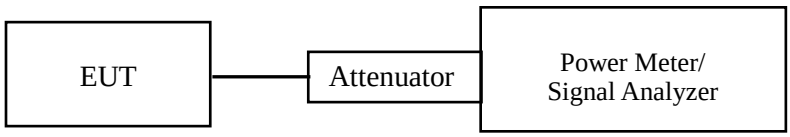
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

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.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on from 2021-10-09 to 2021-10-11

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

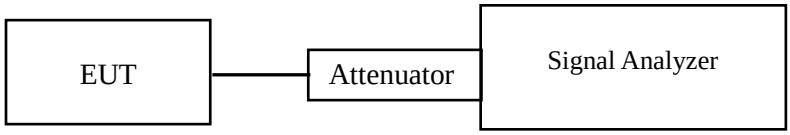
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz 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 100 kHz 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 30 dB instead of 20 dB. 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) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on from 2021-10-09 to 2021-10-11

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi.

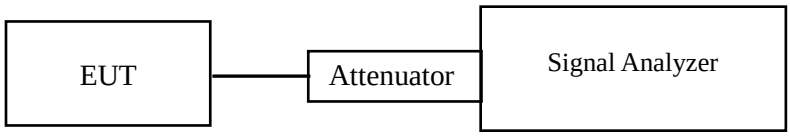
FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

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.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on from 2021-10-09 to 2021-10-11

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

APPENDIX Wi-Fi

Appendix A: 6dB Emission Bandwidth

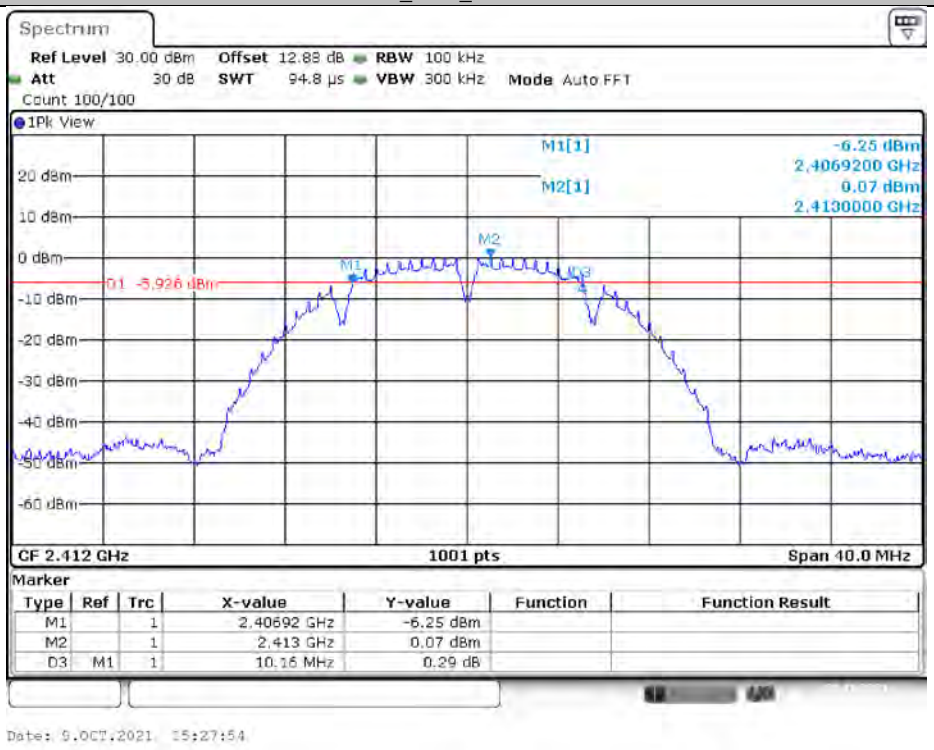
Test Result

TestMode	Antenna	Channel [MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	10.160	0.5	PASS
		2437	10.200	0.5	PASS
		2462	10.160	0.5	PASS
11G	Ant0	2412	16.480	0.5	PASS
		2437	16.480	0.5	PASS
		2462	16.480	0.5	PASS
11N20	Ant0	2412	17.680	0.5	PASS
		2437	17.680	0.5	PASS
		2462	17.680	0.5	PASS
11N40	Ant0	2422	36.560	0.5	PASS
		2437	36.560	0.5	PASS
		2452	36.560	0.5	PASS

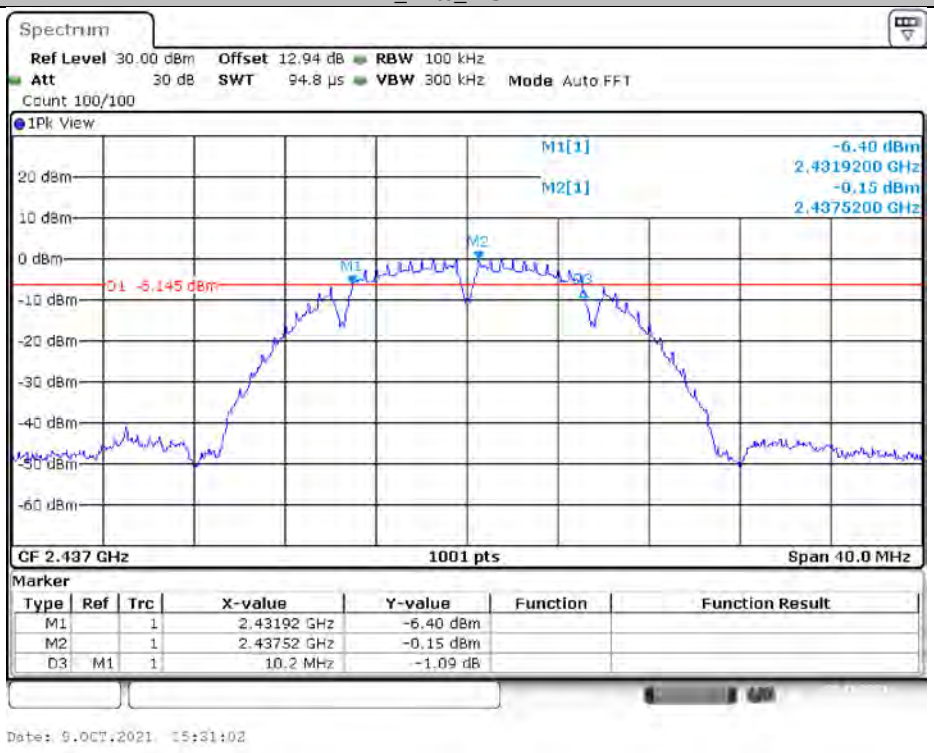
TestMode	Antenna	Channel [MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	10.160	0.5	PASS
		2437	10.160	0.5	PASS
		2462	10.160	0.5	PASS
11G	Ant1	2412	16.480	0.5	PASS
		2437	16.480	0.5	PASS
		2462	16.480	0.5	PASS
11N20	Ant1	2412	17.680	0.5	PASS
		2437	17.680	0.5	PASS
		2462	17.680	0.5	PASS
11N40	Ant1	2422	36.480	0.5	PASS
		2437	36.560	0.5	PASS
		2452	36.480	0.5	PASS

Test Graphs

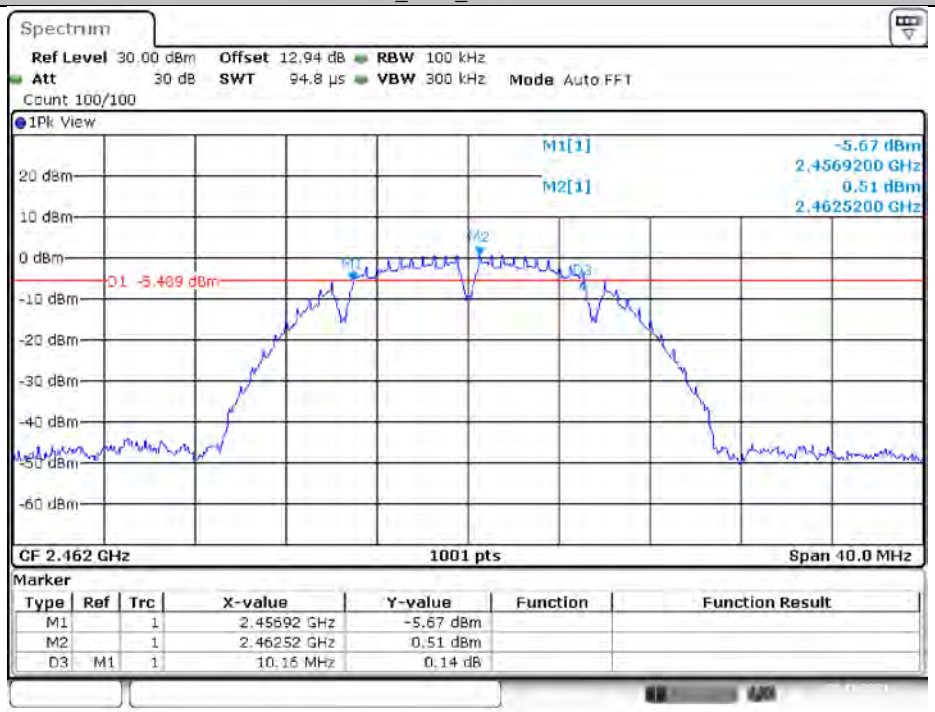
11B_Ant0_2412MHz



11B_Ant0_2437MHz

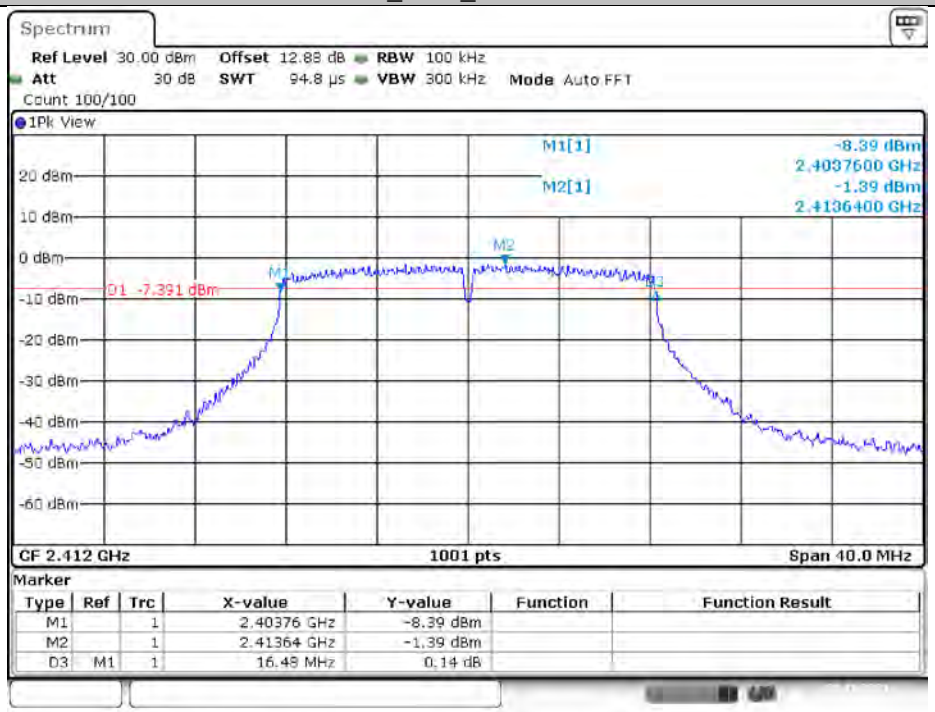


11B_Ant0_2462MHz



Date: 9.OCT.2021 15:33:41

11G_Ant0_2412MHz



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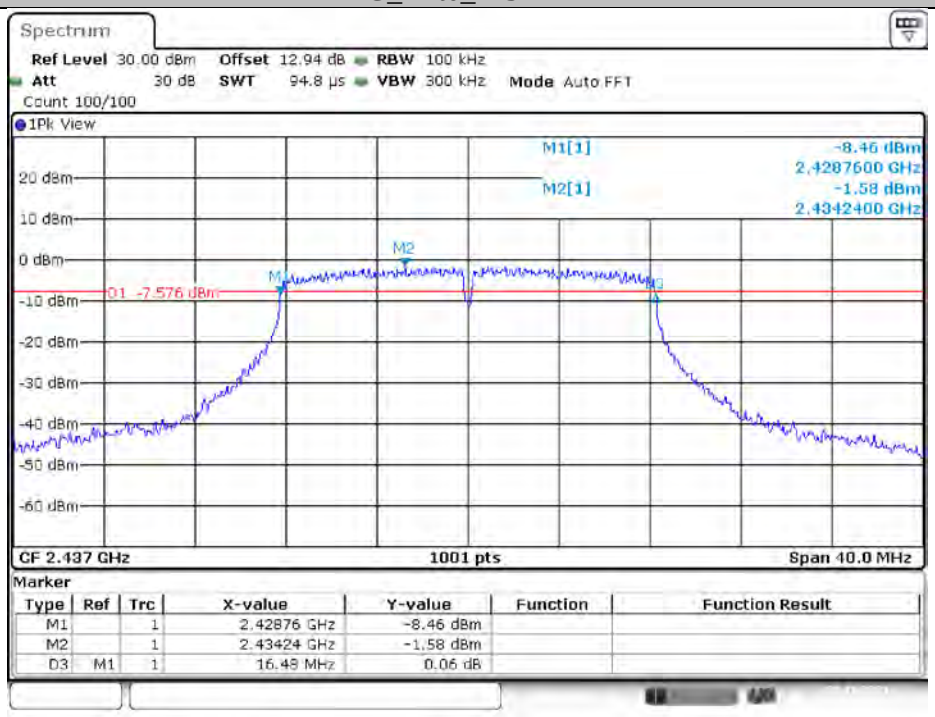
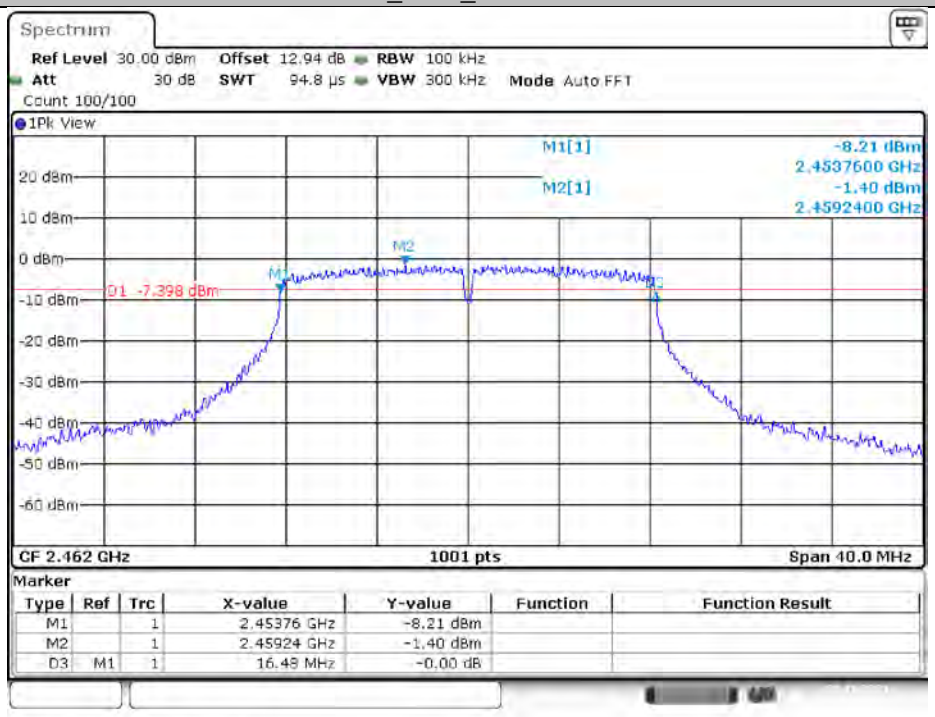
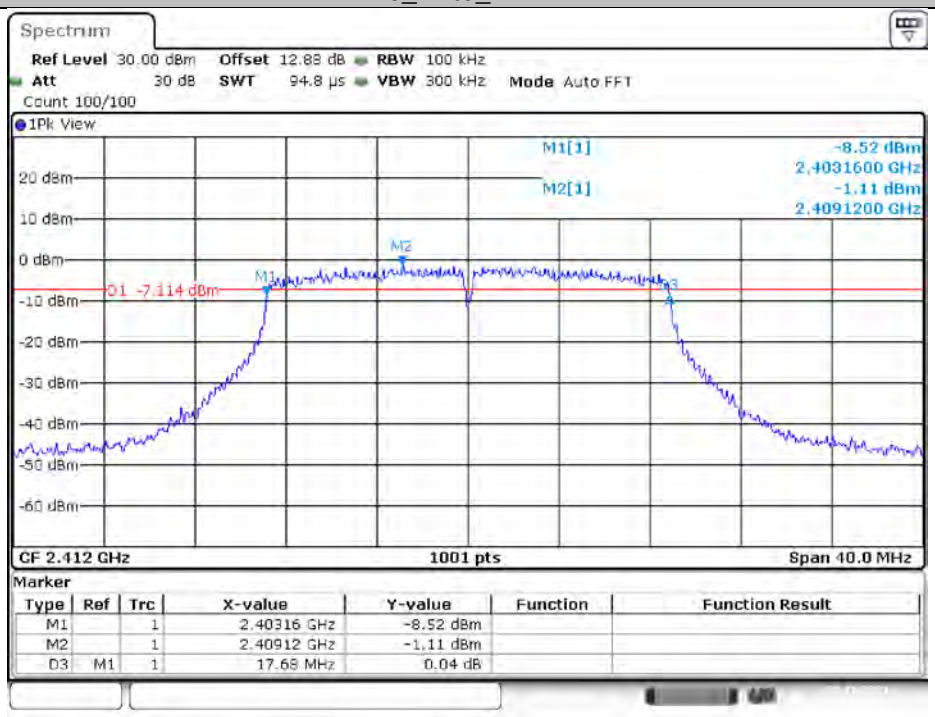
11G_Ant0_2437MHz



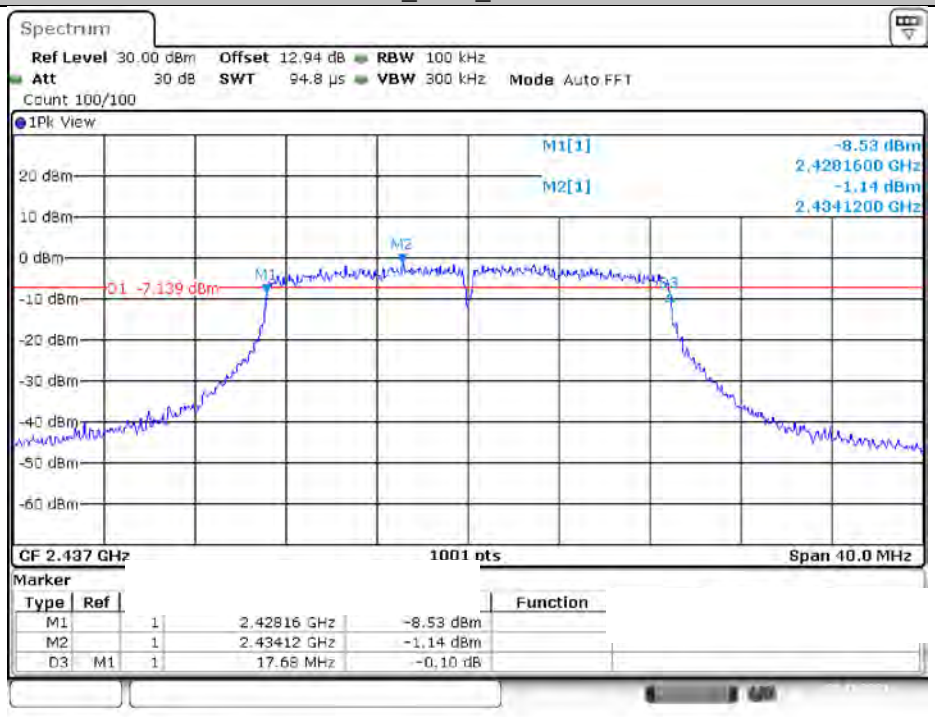
11G_Ant0_2462MHz



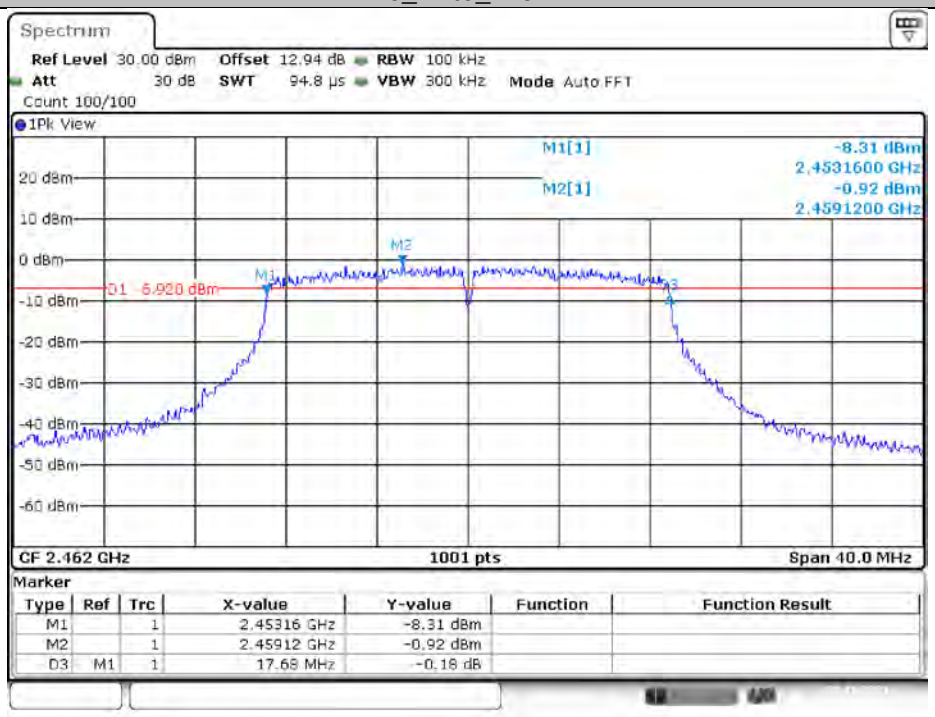
11N20_Ant0_2412MHz



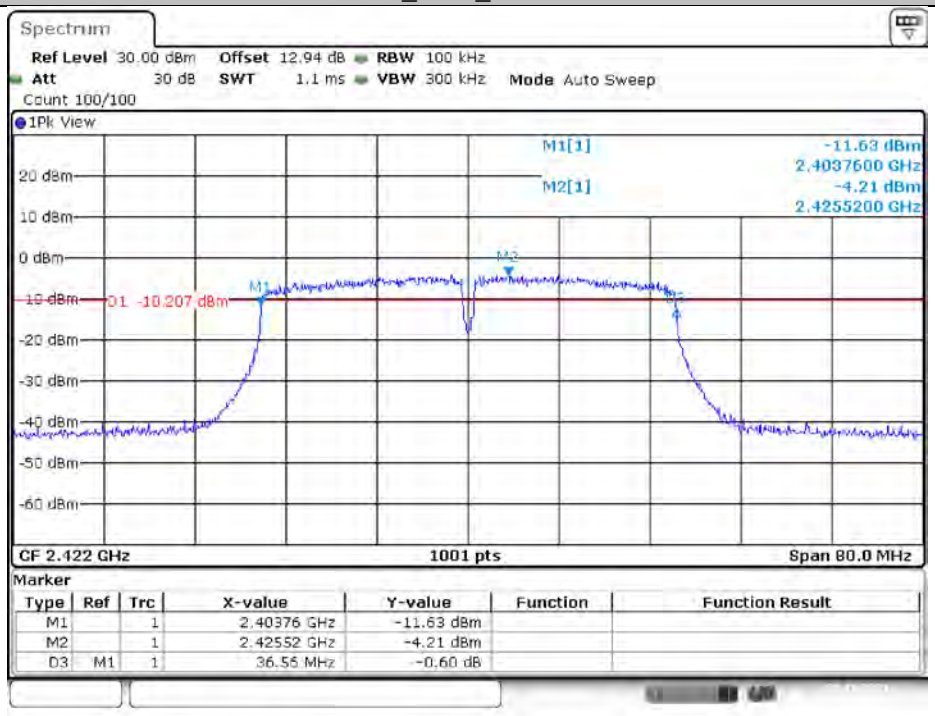
11N20_Ant0_2437MHz



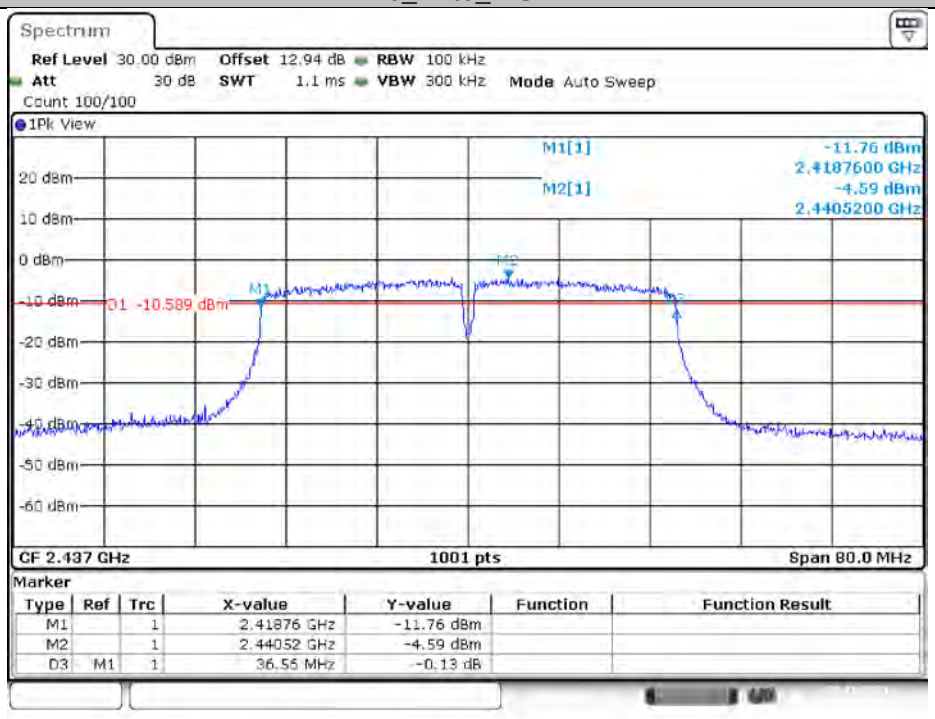
11N20_Ant0_2462MHz



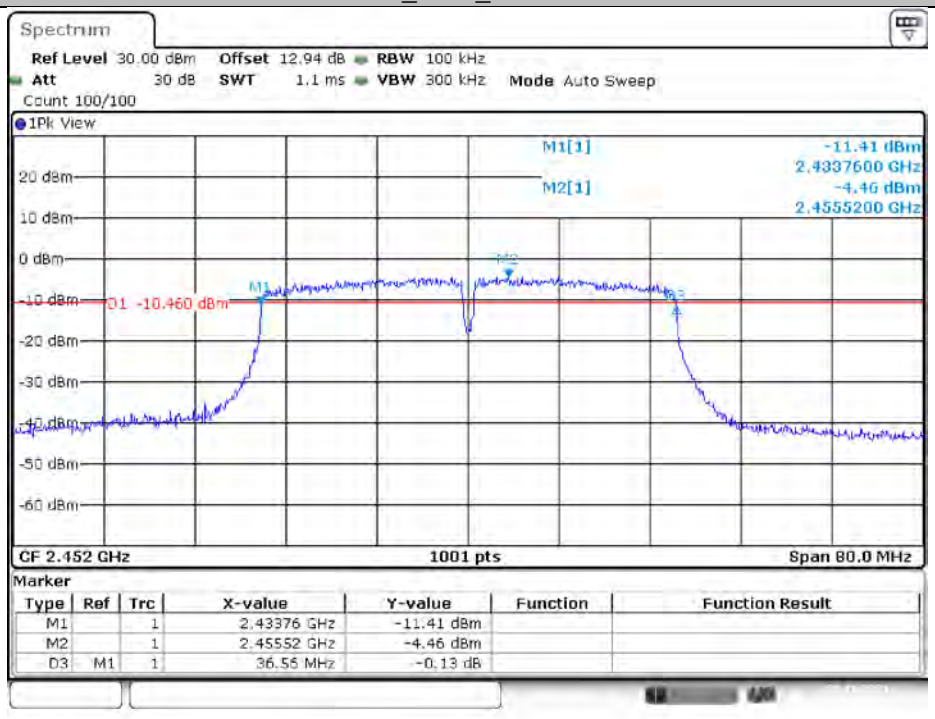
11N40_Ant0_2422MHz



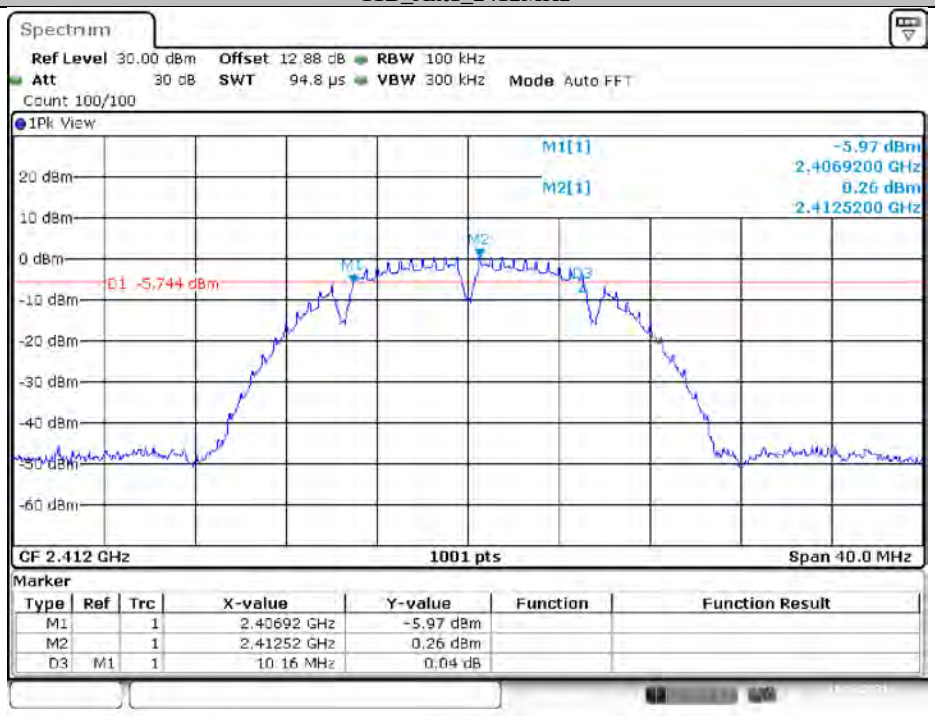
11N40_Ant0_2437MHz



11N40_Ant0_2452MHz



11B_Ant1_2412MHz



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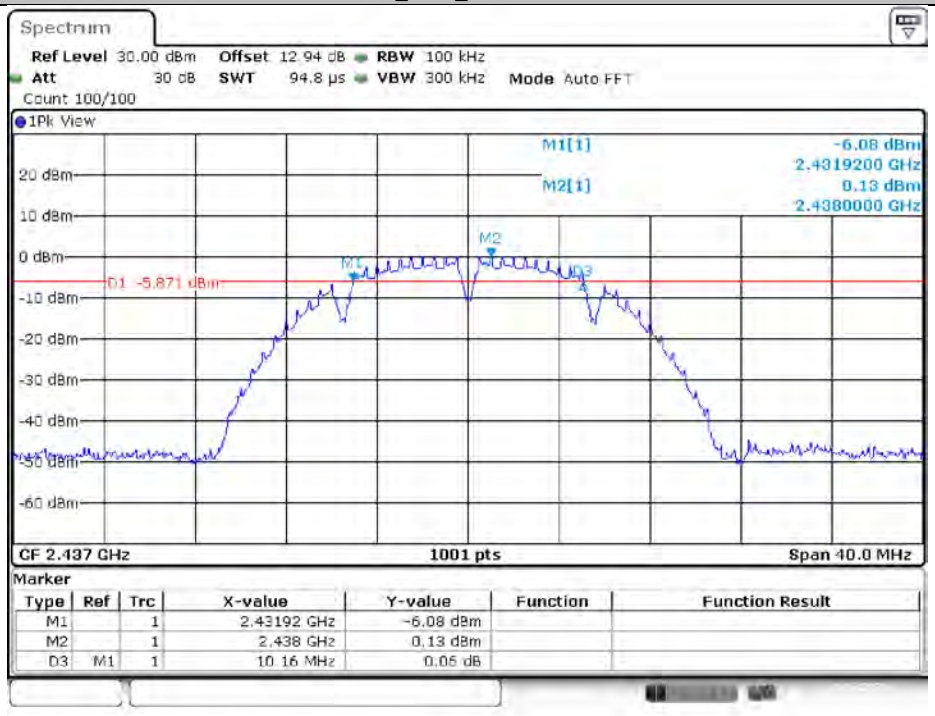
11B_Ant1_2437MHz



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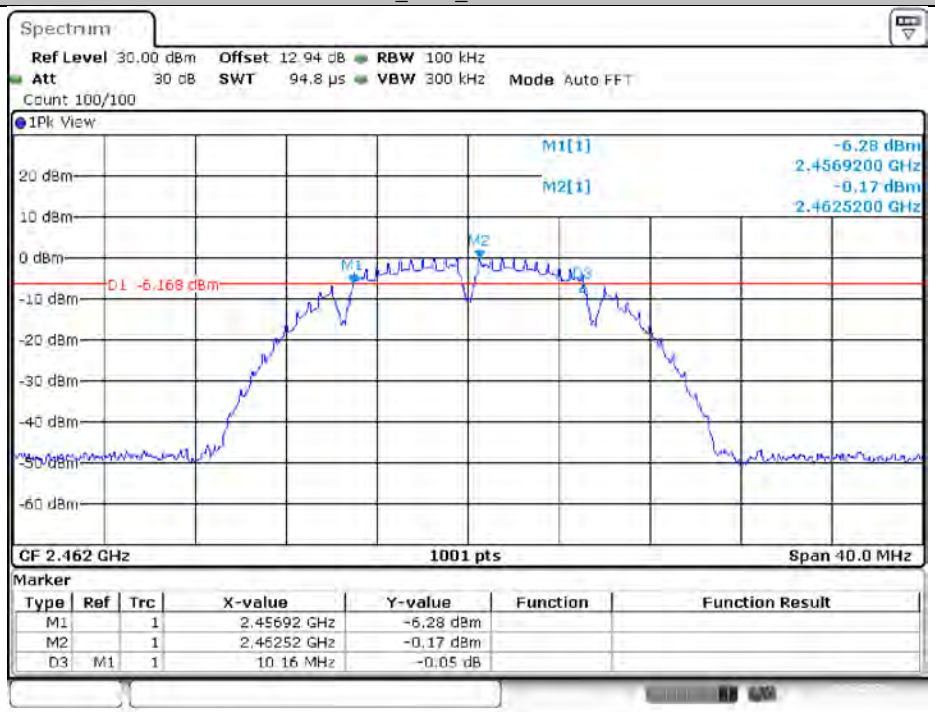
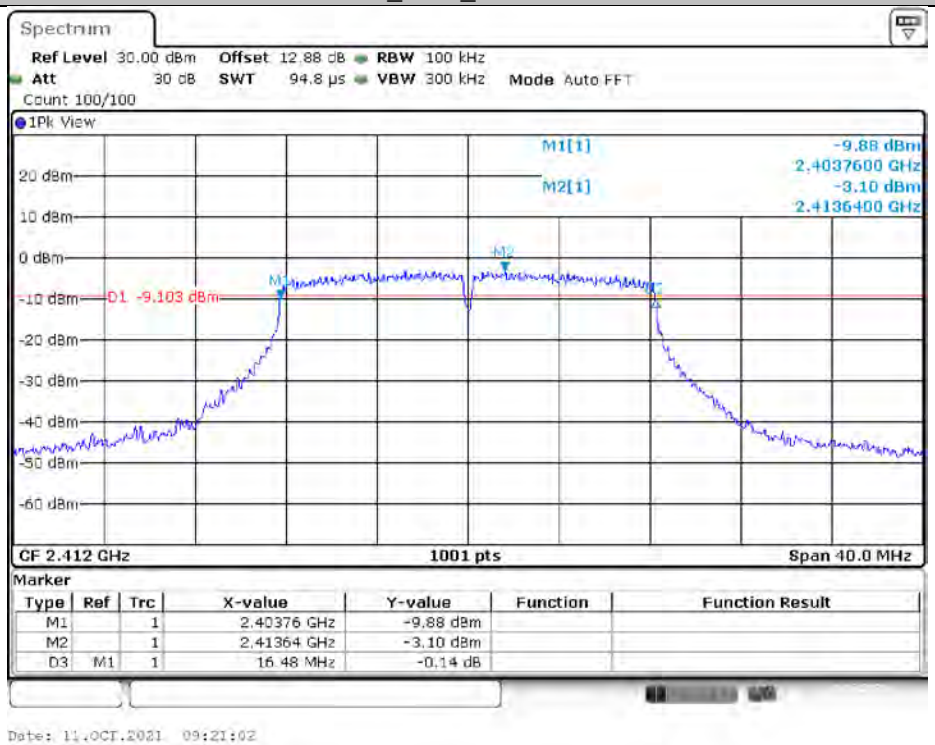
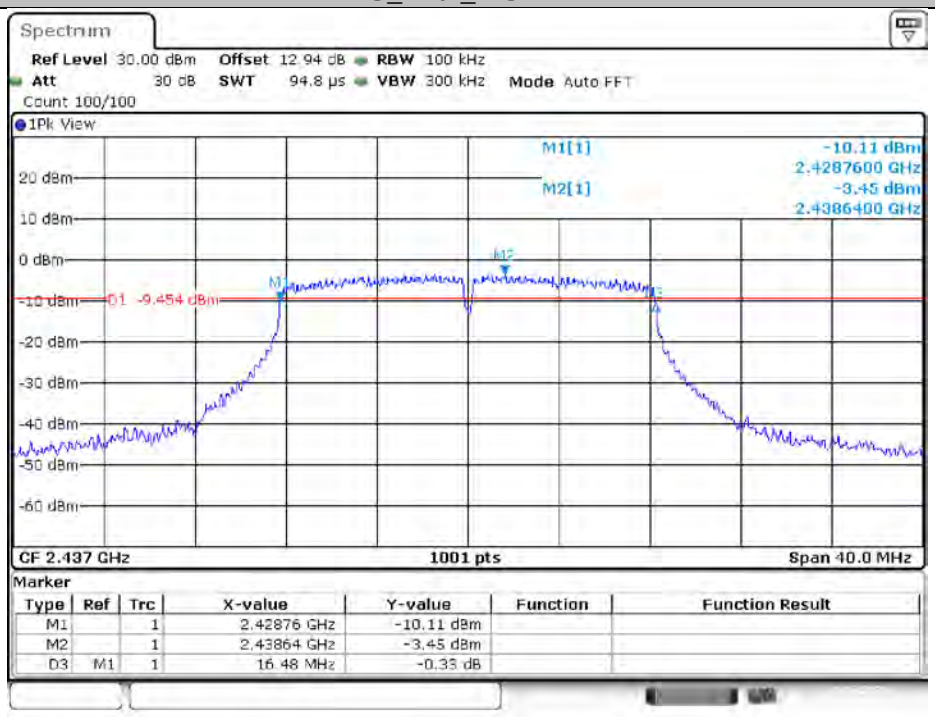


11G_Ant1_2412MHz



11G_Ant1_2437MHz



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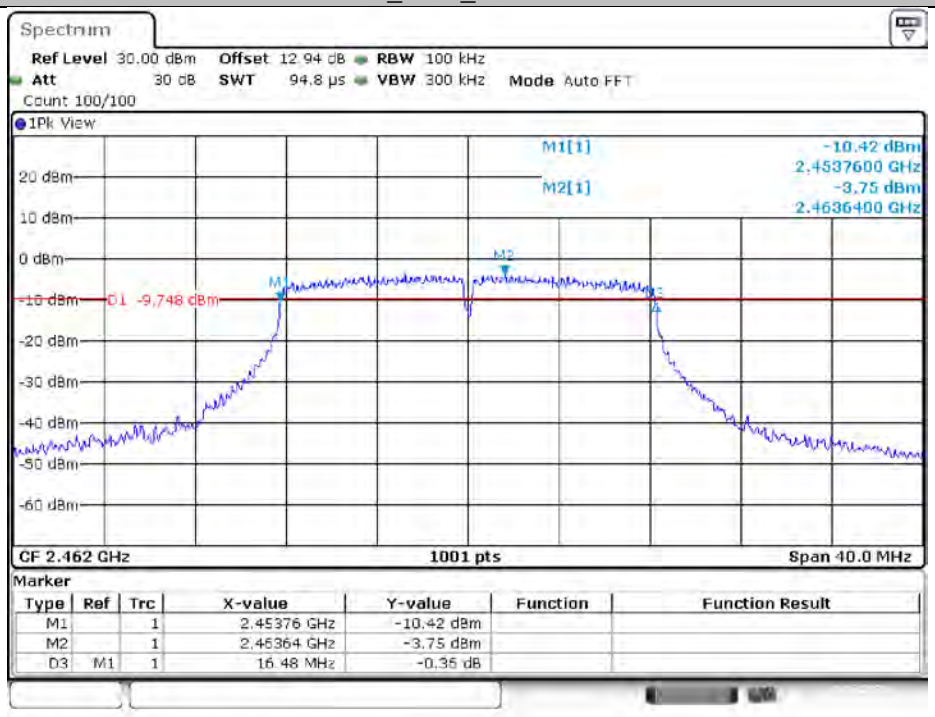
11G_Ant1_2462MHz



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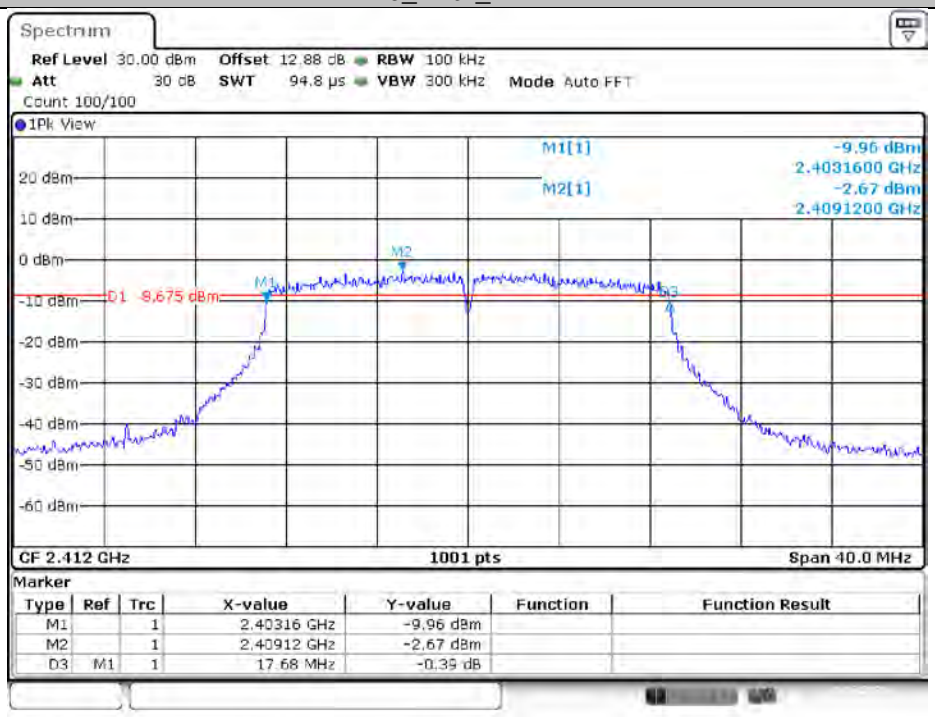
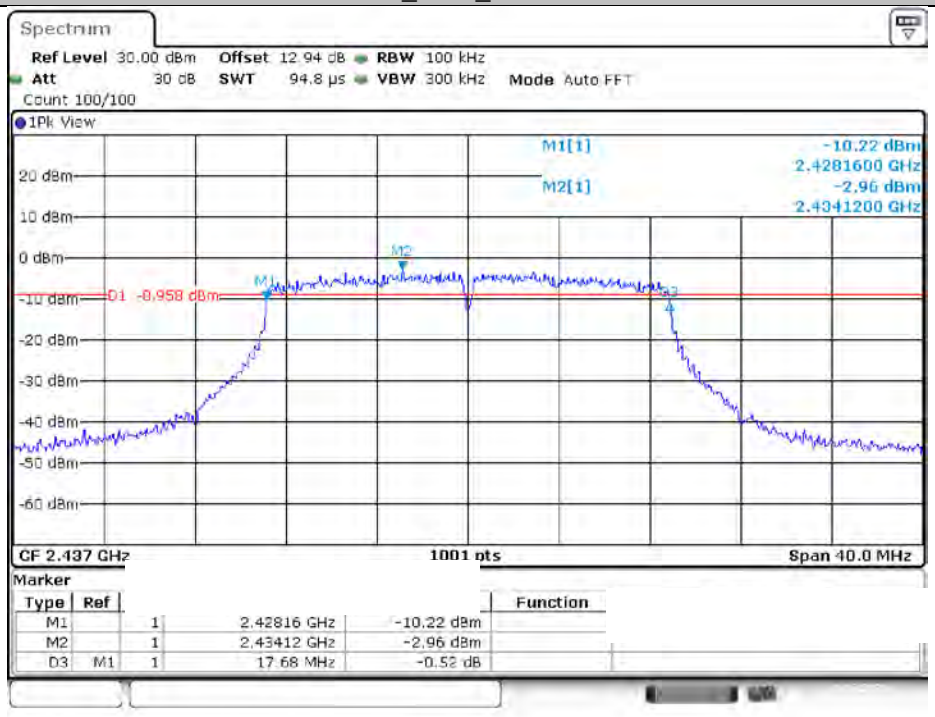
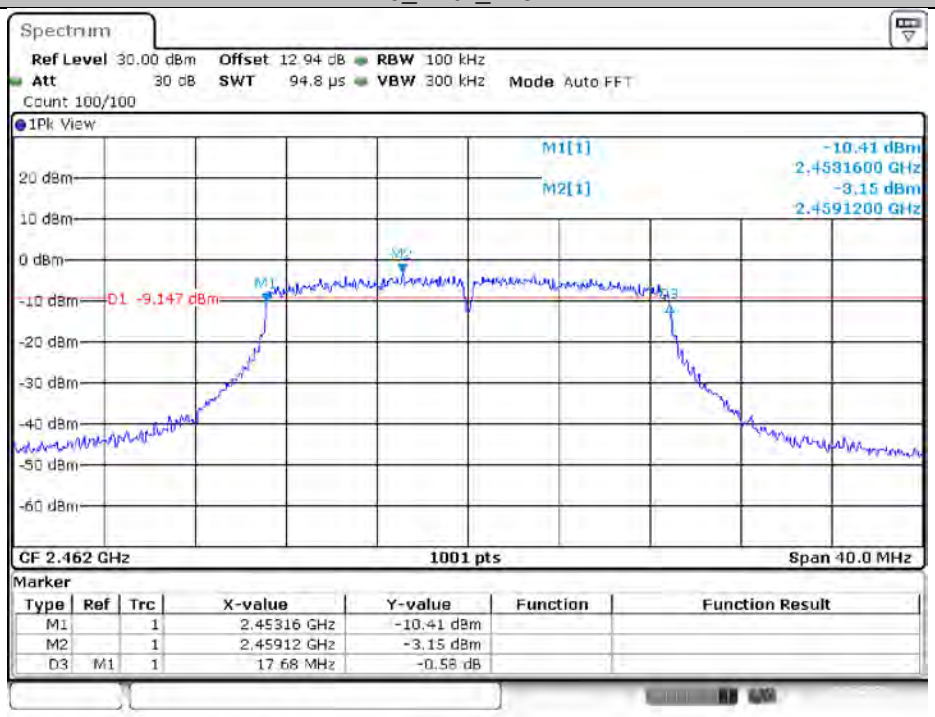
11N20_Ant1_2412MHz



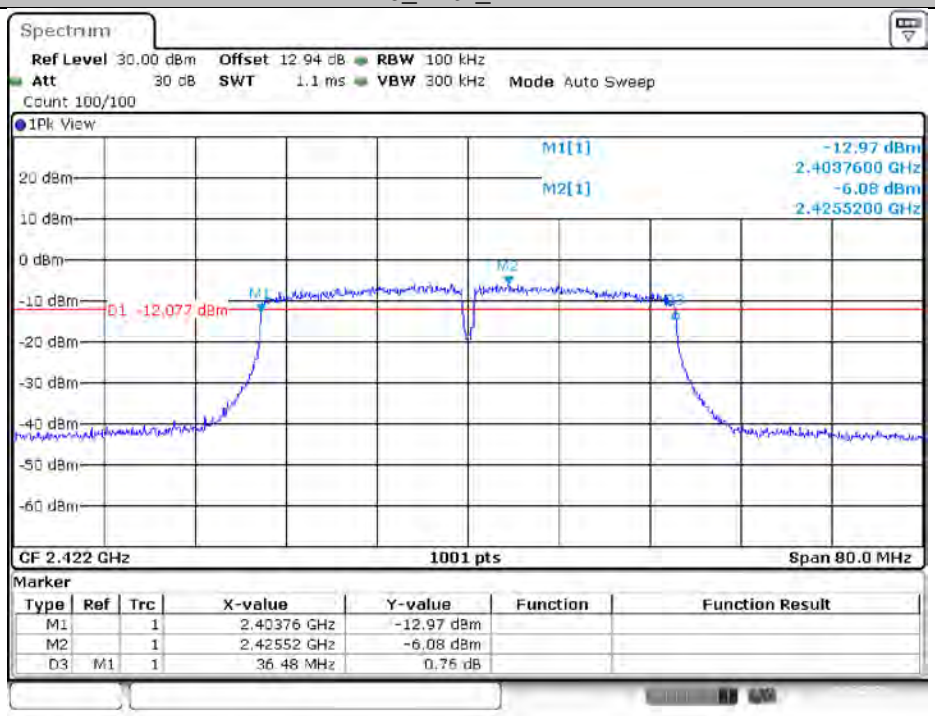
11N20_Ant1_2437MHz



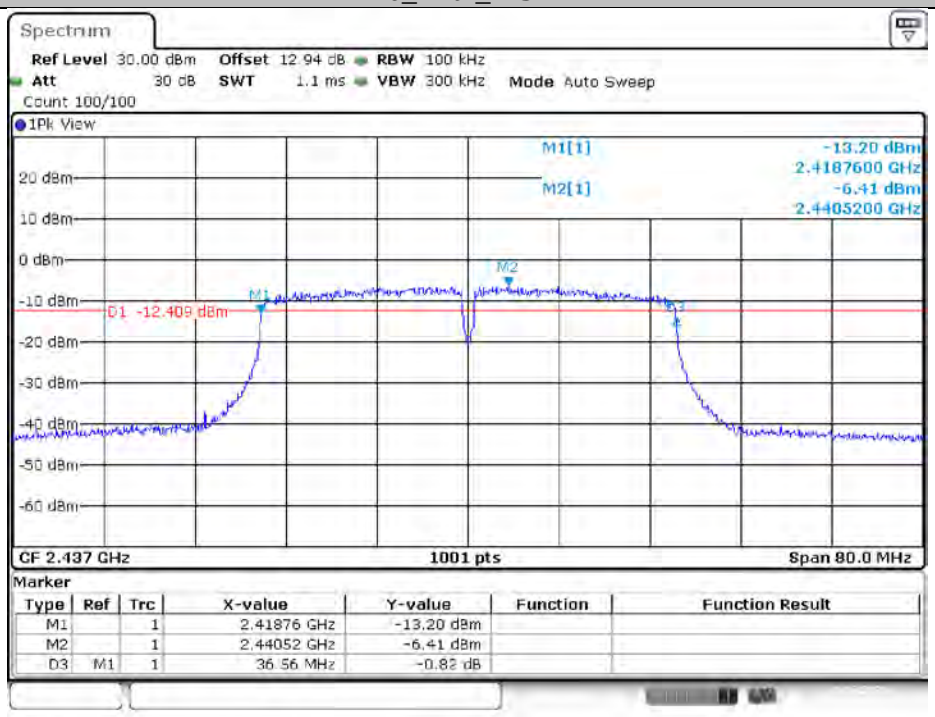
11N20_Ant1_2462MHz



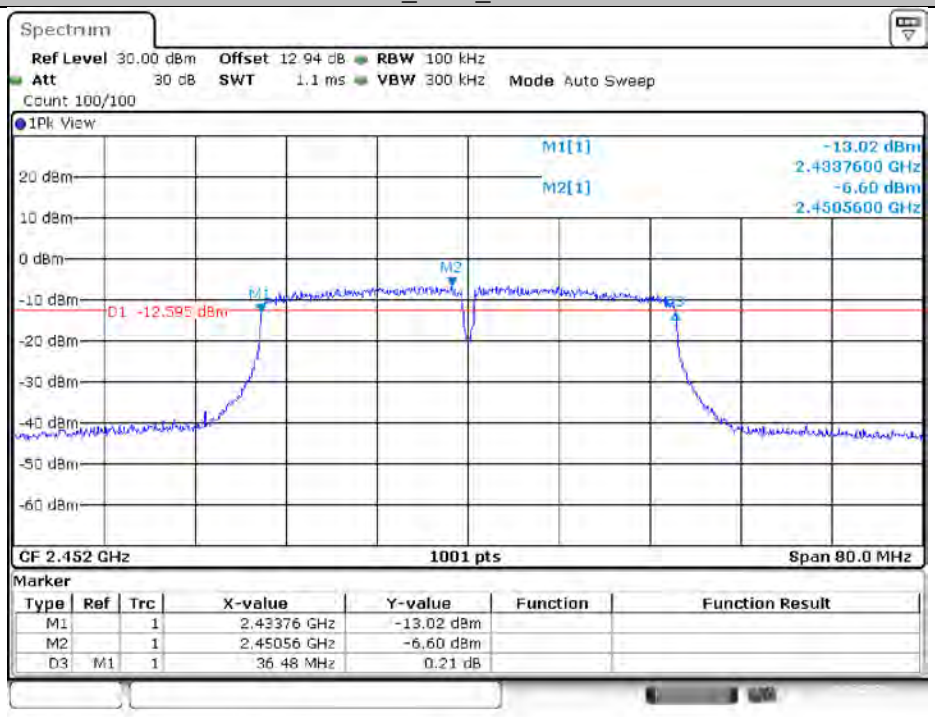
11N40_Ant1_2422MHz



11N40_Ant1_2437MHz



11N40_Ant1_2452MHz



Appendix B: Occupied Channel Bandwidth

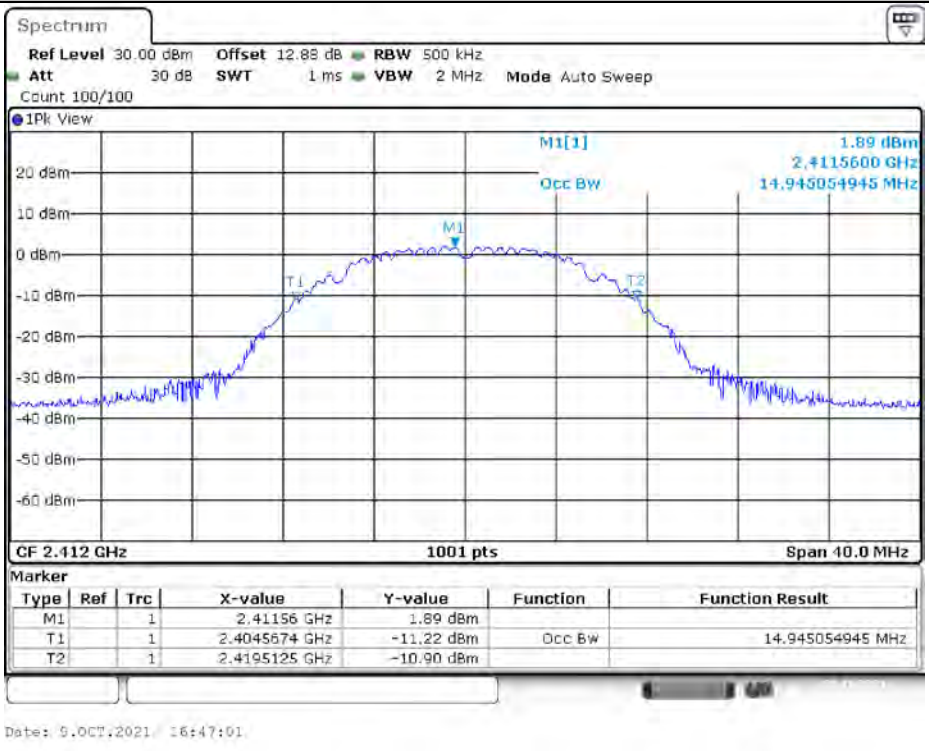
Test Result

TestMode	Antenna	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant0	2412	14.945	---	PASS
		2437	14.945	---	PASS
		2462	14.825	---	PASS
11G	Ant0	2412	16.983	---	PASS
		2437	16.983	---	PASS
		2462	16.983	---	PASS
11N20	Ant0	2412	18.102	---	PASS
		2437	18.062	---	PASS
		2462	18.102	---	PASS
11N40	Ant0	2422	36.523	---	PASS
		2437	36.523	---	PASS
		2452	36.603	---	PASS

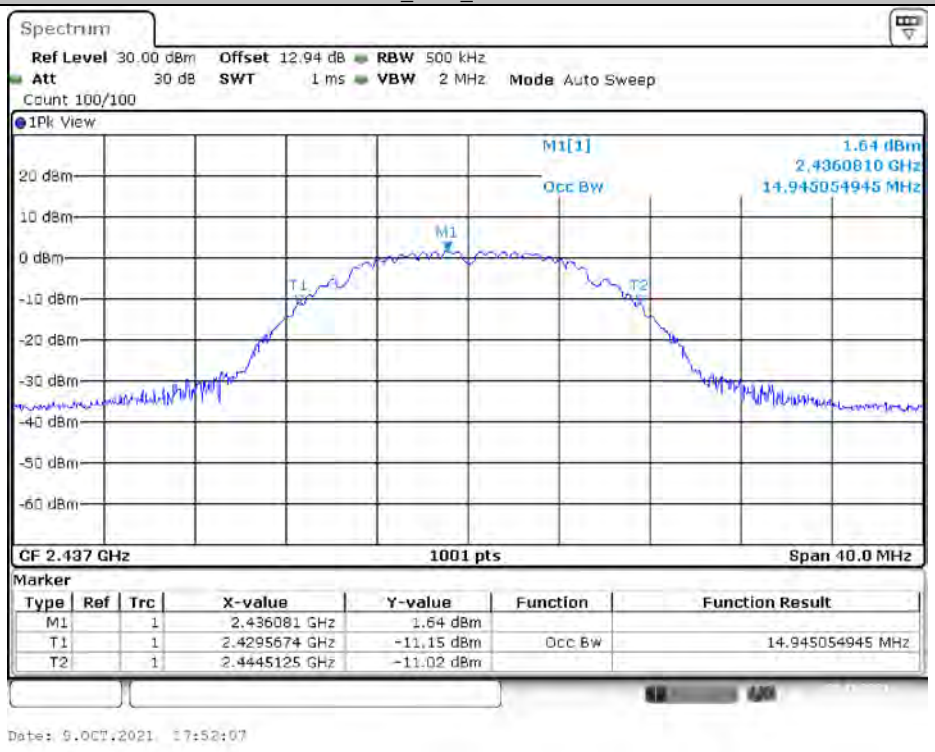
TestMode	Antenna	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	14.745	---	PASS
		2437	14.785	---	PASS
		2462	14.785	---	PASS
11G	Ant1	2412	16.983	---	PASS
		2437	16.983	---	PASS
		2462	16.983	---	PASS
11N20	Ant1	2412	18.142	---	PASS
		2437	18.142	---	PASS
		2462	18.142	---	PASS
11N40	Ant1	2422	36.444	---	PASS
		2437	36.523	---	PASS
		2452	36.523	---	PASS

Test Graphs

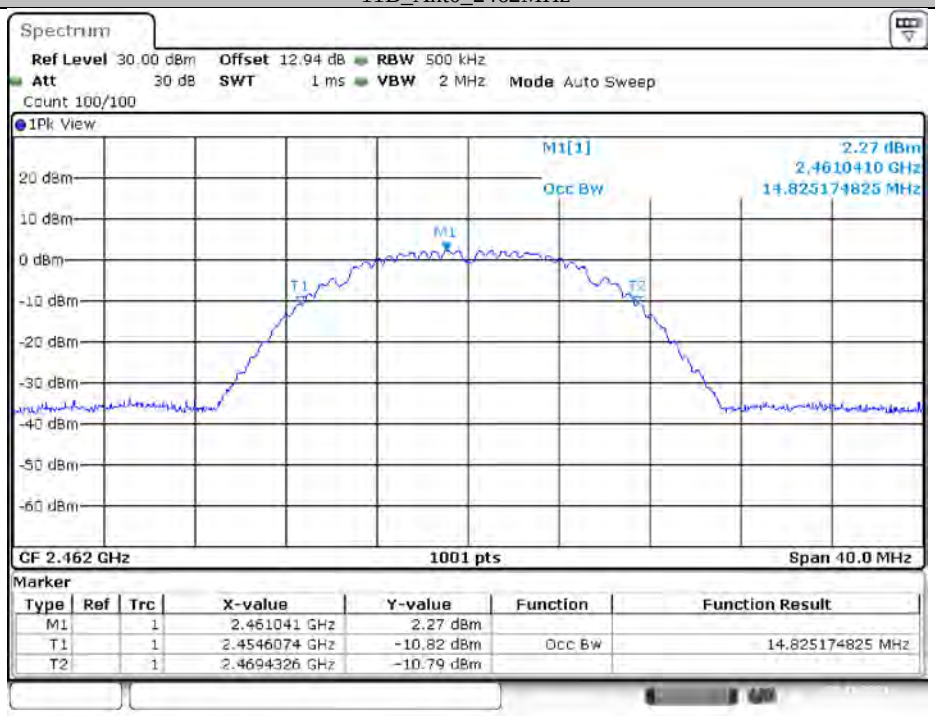
11B_Ant0_2412MHz



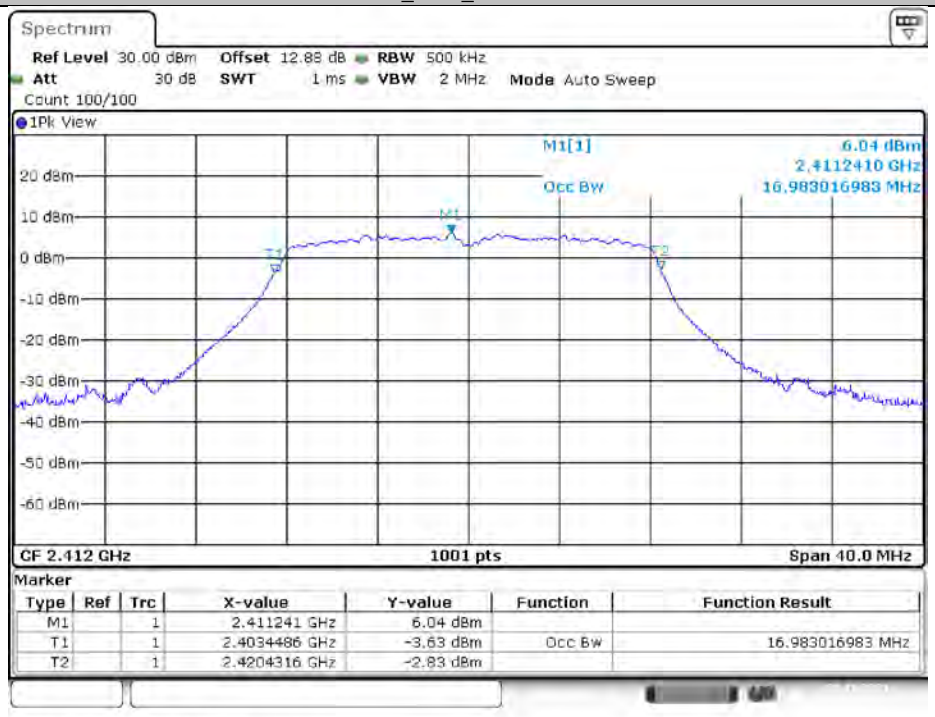
11B_Ant0_2437MHz



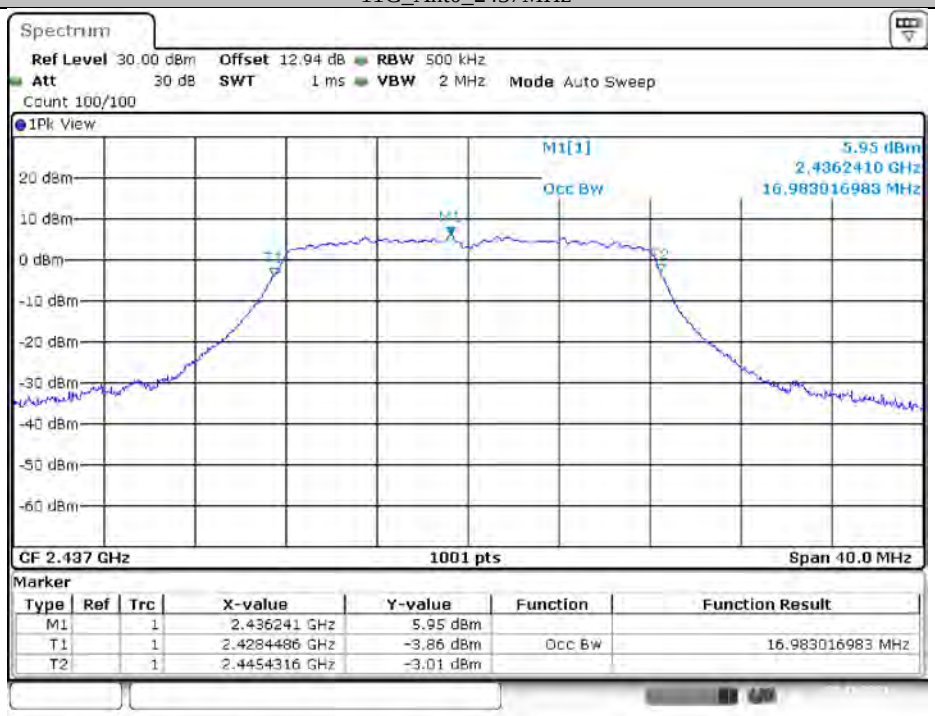
11B_Ant0_2462MHz



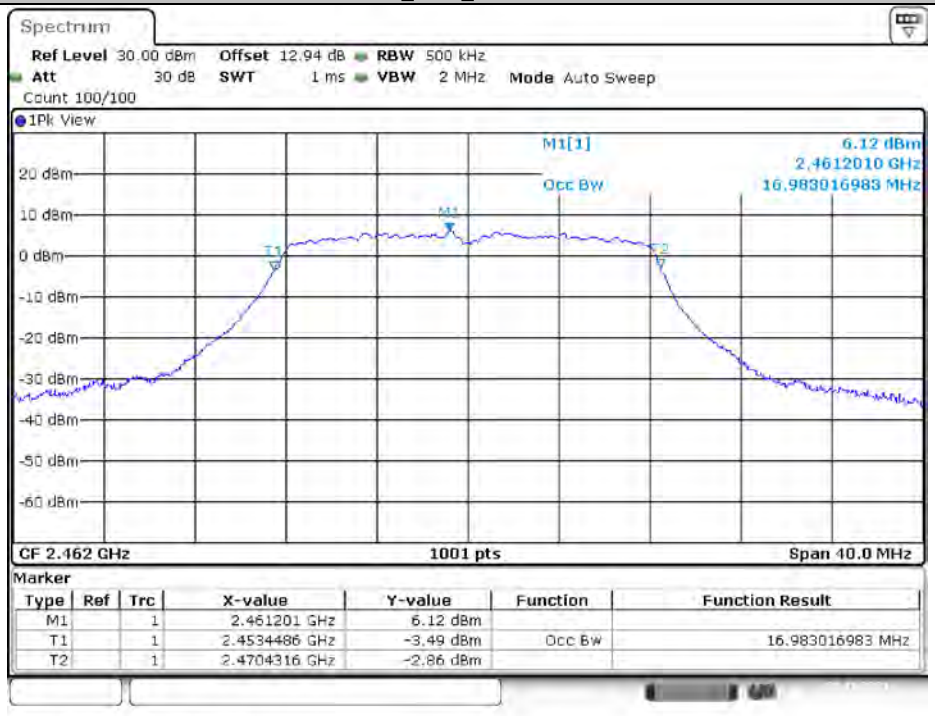
11G_Ant0_2412MHz



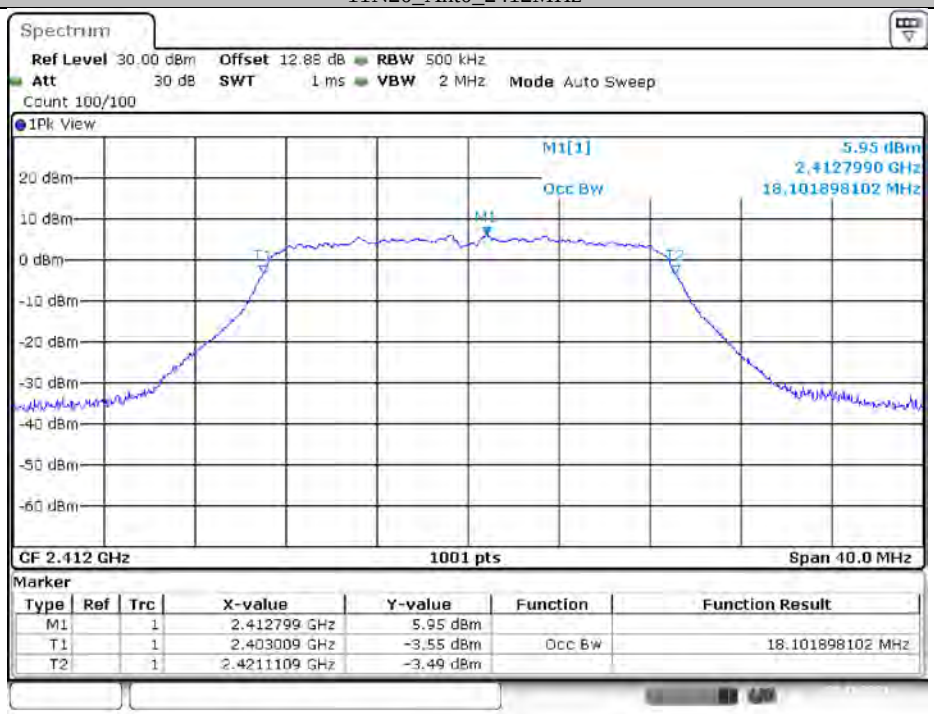
11G_Ant0_2437MHz



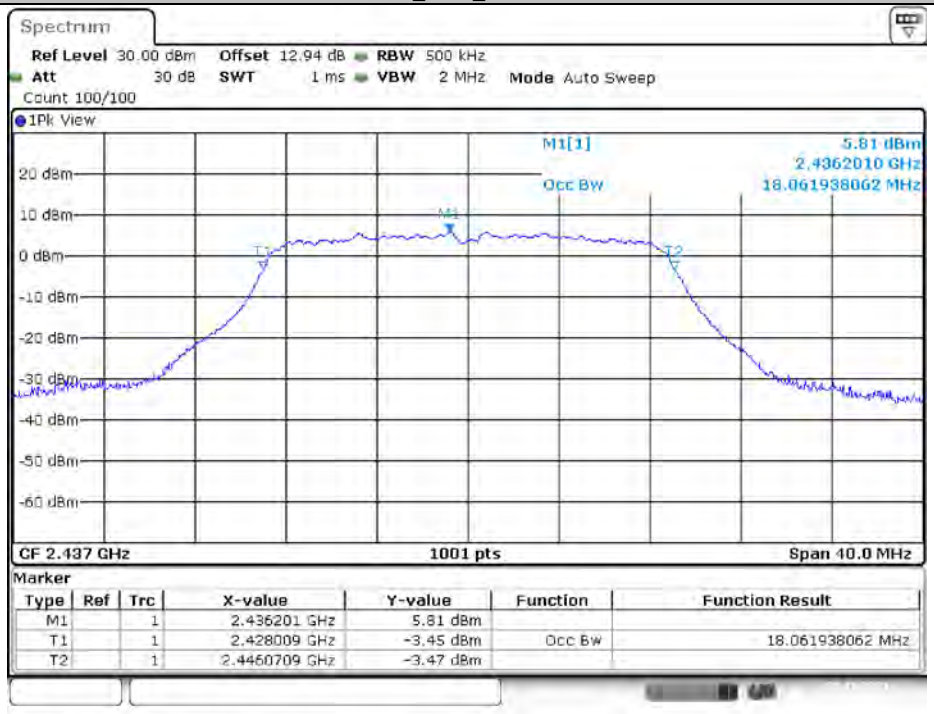
11G_Ant0_2462MHz



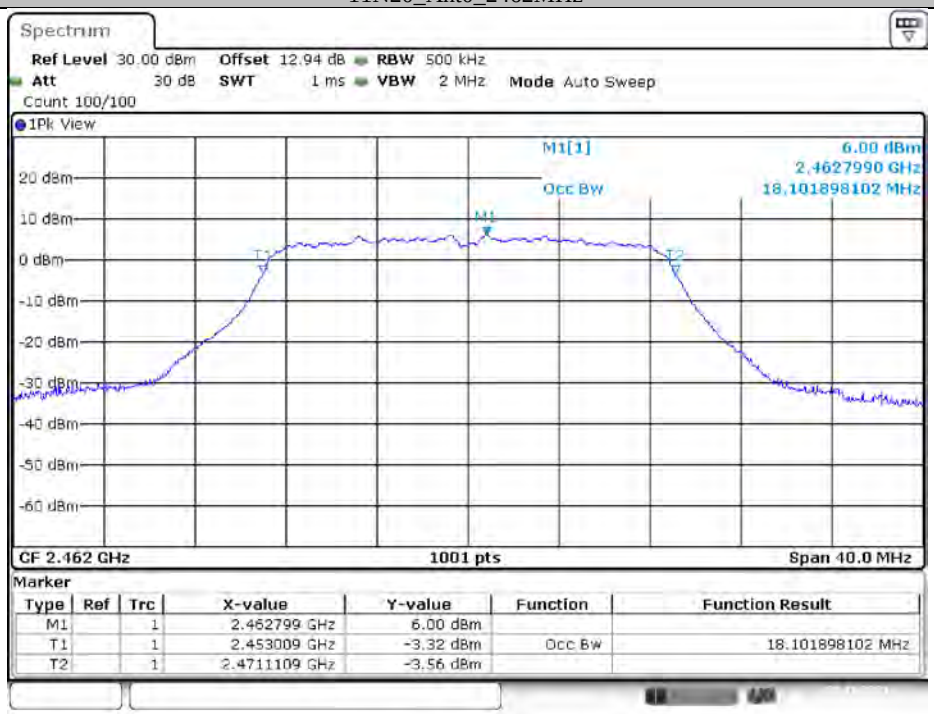
11N20_Ant0_2412MHz



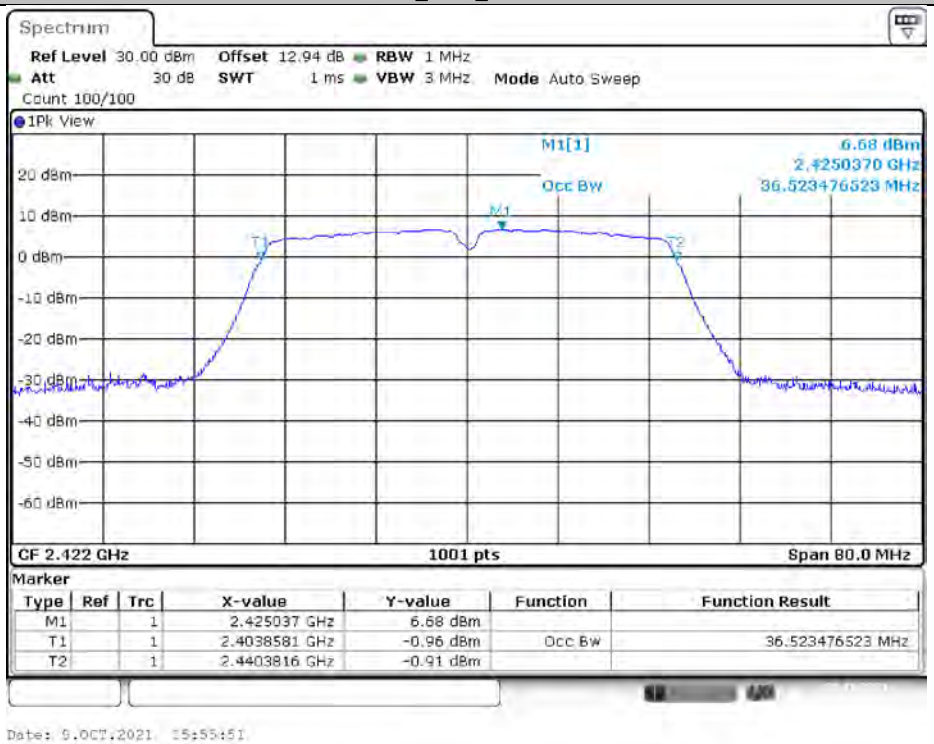
11N20_Ant0_2437MHz



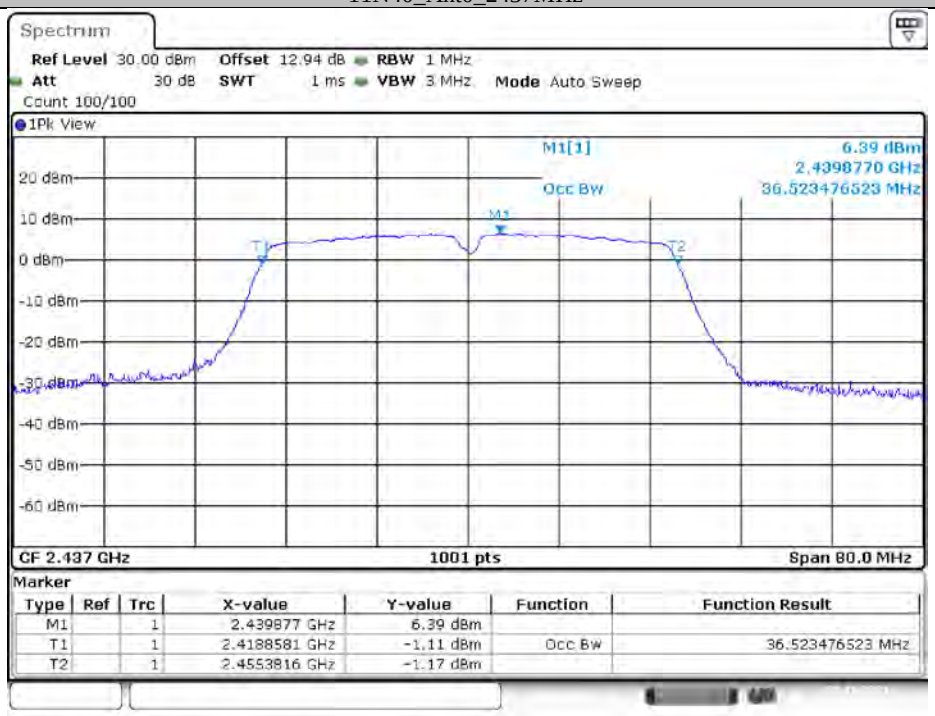
11N20_Ant0_2462MHz



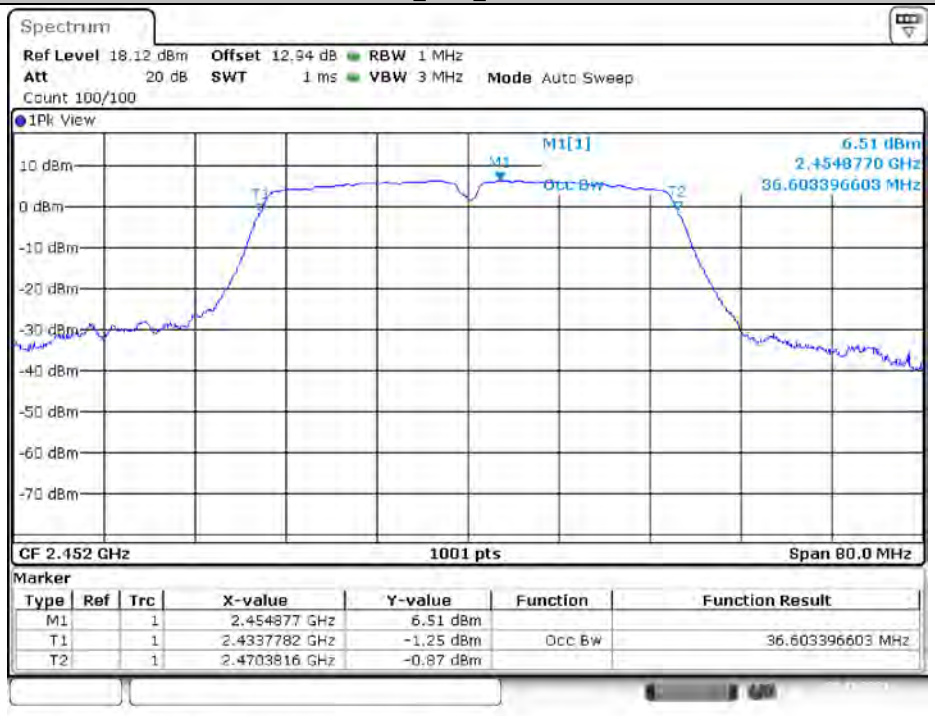
11N40 _Ant0_2422MHz



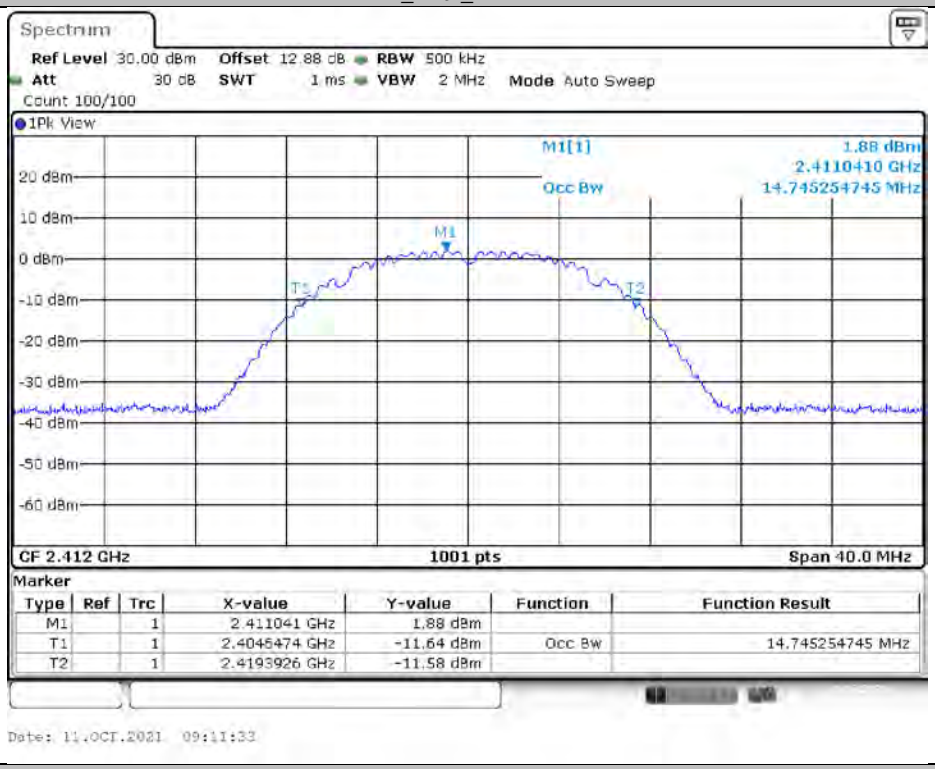
11N40_Ant0_2437MHz



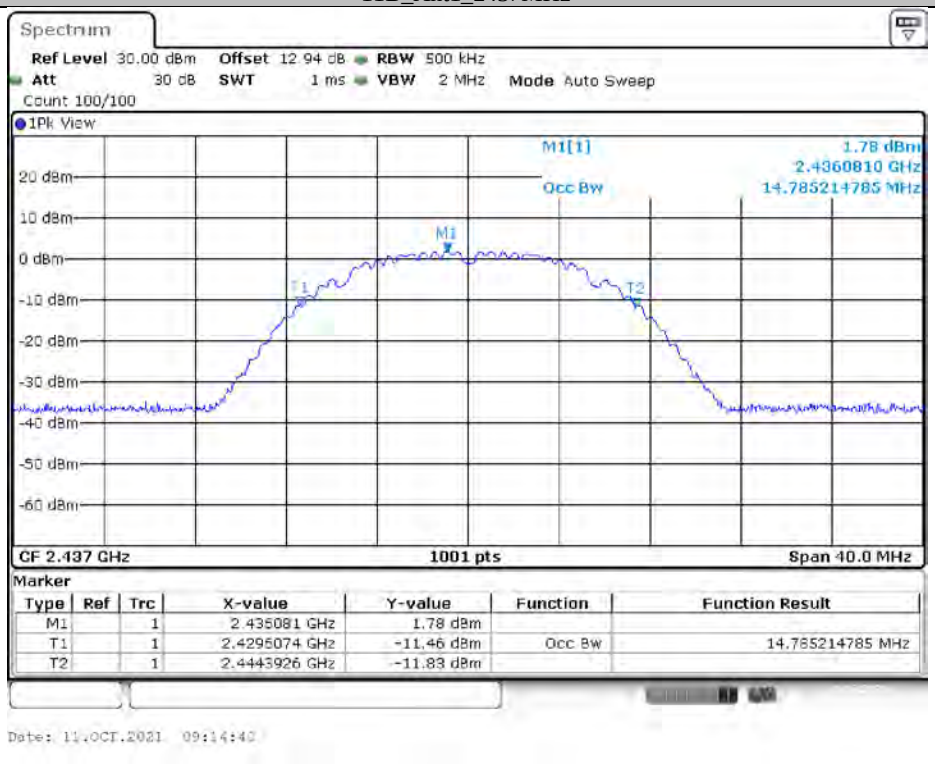
11N40_Ant0_2452MHz



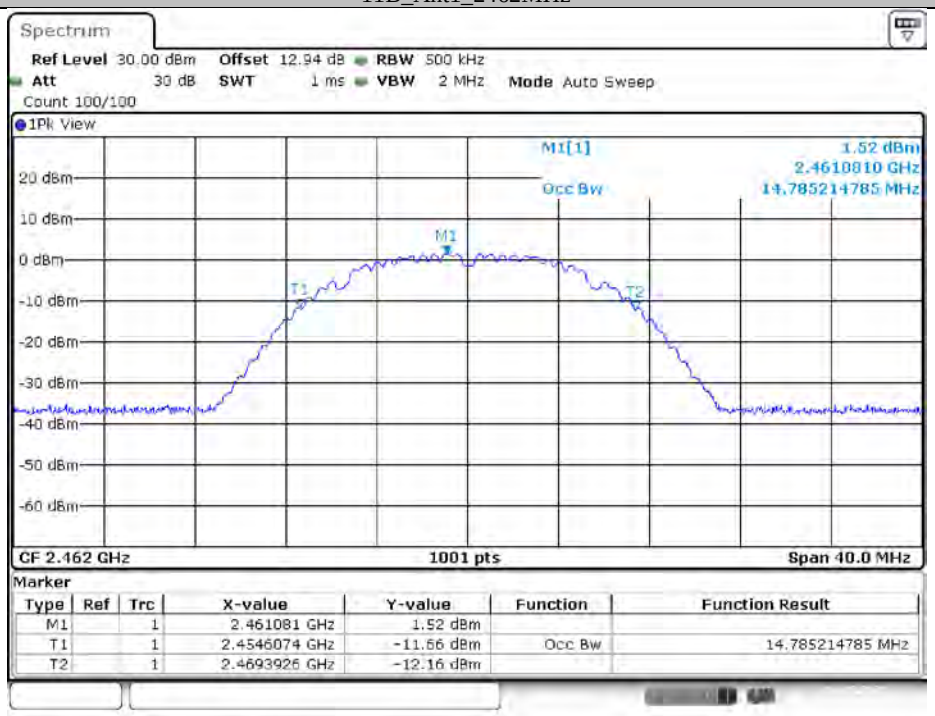
11B_Ant1_2412MHz



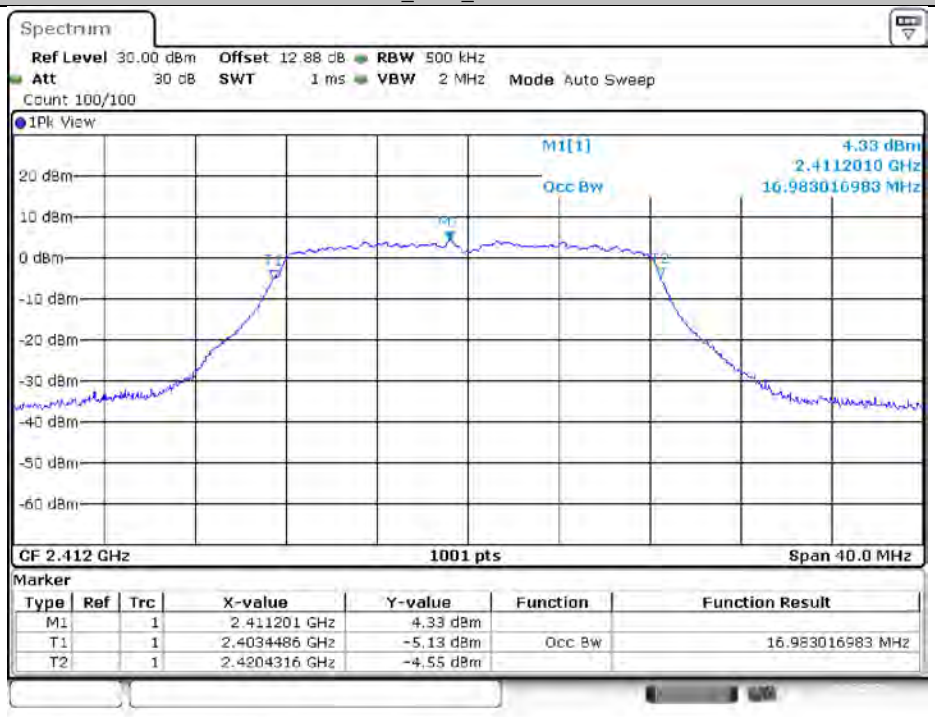
11B_Ant1_2437MHz



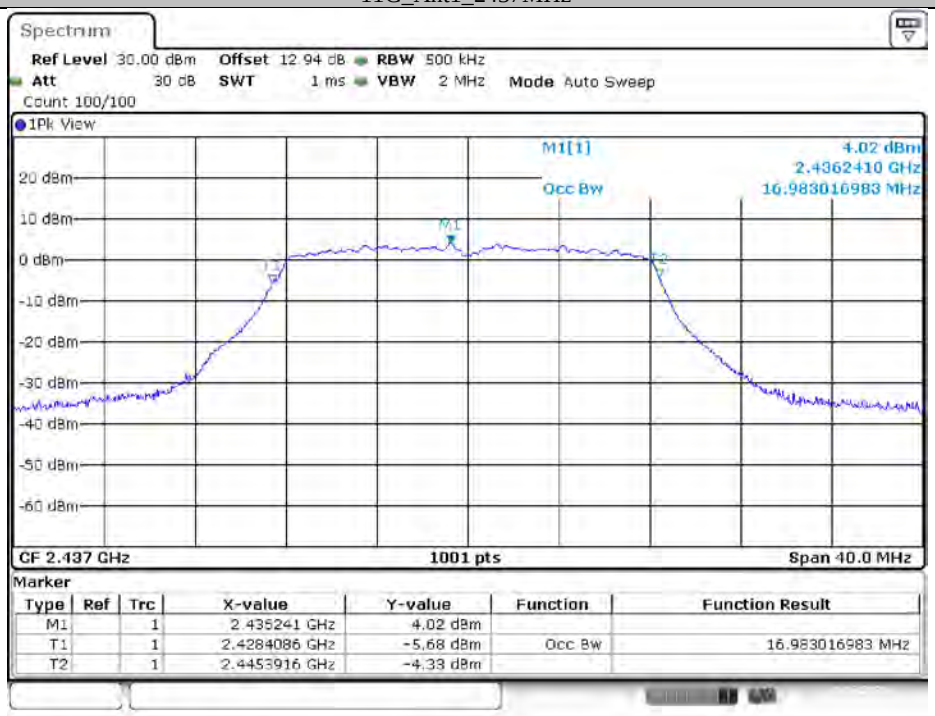
11B_Ant1_2462MHz



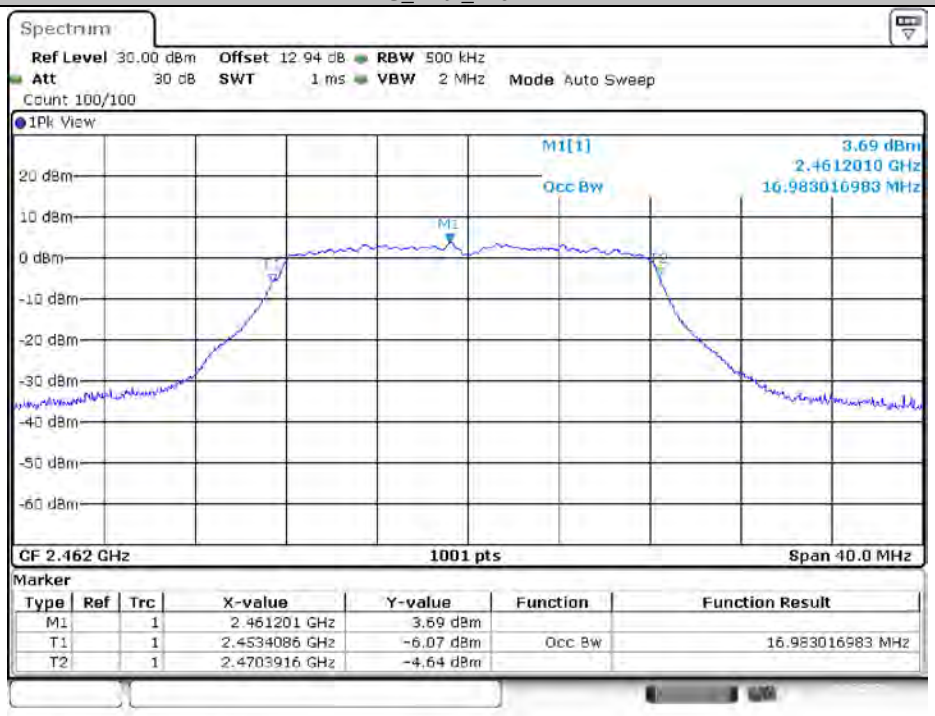
11G_Ant1_2412MHz



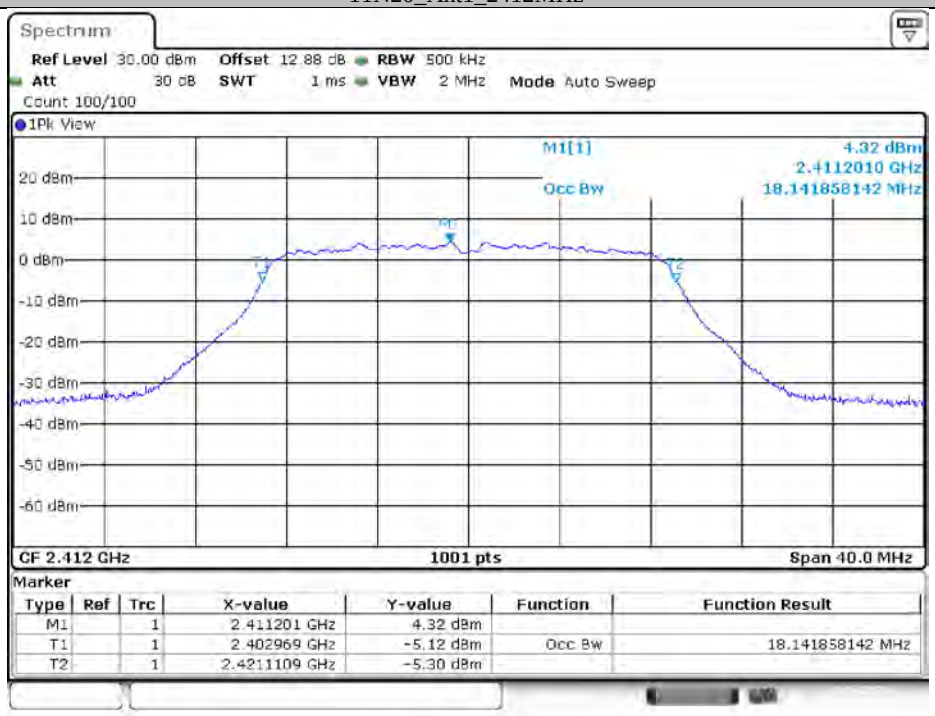
11G_Ant1_2437MHz



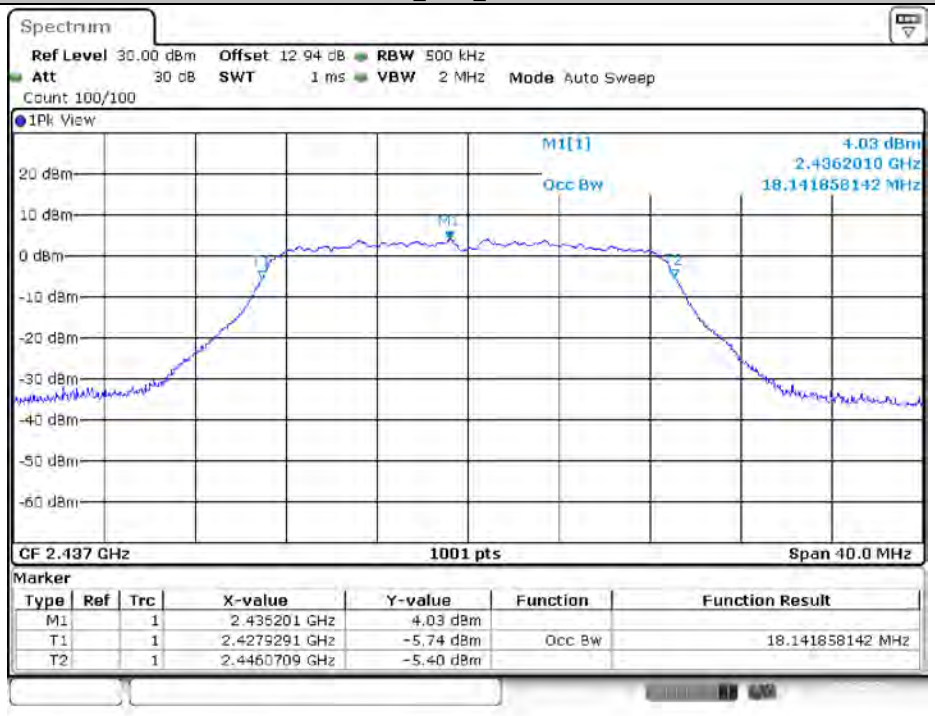
11G_Ant1_2462MHz



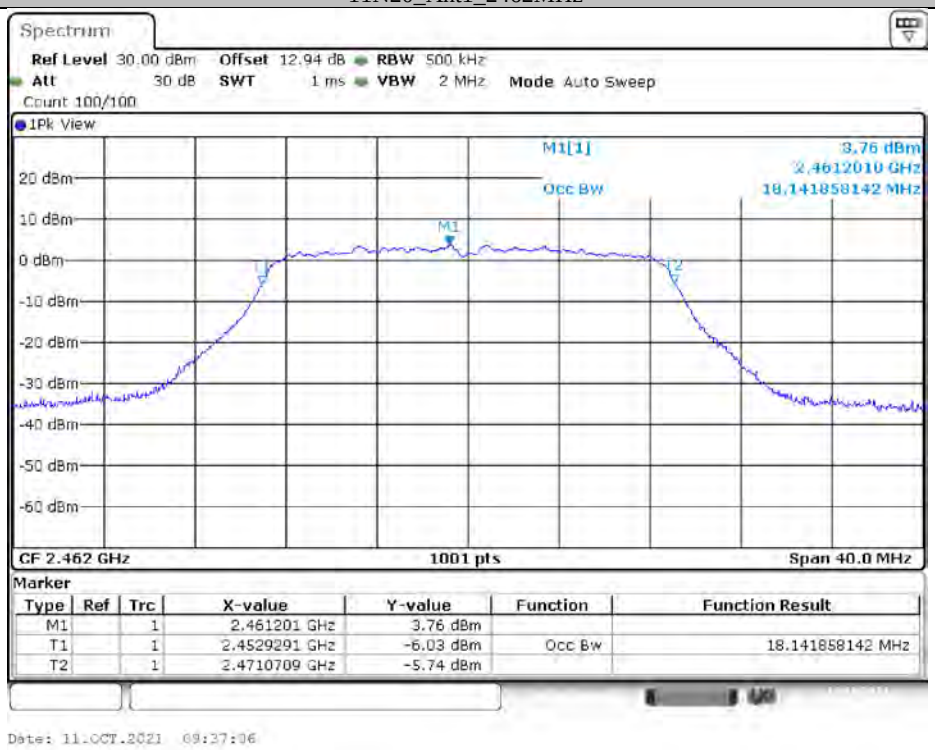
11N20_Ant1_2412MHz



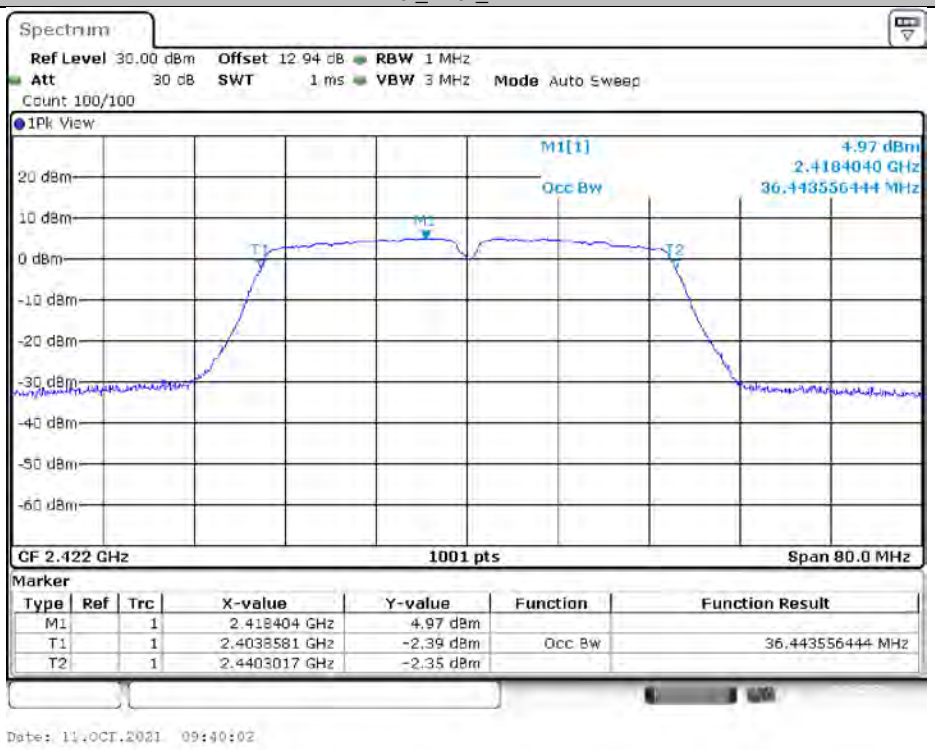
11N20_Ant1_2437MHz



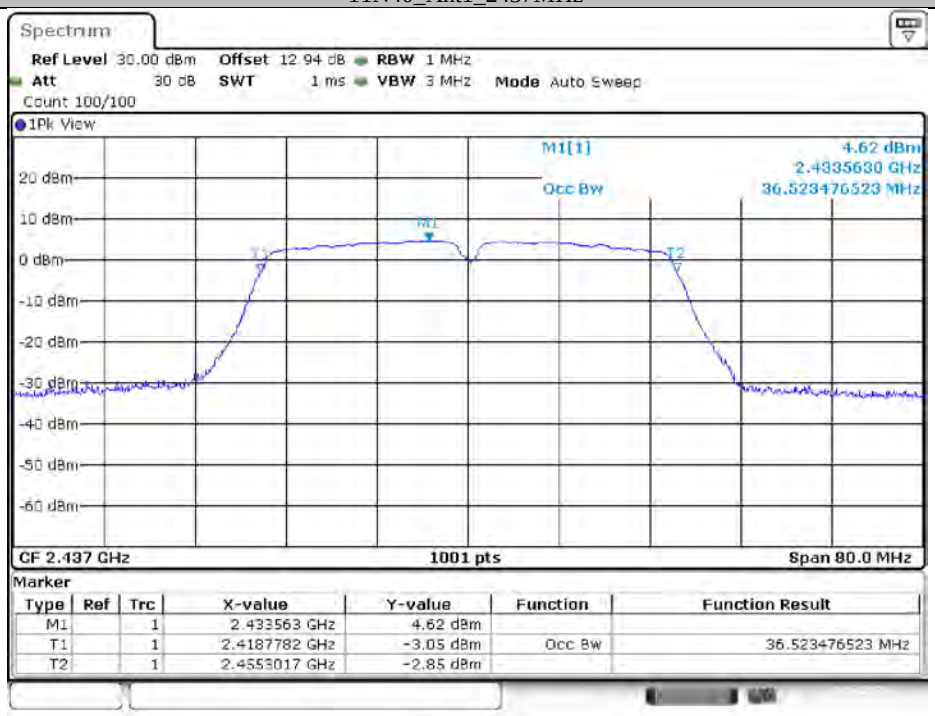
11N20_Ant1_2462MHz



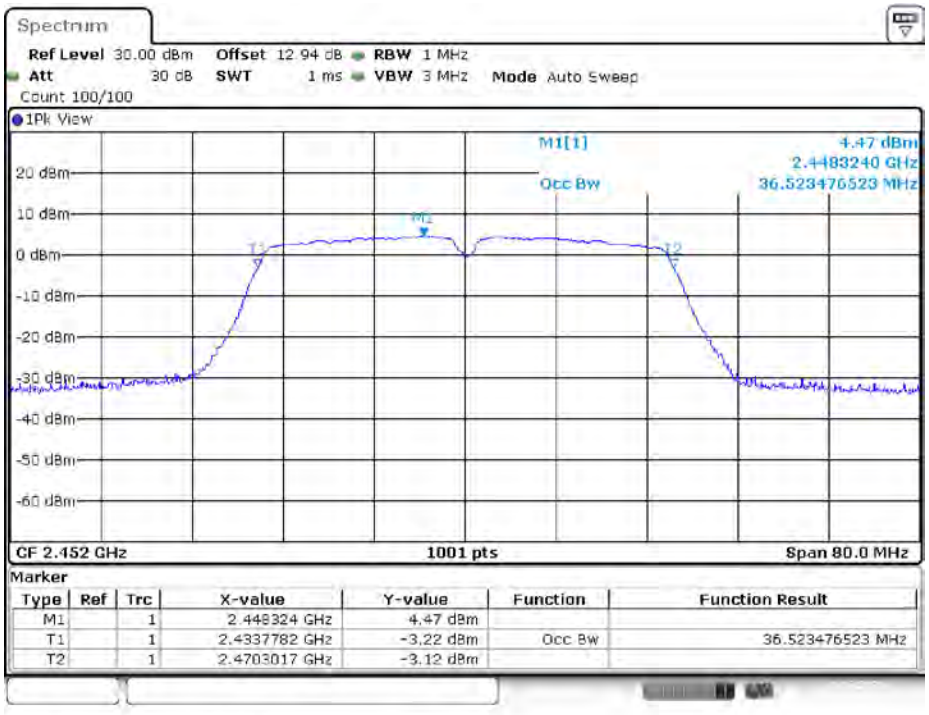
11N40 _Ant1_2422MHz



11N40_Ant1_2437MHz



11N40 _Ant1_2452MHz



Test Graphs

Appendix C: Maximum conducted output power

Test Result

Test Mode	Channel [MHz]	Power Result [dBm]			Limit [dBm]	Verdict
		Ant 0	Ant 1	Total		
11B	2412	15.67	15.31	18.5	<=30	PASS
	2437	15.75	15.48	18.63	<=30	PASS
	2462	16.61	14.64	18.75	<=30	PASS
11G	2412	16.51	15.58	19.08	<=30	PASS
	2437	16.11	14.86	18.54	<=30	PASS
	2462	16.9	14.87	19.01	<=30	PASS
11N20	2412	15.84	15.07	18.48	<=30	PASS
	2437	15.63	14.58	18.15	<=30	PASS
	2462	16.81	14.91	18.97	<=30	PASS
11N40	2422	16.42	15.25	18.88	<=30	PASS
	2437	16.08	14.67	18.44	<=30	PASS
	2452	16.3	14.43	18.48	<=30	PASS

Note 1: The maximum antenna gain is -0.76 dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power measurements on IEEE 802.11 devices:

Array Gain = 0dB (i.e., no array gain) For $N_{ANT} \leq 4$;

So: Directional gain=-0.76dBi <6dBi

Appendix D: Power spectral density

Test Result

TestMode	Channel[MHz]	Result[dBm/3kHz]			Limit[dBm/3kHz]	Verdict
		Ant 0	Ant 1	Total		
11B	2412	-20.55	-19.89	-17.20	<=8	PASS
	2437	-20.68	-19.99	-17.31	<=8	PASS
	2462	-20.1	-20.33	-17.20	<=8	PASS
11G	2412	-15.79	-13.15	-11.26	<=8	PASS
	2437	-15.86	-13.76	-11.67	<=8	PASS
	2462	-14.56	-14.24	-11.39	<=8	PASS
11N20	2412	-14.33	-12.64	-10.39	<=8	PASS
	2437	-14.69	-13.12	-10.82	<=8	PASS
	2462	-14.62	-13.56	-11.05	<=8	PASS
11N40	2422	-15.31	-14.08	-11.64	<=8	PASS
	2437	-15.61	-14.63	-12.08	<=8	PASS
	2452	-15.47	-14.72	-12.07	<=8	PASS

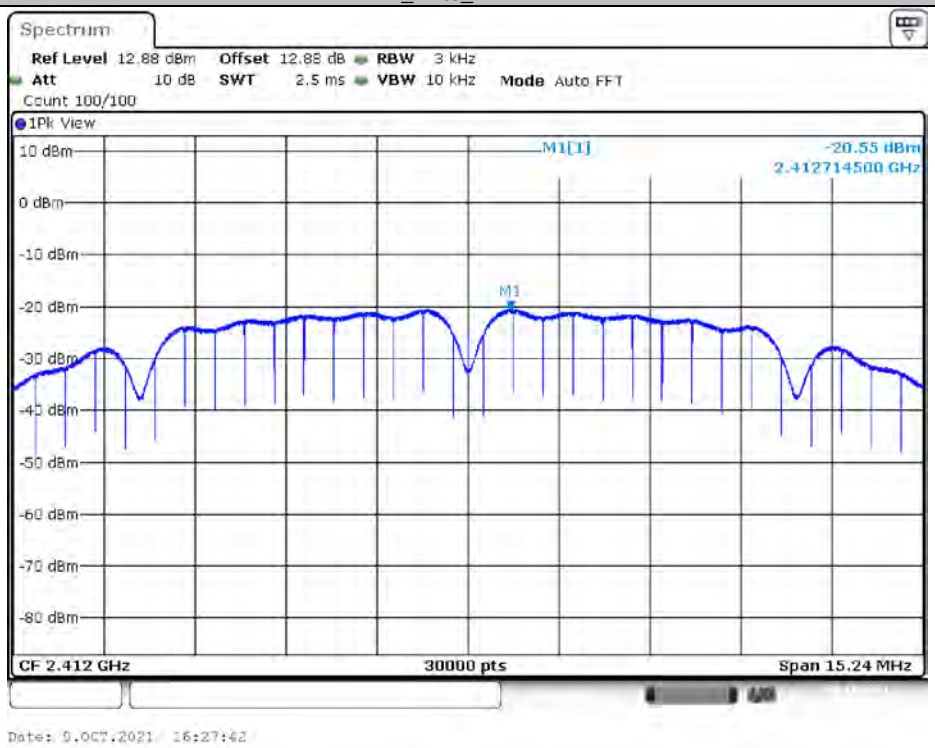
Note 1: The maximum antenna gain is -0.76 dBi. The device employed Cyclic Delay Diversity (CDD) for 802.11 MIMO transmitting, per KDB 662911 D01 Multiple Transmitter Output v02r01, for power spectral density (PSD) measurements on the devices

Array Gain = 10 log(N_{ANT}/N_{ss})dB

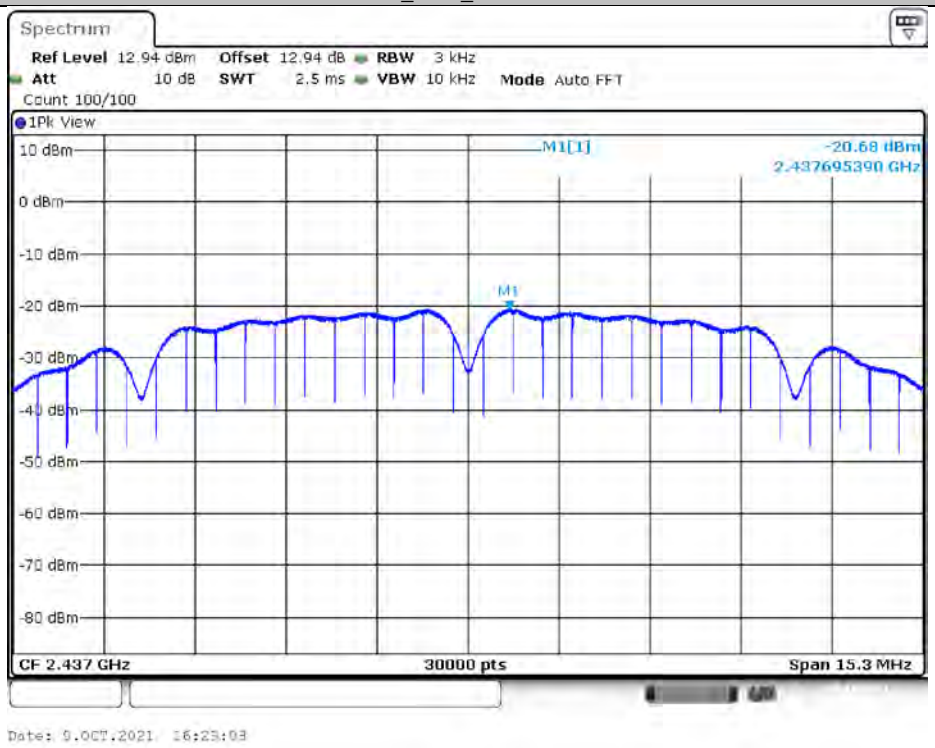
So: Directional gain=G_{ANT} + Array Gain =-0.76+10*log(2/1)=2.25dBi

Test Graphs

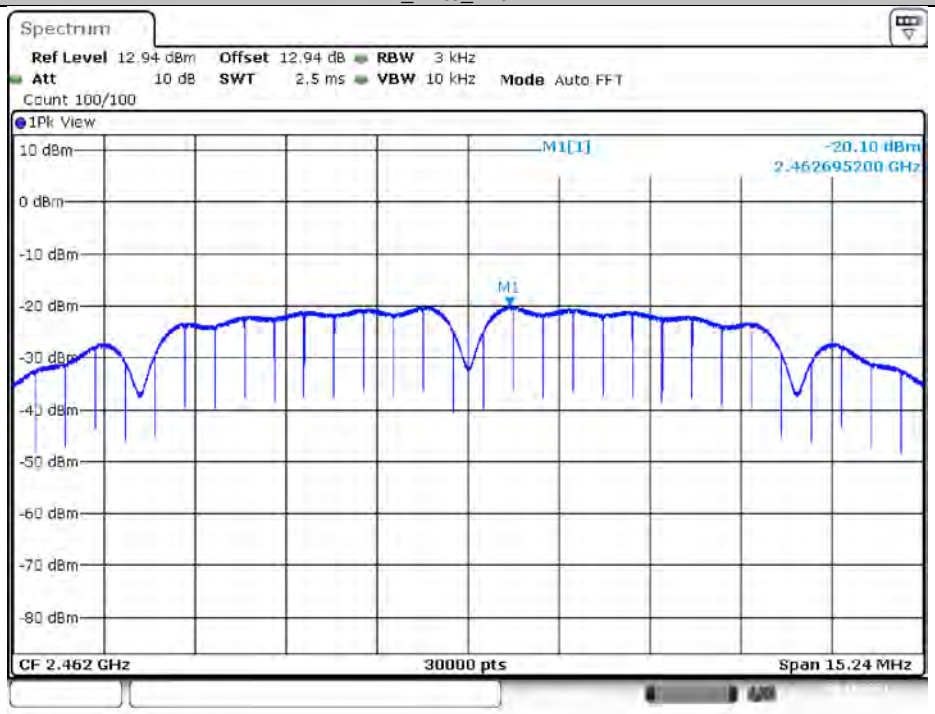
11B_Ant0_2412MHz



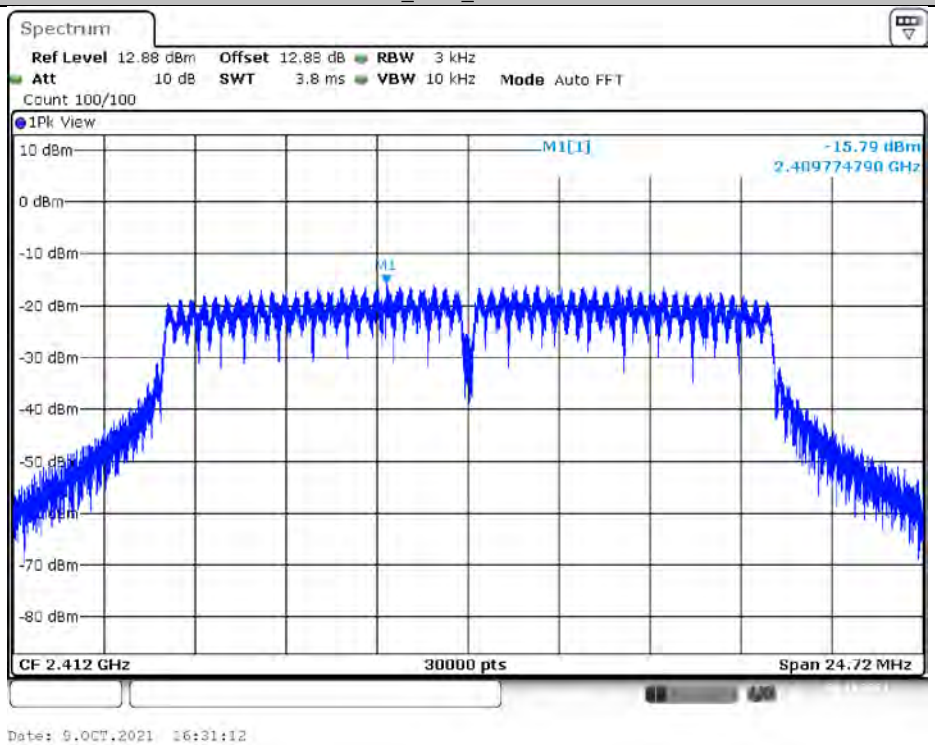
11B_Ant0_2437MHz



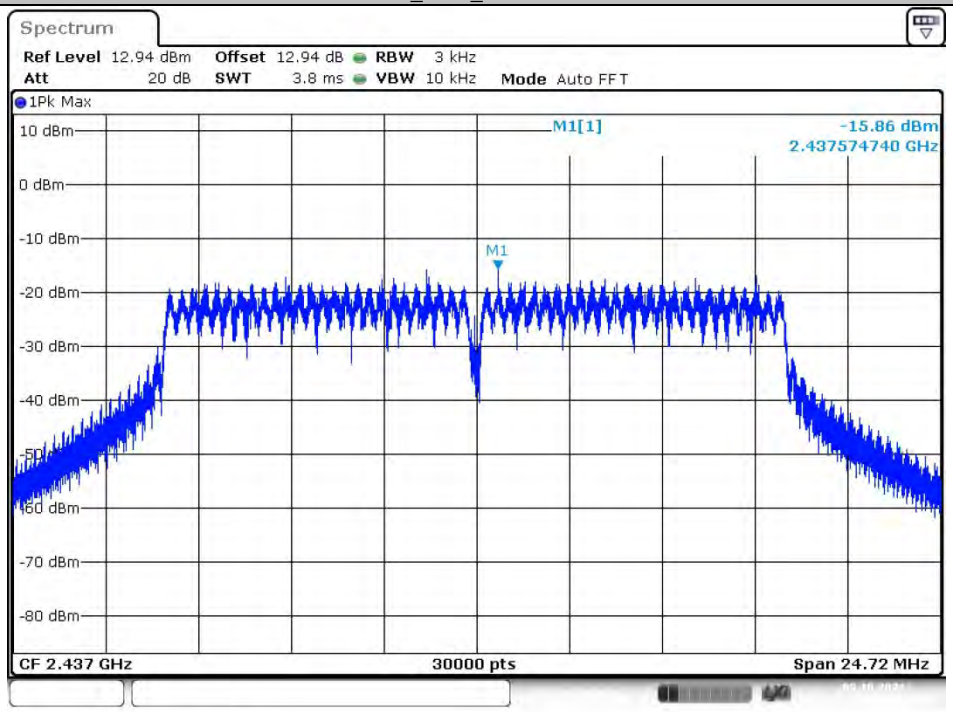
11B_Ant0_2462MHz



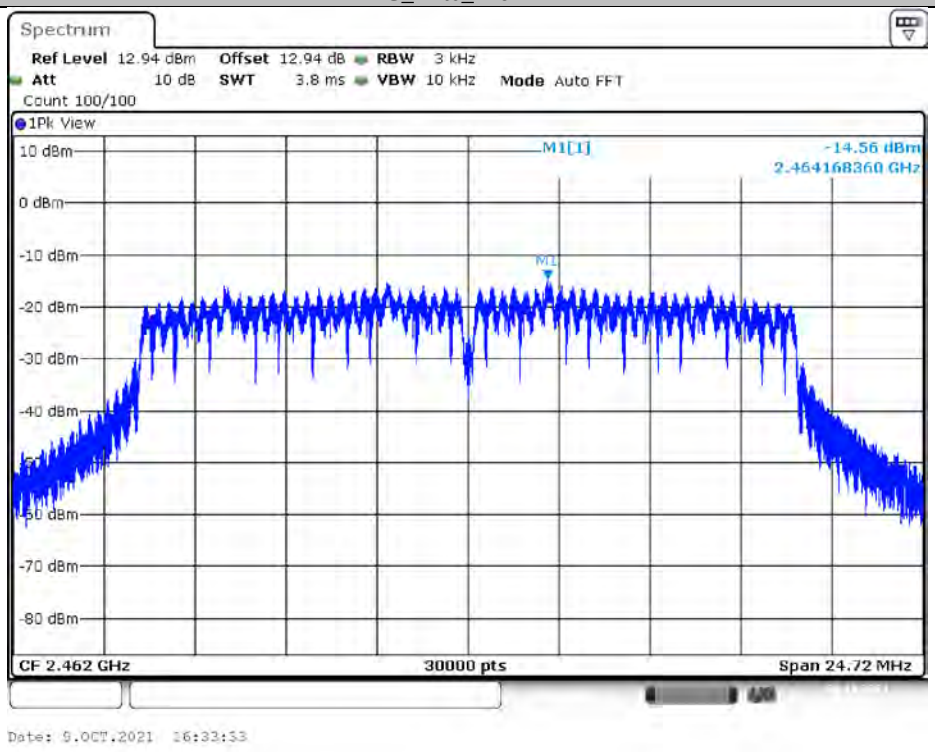
11G_Ant0_2412MHz



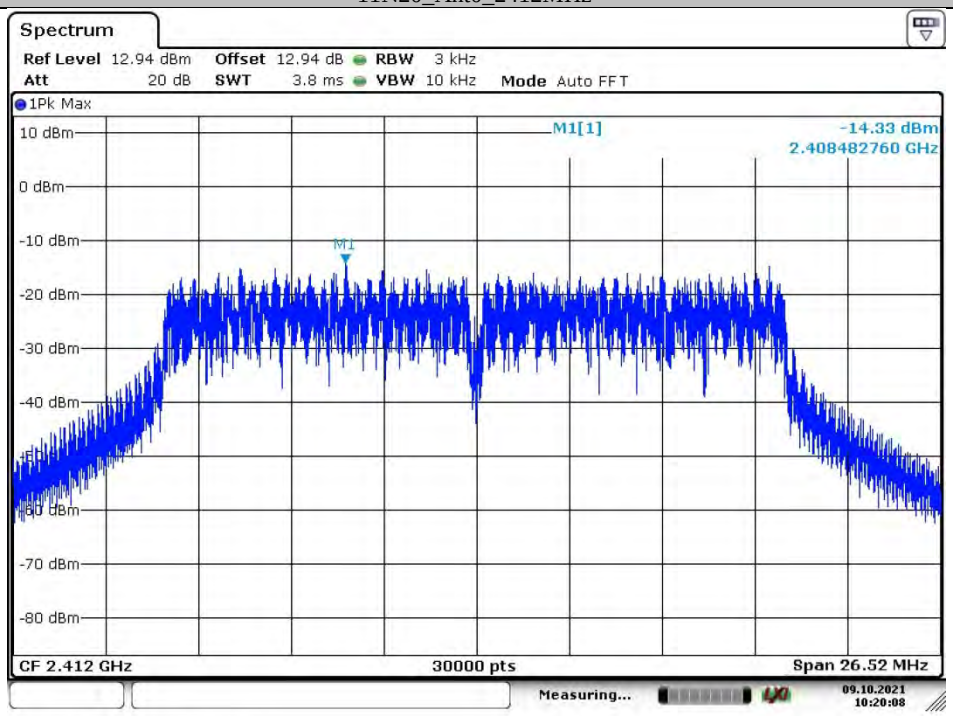
11G_Ant0_2437MHz



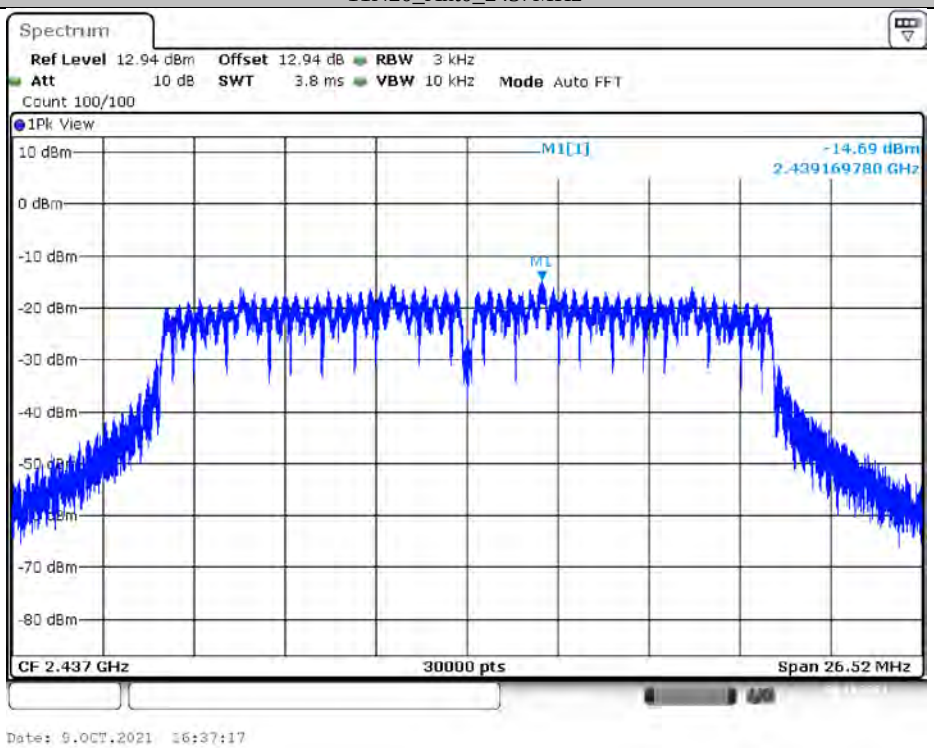
11G_Ant0_2462MHz



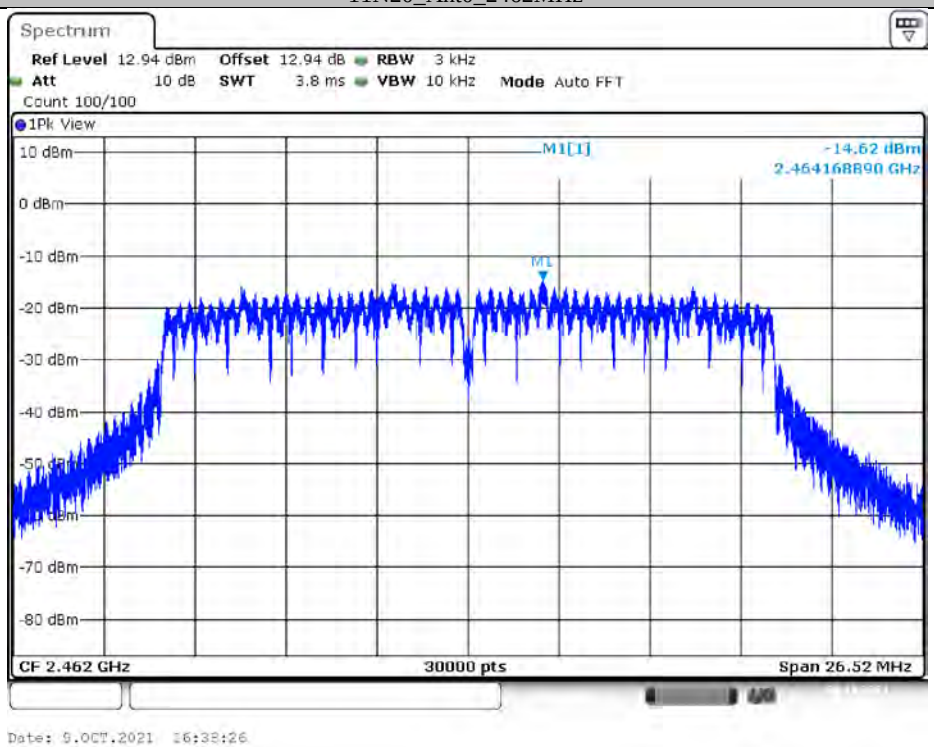
11N20_Ant0_2412MHz



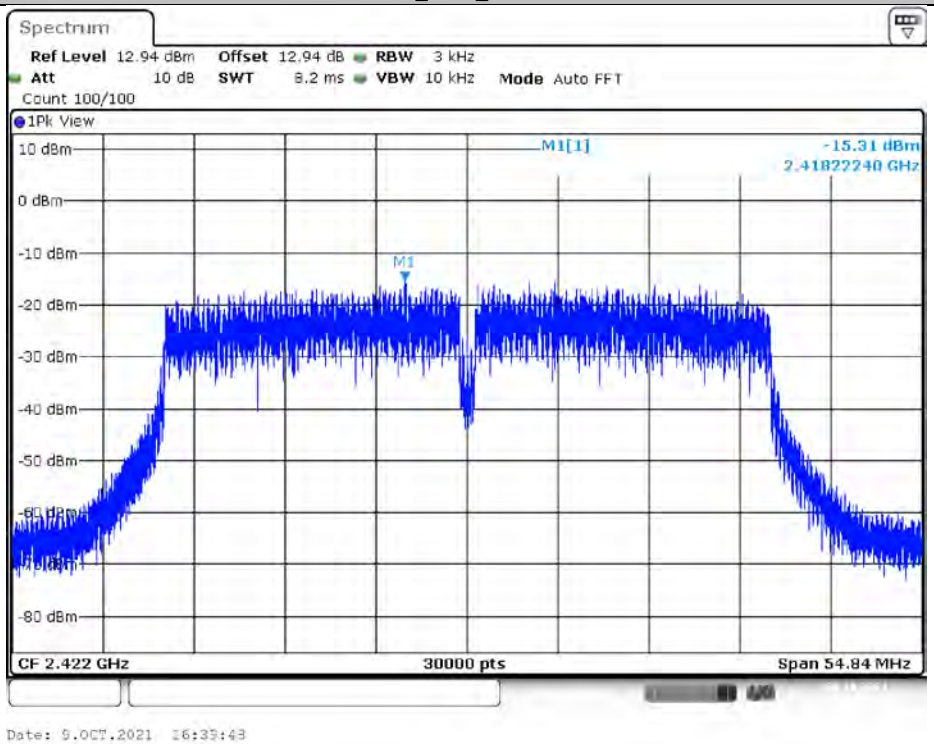
11N20_Ant0_2437MHz



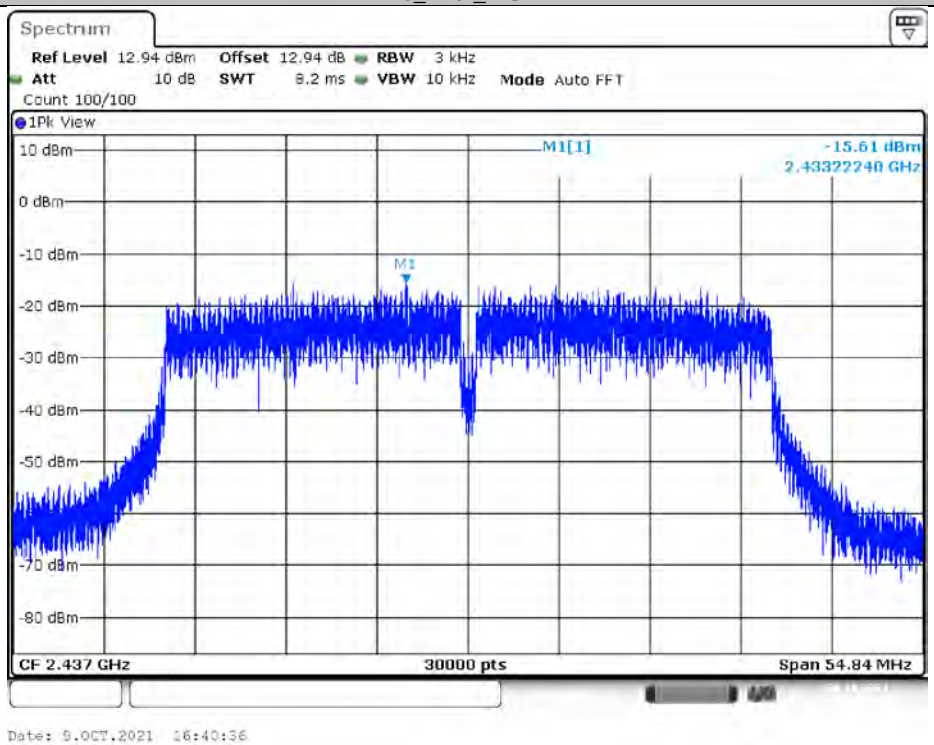
11N20_Ant0_2462MHz



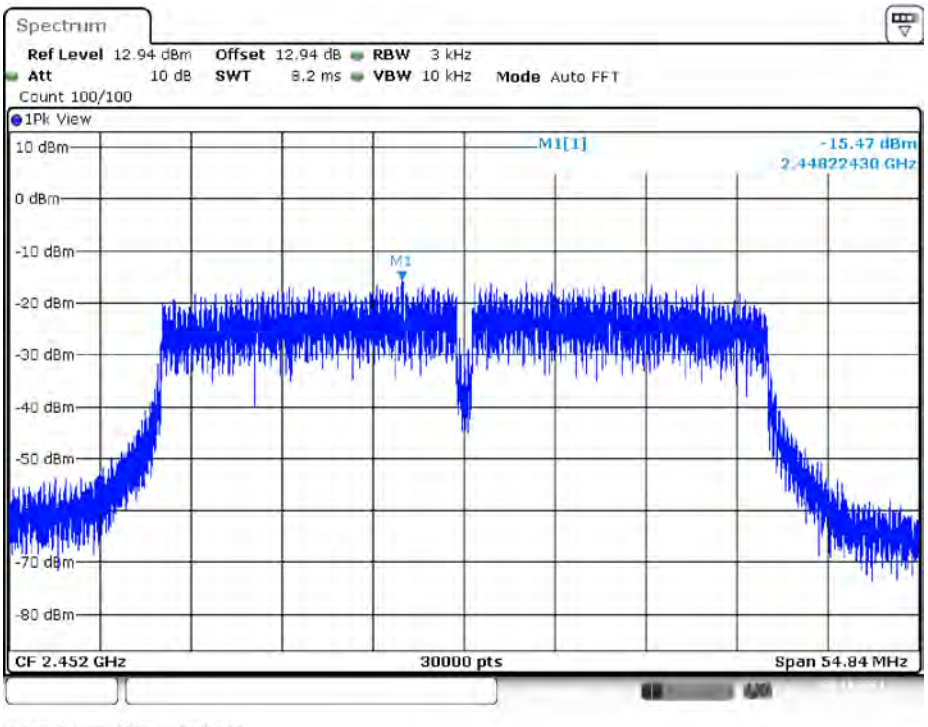
11N40 _Ant1_2422MHz



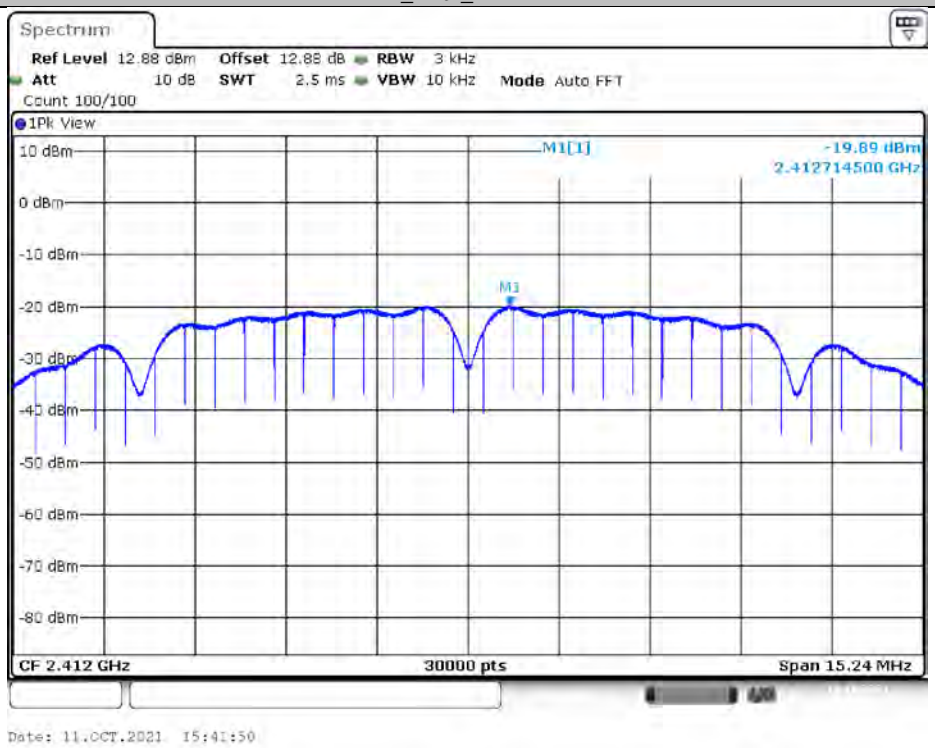
11N40_Ant1_2437MHz



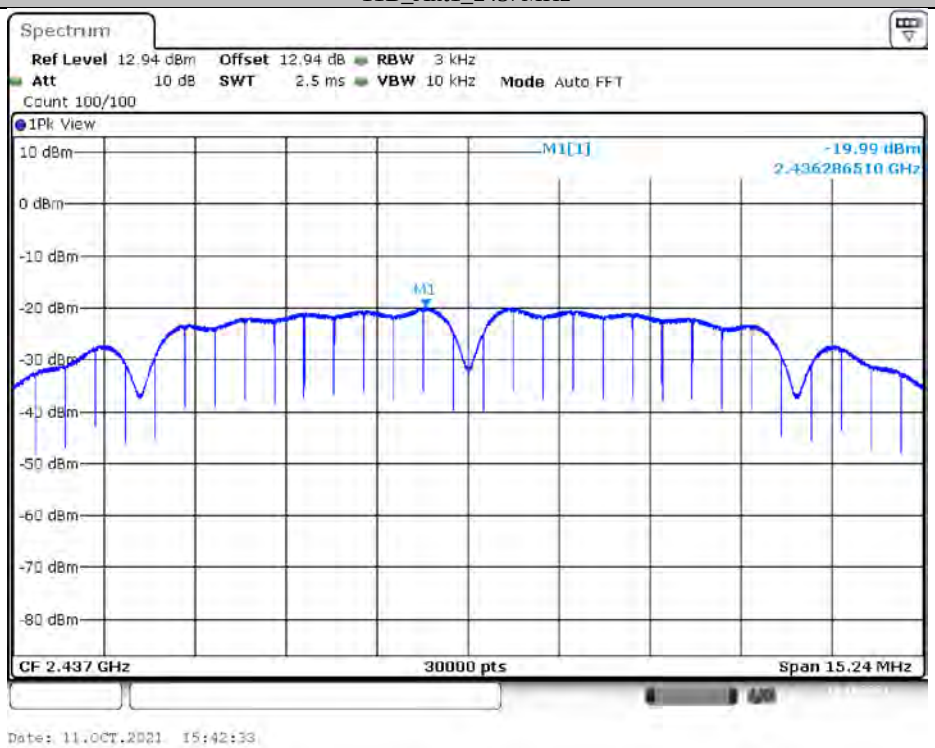
11N40_Ant1_2452MHz



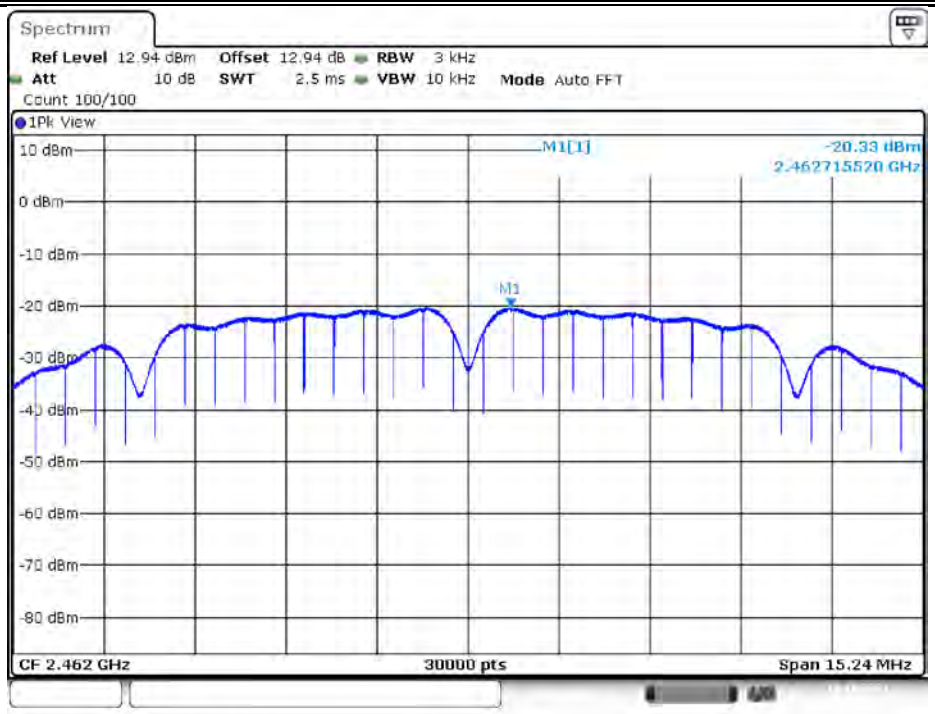
11B_Ant1_2412MHz



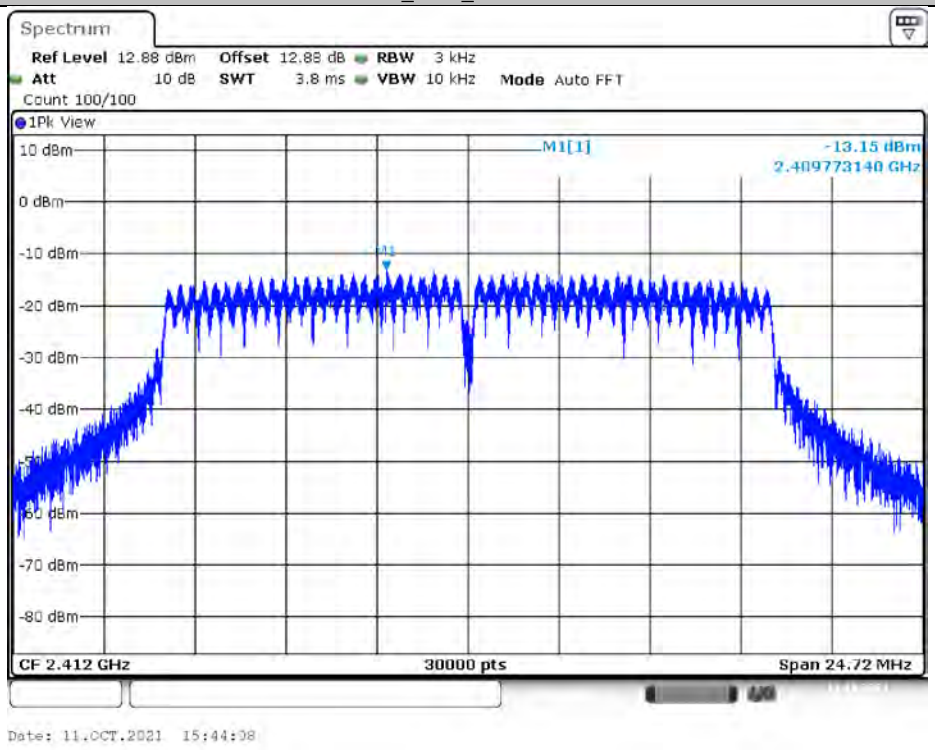
11B_Ant1_2437MHz



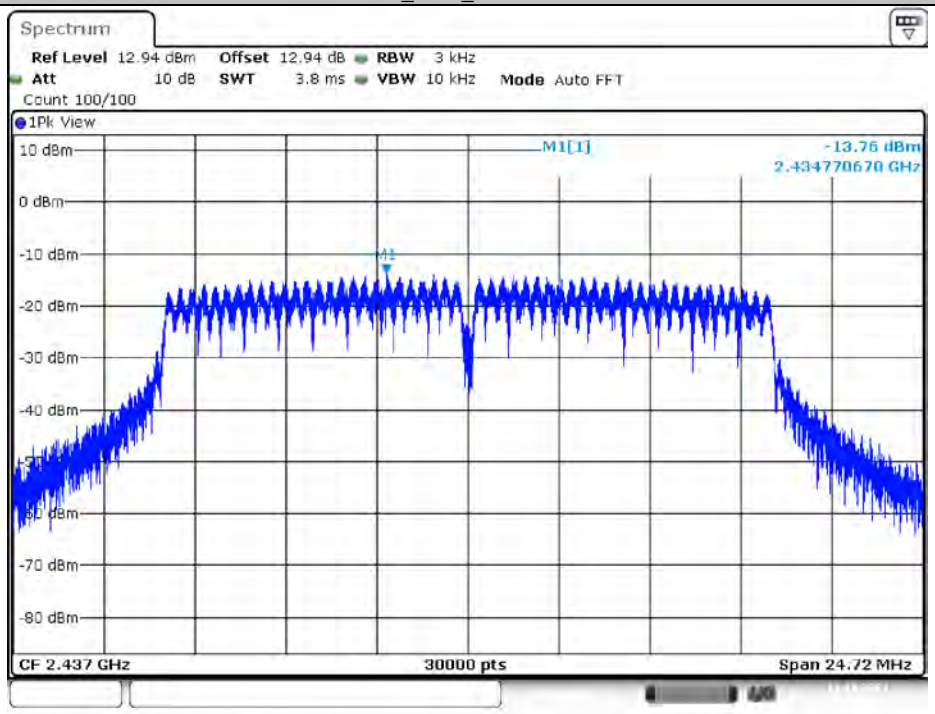
11B_Ant1_2462MHz



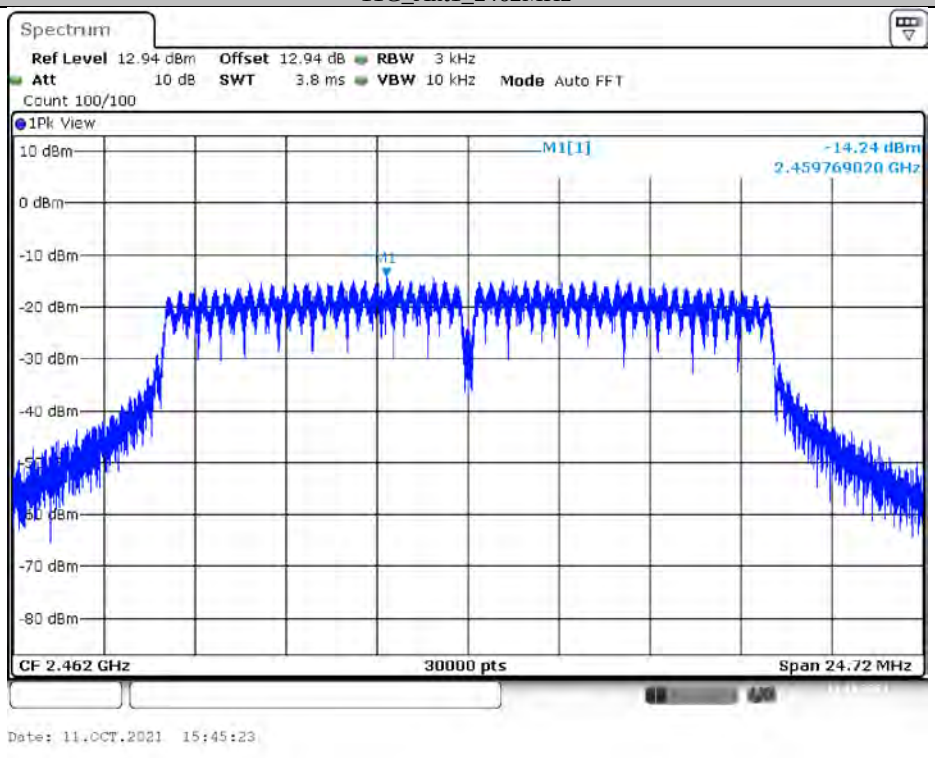
11G_Ant1_2412MHz



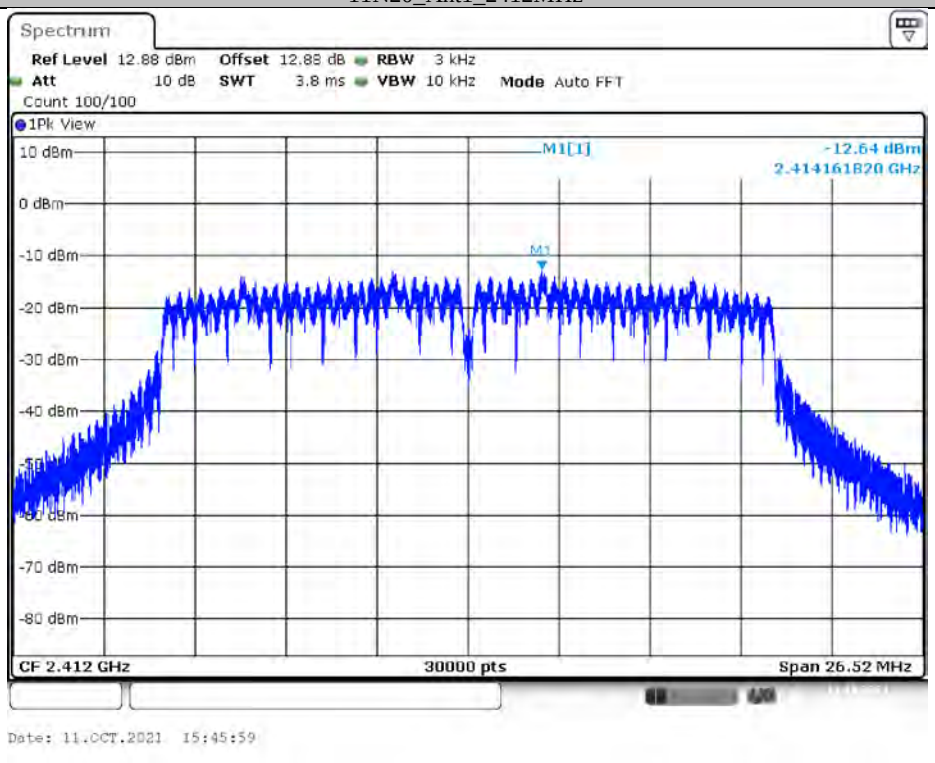
11G_Ant1_2437MHz



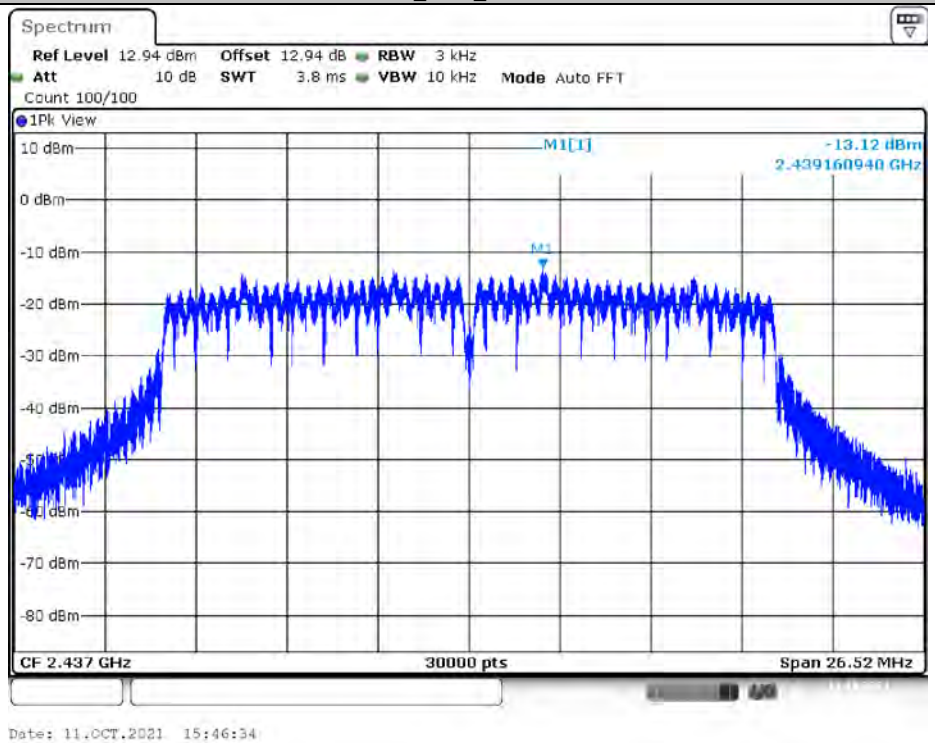
11G_Ant1_2462MHz



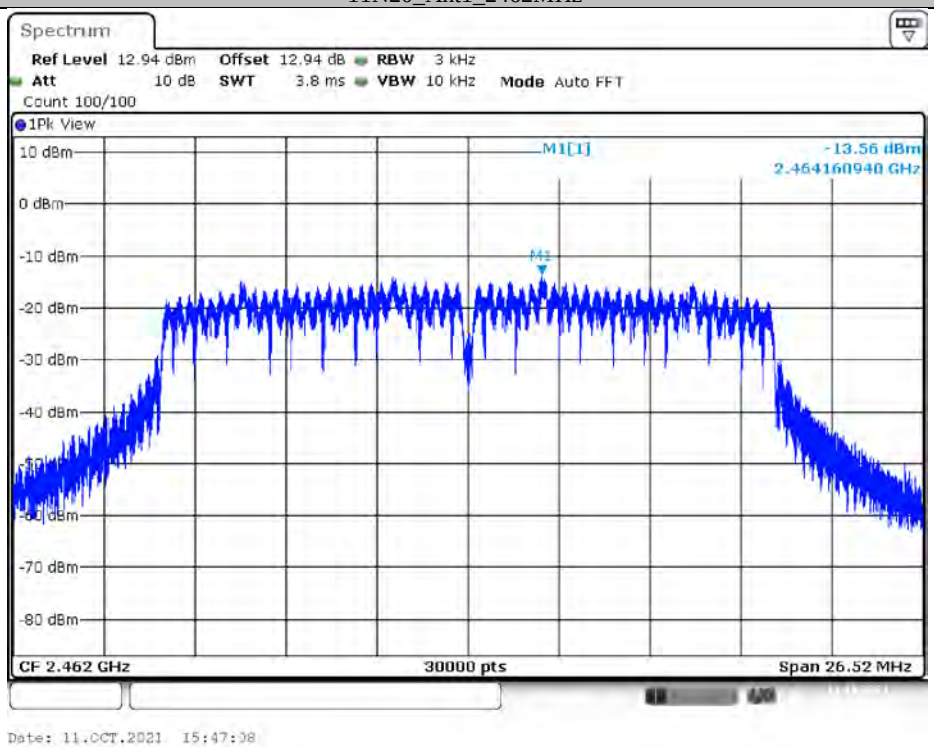
11N20_Ant1_2412MHz



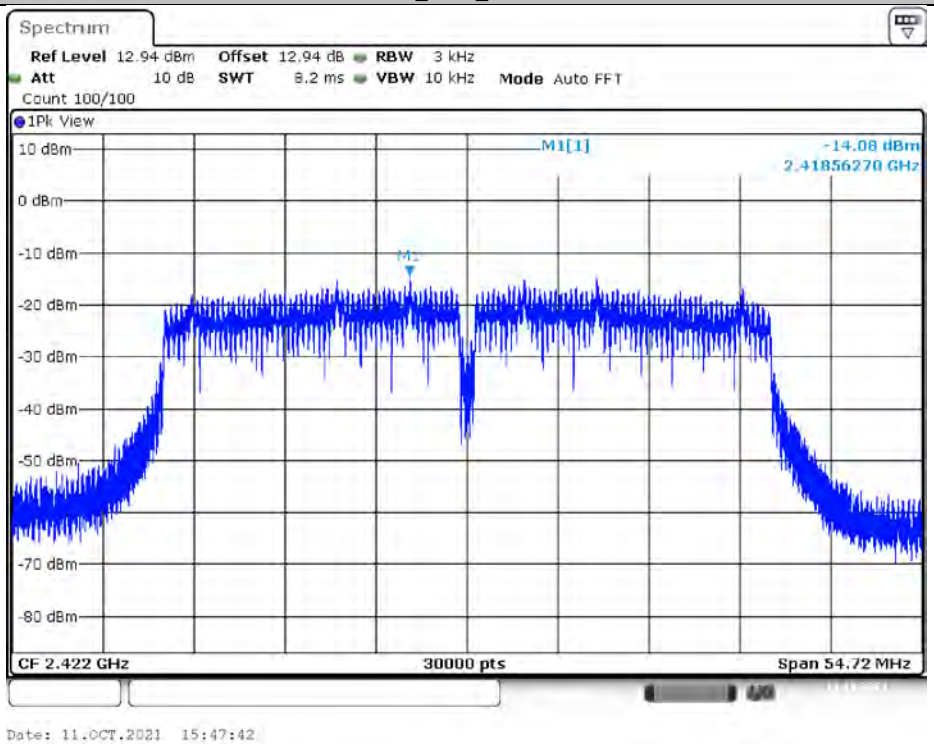
11N20_Ant1_2437MHz



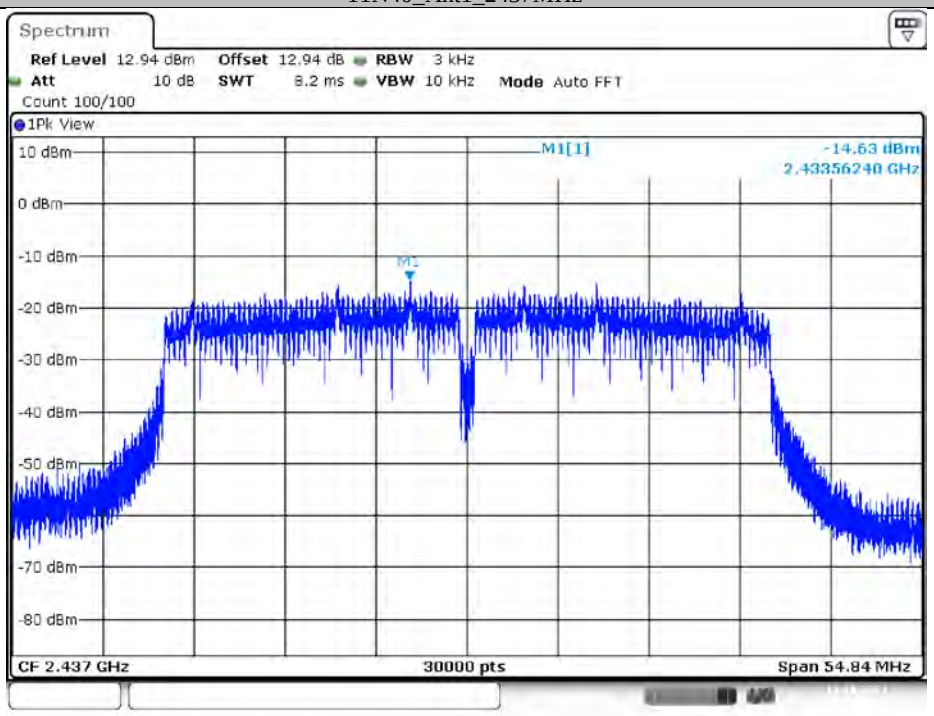
11N20_Ant1_2462MHz



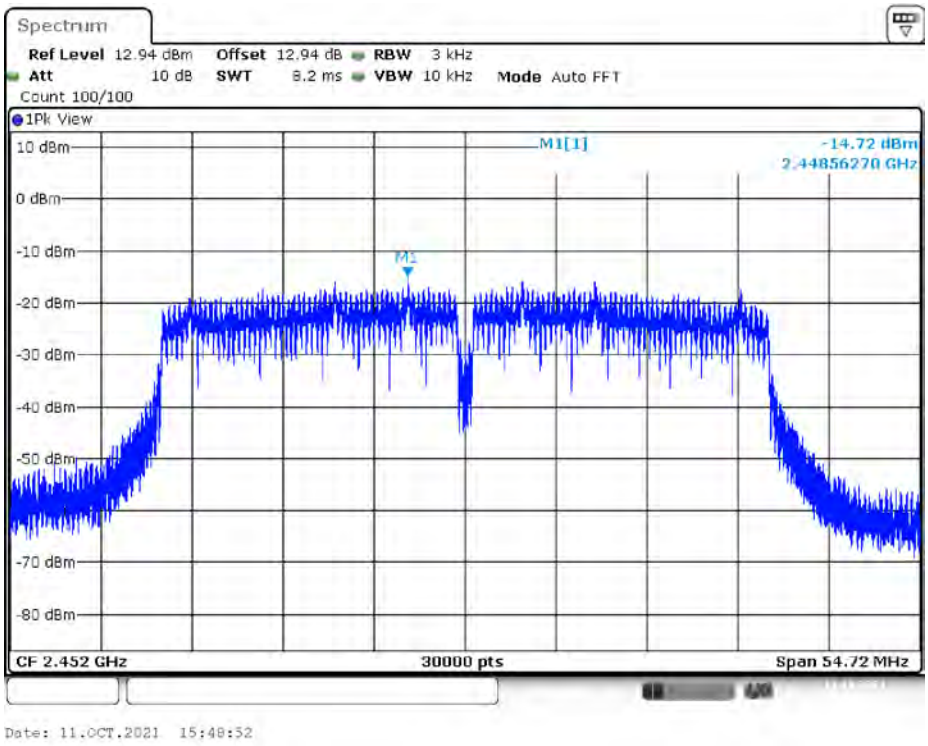
11N40 _Ant1_2422MHz



11N40_Ant1_2437MHz



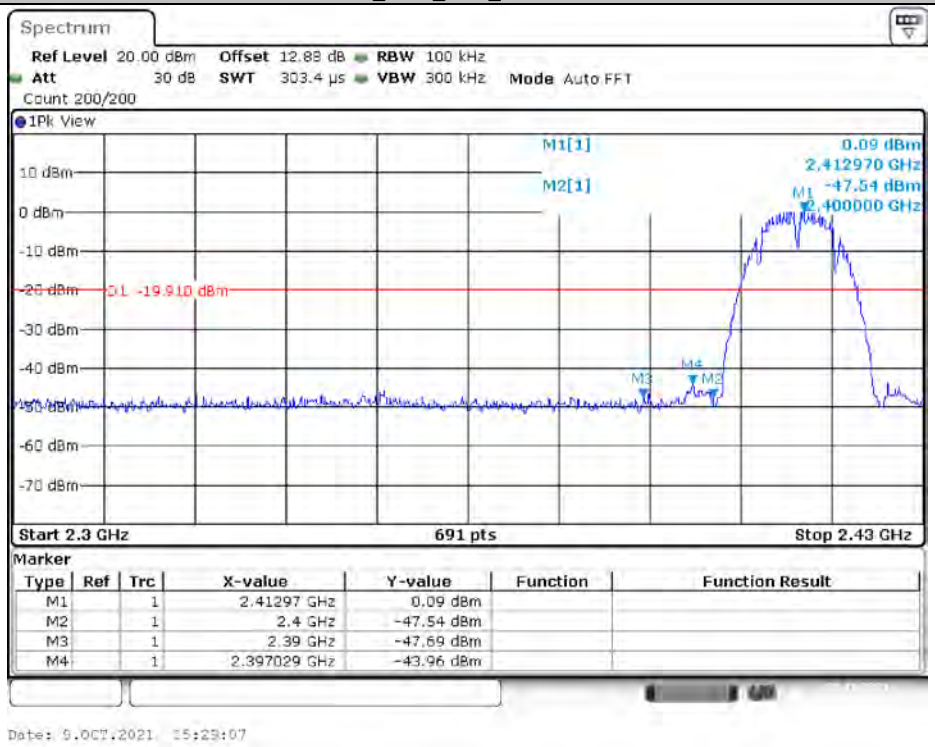
11N40_Ant1_2452MHz



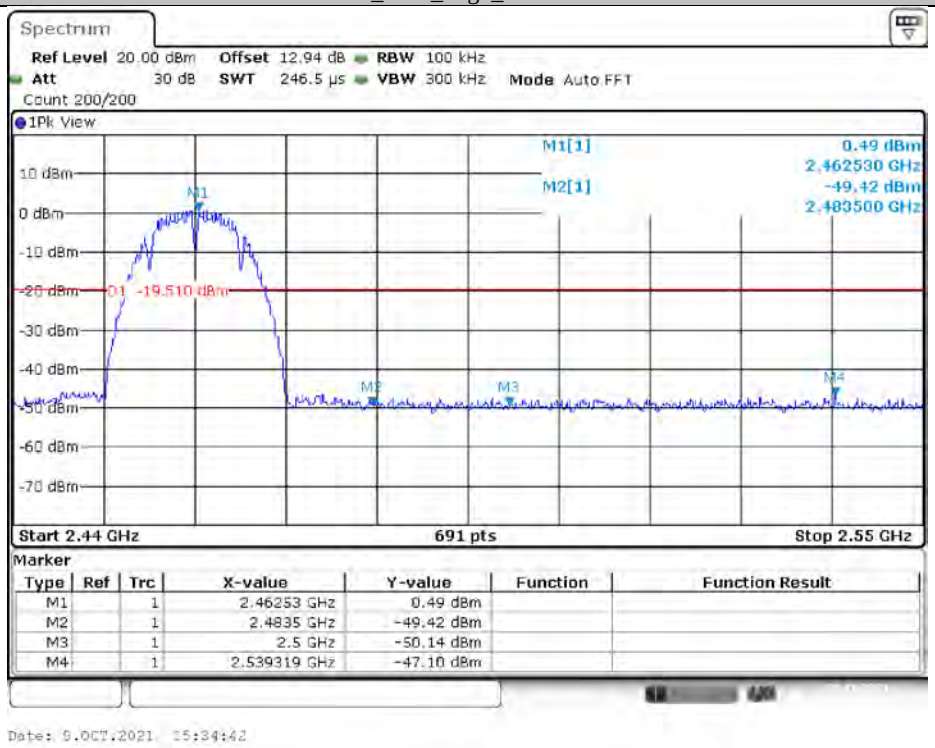
Appendix E: Band edge measurements

Test Graphs

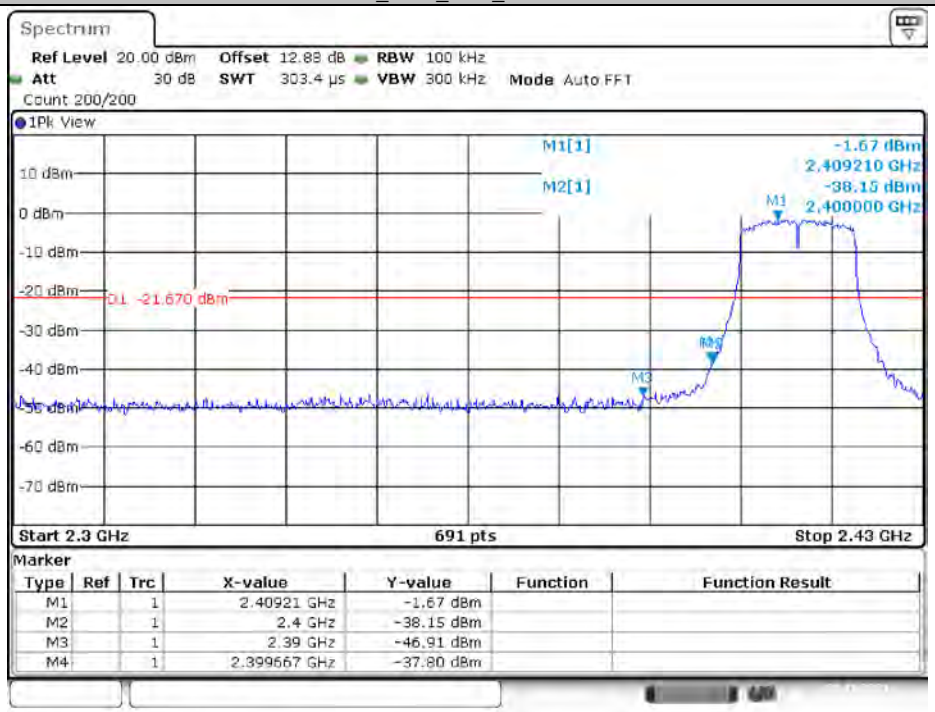
11B_Ant0_Low_2412MHz



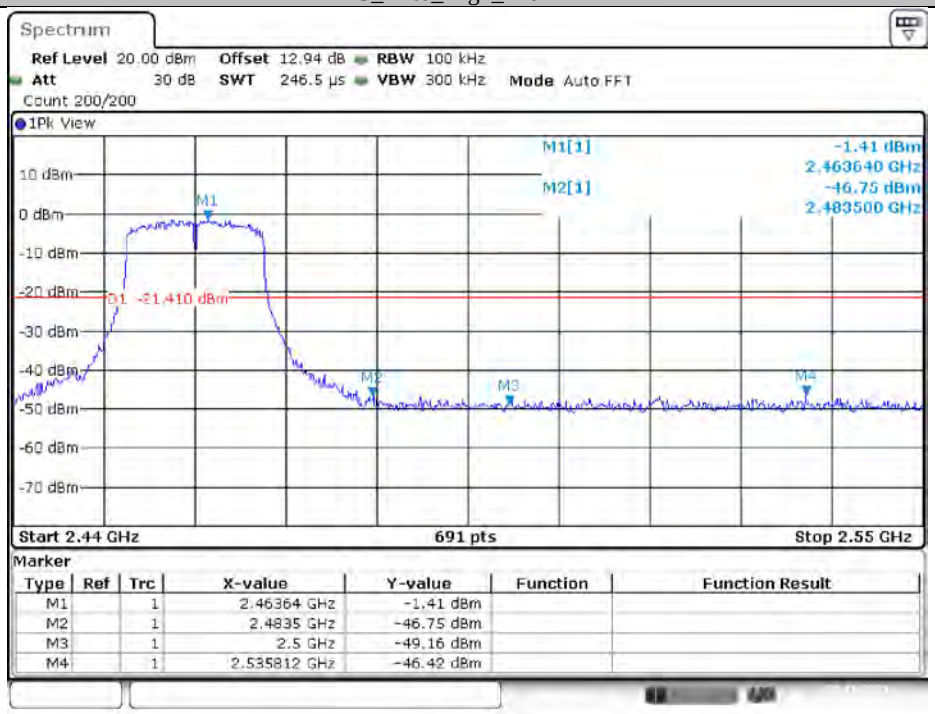
11B_Ant0_High_2462MHz



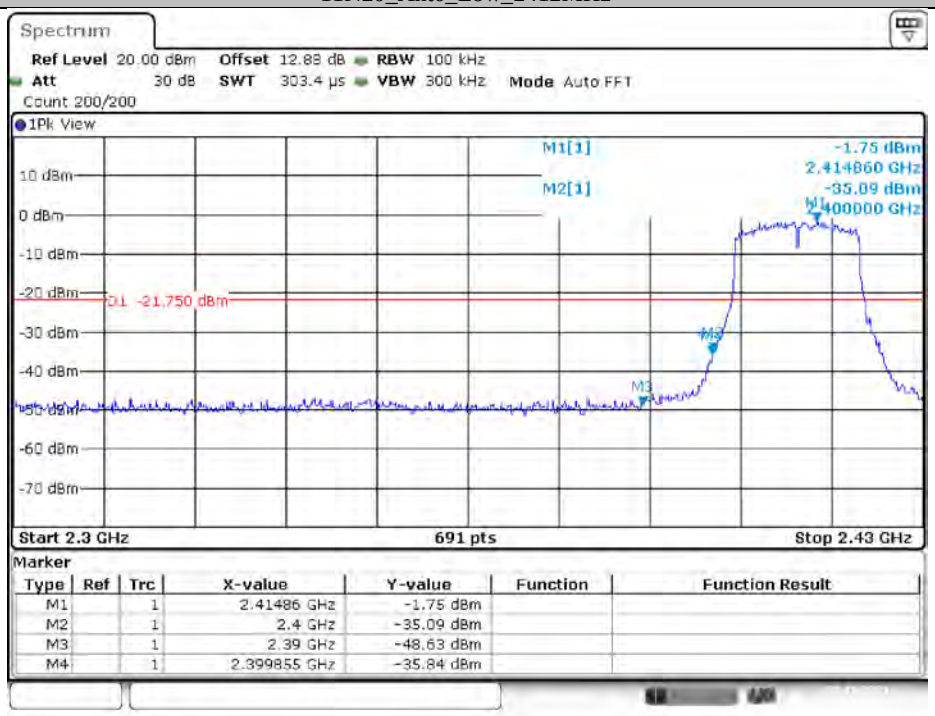
11G _Ant0_Low_2412MHz



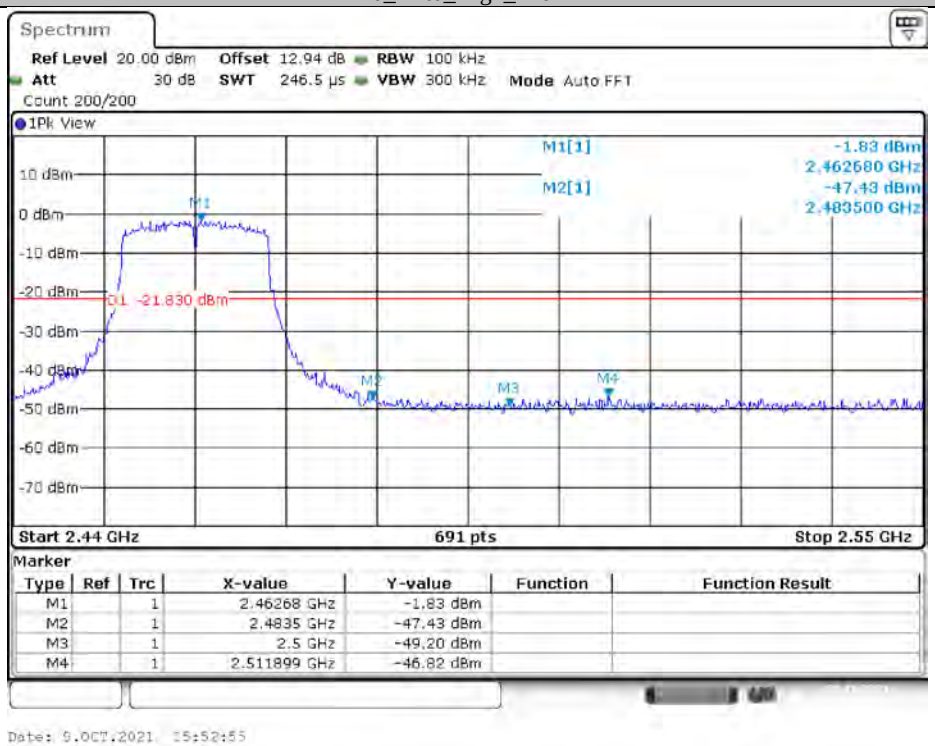
11G_Ant0_High_2462MHz



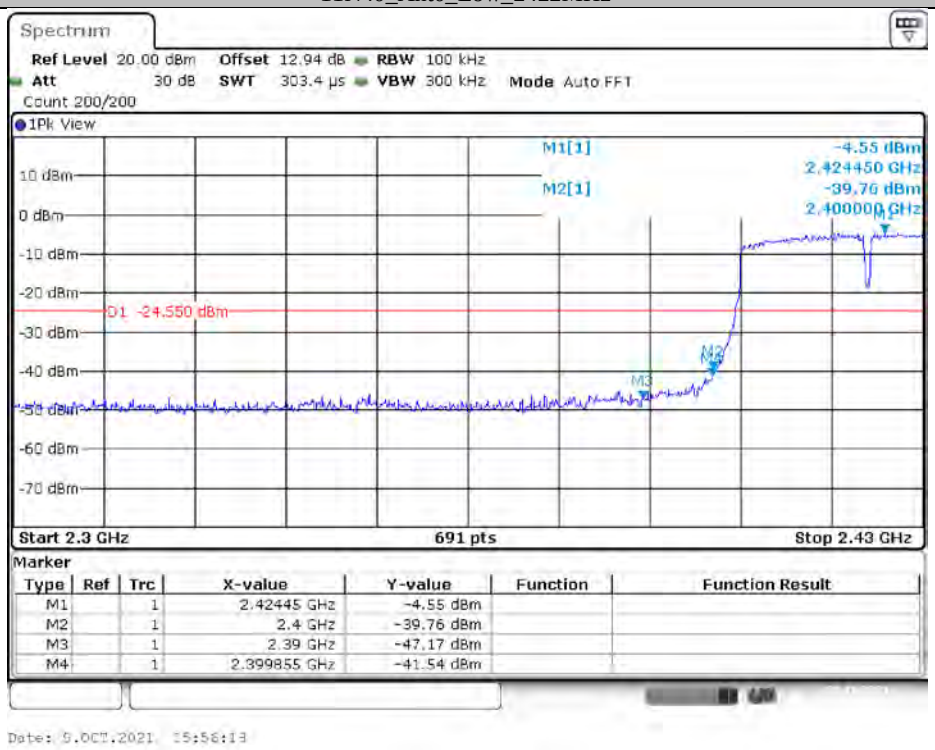
11N20_Ant0_Low_2412MHz



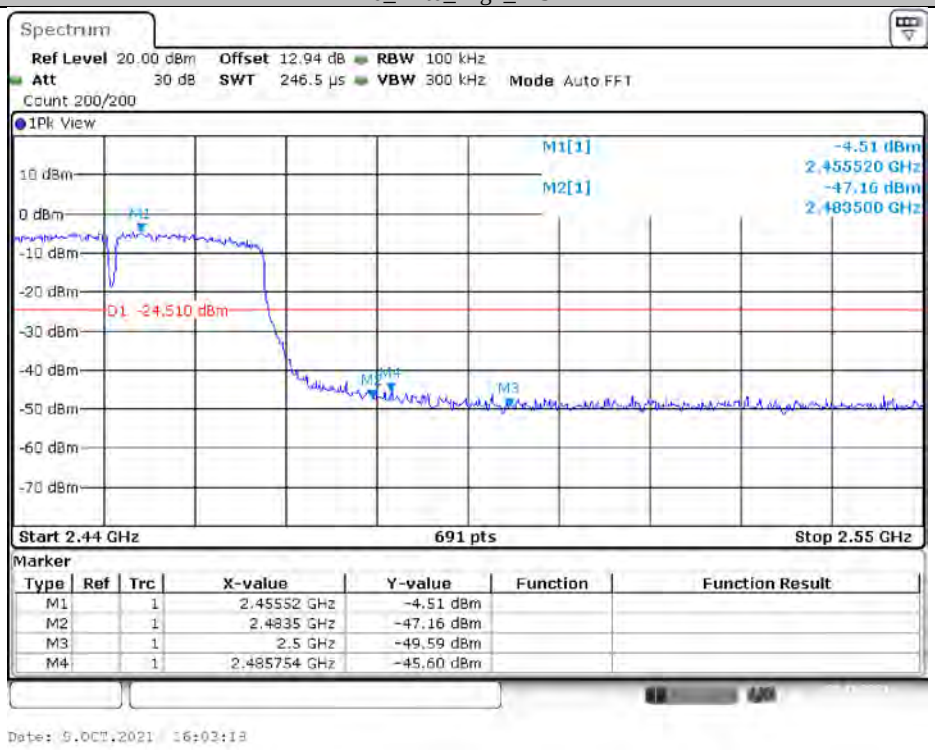
11N20_Ant0_High_2462MHz



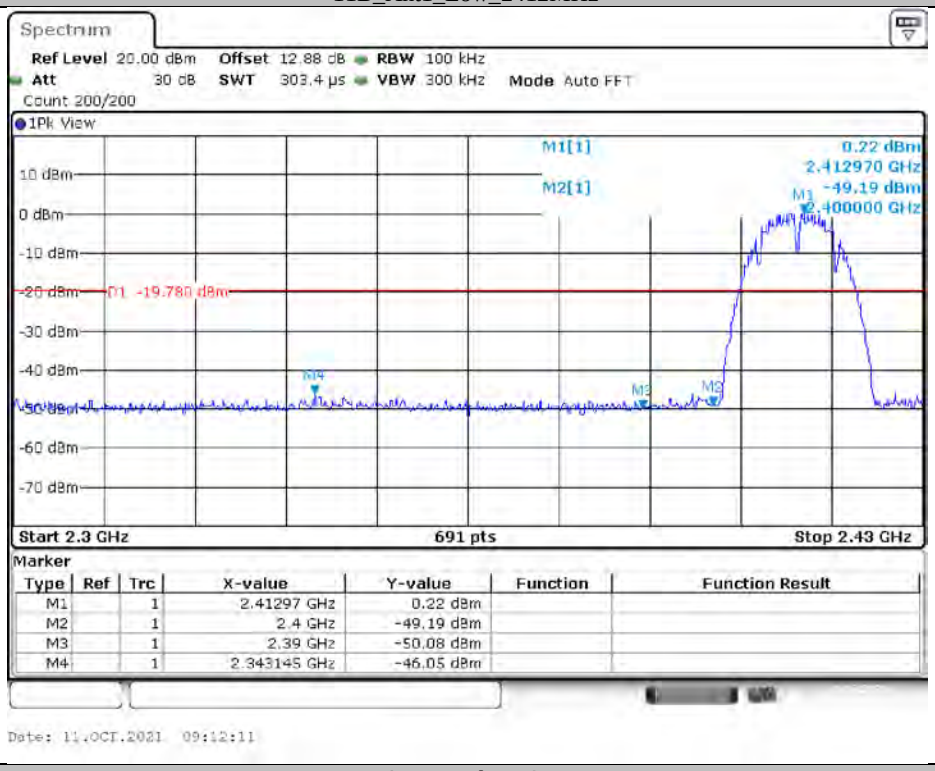
11N40_Ant0_Low_2422MHz



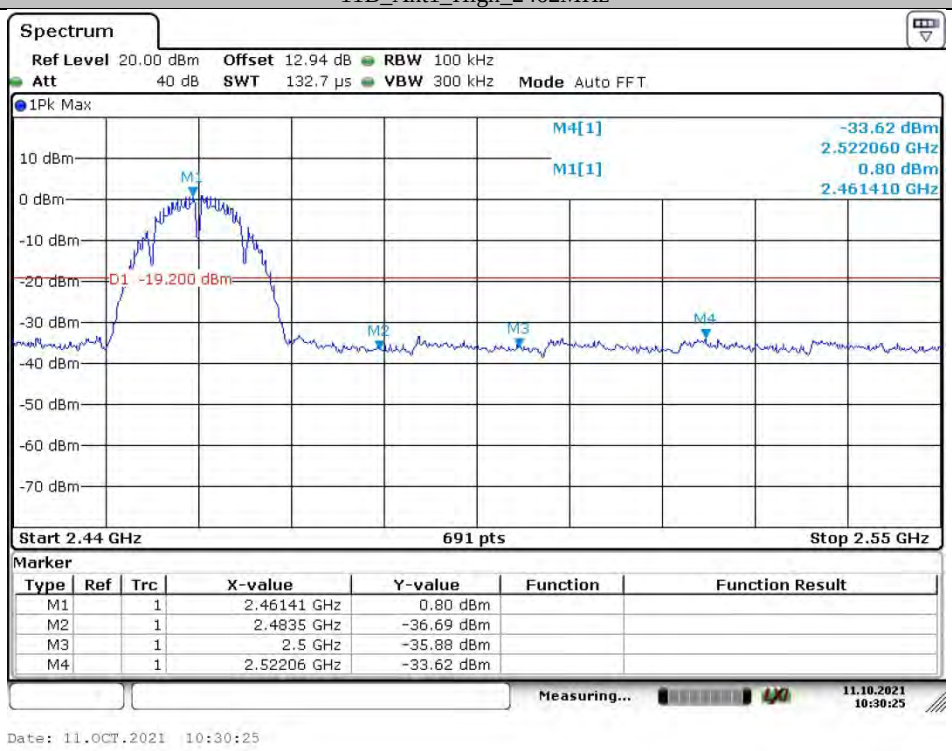
11N40_Ant0_High_2452MHz



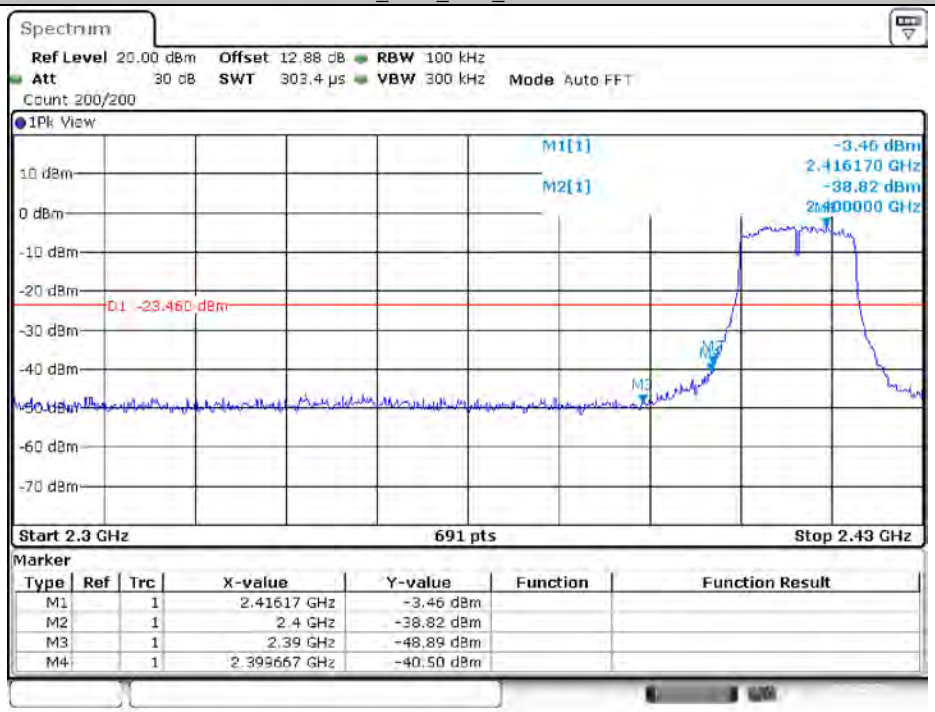
11B_Ant1_Low_2412MHz



11B_Ant1_High_2462MHz



11G _Ant1_Low_2412MHz

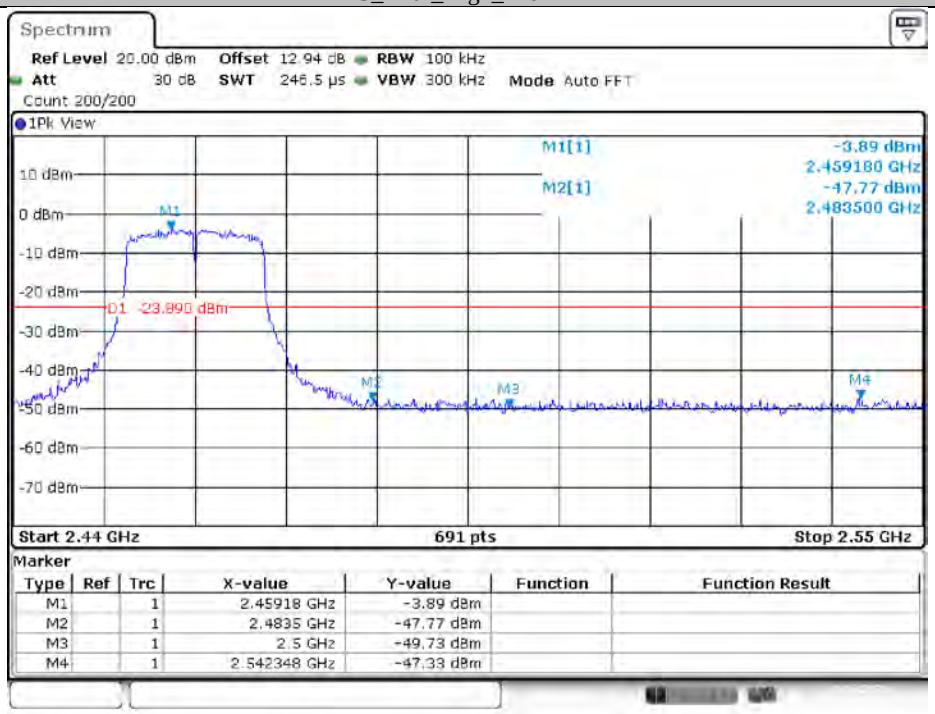


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41617 GHz	-3.46 dBm		
M2		1	2.4 GHz	-38.82 dBm		
M3		1	2.39 GHz	-48.89 dBm		
M4		1	2.399667 GHz	-40.50 dBm		

Date: 11.OCT.2021 09:22:05

11G_Ant1_High_2462MHz

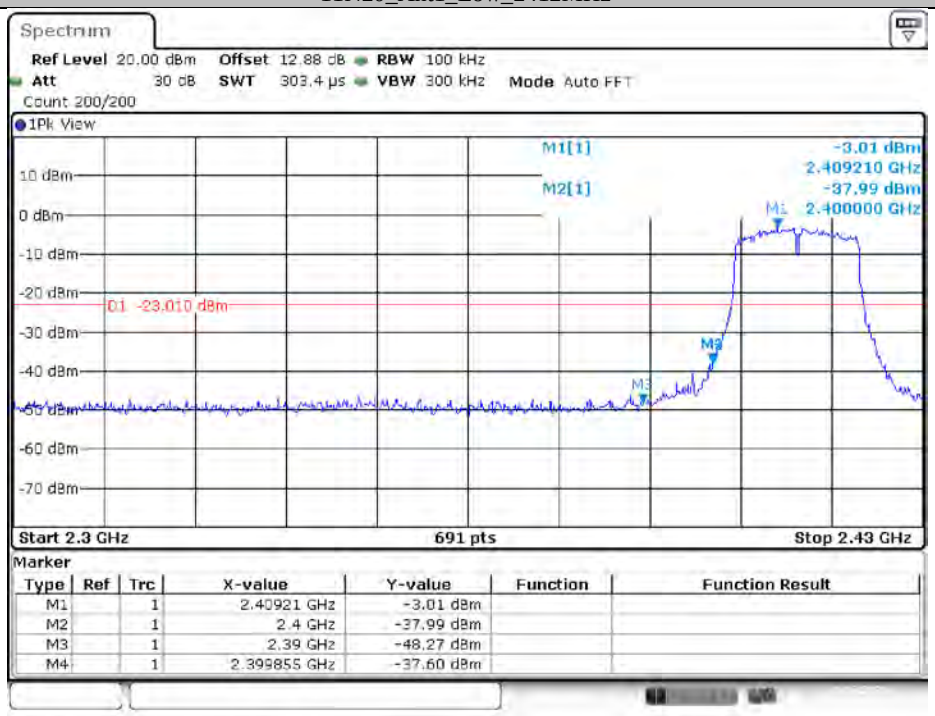


Marker

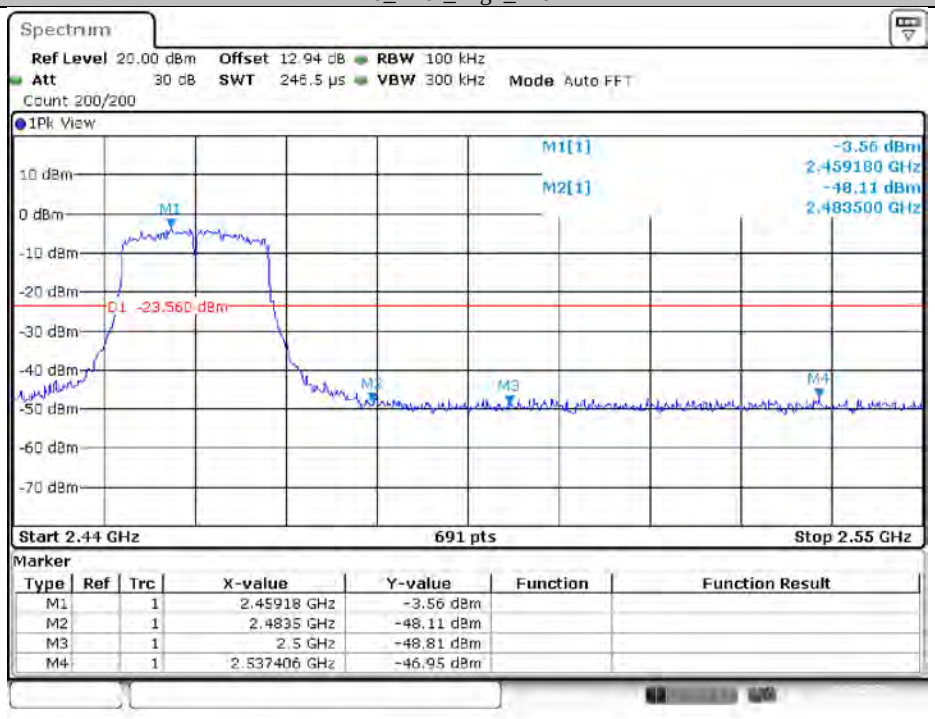
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.45918 GHz	-3.89 dBm		
M2		1	2.4835 GHz	-47.77 dBm		
M3		1	2.5 GHz	-49.73 dBm		
M4		1	2.542348 GHz	-47.33 dBm		

Date: 11.OCT.2021 09:27:30

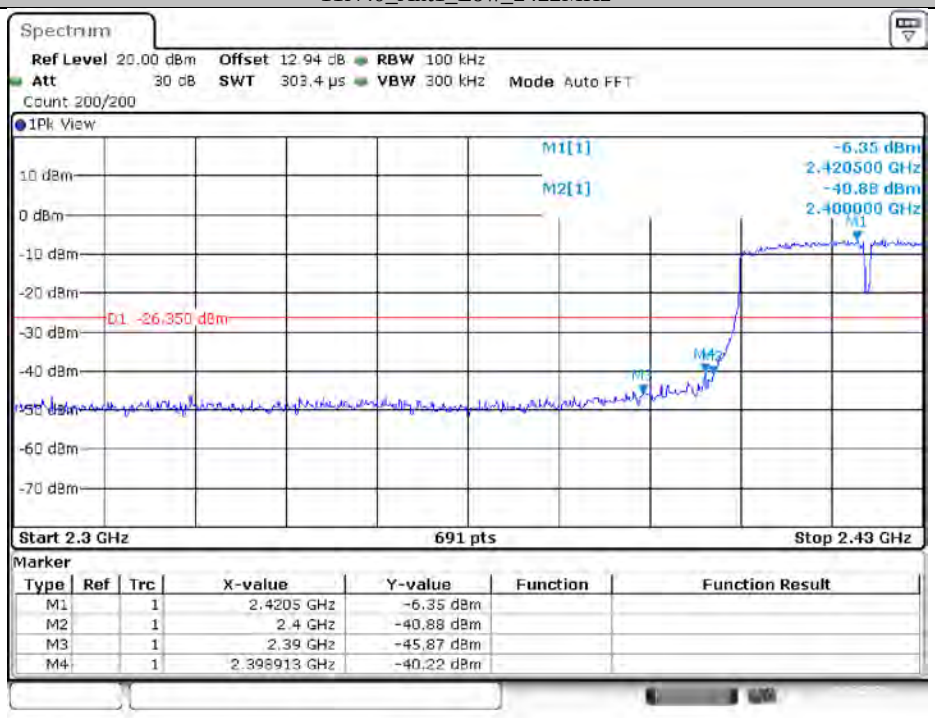
11N20_Ant1_Low_2412MHz



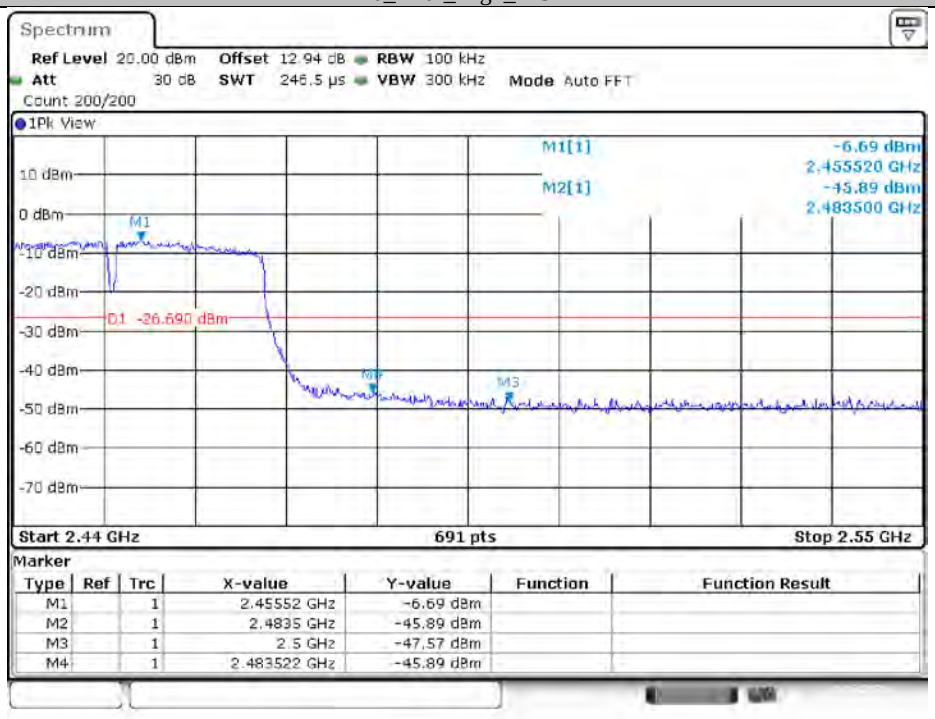
11N20_Ant1_High_2462MHz



11N40_Ant1_Low_2422MHz



11N40_Ant1_High_2452MHz



Appendix F: Duty Cycle

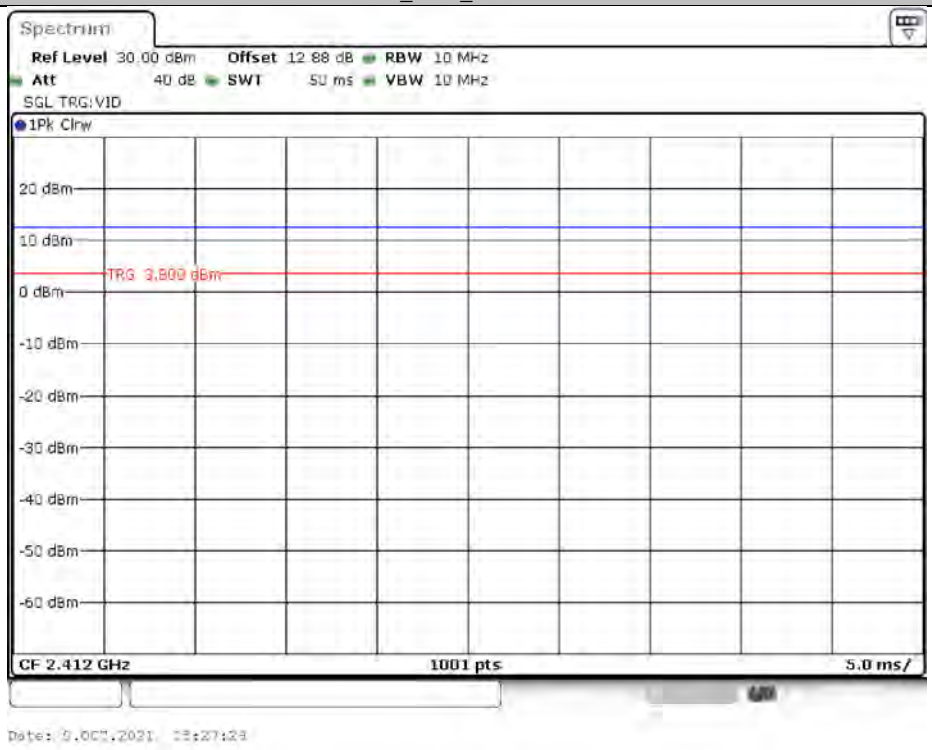
Test Result

TestMode	Antenna	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant0	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11G	Ant0	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11N20	Ant0	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11N40	Ant0	2422	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2452	50.00	50.00	100.00

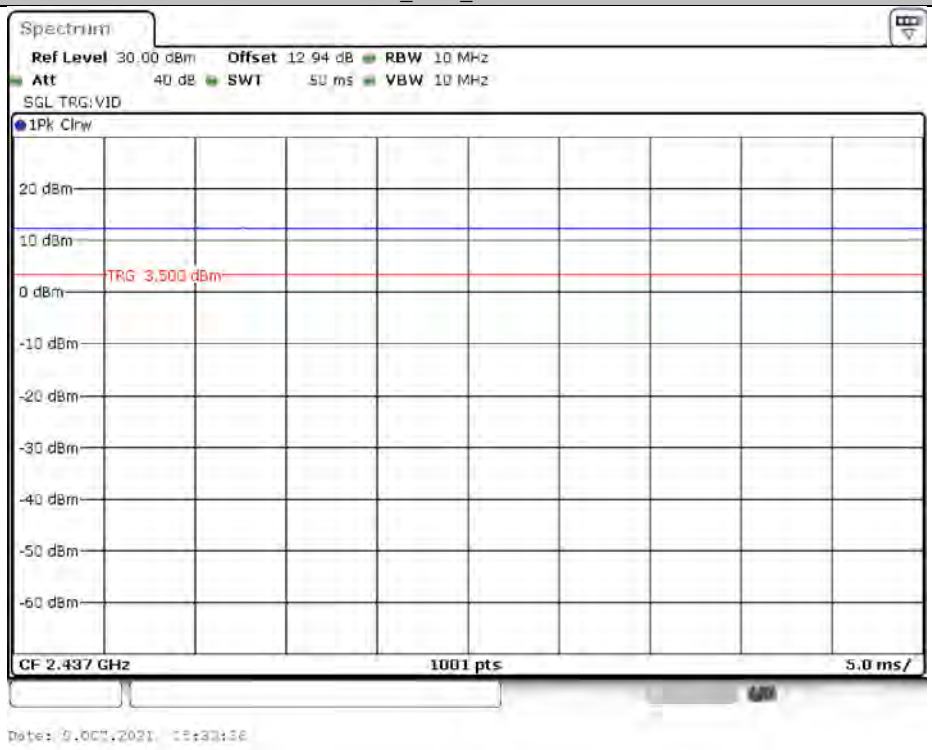
TestMode	Antenna	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11G	Ant1	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11N20	Ant1	2412	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2462	50.00	50.00	100.00
11N40	Ant1	2422	50.00	50.00	100.00
		2437	50.00	50.00	100.00
		2452	50.00	50.00	100.00

Test Graphs

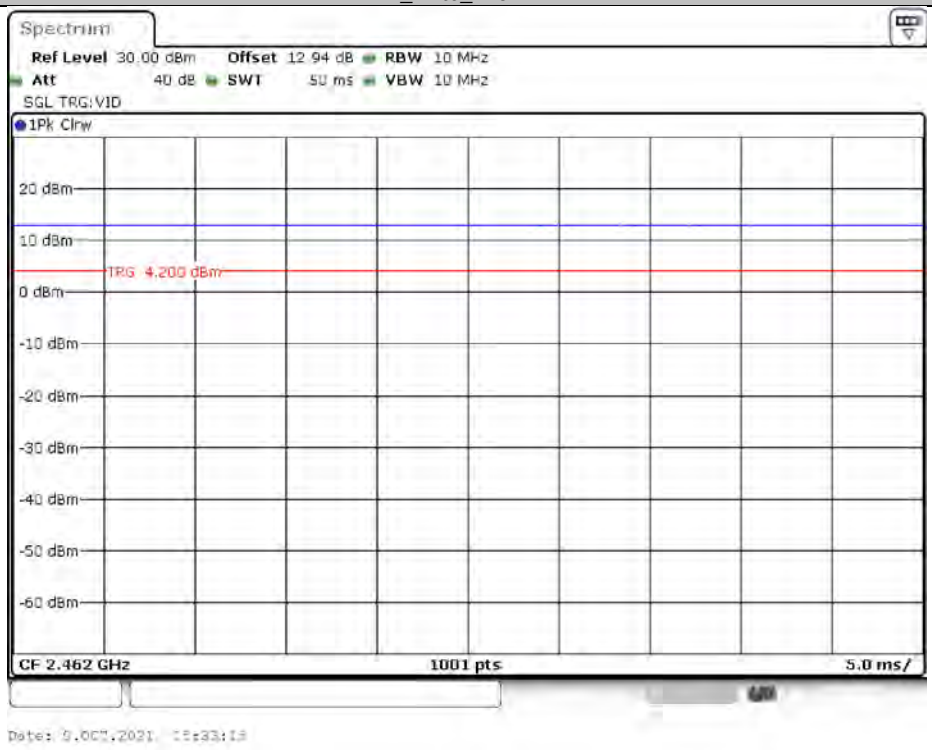
11B_Ant0_2412MHz



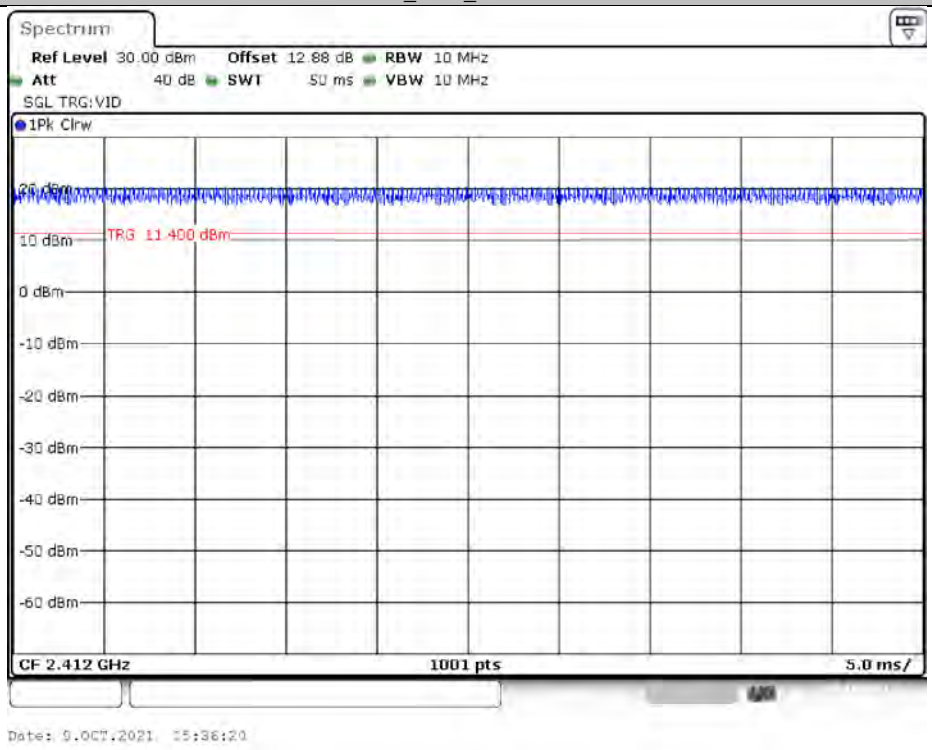
11B_Ant0_2437MHz



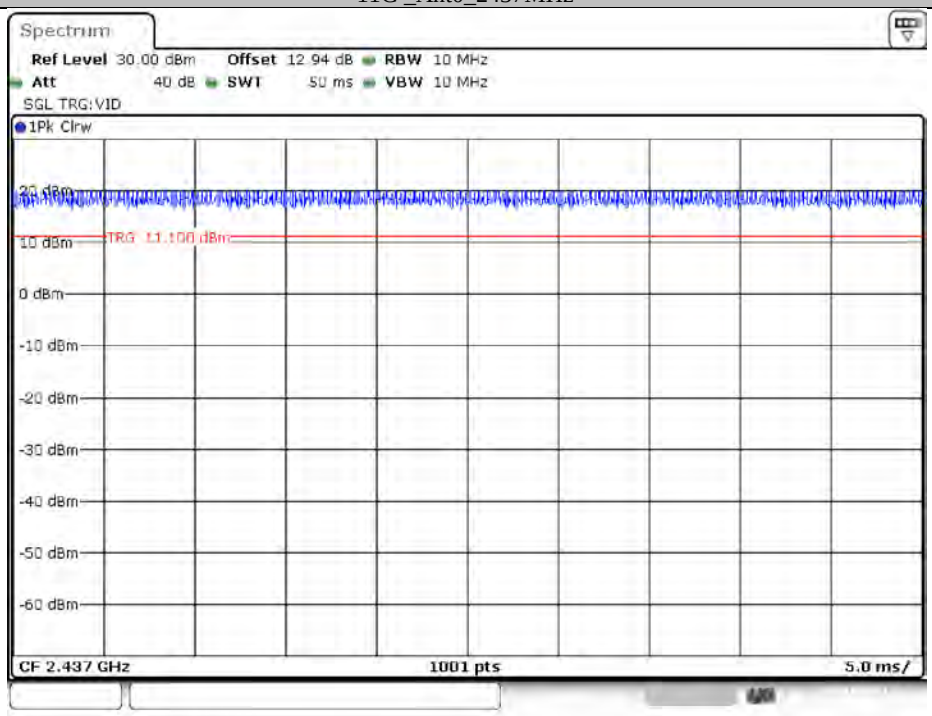
11B_Ant0_2462MHz



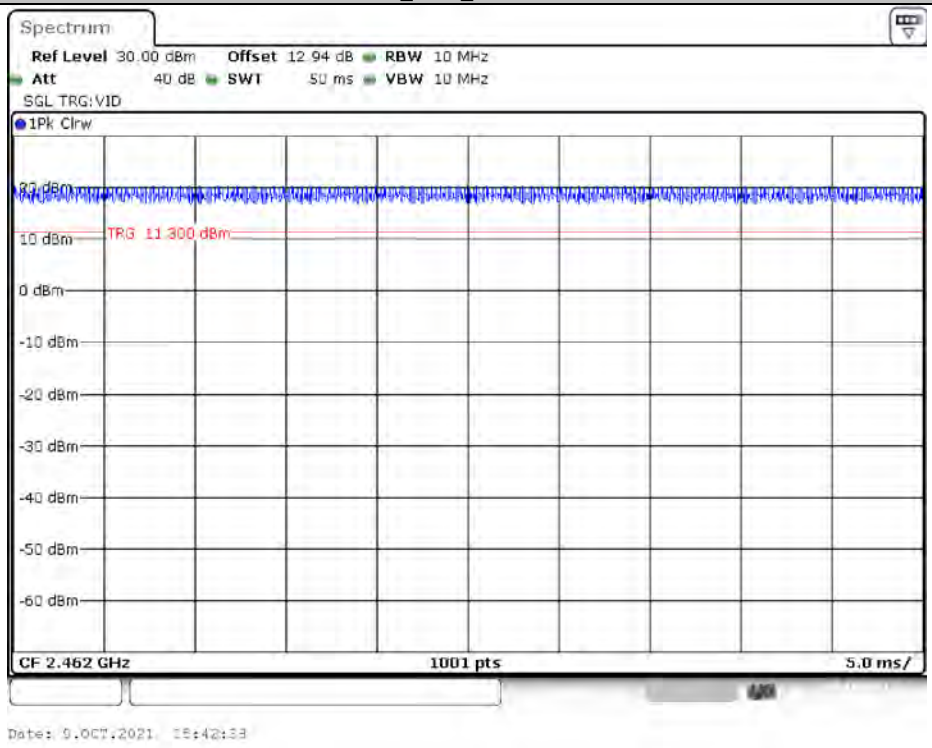
11G _Ant0_2412MHz



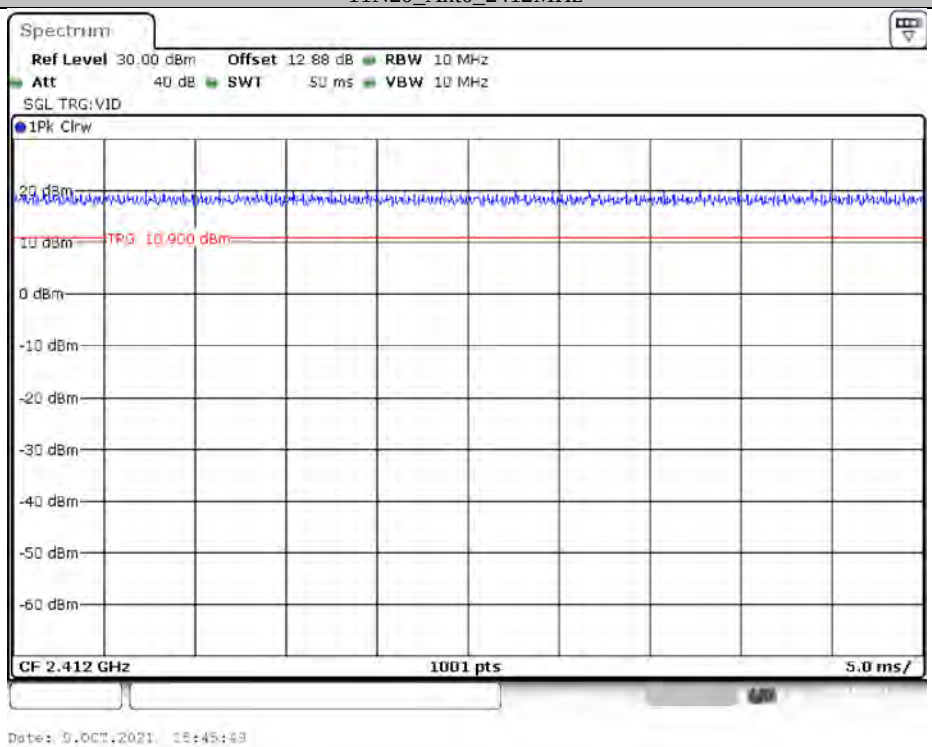
11G _Ant0_2437MHz



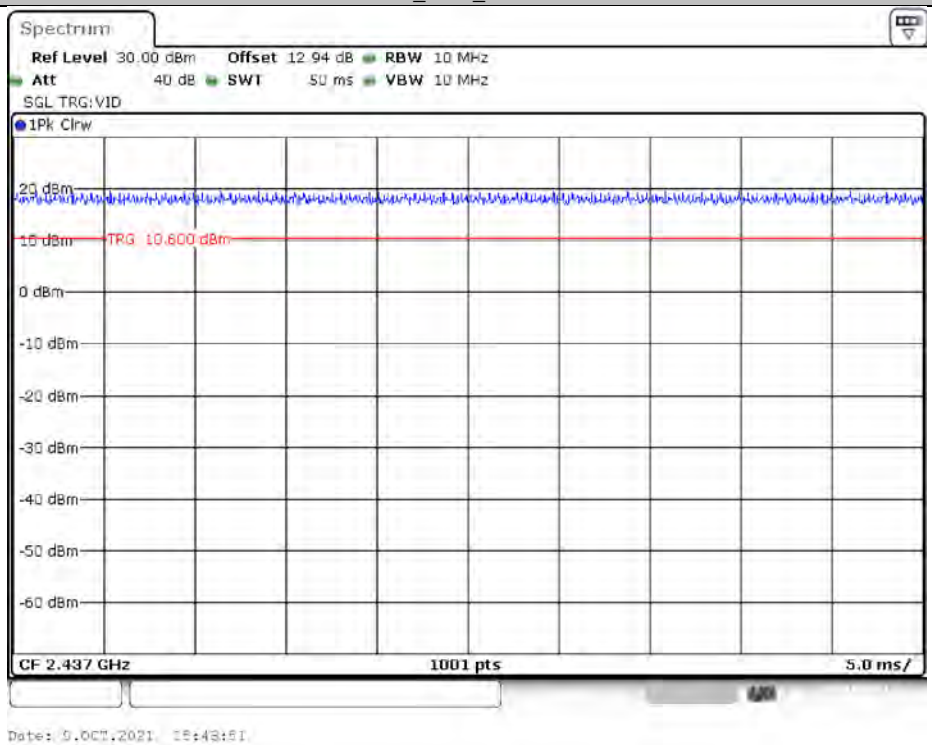
11G_Ant0_2462MHz



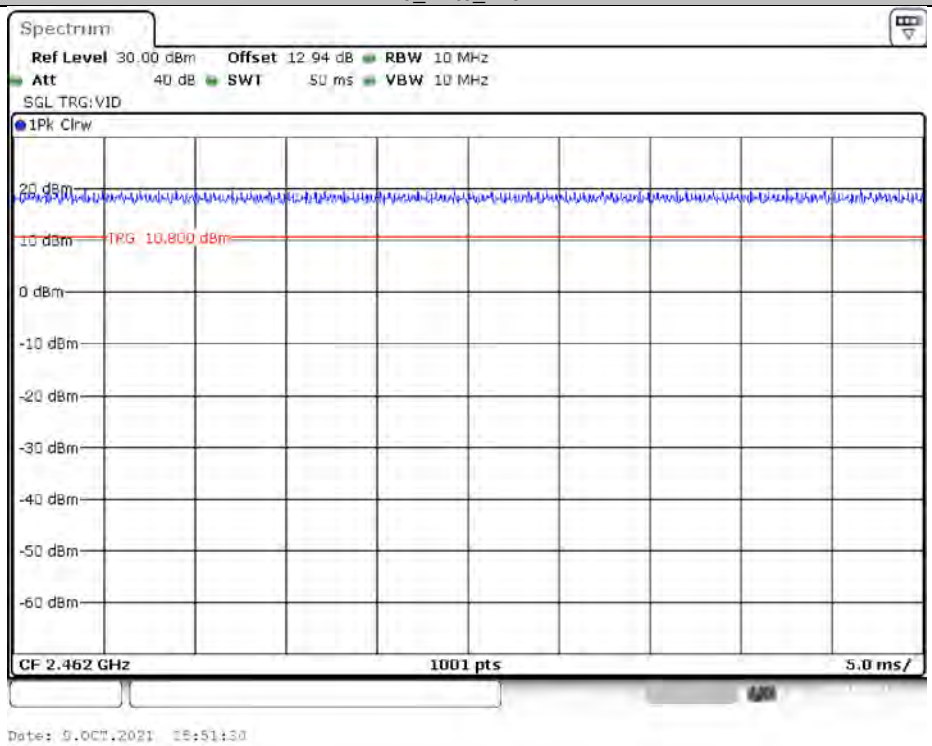
11N20_Ant0_2412MHz



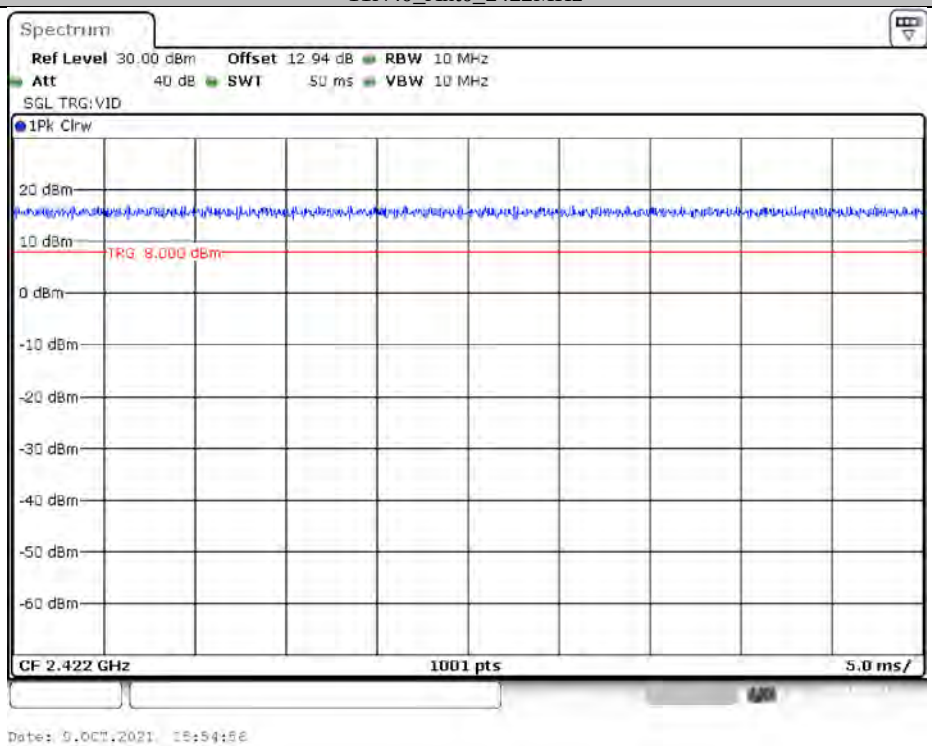
11N20_Ant0_2437MHz



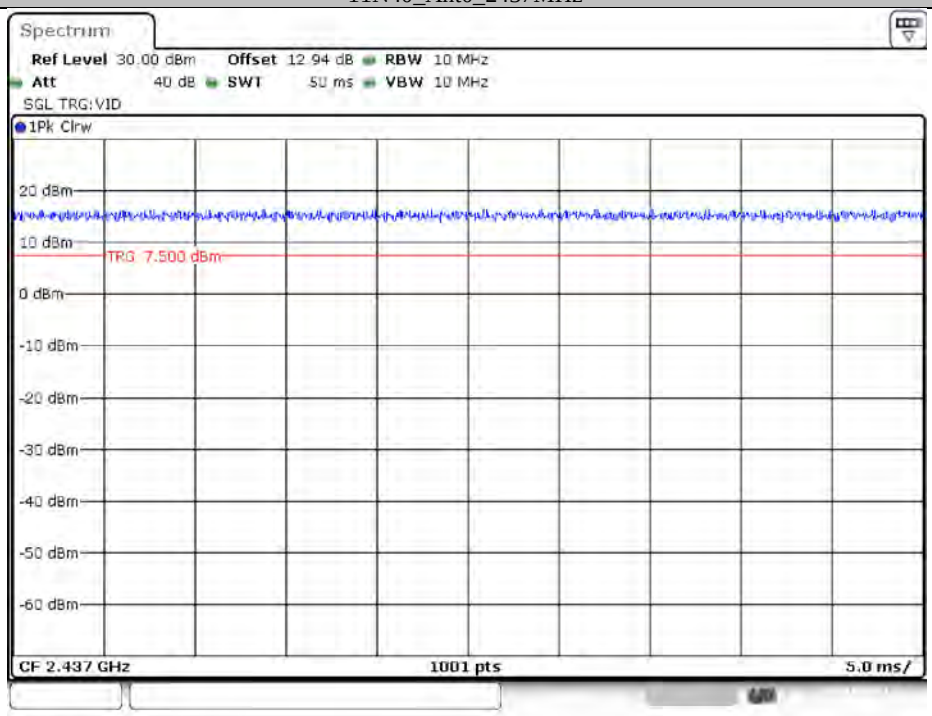
11N20_Ant0_2462MHz



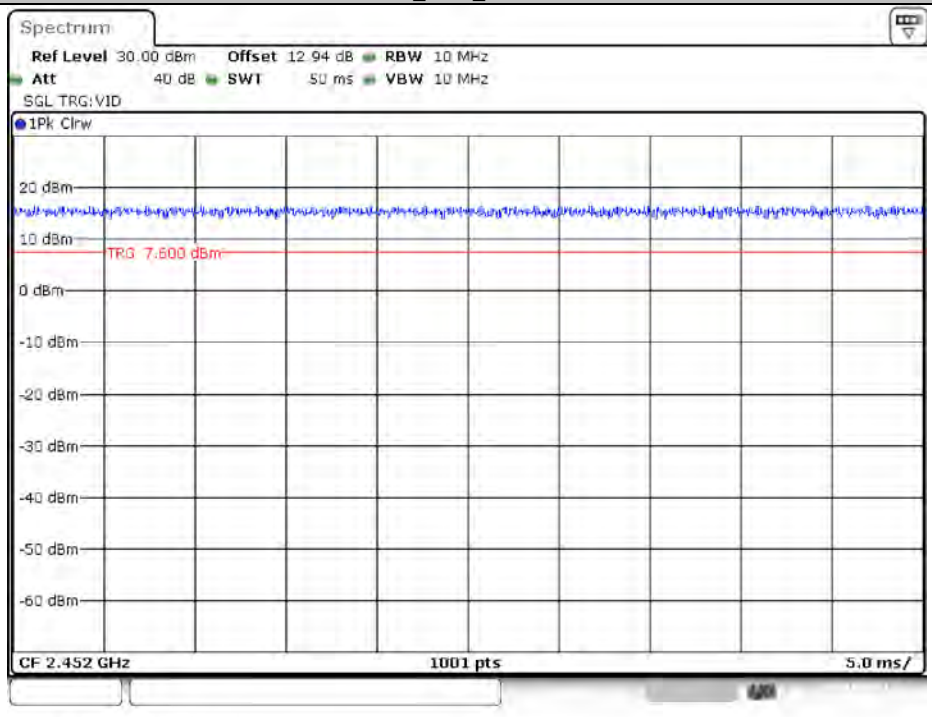
11N40_Ant0_2422MHz

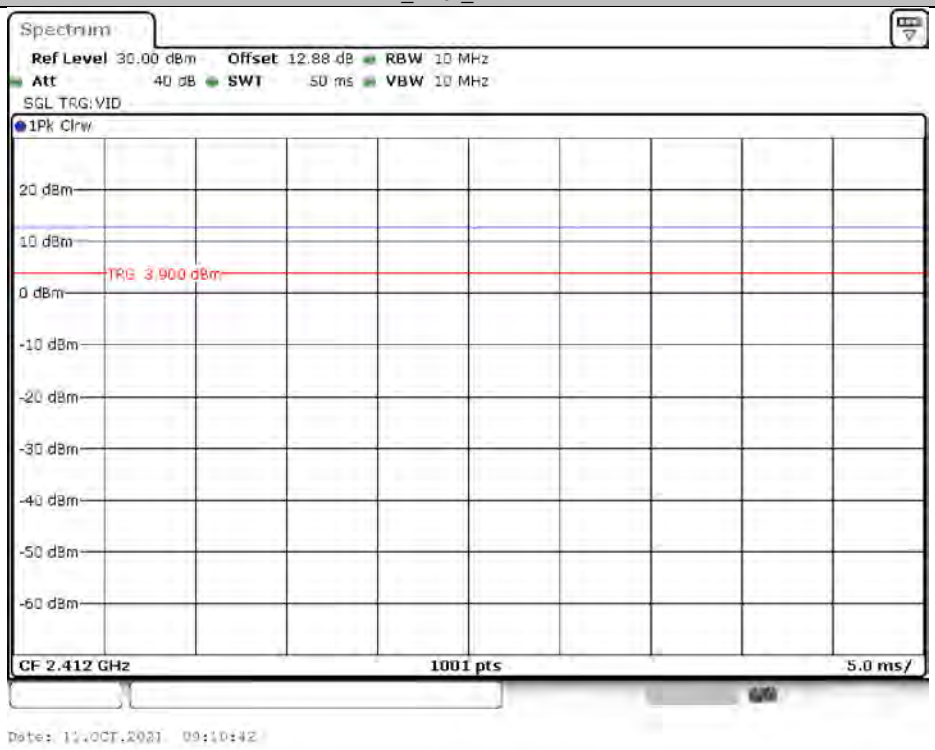


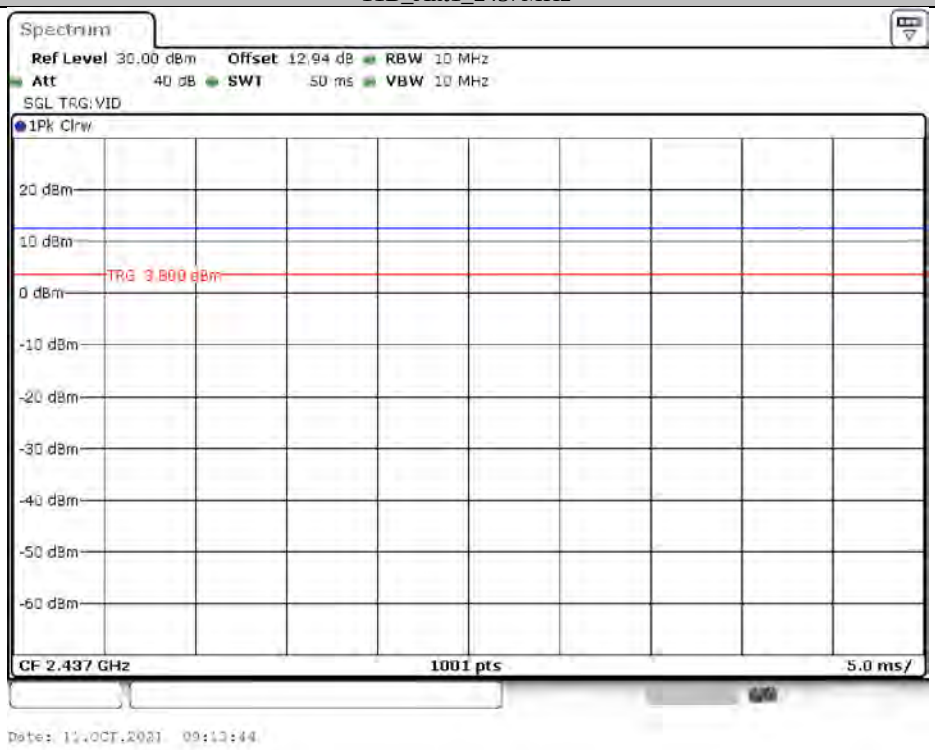
11N40_Ant0_2437MHz



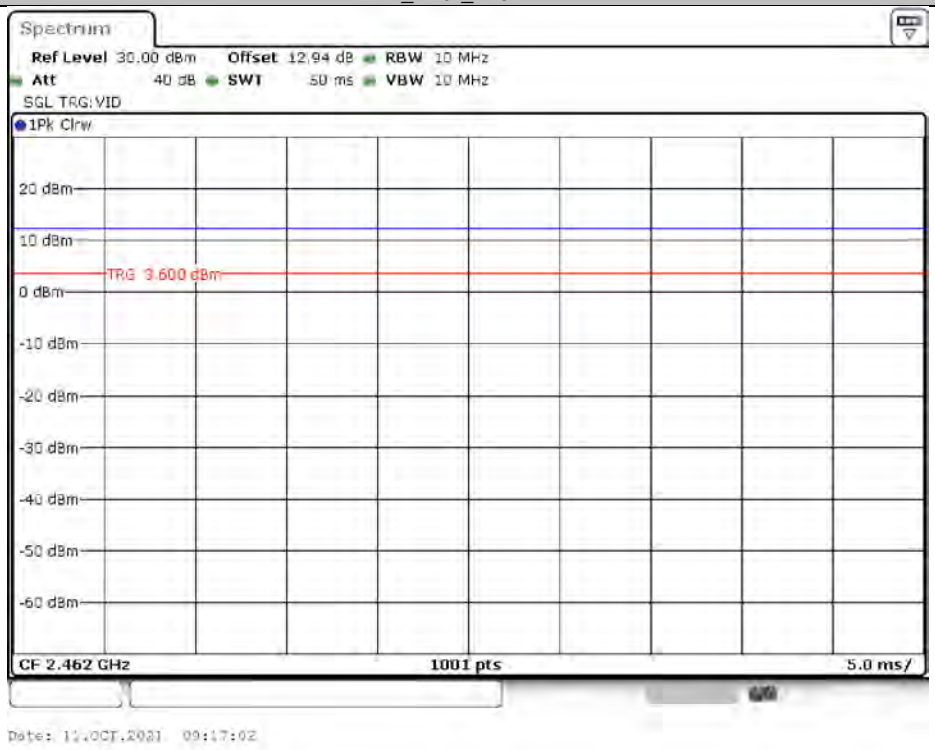
11N40_Ant0_2452MHz



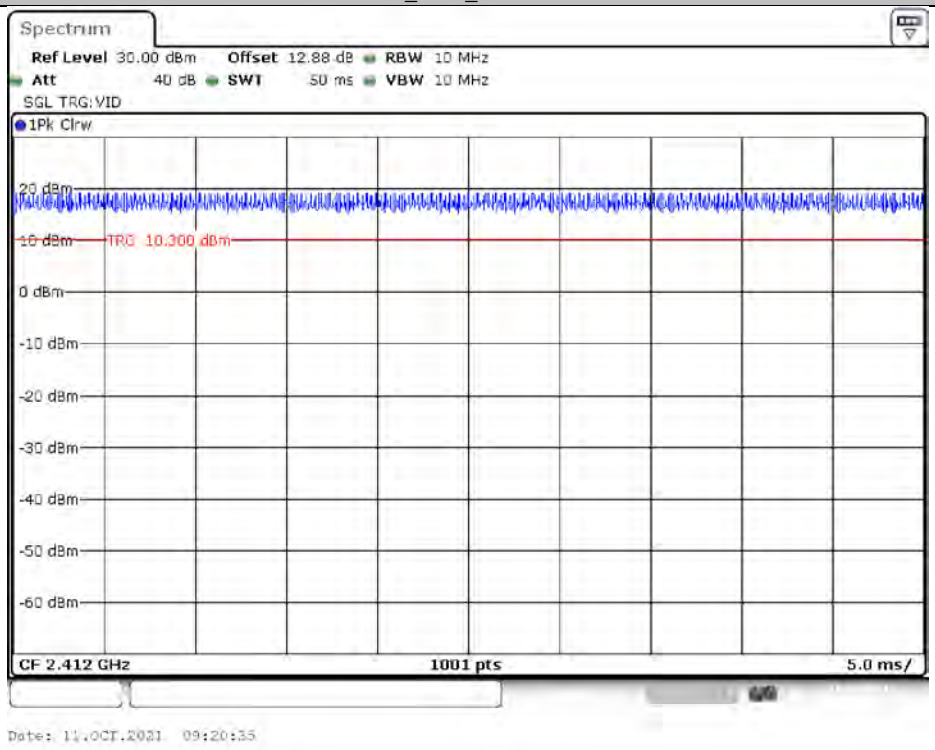
11B_Ant1_2412MHz


11B_Ant1_2437MHz


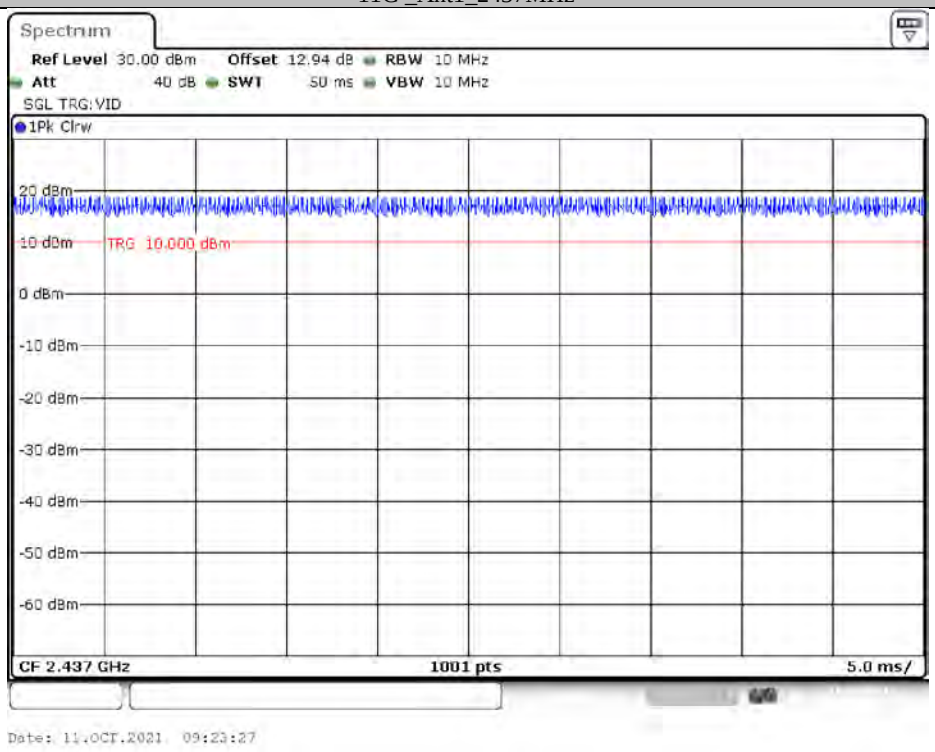
11B_Ant1_2462MHz



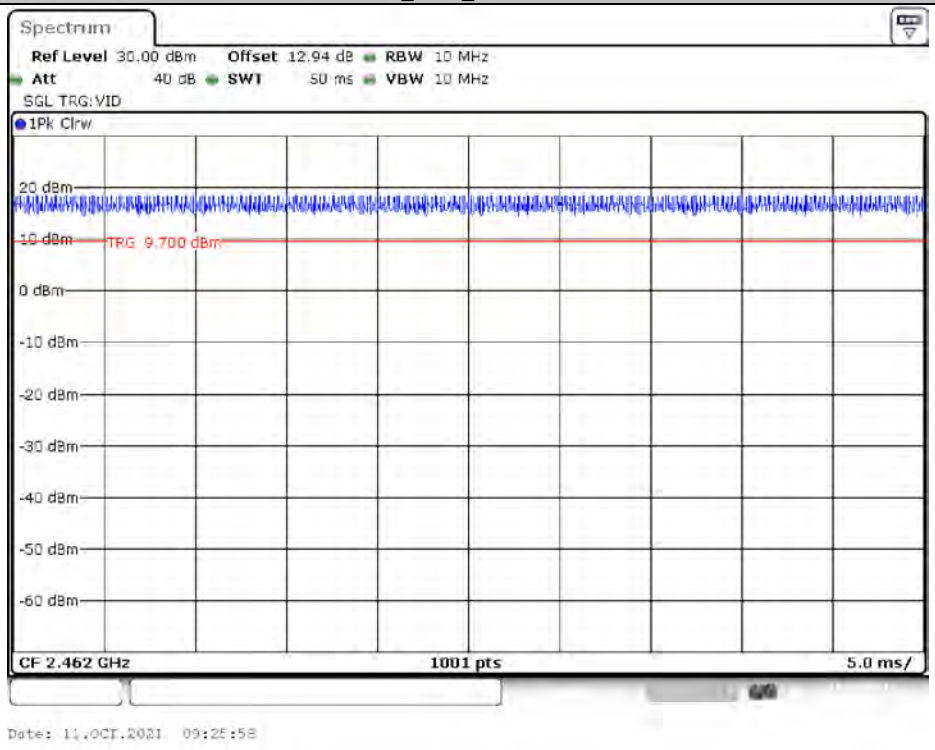
11G _Ant1_2412MHz



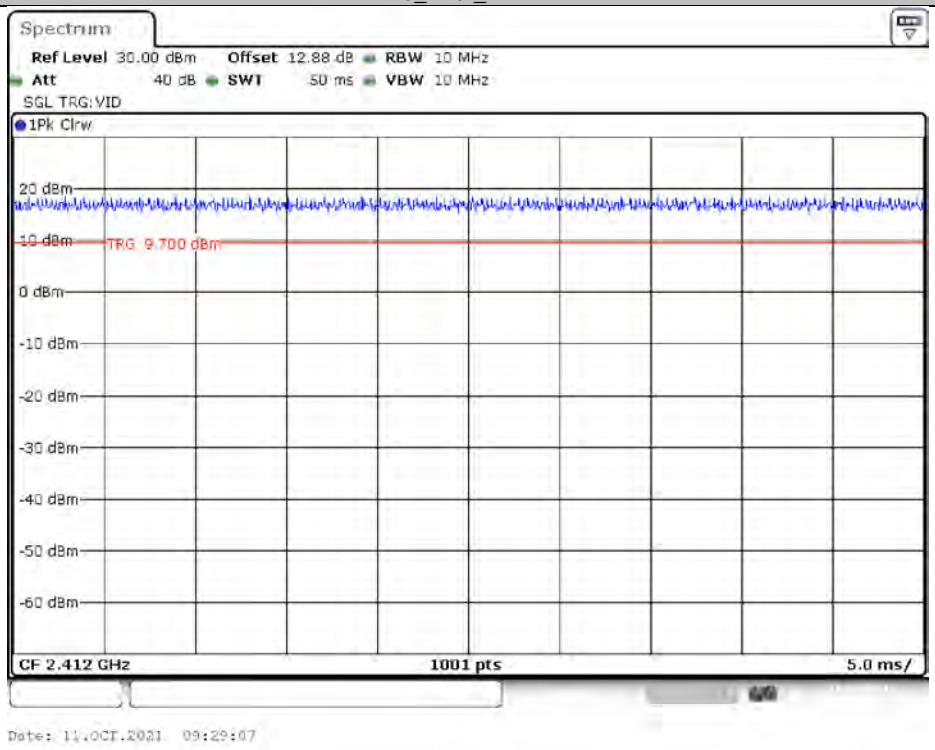
11G _Ant1_2437MHz



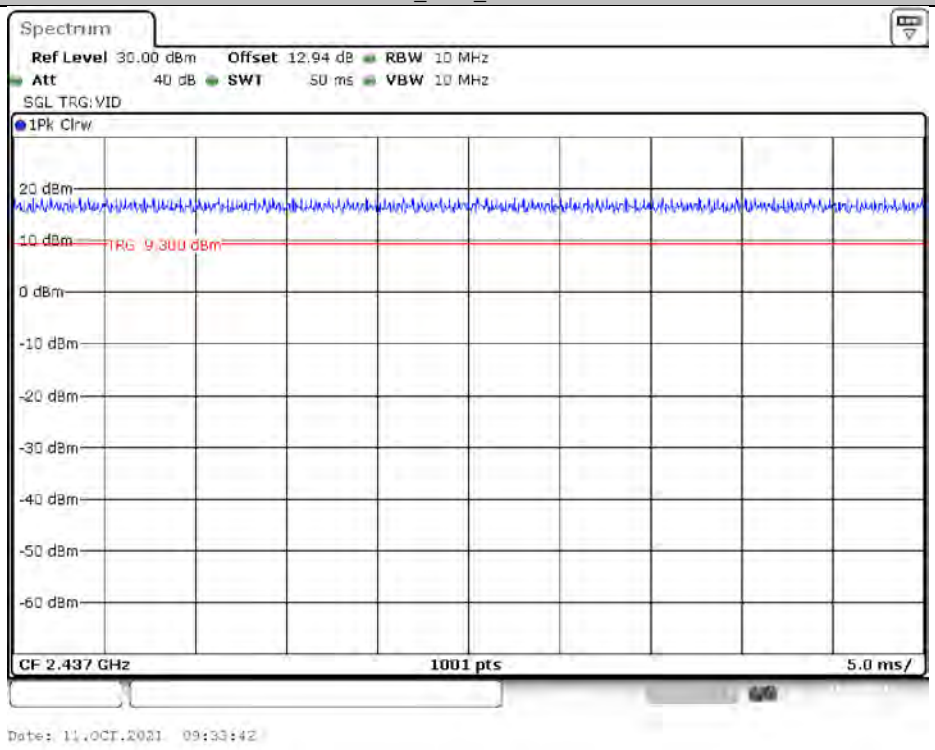
11G_Ant1_2462MHz



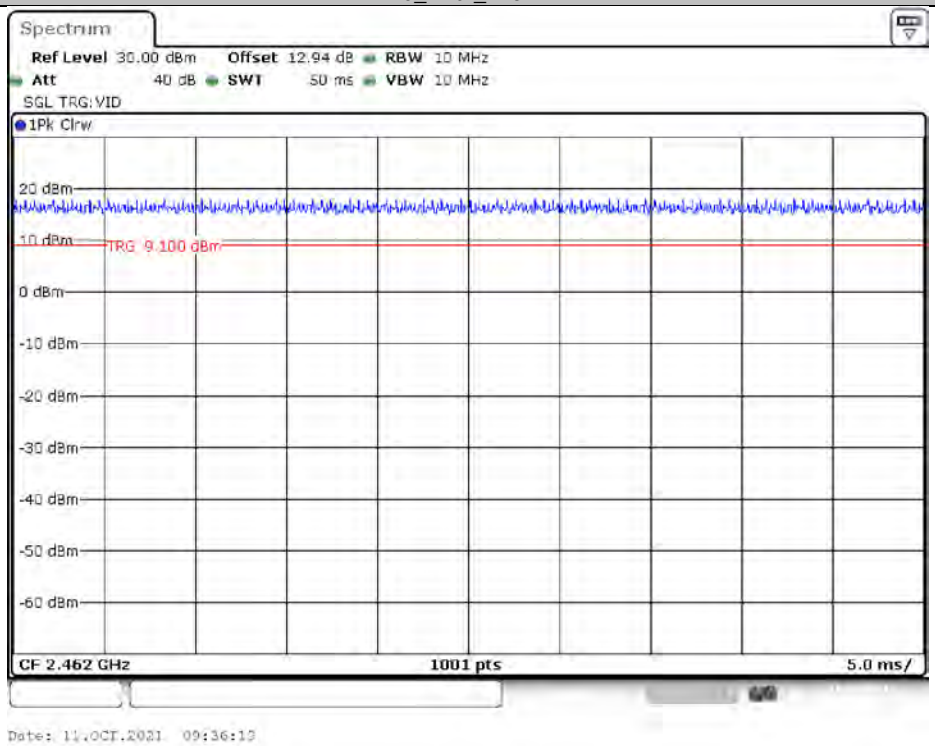
11N20_Ant1_2412MHz



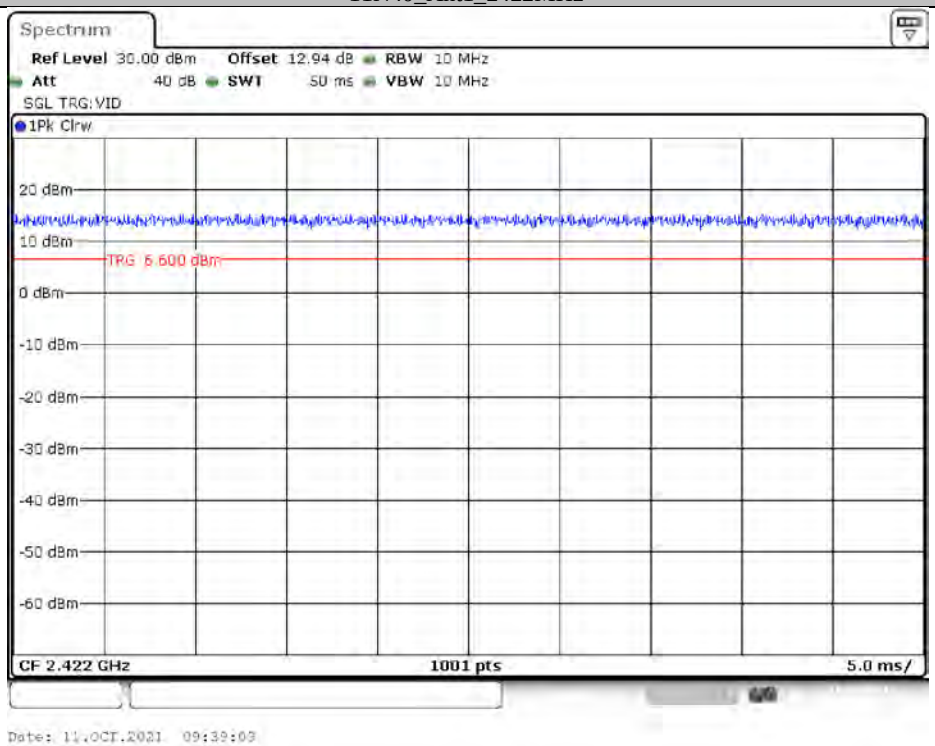
11N20_Ant1_2437MHz



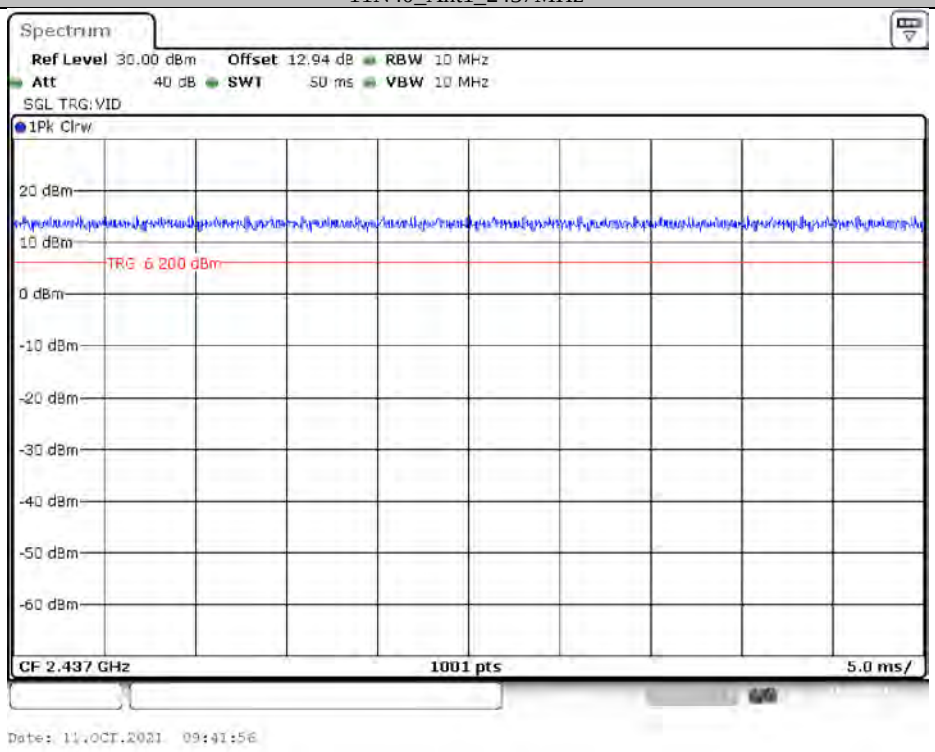
11N20_Ant1_2462MHz



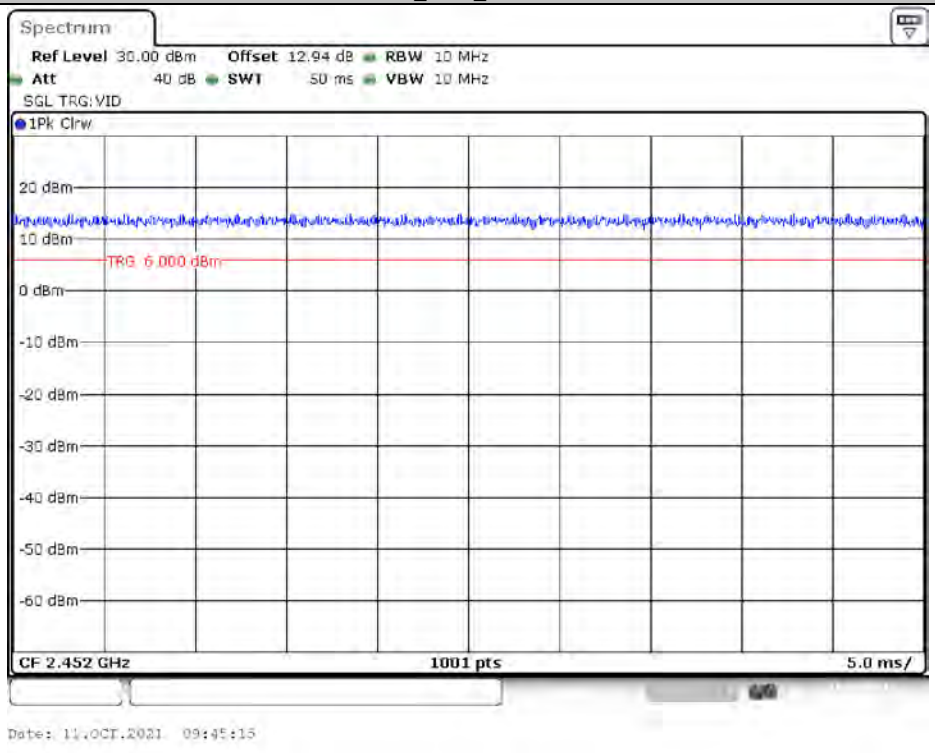
11N40_Ant1_2422MHz



11N40_Ant1_2437MHz



11N40_Ant1_2452MHz



******* END OF REPORT *******