FCC PART 15.247

TEST REPORT

For

Shenzhen Vanson Smartlinking Technology CO., Ltd.

703, Shangfu building,Dengliang Road, Nanshan, Shenzhen,China

FCC ID:2AZ2N-WF001

Report Type:	**Product Type:**
Original Report	WIFI Smart Controller

Report Number: RSZ210316004-00A

Report Date: 2021-05-25

Reviewed By: Candy Li, RF Engineer

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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	WIFI Smart Controller
Tested Model	DBF0362CN0V
Frequency Range	Wi-Fi: 2412-2462MHz
Maximum Conducted Peak Output Power	14.21dBm(802.11b), 13.64dBm(802.11g), 13.71dBm(802.11n-HT20), 12.98dBm(802.11n-HT40)
Modulation Technique	Wi-Fi: DSSS, OFDM
Antenna Specification*	PCB Antenna: 1dBi(provided by the applicant)
Voltage Range	DC 5-28V
Date of Test	2021-03-24 to 2021-05-16
Sample serial number	RSZ210316004-RF-S1(Assigned by ATC)
Received date	2021-03-20
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

Item		Expanded Measurement uncertainty
Conducted Emissions	AC Mains	*2.72 dB (k=2, 95% level of confidence)*
Radiated emission	30MHz-1GHz	*4.28 dB (k=2, 95% level of confidence)*
	1GHz-18GHz	*4.98 dB (k=2, 95% level of confidence)*

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.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A-2.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g, 802.11n-HT20 and 802.11n-HT40 mode 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	/	/

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

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

The EUT was configured in engineering mode and the power level was default.

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

Mode	Data rate	Power level*		
		Low channel	Middle channel	High channel
802.11b	1 Mbps	Default	Default	Default
802.11g	6 Mbps	Default	Default	Default
802.11n-HT20	MCS0	Default	Default	Default
802.11n-HT40	MCS0	Default	Default	Default

Duty cycle

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

Support Equipment List and Details

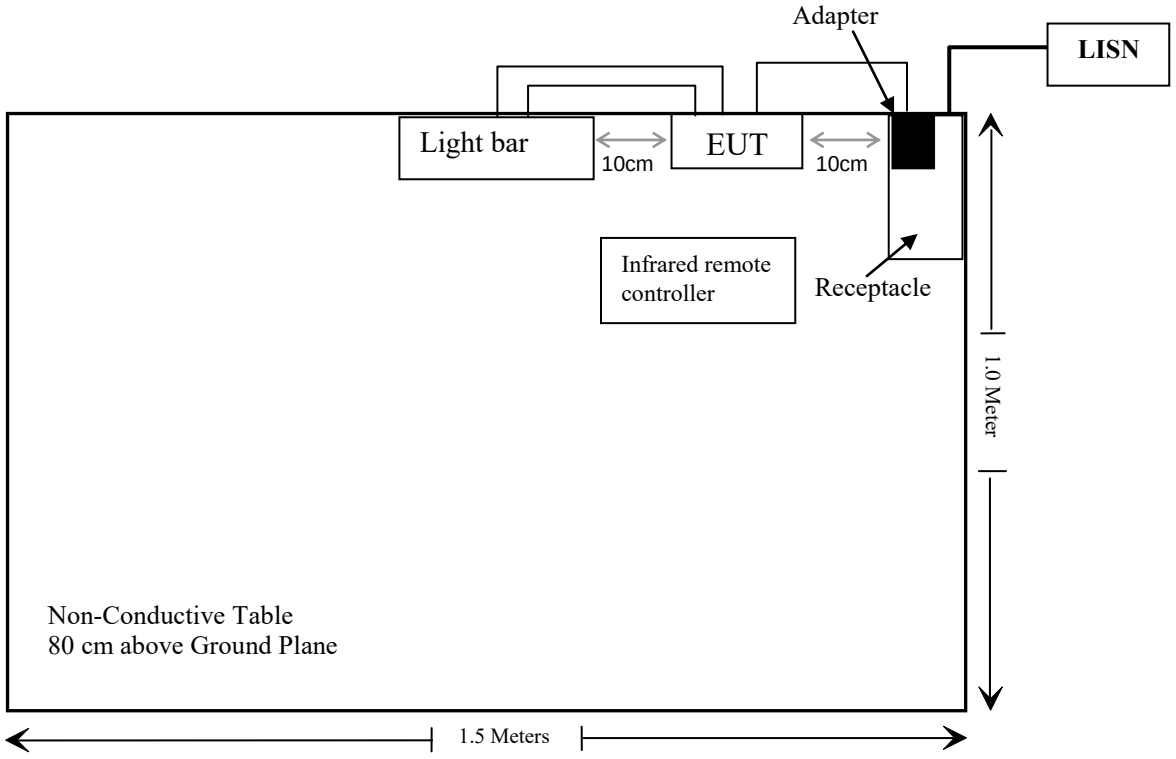
Manufacturer	Description	Model	Serial Number
Yanson Smartlinkiing	Adapter	WS-1202500	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable DC Cable	1.5	EUT	Adapter
Un-shielding Un-Detachable Control Line*2	0.08	Controller	Light bar

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

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

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
Rohde & Schwarz	Pulse Limiter	ESH3-Z2	100815	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
RF Coaxial Cable	Unknown	N-2m	No.2	2020/12/25	2021/12/24
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	2020/07/08	2021/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9170	9170-359	2020/01/05	2023/01/04
Quinstar	Amplifier	QLW-184055 36-J0	15964001002	2020/11/28	2021/11/27
RF Coaxial Cable	Unknown	N-5m	No.3	2020/12/25	2021/12/24
RF Coaxial Cable	Unknown	N-5m	No.4	2020/12/25	2021/12/24
RF Coaxial Cable	Unknown	N-1m	No.5	2020/12/25	2021/12/24
RF Coaxial Cable	Unknown	N-1m	No.6	2020/12/25	2021/12/24
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	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
WEINSCHEL	10dB Attenuator	5324	AU 3842	Each time	

*** 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 §15.247 (i) & §2.1091- MAXIMUM PER MISSIWIFI EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = 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)

For worst case:

Mode	Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi	2412-2462	1	1.26	14.5	28.18	20	0.007	1

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

Result: Compliance

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 one internal antenna arrangement, which was permanently attached and the antenna gain is 1 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

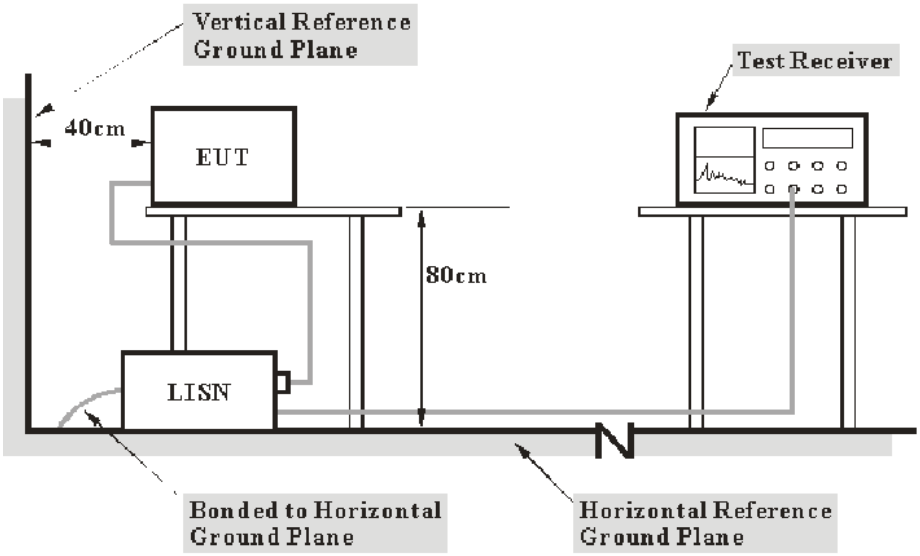
Result: Compliance.

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 adapter 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:

Transd 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:

Margin = Limit – level
Level= reading level+ Transd Factor

Test Data

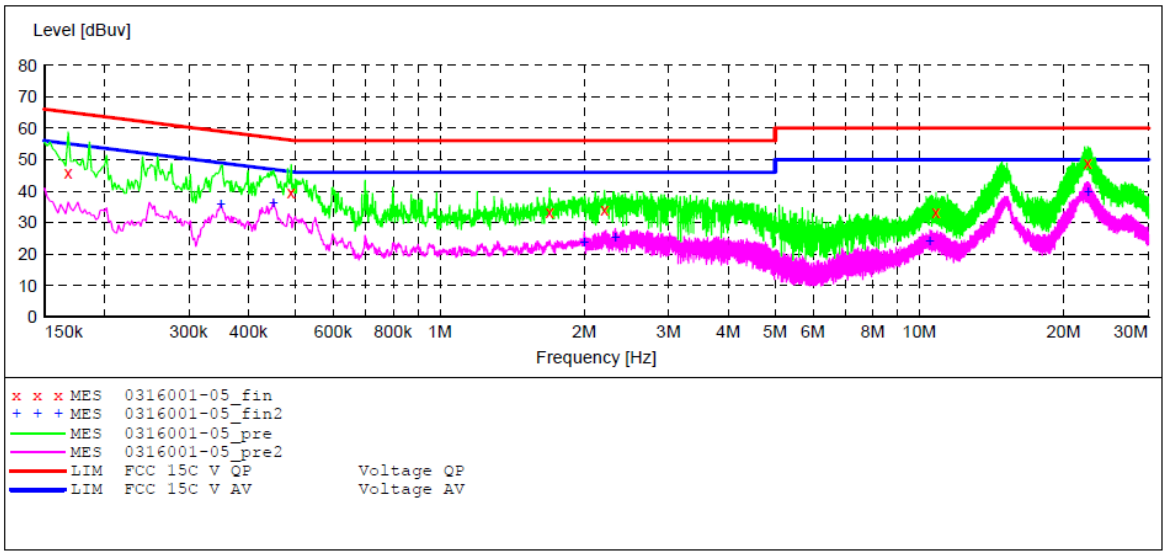
Environmental Conditions

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

The testing was performed by Fan Yang on 2021-03-24.

EUT operation mode: Transmitting (Worst case as below)

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "0316001-05_fin"

2021-3-24 20:51

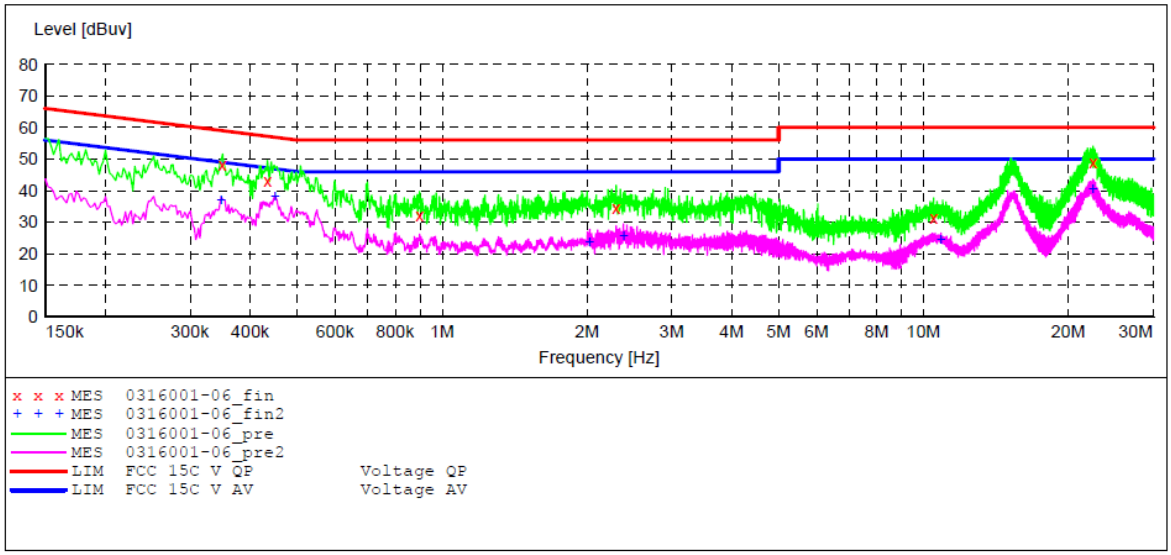
Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.168000	46.00	10.8	65	19.0	QP	L1	GND
0.490000	39.20	11.0	56	16.8	QP	L1	GND
1.694000	33.40	11.2	56	22.6	QP	L1	GND
2.205000	34.20	11.3	56	21.8	QP	L1	GND
10.825000	33.30	11.6	60	26.7	QP	L1	GND
22.430000	49.00	11.7	60	11.0	QP	L1	GND

MEASUREMENT RESULT: "0316001-05_fin2"

2021-3-24 20:51

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.350000	35.90	10.9	49	13.1	AV	L1	GND
0.450000	36.50	11.0	47	10.5	AV	L1	GND
2.000000	23.70	11.3	46	22.3	AV	L1	GND
2.320000	25.50	11.3	46	20.5	AV	L1	GND
10.510000	24.40	11.6	50	25.6	AV	L1	GND
22.465000	39.90	11.7	50	10.1	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "0316001-06_fin"

2021-3-24 20:54

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.350000	48.00	10.9	59	11.0	QP	N	GND
0.434000	43.00	11.0	57	14.0	QP	N	GND
0.898000	32.30	11.1	56	23.7	QP	N	GND
2.300000	34.50	11.3	56	21.5	QP	N	GND
10.490000	31.40	11.6	60	28.6	QP	N	GND
22.485000	48.80	11.7	60	11.2	QP	N	GND

MEASUREMENT RESULT: "0316001-06_fin2"

2021-3-24 20:54

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.348000	37.40	10.9	49	11.6	AV	N	GND
0.450000	38.30	11.0	47	8.7	AV	N	GND
2.025000	24.10	11.3	46	21.9	AV	N	GND
2.380000	25.70	11.3	46	20.3	AV	N	GND
10.865000	24.80	11.6	50	25.2	AV	N	GND
22.480000	40.70	11.7	50	9.3	AV	N	GND

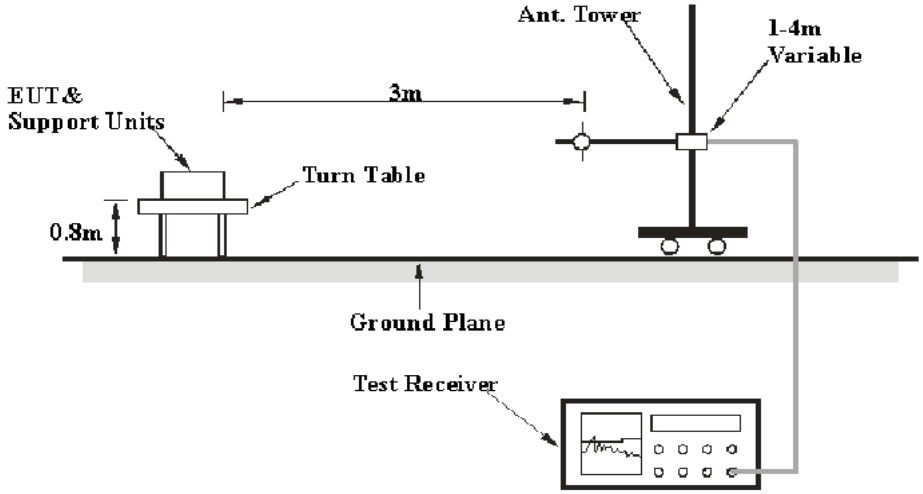
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

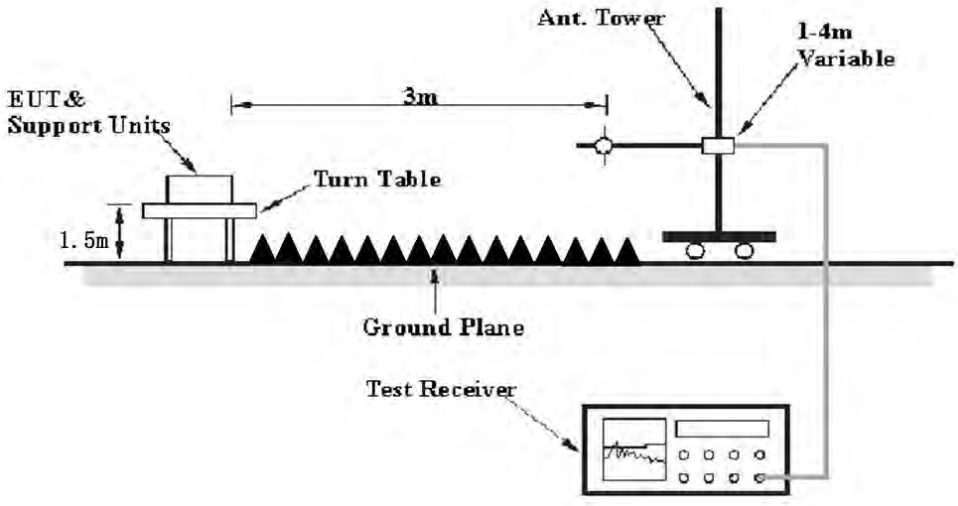
FCC §15.247 (d); §15.209; §15.205;

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 = Meter Reading + 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-Limit
Result = Reading + Factor

Test Data

Environmental Conditions

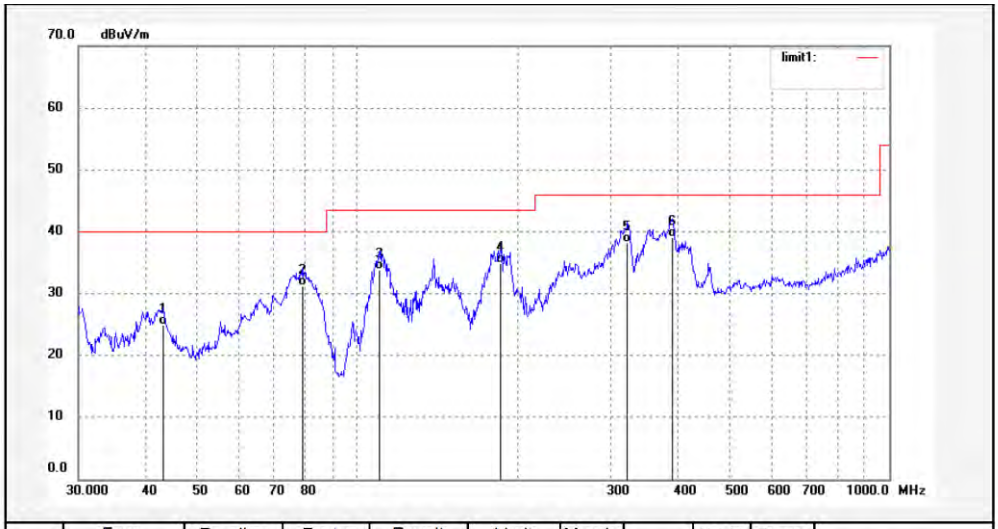
Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-03-30.

EUT operation mode: Transmitting

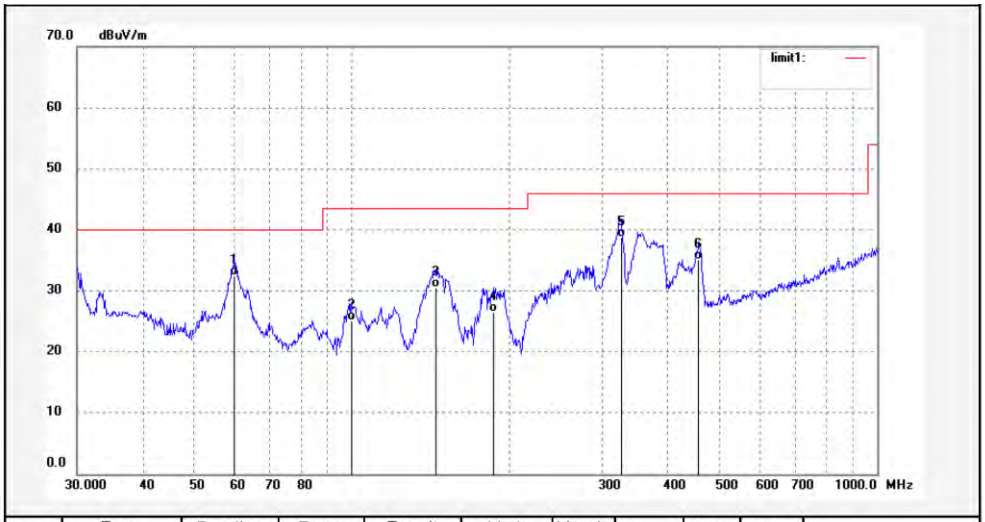
30 MHz~1 GHz: *(Worst case 802.11b, Low Channel as below)*

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	43.3534	36.38	-11.46	24.92	40.00	-15.08	QP			
2	78.9651	47.87	-16.67	31.20	40.00	-8.80	QP			
3	110.1816	46.49	-12.61	33.88	43.50	-9.62	QP			
4	186.4406	46.67	-11.67	35.00	43.50	-8.50	QP			
5	322.1886	46.14	-7.83	38.31	46.00	-7.69	QP			
6	390.7225	45.18	-6.13	39.05	46.00	-6.95	QP			

Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	59.8588	44.97	-12.57	32.40	40.00	-7.60	QP			
2	99.8777	36.85	-11.82	25.03	43.50	-18.47	QP			
3	144.3348	44.67	-14.20	30.47	43.50	-13.03	QP			
4	185.7880	38.17	-11.68	26.49	43.50	-17.01	QP			
5	325.5957	46.48	-7.66	38.82	46.00	-7.18	QP			
6	457.5072	40.05	-4.92	35.13	46.00	-10.87	QP			

1 GHz-18 GHz:

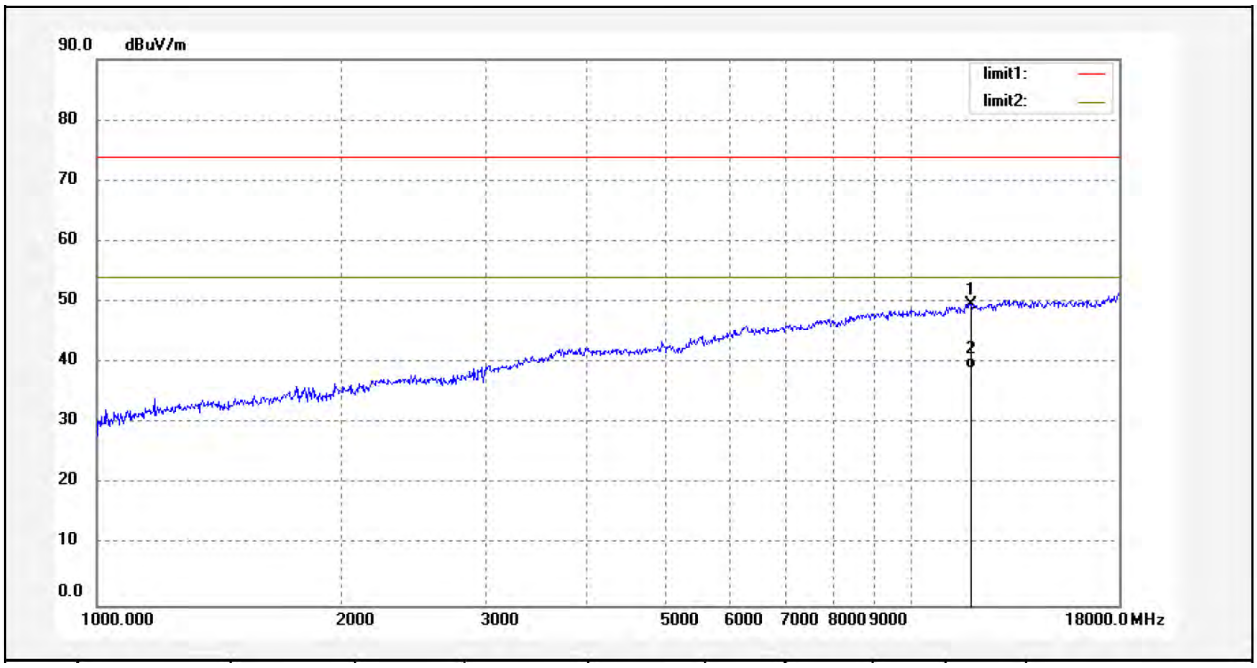
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	51.72	PK	53	1.2	H	-6.84	44.88	74	29.12
2310	52.12	PK	77	1.3	V	-6.84	45.28	74	28.72
2390	51.08	PK	195	1.5	H	-6.44	44.64	74	29.36
2390	51.17	PK	342	1.8	V	-6.44	44.73	74	29.27
4824	42.15	PK	147	1.7	H	2.87	45.02	74	28.98
4824	42.32	PK	305	1.5	V	2.87	45.19	74	28.81
802.11B, Middle Channel									
4874	42.20	PK	141	1.7	H	3.01	45.21	74	28.79
4874	42.55	PK	211	1.4	V	3.01	45.56	74	28.44
802.11B, High Channel									
2483.5	50.17	PK	222	1.4	H	-5.96	44.21	74	29.79
2483.5	50.43	PK	177	1	V	-5.96	44.47	74	29.53
2500	50.66	PK	191	1.7	H	-5.88	44.78	74	29.22
2500	50.52	PK	196	1.9	V	-5.88	44.64	74	29.36
4924	42.68	PK	245	1.6	H	3.17	45.85	74	28.15
4924	42.19	PK	295	1.3	V	3.17	45.36	74	28.64
802.11G, Low Channel									
2310	51.08	PK	245	2.0	H	-6.84	44.24	74	29.76
2310	52.01	PK	253	1.7	V	-6.84	45.17	74	28.83
2390	50.90	PK	177	1.3	H	-6.44	44.46	74	29.54
2390	50.57	PK	235	2.0	V	-6.44	44.13	74	29.87
4824	41.75	PK	96	2.0	H	2.87	44.62	74	29.38
4824	41.46	PK	163	1.0	V	2.87	44.33	74	29.67
802.11G, Middle Channel									
4874	41.28	PK	205	1.6	H	3.01	44.29	74	29.71
4874	42.33	PK	338	2.0	V	3.01	45.34	74	28.66
802.11G, High Channel									
2483.5	49.90	PK	99	1.8	H	-5.96	43.94	74	30.06
2483.5	49.59	PK	144	2.0	V	-5.96	43.63	74	30.37
2500	50.17	PK	185	1.3	H	-5.88	44.29	74	29.71
2500	50.14	PK	220	1.7	V	-5.88	44.26	74	29.74
4924	42.05	PK	171	1.3	H	3.17	45.22	74	28.78
4924	41.33	PK	191	2.1	V	3.17	44.50	74	29.50
11N20, Low Channel									

2310	50.78	PK	236	1.7	H	-6.84	43.94	74	30.06
2310	51.93	PK	295	1.1	V	-6.84	45.09	74	28.91
2390	50.85	PK	94	1.7	H	-6.44	44.41	74	29.59
2390	50.98	PK	103	1.7	V	-6.44	44.54	74	29.46
4824	41.73	PK	96	1.6	H	2.87	44.60	74	29.40
4824	41.62	PK	285	1.9	V	2.87	44.49	74	29.51
11N20, Middle Channel									
4874	41.34	PK	330	2.0	H	3.01	44.35	74	29.65
4874	41.77	PK	307	1.0	V	3.01	44.78	74	29.22
11N20, High Channel									
2483.5	49.68	PK	278	2.0	H	-5.96	43.72	74	30.28
2483.5	50.38	PK	59	1.0	V	-5.96	44.42	74	29.58
2500	50.46	PK	215	1.7	H	-5.88	44.58	74	29.42
2500	50.01	PK	215	1.9	V	-5.88	44.13	74	29.87
4924	42.38	PK	312	2.0	H	3.17	45.55	74	28.45
4924	42.02	PK	117	1.2	V	3.17	45.19	74	28.81
11N40, Low Channel									
2310	51.67	PK	58	1.6	H	-6.84	44.83	74	29.17
2310	52.26	PK	145	1.1	V	-6.84	45.42	74	28.58
2390	52.69	PK	196	2	H	-6.44	46.25	74	27.75
2390	51.65	PK	360	1.7	V	-6.44	45.21	74	28.79
4844	42.65	PK	343	1.9	H	2.92	45.57	74	28.43
4844	42.57	PK	251	1.3	V	2.92	45.49	74	28.51
11N40, Middle Channel									
4874	42.12	PK	72	1.7	H	3.01	45.13	74	28.87
4874	41.92	PK	341	1.5	V	3.01	44.93	74	29.07
11N40, High Channel									
2483.5	51.99	PK	236	1.2	H	-5.96	46.03	74	27.97
2483.5	52.86	PK	201	1.1	V	-5.96	46.90	74	27.1
2500	51.80	PK	203	1	H	-5.88	45.92	74	28.08
2500	51.78	PK	82	1	V	-5.88	45.90	74	28.1
4904	42.77	PK	101	1.4	H	3.11	45.88	74	28.12
4904	42.47	PK	133	1.2	V	3.11	45.58	74	28.42

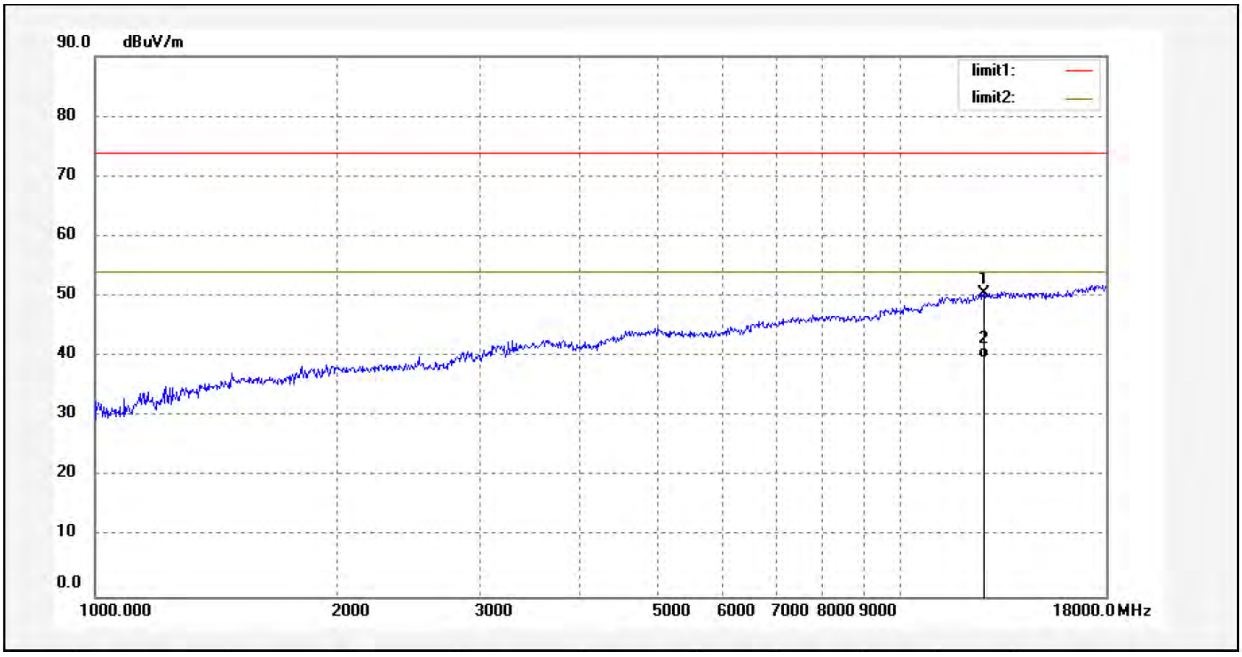
Note 1:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.
The test result of peak was less than the limit of average, so just peak values were recorded.

Note 2:
18~25GHz: The test values lower than the limits of 20dB or in the noise floor level, the test data were not recorded in the report.

Pre-scan for Peak
802.11B, Low Channel
Horizontal:



Vertical:



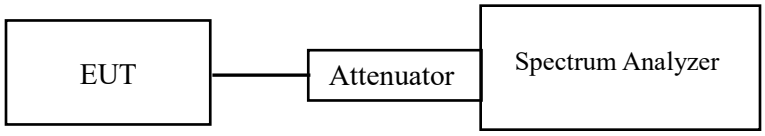
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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 on 2021-05-16.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix WIFI.

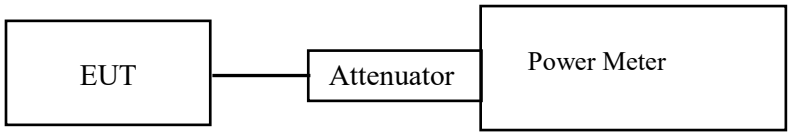
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 2021-05-16.

EUT operation mode: Transmitting

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

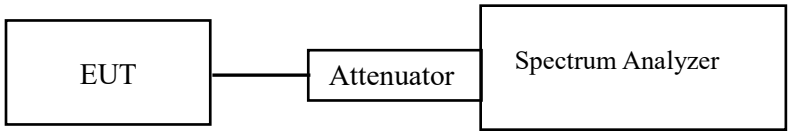
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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 2021-05-16.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix WIFI.

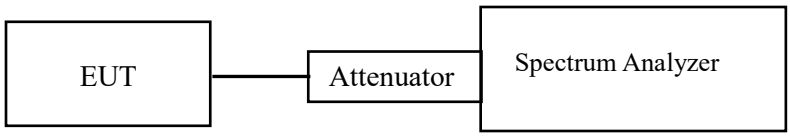
FCC §15.247(e) - POWER SPECTRAL DENSITY

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 2021-05-16.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix WIFI.

APPENDIX WIFI

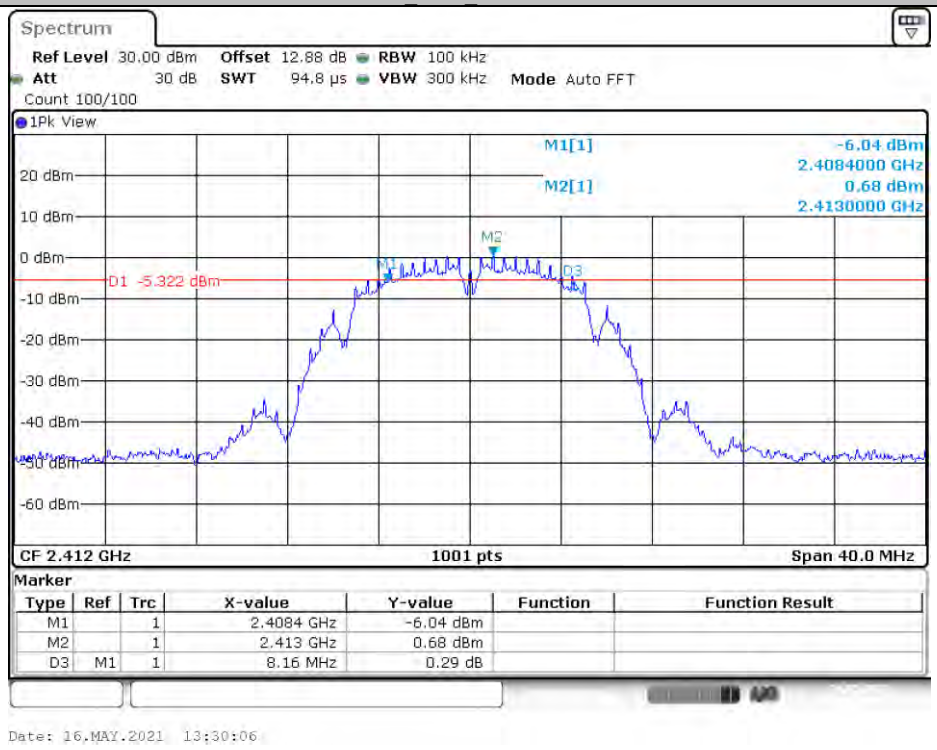
Appendix A: 6dB Emission Bandwidth

Test Result

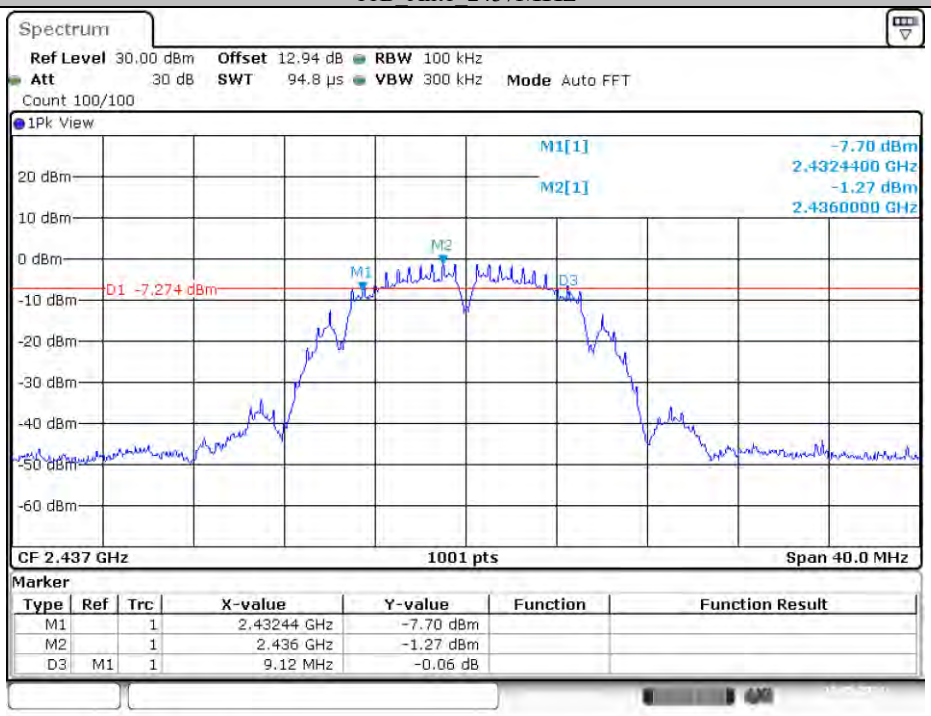
TestMode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.160	0.5	PASS
		2437	9.120	0.5	PASS
		2462	8.160	0.5	PASS
11NG	Ant1	2412	16.120	0.5	PASS
		2437	16.440	0.5	PASS
		2462	16.440	0.5	PASS
11N20SISO	Ant1	2412	17.360	0.5	PASS
		2437	17.680	0.5	PASS
		2462	17.640	0.5	PASS
11N40SISO	Ant1	2422	35.280	0.5	PASS
		2437	35.920	0.5	PASS
		2452	36.320	0.5	PASS

Test Graphs

11B_Ant1_2412MHz



11B_Ant1_2437MHz

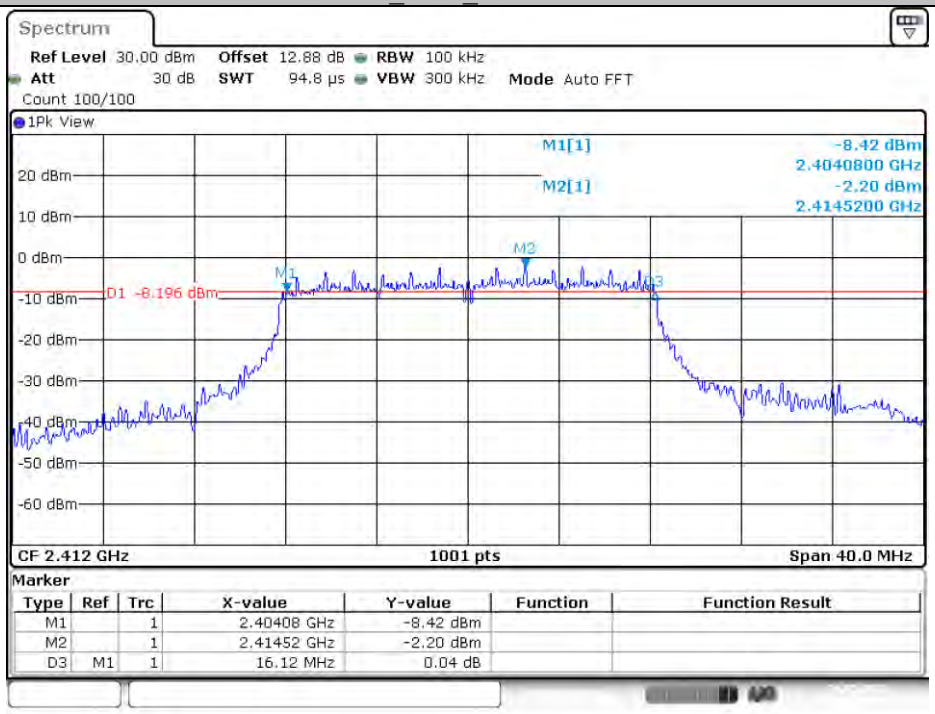


Date: 16.MAY.2021 13:51:57

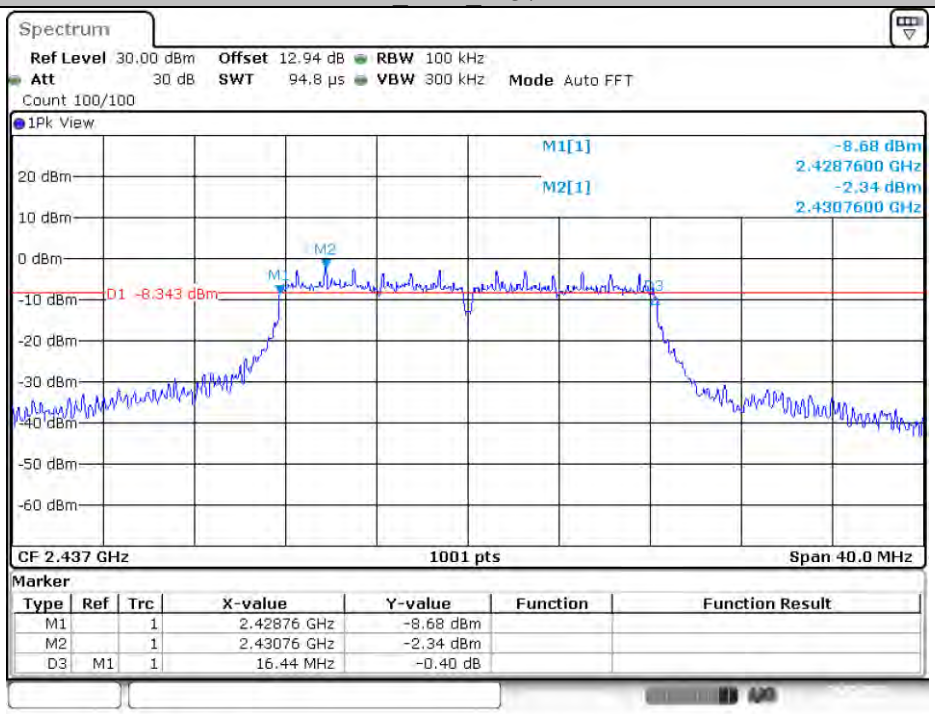
11B_Ant1_2462MHz

Date: 16.MAY.2021 13:32:58

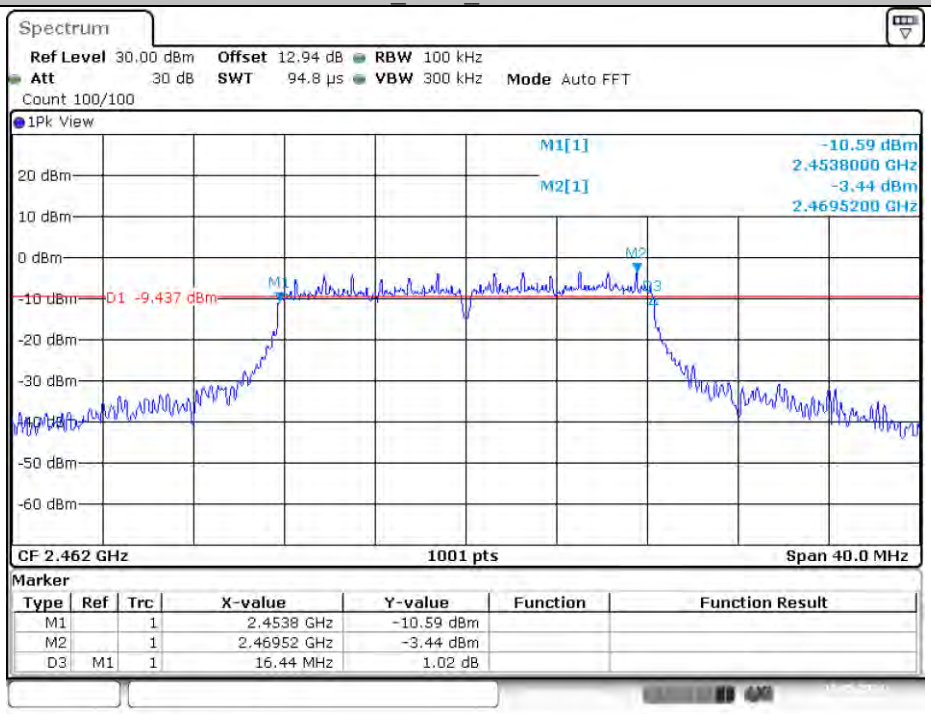
11G_Ant1_2412MHz



11G_Ant1_2437MHz

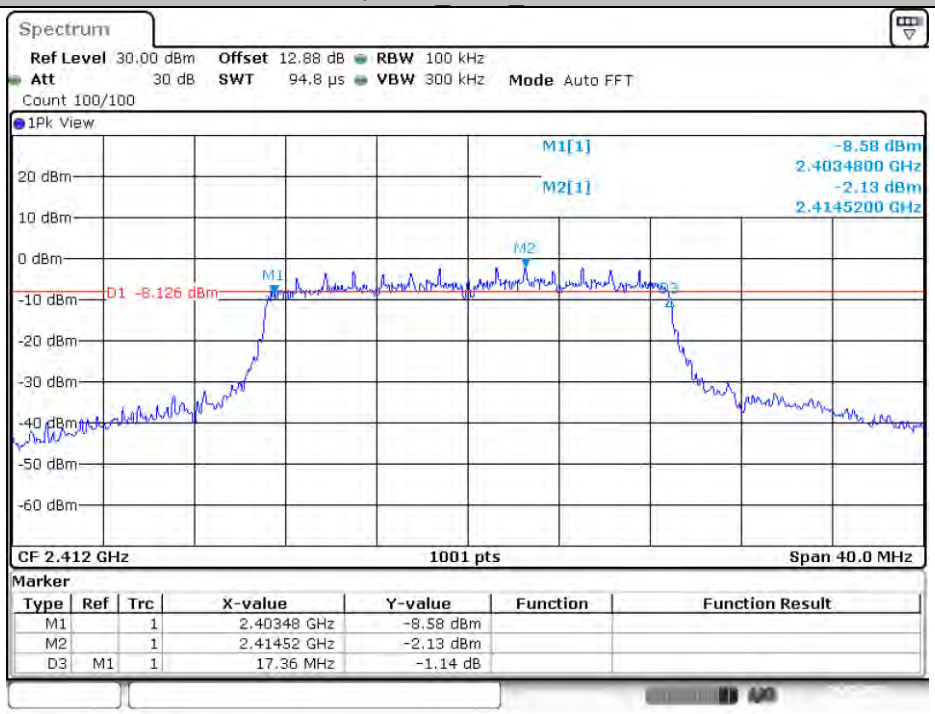


11G_Ant1_2462MHz



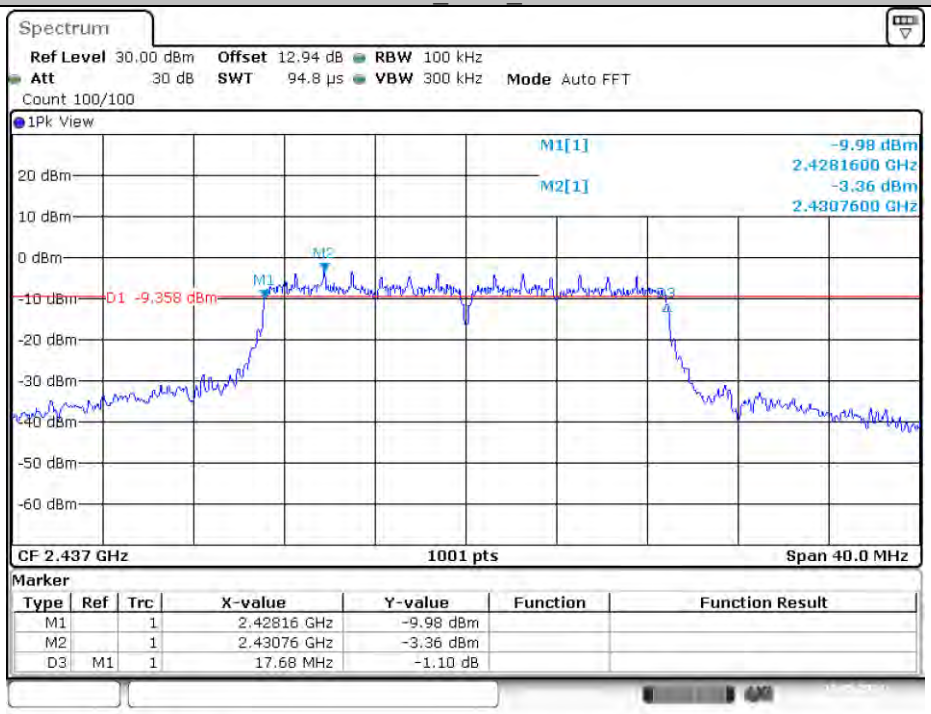
Date: 16.MAY.2021 13:37:16

11N20SISO_Ant1_2412MHz



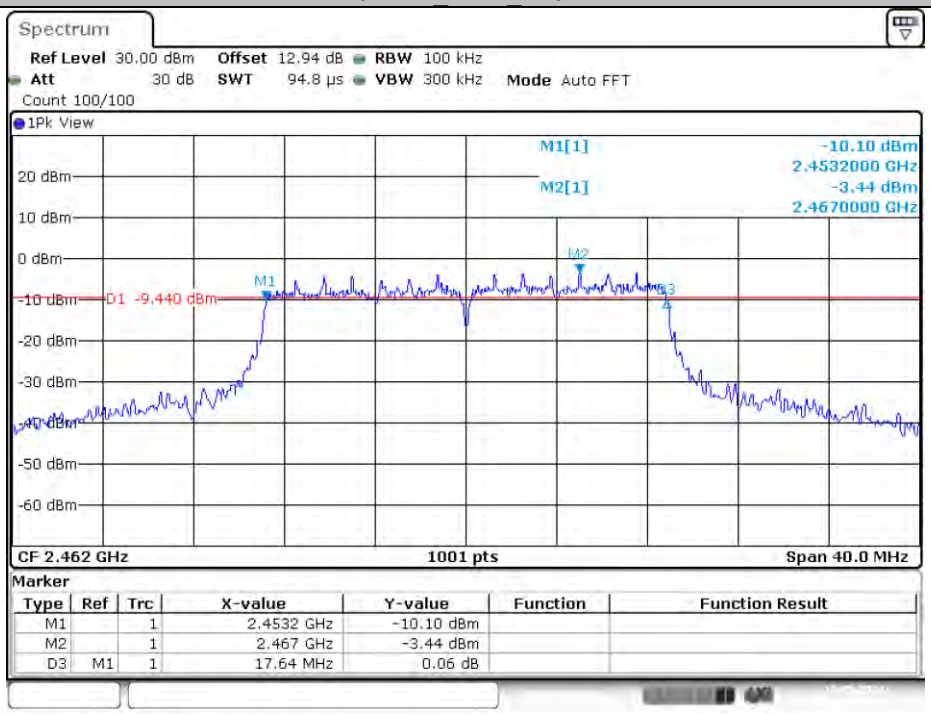
Date: 16.MAY.2021 13:38:33

11N20SISO_Ant1_2437MHz



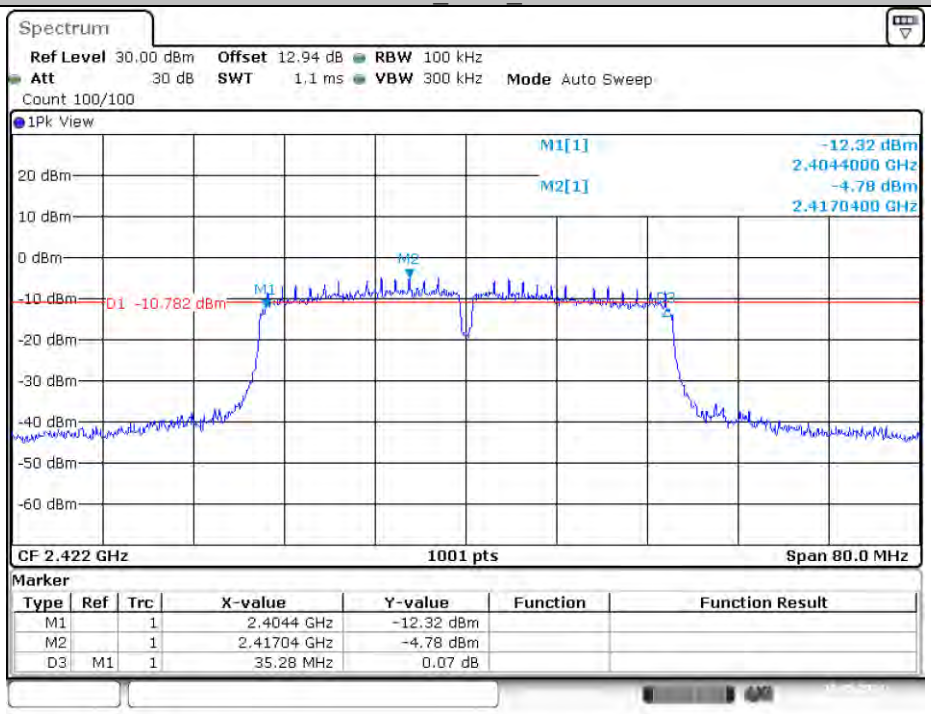
Date: 16.MAY.2021 13:39:47

11N20SISO_Ant1_2462MHz

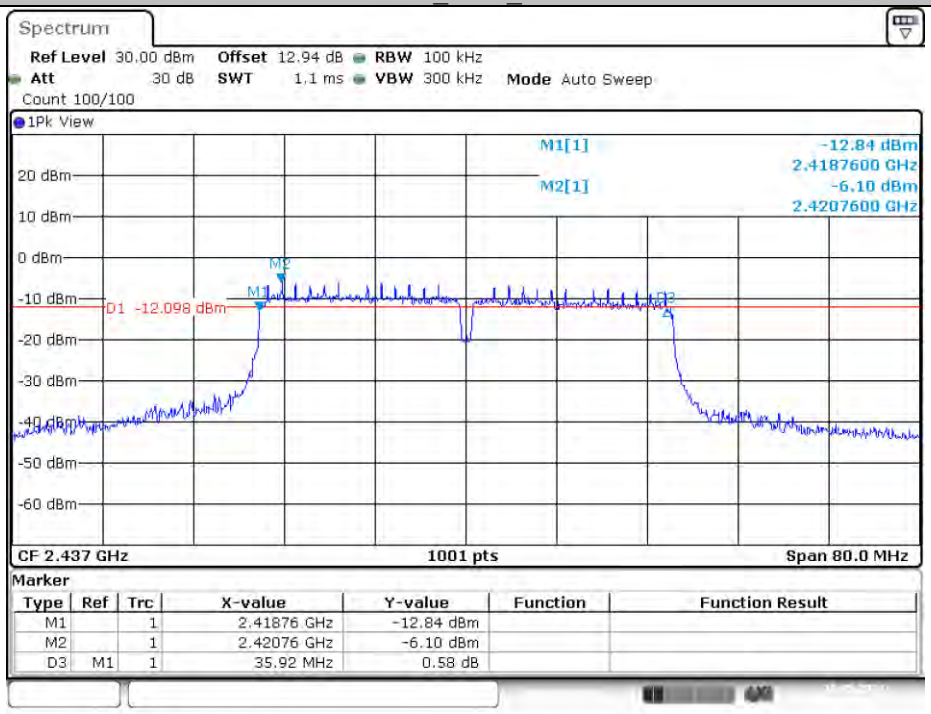


Date: 16.MAY.2021 13:40:59

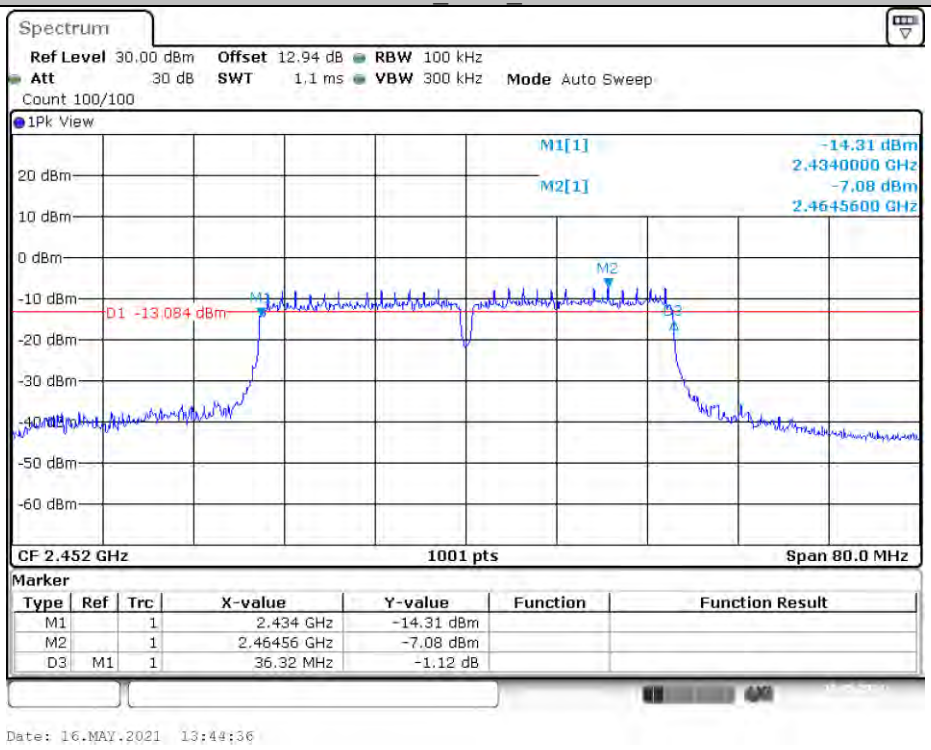
11N40SISO_Ant1_2422MHz



11N40SISO_Ant1_2437MHz



11N40SISO_Ant1_2452MHz



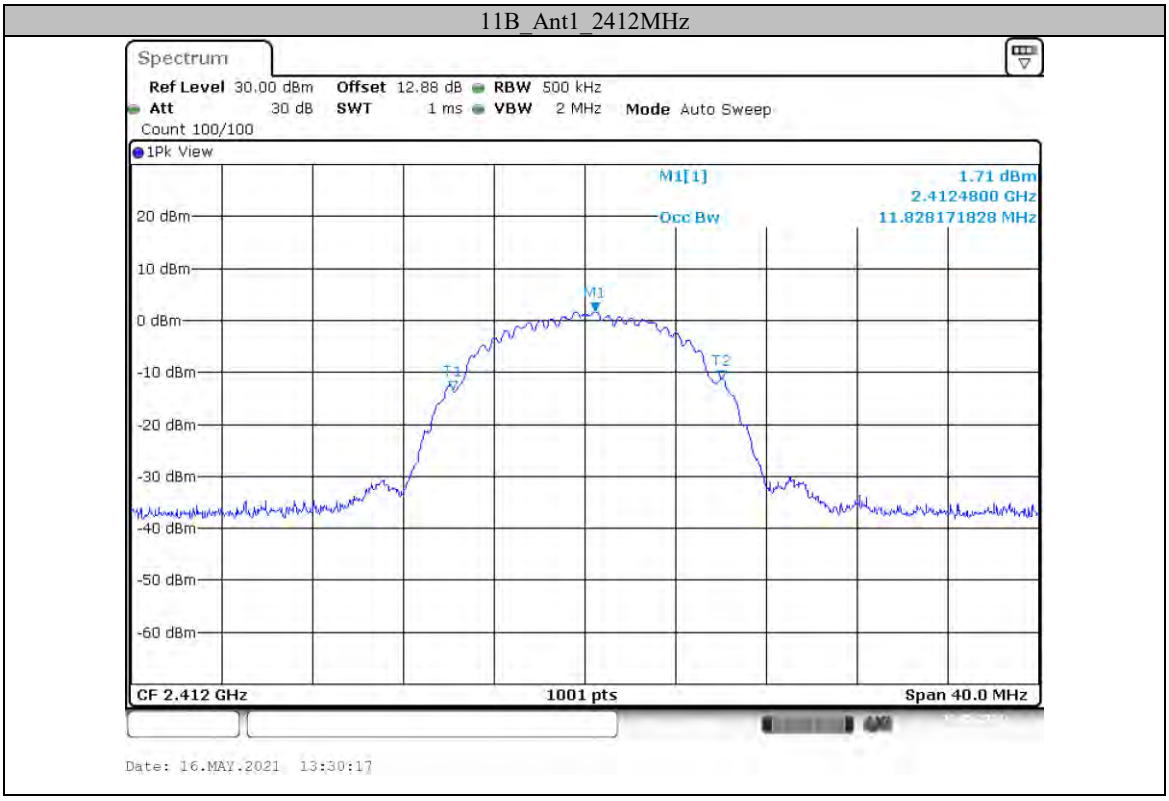
Appendix B: Occupied Channel Bandwidth

Test Result

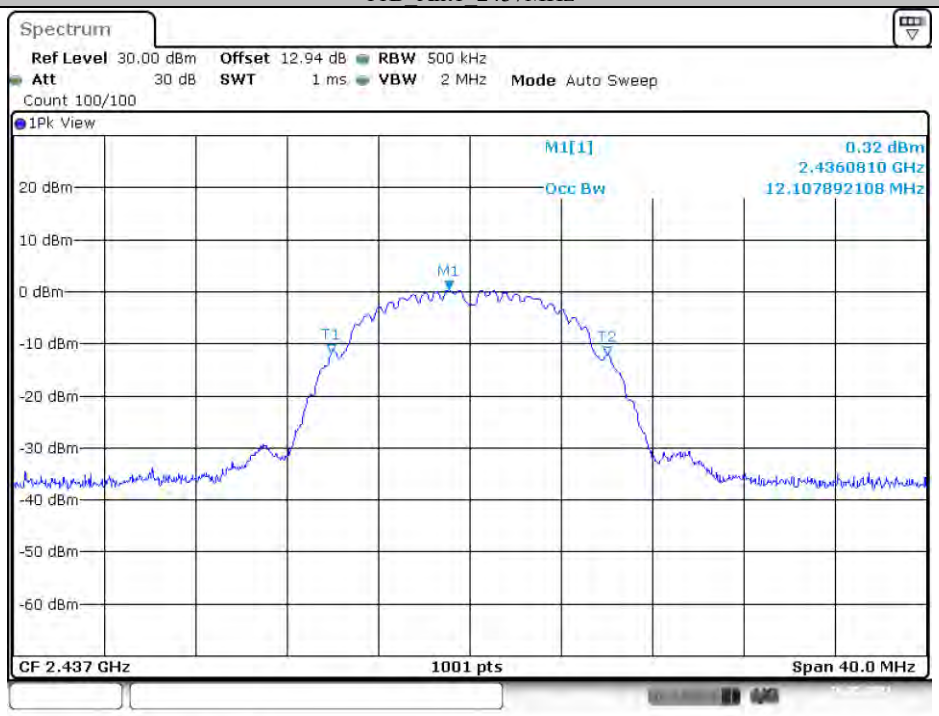
TestMode	Antenna	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	11.828	---	PASS
		2437	12.108	---	PASS
		2462	12.108	---	PASS
11G	Ant1	2412	17.542	---	PASS
		2437	18.302	---	PASS
		2462	17.942	---	PASS
11N20SISO	Ant1	2412	18.142	---	PASS
		2437	18.501	---	PASS
		2462	18.462	---	PASS
11N40SISO	Ant1	2422	36.204	---	PASS
		2437	36.843	---	PASS
		2452	36.923	---	PASS

Test Graphs

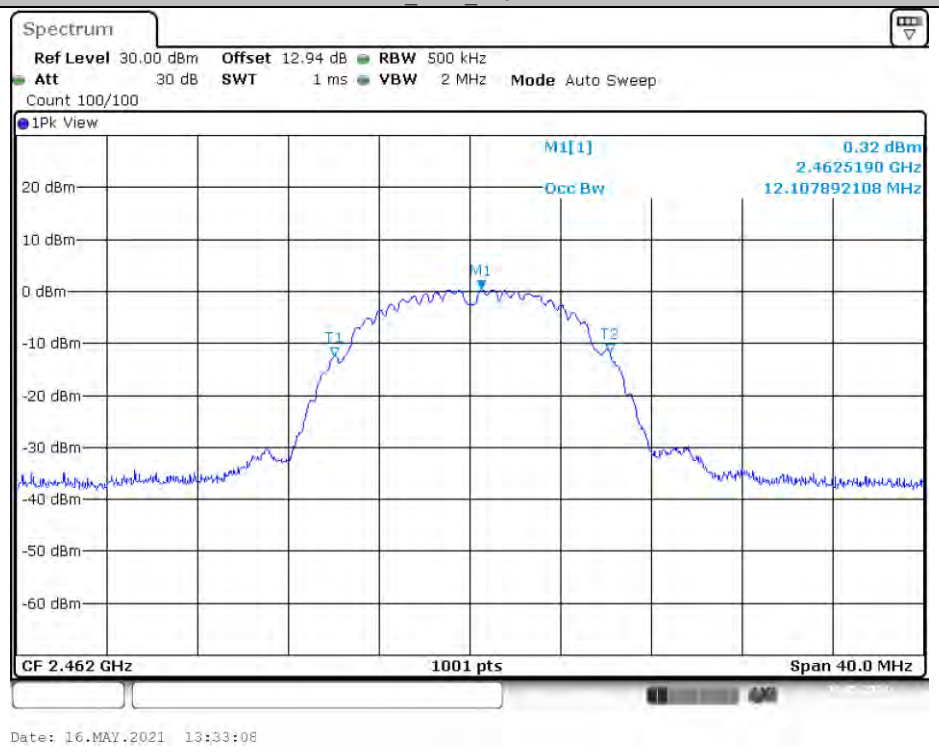
11B_Ant1_2412MHz



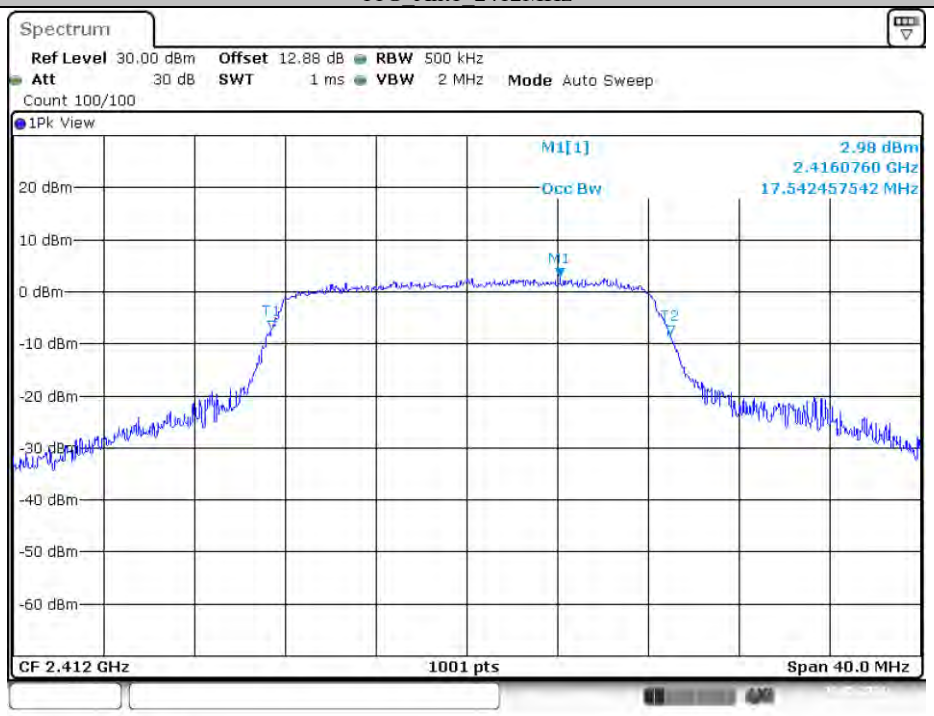
11B_Ant1_2437MHz



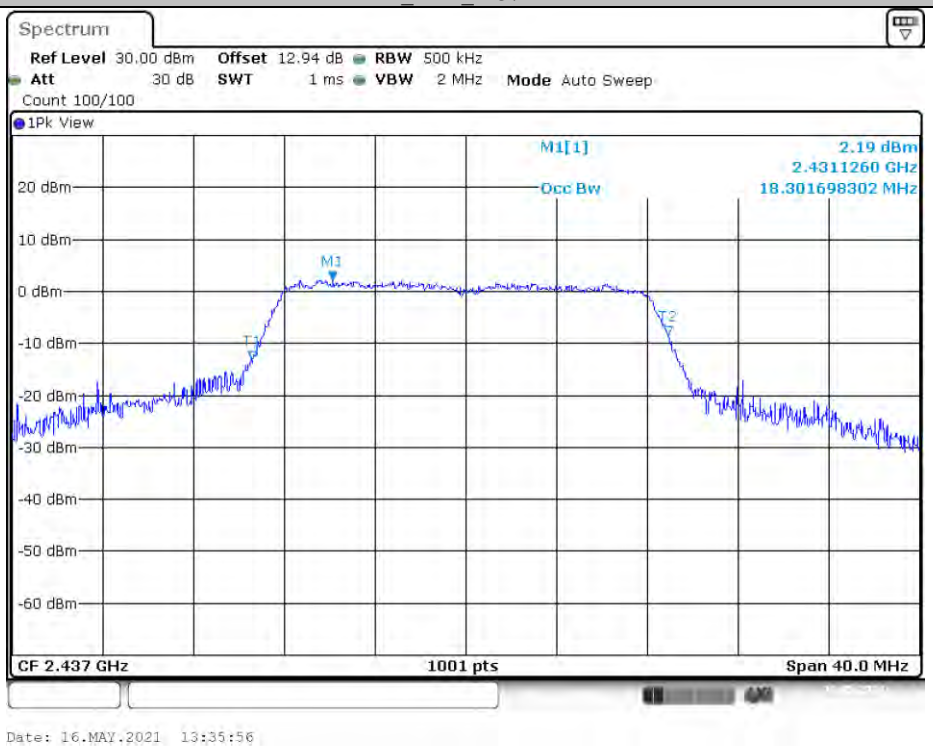
11B_Ant1_2462MHz



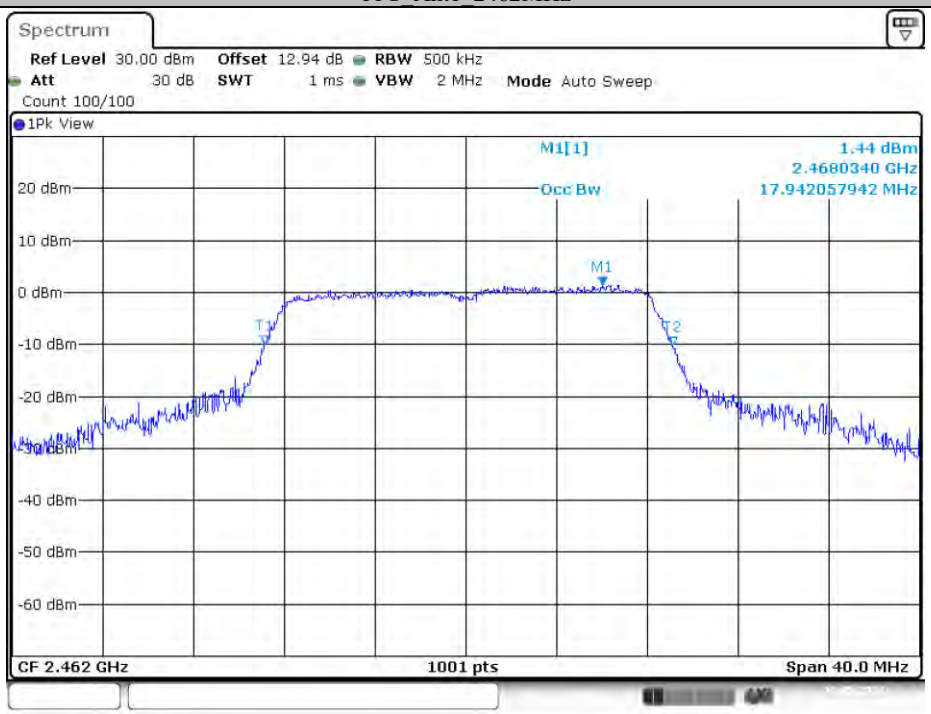
11G_Ant1_2412MHz



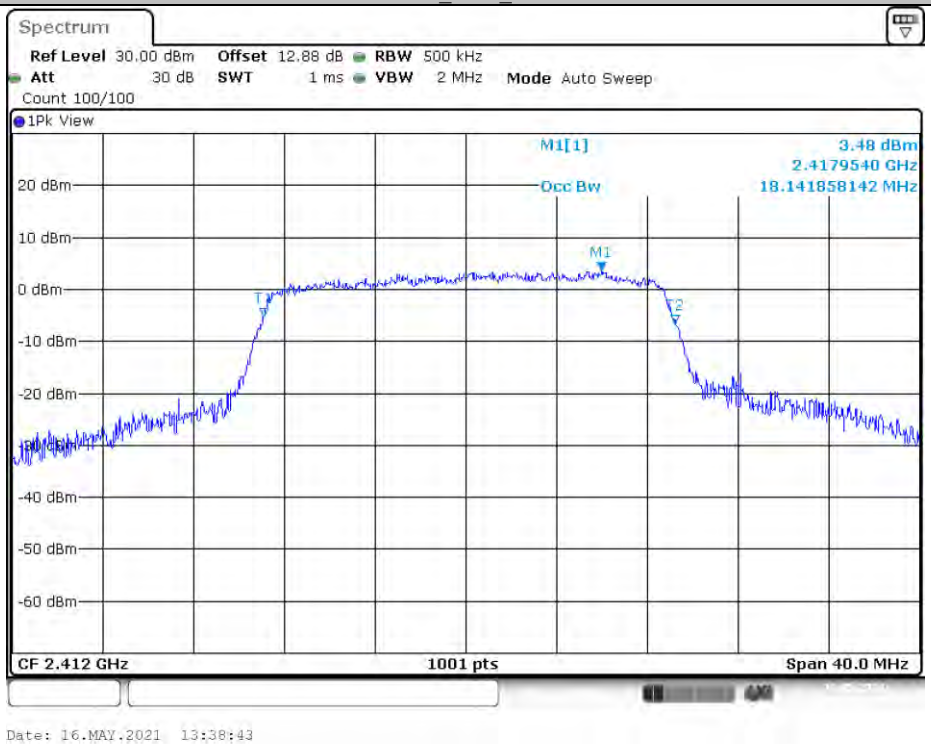
11G_Ant1_2437MHz



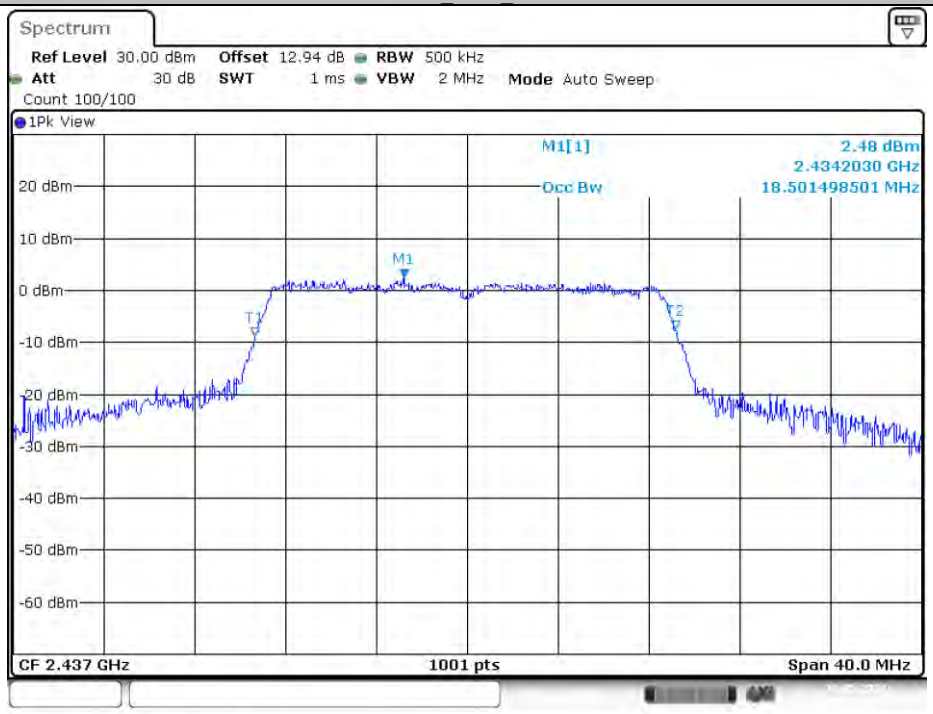
11G_Ant1_2462MHz



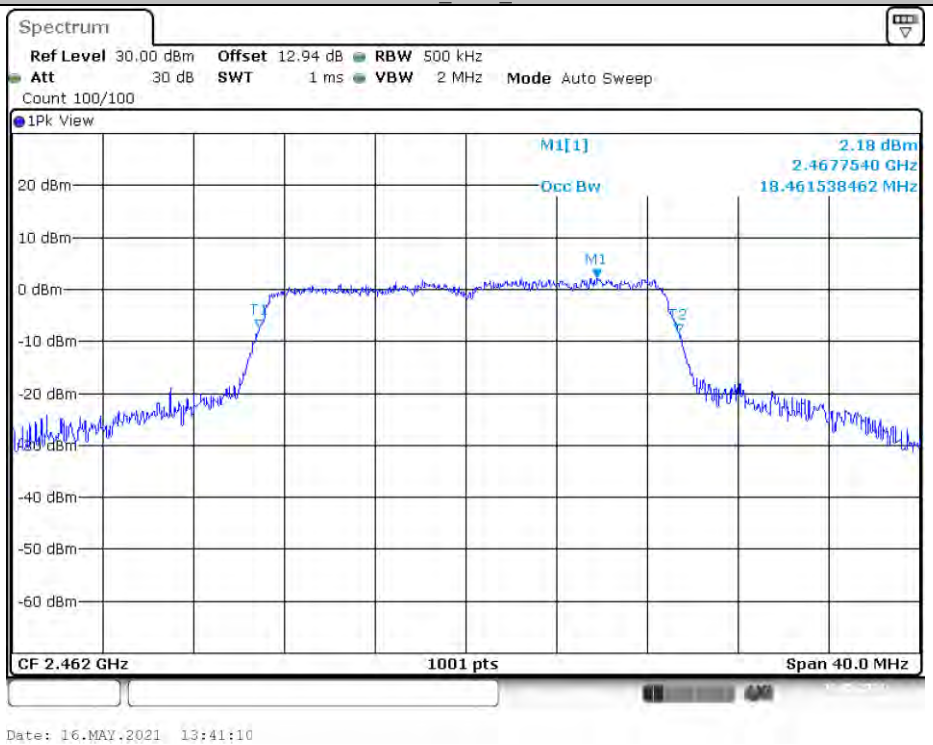
11N20SISO_Ant1_2412MHz



11N20SISO_Ant1_2437MHz



11N20SISO_Ant1_2462MHz



11N40SISO_Ant1_2422MHz

11N40SISO_Ant1_2437MHz

11N40SISO_Ant1_2452MHz

Appendix C: Maximum conducted output power

Test Result

Test Mode	Antenna	Channel [MHz]	Conducted Peak Power Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	14.21	<=30	PASS
		2437	14.17	<=30	PASS
		2462	14.02	<=30	PASS
11G	Ant1	2412	13.61	<=30	PASS
		2437	13.64	<=30	PASS
		2462	13.50	<=30	PASS
11N20SISO	Ant1	2412	13.21	<=30	PASS
		2437	13.71	<=30	PASS
		2462	13.56	<=30	PASS
11N40SISO	Ant1	2422	12.82	<=30	PASS
		2437	12.98	<=30	PASS
		2452	12.43	<=30	PASS

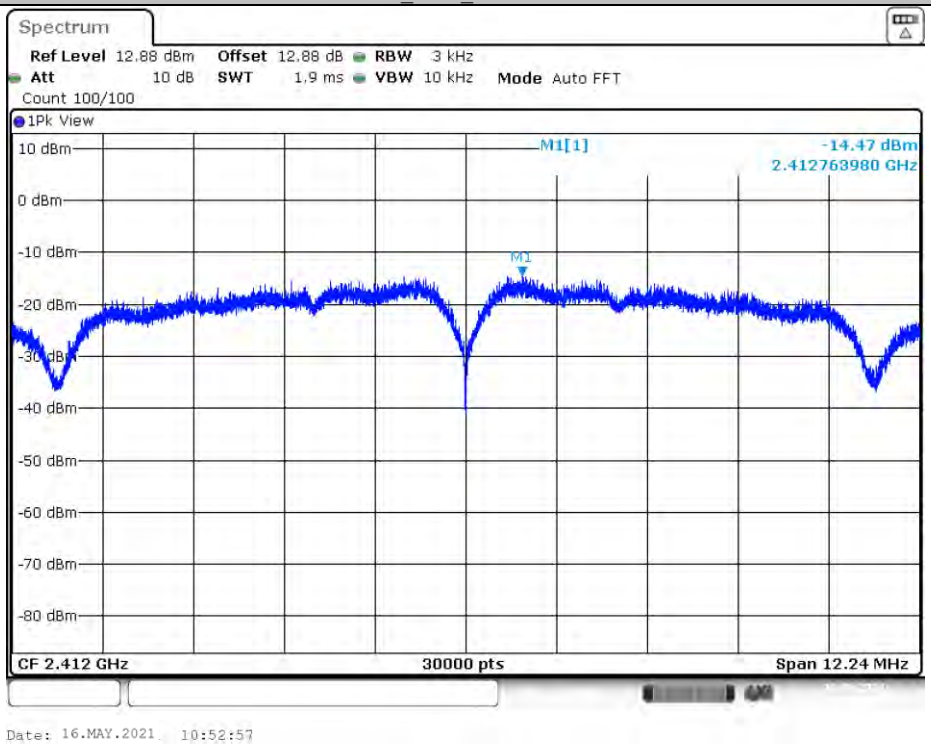
Appendix D: Power spectral density

Test Result

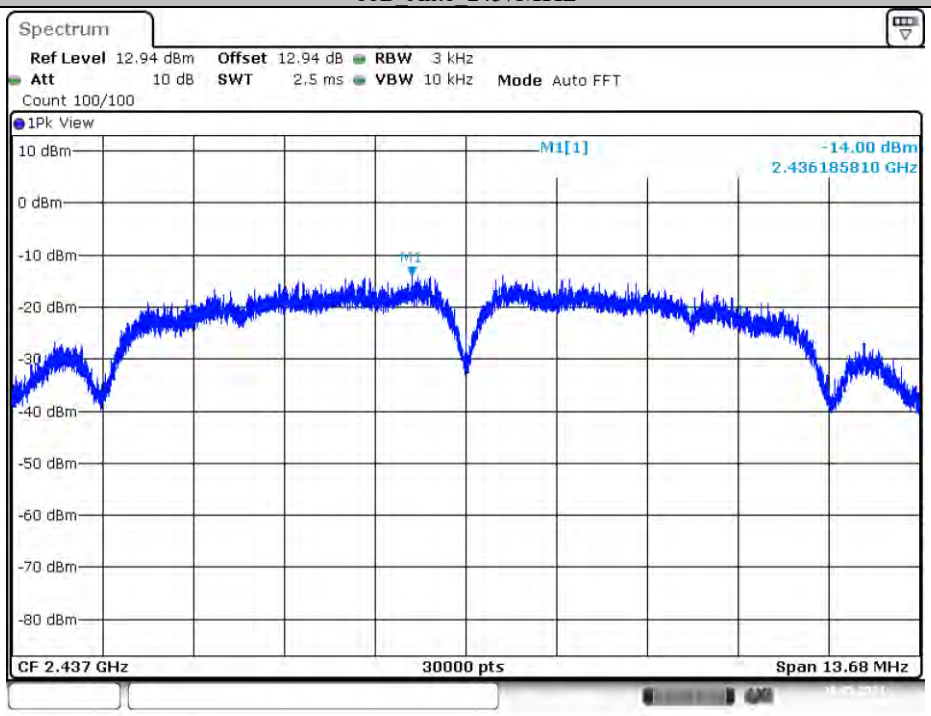
TestMode	Antenna	Channel[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-14.47	<=8	PASS
		2437	-14	<=8	PASS
		2462	-13.77	<=8	PASS
11G	Ant1	2412	-16.36	<=8	PASS
		2437	-15.43	<=8	PASS
		2462	-18.11	<=8	PASS
11N20SISO	Ant1	2412	-17.63	<=8	PASS
		2437	-17.6	<=8	PASS
		2462	-18.01	<=8	PASS
11N40SISO	Ant1	2422	-19.17	<=8	PASS
		2437	-20.73	<=8	PASS
		2452	-21.15	<=8	PASS

Test Graphs

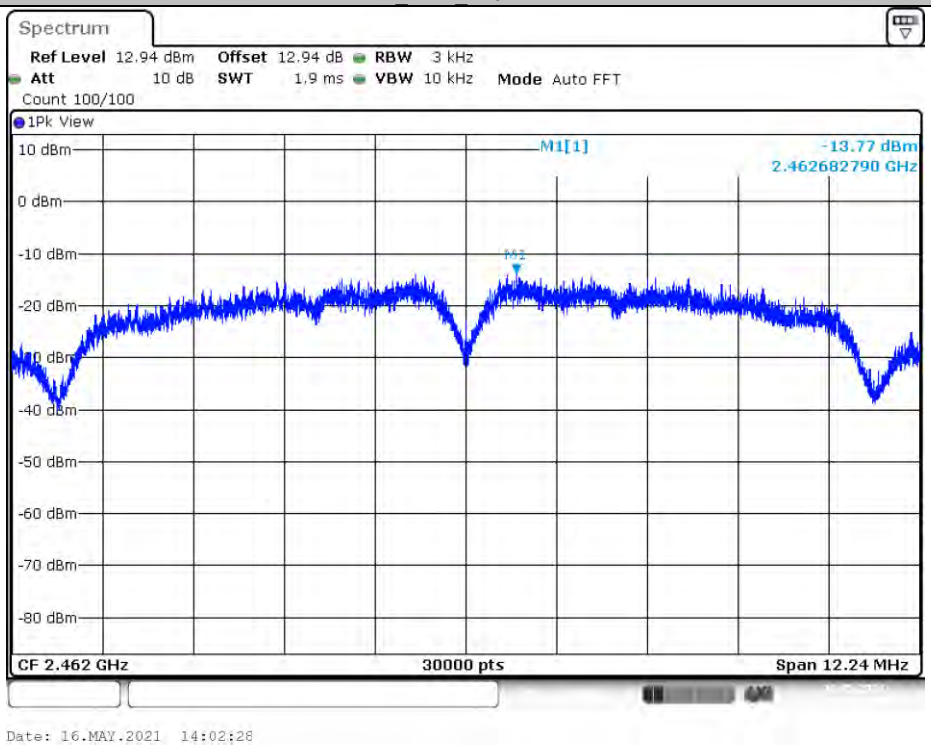
11B_Ant1_2412MHz



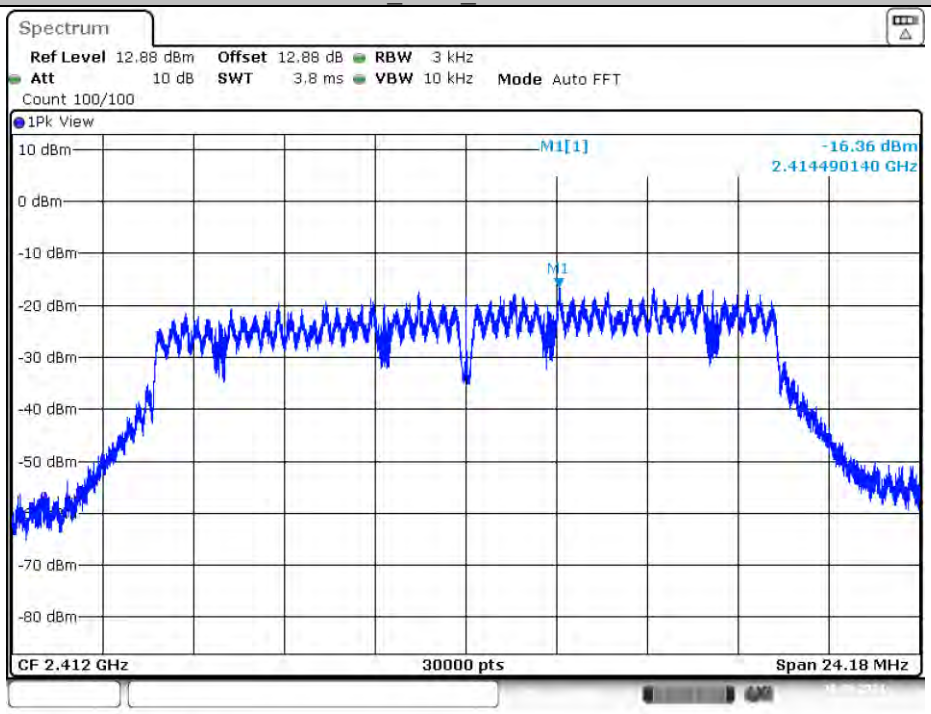
11B_Ant1_2437MHz



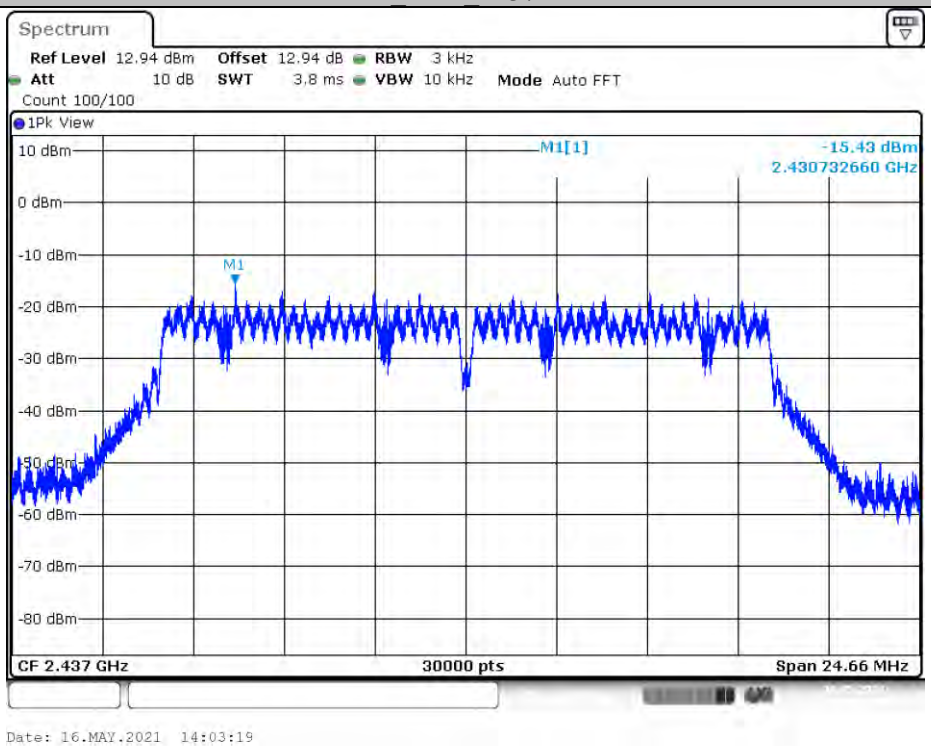
11B_Ant1_2462MHz



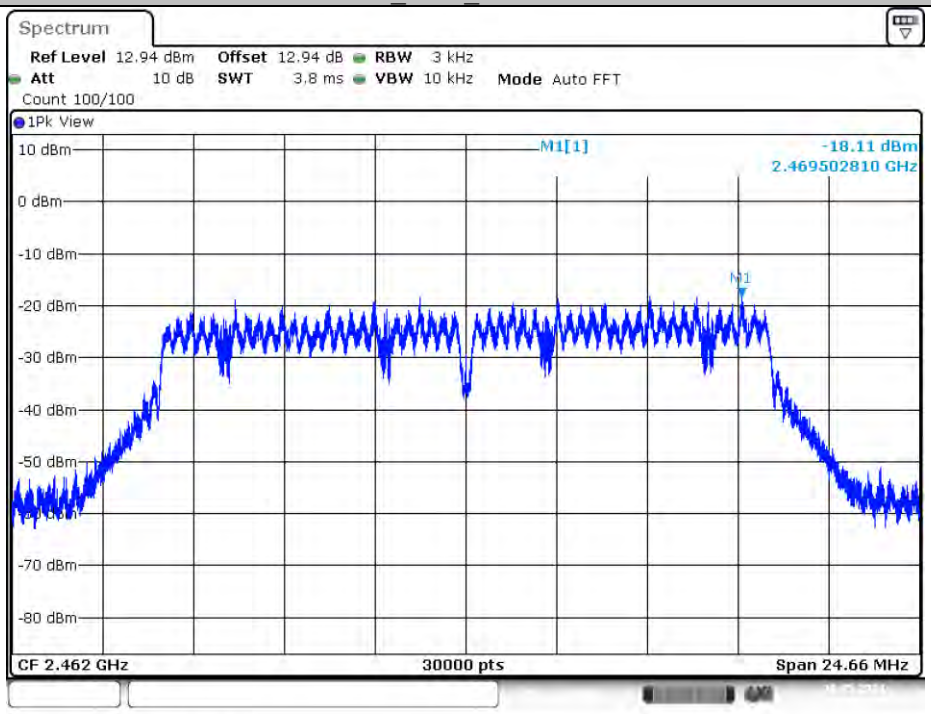
11G_Ant1_2412MHz



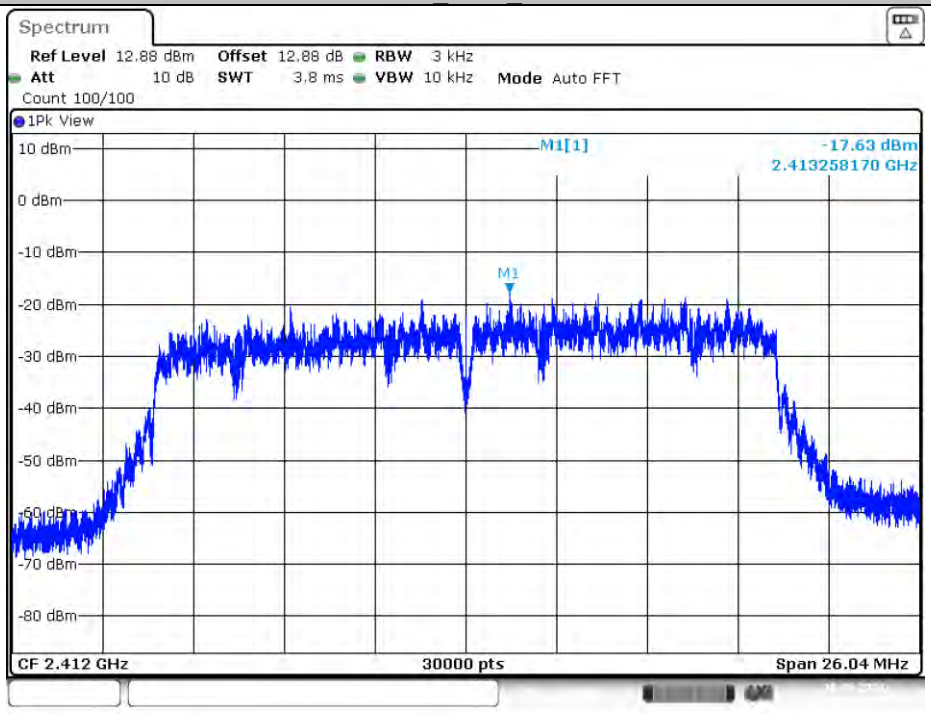
11G_Ant1_2437MHz



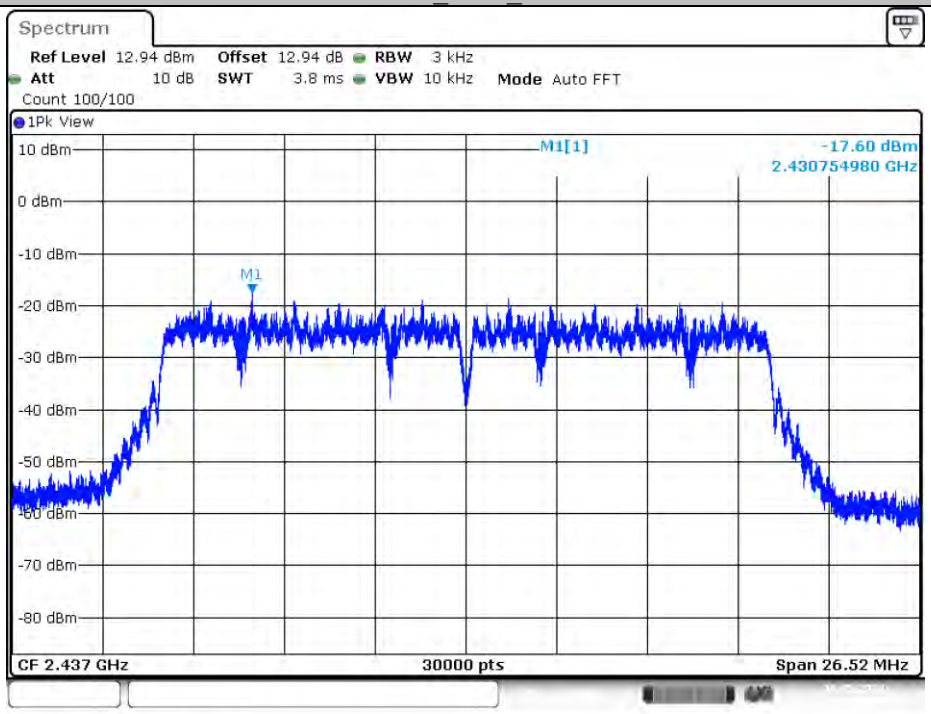
11G_Ant1_2462MHz



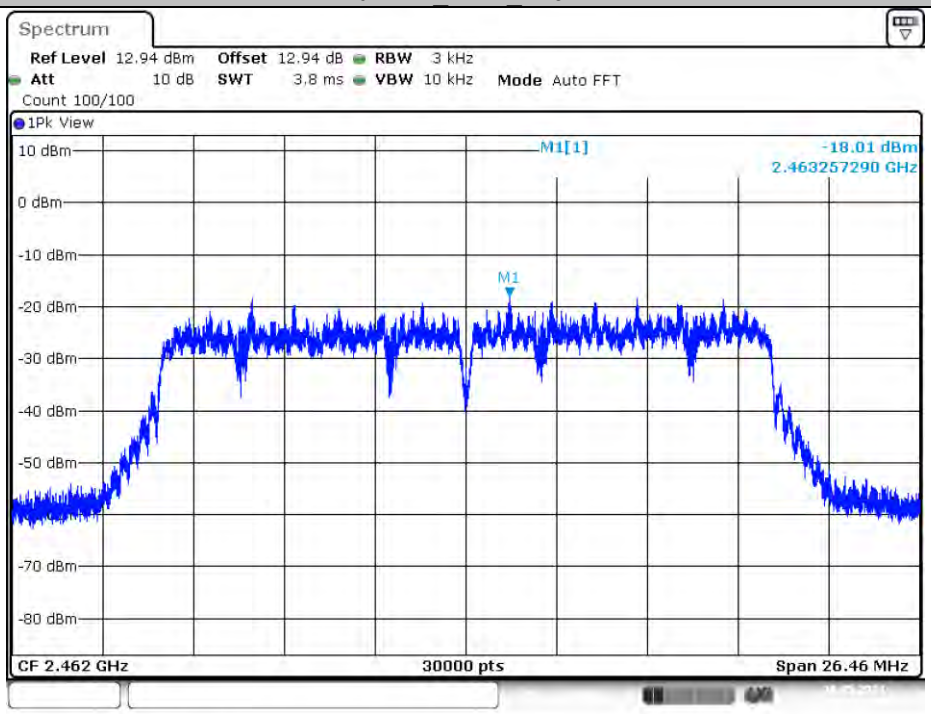
11N20SISO_Ant1_2412MHz



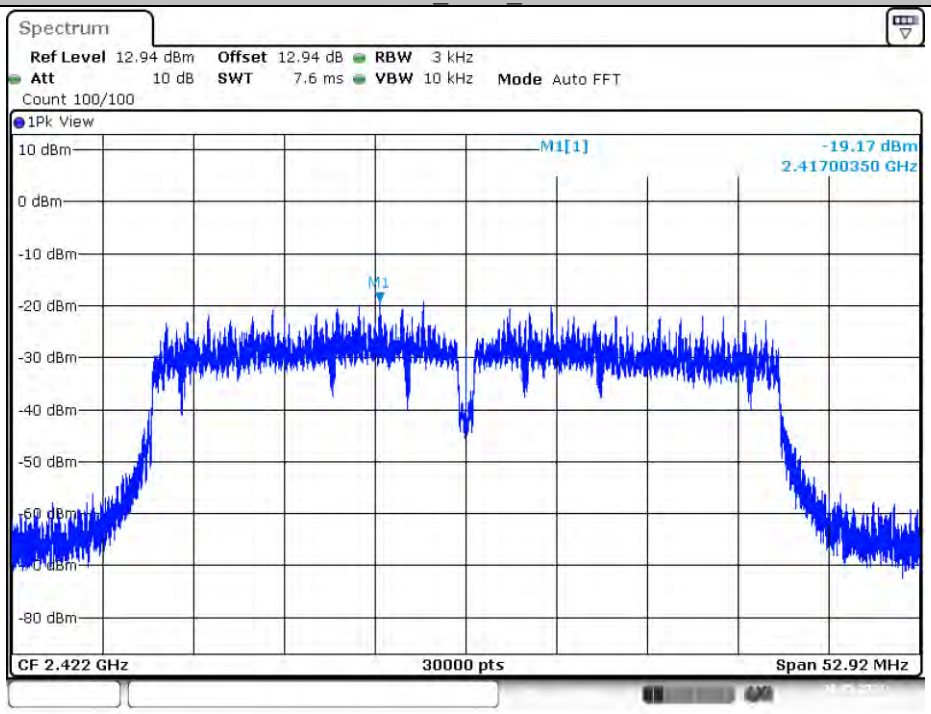
11N20SISO_Ant1_2437MHz



11N20SISO_Ant1_2462MHz



11N40SISO_Ant1_2422MHz



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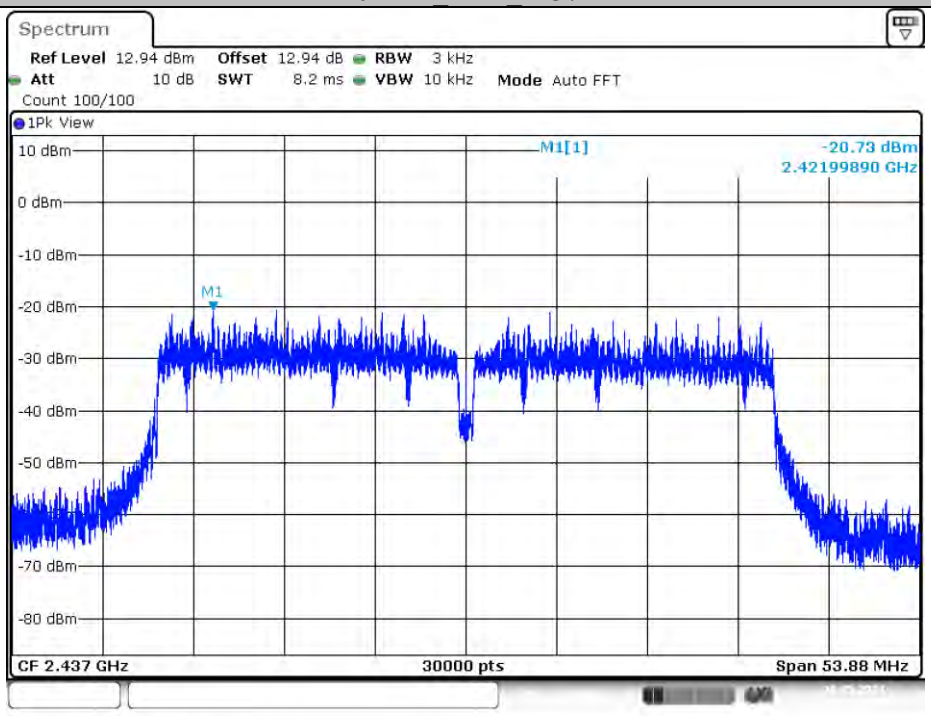
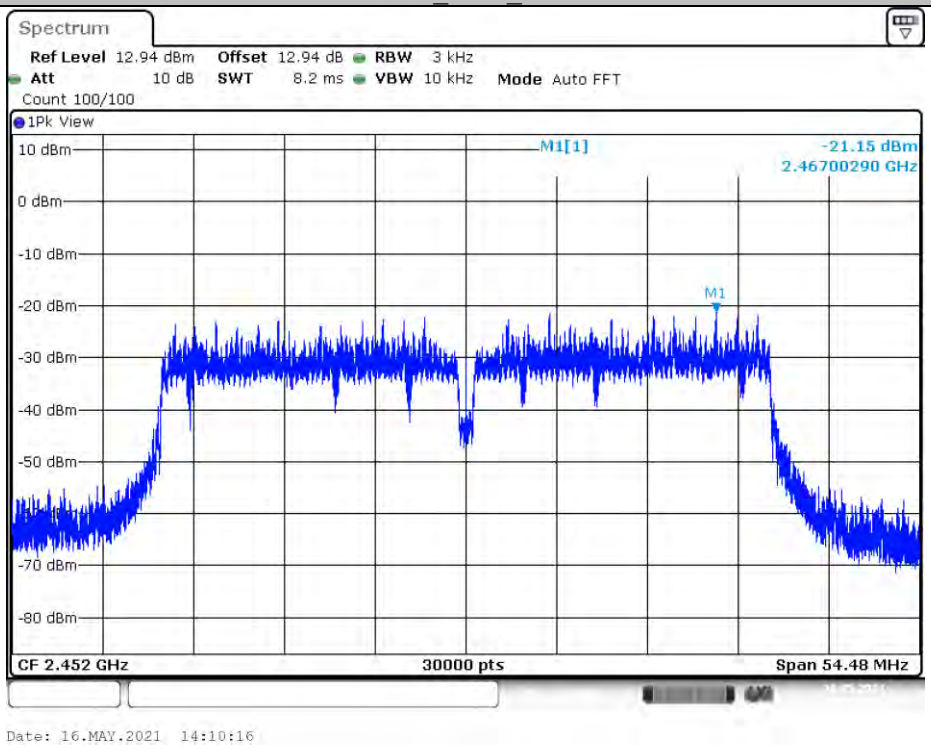


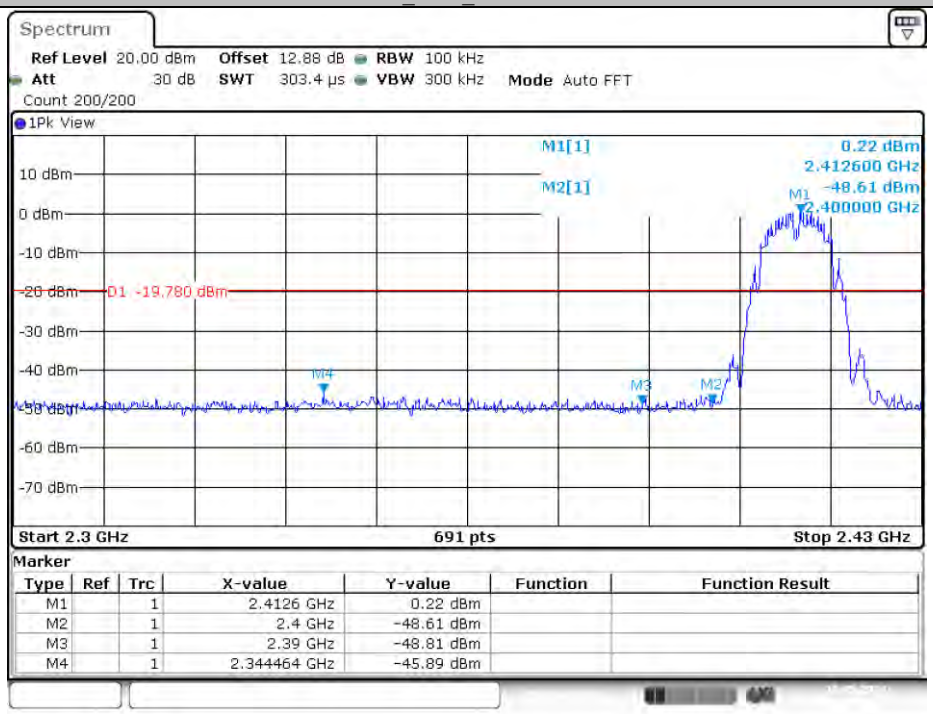
11N40SISO_Ant1_2452MHz



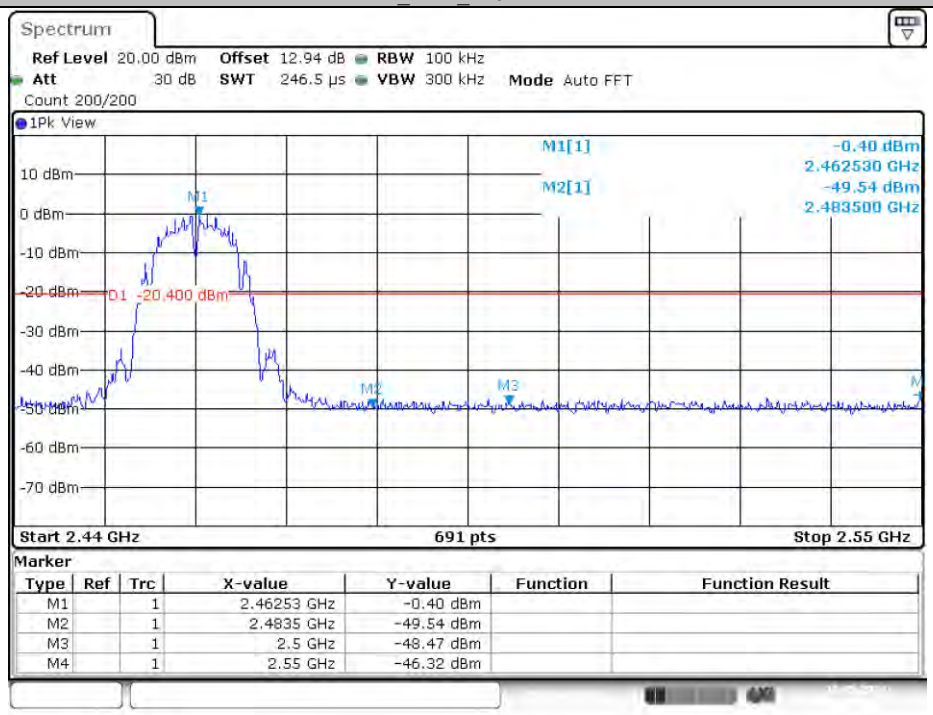
Appendix E: Band edge measurements

Test Graphs

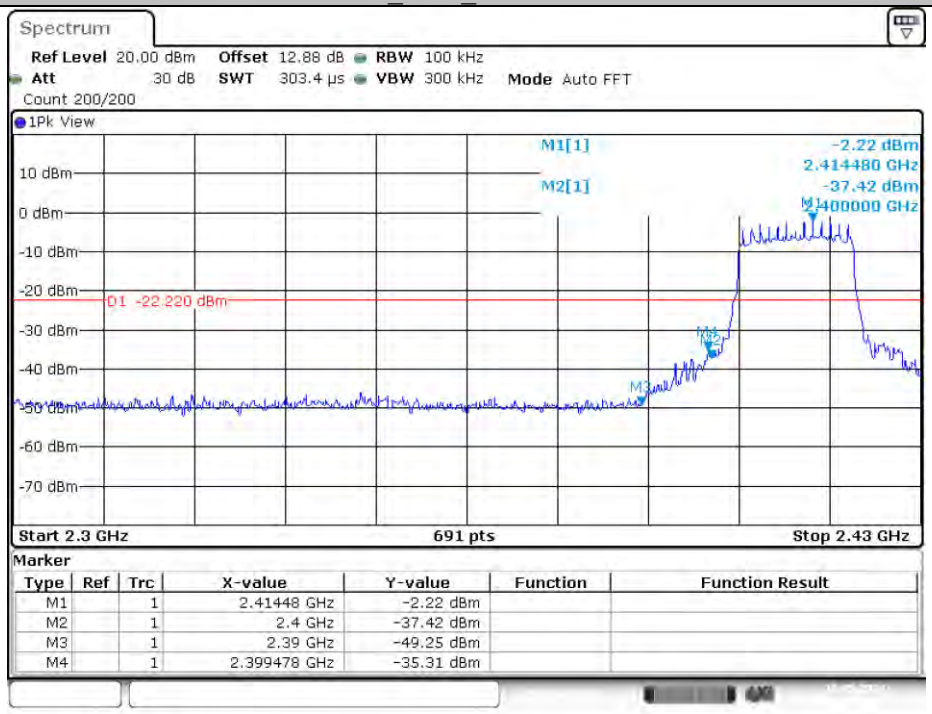
11B_Ant1_2412MHz



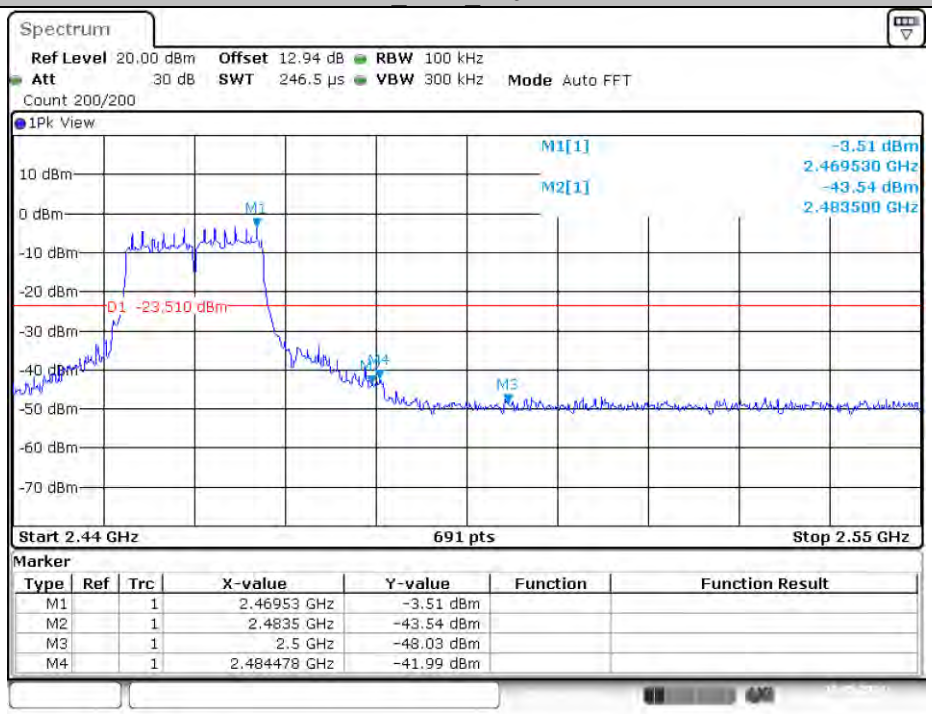
11B_Ant1_2462MHz



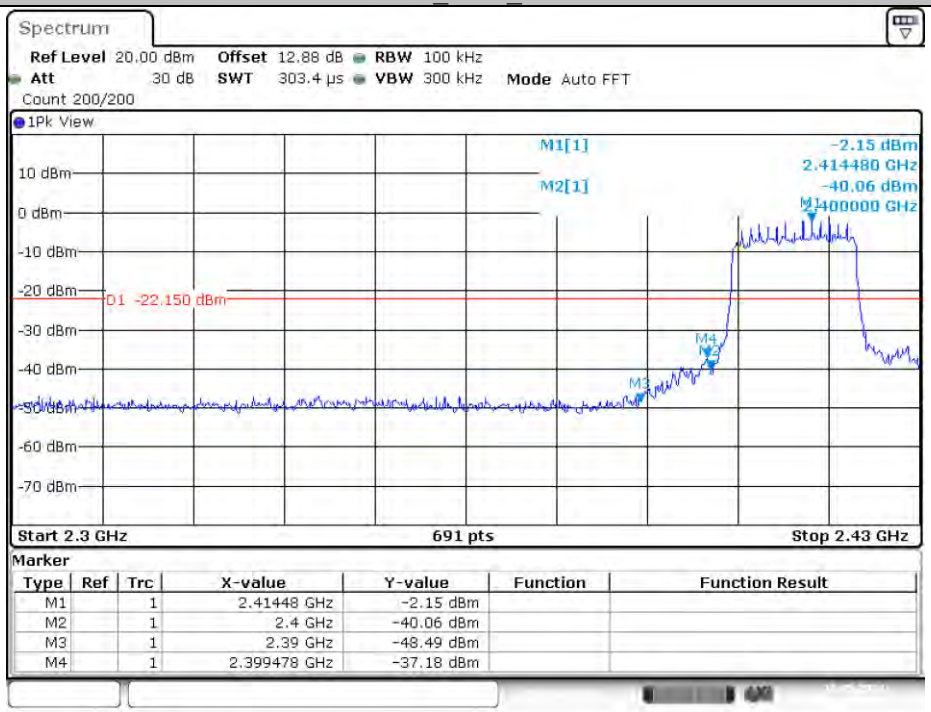
11G_Ant1_2412MHz



11G_Ant1_2462MHz



11N20SISO_Ant1_2412MHz



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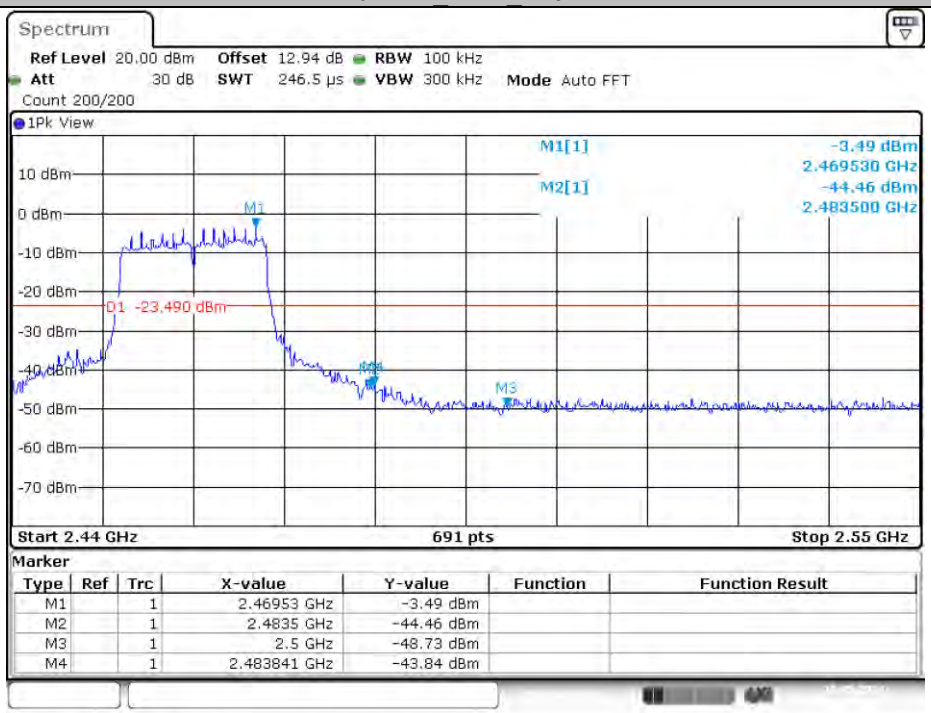
11N20SISO_Ant1_2462MHz



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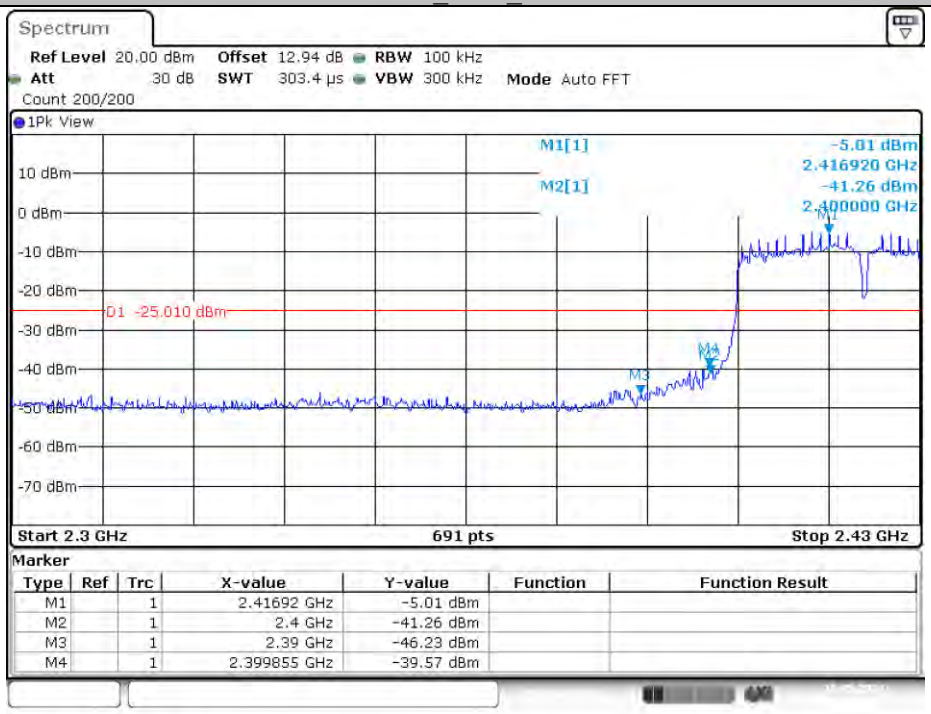
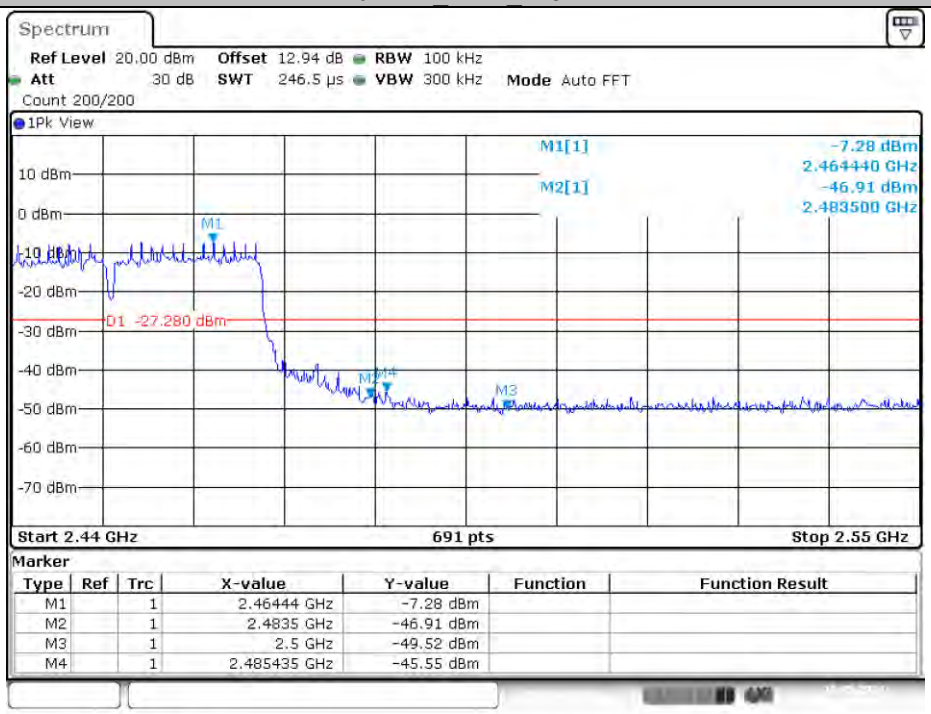
11N40SISO_Ant1_2422MHz



11N40SISO_Ant1_2452MHz



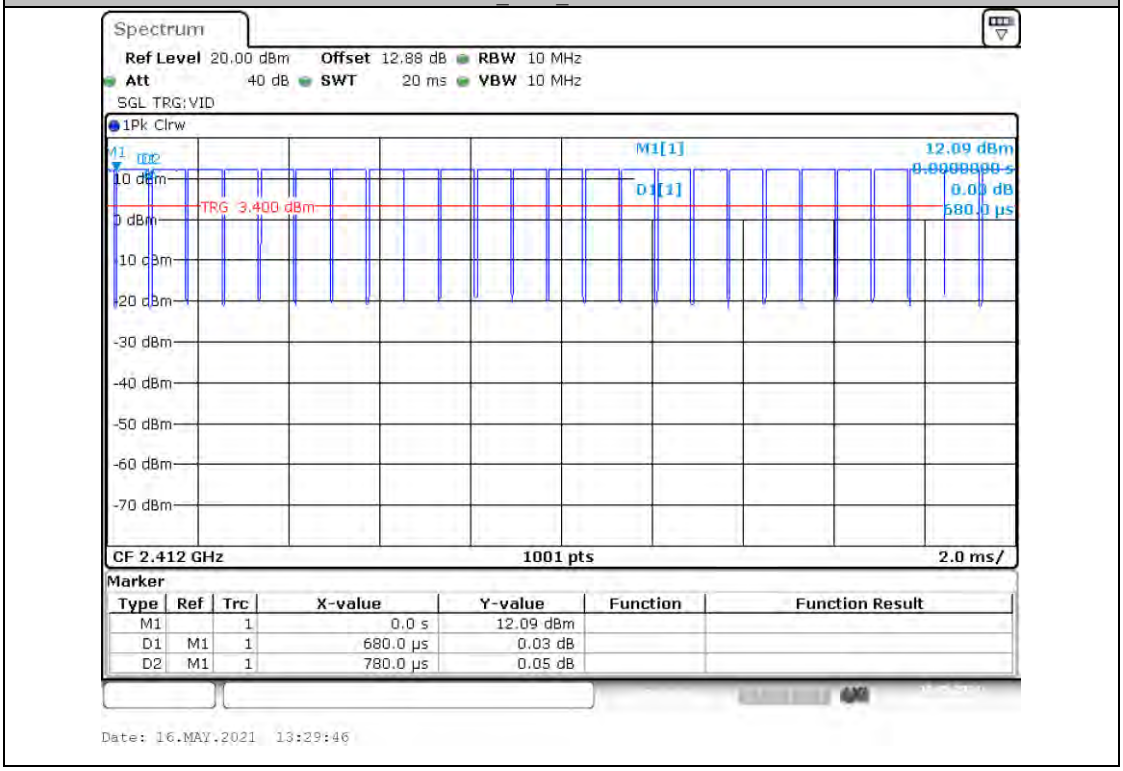
Appendix F: Duty Cycle

Test Result

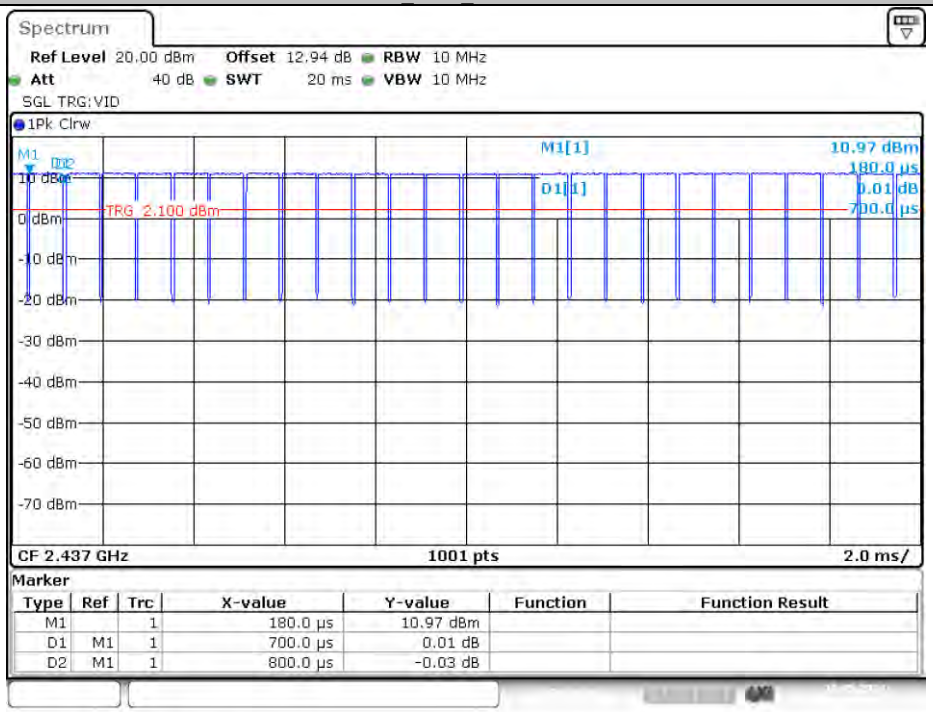
TestMode	Antenna	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2412	0.68	0.78	87.18
		2437	0.70	0.80	87.50
		2462	0.70	0.80	87.50
11G	Ant1	2412	0.10	0.17	58.82
		2437	0.10	0.17	58.82
		2462	0.09	0.17	52.94
11N20SISO	Ant1	2412	0.09	0.17	52.94
		2437	0.10	0.17	58.82
		2462	0.09	0.17	52.94
11N40SISO	Ant1	2422	0.05	0.13	38.46
		2437	0.05	0.13	38.46
		2452	0.05	0.13	38.46

Test Graphs

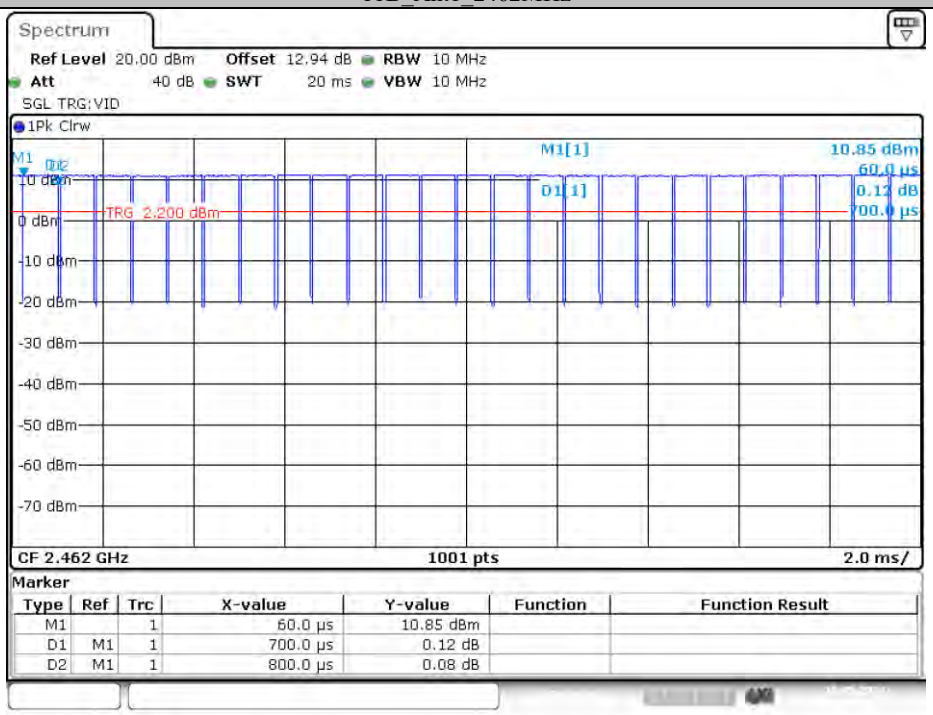
11B_Ant1_2412MHz



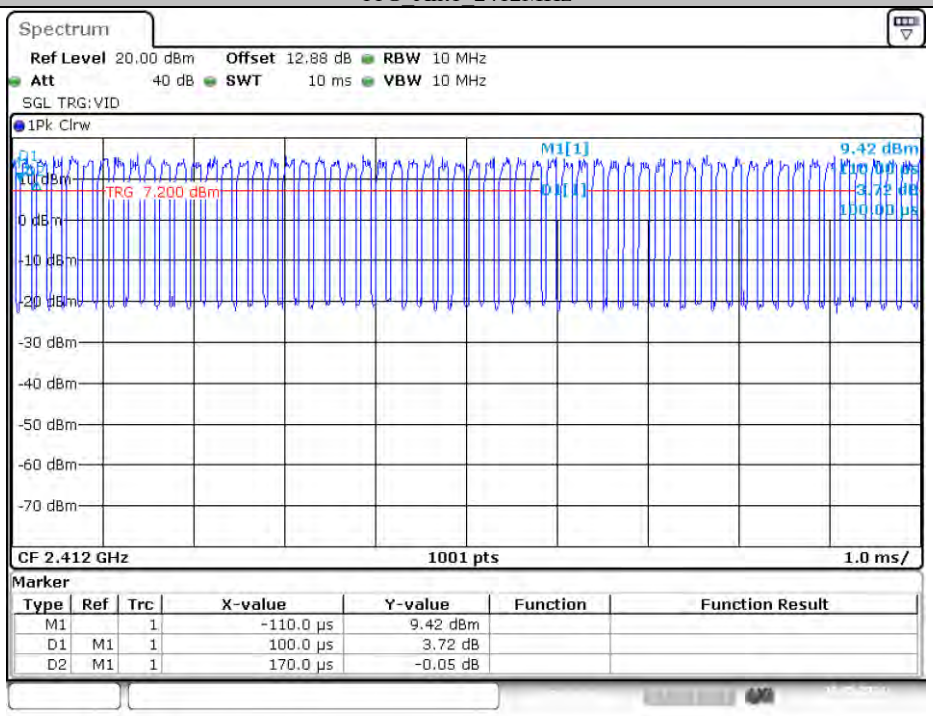
11B_Ant1_2437MHz



11B_Ant1_2462MHz



11G_Ant1_2412MHz



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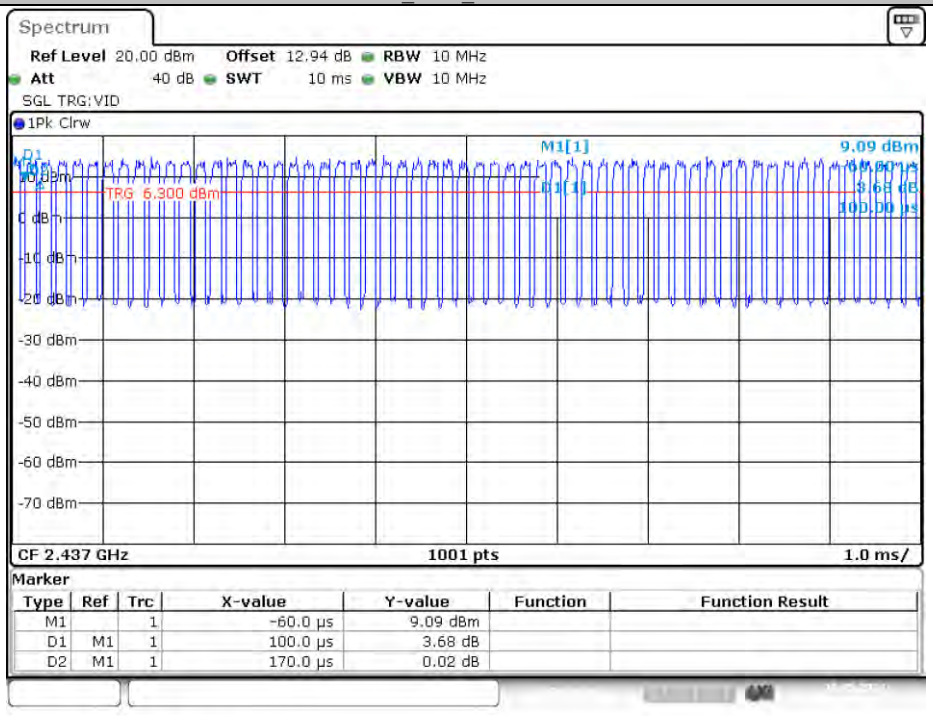
11G_Ant1_2437MHz



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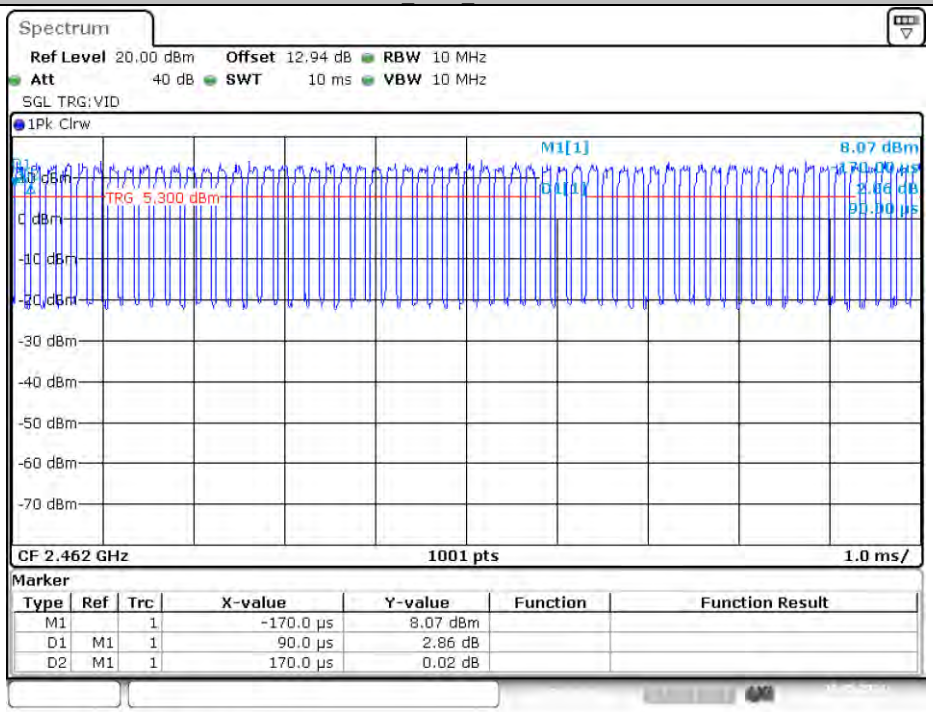
11G_Ant1_2462MHz



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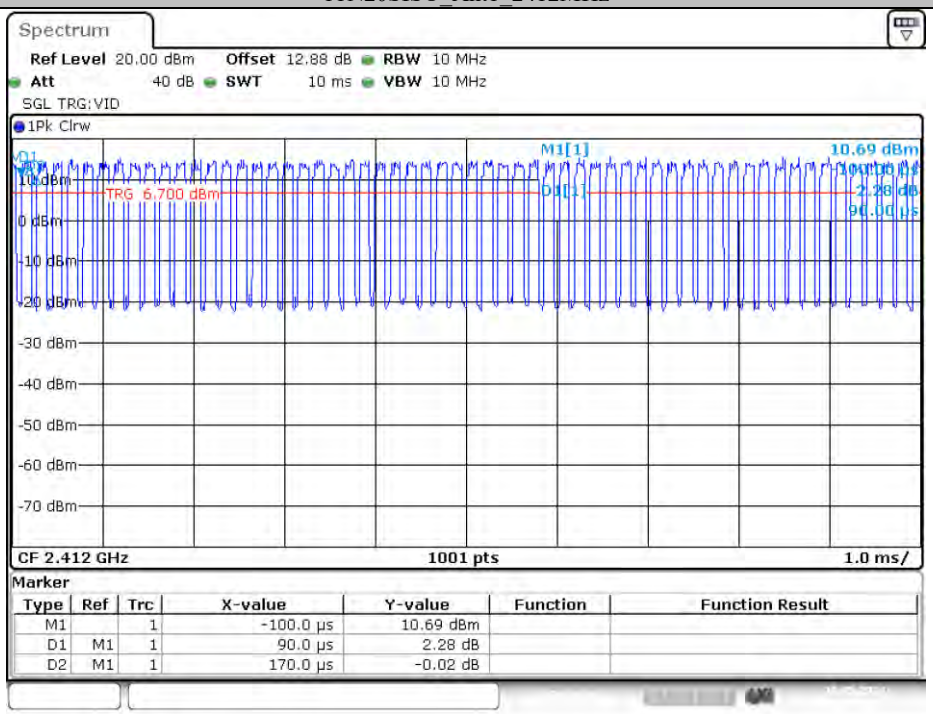
11N20SISO_Ant1_2412MHz



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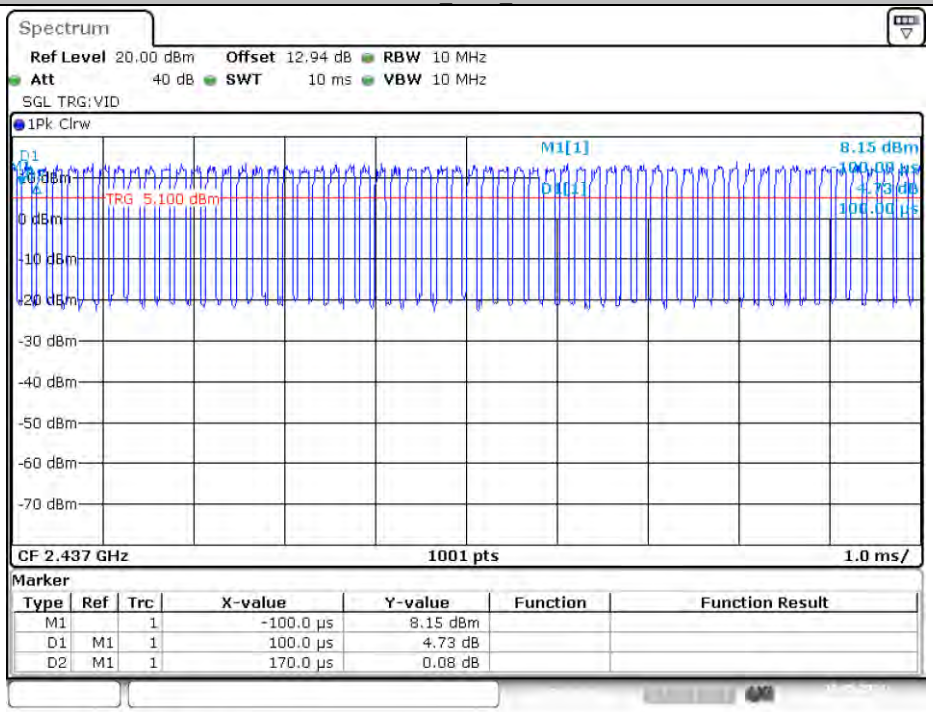
11N20SISO_Ant1_2437MHz



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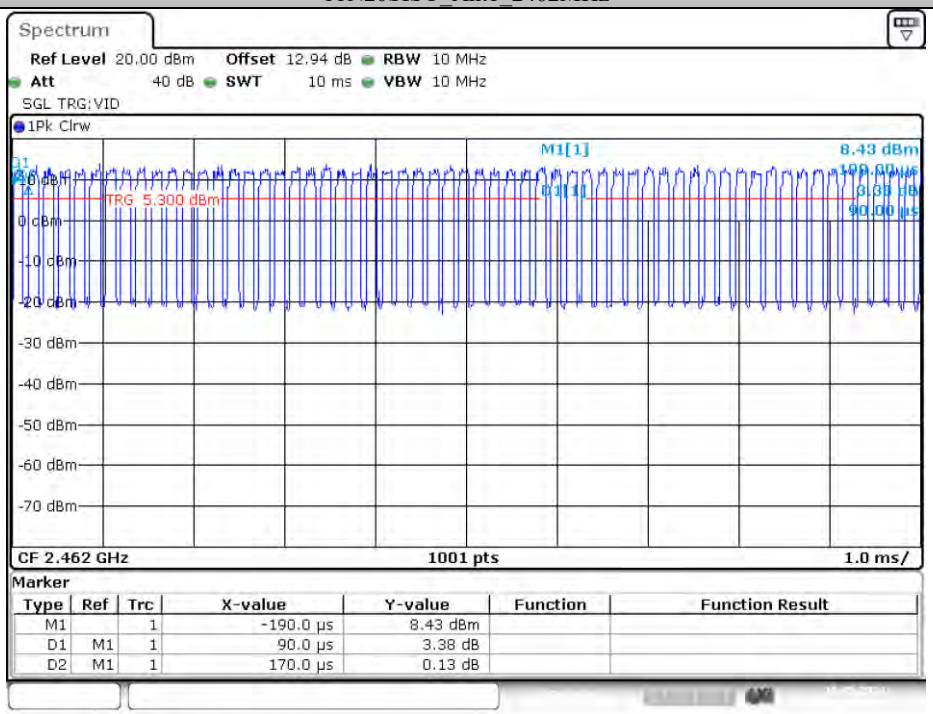
11N20SISO_Ant1_2462MHz



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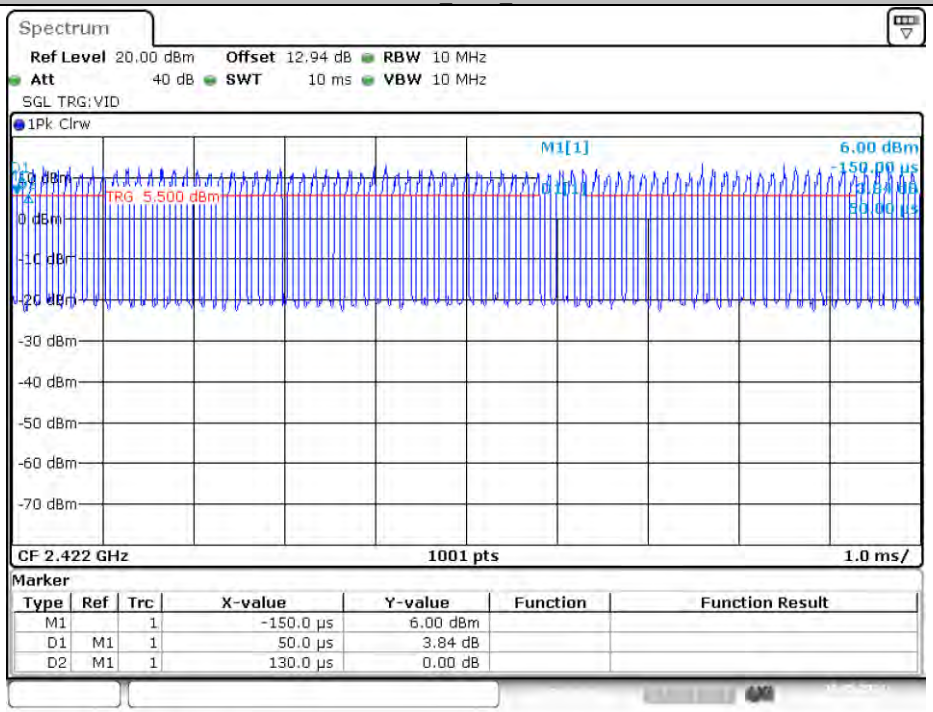
11N40SISO_Ant1_2422MHz



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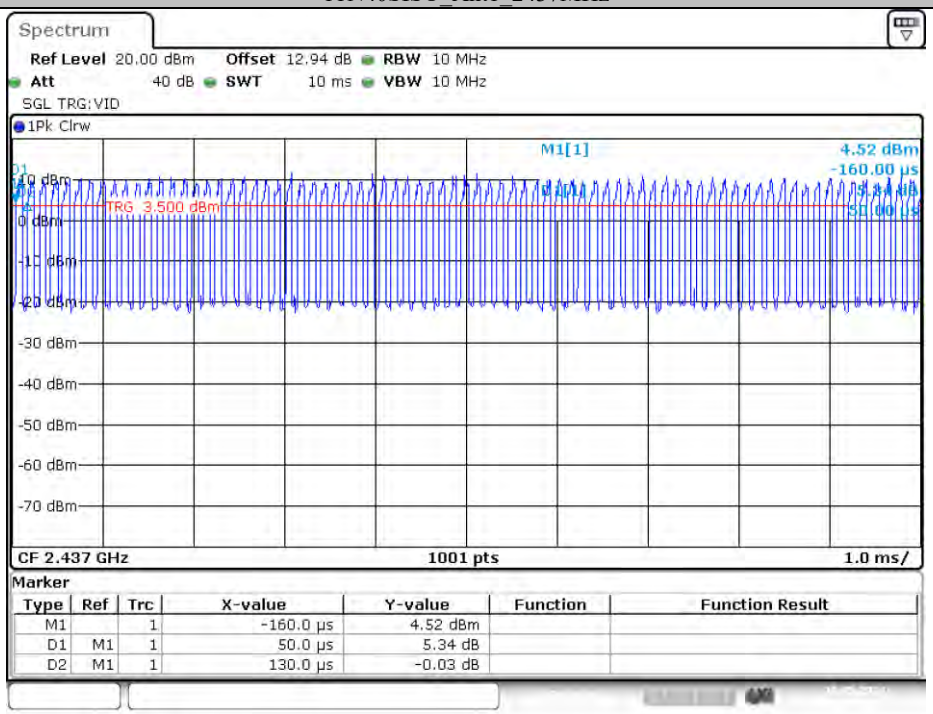
11N40SISO_Ant1_2437MHz



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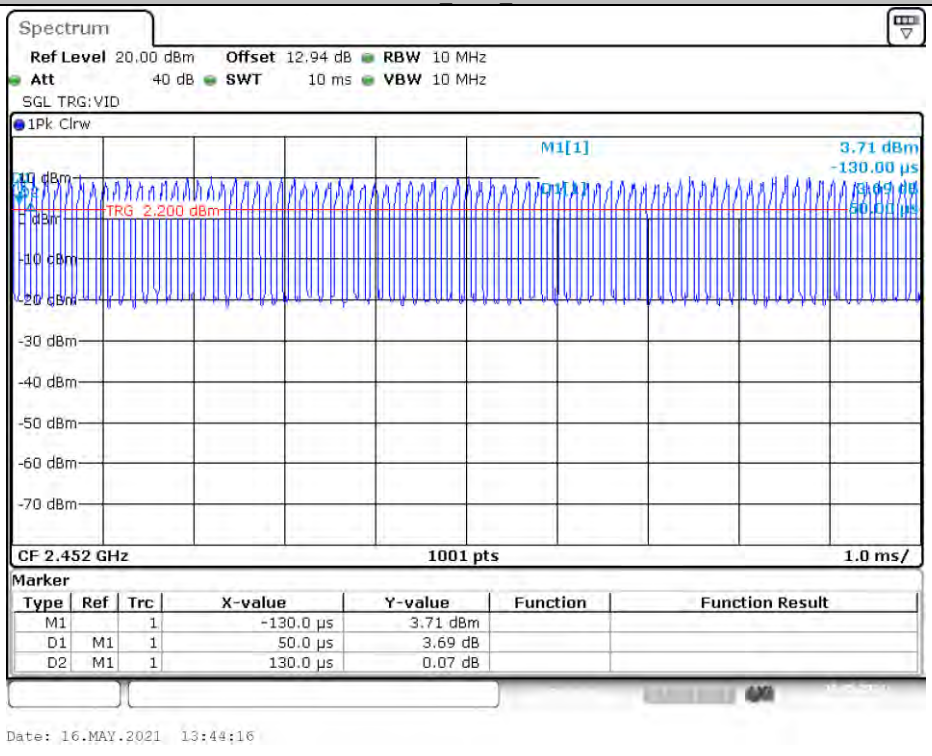
11N40SISO_Ant1_2452MHz



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