FCC PART 15.247

TEST REPORT

For

Shenzhen Offong Technology Co., Ltd.

2006.South China Development Center, No.1, South China Avenue, Hehua Community, Pinghu Street, Longgang District, Shenzhen

FCC ID: 2AY7Z-P1

Report Type:	**Product Type:**
Original Report	Smart plug

Report Number:	RSZ210311001-00A
Report Date:	2020-04-01
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Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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TABLE OF CONTENTS

GENERAL INFORMATION **4**
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 4
OBJECTIVE 4
TEST METHODOLOGY 4
MEASUREMENT UNCERTAINTY 5
SYSTEM TEST CONFIGURATION **6**
DESCRIPTION OF TEST CONFIGURATION 6
EQUIPMENT MODIFICATIONS 6
EUT EXERCISE SOFTWARE 6
DUTY CYCLE 6
SUPPORT EQUIPMENT LIST AND DETAILS 7
EXTERNAL I/O CABLE 7
BLOCK DIAGRAM OF TEST SETUP 7
SUMMARY OF TEST RESULTS **8**
TEST EQUIPMENT LIST **9**
FCC §15.247 (I) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE) **10**
APPLICABLE STANDARD 10
RESULT 10
FCC §15.203 - ANTENNA REQUIREMENT **11**
APPLICABLE STANDARD 11
ANTENNA CONNECTOR CONSTRUCTION 11
FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS **12**
APPLICABLE STANDARD 12
EUT SETUP 12
EMI TEST RECEIVER SETUP 12
TEST PROCEDURE 12
TRANSD FACTOR & MARGIN CALCULATION 13
TEST DATA 13
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS **16**
APPLICABLE STANDARD 16
EUT SETUP 16
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP 17
TEST PROCEDURE 17
FACTOR & MARGIN CALCULATION 17
TEST DATA 17
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH **24**
APPLICABLE STANDARD 24
TEST PROCEDURE 24
TEST DATA 24
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER **25**
APPLICABLE STANDARD 25
TEST PROCEDURE 25
TEST DATA 25

FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....26
APPLICABLE STANDARD 26
TEST PROCEDURE 26
TEST DATA 26
FCC §15.247(e) - POWER SPECTRAL DENSITY 27
APPLICABLE STANDARD 27
TEST PROCEDURE 27
TEST DATA 27
APPENDIX Wi-Fi.....28
APPENDIX A: 6DB EMISSION BANDWIDTH.....28

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Smart plug
Tested Model	P2-3
Multiple Model	P1, P1-1, P1-2, P1-3, P2, P2-1, P2-2, P2-4, P2-5, P3, P3-1, P3-2, P3-3
Model Differences	Refer to DOS letter
Frequency Range	Wi-Fi: 2412-2462MHz
Maximum Conducted Peak Output Power	13.98dBm(802.11b), 12.43dBm(802.11g), 12.46dBm(802.11n-HT20), 12.03dBm(802.11n-HT40)
Modulation Technique	DSSS, OFDM
Antenna Specification*	PCB Antenna: 2dBi(provided by the applicant)
Voltage Range	AC 90-250V
Date of Test	2021-03-19 to 2020-03-27
Sample serial number	RSZ210311001-RF-S1(Assigned by ATC, Shenzhen)
Received date	2020-03-15
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
RF Frequency		$\pm 0.082*10^{-7}$
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-2.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

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

Software “ESP 32” was used test frequencies and power levels were configured as below:
.

Mode	Data Rate (Mbps)	Power Level
802.11 b	1 Mbps	16
802.11 g	6 Mbps	20
802.11 n20	MCS0	24
802.11 n40	MCS0	24

Duty cycle

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

Support Equipment List and Details

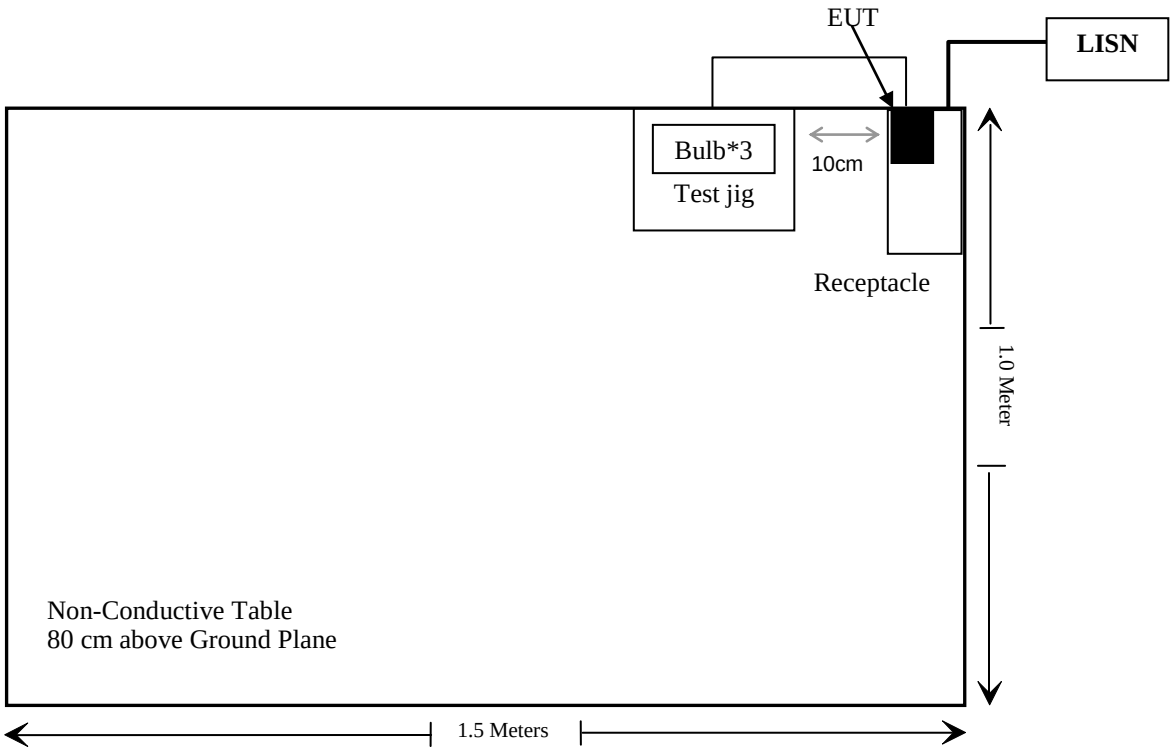
Manufacturer	Description	Model	Serial Number
Unknown	Test jig	Unknown	Unknown
Unknown	Bulb*3	500W	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Detachable AC Power Line	0.6m	EUT	Test jig

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §2.1091	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 & Occupied 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	ESPI	100396/003	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2021/12/25	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: ES-K1 V1.71					
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-18405536-J0	15964001002	2020/11/28	2021/11/27
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
Radiated Emission Test Software: EZ_EMC V 1.1.4.2					
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	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 PERMISSIBLE 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)

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)**			
2412-2462	2	1.58	14	25.12	20	0.008	1

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 PCB antenna arrangement, which was permanently attached and the antenna gain is 2 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

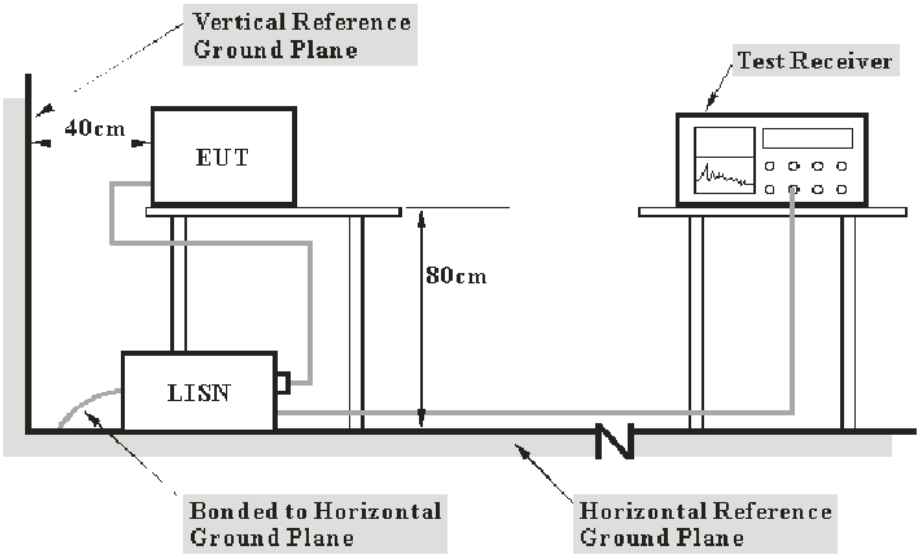
Result: Compliance.

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 EUT 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

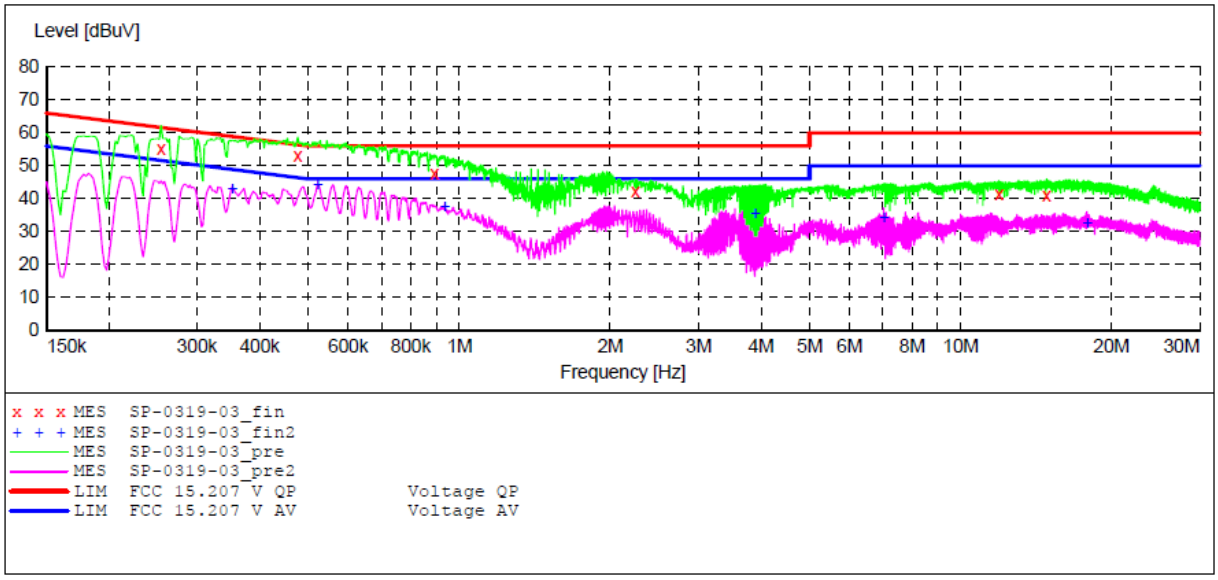
Environmental Conditions

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

The testing was performed by Black Ding on 2021-03-19

EUT operation mode: Transmitting

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "SP-0319-03_fin"

2021-3-19 10:20

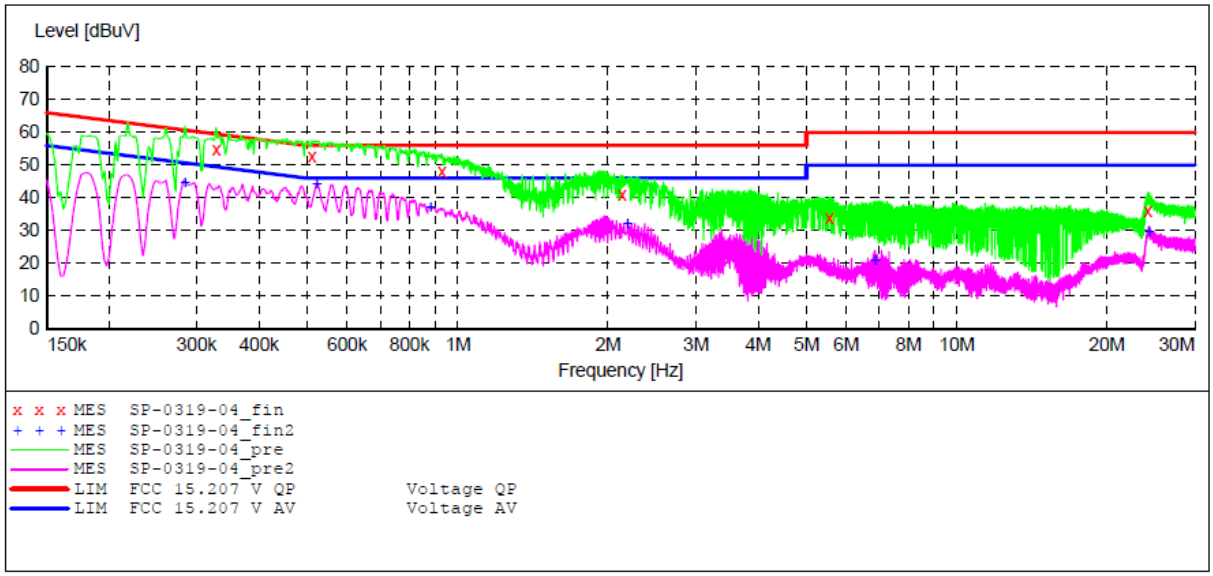
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.254000	55.00	10.9	62	7.0	QP	L1	GND
0.476000	53.00	11.0	56	3.0	QP	L1	GND
0.892000	47.80	11.1	56	8.2	QP	L1	GND
2.245000	42.20	11.3	56	13.8	QP	L1	GND
11.925000	41.40	11.6	60	18.6	QP	L1	GND
14.860000	41.00	11.6	60	19.0	QP	L1	GND

MEASUREMENT RESULT: "SP-0319-03_fin2"

2021-3-19 10:20

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.352000	43.00	10.9	49	6.0	AV	L1	GND
0.522000	44.20	11.0	46	1.8	AV	L1	GND
0.936000	37.80	11.1	46	8.2	AV	L1	GND
3.900000	35.60	11.4	46	10.4	AV	L1	GND
7.030000	34.50	11.5	50	15.5	AV	L1	GND
17.885000	32.50	11.7	50	17.5	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "SP-0319-04_fin"

2021-3-19 10:27

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.328000	54.80	10.9	60	5.2	QP	N	GND
0.510000	52.60	11.0	56	3.4	QP	N	GND
0.930000	48.10	11.1	56	7.9	QP	N	GND
2.135000	40.90	11.3	56	15.1	QP	N	GND
5.555000	34.00	11.5	60	26.0	QP	N	GND
24.145000	35.90	11.7	60	24.1	QP	N	GND

MEASUREMENT RESULT: "SP-0319-04_fin2"

2021-3-19 10:27

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.284000	44.80	10.9	51	6.2	AV	N	GND
0.522000	44.20	11.0	46	1.8	AV	N	GND
0.882000	37.20	11.1	46	8.8	AV	N	GND
2.190000	32.30	11.3	46	13.7	AV	N	GND
6.860000	21.00	11.5	50	29.0	AV	N	GND
24.330000	29.70	11.7	50	20.3	AV	N	GND

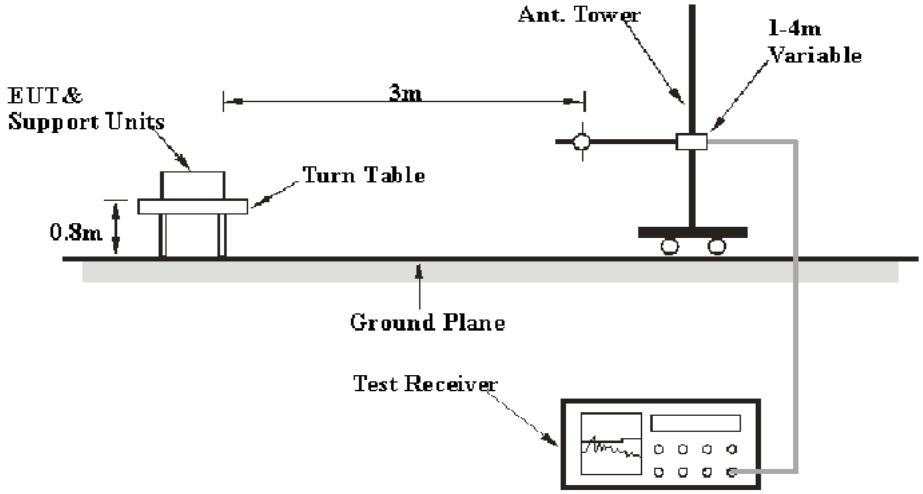
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

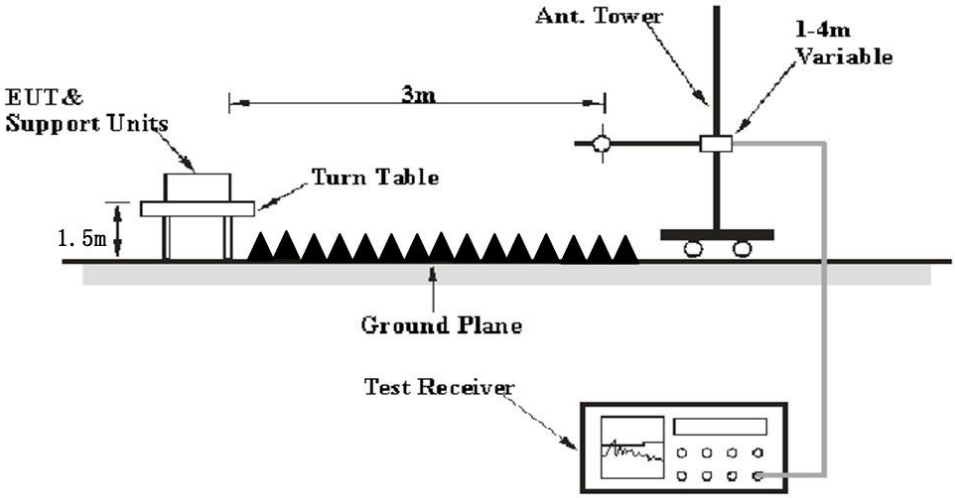
FCC §15.247 (d); §15.209; §15.205;

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

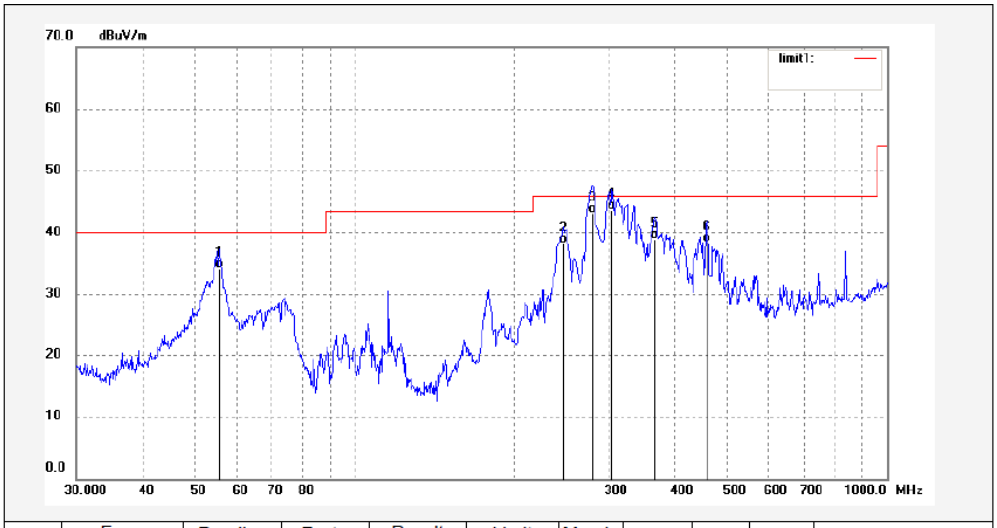
The testing was performed by Black Ding on 2021-03-24.

EUT operation mode: Transmitting
***18~25GHz**: The test values in the noise floor level, the test data were not recorded in the report.*

30 MHz~1 GHz: *(worst case at 802.11b mode)*

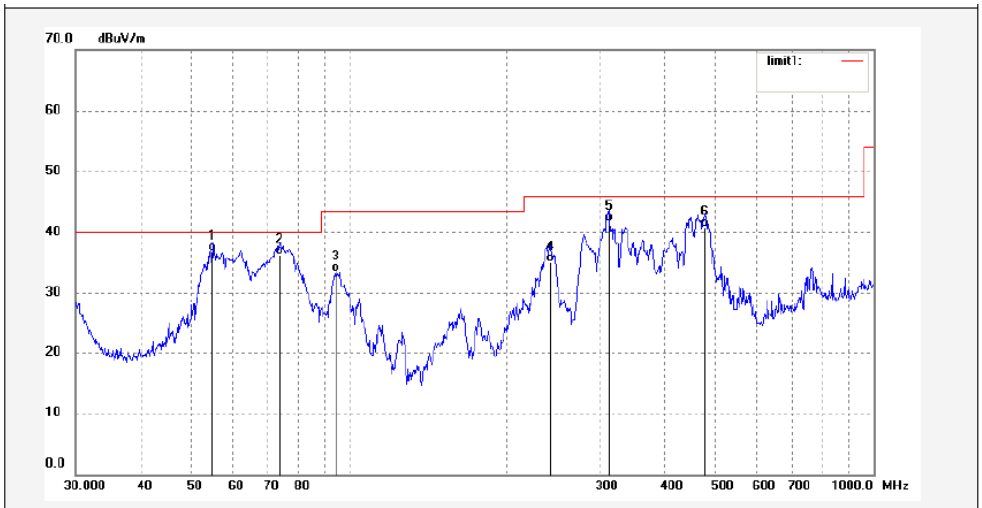
TX Chanel 1:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	55.6094	45.72	-11.49	34.23	40.00	-5.77	QP			
2	245.9507	48.32	-10.14	38.18	46.00	-7.82	QP			
3	279.0436	52.34	-9.23	43.11	46.00	-2.89	QP			
4	305.6800	52.17	-8.48	43.69	46.00	-2.31	QP			
5	366.8231	45.36	-6.49	38.87	46.00	-7.13	QP			
6	459.1143	43.28	-4.88	38.40	46.00	-7.60	QP			

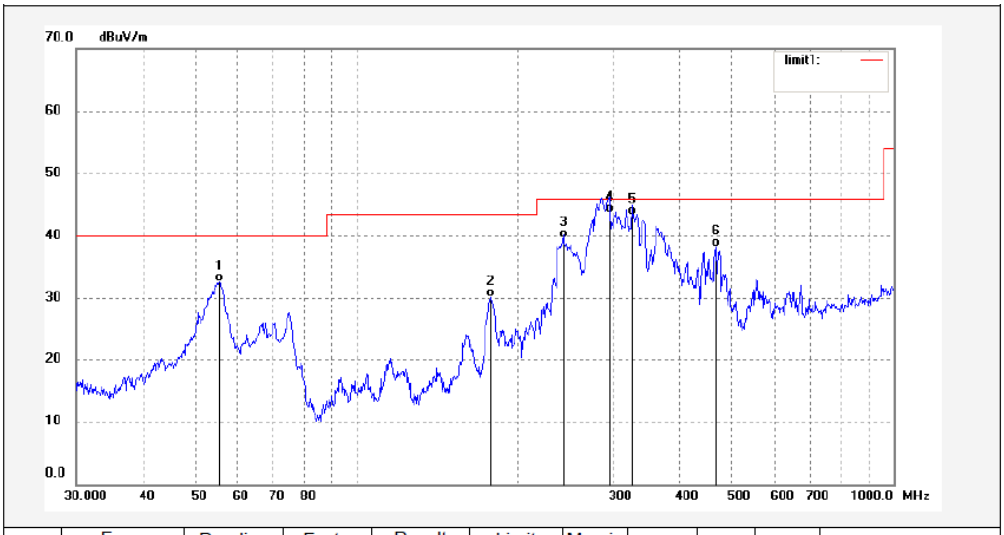
Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	54.6428	48.17	-11.32	36.85	40.00	-3.15	QP			
2	73.3593	52.34	-15.95	36.39	40.00	-3.61	QP			
3	94.0978	47.08	-13.61	33.47	43.50	-10.03	QP			
4	241.6759	45.21	-10.15	35.06	46.00	-10.94	QP			
5	312.1792	50.02	-8.20	41.82	46.00	-4.18	QP			
6	477.1693	45.31	-4.45	40.86	46.00	-5.14	QP			

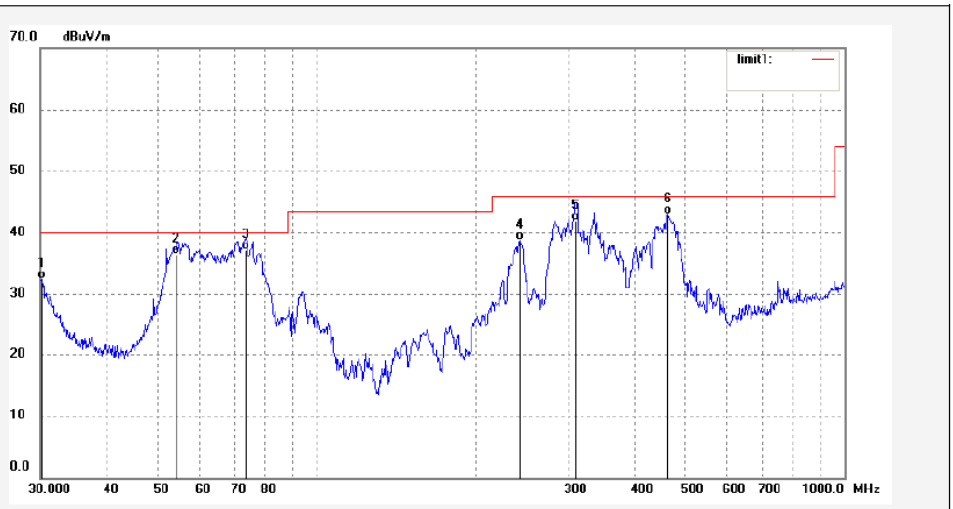
TX Chanel 11:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	55.4147	44.14	-11.45	32.69	40.00	-7.31	QP			
2	177.5089	42.72	-12.55	30.17	43.50	-13.33	QP			
3	242.5252	49.72	-10.14	39.58	46.00	-6.42	QP			
4	295.1469	52.36	-8.71	43.65	46.00	-2.35	QP			
5	325.5957	51.02	-7.66	43.36	46.00	-2.64	QP			
6	467.2348	42.91	-4.72	38.19	46.00	-7.81	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	30.2107	39.96	-7.47	32.49	40.00	-7.51	QP			
2	54.2610	48.12	-11.58	36.54	40.00	-3.46	QP			
3	73.3593	52.47	-15.20	37.27	40.00	-2.73	QP			
4	242.5252	48.90	-10.14	38.76	46.00	-7.24	QP			
5	309.9977	50.23	-8.28	41.95	46.00	-4.05	QP			
6	463.9696	47.70	-4.78	42.92	46.00	-3.08	QP			

Above 1 GHz:

802.11b

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)				
11B, Low Channel (2412 MHz)									
2310	51.07	PK	154	1.60	H	-6.84	44.23	74.00	29.77
2310	51.35	PK	78	1.50	V	-6.84	44.51	74.00	29.49
2390	52.81	PK	256	1.60	H	-6.44	46.37	74.00	27.63
2390	55.87	PK	312	1.70	V	-6.44	49.43	74.00	24.57
4824	52.37	PK	147	1.50	H	2.87	55.24	74.00	18.76
4824	45.73	**Ave**	147	1.50	H	2.87	48.60	54.00	5.40
4824	52.54	PK	54	1.80	V	2.87	55.41	74.00	18.59
4824	46.01	**Ave**	54	1.80	V	2.87	48.88	54.00	5.12
11B, Middle Channel (2437 MHz)									
4874	52.56	PK	73	1.60	H	3.01	55.57	74.00	18.43
4874	45.81	**Ave**	73	1.60	H	3.01	48.82	54.00	5.18
4874	52.71	PK	142	1.50	V	3.01	55.72	74.00	18.28
4874	46.16	**Ave**	142	1.50	V	3.01	49.17	54.00	4.83
11B, High Channel (2462 MHz)									
2483.5	50.28	PK	136	1.60	H	-5.96	44.32	74.00	29.68
2483.5	50.69	PK	148	1.60	V	-5.96	44.73	74.00	29.27
2500	50.11	PK	112	1.70	H	-5.88	44.23	74.00	29.77
2500	52.94	PK	234	1.70	V	-5.88	47.06	74.00	26.94
4924	52.75	PK	168	1.90	H	3.17	55.92	74.00	18.08
4924	46.49	**Ave**	168	1.90	H	3.17	49.66	54.00	4.34
4924	53.71	PK	25	2.00	V	3.17	56.88	74.00	17.12
4924	46.59	**Ave**	25	2.00	V	3.17	49.76	54.00	4.24
11G, Low Channel (2412 MHz)									
2310	51.05	PK	136	1.40	H	-6.84	44.21	74.00	29.79
2310	51.38	PK	115	1.50	V	-6.84	44.54	74.00	29.46
2390	52.77	PK	243	1.70	H	-6.44	46.33	74.00	27.67
2390	53.88	PK	72	1.60	V	-6.44	47.44	74.00	26.56
4824	51.45	PK	154	1.80	H	2.87	54.32	74.00	19.68
4824	44.67	**Ave**	154	1.80	H	2.87	47.54	54.00	6.46
4824	51.82	PK	231	1.40	V	2.87	54.69	74.00	19.31
4824	45.12	**Ave**	231	1.40	V	2.87	47.99	54.00	6.01
11G, Middle Channel (2437 MHz)									
4874	51.64	PK	145	1.60	H	3.01	54.65	74.00	19.35
4874	44.73	**Ave**	145	1.60	H	3.01	47.74	54.00	6.26
4874	51.58	PK	226	1.50	V	3.01	54.59	74.00	19.41
4874	44.82	**Ave**	226	1.50	V	3.01	47.83	54.00	6.17

11G, High Channel (2462 MHz)									
2483.5	50.33	PK	201	1.70	H	-5.96	44.37	74.00	29.63
2483.5	50.71	PK	137	1.50	V	-5.96	44.75	74.00	29.25
2500	50.18	PK	106	1.40	H	-5.88	44.30	74.00	29.70
2500	51.96	PK	42	1.90	V	-5.88	46.08	74.00	27.92
4924	51.31	PK	133	1.80	H	3.17	54.48	74.00	19.52
4924	44.22	**Ave**	133	1.80	H	3.17	47.39	54.00	6.61
4924	51.62	PK	274	1.70	V	3.17	54.79	74.00	19.21
4924	44.47	**Ave**	274	1.70	V	3.17	47.64	54.00	6.36
11N20, Low Channel (2412 MHz)									
2310	51.34	PK	148	1.40	H	-6.84	44.50	74.00	29.50
2310	51.63	PK	163	1.50	V	-6.84	44.79	74.00	29.21
2390	52.67	PK	38	1.70	H	-6.44	46.23	74.00	27.77
2390	53.85	PK	327	1.80	V	-6.44	47.41	74.00	26.59
4824	50.14	PK	159	1.60	H	2.87	53.01	74.00	20.99
4824	50.26	PK	130	1.90	V	2.87	53.13	74.00	20.87
11N20, Middle Channel (2437 MHz)									
4874	49.76	PK	118	1.40	H	3.01	52.77	74.00	21.23
4874	50.01	PK	167	1.60	V	3.01	53.02	74.00	20.98
11N20, High Channel (2462 MHz)									
2483.5	50.47	PK	236	1.50	H	-5.96	44.51	74.00	29.49
2483.5	50.78	PK	308	1.80	V	-5.96	44.82	74.00	29.18
2500	50.34	PK	179	1.60	H	-5.88	44.46	74.00	29.54
2500	51.96	PK	25	1.40	V	-5.88	46.08	74.00	27.92
4924	49.35	PK	149	1.70	H	3.17	52.52	74.00	21.48
4924	49.82	PK	276	1.80	V	3.17	52.99	74.00	21.01
11N40, Low Channel (2422 MHz)									
2310	52.27	PK	68	1.60	H	-6.84	45.43	74.00	28.57
2310	53.33	PK	213	1.50	V	-6.84	46.49	74.00	27.51
2390	52.34	PK	175	1.70	H	-6.44	45.90	74.00	28.10
2390	51.67	PK	37	1.60	V	-6.44	45.23	74.00	28.77
4844	48.85	PK	121	2.10	H	2.92	51.77	74.00	22.23
4844	49.02	PK	207	1.80	V	2.92	51.94	74.00	22.06
11N40, Middle Channel (2437 MHz)									
4874	48.93	PK	146	1.60	H	3.01	51.94	74.00	22.06
4874	48.87	PK	115	1.50	V	3.01	51.88	74.00	22.12

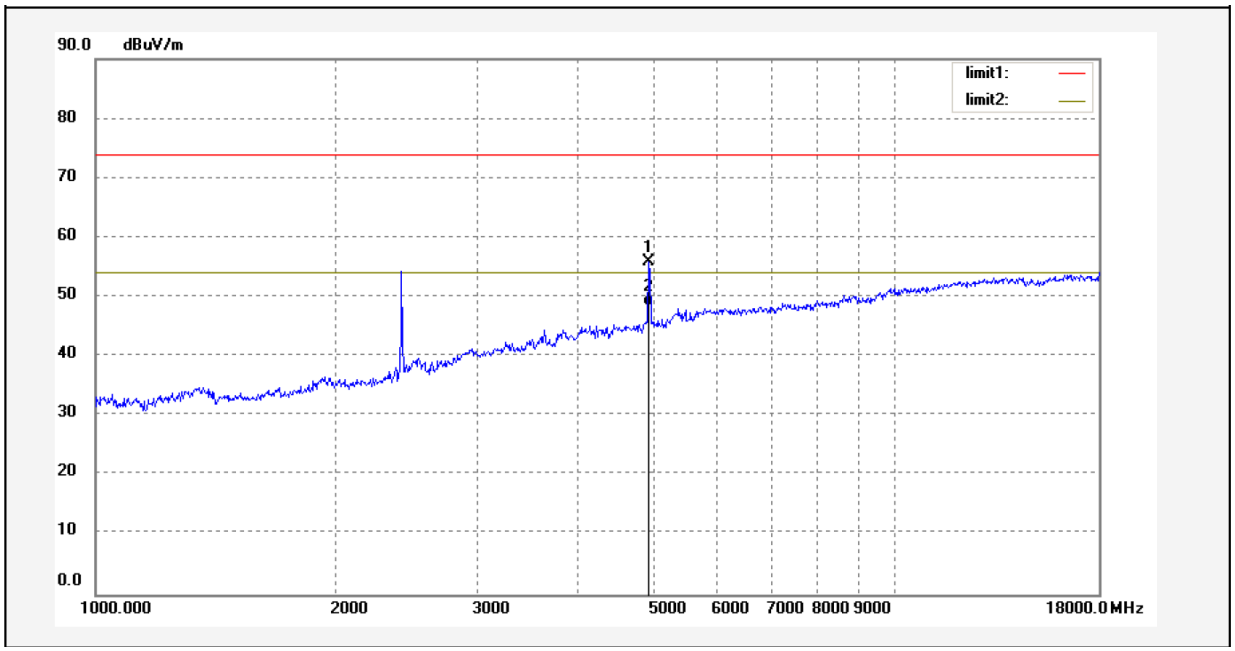
11N40, High Channel (2452 MHz)									
2483.5	50.29	PK	138	1.40	H	-5.96	44.33	74.00	29.67
2483.5	51.42	PK	179	1.60	V	-5.96	45.46	74.00	28.54
2500	50.77	PK	237	1.80	H	-5.88	44.89	74.00	29.11
2500	52.03	PK	21	1.50	V	-5.88	46.15	74.00	27.85
4904	49.84	PK	9	1.50	H	3.11	52.95	74.00	21.05
4904	50.30	PK	143	1.60	V	3.11	53.41	74.00	20.59

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 to the limit was not recorded.

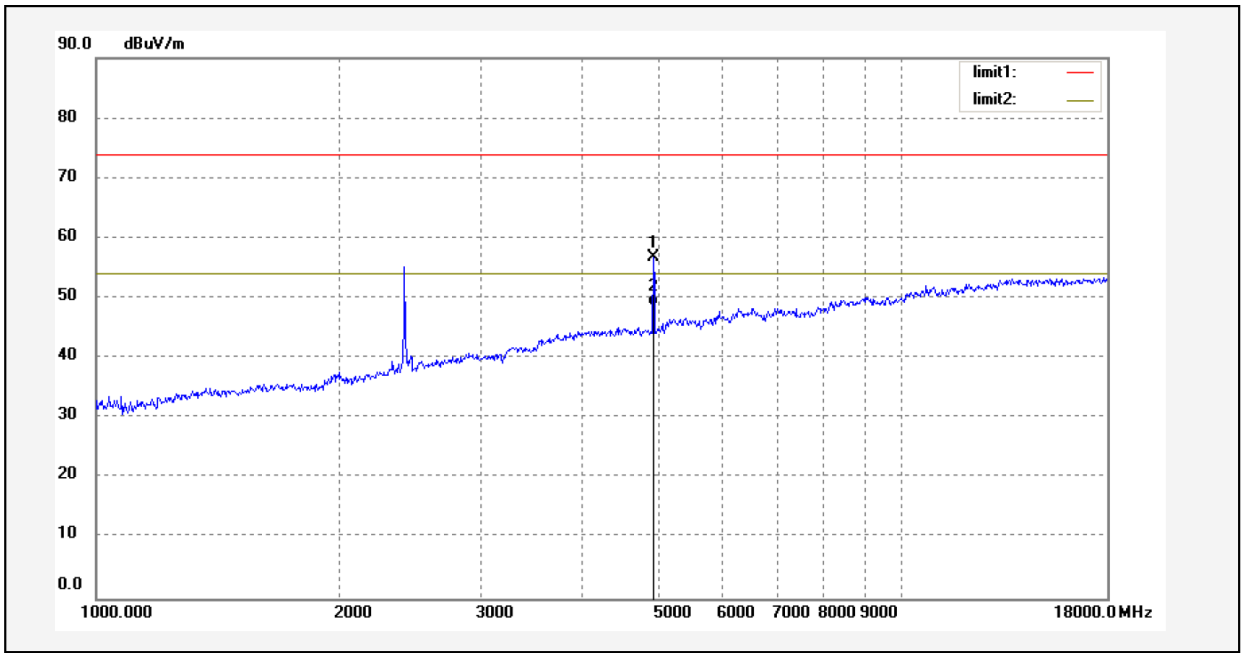
Mode: 11B, High Channel (2462 MHz)

Pre-scan for Peak

Horizontal:



Vertical:



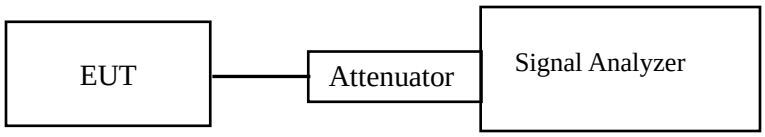
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

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 Black Ding on 2021-03-27

EUT operation mode: Transmitting

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

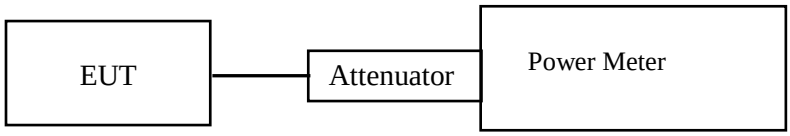
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 Black Ding on 2021-03-27

EUT operation mode: Transmitting

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

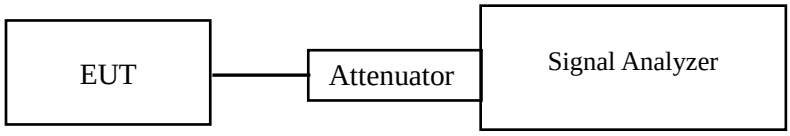
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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 Black Ding on 2021-03-27

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi

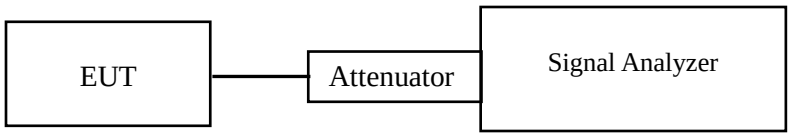
FCC §15.247(e) - POWER SPECTRAL DENSITY

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 Black Ding on 2021-03-27

EUT operation mode: Transmitting

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

APPENDIX Wi-Fi

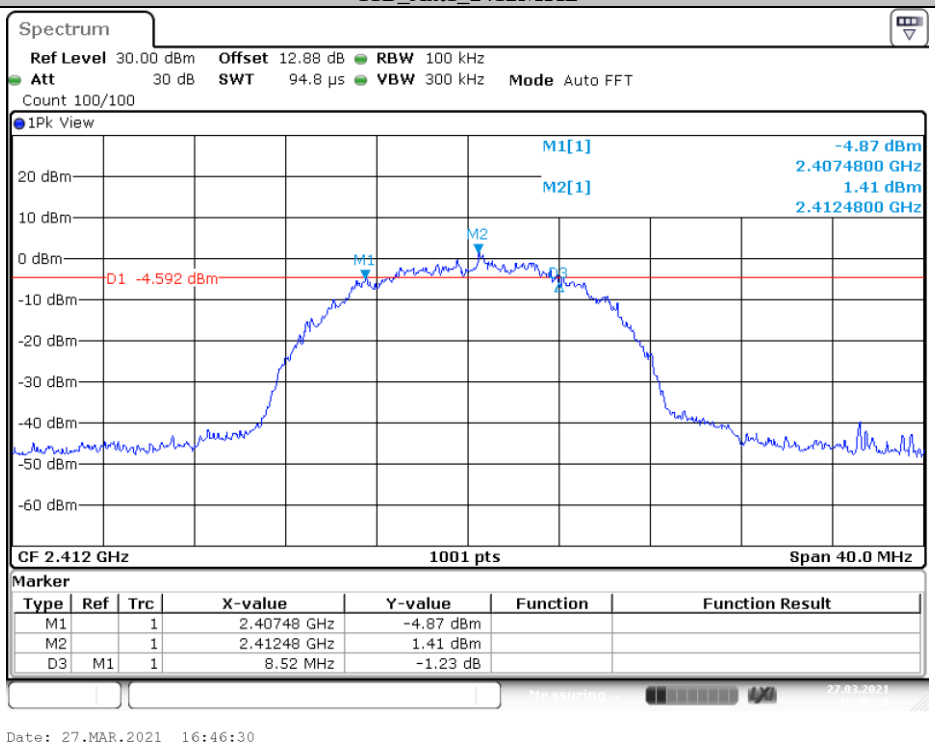
Appendix A: 6dB Emission Bandwidth

Test Result

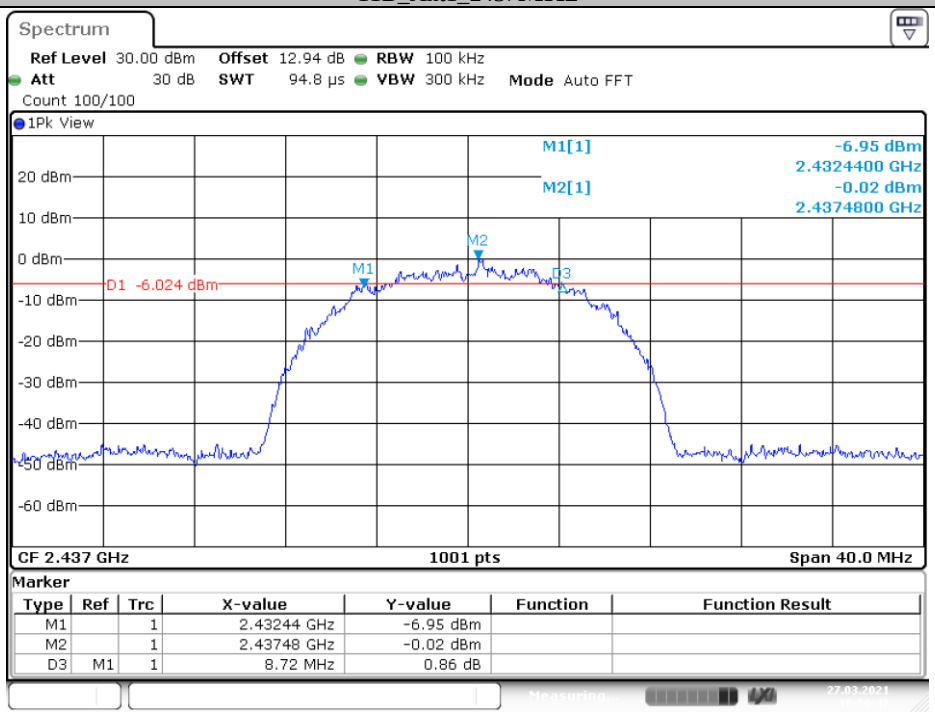
Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.520	0.5	PASS
		2437	8.720	0.5	PASS
		2462	8.520	0.5	PASS
11G	Ant1	2412	16.440	0.5	PASS
		2437	16.440	0.5	PASS
		2462	16.440	0.5	PASS
11N20SISO	Ant1	2412	17.400	0.5	PASS
		2437	17.120	0.5	PASS
		2462	17.360	0.5	PASS
11N40SISO	Ant1	2412	36.320	0.5	PASS
		2437	36.480	0.5	PASS
		2462	36.480	0.5	PASS

Test Graphs

11B_Ant1_2412MHz

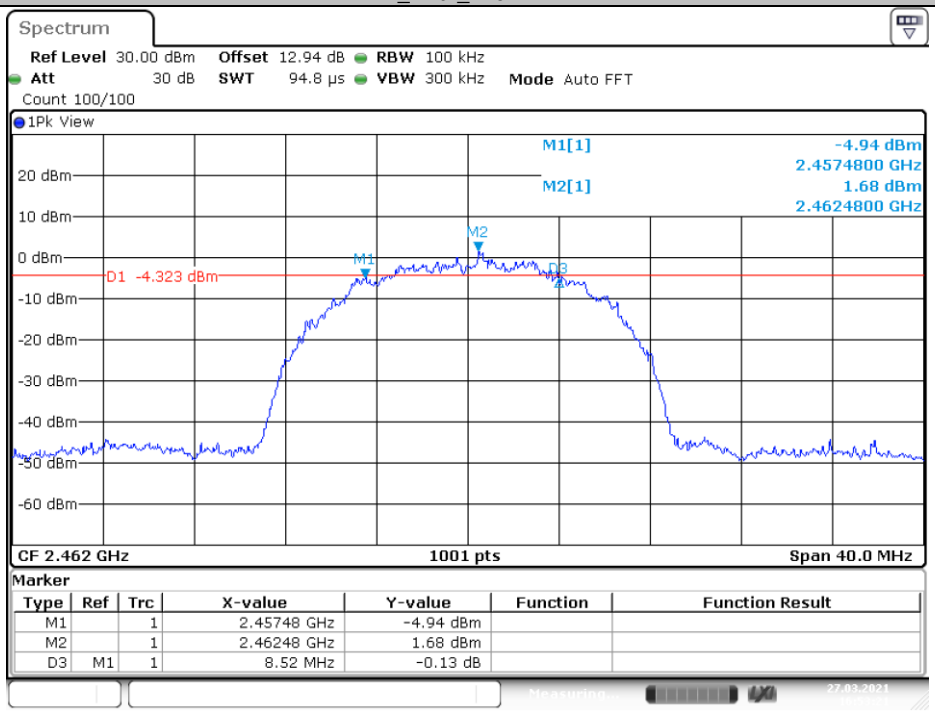


11B_Ant1_2437MHz



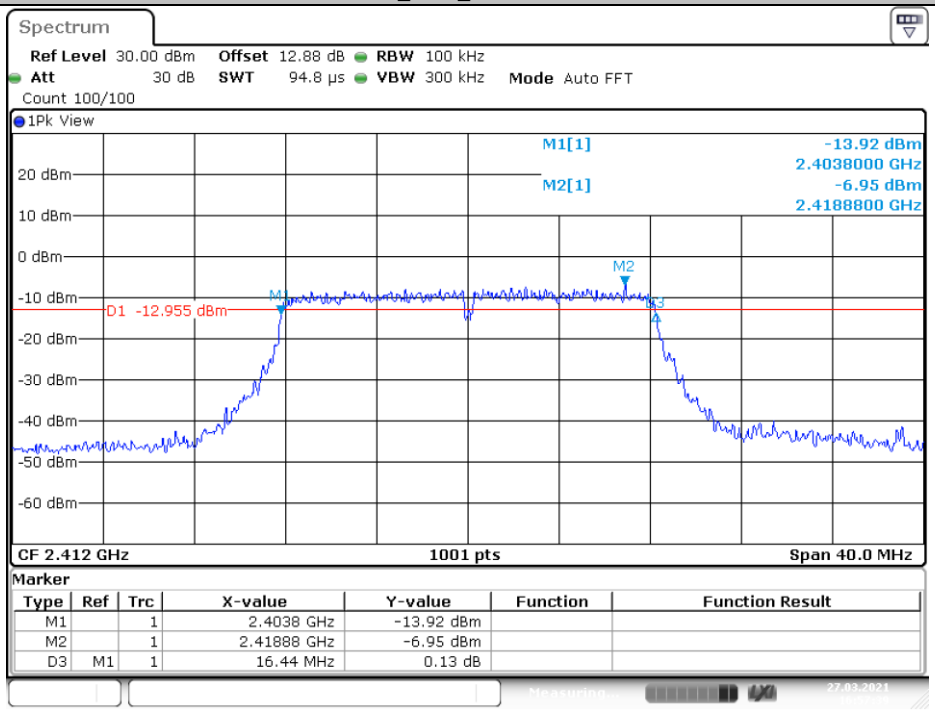
Date: 27.MAR.2021 16:50:47

11B_Ant1_2462MHz



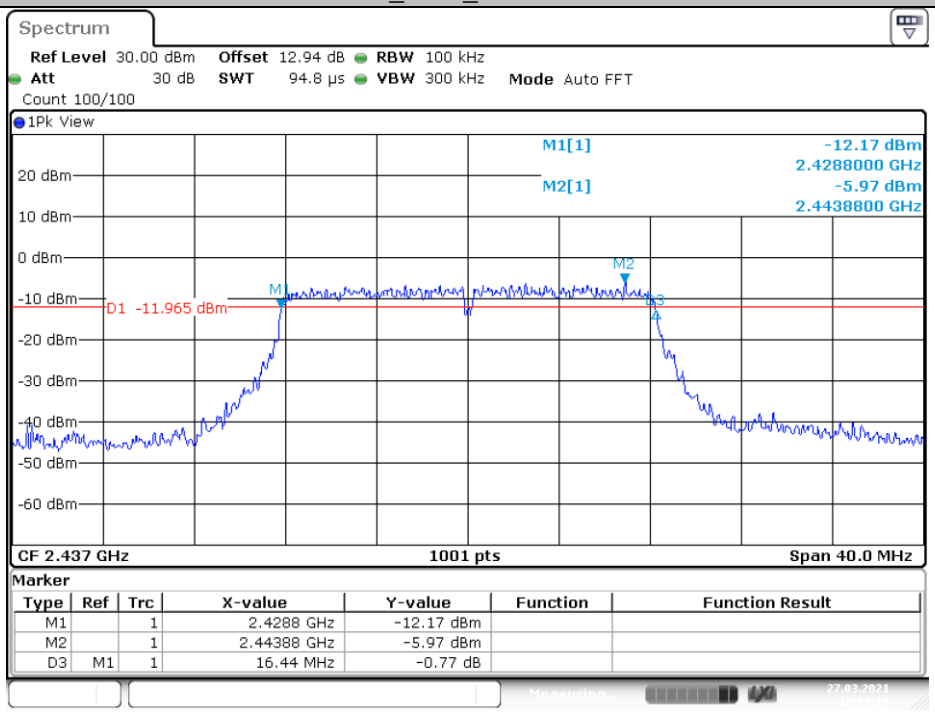
Date: 27.MAR.2021 16:53:21

11G_Ant1_2412MHz



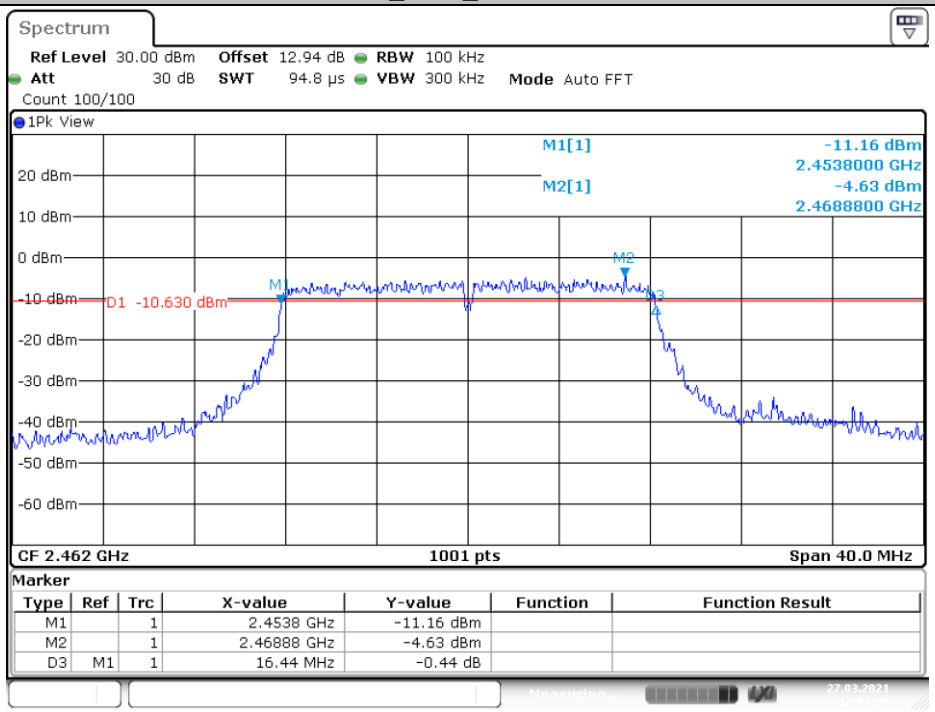
Date: 27.MAR.2021 16:57:40

11G_Ant1_2437MHz



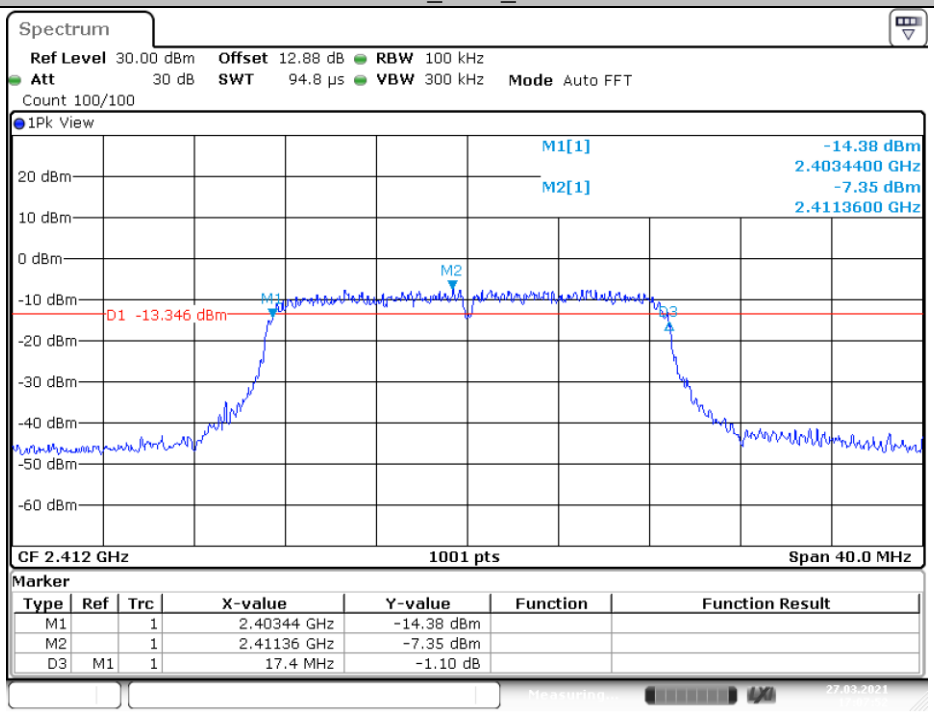
Date: 27.MAR.2021 17:01:20

11G_Ant1_2462MHz



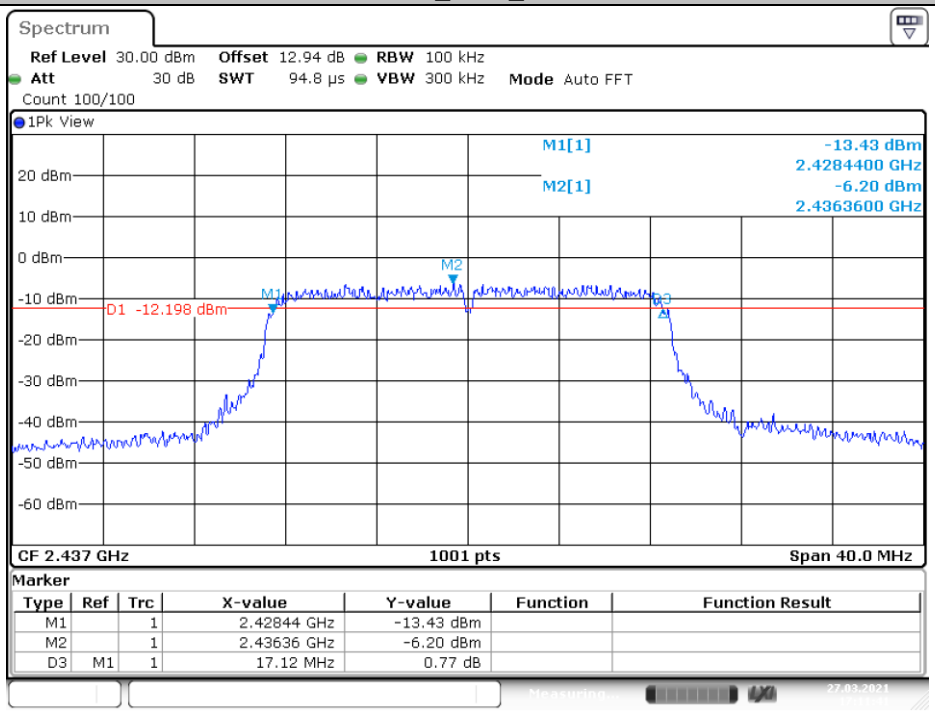
Date: 27.MAR.2021 17:03:59

11N20SISO_Ant1_2412MHz



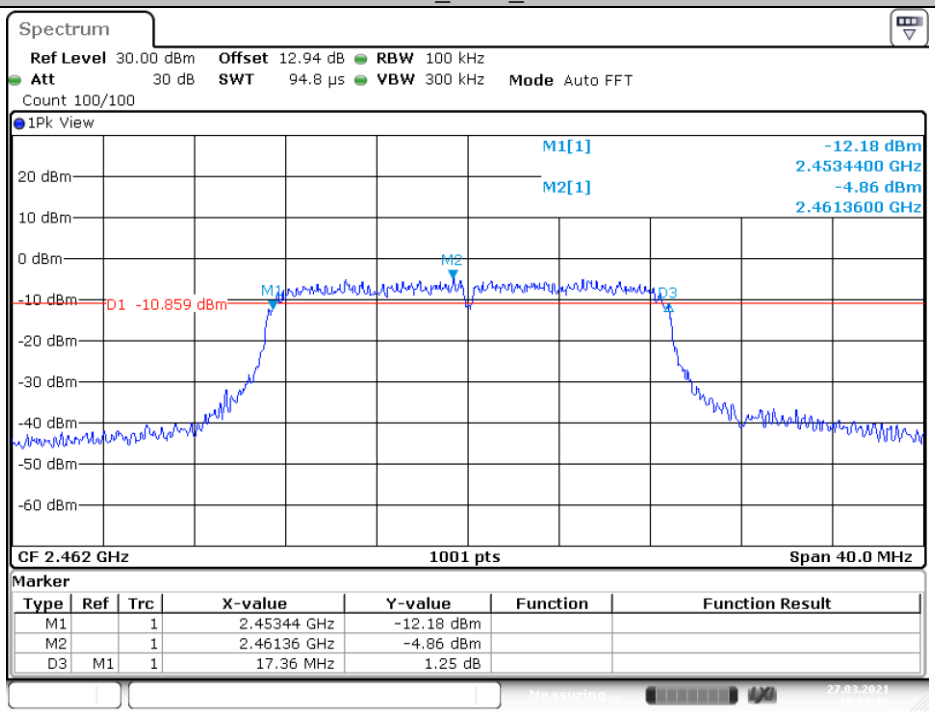
Date: 27.MAR.2021 17:07:52

11N20SISO_Ant1_2437MHz



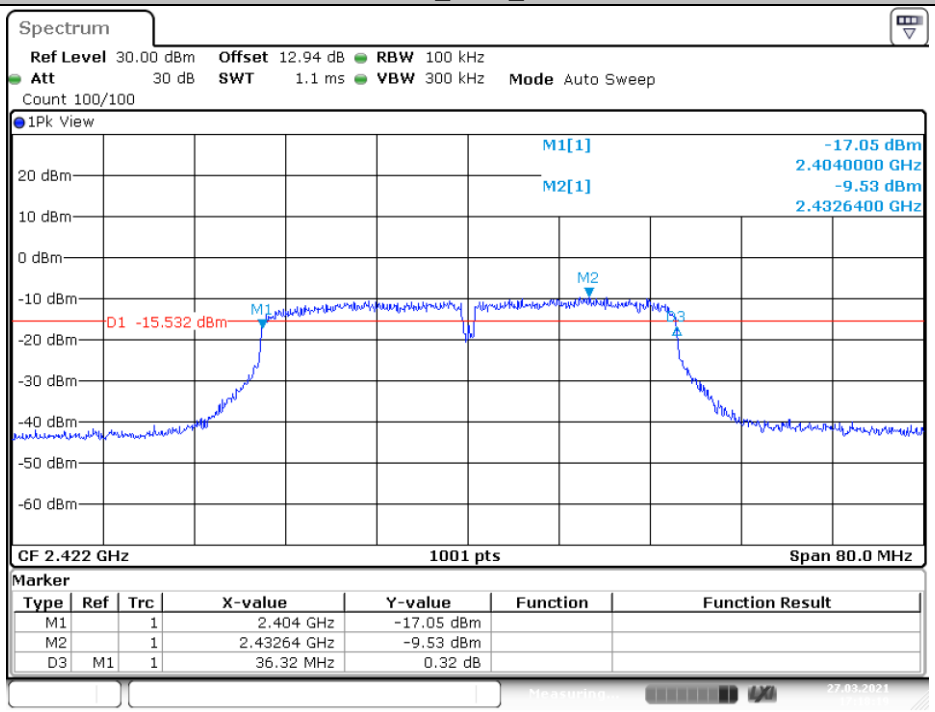
Date: 27.MAR.2021 17:11:42

11N20SISO_Ant1_2462MHz



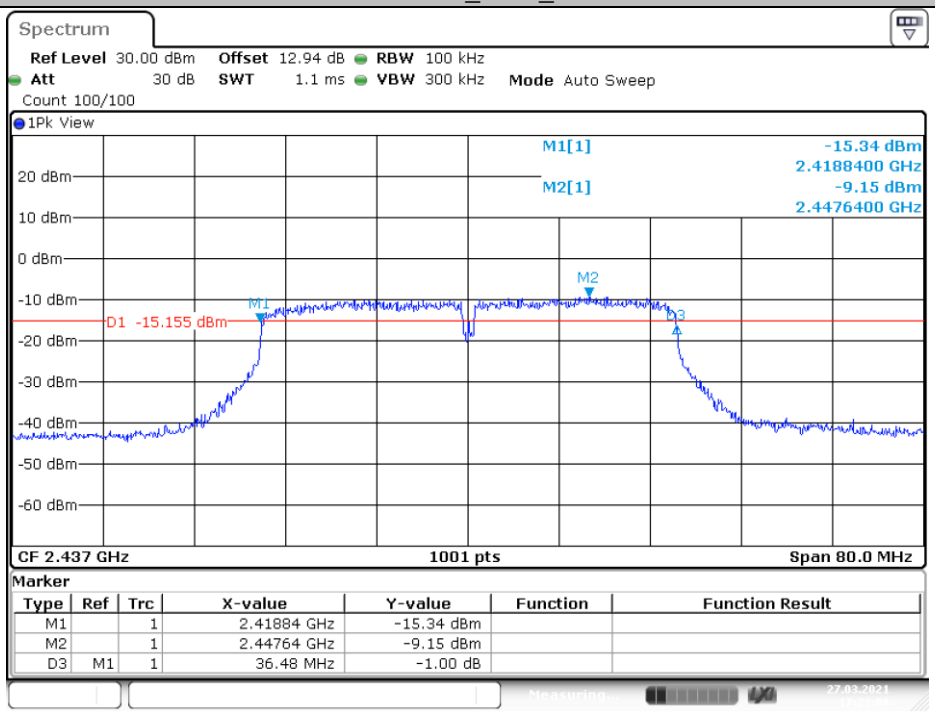
Date: 27.MAR.2021 17:14:13

11N40SISO_Ant1_2422MHz



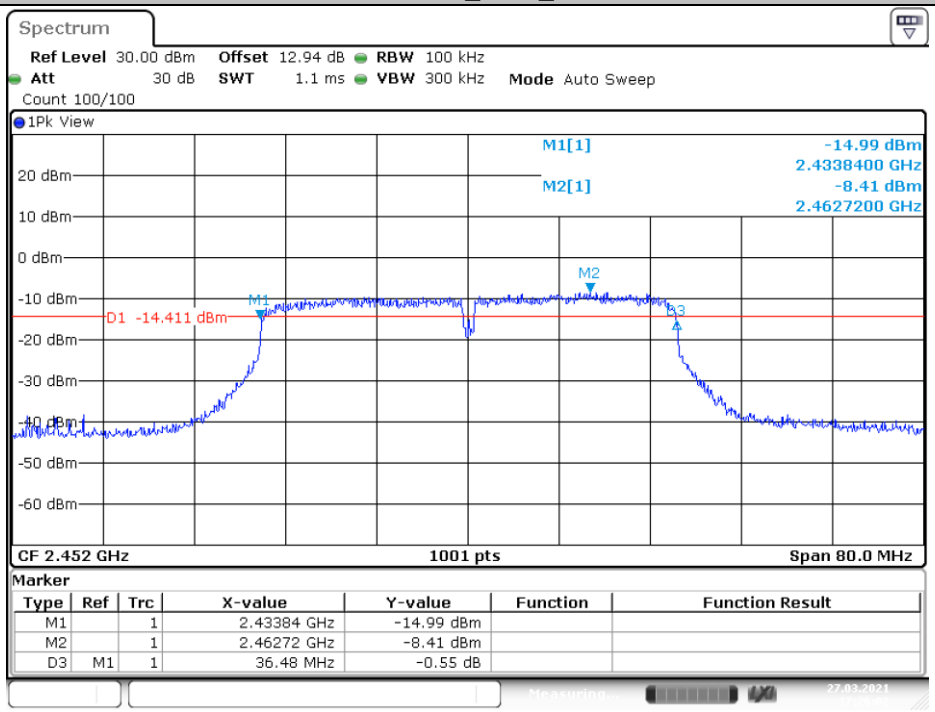
Date: 27.MAR.2021 17:18:20

11N40SISO_Ant1_2437



Date: 27.MAR.2021 17:23:09

11N40SISO_Ant1_2452



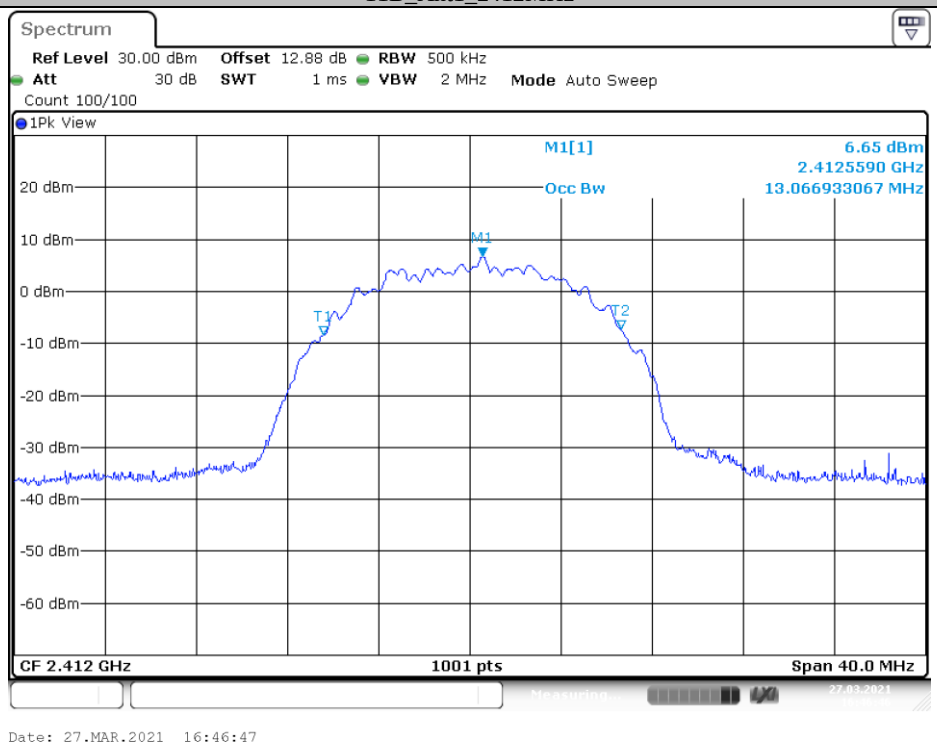
Appendix B: Occupied Channel Bandwidth

Test Result

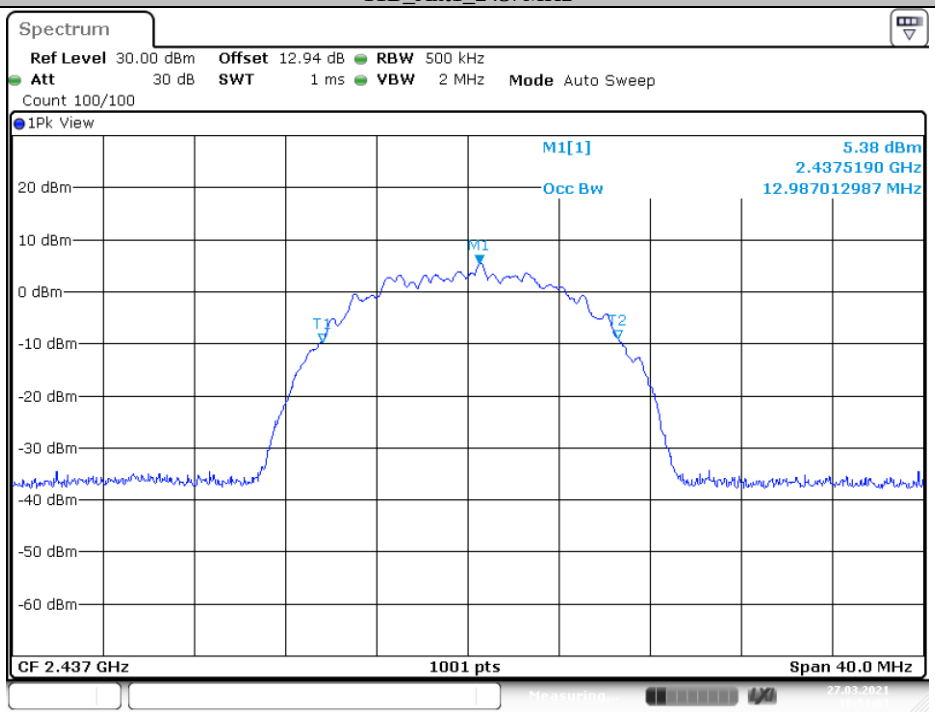
TestMode	Antenna	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.067	---	PASS
		2437	12.987	---	PASS
		2462	12.947	---	PASS
11G	Ant1	2412	16.663	---	PASS
		2437	16.663	---	PASS
		2462	16.663	---	PASS
11N20SISO	Ant1	2412	17.343	---	PASS
		2437	17.343	---	PASS
		2462	17.383	---	PASS
11N40SISO	Ant1	2422	36.444	---	PASS
		2437	36.523	---	PASS
		2452	36.523	---	PASS

Test Graphs

11B_Ant1_2412MHz

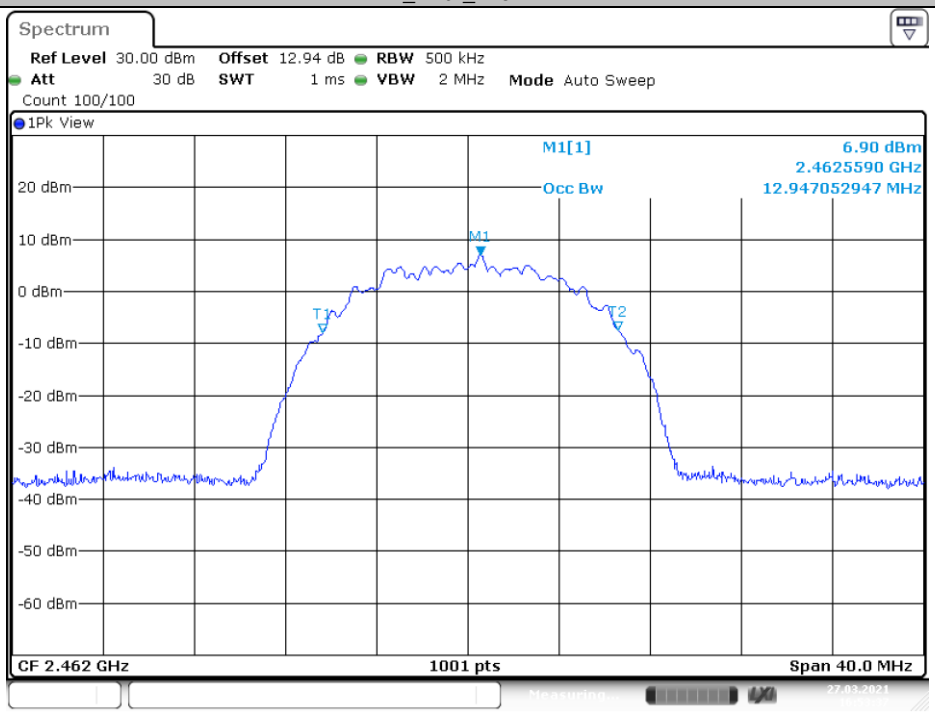


11B_Ant1_2437MHz



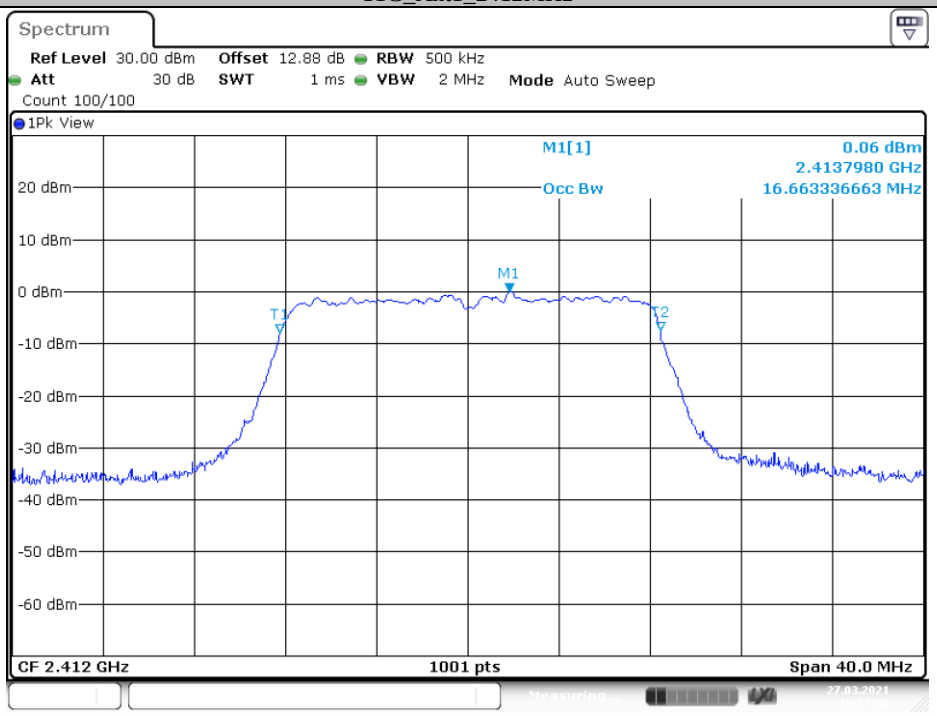
Date: 27.MAR.2021 16:51:04

11B_Ant1_2462MHz



Date: 27.MAR.2021 16:53:38

11G_Ant1_2412MHz



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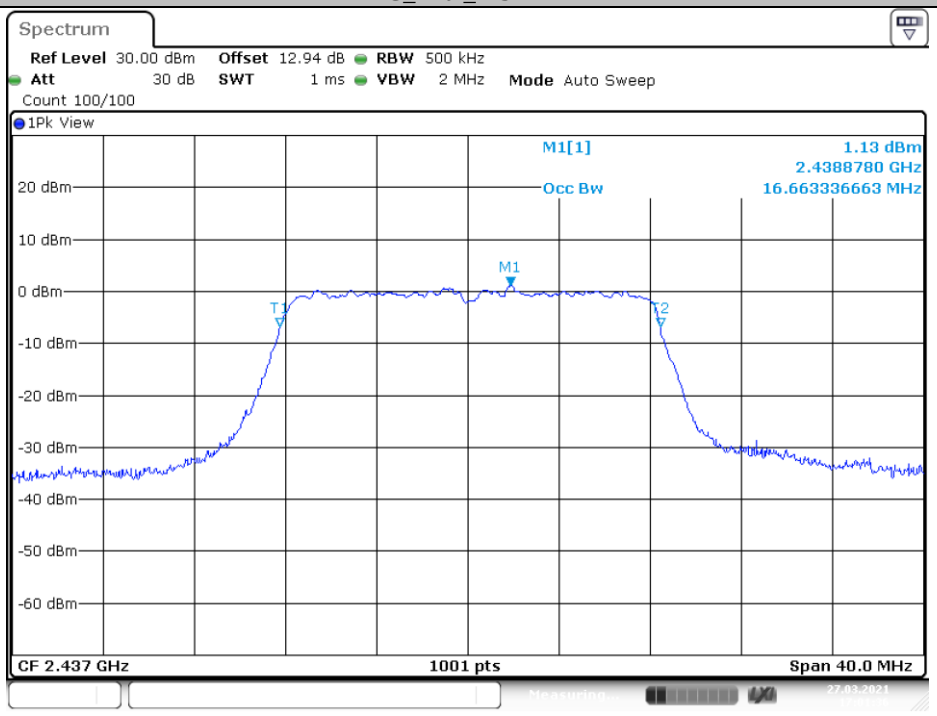

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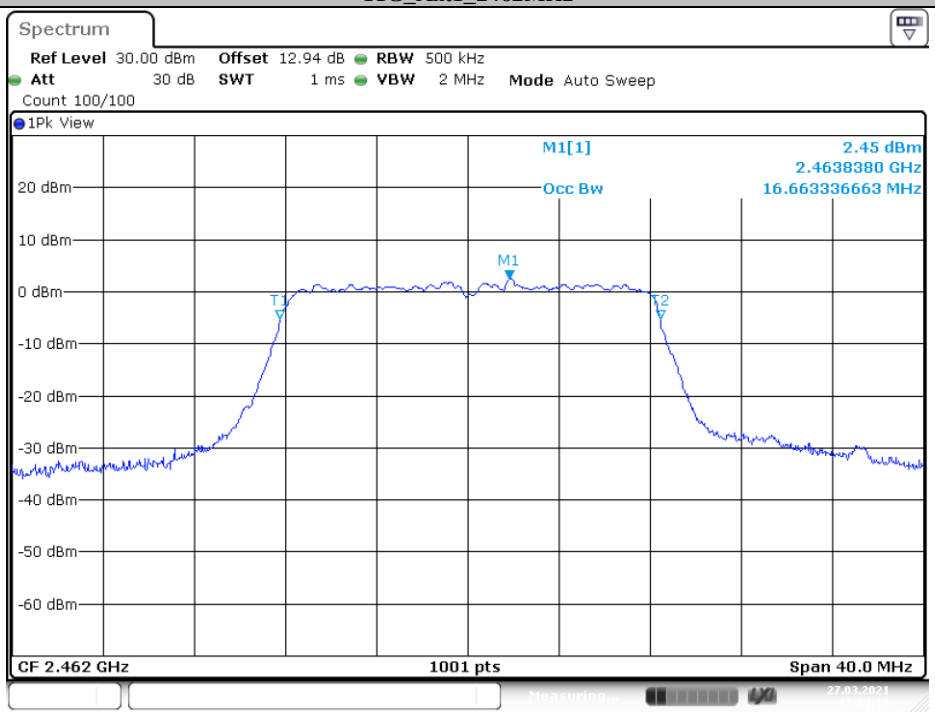

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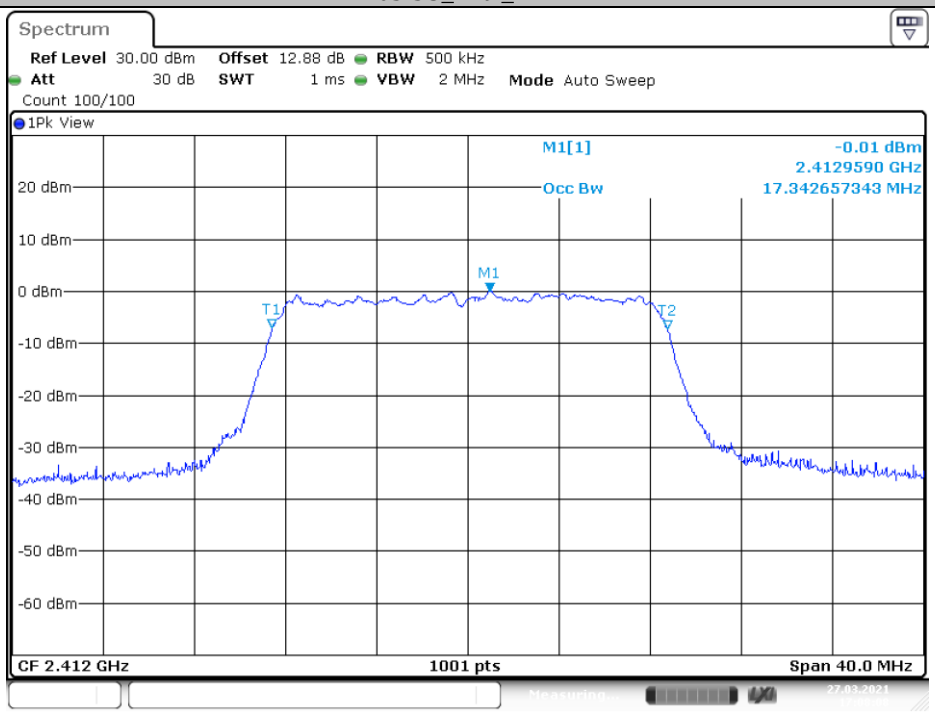
11N20SISO_Ant1_2412MHz



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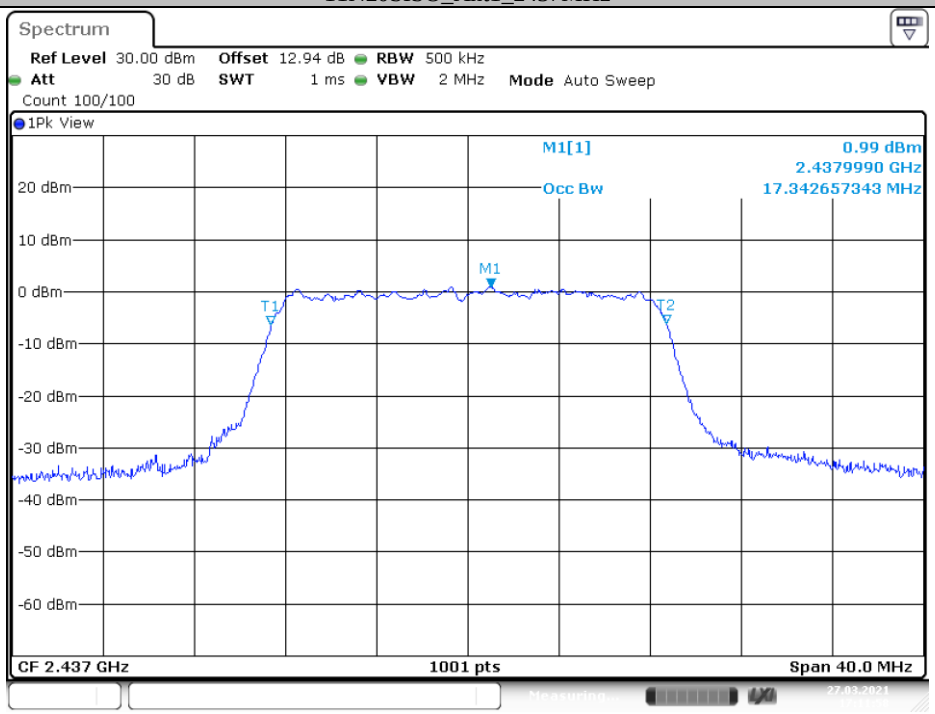

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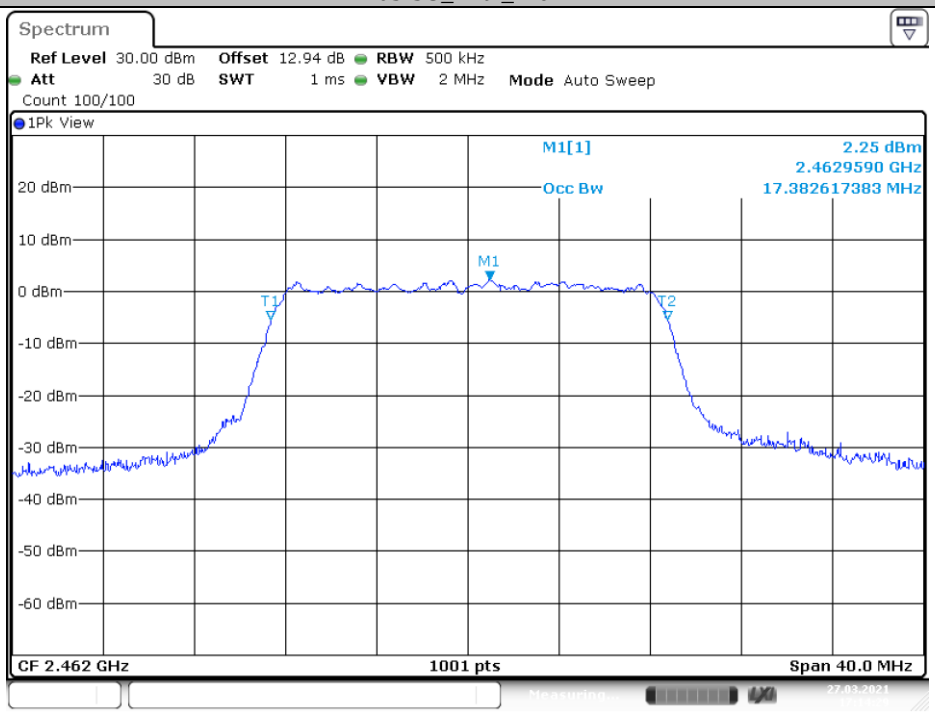

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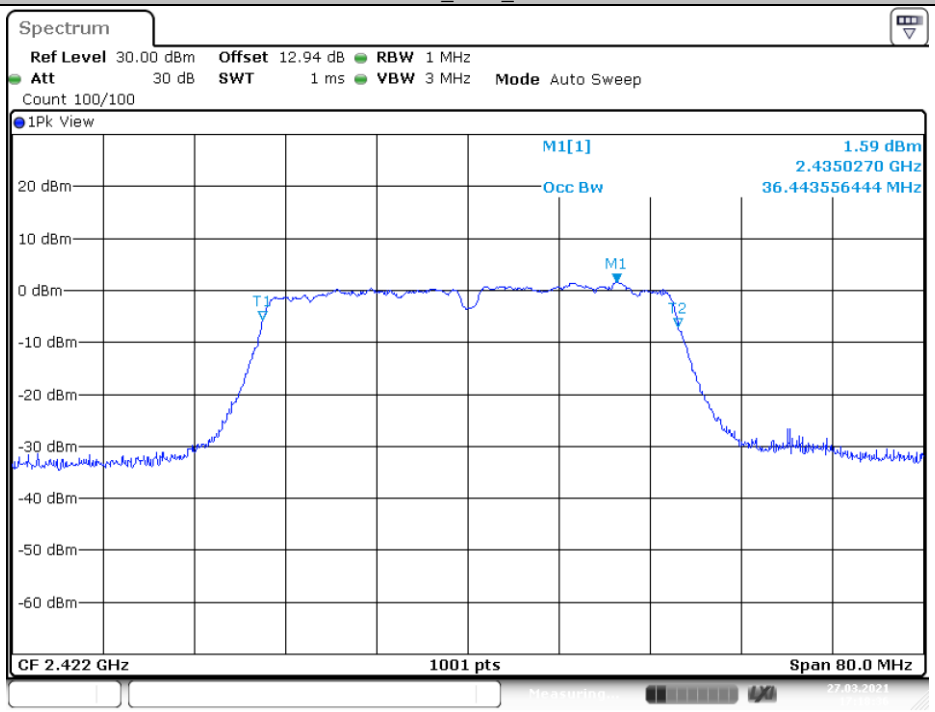
11N40SISO_Ant1_2422MHz



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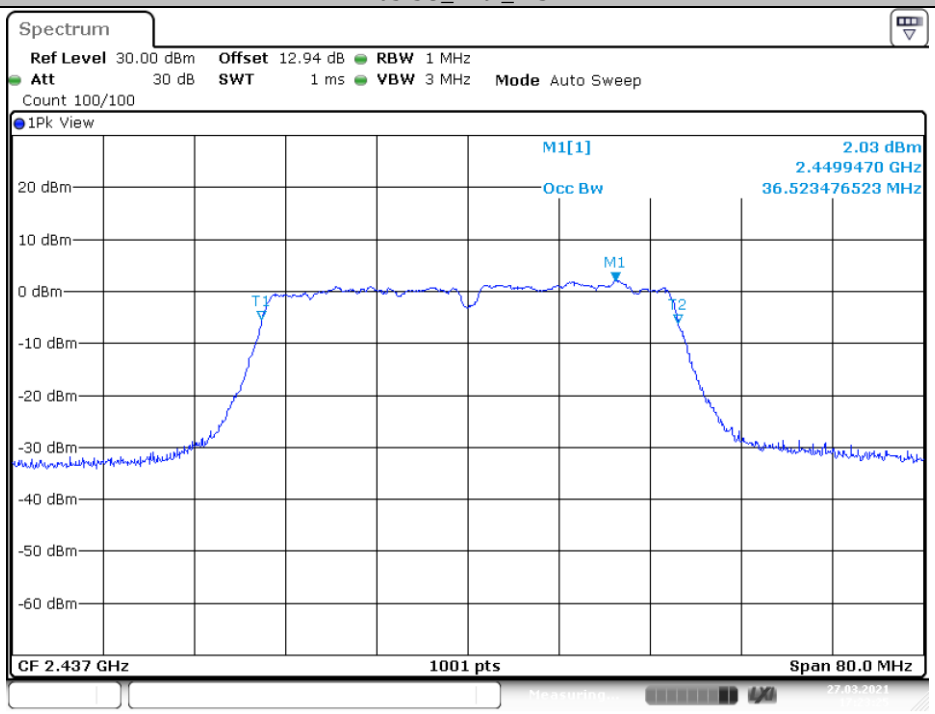
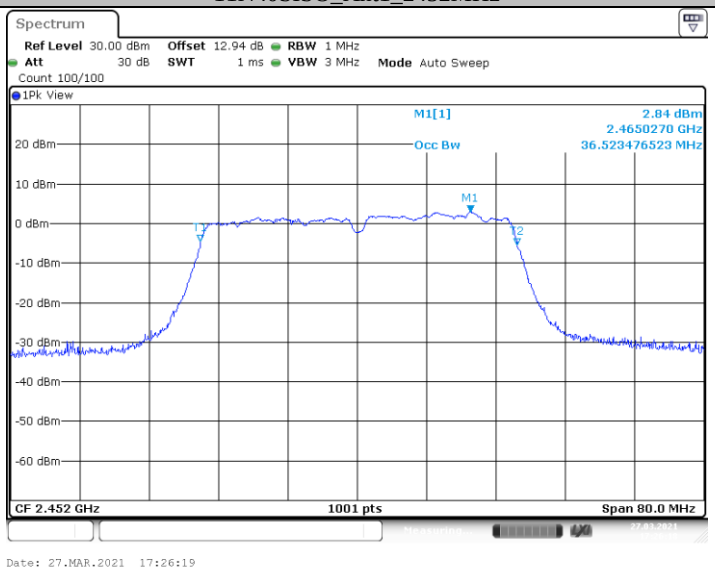
11N40SISO_Ant1_2437MHz



Date: 27.MAR.2021 17:23:26

11N40SISO_Ant1_2452MHz



Appendix C: Maximum conducted Peak output power

Test Result

Test Mode	Antenna	Channel [MHz]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	13.63	<=30	PASS
		2437	13.26	<=30	PASS
		2462	13.98	<=30	PASS
11G	Ant1	2412	11.36	<=30	PASS
		2437	11.88	<=30	PASS
		2462	12.43	<=30	PASS
11N20SISO	Ant1	2412	11.47	<=30	PASS
		2437	11.93	<=30	PASS
		2462	12.46	<=30	PASS
11N40SISO	Ant1	2422	11.50	<=30	PASS
		2437	11.76	<=30	PASS
		2452	12.03	<=30	PASS

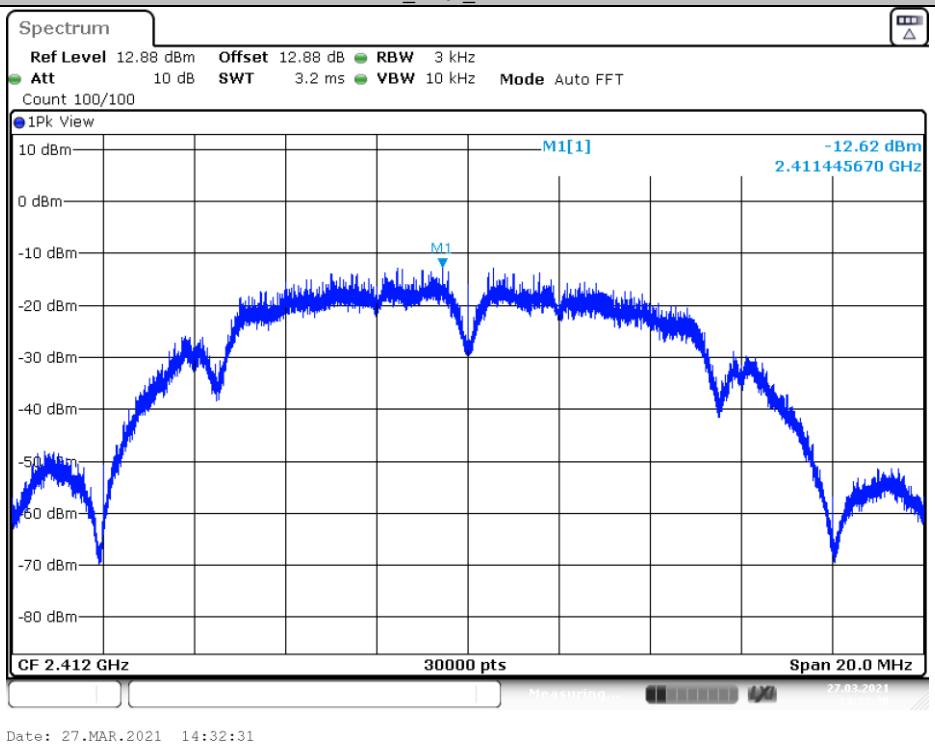
Appendix D: Power spectral density

Test Result

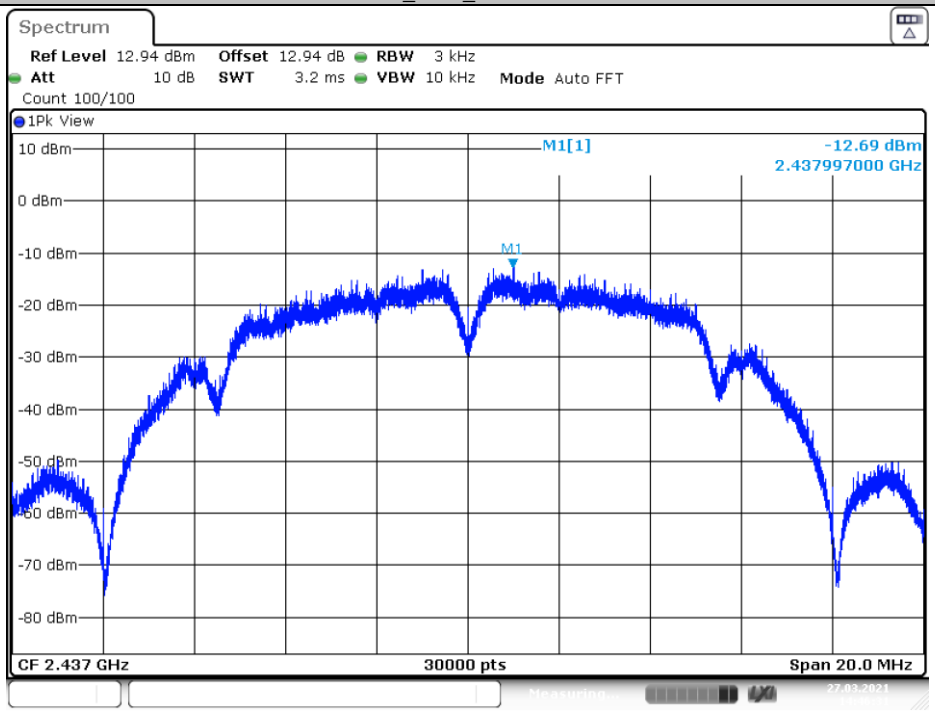
TestMode	Antenna	Channel[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-12.62	<=8	PASS
		2437	-12.69	<=8	PASS
		2462	-12.64	<=8	PASS
11G	Ant1	2412	-18.39	<=8	PASS
		2437	-18.88	<=8	PASS
		2462	-18.24	<=8	PASS
11N20SISO	Ant1	2412	-19.14	<=8	PASS
		2437	-20.32	<=8	PASS
		2462	-19.71	<=8	PASS
11N40SISO	Ant1	2422	-23.07	<=8	PASS
		2437	-23.13	<=8	PASS
		2452	-21.88	<=8	PASS

Test Graphs

11B_Ant1_2412MHz



11B_Ant1_2437MHz



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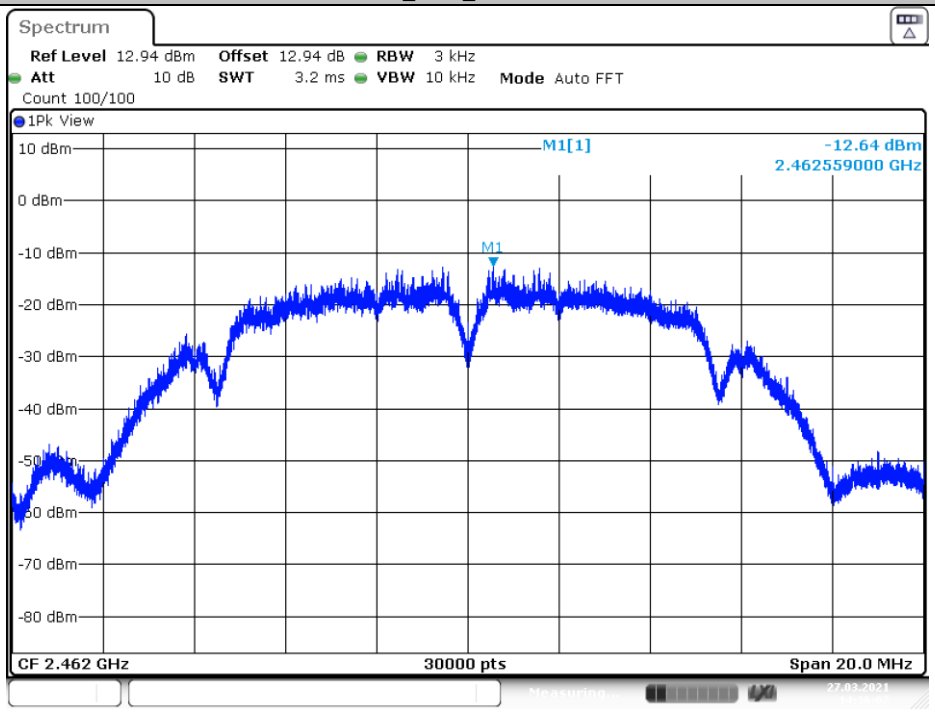
11B_Ant1_2462MHz



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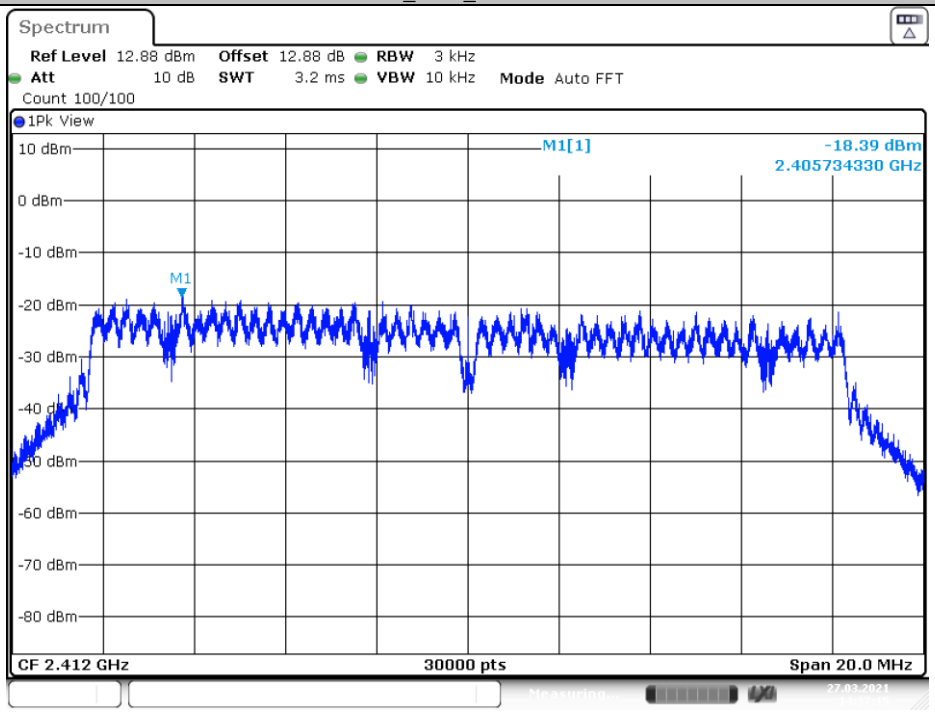
11G_Ant1_2412MHz



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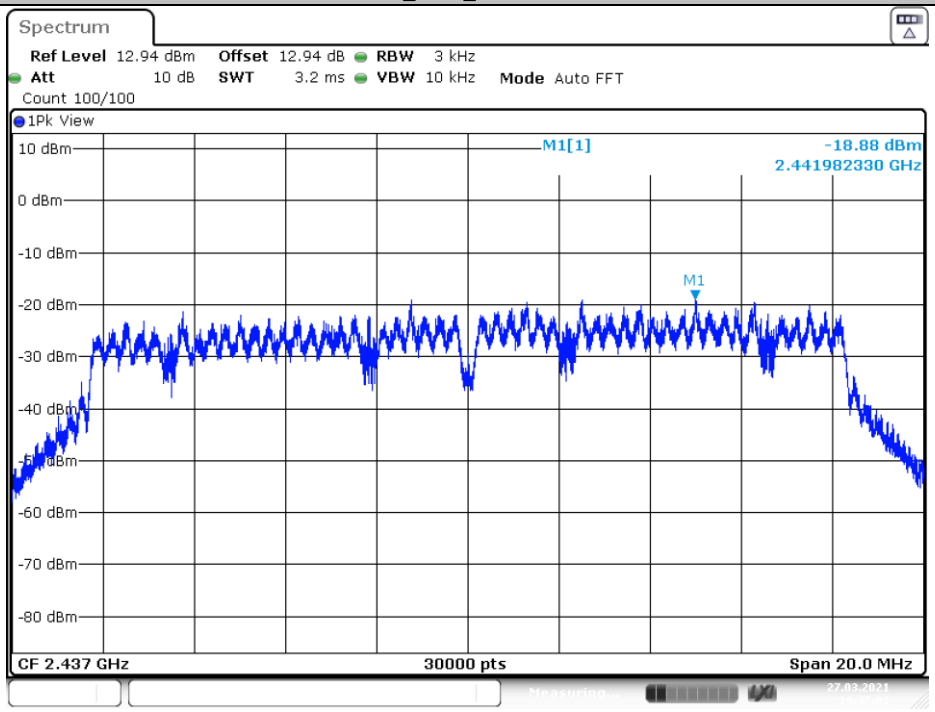
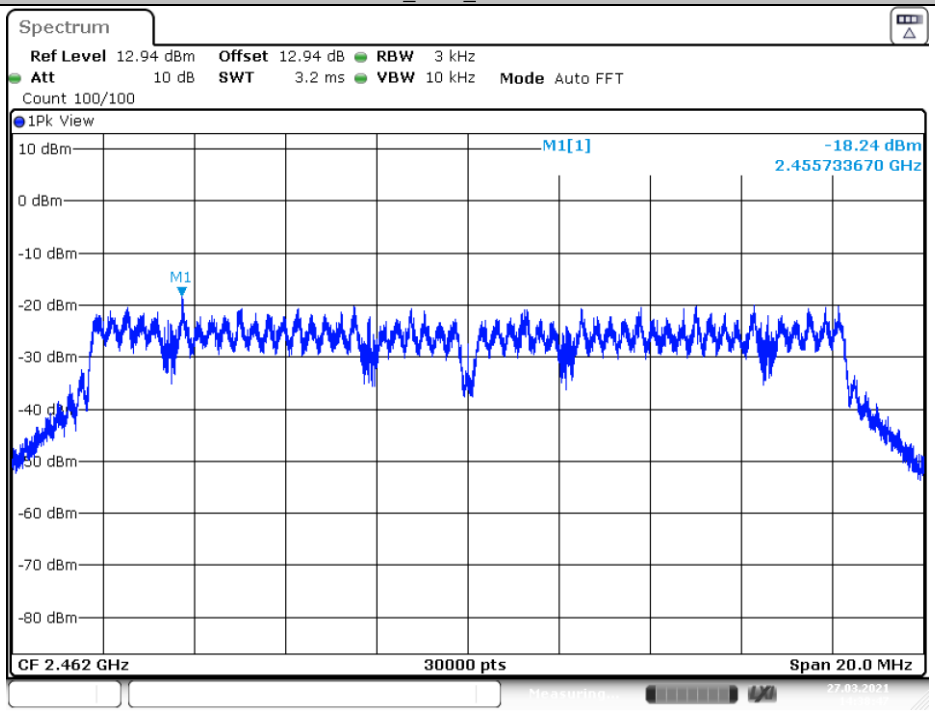
11G_Ant1_2437MHz



Date: 27.MAR.2021 14:47:01

11G_Ant1_2462MHz



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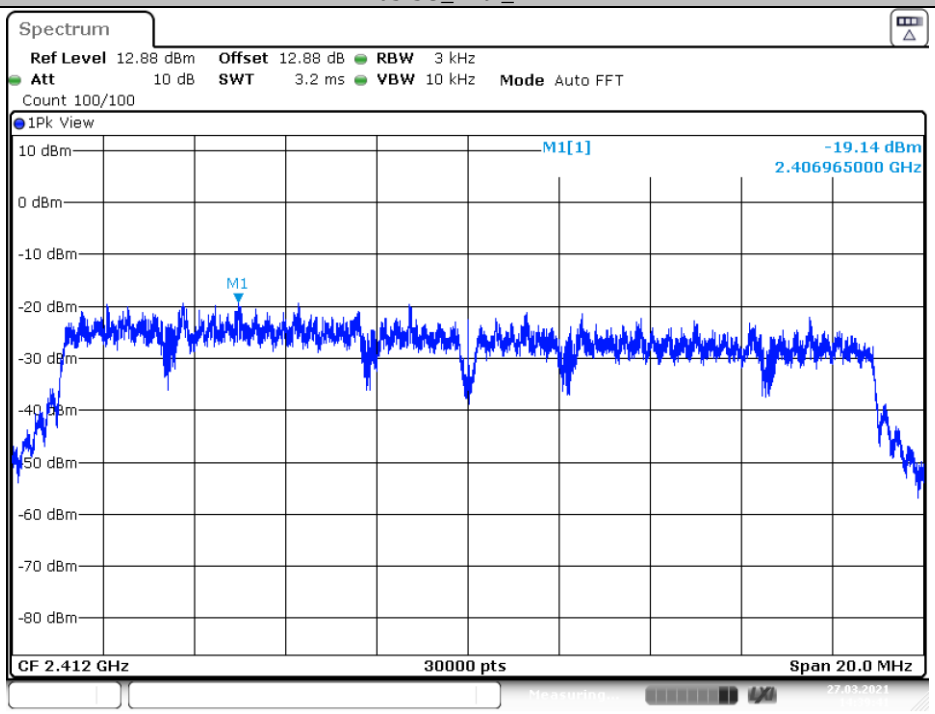
11N20SISO_Ant1_2412MHz



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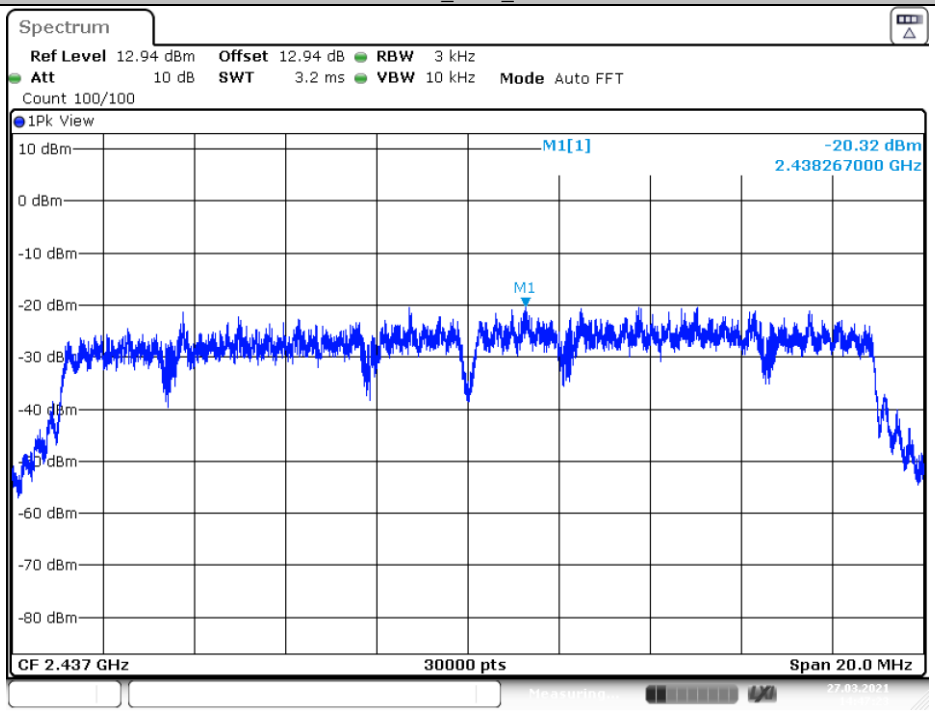

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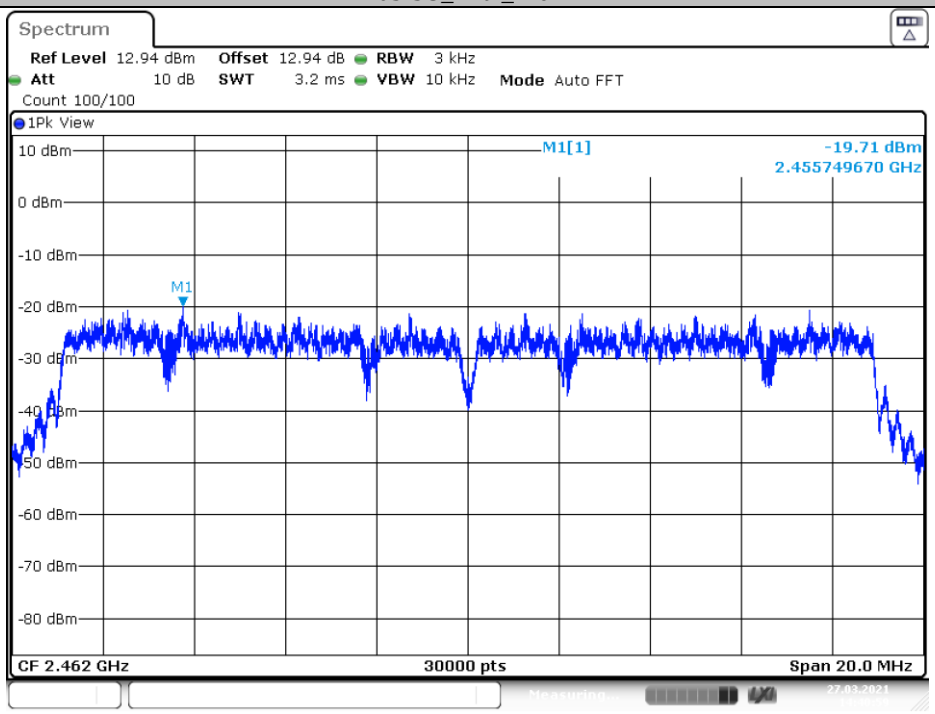
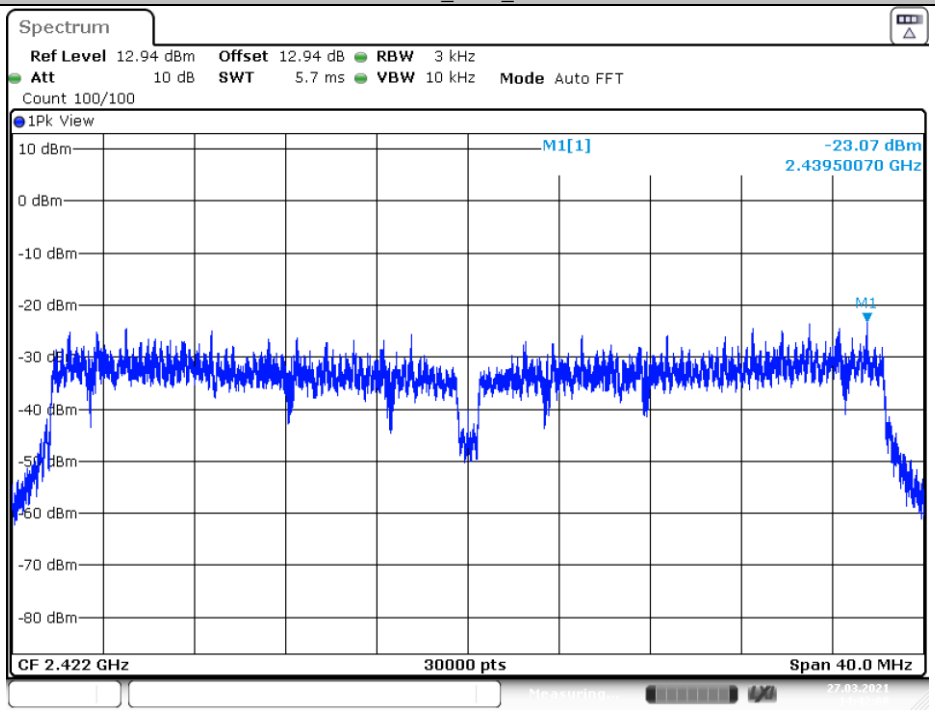
11N20SISO_Ant1_2462MHz



Date: 27.MAR.2021 14:41:00

11N40SISO_Ant1_2422MHz



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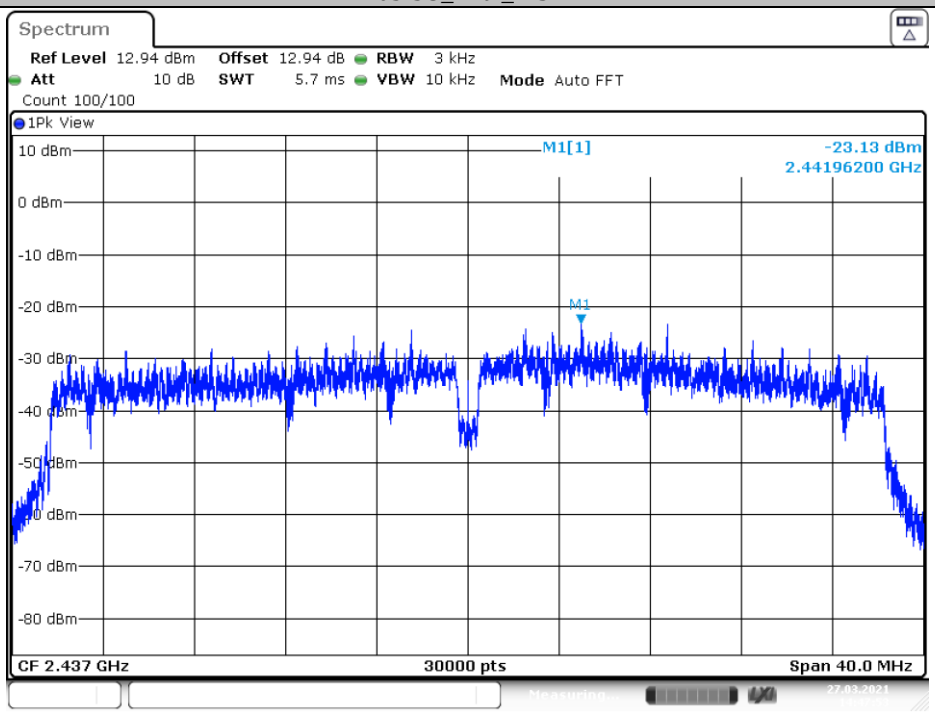

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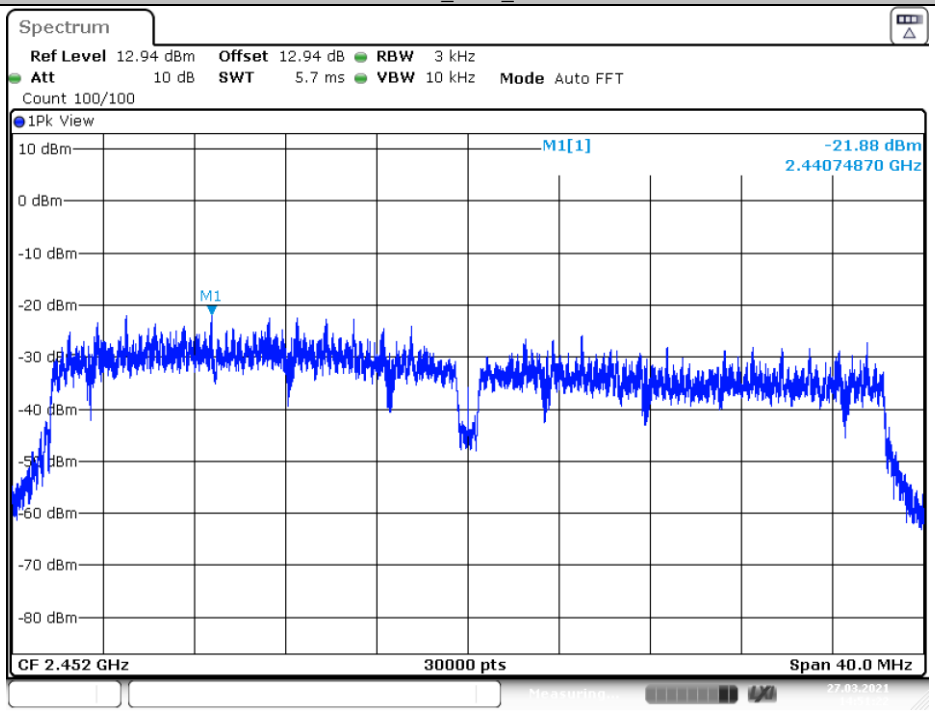
11N40SISO_Ant1_2452MHz

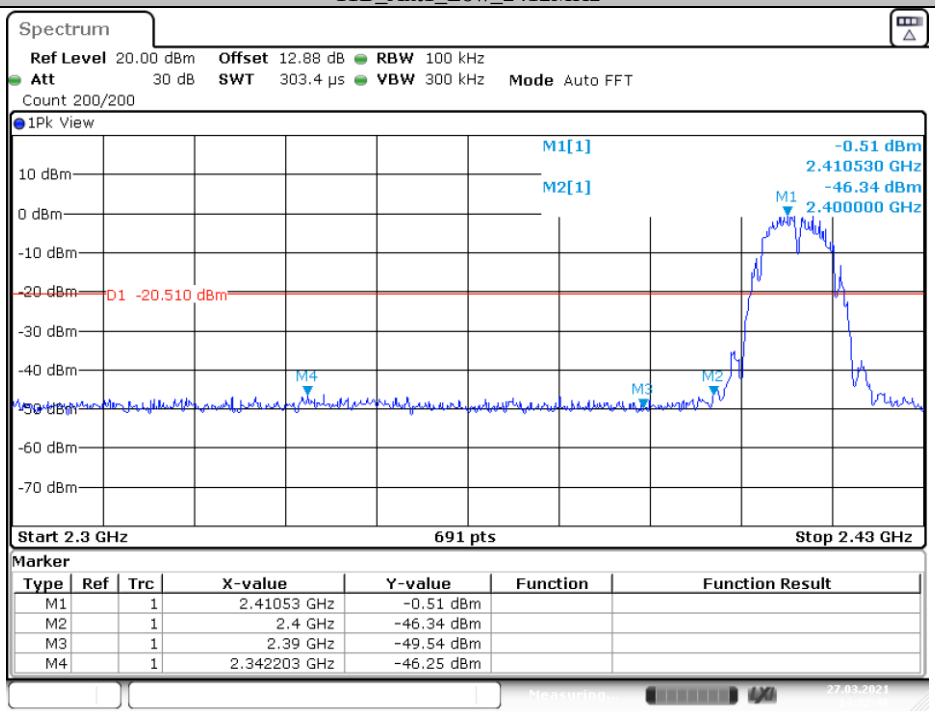


Date: 27.MAR.2021 14:51:23

Appendix E: Band edge measurements

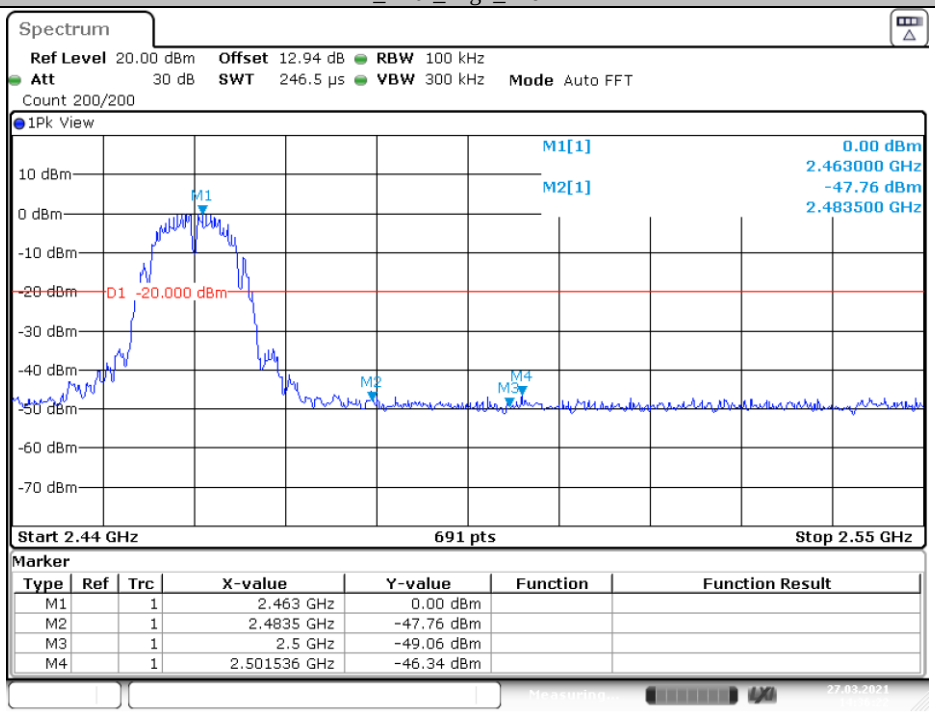
Test Graphs

11B_Ant1_Low_2412MHz



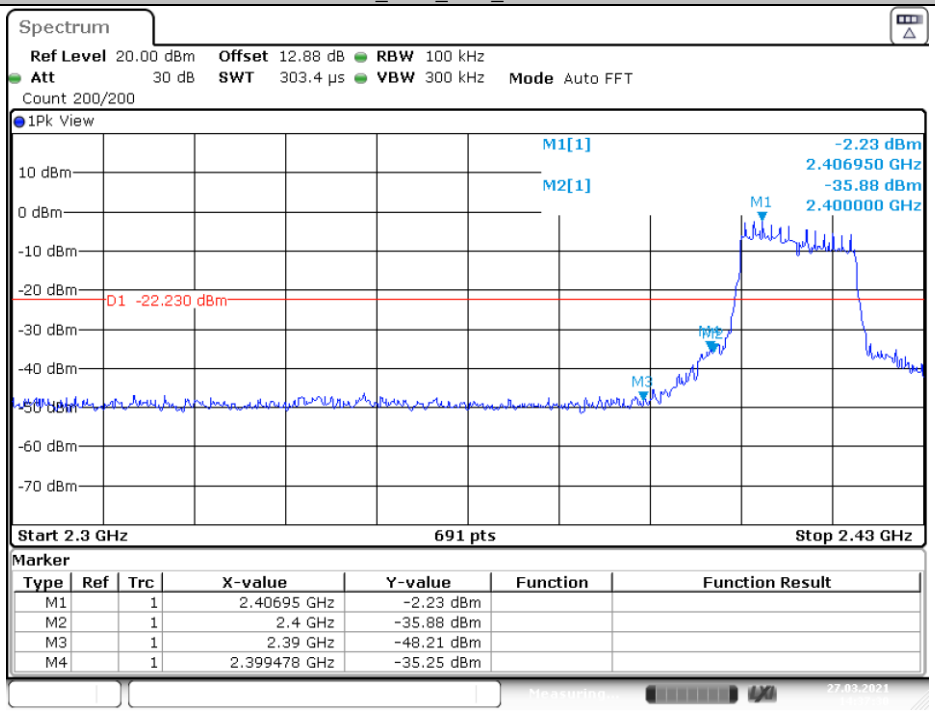
Date: 27.MAR.2021 14:32:46

11B_Ant1_High_2462MHz



Date: 27.MAR.2021 14:36:22

11G_Ant1_Low_2412MHz



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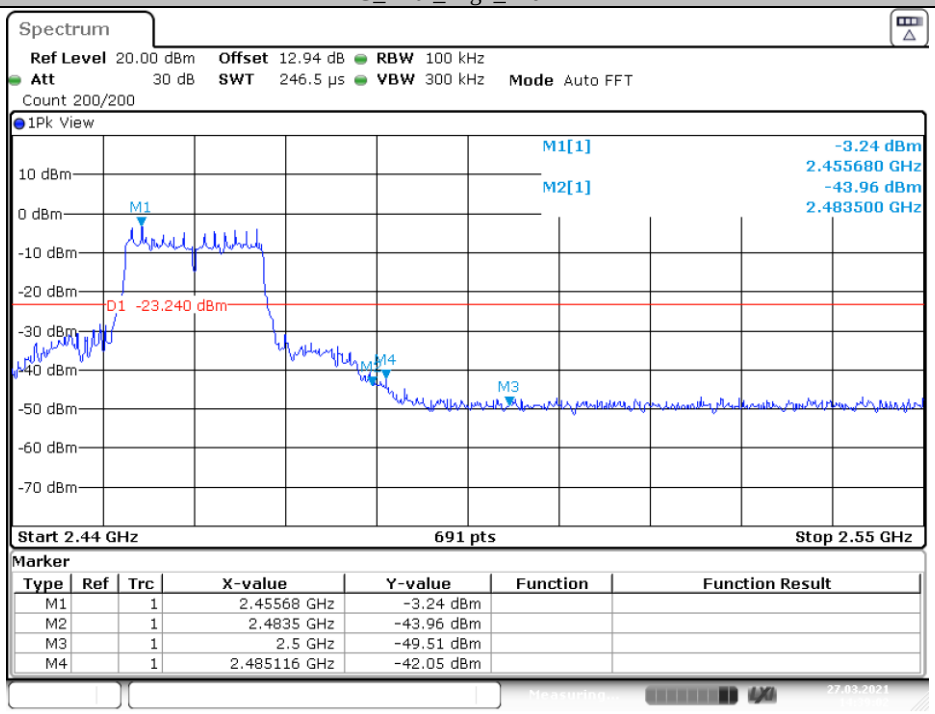

Date: 27.MAR.2021 14:39:03

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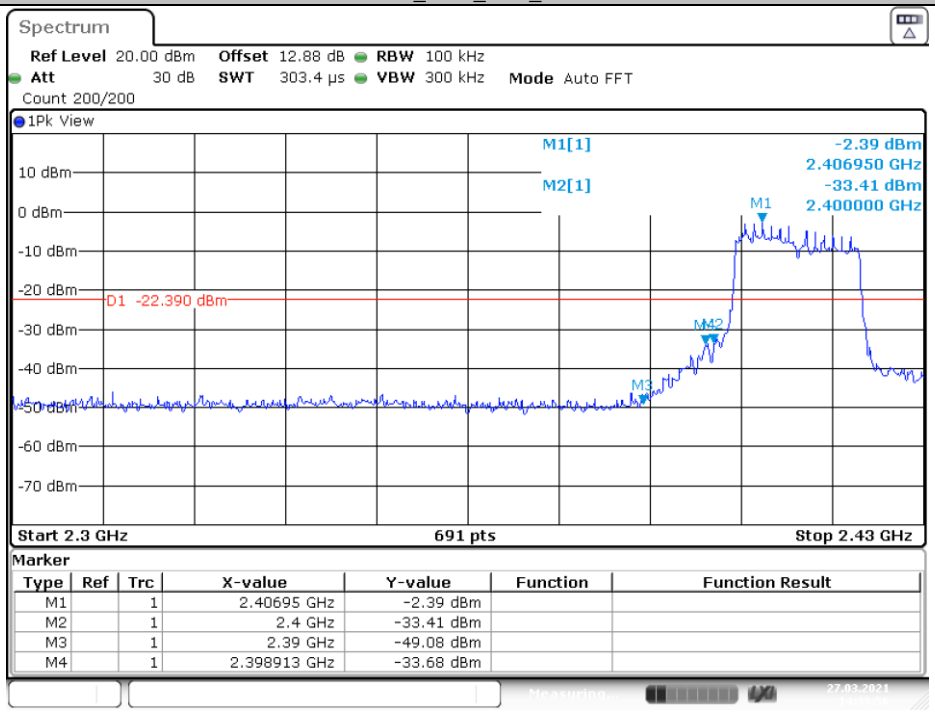

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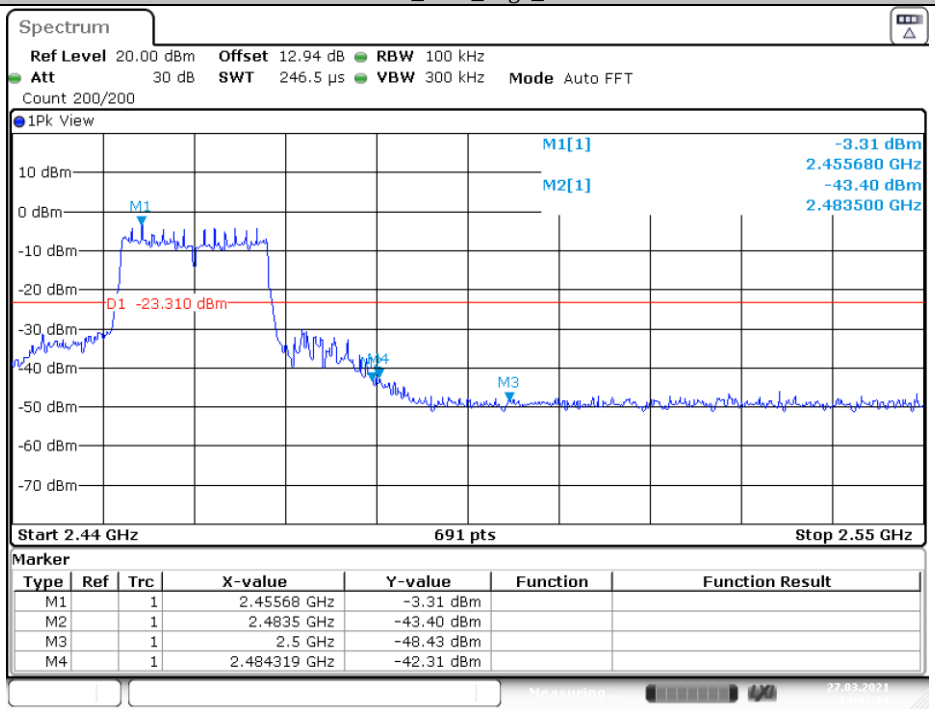
11N20SISO_Ant1_High_2462MHz



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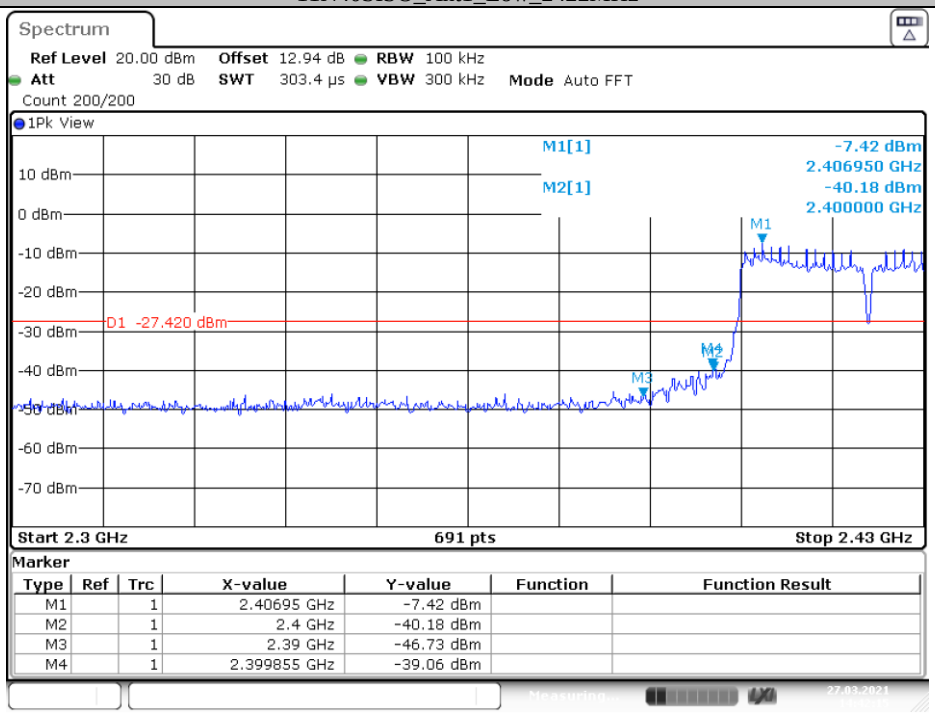
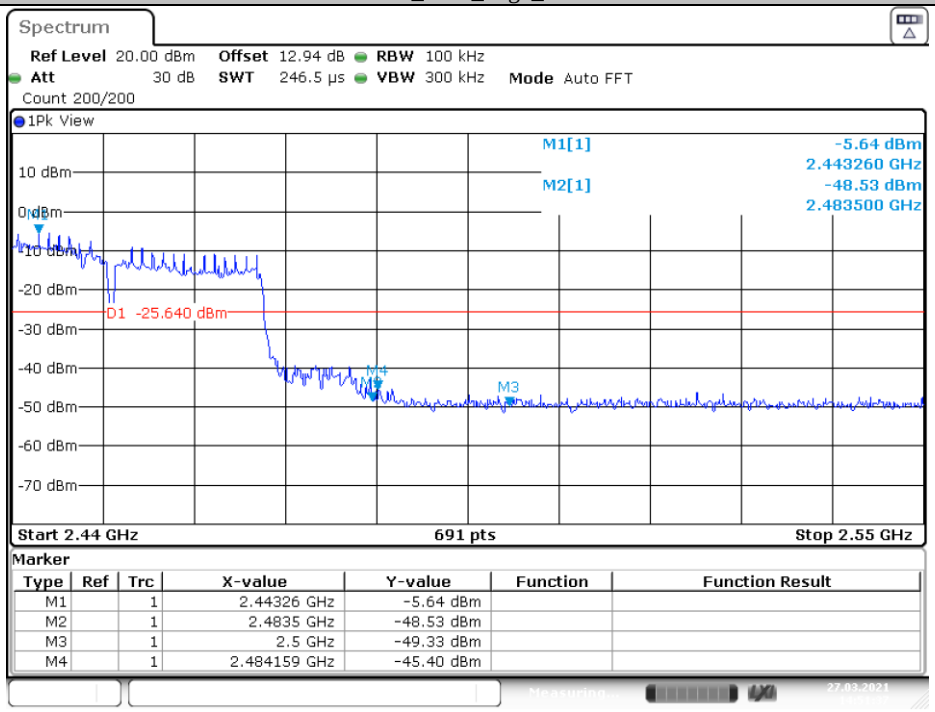


Date: 27.MAR.2021 14:42:16

11N40SISO_Ant1_High_2452MHz



Date: 27.MAR.2021 14:51:38

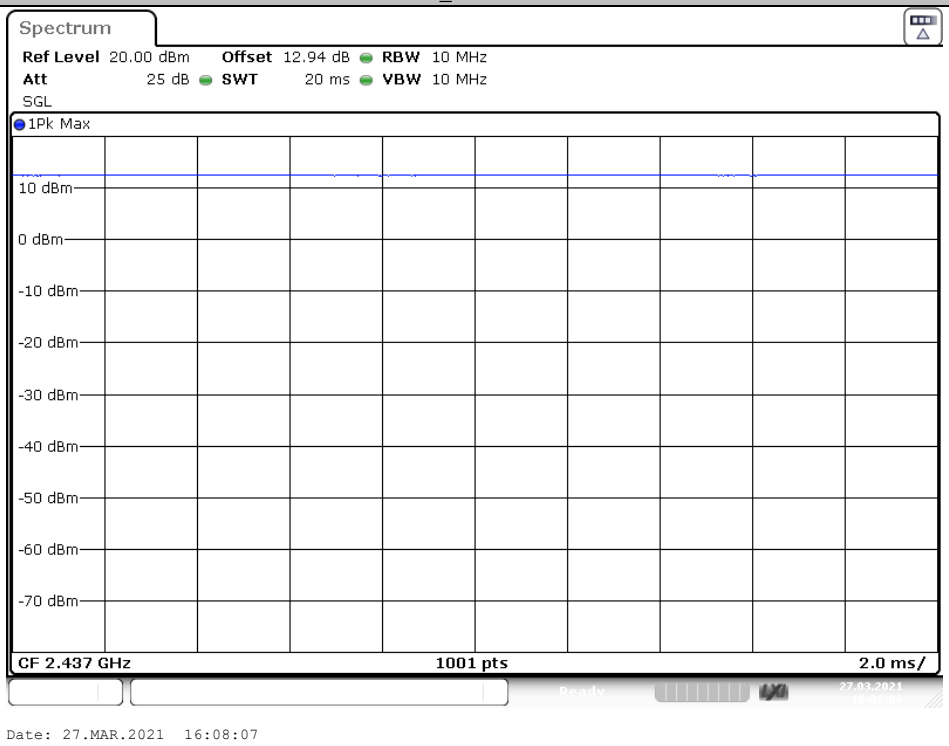
Appendix F: Duty Cycle

Test Result

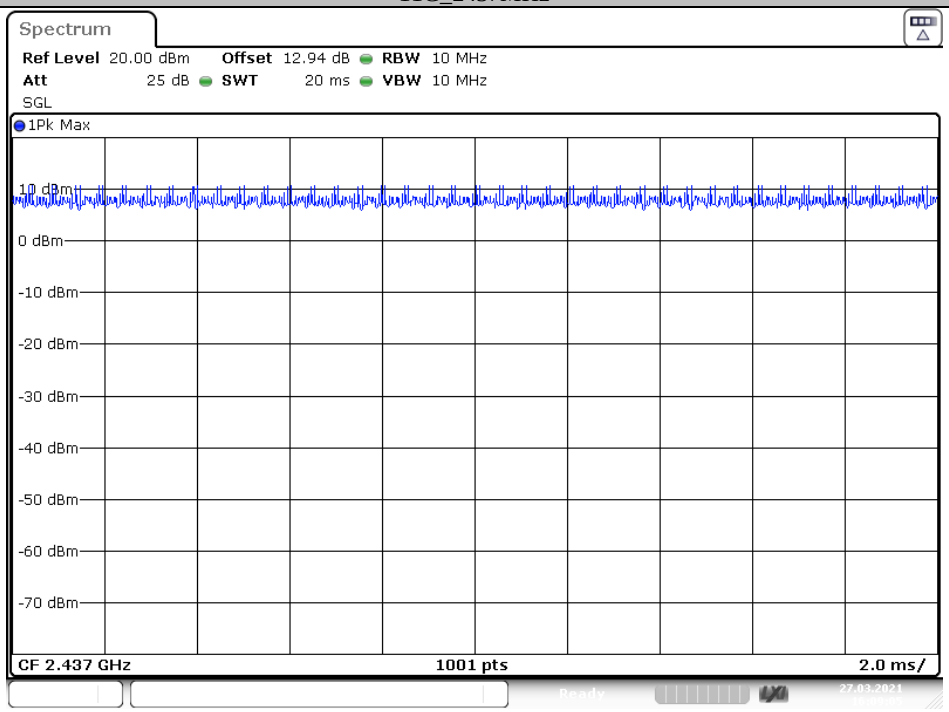
TestMode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2437	20.00	20.00	100.00
11G	Ant1	2437	20.00	20.00	100.00
11N20	Ant1	2437	20.00	20.00	100.00
11N40	Ant1	2437	20.00	20.00	100.00

Test Graphs

11B_2437MHz



11G_2437MHz



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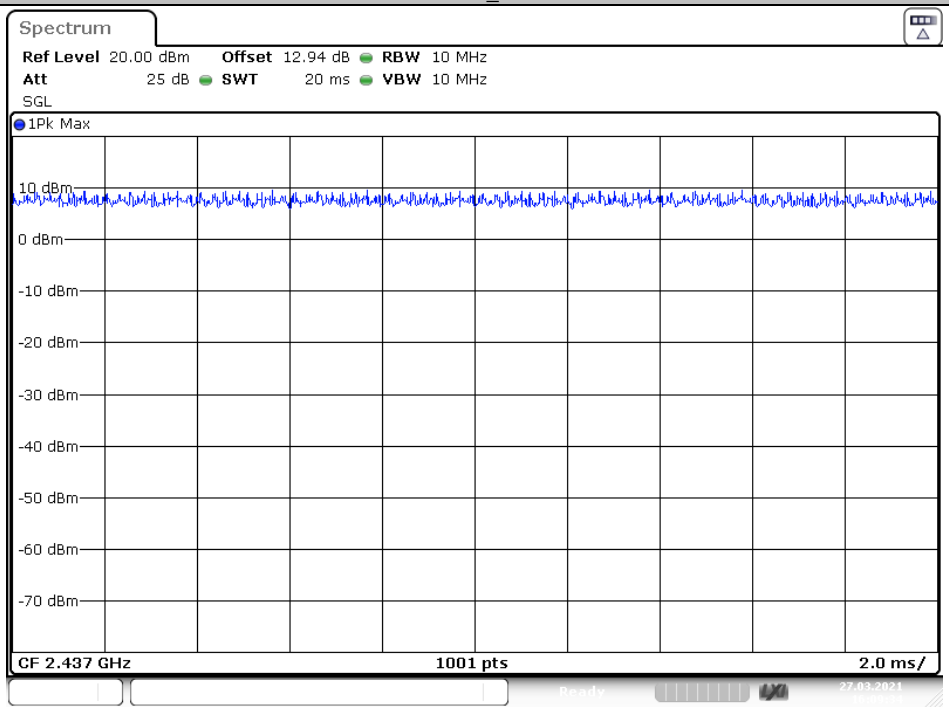
11N20SISO _2437MHz



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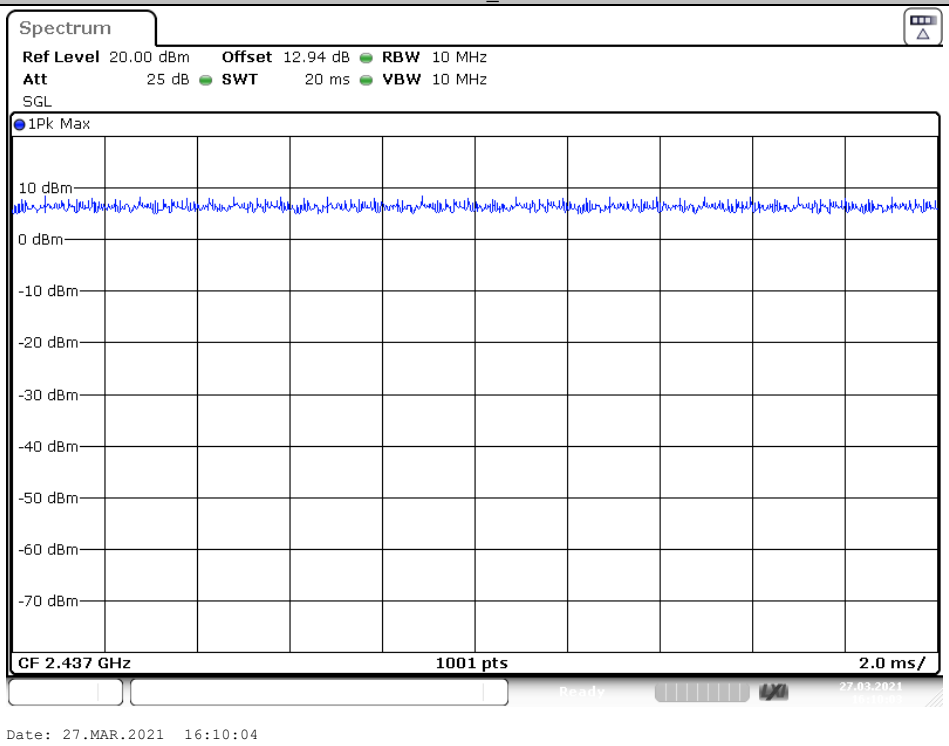
11N40SISO _2437MHz



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