FCC PART 15.247

TEST REPORT

For

Seeed Technology Co., Ltd

9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, China

FCC ID: Z4T-RETERMINAL

Report Type:	Product Type:
Original Report	reTerminal with Raspberry Pi Compute Module CM4X

Report Number:	SZNS210706-27597E-00B
Report Date:	2021-08-23
Reviewed By:	Candy Li RF Engineer
Prepared By:	Shenzhen Accurate Technology Co., Ltd. 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China Tel: (0755) 26503290 Fax: (0755) 26503396 Http://www.atc-lab.com

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	reTerminal with Raspberry Pi Compute Module CM4X
Trademark	Seeed Studio
Tested Model	reTerminal - CM4X
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz
Maximum Conducted Peak Output Power	BLE: -5.75dBm Wi-Fi: 8.63dBm(802.11b), 8.34dBm(802.11g) 8.45dBm(802.11n20), 7.32dBm(802.11n40)
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification*	Ant 0 FPC Antenna: 3.76dBi Ant 1 PCB Antenna: 3.5dBi Ant 2 External Antenna: 2dBi (provided by the applicant)
Voltage Range	DC 5V from adapter.
Date of Test	2021-08-04 to 2021-08-17
Sample serial number	SZNS210706-27597E-RF-S1
Received date	2021-07-06
Sample/EUT Status	Good condition

Note: This product has three types of configuration about antenna for different customer market, and End User can change the configuration files to select antenna used via Windows System, which will not change RF parameter and always only one antenna was used.

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
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

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

Test Facility

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

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

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

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

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

For BLE mode, 40 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"Windows PowerShell" software was used to test, which provided by manufacturer and power level as below:

Item	Mode	Data Rate (Mbps)	Power Level*
Wi-Fi	802.11 b	1	50
	802.11 g	6	50
	802.11 n20	MCS0	50
	802.11 n40	MCS0	50
BLE	BLE-1M	Default	Default

Duty cycle

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

Support Equipment List and Details

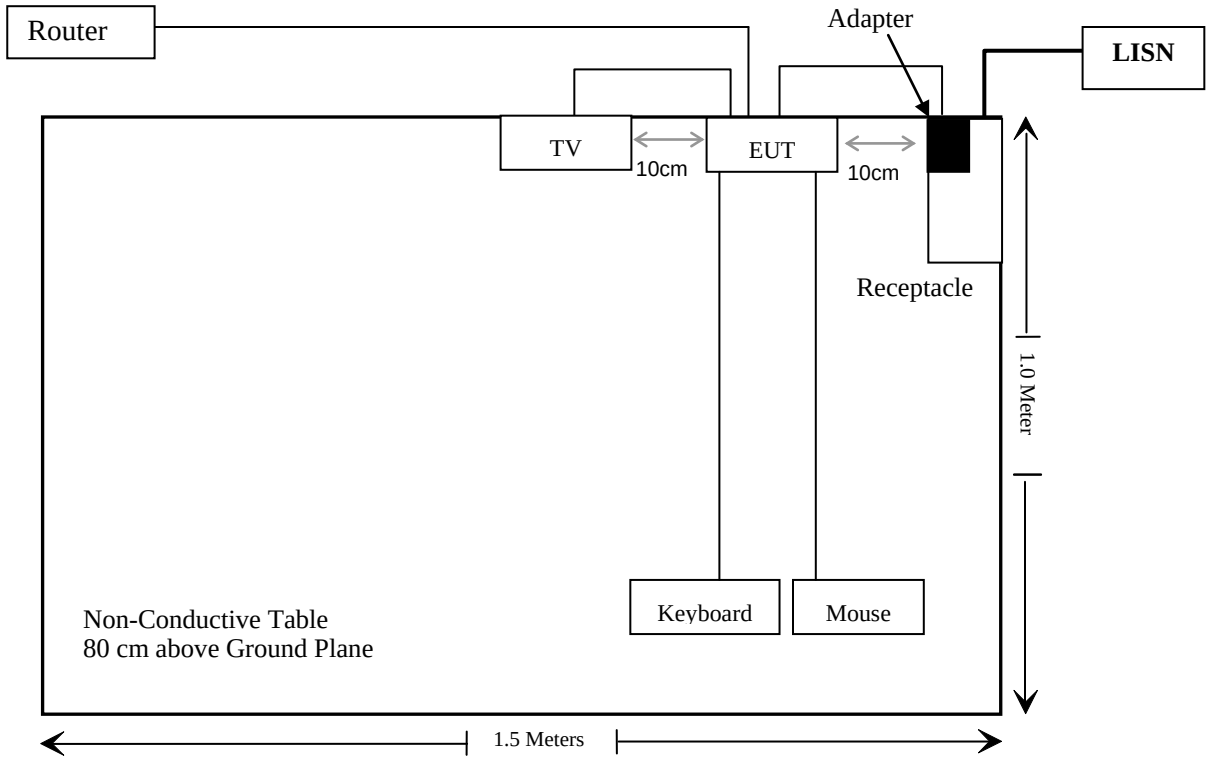
Manufacturer	Description	Model	Serial Number
HUAWEI	Wireless ADSL Router	WS5100	DLJ7S18609013316 10
PENGSHENGYE	Adapter	PSYC0504000	Unknown
XIAOMI	TV	L43M5-ES	25131/114100057334
DELL	Keyboard	L100	CN0RH66658985C018C
DELL	Mouse	MOC5UG	Unknown
SANBAODE	Ferrite Core	740408	Unknown
SANBAODE	Ferrite Core	740421	Unknown
SANBAODE	Ferrite Core	740408	Unknown
SANBAODE	Ferrite Core	740408	Unknown
SANBAODE	Ferrite Core	740415	Unknown
SCI	Ferrite Core	SCRC-130A	Unknown
SCI	Ferrite Core	SCRC-100	Unknown
DONGYANG	Ferrite Core	DYR-2928-160A	Unknown
SCI	Ferrite Core	SCRC-130A	Unknown

External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Detachable USB Cable	1.0	Adapter	EUT
Unshielded Detachable HDMI Cable	1.2	TV	EUT
Unshielded Detachable USB Cable	1.5	EUT	Mouse
Unshielded Detachable USB Cable	1.5	EUT	Keyboard
Unshielded Detachable RJ45 Cable	3	Router	EUT

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §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 & 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	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2020/12/24	2021/12/23

*** 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)

For worst case:

Frequency (MHz)	**Maximum Antenna Gain**		**Tune up conducted power**		**Evaluation Distance (cm)**	**Power Density (mW/cm^2)**	**MPE Limit (mW/cm^2)**
	(dBi)	**(numeric)**	**(dBm)**	**(mW)**			
2402-2480	3.76	2.38	-5.0	0.32	20	0.0001	1
2412-2462	3.76	2.38	9.0	7.94	20	0.0038	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 three types of configuration about antenna, which was permanently attached or used a unique connector, and the maximum antenna gain is 3.76dBi, fulfill the requirement of this section. Please refer to the EUT photos.

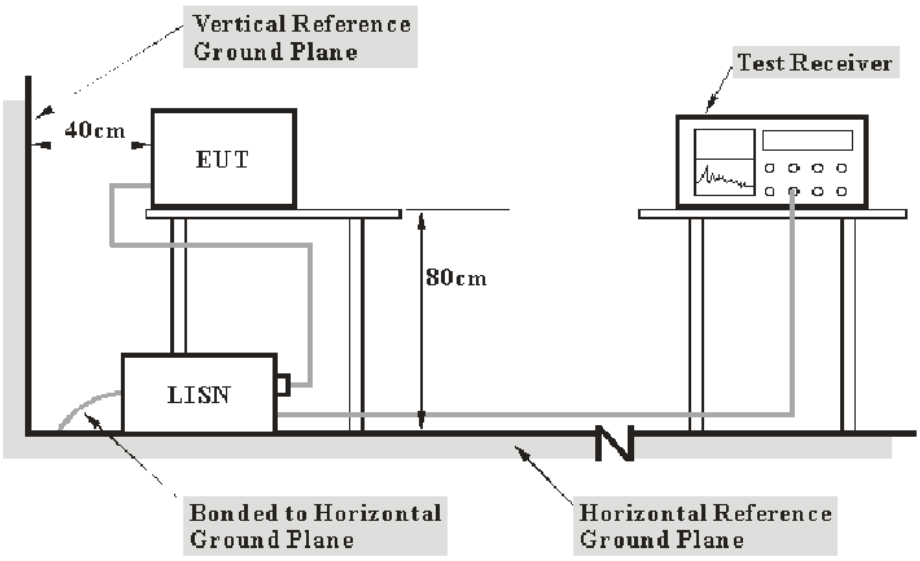
Result: Compliance.

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

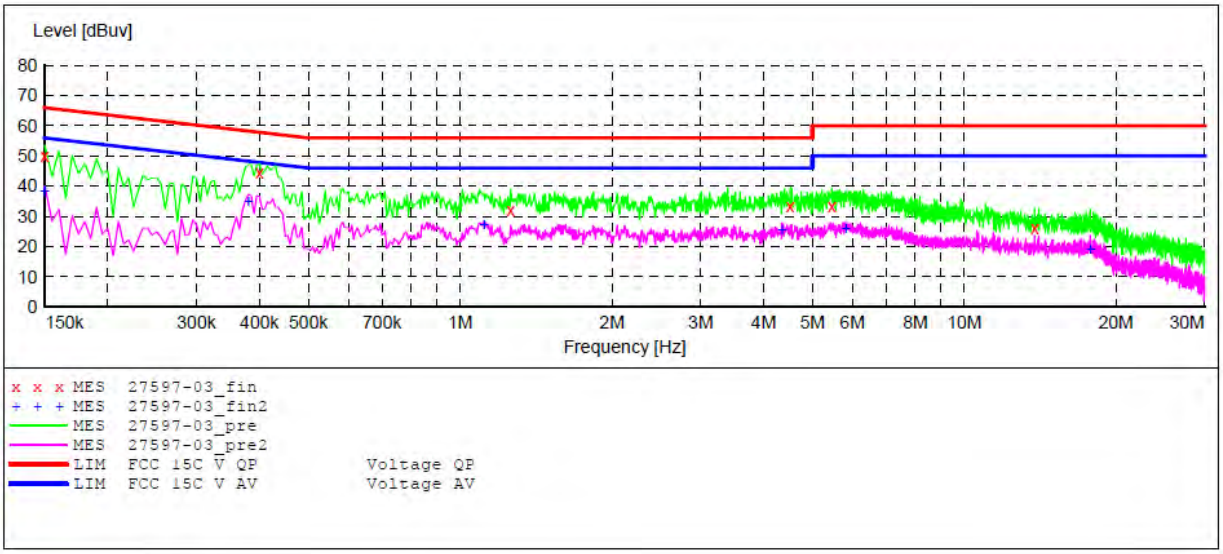
Temperature:	24 ℃
Relative Humidity:	48 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-08-09.

EUT operation mode: Transmitting (Worst case as below)

Wi-Fi: 802.11B mode, low Channel, Ant 2

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "27597-03_fin"

2021-8-9 05:21

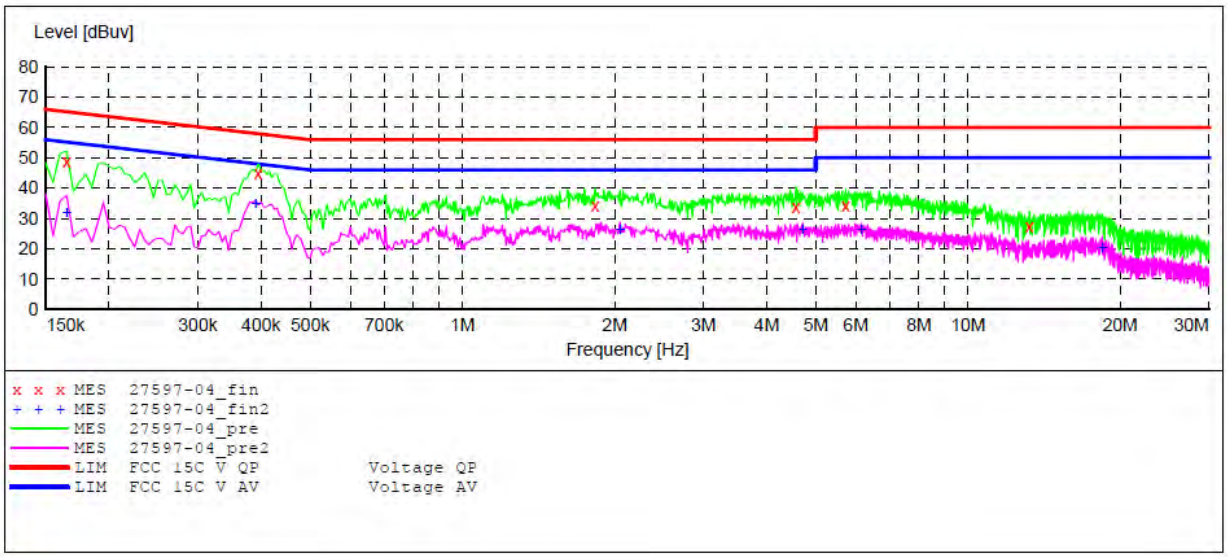
Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.150000	50.20	10.8	66	15.8	QP	L1	GND
0.400000	44.50	11.0	58	13.5	QP	L1	GND
1.260000	31.90	11.2	56	24.1	QP	L1	GND
4.520000	33.30	11.4	56	22.7	QP	L1	GND
5.460000	33.40	11.5	60	26.6	QP	L1	GND
13.800000	26.20	11.6	60	33.8	QP	L1	GND

MEASUREMENT RESULT: "27597-03_fin2"

2021-8-9 05:21

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.150000	38.30	10.8	56	17.7	AV	L1	GND
0.380000	35.00	10.9	48	13.0	AV	L1	GND
1.115000	27.20	11.2	46	18.8	AV	L1	GND
4.350000	25.80	11.4	46	20.2	AV	L1	GND
5.820000	26.10	11.5	50	23.9	AV	L1	GND
17.775000	19.20	11.7	50	30.8	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "27597-04_fin"

2021-8-9 05:24

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.165000	48.50	10.8	65	16.5	QP	N	GND
0.395000	44.80	11.0	58	13.2	QP	N	GND
1.830000	34.40	11.2	56	21.6	QP	N	GND
4.570000	33.90	11.4	56	22.1	QP	N	GND
5.730000	34.40	11.5	60	25.6	QP	N	GND
13.225000	27.40	11.6	60	32.6	QP	N	GND

MEASUREMENT RESULT: "27597-04_fin2"

2021-8-9 05:24

Frequency MHz	Level dBuv	Transd dB	Limit dBuv	Margin dB	Detector	Line	PE
0.165000	31.70	10.8	55	23.3	AV	N	GND
0.390000	34.80	11.0	48	13.2	AV	N	GND
2.050000	26.60	11.3	46	19.4	AV	N	GND
4.710000	26.50	11.4	46	19.5	AV	N	GND
6.150000	26.60	11.5	50	23.4	AV	N	GND
18.450000	20.70	11.7	50	29.3	AV	N	GND

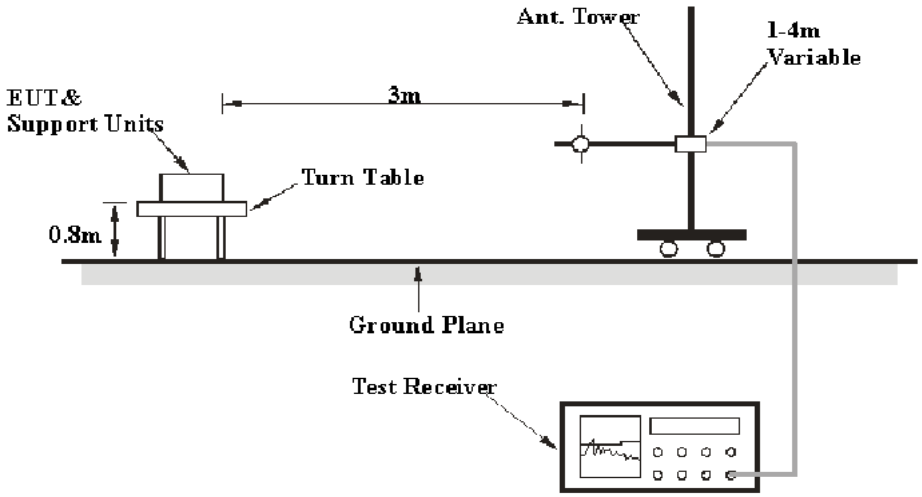
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

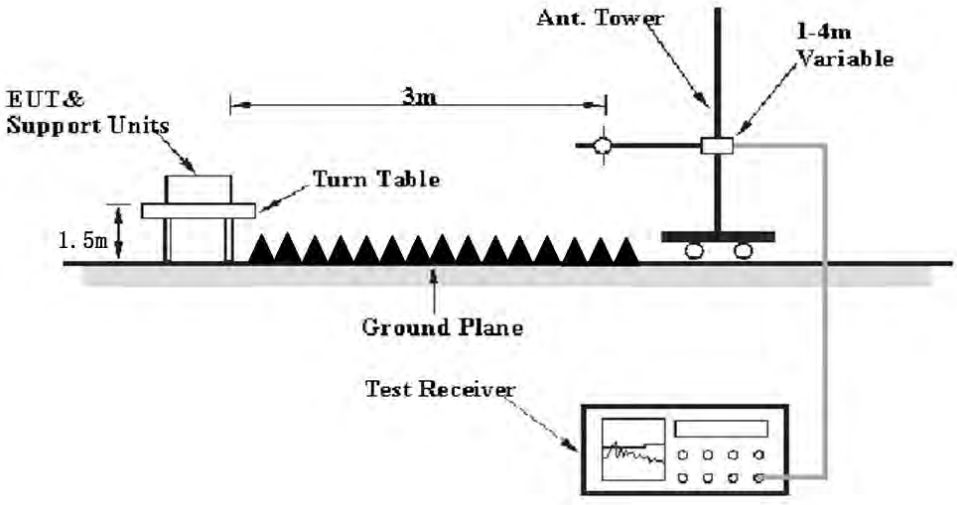
FCC §15.247 (d); §15.209; §15.205;

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

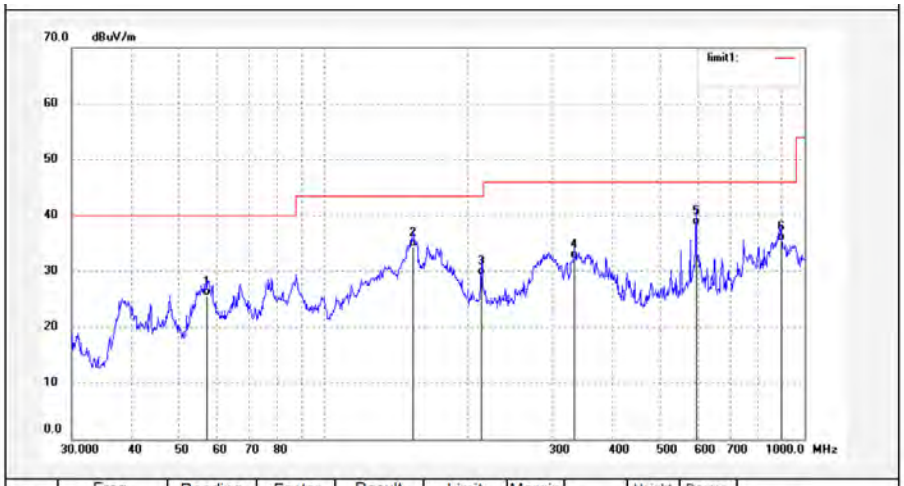
The testing was performed by Fan Yang on 2021-08-07.

EUT operation mode: Transmitting

30MHz-1GHz: (Worst case)

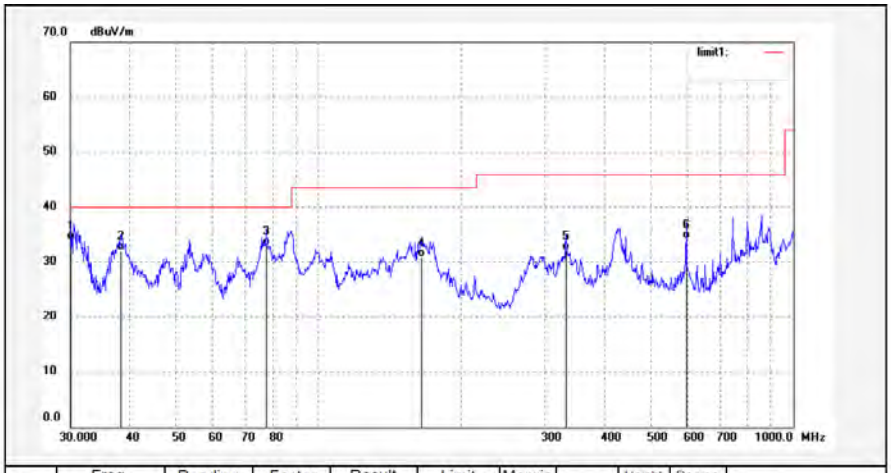
Wi-Fi: 802.11B mode, Low Channel, ANT2

Horizontal



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	57.3922	43.58	-17.97	25.61	40.00	-14.39	QP			
2	153.7384	54.43	-20.03	34.40	43.50	-9.10	QP			
3	213.0149	46.70	-17.31	29.39	43.50	-14.11	QP			
4	332.5187	45.96	-13.74	32.22	46.00	-13.78	QP			
5	595.1326	46.23	-7.91	38.32	46.00	-7.68	QP			
6	893.8567	39.13	-3.69	35.44	46.00	-10.56	QP			

Vertical



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	30.0000	47.65	-13.55	34.10	40.00	-5.90	QP			
2	38.3462	47.91	-15.82	32.09	40.00	-7.91	QP			
3	77.5926	54.53	-21.48	33.05	40.00	-6.95	QP			
4	164.9071	50.35	-19.44	30.91	43.50	-12.59	QP			
5	332.5187	45.90	-13.74	32.16	46.00	-13.84	QP			
6	595.1326	42.13	-7.91	34.22	46.00	-11.78	QP			

1-25 GHz:
Ant0:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	45.05	PK	223	1.2	H	-6.84	38.21	74	35.79
2310	45.23	PK	144	2.2	V	-6.84	38.39	74	35.61
2390	45.57	PK	2	1.3	H	-6.44	39.13	74	34.87
2390	46.09	PK	231	1.0	V	-6.44	39.65	74	34.35
4804	39.58	PK	37	1.9	H	2.81	42.39	74	31.61
4804	39.56	PK	19	2.0	V	2.81	42.37	74	31.63
BLE 1M, Middle Channel									
4880	41.54	PK	166	1.1	H	3.04	44.58	74	29.42
4880	40.83	PK	62	1.4	V	3.04	43.87	74	30.13
BLE 1M, High Channel									
2483.5	45.62	PK	318	1.5	H	-5.96	39.66	74	34.34
2483.5	45.91	PK	147	2.1	V	-5.96	39.95	74	34.05
2500	46.9	PK	243	1.5	H	-5.88	41.02	74	32.98
2500	47.4	PK	322	1.9	V	-5.88	41.52	74	32.48
4960	39.86	PK	271	1.7	H	3.29	43.15	74	30.85
4960	39.22	PK	293	1.1	V	3.29	42.51	74	31.49

Ant1:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	45.39	PK	300	1.3	H	-6.84	38.55	74	35.45
2310	45.73	PK	67	1.2	V	-6.84	38.89	74	35.11
2390	45.73	PK	130	1.7	H	-6.44	39.29	74	34.71
2390	46.33	PK	338	1.4	V	-6.44	39.89	74	34.11
4804	39.81	PK	338	1.4	H	2.81	42.62	74	31.38
4804	39.78	PK	153	2.1	V	2.81	42.59	74	31.41
BLE 1M, Middle Channel									
4880	41.91	PK	55	2.1	H	3.04	44.95	74	29.05
4880	40.9	PK	329	1.2	V	3.04	43.94	74	30.06
BLE 1M, High Channel									
2483.5	45.63	PK	15	1.2	H	-5.96	39.67	74	34.33
2483.5	46.37	PK	191	1.3	V	-5.96	40.41	74	33.59
2500	47.16	PK	315	1.6	H	-5.88	41.28	74	32.72
2500	47.81	PK	109	1.4	V	-5.88	41.93	74	32.07
4960	40.02	PK	215	1.5	H	3.29	43.31	74	30.69
4960	39.31	PK	134	2.0	V	3.29	42.6	74	31.4

Ant2:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
BLE 1M, Low Channel									
2310	45.51	PK	303	1.7	H	-6.84	38.67	74	35.33
2310	45.33	PK	302	1.6	V	-6.84	38.49	74	35.51
2390	45.81	PK	224	2.0	H	-6.44	39.37	74	34.63
2390	46.5	PK	48	1.5	V	-6.44	40.06	74	33.94
4804	40.01	PK	154	2.1	H	2.81	42.82	74	31.18
4804	39.83	PK	114	1.8	V	2.81	42.64	74	31.36
BLE 1M, Middle Channel									
4880	41.66	PK	107	1.3	H	3.04	44.7	74	29.3
4880	40.9	PK	44	2.0	V	3.04	43.94	74	30.06
BLE 1M, High Channel									
2483.5	45.86	PK	97	1.0	H	-5.96	39.9	74	34.1
2483.5	46.12	PK	85	2.2	V	-5.96	40.16	74	33.84
2500	47.15	PK	282	1.1	H	-5.88	41.27	74	32.73
2500	47.84	PK	149	1.8	V	-5.88	41.96	74	32.04
4960	39.99	PK	143	1.3	H	3.29	43.28	74	30.72
4960	39.72	PK	111	1.4	V	3.29	43.01	74	30.99

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.
The test result of peak was less than the limit of average, so just peak values were recorded.

Wi-Fi:
Ant0:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	46.61	PK	140	1.2	H	-6.84	39.77	74	34.23
2310	45.07	PK	346	1.5	V	-6.84	38.23	74	35.77
2390	47.27	PK	314	1.2	H	-6.44	40.83	74	33.17
2390	46.57	PK	62	1.1	V	-6.44	40.13	74	33.87
4824	54.02	PK	350	2.0	H	2.87	56.89	74	17.11
4824	49.66	AV	350	2.0	H	2.87	52.53	54	1.47
4824	54.77	PK	178	1.6	V	2.87	57.64	74	16.36
4824	46.24	AV	178	1.6	V	2.87	49.11	54	4.89
802.11B, Middle Channel									
4874	53.64	PK	62	1.5	H	3.01	56.65	74	17.35
4874	49.08	AV	62	1.5	H	3.01	52.09	54	1.91
4874	54.46	PK	298	1.5	V	3.01	57.47	74	16.53
4874	45.87	AV	298	1.5	V	3.01	48.88	54	5.12
11B, High Channel									
2483.5	45.23	PK	91	1.1	H	-5.96	39.27	74	34.73
2483.5	43.9	PK	256	1.8	V	-5.96	37.94	74	36.06
2500	46.67	PK	186	1.2	H	-5.88	40.79	74	33.21
2500	45.97	PK	23	2.0	V	-5.88	40.09	74	33.91
4924	53.2	PK	172	1.3	H	3.17	56.37	74	17.63
4924	48.72	AV	172	1.3	H	3.17	51.89	54	2.11
4924	54.24	PK	69	1.6	V	3.17	57.41	74	16.59
4924	45.55	AV	69	1.6	V	3.17	48.72	54	5.28
802.11G, Low Channel									
2310	45.74	PK	69	1.6	H	-6.84	38.9	74	35.1
2310	44.43	PK	240	2.1	V	-6.84	37.59	74	36.41
2390	46.8	PK	68	1.8	H	-6.44	40.36	74	33.64
2390	46.09	PK	327	1.1	V	-6.44	39.65	74	34.35
4824	53.25	PK	159	1.6	H	2.87	56.12	74	17.88
4824	48.83	AV	159	1.6	H	2.87	51.7	54	2.3
4824	54.49	PK	276	1.4	V	2.87	57.36	74	16.64
4824	45.59	AV	276	1.4	V	2.87	48.46	54	5.54
802.11G, Middle Channel									
4874	52.92	PK	58	1.2	H	3.01	55.93	74	18.07
4874	48.25	AV	58	1.2	H	3.01	51.26	54	2.74
4874	54.23	PK	103	1.4	V	3.01	57.24	74	16.76
4874	45.23	AV	103	1.4	V	3.01	48.24	54	5.76
802.11G, High Channel									
2483.5	44.74	PK	349	1.1	H	-5.96	38.78	74	35.22
2483.5	44.83	PK	15	1.9	V	-5.96	38.87	74	35.13
2500	46.61	PK	58	1.2	H	-5.88	40.73	74	33.27
2500	45.87	PK	160	1.2	V	-5.88	39.99	74	34.01
4924	52.86	PK	161	2.0	H	3.17	56.03	74	17.97
4924	48.51	AV	161	2.0	H	3.17	51.68	54	2.32
4924	54.01	PK	302	1.2	V	3.17	57.18	74	16.82
4924	45.19	AV	302	1.2	V	3.17	48.36	54	5.64

802.11N20, Low Channel									
2310	45.49	PK	119	1.2	H	-6.84	38.65	74	35.35
2310	45.29	PK	61	1.8	V	-6.84	38.45	74	35.55
2390	47.11	PK	169	2.0	H	-6.44	40.67	74	33.33
2390	46.11	PK	219	1.8	V	-6.44	39.67	74	34.33
4824	52.72	PK	314	1.2	H	2.87	55.59	74	18.41
4824	48.57	AV	314	1.2	H	2.87	51.44	54	2.56
4824	53.9	PK	313	1.3	V	2.87	56.77	74	17.23
4824	45.36	AV	313	1.3	V	2.87	48.23	54	5.77
802.11N20, Middle Channel									
4874	52.42	PK	180	1.8	H	3.01	55.43	74	18.57
4874	48.04	AV	180	1.8	H	3.01	51.05	54	2.95
4874	53.59	PK	41	1.4	V	3.01	56.6	74	17.4
4874	44.76	AV	41	1.4	V	3.01	47.77	54	6.23
802.11N20, High Channel									
2483.5	45.3	PK	245	2.1	H	-5.96	39.34	74	34.66
2483.5	44.14	PK	113	2.1	V	-5.96	38.18	74	35.82
2500	46.63	PK	120	1.4	H	-5.88	40.75	74	33.25
2500	45.79	PK	314	1.2	V	-5.88	39.91	74	34.09
4924	52.16	PK	338	1.9	H	3.17	55.33	74	18.67
4924	47.4	AV	338	1.9	H	3.17	50.57	54	3.43
4924	53.19	PK	152	1.3	V	3.17	56.36	74	17.64
4924	44.33	AV	152	1.3	V	3.17	47.5	54	6.5
802.11N40, Low Channel									
2310	46.38	PK	142	1.1	H	-6.84	39.54	74	34.46
2310	44.91	PK	180	1.8	V	-6.84	38.07	74	35.93
2390	47.2	PK	36	1.5	H	-6.44	40.76	74	33.24
2390	46.47	PK	41	1.4	V	-6.44	40.03	74	33.97
4844	51.04	PK	183	1.7	H	2.92	53.96	74	20.04
4844	48.77	PK	249	2.0	V	2.92	51.69	74	22.31
802.11N40, Middle Channel									
4874	50.53	PK	303	1.8	H	3.01	53.54	74	20.46
4874	48.4	PK	339	1.3	V	3.01	51.41	74	22.59
802.11N40, High Channel									
2483.5	44.51	PK	74	2.1	H	-5.96	38.55	74	35.45
2483.5	44.72	PK	152	1.3	V	-5.96	38.76	74	35.24
2500	46.16	PK	155	1.8	H	-5.88	40.28	74	33.72
2500	45.4	PK	337	1.3	V	-5.88	39.52	74	34.48
4904	49.78	PK	270	1.2	H	3.11	52.89	74	21.11
4904	47.8	PK	347	2.0	V	3.11	50.91	74	23.09

Ant1:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	46.32	PK	173	1.6	H	-6.84	39.48	74	34.52
2310	44.58	PK	94	1.2	V	-6.84	37.74	74	36.26
2390	46.98	PK	140	1.6	H	-6.44	40.54	74	33.46
2390	46.19	PK	177	1.3	V	-6.44	39.75	74	34.25
4824	53.89	PK	327	1.5	H	2.87	56.76	74	17.24
4824	49.31	AV	327	1.5	H	2.87	52.18	54	1.82
4824	54.71	PK	20	1.5	V	2.87	57.58	74	16.42
4824	45.89	AV	20	1.5	V	2.87	48.76	54	5.24
802.11B, Middle Channel									
4874	53.47	PK	85	1.0	H	3.01	56.48	74	17.52
4874	49.04	AV	85	1.0	H	3.01	52.05	54	1.95
4874	54.19	PK	289	1.4	V	3.01	57.2	74	16.8
4874	45.53	AV	289	1.4	V	3.01	48.54	54	5.46
11B, High Channel									
2483.5	44.74	PK	73	2.1	H	-5.96	38.78	74	35.22
2483.5	43.75	PK	15	1.6	V	-5.96	37.79	74	36.21
2500	46.37	PK	350	1.1	H	-5.88	40.49	74	33.51
2500	45.89	PK	355	1.5	V	-5.88	40.01	74	33.99
4924	52.72	PK	317	2.0	H	3.17	55.89	74	18.11
4924	48.47	AV	317	2.0	H	3.17	51.64	54	2.36
4924	53.8	PK	100	1.8	V	3.17	56.97	74	17.03
4924	45.41	AV	100	1.8	V	3.17	48.58	54	5.42
802.11G, Low Channel									
2310	45.63	PK	100	1.8	H	-6.84	38.79	74	35.21
2310	44.37	PK	184	2.0	V	-6.84	37.53	74	36.47
2390	46.73	PK	193	1.3	H	-6.44	40.29	74	33.71
2390	45.99	PK	152	1.5	V	-6.44	39.55	74	34.45
4824	52.88	PK	170	1.6	H	2.87	55.75	74	18.25
4824	48.4	AV	170	1.6	H	2.87	51.27	54	2.73
4824	54.03	PK	144	1.2	V	2.87	56.9	74	17.1
4824	45.46	AV	144	1.2	V	2.87	48.33	54	5.67
802.11G, Middle Channel									
4874	52.87	PK	152	1.2	H	3.01	55.88	74	18.12
4874	48.22	AV	152	1.2	H	3.01	51.23	54	2.77
4874	54.15	PK	32	1.1	V	3.01	57.16	74	16.84
4874	44.83	AV	32	1.1	V	3.01	47.84	54	6.16
802.11G, High Channel									
2483.5	44.42	PK	132	2.0	H	-5.96	38.46	74	35.54
2483.5	44.71	PK	48	1.2	V	-5.96	38.75	74	35.25
2500	46.56	PK	152	1.2	H	-5.88	40.68	74	33.32
2500	45.74	PK	172	2.1	V	-5.88	39.86	74	34.14
4924	52.83	PK	311	2.2	H	3.17	56	74	18
4924	48.07	AV	311	2.2	H	3.17	51.24	54	2.76
4924	53.68	PK	231	1.7	V	3.17	56.85	74	17.15
4924	44.71	AV	231	1.7	V	3.17	47.88	54	6.12
802.11N20, Low Channel									

2310	45.11	PK	207	1.0	H	-6.84	38.27	74	35.73
2310	45.06	PK	15	1.4	V	-6.84	38.22	74	35.78
2390	46.93	PK	192	1.0	H	-6.44	40.49	74	33.51
2390	45.91	PK	146	1.3	V	-6.44	39.47	74	34.53
4824	52.66	PK	208	1.0	H	2.87	55.53	74	18.47
4824	48.4	AV	208	1.0	H	2.87	51.27	54	2.73
4824	53.87	PK	111	2.0	V	2.87	56.74	74	17.26
4824	44.91	AV	111	2.0	V	2.87	47.78	54	6.22
802.11N20, Middle Channel									
4874	52.32	PK	106	1.9	H	3.01	55.33	74	18.67
4874	47.78	AV	106	1.9	H	3.01	50.79	54	3.21
4874	53.52	PK	57	1.9	V	3.01	56.53	74	17.47
4874	44.75	AV	57	1.9	V	3.01	47.76	54	6.24
802.11N20, High Channel									
2483.5	44.81	PK	330	1.6	H	-5.96	38.85	74	35.15
2483.5	43.65	PK	234	2.0	V	-5.96	37.69	74	36.31
2500	46.5	PK	251	1.2	H	-5.88	40.62	74	33.38
2500	45.31	PK	208	1.0	V	-5.88	39.43	74	34.57
4924	52.06	PK	108	2.2	H	3.17	55.23	74	18.77
4924	47.12	AV	108	2.2	H	3.17	50.29	54	3.71
4924	53.17	PK	147	2.0	V	3.17	56.34	74	17.66
4924	44.09	AV	147	2.0	V	3.17	47.26	54	6.74
802.11N40, Low Channel									
2310	46.28	PK	350	1.3	H	-6.84	39.44	74	34.56
2310	44.64	PK	106	1.9	V	-6.84	37.8	74	36.2
2390	47.16	PK	154	1.6	H	-6.44	40.72	74	33.28
2390	46.14	PK	57	1.9	V	-6.44	39.7	74	34.3
4844	51.01	PK	31	1.7	H	2.92	53.93	74	20.07
4844	48.35	PK	111	1.7	V	2.92	51.27	74	22.73
802.11N40, Middle Channel									
4874	50.37	PK	249	1.3	H	3.01	53.38	74	20.62
4874	48.02	PK	71	2.0	V	3.01	51.03	74	22.97
802.11N40, High Channel									
2483.5	44.24	PK	162	2.1	H	-5.96	38.28	74	35.72
2483.5	44.46	PK	147	2.0	V	-5.96	38.5	74	35.5
2500	46	PK	121	1.0	H	-5.88	40.12	74	33.88
2500	44.99	PK	273	1.8	V	-5.88	39.11	74	34.89
4904	49.57	PK	317	1.5	H	3.11	52.68	74	21.32
4904	47.41	PK	228	1.2	V	3.11	50.52	74	23.48

Ant2:

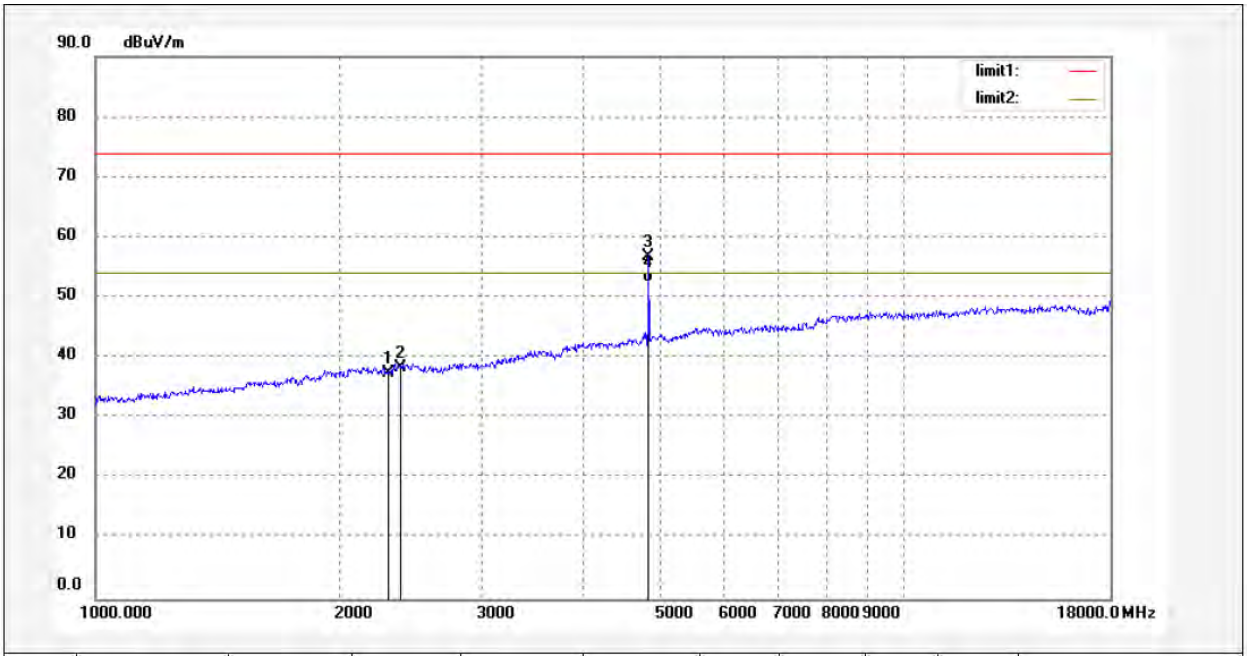
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/AV		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2310	46.16	PK	315	1.9	H	-6.84	39.32	74	34.68
2310	44.68	PK	87	1.7	V	-6.84	37.84	74	36.16
2390	46.96	PK	70	1.9	H	-6.44	40.52	74	33.48
2390	46.46	PK	228	1.9	V	-6.44	40.02	74	33.98
4824	46.53	PK	186	1.6	H	2.87	49.4	74	24.6
4824	47.2	PK	262	2.2	V	2.87	50.07	74	23.93
802.11B, Middle Channel									
4874	46.31	PK	132	1.8	H	3.01	49.32	74	24.68
4874	47.12	PK	194	2.2	V	3.01	50.13	74	23.87
802.11B, High Channel									
2483.5	45.12	PK	166	1.8	H	-5.96	39.16	74	34.84
2483.5	43.5	PK	103	1.6	V	-5.96	37.54	74	36.46
2500	46.34	PK	84	1.0	H	-5.88	40.46	74	33.54
2500	45.49	PK	300	1.7	V	-5.88	39.61	74	34.39
4924	45.89	PK	202	2.1	H	3.17	49.06	74	24.94
4924	46.09	PK	192	1.0	V	3.17	49.26	74	24.74
802.11G, Low Channel									
2310	45.62	PK	192	1.0	H	-6.84	38.78	74	35.22
2310	44.1	PK	330	1.3	V	-6.84	37.26	74	36.74
2390	46.31	PK	292	1.6	H	-6.44	39.87	74	34.13
2390	45.93	PK	215	1.0	V	-6.44	39.49	74	34.51
4824	45.87	PK	288	1.5	H	2.87	48.74	74	25.26
4824	46.12	PK	23	1.2	V	2.87	48.99	74	25.01
802.11G, Middle Channel									
4874	45.89	PK	270	1.1	H	3.01	48.9	74	25.1
4874	46.04	PK	276	2.1	V	3.01	49.05	74	24.95
802.11G, High Channel									
2483.5	44.46	PK	149	1.7	H	-5.96	38.5	74	35.5
2483.5	44.5	PK	261	2.1	V	-5.96	38.54	74	35.46
2500	46.28	PK	270	1.1	H	-5.88	40.4	74	33.6
2500	45.77	PK	222	2.1	V	-5.88	39.89	74	34.11
4924	45.8	PK	91	2.2	H	3.17	48.97	74	25.03
4924	44.85	PK	349	2.2	V	3.17	48.02	74	25.98
802.11N20, Low Channel									
2310	45.48	PK	128	1.3	H	-6.84	38.64	74	35.36
2310	44.82	PK	331	1.6	V	-6.84	37.98	74	36.02
2390	46.97	PK	145	1.8	H	-6.44	40.53	74	33.47
2390	45.78	PK	339	1.8	V	-6.44	39.34	74	34.66
4824	45.44	PK	302	2.1	H	2.87	48.31	74	25.69
4824	45.86	PK	298	1.6	V	2.87	48.73	74	25.27
802.11N20, Middle Channel									
4874	44.23	PK	115	1.5	H	3.01	47.24	74	26.76
4874	44.33	PK	195	1.9	V	3.01	47.34	74	26.66
802.11N20, High Channel									
2483.5	44.89	PK	220	1.8	H	-5.96	38.93	74	35.07
2483.5	43.69	PK	105	2.1	V	-5.96	37.73	74	36.27

2500	46.25	PK	313	2.1	H	-5.88	40.37	74	33.63
2500	45.52	PK	302	2.1	V	-5.88	39.64	74	34.36
4924	44.91	PK	260	1.0	H	3.17	48.08	74	25.92
4924	44.75	PK	295	1.1	V	3.17	47.92	74	26.08
802.11N40, Low Channel									
2310	46.08	PK	168	1.6	H	-6.84	39.24	74	34.76
2310	44.76	PK	115	1.5	V	-6.84	37.92	74	36.08
2390	46.99	PK	225	2.2	H	-6.44	40.55	74	33.45
2390	46.12	PK	195	1.9	V	-6.44	39.68	74	34.32
4844	44.81	PK	294	2.0	H	2.92	47.73	74	26.27
4844	44.63	PK	328	1.8	V	2.92	47.55	74	26.45
802.11N40, Middle Channel									
4874	44.39	PK	175	1.8	H	3.01	47.4	74	26.6
4874	44.16	PK	335	1.6	V	3.01	47.17	74	26.83
802.11N40, High Channel									
2483.5	44.07	PK	240	1.3	H	-5.96	38.11	74	35.89
2483.5	44.7	PK	295	1.1	V	-5.96	38.74	74	35.26
2500	45.8	PK	306	1.5	H	-5.88	39.92	74	34.08
2500	45.14	PK	252	2.1	V	-5.88	39.26	74	34.74
4904	43.62	PK	265	1.6	H	3.11	46.73	74	27.27
4904	42.48	PK	152	1.3	V	3.11	45.59	74	28.41

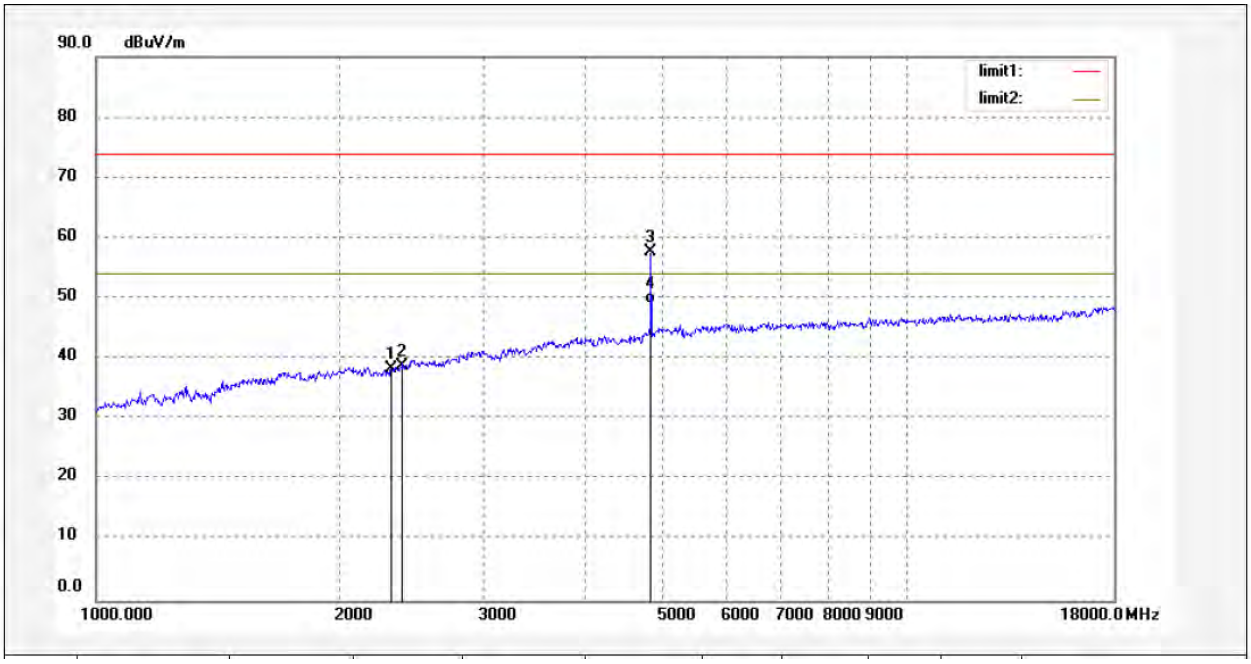
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.
The test result of peak was less than the limit of average, so just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

1-18 GHz:

Pre-scan for Peak
802.11 b Low Channel, Ant 0
Horizontal

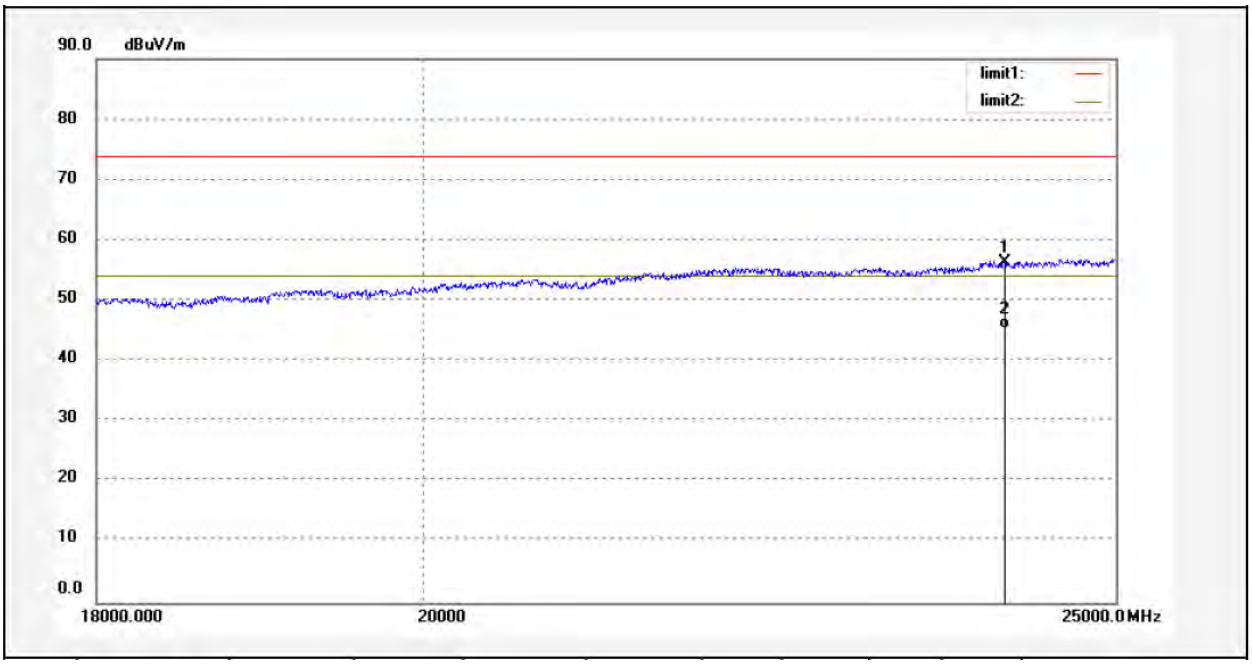


Vertical

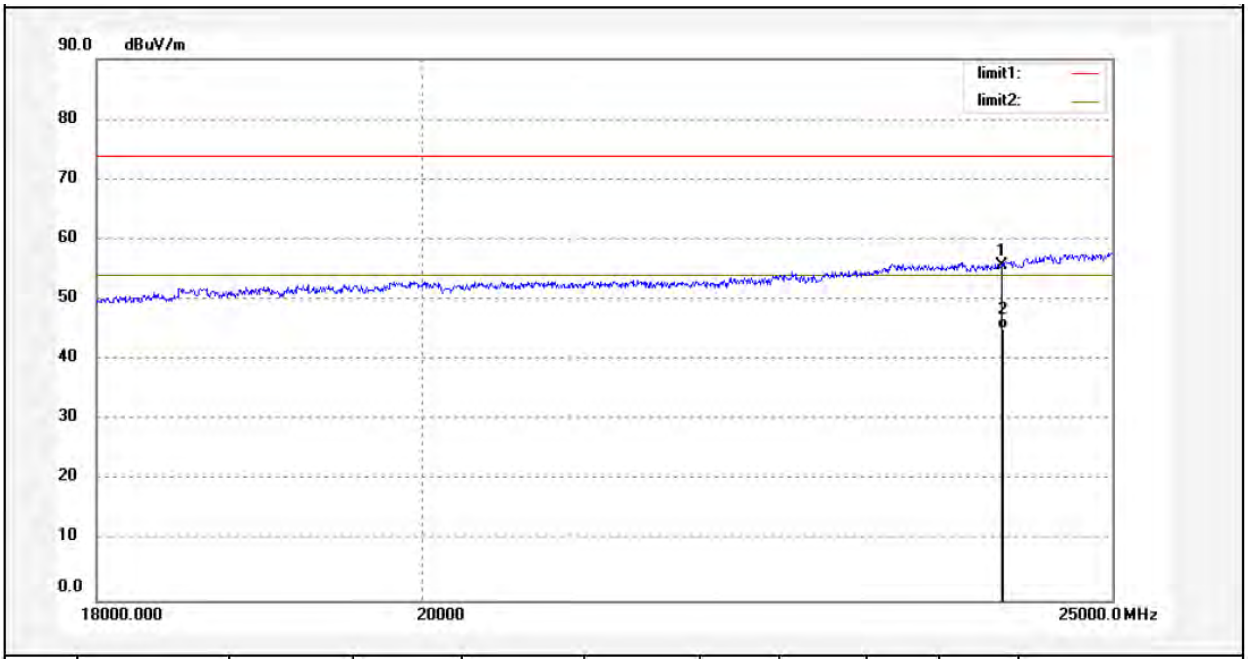


18 -25GHz:

Pre-scan for Peak
802.11 b Low Channel, Ant 0
Horizontal



Vertical



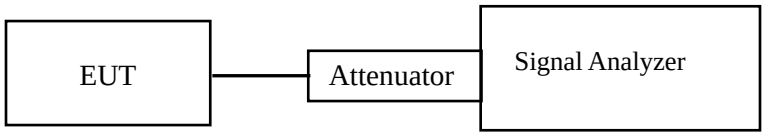
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH & OCCUPIED BANDWIDTH

Applicable Standard

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

Test Procedure

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



Test Data

Environmental Conditions

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

The testing was performed by Fan Yang on 2021-08-08 for BLE and 2021-08-04 for Wi-Fi.

EUT operation mode: Transmitting

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

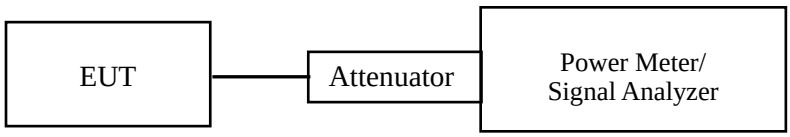
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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 2021-08-08 for BLE and 2021-08-04 for Wi-Fi.

EUT operation mode: Transmitting

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

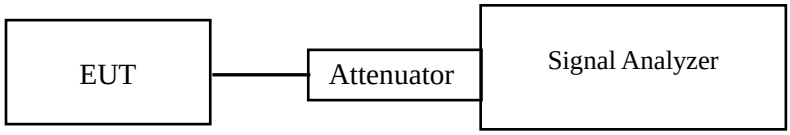
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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 2021-08-08 for BLE and 2021-08-04 for Wi-Fi.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi and Appendix BLE.

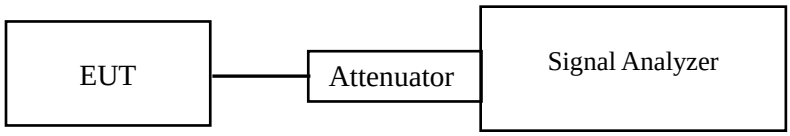
FCC §15.247(e) - POWER SPECTRAL DENSITY

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 2021-08-08 for BLE and 2021-08-04 for Wi-Fi.

EUT operation mode: Transmitting

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

APPENDIX Wi-Fi

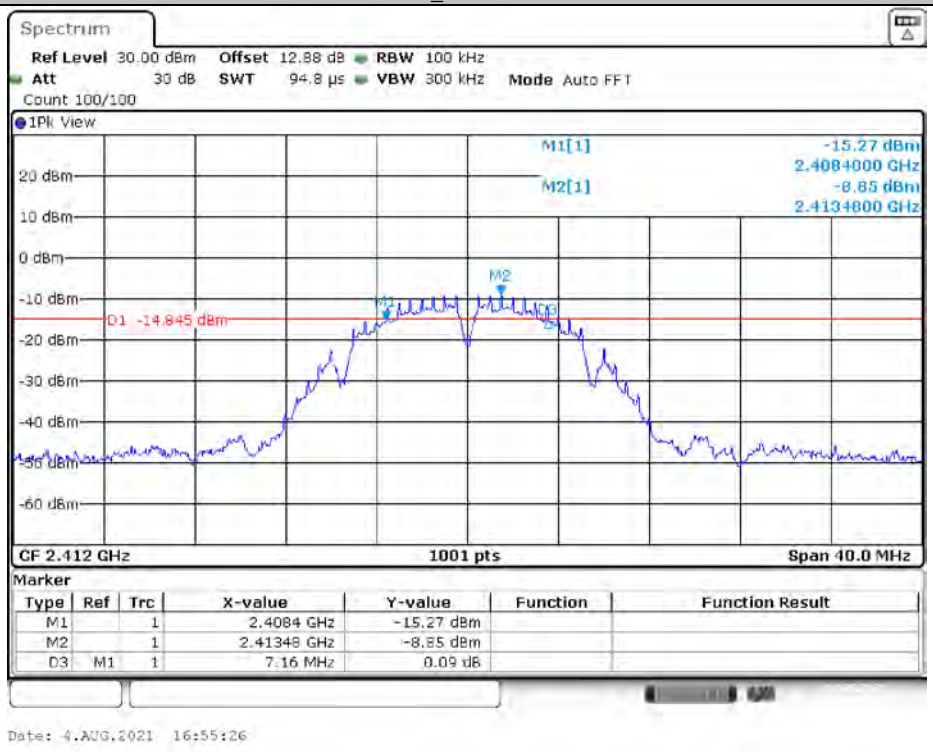
Appendix A: 6dB Emission Bandwidth

Test Result

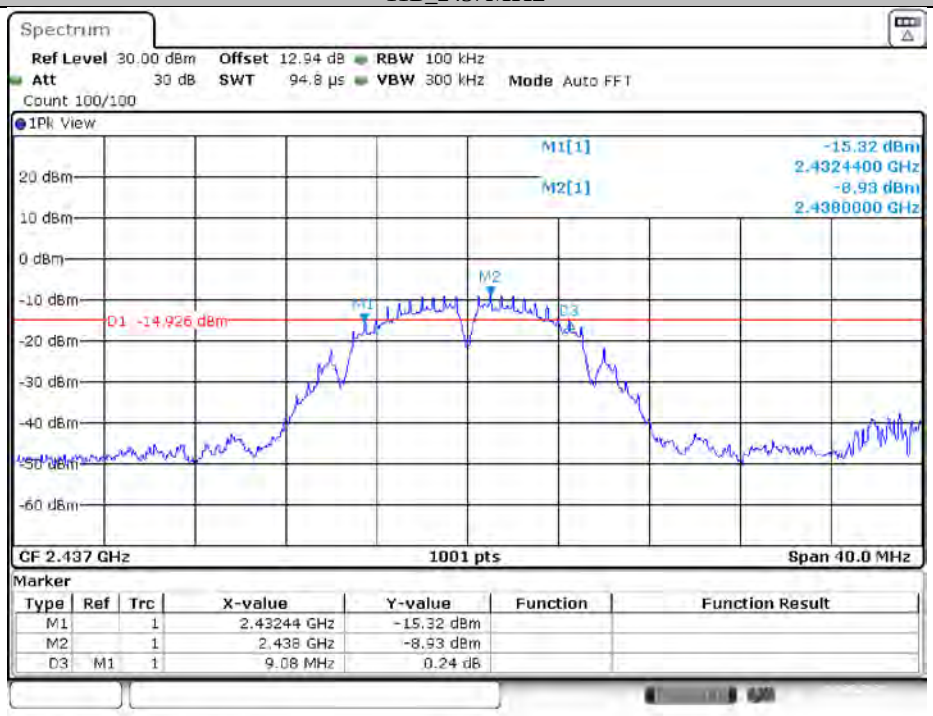
TestMode	Channel [MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	2412	7.160	0.5	PASS
	2437	9.080	0.5	PASS
	2462	8.120	0.5	PASS
11G	2412	16.360	0.5	PASS
	2437	16.360	0.5	PASS
	2462	15.240	0.5	PASS
11N20SISO	2412	17.360	0.5	PASS
	2437	17.240	0.5	PASS
	2462	15.240	0.5	PASS
11N40SISO	2422	36.240	0.5	PASS
	2437	36.080	0.5	PASS
	2452	35.920	0.5	PASS

Test Graphs

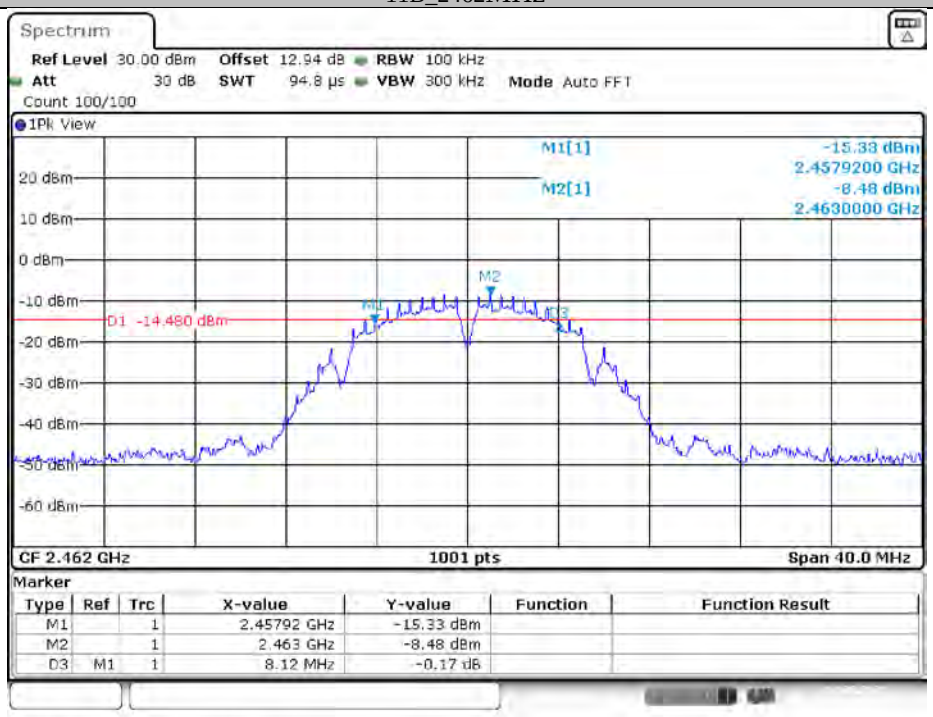
11B_2412MHz



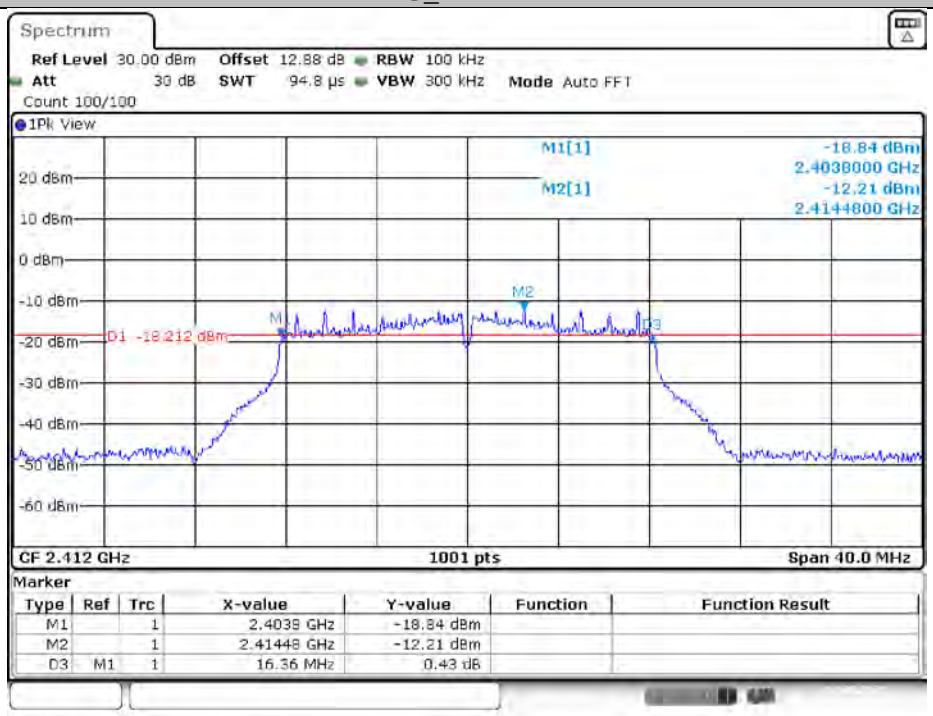
11B_2437MHz



11B_2462MHz

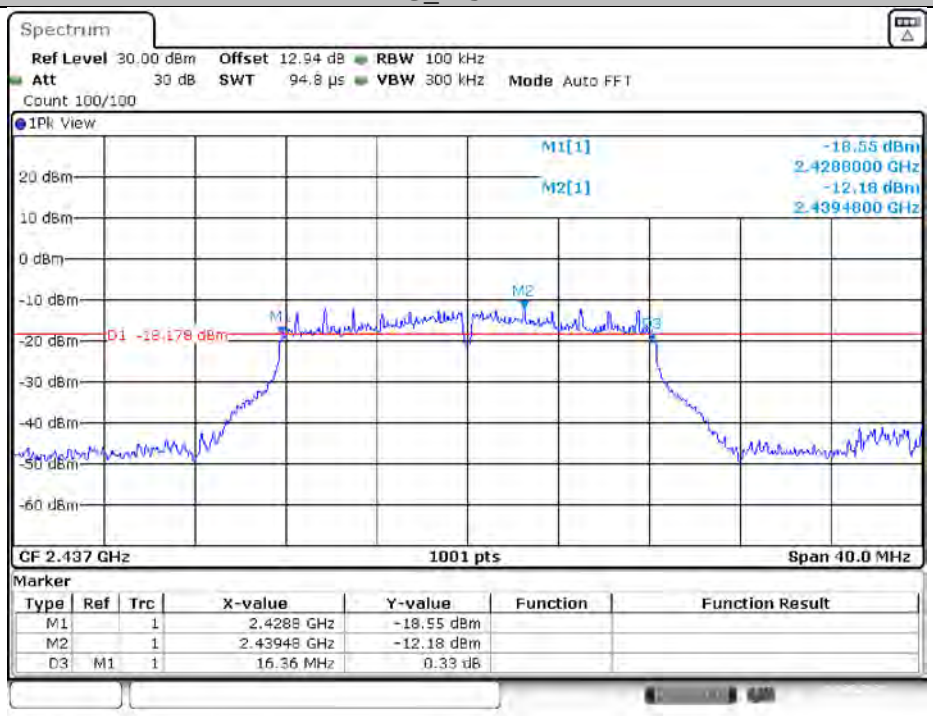


11G_2412MHz



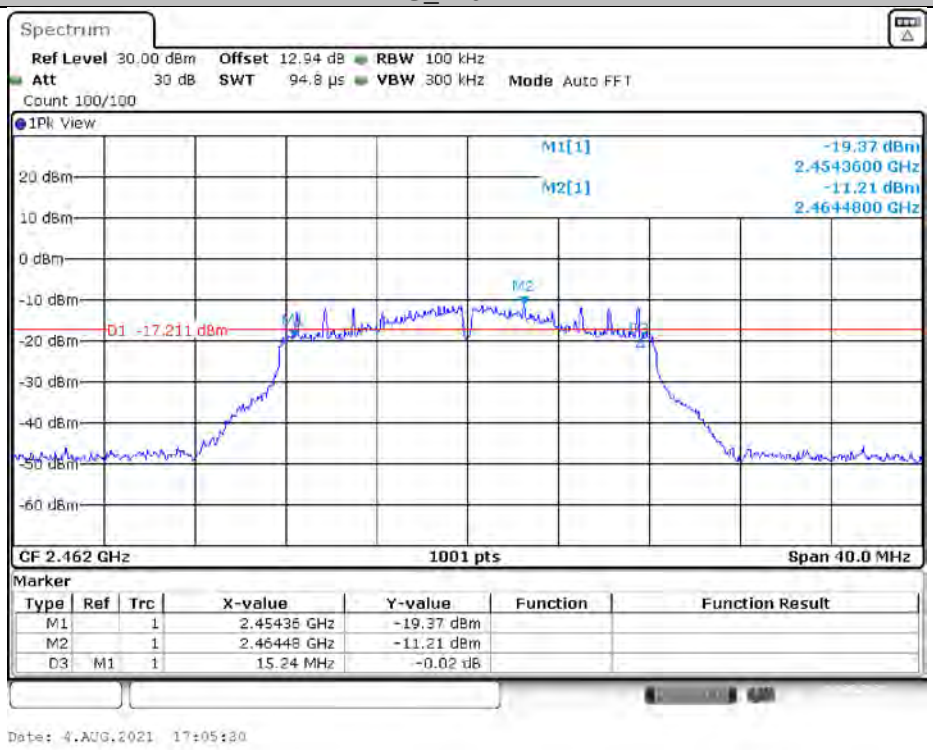
Date: 4.AUG.2021 17:02:30

11G_2437MHz

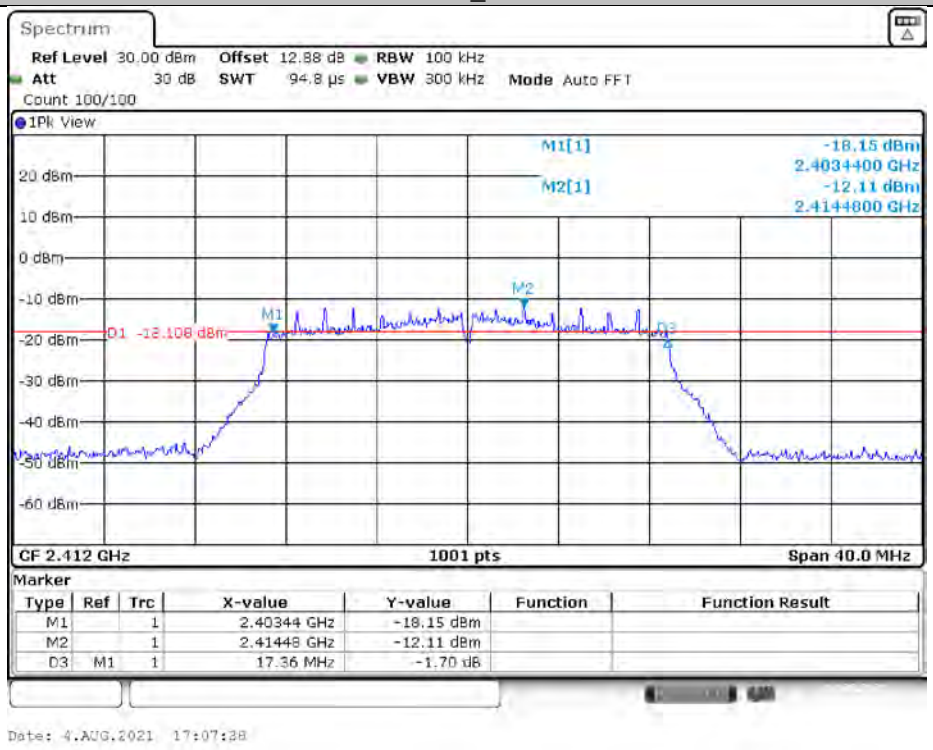


Date: 4.AUG.2021 17:04:07

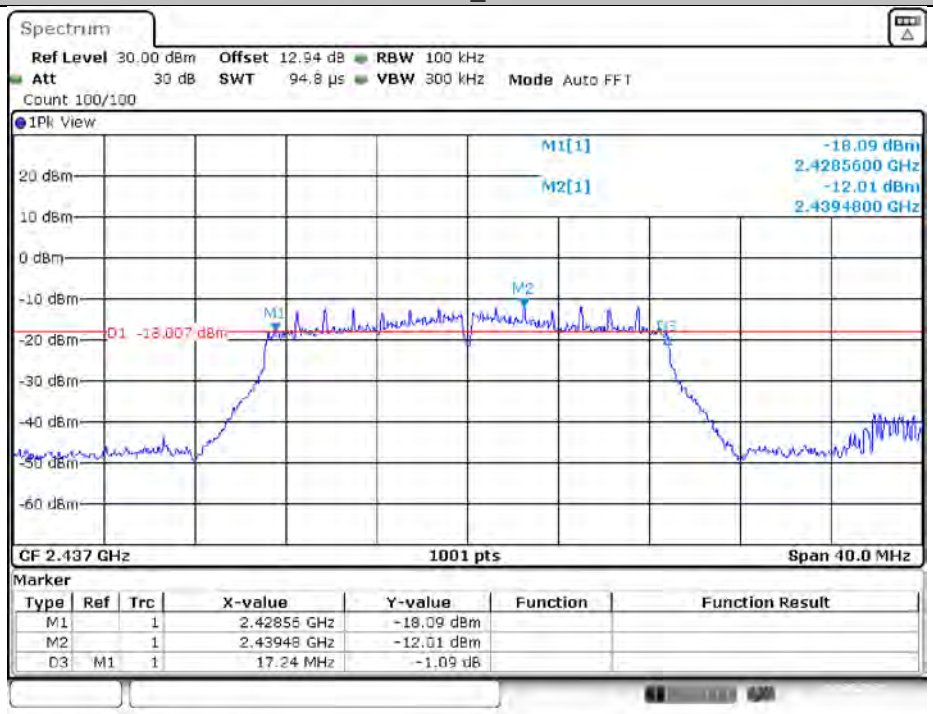
11G_2462MHz



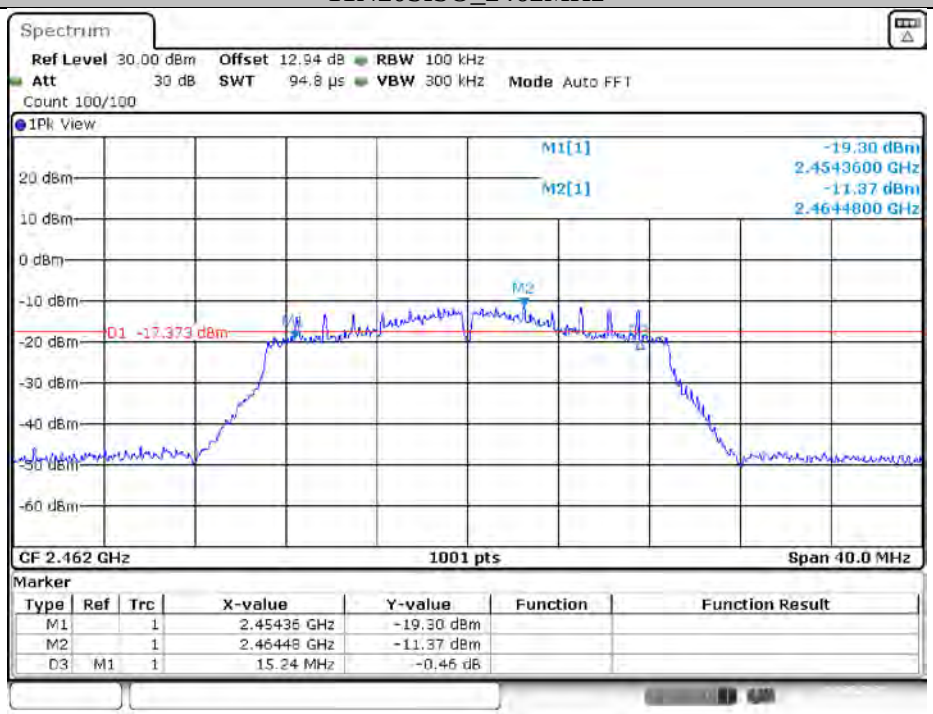
11N20SISO_2412MHz



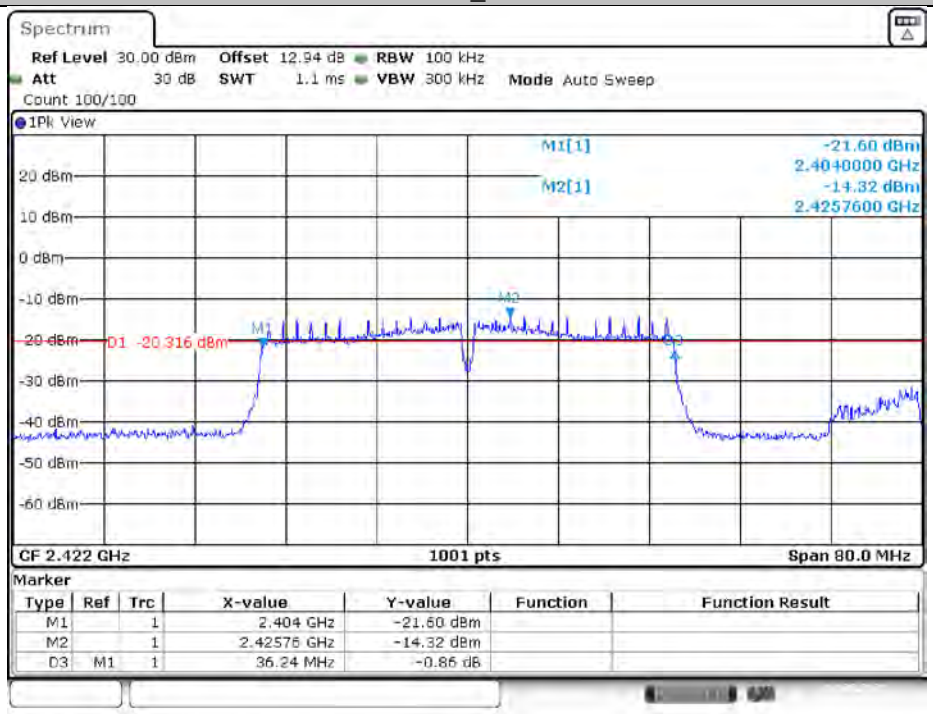
11N20SISO_2437MHz



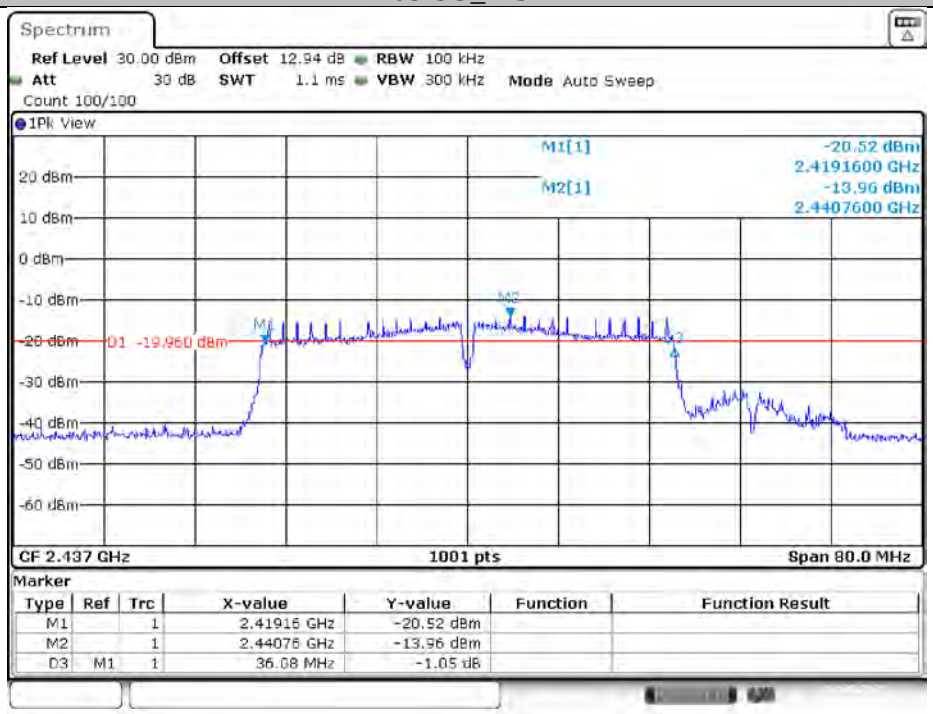
11N20SISO_2462MHz



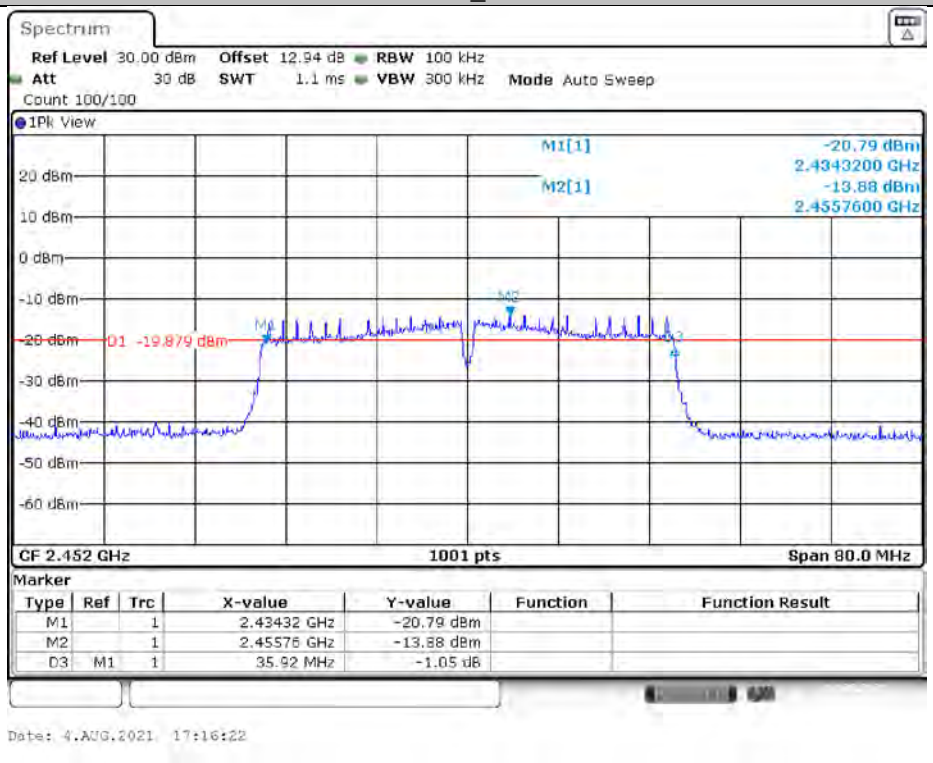
11N40SISO_2422MHz



11N40SISO_2437MHz



11N40SISO_2452MHz



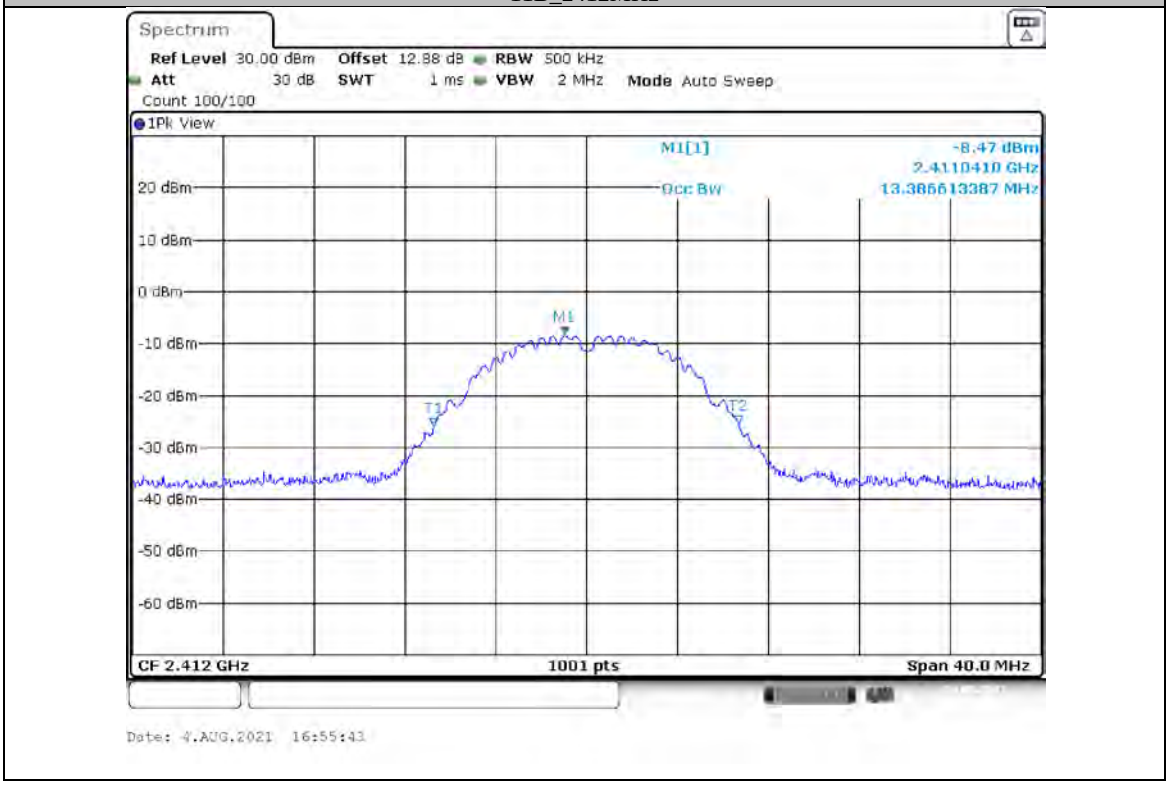
Appendix B: Occupied Channel Bandwidth

Test Result

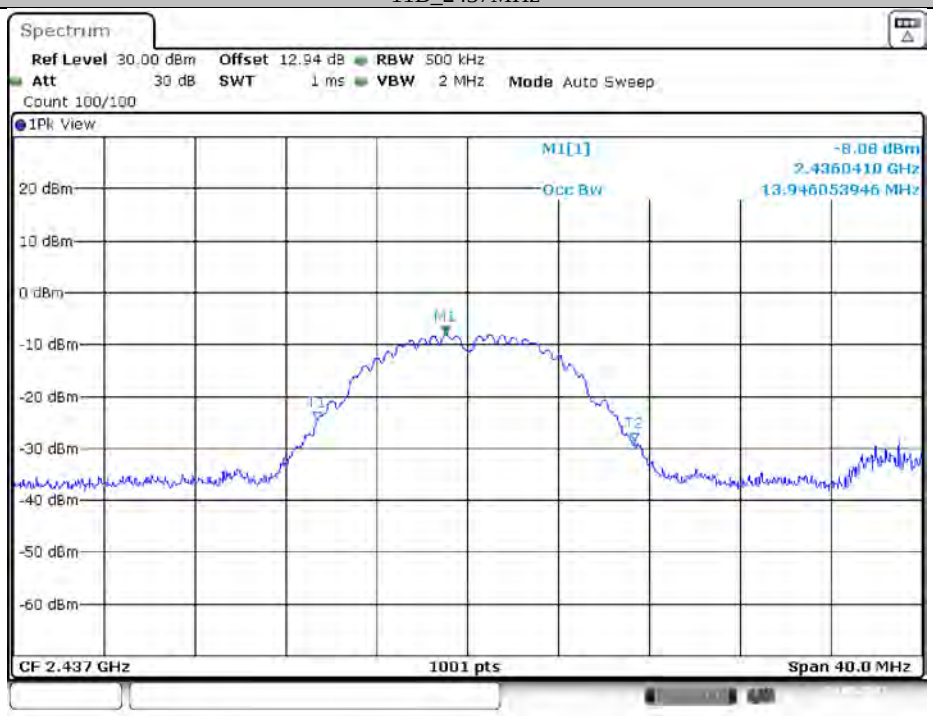
TestMode	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	2412	13.387	---	PASS
	2437	13.946	---	PASS
	2462	13.227	---	PASS
11G	2412	17.862	---	PASS
	2437	17.982	---	PASS
	2462	17.383	---	PASS
11N20SISO	2412	18.781	---	PASS
	2437	18.821	---	PASS
	2462	18.342	---	PASS
11N40SISO	2422	37.243	---	PASS
	2437	37.403	---	PASS
	2452	37.003	---	PASS

Test Graphs

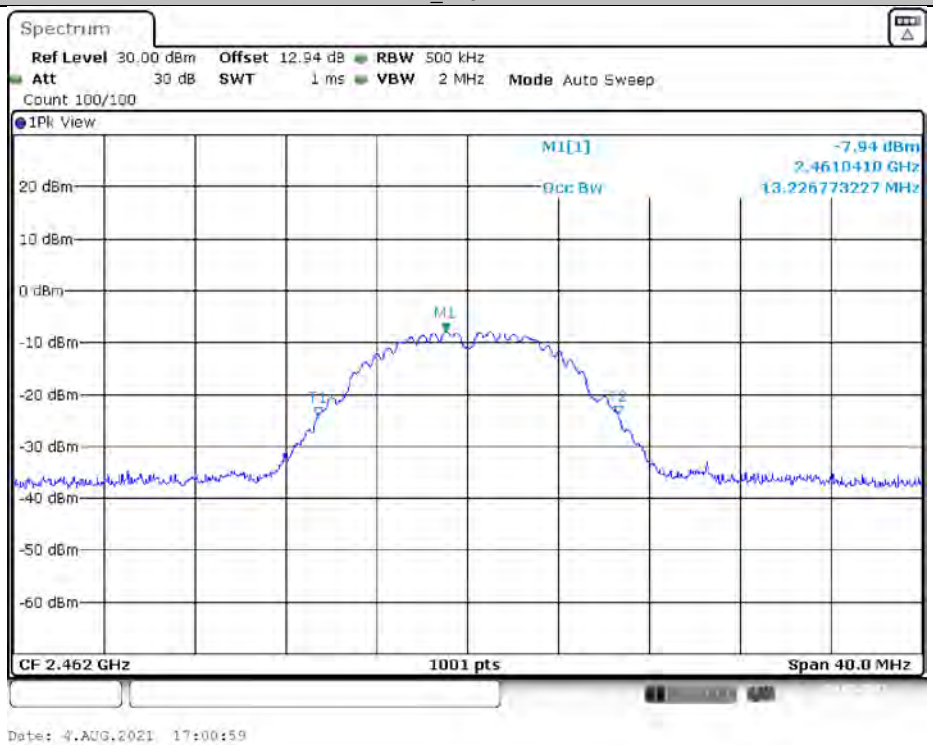
11B_2412MHz



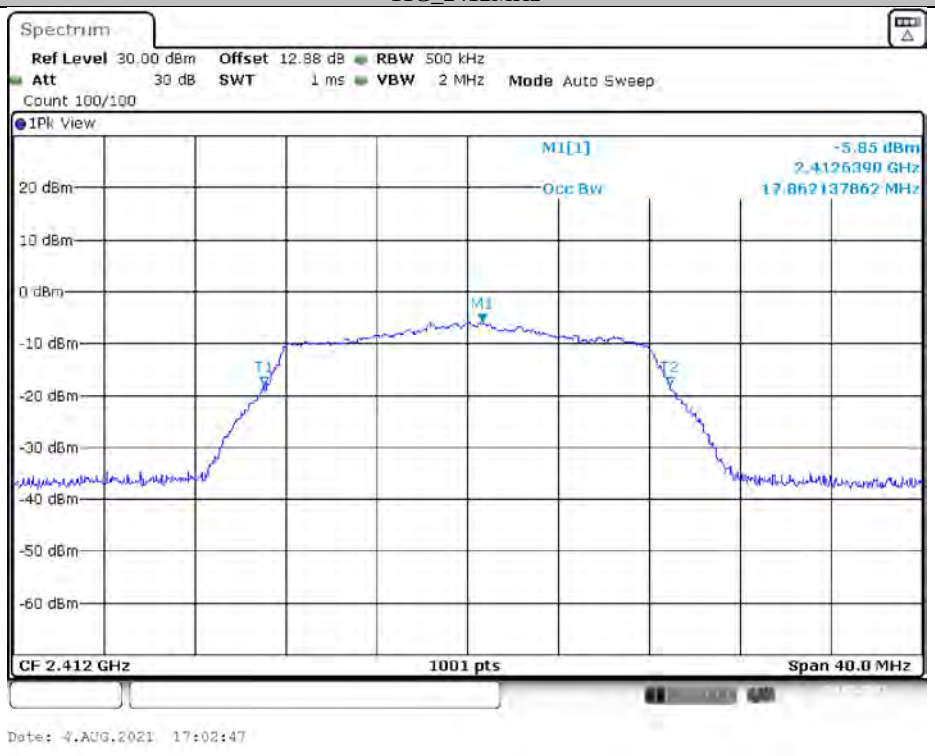
11B_2437MHz



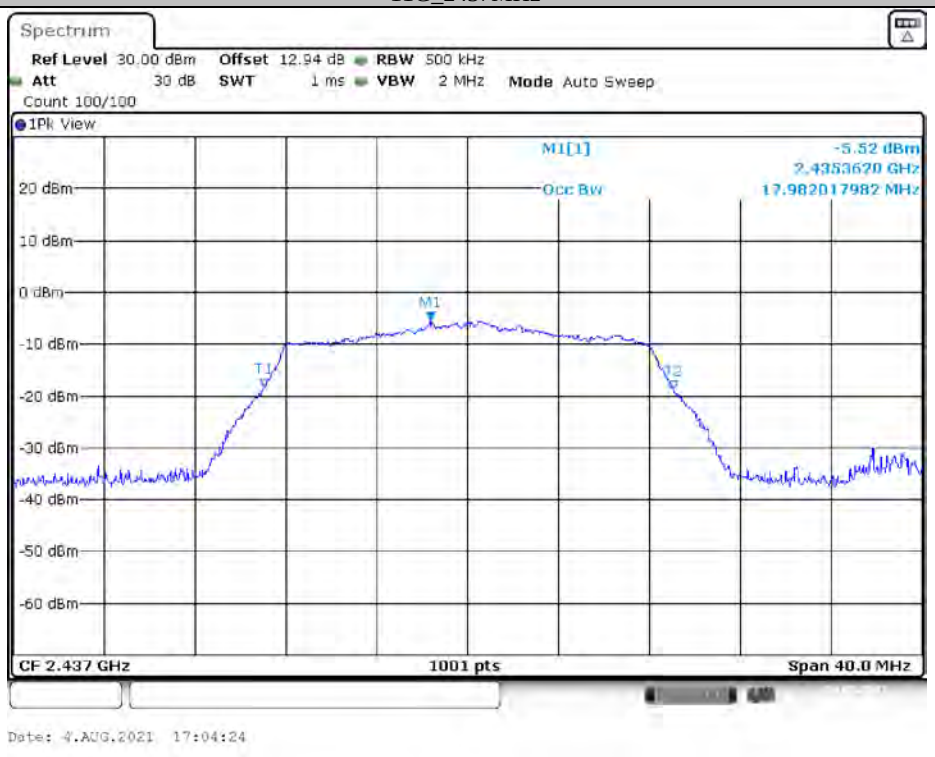
11B_2462MHz



11G_2412MHz

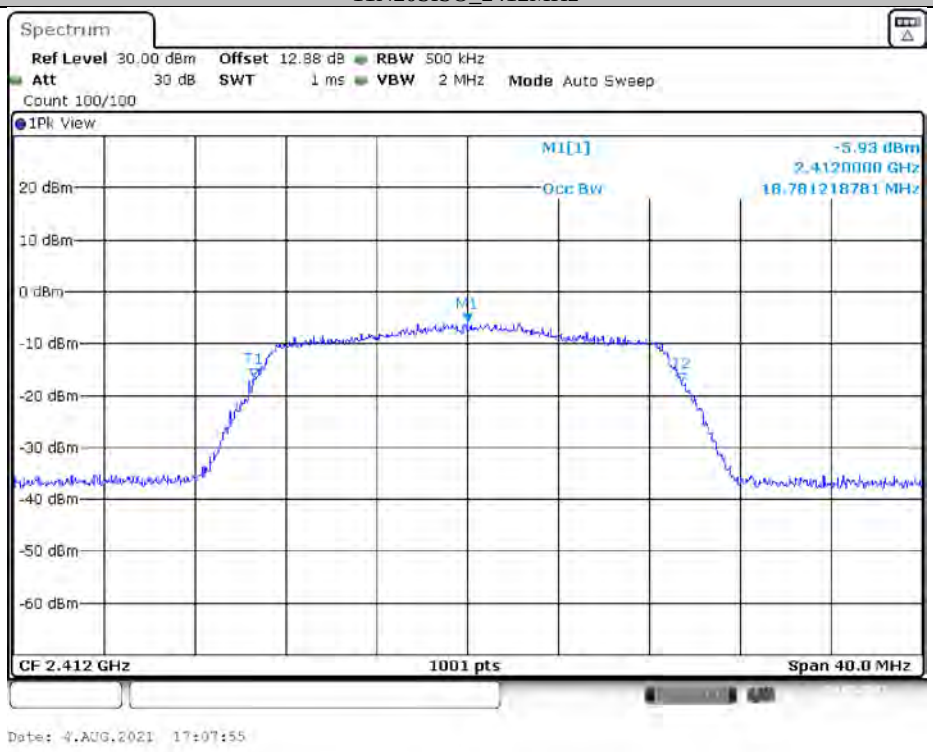


11G_2437MHz

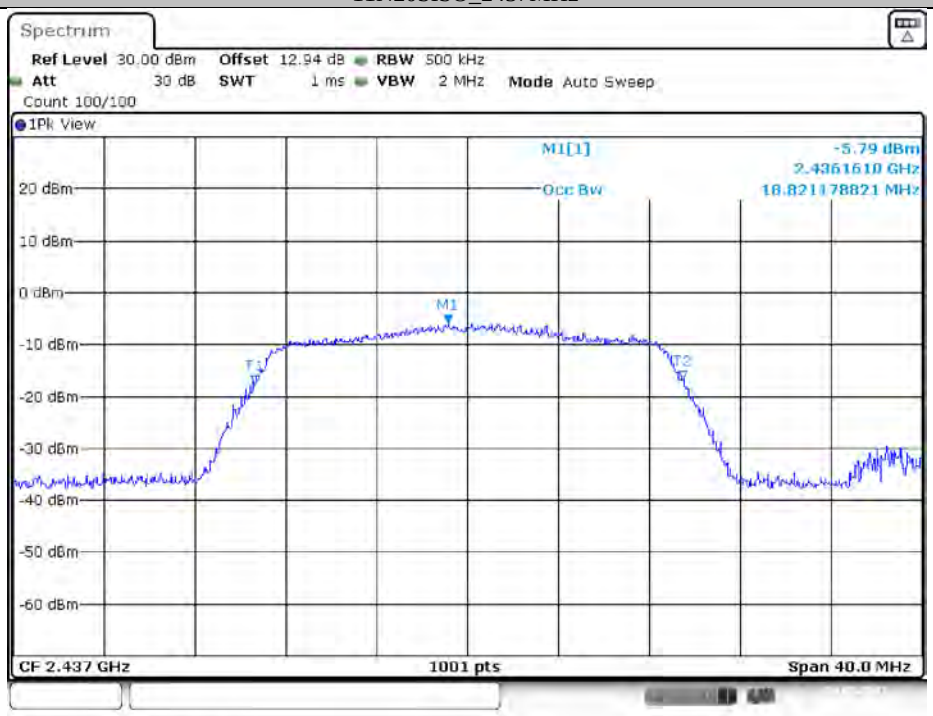


11G_2462MHz

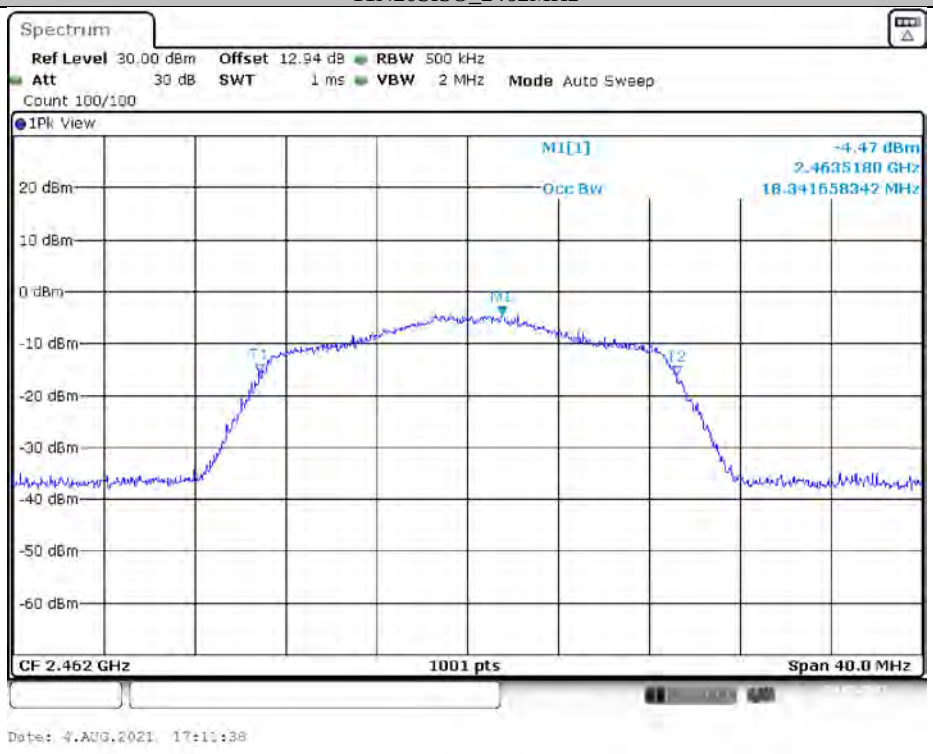
11N20SISO_2412MHz



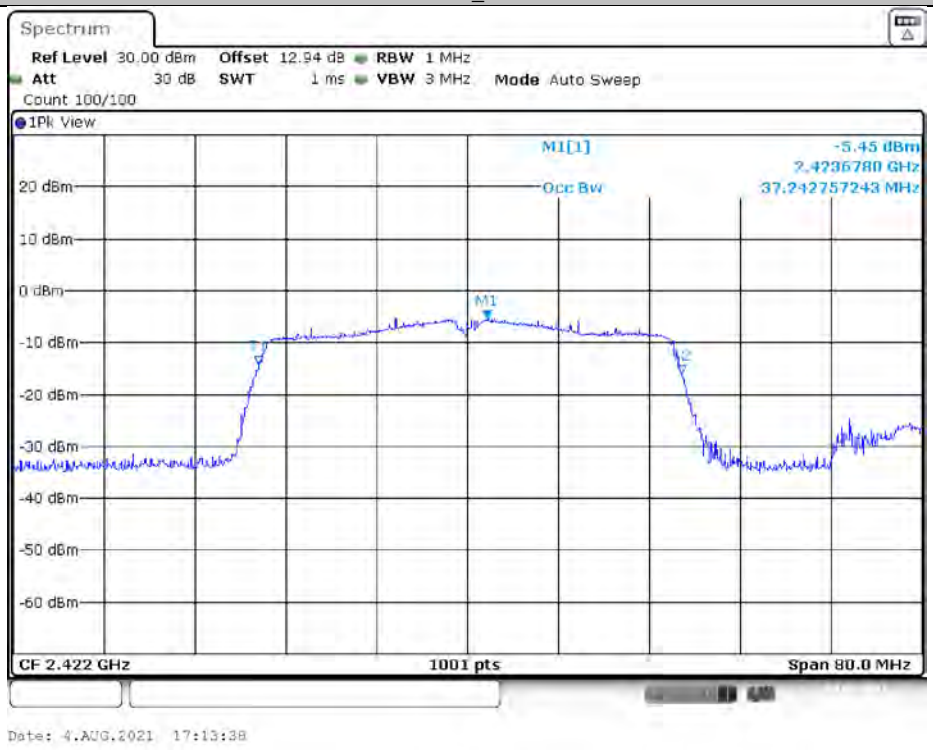
11N20SISO_2437MHz



11N20SISO_2462MHz



11N40SISO _2422MHz



11N40SISO _2437MHz

11N40SISO _2452MHz


Appendix C: Maximum conducted output power

Test Result

Test Mode	Channel [MHz]	Peak Power Result [dBm]	Limit [dBm]	Verdict
11B	2412	8.63	<=30	PASS
	2437	8.38	<=30	PASS
	2462	8.51	<=30	PASS
11G	2412	8.34	<=30	PASS
	2437	8.32	<=30	PASS
	2462	8.17	<=30	PASS
11N20SISO	2412	8.39	<=30	PASS
	2437	8.22	<=30	PASS
	2462	8.45	<=30	PASS
11N40SISO	2422	7.32	<=30	PASS
	2437	7.07	<=30	PASS
	2452	7.21	<=30	PASS

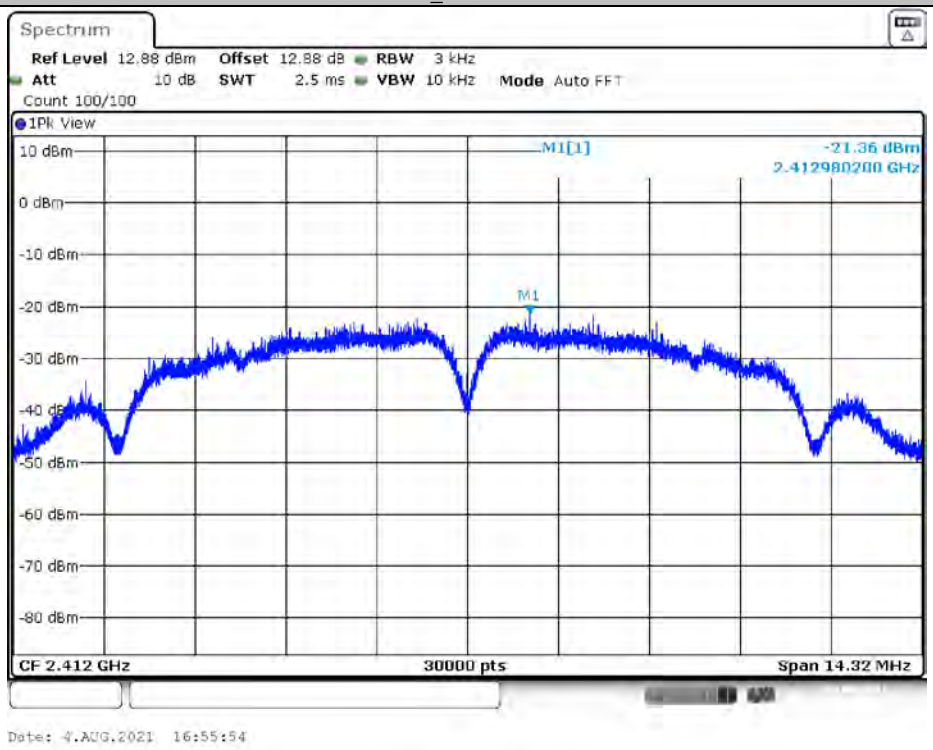
Appendix D: Power spectral density

Test Result

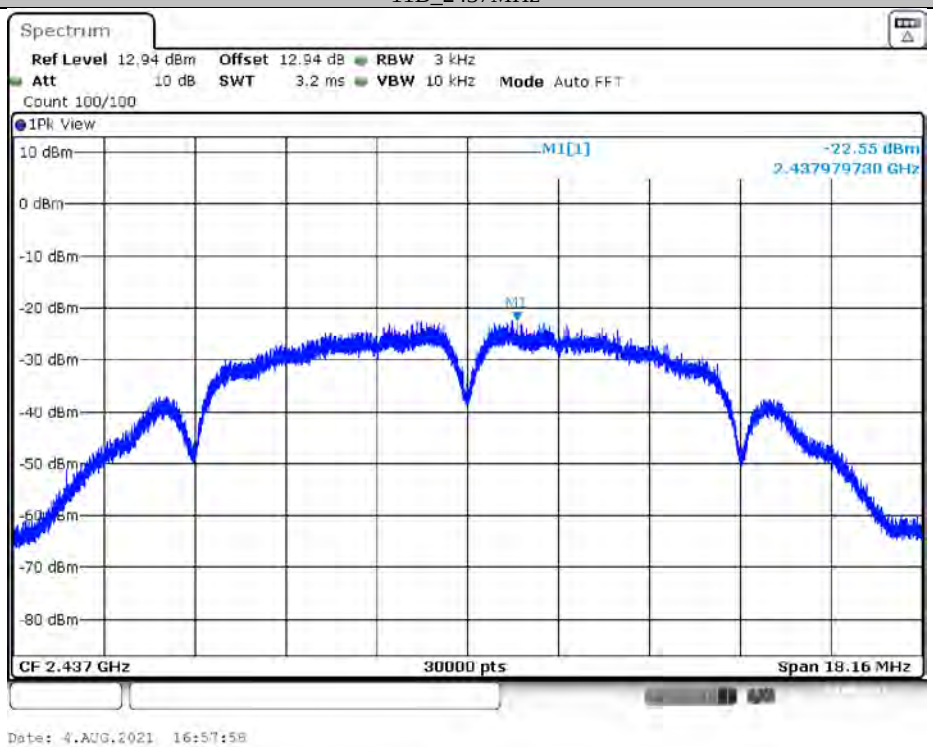
TestMode	Channel[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	2412	-21.36	<=8	PASS
	2437	-22.55	<=8	PASS
	2462	-22.07	<=8	PASS
11G	2412	-24	<=8	PASS
	2437	-23.66	<=8	PASS
	2462	-22.4	<=8	PASS
11N20SISO	2412	-23.99	<=8	PASS
	2437	-23.97	<=8	PASS
	2462	-22.59	<=8	PASS
11N40SISO	2422	-27.63	<=8	PASS
	2437	-26.84	<=8	PASS
	2452	-25.36	<=8	PASS

Test Graphs

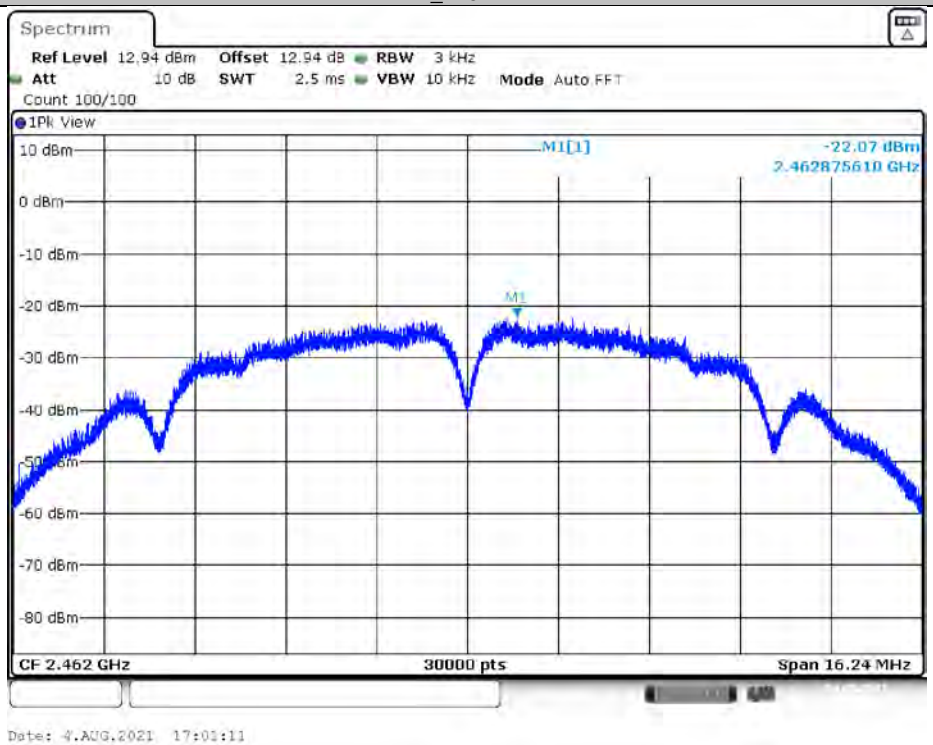
11B_2412MHz



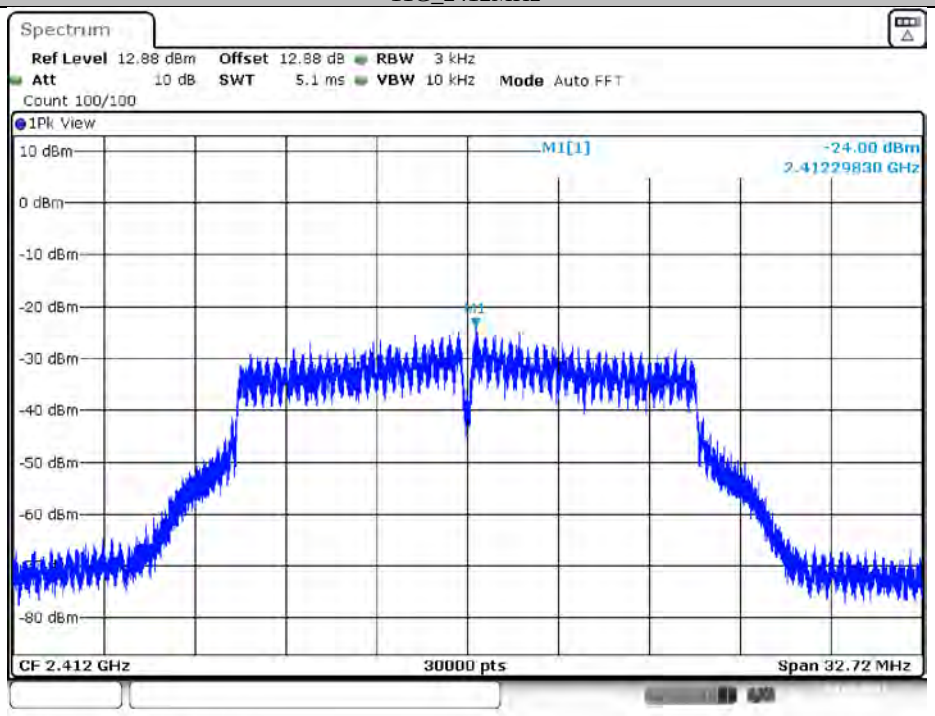
11B_2437MHz



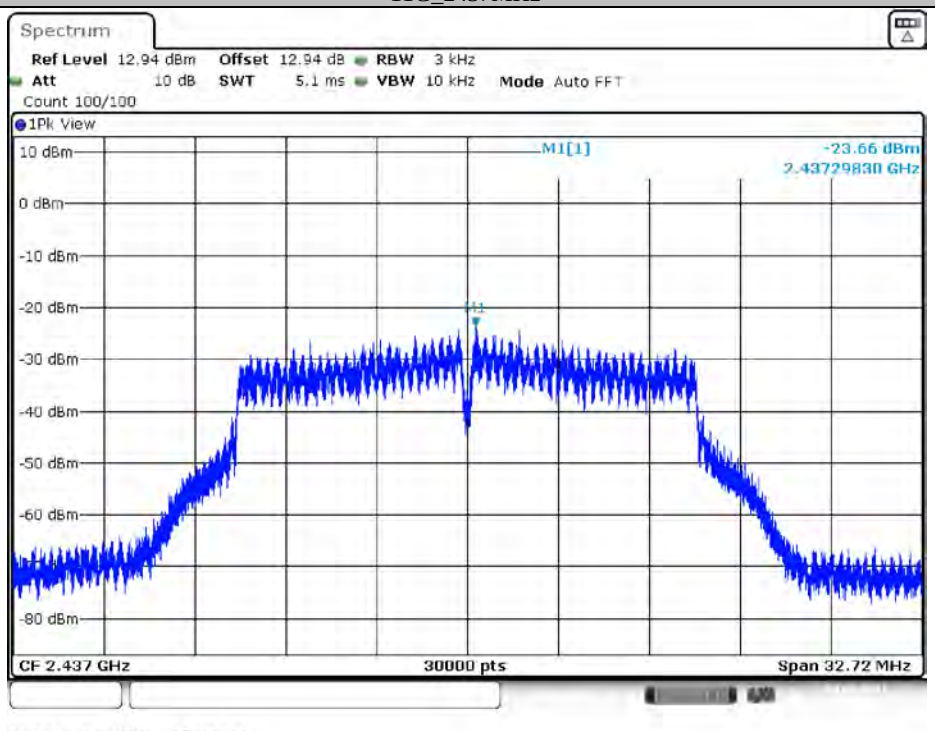
11B_2462MHz



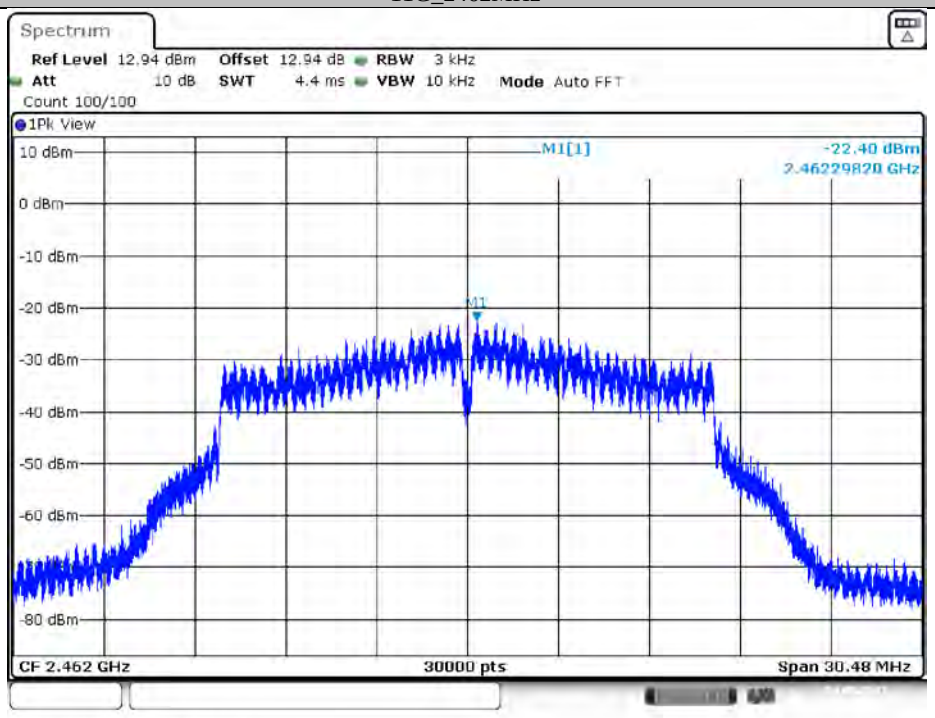
11G_2412MHz



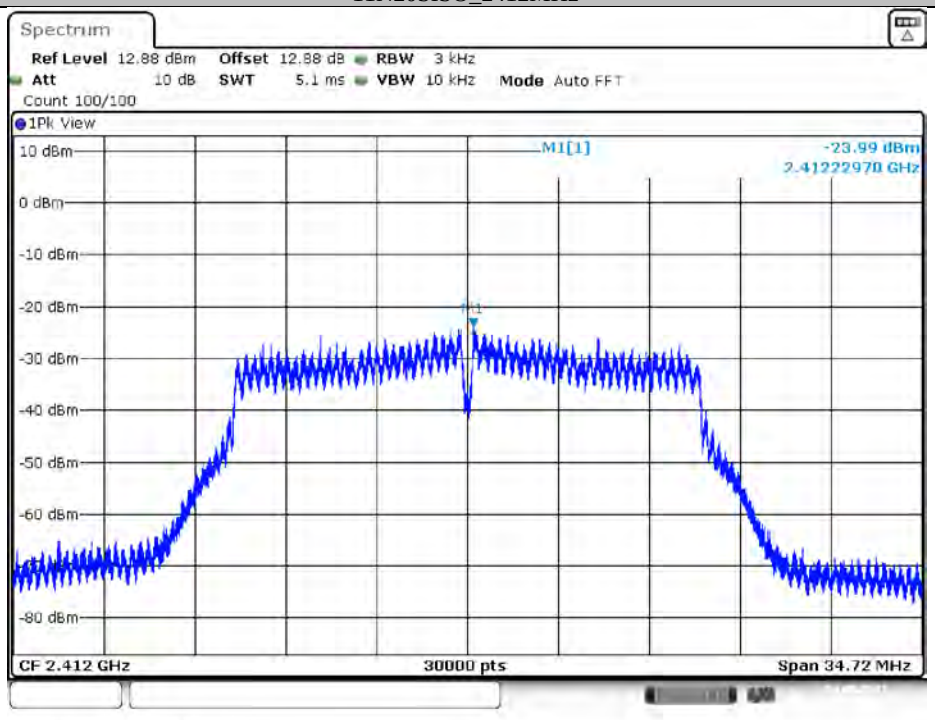
11G_2437MHz



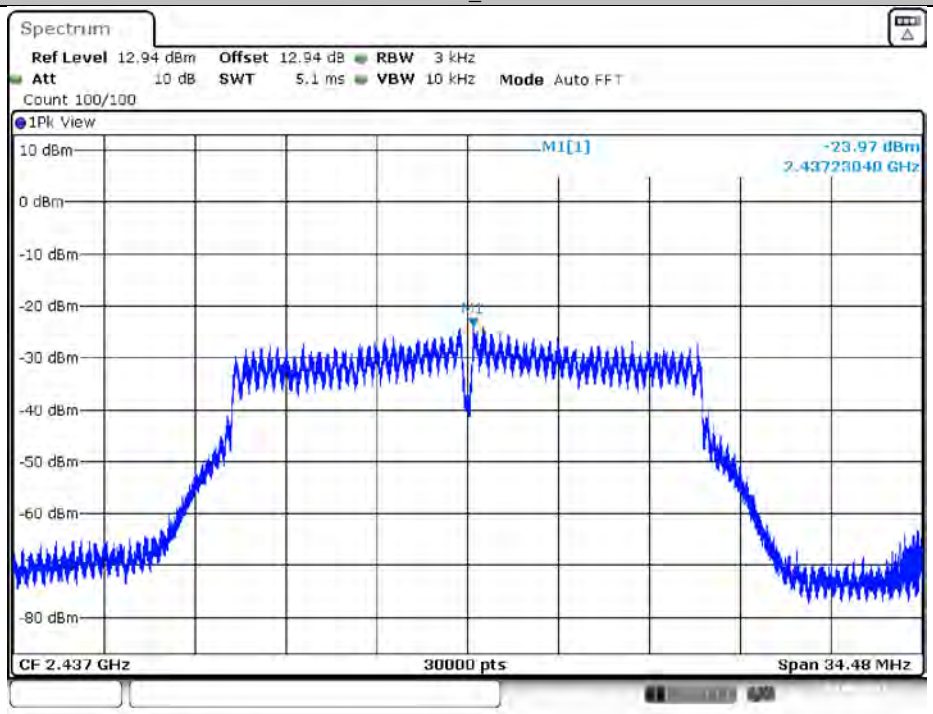
11G_2462MHz



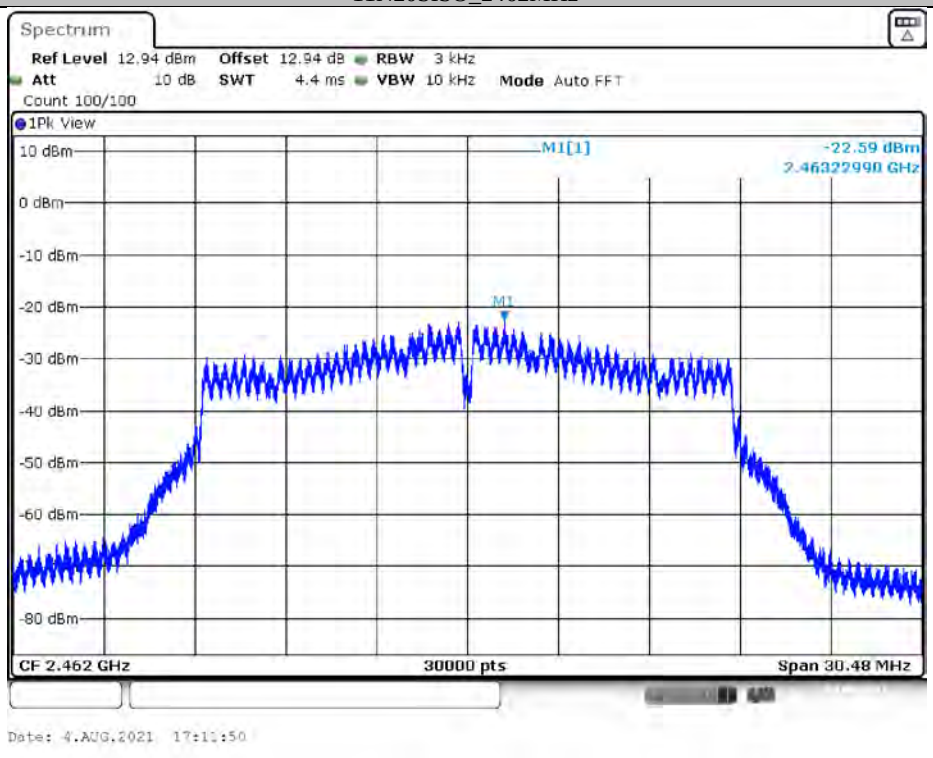
11N20SISO_2412MHz



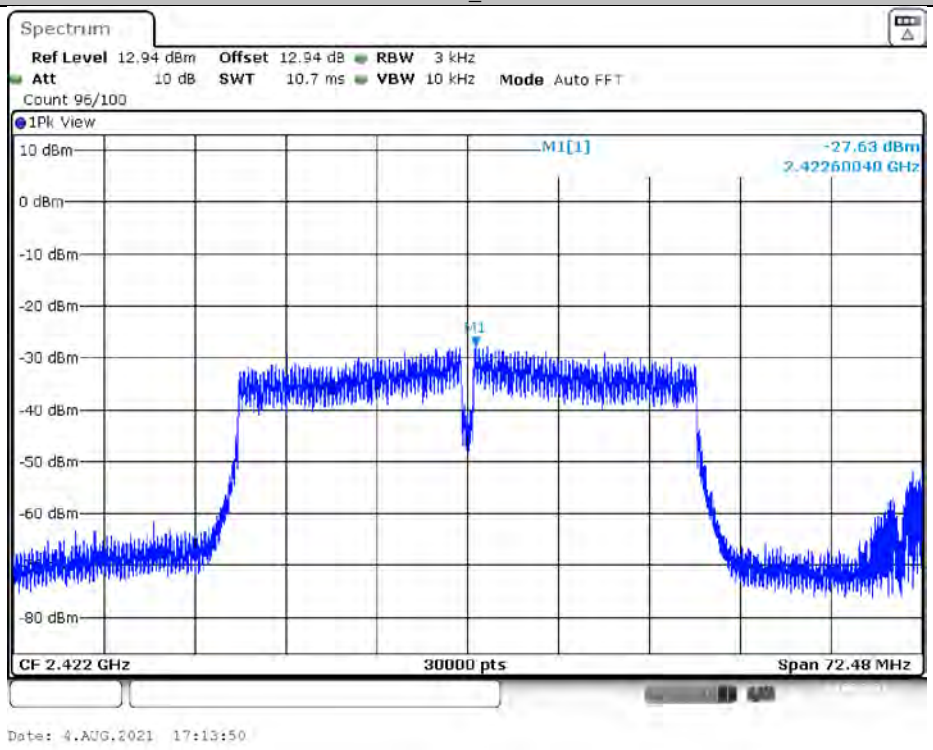
11N20SISO_2437MHz



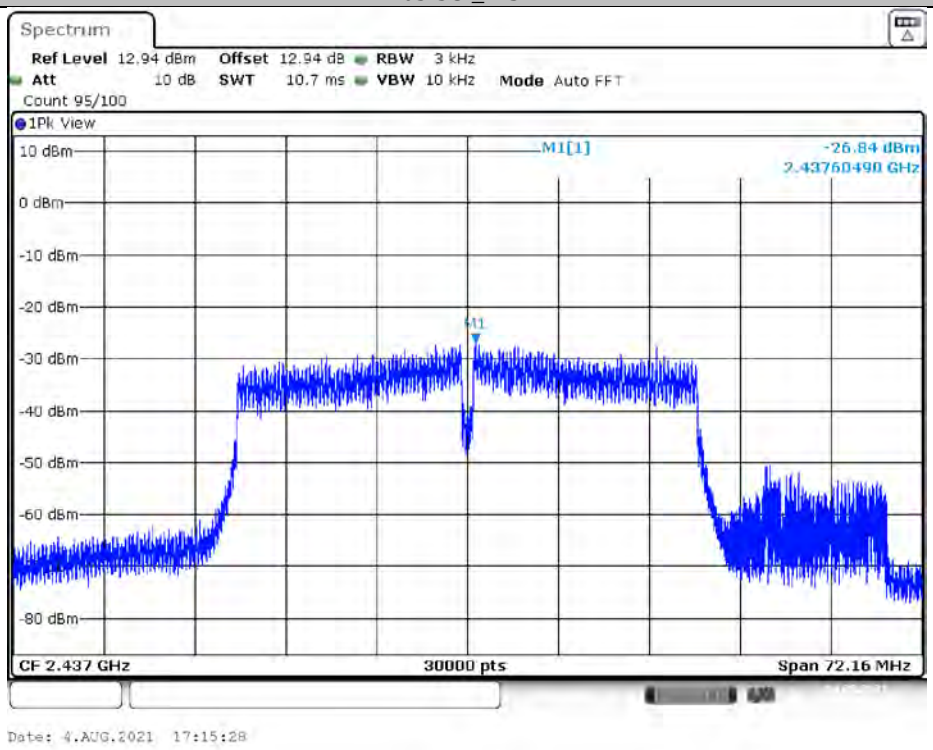
11N20SISO_2462MHz

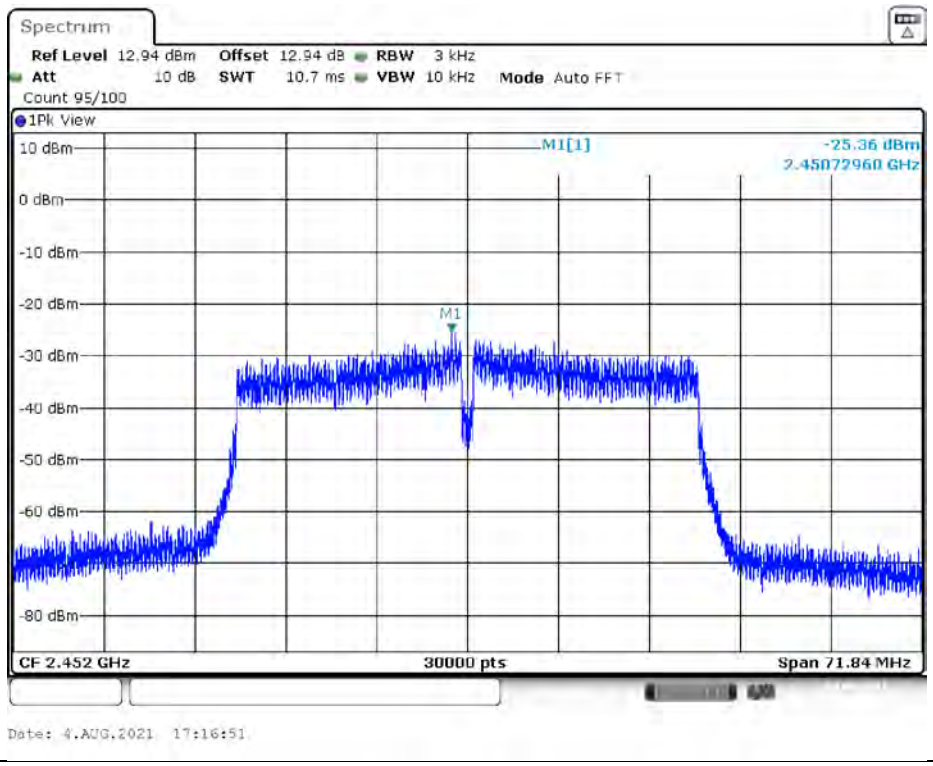


11N40SISO_2422MHz



11N40SISO _2437MHz

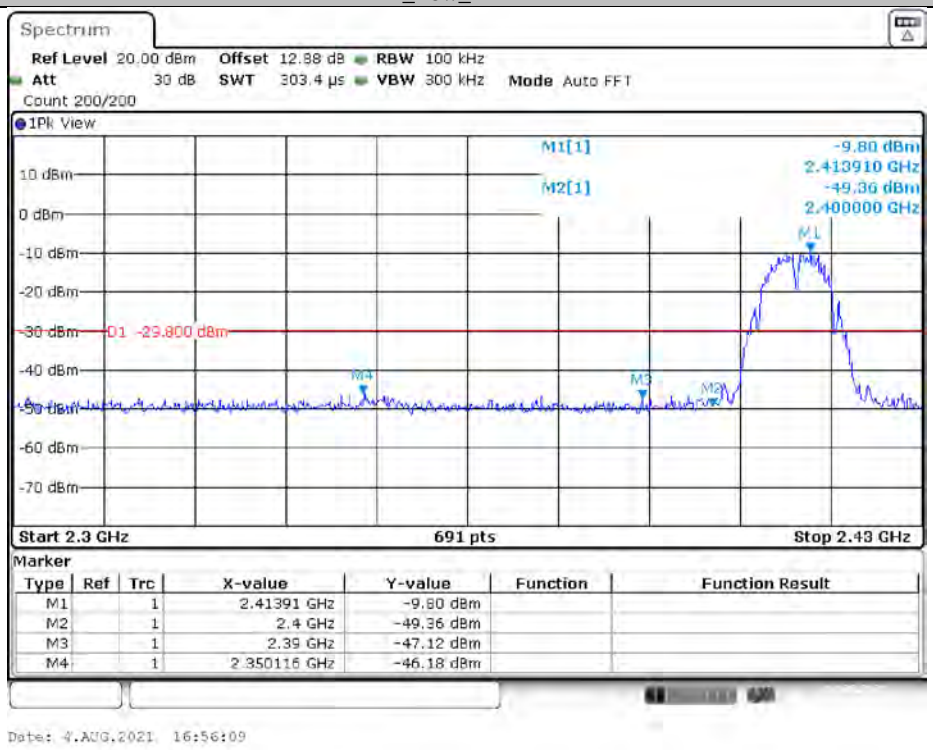


11N40SISO _2452MHz


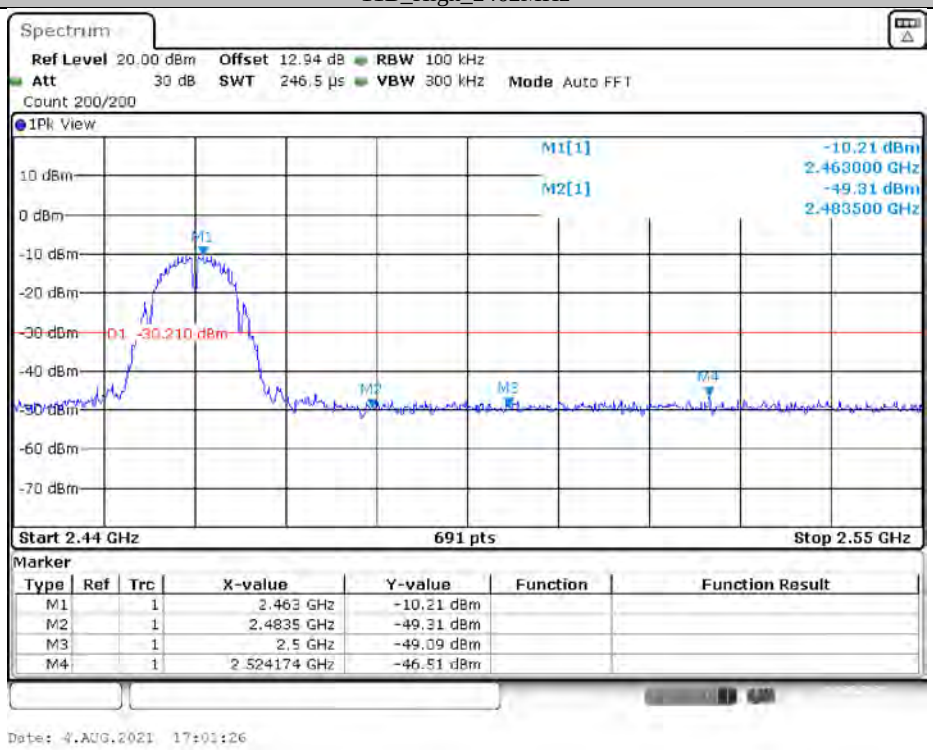
Appendix E: Band edge measurements

Test Graphs

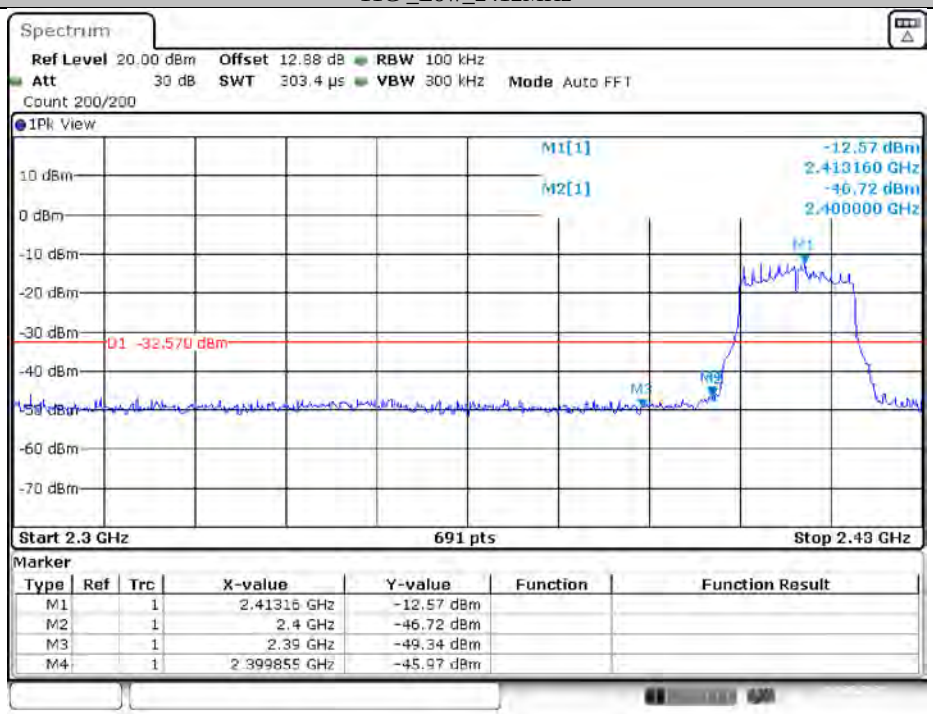
11B_Low_2412MHz



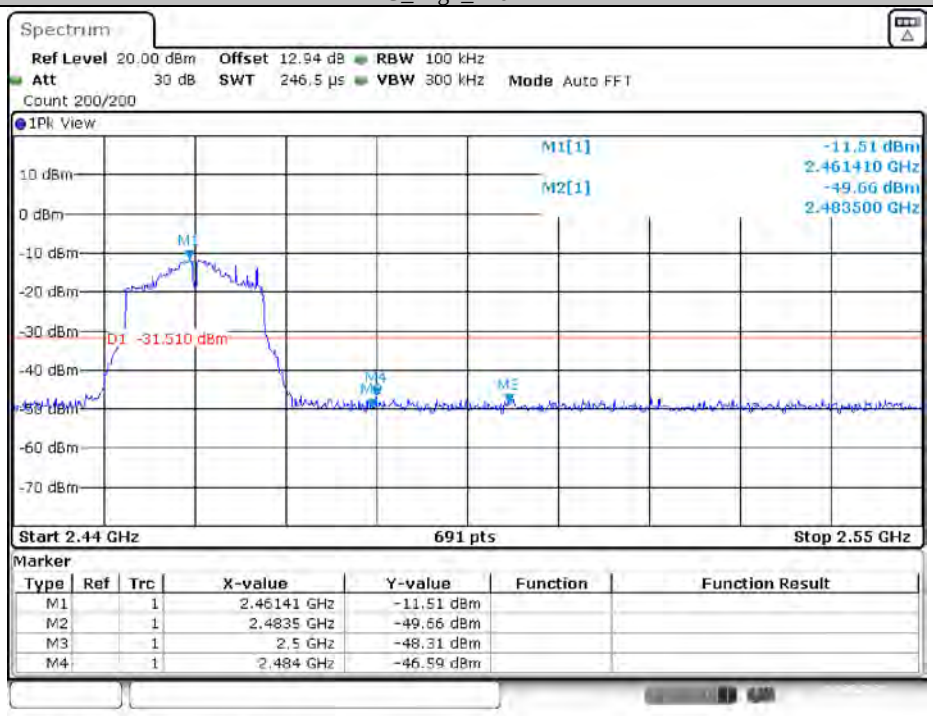
11B_High_2462MHz



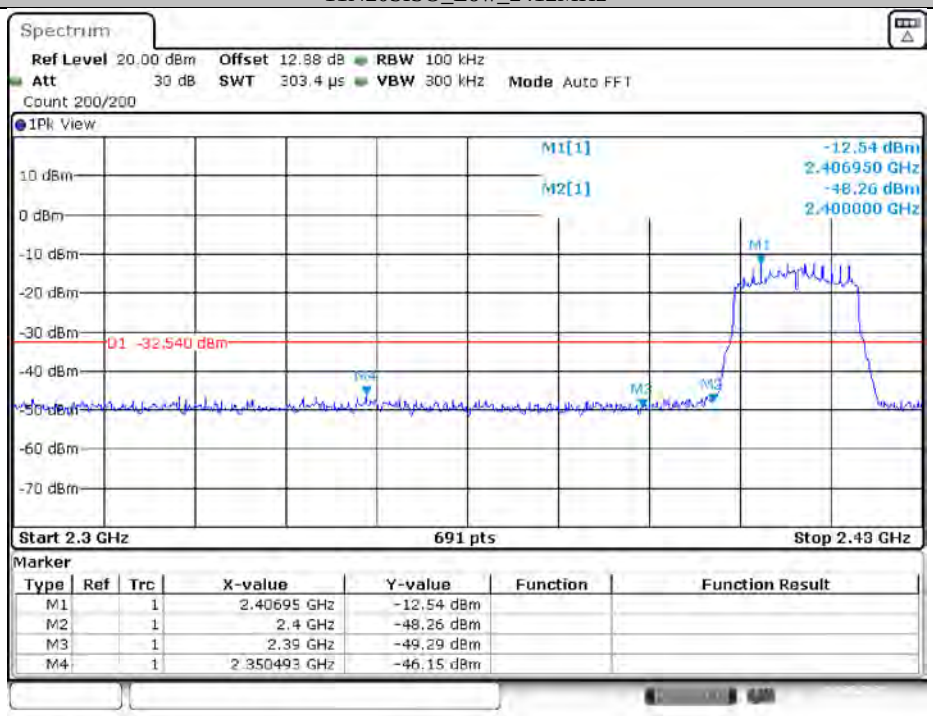
11G _Low_2412MHz



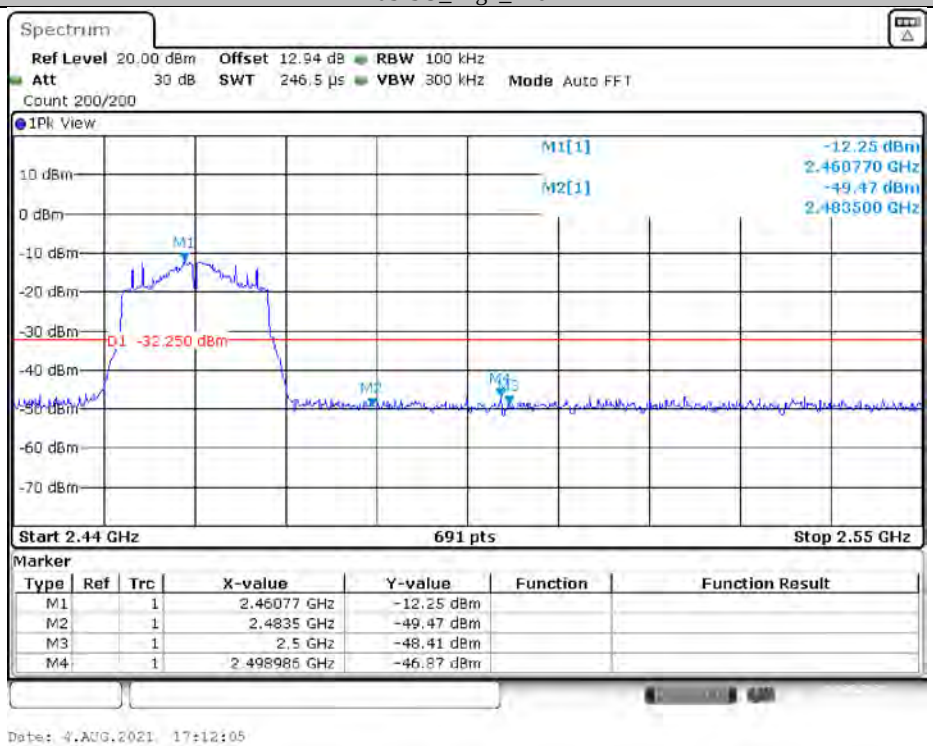
11G_High_2462MHz



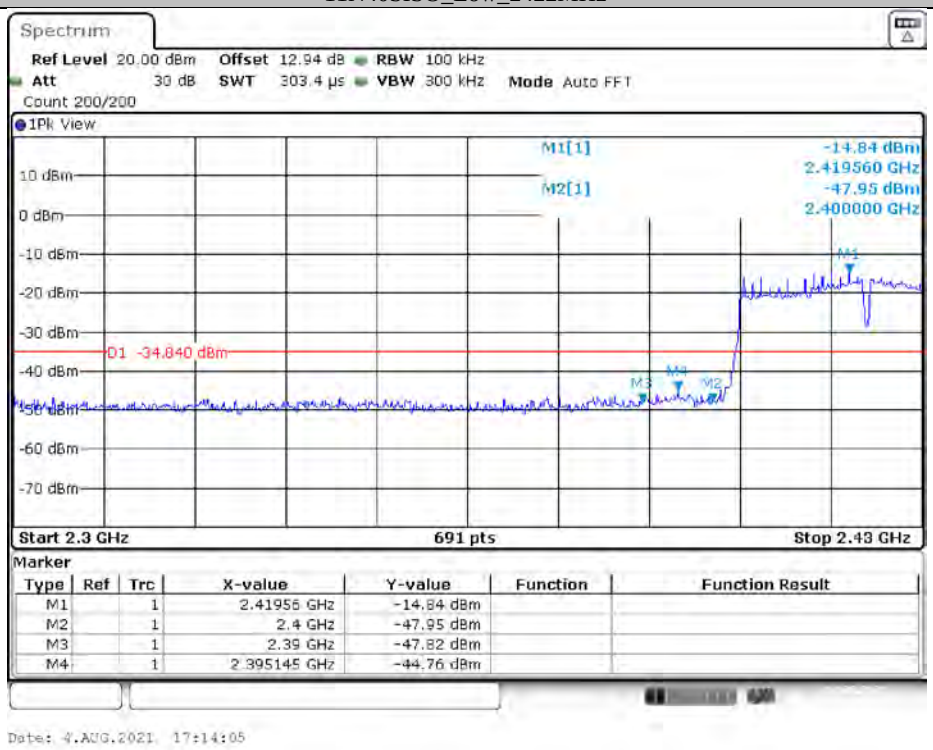
11N20SISO_Low_2412MHz



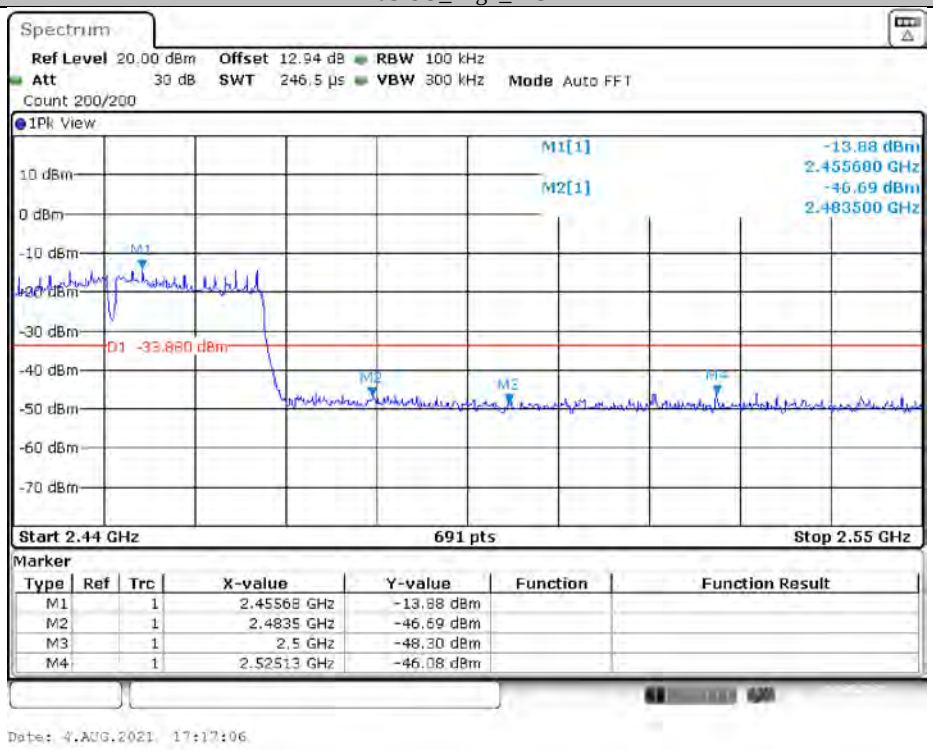
11N20SISO_High_2462MHz



11N40SISO_Low_2422MHz



11N40SISO_High_2452MHz



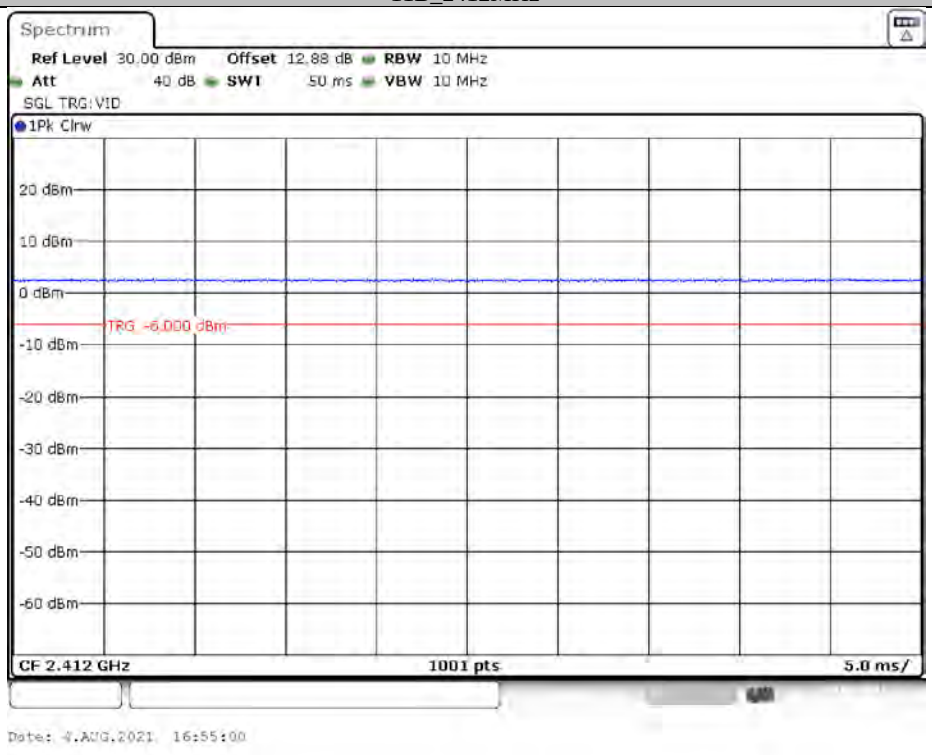
Appendix F: Duty Cycle

Test Result

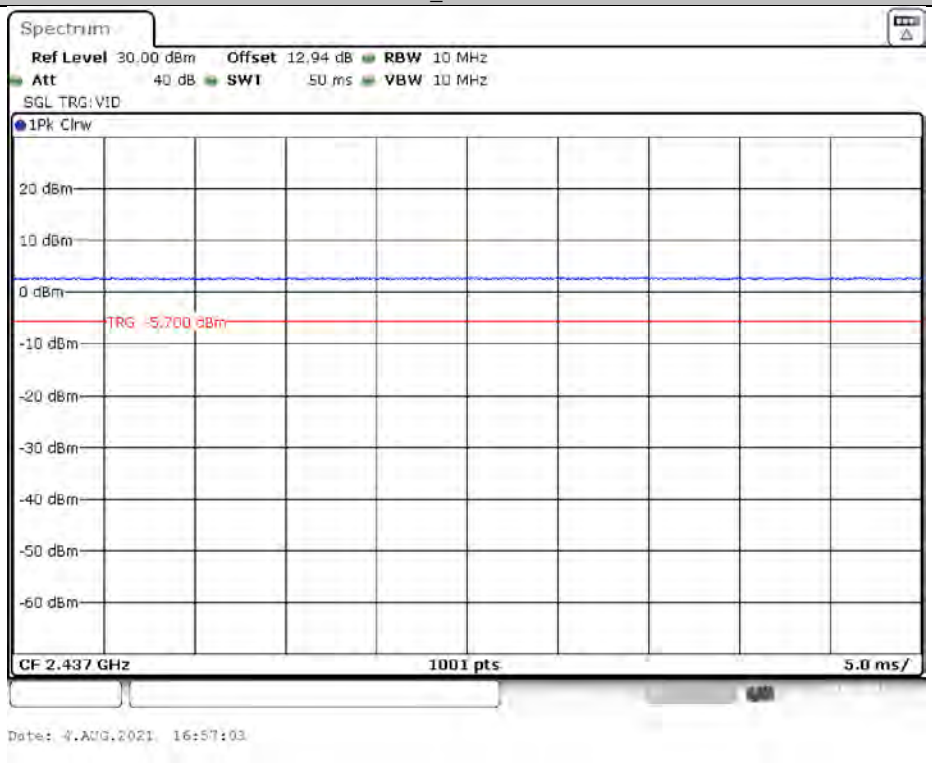
TestMode	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	2412	50.00	50.00	100.00
	2437	50.00	50.00	100.00
	2462	50.00	50.00	100.00
11G	2412	2.04	2.09	97.61
	2437	2.05	2.09	98.09
	2462	2.05	2.09	98.09
11N20SISO	2412	1.90	1.94	97.94
	2437	1.90	1.95	97.44
	2462	1.90	1.94	97.94
11N40SISO	2422	0.92	0.96	95.83
	2437	0.92	0.96	95.83
	2452	0.93	0.97	95.88

Test Graphs

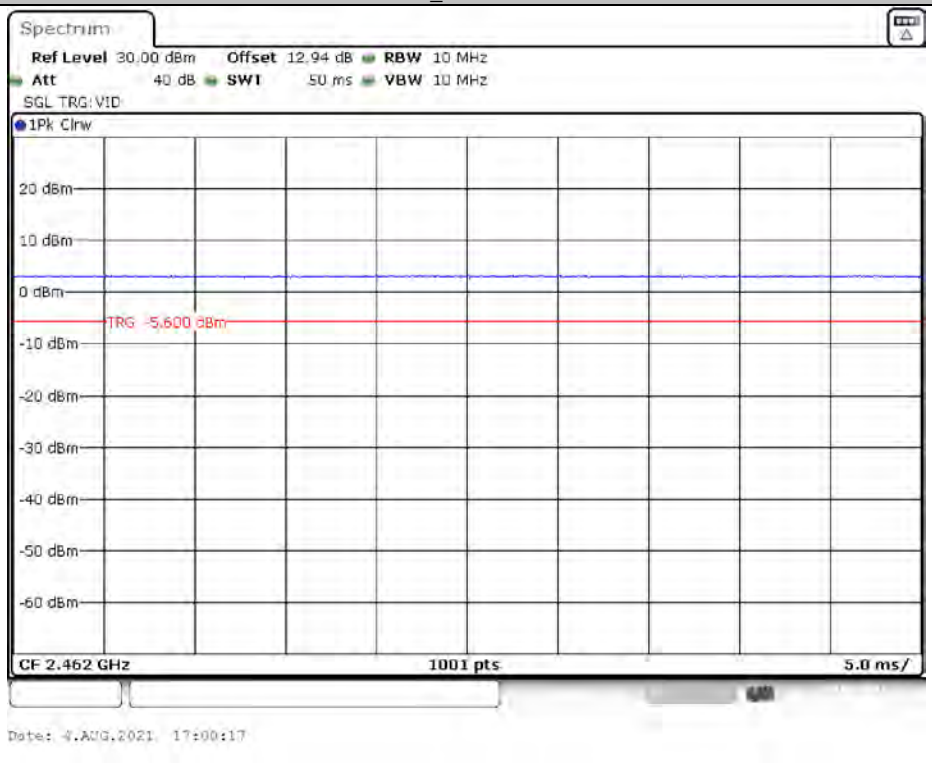
11B_2412MHz



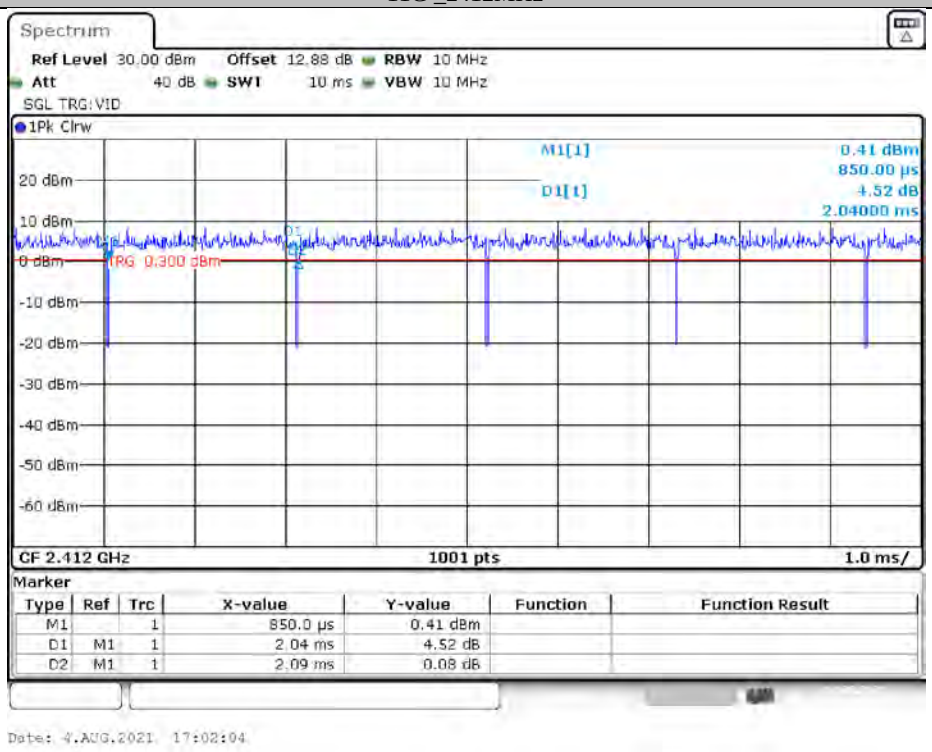
11B_2437MHz



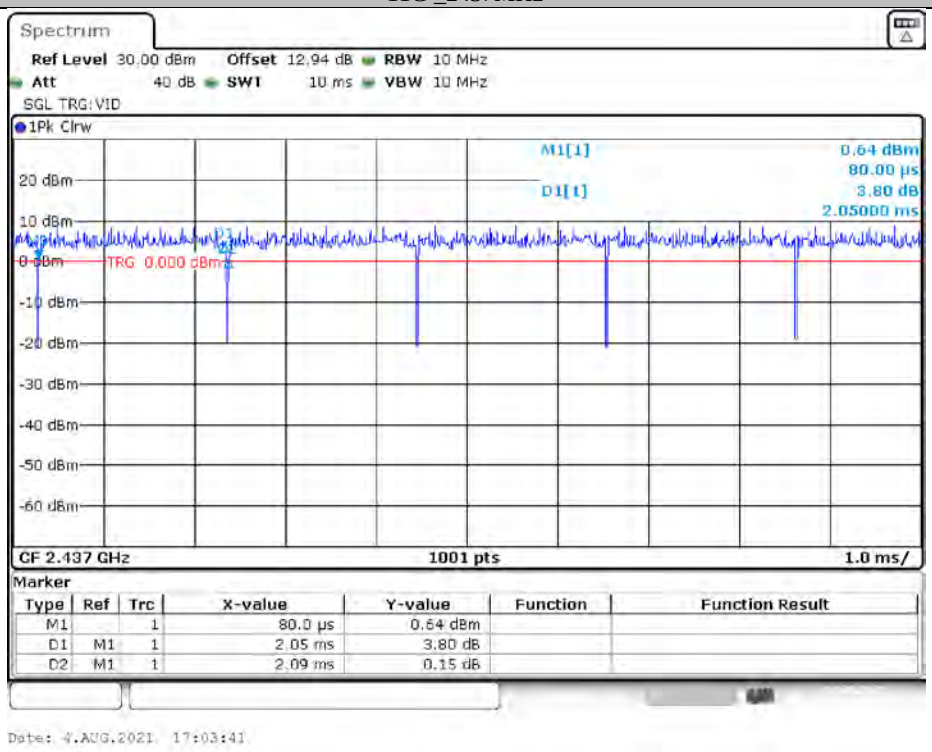
11B_2462MHz



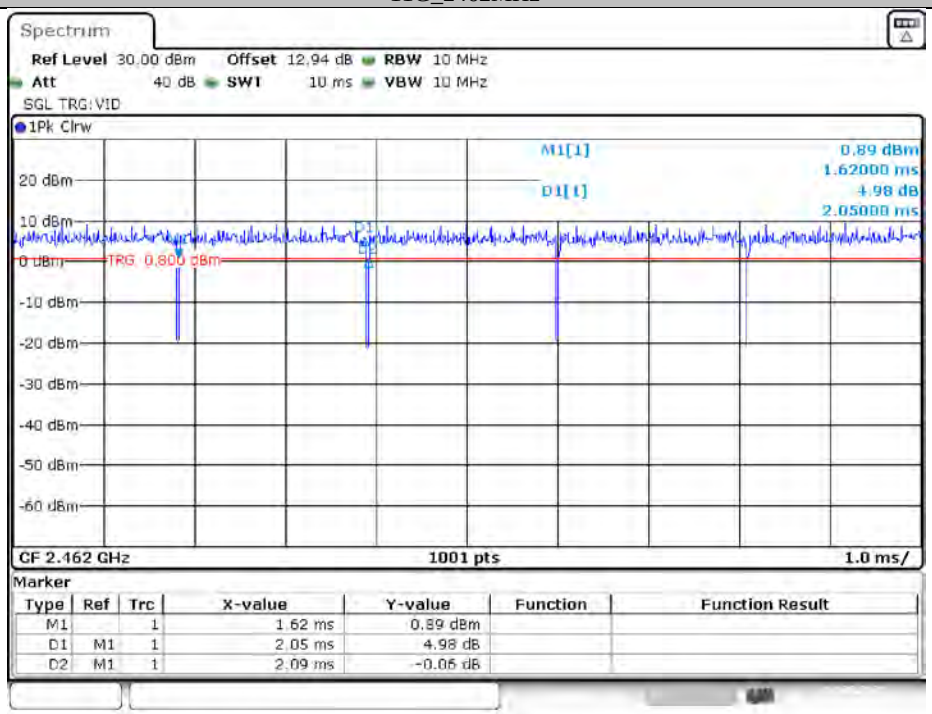
11G _2412MHz



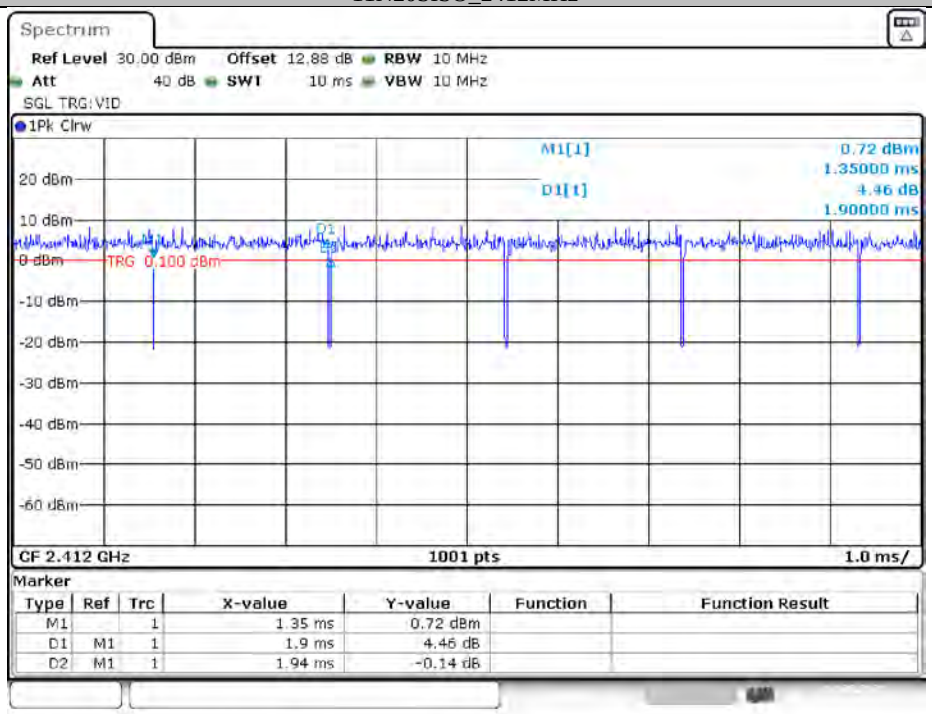
11G _2437MHz



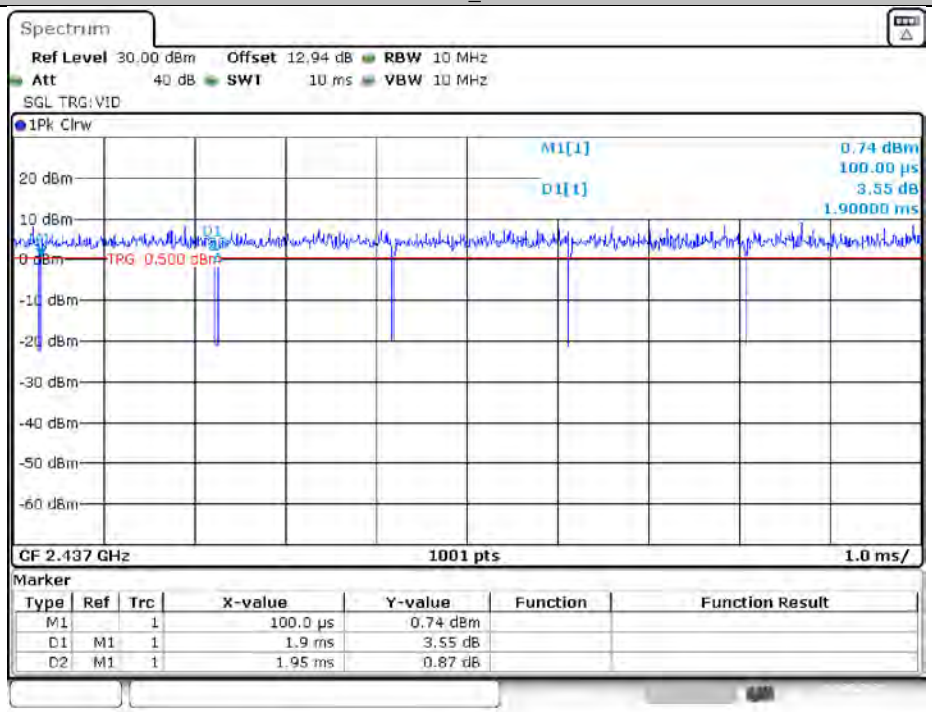
11G_2462MHz



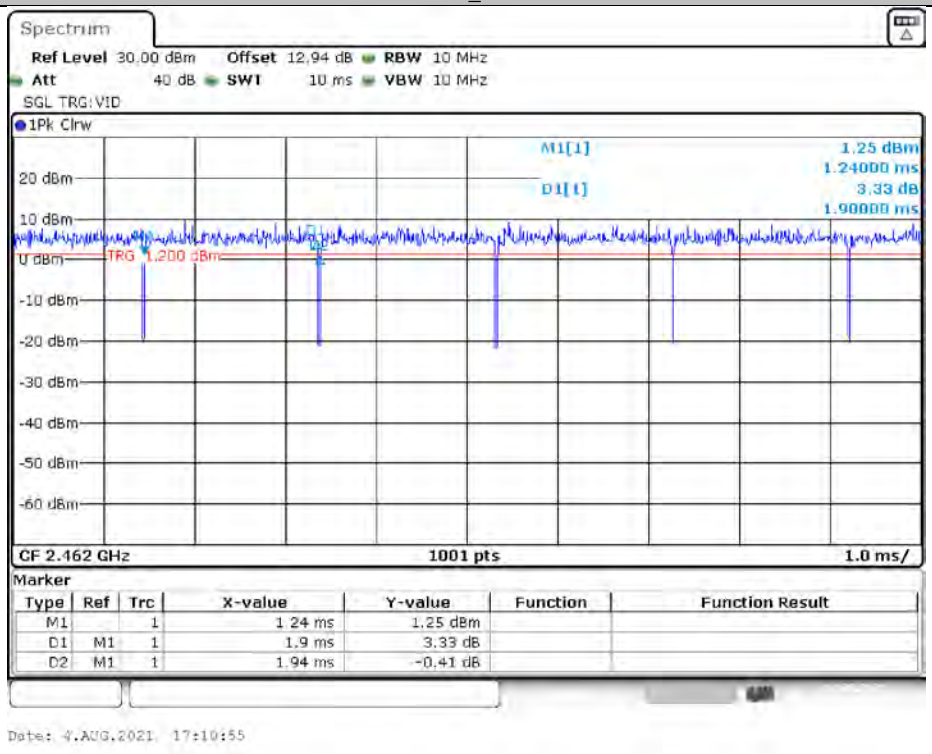
11N20SISO_2412MHz



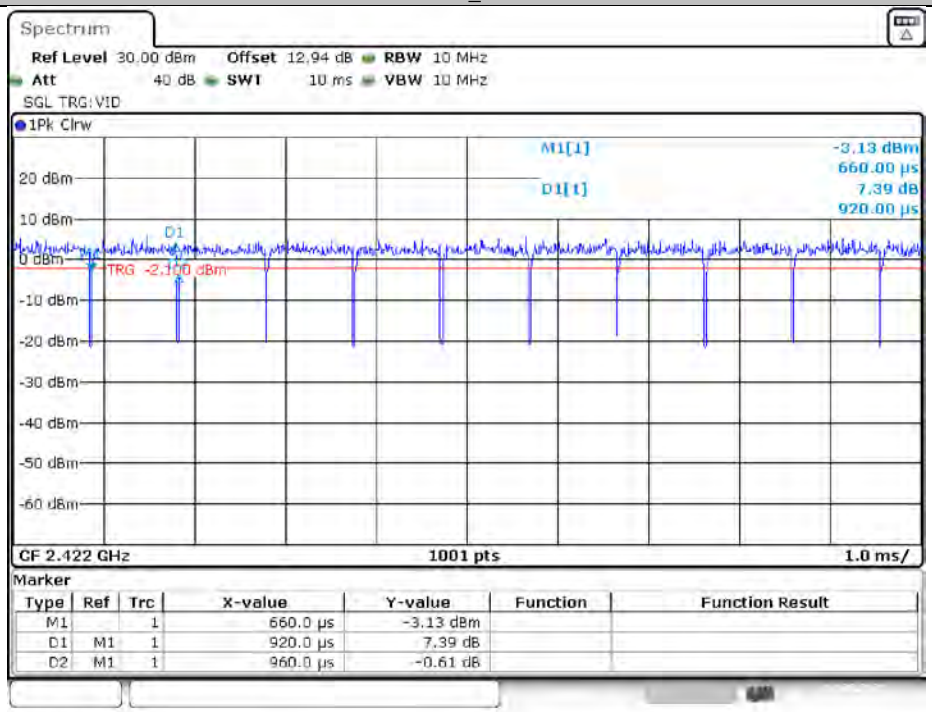
11N20SISO_2437MHz



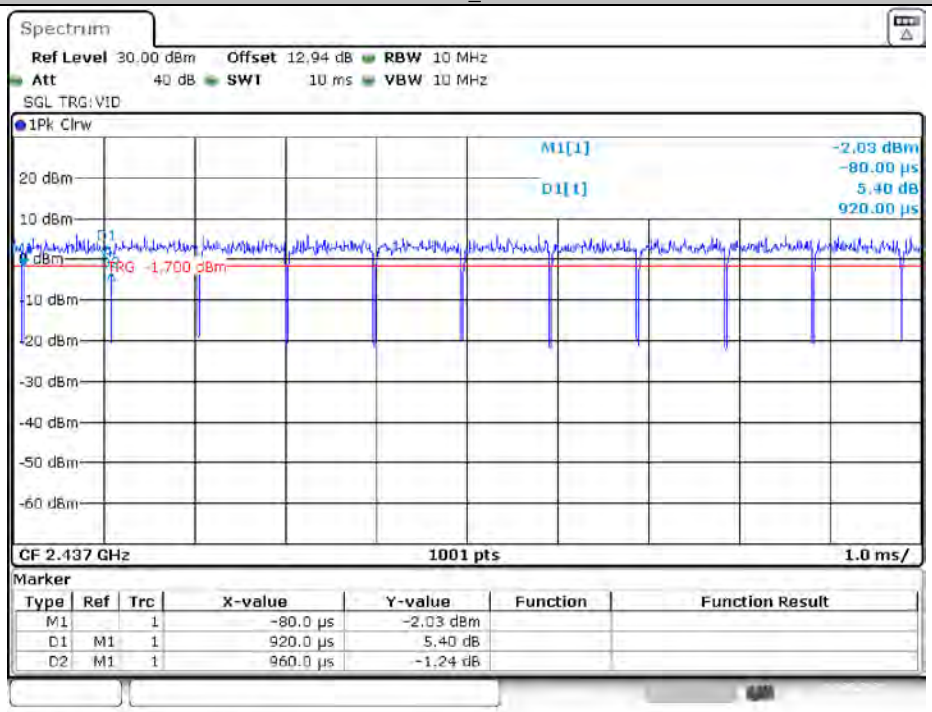
11N20SISO_2462MHz



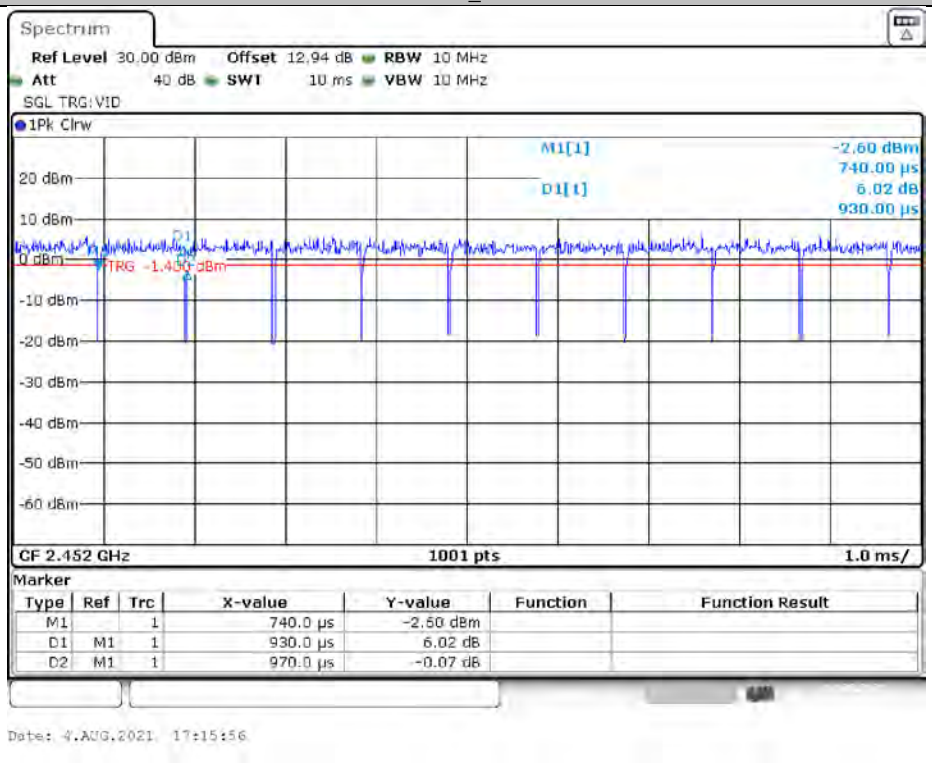
11N40SISO_2422MHz



11N40SISO_2437MHz



11N40SISO_2452MHz



APPENDIX BLE

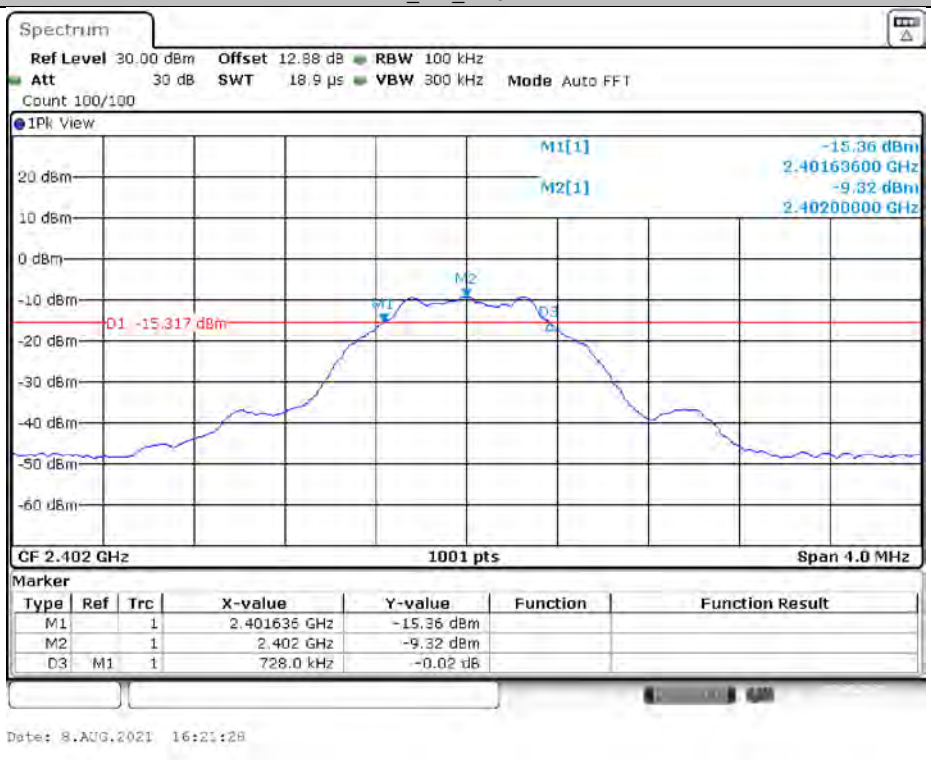
Appendix A: 6dB Emission Bandwidth

Test Result

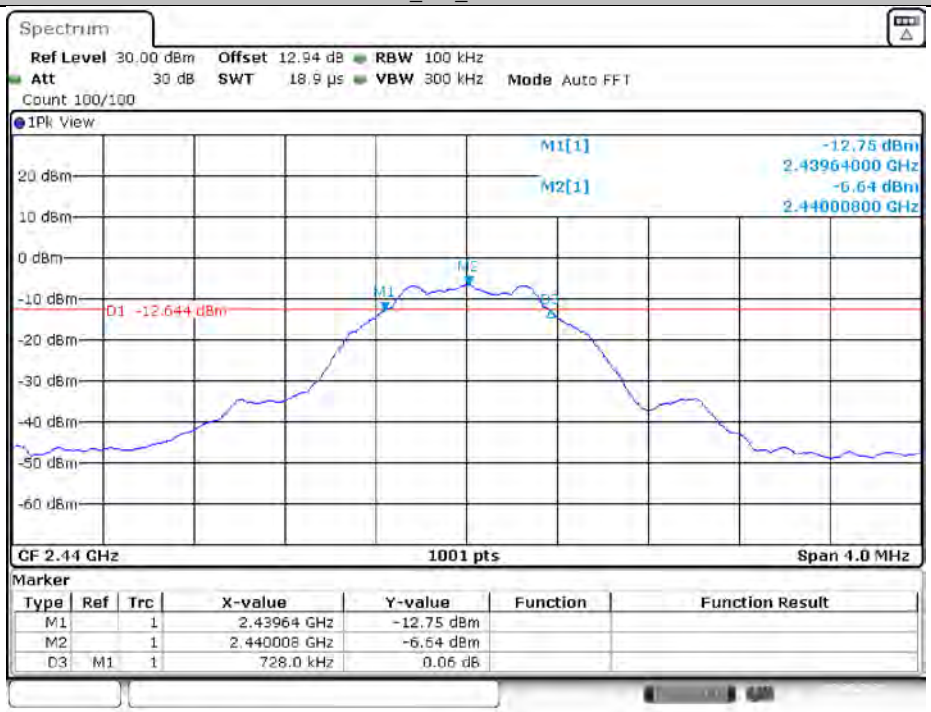
Test Mode	Channel [MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
BLE_1M	2402	0.728	0.5	PASS
	2440	0.728	0.5	PASS
	2480	0.728	0.5	PASS

Test Graphs

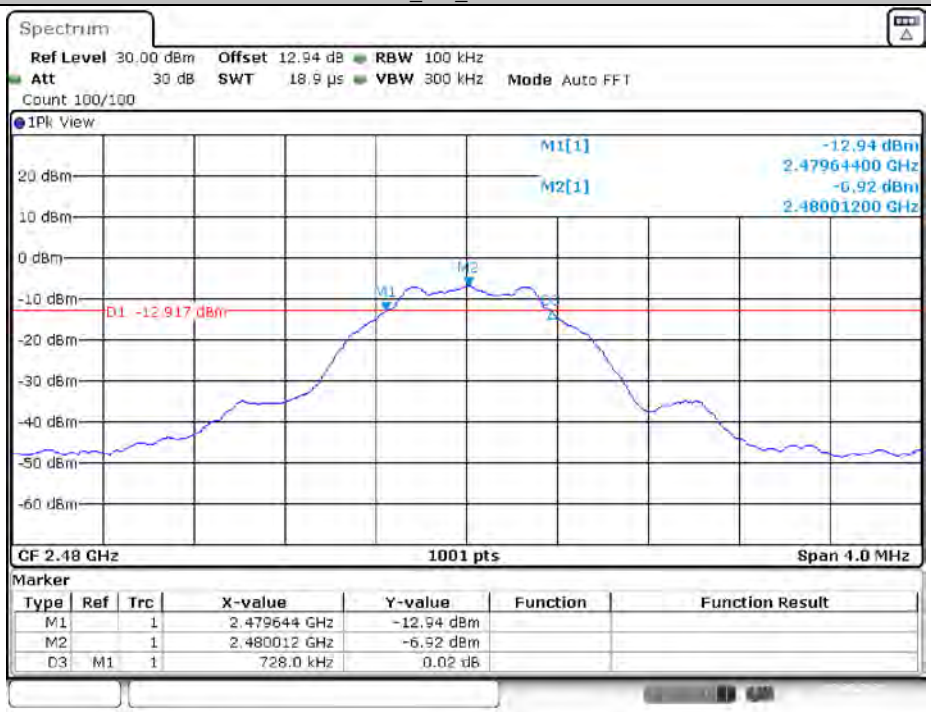
BLE_1M_ 2402MHz



BLE_1M_2440MHz



BLE_1M_2480MHz



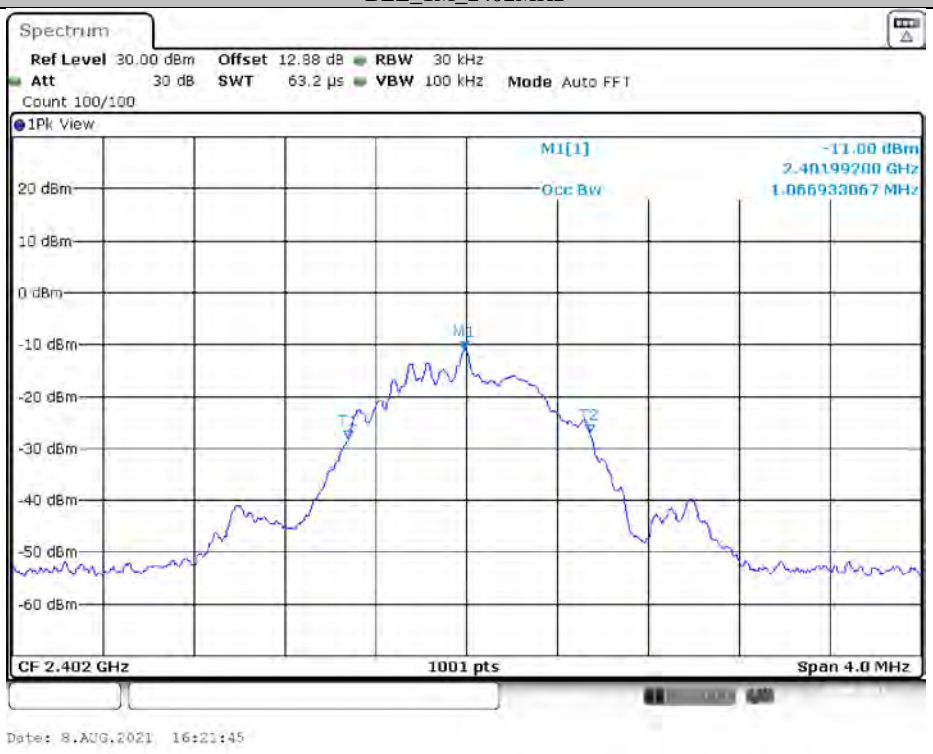
Appendix B: Occupied Channel Bandwidth

Test Result

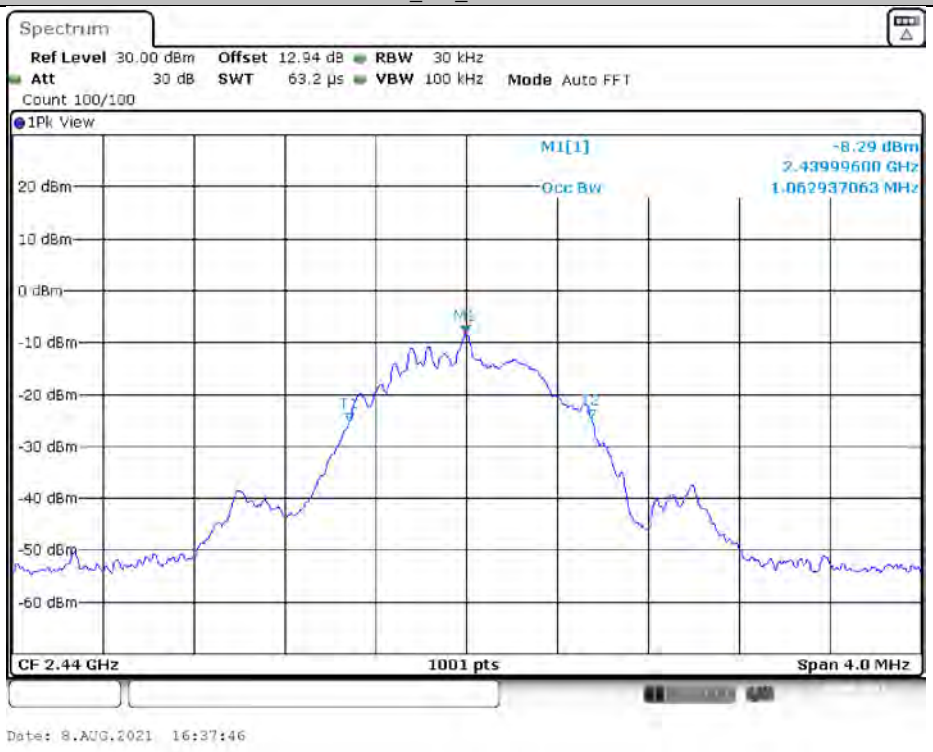
TestMode	Channel [MHz]	OCB [MHz]	Limit[dBm]	Verdict
BLE_1M	2402	1.067	---	PASS
	2440	1.063	---	PASS
	2480	1.063	---	PASS

Test Graphs

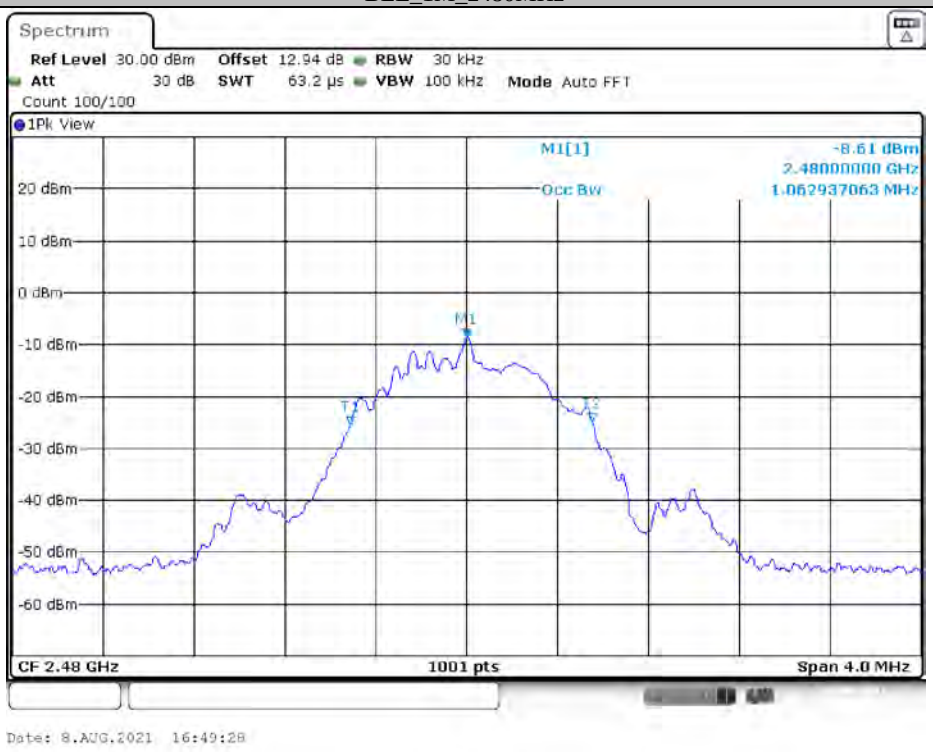
BLE_1M_2402MHz



BLE_1M_2440MHz



BLE_1M_2480MHz



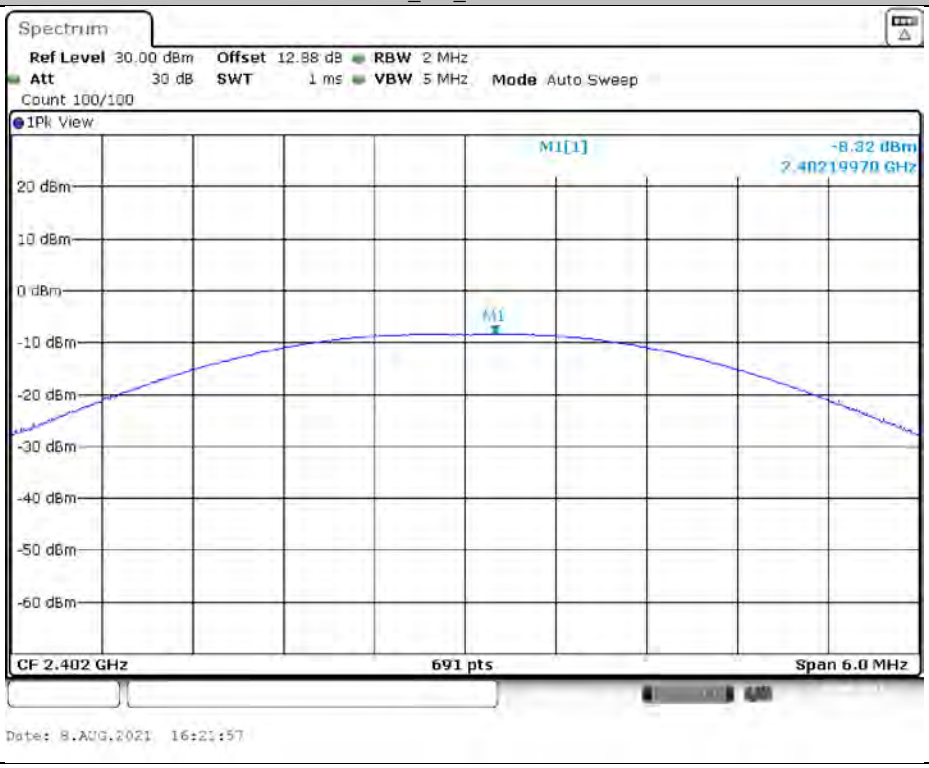
Appendix C: Maximum conducted output power

Test Result

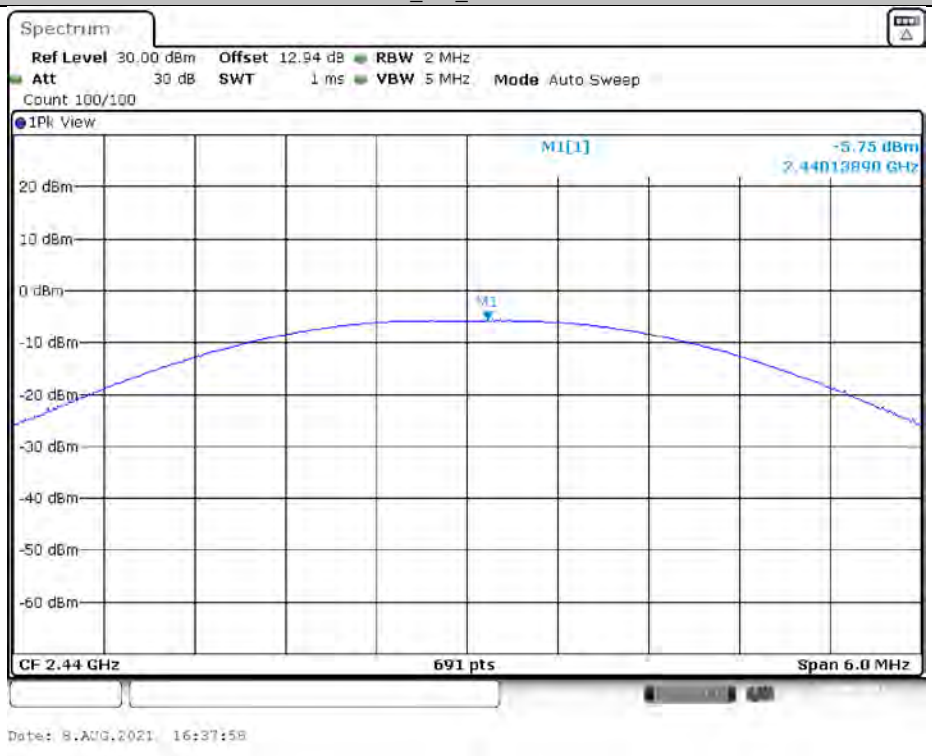
Test Mode	Channel [MHz]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	2402	-8.32	<=30	PASS
	2440	-5.75	<=30	PASS
	2480	-5.99	<=30	PASS

Test Graphs

BLE_1M_2402MHz



BLE_1M_2440MHz



BLE_1M_2480MHz

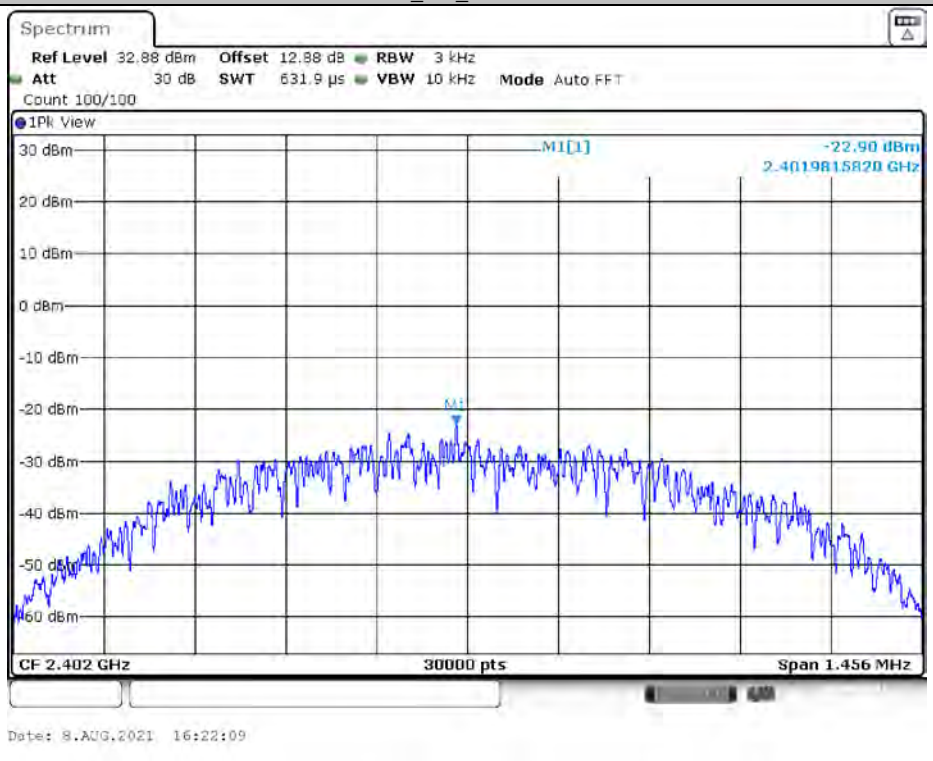
Appendix D: Power spectral density

Test Result

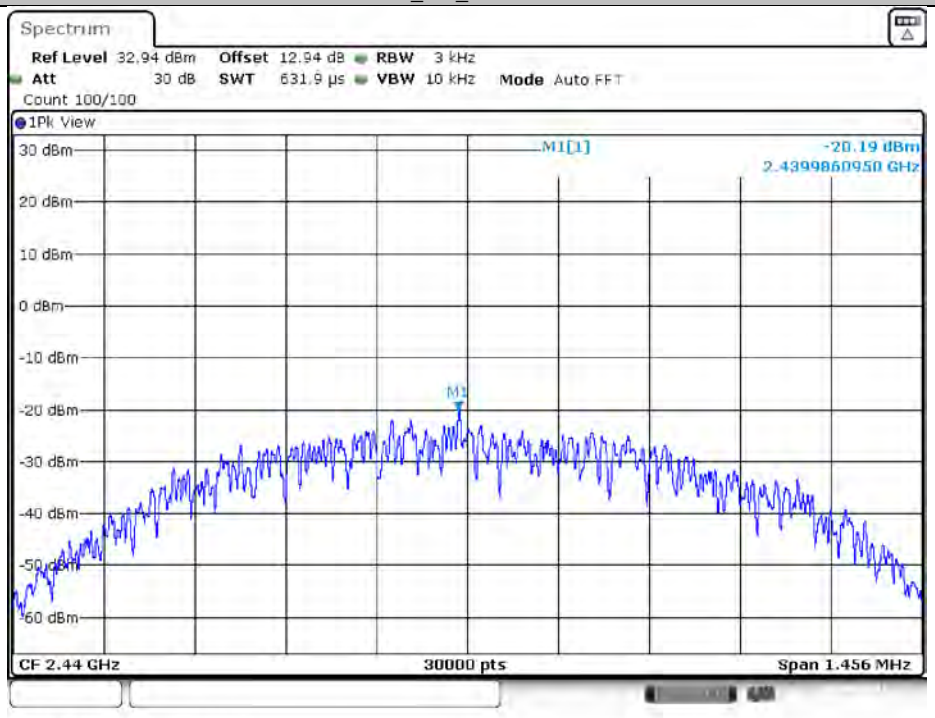
Test Mode	Channel[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	2402	-22.9	<=8	PASS
	2440	-20.19	<=8	PASS
	2480	-20.49	<=8	PASS

Test Graphs

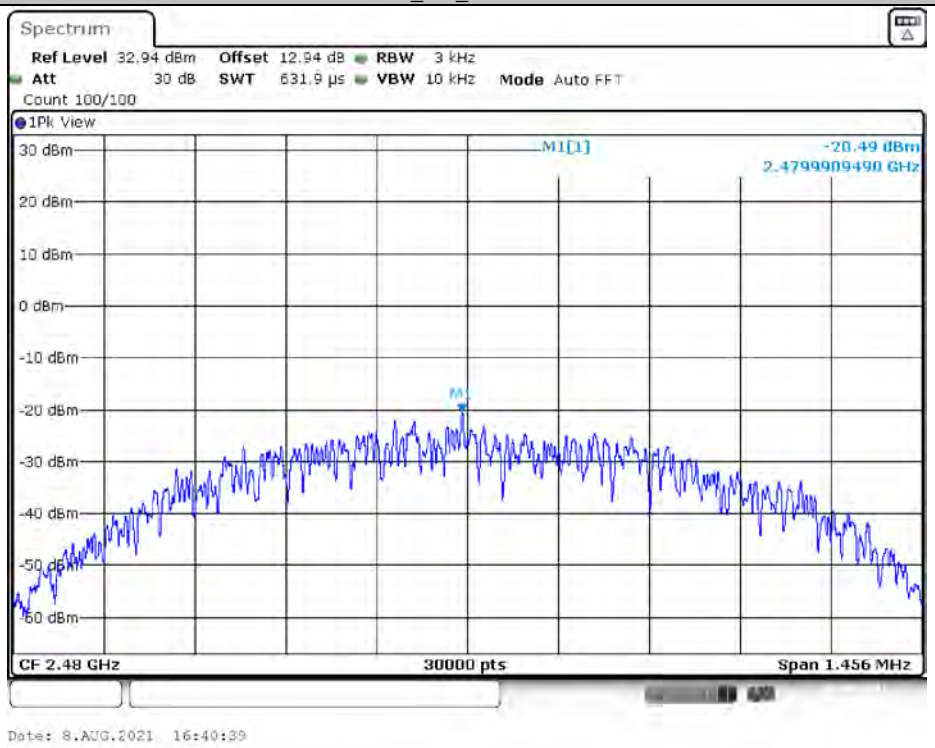
BLE_1M_2402MHz



BLE_1M_2440MHz



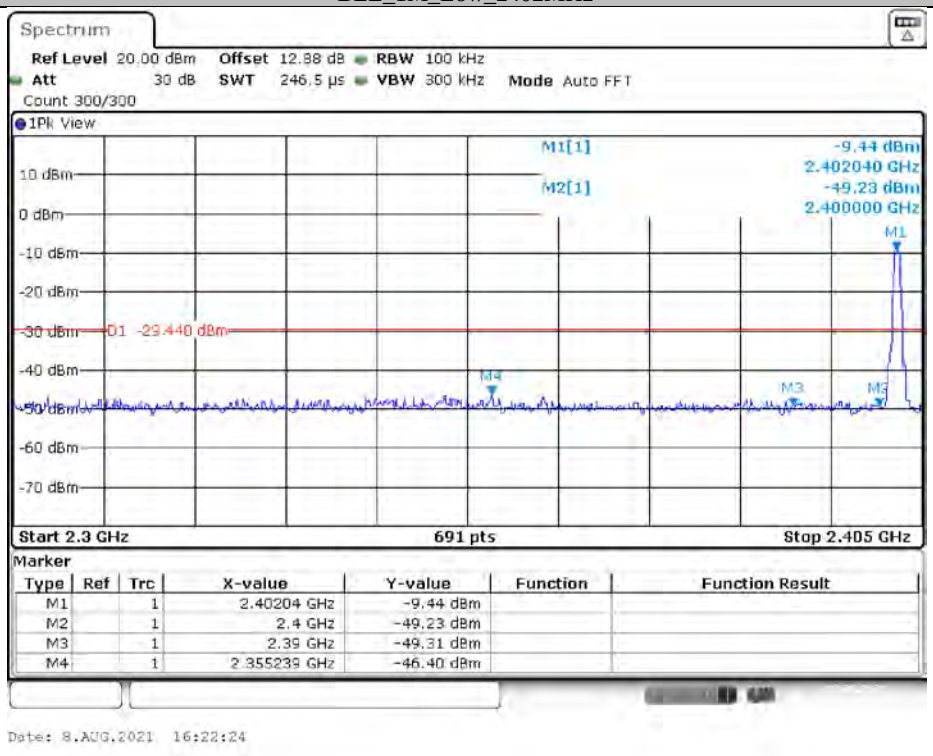
BLE_1M_2480MHz



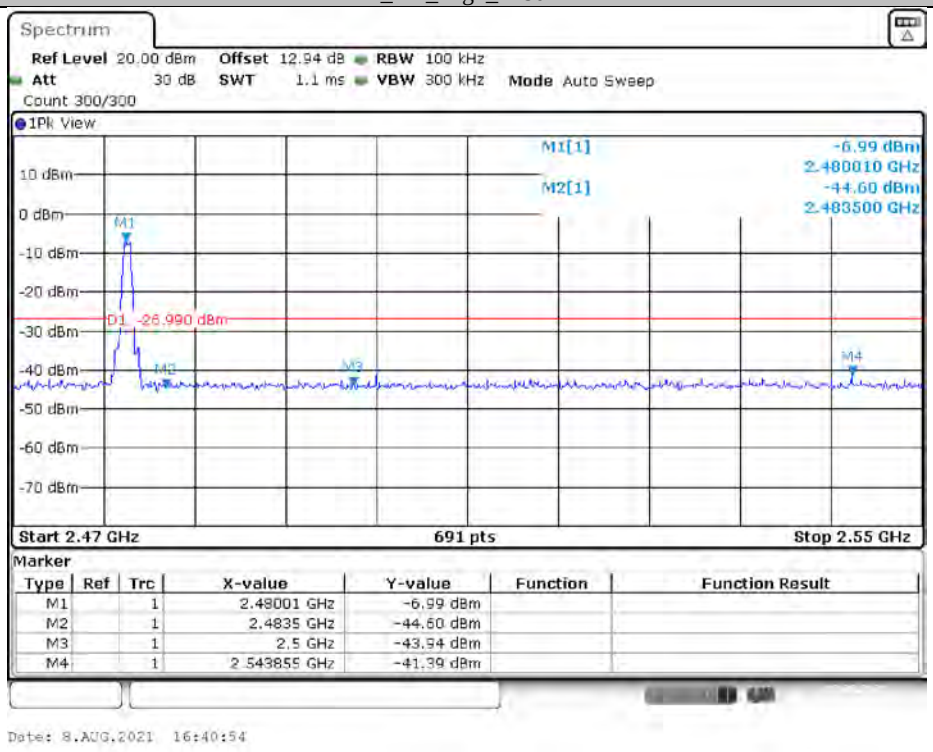
Appendix E: Band edge measurements

Test Graphs

BLE_1M_Low_2402MHz



BLE_1M_High_2480MHz



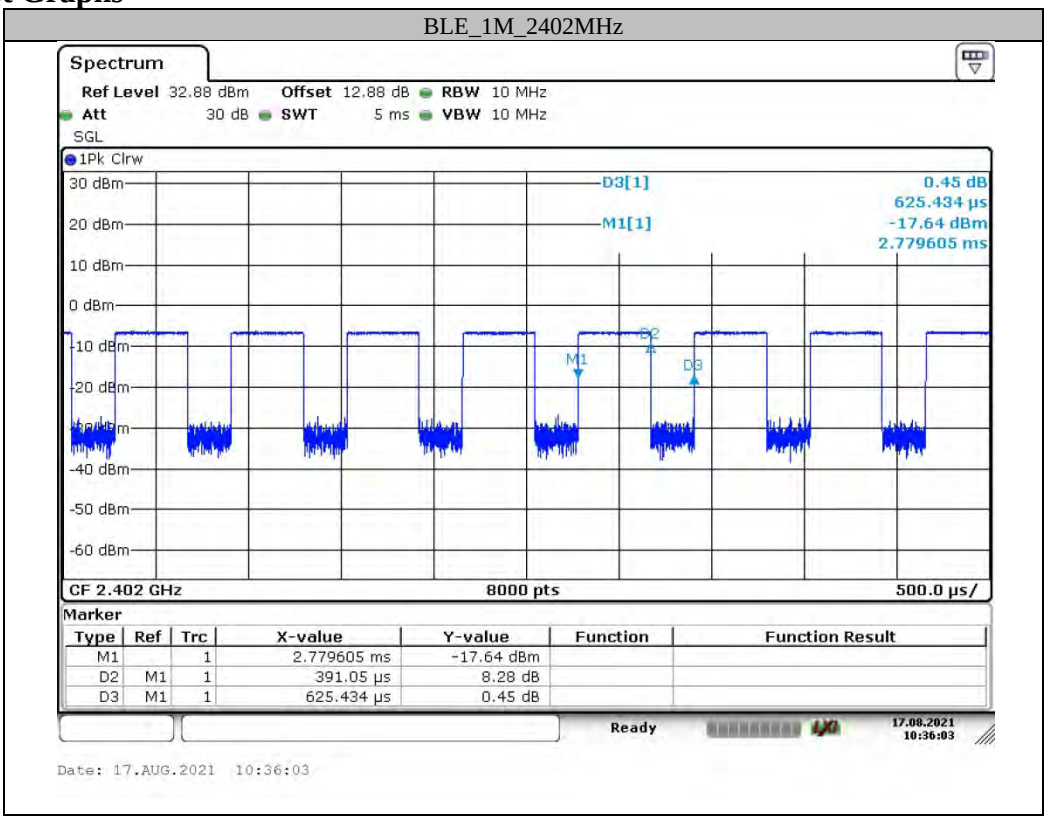
Appendix F: Duty Cycle

Test Result

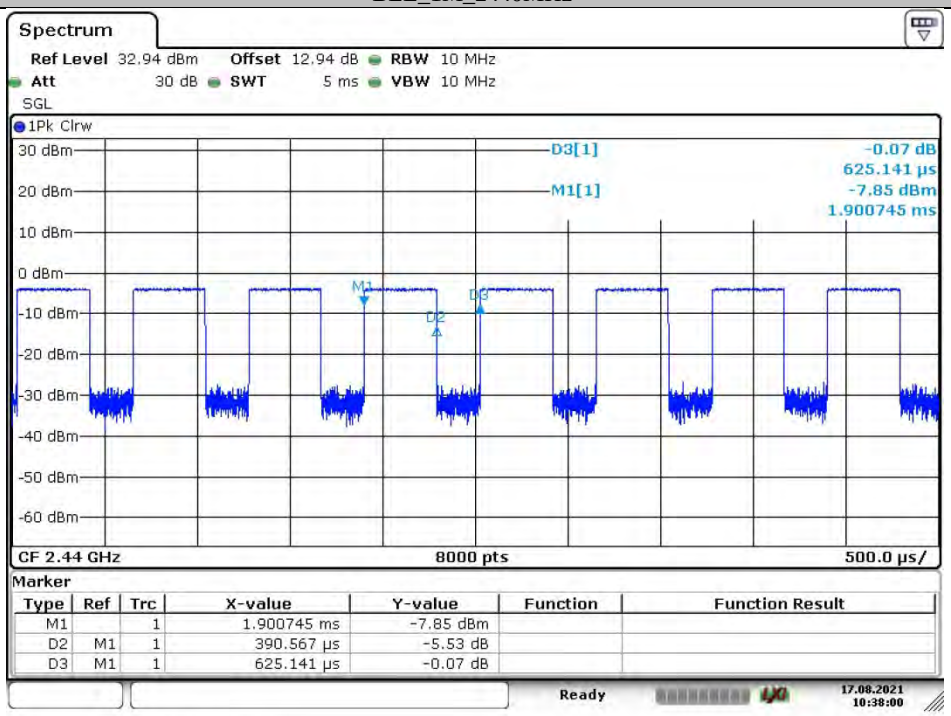
Test Mode	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
BLE_1M	2402	0.391	0.625	62.56
	2440	0.391	0.625	62.56
	2480	0.391	0.625	62.56

Test Graphs

BLE_1M_2402MHz



BLE_1M_2440MHz



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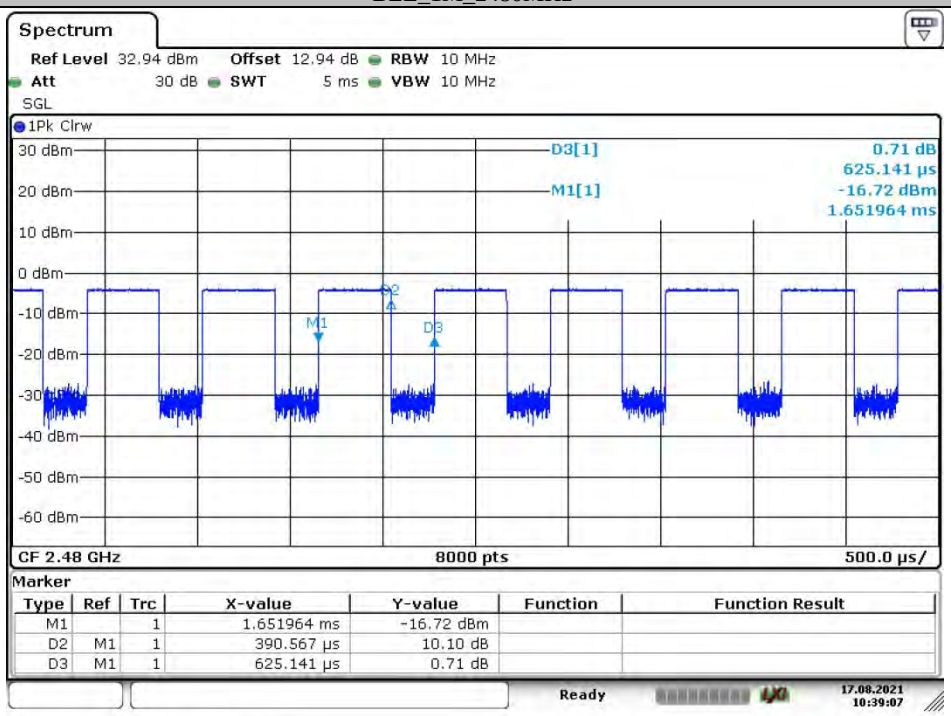
BLE_1M_2480MHz



Date: 17.AUG.2021 10:39:07

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