FCC PART 15.247

TEST REPORT

For

Vanstone Electronic (Beijing) Co., Ltd.

3F No.2 Building, Aisino Corporation Park 18A, Xingshikou Road, Haidian District, Beijing, China 100195

FCC ID: OWLV39

Report Type:	**Product Type:**
Original Report	Mobile POS

Report Number:	SZXX1210513-17047E-RF-00B
Report Date:	2021-07-21
Reviewed By:	Jacob Kong RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 5F(B-West) ,6F,7F,the 3rd Phase of Wan Li Industrial Building D,Shihua Rd, FuTian Free Trade Zone, Shenzhen, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

BACL 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	Mobile POS
Tested Model	V39
Frequency Range	Bluetooth LE: 2402~2480MHz Wi-Fi: 2412~2462MHz
Conducted Peak Power	Bluetooth LE: -5.30 dBm Wi-Fi: 802.11b:12.00 dBm,802.11G:19.48 dBm,802.11N20: 20.26dBm
Modulation Technique	Bluetooth LE: GFSK Wi-Fi: DSSS, OFDM
Antenna Specification*	Bluetooth/Wi-Fi: 1.0dBi (provided by the applicant)
Voltage Range	DC3.8V from battery or DC 5V From Adapter
Date of Test	2021-06-05 to 2021-07-13
Sample serial number	SZXX1210513-17047E-RF-S_5RA (Assigned by BACL, Shenzhen)
Received date	2021-05-13
Sample/EUT Status	Good condition
Adapter information	Model: SW-0018C Input: 100-240V 50/60Hz Output: 5.0V 1.0A

Objective

This 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 Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.
Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
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 Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, 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.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g and 802.11n-HT20 mode, 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 mode, EUT was tested with Channel 1, 6 and 11

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

BLE:
"8200_Test_Tool_V2.0.exe"* software was used to the EUT tested.
Wi-Fi:
"ESP_RF_test_tool_v2.5.exe"* software was used to the EUT tested.

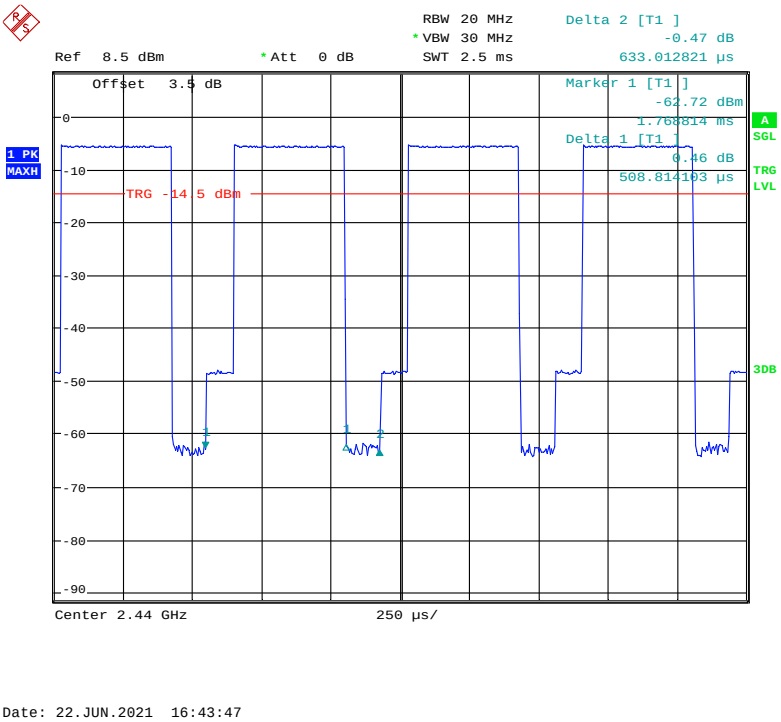
The power level was provided by the applicant.
The device was tested with the worst case was performed as below:

Mode	Data rate	Power level*		
		Low channel	Middle channel	High channel
802.11b	1Mbps	40	34	32
802.11g	6Mbps	0	0	0
802.11n-HT20	MCS0	5	5	5
BLE	/	-3		

Duty cycle

Wi-Fi: Please refer to the Appendix.

BLE Mode 1M



Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
BLE 1M	0.509	0.633	80.41

Support Equipment List and Details

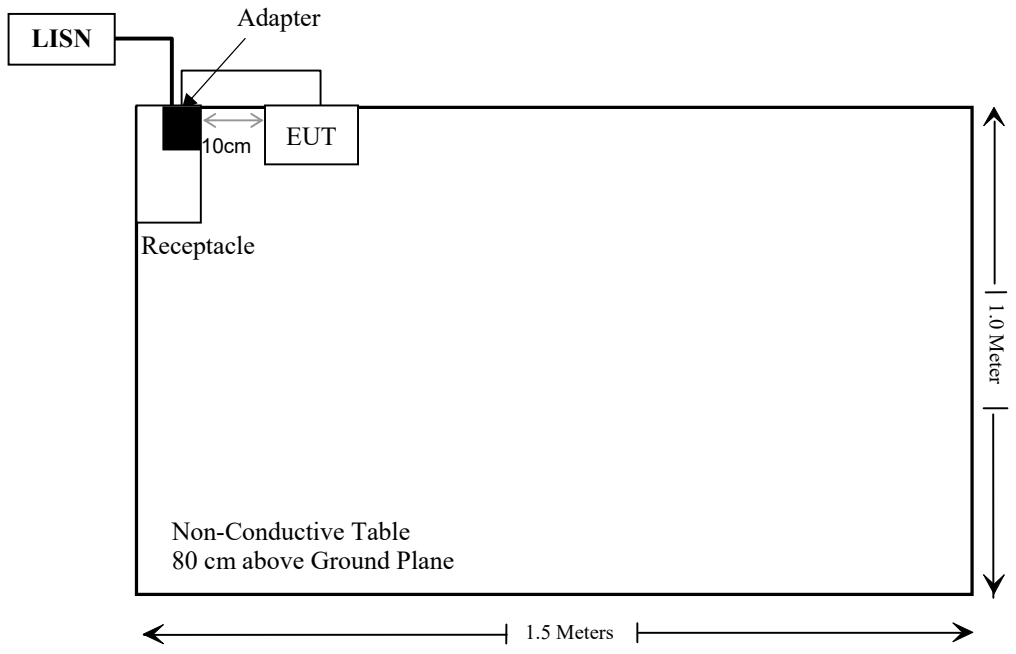
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-Shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	AC Line Conducted Emissions	Compliant
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliant
§15.247(b)(3)	Maximum Conducted Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2020/11/29	2021/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2020/11/29	2021/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2020/12/22	2023/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2020/11/29	2021/11/28
Unknown	Cable	Chamber Cable 4	EC-007	2020/11/29	2021/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2020/11/29	2021/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Sunol Sciences	Horn Antenna	3115	9107-3694	2021/01/15	2024/01/14
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2020/11/29	2021/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2020/11/29	2021/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2021/04/20	2022/04/20
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2020/12/06	2023/12/05

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	1201.002K50-146520-wh	2020/08/04	2021/08/03
Tonscend Corporation	RF control Unit	JS0806-2	19D8060154	2020/08/04	2021/08/03
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2020/08/04	2021/08/03
Agilent	MXG Vector Signal Generator	N5182B	MY53051503	2020/08/04	2021/08/03
Agilent	Signal Generator	N5183A	MY51040755	2020/12/29	2021/12/28
Yijia	Temperature & Humidity Meter	10316377	T-03-EM397	2020/09/30	2021/09/29
Unknown	RF Cable	Unknown	2301 276	2020/11/29	2021/11/28

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

Measurement Result

For BLE:

Mode	Frequency (MHz)	Max Tune-up Conducted Power (dBm)	Max Tune-up Conducted Power (mW)	Calculated Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
BLE	2480	-5.0	0.32	5	0.1	3.0	Yes

Result: No SAR test is required.

For Wi-Fi:

Wi-Fi: please refer to the report number: SZXX1210513-17047E-20B

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 an internal antenna arrangement, which was permanently attached and the antenna gain is 1.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

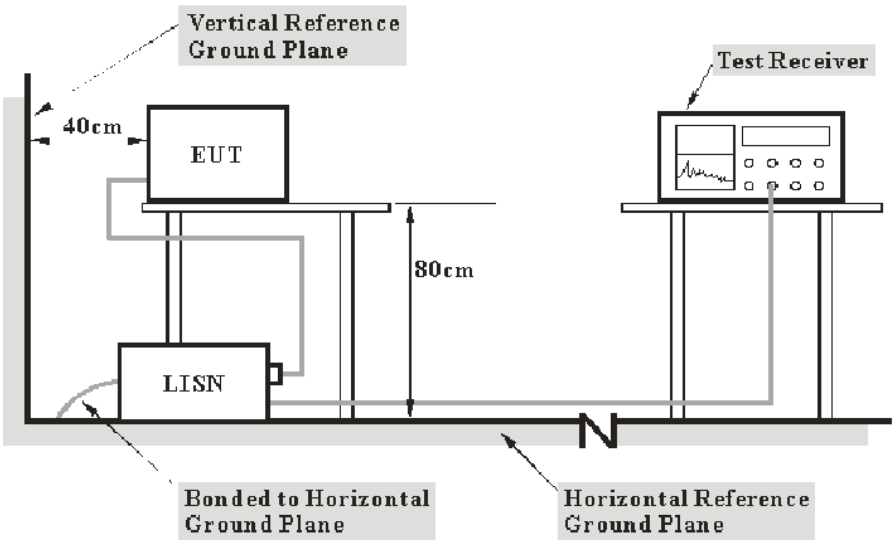
Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

Test Procedure

During the conducted emission test, the 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.

Corrected Factor & Margin Calculation

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

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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 – Corrected Amplitude

Test Data

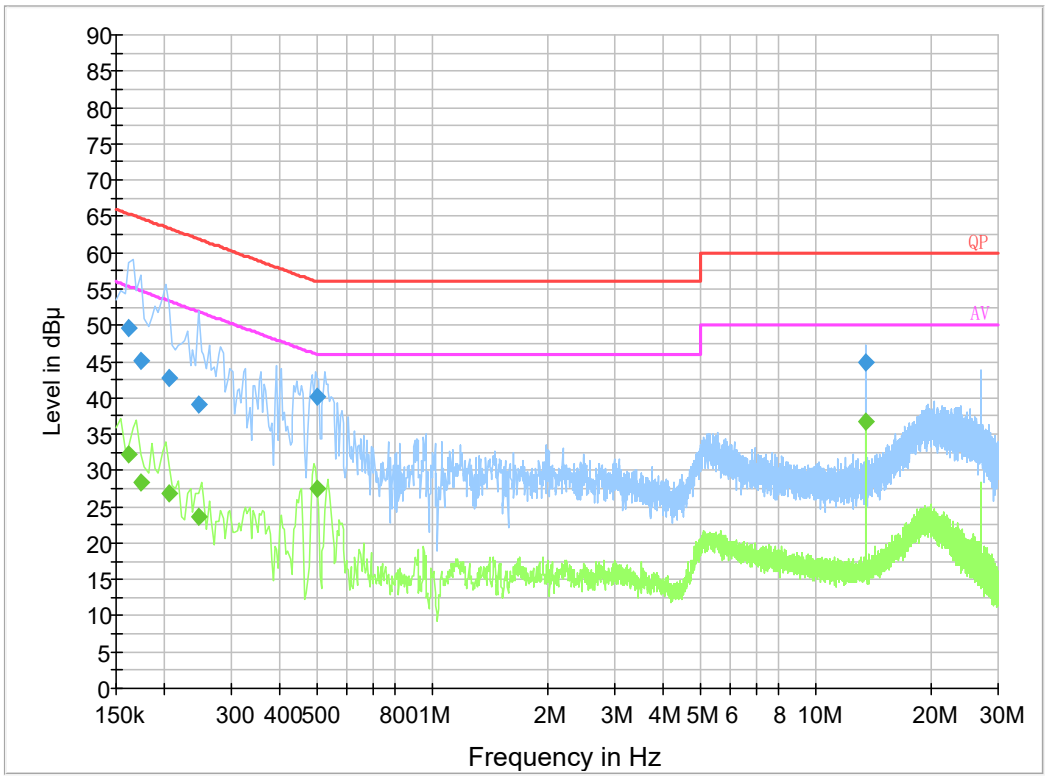
Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	59 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2021-06-07.

EUT operation mode: Charging with BT&Wi-Fi communication

AC 120V/60 Hz, Line



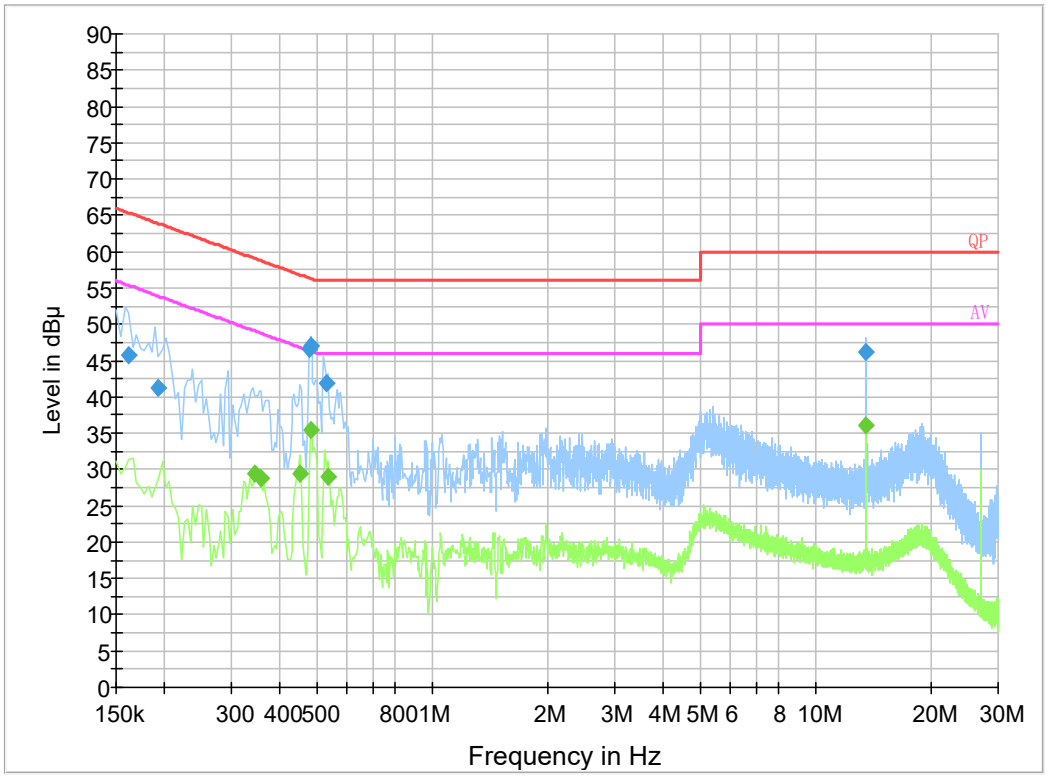
Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.161500	49.7	9.000	L1	19.9	15.7	65.4
0.173500	45.2	9.000	L1	19.9	19.6	64.8
0.206500	42.8	9.000	L1	19.8	20.5	63.3
0.245500	39.1	9.000	L1	19.8	22.8	61.9
0.502530	40.3	9.000	L1	19.8	15.7	56.0
13.562630	44.9	9.000	L1	20.0	15.1	60.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.161500	32.3	9.000	L1	19.9	23.1	55.4
0.173500	28.4	9.000	L1	19.9	26.4	54.8
0.206500	26.9	9.000	L1	19.8	26.4	53.3
0.245500	23.7	9.000	L1	19.8	28.2	51.9
0.502530	27.6	9.000	L1	19.8	18.4	46.0
13.562630	36.8	9.000	L1	20.0	13.2	50.0

AC 120V/60 Hz, Neutral:



Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.161500	45.7	9.000	N	19.8	19.7	65.4
0.193500	41.3	9.000	N	19.8	22.6	63.9
0.478830	46.5	9.000	N	19.8	9.9	56.4
0.482770	47.0	9.000	N	19.8	9.3	56.3
0.529930	41.8	9.000	N	19.8	14.2	56.0
13.558570	46.3	9.000	N	19.9	13.7	60.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.346000	29.4	9.000	N	19.8	19.7	49.1
0.358000	28.9	9.000	N	19.9	19.9	48.8
0.454000	29.4	9.000	N	19.8	17.4	46.8
0.482000	35.5	9.000	N	19.8	10.8	46.3
0.538000	28.9	9.000	N	19.8	17.1	46.0
13.562000	36.1	9.000	N	19.9	13.9	50.0

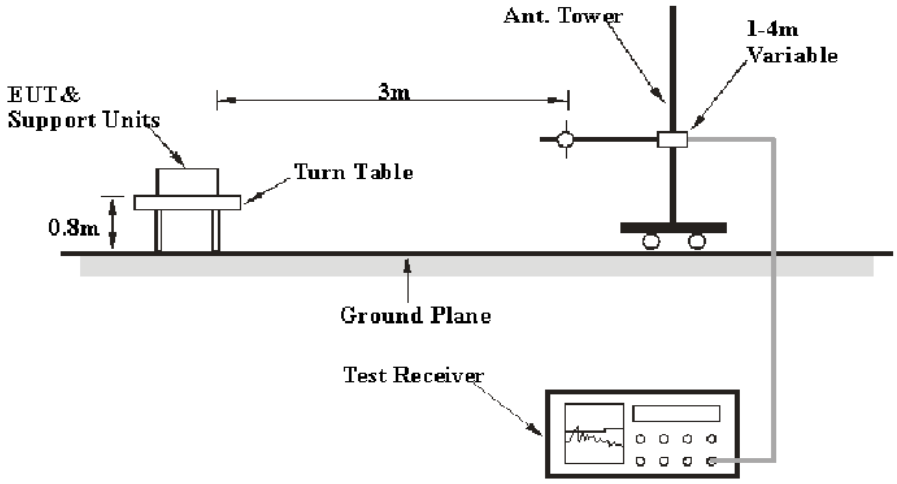
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

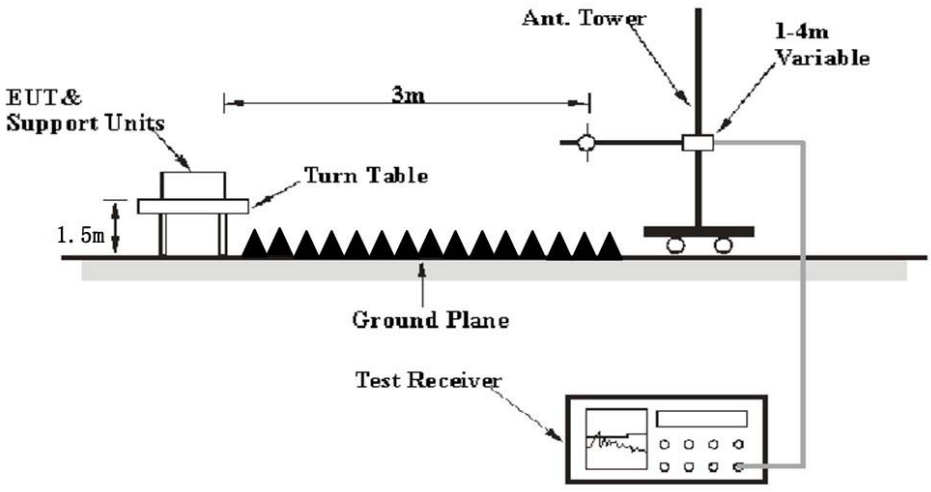
FCC §15.247 (d); §15.209; §15.205;

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.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude 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:

Corrected Amplitude = 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 = Limit – Corrected Amplitude

Test Data

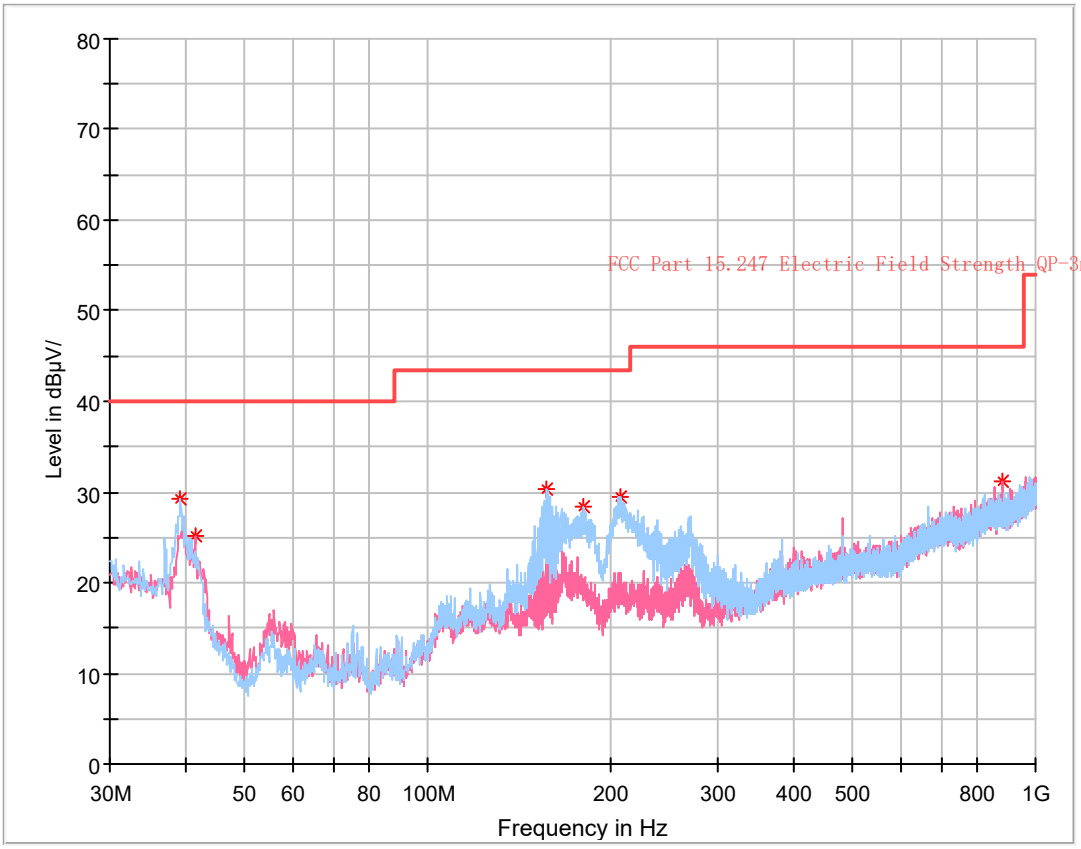
Environmental Conditions

Temperature:	27.1~28.8 ℃
Relative Humidity:	44~58 %
ATM Pressure:	101~101.2 kPa

The testing was performed by Zero Yan on 2021-06-05 for below 1GHz and Dio Ding on 2021-06-23 and 2021-07-13 for above 1GHz.

EUT operation mode: Charging with BT&Wi-Fi communication

30 MHz~1 GHz:



Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.215000	29.35	40.00	10.65	100.0	H	169.0	-9.9
41.397500	25.18	40.00	14.82	200.0	V	0.0	-11.4
157.312500	30.41	43.50	13.09	200.0	H	79.0	-11.7
180.956250	28.30	43.50	15.20	100.0	H	62.0	-12.2
207.025000	29.51	43.50	13.99	200.0	H	69.0	-11.2
885.297500	31.14	46.00	14.86	200.0	V	0.0	0.8

1 GHz-25 GHz (Wi-Fi):

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)				
Low Channel(2412MHz)									
2331.13	28.69	PK	284	1.3	H	31.64	60.33	74	13.67
2331.13	14.85	Ave.	284	1.3	H	31.64	46.49	54	7.51
2497.88	29.04	PK	44	1.9	H	32.13	61.17	74	12.83
2497.88	15.1	Ave.	44	1.9	H	32.13	47.23	54	6.77
4824.00	49.56	PK	143	2.3	H	6.28	55.84	74	18.16
4824.00	44.70	Ave.	143	2.3	H	6.28	50.98	54	3.02
Middle Channel(2437MHz)									
4874.00	59.63	PK	31	2.3	H	6.76	66.39	74	7.61
4874.00	43.01	Ave.	31	2.3	H	6.76	49.77	54	4.23
High Channel(2462 MHz)									
2327.19	29.37	PK	19	2.0	H	31.64	61.01	74	12.99
2327.19	14.97	Ave.	19	2.0	H	31.64	46.61	54	7.39
2485.59	28.98	PK	122	1.4	H	32.13	61.11	74	12.89
2485.59	15.15	Ave.	122	1.4	H	32.13	47.28	54	6.72
4924.00	48.61	PK	278	1.2	H	6.76	55.37	74	18.63
4924.00	43.31	Ave.	278	1.2	H	6.76	50.07	54	3.93

802.11g

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)				
Low Channel(2412MHz)									
2389.94	33.75	PK	236	1.4	H	31.87	65.62	74	8.38
2389.94	21.12	Ave.	236	1.4	H	31.87	52.99	54	1.01
2485.57	28.53	PK	315	1.2	H	32.13	60.66	74	13.34
2485.57	16.04	Ave.	315	1.2	H	32.13	48.17	54	5.83
4824.00	59.56	PK	132	2.2	H	6.28	65.84	74	8.16
4824.00	46.28	PK	132	1.3	H	6.28	52.56	54	1.44
7236.00	45.35	PK	335	1.4	H	11.93	57.28	74	16.72
7236.00	30.54	Ave.	335	1.4	H	11.93	42.47	54	11.53
Middle Channel(2437MHz)									
4874.00	57.54	PK	38	2.0	H	6.76	64.30	74	9.70
4874.00	44.48	Ave.	38	2.0	H	6.76	51.24	54	2.76
7311.00	44.82	PK	26	1.6	H	11.56	56.38	74	17.62
7311.00	29.52	Ave.	26	1.6	H	11.56	41.08	54	12.92
High Channel(2462 MHz)									
2319.21	29.06	PK	167	1.5	H	31.64	60.70	74	13.30
2319.21	15.75	Ave.	167	1.5	H	31.64	47.39	54	6.61
2483.71	33.28	PK	314	1.4	H	32.13	65.41	74	8.59
2483.71	19.77	Ave.	314	1.4	H	32.13	51.90	54	2.10
4924.00	57.02	PK	289	1.4	H	6.76	63.78	74	10.22
4924.00	42.83	Ave.	289	1.4	H	6.76	49.59	54	4.41
7386.00	44.16	PK	347	2.1	H	12.29	56.45	74	17.55
7386.00	29.68	Ave.	347	2.1	H	12.29	41.97	54	12.03

802.11n-HT20

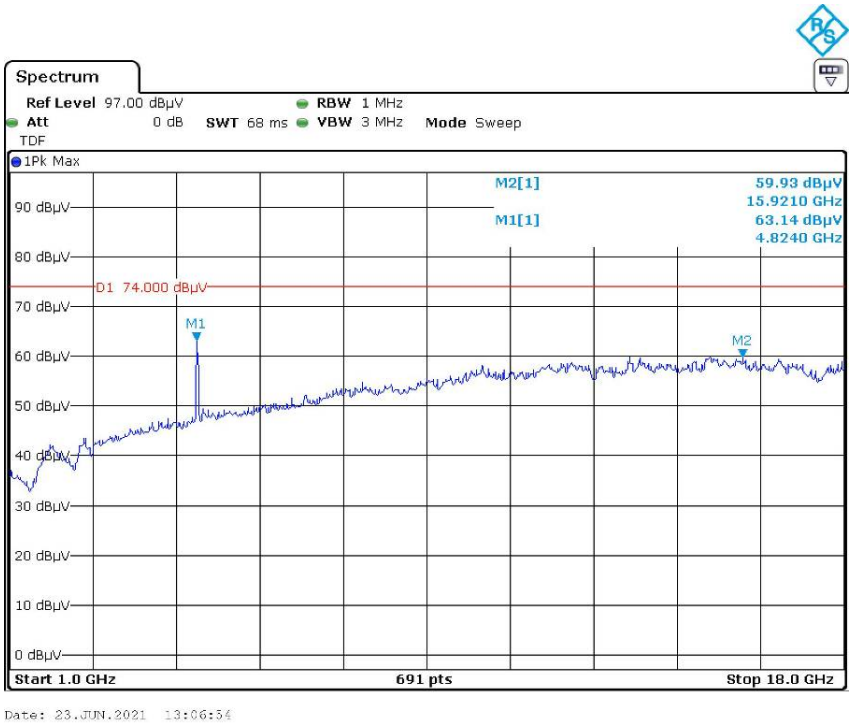
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel(2412MHz)									
2319.21	34.02	PK	288	2.1	H	31.64	65.66	74	8.34
2319.21	19.62	Ave.	288	2.1	H	31.64	51.26	54	2.74
2494.81	29.07	PK	105	2.1	H	32.13	61.20	74	12.80
2494.81	15.83	Ave.	105	2.1	H	32.13	47.96	54	6.04
4824.00	58.32	PK	263	1.5	H	6.28	64.60	74	9.40
4824.00	44.45	Ave.	263	1.5	H	6.28	50.73	54	3.27
7236.00	46.05	PK	173	1.5	H	11.93	57.98	74	16.02
7236.00	30.57	Ave.	173	1.5	H	11.93	42.50	54	11.50
Middle Channel(2437MHz)									
4874.00	59.09	PK	297	2.0	H	6.76	65.85	74	8.15
4874.00	43.86	Ave.	297	2.0	H	6.76	50.62	54	3.38
7311.00	46.39	PK	188	1.9	H	11.56	57.95	74	16.05
7311.00	29.68	Ave.	188	1.9	H	11.56	41.24	54	12.76
High Channel(2462 MHz)									
2329.16	29.53	PK	11	2.4	H	31.64	61.17	74	12.83
2329.16	15.76	Ave.	11	2.4	H	31.64	47.40	54	6.60
2483.73	35.65	PK	149	1.3	H	32.13	67.78	74	6.22
2483.73	20.86	Ave.	149	1.3	H	32.13	52.99	54	1.01
4924.00	57.92	PK	34	1.4	H	6.76	64.68	74	9.32
4924.00	43.86	Ave.	34	1.4	H	6.76	50.62	54	3.38
7386.00	46.01	PK	310	2.3	H	12.29	58.30	74	15.70
7386.00	29.85	Ave.	310	2.3	H	12.29	42.14	54	11.86

1 GHz-25 GHz(BLE):

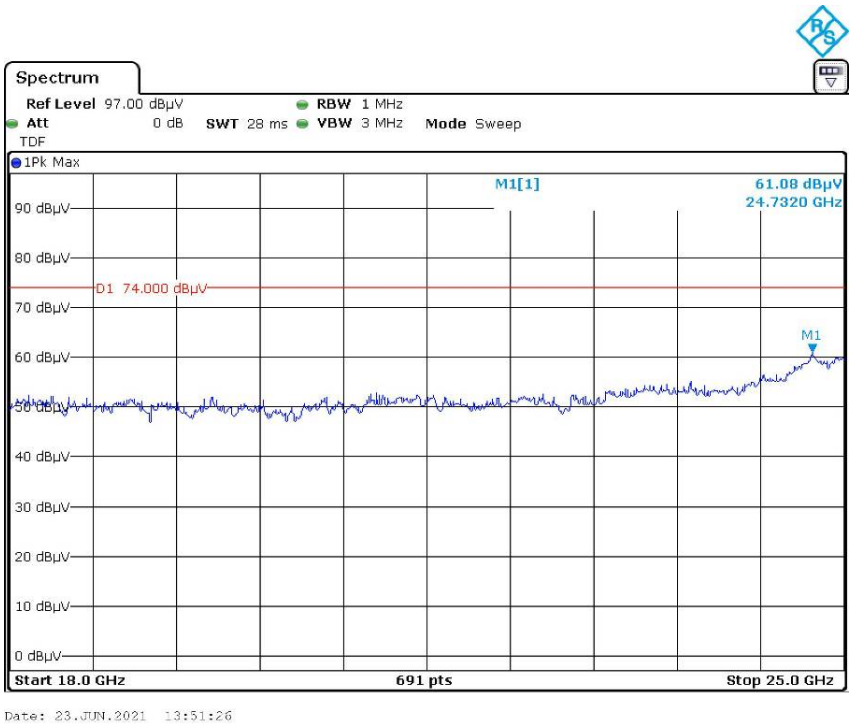
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2322.56	29.05	PK	230	2.1	H	31.64	60.69	74	13.31
2322.56	15.08	Ave.	230	2.1	H	31.64	46.72	54	7.28
2484.25	29.61	PK	318	1.9	H	32.13	61.74	74	12.26
2484.25	15.15	Ave.	318	1.9	H	32.13	47.28	54	6.72
4804.00	45.78	PK	37	1.5	H	6.28	52.06	74	21.94
4804.00	32.1	Ave.	37	1.5	H	6.28	38.38	54	15.62
Middle Channel(2440MHz)									
4880.00	46.33	PK	289	2.0	H	6.76	53.09	74	20.91
4880.00	35.41	Ave.	289	2.0	H	6.76	42.17	54	11.83
High Channel(2480 MHz)									
2363.66	28.31	PK	111	1.9	H	31.87	60.18	74	13.82
2363.66	15.05	Ave.	111	1.9	H	31.87	46.92	54	7.08
2498.91	29.85	PK	46	2.4	H	32.13	61.98	74	12.02
2498.91	15.25	Ave.	46	2.4	H	32.13	47.38	54	6.62
4960.00	46.59	PK	145	1.2	H	6.80	53.39	74	20.61
4960.00	35.79	Ave.	145	1.2	H	6.80	42.59	54	11.41

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.
And for the pre-scan is performed with the 2400-2483.5MHz band filter.

Pre-scan with 802.11G Mode, Low channel
Horizontal

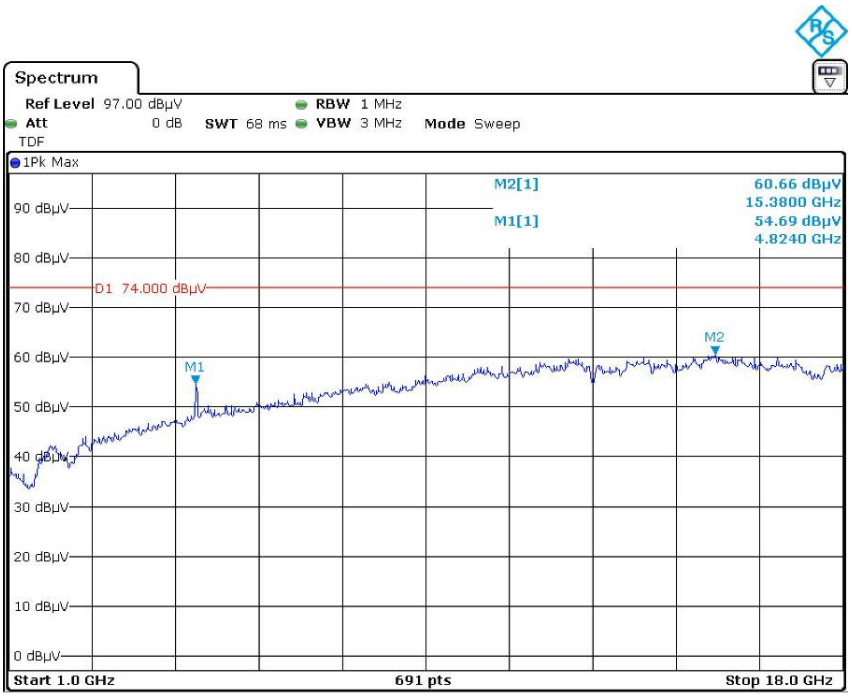


Date: 23.JUN.2021 13:06:54

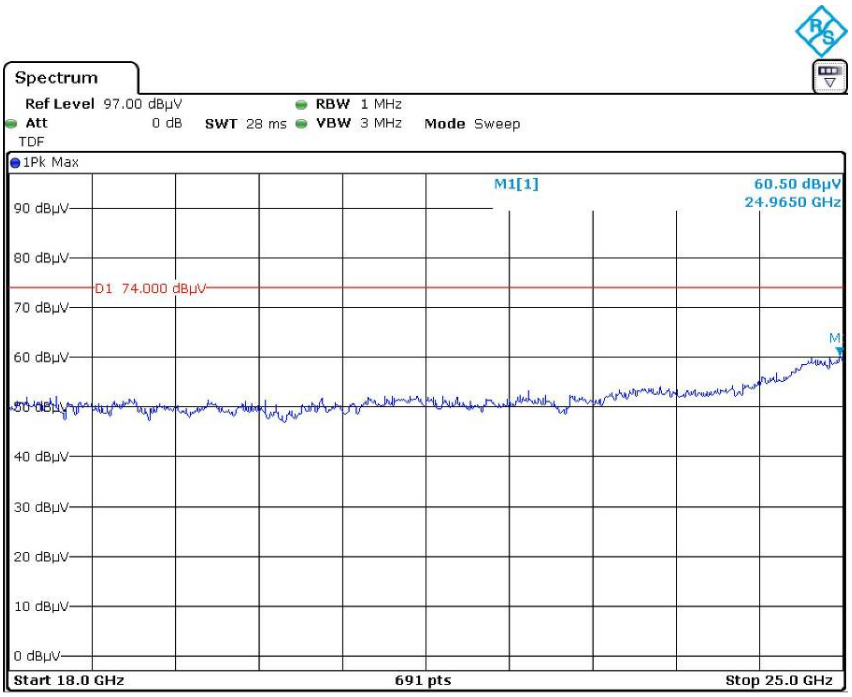


Date: 23.JUN.2021 13:51:26

Vertical

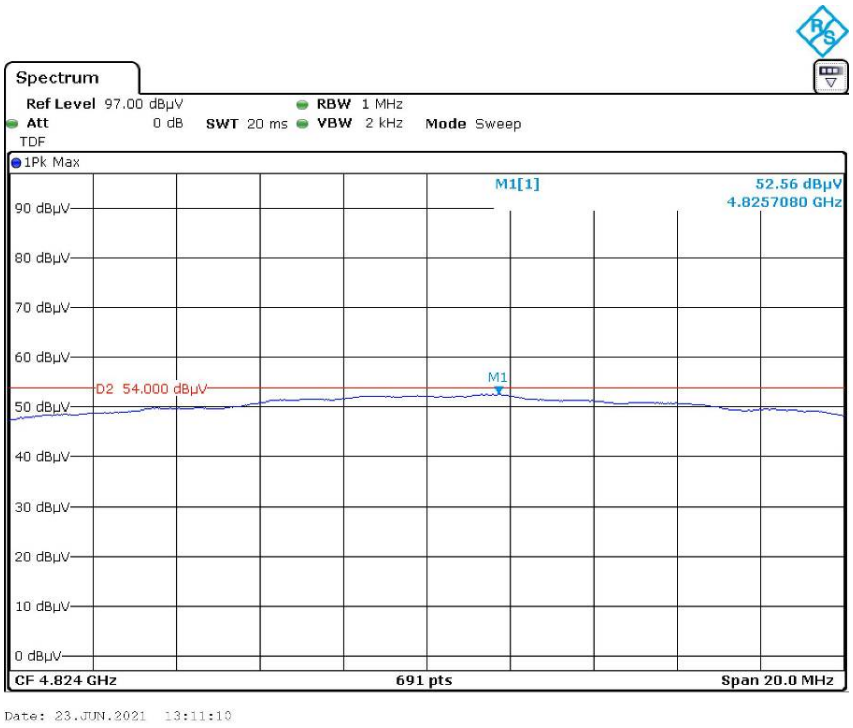


Date: 23.JUN.2021 13:16:14

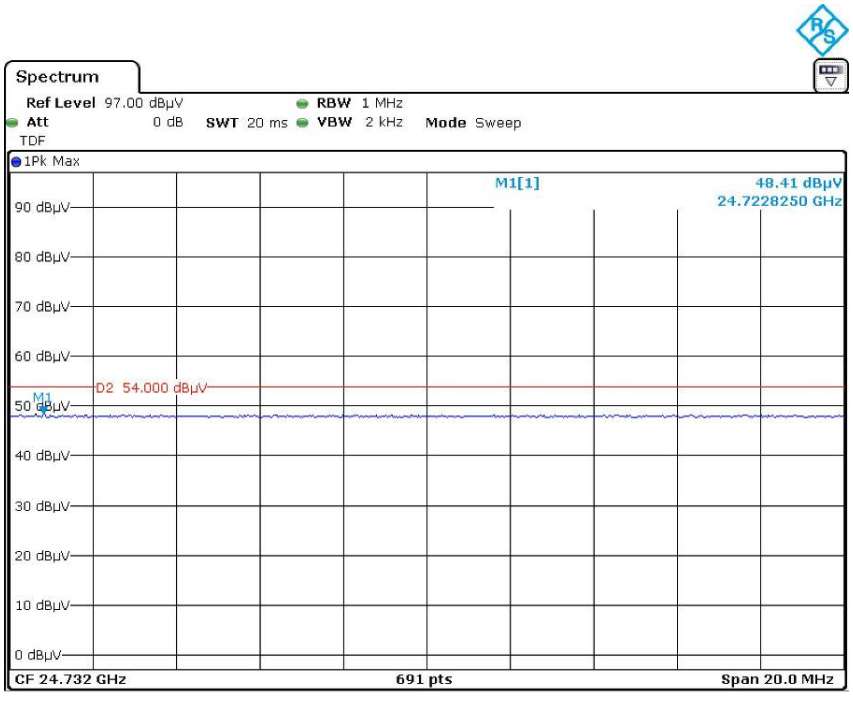


Date: 23.JUN.2021 14:01:47

Pre-scan for Average
Horizontal

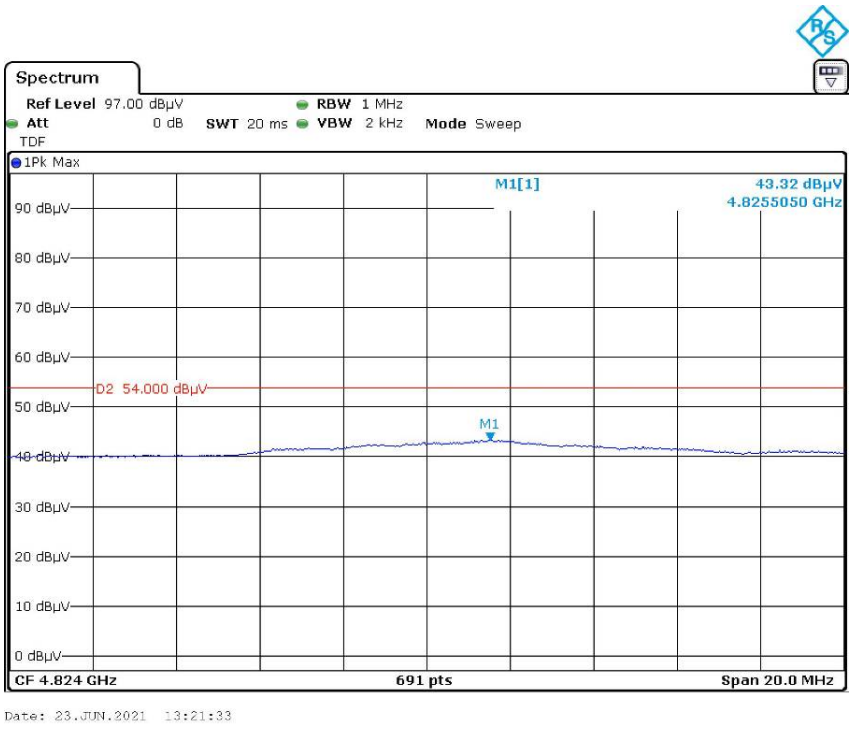


Date: 23.JUN.2021 13:11:10

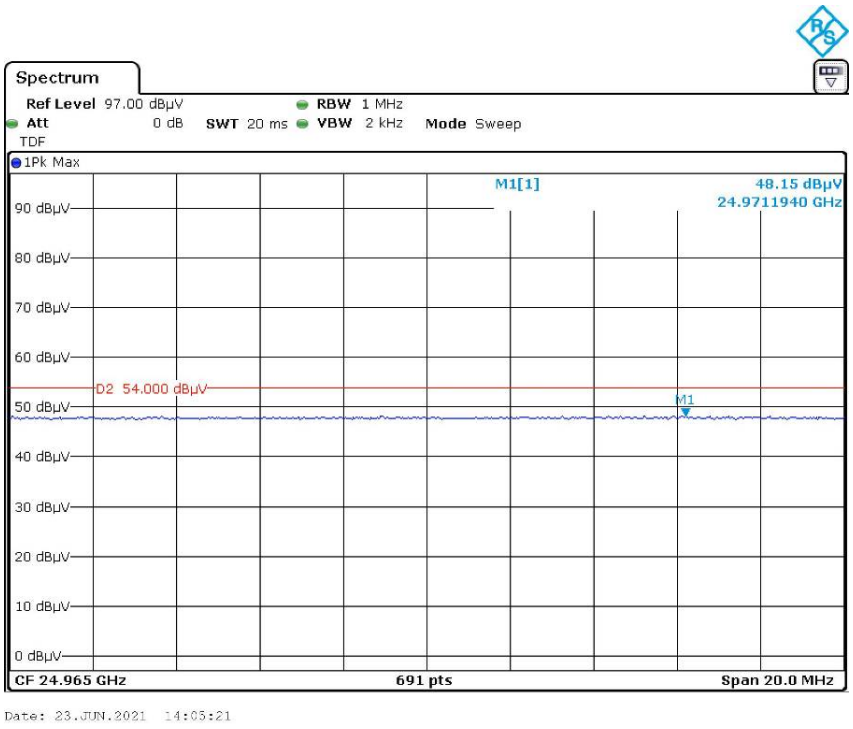


Date: 23.JUN.2021 13:56:09

Vertical



Date: 23.JUN.2021 13:21:33



Date: 23.JUN.2021 14:05:21

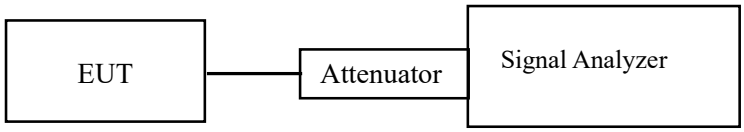
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

Applicable Standard

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

Test Procedure

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



Test Data

Environmental Conditions

Temperature:	25~27 ℃
Relative Humidity:	56~57 ℃
ATM Pressure:	101.0 kPa

The testing was performed by Carl Yang on 2021-06-22 and Bravos Zhao on 2021-06-25.

EUT operation mode: Transmitting

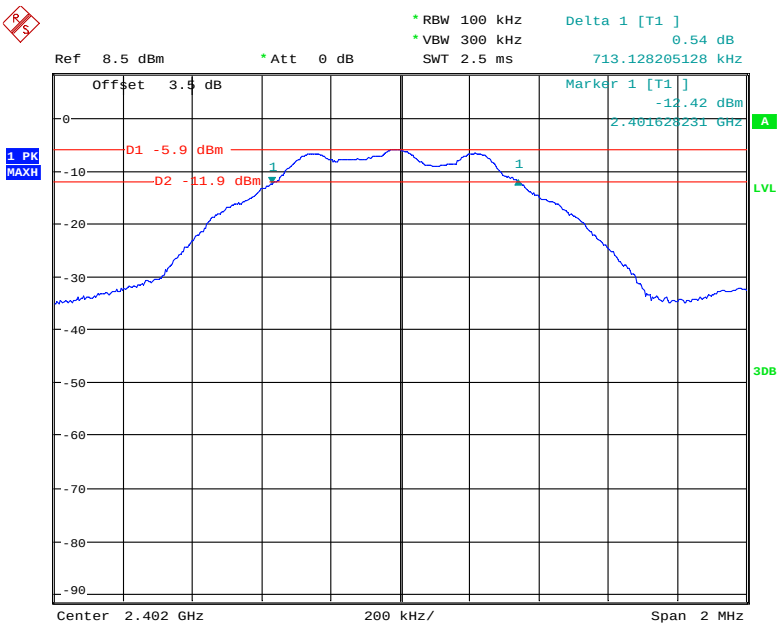
Test Result: Pass.

Wi-Fi: Please refer to the Appendix.

BLE: Please refer to the following table and plots.

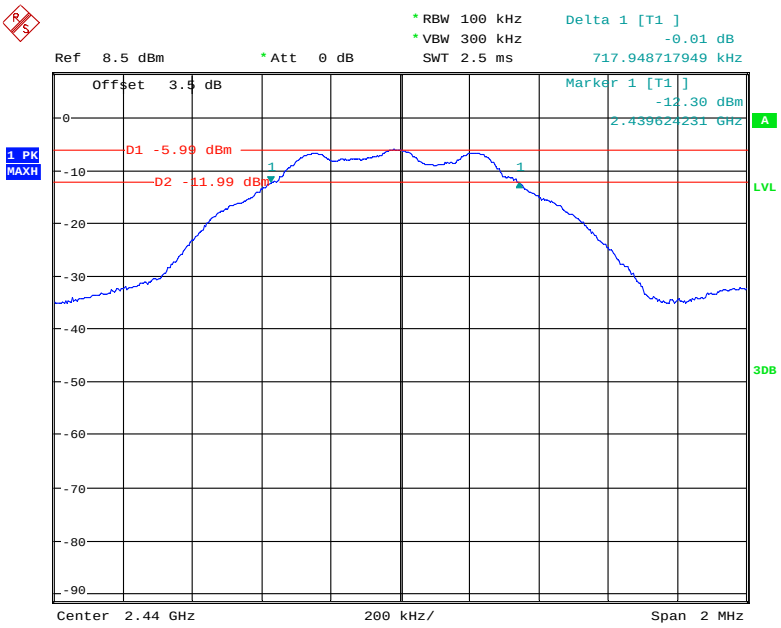
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	Limit (kHz)
BLE 1M			
Low	2402	0.713	≥500
Middle	2440	0.718	≥500
High	2480	0.722	≥500

BLE 1M Low Channel



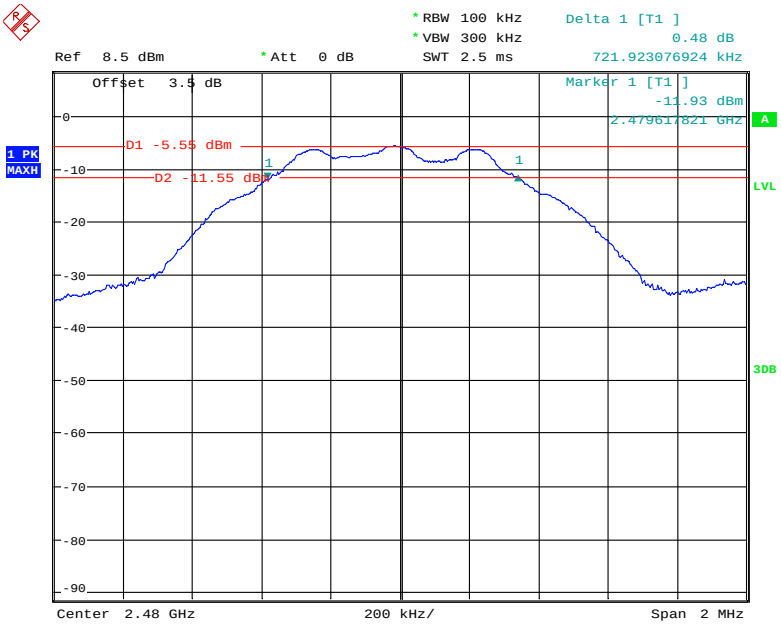
Date: 22.JUN.2021 16:37:44

BLE 1M Middle Channel



Date: 22.JUN.2021 16:34:06

BLE 1M High Channel



Date: 22.JUN.2021 16:36:27

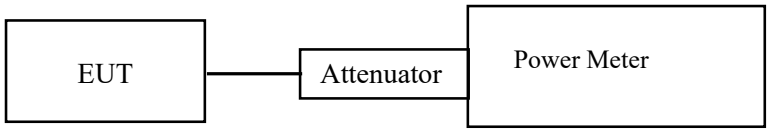
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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:	25~27 ℃
Relative Humidity:	56~57 ℃
ATM Pressure:	101.0 kPa

The testing was performed by Carl Yang on 2021-06-22 and Bravos Zhao on 2021-06-25.

EUT operation mode: Transmitting

Test Result: Pass.

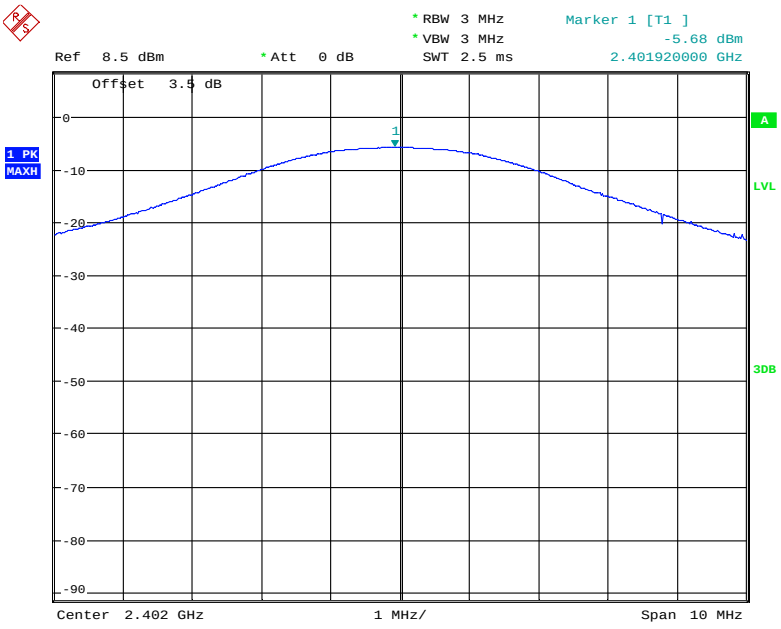
Wi-Fi: Please refer to the Appendix.

BLE: Please refer to the following table and plots.

BLE mode

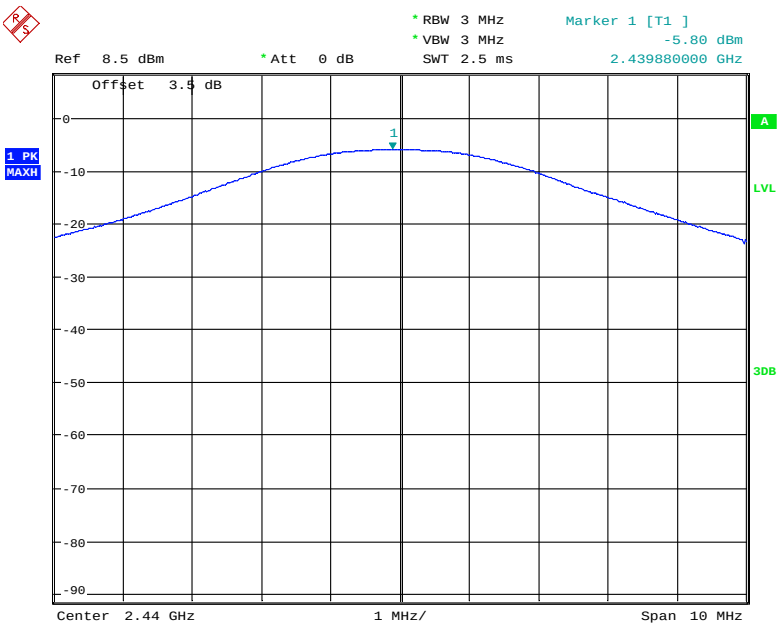
Channel	Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Limit (dBm)
BLE 1M			
Low	2402	-5.68	30
Middle	2440	-5.80	30
High	2480	-5.30	30

Low Channel



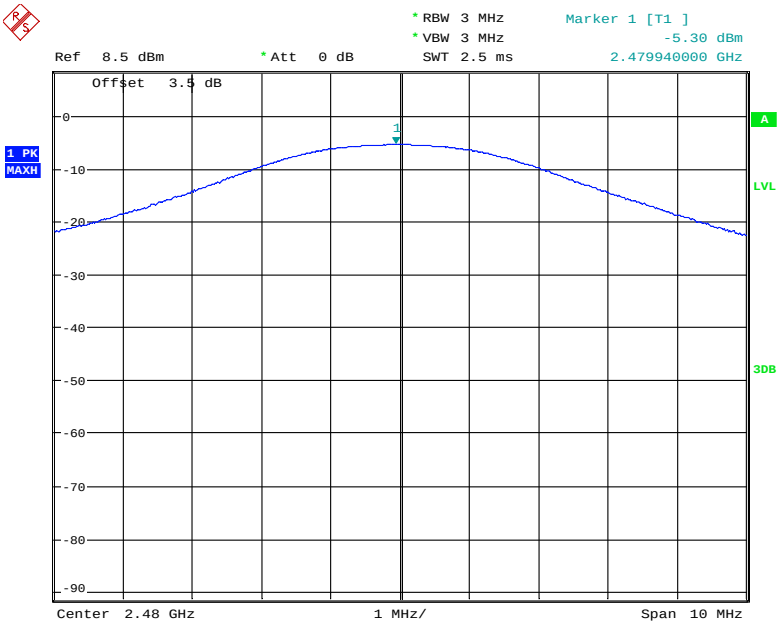
Date: 22.JUN.2021 16:28:19

Middle Channel



Date: 22.JUN.2021 16:32:38

High Channel



Date: 22.JUN.2021 16:30:41

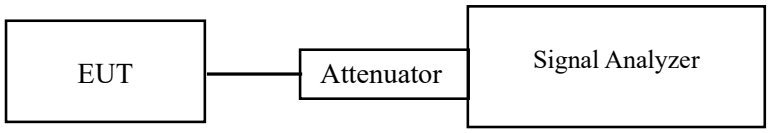
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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:	25~27 ℃
Relative Humidity:	56~57 ℃
ATM Pressure:	101.0 kPa

The testing was performed by Carl Yang on 2021-06-22 and Bravos Zhao on 2021-06-25.

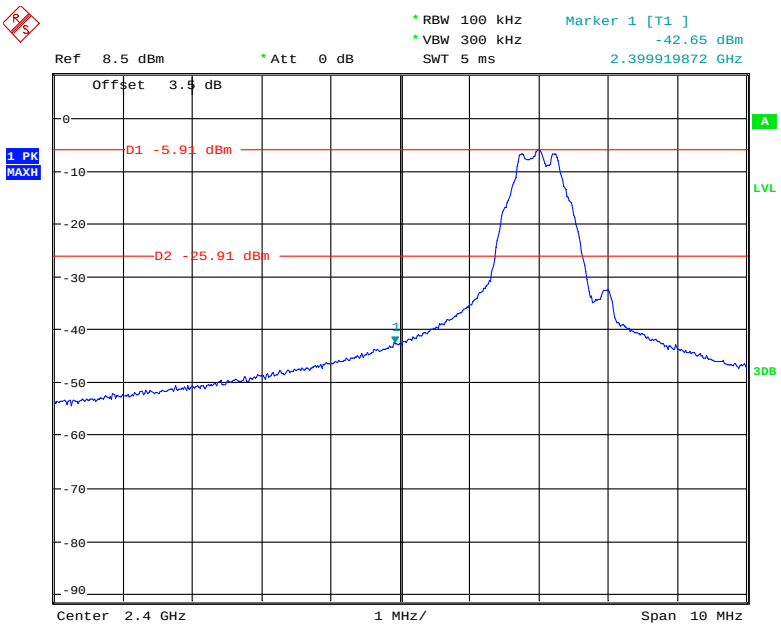
EUT operation mode: Transmitting

Test Result: Pass.

Wi-Fi: Please refer to the Appendix.

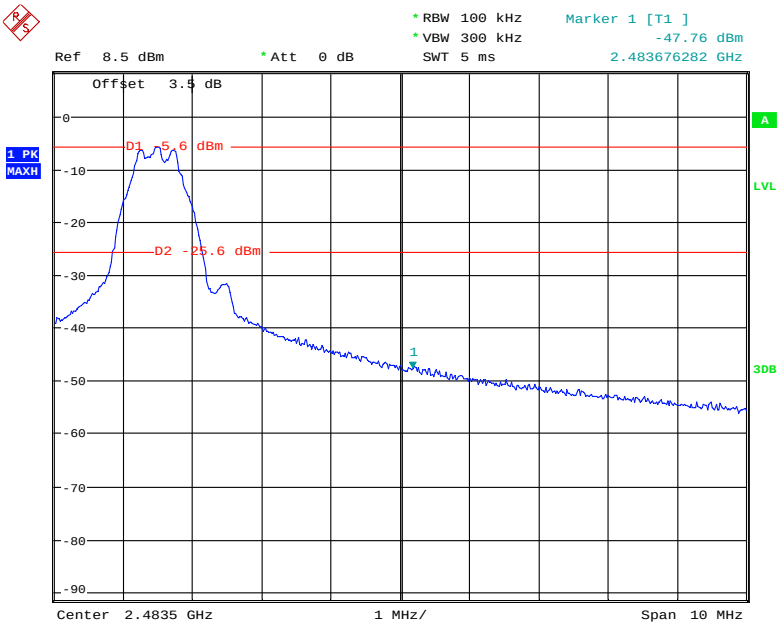
BLE: Please refer to the following plots.

BLE 1M: Band Edge, Left Side



Date: 22.JUN.2021 16:38:49

BLE 1M: Band Edge, Right Side



Date: 22.JUN.2021 16:40:06

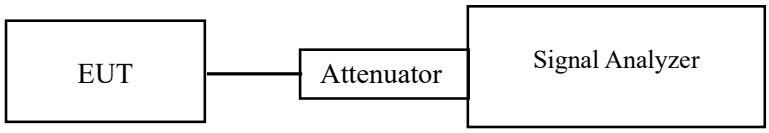
FCC §15.247(e) - POWER SPECTRAL DENSITY

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:	25~27 ℃
Relative Humidity:	56~57 ℃
ATM Pressure:	101.0 kPa

The testing was performed by Carl Yang on 2021-06-22 and Bravos Zhao on 2021-06-25.

EUT operation mode: Transmitting

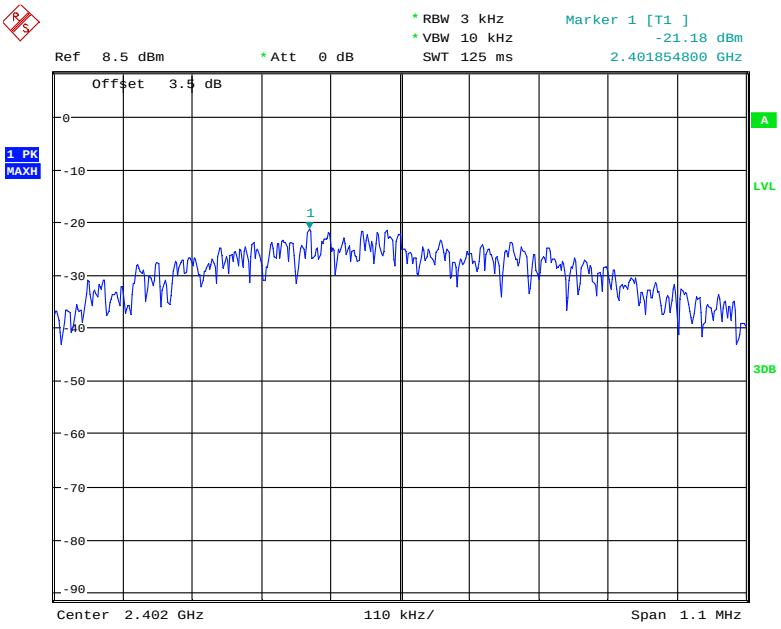
Test Result: Pass

Wi-Fi: Please refer to the Appendix.

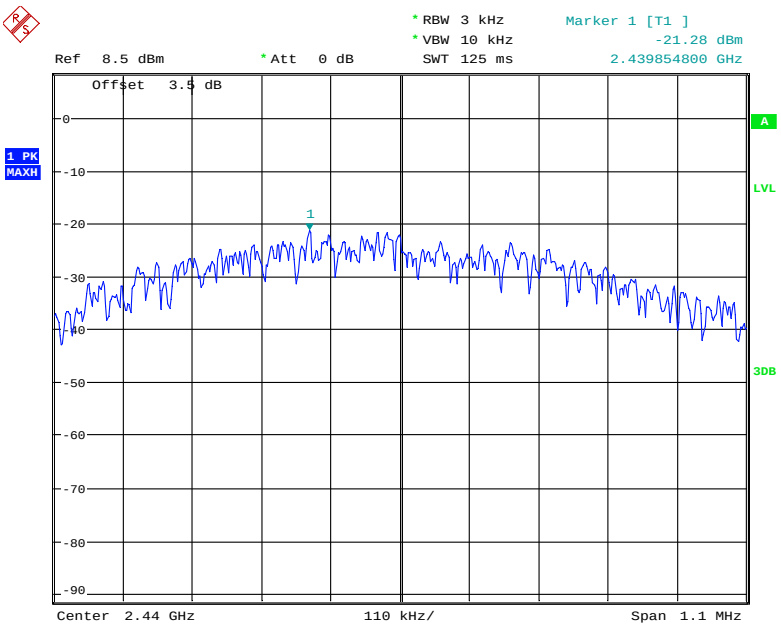
BLE: Please refer to the following table and plots.

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
BLE 1M			
Low	2402	-21.18	≤8
Middle	2440	-21.28	≤8
High	2480	-21.01	≤8

Power Spectral Density, BLE 1M Low Channel

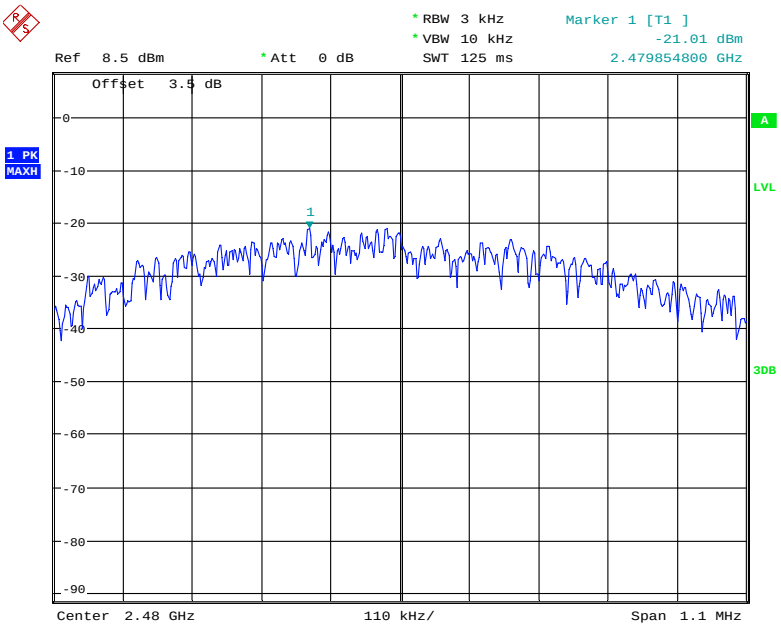


Power Spectral Density, BLE 1M Middle Channel



Date: 22.JUN.2021 16:48:40

Power Spectral Density, BLE 1M High Channel



Date: 22.JUN.2021 16:50:04

APPENDIX

Appendix A: DTS Bandwidth

Test Result

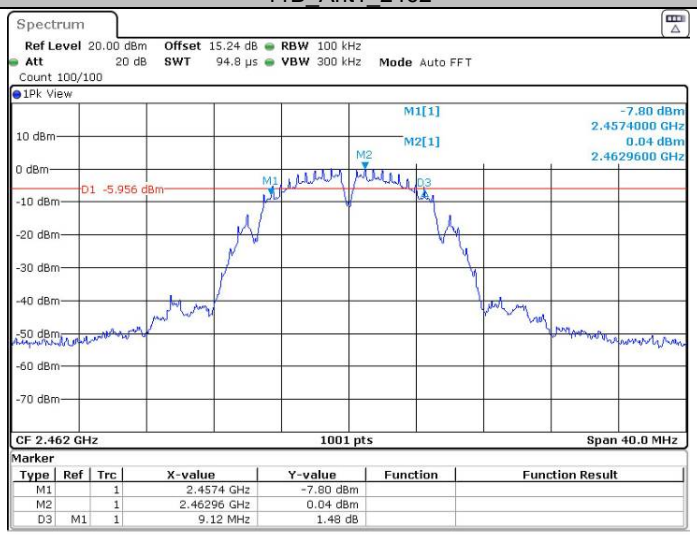
TestMode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	7.200	0.5	PASS
		2437	7.640	0.5	PASS
		2462	9.120	0.5	PASS
11G	Ant1	2412	16.400	0.5	PASS
		2437	16.440	0.5	PASS
		2462	16.440	0.5	PASS
11N20SISO	Ant1	2412	17.640	0.5	PASS
		2437	17.640	0.5	PASS
		2462	17.640	0.5	PASS

Test Graphs

11B_Ant1_2412

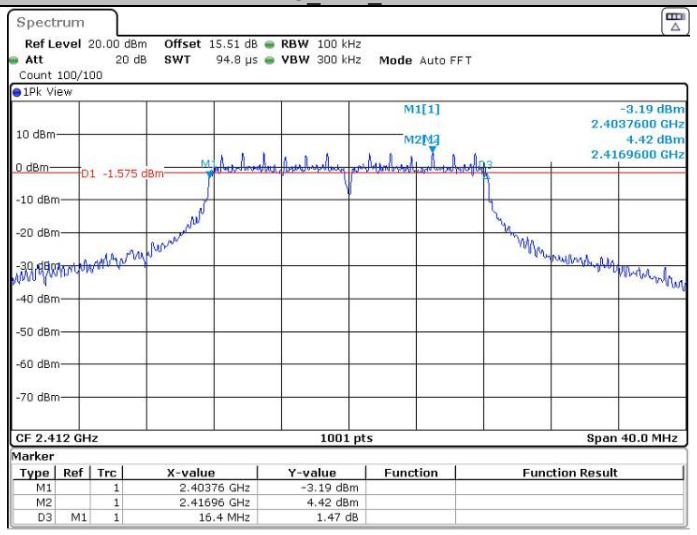
11B_Ant1_2437

11B_Ant1_2462



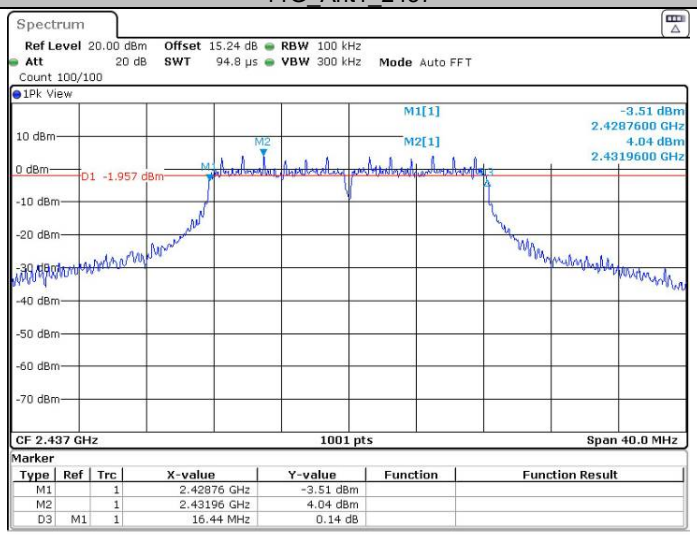
Date: 25.JUN.2021 02:34:00

11G_Ant1_2412



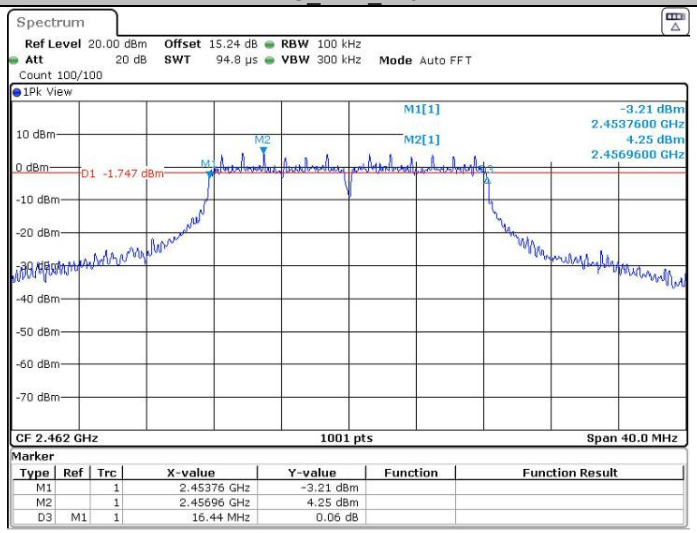
Date: 25.JUN.2021 03:39:50

11G_Ant1_2437



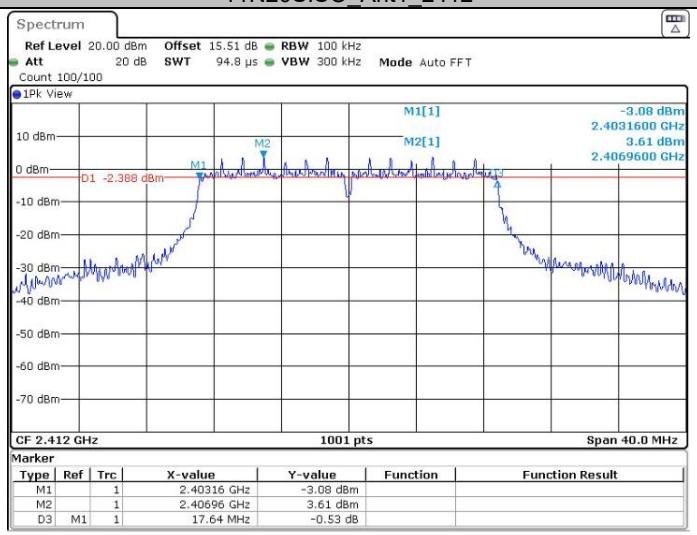
Date: 25.JUN.2021 03:41:34

11G_Ant1_2462



Date: 25.JUN.2021 03:43:29

11N20SISO_Ant1_2412



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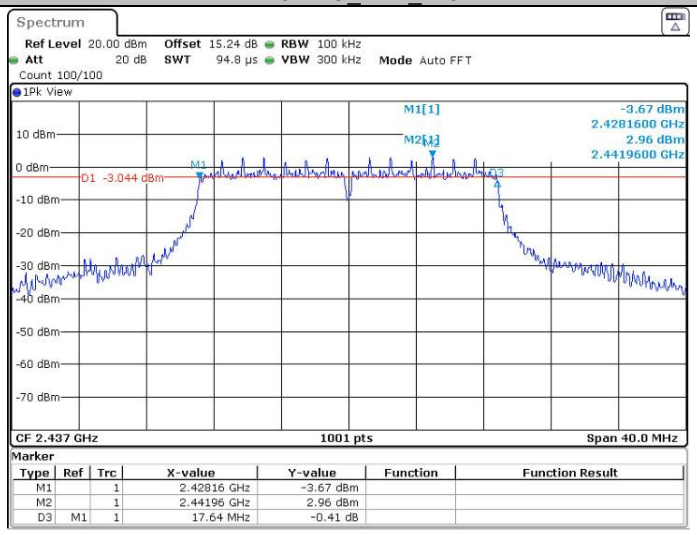
11N20SISO_Ant1_2437



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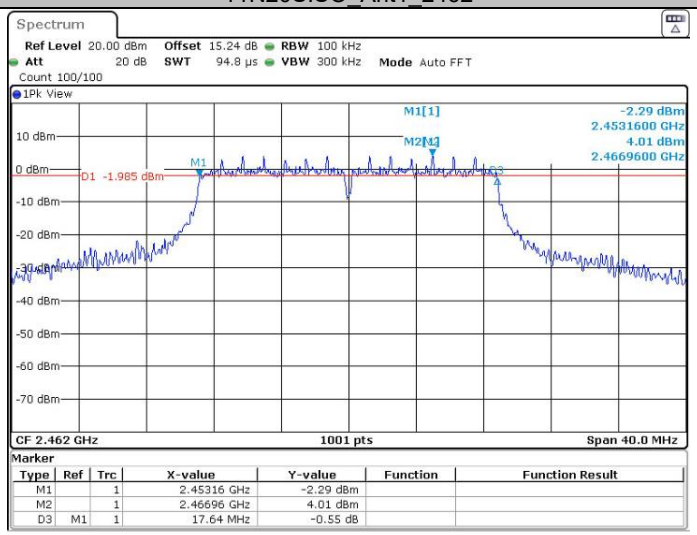
11N20SISO_Ant1_2462



Appendix B: Occupied Channel Bandwidth

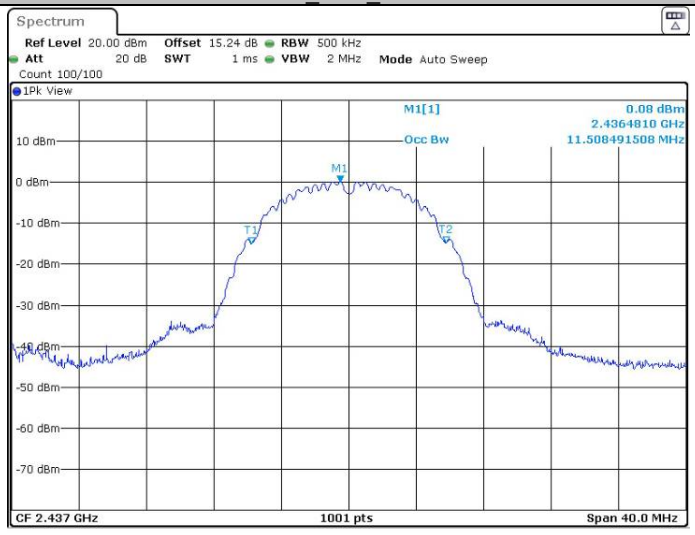
Test Result

Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	11.469	---	PASS
		2437	11.508	---	PASS
		2462	11.469	---	PASS
11G	Ant1	2412	17.862	---	PASS
		2437	17.902	---	PASS
		2462	17.862	---	PASS
11N20SISO	Ant1	2412	18.701	---	PASS
		2437	18.741	---	PASS
		2462	18.861	---	PASS

Test Graphs

11B_Ant1_2412

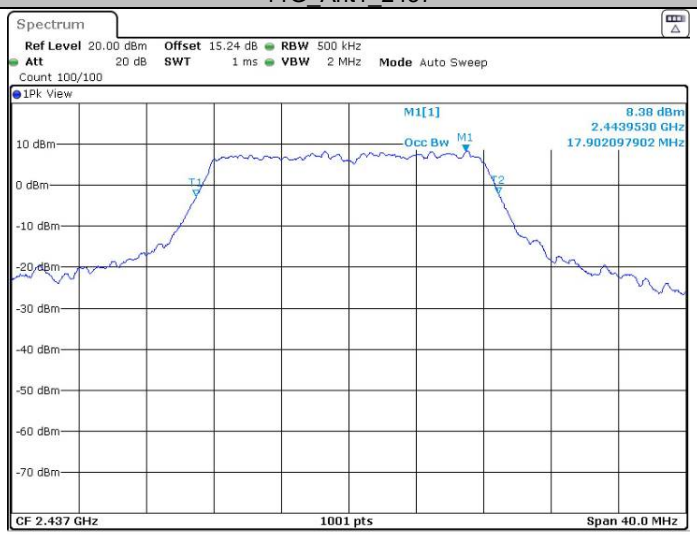
11B_Ant1_2437



11B_Ant1_2462

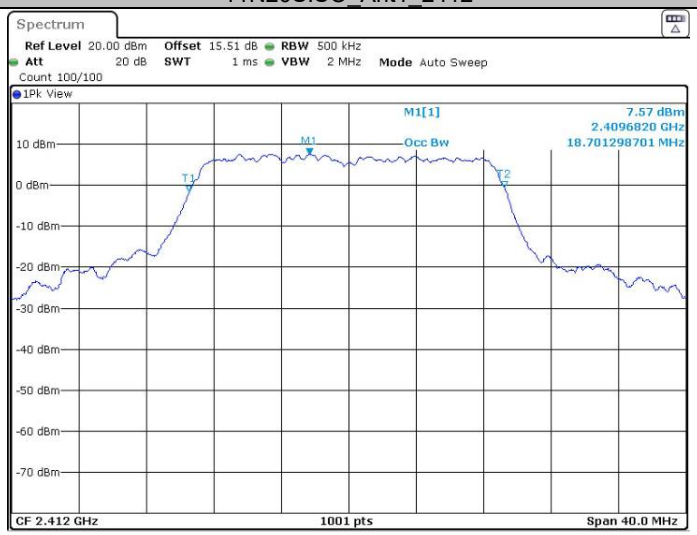
11G_Ant1_2412

11G_Ant1_2437

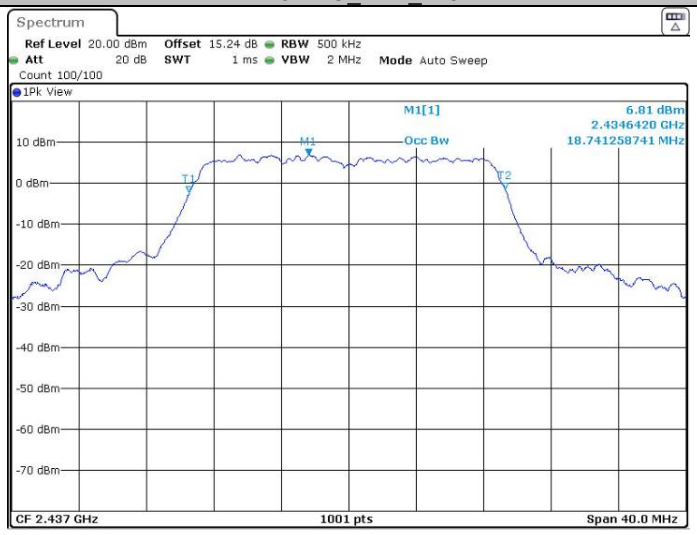


11G_Ant1_2462

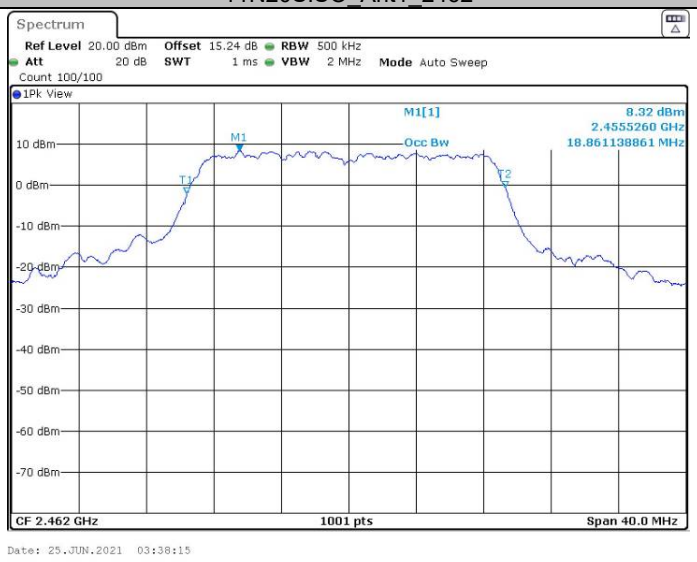
11N20SISO_Ant1_2412



11N20SISO_Ant1_2437



11N20SISO_Ant1_2462



Appendix C: Maximum conducted output power

Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	9.83	≤30	PASS
		2437	11.28	≤30	PASS
		2462	12.00	≤30	PASS
11G	Ant1	2412	19.48	≤30	PASS
		2437	19.21	≤30	PASS
		2462	19.11	≤30	PASS
11N20SISO	Ant1	2412	19.68	≤30	PASS
		2437	19.48	≤30	PASS
		2462	20.26	≤30	PASS

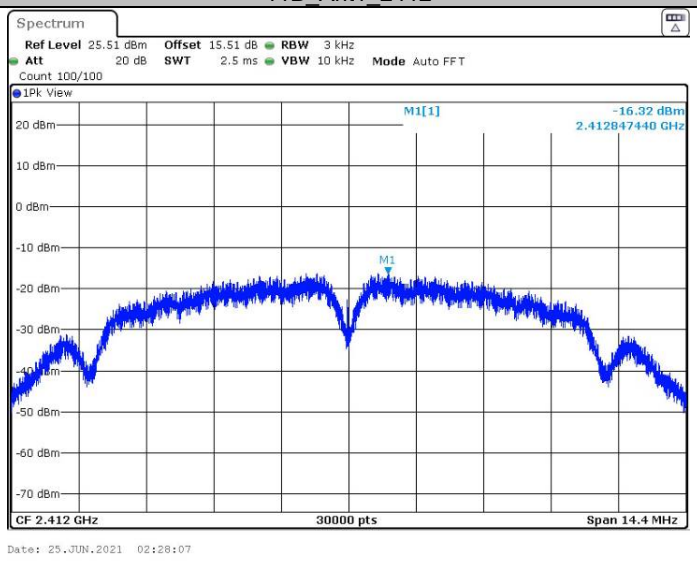
Appendix D: Maximum power spectral density

Test Result

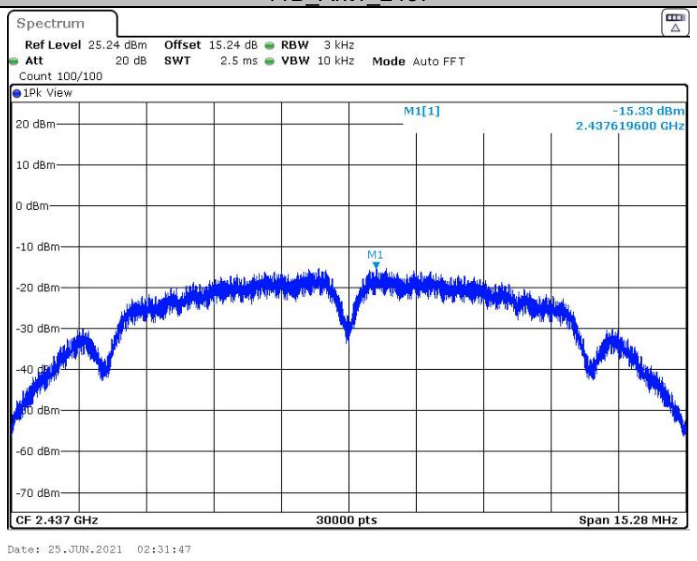
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-16.32	≤8	PASS
		2437	-15.33	≤8	PASS
		2462	-14.33	≤8	PASS
11G	Ant1	2412	-9.91	≤8	PASS
		2437	-10.33	≤8	PASS
		2462	-10.11	≤8	PASS
11N20SISO	Ant1	2412	-11.14	≤8	PASS
		2437	-11.69	≤8	PASS
		2462	-10.41	≤8	PASS

Test Graphs

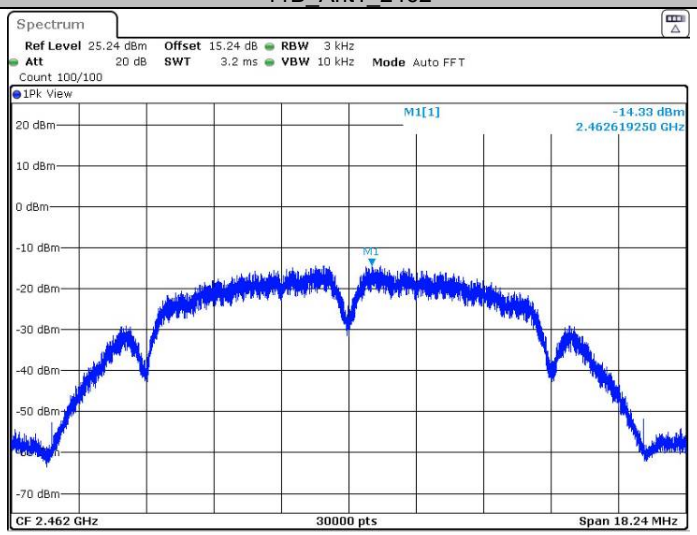
11B_Ant1_2412



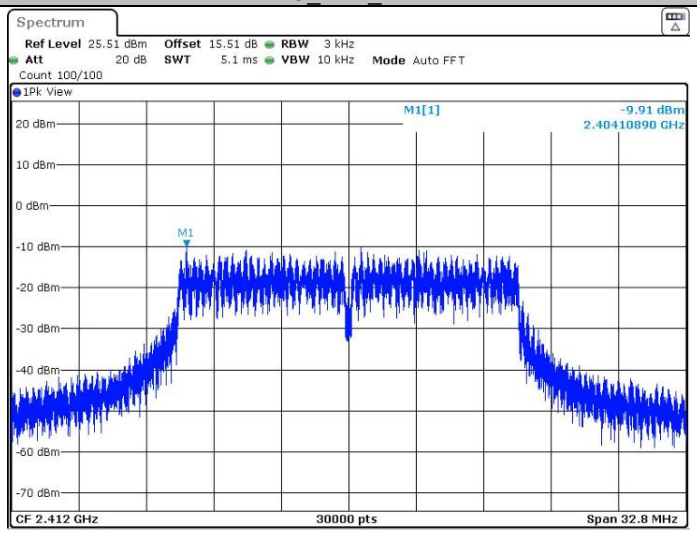
11B_Ant1_2437



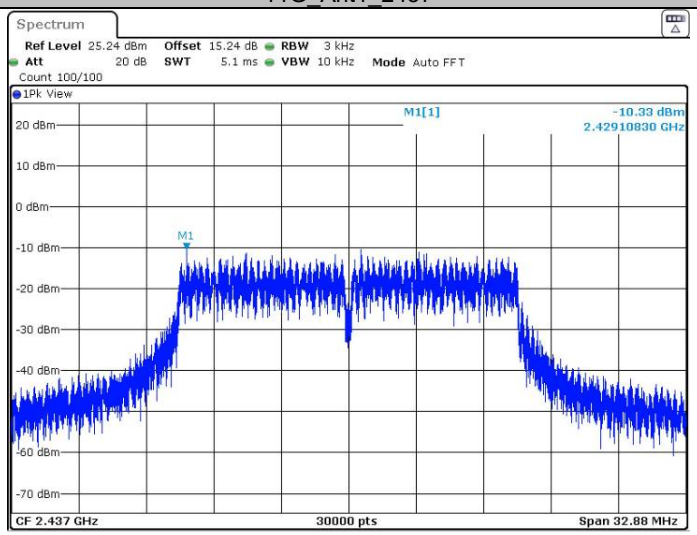
11B_Ant1_2462



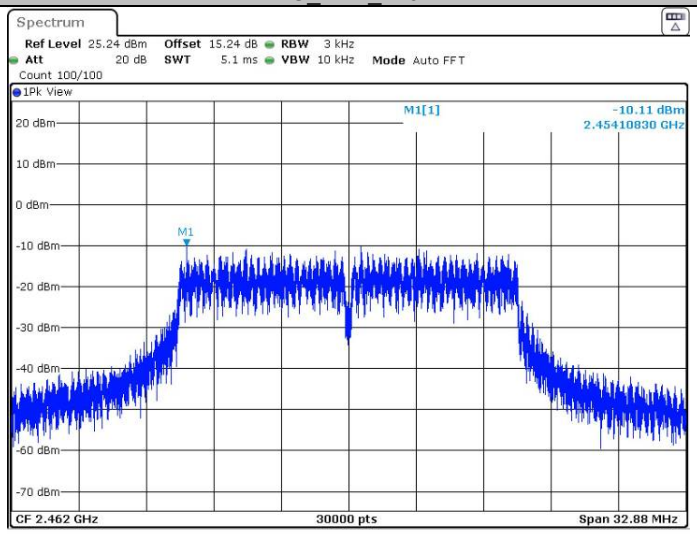
11G_Ant1_2412



11G_Ant1_2437



11G_Ant1_2462



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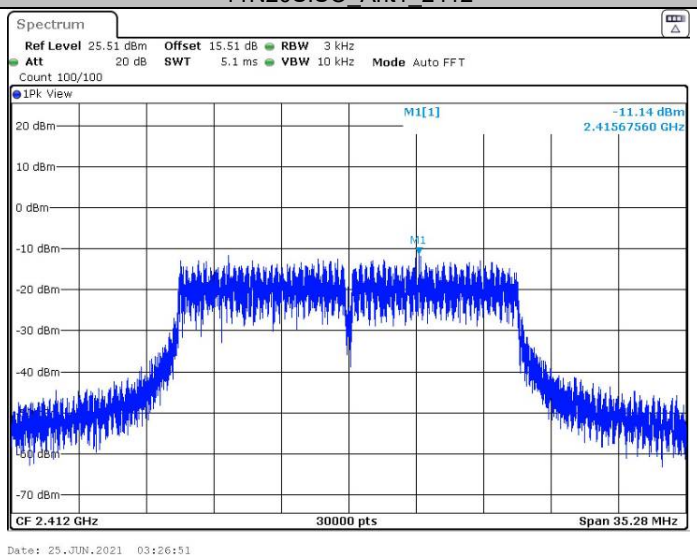
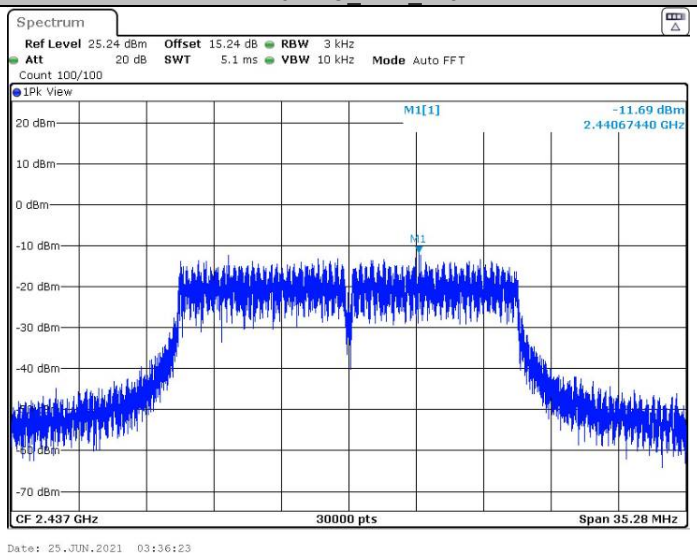
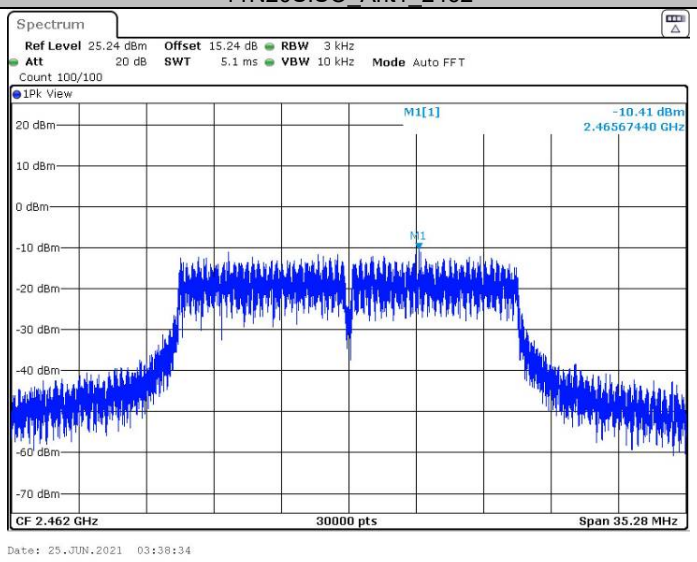


11N20SISO_Ant1_2437


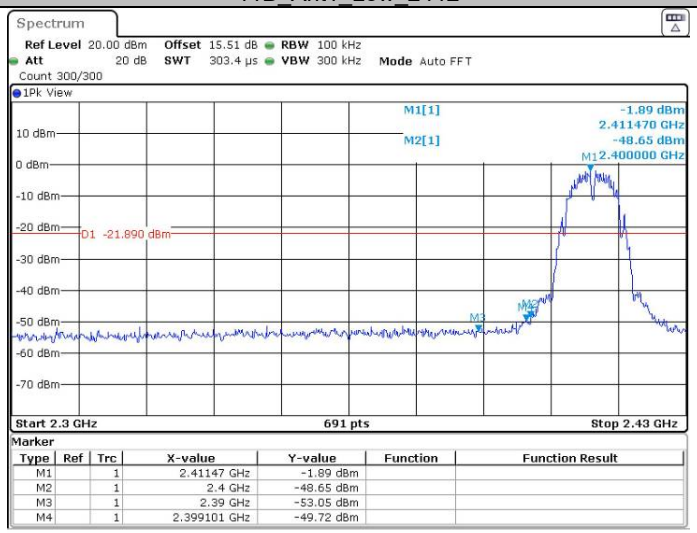
11N20SISO_Ant1_2462



Appendix E: Band edge measurements

Test Graphs

11B_Ant1_Low_2412



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41147 GHz	-1.89 dBm		
M2		1	2.4 GHz	-48.65 dBm		
M3		1	2.39 GHz	-53.05 dBm		
M4		1	2.399101 GHz	-49.72 dBm		

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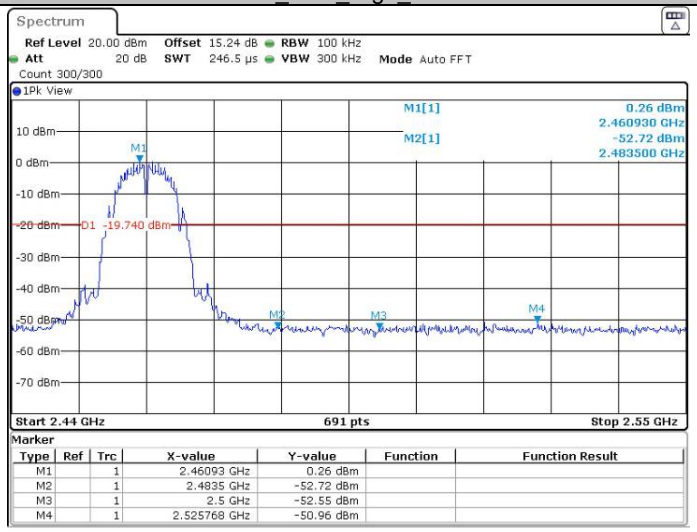
11B_Ant1_High_2462



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.46093 GHz	0.26 dBm		
M2		1	2.4835 GHz	-52.72 dBm		
M3		1	2.5 GHz	-52.55 dBm		
M4		1	2.525768 GHz	-50.96 dBm		

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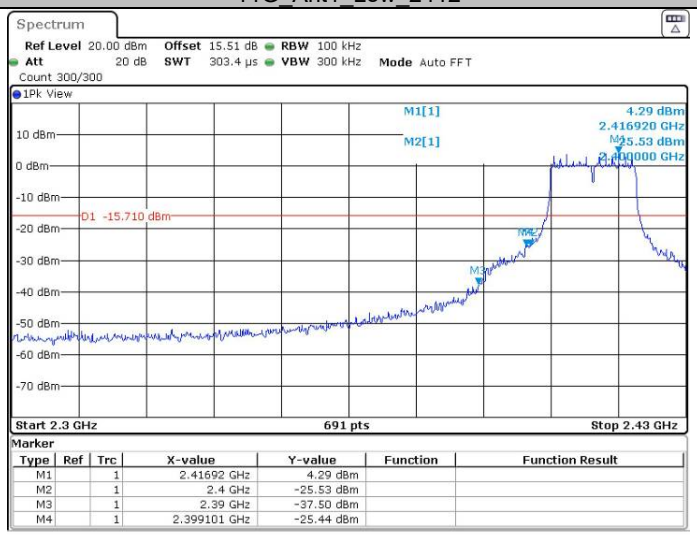
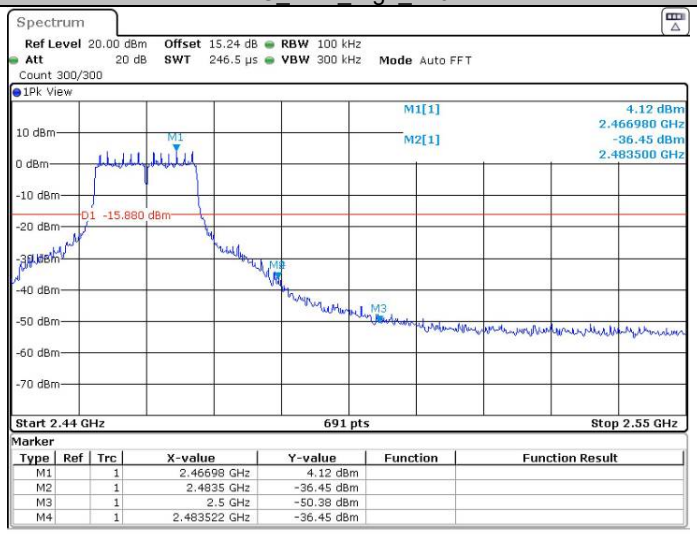
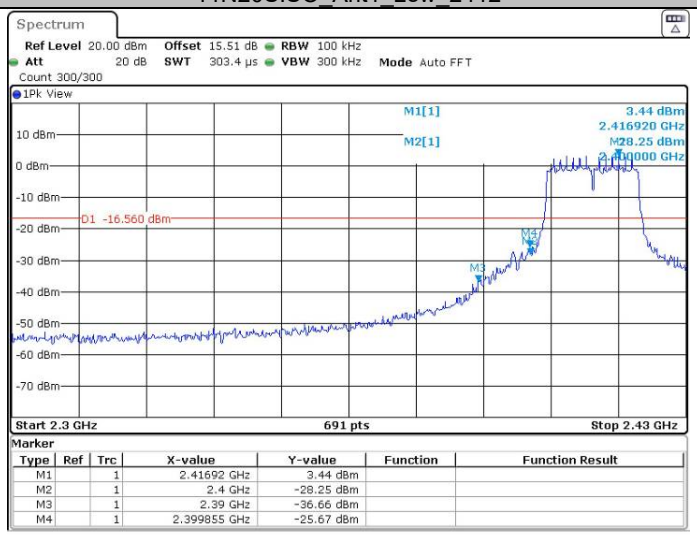
11G_Ant1_Low_2412



11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.41692 GHz	3.44 dBm		
M2		1	2.4 GHz	-28.25 dBm		
M3		1	2.39 GHz	-36.66 dBm		
M4		1	2.399855 GHz	-25.67 dBm		

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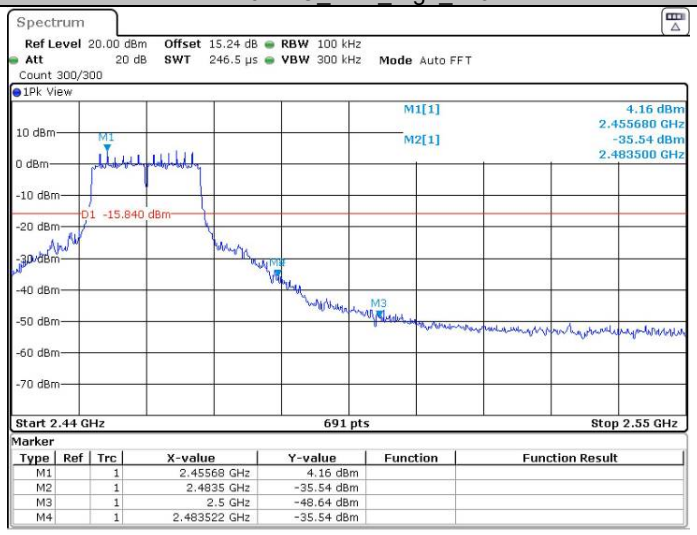
11N20SISO_Ant1_High_2462



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.45568 GHz	4.16 dBm		
M2		1	2.4835 GHz	-35.54 dBm		
M3		1	2.5 GHz	-48.64 dBm		
M4		1	2.483522 GHz	-35.54 dBm		

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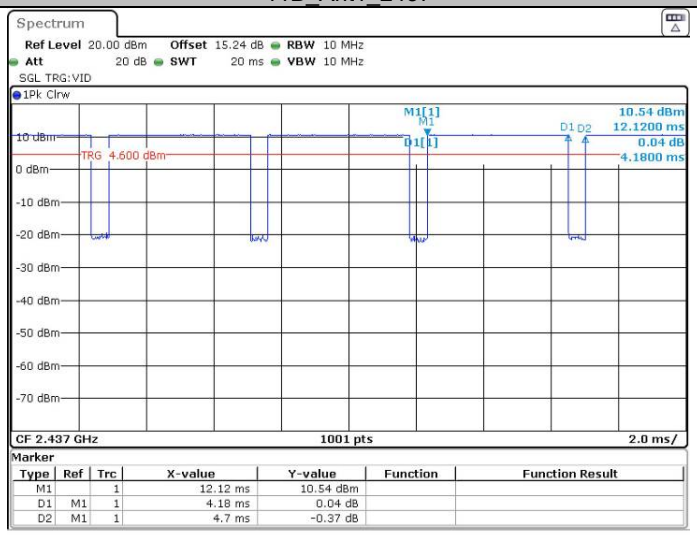
Appendix F: Duty Cycle

Test Result

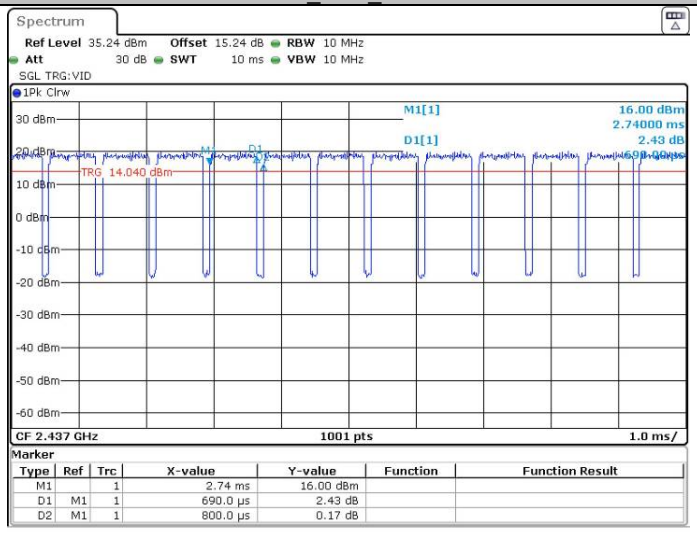
TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2437	4.18	4.70	88.94
11G	Ant1	2437	0.69	0.80	86.25
11N20	Ant1	2437	0.68	0.76	89.47

Test Graphs

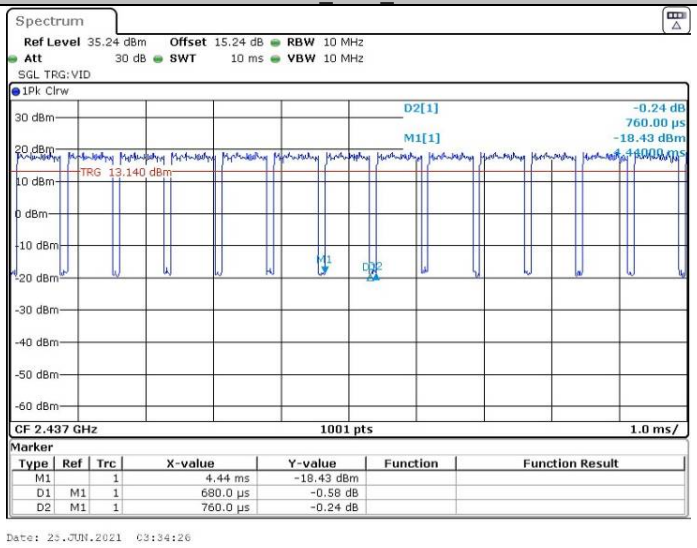
11B_Ant1_2437



11G_Ant1_2437



11N20_Ant1_2437



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