ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

Bay Area Compliance Labs Corp.

FCC PART 15.247

TEST REPORT

For

Swamcam LLC.

400 Rella Blvd, Ste 123-115, Montebello, New York 10901, United States

FCC ID: 2AYO8-SCCAM1

Report Type:	**Product Type:**
Original Report	camera

Report Number:	SZ1210201-03805E-00
Report Date:	2021-04-16
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

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	camera
Tested Model	SCCAM1
Frequency Range	Wi-Fi: 2412-2462 MHz/2422-2452 MHz ZigBee: 2405-2480 MHz
Maximum Conducted Peak Power	Wi-Fi: 14.75 dBm (802.11b), 15.72 dBm (802.11g), 13.25 dBm (802.11n-HT20), 12.99 dBm(802.11n-HT40) ZigBee: 5.44dBm
Modulation Technique	Wi-Fi: DSSS, OFDM ZigBee: OQPSK
Antenna Specification*	Wi-Fi: 3dBi ZigBee: 3dBi (provided by the applicant)
Voltage Range	DC 12V from adapter
Date of Test	2021-02-25 to 2021-04-16
Sample number	SZ1210201-03805E-RF-S1(Assigned by BACL, Shenzhen)
Received date	2021-02-01
Sample/EUT Status	Good condition
Adapter information	Model: JHD-AP024U-120200BA-B Input: AC 100-240V, 50/60Hz, 0.45A Output: DC 12V, 2000mA

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.

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 802.11n-HT40 mode, 7 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2422	6	2447
2	2427	7	2452
3	2432	/	/
4	2437	/	/
5	2442	/	/

EUT was tested with Channel 1, 4 and 7.

For ZigBee mode, 16 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	19	2445
12	2410	…	…
…	…	…	…
…	…	…	…
…	…	26	2480
18	2440	/	/

EUT was tested with Channel 11, 18 and 26.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"total control" software was used to configure Wi-Fi in engineering mode. For ZigBee mode, EUT has configured to test mode by manufacturer.

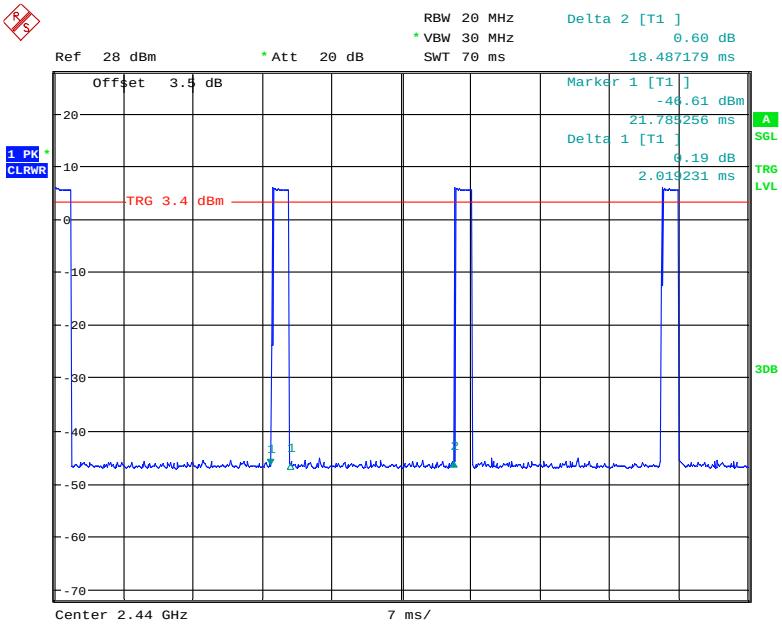
The device was tested with the worst case was performed as below:

Mode	Data rate	Power level*		
		Low channel	Middle channel	High channel
802.11b	1 Mbps	15	15	15
802.11g	6 Mbps	12	12	12
802.11n-HT20	6.5 Mbps	11	11	11
802.11n-HT40	6.5 Mbps	9	9	9
ZigBee	/	Default	Default	Default

Duty cycle

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

For ZigBee:



Mode	T_{on} (ms)	T_{on+off} (ms)	Duty Cycle (%)
ZigBee	2.02	18.49	10.92

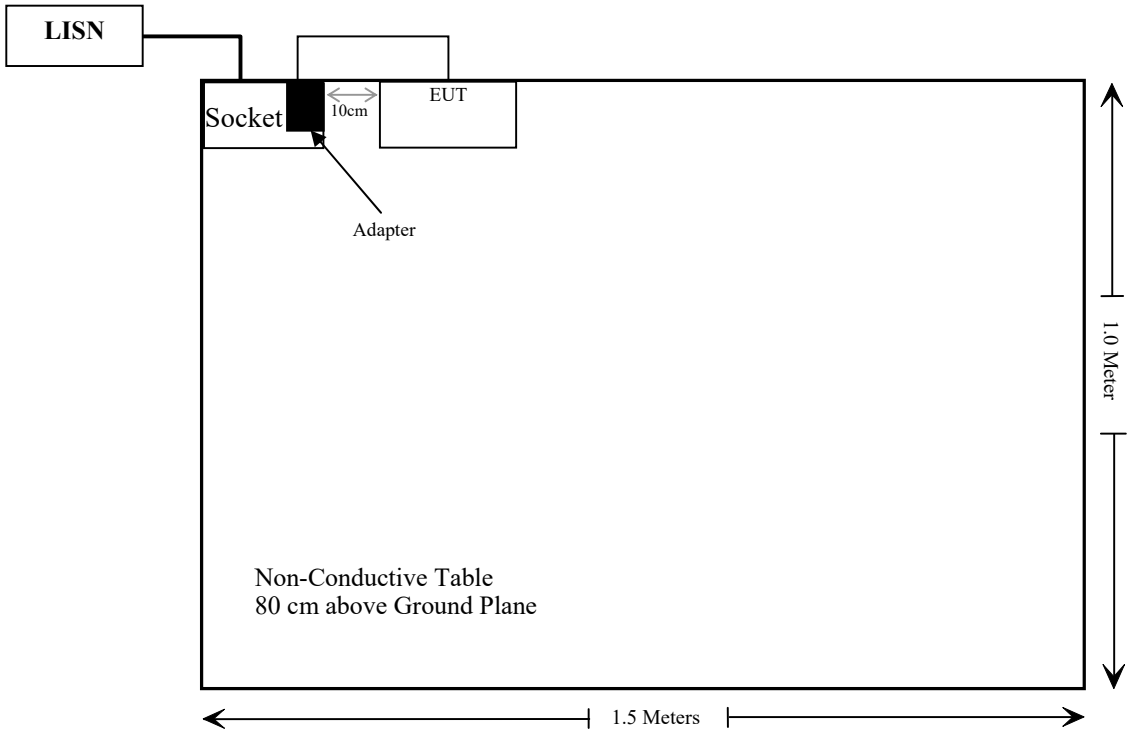
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
BULL	Socket	GN-212	A37209315081183

External I/O Cable

Cable Description	Length (m)	From Port	To
Unshielded Undetachable AC cable	1.0	Socket	LISN
Unshielded Undetachable DC cable	4.8	EUT	Adapter

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	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 1	F-03-EM236	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	2020/11/29	2021/11/28
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	2020/04/20	2021/04/20
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					
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
Unknown	RF Cable	Unknown	2301 276	2020/11/29	2021/11/28
WEINSCHEL	3dB Attenuator	Unknown	F-03-EM121	2020/11/29	2021/11/28
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200982	2020/08/04	2021/08/03

*** 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) & §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 simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

Mode	Frequency (MHz)	Antenna Gain		Max Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
ZigBee	2405-2480	3.0	2.0	5.5	3.55	20	0.0014	1
Wi-Fi	2412-2462	3.0	2.0	16.0	39.81	20	0.016	1

Note: 1. the tune up conducted power was declared by the applicant
2. the Wi-Fi can transmit at the same time with the Zigbee.

Simultaneous transmitting consideration:

The ratio=$MPE_{Wi\text{-}Fi}$/limit+MPE_{ZigBee}/limit=0.0014+0.016=0.0174＜1.0

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 two integral antennas arrangement, one for Wi-Fi and another for ZigBee, which were permanently attached, both antenna gain is 3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

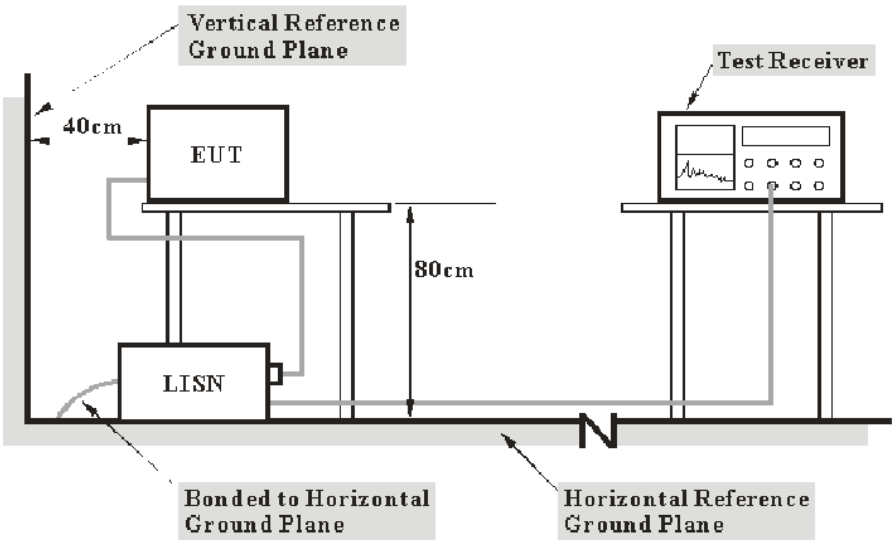
Result: Pass.

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

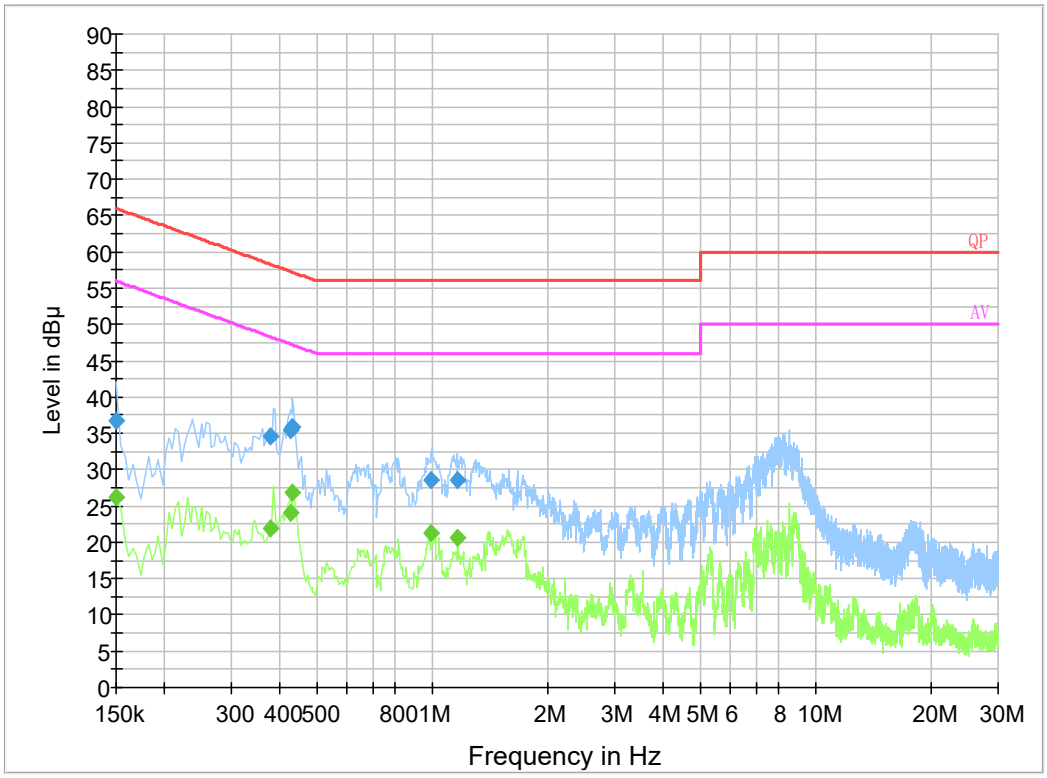
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2021-02-25.

EUT operation mode: Transmitting (Worst case: Wi-Fi 802.11g mode High channel)

AC 120V/60 Hz, Line



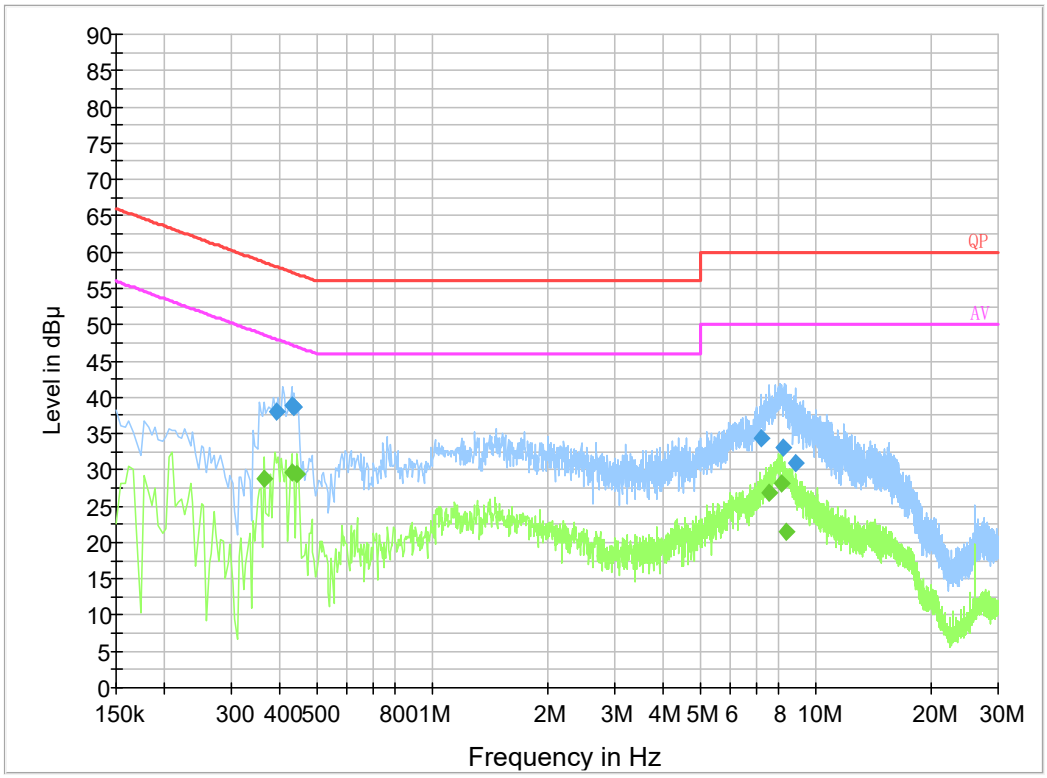
Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.150000	36.8	0.200	L1	19.8	29.2	66.0
0.380210	34.7	9.000	L1	19.9	23.6	58.3
0.427610	35.5	9.000	L1	19.9	21.8	57.3
0.431490	35.9	9.000	L1	19.8	21.3	57.2
0.990970	28.5	9.000	L1	19.9	27.5	56.0
1.160570	28.6	9.000	L1	19.8	27.4	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.150000	**26.2**	**9.000**	**L1**	**19.8**	**29.8**	**56.0**
0.380210	**22.0**	**9.000**	**L1**	**19.9**	**26.3**	**48.3**
0.427610	**24.0**	**9.000**	**L1**	**19.9**	**23.3**	**47.3**
0.431490	**26.8**	**9.000**	**L1**	**19.8**	**20.4**	**47.2**
0.990970	**21.2**	**9.000**	**L1**	**19.9**	**24.8**	**46.0**
1.160570	**20.7**	**9.000**	**L1**	**19.8**	**25.3**	**46.0**

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)
0.391790	38.0	9.000	N	19.8	20.0	58.0
0.431550	38.9	9.000	N	19.8	18.3	57.2
0.435430	38.8	9.000	N	19.8	18.3	57.1
7.201250	34.4	9.000	N	19.9	25.6	60.0
8.225350	33.1	9.000	N	19.9	26.9	60.0
8.844410	31.0	9.000	N	19.9	29.0	60.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.366000	28.8	9.000	N	19.9	19.8	48.6
0.430000	29.6	9.000	N	19.8	17.7	47.3
0.446000	29.4	9.000	N	19.8	17.5	46.9
7.562000	26.9	9.000	N	19.9	23.1	50.0
8.158000	28.2	9.000	N	19.9	21.8	50.0
8.430000	21.6	9.000	N	19.9	28.4	50.0

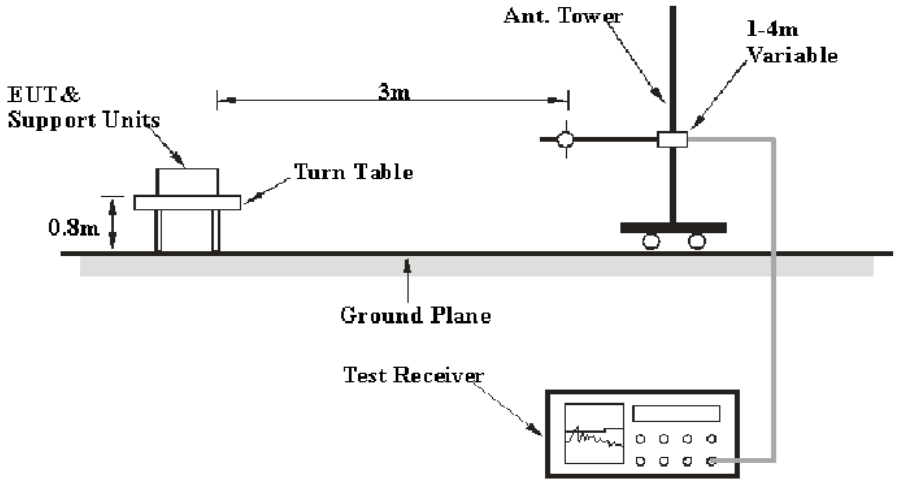
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

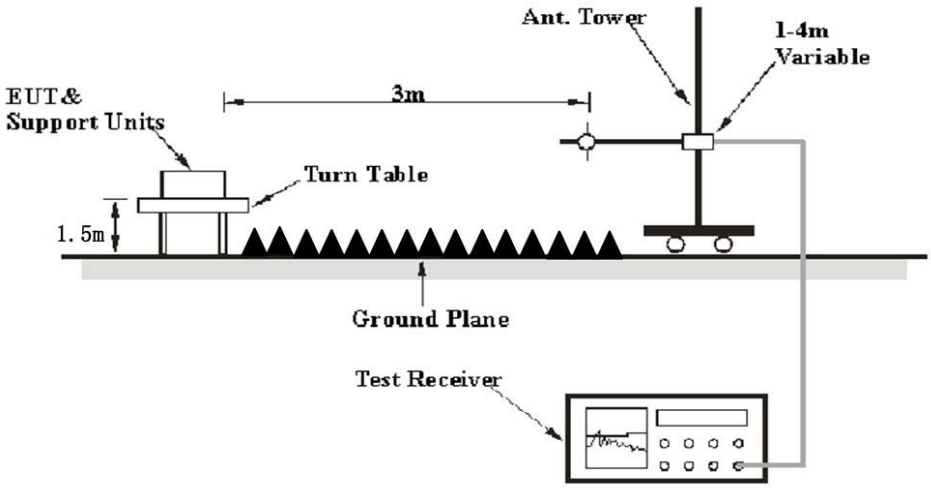
FCC §15.247 (d); §15.209; §15.205;

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.

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

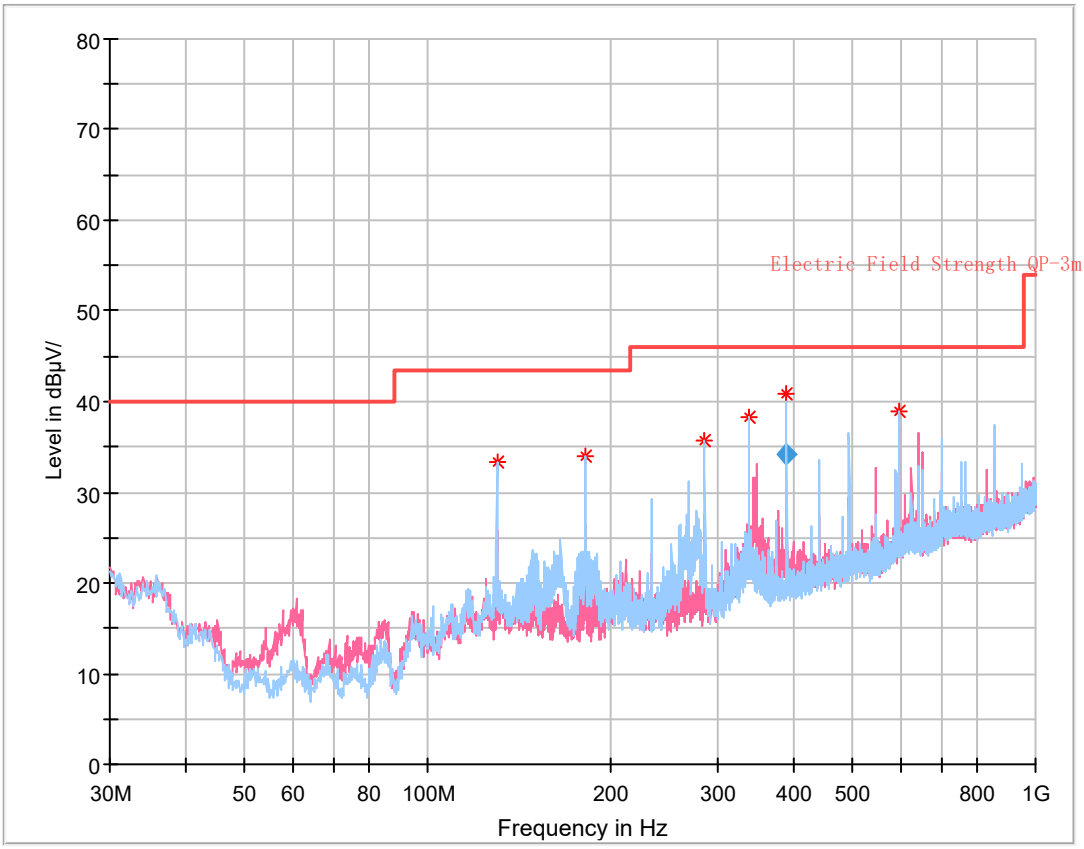
Temperature:	23.4~24.1 ℃
Relative Humidity:	44~53 %
ATM Pressure:	101.0~101.1 kPa

The testing was performed by Andy Yu on 2021-04-08 for below 1GHz and Troy Wang and Alan He from 2021-03-02 to 2021-03-03 for above 1GHz.

EUT operation mode: Transmitting.

30 MHz~1 GHz (Wi-Fi 802.11g mode, High channel was worst case):

For Wifi:



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
389.994625	34.18	46.00	11.82	145.0	H	123.0	-7.6

Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ	Limit (dB µ	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
129.910000	33.26	43.50	10.24	300.0	H	92.0	-10.3	16:21:22 - 2021/4/8
181.926250	33.92	43.50	9.58	100.0	H	53.0	-12.2	16:21:26 - 2021/4/8
285.958750	35.71	46.00	10.29	100.0	H	248.0	-10.5	16:21:45 - 2021/4/8
337.975000	38.23	46.00	7.77	100.0	H	86.0	-9.1	16:21:32 - 2021/4/8
389.994625	40.77	46.00	5.23	144.0	H	123.0	-7.6	16:20:33 - 2021/4/8
597.935000	38.86	46.00	7.14	300.0	H	81.0	-3.1	16:21:39 - 2021/4/8

Note: the QP measurement not performed when the PK level is more than 6dB lower than limit.

1 GHz-25 GHz (Wi-Fi):

802.11b Mode:

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 (2412 MHz)									
2387.67	28.92	PK	144	2.3	H	31.87	60.79	74	13.21
2387.67	13.55	Ave.	144	2.3	H	31.87	45.42	54	8.58
2486.18	28.25	PK	240	1.7	H	32.13	60.38	74	13.62
2486.18	13.60	Ave.	240	1.7	H	32.13	45.73	54	8.27
4824.00	42.88	PK	354	2.5	H	6.28	49.16	74	24.84
4824.00	28.32	Ave.	354	2.5	H	6.28	34.60	54	19.40
Middle Channel (2437 MHz)									
4874.00	42.55	PK	159	1.1	H	6.76	49.31	74	24.69
4874.00	28.05	Ave.	159	1.1	H	6.76	34.81	54	19.19
High Channel (2462 MHz)									
2388.61	28.27	PK	250	1.5	H	31.87	60.14	74	13.86
2388.61	13.56	Ave.	250	1.5	H	31.87	45.43	54	8.57
2484.23	28.15	PK	97	2.1	H	32.13	60.28	74	13.72
2484.23	13.79	Ave.	97	2.1	H	32.13	45.92	54	8.08
4924.00	42.86	PK	239	2.4	H	6.76	49.62	74	24.38
4924.00	28.52	Ave.	239	2.4	H	6.76	35.28	54	18.72

802.11g Mode:

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 (2412 MHz)									
2389.26	28.23	PK	268	1.3	H	31.87	60.10	74	13.90
2389.26	14.05	Ave.	268	1.3	H	31.87	45.92	54	8.08
2484.23	28.17	PK	235	1.7	H	32.13	60.30	74	13.70
2484.23	14.08	Ave.	235	1.7	H	32.13	46.21	54	7.79
4824.00	42.94	PK	247	2.1	H	6.28	49.22	74	24.78
4824.00	28.95	Ave.	247	2.1	H	6.28	35.23	54	18.77
Middle Channel (2437 MHz)									
4874.00	42.87	PK	182	1.5	H	6.76	49.63	74	24.37
4874.00	28.89	Ave.	182	1.5	H	6.76	35.65	54	18.35
High Channel (2462 MHz)									
2387.45	28.25	PK	59	1.3	H	31.87	60.12	74	13.88
2387.45	14.08	Ave.	59	1.3	H	31.87	45.95	54	8.05
2484.23	28.15	PK	338	1.7	H	32.13	60.28	74	13.72
2484.23	14.23	Ave.	338	1.7	H	32.13	46.36	54	7.64
4924.00	43.02	PK	340	1.8	H	6.76	49.78	74	24.22
4924.00	29.06	Ave.	340	1.8	H	6.76	35.82	54	18.18

802.11n-HT20 Mode:

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 (2412 MHz)									
2387.35	28.20	PK	296	1.6	H	31.87	60.07	74	13.93
2387.35	14.12	Ave.	296	1.6	H	31.87	45.99	54	8.01
2485.61	28.19	PK	11	1.7	H	32.13	60.32	74	13.68
2485.61	14.13	Ave.	11	1.7	H	32.13	46.26	54	7.74
4824.00	42.81	PK	176	2.2	H	6.28	49.09	74	24.91
4824.00	29.05	Ave.	176	2.2	H	6.28	35.33	54	18.67
Middle Channel (2437 MHz)									
4874.00	42.58	PK	63	1.9	H	6.76	49.34	74	24.66
4874.00	29.02	Ave.	63	1.9	H	6.76	35.78	54	18.22
High Channel (2462 MHz)									
2389.25	28.24	PK	205	1.2	H	31.87	60.11	74	13.89
2389.25	14.10	Ave.	205	1.2	H	31.87	45.97	54	8.03
2485.39	28.31	PK	291	2.5	H	32.13	60.44	74	13.56
2485.39	14.24	Ave.	291	2.5	H	32.13	46.37	54	7.63
4924.00	42.35	PK	333	1.3	H	6.76	49.11	74	24.89
4924.00	29.11	Ave.	333	1.3	H	6.76	35.87	54	18.13

802.11n-HT40 Mode:

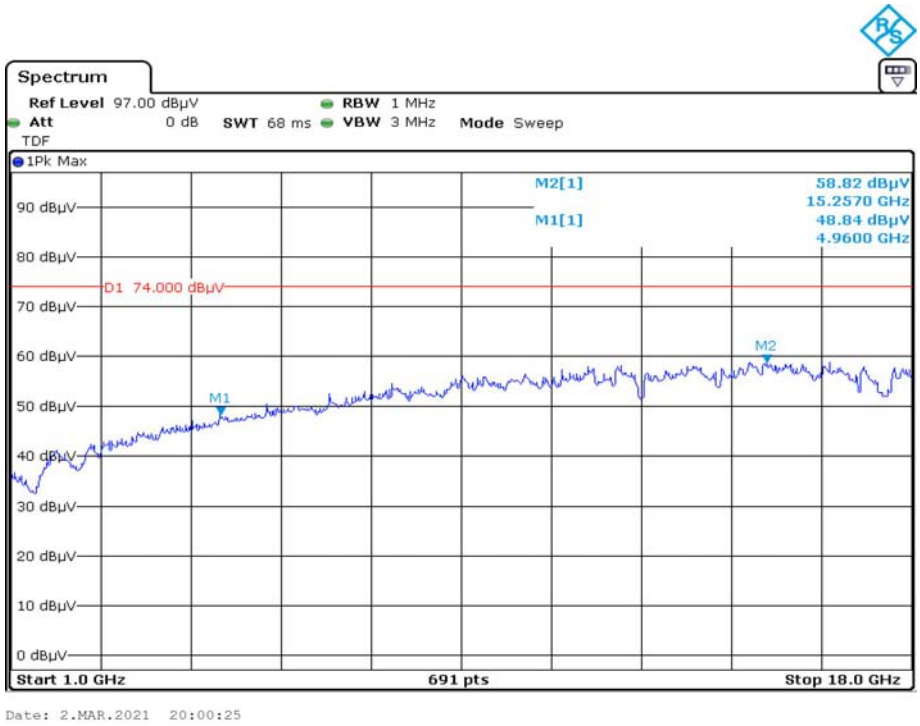
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2422 MHz)									
2387.34	28.23	PK	356	1.8	H	31.87	60.10	74	13.90
2387.34	14.84	Ave.	356	1.8	H	31.87	46.71	54	7.29
2484.28	28.15	PK	288	1.7	H	32.13	60.28	74	13.72
2484.28	14.81	Ave.	288	1.7	H	32.13	46.94	54	7.06
4844.00	42.78	PK	347	2.1	H	6.28	49.06	74	24.94
4844.00	29.25	Ave.	347	2.1	H	6.28	35.53	54	18.47
Middle Channel (2437 MHz)									
4874.00	42.70	PK	148	1.9	H	6.76	49.46	74	24.54
4874.00	29.28	Ave.	148	1.9	H	6.76	36.04	54	17.96
High Channel (2452 MHz)									
2389.13	28.25	PK	42	2.0	H	31.87	60.12	74	13.88
2389.13	14.83	Ave.	42	2.0	H	31.87	46.70	54	7.30
2483.65	28.75	PK	287	1.9	H	32.13	60.88	74	13.12
2483.65	15.43	Ave.	287	1.9	H	32.13	47.56	54	6.44
4904.00	42.75	PK	71	1.4	H	6.76	49.51	74	24.49
4904.00	29.31	Ave.	71	1.4	H	6.76	36.07	54	17.93

1 GHz-25 GHz (ZigBee):

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 (2405 MHz)									
2389.25	29.12	PK	75	1.1	H	31.87	60.99	74	13.01
2389.25	13.51	Ave.	75	1.1	H	31.87	45.38	54	8.62
2484.52	28.85	PK	66	2.5	H	32.13	60.98	74	13.02
2484.52	13.47	Ave.	66	2.5	H	32.13	45.60	54	8.40
4810.00	44.51	PK	323	2.5	H	6.28	50.79	74	23.21
4810.00	31.02	Ave.	323	2.5	H	6.28	37.30	54	16.70
Middle Channel (2440 MHz)									
4880.00	44.18	PK	240	1.9	H	6.76	50.94	74	23.06
4880.00	31.15	Ave.	240	1.9	H	6.76	37.91	54	16.09
High Channel (2480 MHz)									
2388.37	28.97	PK	346	1.5	H	31.87	60.84	74	13.16
2388.37	13.48	Ave.	346	1.5	H	31.87	45.35	54	8.65
2483.52	28.95	PK	21	2.0	H	32.13	61.08	74	12.92
2483.52	13.61	Ave.	21	2.0	H	32.13	45.74	54	8.26
4960.00	44.62	PK	136	1.3	H	6.80	51.42	74	22.58
4960.00	32.34	Ave.	136	1.3	H	6.80	39.14	54	14.86

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.

Pre-scan with ZigBee High channel
Horizontal



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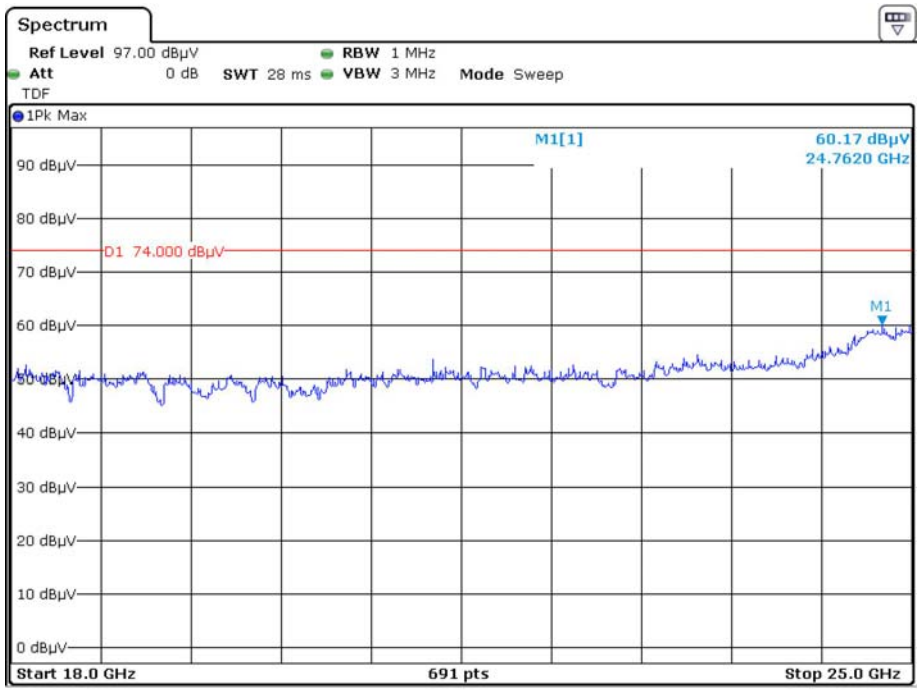
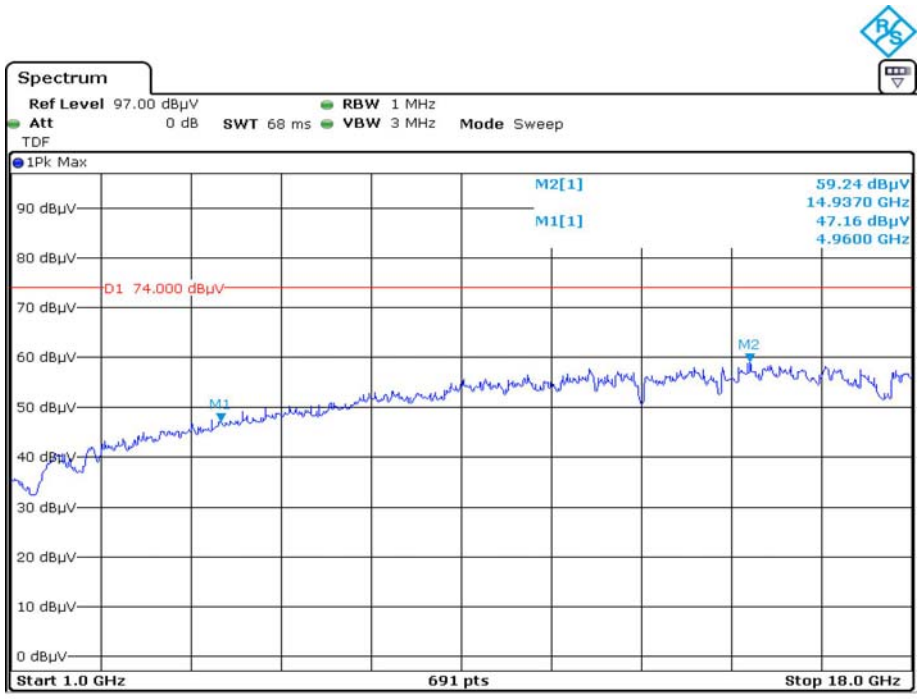


Date: 2.MAR.2021 20:47:59

Vertical



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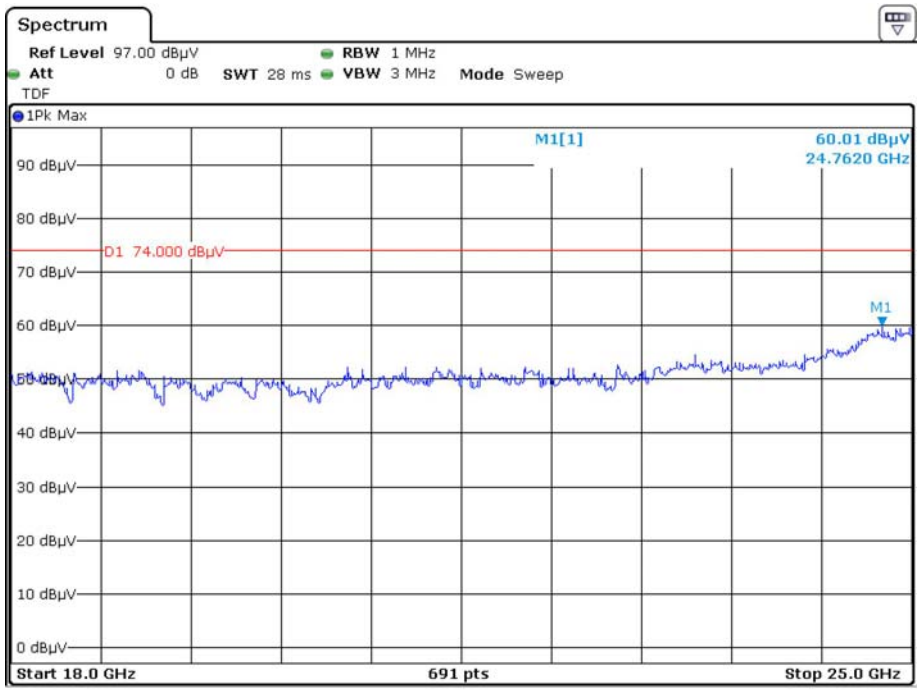
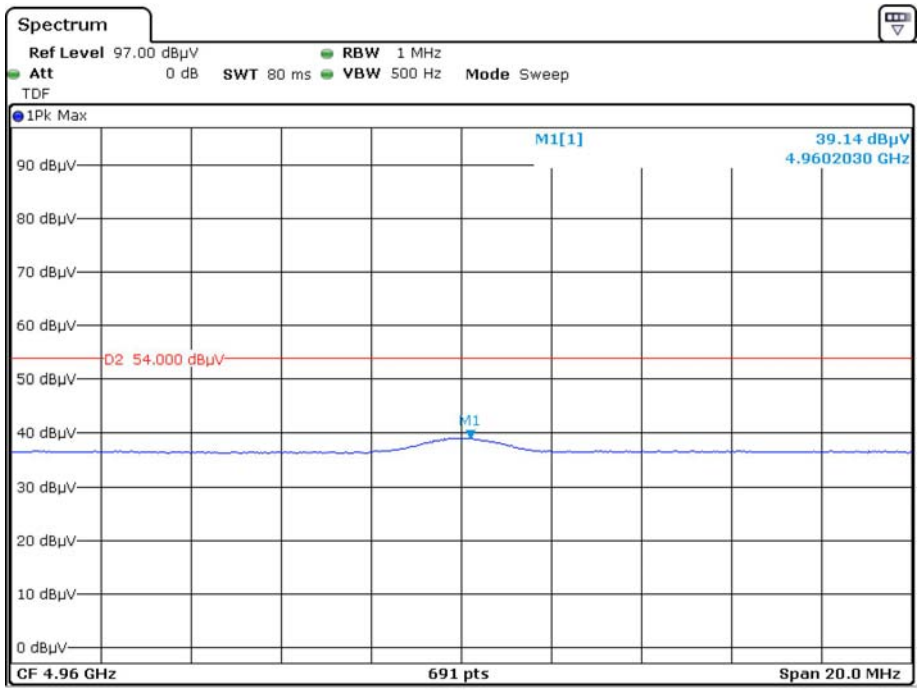
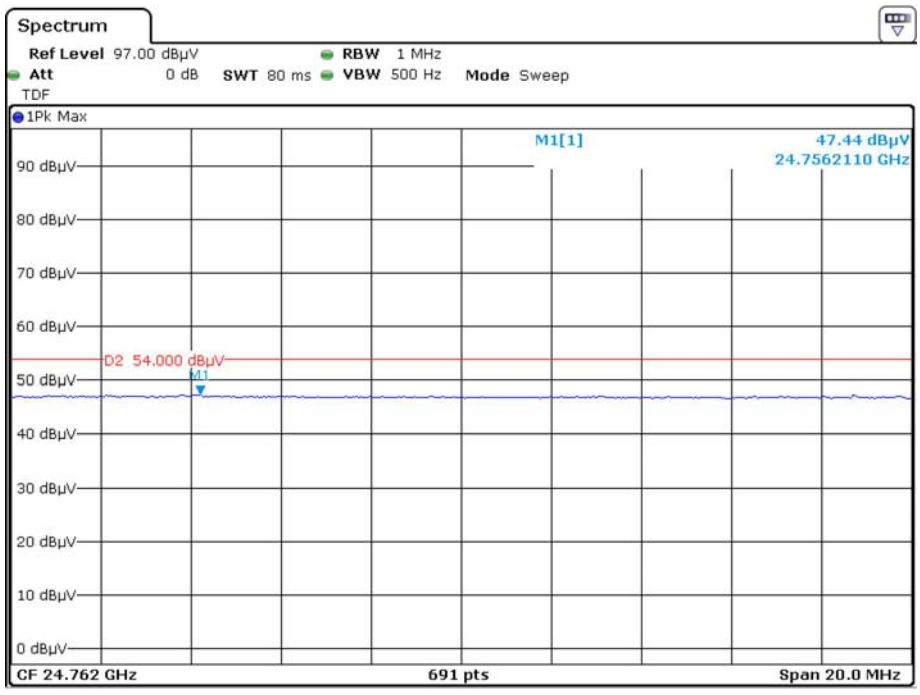


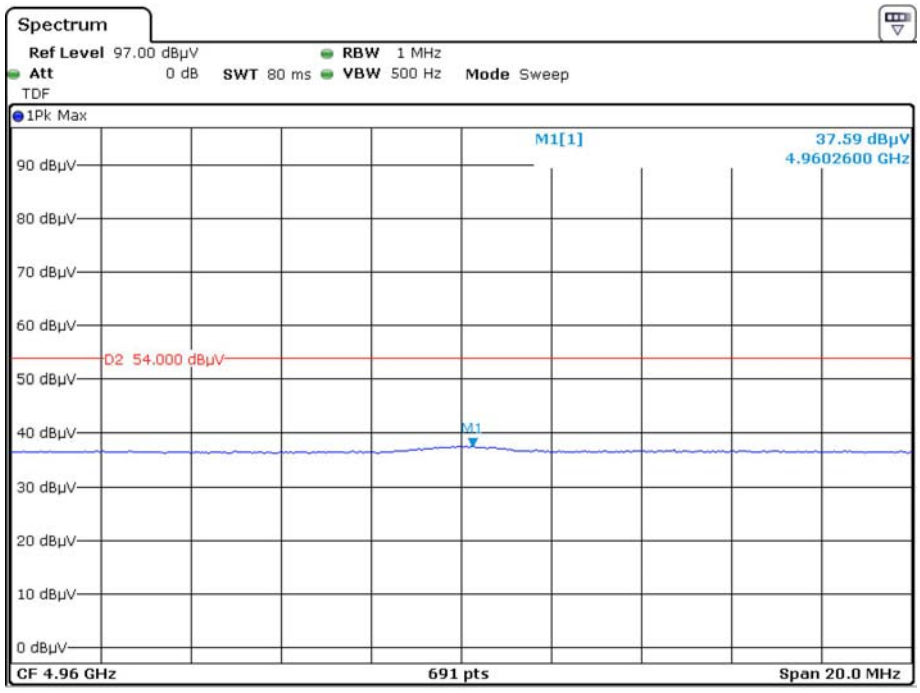
Date: 2.MAR.2021 20:57:02

Average
Horizontal





Vertical



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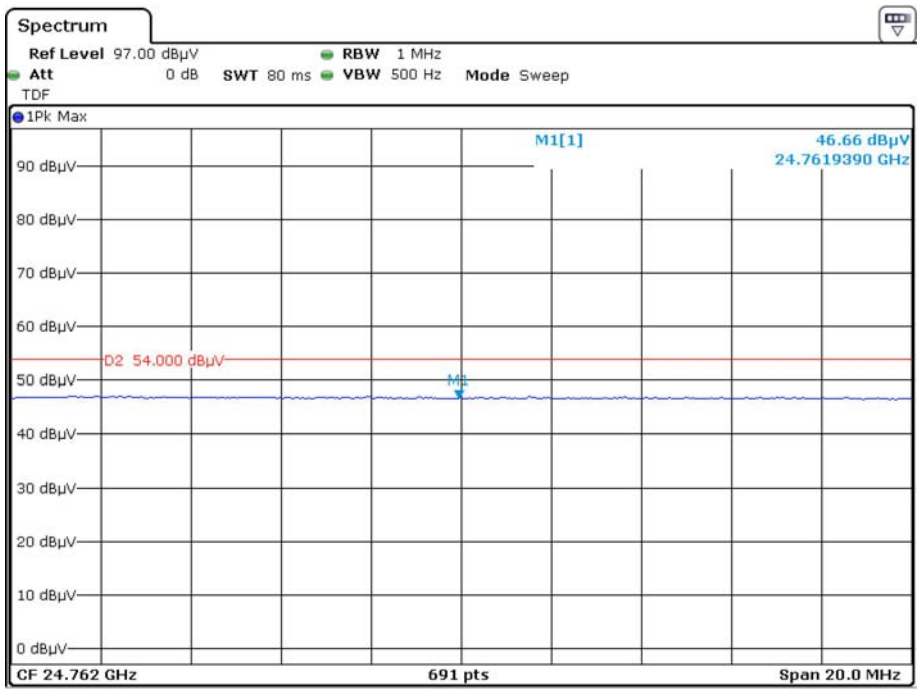


Date: 2.MAR.2021 21:01:23

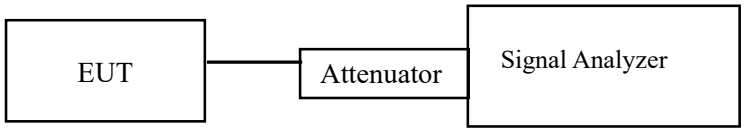
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH

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:	23~25 ℃
Relative Humidity:	54~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2021-02-25 to 2021-03-03.

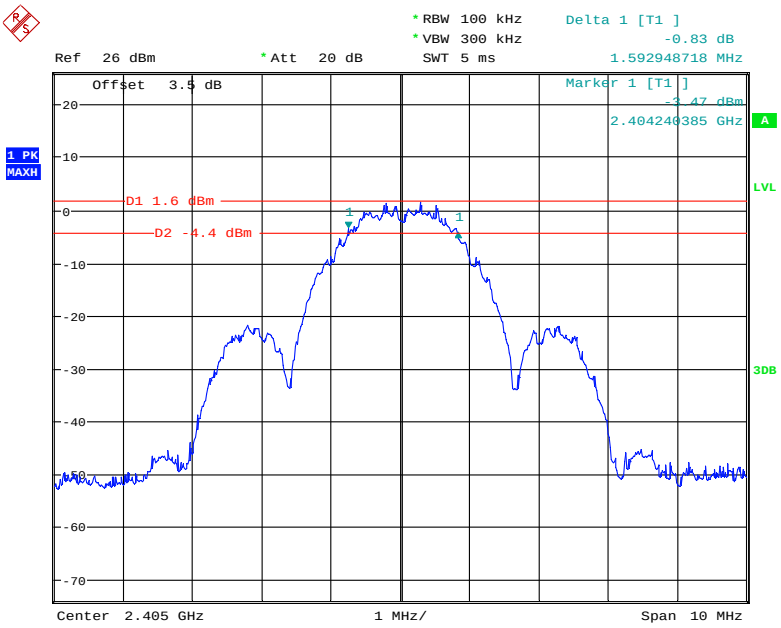
EUT operation mode: Transmitting

Test Result Compliant. The data of Wi-Fi please refer to the Appendix.

The data of ZigBee as below:

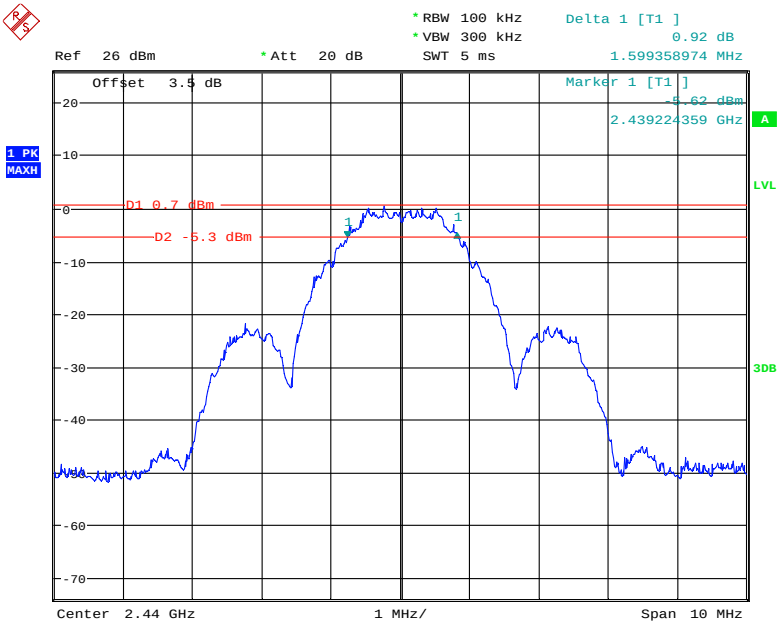
Frequency (MHz)	DTS BW (MHz)	Limit (kHz)	Verdict
2405	1.593	≥500	PASS
2440	1.599	≥500	PASS
2480	1.625	≥500	PASS

Low channel



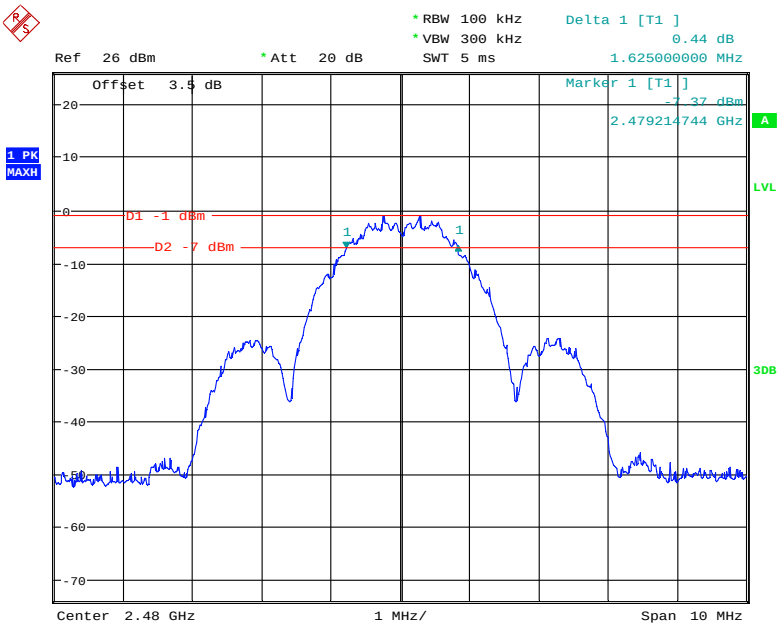
Date: 25.FEB.2021 10:32:56

Middle channel



Date: 25.FEB.2021 10:35:11

High channel



Date: 25.FEB.2021 10:31:28

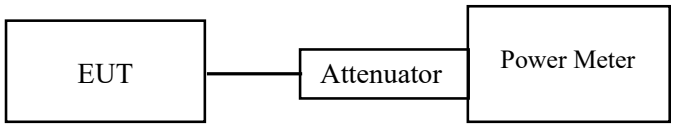
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

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:	23~25 ℃
Relative Humidity:	54~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2021-03-03 to 2021-03-13.

EUT operation mode: Transmitting

Test Result Compliant. The data of Wi-Fi please refer to the Appendix.

The data of ZigBee as below:

Frequency (MHz)	Conducted Peak Output Power (dBm)	Limit (dBm)	Verdict
2405	5.44	<=30	PASS
2440	4.06	<=30	PASS
2480	2.69	<=30	PASS

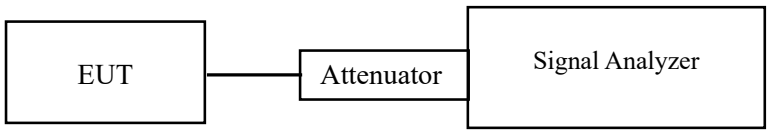
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

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:	23~24 ℃
Relative Humidity:	54~55 %
ATM Pressure:	101.0 kPa

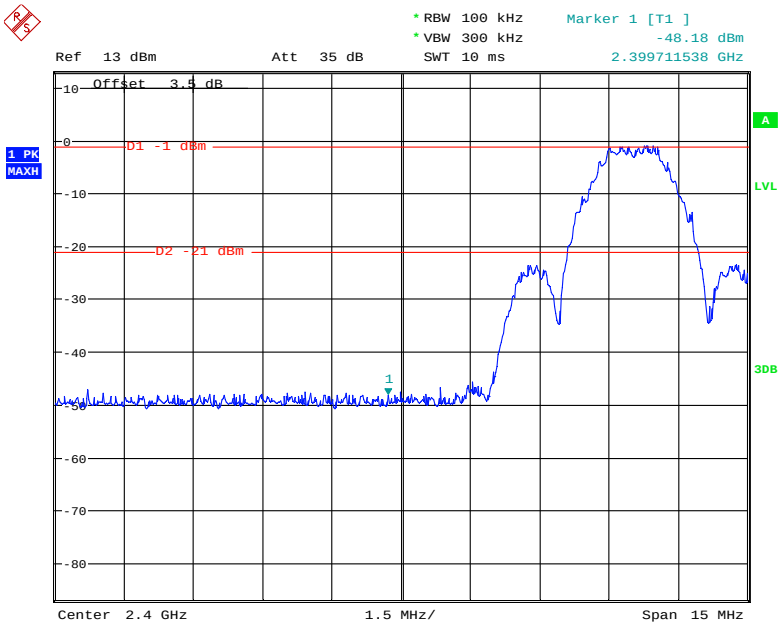
The testing was performed by Bravos Zhao from 2021-03-03 to 2021-04-16.

EUT operation mode: Transmitting

Test Result Compliant. The data of Wi-Fi please refer to the Appendix.

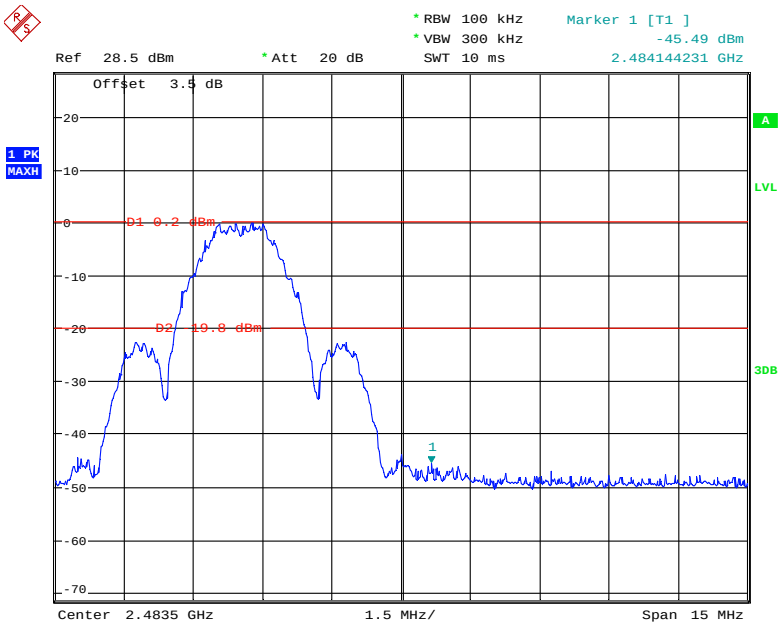
The data of ZigBee as below:

Band Edge, Left Side



Date: 9.MAR.2021 15:38:32

Band Edge, Right Side



Date: 16.APR.2021 18:32:38

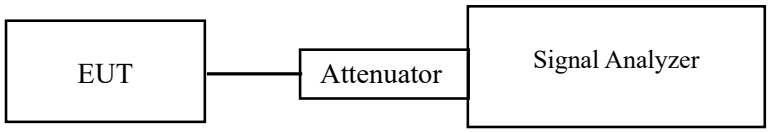
FCC §15.247(e) - POWER SPECTRAL DENSITY

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:	23~25 ℃
Relative Humidity:	54~57 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2021-03-03 to 2021-03-09.

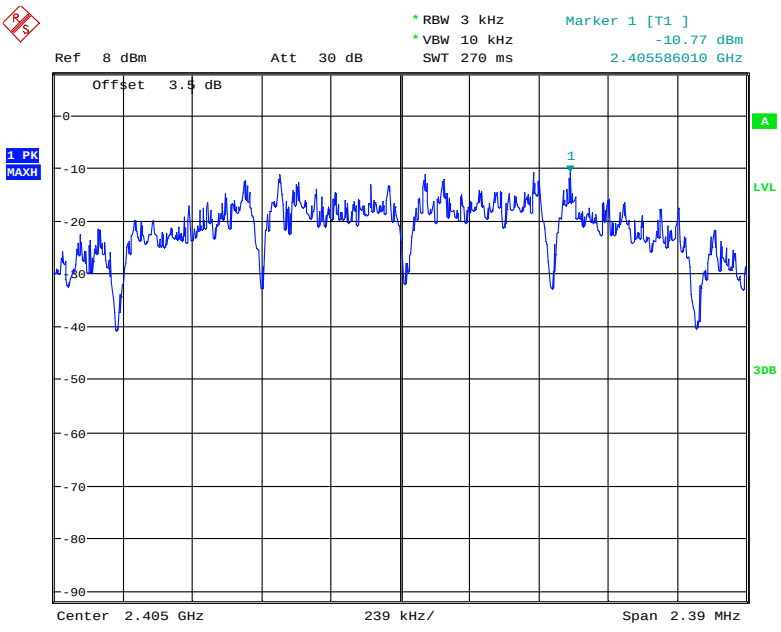
EUT operation mode: Transmitting

Test Result Compliant. The data of Wi-Fi please refer to the Appendix.

The data of ZigBee as below:

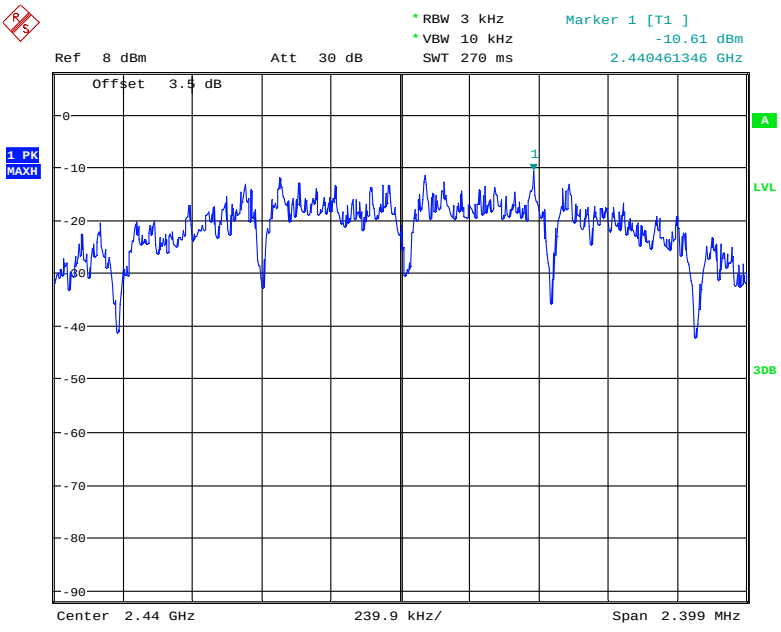
Frequency (MHz)	Result (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
2405	-10.77	≤8	PASS
2440	-10.61	≤8	PASS
2480	-11.09	≤8	PASS

Low channel



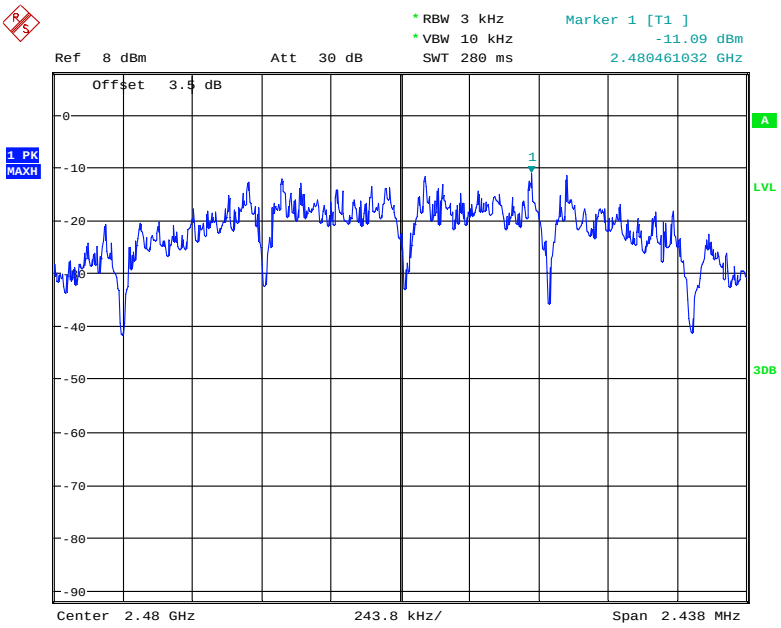
Date: 9.MAR.2021 15:37:18

Middle channel



Date: 9.MAR.2021 15:34:08

High channel



Date: 9.MAR.2021 15:35:41

APPENDIX

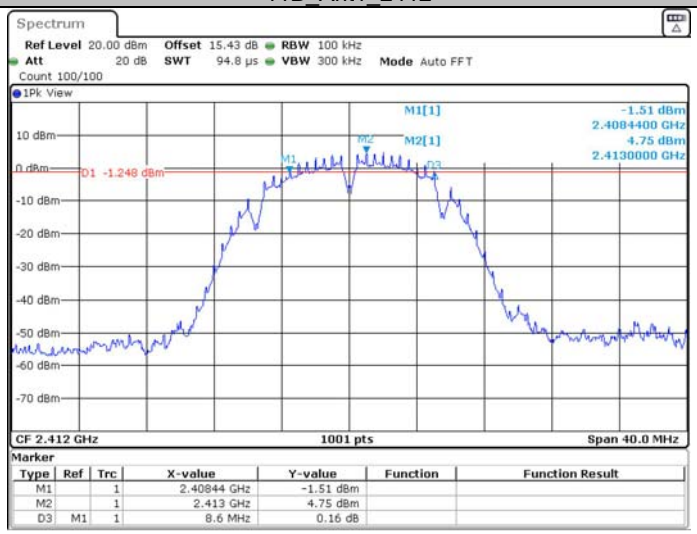
Appendix A: DTS Bandwidth

Test Result

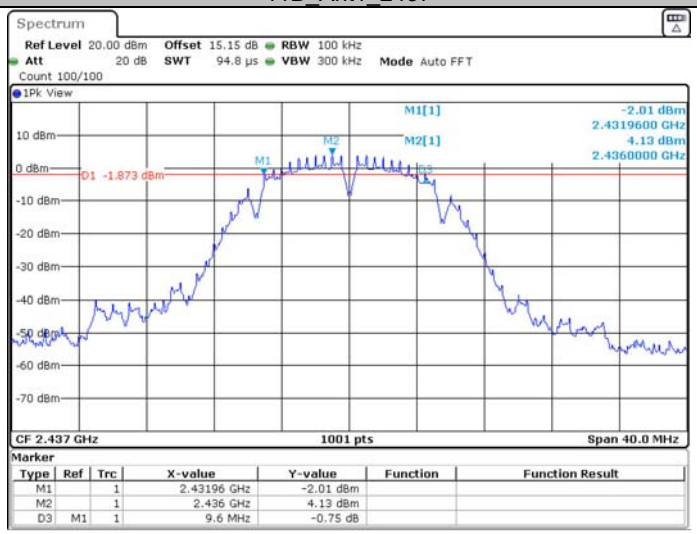
TestMode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.600	0.5	PASS
		2437	9.600	0.5	PASS
		2462	9.640	0.5	PASS
11G	Ant1	2412	15.760	0.5	PASS
		2437	16.200	0.5	PASS
		2462	14.560	0.5	PASS
11N20SISO	Ant1	2412	16.400	0.5	PASS
		2437	17.640	0.5	PASS
		2462	16.400	0.5	PASS
11N40SISO	Ant1	2422	30.240	0.5	PASS
		2437	35.920	0.5	PASS
		2452	34.560	0.5	PASS

Test Graphs

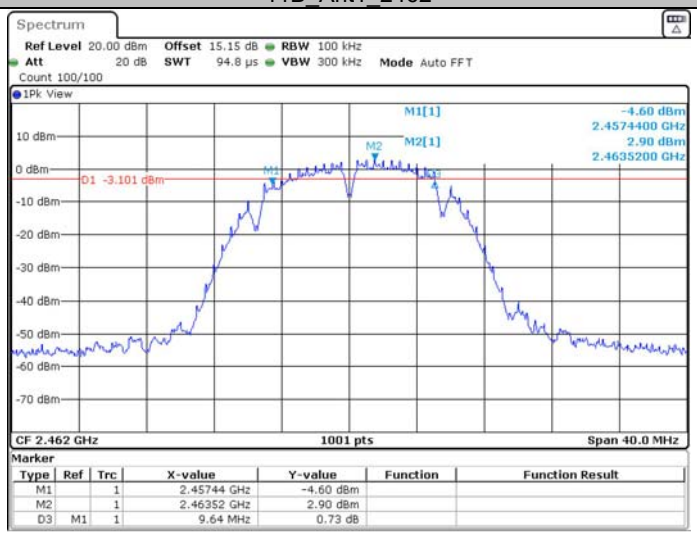
11B_Ant1_2412



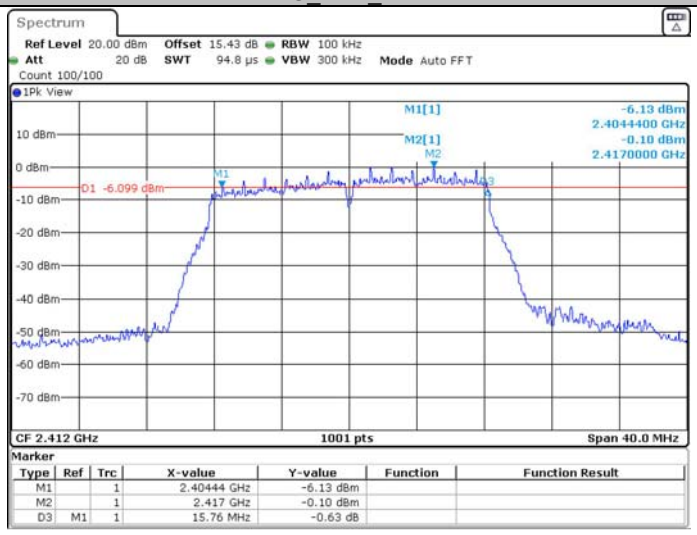
11B_Ant1_2437



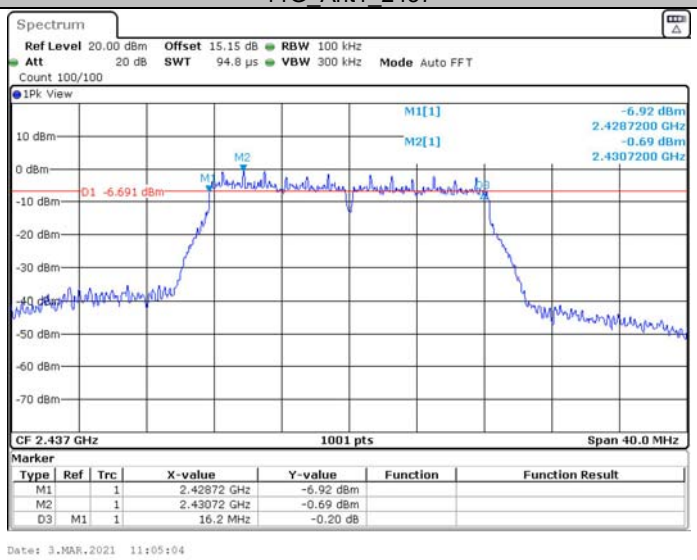
11B_Ant1_2462



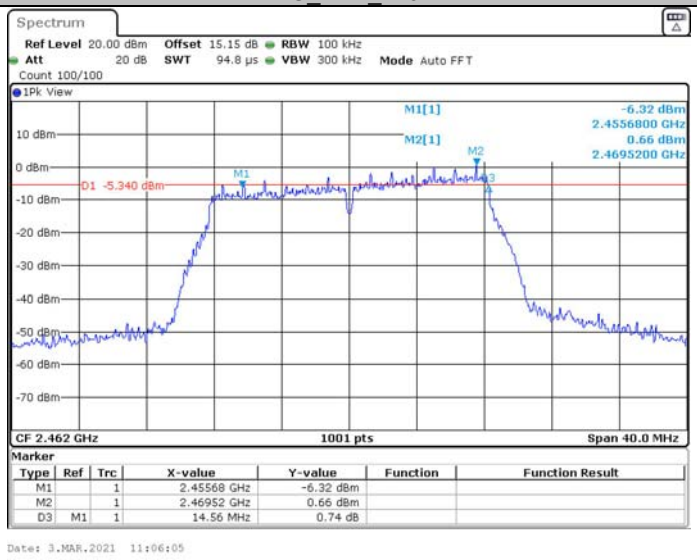
11G_Ant1_2412



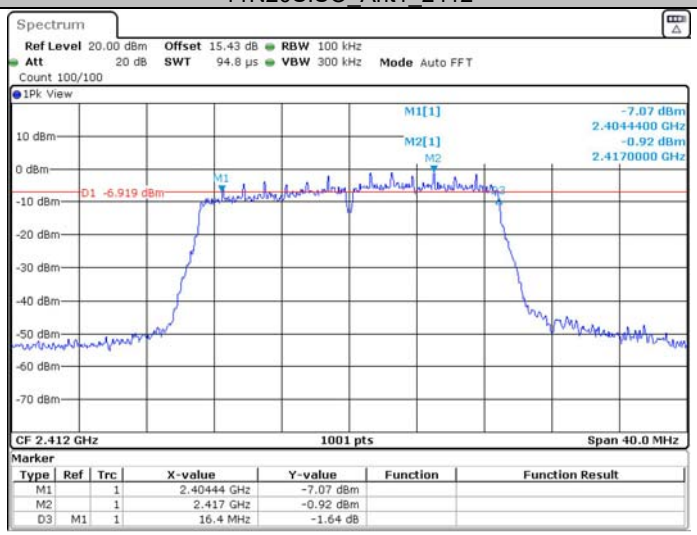
11G_Ant1_2437



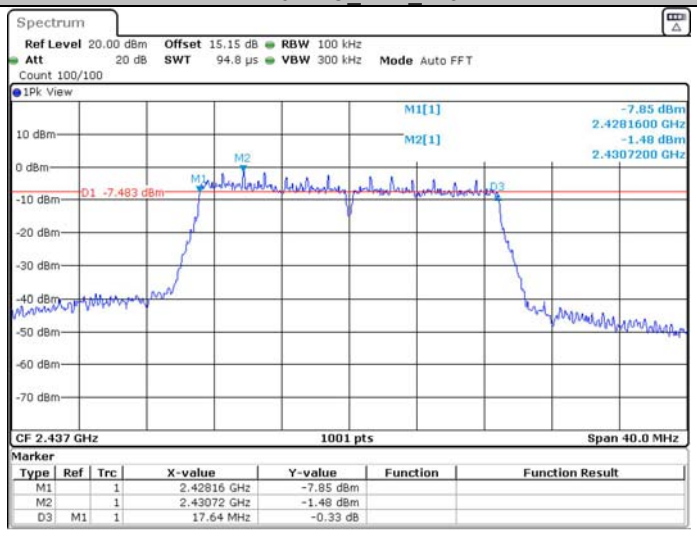
11G_Ant1_2462



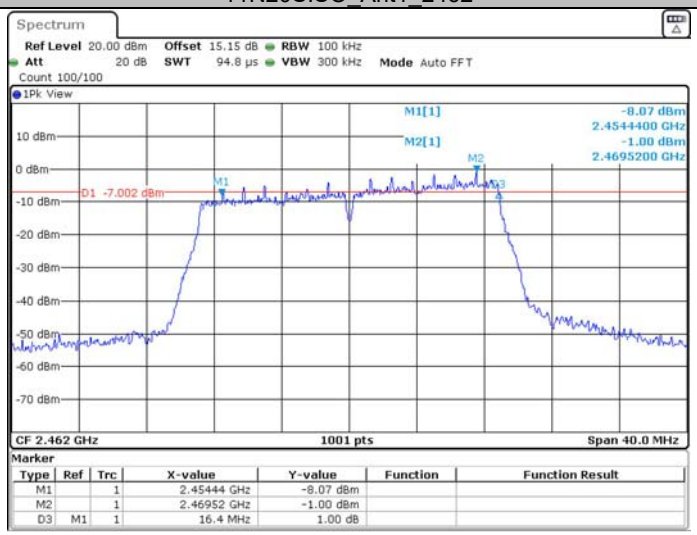
11N20SISO_Ant1_2412



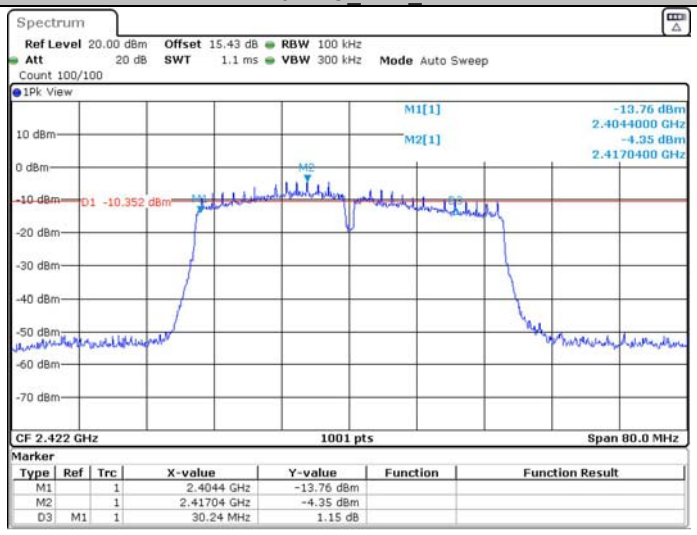
11N20SISO_Ant1_2437



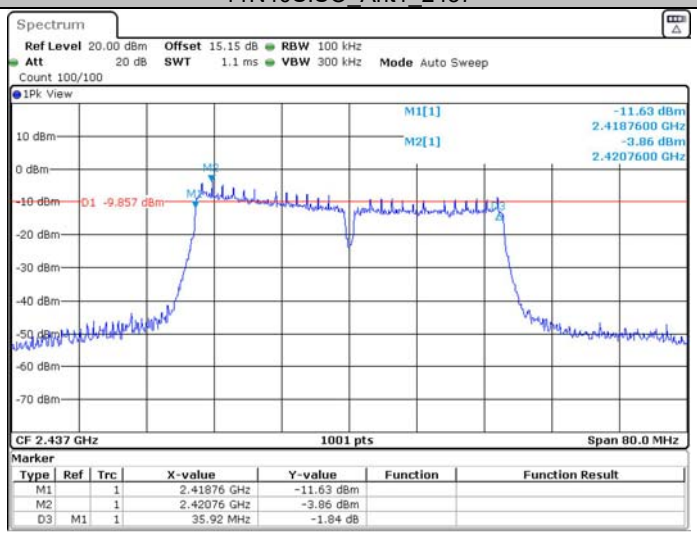
11N20SISO_Ant1_2462



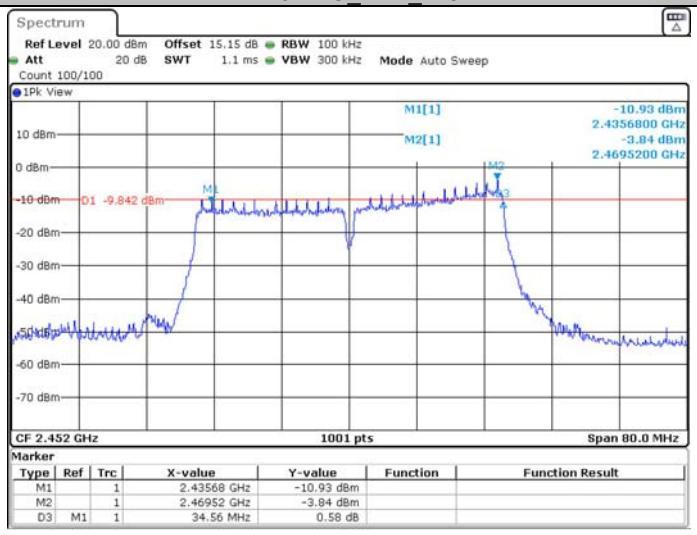
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



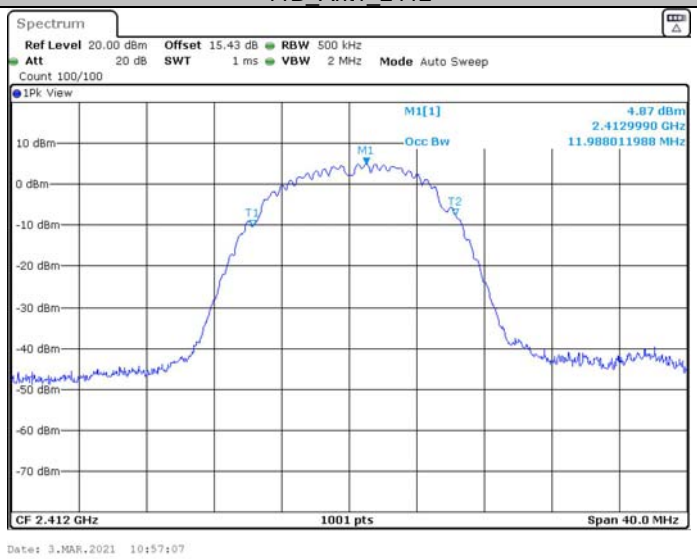
Appendix B: Occupied Channel Bandwidth

Test Result

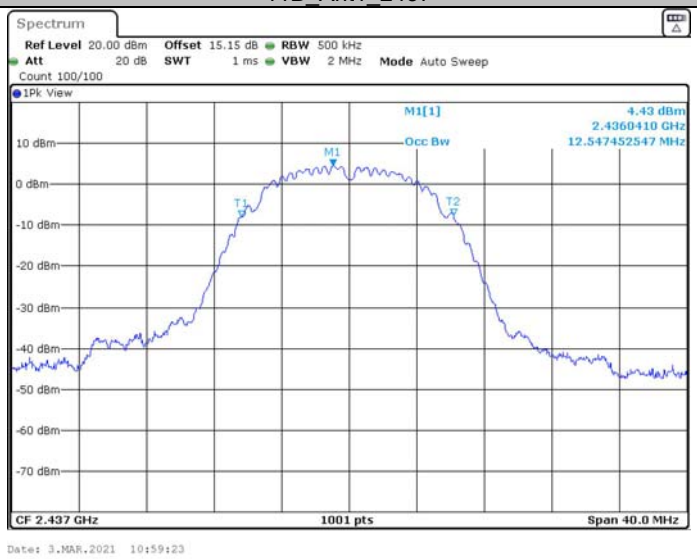
TestMode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	11.988	---	PASS
		2437	12.547	---	PASS
		2462	12.308	---	PASS
11G	Ant1	2412	17.183	---	PASS
		2437	17.662	---	PASS
		2462	17.463	---	PASS
11N20SISO	Ant1	2412	17.942	---	PASS
		2437	18.302	---	PASS
		2462	18.102	---	PASS
11N40SISO	Ant1	2422	35.804	---	PASS
		2437	37.163	---	PASS
		2452	37.083	---	PASS

Test Graphs

11B_Ant1_2412

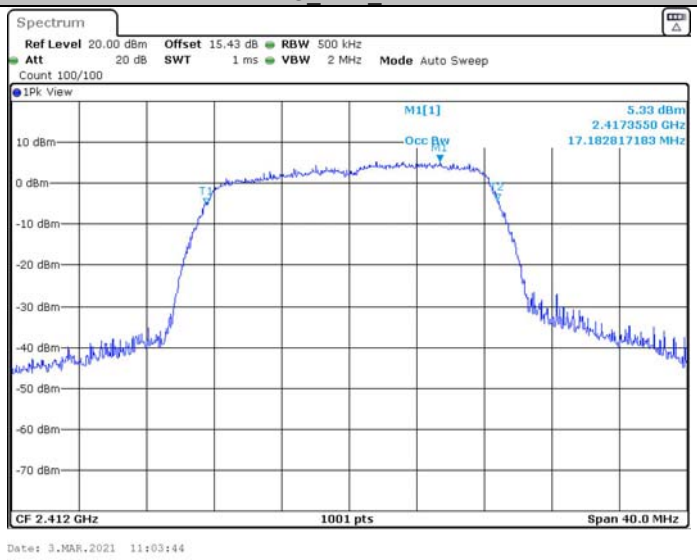


11B_Ant1_2437

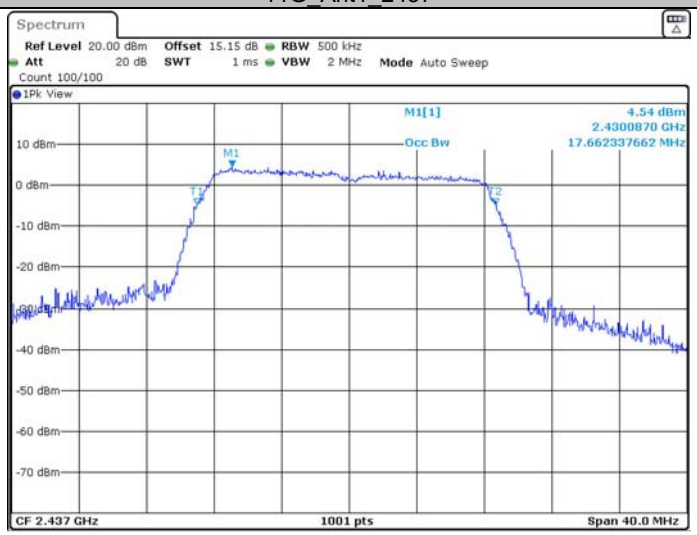


11B_Ant1_2462

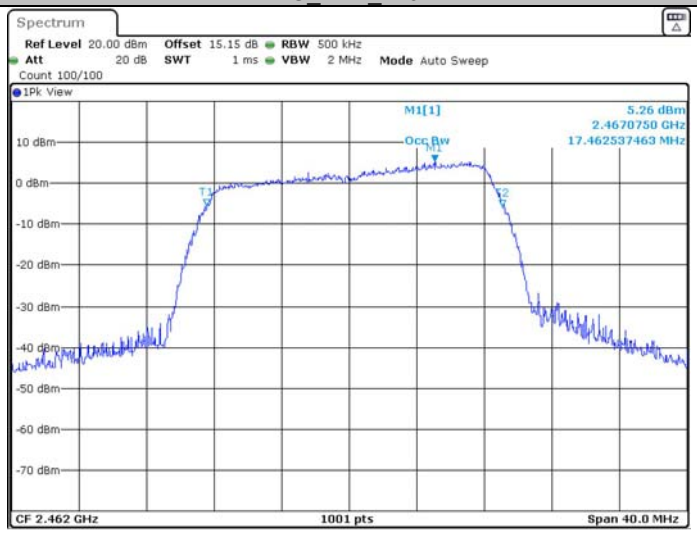
11G_Ant1_2412



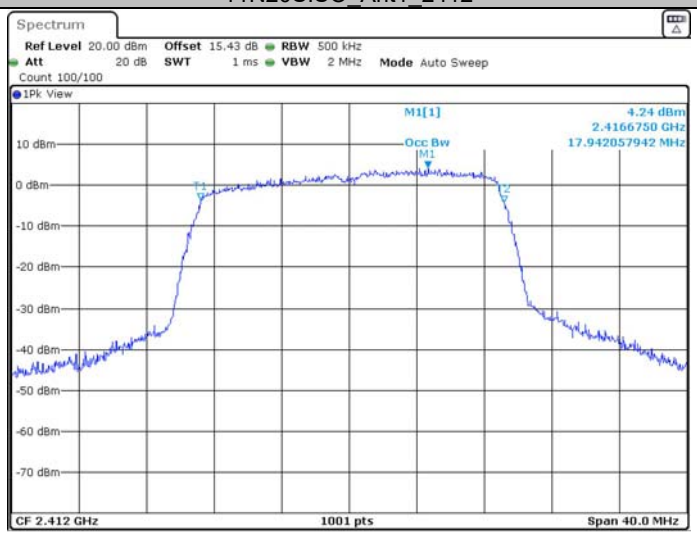
11G_Ant1_2437



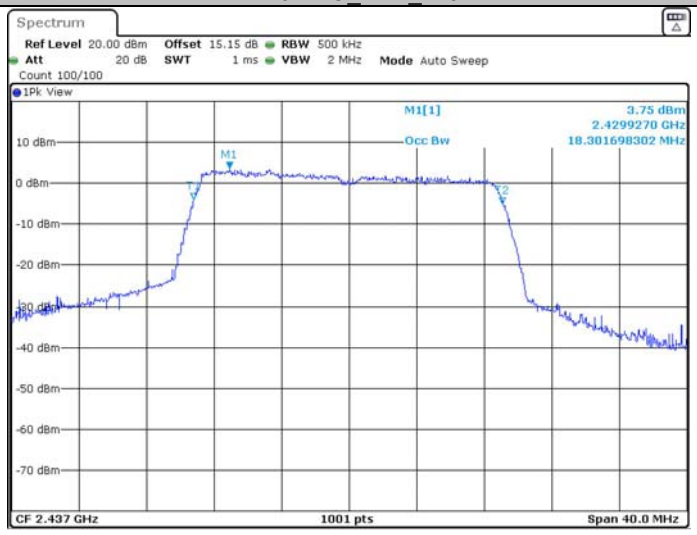
11G_Ant1_2462



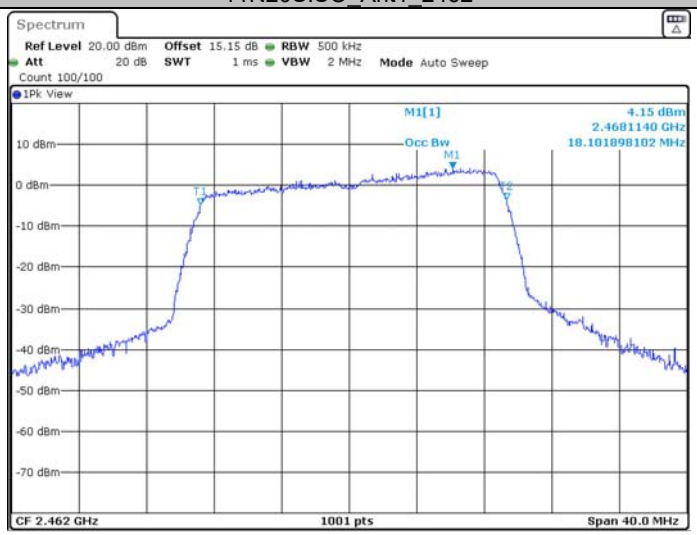
11N20SISO_Ant1_2412



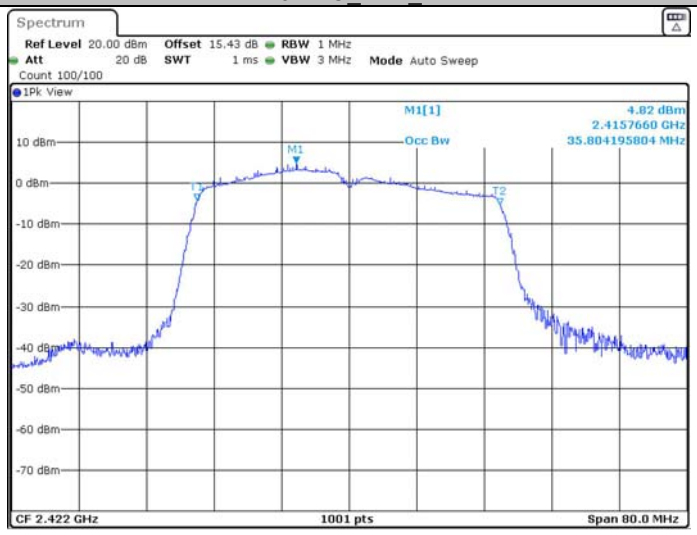
11N20SISO_Ant1_2437



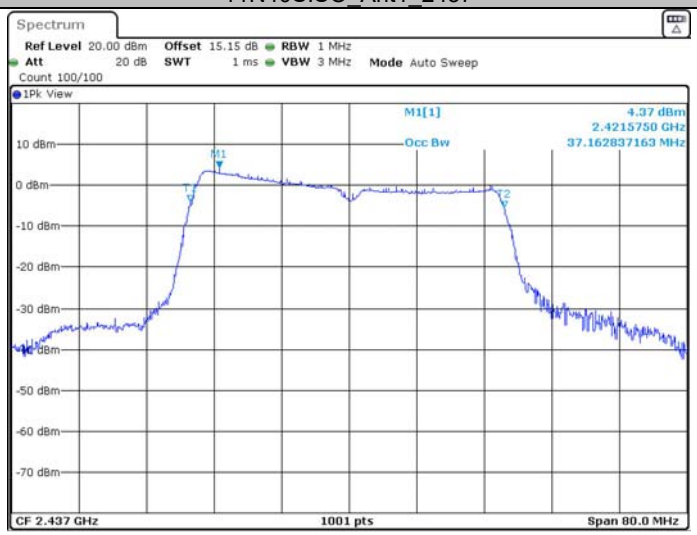
11N20SISO_Ant1_2462



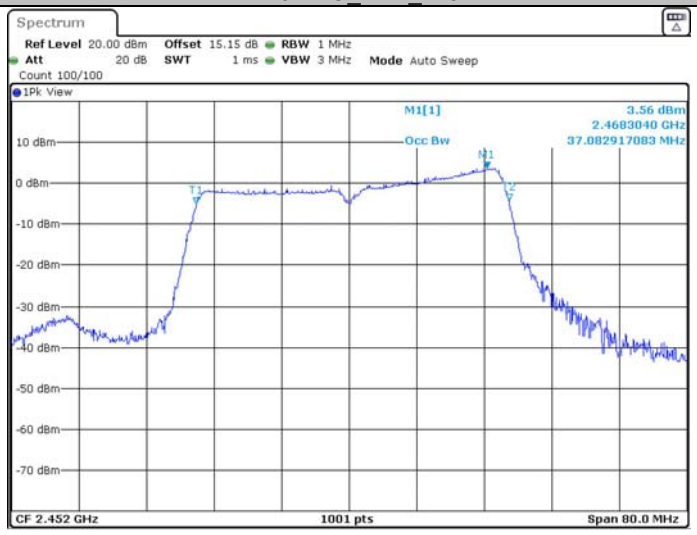
11N40SISO_Ant1_2422



11N40SISO_Ant1_2437



11N40SISO_Ant1_2452



Appendix C: Maximum conducted output power

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	14.75	<=30	PASS
		2437	14.56	<=30	PASS
		2462	14.27	<=30	PASS
11G	Ant1	2412	15.23	<=30	PASS
		2437	15.65	<=30	PASS
		2462	15.72	<=30	PASS
11N20SISO	Ant1	2412	12.80	<=30	PASS
		2437	12.62	<=30	PASS
		2462	13.25	<=30	PASS
11N40SISO	Ant1	2422	12.42	<=30	PASS
		2437	12.35	<=30	PASS
		2452	12.99	<=30	PASS

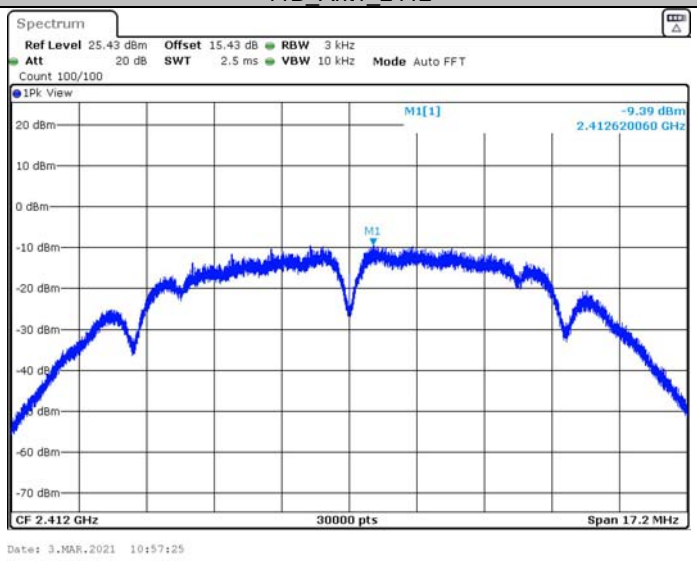
Appendix D: Maximum power spectral density

Test Result

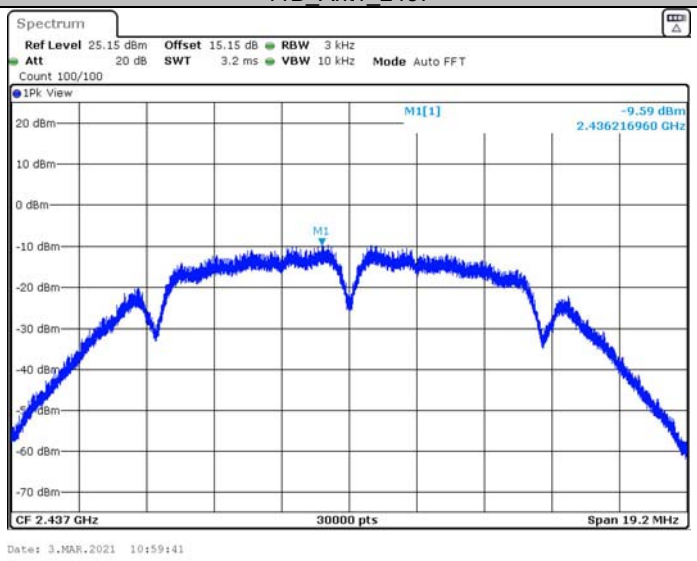
TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-9.39	<=8	PASS
		2437	-9.59	<=8	PASS
		2462	-9.78	<=8	PASS
11G	Ant1	2412	-13.34	<=8	PASS
		2437	-13.87	<=8	PASS
		2462	-13.41	<=8	PASS
11N20SISO	Ant1	2412	-15.84	<=8	PASS
		2437	-17.46	<=8	PASS
		2462	-16.00	<=8	PASS
11N40SISO	Ant1	2422	-18.85	<=8	PASS
		2437	-18.59	<=8	PASS
		2452	-17.08	<=8	PASS

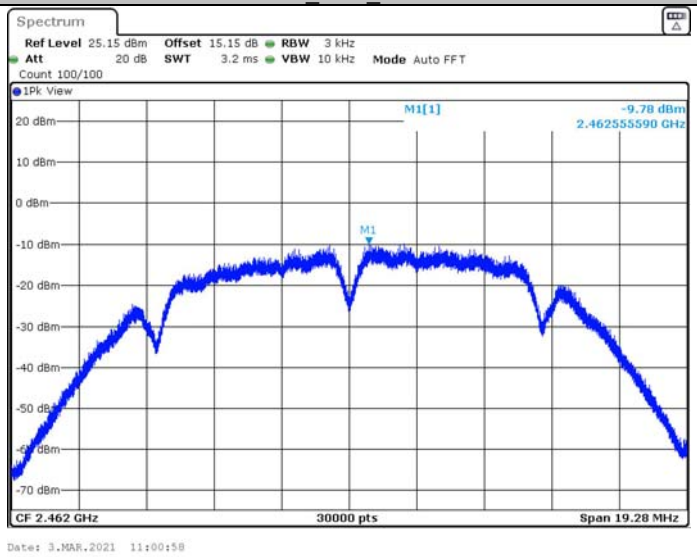
Test Graphs

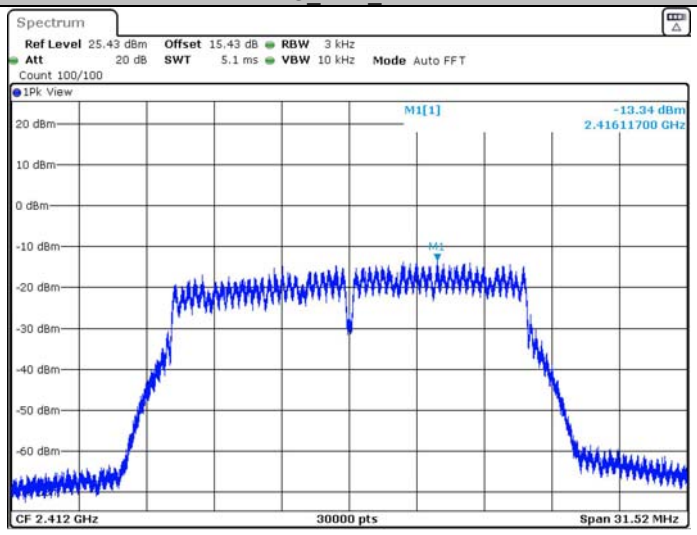
11B_Ant1_2412



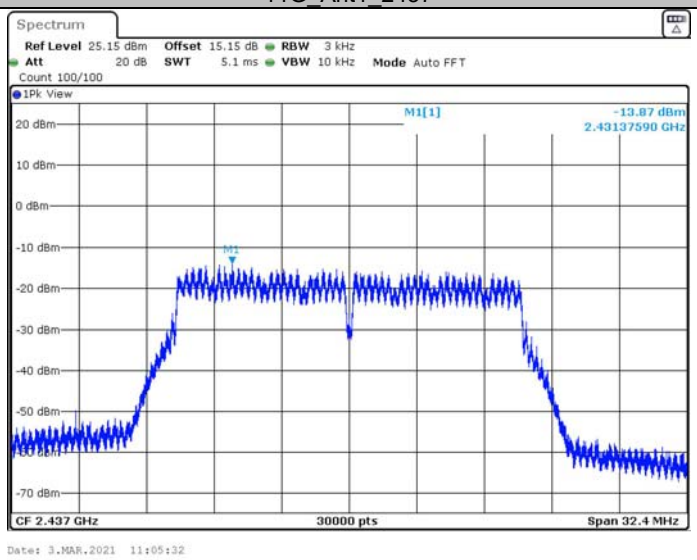
11B_Ant1_2437



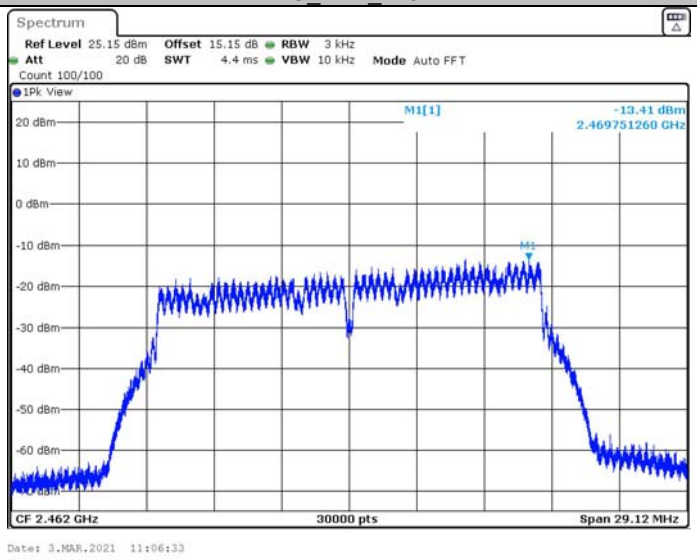
11B_Ant1_2462


11G_Ant1_2412


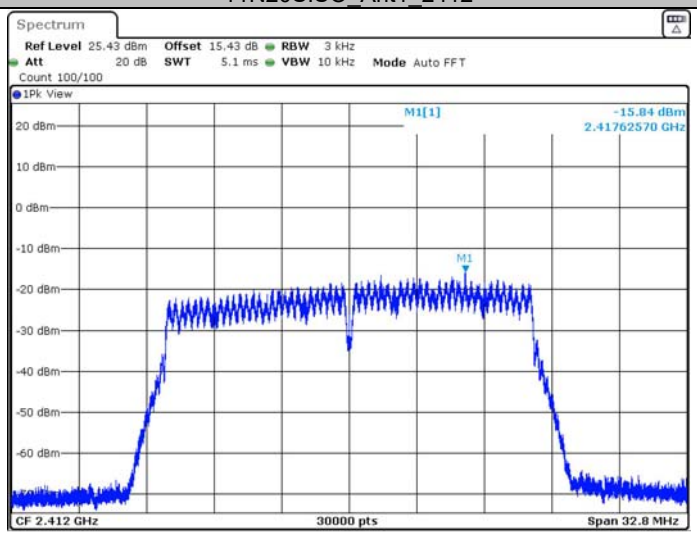
11G_Ant1_2437



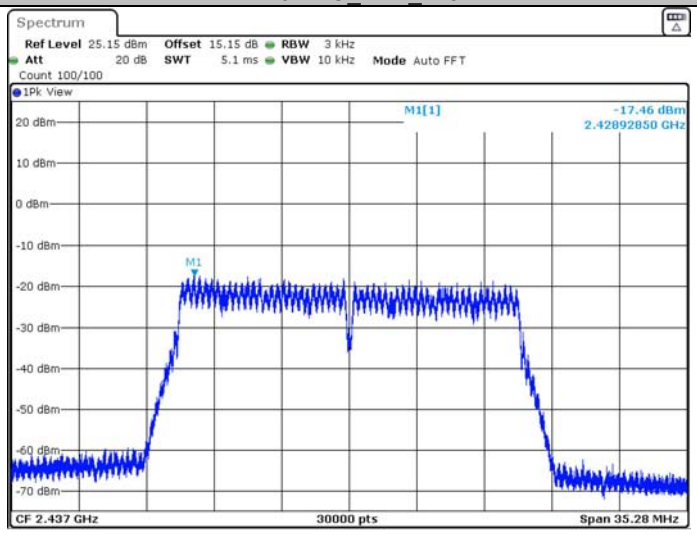
11G_Ant1_2462

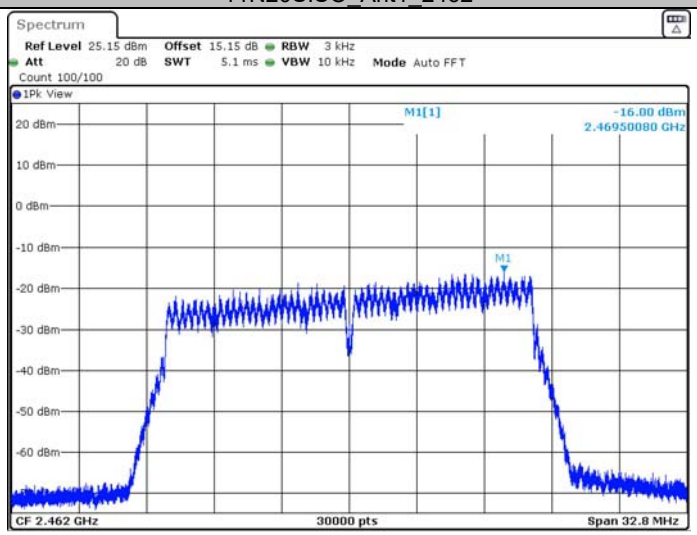
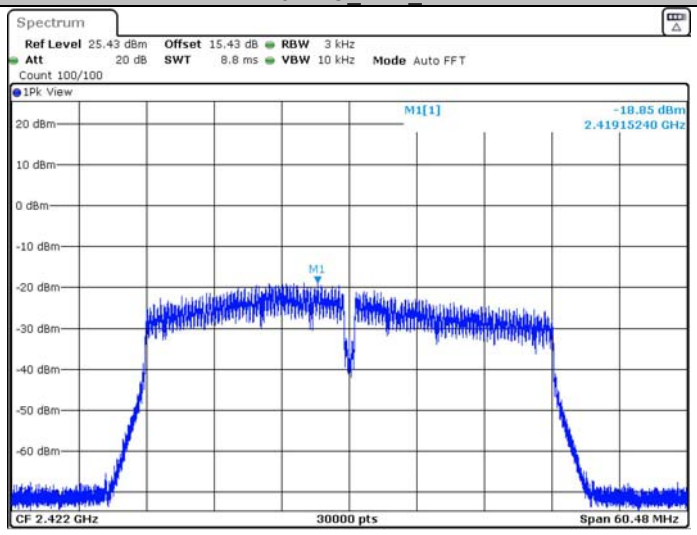


11N20SISO_Ant1_2412

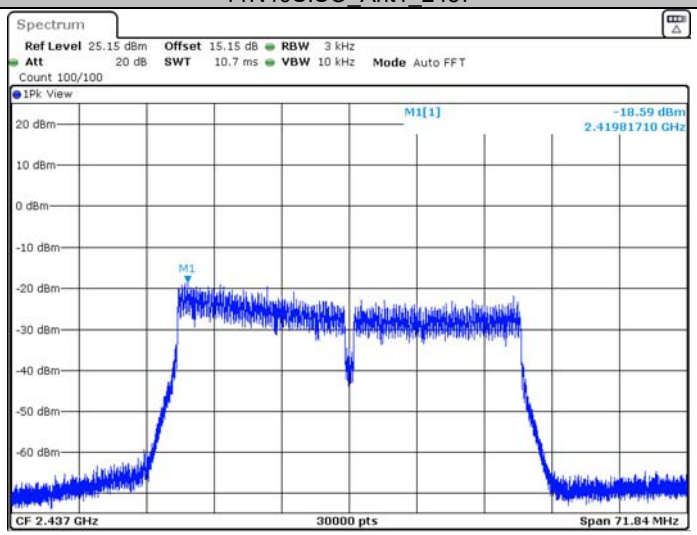


11N20SISO_Ant1_2437

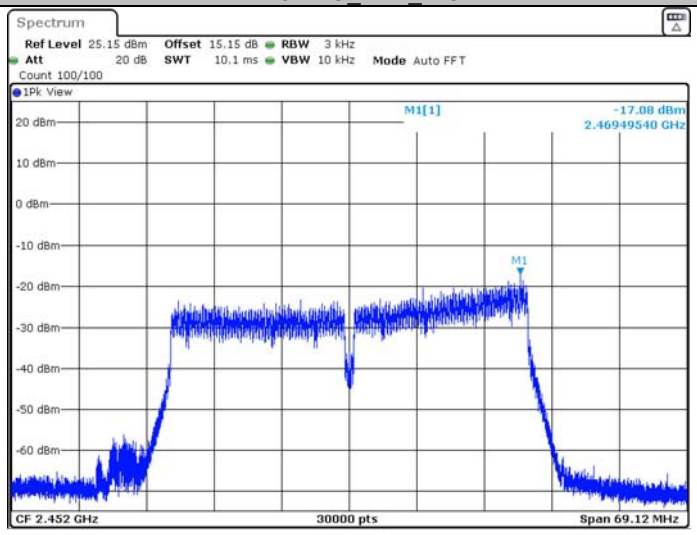


11N20SISO_Ant1_2462

11N40SISO_Ant1_2422


11N40SISO_Ant1_2437



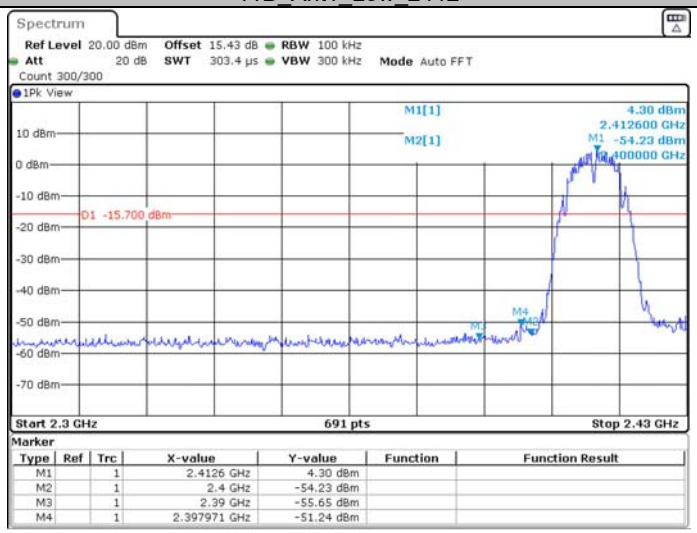
11N40SISO_Ant1_2452



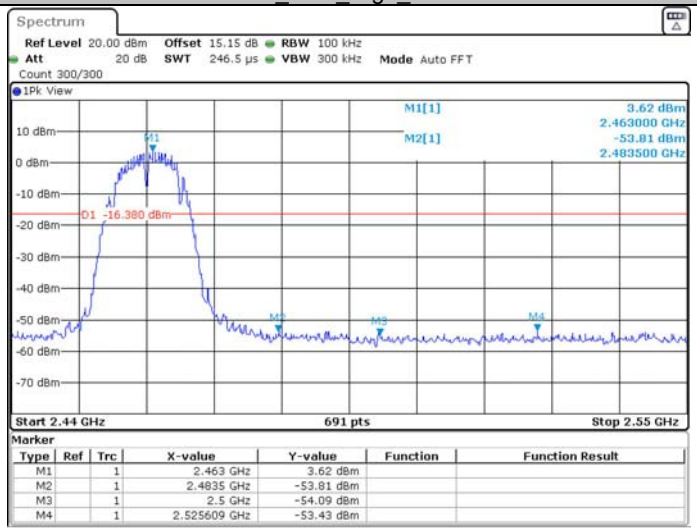
Appendix E:Band edge measurements

Test Graphs

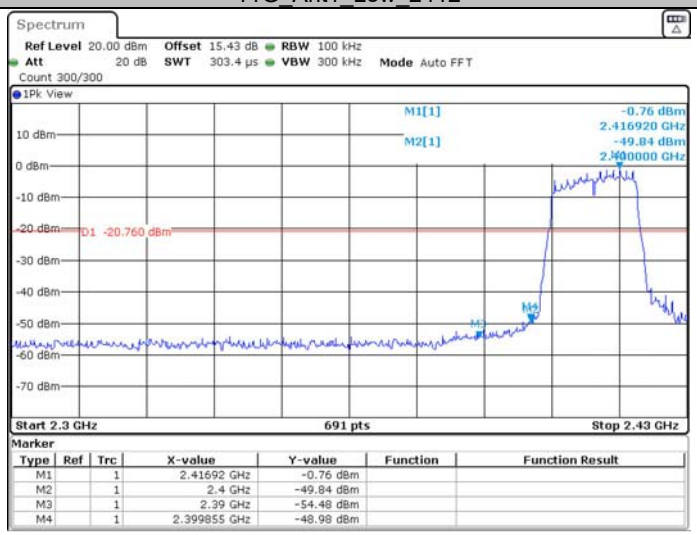
11B_Ant1_Low_2412



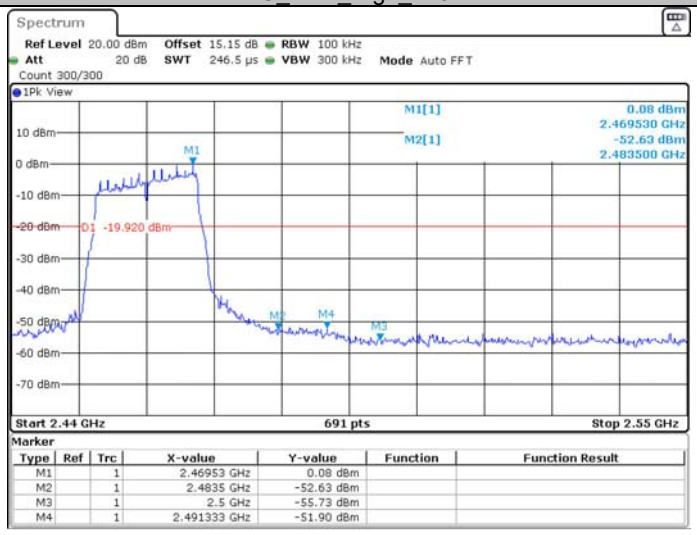
11B_Ant1_High_2462



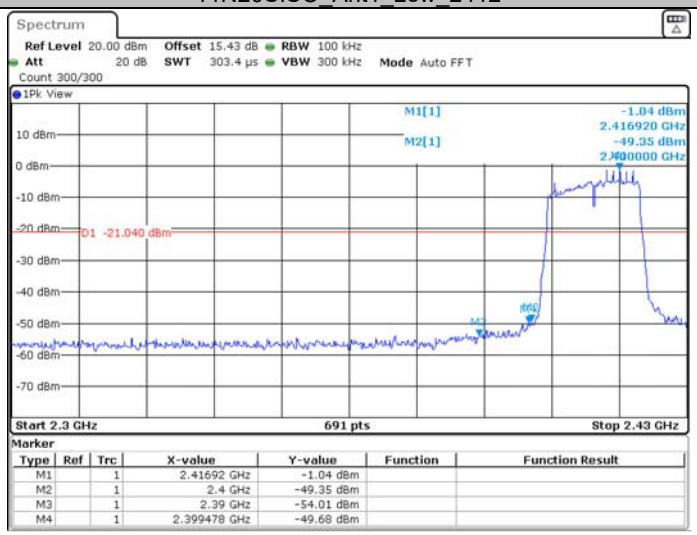
11G_Ant1_Low_2412



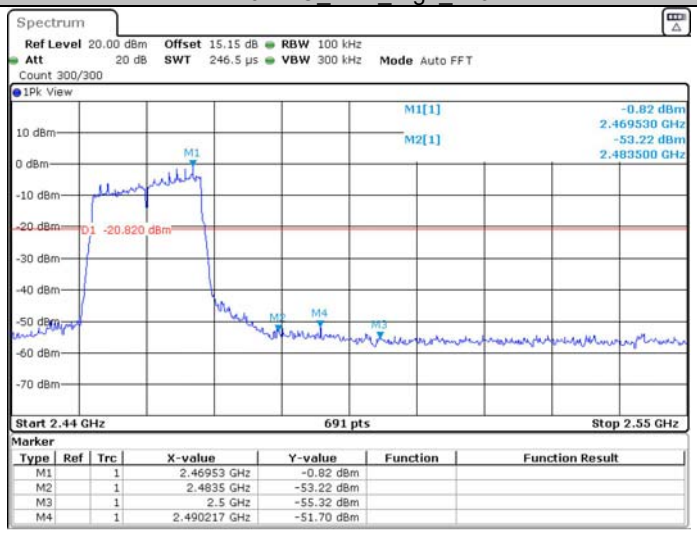
11G_Ant1_High_2462



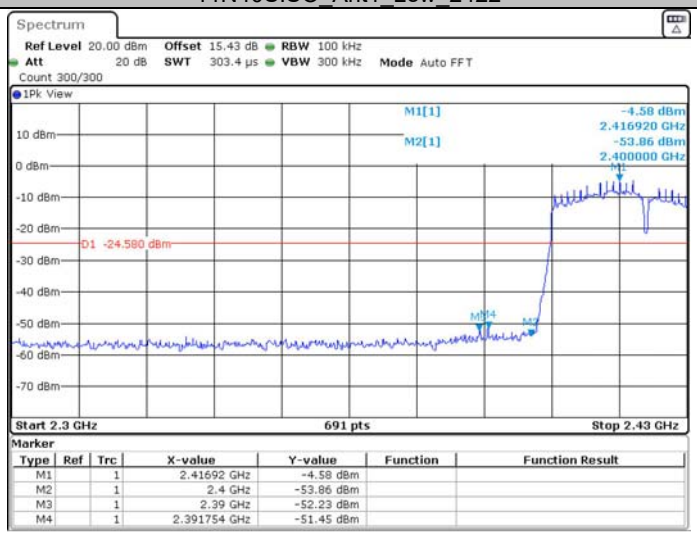
11N20SISO_Ant1_Low_2412



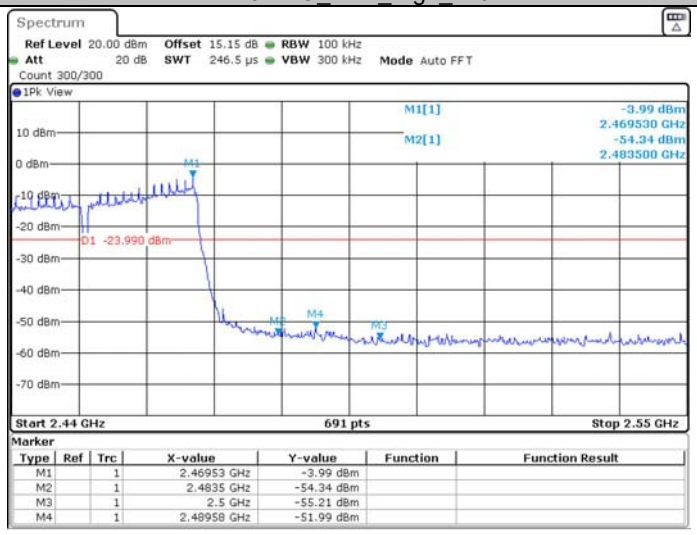
11N20SISO_Ant1_High_2462



11N40SISO_Ant1_Low_2422



11N40SISO_Ant1_High_2452



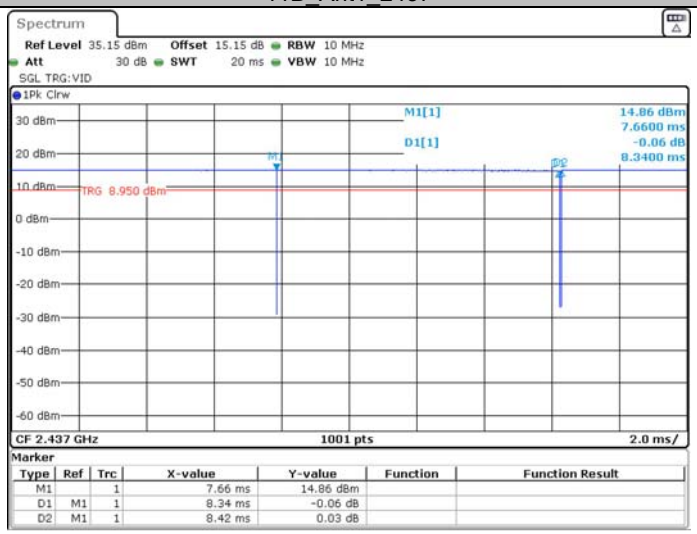
Appendix F: Duty Cycle

Test Result

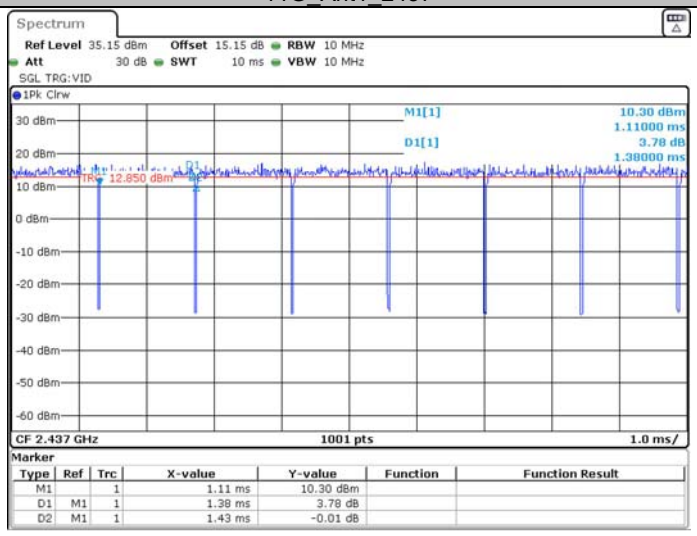
TestMode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	Ant1	2437	8.34	8.42	99.05
11G	Ant1	2437	1.38	1.43	96.50
11N20SISO	Ant1	2437	1.29	1.34	96.27
11N40SISO	Ant1	2437	0.63	0.69	91.30

Test Graphs

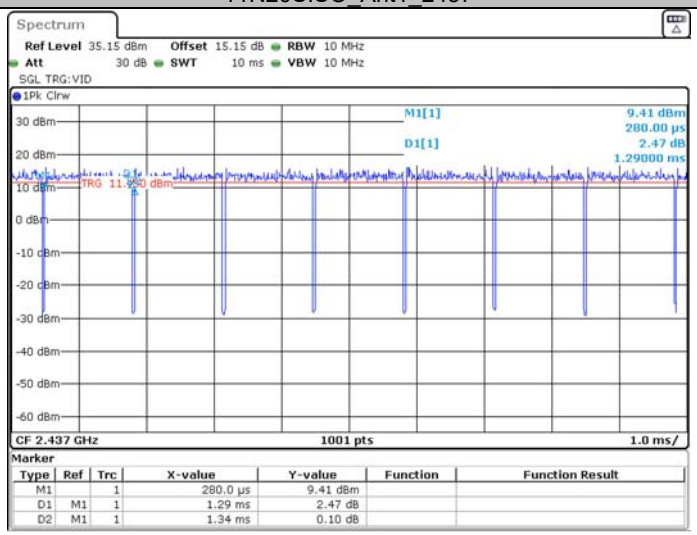
11B_Ant1_2437



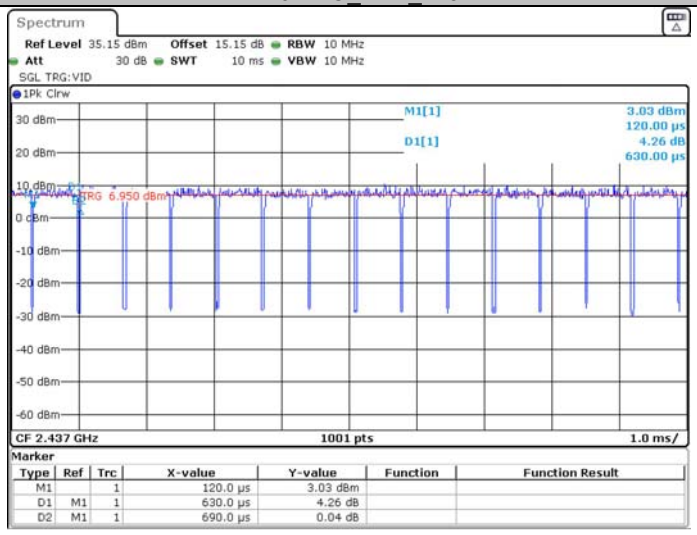
11G_Ant1_2437



11N20SISO_Ant1_2437



11N40SISO_Ant1_2437



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