



FCC PART 15.247

TEST REPORT

For

Shenzhen RAKwireless Technology Co.,Ltd.

Room 506, Bldg B, New Compark, Pingshan First Road, Taoyuan Street, XiLi town,
Nanshan District, Shenzhen, China

FCC ID: 2AF6B-RAK7268112

Report Type: Original Report	Product Type: WisGate
Report Number: RSZ200812005-00B	
Report Date: 2020-09-27	
Nancy Wang 	
Reviewed By: RF Engineer	
Prepared By: Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, 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	WisGate
Tested Model	RAK7268-112
Frequency Range	BLE: 2402-2480MHz Wi-Fi: 2412-2462MHz/2422-2452MHz LoRa: 923.3-927.5MHz
Maximum Conducted Peak Output Power	BLE: 3.13Bm(LE 1M), 3.23dBm(LE 2M) Wi-Fi: 18.10dBm(802.11b), 16.14dBm(802.11g), 16.26dBm(802.11n-HT20), 15.78dBm(802.11n-HT40) Lora: 12.70dBm
Modulation Technique	BLE: GFSK Wi-Fi: DSSS, OFDM LoRa: FSK
Antenna Specification*	BLE & Wi-Fi: 1.75 dBi (It is provided by the applicant) LoRa: 2.3dBi (It is provided by the applicant)
Voltage Range	DC 12V from adapter or DC 48V from POE
Date of Test	2020-08-21 to 2020-09-20
Sample serial number	RSZ200812005-RF-S2 & RSZ200812005-RF-S6 (Assigned by BACL, Shenzhen)
Received date	2020-08-12
Sample/EUT Status	Good condition
Adapter 1 information	Model: PSY1202000US Input: AC 100-240V, 50/60Hz, 1.3A Output: DC 12V, 2.0A
Adapter 2 information	Model: AD-0241200200US-1 Input: AC 100-240V, 50/60Hz, 0.6A Output: DC 12.0V, 2.0A

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

And KDB 558074 D01 15.247 Meas Guidance v05r02.

All emissions measurement was performed at 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 °C
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 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, 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

The EUT has two antennas for Wi-Fi, it can operate in 802.11b/g/n20/n40 modes.

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, EUT was tested with Channel 1, 6 and 11.

For 802.11n-HT40, EUT was tested with Channel 3, 6 and 9.

For LE 1M&2M 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

“SecurCRT.exe” exercise software was used

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	19	19	19
802.11g	6 Mbps	9	9	9
802.11n-HT20	MCS0	8	8	8
802.11n-HT40	MCS0	6	6	6
BLE	Default	0	0	0

The worse-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rated bandwidths, and modulations. The device supports SISO and MIMO in all modes, per pretest, the MIMO mode was the worst mode for all the modes.

The software and power level was provided by the applicant.

Duty cycle

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

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
HIKVISION	Router	DS-3WR03-E	10021642429
GOSPELL	POE	G0720-480-050	200200015
Unknown	SD card	Unknown	SD card

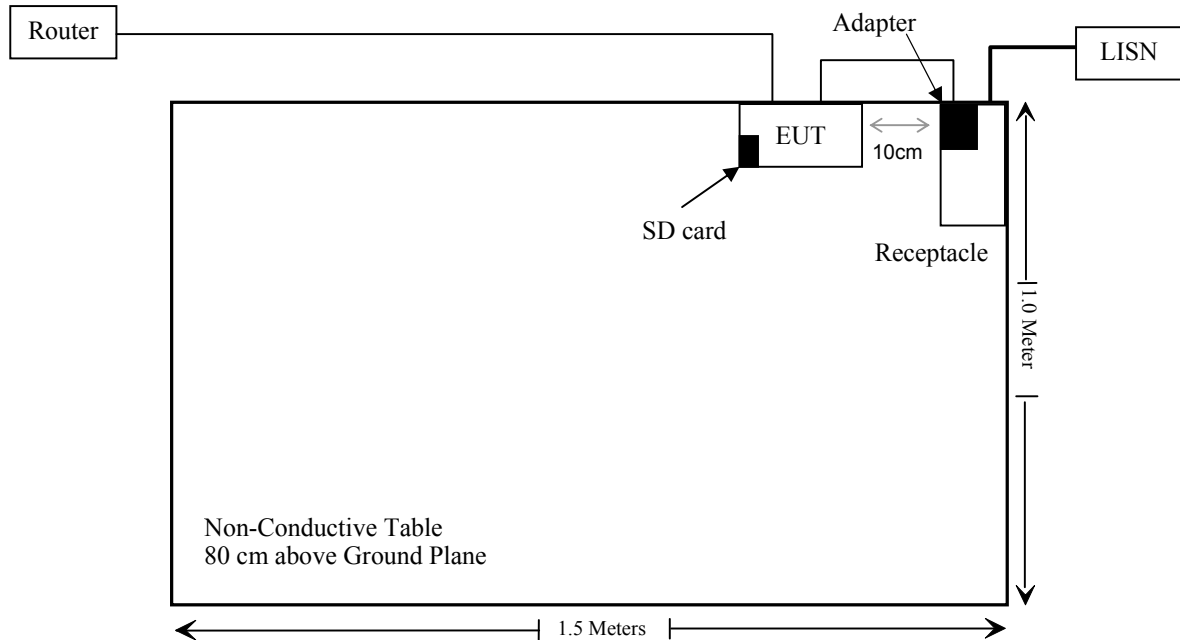
External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shield Detachable DC cable	1.0/1.5	EUT	Adapter
Un-shield Detachable RJ45 cable	10	EUT/POE	Router
Un-shield Detachable RJ45 cable	1.0	POE	EUT

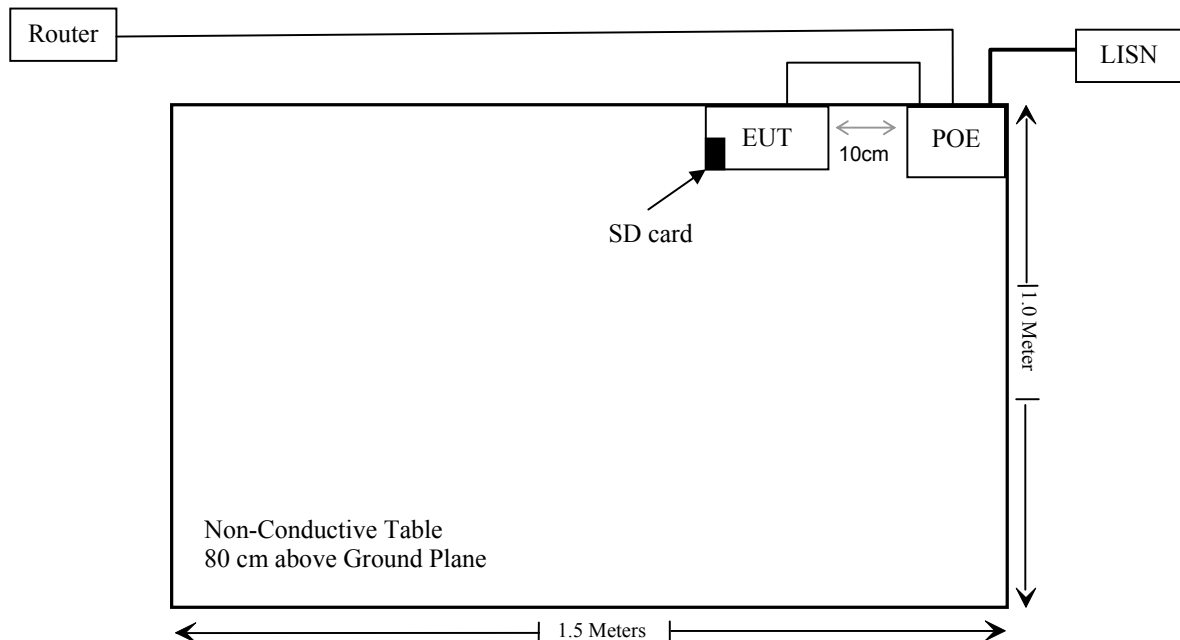
Block Diagram of Test Setup

For conducted emission:

Powered by adapter



Powered by POE



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*

Note:

Compliance*: This EUT contains the certified LoRa modules, which have the model is RAK2247 (FCC ID: 2AF6B-RAK2247). For RAK2247 (FCC ID: 2AF6B-RAK2247), the antenna type remains the same, but the antenna gain increases, so the section “Maximum Permissible exposure (MPE)”, “Antenna Requirement”, “AC Line Conducted Emissions” and “Spurious Emissions” were updated. All the other test data are referred to the report RSZ181207002-00B with model number RAK2247 (FCC ID: 2AF6B-RAK2247), issued on 2018-12-24 by Bay Area Compliance Laboratories Corp. (Shenzhen).

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	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
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	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
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	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulated Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2020/04/20	2021/04/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-021304	2017/12/06	2020/12/05
Unknown	High Pass filter	1.3GHz	101120	2020/04/20	2021/04/20
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	2019/11/29	2020/11/28

* **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) & §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/cm²)

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:

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

Mode	Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BLE	2402-2480	1.75	1.5	3.5	2.24	20	0.001	1.0
Wi-Fi	2412-2462	1.75	1.5	18.5	70.79	20	0.021	1.0
Lora	923.3-927.5	2.3	1.7	13.0	19.95	20	0.007	0.6

Note: 1. The tune up conducted power was declared by the applicant
 2. Lora, BLE and Wi-Fi can transmit simultaneously for this device..
 3. Please refer to the MPE report of the FCC ID: 2AF6B-RAK2247 for the Lora output power.

So the worst simultaneous transmitting consideration:

The ratio= $MPE_{BLE}/limit + MPE_{Wi-Fi}/limit + MPE_{Lora}/limit = 0.001/1.0 + 0.021/1.0 + 0.007/0.6$
 $= 0.034 < 1.0$

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 an internal antenna for BLE and two internal antennas for Wi-Fi, which were permanently attached and the antenna gain is 1.75dBi (BLE & Wi-Fi) , and the EUT has an external antenna for lora with a non-standard antenna jack which the maximum antenna gain is 2.3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

EUT Setup



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

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

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

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:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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:

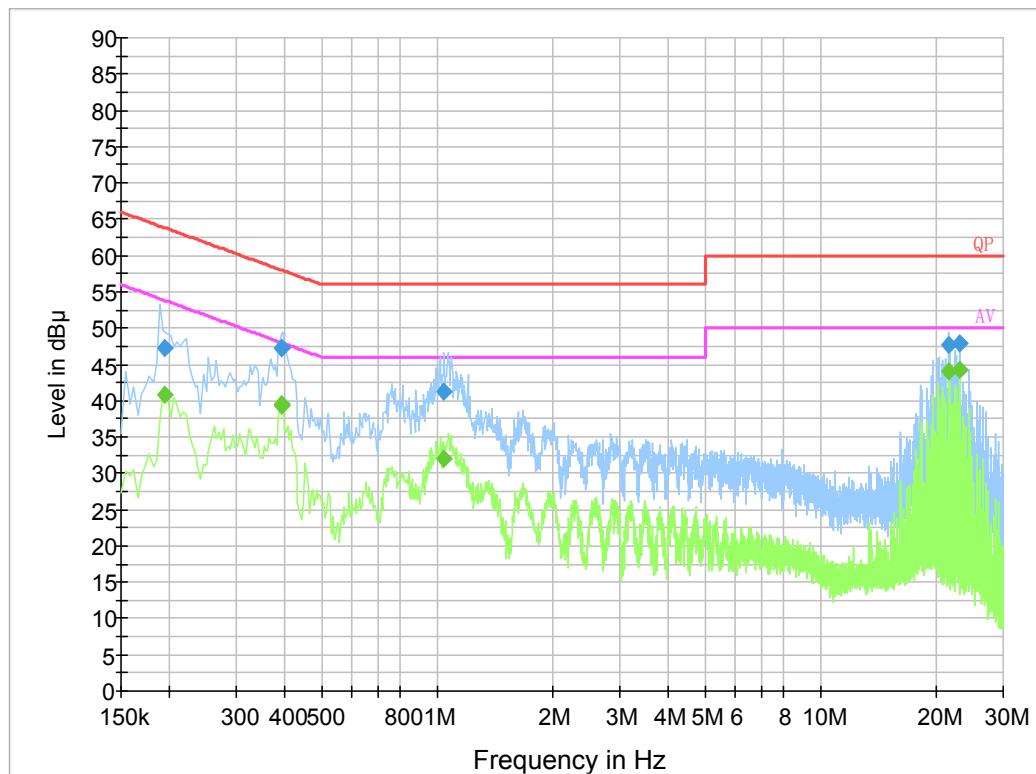
$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-08-21 and 2020-08-31.

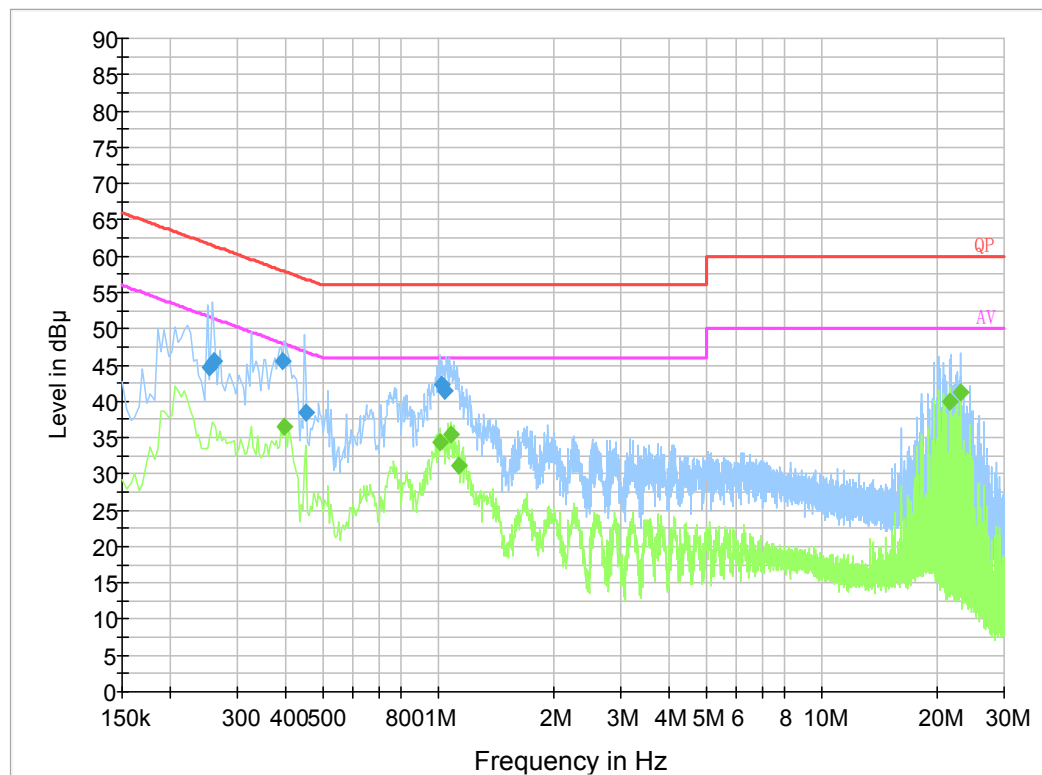
EUT operation mode: Transmitting (worst case at 802.11b mode, low channel)

Powered by adapter 1 (Model: PSY1202000US):**AC 120V/60 Hz, Line****Final Result 1**

Frequency (MHz)	QuasiPeak (dB μV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μV)
0.194500	47.3	9.000	L1	19.8	16.5	63.8
0.391790	47.3	9.000	L1	19.9	10.7	58.0
0.392030	47.2	9.000	L1	19.9	10.8	58.0
1.042310	41.3	9.000	L1	19.9	14.7	56.0
21.661070	47.6	9.000	L1	20.5	12.4	60.0
23.127050	47.9	9.000	L1	20.4	12.1	60.0

Final Result 2

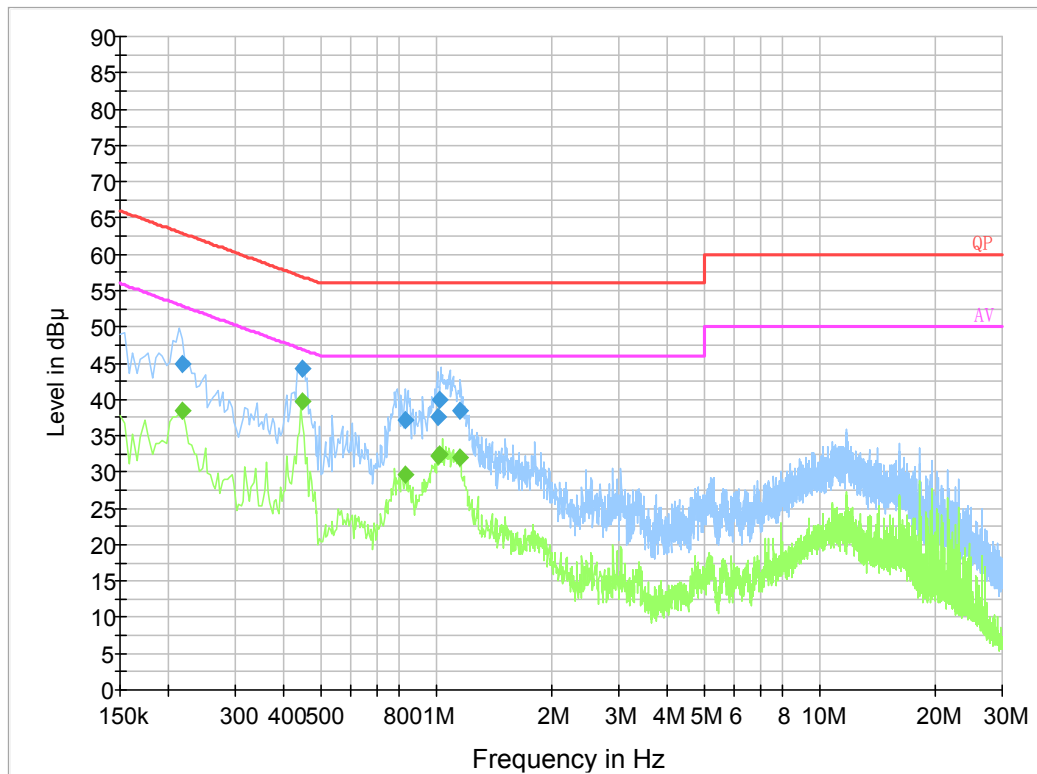
Frequency (MHz)	Average (dB μV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μV)
0.194500	40.8	9.000	L1	19.8	13.0	53.8
0.391790	39.4	9.000	L1	19.9	8.6	48.0
0.392030	39.4	9.000	L1	19.9	8.6	48.0
1.042310	32.0	9.000	L1	19.9	14.0	46.0
21.661070	44.1	9.000	L1	20.5	5.9	50.0
23.127050	44.3	9.000	L1	20.4	5.7	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)
0.254500	44.6	9.000	N	19.8	17.0	61.6
0.261500	45.6	9.000	N	19.8	15.8	61.4
0.392030	45.6	9.000	N	19.8	12.4	58.0
0.451250	38.5	9.000	N	19.8	18.4	56.9
1.022850	42.3	9.000	N	19.8	13.7	56.0
1.042190	41.4	9.000	N	19.8	14.6	56.0

Final Result 2

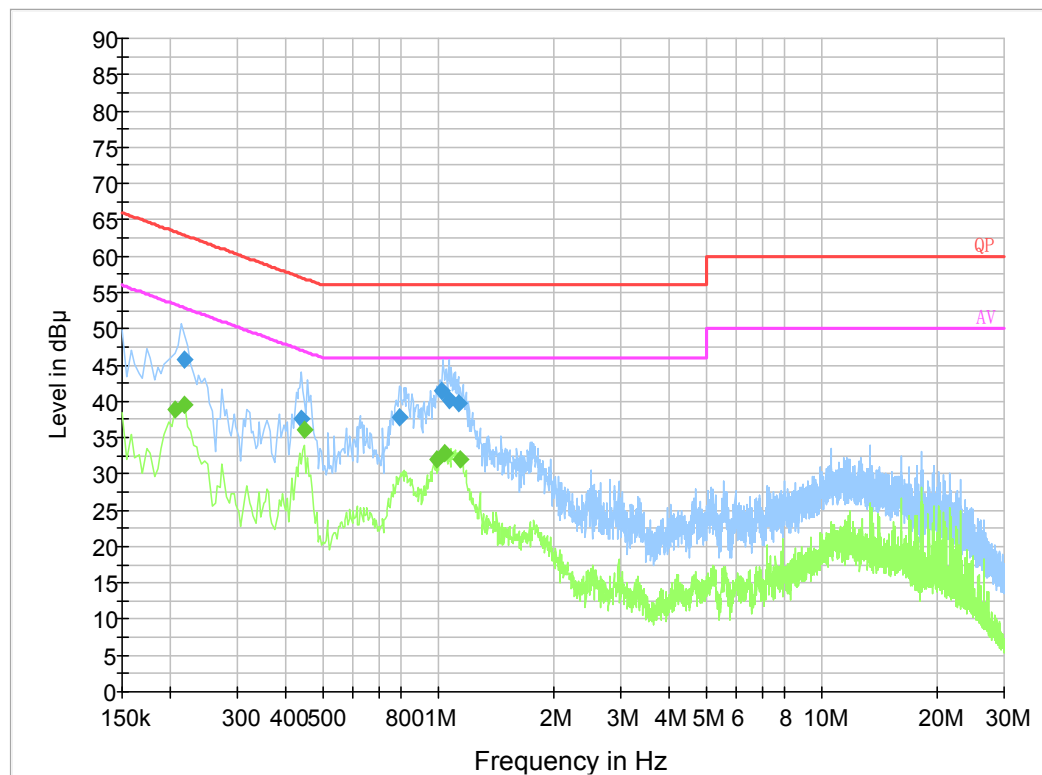
Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.398000	36.6	9.000	N	19.8	11.3	47.9
1.010000	34.3	9.000	N	19.8	11.7	46.0
1.086000	35.5	9.000	N	19.8	10.5	46.0
1.138000	31.1	9.000	N	19.8	14.9	46.0
21.666000	40.0	9.000	N	20.4	10.0	50.0
23.126000	41.2	9.000	N	20.3	8.8	50.0

Powered by adapter 2 (Model: AD-0241200200US-1):**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)
0.217500	44.9	9.000	L1	19.8	18.0	62.9
0.447190	44.3	9.000	L1	19.8	12.6	56.9
0.829490	37.2	9.000	L1	19.8	18.8	56.0
1.014850	37.6	9.000	L1	19.9	18.4	56.0
1.018550	40.0	9.000	L1	19.9	16.0	56.0
1.152630	38.5	9.000	L1	19.8	17.5	56.0

Final Result 2

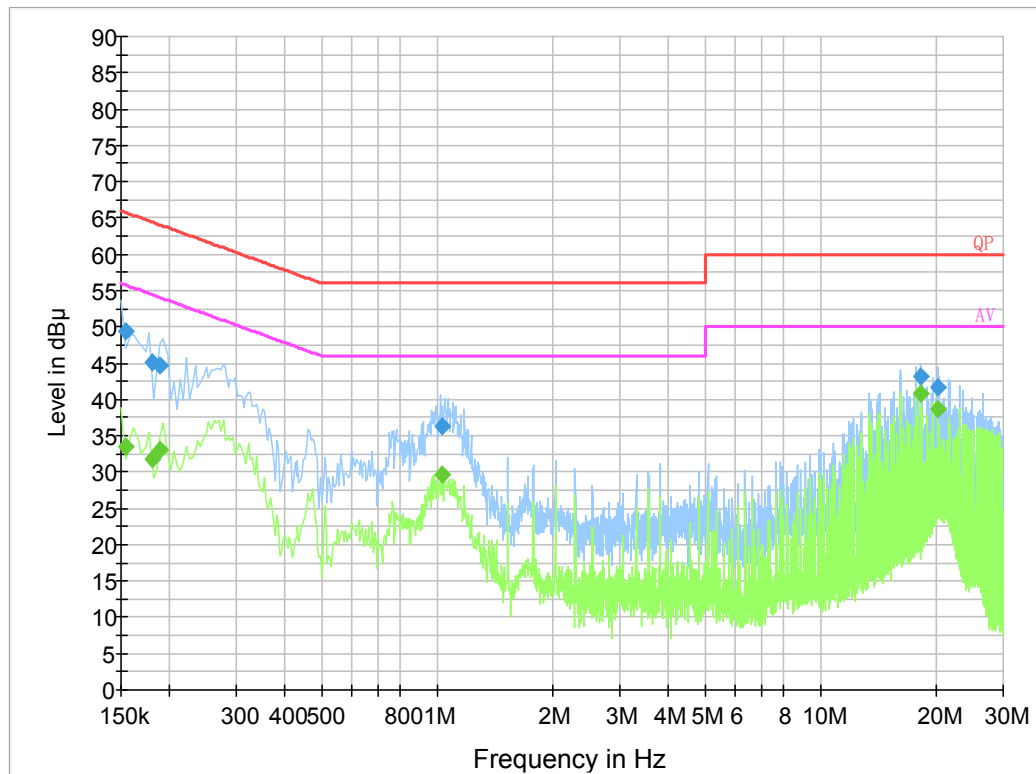
Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.217500	38.4	9.000	L1	19.8	14.5	52.9
0.447190	39.6	9.000	L1	19.8	7.3	46.9
0.829490	29.6	9.000	L1	19.8	16.4	46.0
1.014850	32.2	9.000	L1	19.9	13.8	46.0
1.018550	32.5	9.000	L1	19.9	13.5	46.0
1.152630	32.1	9.000	L1	19.8	13.9	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)
0.217500	45.7	9.000	N	19.8	17.2	62.9
0.439370	37.5	9.000	N	19.8	19.6	57.1
0.794090	37.8	9.000	N	19.8	18.2	56.0
1.025150	41.4	9.000	N	19.8	14.6	56.0
1.073950	40.2	9.000	N	19.8	15.8	56.0
1.137050	39.7	9.000	N	19.8	16.3	56.0

Final Result 2

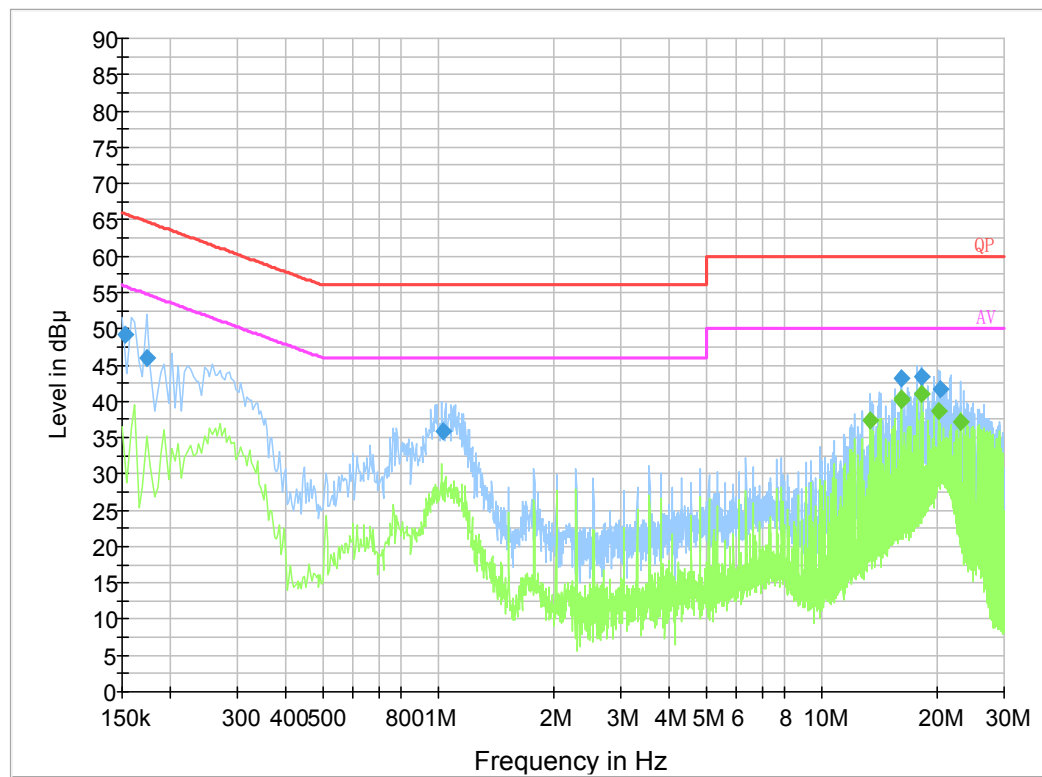
Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.206000	39.0	9.000	N	19.8	14.4	53.4
0.218000	39.6	9.000	N	19.8	13.3	52.9
0.450000	36.0	9.000	N	19.8	10.9	46.9
0.998000	32.1	9.000	N	19.8	13.9	46.0
1.046000	32.9	9.000	N	19.8	13.1	46.0
1.142000	32.1	9.000	N	19.8	13.9	46.0

Powered by POE:**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)
0.154500	49.5	9.000	L1	19.8	16.3	65.8
0.181500	45.2	9.000	L1	19.9	19.2	64.4
0.189500	44.7	9.000	L1	19.8	19.4	64.1
1.034670	36.4	9.000	L1	19.9	19.6	56.0
18.244370	43.2	9.000	L1	20.4	16.8	60.0
20.258130	41.7	9.000	L1	20.5	18.3	60.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.154500	33.4	9.000	L1	19.8	22.4	55.8
0.181500	31.9	9.000	L1	19.9	22.5	54.4
0.189500	33.1	9.000	L1	19.8	21.0	54.1
1.034670	29.7	9.000	L1	19.9	16.3	46.0
18.244370	40.8	9.000	L1	20.4	9.2	50.0
20.258130	38.6	9.000	L1	20.5	11.4	50.0

AC 120V/60 Hz, Neutral**Final Result 1**

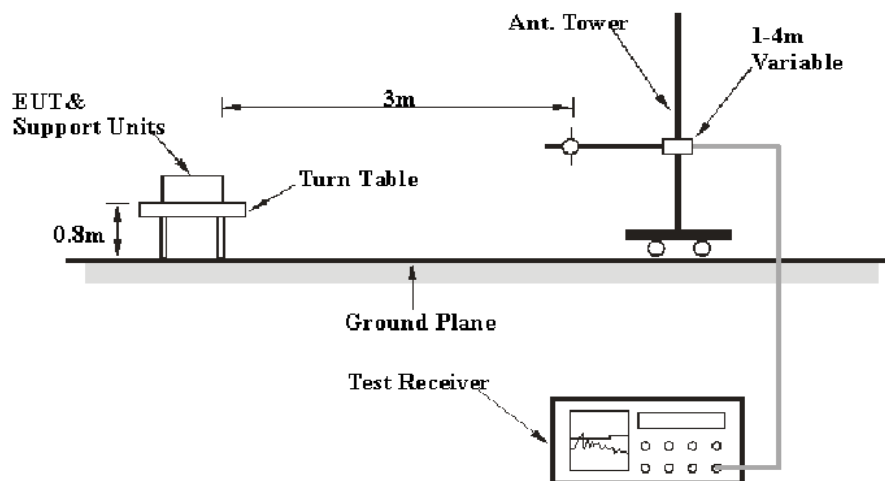
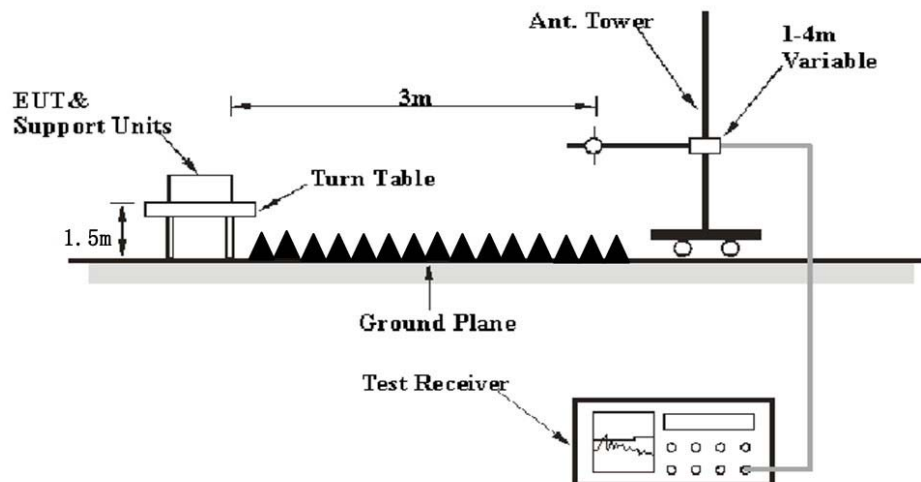
Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.153500	49.2	9.000	N	19.8	16.6	65.8
0.173500	45.9	9.000	N	19.8	18.9	64.8
1.034670	35.8	9.000	N	19.8	20.2	56.0
16.226550	43.1	9.000	N	20.1	16.9	60.0
18.244370	43.3	9.000	N	20.3	16.7	60.0
20.382130	41.8	9.000	N	20.4	18.2	60.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
13.418000	37.5	9.000	N	19.9	12.5	50.0
16.166000	40.1	9.000	N	20.1	9.9	50.0
16.230000	40.4	9.000	N	20.1	9.6	50.0
18.242000	41.1	9.000	N	20.3	8.9	50.0
20.258000	38.7	9.000	N	20.4	11.3	50.0
23.130000	37.1	9.000	N	20.3	12.9	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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data

Environmental Conditions

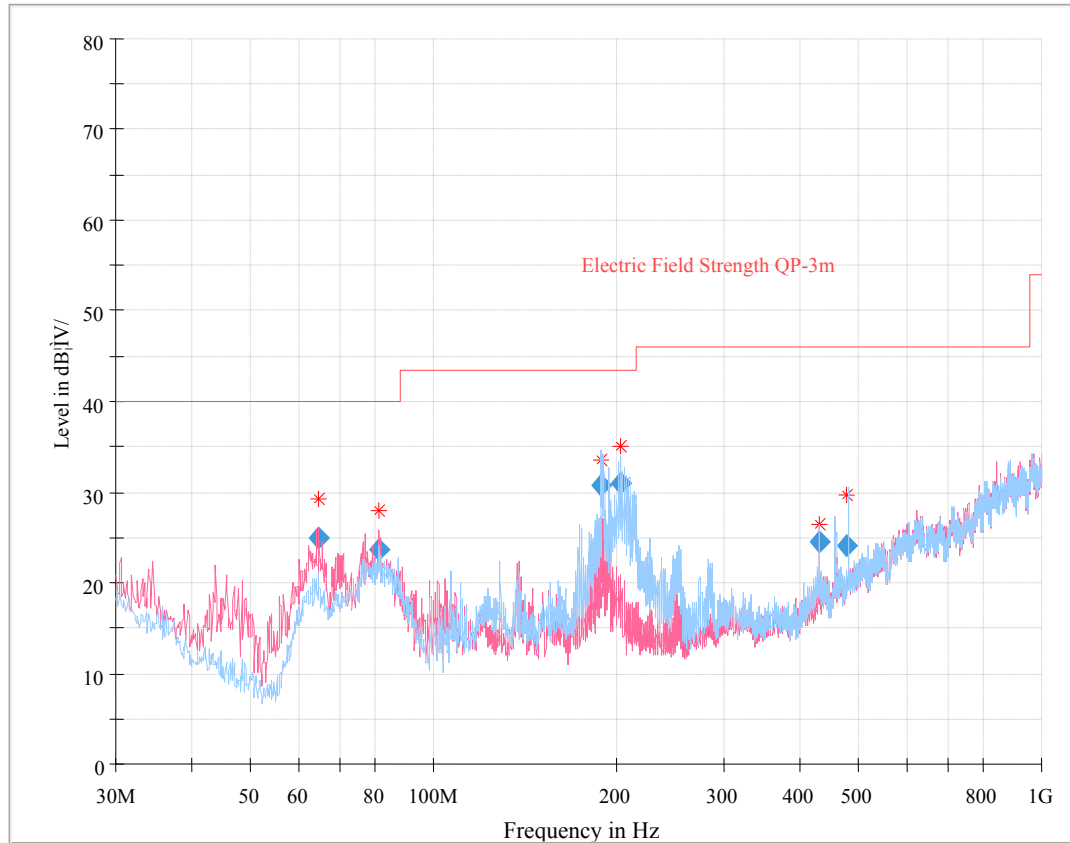
Temperature:	29~30.4 °C
Relative Humidity:	50~56 %
ATM Pressure:	101.0~101.1 kPa

The testing was performed by Charlie Cha, Harris He and Holland Yang from 2020-08-22 to 2020-08-28 for below 1GHz, Leven Gan and Lovan Liang from 2020-08-25 to 2020-09-20 for above 1GHz.

EUT operation mode: Transmitting

Powered by adapter 1 (Model: PSY1202000US):

30 MHz~1 GHz: (Worst case at 802.11b mode, low channel)

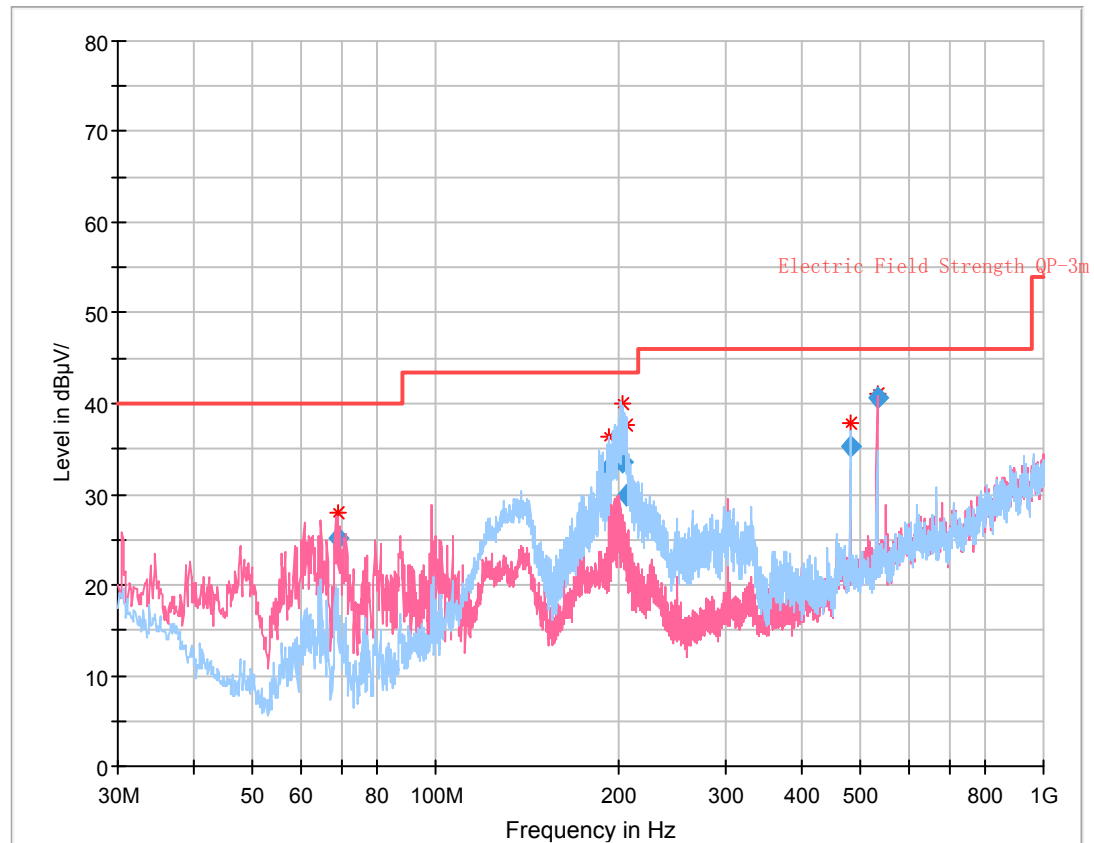


Final Result

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
64.794375	25.05	40.00	14.95	110.0	V	20.0	-20.4
81.206250	23.69	40.00	16.31	126.0	V	30.0	-19.9
188.679625	30.79	43.50	12.71	196.0	H	80.0	-15.2
203.112500	30.87	43.50	12.63	146.0	H	67.0	-13.8
429.982125	24.43	46.00	21.57	232.0	H	62.0	-9.1
479.728125	24.02	46.00	21.98	285.0	H	147.0	-6.4

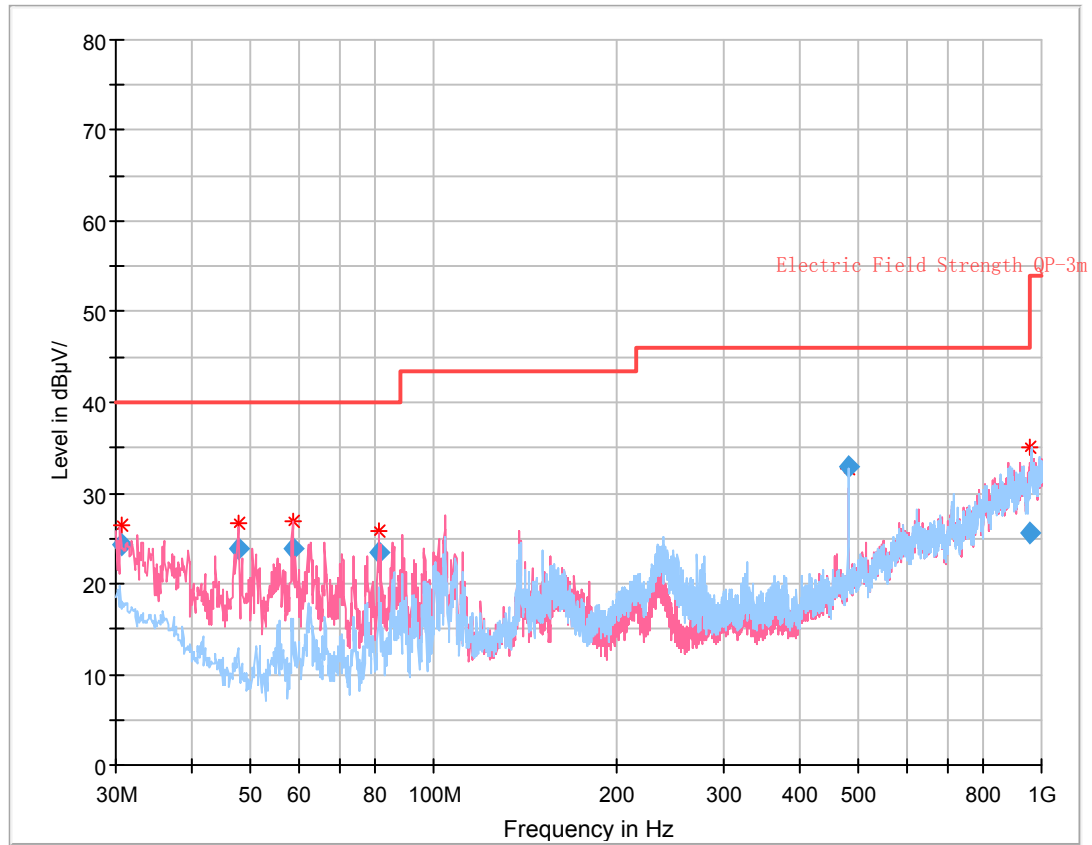
Powered by adapter 2 (Model: AD-0241200200US-1):

30 MHz~1 GHz: (Worst case at 802.11b mode, low channel)



Final Result

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
69.123000	25.12	40.00	14.88	130.0	V	0.0	-20.6
193.185500	32.97	43.50	10.53	122.0	H	181.0	-14.7
202.271000	33.61	43.50	9.89	176.0	H	209.0	-13.8
206.524250	29.93	43.50	13.57	164.0	H	149.0	-13.9
479.835750	35.26	46.00	10.74	223.0	H	25.0	-6.4
531.998000	40.61	46.00	5.39	102.0	V	209.0	-4.5

Powered by POE:**30 MHz~1 GHz:** (Worst case at 802.11b mode, low channel)**Final_Result**

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.573147	24.23	40.00	15.77	102.0	V	266.0	-8.0
47.823500	23.91	40.00	16.09	127.0	V	29.0	-18.6
58.778500	23.95	40.00	16.05	115.0	V	20.0	-20.1
81.490500	23.41	40.00	16.59	153.0	V	0.0	-19.8
479.973000	32.91	46.00	13.09	184.0	H	184.0	-6.4
958.795625	25.49	46.00	20.51	238.0	V	356.0	5.3

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)									
2383.00	28.35	PK	3	1.6	H	31.87	60.22	74	13.78
2383.00	15.27	Ave.	3	1.6	H	31.87	47.14	54	6.86
2488.89	28.54	PK	136	2.3	H	32.13	60.67	74	13.33
2488.89	14.33	Ave.	136	2.3	H	32.13	46.46	54	7.54
4824.00	44.13	PK	48	1.6	H	5.40	49.53	74	24.47
4824.00	32.81	Ave.	48	1.6	H	5.40	38.21	54	15.79
Middle Channel (2437MHz)									
4874.00	44.93	PK	90	1.7	H	6.43	51.36	74	22.64
4874.00	33.95	Ave.	90	1.7	H	6.43	40.38	54	13.62
High Channel (2462 MHz)									
2379.99	27.78	PK	355	1.8	H	31.87	59.65	74	14.35
2379.99	14.49	Ave.	355	1.8	H	31.87	46.36	54	7.64
2498.75	28.43	PK	18	2.3	H	32.13	60.56	74	13.44
2498.75	14.65	Ave.	18	2.3	H	32.13	46.78	54	7.22
4924.00	45.11	PK	201	2.0	H	6.43	51.54	74	22.46
4924.00	35.12	Ave.	100	2.1	H	6.43	41.55	54	12.45

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)									
2340.85	27.69	PK	36	2.1	H	31.64	59.33	74	14.67
2340.85	14.44	Ave.	36	2.1	H	31.64	46.08	54	7.92
2493.59	28.17	PK	44	2.0	H	32.13	60.30	74	13.70
2493.59	14.52	Ave.	44	2.0	H	32.13	46.65	54	7.35
4824.00	44.01	PK	134	1.6	H	5.40	49.41	74	24.59
4824.00	28.95	Ave.	134	1.6	H	5.40	34.35	54	19.65
Middle Channel (2437MHz)									
4874.00	43.65	PK	306	1.2	H	6.43	50.08	74	23.92
4874.00	29.08	Ave.	306	1.2	H	6.43	35.51	54	18.49
High Channel (2462 MHz)									
2372.58	27.85	PK	320	1.6	H	31.87	59.72	74	14.28
2372.58	14.43	Ave.	320	1.6	H	31.87	46.30	54	7.70
2489.63	28.97	PK	86	2.2	H	32.13	61.10	74	12.90
2489.63	15.10	Ave.	86	2.2	H	32.13	47.23	54	6.77
4924.00	43.27	PK	310	1.1	H	6.43	49.70	74	24.30
4924.00	29.01	Ave.	310	1.1	H	6.43	35.44	54	18.56

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)									
2321.40	29.19	PK	170	2.0	H	31.64	60.83	74	13.17
2321.40	14.41	Ave.	170	2.0	H	31.64	46.05	54	7.95
2496.02	28.57	PK	352	2.4	H	32.13	60.70	74	13.30
2496.02	14.50	Ave.	352	2.4	H	32.13	46.63	54	7.37
4824.00	43.63	PK	29	2.4	H	5.40	49.03	74	24.97
4824.00	29.11	Ave.	29	2.4	H	5.40	34.51	54	19.49
Middle Channel (2437MHz)									
4874.00	43.47	PK	61	2.0	H	6.43	49.90	74	24.10
4874.00	29.25	Ave.	61	2.0	H	6.43	35.68	54	18.32
High Channel (2462 MHz)									
2313.65	27.84	PK	323	1.5	H	31.64	59.48	74	14.52
2313.65	14.41	Ave.	323	1.5	H	31.64	46.05	54	7.95
2496.38	28.69	PK	160	2.1	H	32.13	60.82	74	13.18
2496.38	14.79	Ave.	160	2.1	H	32.13	46.92	54	7.08
4924.00	43.92	PK	185	2.0	H	6.43	50.35	74	23.65
4924.00	29.12	Ave.	185	2.0	H	6.43	35.55	54	18.45

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)									
2311.33	27.84	PK	282	1.4	H	31.64	59.48	74	14.52
2311.33	15.77	Ave.	282	1.4	H	31.64	47.41	54	6.59
2496.86	28.59	PK	122	1.8	H	32.13	60.72	74	13.28
2496.86	14.55	Ave.	122	1.8	H	32.13	46.68	54	7.32
4844.00	43.59	PK	56	1.3	H	5.40	48.99	74	25.01
4844.00	29.05	Ave.	56	1.3	H	5.40	34.45	54	19.55
Middle Channel (2437MHz)									
4874.00	43.84	PK	278	1.2	H	6.43	50.27	74	23.73
4874.00	29.06	Ave.	278	1.2	H	6.43	35.49	54	18.51
High Channel (2452 MHz)									
2341.78	27.95	PK	119	1.7	H	31.64	59.59	74	14.41
2341.78	14.39	Ave.	119	1.7	H	31.64	46.03	54	7.97
2489.84	28.55	PK	168	1.1	H	32.13	60.68	74	13.32
2489.84	15.46	Ave.	168	1.1	H	32.13	47.59	54	6.41
4904.00	43.83	PK	264	1.7	H	6.43	50.26	74	23.74
4904.00	28.96	Ave.	264	1.7	H	6.43	35.39	54	18.61

1 GHz-25 GHz (LE 1M):

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 (2402 MHz)									
2387.97	28.02	PK	164	1.1	H	31.87	59.89	74	14.11
2387.97	14.66	Ave.	164	1.1	H	31.87	46.53	54	7.47
2489.29	29.76	PK	108	1.1	H	32.13	61.89	74	12.11
2489.29	14.89	Ave.	108	1.1	H	32.13	47.02	54	6.98
4804.00	46.83	PK	132	1.1	H	5.40	52.23	74	21.77
4804.00	37.72	Ave.	132	1.1	H	5.40	43.12	54	10.88
Middle Channel (2440 MHz)									
4880.00	45.40	PK	192	2.5	H	6.43	51.83	74	22.17
4880.00	34.63	Ave.	192	2.5	H	6.43	41.06	54	12.94
High Channel (2480 MHz)									
2312.60	28.27	PK	9	2.1	H	31.64	59.91	74	14.09
2312.60	14.68	Ave.	9	2.1	H	31.64	46.32	54	7.68
2492.44	29.34	PK	318	2.2	H	32.13	61.47	74	12.53
2492.44	14.87	Ave.	318	2.2	H	32.13	47.00	54	7.00
4960.00	45.83	PK	240	1.3	H	6.95	52.78	74	21.22
4960.00	36.51	Ave.	269	1.4	H	6.95	43.46	54	10.54

1 GHz-25 GHz (LE 2M):

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 (2402 MHz)									
2345.60	27.83	PK	309	2.1	H	31.64	59.47	74	14.53
2345.60	14.78	Ave.	309	2.1	H	31.64	46.42	54	7.58
2497.67	28.16	PK	20	2.4	H	32.13	60.29	74	13.71
2497.67	14.91	Ave.	20	2.4	H	32.13	47.04	54	6.96
4804.00	47.05	PK	60	1.9	H	5.40	52.45	74	21.55
4804.00	37.22	Ave.	60	1.9	H	5.40	42.62	54	11.38
Middle Channel (2440 MHz)									
4880.00	45.94	PK	23	2.4	H	6.43	52.37	74	21.63
4880.00	35.29	Ave.	23	2.4	H	6.43	41.72	54	12.28
High Channel (2480 MHz)									
2360.30	28.12	PK	88	1.7	H	31.77	59.89	74	14.11
2360.30	14.60	Ave.	88	1.7	H	31.77	46.37	54	7.63
2484.09	30.08	PK	113	1.4	H	32.13	62.21	74	11.79
2484.09	15.82	Ave.	113	1.4	H	32.13	47.95	54	6.05
4960.00	45.19	PK	59	2.2	H	6.95	52.14	74	21.86
4960.00	34.63	Ave.	59	2.2	H	6.95	41.58	54	12.42

1 GHz-10 GHz (Lora)

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(923.3MHz)									
1846.60	45.39	PK	309	1.7	V	-1.55	43.84	74	30.16
1846.60	33.52	Ave.	309	1.7	V	-1.55	31.97	54	22.03
High Channel(927.5 MHz)									
1855.00	45.67	PK	342	2.2	V	-1.16	44.51	74	29.49
1855.00	32.99	Ave.	342	2.2	V	-1.16	31.83	54	22.17

Note:

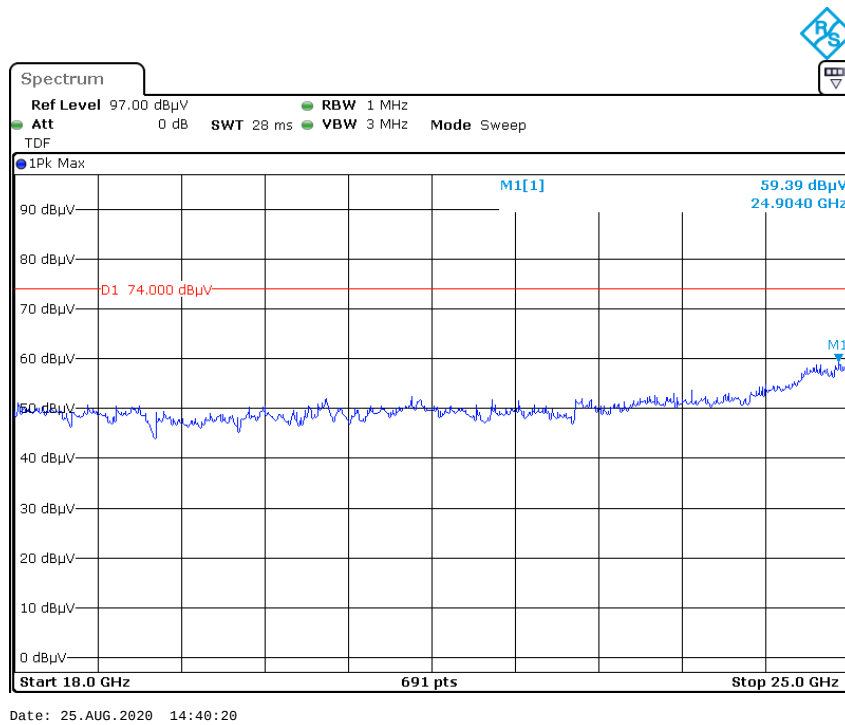
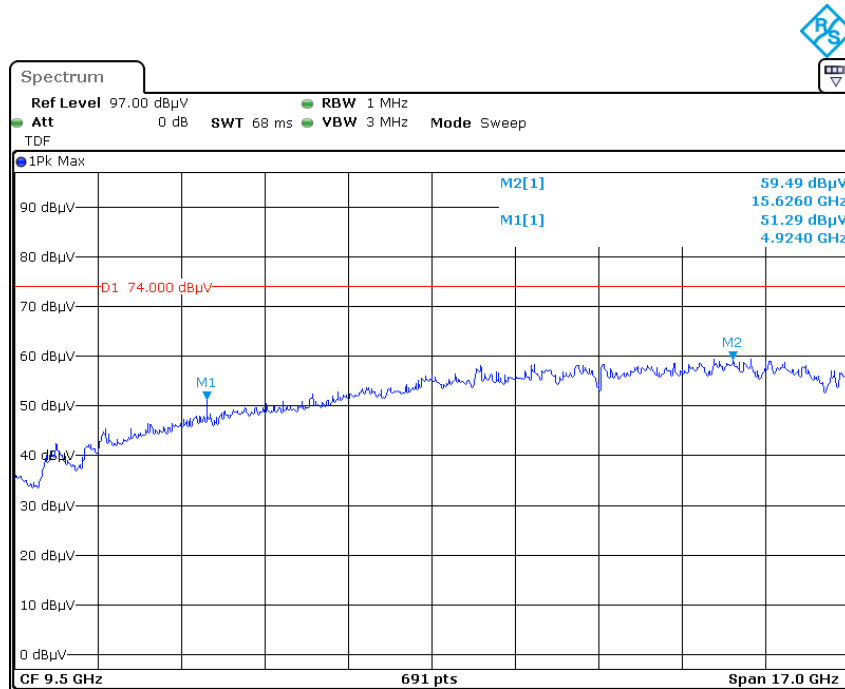
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

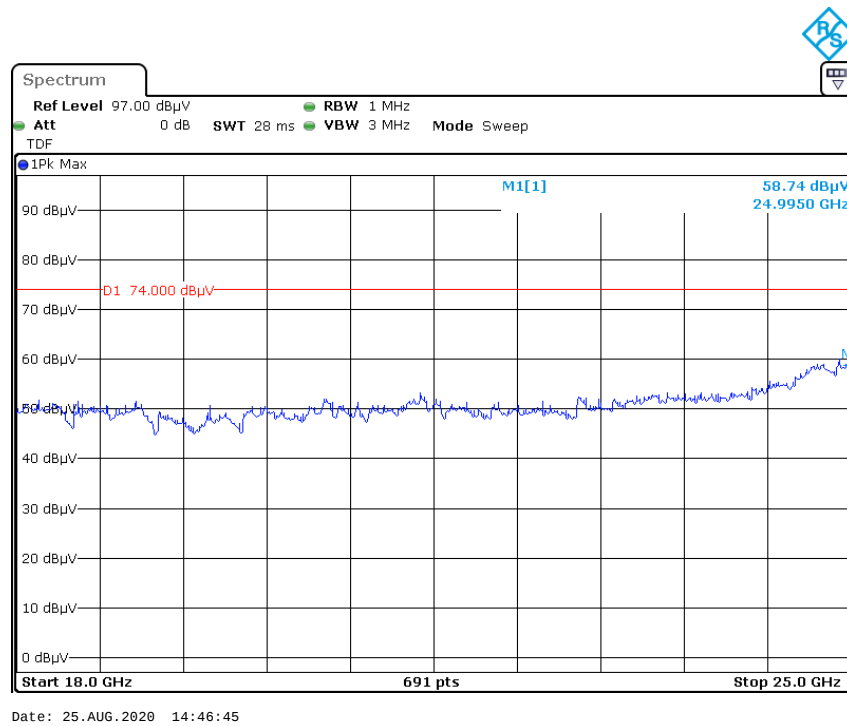
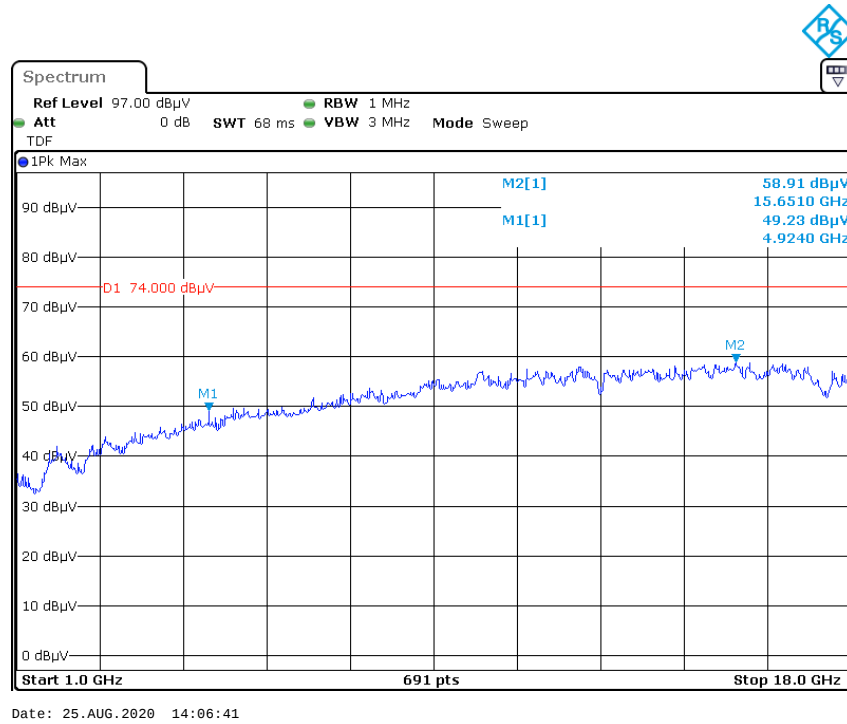
Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

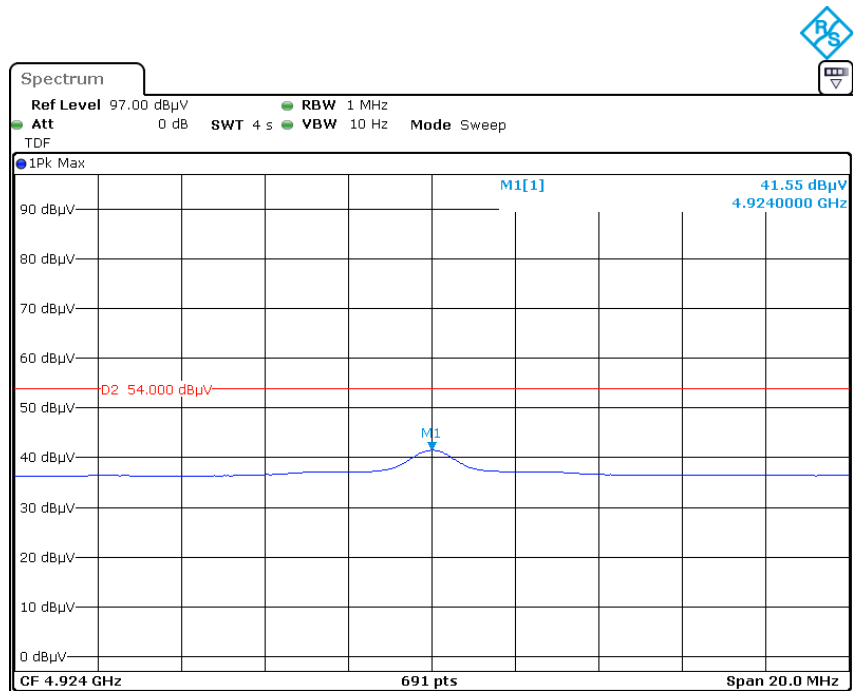
Pre-scan with Wi-Fi, high channel in 802.11b mode
Horizontal



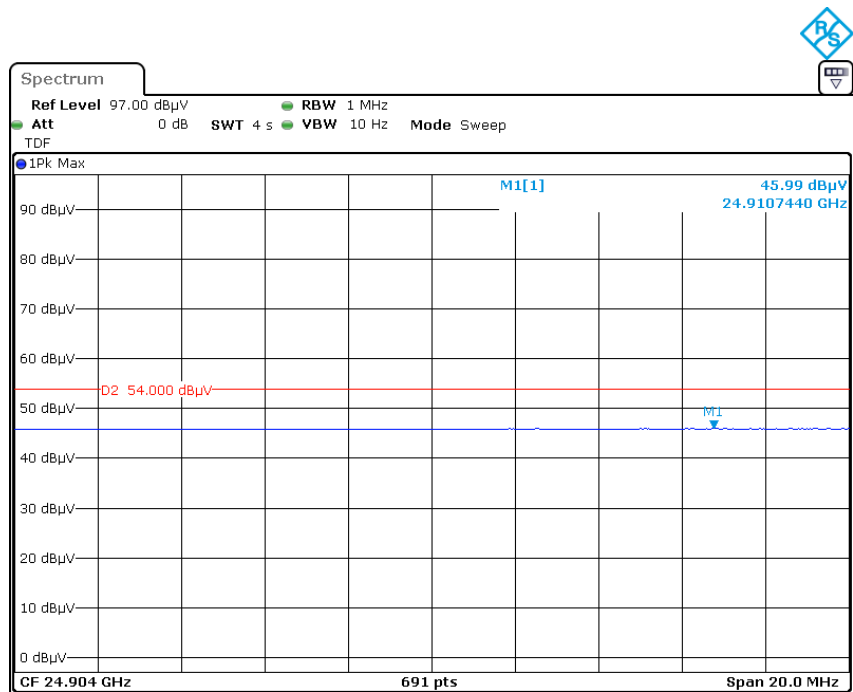
Vertical



Pre-scan for Average Horizontal

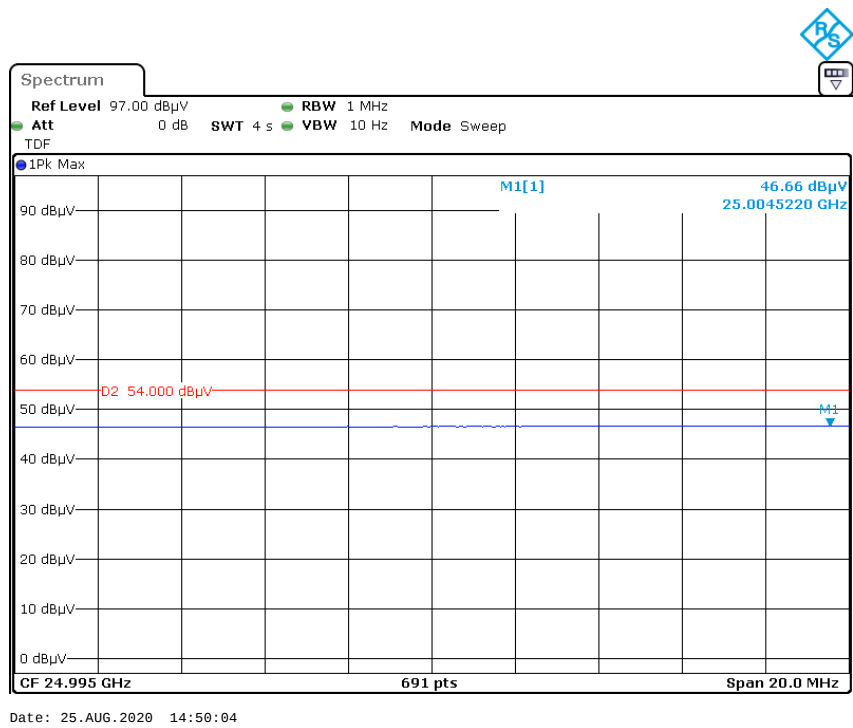
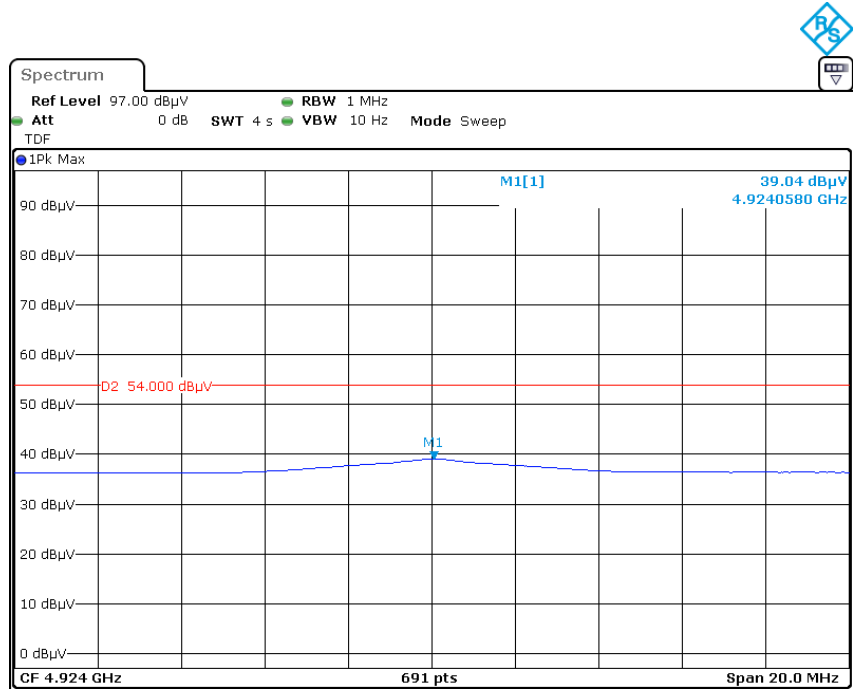


Date: 25.AUG.2020 14:03:20



Date: 25.AUG.2020 14:43:34

Vertical

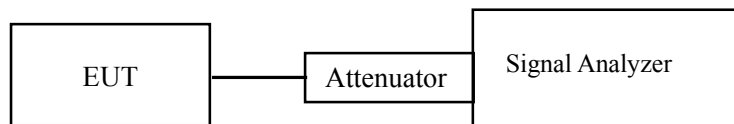


FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH**Applicable Standard**

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

Test Procedure

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

**Test Data****Environmental Conditions**

Temperature:	24~25 °C
Relative Humidity:	52~53 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-08-24 to 2020-09-01.

EUT operation mode: Transmitting

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

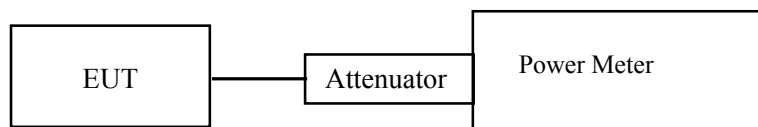
FCC §15.247(b) (3) - MAXIMUM CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	24~25 °C
Relative Humidity:	52~53 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-08-24 to 2020-09-01.

EUT operation mode: Transmitting

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

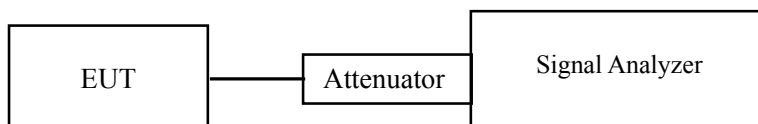
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	24~25 °C
Relative Humidity:	52~53 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-08-24 to 2020-09-01.

EUT operation mode: Transmitting

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

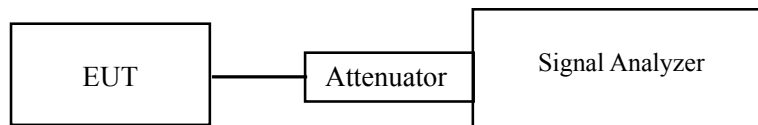
FCC §15.247(e) - POWER SPECTRAL DENSITY

Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: $3\text{kHz} \leq \text{RBW} \leq 100\text{ kHz}$.
3. Set the VBW $\geq 3 \times \text{RBW}$.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	24~25 °C
Relative Humidity:	52~53 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-09-01 to 2020-09-20.

EUT operation mode: Transmitting

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

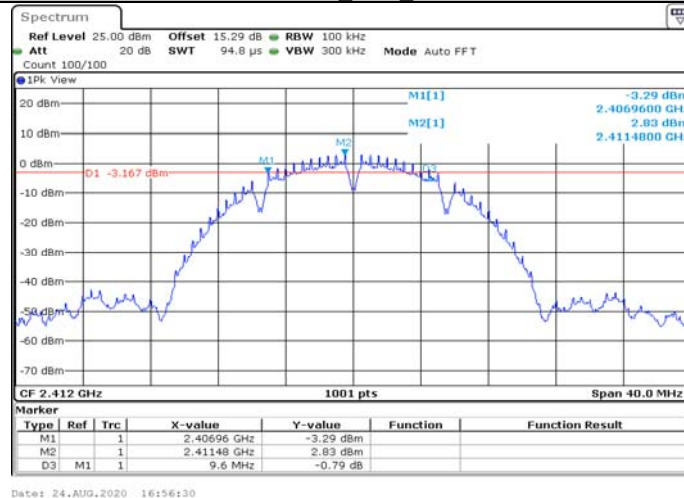
APPENDIX Wi-Fi

Appendix A: DTS Bandwidth Test Result

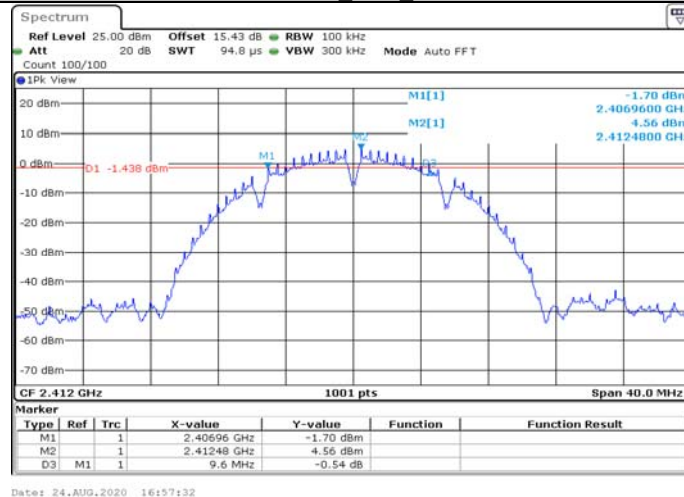
Test Mode	Antenna	Channel	DTS BW [MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	9.600	0.5	PASS
	Ant2	2412	9.600	0.5	PASS
	Ant1	2437	9.600	0.5	PASS
	Ant2	2437	9.600	0.5	PASS
	Ant1	2462	10.120	0.5	PASS
	Ant2	2462	9.120	0.5	PASS
11G-CDD	Ant1	2412	16.400	0.5	PASS
	Ant2	2412	16.160	0.5	PASS
	Ant1	2437	16.400	0.5	PASS
	Ant2	2437	16.400	0.5	PASS
	Ant1	2462	16.400	0.5	PASS
	Ant2	2462	16.400	0.5	PASS
11N20MIMO	Ant1	2412	17.640	0.5	PASS
	Ant2	2412	17.600	0.5	PASS
	Ant1	2437	17.640	0.5	PASS
	Ant2	2437	17.600	0.5	PASS
	Ant1	2462	17.640	0.5	PASS
	Ant2	2462	17.640	0.5	PASS
11N40MIMO	Ant1	2422	35.840	0.5	PASS
	Ant2	2422	36.000	0.5	PASS
	Ant1	2437	35.280	0.5	PASS
	Ant2	2437	35.840	0.5	PASS
	Ant1	2452	35.200	0.5	PASS
	Ant2	2452	35.600	0.5	PASS

Test Graphs

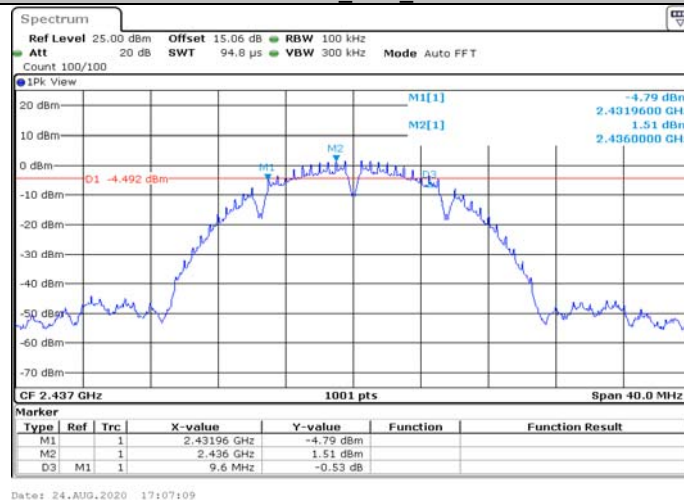
11B-CDD_Ant1_2412



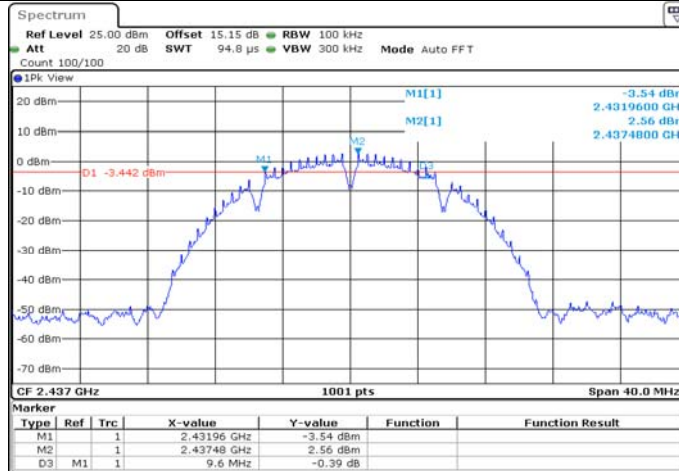
11B-CDD_Ant2_2412



11B-CDD_Ant1_2437

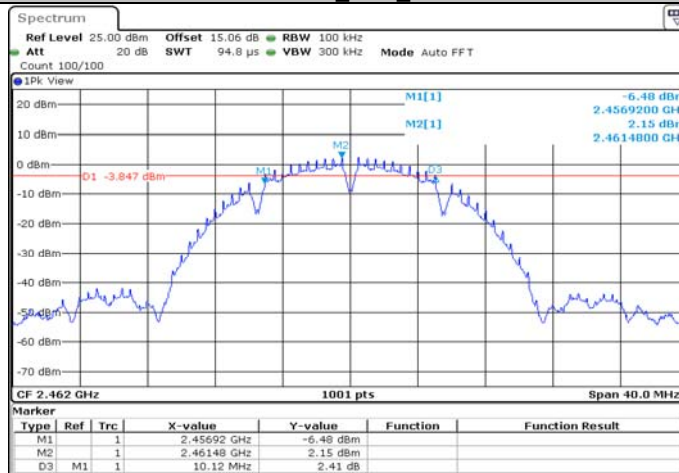


11B-CDD_Ant2_2437



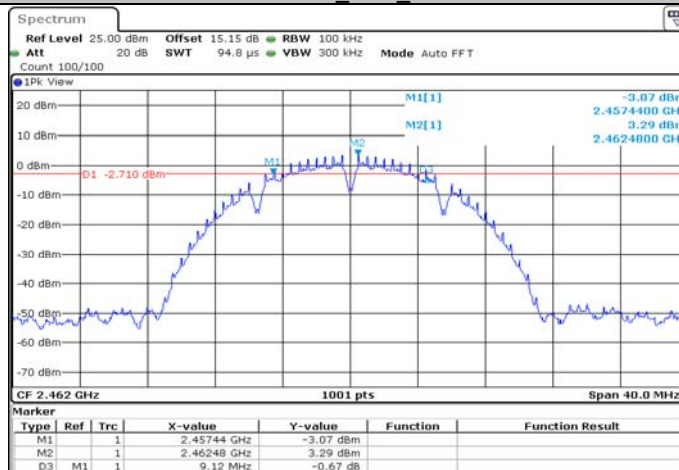
Date: 24.AUG.2020 17:09:29

11B-CDD_Ant1_2462



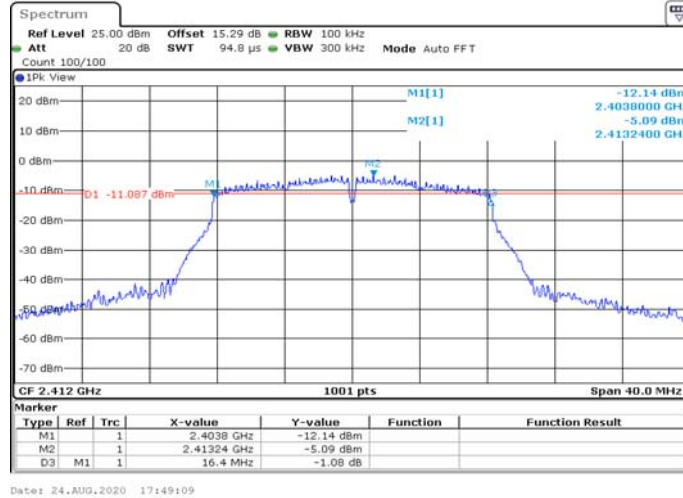
Date: 24.AUG.2020 17:12:32

11B-CDD_Ant2_2462

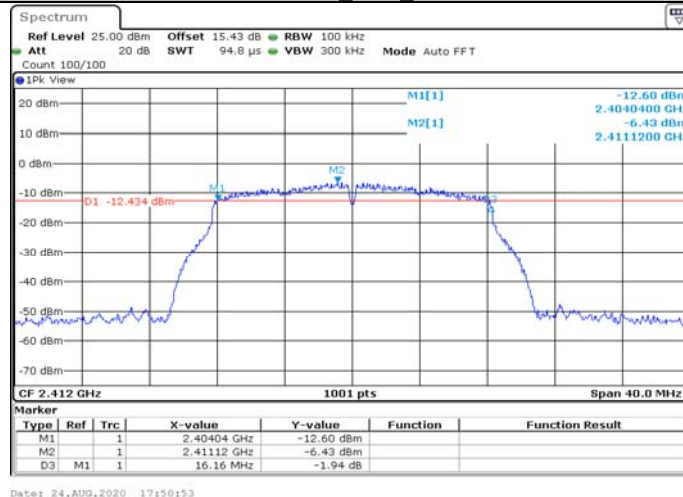


Date: 24.AUG.2020 17:13:33

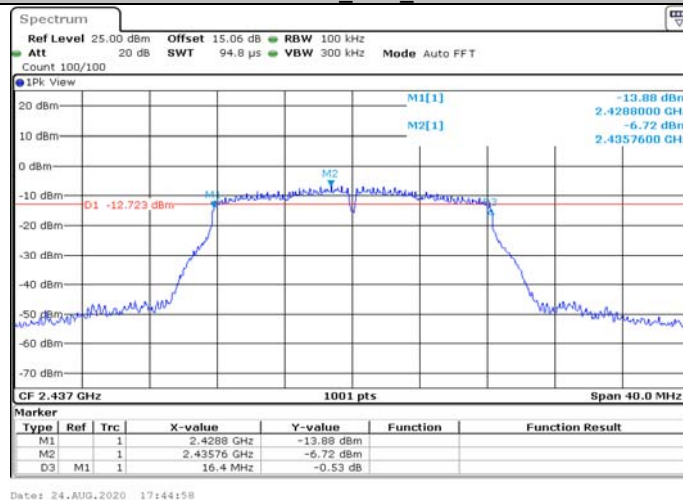
11G-CDD_Ant1_2412



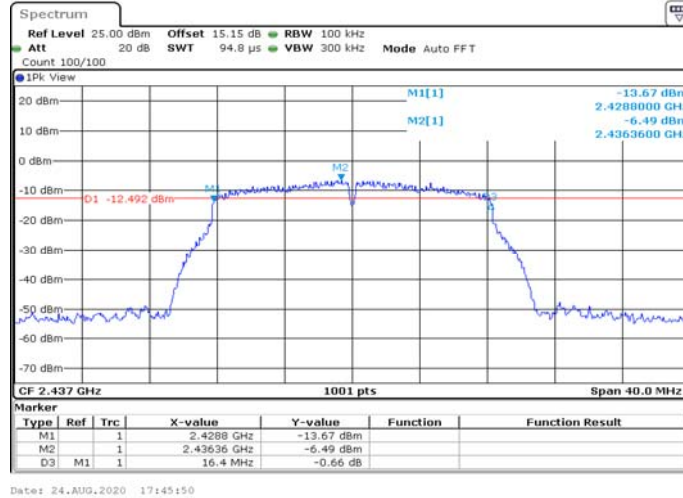
11G-CDD_Ant2_2412



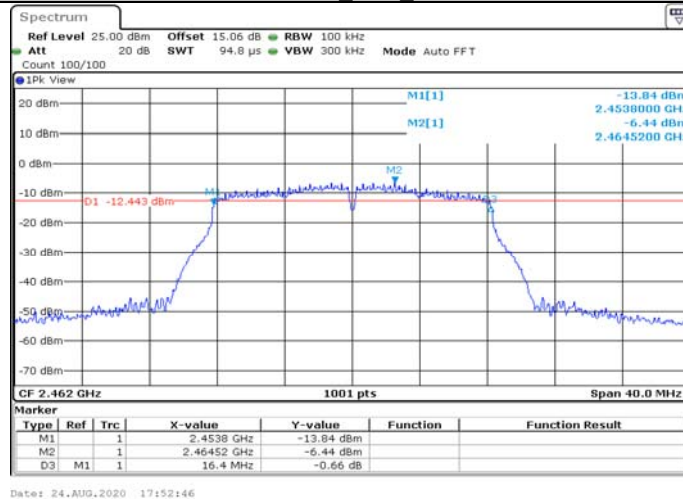
11G-CDD_Ant1_2437



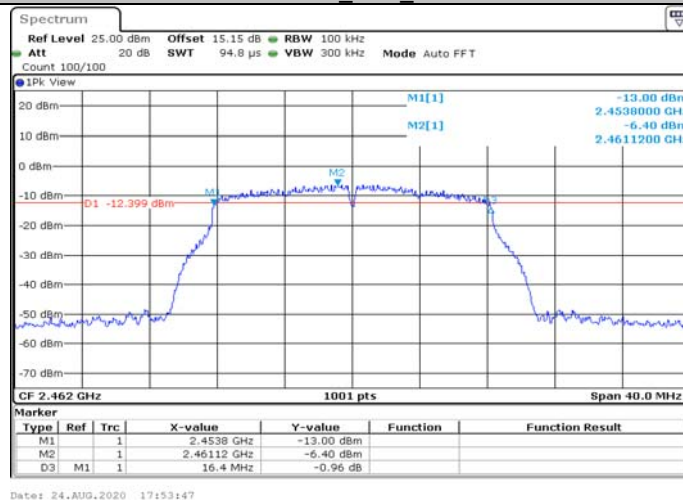
11G-CDD_Ant2_2437



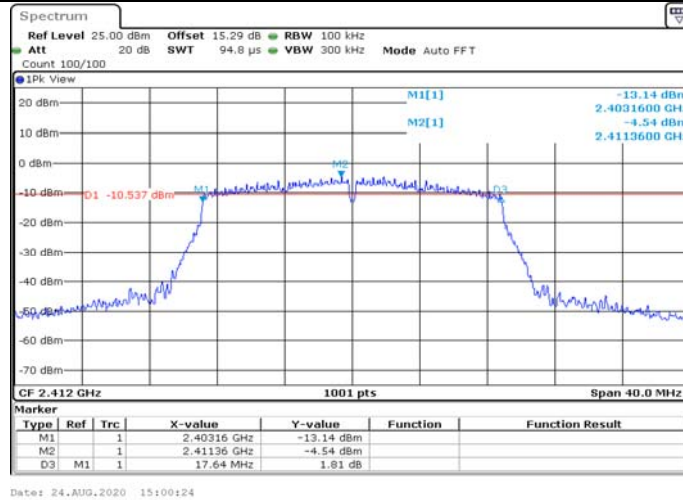
11G-CDD_Ant1_2462



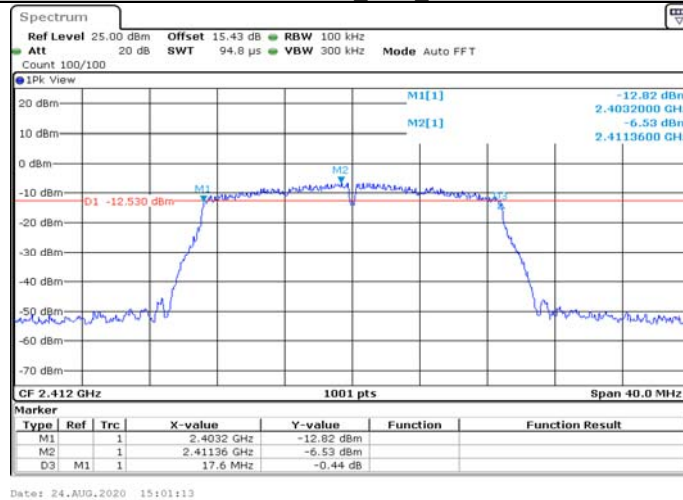
11G-CDD_Ant2_2462



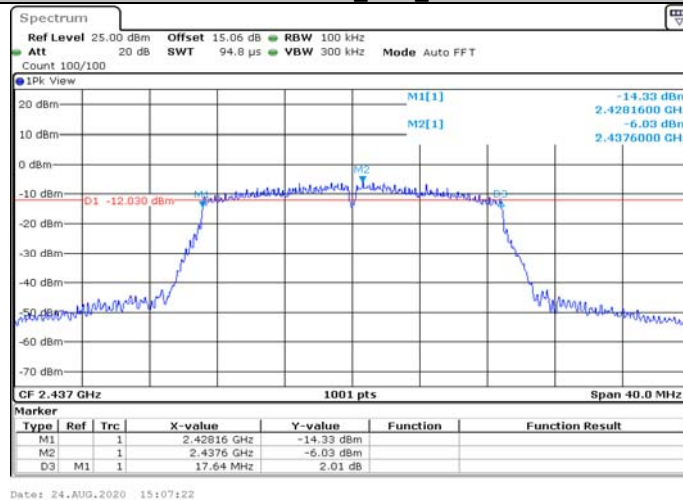
11N20MIMO_Ant1_2412



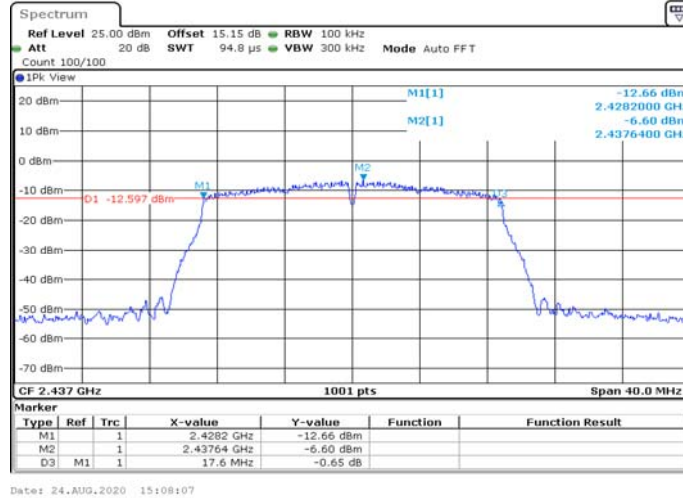
11N20MIMO_Ant2_2412



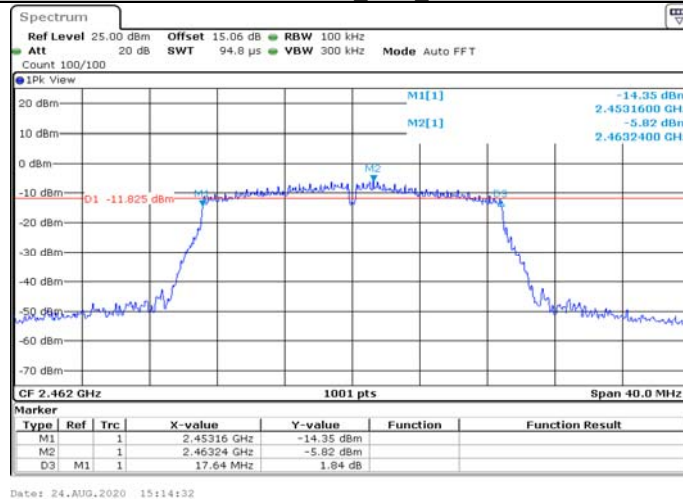
11N20MIMO_Ant1_2437



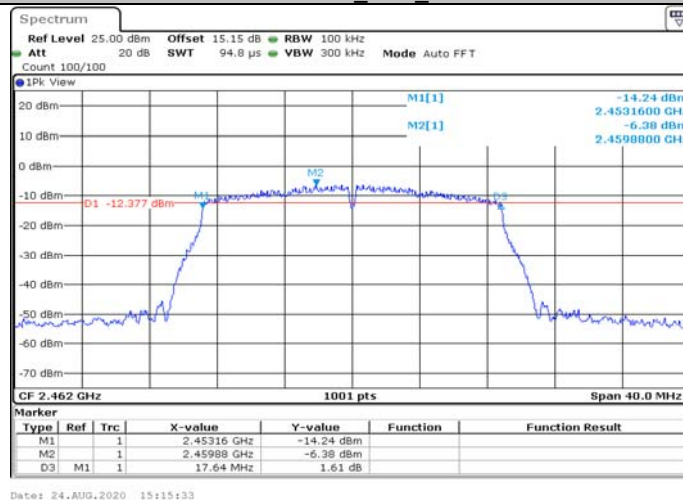
11N20MIMO_Ant2_2437



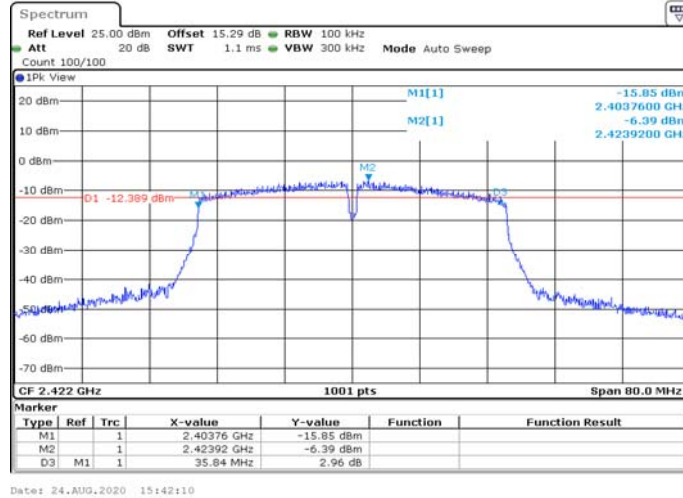
11N20MIMO_Ant1_2462



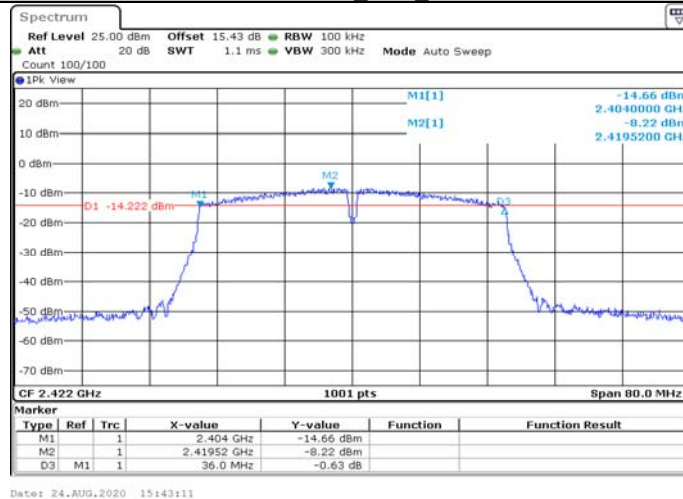
11N20MIMO_Ant2_2462



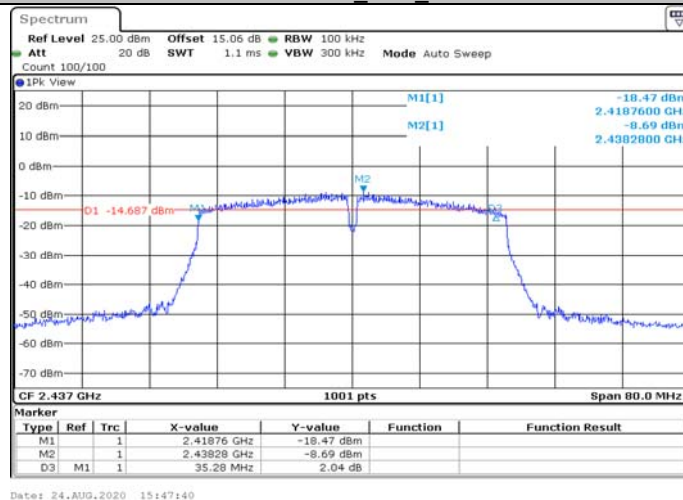
11N40MIMO_Ant1_2422



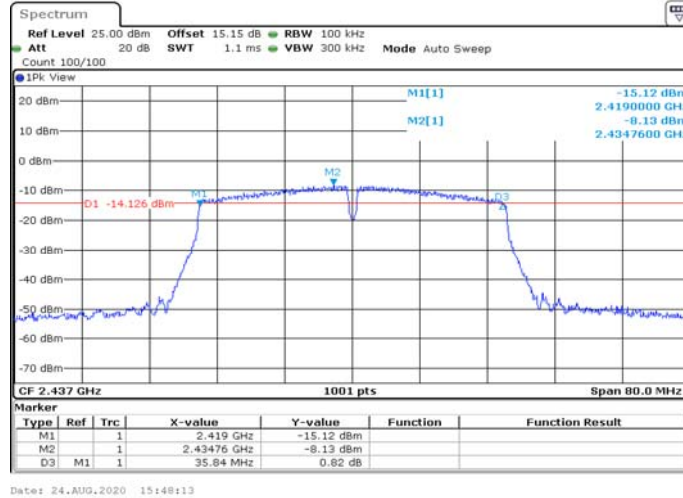
11N40MIMO_Ant2_2422



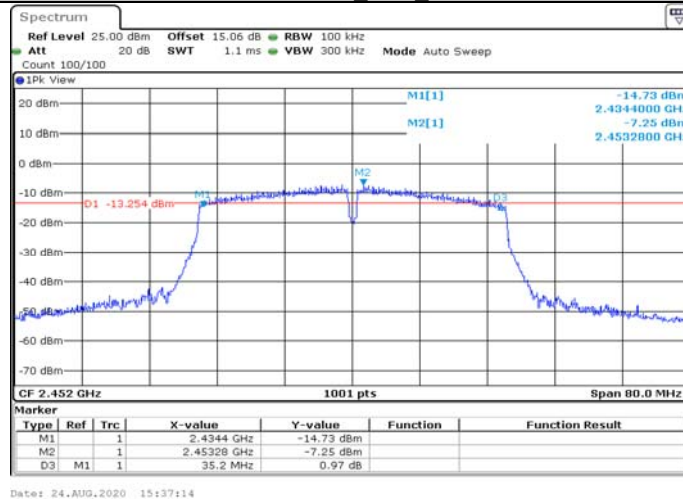
11N40MIMO_Ant1_2437



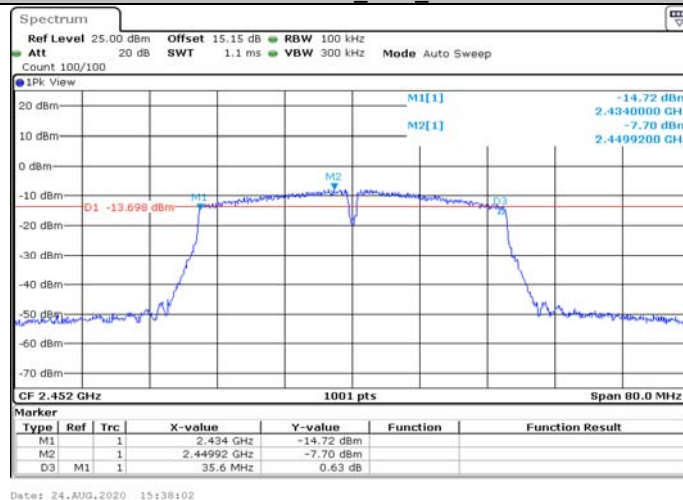
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



11N40MIMO_Ant2_2452

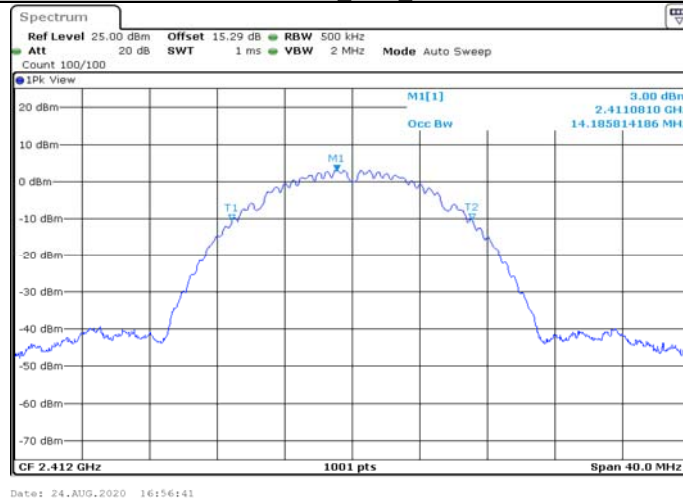


Appendix B: Occupied Channel Bandwidth Test Result

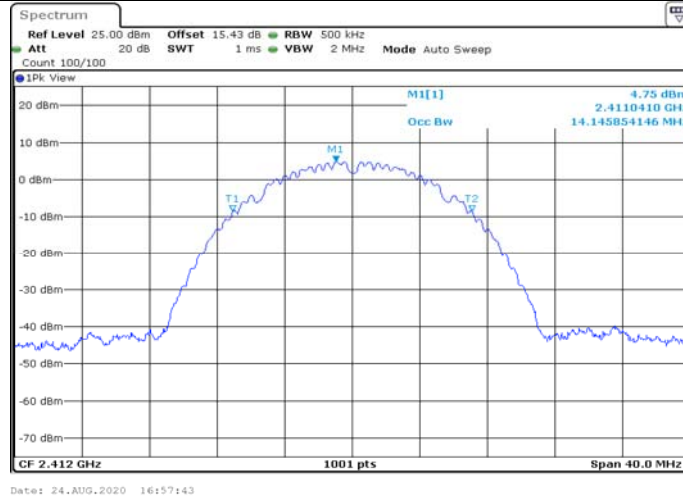
Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11B-CDD	Ant1	2412	14.186	---	PASS
	Ant2	2412	14.146	---	PASS
	Ant1	2437	14.226	---	PASS
	Ant2	2437	14.146	---	PASS
	Ant1	2462	14.266	---	PASS
	Ant2	2462	14.146	---	PASS
11G-CDD	Ant1	2412	16.703	---	PASS
	Ant2	2412	17.143	---	PASS
	Ant1	2437	16.703	---	PASS
	Ant2	2437	17.143	---	PASS
	Ant1	2462	16.703	---	PASS
	Ant2	2462	17.143	---	PASS
11N20MIMO	Ant1	2412	17.702	---	PASS
	Ant2	2412	17.982	---	PASS
	Ant1	2437	17.742	---	PASS
	Ant2	2437	18.022	---	PASS
	Ant1	2462	17.702	---	PASS
	Ant2	2462	17.942	---	PASS
11N40MIMO	Ant1	2422	36.204	---	PASS
	Ant2	2422	36.444	---	PASS
	Ant1	2437	36.284	---	PASS
	Ant2	2437	36.444	---	PASS
	Ant1	2452	36.124	---	PASS
	Ant2	2452	36.364	---	PASS

Test Graphs

11B-CDD_Ant1_2412



11B-CDD_Ant2_2412



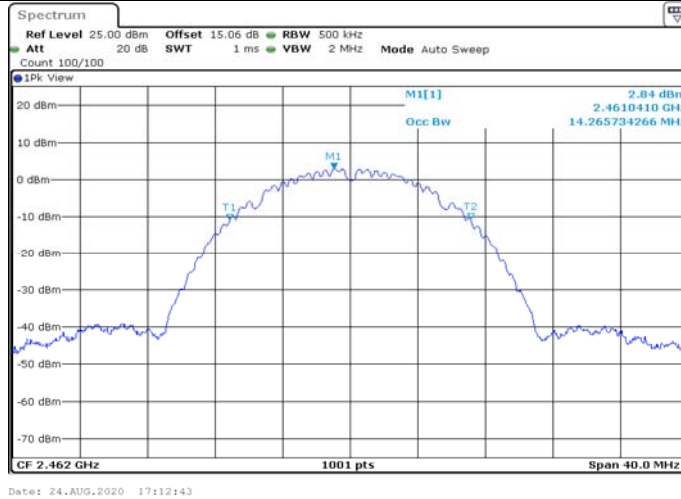
11B-CDD_Ant1_2437



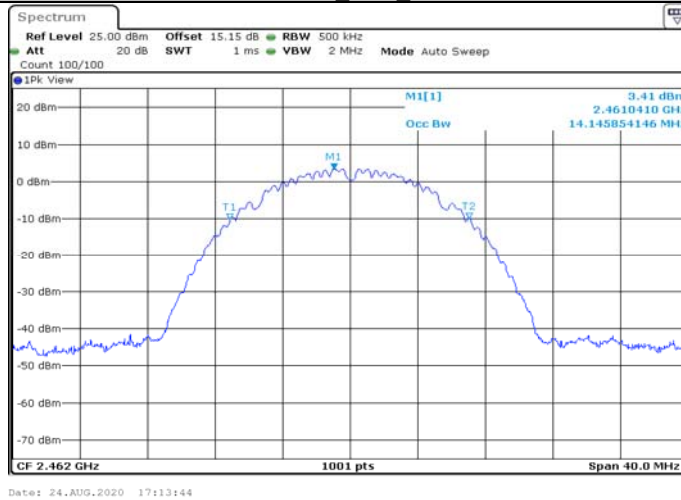
11B-CDD_Ant2_2437



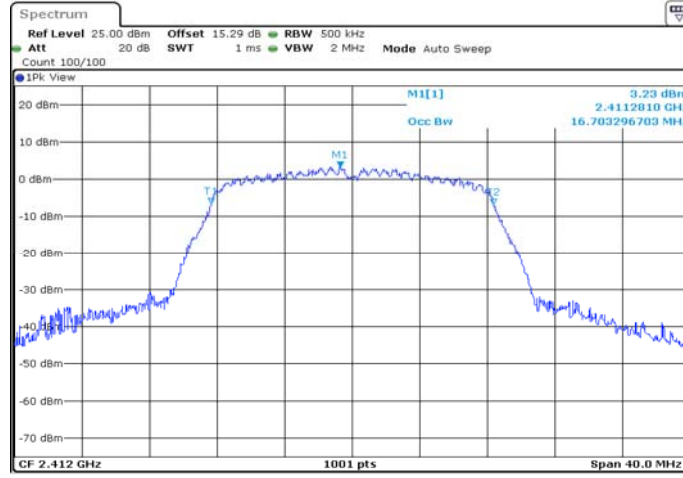
11B-CDD_Ant1_2462



11B-CDD_Ant2_2462



11G-CDD_Ant1_2412



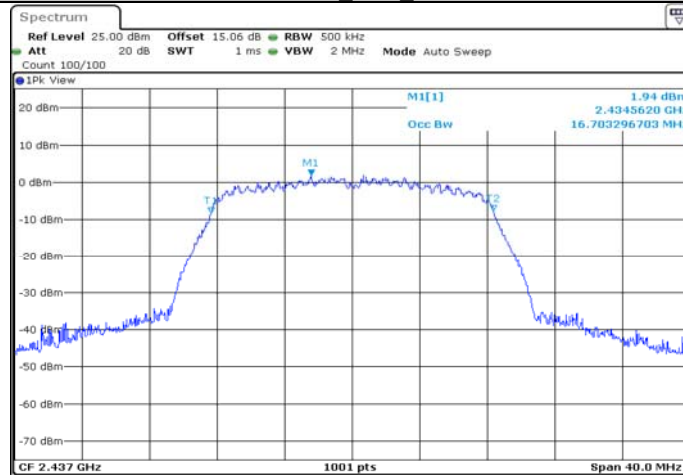
Date: 24.AUG.2020 17:49:20

11G-CDD_Ant2_2412



Date: 24.AUG.2020 17:51:04

11G-CDD_Ant1_2437



Date: 24.AUG.2020 17:45:09

11G-CDD_Ant2_2437



11G-CDD_Ant1_2462



11G-CDD_Ant2_2462



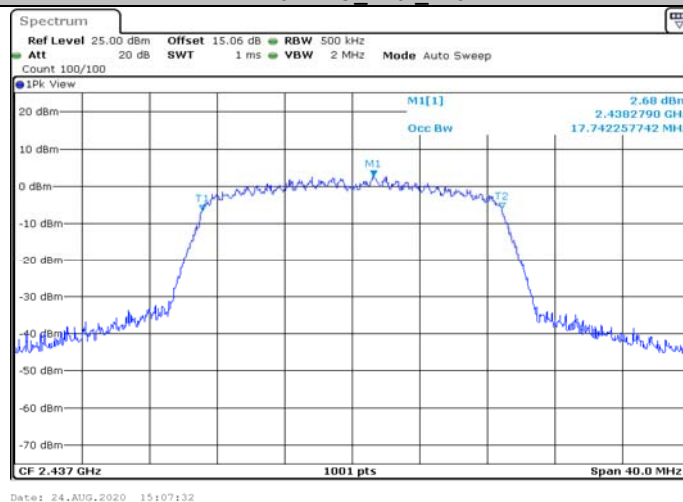
11N20MIMO_Ant1_2412



11N20MIMO_Ant2_2412



11N20MIMO_Ant1_2437



11N20MIMO_Ant2_2437



11N20MIMO_Ant1_2462



11N20MIMO_Ant2_2462



11N40MIMO_Ant1_2422



11N40MIMO_Ant2_2422



11N40MIMO_Ant1_2437



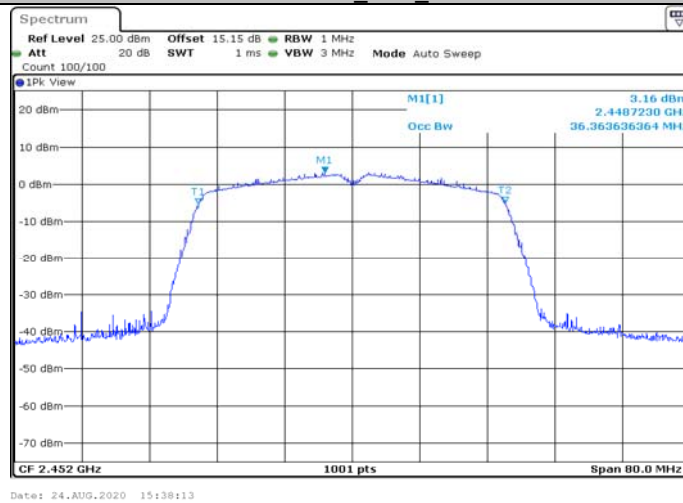
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



11N40MIMO_Ant2_2452



Appendix C: Maximum conducted output power (Peak) Test Result

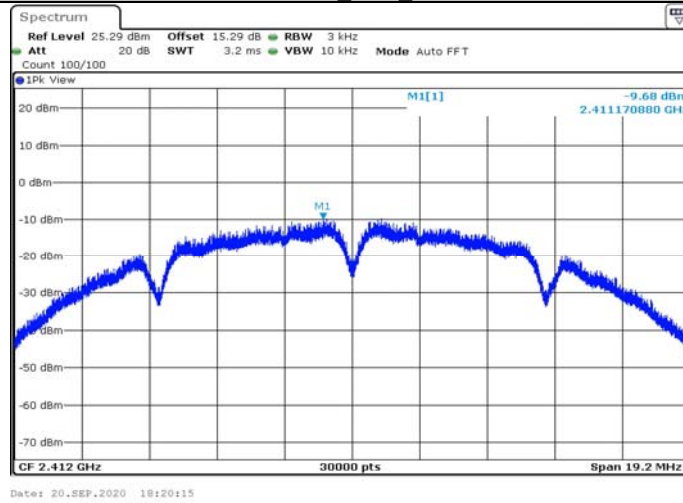
Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B-CDD	Ant1	2412	14.20	<=30	PASS
	Ant2	2412	15.82	<=30	PASS
	total	2412	18.10	<=30	PASS
	Ant1	2437	13.45	<=30	PASS
	Ant2	2437	14.58	<=30	PASS
	total	2437	17.06	<=30	PASS
	Ant1	2462	14.44	<=30	PASS
	Ant2	2462	14.77	<=30	PASS
11G-CDD	total	2462	17.62	<=30	PASS
	Ant1	2412	13.70	<=30	PASS
	Ant2	2412	12.05	<=30	PASS
	total	2412	15.96	<=30	PASS
	Ant1	2437	12.79	<=30	PASS
	Ant2	2437	13.30	<=30	PASS
	total	2437	16.06	<=30	PASS
	Ant1	2462	13.00	<=30	PASS
11N20MIMO	Ant2	2462	13.25	<=30	PASS
	total	2462	16.14	<=30	PASS
	Ant1	2412	13.14	<=30	PASS
	Ant2	2412	13.35	<=30	PASS
	total	2412	16.26	<=30	PASS
	Ant1	2437	12.44	<=30	PASS
	Ant2	2437	13.15	<=30	PASS
	total	2437	15.82	<=30	PASS
11N40MIMO	Ant1	2462	12.17	<=30	PASS
	Ant2	2462	13.55	<=30	PASS
	total	2462	15.92	<=30	PASS
	Ant1	2422	12.97	<=30	PASS
	Ant2	2422	12.55	<=30	PASS
	total	2422	15.78	<=30	PASS
	Ant1	2437	11.59	<=30	PASS
	Ant2	2437	12.86	<=30	PASS
	total	2437	15.28	<=30	PASS
	Ant1	2452	12.80	<=30	PASS
	Ant2	2452	12.28	<=30	PASS
	total	2452	15.56	<=30	PASS

Appendix D: Maximum power spectral density Test Result

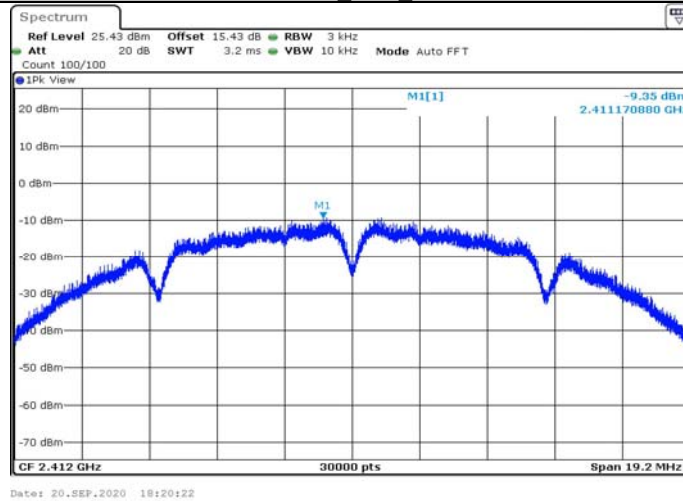
Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B-CDD	Ant1	2412	-9.68	<=8	PASS
	Ant2	2412	-9.35	<=8	PASS
	total	2412	-6.50	<=8	PASS
	Ant1	2437	-9.08	<=8	PASS
	Ant2	2437	-9.36	<=8	PASS
	total	2437	-6.21	<=8	PASS
	Ant1	2462	-9.46	<=8	PASS
	Ant2	2462	-10.03	<=8	PASS
11G-CDD	total	2462	-6.73	<=8	PASS
	Ant1	2412	-17.03	<=8	PASS
	Ant2	2412	-15.21	<=8	PASS
	total	2412	-13.02	<=8	PASS
	Ant1	2437	-16.13	<=8	PASS
	Ant2	2437	-17.35	<=8	PASS
	total	2437	-13.69	<=8	PASS
	Ant1	2462	-17.54	<=8	PASS
11N20MIMO	Ant2	2462	-17.53	<=8	PASS
	total	2462	-14.52	<=8	PASS
	Ant1	2412	-18.64	<=8	PASS
	Ant2	2412	-16.71	<=8	PASS
	total	2412	-14.70	<=8	PASS
	Ant1	2437	-17.8	<=8	PASS
	Ant2	2437	-18.2	<=8	PASS
	total	2437	-14.99	<=8	PASS
11N40MIMO	Ant1	2462	-16.28	<=8	PASS
	Ant2	2462	-17.25	<=8	PASS
	total	2462	-13.73	<=8	PASS
	Ant1	2422	-19.84	<=8	PASS
	Ant2	2422	-19.1	<=8	PASS
	total	2422	-16.44	<=8	PASS
	Ant1	2437	-19.13	<=8	PASS
	Ant2	2437	-18.99	<=8	PASS
	total	2437	-16.05	<=8	PASS
	Ant1	2452	-19.01	<=8	PASS
	Ant2	2452	-19.99	<=8	PASS
	total	2452	-16.46	<=8	PASS

Test Graphs

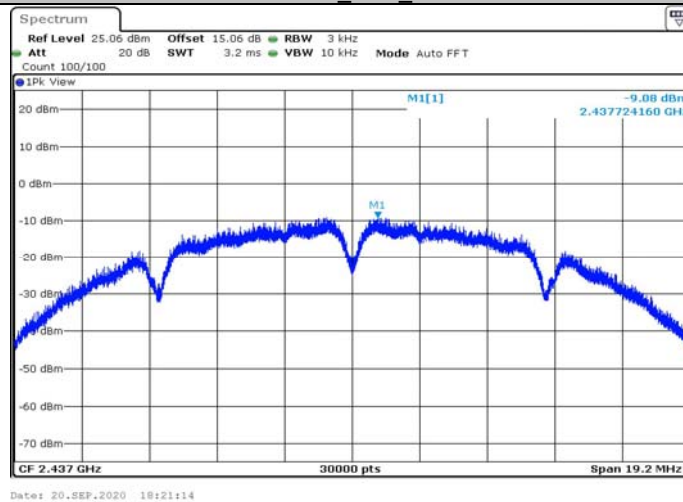
11B-CDD_Ant1_2412



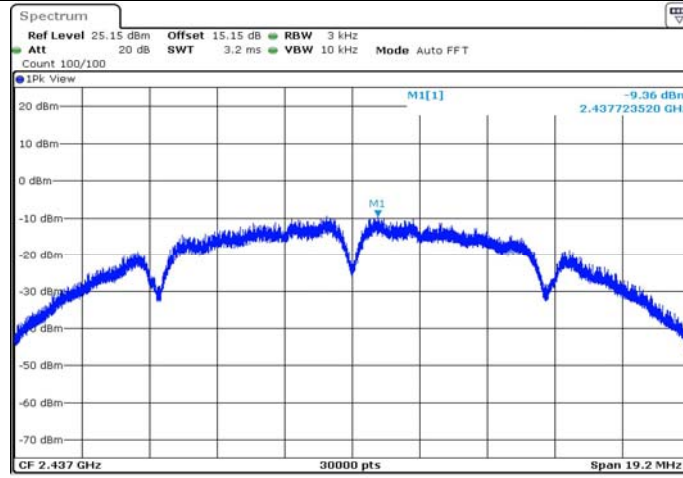
11B-CDD_Ant2_2412



11B-CDD_Ant1_2437

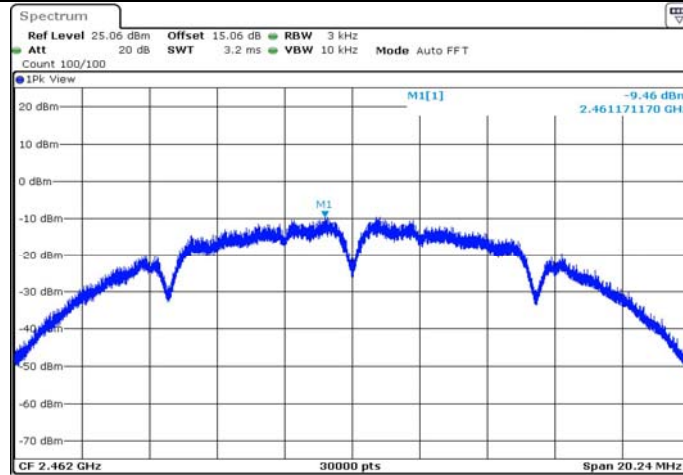


11B-CDD_Ant2_2437



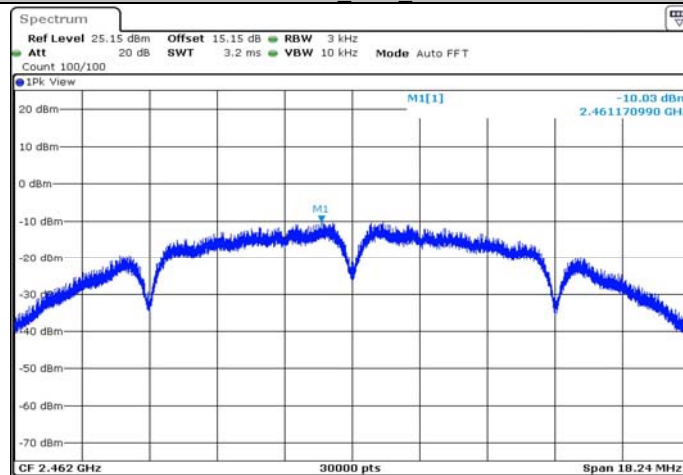
Date: 20.SEP.2020 18:21:21

11B-CDD_Ant1_2462



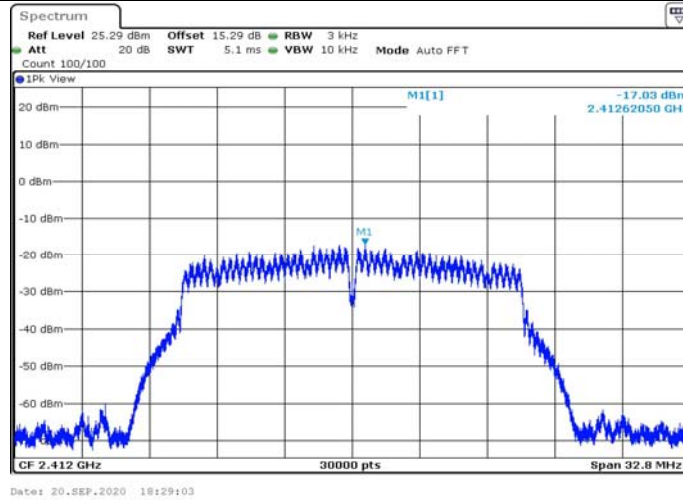
Date: 20.SEP.2020 18:23:10

11B-CDD_Ant2_2462

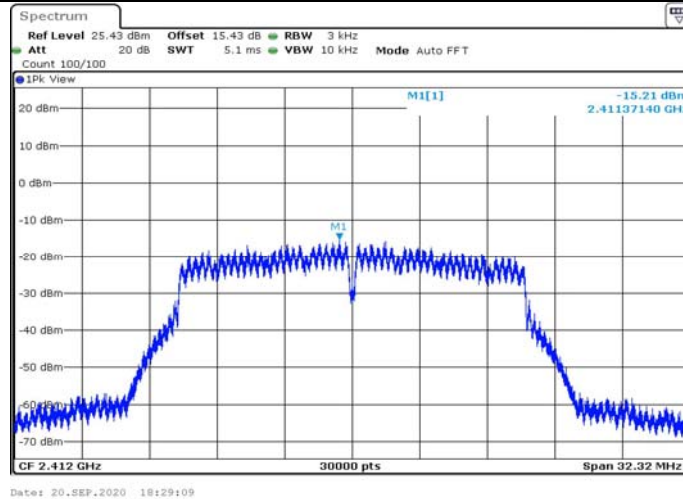


Date: 20.SEP.2020 18:24:35

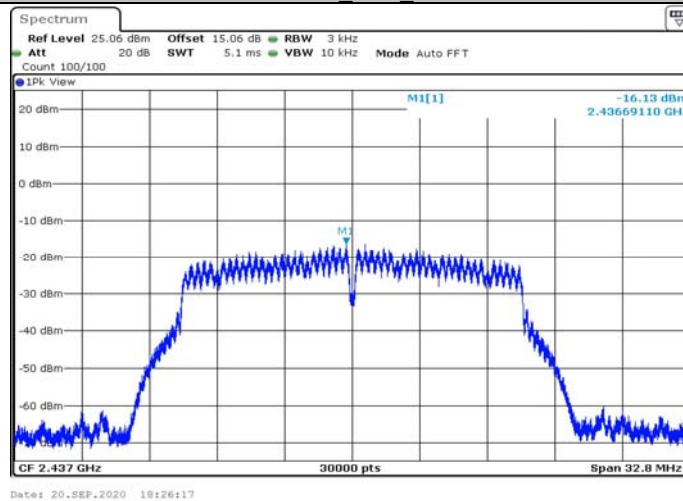
11G-CDD_Ant1_2412



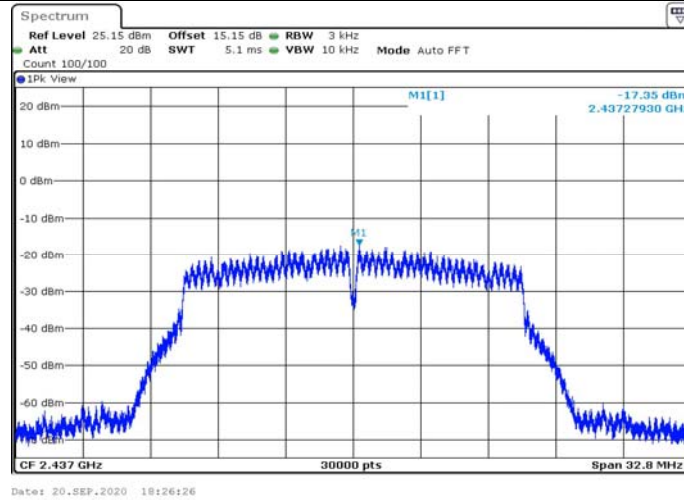
11G-CDD_Ant2_2412



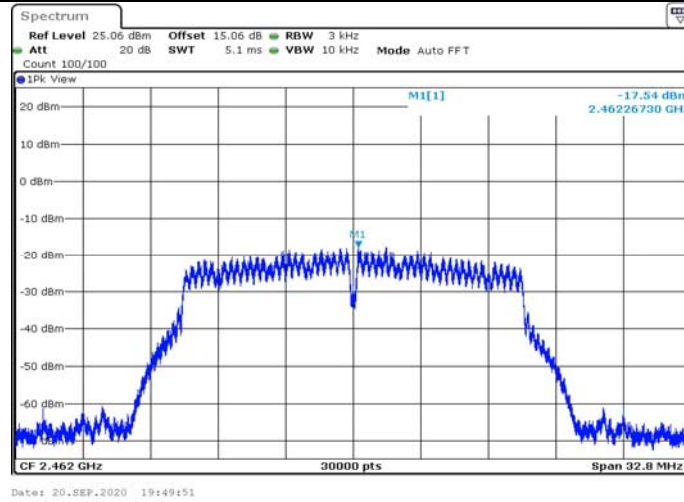
11G-CDD_Ant1_2437



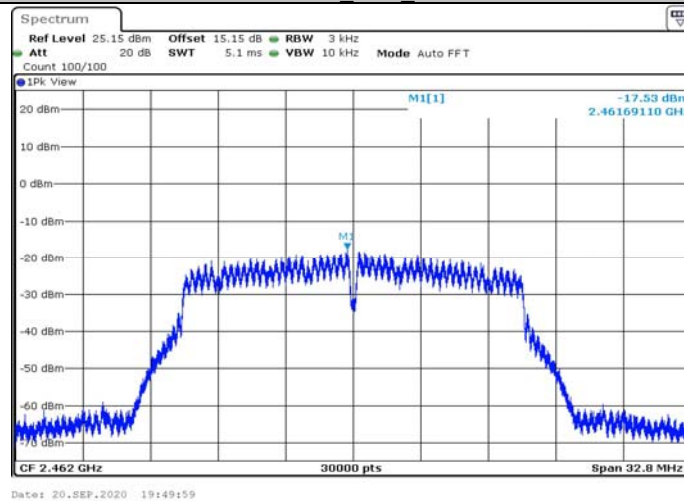
11G-CDD_Ant2_2437



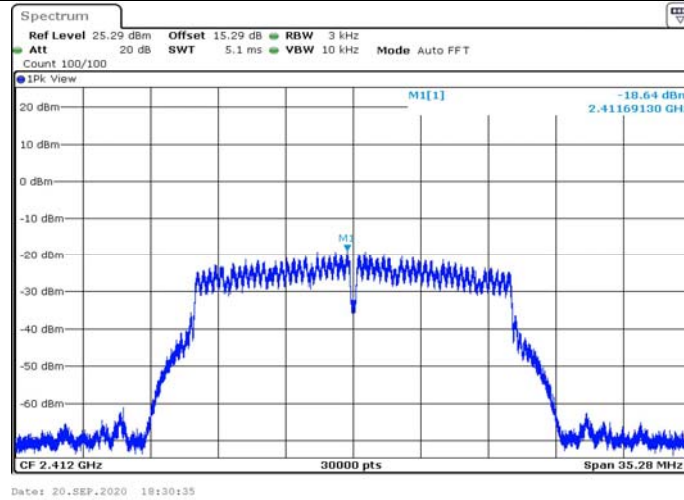
11G-CDD_Ant1_2462



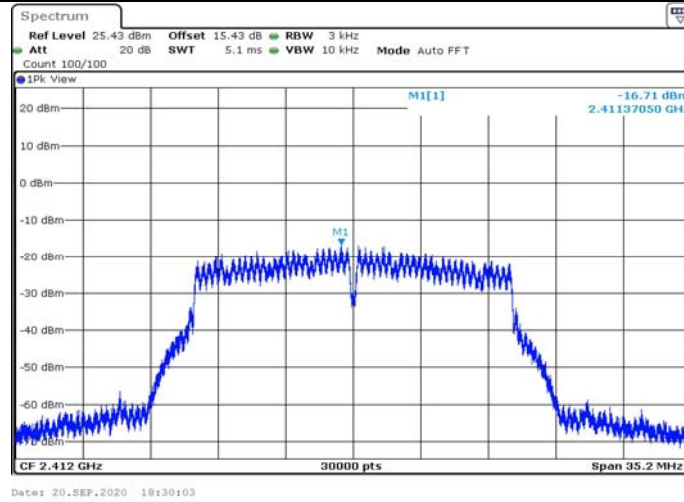
11G-CDD_Ant2_2462



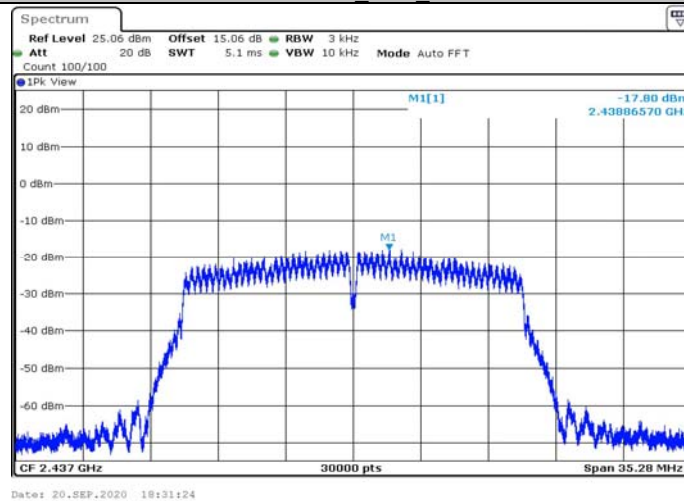
11N20MIMO_Ant1_2412



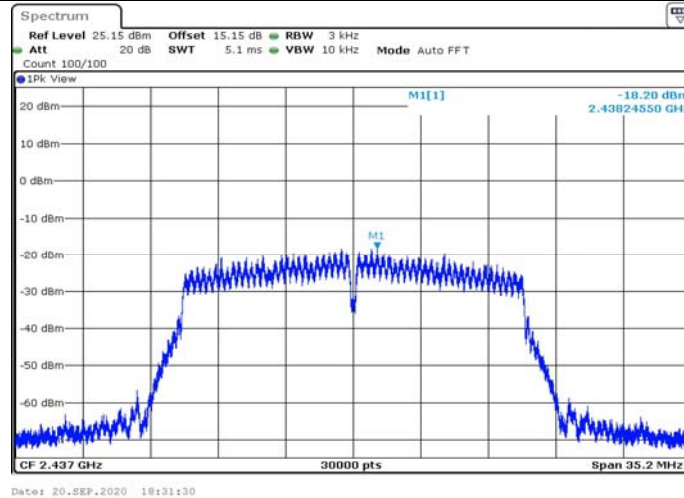
11N20MIMO_Ant2_2412



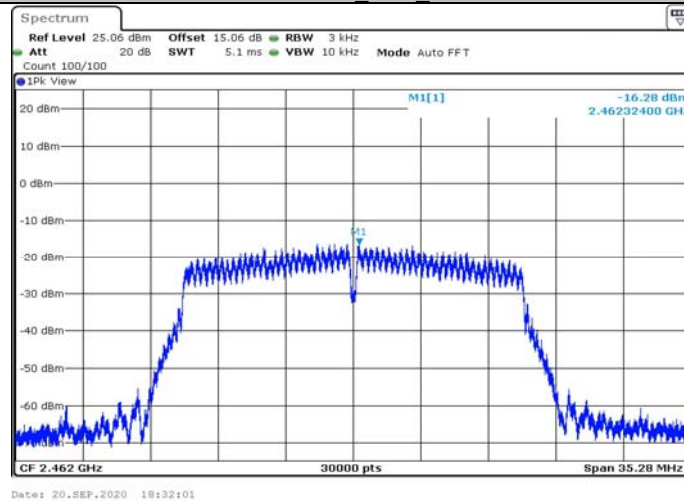
11N20MIMO_Ant1_2437



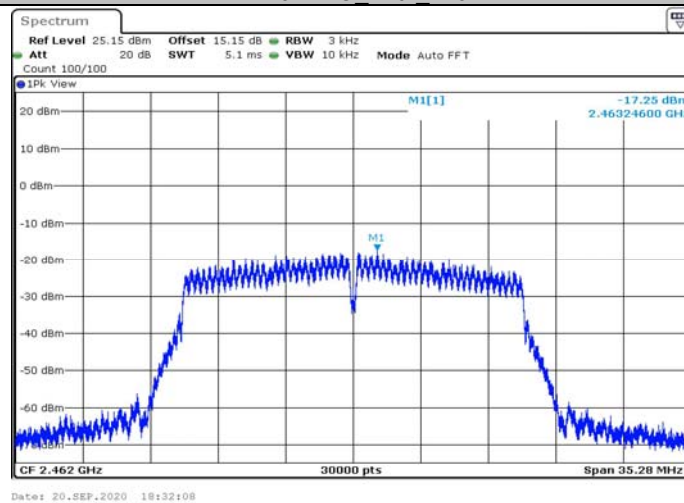
11N20MIMO_Ant2_2437



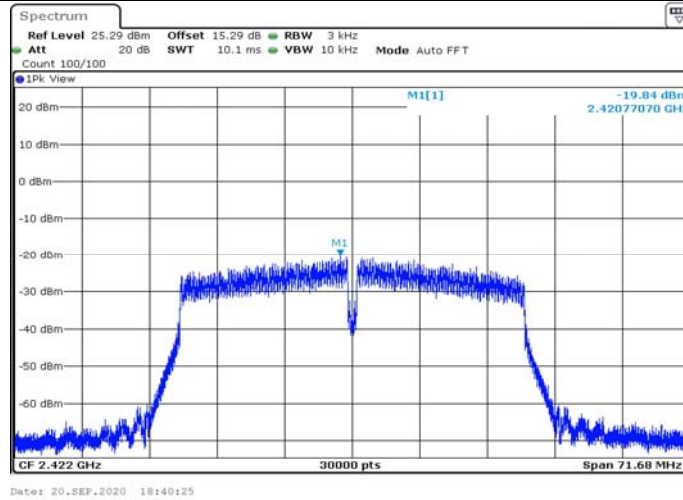
11N20MIMO_Ant1_2462



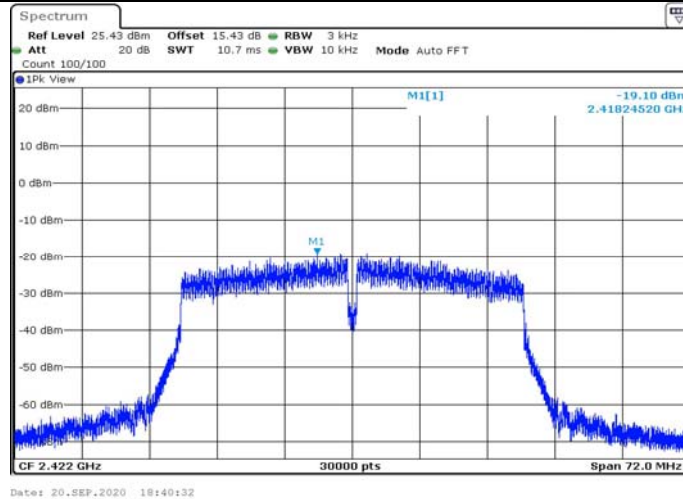
11N20MIMO_Ant2_2462



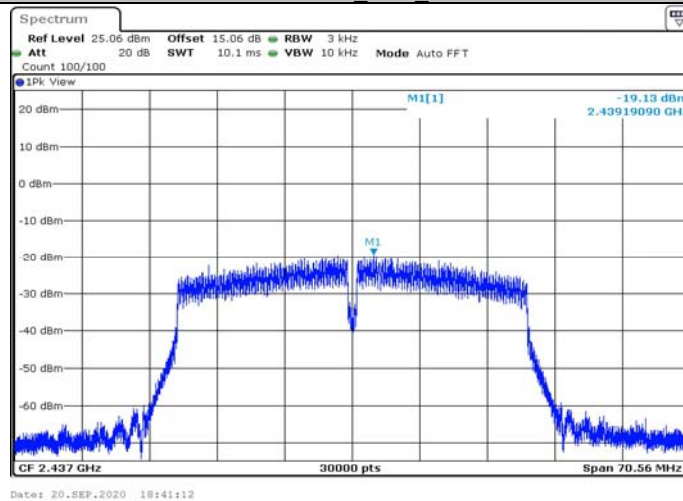
11N40MIMO_Ant1_2422



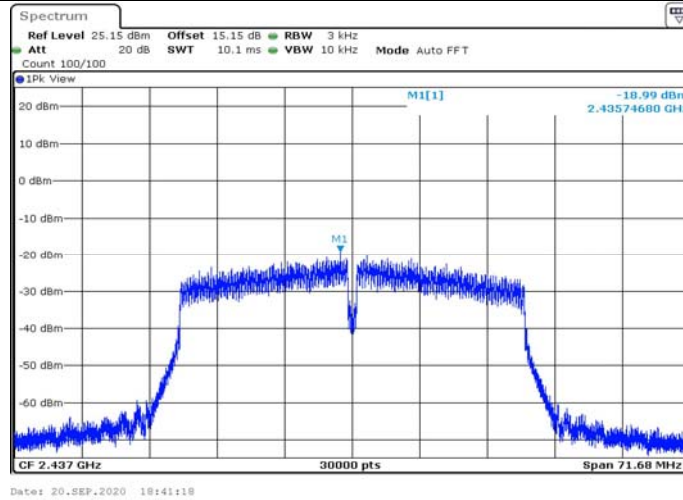
11N40MIMO_Ant2_2422



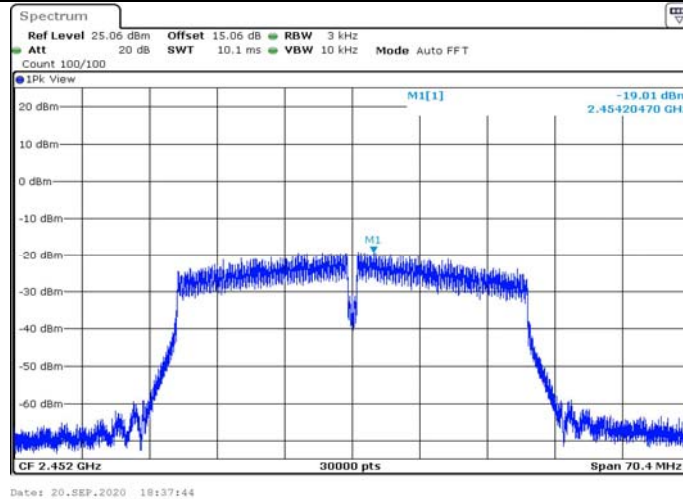
11N40MIMO_Ant1_2437



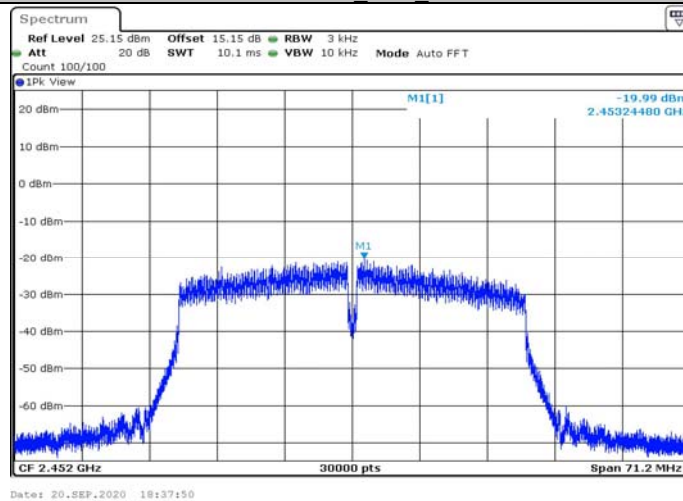
11N40MIMO_Ant2_2437



11N40MIMO_Ant1_2452



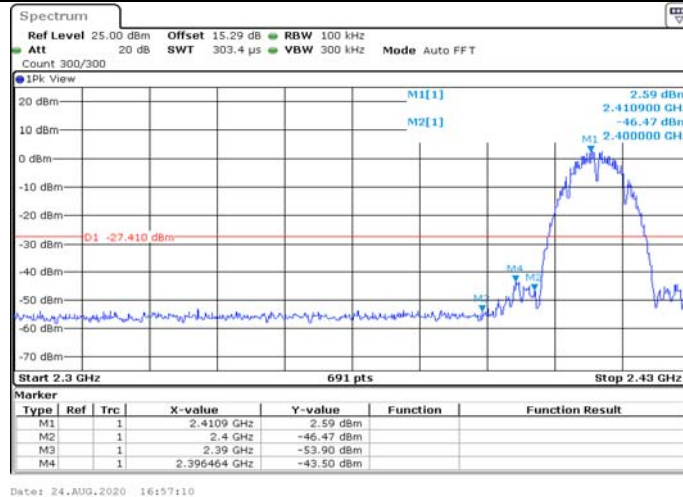
11N40MIMO_Ant2_2452



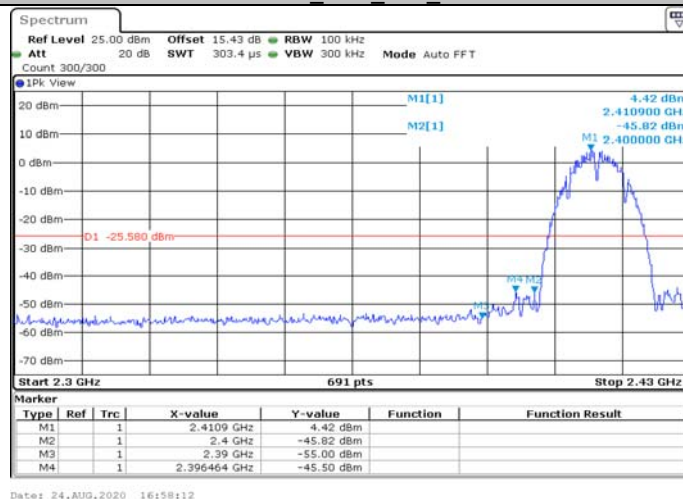
Appendix E: Band edge measurements

Test Graphs

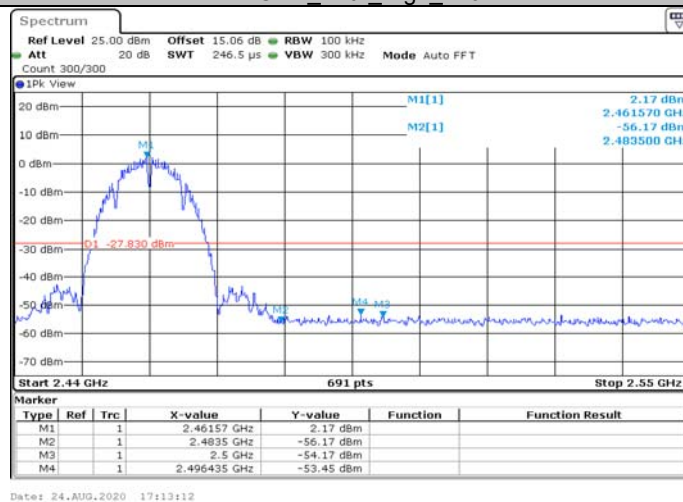
11B-CDD_Ant1_Low_2412



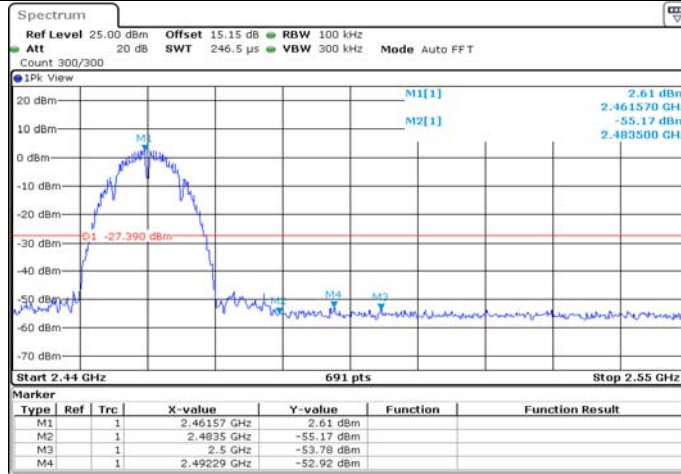
11B-CDD_Ant2_Low_2412



11B-CDD_Ant1_High_2462

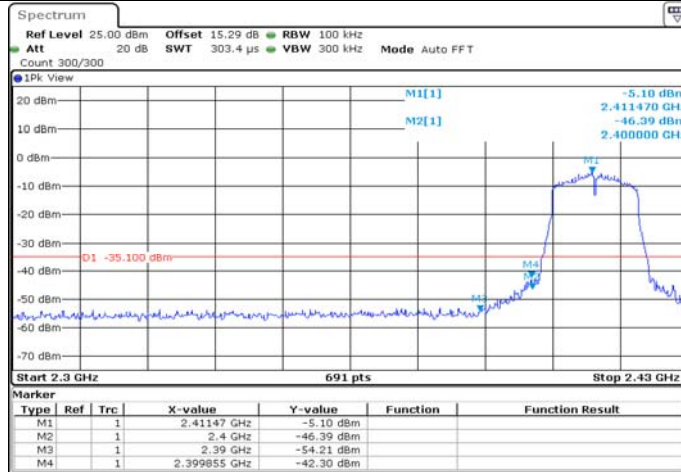


11B-CDD_Ant2_High_2462



Date: 24.AUG.2020 17:14:13

11G-CDD_Ant1_Low_2412



Date: 24.AUG.2020 17:49:48

11G-CDD_Ant2_Low_2412



Date: 24.AUG.2020 17:51:33

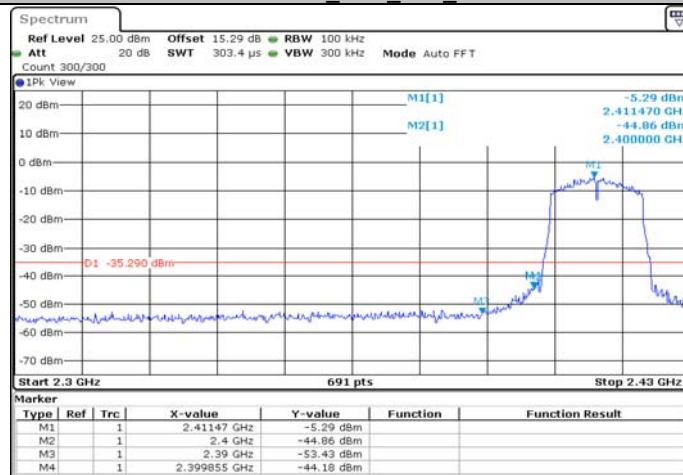
11G-CDD_Ant1_High_2462

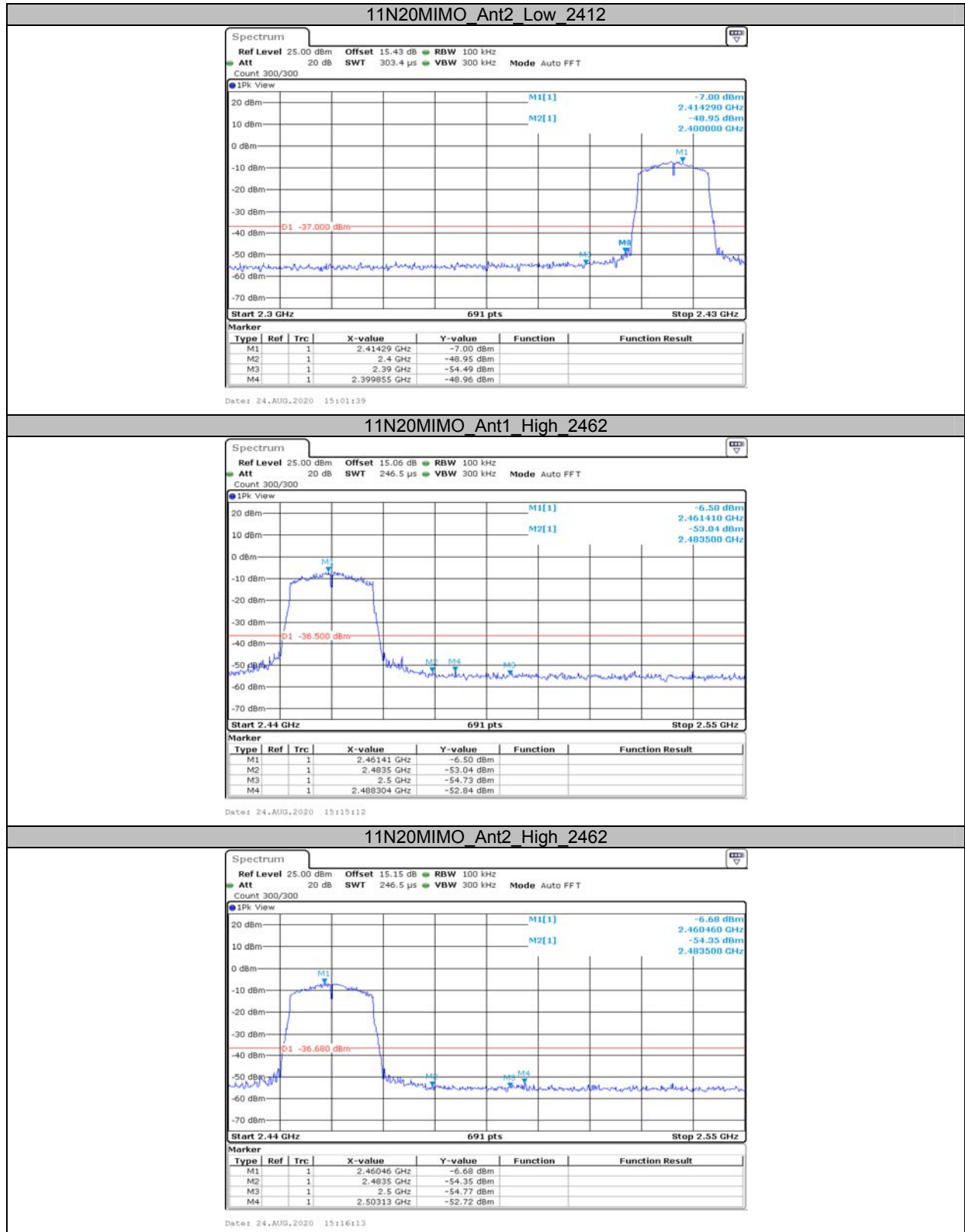


11G-CDD_Ant2_High_2462

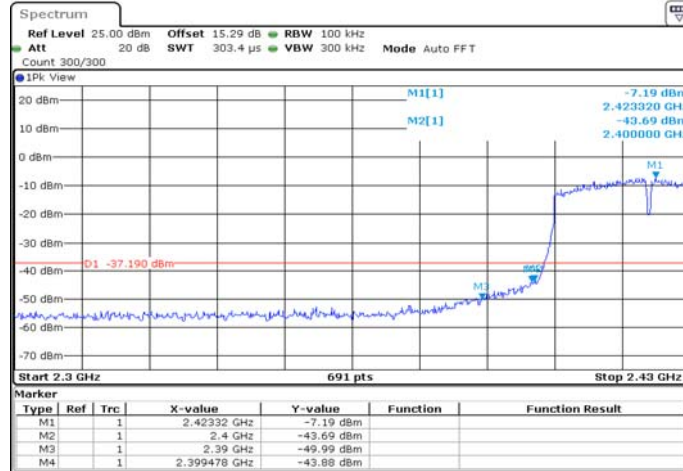


11N20MIMO_Ant1_Low_2412

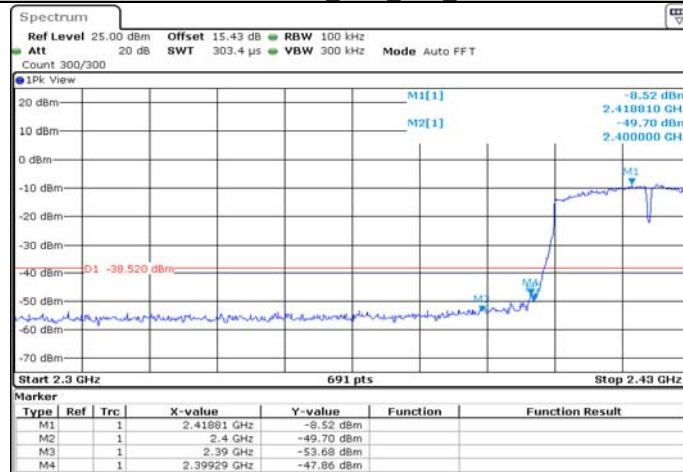




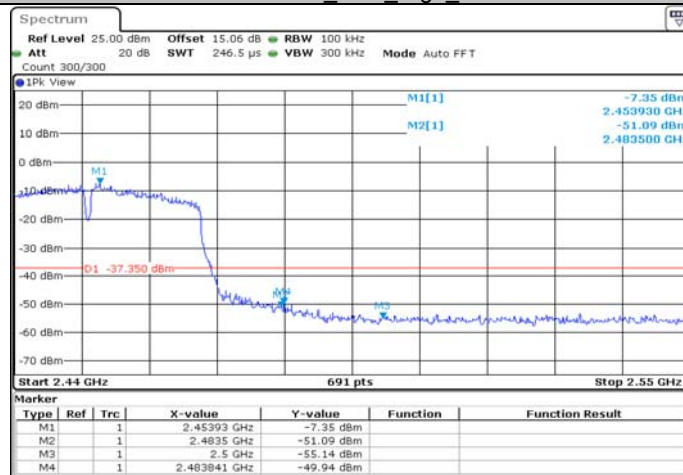
11N40MIMO_Ant1_Low_2422

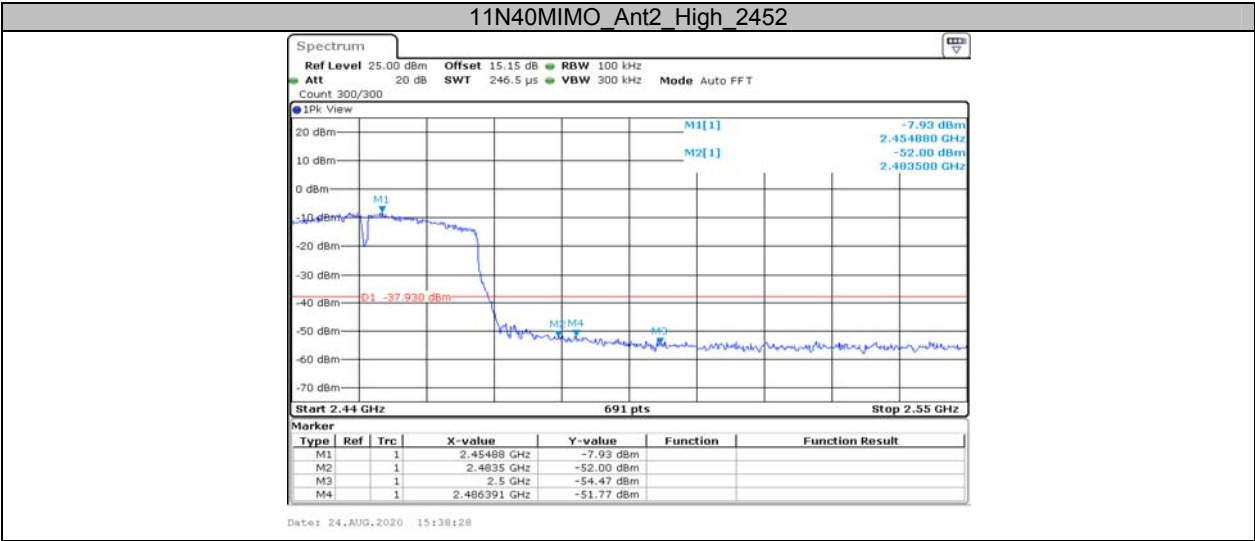


11N40MIMO_Ant2_Low_2422



11N40MIMO_Ant1_High_2452



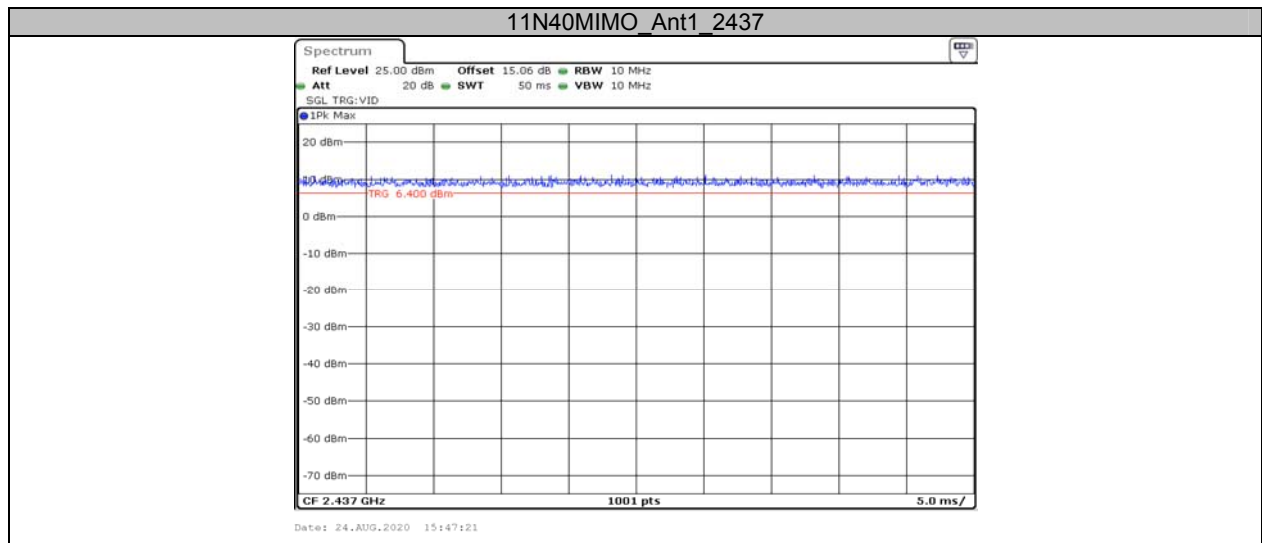


**Appendix F: Duty Cycle
Test Result**

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B-CDD	Ant1	2437	50.00	50.00	100.00
11G-CDD	Ant1	2437	50.00	50.00	100.00
11N20MIMO	Ant1	2437	50.00	50.00	100.00
11N40MIMO	Ant1	2437	50.00	50.00	100.00

Test Graphs



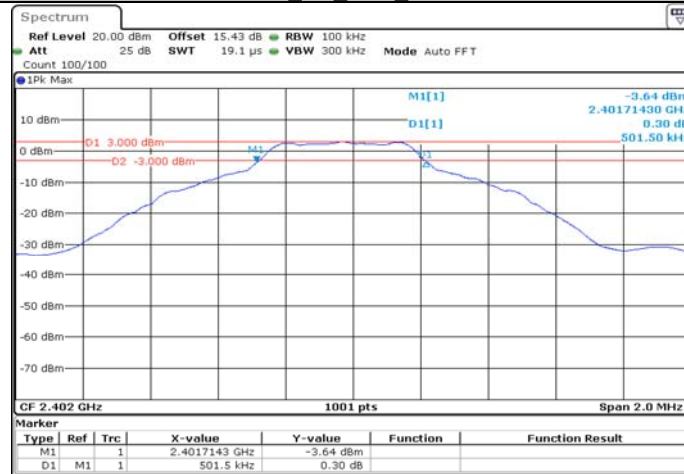


APPENDIX BLE**Appendix A: DTS Bandwidth
Test Result**

Test Mode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.502	2401.714	2402.216	0.5	PASS
		2440	0.501	2439.714	2440.214	0.5	PASS
		2480	0.501	2479.716	2480.217	0.5	PASS
BLE_2M	Ant1	2402	0.859	2401.529	2402.388	0.5	PASS
		2440	0.783	2439.592	2440.376	0.5	PASS
		2480	0.855	2479.541	2480.396	0.5	PASS

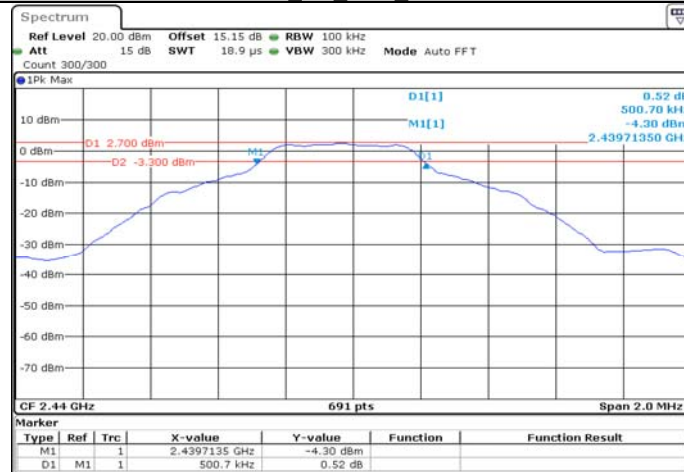
Test Graphs

BLE_1M_Ant1_2402



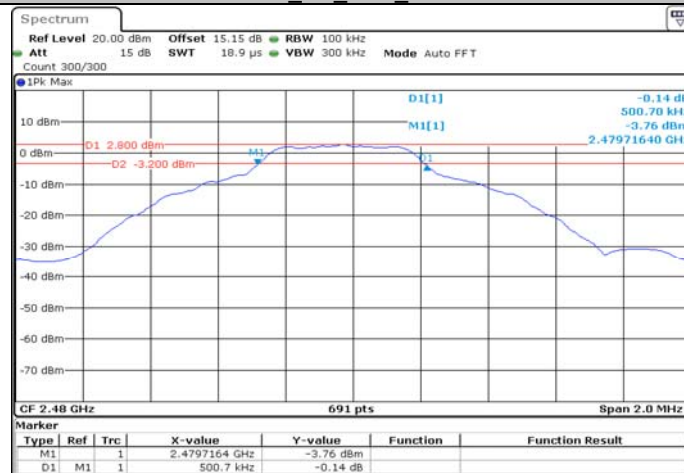
Date: 1.SEP.2020 20:05:12

BLE_1M_Ant1_2440

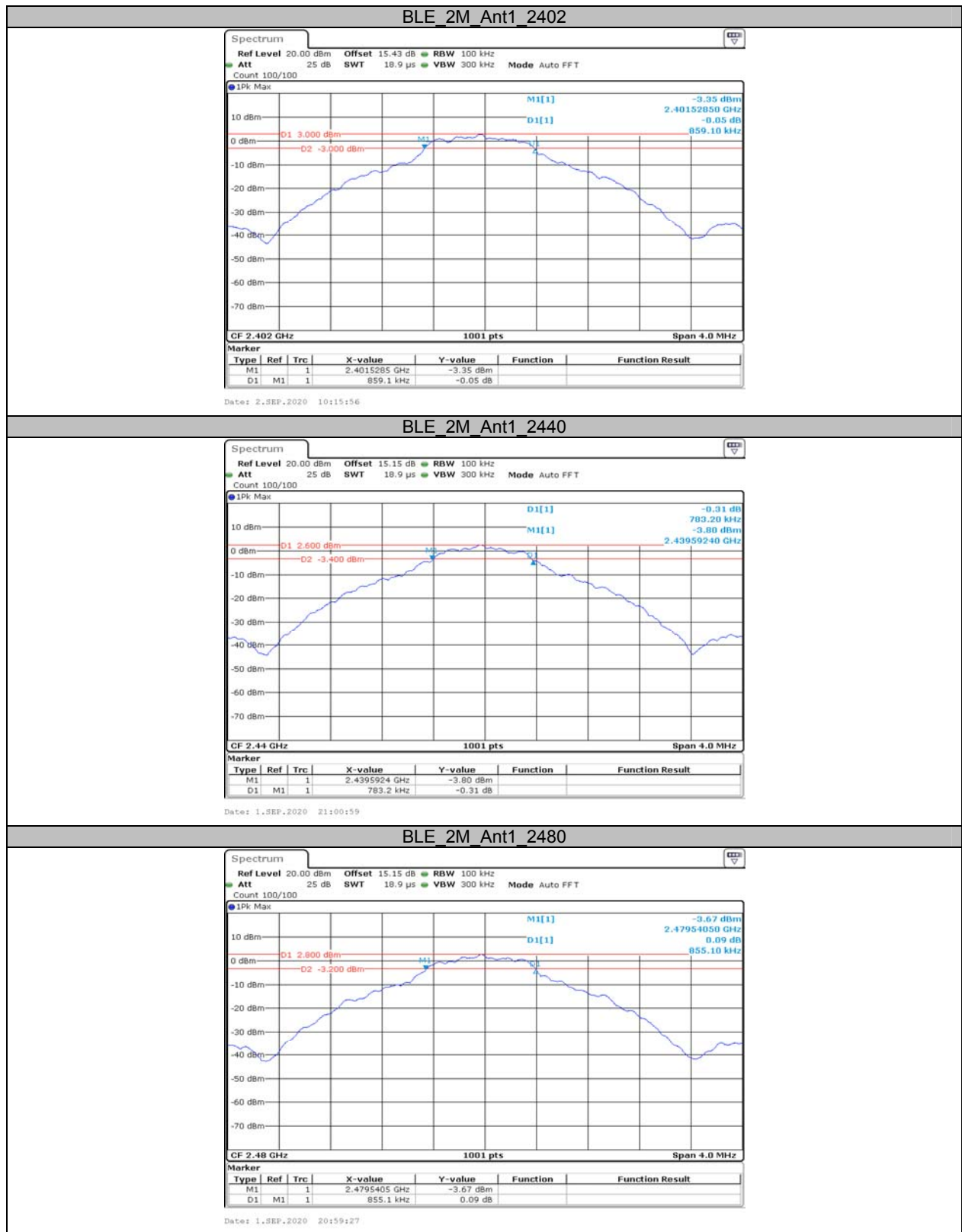


Date: 1.SEP.2020 20:38:28

BLE_1M_Ant1_2480



Date: 1.SEP.2020 20:37:13



**Appendix B: Occupied Channel Bandwidth
Test Result**

Test Mode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.923	2401.504	2402.428	---	PASS
		2440	0.963	2439.489	2440.452	---	PASS
		2480	0.955	2479.489	2480.444	---	PASS
BLE_2M	Ant1	2402	1.794	2401.069	2402.863	---	PASS
		2440	1.722	2439.101	2440.823	---	PASS
		2480	1.754	2479.097	2480.851	---	PASS

Test Graphs

BLE_1M_Ant1_2402

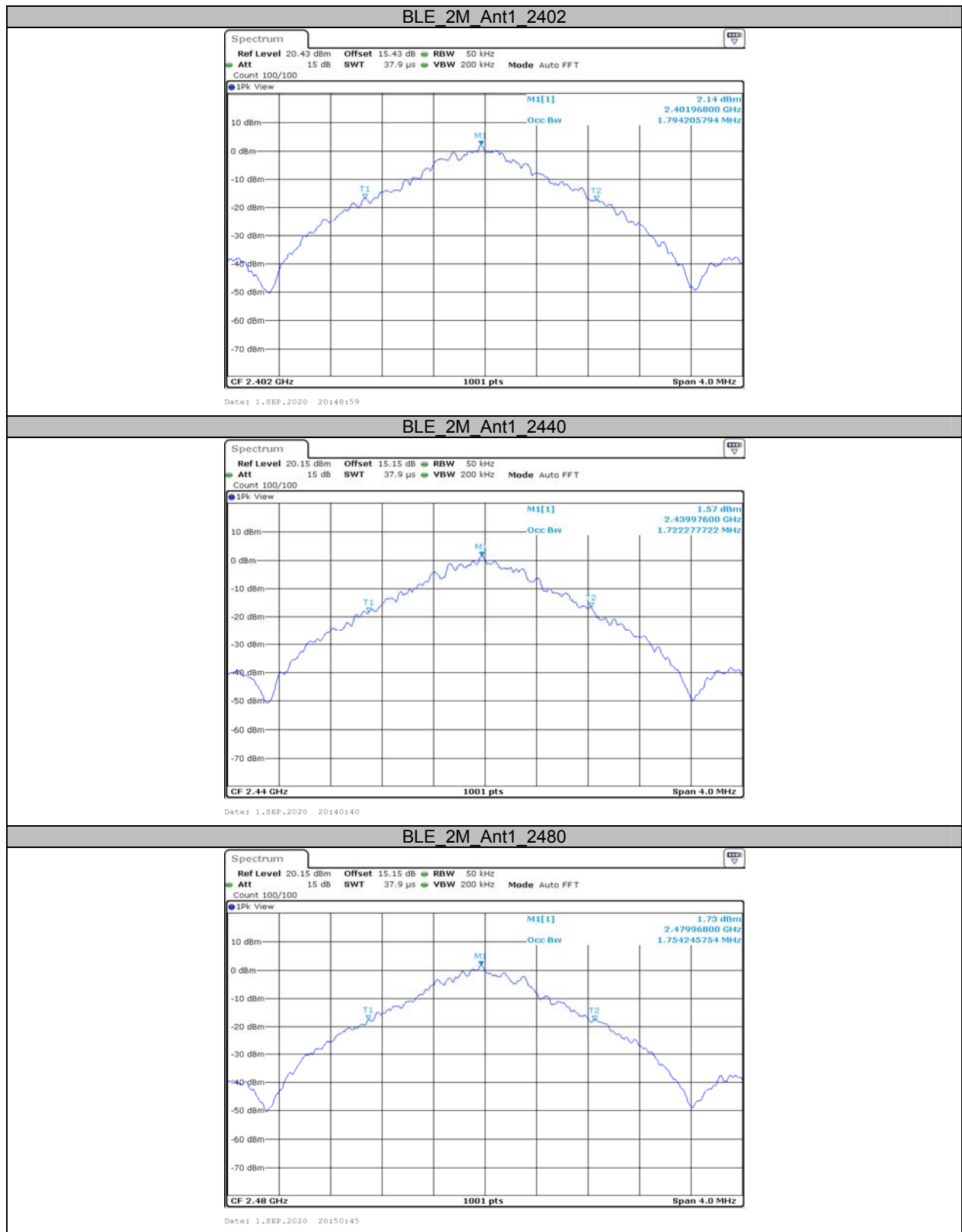


BLE_1M_Ant1_2440



BLE_1M_Ant1_2480



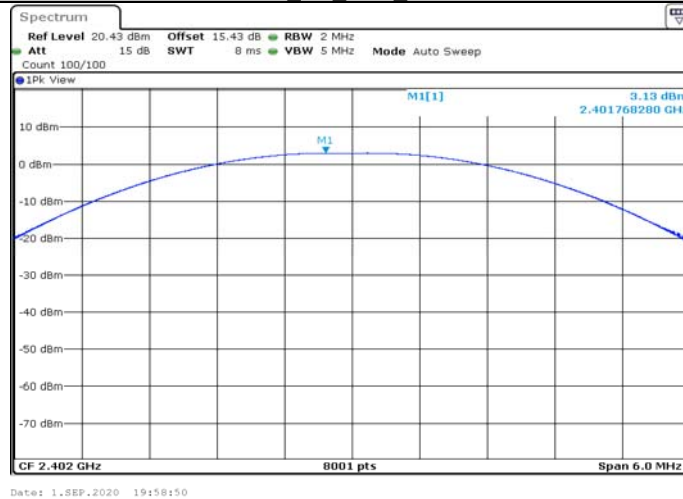


**Appendix C: Maximum Conducted Peak Output Power
Test Result**

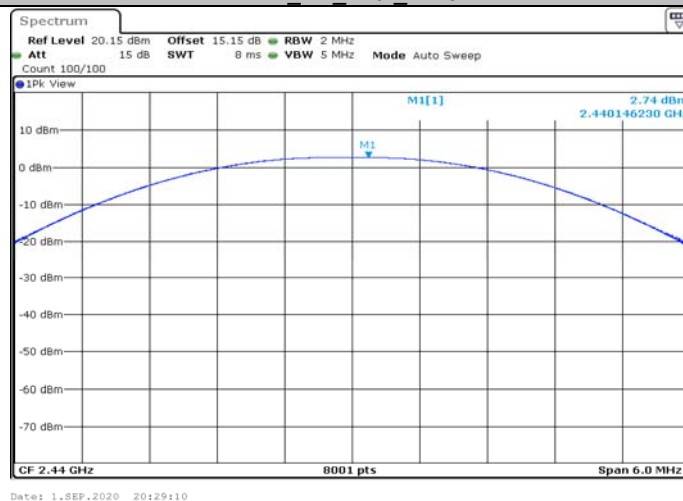
Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	3.13	<=30	PASS
		2440	2.74	<=30	PASS
		2480	2.84	<=30	PASS
BLE_2M	Ant1	2402	3.23	<=30	PASS
		2440	2.75	<=30	PASS
		2480	2.88	<=30	PASS

Test Graphs

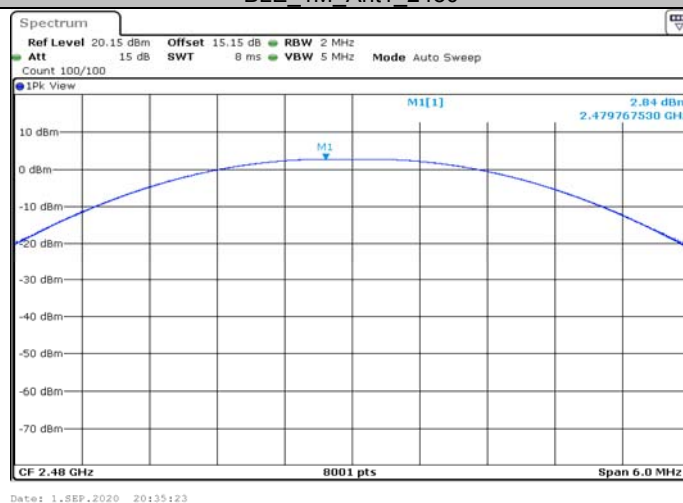
BLE_1M_Ant1_2402

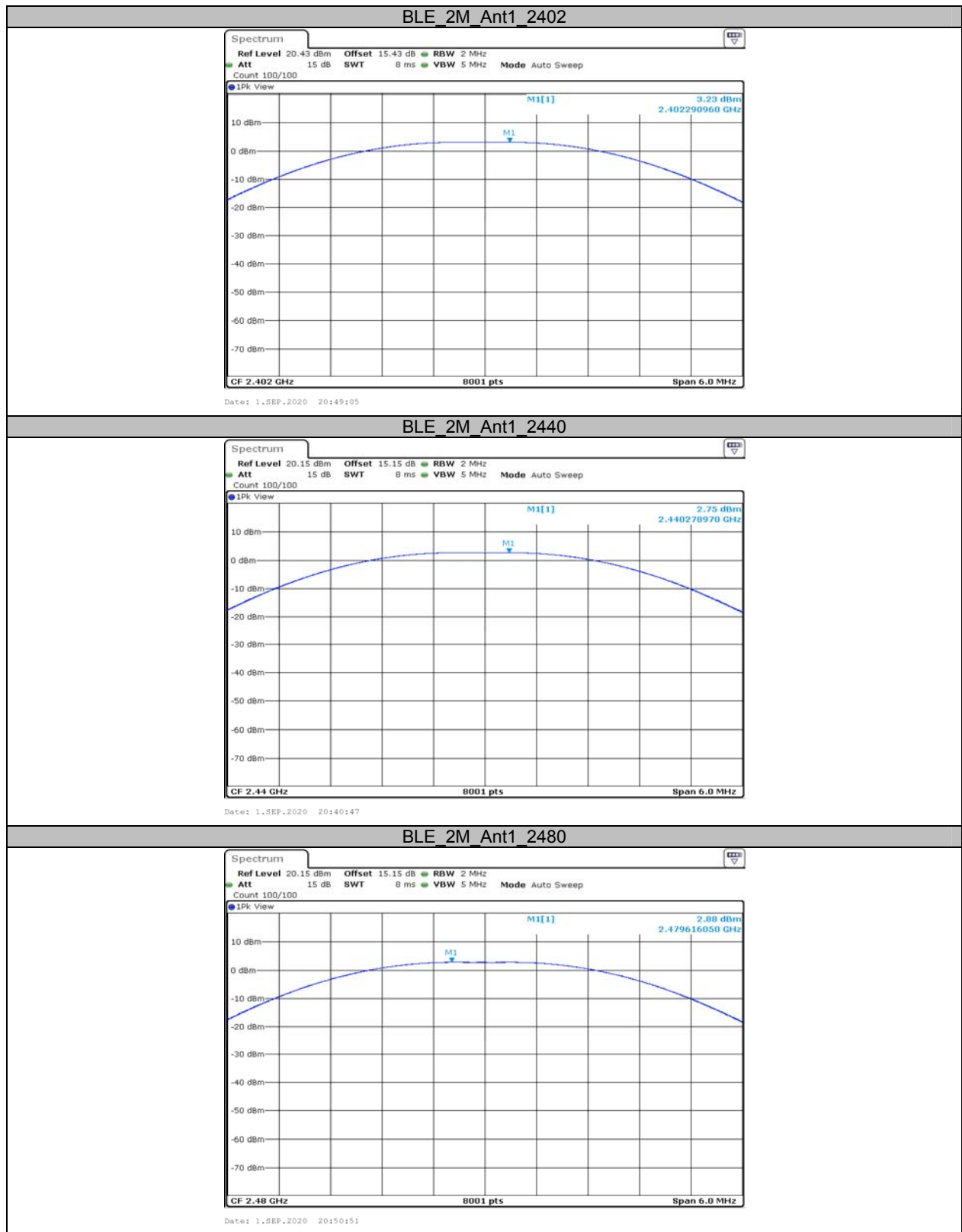


BLE_1M_Ant1_2440



BLE_1M_Ant1_2480

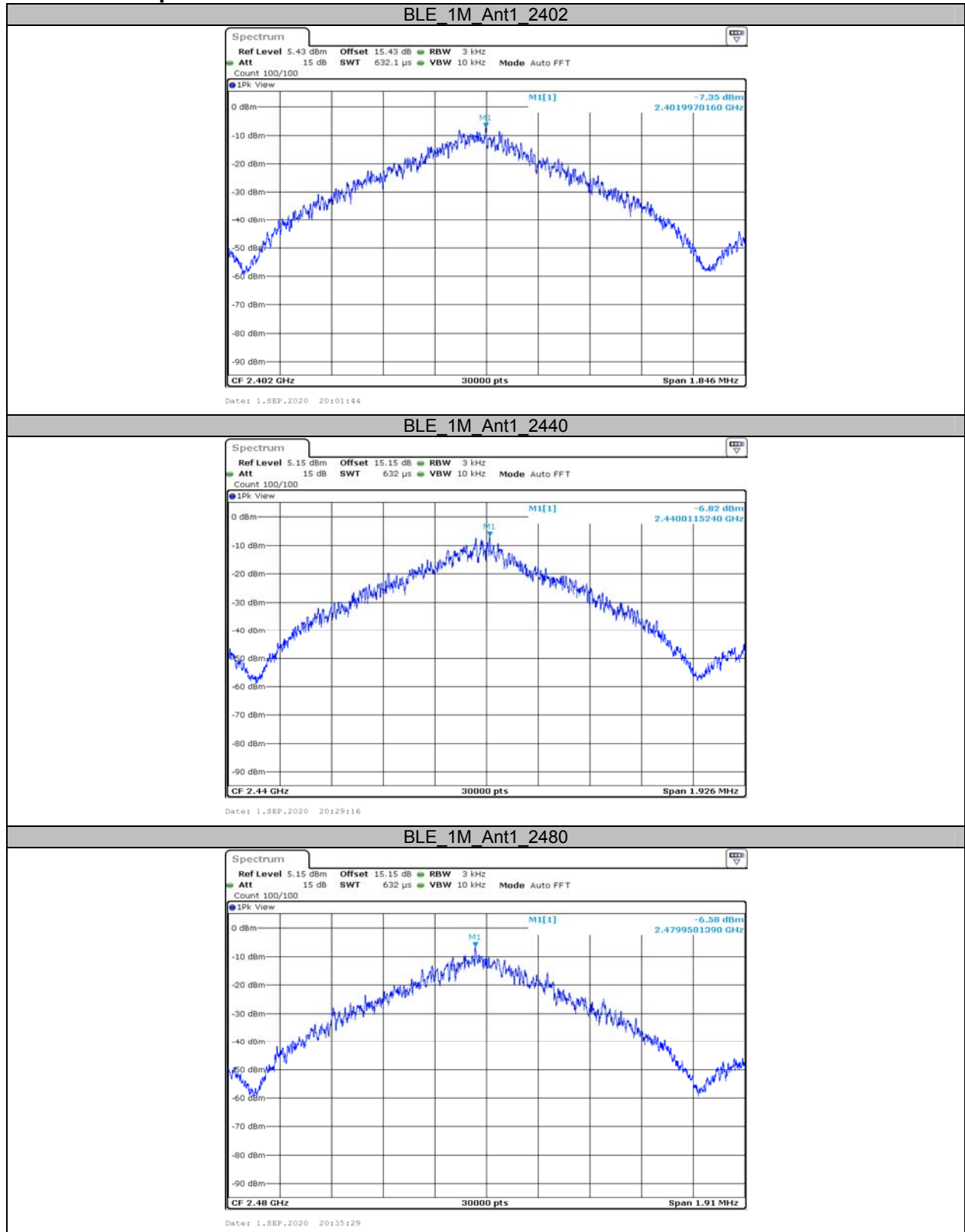


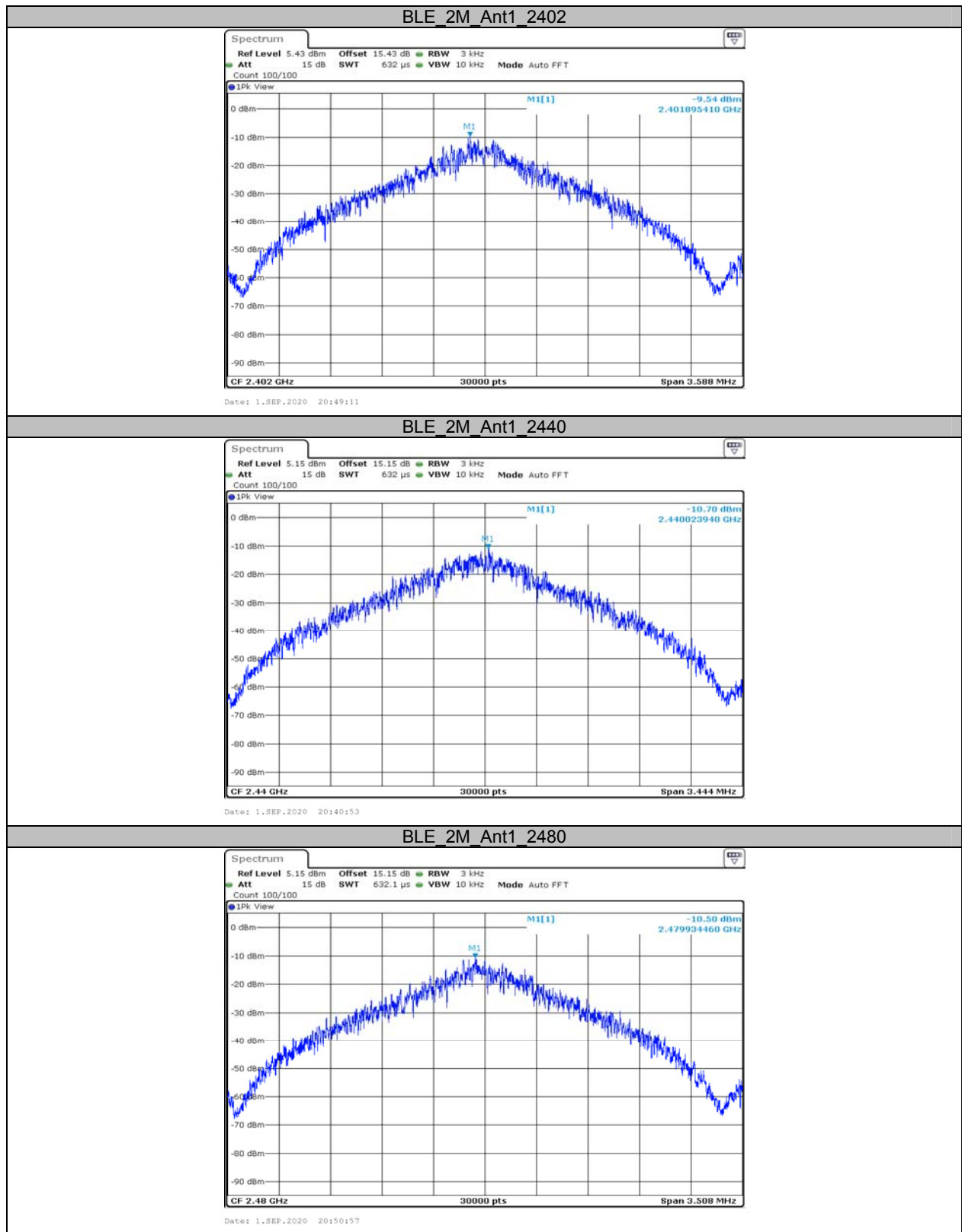


**Appendix D: Maximum power spectral density
Test Result**

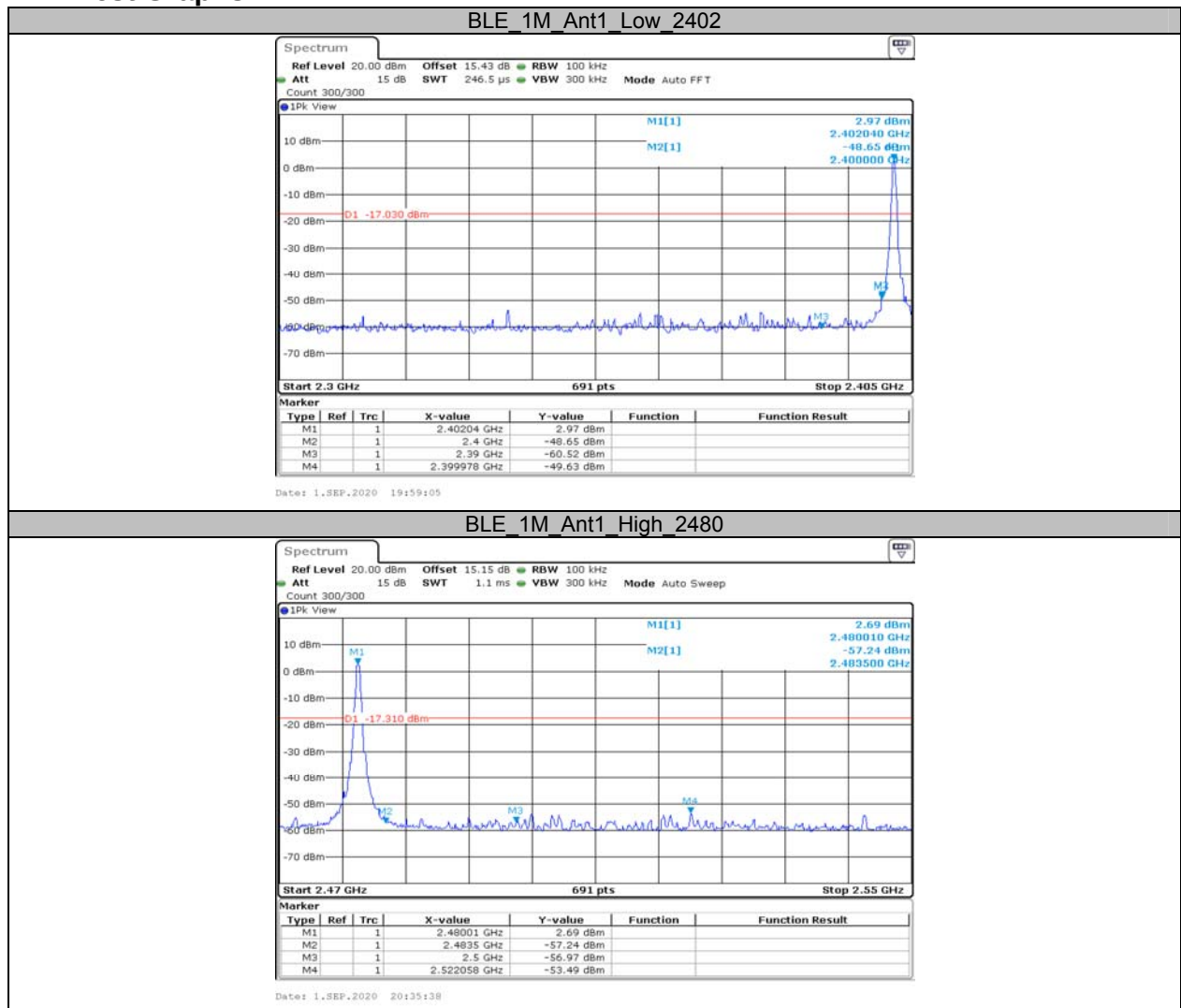
Test Mode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-7.35	<=8	PASS
		2440	-6.82	<=8	PASS
		2480	-6.58	<=8	PASS
BLE_2M	Ant1	2402	-9.54	<=8	PASS
		2440	-10.7	<=8	PASS
		2480	-10.5	<=8	PASS

Test Graphs

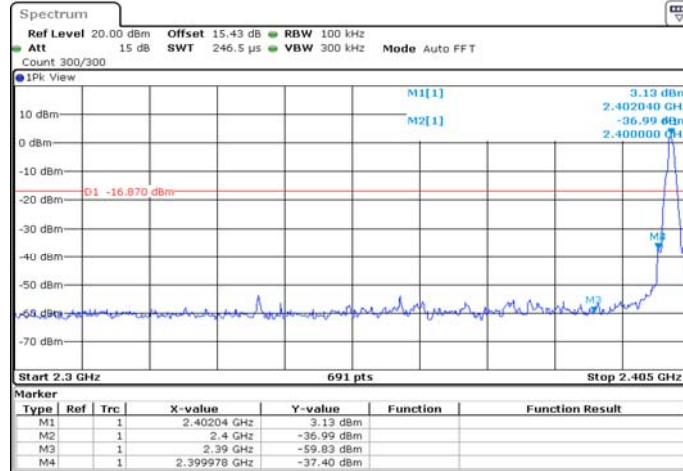




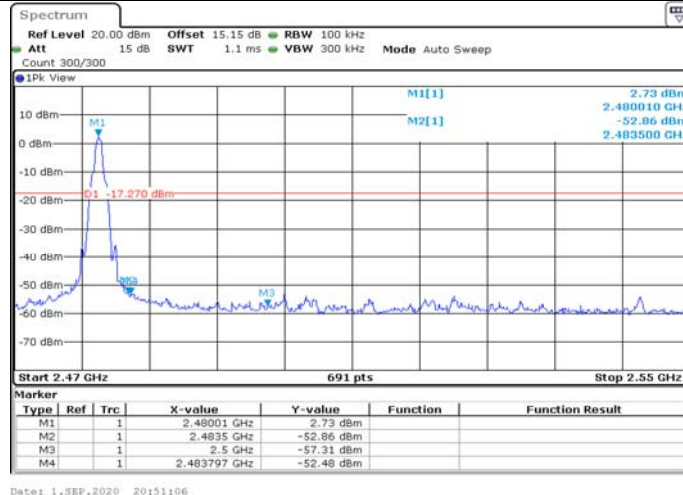
Appendix E: Band edge measurements Test Graphs



BLE_2M_Ant1_Low_2402



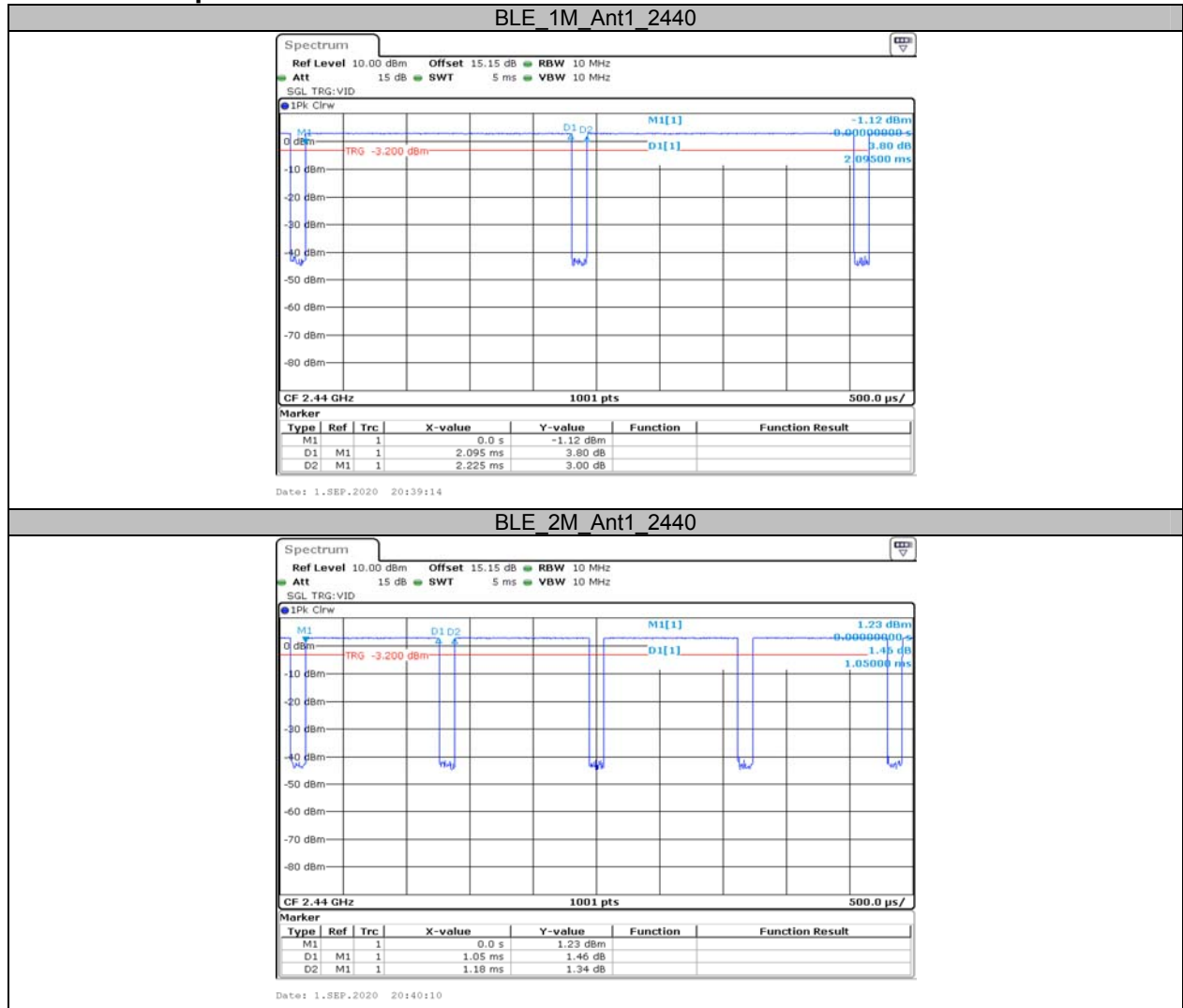
BLE_2M_Ant1_High_2480



**Appendix F: Duty Cycle
Test Result**

Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
BLE_1M	Ant1	2440	2.10	2.23	94.16
BLE_2M	Ant1	2440	1.05	1.18	88.98

Test Graphs



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