FCC TEST REPORT

Application No:	ZR/2020/50038
Applicant:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Applicant:	NO.18 HaiBin Road, Wusha Village, Chang An Town, DongGuan City，GuangDong,China
Manufacturer:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Manufacturer	NO.18 HaiBin Road, Wusha Village, Chang An Town, DongGuan City，GuangDong,China
EUT Description:	Mobile Phone
Model No.:	CPH2089
Trade Mark:	OPPO
FCC ID:	R9C-CPH2089
Standards:	47 CFR FCC Part 2, Subpart J 47 CFR Part 15, Subpart C
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02 KDB 662911 D01 Multiple Transmitter Output v02r01 ANSI C63.10 (2013)
Date of Receipt:	2020/6/1
Date of Test:	2020/6/1 to 2020/6/30
Date of Issue:	2021/4/29
Test Result:	**PASS ***

. * In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2020/8/3		Original
02		2021/4/29	Flora Wang	1.Add test site Information 2.Modify data conversion error of antenna height 3.Update equipment list

*This test report supersedes the original report (report No.: ZR/2020/5003804, issue date: 2020-8-3), original report shall be invalid.

Authorized for issue by:				
Prepared By		Flora Wang **(Flora Wang) /Project Engineer**		
Checked By		David Chen **(David Chen) /Reviewer**		

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2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result	Test Lab*
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS	B
Duty Cycle	--	--	Clause 4.3	PASS	A
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.4	PASS	A
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.5	PASS	A
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.6	PASS	A
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS	A
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.8	PASS	A
Radiated Spurious Emissions	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS	B
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d);15.205/15.209	ANSI C63.10 2013	Clause 4.10	PASS	B

Remark：All test were performed by Lab A and B.
Parts of test items above were subcontracted to Lab B.
Lab A SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Lab B SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.

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Contents

1 VERSION 2

2 TEST SUMMARY 3

3 GENERAL INFORMATION 5

3.1 CLIENT INFORMATION 5
3.2 TEST LOCATION 5
3.3 TEST FACILITY 6
3.4 GENERAL DESCRIPTION OF EUT 7
3.5 TEST ENVIRONMENT AND MODE 8
3.6 DESCRIPTION OF SUPPORT UNITS 8

4 TEST RESULTS AND MEASUREMENT DATA 9

4.1 ANTENNA REQUIREMENT 9
4.2 AC POWER LINE CONDUCTED EMISSIONS 10
4.3 DUTY CYCLE 14
4.3.1 TEST RESULTS 14
4.3.1 TEST PLOTS 14
4.4 CONDUCTED OUTPUT POWER 20
4.4.1 TEST RESULTS 21
4.5 DTS (6 DB) BANDWIDTH & 99% OCCUPIED BANDWIDTH 22
4.5.1 TEST RESULTS 23
4.5.2 TEST PLOTS 24
4.6 POWER SPECTRAL DENSITY 52
4.6.1 TEST RESULTS 53
4.6.2 TEST PLOTS 54
4.7 BAND-EDGE FOR RF CONDUCTED EMISSIONS 68
4.7.1 TEST PLOTS 69
4.8 RF CONDUCTED SPURIOUS EMISSIONS 80
4.8.1 TEST PLOTS 81
4.9 RADIATED SPURIOUS EMISSIONS 96
4.9.1 RADIATED EMISSION BELOW 1GHZ 99
4.9.2 TRANSMITTER EMISSION ABOVE 1GHZ 101
4.10 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY 119
4.10.1 ANT1 121

5 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2) 133

6 EQUIPMENT LIST 134

7 PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS 135

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3 General Information

3.1 Client Information

Applicant:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Applicant:	NO.18 HaiBin Road, Wusha Village, Chang An Town, DongGuan City，GuangDong,China
Manufacturer:	Guangdong OPPO Mobile Telecommunications Corp., Ltd.
Address of Manufacturer:	NO.18 HaiBin Road, Wusha Village, Chang An Town, DongGuan City，GuangDong,China

3.2 Test Location

Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Dee Zheng, Mike Hu

Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Ben Huang, Leah Chen

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3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Lab A:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Lab B:

A2LA (Certificate No. 4854.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

FCC-Designation Number: CN1271.

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3.4 General Description of EUT

EUT Description::	Mobile Phone
Model No.:	CPH2089
Trade Mark:	OPPO
Hardware Version:	11
Software Version:	ColorOS V7.2
IEEE 802.11 WLAN Mode Supported	☒ 802.11B (20 MHz channel bandwidth), ☒ 802.11G (20 MHz channel bandwidth) ☒ 802.11N (20 MHz channel bandwidth), ☐ 802.11N (40 MHz channel bandwidth)
Operation Frequency:	2400 MHz -2483.5MHz fc = 2407 MHz + N * 5 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 1 to 11 for the 20 MHz channel bandwidth, or 3 to 9 for the 40 MHz channel bandwidth.
Type of Modulation:	IEEE for 802.11B: DSSS IEEE for 802.11G : OFDM IEEE for 802.11N(HT20) : OFDM
Sample Type:	☒ Portable Device, ☐Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Ports	☒ Ant 1, ☒ Ant 2, ☐ Ant 3
Smart System	☒ SISO (for 802.11B/G/N), ☒ MIMO (for 802.11N): 2 Tx & 2 Rx, ☐ Diversity (for 802.11B/G) : Tx & Rx
Antenna Gain:	ANT1:-3.5dBi; ANT2:-5dBi
Power Supply:	☒ AC/DC Adapter; ☒ Battery ☐ PoE:; ☐ Other:
Directional Gain:	-1.21(Correlated)

Operation Frequency of each channel (802.11B/G/N HT20)							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency for 802.11B/G/N (HT20)
The Lowest channel	2412MHz

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The Middle channel	2437MHz
The Highest channel	2462MHz

3.5 Test Environment and Mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	50 % RH
Atmospheric Pressure:	101.30 KPa
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

3.6 Description of Support Units

The EUT has been tested independent unit.

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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -3.5dBi.	

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4.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.		

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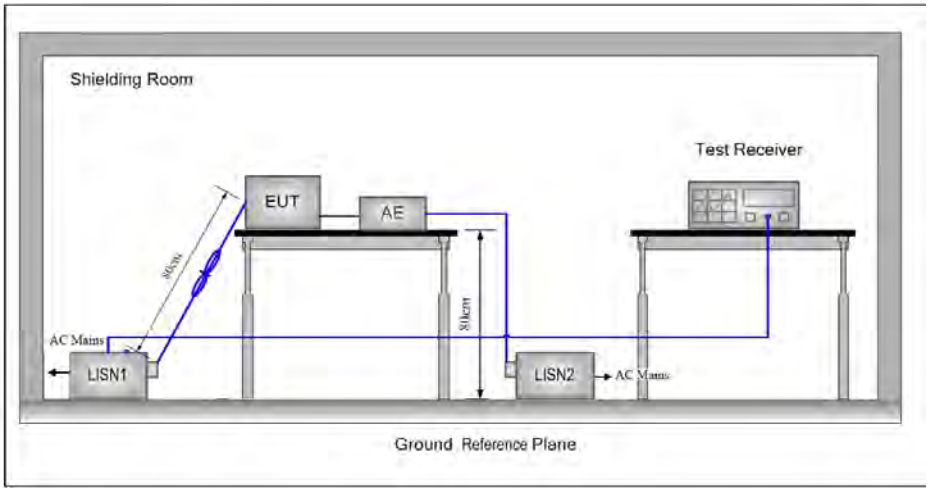
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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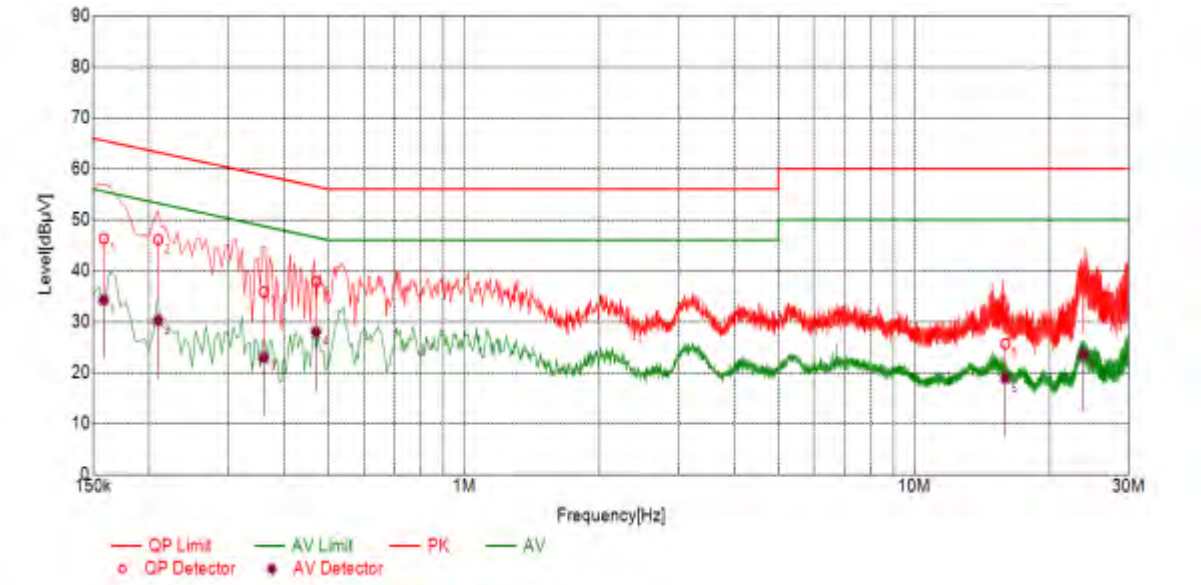
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1584	10.10	46.28	65.55	19.27	34.26	55.55	21.29	L
2	0.2093	10.10	46.09	63.23	17.14	30.22	53.23	23.01	L
3	0.3590	10.10	35.86	58.75	22.89	22.98	48.75	25.77	L
4	0.4694	10.10	37.92	56.52	18.60	28.03	46.52	18.49	L
5	15.9577	10.11	25.67	60.00	34.33	18.89	50.00	31.11	L
6	23.7684	10.11	39.36	60.00	20.64	23.71	50.00	26.29	L

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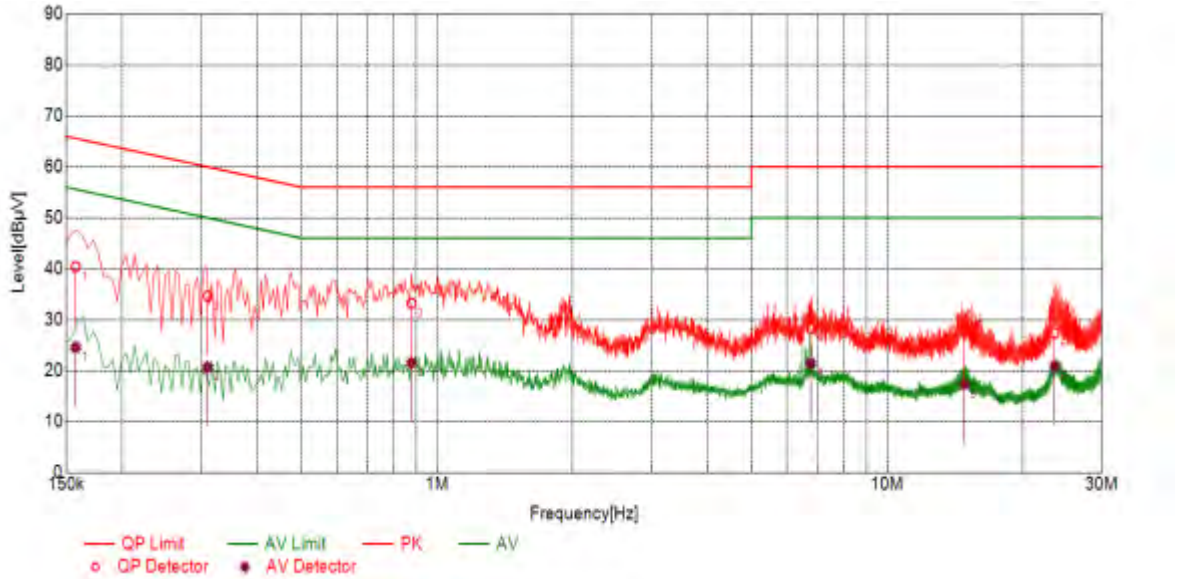
Neutral Line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1576	10.10	40.39	65.59	25.20	24.53	55.59	31.06	N
2	0.3094	10.10	34.61	59.99	25.38	20.66	49.99	29.33	N
3	0.8780	10.10	33.22	56.00	22.78	21.52	46.00	24.48	N
4	6.7697	10.10	28.37	60.00	31.63	21.43	50.00	28.57	N
5	14.8626	10.11	27.85	60.00	32.15	17.29	50.00	32.71	N
6	23.5569	10.11	27.31	60.00	32.69	20.87	50.00	29.13	N

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

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4.3 Duty Cycle

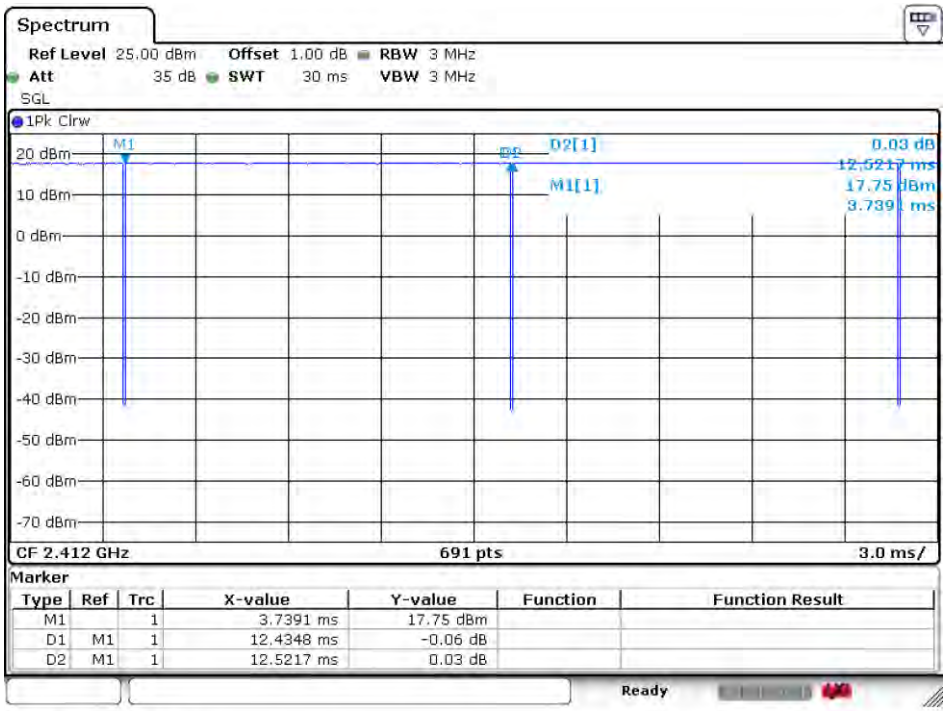
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1,CH6,CH11	99.31
11G	Ant 1: CH1,CH6,CH11	97.12
11G_CDD	Ant 1: CH1,CH6,CH11	97.10
11N20	Ant 1: CH1,CH6,CH11	96.90
11N20_MIMO	Ant 1: CH1,CH6,CH11	96.92
11G	Ant 2: CH1,CH6,CH11	97.11
11G_CDD	Ant 2: CH1,CH6,CH11	97.79
11N20	Ant 2: CH1,CH6,CH11	97.52
11N20_MIMO	Ant 2: CH1,CH6,CH11	97.79

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



Date: 17.APR.2019 09:28:26

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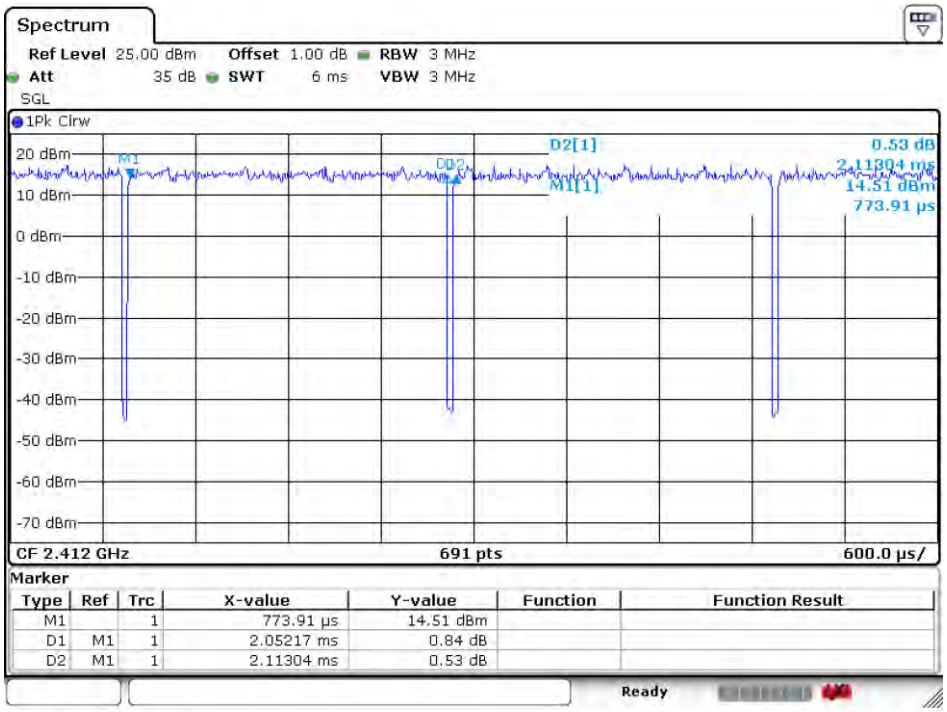
4.3.1.1.2 11G



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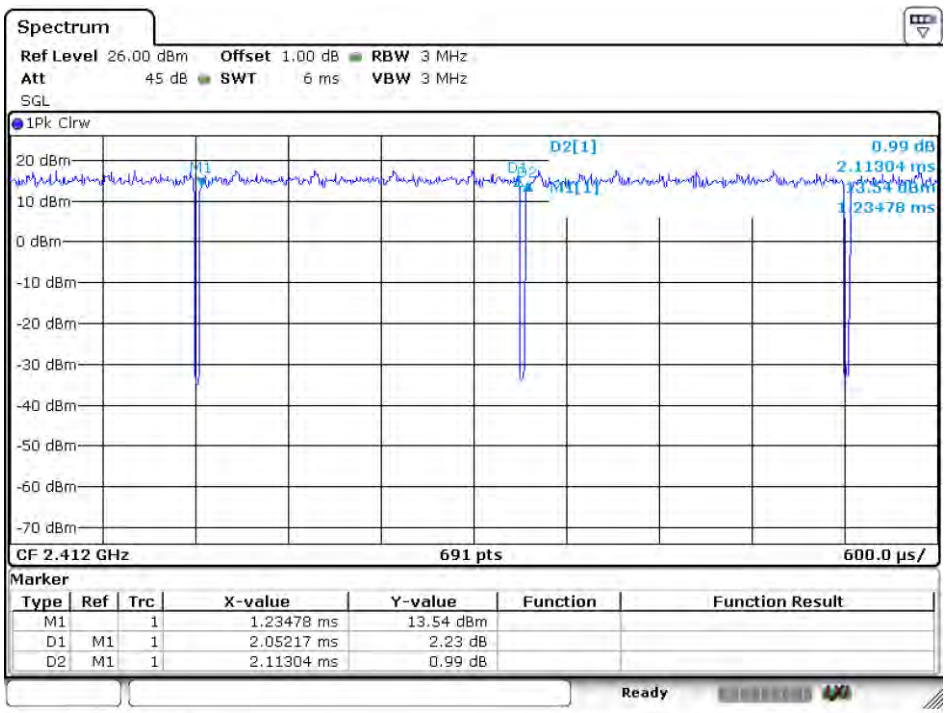
4.3.1.1.3 11G_CDD



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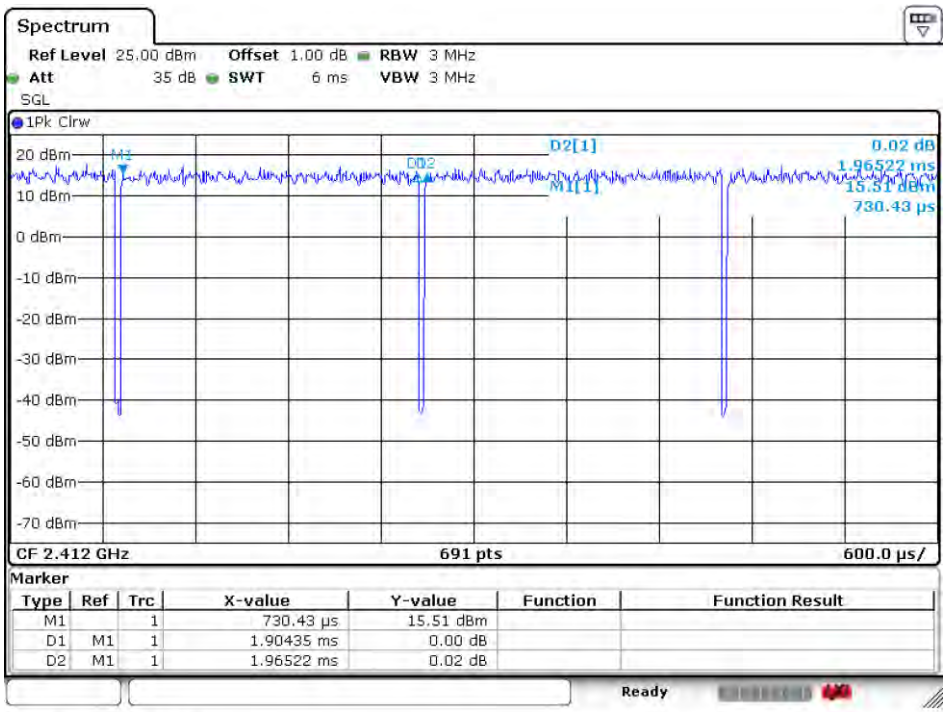
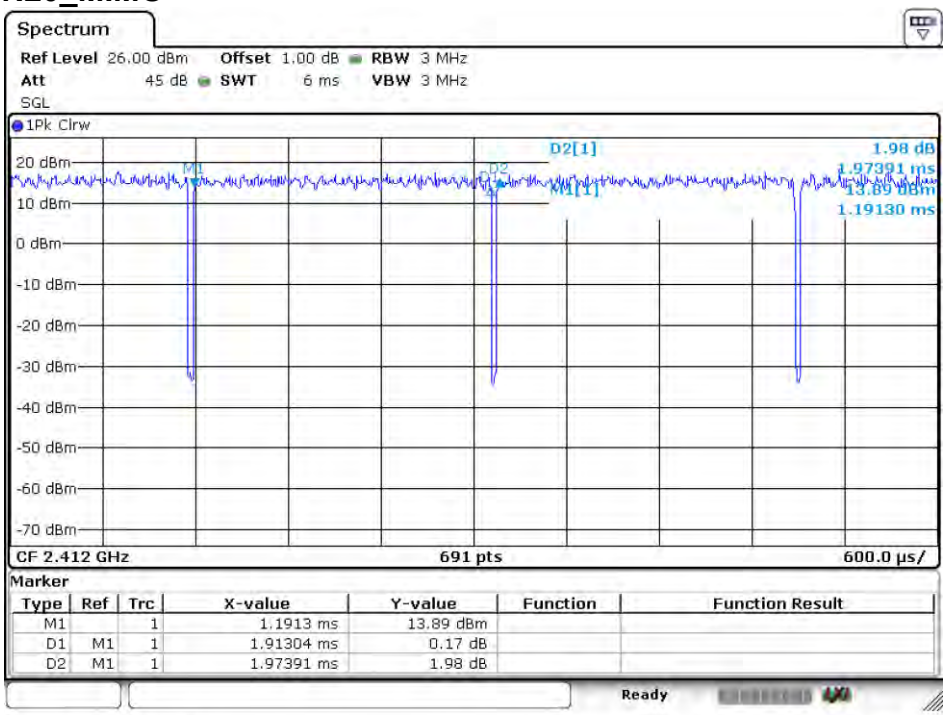
4.3.1.1.4 11N20



Date: 17.APR.2019 09:30:05

4.3.1.1.5 11N20_MIMO



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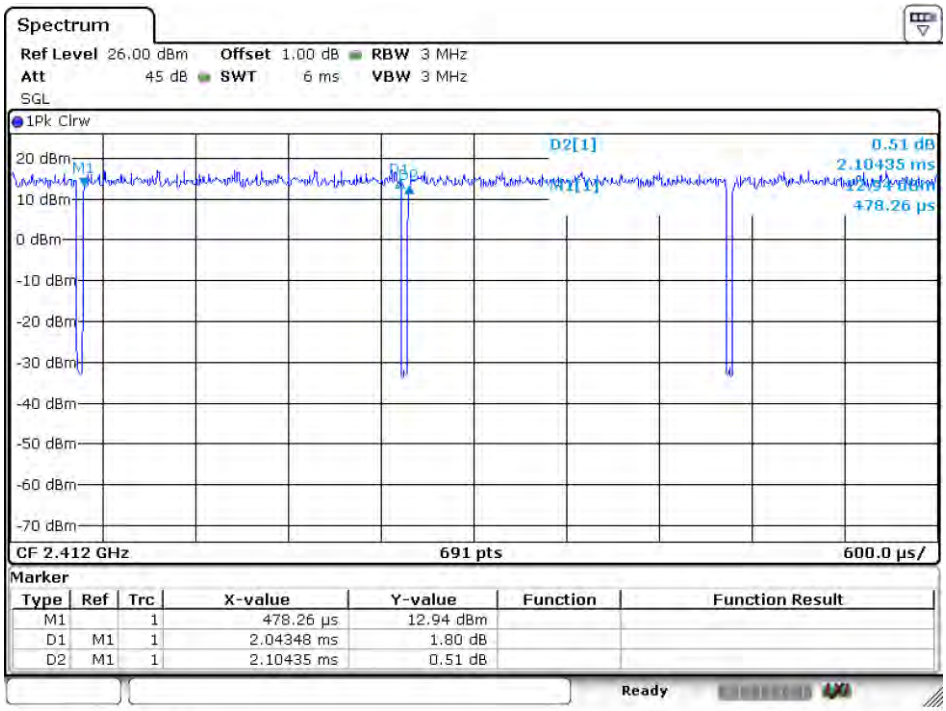
4.3.1.2 ANT2

4.3.1.2.1 11G



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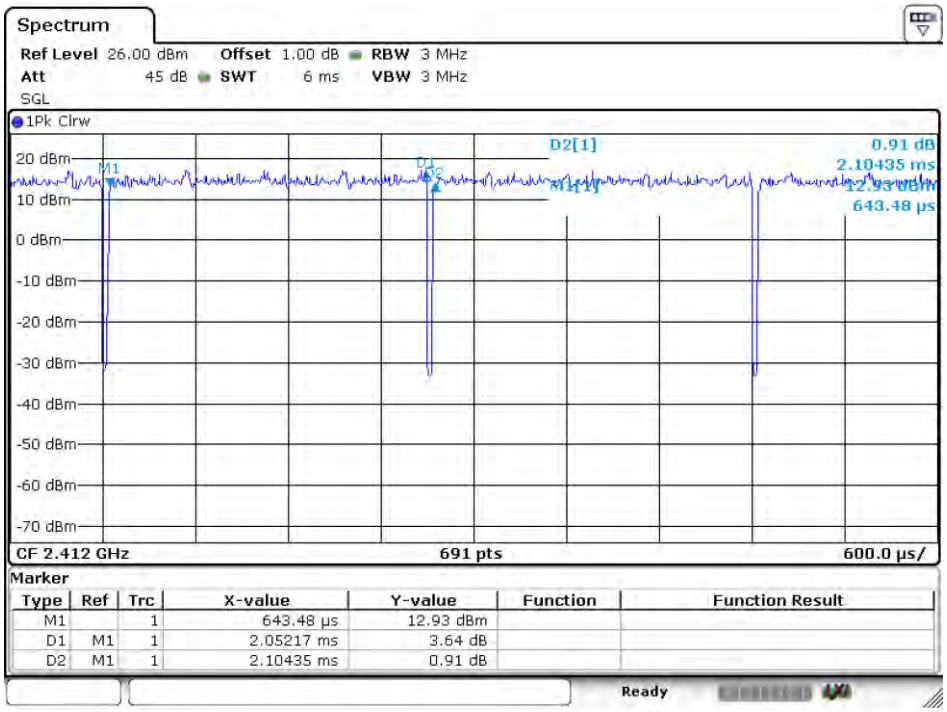
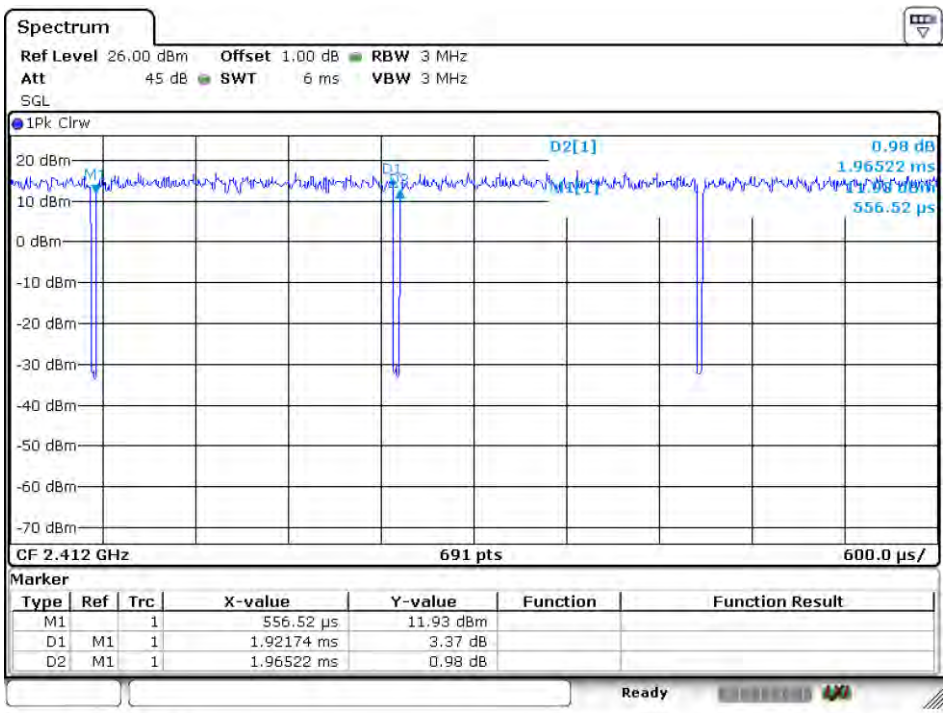
4.3.1.2.2 11G_CDD



Date: 11.JUN.2020 09:52:19

4.3.1.2.3 11N20



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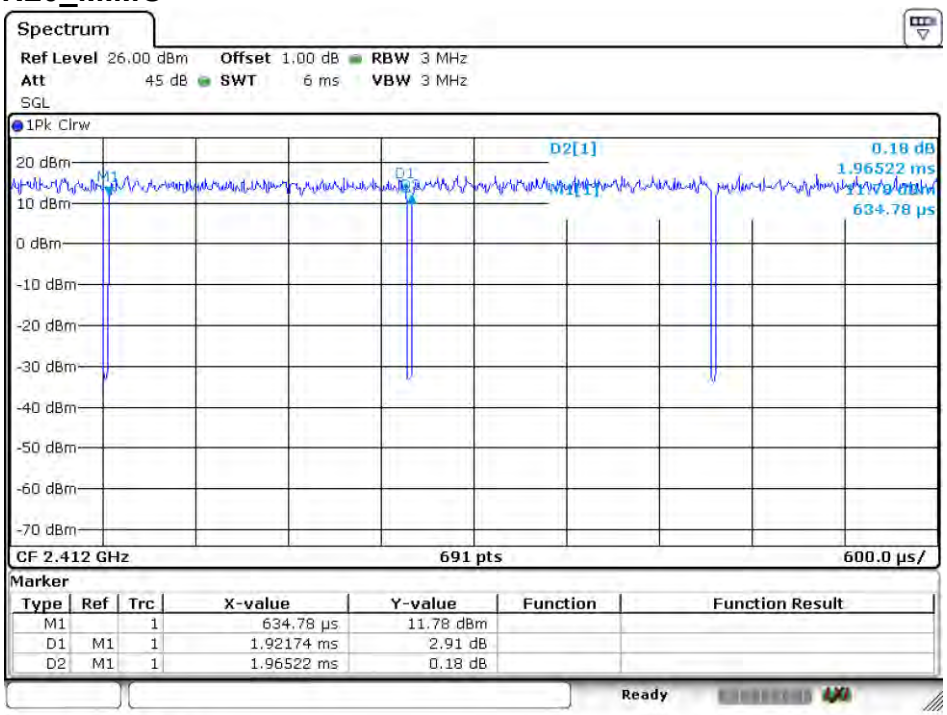
4.3.1.2.4 11N20_MIMO



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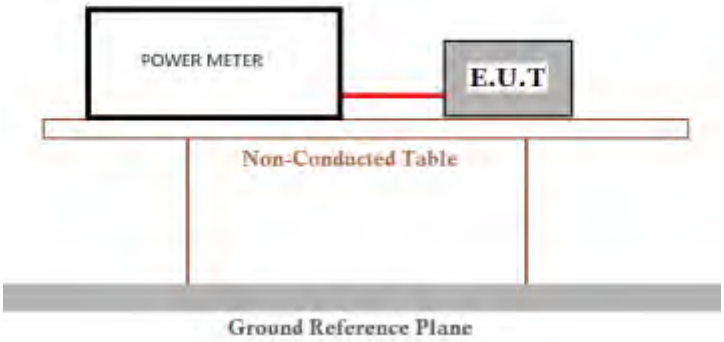
4.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10 :2013 Section 11.9.1.3
Test Setup:	
Test Instruments:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20); 13.5Mbps of rate is the worst case of 802.11N(HT40).
Limit:	30dBm
Test Results:	Pass

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4.4.1 Test Results

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)			Limit (dBm)	Result
		ANT1	ANT2	SUM		
802.11B	Lowest	17.32	---	---	30.00	Pass
	Middle	17.39	---	---	30.00	Pass
	Highest	17.01	---	---	30.00	Pass
802.11G	Lowest	15.20	15.26	---	30.00	Pass
	Middle	15.30	15.05	---	30.00	Pass
	Highest	15.17	15.03	---	30.00	Pass
802.11G_CDD	Lowest	17.26	15.07	19.31	30.00	Pass
	Middle	16.77	14.94	18.96	30.00	Pass
	Highest	17.31	14.93	19.29	30.00	Pass
802.11N20	Lowest	15.02	16.28	---	30.00	Pass
	Middle	15.11	16.02	---	30.00	Pass
	Highest	15.07	15.92	---	30.00	Pass
802.11N20_MIMO	Lowest	17.05	15.95	19.55	30.00	Pass
	Middle	17.10	15.77	19.50	30.00	Pass
	Highest	17.07	15.65	19.43	30.00	Pass

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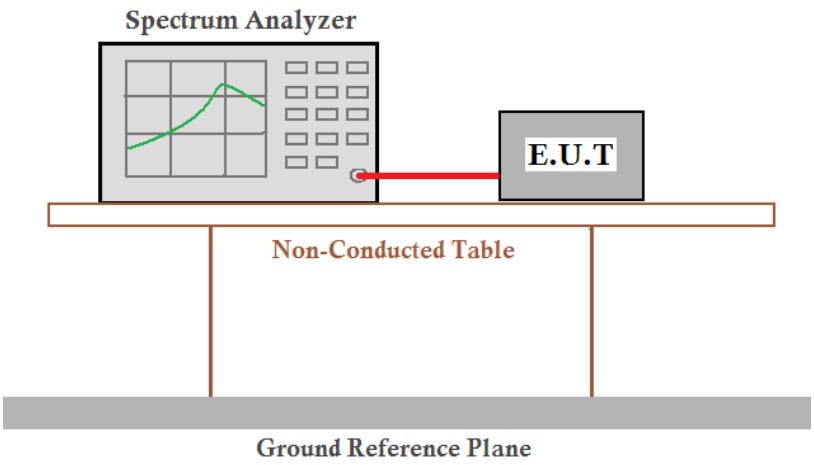
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8.1 Option 1
Test Setup:	
Instruments Used:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	≥ 500 kHz
Test Results:	Pass

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4.5.1 Test Results

ANT1					
Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	13.85	9.03	≥500	Pass
	Middle	13.81	8.12	≥500	Pass
	Highest	13.94	9.07	≥500	Pass
802.11G	Lowest	16.63	15.89	≥500	Pass
	Middle	16.63	16.24	≥500	Pass
	Highest	16.71	16.28	≥500	Pass
802.11G_CDD	Lowest	16.67	16.02	≥500	Pass
	Middle	16.67	15.89	≥500	Pass
	Highest	16.63	16.24	≥500	Pass
802.11N20	Lowest	17.71	17.15	≥500	Pass
	Middle	17.71	17.15	≥500	Pass
	Highest	17.80	17.50	≥500	Pass
802.11N20 _MIMO	Lowest	17.80	17.19	≥500	Pass
	Middle	17.76	17.15	≥500	Pass
	Highest	17.76	17.50	≥500	Pass

ANT2					
Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11G	Lowest	16.63	15.88	≥500	Pass
	Middle	16.63	15.89	≥500	Pass
	Highest	16.71	16.28	≥500	Pass
802.11G_CDD	Lowest	16.58	16.28	≥500	Pass
	Middle	16.58	16.02	≥500	Pass
	Highest	16.58	16/28	≥500	Pass
802.11N20	Lowest	17.76	17.15	≥500	Pass
	Middle	17.76	17.28	≥500	Pass
	Highest	17.80	17.32	≥500	Pass
802.11N20 _MIMO	Lowest	17.76	17.19	≥500	Pass
	Middle	17.71	17.19	≥500	Pass
	Highest	17.76	17.32	≥500	Pass

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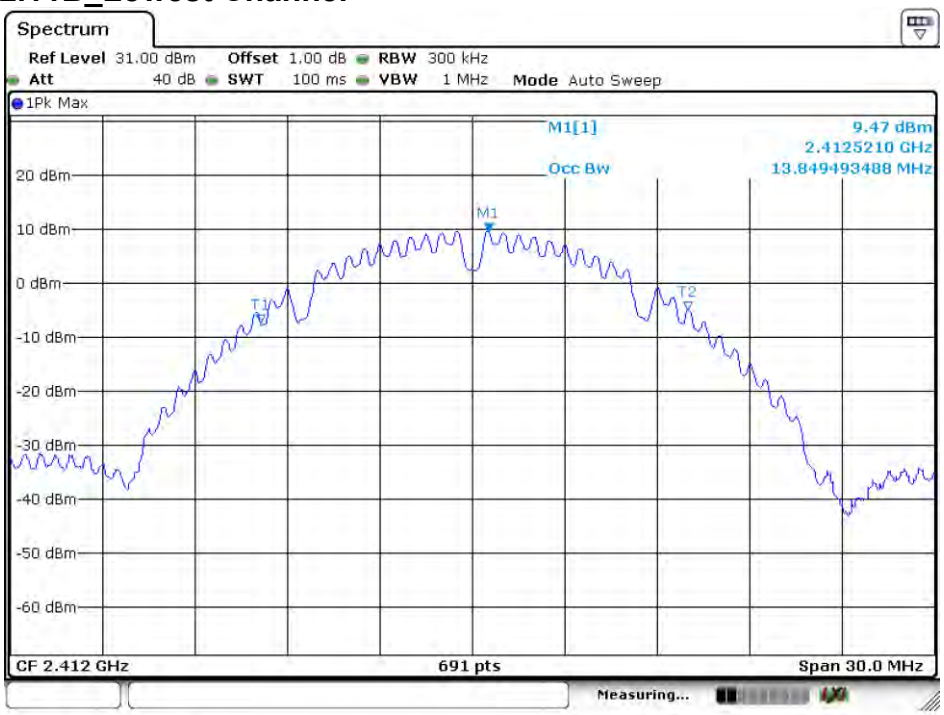
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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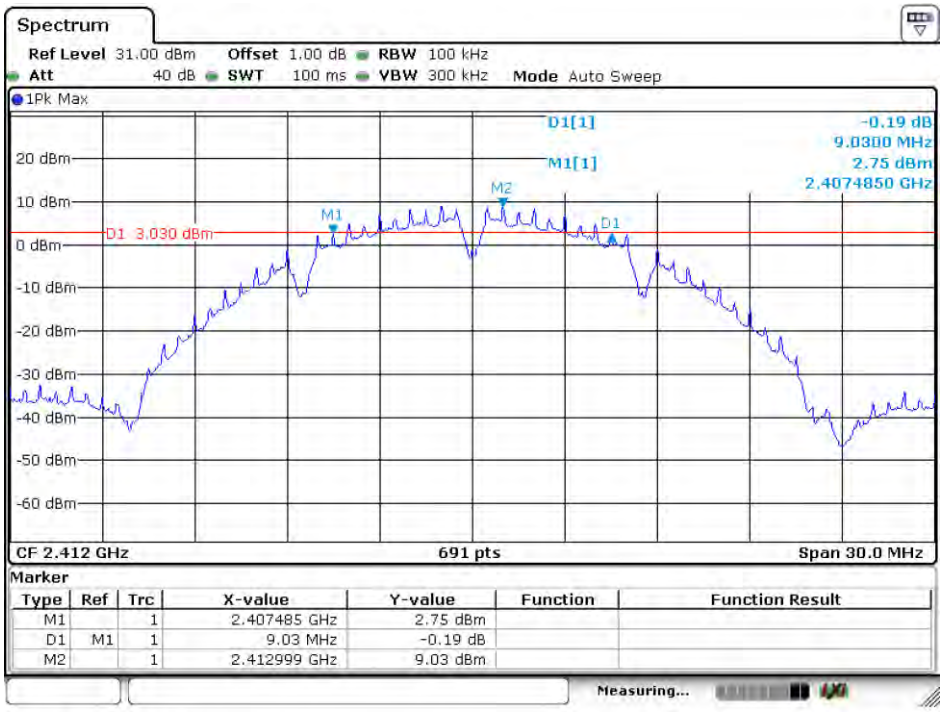

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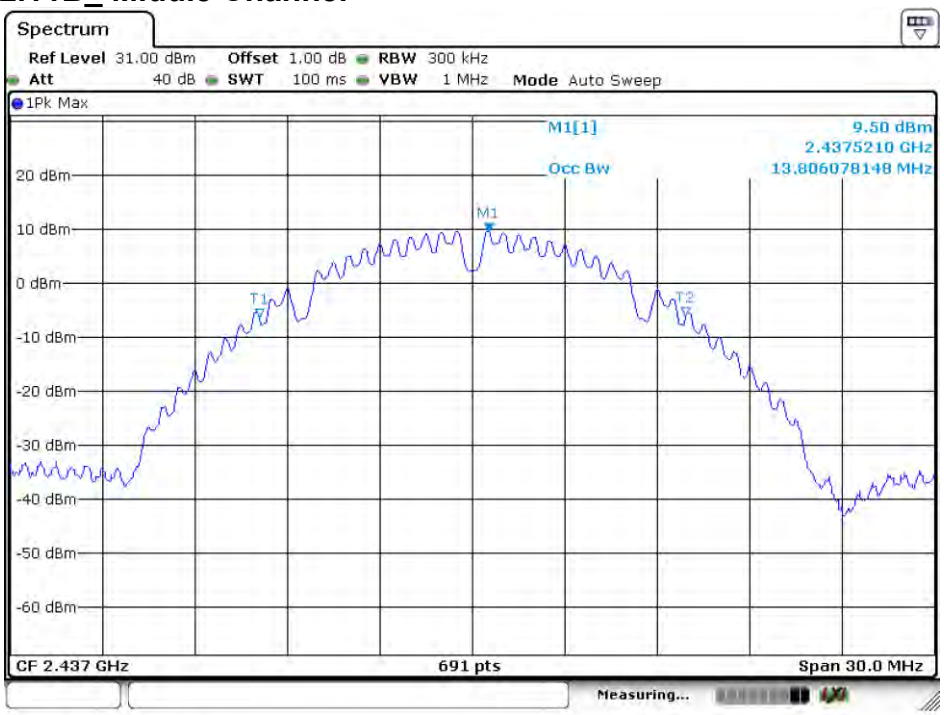
4.5.2.1.2 802.11B_ Middle Channel



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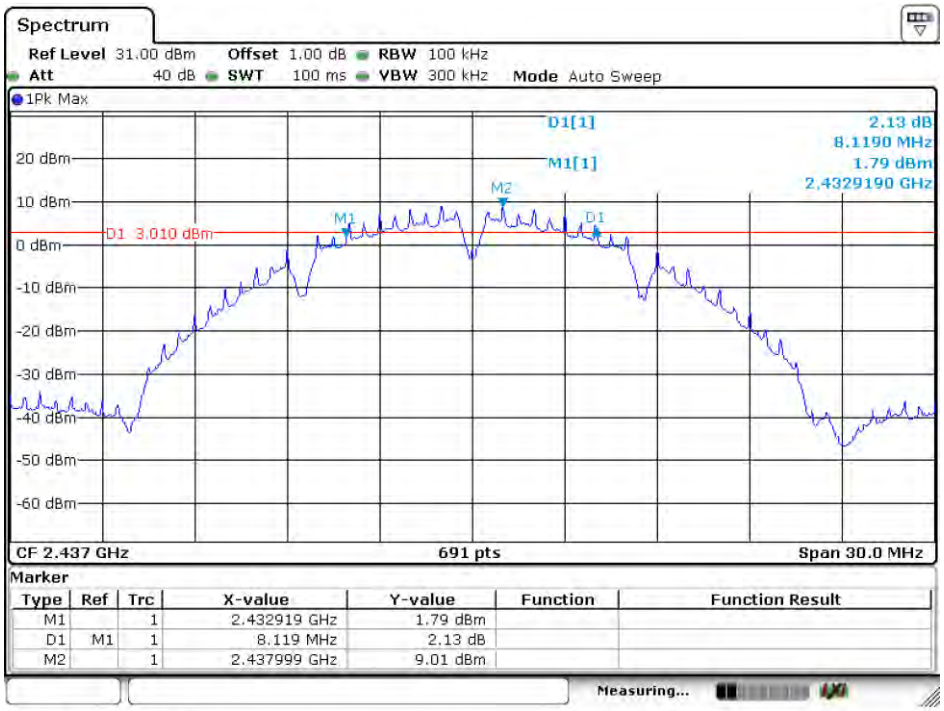

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.432919 GHz	1.79 dBm		
D1	M1	1	8.119 MHz	2.13 dB		
M2		1	2.437999 GHz	9.01 dBm		

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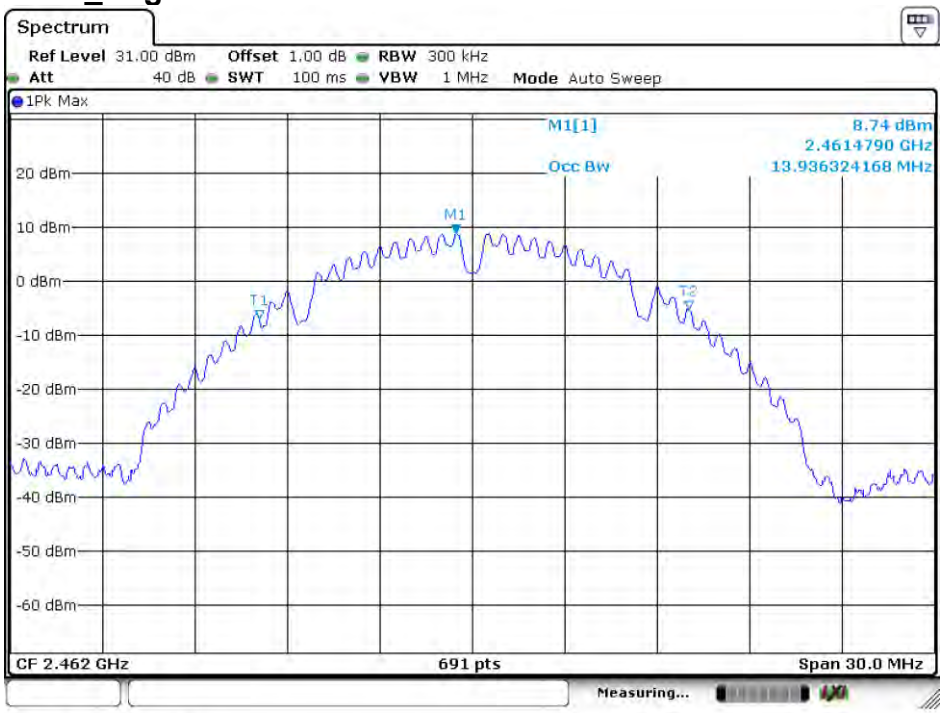
4.5.2.1.3 802.11B_ Highest Channel



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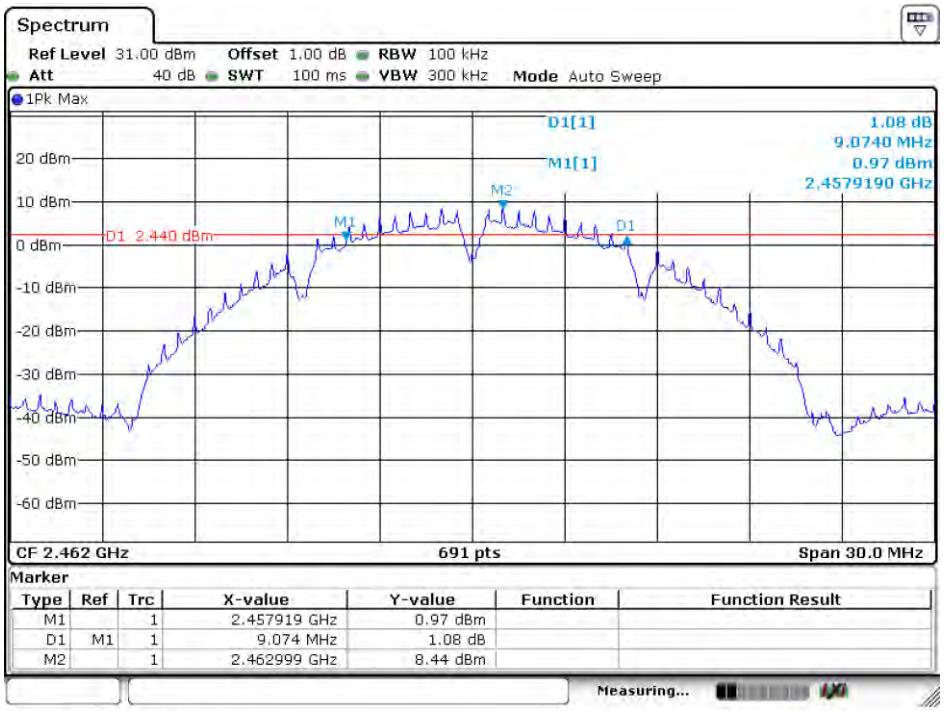

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.457919 GHz	0.97 dBm		
D1	M1	1	9.074 MHz	1.08 dB		
M2		1	2.462999 GHz	8.44 dBm		

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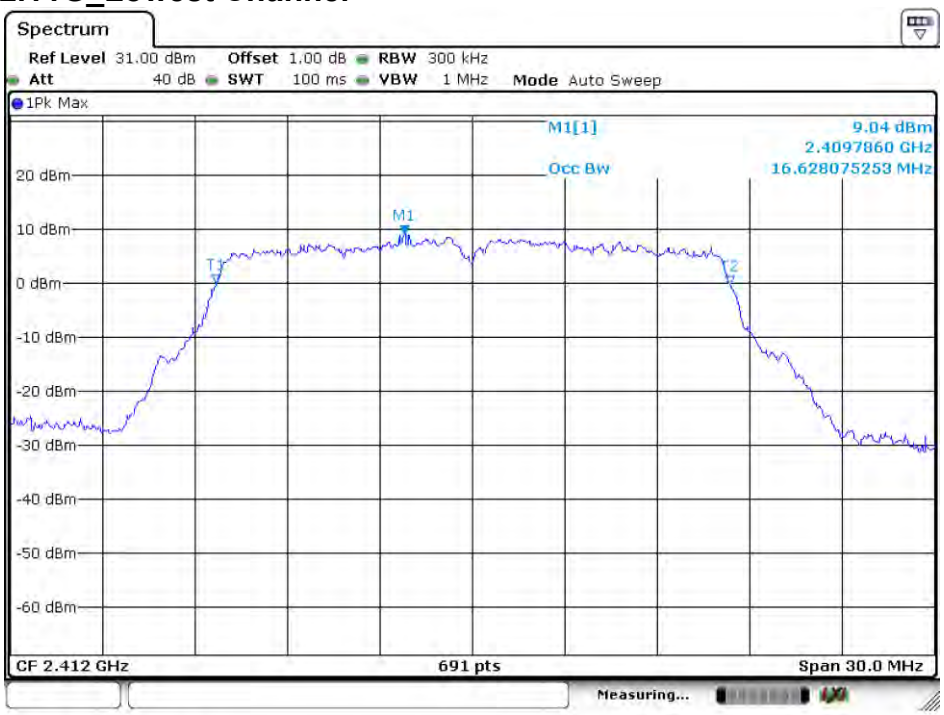
4.5.2.1.4 802.11G_Lowest Channel



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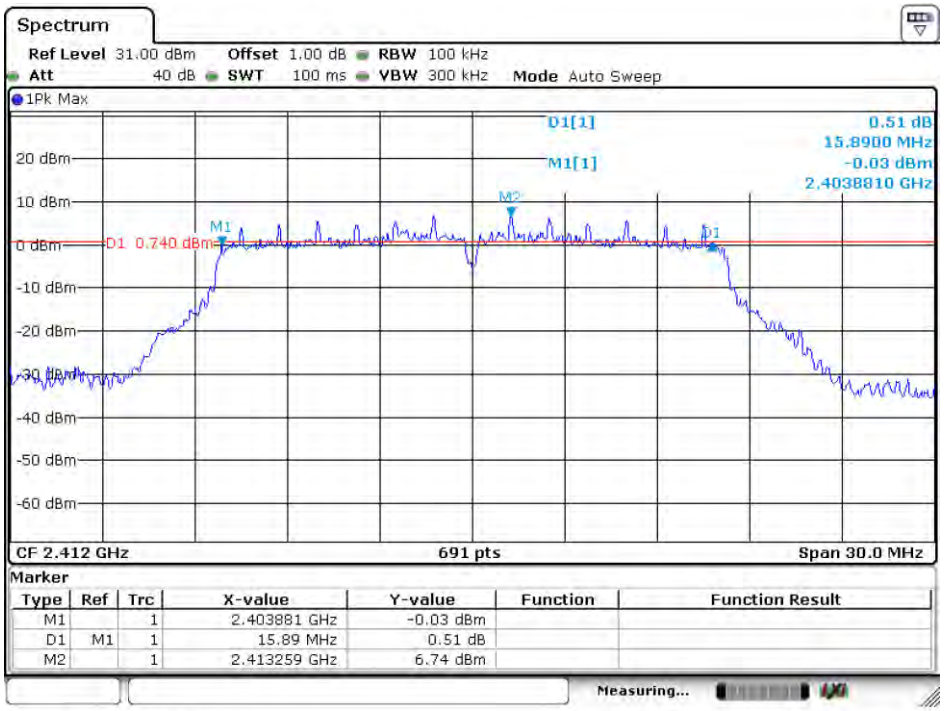

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403881 GHz	-0.03 dBm		
D1	M1	1	15.89 MHz	0.51 dB		
M2		1	2.413259 GHz	6.74 dBm		

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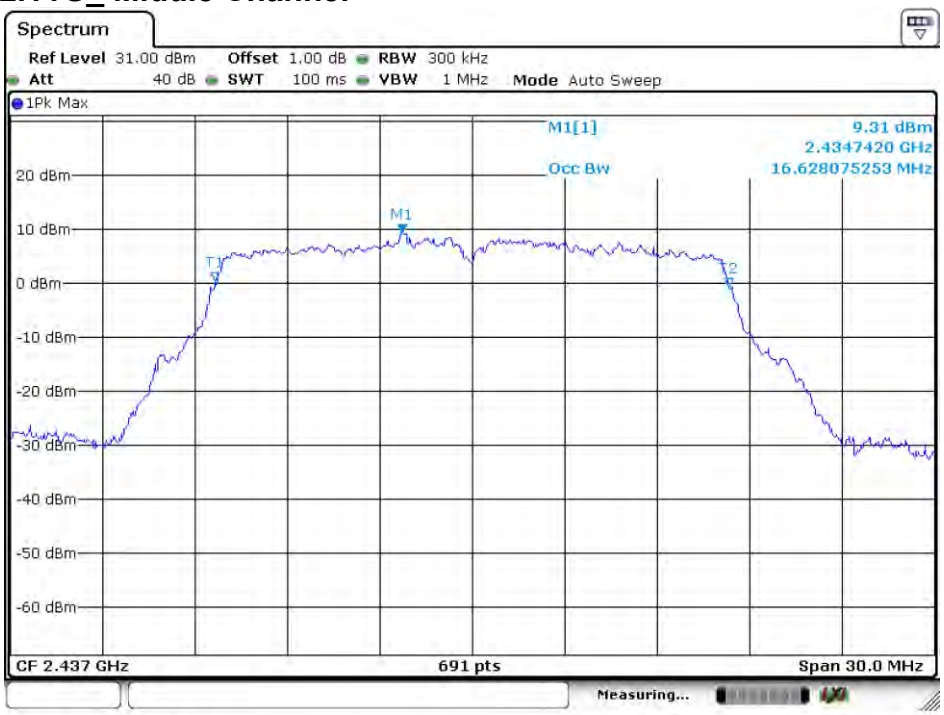
4.5.2.1.5 802.11G_ Middle Channel



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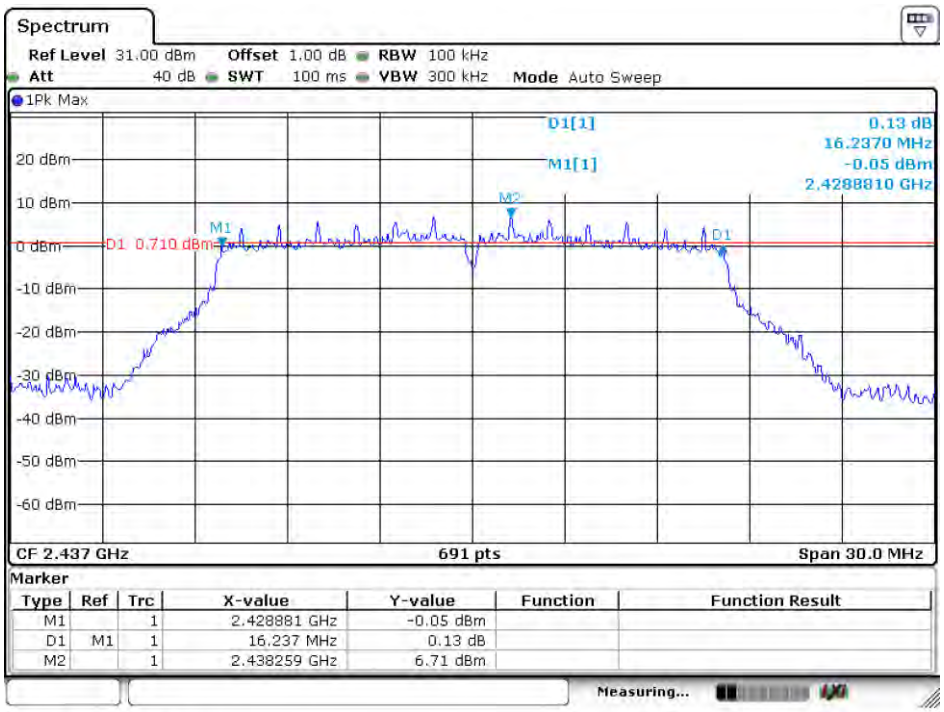

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428881 GHz	-0.05 dBm		
D1	M1	1	16.237 MHz	0.13 dB		
M2		1	2.438259 GHz	6.71 dBm		

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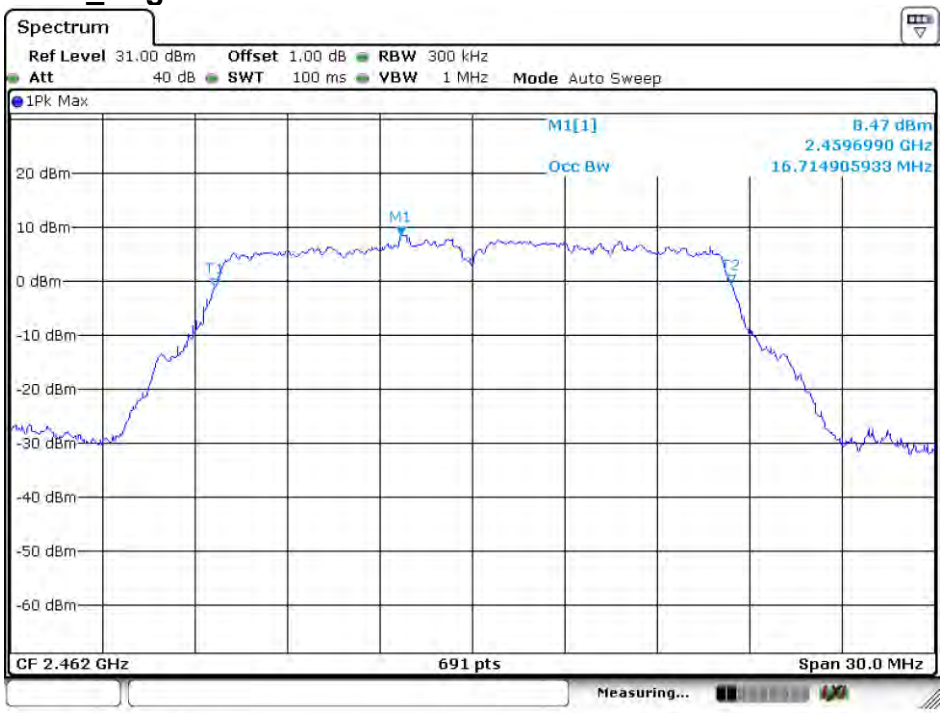
4.5.2.1.6 802.11G_ Highest Channel



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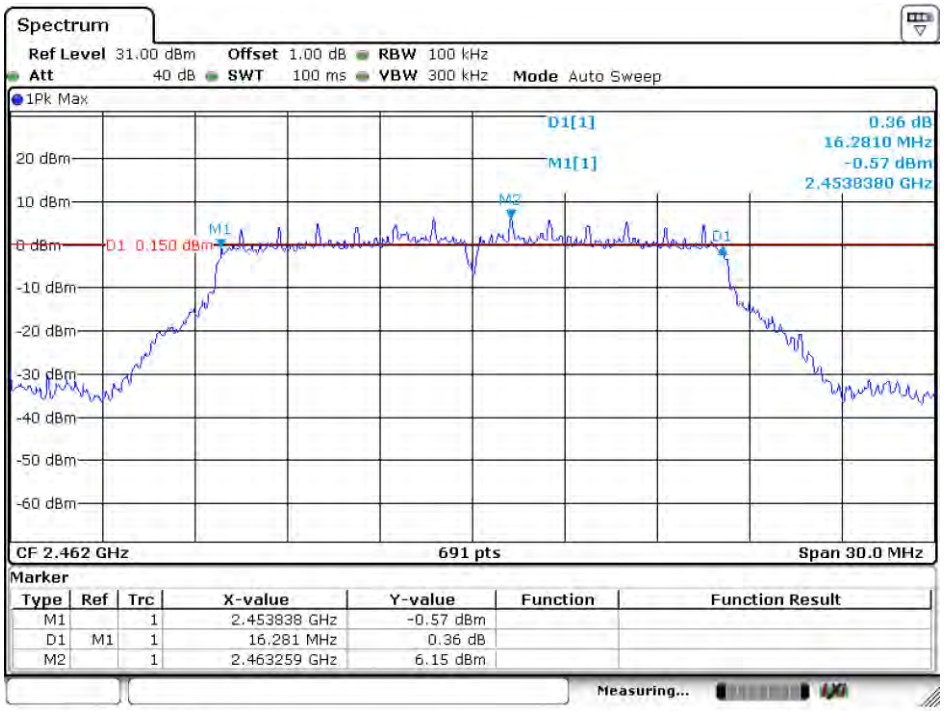

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453838 GHz	-0.57 dBm		
D1	M1	1	16.281 MHz	0.36 dB		
M2		1	2.463259 GHz	6.15 dBm		

Date: 10.JUN.2020 06:52:23

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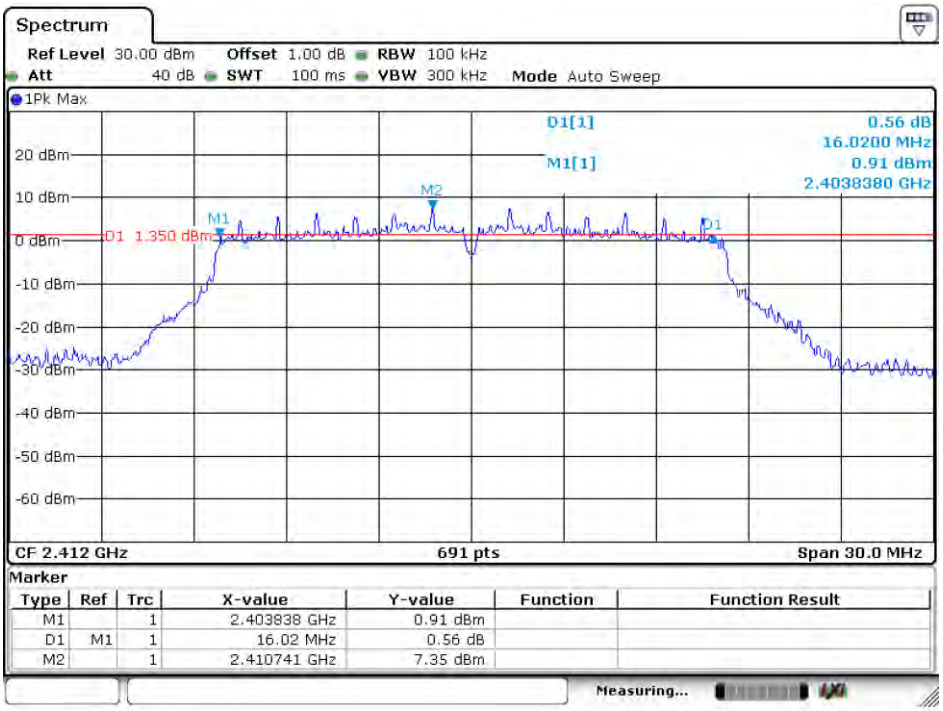
4.5.2.1.7 802.11G_CDD_Lowest Channel

Date: 11.JUN.2020 09:31:05



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403838 GHz	0.91 dBm		
D1	M1	1	16.02 MHz	0.56 dB		
M2		1	2.410741 GHz	7.35 dBm		

Date: 11.JUN.2020 09:14:54

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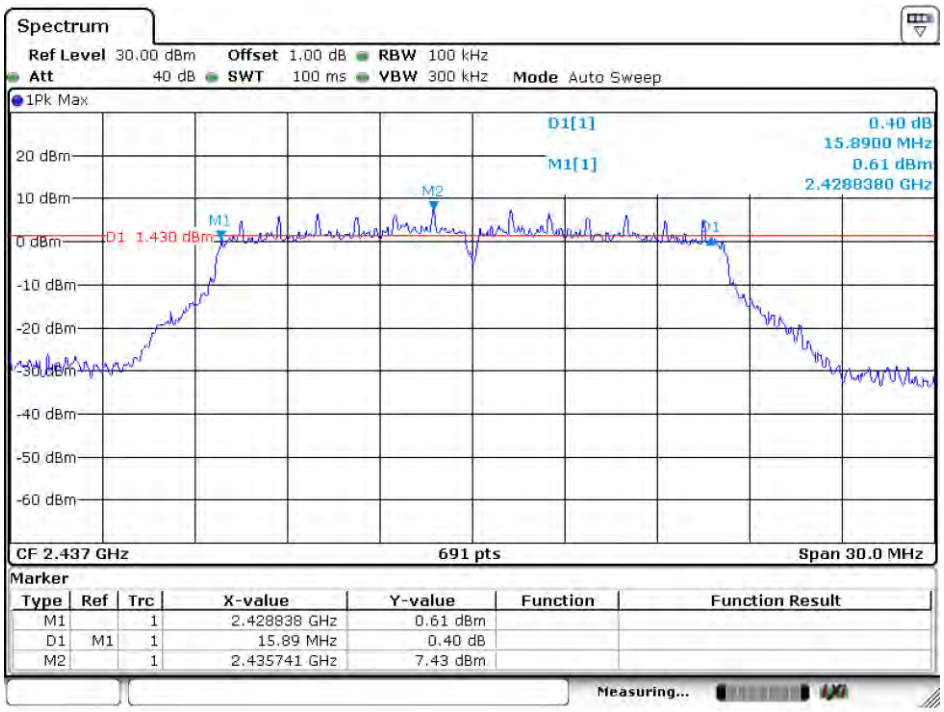
4.5.2.1.8 802.11G_CDD _ Middle Channel

Date: 11.JUN.2020 09:27:39



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428838 GHz	0.61 dBm		
D1	M1	1	15.89 MHz	0.40 dB		
M2		1	2.435741 GHz	7.43 dBm		

Date: 11.JUN.2020 09:16:31

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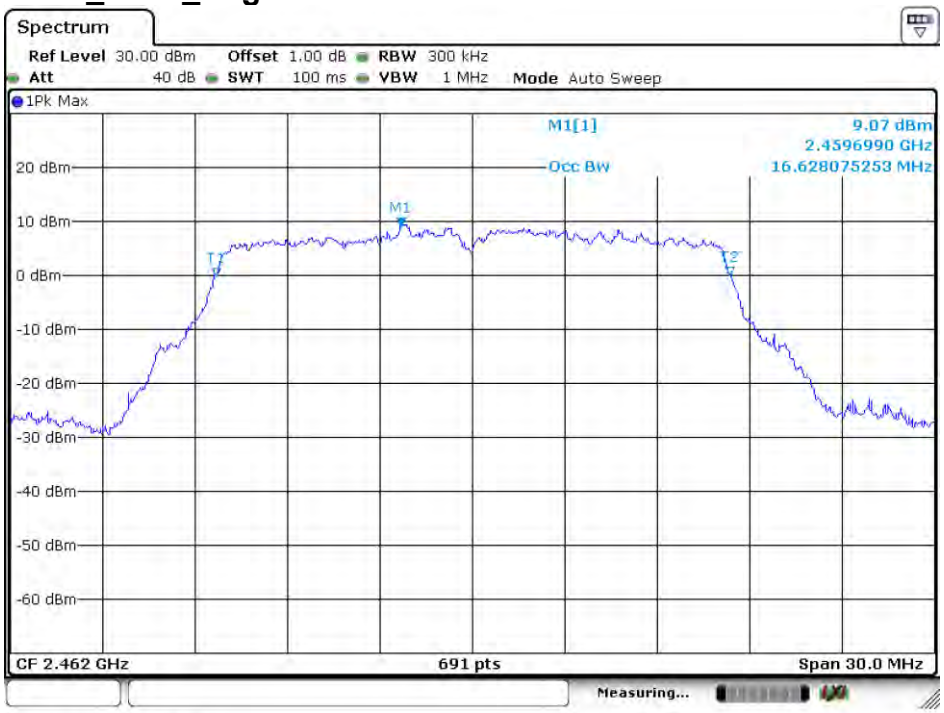
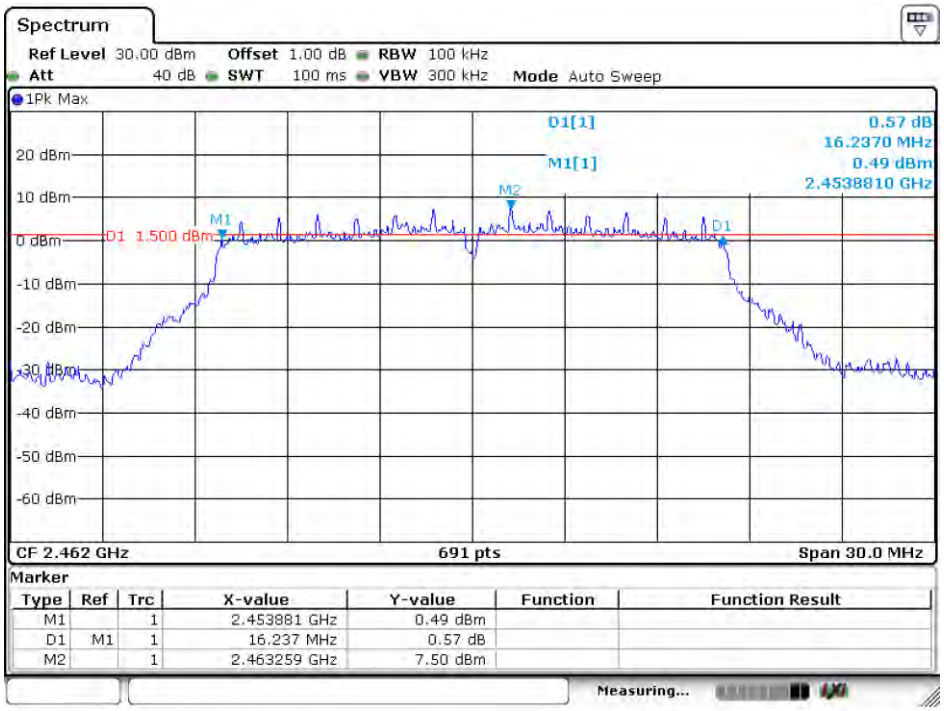
4.5.2.1.9 802.11G_CDD _ Highest Channel



Date: 11.JUN.2020 09:27:10



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453881 GHz	0.49 dBm		
D1	M1	1	16.237 MHz	0.57 dB		
M2		1	2.463259 GHz	7.50 dBm		

Date: 11.JUN.2020 09:18:20

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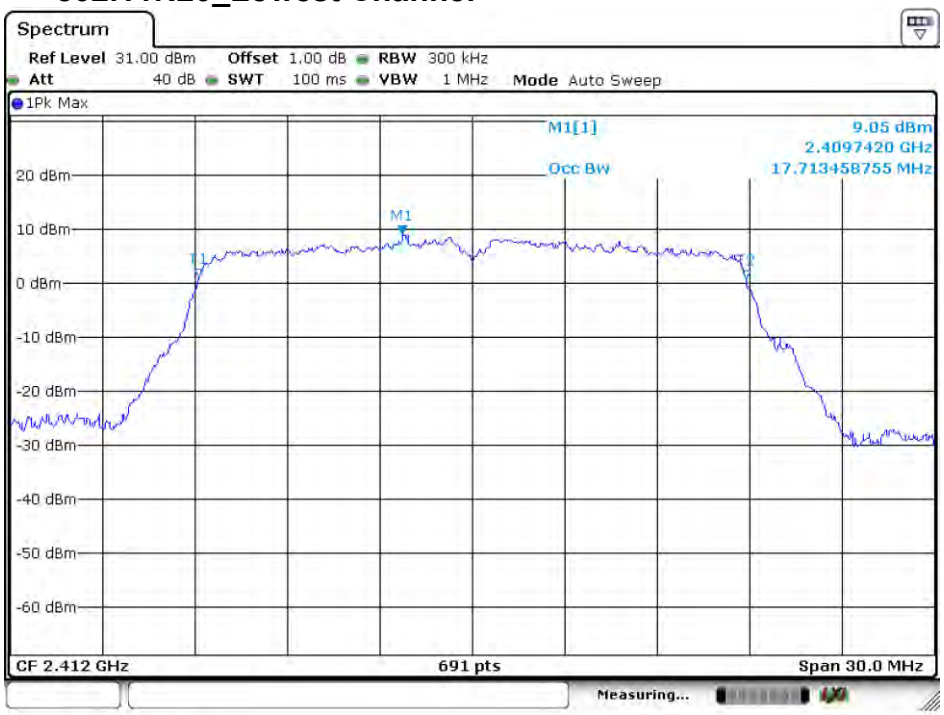
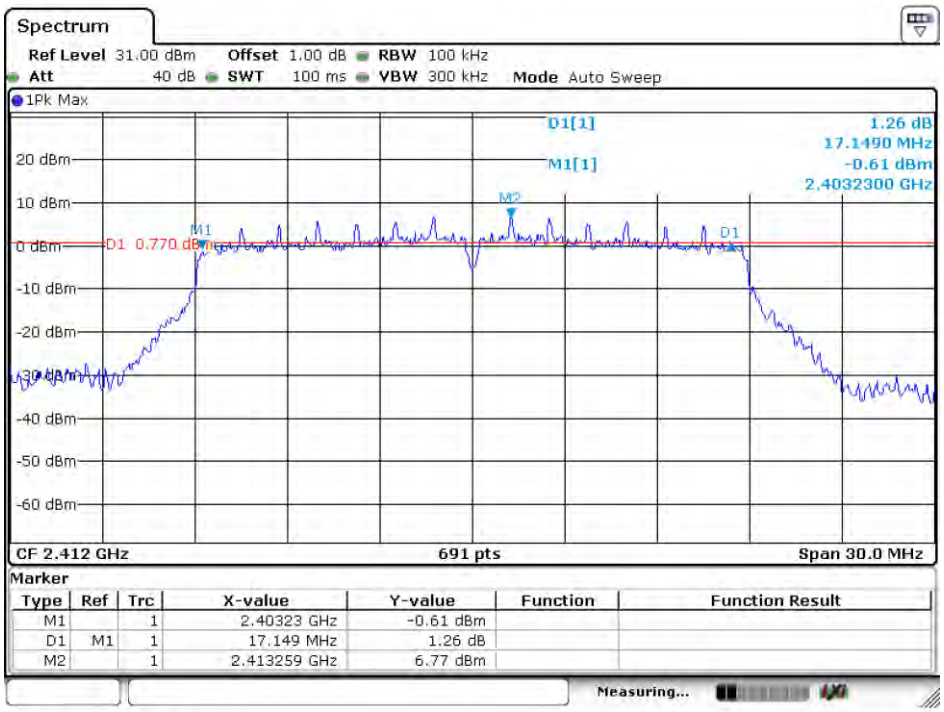
4.5.2.1.10 802.11N20_Lowest Channel



Date: 10.JUN.2020 04:42:01



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40323 GHz	-0.61 dBm		
D1	M1	1	17.149 MHz	1.26 dB		
M2		1	2.413259 GHz	6.77 dBm		

Date: 10.JUN.2020 04:53:17

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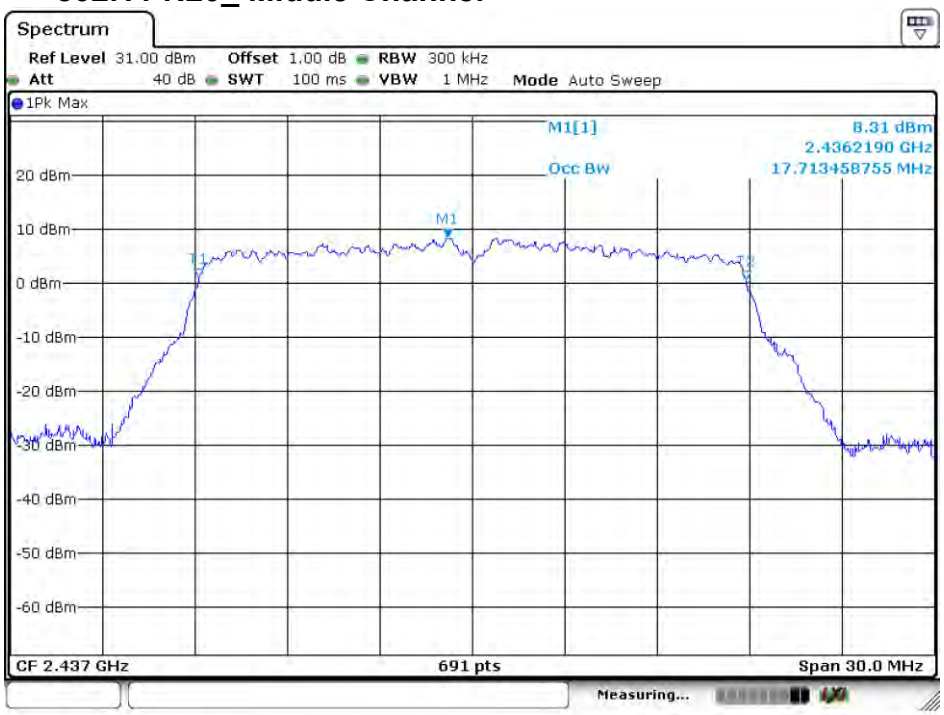
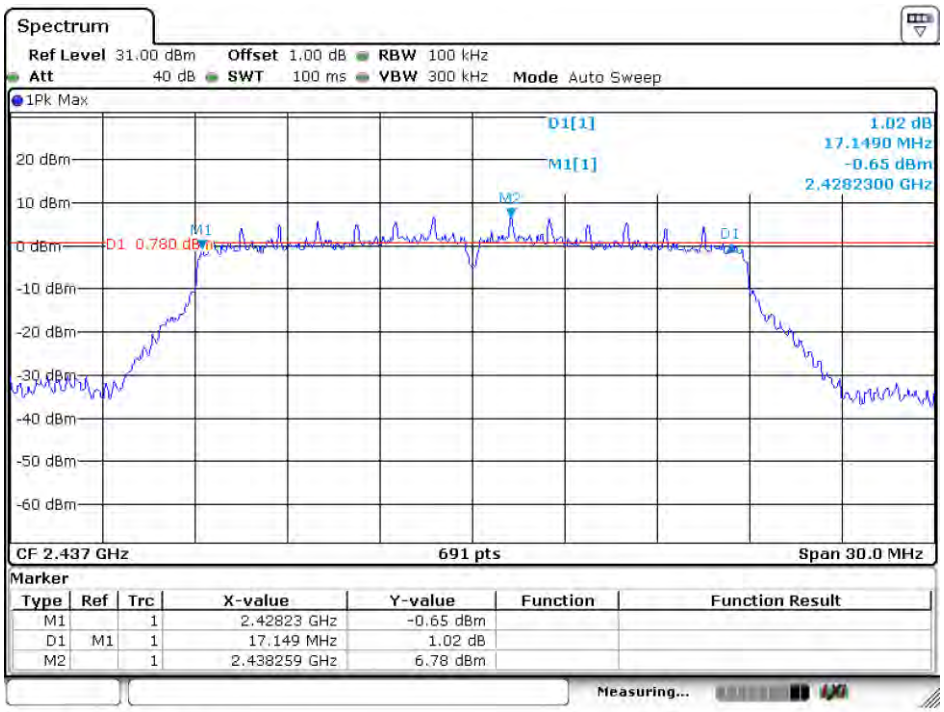
4.5.2.1.11 802.11 N20_ Middle Channel



Date: 10.JUN.2020 04:42:18



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.42823 GHz	-0.65 dBm		
D1	M1	1	17.149 MHz	1.02 dB		
M2		1	2.438259 GHz	6.78 dBm		

Date: 10.JUN.2020 04:51:53

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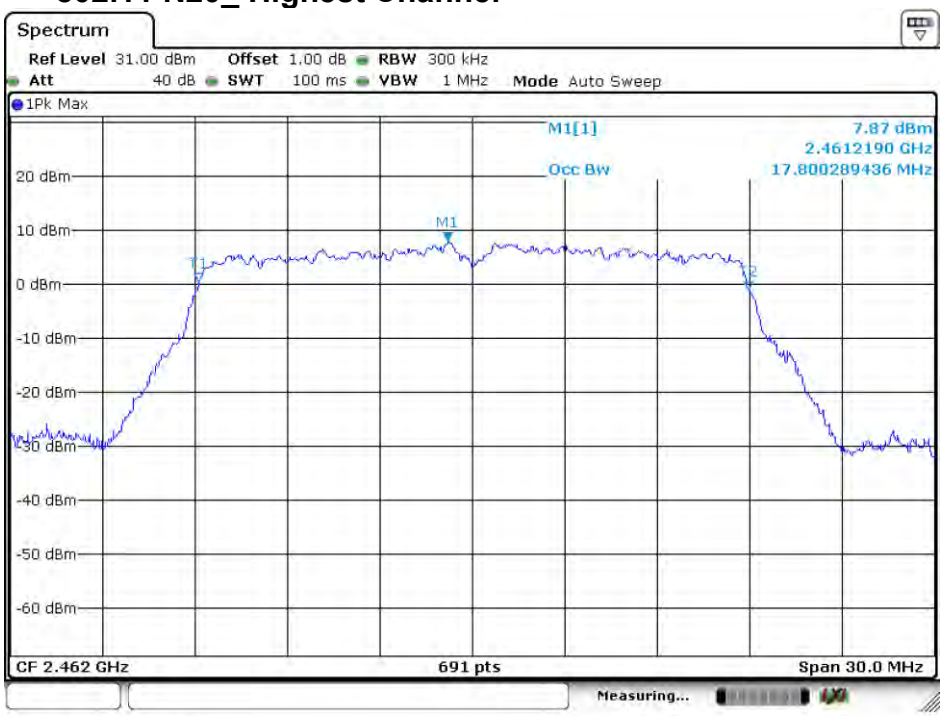
4.5.2.1.12 802.11 N20_ Highest Channel



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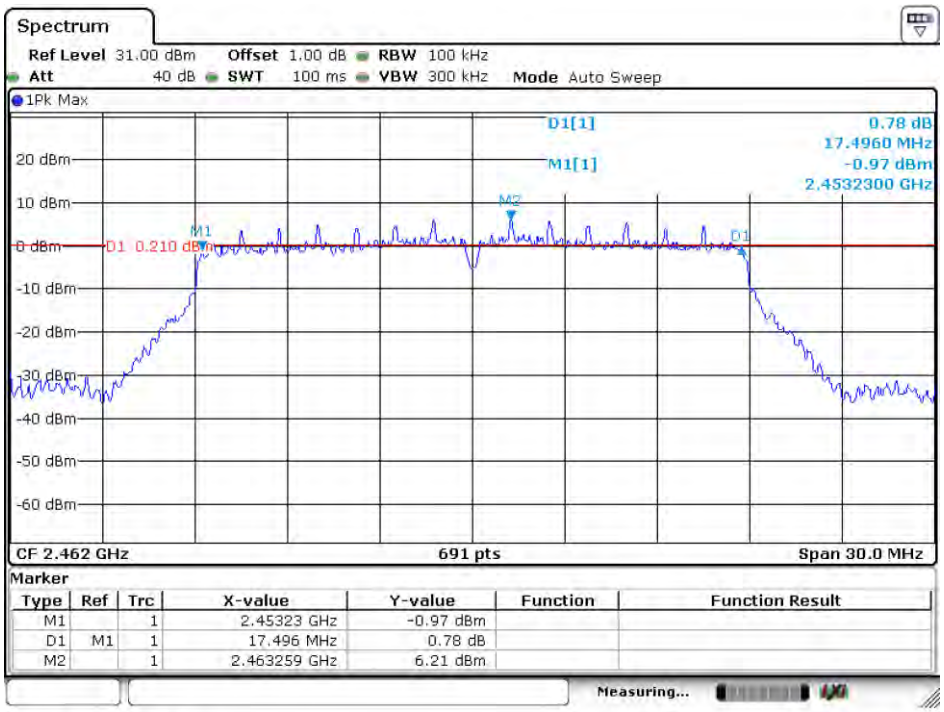

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.45323 GHz	-0.97 dBm		
D1	M1	1	17.496 MHz	0.78 dB		
M2		1	2.463259 GHz	6.21 dBm		

Date: 10.JUN.2020 04:50:51

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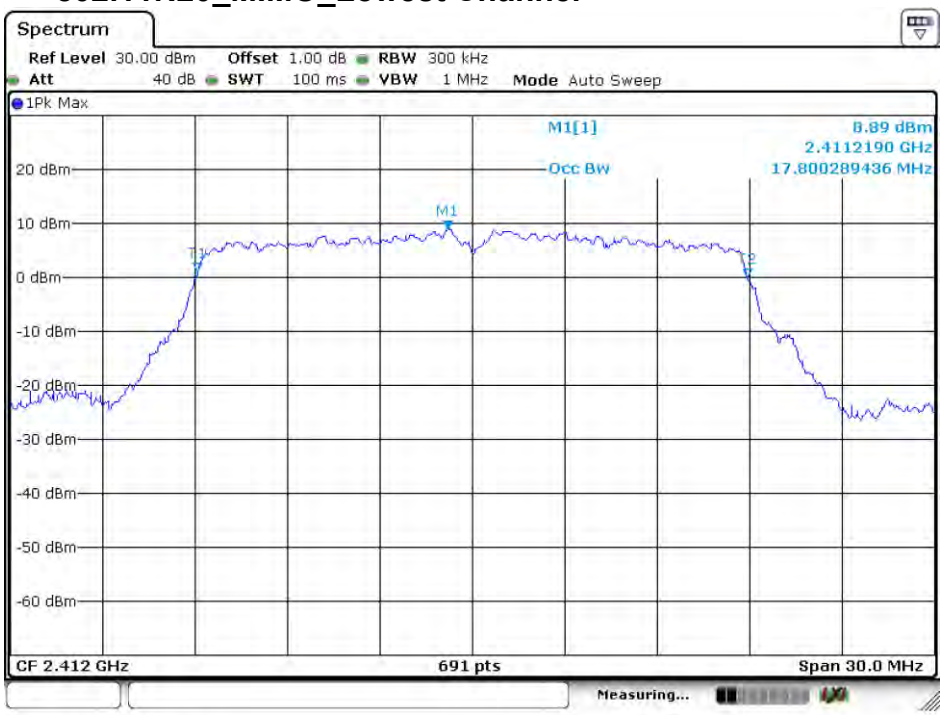
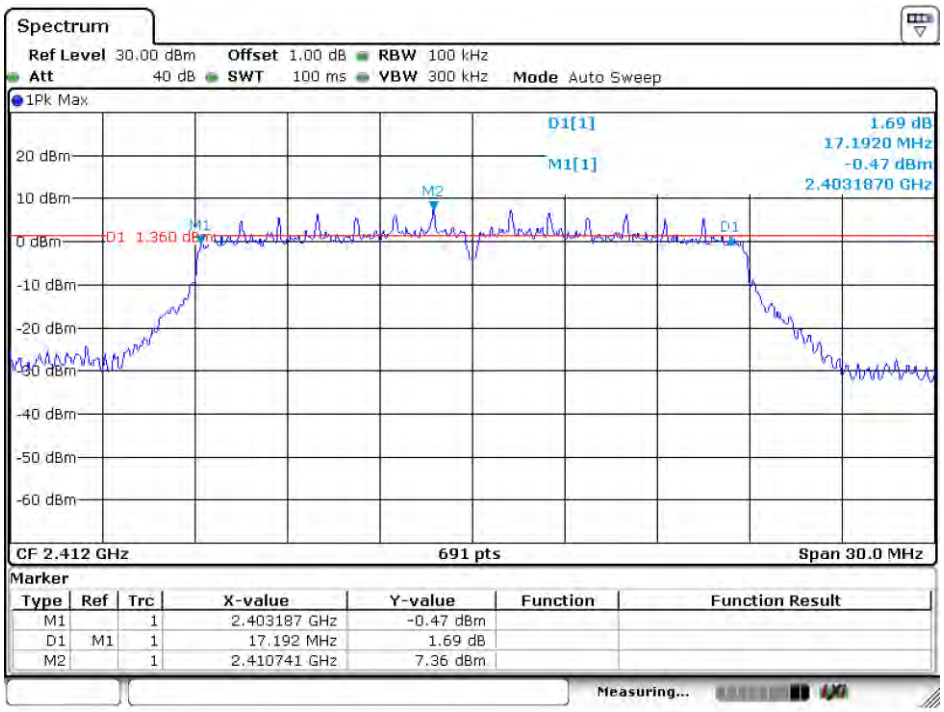
4.5.2.1.13 802.11N20_MIMO_Lowest Channel



Date: 11.JUN.2020 09:24:20



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403187 GHz	-0.47 dBm		
D1	M1	1	17.192 MHz	1.69 dB		
M2		1	2.410741 GHz	7.36 dBm		

Date: 11.JUN.2020 09:23:58

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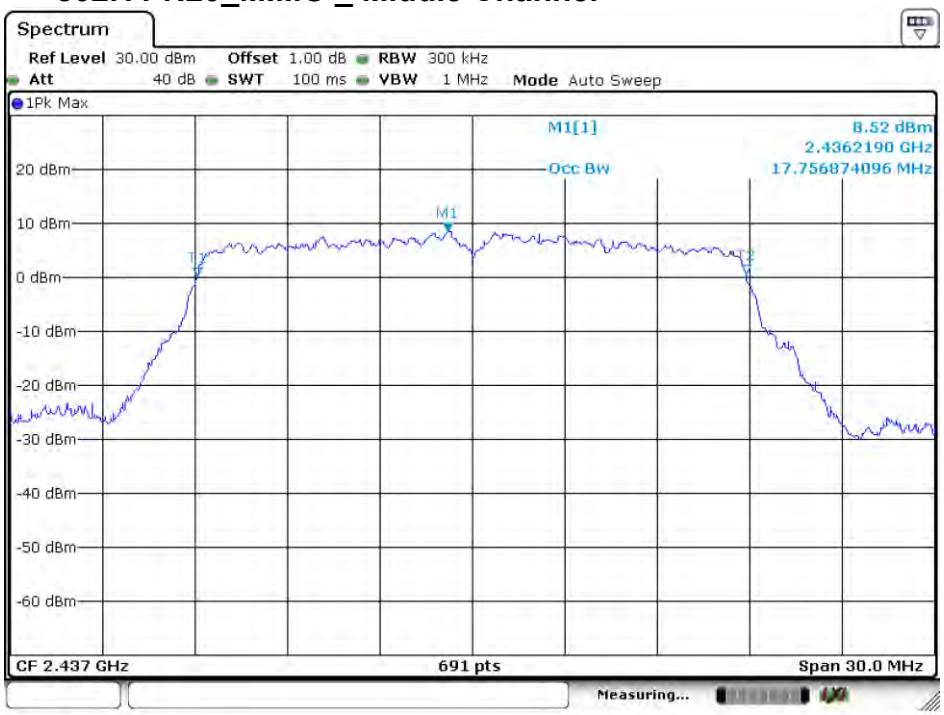
4.5.2.1.14 802.11 N20_MIMO _ Middle Channel



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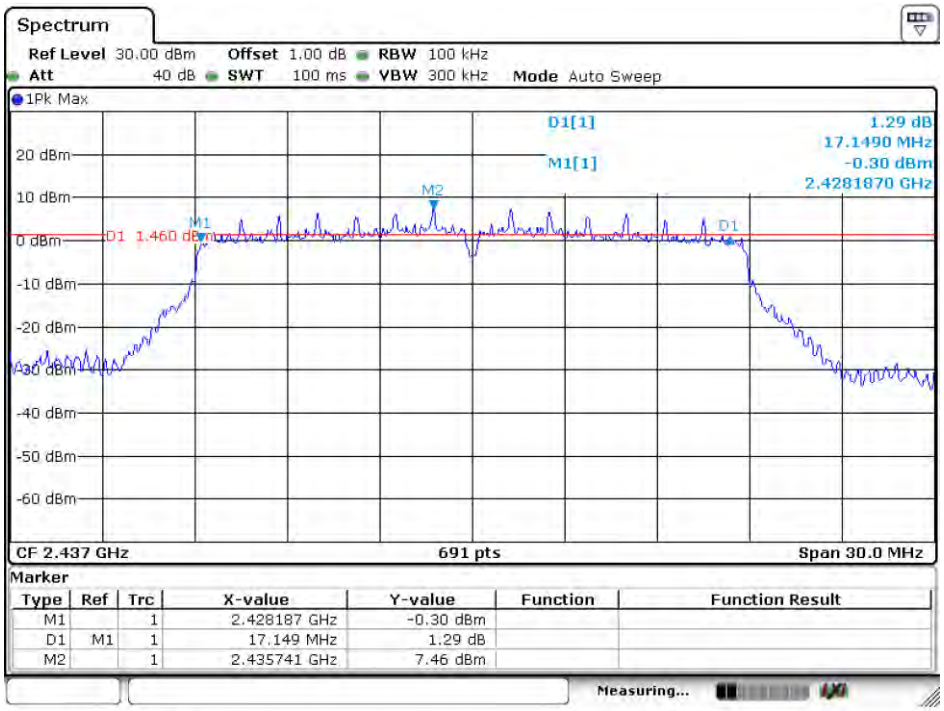

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428187 GHz	-0.30 dBm		
D1	M1	1	17.149 MHz	1.29 dB		
M2		1	2.435741 GHz	7.46 dBm		

Date: 11.JUN.2020 09:23:10

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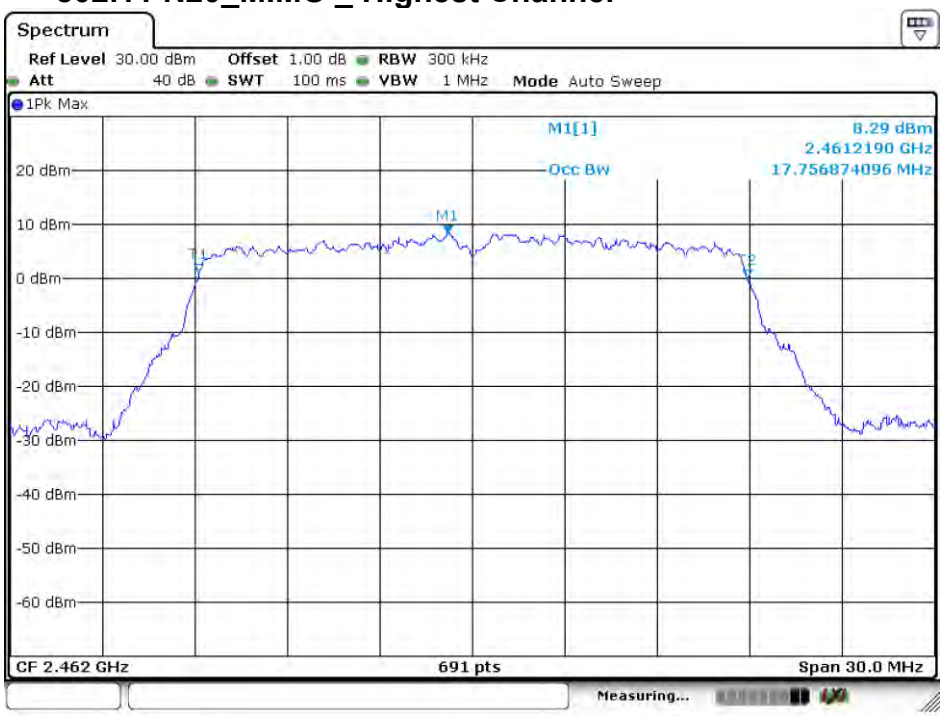
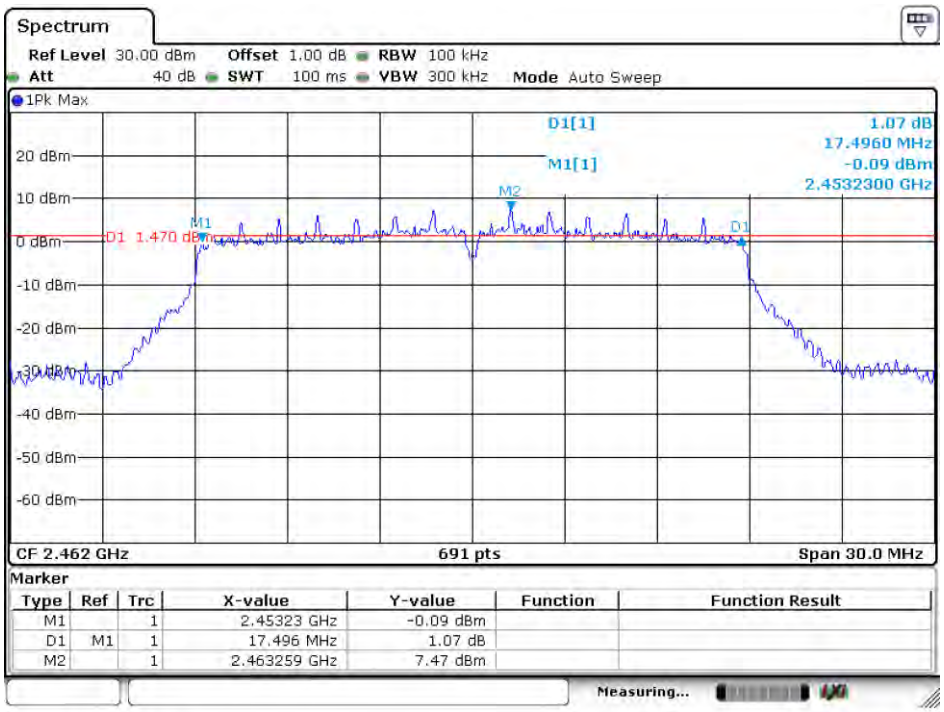
4.5.2.1.15 802.11 N20_MIMO _ Highest Channel



Date: 11.JUN.2020 09:24:56



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.45323 GHz	-0.09 dBm		
D1	M1	1	17.496 MHz	1.07 dB		
M2		1	2.463259 GHz	7.47 dBm		

Date: 11.JUN.2020 09:21:13

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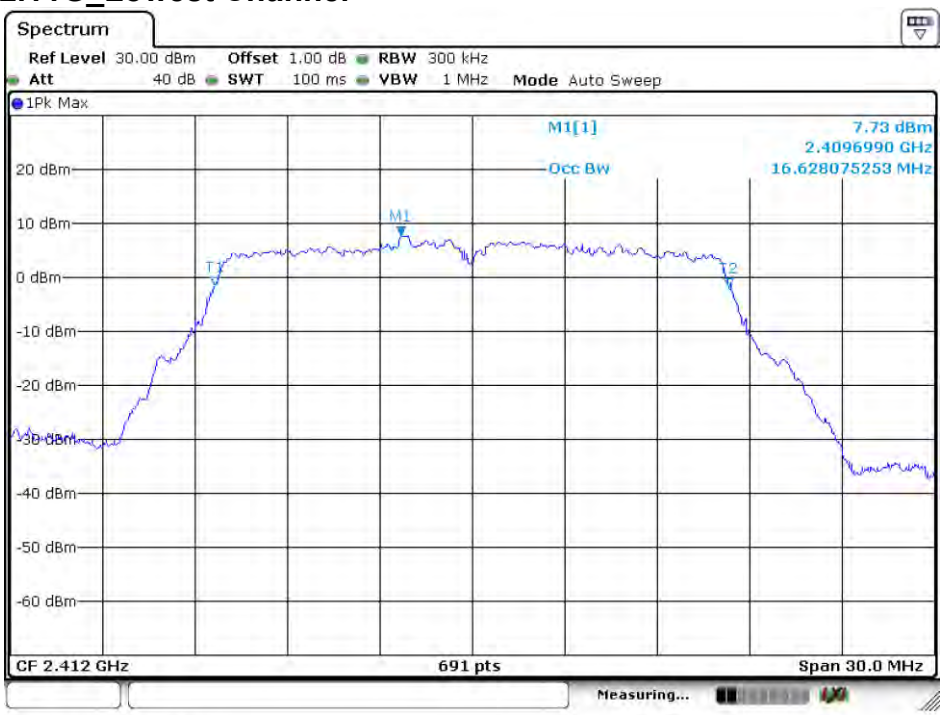
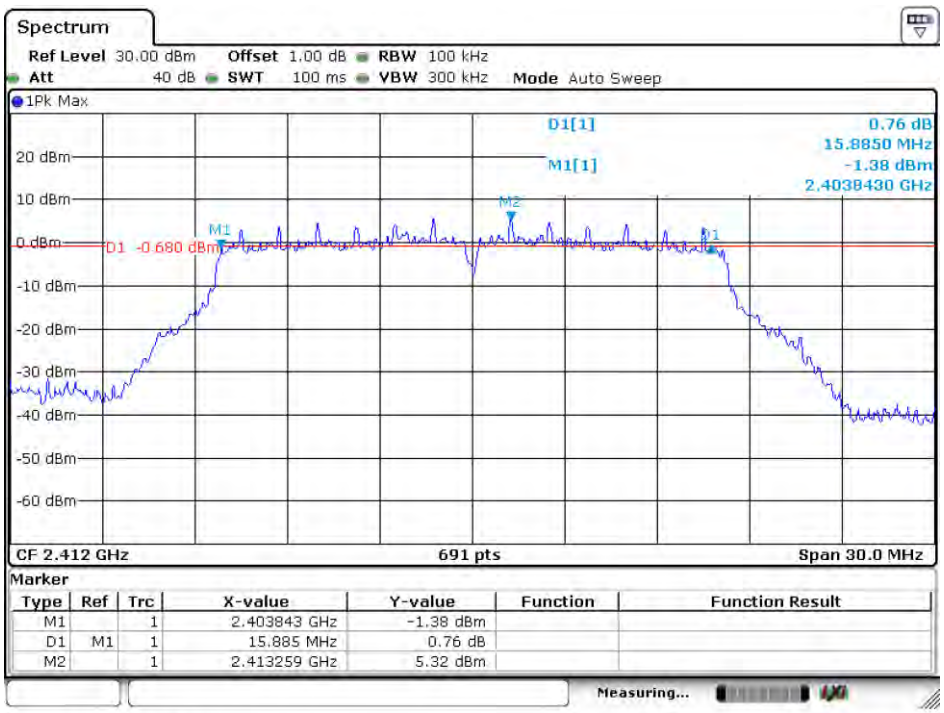
4.5.2.2 ANT2

4.5.2.2.1 802.11G_Lowest Channel



Date: 11.JUN.2020 08:37:30



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403843 GHz	-1.38 dBm		
D1	M1	1	15.885 MHz	0.76 dB		
M2		1	2.413259 GHz	5.32 dBm		

Date: 11.JUN.2020 08:27:48

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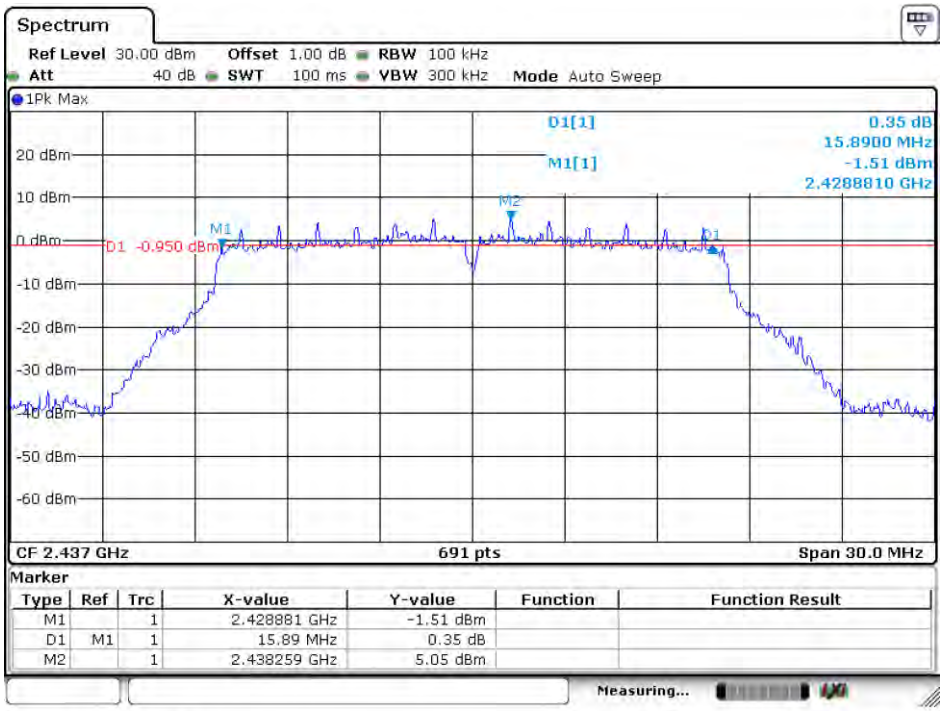
4.5.2.2.2 802.11G_ Middle Channel

Date: 11.JUN.2020 08:37:12



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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428881 GHz	-1.51 dBm		
D1	M1	1	15.89 MHz	0.35 dB		
M2		1	2.438259 GHz	5.05 dBm		

Date: 11.JUN.2020 08:28:57

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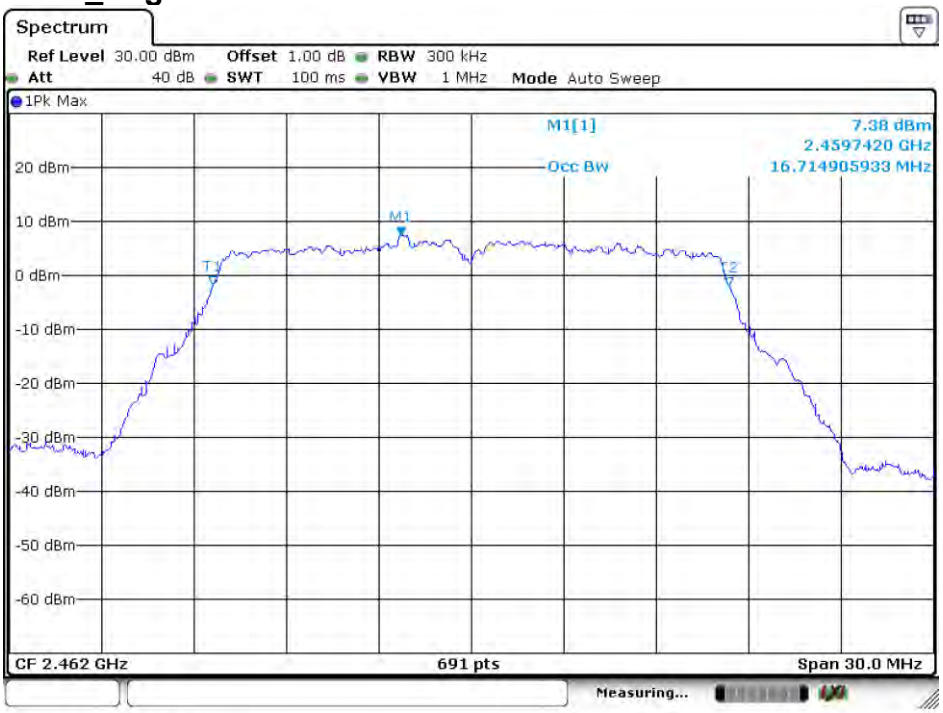
4.5.2.2.3 802.11G_ Highest Channel



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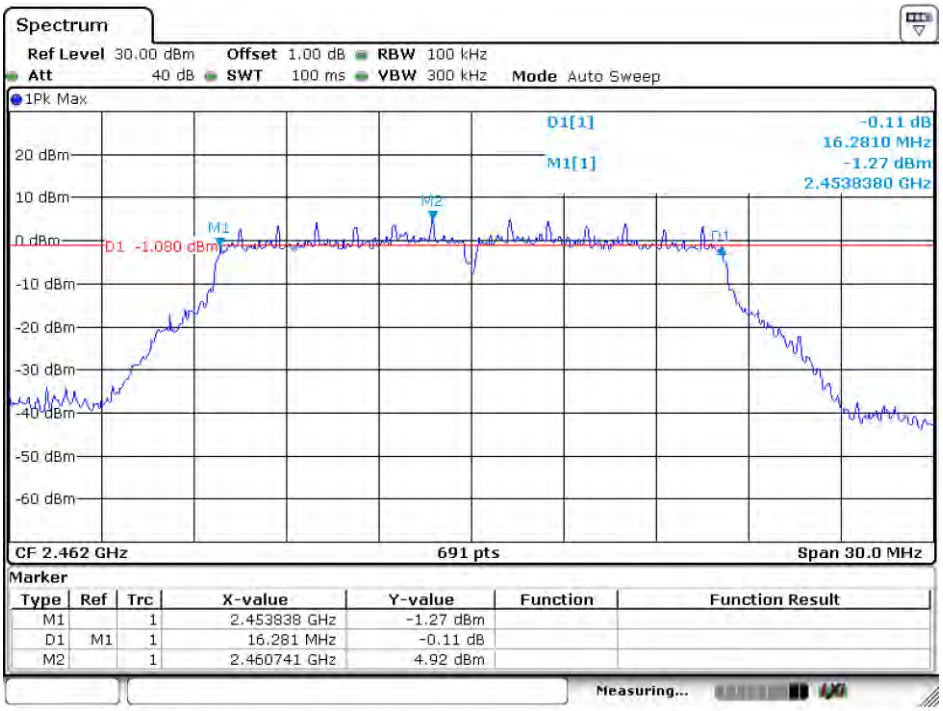

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453838 GHz	-1.27 dBm		
D1	M1	1	16.281 MHz	-0.11 dB		
M2		1	2.460741 GHz	4.92 dBm		

Date: 11.JUN.2020 08:30:10

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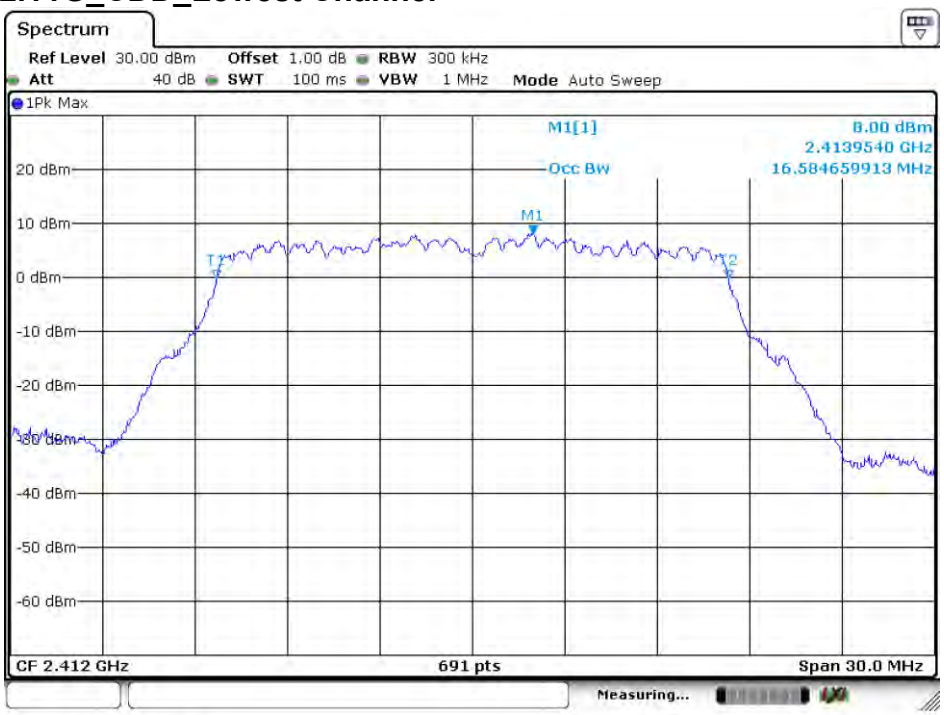
4.5.2.2.4 802.11G_CDD_Lowest Channel



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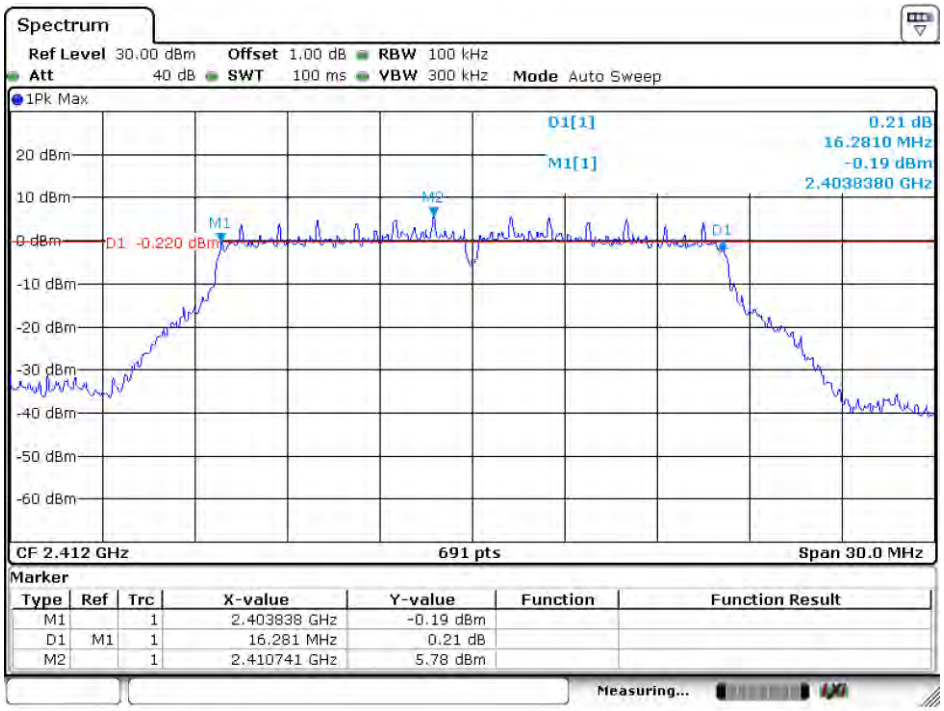

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403838 GHz	-0.19 dBm		
D1	M1	1	16.281 MHz	0.21 dB		
M2		1	2.410741 GHz	5.78 dBm		

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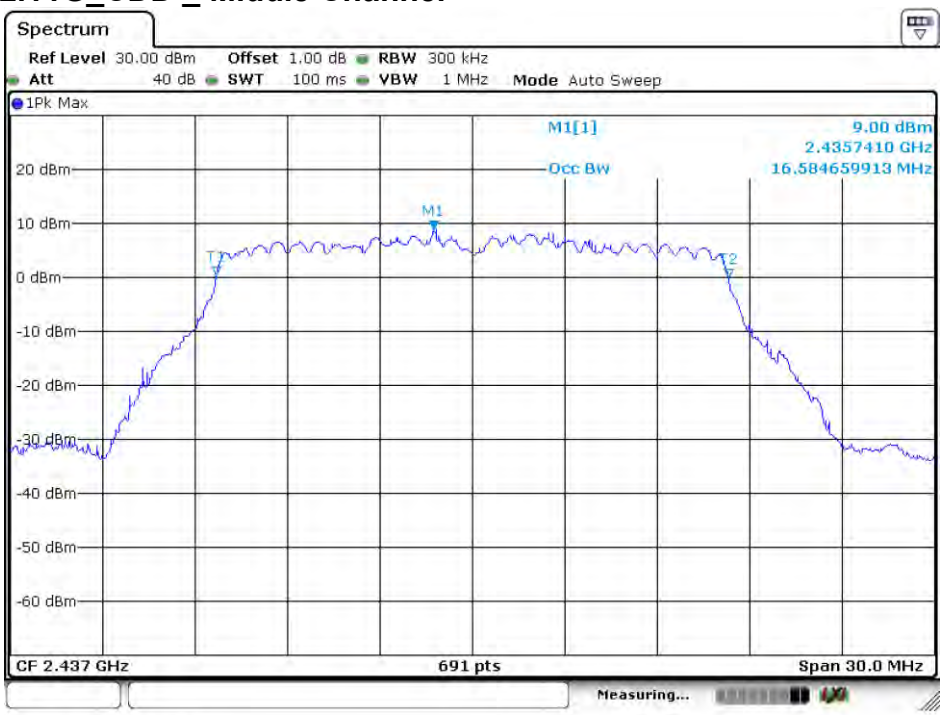
4.5.2.2.5 802.11G_CDD _ Middle Channel



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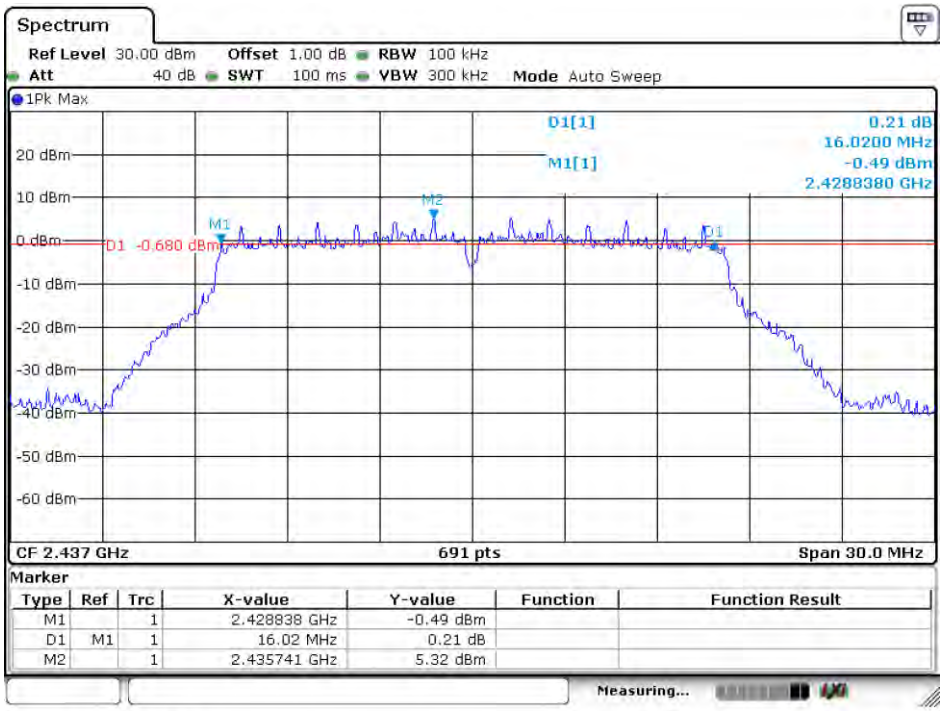

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428838 GHz	-0.49 dBm		
D1	M1	1	16.02 MHz	0.21 dB		
M2		1	2.435741 GHz	5.32 dBm		

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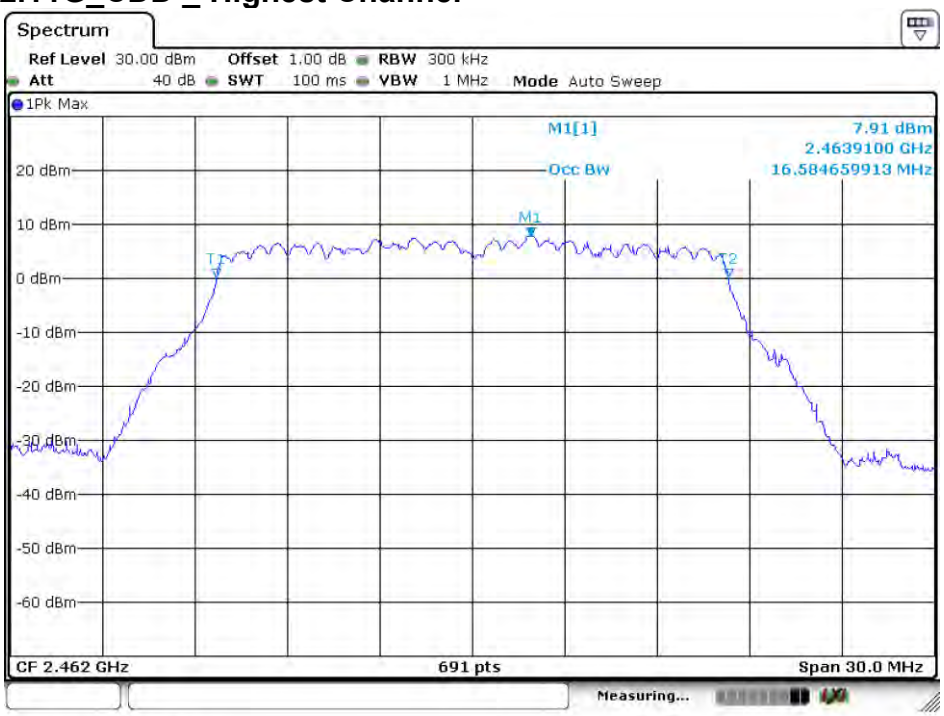
4.5.2.2.6 802.11G_CDD _ Highest Channel



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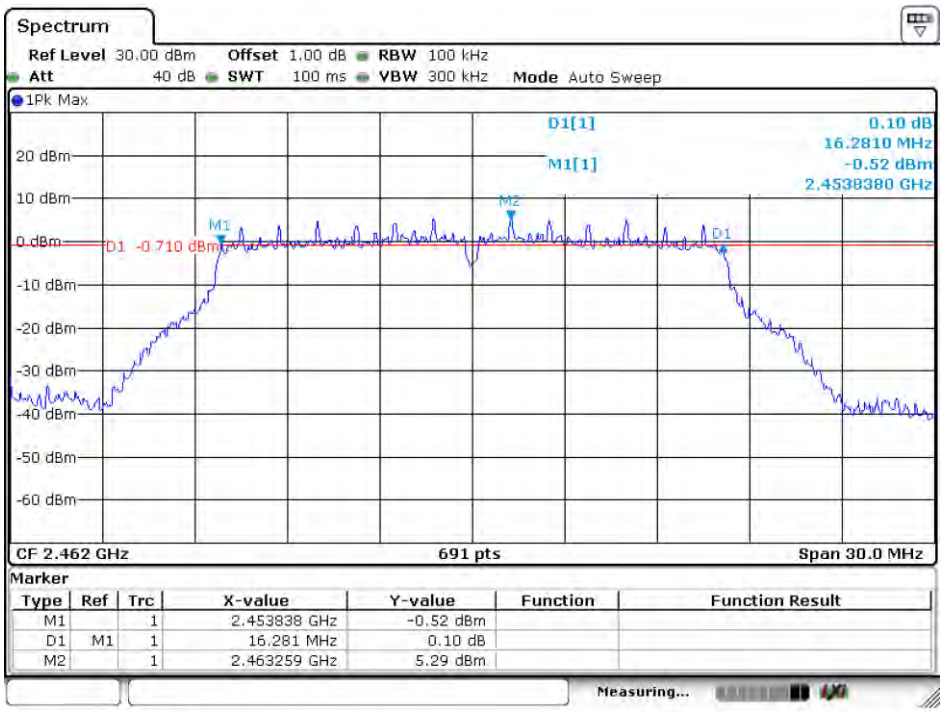

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453838 GHz	-0.52 dBm		
D1	M1	1	16.281 MHz	0.10 dB		
M2		1	2.463259 GHz	5.29 dBm		

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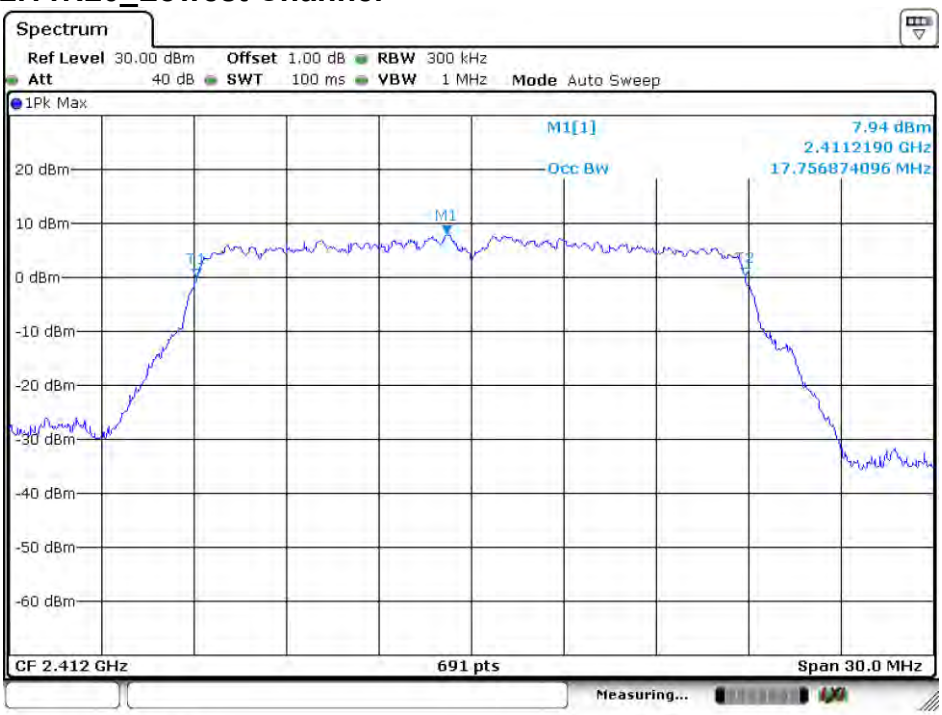
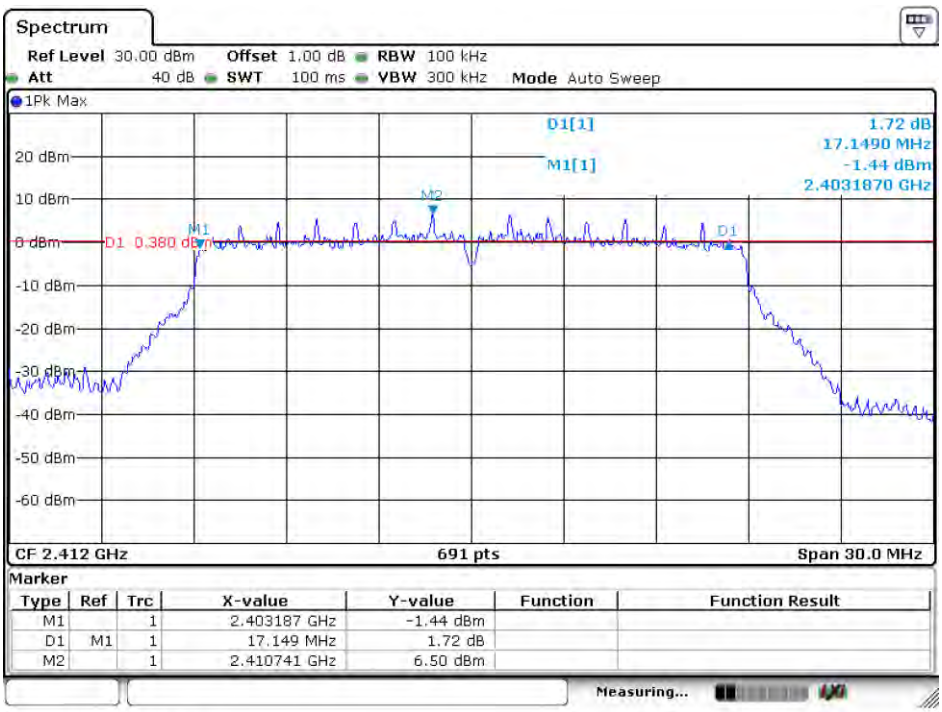
4.5.2.2.7 802.11N20_Lowest Channel



Date: 11.JUN.2020 08:35:27



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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403187 GHz	-1.44 dBm		
D1	M1	1	17.149 MHz	1.72 dB		
M2		1	2.410741 GHz	6.50 dBm		

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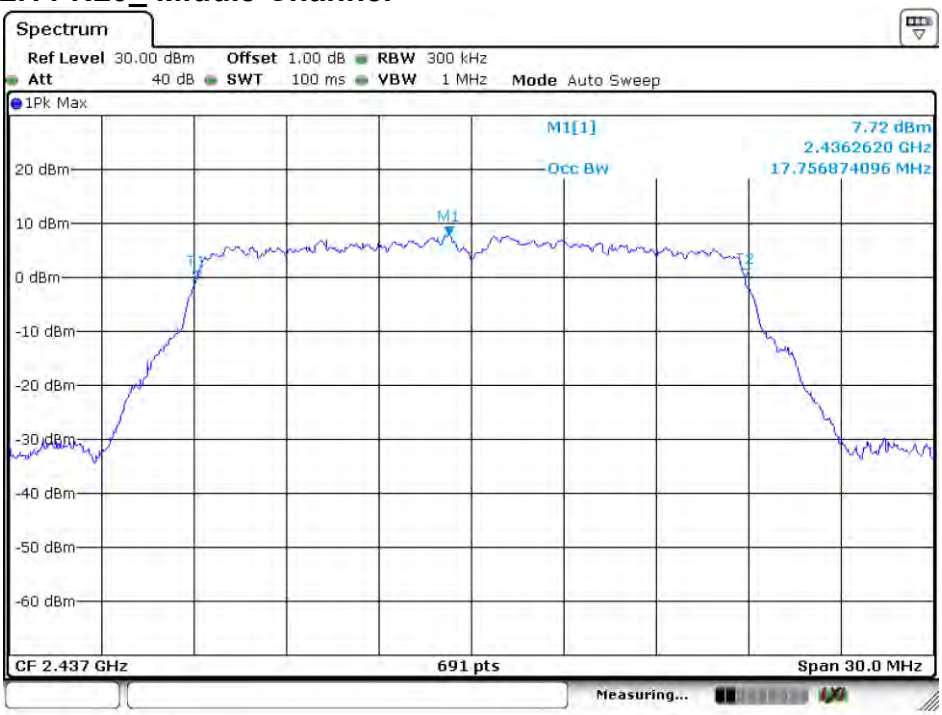
4.5.2.2.8 802.11 N20_ Middle Channel



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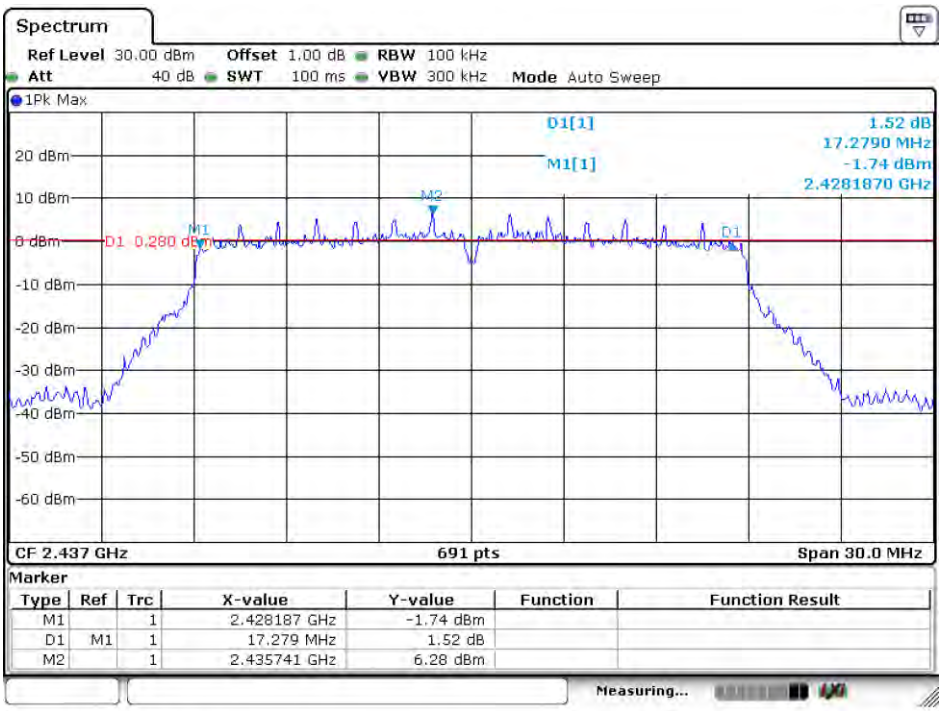

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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428187 GHz	-1.74 dBm		
D1	M1	1	17.279 MHz	1.52 dB		
M2		1	2.435741 GHz	6.28 dBm		

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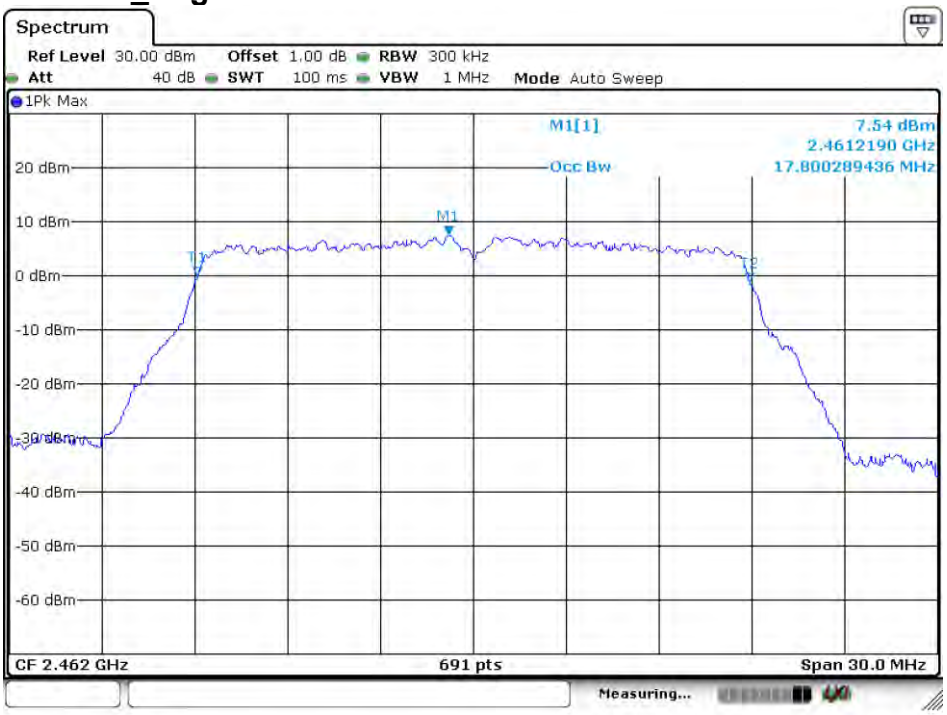
4.5.2.2.9 802.11 N20_ Highest Channel



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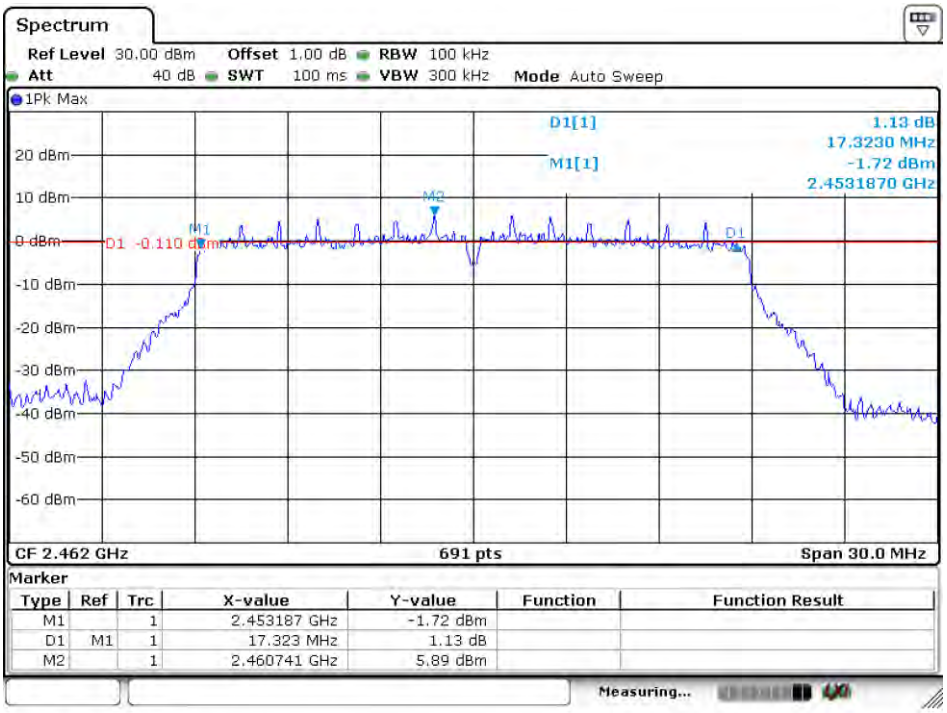

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453187 GHz	-1.72 dBm		
D1	M1	1	17.323 MHz	1.13 dB		
M2		1	2.460741 GHz	5.89 dBm		

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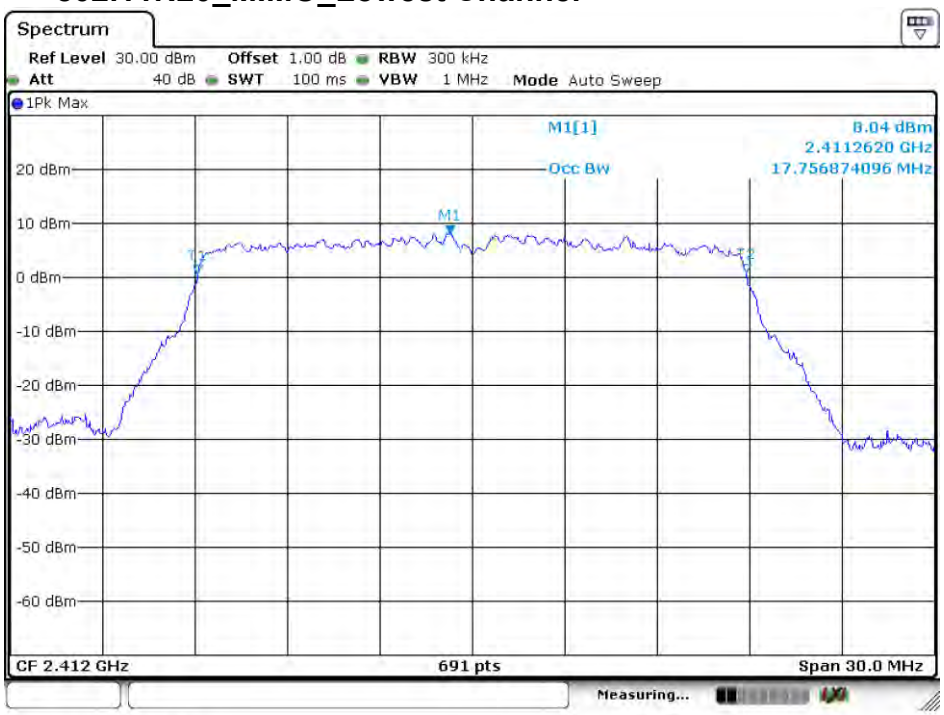
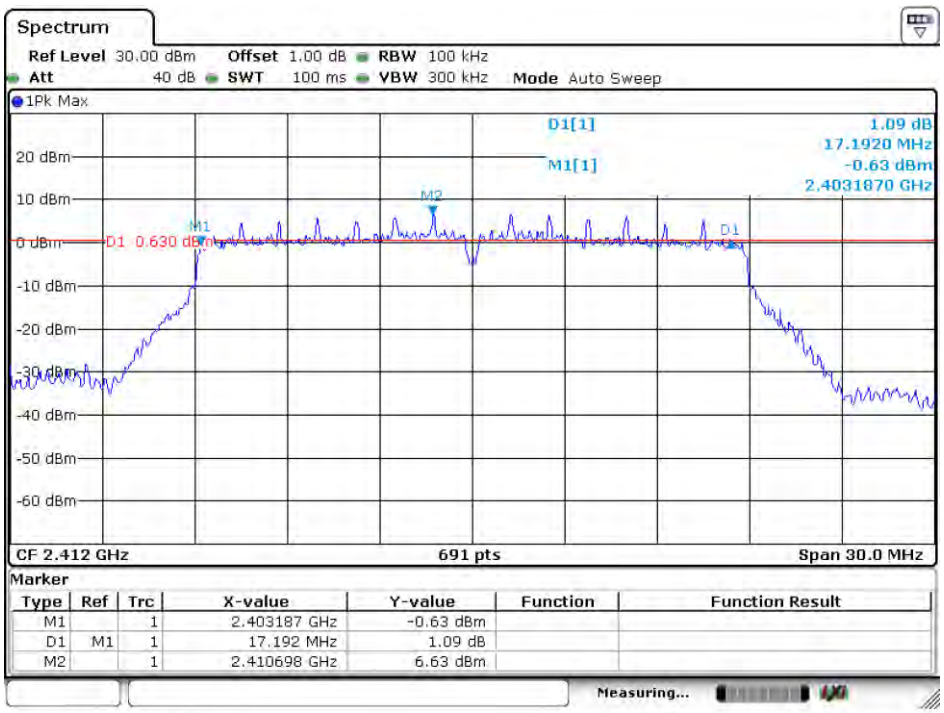
4.5.2.2.10 802.11N20_MIMO_Lowest Channel



Date: 11.JUN.2020 06:55:55



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.403187 GHz	-0.63 dBm		
D1	M1	1	17.192 MHz	1.09 dB		
M2		1	2.410698 GHz	6.63 dBm		

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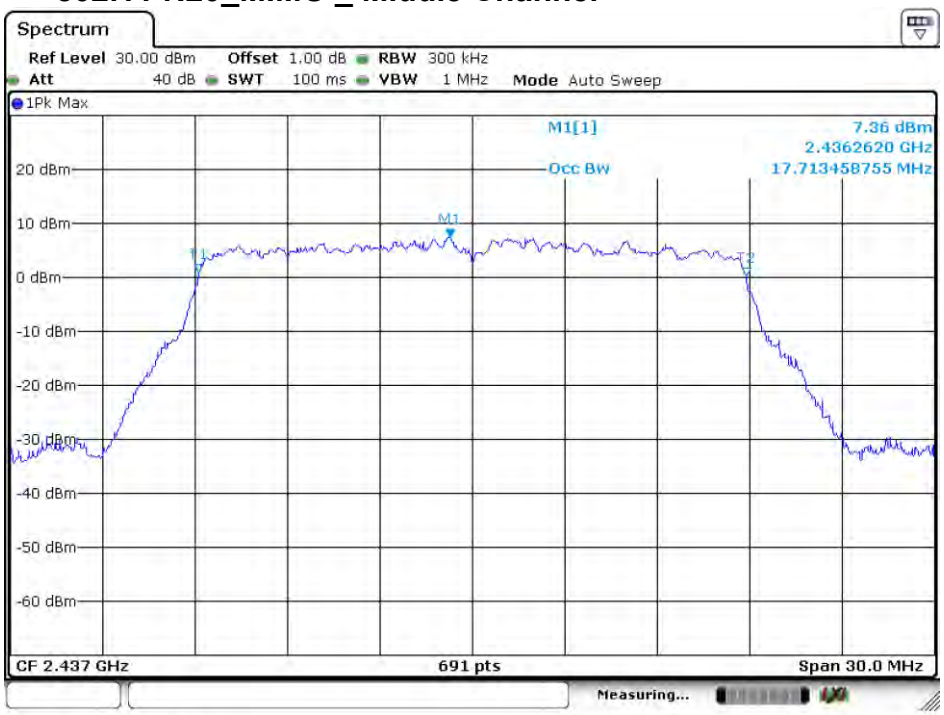
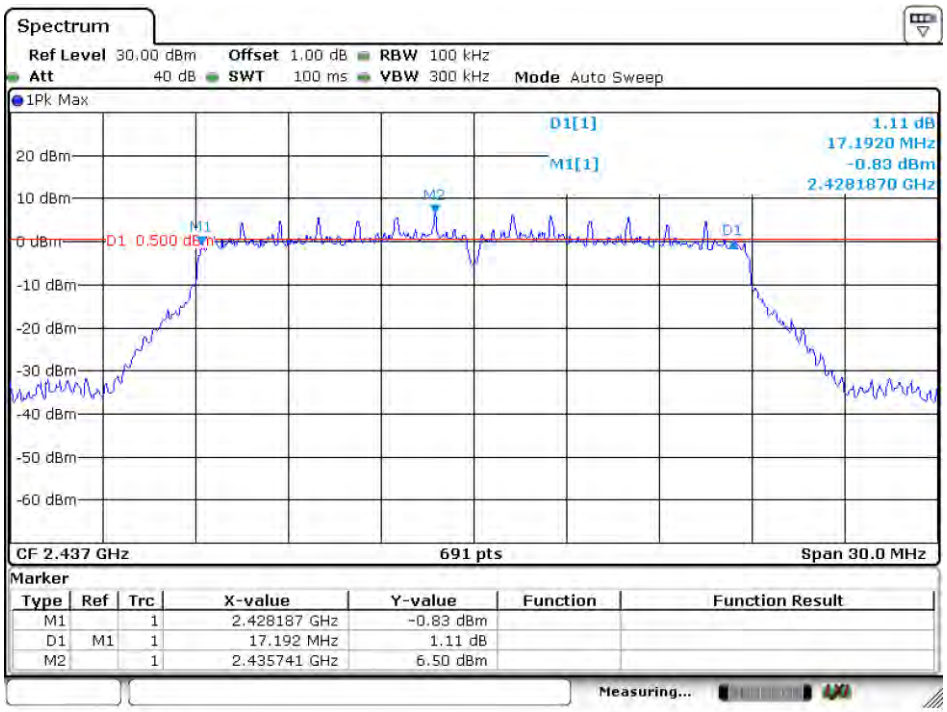
4.5.2.2.11 802.11 N20_MIMO _ Middle Channel



Date: 11.JUN.2020 06:56:18



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.428187 GHz	-0.83 dBm		
D1	M1	1	17.192 MHz	1.11 dB		
M2		1	2.435741 GHz	6.50 dBm		

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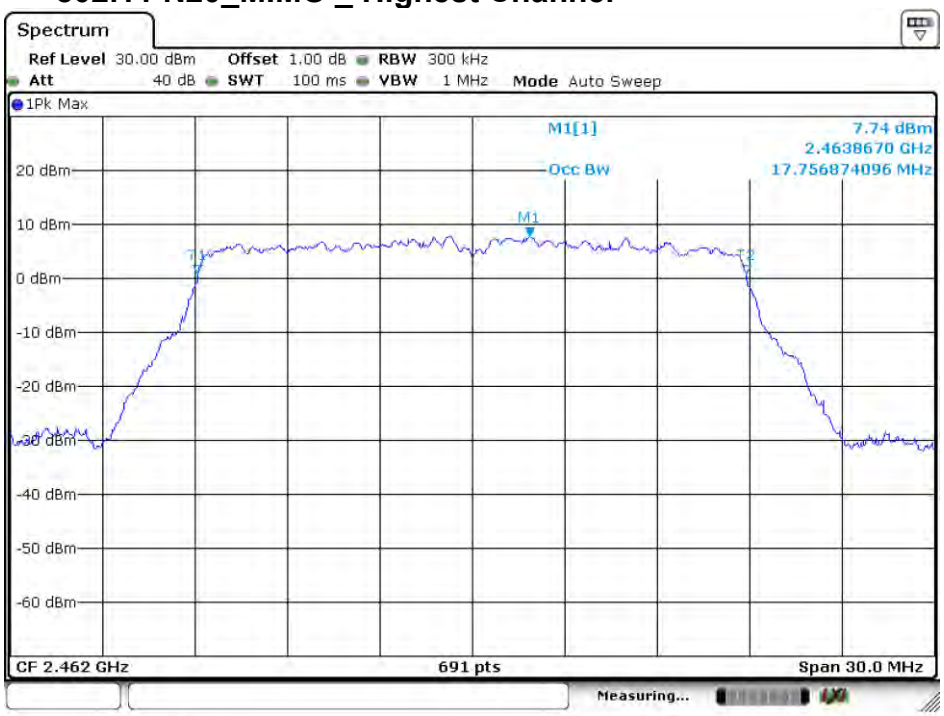
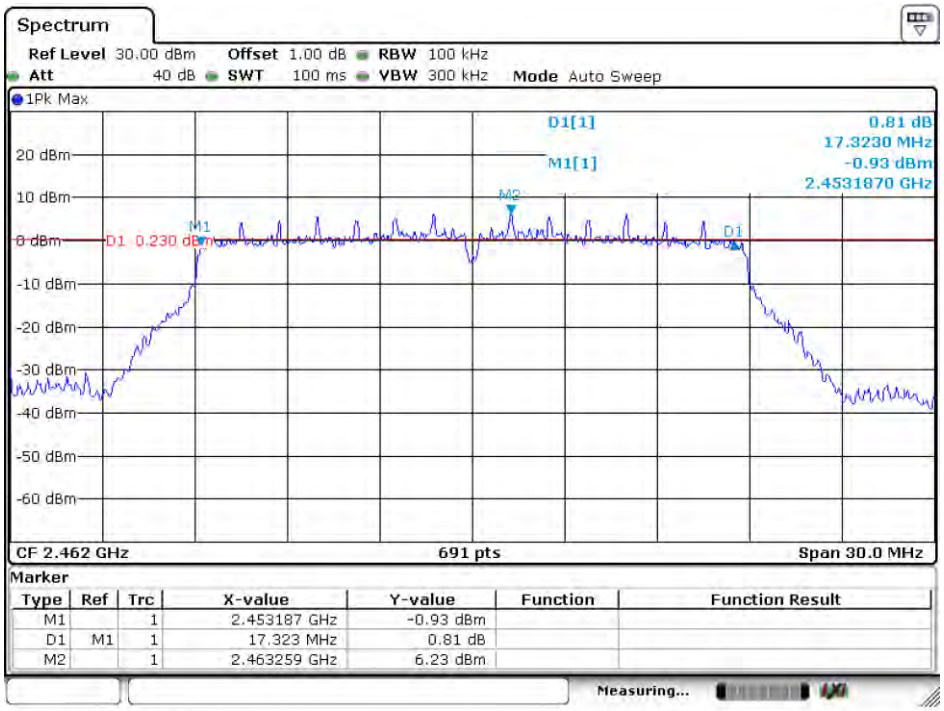
4.5.2.2.12 802.11 N20_MIMO _ Highest Channel



Date: 11.JUN.2020 06:56:58



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.453187 GHz	-0.93 dBm		
D1	M1	1	17.323 MHz	0.81 dB		
M2		1	2.463259 GHz	6.23 dBm		

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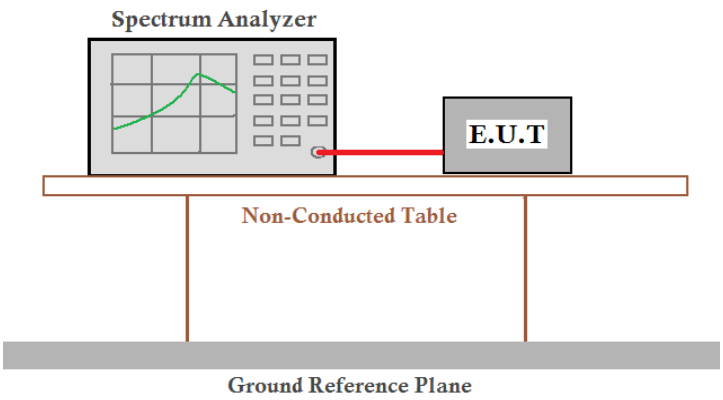
4.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2
Test Setup:	
Test Instruments:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	≤8.00dBm/3kHz
Test Results:	Pass

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4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)		Limit (dBm/3kHz)	Result
		ANT1	ANT2		
802.11B	Lowest	-4.00	--	≤8.00	Pass
	Middle	-3.76	--	≤8.00	Pass
	Highest	-3.03	--	≤8.00	Pass
802.11G	Lowest	-9.10	-9.21	≤8.00	Pass
	Middle	-8.60	-10.28	≤8.00	Pass
	Highest	-9.65	-10.25	≤8.00	Pass
802.11G_CDD	Lowest	-8.10	-9.49	≤8.00	Pass
	Middle	-8.31	-9.98	≤8.00	Pass
	Highest	-8.50	-9.68	≤8.00	Pass
802.11N20	Lowest	-9.71	-8.29	≤8.00	Pass
	Middle	-9.94	-8.48	≤8.00	Pass
	Highest	-9.67	-9.15	≤8.00	Pass
802.11N20_MIMO	Lowest	-7.54	-8.12	≤8.00	Pass
	Middle	-7.86	-8.68	≤8.00	Pass
	Highest	-7.67	-8.55	≤8.00	Pass

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4.6.2 Test plots

4.6.2.1 ANT1

4.6.2.1.1 802.11B_Lowest Channel

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4.6.2.1.2 802.11B_ Middle Channel

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4.6.2.1.3 802.11B_ Highest Channel

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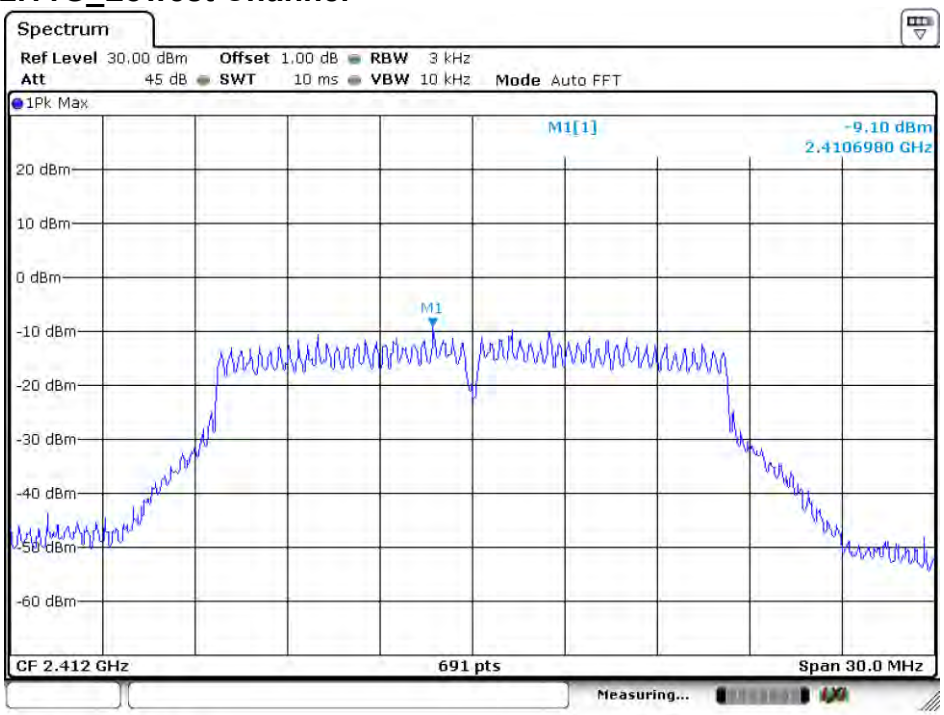
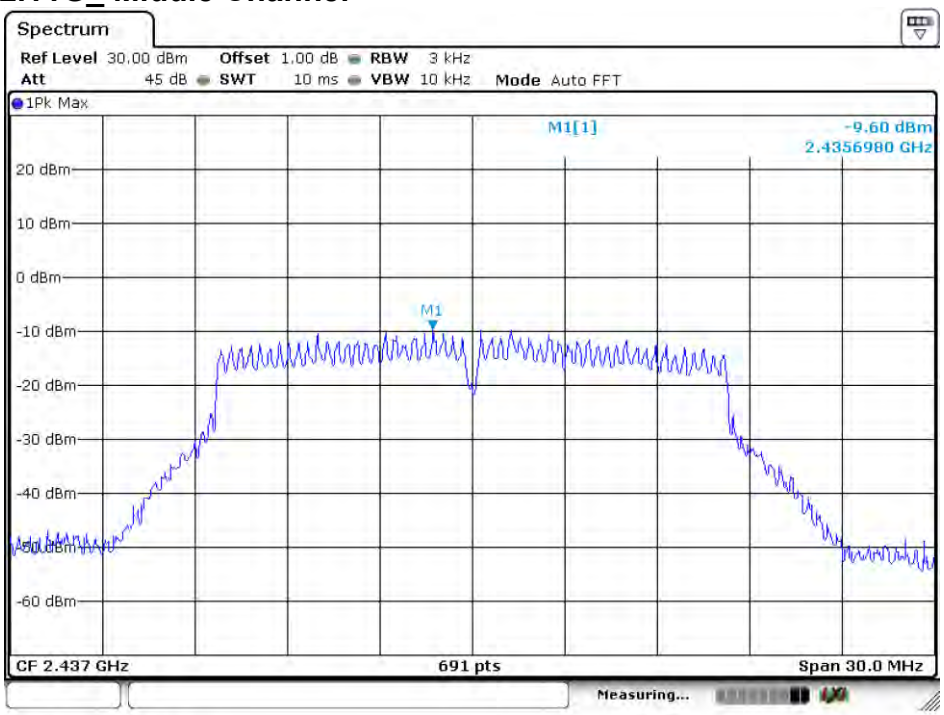
4.6.2.1.4 802.11G_Lowest Channel



Date: 5.JUN.2020 07:55:53

4.6.2.1.5 802.11G_ Middle Channel



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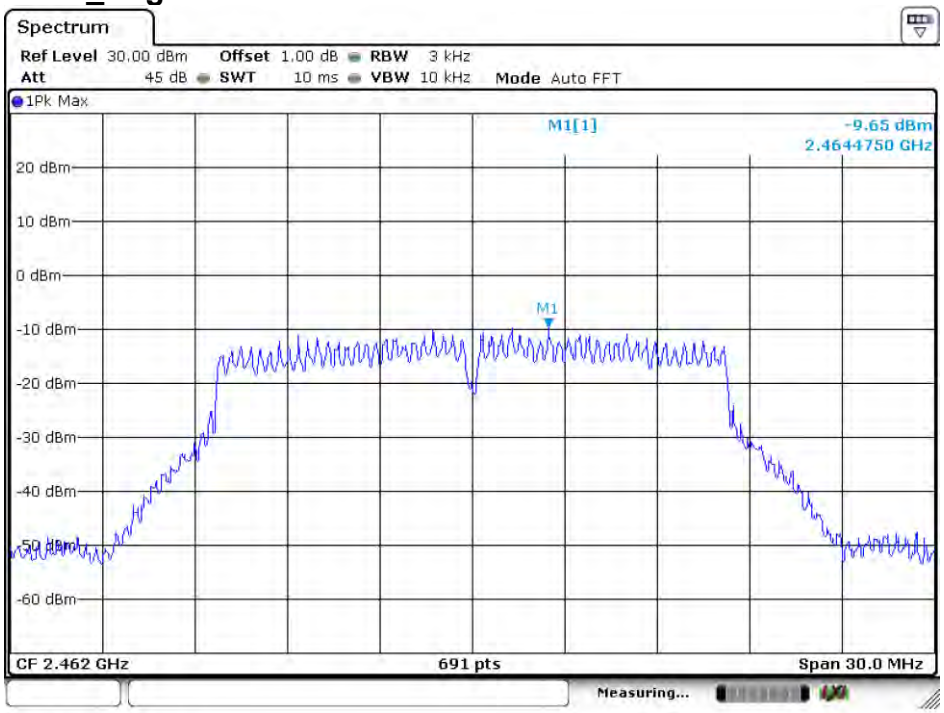
4.6.2.1.6 802.11G_ Highest Channel



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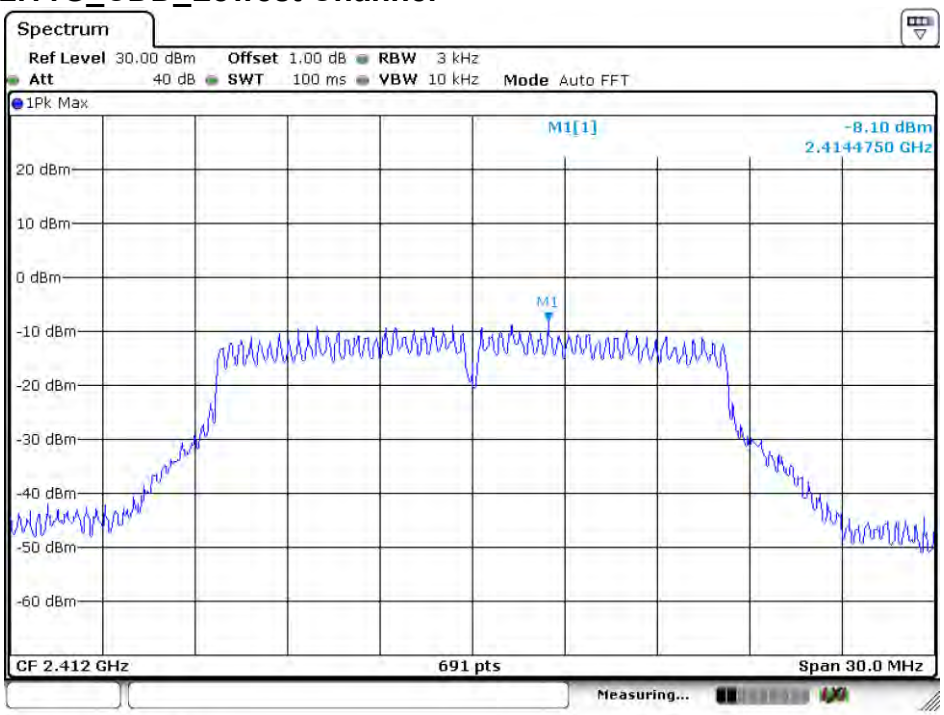
4.6.2.1.7 802.11G_CDD_Lowest Channel



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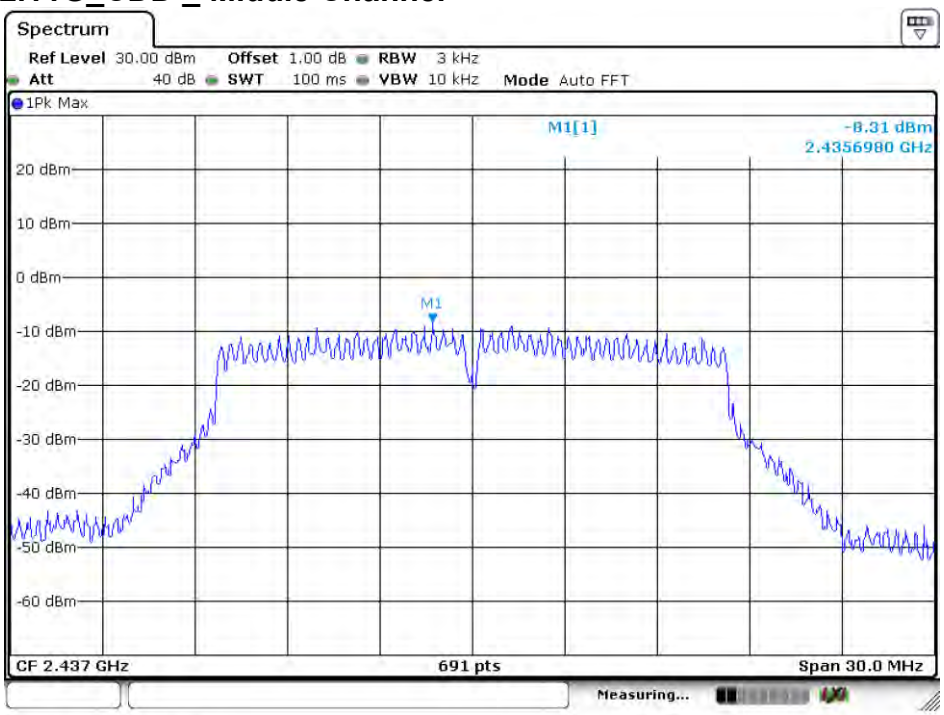
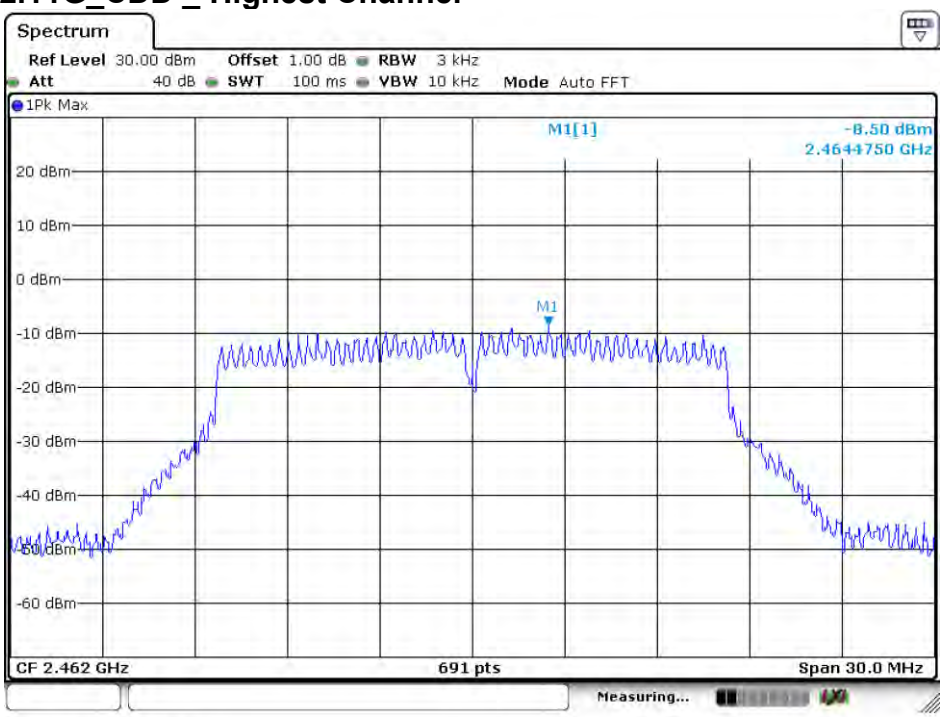
4.6.2.1.8 802.11G_CDD _ Middle Channel



Date: 11.JUN.2020 09:36:47

4.6.2.1.9 802.11G_CDD _ Highest Channel



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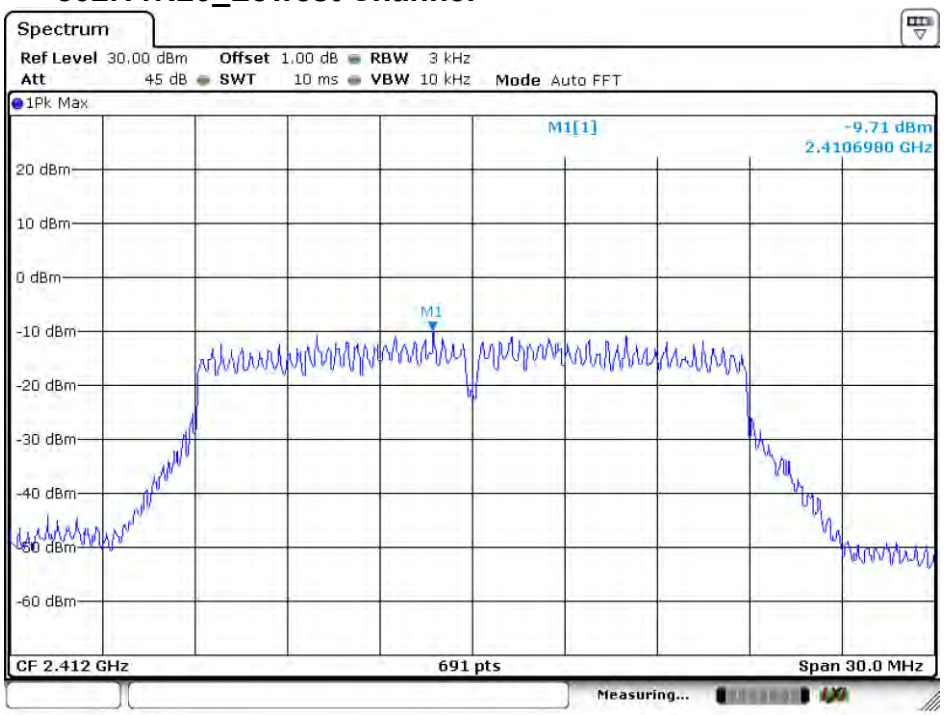
4.6.2.1.10 802.11N20_Lowest Channel



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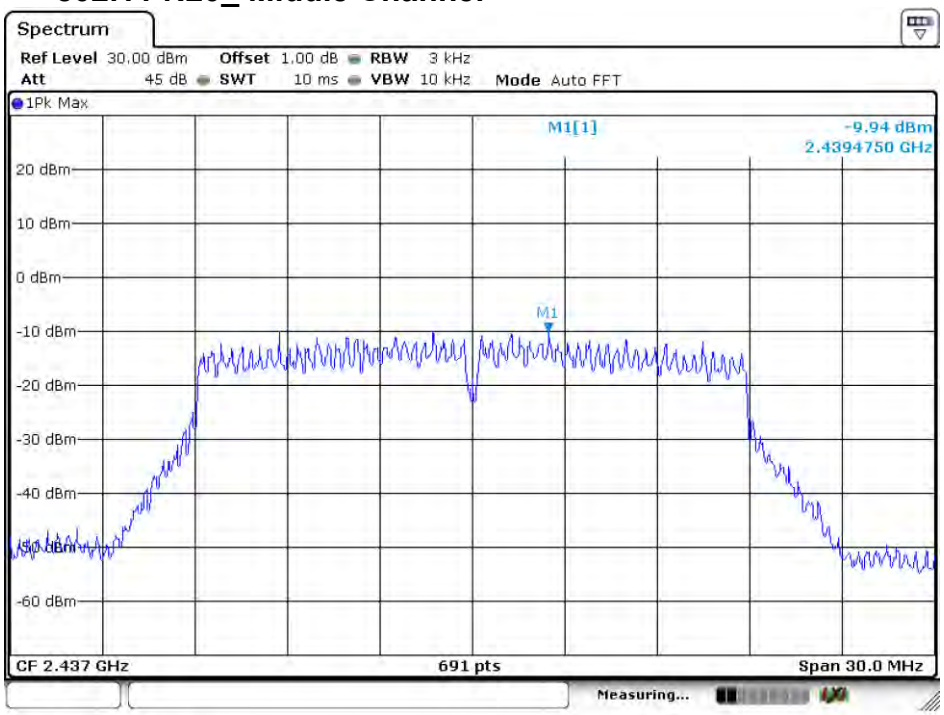
4.6.2.1.11 802.11 N20_ Middle Channel



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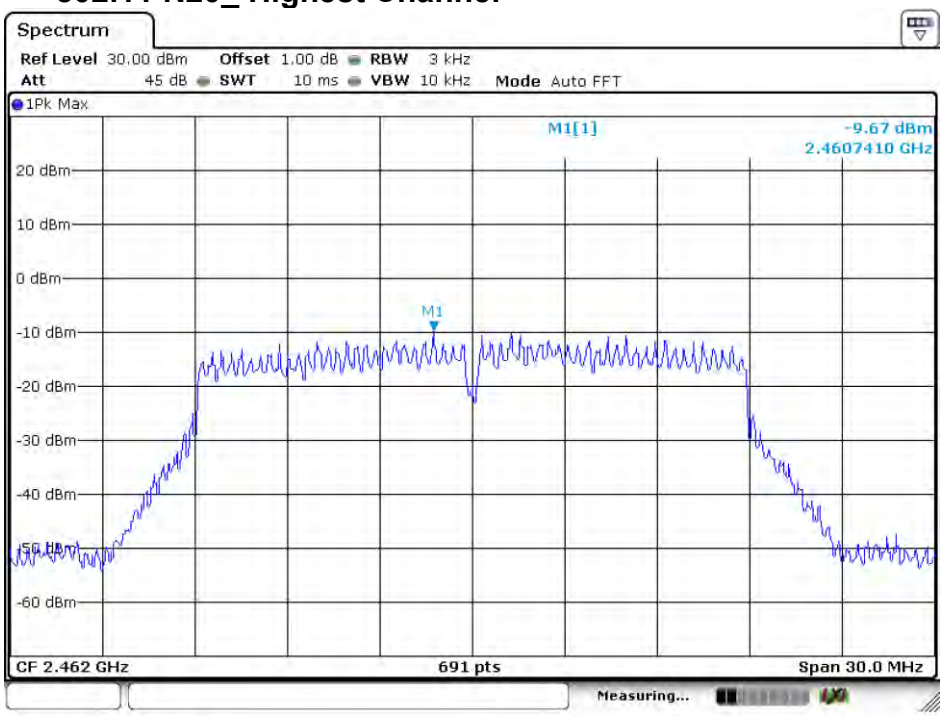
4.6.2.1.12 802.11 N20_ Highest Channel



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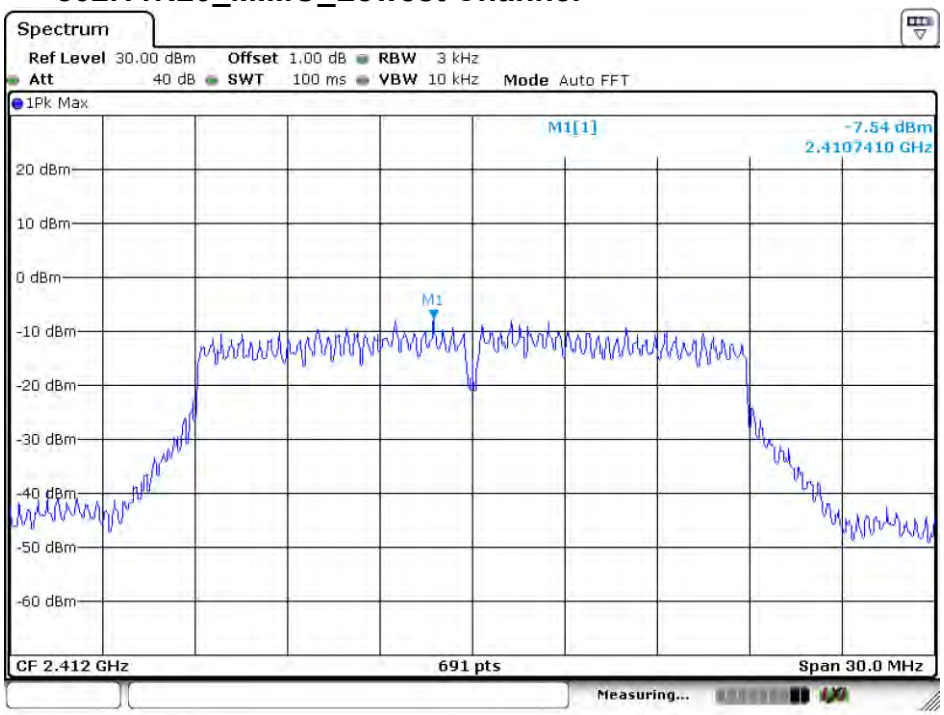
4.6.2.1.13 802.11N20_MIMO_Lowest Channel



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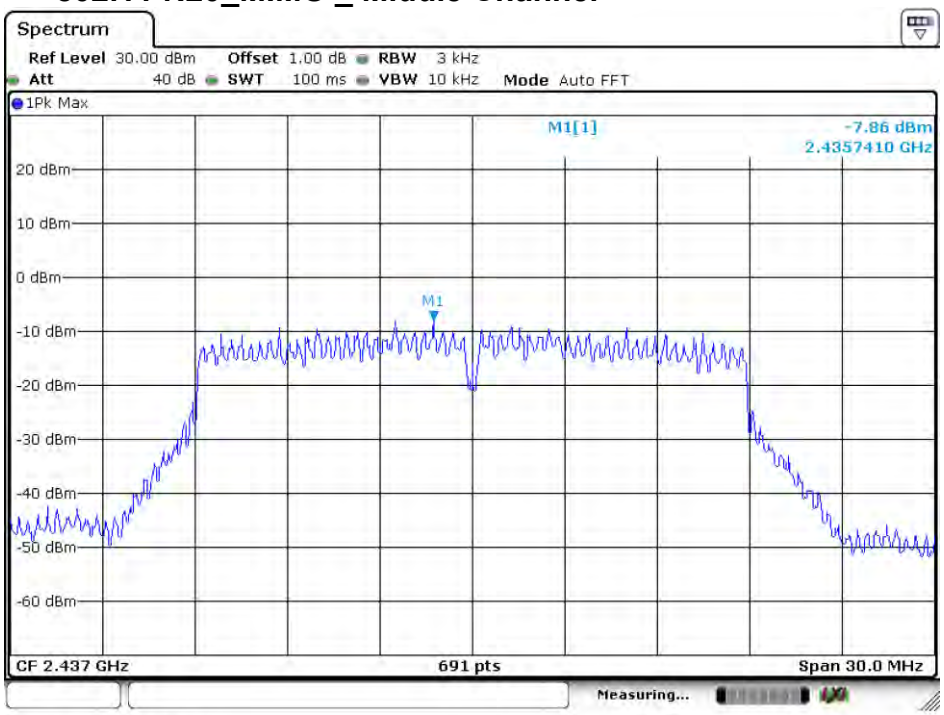
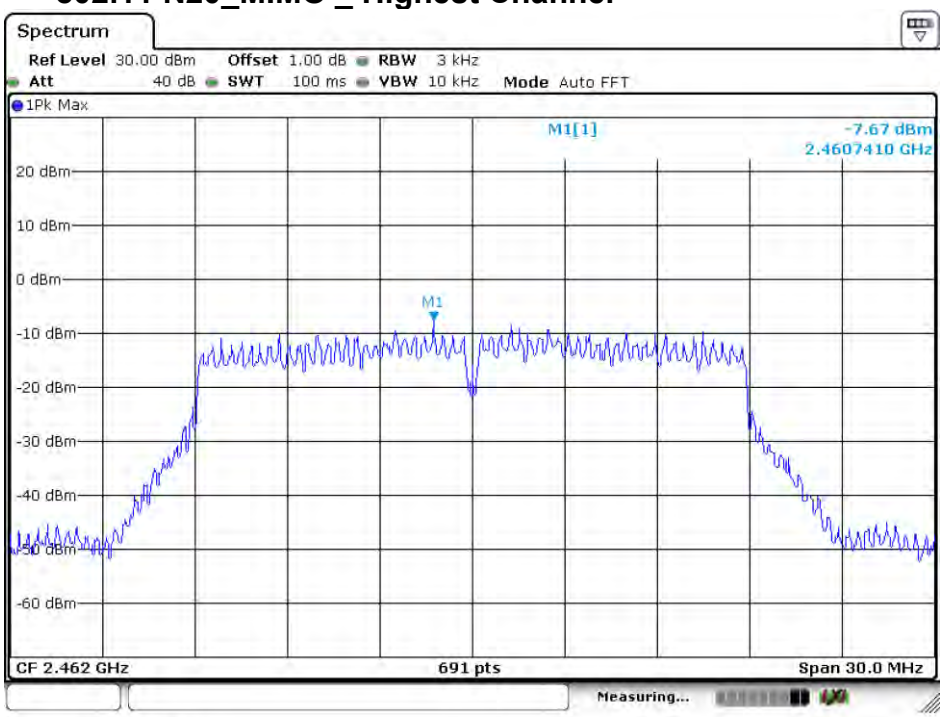
4.6.2.1.14 802.11 N20_MIMO _ Middle Channel



Date: 11.JUN.2020 09:35:45

4.6.2.1.15 802.11 N20_MIMO _ Highest Channel



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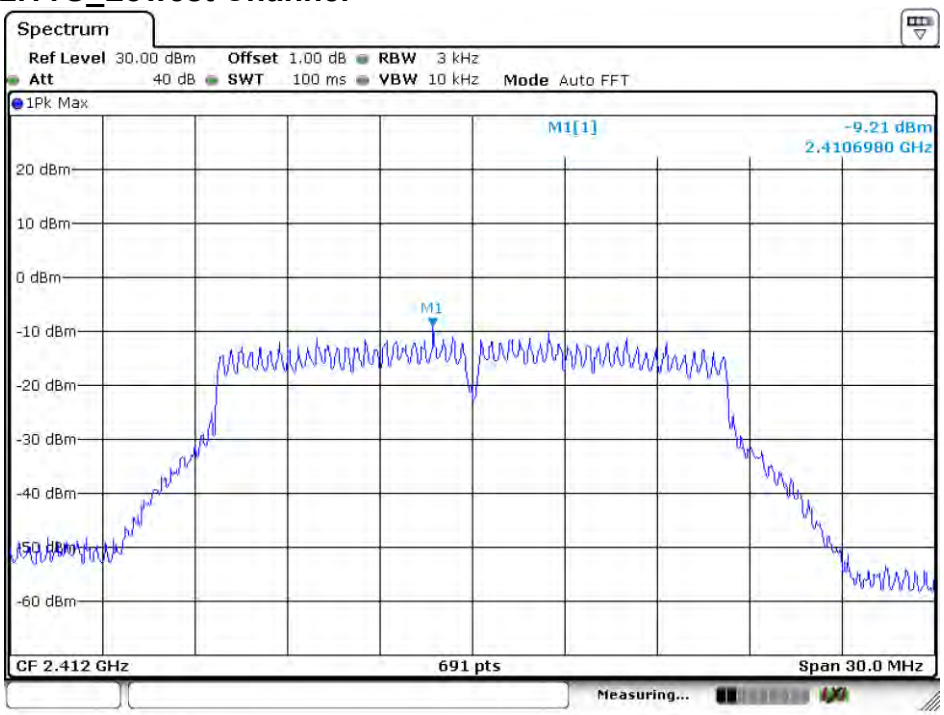
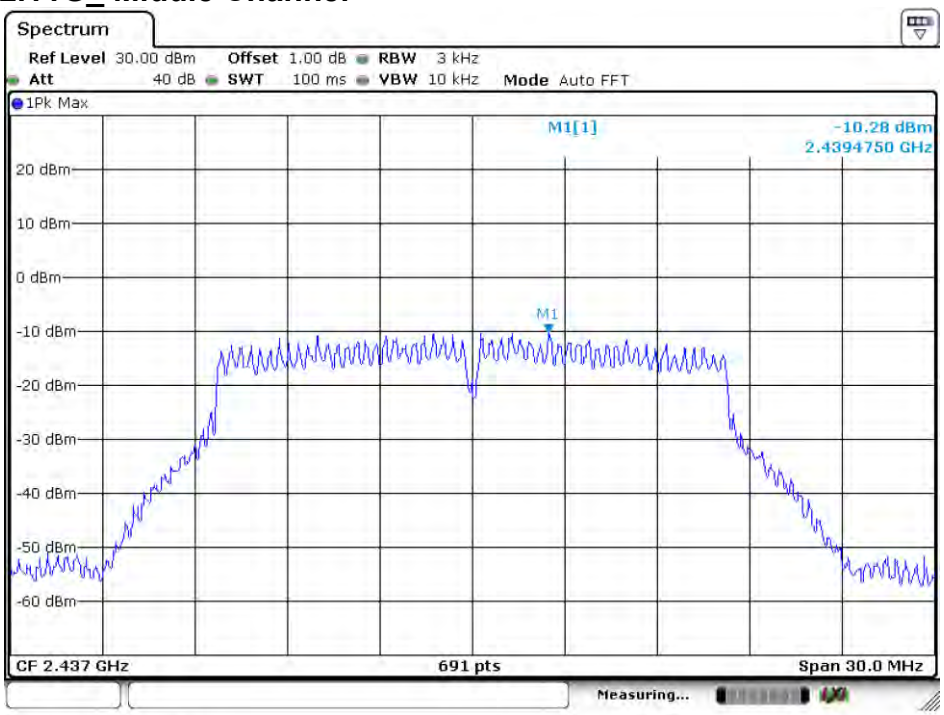
4.6.2.2 ANT2

4.6.2.2.1 802.11G_Lowest Channel



Date: 11.JUN.2020 08:48:02

4.6.2.2.2 802.11G_ Middle Channel



Date: 11.JUN.2020 08:47:48

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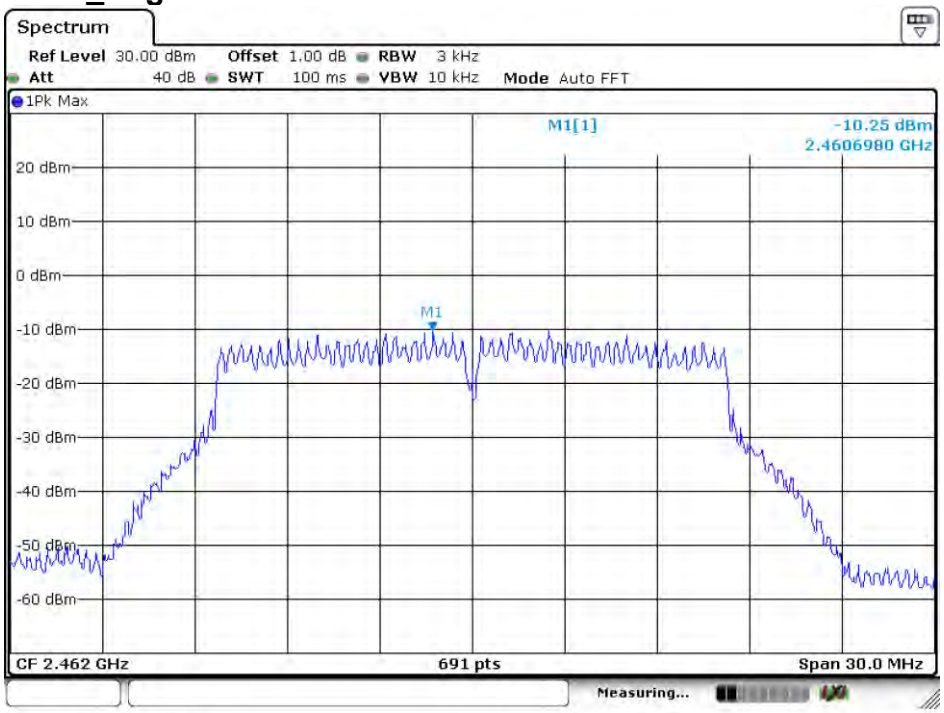
4.6.2.2.3 802.11G_ Highest Channel



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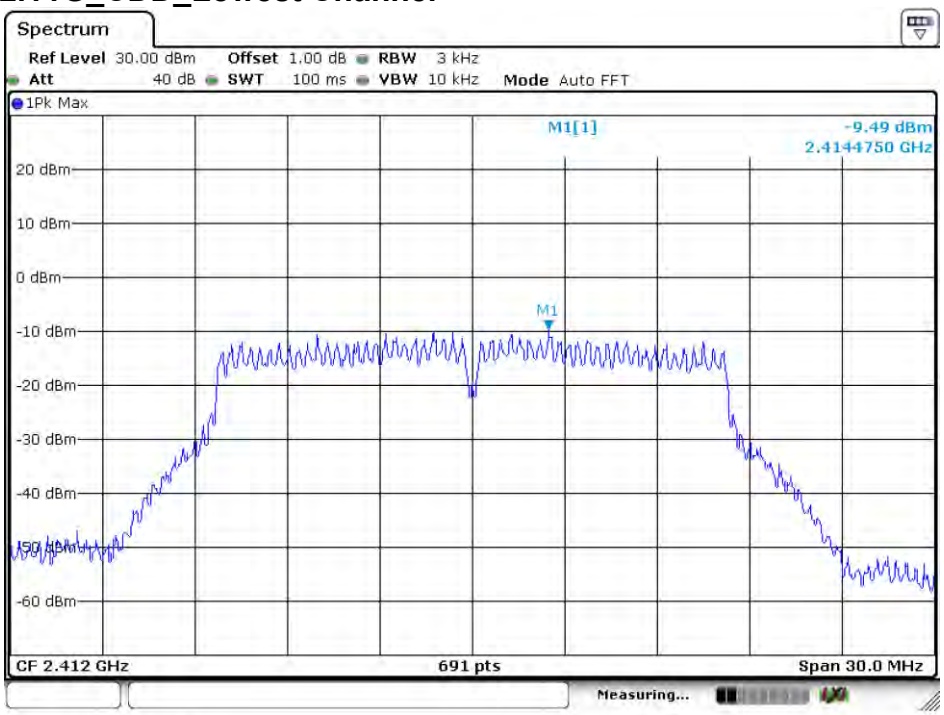
4.6.2.2.4 802.11G_CDD_Lowest Channel



Date: 11.JUN.2020 06:46:30

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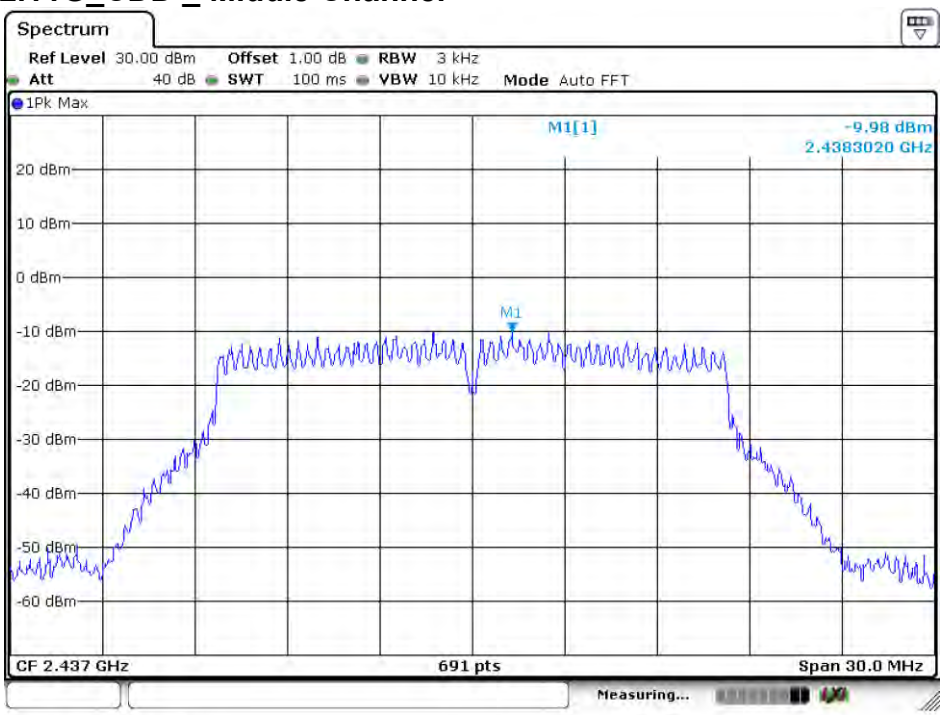
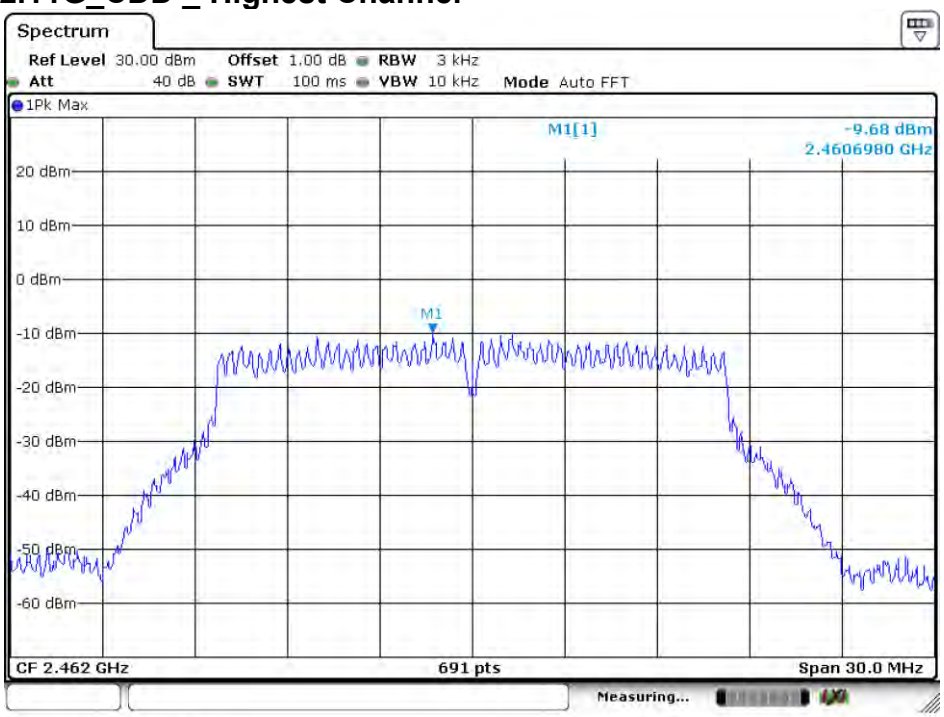
4.6.2.2.5 802.11G_CDD _ Middle Channel



Date: 11.JUN.2020 06:46:11

4.6.2.2.6 802.11G_CDD _ Highest Channel



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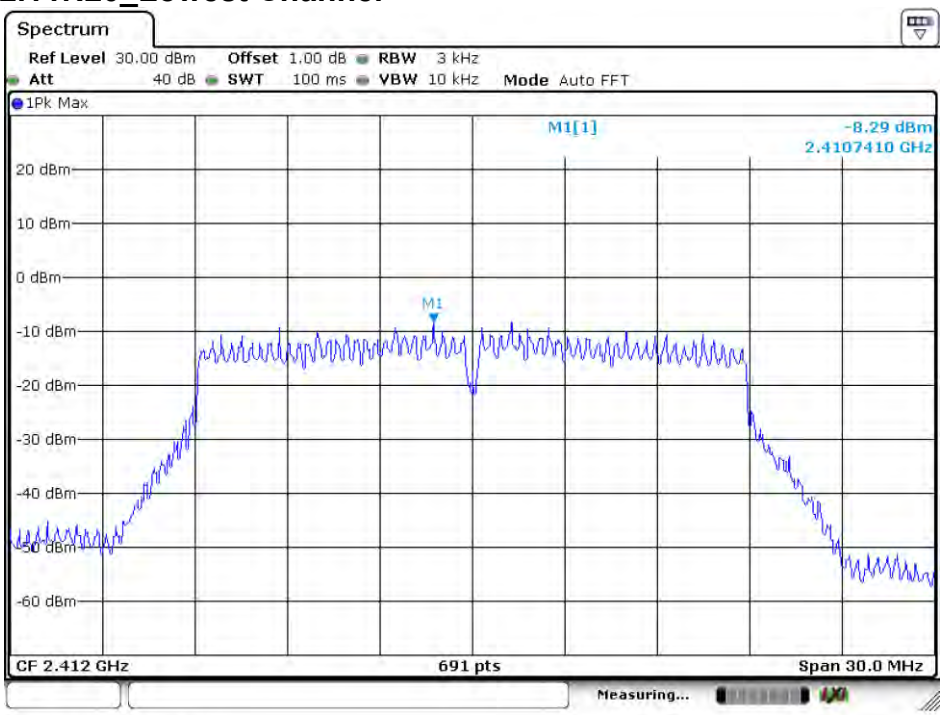
4.6.2.2.7 802.11N20_Lowest Channel



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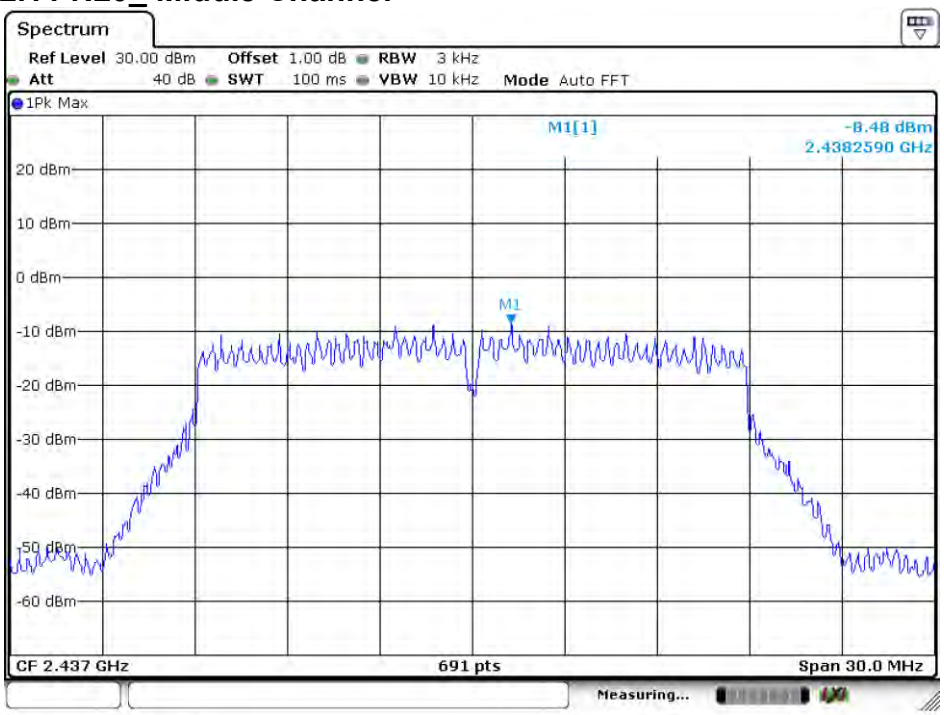
4.6.2.2.8 802.11 N20_ Middle Channel



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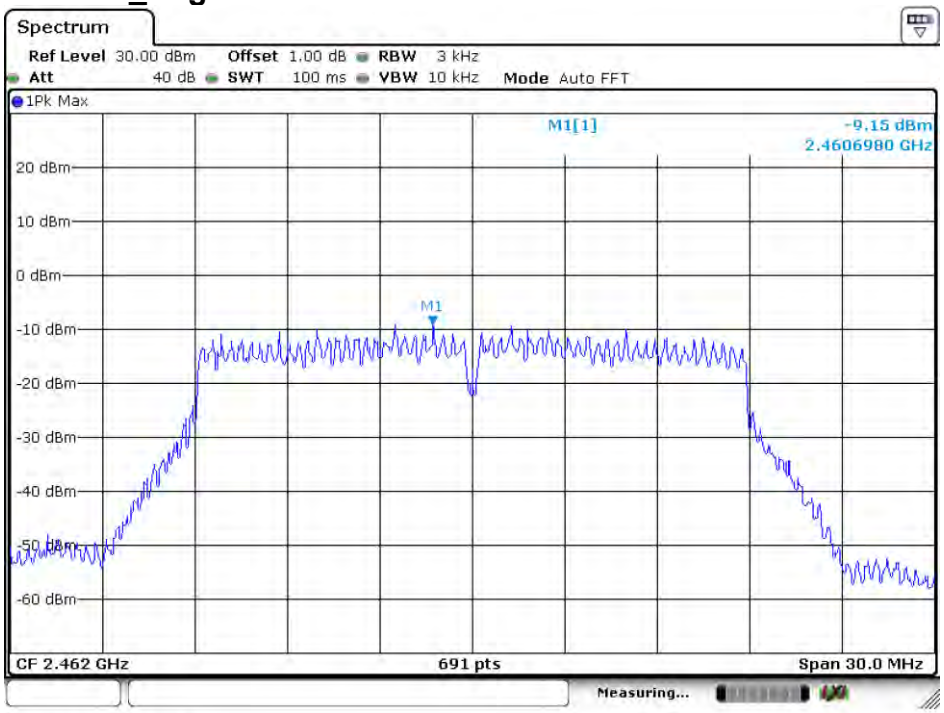
4.6.2.2.9 802.11 N20_ Highest Channel



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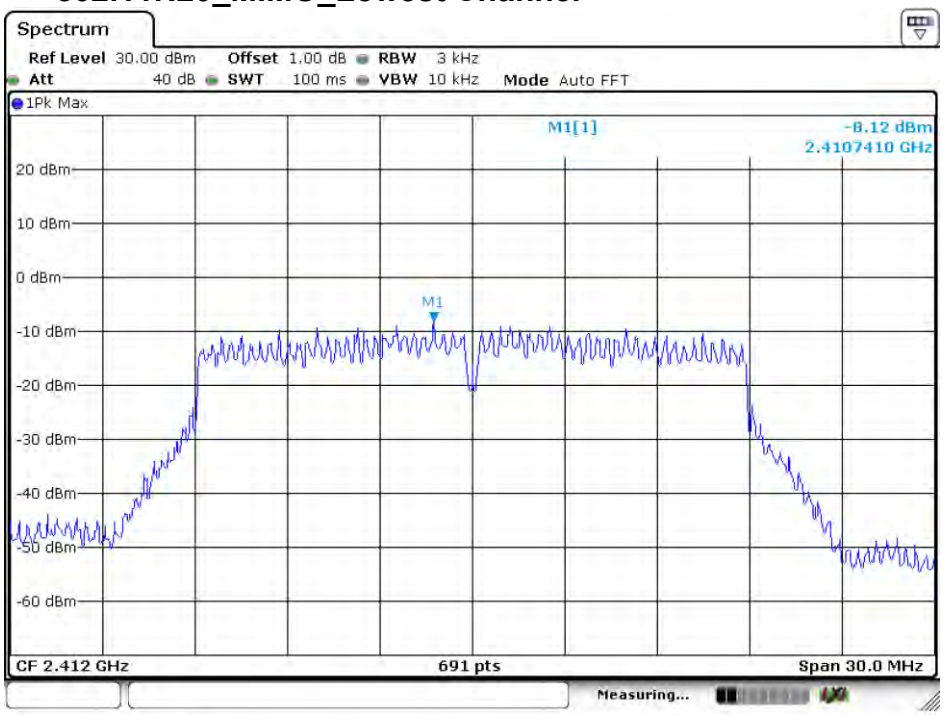
4.6.2.2.10 802.11N20_MIMO_Lowest Channel



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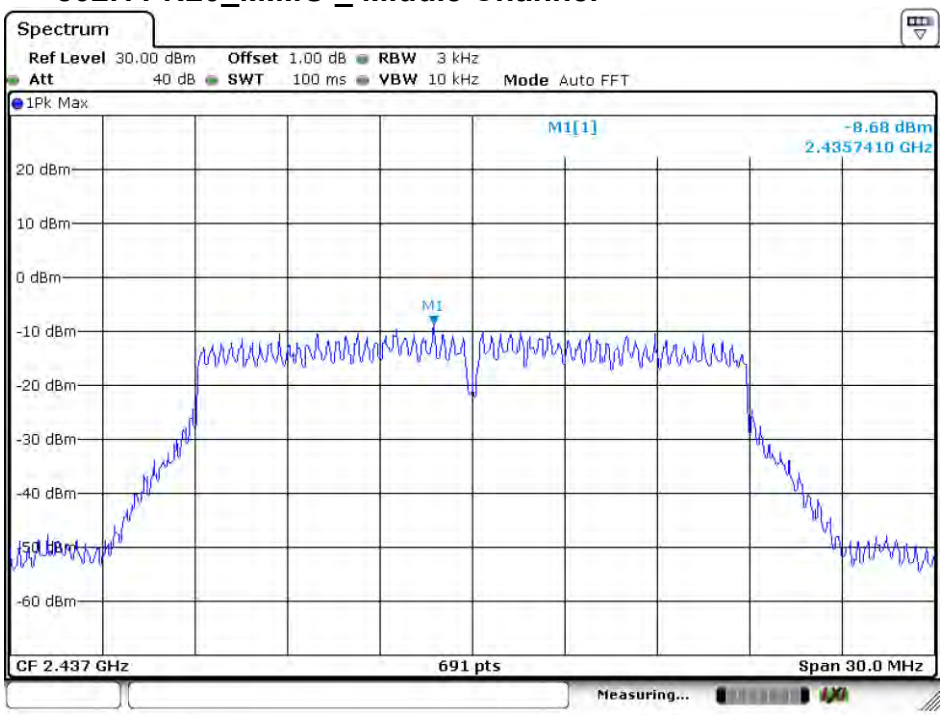
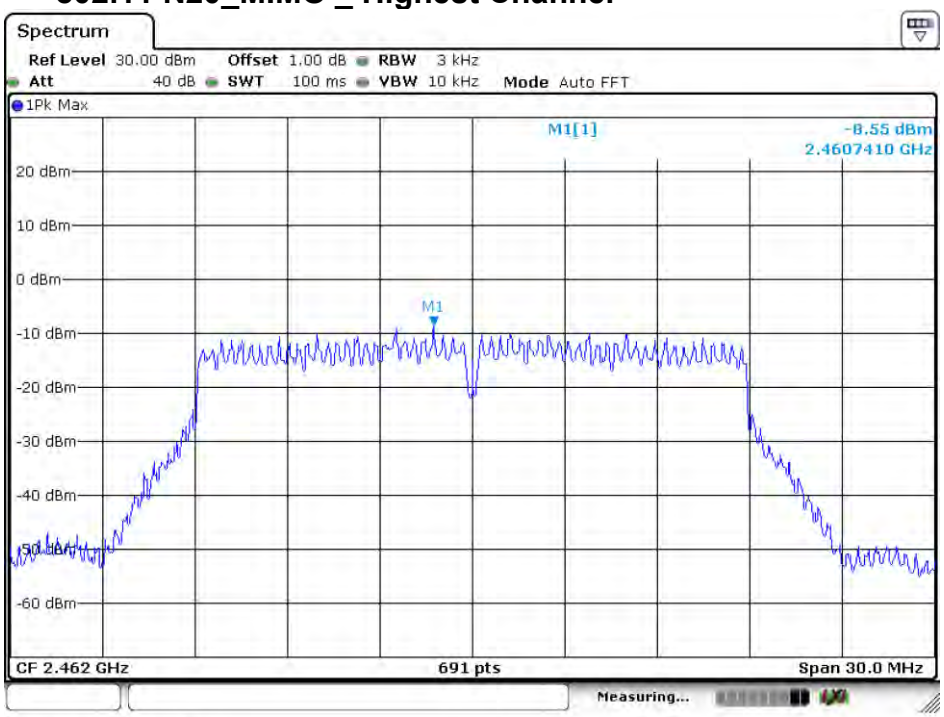
4.6.2.2.11 802.11 N20_MIMO _ Middle Channel



Date: 11.JUN.2020 06:43:30

4.6.2.2.12 802.11 N20_MIMO _ Highest Channel



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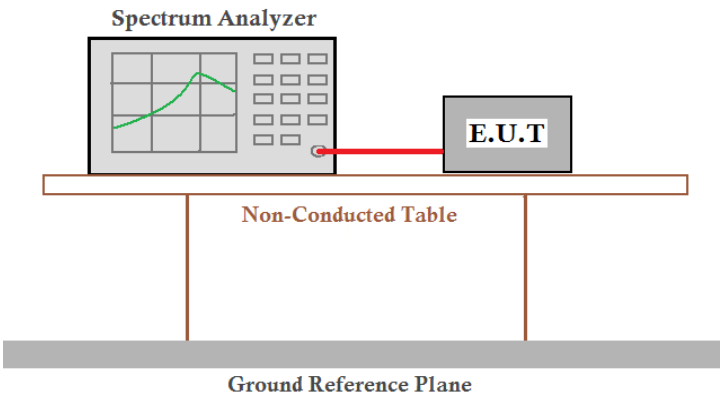
4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G ; 6.5Mbps of rate is the worst case of 802.11N(HT20) ;
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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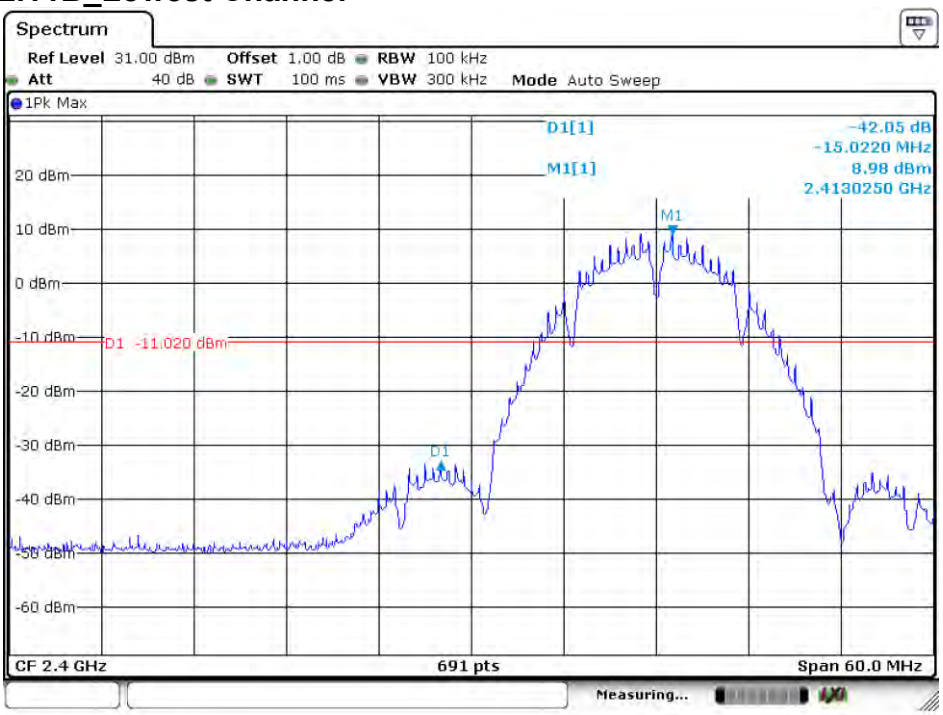
4.7.1 Test plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



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4.7.1.1.2 802.11B_ Highest Channel

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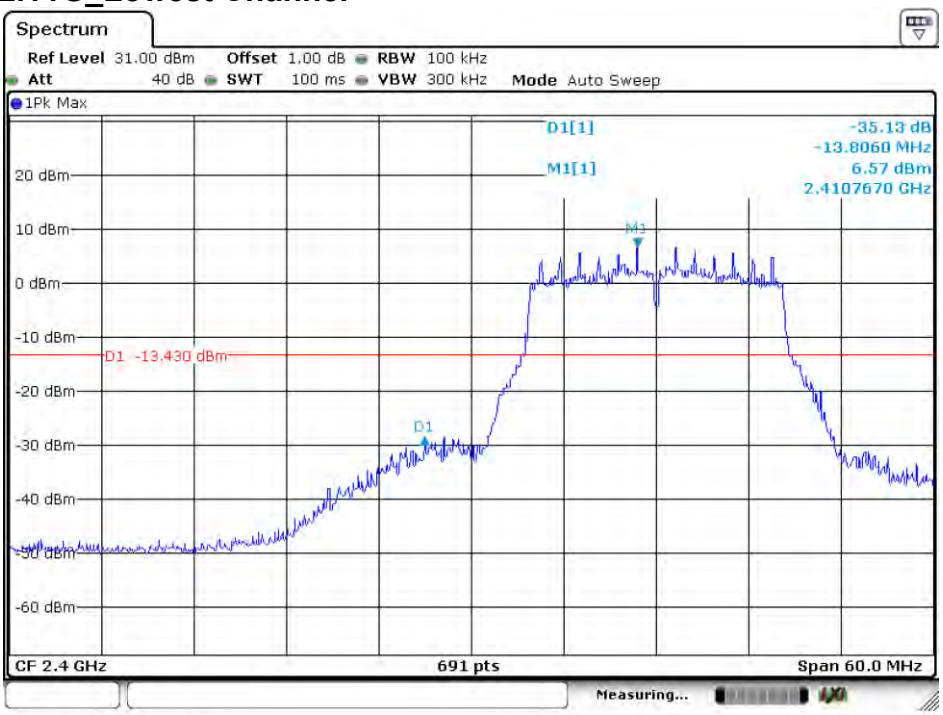
4.7.1.1.3 802.11G_Lowest Channel



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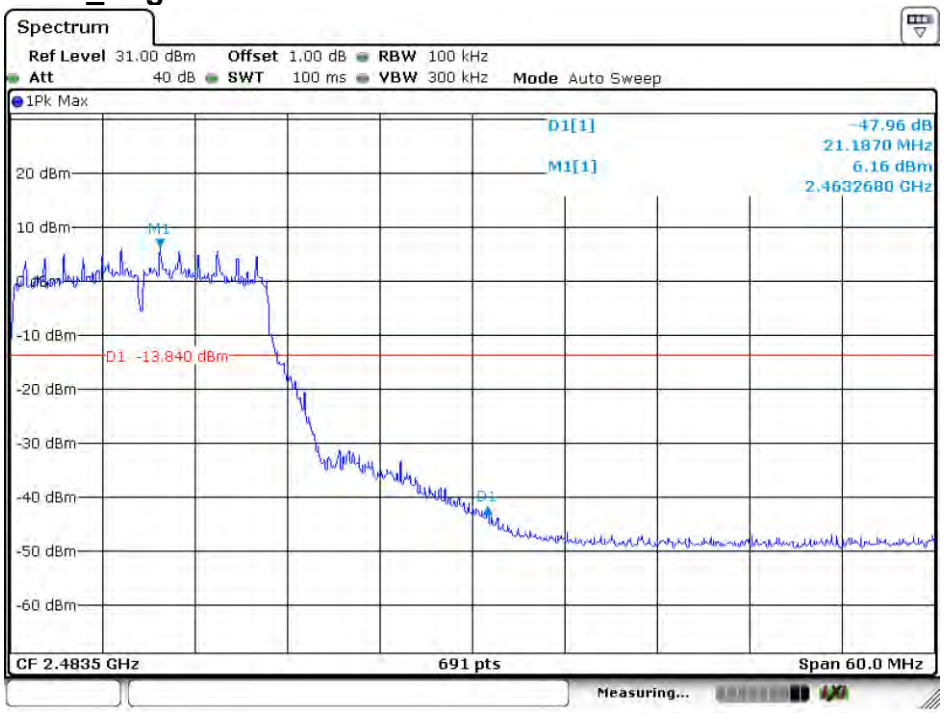
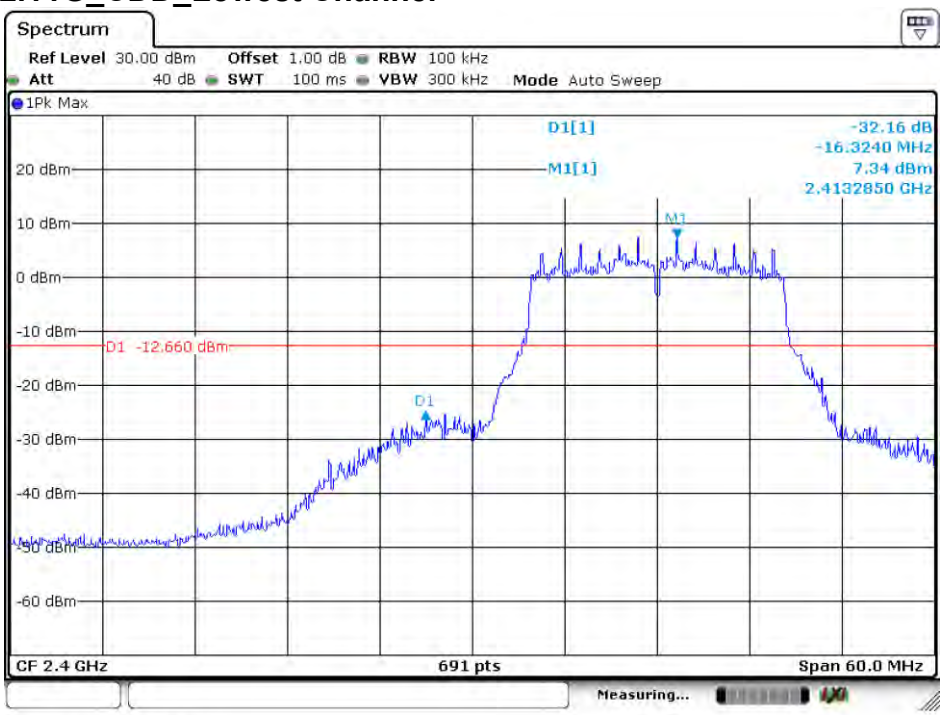
4.7.1.1.4 802.11G_ Highest Channel



Date: 10.JUN.2020 07:12:48

4.7.1.1.5 802.11G_CDD_Lowest Channel



Date: 11.JUN.2020 09:32:02

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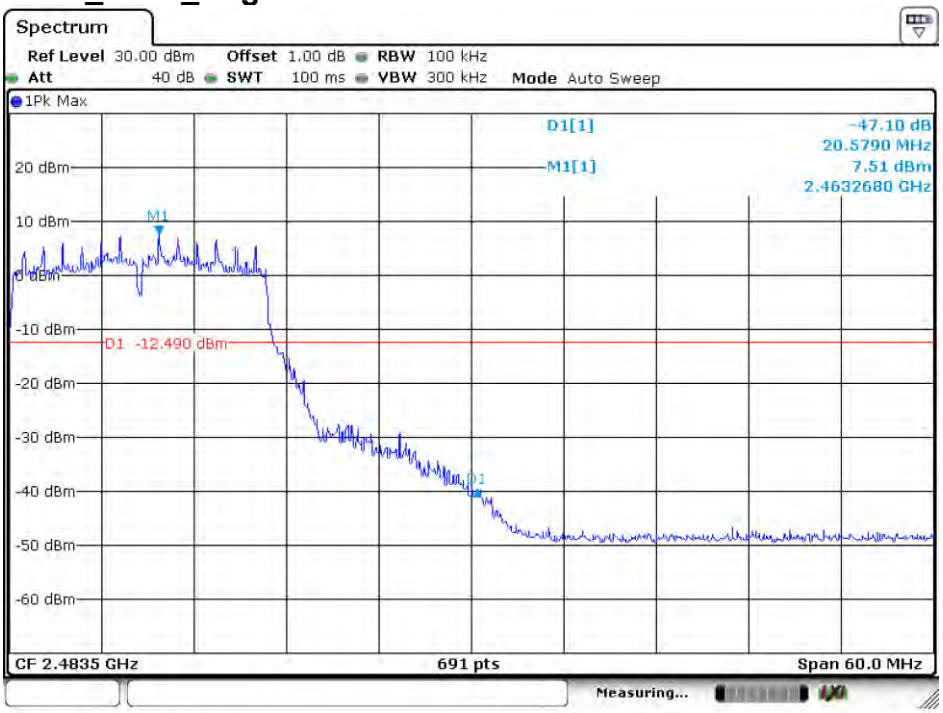
4.7.1.1.6 802.11G_CDD _ Highest Channel



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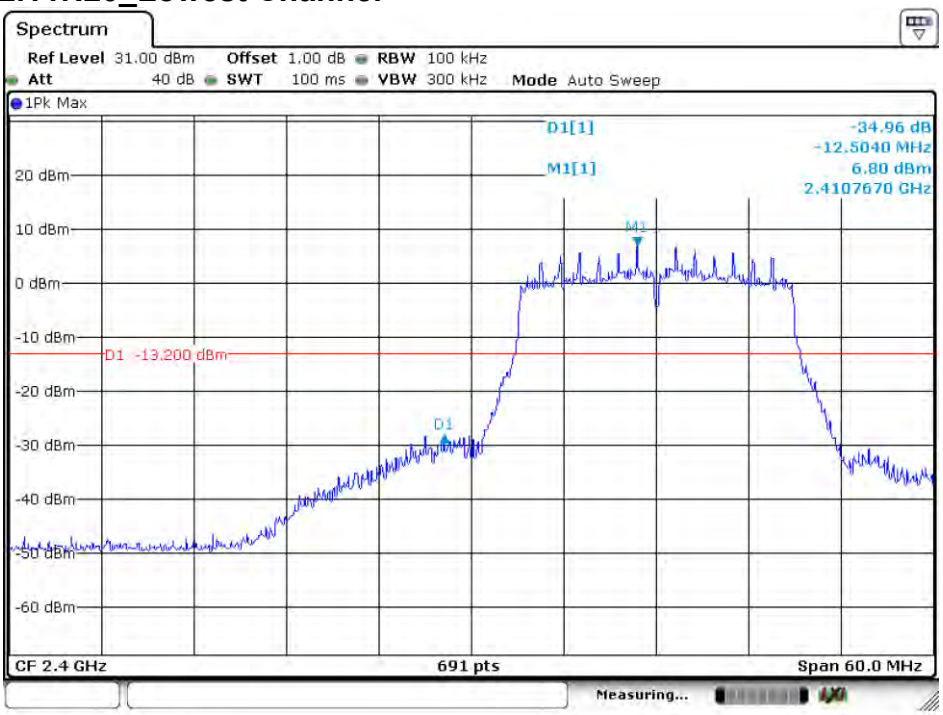
4.7.1.1.7 802.11N20_Lowest Channel



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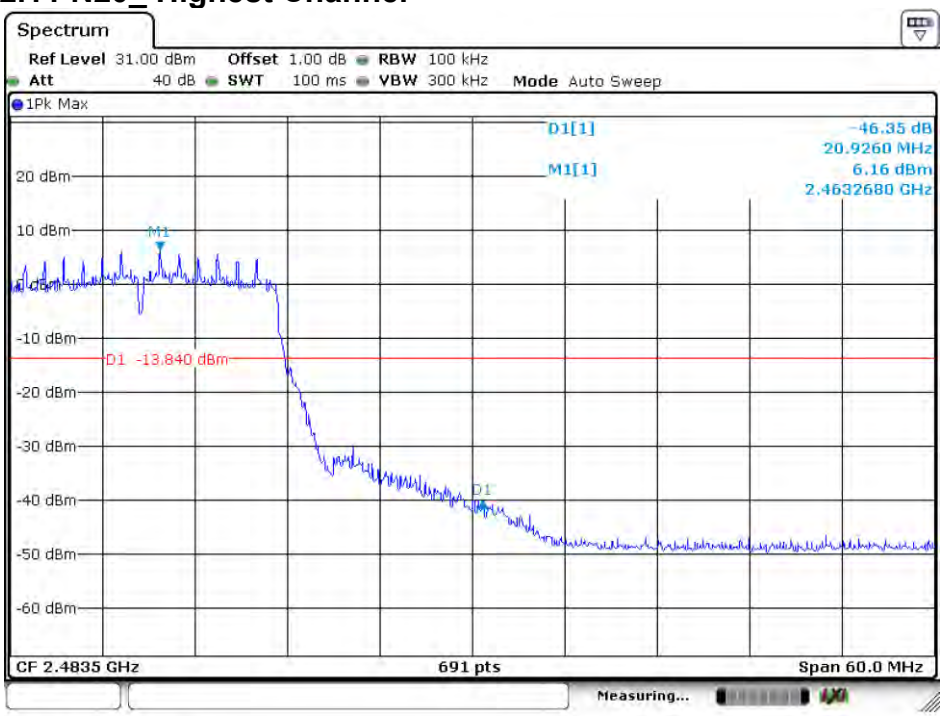
4.7.1.1.8 802.11 N20_ Highest Channel



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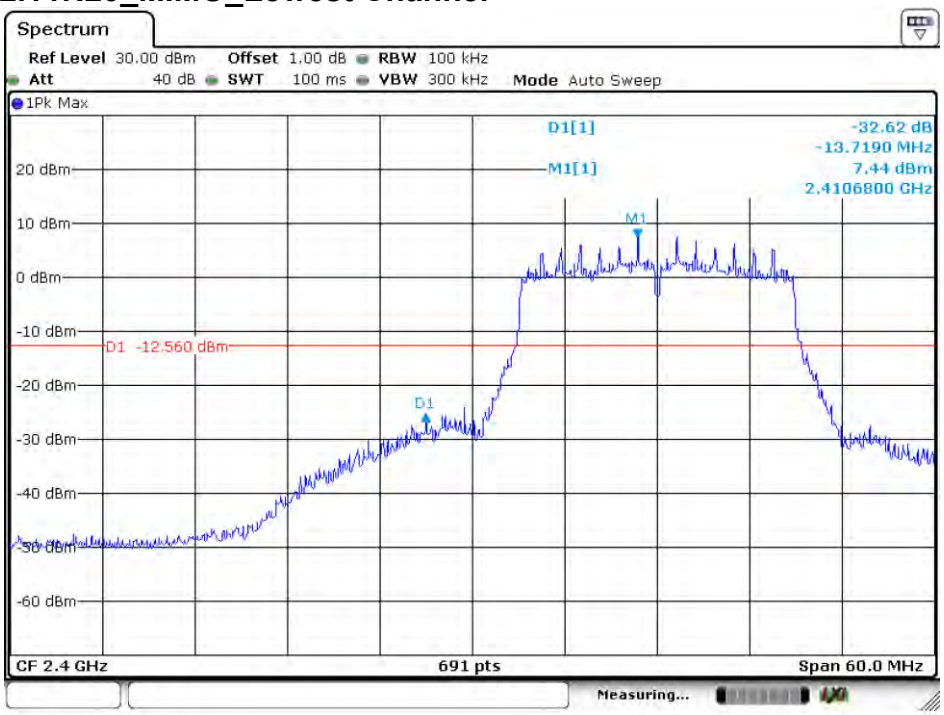
4.7.1.1.9 802.11N20_MIMO_Lowest Channel



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4.7.1.1.10 802.11 N20_MIMO _ Highest Channel

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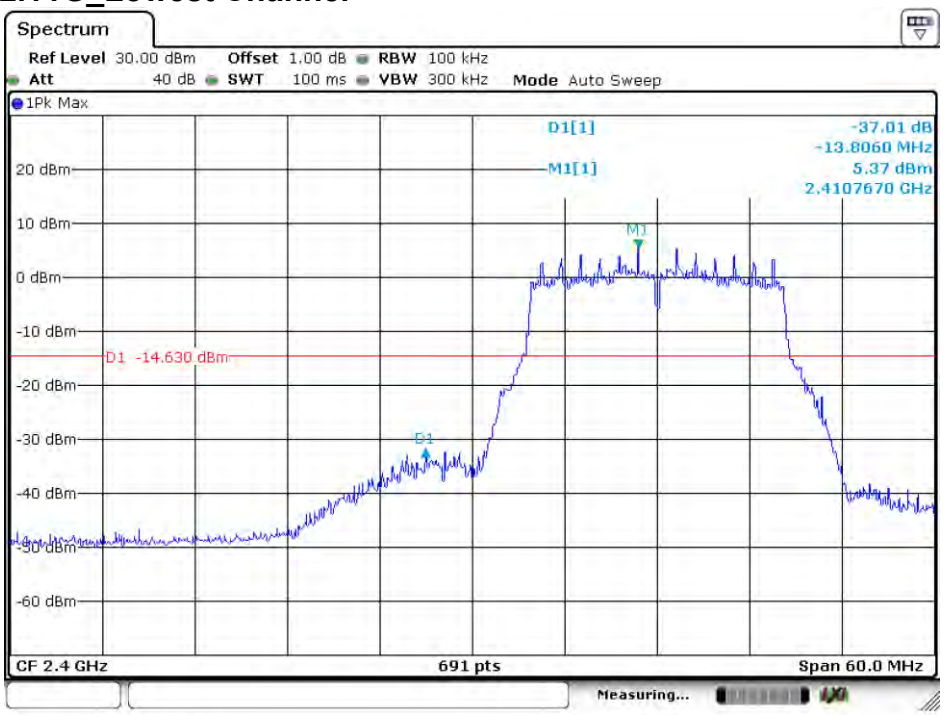
4.7.1.2 ANT2

4.7.1.2.1 802.11G_Lowest Channel



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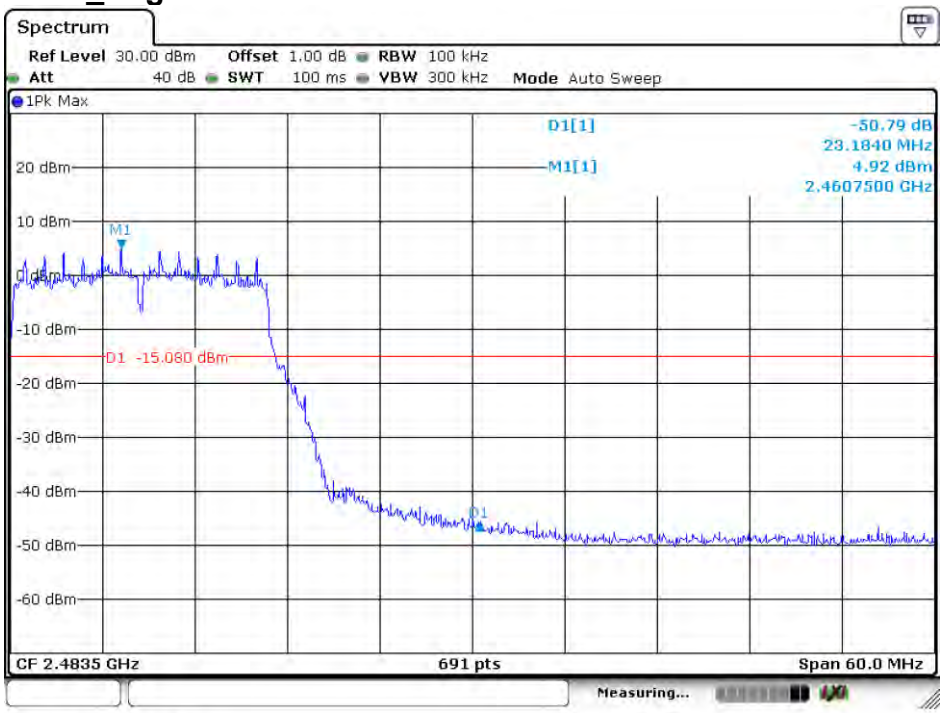
4.7.1.2.2 802.11G_ Highest Channel



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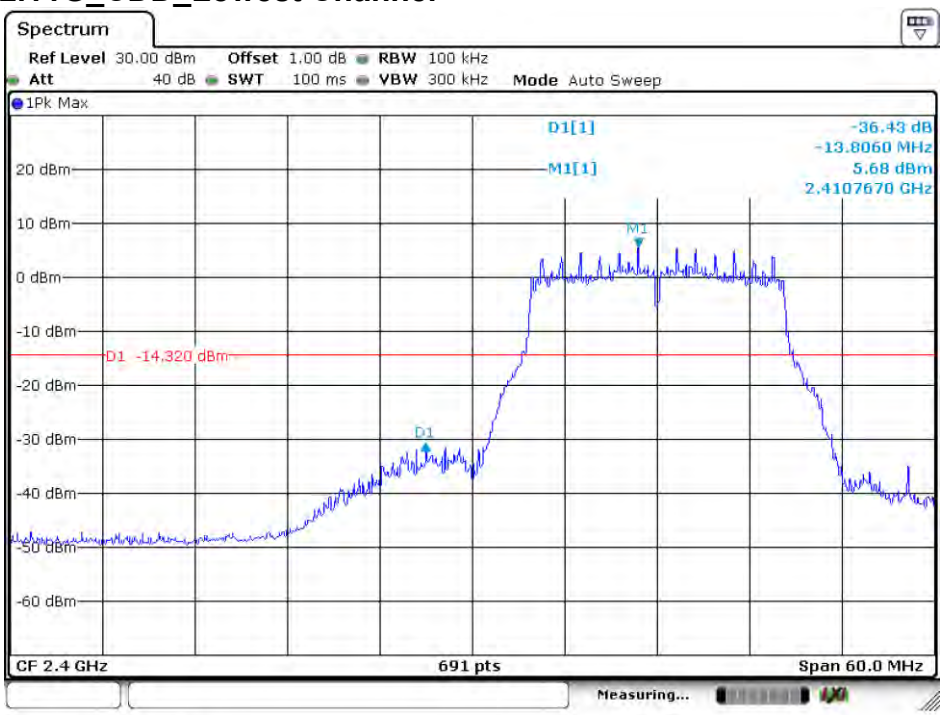
4.7.1.2.3 802.11G_CDD_Lowest Channel



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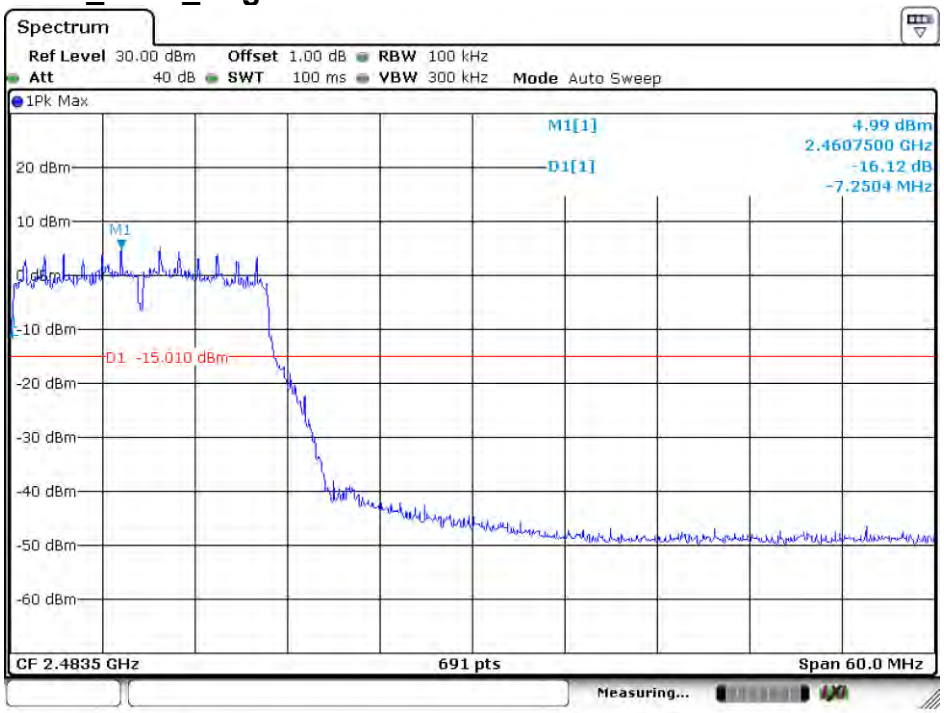
4.7.1.2.4 802.11G_CDD _ Highest Channel



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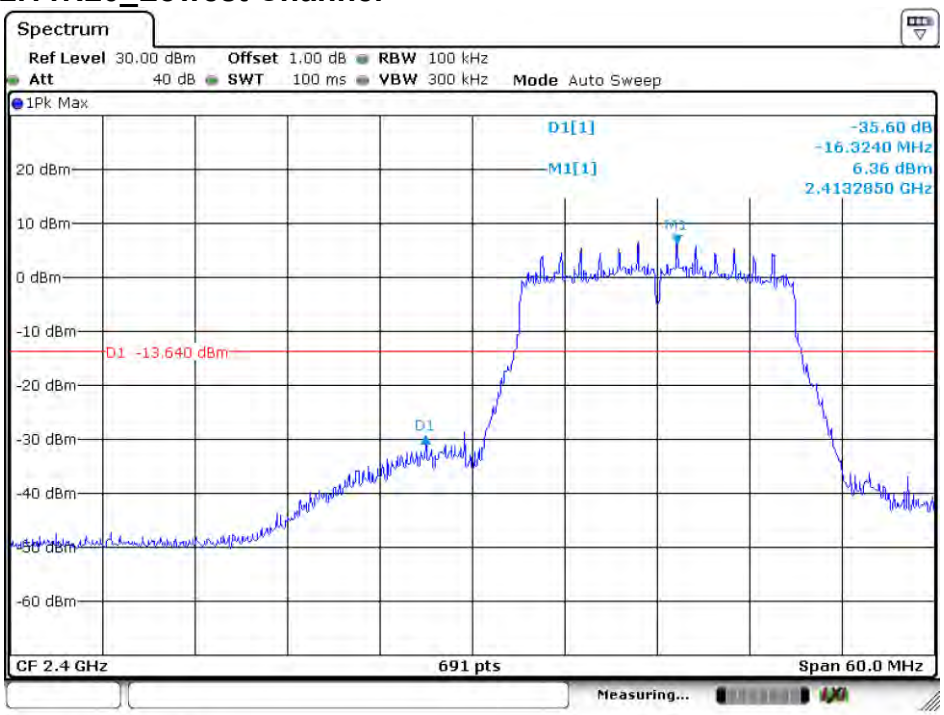
4.7.1.2.5 802.11N20_Lowest Channel



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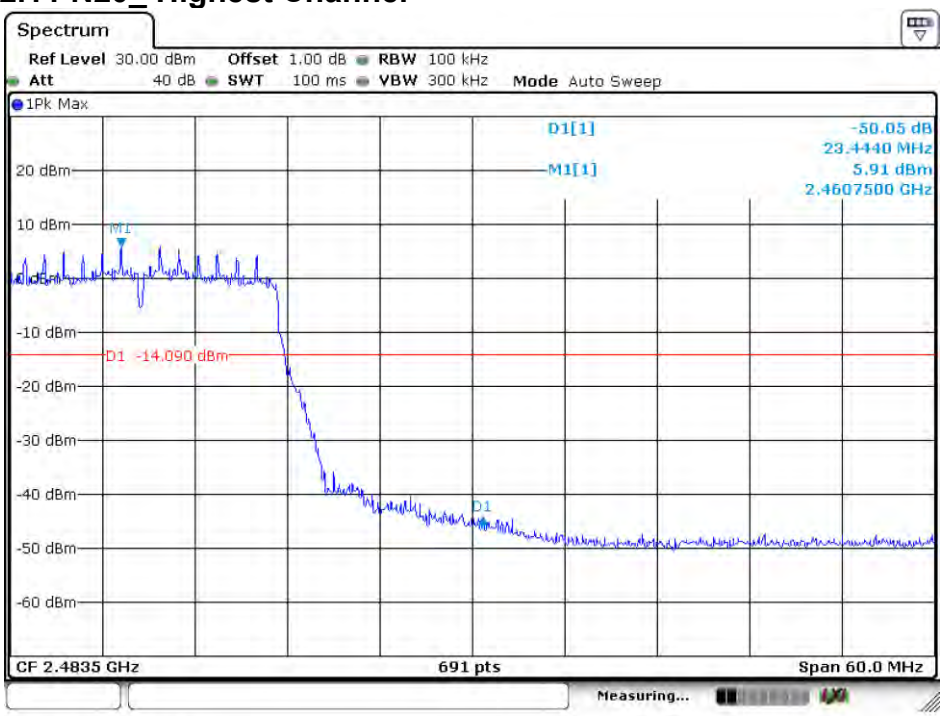
4.7.1.2.6 802.11 N20_ Highest Channel



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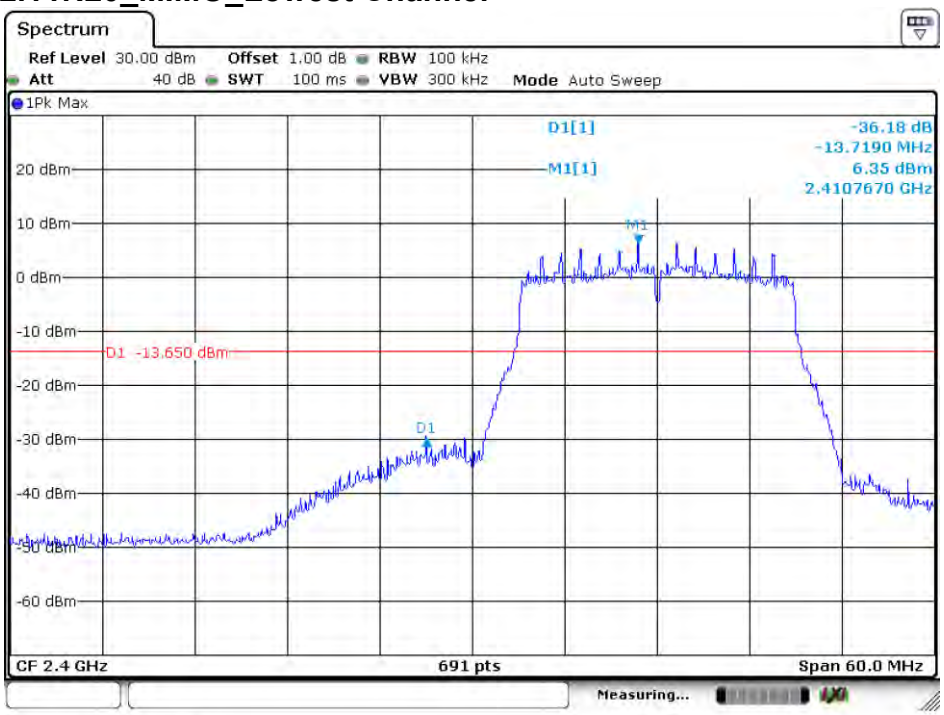
4.7.1.2.7 802.11N20_MIMO_Lowest Channel



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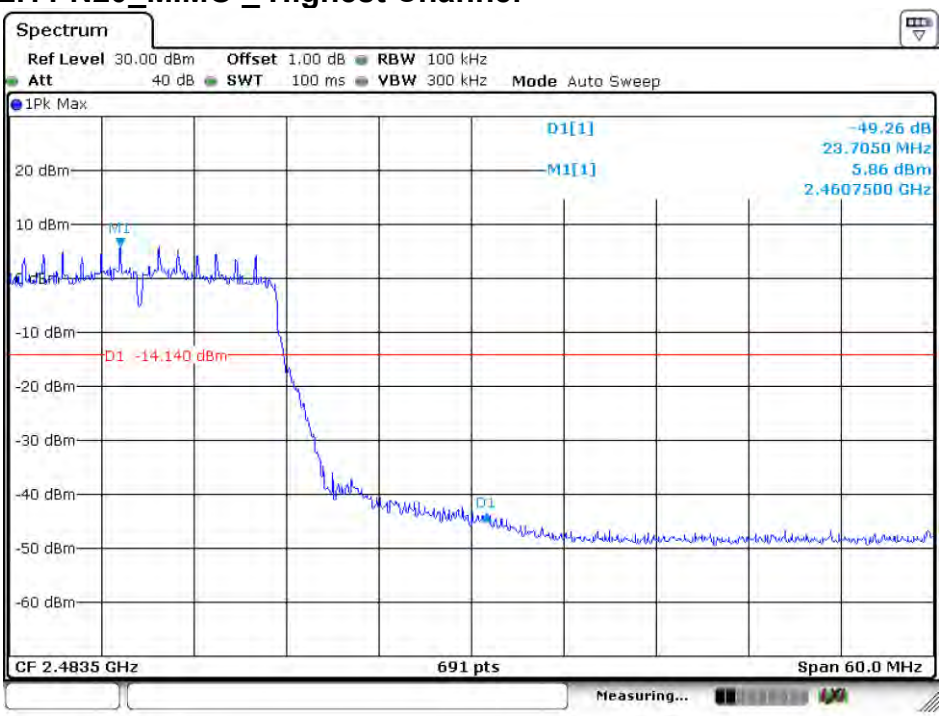
4.7.1.2.8 802.11 N20_MIMO _ Highest Channel



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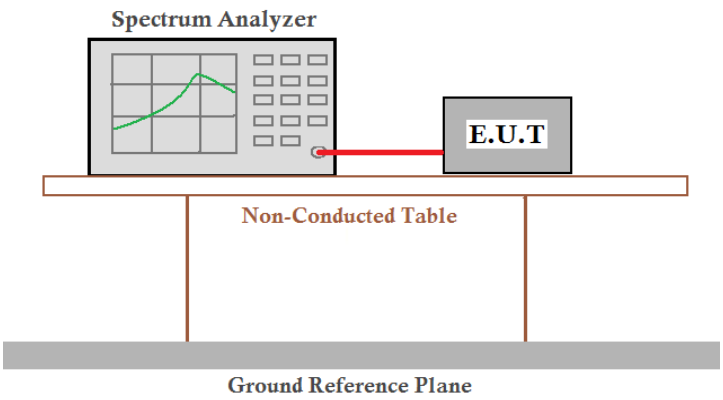
4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20);
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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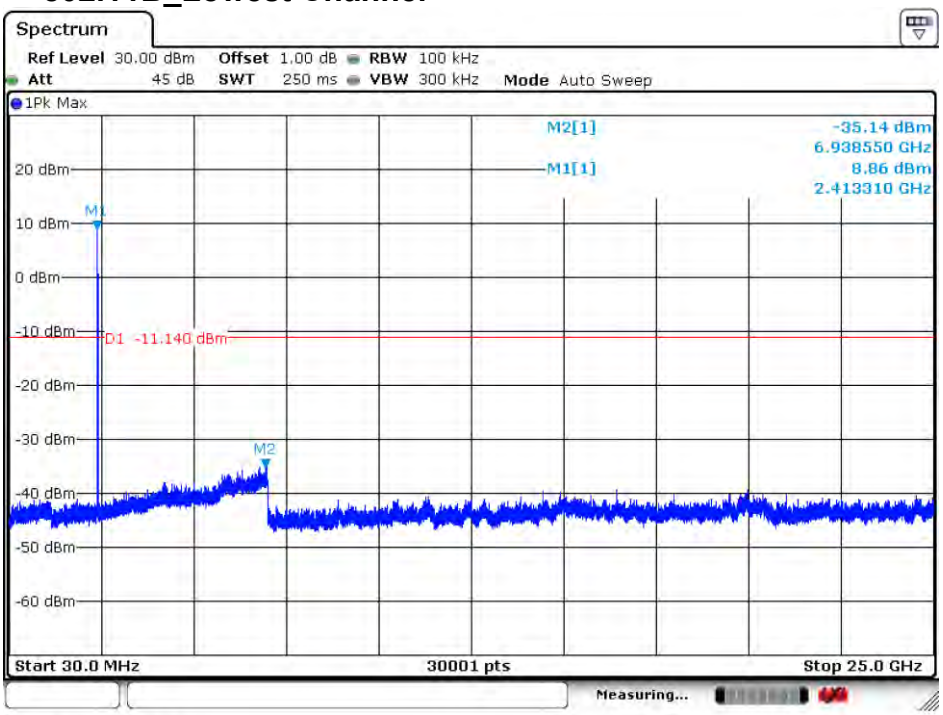
4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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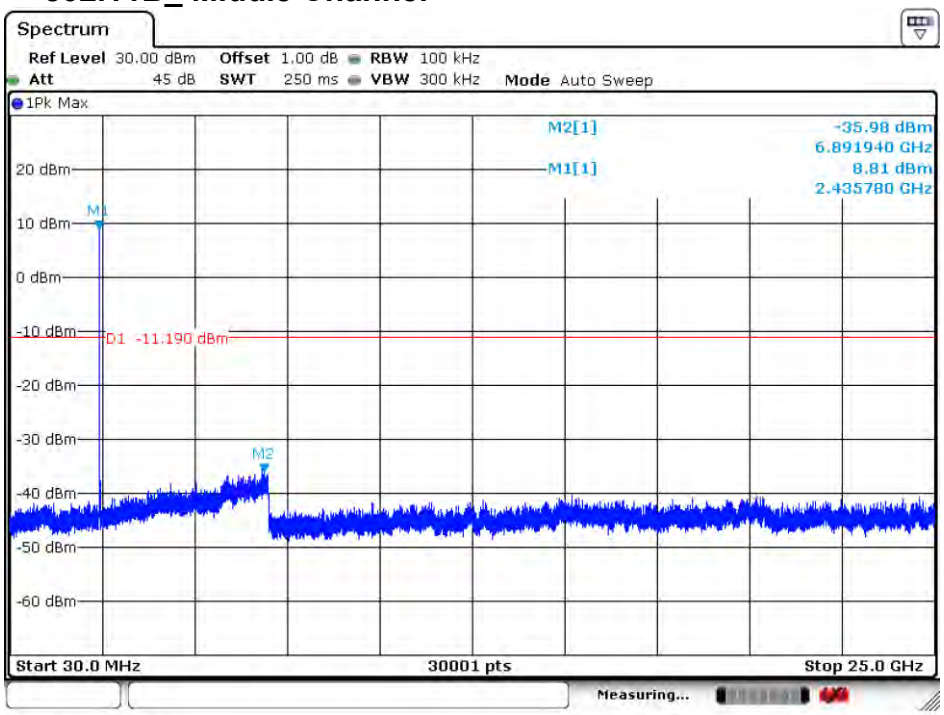
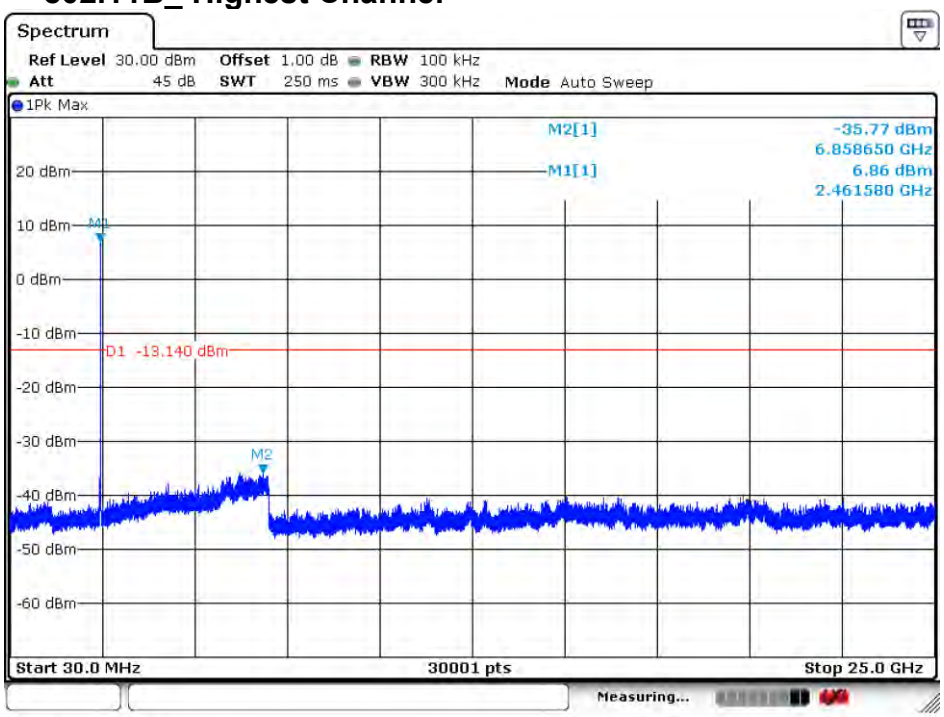
4.8.1.1.2 802.11B_ Middle Channel



Date: 17.APR.2019 09:26:14

4.8.1.1.3 802.11B_ Highest Channel



Date: 17.APR.2019 09:27:14

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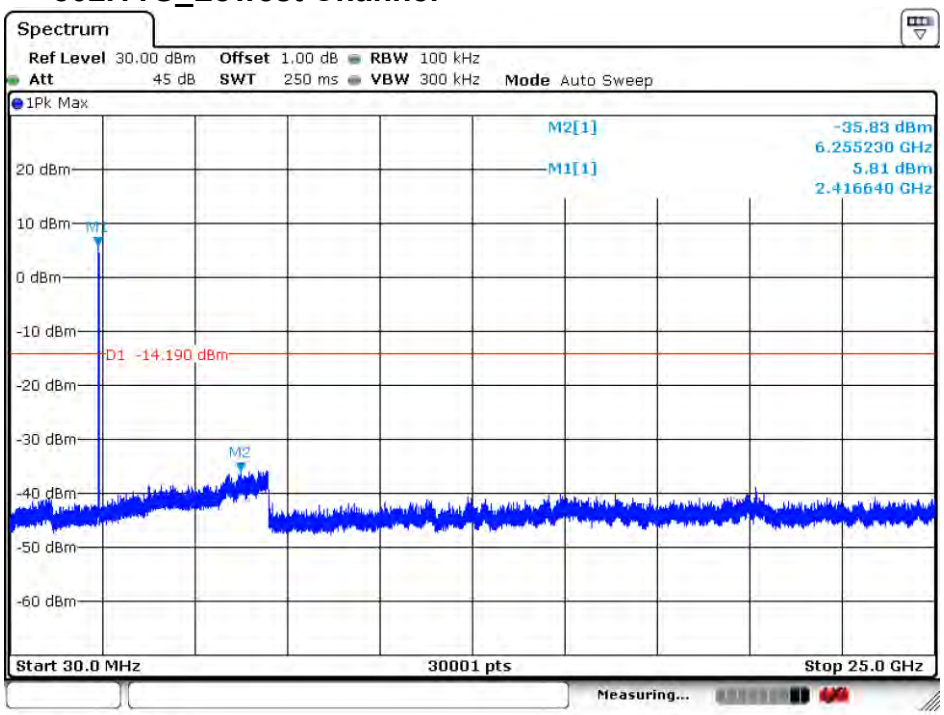
4.8.1.1.4 802.11G_Lowest Channel



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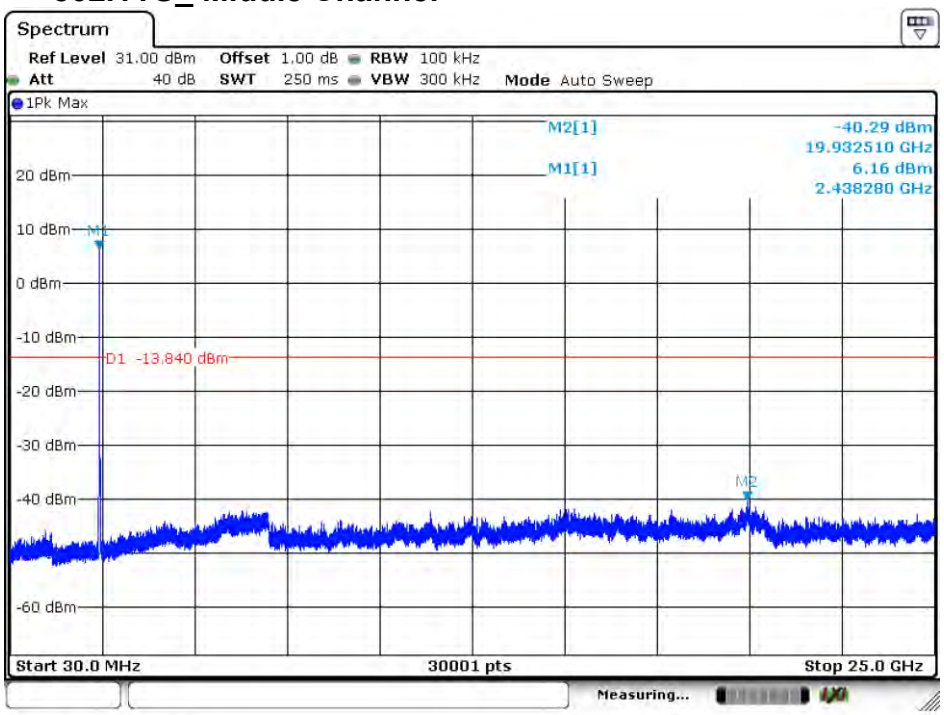
4.8.1.1.5 802.11G_ Middle Channel



Date: 10.JUN.2020 07:37:33

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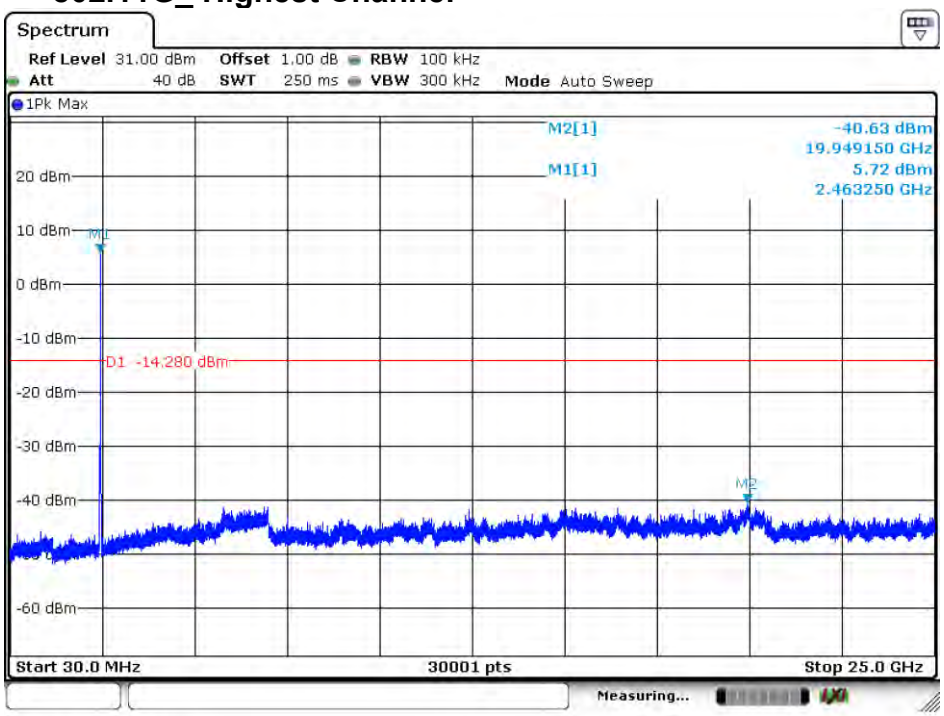
4.8.1.1.6 802.11G_ Highest Channel



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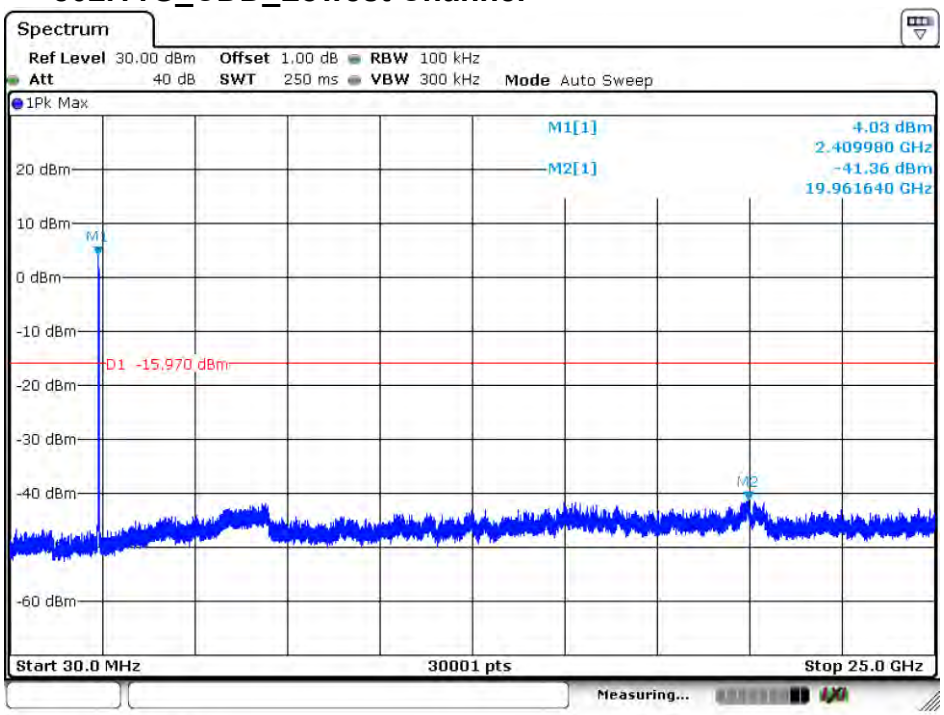
4.8.1.1.7 802.11G_CDD_Lowest Channel



Date: 11.JUN.2020 09:39:30

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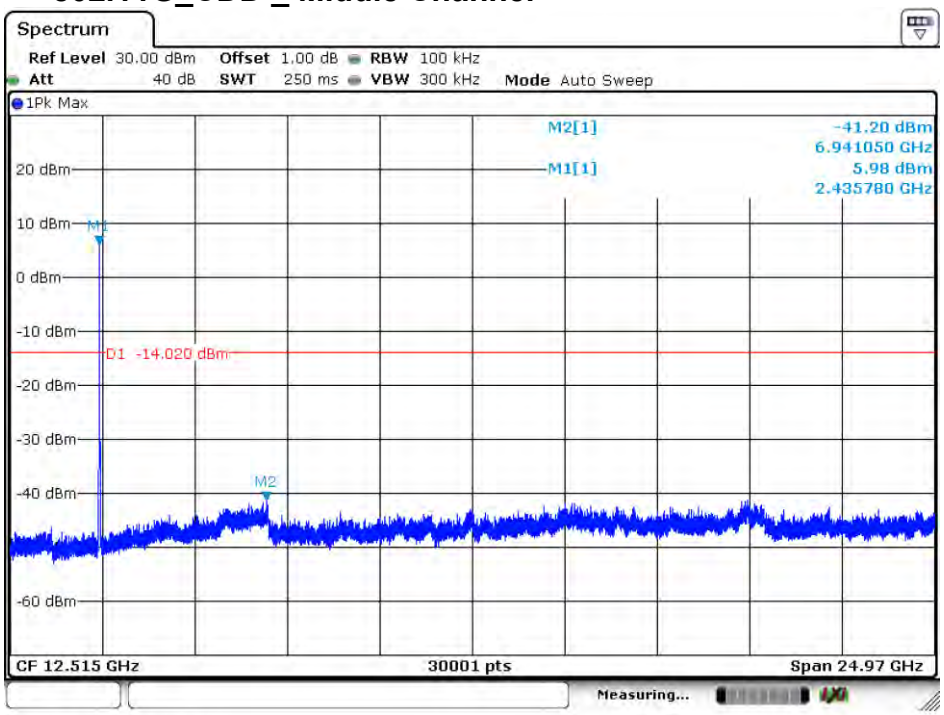
4.8.1.1.8 802.11G_CDD _ Middle Channel



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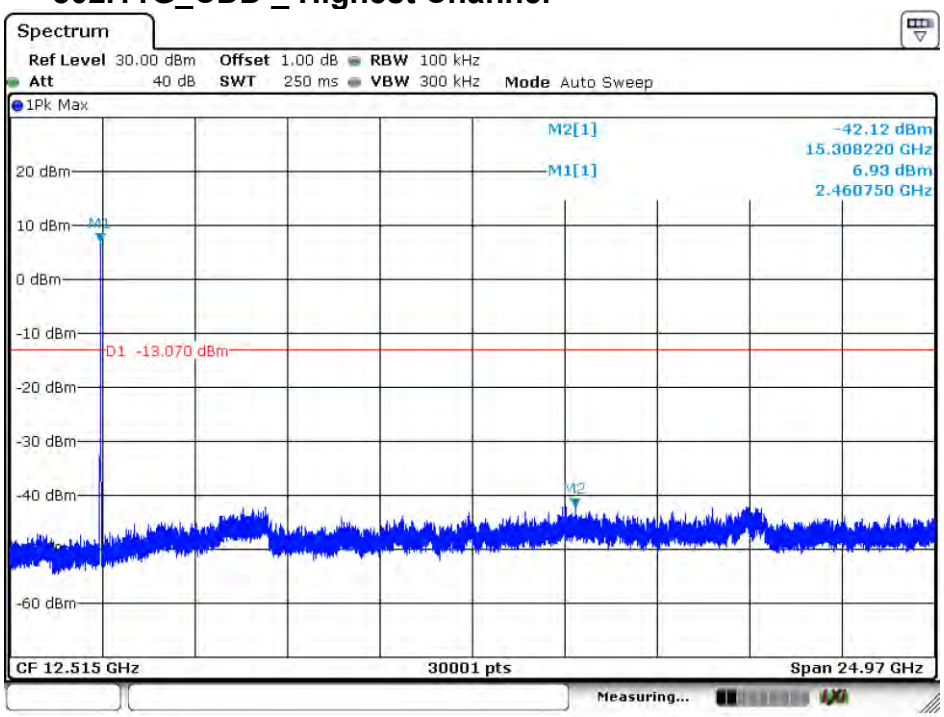
4.8.1.1.9 802.11G_CDD _ Highest Channel



Date: 11.JUN.2020 09:41:23

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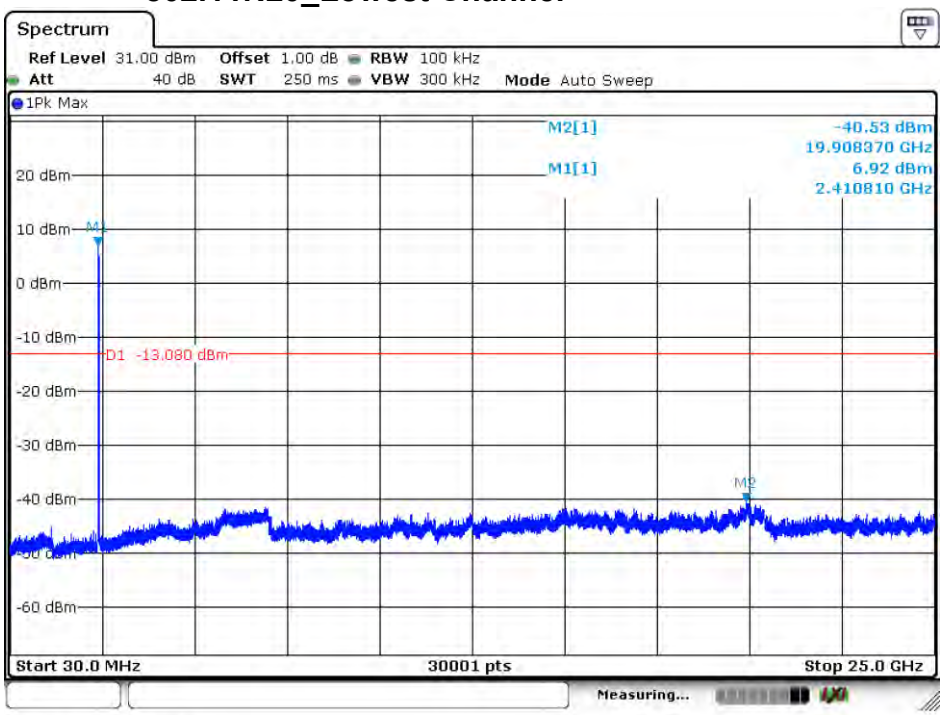
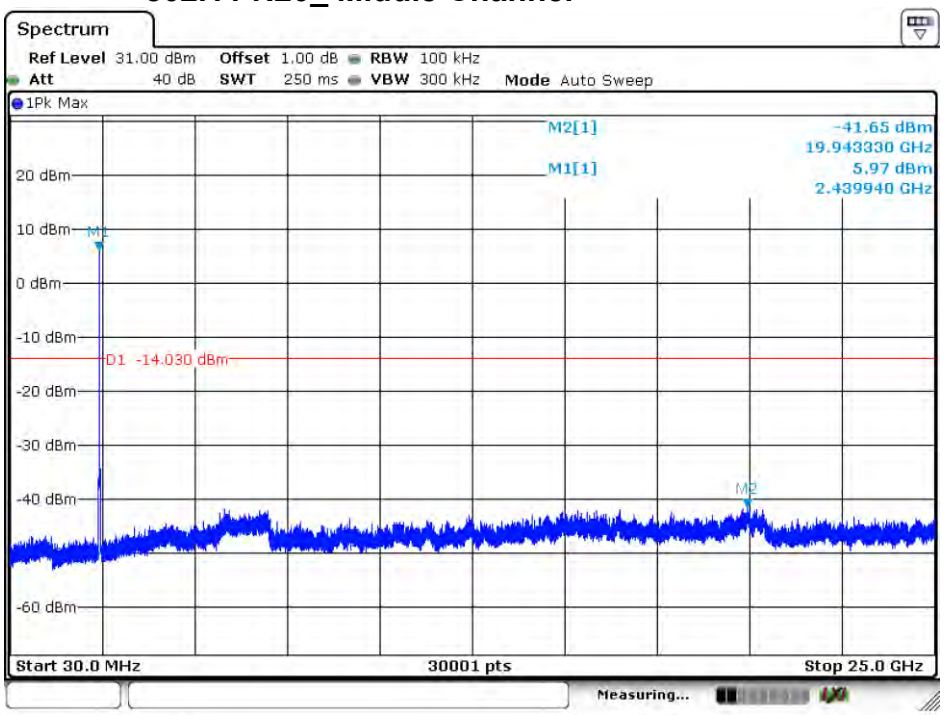
4.8.1.1.10 802.11N20_Lowest Channel



Date: 10.JUN.2020 07:23:44

4.8.1.1.11 802.11 N20_ Middle Channel



Date: 10.JUN.2020 07:26:32

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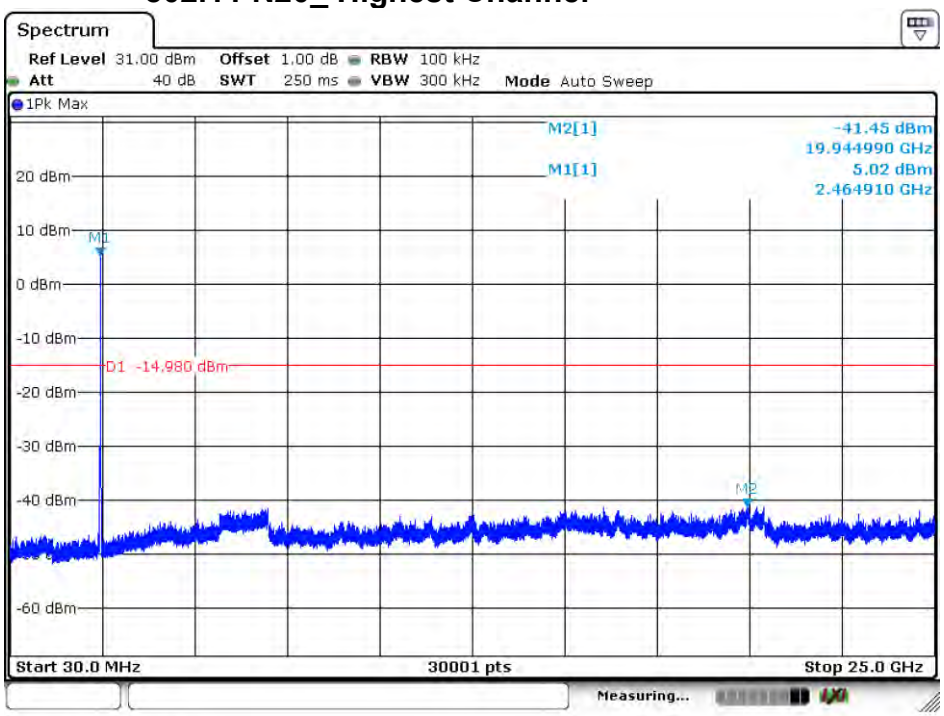
4.8.1.1.12 802.11 N20_ Highest Channel



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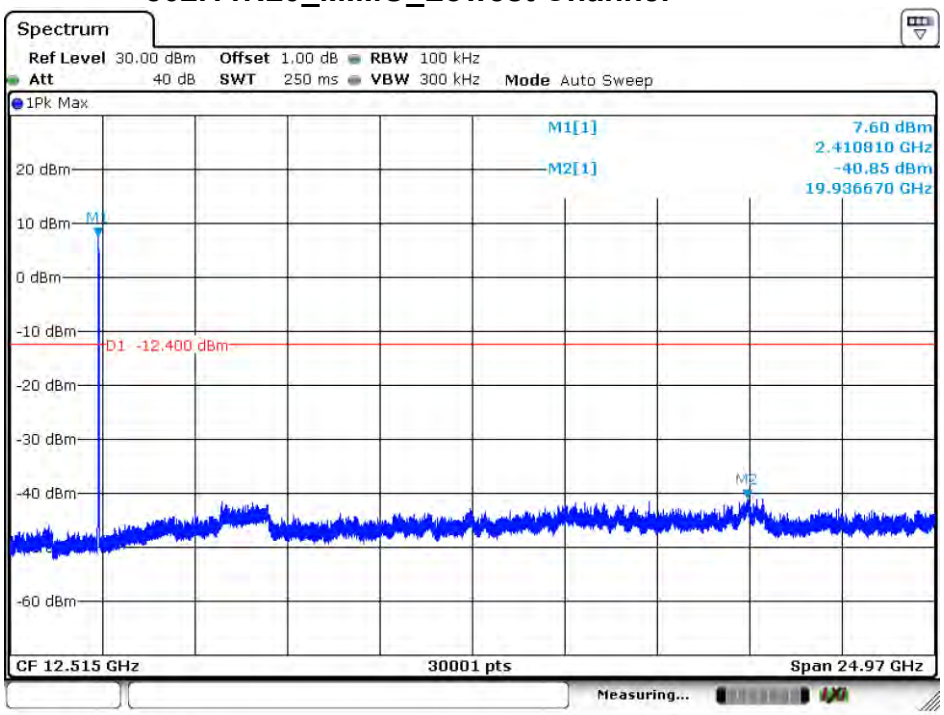
4.8.1.1.13 802.11N20_MIMO_Lowest Channel



Date: 11.JUN.2020 09:48:02

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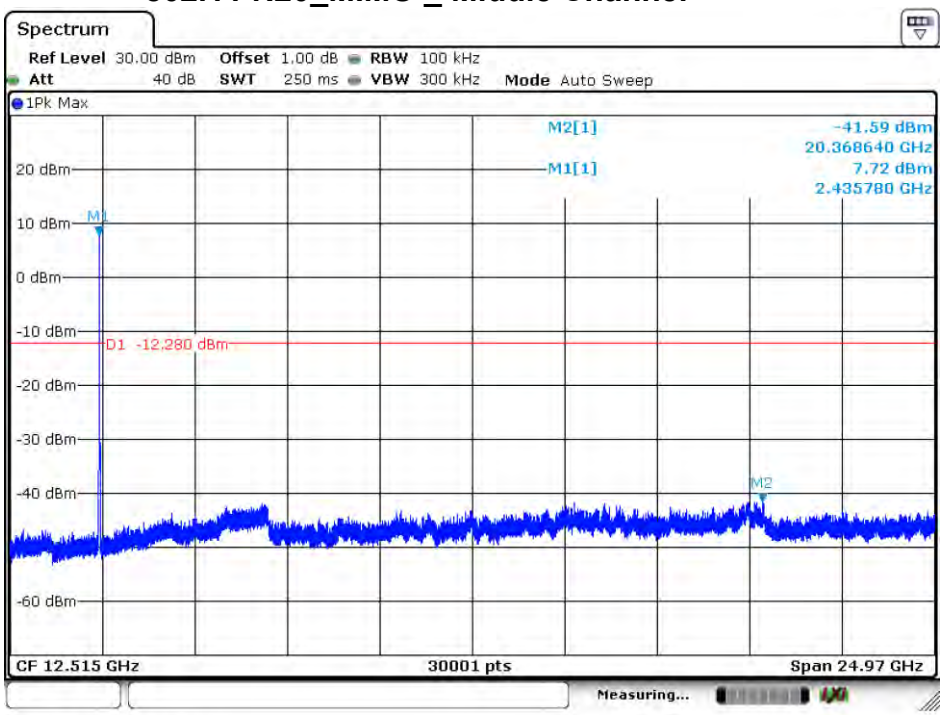
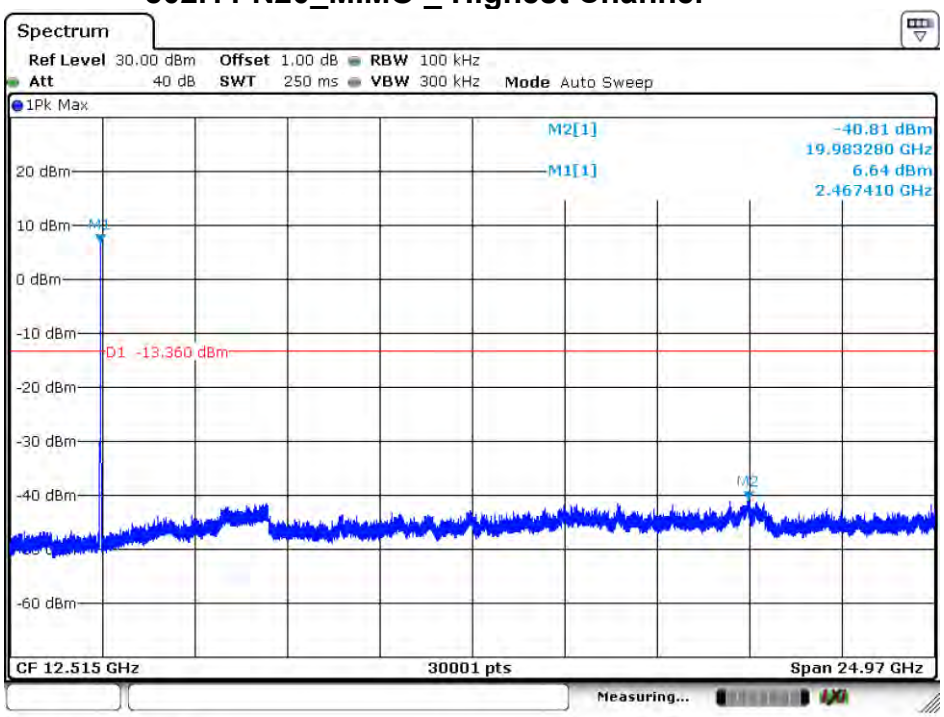
4.8.1.1.14 802.11 N20_MIMO _ Middle Channel



Date: 11.JUN.2020 09:46:04

4.8.1.1.15 802.11 N20_MIMO _ Highest Channel



Date: 11.JUN.2020 09:45:05

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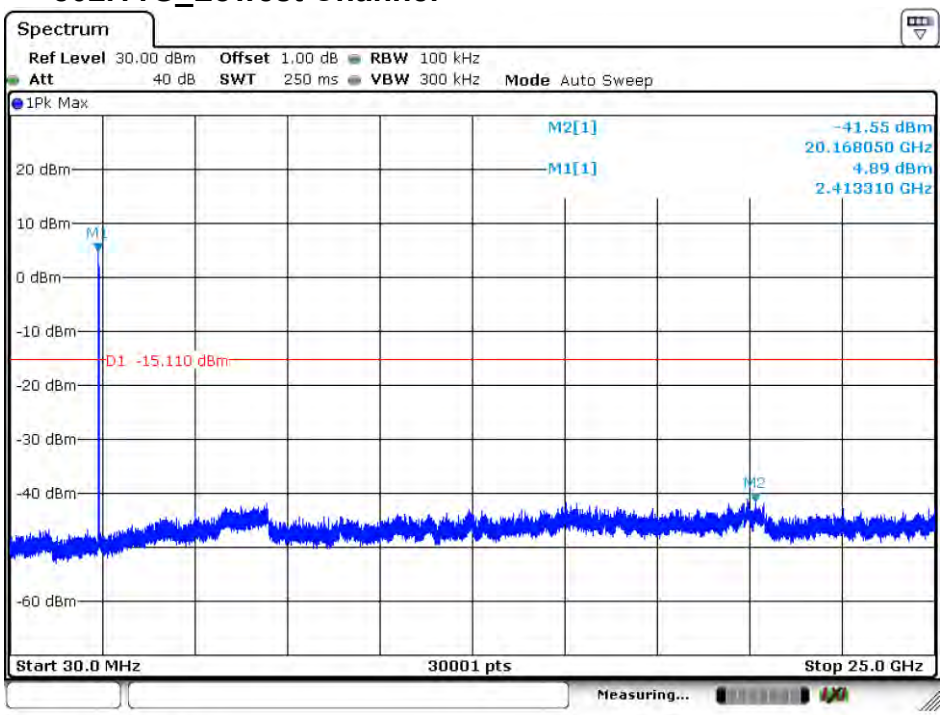
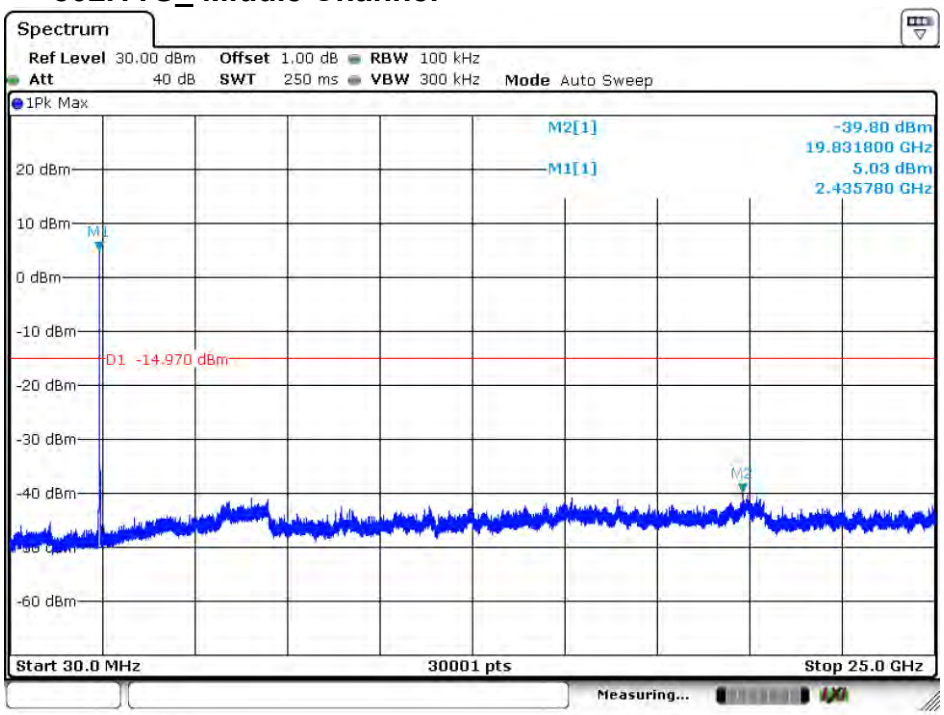
4.8.1.2 ANT2

4.8.1.2.1 802.11G_Lowest Channel



Date: 11.JUN.2020 08:26:48

4.8.1.2.2 802.11G_ Middle Channel



Date: 11.JUN.2020 08:25:43

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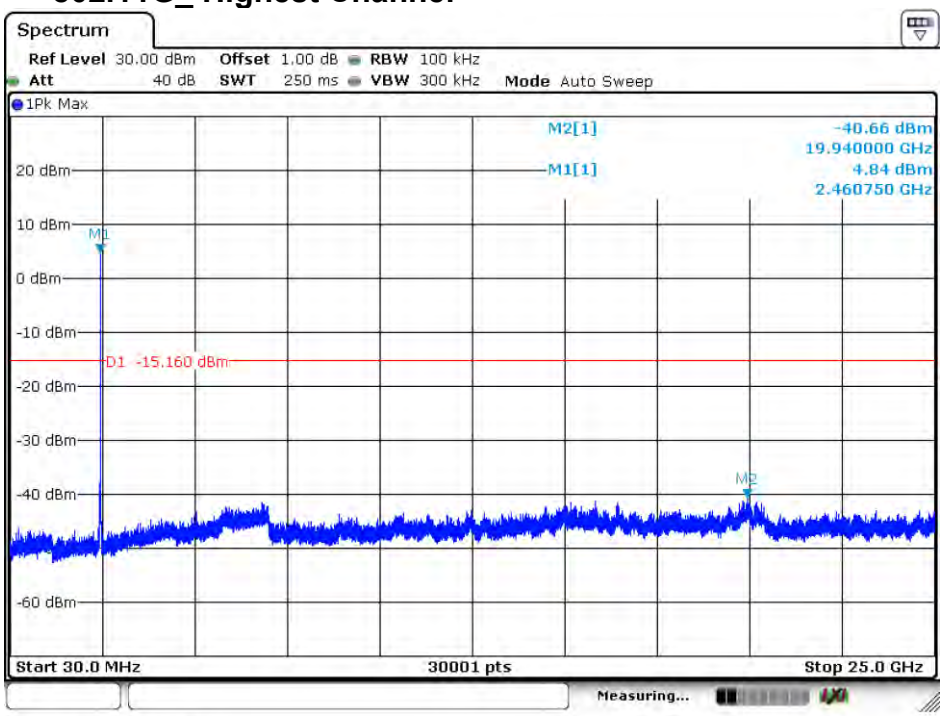
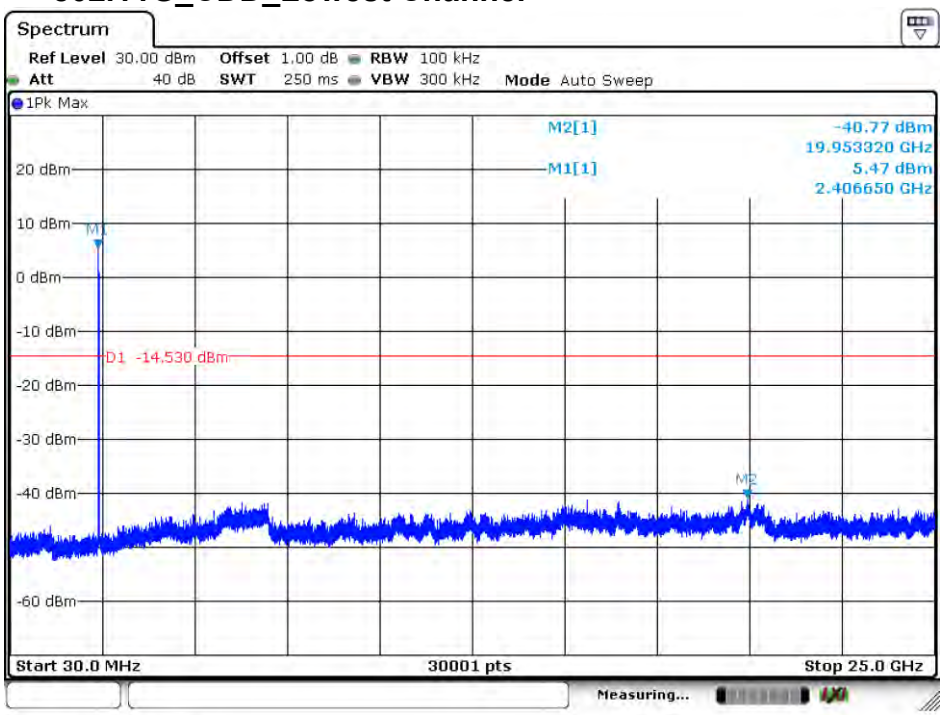
4.8.1.2.3 802.11G_ Highest Channel



Date: 11.JUN.2020 08:19:26

4.8.1.2.4 802.11G_CDD_Lowest Channel



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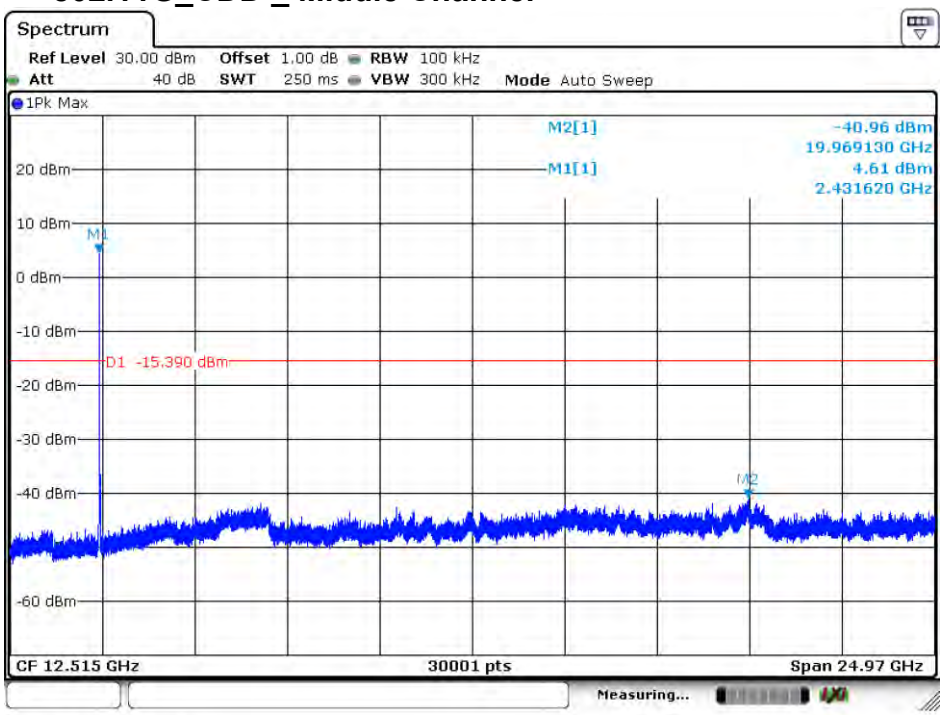
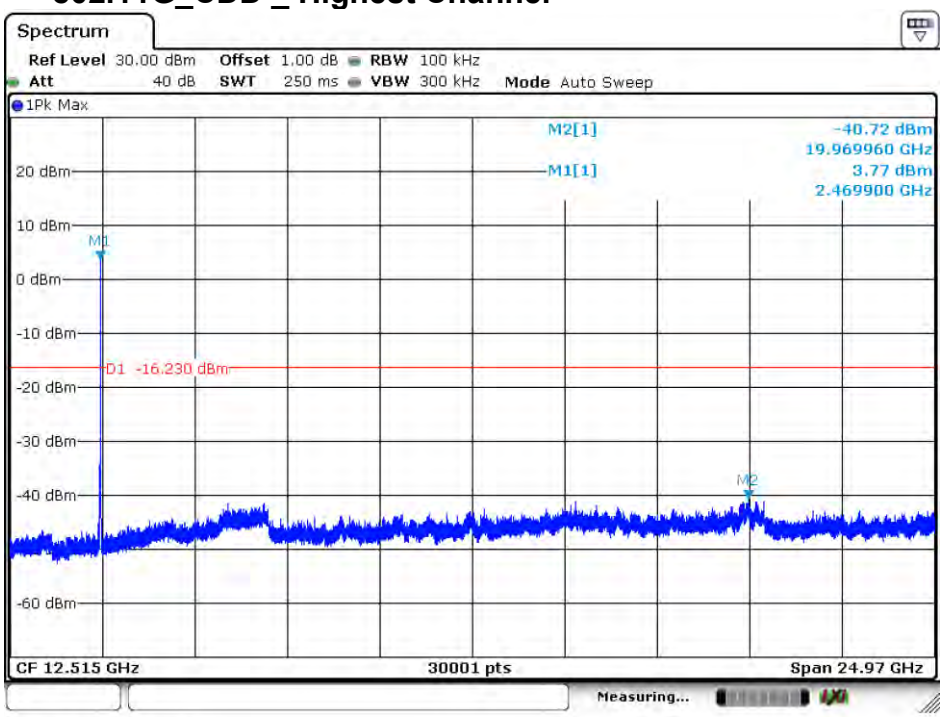
4.8.1.2.5 802.11G_CDD _ Middle Channel



Date: 11.JUN.2020 07:41:41

4.8.1.2.6 802.11G_CDD _ Highest Channel



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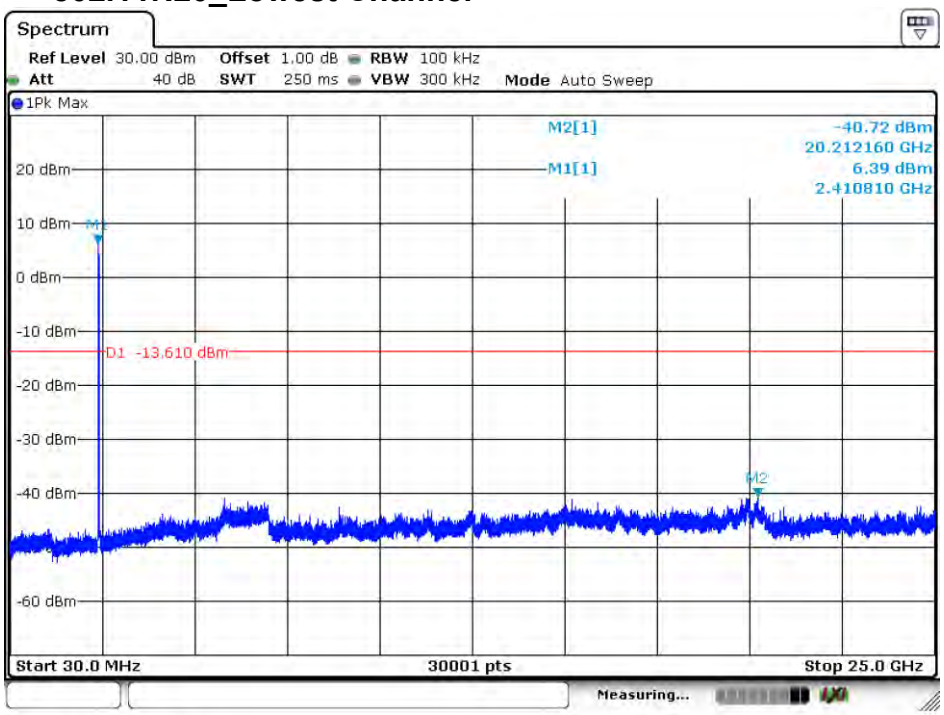
4.8.1.2.7 802.11N20_Lowest Channel



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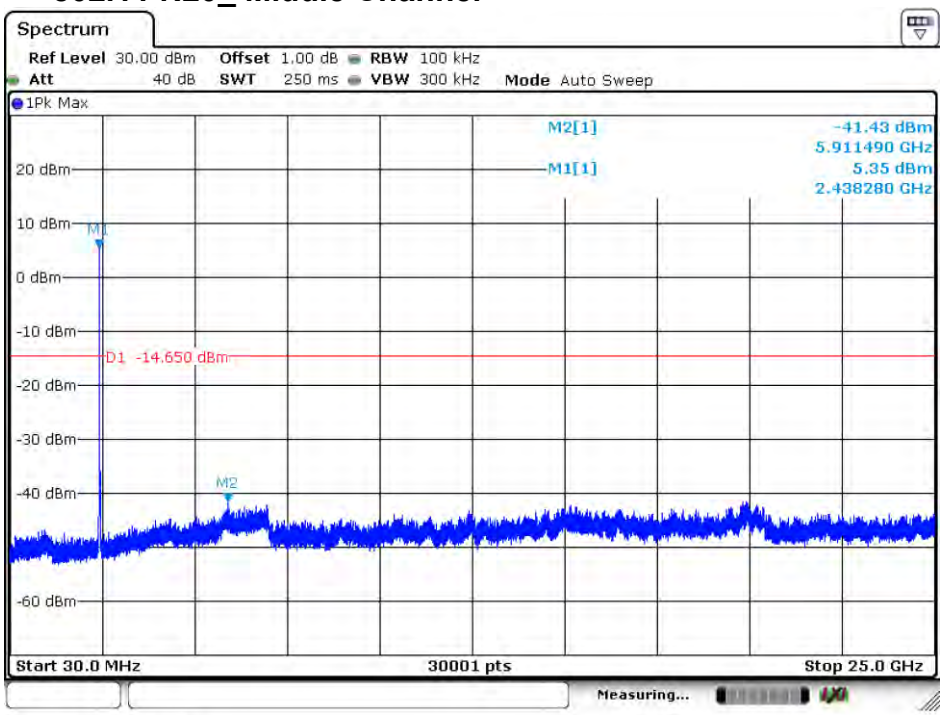
4.8.1.2.8 802.11 N20_ Middle Channel



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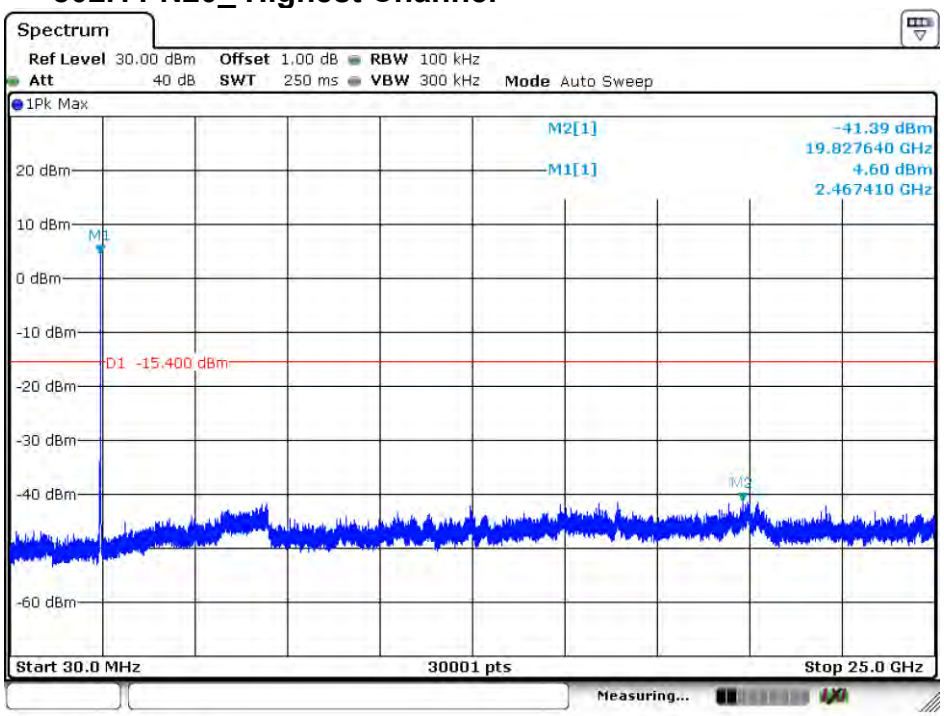
4.8.1.2.9 802.11 N20_ Highest Channel



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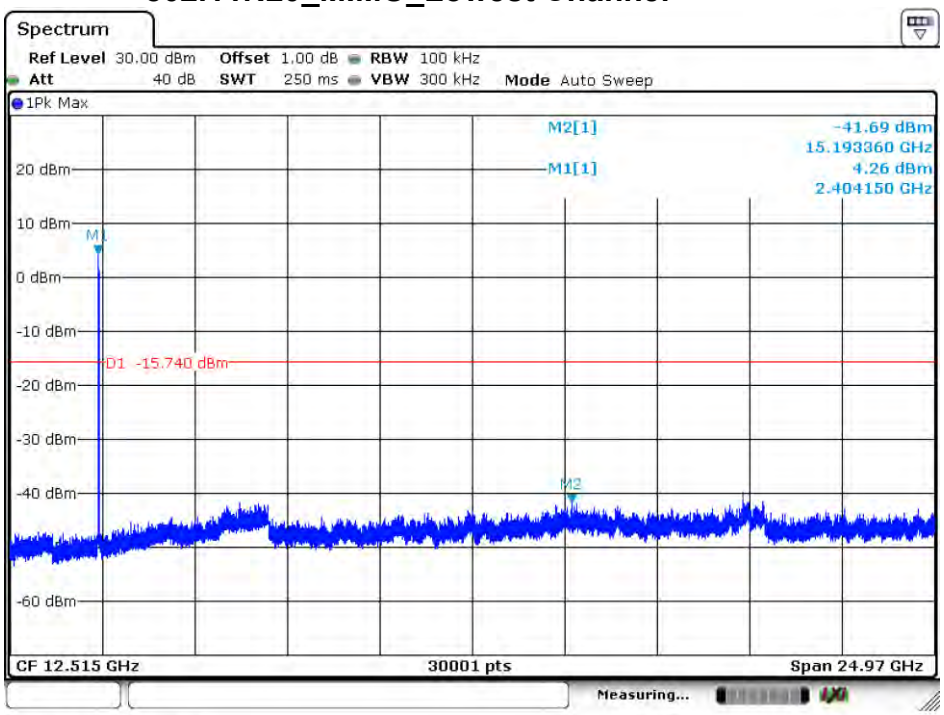
4.8.1.2.10 802.11N20_MIMO_Lowest Channel



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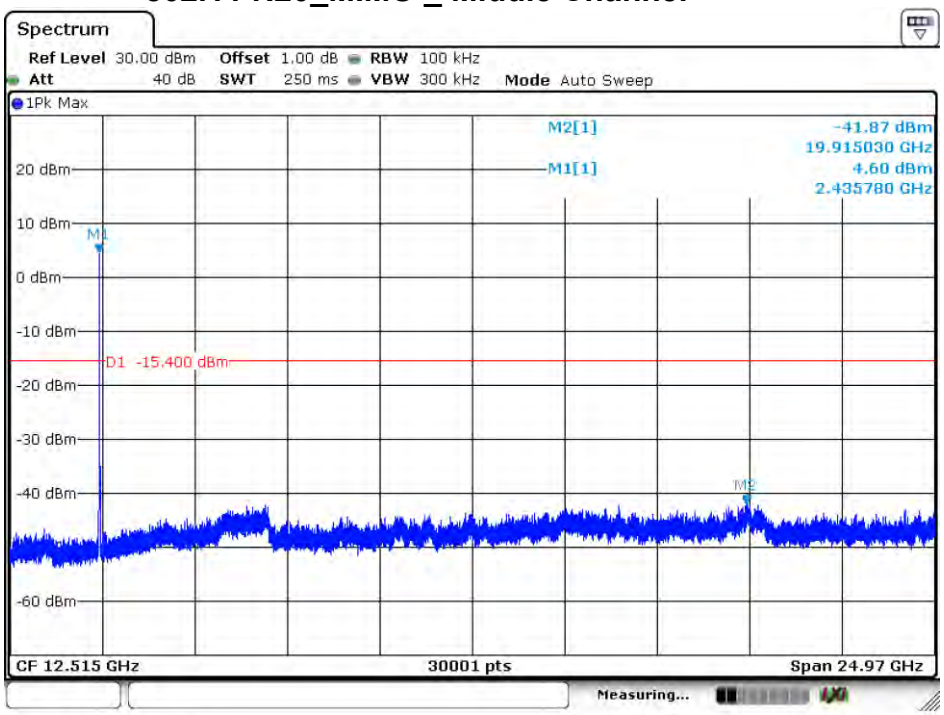
4.8.1.2.11 802.11 N20_MIMO _ Middle Channel



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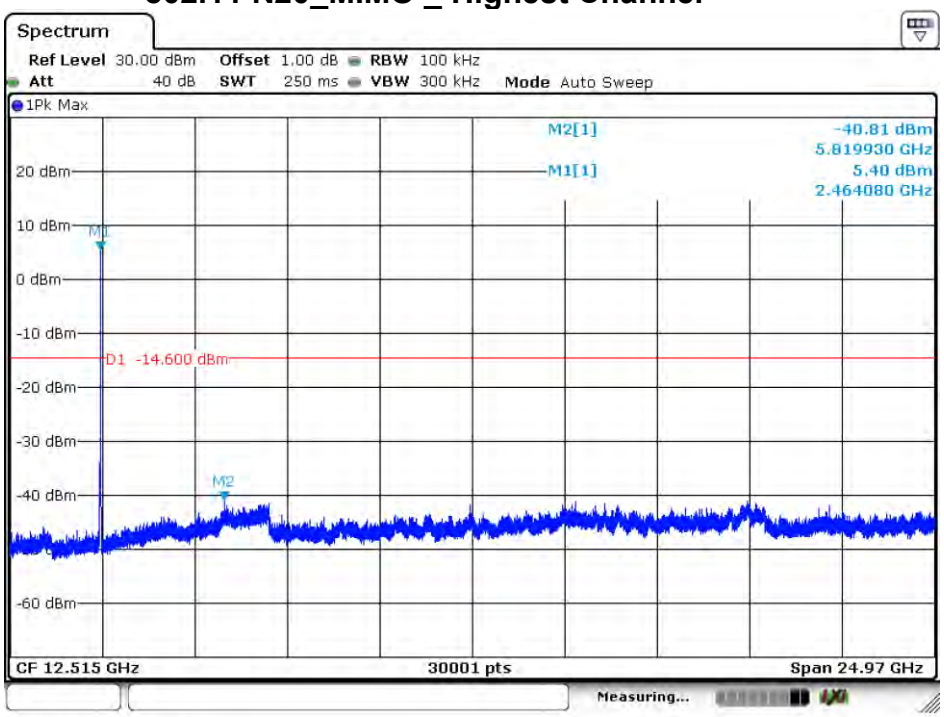
4.8.1.2.12 802.11 N20_MIMO _ Highest Channel



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Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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4.9 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 :2013 Section 11.12				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				

Test Setup:	

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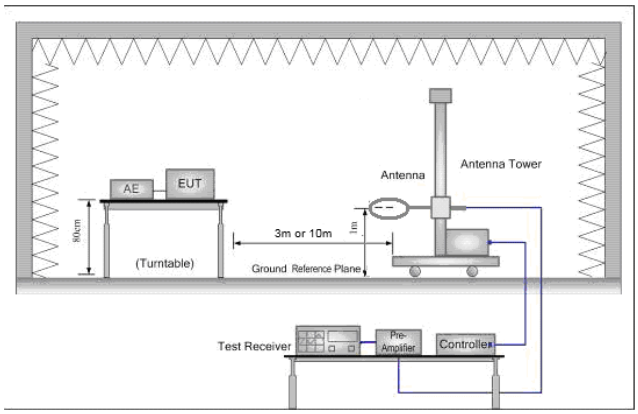

Figure 1. Below 30MHz

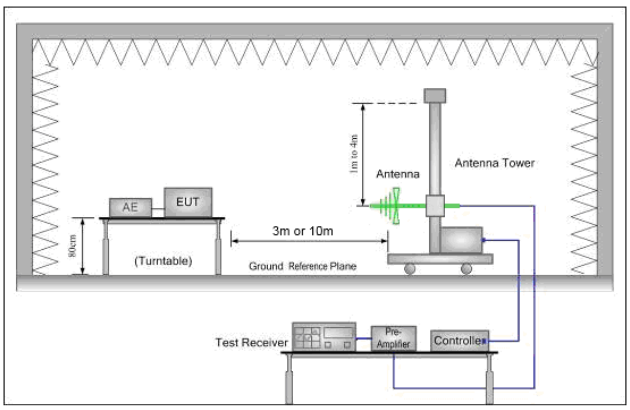

Figure 2. 30MHz to 1GHz

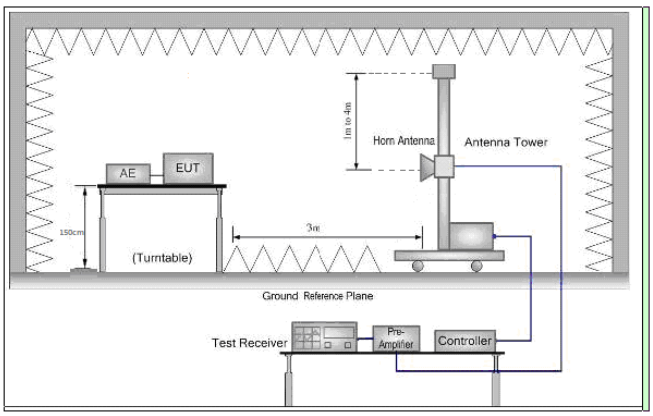

Figure 3. Above 1 GHz

Test Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ⩾ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds

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	On time = N 1 *L 1 +N 2 *L 2 +...+N n-1 *LN n-1 +N n *L n Where N 1 is number of type 1 pulses, L 1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log(Duty cycl f. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. h. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. i. Test the EUT in the lowest channel, the middle channel ,the Highest channel j. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. k. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode. Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11B; 6Mbps of rate is the worst case of 802.11G; 6.5Mbps of rate is the worst case of 802.11N(HT20); For below 1GHz, through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

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