

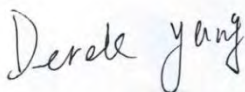
FCC TEST REPORT

Application No.: ZR/2020/A0015
Applicant: HMD global Oy
Address of Applicant: Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer: HMD global Oy
Address of Manufacturer: Bertel Jungin aukio 9, 02600 Espoo, Finland
EUT Description: Smart Phone
Model No.: TA-1322
Trade Mark: NOKIA
FCC ID: 2AJOTTA-1322
Standards: 47 CFR FCC Part 2, Subpart J
47 CFR Part 15, Subpart C
Date of Receipt: 2020/10/19
Date of Test: 2020/10/23 to 2020/12/10
Date of Issue: 2021/4/21

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature :



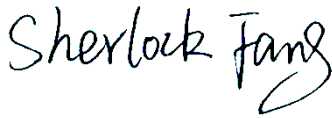
Derek Yang
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020-12-11		Original
02		2021-04-21	Sherlock Fang	1.Add test site Information 2. Modify data conversion error of antenna height 3.Update equipment list

Authorized for issue by:	
Prepared By	 (Sherlock Fang) / Engineer
Checked By	 (Jim Huang) / 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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3 General Information

3.1 Details of Client

Applicant:	HMD global Oy
Address of Applicant	Bertel Jungin aukio 9, 02600 Espoo, Finland
Manufacturer:	HMD global Oy
Address of Manufacturer	Bertel Jungin aukio 9, 02600 Espoo, Finland

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:	Smart Phone
Model No.:	TA-1322
Trade Mark:	NOKIA
Hardware Version:	V1.0
Software Version:	00WW_0_070
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 $f_c = 2407 \text{ MHz} + N * 5 \text{ MHz}$, where: $-f_c$ = "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:	-1.0dBi
Power Supply	☒ AC/DC Adapter; ☐ Battery ☐ PoE;; ☐ Other:

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		



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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
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 -1.0dBi.	



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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. 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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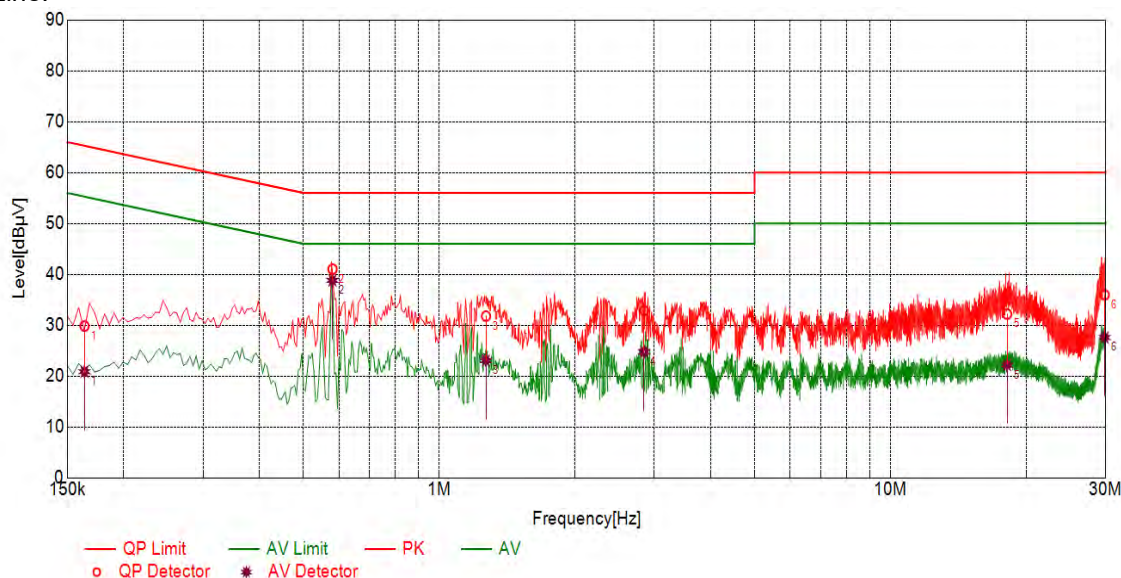
Measurement Data

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.

Firstly Supply:

Live Line:



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	0.1638	10.10	29.83	65.27	35.44	20.86	55.27	34.41	L
2	0.5805	10.10	41.02	56.00	14.98	38.81	46.00	7.19	L
3	1.2704	10.10	31.78	56.00	24.22	23.05	46.00	22.95	L
4	2.8461	10.10	32.89	56.00	23.11	24.78	46.00	21.22	L
5	18.1401	10.11	32.19	60.00	27.81	22.17	50.00	27.83	L
6	29.8459	10.11	35.97	60.00	24.03	27.58	50.00	22.42	L

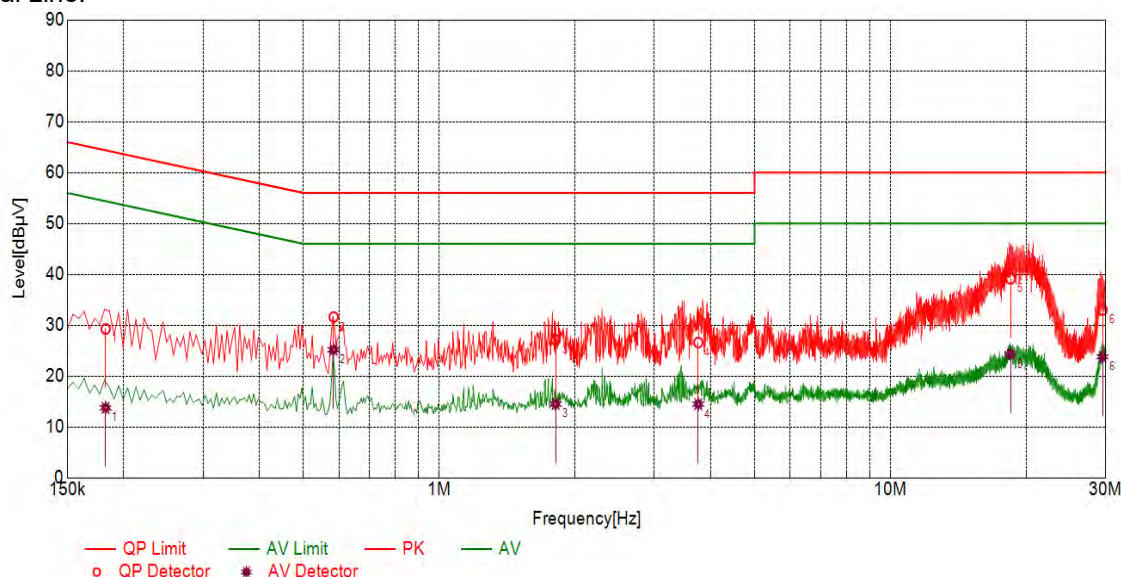


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Neutral Line:



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	0.1824	10.10	29.27	64.37	35.10	13.74	54.37	40.63	N
2	0.5838	10.10	31.60	56.00	24.40	25.17	46.00	20.83	N
3	1.8128	10.10	27.09	56.00	28.91	14.50	46.00	31.50	N
4	3.7529	10.10	26.60	56.00	29.40	14.48	46.00	31.52	N
5	18.4710	10.11	39.14	60.00	20.86	24.29	50.00	25.71	N
6	29.5255	10.11	33.00	60.00	27.00	23.79	50.00	26.21	N



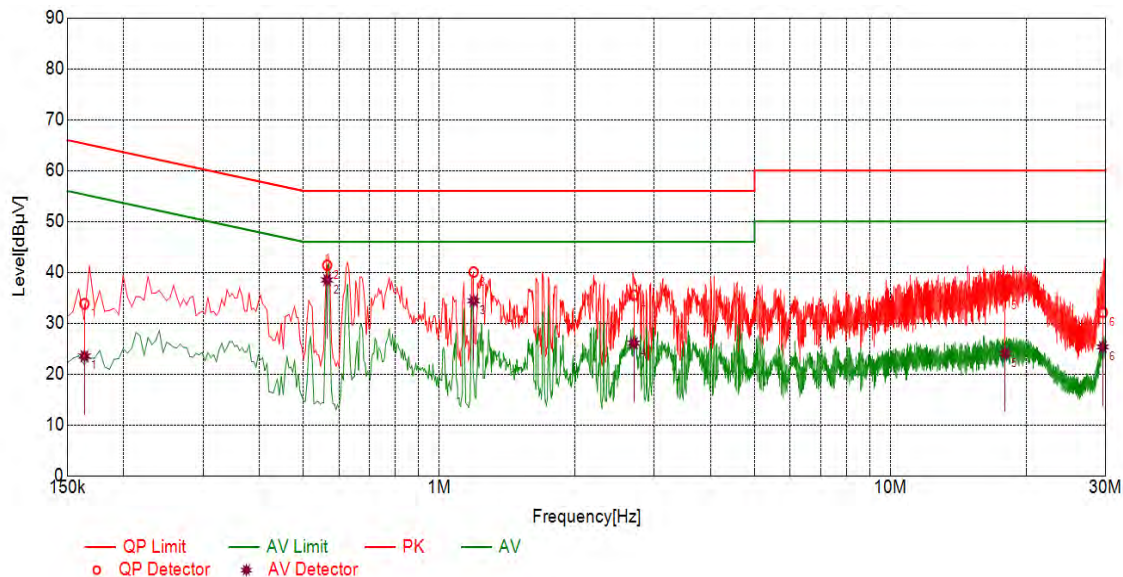
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Secondly Supply:

Live Line:



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	0.1638	10.10	33.82	65.27	31.45	23.53	55.27	31.74	L
2	0.5650	10.10	41.38	56.00	14.62	38.50	46.00	7.50	L
3	1.1924	10.10	40.05	56.00	15.95	34.41	46.00	11.59	L
4	2.7019	10.10	35.54	56.00	20.46	26.08	46.00	19.92	L
5	17.9746	10.11	35.35	60.00	24.65	24.08	50.00	25.92	L
6	29.5575	10.11	32.10	60.00	27.90	25.34	50.00	24.66	L

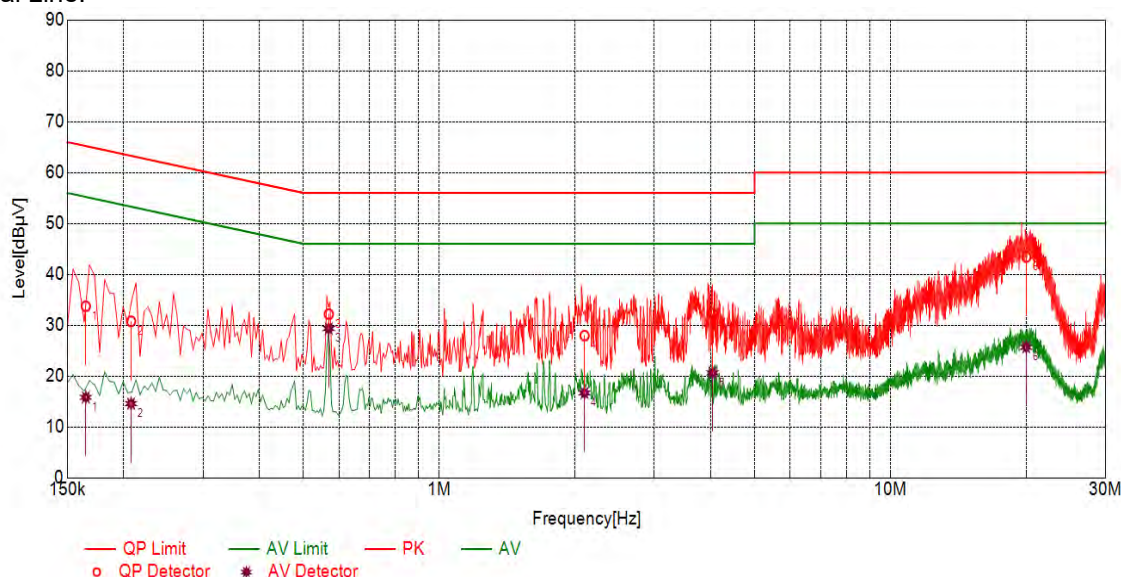


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Neutral Line:



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	0.1649	10.10	33.71	65.21	31.50	15.82	55.21	39.39	N
2	0.2077	10.10	30.76	63.30	32.54	14.59	53.30	38.71	N
3	0.5696	10.10	32.16	56.00	23.84	29.35	46.00	16.65	N
4	2.1006	10.10	27.96	56.00	28.04	16.68	46.00	29.32	N
5	4.0374	10.10	32.32	56.00	23.68	20.63	46.00	25.37	N
6	19.9997	10.11	43.40	60.00	16.60	25.66	50.00	24.34	N

Remarks:

- The following Quasi-Peak and Average measurements were performed on the EUT:
- 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	97.67
11G	Ant 1: CH1,CH6,CH11	87.04
11N20	Ant 1: CH1,CH6,CH11	86.70



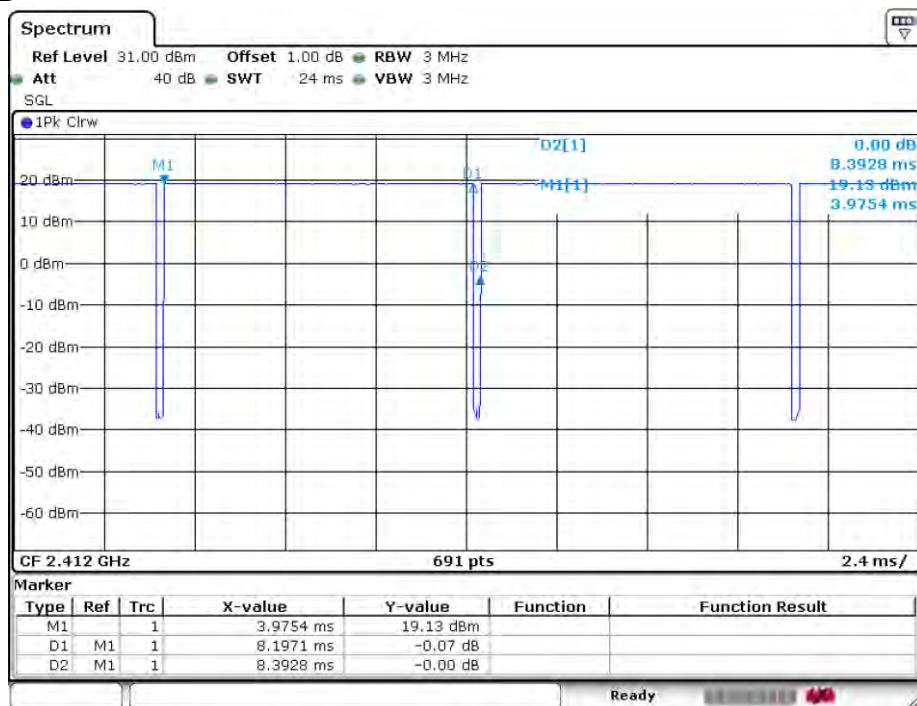
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4.3.2 Test Plots

4.3.2.1 ANT1

4.3.2.1.1 11B



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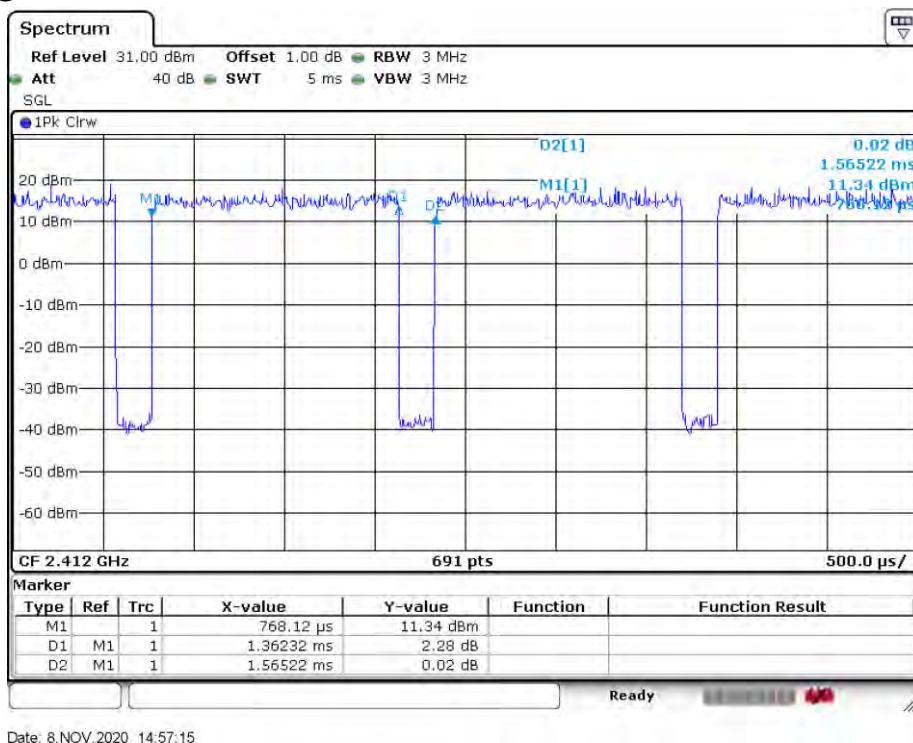
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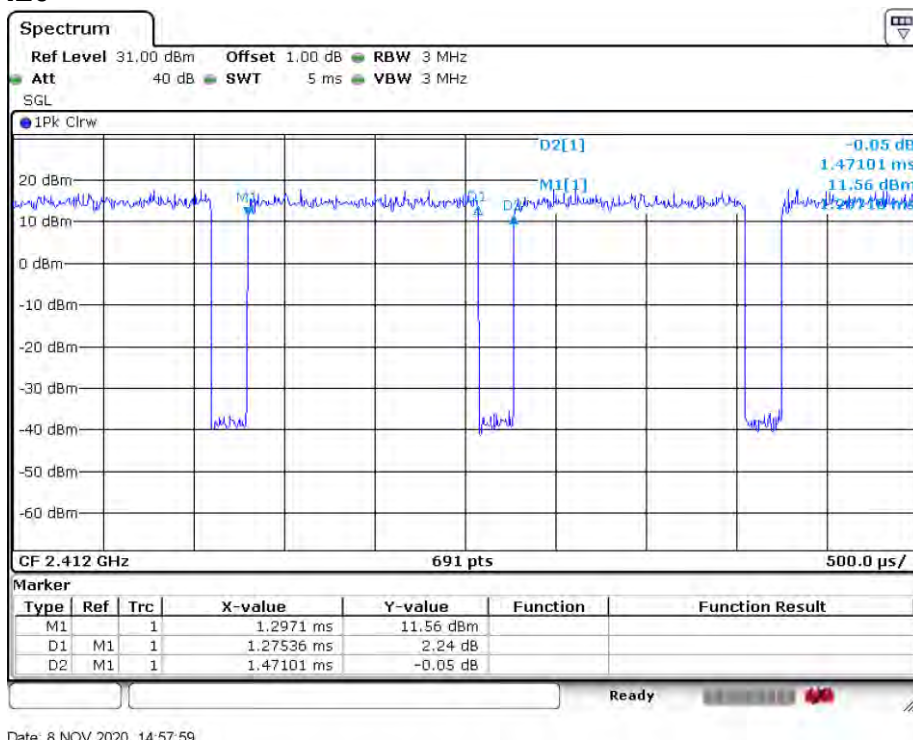
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4.3.2.1.2 11G



Date: 8.NOV.2020 14:57:15

4.3.2.1.3 11N20



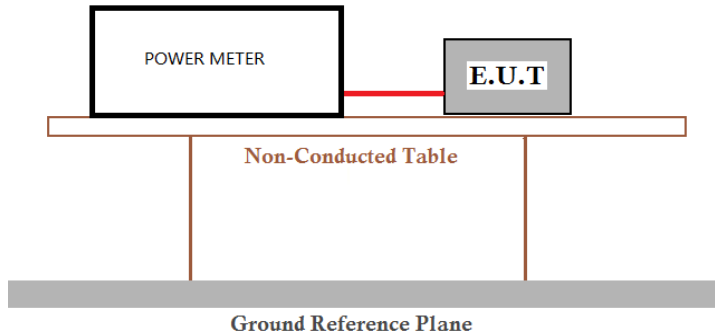
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4.4 Conducted Output Power

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);
Limit:	30dBm
Test Results:	Pass



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4.4.1 Test Results

Measurement Data of Peak Power:

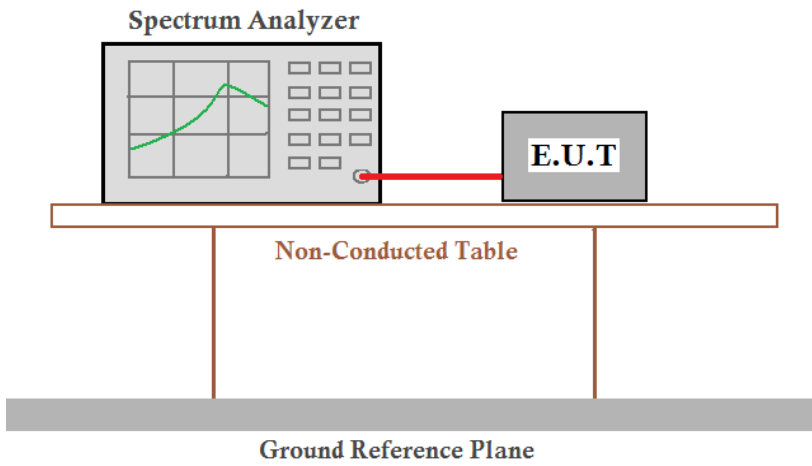
Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	19.69	30.00	Pass
	Middle	19.47	30.00	Pass
	Highest	19.21	30.00	Pass
802.11G	Lowest	16.61	30.00	Pass
	Middle	16.37	30.00	Pass
	Highest	16.37	30.00	Pass
802.11N20	Lowest	15.64	30.00	Pass
	Middle	15.25	30.00	Pass
	Highest	15.55	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:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
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

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	13.24	8.55	≥500	Pass
	Middle	13.15	9.03	≥500	Pass
	Highest	13.24	9.07	≥500	Pass
802.11G	Lowest	17.15	16.41	≥500	Pass
	Middle	17.28	16.46	≥500	Pass
	Highest	17.50	16.46	≥500	Pass
802.11N20	Lowest	18.10	17.54	≥500	Pass
	Middle	18.19	17.58	≥500	Pass
	Highest	18.32	17.58	≥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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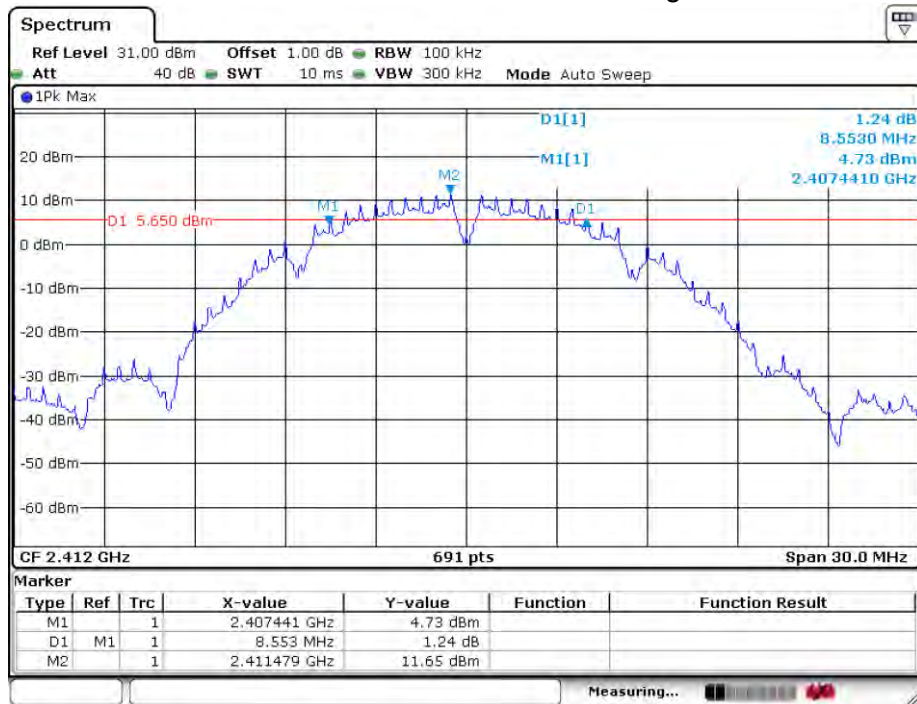


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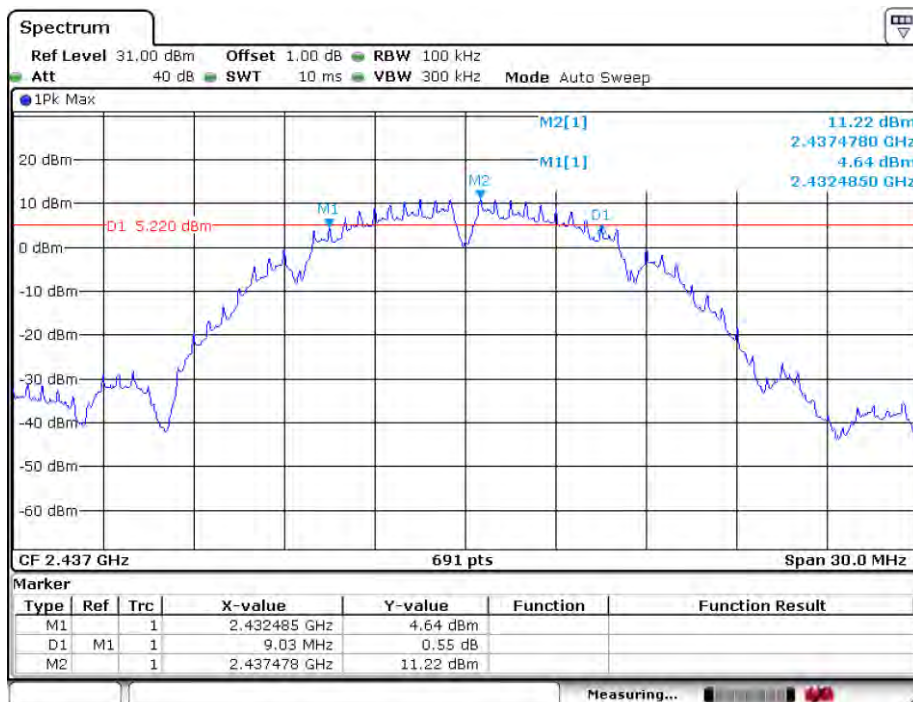
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4.5.2.1.2 802.11B_Middle Channel



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Date: 8.NOV.2020 14:31:12



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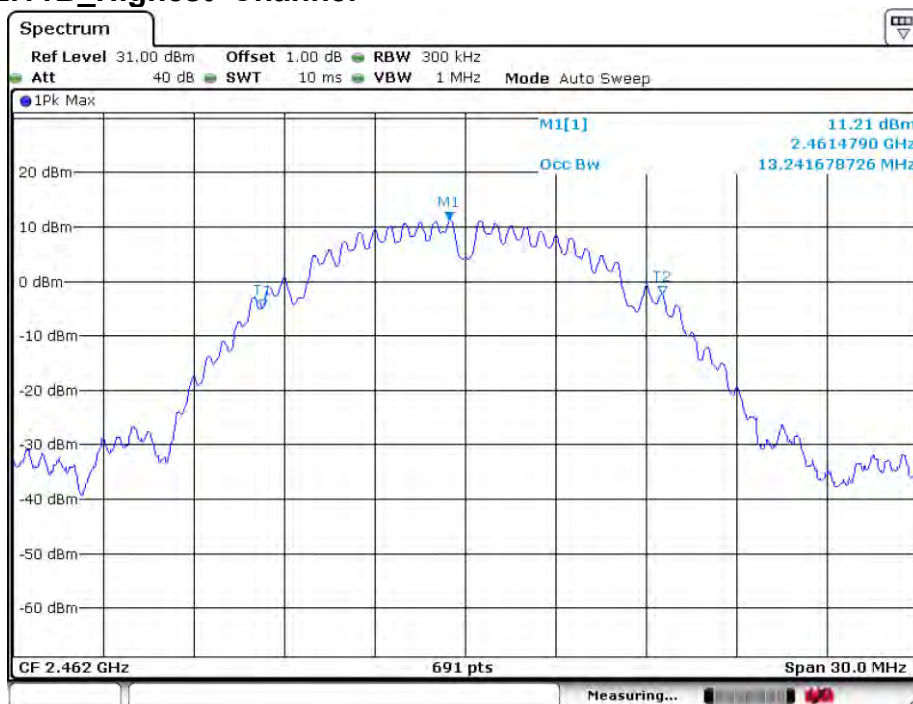
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4.5.2.1.3 802.11B_Highest Channel



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Date: 8.NOV.2020 14:31:50



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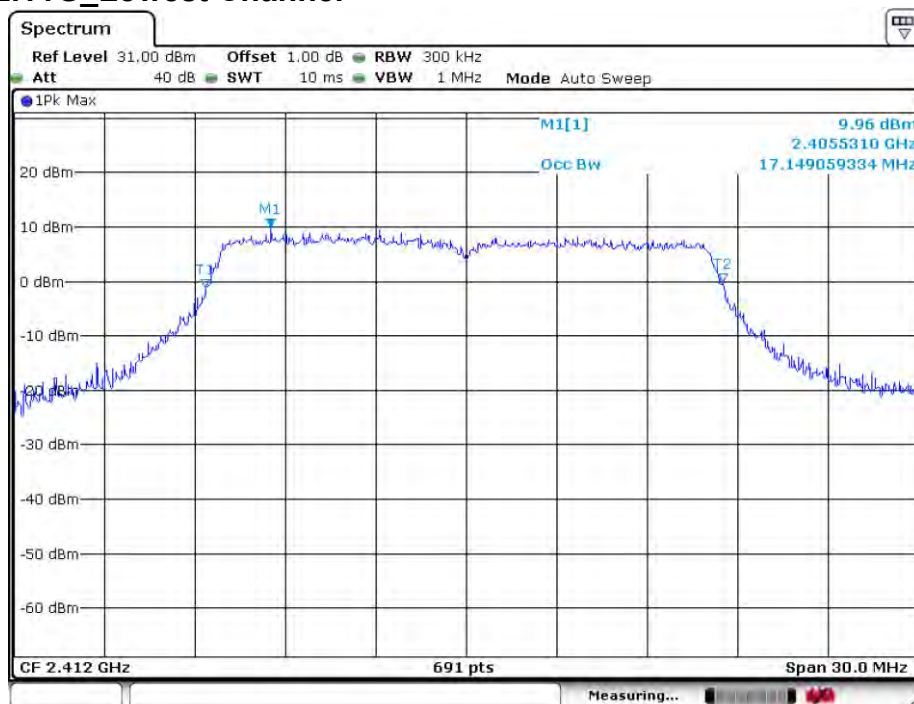
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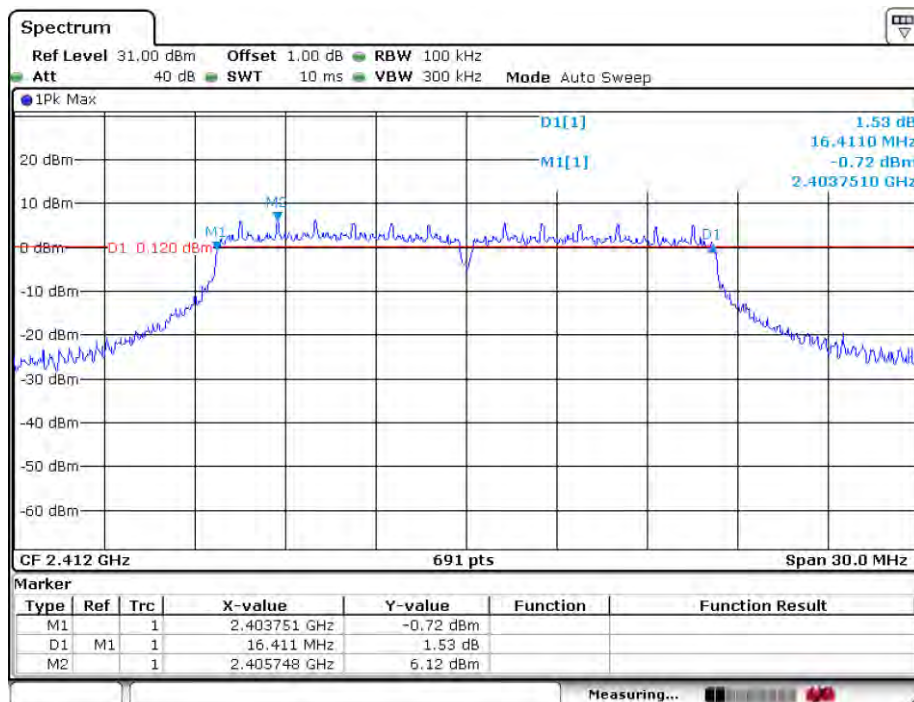
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4.5.2.1.4 802.11G_Lowest Channel



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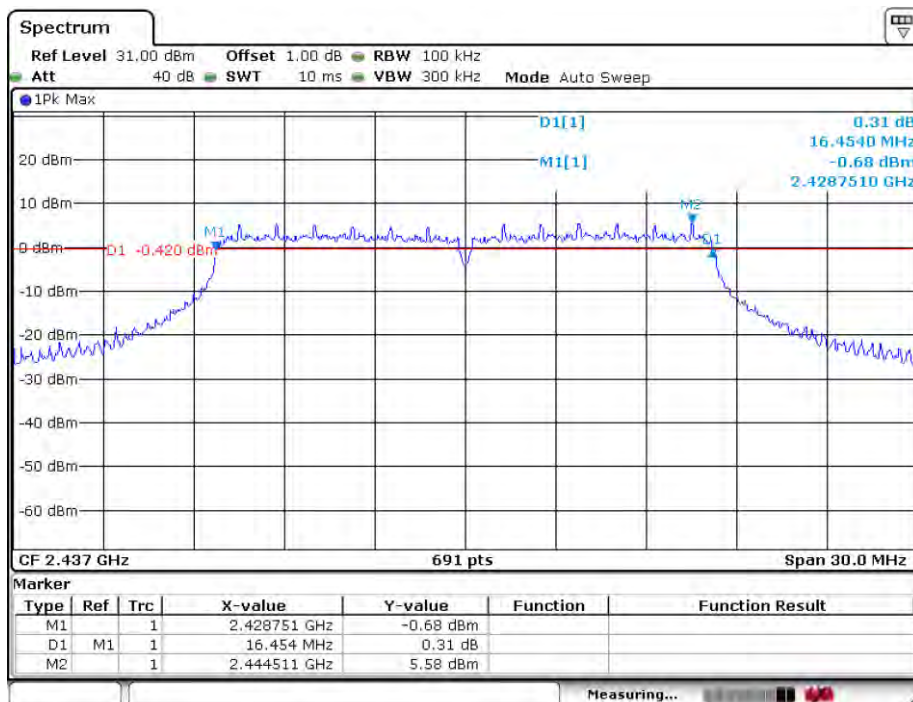
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4.5.2.1.5 802.11G_Middle Channel



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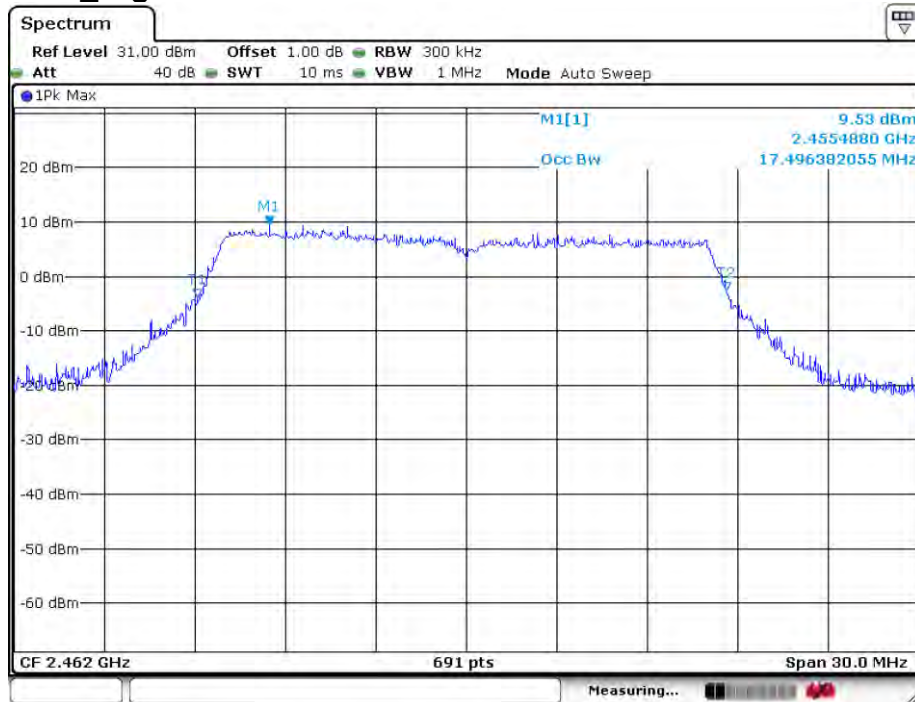
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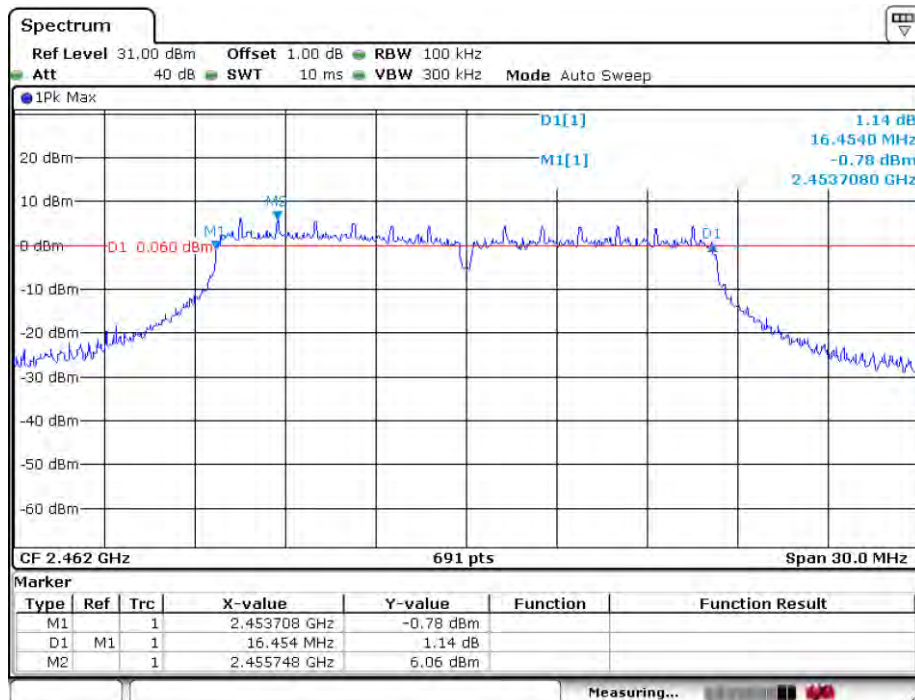
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4.5.2.1.6 802.11G_Highest Channel



Date: 8.NOV.2020 14:44:43



Date: 8.NOV.2020 14:21:02



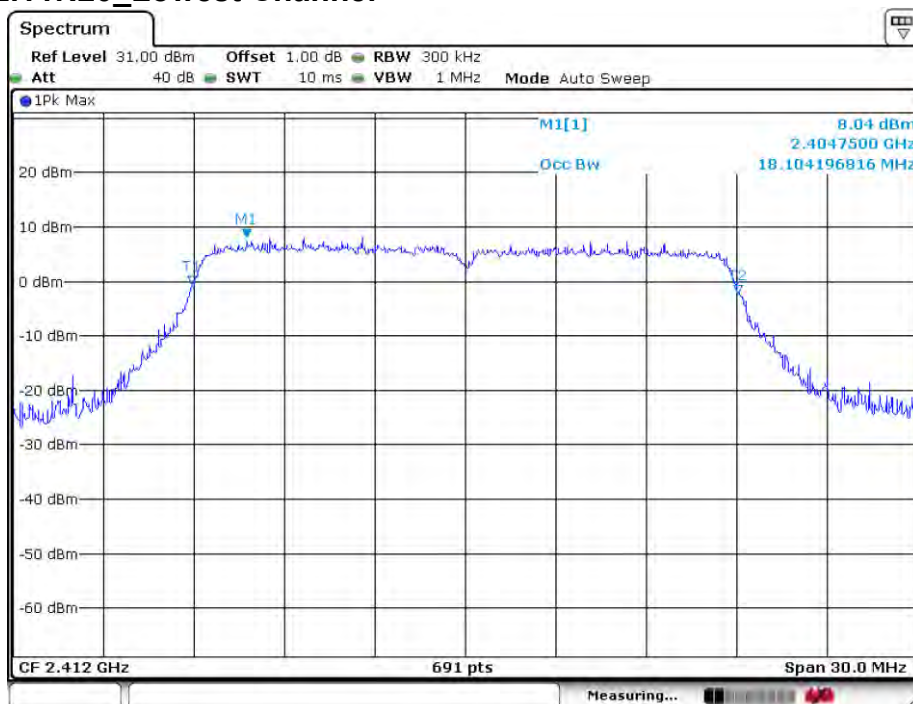
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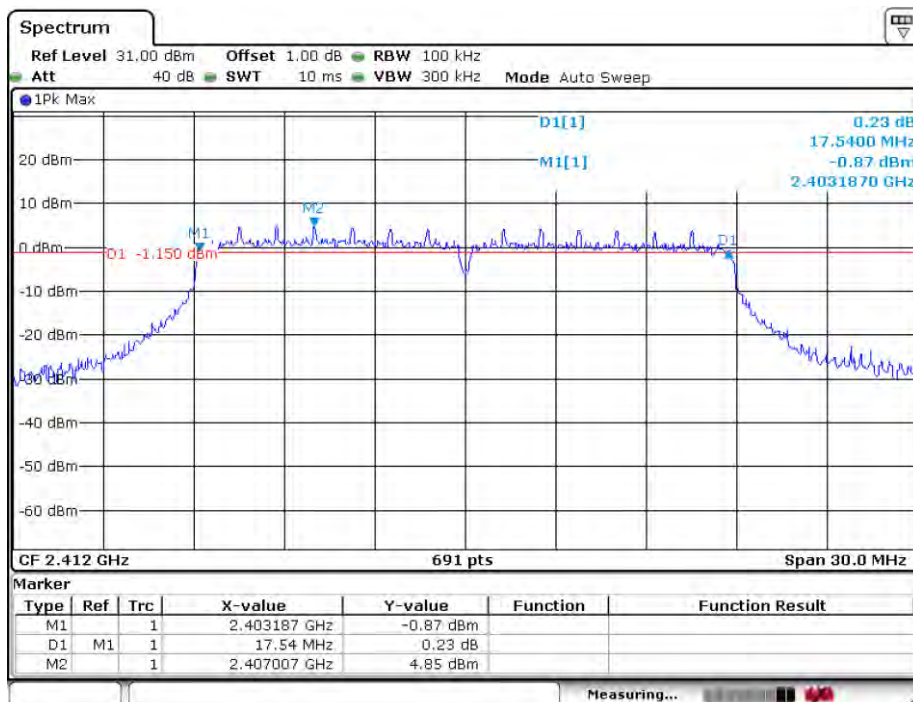
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4.5.2.1.7 802.11N20_Lowest Channel



Date: 8.NOV.2020 14:42:55



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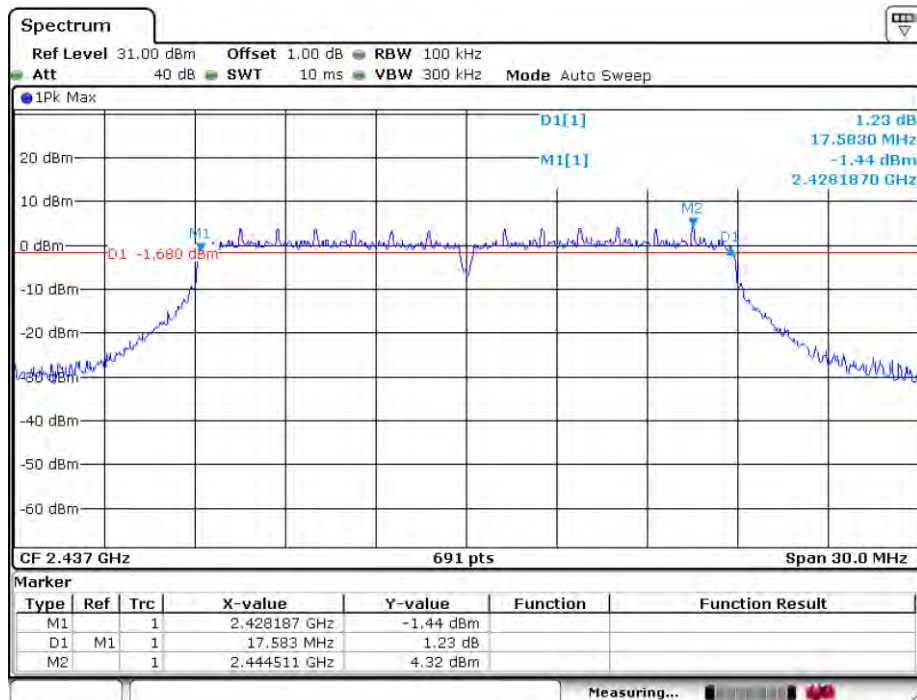


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4.5.2.1.8 802.11N20_Middle Channel



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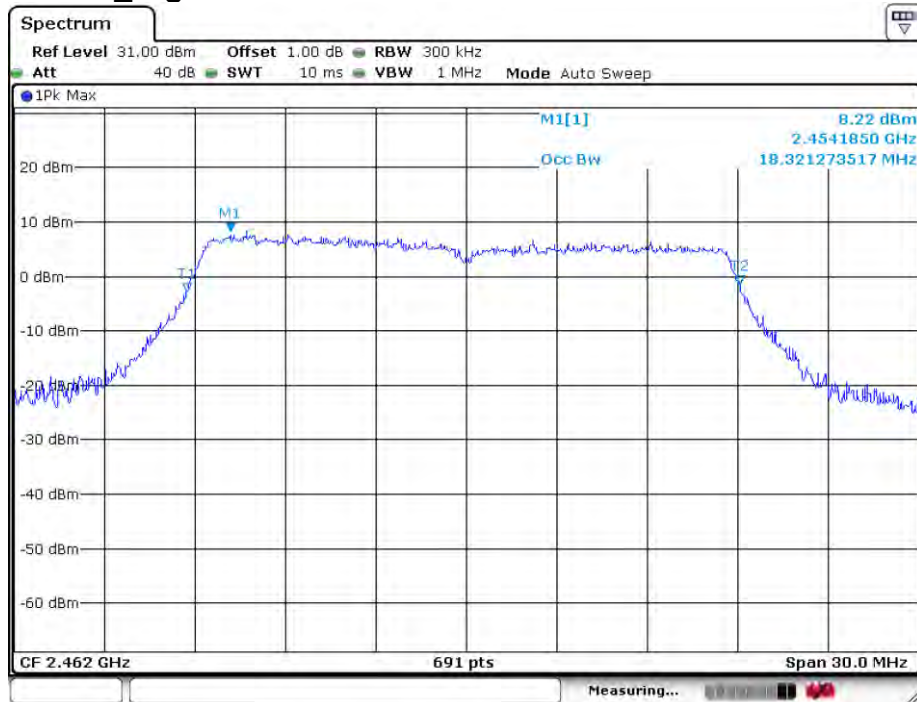
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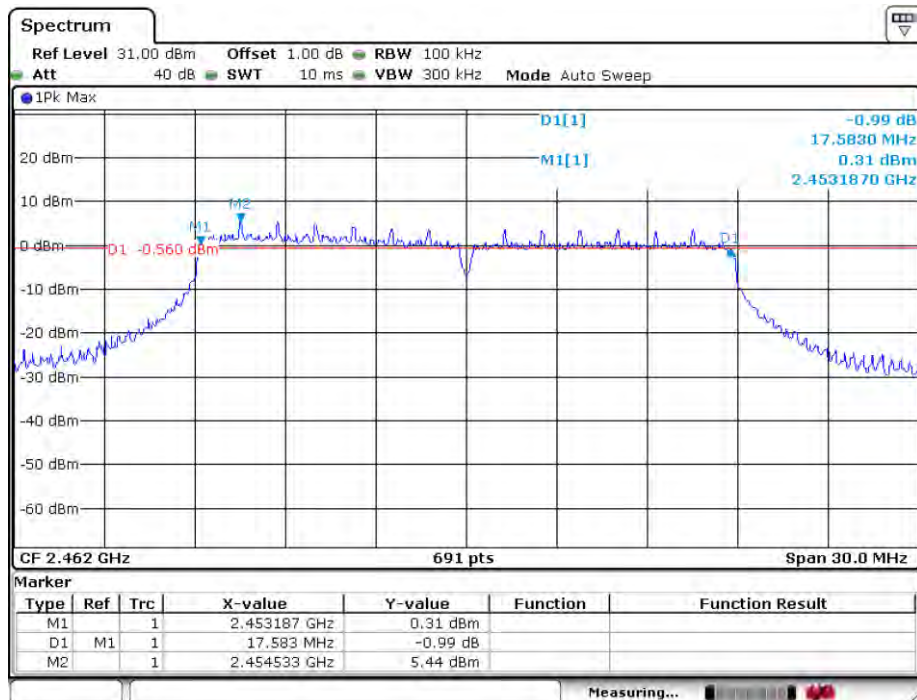
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4.5.2.1.9 802.11N20_Highest Channel



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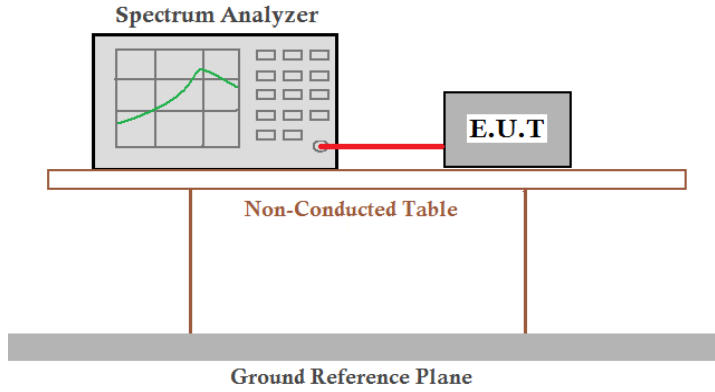
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4.6 Power Spectral Density

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

4.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	Lowest	-1.98	≤8.00	Pass
	Middle	-2.44	≤8.00	Pass
	Highest	-2.14	≤8.00	Pass
802.11G	Lowest	-7.02	≤8.00	Pass
	Middle	-5.99	≤8.00	Pass
	Highest	-6.47	≤8.00	Pass
802.11N20	Lowest	-8.04	≤8.00	Pass
	Middle	-8.66	≤8.00	Pass
	Highest	-9.00	≤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

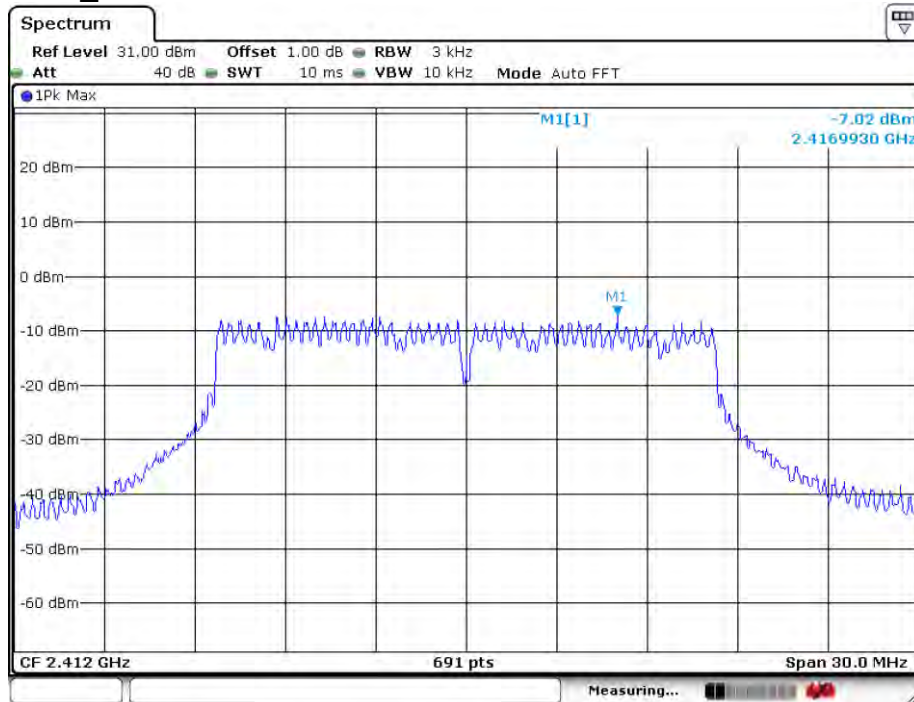


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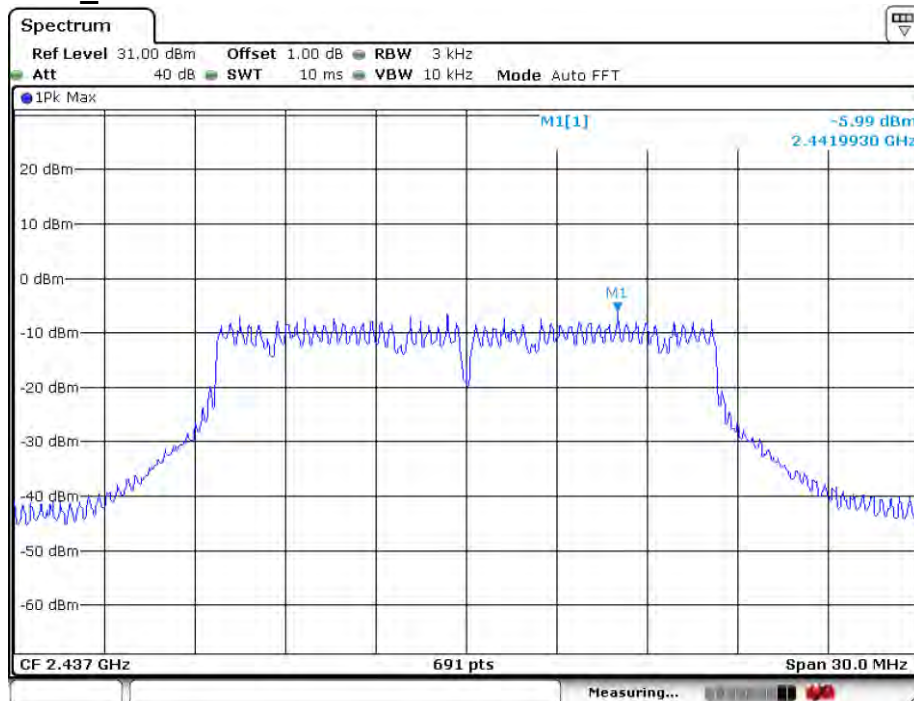
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4.6.2.1.4 802.11G_Lowest Channel



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4.6.2.1.5 802.11G_Middle Channel

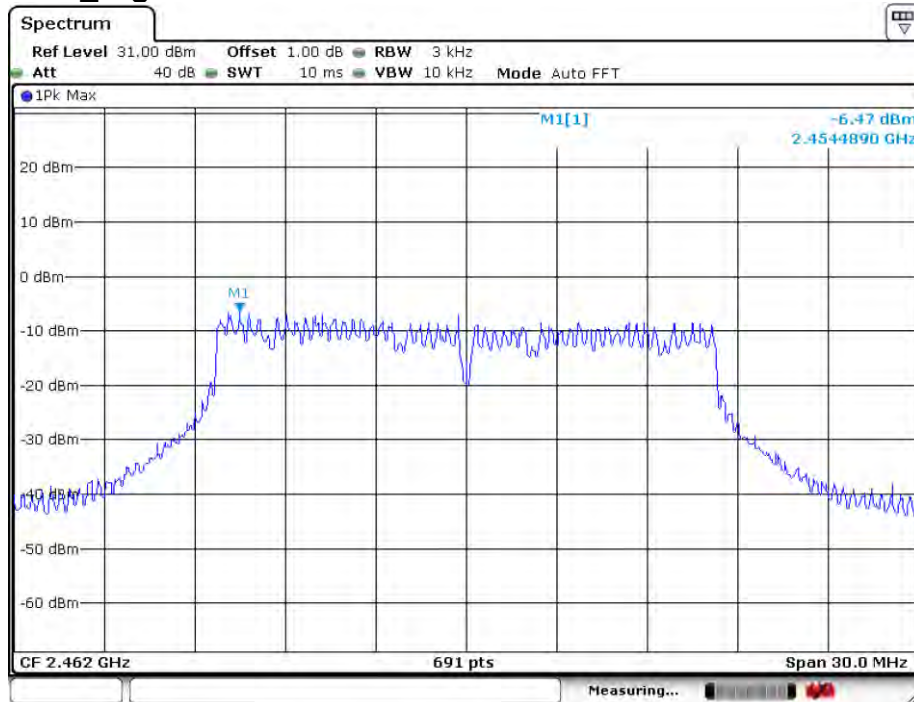


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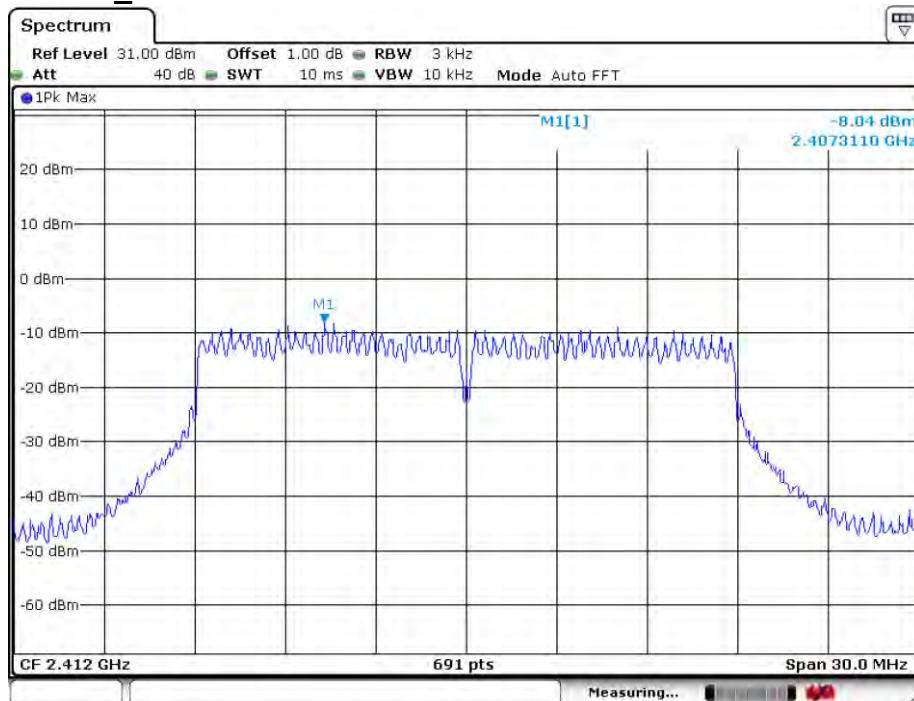
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4.6.2.1.6 802.11G_Highest Channel



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4.6.2.1.7 802.11N20_Lowest Channel



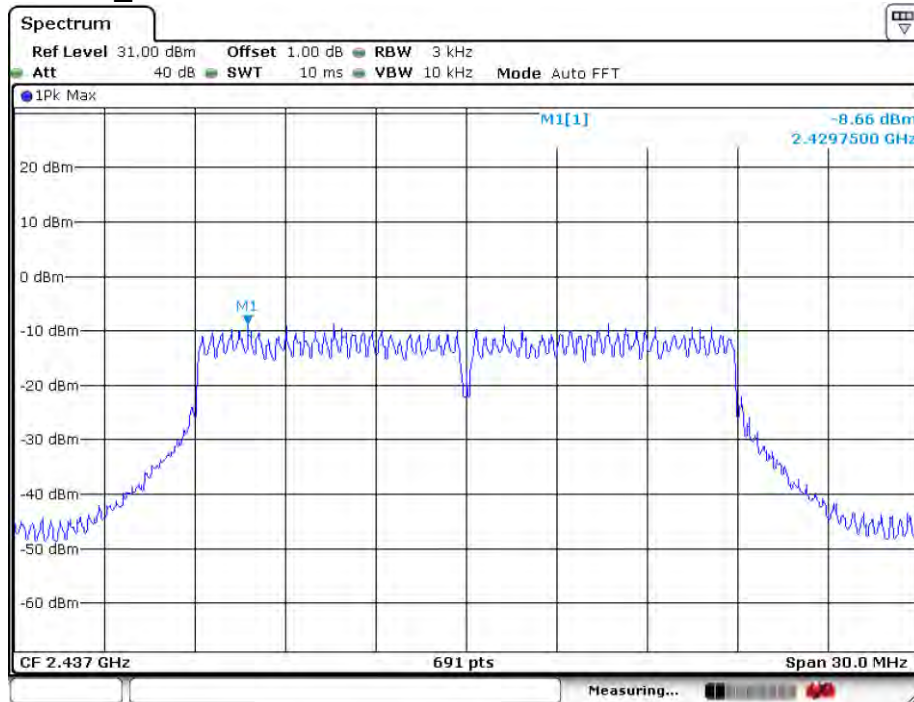
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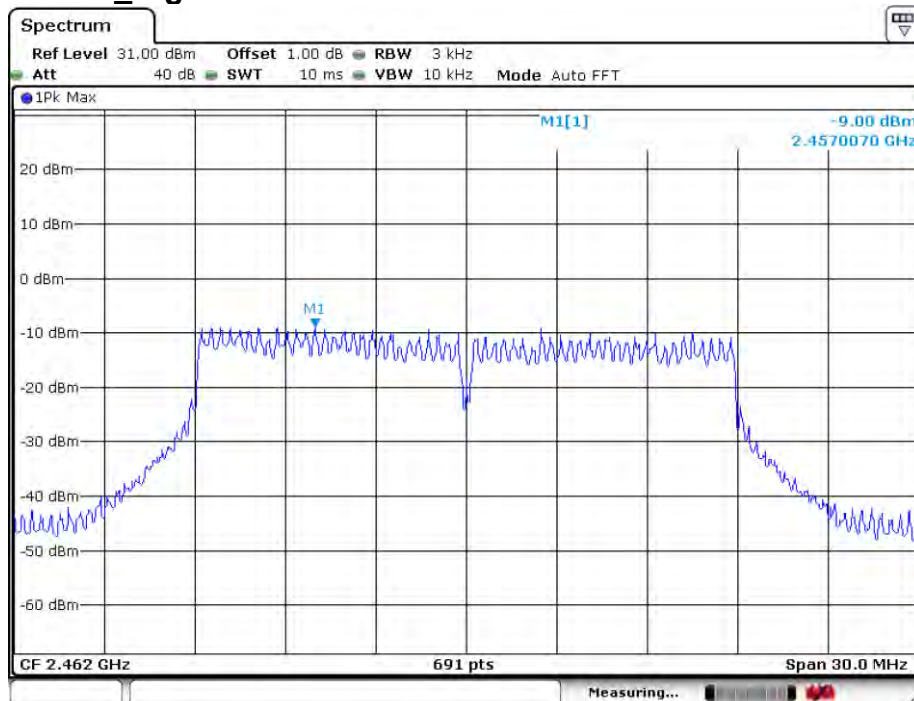
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4.6.2.1.9 802.11N20_Highest Channel



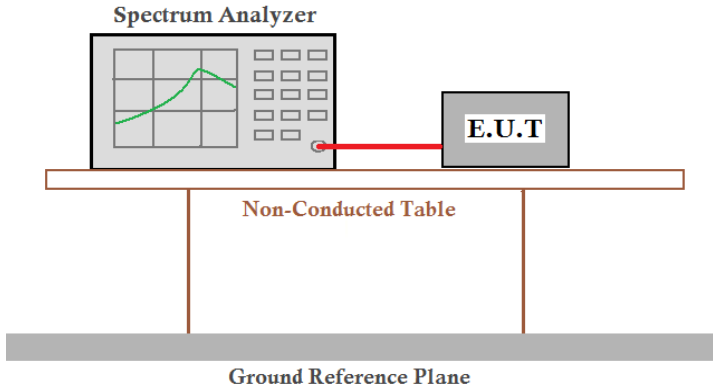
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4.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
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:	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.
Test Results:	Pass



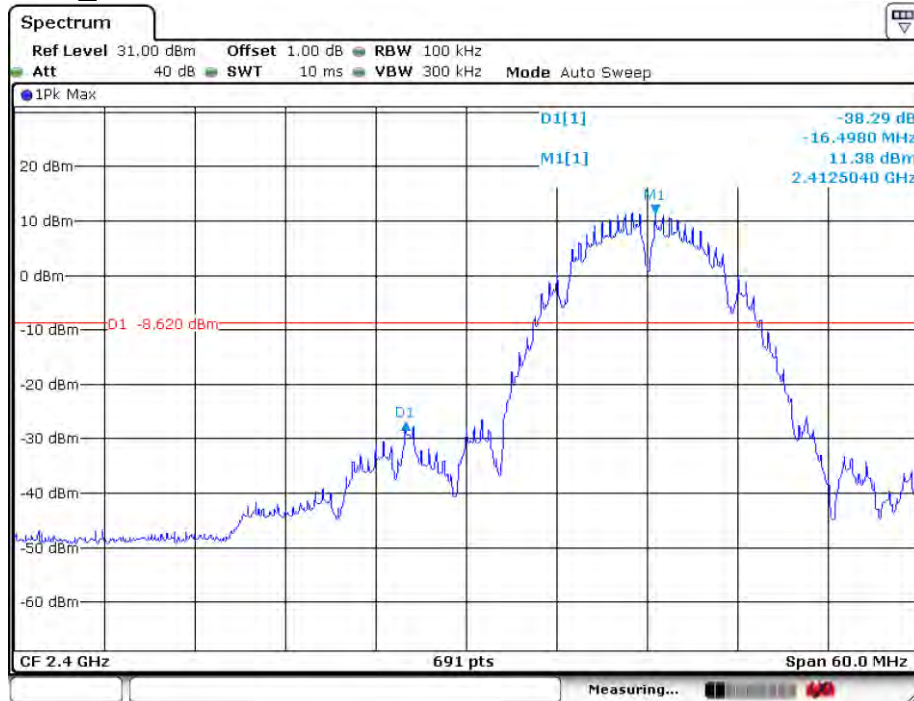
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4.7.1 Test Plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



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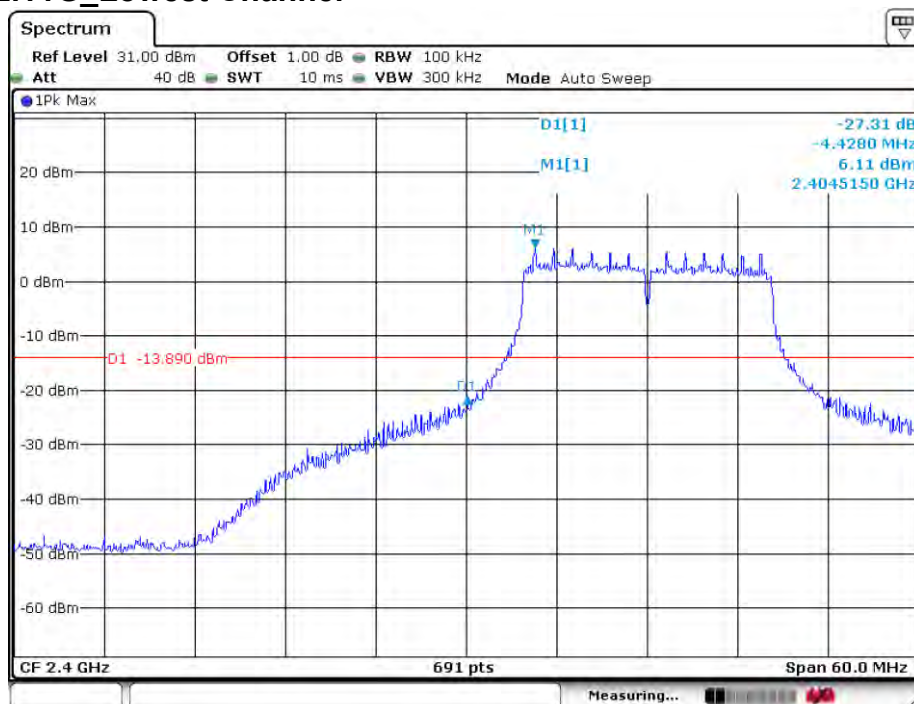
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4.7.1.1.2 802.11B_Highest Channel



Date: 8.NOV.2020 14:32:24

4.7.1.1.3 802.11G_Lowest Channel



Date: 8.NOV.2020 14:34:24



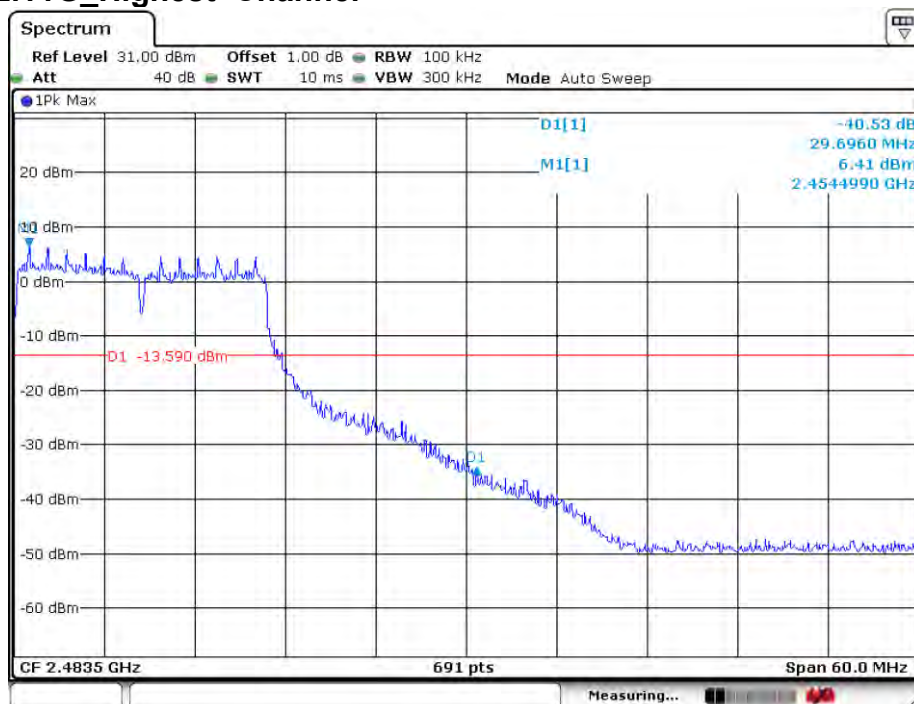
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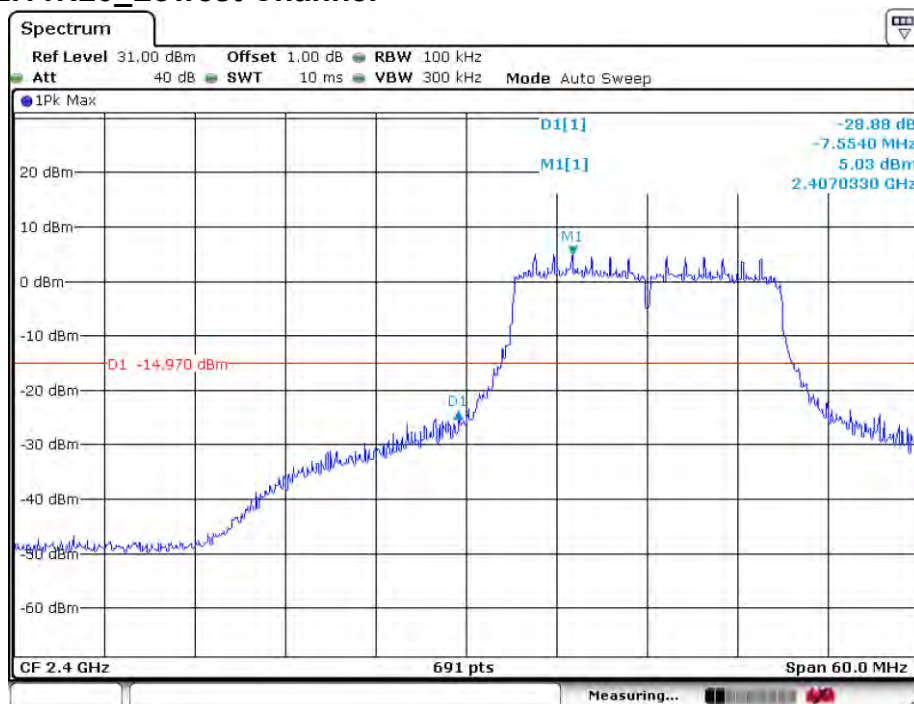
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4.7.1.1.4 802.11G_Highest Channel



Date: 8.NOV.2020 14:34:57

4.7.1.1.5 802.11N20_Lowest Channel



Date: 8.NOV.2020 14:40:42



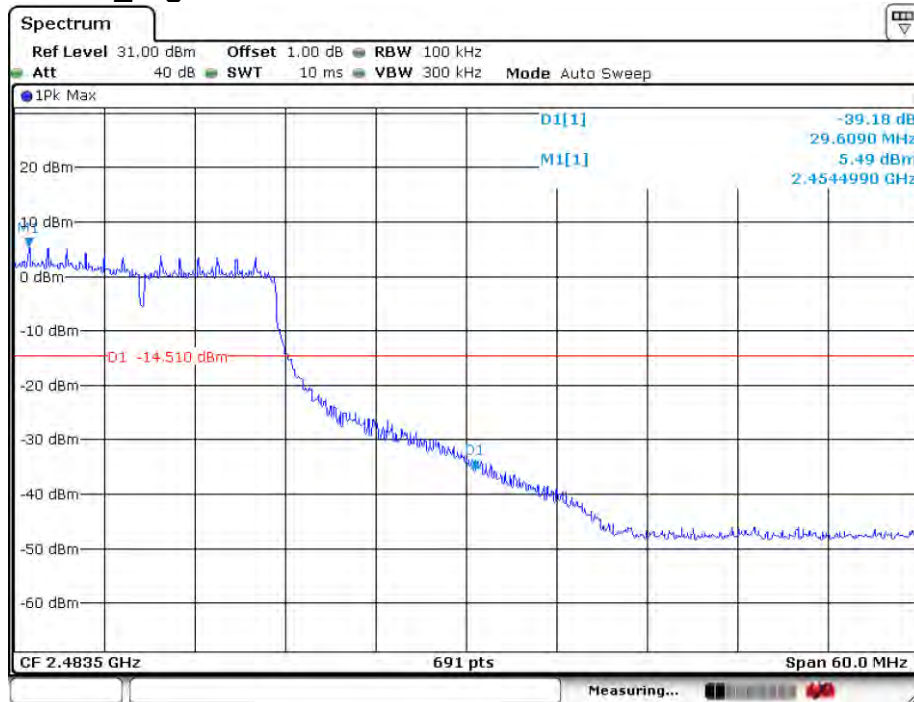
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4.7.1.1.6 802.11N20_Highest Channel



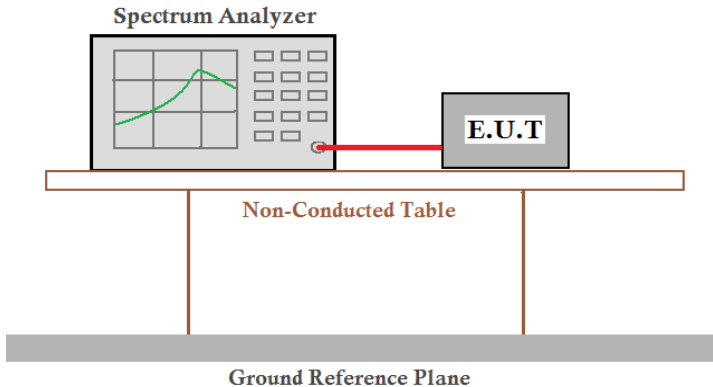
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4.8 RF Conducted Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
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:	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.
Test Results:	Pass



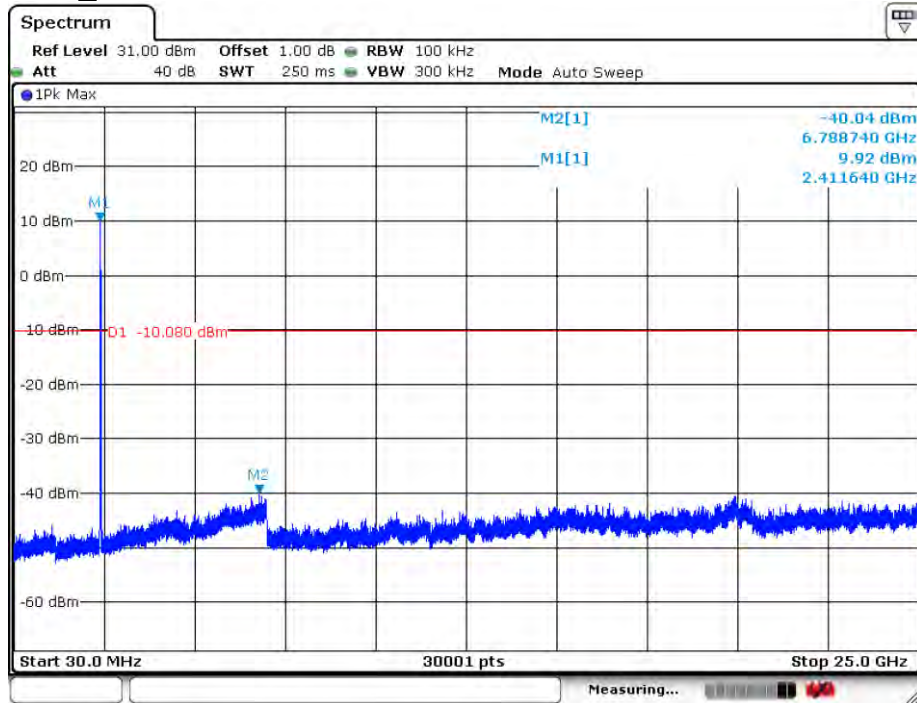
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4.8.1 Test Plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



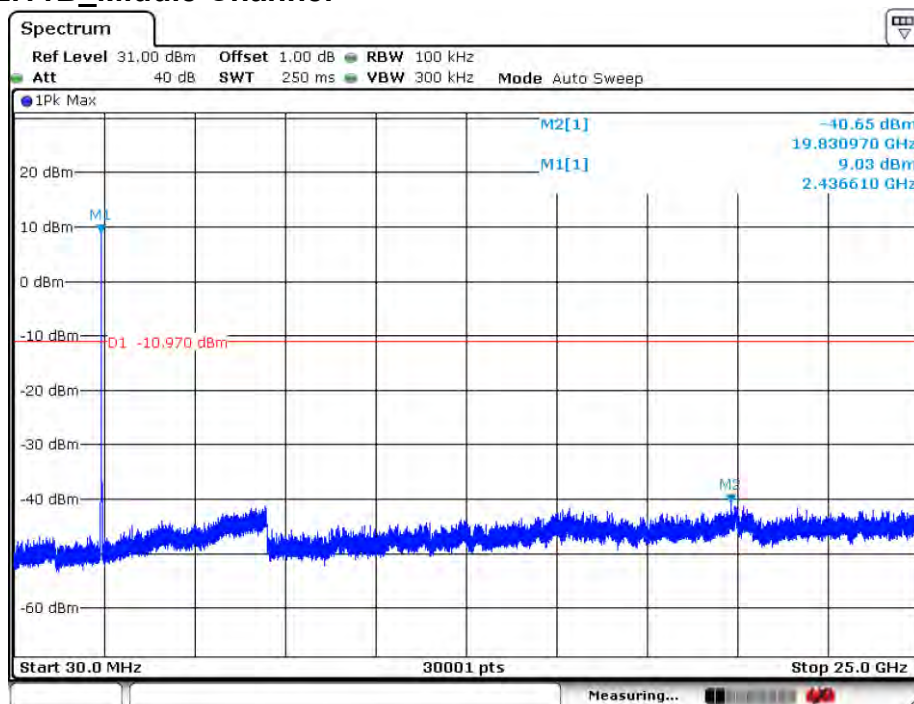
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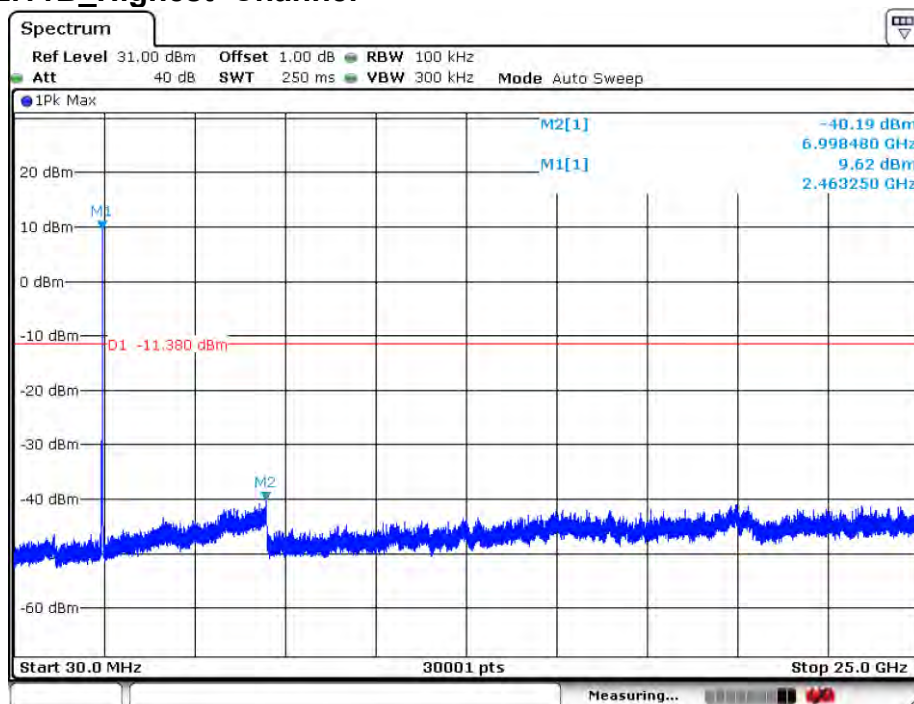
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4.8.1.1.2 802.11B_Middle Channel



Date: 8.NOV.2020 14:52:38

4.8.1.1.3 802.11B_Highest Channel



Date: 8.NOV.2020 14:51:56



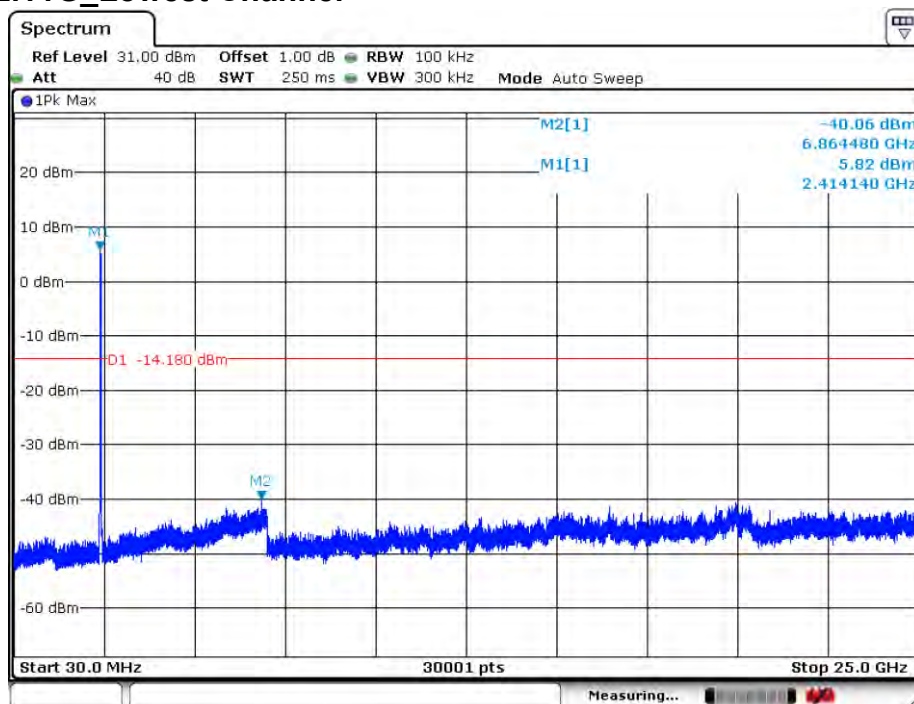
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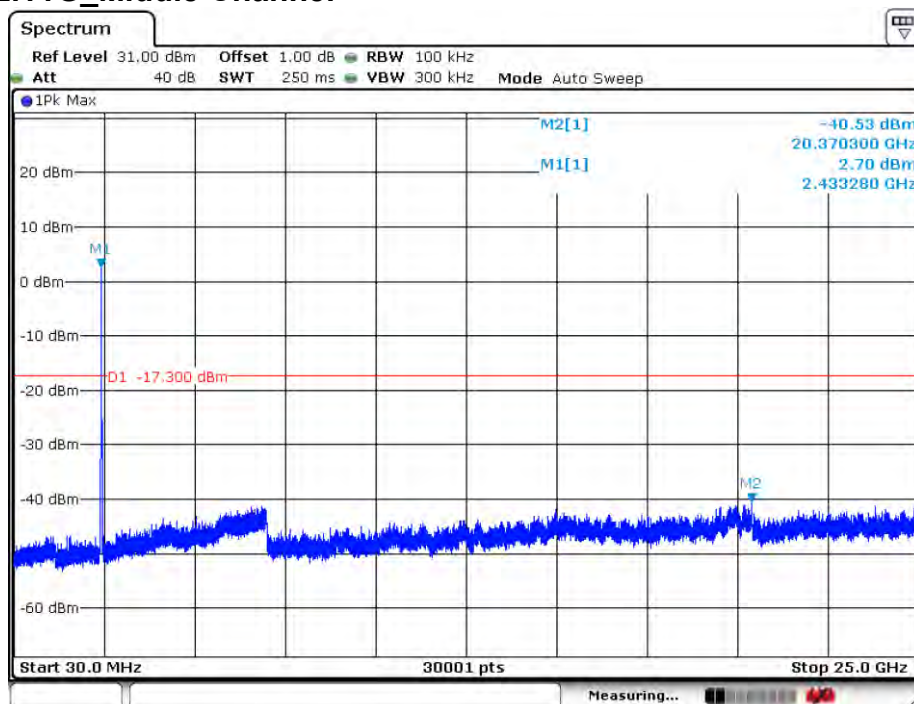
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4.8.1.1.4 802.11G_Lowest Channel



Date: 8.NOV.2020 14:54:27

4.8.1.1.5 802.11G_Middle Channel



Date: 8.NOV.2020 14:55:12

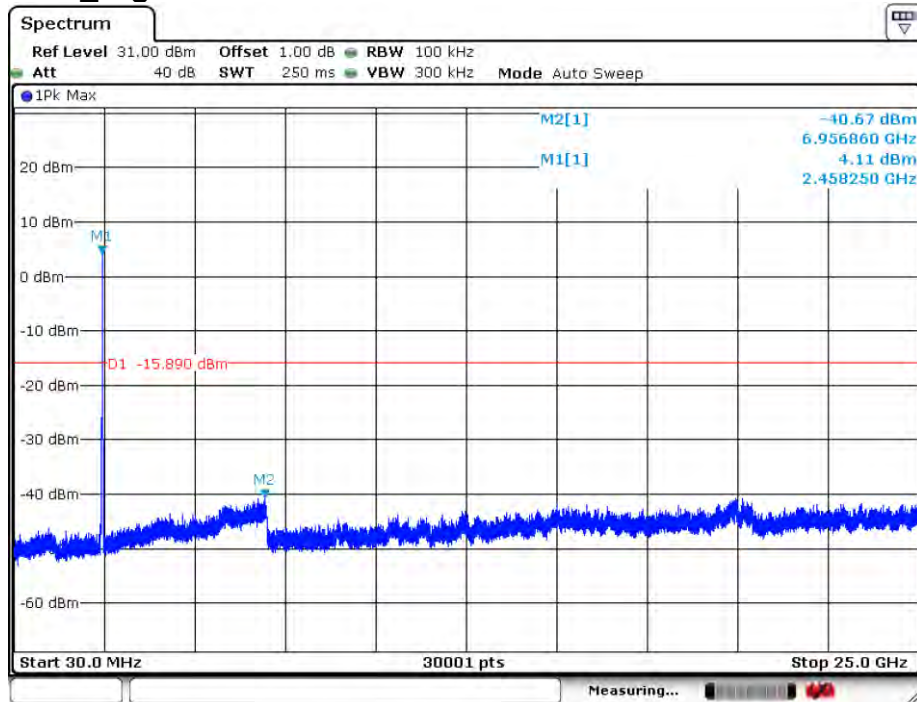


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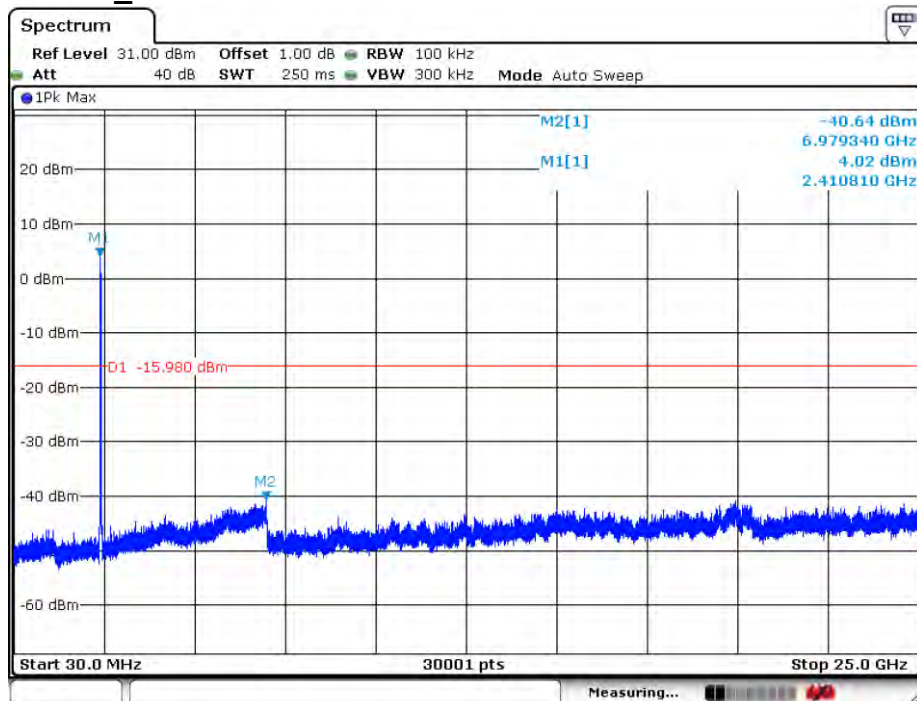
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4.8.1.1.6 802.11G_Highest Channel



Date: 8.NOV.2020 14:56:22

4.8.1.1.7 802.11N20_Lowest Channel

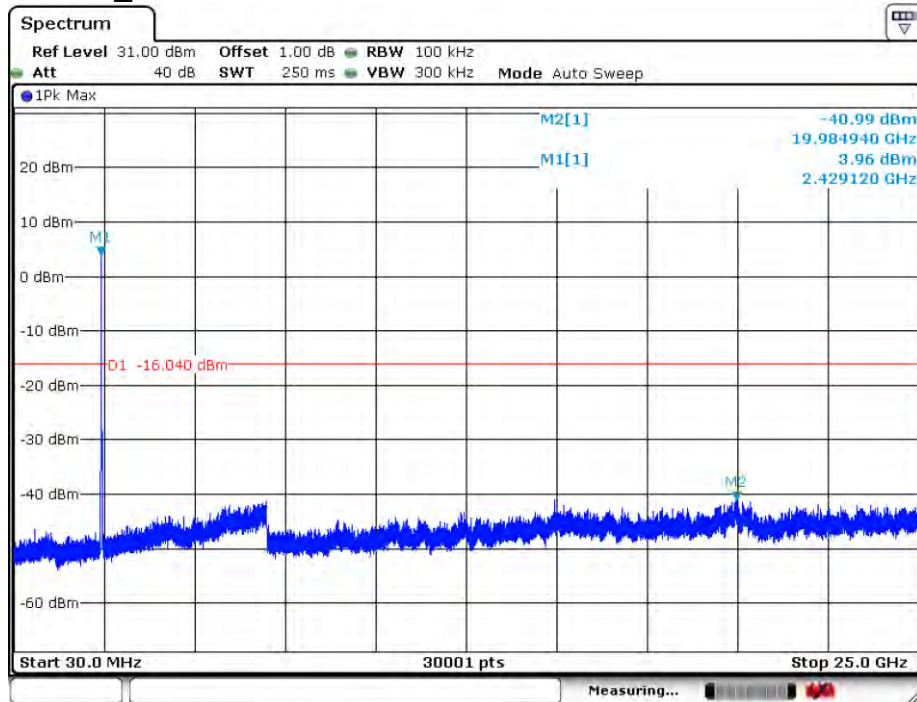


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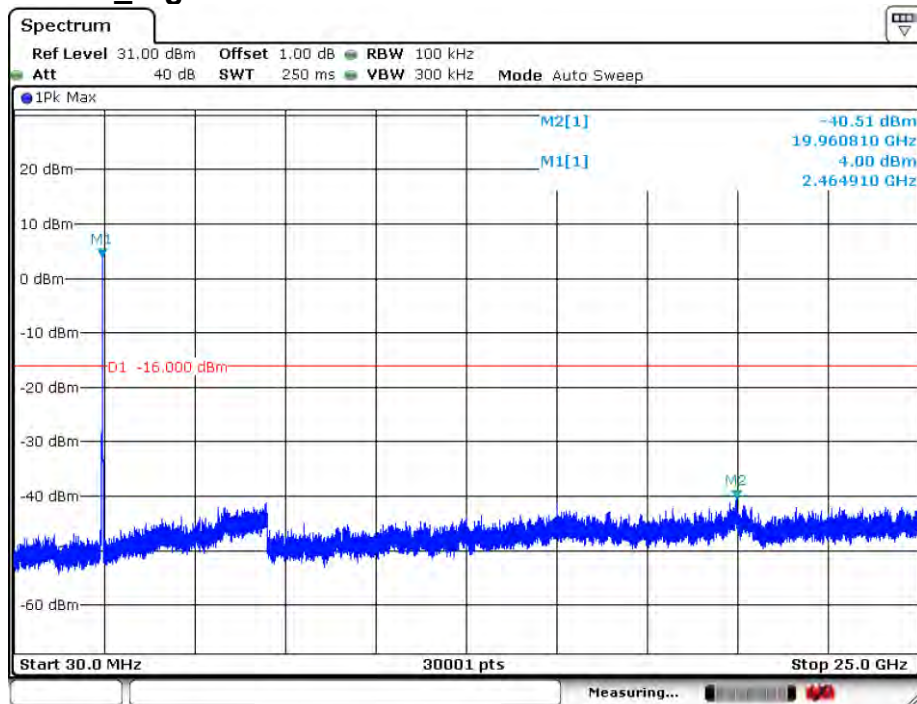
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4.8.1.1.8 802.11N20_Middle Channel



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4.8.1.1.9 802.11N20_Highest Channel



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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	100kHz	30kHz	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.				



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Test Setup:

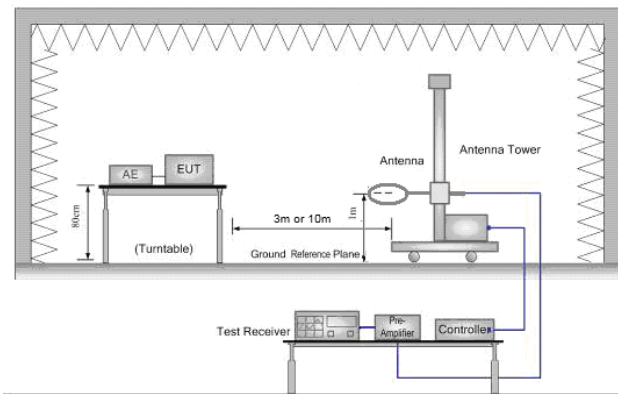


Figure 1. Below 30MHz

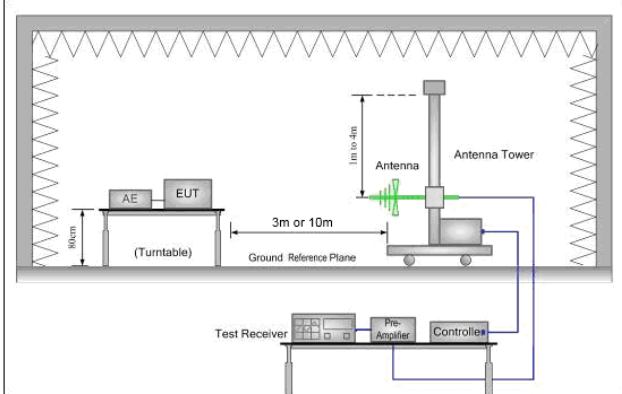


Figure 2. 30MHz to 1GHz

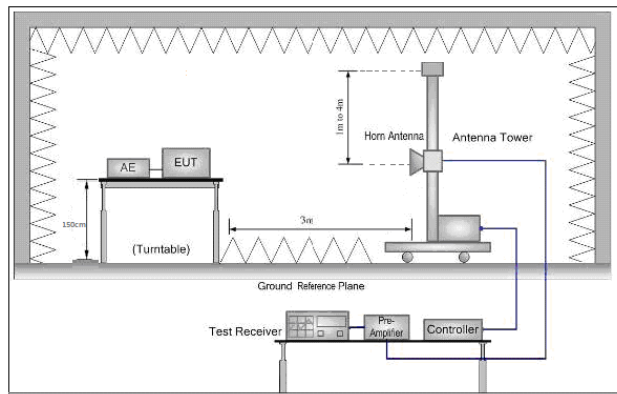


Figure 3. Above 1 GHz

Test Procedure:

- 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 chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 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 chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- 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.
- 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.
- Use the following spectrum analyzer settings:
 - Span shall wide enough to fully capture the emission being measured;
 - Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ;
VBW $\geq$ RBW; Sweep = auto;
Detector function = peak; Trace = max hold for peak
 - 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 = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$ Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + $20 \cdot \log(\text{Duty cycle})$ 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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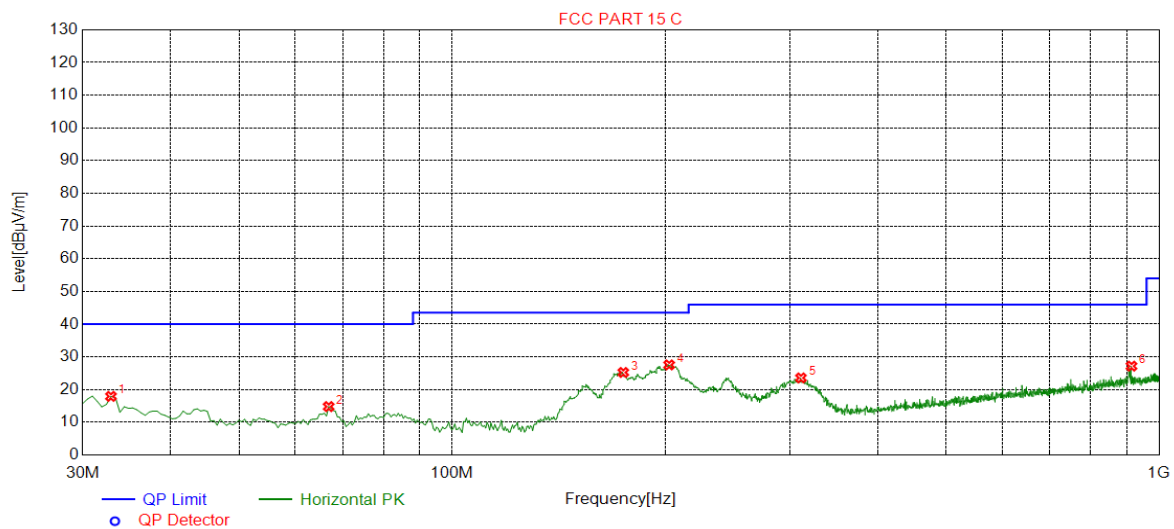
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No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Firstly Supply:

4.9.1 Radiated emission below 1GHz

4.9.1.1 Charge + Transmitting



Suspected List

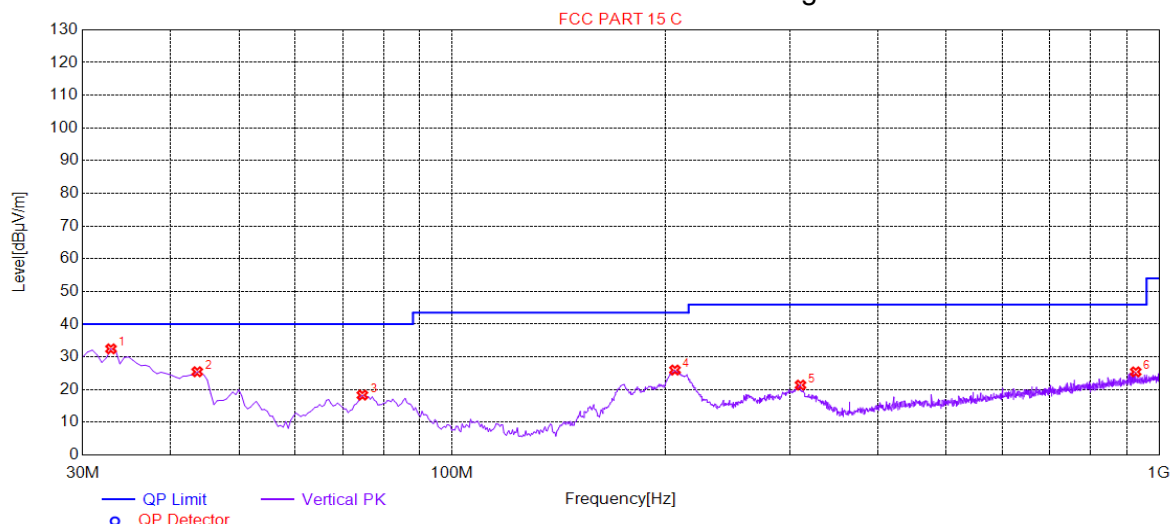
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	32.9115	17.93	-32.79	40.00	22.07	172	Horizontal
2	66.8784	14.81	-33.39	40.00	25.19	209	Horizontal
3	174.6023	25.25	-33.29	43.50	18.25	174	Horizontal
4	202.7464	27.55	-30.76	43.50	15.95	175	Horizontal
5	311.4407	23.58	-27.52	46.00	22.42	115	Horizontal
6	914.1121	27.18	-15.02	46.00	18.82	227	Horizontal

Final Data List



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Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	32.9115	32.46	-32.79	40.00	7.54	193	Vertical
2	43.5868	25.46	-30.48	40.00	14.54	273	Vertical
3	74.6423	18.31	-34.96	40.00	21.69	247	Vertical
4	206.6283	25.98	-30.68	43.50	17.52	293	Vertical
5	310.9555	21.38	-27.53	46.00	24.62	287	Vertical
6	926.7284	25.43	-14.82	46.00	20.57	233	Vertical

Final Data List

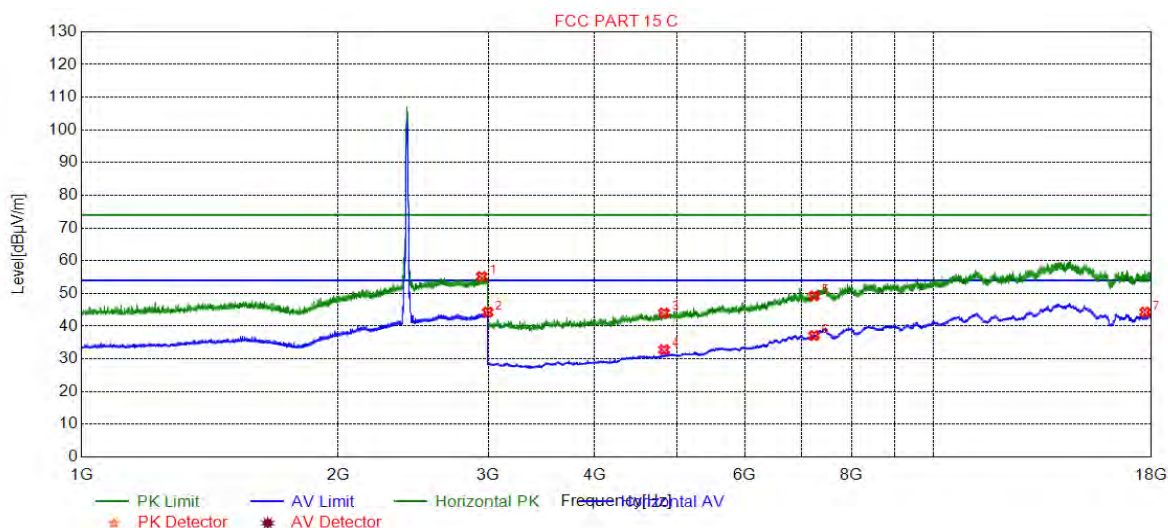
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4.9.2 Transmitter emission above 1GHz

4.9.2.1 802.11B_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2948.48	55.18	9.66	74.00	18.82	203	164	Horizontal
2	2996.49	44.28	9.47	54.00	9.72	172	178	Horizontal
3	4824.00	44.03	-17.13	74.00	29.97	175	14	Horizontal
4	4825.68	32.80	-17.12	54.00	21.20	249	327	Horizontal
5	7236.00	49.25	-8.48	74.00	24.75	234	146	Horizontal
6	7236.00	37.13	-8.48	54.00	16.87	231	344	Horizontal
7	17689.4	44.26	-0.65	54.00	9.74	182	63	Horizontal

Final Data List

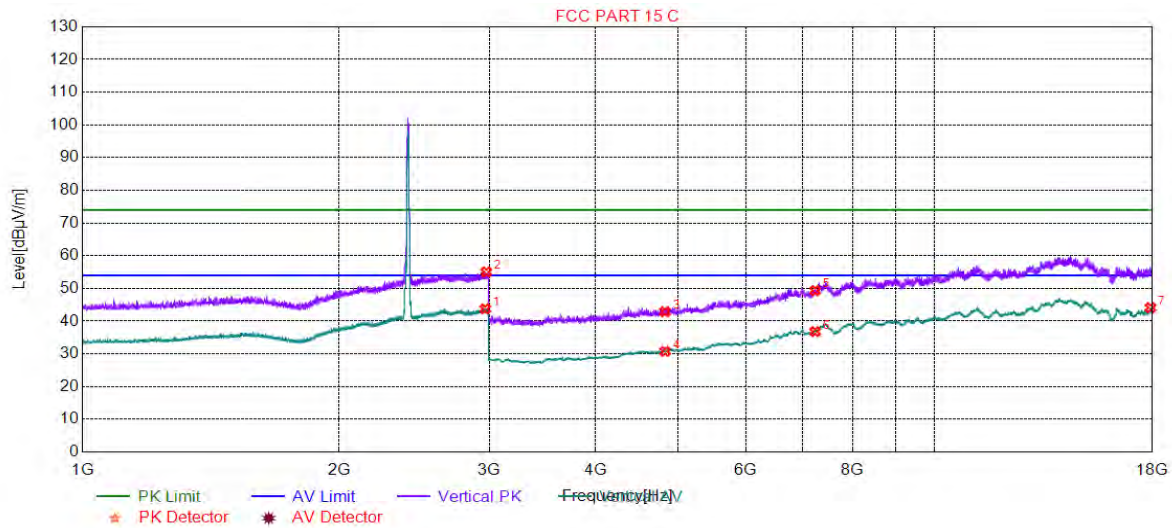


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4.9.2.2

802.11B_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2967.49	43.76	9.60	54.00	10.24	173	325	Vertical
2	2976.49	55.07	9.56	74.00	18.93	152	132	Vertical
3	4824.00	42.89	-17.13	74.00	31.11	166	82	Vertical
4	4824.00	30.76	-17.13	54.00	23.24	281	343	Vertical
5	7236.00	49.36	-8.48	74.00	24.64	176	82	Vertical
6	7236.00	36.83	-8.48	54.00	17.17	277	115	Vertical
7	17902.4	44.13	-1.31	54.00	9.87	296	82	Vertical

Final Data List

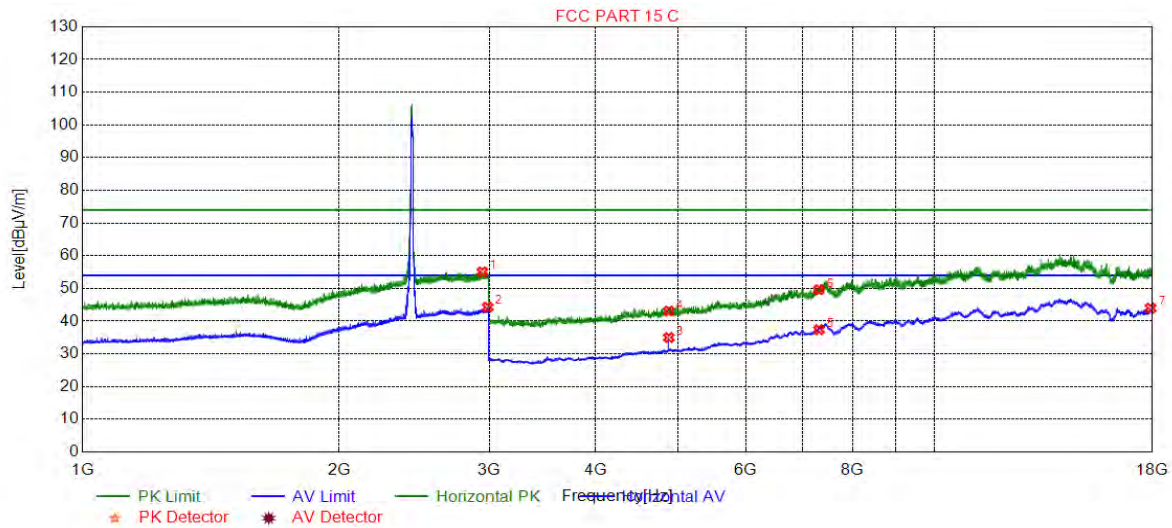


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4.9.2.3

802.11B_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2944.98	55.09	9.63	74.00	18.91	130	95	Horizontal
2	2987.49	44.29	9.51	54.00	9.71	100	54	Horizontal
3	4874.00	35.02	-16.97	54.00	18.98	237	1	Horizontal
4	4874.00	43.09	-16.97	74.00	30.91	117	99	Horizontal
5	7311.00	37.41	-8.10	54.00	16.59	154	99	Horizontal
6	7311.00	49.63	-8.10	74.00	24.37	201	297	Horizontal
7	17905.4	44.00	-1.31	54.00	10.00	210	215	Horizontal

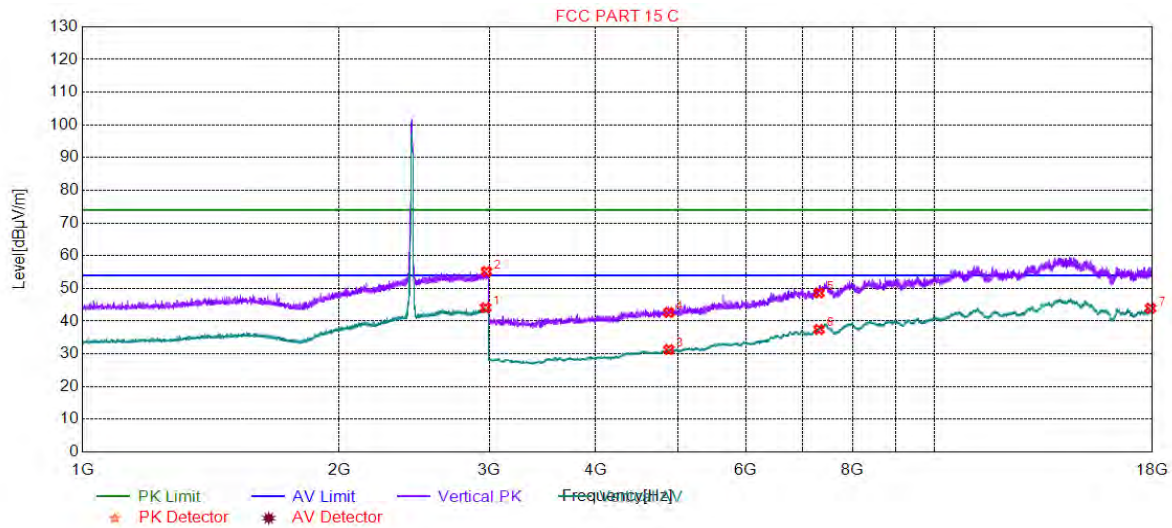
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4.9.2.4 802.11B_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2970.99	44.11	9.58	54.00	9.89	207	306	Vertical
2	2977.99	55.20	9.55	74.00	18.80	235	100	Vertical
3	4874.00	31.32	-16.97	54.00	22.68	283	146	Vertical
4	4874.00	42.65	-16.97	74.00	31.35	201	30	Vertical
5	7311.00	48.64	-8.10	74.00	25.36	154	63	Vertical
6	7311.00	37.48	-8.10	54.00	16.52	172	262	Vertical
7	17903.9	43.97	-1.31	54.00	10.03	191	212	Vertical

Final Data List

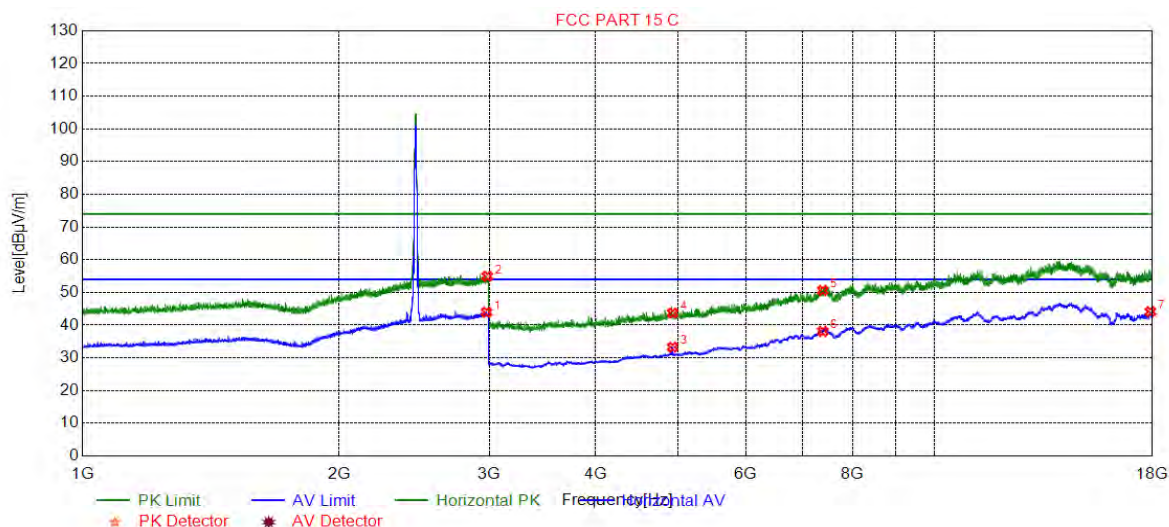


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4.9.2.5

802.11B_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2978.49	43.97	9.55	54.00	10.03	183	204	Horizontal
2	2984.49	54.96	9.52	74.00	19.04	214	190	Horizontal
3	4924.00	33.29	-16.81	54.00	20.71	148	16	Horizontal
4	4924.00	43.74	-16.81	74.00	30.26	148	330	Horizontal
5	7386.00	50.60	-7.78	74.00	23.40	223	346	Horizontal
6	7386.00	38.10	-7.78	54.00	15.90	217	65	Horizontal
7	17900.9	44.15	-1.31	54.00	9.85	172	297	Horizontal

Final Data List

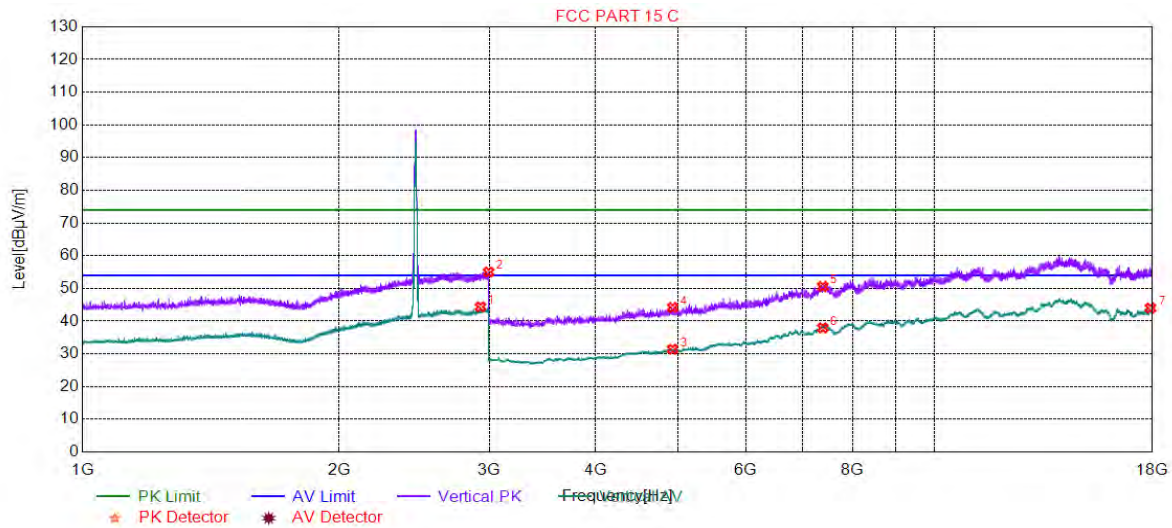


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4.9.2.6

802.11B_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2930.48	44.39	9.47	54.00	9.61	221	320	Vertical
2	2995.99	55.02	9.47	74.00	18.98	151	18	Vertical
3	4924.00	31.43	-16.81	54.00	22.57	173	277	Vertical
4	4924.00	44.18	-16.81	74.00	29.82	271	145	Vertical
5	7386.00	50.59	-7.78	74.00	23.41	190	343	Vertical
6	7386.00	37.95	-7.78	54.00	16.05	164	29	Vertical
7	17903.9	44.02	-1.31	54.00	9.98	189	96	Vertical

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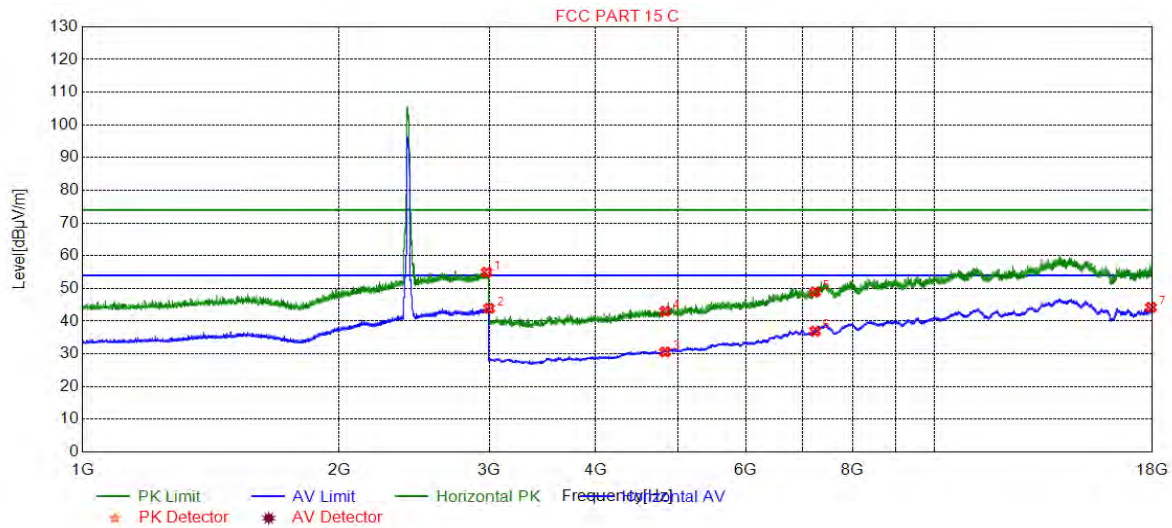
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4.9.2.7

802.11G_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2979.49	54.93	9.54	74.00	19.07	169	237	Horizontal
2	2998.99	43.93	9.45	54.00	10.07	189	128	Horizontal
3	4824.00	30.60	-17.13	54.00	23.40	130	346	Horizontal
4	4824.00	43.03	-17.13	74.00	30.97	121	83	Horizontal
5	7236.00	48.94	-8.48	74.00	25.06	229	198	Horizontal
6	7236.00	36.96	-8.48	54.00	17.04	209	50	Horizontal
7	17921.9	44.24	-1.30	54.00	9.76	175	116	Horizontal

Final Data List

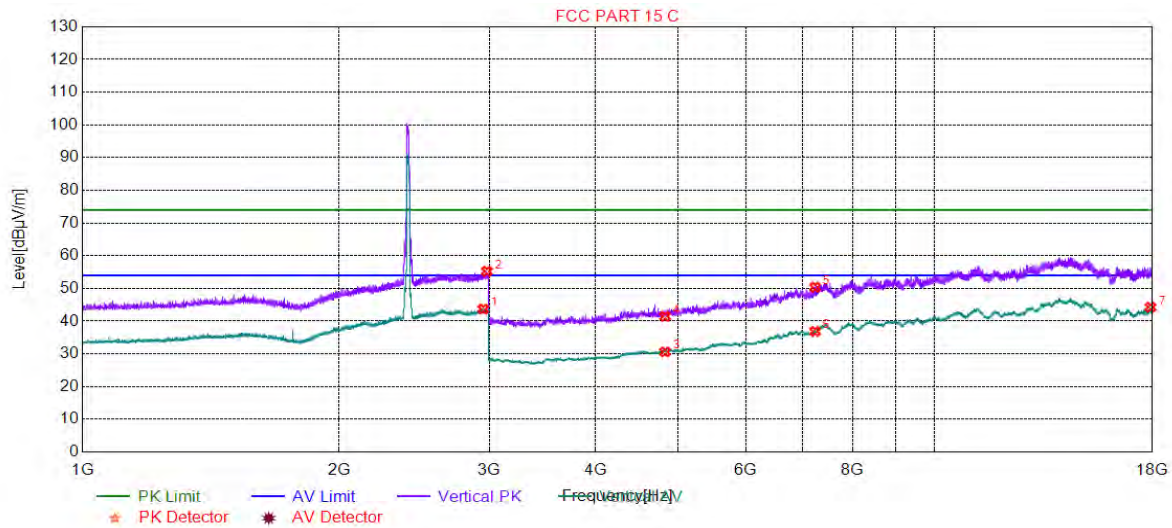


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4.9.2.8

802.11G_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2951.48	43.72	9.67	54.00	10.28	288	40	Vertical
2	2981.49	55.26	9.54	74.00	18.74	274	82	Vertical
3	4824.00	30.62	-17.13	54.00	23.38	286	79	Vertical
4	4824.00	41.45	-17.13	74.00	32.55	201	63	Vertical
5	7236.00	50.42	-8.48	74.00	23.58	264	244	Vertical
6	7236.00	36.88	-8.48	54.00	17.12	233	293	Vertical
7	17903.9	44.26	-1.31	54.00	9.74	295	161	Vertical

Final Data List

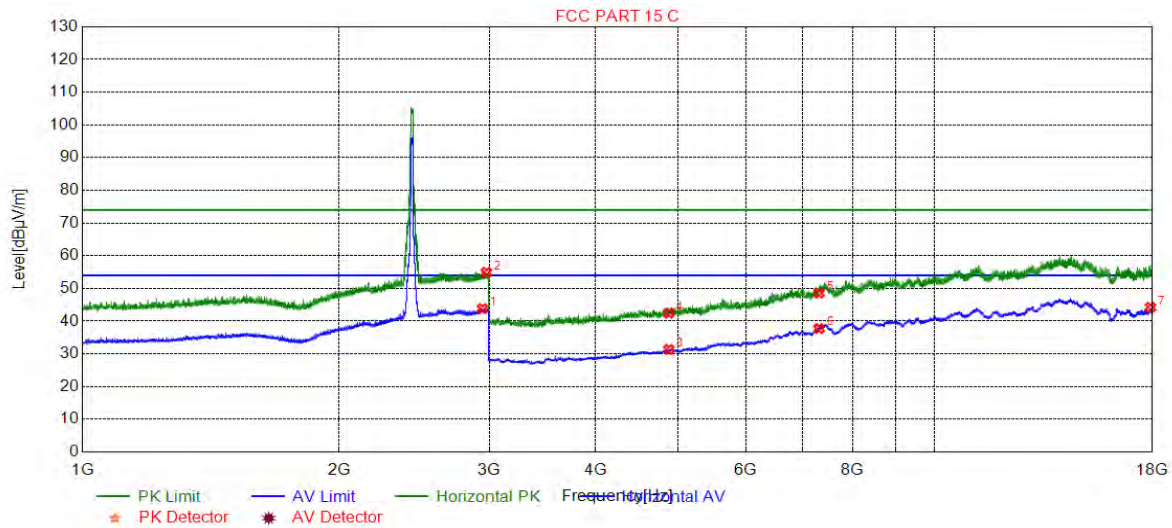


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4.9.2.9

802.11G_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2945.48	43.84	9.63	54.00	10.16	160	18	Horizontal
2	2976.99	54.94	9.56	74.00	19.06	193	18	Horizontal
3	4874.00	31.34	-16.97	54.00	22.66	173	1	Horizontal
4	4874.00	42.46	-16.97	74.00	31.54	138	66	Horizontal
5	7311.00	48.59	-8.10	74.00	25.41	165	264	Horizontal
6	7311.00	37.75	-8.10	54.00	16.25	116	33	Horizontal
7	17902.4	44.24	-1.31	54.00	9.76	193	248	Horizontal

Final Data List

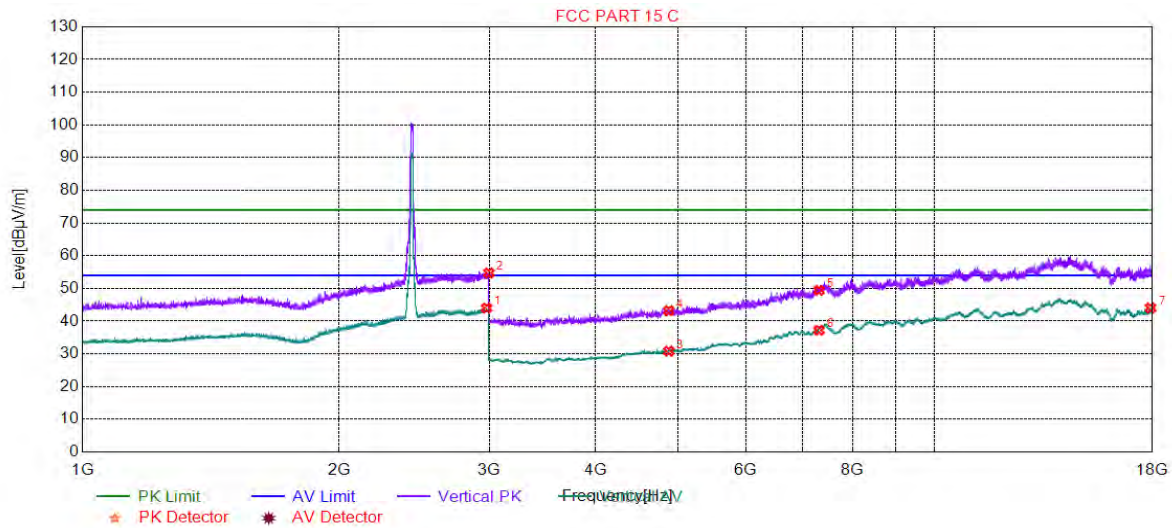


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4.9.2.10

802.11G_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2979.49	44.02	9.54	54.00	9.98	211	204	Vertical
2	2997.99	54.75	9.46	74.00	19.25	178	190	Vertical
3	4874.00	30.83	-16.97	54.00	23.17	209	294	Vertical
4	4874.00	43.22	-16.97	74.00	30.78	238	63	Vertical
5	7311.00	49.44	-8.10	74.00	24.56	235	30	Vertical
6	7311.00	37.22	-8.10	54.00	16.78	162	46	Vertical
7	17908.4	44.05	-1.31	54.00	9.95	228	80	Vertical

Final Data List

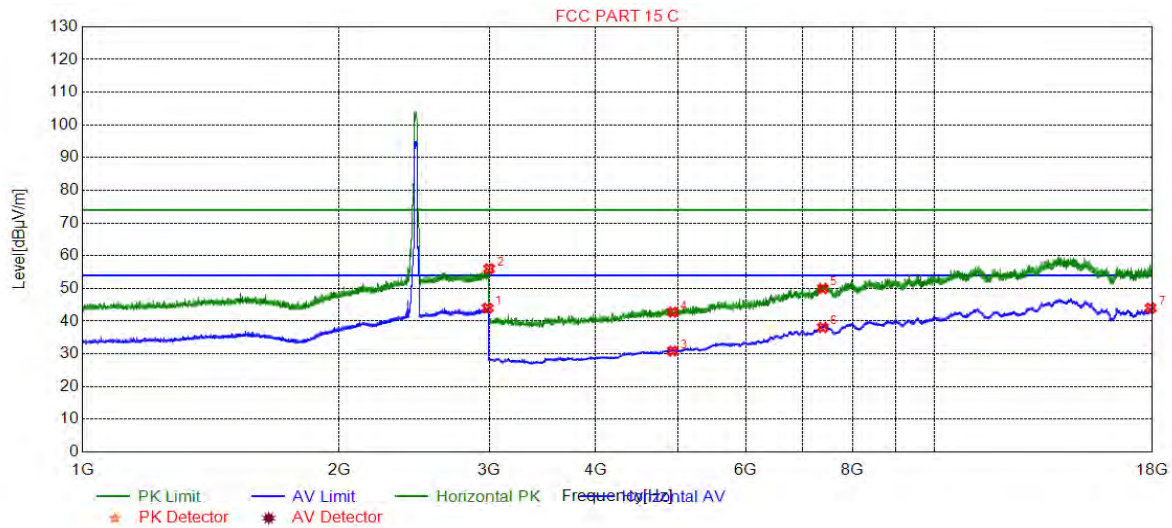


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4.9.2.11

802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2986.99	44.00	9.51	54.00	10.00	223	18	Horizontal
2	2998.99	56.05	9.45	74.00	17.95	211	358	Horizontal
3	4924.00	30.88	-16.81	54.00	23.12	134	232	Horizontal
4	4924.00	42.78	-16.81	74.00	31.22	161	50	Horizontal
5	7386.00	49.97	-7.78	74.00	24.03	213	346	Horizontal
6	7386.00	38.10	-7.78	54.00	15.90	110	265	Horizontal
7	17905.4	44.02	-1.31	54.00	9.98	213	198	Horizontal

Final Data List

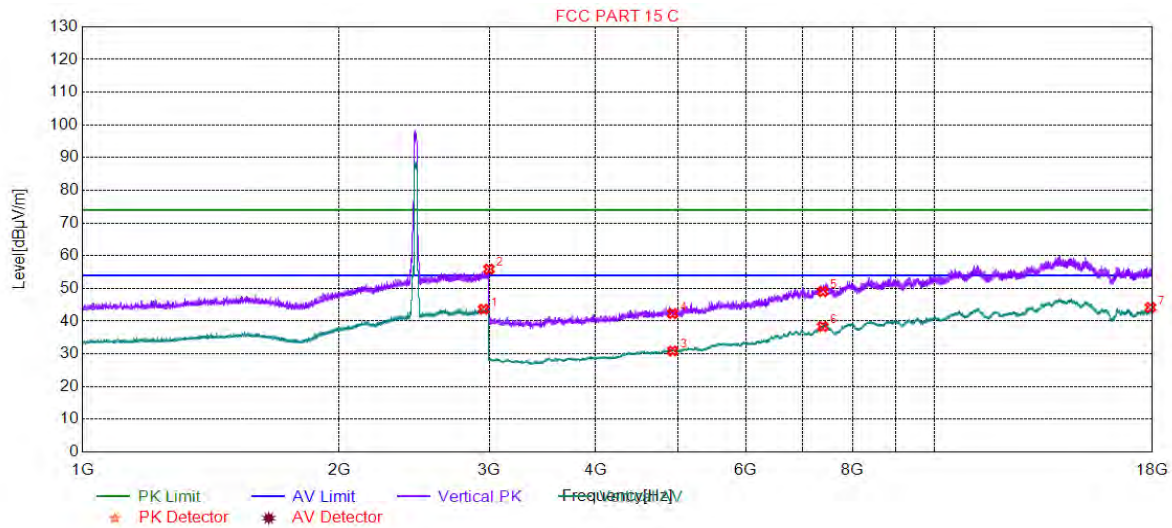


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4.9.2.12

802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2954.48	43.65	9.66	54.00	10.35	281	2	Vertical
2	2997.99	55.92	9.46	74.00	18.08	220	163	Vertical
3	4924.00	30.91	-16.81	54.00	23.09	231	195	Vertical
4	4924.00	42.32	-16.81	74.00	31.68	294	30	Vertical
5	7386.00	49.05	-7.78	74.00	24.95	290	14	Vertical
6	7386.00	38.36	-7.78	54.00	15.64	178	112	Vertical
7	17902.4	44.21	-1.31	54.00	9.79	185	359	Vertical

Final Data List



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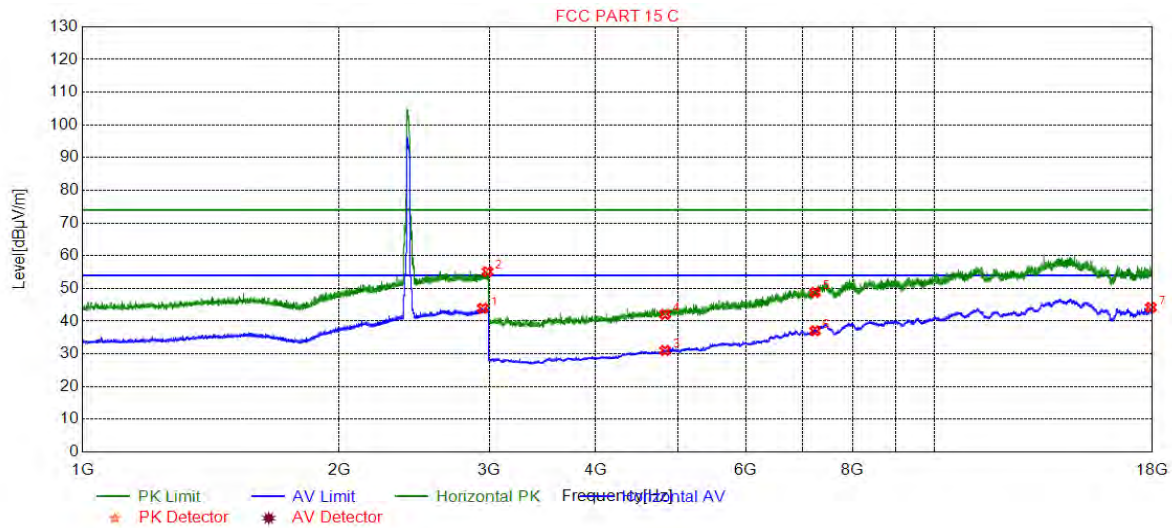
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4.9.2.13

802.11N20_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2947.98	43.96	9.66	54.00	10.04	152	224	Horizontal
2	2986.49	55.17	9.51	74.00	18.83	231	334	Horizontal
3	4824.00	31.06	-17.13	54.00	22.94	242	33	Horizontal
4	4824.00	42.08	-17.13	74.00	31.92	212	50	Horizontal
5	7236.00	48.80	-8.48	74.00	25.20	150	313	Horizontal
6	7236.00	37.07	-8.48	54.00	16.93	196	214	Horizontal
7	17920.4	44.20	-1.30	54.00	9.80	235	2	Horizontal

Final Data List

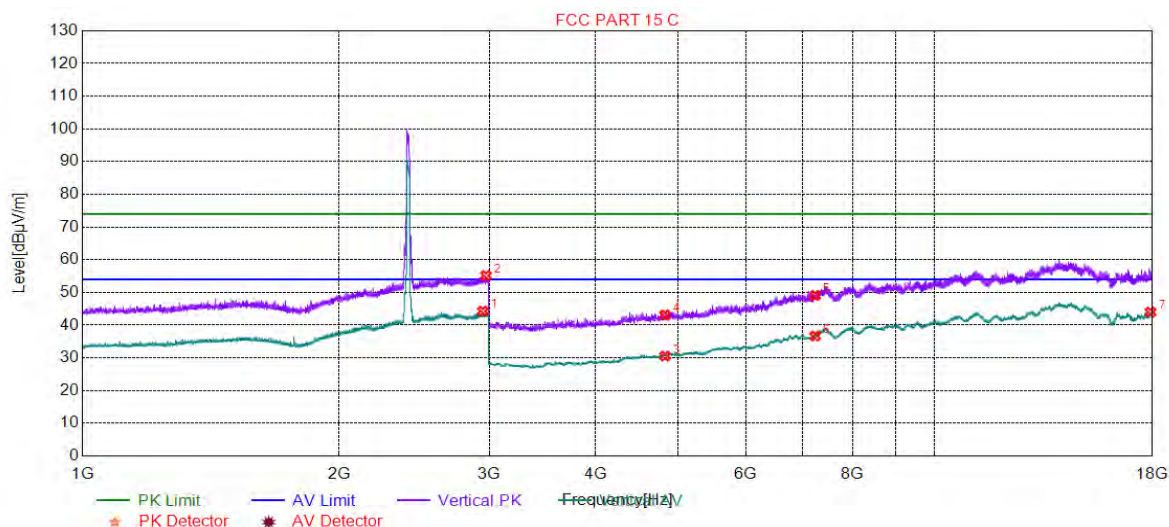


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4.9.2.14

802.11N20_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2948.48	44.30	9.66	54.00	9.70	227	13	Vertical
2	2973.49	55.18	9.57	74.00	18.82	225	40	Vertical
3	4824.00	30.56	-17.13	54.00	23.44	153	62	Vertical
4	4824.00	43.15	-17.13	74.00	30.85	206	292	Vertical
5	7236.00	49.09	-8.48	74.00	24.91	200	177	Vertical
6	7236.00	36.69	-8.48	54.00	17.31	166	342	Vertical
7	17903.9	44.00	-1.31	54.00	10.00	298	358	Vertical

Final Data List

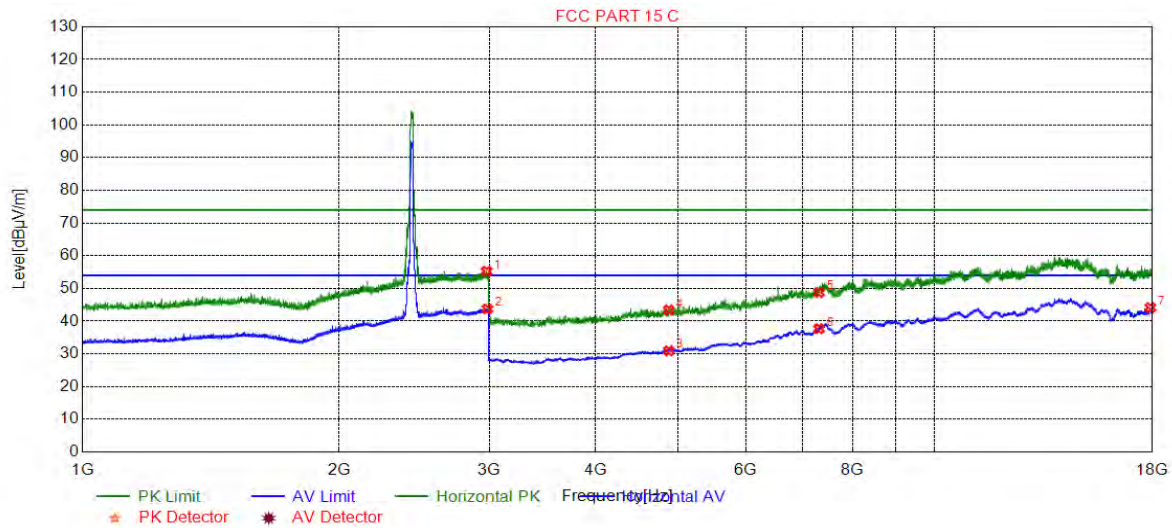


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4.9.2.15

802.11N20_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2980.49	55.26	9.54	74.00	18.74	146	194	Horizontal
2	2985.99	43.75	9.51	54.00	10.25	201	44	Horizontal
3	4874.00	30.93	-16.97	54.00	23.07	190	133	Horizontal
4	4874.00	43.38	-16.97	74.00	30.62	123	314	Horizontal
5	7311.00	48.77	-8.10	74.00	25.23	177	116	Horizontal
6	7311.00	37.71	-8.10	54.00	16.29	135	17	Horizontal
7	17897.9	44.16	-1.34	54.00	9.84	207	346	Horizontal

Final Data List

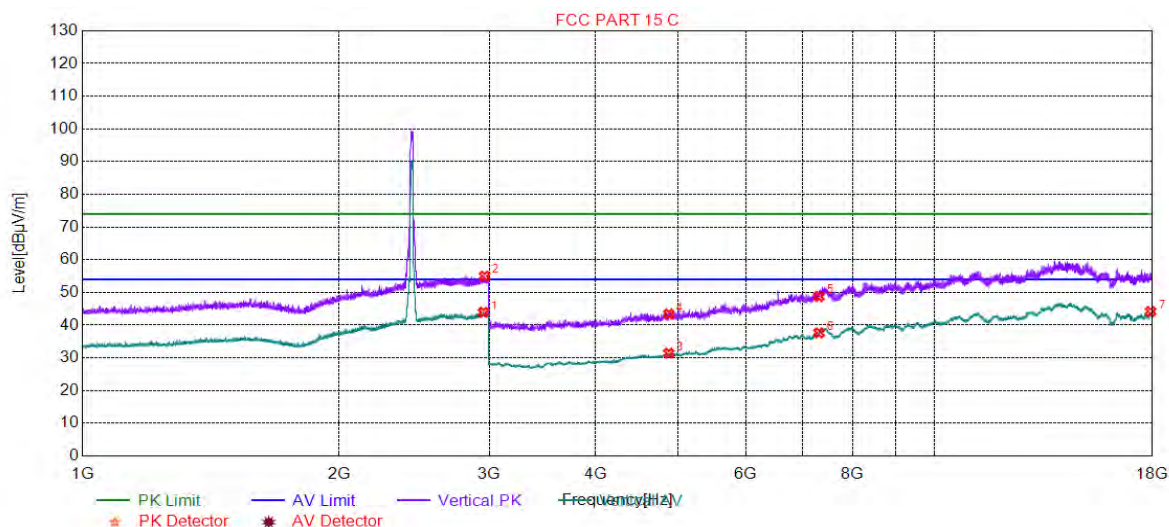


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4.9.2.16

802.11N20_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2953.48	43.94	9.66	54.00	10.06	163	11	Vertical
2	2962.99	55.01	9.62	74.00	18.99	219	121	Vertical
3	4874.00	31.44	-16.97	54.00	22.56	246	14	Vertical
4	4874.00	43.38	-16.97	74.00	30.62	199	314	Vertical
5	7311.00	48.77	-8.10	74.00	25.23	176	116	Vertical
6	7311.00	37.65	-8.10	54.00	16.35	257	343	Vertical
7	17905.4	44.18	-1.31	54.00	9.82	247	326	Vertical

Final Data List

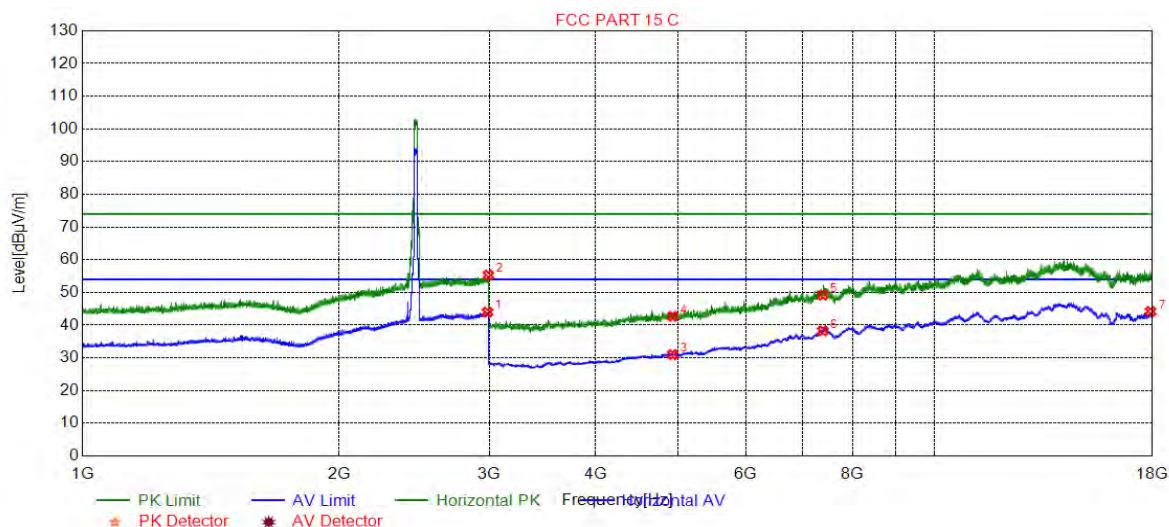


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4.9.2.17

802.11N20_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2985.99	44.00	9.51	54.00	10.00	228	264	Horizontal
2	2993.49	55.31	9.48	74.00	18.69	116	18	Horizontal
3	4924.00	31.00	-16.81	54.00	23.00	149	181	Horizontal
4	4924.00	42.72	-16.81	74.00	31.28	213	82	Horizontal
5	7386.00	49.22	-7.78	74.00	24.78	209	281	Horizontal
6	7386.00	38.28	-7.78	54.00	15.72	132	297	Horizontal
7	17903.9	44.21	-1.31	54.00	9.79	165	264	Horizontal

Final Data List

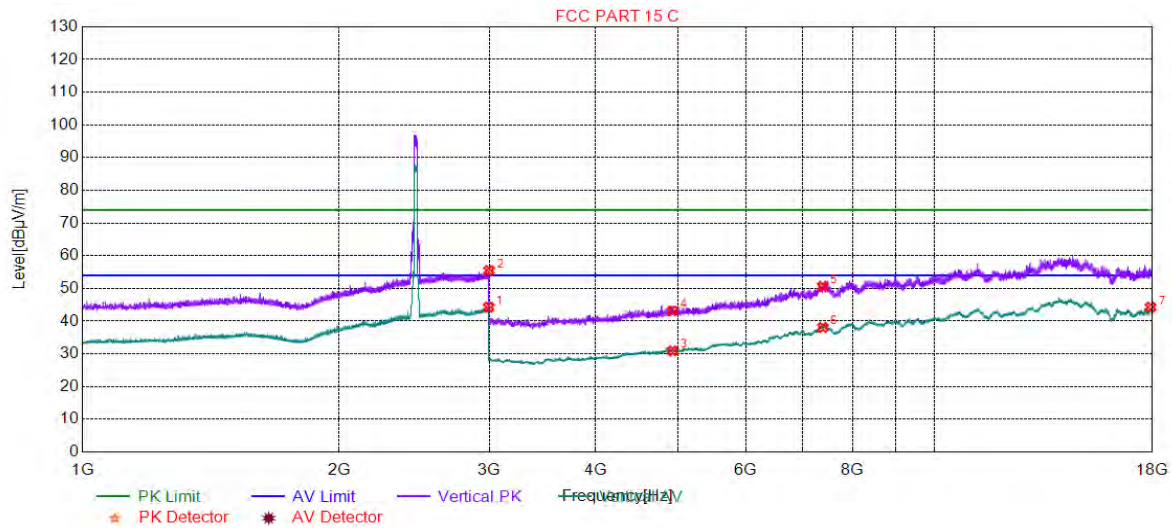


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4.9.2.18

802.11N20_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2995.99	44.27	9.47	54.00	9.73	265	274	Vertical
2	2998.49	55.47	9.46	74.00	18.53	180	301	Vertical
3	4924.00	30.93	-16.81	54.00	23.07	222	96	Vertical
4	4924.00	43.18	-16.81	74.00	30.82	202	212	Vertical
5	7386.00	50.62	-7.78	74.00	23.38	242	63	Vertical
6	7386.00	38.08	-7.78	54.00	15.92	261	228	Vertical
7	17906.9	44.27	-1.31	54.00	9.73	270	245	Vertical

Final Data List



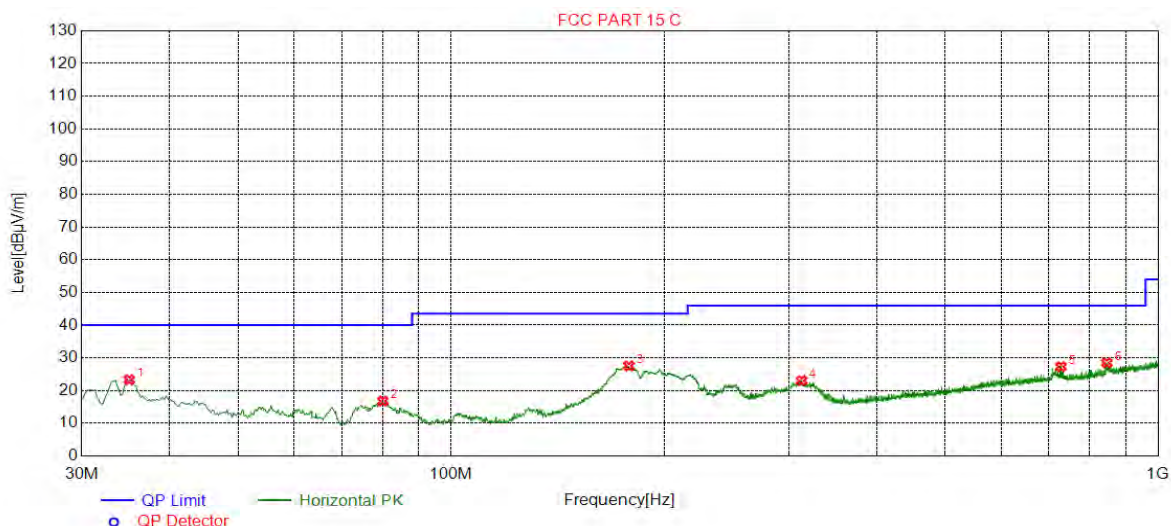
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Secondly Supply:

4.9.3 Radiated emission below 1GHz

4.9.3.1 Charge + Transmitting



Suspected List

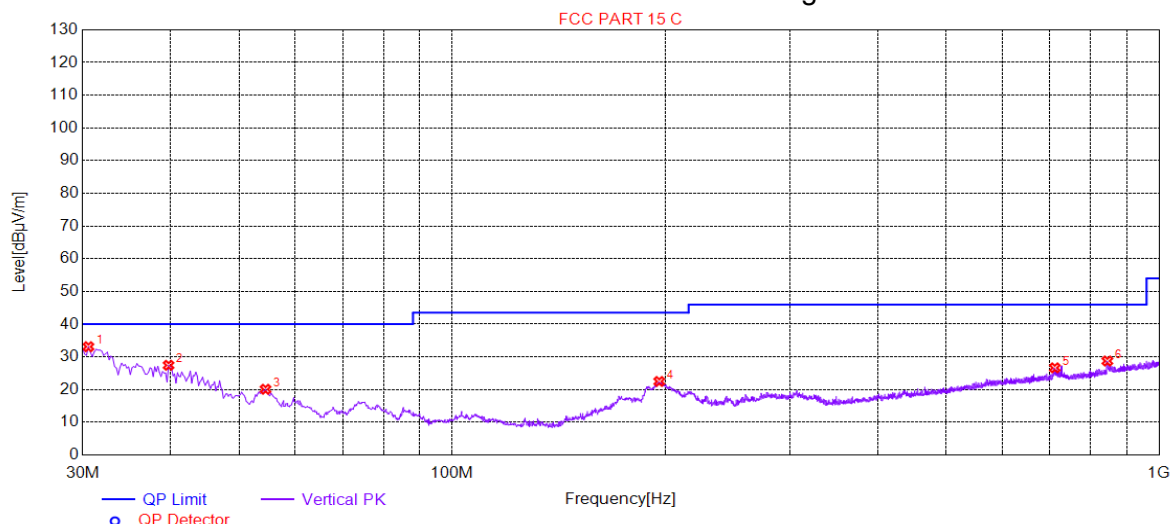
NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	35.0450	23.34	40.00	16.66	Horizontal
2	80.0620	16.80	40.00	23.20	Horizontal
3	178.4397	27.53	43.50	15.97	Horizontal
4	313.2967	23.08	46.00	22.92	Horizontal
5	728.9278	27.31	46.00	18.69	Horizontal
6	846.1272	28.51	46.00	17.49	Horizontal

Final Data List



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Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	30.5821	33.12	40.00	6.88	Vertical
2	39.7019	27.44	40.00	12.56	Vertical
3	54.4489	20.11	40.00	19.89	Vertical
4	196.2913	22.50	43.50	21.00	Vertical
5	712.0464	26.66	46.00	19.34	Vertical
6	844.9630	28.75	46.00	17.25	Vertical

Final Data List

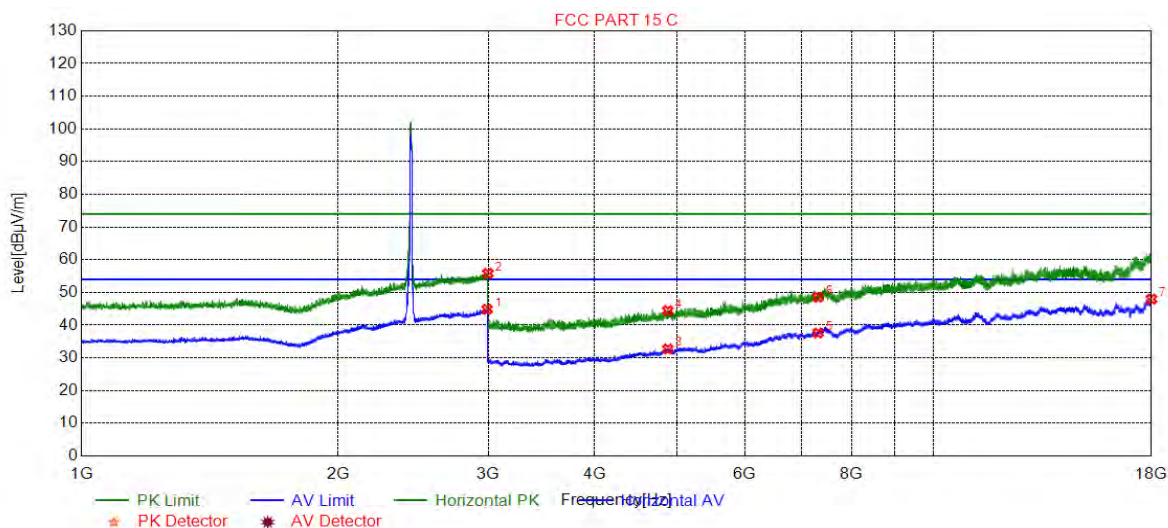


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4.9.4 Transmitter emission above 1GHz

4.9.4.1 802.11B_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	2990.497	44.88	10.46	54.00	9.12	174	Horizontal
2	2996.999	55.83	10.44	74.00	18.17	139	Horizontal
3	4874.000	32.72	-16.84	54.00	21.28	126	Horizontal
4	4874.000	44.46	-16.84	74.00	29.54	229	Horizontal
5	7311.000	37.61	-9.32	54.00	16.39	161	Horizontal
6	7311.000	48.57	-9.32	74.00	25.43	150	Horizontal
7	18000.00	47.97	2.82	54.00	6.03	132	Horizontal

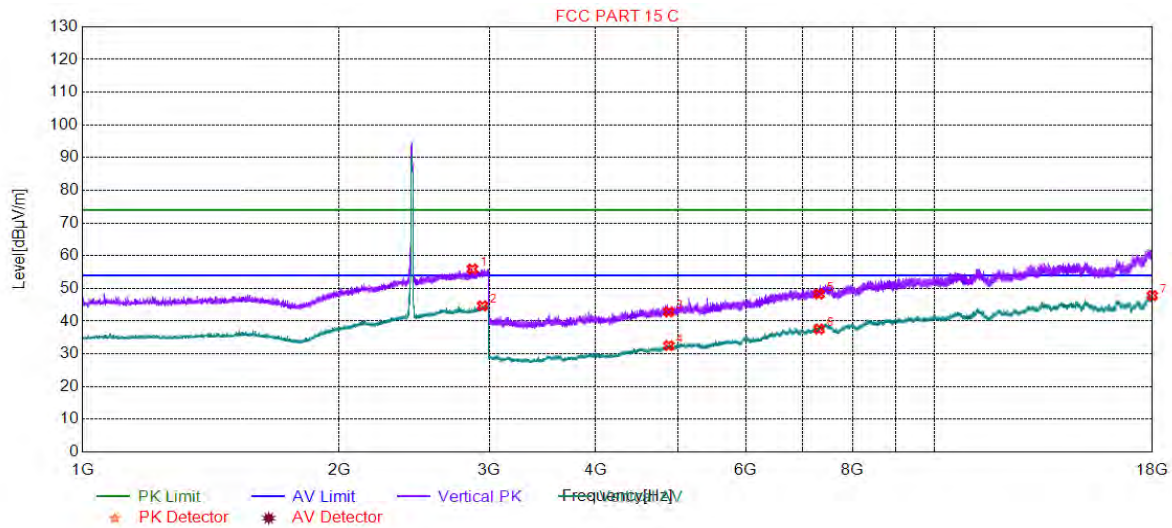
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4.9.4.2 802.11B_Channel 6



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	2867.466	55.95	9.93	74.00	18.05	167	Vertical
2	2945.986	44.70	10.51	54.00	9.30	291	Vertical
3	4874.000	42.82	-16.84	74.00	31.18	262	Vertical
4	4874.000	32.51	-16.84	54.00	21.49	159	Vertical
5	7311.000	48.32	-9.32	74.00	25.68	153	Vertical
6	7311.000	37.60	-9.32	54.00	16.40	266	Vertical
7	17990.24	47.83	2.76	54.00	6.17	285	Vertical

Final Data List

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz and 18GHz to 25GHz 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.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes have been tested, but only the worst case data displayed in this report.



4.10 Restricted bands around fundamental frequency

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)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
Test Setup:			

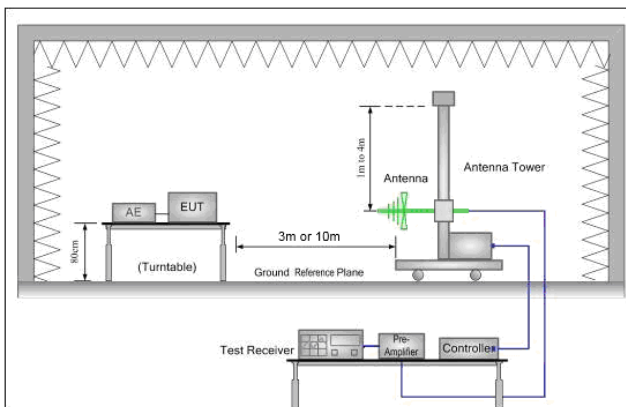


Figure 1. 30MHz to 1GHz

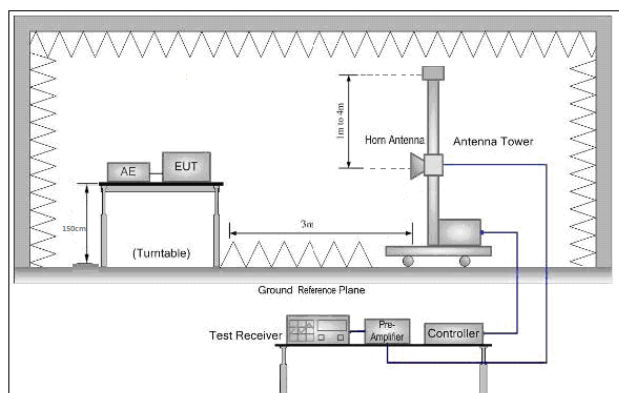


Figure 2. Above 1 GHz

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 chamber. 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 chamber. 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. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. 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. j. 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); Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



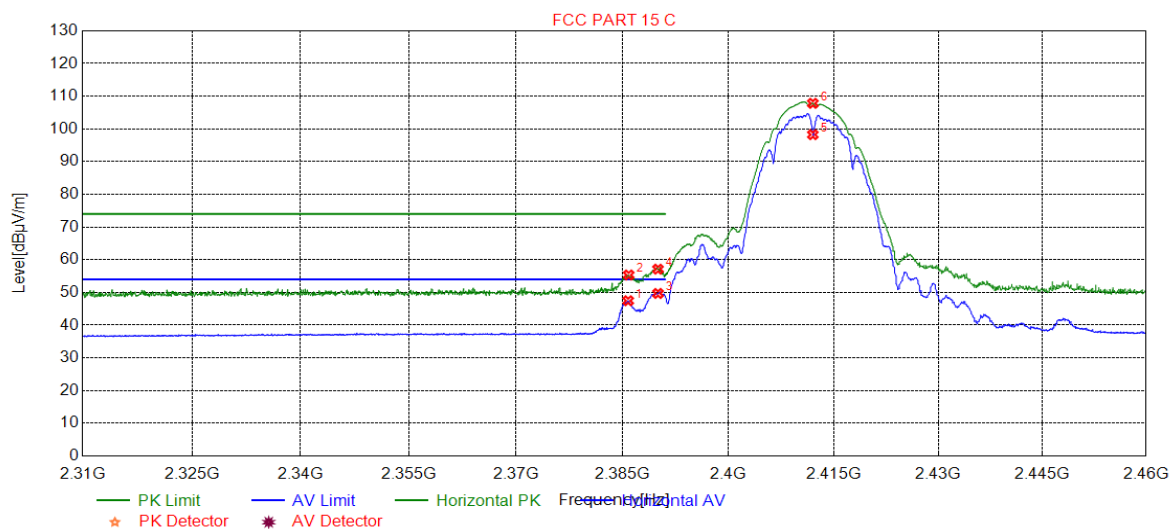
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Firstly supply:

4.10.1 Test Plots

4.10.1.1 802.11B_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.78	47.48	7.77	54.00	6.52	169	57	Horizontal
2	2385.86	55.35	7.77	74.00	18.65	105	57	Horizontal
3	2390.00	49.71	7.77	54.00	4.29	211	57	Horizontal
4	2390.00	57.13	7.77	74.00	16.87	225	57	Horizontal
5	2412.00	98.26	7.81	0.00	-98.26	227	57	Horizontal
6	2412.00	107.84	7.81	0.00	-107.84	105	57	Horizontal

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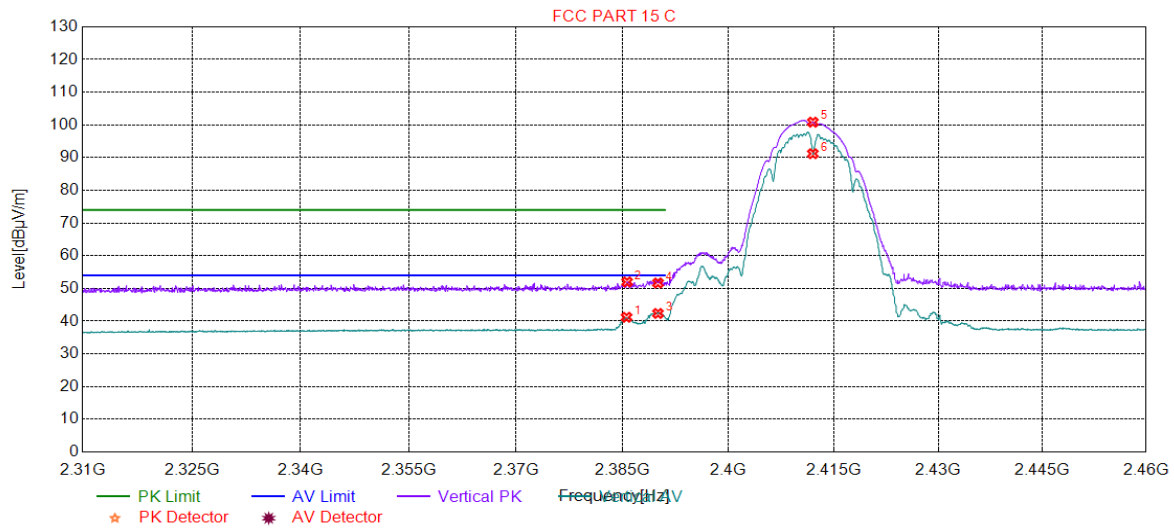
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4.10.1.2

802.11B_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.56	41.20	7.77	54.00	12.80	281	24	Vertical
2	2385.63	52.01	7.77	74.00	21.99	265	24	Vertical
3	2390.00	42.37	7.77	54.00	11.63	158	24	Vertical
4	2390.00	51.69	7.77	74.00	22.31	226	193	Vertical
5	2412.00	100.85	7.81	0.00	-100.85	197	18	Vertical
6	2412.00	91.21	7.81	0.00	-91.21	227	24	Vertical

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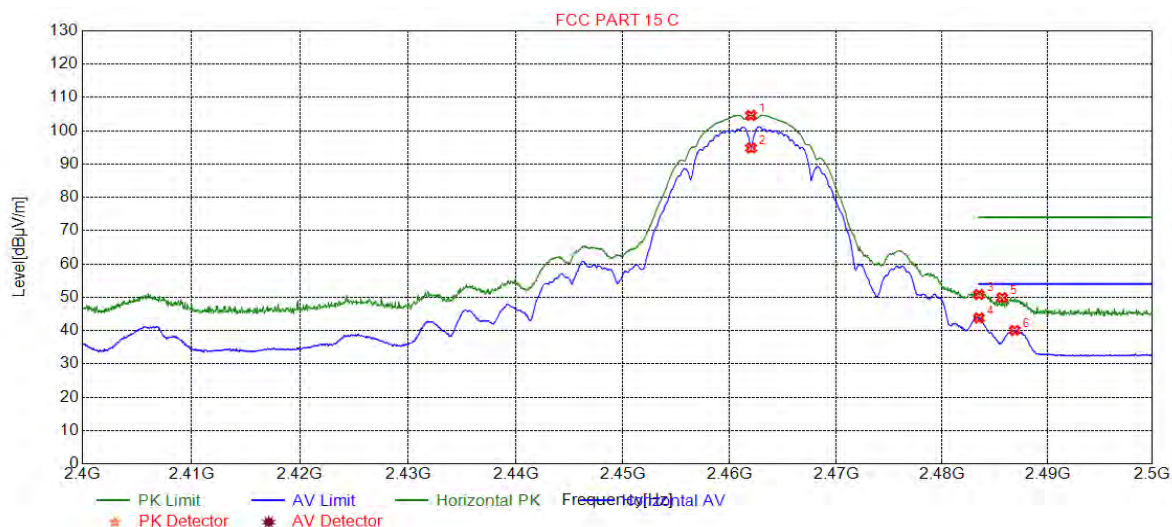
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4.10.1.3

802.11B_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	104.60	7.98	0.00	-104.60	139	202	Horizontal
2	2462.00	94.82	7.98	0.00	-94.82	235	202	Horizontal
3	2483.50	50.83	8.01	74.00	23.17	195	225	Horizontal
4	2483.50	43.81	8.01	54.00	10.19	231	208	Horizontal
5	2485.69	49.92	8.01	74.00	24.08	172	213	Horizontal
6	2486.89	40.09	8.01	54.00	13.91	213	208	Horizontal

Final Data List



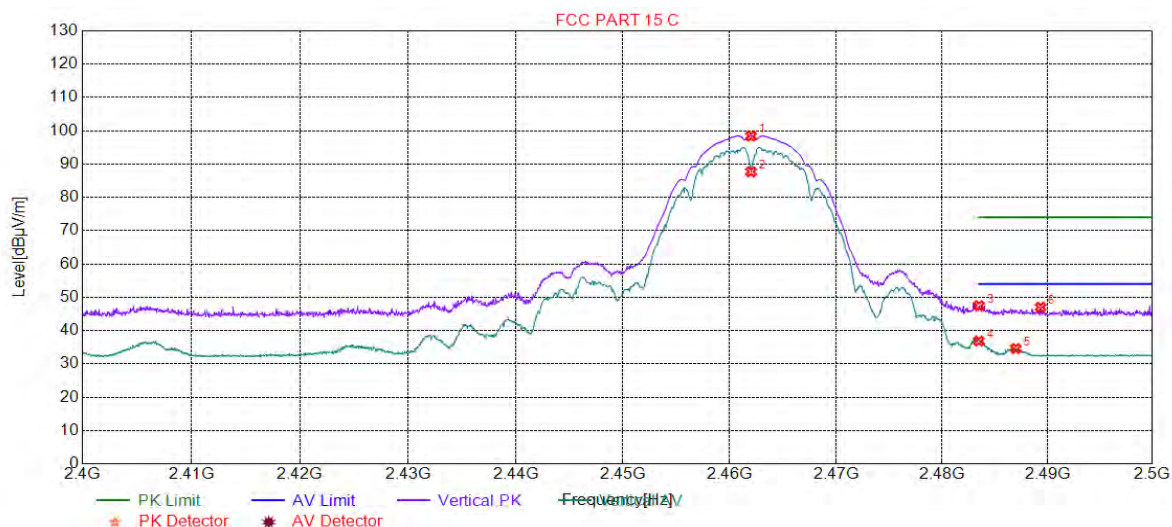
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4.10.1.4

802.11B_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	98.40	7.98	0.00	-98.40	214	221	Vertical
2	2462.00	87.68	7.98	0.00	-87.68	242	216	Vertical
3	2483.50	47.48	8.01	74.00	26.52	285	221	Vertical
4	2483.50	36.91	8.01	54.00	17.09	198	216	Vertical
5	2486.99	34.65	8.01	54.00	19.35	279	216	Vertical
6	2489.34	47.02	8.02	74.00	26.98	209	349	Vertical

Final Data List

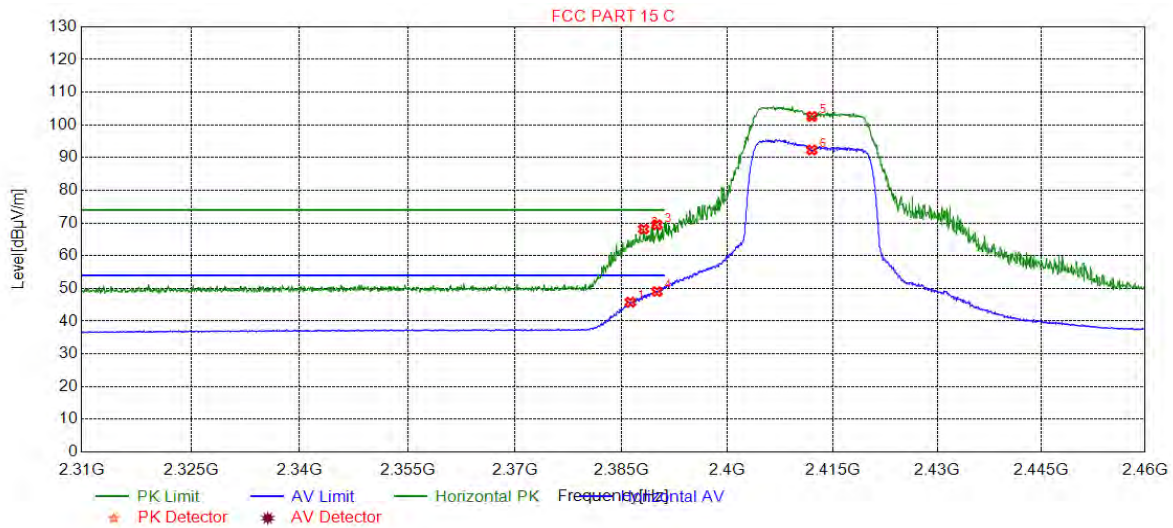


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4.10.1.5

802.11G_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2386.23	45.82	7.77	54.00	8.18	242	207	Horizontal
2	2388.11	68.16	7.77	74.00	5.84	200	207	Horizontal
3	2390.00	69.48	7.77	74.00	4.52	207	207	Horizontal
4	2390.00	49.06	7.77	54.00	4.94	204	207	Horizontal
5	2412.00	102.58	7.81	0.00	-102.58	237	201	Horizontal
6	2412.00	92.34	7.81	0.00	-92.34	141	207	Horizontal

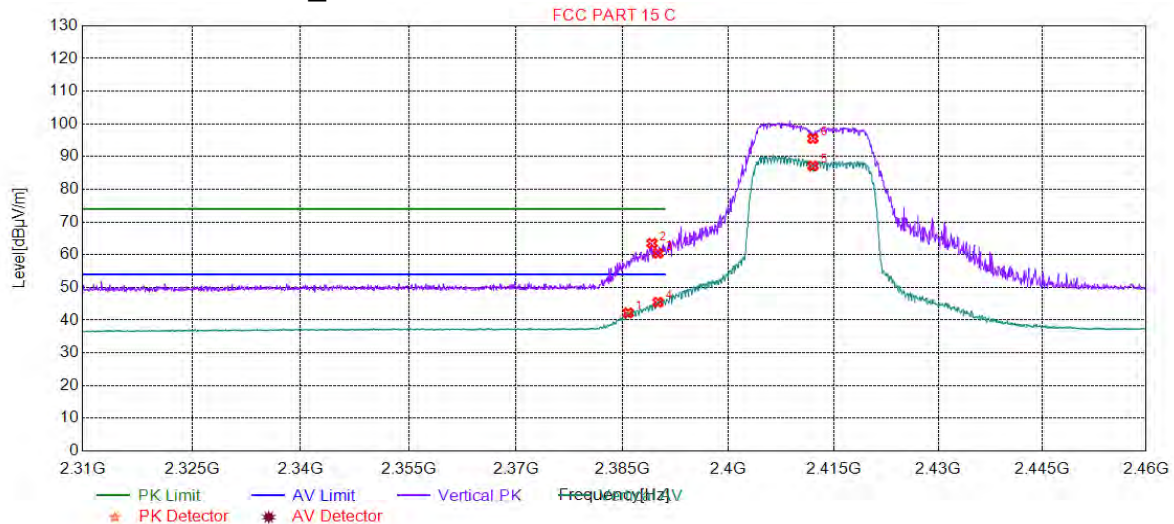
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4.10.1.6 802.11G_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2385.78	42.23	7.77	54.00	11.77	162	214	Vertical
2	2389.16	63.50	7.77	74.00	10.50	294	209	Vertical
3	2390.00	60.45	7.77	74.00	13.55	238	214	Vertical
4	2390.00	45.48	7.77	54.00	8.52	287	214	Vertical
5	2412.00	87.17	7.81	0.00	-87.17	159	214	Vertical
6	2412.00	95.51	7.81	0.00	-95.51	188	214	Vertical

Final Data List

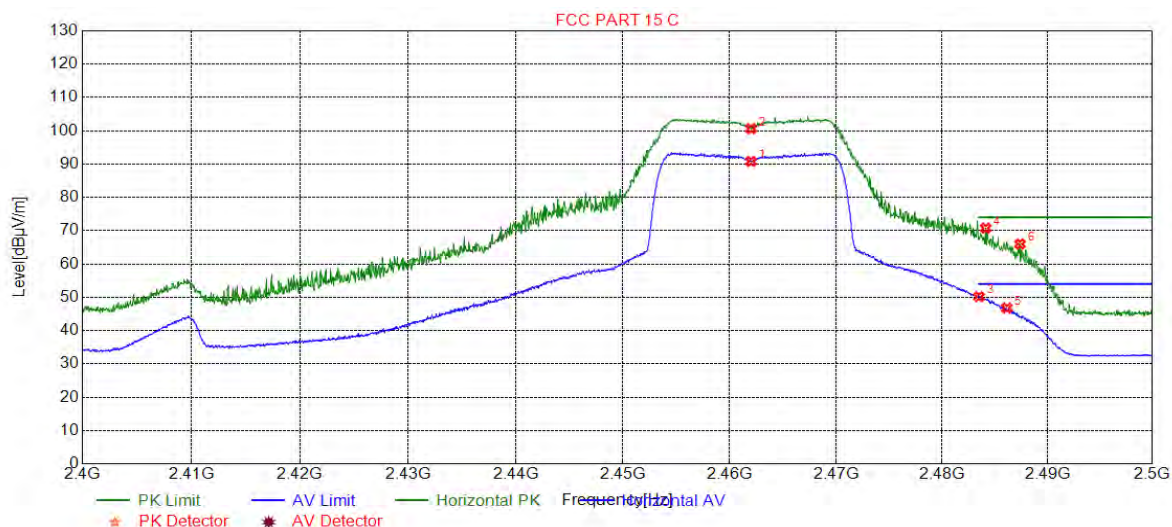


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4.10.1.7

802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	90.80	7.98	0.00	-90.80	122	207	Horizontal
2	2462.00	100.62	7.98	0.00	-100.62	238	218	Horizontal
3	2483.50	50.18	8.01	54.00	3.82	132	212	Horizontal
4	2484.14	70.78	8.01	74.00	3.22	240	234	Horizontal
5	2486.14	46.81	8.01	54.00	7.19	125	212	Horizontal
6	2487.39	66.02	8.01	74.00	7.98	169	234	Horizontal

Final Data List

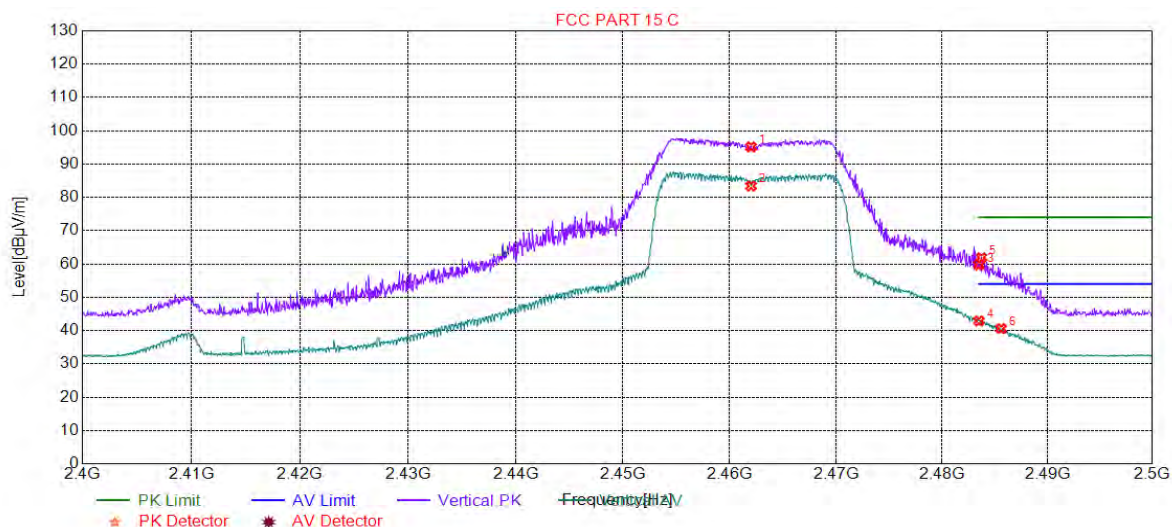


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4.10.1.8

802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	95.16	7.98	0.00	-95.16	289	210	Vertical
2	2462.00	83.43	7.98	0.00	-83.43	292	216	Vertical
3	2483.50	59.75	8.01	74.00	14.25	241	216	Vertical
4	2483.50	42.92	8.01	54.00	11.08	156	216	Vertical
5	2483.74	61.91	8.01	74.00	12.09	295	210	Vertical
6	2485.59	40.63	8.01	54.00	13.37	153	216	Vertical

Final Data List



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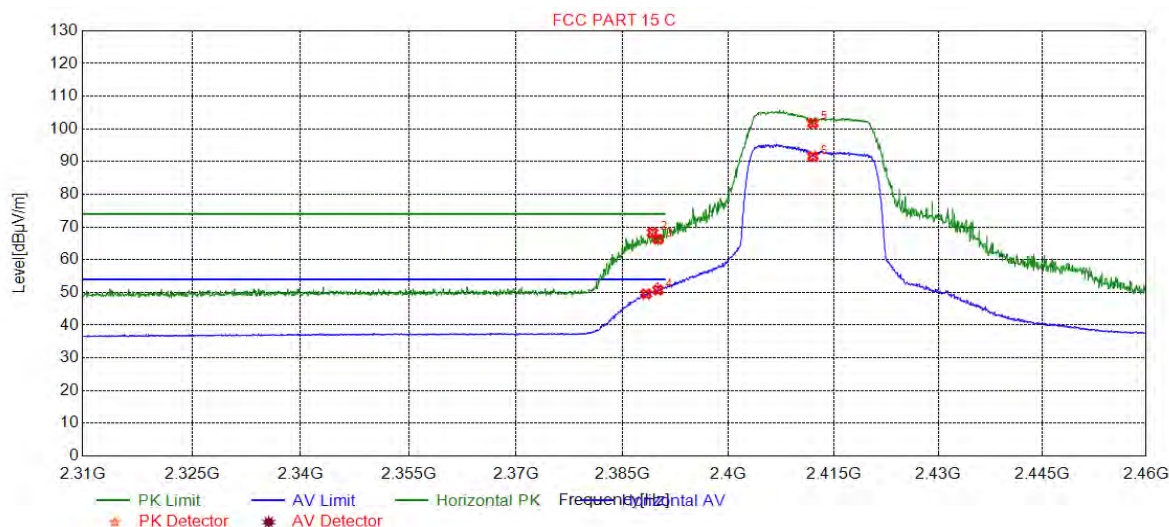
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4.10.1.9

802.11N20_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2388.33	49.56	7.77	54.00	4.44	138	206	Horizontal
2	2389.23	68.30	7.77	74.00	5.70	167	195	Horizontal
3	2390.00	66.28	7.77	74.00	7.72	123	195	Horizontal
4	2390.00	50.76	7.77	54.00	3.24	111	206	Horizontal
5	2412.00	101.72	7.81	0.00	-101.72	226	212	Horizontal
6	2412.00	91.57	7.81	0.00	-91.57	178	206	Horizontal

Final Data List

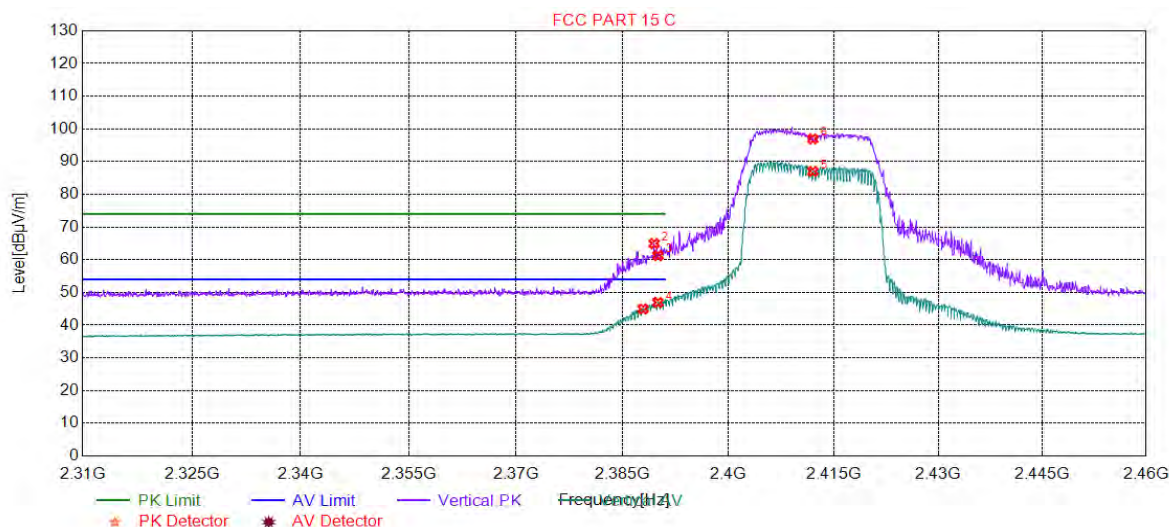


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4.10.1.10

802.11N20_Channel 1



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2387.88	44.97	7.77	54.00	9.03	299	215	Vertical
2	2389.46	64.96	7.77	74.00	9.04	227	215	Vertical
3	2390.00	61.26	7.77	74.00	12.74	286	94	Vertical
4	2390.00	46.94	7.77	54.00	7.06	285	215	Vertical
5	2412.00	87.01	7.81	0.00	-87.01	197	215	Vertical
6	2412.00	96.95	7.81	0.00	-96.95	202	209	Vertical

Final Data List

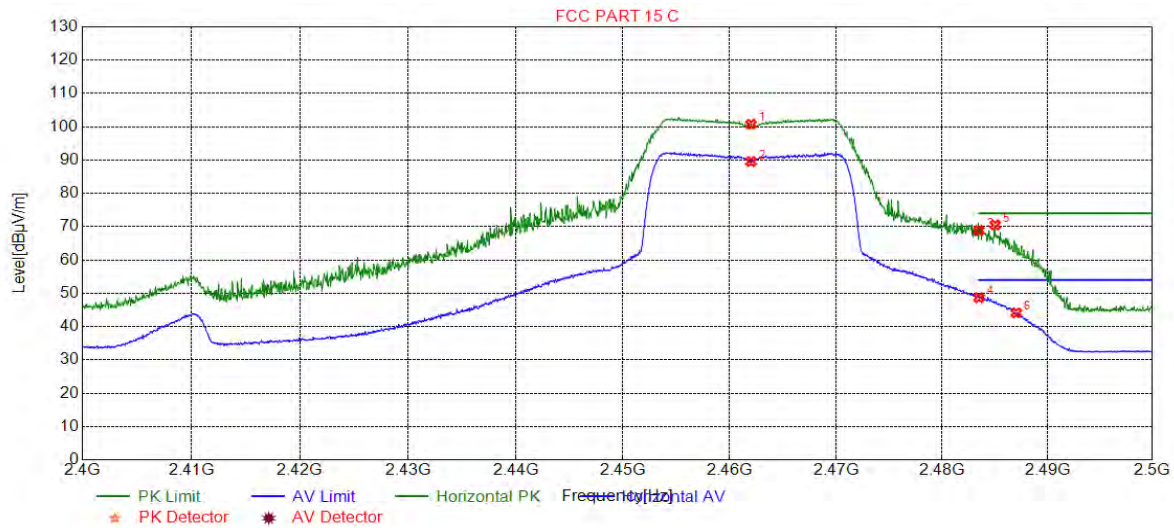


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4.10.1.11

802.11N20_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	100.76	7.98	0.00	-100.76	195	204	Horizontal
2	2462.00	89.55	7.98	0.00	-89.55	205	209	Horizontal
3	2483.50	68.89	8.01	74.00	5.11	106	215	Horizontal
4	2483.50	48.69	8.01	54.00	5.31	129	237	Horizontal
5	2485.04	70.55	8.01	74.00	3.45	233	215	Horizontal
6	2487.04	44.14	8.01	54.00	9.86	231	231	Horizontal

Final Data List



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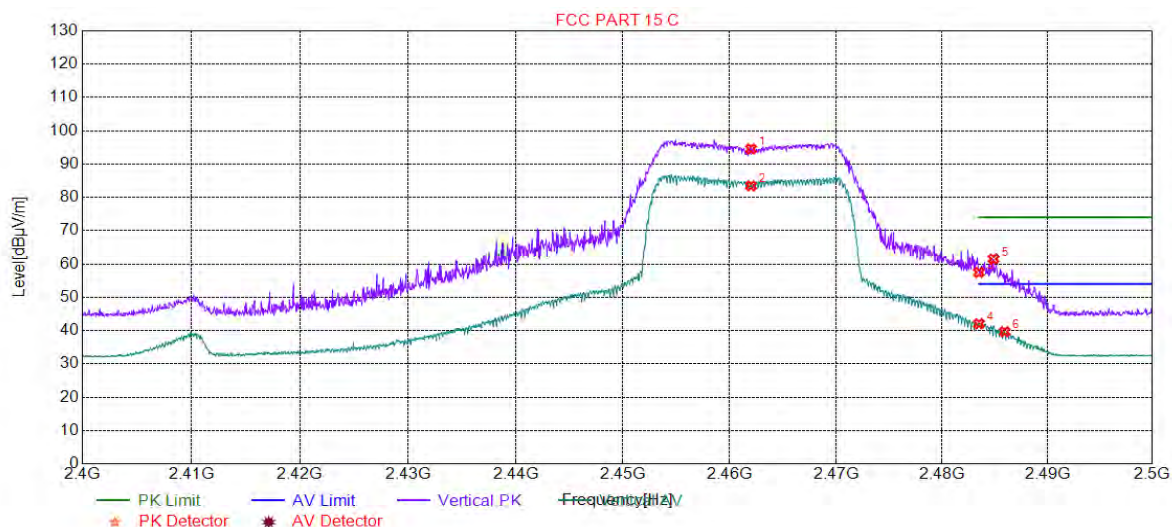
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4.10.1.12

802.11N20_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2462.00	94.56	7.98	0.00	-94.56	199	212	Vertical
2	2462.00	83.46	7.98	0.00	-83.46	173	212	Vertical
3	2483.50	57.45	8.01	74.00	16.55	178	212	Vertical
4	2483.50	42.08	8.01	54.00	11.92	206	212	Vertical
5	2484.89	61.53	8.01	74.00	12.47	212	212	Vertical
6	2485.94	39.70	8.01	54.00	14.30	260	212	Vertical

Final Data List

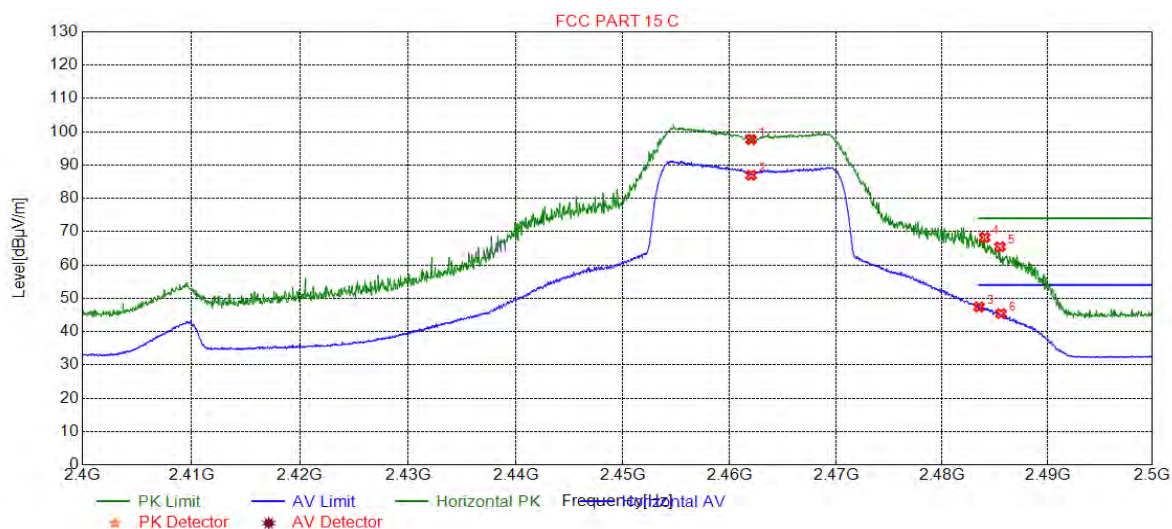


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Secondly supply:

4.10.1.13 802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	2462.000	97.66	8.04	0.00	-97.66	197	Horizontal
2	2462.000	86.97	8.04	0.00	-86.97	125	Horizontal
3	2483.500	47.42	8.05	54.00	6.58	123	Horizontal
4	2484.042	68.27	8.05	74.00	5.73	229	Horizontal
5	2485.492	65.46	8.05	74.00	8.54	200	Horizontal
6	2485.592	45.42	8.05	54.00	8.58	146	Horizontal

Final Data List

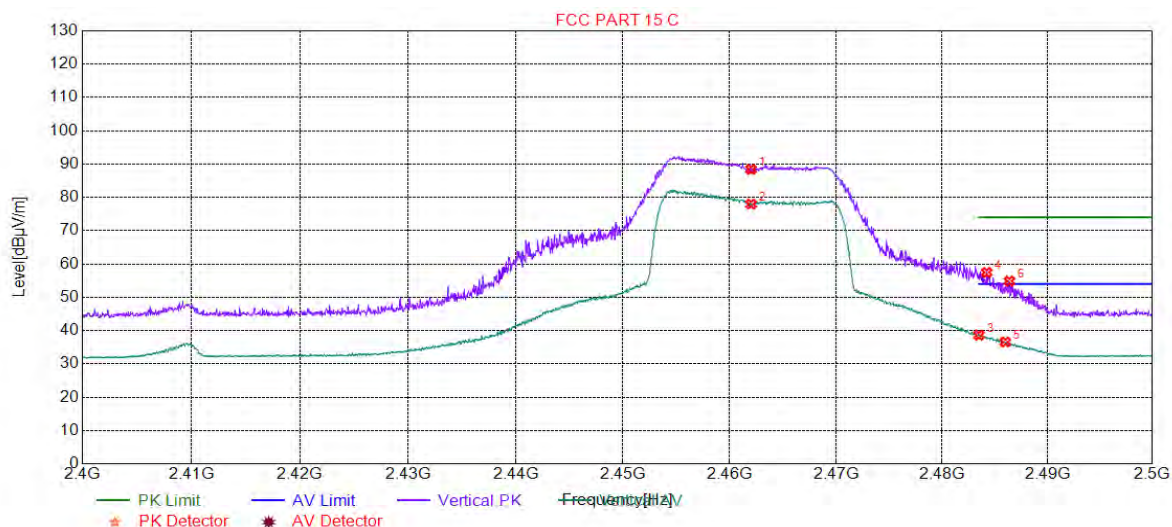


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4.10.1.14

802.11G_Channel 11



Suspected List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Polarity
1	2462.000	88.40	8.04	0.00	-88.40	167	Vertical
2	2462.000	77.99	8.04	0.00	-77.99	168	Vertical
3	2483.500	38.66	8.05	54.00	15.34	277	Vertical
4	2484.242	57.50	8.05	74.00	16.50	236	Vertical
5	2485.993	36.61	8.05	54.00	17.39	224	Vertical
6	2486.393	54.89	8.05	74.00	19.11	207	Vertical

Final Data List

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

All Modes have been tested, but only the worst case data displayed in this report.



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5 Measurement Uncertainty (95% confidence levels, k=2)

Lab A:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	$\pm 0.75\text{dB}$
2	RF power density, conducted	$\pm 2.84\text{dB}$
3	Spurious emissions, conducted	$\pm 0.75\text{dB}$
4	Temperature test	$\pm 1^\circ\text{C}$
5	Humidity test	$\pm 3\%$
6	DC and low frequency voltages	$\pm 0.5\%$

Lab B:

No.	Item	Measurement Uncertainty
1	Conduction Emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
2	Radiated Emission	$\pm 4.8\text{dB}$ (Below 1GHz)
		$\pm 4.8\text{dB}$ (1GHz to 6GHz)
		$\pm 4.5\text{dB}$ (6GHz to 18GHz)
		$\pm 5.02\text{dB}$ (Above 18GHz)



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6 Equipment List

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologie Inc	66311B	W009-09	2020/7/15	2021/7/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2020/1/3	2021/1/2
Coaxial Cable	SGS	N/A	SEM031-01	2020/6/12	2021/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2020/7/14	2021/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2020/10/27	2021/10/27
				2019/10/27	2020/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2020-08-04	2021-08-03
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
				2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ CE V2.5	XAW02-05-02	NCR	NCR



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-01
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Receiving antenna (30MHz~3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2019-11-18	2020-11-17
				2020-10-26	2021-10-25
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2019-11-18	2020-11-17
				2020-10-26	2021-10-25
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-02
				2020-10-27	2021-10-26
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2019-11-18	2020-11-17
				2020-10-26	2021-10-25
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-12-06	2020-12-05
				2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR



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7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of Set-Up for ZR/2020/A0015.

The End



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