FCC TEST REPORT

Application No:	ZR/2020/10013
Applicant:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Address of Applicant:	Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone
Manufacturer:	Lenovo PC HK Limited
Address of Manufacturer	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong P.R.China
Factory:	MOTOROLA (WUHAN) MOBILITY TECHNOLOGIES COMMNICATION CO. LTD.
Address of Factory:	19 GAOXIN 4TH RD, EAST LAKE HIGH TECH ZONE, WUHAN HUBEI CHINA
EUT Description:	Portable Tablet Computer
Model No.:	Lenovo TB-X606F
Trade Mark:	Lenovo
FCC ID:	O57TBX606F
Standards:	47 CFR FCC Part 2, Subpart J 47 CFR Part 15, Subpart C
Test Method:	KDB558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10 (2013)
Date of Receipt:	2019/11/9
Date of Test:	2019/11/10 to 2019/11/21
Date of Issue:	2021/7/4
Test Result:	**PASS ***

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

Derek Yang
Wireless Laboratory Manager

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1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2019/12/12		Original
01		2021/7/4	Sherlock Fang	1.Add test site Information 2. Modify data conversion error of antenna height 3.Update equipment list

*This report supersedes our previous report ZR/2020/1001302, issued on 2019-12-12, which is hereby deemed null and void.

Authorized for issue by:		
Prepared By		Sherlock Fang **(Sherlock Fang) / Engineer**
Checked By		Jim Huang **(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（Test date :2019.11.18-2019.11.29）.
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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Remark:

Battery			
Battery1	Lenovo(SCUD)	L19D1P32	3.86V; 5000mAh/19.3Wh/1cell
Battery2	Lenovo(ATL)	L19D1P32	3.86V; 5000mAh/19.3Wh/1cell
USB Cable			
USB Cable1	Lenovo(LiQi)	-	1.0m shielded cable without core
USB Cable2	Lenovo(Saibao)	-	1.0m shielded cable without core
Adapter			
Adapter1 (US)	Lenovo(Salom)	SC-41	I/P: 100-240 Vac, 300mA ,50/60HZ O/P: 5Vdc 2000mA
Adapter2 (US)	Lenovo(Acbel)	SC-41	I/P: 100-240 Vac, 300mA ,50/60HZ O/P: 5Vdc 2000mA
Smart Charging Station			
Smart Charging Station1	Lenovo	Lenovo CD-100	I/P: 5Vdc 2000mA O/P: 5Vdc 2000mA
Lenovo Smart Dock			
Lenovo Smart Dock	Lenovo	LenovoHA-200	I/P: 12V 2A O/P: 5V 1.5A

There were no difference between Lenovo TB-X606FA and Lenovo TB-X606F, but only Smart Charging Station and Lenovo Smart Dock added on Lenovo TB-X606FA.
According to the difference above, there were no test on Lenovo TB-X606FA, all test data reuse the original report (Report No.: ZR/2019/A002602-01).

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3 General Information

3.1 Client Information

Applicant:	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Address of Applicant:	Section 304-305, Building No. 4, # 222, Meiyue Road, China (Shanghai) Pilot Free Trade Zone
Manufacturer:	Lenovo PC HK Limited
Address of Manufacturer:	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong P.R.China
Factory:	MOTOROLA (WUHAN) MOBILITY TECHNOLOGIES COMMNICATION CO. LTD.
Address of Factory:	19 GAOXIN 4TH RD, EAST LAKE HIGH TECH ZONE, WUHAN HUBEI 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:	Adam Liang, 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

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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:	Portable Tablet Computer
Model No.:	Lenovo TB-X606FA
Trade Mark:	Lenovo
Hardware Version:	Lenovo Tablet TB-X606FA
Software Version:	TB-X606F_RF01_200115
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:	0.43dBi
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		

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)	Frequency for 802.11N (HT40)
The Lowest channel	2412MHz	2422MHz
The Middle channel	2437MHz	2437MHz

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The Highest channel	2462MHz	2452MHz

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.

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 0.43dBi.	

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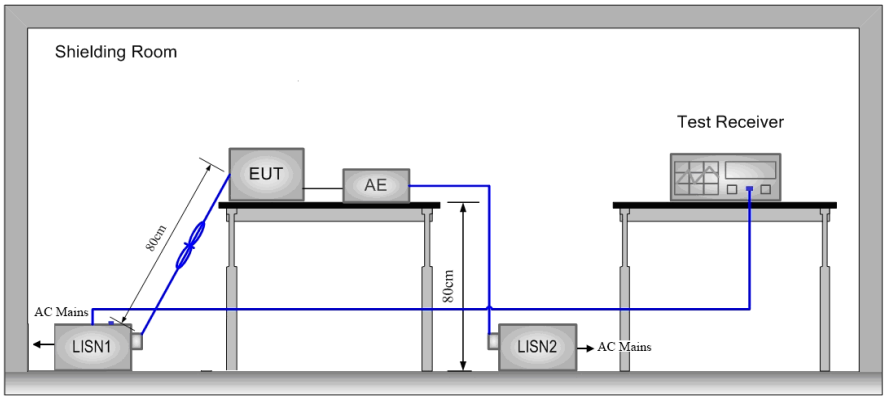
Test Setup:	
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates at lowest, middle and highest channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of rate of 802.11B at lowest channel is the worst case. Charge + Transmitting mode. Only the worst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

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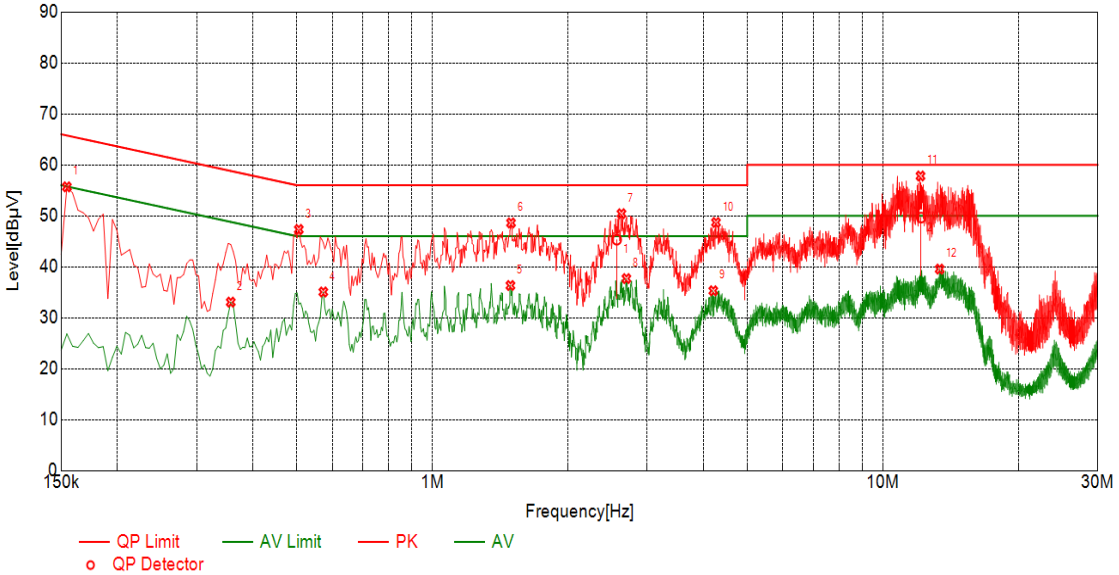
Measurement Data

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

Suspected List							
NO.	Freq.[MHz]	Level[dBµV]	Factor[dB]	Limit[dBµV]	Margin[dB]	Detector	Type
1	0.1545	55.68	10.10	65.75	10.07	PK	L
2	0.3570	33.06	10.10	48.80	15.74	AV	L
3	0.5055	47.32	10.10	56.00	8.68	PK	L
4	0.5730	35.05	10.10	46.00	10.95	AV	L
5	1.4910	36.32	10.10	46.00	9.68	AV	L
6	1.4955	48.60	10.10	56.00	7.40	PK	L
7	2.6295	50.41	10.10	56.00	5.59	PK	L
8	2.6970	37.68	10.10	46.00	8.32	AV	L
9	4.2045	35.29	10.10	46.00	10.71	AV	L
10	4.2630	48.69	10.10	56.00	7.31	PK	L
11	12.1245	57.81	10.10	60.00	2.19	PK	L
12	13.3710	39.54	10.11	50.00	10.46	AV	L

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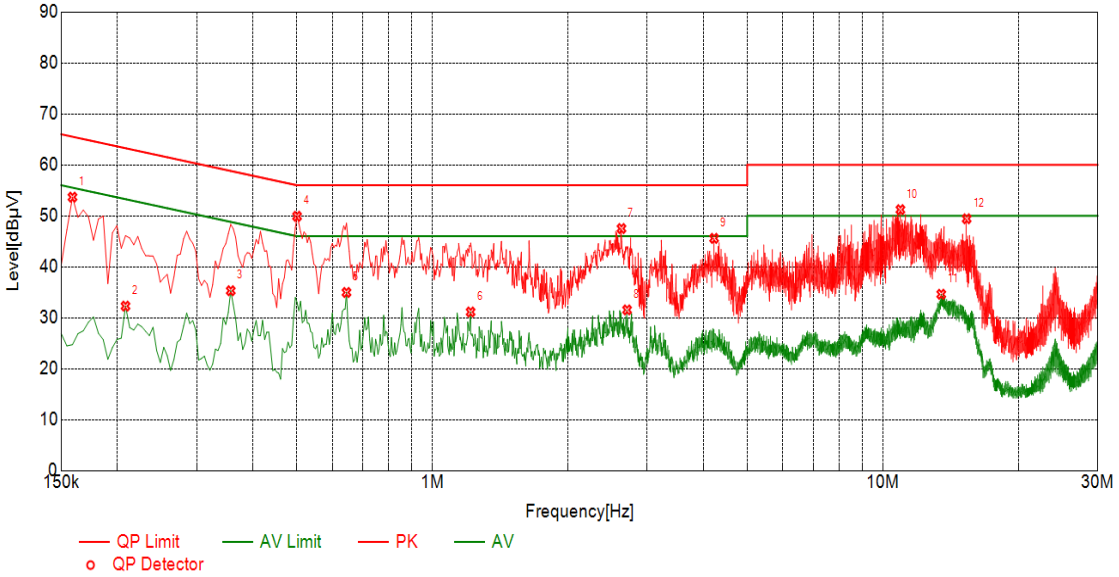
Neutral Line:



Test Graph

Suspected List							
NO.	Freq.[MHz]	Level[dBμV]	Factor[dB]	Limit[dBμV]	Margin[dB]	Detector	Type
1	0.1590	53.66	10.10	65.52	11.86	PK	N
2	0.2085	32.28	10.10	53.26	20.98	AV	N
3	0.3570	35.30	10.10	48.80	13.50	AV	N
4	0.5010	49.91	10.10	56.00	6.09	PK	N
5	0.6450	34.96	10.10	46.00	11.04	AV	N
6	1.2165	31.13	10.10	46.00	14.87	AV	N
7	2.6295	47.50	10.10	56.00	8.50	PK	N
8	2.7060	31.54	10.10	46.00	14.46	AV	N
9	4.2225	45.57	10.10	56.00	10.43	PK	N
10	10.9410	51.21	10.10	60.00	8.79	PK	N
11	13.4790	34.61	10.11	50.00	15.39	AV	N
12	15.3510	49.42	10.11	60.00	10.58	PK	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

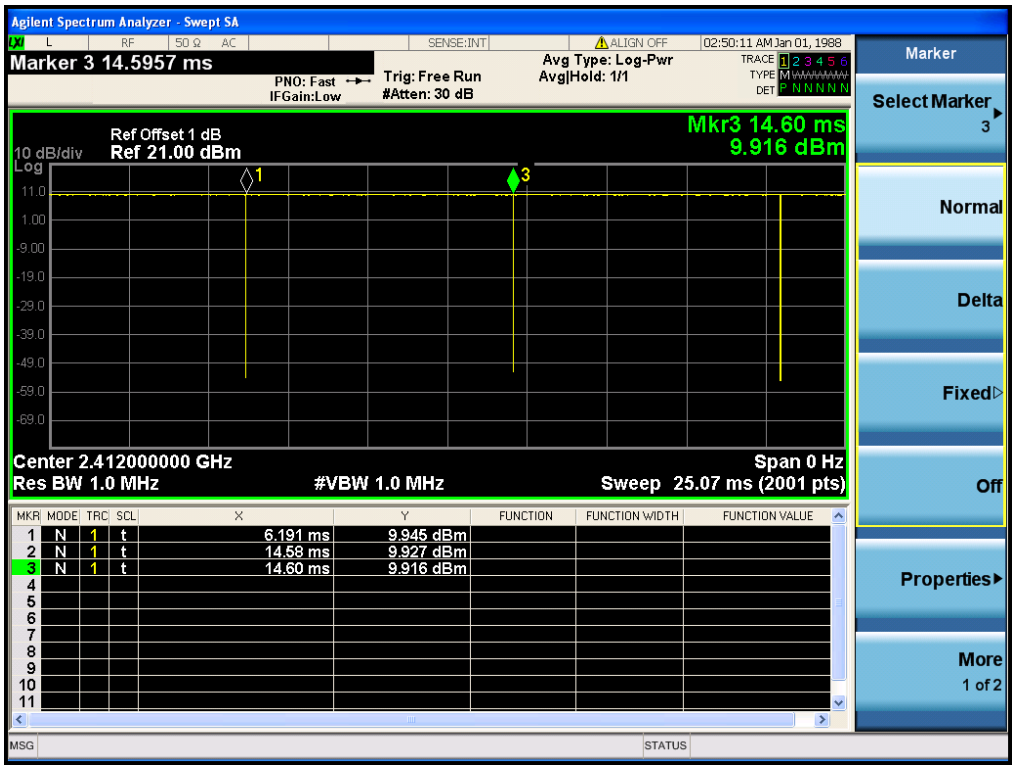
4.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
11B	Ant 1: CH1	99.76
11G	Ant 1: CH1	97.05
11N20	Ant 1: CH1	98.27

4.3.1 Test Plots

4.3.1.1 ANT1

4.3.1.1.1 11B



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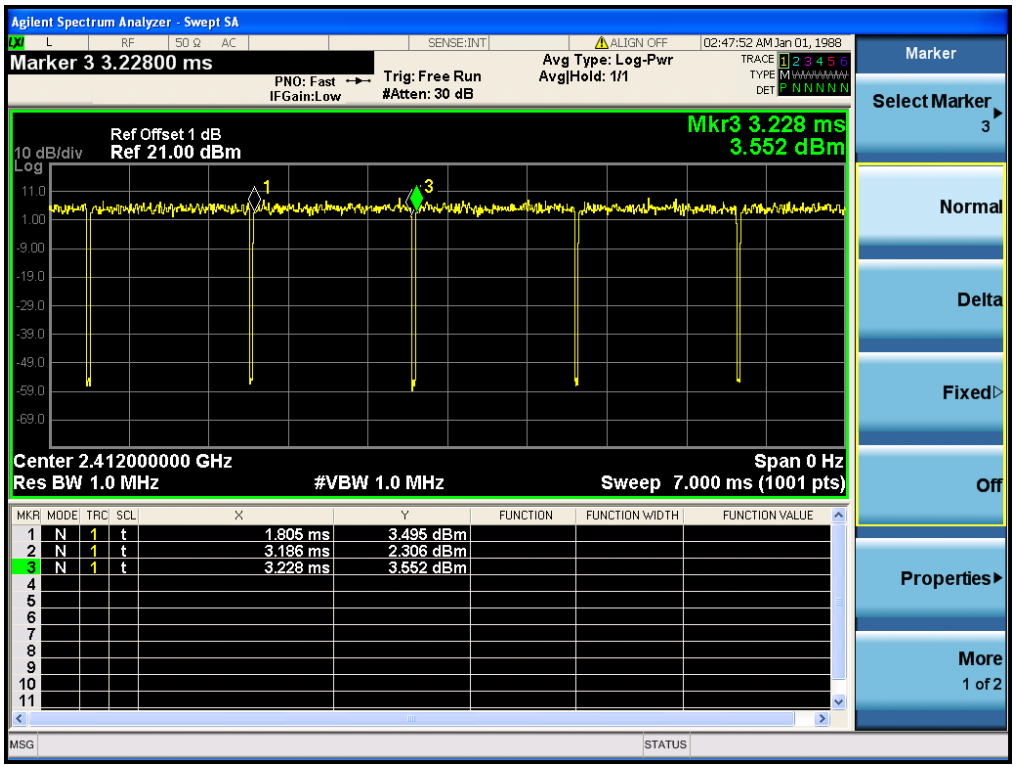
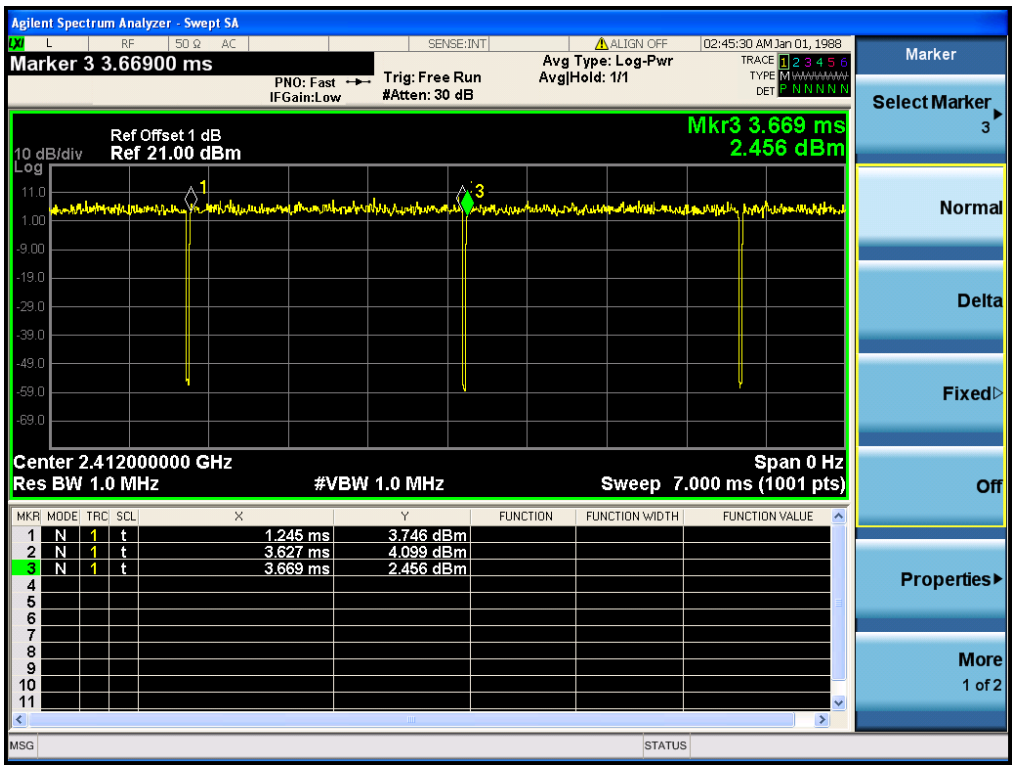
4.3.1.1.2 11G



4.3.1.1.3 11N20



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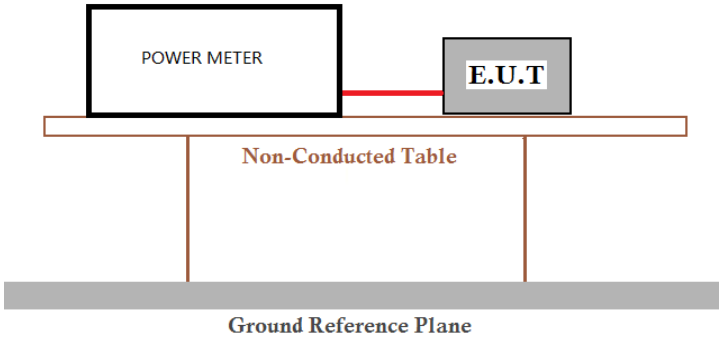
4.4 Conducted Output Power

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 Average Power:

Mode	Test Channel	Average Output Power (dBm) [Duty Cycle Considered]	Result
802.11B	Lowest	17.19	Report purpose only
	Middle	17.41	Report purpose only
	Highest	17.08	Report purpose only
802.11G	Lowest	15.95	Report purpose only
	Middle	16.04	Report purpose only
	Highest	15.77	Report purpose only
802.11N20	Lowest	12.99	Report purpose only
	Middle	16.12	Report purpose only
	Highest	12.79	Report purpose only

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	17.56	30.00	Pass
	Middle	21.50	30.00	Pass
	Highest	21.04	30.00	Pass
802.11G	Lowest	21.39	30.00	Pass
	Middle	21.58	30.00	Pass
	Highest	21.17	30.00	Pass
802.11N20	Lowest	20.85	30.00	Pass
	Middle	21.07	30.00	Pass
	Highest	20.67	30.00	Pass

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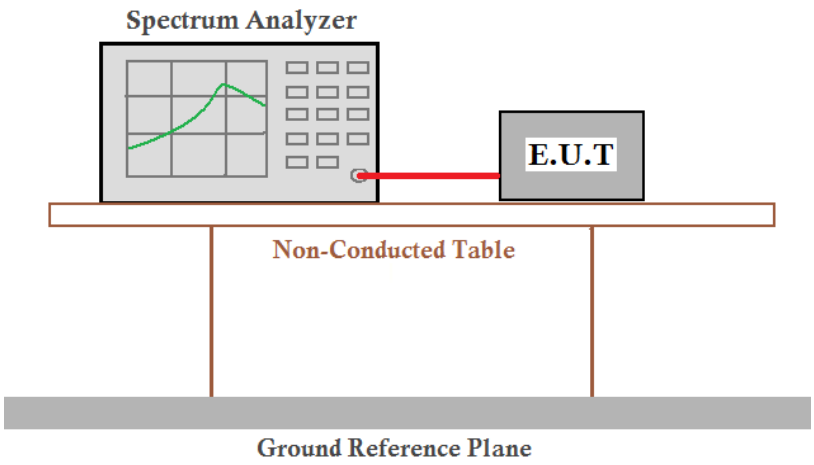
4.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

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

4.5.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	12.67	12.70	≥500	Pass
	Middle	13.06	13.02	≥500	Pass
	Highest	12.90	12.87	≥500	Pass
802.11G	Lowest	16.41	16.30	≥500	Pass
	Middle	16.55	16.43	≥500	Pass
	Highest	16.43	16.32	≥500	Pass
802.11N20	Lowest	17.50	17.50	≥500	Pass
	Middle	17.68	17.60	≥500	Pass
	Highest	17.51	17.51	≥500	Pass

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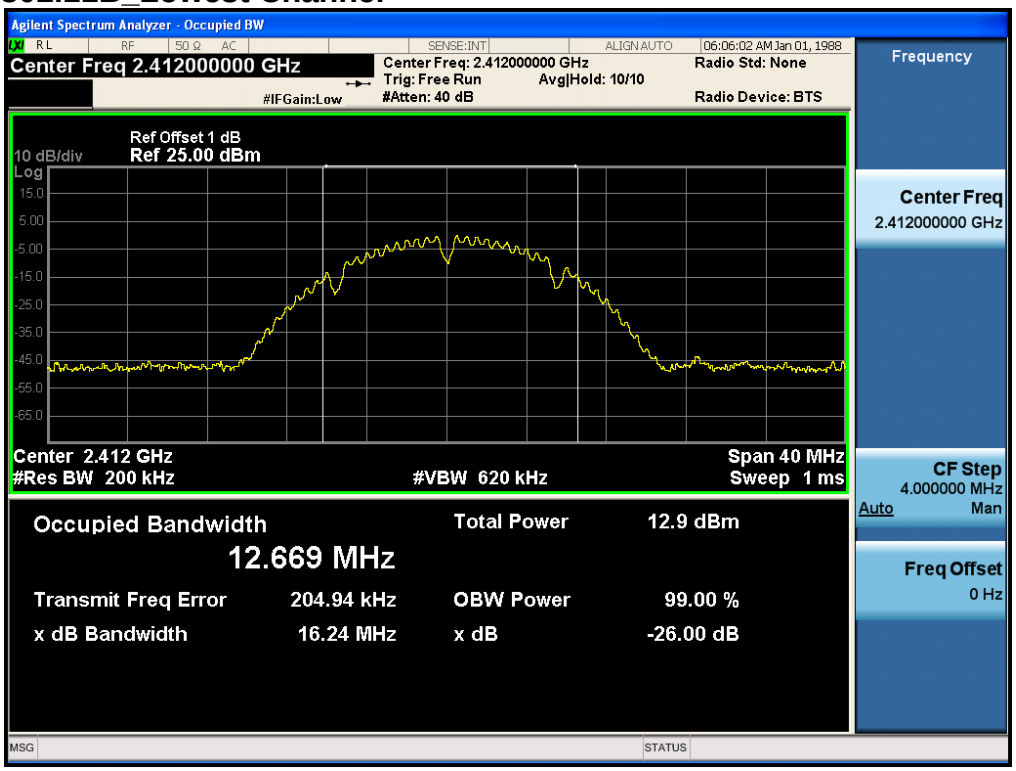
4.5.2 Test plots

4.5.2.1 ANT1

4.5.2.1.1 802.11B_Lowest Channel



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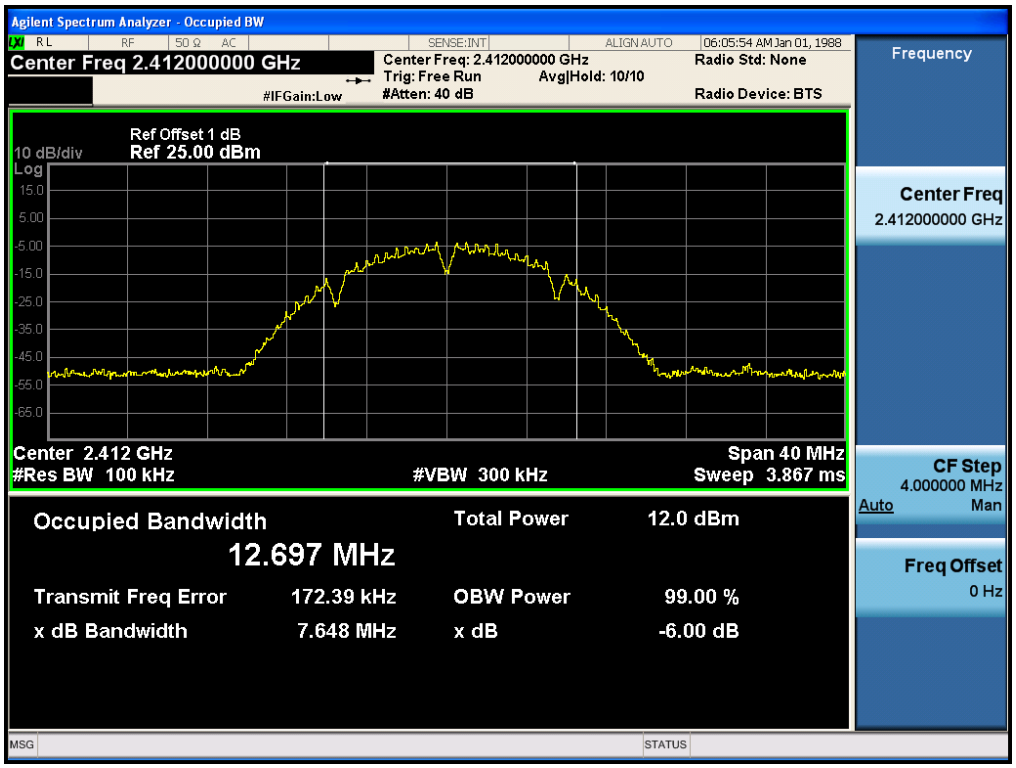

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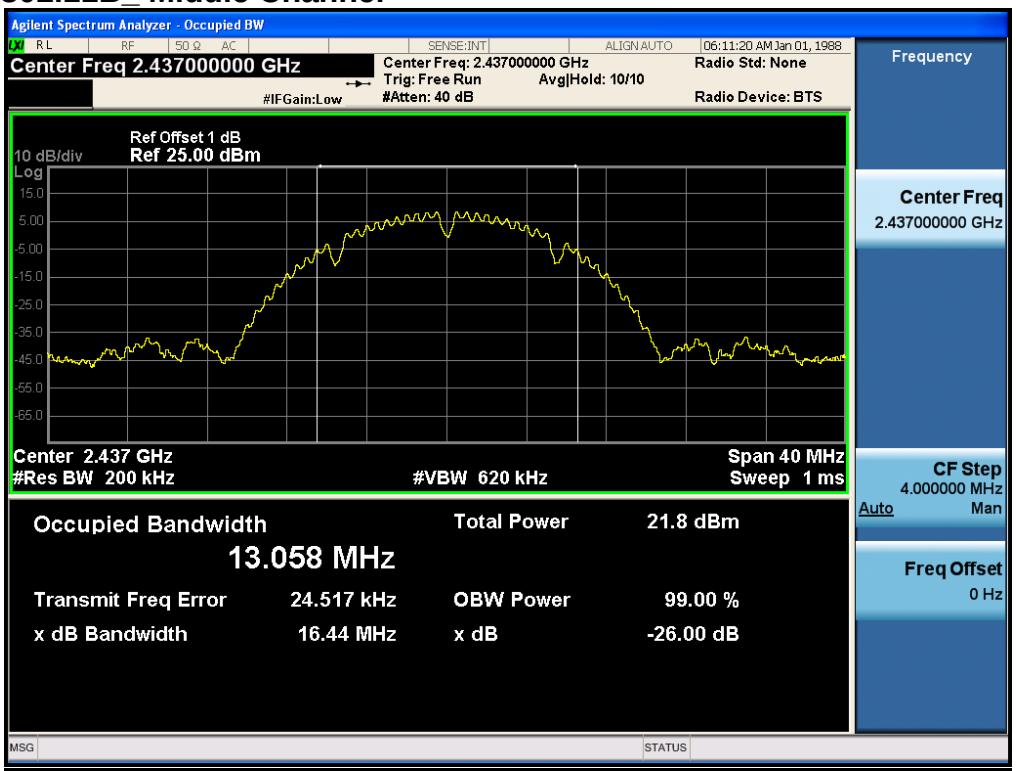
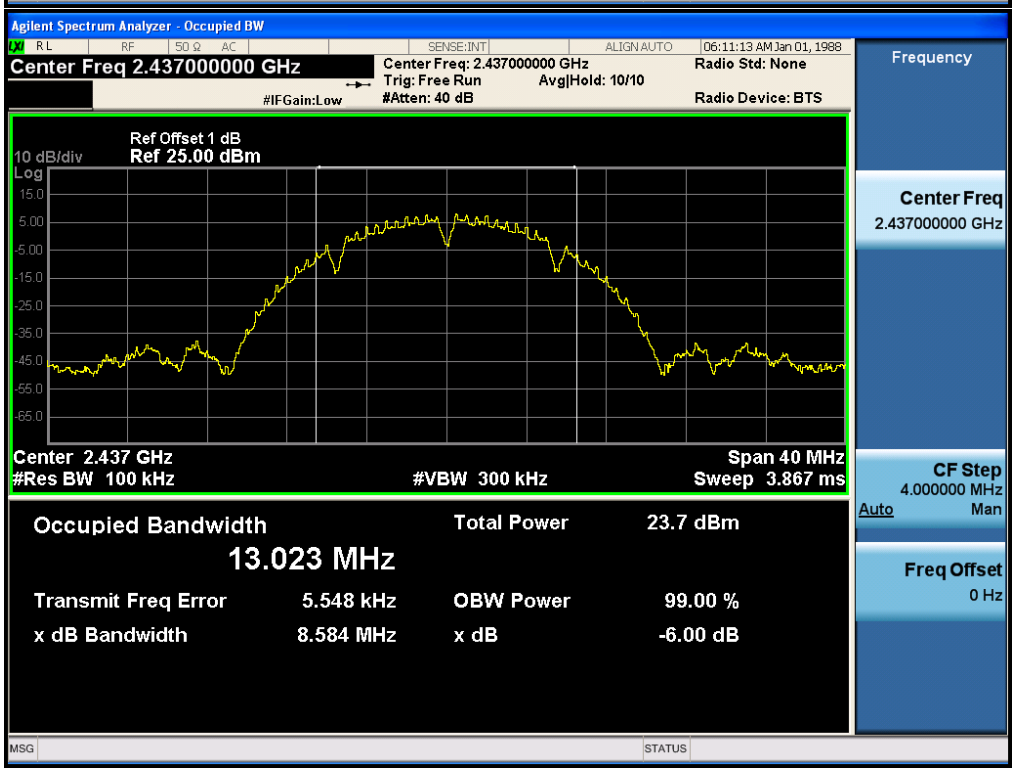
4.5.2.1.2 802.11B_ Middle Channel





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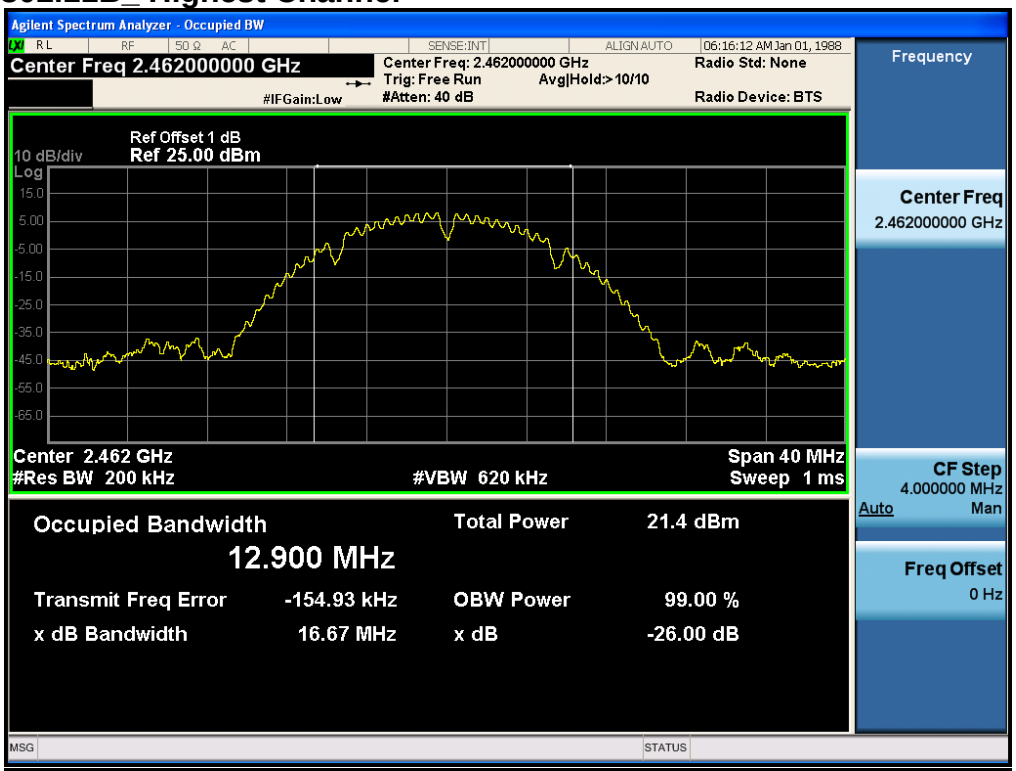
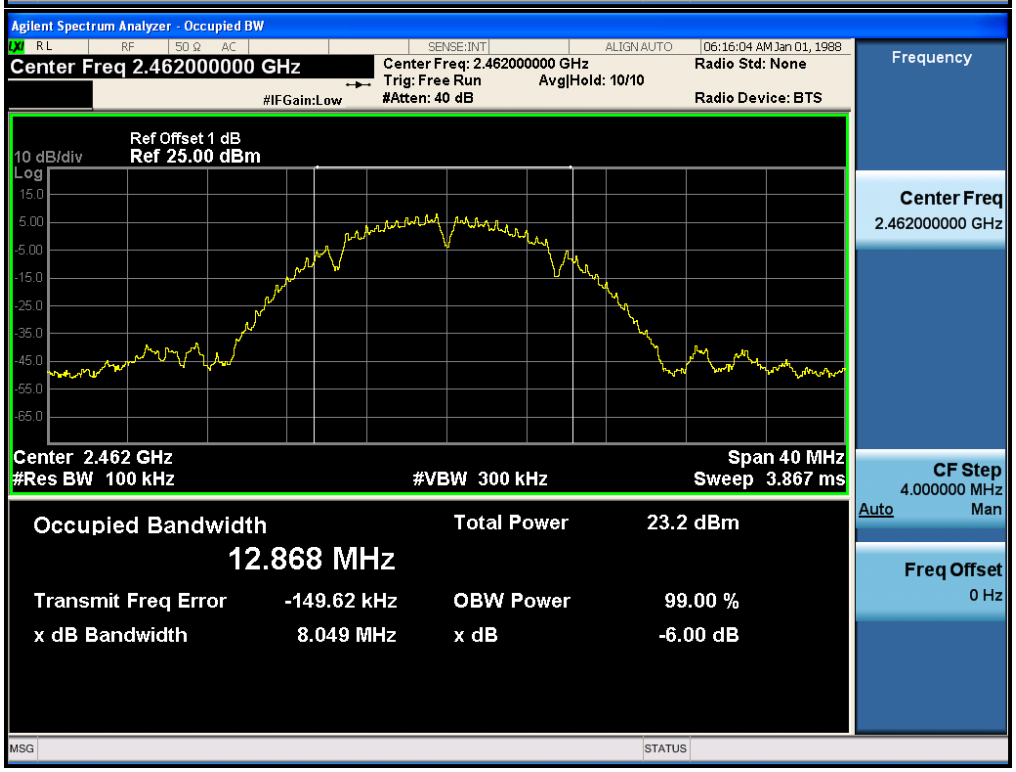
4.5.2.1.3 802.11B_ Highest Channel





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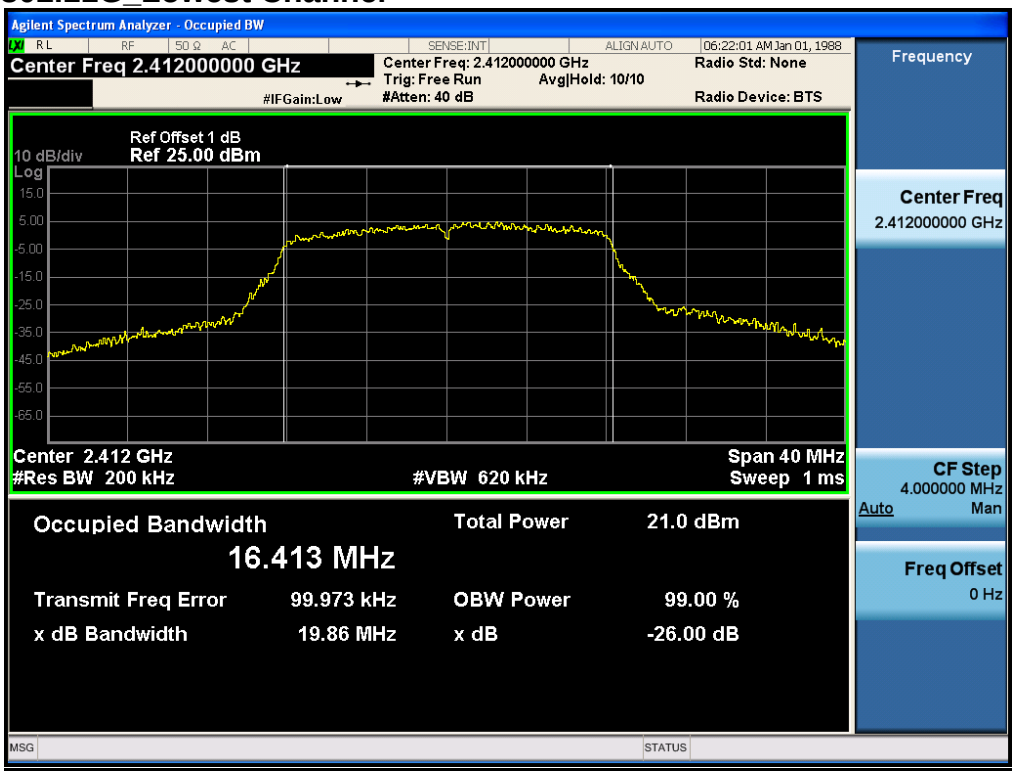
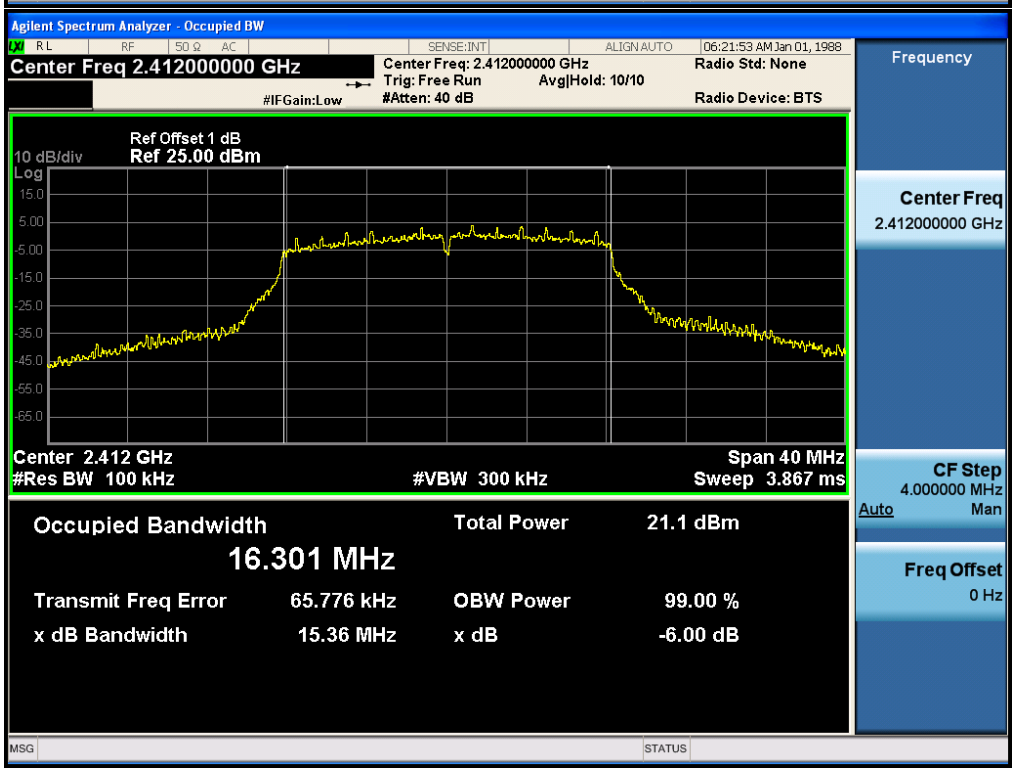
4.5.2.1.4 802.11G_Lowest Channel





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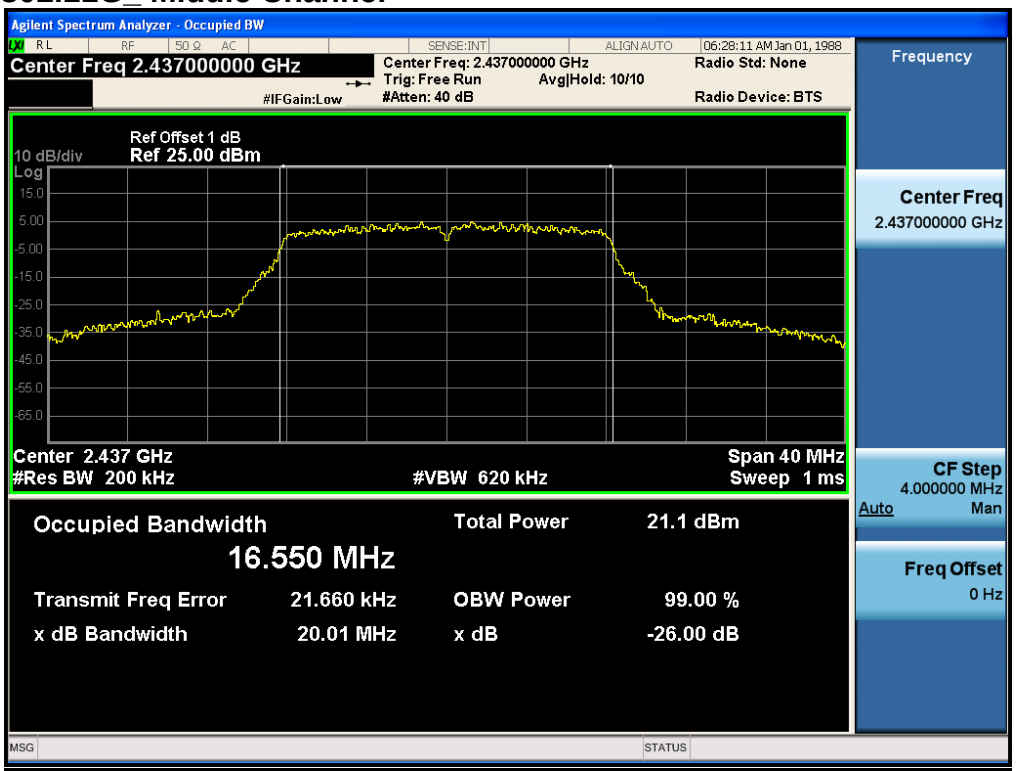
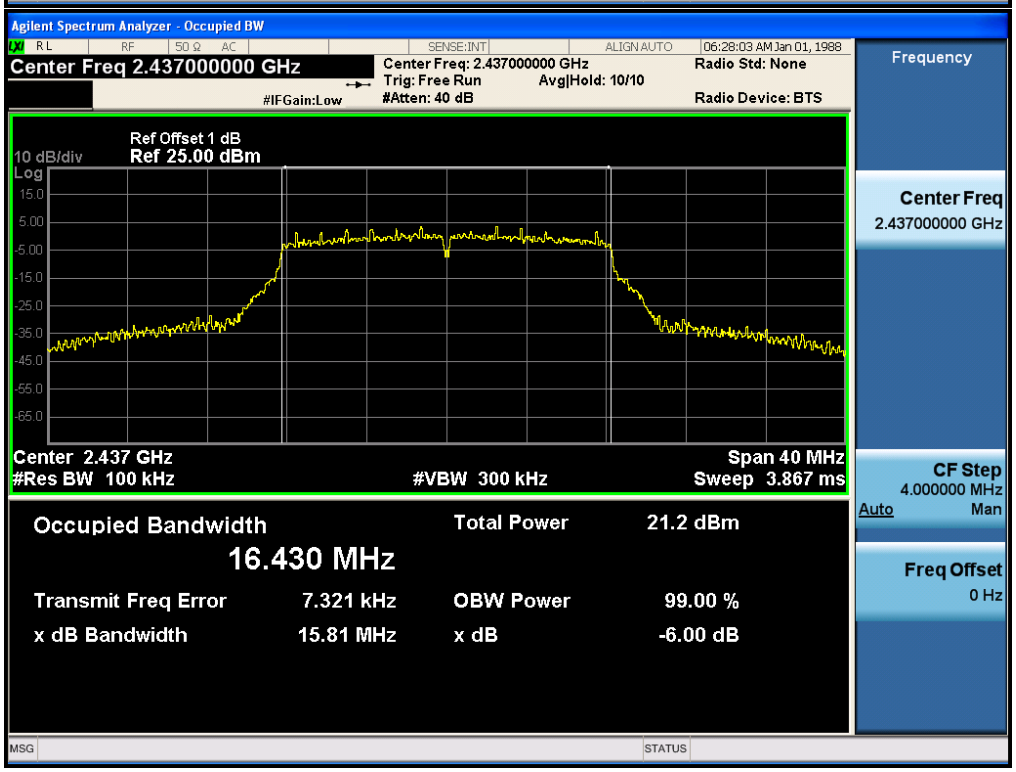
4.5.2.1.5 802.11G_ Middle Channel





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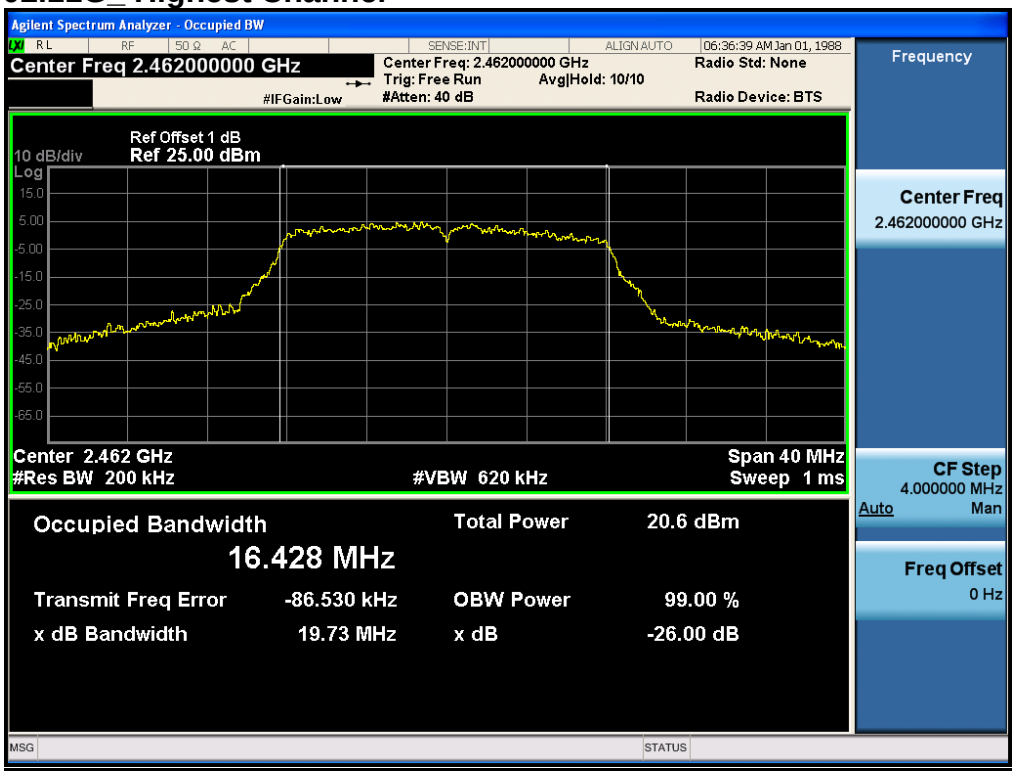
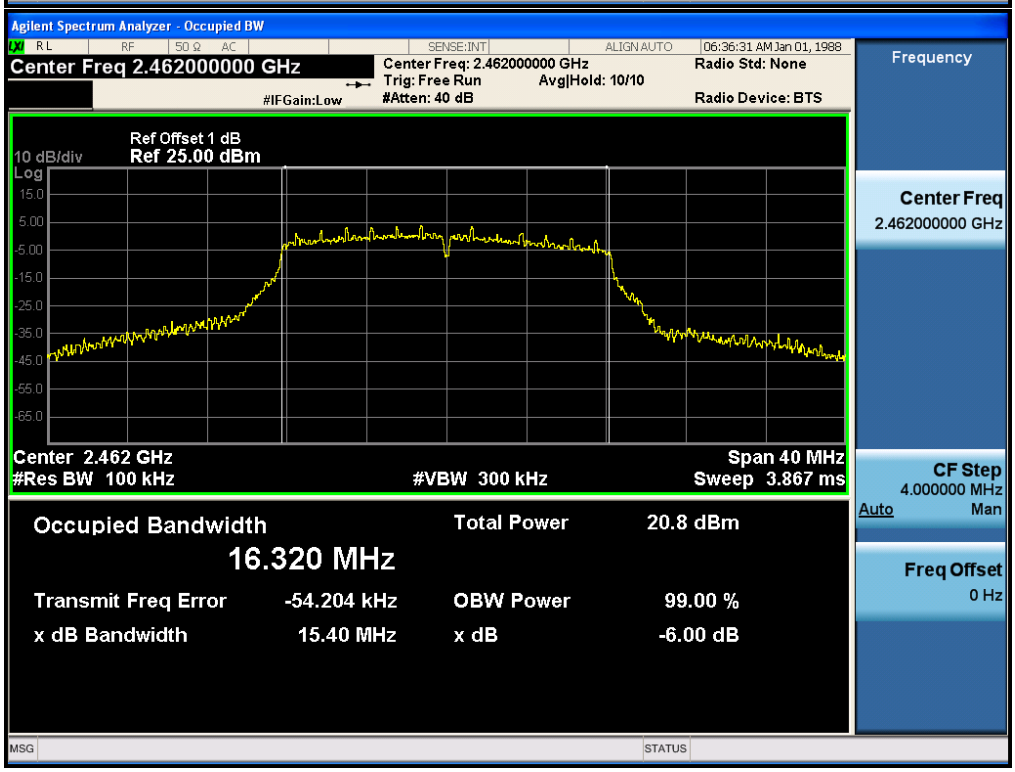
4.5.2.1.6 802.11G_ Highest Channel





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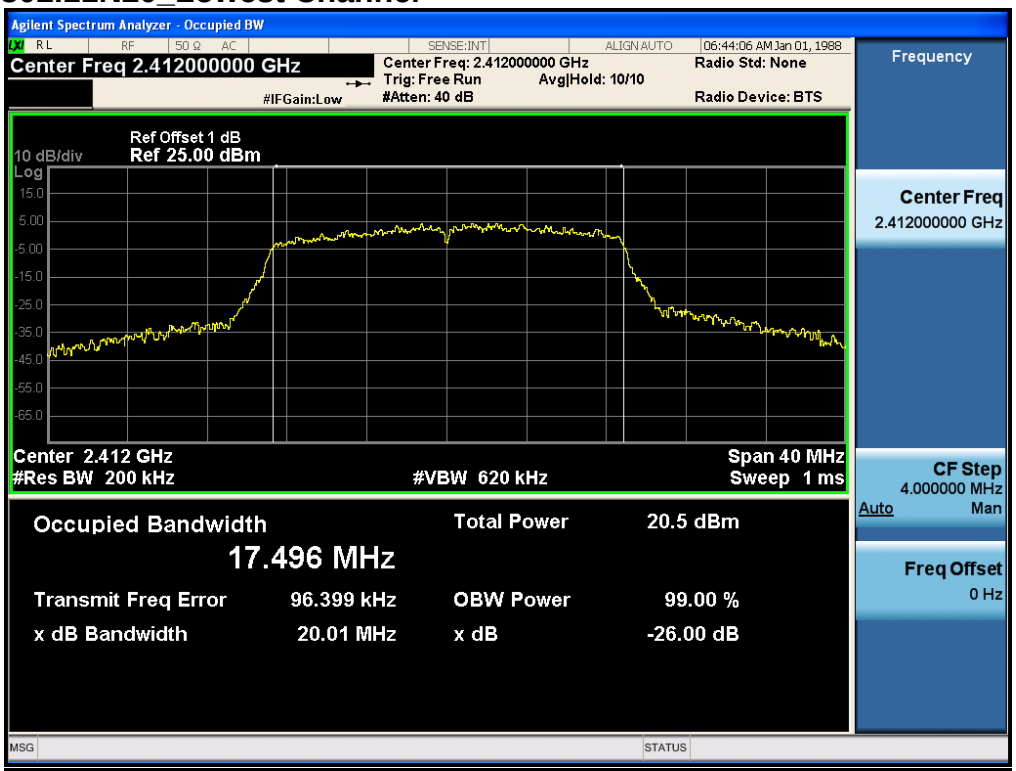
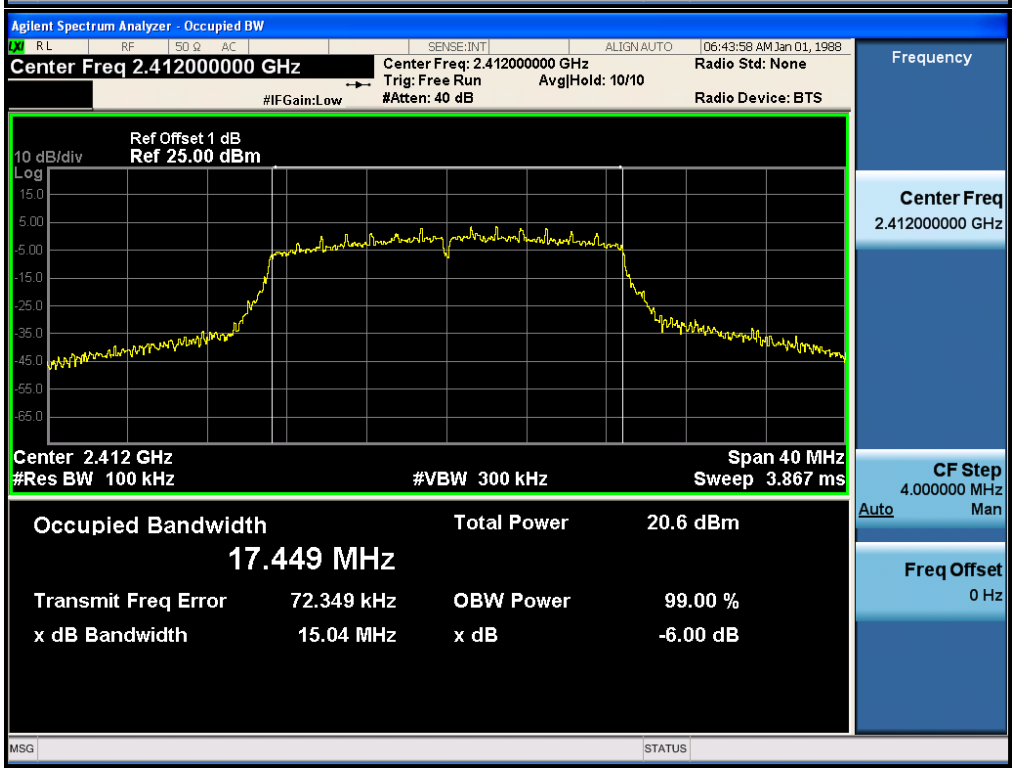
4.5.2.1.7 802.11N20_Lowest Channel





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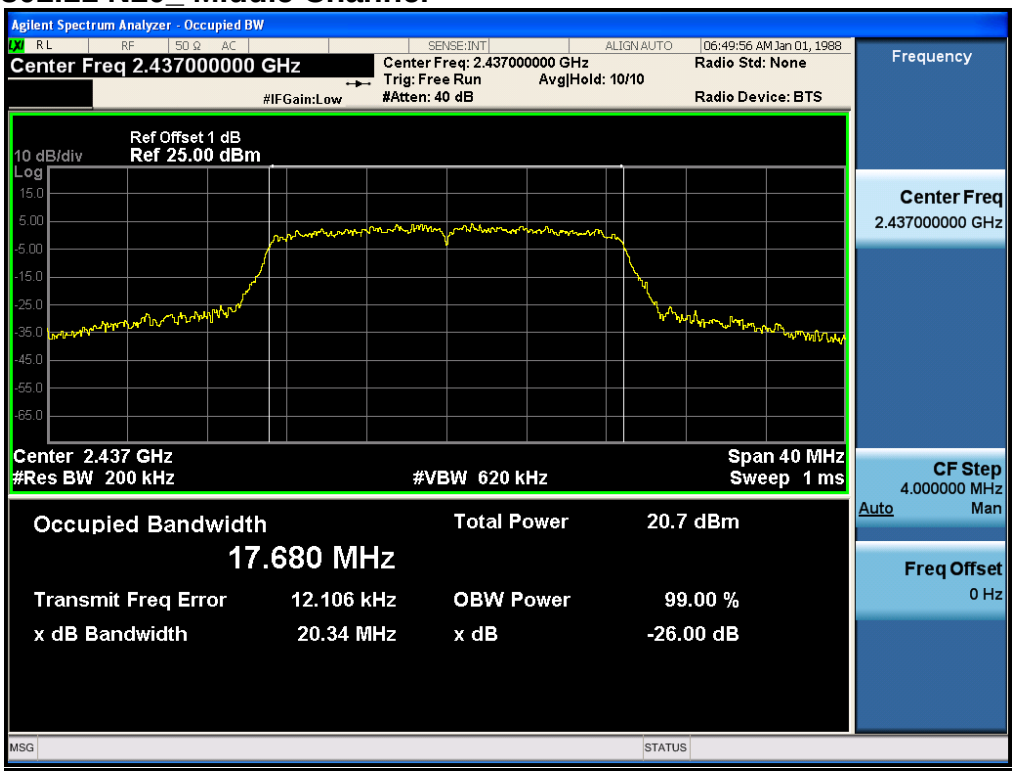

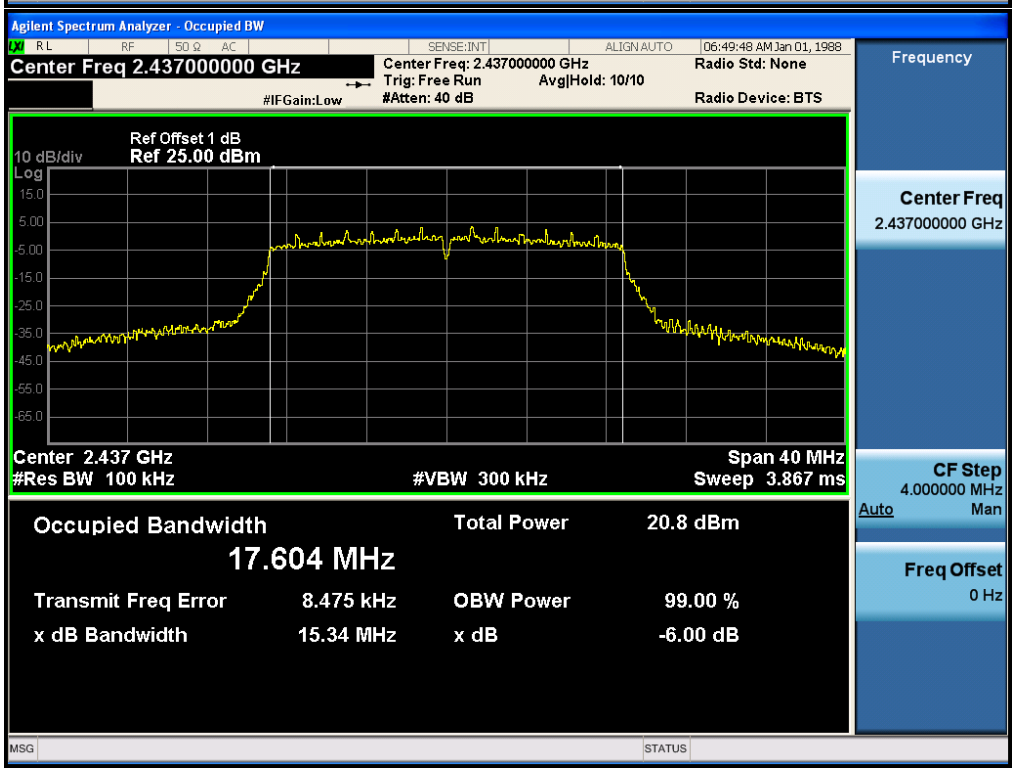

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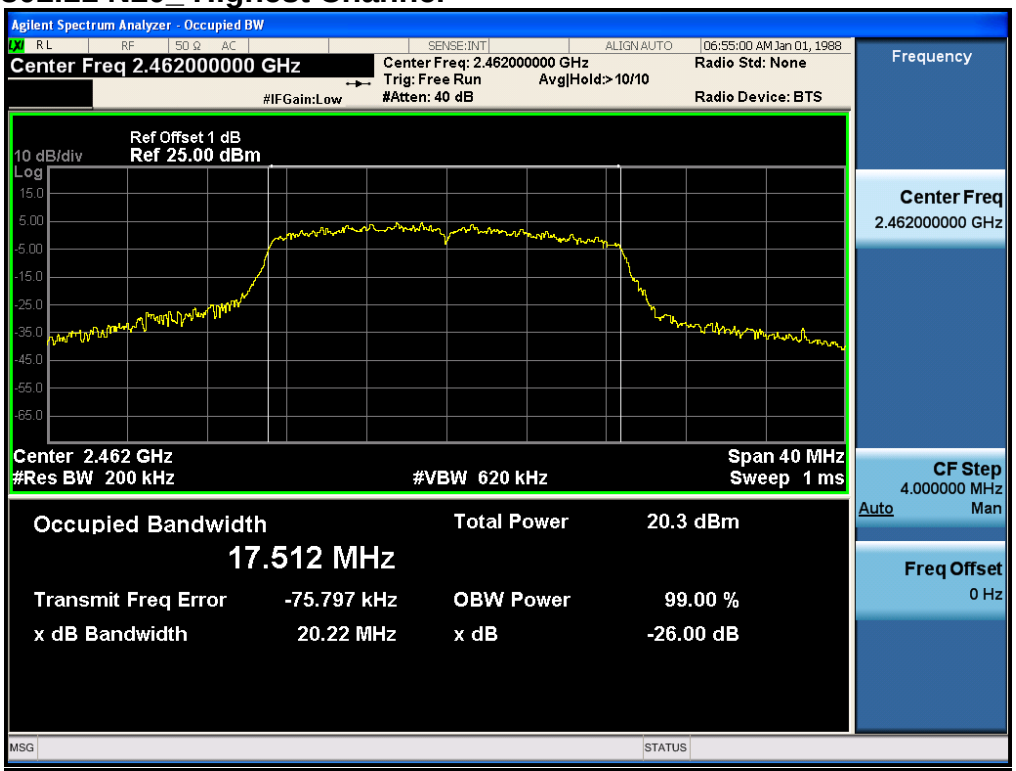
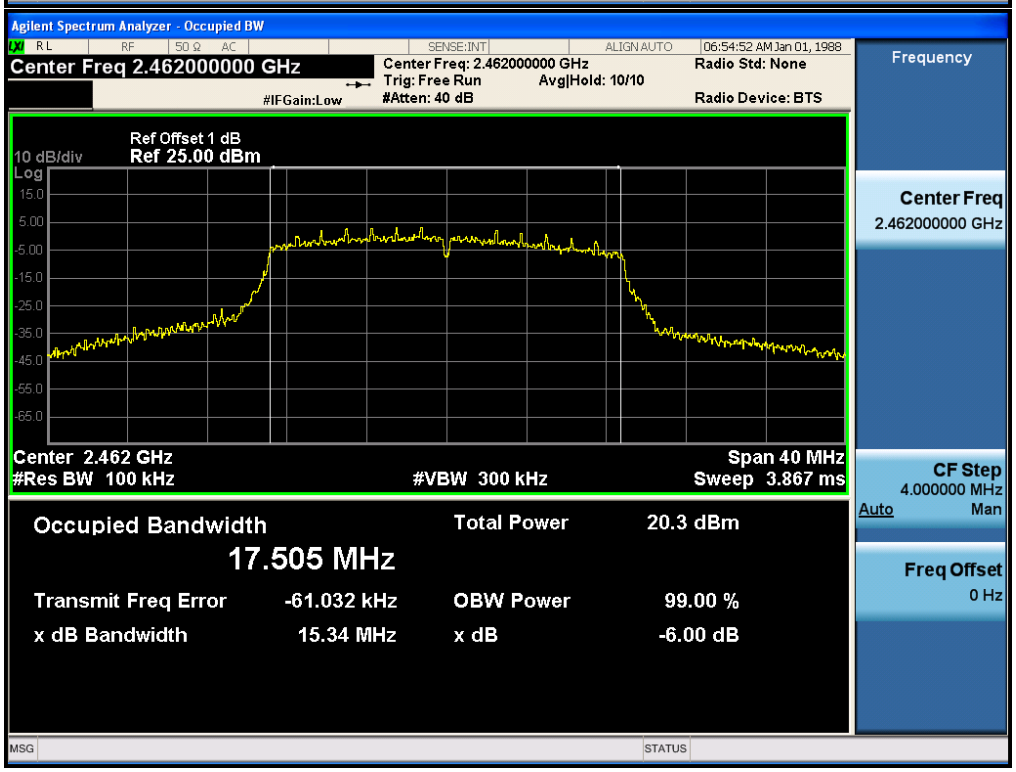
4.5.2.1.9 802.11 N20_ Highest Channel





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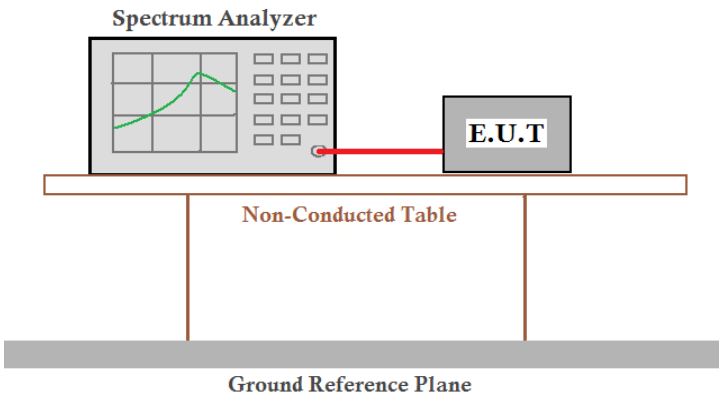
4.6 Power Spectral Density

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	-6.57	≤8.00	Pass
	Middle	-4.49	≤8.00	Pass
	Highest	-6.10	≤8.00	Pass
802.11G	Lowest	-9.99	≤8.00	Pass
	Middle	-9.71	≤8.00	Pass
	Highest	-9.44	≤8.00	Pass
802.11N20	Lowest	-11.12	≤8.00	Pass
	Middle	-10.41	≤8.00	Pass
	Highest	-10.70	≤8.00	Pass

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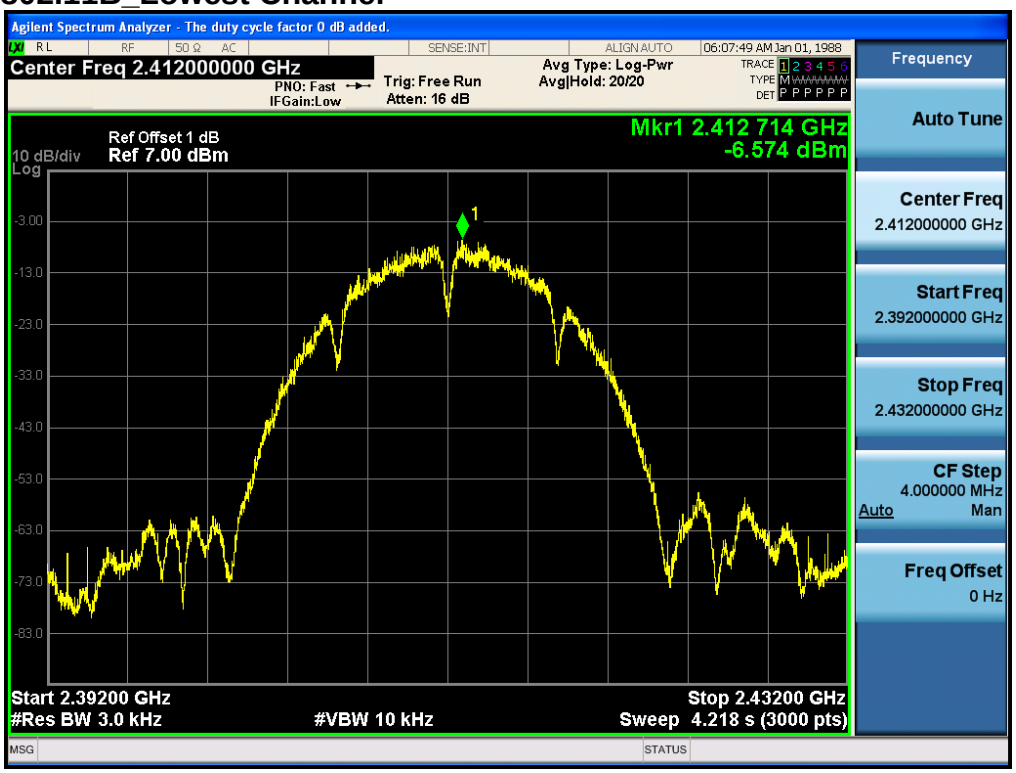
4.6.2 Test plots

4.6.2.1 ANT1

4.6.2.1.1 802.11B_Lowest Channel



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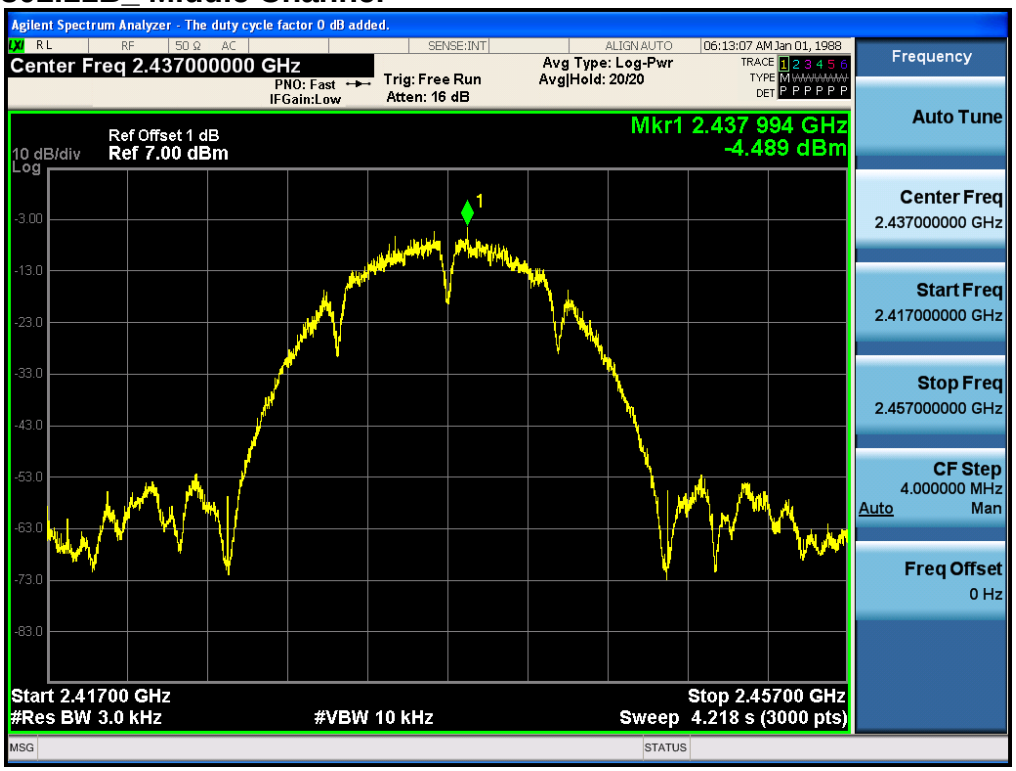
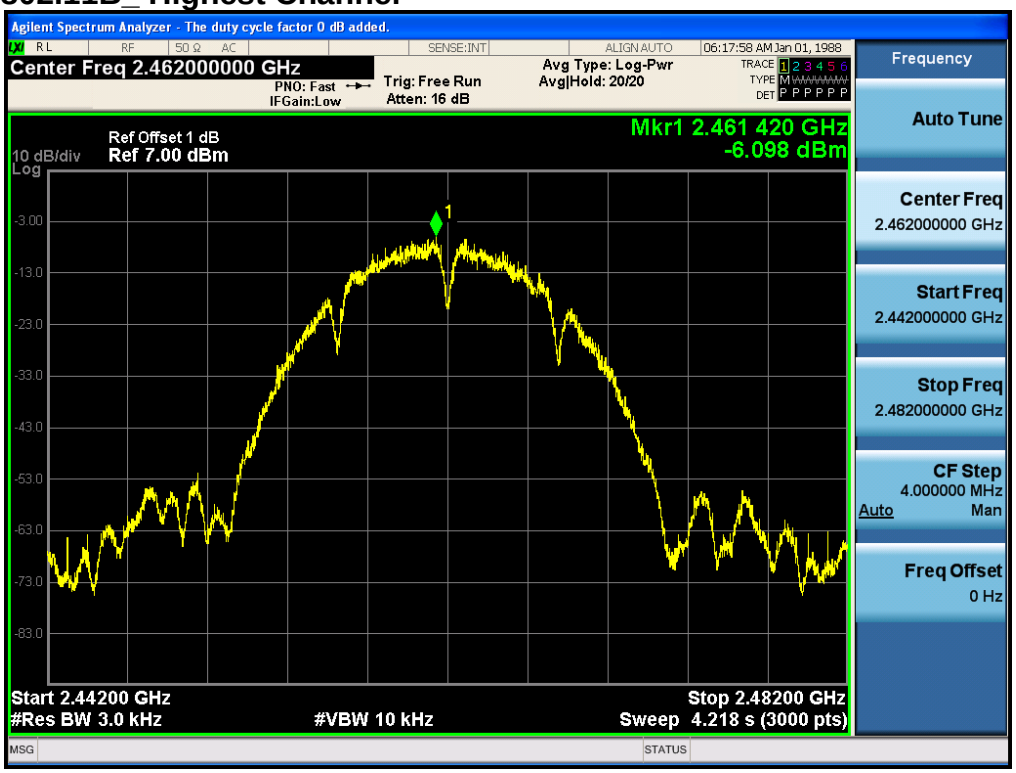
4.6.2.1.2 802.11B_ Middle Channel



4.6.2.1.3 802.11B_ Highest Channel



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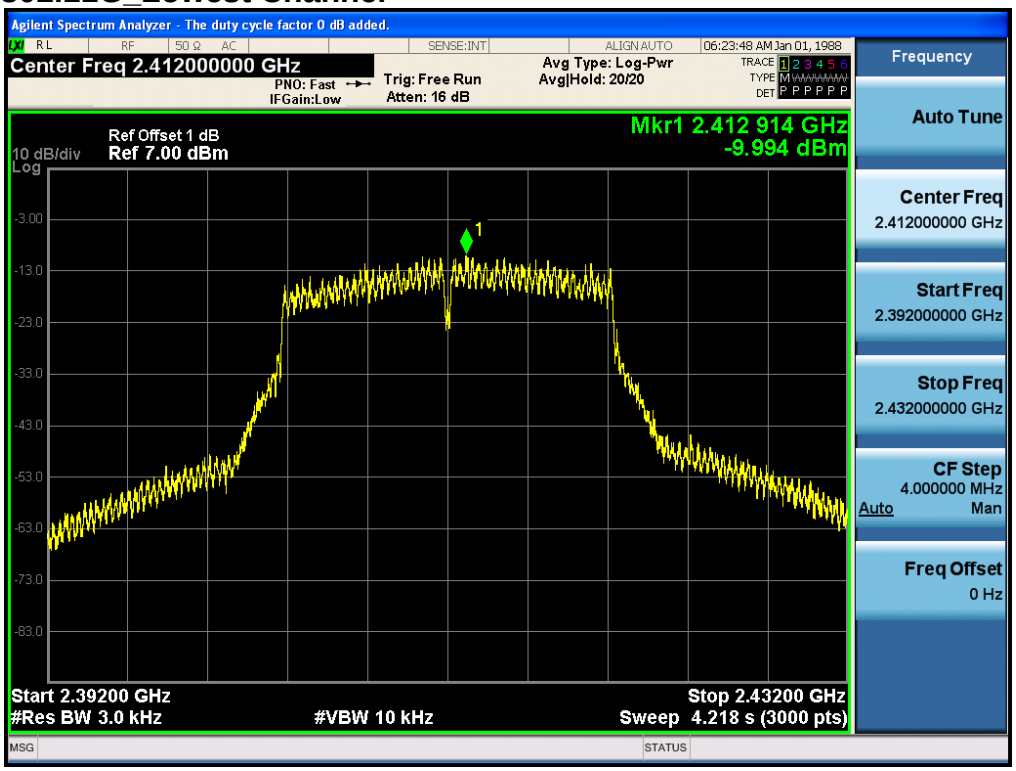
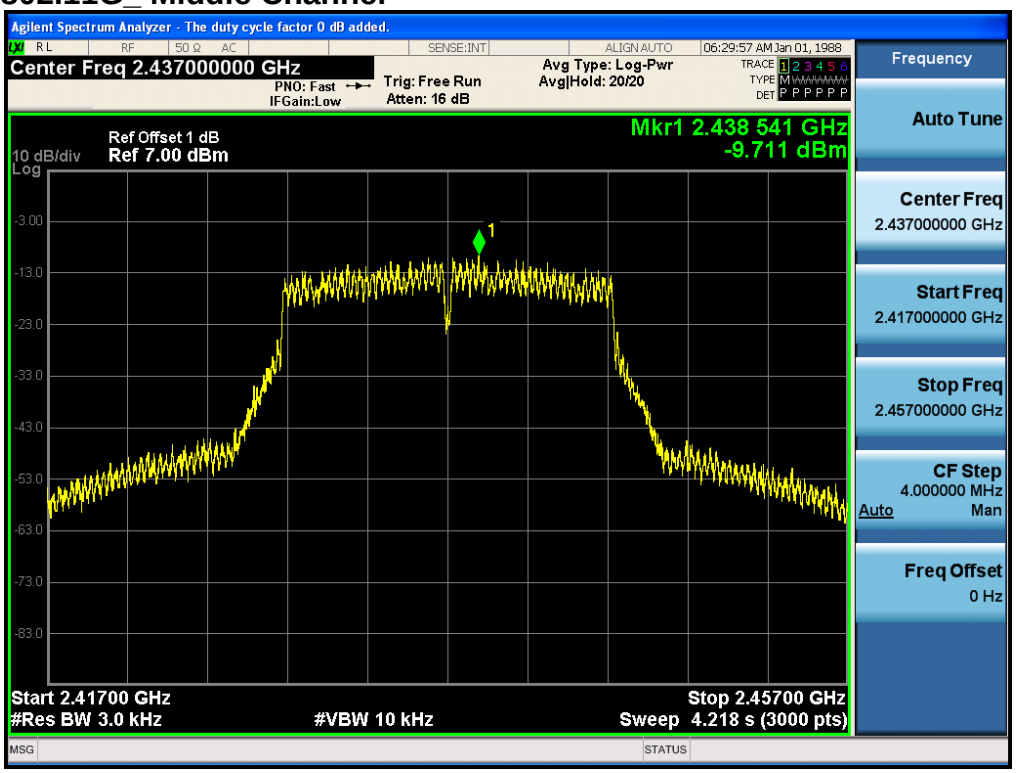
4.6.2.1.4 802.11G_Lowest Channel



4.6.2.1.5 802.11G_ Middle Channel



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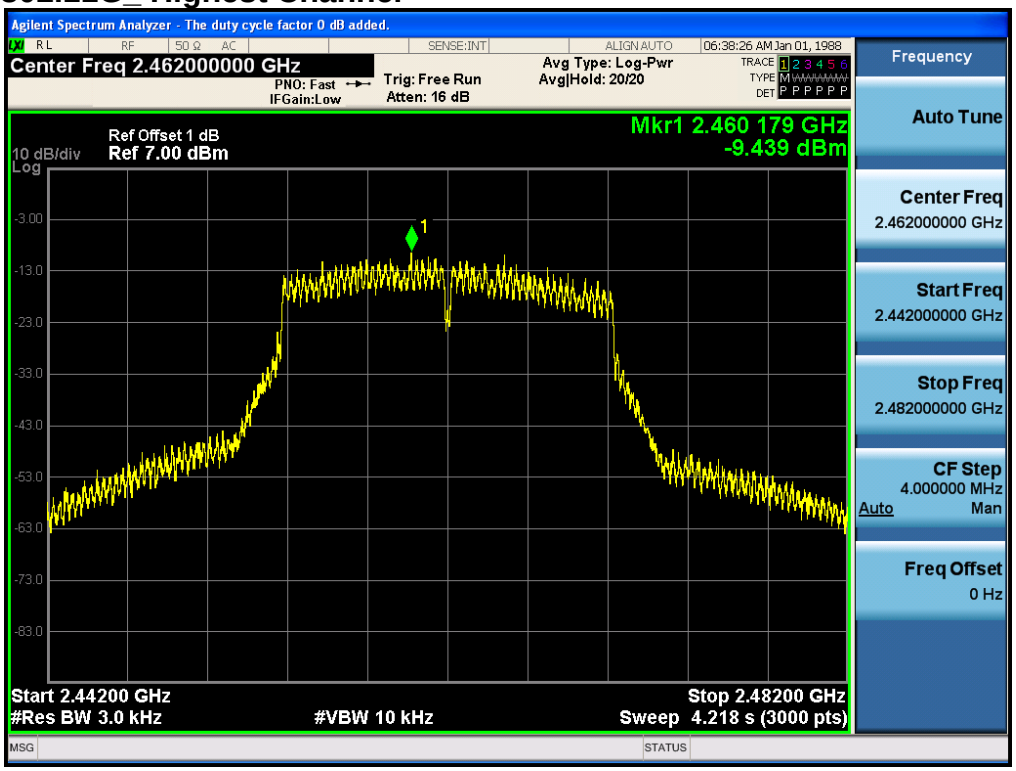
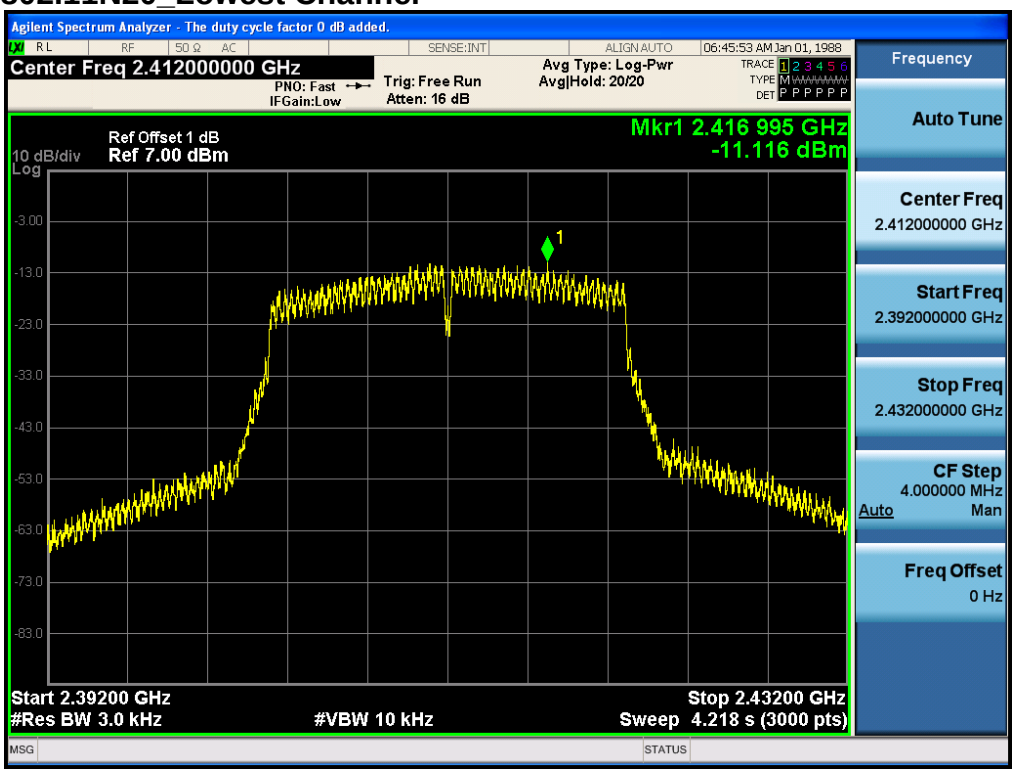
4.6.2.1.6 802.11G_ Highest Channel



4.6.2.1.7 802.11N20_Lowest Channel



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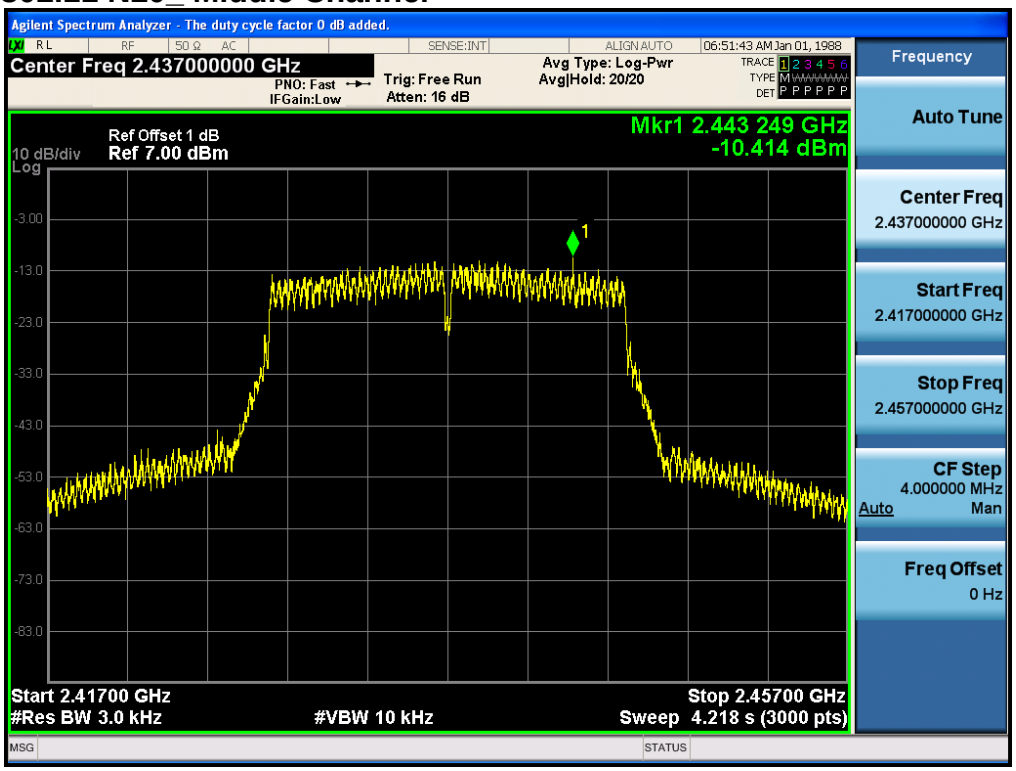
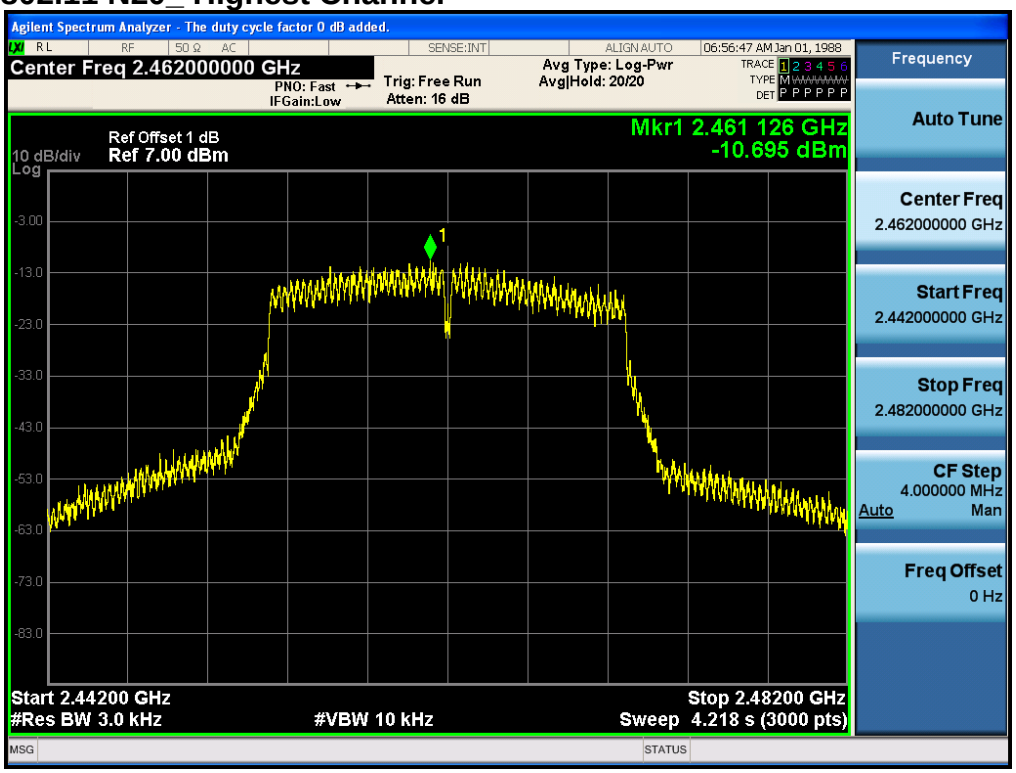
4.6.2.1.8 802.11 N20_ Middle Channel



4.6.2.1.9 802.11 N20_ Highest Channel



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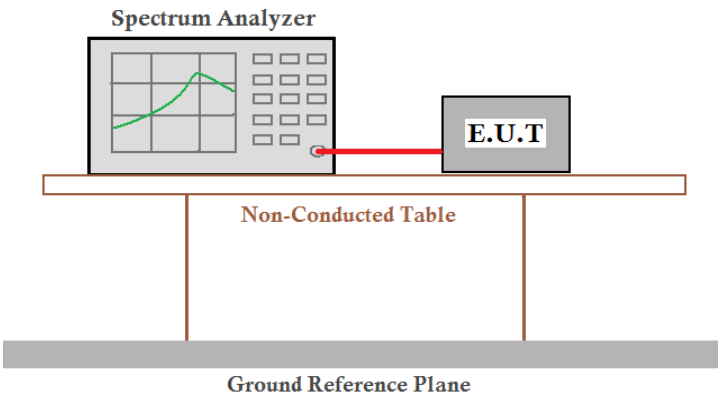
4.7 Band-edge for RF Conducted Emissions

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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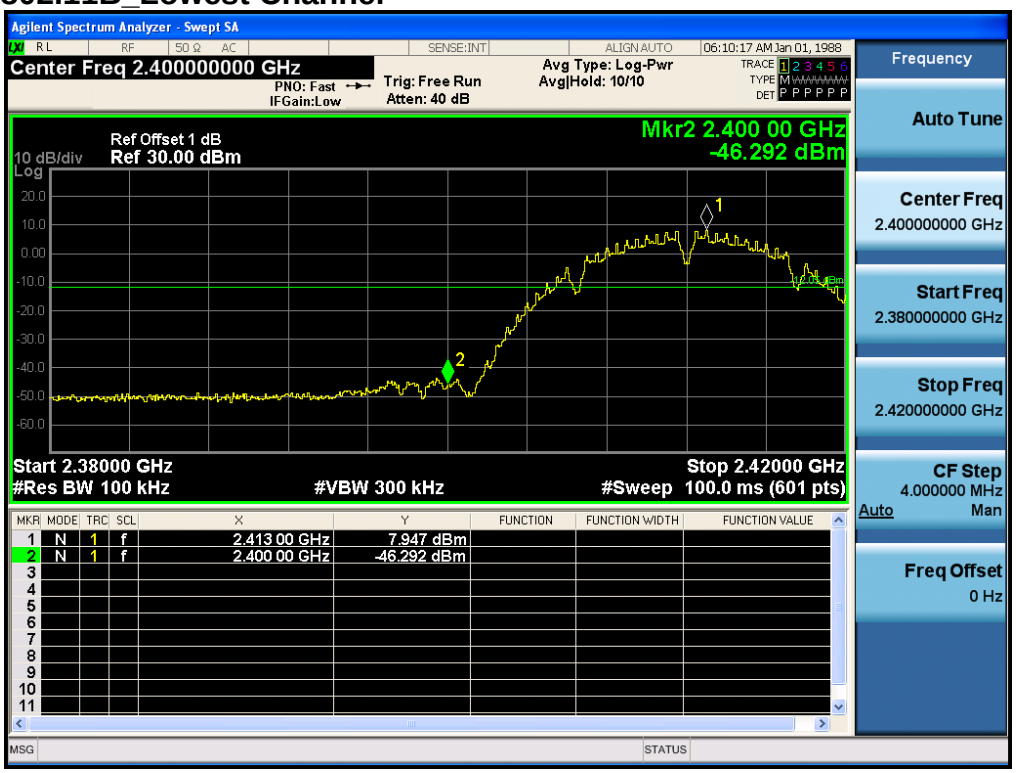
4.7.1 Test plots

4.7.1.1 ANT1

4.7.1.1.1 802.11B_Lowest Channel



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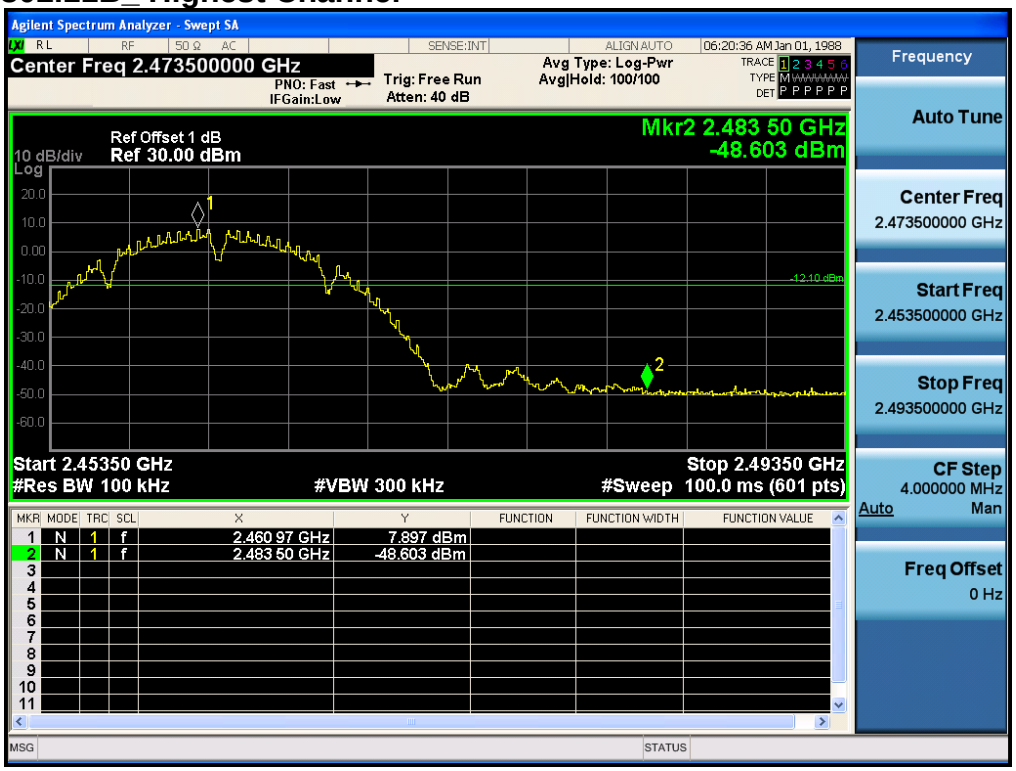
4.7.1.1.2 802.11B_ Highest Channel



4.7.1.1.3 802.11G_Lowest Channel

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4.7.1.1.4 802.11G_ Highest Channel

4.7.1.1.5 802.11N20_Lowest Channel

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4.7.1.1.6 802.11 N20_ Highest Channel

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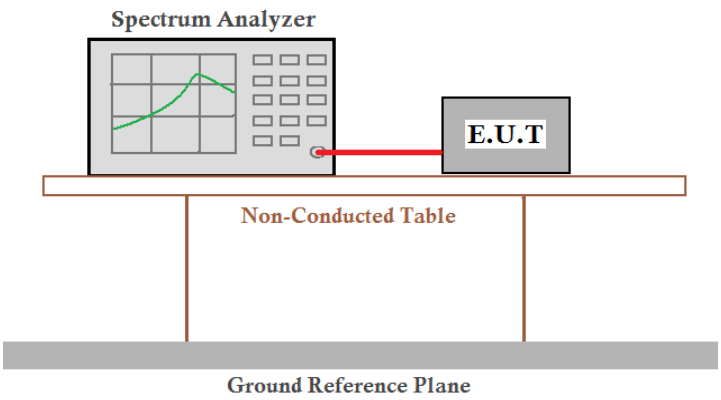
4.8 RF Conducted Spurious Emissions

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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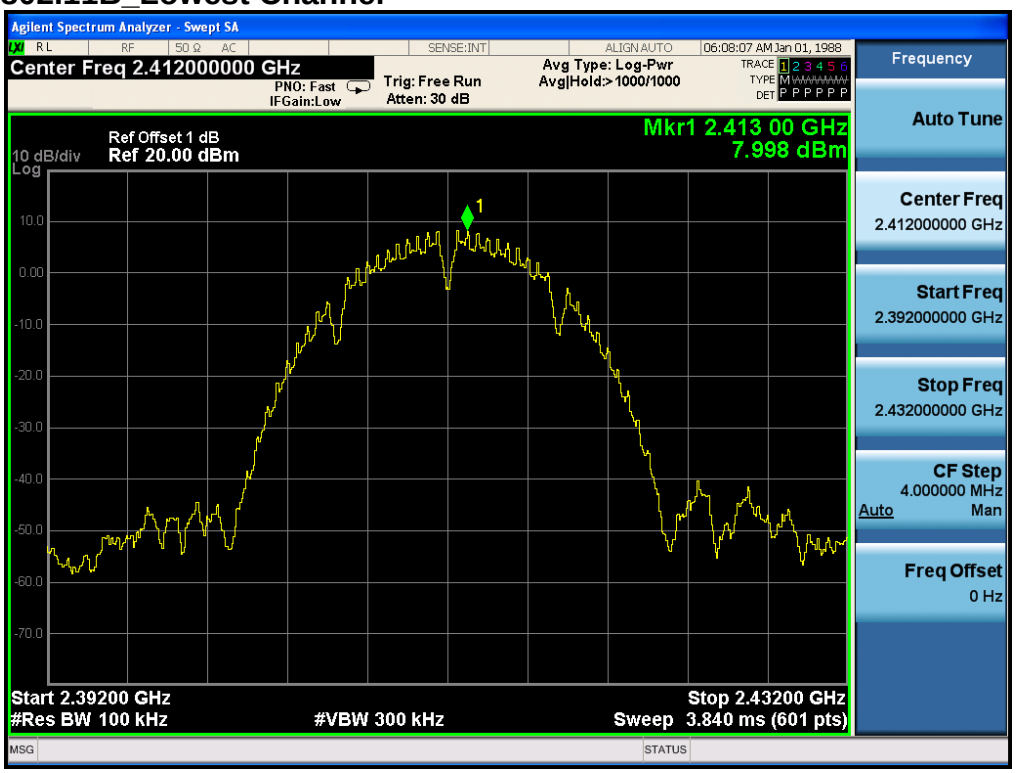
4.8.1 Test plots

4.8.1.1 ANT1

4.8.1.1.1 802.11B_Lowest Channel



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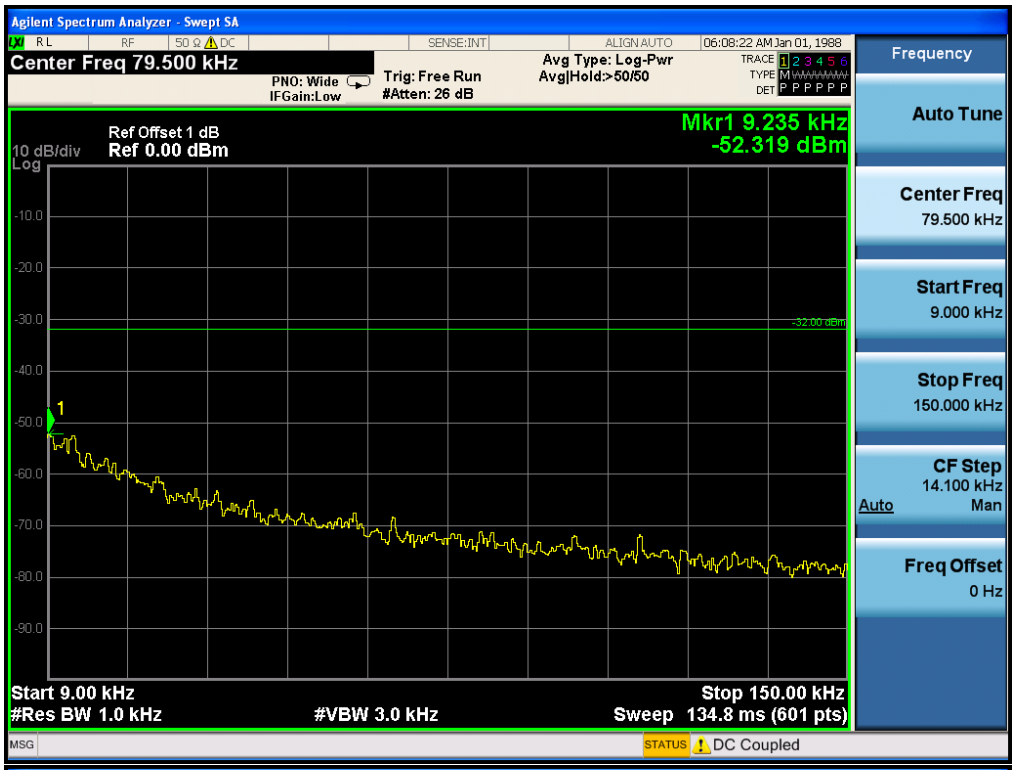

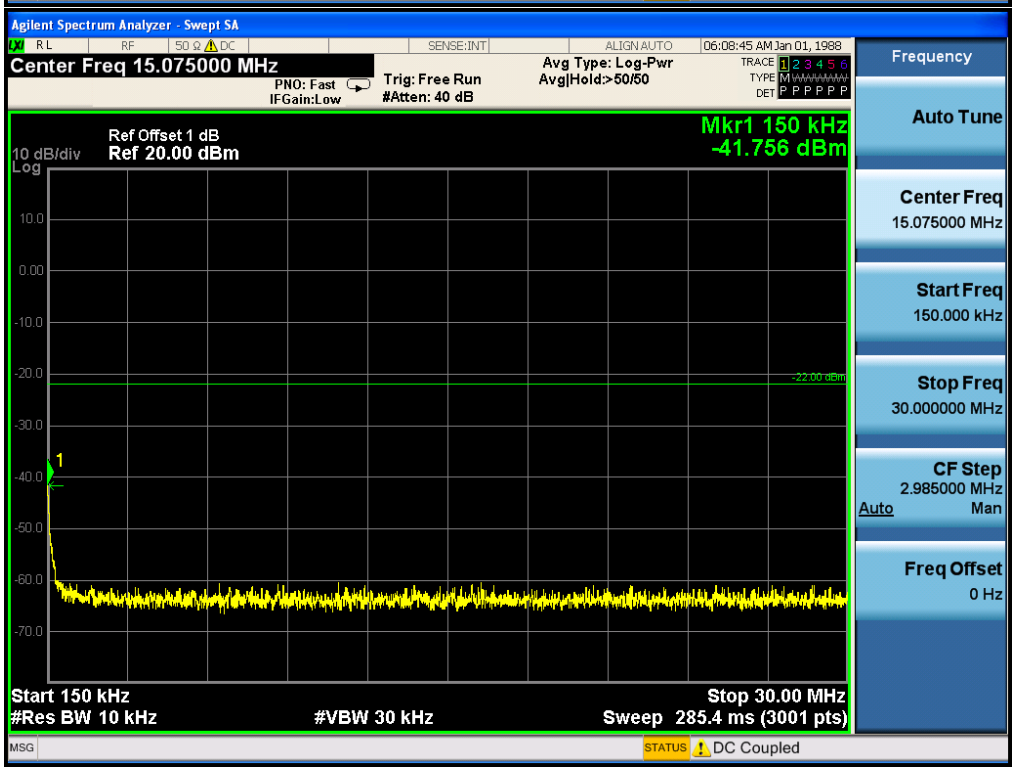

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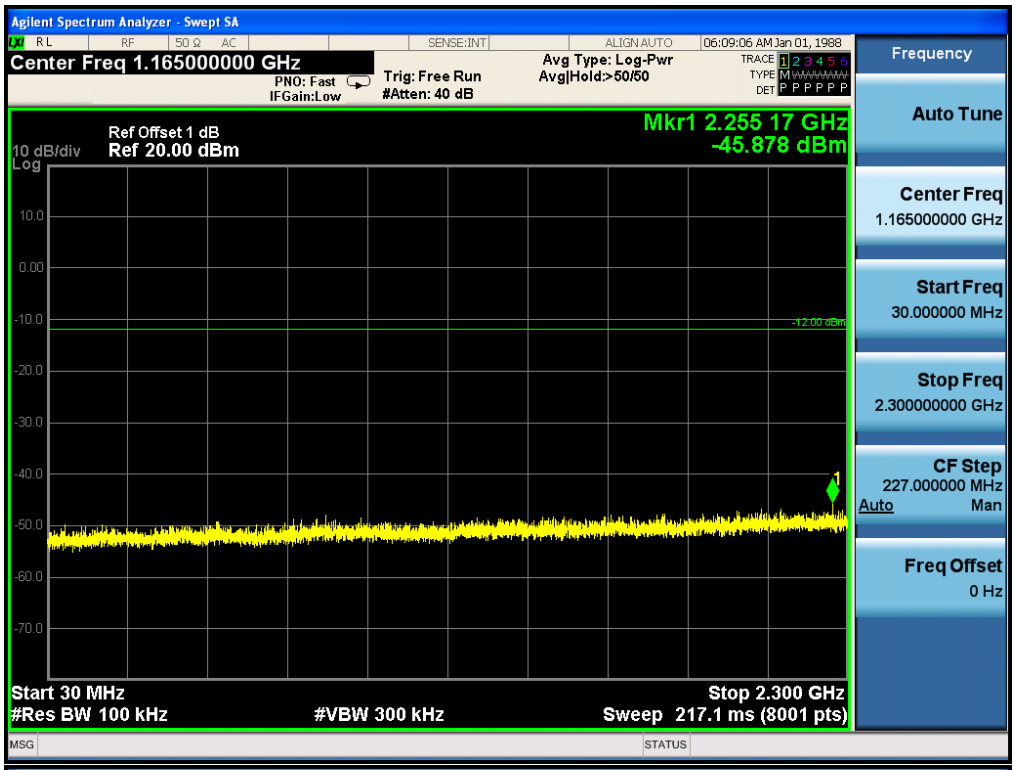

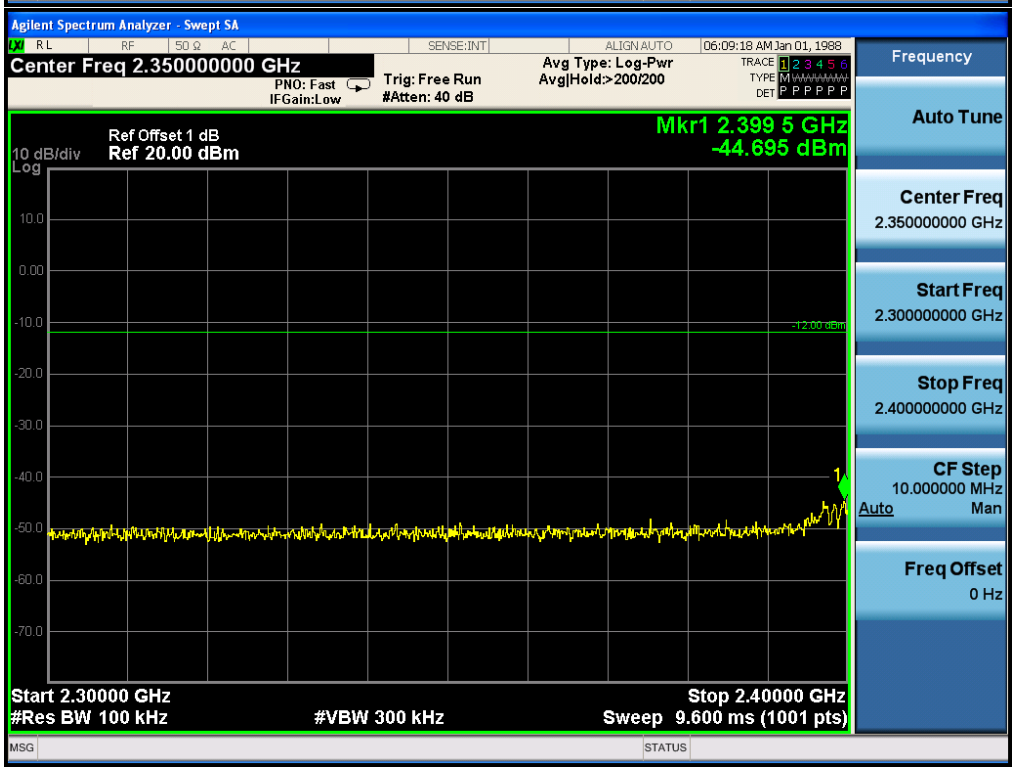

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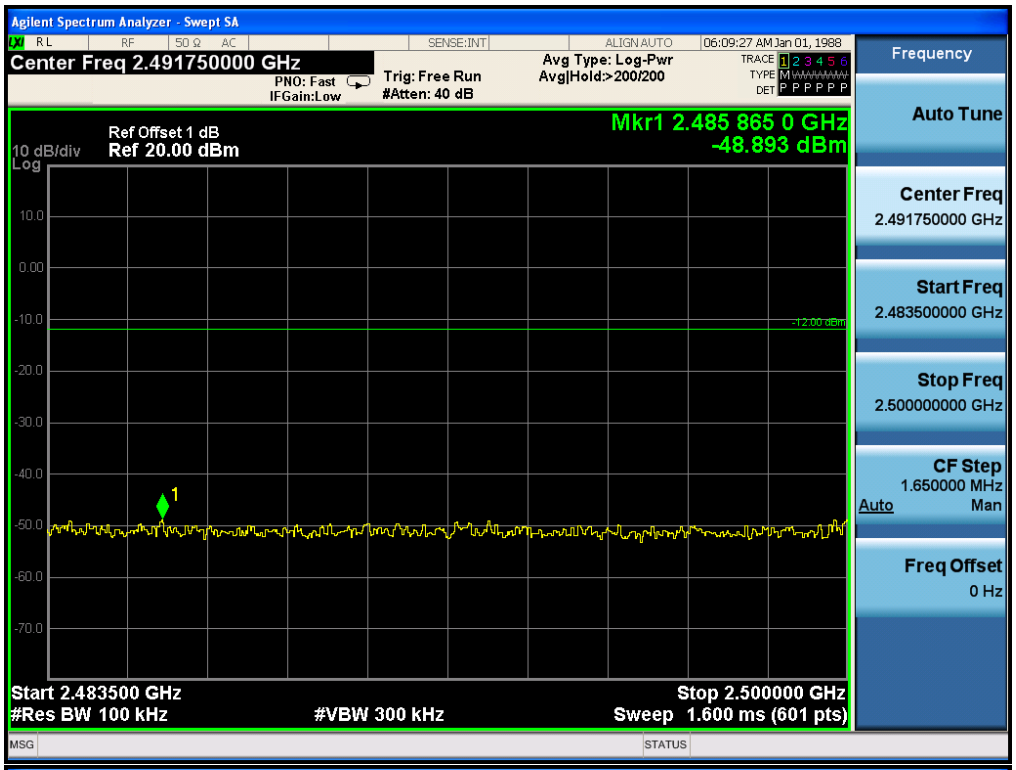

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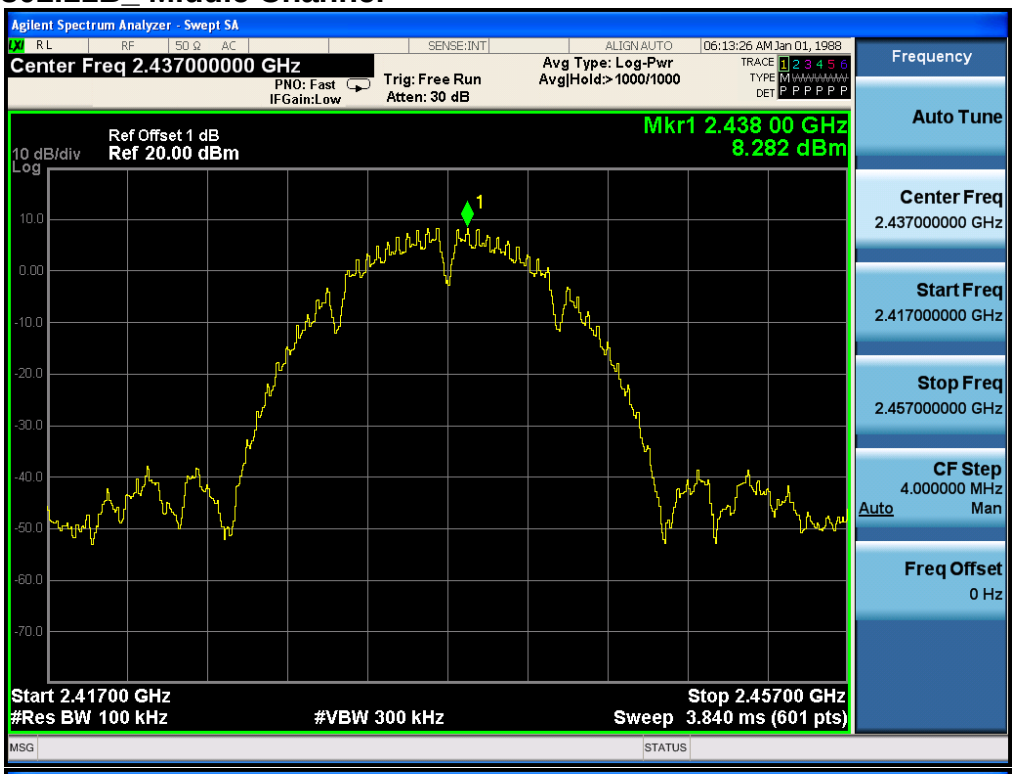
4.8.1.1.2 802.11B_ Middle Channel



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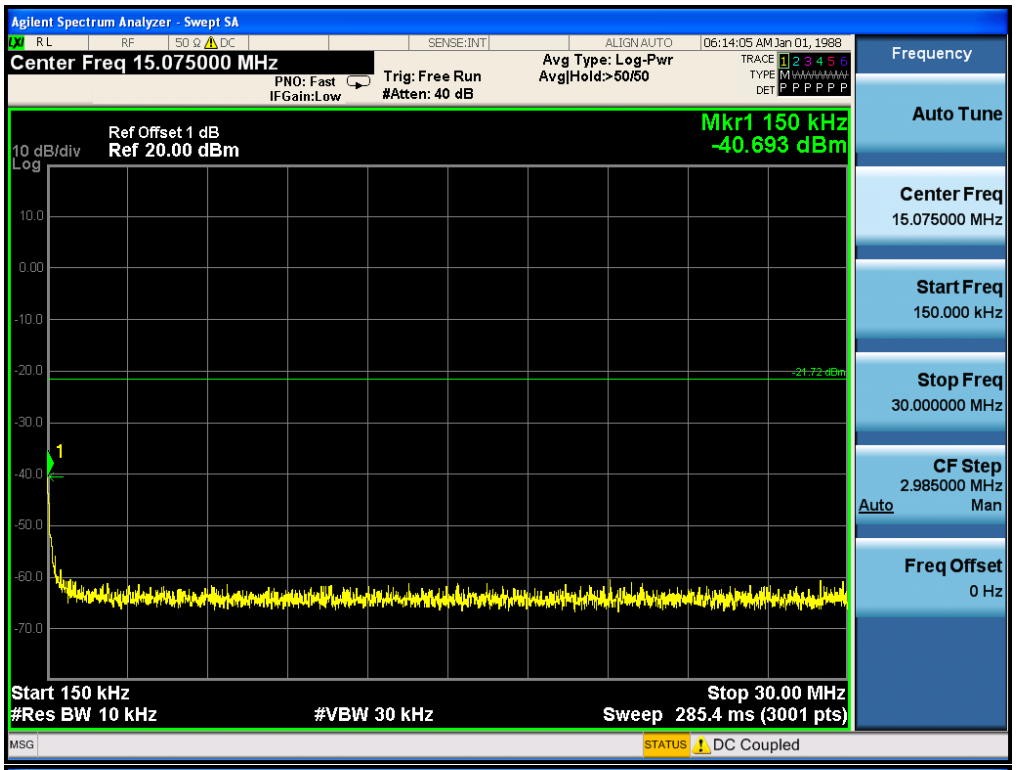

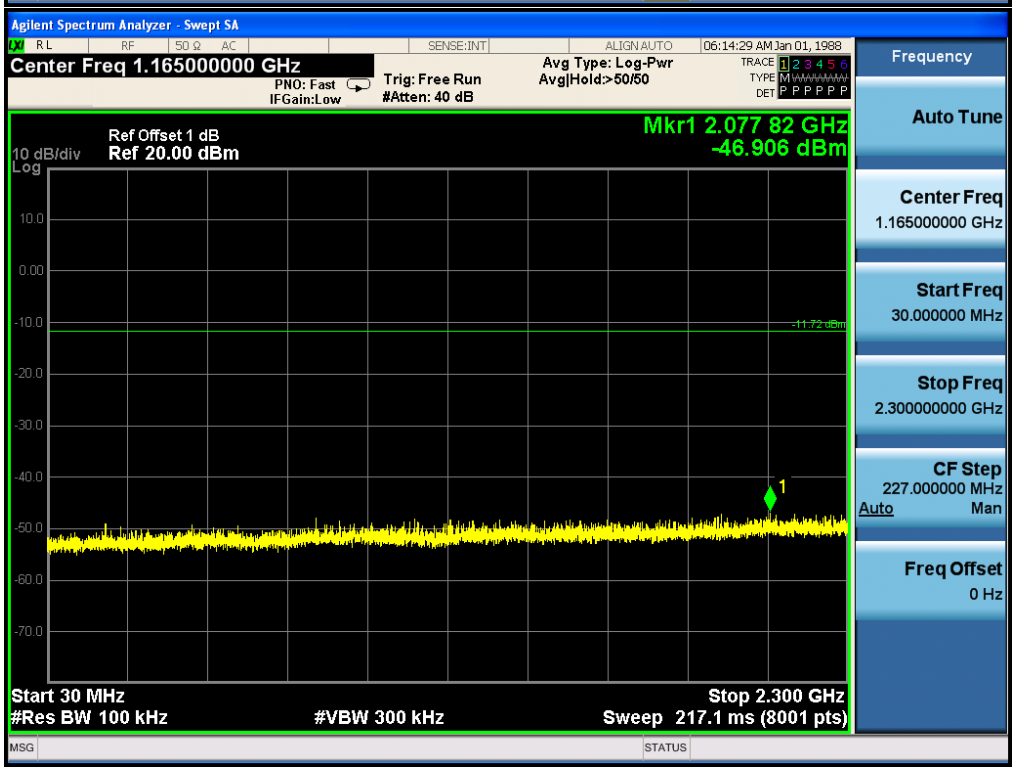

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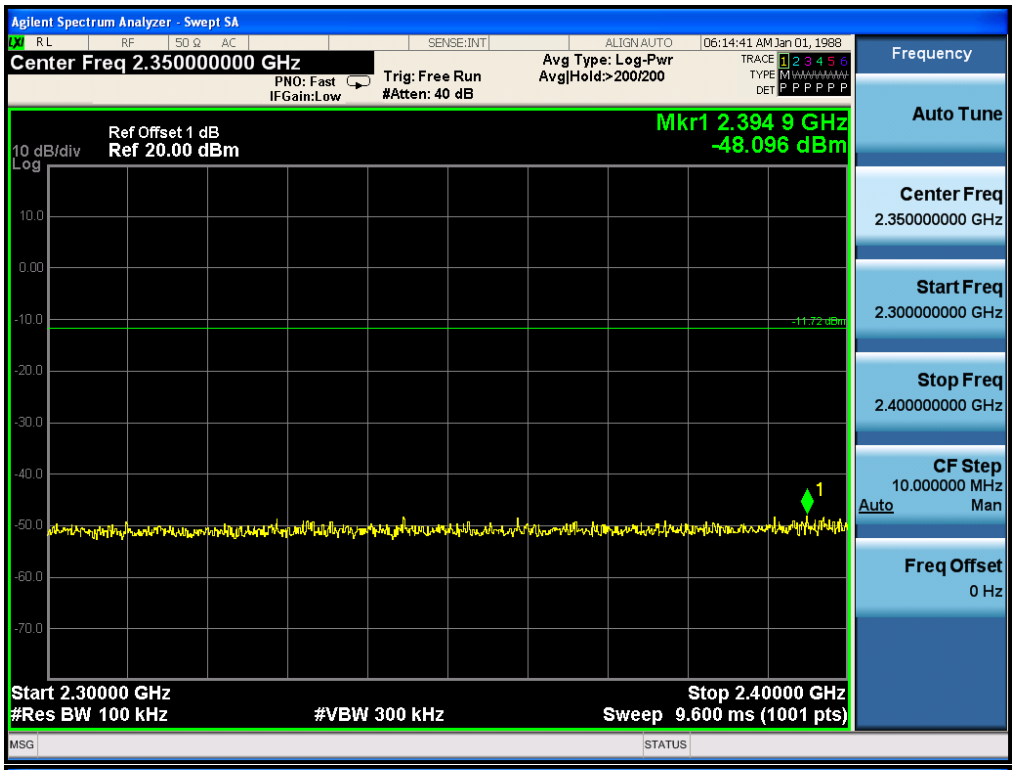

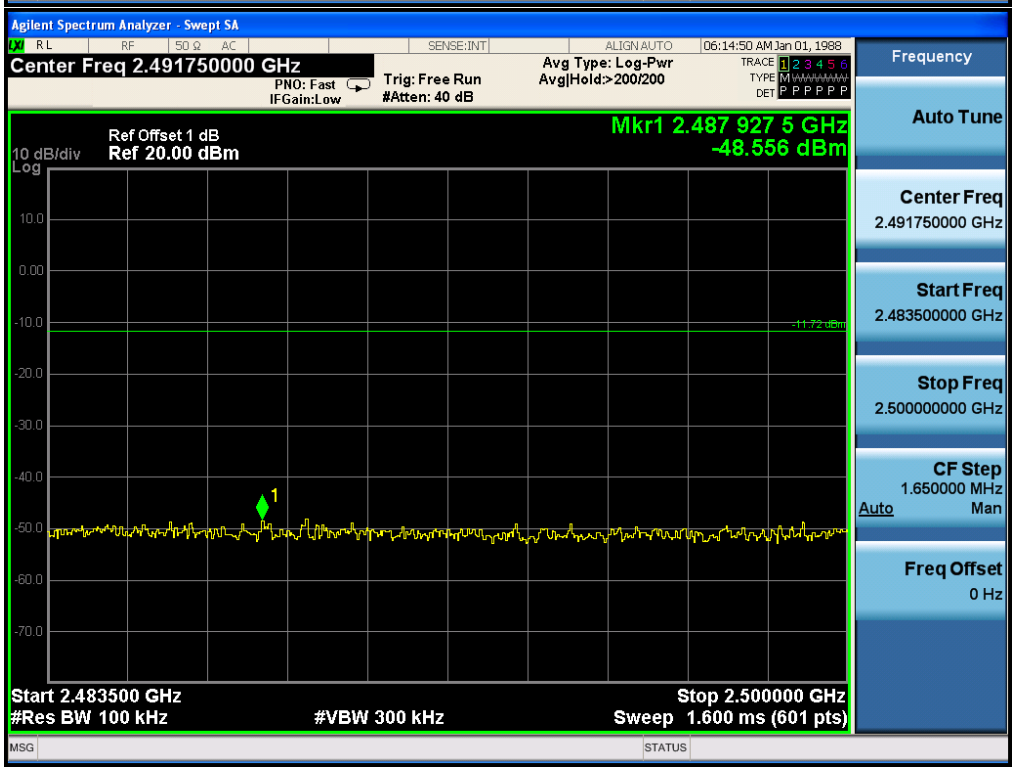

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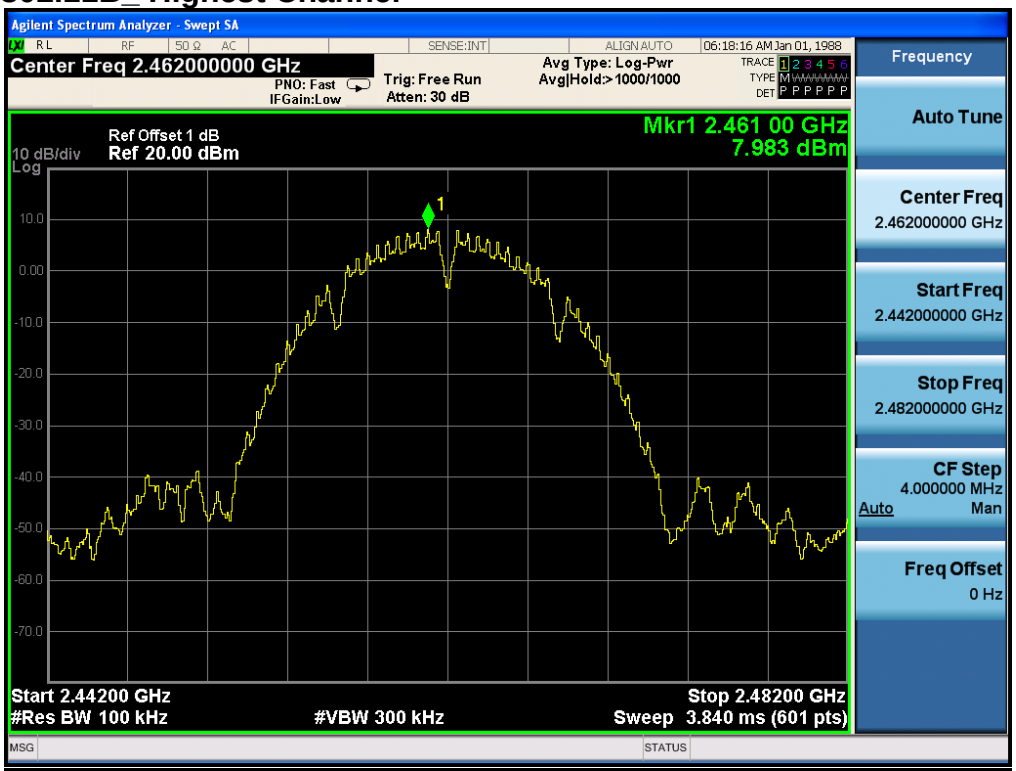
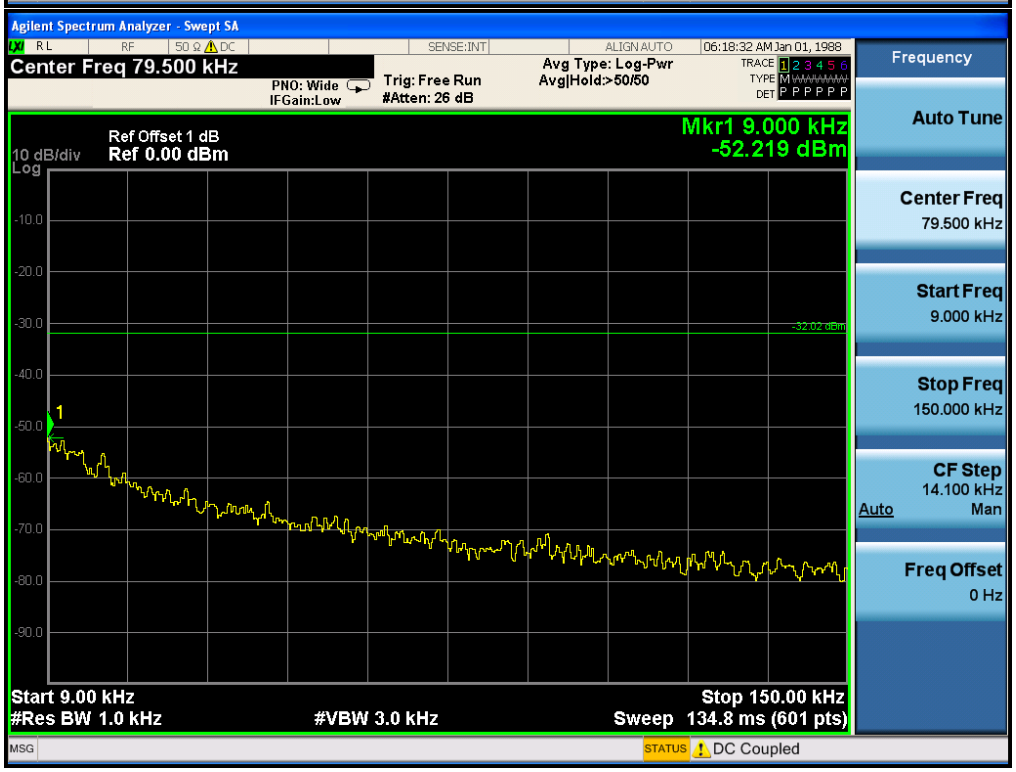
4.8.1.1.3 802.11B_ Highest Channel





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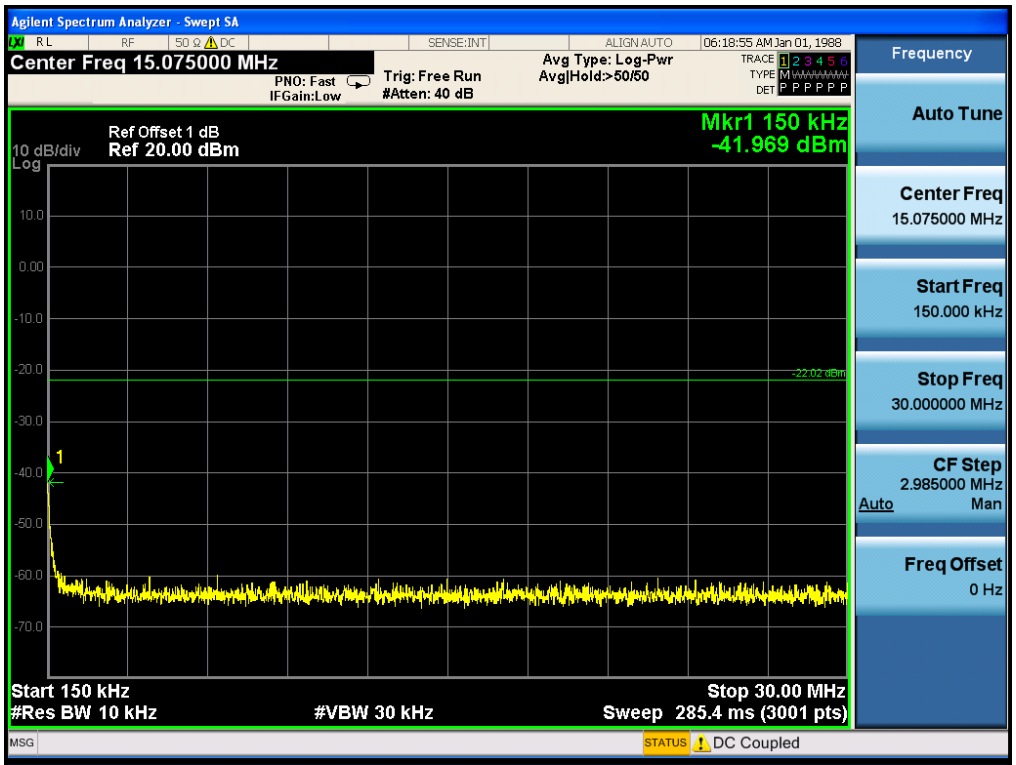

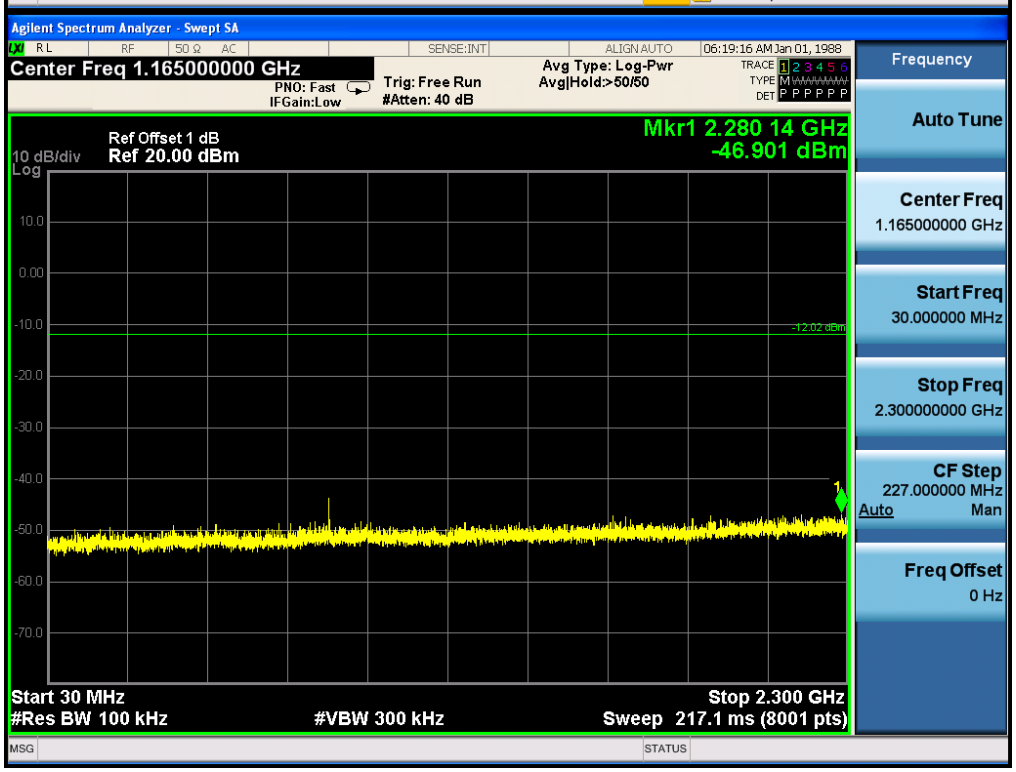

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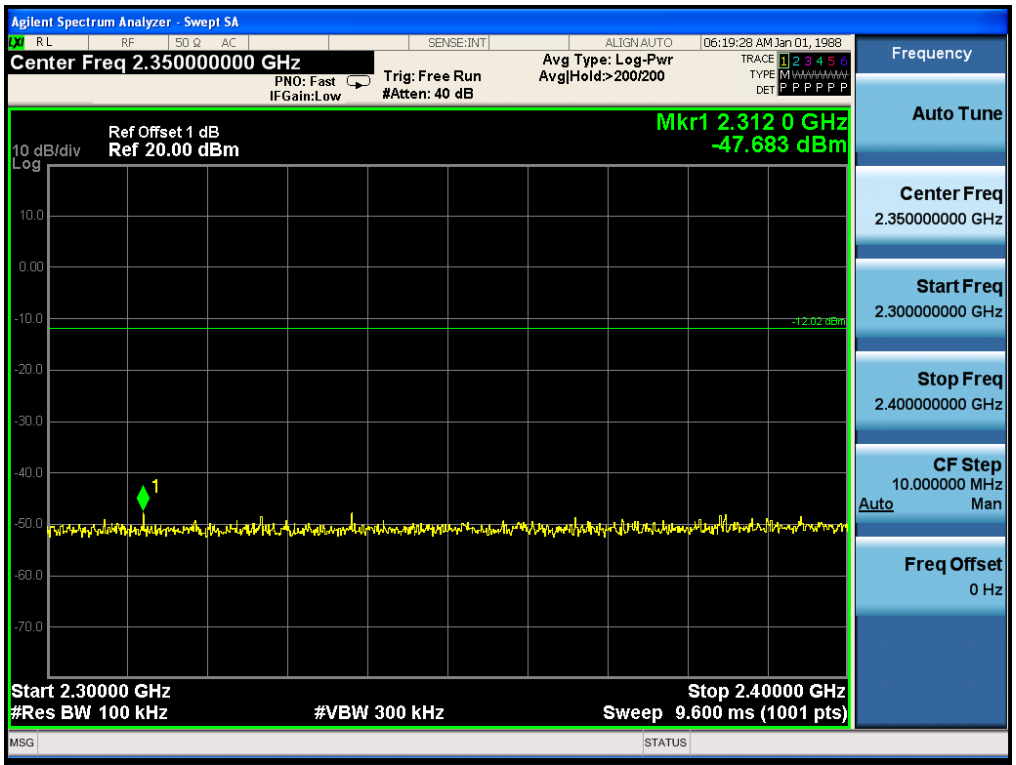

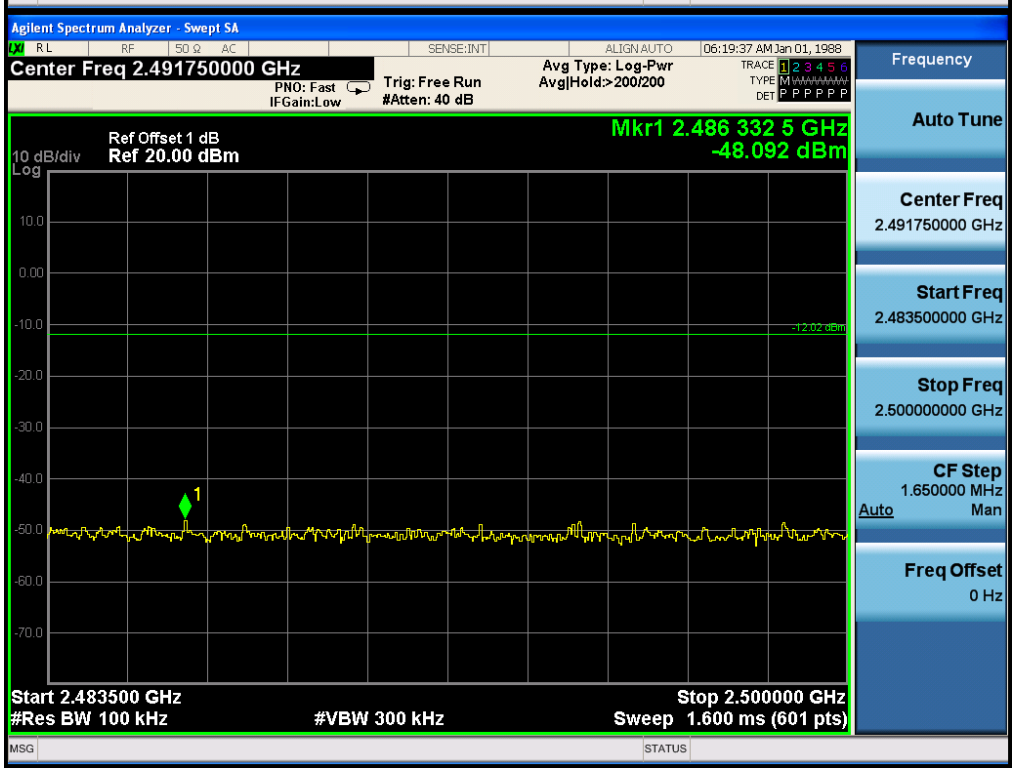

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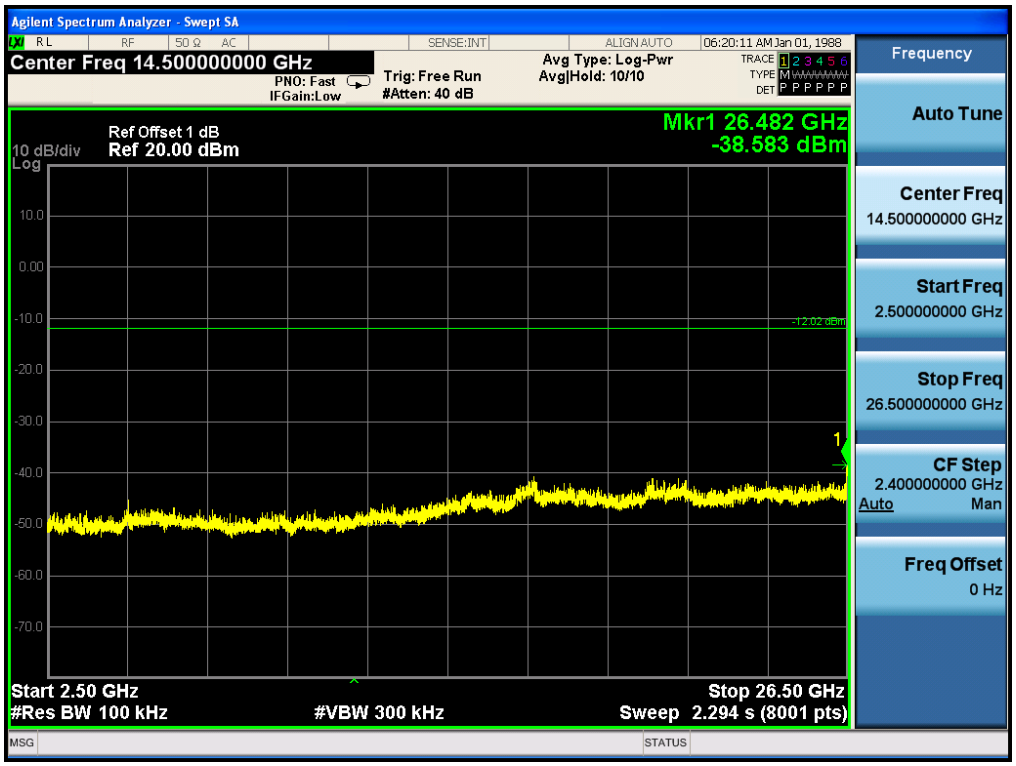

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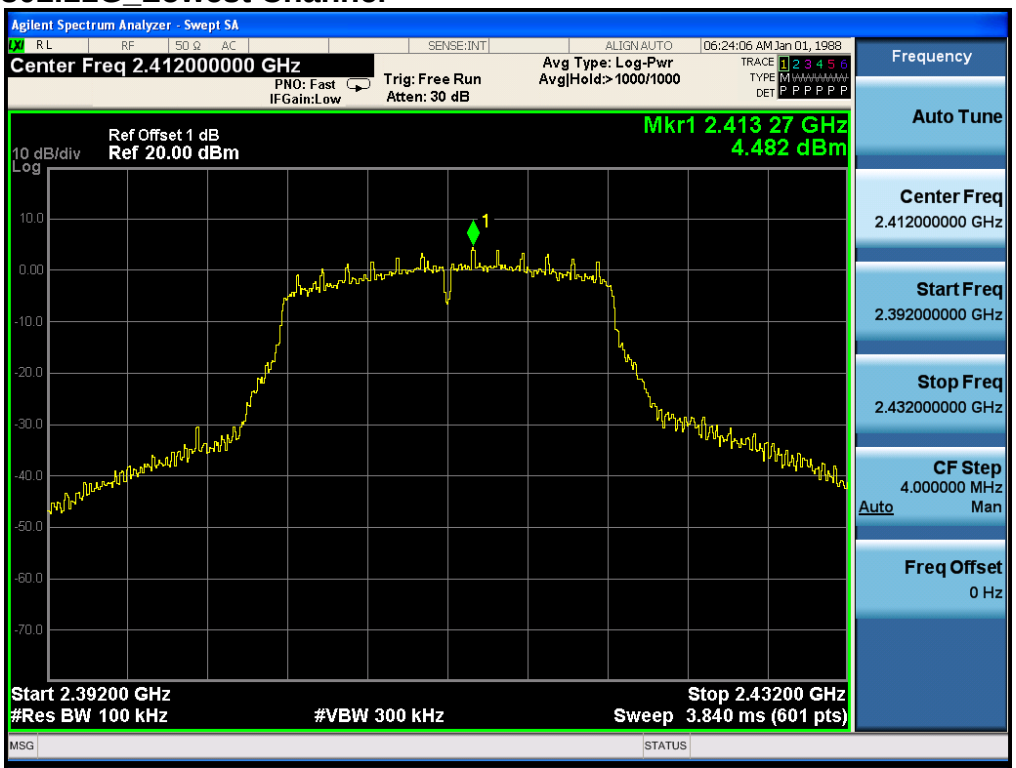
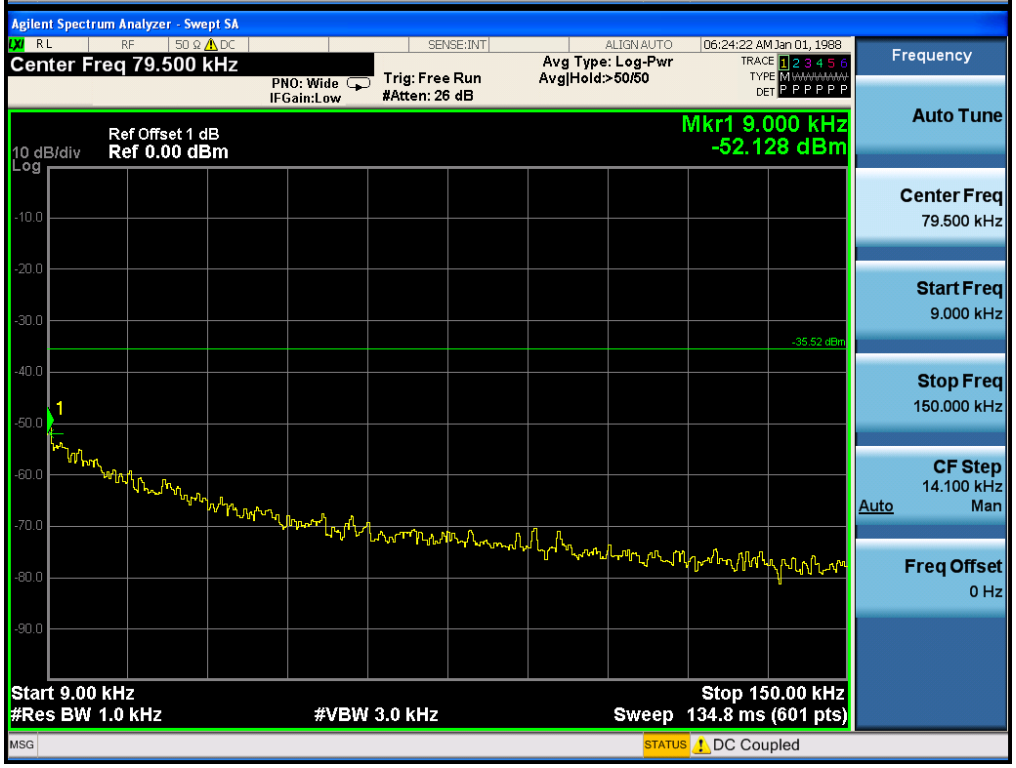
4.8.1.1.4 802.11G_Lowest Channel





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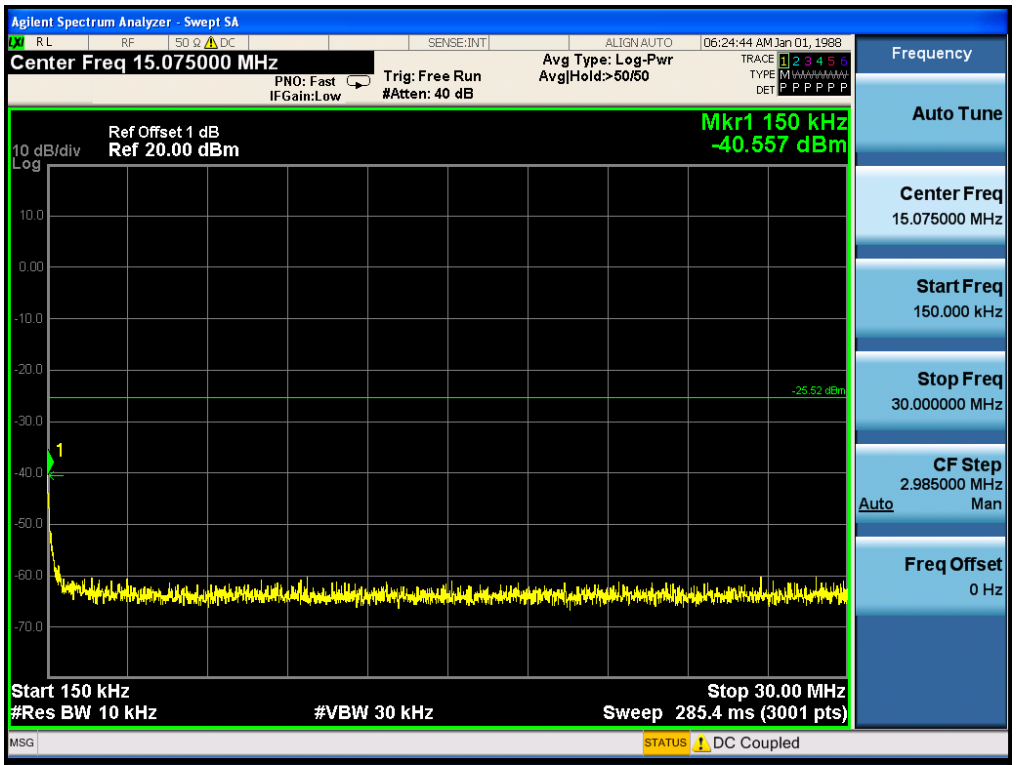

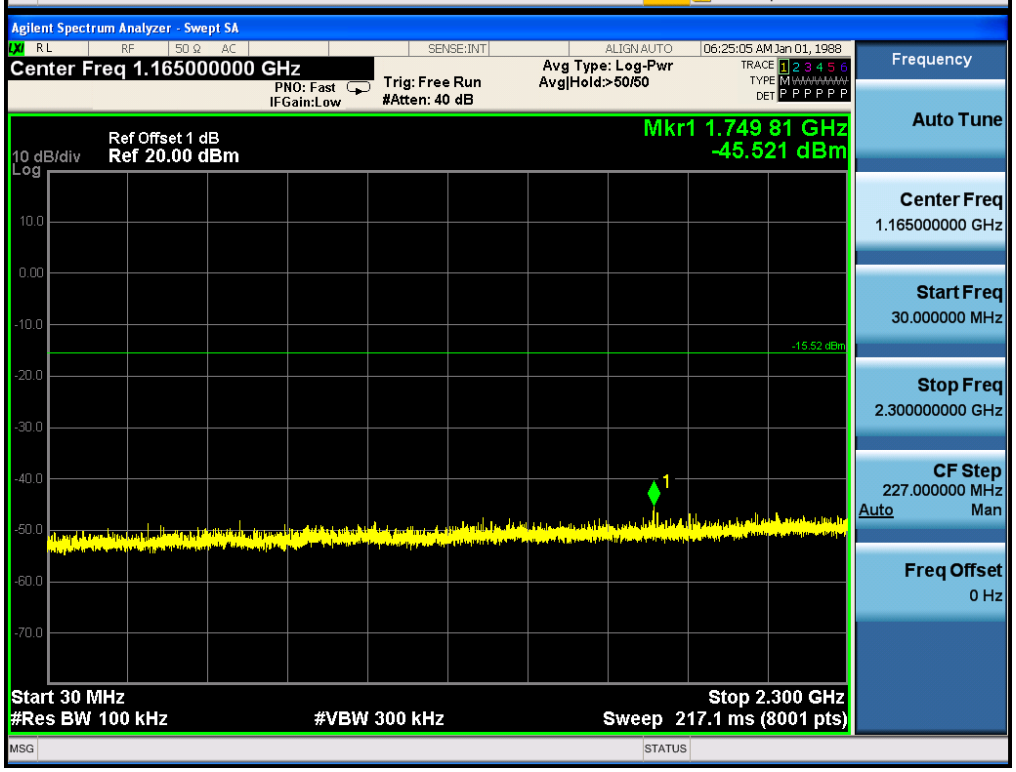

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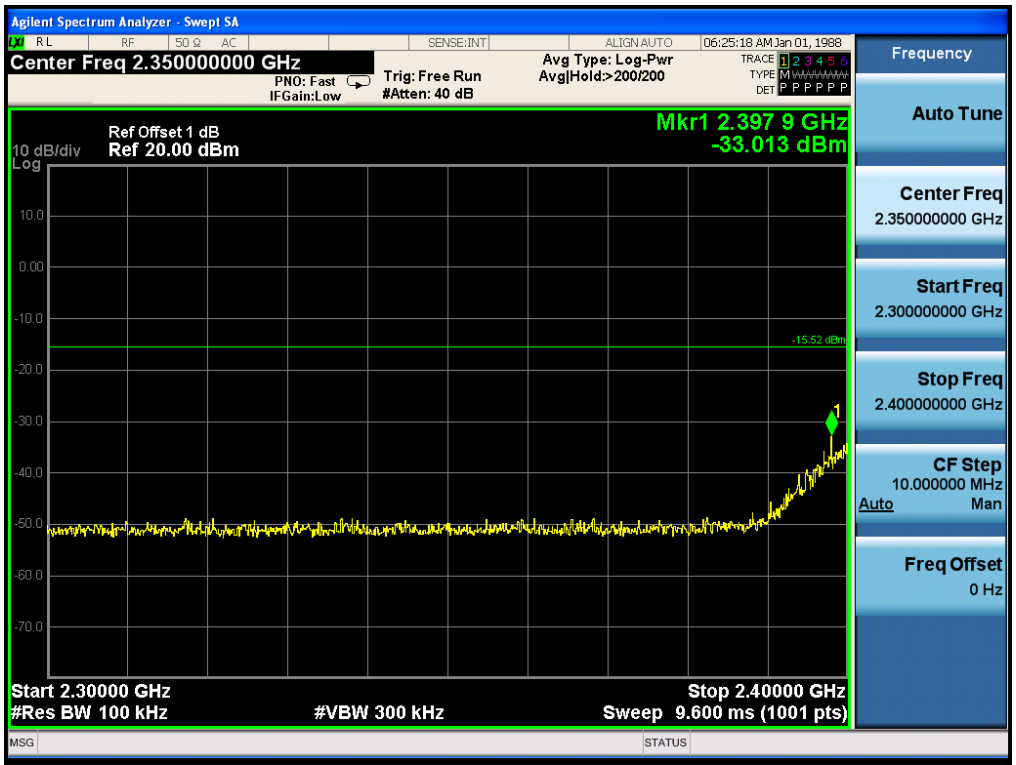

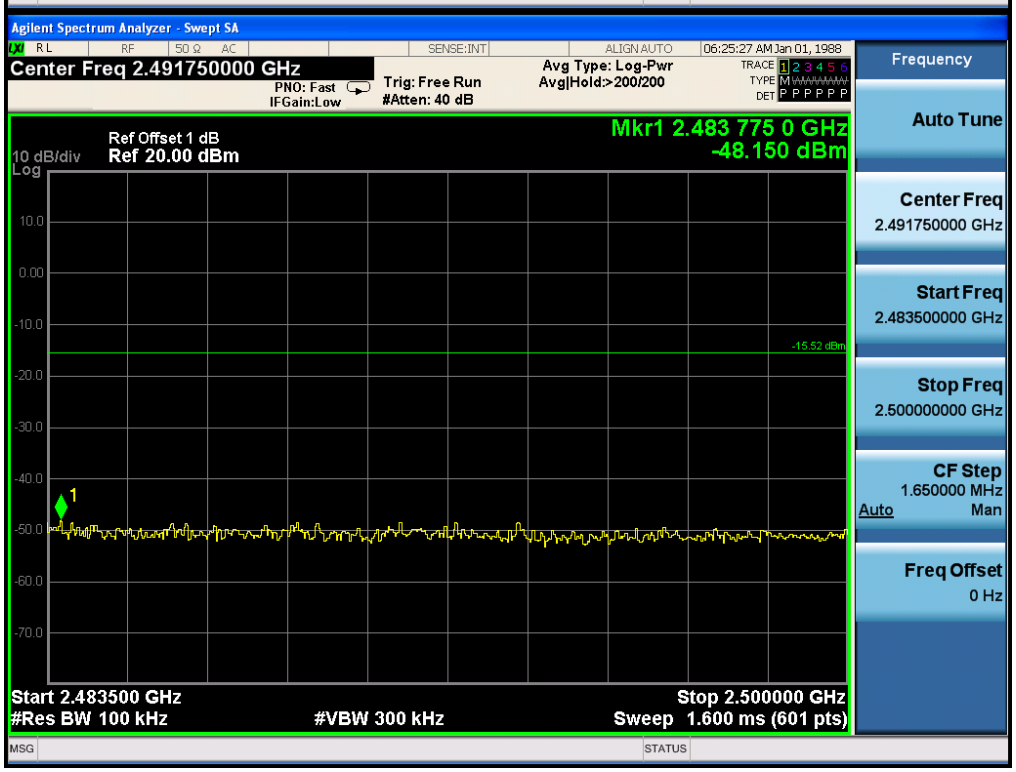

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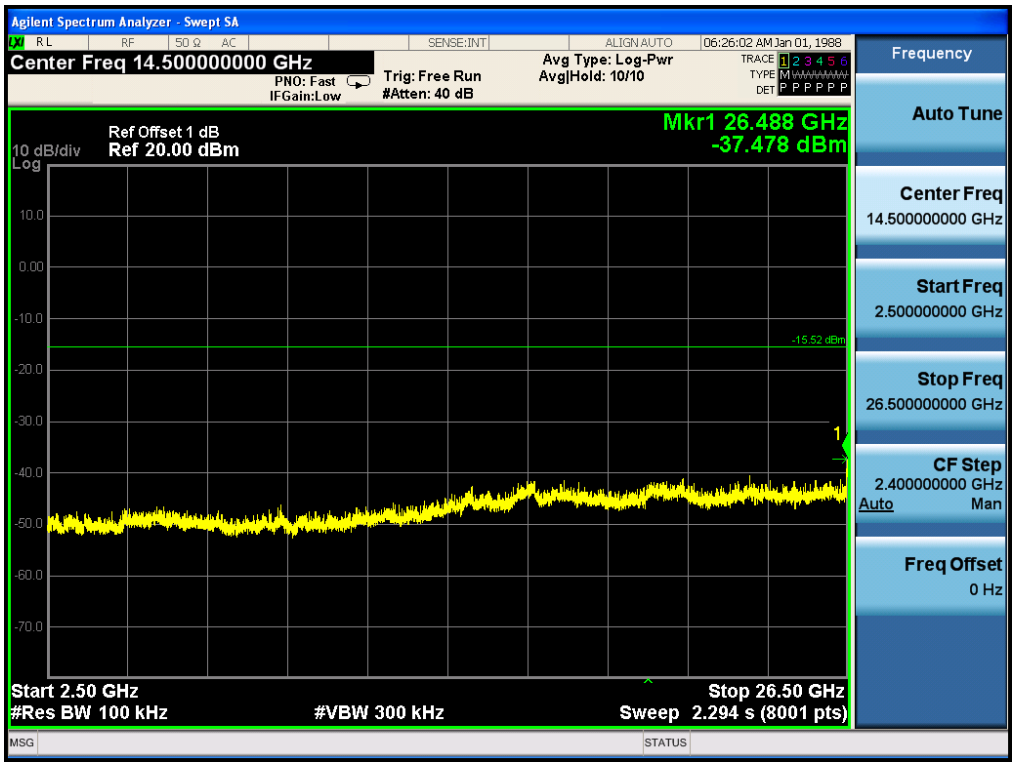

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4.8.1.1.5 802.11G_ Middle Channel

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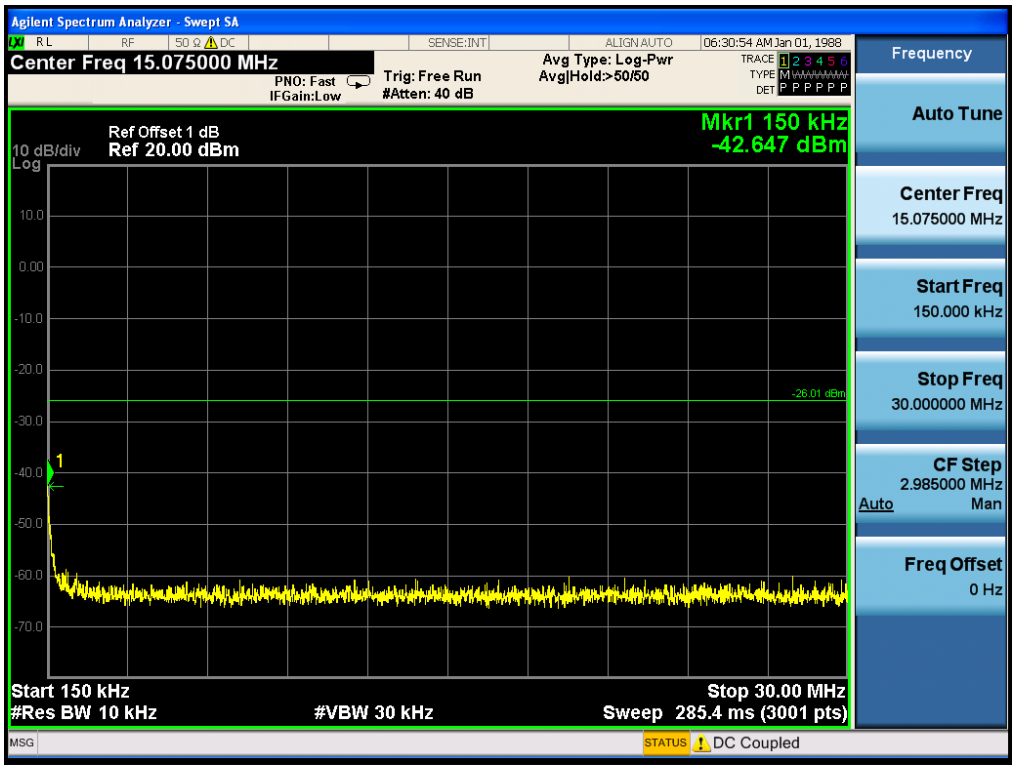

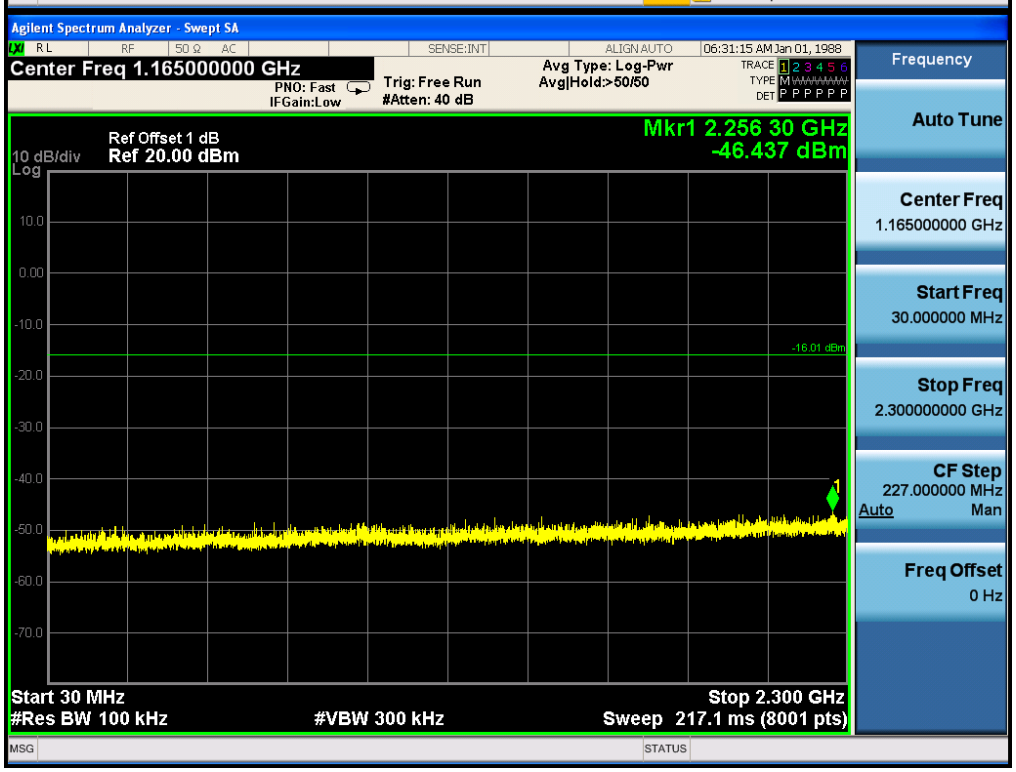

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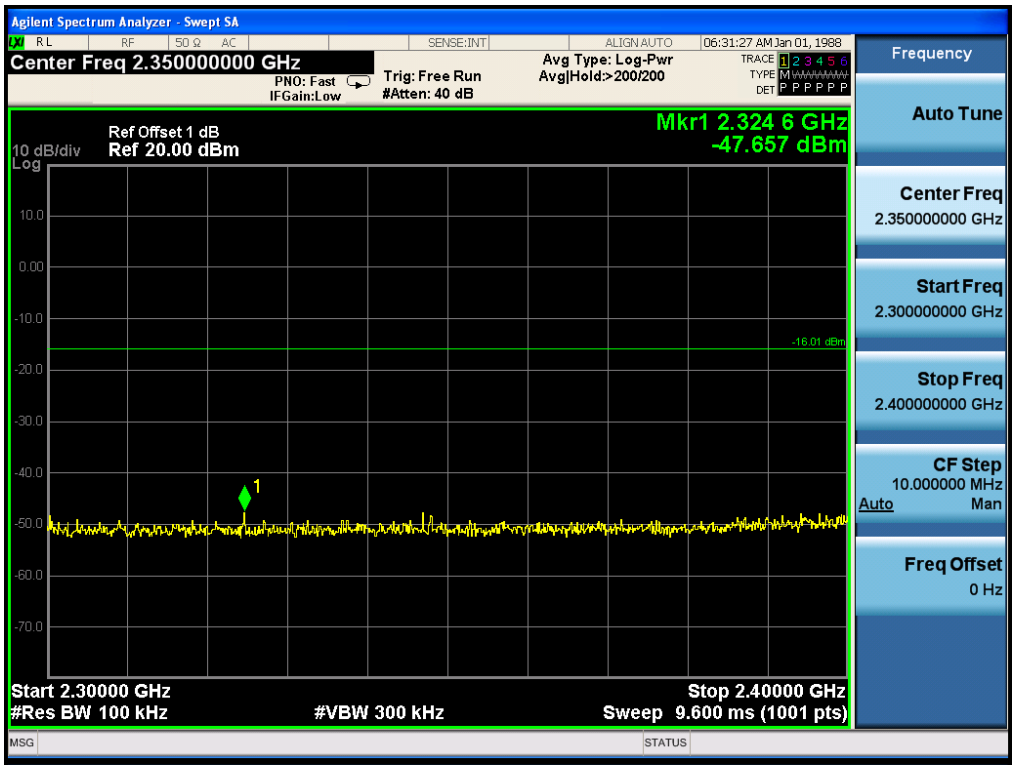

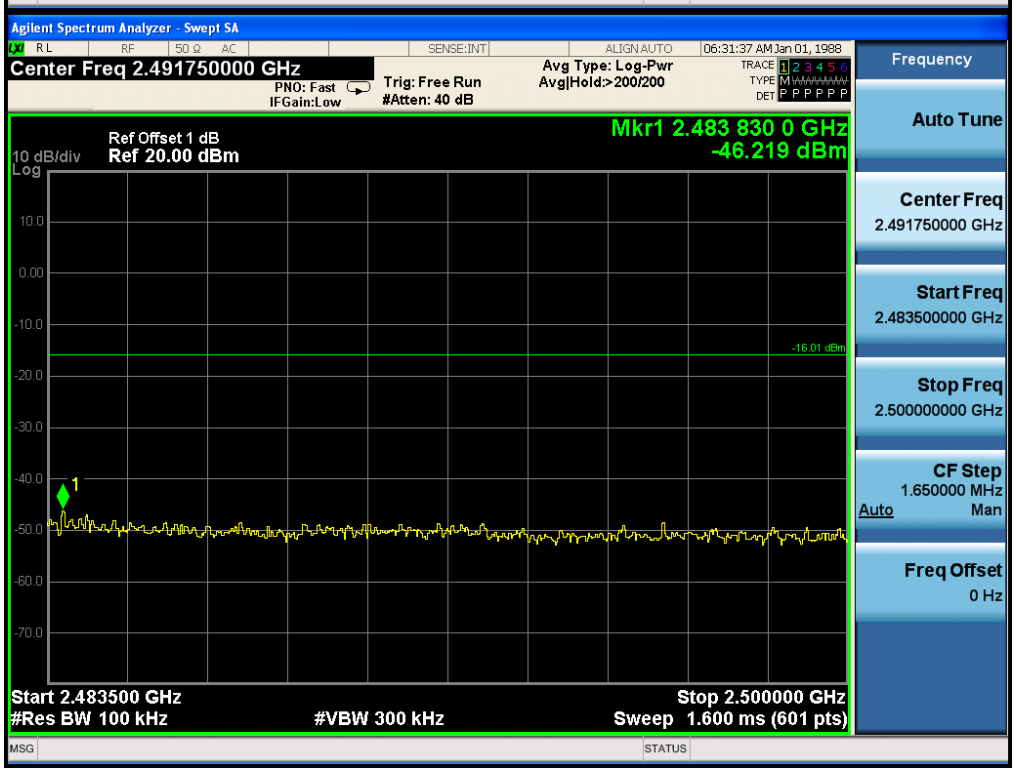

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4.8.1.1.6 802.11G_ Highest Channel

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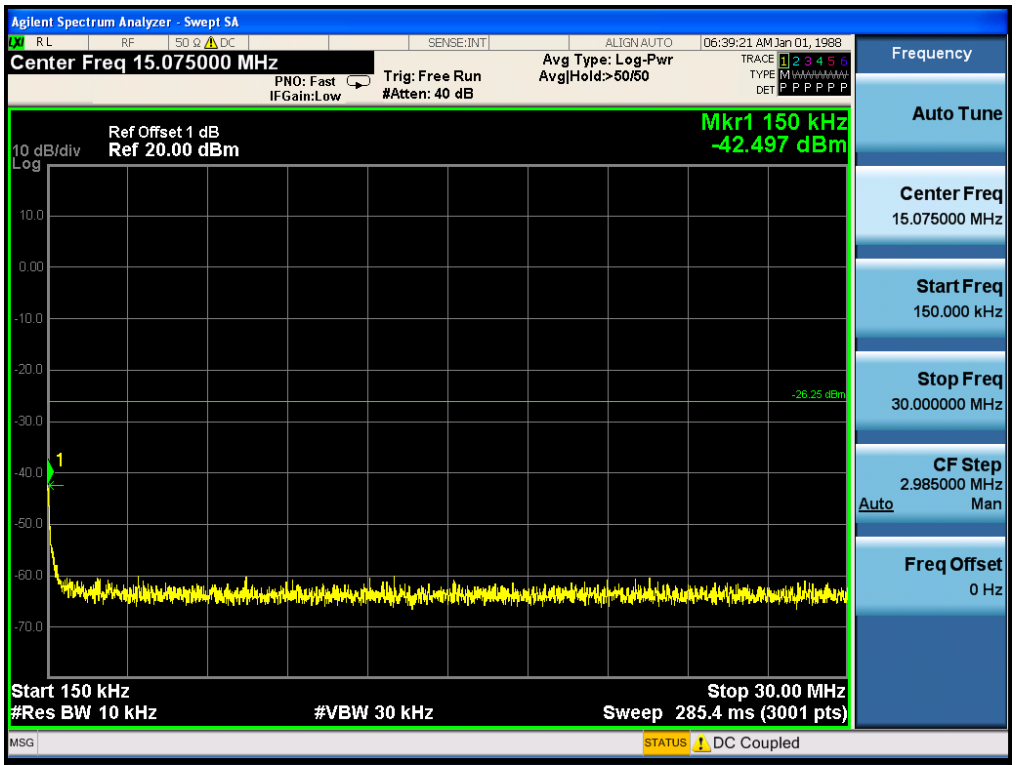

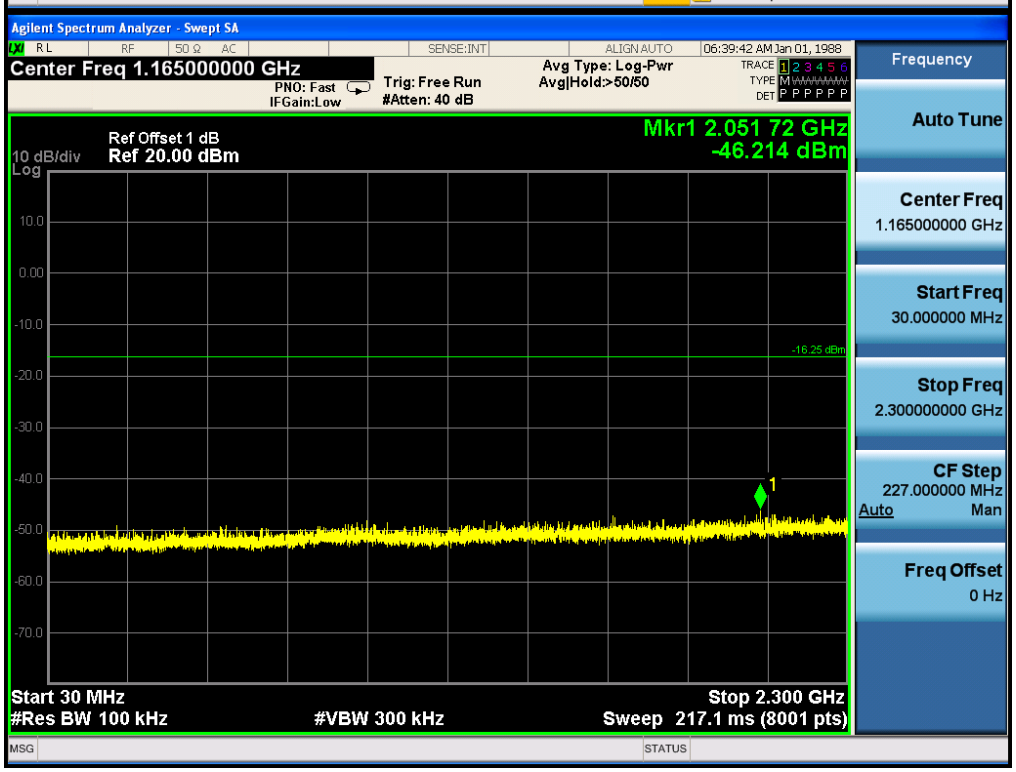

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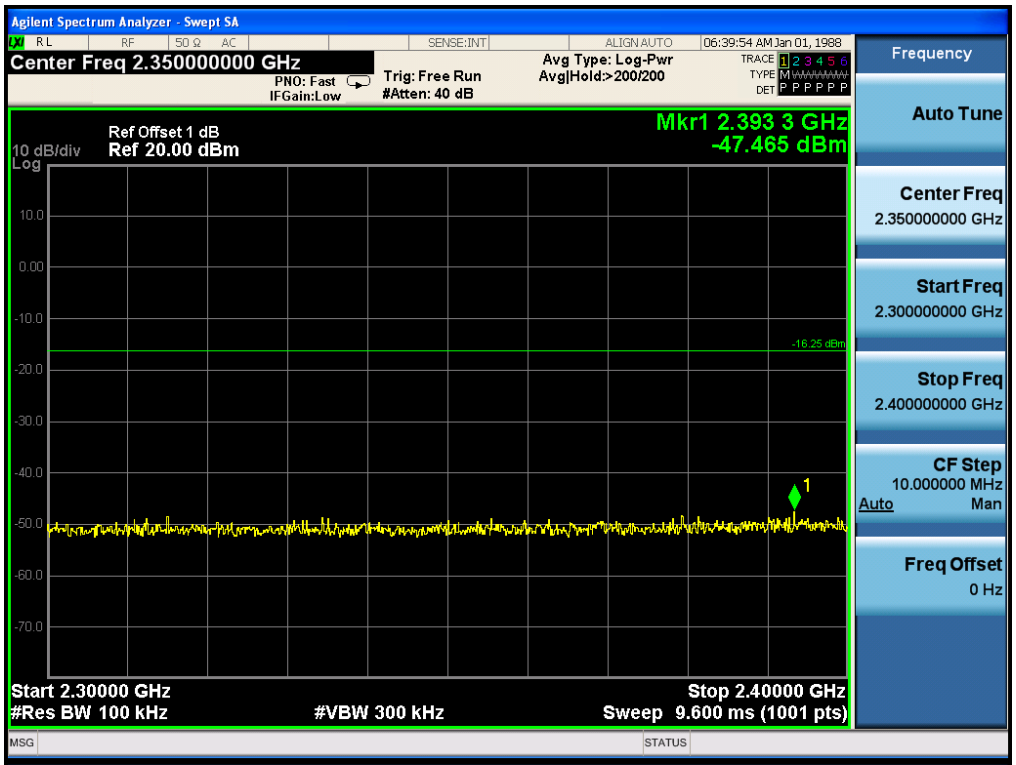

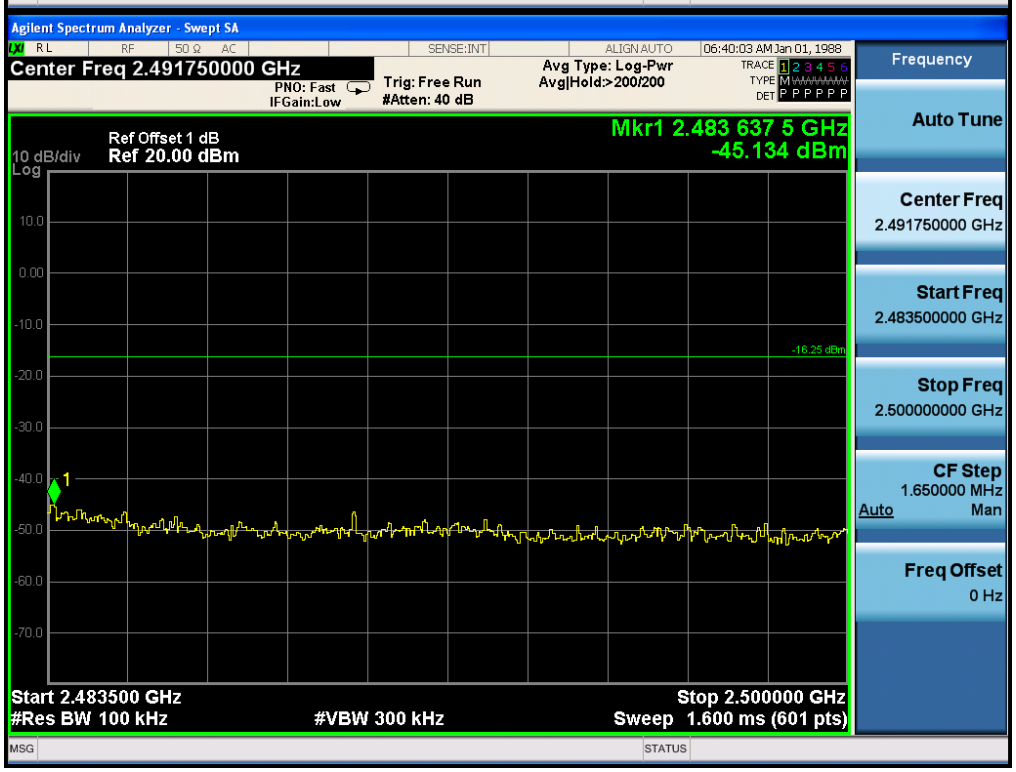

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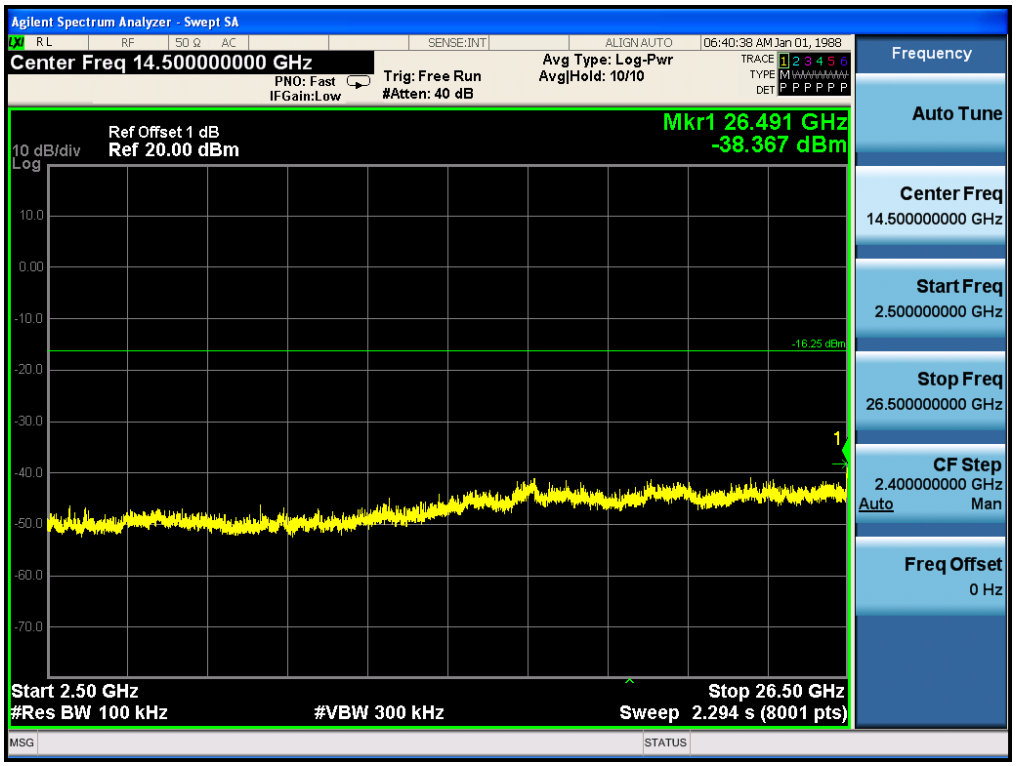

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4.8.1.1.7 802.11N20_Lowest Channel

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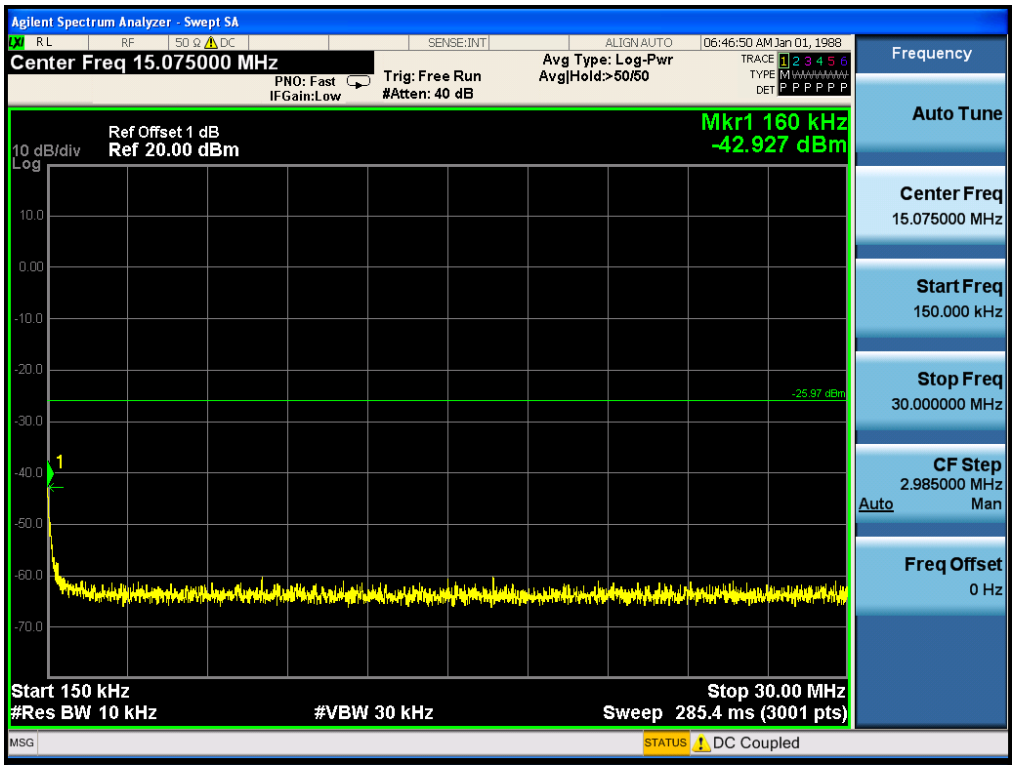

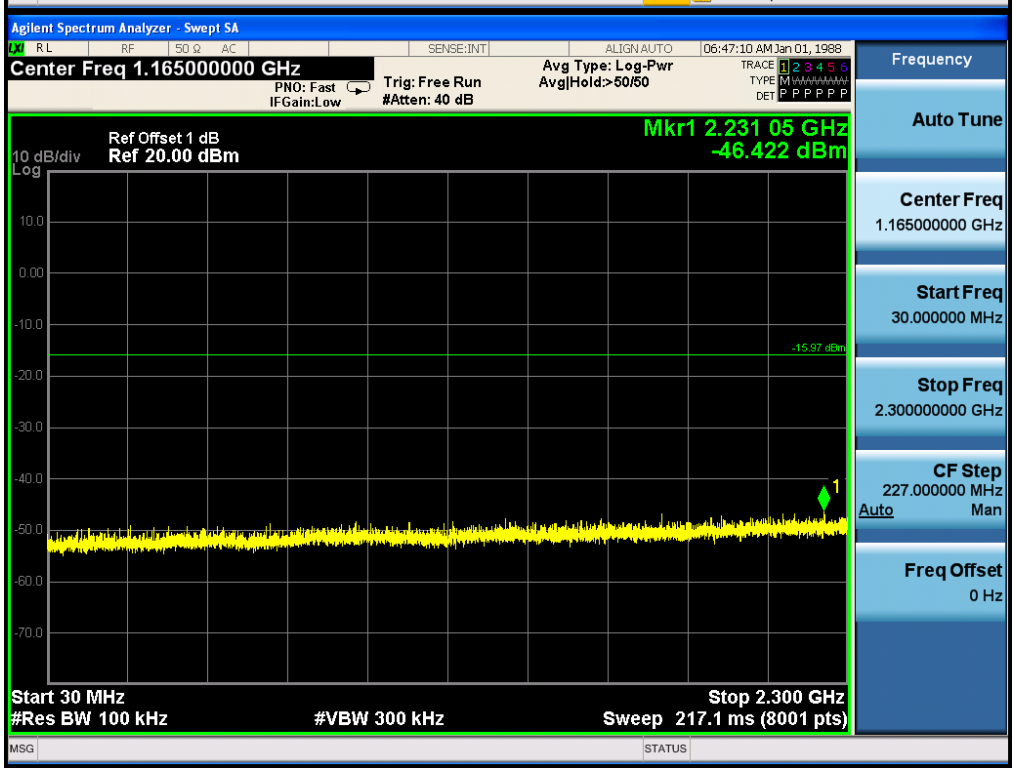

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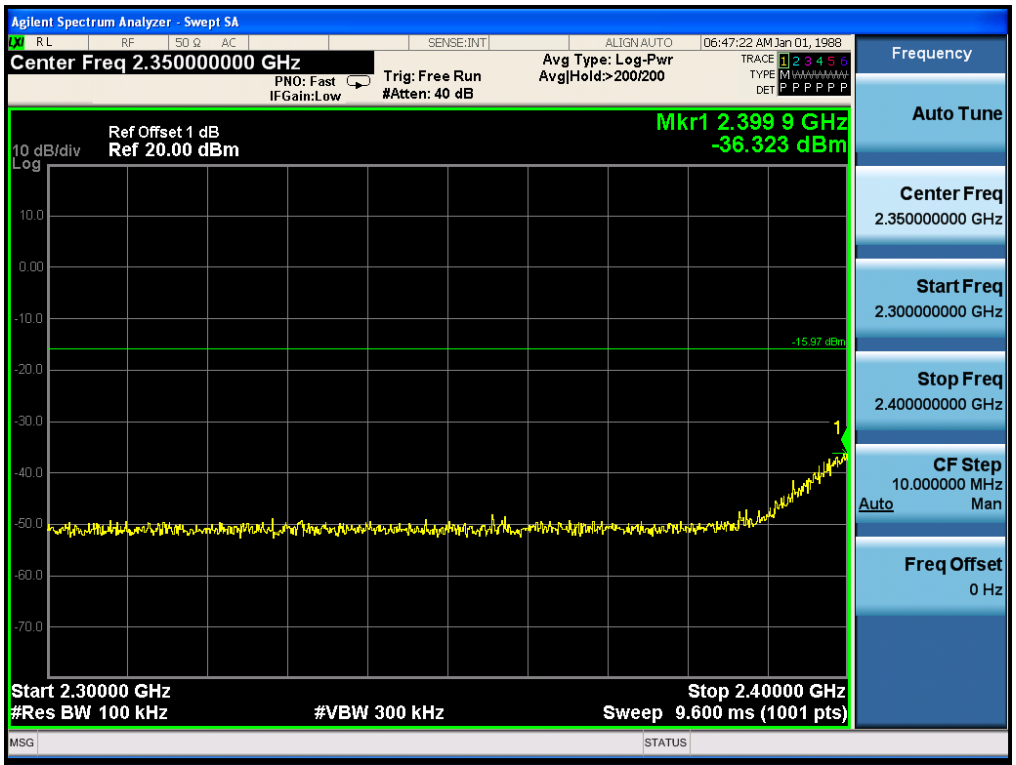

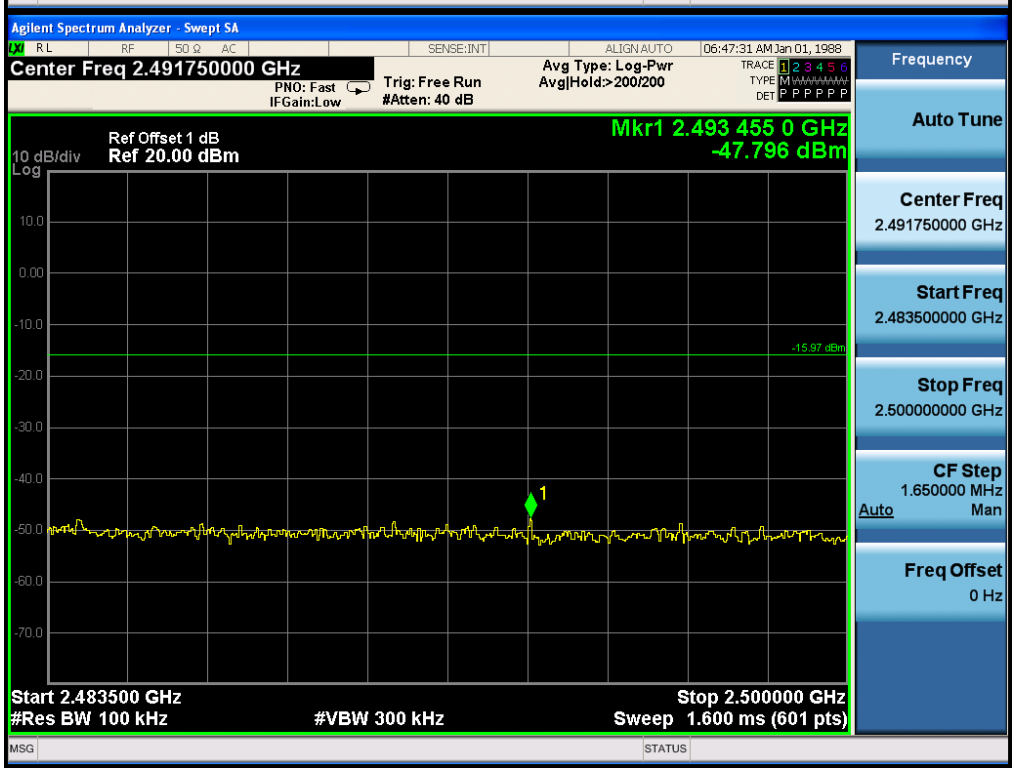

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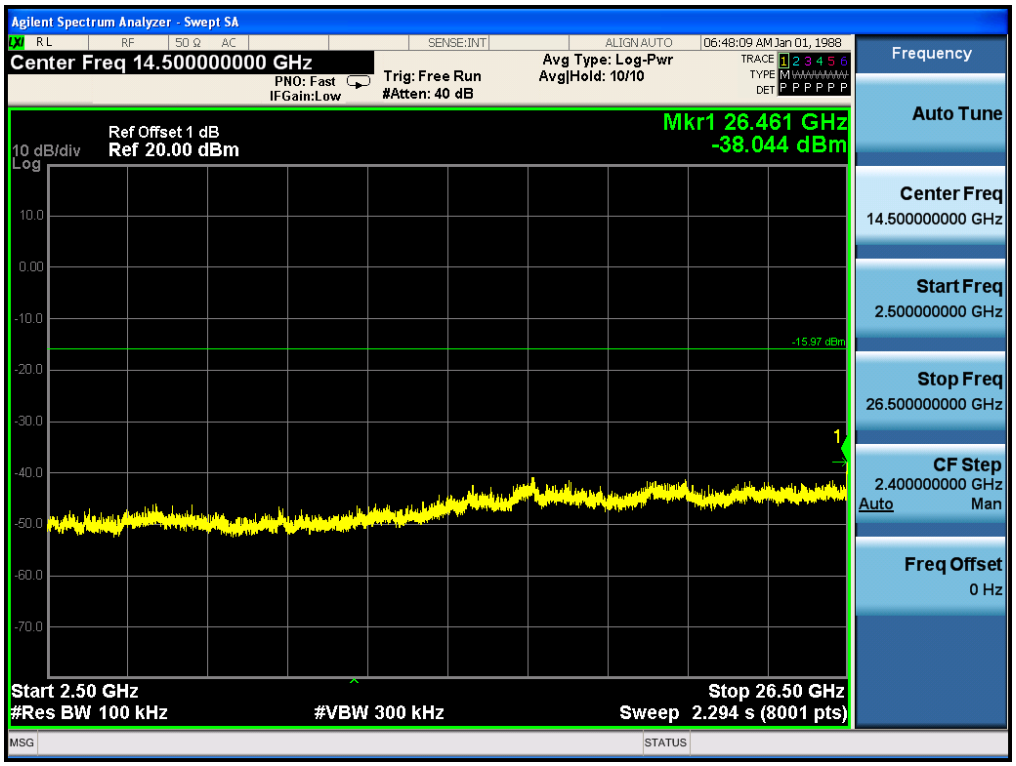

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4.8.1.1.8 802.11 N20_ Middle Channel

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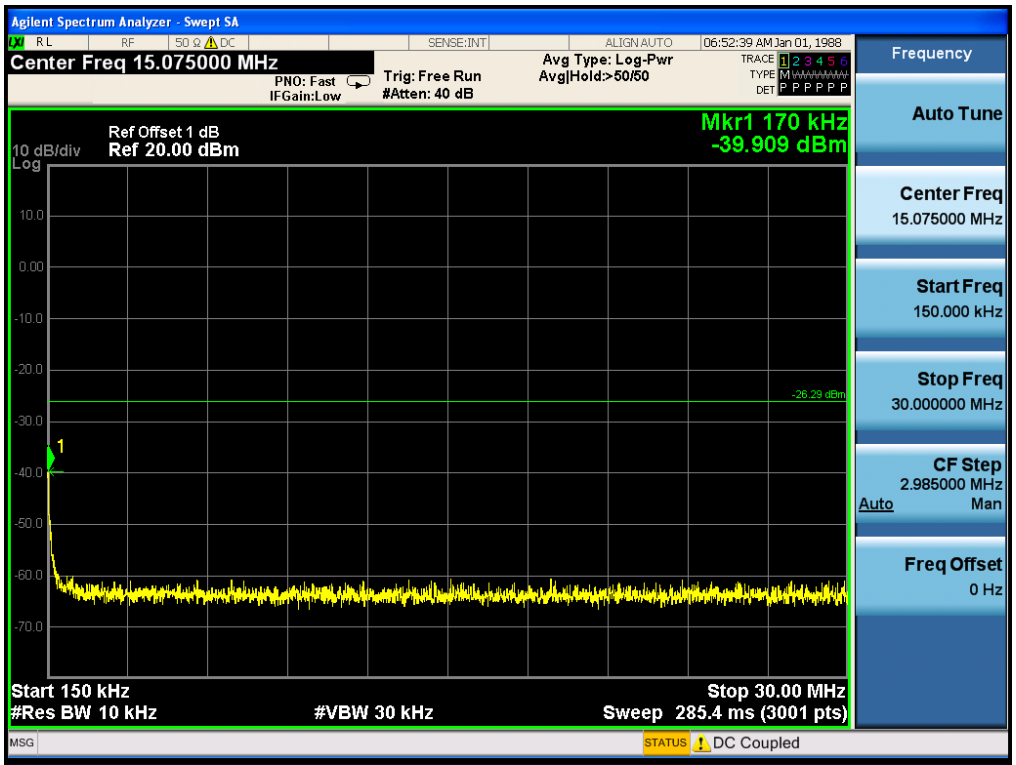

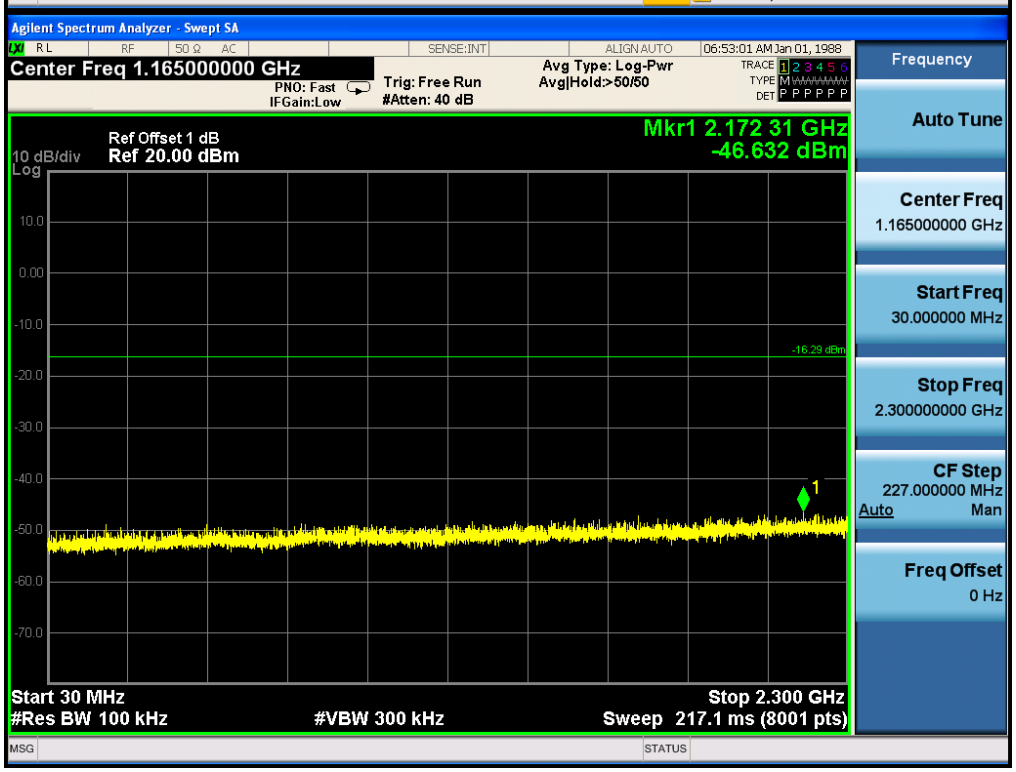

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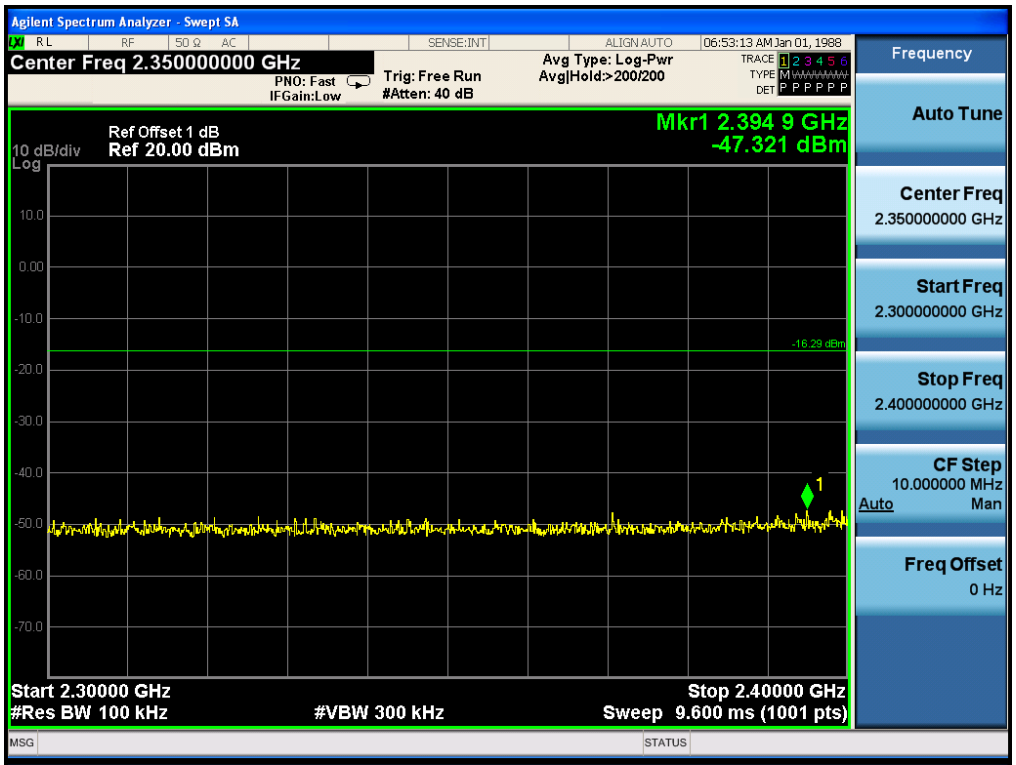

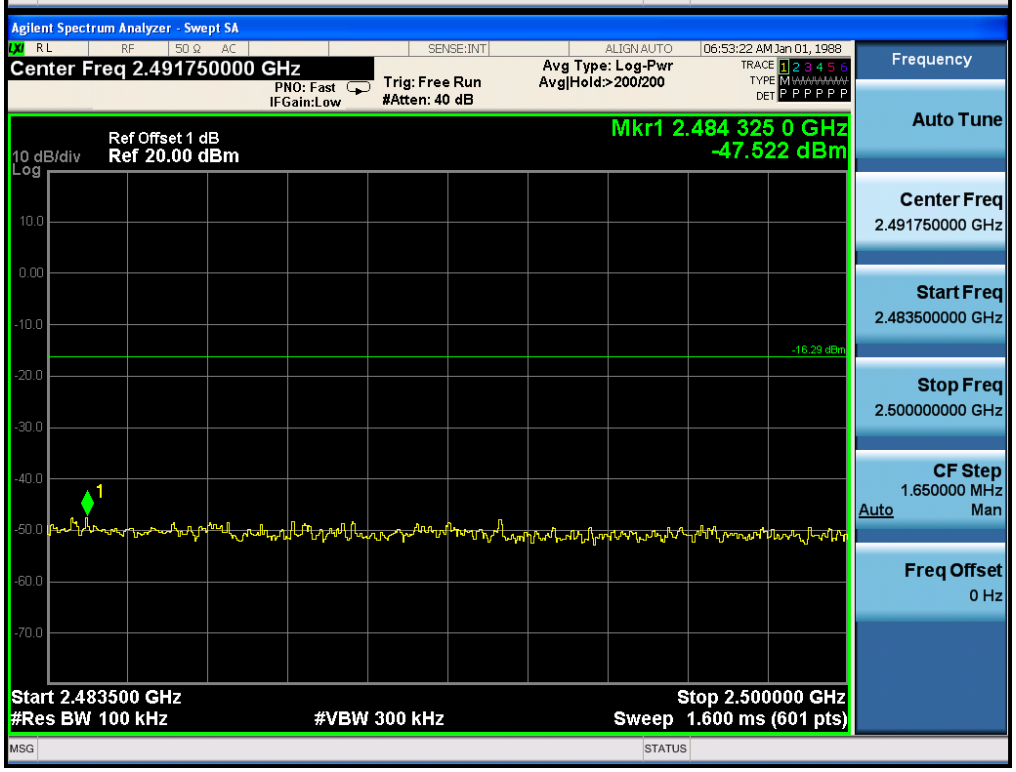

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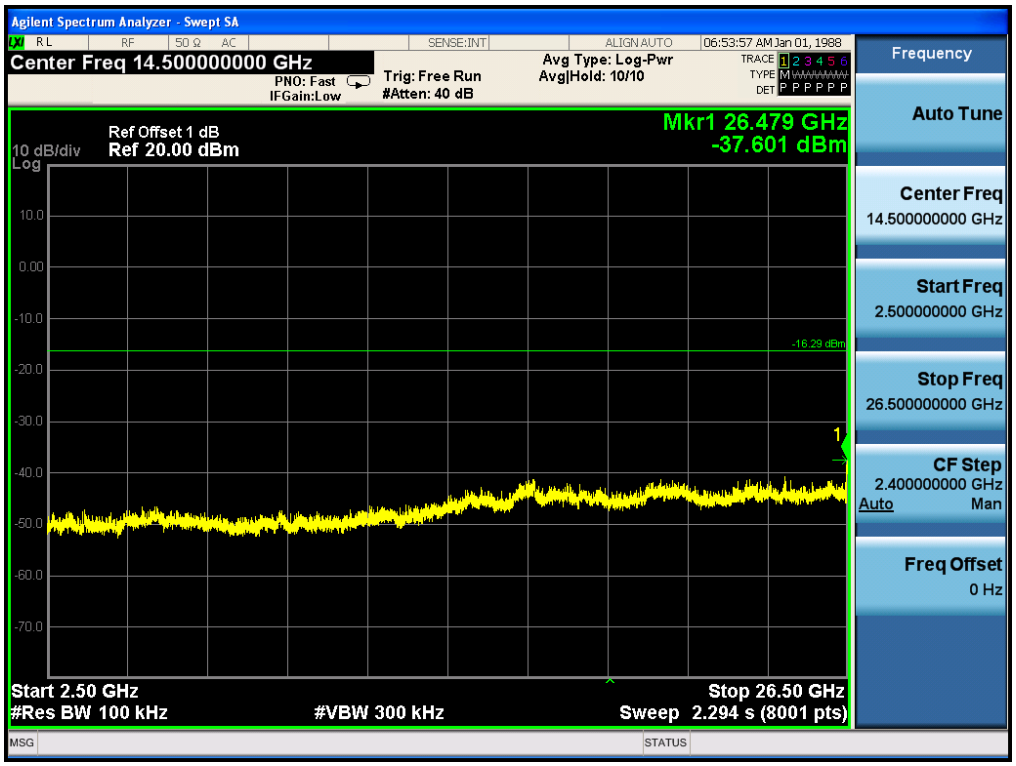

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4.8.1.1.9 802.11 N20_ Highest Channel

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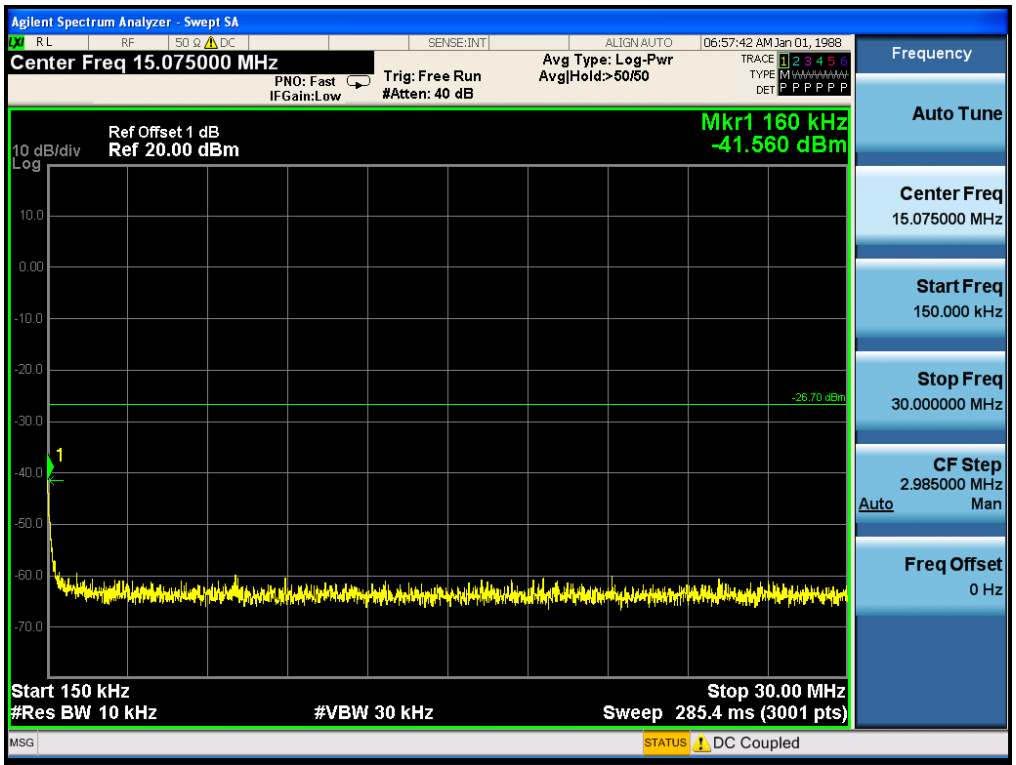

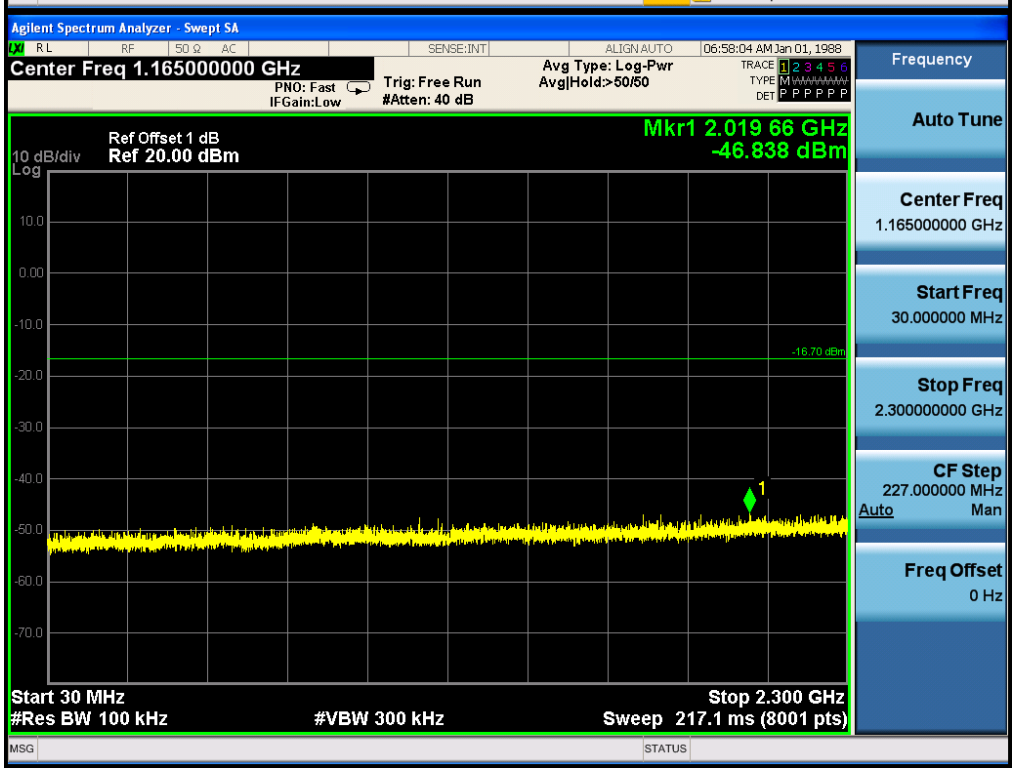

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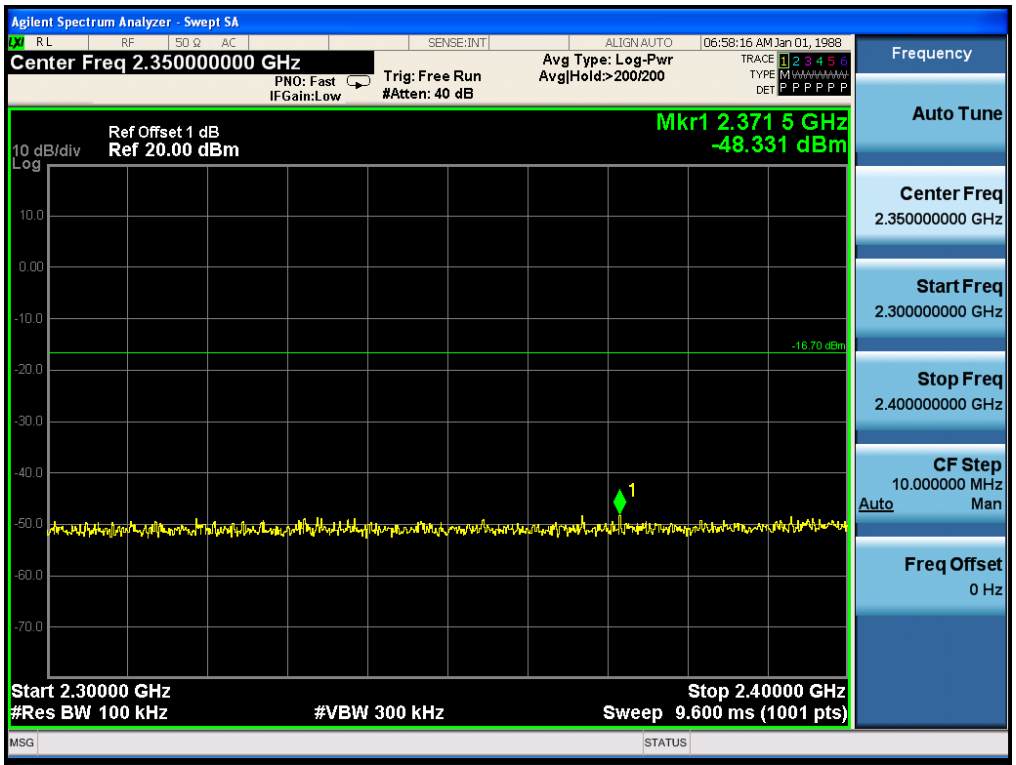

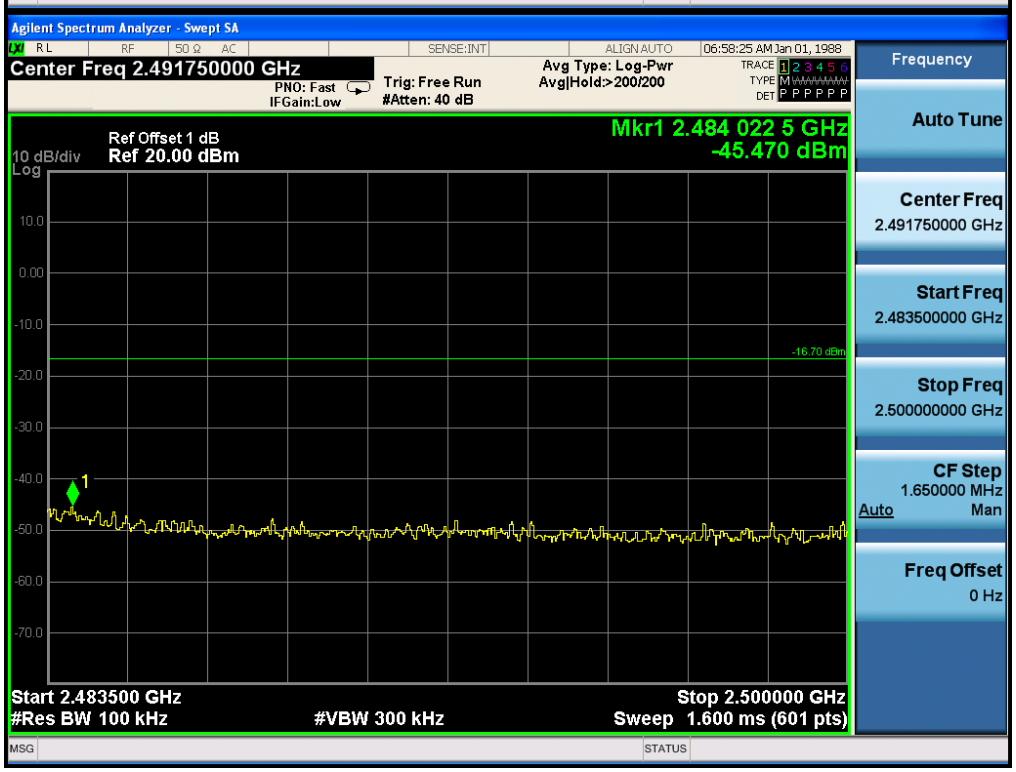

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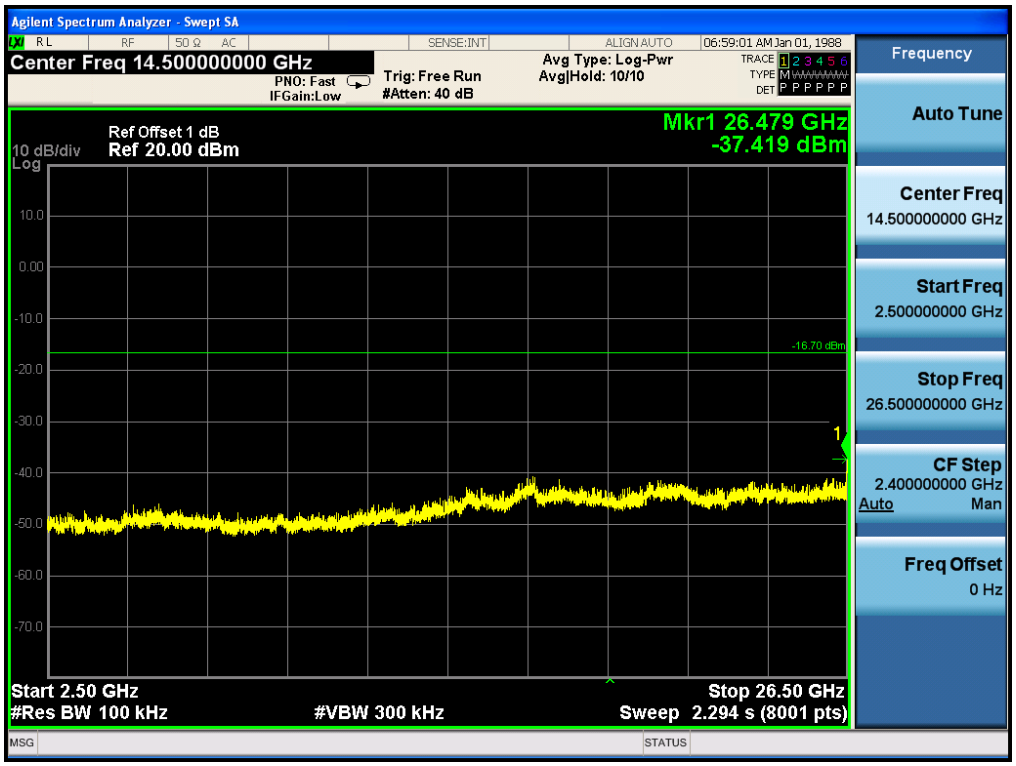

Remark:

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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