

Appendix

2.4G WLAN

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1 Equipment List

Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2019/4/1	2020/3/31
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2019/6/12	2020/6/11
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2019/2/11	2020/2/10
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019/3/2	2020/3/1

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/1/13	2020/1/12
Coaxial Cable	SGS	N/A	SEM031-01	2019/6/12	2020/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

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

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	RF power density, conducted	±2.84dB
3	Spurious emissions, conducted	±0.75dB
4	Conduct emission test	±3.12 dB (9KHz- 30MHz)

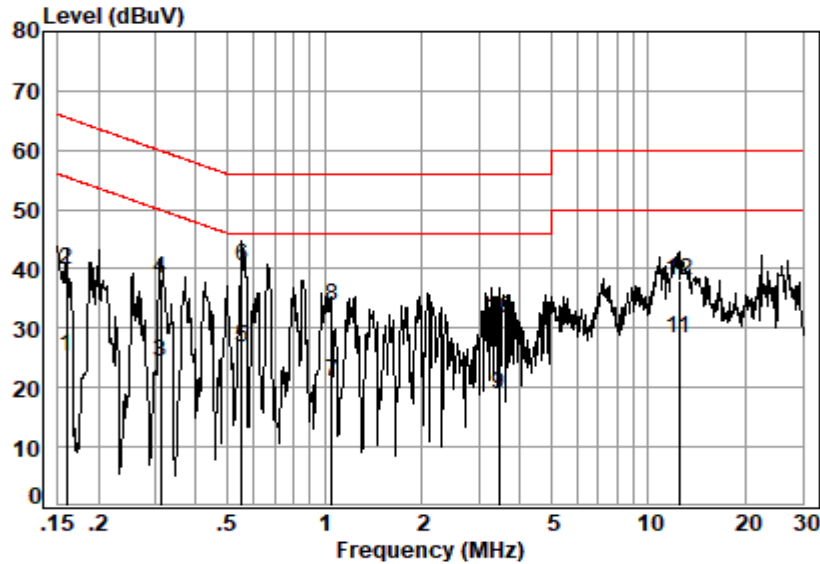
3 AC Power Line Conducted Emissions

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:



Site : Shielding Room

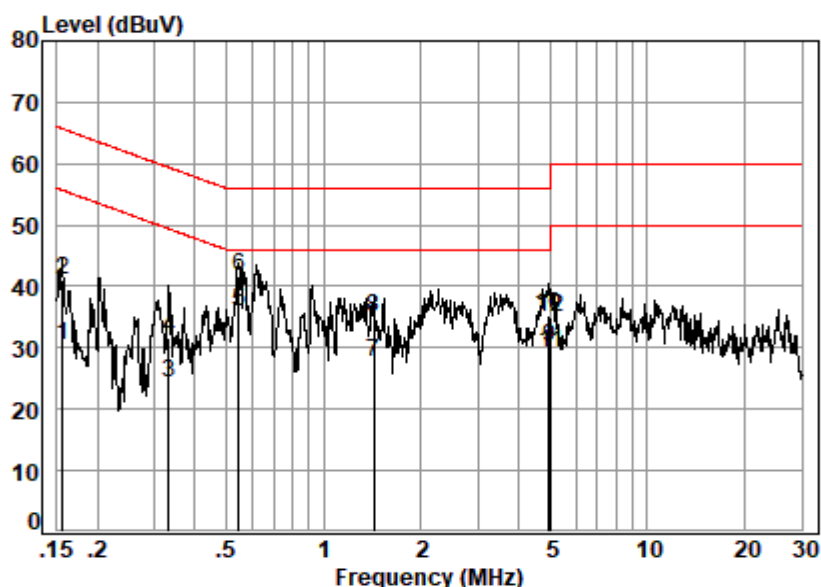
Condition: Line

Job No. : 16957CR

Test mode: d

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1598	0.01	9.66	15.48	25.15	55.47	-30.32	Average
2	0.1598	0.01	9.66	30.05	39.72	65.47	-25.75	QP
3	0.3116	0.04	9.67	14.67	24.38	49.93	-25.55	Average
4	0.3116	0.04	9.67	28.55	38.26	59.93	-21.67	QP
5	0.5552	0.06	9.67	17.11	26.84	46.00	-19.16	Average
6	0.5552	0.06	9.67	30.84	40.57	56.00	-15.43	QP
7	1.0485	0.09	9.74	11.06	20.89	46.00	-25.11	Average
8	1.0485	0.09	9.74	23.87	33.70	56.00	-22.30	QP
9	3.4538	0.16	9.71	8.85	18.72	46.00	-27.28	Average
10	3.4538	0.16	9.71	21.80	31.67	56.00	-24.33	QP
11	12.4495	0.19	10.12	17.96	28.27	50.00	-21.73	Average
12	12.4495	0.19	10.12	27.63	37.94	60.00	-22.06	QP

Neutral Line:



Site : Shielding Room

Condition: Neutral

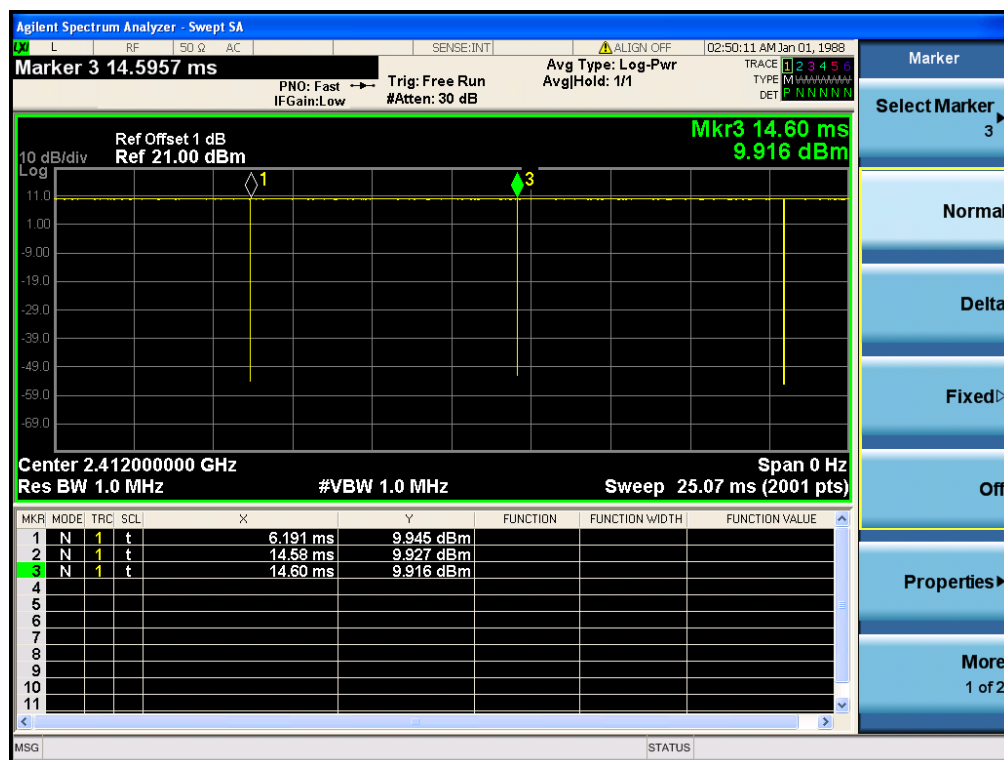
Job No. : 16957CR

Test mode: d

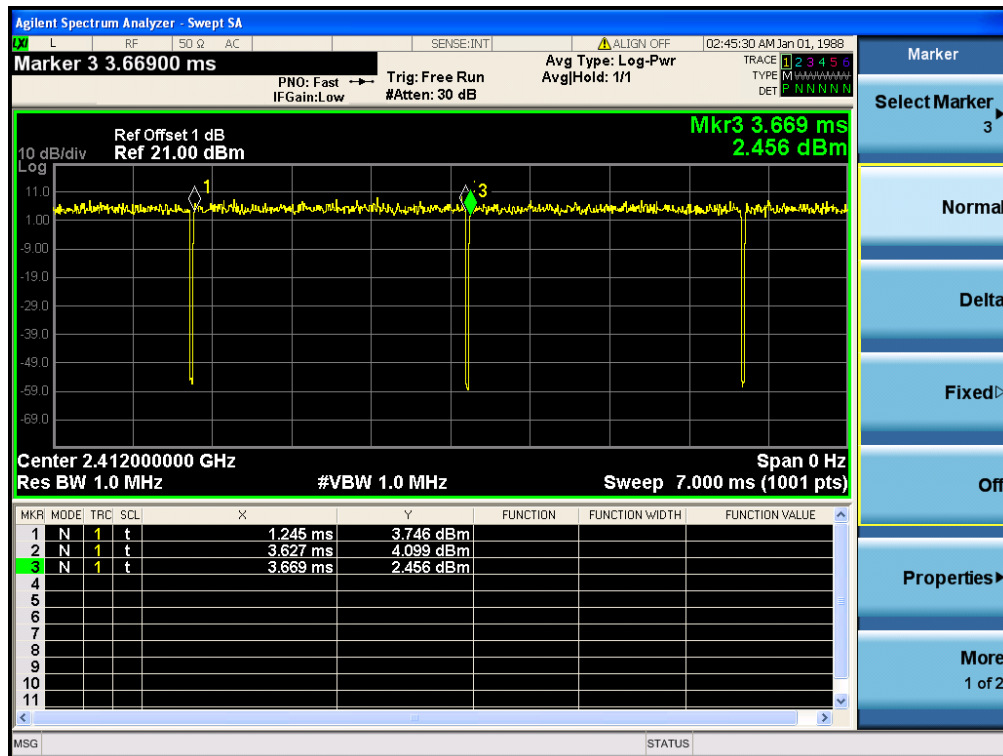
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1557	0.01	9.63	20.67	30.31	55.69	-25.38	Average
2	0.1557	0.01	9.63	31.28	40.92	65.69	-24.77	QP
3	0.3321	0.04	9.64	14.58	24.26	49.40	-25.14	Average
4	0.3321	0.04	9.64	21.85	31.53	59.40	-27.87	QP
5	0.5464	0.06	9.64	26.28	35.98	46.00	-10.02	Average
6	0.5464	0.06	9.64	31.98	41.68	56.00	-14.32	QP
7	1.4257	0.13	9.70	17.70	27.53	46.00	-18.47	Average
8	1.4257	0.13	9.70	25.29	35.12	56.00	-20.88	QP
9	4.9519	0.17	9.71	20.20	30.08	46.00	-15.92	Average
10	4.9519	0.17	9.71	25.48	35.36	56.00	-20.64	QP
11	5.0312	0.17	9.71	19.40	29.28	50.00	-20.72	Average
12	5.0312	0.17	9.71	24.98	34.86	60.00	-25.14	QP

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.



11N20



Agilent Spectrum Analyzer - Swept SA

L RF 50 Ω AC SENSE:INT ALIGN OFF 02:43:42 AM Jan 01, 1988

Marker 3 2.64000 ms

PNO: Fast → Trg: Free Run Avg Type: Log-Pwr
IF Gain: Low #Atten: 30 dB Avg/Hold: 1/1

TRACE 1 2 3 4 5 6
TYPE M P N N N N N
DET P N N N N N

Ref Offset 1 dB Ref 21.00 dBm Mkr3 2.640 ms
-4.484 dBm

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	1.427 ms	-5.454 dBm			
2	N	1	t	2.570 ms	-3.417 dBm			
3	N	1	t	2.640 ms	-4.484 dBm			
4								
5								
6								
7								
8								
9								
10								
11								

Center 2.42200000 GHz Span 0 Hz
Res BW 1.0 MHz #VBW 1.0 MHz Sweep 5.000 ms (1001 pts)

5 Conducted Output Power

5.1 Test Results

Measurement Data of Peak Power:

Mode	Test Channel	Peak Output Power (dBm)	Limit (dBm)	Result
802.11B	Lowest	22.34	30.00	Pass
	Middle	22.44	30.00	Pass
	Highest	22.10	30.00	Pass
802.11G	Lowest	20.54	30.00	Pass
	Middle	22.61	30.00	Pass
	Highest	22.21	30.00	Pass
802.11N20	Lowest	20.52	30.00	Pass
	Middle	21.78	30.00	Pass
	Highest	21.37	30.00	Pass
802.11N40	Lowest	20.34	30.00	Pass
	Middle	20.24	30.00	Pass
	Highest	19.93	30.00	Pass

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

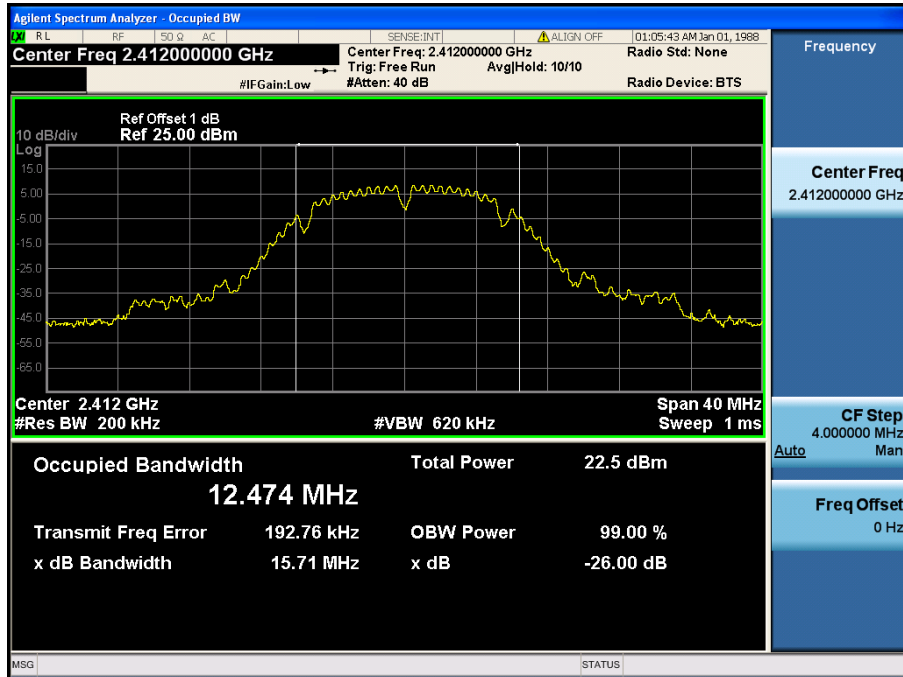
6.1 Test Results

Mode	Test Channel	Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
802.11B	Lowest	22.50	24.40	≥500	Pass
	Middle	22.60	24.50	≥500	Pass
	Highest	22.30	24.20	≥500	Pass
802.11G	Lowest	19.90	20.10	≥500	Pass
	Middle	22.10	22.10	≥500	Pass
	Highest	21.70	21.70	≥500	Pass
802.11N20	Lowest	20.00	20.10	≥500	Pass
	Middle	21.10	21.10	≥500	Pass
	Highest	20.80	20.90	≥500	Pass
802.11N40	Lowest	19.20	19.60	≥500	Pass
	Middle	19.20	19.50	≥500	Pass
	Highest	18.80	19.30	≥500	Pass

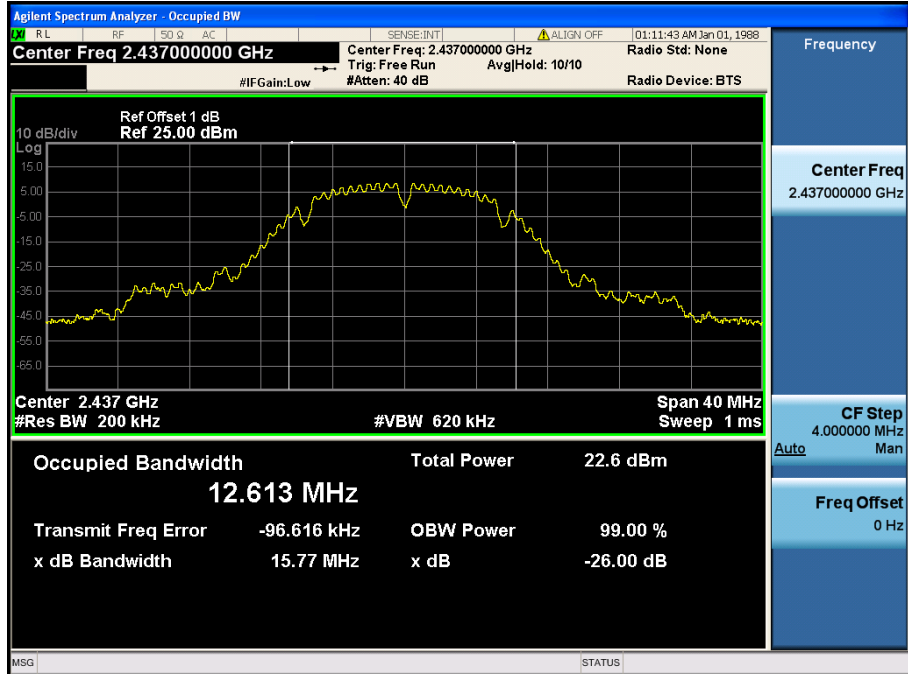
6.2 Test plots

ANT1

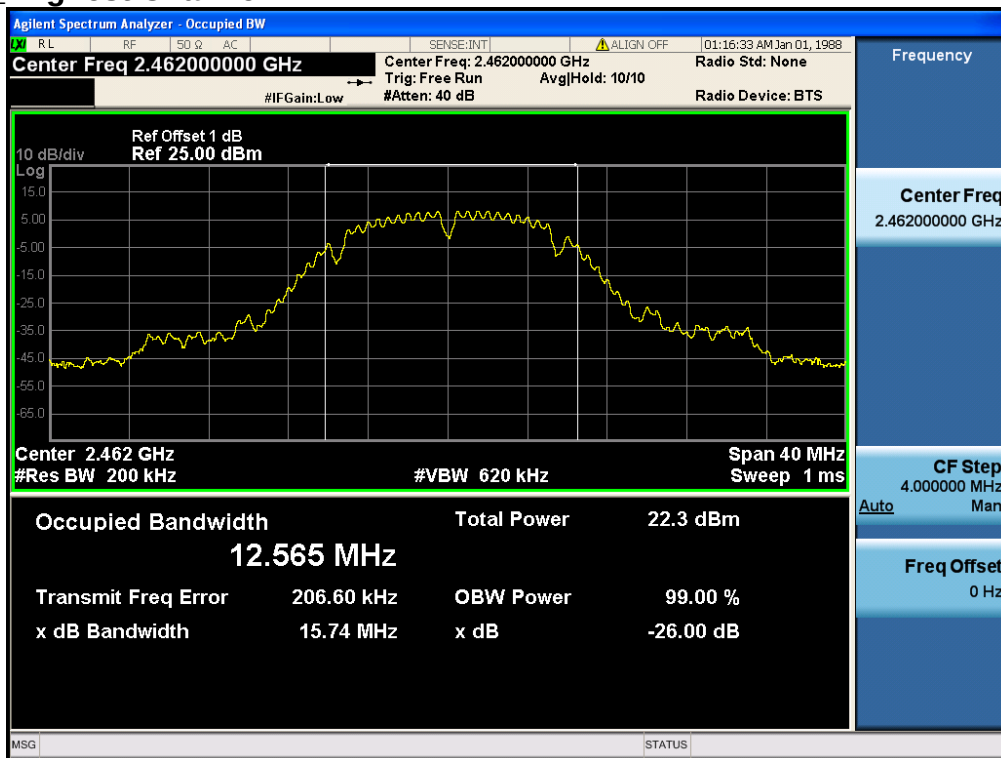
802.11B_Lowest Channel



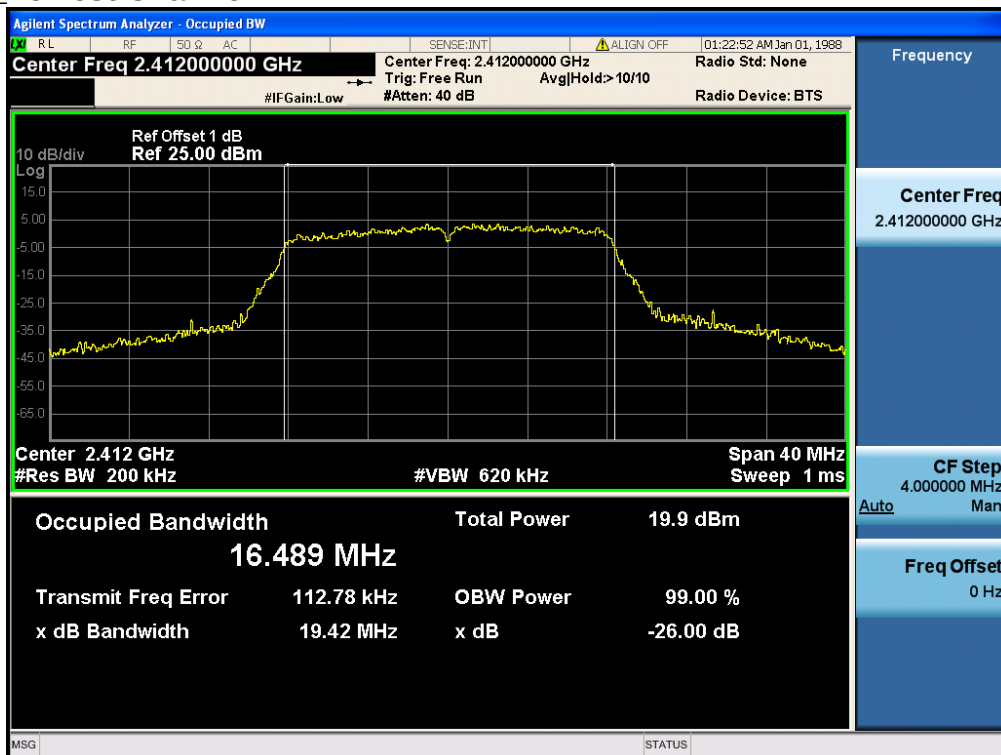
802.11B_Middle Channel



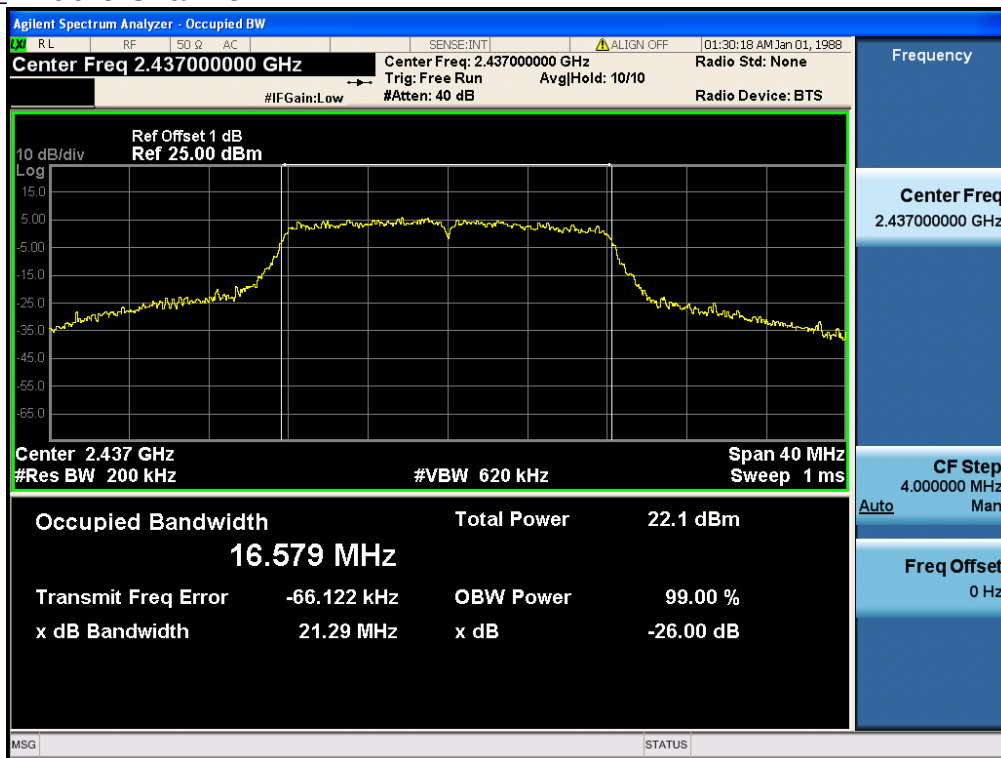
802.11B_Highest Channel



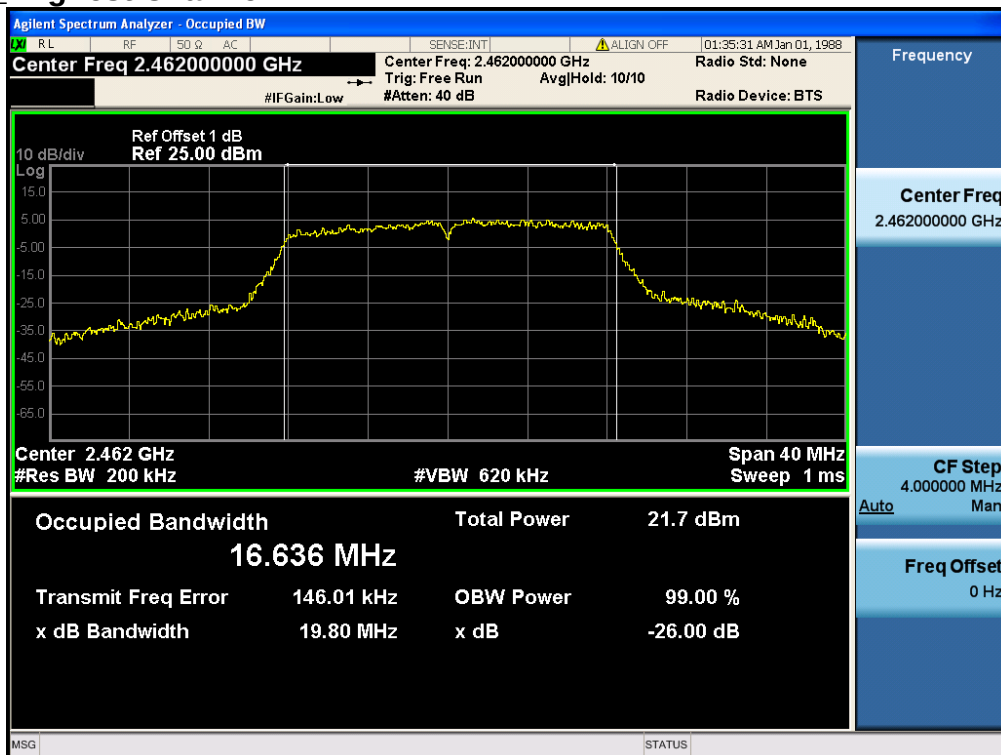
802.11G_Lowest Channel



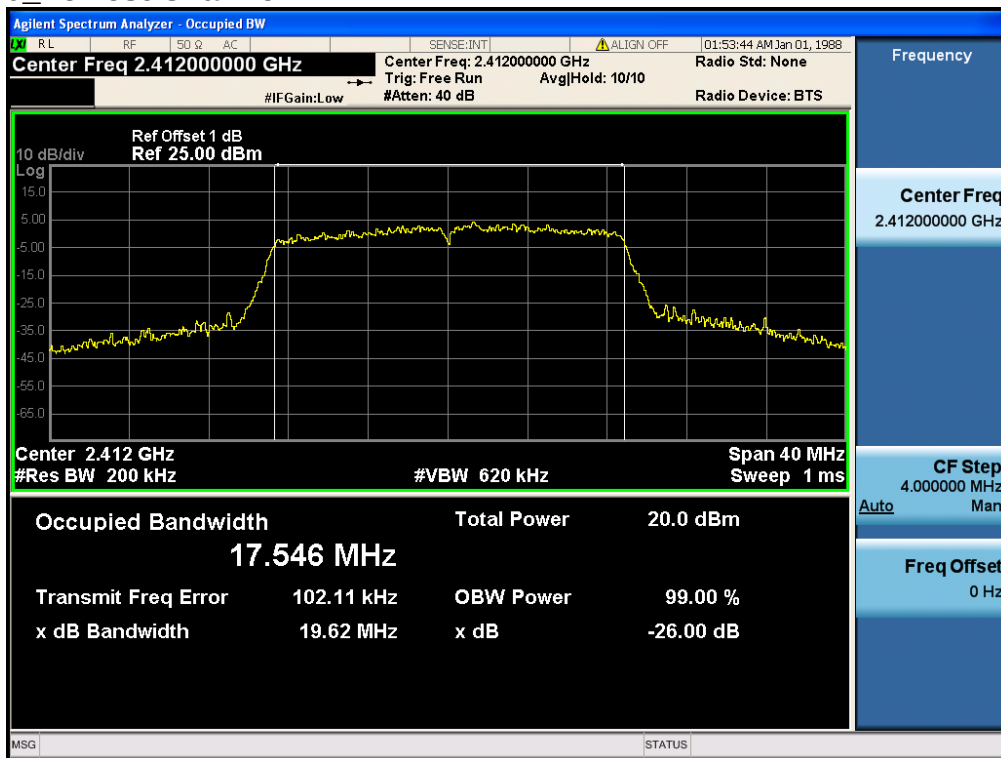
802.11G_Middle Channel



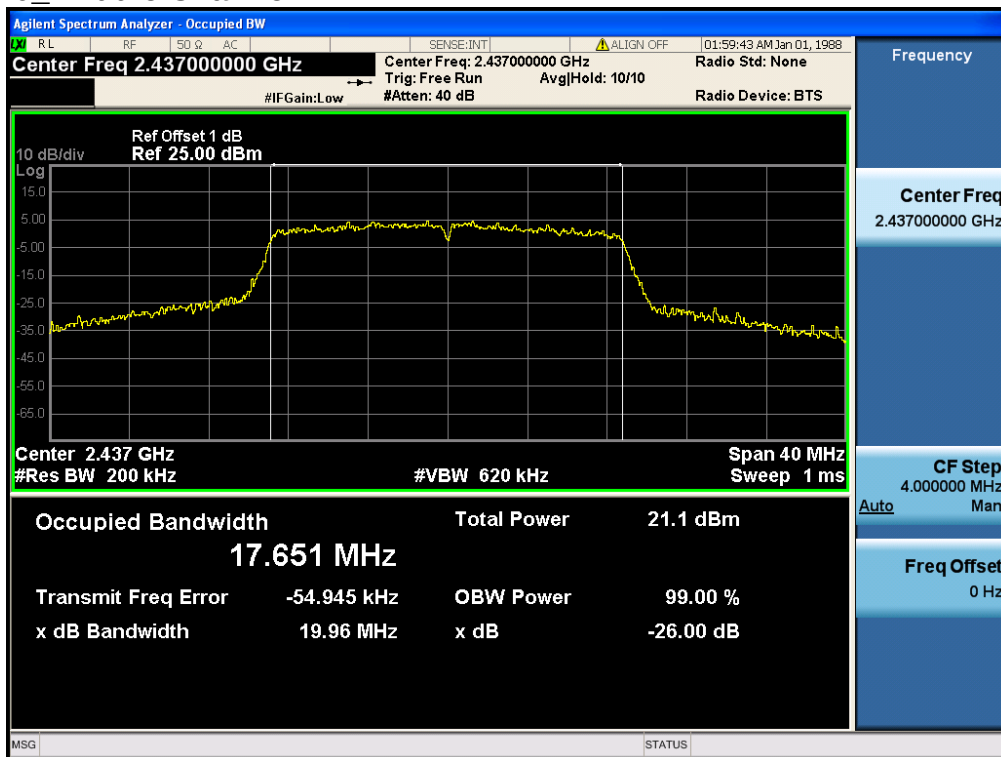
802.11G_Highest Channel



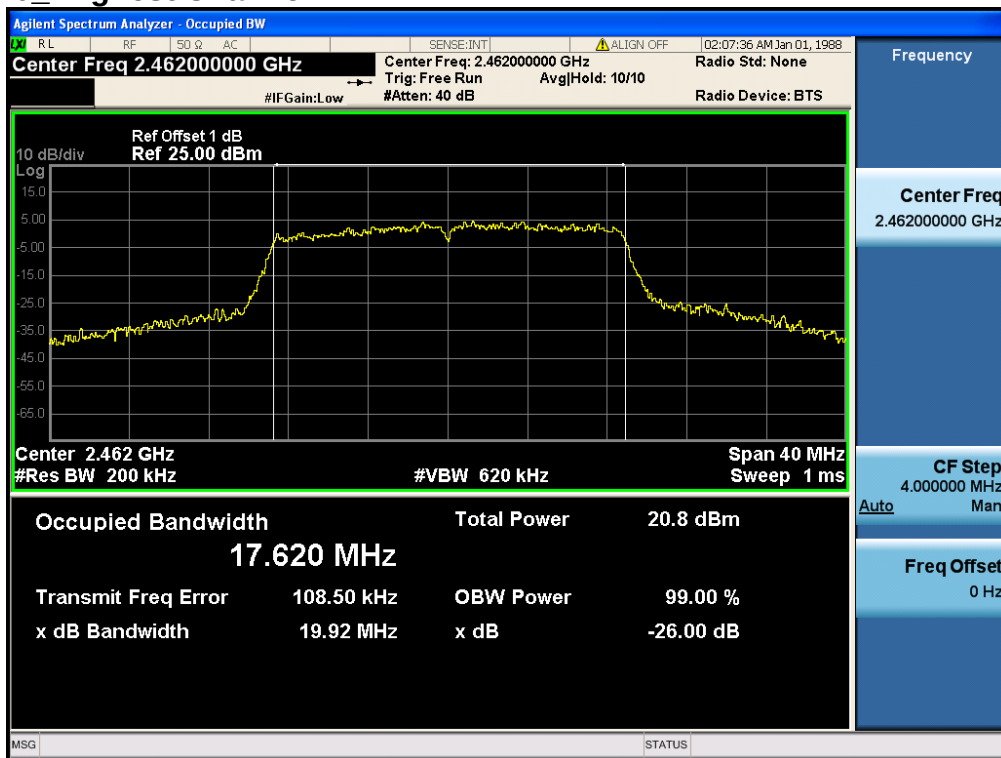
802.11N20_Lowest Channel



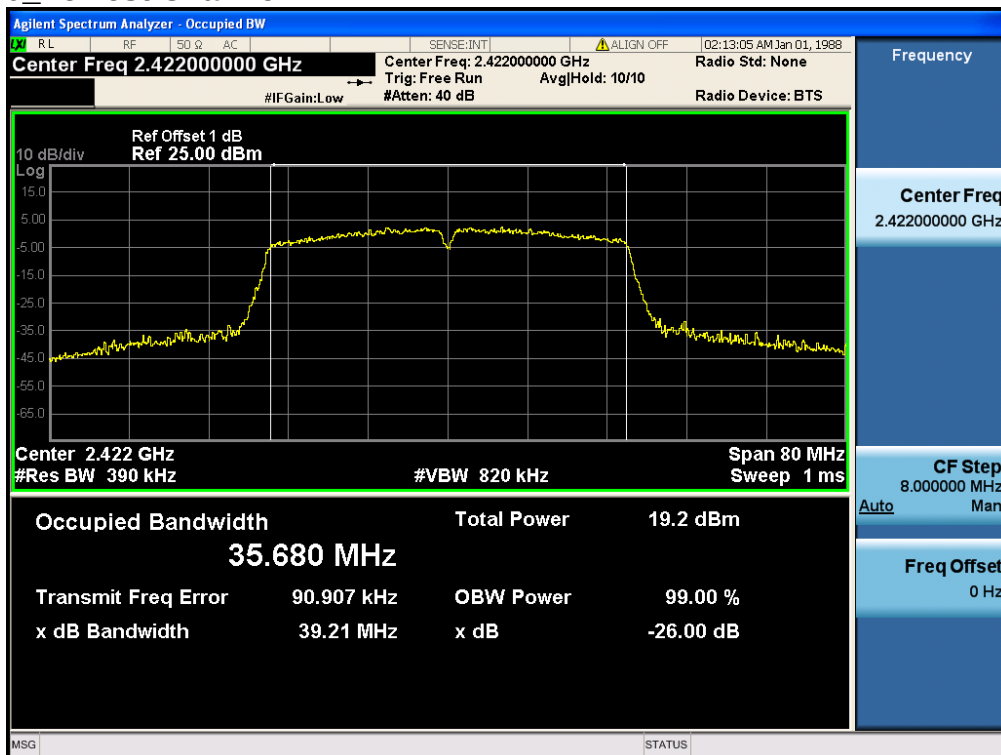
802.11 N20_Middle Channel



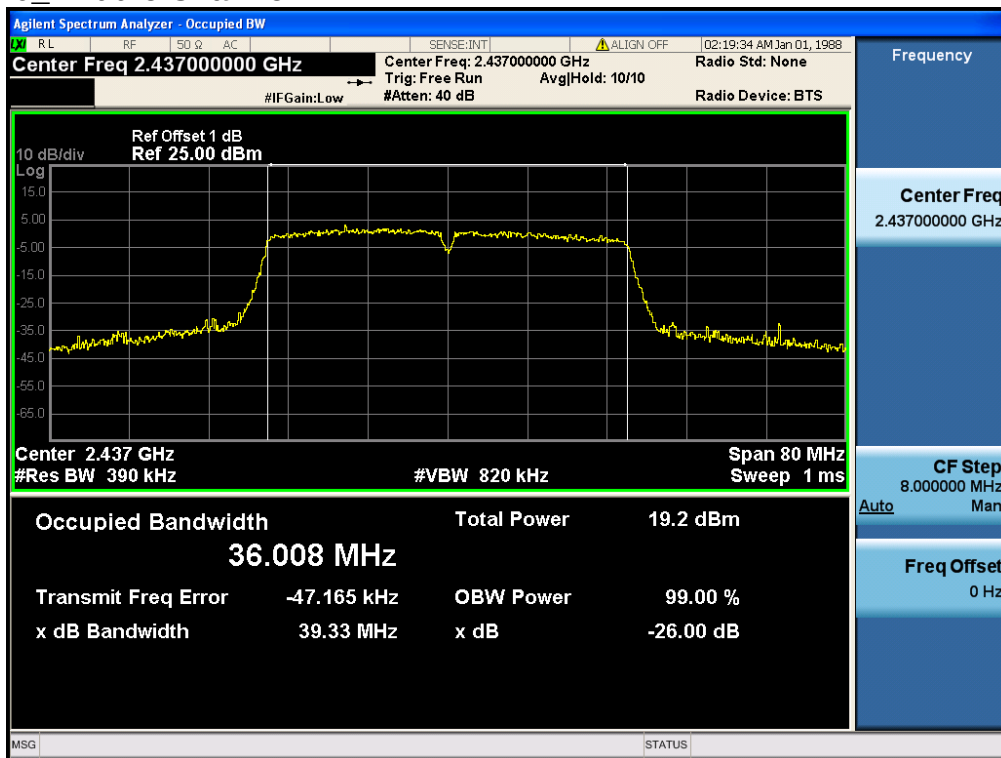
802.11 N20_Highest Channel



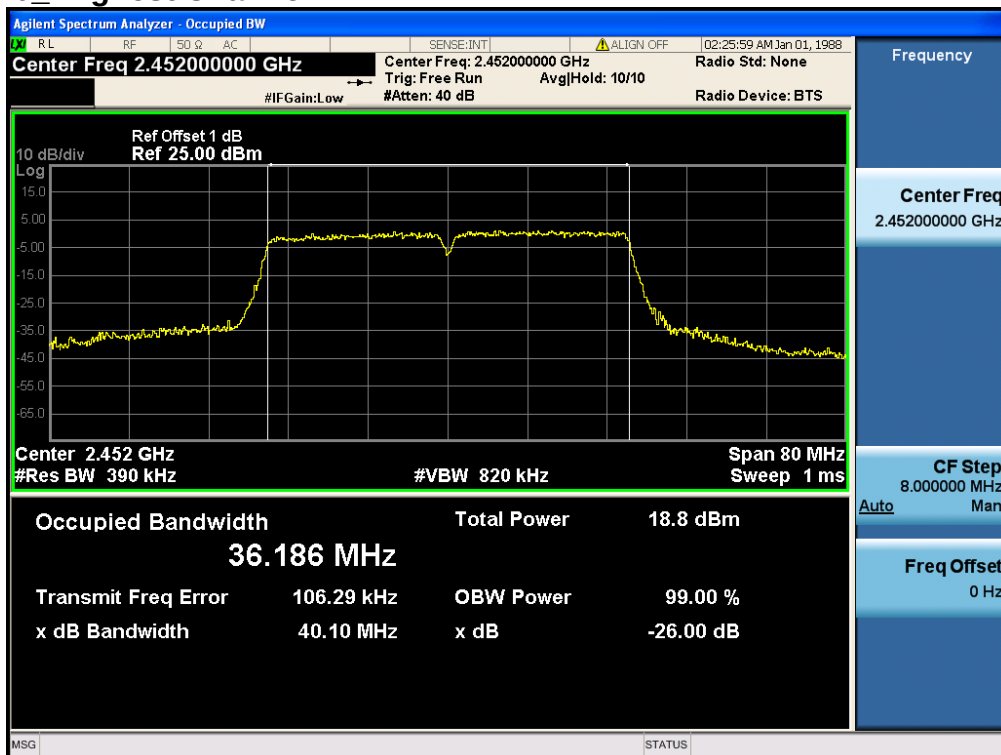
802.11N40_Lowest Channel



802.11 N40_ Middle Channel



802.11 N40_ Highest Channel



7 Power Spectral Density

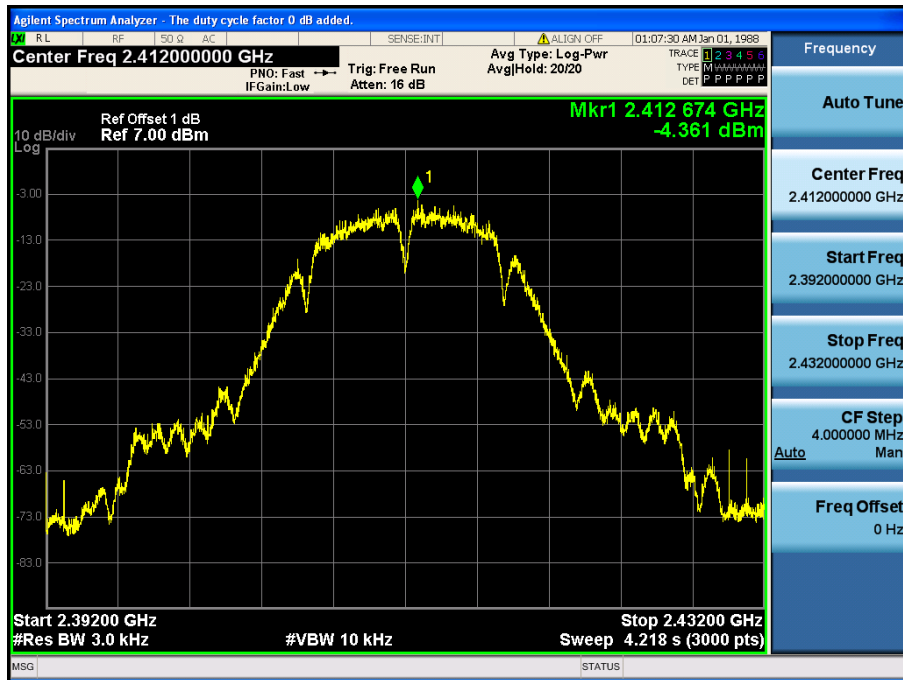
7.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
802.11B	Lowest	-4.36	≤8.00	Pass
	Middle	-4.29	≤8.00	Pass
	Highest	-5.36	≤8.00	Pass
802.11G	Lowest	-9.87	≤8.00	Pass
	Middle	-9.68	≤8.00	Pass
	Highest	-9.40	≤8.00	Pass
802.11N20	Lowest	-10.46	≤8.00	Pass
	Middle	-10.03	≤8.00	Pass
	Highest	-9.80	≤8.00	Pass
802.11N40	Lowest	-14.25	≤8.00	Pass
	Middle	-14.51	≤8.00	Pass
	Highest	-14.59	≤8.00	Pass

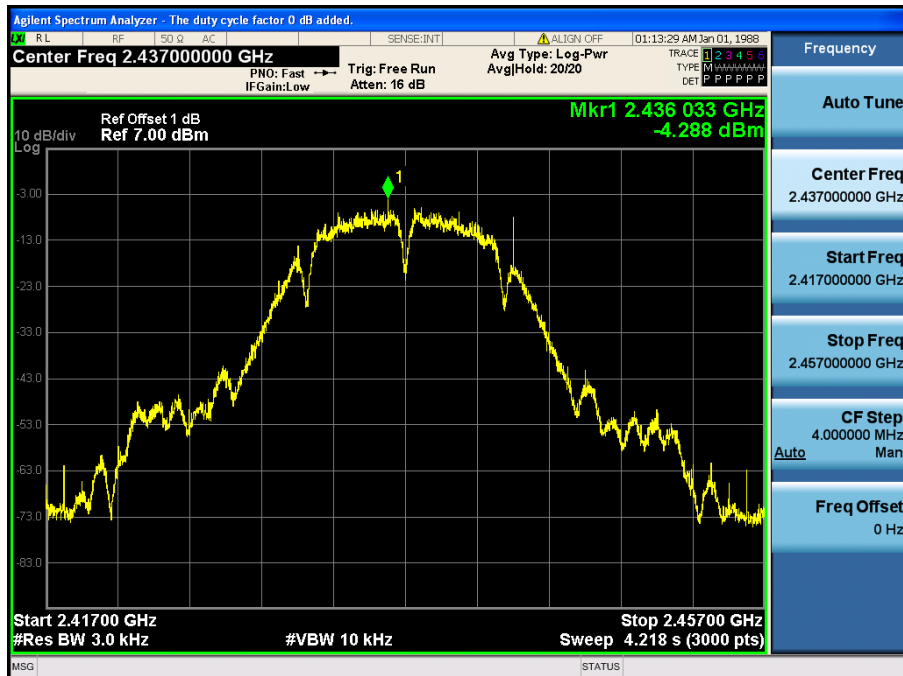
7.2 Test plots

ANT1

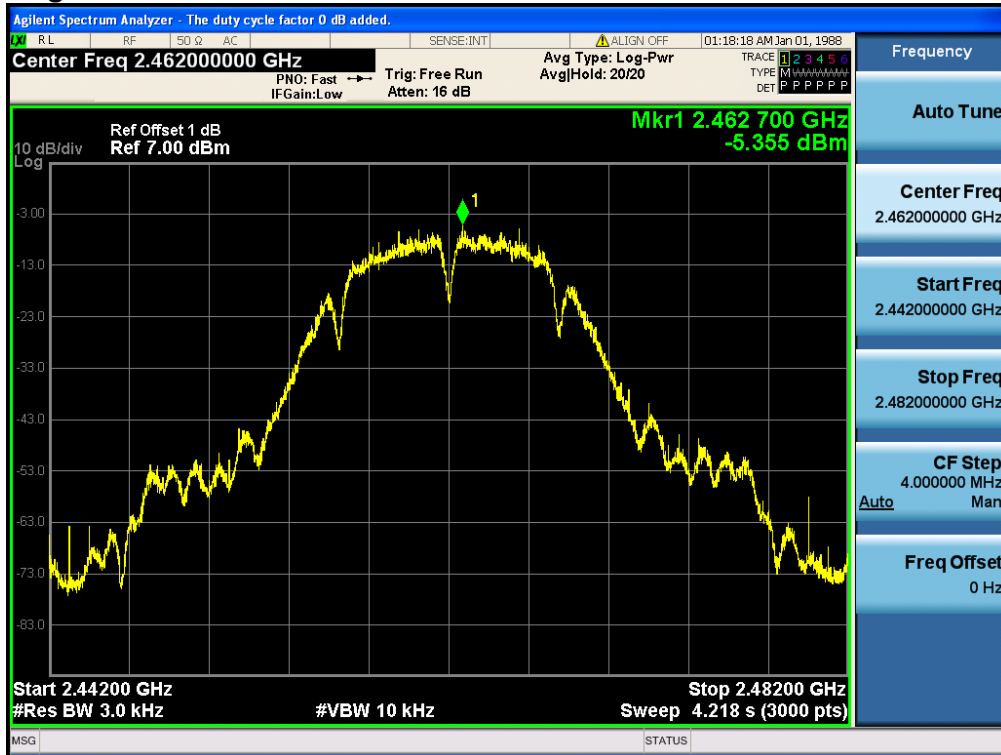
802.11B_Lowest Channel



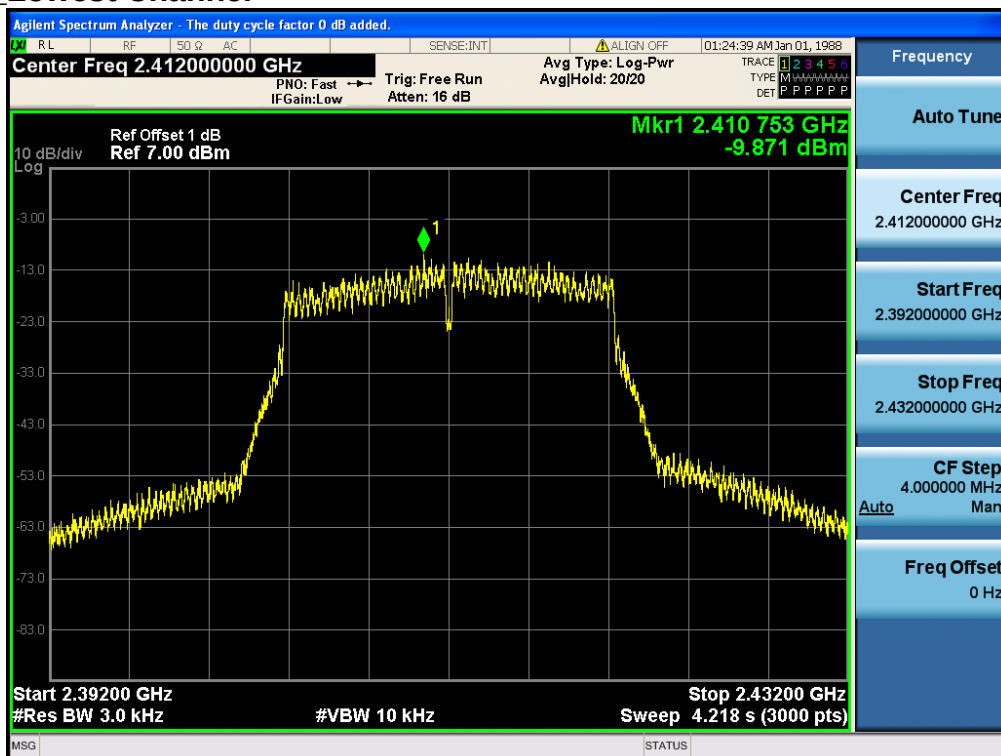
802.11B_Middle Channel

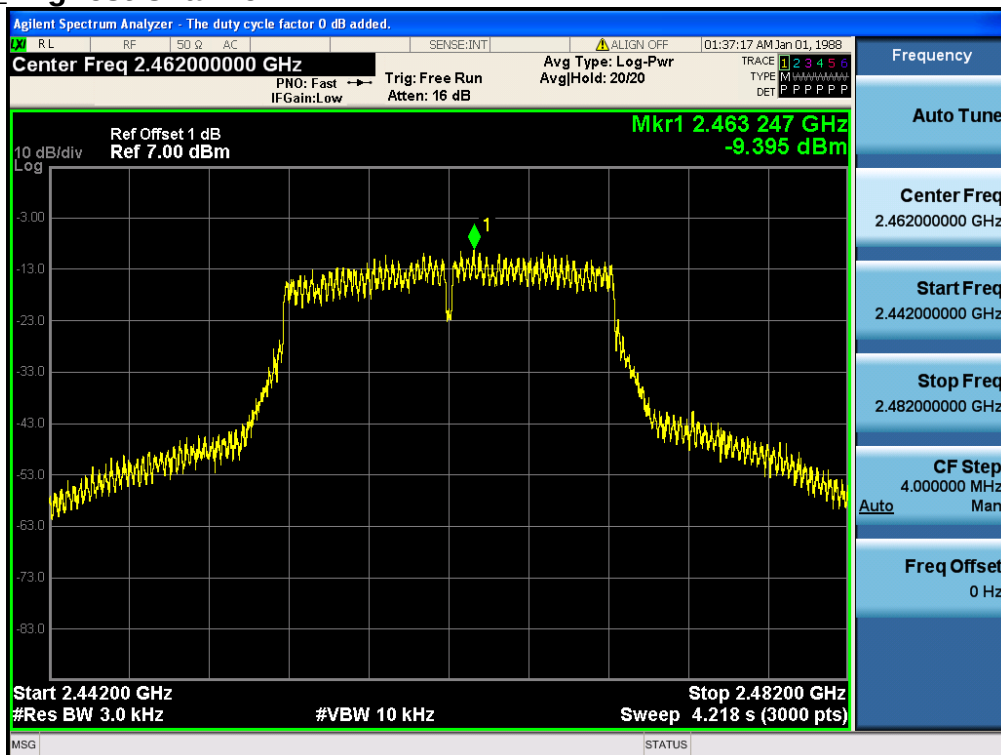


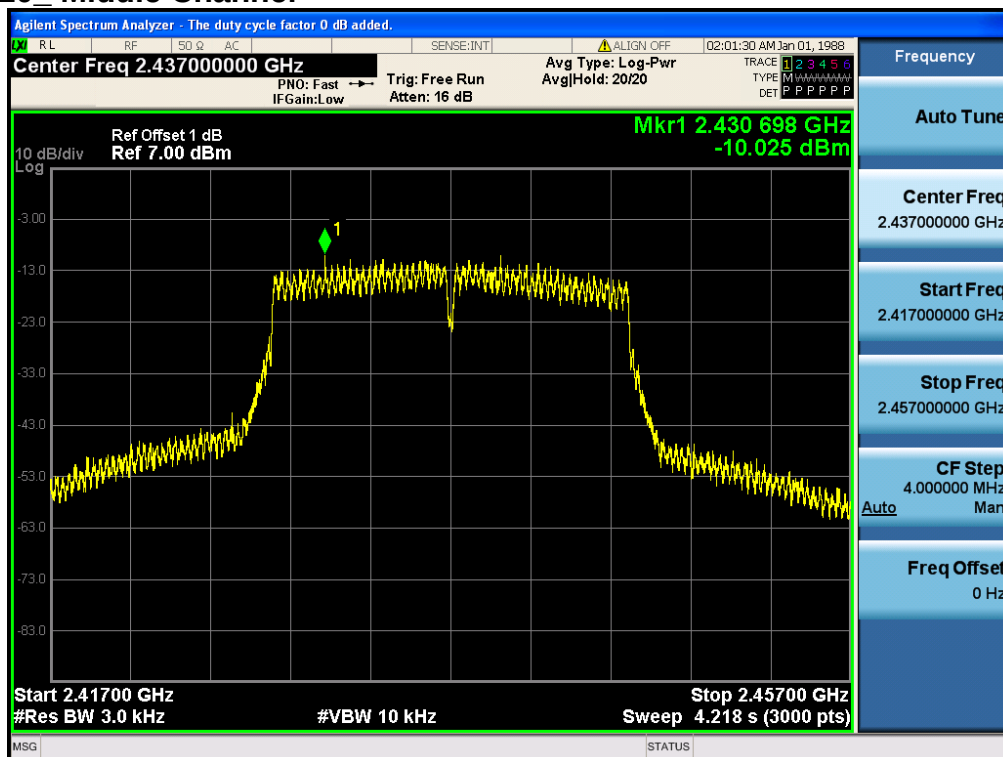
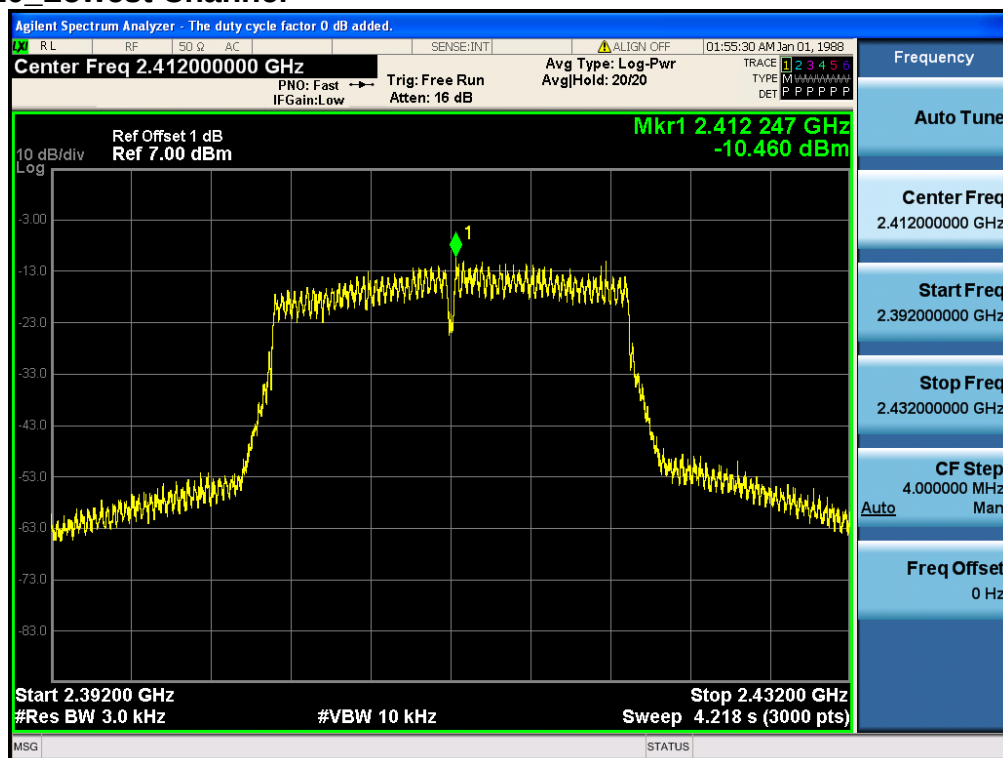
802.11B_Highest Channel



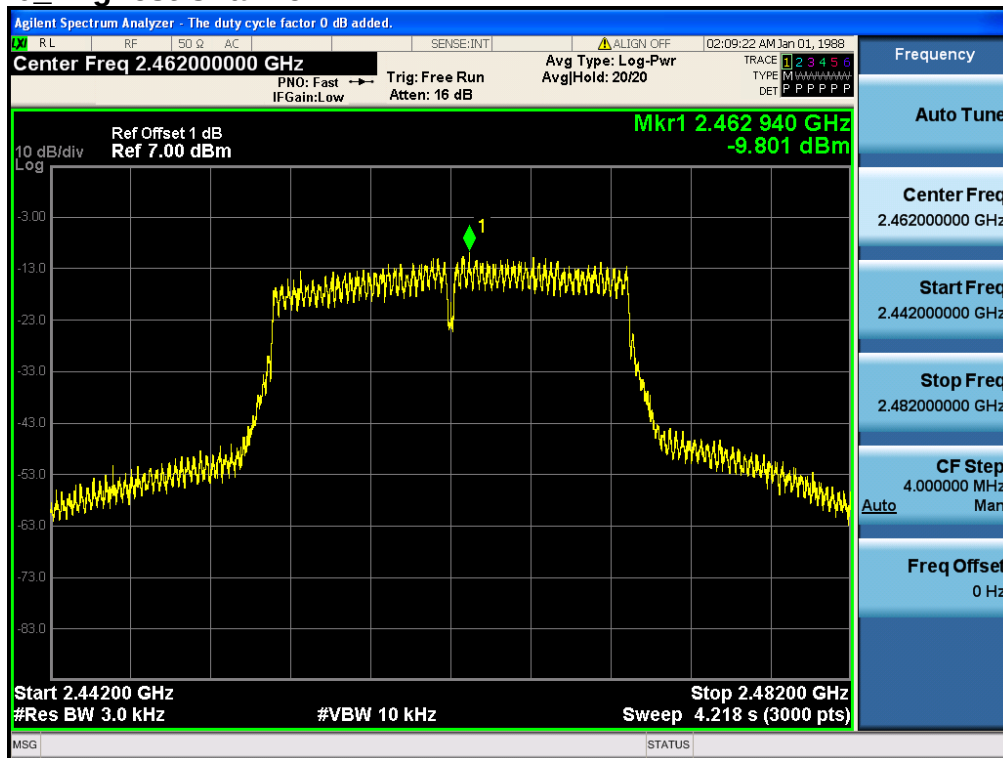
802.11G_Lowest Channel



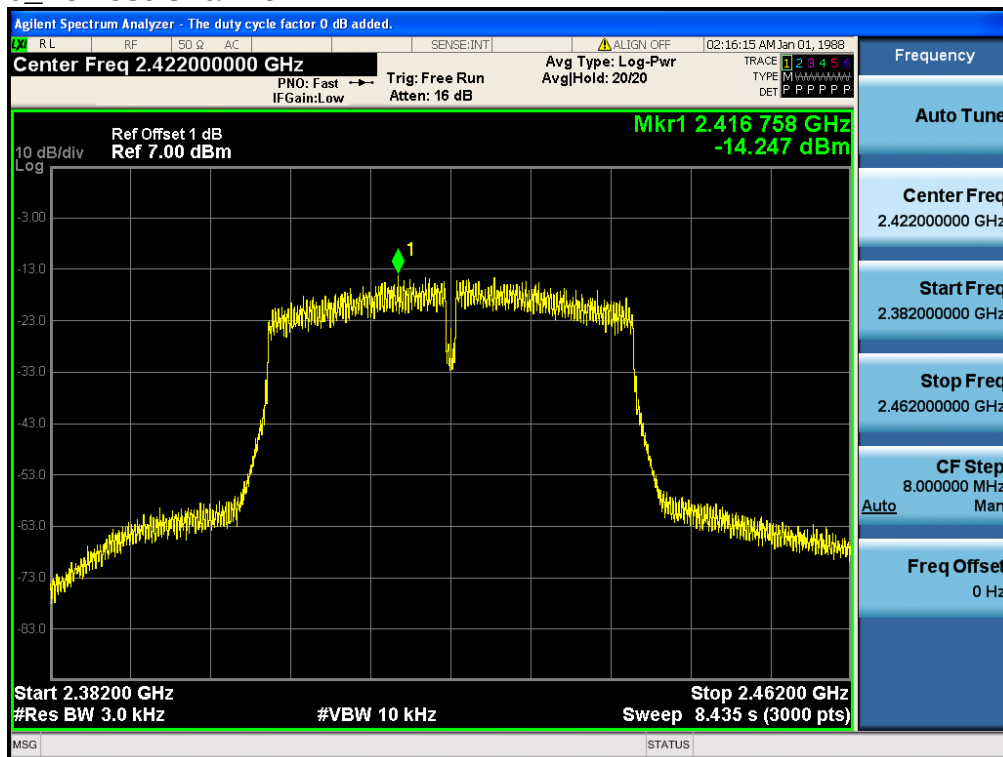




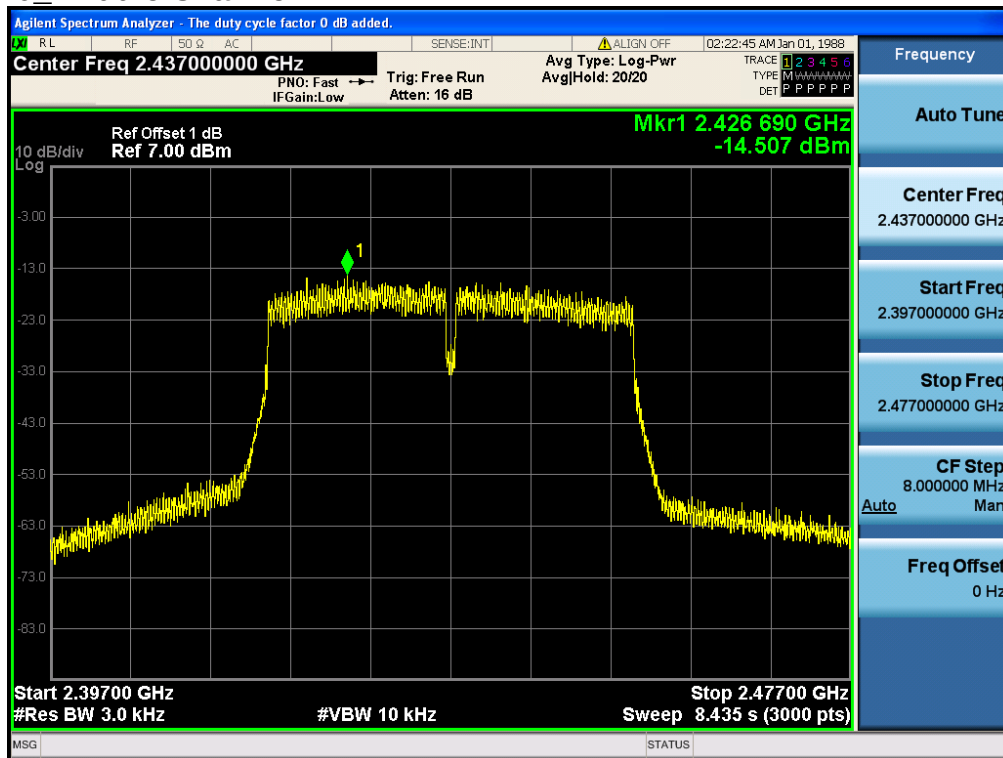
802.11 N20_Highest Channel



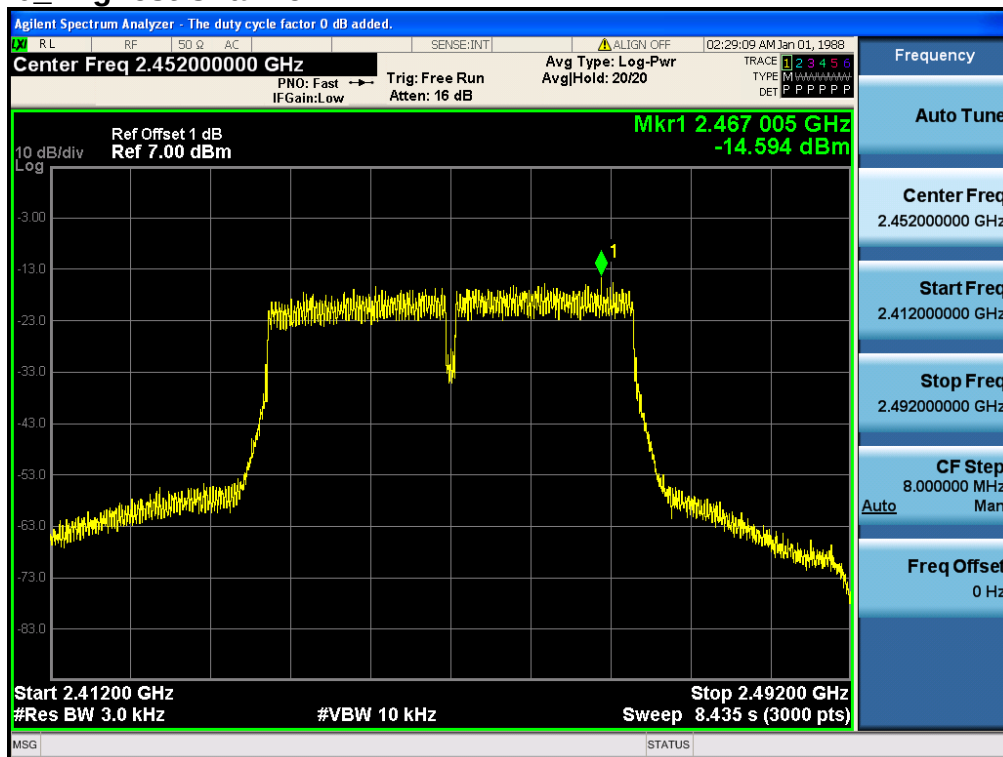
802.11N40_Lowest Channel



802.11 N40 Middle Channel



802.11 N40 Highest Channel



8 Band-edge for RF Conducted Emissions

8.1 Test plots

ANT1

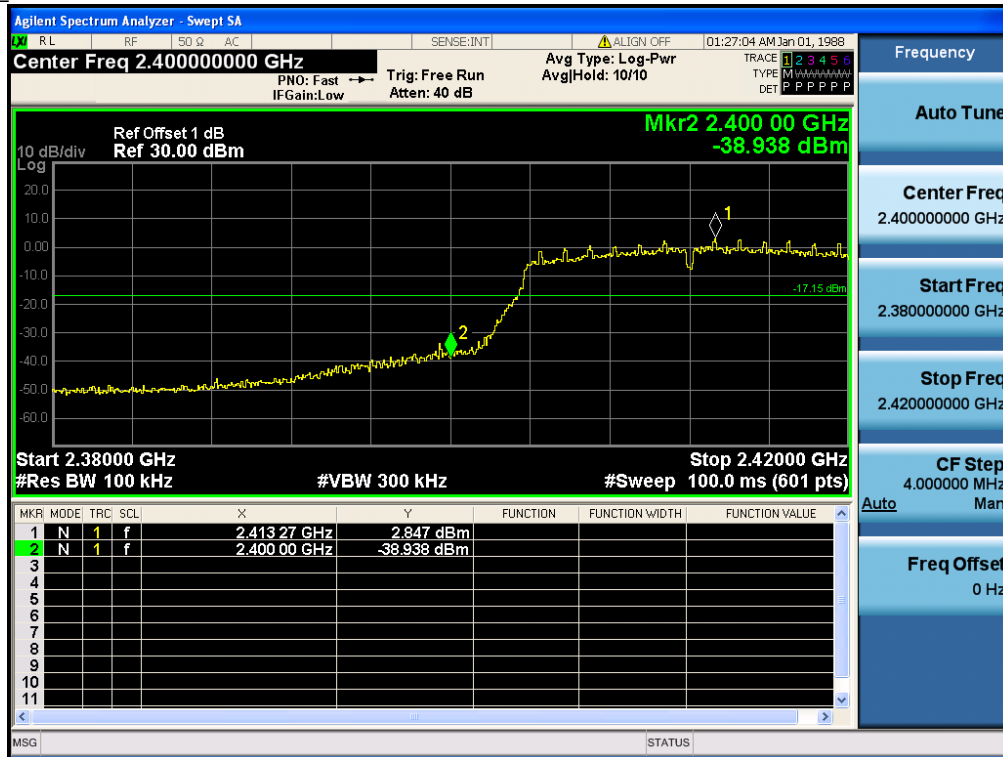
802.11B_Lowest Channel



802.11B_Highest Channel



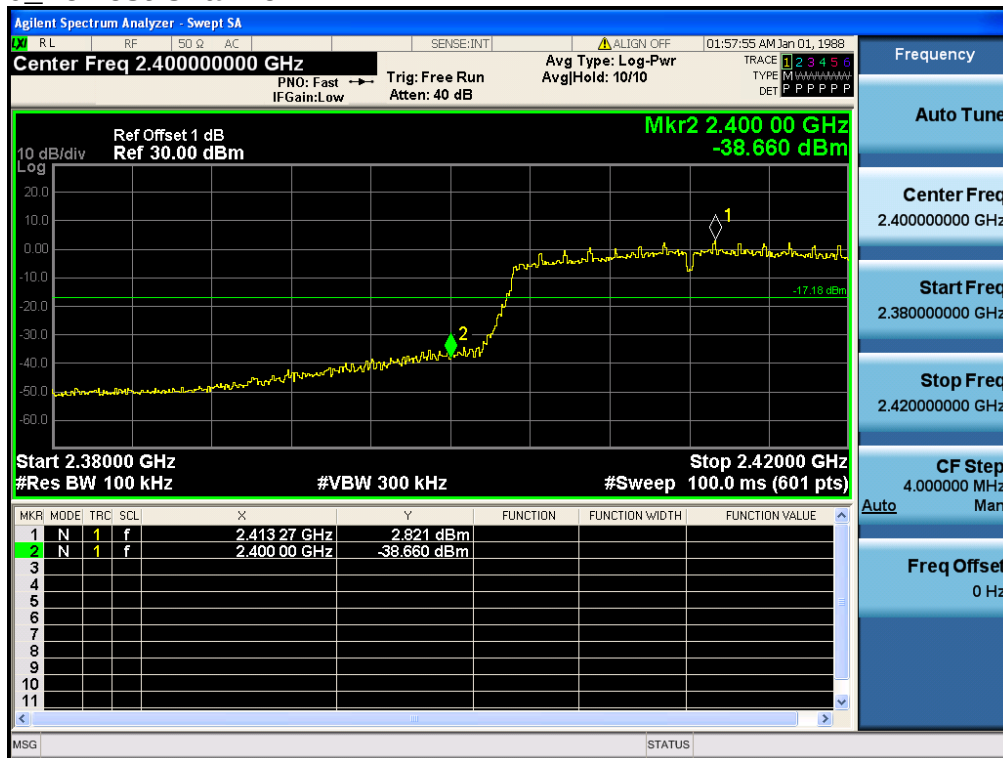
802.11G Lowest Channel



802.11G Highest Channel



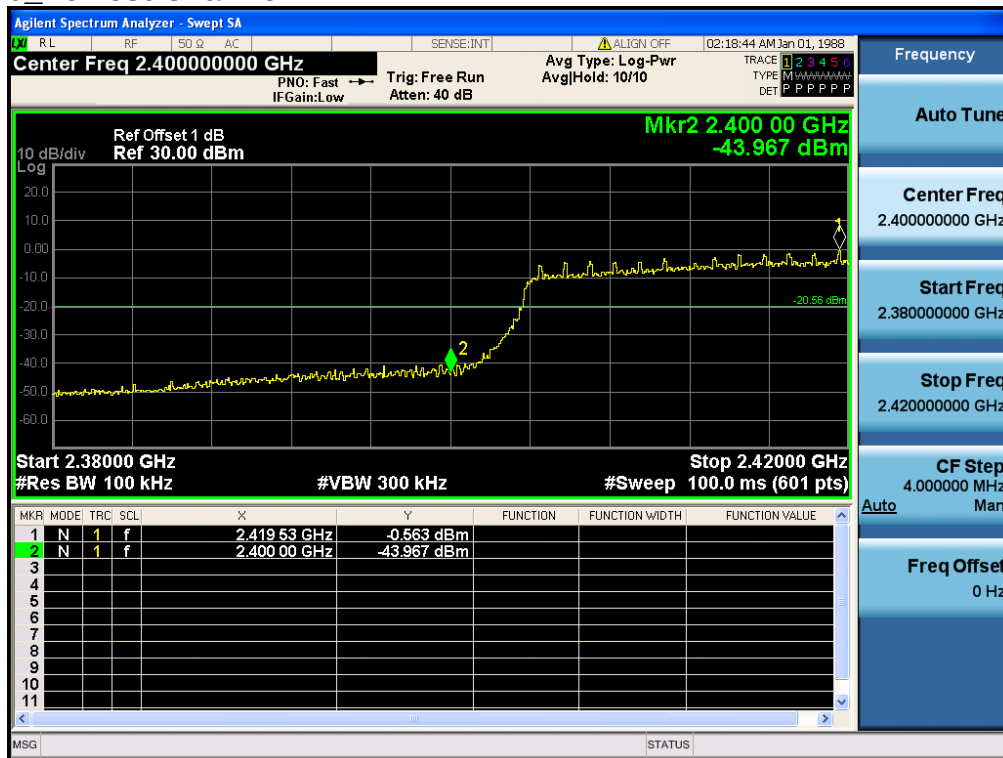
802.11N20 Lowest Channel



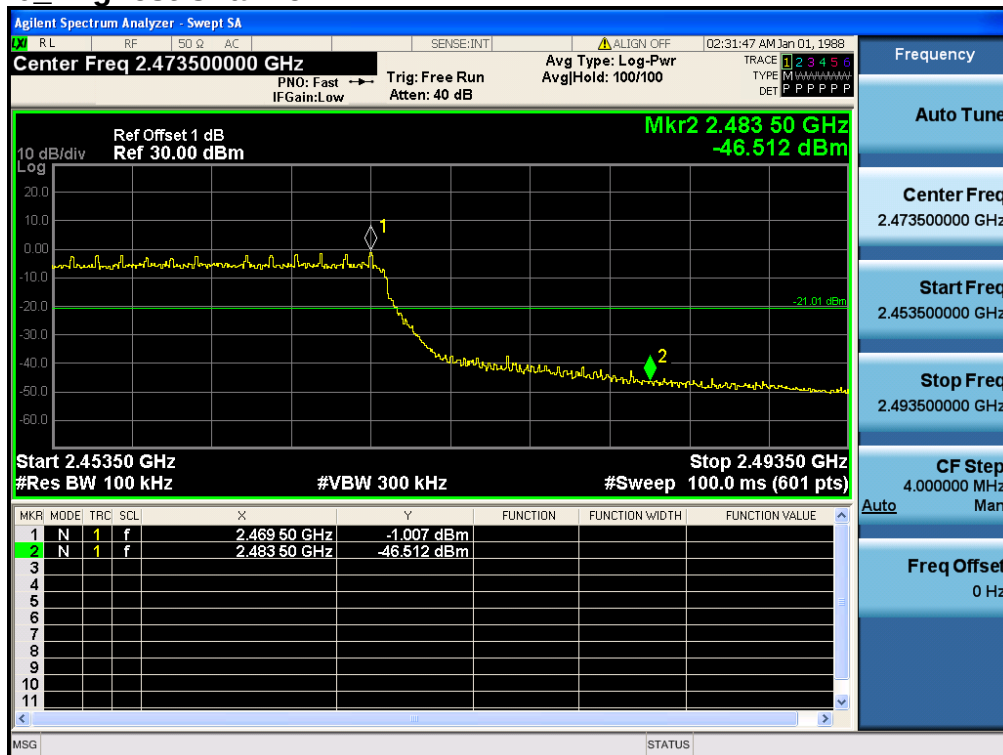
802.11 N20_Highest Channel



802.11N40 Lowest Channel



802.11 N40 Highest Channel



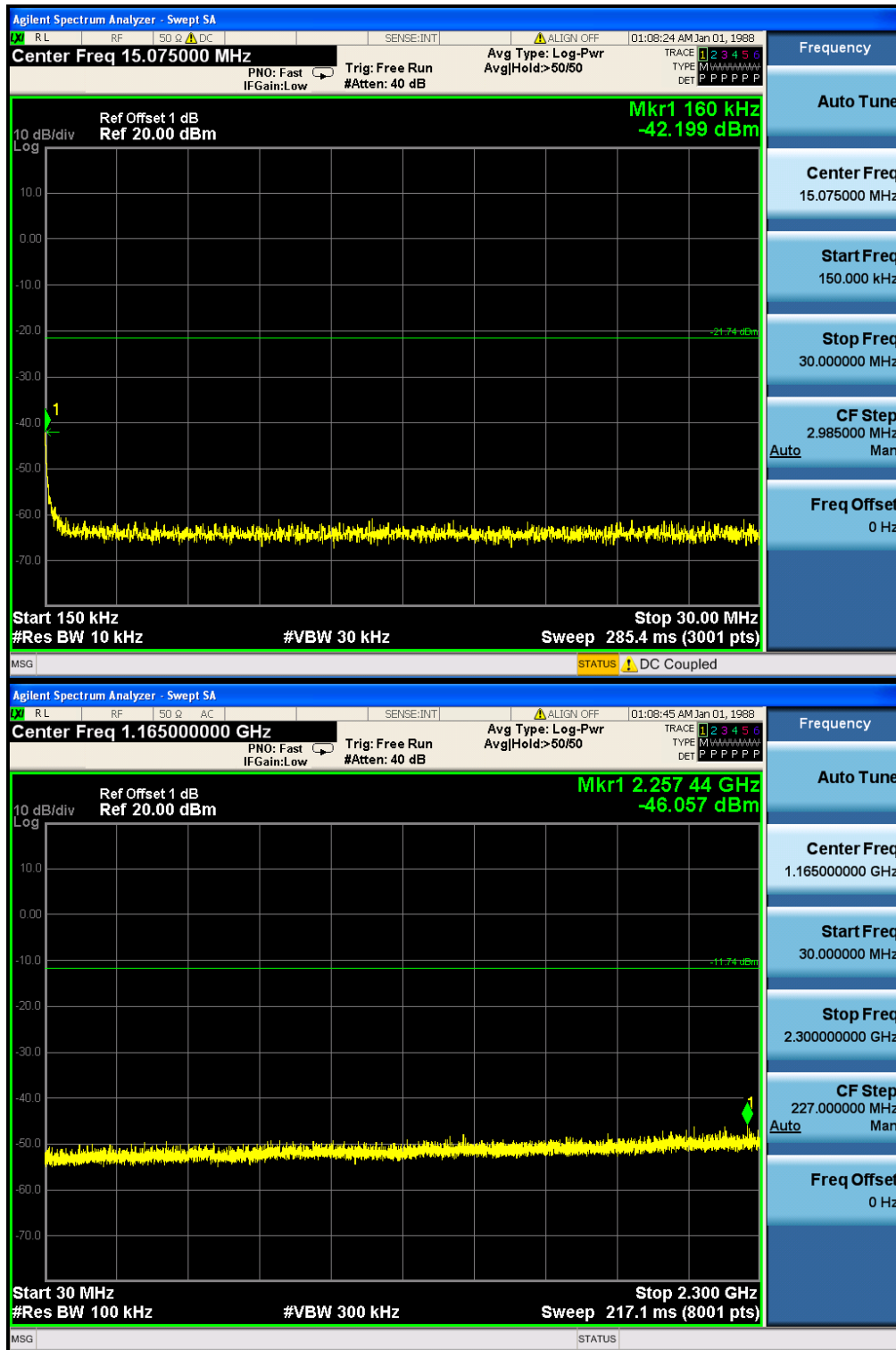
9 RF Conducted Spurious Emissions

9.1 Test plots

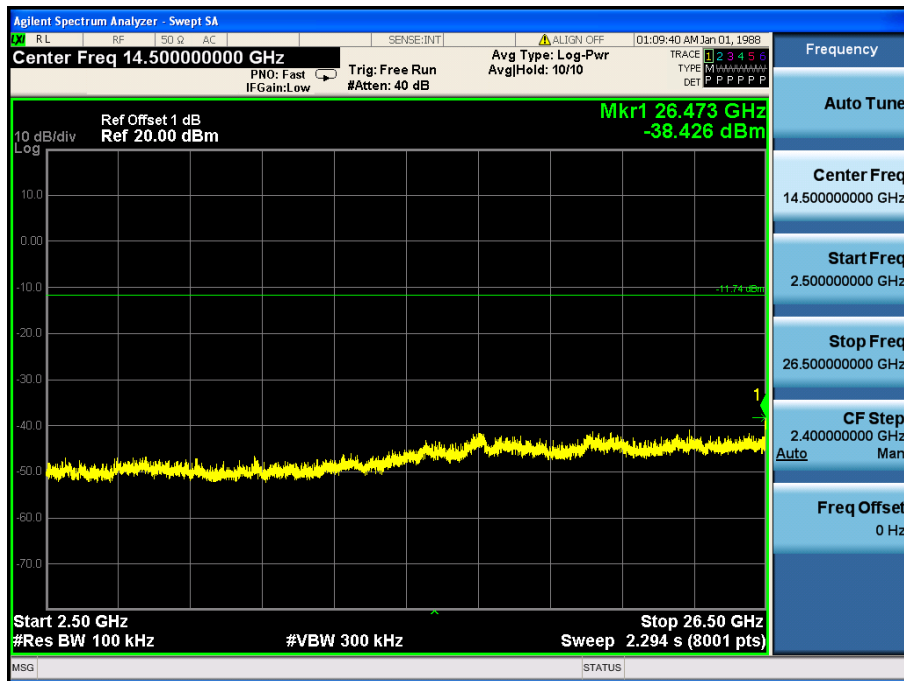
ANT1

802.11B_Lowest Channel

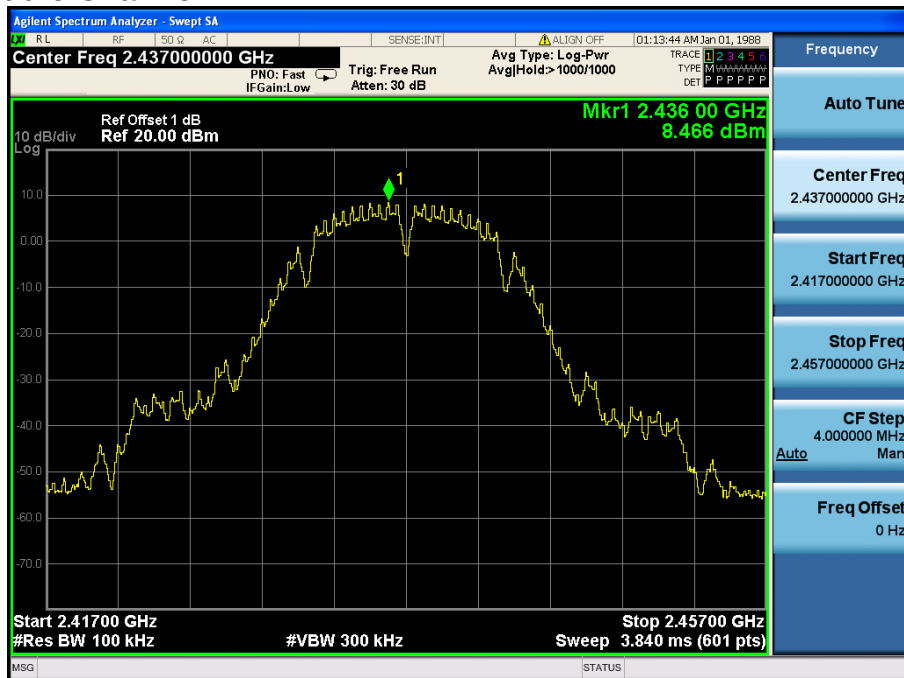


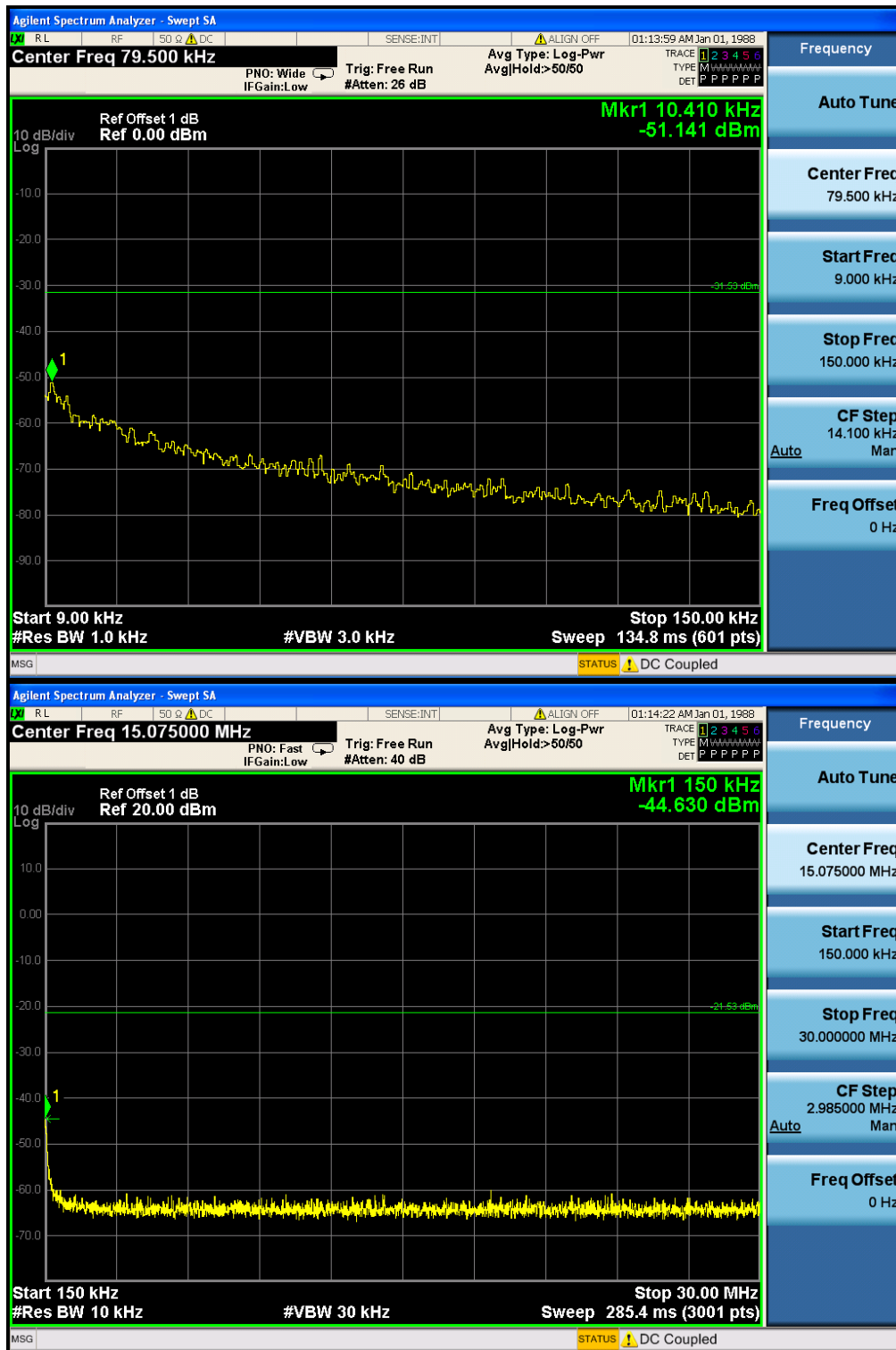






802.11B_ Middle Channel



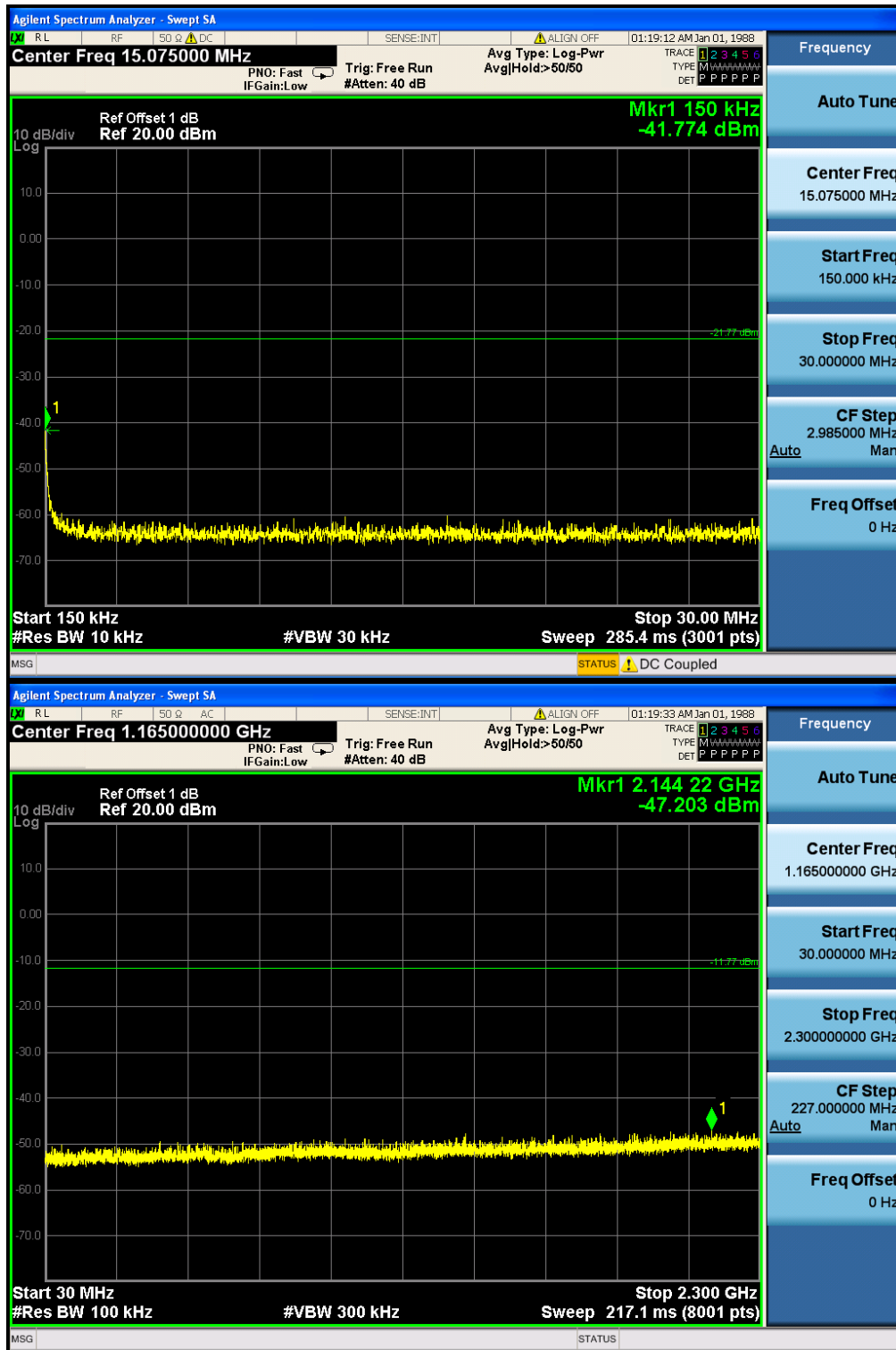




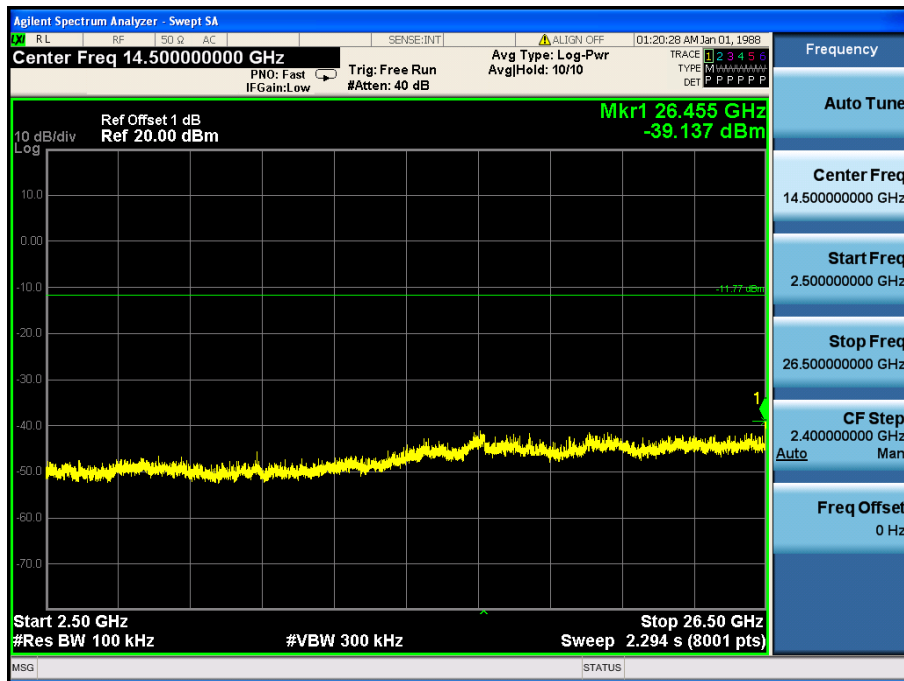


802.11B Highest Channel

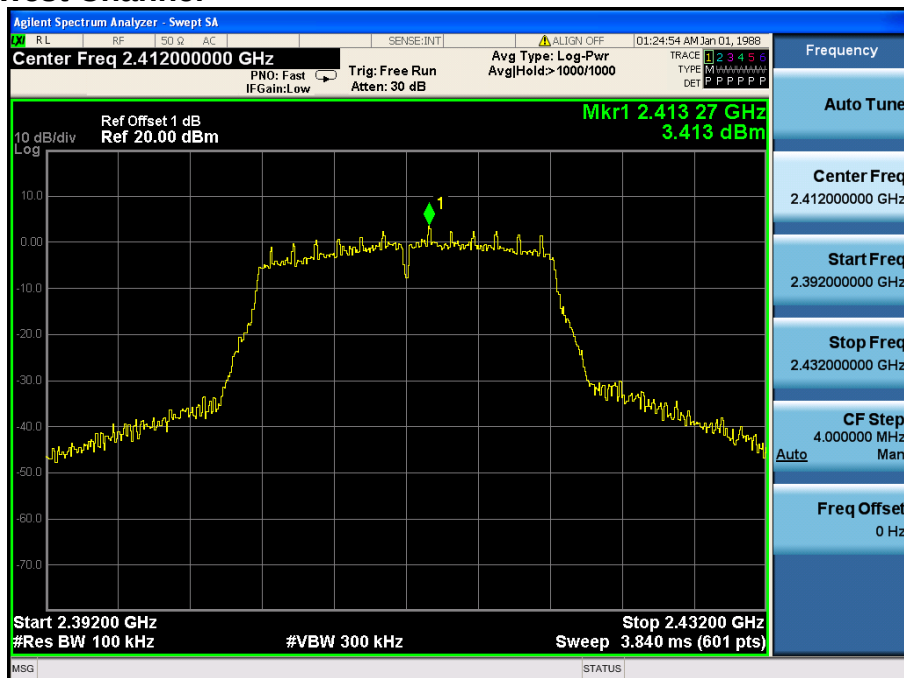






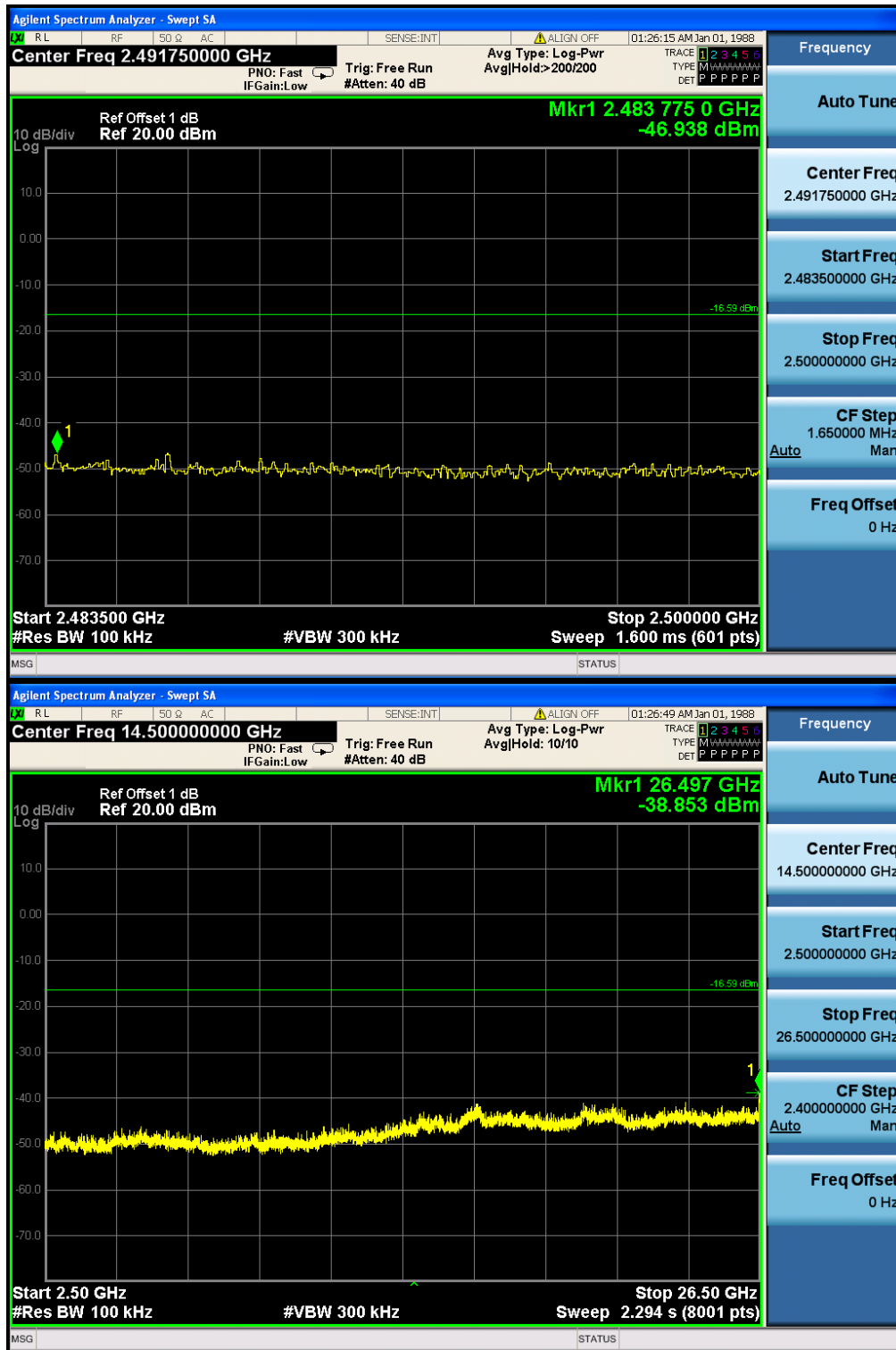


802.11G_Lowest Channel



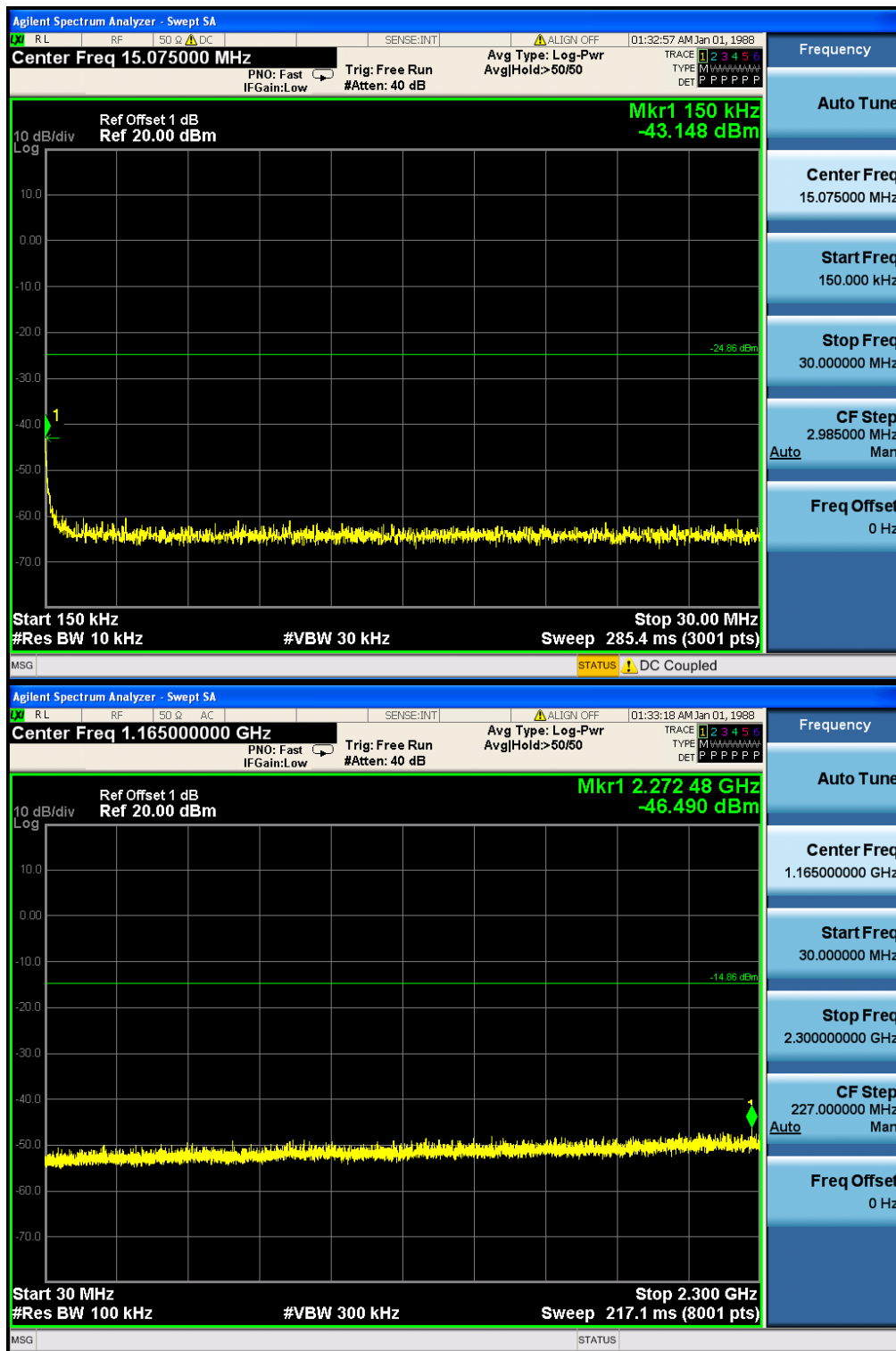




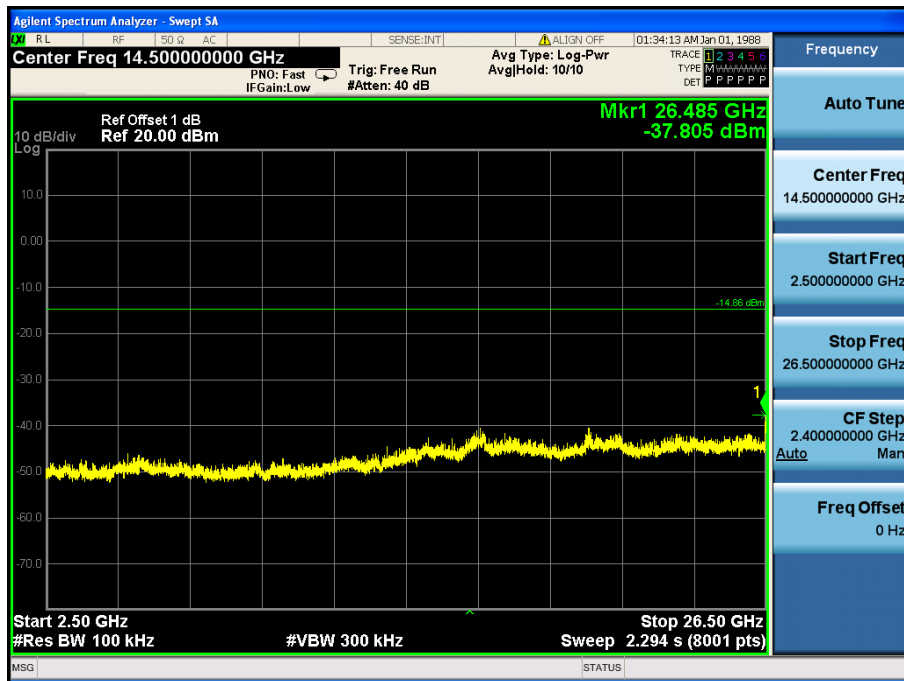


802.11G Middle Channel

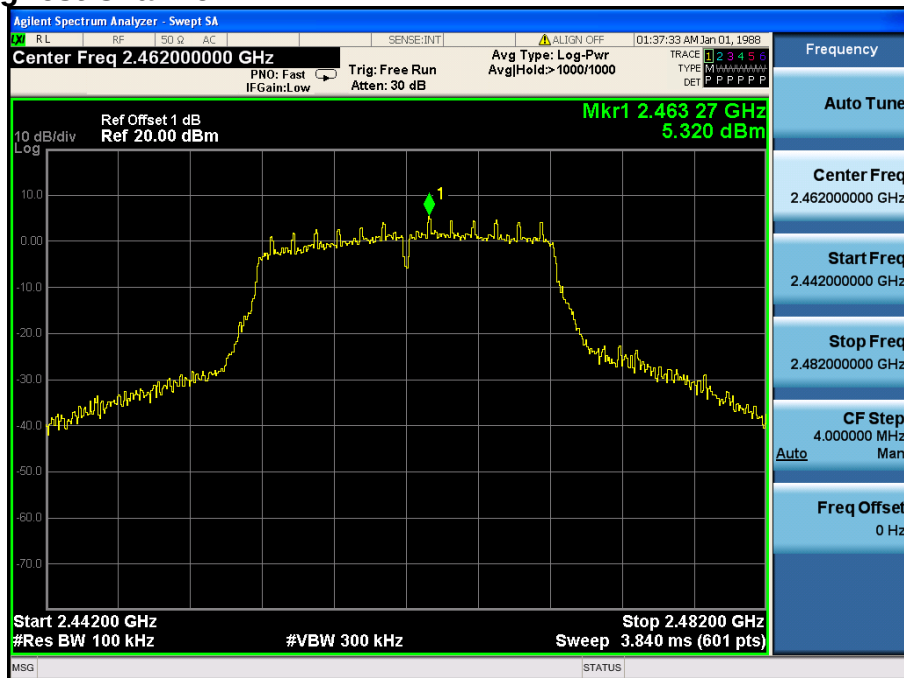




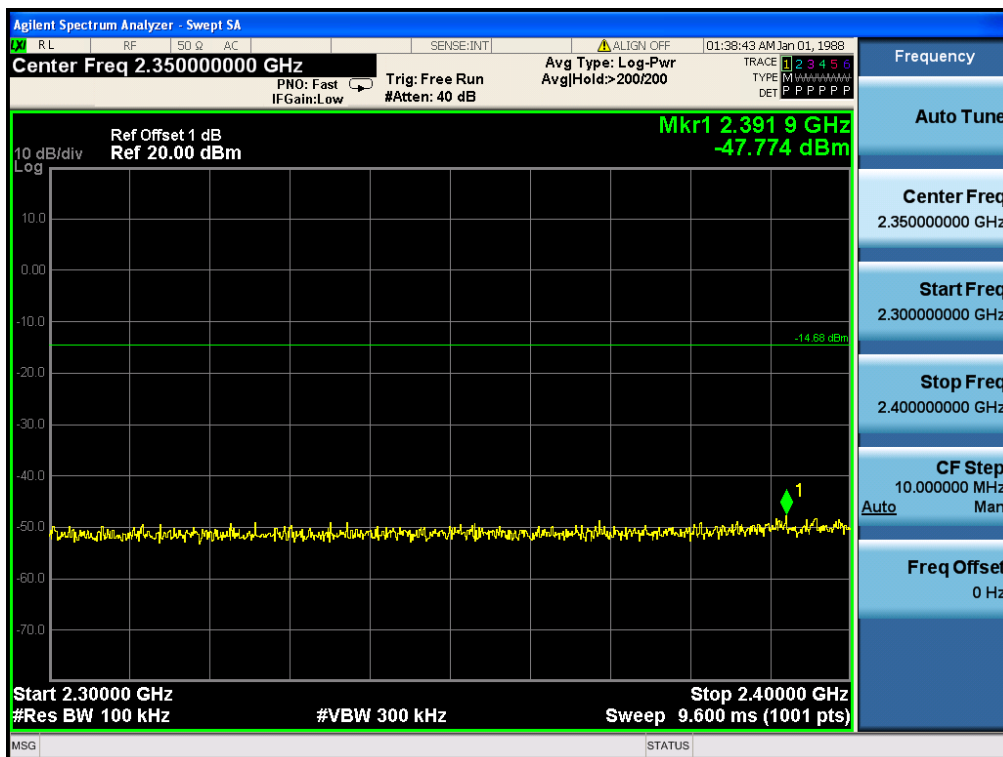
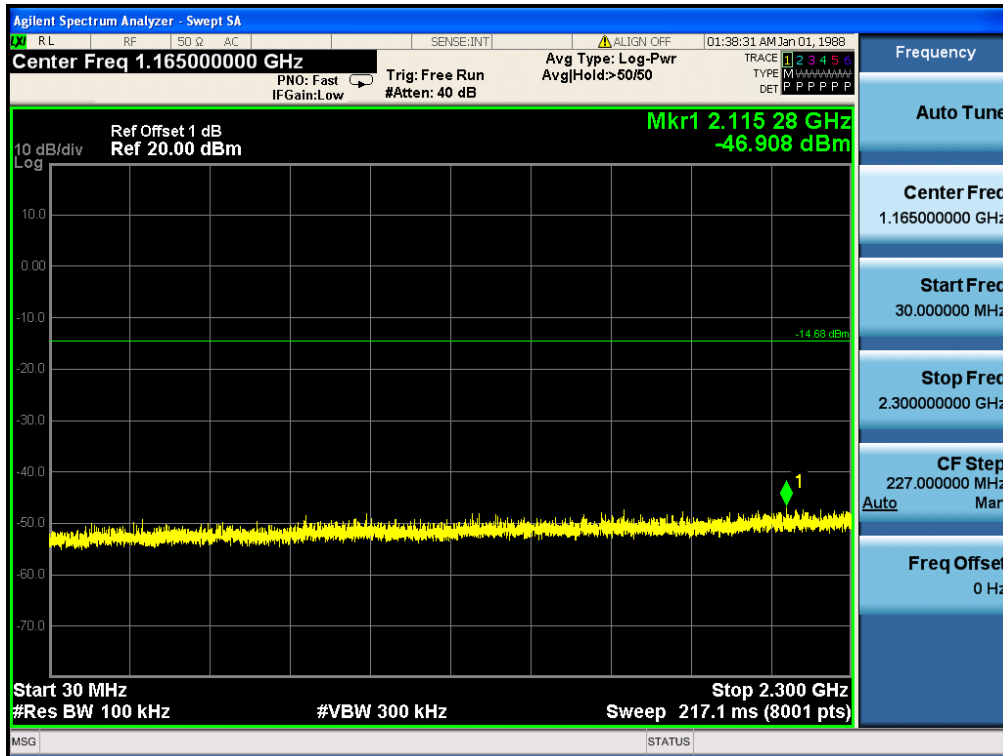




802.11G_ Highest Channel

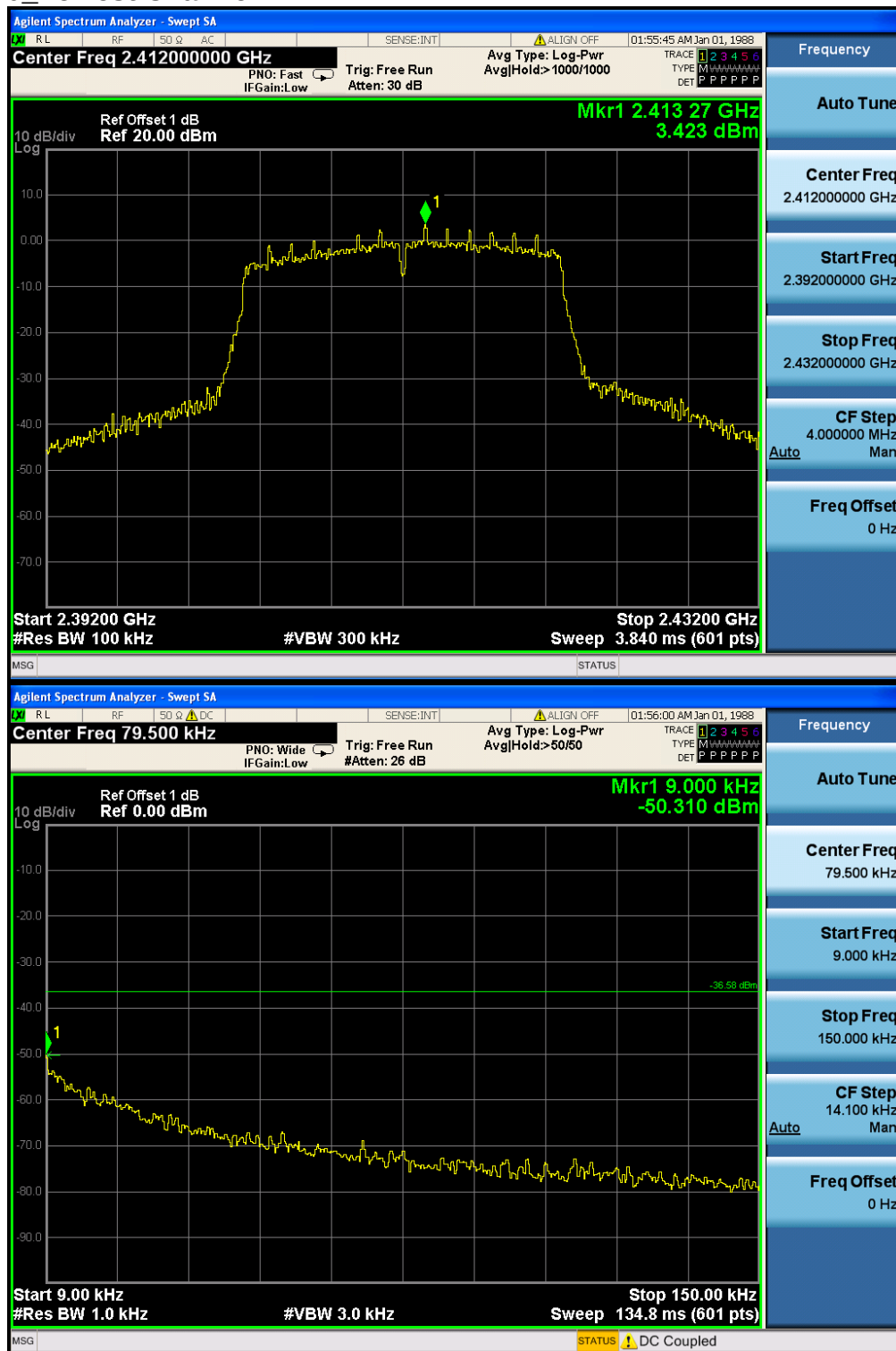


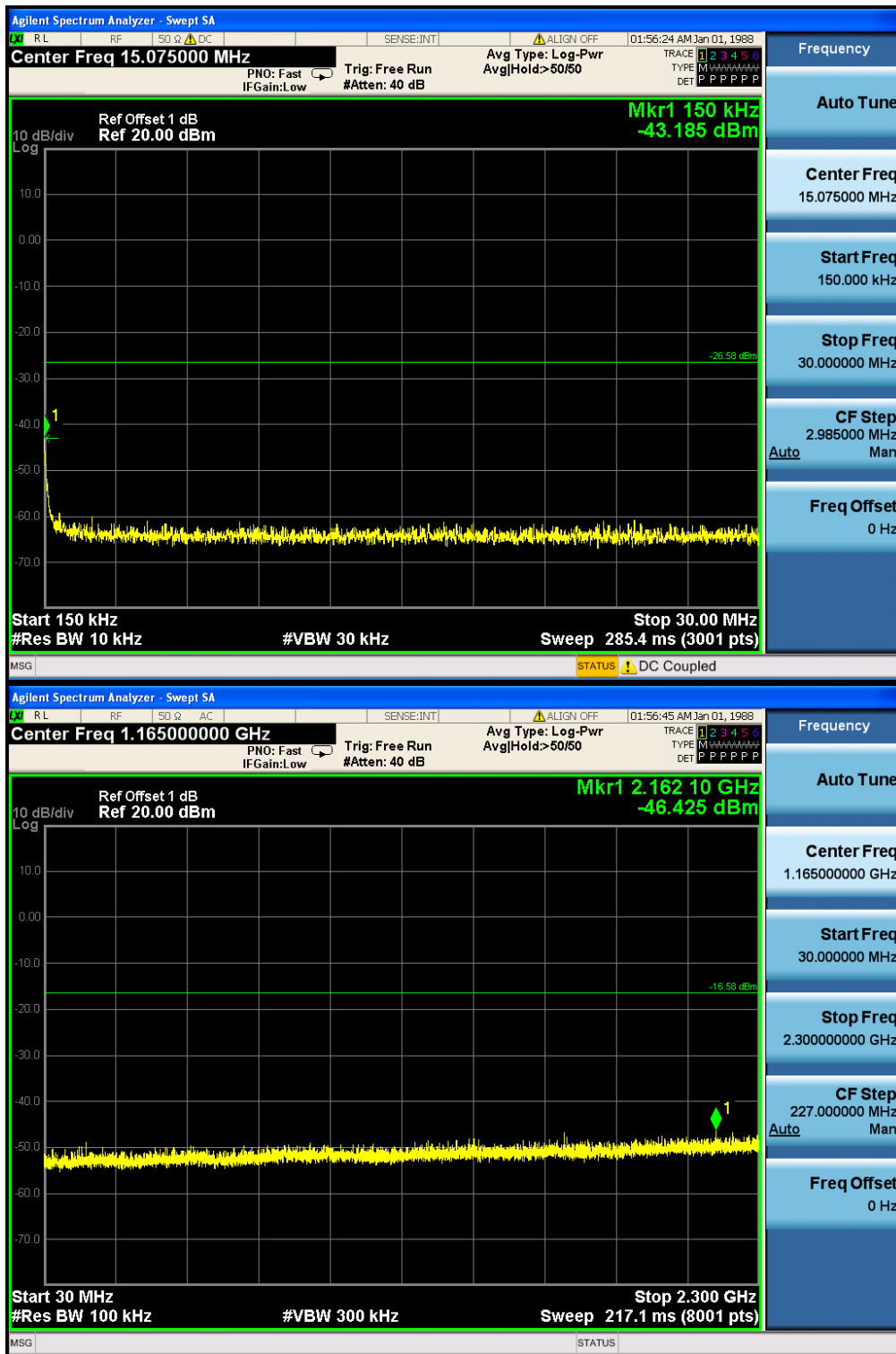




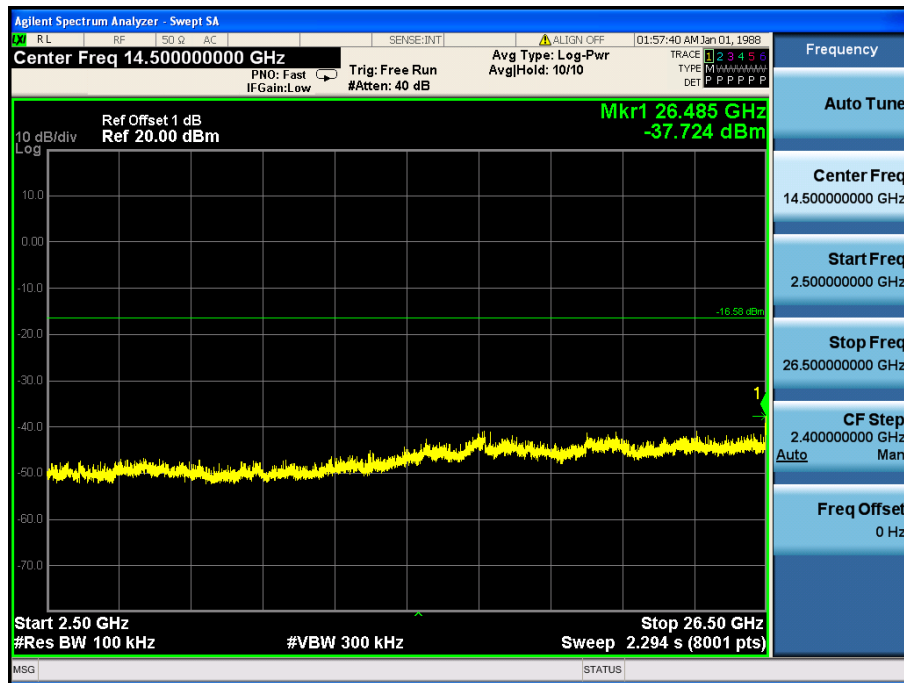


802.11N20_Lowest Channel





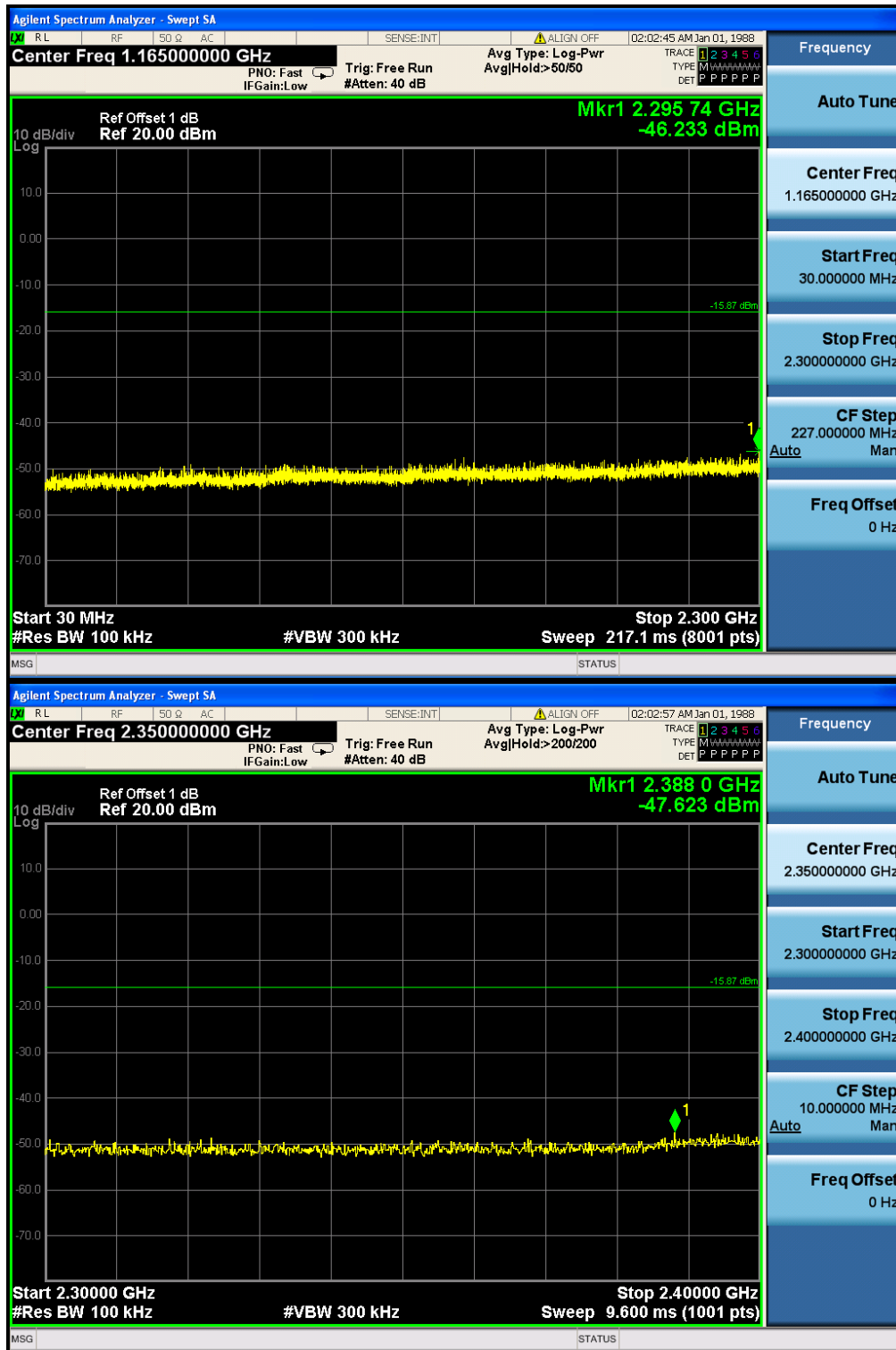


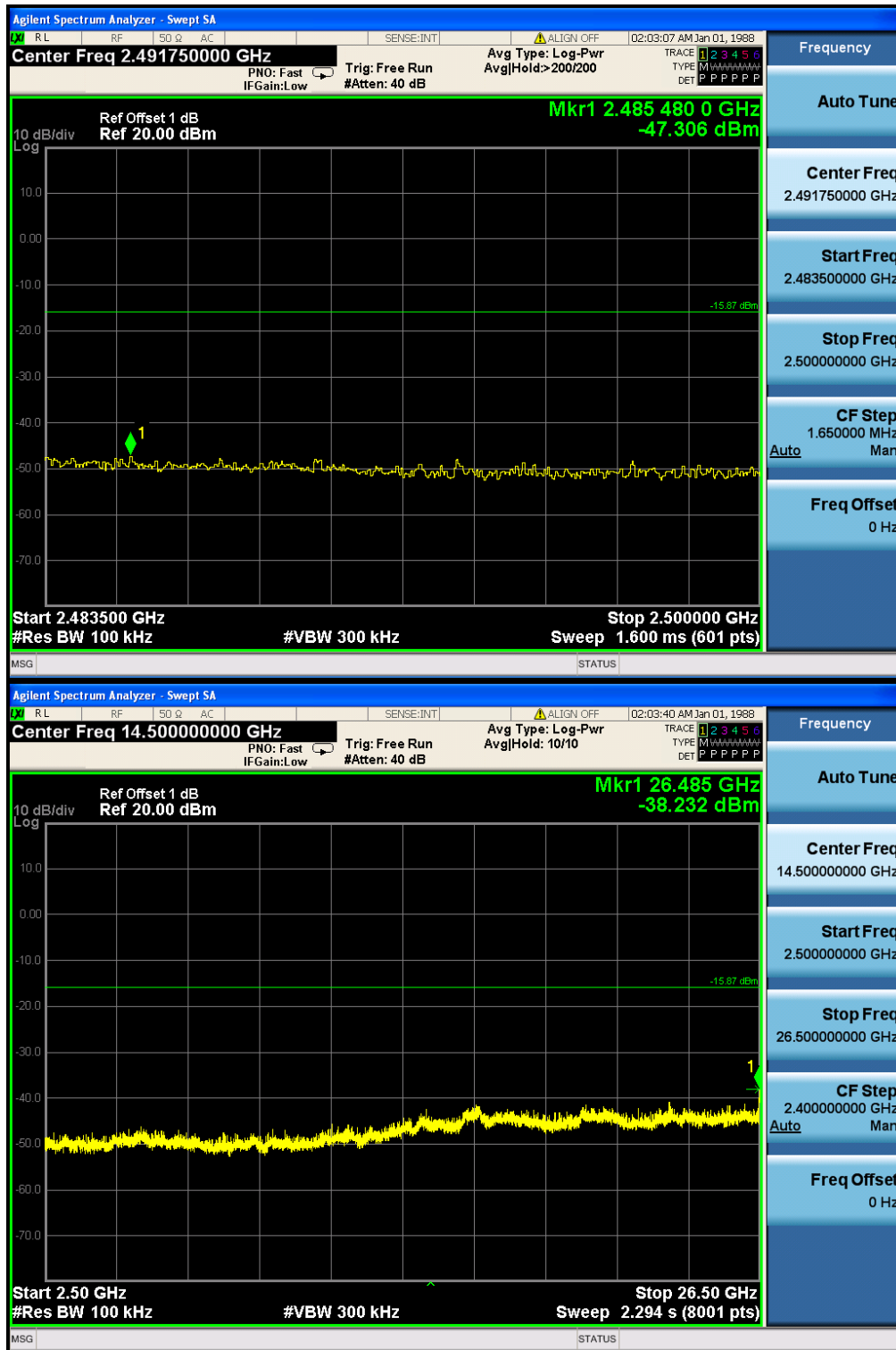


802.11 N20 Middle Channel



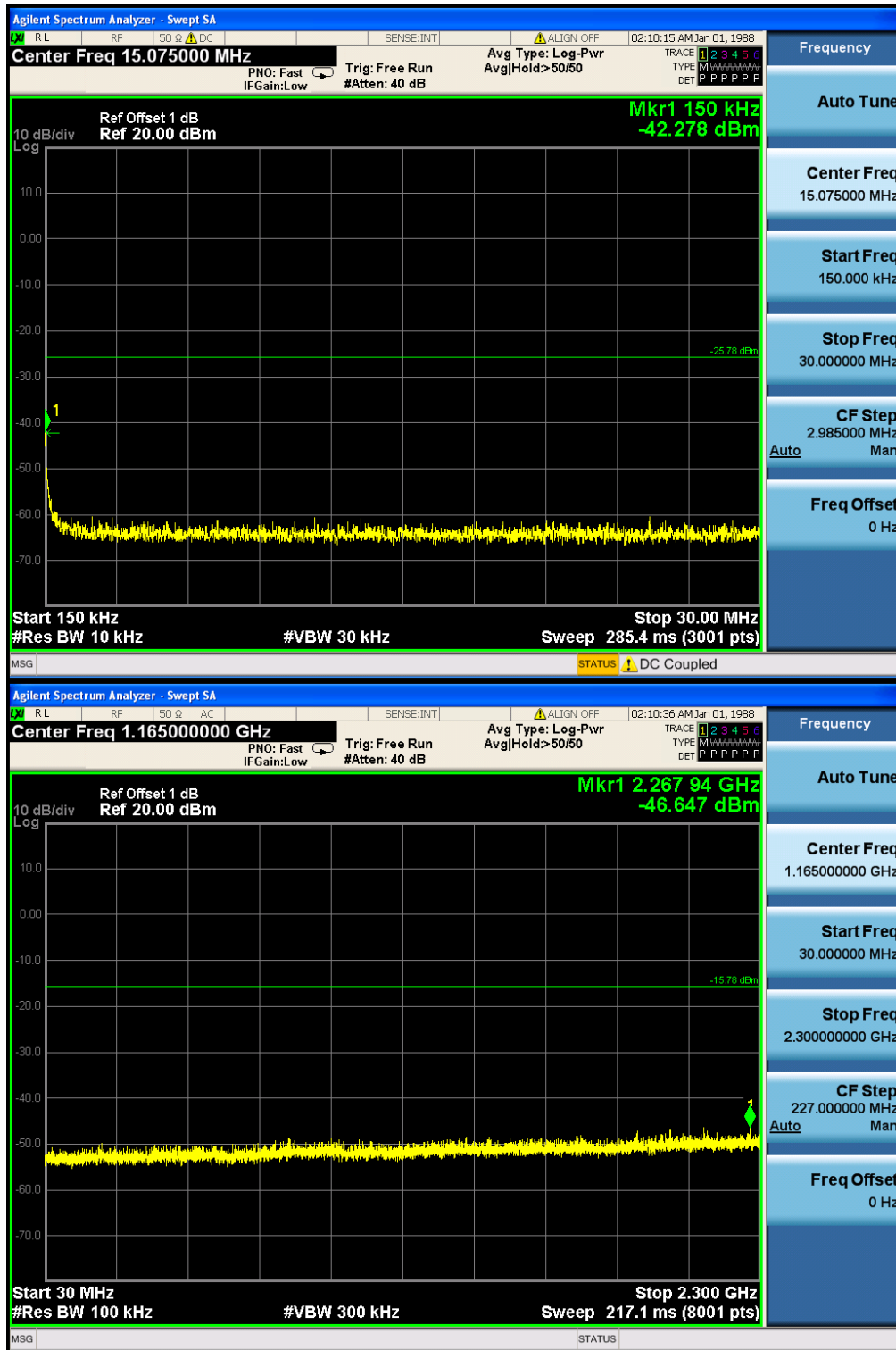




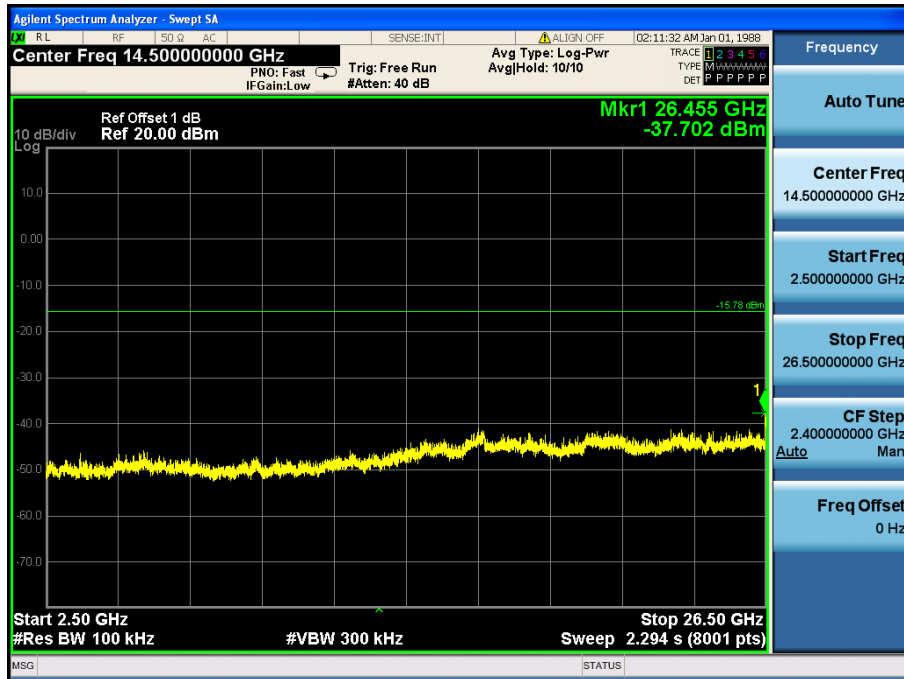


802.11 N20_Highest Channel

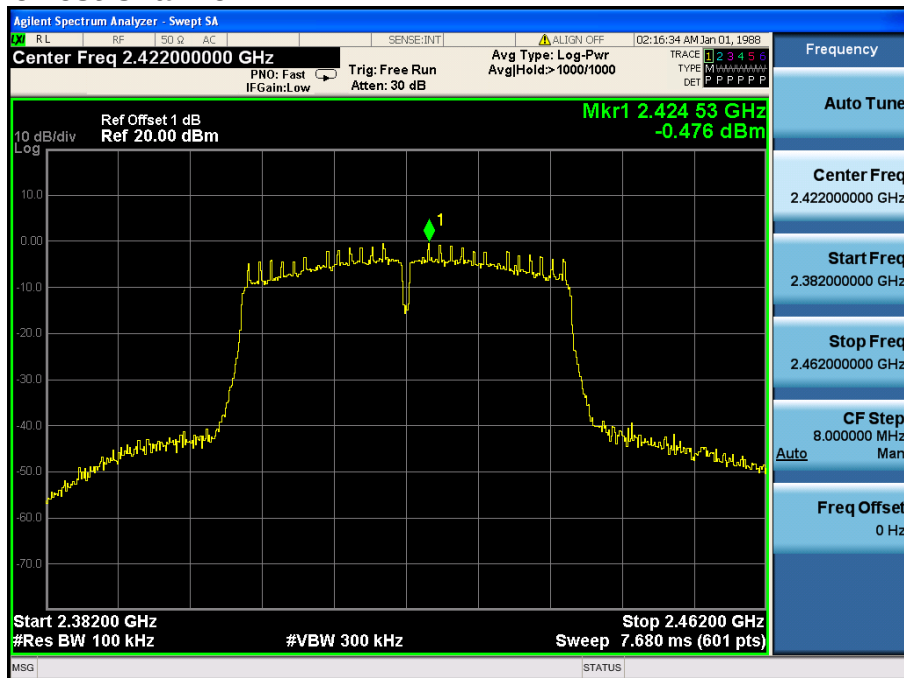


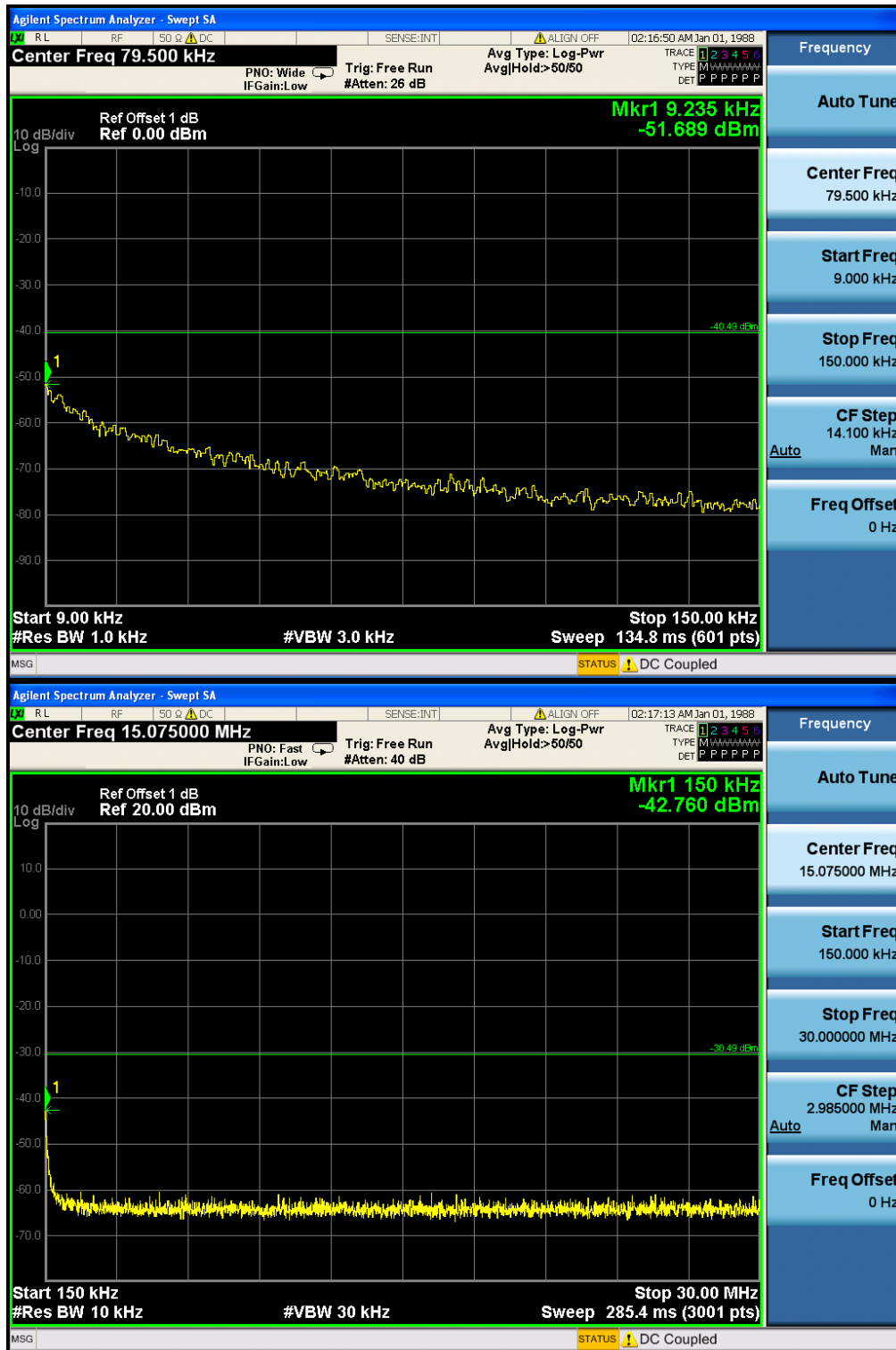


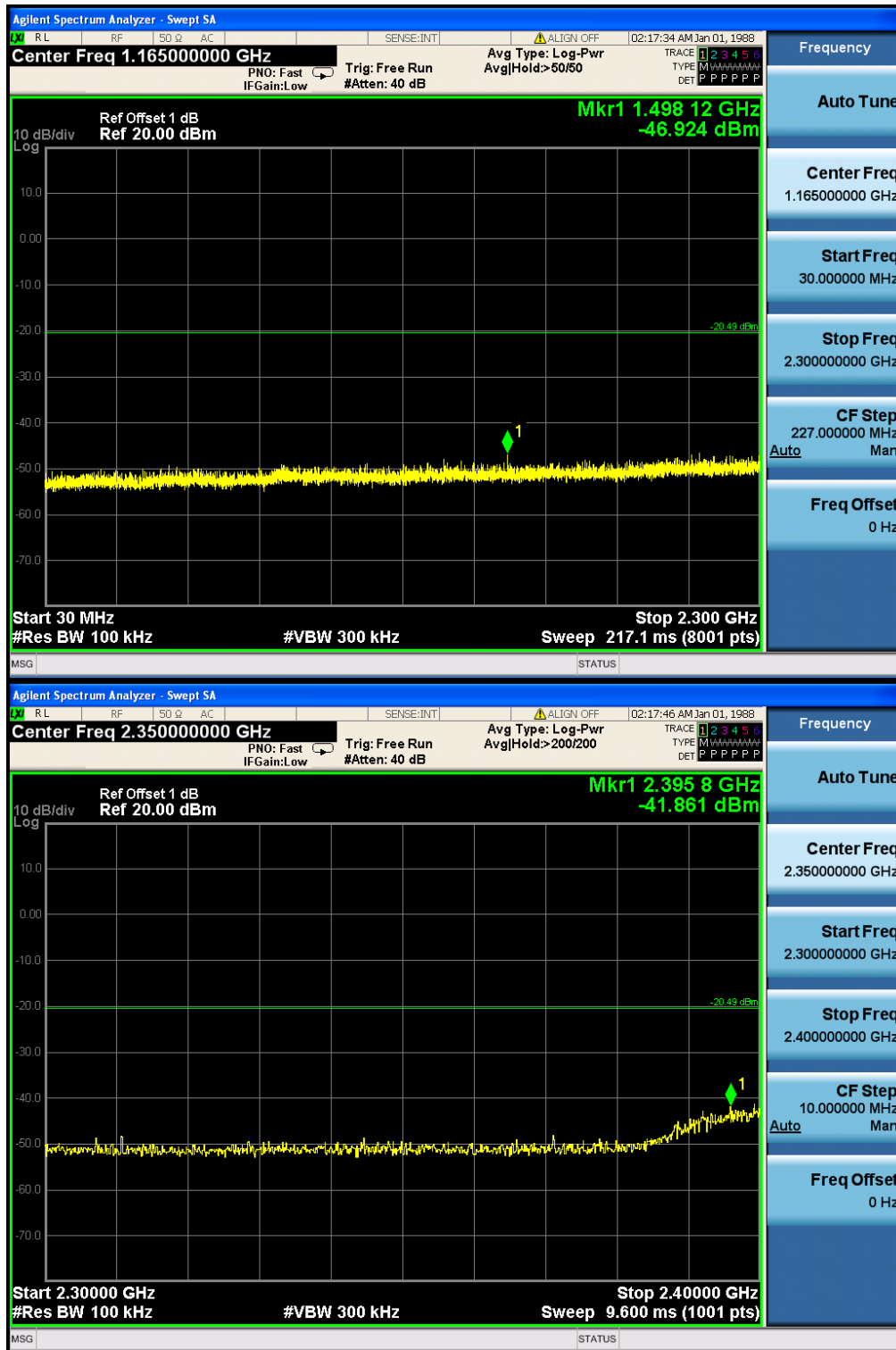




802.11N40_Lowest Channel



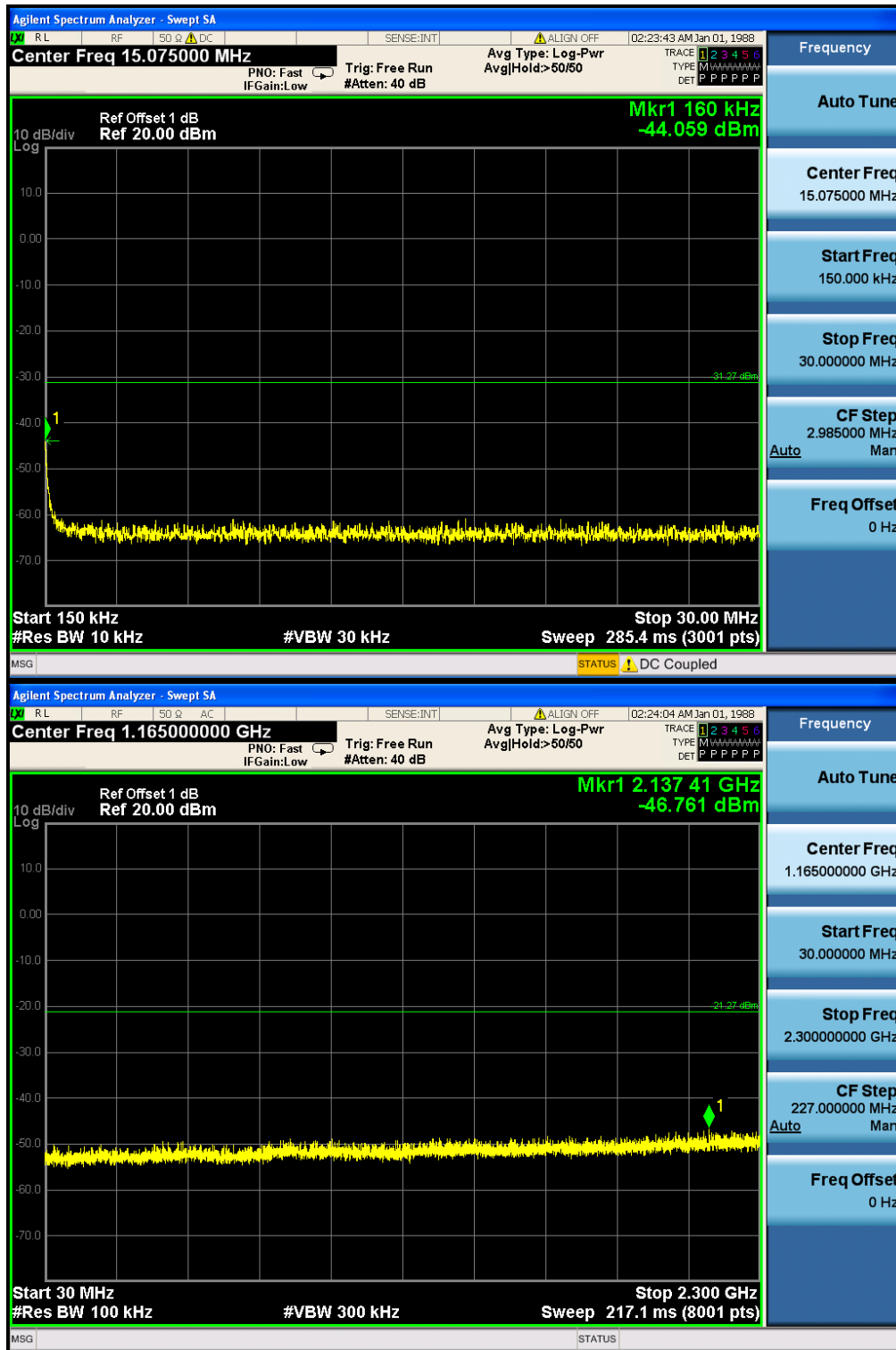






802.11 N40 Middle Channel

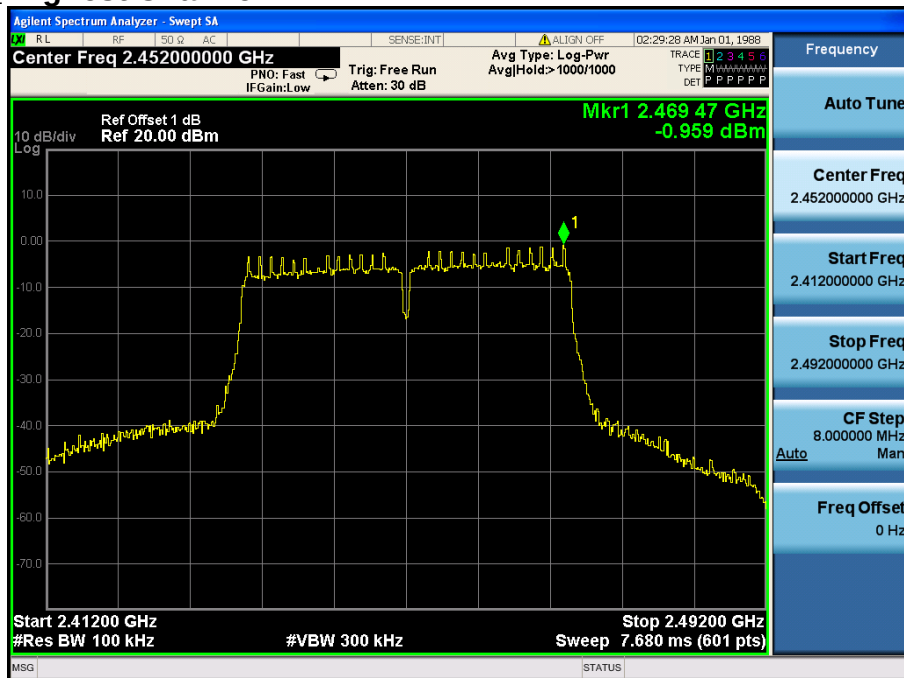




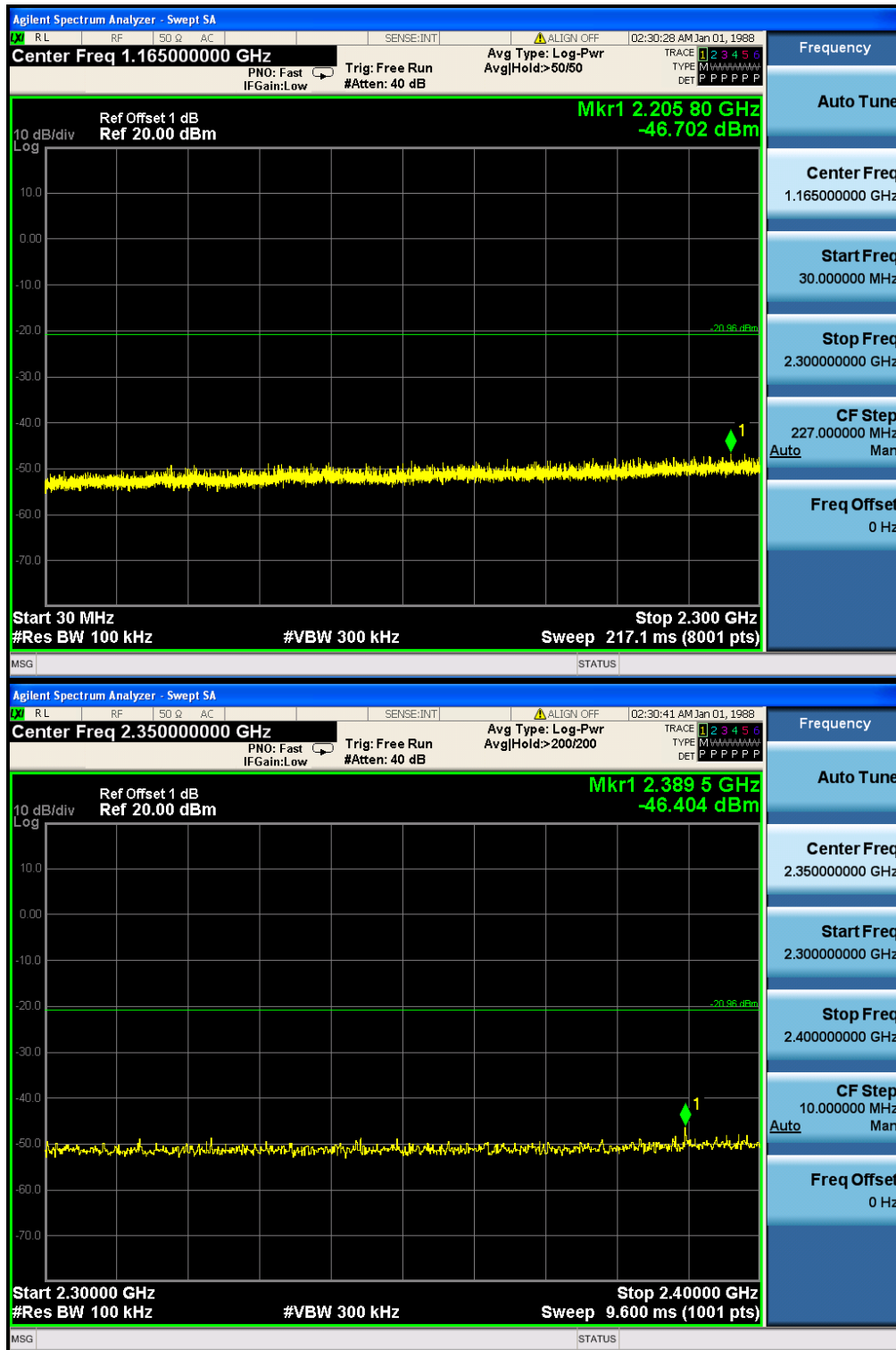




802.11 N40_Highest Channel









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.

The End