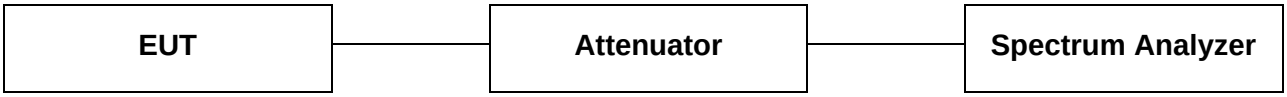
5. Peak power spectral density

5.1. Test setup



5.2. Limit

5.2.1. FCC 15.407

(a)(1)

For the band 5.15-5.25 ㎓ band, the peak power spectral density shall not exceed 4 ㏈m in any 1 ㎒ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

(a)(2)

For the band 5.25–5.35 ㎓ and 5.47–5.725 ㎓ bands, the peak power spectral density shall not exceed 11 ㏈m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

5.3. Test procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in clause d) Method SA-2 of section E of KDB 789033_v01r03.
2. Measure the duty cycle, x, of the transmitter output signal as described in section B).
3. Set span to encompass the 26 ㏈ EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
4. Set RBW = 1 ㎒
5. Set VBW ≥ 3 ㎒
6. Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
7. Sweep time = auto.
8. Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
9. Do not use sweep triggering. Allow the sweep to “free run”.
10. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
11. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
12. The result is the PPSD.

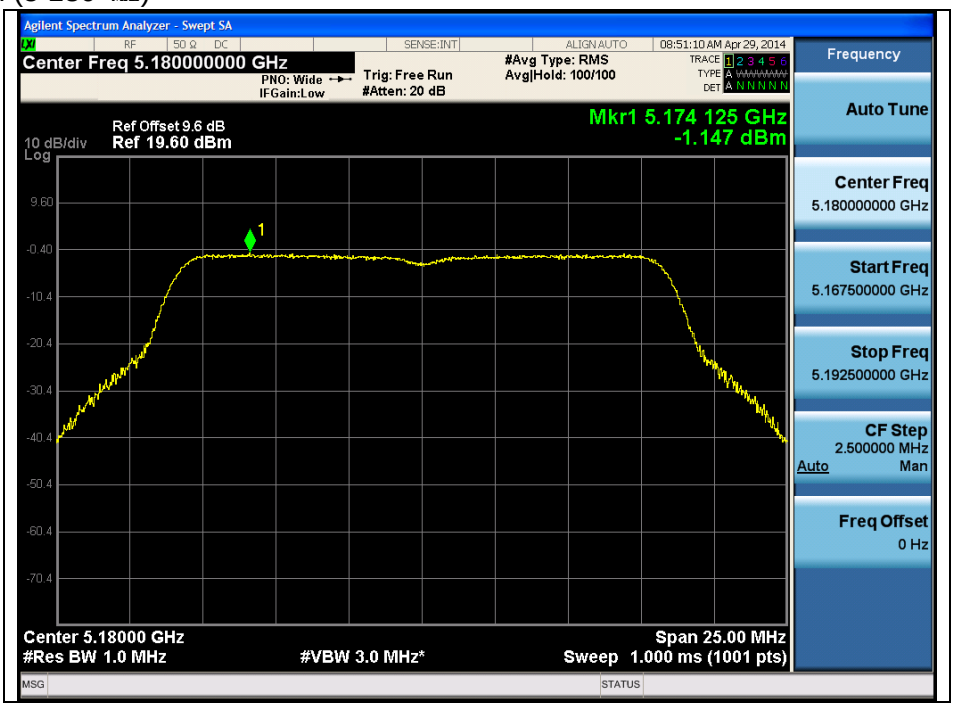
5.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

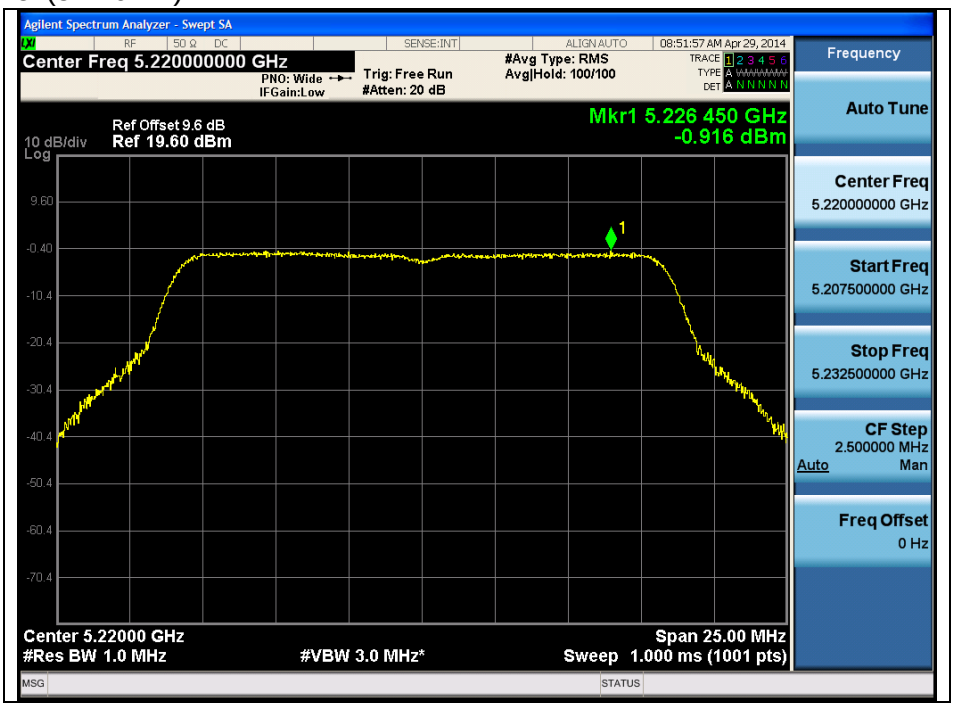
Band	Mode	Frequency (㎒)	Ch.	Data Rate	Measured PPSD (㏈ m)	Duty Factor (㏈)	Final PPSD (㏈ m)	Limit (㏈ m/㒒)
U-NII 1	11a	5 180	36	6	-1.15	0.22	-0.93	4
		5 220	44	6	-0.92	0.22	-0.70	4
		5 240	48	6	-0.77	0.22	-0.55	4
	11an_HT20	5 180	36	MCS0	-2.29	0.27	-2.02	4
		5 220	44	MCS0	-2.04	0.27	-1.77	4
		5 240	48	MCS0	-2.20	0.27	-1.93	4
	11an_HT40	5 190	38	MCS0	-5.11	0.51	-4.60	4
		5 230	46	MCS0	-5.12	0.51	-4.61	4
	11ac_VHT20	5 180	36	MCS0	-2.44	0.46	-1.98	4
		5 220	44	MCS0	-2.34	0.46	-1.88	4
		5 240	48	MCS0	-2.35	0.46	-1.89	4
	11ac_VHT40	5 190	38	MCS0	-5.42	0.86	-4.56	4
		5 230	46	MCS0	-5.34	0.86	-4.48	4
	11ac_VHT80	5 210	42	MCS0	-8.92	1.49	-7.43	4
U-NII 2A	11a	5 260	52	6	-0.78	0.22	-0.56	11
		5 300	60	6	-1.11	0.22	-0.89	11
		5 320	64	6	-1.10	0.22	-0.88	11
	11an_HT20	5 260	52	MCS0	-2.11	0.27	-1.84	11
		5 300	60	MCS0	-2.33	0.27	-2.06	11
		5 320	64	MCS0	-2.26	0.27	-1.99	11
	11an_HT40	5 270	54	MCS0	-5.50	0.51	-4.99	11
		5 310	62	MCS0	-5.64	0.51	-5.13	11
	11ac_VHT20	5 260	52	MCS0	-2.23	0.46	-1.77	11
		5 300	60	MCS0	-2.17	0.46	-1.71	11
		5 320	64	MCS0	-2.41	0.46	-1.95	11
	11ac_VHT40	5 270	54	MCS0	-5.78	0.86	-4.92	11
		5 310	62	MCS0	-6.15	0.86	-5.29	11
	11ac_VHT80	5 290	58	MCS0	-9.09	1.49	-7.60	11
U-NII 2C	11a	5 500	100	6	-1.52	0.22	-1.30	11
		5 580	116	6	-1.40	0.22	-1.18	11
		5 700	140	6	-1.01	0.22	-0.79	11
	11an_HT20	5 500	100	MCS0	-2.52	0.27	-2.25	11
		5 580	116	MCS0	-2.68	0.27	-2.41	11
		5 700	140	MCS0	-2.69	0.27	-2.42	11
	11an_HT40	5 510	102	MCS0	-6.06	0.51	-5.55	11
		5 550	110	MCS0	-5.69	0.51	-5.18	11
		5 670	134	MCS0	-5.34	0.51	-4.83	11
	11ac_VHT20	5 500	100	MCS0	-2.59	0.46	-2.13	11
		5 580	116	MCS0	-2.62	0.46	-2.16	11
		5 700	140	MCS0	-2.77	0.46	-2.31	11
	11ac_VHT40	5 510	102	MCS0	-6.12	0.86	-5.26	11
		5 550	110	MCS0	-5.94	0.86	-5.08	11
		5 670	134	MCS0	-5.74	0.86	-4.88	11
	11ac_VHT80	5 530	106	MCS0	-9.25	1.49	-7.76	11

802.11a (Band 1)

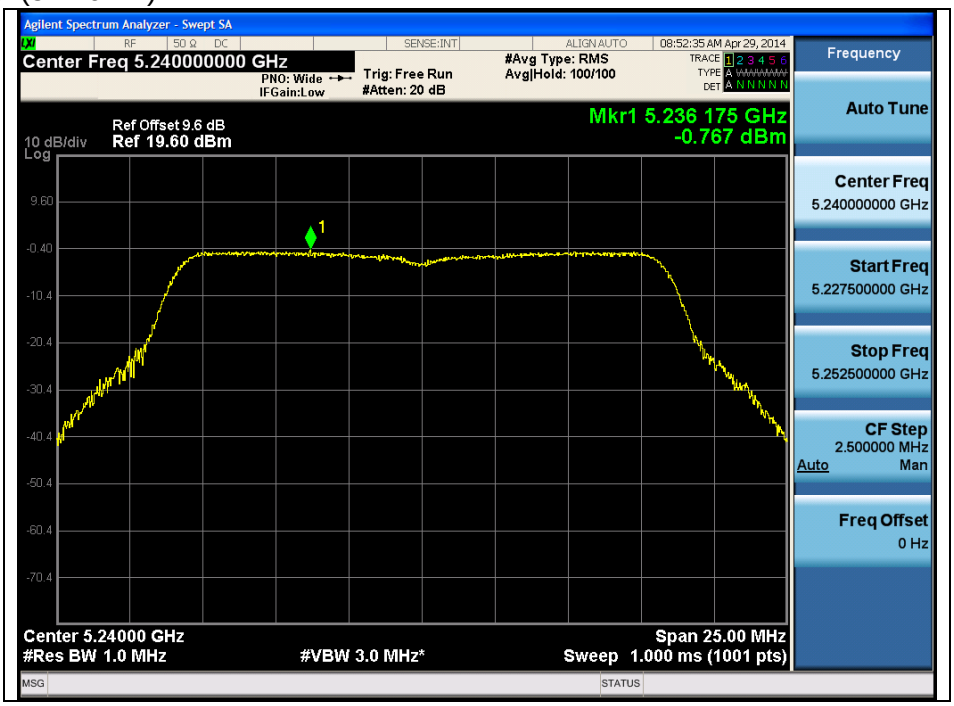
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

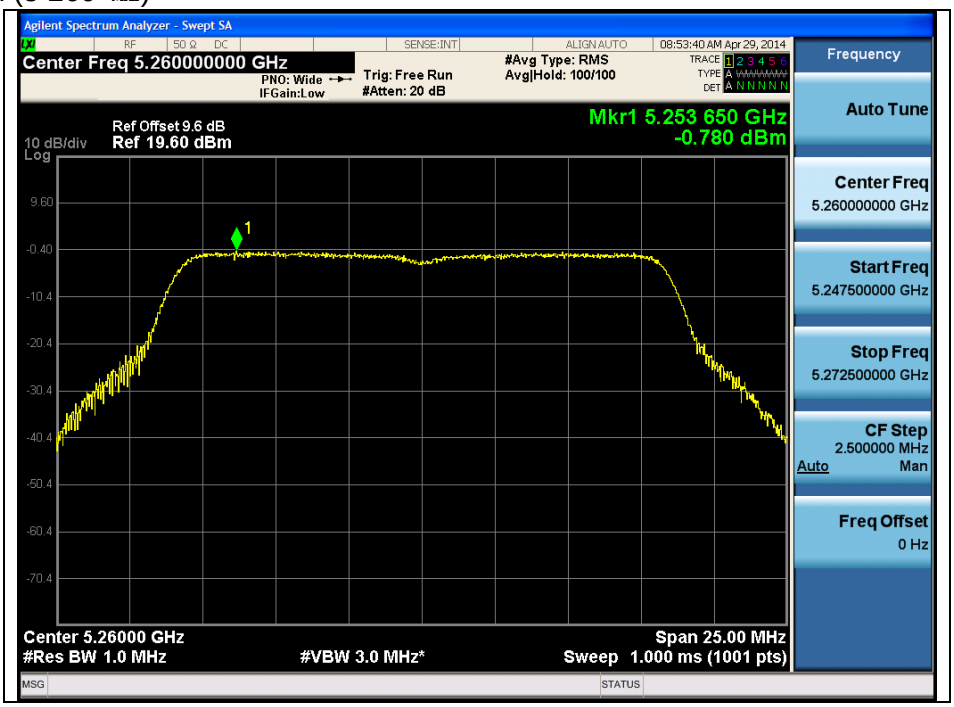


High Channel (5 240 ㎒)

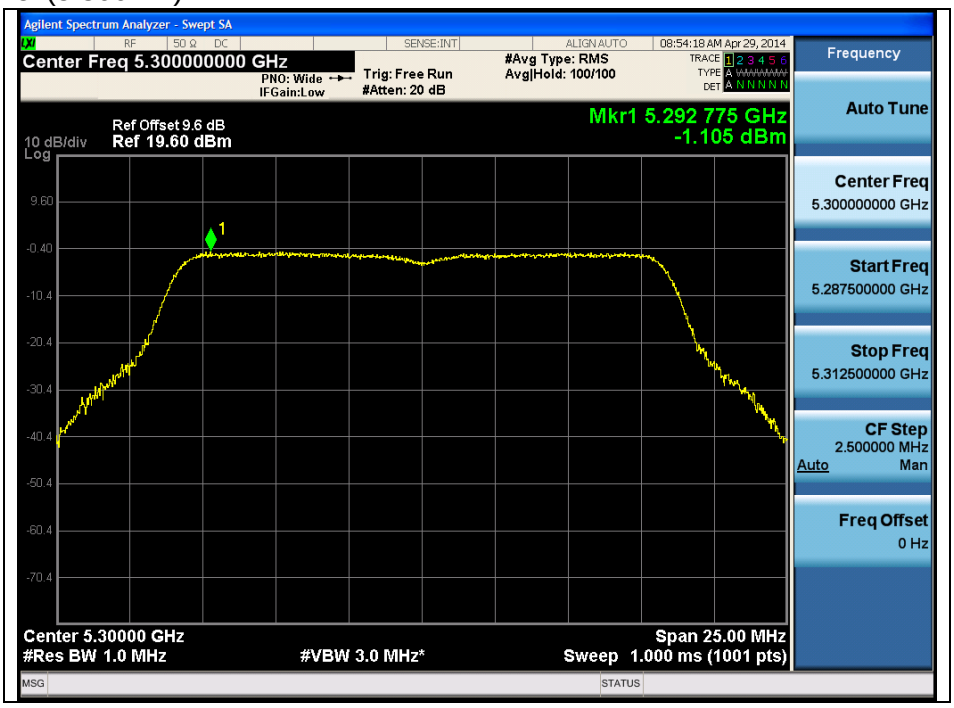


802.11a (Band 2A)

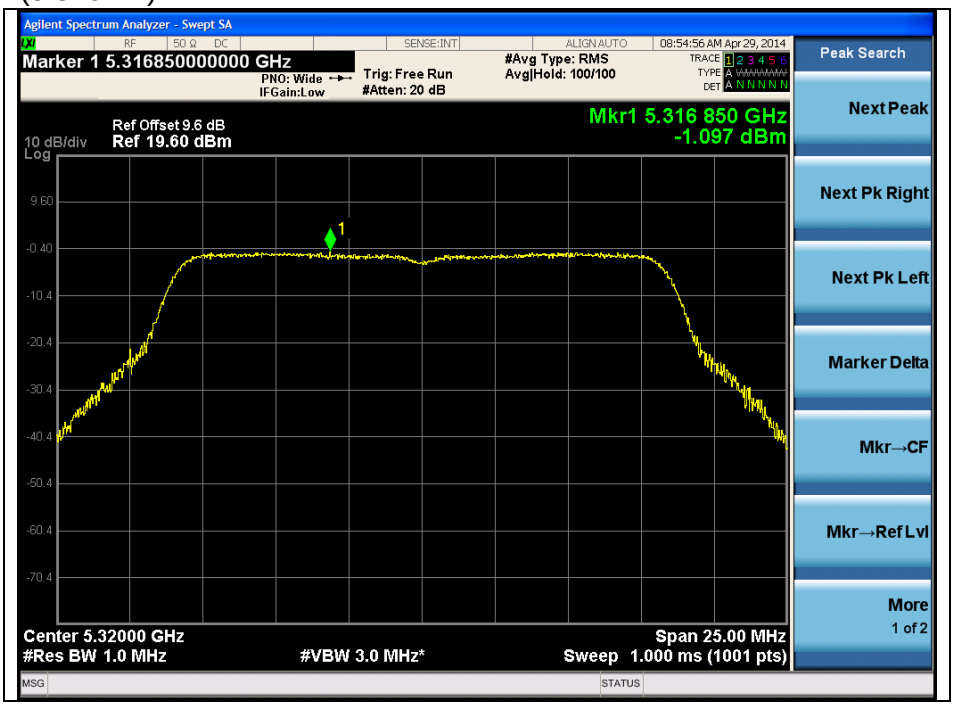
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

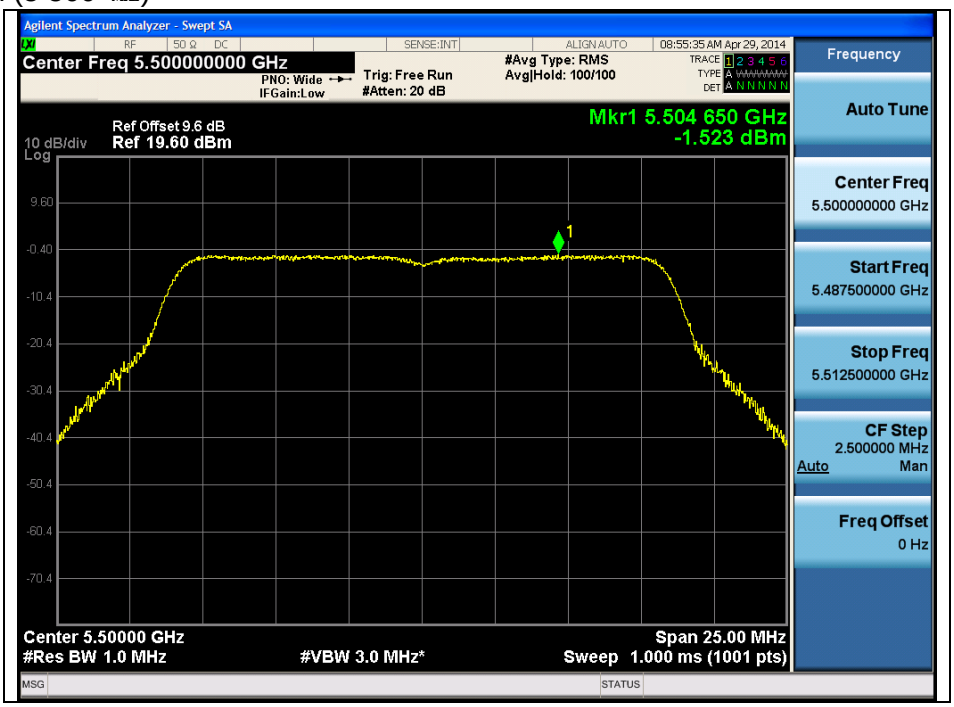


High Channel (5 320 ㎒)

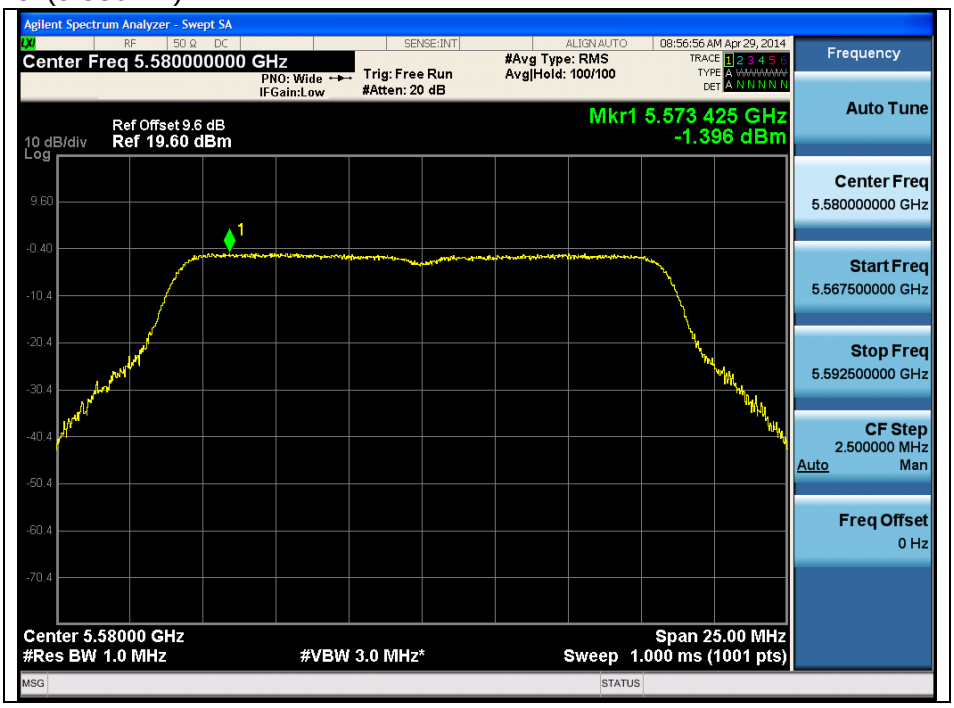


802.11a (Band 2C)

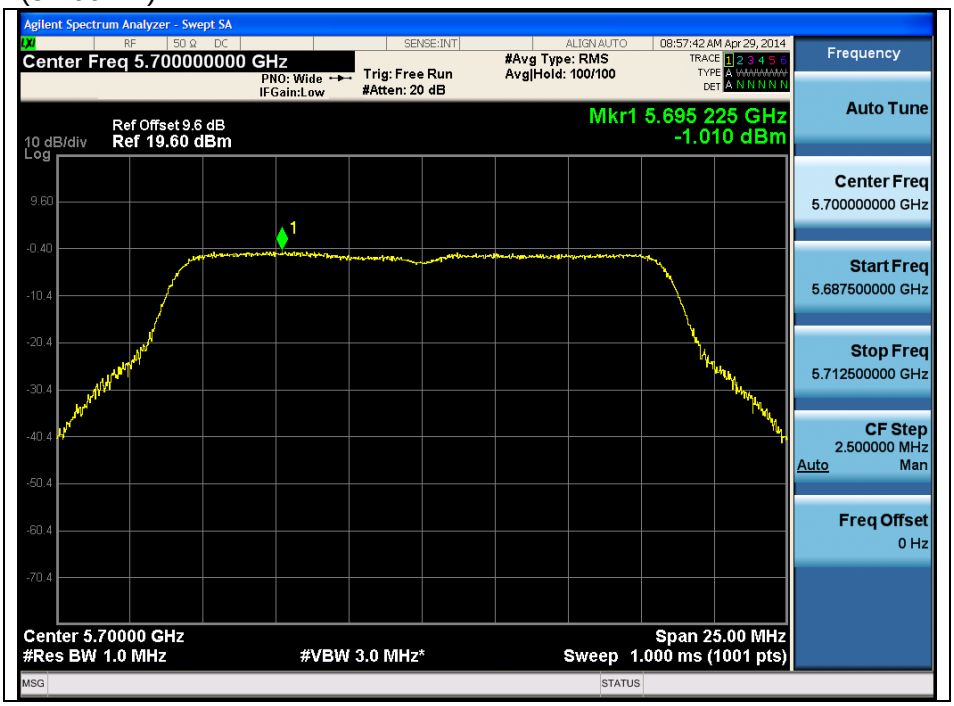
Low Channel (5 500 ㎒)



Middle Channel (5 580 ㎒)

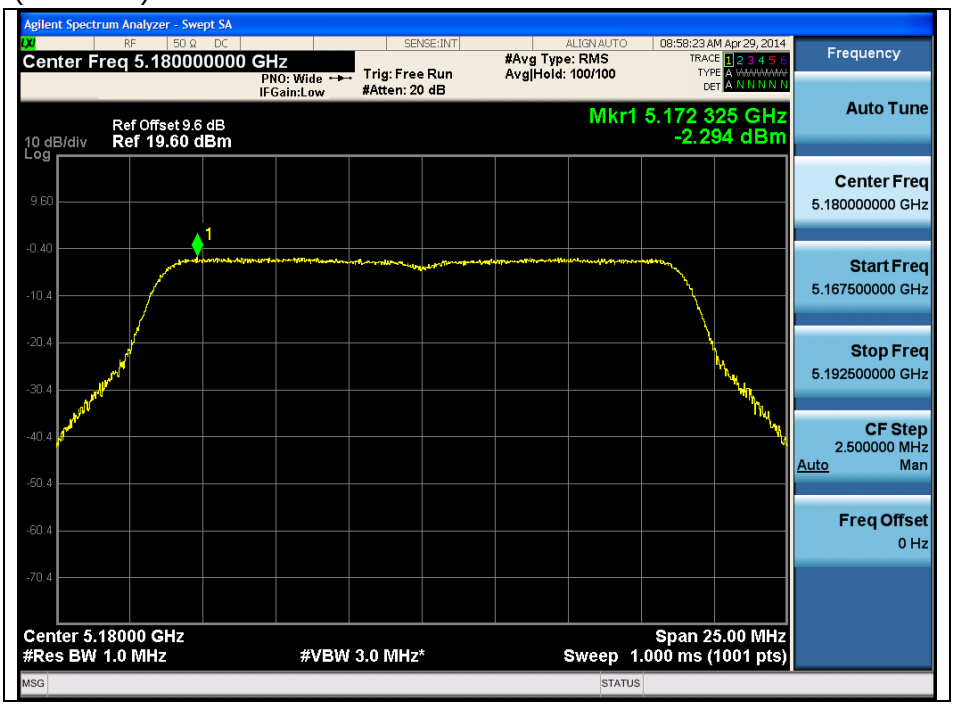


High Channel (5 700 ㎒)

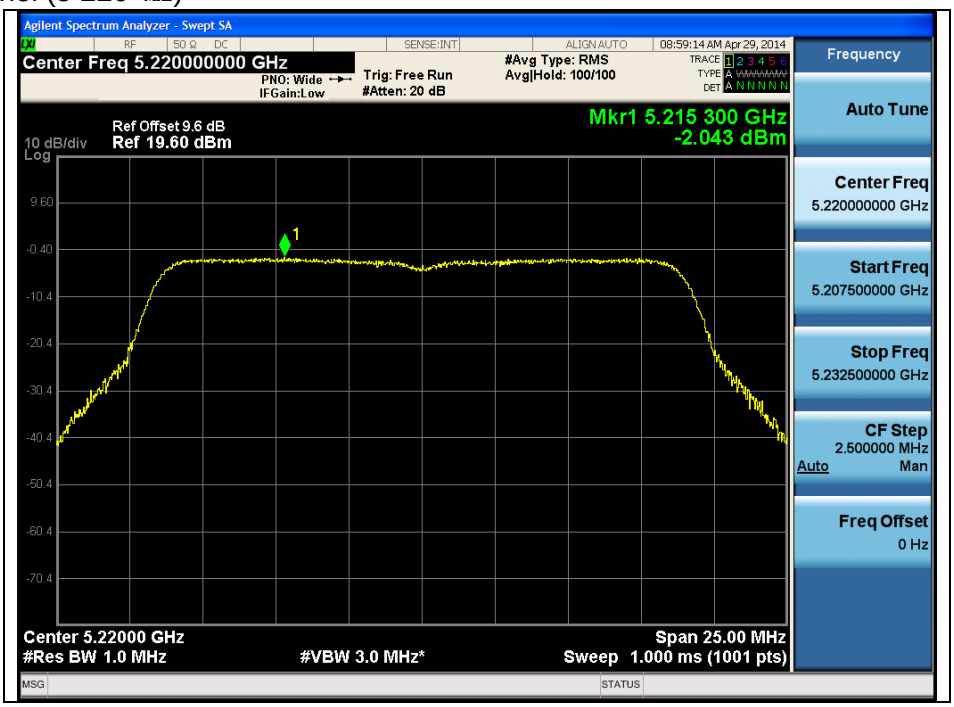


802.11n_HT20 (Band 1)

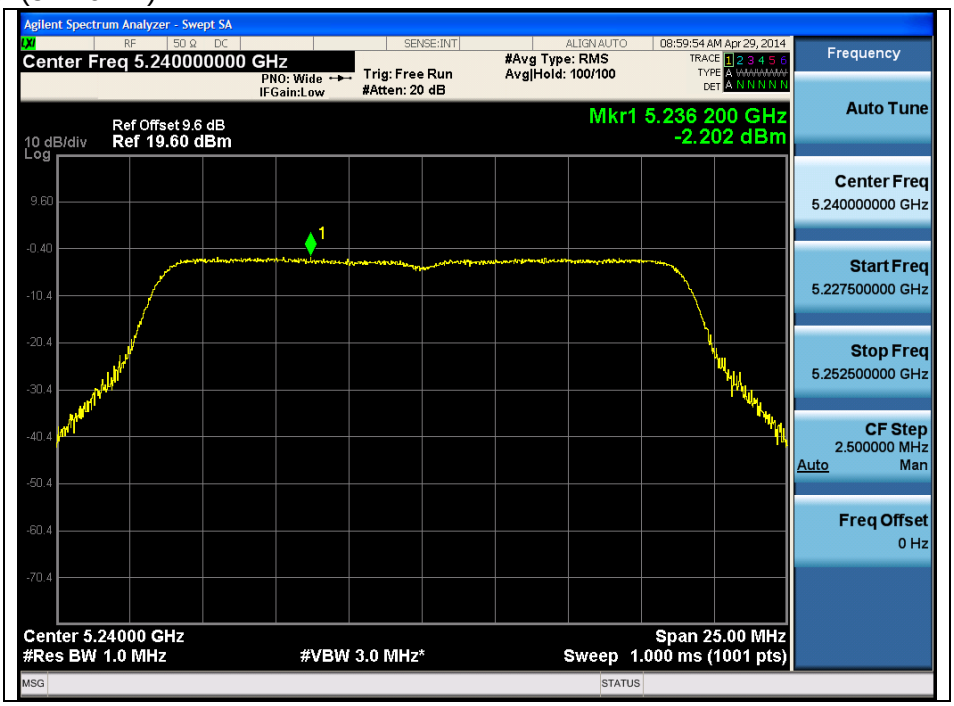
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

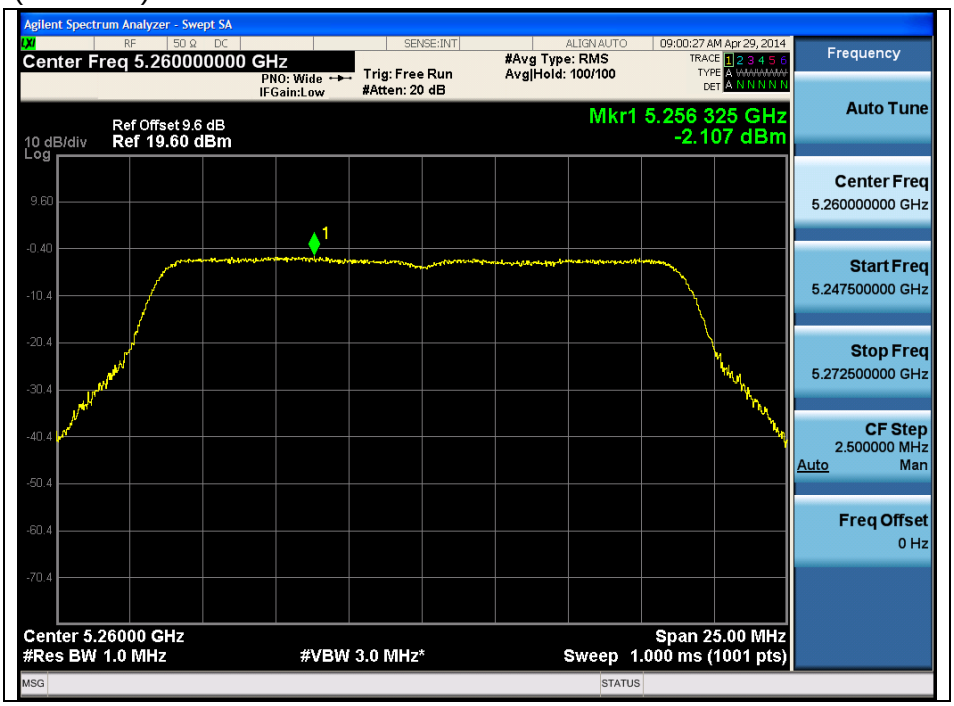


High Channel (5 240 ㎒)

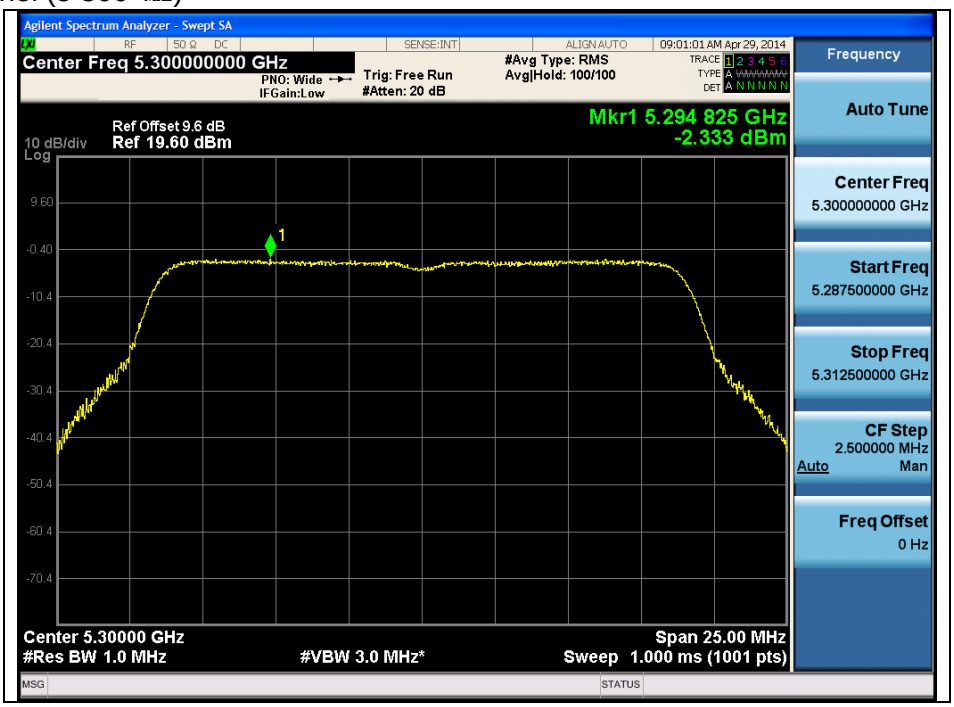


802.11_HT20 (Band 2A)

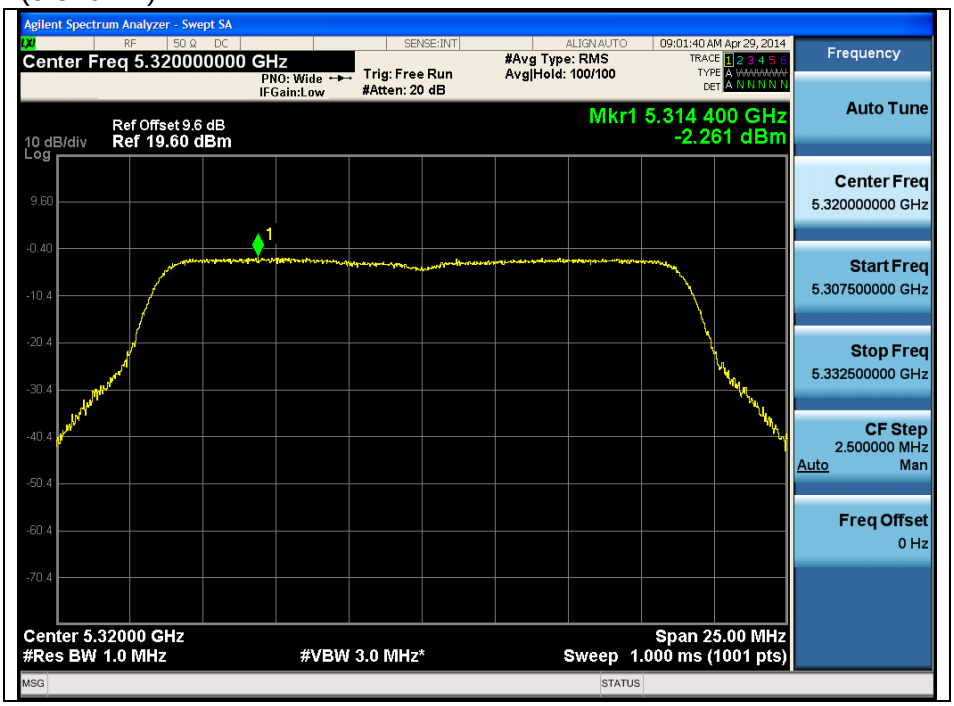
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

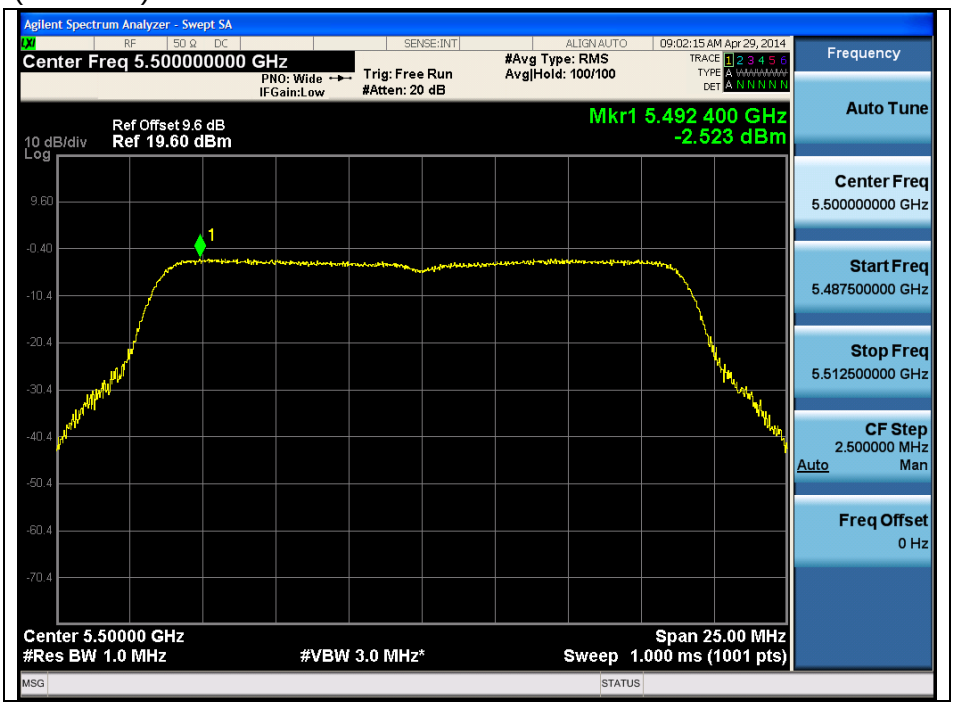


High Channel (5 320 ㎒)

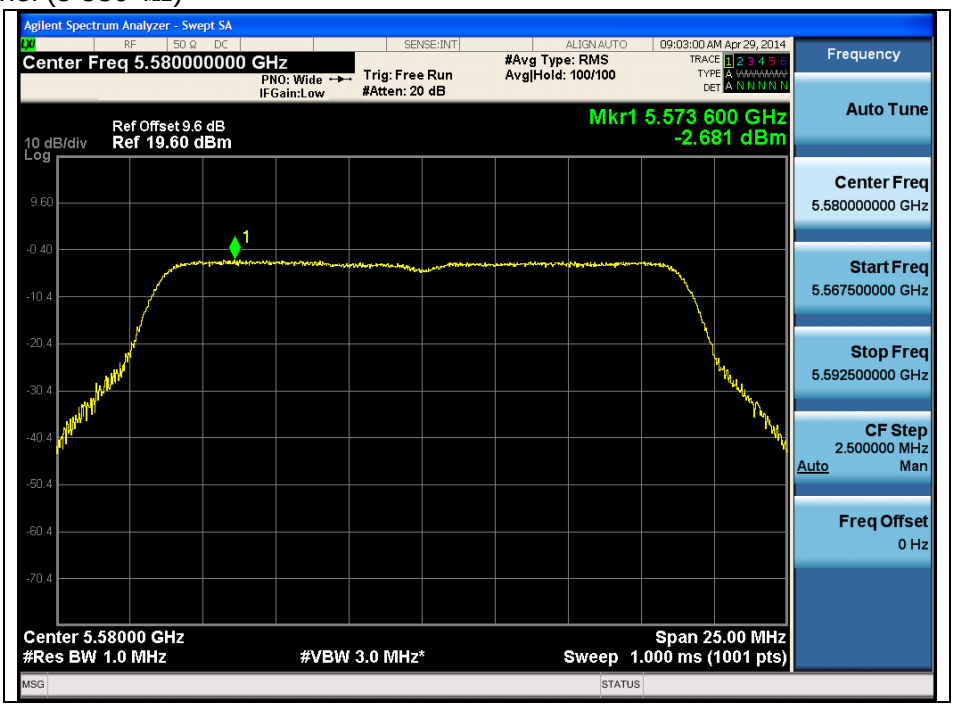


802.11_HT20 (Band 2C)

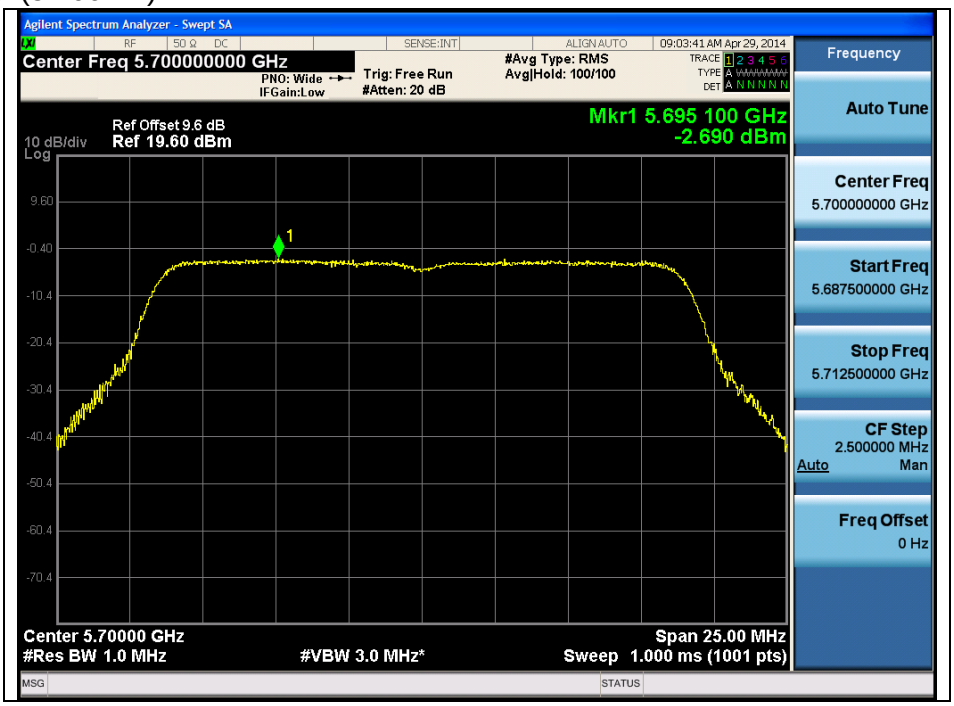
Low Channel (5 500 ㎒)



Middle Channel (5 580 ㎒)

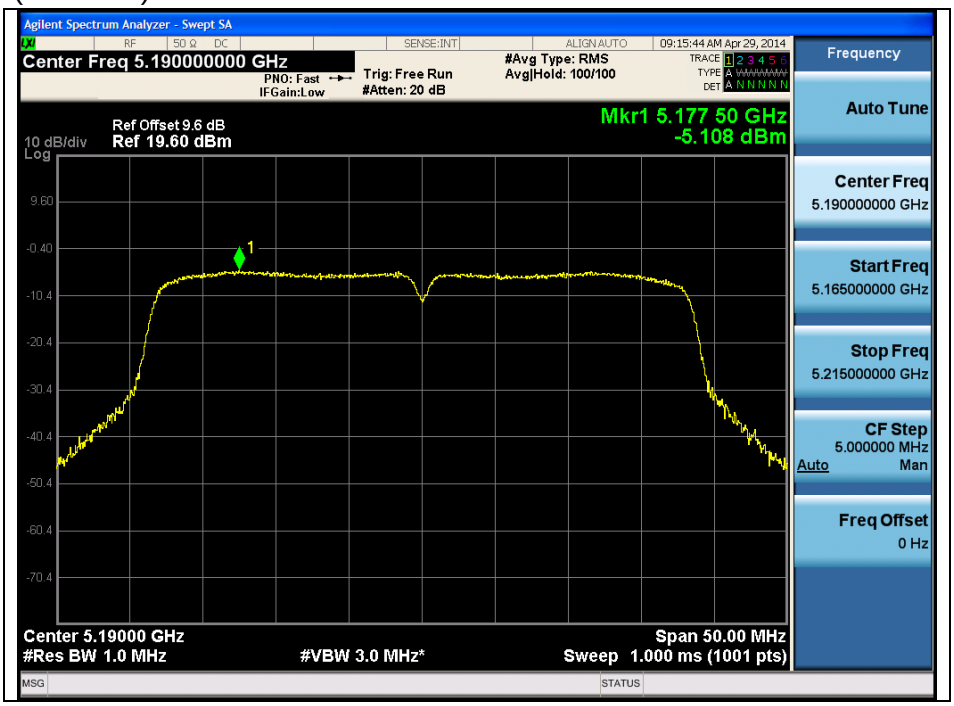


High Channel (5 700 ㎒)

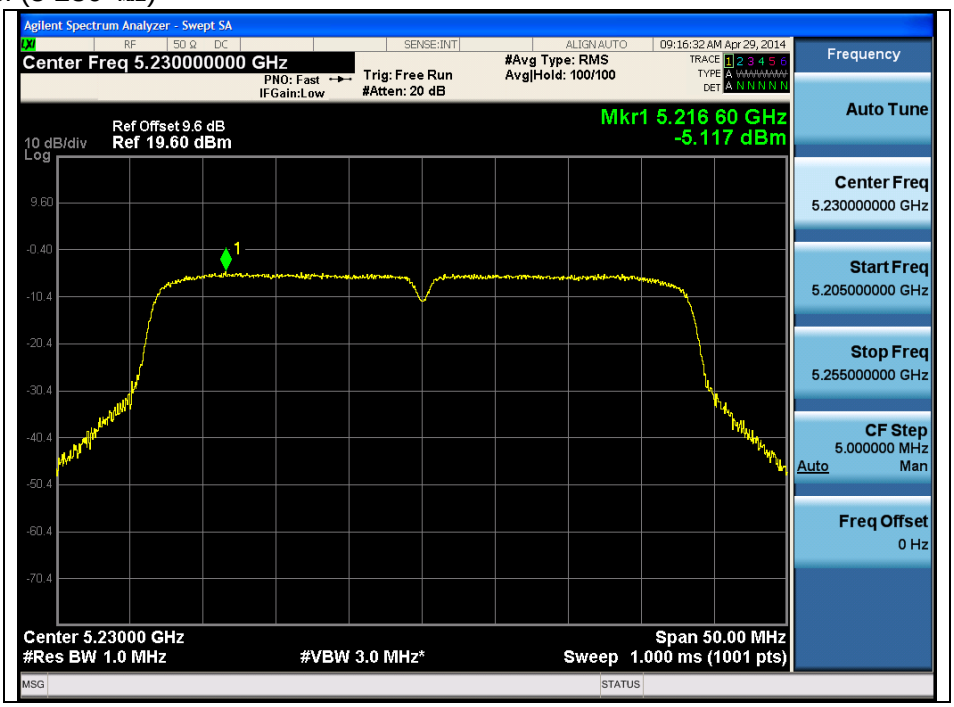


802.11n_HT40 (Band 1)

Low Channel (5 190 ㎒)

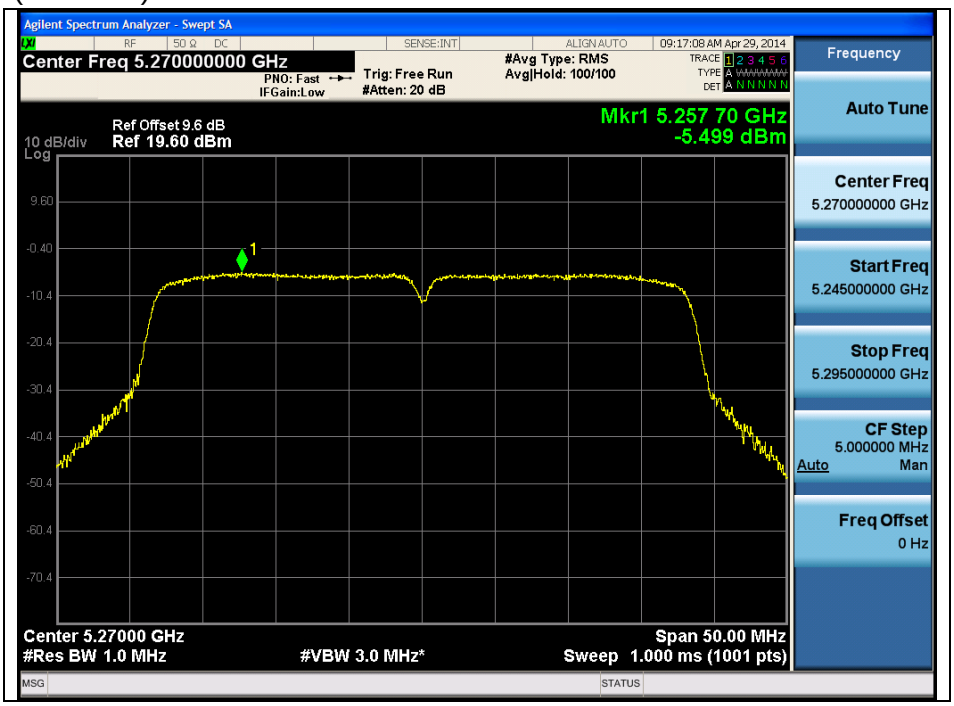


High Channel (5 230 ㎒)

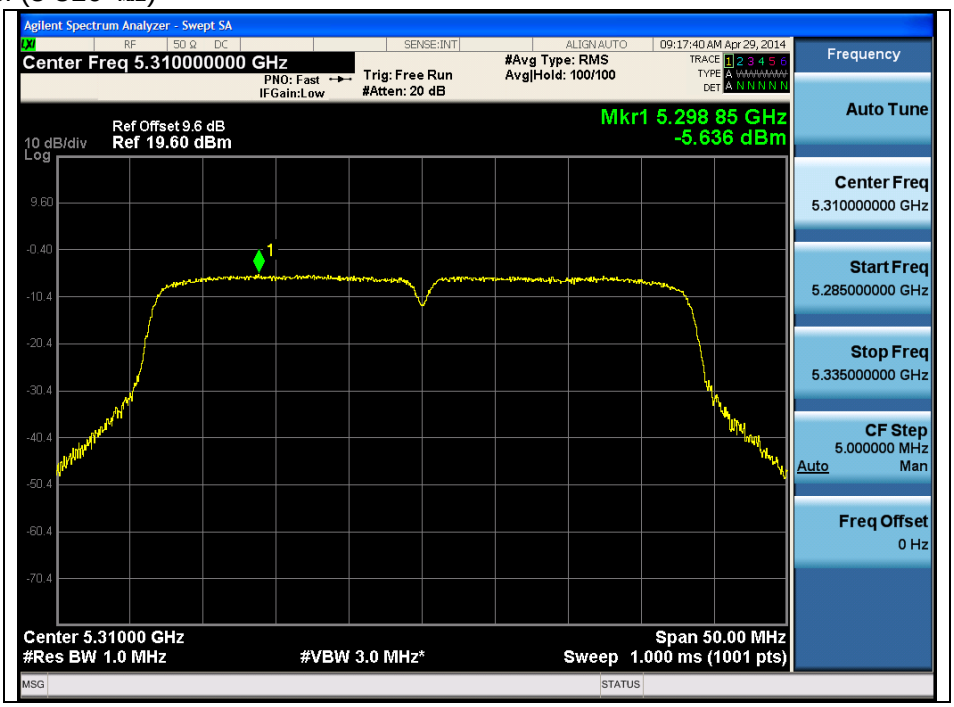


802.11_HT40 (Band 2A)

Low Channel (5 270 ㎒)

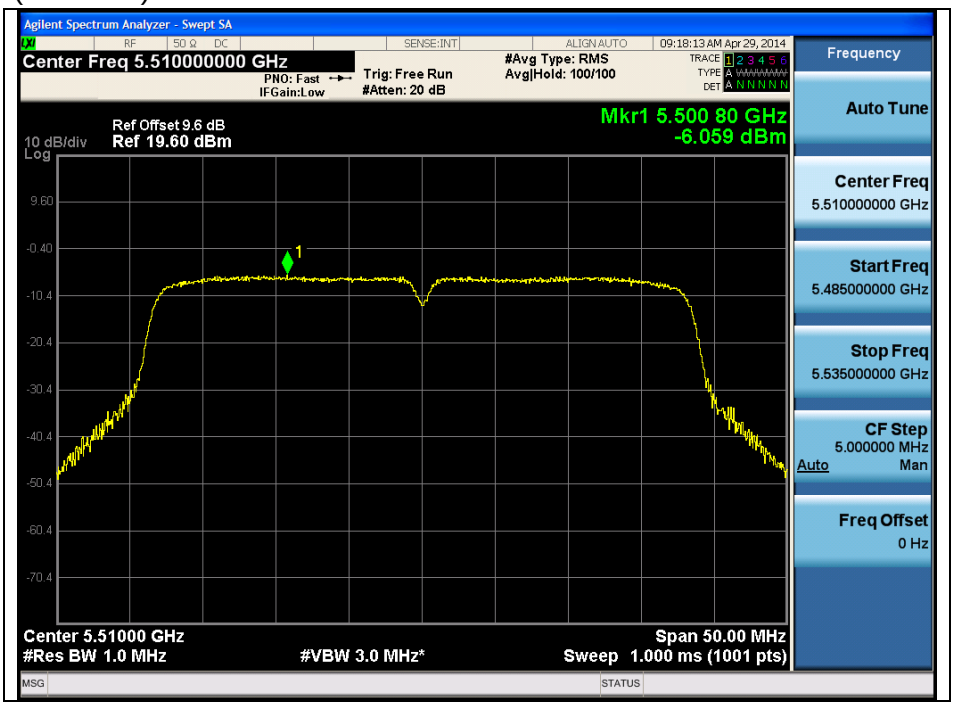


High Channel (5 310 ㎒)

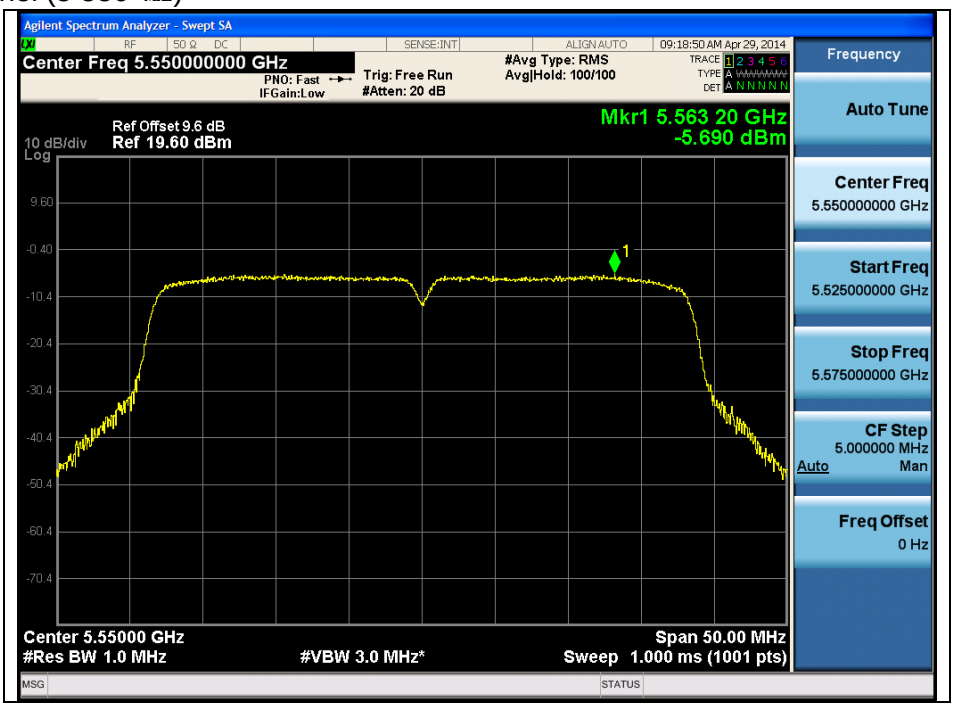


802.11_HT40 (Band 2C)

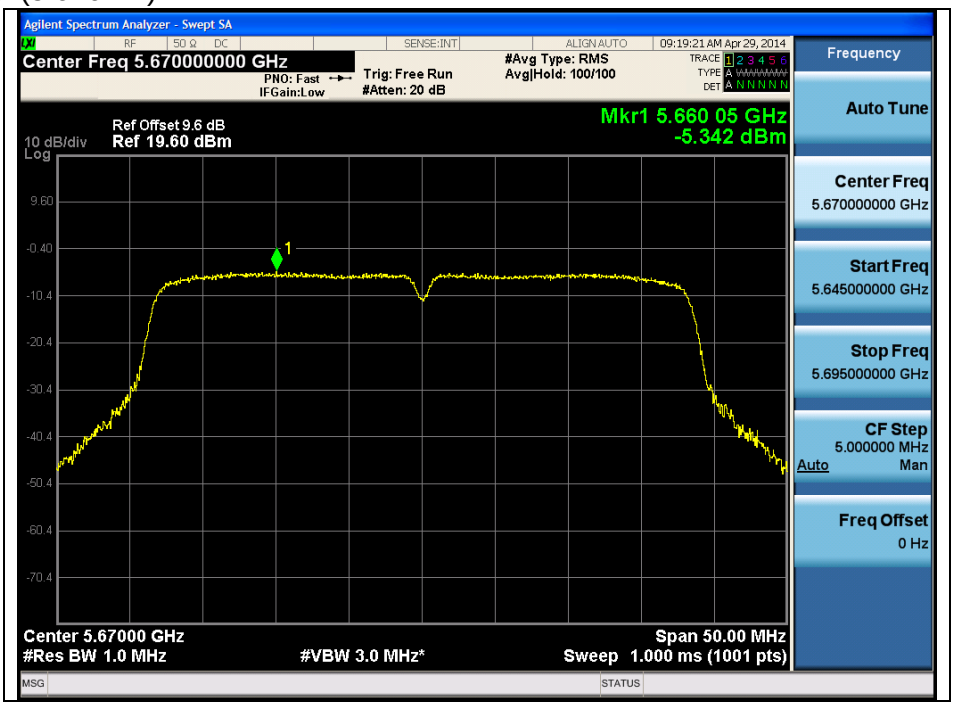
Low Channel (5 510 ㎒)



Middle Channel (5 550 ㎒)

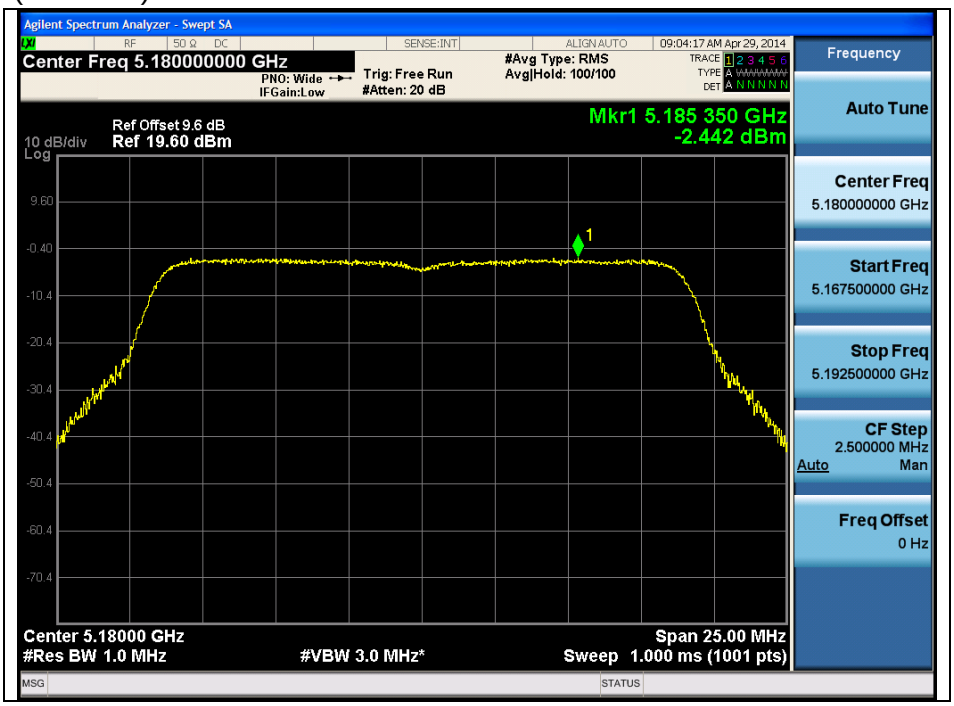


High Channel (5 670 ㎒)

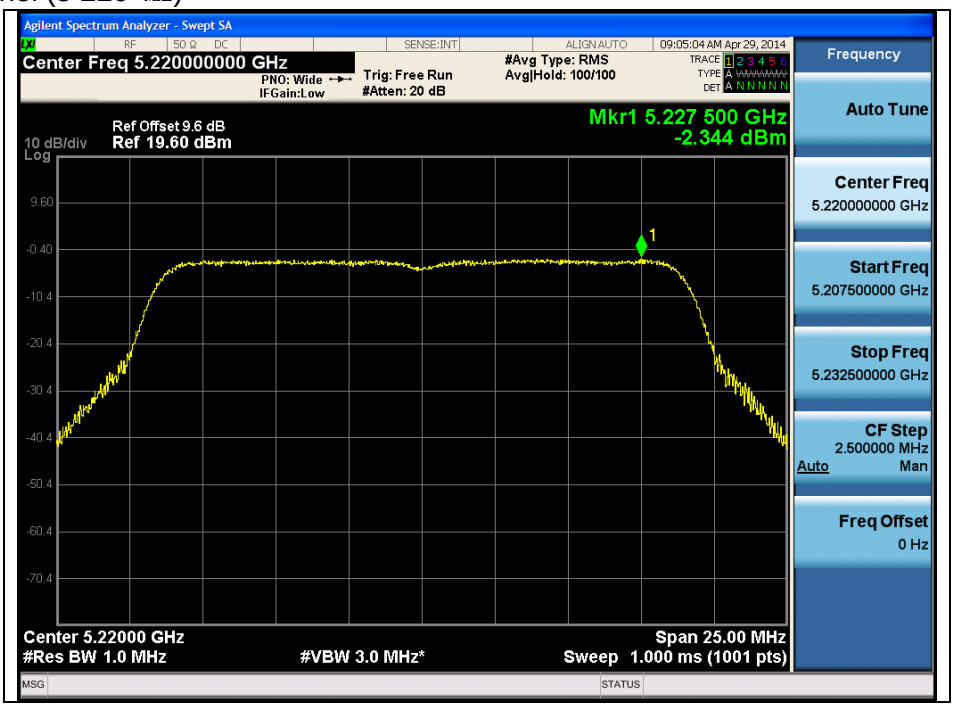


802.11ac_VHT20 (Band 1)

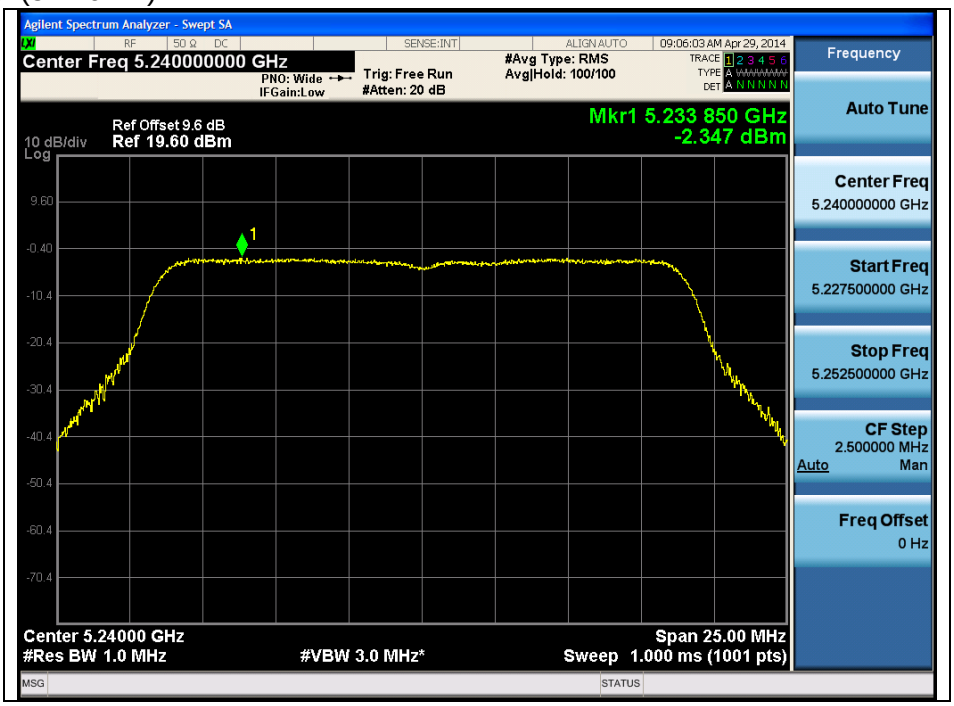
Low Channel (5 180 ㎒)



Middle Channel (5 220 ㎒)

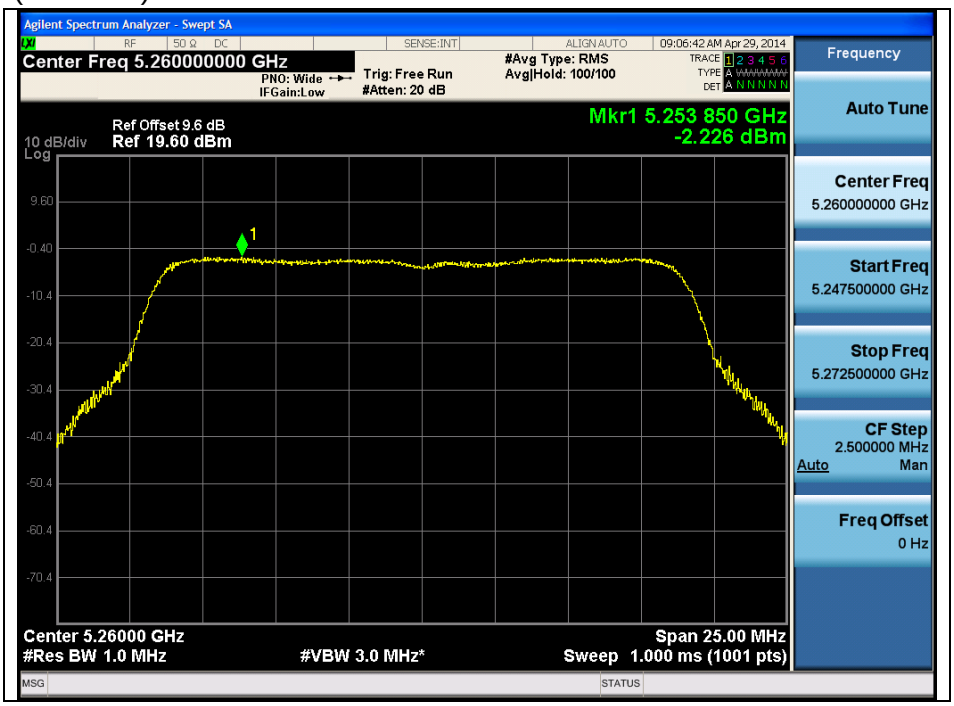


High Channel (5 240 ㎒)

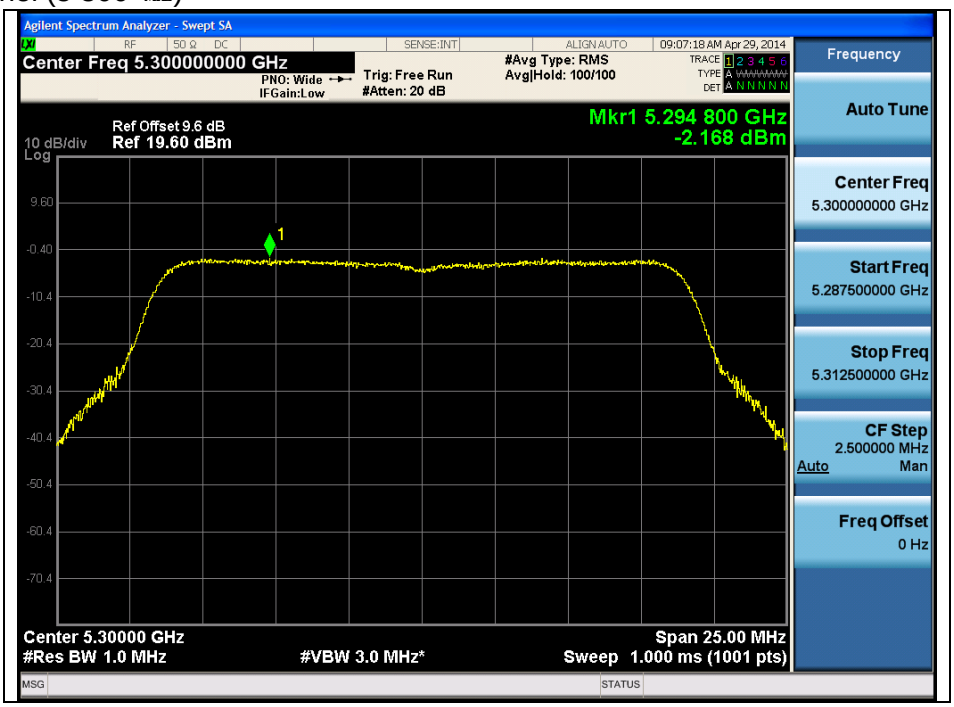


802.11ac_VHT20 (Band 2A)

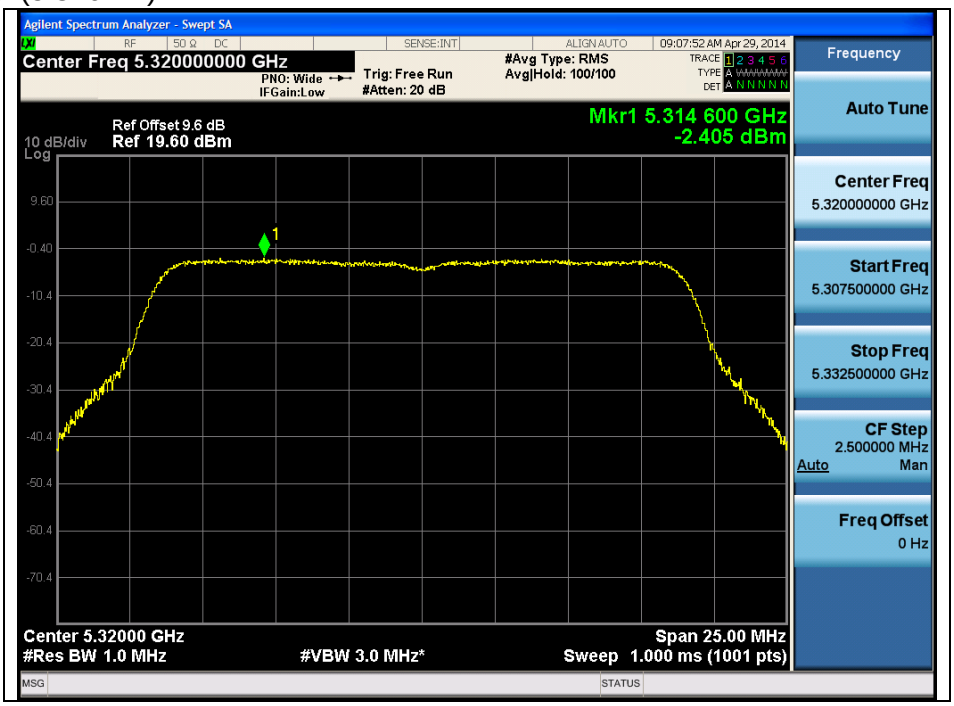
Low Channel (5 260 ㎒)



Middle Channel (5 300 ㎒)

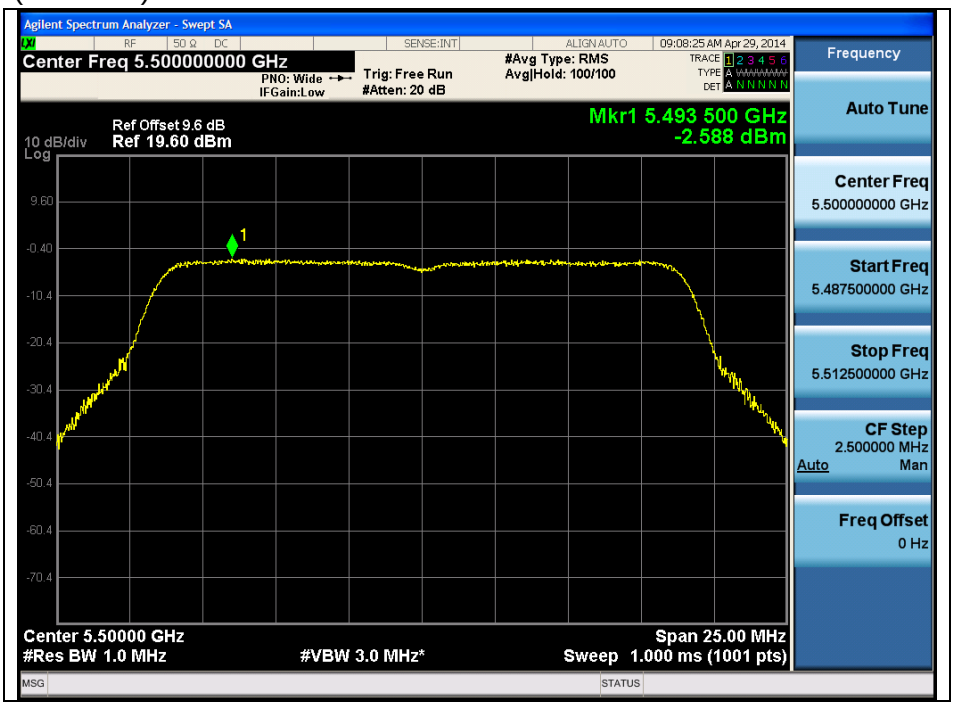


High Channel (5 320 ㎒)

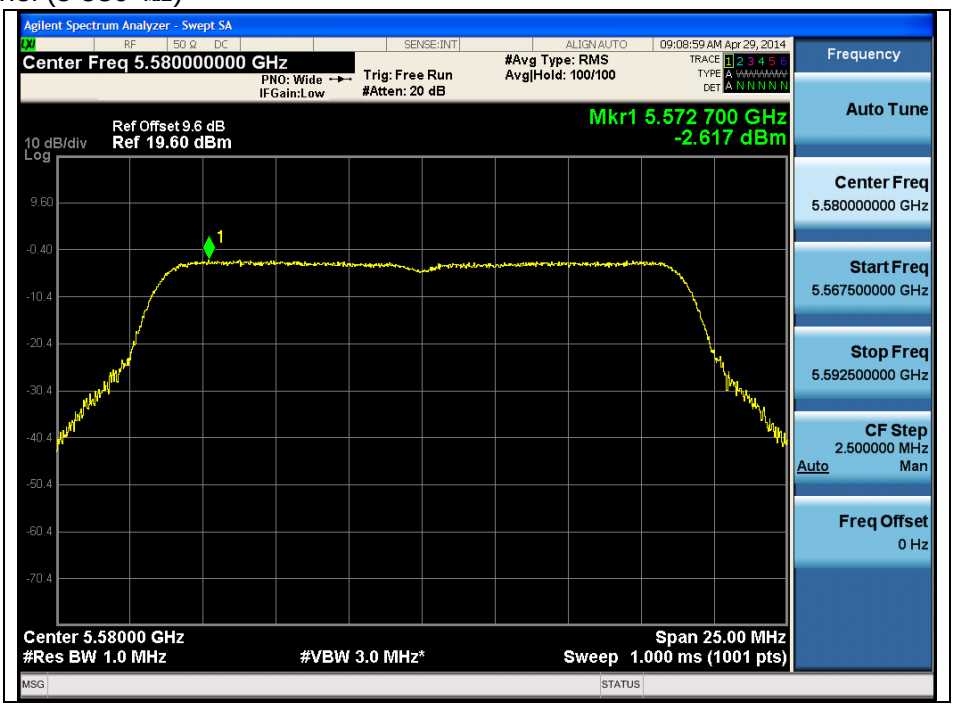


802. 11ac_VHT20 (Band 2C)

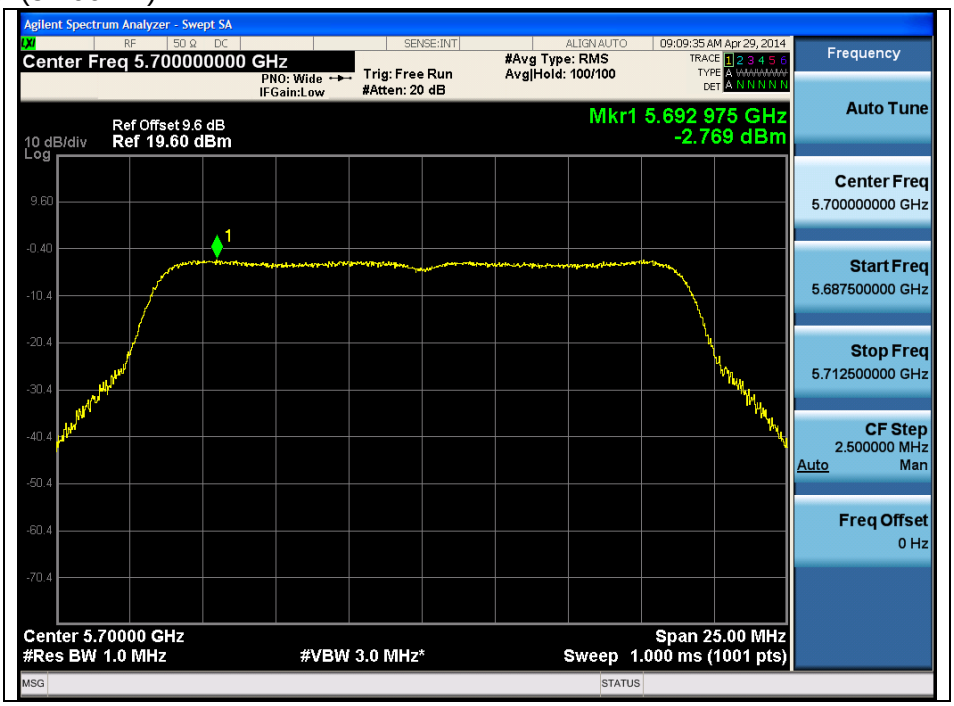
Low Channel (5 500 ㎒)



Middle Channel (5 580 ㎒)

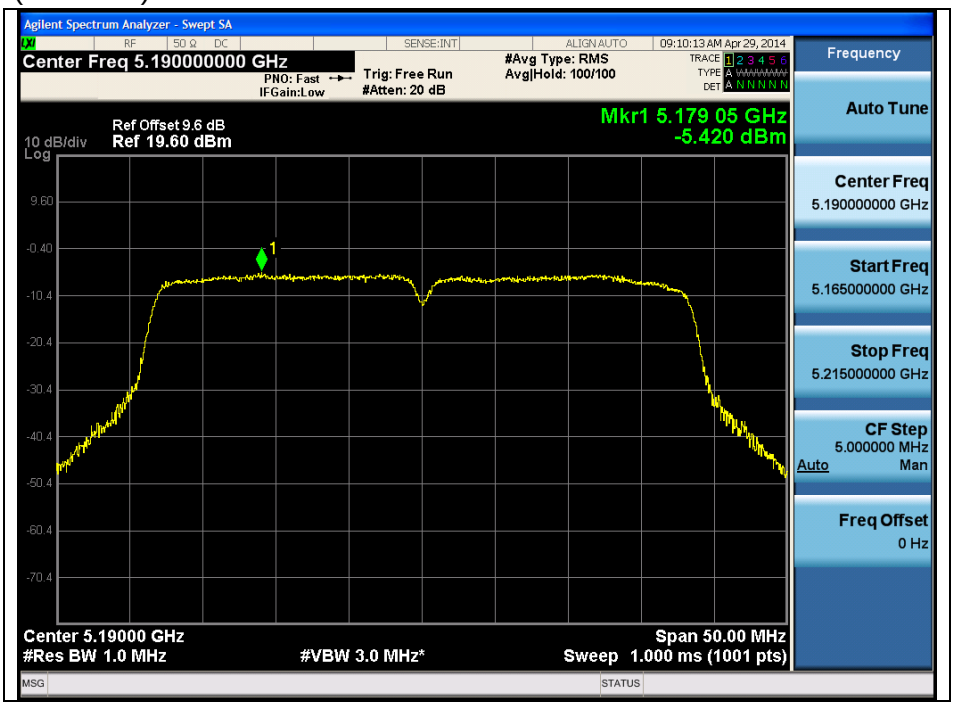


High Channel (5 700 ㎒)



802.11ac_VHT40 (Band 1)

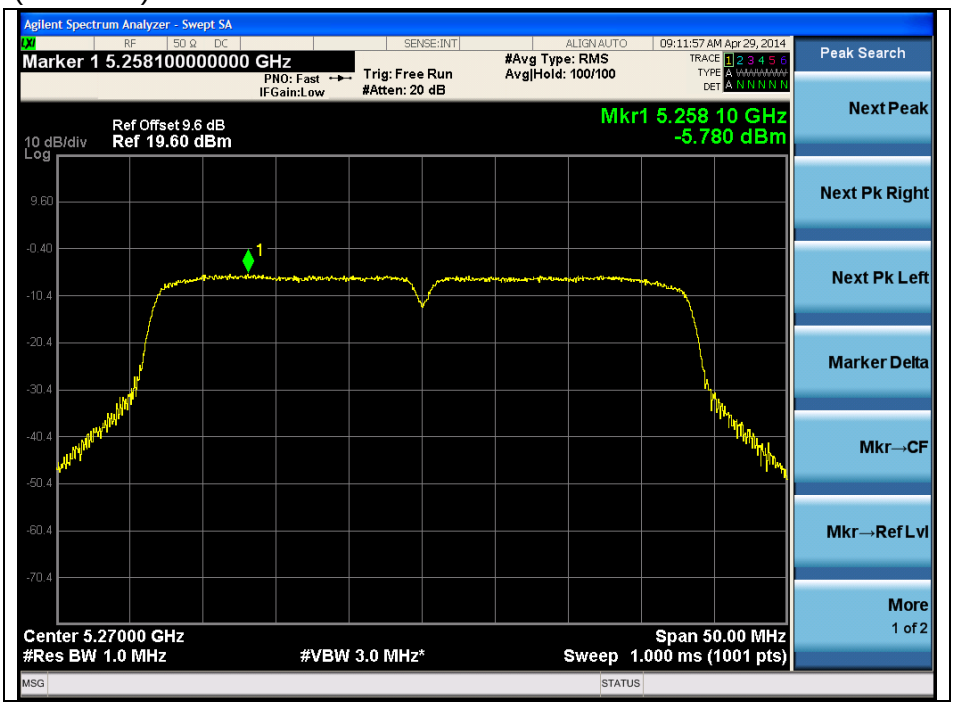
Low Channel (5 190 ㎒)



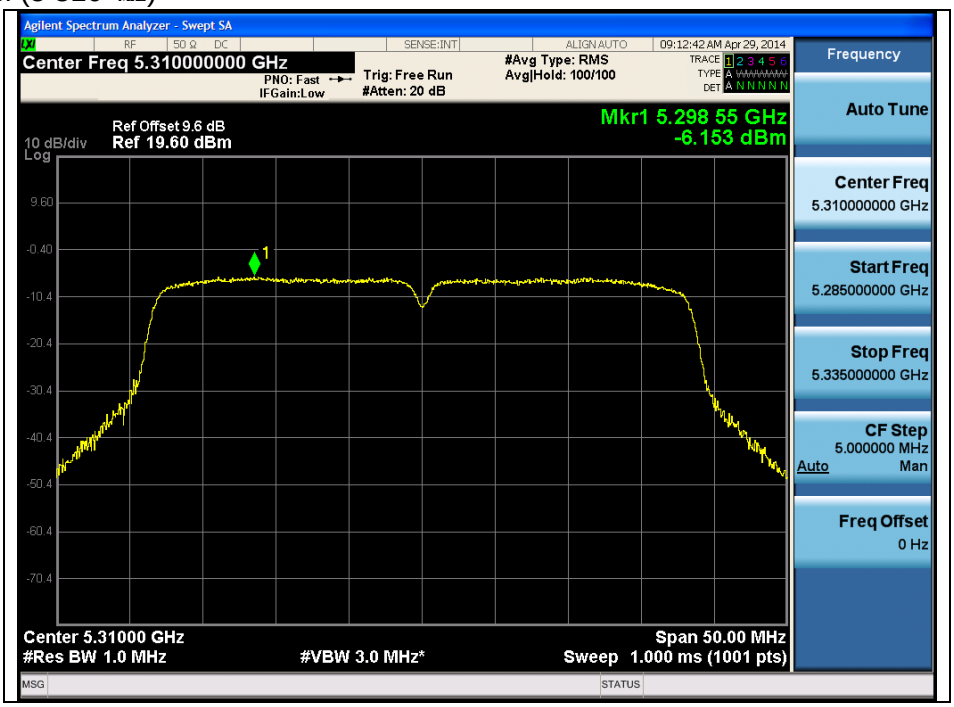
High Channel (5 230 ㎒)

802.11ac_VHT40 (Band 2A)

Low Channel (5 270 ㎒)

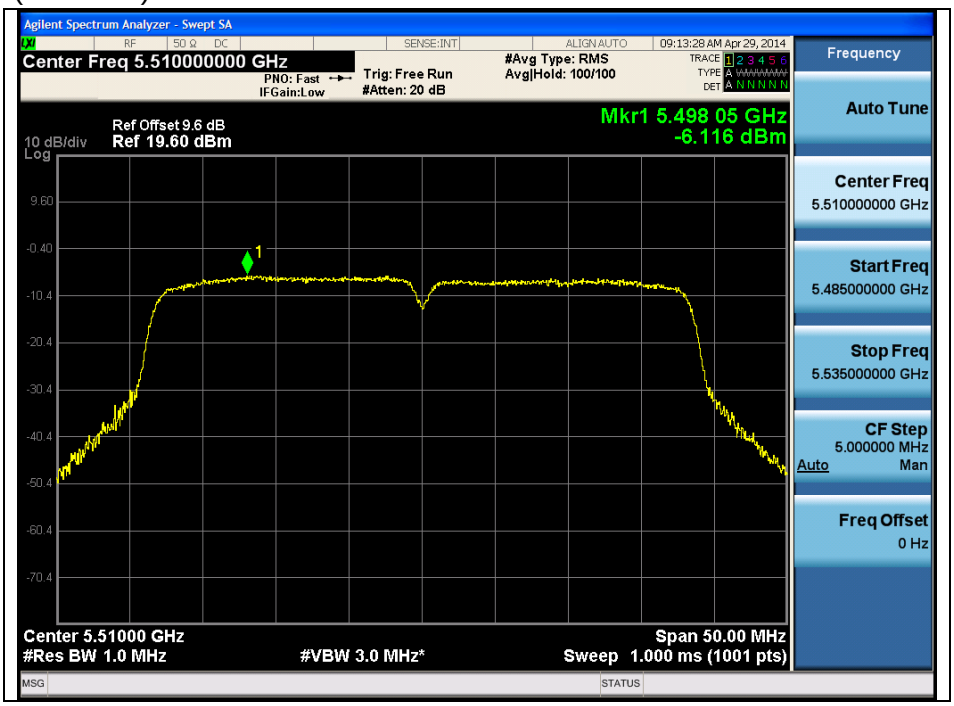


High Channel (5 310 ㎒)

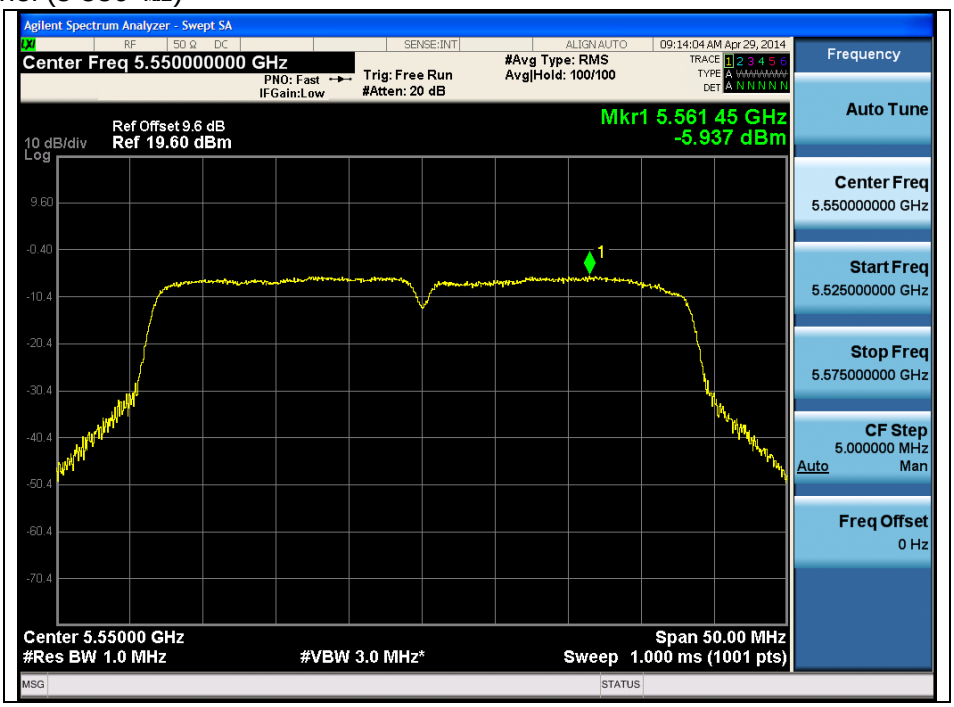


802.11ac_VHT40 (Band 2C)

Low Channel (5 510 ㎒)



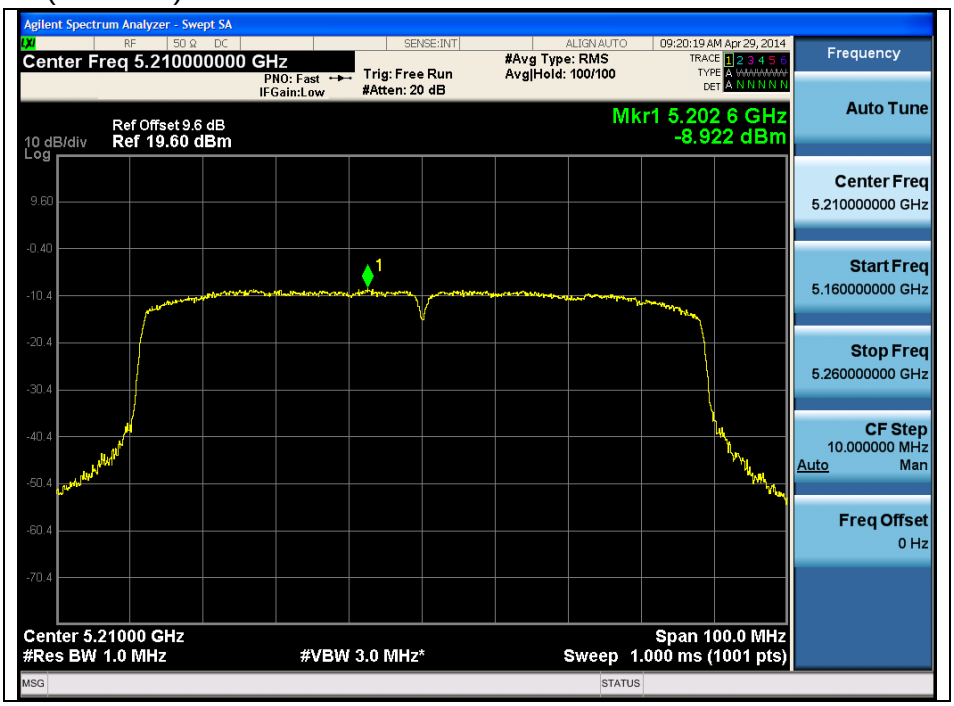
Middle Channel (5 550 ㎒)



High Channel (5 670 ㎒)

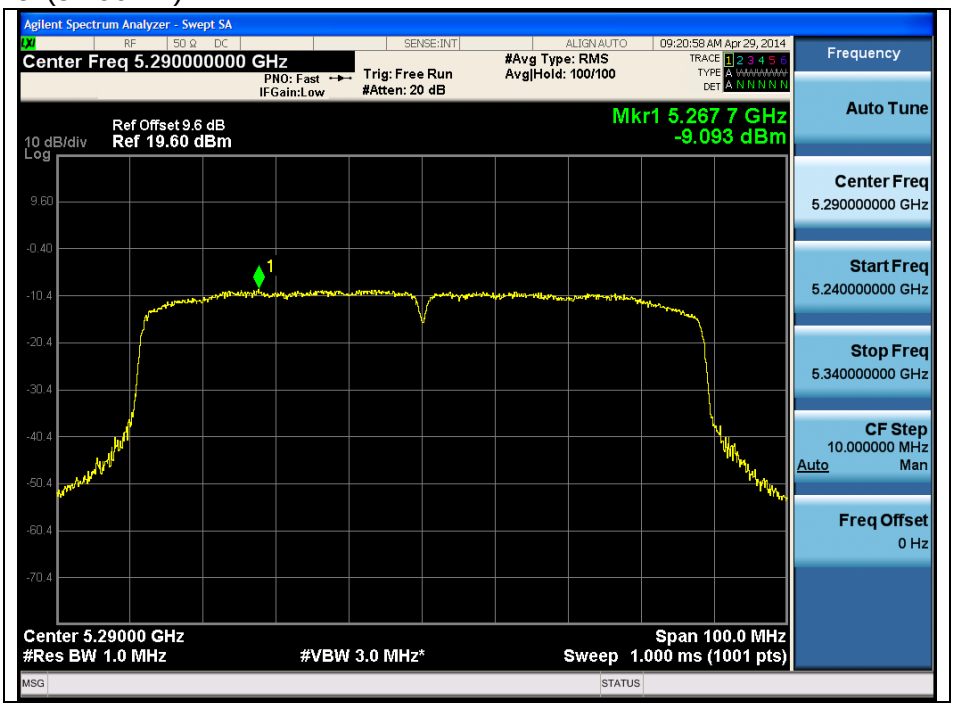
802.11ac_VHT80 (Band 1)

Middle Channel (5 210 ㎒)



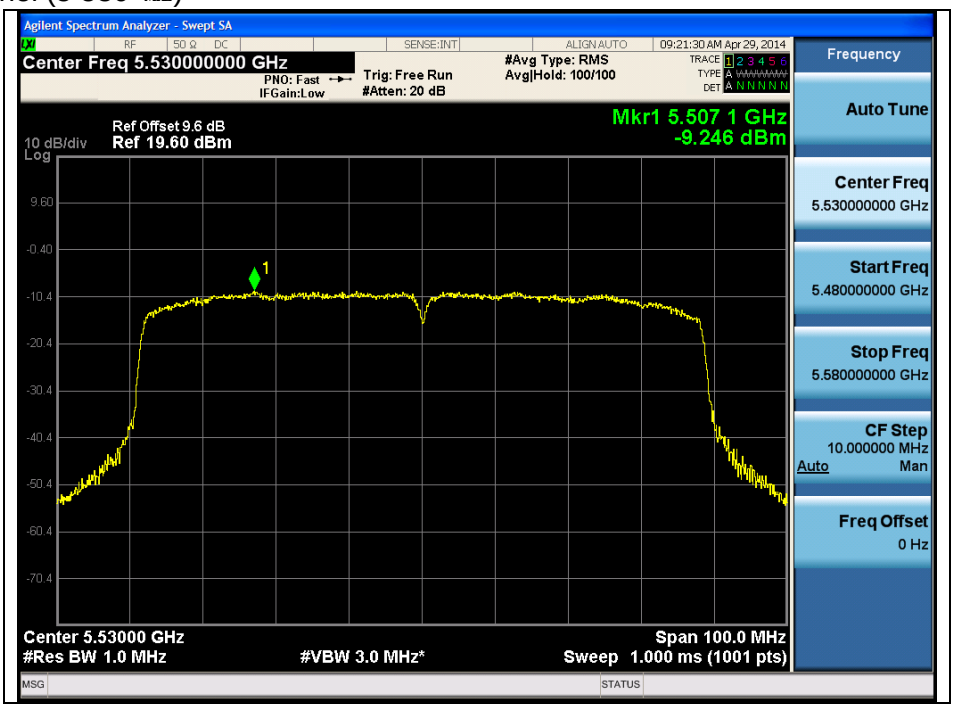
802.11ac_VHT80 (Band 2A)

Middle Channel (5 290 ㎒)



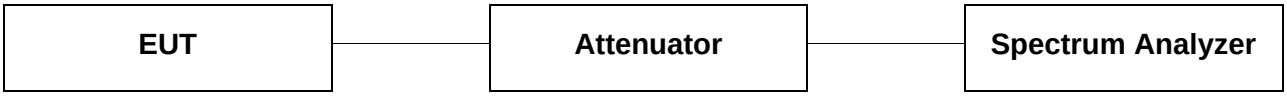
802.11ac_VHT80 (Band 2C)

Middle Channel (5 530 ㎒)



6. Peak excursion

6.1. Test setup



6.2. Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 ㏈ across any 1 ㎒ bandwidth or the emission bandwidth whichever is less.

6.3. Test procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section G of KDB 789033_v01r03.
2. Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth.
3. Find the maximum of the peak-max-hold spectrum.
4. Set RBW = 1 ㎒.
5. Set VBW ≥ 3 ㎒.
6. Detector = Peak.
7. Trace mode = max-hold.
8. Allow the sweeps to continue until the trace stabilizes.
9. Use the peak search function to find the peak of the spectrum.
10. Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.
    - Testing each modulation mode on a single channel in a single operating band is sufficient to demonstrate compliance with the peak excursion requirement.
    - Tests performed all signal types, all modulation types, all bandwidth modes, all variations in signal parameters.

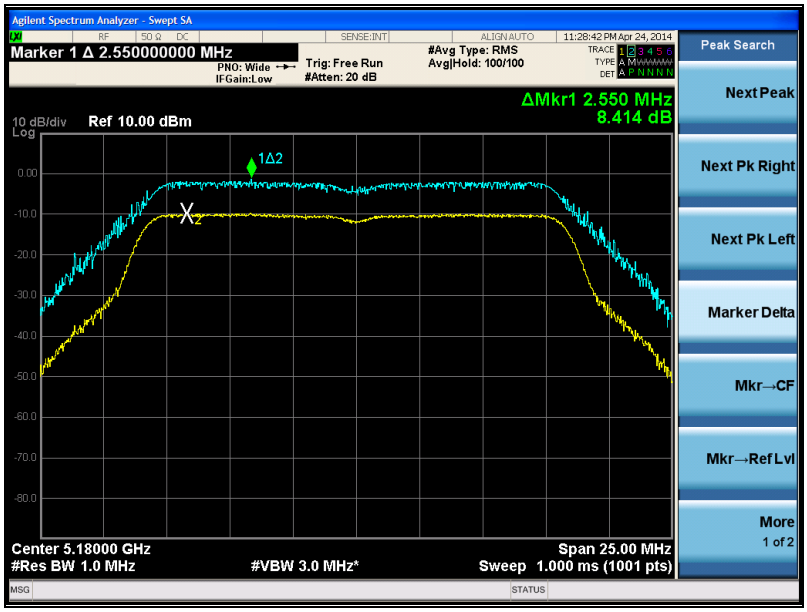
6.4. Test result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 49 % R.H.

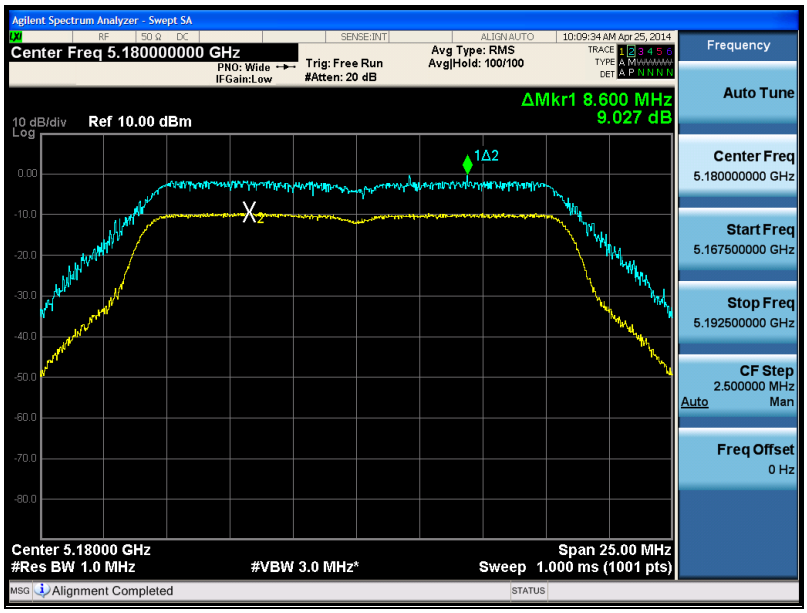
Peak Excursion (dB)												
Mode	**Frequency (㎒)**	**Data Rate (Mbps / MCS)**										**Limit (dB m/㎒)**
11a	5 180	**6**	**9**	**12**	**18**	**24**	**36**	**48**	**54**	**-**	**-**	**-**
		8.41	9.03	8.59	8.49	9.37	10.41	9.73	9.81	-	-	13
11an_ HT20	5 180	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**-**	**-**
		9.74	9.07	8.72	9.33	9.68	10.08	9.80	10.51	-	-	13
11an_ HT40	5 190	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**-**	**-**	**-**
		8.43	9.24	9.70	10.37	10.63	10.06	10.66	10.80	-	-	13
11ac_ VHT20	5 180	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**-**	**-**
		7.93	8.30	8.71	8.65	9.48	9.75	10.20	10.35	9.47	-	13
11ac_ VHT40	5 190	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**-**
		8.84	11.89	9.25	10.61	9.69	9.80	10.01	10.87	11.57	11.55	13
11ac_ VHT80	5 210	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**-**
		9.68	9.80	10.31	10.07	9.13	11.25	10.07	9.48	11.74	11.42	13

- 11a

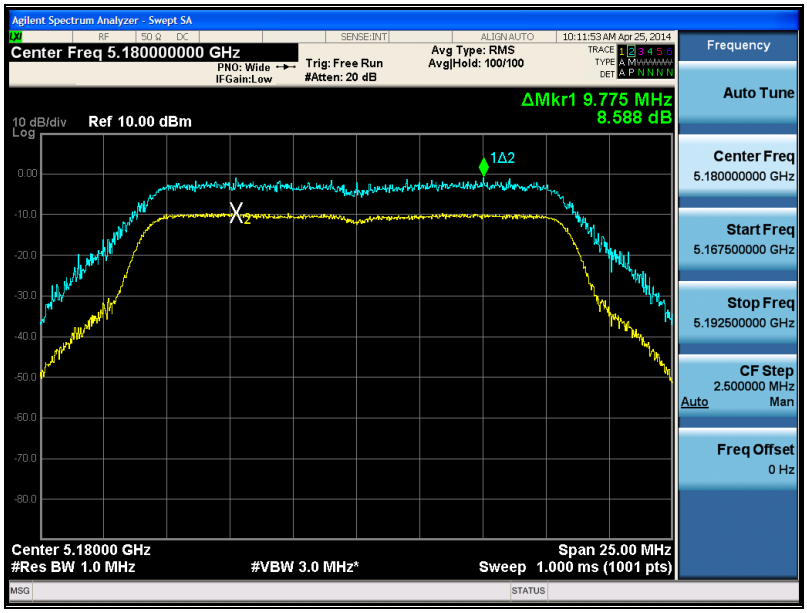
5 180 ㎒(6 Mbps)



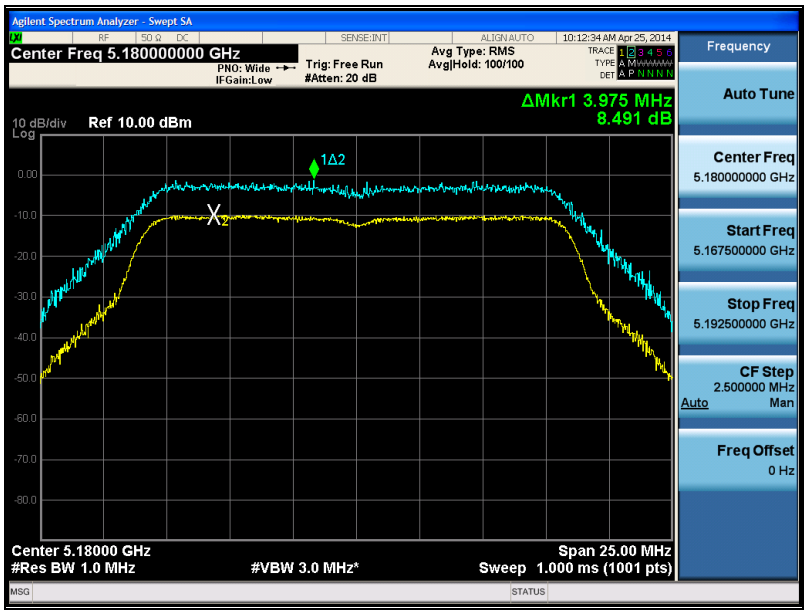
5 180 ㎒(9 Mbps)



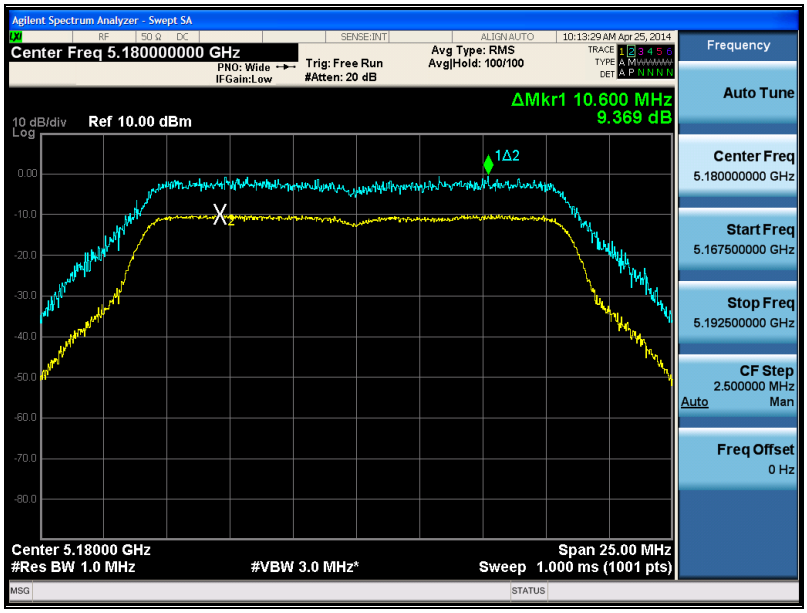
5 180 ㎒(12 Mbps)



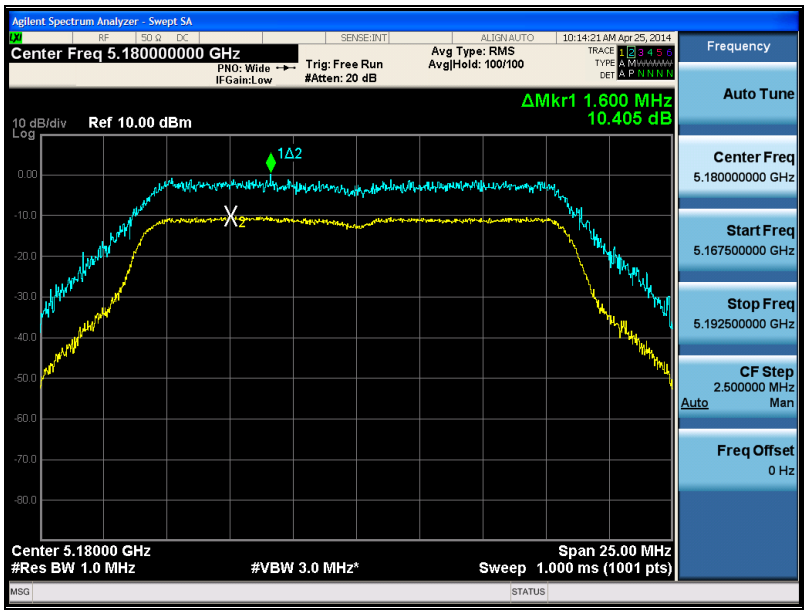
5 180 ㎒(18 Mbps)



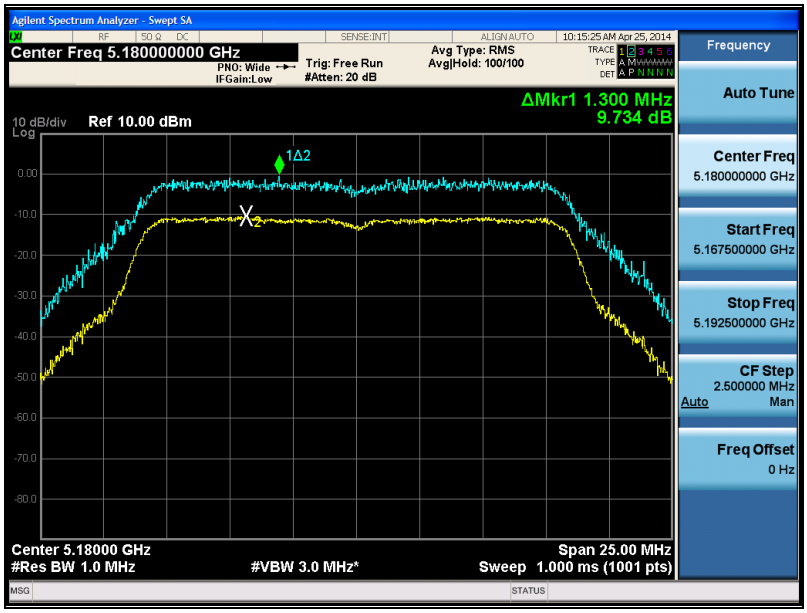
5 180 ㎒(24 Mbps)



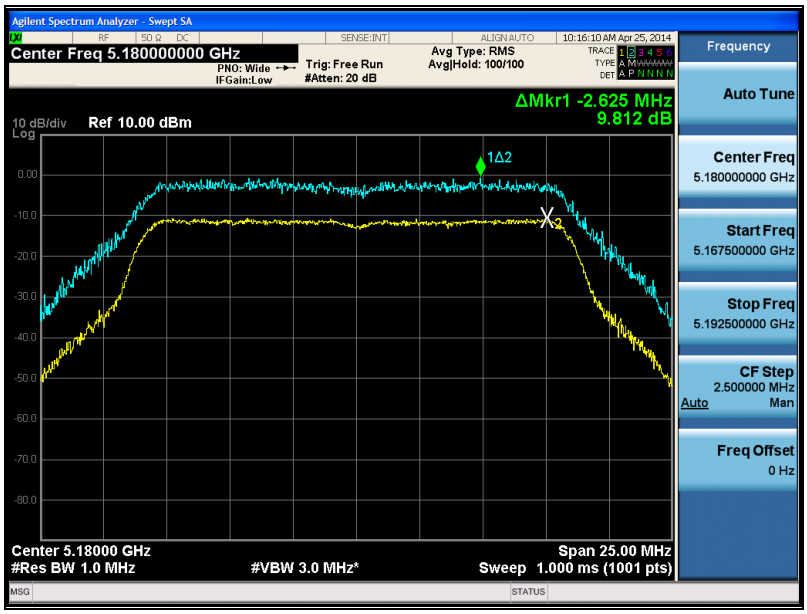
5 180 ㎒(36 Mbps)



5 180 ㎒(48 Mbps)

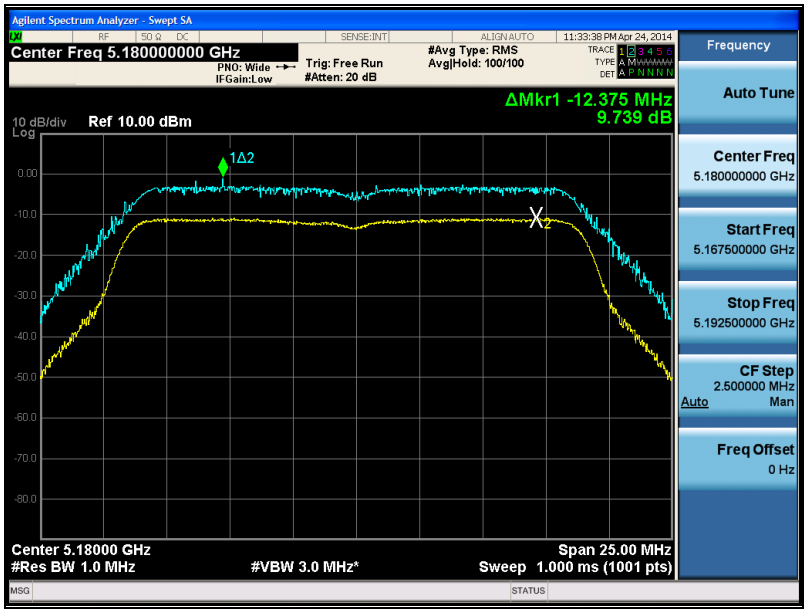


5 180 ㎒(54 Mbps)

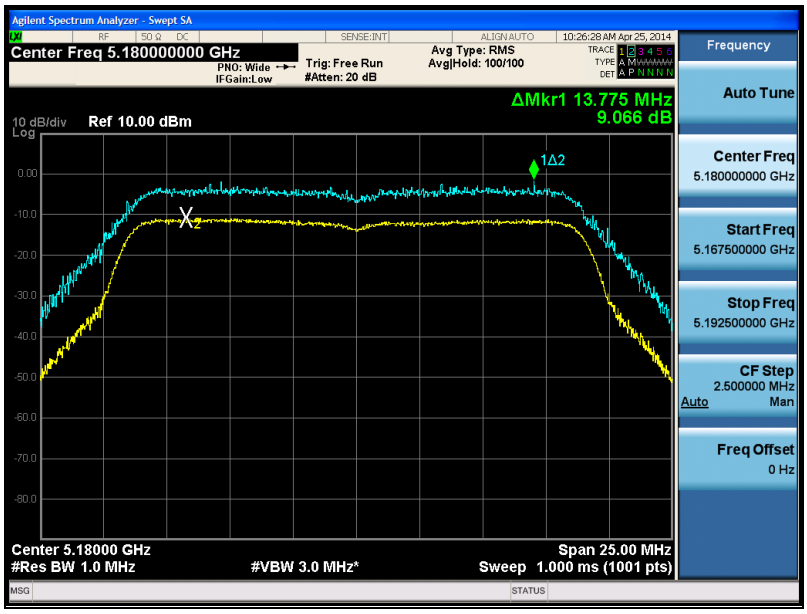


- 11an_HT20

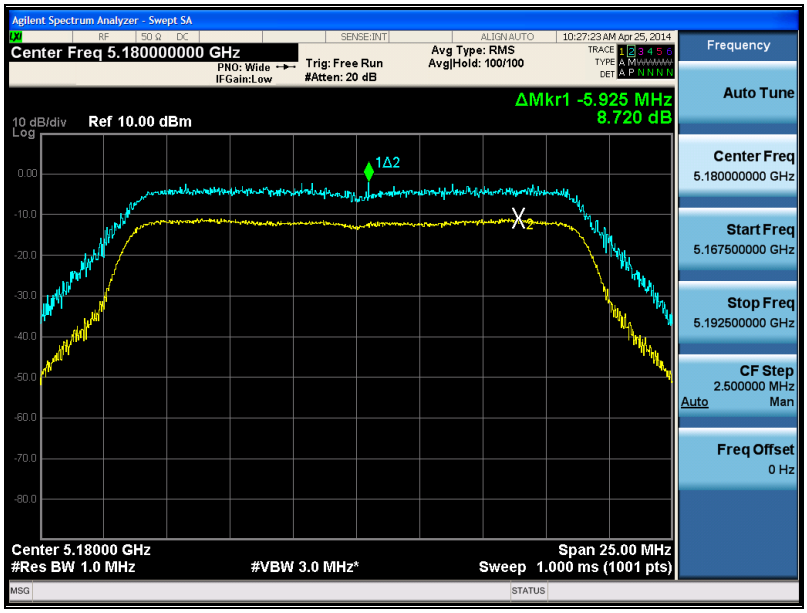
5 180 ㎒(MCS0)



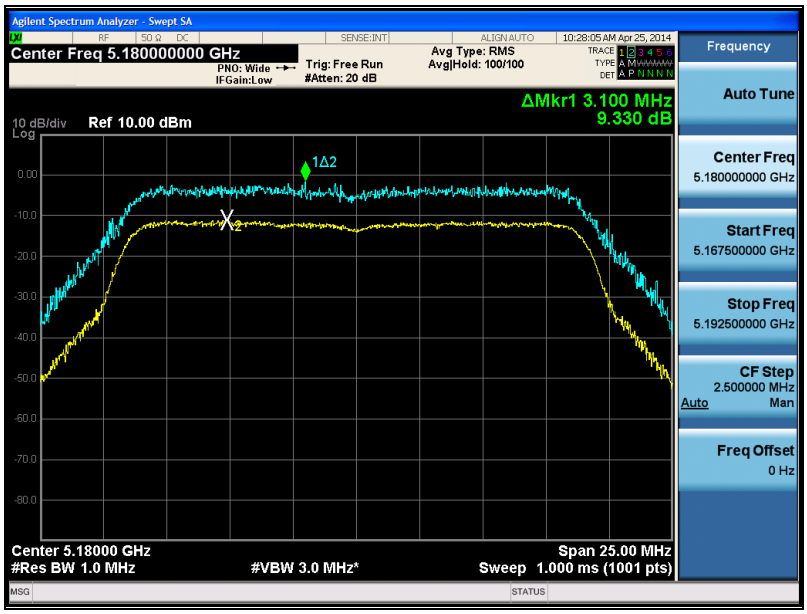
5 180 ㎒(MCS1)



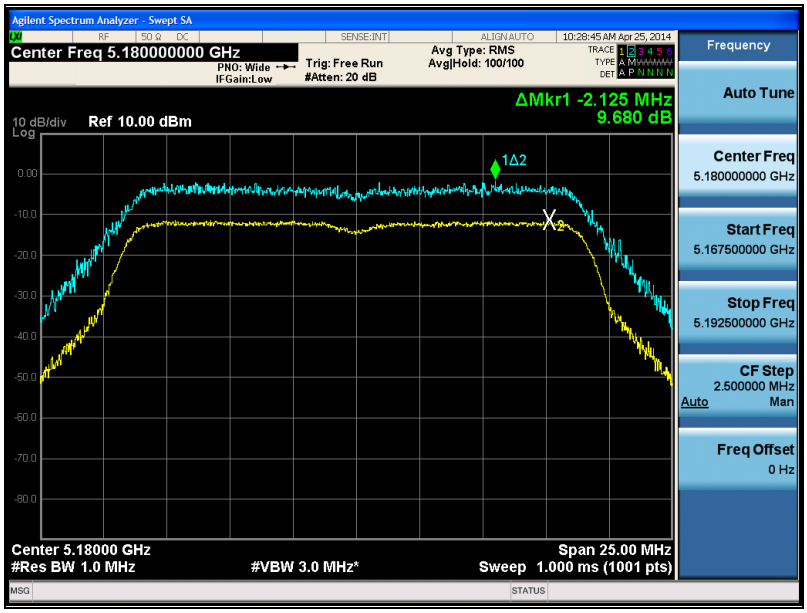
5 180 ㎒(MCS2)



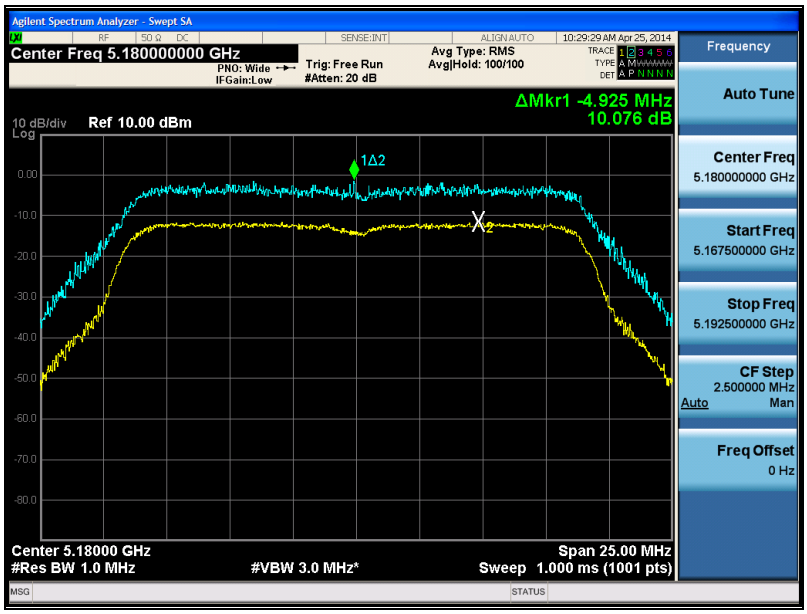
5 180 ㎒(MCS3)



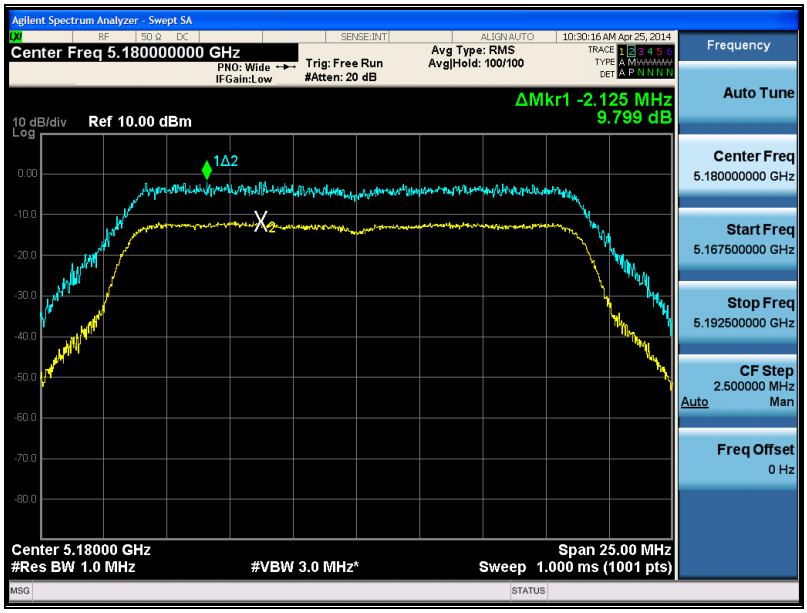
5 180 ㎒(MCS4)



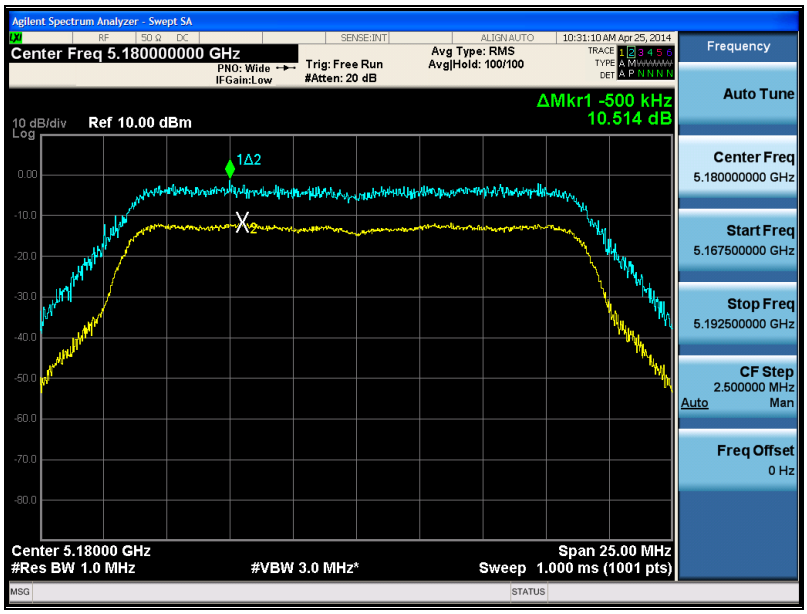
5 180 ㎒(MCS5)



5 180 ㎒(MCS6)

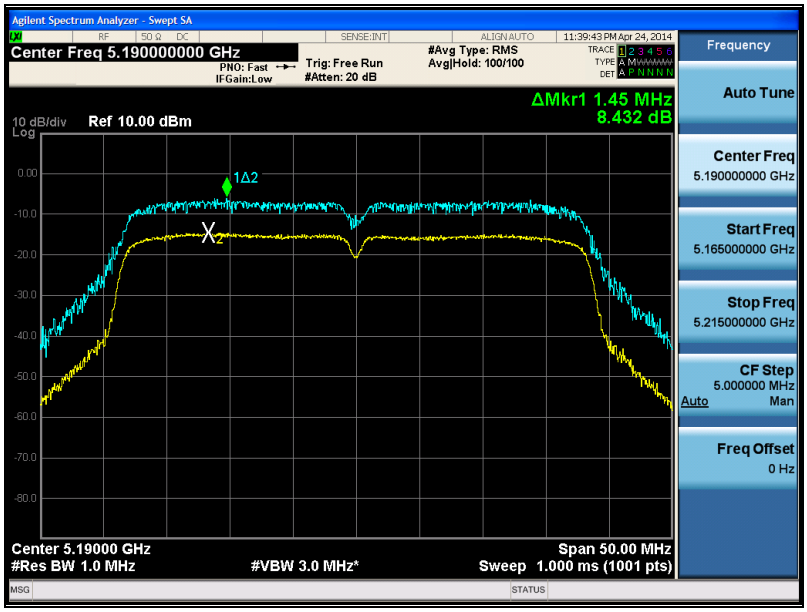


5 180 ㎒(MCS7)

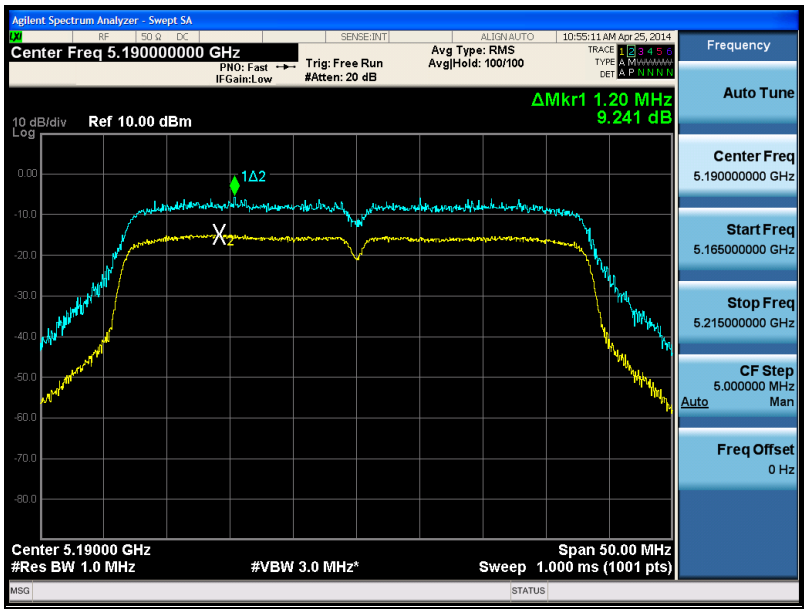


- 11an_HT40

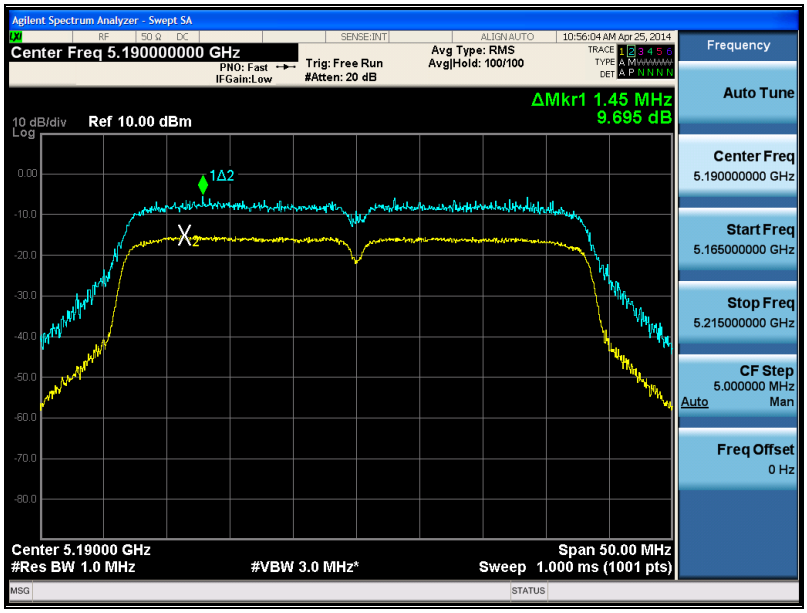
5 190 ㎒(MCS0)



5 190 ㎒(MCS1)

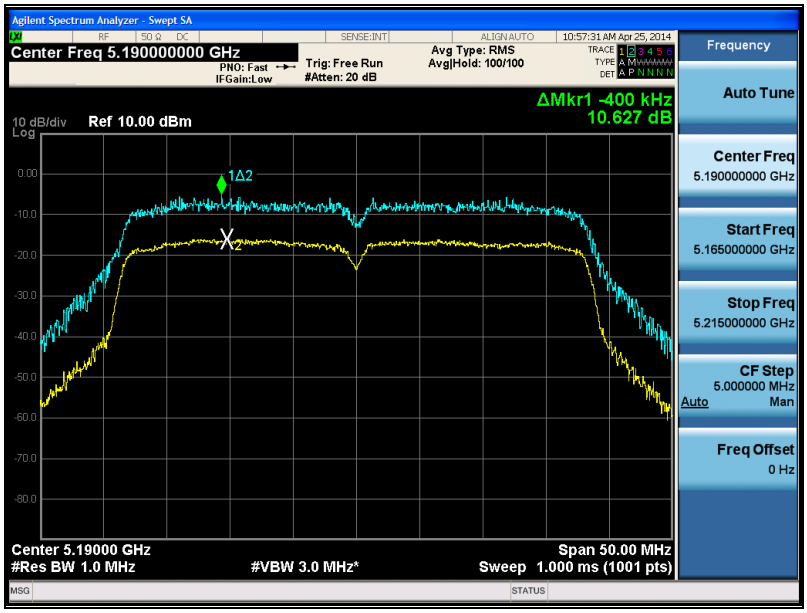


5 190 ㎒(MCS2)

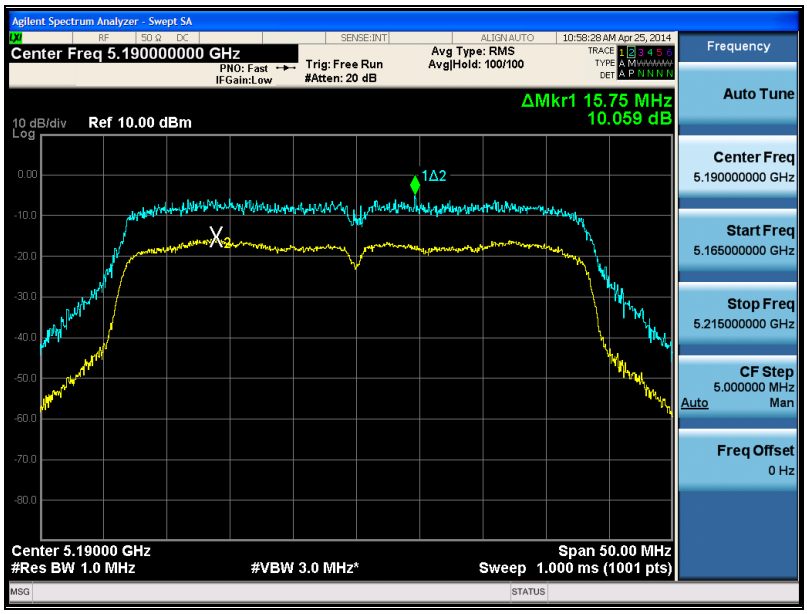


5 190 ㎒(MCS3)

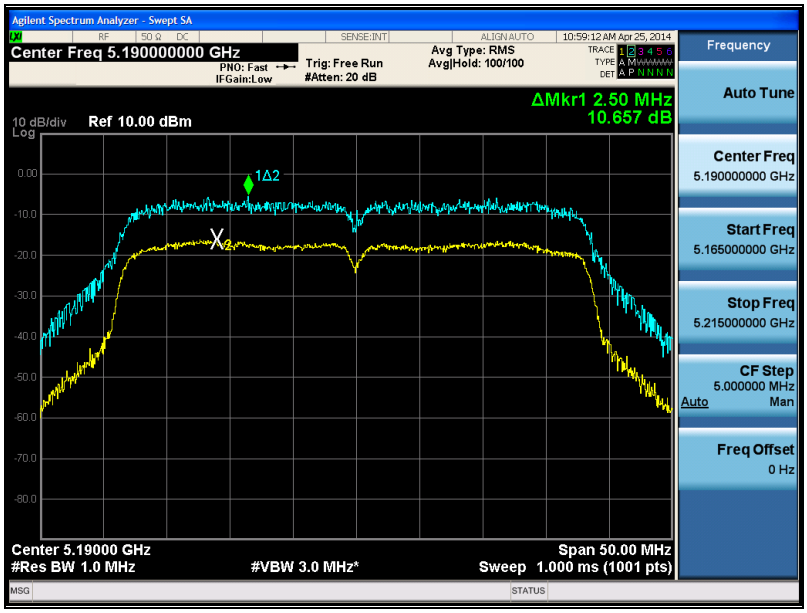
5 190 ㎒(MCS4)



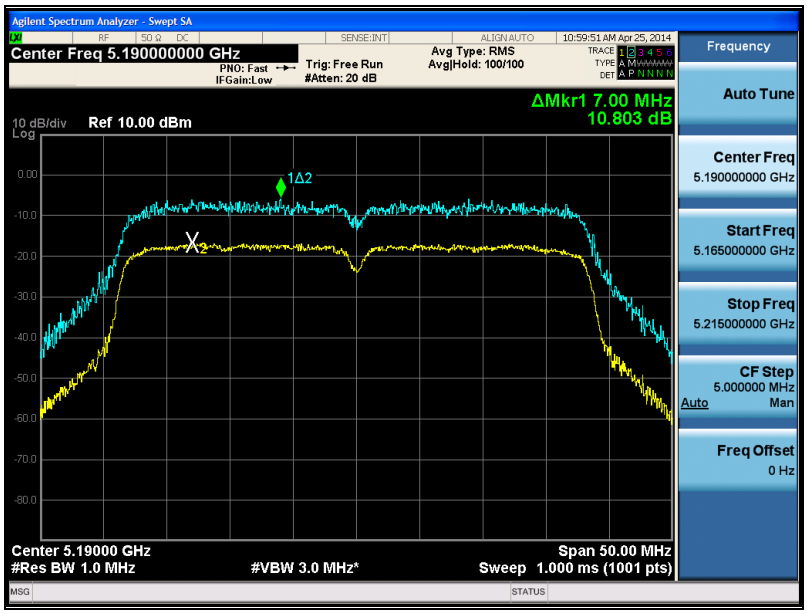
5 190 ㎒(MCS5)



5 190 ㎒(MCS6)

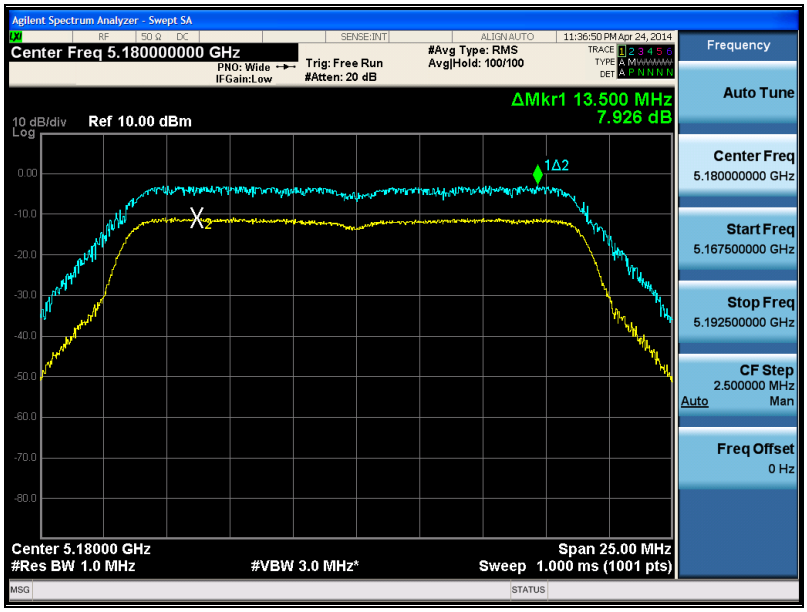


5 190 ㎒(MCS7)

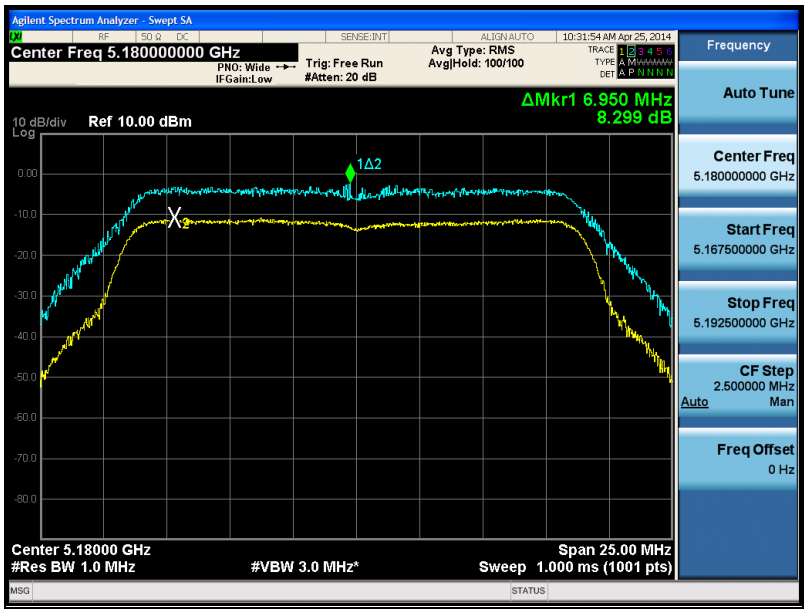


- 11ac_VHT20

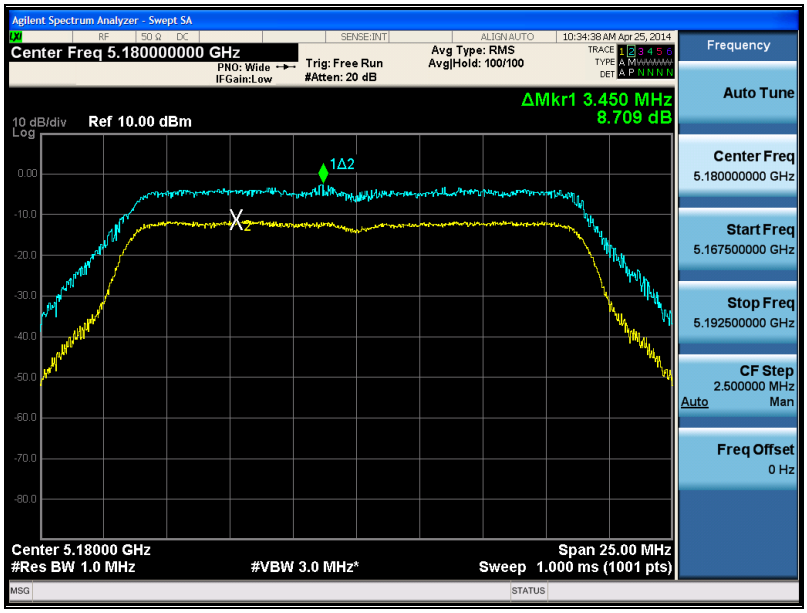
5 180 ㎒(MCS0)



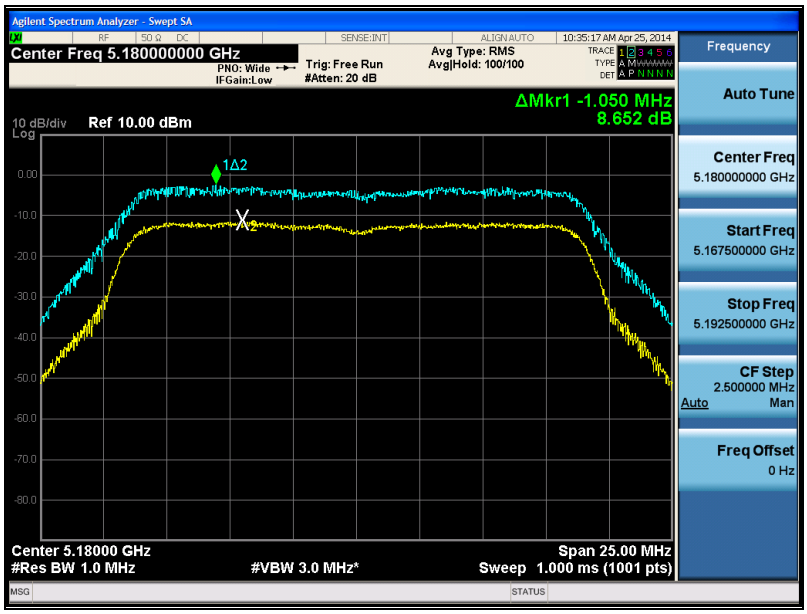
5 180 ㎒(MCS1)



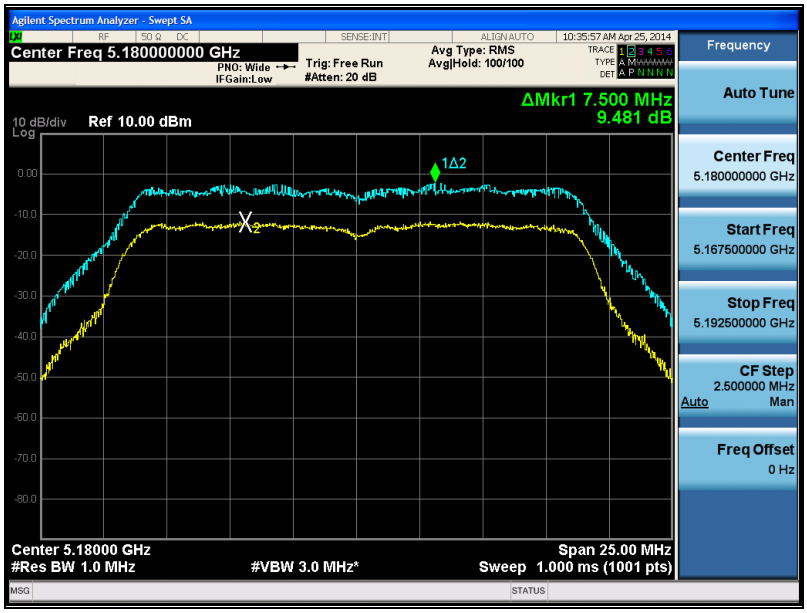
5 180 ㎒(MCS2)



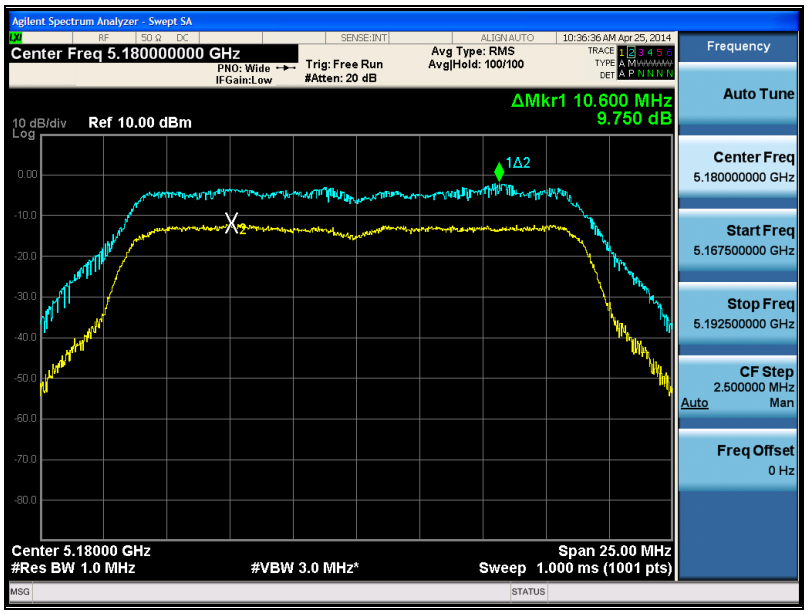
5 180 ㎒(MCS3)



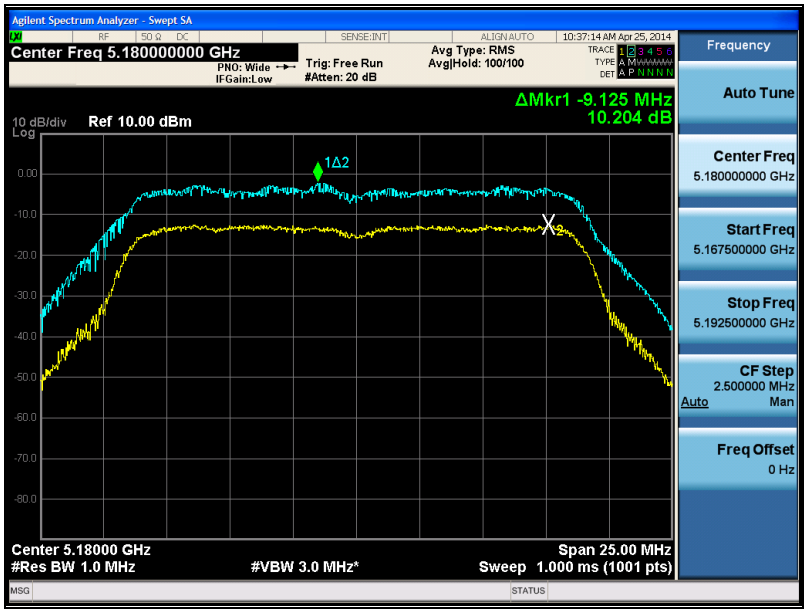
5 180 ㎒(MCS4)



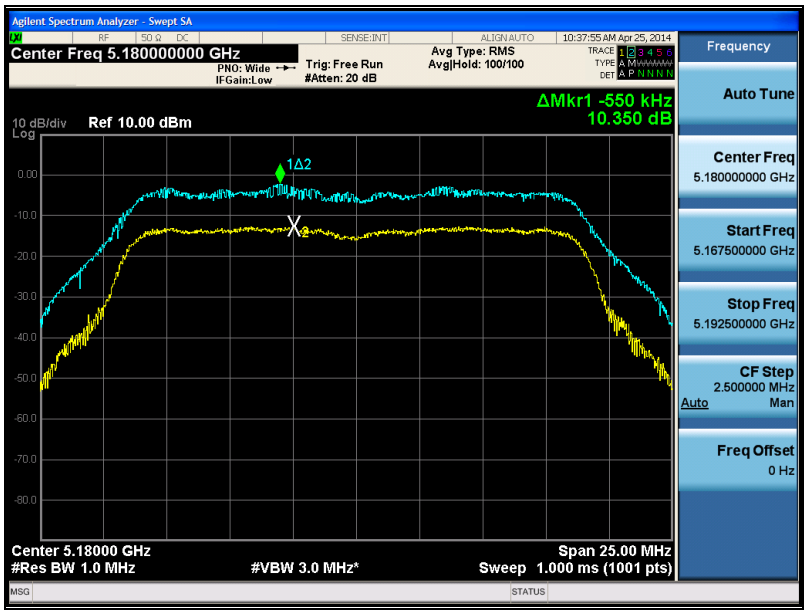
5 180 ㎒(MCS5)



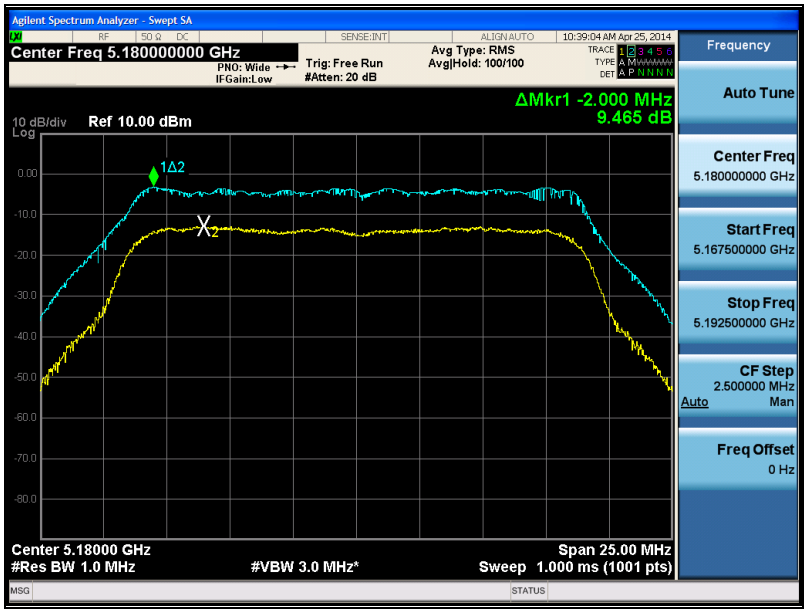
5 180 ㎒(MCS6)



5 180 ㎒(MCS7)

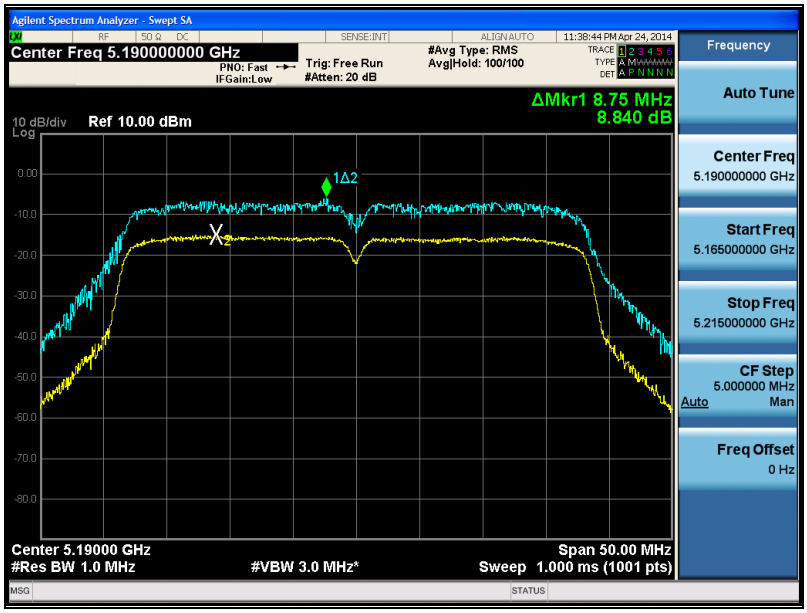


5 180 ㎒(MCS8)

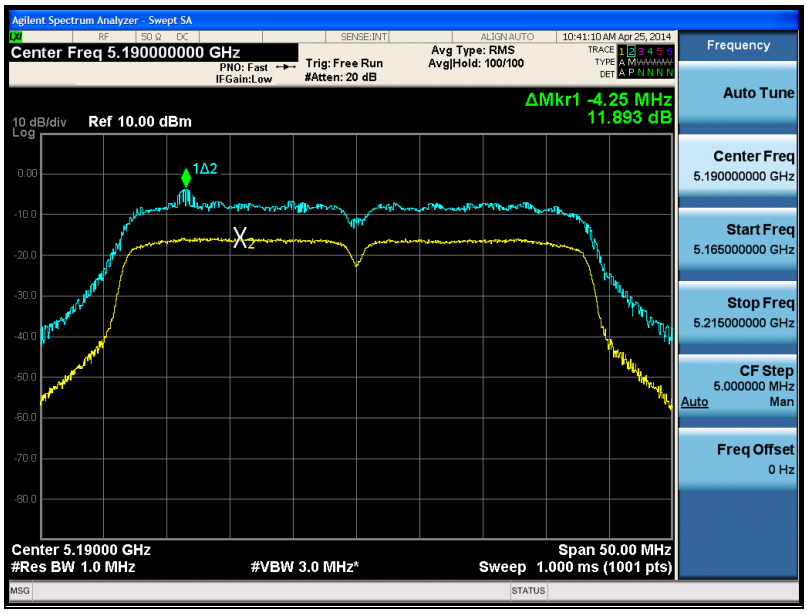

Agilent Spectrum Analyzer - Swept SA
Center Freq 5.180000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: RMS
Avg|Hold: 100/100
10:39:04 AM Apr 25, 2014
ΔMkr1 -2.000 MHz
9.465 dB
10 dB/div
Log
Ref 10.00 dBm
1Δ2
X2
Center 5.18000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Span 25.00 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
5.180000000 GHz
Start Freq
5.167500000 GHz
Stop Freq
5.192500000 GHz
CF Step
2.500000 MHz
Auto
Man
Freq Offset
0 Hz

- 11ac_VHT40

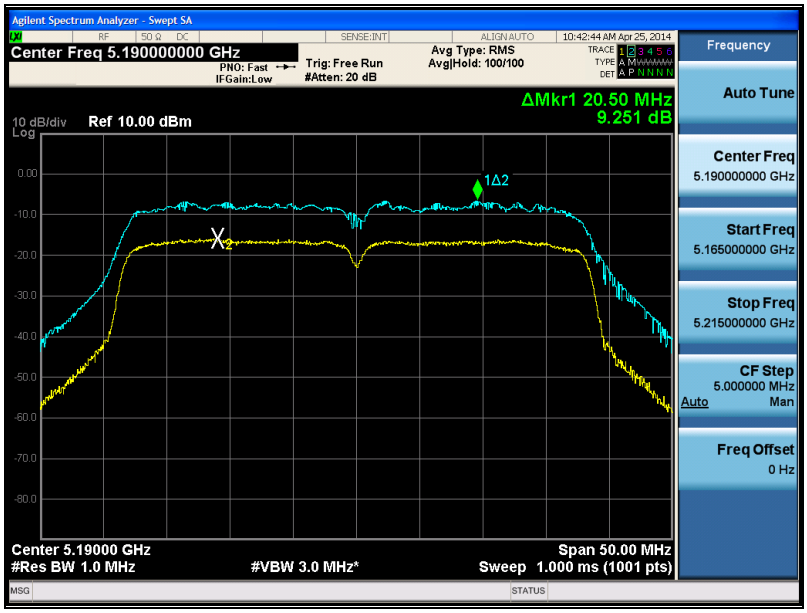
5 190 ㎒(MCS0)



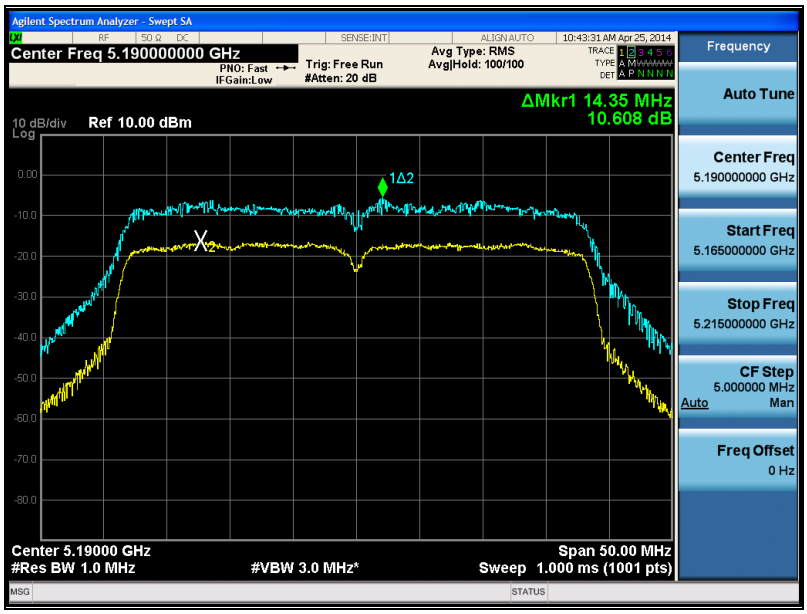
5 190 ㎒(MCS1)



5 190 ㎒(MCS2)

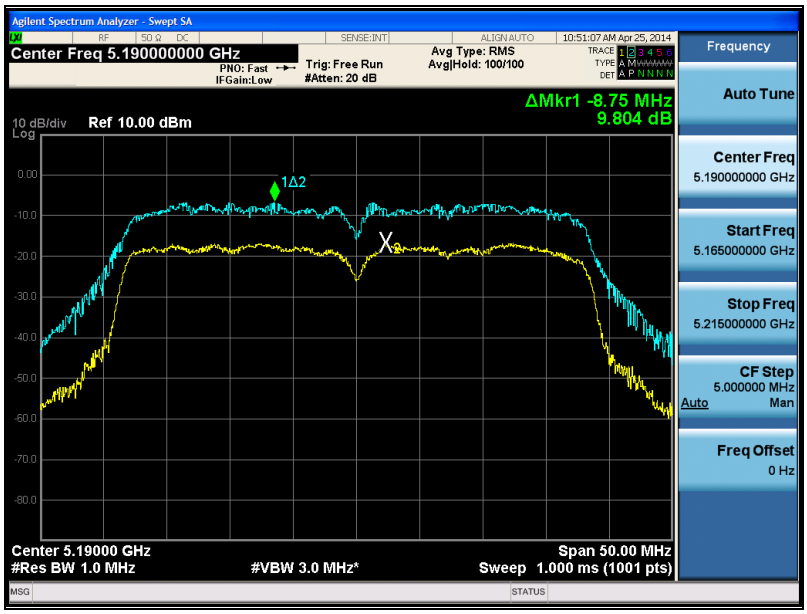


5 190 ㎒(MCS3)

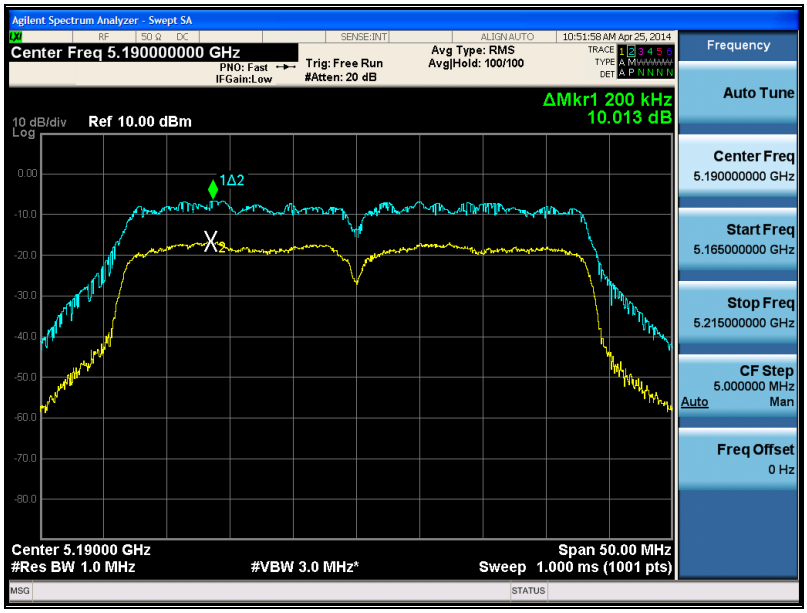


5 190 ㎒(MCS4)

5 190 ㎒(MCS5)

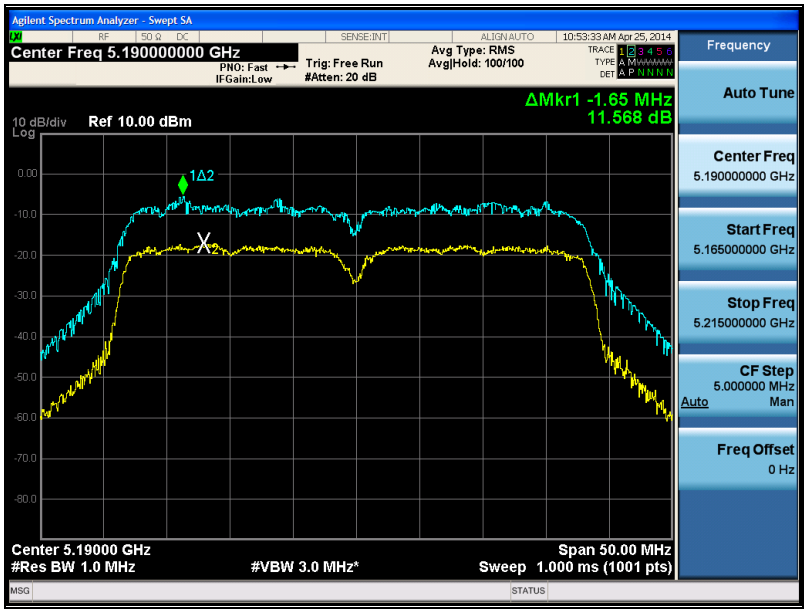


5 190 ㎒(MCS6)

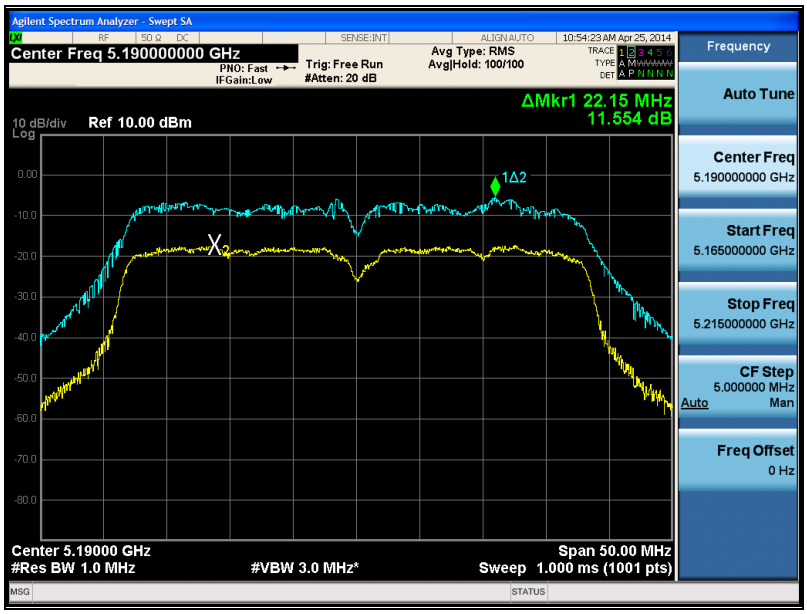


5 190 ㎒(MCS7)

5 190 ㎒(MCS8)

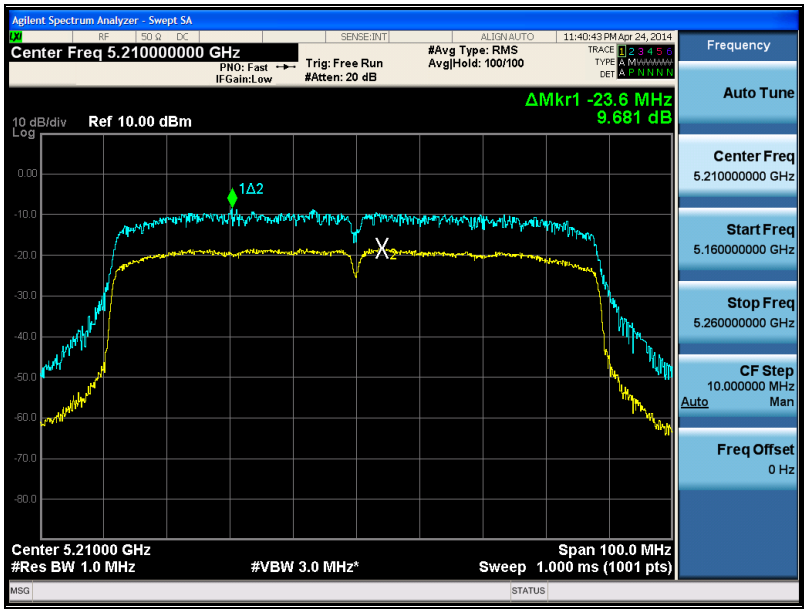


5 190 ㎒(MCS9)

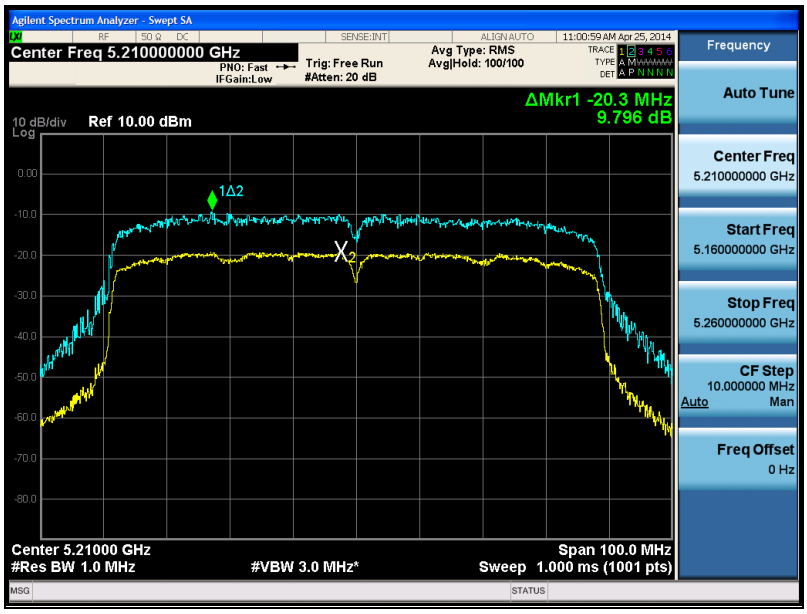


- 11ac_VHT80

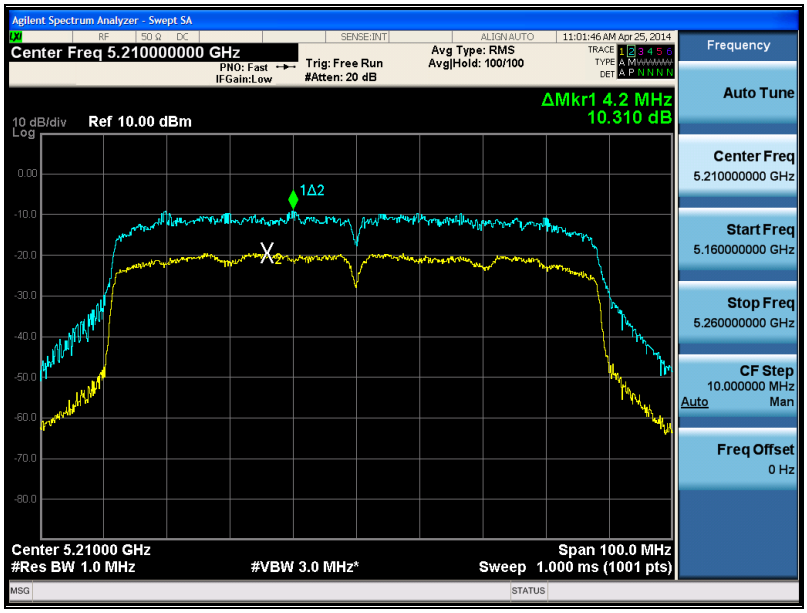
5 210 ㎒(MCS0)



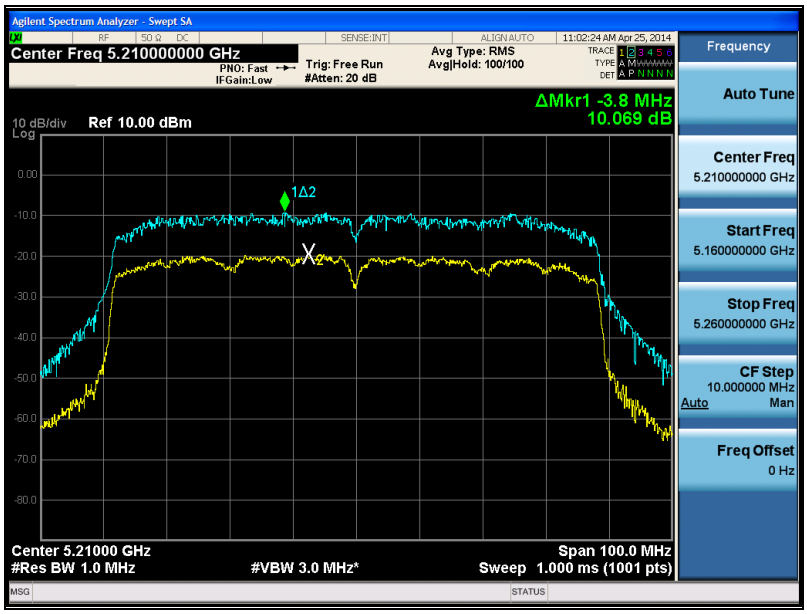
5 210 ㎒(MCS1)



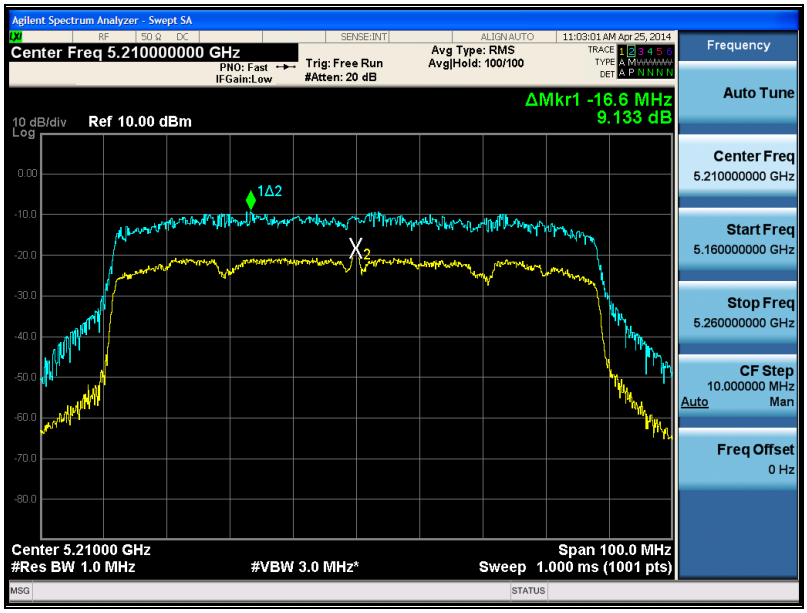
5 210 ㎒(MCS2)



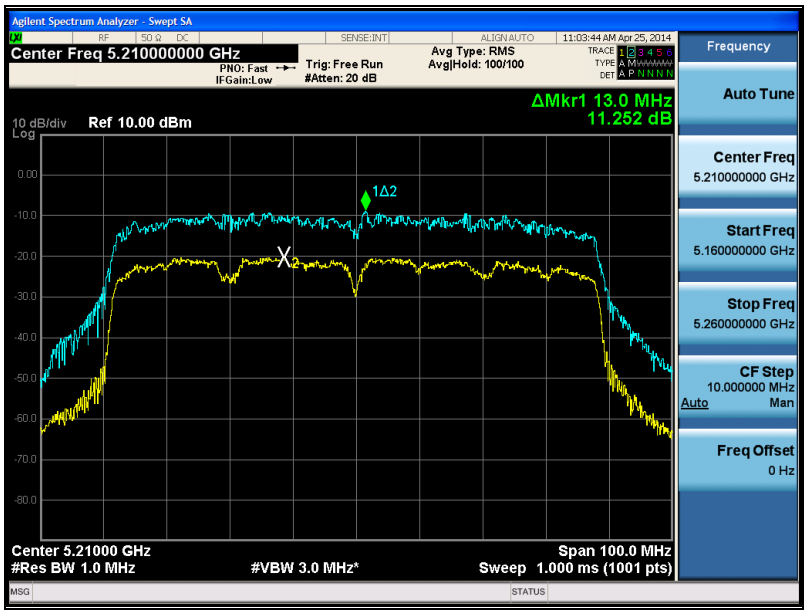
5 210 ㎒(MCS3)



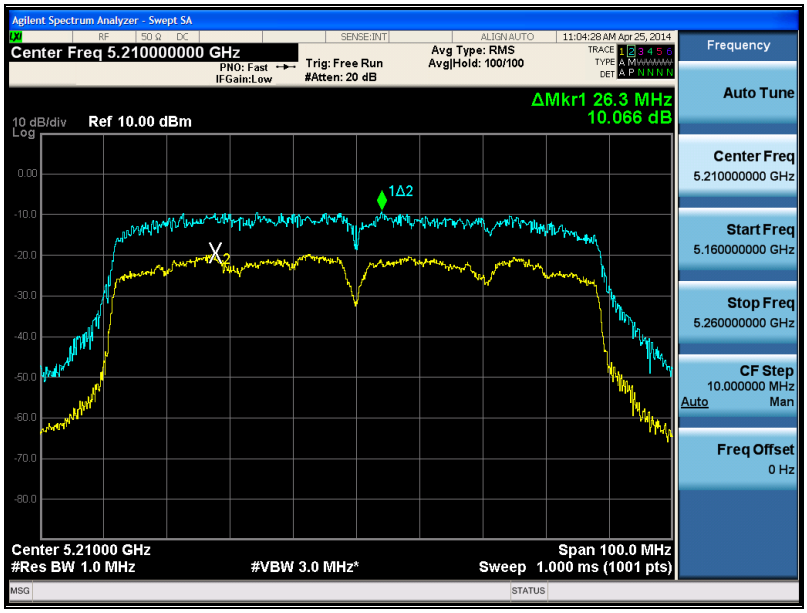
5 210 ㎒(MCS4)



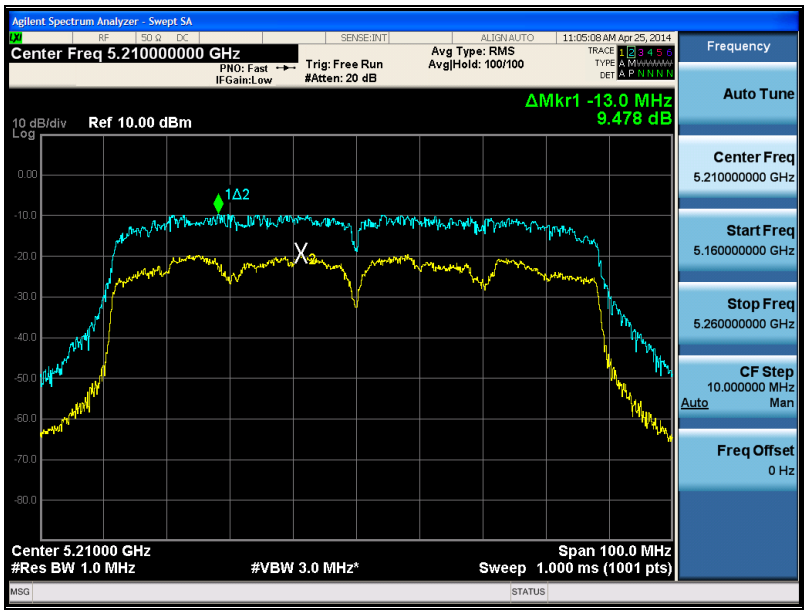
5 210 ㎒(MCS5)



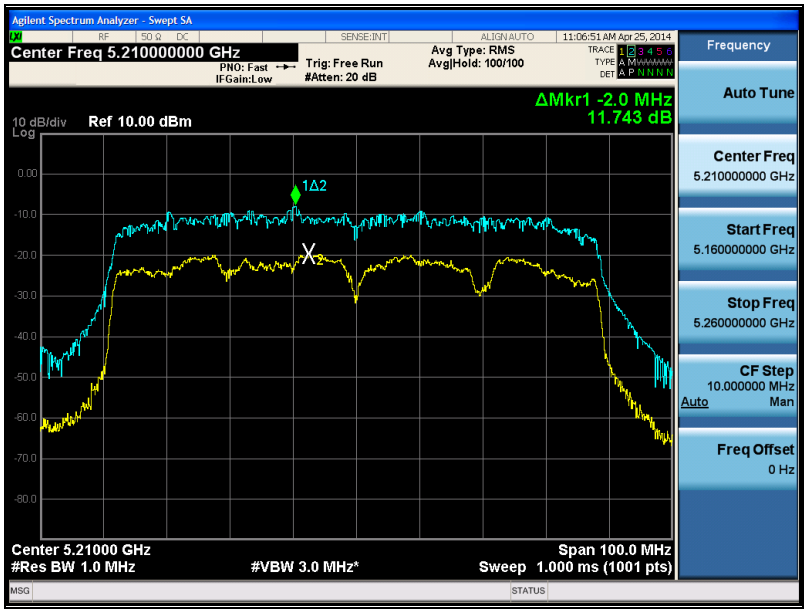
5 210 ㎒(MCS6)



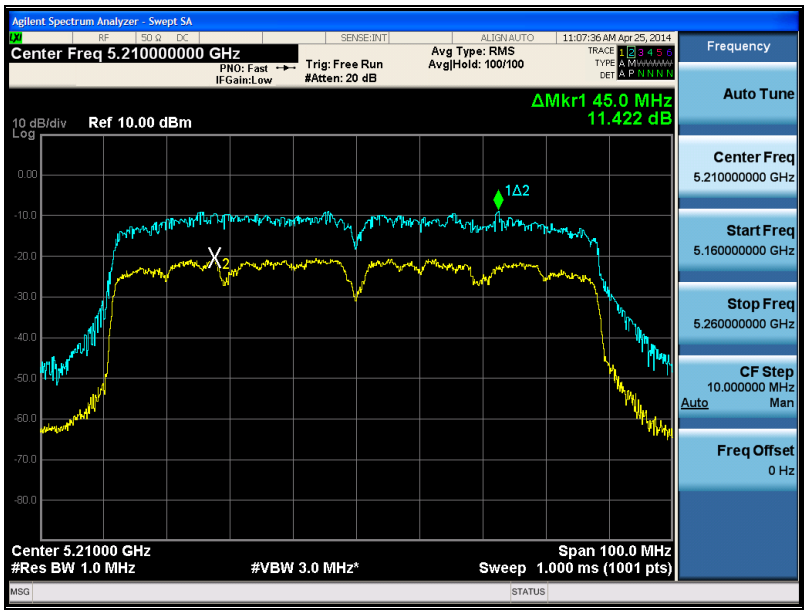
5 210 ㎒(MCS7)



5 210 ㎒(MCS8)

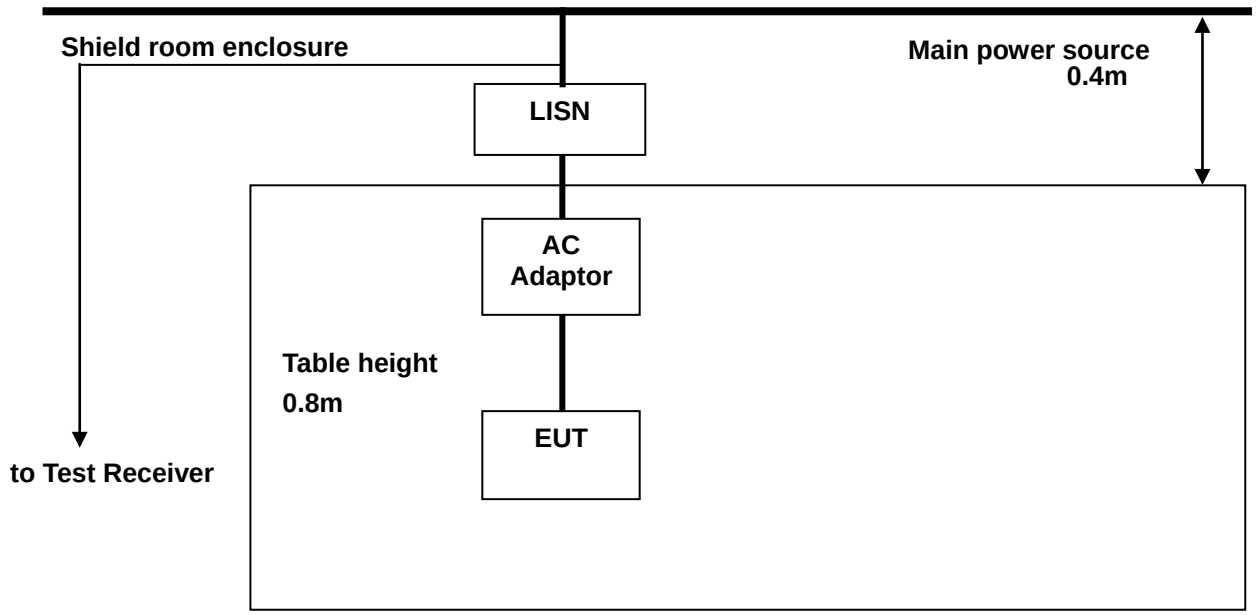


5 210 ㎒(MCS9)



7. Transmitter AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

7.3. Test Procedures

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.
AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2003

1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.

7.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line

Ambient temperature : (23 ± 2) ℃
Relative humidity : 47 % R.H.

Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

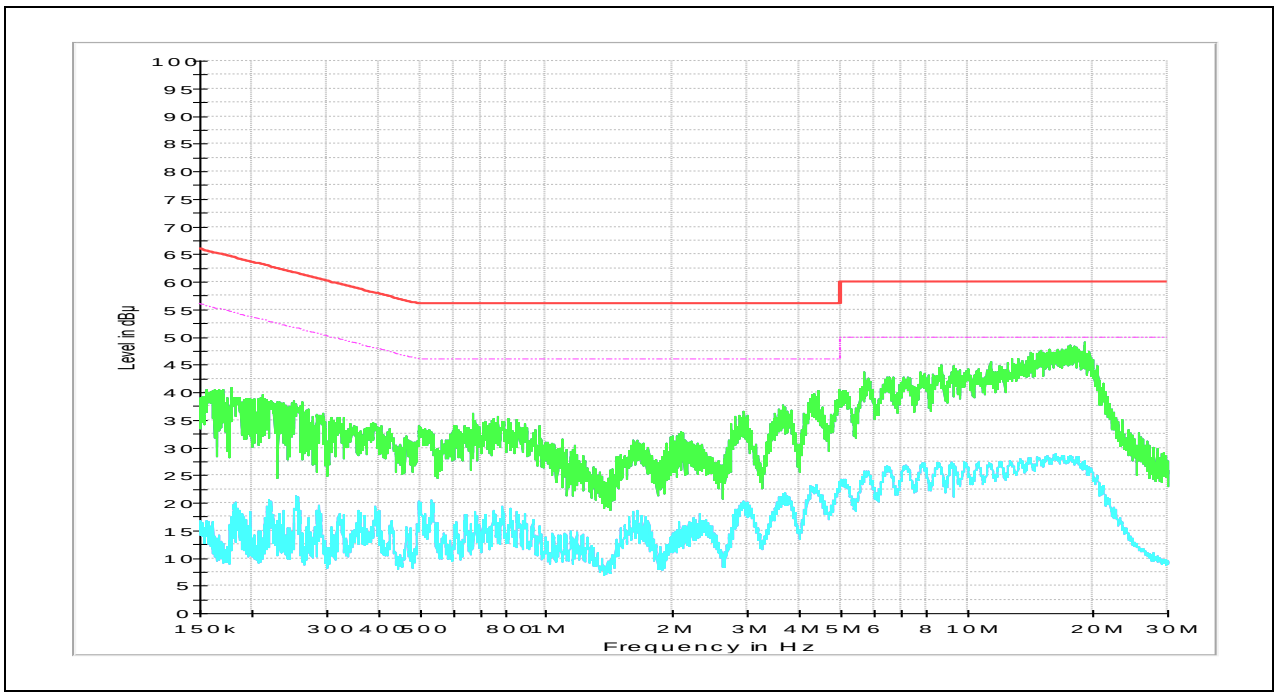
FREQ.	LEVEL(dB㎶)		LINE	LIMIT(dB㎶)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.18	34.60	19.40	H	64.49	54.49	29.89	35.09
0.29	27.80	21.30	H	60.52	50.52	32.72	29.22
0.77	31.50	19.70	H	56.00	46.00	24.50	26.30
3.53	34.10	24.70	H	56.00	46.00	21.90	21.30
9.10	40.00	30.20	H	60.00	50.00	20.00	19.80
16.05	41.30	30.80	H	60.00	50.00	18.70	19.20
0.18	35.30	19.50	N	64.49	54.49	29.19	34.99
0.26	25.20	11.90	N	61.43	51.43	36.23	39.53
0.50	29.80	19.90	N	56.00	46.00	26.20	26.10
5.78	35.50	25.50	N	60.00	50.00	24.50	24.50
11.32	38.30	27.20	N	60.00	50.00	21.70	22.80
19.02	41.00	27.40	N	60.00	50.00	19.00	22.60

Remark;

1. Line (H): Hot, Line (N): Neutral
2. All modes of operation were investigated and the worst-case emissions were reported using 11a Mode 6 Mbps, 44 channel
3. Traces shown in plot mad using a peak detector and average detector
4. The limit for Class B device(s) from 150 ㎑ to 30 ㎒ are specified in Section of the Title 47 CFR.
5. Deviations to the Specifications: None.

Plots of Conducted Power line

Test mode : (Neutral)



Test mode : (Hot)