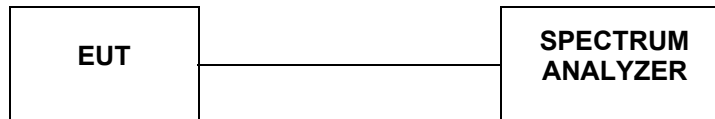


4.7. 26dBc Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

According to KDB789033 D02 General UNII Test Procedures New Rules v01 for one of the following procedures may be used for Emission Bandwidth (EBW) measurement:

- Set RBW = 300 kHz (approximately 1% of the emission bandwidth).
- Set the video bandwidth (VBW) = 1000 KHz (VBW > RBW)
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize
- Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

LIMIT

No Limits for 26dBc Bandwidth

TEST RESULTS

For UNII-1 Band

4.7.1 801.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
36	5180	19.03	Plot 4.7.1 A	---	PASS
40	5200	20.27	Plot 4.7.1 B	---	PASS
48	5240	19.00	Plot 4.7.1 C	---	PASS

Note:

- For 802.11a mode at final test to get the worst-case emission at 6Mbps.
- The test results including the cable loss.

4.7.2 801.11n HT20 Test Mode

A. Test Verdict

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Verdict
36	5180	19.25	Plot 4.7.2 A	---	PASS
40	5200	19.93	Plot 4.7.2 B	---	PASS
48	5240	19.39	Plot 4.7.2 C	---	PASS

Note:

- For 802.11n HT20 mode at final test to get the worst-case emission at 6.5Mbps.
- The test results including the cable loss.

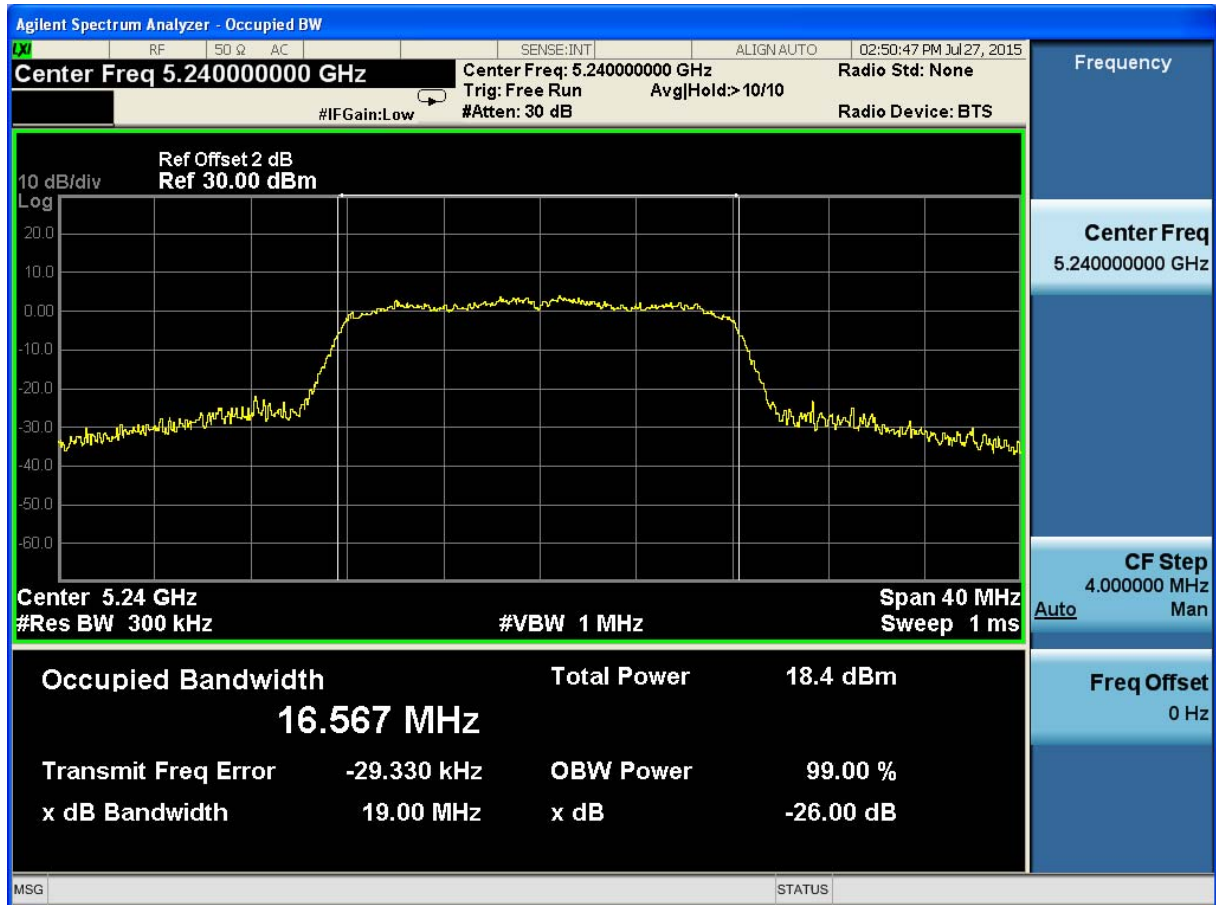
B. Test Plots



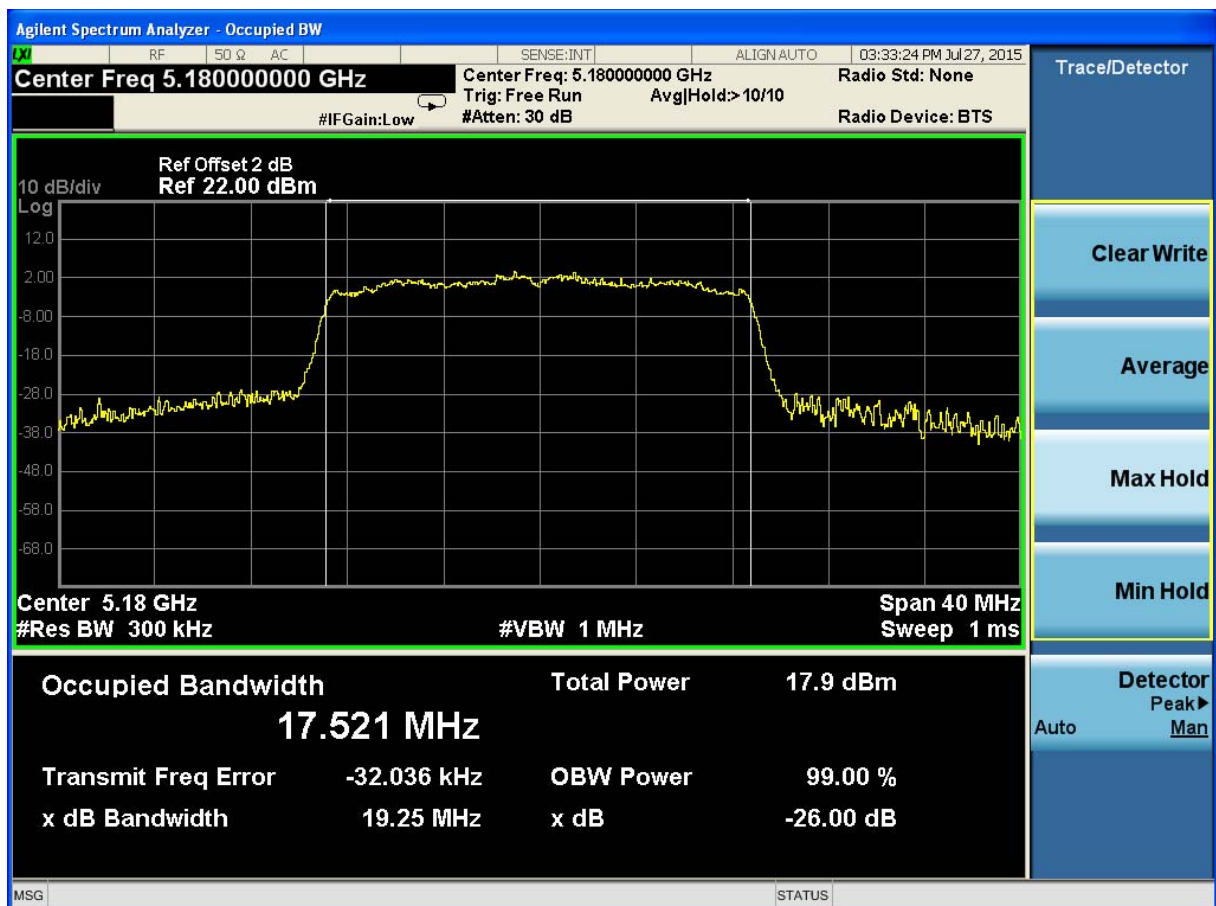
(Plot 4.7.1 A: Channel 36: 5180MHz @ 802.11a)



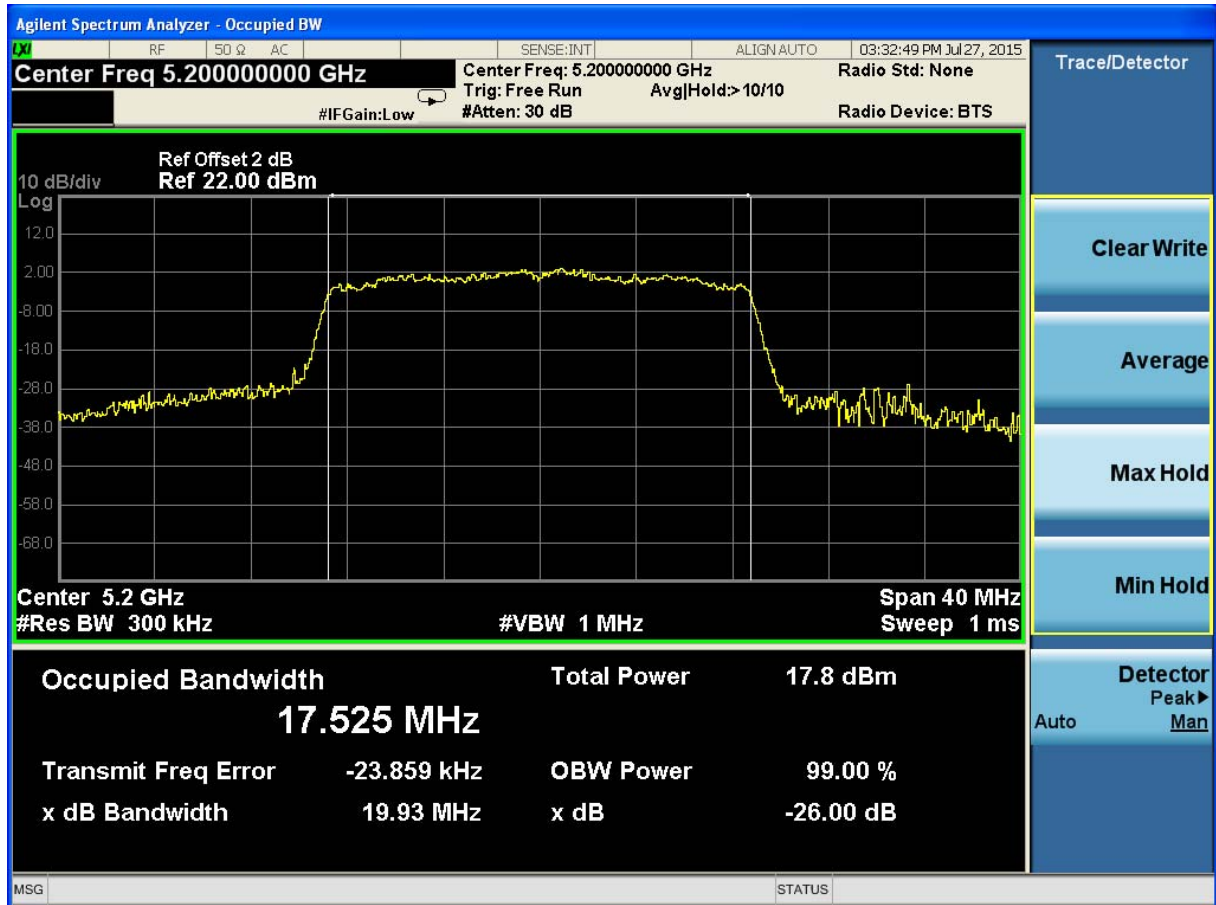
(Plot 4.7.1 B: Channel 40: 5200MHz @ 802.11a)



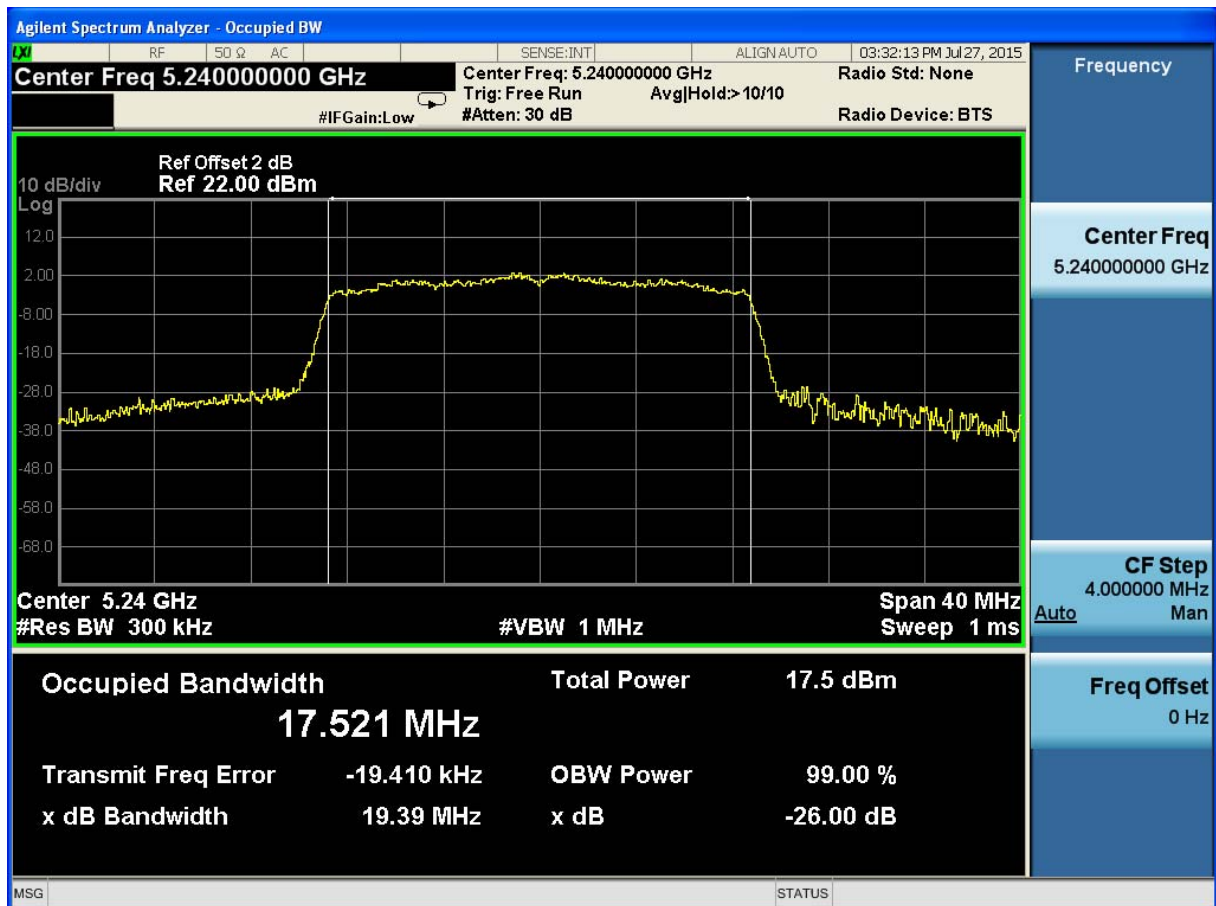
(Plot 4.7.1 C: Channel 48: 5240MHz @ 802.11a)



(Plot 4.7.2 A: Channel 36: 5180MHz @ 802.11n HT20)



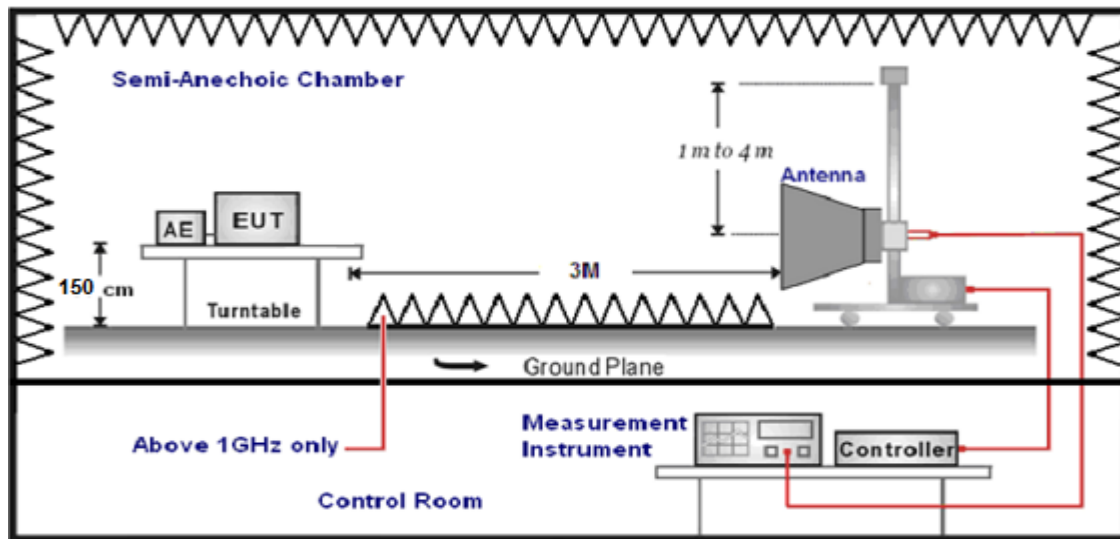
(Plot 4.7.2 B: Channel 40: 5200MHz @ 802.11n HT20)



(Plot 4.7.2 C: Channel 48: 5240MHz @ 802.11n HT20)

4.8. Band Edge Compliance

TEST CONFIGURATION



LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz})) + 40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz})) + 40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30) + 40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

According to §15.407 (b): Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits

Frequency (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBμV/m)
5150-5250	-27	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
5725-5850	-27 (beyond 10MHz of the bandedge)	68.3
	-17 (within 10 MHz of band edge)	78.3

TEST PROCEDURE

- The EUT was placed on a turn table which is 1.5m above 1GHz.
- Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT.
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Repeat above procedures until all frequency measurements have been completed..
- The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
1GHz-18GHz	Double Ridged Horn Antenna	3

- Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-18GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

$$\text{Transd} = \text{AF} + \text{CL} - \text{AG}$$

TEST RESULTS

Remark:

1. We measured at all data rate and recorded worst case at lowest data rate;
2. We measured at both 802.11 a and 802.11 n HT20 mode, recorded worst case at 802.11 a mode;

For UNII-1 Band

Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
5150.00	36.32	35.58	29.04	8.28	51.14	68.30	-17.16	Peak	Horizontal
5150.00	27.21	35.58	29.04	8.28	42.03	54.00	-11.97	AV ^[1]	Horizontal
5174.60	84.06	35.55	29.04	8.28	98.85	---	---	Peak	Horizontal
5175.00	75.17	35.55	29.04	8.28	89.96	---	---	AV ^[1]	Horizontal
5150.00	34.89	35.58	29.04	8.28	49.71	68.30	-18.59	Peak	Vertical
5150.00	25.84	35.58	29.04	8.28	40.66	54.00	-13.34	AV ^[1]	Vertical
5177.90	77.46	35.55	29.04	8.28	92.25	---	---	Peak	Vertical
5177.55	68.98	35.55	29.04	8.28	83.77	---	---	AV ^[1]	Vertical
5237.46	82.66	35.51	29.05	8.32	97.44	---	---	Peak	Horizontal
5238.65	74.13	35.51	29.05	8.32	88.91	---	---	AV ^[1]	Horizontal
5350.00	35.30	35.42	29.06	8.39	50.05	68.30	-18.25	Peak	Horizontal
5350.00	26.44	35.42	29.06	8.39	41.19	54.00	-12.81	AV ^[1]	Horizontal
5243.26	79.26	35.51	29.05	8.32	94.04	---	---	Peak	Vertical
4242.30	71.90	35.51	29.05	8.32	86.68	---	---	AV ^[1]	Vertical
5350.00	34.07	35.42	29.06	8.39	48.82	68.30	-19.48	Peak	Vertical
5350.00	25.31	35.42	29.06	8.39	40.06	54.00	-13.94	AV ^[1]	Vertical

REMARKS:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. The other emission levels were very low against the limit.
3. Over Limit=Emission Level - Limit.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=10Hz/Sweep time=Auto/Detector=Peak;

For UNII-3 Band

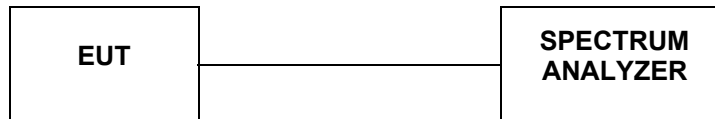
Freq (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
5725.00	40.21	35.69	29.13	8.65	55.42	78.30	-22.88	Peak	Horizontal
5725.00	30.76	35.69	29.13	8.65	45.97	68.30	-22.33	AV ^[1]	Horizontal
5740.12	82.58	35.69	29.14	8.69	97.82	---	---	Peak	Horizontal
5743.35	73.54	35.69	29.14	8.69	88.78	---	---	AV ^[1]	Horizontal
5725.00	36.42	35.69	29.13	8.65	51.63	78.30	-26.67	Peak	Vertical
5725.00	26.85	35.69	29.13	8.65	42.06	68.30	-26.24	AV ^[1]	Vertical
5737.95	78.22	35.69	29.14	8.69	93.46	---	---	Peak	Vertical
5751.50	66.00	35.69	29.14	8.69	81.24	---	---	AV ^[1]	Vertical
5826.92	83.35	35.82	29.16	8.77	98.78	---	---	Peak	Horizontal
5828.41	73.99	35.82	29.16	8.77	89.42	---	---	AV ^[1]	Horizontal
5850.00	36.90	35.85	29.16	8.77	52.36	78.30	-15.94	Peak	Horizontal
5850.00	27.53	35.85	29.16	8.77	42.99	68.30	-11.01	AV ^[1]	Horizontal
5820.43	73.29	35.82	29.16	8.77	88.72	---	---	Peak	Vertical
5819.09	64.22	35.82	29.16	8.77	79.65	---	---	AV ^[1]	Vertical
5850.00	34.67	35.85	29.16	8.77	50.13	78.30	-18.17	Peak	Vertical
5850.00	27.06	35.85	29.16	8.77	42.52	68.30	-11.48	AV ^[1]	Vertical

REMARKS:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. The other emission levels were very low against the limit.
3. Over Limit=Emission Level - Limit.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=10Hz/Sweep time=Auto/Detector=Peak;

4.9. Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=1MHz and VBW= 3MHz to measure the peak field strength , and measure frequency range from 9KHz to 40GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency or 40GHz. The lowest, middle and highest channels are tested to verify the spurious emissions and bandedge measurement data.

For UNII-1 Band

4.9.1 802.11a Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBm)	Verdict
36	5180	5180MHz	Plot 4.9.1 A1	-27	PASS
		9KHz-30MHz	Plot 4.9.1 A2	-27	PASS
		30MHz-1GHz	Plot 4.9.1 A3	-27	PASS
		1GHz-8GHz	Plot 4.9.1 A4	-27	PASS
		8GHz-16GHz	Plot 4.9.1 A5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.1 A6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.1 A7	-27	PASS
40	5200	5200MHz	Plot 4.9.1 B1	-27	PASS
		9KHz-30MHz	Plot 4.9.1 B2	-27	PASS
		30MHz-1GHz	Plot 4.9.1 B3	-27	PASS
		1GHz-8GHz	Plot 4.9.1 B4	-27	PASS
		8GHz-16GHz	Plot 4.9.1 B5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.1 B6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.1 B7	-27	PASS
48	5240	5240MHz	Plot 4.9.1 C1	-27	PASS
		9KHz-30MHz	Plot 4.9.1 C2	-27	PASS
		30MHz-1GHz	Plot 4.9.1 C3	-27	PASS
		1GHz-8GHz	Plot 4.9.1 C4	-27	PASS
		8GHz-16GHz	Plot 4.9.1 C5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.1 C6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.1 C7	-27	PASS

Note:

1. For 802.11a mode at final test to get the worst-case emission at 6Mbps.
2. The test results including the cable loss.

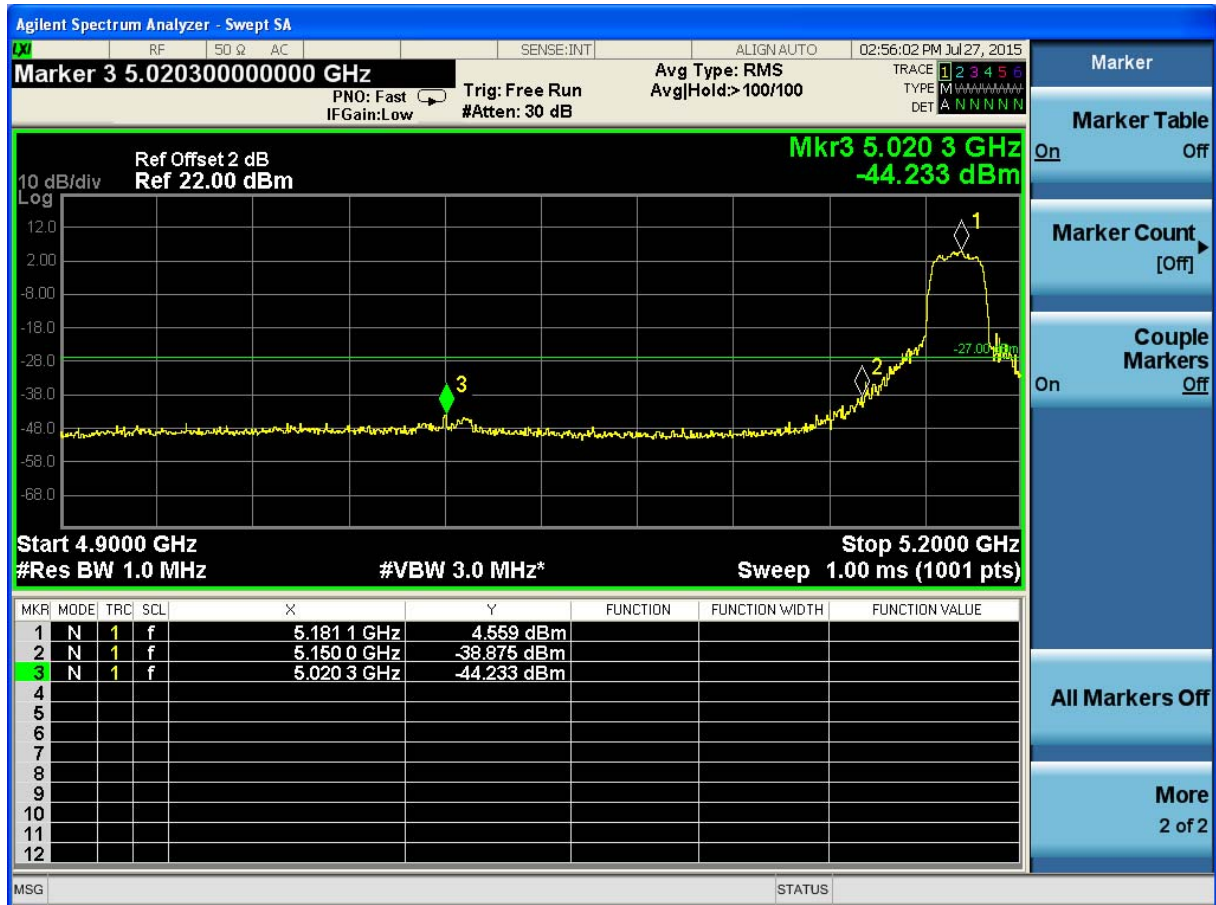
4.9.2 802.11n HT20 Test Mode**A. Test Verdict**

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBm)	Verdict
36	5180	5180MHz	Plot 4.9.2 A1	-27	PASS
		9KHz-30MHz	Plot 4.9.2 A2	-27	PASS
		30MHz-1GHz	Plot 4.9.2 A3	-27	PASS
		1GHz-8GHz	Plot 4.9.2 A4	-27	PASS
		8GHz-16GHz	Plot 4.9.2 A5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.2 A6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.2 A7	-27	PASS
40	5200	5200MHz	Plot 4.9.2 B1	-27	PASS
		9KHz-30MHz	Plot 4.9.2 B2	-27	PASS
		30MHz-1GHz	Plot 4.9.2 B3	-27	PASS
		1GHz-8GHz	Plot 4.9.2 B4	-27	PASS
		8GHz-16GHz	Plot 4.9.2 B5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.2 B6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.2 B7	-27	PASS
48	5240	5240MHz	Plot 4.9.2 C1	-27	PASS
		9KHz-30MHz	Plot 4.9.2 C2	-27	PASS
		30MHz-1GHz	Plot 4.9.2 C3	-27	PASS
		1GHz-8GHz	Plot 4.9.2 C4	-27	PASS
		8GHz-16GHz	Plot 4.9.2 C5	-27	PASS
		16GHz-26.5GHz	Plot 4.9.2 C6	-27	PASS
		26.5GHz-40GHz	Plot 4.9.2 C7	-27	PASS

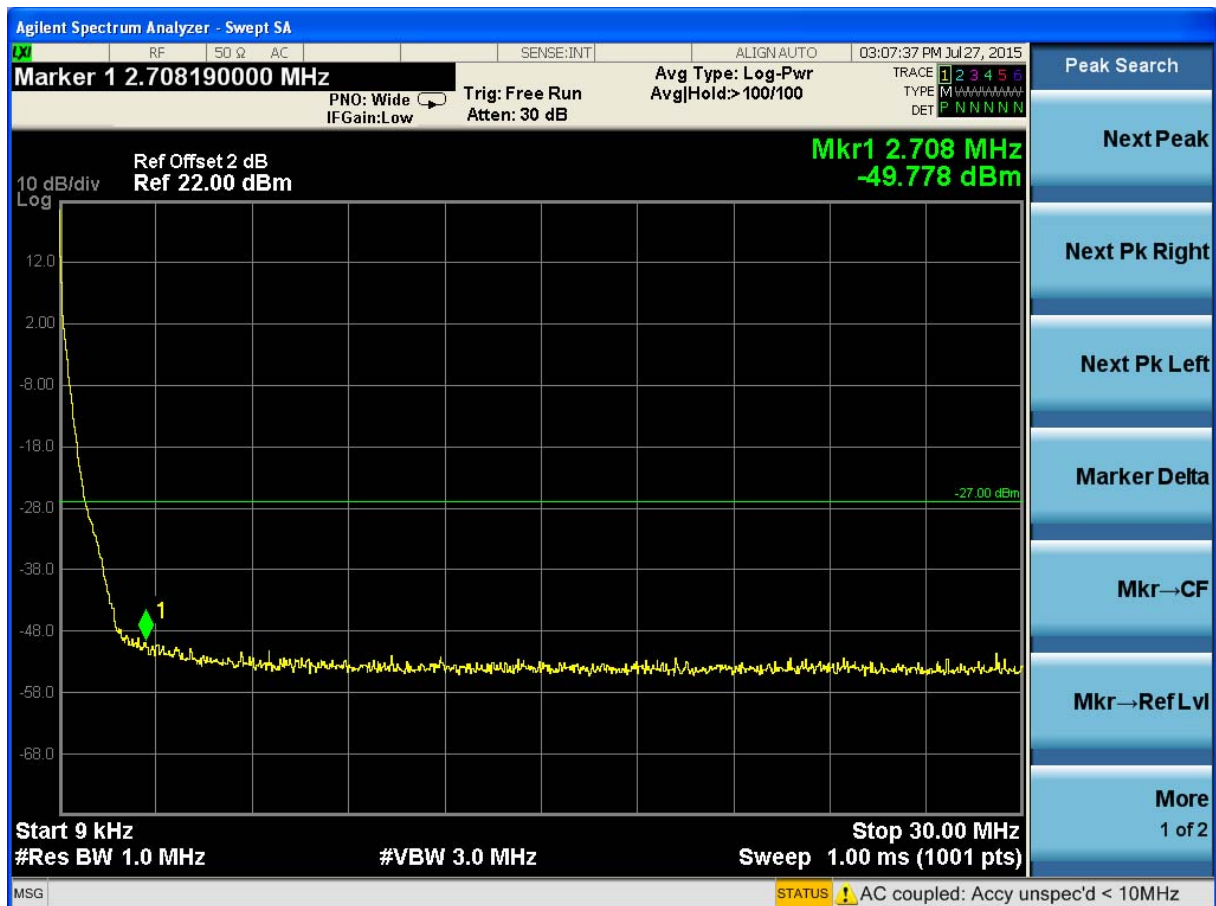
Note:

1. For 802.11n HT20 mode at final test to get the worst-case emission at 6.5Mbps.
2. The test results including the cable loss.

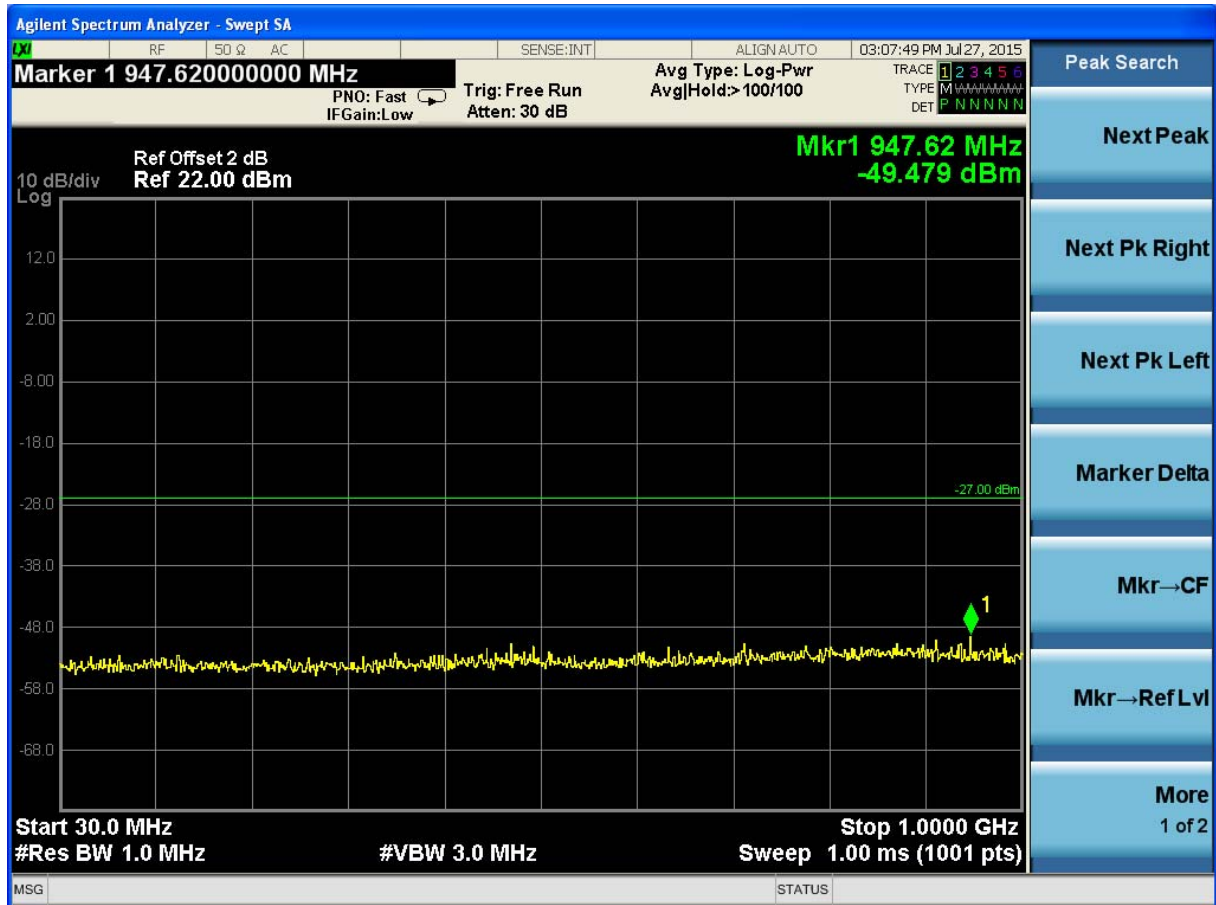
B. Test Plots



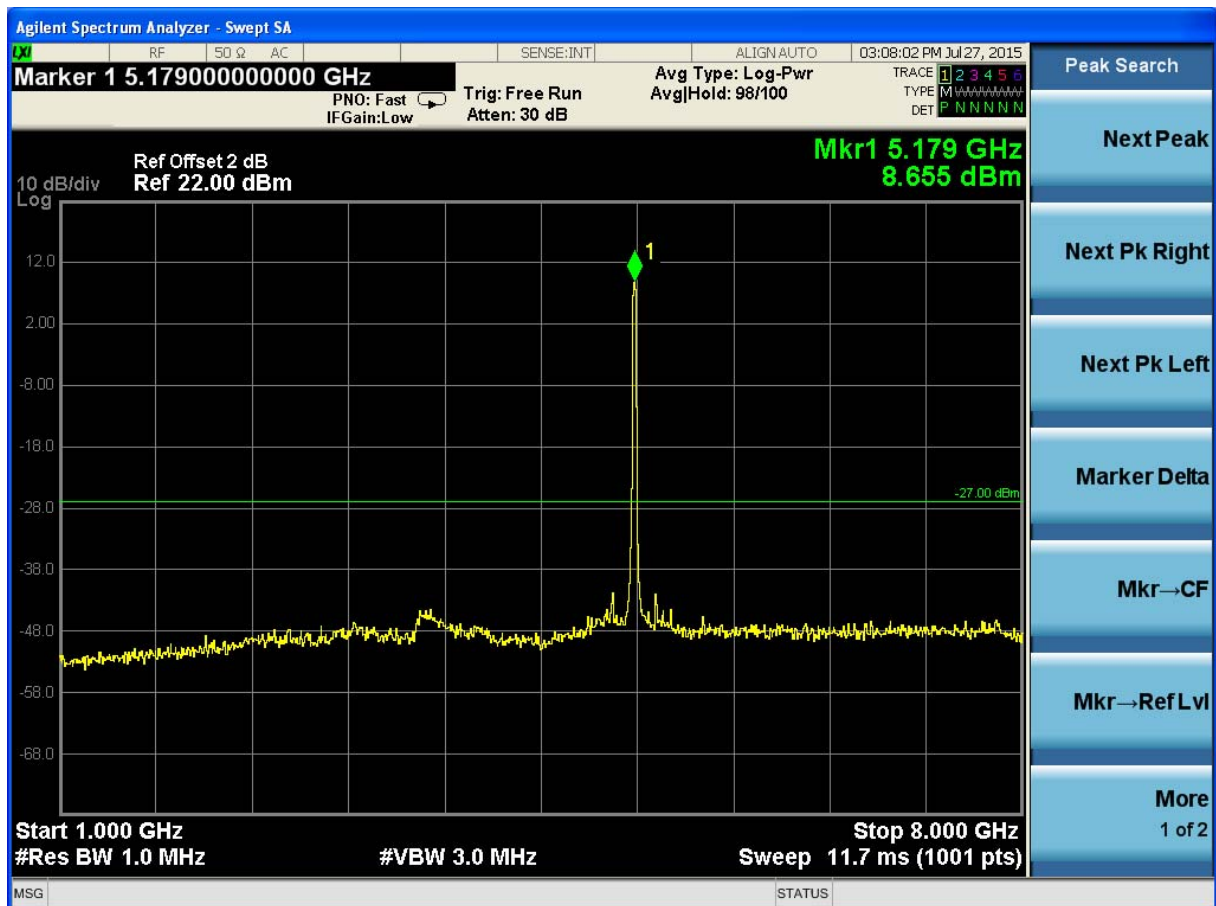
(Plot 4.9.1 A1: Channel 36: 5180MHz @ 802.11a)



(Plot 4.9.1 A2: Channel 36: 5180MHz @ 802.11a)



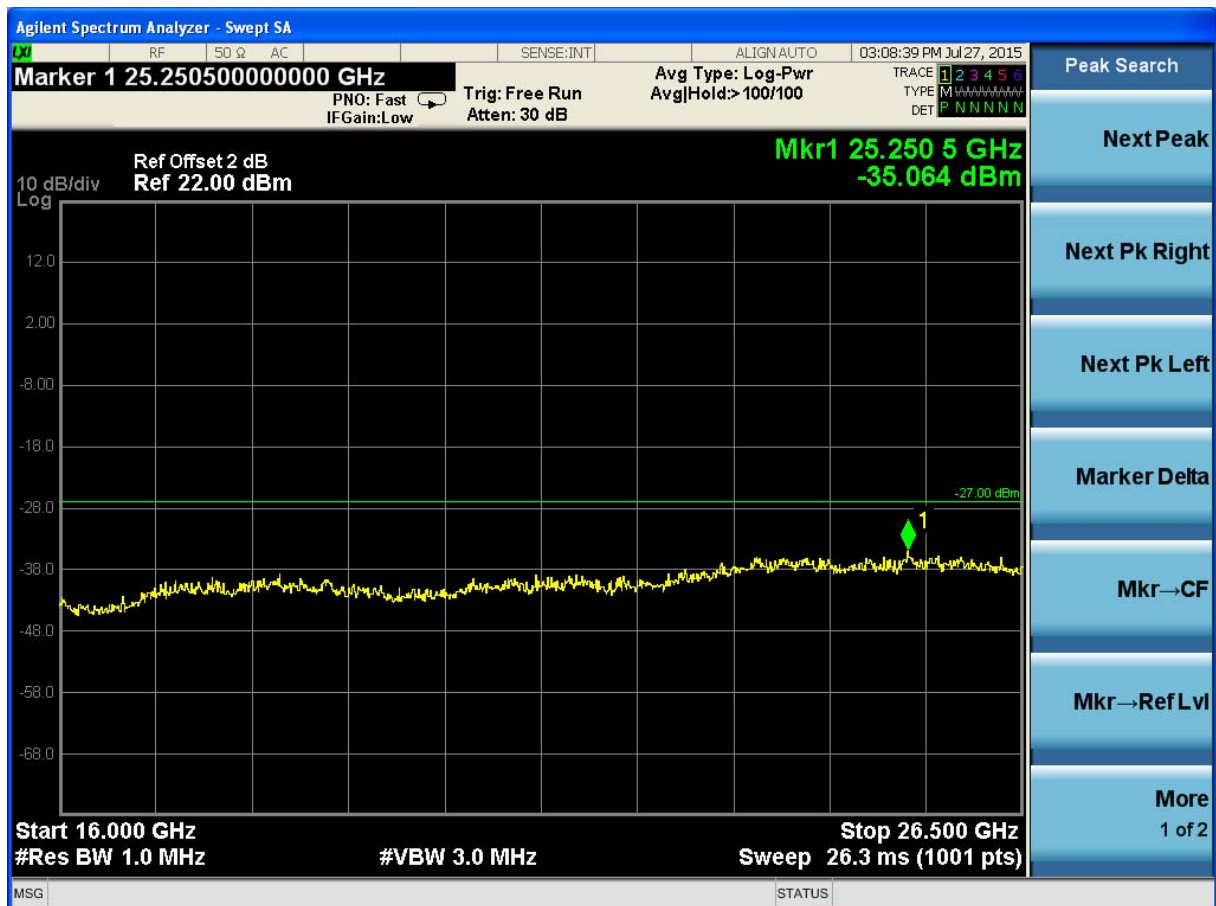
(Plot 4.9.1 A3: Channel 36: 5180MHz @ 802.11a)



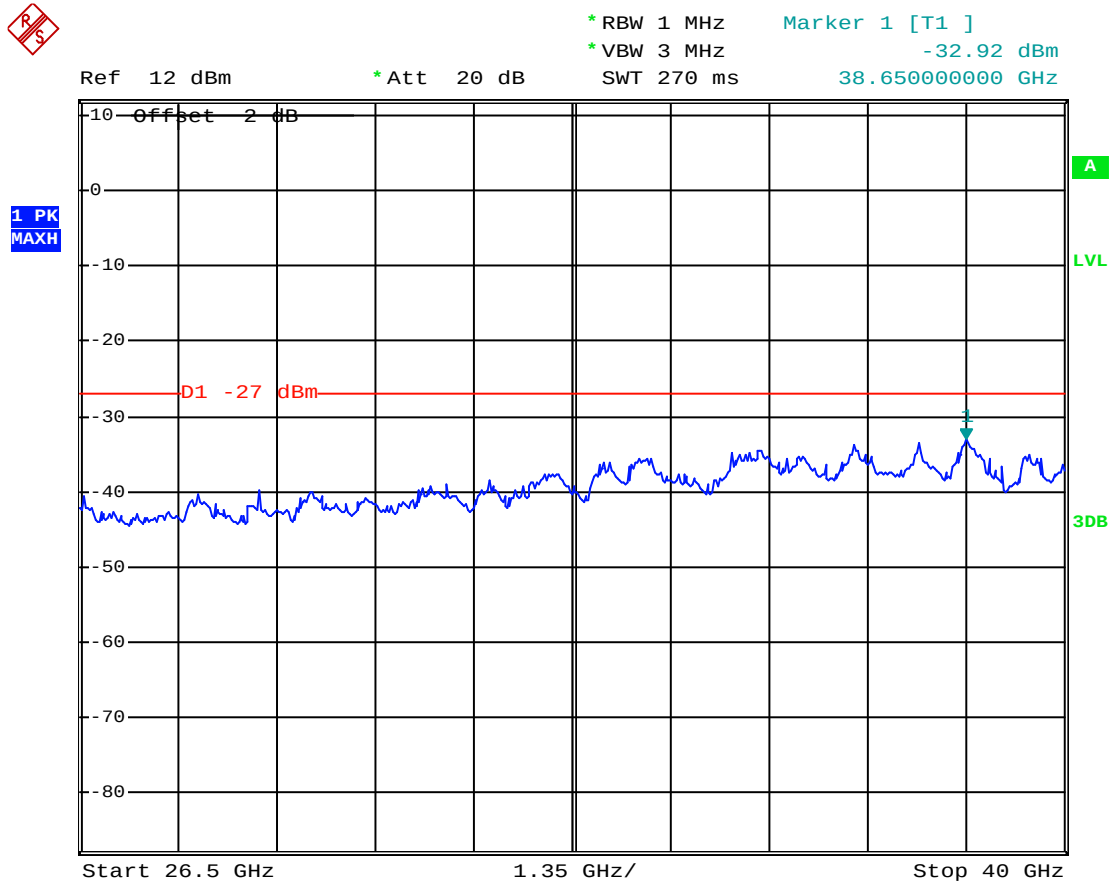
(Plot 4.9.1 A4: Channel 36: 5180MHz @ 802.11a)



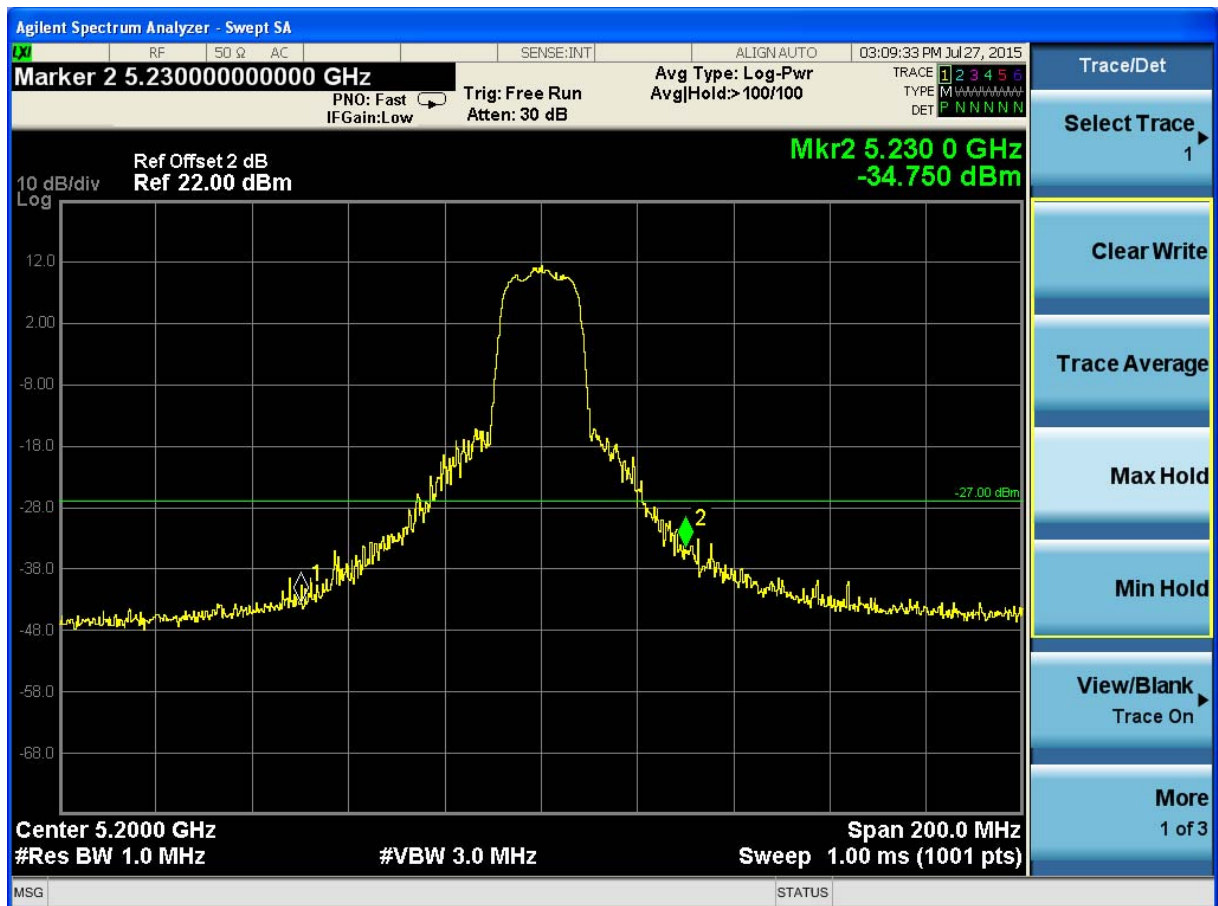
(Plot 4.9.1 A5: Channel 36: 5180MHz @ 802.11a)



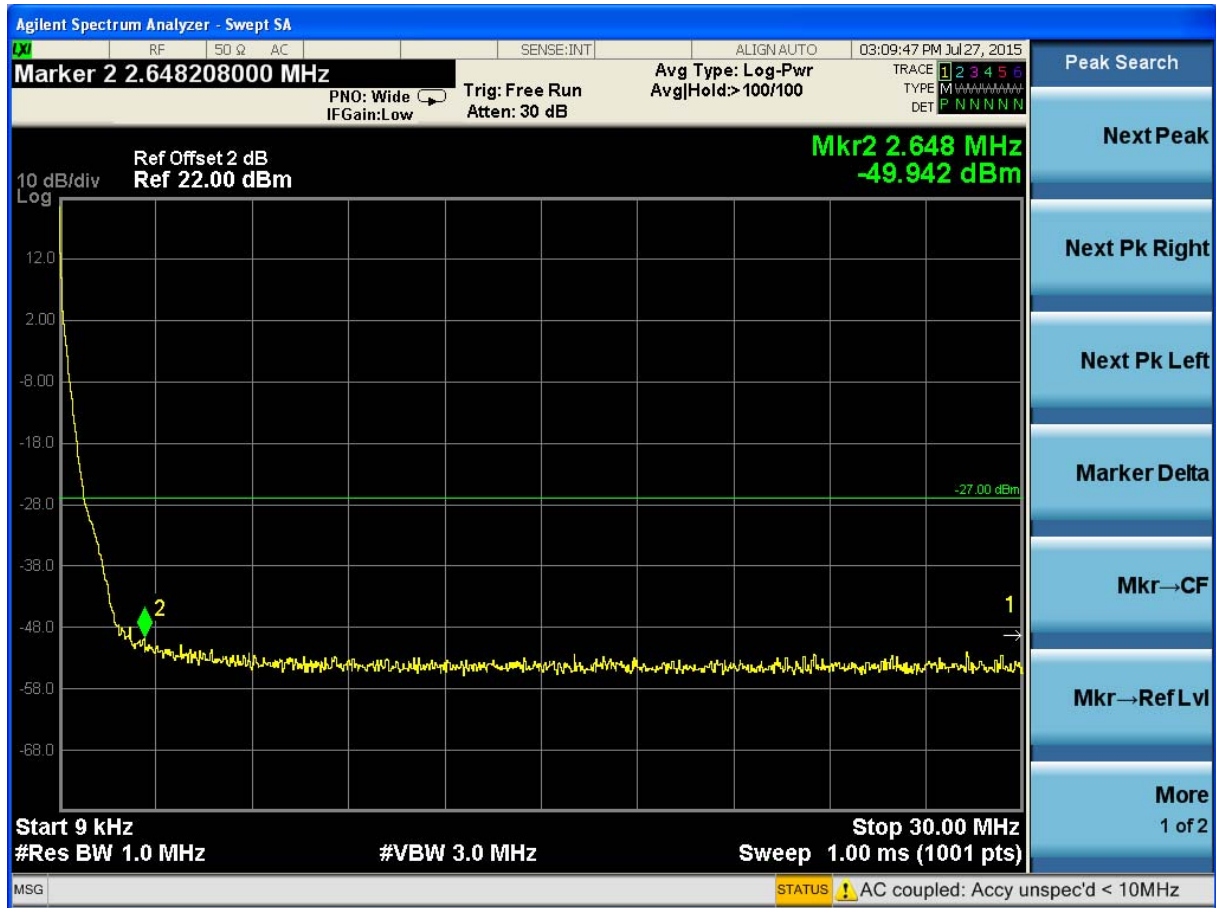
(Plot 4.9.1 A6: Channel 36: 5180MHz @ 802.11a)



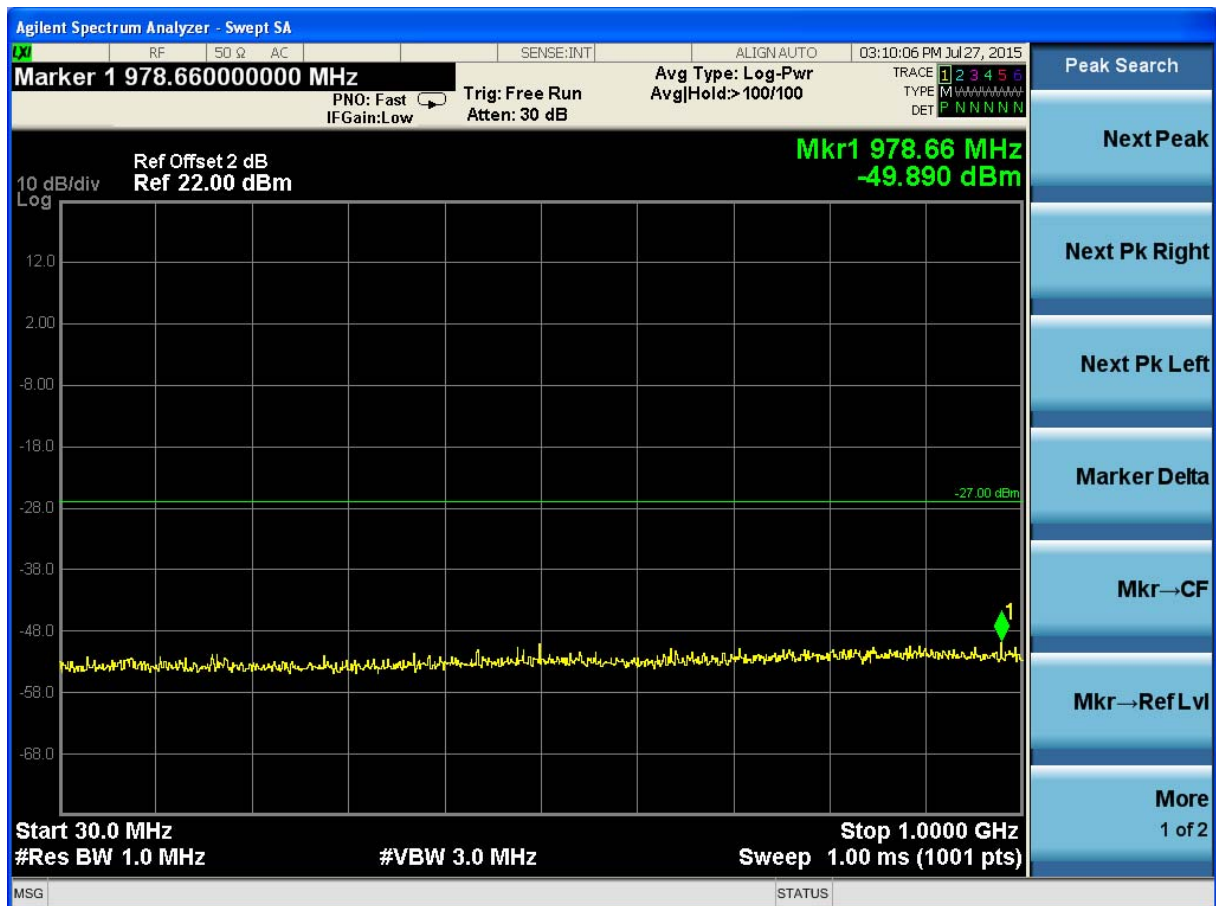
(Plot 4.9.1 A7: Channel 36: 5180MHz @ 802.11a)



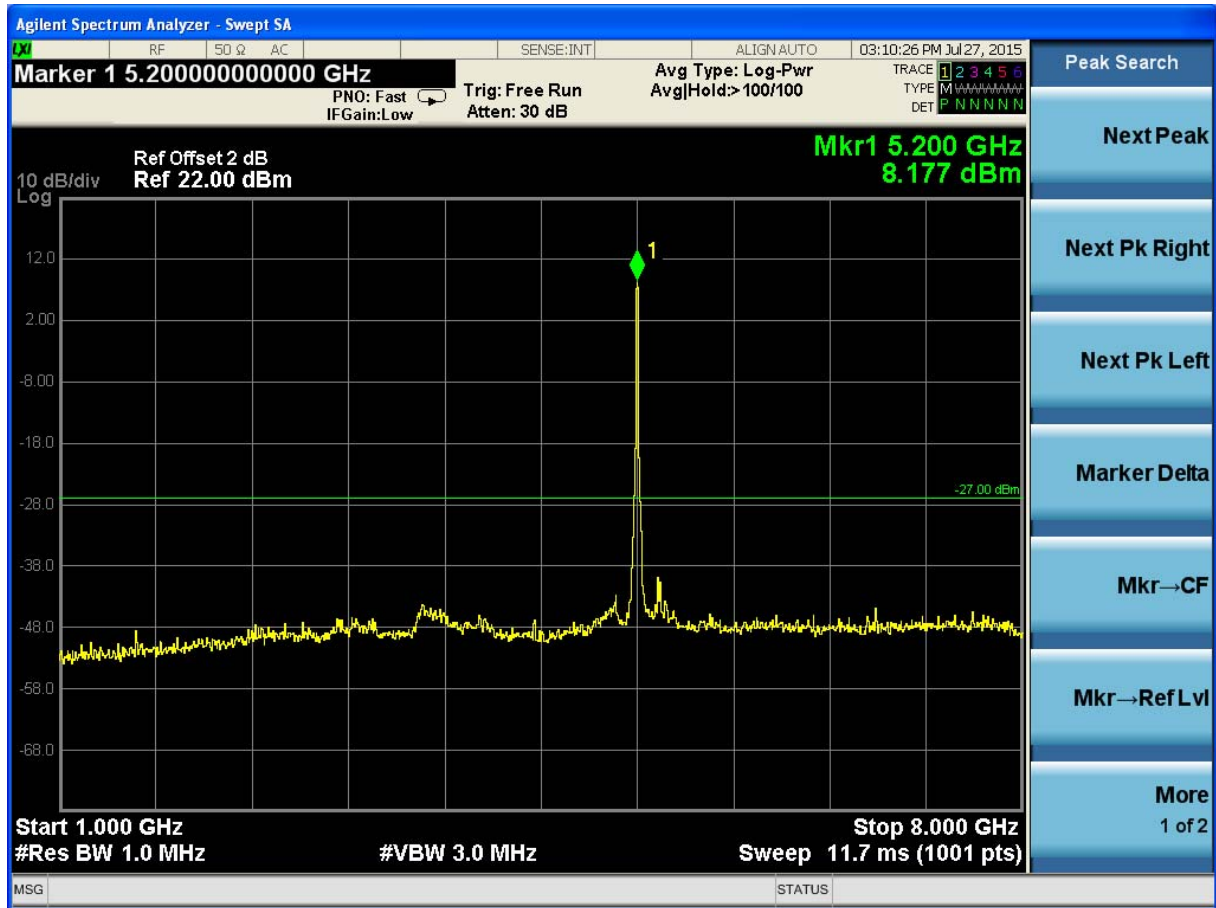
(Plot 4.9.1 B1: Channel 40: 5200MHz @ 802.11a)



(Plot 4.9.1 B2: Channel 40: 5200MHz @ 802.11a)



(Plot 4.9.1 B3: Channel 40: 5200MHz @ 802.11a)



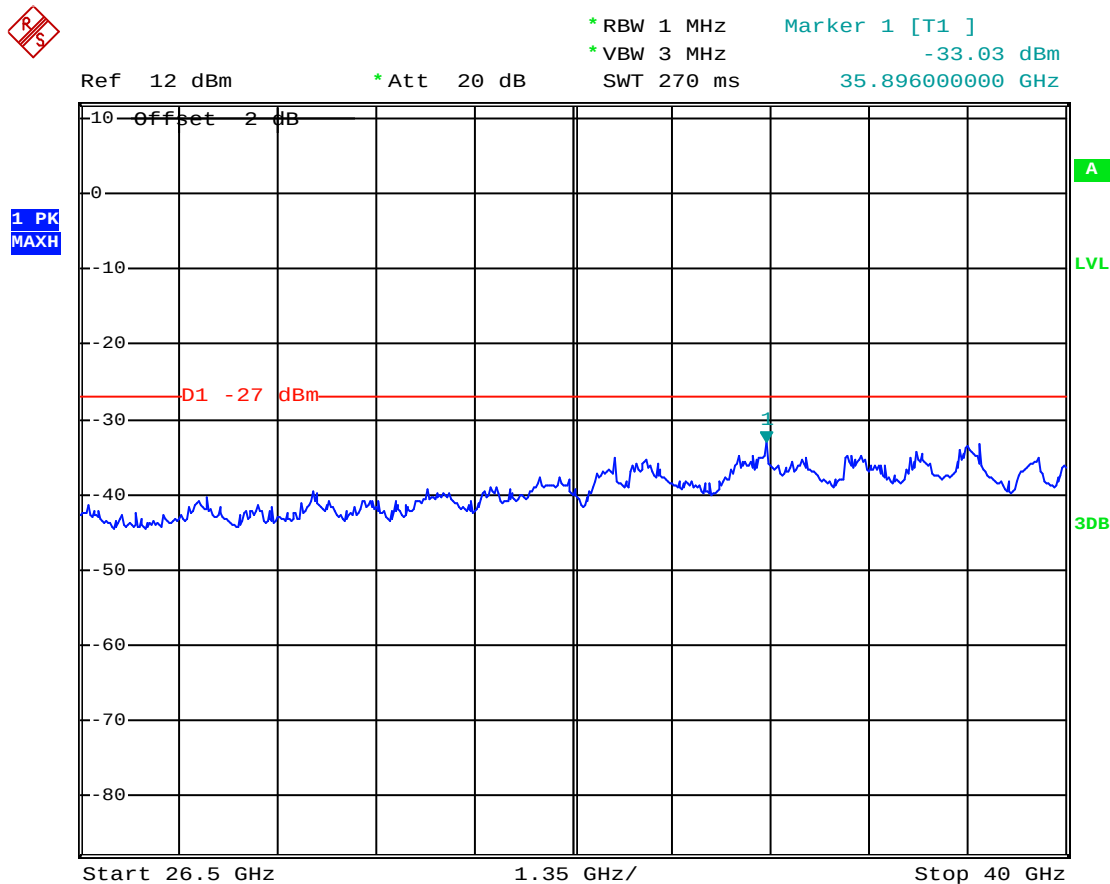
(Plot 4.9.1 B4: Channel 40: 5200MHz @ 802.11a)



(Plot 4.9.1 B5: Channel 40: 5200MHz @ 802.11a)



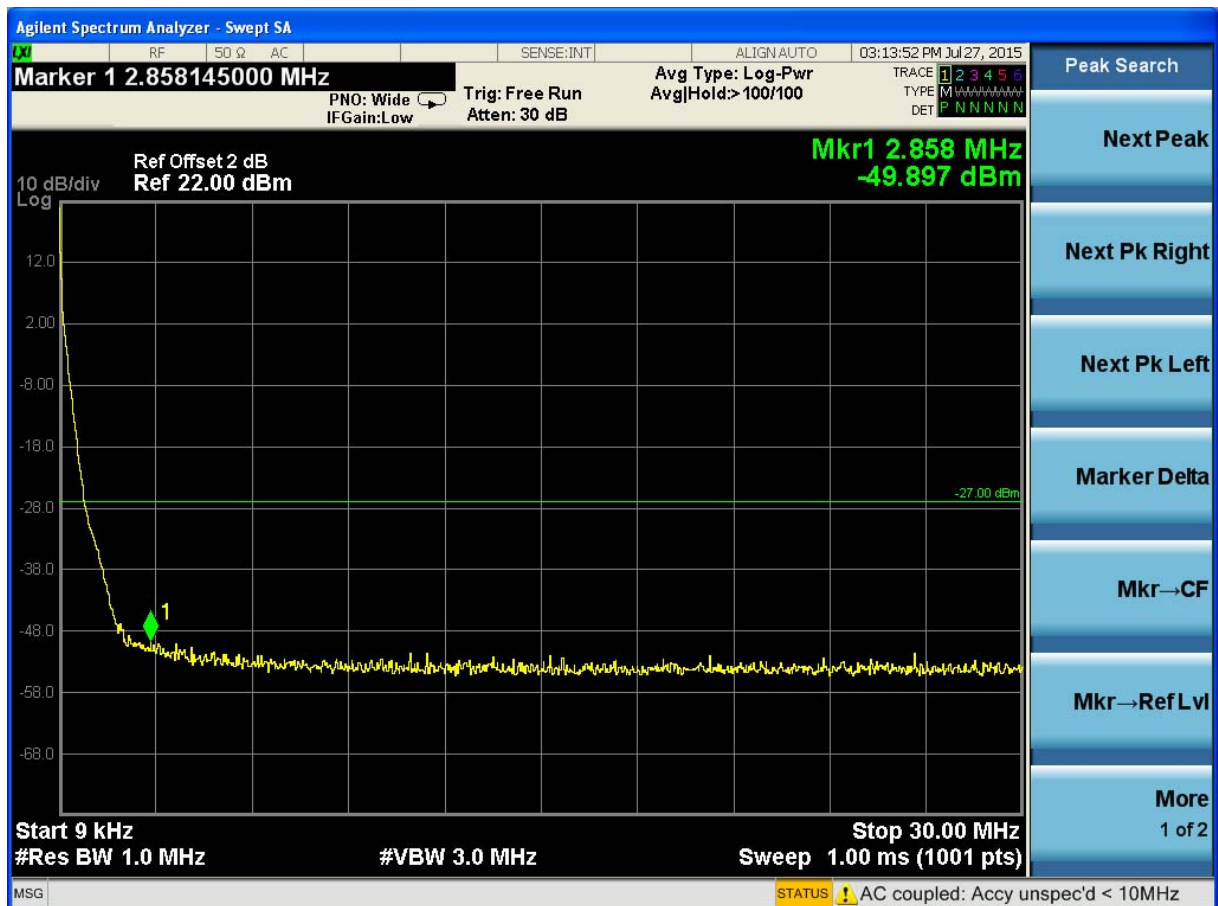
(Plot 4.9.1 B6: Channel 40: 5200MHz @ 802.11a)



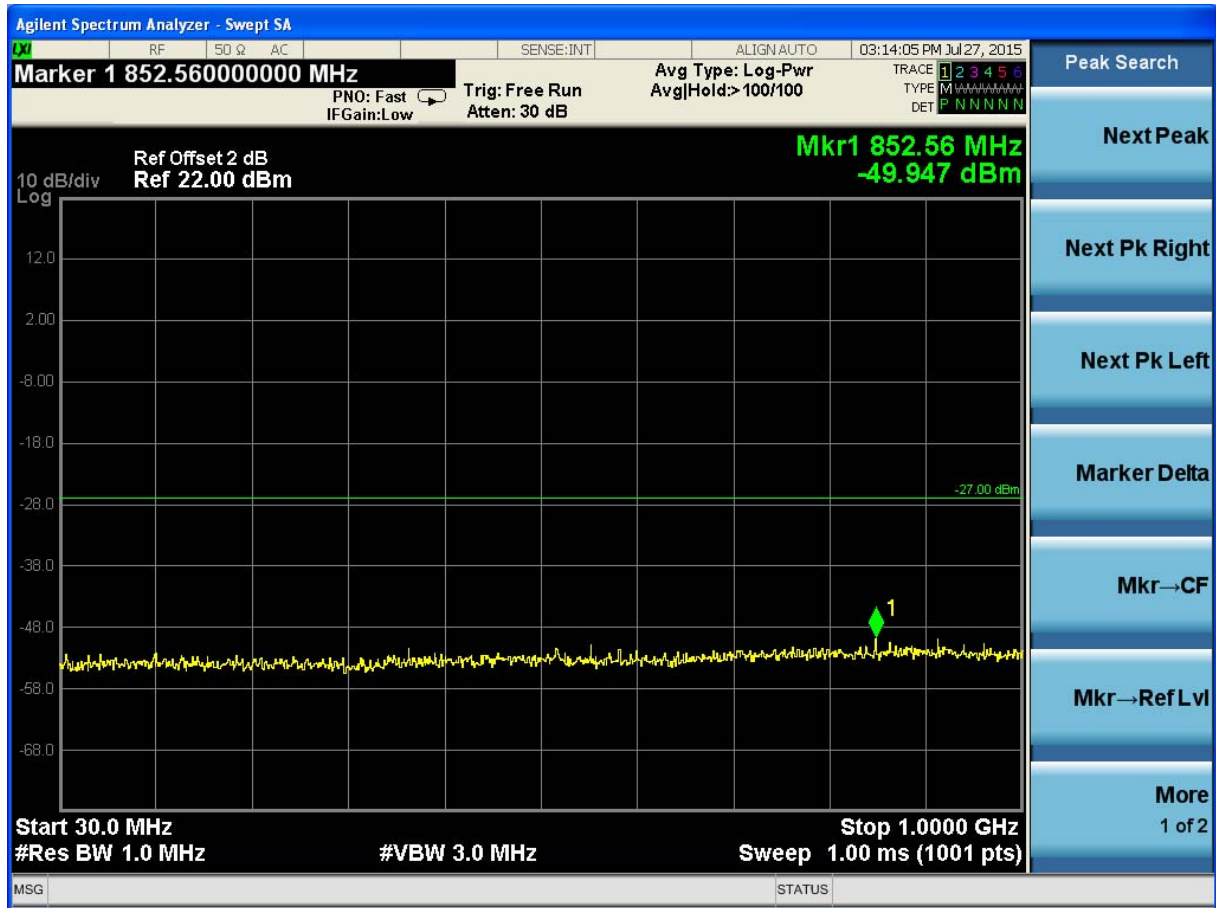
(Plot 4.9.1 B7: Channel 40: 5200MHz @ 802.11a)



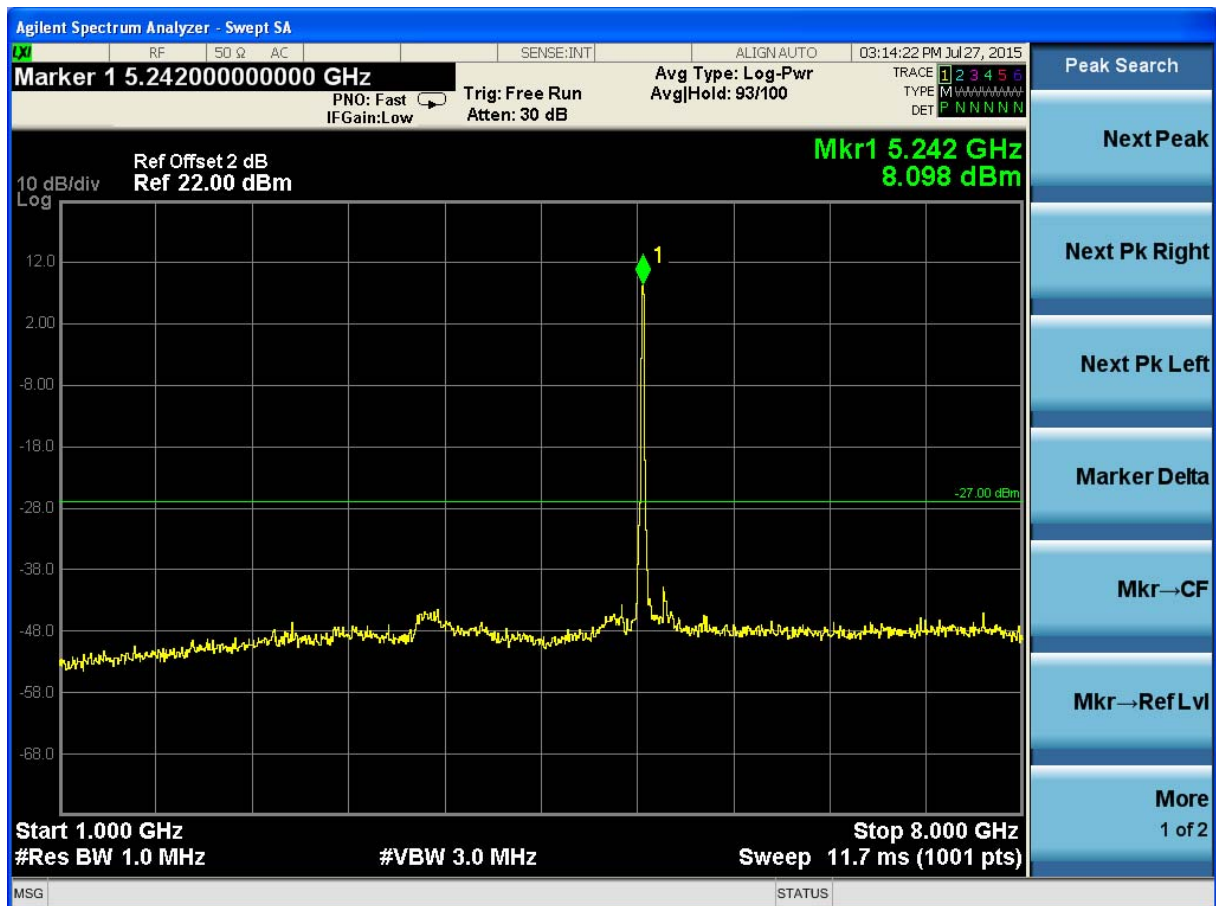
(Plot 4.9.1 C1: Channel 48: 5240MHz @ 802.11a)



(Plot 4.9.1 C2: Channel 48: 5240MHz @ 802.11a)



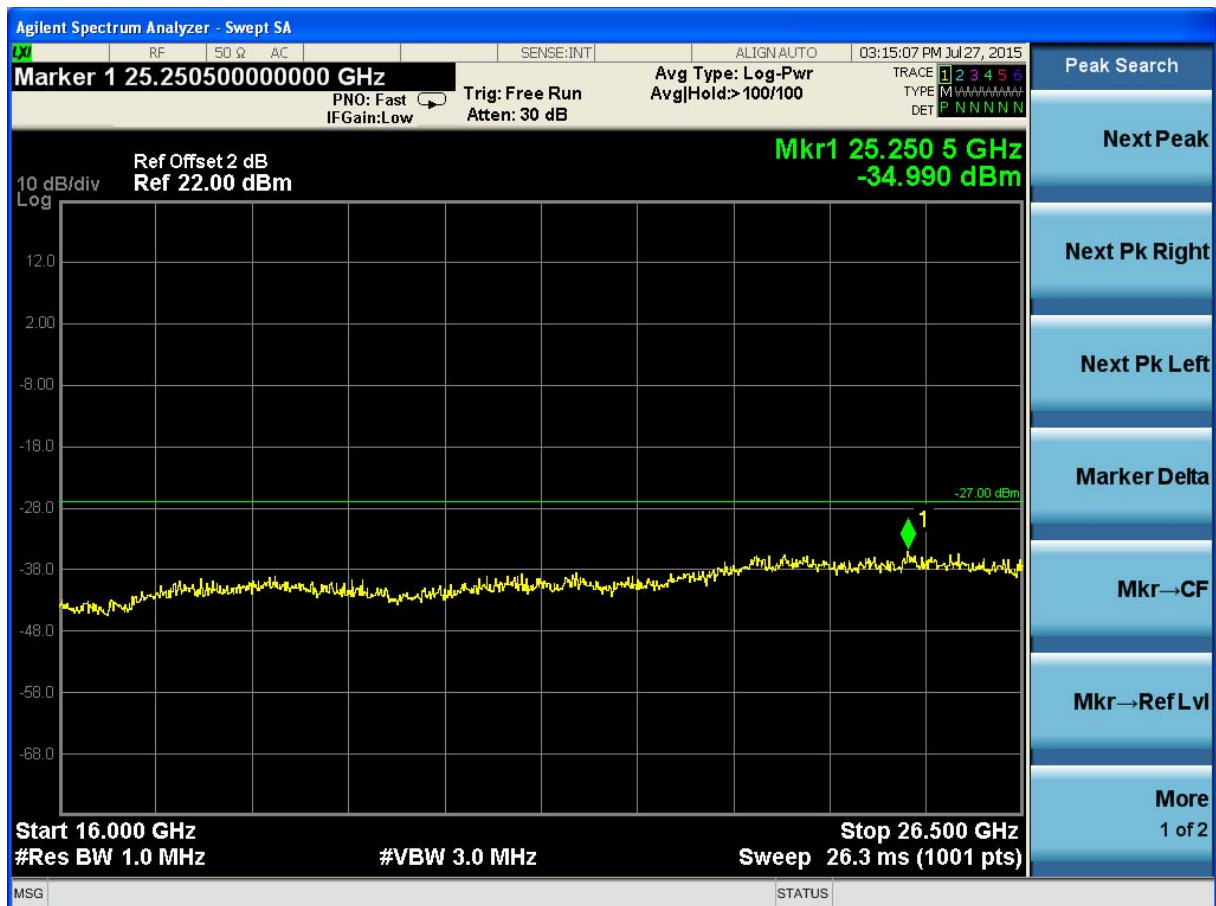
(Plot 4.9.1 C3: Channel 48: 5240MHz @ 802.11a)



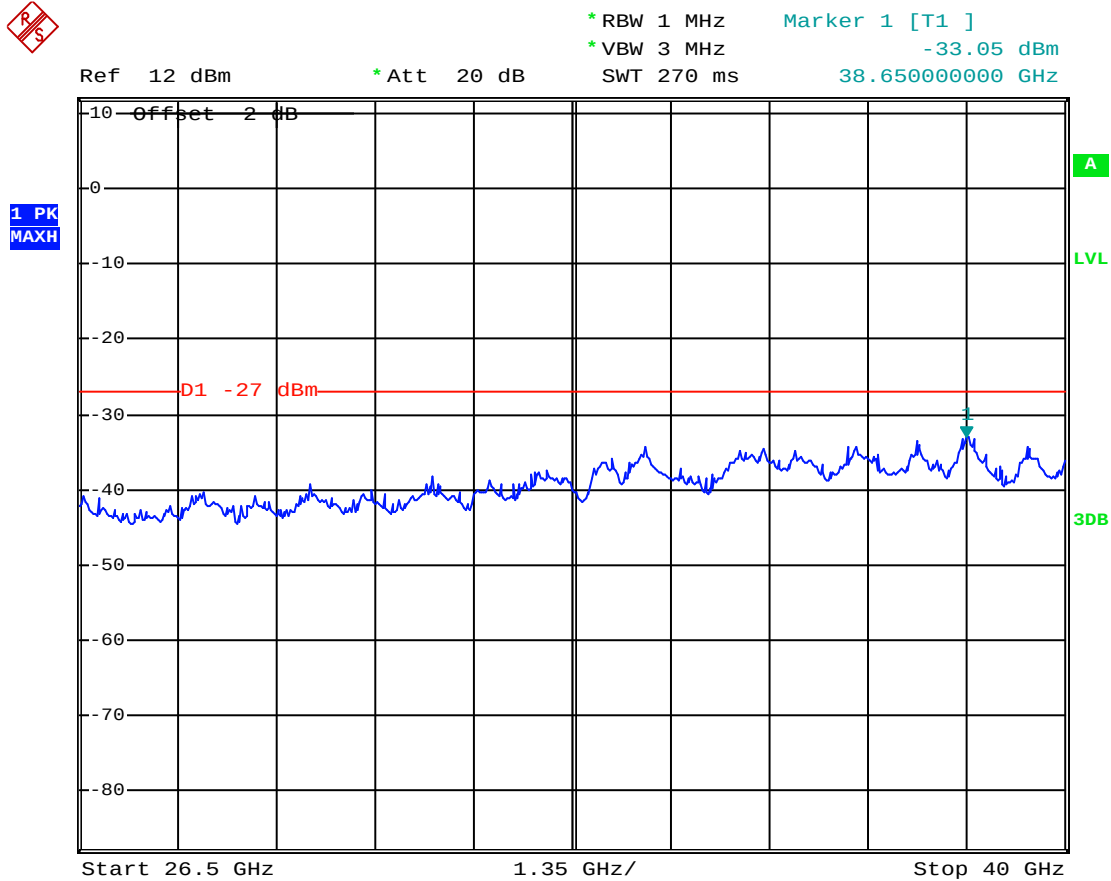
(Plot 4.9.1 C4: Channel 48: 5240MHz @ 802.11a)



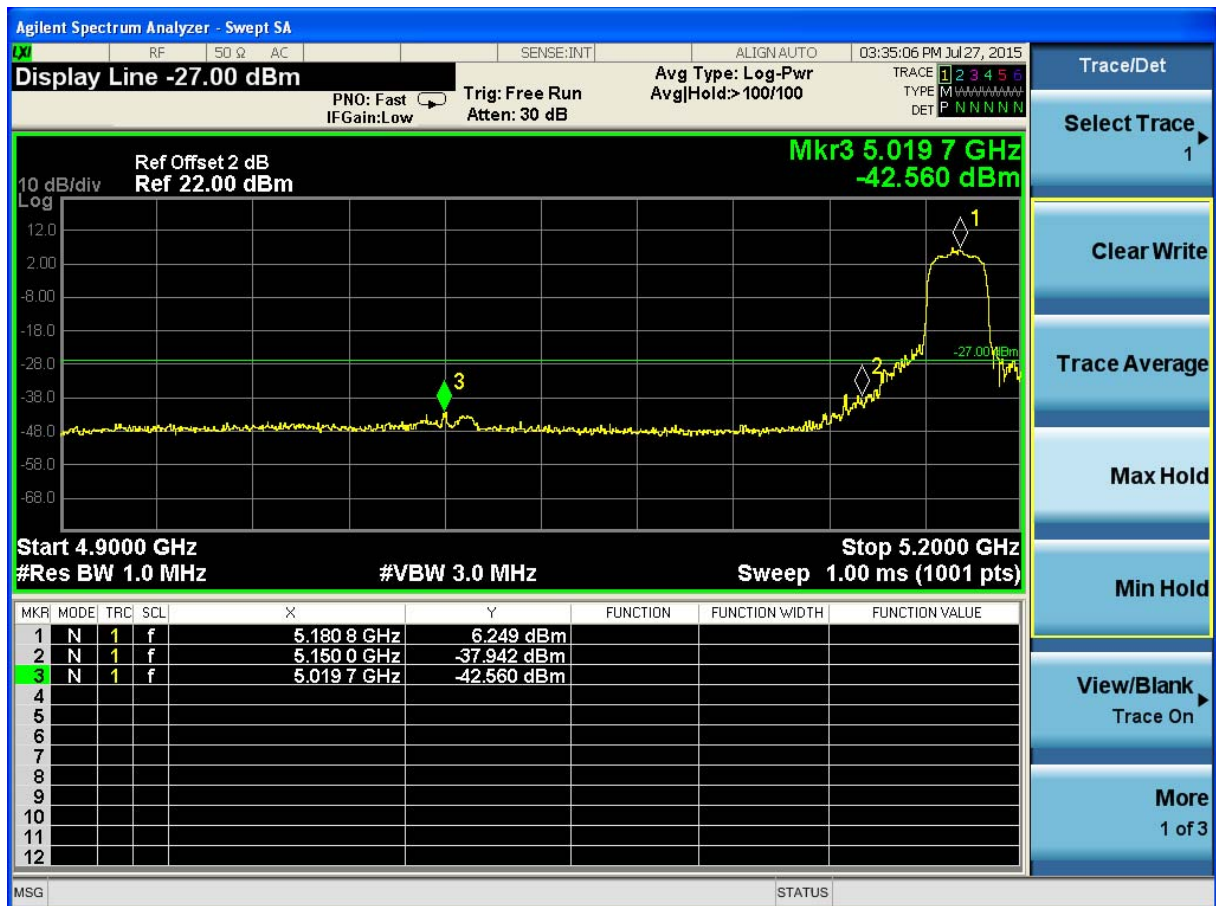
(Plot 4.9.1 C5: Channel 48: 5240MHz @ 802.11a)



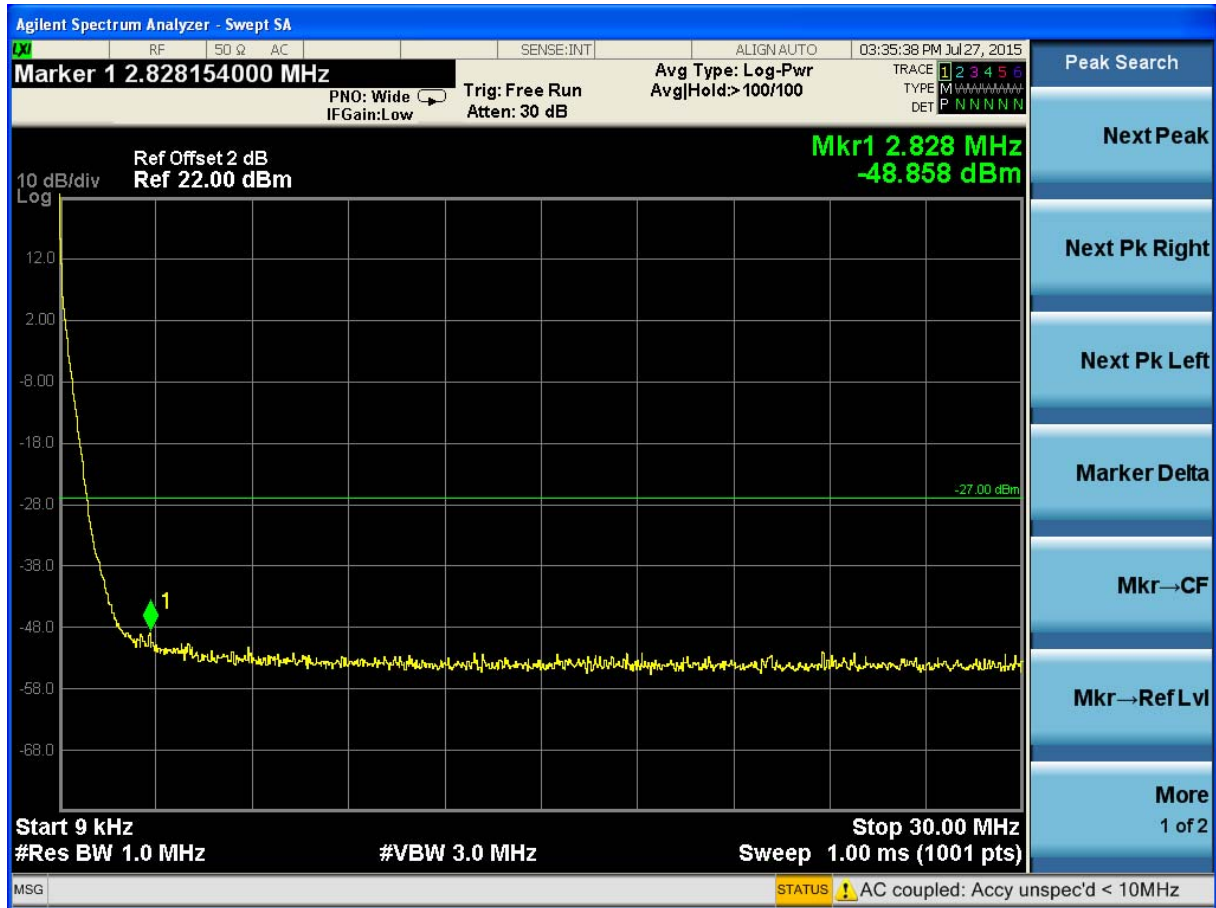
(Plot 4.9.1 C6: Channel 48: 5240MHz @ 802.11a)



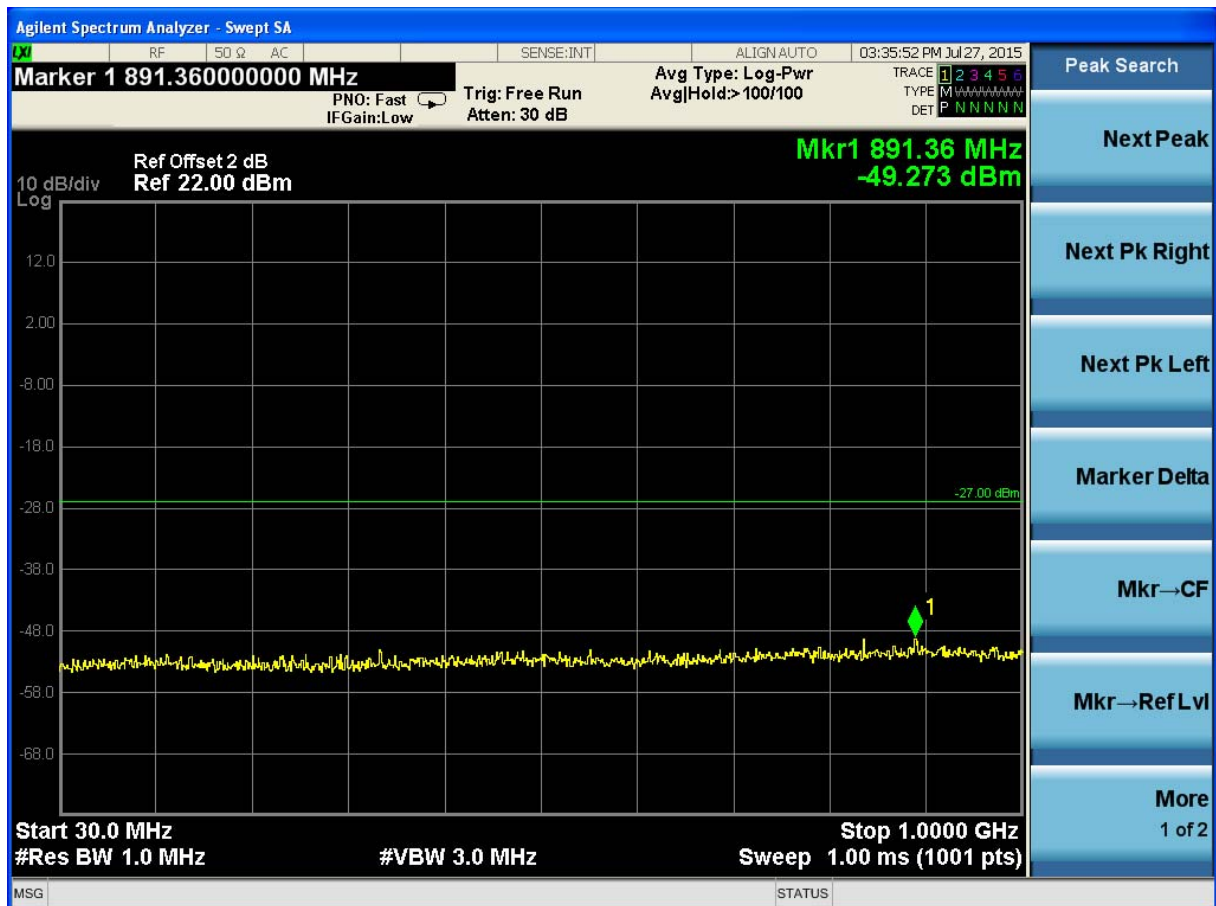
(Plot 4.9.1 C7: Channel 48: 5240MHz @ 802.11a)



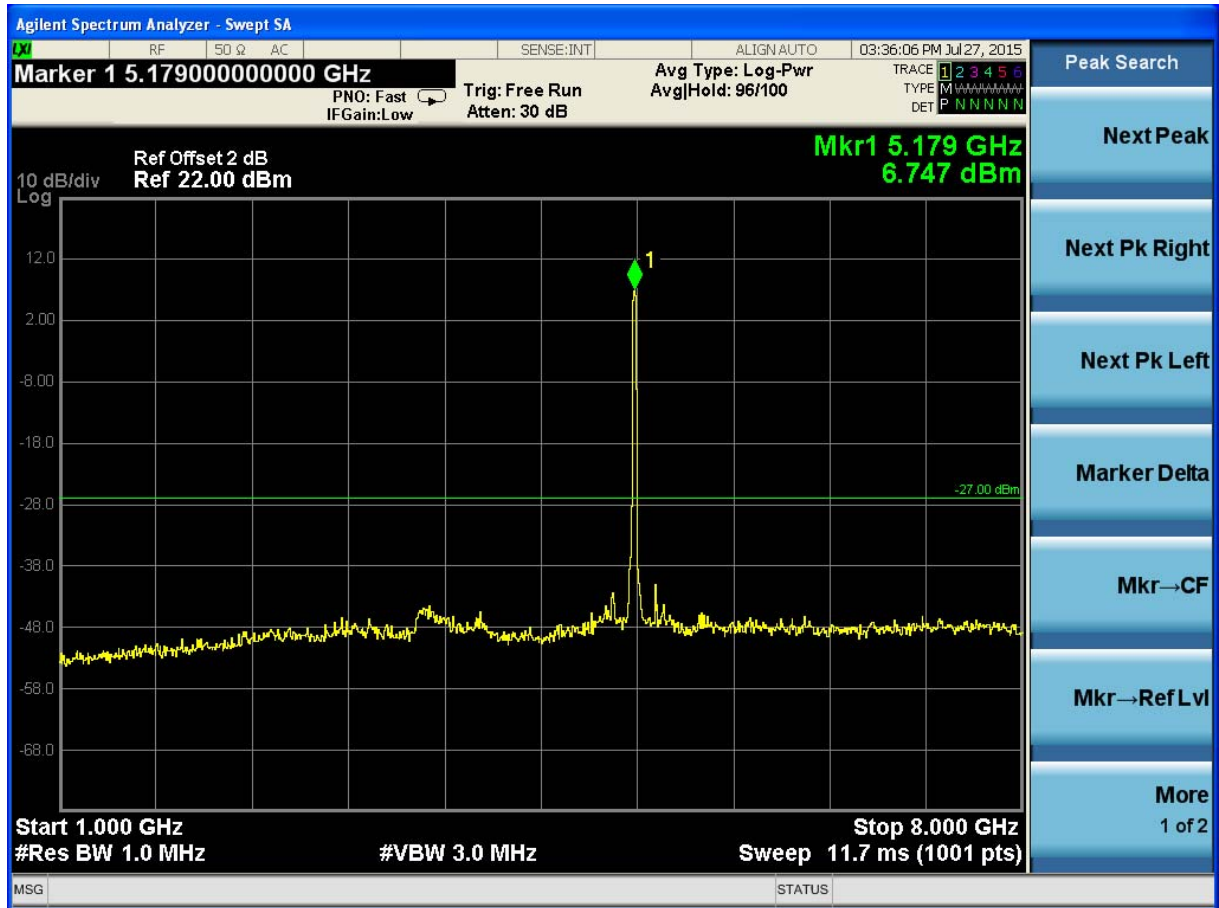
(Plot 4.9.2 A1: Channel 36: 5180MHz @ 802.11n HT20)



(Plot 4.9.2 A2: Channel 36: 5180MHz @ 802.11n HT20)



(Plot 4.9.2 A3: Channel 36: 5180MHz @ 802.11n HT20)



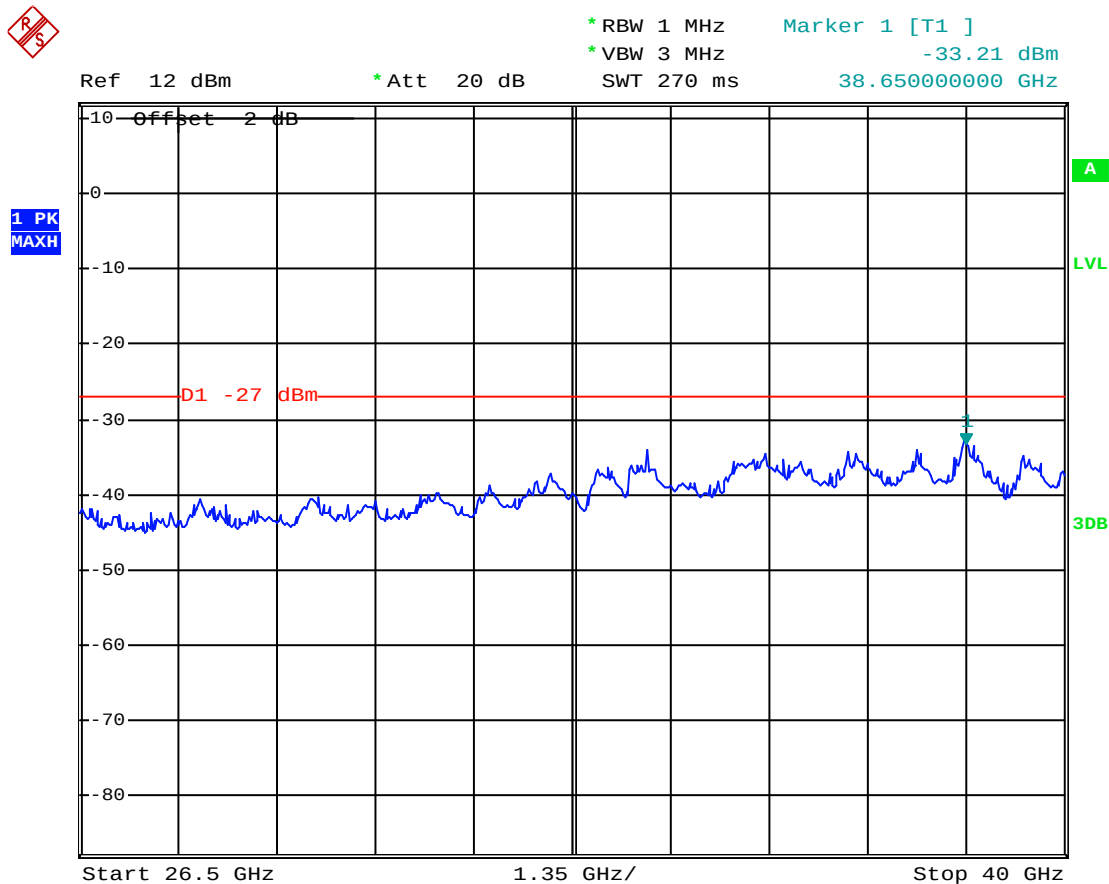
(Plot 4.9.2 A4: Channel 36: 5180MHz @ 802.11n HT20)



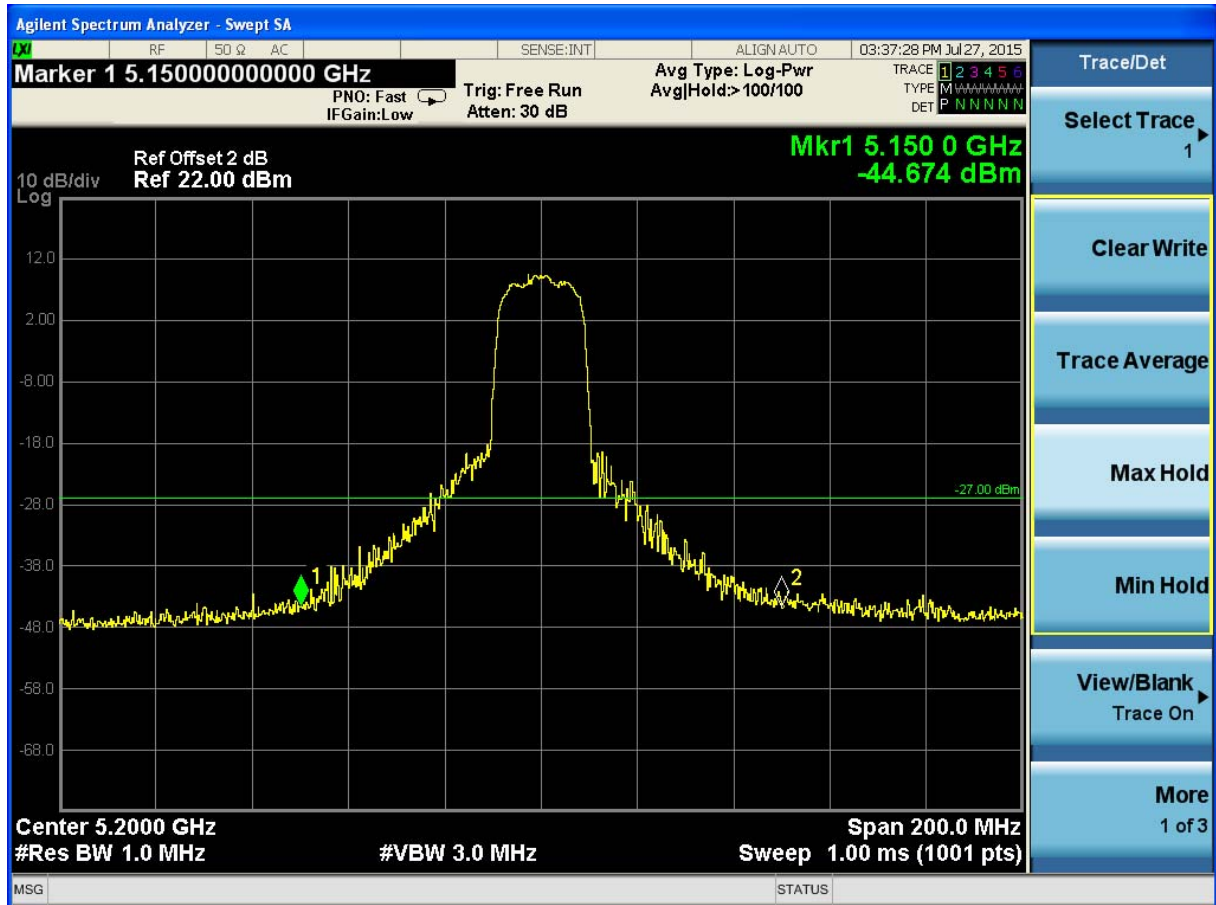
(Plot 4.9.2 A5: Channel 36: 5180MHz @ 802.11n HT20)



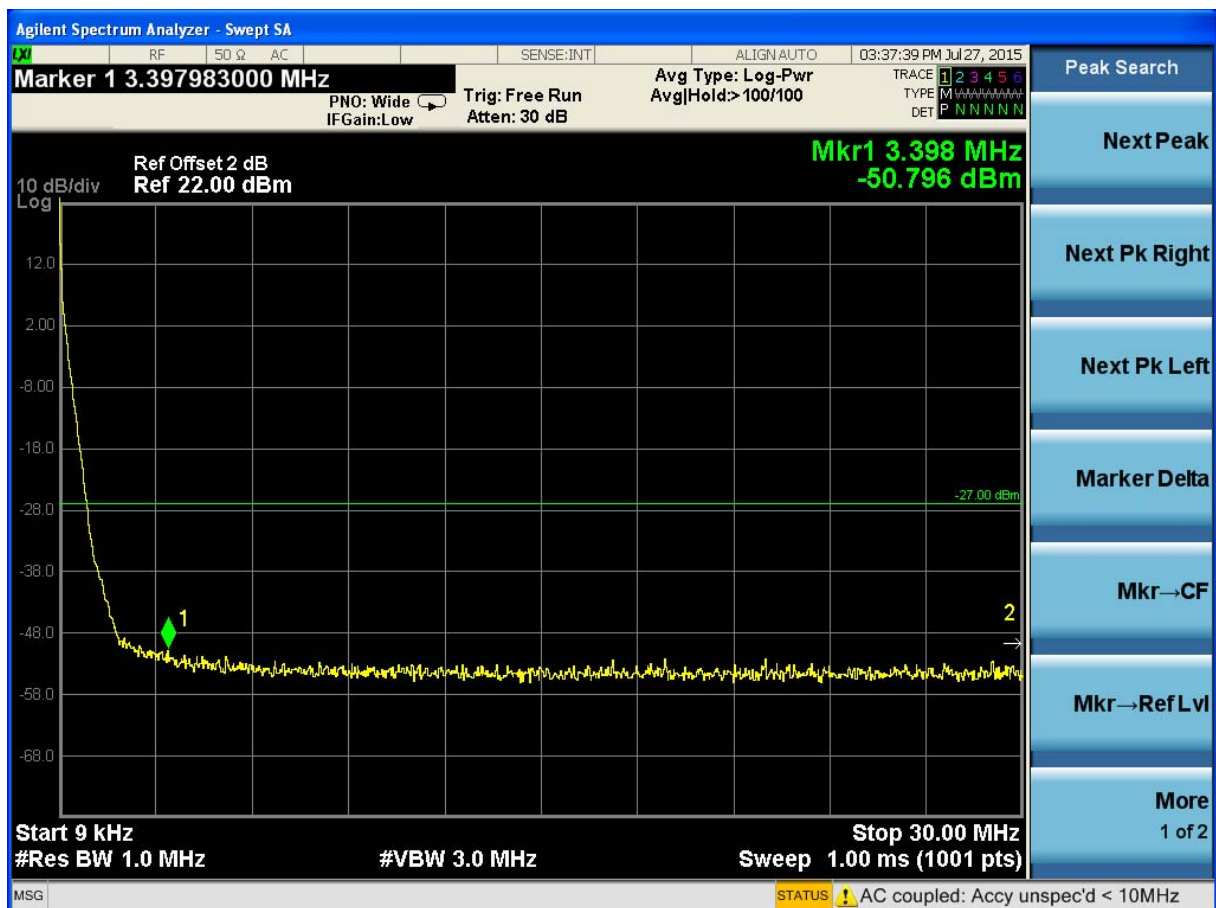
(Plot 4.9.2 A6: Channel 36: 5180MHz @ 802.11n HT20)



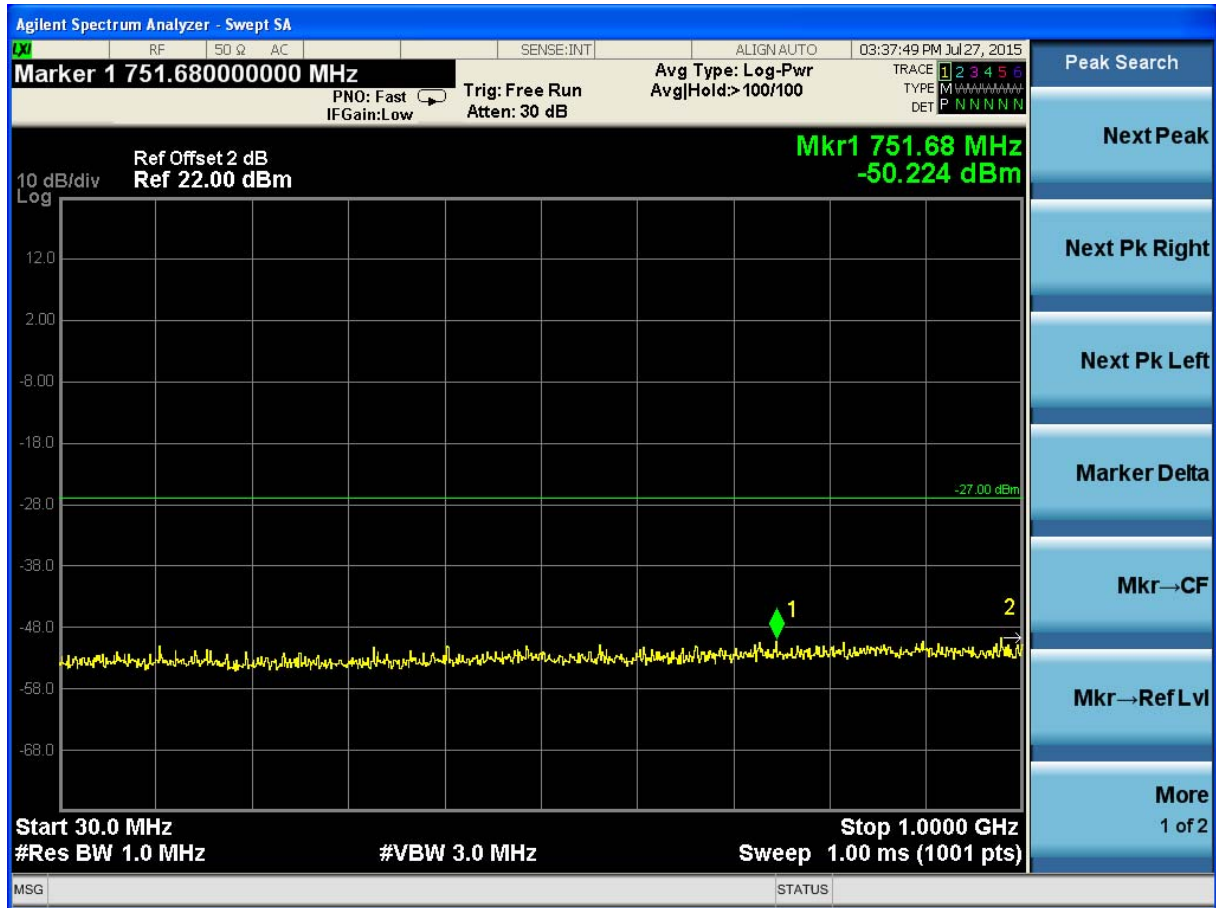
(Plot 4.9.2 A7: Channel 36: 5180MHz @ 802.11n HT20)



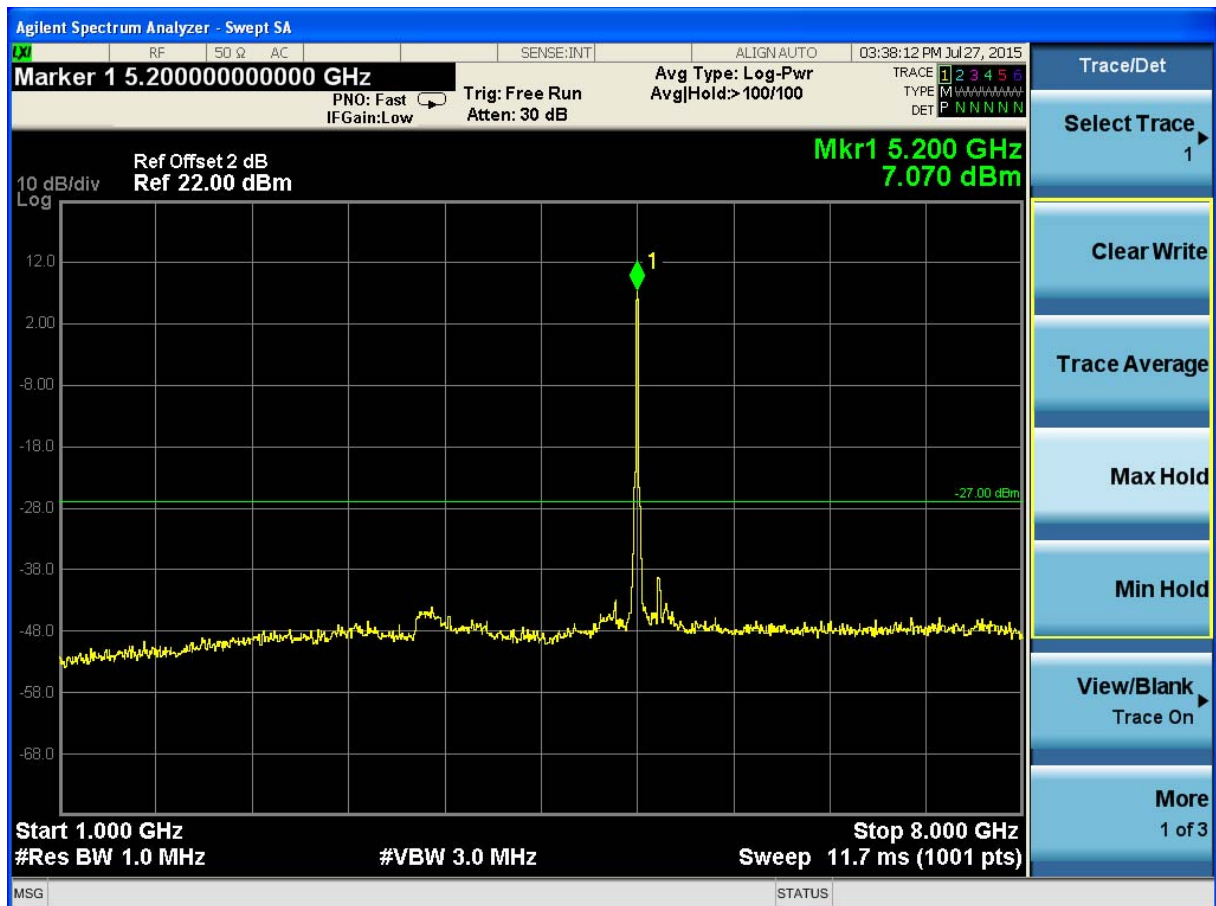
(Plot 4.9.2 B1: Channel 40: 5200MHz @ 802.11n HT20)



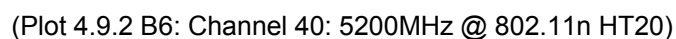
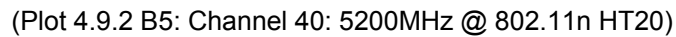
(Plot 4.9.2 B2: Channel 40: 5200MHz @ 802.11n HT20)

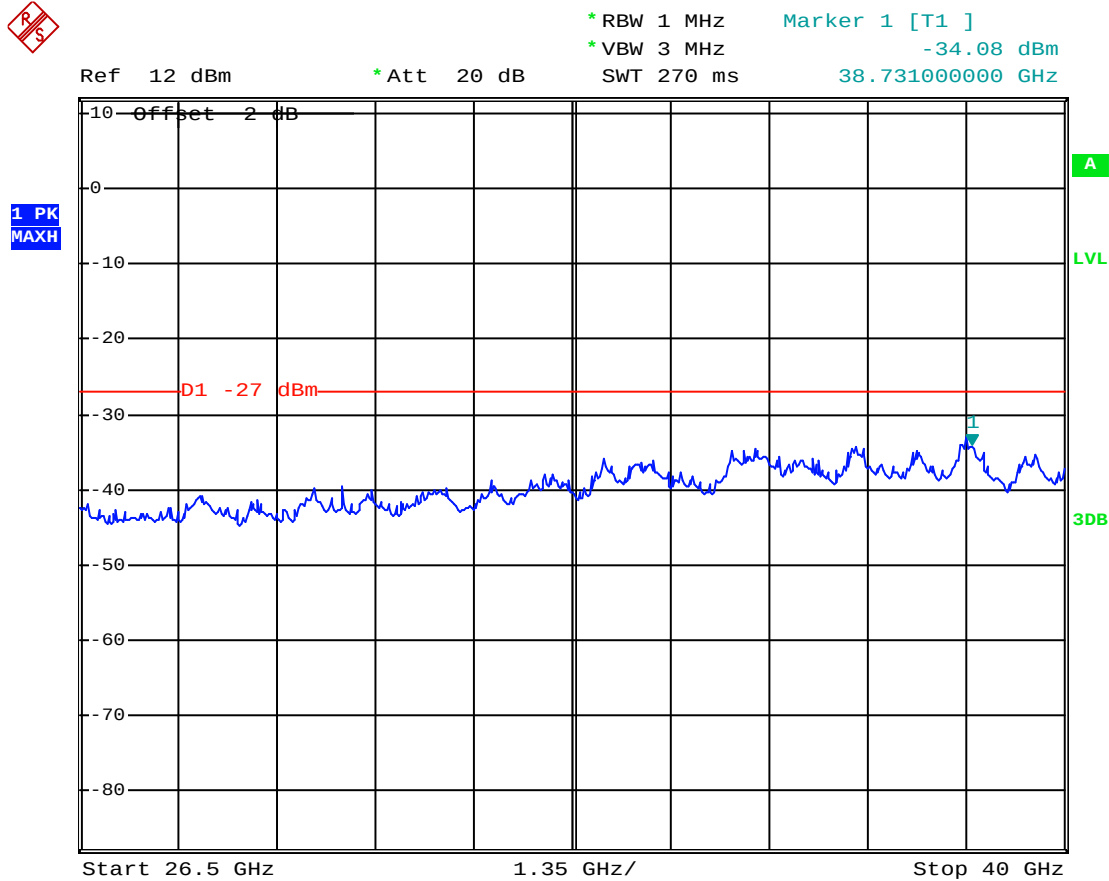


(Plot 4.9.2 B3: Channel 40: 5200MHz @ 802.11n HT20)



(Plot 4.9.2 B4: Channel 40: 5200MHz @ 802.11n HT20)

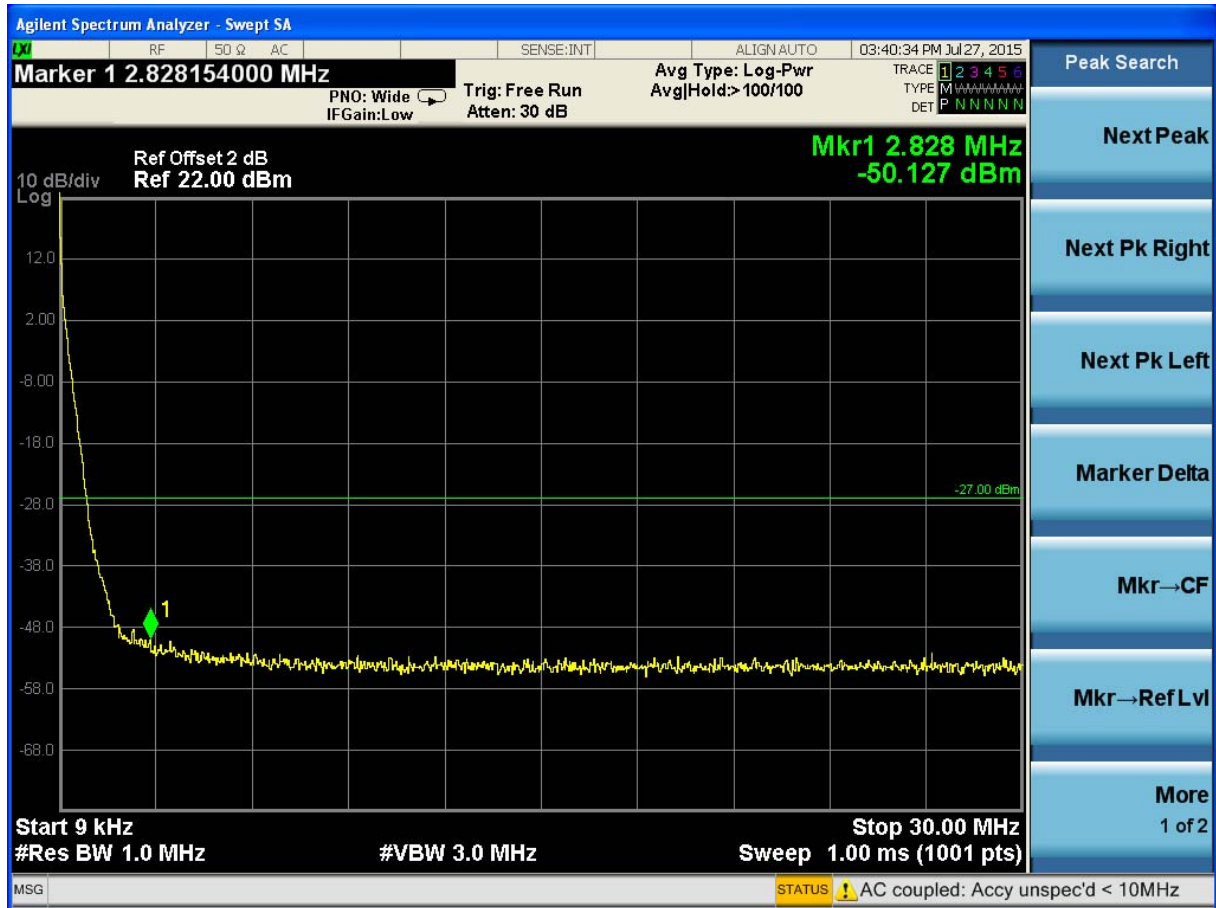




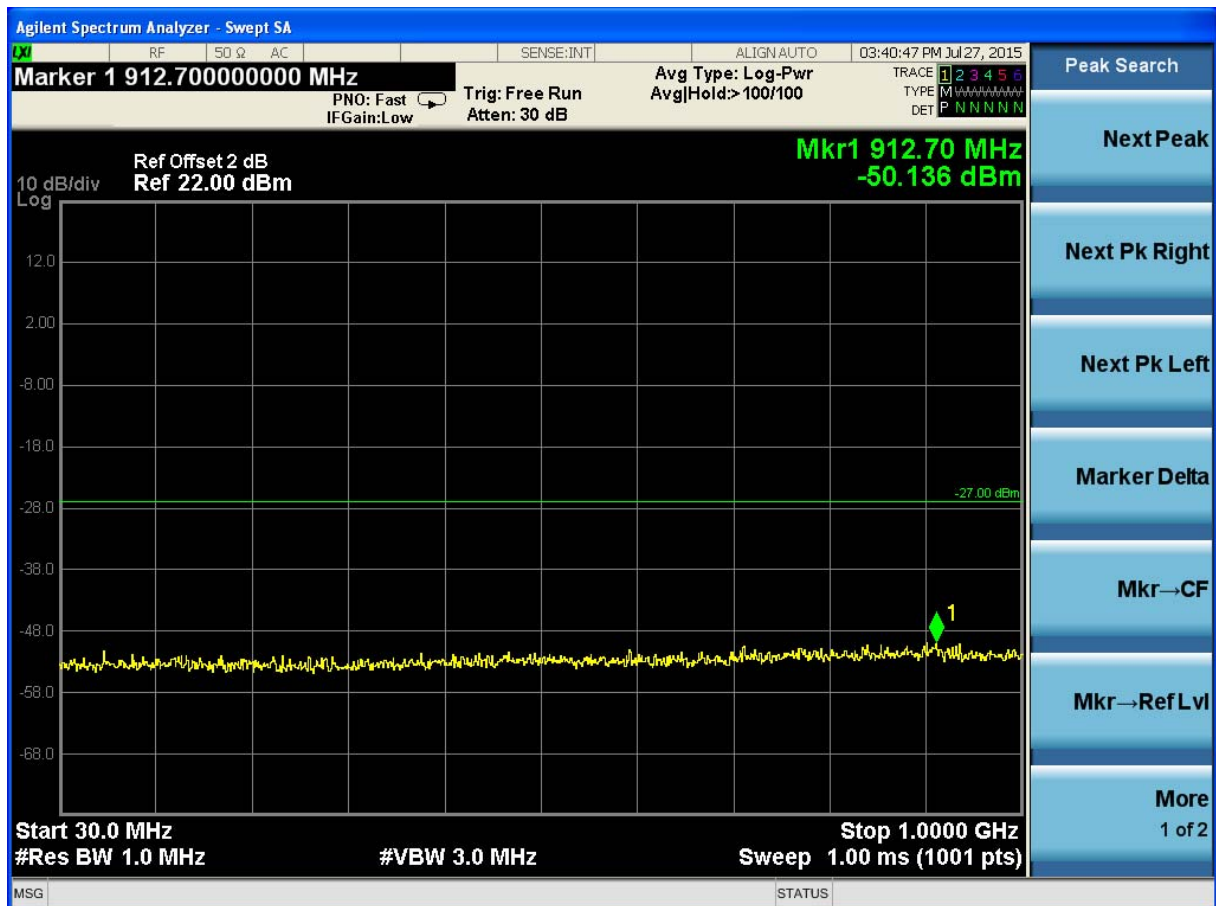
(Plot 4.9.2 B7: Channel 40: 5200MHz @ 802.11n HT20)



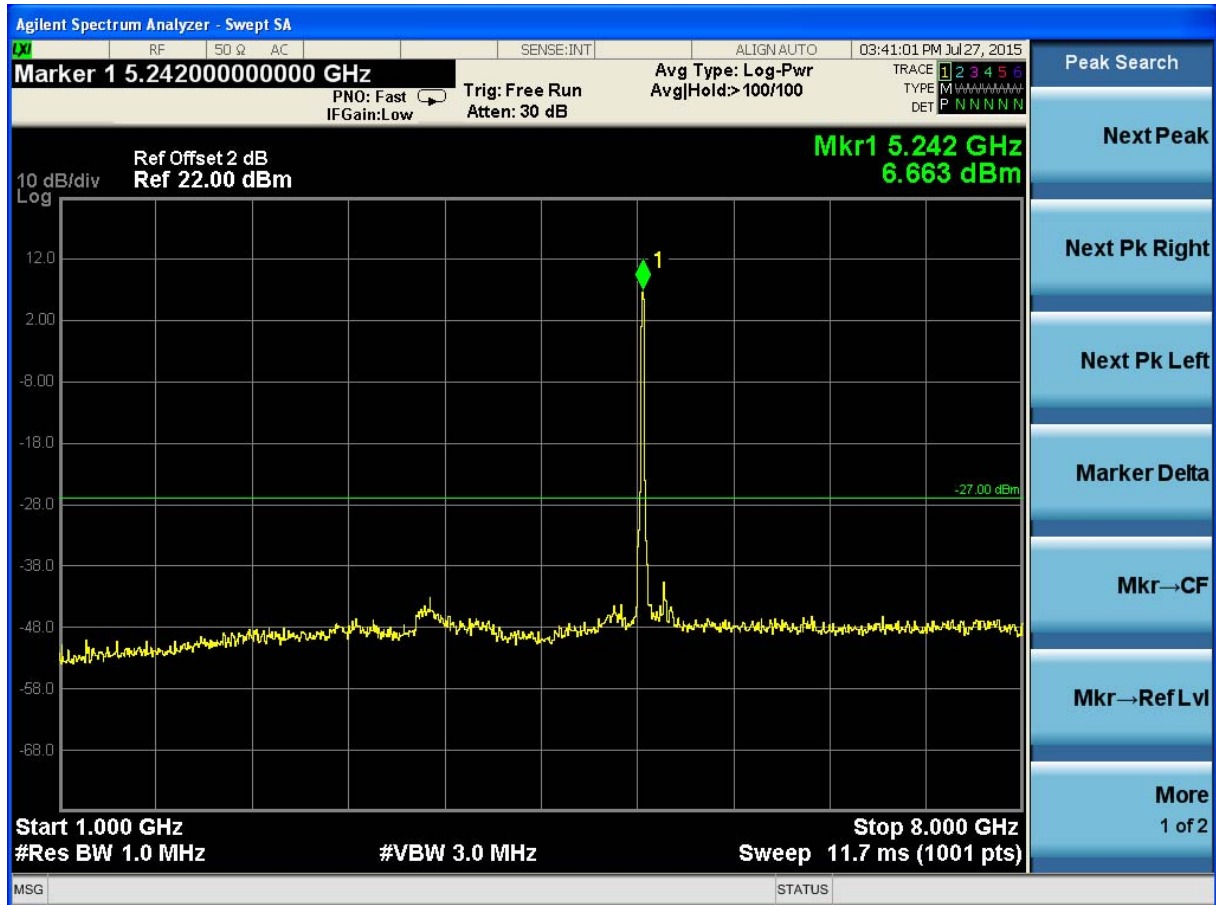
(Plot 4.9.2 C1: Channel 48: 5240MHz @ 802.11n HT20)



(Plot 4.9.2 C2: Channel 48: 5240MHz @ 802.11n HT20)



(Plot 4.9.2 C3: Channel 48: 5240MHz @ 802.11n HT20)



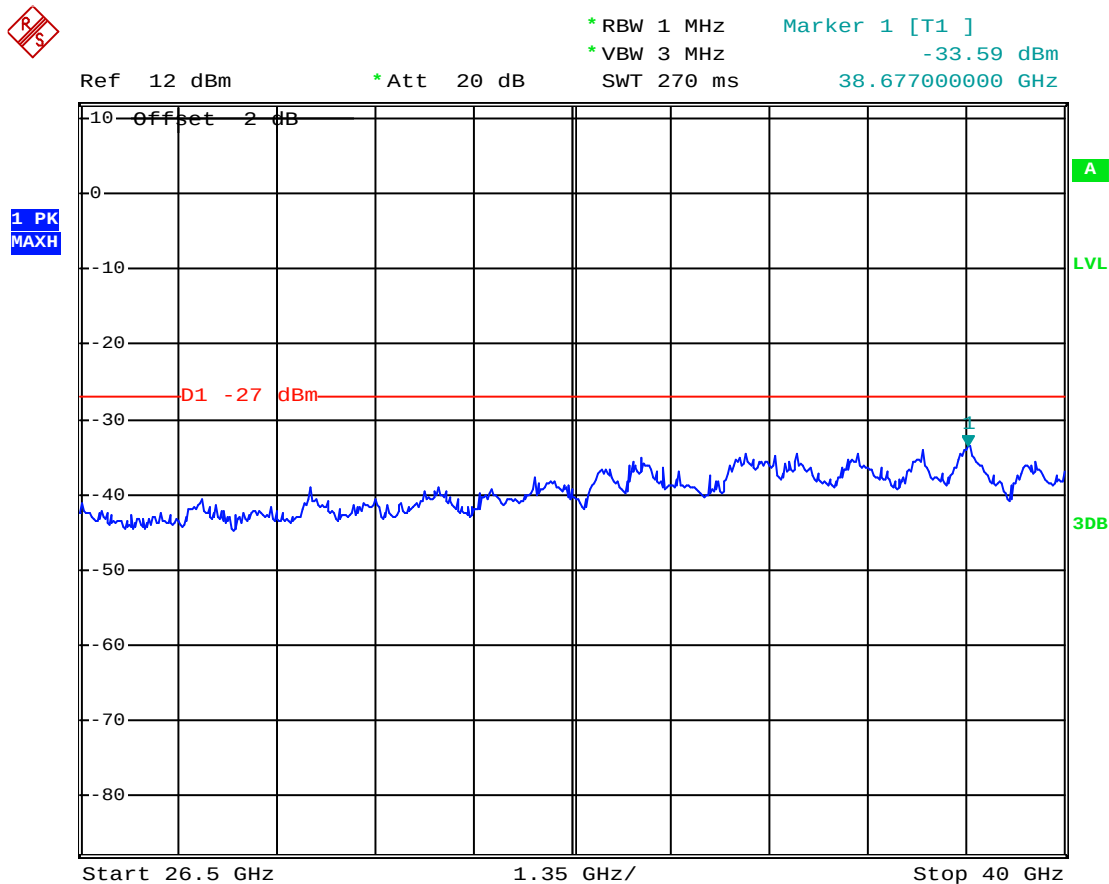
(Plot 4.9.2 C4: Channel 48: 5240MHz @ 802.11n HT20)



(Plot 4.9.2 C5: Channel 48: 5240MHz @ 802.11n HT20)



(Plot 4.9.2 C6: Channel 48: 5240MHz @ 802.11n HT20)



(Plot 4.9.2 C7: Channel 48: 5240MHz @ 802.11n HT20)