8.4 Out of Band Emissions at the Band Edge / Conducted Spurious Emissions

Test requirements and limit, §15.247(d)

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in band average PSD level.

In either case, attenuation to levels below the general emission limits specified in **§15.209(a)** is not required.

▣TEST CONFIGURATION

Refer to the APPENDIX I.

▣TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer.

- Measurement Procedure 1 – Reference Level

1. Set instrument center frequency to DTS channel center frequency.
2. Set the span to ≥ 1.5 times the DTS bandwidth.
3. Set the RBW = 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum PSD level

- Measurement Procedure 2 - Unwanted Emissions

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = **100 kHz.(Actual 1 MHz , See below note)**
3. Set the VBW **≥ 3 x RBW.(Actual 3 MHz, See below note)**
4. Detector = **peak**.
5. Ensure that the number of measurement points ≥ span/RBW
6. Sweep time = **auto couple.**
7. Trace mode = **max hold.**
8. **Allow the trace to stabilize** (this may take some time, depending on the extent of the span).
9. Use the peak marker function to determine the maximum amplitude level.

Note: The conducted spurious emission was tested each ranges were set as below.

Frequency range: 30MHz~10GHz, 10GHz~25GHz
RBW= 1MHz, VBW= 3MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, BINS: 40001

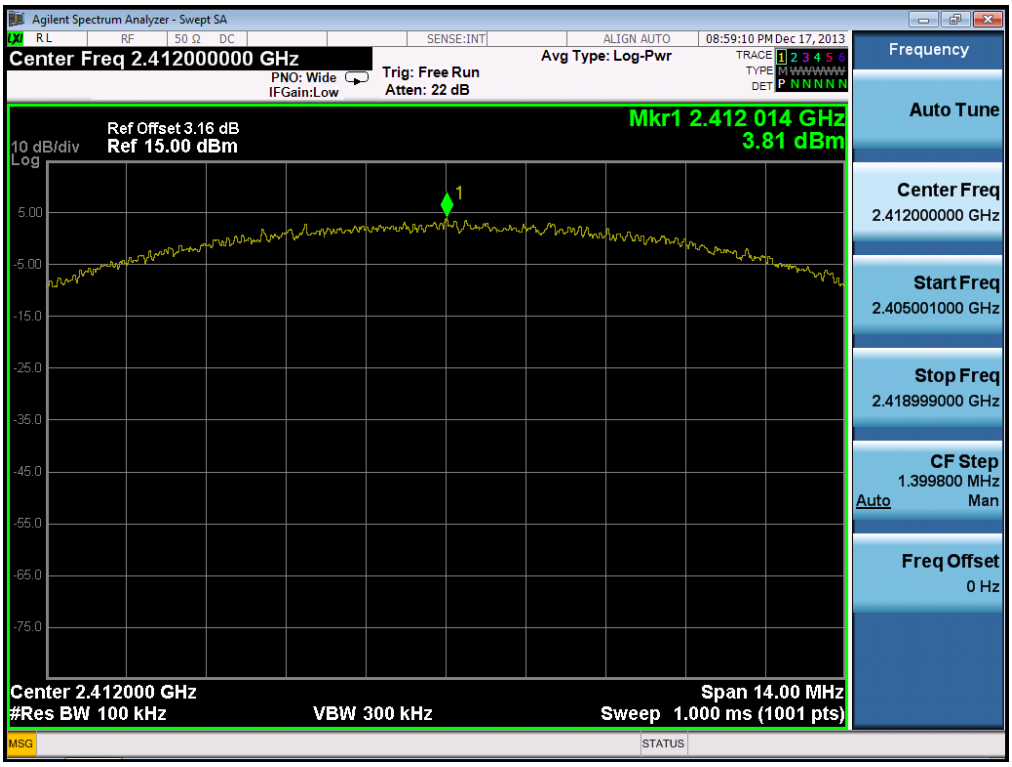
If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 KHz, VBW = 300 KHz, SPAN = 100 MHz and BINS = 1001 to get accurate emission level within 100 KHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

▣ RESULT PLOTS

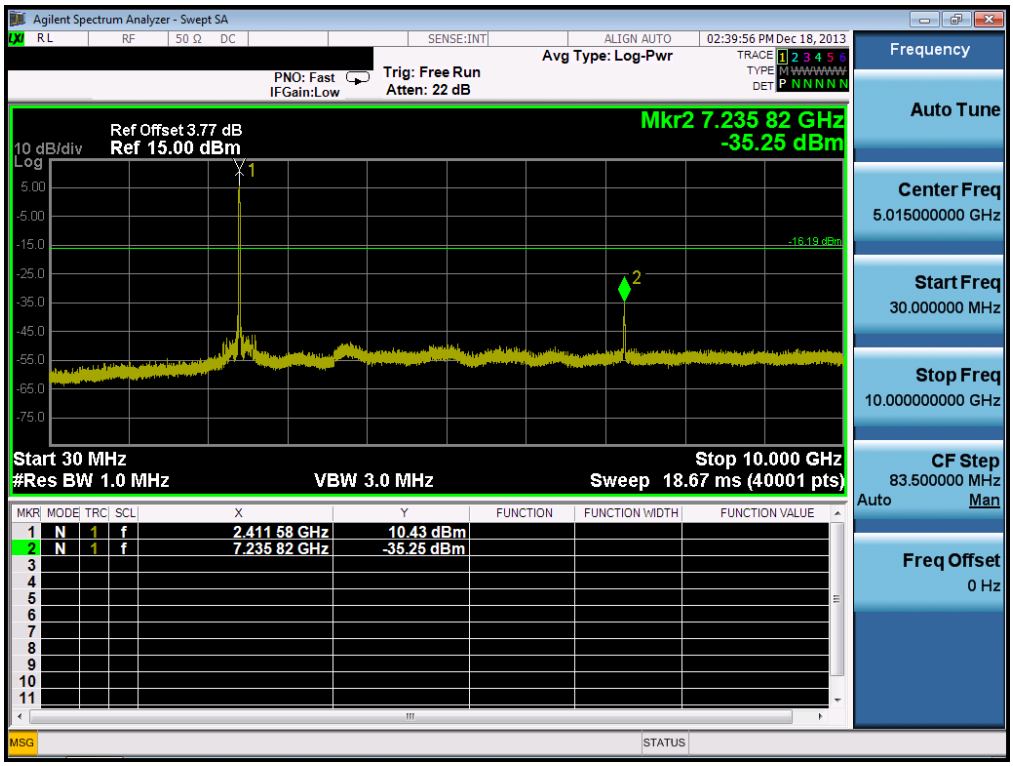
Test Mode: DC 12 V & 802.11b & 11Mbps & 2412MHz

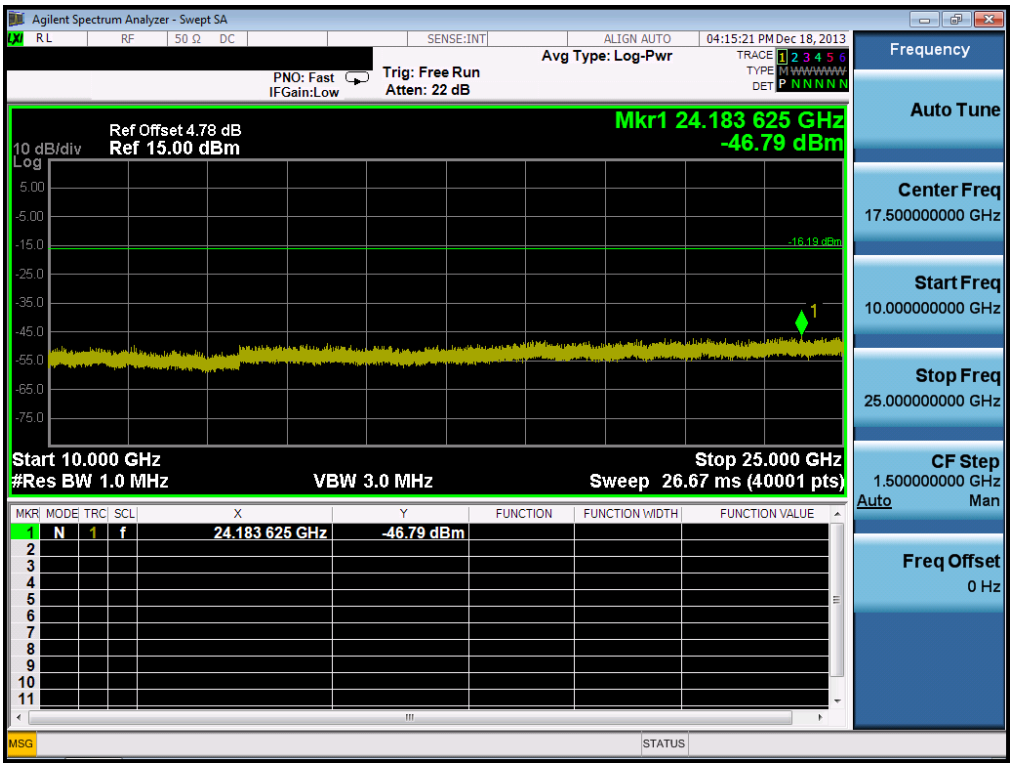
Reference



Low Band-edge

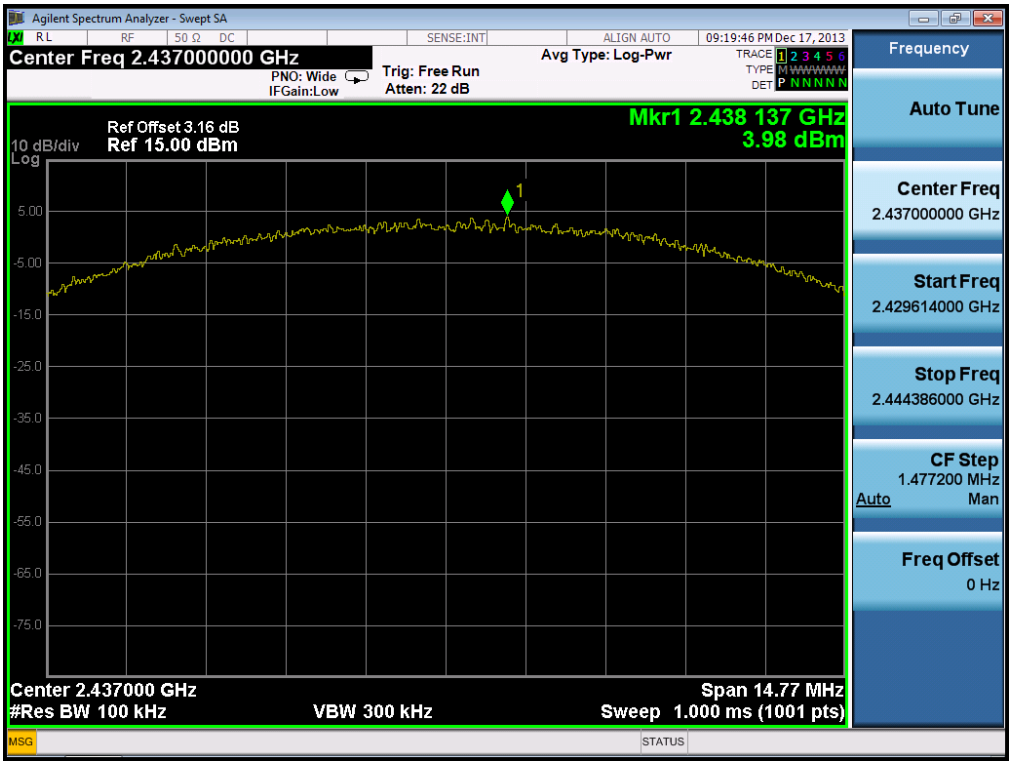
Conducted Spurious Emissions



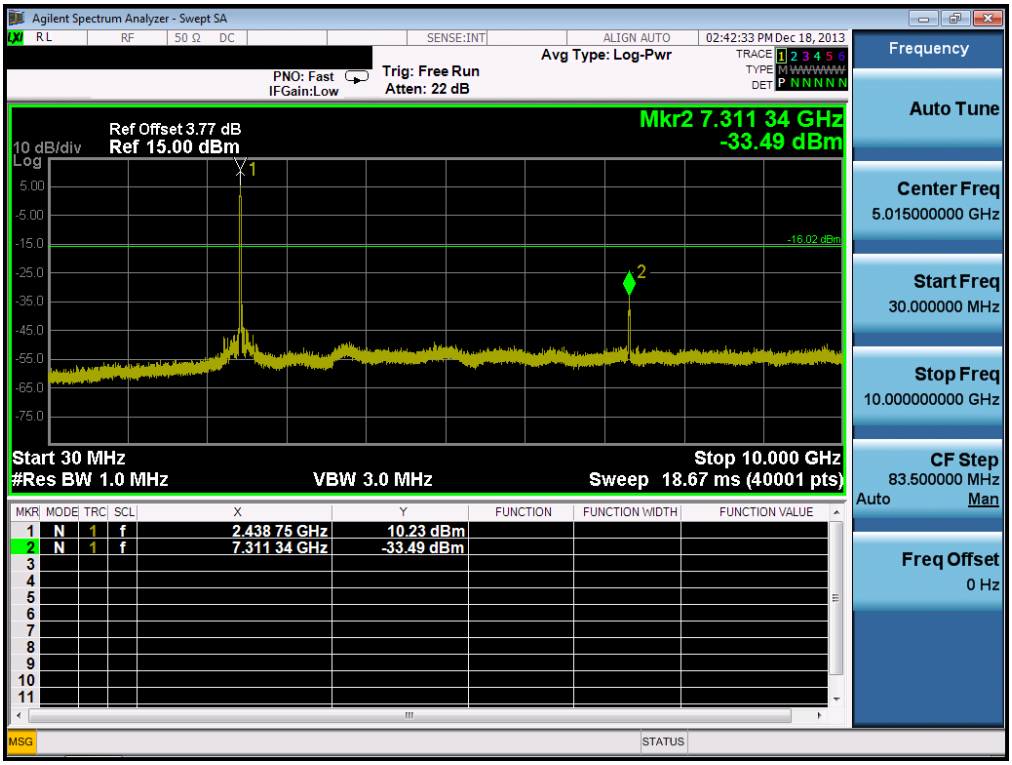


Test Mode: DC 12 V & 802.11b & 11Mbps & 2437MHz

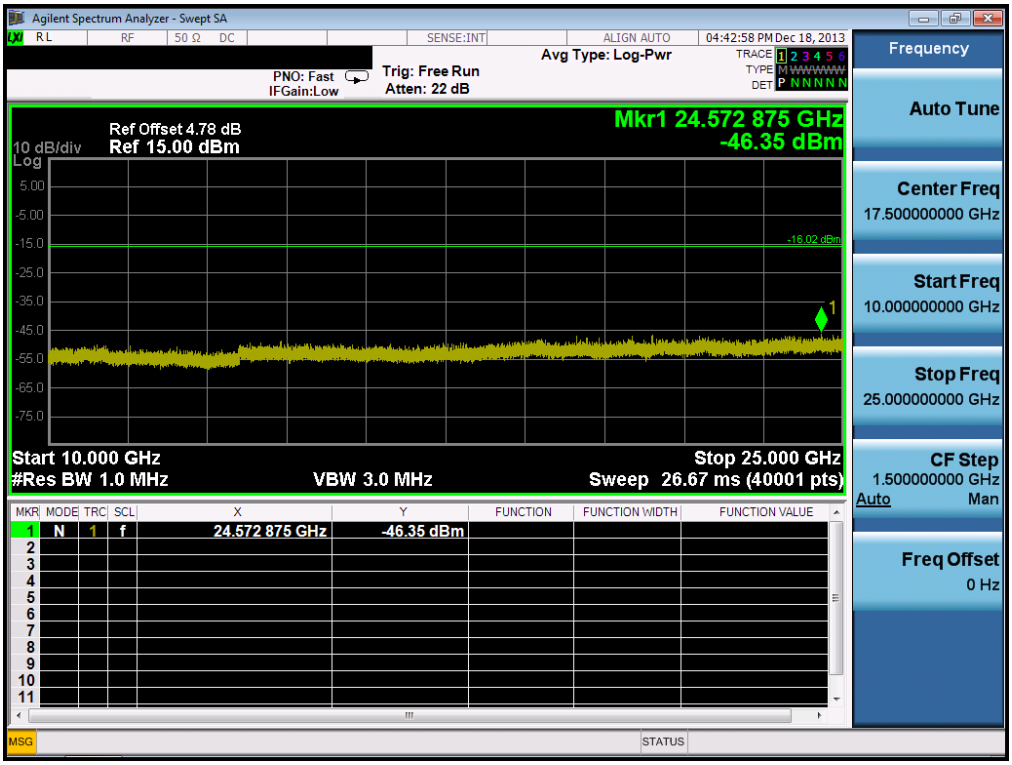
Reference



Conducted Spurious Emissions



Conducted Spurious Emissions

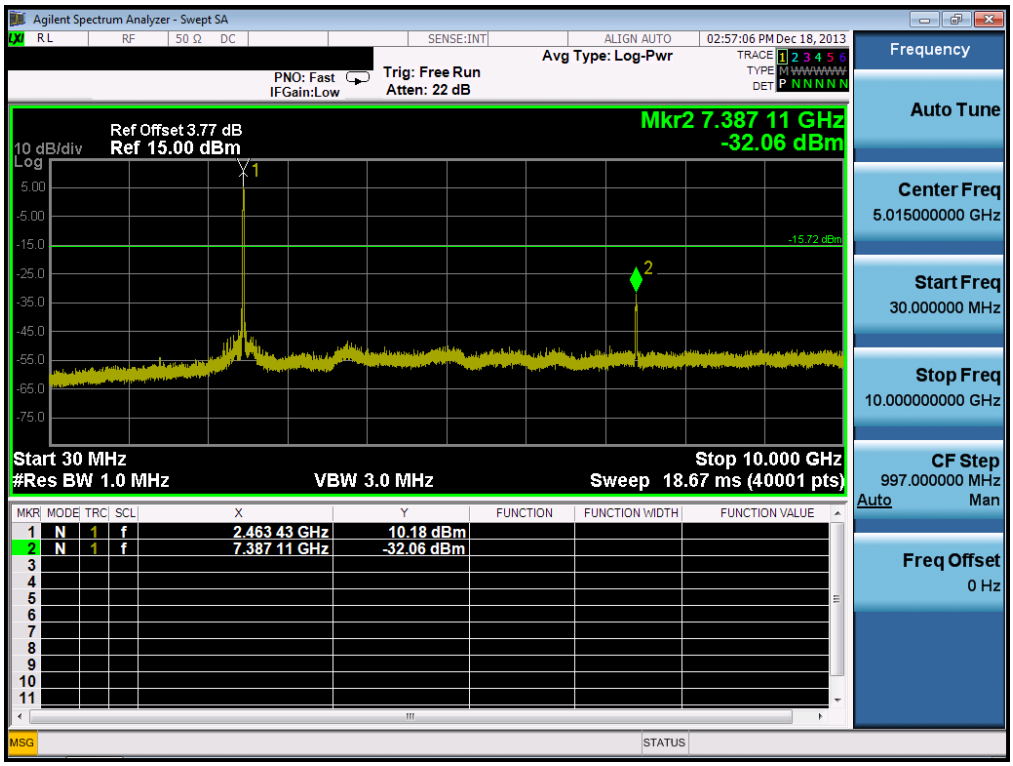


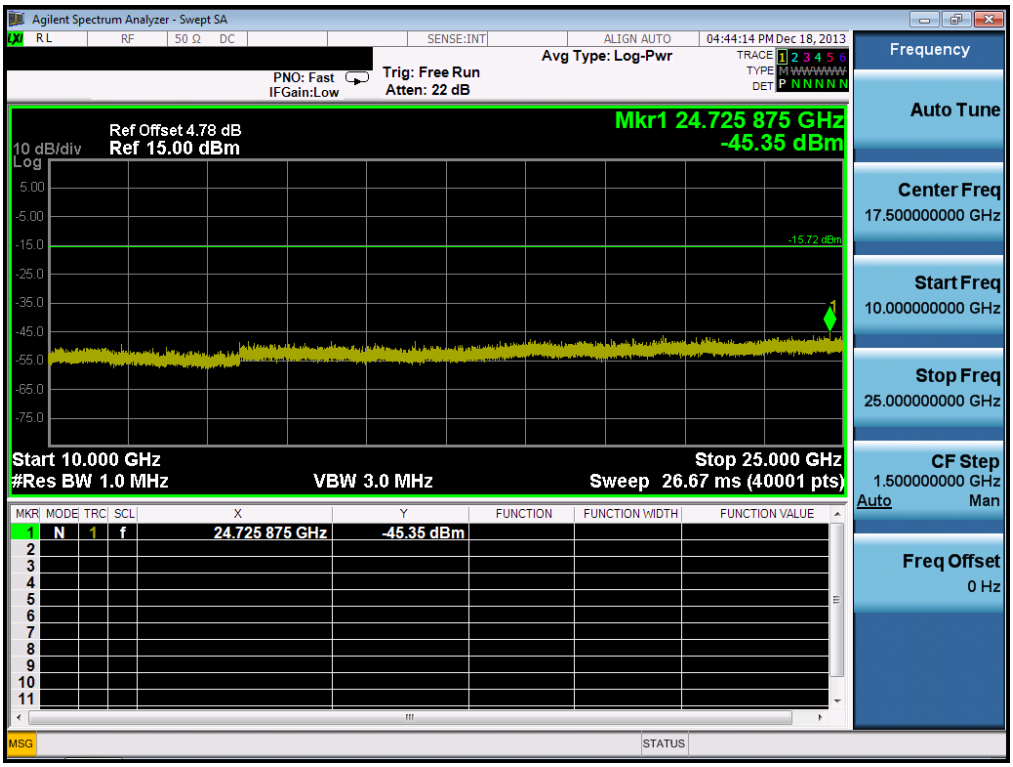
Test Mode: DC 12 V & 802.11b & 11Mbps & 2462MHz

Reference

High Band-edge

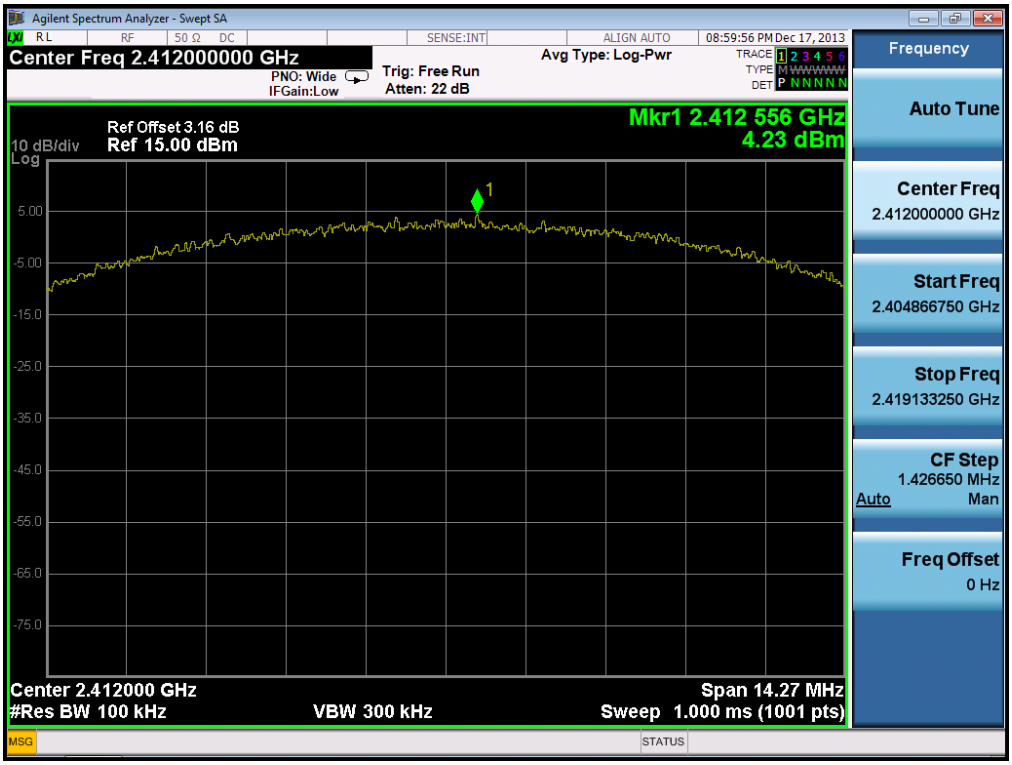
Conducted Spurious Emissions





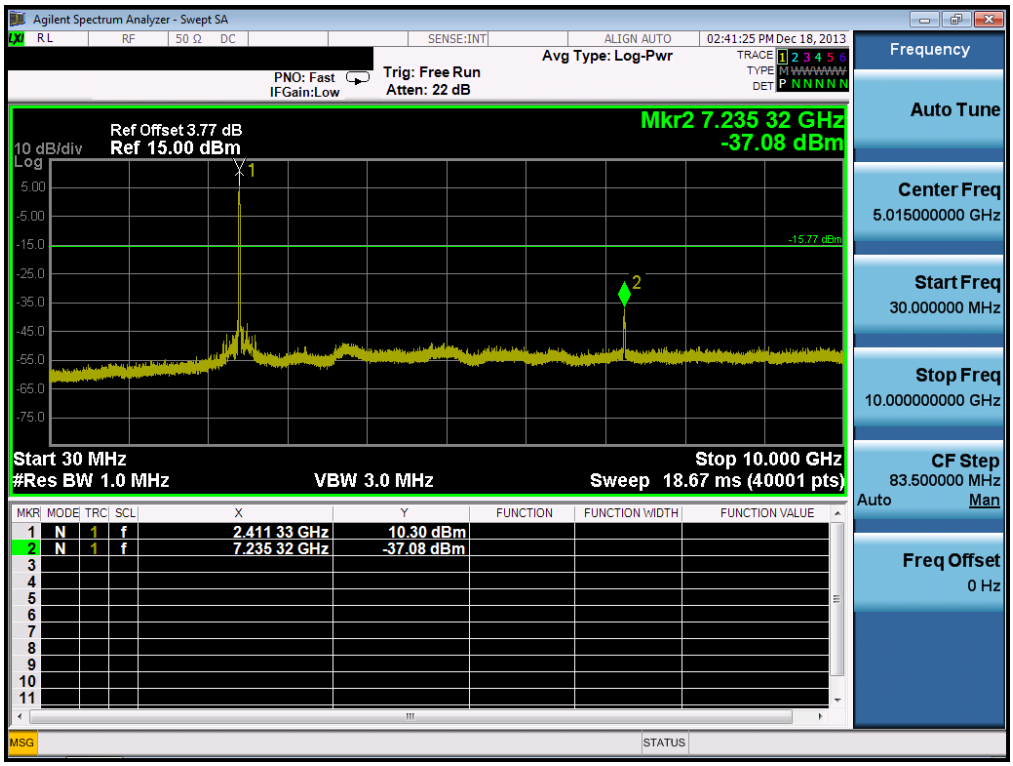
Test Mode: DC 24 V & 802.11b & 11Mbps & 2412MHz

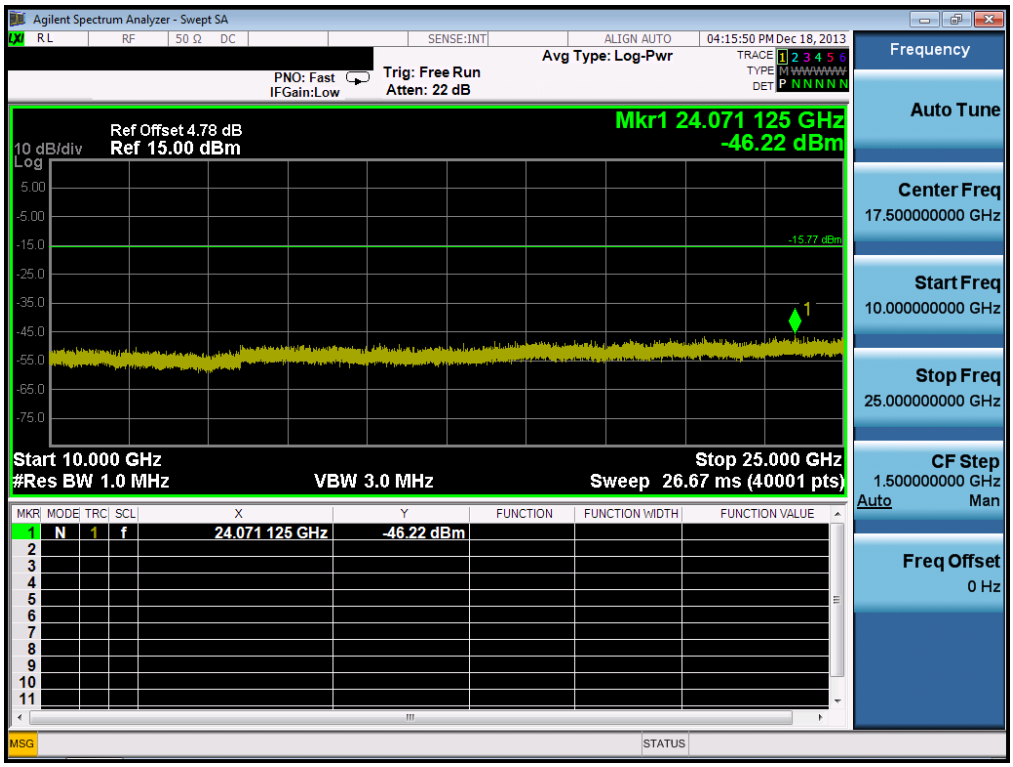
Reference



Low Band-edge

Conducted Spurious Emissions

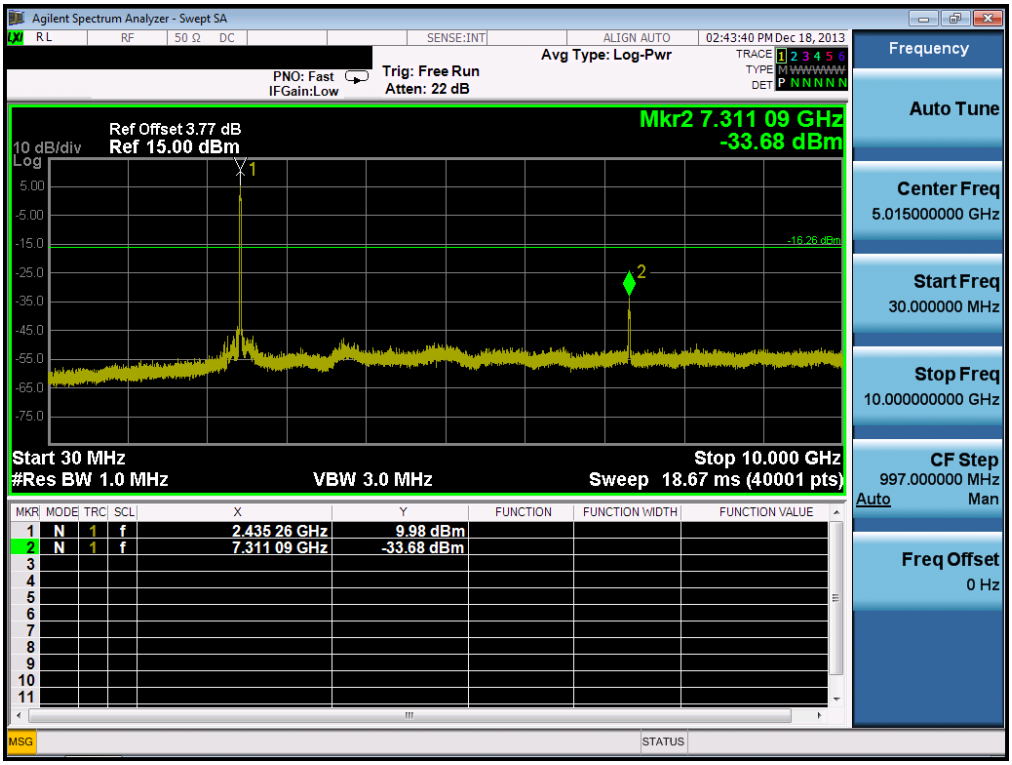




Test Mode: DC 24 V & 802.11b & 11Mbps & 2437MHz

Reference

Conducted Spurious Emissions



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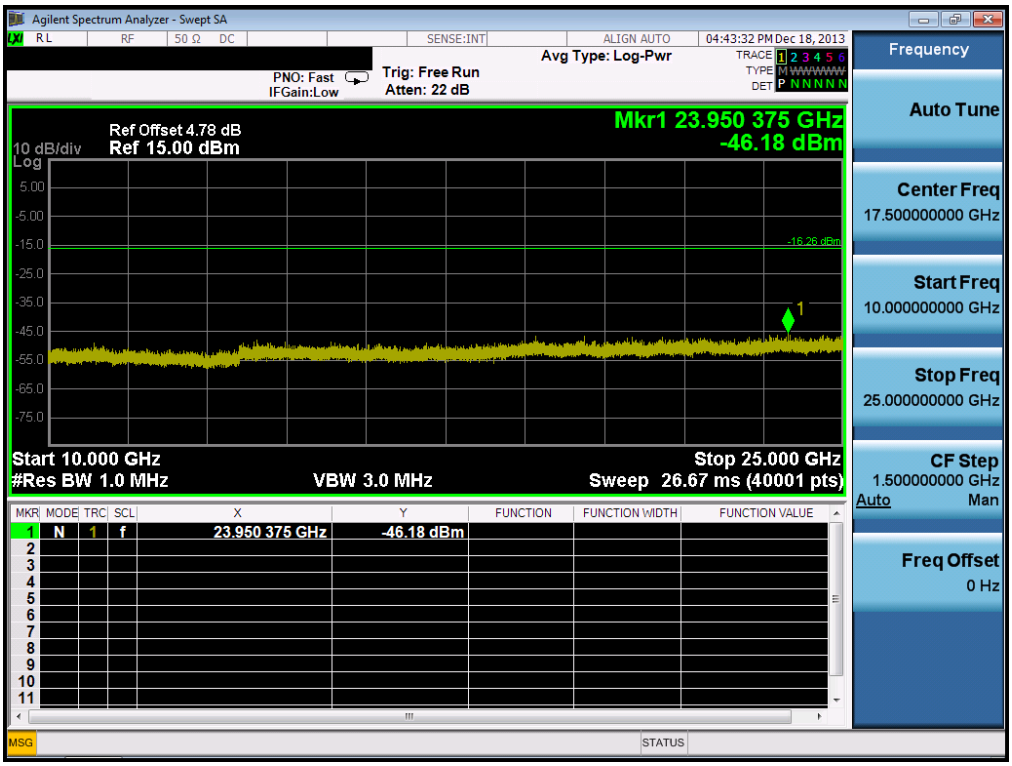
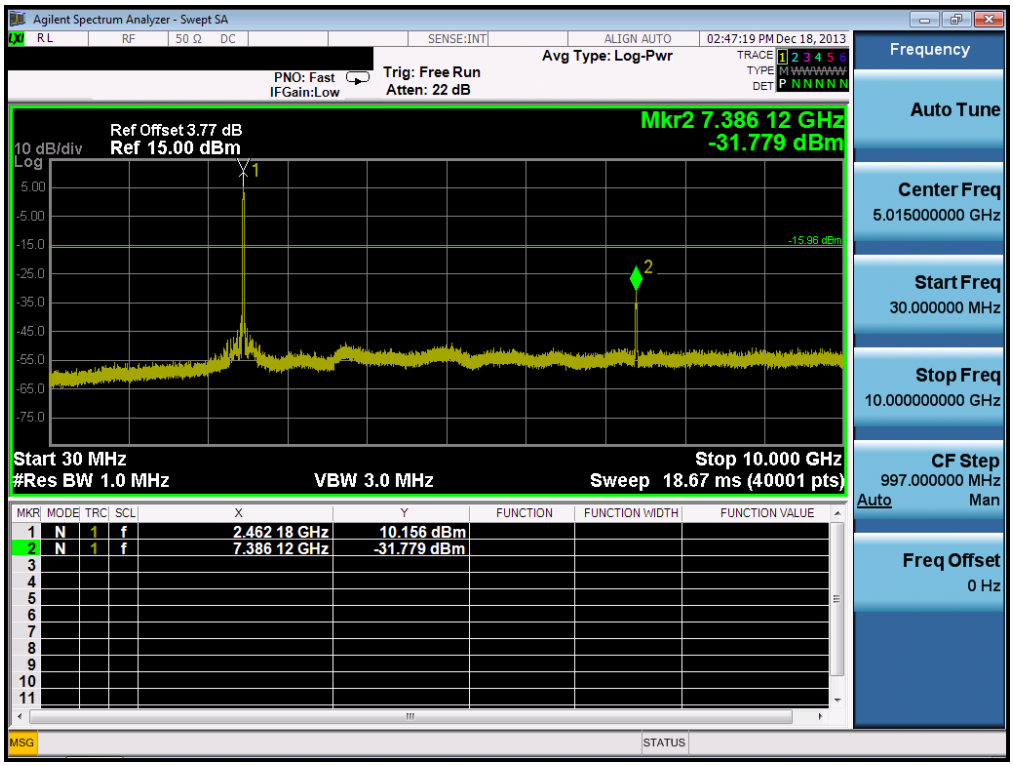


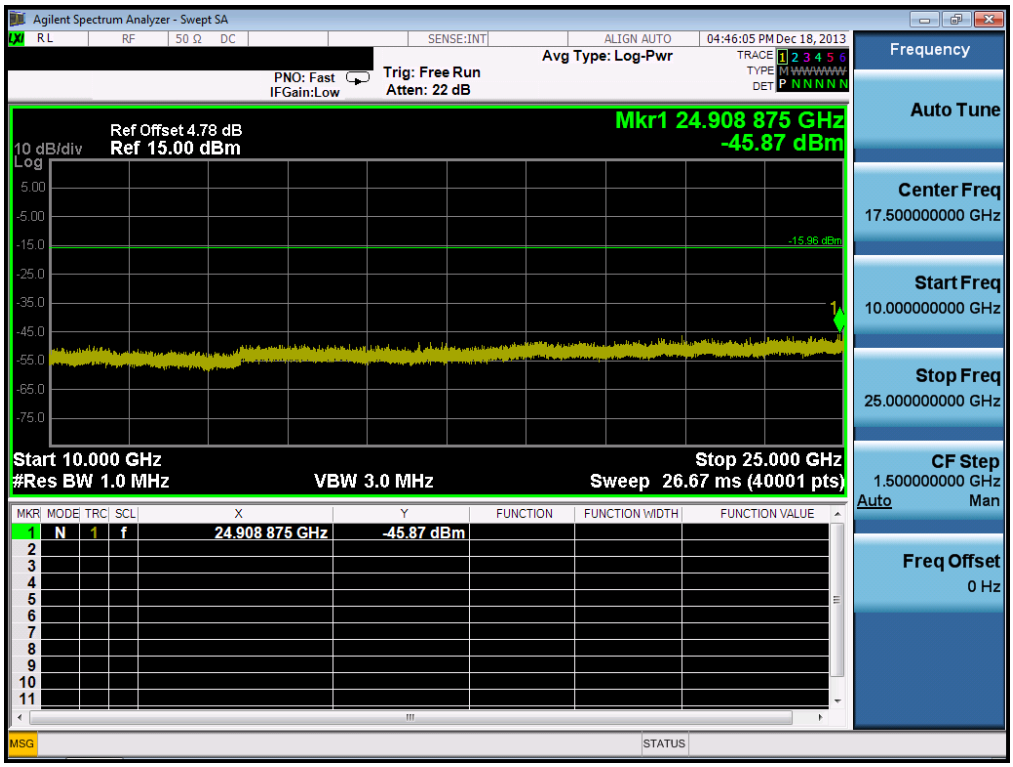
Test Mode: DC 24 V & 802.11b & 11Mbps & 2462MHz

Reference

High Band-edge

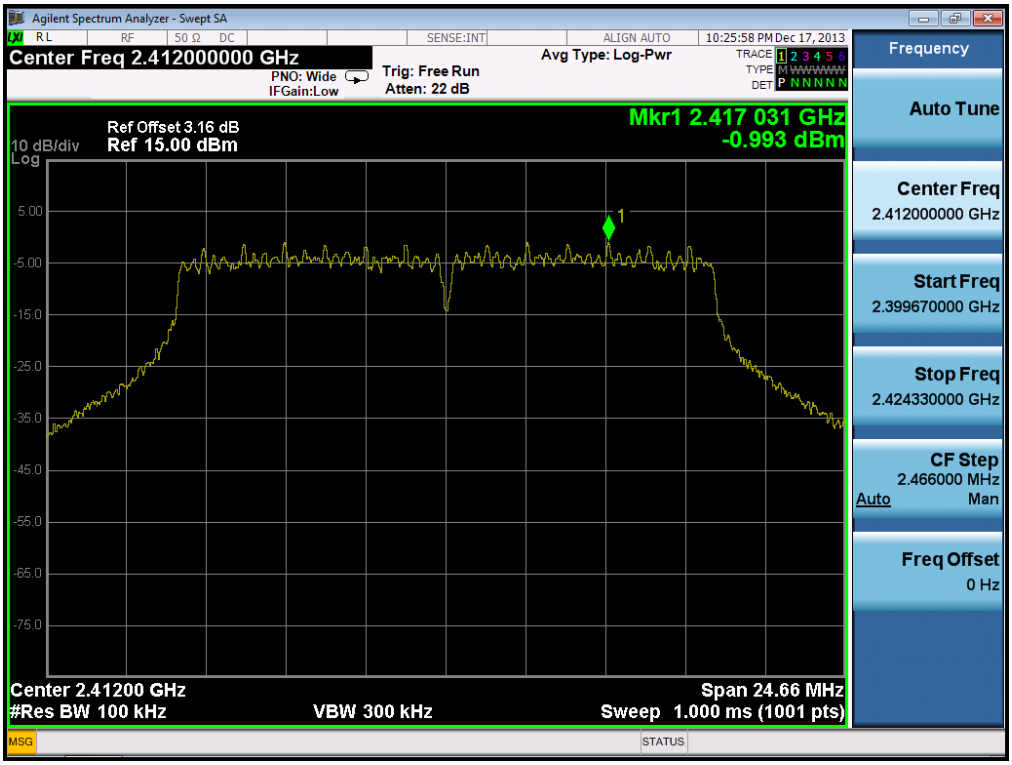
Conducted Spurious Emissions





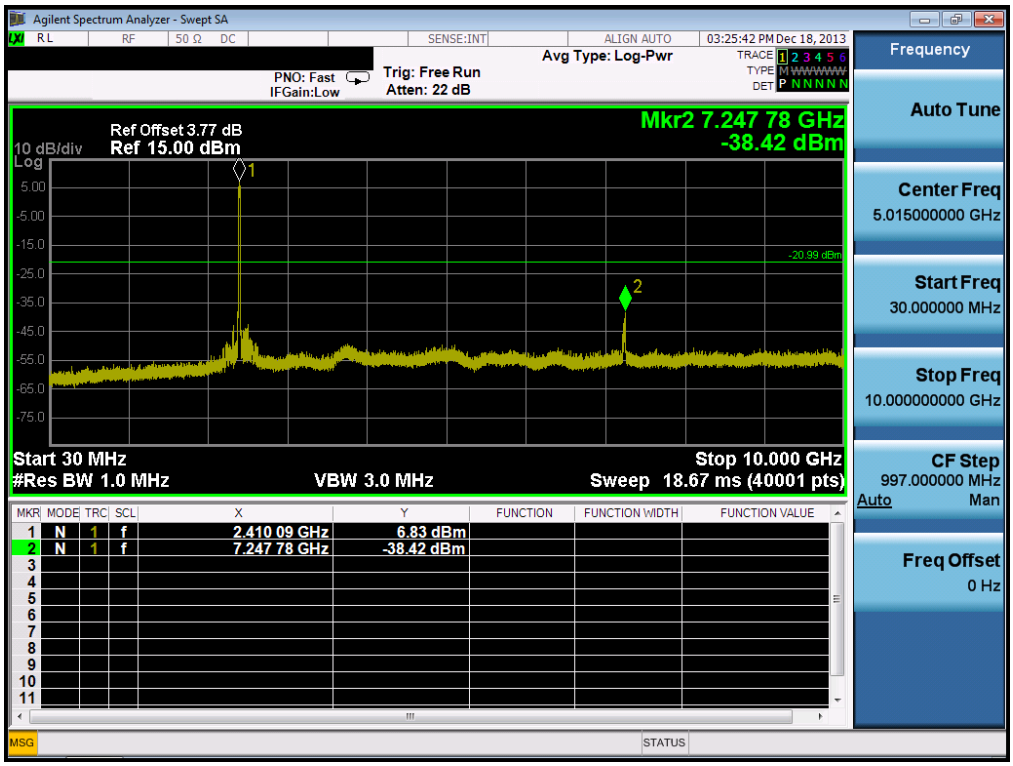
Test Mode: DC 12 V & 802.11g & 54Mbps & 2412MHz

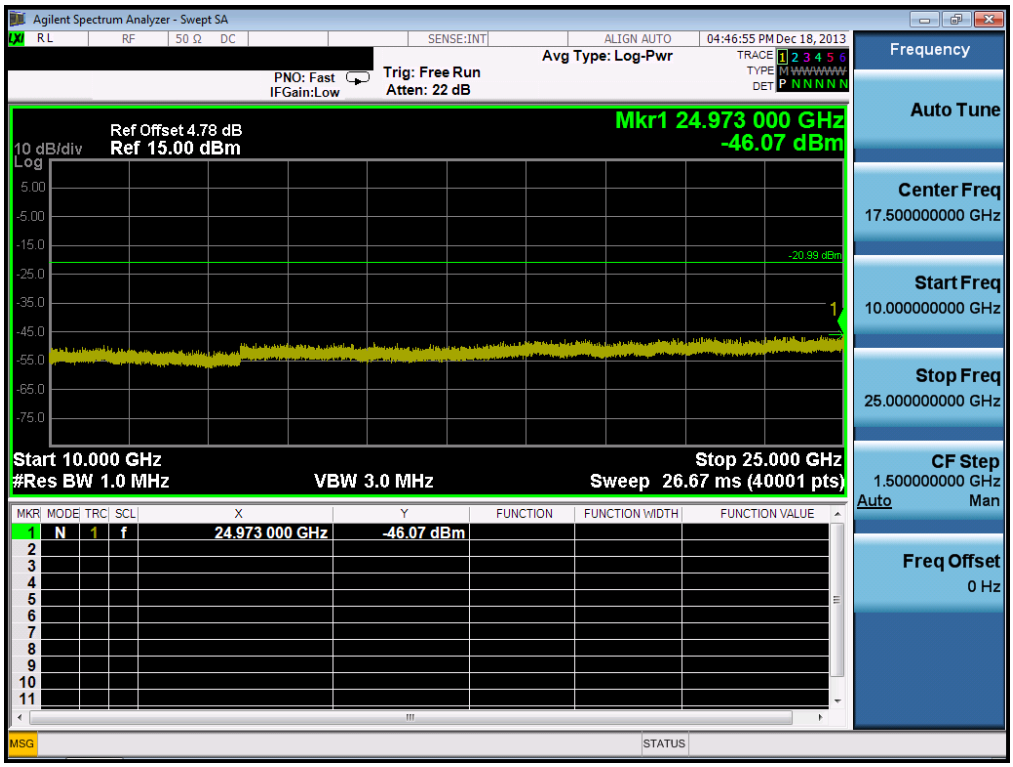
Reference



Low Band-edge

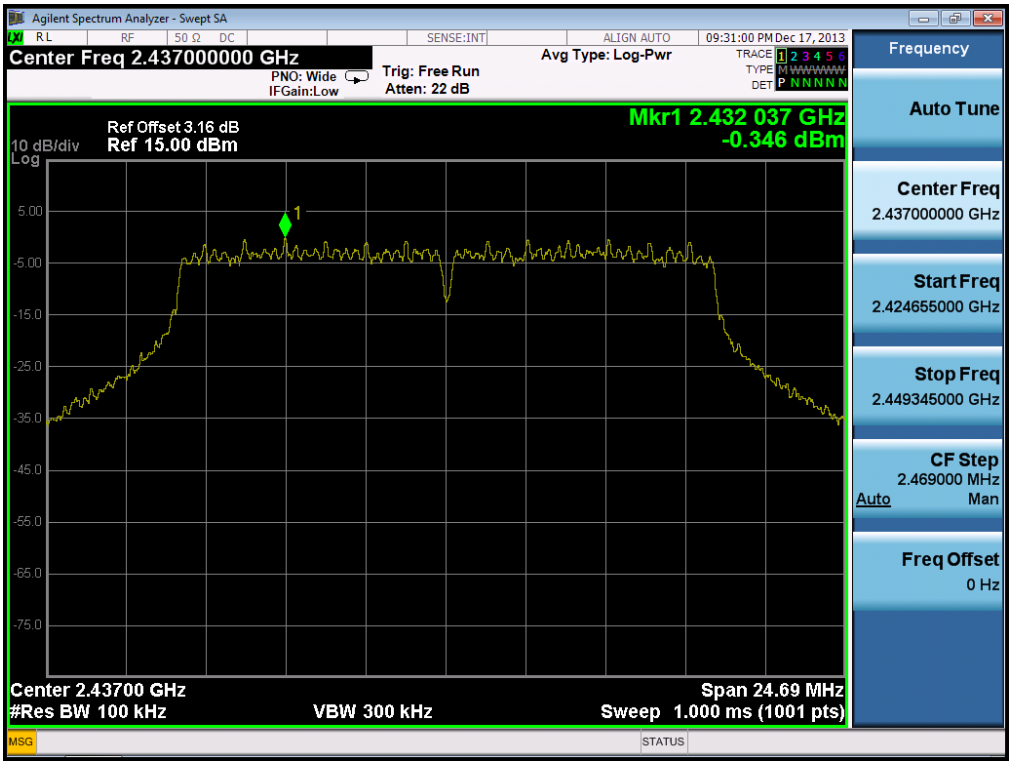
Conducted Spurious Emissions





Test Mode: DC 12 V & 802.11g & 24Mbps & 2437MHz

Reference



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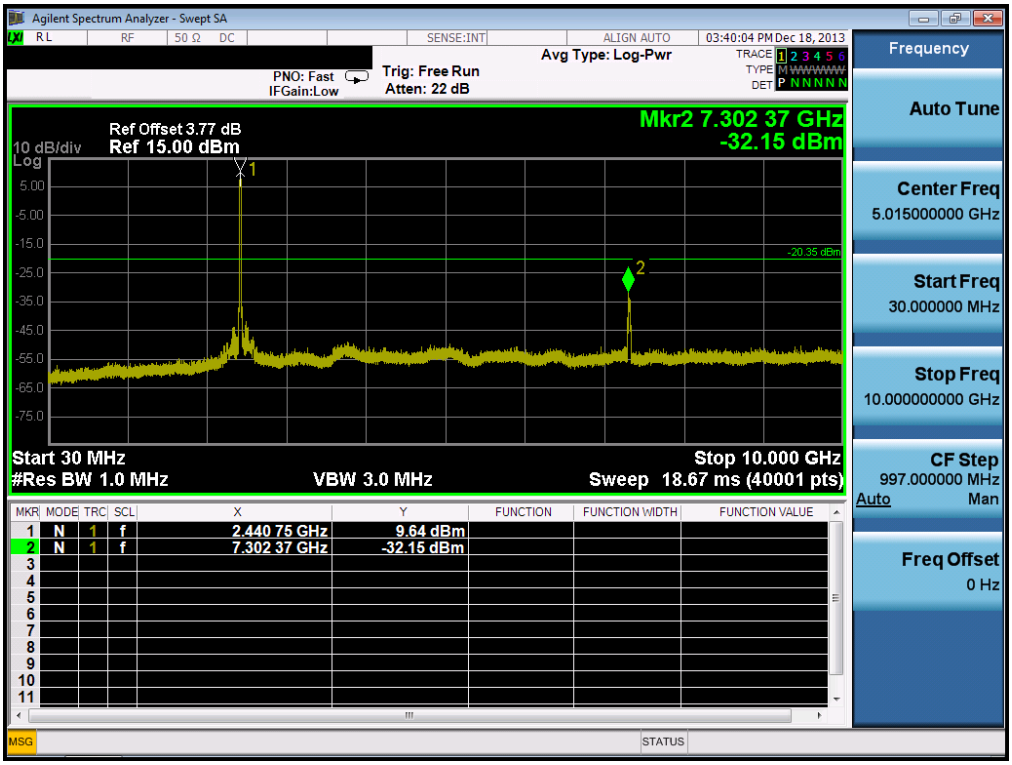

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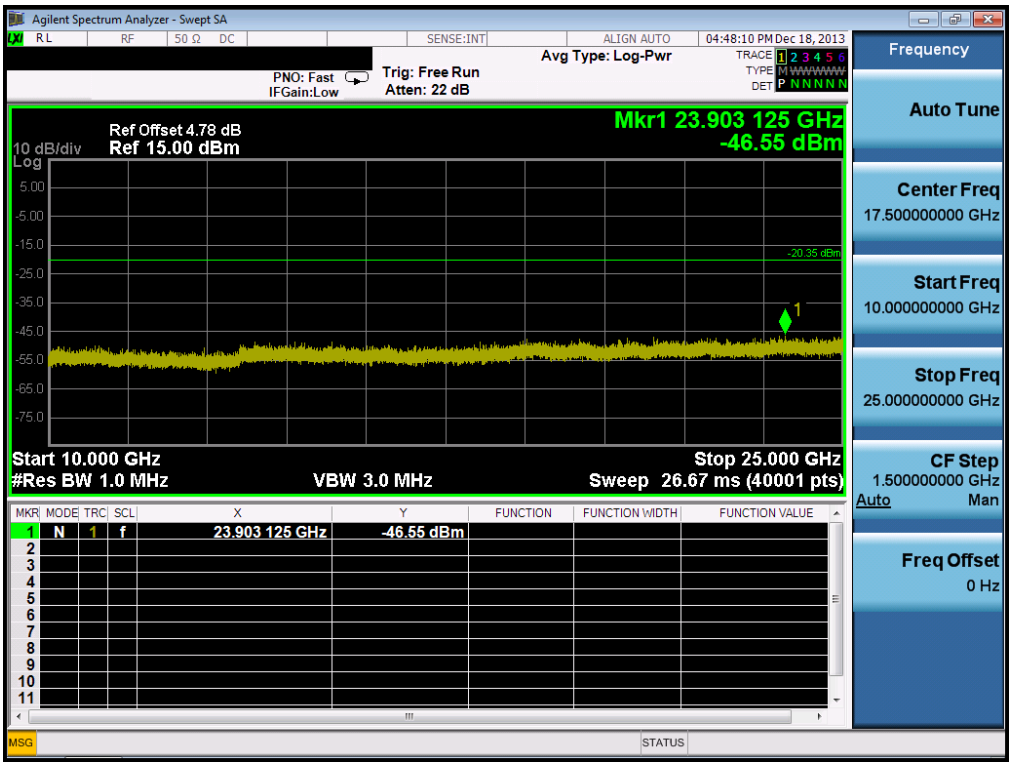
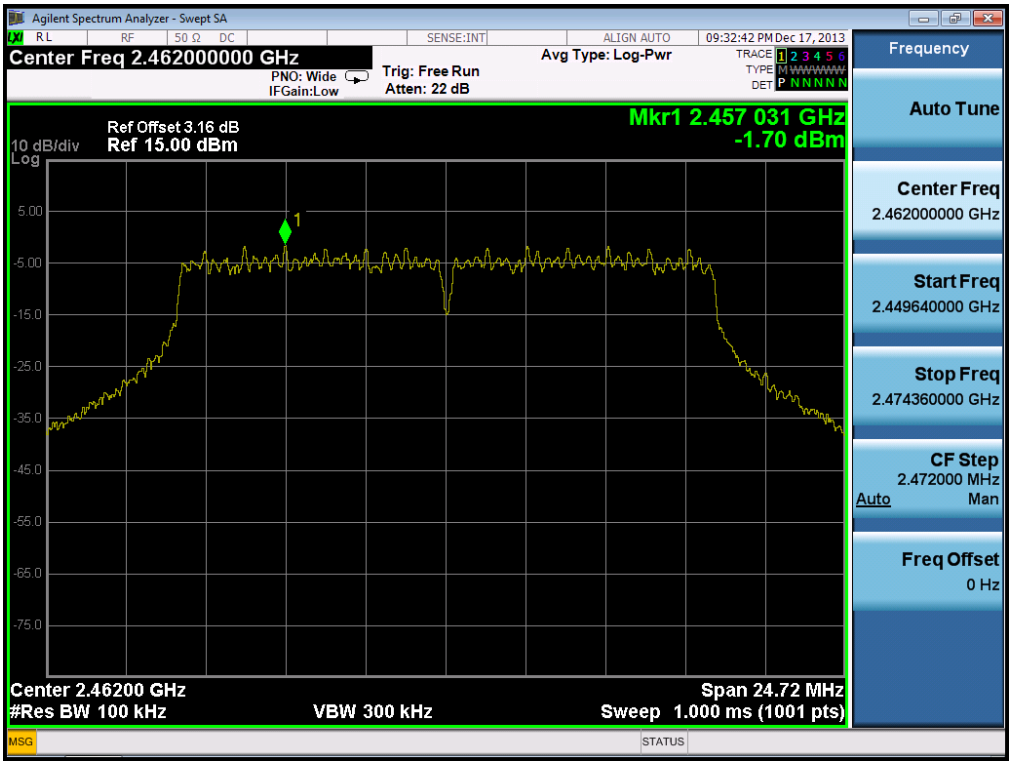


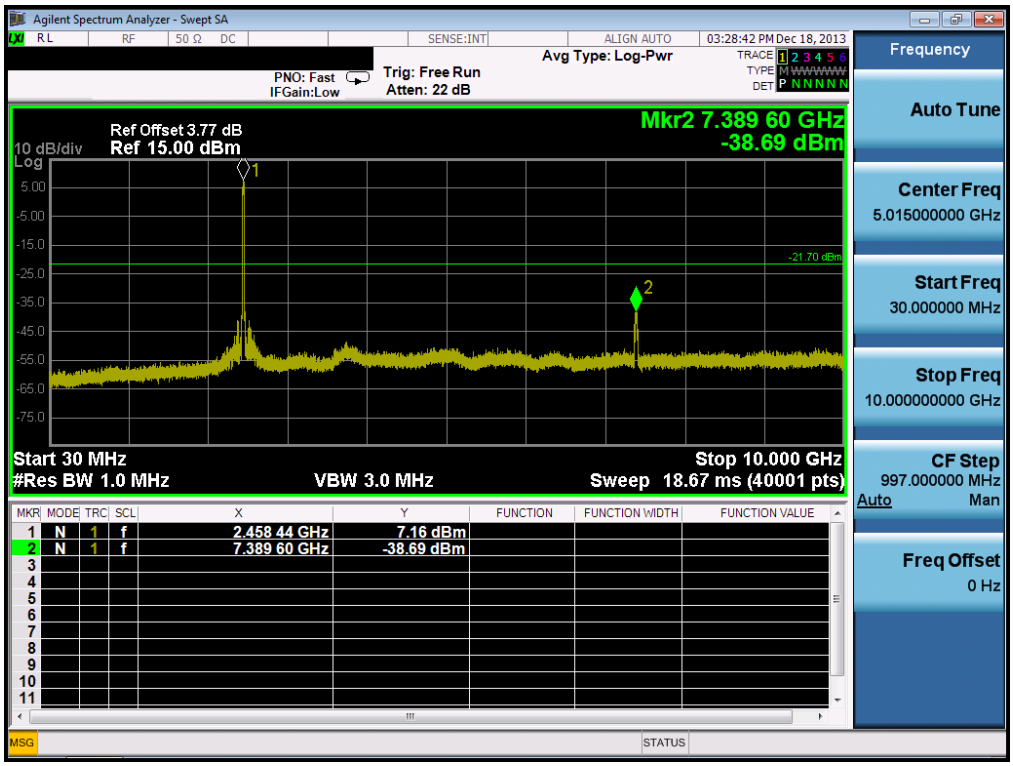
Test Mode: DC 12 V & 802.11g & 54Mbps & 2462MHz

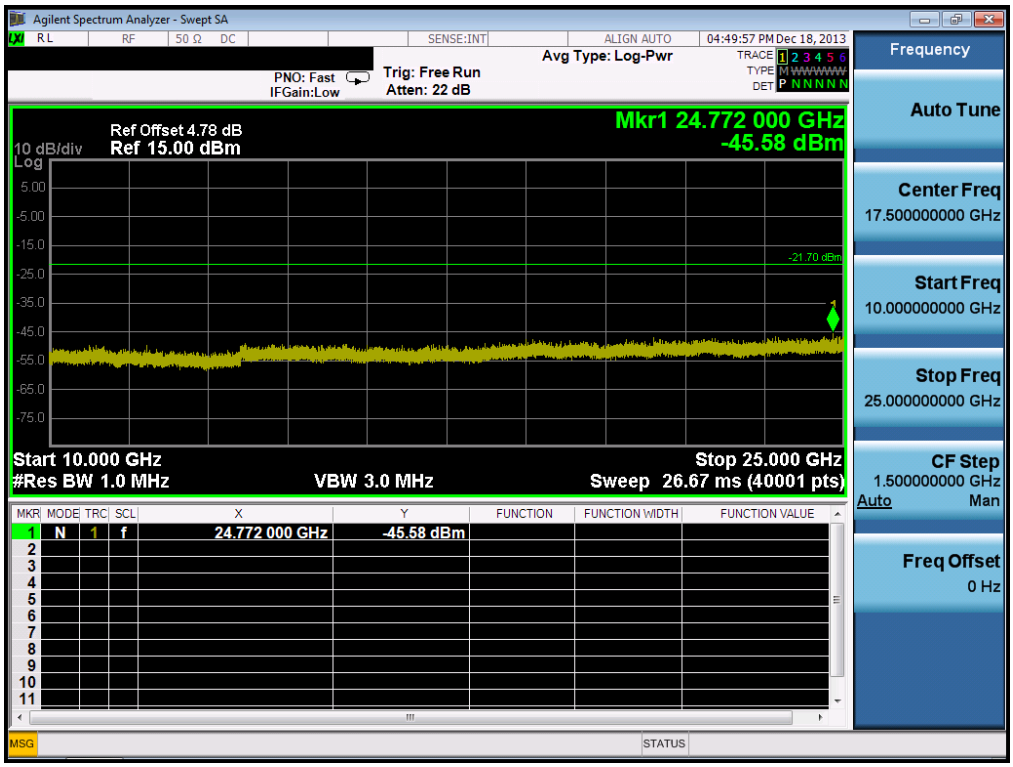
Reference



High Band-edge

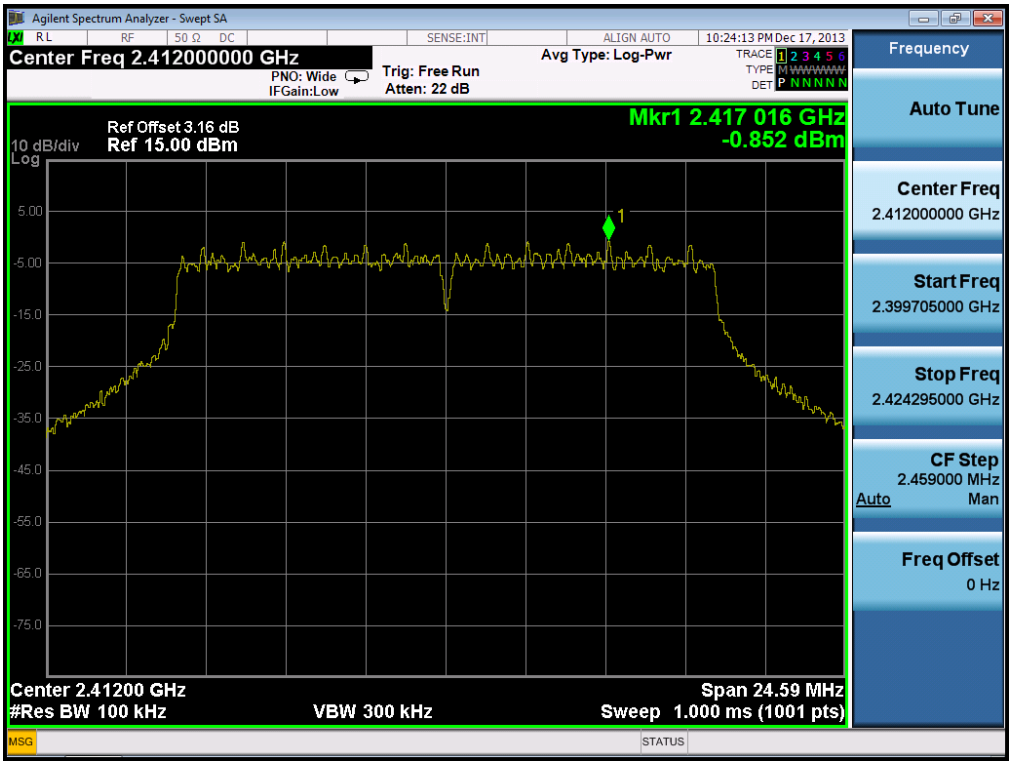
Conducted Spurious Emissions





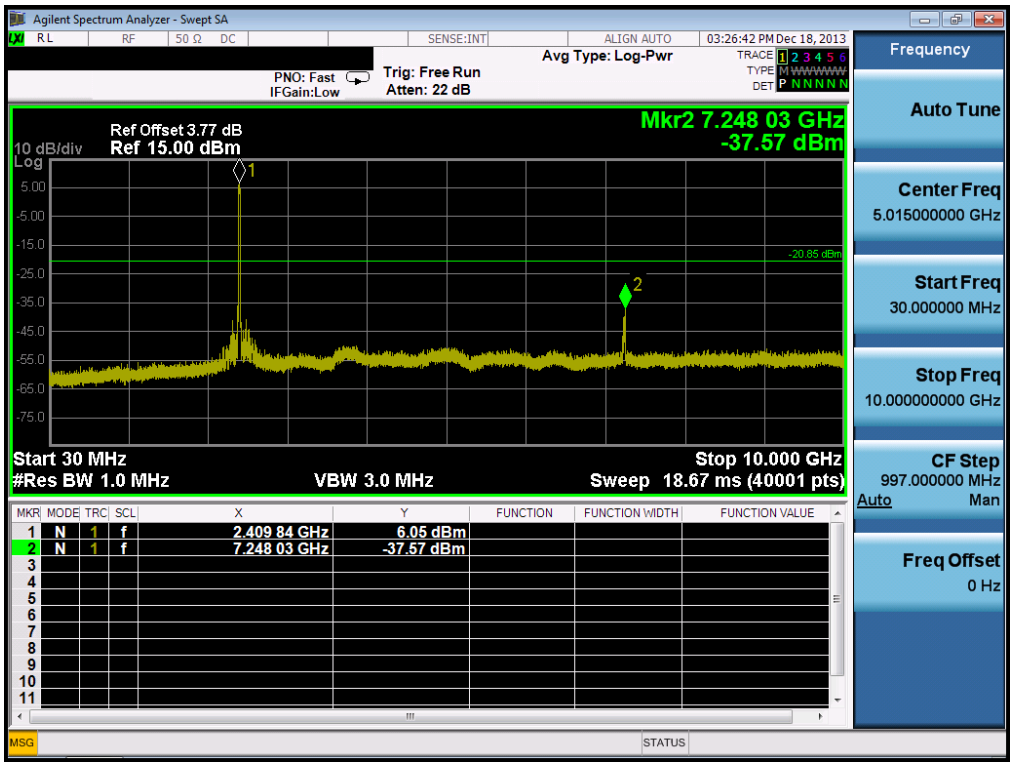
Test Mode: DC 24 V & 802.11g & 54Mbps & 2412MHz

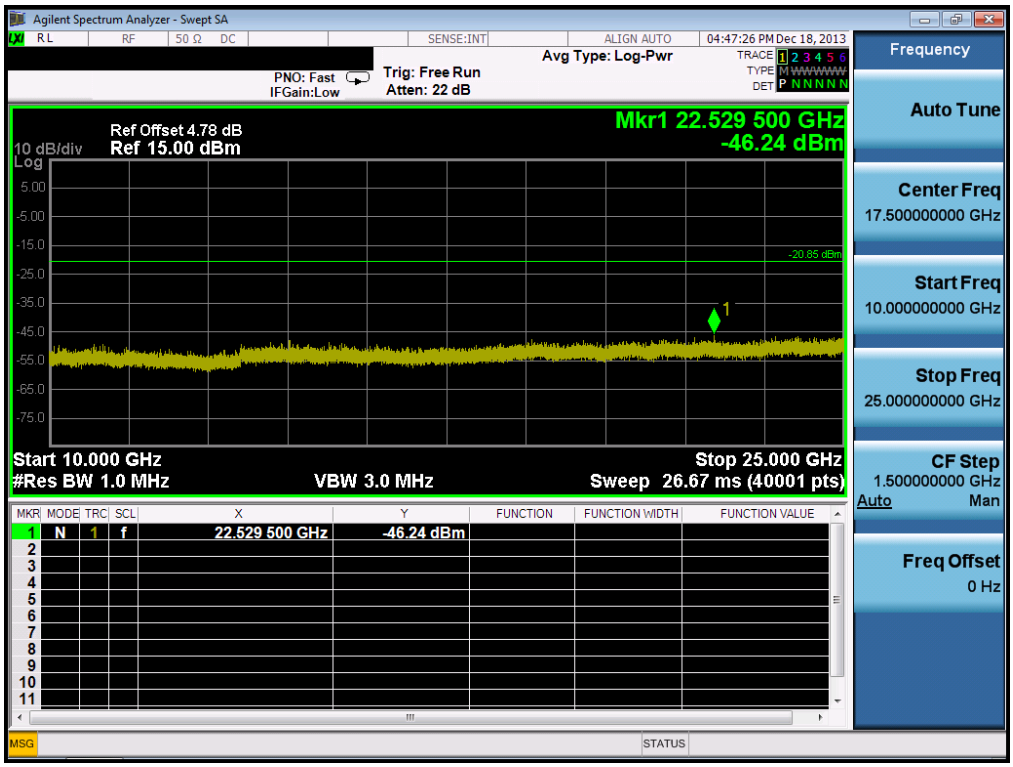
Reference



Low Band-edge

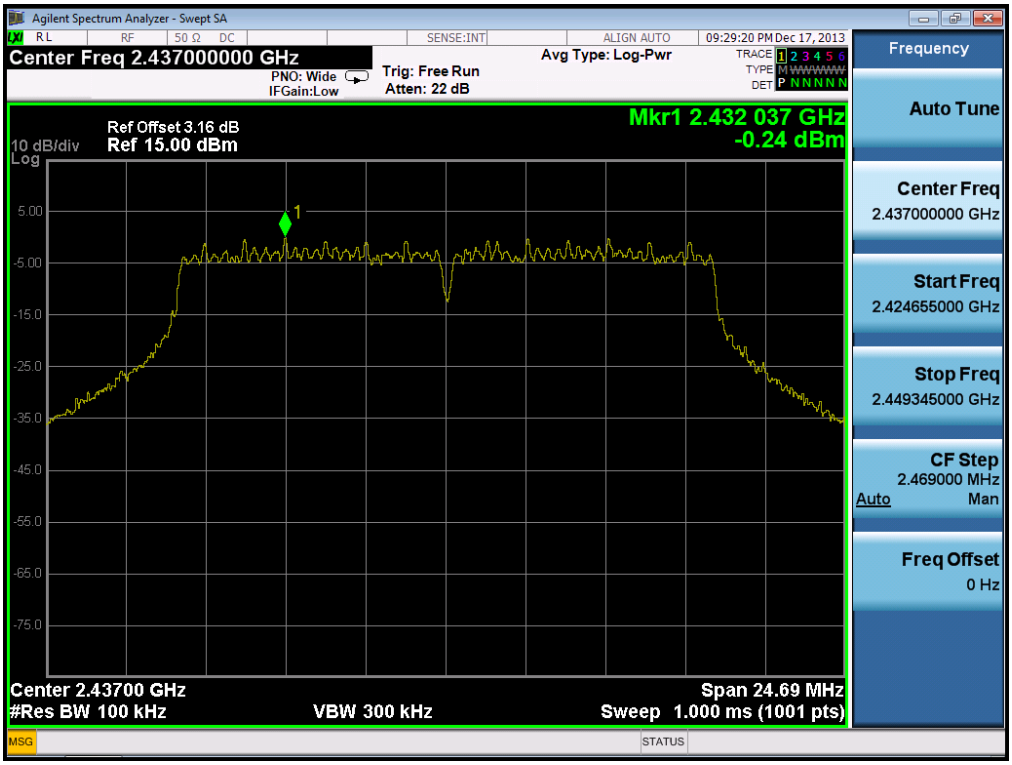
Conducted Spurious Emissions





Test Mode: DC 24 V & 802.11g & 24Mbps & 2437MHz

Reference



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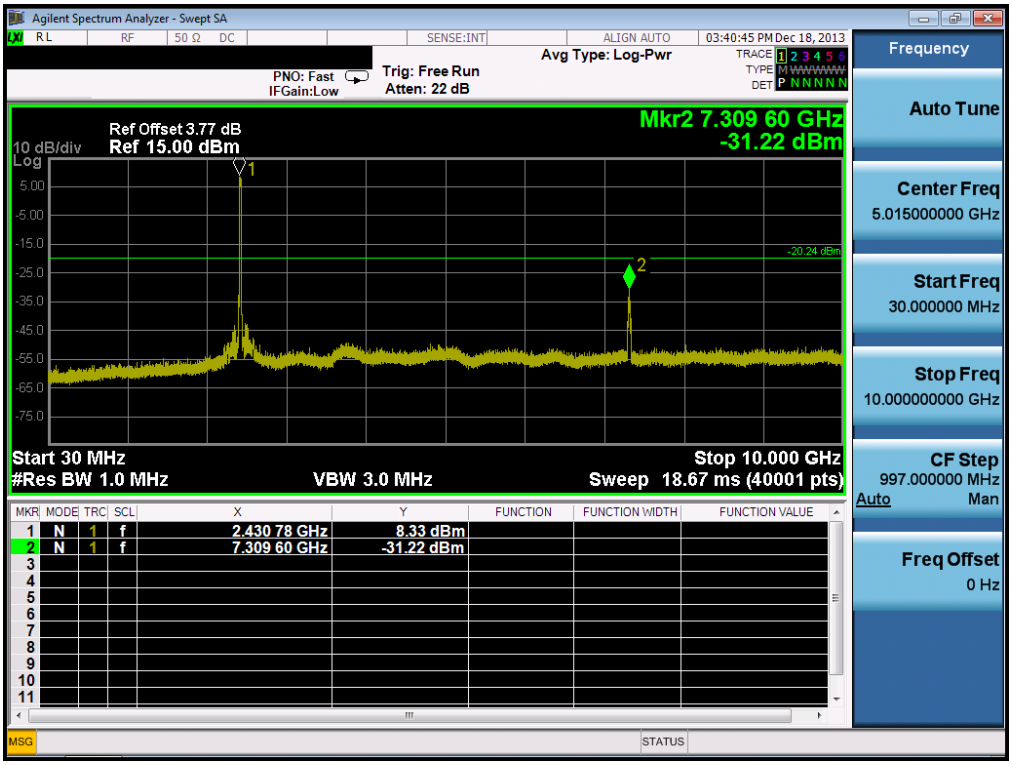
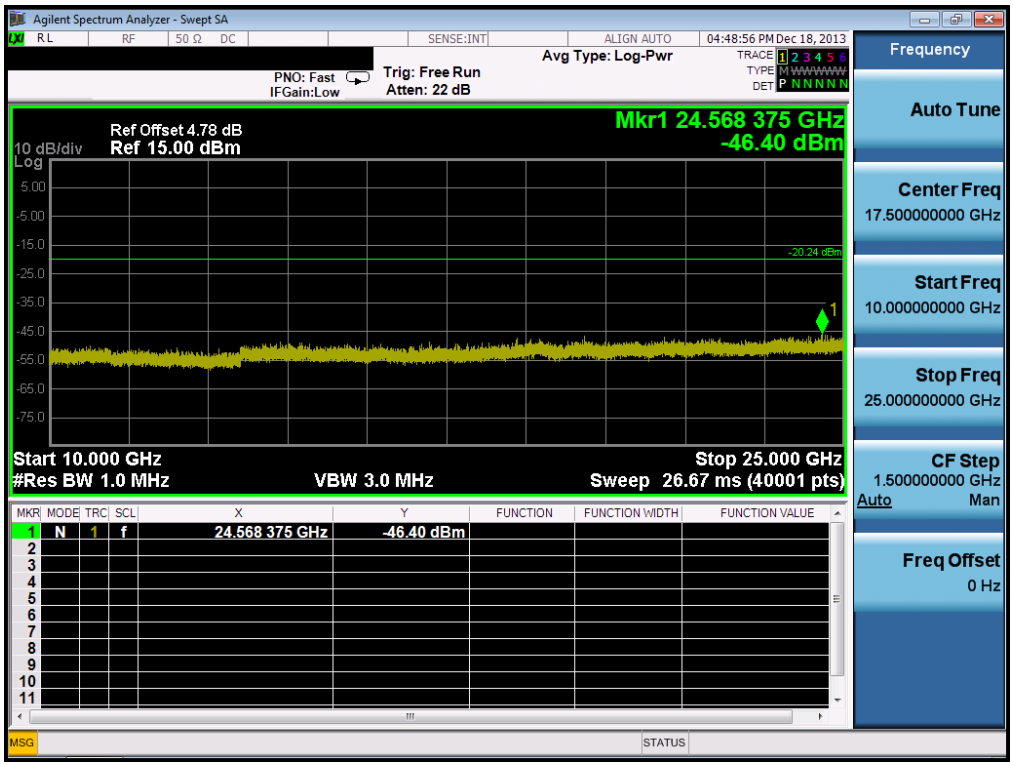
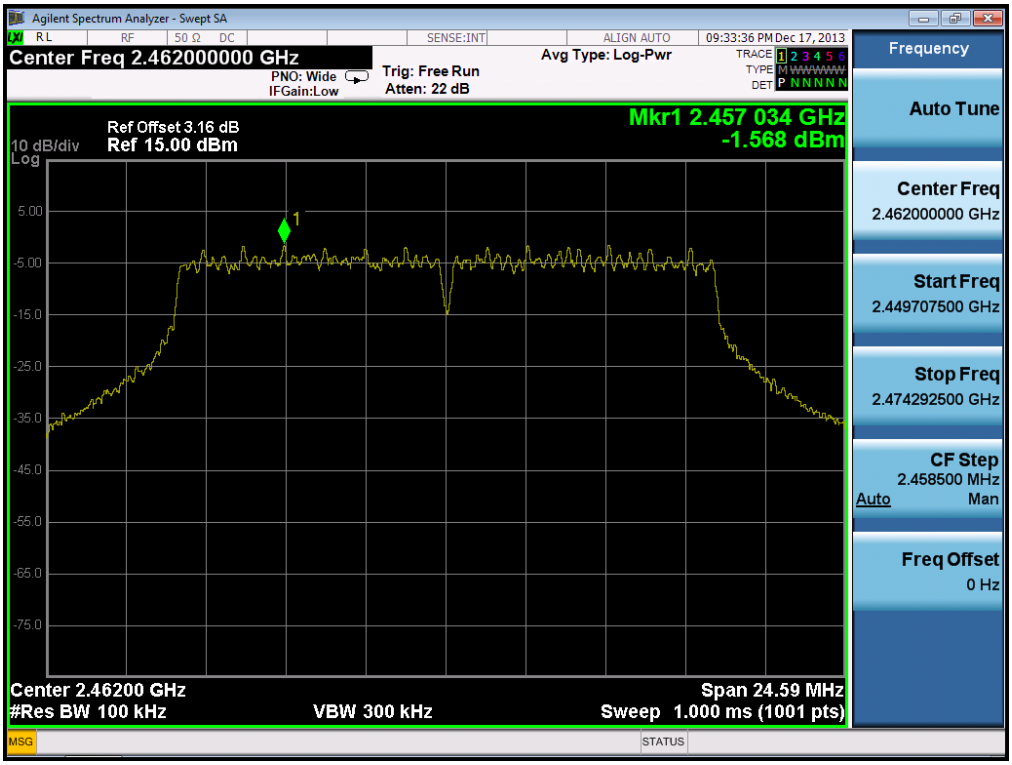


Conducted Spurious Emissions

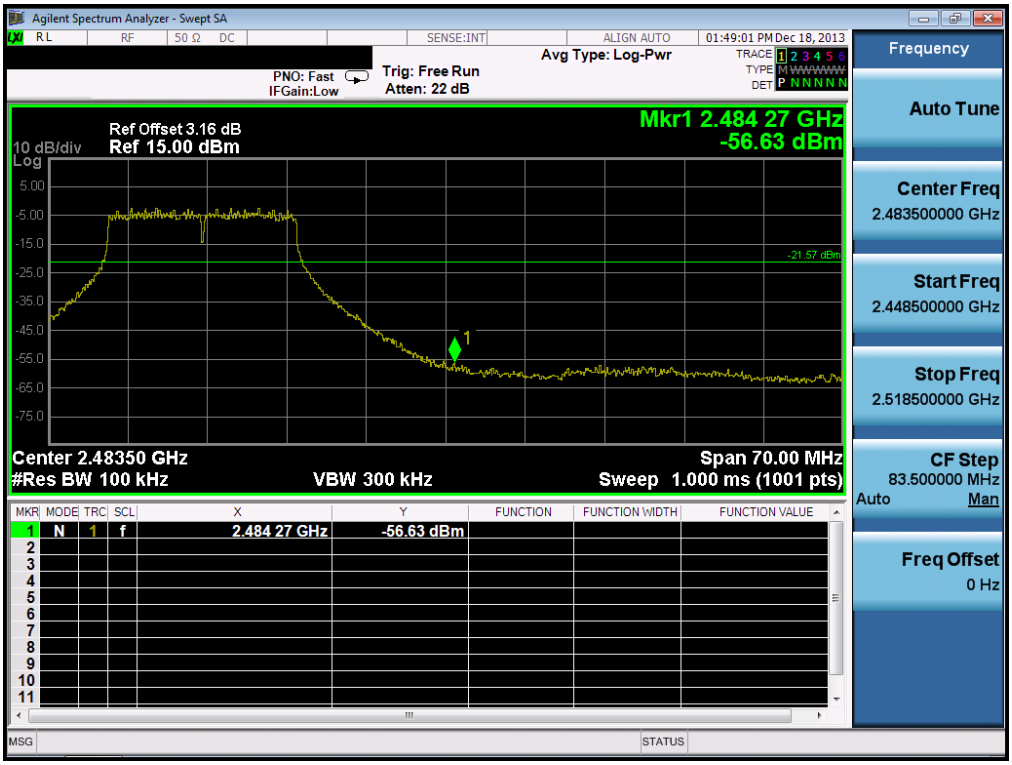


Test Mode: DC 24 V & 802.11g & 54Mbps & 2462MHz

Reference



High Band-edge



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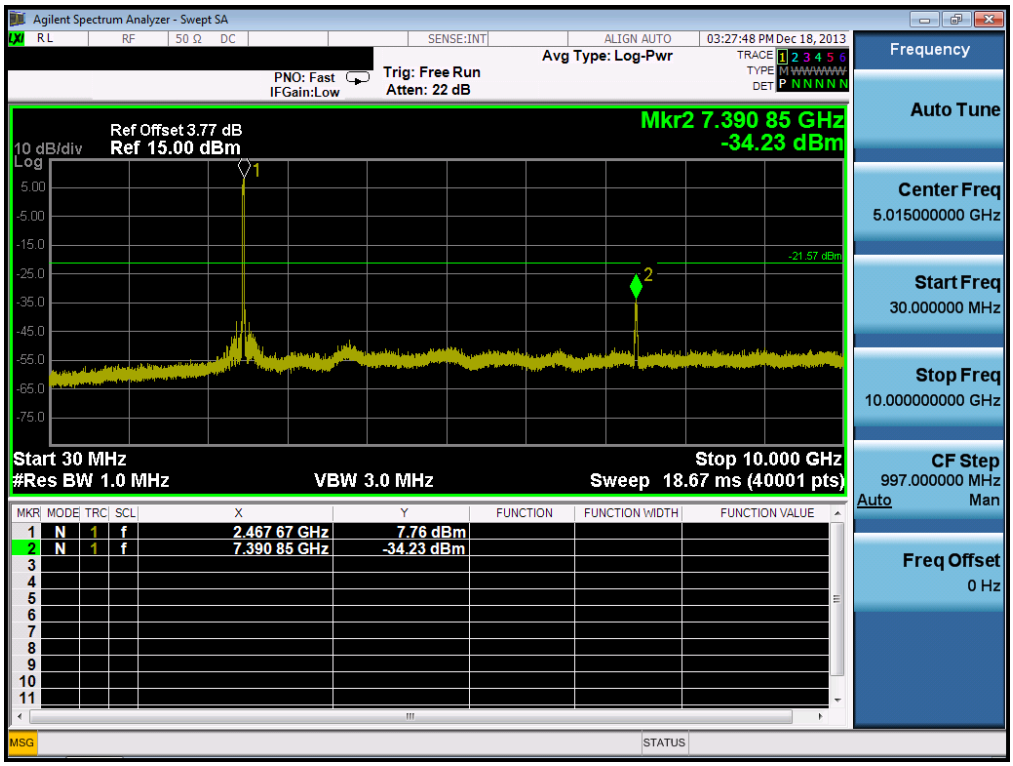
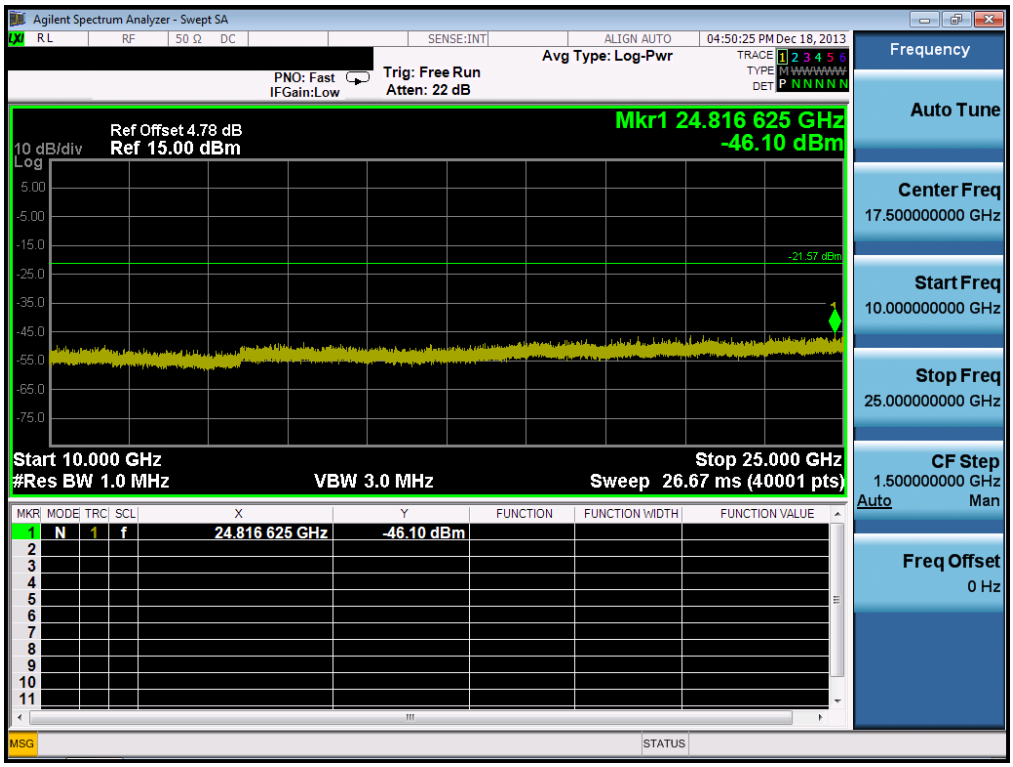
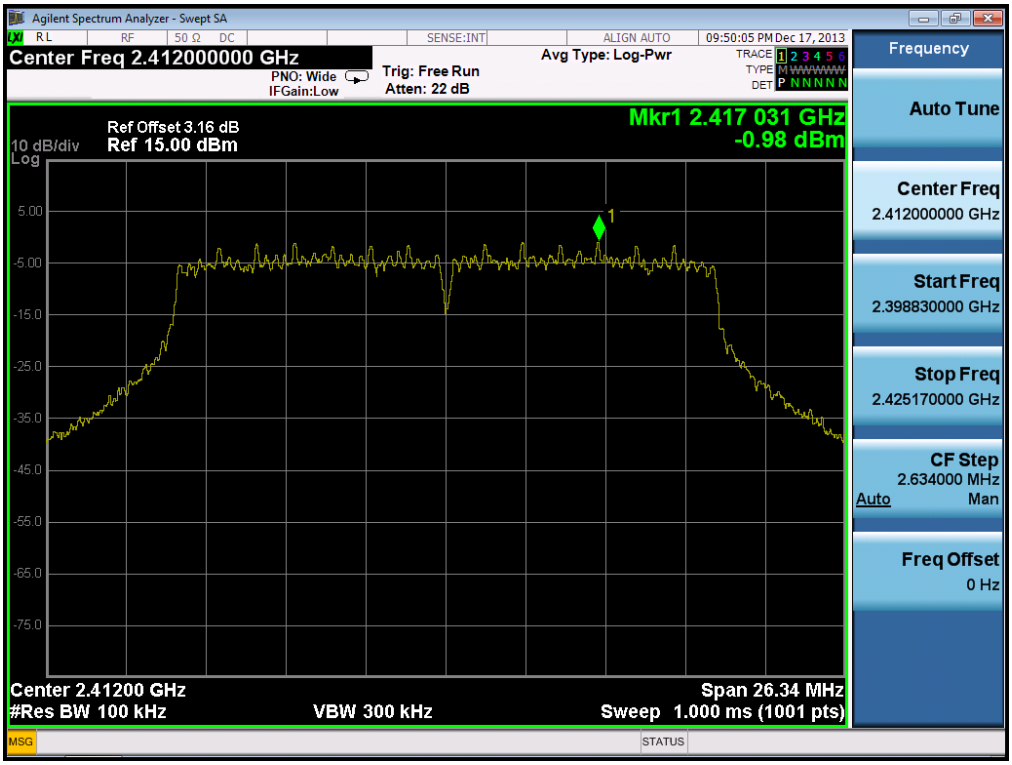




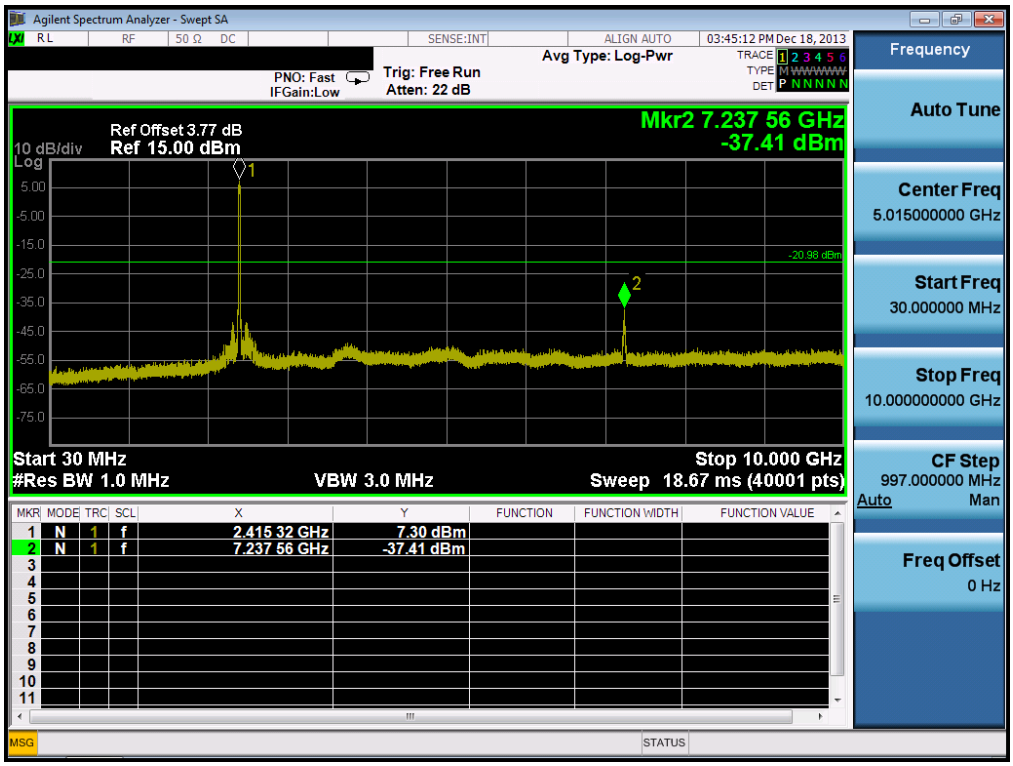
Test Mode: DC 12 V & 802.11n(HT20) & MCS 7 & 2412MHz

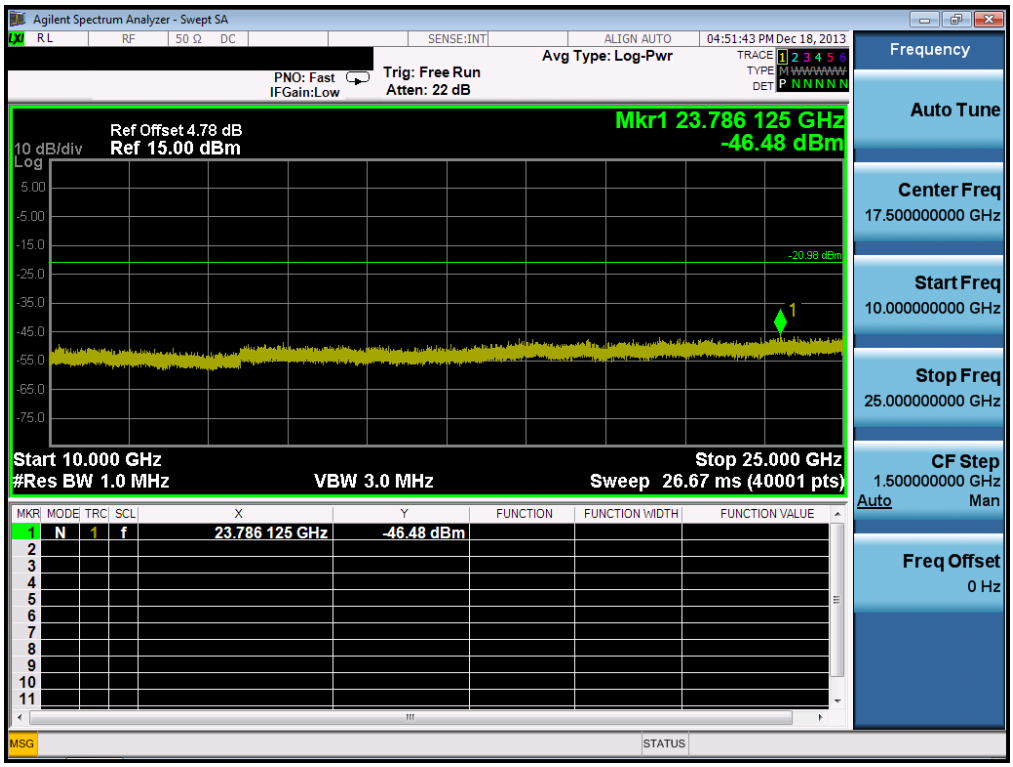
Reference



Low Band-edge

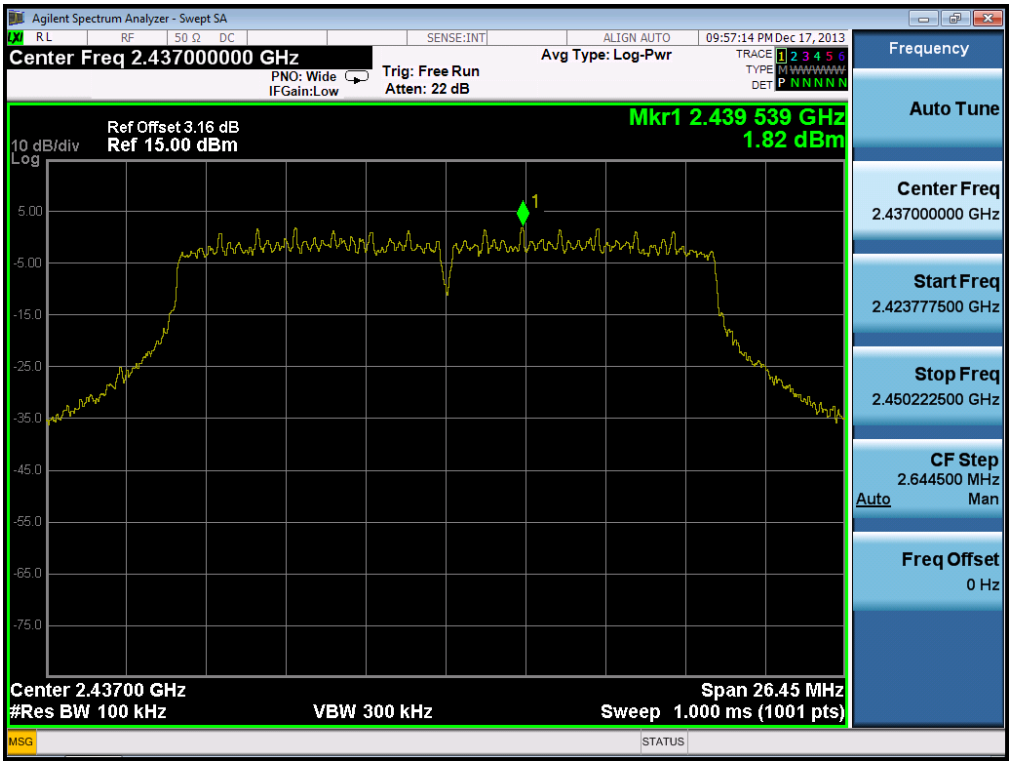
Conducted Spurious Emissions





Test Mode: DC 12 V & 802.11n(HT20) & MCS 4 & 2437MHz

Reference



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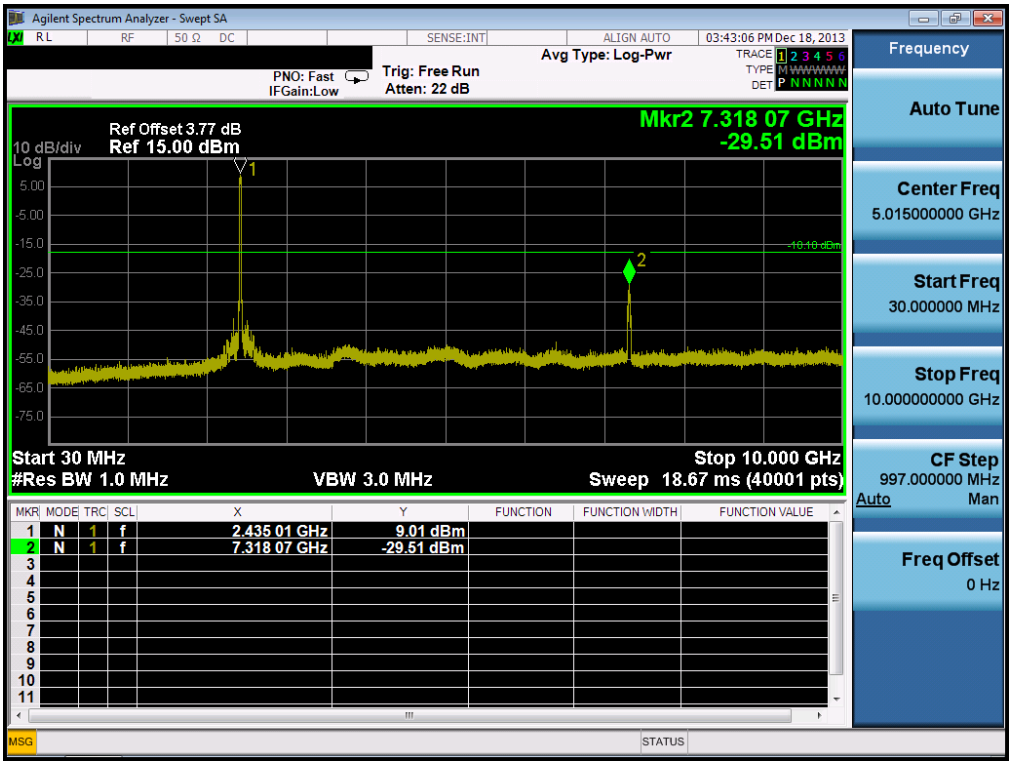

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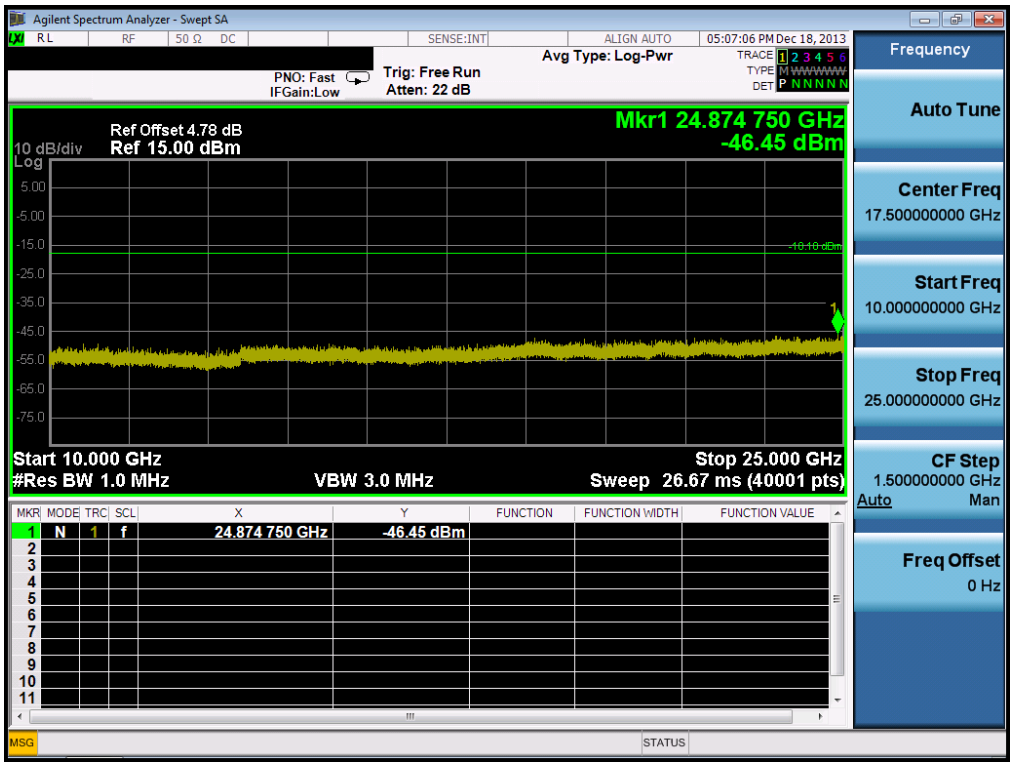
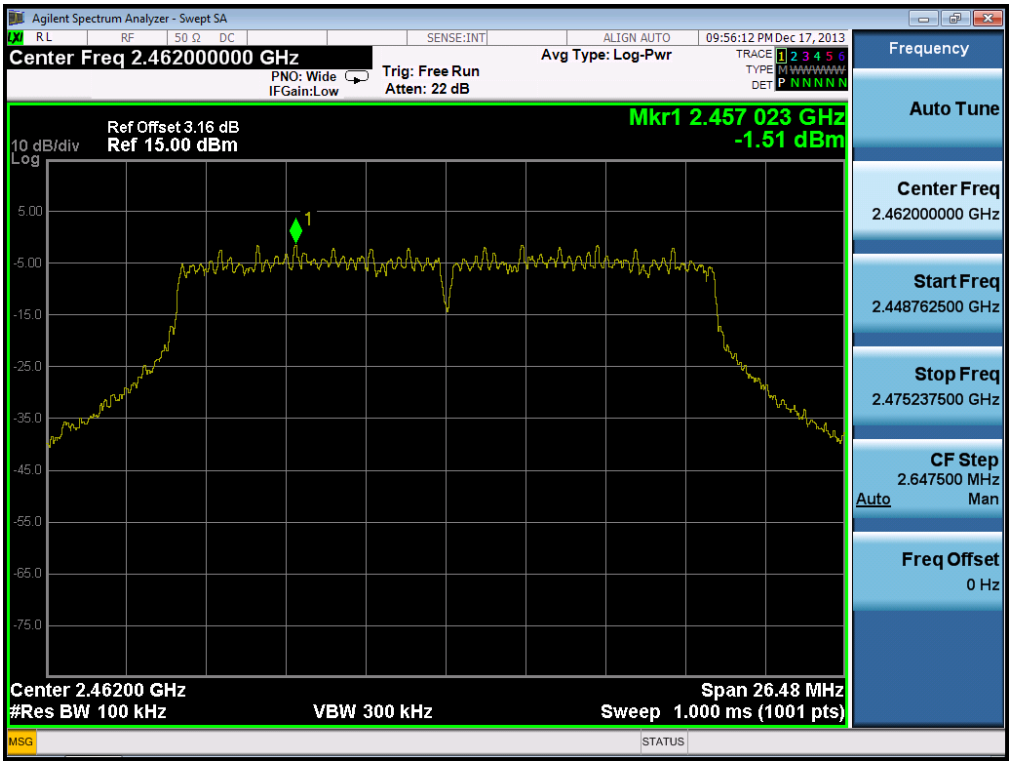
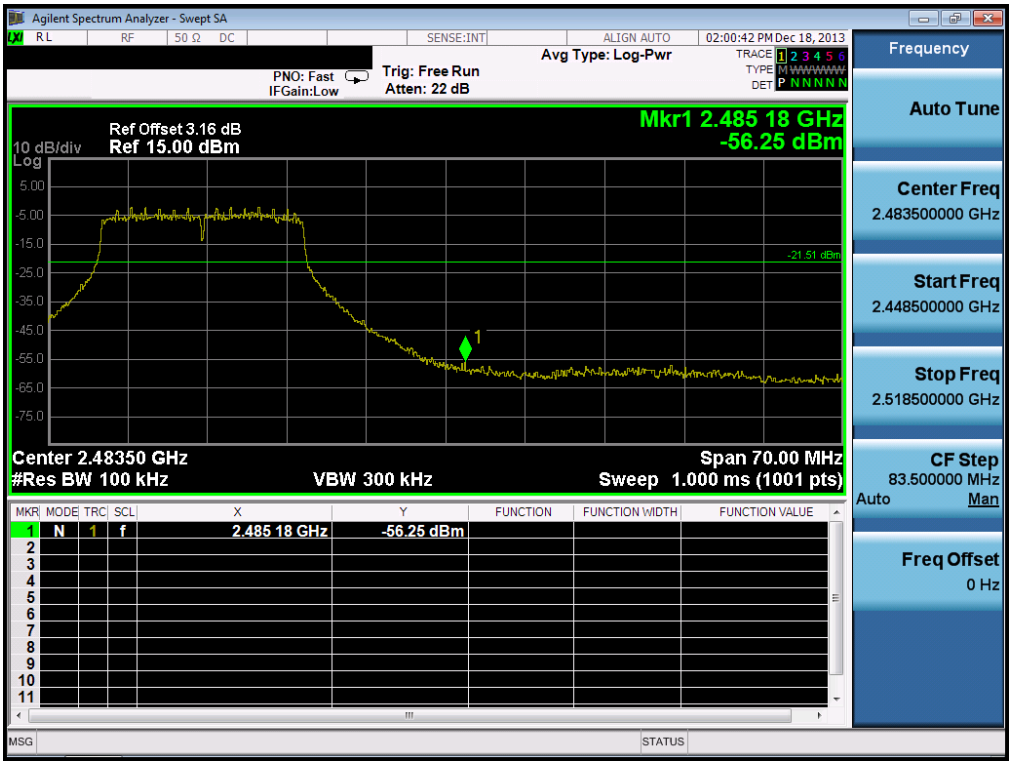


Test Mode: DC 12 V & 802.11n(HT20) & MCS 7 & 2462MHz

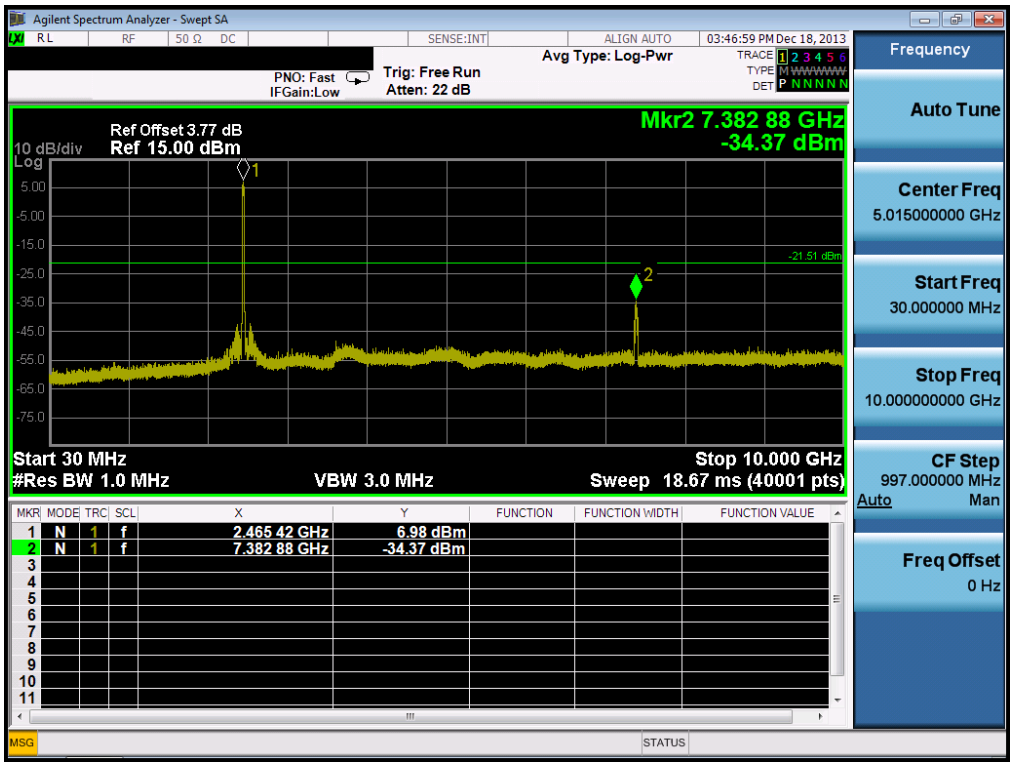
Reference

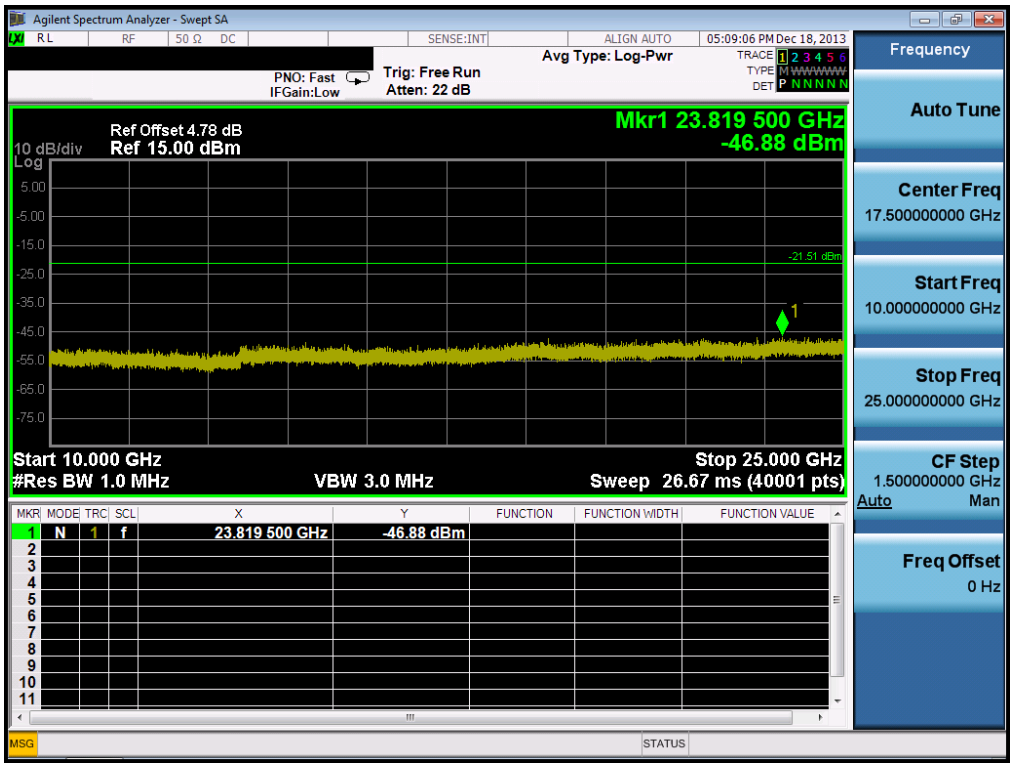


High Band-edge



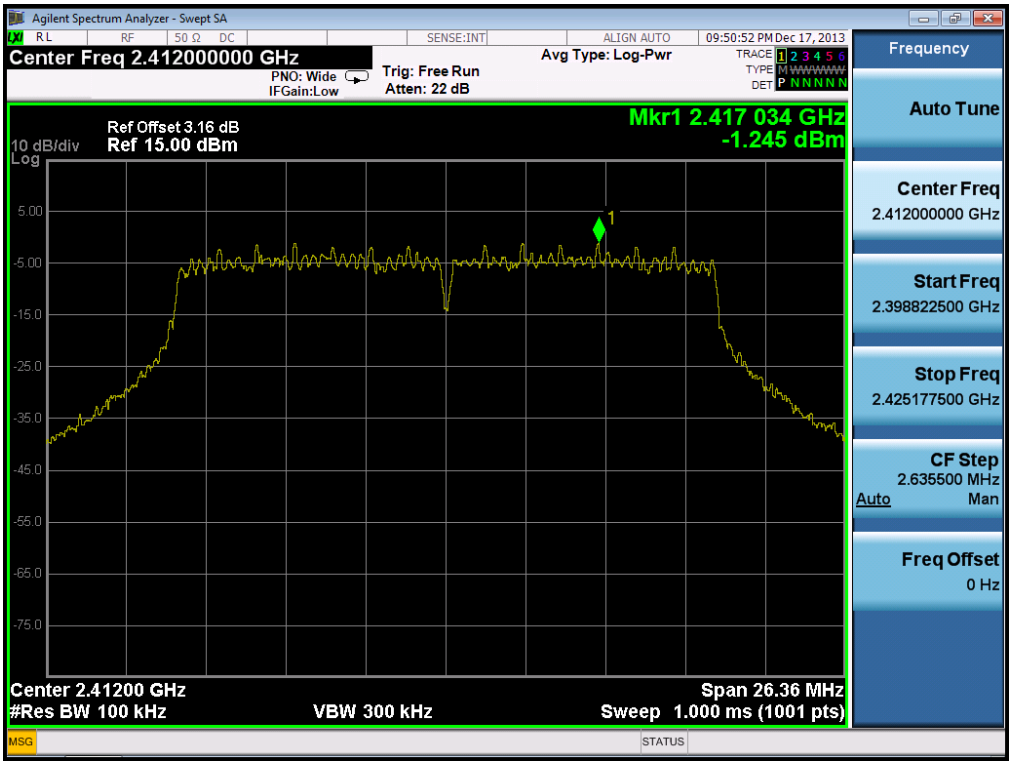
Conducted Spurious Emissions





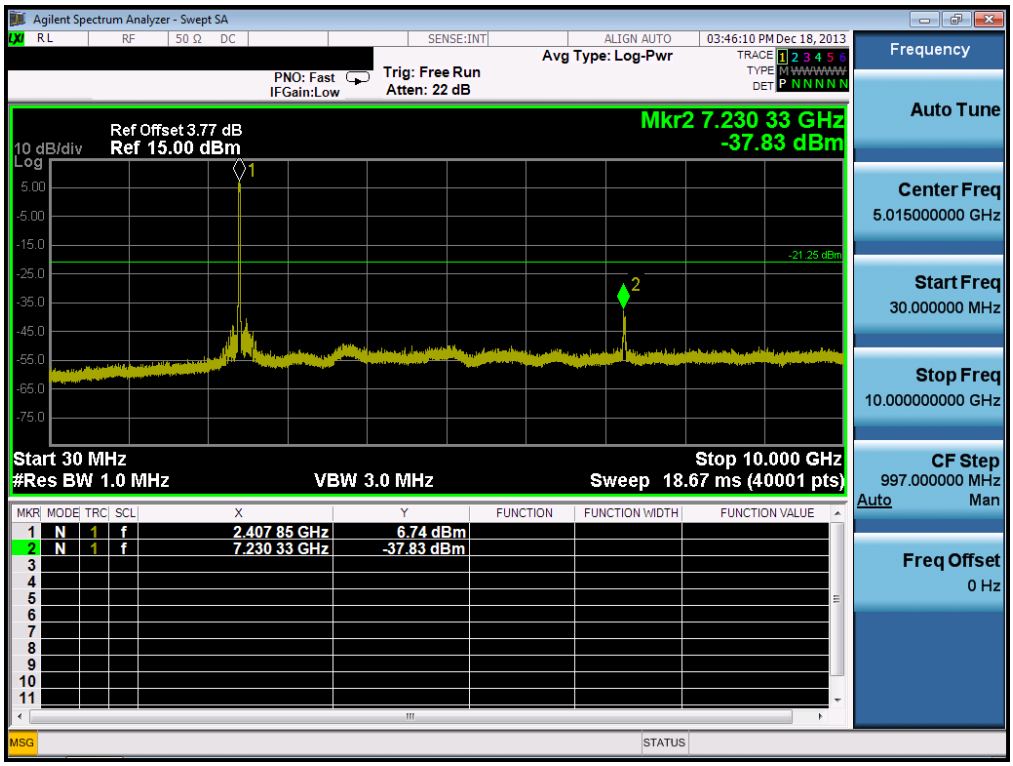
Test Mode: DC 24 V & 802.11n(HT20) & MCS 7 & 2412MHz

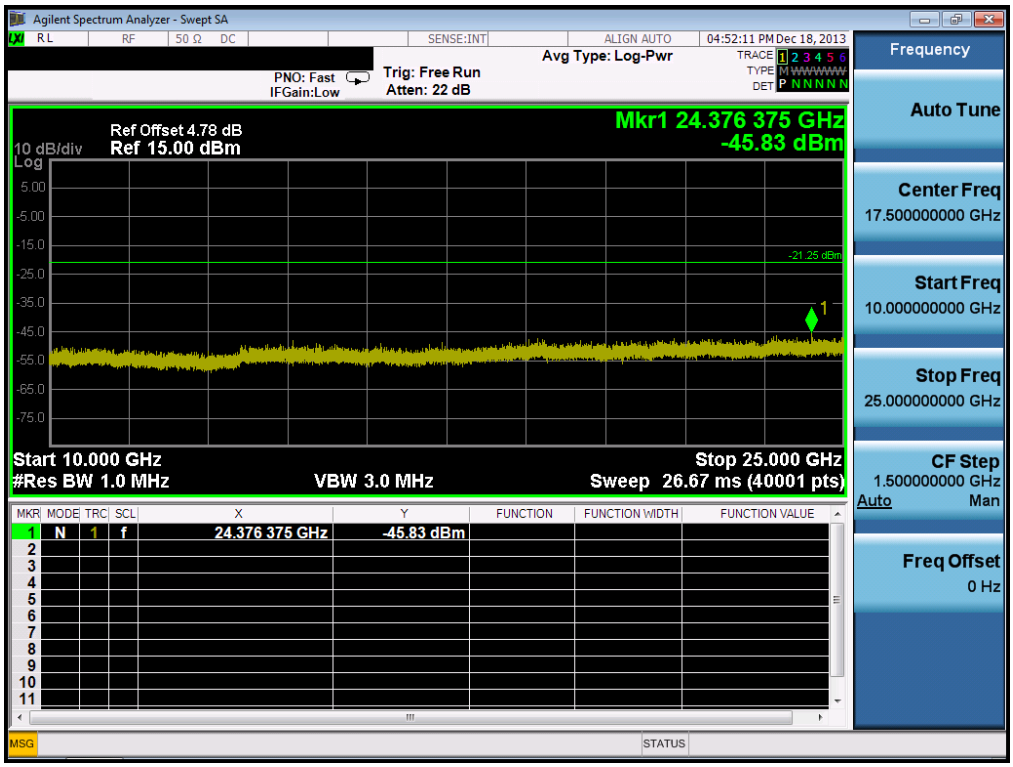
Reference



Low Band-edge

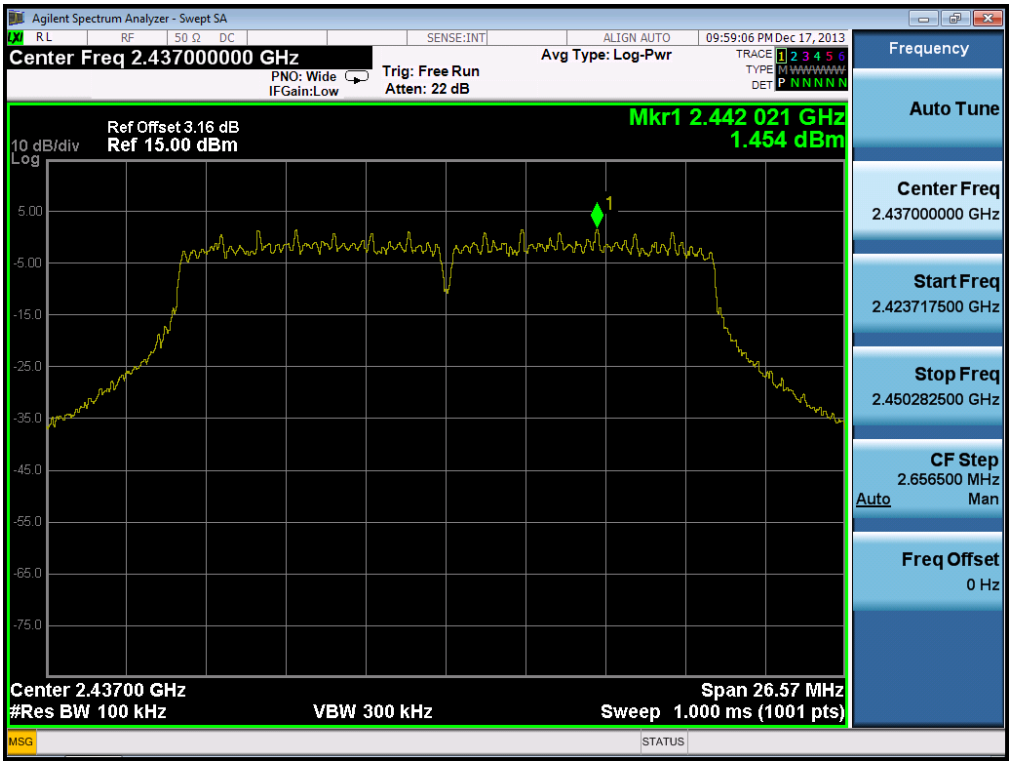
Conducted Spurious Emissions



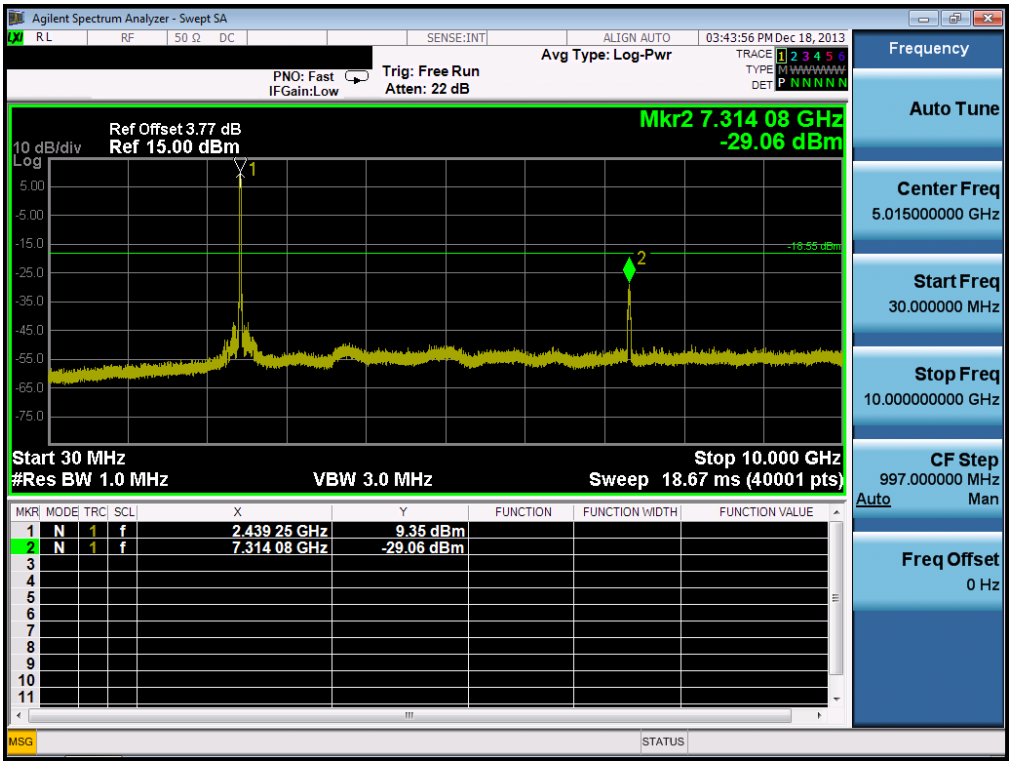


Test Mode: DC 24 V & 802.11n(HT20) & MCS 4 & 2437MHz

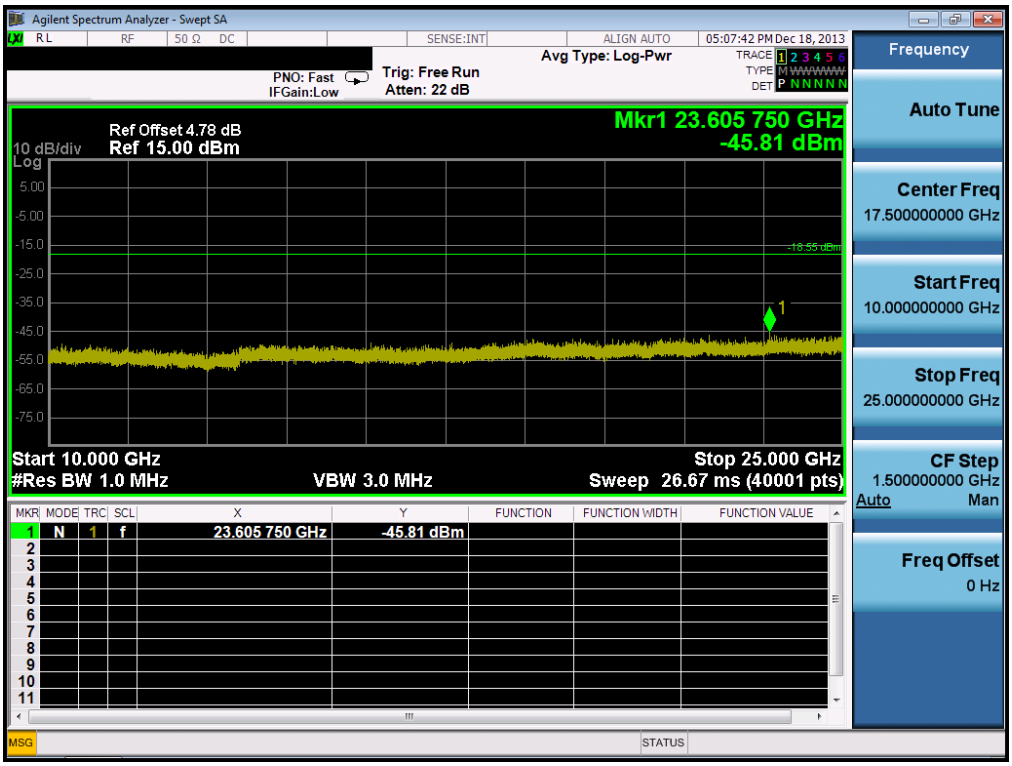
Reference



Conducted Spurious Emissions

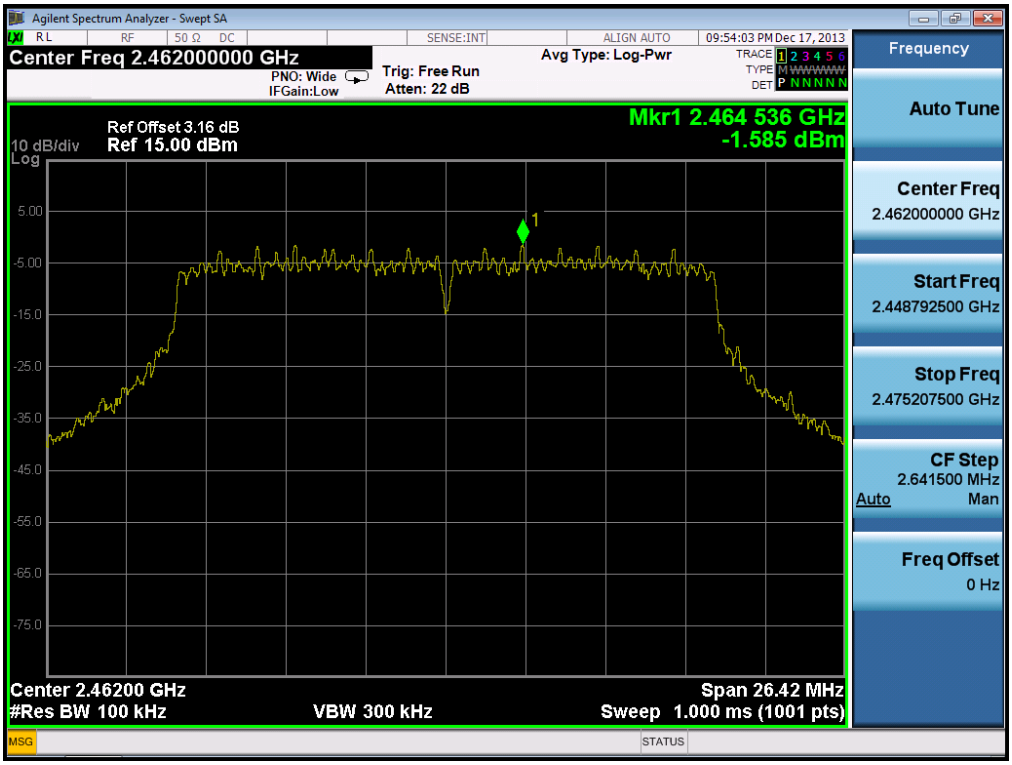


Conducted Spurious Emissions

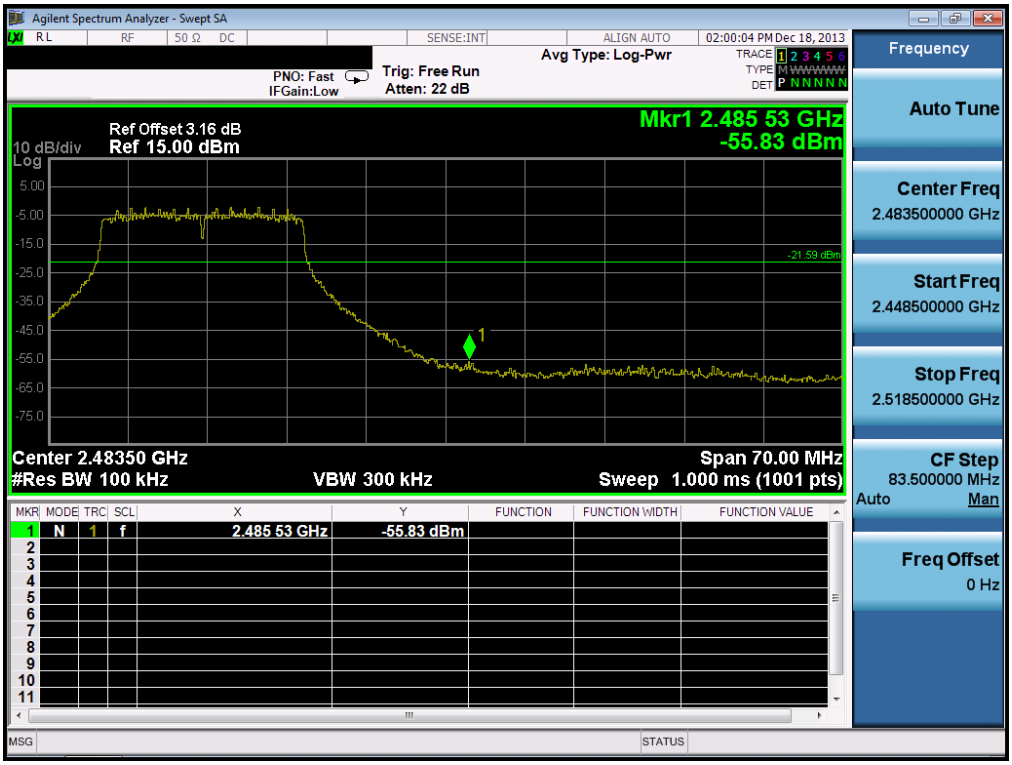


Test Mode: DC 24 V & 802.11n(HT20) & MCS 7 & 2462MHz

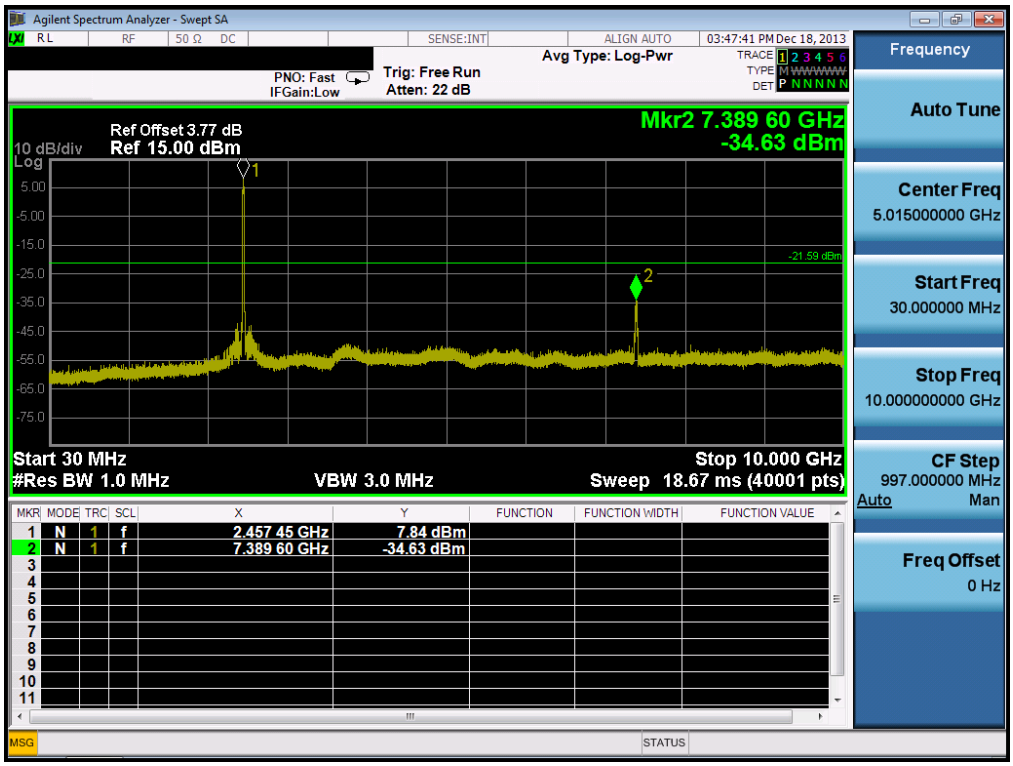
Reference

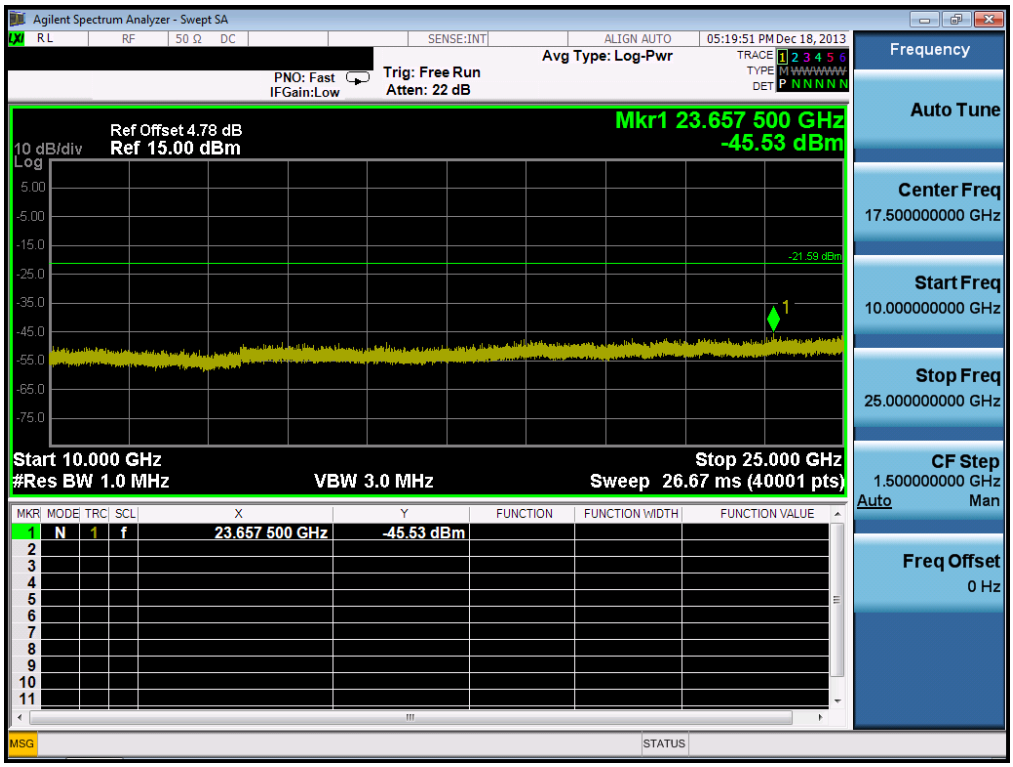


High Band-edge



Conducted Spurious Emissions



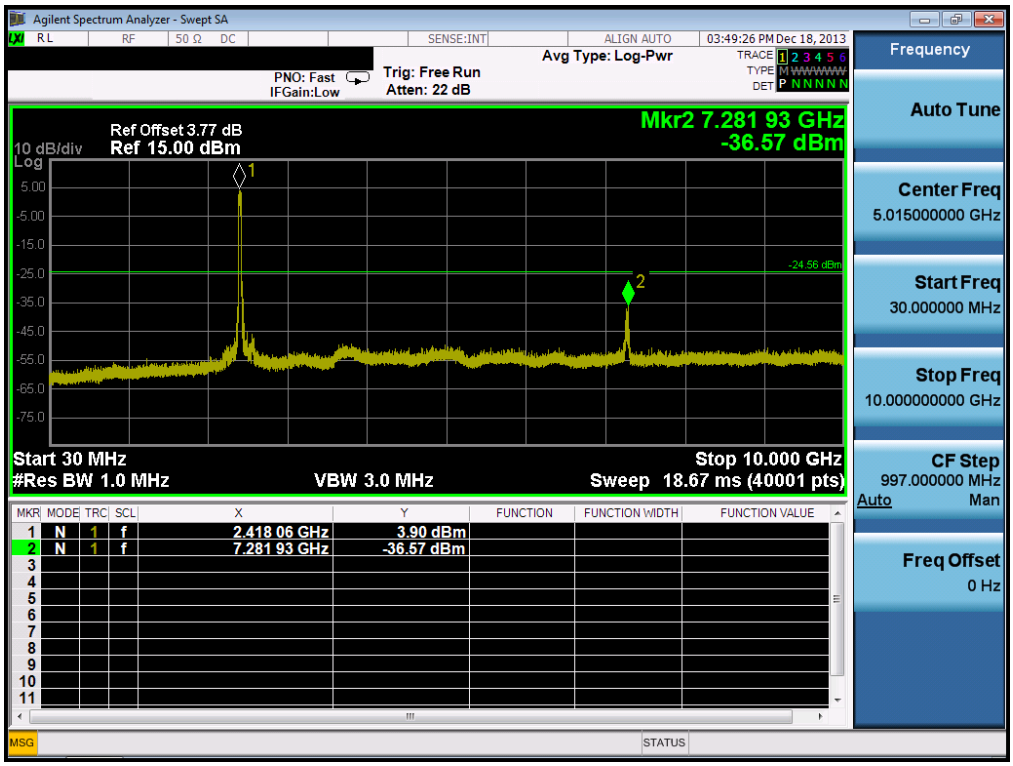


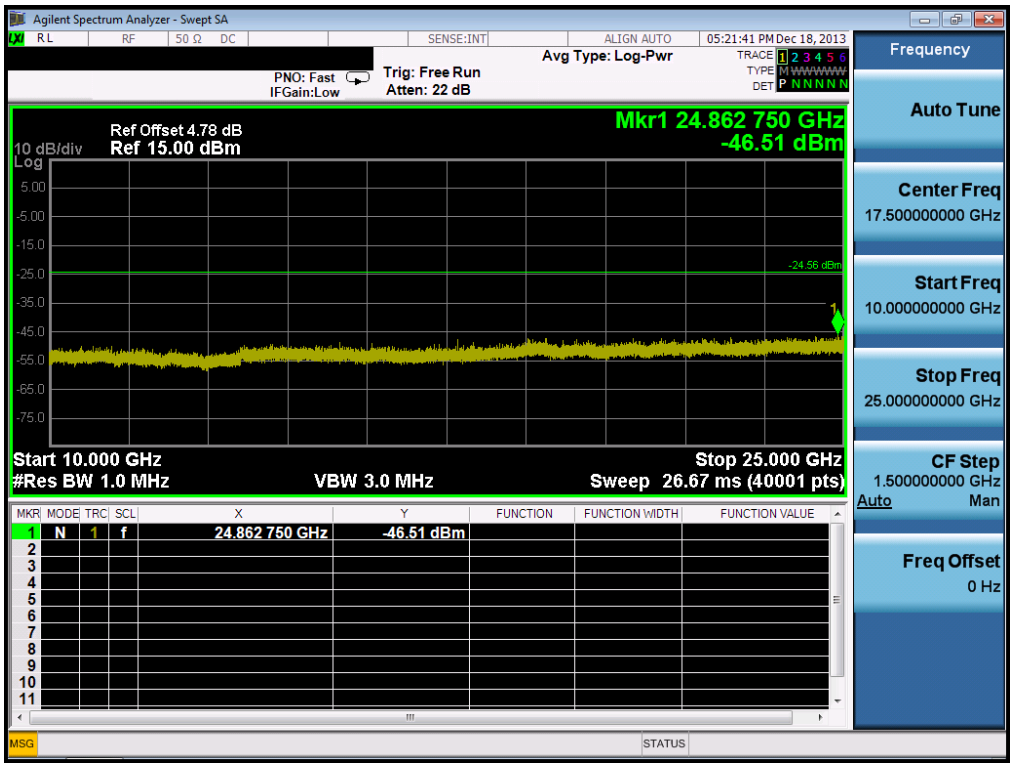
Test Mode: DC 12 V & 802.11n(HT40) & MCS 7 & 2422MHz

Reference

Low Band-edge

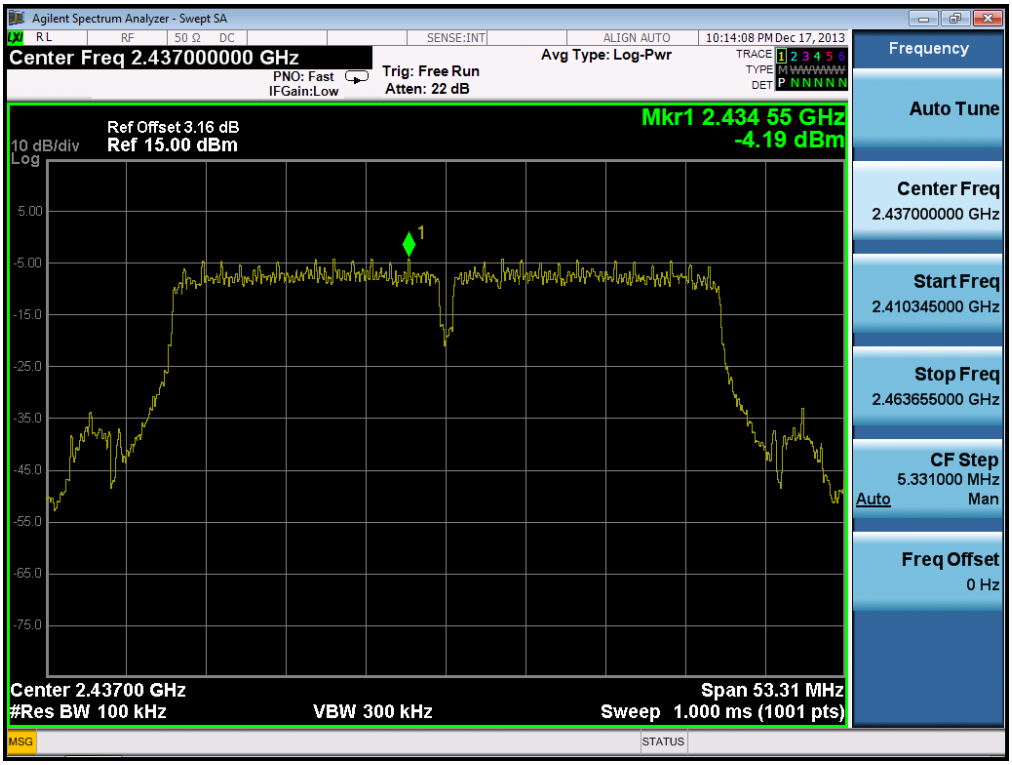
Conducted Spurious Emissions



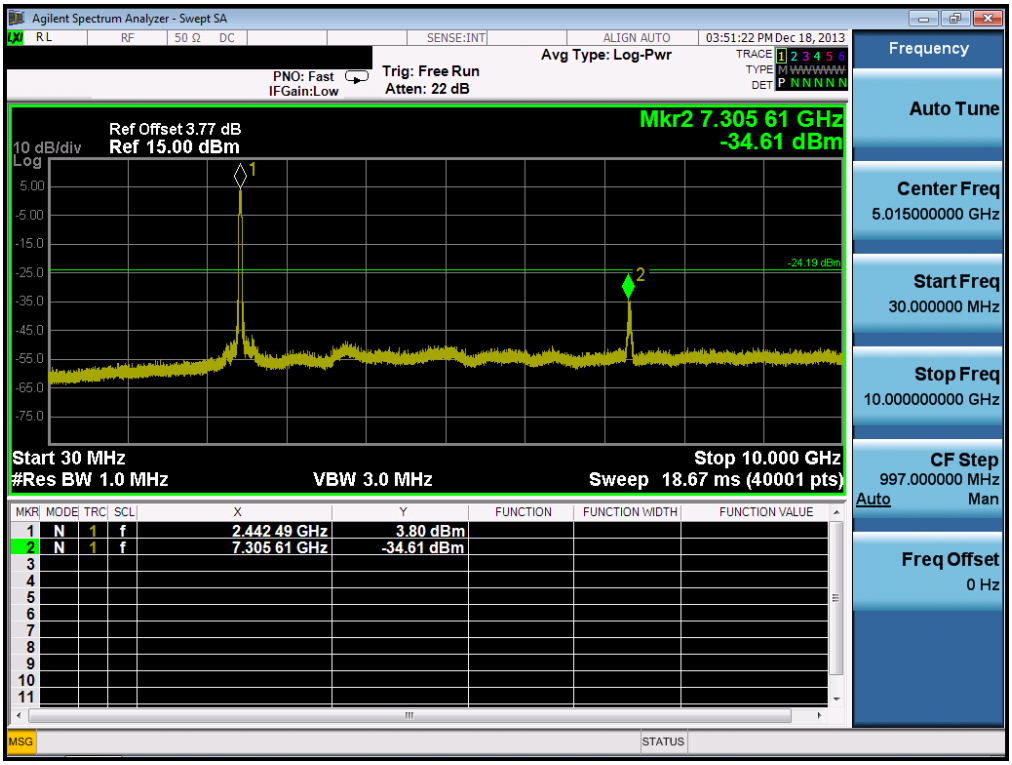


Test Mode: DC 12 V & 802.11n(HT40) & MCS 7 & 2437MHz

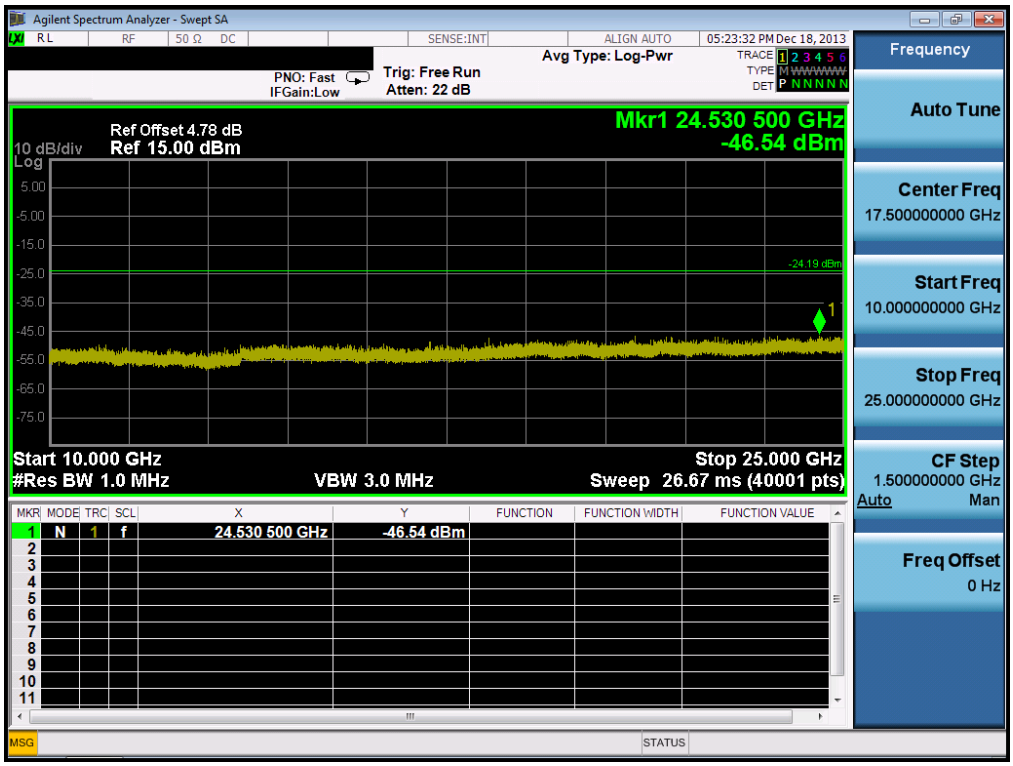
Reference



Conducted Spurious Emissions



Conducted Spurious Emissions

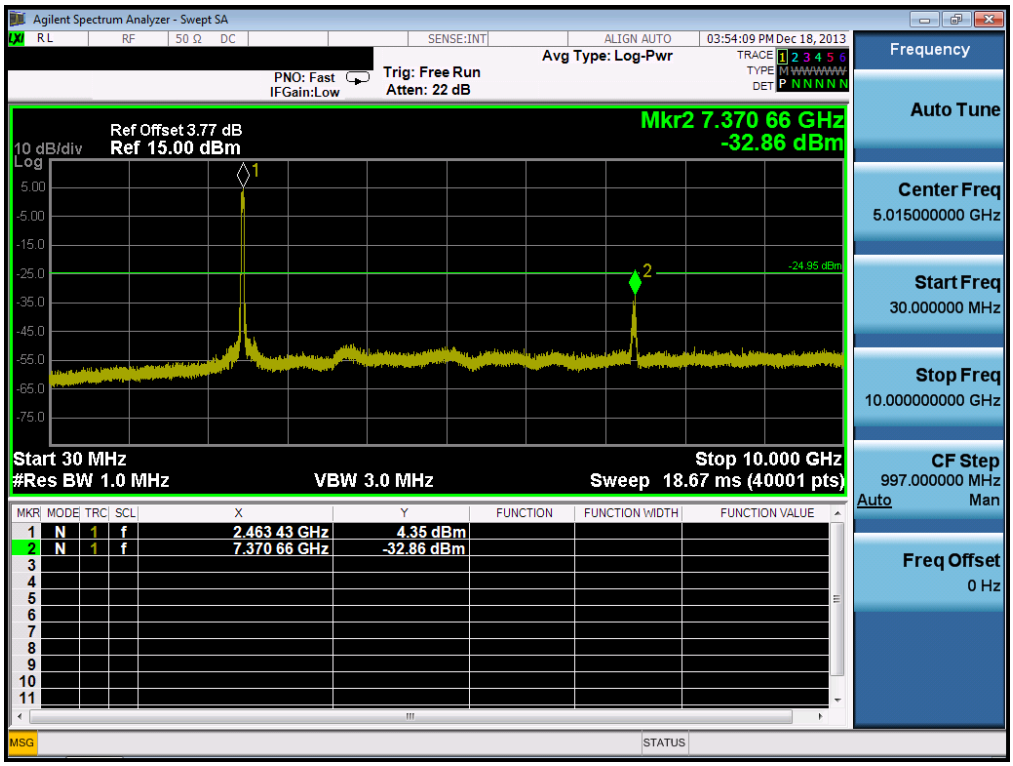


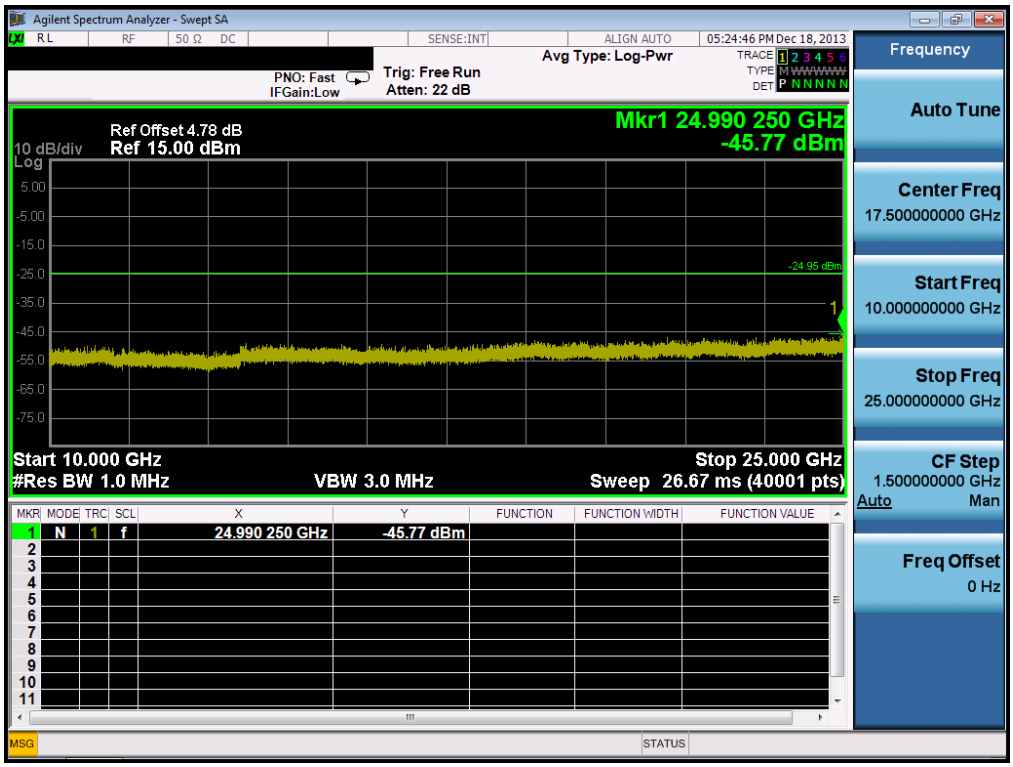
Test Mode: DC 12 V & 802.11n(HT40) & MCS 7 & 2452MHz

Reference

High Band-edge

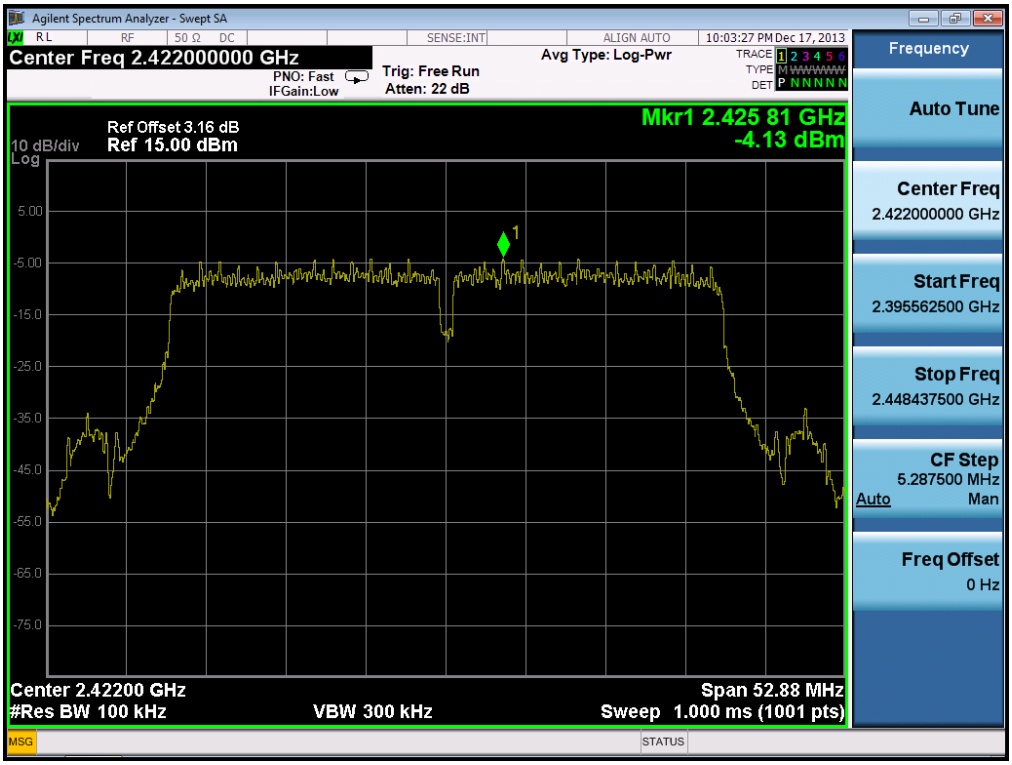
Conducted Spurious Emissions





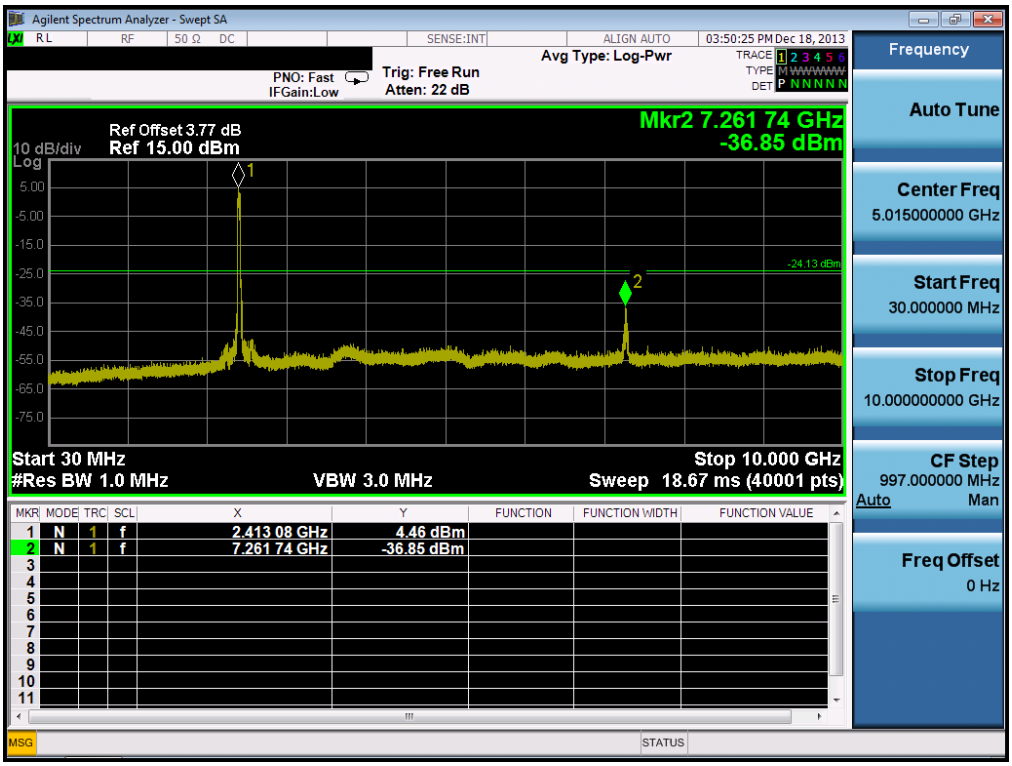
Test Mode: DC 24 V & 802.11n(HT40) & MCS 7 & 2422MHz

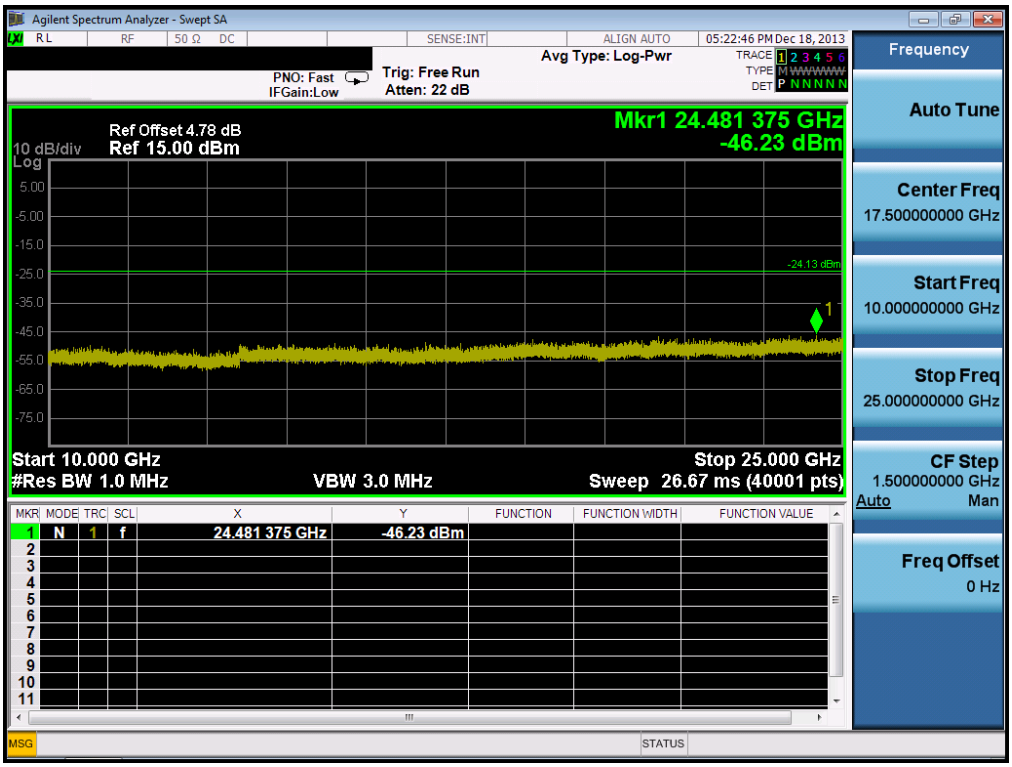
Reference



Low Band-edge

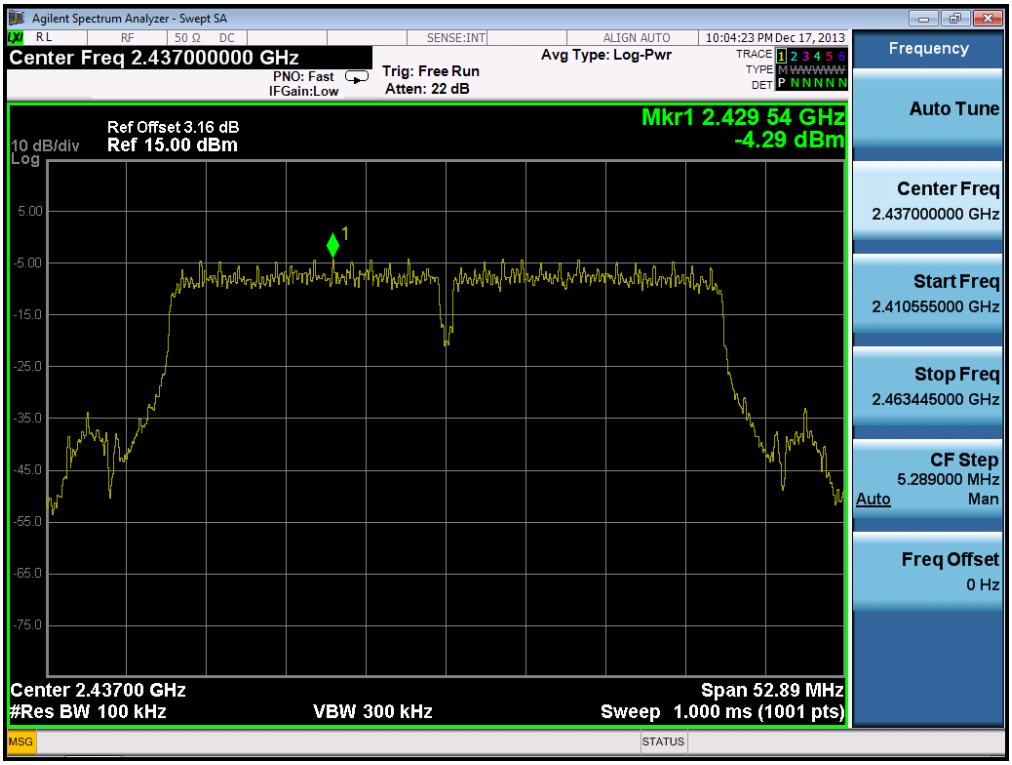
Conducted Spurious Emissions



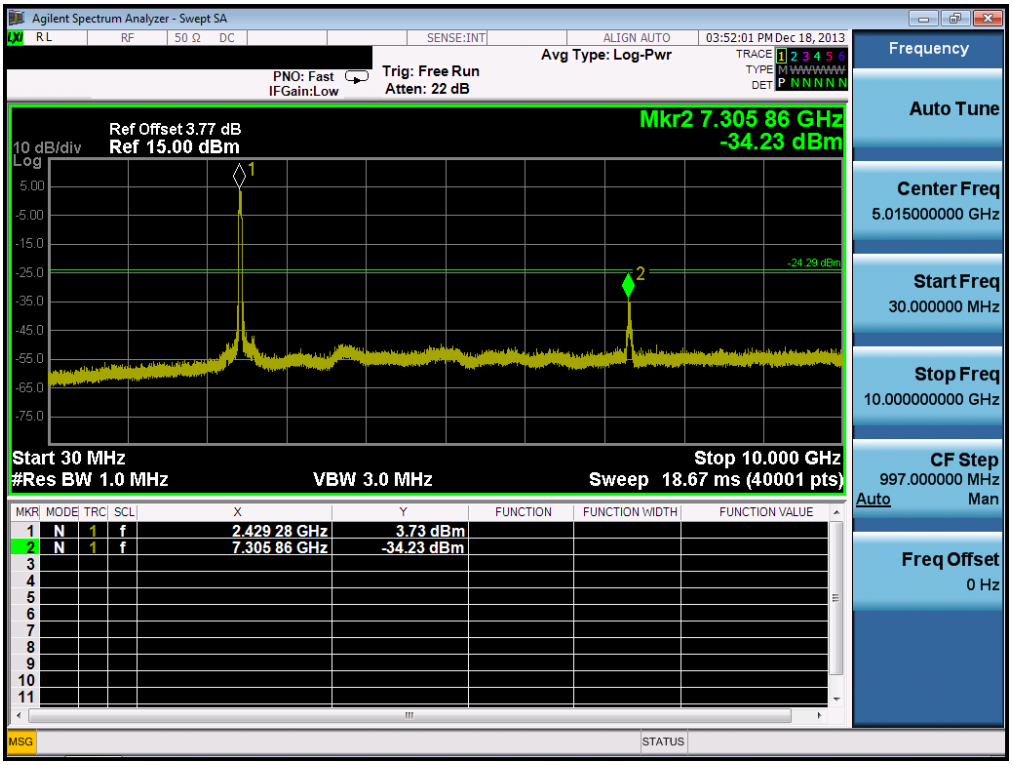


Test Mode: DC 24 V & 802.11n(HT40) & MCS 7 & 2437MHz

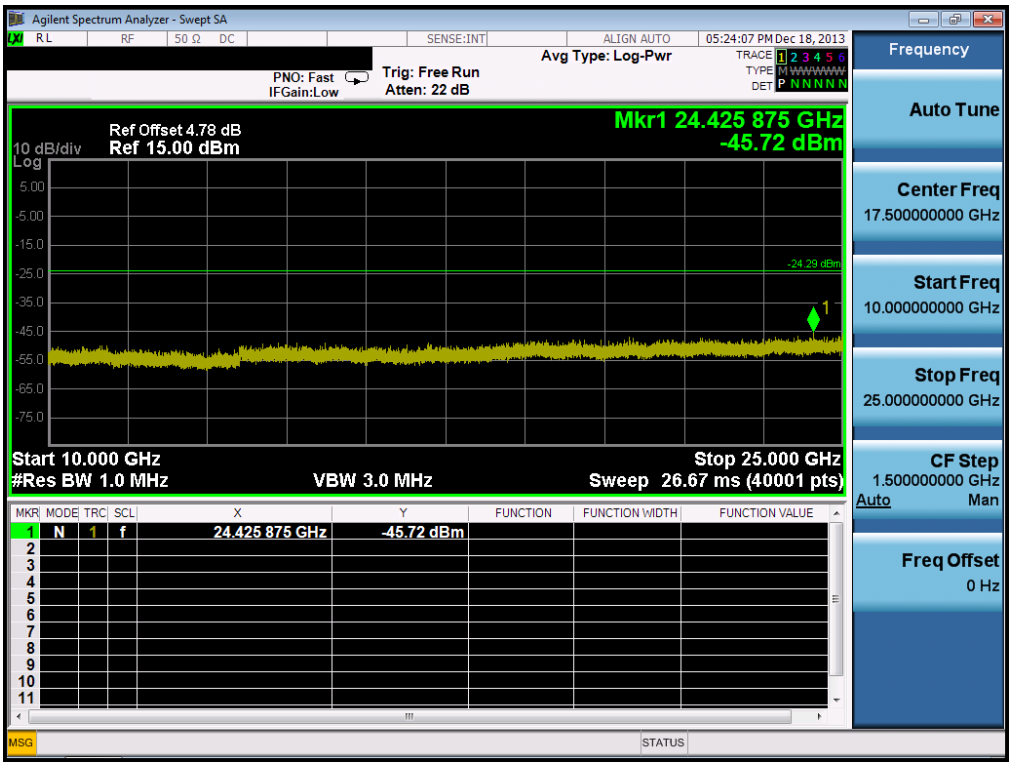
Reference



Conducted Spurious Emissions



Conducted Spurious Emissions

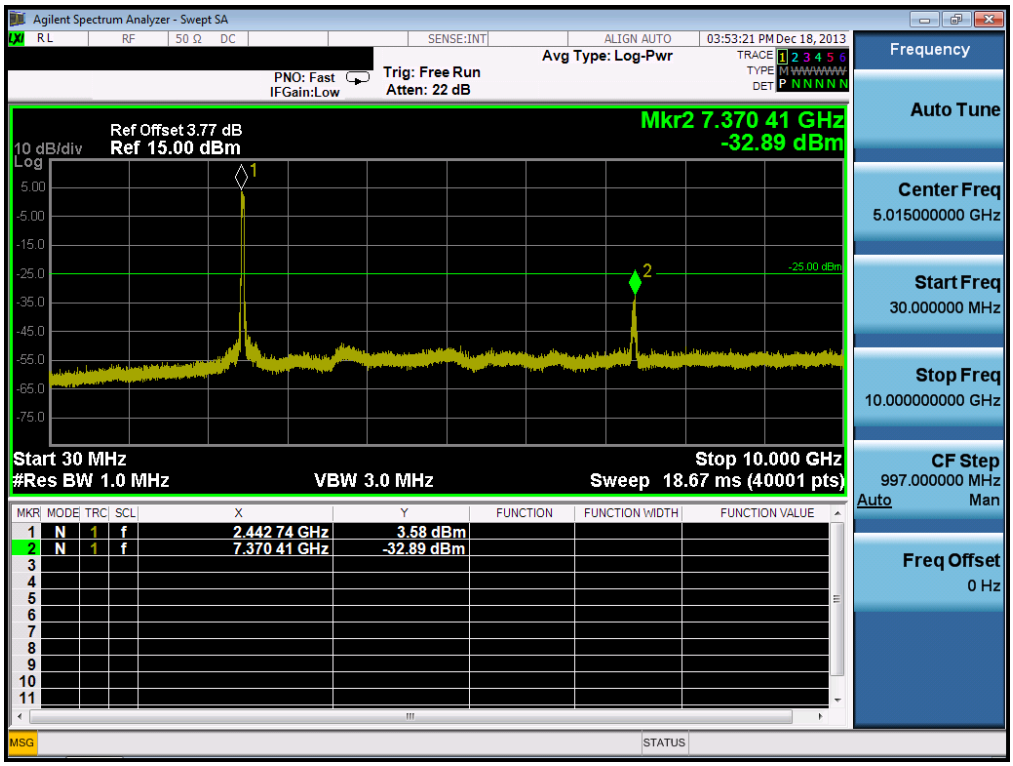


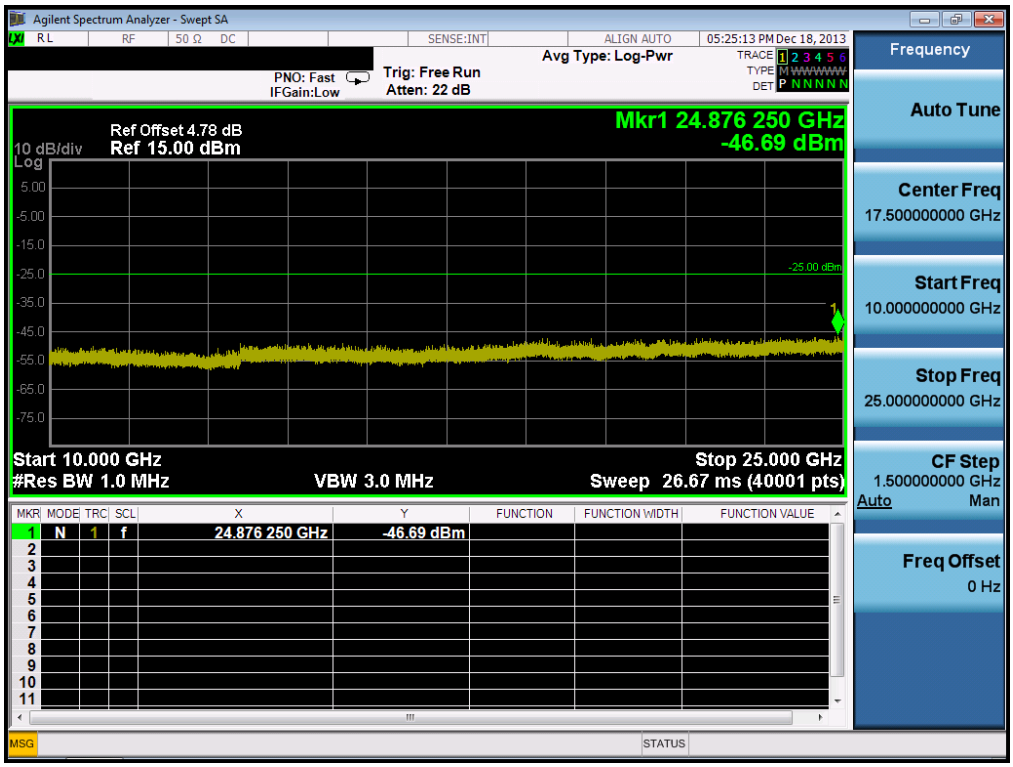
Test Mode: DC 24 V & 802.11n(HT40) & MCS 7 & 2452MHz

Reference

High Band-edge

Conducted Spurious Emissions





8.5 Radiated Spurious Emissions

Test Requirements and limit,§15.247(d), §15.205, §15.209& RSS-210 [A8.5], RSS-Gen [7.2.2]

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

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

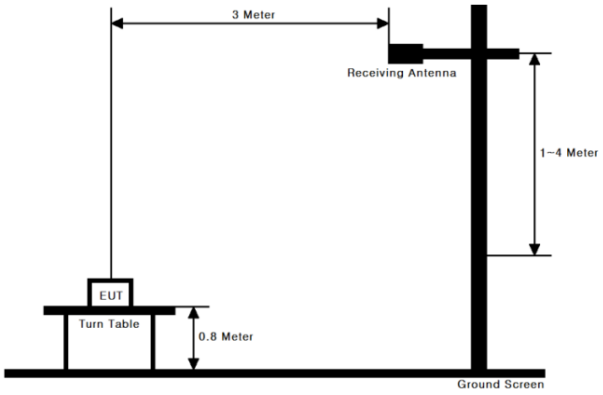
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4400		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

Test Configuration



▣ TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

▣ Measurement Instrument Setting for Radiated Emission Measurements.

Peak Measurement: 12.2.4 of KDB 558074 v03r1

RBW = As specified in below table , VBW ≥ 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

Average Measurement: 12.2.5.3 of KDB 558074 v03r1

1. RBW = 1 MHz.
2. VBW ≥ 1/T.
3. Video bandwidth mode or display mode
   1) The instrument shall be set to ensure that video filtering is applied in the power domain.
      Typically, this requires setting the detector mode to RMS and setting the Average-VBW Type to Power (RMS).
   2) As an alternative, the instrument may be set to linear detector mode.
      Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain).
      Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode.
4. Detector = Peak.
5. Sweep time = auto.
6. Trace mode = max hold.
7. Allow max hold to run for at least 50 times (1/duty cycle) traces.

Mode	Rate	T_{on}(ms)	$1/T_{on}$ (Hz)	Determined VBW Setting (KHz)
802.11b	11Mbps	0.930	1075	2
802.11g	24Mbps	0.358	2793	3
802.11g	54Mbps	0.171	5848	6
802.11n(HT20)	MCS4	0.247	4049	5
802.11n(HT20)	MCS7	0.161	6211	7
802.11n(HT40)	MCS7	0.100	10000	10

Note. This device is duty cycle variations exceed ± 2 percent.

9KHz ~ 25GHz Data (*DC 12 V & 802.11b*)

▪ Lowest Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.02	H	Z	QP	48.91	- 7.90	-	-	41.01	46.00	4.99
400.22	H	Z	QP	46.02	- 2.30	-	-	43.72	46.00	2.28
2384.88	V	Y	PK	60.84	- 3.38	-	-	57.46	74.00	16.54
2385.44	V	Y	AV	44.70	- 3.38	-	-	41.32	54.00	12.68
7236.50	V	Y	PK	49.56	10.71	-	-	60.27	74.00	13.73
7235.68	V	Y	AV	40.19	10.71	-	-	50.90	54.00	3.10

▪ Middle Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.18	H	Z	QP	48.17	- 7.90	-	-	40.27	46.00	5.73
400.41	H	Z	QP	45.51	- 2.30	-	-	43.21	46.00	2.79
7311.24	V	Y	PK	49.01	10.75	-	-	59.76	74.00	14.24
7310.70	V	Y	AV	40.64	10.75	-	-	51.39	54.00	2.61

▪ Highest Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.05	H	Z	QP	48.11	- 7.90	-	-	40.21	46.00	5.79
400.43	H	Z	QP	46.14	- 2.30	-	-	43.84	46.00	2.16
2483.64	V	Y	PK	63.17	- 2.79	-	-	60.38	74.00	13.62
2483.59	V	Y	AV	46.74	- 2.79	-	-	43.95	54.00	10.05
7386.16	V	Y	PK	49.19	10.86	-	-	60.05	74.00	13.95
7387.21	V	Y	AV	40.72	10.86	-	-	51.58	54.00	2.42

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC 24 V & 802.11b*)

▪ Lowest Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.10	H	Z	QP	48.64	- 7.90	-	-	40.74	46.00	5.26
400.28	H	Z	QP	46.07	- 2.30	-	-	43.77	46.00	2.23
2384.45	V	Y	PK	60.87	- 3.38	-	-	57.49	74.00	16.51
2384.97	V	Y	AV	44.83	- 3.38	-	-	41.45	54.00	12.55
7236.14	V	Y	PK	50.15	10.71	-	-	60.86	74.00	13.14
7236.02	V	Y	AV	40.37	10.71	-	-	51.08	54.00	2.92

▪ Middle Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.05	H	Z	QP	48.37	- 7.90	-	-	40.47	46.00	5.53
400.38	H	Z	QP	46.61	- 2.30	-	-	44.31	46.00	1.69
7311.10	V	Y	PK	48.95	10.75	-	-	59.70	74.00	14.30
7310.85	V	Y	AV	40.52	10.75	-	-	51.27	54.00	2.73

▪ Highest Channel ***(11 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.92	H	Z	QP	47.83	- 7.90	-	-	39.93	46.00	6.07
400.41	H	Z	QP	45.85	- 2.30	-	-	43.55	46.00	2.45
2484.75	V	Y	PK	62.88	- 2.79	-	-	60.09	74.00	13.91
2483.52	V	Y	AV	46.93	- 2.79	-	-	44.14	54.00	9.86
7385.98	V	Y	PK	48.86	10.86	-	-	59.72	74.00	14.28
7386.19	V	Y	AV	40.66	10.86	-	-	51.52	54.00	2.48

Note.

1. Measurement Distance = 3 m for below 10 GHz , Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC 12 V & 802.11g*)

▪ Lowest Channel ***(54 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.17	H	Z	QP	48.71	- 7.90	-	-	40.81	46.00	5.19
400.30	H	Z	QP	45.48	- 2.30	-	-	43.18	46.00	2.82
2378.04	V	Y	PK	55.01	- 3.38	-	-	51.63	74.00	22.37
2378.60	V	Y	AV	43.89	- 3.38	-	-	40.51	54.00	13.49
7237.95	V	Y	PK	43.92	10.71	-	-	54.63	74.00	19.37
7236.00	V	Y	AV	32.49	10.71	-	-	43.20	54.00	10.80

▪ Middle Channel ***(24 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.80	H	Z	QP	48.34	- 7.90	-	-	40.44	46.00	5.56
400.41	H	Z	QP	46.22	- 2.30	-	-	43.92	46.00	2.08
7309.75	V	Y	PK	48.04	10.75	-	-	58.79	74.00	15.21
7308.35	V	Y	AV	34.48	10.75	-	-	45.23	54.00	8.77

▪ Highest Channel ***(54 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.87	H	Z	QP	48.49	- 7.90	-	-	40.59	46.00	5.41
400.27	H	Z	QP	46.34	- 2.30	-	-	44.04	46.00	1.96
2483.56	V	Y	PK	57.29	- 2.79	-	-	54.50	74.00	19.50
2483.83	V	Y	AV	43.05	- 2.79	-	-	40.26	54.00	13.74
7384.25	V	Y	PK	45.06	10.86	-	-	55.92	74.00	18.08
7383.95	V	Y	AV	31.93	10.86	-	-	42.79	54.00	11.21

Note.

1. Measurement Distance = 3 m for below 10 GHz , Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC 24 V & 802.11g*)

▪ Lowest Channel ***(54 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.24	H	Z	QP	48.71	- 7.90	-	-	40.81	46.00	5.19
400.44	H	Z	QP	45.90	- 2.30	-	-	43.60	46.00	2.40
2378.36	V	Y	PK	54.82	- 3.38	-	-	51.44	74.00	22.56
2378.00	V	Y	AV	43.52	- 3.38	-	-	40.14	54.00	13.86
7237.06	V	Y	PK	43.76	10.71	-	-	54.47	74.00	19.53
7236.20	V	Y	AV	32.63	10.71	-	-	43.34	54.00	10.66

▪ Middle Channel ***(24 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.05	H	Z	QP	48.67	- 7.90	-	-	40.77	46.00	5.23
400.33	H	Z	QP	45.93	- 2.30	-	-	43.63	46.00	2.37
7311.09	V	Y	PK	47.65	10.75	-	-	58.40	74.00	15.60
7310.22	V	Y	AV	34.30	10.75	-	-	45.05	54.00	8.95

▪ Highest Channel ***(54 Mbps)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.01	H	Z	QP	48.56	- 7.90	-	-	40.66	46.00	5.34
400.46	H	Z	QP	46.44	- 2.30	-	-	44.14	46.00	1.86
2483.51	V	Y	PK	57.30	- 2.79	-	-	54.51	74.00	19.49
2484.33	V	Y	AV	43.16	- 2.79	-	-	40.37	54.00	13.63
7382.09	V	Y	PK	44.72	10.86	-	-	55.58	74.00	18.42
7383.60	V	Y	AV	31.60	10.86	-	-	42.46	54.00	11.54

Note.

1. Measurement Distance = 3 m for below 10 GHz , Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC12V & 802.11n HT20*)

▪ Lowest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.88	H	Z	QP	48.05	- 7.90	-	-	40.15	46.00	5.85
400.31	H	Z	QP	46.45	- 2.30	-	-	44.15	46.00	1.85
2377.92	V	Y	PK	54.84	- 3.38	-	-	51.46	74.00	22.54
2378.96	V	Y	AV	43.64	- 3.38	-	-	40.26	54.00	13.74
7235.95	V	Y	PK	44.45	10.71	-	-	55.16	74.00	18.84
7235.60	V	Y	AV	32.05	10.71	-	-	42.76	54.00	11.24

▪ Middle Channel ***(MCS 4)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.79	H	Z	QP	48.43	- 7.90	-	-	40.53	46.00	5.47
400.53	H	Z	QP	45.89	- 2.30	-	-	43.59	46.00	2.41
7312.65	V	Y	PK	50.80	10.75	-	-	61.55	74.00	12.45
7311.55	V	Y	AV	35.82	10.75	-	-	46.57	54.00	7.43

▪ Highest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.03	H	Z	QP	47.85	- 7.90	-	-	39.95	46.00	6.05
400.66	H	Z	QP	46.18	- 2.30	-	-	43.88	46.00	2.12
2483.66	V	Y	PK	57.63	- 2.79	-	-	54.84	74.00	19.16
2483.74	V	Y	AV	43.84	- 2.79	-	-	41.05	54.00	12.95
7381.60	V	Y	PK	44.67	10.86	-	-	55.53	74.00	18.47
7380.90	V	Y	AV	32.37	10.86	-	-	43.23	54.00	10.77

Note.

1. Measurement Distance = 3 m for below 10 GHz , Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC24V & 802.11n HT20*)

▪ Lowest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.24	H	Z	QP	47.77	- 7.90	-	-	39.87	46.00	6.13
400.35	H	Z	QP	46.23	- 2.30	-	-	43.93	46.00	2.07
2378.06	V	Y	PK	55.15	- 3.38	-	-	51.77	74.00	22.23
2378.12	V	Y	AV	43.89	- 3.38	-	-	40.51	54.00	13.49
7235.89	V	Y	PK	43.94	10.71	-	-	54.65	74.00	19.35
7235.88	V	Y	AV	31.84	10.71	-	-	42.55	54.00	11.45

▪ Middle Channel ***(MCS 4)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.16	H	Z	QP	48.31	- 7.90	-	-	40.41	46.00	5.59
400.52	H	Z	QP	45.99	- 2.30	-	-	43.69	46.00	2.31
7313.07	V	Y	PK	50.96	10.75	-	-	61.71	74.00	12.29
7311.39	V	Y	AV	36.13	10.75	-	-	46.88	54.00	7.12

▪ Highest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.17	H	Z	QP	48.08	- 7.90	-	-	40.18	46.00	5.82
400.69	H	Z	QP	46.58	- 2.30	-	-	44.28	46.00	1.72
2484.78	V	Y	PK	57.40	- 2.79	-	-	54.61	74.00	19.39
2484.94	V	Y	AV	43.69	- 2.79	-	-	40.90	54.00	13.10
7382.86	V	Y	PK	44.50	10.86	-	-	55.36	74.00	18.64
7381.98	V	Y	AV	32.47	10.86	-	-	43.33	54.00	10.67

Note.

1. Measurement Distance = 3 m for below 10 GHz , Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC12V & 802.11n HT40*)

▪ Lowest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.97	H	Z	QP	47.95	- 7.90	-	-	40.05	46.00	5.95
400.59	H	Z	QP	46.50	- 2.30	-	-	44.20	46.00	1.80
2385.46	V	Y	PK	58.94	- 3.38	-	-	55.56	74.00	18.44
2384.72	V	Y	AV	46.79	- 3.38	-	-	43.41	54.00	10.59
7274.50	V	Y	PK	42.85	10.71	-	-	53.56	74.00	20.44
7275.50	V	Y	AV	31.69	10.71	-	-	42.40	54.00	11.60

▪ Middle Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.88	H	Z	QP	48.27	- 7.90	-	-	40.37	46.00	5.63
400.61	H	Z	QP	46.38	- 2.30	-	-	44.08	46.00	1.92
7321.20	V	Y	PK	42.99	10.75	-	-	53.74	74.00	20.26
7320.50	V	Y	AV	31.74	10.75	-	-	42.49	54.00	11.51

▪ Highest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.16	H	Z	QP	48.31	- 7.90	-	-	40.41	46.00	5.59
400.55	H	Z	QP	45.98	- 2.30	-	-	43.68	46.00	2.32
2485.96	V	Y	PK	60.15	- 2.79	-	-	57.36	74.00	16.64
2485.06	V	Y	AV	46.96	- 2.79	-	-	44.17	54.00	9.83
7357.40	V	Y	PK	43.04	10.86	-	-	53.90	74.00	20.10
7357.10	V	Y	AV	31.57	10.86	-	-	42.43	54.00	11.57

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

9KHz ~ 25GHz Data (*DC24V & 802.11n HT40*)

▪ Lowest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.89	H	Z	QP	48.05	- 7.90	-	-	40.15	46.00	5.85
400.52	H	Z	QP	46.21	- 2.30	-	-	43.91	46.00	2.09
2384.70	V	Y	PK	59.21	- 3.38	-	-	55.83	74.00	18.17
2384.64	V	Y	AV	46.49	- 3.38	-	-	43.11	54.00	10.89
7273.58	V	Y	PK	42.30	10.71	-	-	53.01	74.00	20.99
7274.87	V	Y	AV	31.46	10.71	-	-	42.17	54.00	11.83

▪ Middle Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
239.60	H	Z	QP	47.86	- 7.90	-	-	39.96	46.00	6.04
400.59	H	Z	QP	46.10	- 2.30	-	-	43.80	46.00	2.20
7322.39	V	Y	PK	43.32	10.75	-	-	54.07	74.00	19.93
7321.65	V	Y	AV	31.30	10.75	-	-	42.05	54.00	11.95

▪ Highest Channel ***(MCS 7)***

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCF (dB)	Distance Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
240.00	H	Z	QP	47.87	- 7.90	-	-	39.97	46.00	6.03
400.51	H	Z	QP	46.28	- 2.30	-	-	43.98	46.00	2.02
2486.23	V	Y	PK	59.60	- 2.79	-	-	56.81	74.00	17.19
2485.31	V	Y	AV	46.57	- 2.79	-	-	43.78	54.00	10.22
7356.80	V	Y	PK	43.69	10.86	-	-	54.55	74.00	19.45
7356.70	V	Y	AV	31.90	10.86	-	-	42.76	54.00	11.24

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54 dB = 20*log(1m/3m)
2. No other spurious and harmonic emissions were found greater than listed emissions on above table.
3. Above listed point data is the worst case data.
4. Sample Calculation.

   Margin = Limit – Result / Result = Reading + T.F+ DCF + Distance Factor / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCF = Duty Cycle Correction Factor.

8.6 Power-line Conducted Emissions

Test Requirements and limit, §15.207& RSS-Gen [7.2.2]

For an intentional radiator which 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 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Conducted 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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

▣ **TEST PROCEDURE**

1. The EUT is placed on a wooden table 80 cm above the reference groundplane.
2. The EUT is connected via LISN to the test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

▣ **Test Results: N/A**

8.7 Occupied Bandwidth

Test Requirements, RSS-Gen [4.6.1]

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%.
The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted.
Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

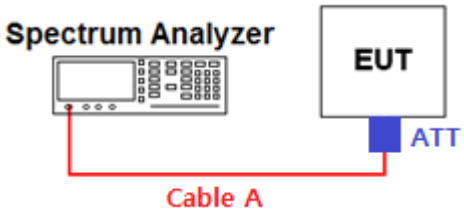
▣ TEST RESULTS: N/A

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9030A	13/10/29	14/10/29	MY53310140
Spectrum Analyzer	Agilent	N9020A	13/03/28	14/03/28	MY50510026
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	13/09/16	14/09/16	1111002 / 011290
Power Sensor	Rohde Schwarz	NRP-Z81	13/05/27	14/05/27	1137.9009.02-101001-EA
Virtual Power Meter(S/W)	Rohde Schwarz	R&S Power Viewer Plus	-	-	V 6.1.0
Digital Multimeter	H.P	34401A	13/02/27	14/02/27	3146A13475
Vector Signal Generator	Rohde Schwarz	SMJ100A	13/01/08 14/01/07	14/01/07 15/01/07	100148
Signal Generator	Rohde Schwarz	SMF100A	13/07/22	14/07/22	102341
Thermo hygrometer	BODYCOM	BJ5478	13/06/01	14/06/01	120612-2
DC Power Supply	SM techno	SDP30-5D	13/10/10	14/10/10	305DMG305
Attenuator(3dB)	Aeroflex/Weinschel	56-3	13/09/12	14/09/12	Y2342
High-pass filter	Wainwright	WHKX3.0	13/09/12	14/09/12	9
LOOP Antenna	Schwarzbeck	FMZB1513	12/09/24	14/09/24	1513-128
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
Horn Antenna	ETS	3115	13/02/28	15/02/28	00021097
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
Amplifier (22dB)	H.P	8447E	13/01/08 14/01/07	14/01/08 15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	13/02/27	14/02/27	3008A00370
EMI TEST RECEIVER	R&S	ESU	13/01/08 14/01/07	14/01/08 15/01/07	100014

APPENDIX I
Conducted Test set up Diagram & Path loss Information

▪Conducted Measurement(30MHz ~ 25GHz)



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	2.95	15	4.28
1	3.02	20	4.51
2412& 2437 & 2462	3.16	25	4.78
5	3.22	-	-
10	3.77	-	-

Note. 1: The path loss from EUT to Spectrum analyzer was measured and used for test.
Path loss (=S/A's offset value) = Cable A + ATT (Attenuator, Applied only when it was used externally)