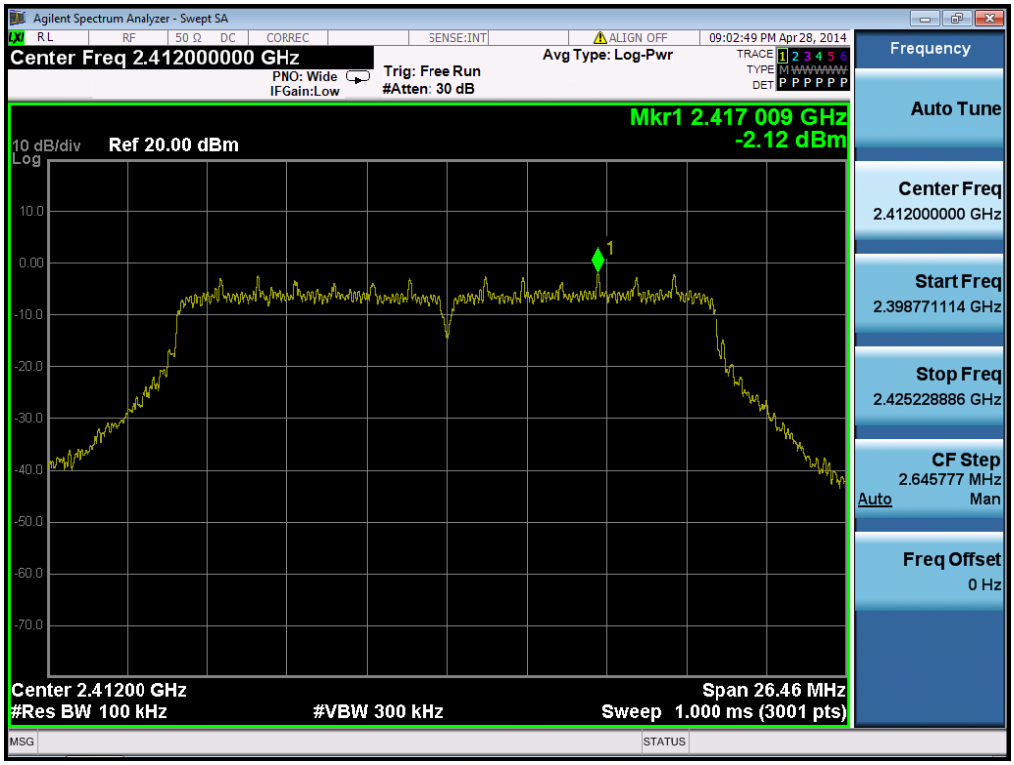
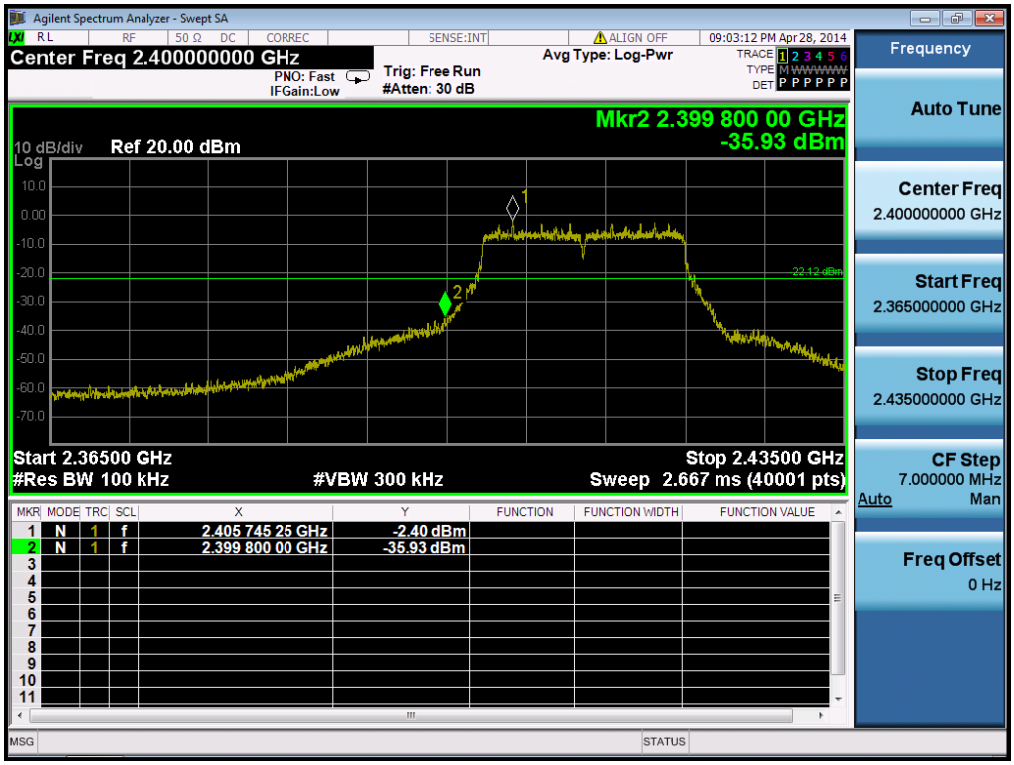
802.11n(HT20)&MCS 0&2412 MHz

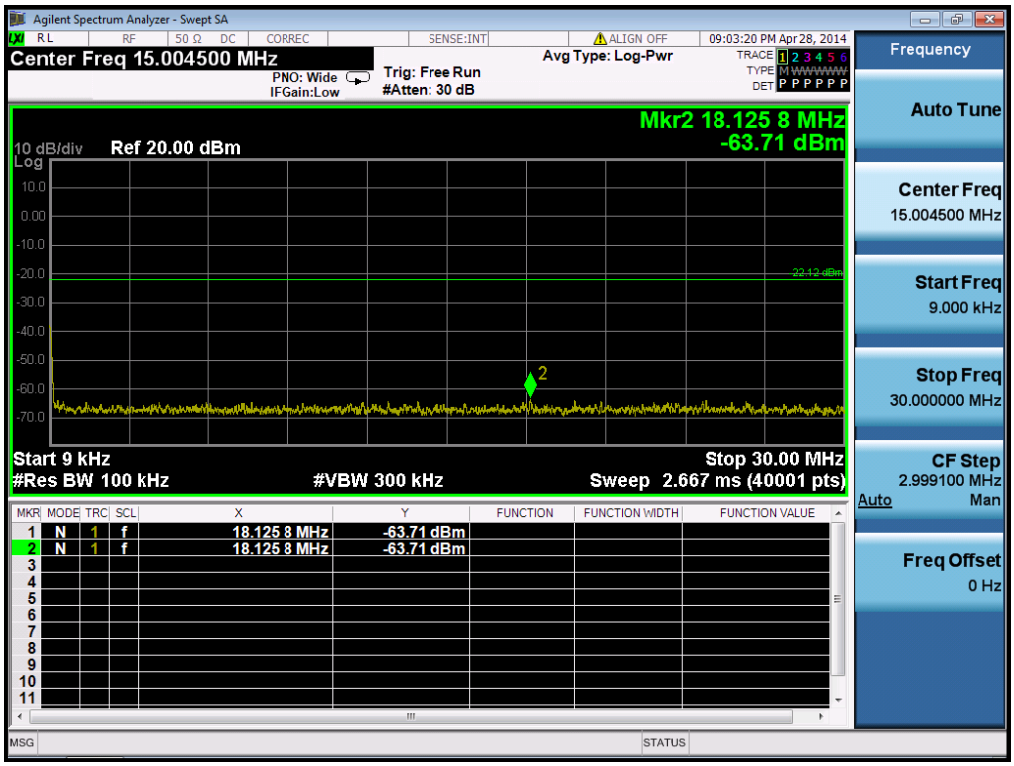
Reference

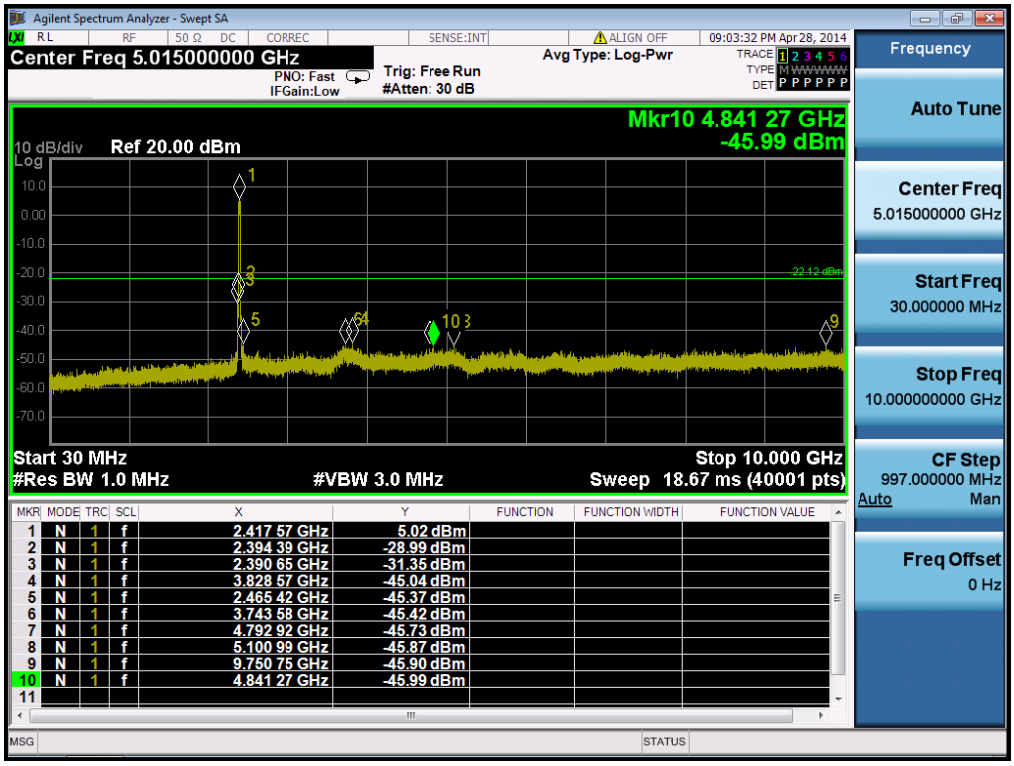


Low Band-edge



Conducted Spurious Emissions





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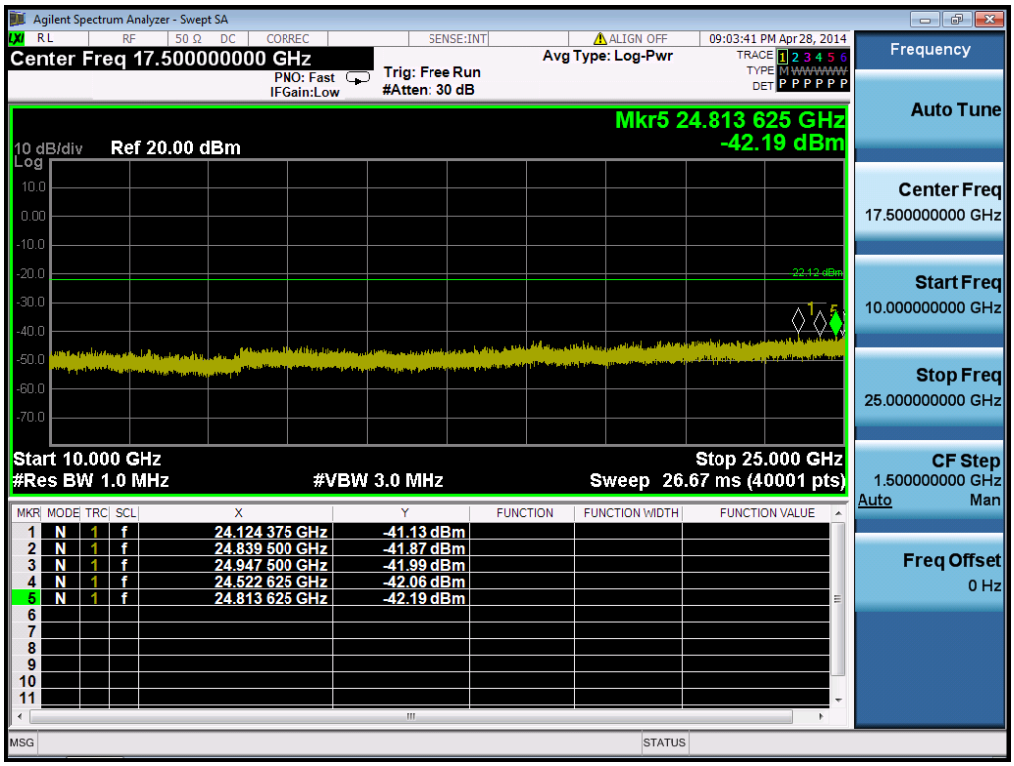
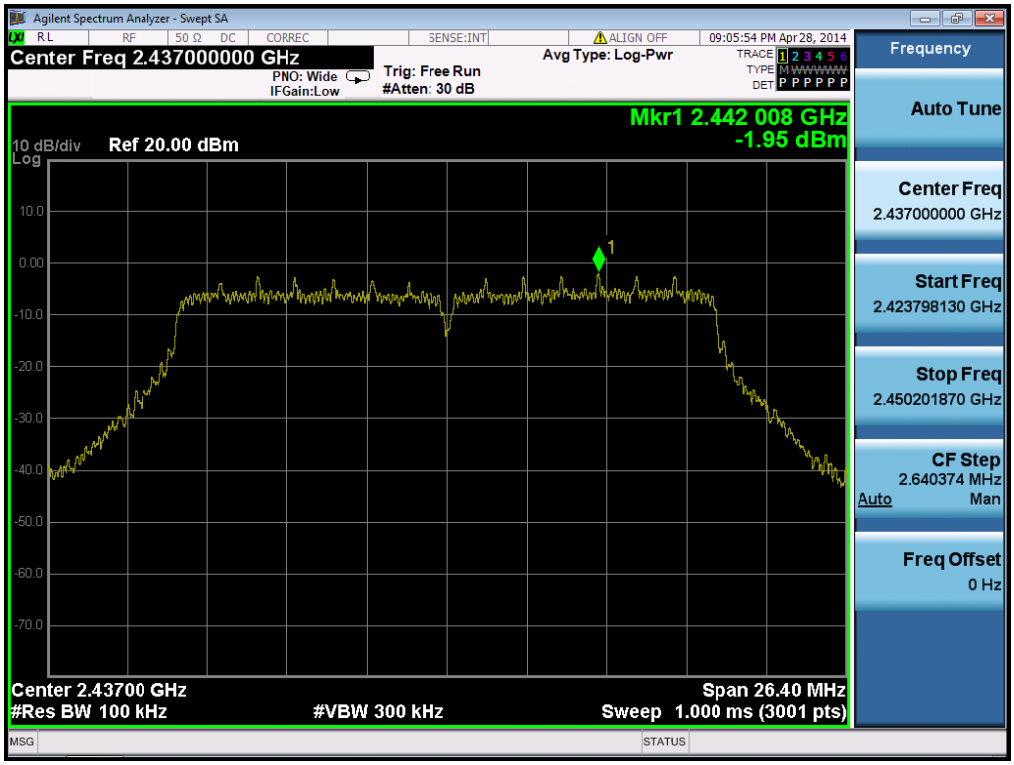
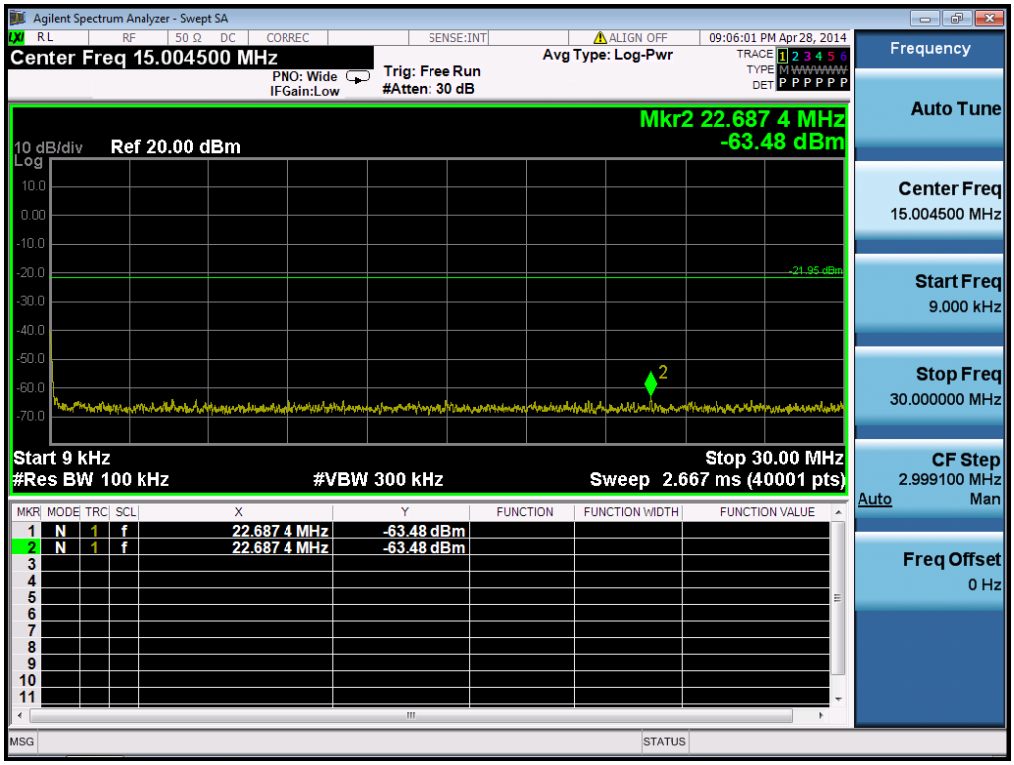


802.11n(HT20)&MCS 0&2437 MHz

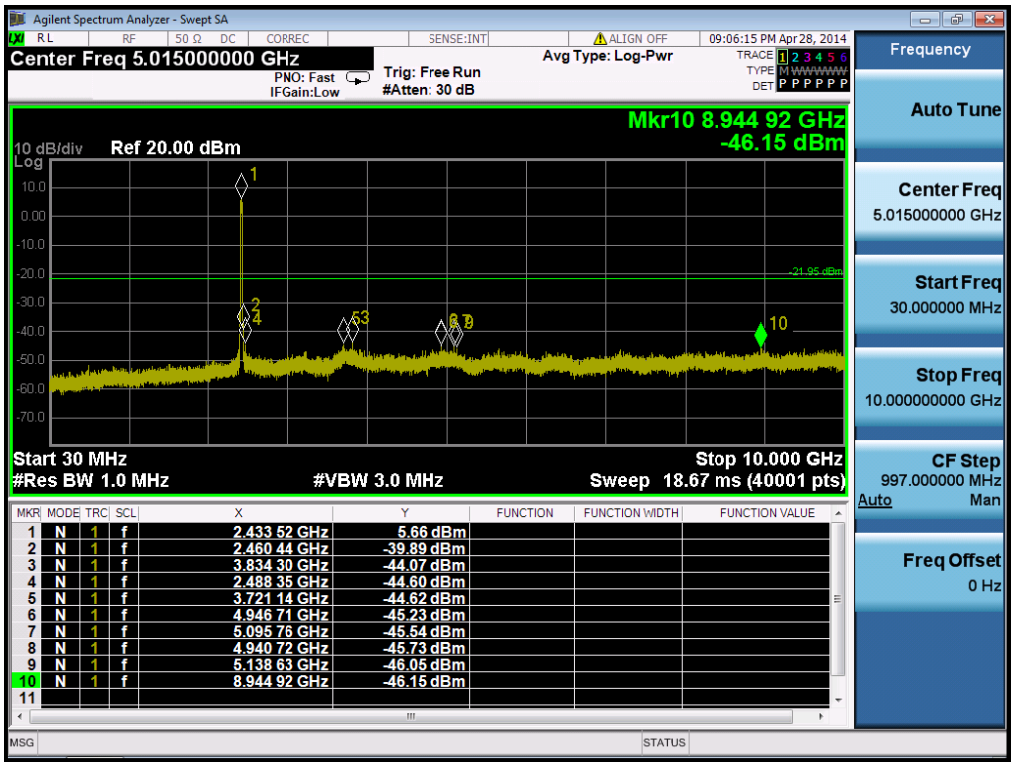
Reference

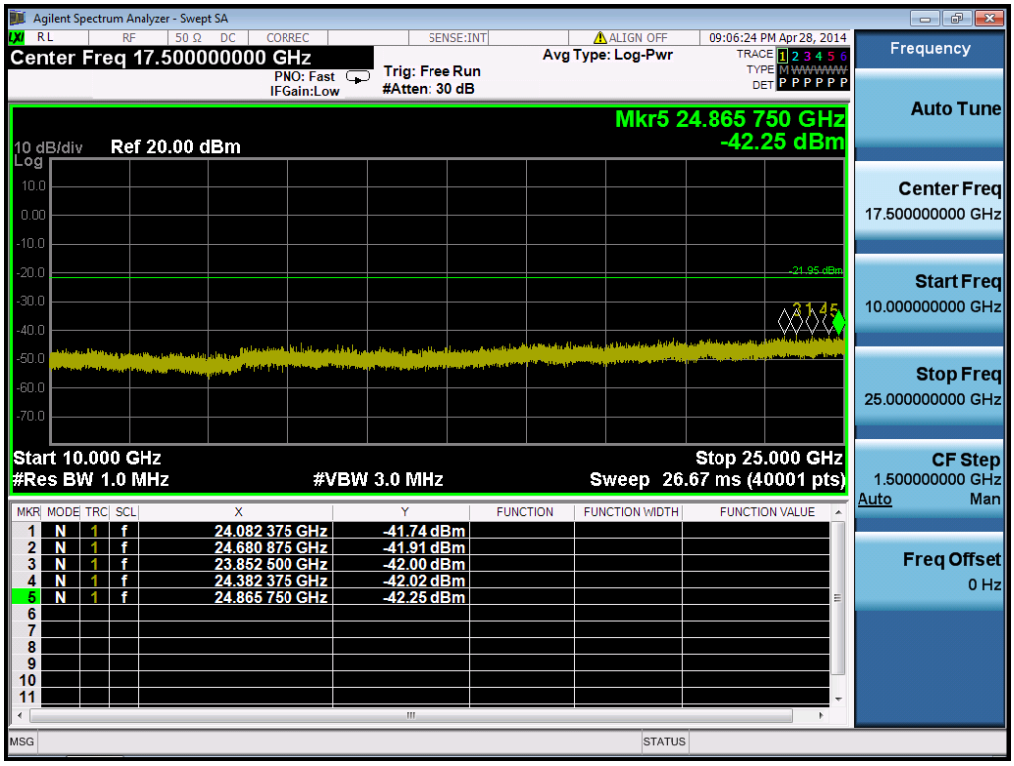


Conducted Spurious Emissions



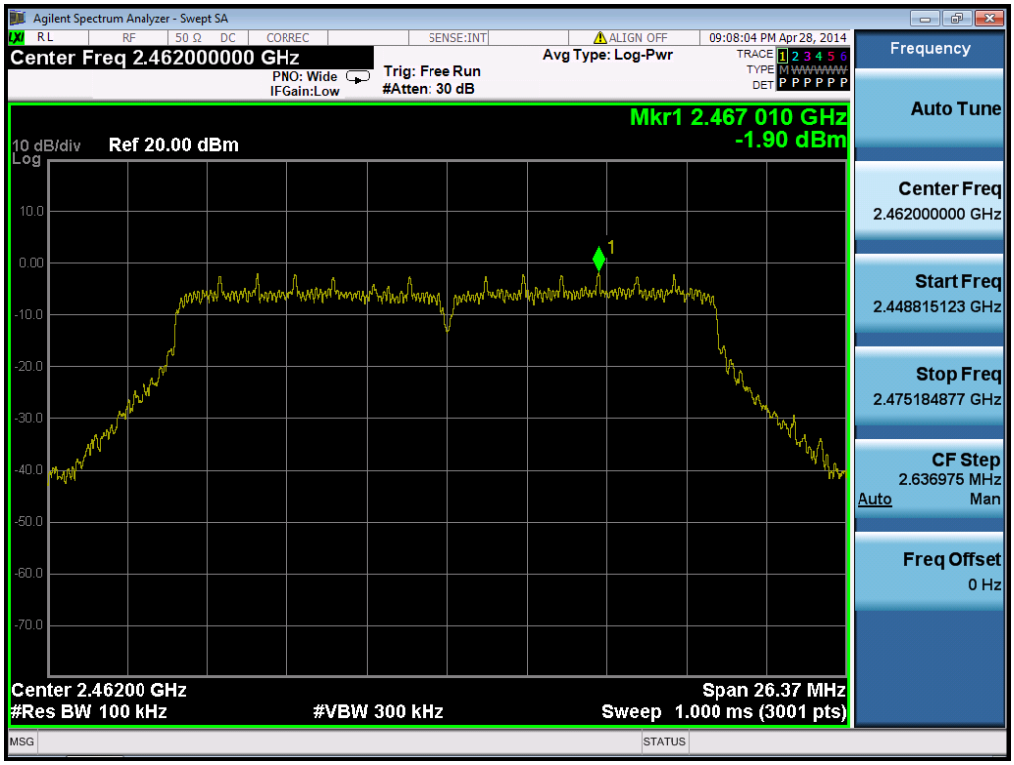
Conducted Spurious Emissions





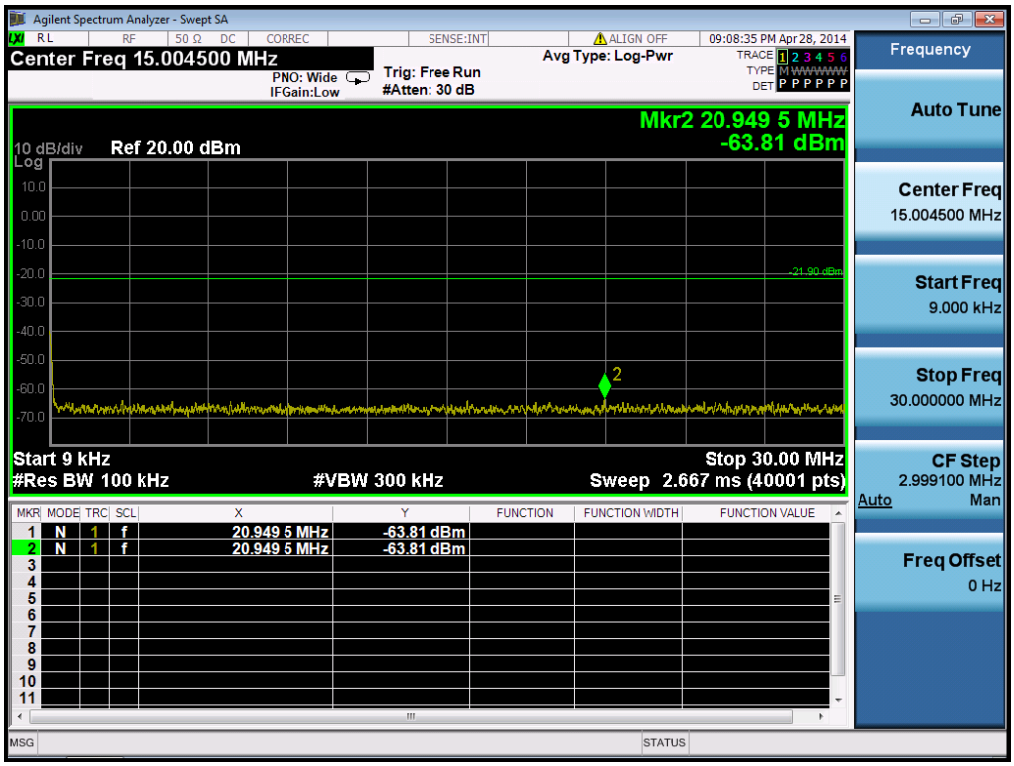
802.11n(HT20)&MCS 0&2462 MHz

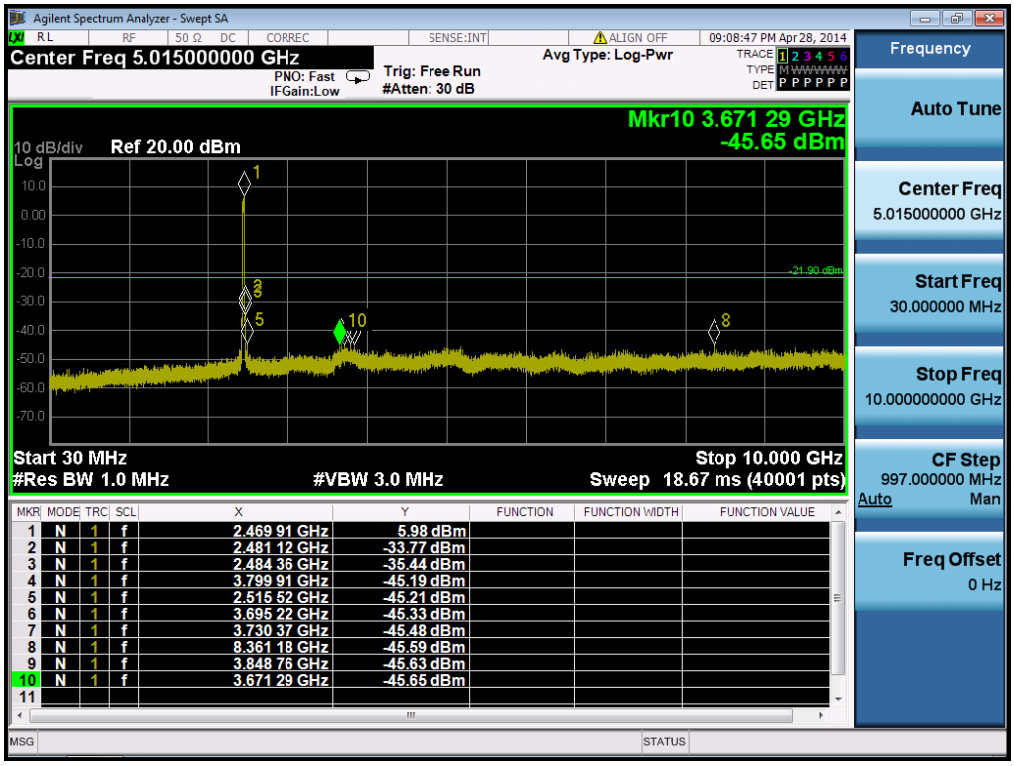
Reference



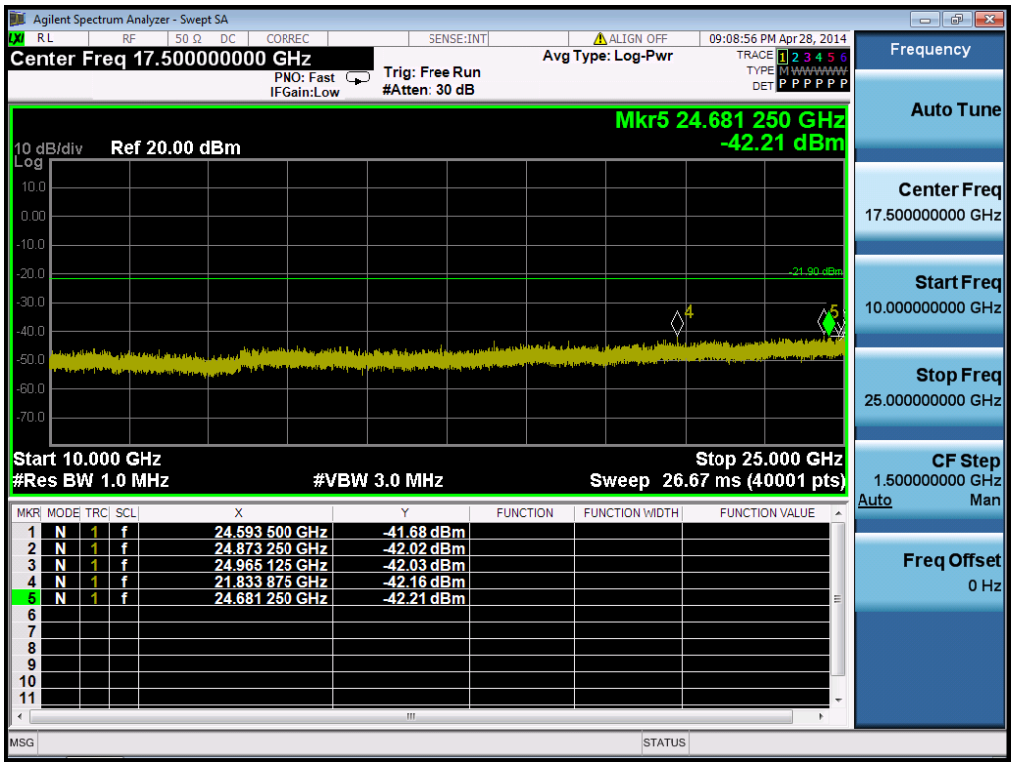
High Band-edge

Conducted Spurious Emissions





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], RSS-Gen [7.2.5]

In any 100kHz bandwidth outside the operating frequency band. In case the emissionfall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table belowhas 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

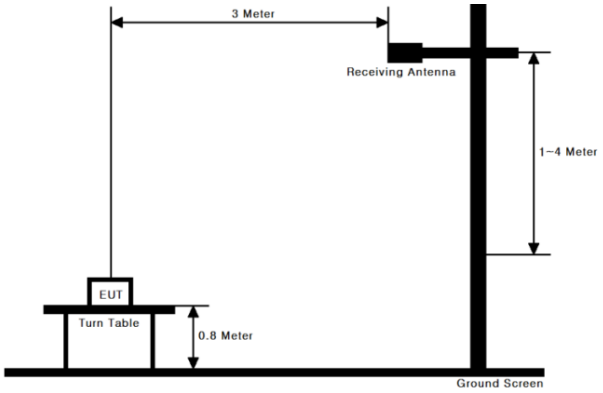
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz.However, operation within these frequency bands is permitted under other sections of this Part, e.g.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

The radiated emission was tested according to the section 6.3 6.4, 6.5 and 6.6 of the ANSI C63.10-2009 with following settings.

Peak Measurement:

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 :

1. RBW = 1 MHz (unless otherwise specified).
2. VBW ≥ 3 x RBW.
3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
4. Averaging type = power (i.e., RMS).
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.
7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Duty Cycle Corrections (Refer to appendix II for duty cycle measurement procedure and plots)

Band	Duty Cycle(%)	T_{on}(ms)	T_{on}+ T_{off}(ms)	DCF = 10log(1/Duty) (dB)
802.11b	99.27	12.240	12.330	0.03
802.11g	95.21	2.028	2.130	0.21
802.11n(HT20)	94.35	1.704	1.806	0.25
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

9KHz ~ 25GHz Data(*802.11b &1 Mbps*)

▪ Lowest Channel

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)
2387.66	H	Y	PK	53.44	-4.32	-	-	49.12	74.00	24.88
2387.54	H	Y	AV	43.67	-4.32	-	-	39.35	54.00	14.65
4823.97	H	Z	PK	45.73	5.20	-	-	50.93	74.00	23.07
4824.00	H	Z	AV	36.02	5.20	-	-	41.22	54.00	12.78
7235.99	H	Z	PK	43.05	11.46	-	-	54.51	74.00	19.49
7236.02	H	Z	AV	32.61	11.46	-	-	44.07	54.00	9.93

▪ Middle Channel

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)
4873.97	H	Z	PK	45.32	5.38	-	-	50.70	74.00	23.30
4874.05	H	Z	AV	36.54	5.38	-	-	41.92	54.00	12.08
7311.60	H	Z	PK	44.21	11.47	-	-	55.68	74.00	18.32
7311.54	H	Z	AV	33.05	11.47	-	-	44.52	54.00	9.48

▪ Highest Channel

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)
2484.15	H	Y	PK	55.44	-3.99	-	-	51.45	74.00	22.55
2483.72	H	Y	AV	45.69	-3.99	-	-	41.70	54.00	12.30
4923.65	H	Z	PK	45.72	5.56	-	-	51.28	74.00	22.72
4923.82	H	Z	AV	35.94	5.56	-	-	41.50	54.00	12.50
7386.05	H	Z	PK	44.66	11.33	-	-	55.99	74.00	18.01
7386.33	H	Z	AV	33.42	11.33	-	-	44.75	54.00	9.25

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54dB = 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(*802.11g &6 Mbps*)

▪ Lowest Channel

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)
2389.95	H	Y	PK	68.54	-4.32	-	-	64.22	74.00	9.78
2389.98	H	Y	AV	53.95	-4.32	0.21	-	49.84	54.00	4.16
4823.96	H	Z	PK	44.09	5.20	-	-	49.29	74.00	24.71
4823.97	H	Z	AV	32.97	5.20	0.21	-	38.38	54.00	15.62
7236.01	H	Z	PK	44.24	11.46	-	-	55.70	74.00	18.30
7235.89	H	Z	AV	33.31	11.46	0.21	-	44.98	54.00	9.02

▪ Middle Channel

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)
4874.05	H	Z	PK	44.21	5.38	-	-	49.59	74.00	24.41
4873.67	H	Z	AV	33.05	5.38	0.21	-	38.64	54.00	15.36
7311.24	H	Z	PK	44.33	11.47	-	-	55.80	74.00	18.20
7311.30	H	Z	AV	33.61	11.47	0.21	-	45.29	54.00	8.71

▪ Highest Channel

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)
2483.63	H	Y	PK	67.12	-3.99	-	-	63.13	74.00	10.87
2483.76	H	Y	AV	50.40	-3.99	0.21	-	46.62	54.00	7.38
4924.03	H	Z	PK	44.62	5.56	-	-	50.18	74.00	23.82
4924.12	H	Z	AV	32.14	5.56	0.21	-	37.91	54.00	16.09
7386.32	H	Z	PK	45.10	11.33	-	-	56.43	74.00	17.57
7386.27	H	Z	AV	33.27	11.33	0.21	-	44.81	54.00	9.19

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54dB = 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(*802.11n HT20 &MCS 0*)

▪ Lowest Channel

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)
2389.98	H	Y	PK	69.60	-4.32	-	-	65.28	74.00	8.72
2389.80	H	Y	AV	52.31	-4.32	0.25	-	48.24	54.00	5.76
4823.92	H	Z	PK	44.37	5.20	-	-	49.57	74.00	24.43
4823.89	H	Z	AV	32.65	5.20	0.25	-	38.10	54.00	15.90
7236.20	H	Z	PK	44.20	11.46	-	-	55.66	74.00	18.34
7236.09	H	Z	AV	32.97	11.46	0.25	-	44.68	54.00	9.32

▪ Middle Channel

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)
4874.02	H	Z	PK	44.75	5.38	-	-	50.13	74.00	23.87
4874.11	H	Z	AV	33.36	5.38	0.25	-	38.99	54.00	15.01
7310.79	H	Z	PK	45.14	11.47	-	-	56.61	74.00	17.39
7311.07	H	Z	AV	33.22	11.47	0.25	-	44.94	54.00	9.06

▪ Highest Channel

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)
2483.80	H	Y	PK	65.82	-3.99	-	-	61.83	74.00	12.17
2483.88	H	Y	AV	49.32	-3.99	0.25	-	45.58	54.00	8.42
4924.03	H	Z	PK	44.40	5.56	-	-	49.96	74.00	24.04
4924.17	H	Z	AV	33.36	5.56	0.25	-	39.17	54.00	14.83
7386.52	H	Z	PK	44.55	11.33	-	-	55.88	74.00	18.12
7386.34	H	Z	AV	33.42	11.33	0.25	-	45.00	54.00	9.00

Note.

1. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   So Distance Correction Factor :- 9.54dB = 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 [7.2.4]

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 Configuration

See test photographs for the actual connections between EUT and supportequipment.

Test Mode

The all modes of EUT operation were investigated and the worst case mode was reported.

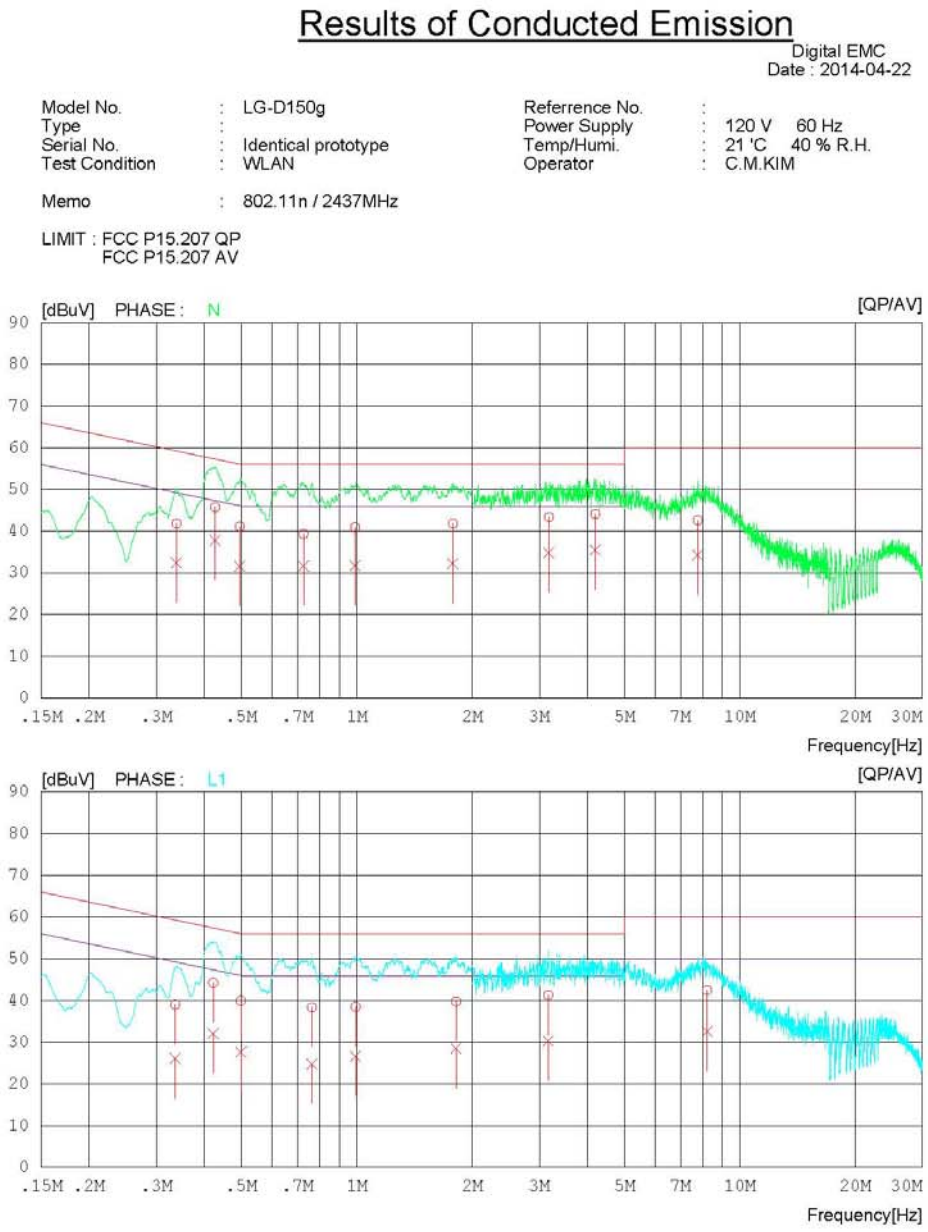
TEST PROCEDURE

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.

▣RESULT PLOTS

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n& 1Mbps & 2437MHz



AC Line Conducted Emissions (List)

Test Mode: 802.11n& 1Mbps & 2437MHz

Results of Conducted Emission

Digital EMC
Date : 2014-04-22

Model No.	:	LG-D150g	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	21 'C 40 % R.H.
Test Condition	:	WLAN	Operator	:	C.M.KIM

Memo : 802.11n / 2437MHz

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.33827	31.7	22.2	10.2	41.9	32.4	59.2	49.2	17.3	16.8	N
2	0.42670	35.5	27.6	10.2	45.7	37.8	57.3	47.3	11.6	9.5	N
3	0.49491	30.9	21.4	10.2	41.1	31.6	56.1	46.1	15.0	14.5	N
4	0.72636	29.1	21.5	10.2	39.3	31.7	56.0	46.0	16.7	14.3	N
5	0.99035	30.7	21.5	10.2	40.9	31.7	56.0	46.0	15.1	14.3	N
6	1.78259	31.5	21.9	10.3	41.8	32.2	56.0	46.0	14.2	13.8	N
7	3.17783	33.1	24.5	10.3	43.4	34.8	56.0	46.0	12.6	11.2	N
8	4.19779	33.8	25.2	10.3	44.1	35.5	56.0	46.0	11.9	10.5	N
9	7.76694	32.2	23.9	10.4	42.6	34.3	60.0	50.0	17.4	15.7	N
10	0.33564	28.7	15.8	10.3	39.0	26.1	59.3	49.3	20.3	23.2	L1
11	0.42165	33.9	21.9	10.3	44.2	32.2	57.4	47.4	13.2	15.2	L1
12	0.49821	29.7	17.4	10.3	40.0	27.7	56.0	46.0	16.0	18.3	L1
13	0.76374	28.1	14.5	10.3	38.4	24.8	56.0	46.0	17.6	21.2	L1
14	0.99269	28.2	16.4	10.3	38.5	26.7	56.0	46.0	17.5	19.3	L1
15	1.81650	29.5	18.2	10.3	39.8	28.5	56.0	46.0	16.2	17.5	L1
16	3.15900	30.9	19.9	10.4	41.3	30.3	56.0	46.0	14.7	15.7	L1
17	8.22776	32.0	22.1	10.5	42.5	32.6	60.0	50.0	17.5	17.4	L1

8.7Occupied 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 practicala sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

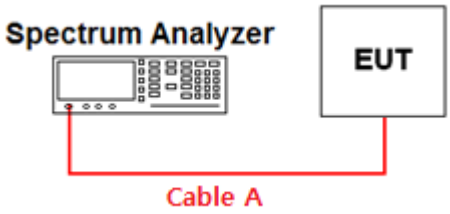
▣TEST RESULTS: N/A

9. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
PXA Signal Analyzer	Agilent Technologies	N9030A	13/10/29	14/10/29	MY53310140
Digital Multimeter	H.P	34401A	14/02/27	15/02/27	3146A13475
Dynamic Measurement DC Source	Agilent Technologies	66332A	13/09/24	14/09/24	MY43000211
Thermohygrometer	BODYCOM	BJ5478	14/03/03	15/03/03	1209
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
Signal Generator	Rohde Schwarz	SMF100A	13/07/22	14/07/22	102341
Attenuator(3dB)	SMAJK	SMAJK-2-3	13/10/22	14/10/22	3
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	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A00370
EMI TEST RECEIVER	R&S	ESU	14/01/07	15/01/07	100014
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESR	14/02/07	15/02/07	101767
CVCF	NF	4420	13/09/12	14/09/12	3049354420023
LISN	Narda S.T.S. / PMM	PMM L2-16B	13/06/27	14/06/27	000WX20305
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A/ MA2411B	13/10/29	14/10/29	1338004 / 1306053

APPENDIX I
Conducted Test set up Diagram &Path lossInformation

▪Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.10	15	1.18
1	0.21	20	1.30
2402 & 2440 & 2480	0.31	25	2.75
5	0.50	-	-
10	1.05	-	-

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

APPENDIX II
Duty cycle plots

▣ TEST PROCEDURE

Duty Cycle measured using **section 6.0 b) of KDB558074 v03r1 :**

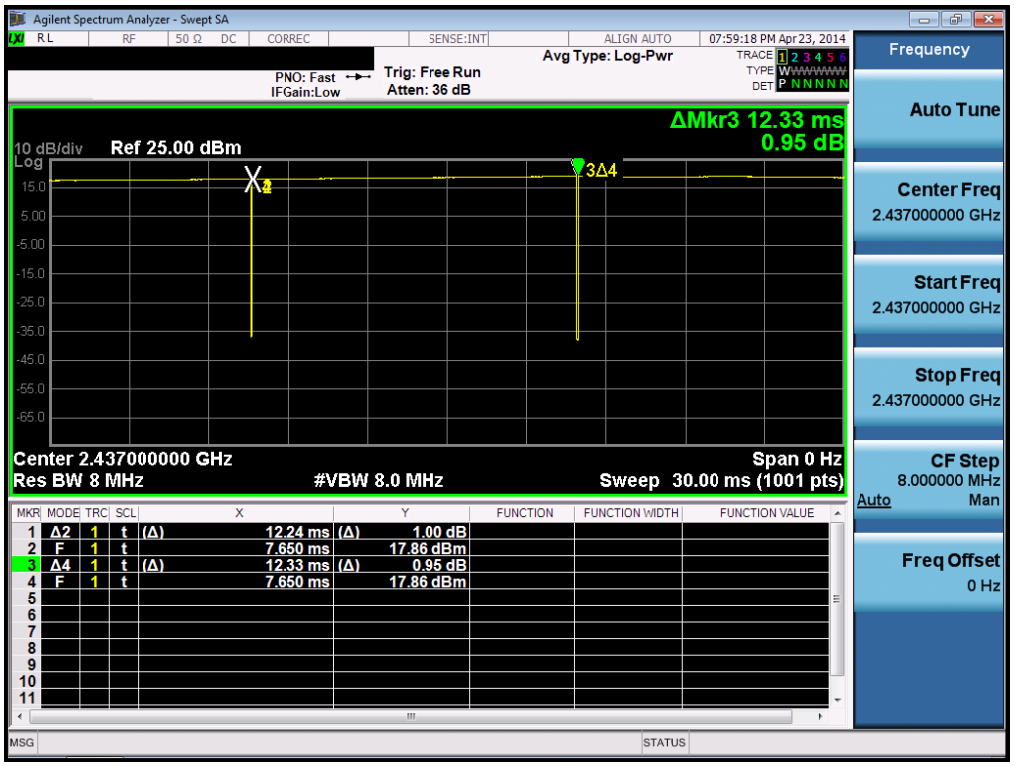
The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW≥ RBW. Set detector = peak or average.

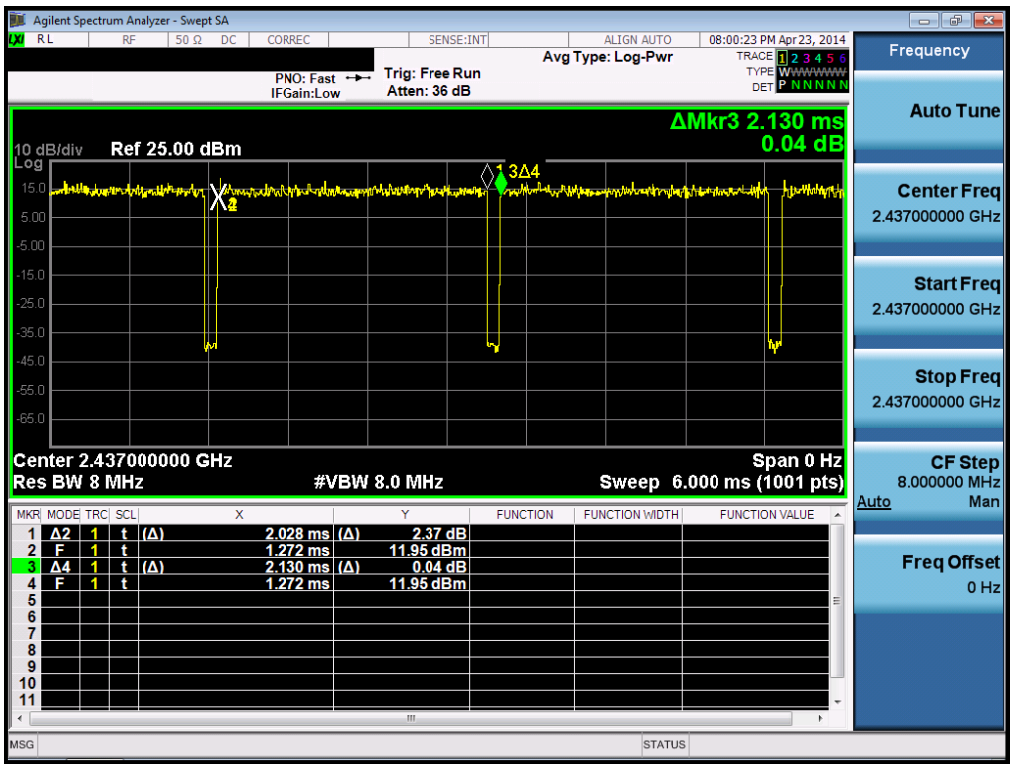
The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

Test Plots :

Duty Cycle Test Mode: 802.11b &1 Mbps&2437 MHz



Duty Cycle Test Mode: 802.11g &6 Mbps&2437 MHz



Duty Cycle Test Mode: 802.11n &MCS 0&2437 MHz