EMC
TEST REPORT

Report No. : TS13100074-EME
Model No. : WMTB-177N
Brand Name lenovo ThinkPad
Issued Date : Dec. 24, 2013

Applicant: **Gemtek Technology Co., Ltd.**
No. 15-1 Zhonghua Road, Hsinchu Industrial Park,
Hukou, Hsinchu, 30352, Taiwan

Test Method/ Standard: **FCC Part 15 Subpart E Section §15.207、§15.209 、§15.407 、KDB 789033 D01 v01r03、KDB 662911 D01 v02r01and ANSI C63.4 2009.**

Test By: **Intertek Testing Services Taiwan Ltd.**
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Chester/ Engineer

The test report was reviewed by: Rico Deng

Name Rico Deng
Title Senior Engineer

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Summary of Tests

Test	Reference	Results
Max average output power test	15.407 (a)(1)/(2)/(3) KDB 789033 D01 v01r03 KDB 662911 D01 v02r01	Pass
Power Spectrum Density test	15.407 (a)(1)/(2)/(3) KDB 789033 D01 v01r03 KDB 662911 D01 v02r01	Pass
Peak excursion to average ratio test	15.407(a)(6) KDB 789033 D01 v01r03	Pass
Radiated spurious emission test	15.407(b)(1)/(2)/(3)/(6), 15.209	Pass
AC line conducted emission test	15.407(b)(6) 15.207	Pass

1. General information

1.1 Identification of the EUT

Product:	ThinkPad Enterprise Wireless Display Adapter
Model No.:	WMTB-177N
Operating Frequency:	1. 5180 MHz ~ 5240 MHz for 802.11a, 802.11n HT20 2. 5190 MHz ~ 5230 MHz for 802.11n HT40
Channel Number:	1. 4 channels for 5180 MHz ~ 5240 MHz for 802.11a, 802.11n HT20 2. 2 channels for 5190 MHz ~ 5230 MHz for 802.11n HT40
Access scheme:	OFDM
Rated Power:	DC 5.2 V from adapter
Power Cord:	N/A
Sample Received:	Jul. 26, 2013
Sample condition:	Workable
Test Date(s):	Nov. 28, 2013 ~ Dec. 17, 2013
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is a ThinkPad Enterprise Wireless Display Adapter, it's MIMO(2TX) devcie and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

1.3 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Adapter	lenovo	PA-1100-17IL	I/P: 100-240V~, 0.3A, 50-60Hz O/P: 5.2V, 2.0A

Peripherals equipment

Peripherals	Brand	Model No.	Serial No.	Data cable
Notebook PC	Toshiba	Protégé M800	N/A	USB Cable 1 meter
Notebook PC	DELL	TND-609	N/A	VGA Cable
Monitor	ViewSonic	VS11871-1E	QRE074990701	HDMI & VGA 1 meter & 3.5mm audio line

1.4 Antenna description

1. Antenna 0 (Chain 0)

The EUT uses a permanently connected antenna.

Antenna Gain : 1.28 dBi max
Antenna Type : PIFA antenna
Connector Type : I-PEX

2. Antenna 1 (Chain 1)

The EUT uses a permanently connected antenna.

Antenna Gain : 1.81 dBi max
Antenna Type : PIFA antenna
Connector Type : I-PEX

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart E Section §15.207、§15.209、§15.407、KDB 789033 D01 v01r03、KDB 662911 D01 v02r01 and ANSI C63.4:2009.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

The AC power conducted emissions was invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz (15.207 paragraph).

Radiated emissions were invested cover the frequency range from 30 MHz to 1000 MHz using a receiver RBW of 120 kHz record QP reading, and the frequency over 1 GHz using a spectrum analyzer RBW of 1 MHz and 10 Hz VBW record Average reading (15.209 paragraph), the Peak reading recorded also on the report.

The EUT setup configurations please refer to the photo of test configuration in item.

2.2 Operation mode

TX Mode: Based on “M Tool” to execute, and select different frequency and modulation.

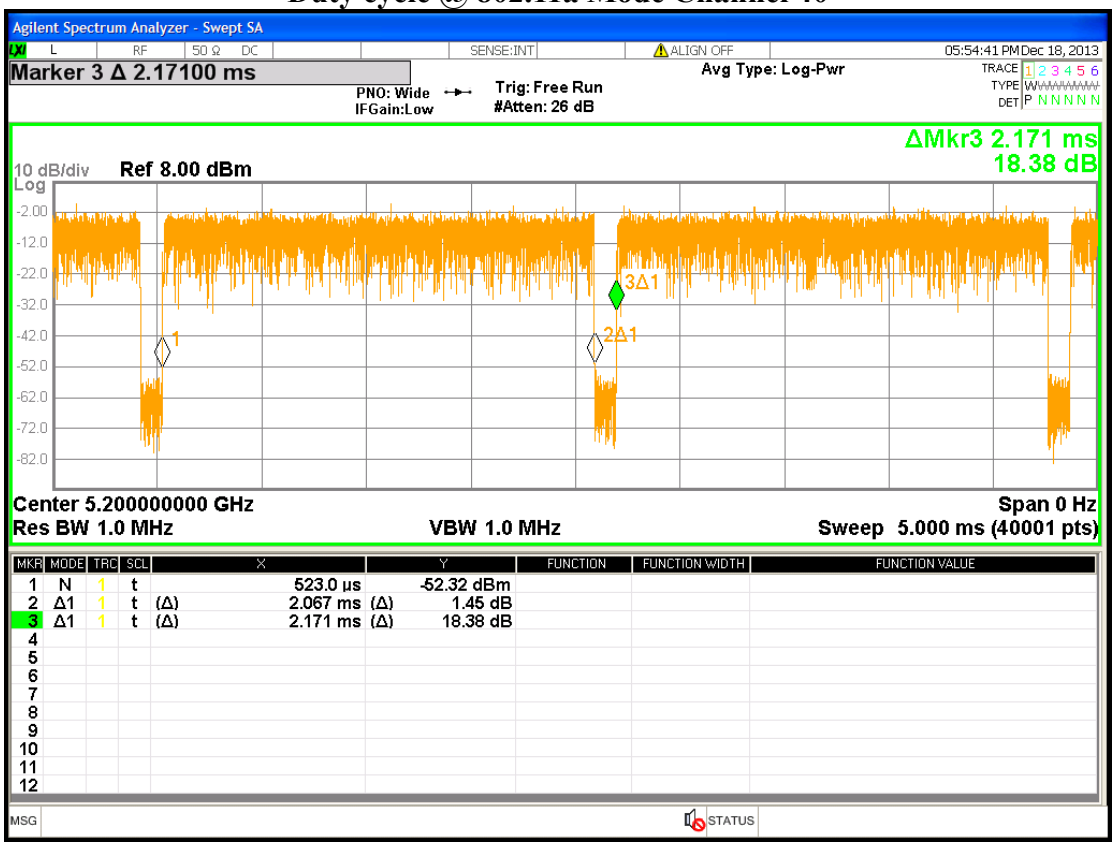
With individual verifying, the maximum output power was found at 6 Mbps data rate for 802.11a mode, 6.5 Mbps data rate for 802.11n HT 20 mode, and 13.5 Mbps data rate for 802.11n HT 40 mode. The final tests were executed under these conditions and recorded in this report individually.

802.11a Ch40 chain0		802.11n HT20 Ch40 chain0		802.11n HT40 Ch38 chain0		802.11n HT20 Ch40 chain1+chain0	
Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)
6	12.36	6.5	9.79	13.5	9.60	6.5	12.15
9	12.32	13	9.75	27	9.58	13	12.12
12	12.30	19.5	9.73	40.5	9.54	19.5	12.10
18	12.27	26	9.72	27	9.51	26	12.06
24	12.24	39	9.69	81	9.48	39	12.03
36	12.21	52	9.67	108	9.45	52	12.00
48	12.19	58.5	9.64	121.5	9.42	58.5	11.97
54	12.16	65	9.62	135	9.39	65	11.94
802.11a Ch40 chain1		802.11n HT20 Ch40 chain1		802.11n HT40 Ch38 chain1		802.11n HT40 Ch38 chain1+chain0	
Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)	Data rate (Mbps)	AV (dBm)
6	12.03	6.5	8.37	13.5	8.92	13.5	12.28
9	12.01	13	8.35	27	8.91	27	12.26
12	12.00	19.5	8.32	40.5	8.86	40.5	12.23
18	11.98	26	8.30	27	8.83	27	12.21
24	11.96	39	8.28	81	8.80	81	12.18
36	11.93	52	8.25	108	8.76	108	12.16
48	11.92	58.5	8.23	121.5	8.73	121.5	12.13
54	11.90	65	8.20	135	8.70	135	12.11

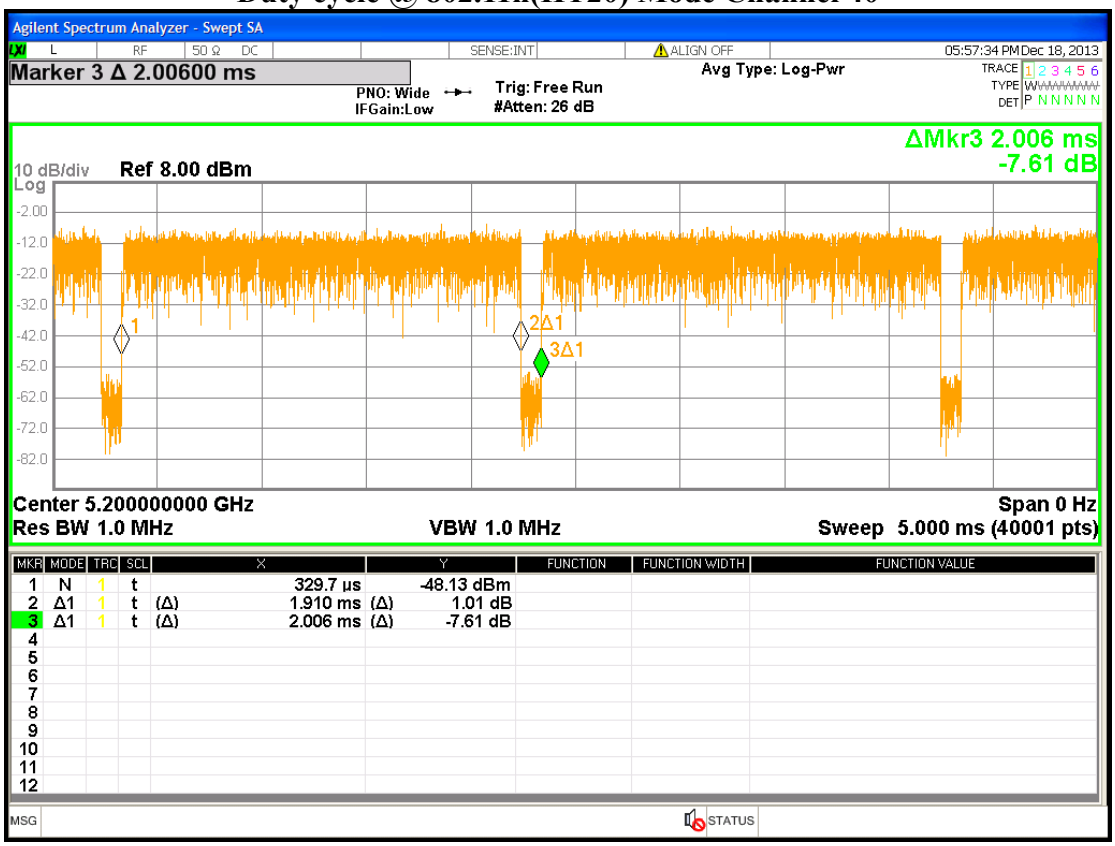
Duty cycle of test signal

Mode	Channel	Frequency (MHz)	Data rate	Signal on time(ms)	Total signal transmit time(ms)	Duty cycle	Duty Cycle factor
802.11a	40	5200	1	2.07	2.17	0.952	0.21
802.11n (HT 20)	40	5200	6.5	1.91	2.00	0.952	0.21
802.11n (HT 40)	38	5190	13.5	0.93	1.03	0.907	0.43

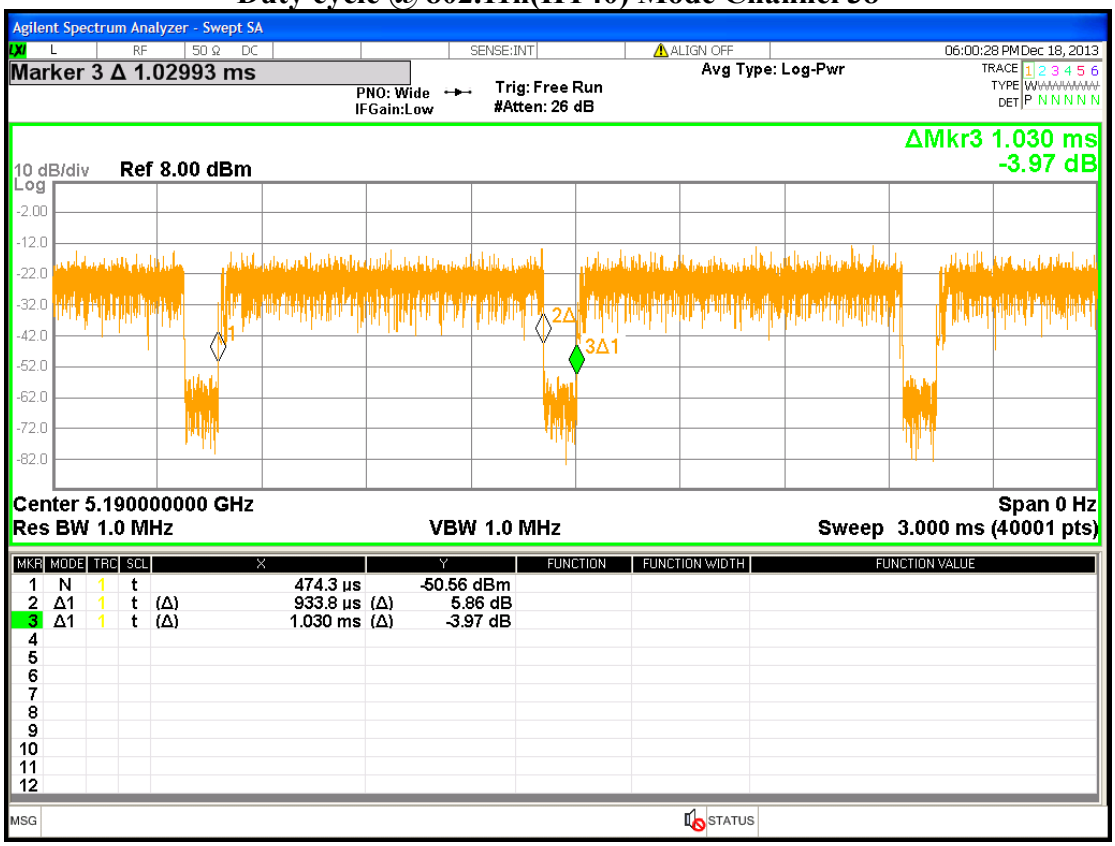
Duty cycle @ 802.11a Mode Channel 40



Duty cycle @ 802.11n(HT20) Mode Channel 40



Duty cycle @ 802.11n(HT40) Mode Channel 38



2.3 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2013/12/3	2014/12/2
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2013/06/21	2014/06/20
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2013/01/23	2014/01/22
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/09/03	2014/09/02
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2012/09/05	2014/09/04
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2013/08/08	2015/08/07
Loop Antenna	RolfHeine	LA-285	02/10033	2012/03/20	2014/03/19
Pre-Amplifier	MITEQ	AFS44-00102650--42-10P-44	1495287	2013/10/27	2015/10/26
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2012/9/18	2014/9/17
Power Meter	Anritsu	ML2495A	0844001	2013/10/10	2014/10/9
Power Senor	Anritsu	MA2411B	0738452	2013/10/10	2014/10/9
Temperature&Humidity Test Chamber	TERCHY	MHU-225LRU (SA)	950838	2013/06/14	2014/06/13
Two-Line -V-Network	Rohde&schwarz	ESH3-Z5	825562/003	2013/10/12	2014/10/11
Two-Line V-Network	Rohde&schwarz	ESH3-Z5	838979/014	2013/10/12	2014/10/11

Note: The above equipments are within the valid calibration period.

3. Max Average Output Power test (FCC 15.407)

3.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

3.2 Test setup & procedure

Reference FCC document: KDB 789033 D01 v01r03 & KDB 662911 D01 v02r01

Test procedures refer to clause E) 3) b) measurement using a gated RF average power meter of KDB 789033 D01 v01r03.

Measurements is performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

3.3 Limit

Operating Frequency (MHz)	Output power limit
5150~5250	< 50 mW (17 dBm) or 4 dBm+10 log B
5250~5350, 5470~5725	< 250 mW (24 dBm) or 11 dBm+10 log B
5725~5825	< 1 W (30 dBm) or 17 dBm+10 log B

Remark: 1. whichever power is less.

Remark: 2 where B is the –26 dB emission bandwidth in MHz.

3.4 Measured data of Maximum Output Power test results

Mode	Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm) (conducted power)	Margin (dB)
			AV		
802.11a (chain0)	36	5180	12.37	16.84	-4.47
	40	5200	12.36	16.84	-4.48
	48	5240	12.37	16.84	-4.47
802.11a (chain1)	36	5180	12.29	16.84	-4.55
	40	5200	12.03	16.84	-4.81
	48	5240	12.48	16.84	-4.36

Note 1.: Limit(dBm) conducted power: 4 dBm +10 log (19.25)=16.84

Mode	Channel	Frequency (MHz)	Output Power (dBm)			Total Power (AV)		Limit (dBm)	Margin (dB)
			Chain 0	Chain 1	Total				
			AV	AV	AV	mW	dBm		
802.11n (HT 20)	36	5180	10.1	8.62	12.43	17.51	12.43	16.89	-4.45
	40	5200	9.79	8.37	12.15	16.40	12.15	16.89	-4.74
	48	5240	9.09	8.43	11.78	15.08	11.78	16.89	-5.10
802.11n (HT 40)	38	5190	9.60	8.92	12.28	16.92	12.28	17.00	-7.95
	46	5230	9.62	8.84	12.26	16.82	12.26	17.00	-4.74

Note 1.: Limit(dBm) conducted power: 4 dBm +10 log (19.44)=16.89

4. Power Spectrum Density test (FCC 15.407)

4.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

4.2 Test setup & procedure

The power spectrum density per FCC §15.407(a) was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer with the resolution bandwidth set at 1MHz, the video bandwidth set at 3 MHz. Power spectrum density was read directly and cable loss (1.5 dB)/external attenuator (20 dB) correction was added to the reading to obtain power at the EUT antenna terminals.

4.3 Limitation

Operating Frequency (MHz)	Power density limit
5150~5250	< 4 dBm/MHz
5250~5350, 5470~5725	< 11 dBm/MHz
5725~5825	< 17 dBm/MHz

4.4 Measured data of Power Spectrum Density test results

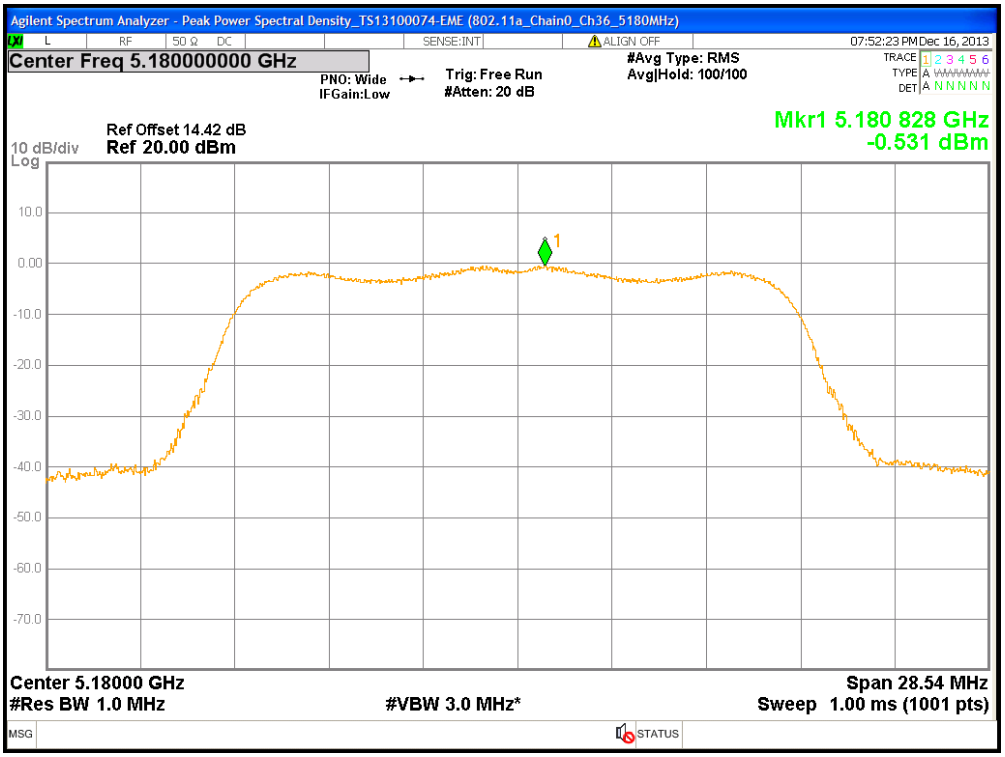
Mode	Channel	Frequency (MHz)	PSD (dBm)		Duty Cycle (dBm)	Total PSD with Duty factor		Limit (dBm)	Margin (dB)
			Chain 0	Chain 1		mW	dBm		
802.11a (chain0)	36	5180	-0.53	-	0.213	0.93	-0.32	4	-4.32
	40	5200	-0.27	-	0.213	0.99	-0.06	4	-4.06
	48	5240	-0.46	-	0.213	0.94	-0.25	4	-4.25
802.11a (chain1)	36	5180	-	0.28	0.213	1.12	0.49	4	-3.51
	40	5200	-	0.07	0.213	1.07	0.28	4	-3.72
	48	5240	-	0.47	0.213	1.17	0.69	4	-3.31

Mode	Channel	Frequency (MHz)	PSD (dBm)		Duty Cycle(dBm)	PSD with Duty factor	
			Chain 0	Chain 1		Chain 0	Chain 1
802.11n (HT 20)	36	5180	-3.16	-3.71	0.21	0.51	0.45
	40	5200	-3.14	-4.35	0.21	0.51	0.39
	48	5240	-3.03	-3.78	0.21	0.52	0.44
802.11n (HT 40)	38	5190	-8.34	-7.22	0.43	0.16	0.21
	46	5230	-7.60	-7.68	0.43	0.19	0.19

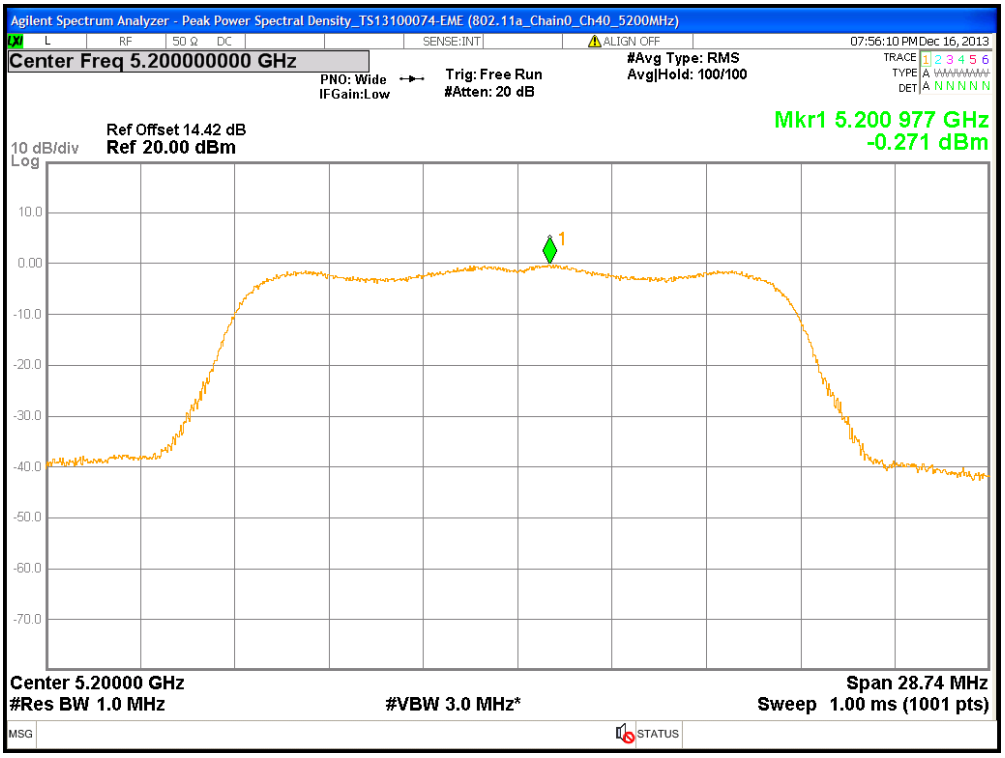
Mode	Channel	Frequency (MHz)	Total PSD with Duty factor		Limit (dBm)	Margin (dB)
			mW	dBm		
802.11n (HT 20)	36	5180	0.95	-0.20	4	-3.55
	40	5200	0.90	-0.48	4	-3.61
	48	5240	0.96	-0.16	4	-3.56
802.11n (HT 40)	38	5190	0.37	-4.31	4	-3.79
	46	5230	0.38	-4.20	4	-3.81

Please see the plot below.

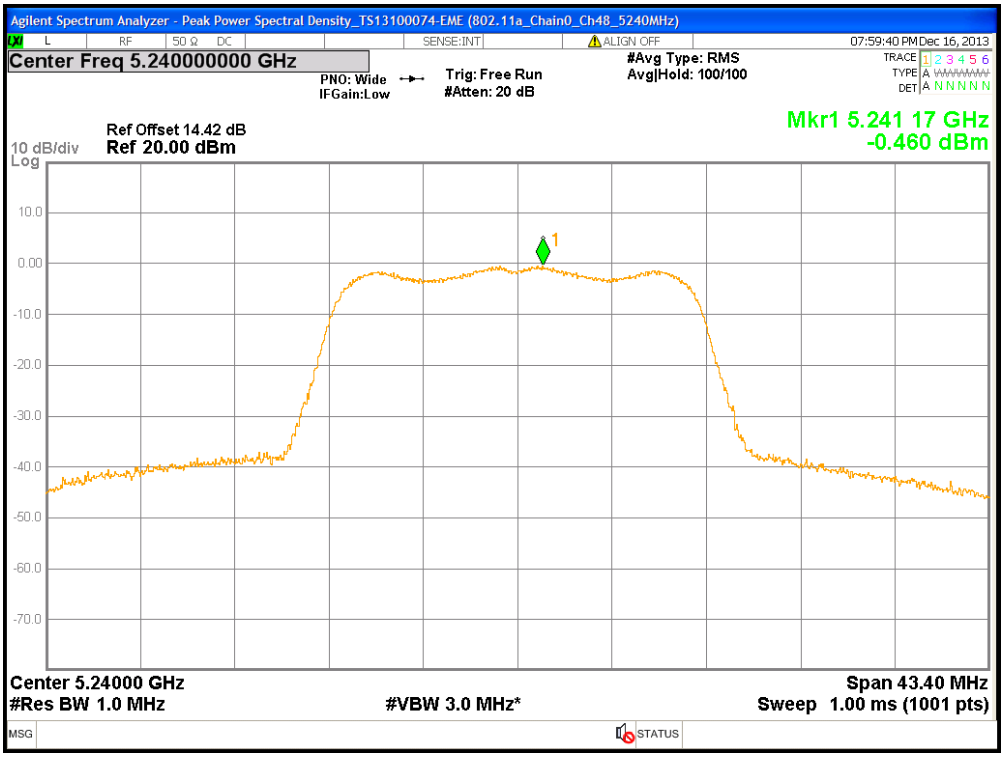
Chain0 : Peak Power Spectral Density @ 802.11a Mode Ch36



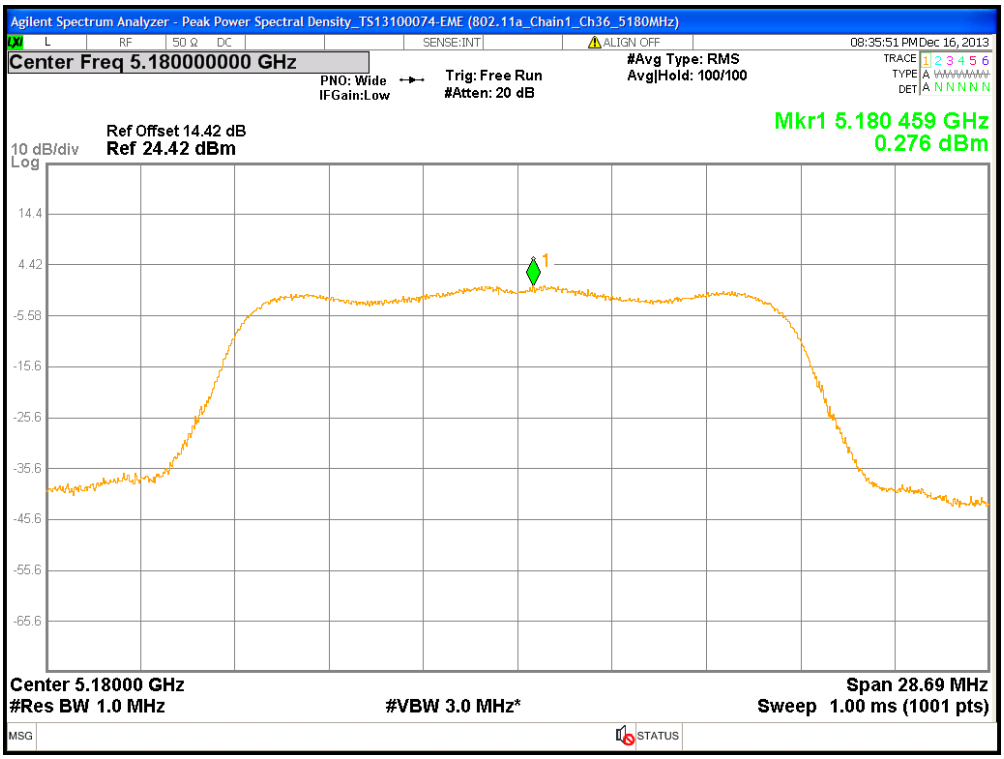
Chain0 : Peak Power Spectral Density @ 802.11a Mode Ch40



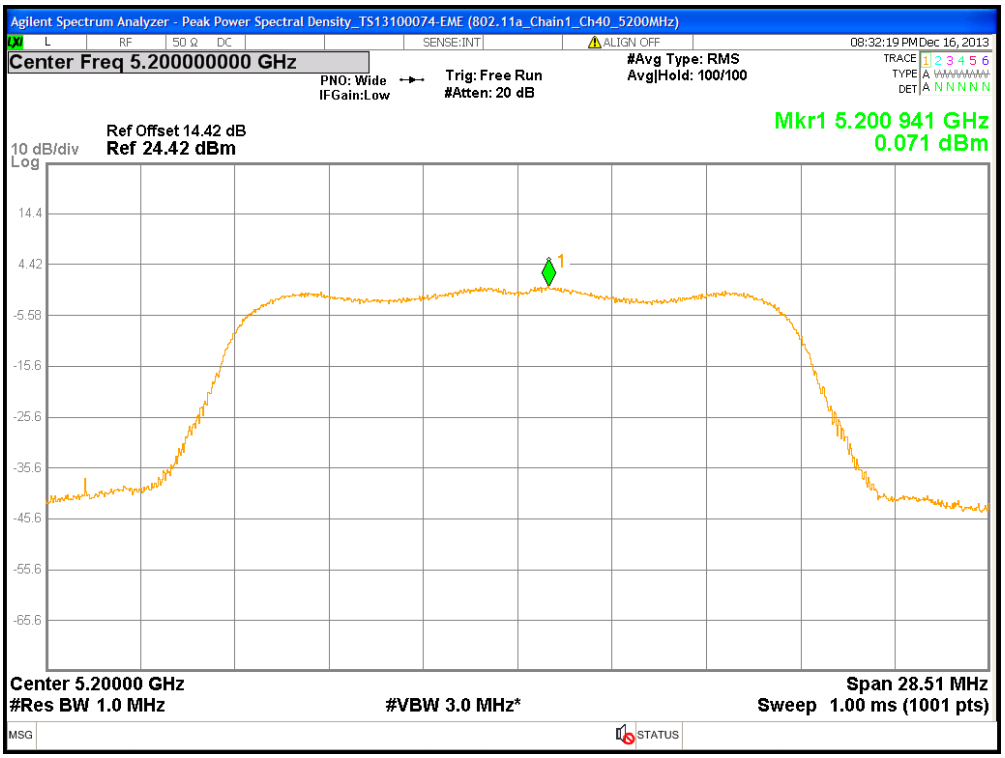
Chain0 : Peak Power Spectral Density @ 802.11a Mode Ch48



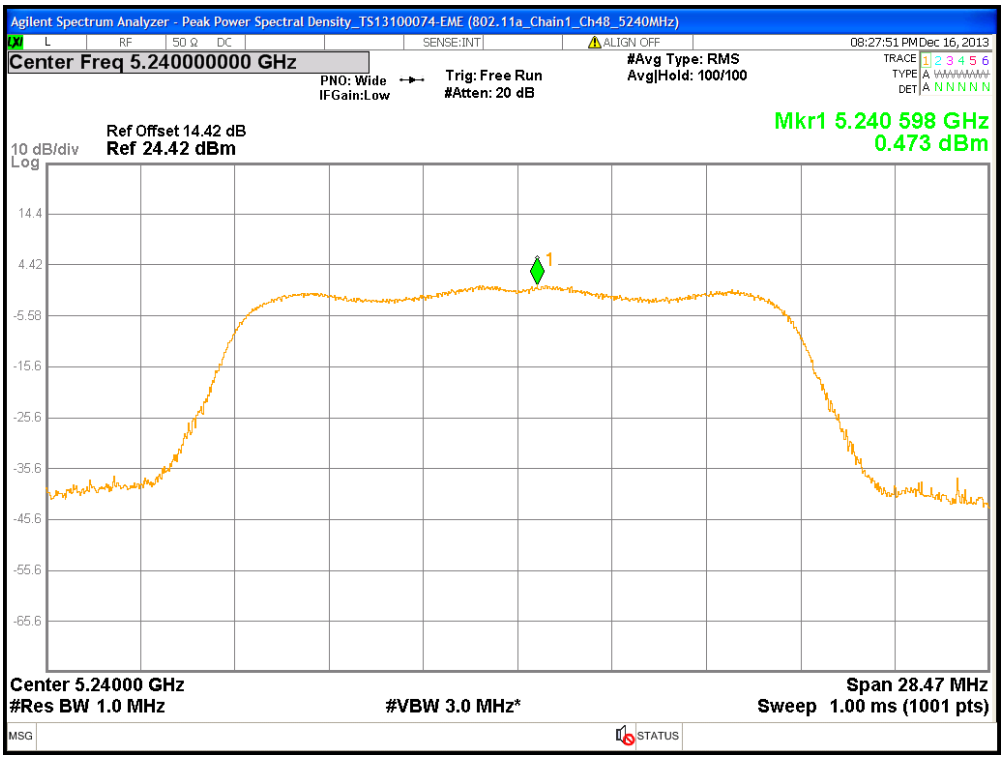
Chain1 : Peak Power Spectral Density @ 802.11a Mode Ch36



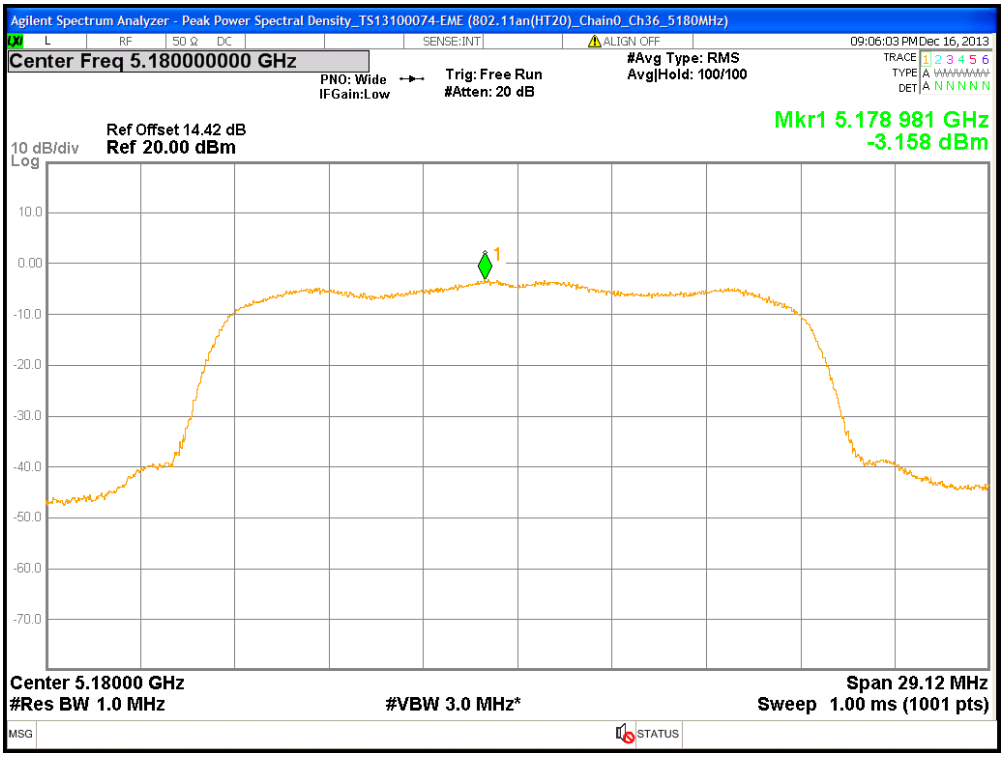
Chain1 : Peak Power Spectral Density @ 802.11a Mode Ch40



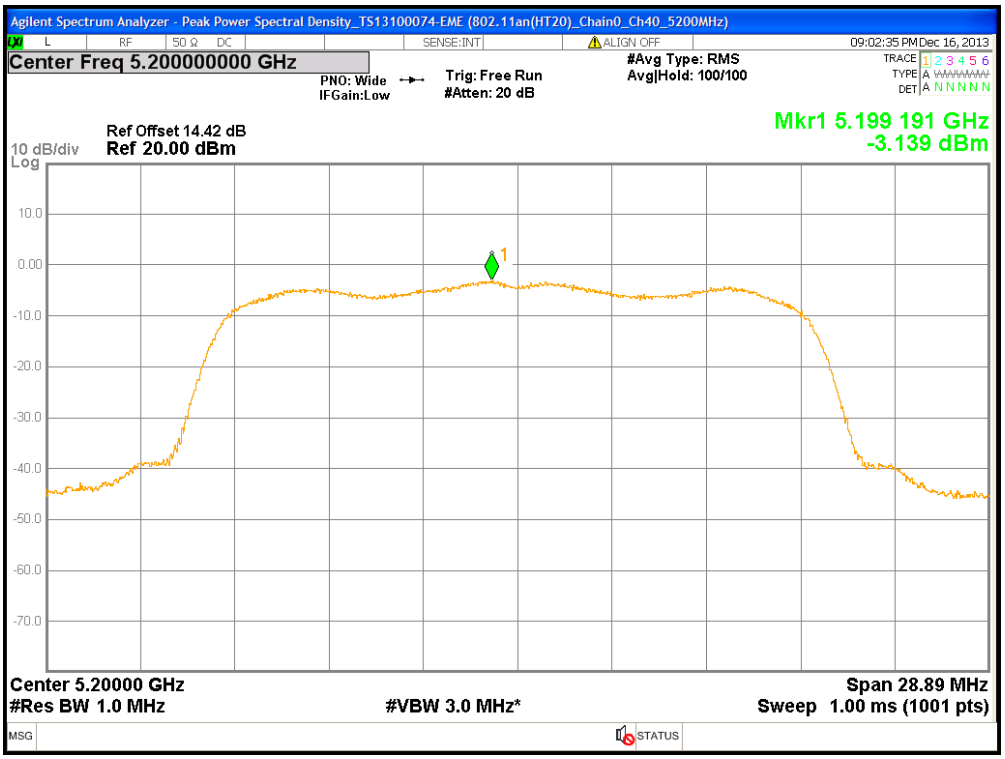
Chain1 : Peak Power Spectral Density @ 802.11a Mode Ch48



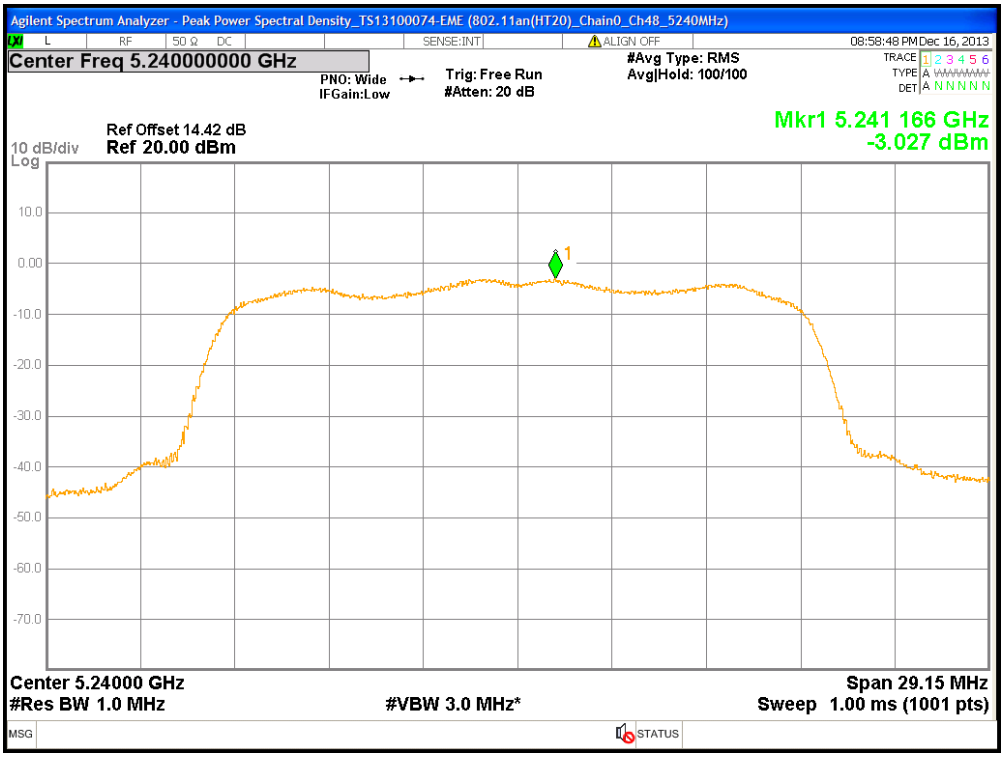
Chain0 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch36



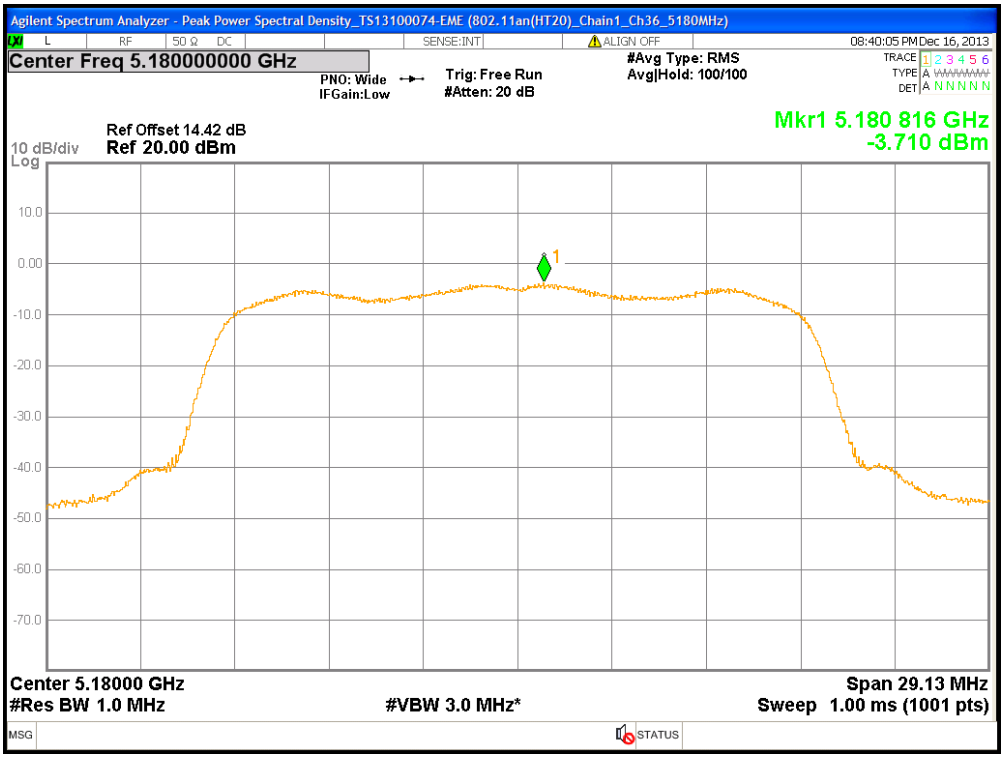
Chain0 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch40



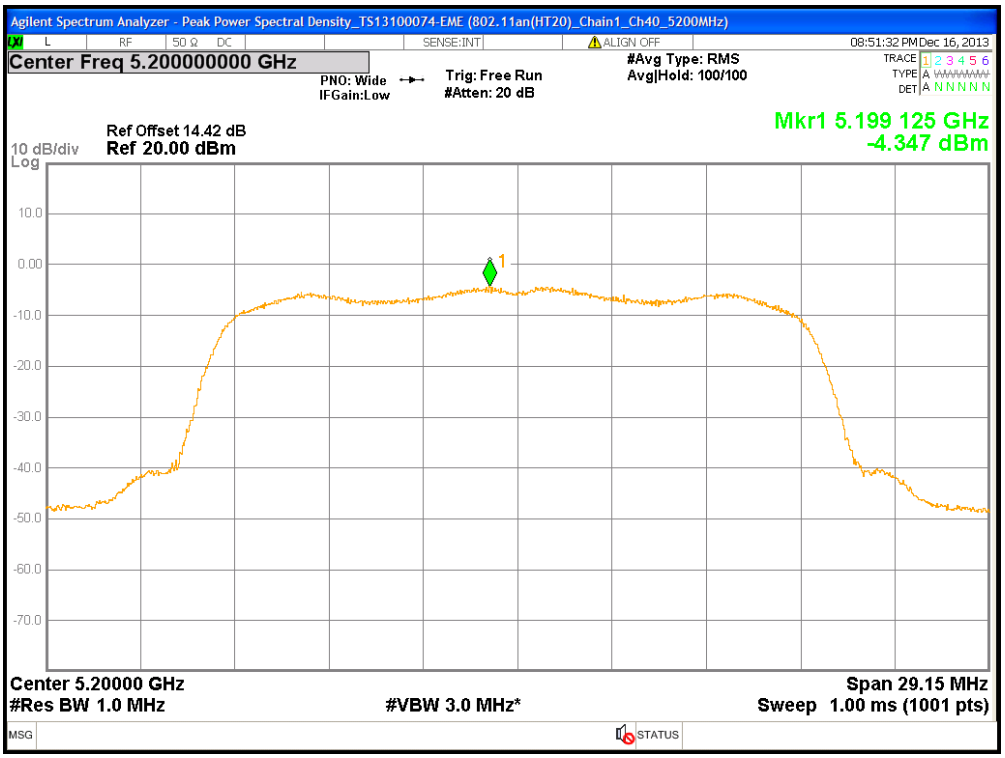
Chain0 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch48



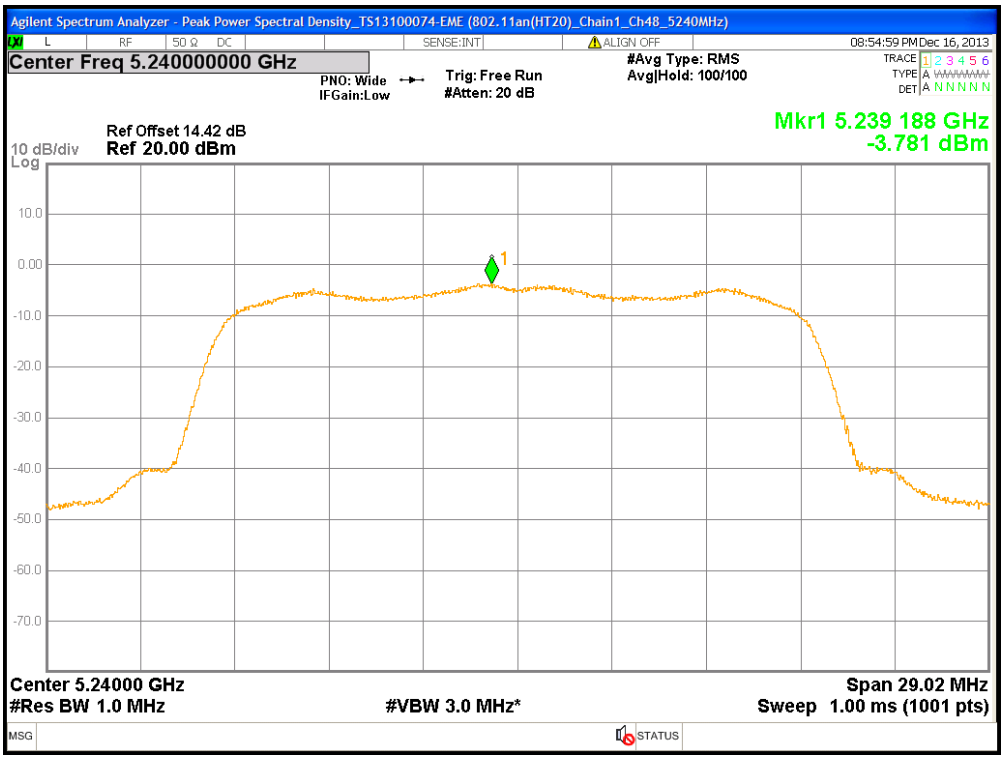
Chain1 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch36



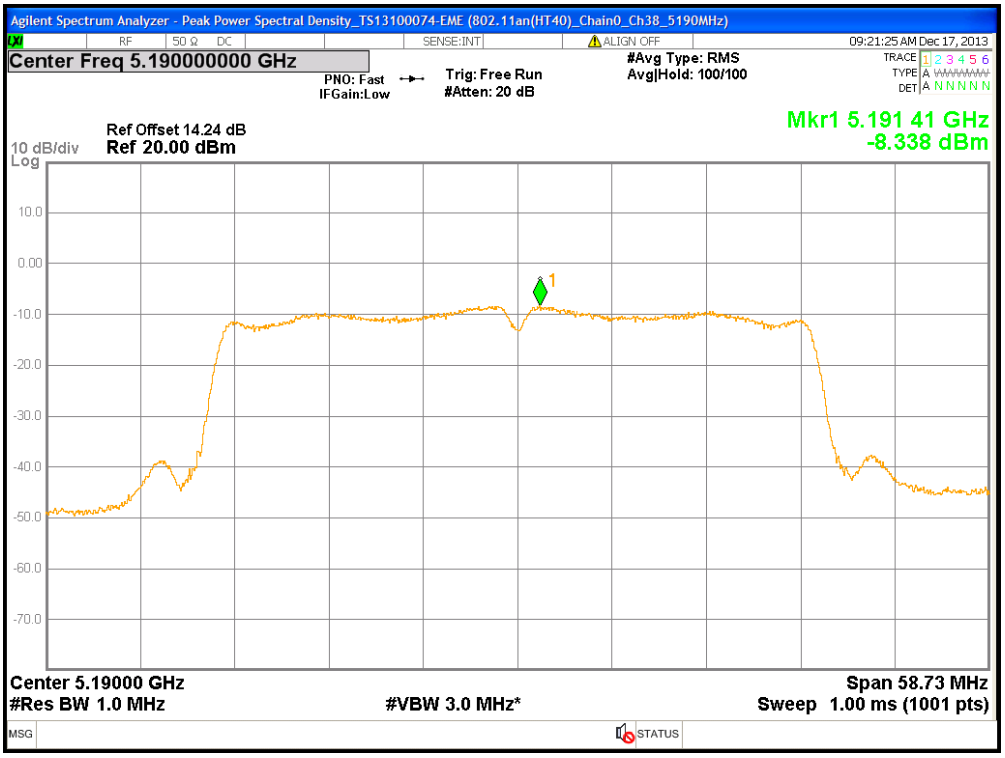
Chain1 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch40



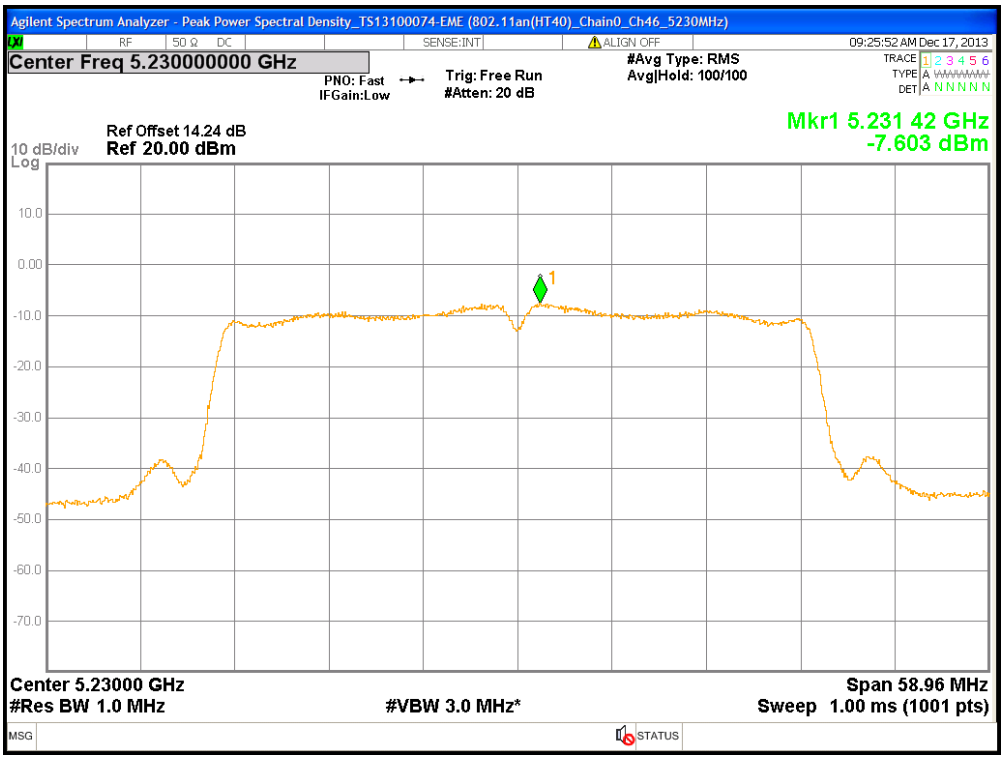
Chain1 : Peak Power Spectral Density @ 802.11n(HT20) Mode Ch48



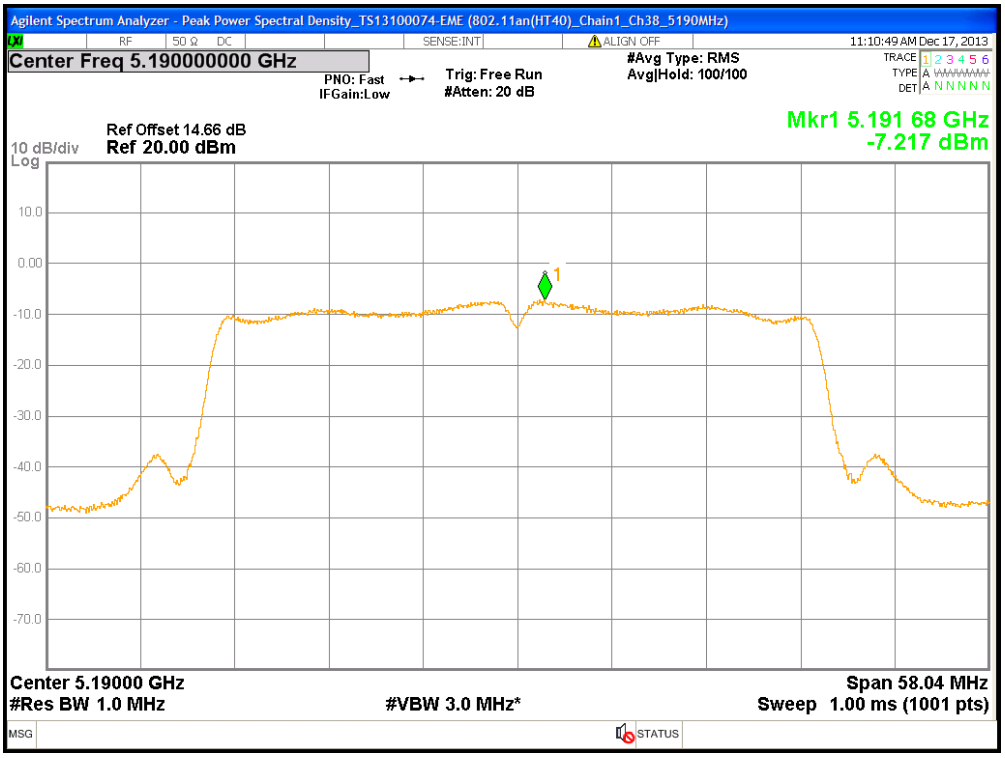
Chain0 : Peak Power Spectral Density @ 802.11n(HT40) Mode Ch38



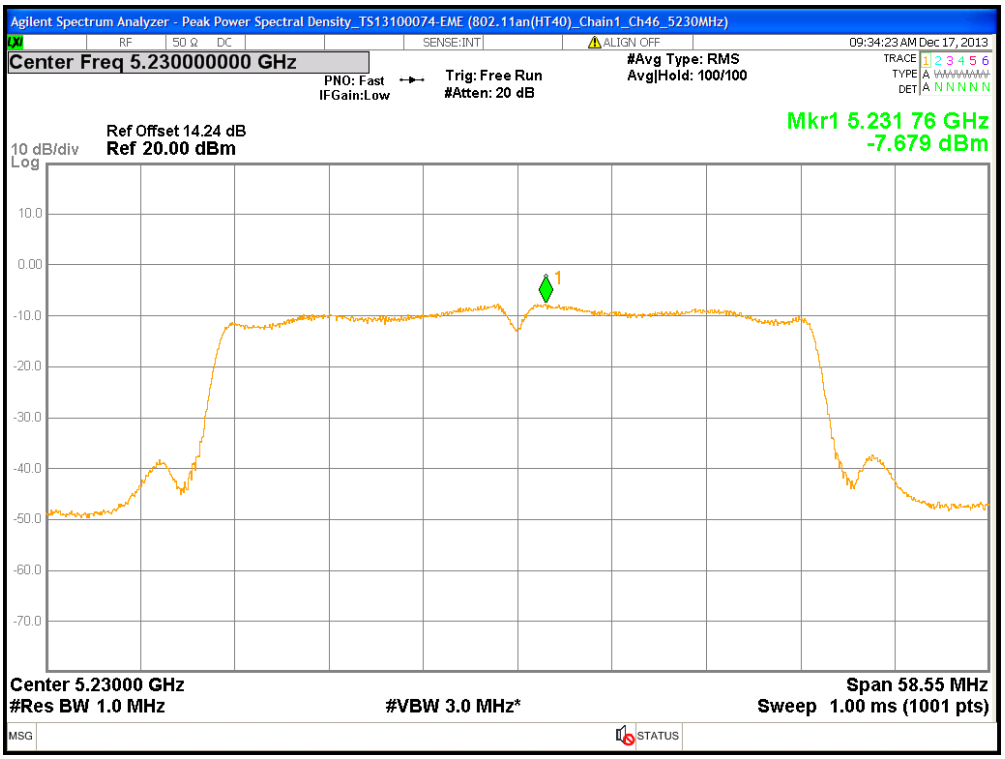
Chain0 : Peak Power Spectral Density @ 802.11n(HT40) Mode Ch46



Chain1 : Peak Power Spectral Density @ 802.11n(HT40) Mode Ch38



Chain1 : Peak Power Spectral Density @ 802.11n(HT40) Mode Ch46



5. Peak excursion to average ratio test (FCC 15.407)

5.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

5.2 Test setup & procedure

(1) The power spectrum density per FCC §15.407(a)(6) was measured from the antenna port of the EUT. Using a 50ohm spectrum analyzer.
(2) Set RBW=1MHz,VBW>=3MHz,Dector=Peak
(3) Trace mode=max-hold. Allow the sweeps to continue until the trace stabilizes.
(4) Use the peak search function to find the peak of the spectrum.
(5) Compute the ratio of the maximum of the peak-max-hold spectrum to the Peak Power Spectral Density
(6)

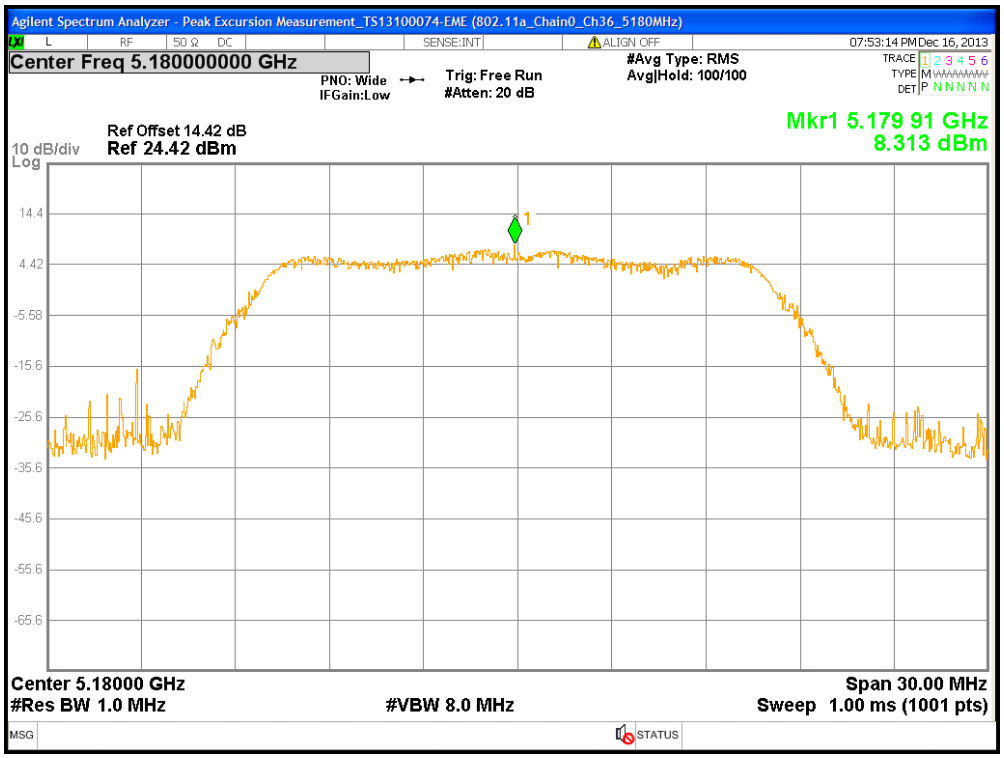
5.3 Limitation

Operating Frequency (MHz)	Peak excursion to average ratio limit
5150~5250	<13dB
5250~5350, 5470~5725	<13dB
5725~5825	<13dB

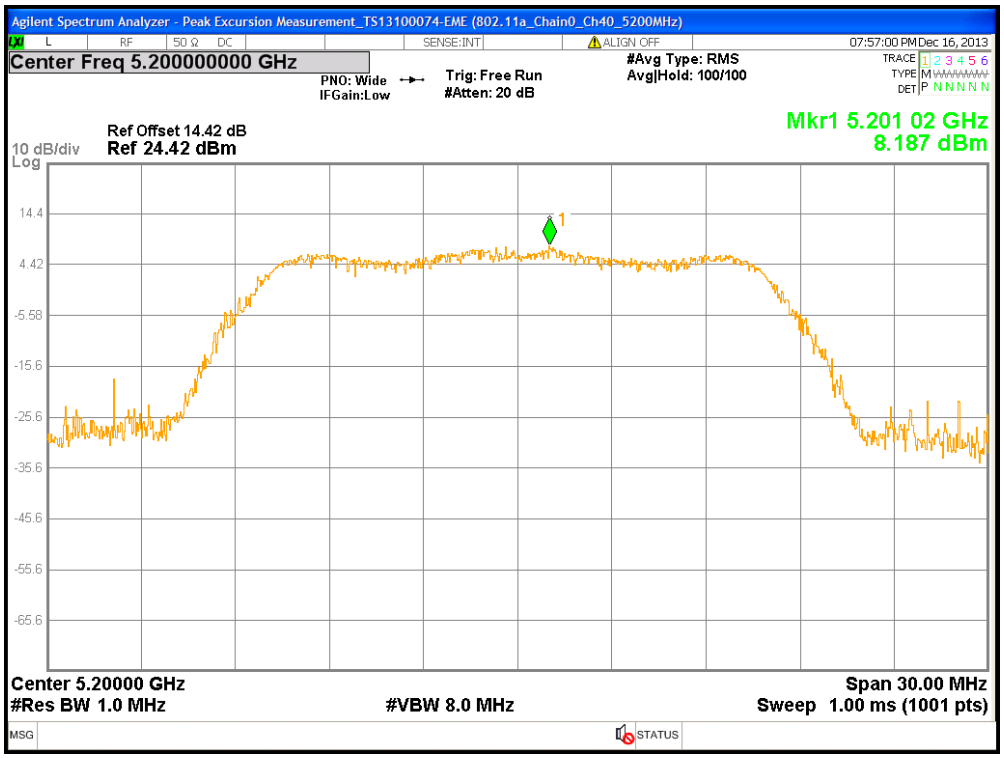
5.4 Measured data of Peak excursion to average ratio test results

Mode	Channel	Frequency (MHz)	PK Value (dBm)	PSD with Duty factor		PK Excursion (dBm)	Limit (dBm)	Result
				mW	dBm			
802.11a (Chain0)	36	5180	8.31	0.93	-0.32	8.63	13	PASS
	40	5200	8.19	0.99	-0.06	8.24	13	PASS
	48	5240	8.59	0.94	-0.25	8.83	13	PASS
802.11a (Chain1)	36	5180	8.76	1.12	0.49	8.27	13	PASS
	40	5200	8.29	1.07	0.28	8.00	13	PASS
	48	5240	8.79	1.17	0.69	8.10	13	PASS
802.11n (HT 20) (Chain0)	36	5180	4.53	0.51	-2.95	7.47	13	PASS
	40	5200	5.24	0.51	-2.93	8.17	13	PASS
	48	5240	5.15	0.52	-2.81	7.96	13	PASS
802.11n (HT 20) (Chain1)	36	5180	4.84	0.45	-3.50	8.34	13	PASS
	40	5200	4.01	0.39	-4.13	8.14	13	PASS
	48	5240	5.03	0.44	-3.57	8.59	13	PASS
802.11n (HT 40) (Chain0)	38	5190	0.11	0.16	-7.91	8.02	13	PASS
	46	5230	0.72	0.19	-7.18	7.89	13	PASS
802.11n (HT 40) (Chain1)	38	5190	1.57	0.21	-6.79	8.37	13	PASS
	46	5230	0.59	0.19	-7.25	7.85	13	PASS

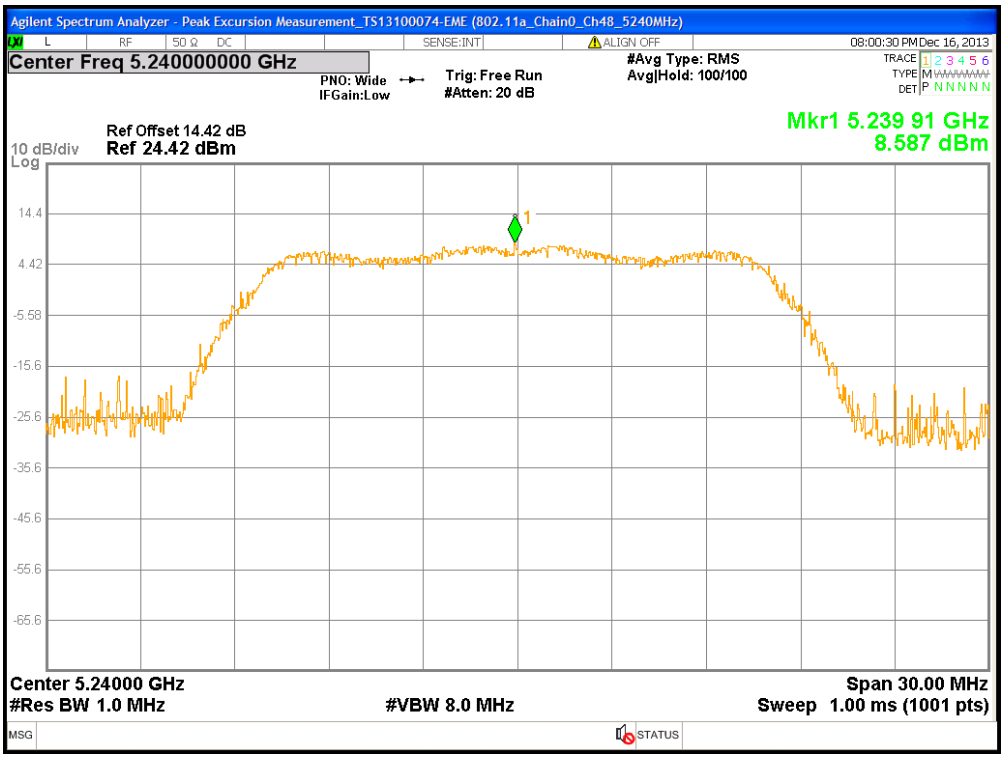
Chain0 : Peak Excursion Measurement @ 802.11a Mode Ch36



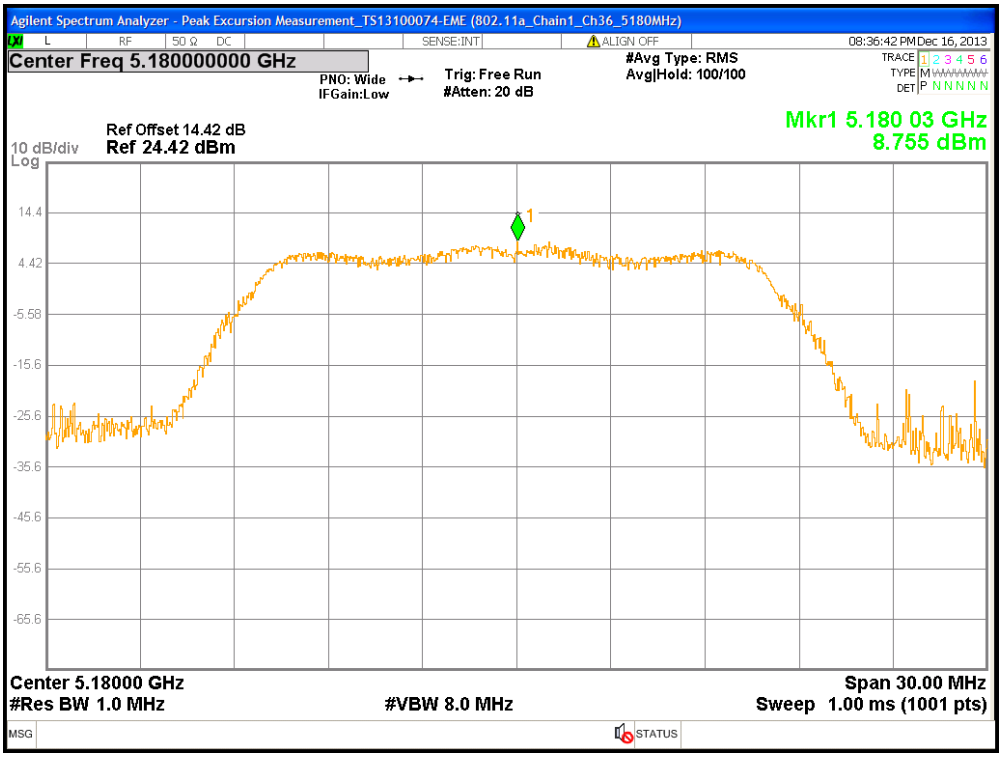
Chain0 : Peak Excursion Measurement @ 802.11a Mode Ch40



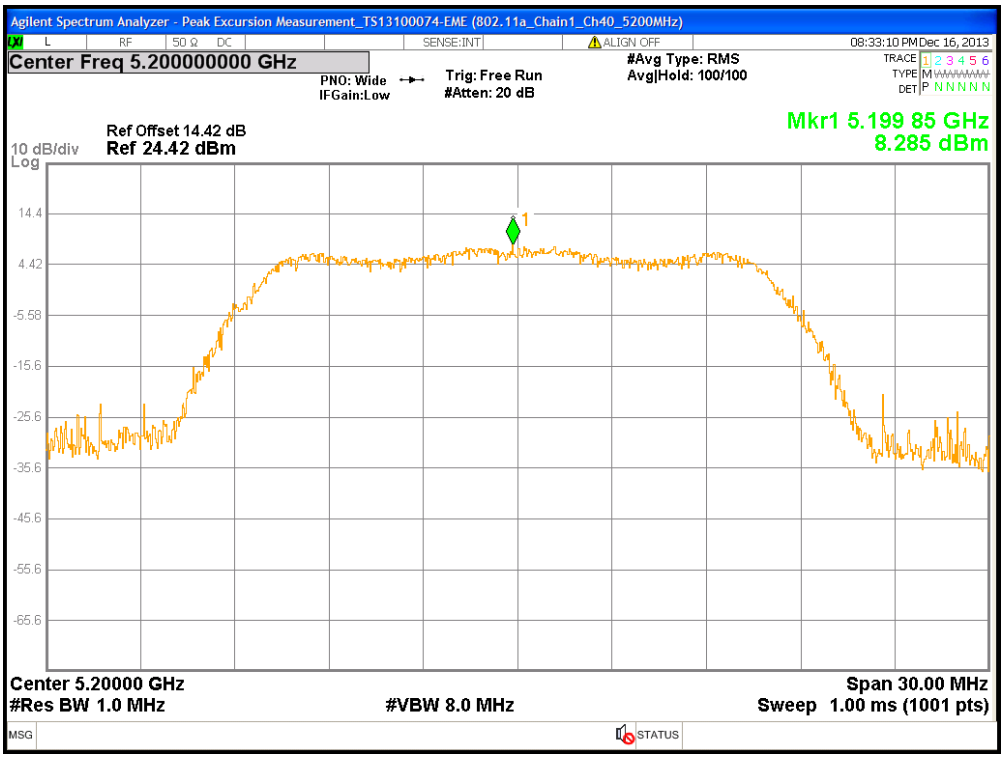
Chain0 : Peak Excursion Measurement @ 802.11a Mode Ch48



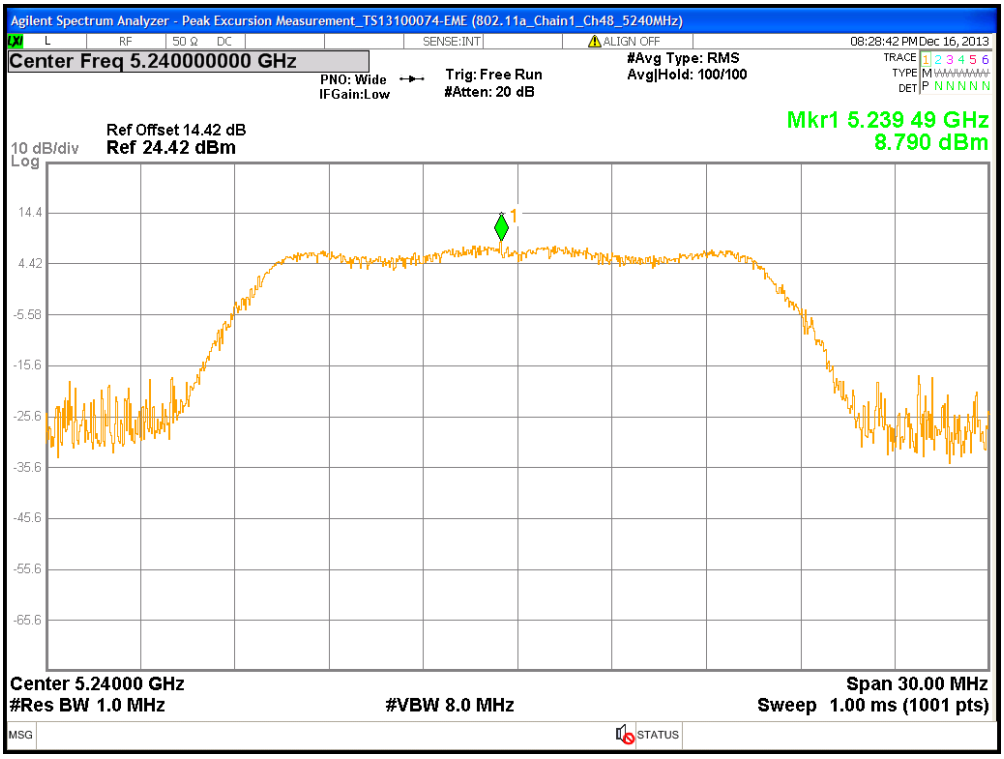
Chain1 : Peak Excursion Measurement @ 802.11a Mode Ch36



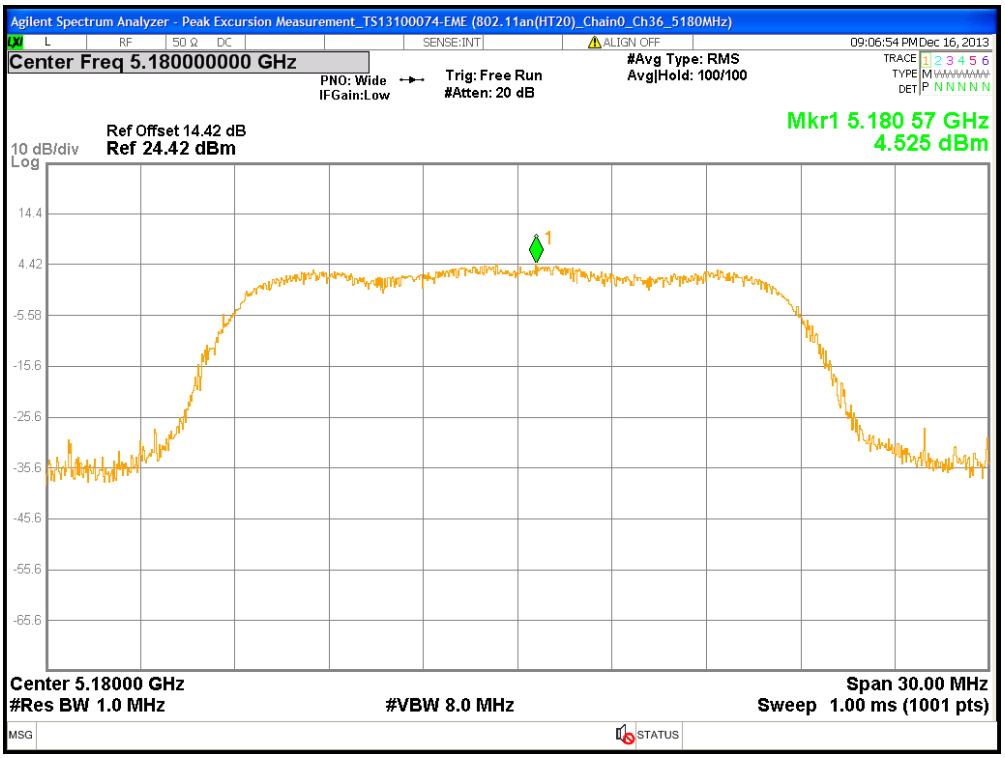
Chain1 : Peak Excursion Measurement @ 802.11a Mode Ch40



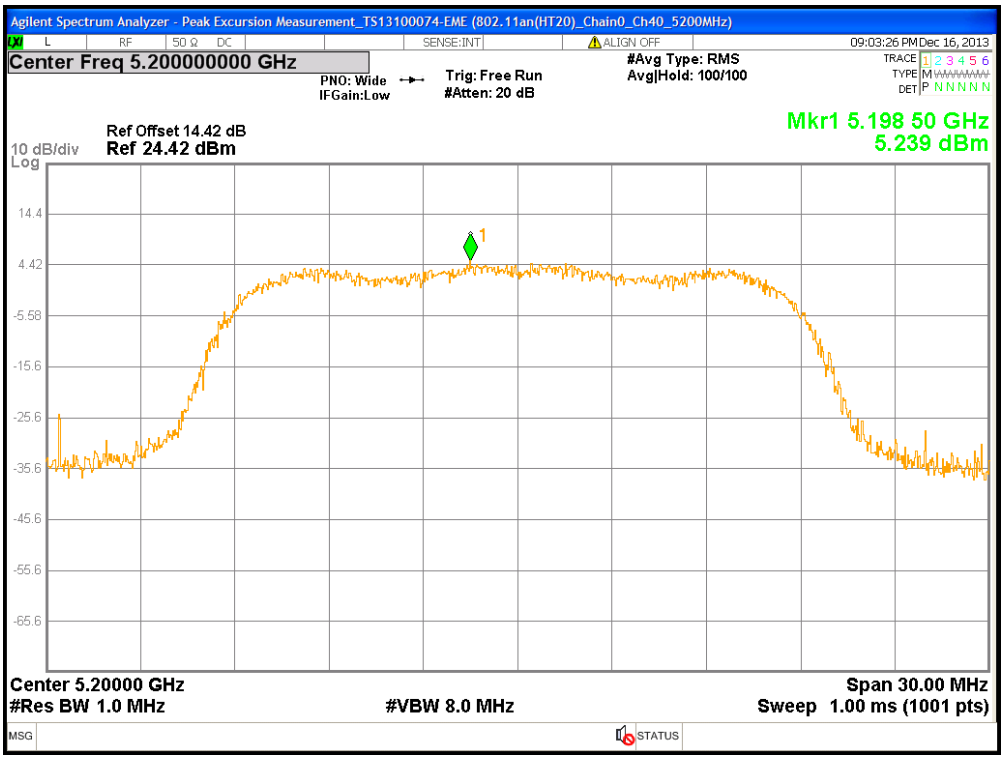
Chain1 : Peak Excursion Measurement @ 802.11a Mode Ch48



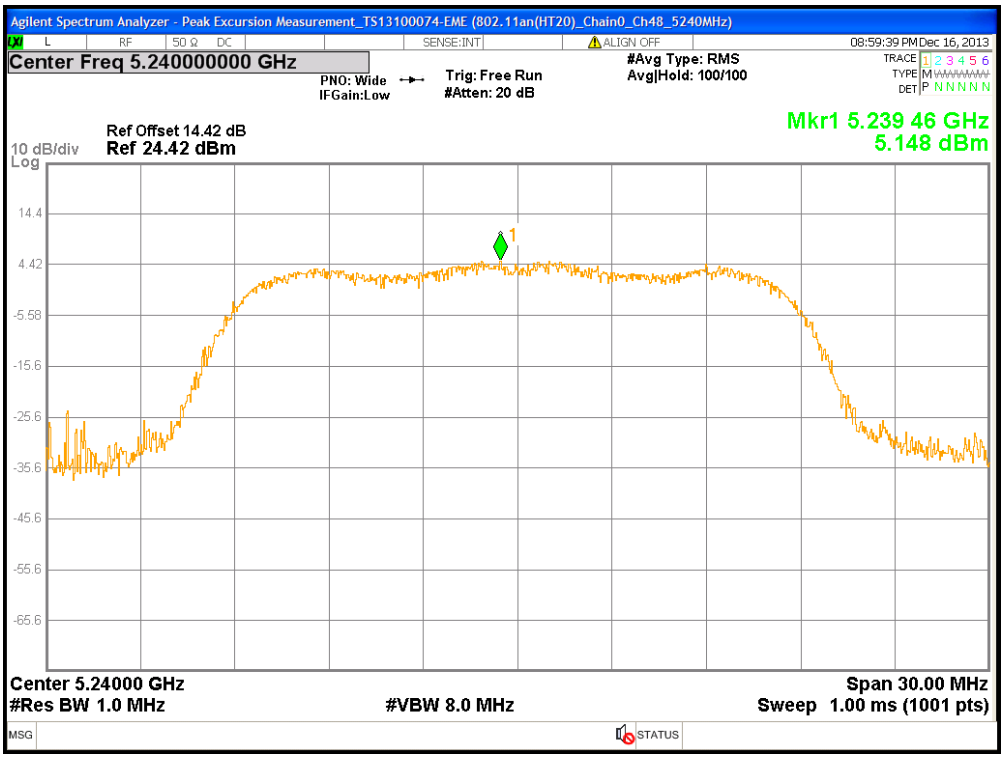
Chain0 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch36



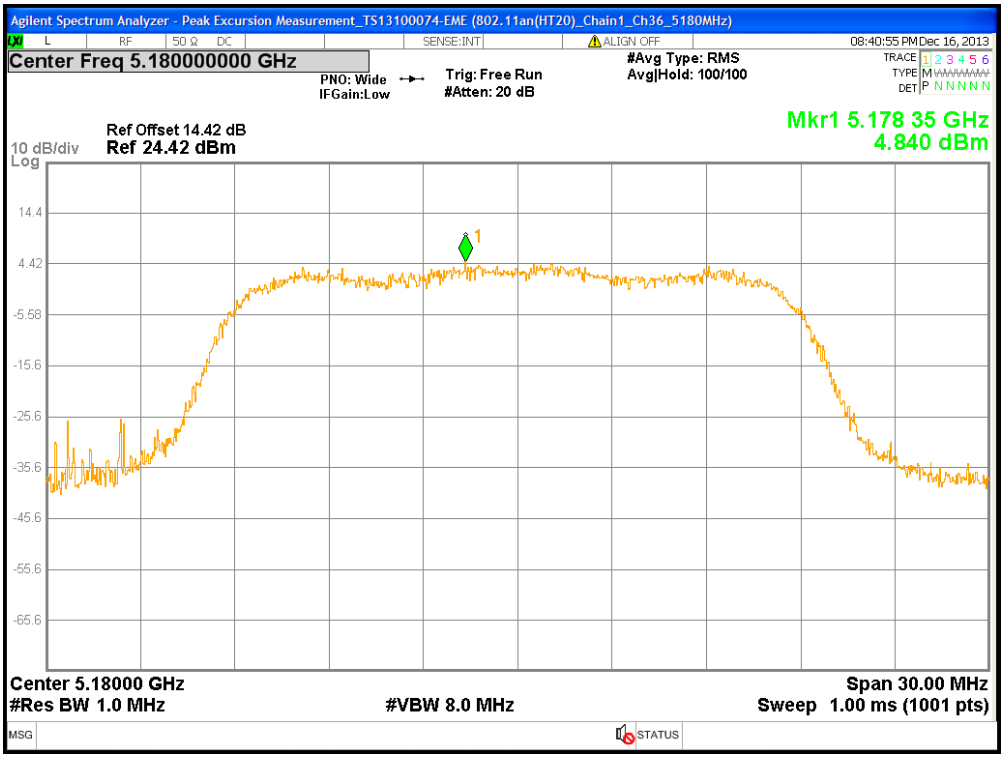
Chain0 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch40



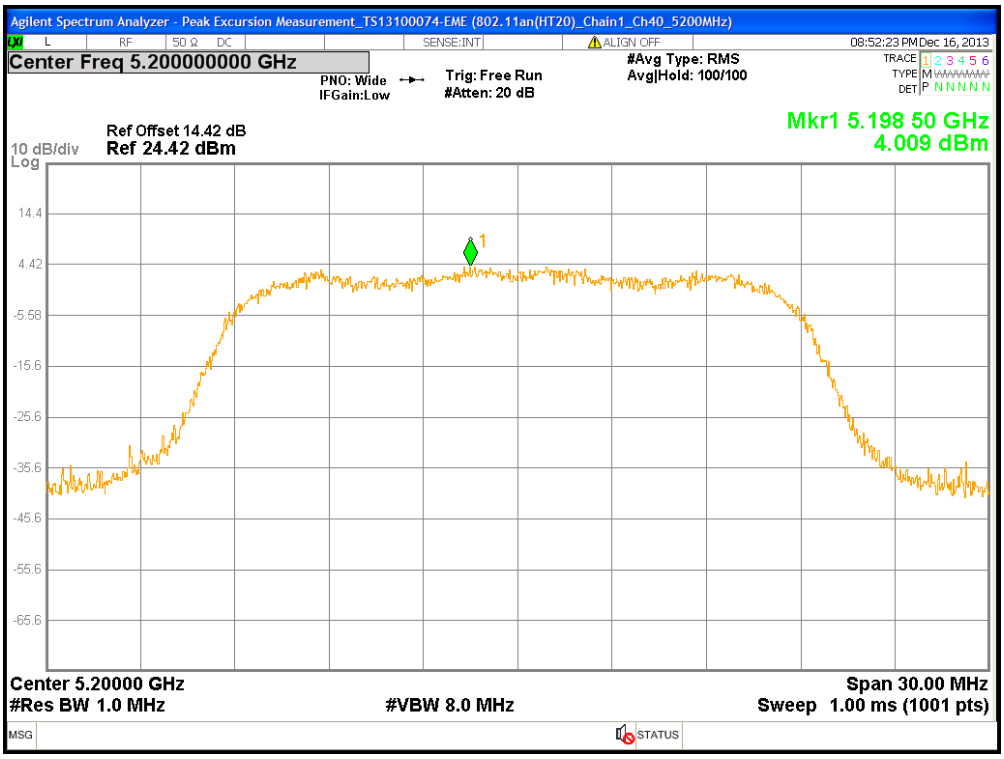
Chain0 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch48



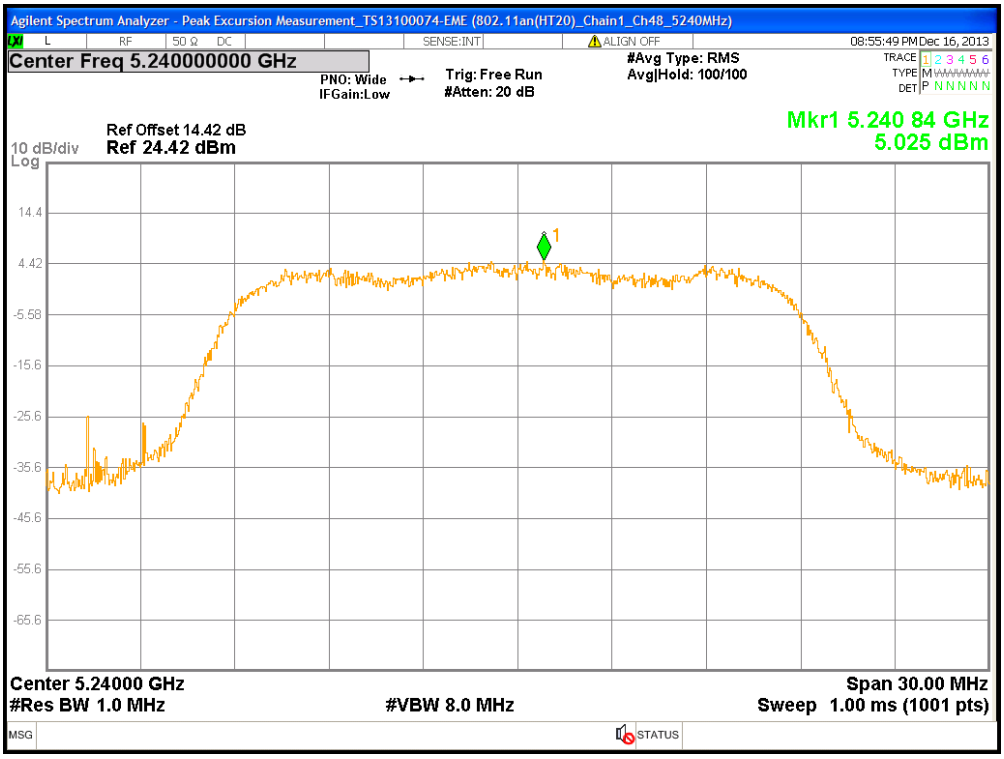
Chain1 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch36



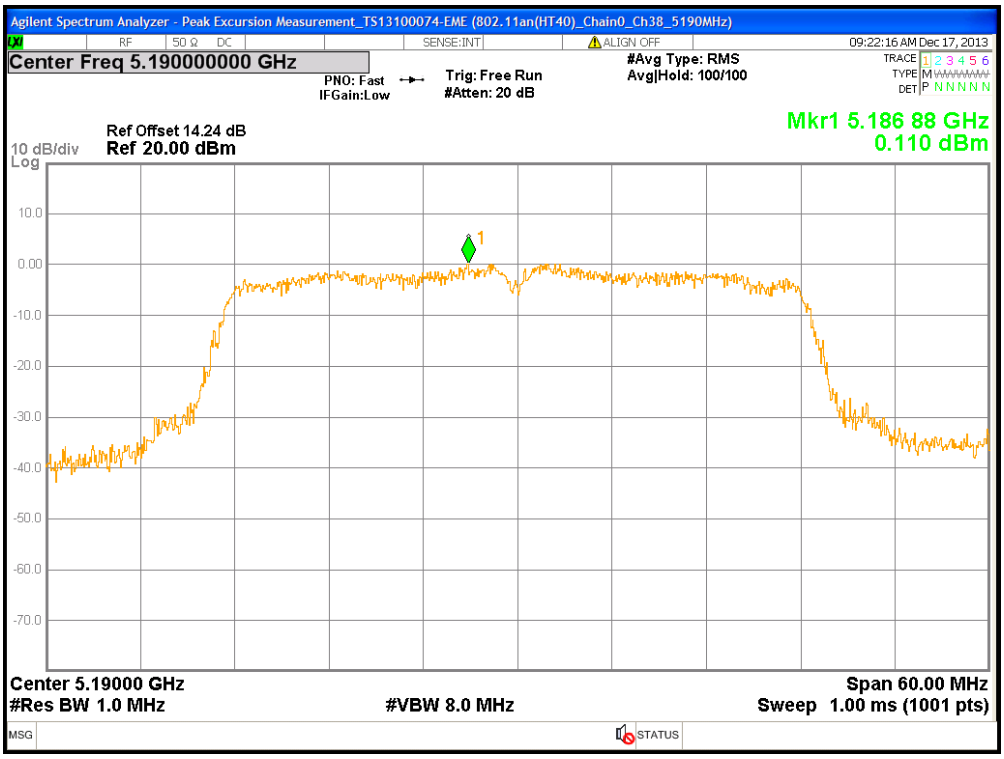
Chain1 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch40



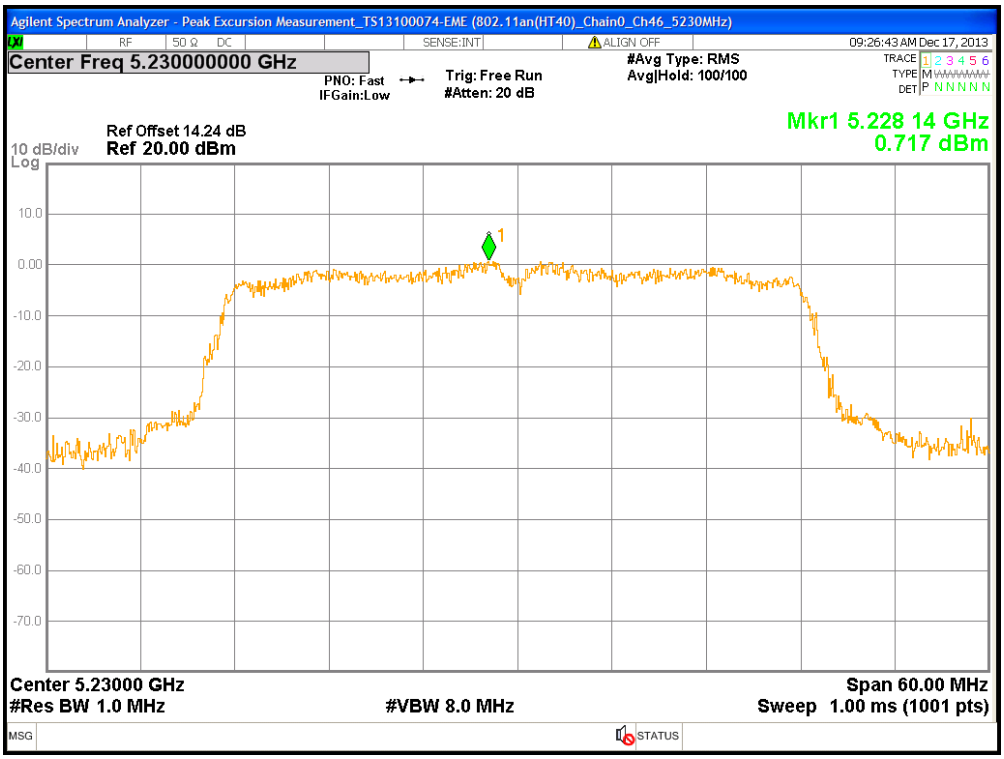
Chain1 : Peak Excursion Measurement @ 802.11n(HT20) Mode Ch48



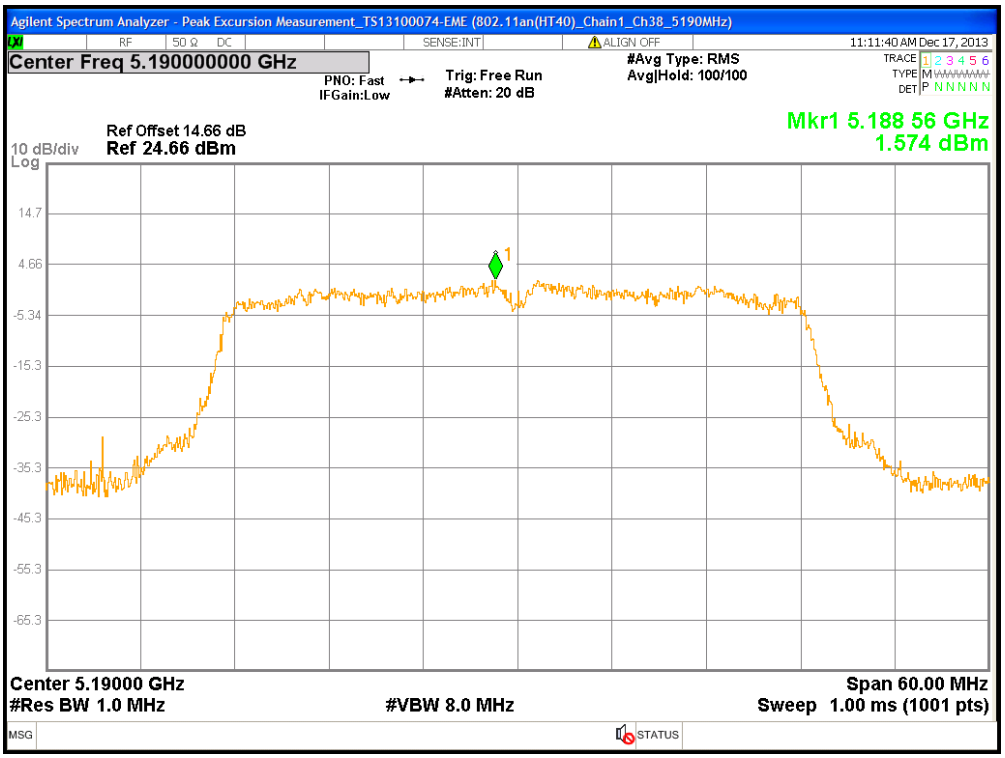
Chain0 : Peak Excursion Measurement @ 802.11n(HT40) Mode Ch38



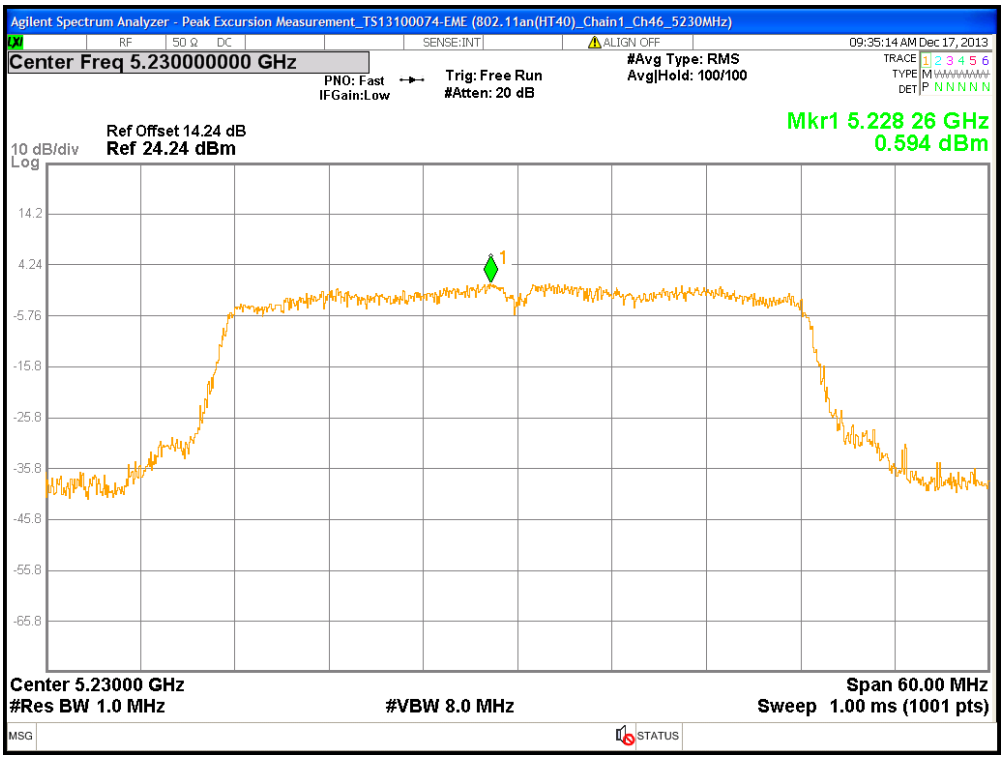
Chain0 : Peak Excursion Measurement @ 802.11n(HT40) Mode Ch46



Chain1 : Peak Excursion Measurement @ 802.11n(HT40) Mode Ch38



Chain1 : Peak Excursion Measurement @ 802.11n(HT40) Mode Ch46



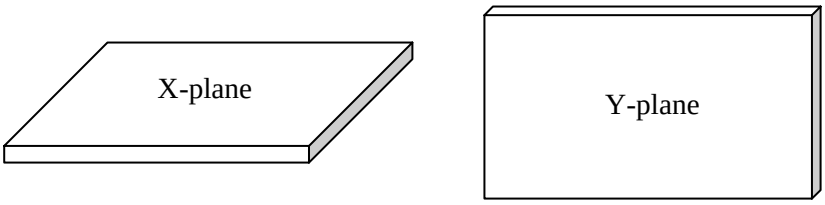
7. Radiated Emission test (FCC 15.205 & 15.209)

7.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

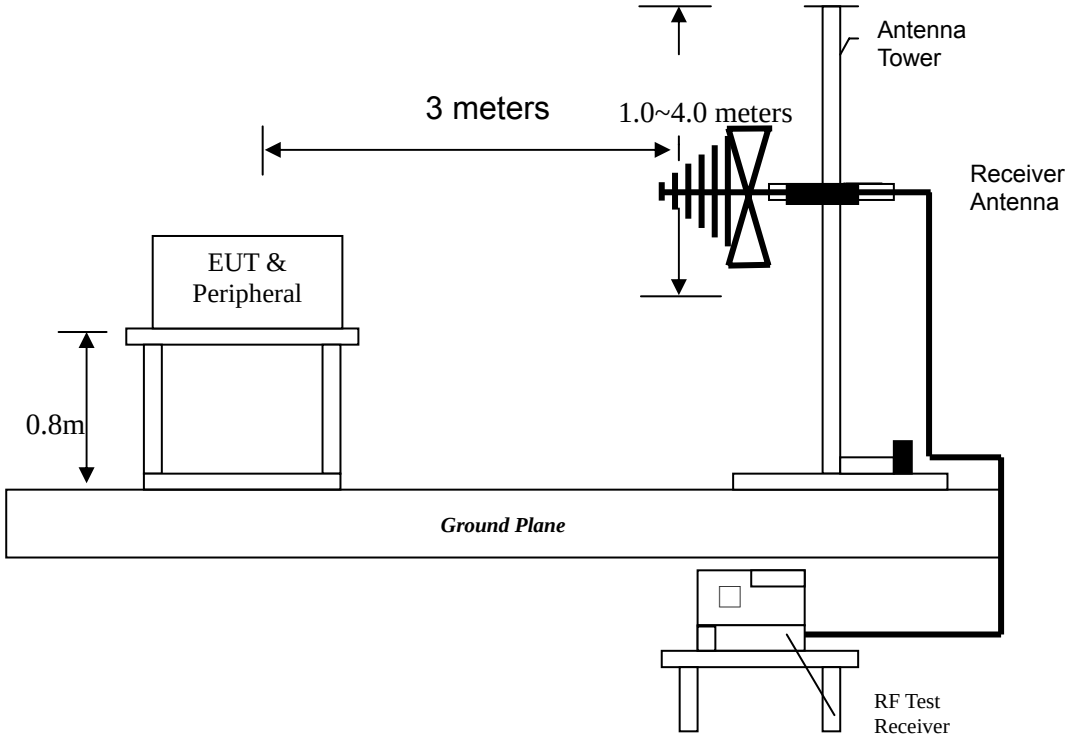
7.2 Test setup & procedure

The signal is maximized through rotation and placement in the two orthogonal axes.

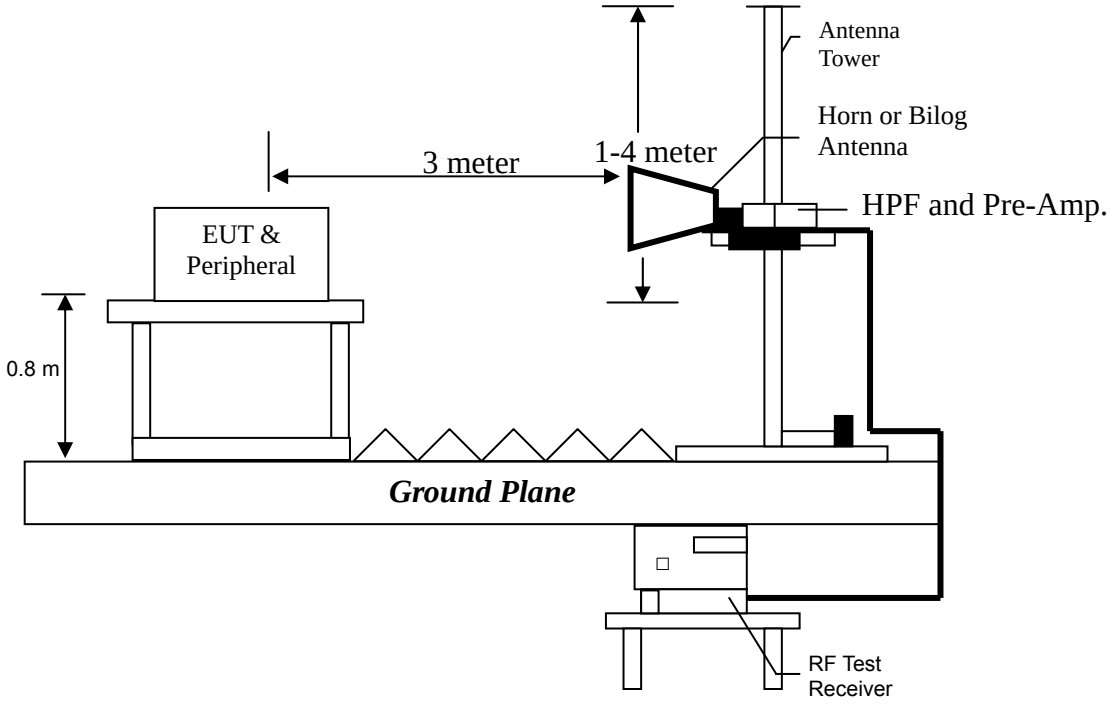


After verifying two axes, we found the maximum electromagnetic field was occurred at Y-plane configuration. The final test data was executed under this configuration.

Radiated emission from 30MHz to 1GHz uses Bilog Antenna:



Radiated emission above 1GHz uses Horn Antenna:



Radiated emission measurements were performed from 30MHz to tenth harmonic or 40GHz. The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

7.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Field Strength (microvolts/meter)
0.009~0.490	2400/F(kHz)
0.490~1.705	2400/F(kHz)
1.705~30	30
30-88	100
88-216	150
216-960	200
Above 960	500

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit

Applicable to	Limit	
	Field strength at 3m (dBμV/m)	
V	PK	AV
	74	54
	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBμV/m)
	PK	PK
	-27	68.3

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength: $E = 1000000(\sqrt{30P})/3$ (μV/m), where P is the eirp (Watt)

Measurement Uncertainty:
Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty		
Radiated Emission	Below 1 GHz	Vertical	3.90 dB
		Horizontal	3.86 dB
	Above 1 GHz	Vertical	5.74 dB
		Horizontal	5.55 dB
Conducted Emission	2.08 dB		

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

7.4 Radiated spurious emission test data

7.4.1 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under 802.11a/an continuously transmitting mode. The worst case occurred at chain 1: 802.11a Tx channel 36.

EUT : WMTB-177N
Worst Case : Chain 1: 802.11a Tx channel 36

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	103.72	QP	7.64	28.47	36.11	43.50	-7.39
V	259.78	QP	12.36	20.60	32.96	46.00	-13.04
V	518.88	QP	18.56	15.55	34.10	46.00	-11.90
V	594.54	QP	20.71	21.23	41.94	46.00	-4.06
V	623.64	QP	20.75	14.25	35.00	46.00	-11.00
V	743.92	QP	22.74	20.92	43.66	46.00	-2.34
H	222.06	QP	11.63	22.28	33.90	46.00	-12.10
H	295.78	QP	14.17	20.65	34.81	46.00	-11.19
H	431.58	QP	18.12	14.23	32.35	46.00	-13.65
H	594.54	QP	20.84	15.61	36.44	46.00	-9.56
H	720.64	QP	22.44	20.68	43.12	46.00	-2.88
H	796.30	QP	23.52	12.78	36.30	46.00	-9.70

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

7.4.2 Measurement results: frequency above 1GHz

EUT : WMTB-177N
Test Condition : Chain 0: 802.11a Tx at channel 36

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10360	PK	V	31.3	50.09	38.33	57.12	74	-16.88
10360	AV	V	31.3	50.09	23.33	42.12	54	-11.88
15540	PK	V	33.5	51.54	47.14	65.18	74	-8.82
15540	AV	V	33.5	51.54	31.81	49.85	54	-4.15
10360	PK	H	31.3	50.09	33.66	52.45	54	-1.55
15540	PK	H	33.5	51.54	49.27	67.31	74	-6.69
15540	AV	H	33.5	51.54	34.57	52.61	54	-1.39

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0: 802.11a Tx at channel 40

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10400	PK	V	31.3	50.09	37.66	56.45	74	-17.55
10400	AV	V	31.3	50.09	22.66	41.45	54	-12.55
15600	PK	V	33.5	51.54	44.86	62.9	74	-11.10
15600	AV	V	33.5	51.54	29.86	47.9	54	-6.10
10400	PK	H	31.3	50.09	34.78	53.57	54	-0.43
15600	PK	H	33.5	51.54	48.99	67.03	74	-6.97
15600	AV	H	33.5	51.54	33.99	52.03	54	-1.97

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0: 802.11a Tx at channel 48

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10480	PK	V	31.3	50.09	38.59	57.38	74	-16.62
10480	AV	V	31.3	50.09	23.59	42.38	54	-11.62
15720	PK	V	33.5	51.54	43.32	61.36	74	-12.64
15720	AV	V	33.5	51.54	28.32	46.36	54	-7.64
10480	PK	H	31.3	50.09	36.11	54.9	74	-19.10
10480	AV	H	31.3	50.09	21.11	39.9	54	-14.10
15720	PK	H	33.5	51.54	48.66	66.7	74	-7.30
15720	AV	H	33.5	51.54	33.66	51.7	54	-2.30

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 1: 802.11a Tx at channel 36

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10360	PK	V	31.3	50.09	41.65	60.44	74	-13.56
10360	AV	V	31.3	50.09	26.97	45.76	54	-8.24
15540	PK	V	33.5	51.54	45.4	63.44	74	-10.56
15540	AV	V	33.5	51.54	30.4	48.44	54	-5.56
10360	PK	H	31.3	50.09	38.49	57.28	74	-16.72
10360	AV	H	31.3	50.09	23.49	42.28	54	-11.72
15540	PK	H	33.5	51.54	41.89	59.93	74	-14.07
15540	AV	H	33.5	51.54	27.89	45.93	54	-8.07

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 1: 802.11a Tx at channel 40

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10400	PK	V	31.3	50.09	39.29	58.08	74	-15.92
10400	AV	V	31.3	50.09	24.29	43.08	54	-10.92
15600	PK	V	33.5	51.54	42.86	60.9	74	-13.10
15600	AV	V	33.5	51.54	27.86	45.9	54	-8.10
10400	PK	H	31.3	50.09	38.46	57.25	74	-16.75
10400	AV	H	31.3	50.09	23.46	42.25	54	-11.75
15600	PK	H	33.5	51.54	41.51	59.55	74	-14.45
15600	AV	H	33.5	51.54	26.51	44.55	54	-9.45

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 1: 802.11a Tx at channel 48

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10480	PK	V	31.3	50.09	43.96	62.75	74	-11.25
10480	AV	V	31.3	50.09	28.96	47.75	54	-6.25
15720	PK	V	33.5	51.54	41.89	59.93	74	-14.07
15720	AV	V	33.5	51.54	26.89	44.93	54	-9.07
10480	PK	H	31.3	50.09	41.54	60.33	74	-13.67
10480	AV	H	31.3	50.09	26.54	45.33	54	-8.67
15720	PK	H	33.5	51.54	40.66	58.7	74	-15.30
15720	AV	H	33.5	51.54	25.66	43.7	54	-10.30

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 20) Tx at channel 36

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10360	PK	V	31.3	50.09	35.08	53.87	54	-0.13
15540	PK	V	33.5	51.54	40.16	58.2	74	-15.80
15540	AV	V	33.5	51.54	25.16	43.2	54	-10.80
10360	PK	H	31.3	50.09	34.34	53.13	54	-0.87
15540	PK	H	33.5	51.54	41.84	59.88	74	-14.12
15540	PK	H	33.5	51.54	26.84	44.88	54	-9.12

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 20) Tx at channel 40

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10400	PK	V	31.3	50.09	35.11	53.9	54	-0.10
10400	PK	H	31.3	50.09	34.46	53.25	54	-0.75
15600	PK	H	33.5	51.54	41.35	59.39	74	-14.61
15600	PK	H	33.5	51.54	26.35	44.39	54	-9.61

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 20) Tx at channel 48

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10480	PK	V	31.3	50.09	38.82	57.61	74	-16.39
10480	AV	V	31.3	50.09	23.82	42.61	54	-11.39
10480	PK	H	31.3	50.09	36.85	55.64	74	-18.36
10480	AV	H	31.3	50.09	21.85	40.64	54	-13.36
15720	PK	H	33.5	51.54	41.42	59.46	74	-14.54
15720	AV	H	33.5	51.54	26.42	44.46	54	-9.54

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 40) Tx at channel 38

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10380	PK	V	31.3	50.09	34.13	52.92	54	-1.08
10380	PK	H	31.3	50.09	34.13	52.92	54	-1.08

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 40) Tx at channel 46

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
10460	PK	V	31.3	50.09	35.57	54.36	74	-19.64
10460	AV	V	31.3	50.09	20.57	39.36	54	-14.64
10460	PK	H	31.3	50.09	34.07	52.86	54	-1.14

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz.The data value listed above which is higher than the system noise floor.

8. Emission on the band edge §FCC 15.205

The measurement was made to the average and peak field strength of the fundamental frequency. And the spurious emission in the restrict band must also comply with the FCC subpart C 15.209.

8.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

8.2 Test setup & procedure

The output of EUT was connected to spectrum analyzer via a 50ohm cable.

The setting of spectrum analyzer is:

Peak: RBW = 1MHz ; VBW = 3MHz
Average: RBW = 1MHz ; VBW = 10Hz

8.3 Test Result

EUT : WMTB-177N
Test Condition : Chain 0: 802.11a mode

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Restricted band (MHz)
5150.00	PK	V	40.075	39.11	61.34	60.37	74	-13.63	4500~5150
5150.00	AV	V	40.075	39.11	47.54	46.57	54	-7.43	
5180.00	PK	V	40.09	39.17	105.82	104.90	-	104.90	-
5180.00	AV	V	40.09	39.17	92.63	91.71	-	91.71	-

EUT : WMTB-177N
Test Condition : Chain 1: 802.11a mode

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Restricted band (MHz)
5150.00	PK	V	40.075	39.11	60.77	59.81	74	-14.39	4500~5150
5150.00	AV	V	40.075	39.11	46.99	46.02	54	-7.98	
5180.00	PK	V	40.09	39.17	105.50	104.58	-	104.58	-
5180.00	AV	V	40.09	39.17	92.35	91.43	-	91.43	-

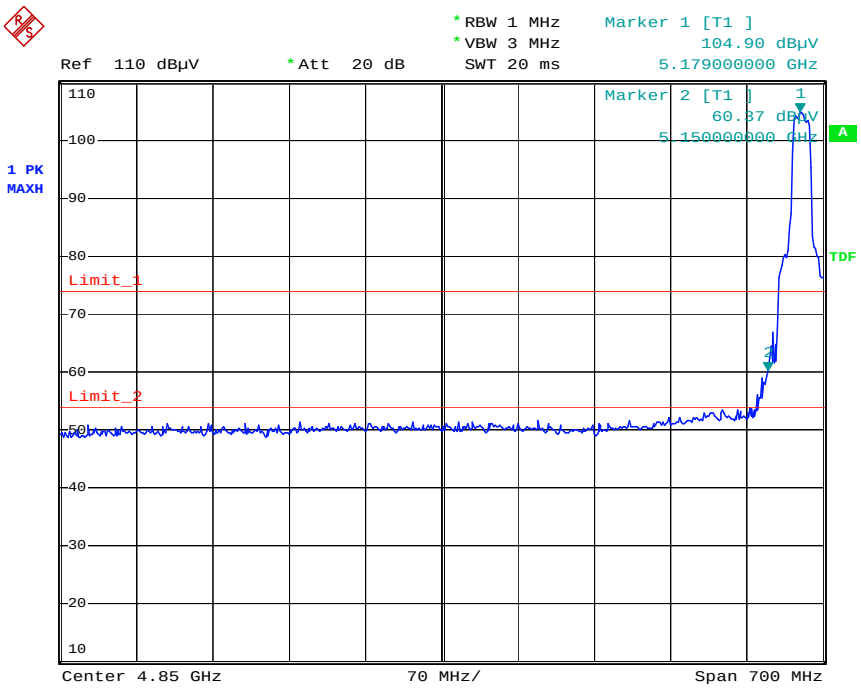
EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 20) mode

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Restricted band (MHz)
5150.00	PK	H	40.075	39.11	59.48	58.51	74	-15.49	4500~5150
5150.00	AV	H	40.075	39.11	46.82	45.85	54	-8.95	
5180.00	PK	H	40.09	39.17	105.28	104.36	-	104.36	-
5180.00	AV	H	40.09	39.17	91.04	90.12	-	94.12	-

EUT : WMTB-177N
Test Condition : Chain 0+1: 802.11n (HT 40) mode

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Restricted band (MHz)
5150.00	PK	H	40.075	39.11	68.47	67.50	74	-6.50	4500~5150
5150.00	AV	H	40.075	39.11	49.36	48.39	54	-5.61	
5190.00	PK	H	40.095	39.19	101.69	100.79	-	100.79	-
5190.00	AV	H	40.095	39.19	85.22	84.32	-	64.32	-

Chain0 : Bandedge Measurement Peak value @ 802.11a Mode Ch36



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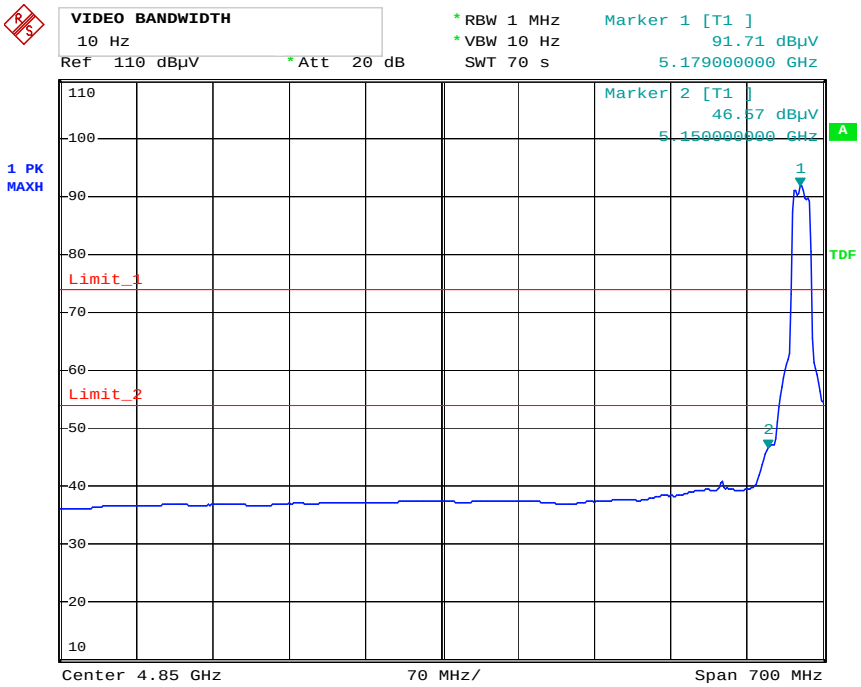
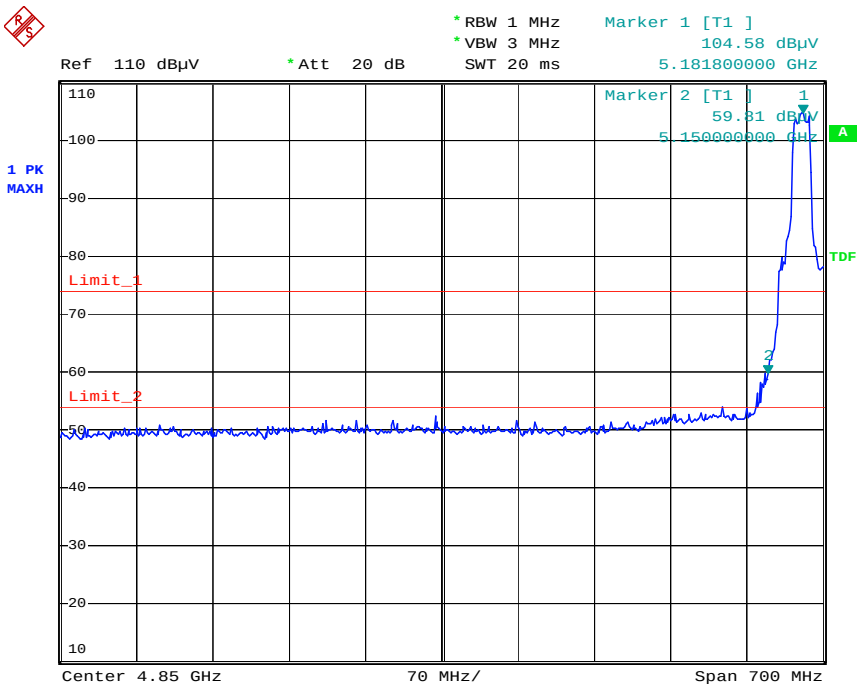
Date: 12.DEC.2013 18:04:38

Chain0 : Bandedge Measurement Average Value @ 802.11a Mode Ch36



Comment: 2nd comment ...
Date: 12.DEC.2013 18:06:12

Chain1 : Bandedge Measurement Peak value @ 802.11a Mode Ch36



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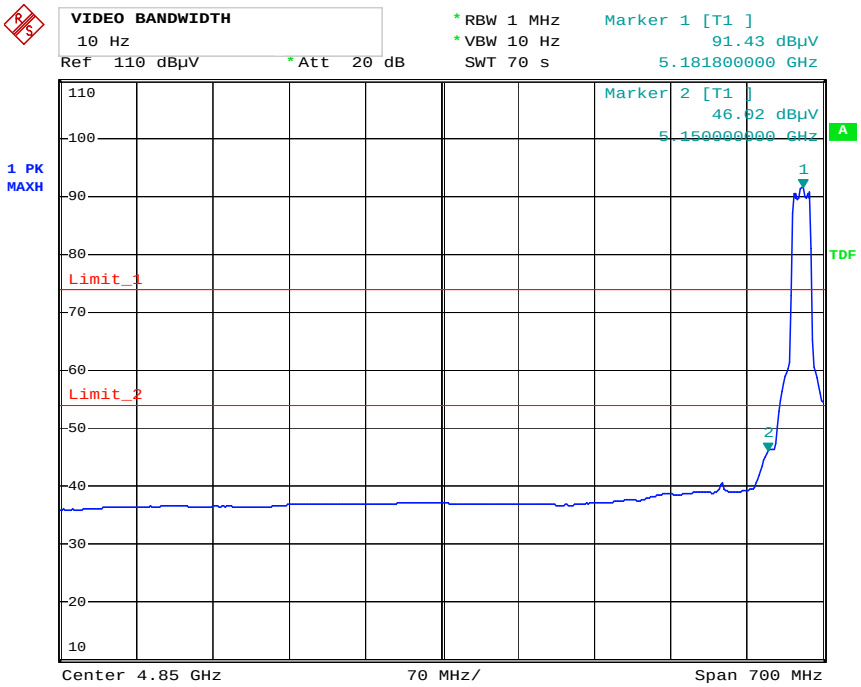
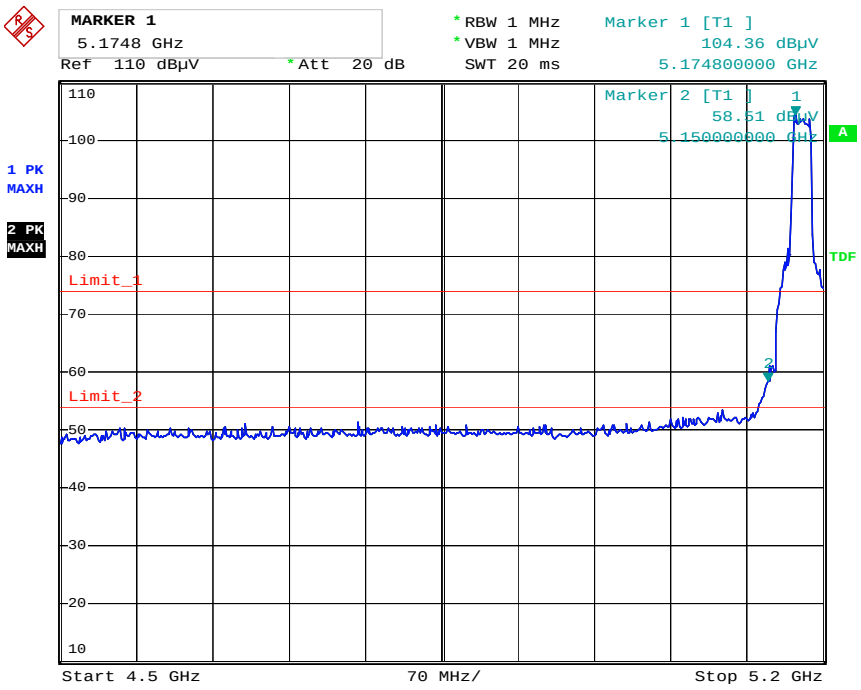
Date: 12.DEC.2013 18:07:40

Chain1 : Bandedge Measurement Average Value @ 802.11a Mode Ch36



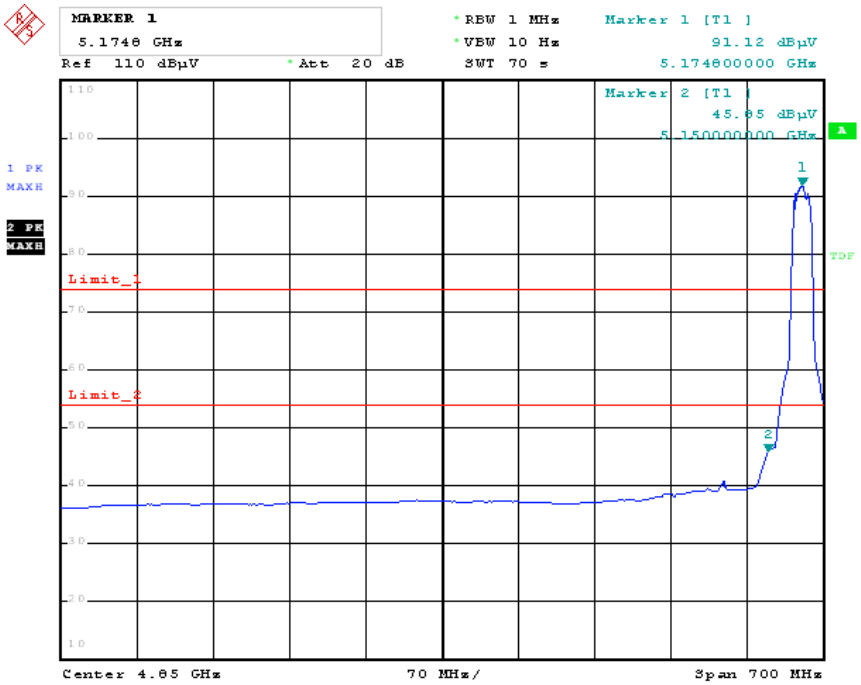
Comment: 2nd comment ...
Date: 12.DEC.2013 18:10:33

Chain 0+1 : Bandedge Measurement Peak value @ 802.11n (HT 20) Mode Ch36



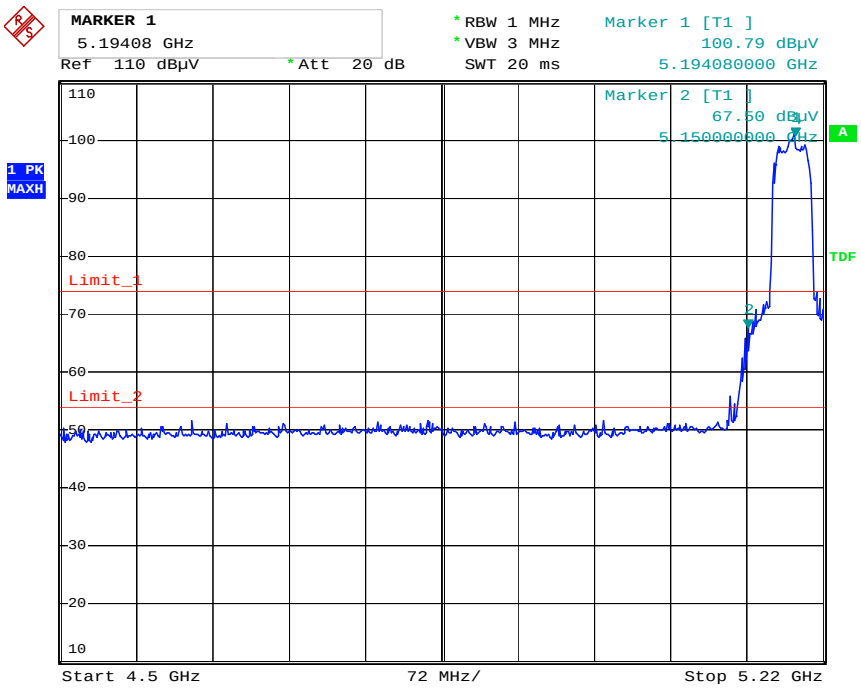
Comment: 2nd comment ...
Date: 12.DEC.2013 17:55:52

Chain 0+1 : Bandedge Measurement Average Value @ 802.11n (HT 20) Mode Ch36



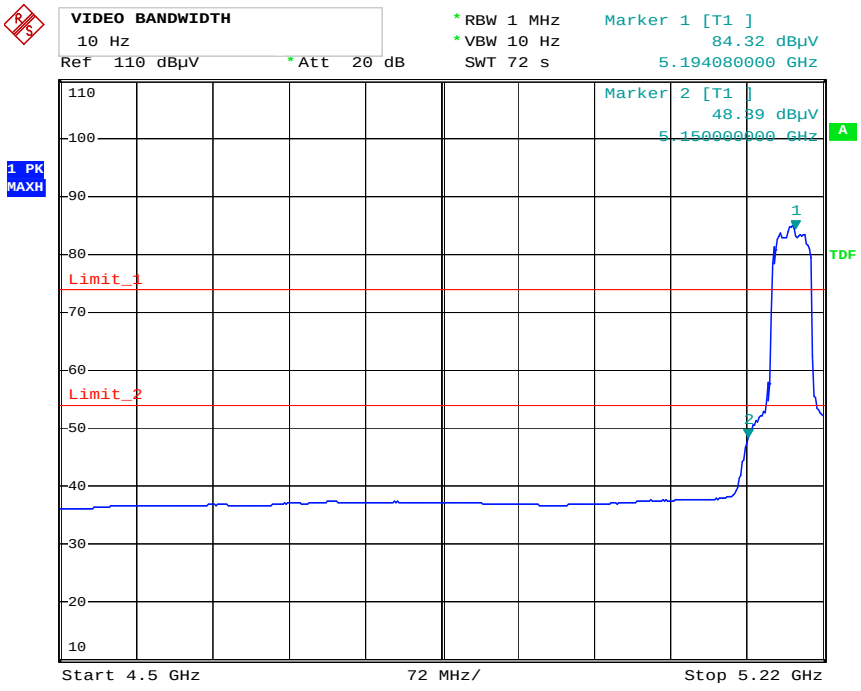
Comment: 2nd comment ...
Date: 12.DEC.2013 17:57:47

Chain 0+1 : Bandedge Measurement Peak value @ 802.11n (HT 40) Mode Ch36



Comment: 2nd comment ...
Date: 11.DEC.2013 22:06:21

Chain 0+1 : Bandedge Measurement Average Value @ 802.11n (HT 40) Mode Ch36



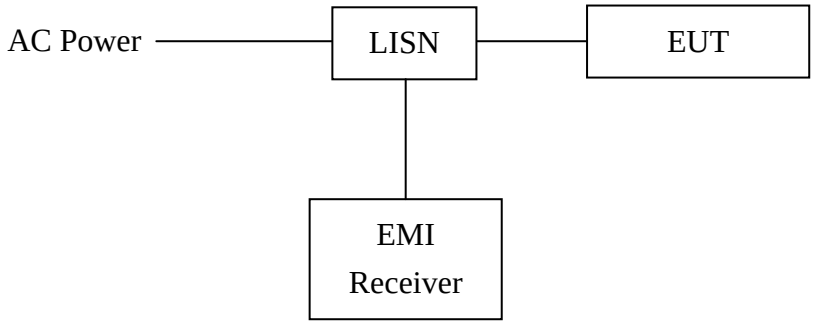
Comment: 2nd comment ...
Date: 11.DEC.2013 22:09:06

9. Power Line Conducted Emission test §FCC 15.207

9.1 Operating environment

Temperature:	20	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

9.2 Test setup & procedure



The test procedure was according to ANSI C63.4:2009.

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50uH coupling impedance with 50 ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4:2009 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9 kHz.

9.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

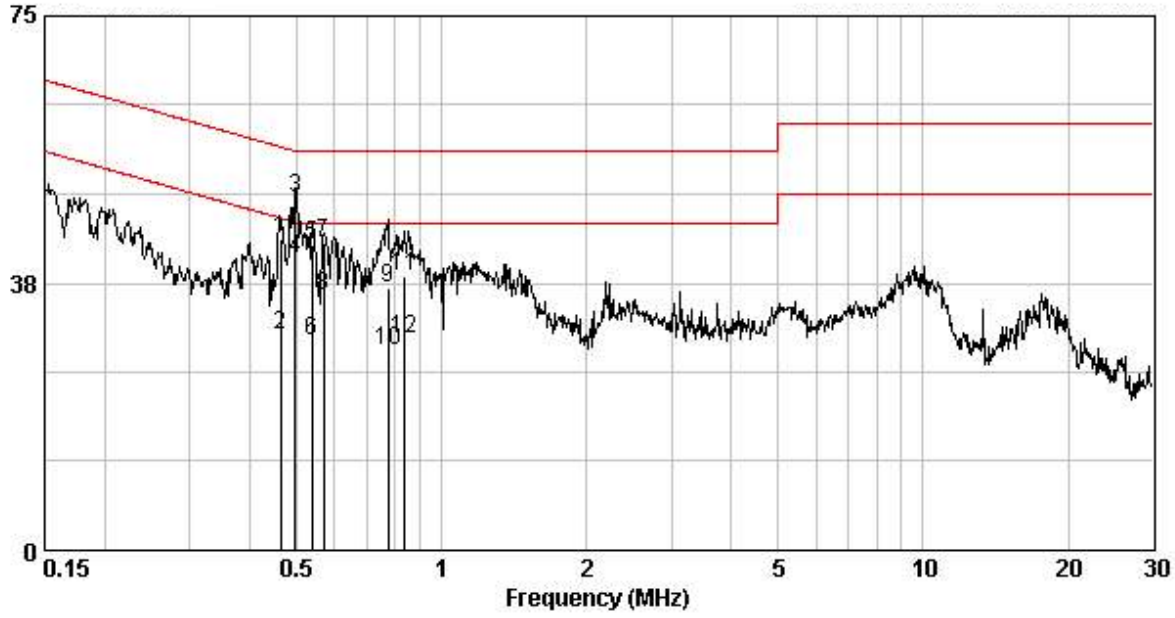
*Decreases with the logarithm of the frequency.

9.4 Power Line Conducted Emission test data

Phase: Live Line
Model No.: WMTB-177N
Operating mode: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.464	9.59	43.62	56.63	30.15	46.63	-13.00	-16.47
0.497	9.60	49.39	56.05	40.95	46.05	-6.67	-5.11
0.538	9.60	42.91	56.00	29.45	46.00	-13.09	-16.55
0.570	9.60	43.06	56.00	35.60	46.00	-12.94	-10.40
0.775	9.61	36.72	56.00	27.92	46.00	-19.28	-18.08
0.839	9.62	38.58	56.00	29.56	46.00	-17.42	-16.44

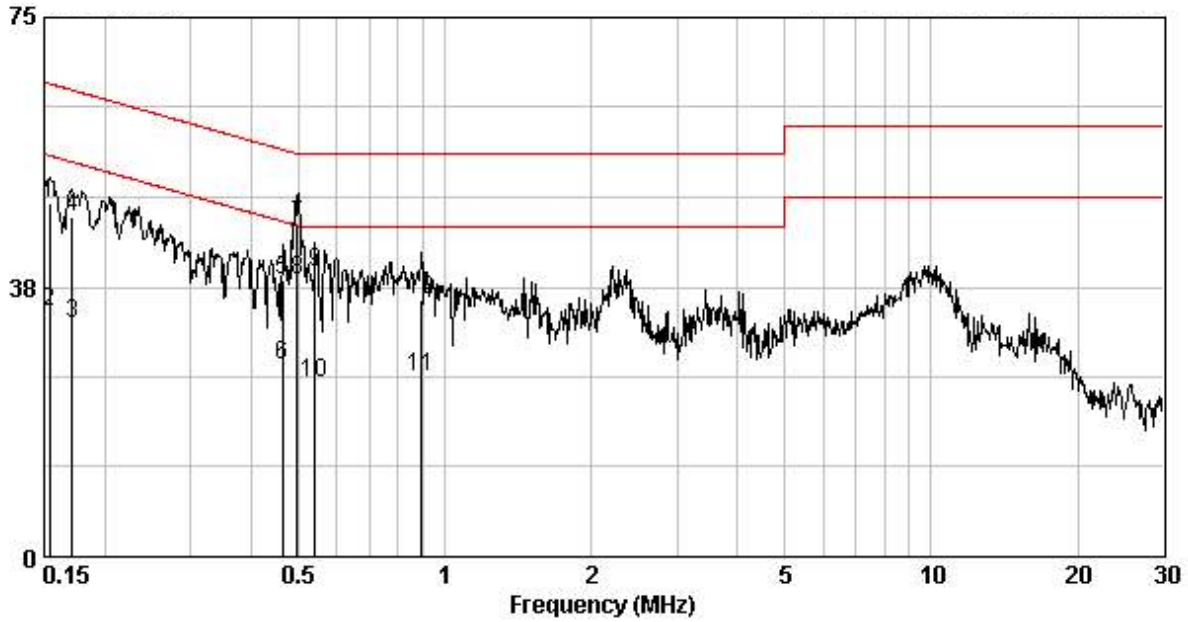
Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral Line
Model No.: WMTB-177N
Operating mode: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.154	9.55	49.17	65.78	34.18	55.78	-16.61	-21.60
0.171	9.55	47.26	64.90	32.41	54.90	-17.64	-22.49
0.464	9.59	38.37	56.63	26.71	46.63	-18.25	-19.91
0.498	9.60	46.03	56.03	38.51	46.03	-10.01	-7.53
0.541	9.60	39.56	56.00	24.18	46.00	-16.44	-21.82
0.894	9.62	35.81	56.00	24.88	46.00	-20.19	-21.12

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



10. Frequency stability

10.1 Operating environment

Temperature:	-5 ~ 40	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa

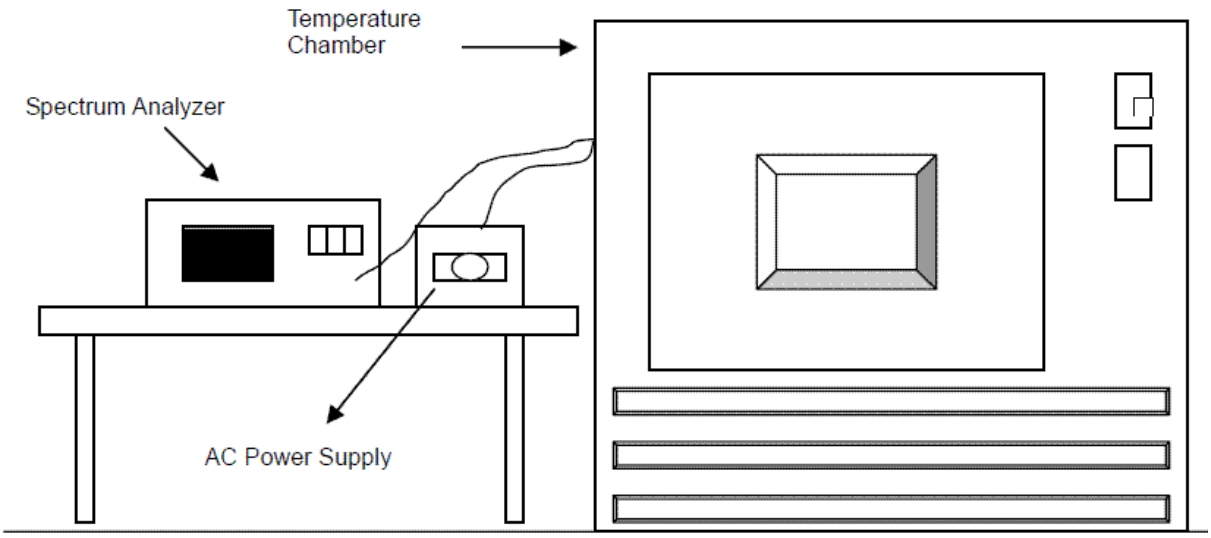
10.2 Test setup & procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
f. The test chamber was allowed to stabilize at +20degree C for minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record

10.3 Limit

The frequency of the carrier signal shall be maintained within band of operation.

10.4 Test Diagram



10.5 Test result

Voltage V.S. Frequency Stability

Voltage	Measurement Frequency (MHz)
(V)	5190
126.50	5189.9976
110.00	5189.9975
93.50	5190.0030
Max. Deviation (MHz)	0.003000
Max. Deviation (ppm)	0.58

Temperature V.S. Frequency Stability

Temperature	Measurement Frequency (MHz)
(℃)	5190
-5	5190.0003
0	5190.0109
10	5189.9887
20	5190.9963
30	5190.9956
40	5189.9977
Max. Deviation (MHz)	0.011300
Max. Deviation (ppm)	2.18