RF TEST REPORT

Test item	:	Wi-Fi Module
Model No.	:	TWFM-B005D
Order No.	:	1109-01309
Date of receipt	:	2011-09-28
Test duration	:	2011-10-26 ~ 2011-11-11
Date of issue	:	2011-11-17
Use of report	:	FCC Original Grant

Applicant : LG Innotek Co., Ltd.
#978-1, Jangduk-dong, Gwangsan-gu, Gwangju, 506-731, Korea

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Kyunggi-Do, 449-080, Korea

Test specification	:	FCC Part 15.407 Subpart E ANSI C63.4-2003
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:	Witnessed by:	Reviewed by:
Engineer S.K.Ryu	N/A	Manager W.J. Lee

CONTENTS

1. Equipment information

1.1 Equipment description

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Equipment type	Wi-Fi Module
Equipment model name	TWFM-B005D
Equipment add model name	TWFM-B015D, TWFM-B025D
Equipment serial no.	Identical prototype
Frequency band	802.11a/n(20MHz): 5180 ~ 5240MHz 802.11n(40MHz): 5190 ~ 5230 MHz
Channel number	802.11a/n(20MHz): 4 802.11n(40MHz): 2
Modulation type	OFDM
Data rate	802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n(20MHz): 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps 802.11n(40MHz): 13.5, 27, 40.5, 54, 81, 108, 121.5, 135 Mbps
Antenna type	PIFA Antenna (Max. peak gain) Chain 0 : 3.32dBi, Chain 1 : 4.14dBi
Power Supply	DC 5.0 V

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2. Information about test items

2.1 Test mode

Band	Mode	Single Transmitting		Multiple Transmitting (2 TX / 2 RX)
		Chain 0	Chain 1	
5GHz	802.11a			N/A
	802.11n(20MHz)	N/A	N/A	
	802.11n(40MHz)	N/A	N/A	

For all test items, the low, middle and high channels of the modes were tested respectively by choosing the highest RF out power chain, and transmission rate from preliminary testing.

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Notebook	X51RL	85N0AS318314227	ASUSTeK Computer Inc.	-
Mouse	M-UAE96	910-000004	Logitech Inc.	-
-	-	-	-	-

2.3 Frequency / Channel Operations

▪ **Frequency / Channel information**

Band	Mode	Channel No.	Freq. [MHz]	Channel No.	Freq. [MHz]	Channel No.	Freq. [MHz]
5GHz	802.11a/n(20MHz)	36	5180	44	5220	-	-
		40	5200	48	5240	-	-
	802.11n(40MHz)	38	5190	46	5230	-	-

▪ **Supported Antenna Configuration**

Band	Mode	Single Transmitting		Multiple Transmitting (2 TX / 2 RX)
		Chain 0	Chain 1	
5GHz	802.11a	Yes	Yes	No
	802.11n(20MHz)	No	No	Yes
	802.11n(40MHz)	No	No	Yes

2.4 Tested environment

Temperature	:	21 ~ 25 °C
Relative humidity content	:	38 ~ 42 % R.H.
Details of power supply	:	DC 5.0 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Test Items (TX)				
15.407(a)	26 dB Bandwidth	N/A	Conducted	C
15.407(a)	Maximum Conducted Output Power	< the lesser of 50mW or 4 + 10log$_{10}$(B) dBm		C
15.407(a)	Peak Power Spectral Density	< 4 dBm/MHz		C
15.407(a)	Peak Excursion	< 13 dB/MHz maximum difference		C
15.407(c)	Frequency Stability	The emissions is maintained within the band of the operation.		C
15.407(b)	Undesirable Emissions	< -27 dBm/MHz EIRP	Radiated	C
15.205 15.209 15.407(b)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note.2
15.207	AC Conducted Emissions	15.207	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: This test item was performed in each axis and the worst case data were reported.

The sample was tested according to the following specification:
ANSI C-63.4-2003, DA02-2138

3.2 Transmitter requirements

3.2.1 26 dB and 99% Bandwidth

- Procedure:

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26dB bandwidth is used to determine the conducted power limits.

- Measurement Data: Comply

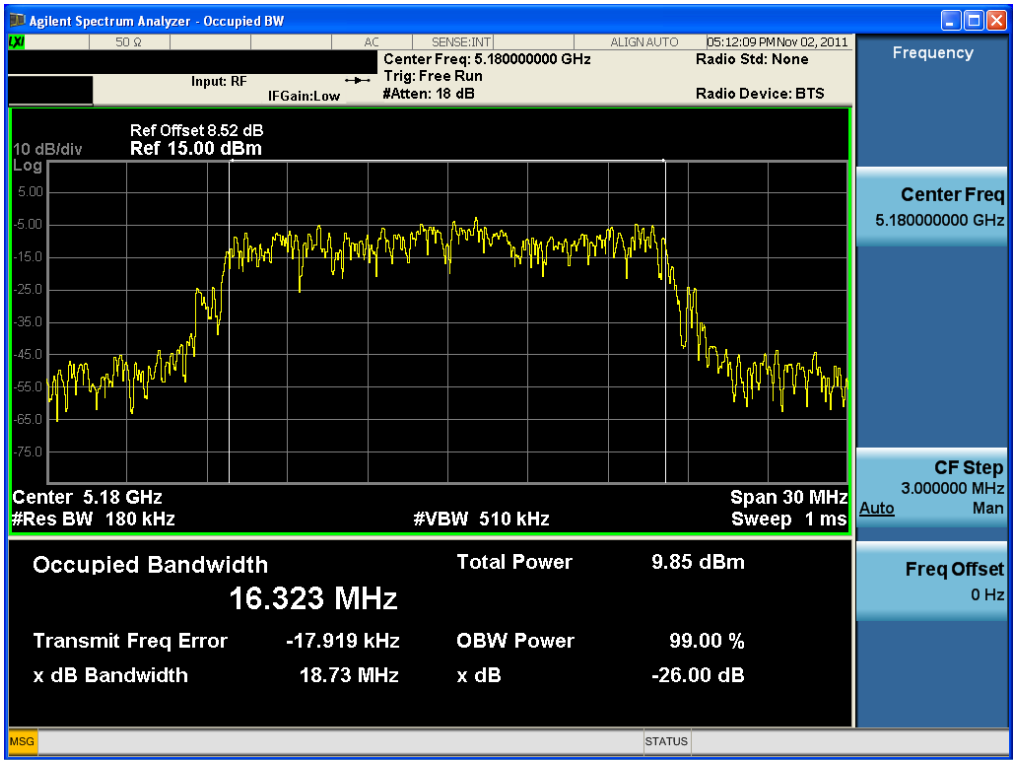
Mode	Channel	Frequency [MHz]	Test Result [MHz]	
			Chain 0	Chain 1
802.11a	36	5180	18.36	***18.73***
	40	5200	18.04	***18.73***
	48	5240	18.45	***18.52***
802.11n (20MHz)	36	5180	18.59	***18.62***
	40	5200	***18.93***	18.50
	48	5240	18.66	***18.97***
802.11n (40MHz)	38	5190	39.11	***39.38***
	46	5230	***39.15***	39.07

Note 1: The worst case plots in both chains are attached on next page.

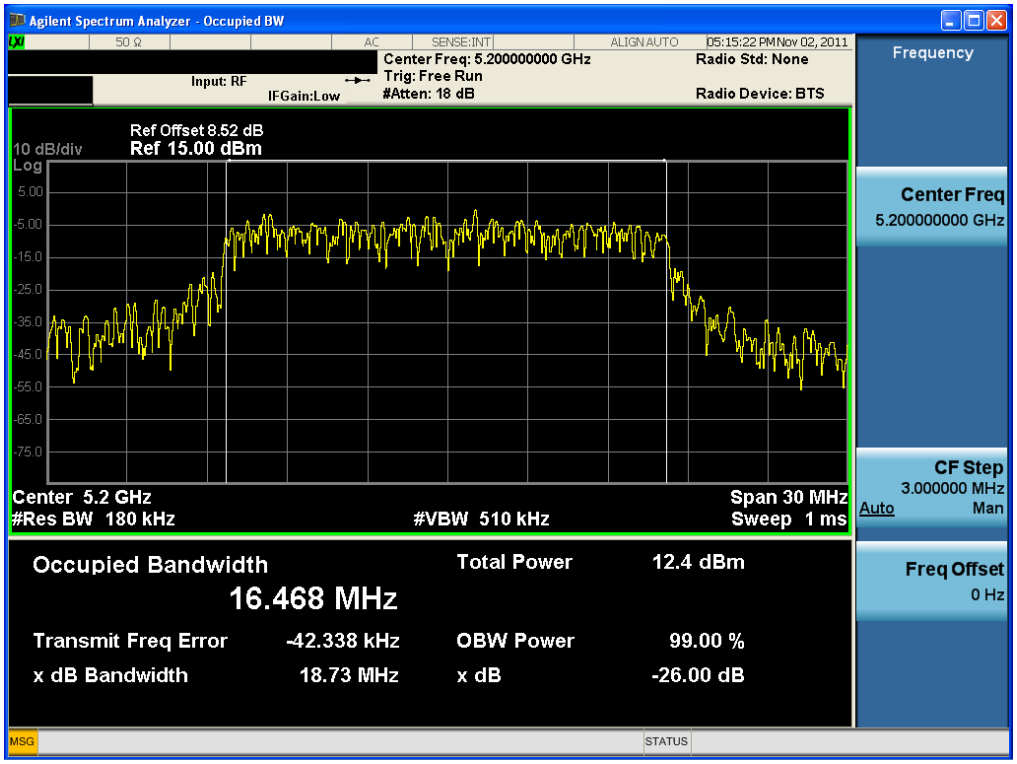
- **Minimum Standard:**

The minimum 26 dB bandwidth shall be at least 500 kHz

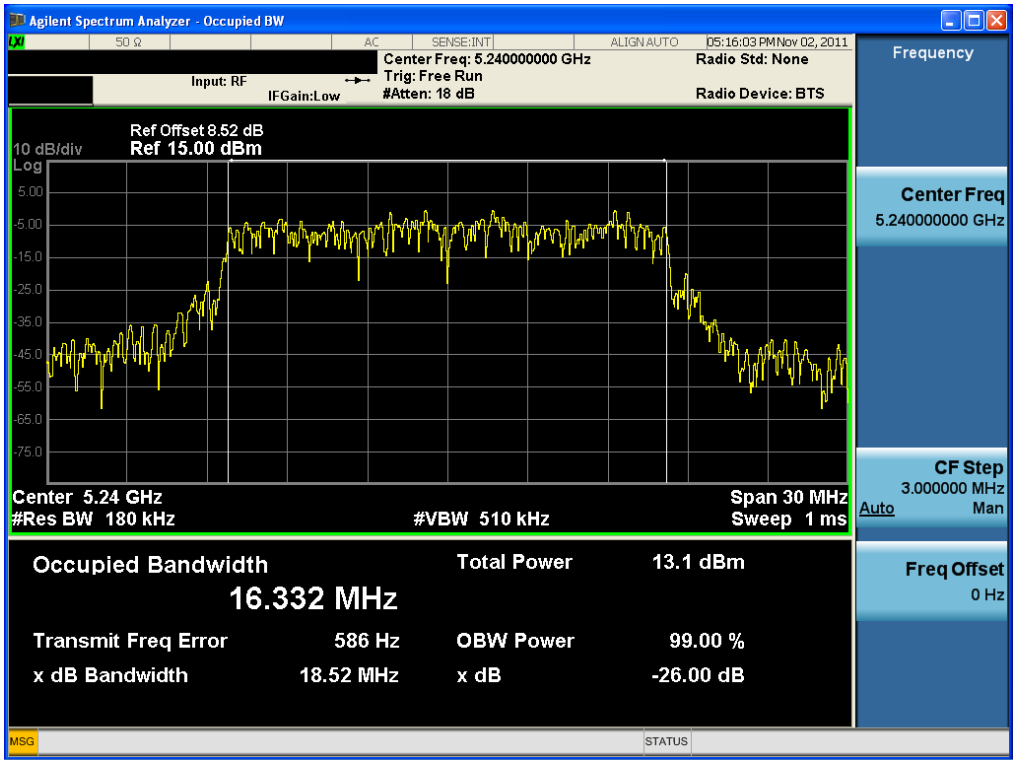
26 dB and 99% Bandwidth Test Mode: 802.11a & Ch.36 & Chain 1



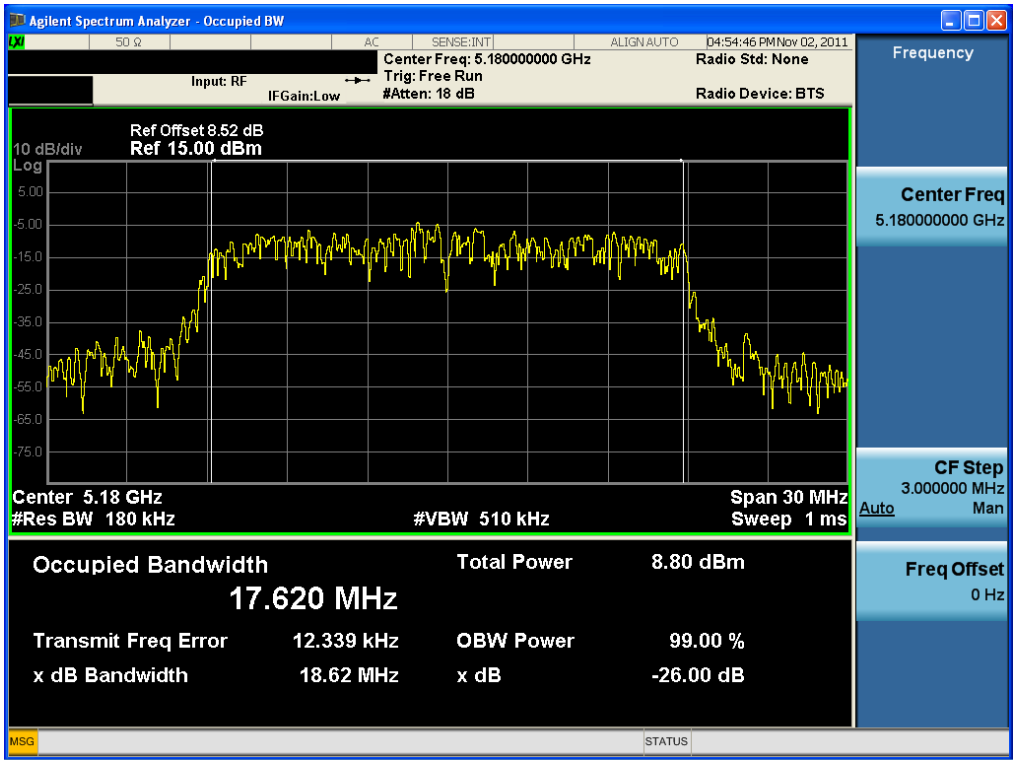
26 dB and 99% Bandwidth Test Mode: 802.11a & Ch.40 & Chain 1



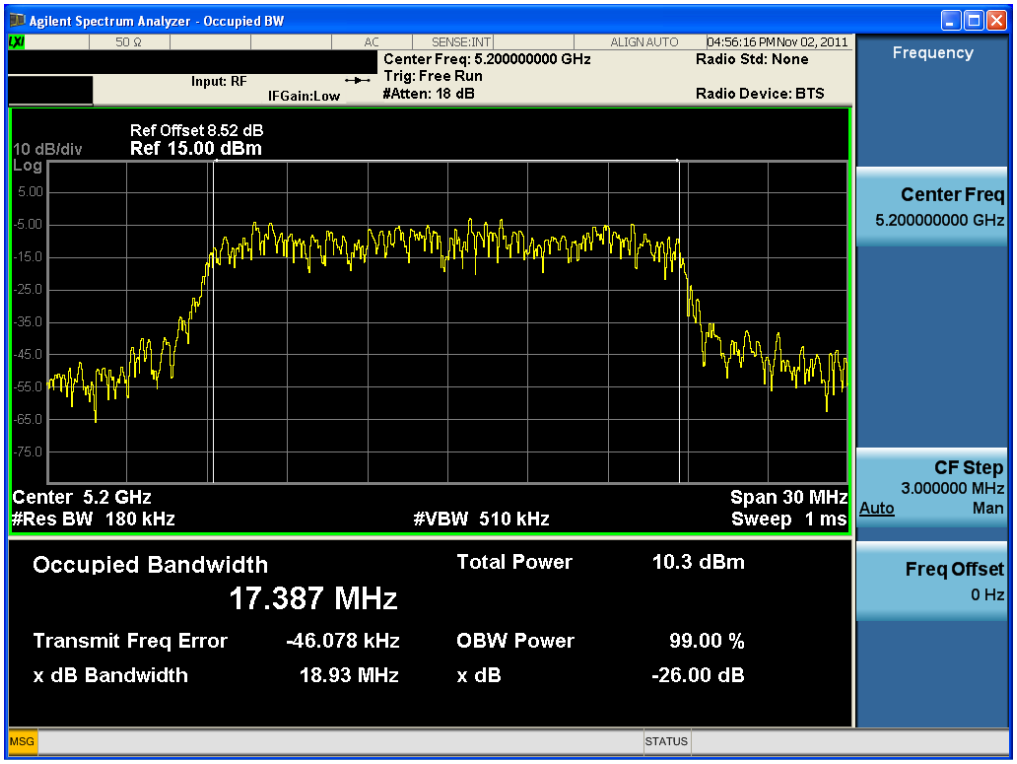
26 dB and 99% Bandwidth Test Mode: 802.11a & Ch.48 & Chain 1



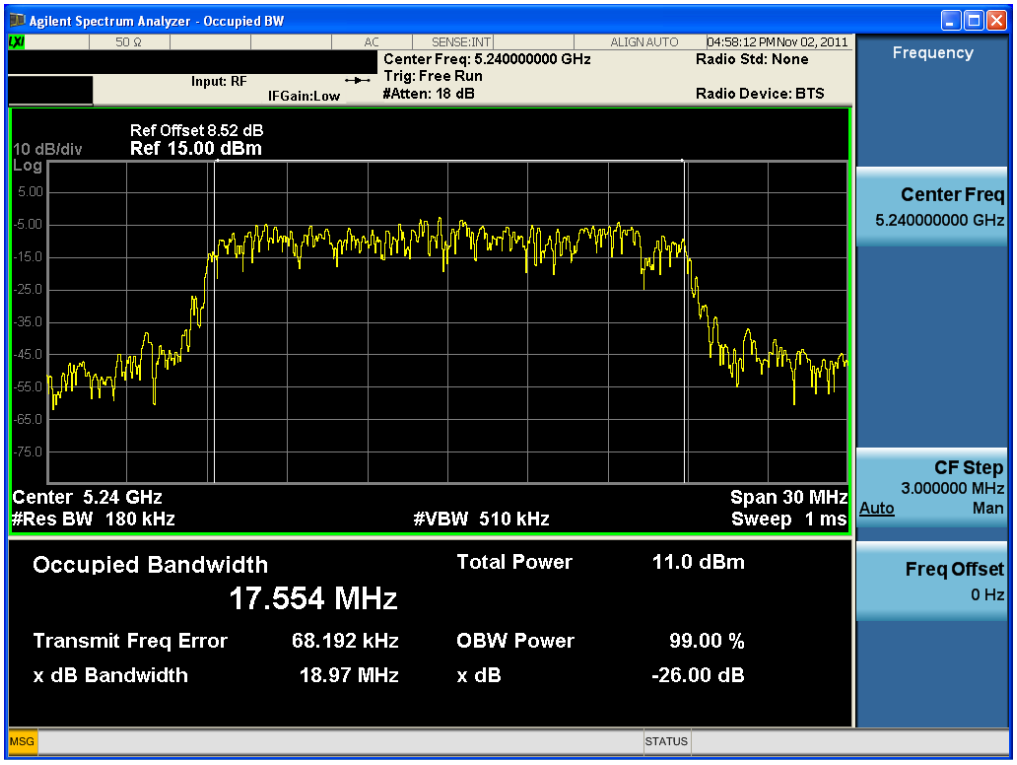
26 dB and 99% Bandwidth Test Mode: 802.11n-HT20 & Ch.36 & Chain 1



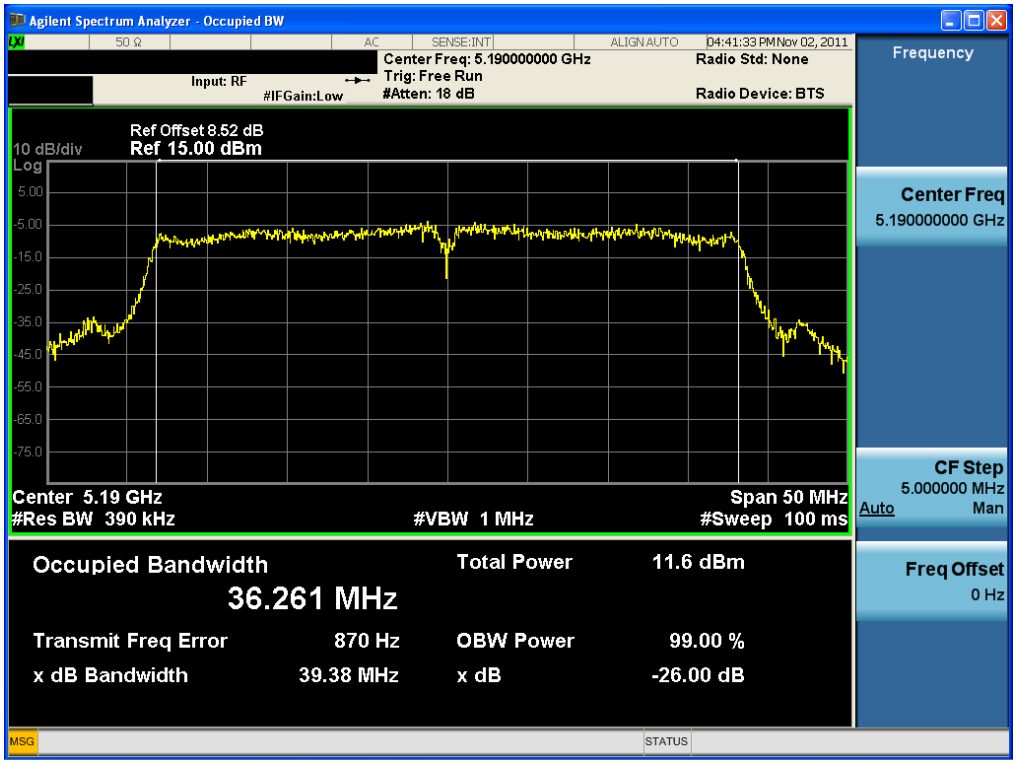
26 dB and 99% Bandwidth Test Mode: 802.11n-HT20 & Ch.40 & Chain 0



26 dB and 99% Bandwidth Test Mode: 802.11n-HT20 & Ch.48 & Chain 1



26 dB and 99% Bandwidth Test Mode: 802.11n-HT40 & Ch.38 & Chain 1



26 dB and 99% Bandwidth Test Mode: 802.11n-HT40 & Ch.46 & Chain 0

3.2.2 Output Power

- Test Procedure

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpar E, August 2002.

- **Measurement Data: Comply**

Mode	Channel	Frequency [MHz]	Test Result			
			Chain 0		Chain 1	
			[dBm]	[W]	[dBm]	[W]
802.11a	36	5180	7.90	0.006	***8.45***	***0.007***
	40	5200	11.28	0.013	***11.33***	***0.014***
	48	5240	11.91	0.016	***12.08***	***0.016***

Mode	Channel	Frequency [MHz]	Test Result			
			Chain 0 [dBm]	Chain 1 [dBm]	Aggregate Power[Note1]	
					[dBm]	[W]
802.11n HT20	36	5180	6.54	7.17	***9.88***	***0.010***
	40	5200	9.00	9.43	***12.23***	***0.017***
	48	5240	9.84	10.15	***13.01***	***0.019***
802.11n HT40	38	5190	5.04	5.34	***8.20***	***0.007***
	46	5230	11.84	12.10	***14.98***	***0.031***

Note 1: Aggregate power = $10\log(10^{(\frac{\text{chain 0}}{10})} + 10^{(\frac{\text{chain 1}}{10})})$

Note 2: Calculation of multiple transmitting antennas gain for minimum standard.

$= 10\log\left(10^{(\frac{3.32\text{dBi}}{10})} + 10^{(\frac{4.14\text{dBi}}{10})}\right)$ = 6.76dBi

Note 3: The worst case plots in both chains are attached on next page.

- **Calculation of limit**

The limit shall be reduced by the amount in dB that the directional gain of the antenna of the antenna exceeds 6dBi.

Mode	26dB BW (MHz)	Limit 1 (dBm)		Limit 2 (dBm)	
		50mW	Corrected (-0.76dB)	4dbm + 10log(26dB BW)	Corrected (-0.76dB)
802.11a	18.73	16.99	16.23	16.73	**15.97**[Note 1]
802.11n HT20	18.97	16.99	16.23	16.78	**16.02**[Note 1]
802.11n HT40	39.38	16.99	**16.23**[Note 1]	19.95	19.19

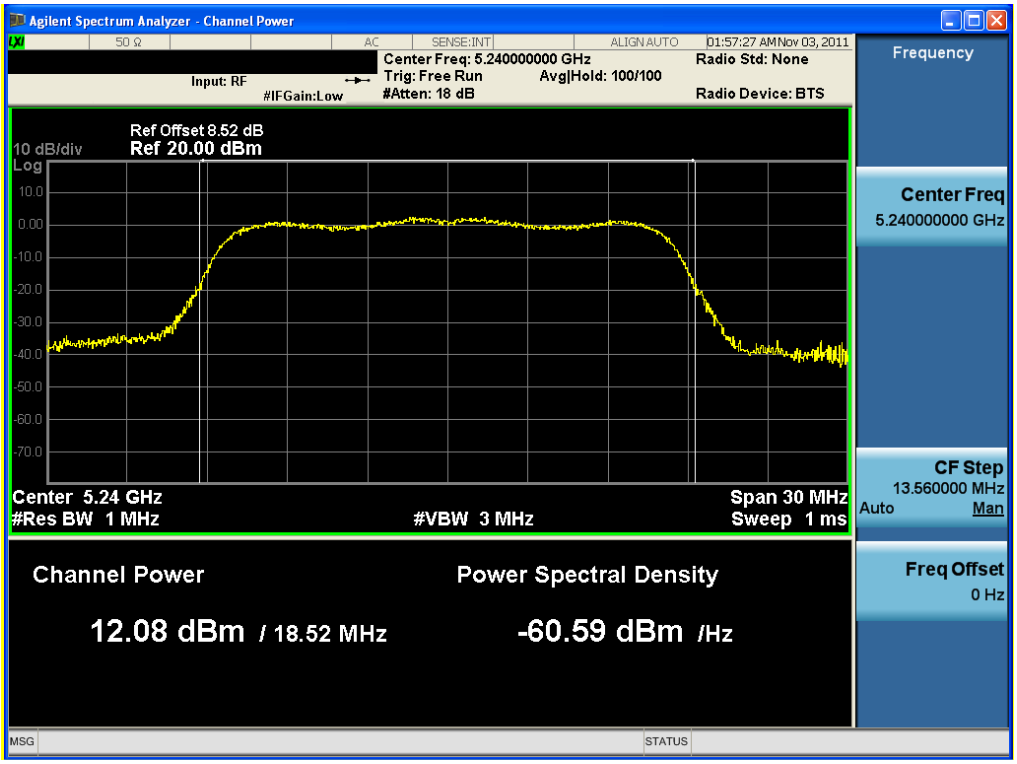
Note 1: This limit is applied for compliance of the requirement.

Minimum Standard:	Maximum conducted output power shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26dB emission bandwidth in MHz.

Output Power Test Mode: 802.11a & Ch.36 & Chain 1

Output Power Test Mode: 802.11a & Ch.40 & Chain 1

Output Power Test Mode: 802.11a & Ch.48 & Chain 1



Output Power Test Mode: 802.11n HT20 & Ch.36 & Chain 0

Output Power Test Mode: 802.11n HT20 & Ch.40 & Chain 0

Output Power Test Mode: 802.11n HT20 & Ch.48 & Chain 0

Output Power Test Mode: 802.11n HT20 & Ch.36 & Chain 1

Output Power Test Mode: 802.11n HT20 & Ch.40 & Chain 1

Output Power Test Mode: 802.11n HT20 & Ch.48 & Chain 1

Output Power Test Mode: 802.11n HT40 & Ch.38 & Chain 0

Output Power Test Mode: 802.11n HT40 & Ch.46 & Chain 0

Output Power Test Mode: 802.11n HT40 & Ch.38 & Chain 1

Output Power Test Mode: 802.11n HT40 & Ch.46 & Chain 1

3.2.3 Peak Power Spectral Density

- Procedure:

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for assessing Unlicensed National Information Infrastructure (U-NII) devices – Part 15, Subpart E, August 2002.
PPSD method #2 was used.

- Measurement Data: Comply

Mode	Channel	Frequency [MHz]	Test Result [dBm]	
			Chain 0	Chain 1
802.11a	36	5180	-0.859	**-0.079**
	40	5200	2.977	**2.993**
	48	5240	2.872	**3.115**

Frequency [MHz]	Channel No.	802.11 Mode	Chain 0 [dBm]	Chain 1 [dBm]	Aggregate PPSD Note 1 [dBm]
5180	36	n(HT20)	-2.158	-2.035	**0.91**
5200	40	n(HT20)	-0.535	-0.384	**2.55**
5240	48	n(HT20)	-0.287	0.103	**2.92**
5190	38	n(HT40)	-7.428	-7.086	**-4.24**
5230	46	n(HT40)	-0.003	0.000	**3.01**

Note 1: Aggregate PPSD = $10\log(10^{(\frac{\text{chain 0}}{10})} + 10^{(\frac{\text{chain 1}}{10})})$
Note 2: Calculation of multiple transmitting antennas gain for minimum standard.

$= 10\log\left(10^{(\frac{3.32\text{dBi}}{10})} + 10^{(\frac{4.14\text{dBi}}{10})}\right)$ = 6.76dBi

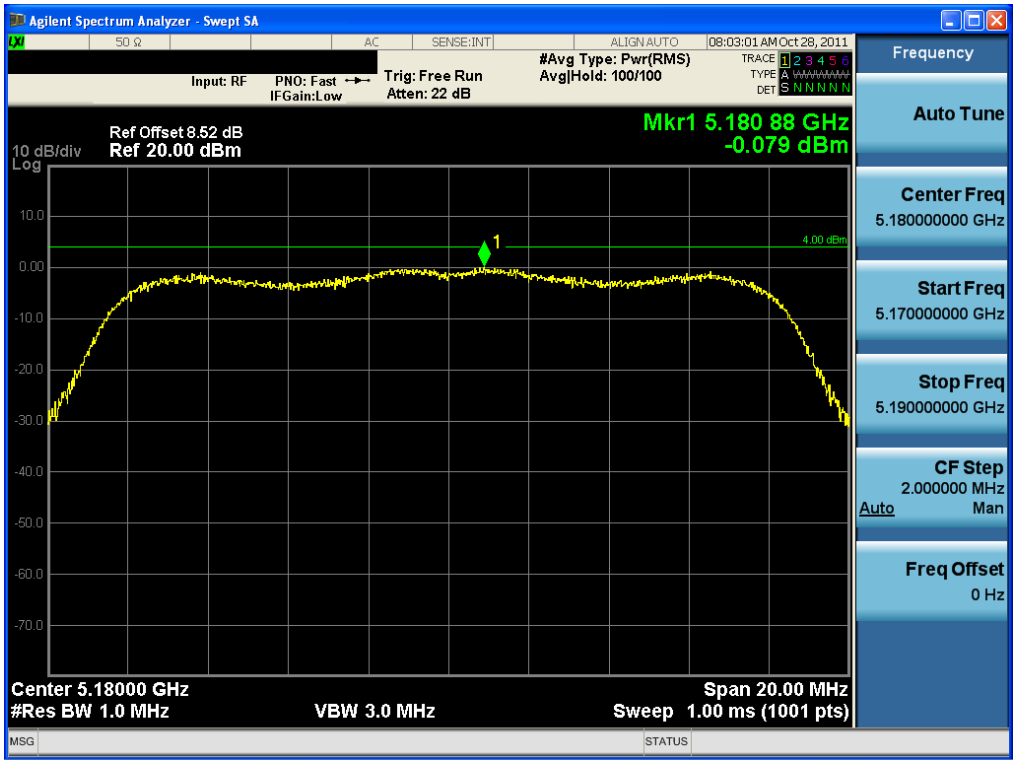
Note 3: The worst case plots in both chains are attached on next page.

- Calculation of limit

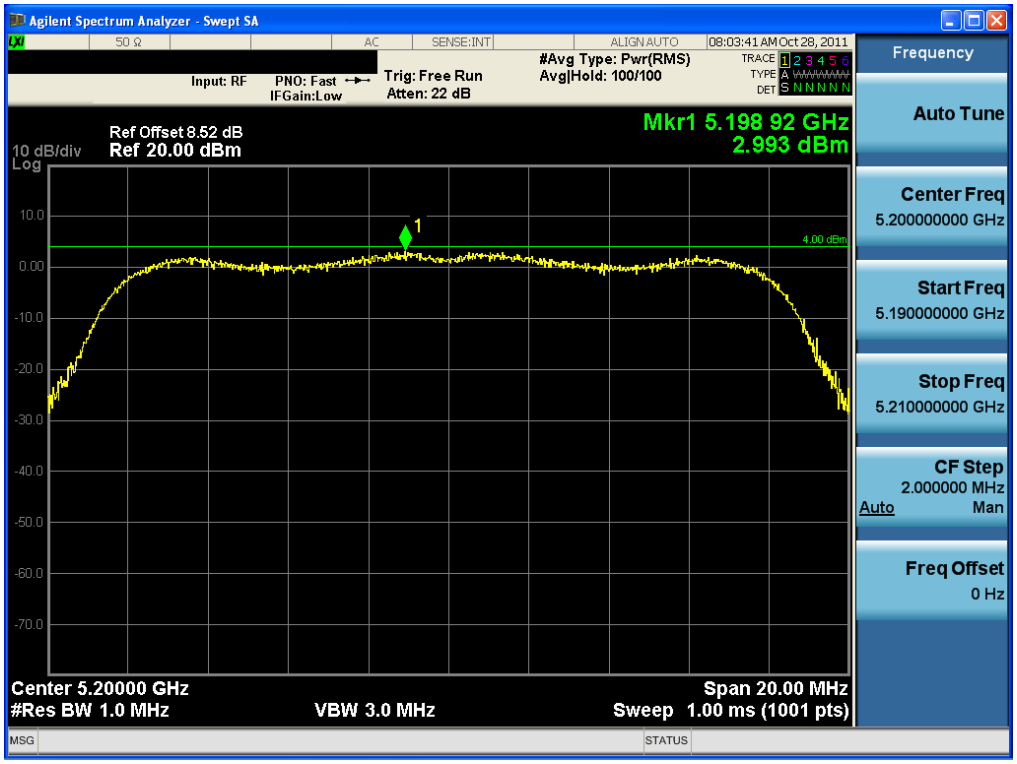
The limit shall be reduced by the amount in dB that the directional gain of the antenna of the antenna exceeds 6dBi.
Corrected Limit = 4 dBm – (6.76dBi – 6dBi) = **3.24dBm**

Minimum Standard:	The peak power spectral density shall not exceed 4 dBm in any 1MHz band.

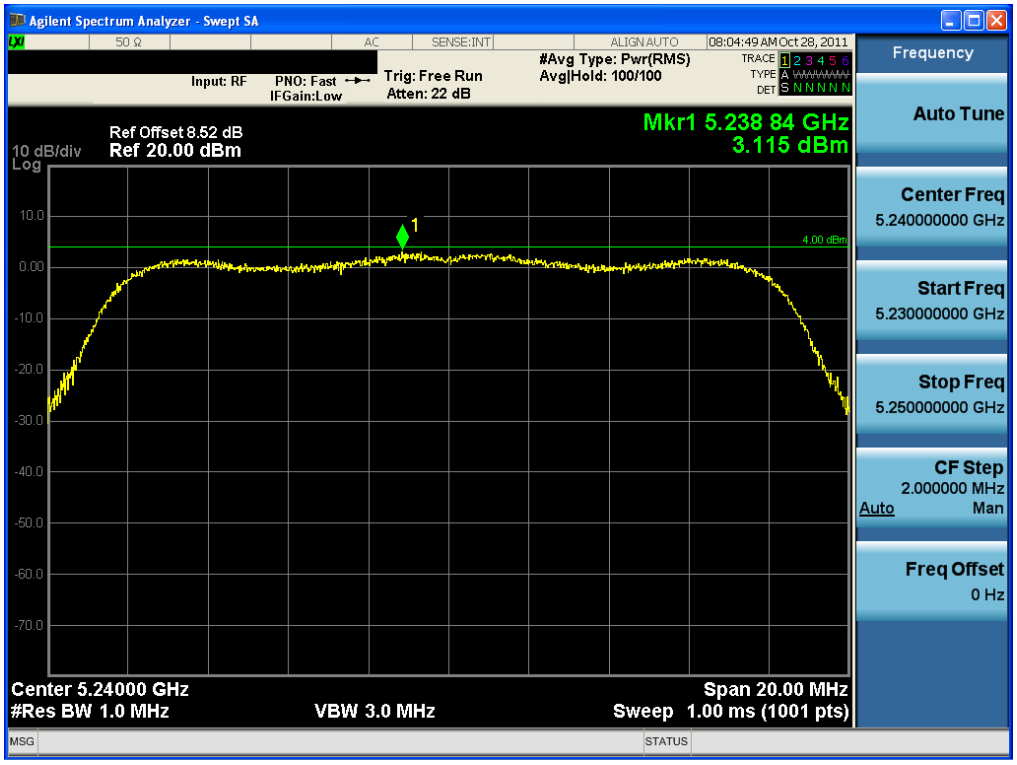
Peak Power Spectral Density Test Mode: 802.11a & Ch.36 & Chain 1



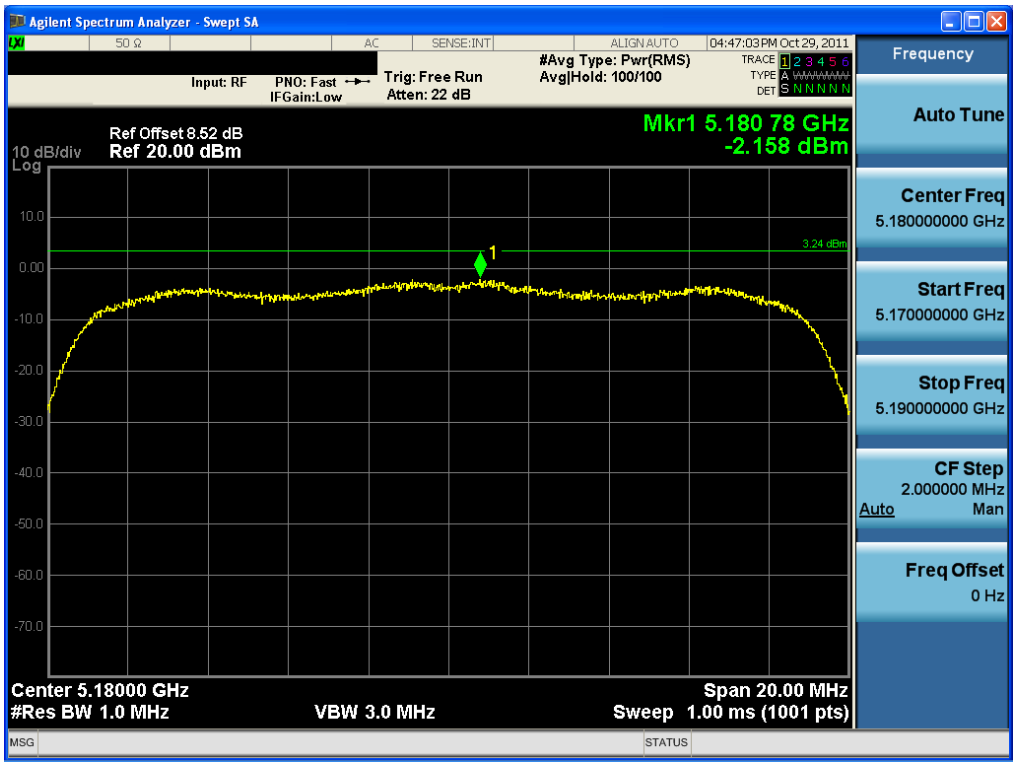
Peak Power Spectral Density Test Mode: 802.11a & Ch.40 & Chain 1



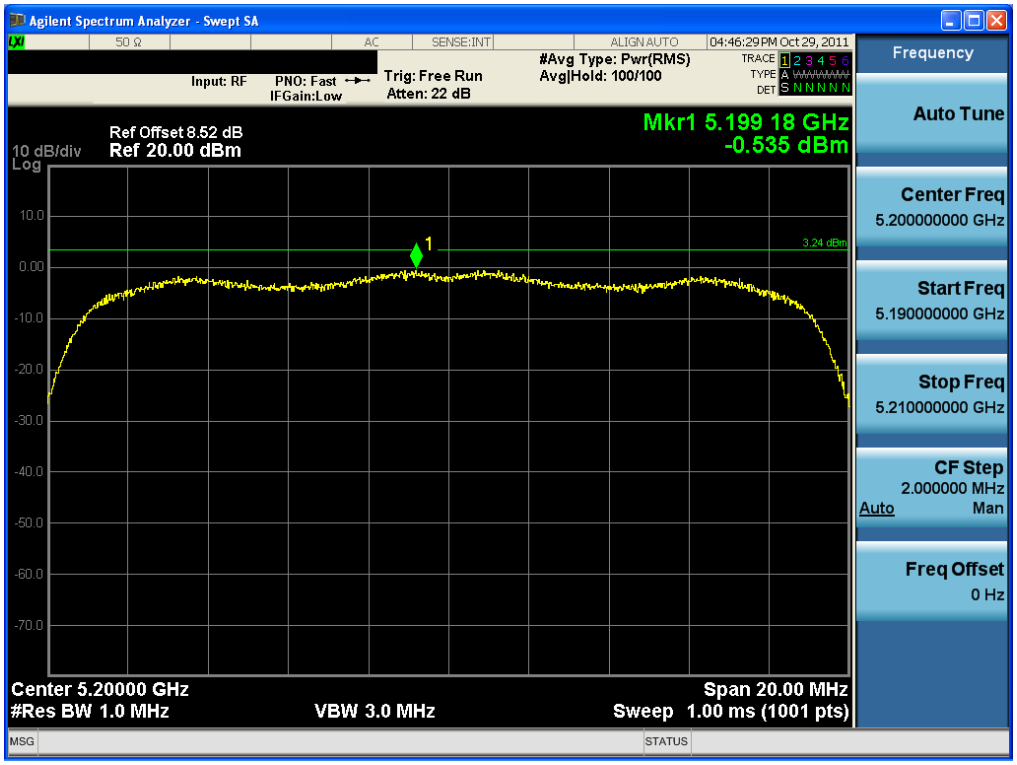
Peak Power Spectral Density Test Mode: 802.11a & Ch.48 & Chain 1



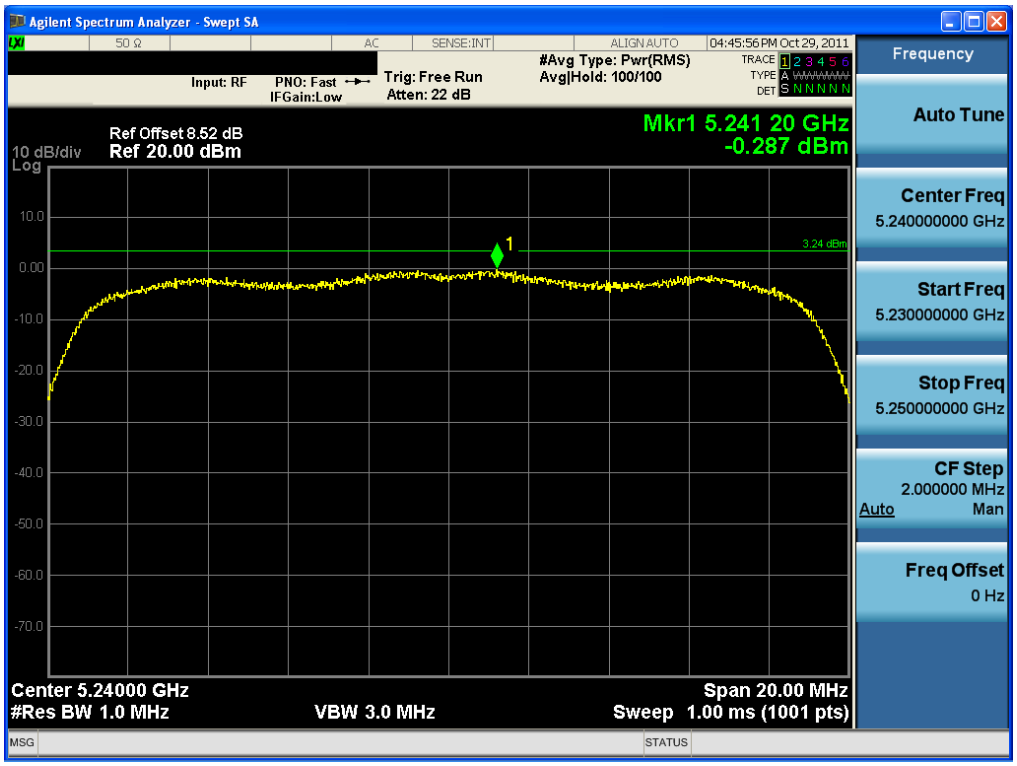
Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.36 & Chain 0



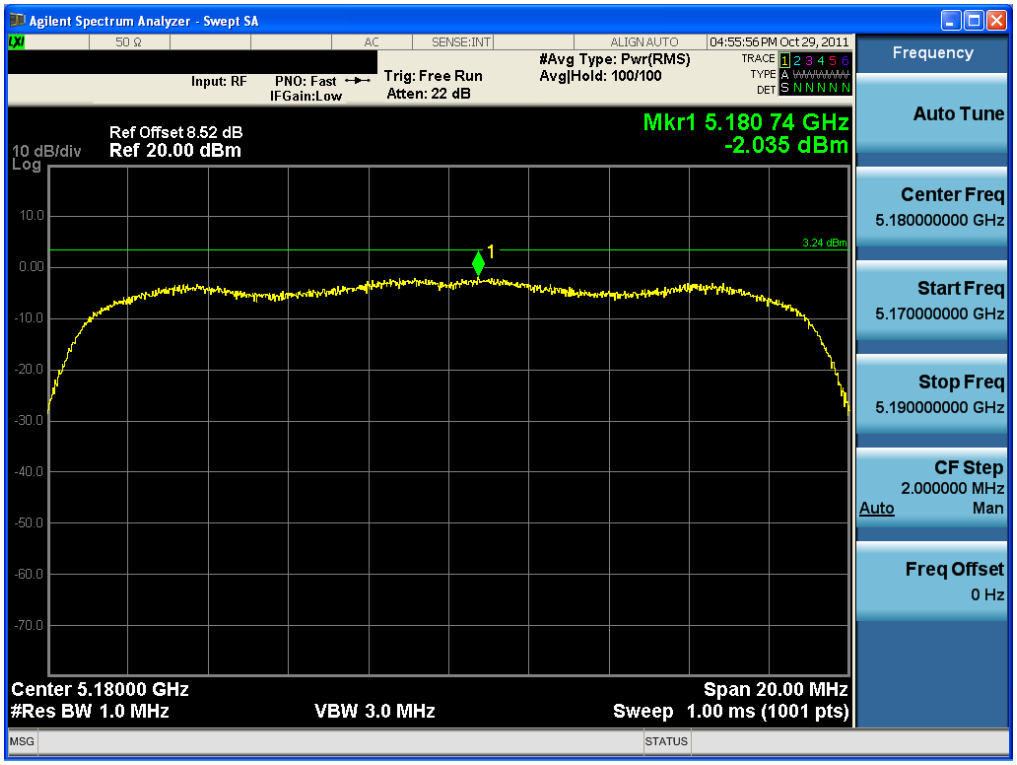
Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.40 & Chain 0



Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.48 & Chain 0



Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.36 & Chain 1



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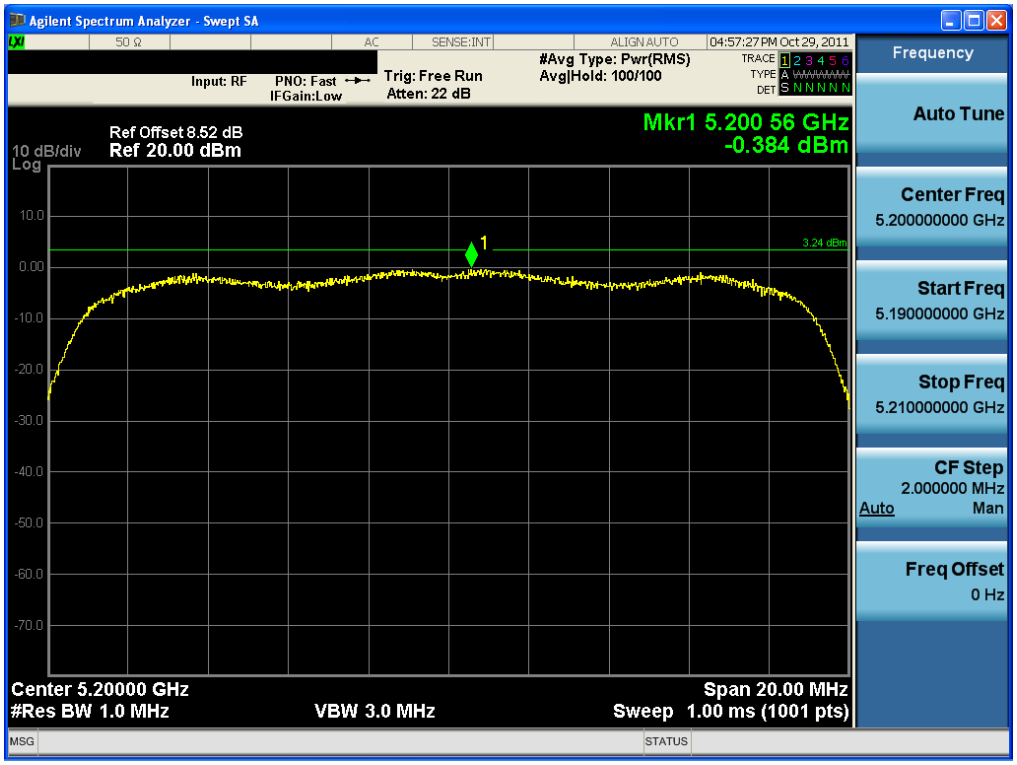
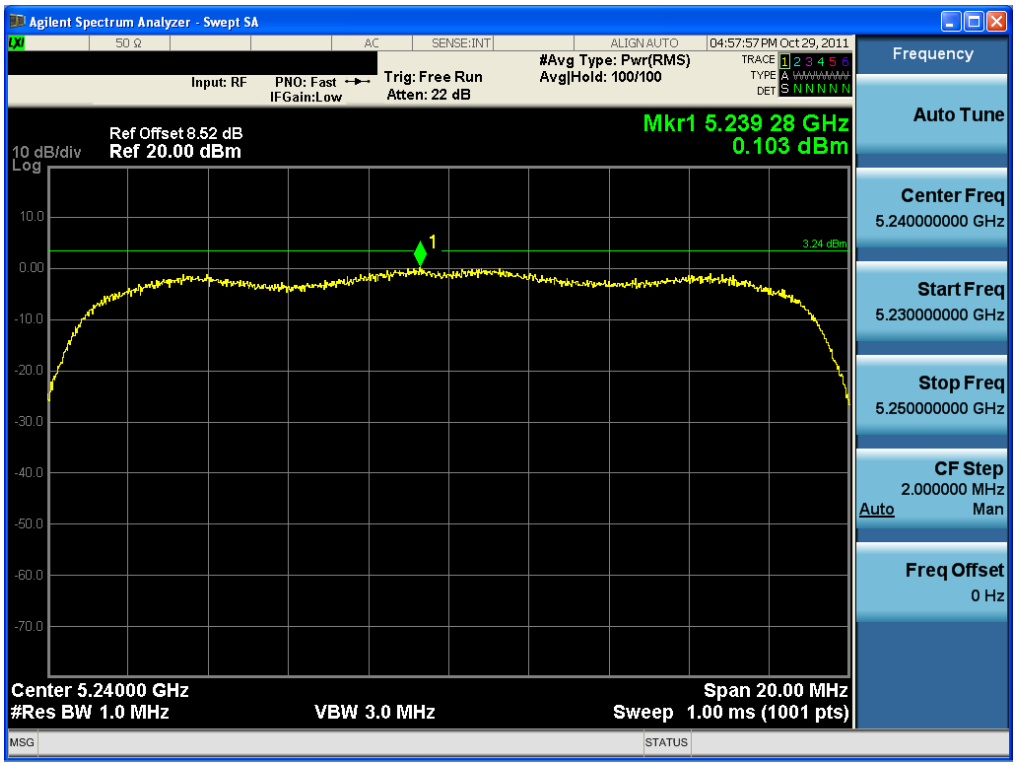
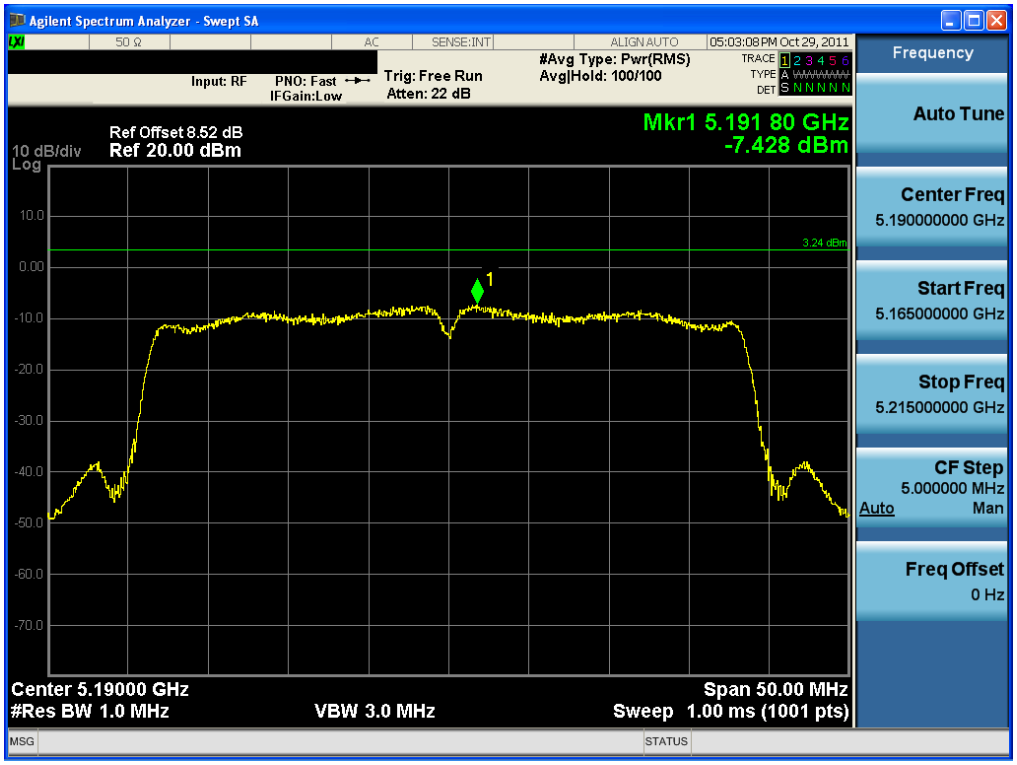


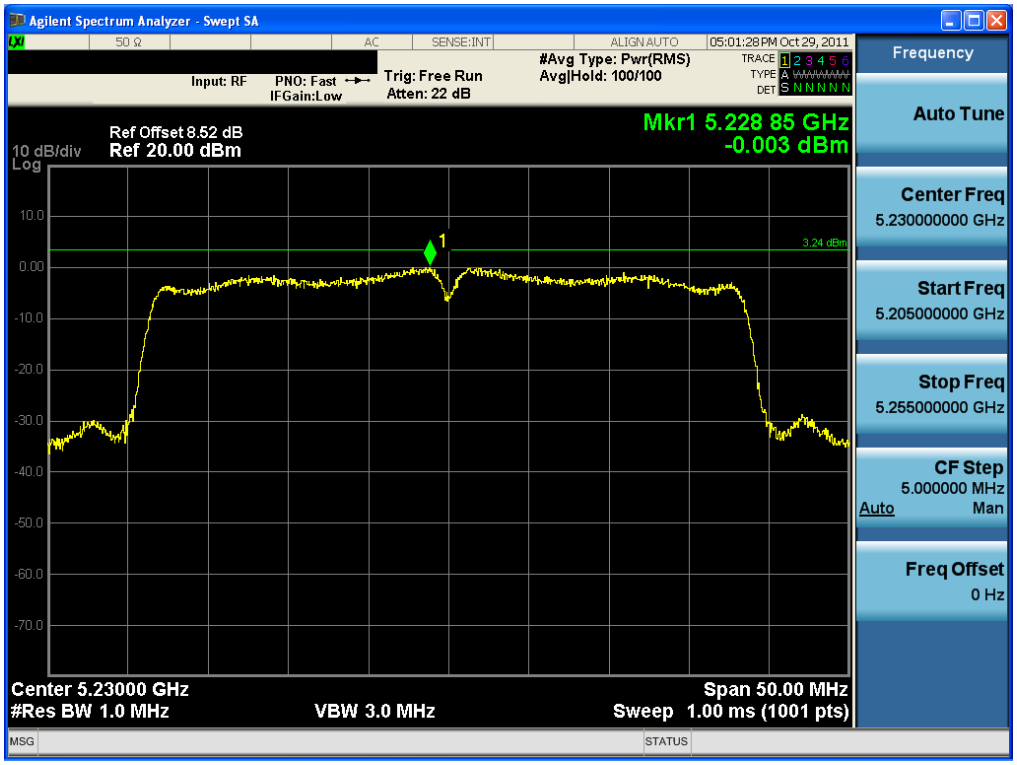
Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.48 & Chain 1



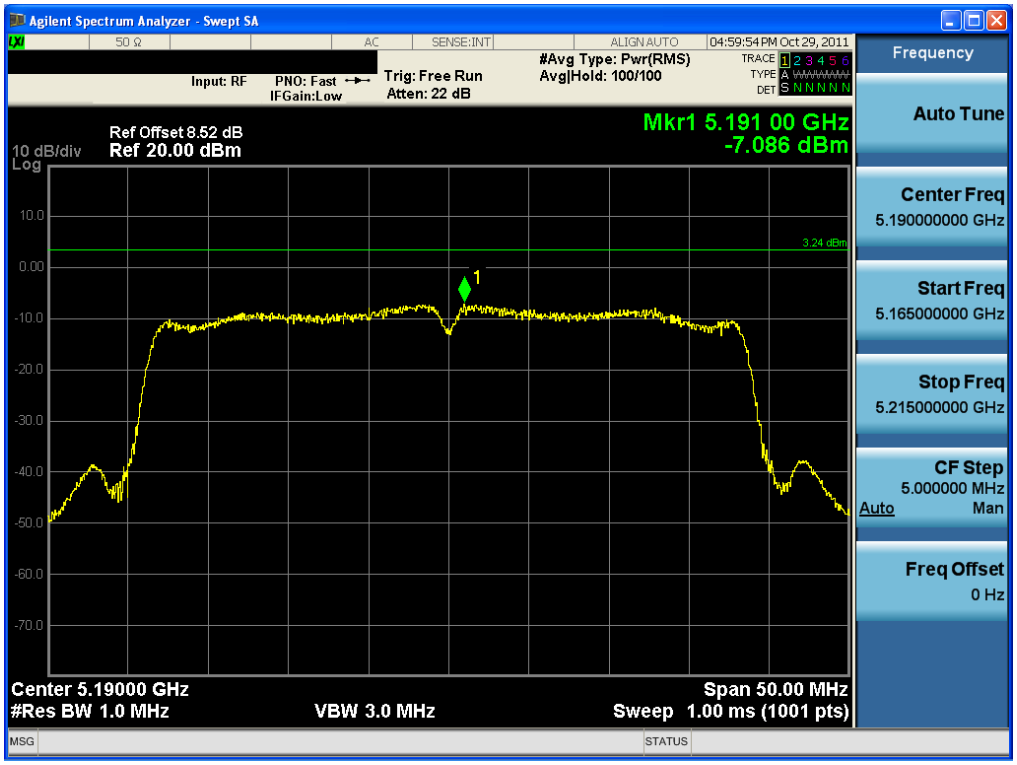
Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.38 & Chain 0



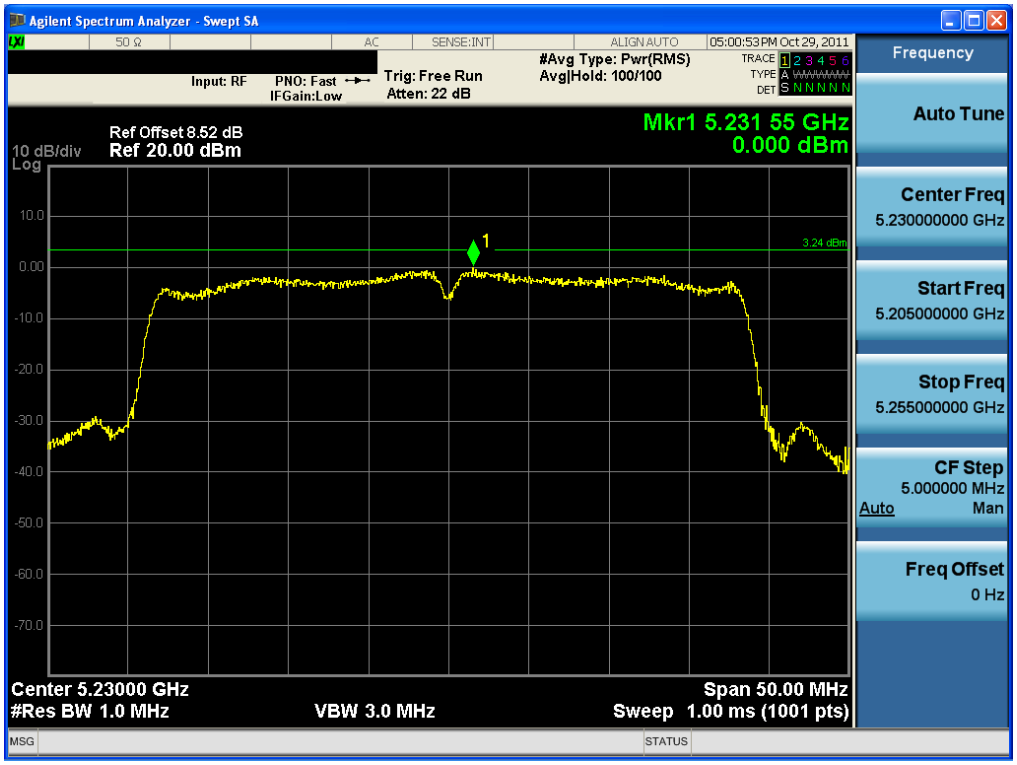
Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.46 & Chain 0



Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.38 & Chain 1



Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.46 & Chain 1



3.2.4 Peak Excursion Ratio

- Procedure:

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

- Measurement Data: Comply

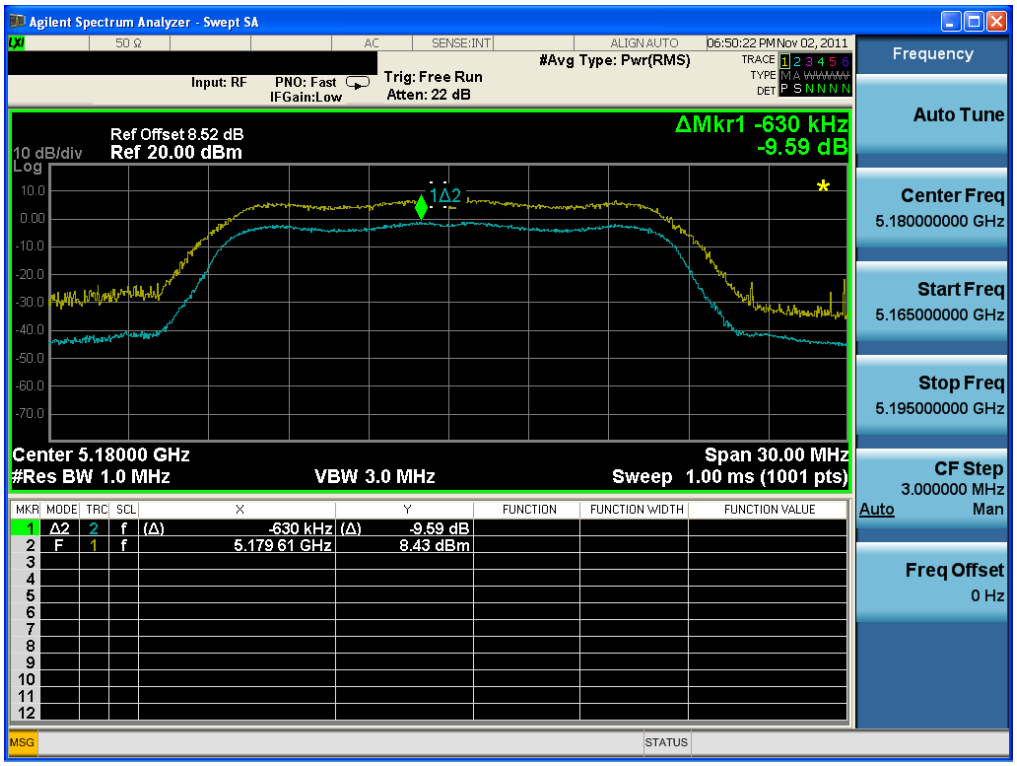
Mode	Channel	Frequency [MHz]	Test Result [dB]	
			Chain 0	Chain 1
802.11a	36	5180	8.930	***9.590***
	40	5200	***8.960***	8.520
	48	5240	8.490	***8.790***
802.11n HT20	36	5180	***8.760***	8.050
	40	5200	8.790	***8.800***
	48	5240	***8.790***	8.230
802.11n HT40	38	5190	8.950	***8.980***
	46	5230	8.800	***9.040***

Note 1: The worst case plots in both chains are attached on next page.

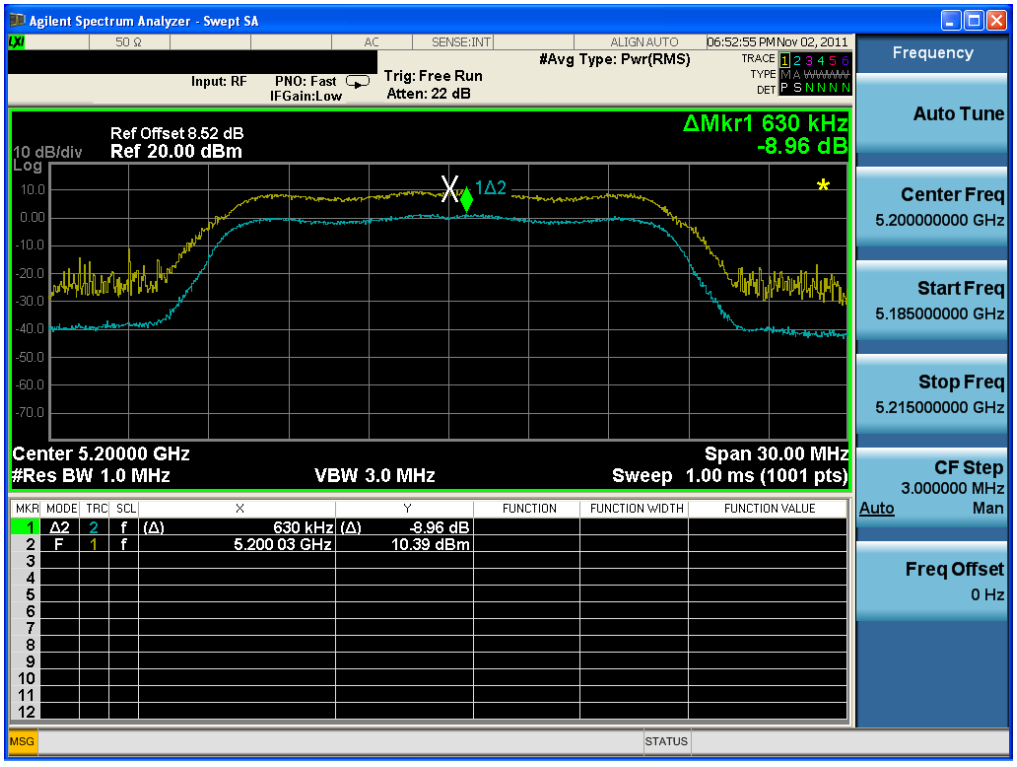
- Minimum Standard:

Minimum Standard:	13 dBm/MHz

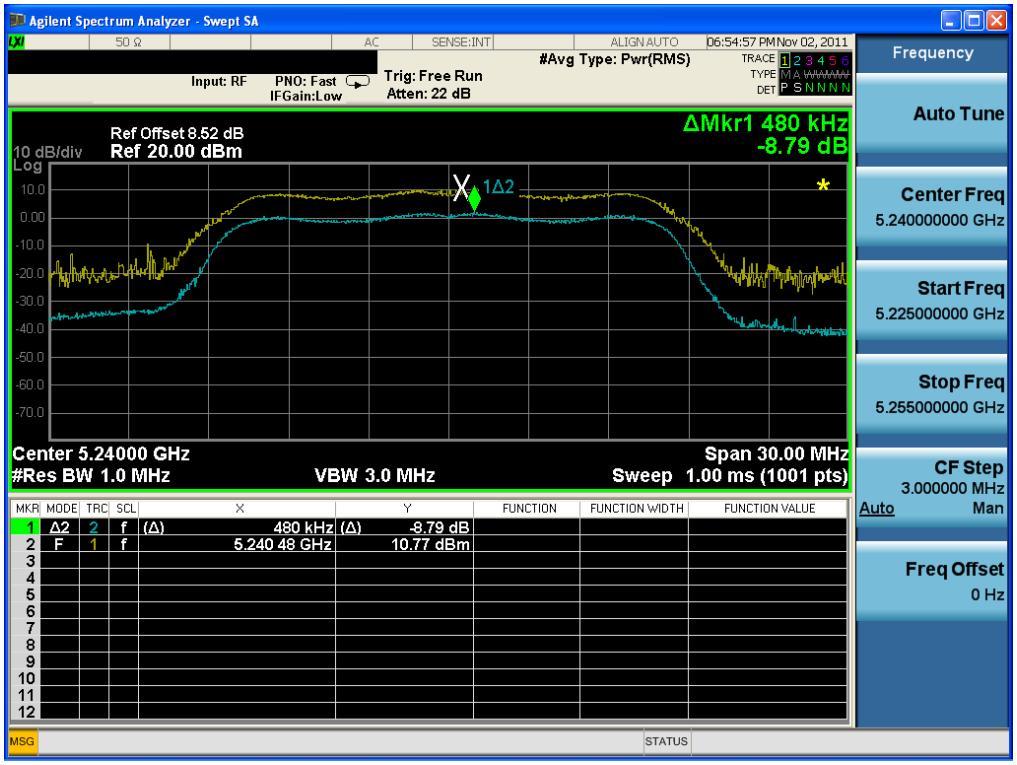
Peak Excursion Ratio Test Mode: 802.11a & Ch.36 & Chain 1



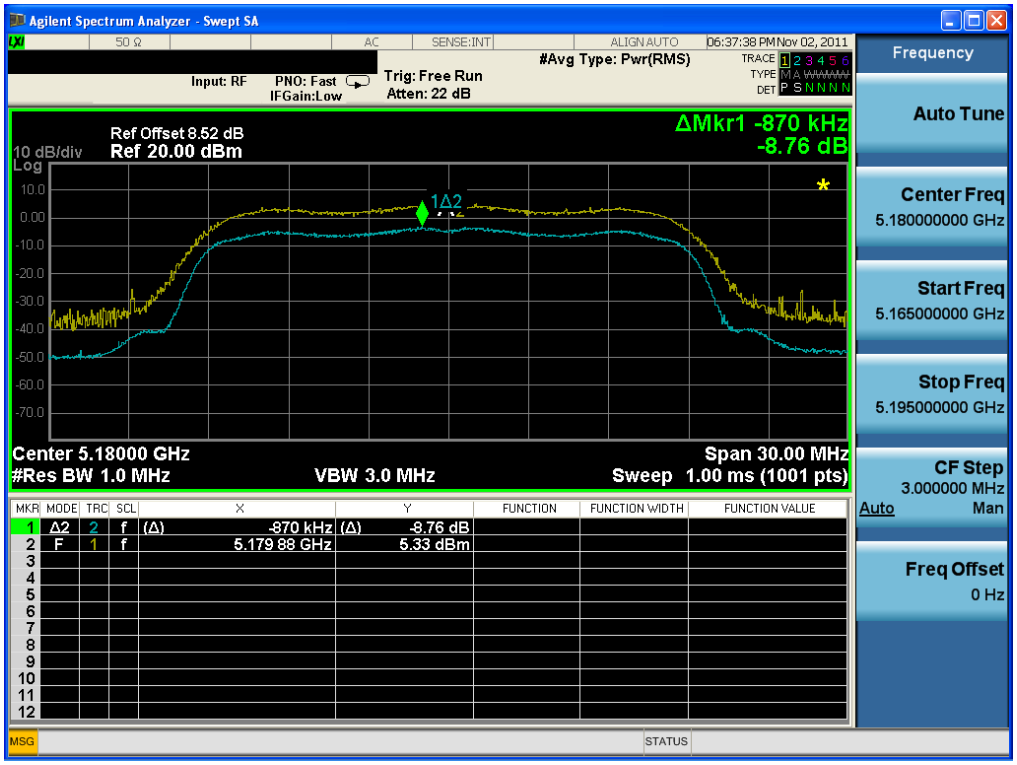
Peak Excursion Ratio Test Mode: 802.11a & Ch.40 & Chain 0



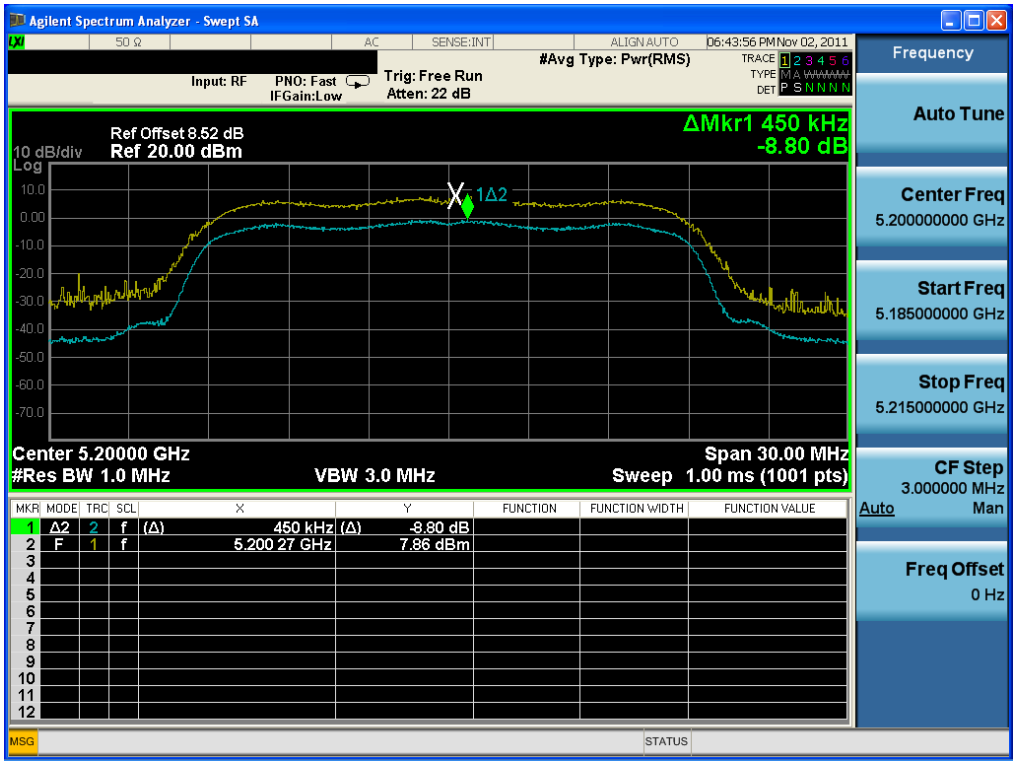
Peak Excursion Ratio Test Mode: 802.11a & Ch.48 & Chain 1



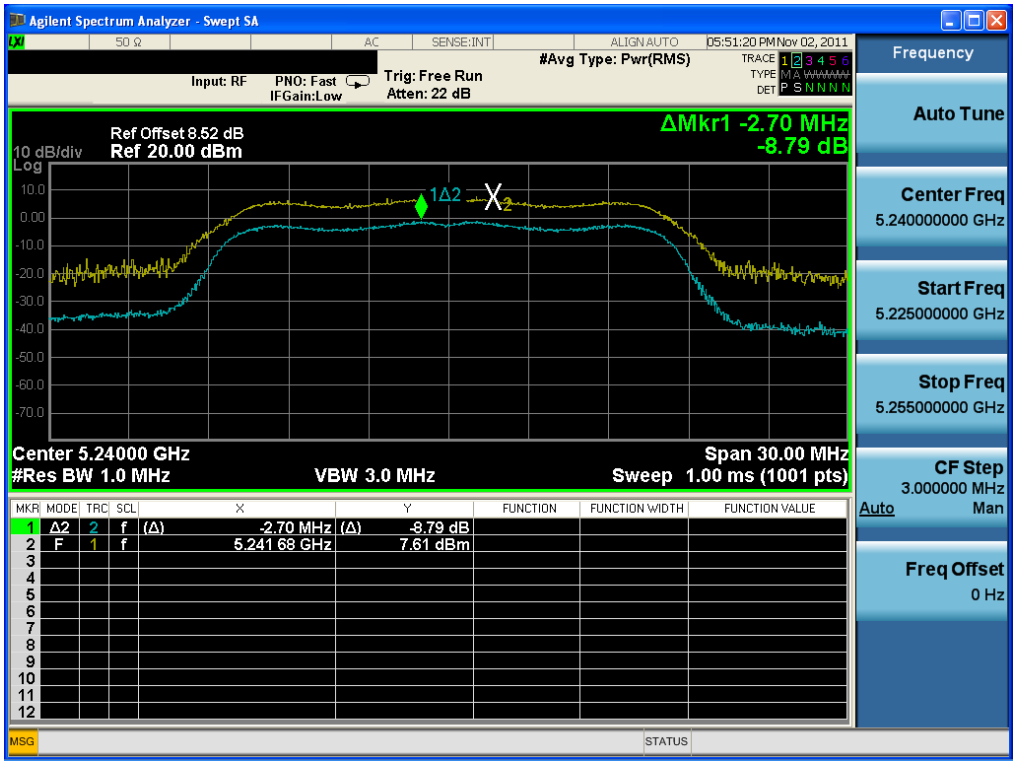
Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.36 & Chain 0



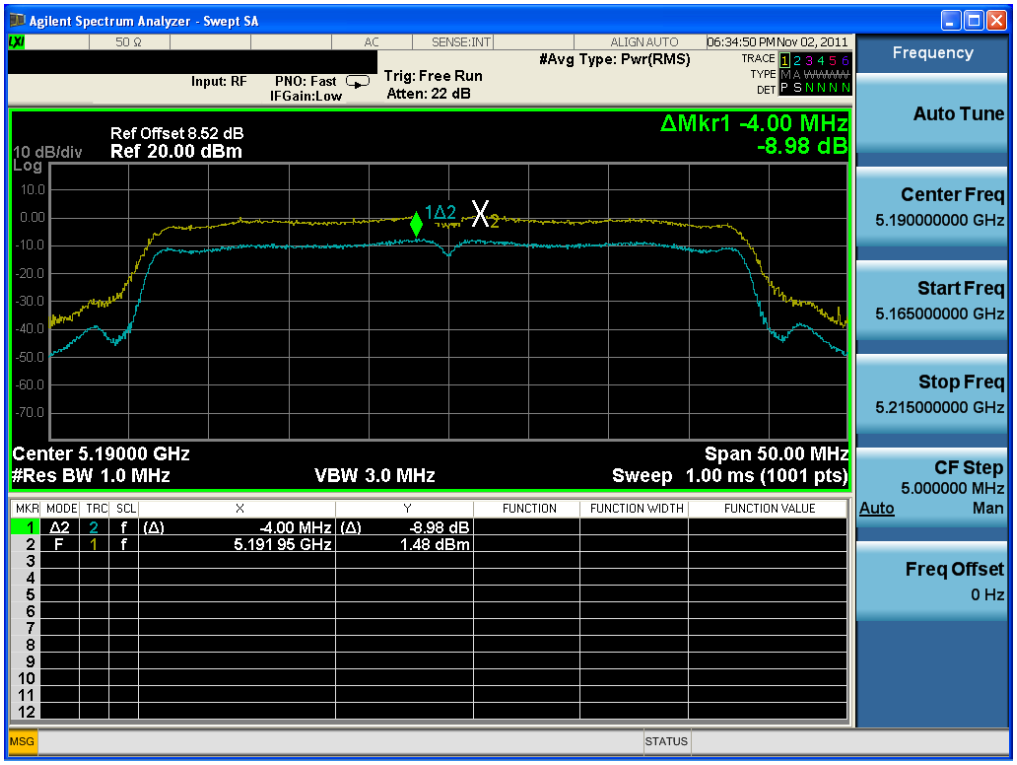
Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.40 & Chain 1



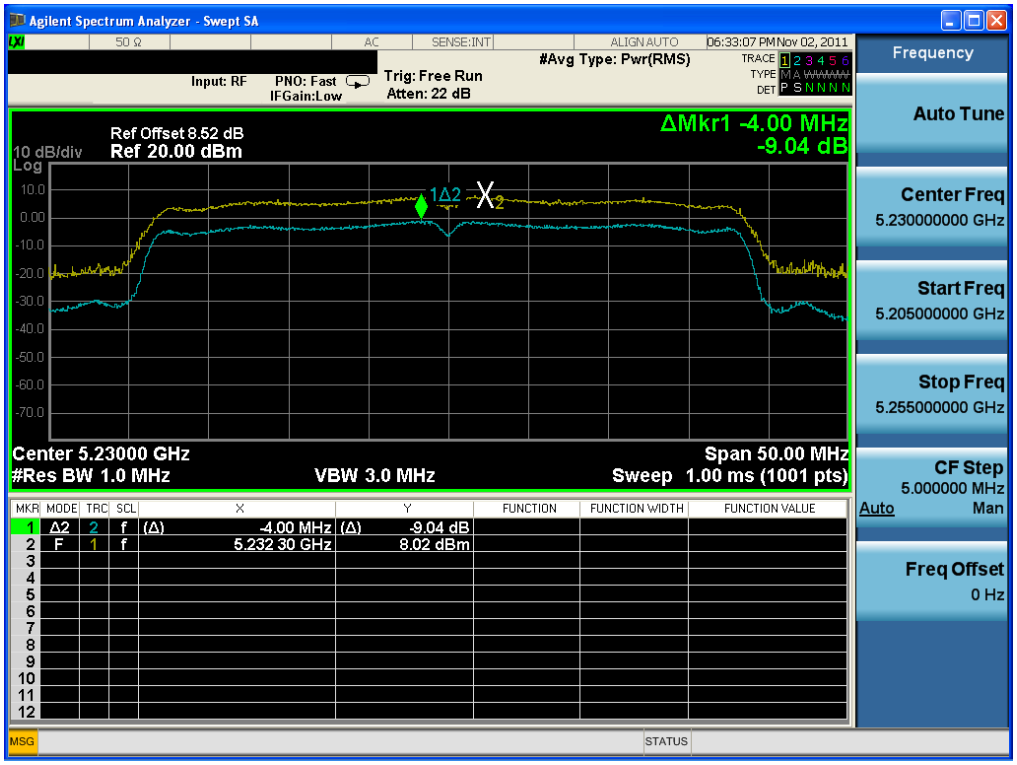
Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.48 & Chain 0



Peak Excursion Ratio Test Mode: 802.11n HT40 & Ch.38 & Chain 1



Peak Excursion Ratio Test Mode: 802.11n HT40 & Ch.46 & Chain 1



3.2.5 Frequency Stability

- Procedure:

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -10℃ and +60℃. The temperature was incremented by 10℃ intervals and the unit was allowed to stabilize at each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

- Measurement Data:

Test Mode : 802.11a & Ch.40 & Chain 0

OPERATING FREQUENCY : 5,200,000,000 Hz

CHANNEL : 40

REFERENCE VOLTAGE : 5.00 V DC

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQ (Hz)	Deviation (%)
100%	5.00	+25(Ref)	5,199,993,248	-0.000130
100%		-10	5,200,017,096	0.000329
100%		0	5,200,012,200	0.000235
100%		+10	5,200,002,733	0.000053
100%		+20	5,199,984,297	-0.000302
100%		+30	5,199,988,398	-0.000223
100%		+40	5,199,985,173	-0.000285
100%		+50	5,199,996,941	-0.000059
100%		+60	5,200,023,281	0.000448
115%	5.75	+25	5,200,010,154	0.000195
BATT.ENDPOINT	4.50	+25	5,200,007,430	0.000143

Note1 : This device was tested above operating temperatures according to manufacturer's declaration

- Minimum Standard: the emissions is maintained within the band of the operation.

- Measurement Data:

Test Mode : 802.11n HT20 & Ch.40 & Chain 1

OPERATING FREQUENCY : 5,200,000,000 Hz

CHANNEL : 40

REFERENCE VOLTAGE : 5.00 V DC

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQ (Hz)	Deviation (%)
100%	5.00	+25(Ref)	5,199,986,867	-0.000253
100%		-10	5,200,024,895	0.000479
100%		0	5,200,005,941	0.000114
100%		+10	5,199,976,063	-0.000460
100%		+20	5,199,995,761	-0.000082
100%		+30	5,199,993,413	-0.000127
100%		+40	5,199,991,564	-0.000162
100%		+50	5,199,998,619	-0.000027
100%		+60	5,200,034,918	0.000671
115%	5.75	+25	5,200,006,940	0.000133
BATT.ENDPOINT	4.50	+25	5,200,005,649	0.000109

Note1 : This device was tested above operating temperatures according to manufacturer's declaration
Note 2: The worst case plots in both chains are attached.

- Minimum Standard: the emissions is maintained within the band of the operation.

- Measurement Data:

Test Mode : 802.11n HT40 & Ch.38 & Chain 0

OPERATING FREQUENCY : 5,190,000,000 Hz

CHANNEL : 38

REFERENCE VOLTAGE : 5.00 V DC

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQ (Hz)	Deviation (%)
100%	5.00	+25(Ref)	5,189,986,249	-0.000265
100%		-10	5,190,011,649	0.000224
100%		0	5,189,992,882	-0.000137
100%		+10	5,189,983,917	-0.000310
100%		+20	5,189,994,270	-0.000110
100%		+30	5,189,991,069	-0.000172
100%		+40	5,189,985,979	-0.000270
100%		+50	5,189,990,725	-0.000179
100%		+60	5,190,047,291	0.000911
115%	5.75	+25	5,189,997,691	-0.000044
BATT.ENDPOINT	4.50	+25	5,189,994,369	-0.000108

Note1 : This device was tested above operating temperatures according to manufacturer's declaration
Note 2: The worst case plots in both chains are attached.

- Minimum Standard: the emissions is maintained within the band of the operation.

3.2.6 Radiated Spurious Emission Measurements

- Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

- Measurement Data: Comply

- Minimum Standard:

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m) @ 3m
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** 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	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	156.52475 ~	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	156.52525	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	156.7 ~ 156.9	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900	13.25 ~ 13.4	
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			
	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.

▪ **FCC Part 15.407(b)(2)**

For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27dBm/MHz.

- Measurement Data:

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 1 & 5180MHz(Ch. 36)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
34.425	V	X axis	QP	36.23	-5.60	30.63	40.00	9.37
265.348	H	X axis	QP	48.40	-7.90	40.50	46.00	5.50
5148.250	V	Z axis	PK	61.50	9.06	70.56	74.00	3.44
5150.000	V	Z axis	AV	42.85	9.06	51.91	54.00	2.09
10361.000	V	X axis	PK	44.37	5.53	49.90	68.23	18.33

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 1 & 5200MHz(Ch. 40)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.489	V	X axis	QP	36.45	-5.60	30.85	40.00	9.15
265.442	H	X axis	QP	48.56	-7.90	40.66	46.00	5.34
10398.950	V	Z axis	PK	46.97	5.56	52.53	68.23	15.70

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 1 & 5240MHz(Ch. 48)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.458	V	X axis	QP	37.98	-5.60	32.38	40.00	7.62
265.487	H	X axis	QP	49.26	-7.90	41.36	46.00	4.64
5350.850	V	Z axis	PK	46.47	9.49	55.96	74.00	18.04
5360.900	V	Z axis	AV	33.98	9.49	43.47	54.00	10.53
10481.690	V	Z axis	PK	51.33	5.64	56.97	68.23	11.26

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
3. The total factor above 10GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (3m/1m) dB
   Above 10GHz T.F = AF + CL – AG – 9.54dB

- Measurement Data:

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 0 & 5180MHz(Ch. 36)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.036	V	X axis	QP	38.10	-5.60	32.50	40.00	7.50
265.325	H	X axis	QP	50.27	-7.90	42.37	46.00	3.63
5150.000	V	Z axis	PK	54.89	9.06	63.95	74.00	10.05
5150.000	V	Z axis	AV	42.91	9.06	51.97	54.00	2.03
10359.400	H	Y axis	PK	54.56	5.53	60.09	68.23	8.14

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 0 & 5200MHz(Ch. 40)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.125	V	X axis	QP	38.64	-5.60	33.04	40.00	6.96
265.334	H	X axis	QP	49.99	-7.90	42.09	46.00	3.92
10399.000	H	Y axis	PK	56.73	5.56	62.29	68.23	5.94

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11a & Chain 0 & 5240MHz(Ch. 48)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.483	V	X axis	QP	36.23	-5.60	30.63	40.00	9.37
265.655	H	X axis	QP	49.76	-7.90	41.86	46.00	4.14
5365.550	V	Z axis	PK	46.86	9.49	56.35	74.00	17.65
5360.950	V	Z axis	AV	34.52	9.49	44.01	54.00	9.99
10484.200	H	Y axis	PK	59.08	5.64	64.72	68.23	3.51

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
3. The total factor above 10GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (3m/1m) dB
   Above 10GHz T.F = AF + CL – AG – 9.54dB

- Measurement Data:

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5180MHz(Ch. 36)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
35.842	V	X axis	QP	38.66	-5.50	33.16	40.00	6.84
265.325	H	X axis	QP	49.84	-7.90	41.94	46.00	4.06
5149.950	V	Z axis	PK	53.37	9.06	62.43	74.00	11.57
5150.000	V	Z axis	AV	42.64	9.06	51.70	54.00	2.30
10360.100	H	Y axis	PK	52.76	5.53	58.29	68.23	9.94

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5200MHz(Ch. 40)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.054	V	X axis	QP	37.98	-5.60	32.38	40.00	7.62
264.985	H	X axis	QP	49.73	-7.90	41.83	46.00	4.17
5120.700	V	Z axis	PK	55.12	9.06	64.18	74.00	9.82
5119.250	V	Z axis	AV	41.35	9.06	50.41	54.00	3.59
10400.100	H	Y axis	PK	55.15	5.56	60.71	68.23	7.52

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5240MHz(Ch. 48)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.028	V	X axis	QP	37.90	-5.60	32.30	40.00	7.71
265.349	H	X axis	QP	48.98	-7.90	41.08	46.00	4.92
5381.250	V	Z axis	PK	46.81	9.49	56.30	74.00	17.70
5359.350	V	Z axis	AV	33.99	9.49	43.48	54.00	10.52
10480.600	V	Z axis	PK	54.15	5.64	59.79	68.23	8.44

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
3. The total factor above 10GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (3m/1m) dB
   Above 10GHz T.F = AF + CL – AG – 9.54dB

- Measurement Data:

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT40 & 5190MHz(Ch. 38)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.245	V	X axis	QP	38.94	-5.60	33.34	40.00	6.66
265.340	H	X axis	QP	49.74	-7.90	41.84	46.00	4.17
5147.800	V	Z axis	PK	62.62	9.06	71.68	74.00	2.32
5150.000	V	Z axis	AV	42.80	9.06	51.86	54.00	2.14
10380.500	V	Z axis	PK	56.56	5.53	62.09	68.23	6.14

30MHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT40 & 5230MHz(Ch. 46)*

Frequency (MHz)	ANT Pol	The worst case EUT Position	Detector	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36.200	V	X axis	QP	37.84	-5.60	32.24	40.00	7.76
265.325	H	X axis	QP	48.97	-7.90	41.07	46.00	4.94
5393.550	H	Z axis	PK	45.77	9.06	54.83	74.00	19.17
5389.350	H	Z axis	AV	33.48	9.06	42.54	54.00	11.46
10460.700	H	Y axis	PK	56.39	5.56	61.95	68.23	6.28

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
3. The total factor above 10GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.
   Distance extrapolation factor = 20 log (3m/1m) dB
   Above 10GHz T.F = AF + CL – AG – 9.54dB

3.2.7 AC Conducted Emissions

- Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) and average mode (AV) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

- Measurement Data: Comply

Note 1: See next pages for actual measured spectrum plots and data.

- Minimum Standard: FCC Part 15.207(a)/EN 55022

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

AC Line Conducted Emissions (Graph)

Test Mode: 802.11a

Digital EMC

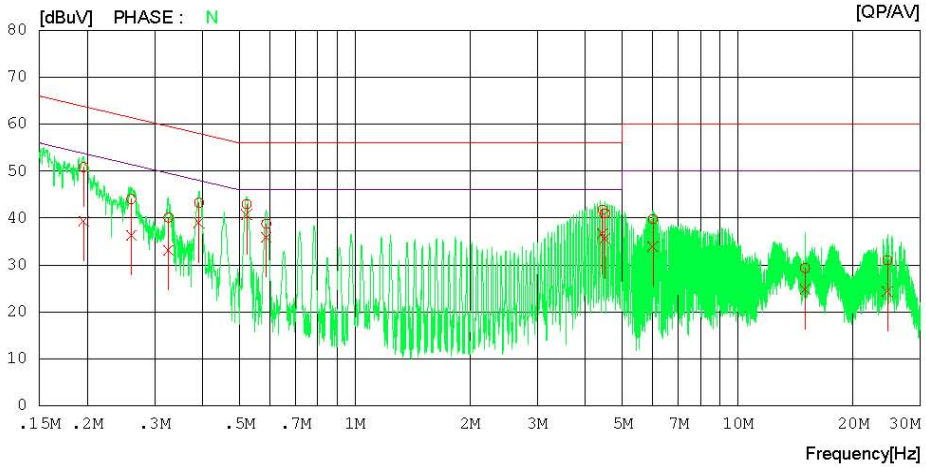
Results of Conducted Emission

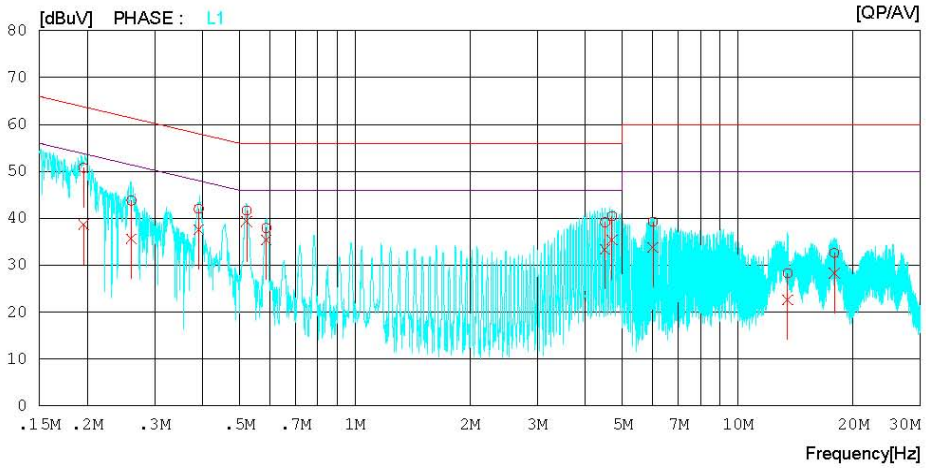
Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11a

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (Data List)

Test Mode: 802.11a

Digital EMC

Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11a

LIMIT : CISPR22_B QP
CISPR22_B 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	0.19581	50.7	39.2	0.1	50.8	39.3	63.8	53.8	13.0	14.5	N
2	0.26088	43.9	36.2	0.1	44.0	36.3	61.4	51.4	17.4	15.1	N
3	0.32599	40.0	33.0	0.1	40.1	33.1	59.6	49.6	19.5	16.5	N
4	0.39171	43.1	38.9	0.1	43.2	39.0	58.0	48.0	14.8	9.0	N
5	0.52193	42.8	40.6	0.1	42.9	40.7	56.0	46.0	13.1	5.3	N
6	0.58705	38.7	35.8	0.1	38.8	35.9	56.0	46.0	17.2	10.1	N
7	4.43550	41.4	36.2	0.4	41.8	36.6	56.0	46.0	14.2	9.4	N
8	4.50250	40.5	35.2	0.4	40.9	35.6	56.0	46.0	15.1	10.4	N
9	6.00250	39.4	33.4	0.4	39.8	33.8	60.0	50.0	20.2	16.2	N
10	15.00200	28.5	24.0	0.8	29.3	24.8	60.0	50.0	30.7	25.2	N
11	24.58900	30.0	23.4	1.0	31.0	24.4	60.0	50.0	29.0	25.6	N
12	0.19568	50.7	38.5	0.1	50.8	38.6	63.8	53.8	13.0	15.2	L1
13	0.26099	43.7	35.5	0.1	43.8	35.6	61.4	51.4	17.6	15.8	L1
14	0.39138	41.9	37.5	0.1	42.0	37.6	58.0	48.0	16.0	10.4	L1
15	0.52209	41.5	39.2	0.1	41.6	39.3	56.0	46.0	14.4	6.7	L1
16	0.58750	37.9	35.3	0.1	38.0	35.4	56.0	46.0	18.0	10.6	L1
17	4.50400	38.7	33.0	0.4	39.1	33.4	56.0	46.0	16.9	12.6	L1
18	4.69650	40.0	35.0	0.4	40.4	35.4	56.0	46.0	15.6	10.6	L1
19	6.00150	38.9	33.4	0.4	39.3	33.8	60.0	50.0	20.7	16.2	L1
20	13.50150	27.5	21.8	0.8	28.3	22.6	60.0	50.0	31.7	27.4	L1
21	17.87250	31.7	27.4	0.9	32.6	28.3	60.0	50.0	27.4	21.7	L1

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n HT20

Digital EMC

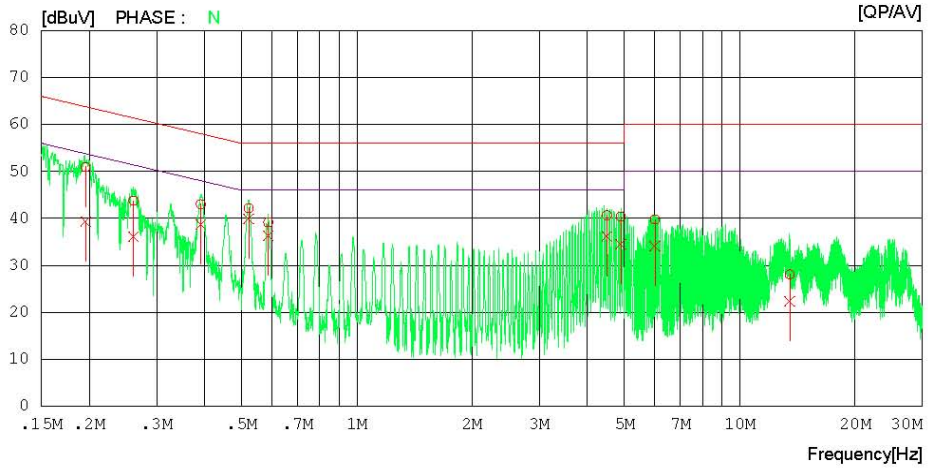
Results of Conducted Emission

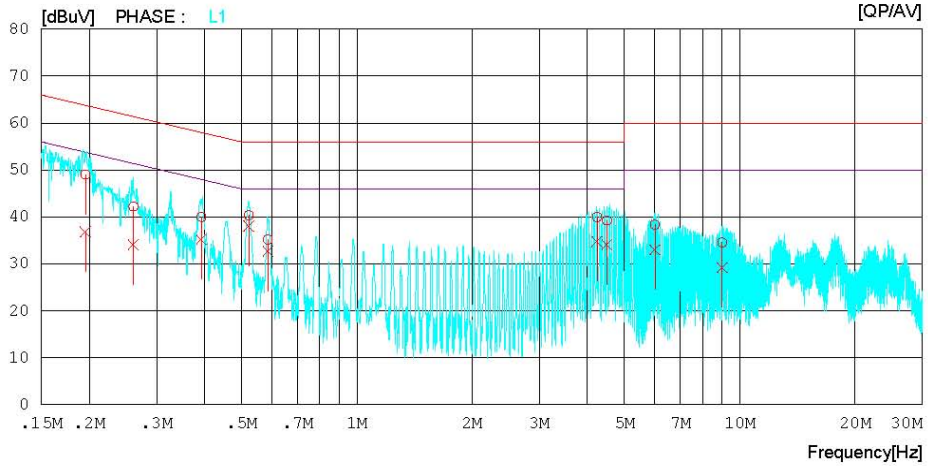
Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11n-HT20

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (Data List)

Test Mode: 802.11n HT20

Digital EMC

Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11n-HT20

LIMIT : CISPR22_B QP
CISPR22_B 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	0.19580	50.8	39.2	0.1	50.9	39.3	63.8	53.8	12.9	14.5	N
2	0.26095	43.7	36.0	0.1	43.8	36.1	61.4	51.4	17.6	15.3	N
3	0.39135	42.9	38.6	0.1	43.0	38.7	58.0	48.0	15.0	9.3	N
4	0.52176	42.1	39.8	0.1	42.2	39.9	56.0	46.0	13.8	6.1	N
5	0.58710	39.0	36.2	0.1	39.1	36.3	56.0	46.0	16.9	9.7	N
6	4.50050	40.2	35.7	0.4	40.6	36.1	56.0	46.0	15.4	9.9	N
7	4.89250	40.0	34.1	0.4	40.4	34.5	56.0	46.0	15.6	11.5	N
8	6.00150	39.4	33.7	0.4	39.8	34.1	60.0	50.0	20.2	15.9	N
9	13.50400	27.3	21.6	0.8	28.1	22.4	60.0	50.0	31.9	27.6	N
10	0.19550	48.9	36.8	0.1	49.0	36.9	63.8	53.8	14.8	16.9	L1
11	0.26100	42.1	34.0	0.1	42.2	34.1	61.4	51.4	19.2	17.3	L1
12	0.39250	39.9	35.1	0.1	40.0	35.2	58.0	48.0	18.0	12.8	L1
13	0.52199	40.3	38.0	0.1	40.4	38.1	56.0	46.0	15.6	7.9	L1
14	0.58580	35.1	32.6	0.1	35.2	32.7	56.0	46.0	20.8	13.3	L1
15	4.24050	39.6	34.3	0.4	40.0	34.7	56.0	46.0	16.0	11.3	L1
16	4.50300	38.8	33.7	0.4	39.2	34.1	56.0	46.0	16.8	11.9	L1
17	6.00150	38.0	32.6	0.4	38.4	33.0	60.0	50.0	21.6	17.0	L1
18	9.00350	34.0	28.6	0.6	34.6	29.2	60.0	50.0	25.4	20.8	L1

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n HT40

Digital EMC

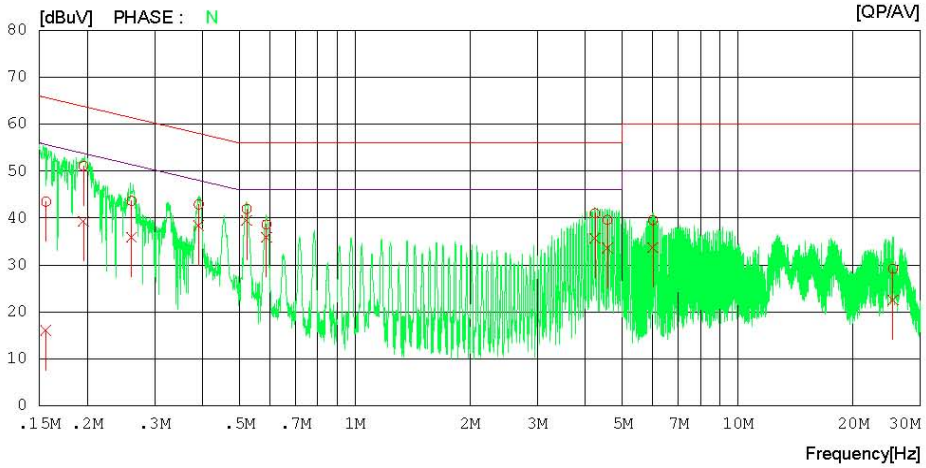
Results of Conducted Emission

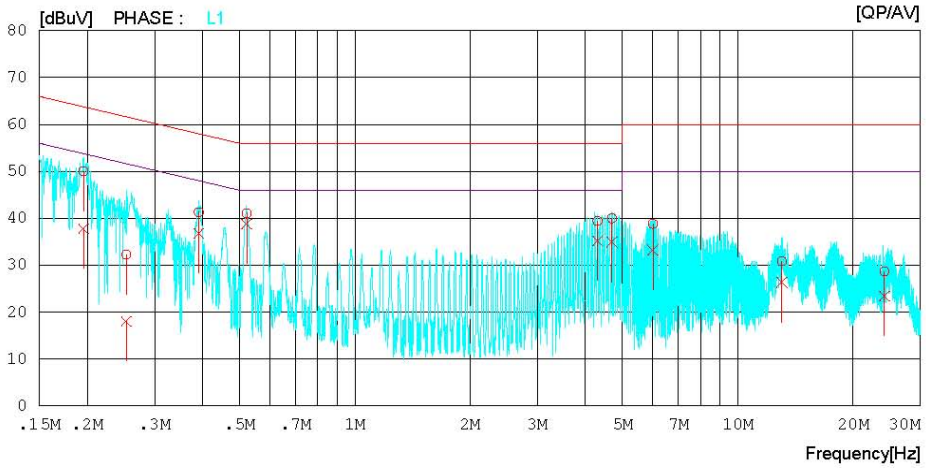
Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11n-HT40

LIMIT : CISPR22_B QP
CISPR22_B AV





AC Line Conducted Emissions (Data List)

Test Mode: 802.11n HT40

Digital EMC

Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	:	TWFM-B005D	Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	:	Identical prototype	Temp/Humi.	:	24 'C 42 % R.H.
Test Condition	:	TX	Operator	:	S.K.RYU

Memo : 5.1GHz / 802.11n-HT40

LIMIT : CISPR22_B QP
CISPR22_B 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	0.15615	43.4	16.0	0.1	43.5	16.1	65.7	55.7	22.2	39.6	N
2	0.19561	51.0	39.1	0.1	51.1	39.2	63.8	53.8	12.7	14.6	N
3	0.26109	43.5	35.8	0.1	43.6	35.9	61.4	51.4	17.8	15.5	N
4	0.39125	42.8	38.3	0.1	42.9	38.4	58.0	48.0	15.1	9.6	N
5	0.52199	41.8	39.4	0.1	41.9	39.5	56.0	46.0	14.1	6.5	N
6	0.58765	38.5	35.8	0.1	38.6	35.9	56.0	46.0	17.4	10.1	N
7	4.24050	40.6	35.3	0.4	41.0	35.7	56.0	46.0	15.0	10.3	N
8	4.56850	39.2	33.2	0.4	39.6	33.6	56.0	46.0	16.4	12.4	N
9	6.00200	39.1	33.3	0.4	39.5	33.7	60.0	50.0	20.5	16.3	N
10	25.43650	28.0	21.5	1.1	29.1	22.6	60.0	50.0	30.9	27.4	N
11	0.19570	49.9	37.7	0.1	50.0	37.8	63.8	53.8	13.8	16.0	L1
12	0.25300	32.2	18.0	0.1	32.3	18.1	61.7	51.7	29.4	33.6	L1
13	0.39135	41.2	36.7	0.1	41.3	36.8	58.0	48.0	16.7	11.2	L1
14	0.52215	41.0	38.7	0.1	41.1	38.8	56.0	46.0	14.9	7.2	L1
15	4.30500	39.0	34.8	0.4	39.4	35.2	56.0	46.0	16.6	10.8	L1
16	4.69750	39.6	34.5	0.4	40.0	34.9	56.0	46.0	16.0	11.1	L1
17	6.00250	38.4	32.9	0.4	38.8	33.3	60.0	50.0	21.2	16.7	L1
18	13.04400	30.0	25.6	0.8	30.8	26.4	60.0	50.0	29.2	23.6	L1
19	24.13900	27.7	22.4	1.0	28.7	23.4	60.0	50.0	31.3	26.6	L1

3.2.8 Antenna Requirements

- Procedure:

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

- Conclusion: Comply

The antenna is permanently attached by soldering. (Refer to Internal Photo file.)

- Minimum Standard:

> An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

APPENDIX

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☐	Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
☒	Spectrum Analyzer	Rohde Schwarz	FSQ26	11/01/11	12/01/11	200445
☐	Spectrum analyzer	Agilent	E4404B	11/03/08	12/03/08	US41061134
☐	Spectrum Analyzer(RE)	H.P	8563E	11/10/04	12/10/04	3551A04634
☒	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	11/01/07	12/01/07	MY49100833
☐	Power Meter	H.P	EPM-442A	11/07/01	12/07/01	GB37170413
☐	Power Sensor	H.P	8481A	11/07/01	12/07/01	3318A96332
☐	Wideband Power Sensor	Rohde Schwarz	NRP-Z81	11/06/04/	12/06/04	1137.9009.02-101001
☐	Power Divider	Agilent	11636B	11/09/30	12/09/30	56471
☐	4-Way Power Divider	ET Industries	D-0526-4	10/12/24	11/12/24	210195001
☐	Power Splitter	Anritsu	K241B	11/09/30	12/09/30	020611
☐	Power Splitter	Anritsu	K241B	11/07/01	12/07/01	017060
☐	Power Splitters & Dividers	Aeroflex/Weinschel	1594	11/02/21	12/02/21	1177
☐	Frequency Counter	H.P	5342A	11/07/01	12/07/01	2119A04450
☒	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	11/09/30	12/09/30	30604493/021031
☒	Digital Multimeter	H.P	34401A	11/03/07	12/03/07	3146A13475, US36122178
☐	Multifunction Synthesizer	HP	8904A	11/10/06	12/10/06	3633A08404
☒	Signal Generator	Rohde Schwarz	SMR20	11/03/08	12/03/08	101251
☐	Signal Generator	H.P	ESG-3000A	11/07/01	12/07/01	US37230529
☐	Vector Signal Generator	Rohde Schwarz	SMJ100A	11/01/11	12/01/11	100148
☐	Vector Signal Generator	Rohde Schwarz	SMBV100A	11/01/11	12/01/11	255571
☐	Audio Analyzer	H.P	8903B	11/07/02	12/07/02	3011A09448
☐	Modulation Analyzer	H.P	8901B	11/07/01	12/07/01	3028A03029
☐	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	11/03/07	12/03/07	GB43461134
☐	Universal Radio communication Tester	Rohde Schwarz	CMU200	11/03/07	12/03/07	106760
☐	Bluetooth Tester	TESCOM	TC-3000B	11/07/01	12/07/01	3000B000268
☐	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-3
☒	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-2
☐	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-4
☐	AC Power supply	DAEKWANG	5KVA	11/03/08	12/03/08	20060321-1
☒	DC Power Supply	HP	6622A	11/03/07	12/03/07	3448A03760
☐	DC Power Supply	HP	6633A	11/03/07	12/03/07	3524A06634
☐	DC Power Supply	Protek	PWS-3010D	11/09/30	12/09/30	4072702
☐	DC Power Supply	SM techno	SDP30-5D	11/05/20	12/05/20	305DKA013
☐	BAND Reject Filter	Microwave Circuits	N0308372	11/09/30	12/09/30	3125-01DC0352
☐	BAND Reject Filter	Wainwright	WRCG1750	11/09/30	12/09/30	2
☐	High-Pass Filter	ANRITSU	MP526D	11/09/30	12/09/30	M27756

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☐	High-pass filter	Wainwright	WHNX2.1	11/09/30	12/09/30	1
☐	High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
☐	High-pass filter	Wainwright	WHNX5.0	11/09/19	12/09/19	8
☒	High-Pass Filter	Wainwright	WHKX8.5	11/09/19	12/09/19	1
☐	High-Pass Filter	Wainwright	WHKX1.0	11/09/30	12/09/30	9
☐	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
☐	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40-10SSK	N/A	N/A	53
☐	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
☒	HORN ANT	ETS	3115	11/09/06	12/09/06	21097
☐	HORN ANT	ETS	3115	11/03/22	12/03/22	6419
☒	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
☐	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	155
☒	HORN ANT	SCHWARZBECK	BBHA9120A	10/04/13	12/04/13	322
☐	Dipole Antenna	Schwarzbeck	VHA9103	10/11/29	11/11/29	2116
☐	Dipole Antenna	Schwarzbeck	VHA9103	10/11/29	11/11/29	2117
☐	Dipole Antenna	Schwarzbeck	UHA9105	10/11/29	11/11/29	2261
☐	Dipole Antenna	Schwarzbeck	UHA9105	10/11/29	11/11/29	2262
☒	LOOP Antenna	ETS	6502	10/10/29	12/10/29	3471
☐	Coaxial Fixed Attenuators	Agilent	8491B	11/07/02	12/07/02	MY39260700
☒	Attenuator (3dB)	WEINSCHEL	56-3	11/09/30	12/09/30	Y2342
☐	Attenuator (3dB)	WEINSCHEL	56-3	11/09/30	12/09/30	Y2370
☐	Attenuator (10dB)	WEINSCHEL	23-10-34	11/09/30	12/09/30	BP4386
☐	Attenuator (10dB)	WEINSCHEL	23-10-34	11/01/11	12/01/11	BP4387
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	11/09/30	12/09/30	446
☐	Attenuator (10dB)	WEINSCHEL	86-10-11	11/09/30	12/09/30	408
☐	Attenuator (20dB)	WEINSCHEL	86-20-11	11/09/30	12/09/30	432
☐	Attenuator (30dB)	JFW	50FH-030-300	11/03/07	12/03/07	060320-1
☐	Attenuator (40dB)	WEINSCHEL	57-40-33	11/09/30	12/09/30	NN837
☐	Termination	H.P	HP-909D	11/07/02	12/07/02	02750
☐	Termination	H.P	HP-909D	11/07/02	12/07/02	02702
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	11/07/01	12/07/01	788
☐	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	11/07/01	12/07/01	790
☐	Amplifier (30dB)	Agilent	8449B	11/03/07	12/03/07	3008A01590
☒	Amplifier (30dB)	H.P	8449B	11/03/07	12/03/07	3008A00370
☐	Amplifier	EMPOWER	BBS3Q7ELU	11/09/30	12/09/30	1020
☐	RF Power Amplifier	OPHIRRF	5069F	11/07/01	12/07/01	1006
☒	EMI TEST RECEIVER	R&S	ESU	11/01/20	12/01/20	100014

	Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
☒	BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
☒	Amplifier (22dB)	H.P	8447E	11/01/11	12/01/11	2945A02865
☐	EMI TEST RECEIVER	R&S	ESCI	11/03/08	12/03/08	100364
☐	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/11/29	11/11/29	91032789
☐	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/11/29	12/11/29	1098
☐	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
☐	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/07/07	12/07/07	0590
☒	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	11/03/07	12/03/07	1252741
☐	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	11/01/11	12/01/11	1518831
☒	Amplifier (25dB)	Agilent	8447D	11/03/07	12/03/07	2944A10144
☐	Amplifier (25dB)	Agilent	8447D	11/07/01	12/07/01	2648A04922
☒	Spectrum Analyzer(CE)	H.P	8591E	11/03/07	12/03/07	3649A05889
☒	LISN	Kyoritsu	KNW-407	11/01/11	12/01/11	8-317-8
☒	LISN	Kyoritsu	KNW-242	11/07/02	12/07/02	8-654-15
☒	CVCF	NF Electronic	4420	11/03/08	12/03/08	304935/337980
☒	50 ohm Terminator	HME	CT-01	11/01/11	12/01/11	N/A
☒	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	11/07/02	12/07/02	4N-170-3
☐	Wideband Radio Communication Tester	R&S	CMW500	11/09/30	12/09/30	100989