

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

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of Digital EMC Co., Ltd.

Tested by:

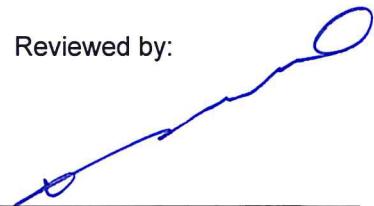


Engineer
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Witnessed by:

N/A

Reviewed by:



Manager
W.J. Lee

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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 $4 + 10\log_{10}(B)$ 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
15.203	Antenna Requirements	FCC 15.203	-	C
<p>Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable</p> <p>Note 2: This test item was performed in each axis and the worst case data were reported.</p>				

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

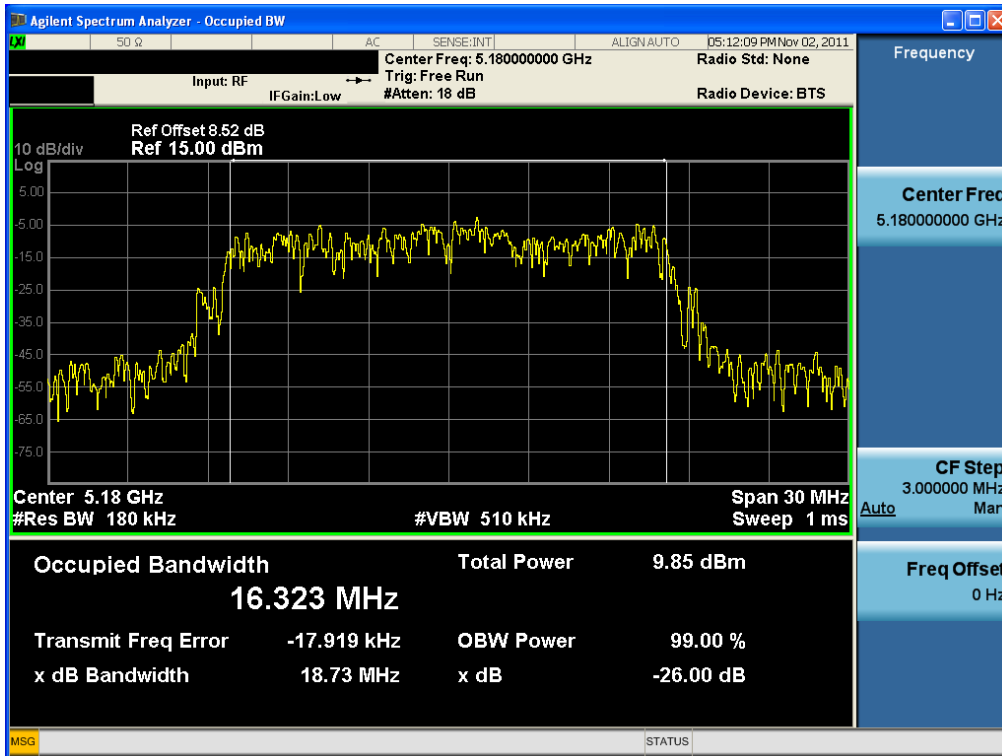
Note 1: The worst case plots in both chains are attached on next page.

- Minimum Standard:

The minimum 26 dB bandwidth shall be at least 500 kHz

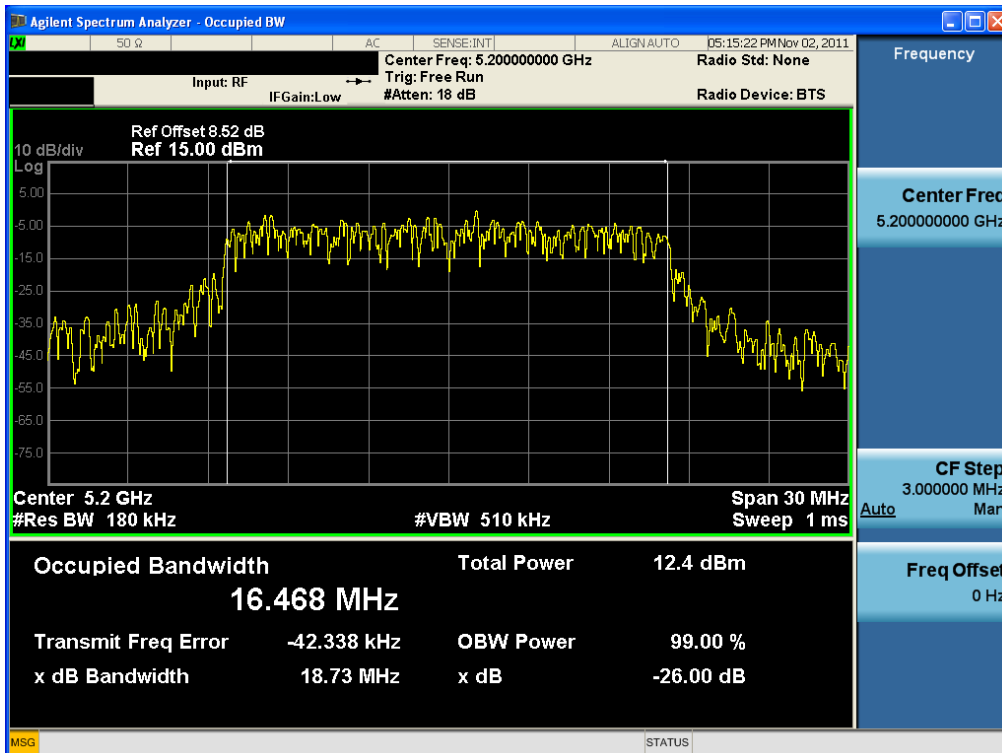
26 dB and 99% Bandwidth

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



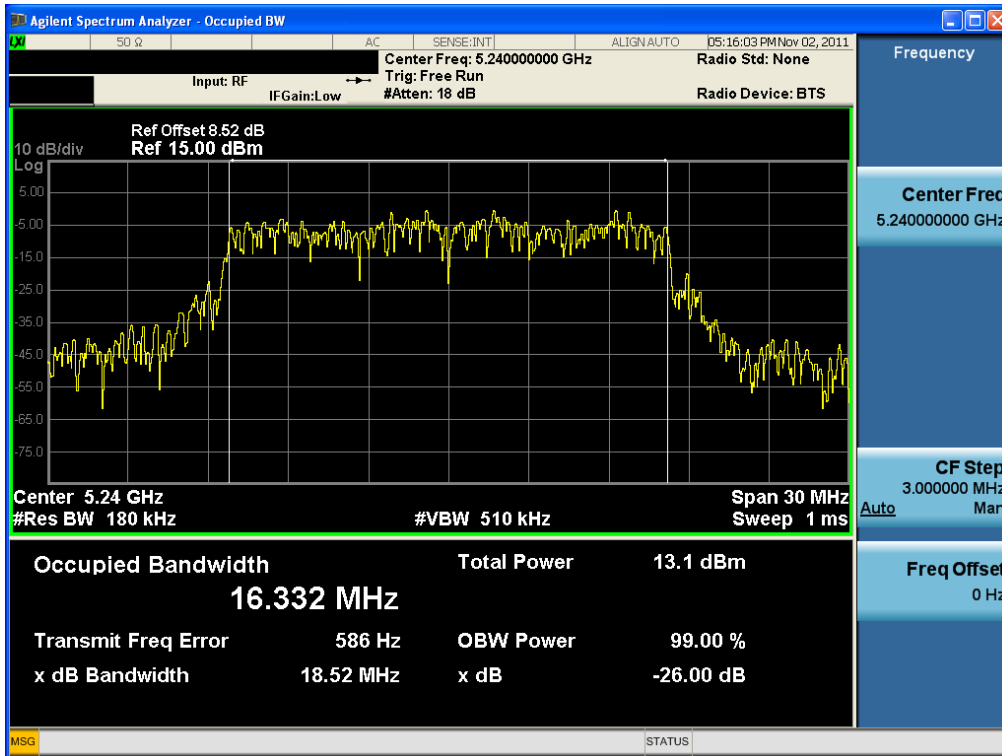
26 dB and 99% Bandwidth

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



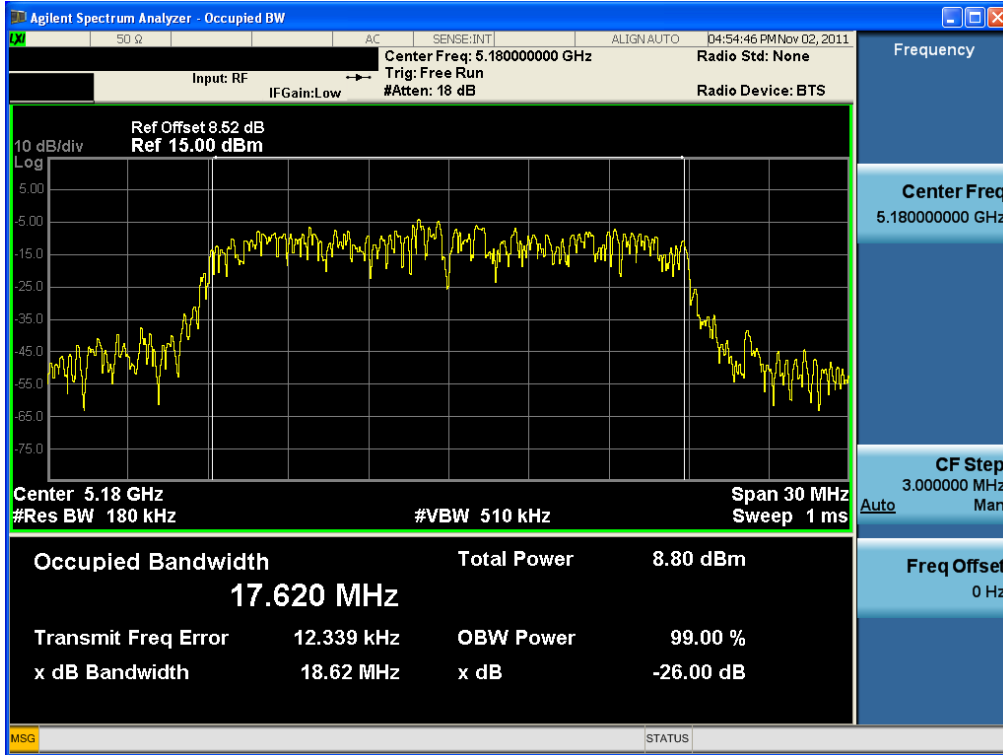
26 dB and 99% Bandwidth

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



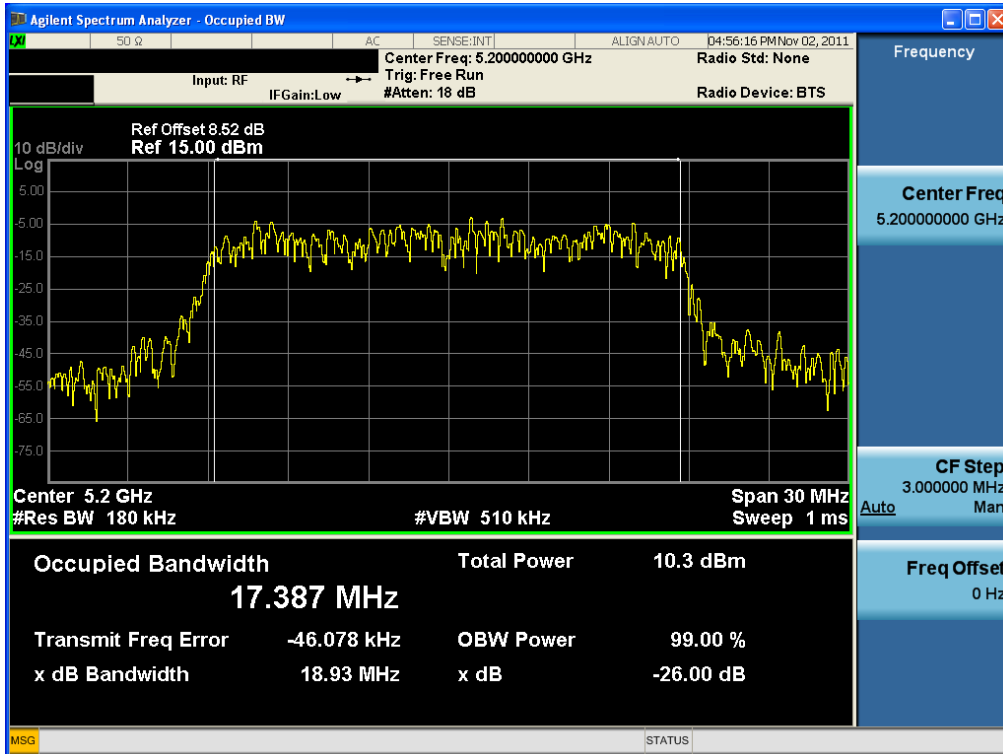
26 dB and 99% Bandwidth

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



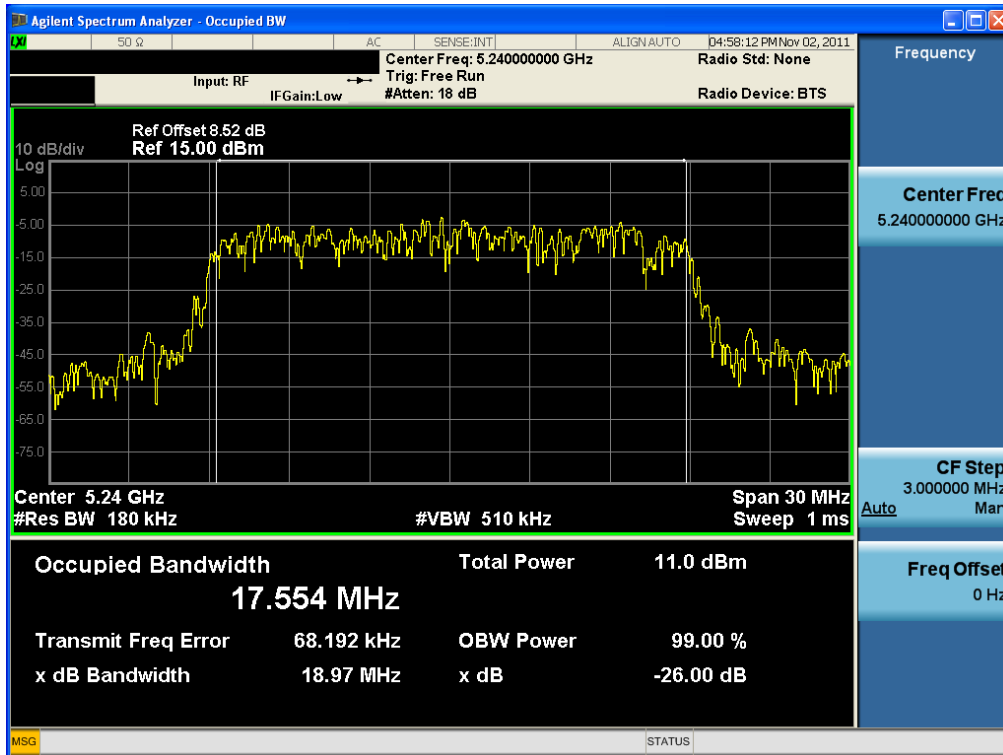
26 dB and 99% Bandwidth

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



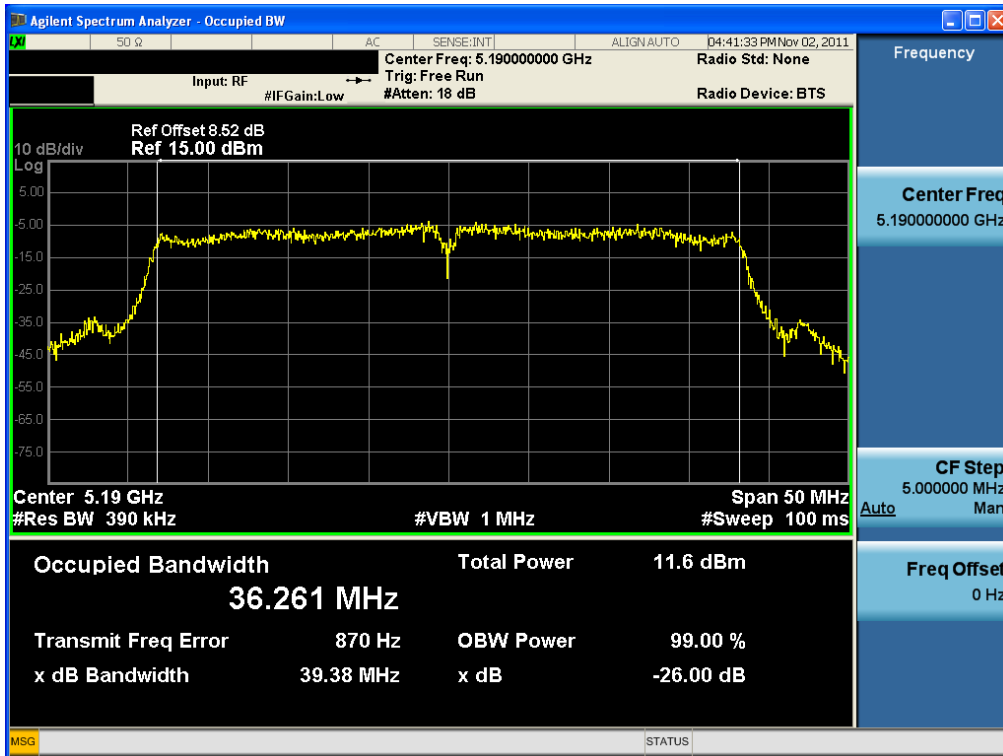
26 dB and 99% Bandwidth

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



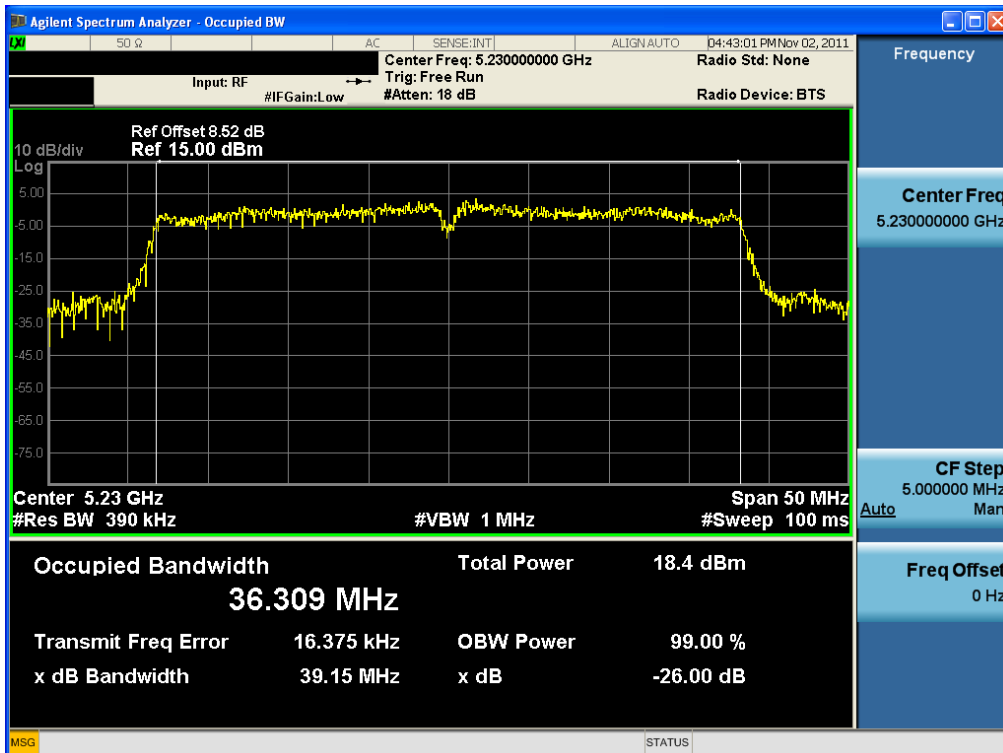
26 dB and 99% Bandwidth

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, Subpart 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 = $10 \log\left(10^{\left(\frac{\text{chain 0}}{10}\right)} + 10^{\left(\frac{\text{chain 1}}{10}\right)}\right)$

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

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

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.

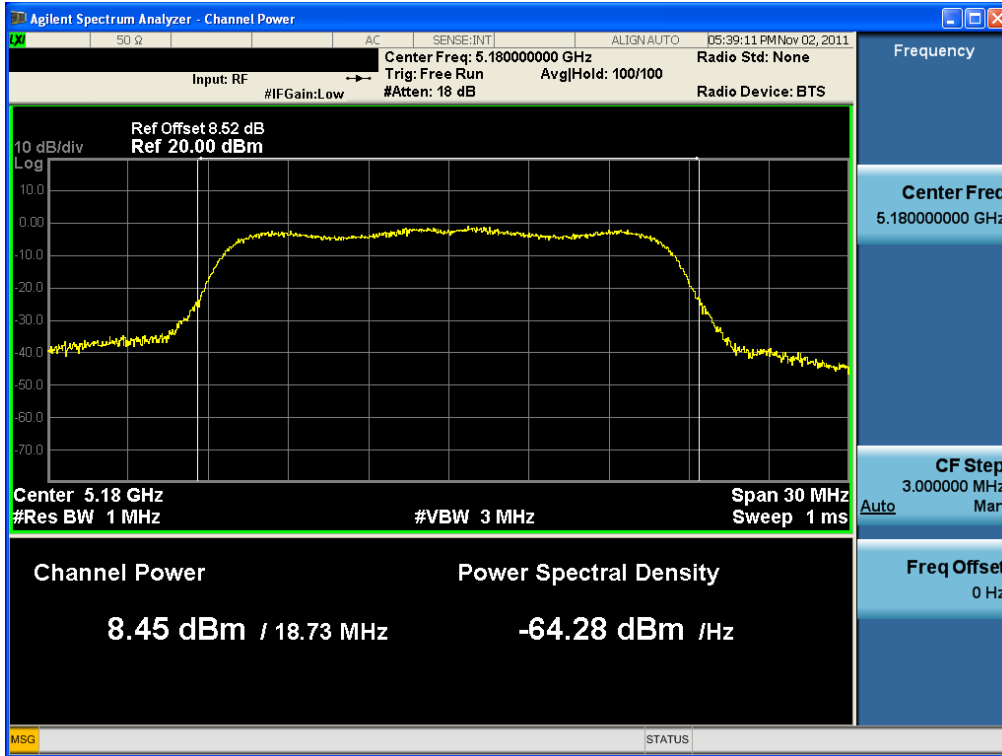
Mode	26dB BW (MHz)	Limit 1 (dBm)		Limit 2 (dBm)	
		50mW	Corrected (-0.76dB)	4dbm + 10log(26dB BW)	Corrected (-0.76dB)
802.11a	18.73	16.99	16.23	16.73	15.97 ^{Note 1}
802.11n HT20	18.97	16.99	16.23	16.78	16.02 ^{Note 1}
802.11n HT40	39.38	16.99	16.23 ^{Note 1}	19.95	19.19

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.
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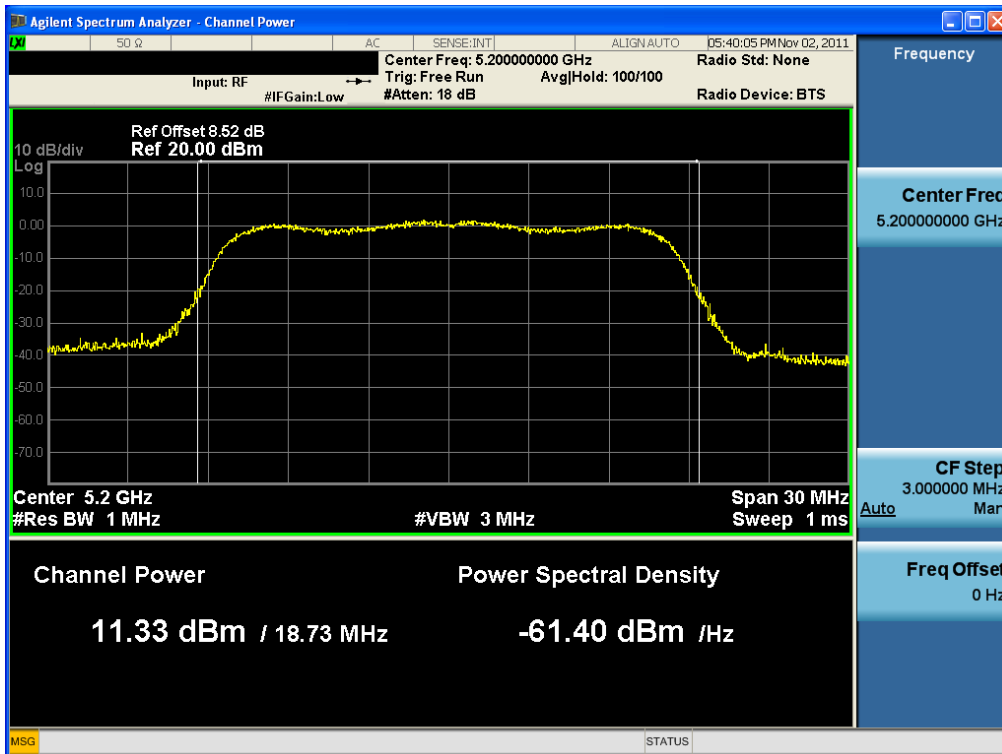
Output Power

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



Output Power

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



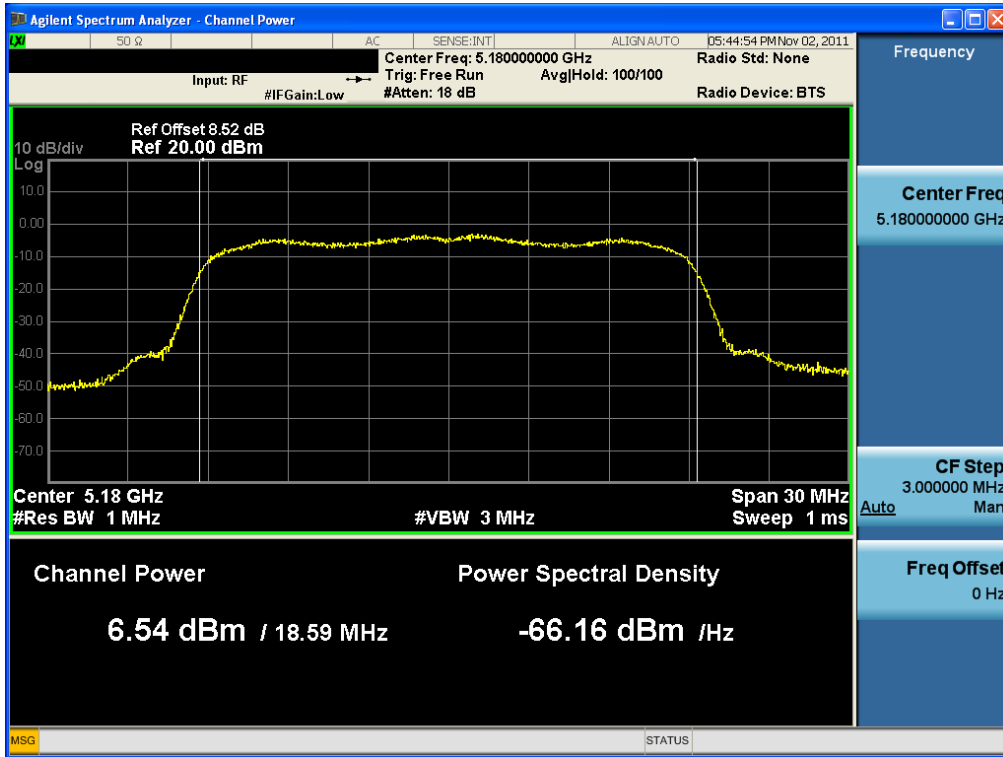
Output Power

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



Output Power

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



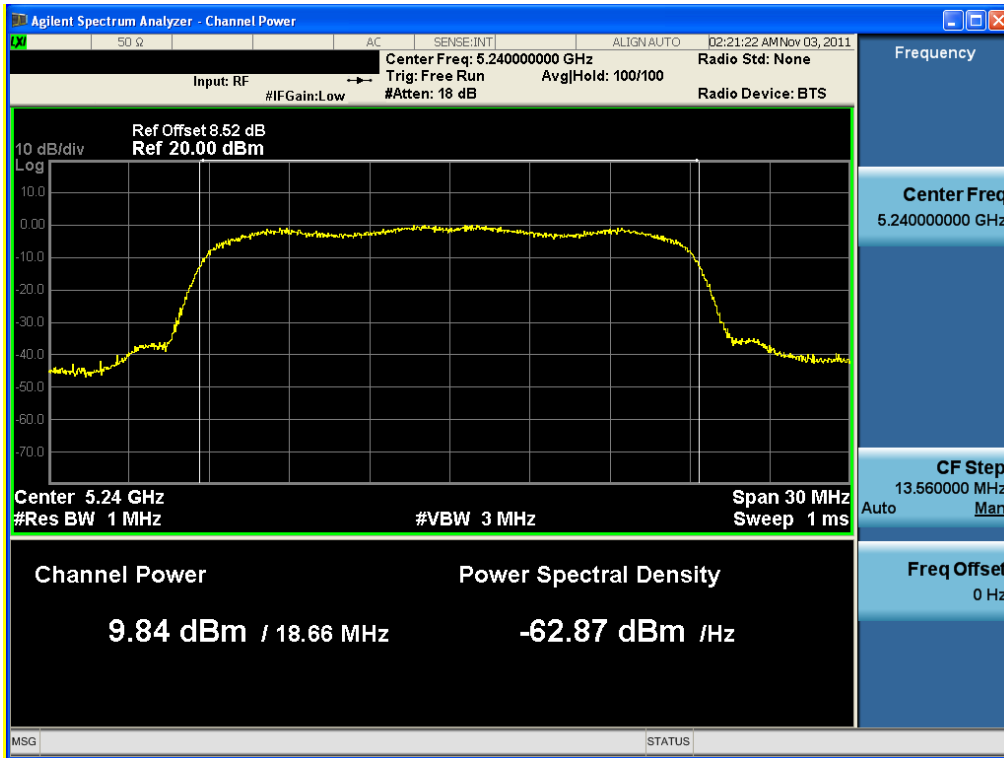
Output Power

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



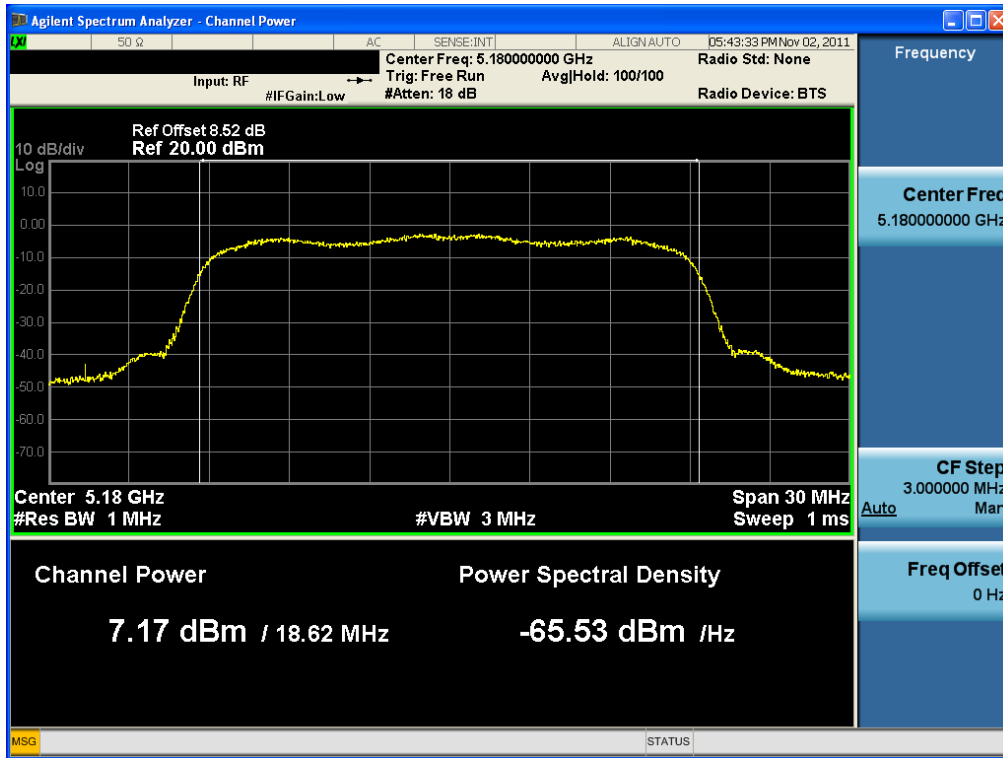
Output Power

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



Output Power

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



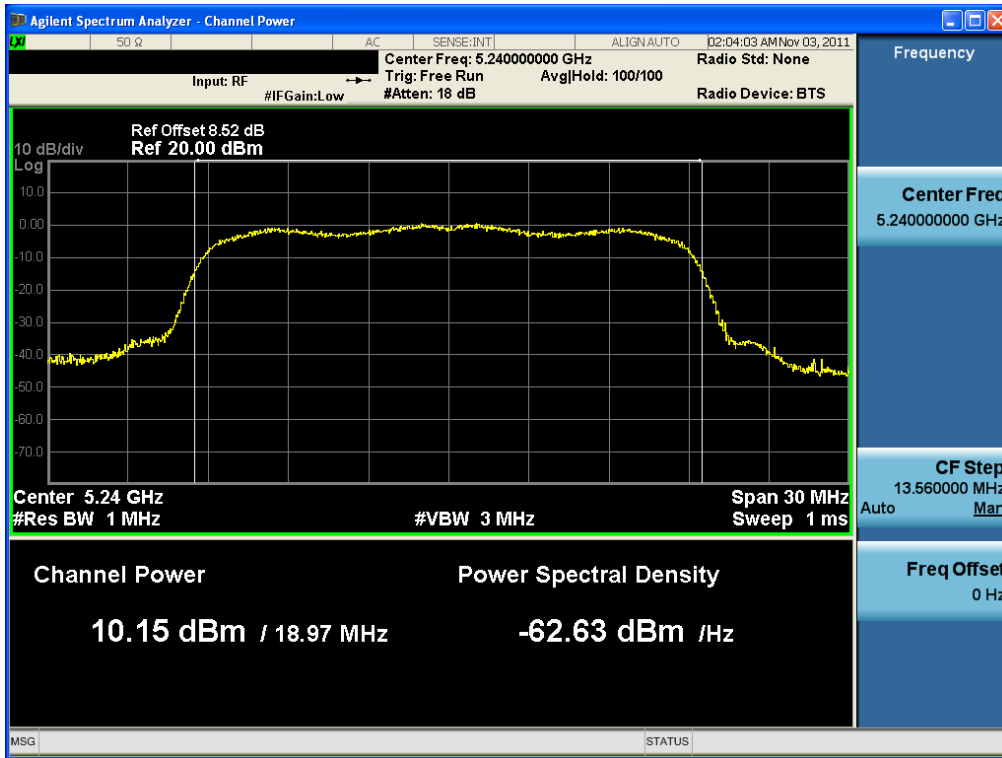
Output Power

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



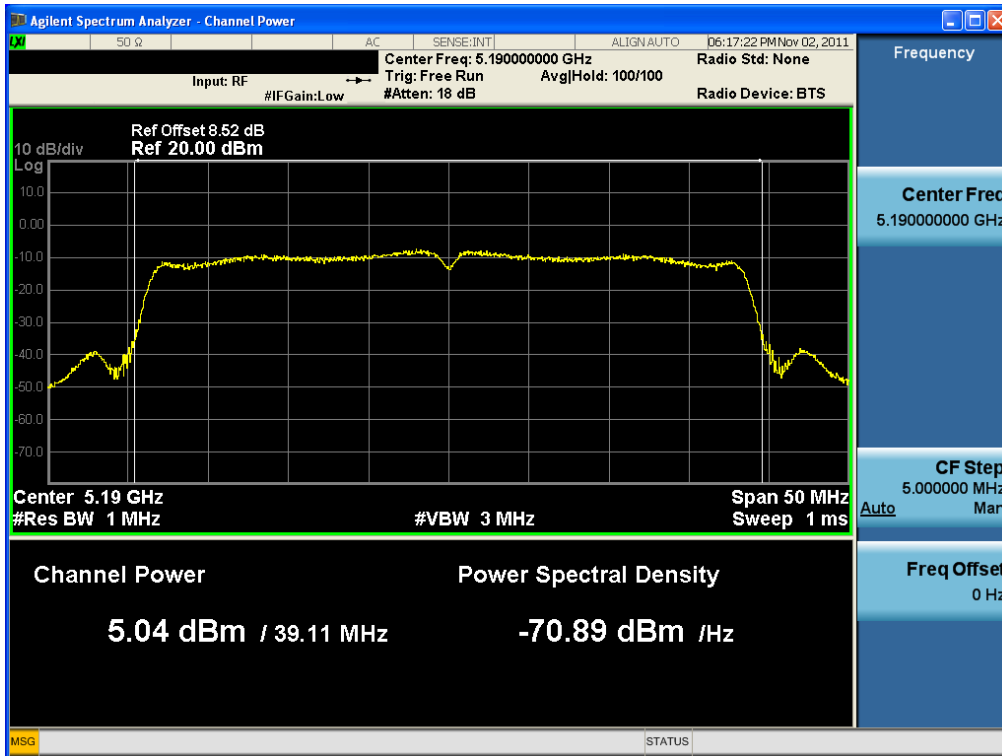
Output Power

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.

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

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

- Calculation of limit

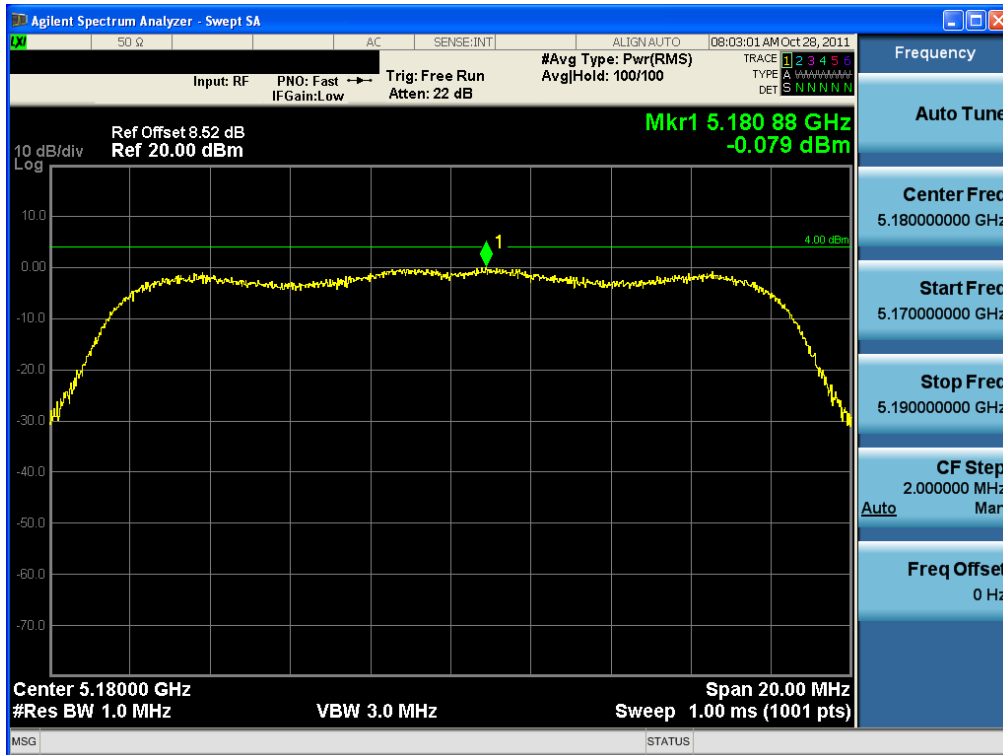
The limit shall be reduced by the amount in dB that the directional gain of the antenna of the antenna exceeds 6dBi.

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.
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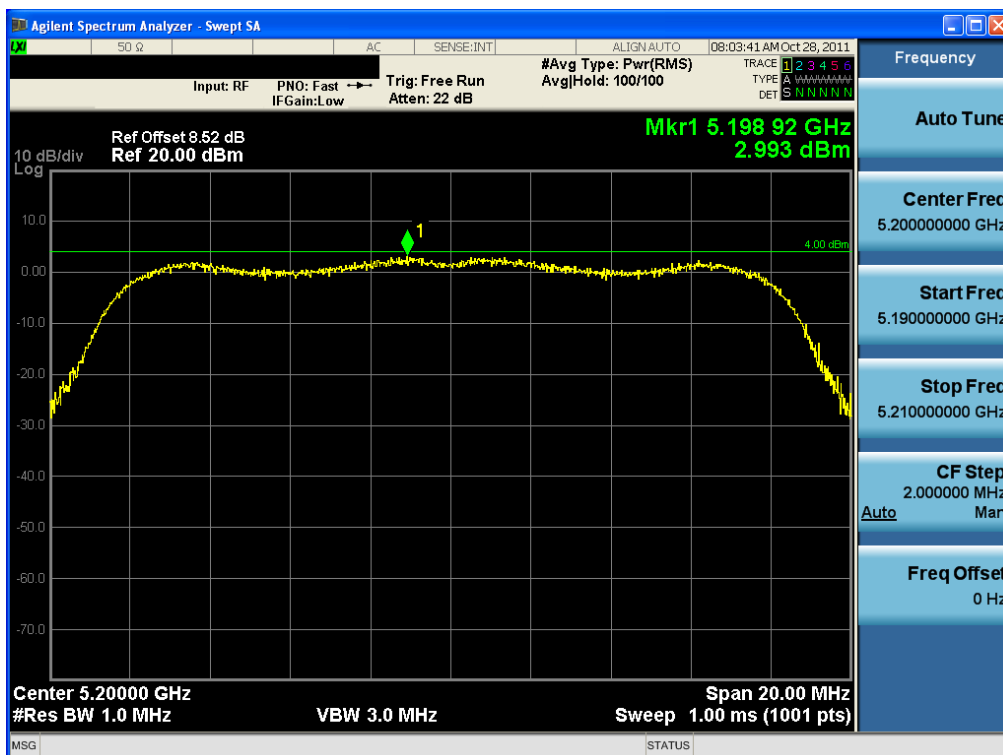
Peak Power Spectral Density

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



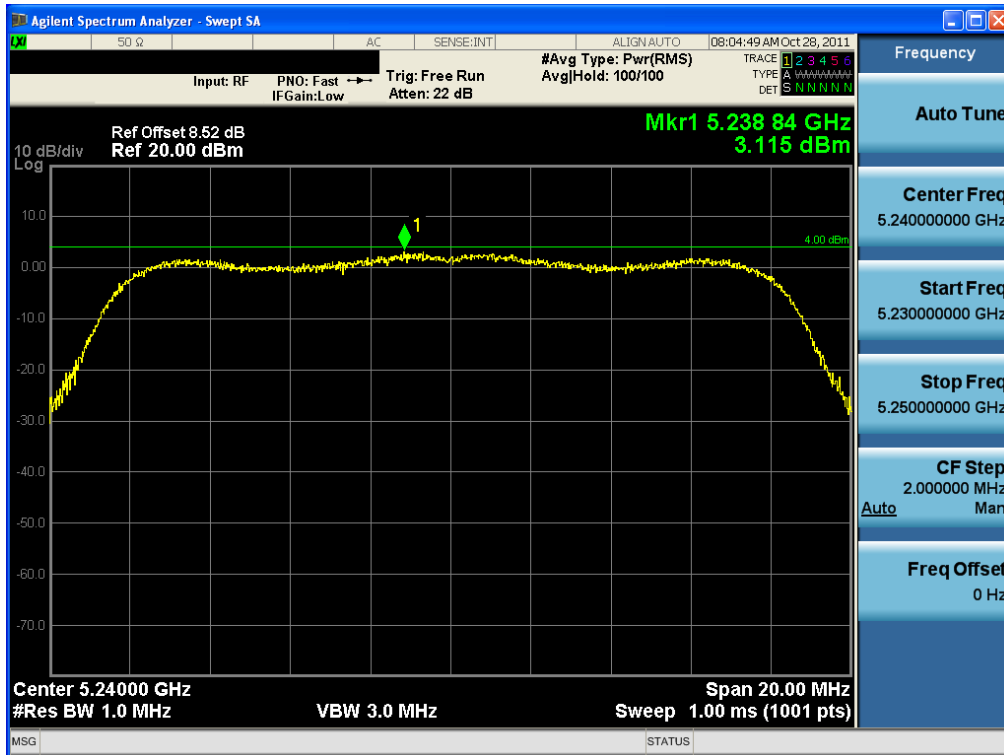
Peak Power Spectral Density

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



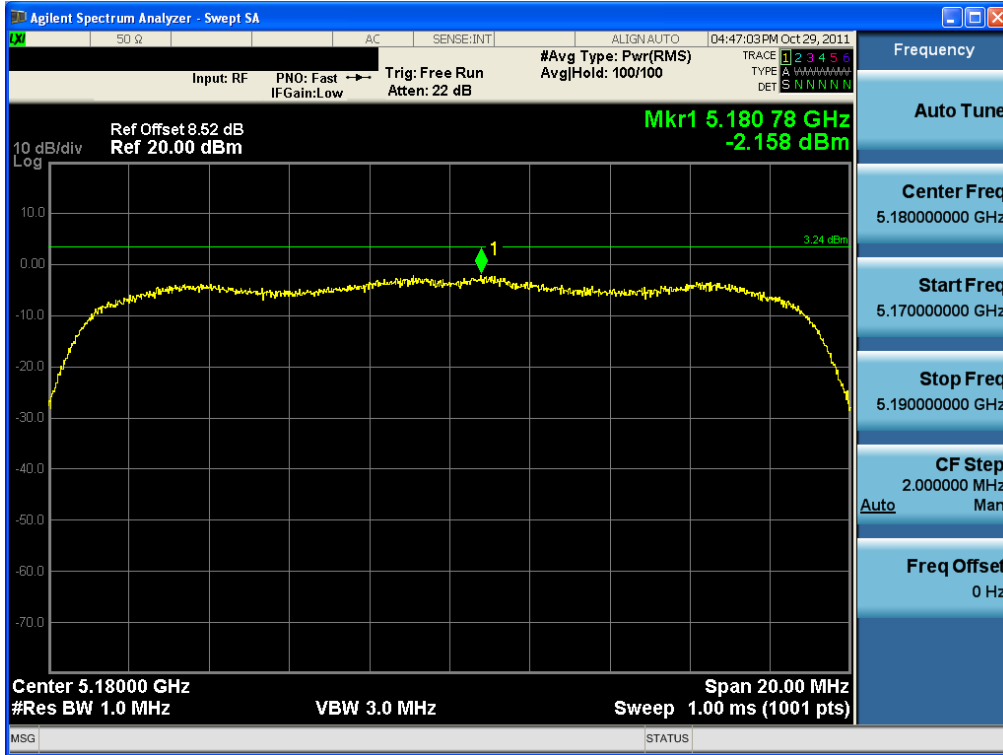
Peak Power Spectral Density

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



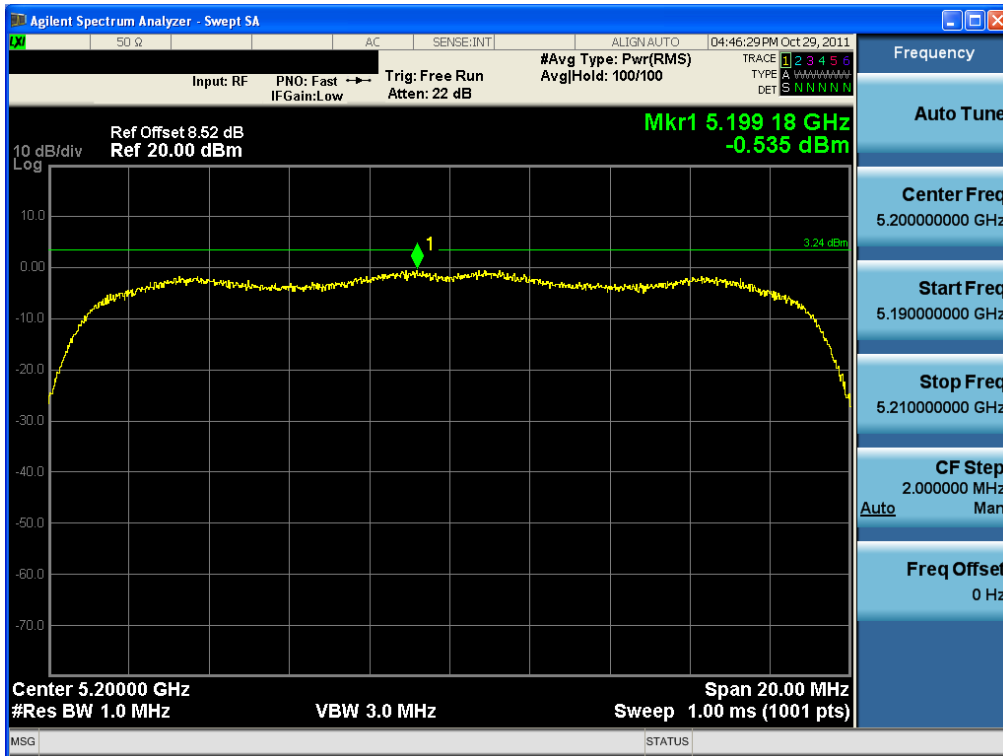
Peak Power Spectral Density

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



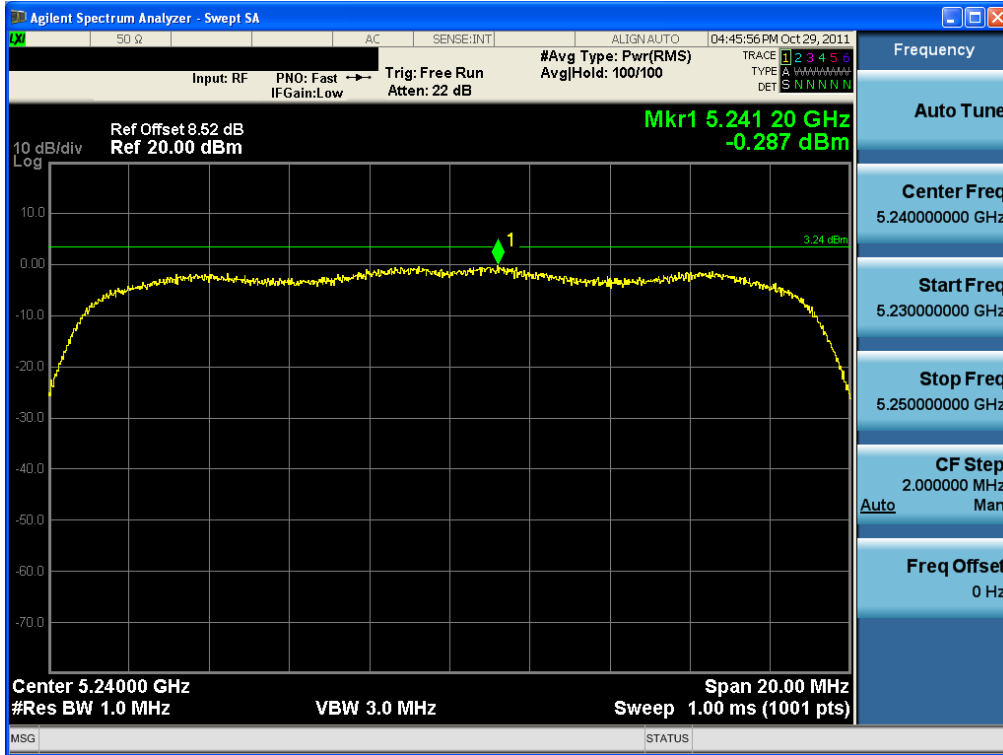
Peak Power Spectral Density

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



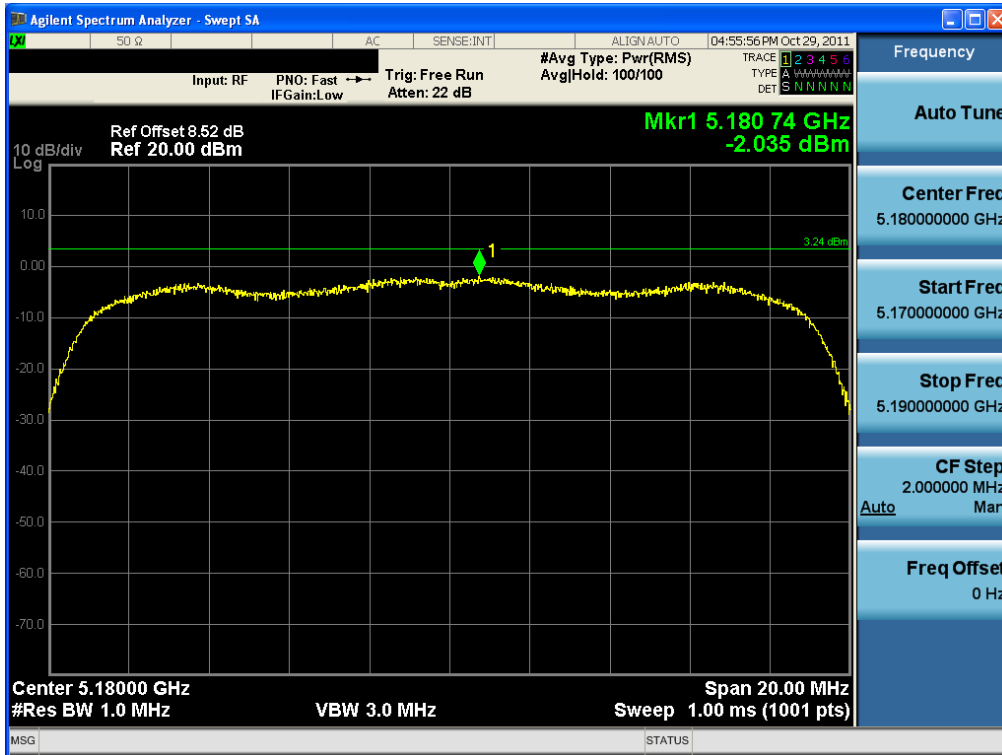
Peak Power Spectral Density

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



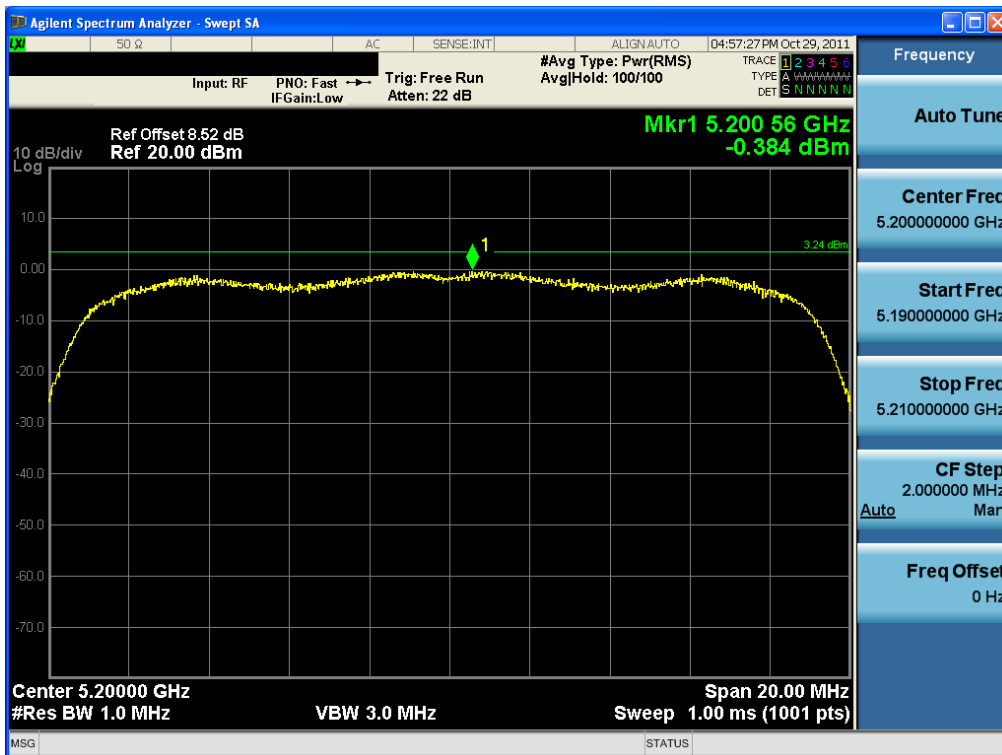
Peak Power Spectral Density

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



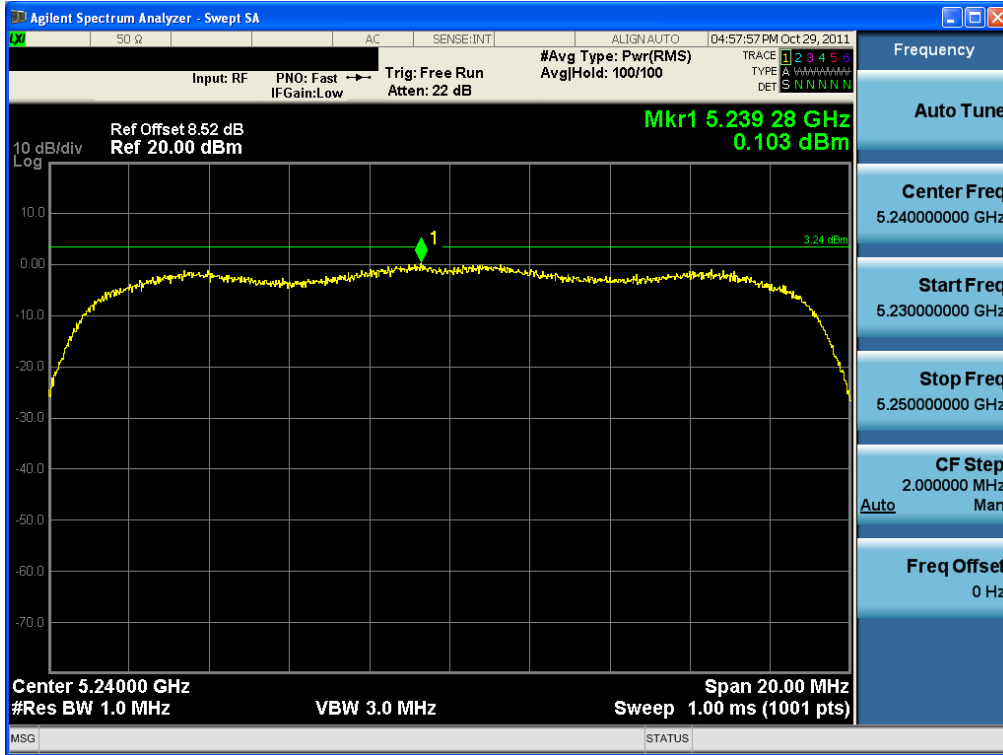
Peak Power Spectral Density

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



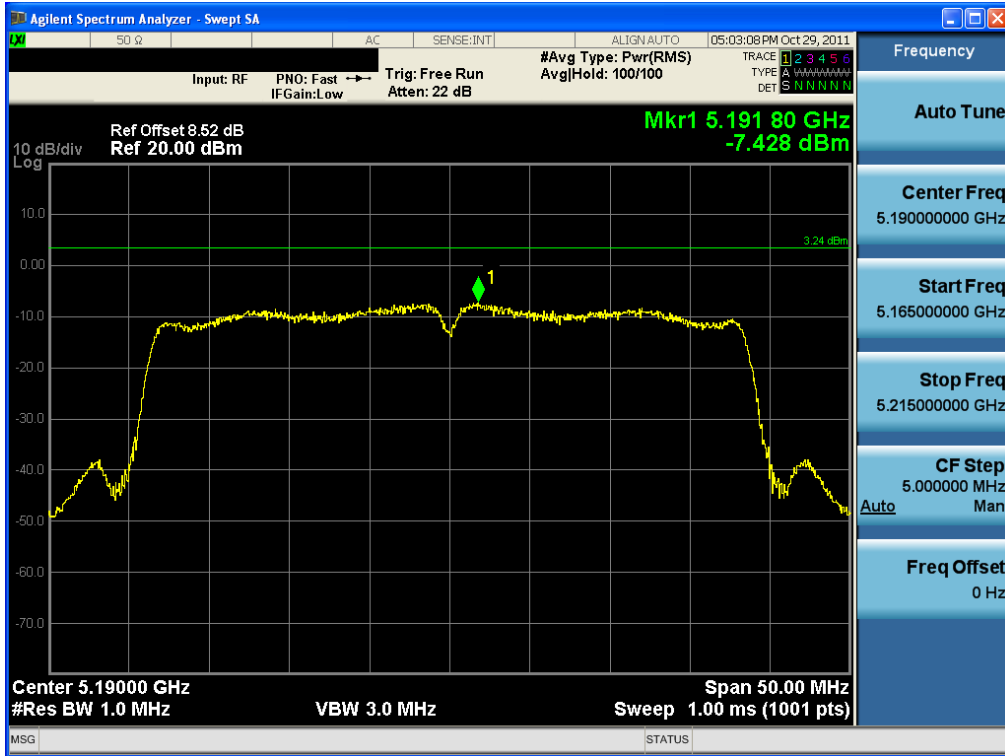
Peak Power Spectral Density

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



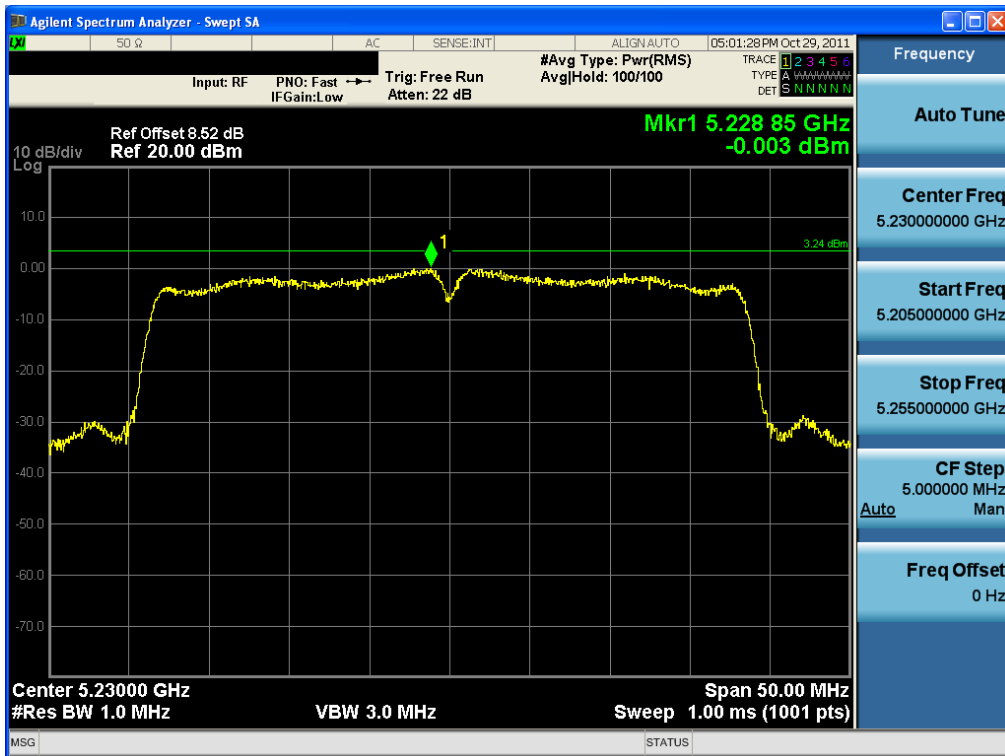
Peak Power Spectral Density

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



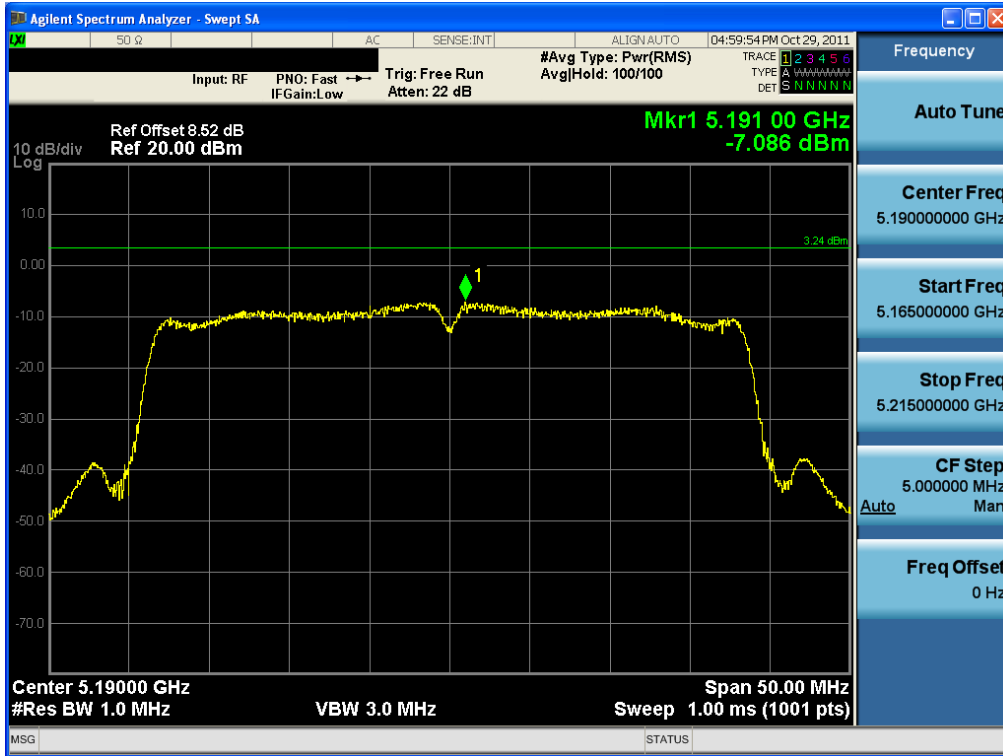
Peak Power Spectral Density

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



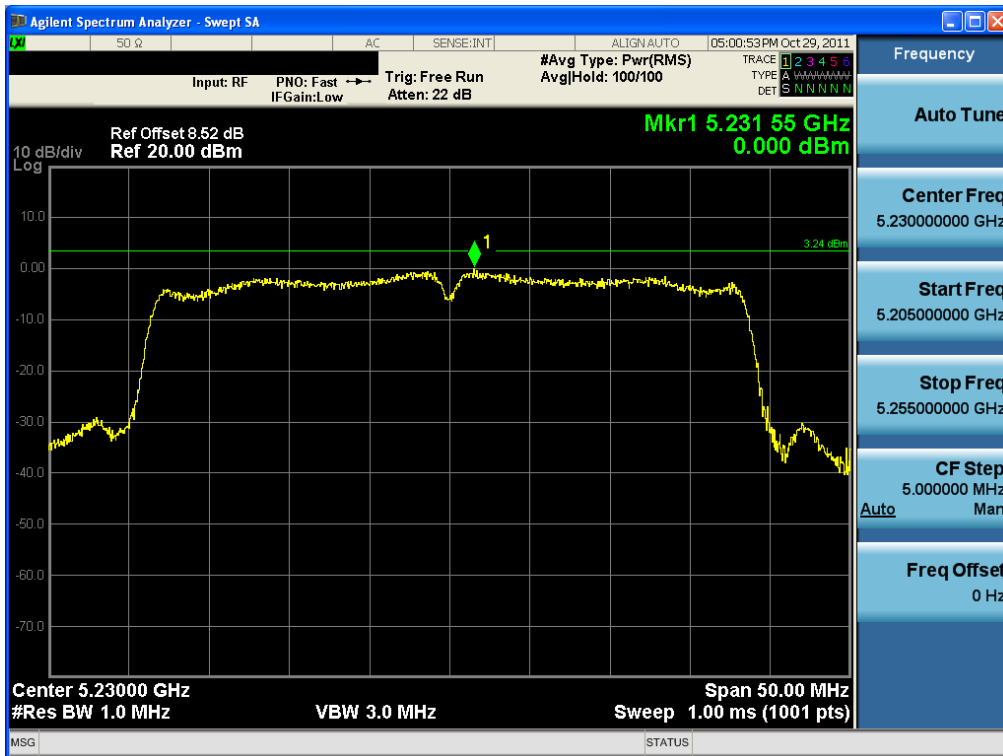
Peak Power Spectral Density

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

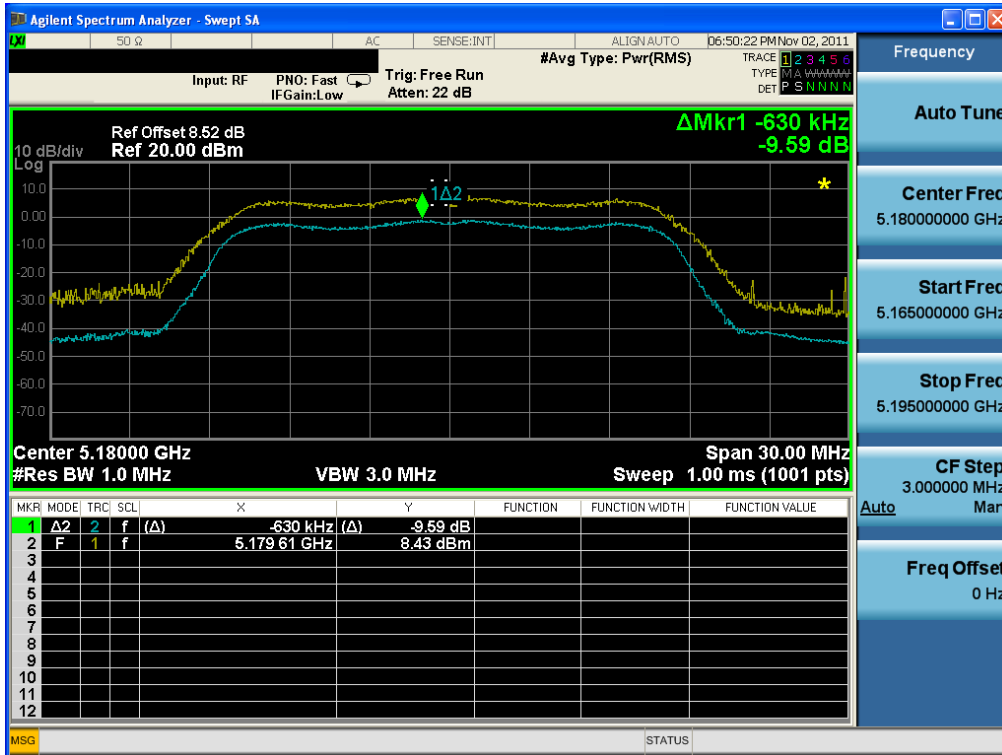
Note 1: The worst case plots in both chains are attached on next page.

- Minimum Standard:

Minimum Standard:	13 dBm/MHz
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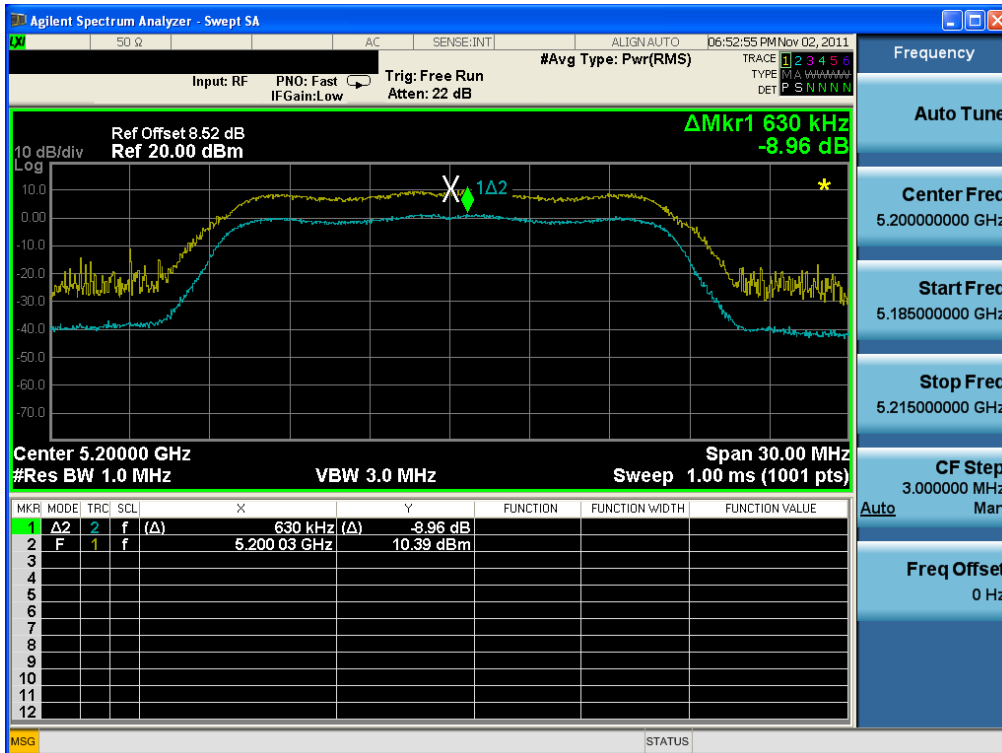
Peak Excursion Ratio

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



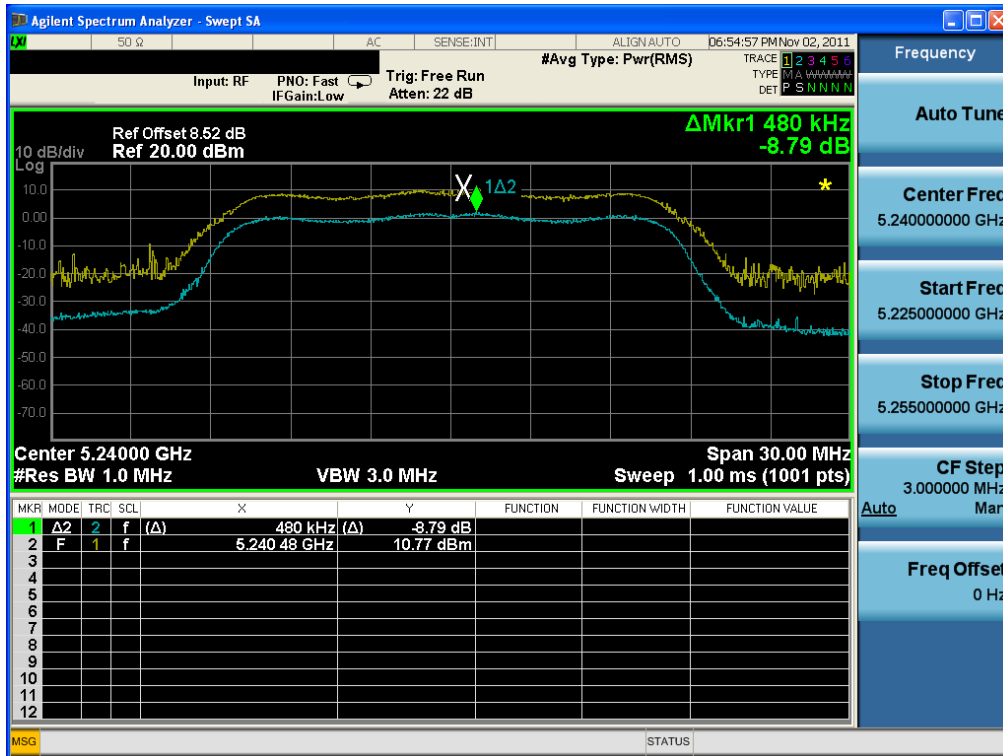
Peak Excursion Ratio

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



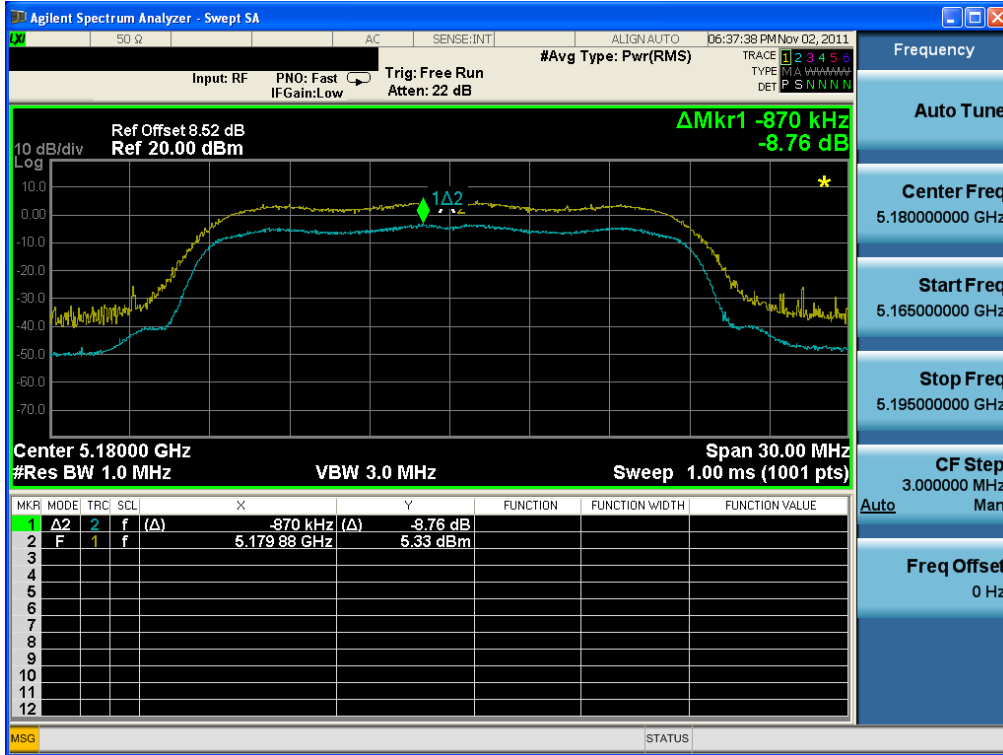
Peak Excursion Ratio

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



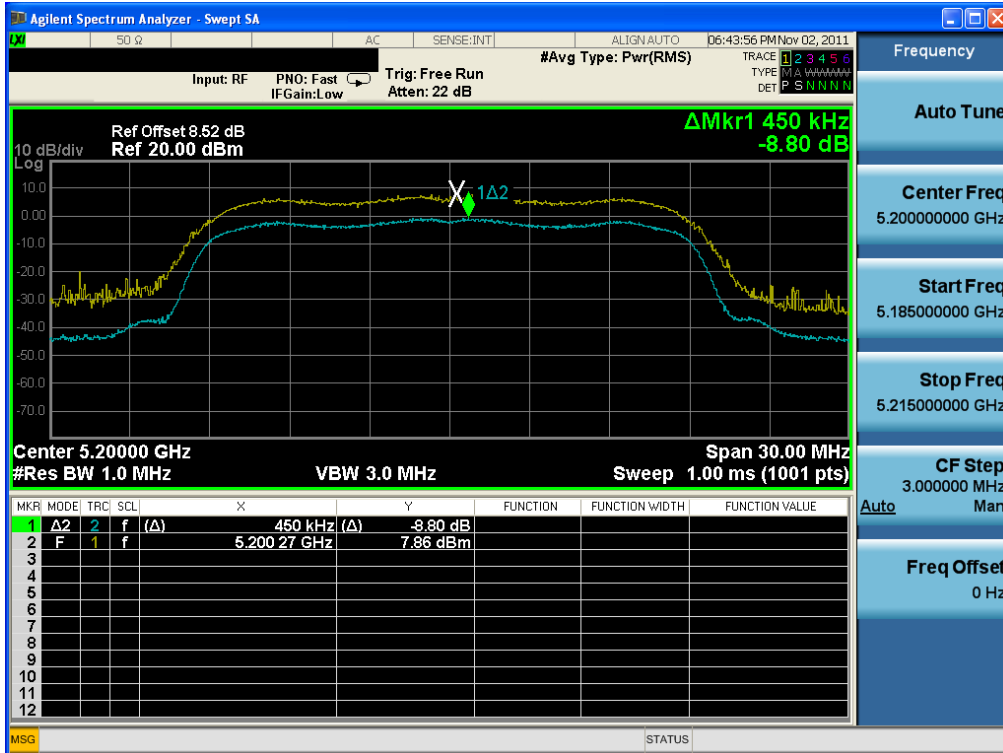
Peak Excursion Ratio

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



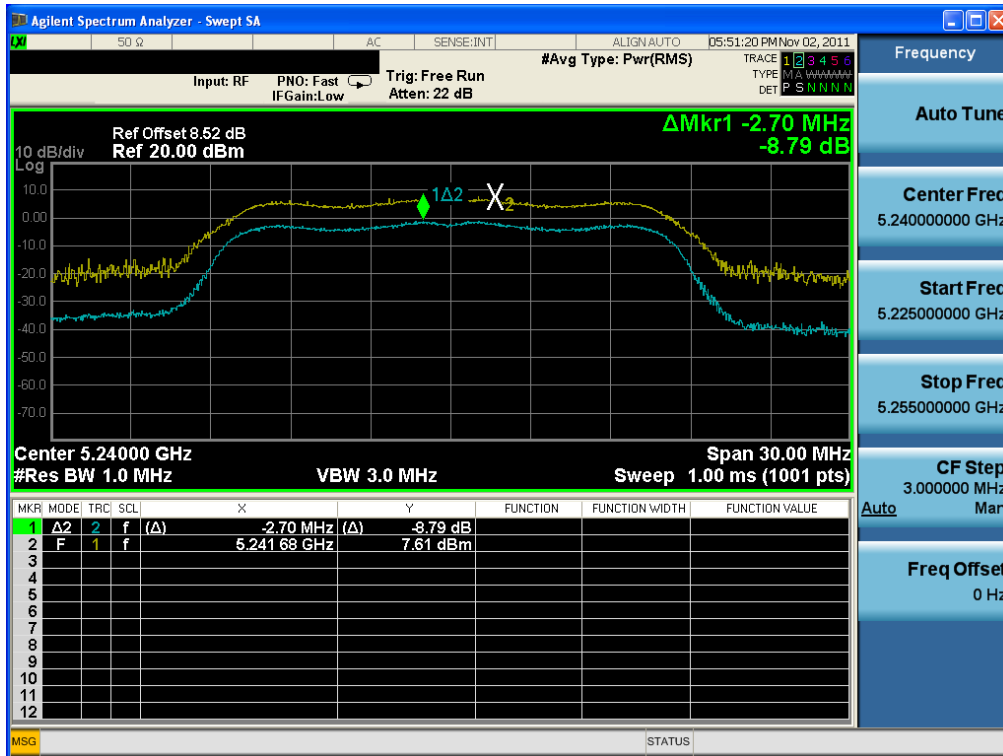
Peak Excursion Ratio

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



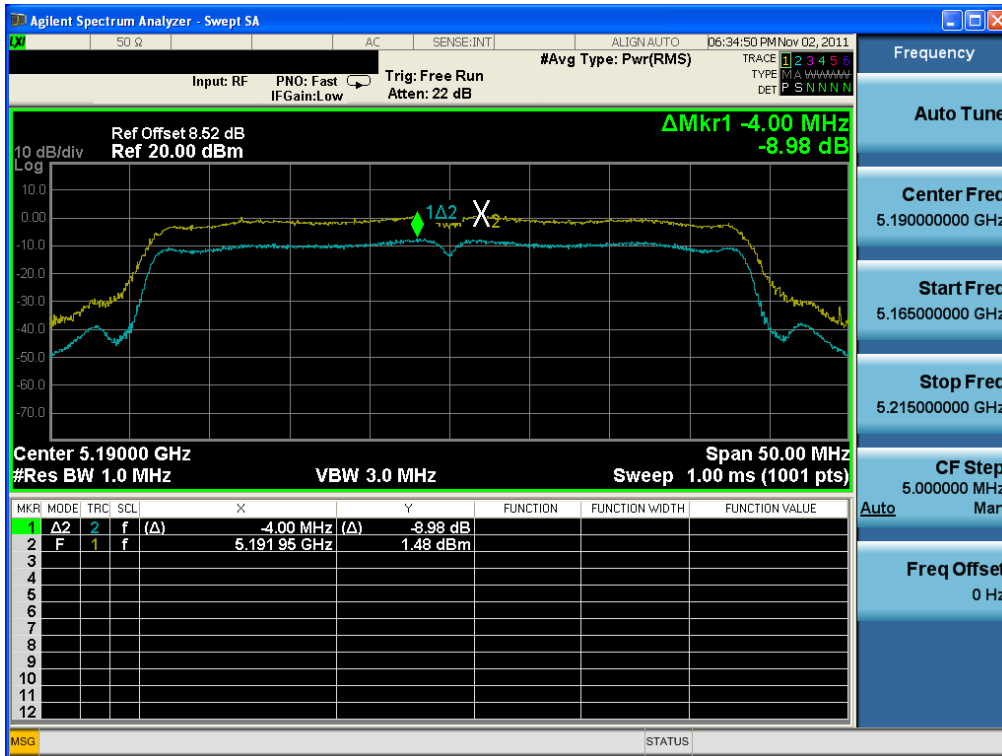
Peak Excursion Ratio

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



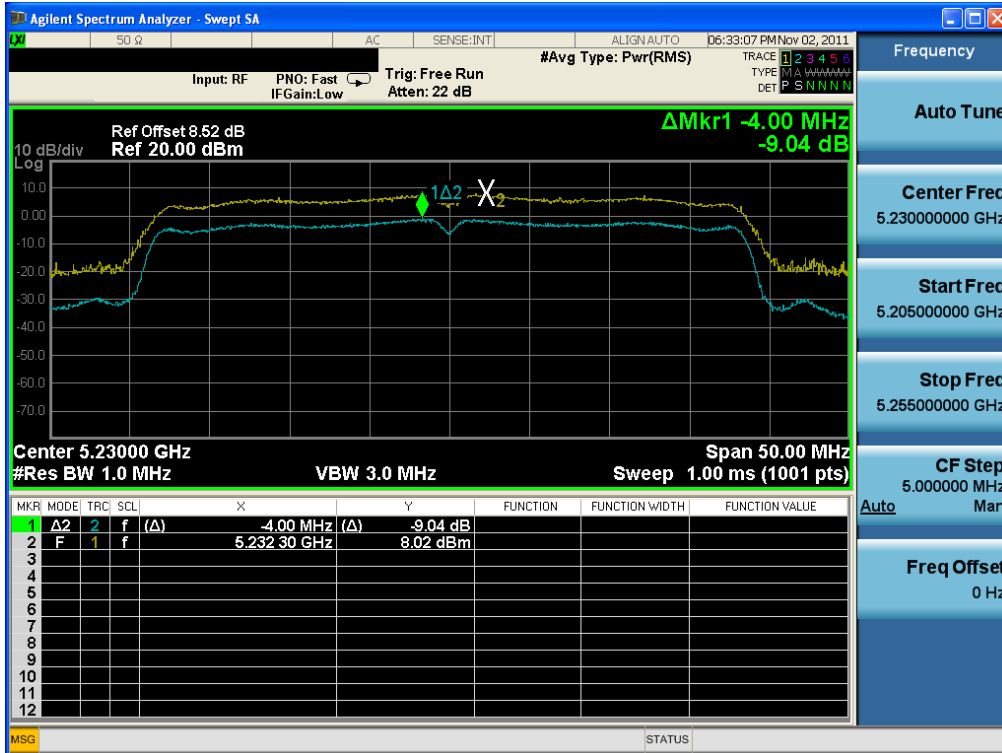
Peak Excursion Ratio

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°C and +60°C. The temperature was incremented by 10°C 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 (°C)	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
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 (°C)	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
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 (°C)	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
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.

- This test item was performed in each axis and the worst case data were reported.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
- 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 = $20 \log (3\text{m}/1\text{m})$ 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.

- This test item was performed in each axis and the worst case data were reported.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
 Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
- The total factor above 10GHz shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1m.

$$\text{Distance extrapolation factor} = 20 \log (3\text{m}/1\text{m}) \text{ dB}$$
 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.

- This test item was performed in each axis and the worst case data were reported.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
- 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 = $20 \log(3\text{m}/1\text{m})$ 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.

- This test item was performed in each axis and the worst case data were reported.
- Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$
Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.
- 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 = $20 \log (3\text{m}/1\text{m})$ 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)

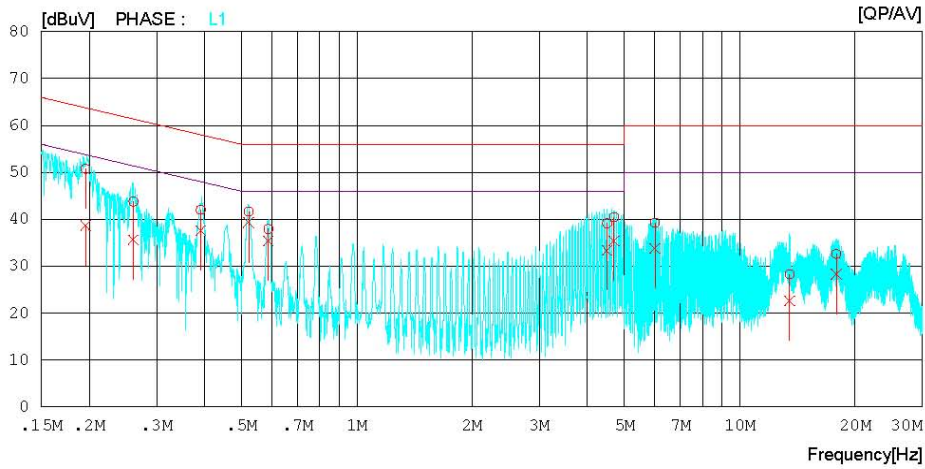
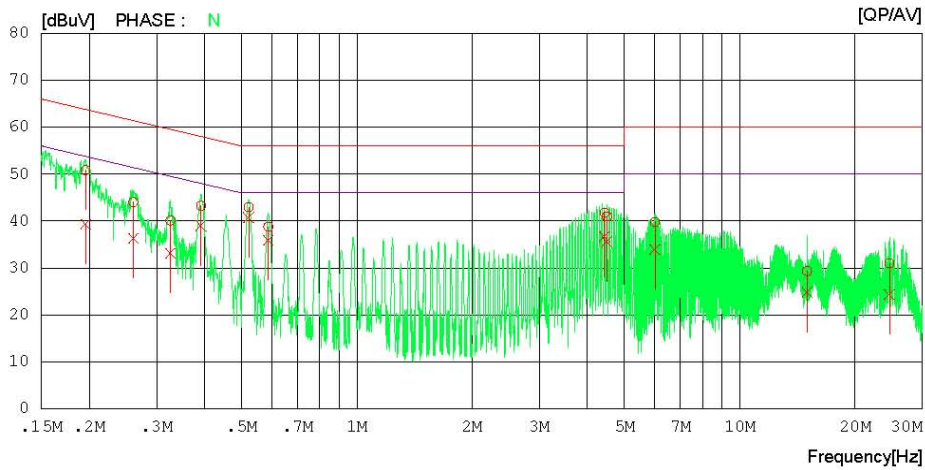
Test Mode: 802.11a



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	: TWFM-B005D	Reference 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



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	: TWFM-B005D	Reference 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 [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [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)

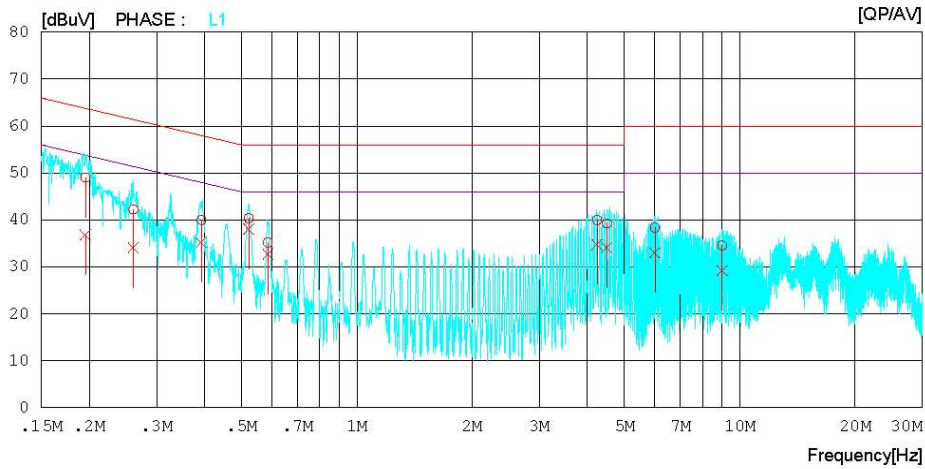
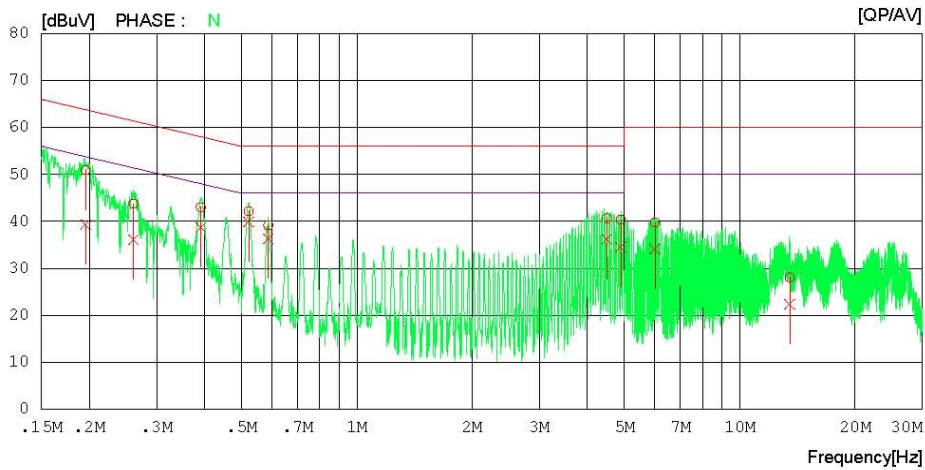
Test Mode: 802.11n HT20



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	: TWFM-B005D	Reference 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.R.YU
Memo	: 5.1GHz / 802.11n-HT20		
LIMIT : CISPR22_B QP			
CISPR22_B AV			



AC Line Conducted Emissions (Data List)

Test Mode: 802.11n HT20



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No. : TWFM-B005D Reference 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 [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [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)

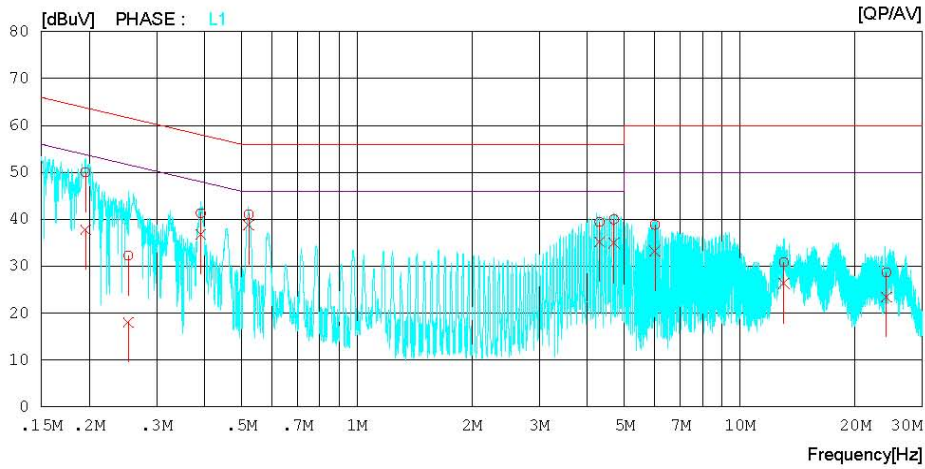
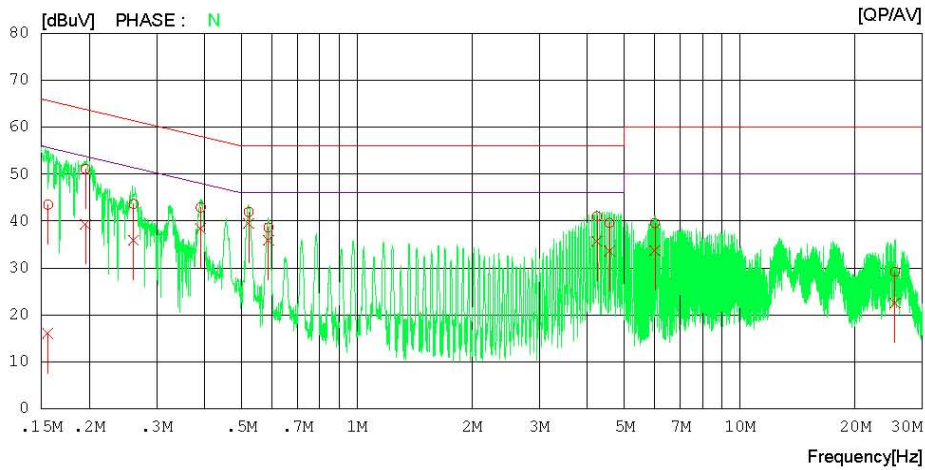
Test Mode: 802.11n HT40



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No.	: TWFM-B005D	Reference 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



Results of Conducted Emission

Digital EMC
Date : 2011-10-26

Model No. : TWFM-B005D Reference 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 [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [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
<input type="checkbox"/>	Spectrum Analyzer	Agilent	E4440A	11/09/30	12/09/30	MY45304199
<input checked="" type="checkbox"/>	Spectrum Analyzer	Rohde Schwarz	FSQ26	11/01/11	12/01/11	200445
<input type="checkbox"/>	Spectrum analyzer	Agilent	E4404B	11/03/08	12/03/08	US41061134
<input type="checkbox"/>	Spectrum Analyzer(RE)	H.P	8563E	11/10/04	12/10/04	3551A04634
<input checked="" type="checkbox"/>	MXA Signal Analyzer	Agilent Technologies, Inc	N9020A	11/01/07	12/01/07	MY49100833
<input type="checkbox"/>	Power Meter	H.P	EPM-442A	11/07/01	12/07/01	GB37170413
<input type="checkbox"/>	Power Sensor	H.P	8481A	11/07/01	12/07/01	3318A96332
<input type="checkbox"/>	Wideband Power Sensor	Rohde Schwarz	NRP-Z81	11/06/04/	12/06/04	1137.9009.02-101001
<input type="checkbox"/>	Power Divider	Agilent	11636B	11/09/30	12/09/30	56471
<input type="checkbox"/>	4-Way Power Divider	ET Industries	D-0526-4	10/12/24	11/12/24	210195001
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/09/30	12/09/30	020611
<input type="checkbox"/>	Power Splitter	Anritsu	K241B	11/07/01	12/07/01	017060
<input type="checkbox"/>	Power Splitters & Dividers	Aeroflex/Weinschel	1594	11/02/21	12/02/21	1177
<input type="checkbox"/>	Frequency Counter	H.P	5342A	11/07/01	12/07/01	2119A04450
<input checked="" type="checkbox"/>	TEMP & HUMIDITY Chamber	JISCO	KR-100/J-RHC2	11/09/30	12/09/30	30604493/021031
<input checked="" type="checkbox"/>	Digital Multimeter	H.P	34401A	11/03/07	12/03/07	3146A13475, US36122178
<input type="checkbox"/>	Multifunction Synthesizer	HP	8904A	11/10/06	12/10/06	3633A08404
<input checked="" type="checkbox"/>	Signal Generator	Rohde Schwarz	SMR20	11/03/08	12/03/08	101251
<input type="checkbox"/>	Signal Generator	H.P	ESG-3000A	11/07/01	12/07/01	US37230529
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMJ100A	11/01/11	12/01/11	100148
<input type="checkbox"/>	Vector Signal Generator	Rohde Schwarz	SMBV100A	11/01/11	12/01/11	255571
<input type="checkbox"/>	Audio Analyzer	H.P	8903B	11/07/02	12/07/02	3011A09448
<input type="checkbox"/>	Modulation Analyzer	H.P	8901B	11/07/01	12/07/01	3028A03029
<input type="checkbox"/>	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	11/03/07	12/03/07	GB43461134
<input type="checkbox"/>	Universal Radio communication Tester	Rohde Schwarz	CMU200	11/03/07	12/03/07	106760
<input type="checkbox"/>	Bluetooth Tester	TESCOM	TC-3000B	11/07/01	12/07/01	3000B000268
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-3
<input checked="" type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-2
<input type="checkbox"/>	Thermo hygrometer	BODYCOM	BJ5478	11/01/13	12/01/13	090205-4
<input type="checkbox"/>	AC Power supply	DAEKWANG	5KVA	11/03/08	12/03/08	20060321-1
<input checked="" type="checkbox"/>	DC Power Supply	HP	6622A	11/03/07	12/03/07	3448A03760
<input type="checkbox"/>	DC Power Supply	HP	6633A	11/03/07	12/03/07	3524A06634
<input type="checkbox"/>	DC Power Supply	Protek	PWS-3010D	11/09/30	12/09/30	4072702
<input type="checkbox"/>	DC Power Supply	SM techno	SDP30-5D	11/05/20	12/05/20	305DKA013
<input type="checkbox"/>	BAND Reject Filter	Microwave Circuits	N0308372	11/09/30	12/09/30	3125-01DC0352
<input type="checkbox"/>	BAND Reject Filter	Wainwright	WRCG1750	11/09/30	12/09/30	2
<input type="checkbox"/>	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
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX2.1	11/09/30	12/09/30	1
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX3.0	11/09/30	12/09/30	9
<input type="checkbox"/>	High-pass filter	Wainwright	WHNX5.0	11/09/19	12/09/19	8
<input checked="" type="checkbox"/>	High-Pass Filter	Wainwright	WHKX8.5	11/09/19	12/09/19	1
<input type="checkbox"/>	High-Pass Filter	Wainwright	WHKX1.0	11/09/30	12/09/30	9
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT800.0 /960.0-0.2/40-8SSK	N/A	N/A	32
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCD1700.0 /2000.0-0.2/40-10SSK	N/A	N/A	53
<input type="checkbox"/>	Tunable Notch Filter	Wainwright	WRCT1900.0/ 2200.0-5/40-10SSK	N/A	N/A	30
<input checked="" type="checkbox"/>	HORN ANT	ETS	3115	11/09/06	12/09/06	21097
<input type="checkbox"/>	HORN ANT	ETS	3115	11/03/22	12/03/22	6419
<input checked="" type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	154
<input type="checkbox"/>	HORN ANT	A.H.Systems	SAS-574	11/03/25	13/03/25	155
<input checked="" type="checkbox"/>	HORN ANT	SCHWARZBECK	BBHA9120A	10/04/13	12/04/13	322
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	10/11/29	11/11/29	2116
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	VHA9103	10/11/29	11/11/29	2117
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	10/11/29	11/11/29	2261
<input type="checkbox"/>	Dipole Antenna	Schwarzbeck	UHA9105	10/11/29	11/11/29	2262
<input checked="" type="checkbox"/>	LOOP Antenna	ETS	6502	10/10/29	12/10/29	3471
<input type="checkbox"/>	Coaxial Fixed Attenuators	Agilent	8491B	11/07/02	12/07/02	MY39260700
<input checked="" type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2342
<input type="checkbox"/>	Attenuator (3dB)	WEINSCHHEL	56-3	11/09/30	12/09/30	Y2370
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	11/09/30	12/09/30	BP4386
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	23-10-34	11/01/11	12/01/11	BP4387
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	446
<input type="checkbox"/>	Attenuator (10dB)	WEINSCHHEL	86-10-11	11/09/30	12/09/30	408
<input type="checkbox"/>	Attenuator (20dB)	WEINSCHHEL	86-20-11	11/09/30	12/09/30	432
<input type="checkbox"/>	Attenuator (30dB)	JFW	50FH-030-300	11/03/07	12/03/07	060320-1
<input type="checkbox"/>	Attenuator (40dB)	WEINSCHHEL	57-40-33	11/09/30	12/09/30	NN837
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02750
<input type="checkbox"/>	Termination	H.P	HP-909D	11/07/02	12/07/02	02702
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0088CAN	11/07/01	12/07/01	788
<input type="checkbox"/>	Type N Coaxial CIRCULATOR	NOVA MICROWAVE	0185CAN	11/07/01	12/07/01	790
<input type="checkbox"/>	Amplifier (30dB)	Agilent	8449B	11/03/07	12/03/07	3008A01590
<input checked="" type="checkbox"/>	Amplifier (30dB)	H.P	8449B	11/03/07	12/03/07	3008A00370
<input type="checkbox"/>	Amplifier	EMPOWER	BBS3Q7ELU	11/09/30	12/09/30	1020
<input type="checkbox"/>	RF Power Amplifier	OPHIRRF	5069F	11/07/01	12/07/01	1006
<input checked="" type="checkbox"/>	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
<input checked="" type="checkbox"/>	BILOG ANTENNA	SCHAFFNER	CBL6112B	10/07/14	12/07/14	2737
<input checked="" type="checkbox"/>	Amplifier (22dB)	H.P	8447E	11/01/11	12/01/11	2945A02865
<input type="checkbox"/>	EMI TEST RECEIVER	R&S	ESCI	11/03/08	12/03/08	100364
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/11/29	11/11/29	91032789
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/11/29	12/11/29	1098
<input type="checkbox"/>	BICONICAL ANT.	Schwarzbeck	VHA 9103	10/12/21	12/12/21	91031946
<input type="checkbox"/>	LOG-PERIODIC ANT.	Schwarzbeck	UHALP9108A1	10/07/07	12/07/07	0590
<input checked="" type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-100K01-B01-2	11/03/07	12/03/07	1252741
<input type="checkbox"/>	Low Noise Pre Amplifier	TSJ	MLA-00108-B02-36	11/01/11	12/01/11	1518831
<input checked="" type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	11/03/07	12/03/07	2944A10144
<input type="checkbox"/>	Amplifier (25dB)	Agilent	8447D	11/07/01	12/07/01	2648A04922
<input checked="" type="checkbox"/>	Spectrum Analyzer(CE)	H.P	8591E	11/03/07	12/03/07	3649A05889
<input checked="" type="checkbox"/>	LISN	Kyoritsu	KNW-407	11/01/11	12/01/11	8-317-8
<input checked="" type="checkbox"/>	LISN	Kyoritsu	KNW-242	11/07/02	12/07/02	8-654-15
<input checked="" type="checkbox"/>	CVCF	NF Electronic	4420	11/03/08	12/03/08	304935/337980
<input checked="" type="checkbox"/>	50 ohm Terminator	HME	CT-01	11/01/11	12/01/11	N/A
<input checked="" type="checkbox"/>	RFI/FIELD Intensity Meter	Kyoritsu	KNM-2402	11/07/02	12/07/02	4N-170-3
<input type="checkbox"/>	Wideband Radio Communication Tester	R&S	CMW500	11/09/30	12/09/30	100989