

TEST REPORT

Report Number: 100953679LEX-003
Project Number: G100953679

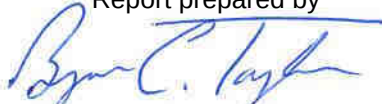
Report Issue Date: 4/4/2013

Product Name: TCA203
Model Number: TCA203
FCCID: G95TCA203
ICID: 431C-TCA203
FCC Standards: CFR Title 47 Part 15 Subpart C
Industry Canada Standards: RSS-210 Issue 8 and RSS-GEN Issue 3

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510

Client:
Technicolor USA, Inc.
101 West 103rd St
Indianapolis, IN 46290

Report prepared by


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1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.

2 Test Summary

Page	Test full name	FCC Reference	IC Reference	Result
6	Peak Conducted Power	§ 15.247(b)(3)(4)	RSS-210 (A8.4)	Pass
9	Occupied Bandwidth	§ 15.247(a)(2)	RSS-210 (A8.2), RSS-GEN (4.6.1)	Pass
18	Conducted Spurious Emissions	§ 15.247(d)	RSS-210 (A8.5)	Pass
35	Power Spectral Density	§ 15.247(e)	RSS-210 (A8.2b)	Pass
42	Radiated Spurious Emissions (Transmitter)	§ 15.247(d), § 15.209, and § 15.205	RSS-210 (2.2) (A8.5)	Pass
49	Radiated Spurious Emissions (Receiver)	§ 15.109	RSS-Gen (6.1)	Pass
51	AC Powerline Conducted Emissions	§ 15.107, § 15.207	RSS-Gen (7.2.4)	Pass
53	Antenna Requirement per FCC Part 15.203	§ 15.203	RSS-Gen (7.1.2)	Pass

3 Description of Equipment Under Test

Equipment Under Test	
Manufacturer	Technicolor USA, Inc.
Model Number	TCA203
Serial Number	Intertek 10
FCC Identifier	G95TCA203
IC Identifier	431C-TCA203
Receive Date	2/13/2013
Test Start Date	8/1/2011
Test End Date	3/20/2013
Device Received Condition	Good
Test Sample Type	Production
Frequency Band	2412MHz – 2462MHz
Mode(s) of Operation	802.11b/g/n
Modulation Type	BPSK, QPSK, CCK, OFDM
Duty Cycle	100%
Transmission Control	Test Commands
Test Channels	1, 6, 11 (3, 6, 9 for the 40MHz wide 802.11n mode)
Antenna Type (15.203)	Internal
Antenna Gain	2.04 dBi
Power Supply	115VAC/60Hz (Via AC / DC Power Adapter)

Description of Equipment Under Test

The TCA203 is a touch screen alarm panel that contains a zigbee, 802.11b/g/n, and cellular modules. This report contains data pertaining to the 802.11 transmissions.

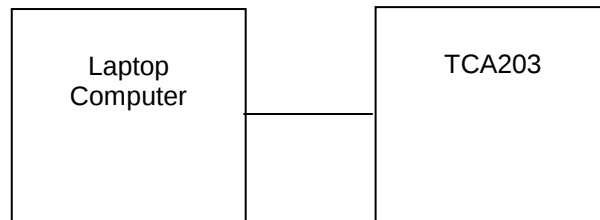
Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Transmitting on low mid or high channels
2	Receive / idle mode

3.1 System setup including cable interconnection details, support equipment and simplified block diagram

3.2 EUT Block Diagram:

During the testing the sample was connected to a laptop computer via a USB cable.



3.3 Cables:

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
Ethernet Cable	50 ft	None	None	Test Sample	Laptop Computer
DC Power Cable	5 ft	None	None	Test Sample	AC/DC Power Converter

3.4 Support Equipment:

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop Computer	Lenovo	Thinkpad	12002MU

4 Peak Conducted Power

4.1 Test Limits

§ 15.247(b)(3): For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§ 15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247). The peak output power was measured using the channel power function of the spectrum analyzer.

4.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	8/27/2010	8/27/2011
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	6/29/2011	6/29/2012

4.4 Results:

Mode	Channel Number	Frequency (MHz)	Data Rate	Average Conducted Power (dBm)	Peak Conducted Power (dBm)	Peak Conducted Power Limit (dBm)	Margin (dB)	Result
802.11b	1	2412	1	17.74	25.77	30	-4.23	Pass
			2	16.37	25.71	30	-4.29	Pass
			5.5	15.06	26.51	30	-3.49	Pass
			11	13.54	25.98	30	-4.02	Pass
802.11b	6	2437	1	17.11	25.16	30	-4.84	Pass
			2	16.11	25.49	30	-4.51	Pass
			5.5	14.73	26.24	30	-3.76	Pass
			11	13.36	25.76	30	-4.24	Pass
802.11b	11	2462	1	17.07	25.12	30	-4.88	Pass
			2	16.42	24.45	30	-5.55	Pass
			5.5	14.7	26.13	30	-3.87	Pass
			11	13.18	25.66	30	-4.34	Pass
802.11g	1	2412	6	13.57	23.57	30	-6.43	Pass
			9	13.21	24.01	30	-5.99	Pass
			12	12.37	23.87	30	-6.13	Pass
			18	11.44	23.73	30	-6.27	Pass
			24	9.18	23.1	30	-6.9	Pass
			36	7.86	22.86	30	-7.14	Pass
			48	6.77	23.01	30	-6.99	Pass
			54	6.49	22.93	30	-7.07	Pass
802.11g	6	2437	6	13.77	23.82	30	-6.18	Pass
			9	13.09	23.91	30	-6.09	Pass
			12	12.24	23.79	30	-6.21	Pass
			18	11.6	24.16	30	-5.84	Pass
			24	8.96	22.89	30	-7.11	Pass
			36	7.69	22.27	30	-7.73	Pass
			48	6.58	22.71	30	-7.29	Pass
			54	6.28	22.6	30	-7.4	Pass
802.11g	11	2462	6	13.62	23.66	30	-6.34	Pass
			9	12.77	23.59	30	-6.41	Pass
			12	12.76	23.56	30	-6.44	Pass
			18	11.09	23.66	30	-6.34	Pass
			24	8.95	22.87	30	-7.13	Pass
			36	7.51	22.55	30	-7.45	Pass
			48	6.62	22.66	30	-7.34	Pass
			54	6.31	22.72	30	-7.28	Pass

802.11b and g results

Mode	Channel Number	Frequency (MHz)	Data Rate	Average Conducted Power (dBm)	Peak Conducted Power (dBm)	Peak Conducted Power Limit (dBm)	Margin (dB)	Result
802.11n (20MHz)	1	2412	MCS0	9.65	19.98	30	-10.02	Pass
			MCS1	7.72	19.64	30	-10.36	Pass
			MCS2	6.4	19.24	30	-10.76	Pass
			MCS3	5.68	19.84	30	-10.16	Pass
			MCS4	4.37	19.54	30	-10.46	Pass
			MCS5	3.47	19.52	30	-10.48	Pass
			MCS6	3.13	19.41	30	-10.59	Pass
802.11n (20MHz)	6	2437	MCS7	2.81	19.55	30	-10.45	Pass
			MCS0	8.96	19.34	30	-10.66	Pass
			MCS1	7.35	19.26	30	-10.74	Pass
			MCS2	6.22	19.09	30	-10.91	Pass
			MCS3	5.29	19.38	30	-10.62	Pass
			MCS4	3.98	19.17	30	-10.83	Pass
			MCS5	3.1	19.32	30	-10.68	Pass
802.11n (20MHz)	11	2462	MCS6	2.84	19.26	30	-10.74	Pass
			MCS7	2.52	19.28	30	-10.72	Pass
			MCS0	8.76	19.14	30	-10.86	Pass
			MCS1	7.22	19.11	30	-10.89	Pass
			MCS2	6.05	18.95	30	-11.05	Pass
			MCS3	5.34	19.53	30	-10.47	Pass
			MCS4	4.07	19.27	30	-10.73	Pass
802.11n (40MHz)	3	2422	MCS5	3.06	19.19	30	-10.81	Pass
			MCS6	2.79	19.12	30	-10.88	Pass
			MCS7	2.5	19.16	30	-10.84	Pass
			MCS0	6.58	14.85	30	-15.15	Pass
			MCS1	6.69	15.09	30	-14.91	Pass
			MCS2	6.6	15.07	30	-14.93	Pass
			MCS3	7.2	16.09	30	-13.91	Pass
802.11n (40MHz)	6	2437	MCS4	7.25	15.97	30	-14.03	Pass
			MCS5	6.88	16.27	30	-13.73	Pass
			MCS6	6.83	16.21	30	-13.79	Pass
			MCS7	6.83	16.21	30	-13.79	Pass
			MCS0	11.71	20.64	30	-9.36	Pass
			MCS1	10.9	19.96	30	-10.04	Pass
			MCS2	10.82	19.95	30	-10.05	Pass
802.11n (40MHz)	9	2452	MCS3	12.11	21.56	30	-8.44	Pass
			MCS4	11.28	20.72	30	-9.28	Pass
			MCS5	11.04	20.89	30	-9.11	Pass
			MCS6	10.85	20.81	30	-9.19	Pass
			MCS7	11.53	21.59	30	-8.41	Pass
			MCS0	10.85	19.71	30	-10.29	Pass
			MCS1	10.83	19.91	30	-10.09	Pass
802.11n (40MHz)	9	2452	MCS2	10.77	19.94	30	-10.06	Pass
			MCS3	11.34	20.78	30	-9.22	Pass
			MCS4	11.02	20.52	30	-9.48	Pass
			MCS5	10.84	20.7	30	-9.3	Pass
			MCS6	10.78	20.75	30	-9.25	Pass
			MCS7	10.77	20.72	30	-9.28	Pass

802.11n results

5 Occupied Bandwidth

5.1 Test Limits

§ 15.247(a)(2): For digital modulation systems, the minimum 6dB bandwidth shall be at least 500kHz.

5.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

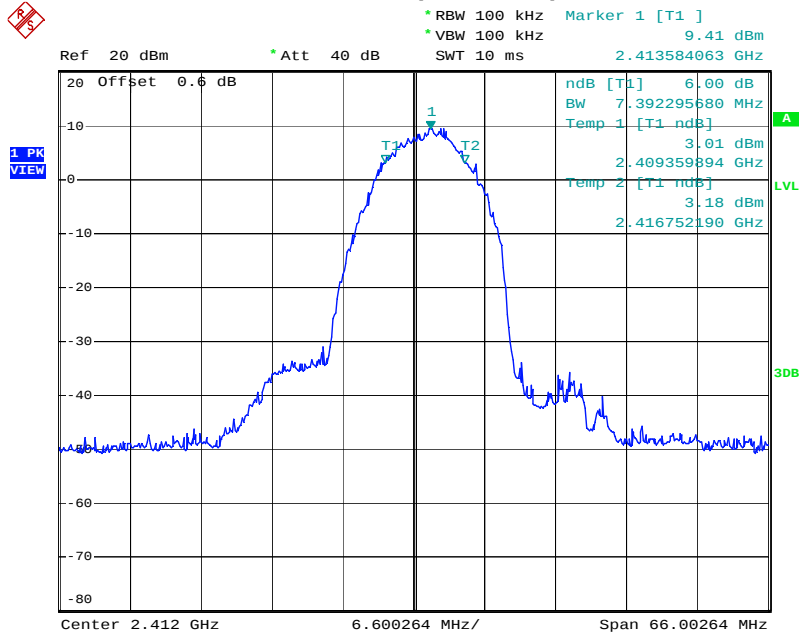
5.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	8/27/2010	8/27/2011
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	6/29/2011	6/29/2012

5.4 Results:

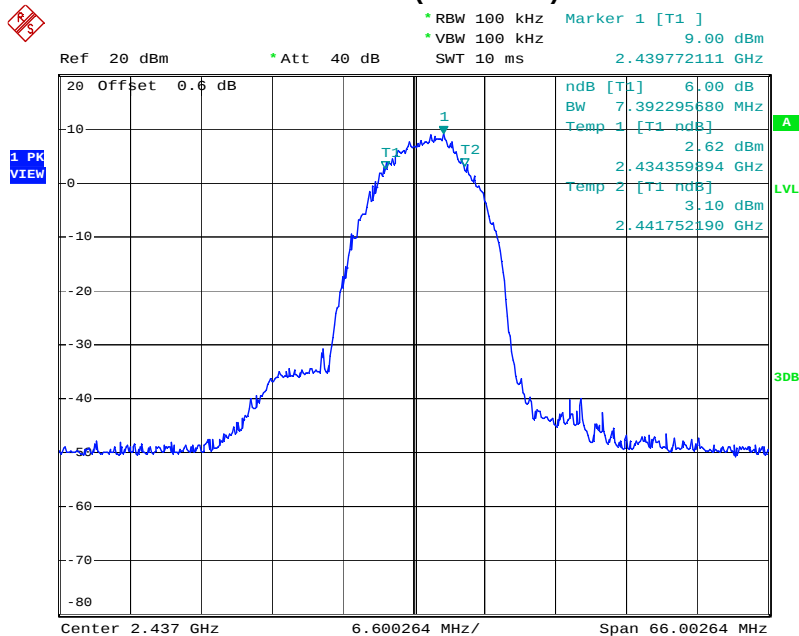
Mode	Channel Number	Frequency (MHz)	6dB Bandwidth	99% Power Bandwidth	Result
802.11b	1	2412	7.39 MHz	---	Pass
802.11b	6	2437	7.39 MHz	15.44 MHz	Pass
802.11b	11	2462	7.26 MHz	---	Pass
802.11g	1	2412	16.24 MHz	---	Pass
802.11g	6	2437	16.24 MHz	16.39 MHz	Pass
802.11g	11	2462	16.24 MHz	---	Pass
802.11n (20MHz)	1	2412	17.54 MHz	---	Pass
802.11n (20MHz)	6	2437	17.8 MHz	17.69 MHz	Pass
802.11n (20MHz)	11	2462	17.6 MHz	---	Pass
802.11n (40MHz)	3	2422	36.43 MHz	---	Pass
802.11n (40MHz)	6	2437	36.43 MHz	36.17 MHz	Pass
802.11n (40MHz)	9	2452	36.17 MHz	---	Pass

6dB Bandwidth Plot (Channel 1) – 802.11b mode

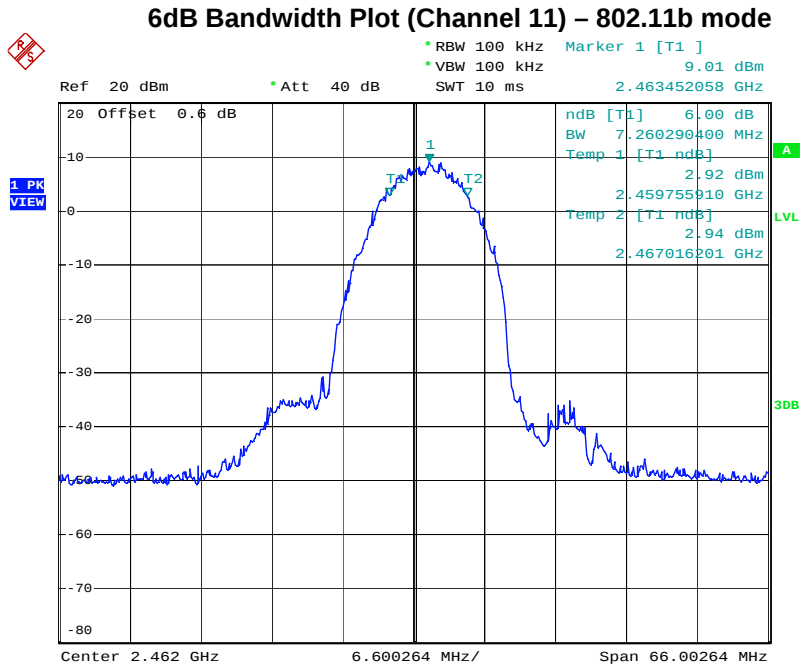


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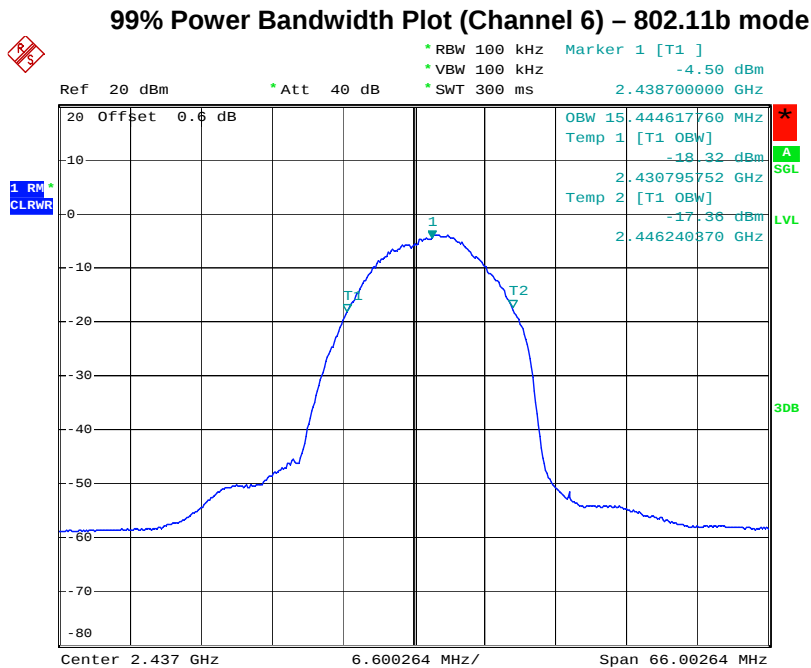
6dB Bandwidth Plot (Channel 6) – 802.11b mode



Date: 9.AUG.2011 14:04:14

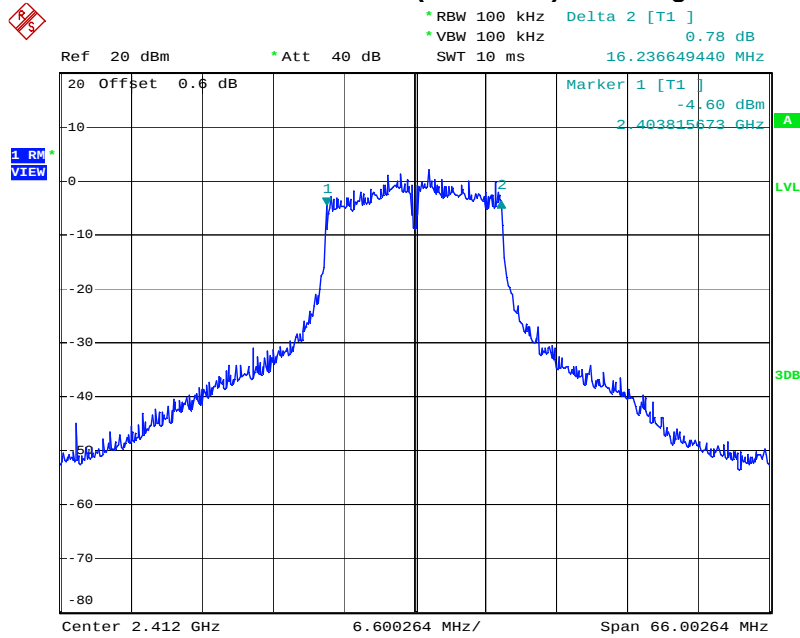


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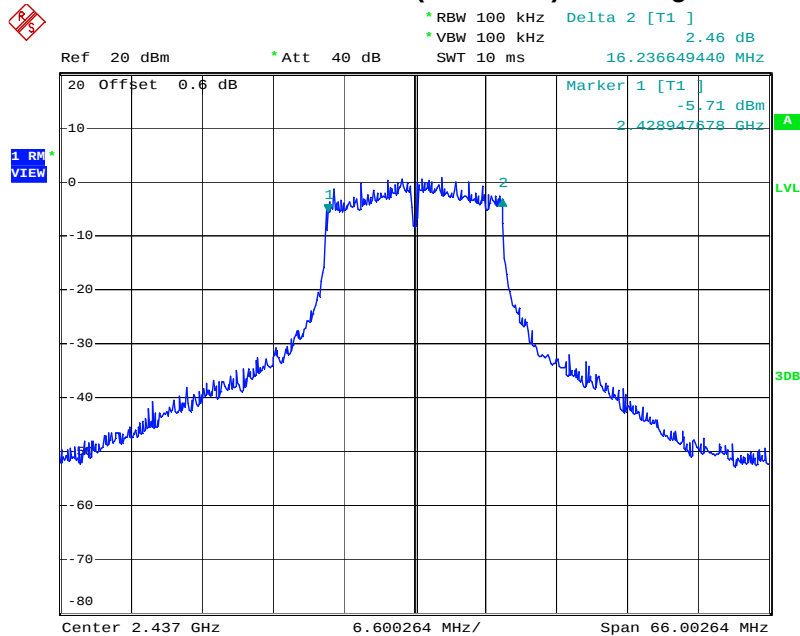
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6dB Bandwidth Plot (Channel 1) – 802.11g mode

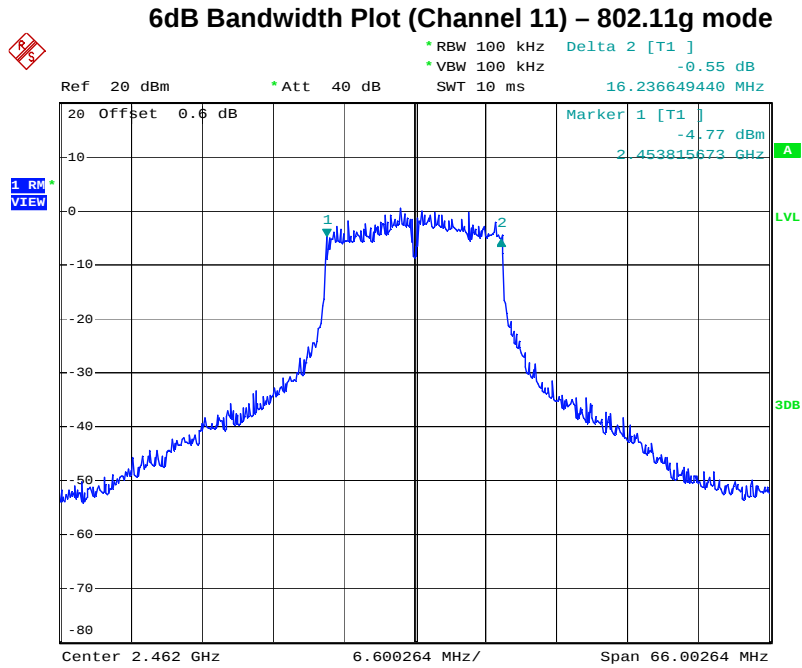


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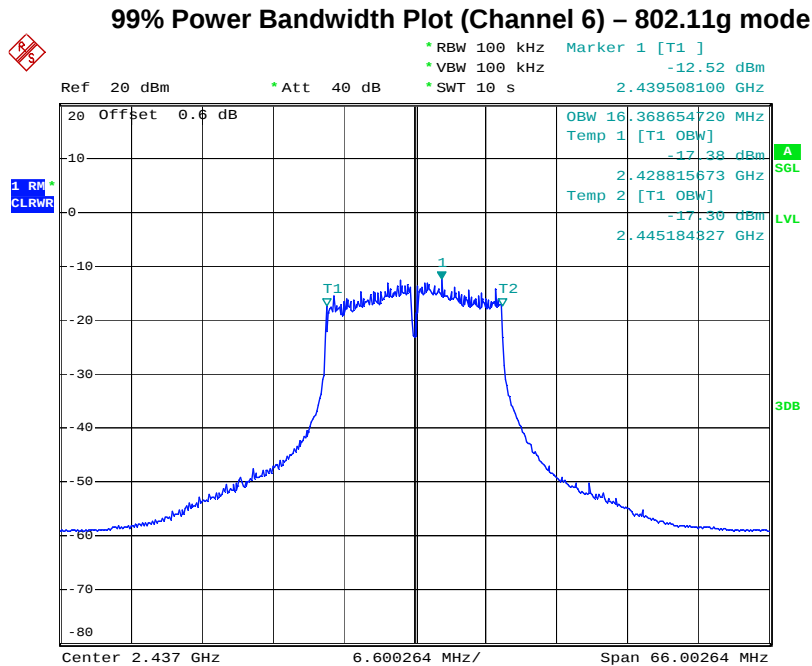
6dB Bandwidth Plot (Channel 6) – 802.11g mode



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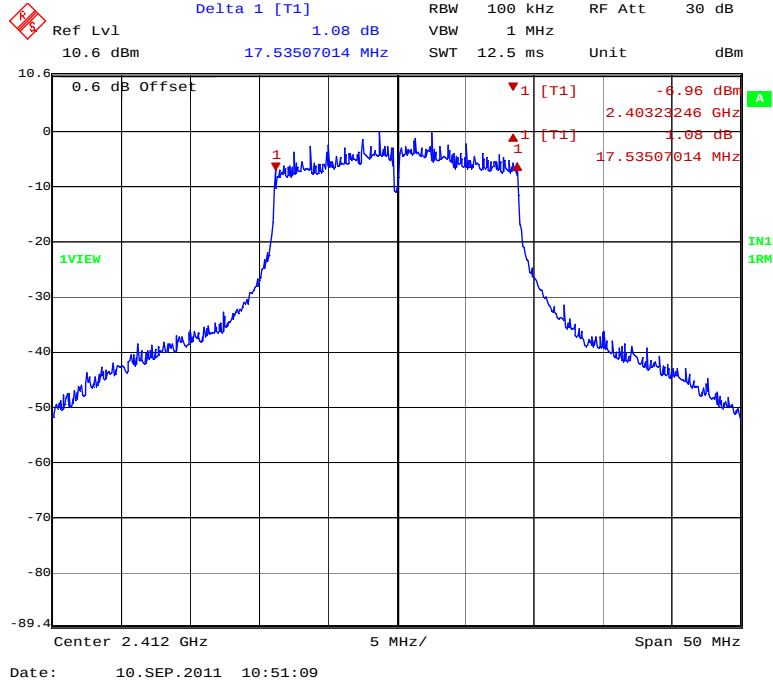


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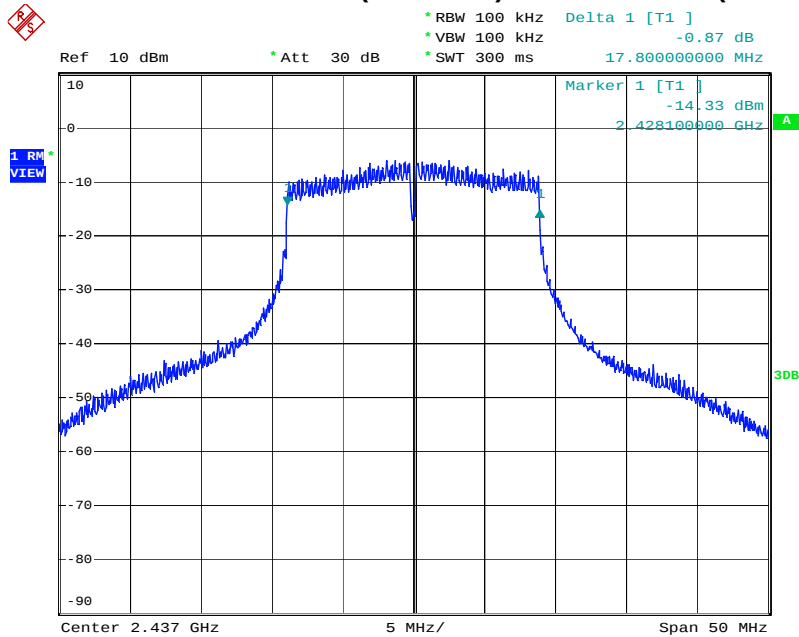


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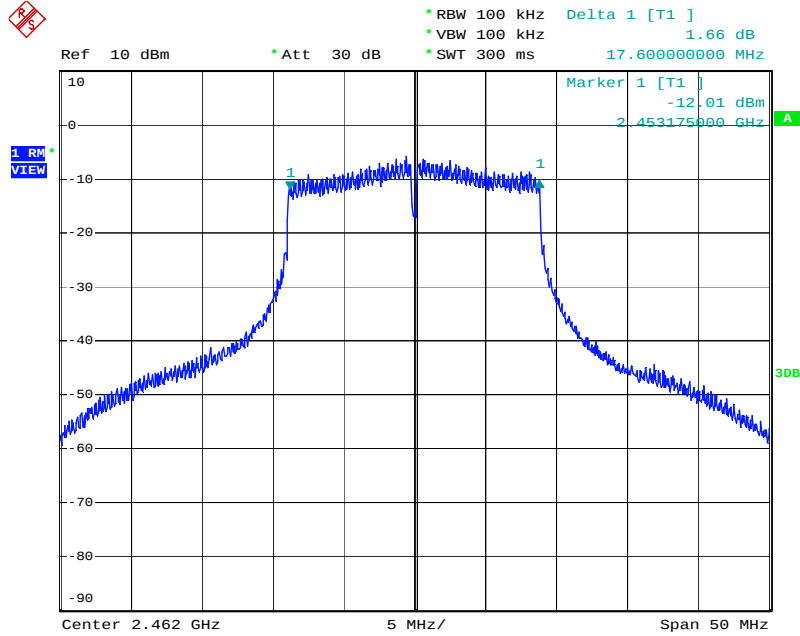
6dB Bandwidth Plot (Channel 1) – 802.11n mode (20MHz)



6dB Bandwidth Plot (Channel 6) – 802.11n mode (20MHz)

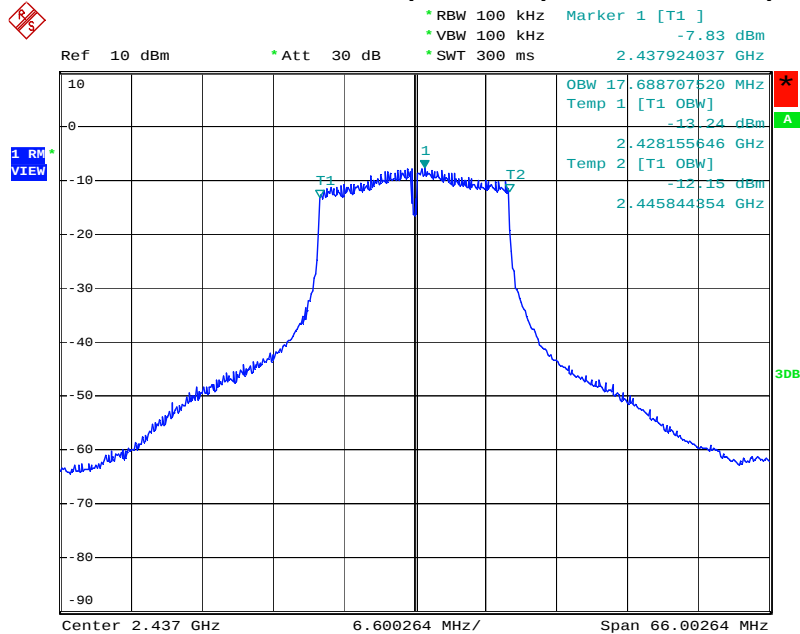


6dB Bandwidth Plot (Channel 11) – 802.11n mode (20MHz)



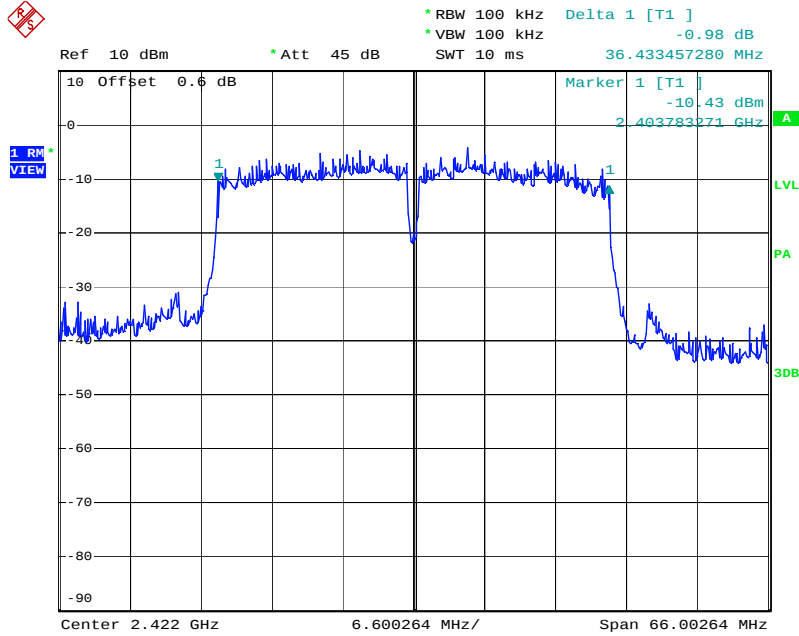
Date: 11.AUG.2011 09:44:06

99% Power Bandwidth Plot (Channel 6) – 802.11n mode (20MHz)



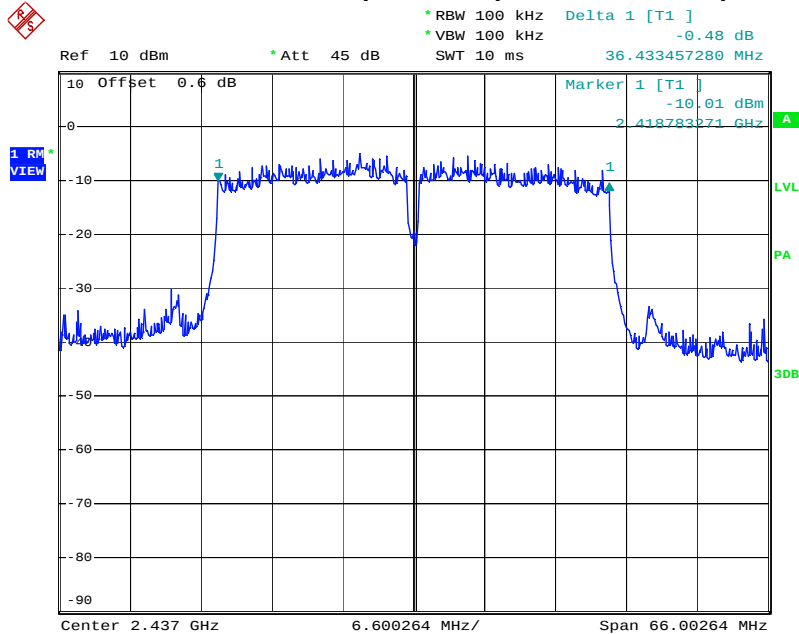
Date: 11.AUG.2011 09:33:42

6dB Bandwidth Plot (Channel 3) – 802.11n mode (40MHz)



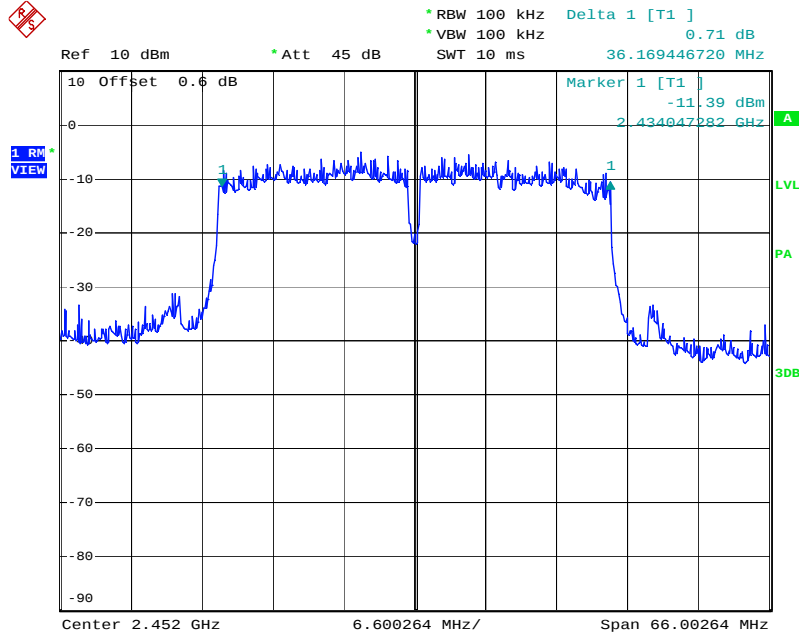
Date: 31.AUG.2011 11:31:20

6dB Bandwidth Plot (Channel 6) – 802.11n mode (40MHz)



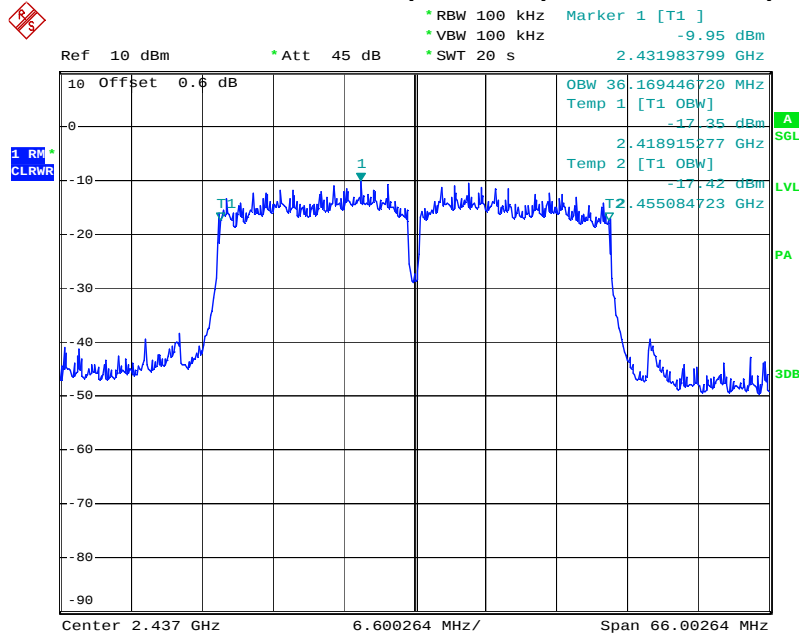
Date: 31.AUG.2011 11:29:17

6dB Bandwidth Plot (Channel 9) – 802.11n mode (40MHz)



Date: 31.AUG.2011 11:32:34

99% Power Bandwidth Plot (Channel 6) – 802.11n mode (40MHz)



Date: 31.AUG.2011 11:02:22

6 Conducted Spurious Emissions

6.1 Test Limits

§ 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

6.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

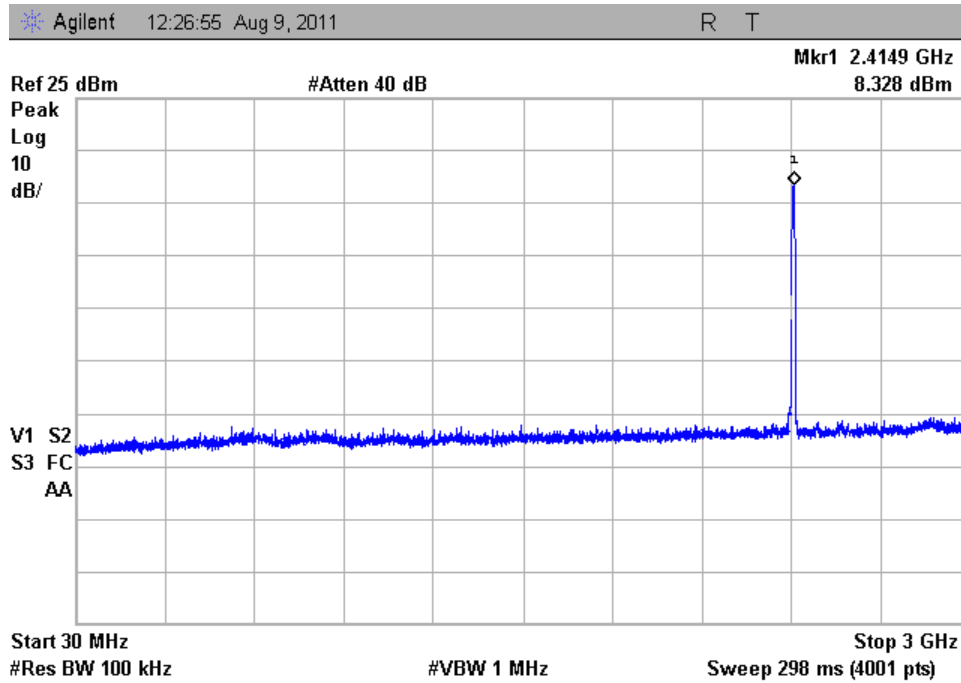
6.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMC Analyzer	2142	HP	E7405	9/1/2010	9/1/2011
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	8/27/2010	8/27/2011
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	6/29/2011	6/29/2012

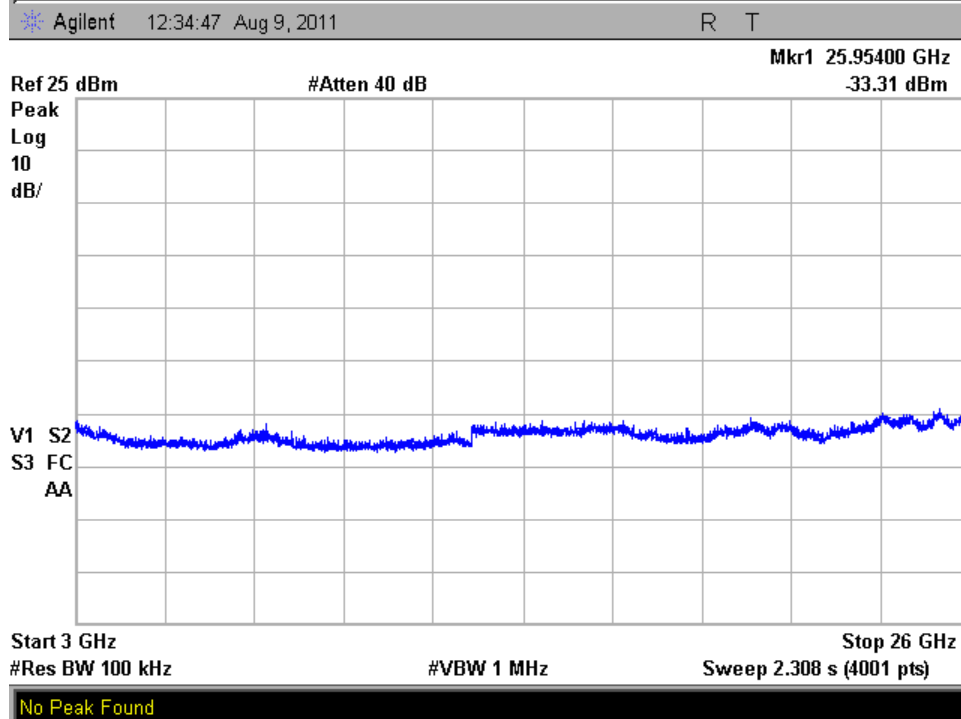
6.4 Results:

The following plots show that there are no conducted spurious emissions exceeding the 20dB down criteria.

Conducted Spurious Emissions - 802.11b Mode Low Channel

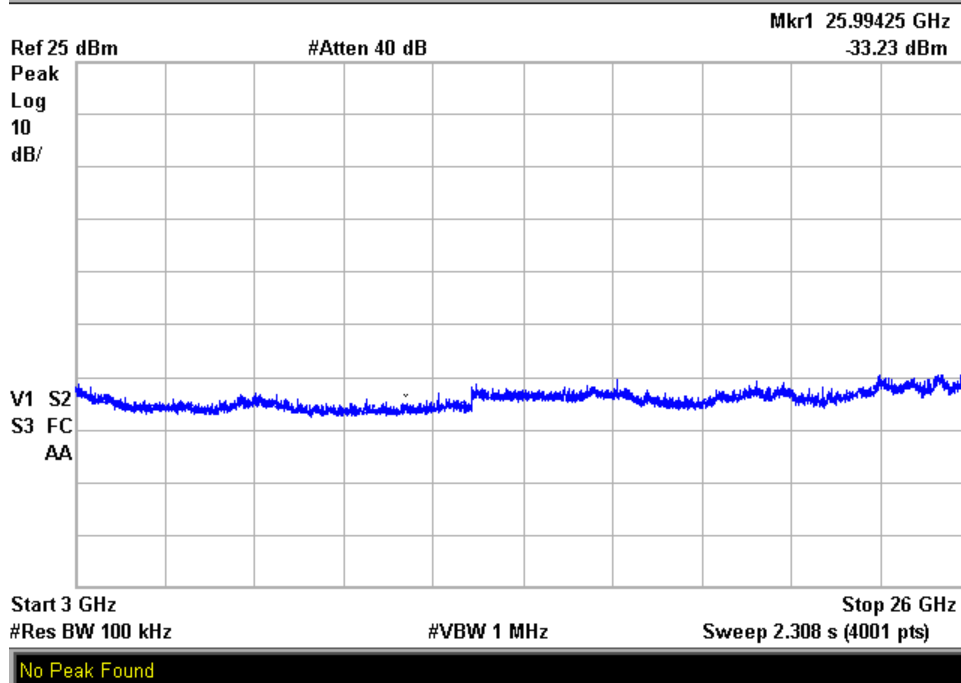
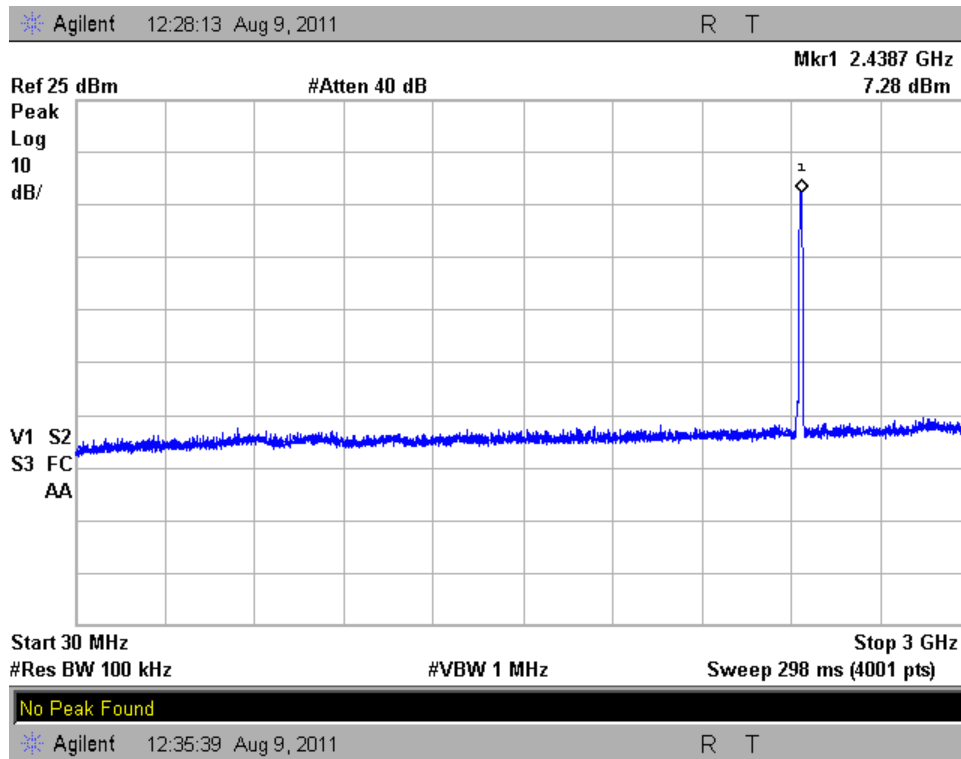


No Peak Found

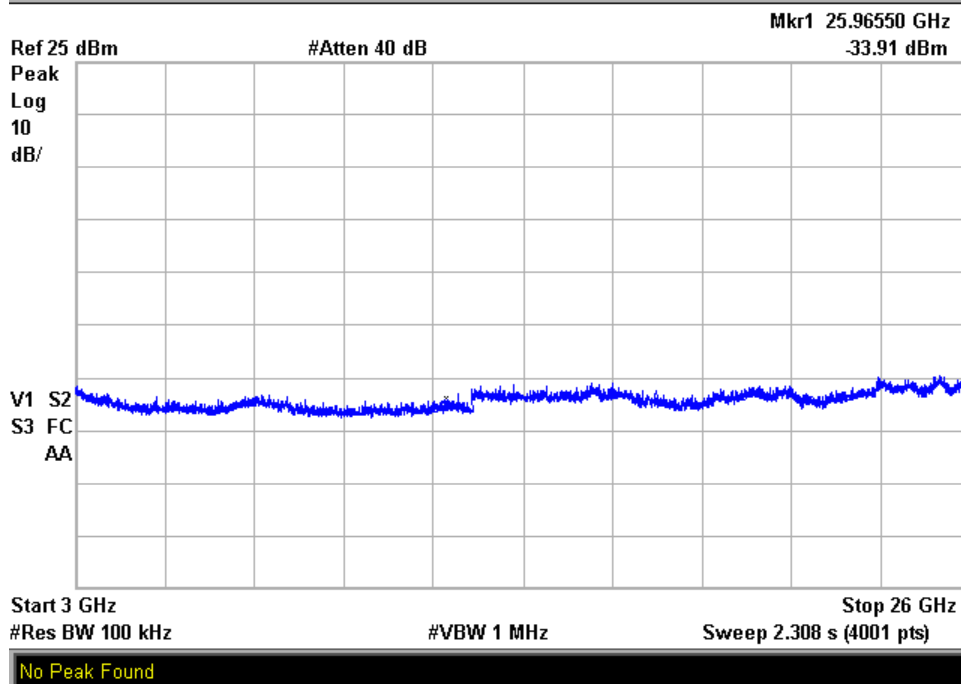
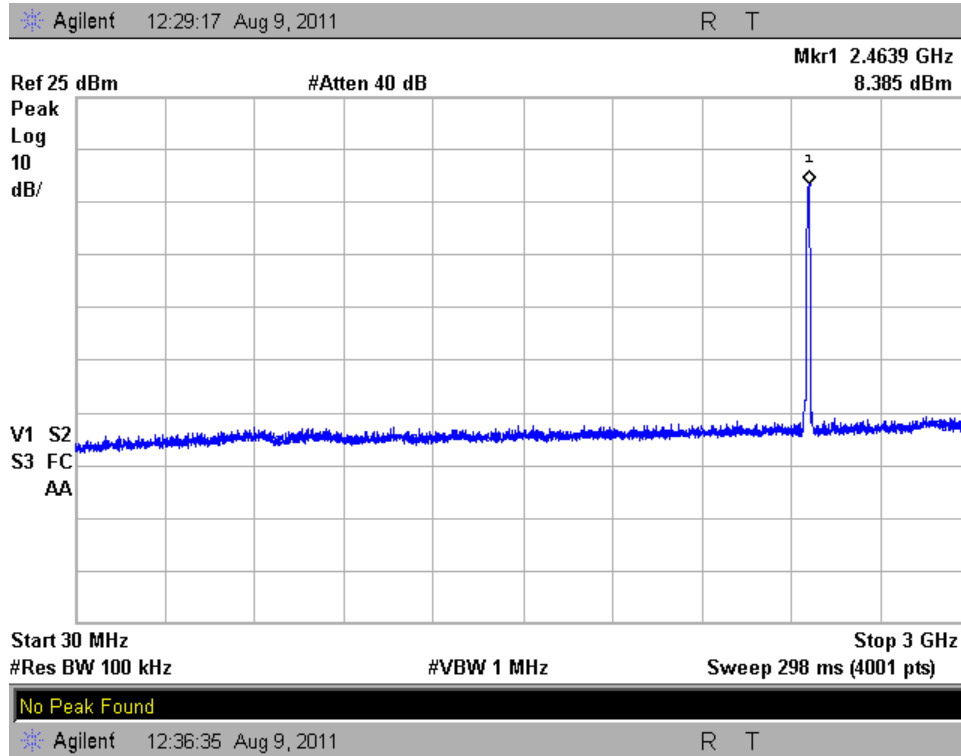


No Peak Found

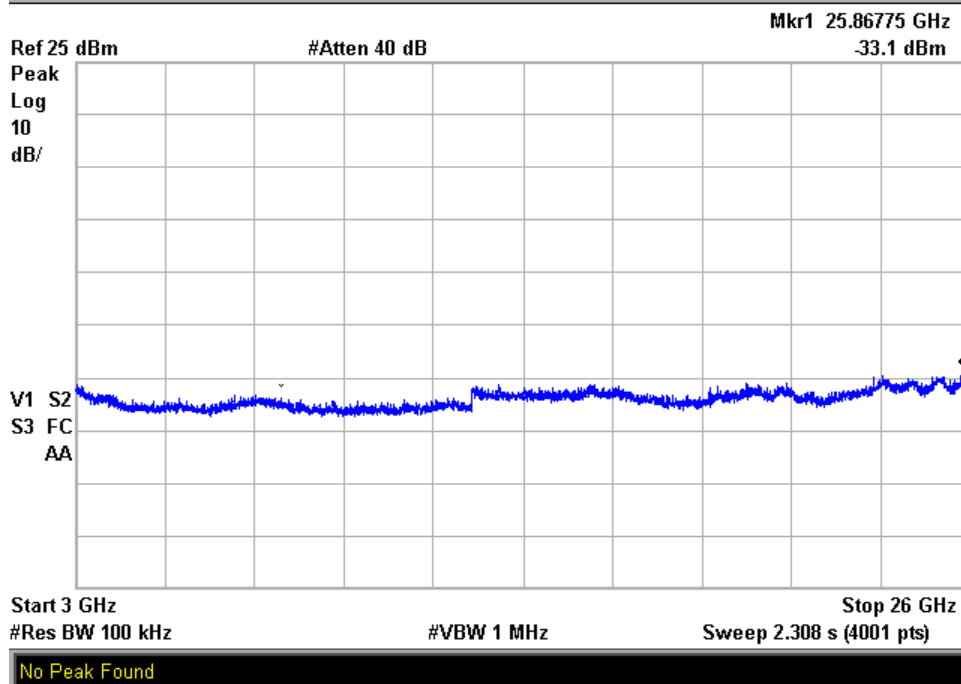
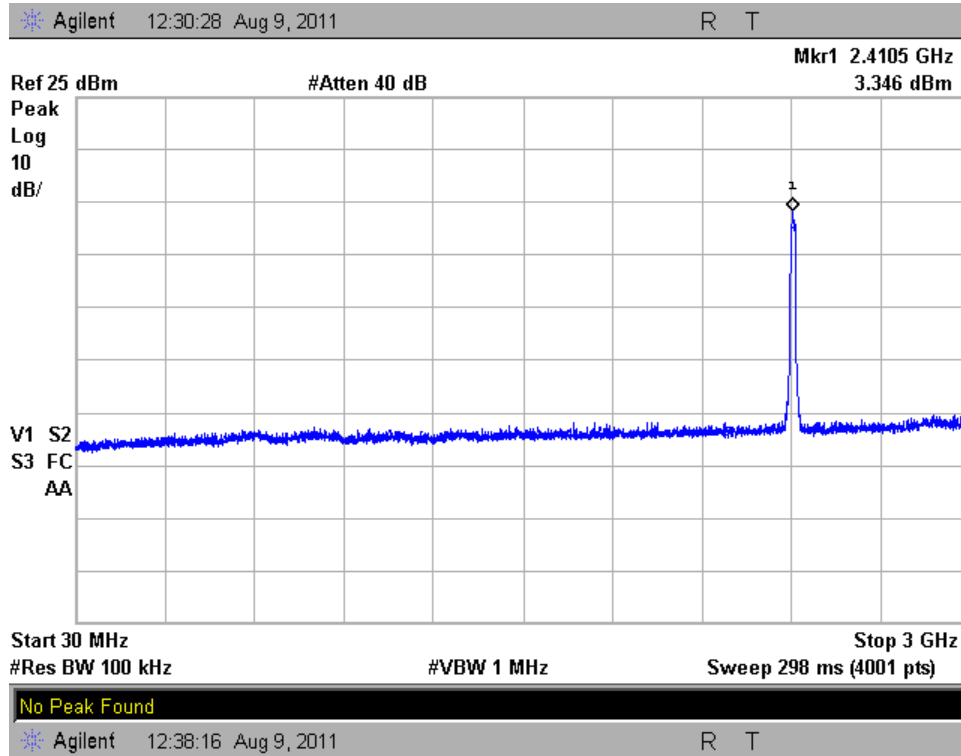
Conducted Spurious Emissions - 802.11b Mode Mid Channel



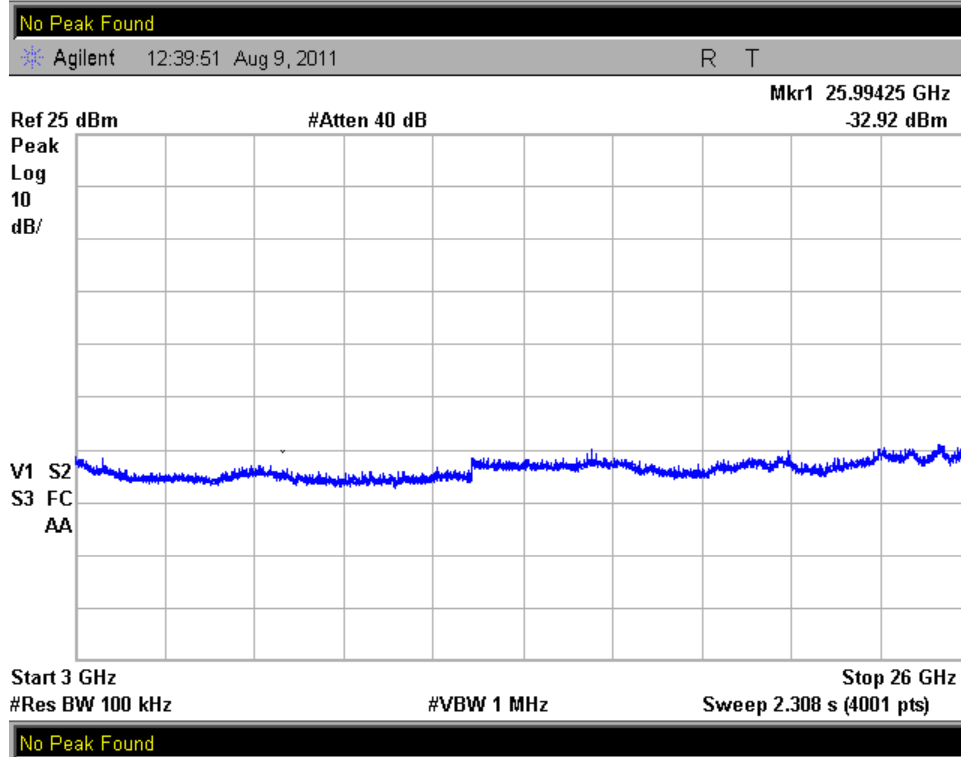
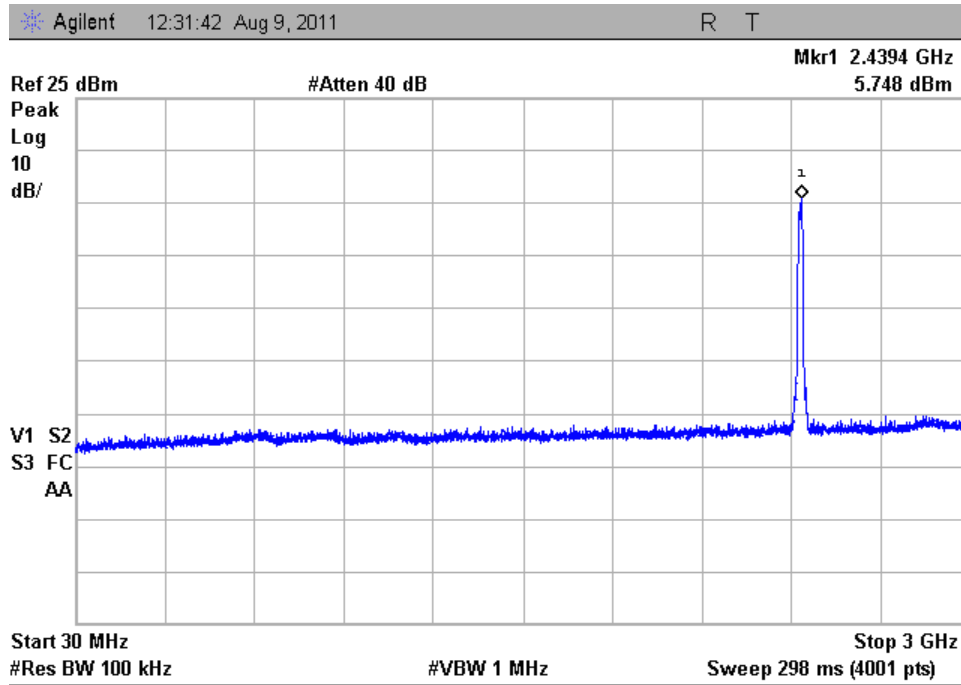
Conducted Spurious Emissions - 802.11b Mode High Channel



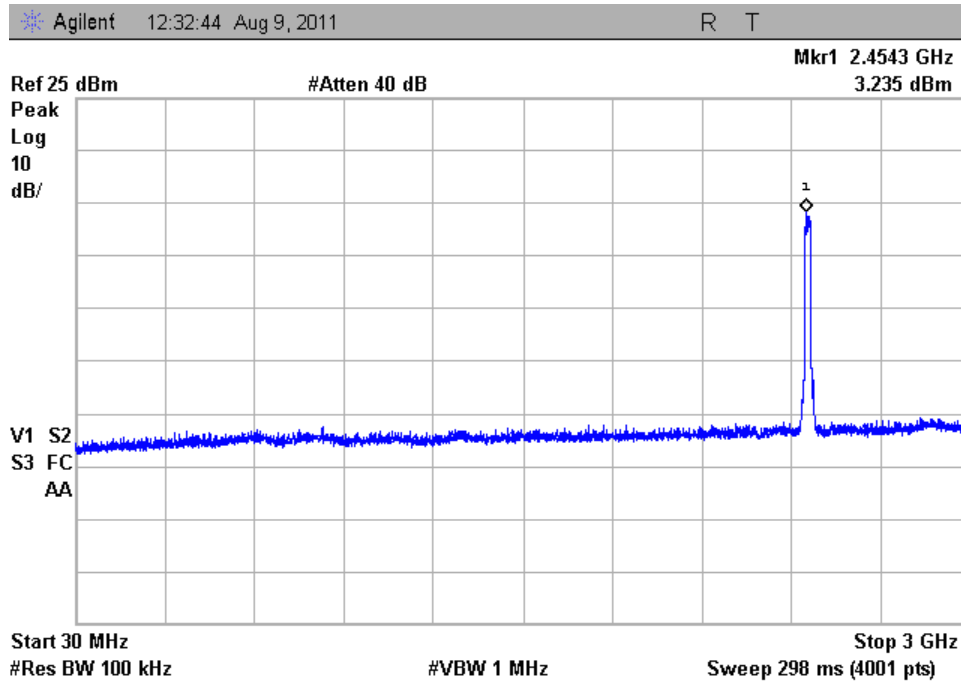
Conducted Spurious Emissions - 802.11g Mode Low Channel



Conducted Spurious Emissions - 802.11g Mode Mid Channel

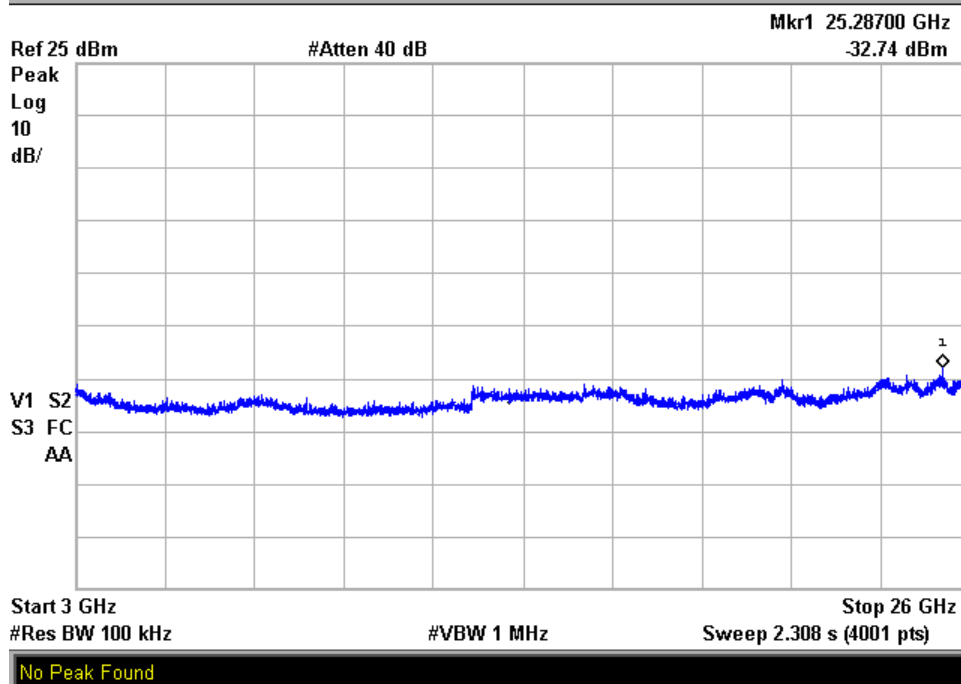


Conducted Spurious Emissions - 802.11g Mode High Channel



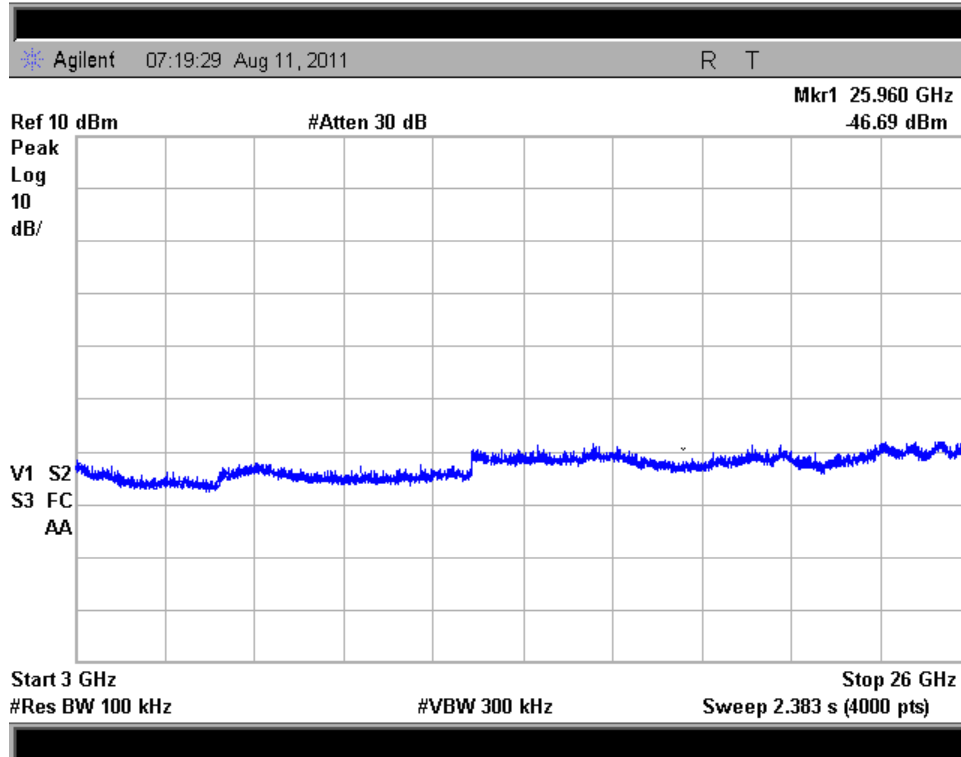
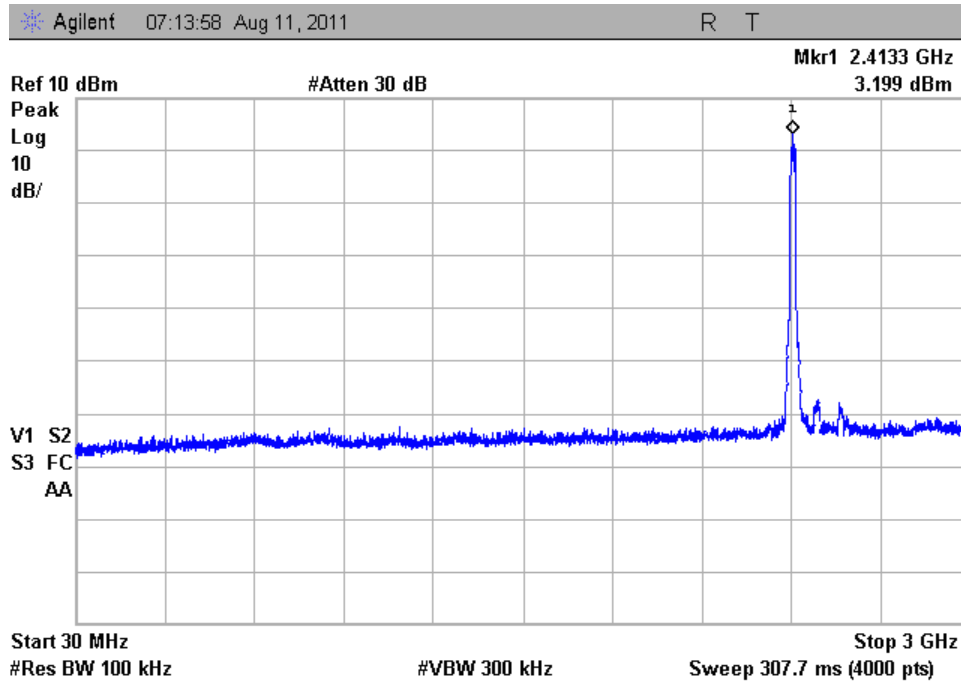
No Peak Found

Agilent 12:41:04 Aug 9, 2011 R T

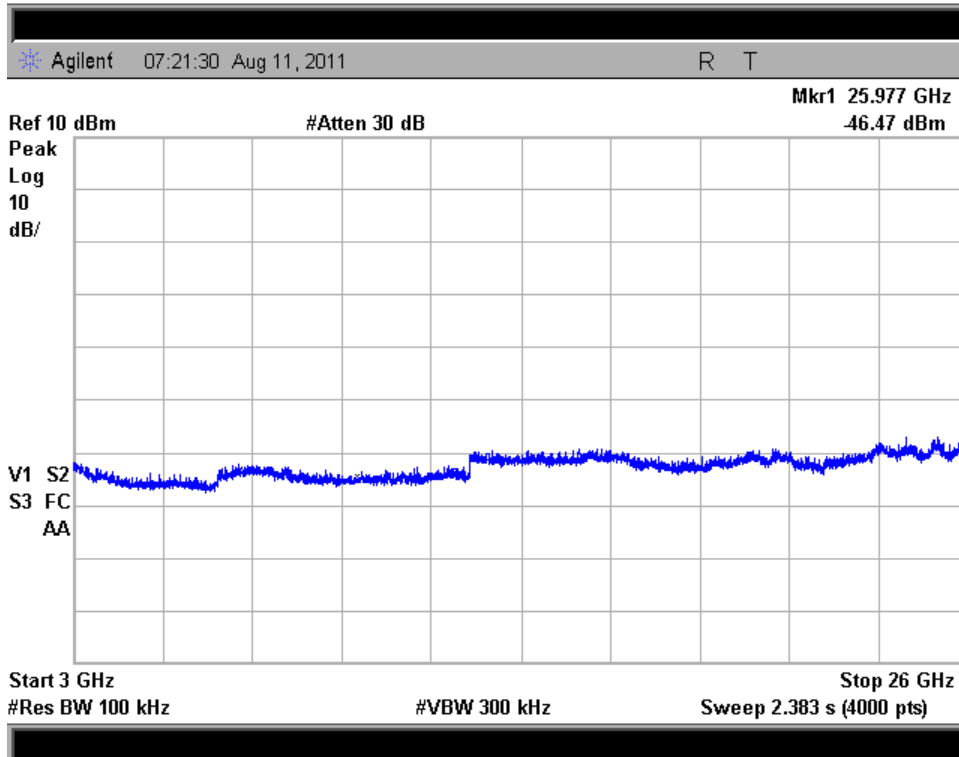
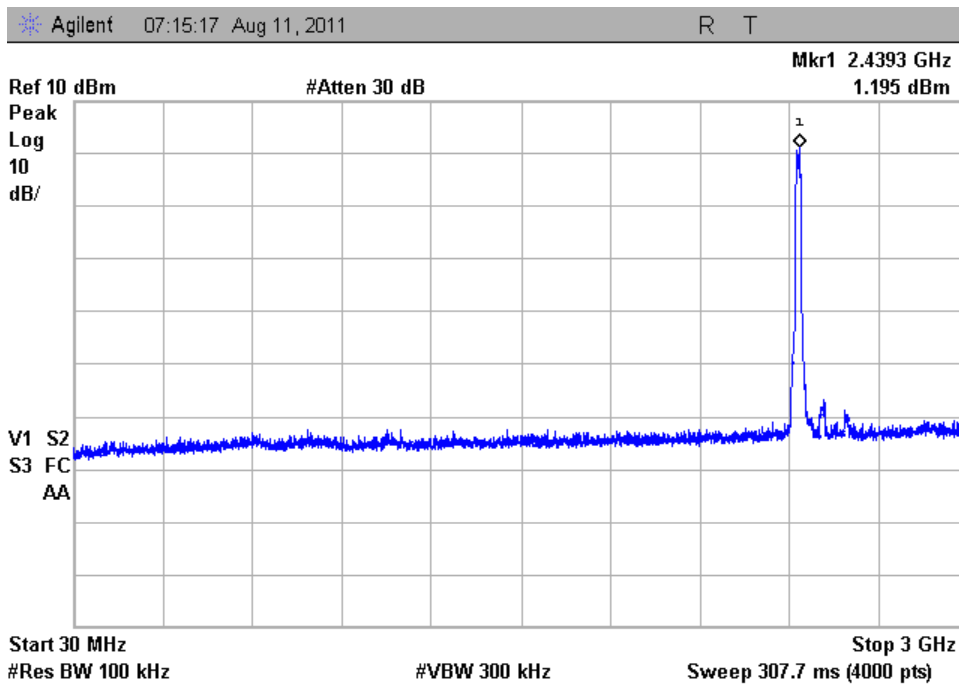


No Peak Found

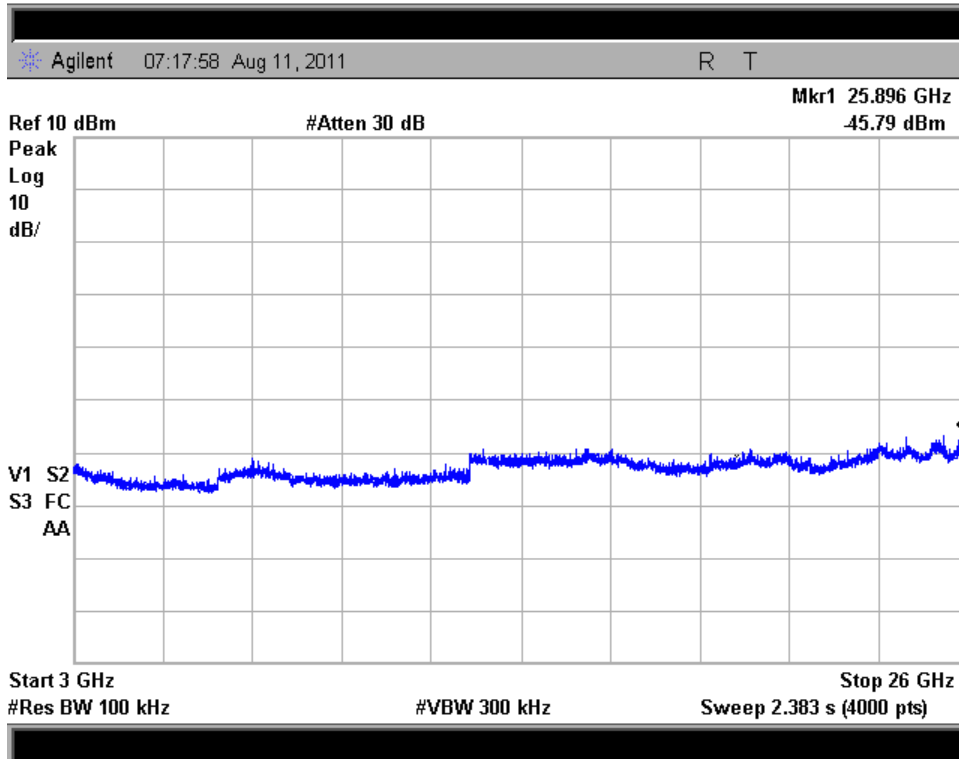
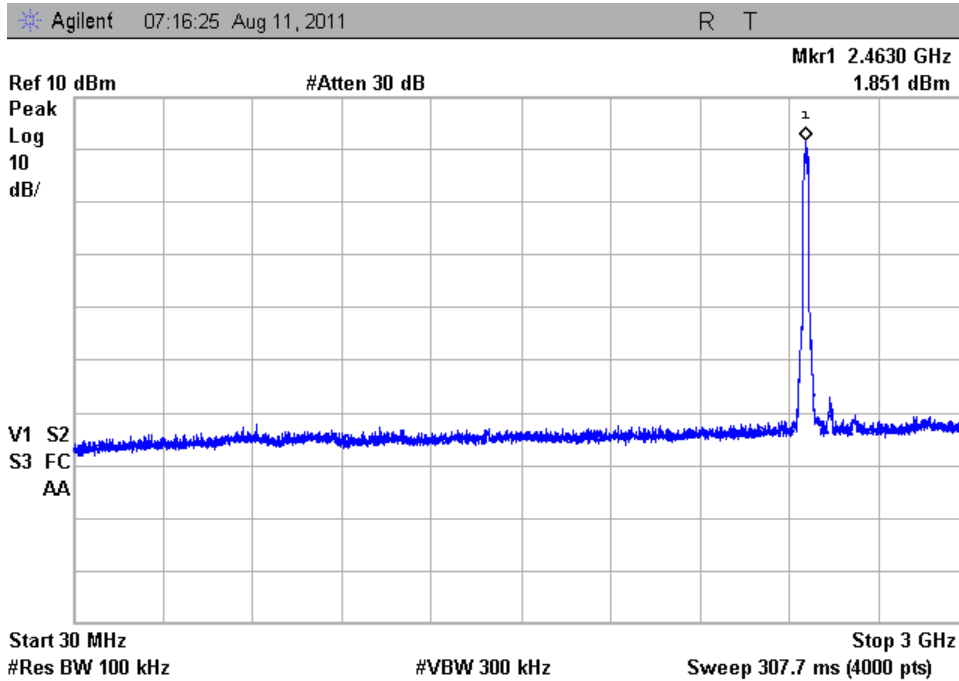
Conducted Spurious Emissions - 802.11n Mode (20MHz) Low Channel



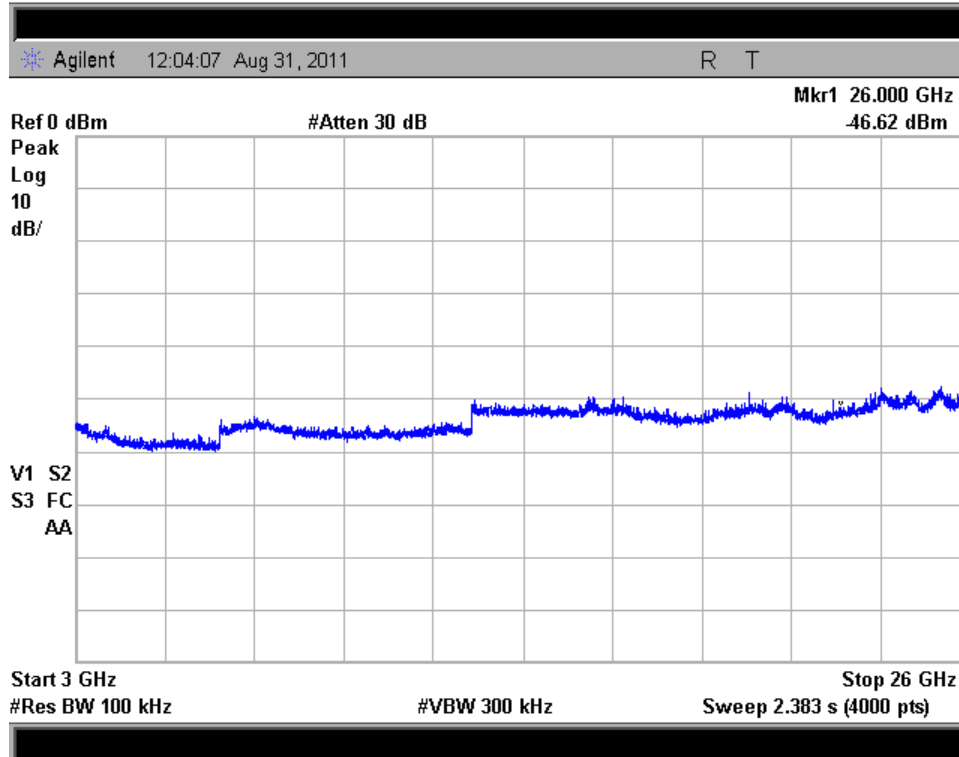
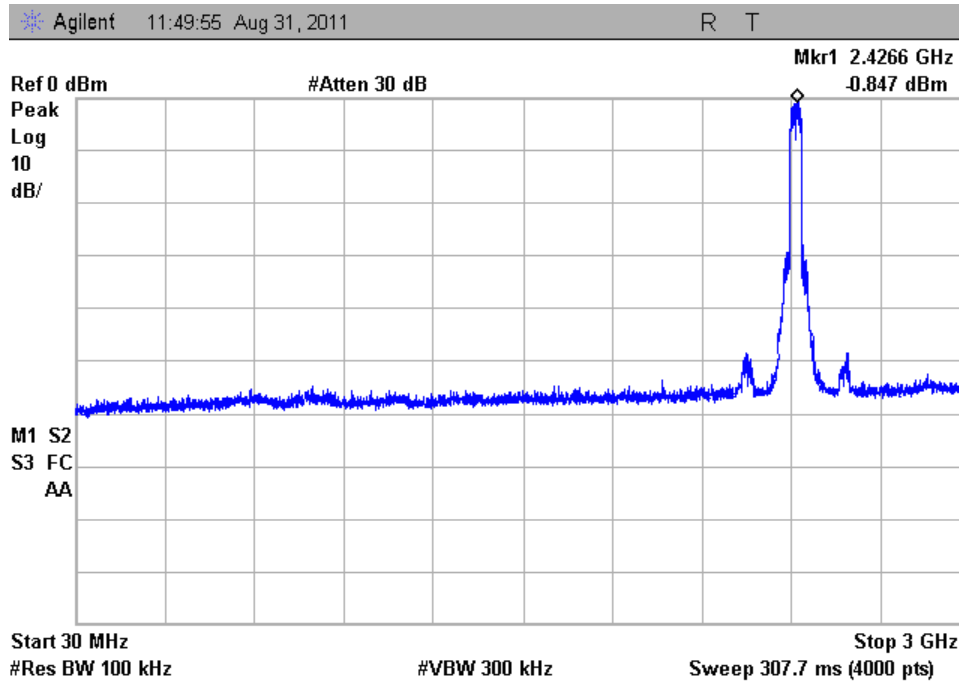
Conducted Spurious Emissions - 802.11n Mode (20MHz) Mid Channel



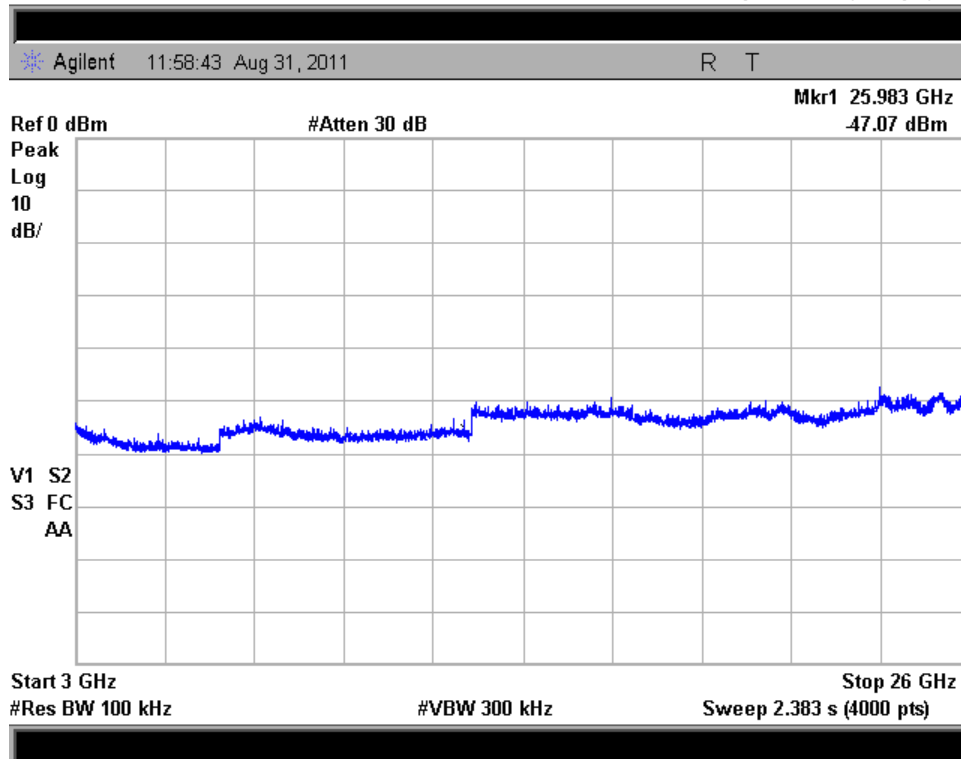
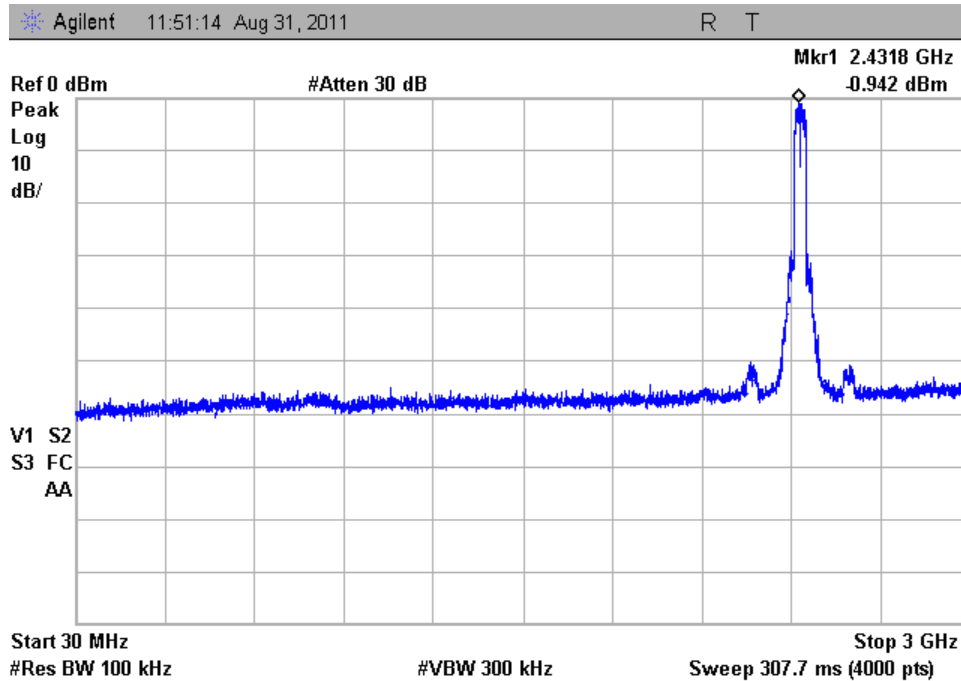
Conducted Spurious Emissions - 802.11n (20MHz) Mode High Channel



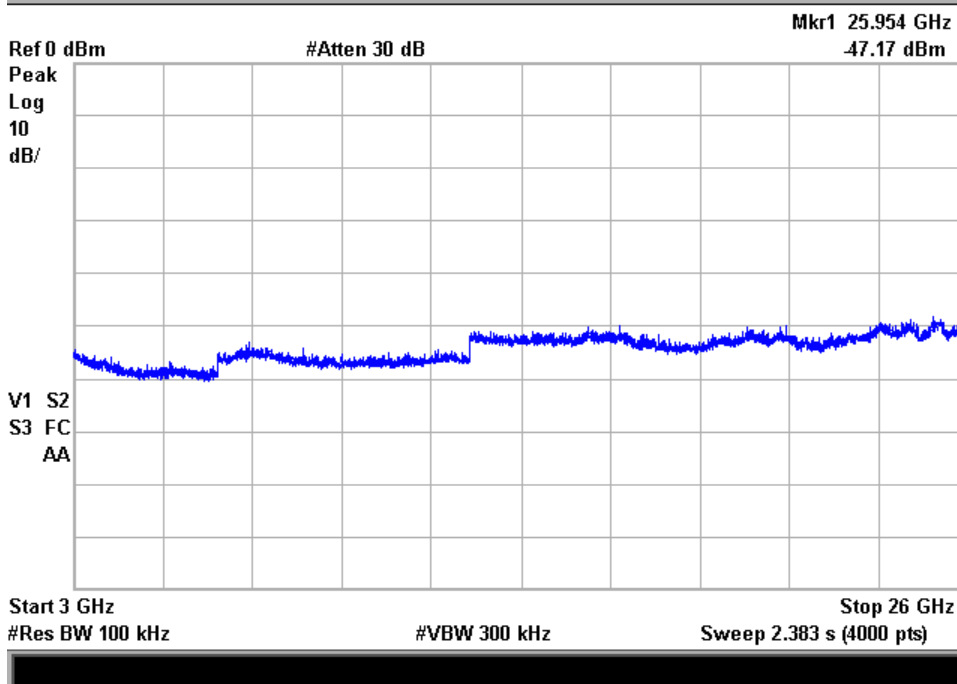
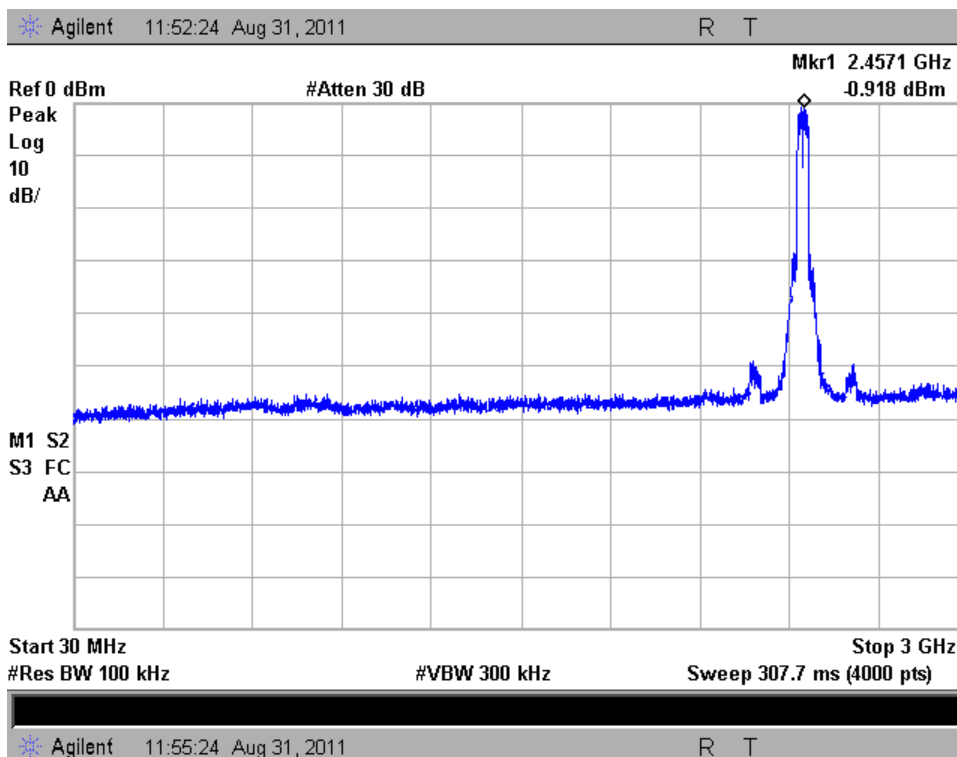
Conducted Spurious Emissions - 802.11n Mode (40MHz) Low Channel



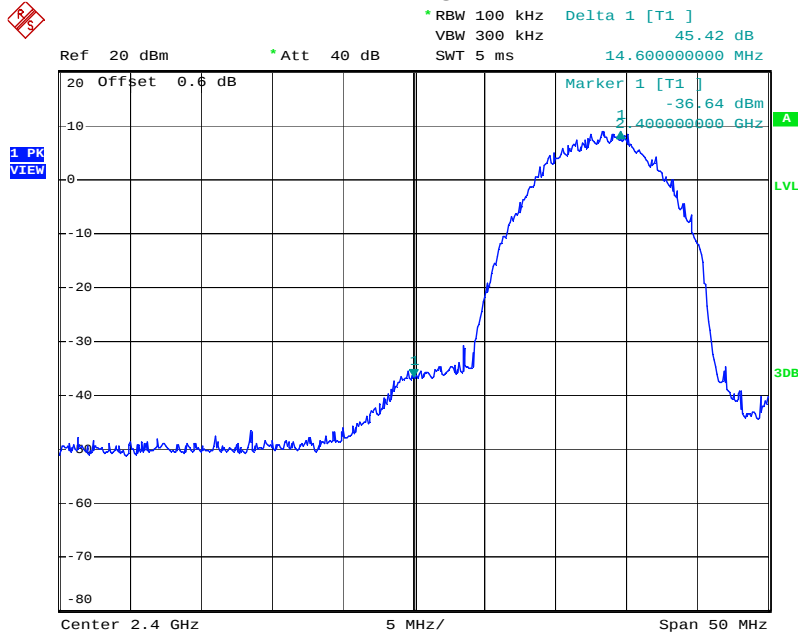
Conducted Spurious Emissions - 802.11n Mode (40MHz) Mid Channel



Conducted Spurious Emissions - 802.11n (40MHz) Mode High Channel

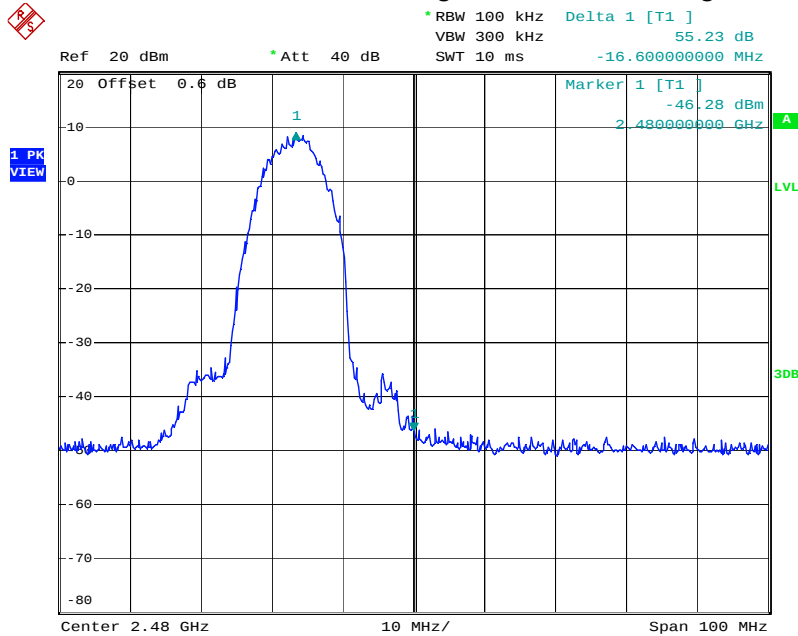


Emissions Close to Band Edge - 802.11b Mode Low Channel



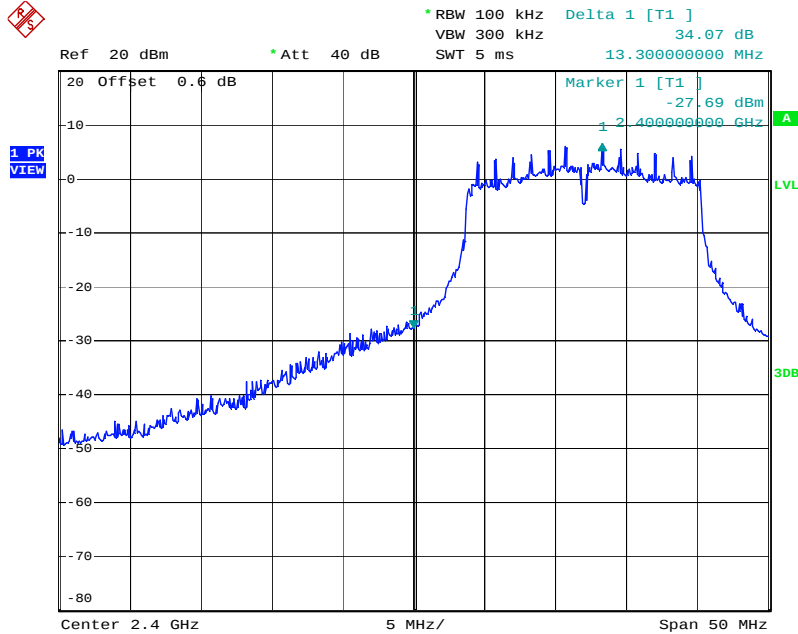
Date: 9.AUG.2011 15:05:32

Emissions Close to Band Edge - 802.11b Mode High Channel



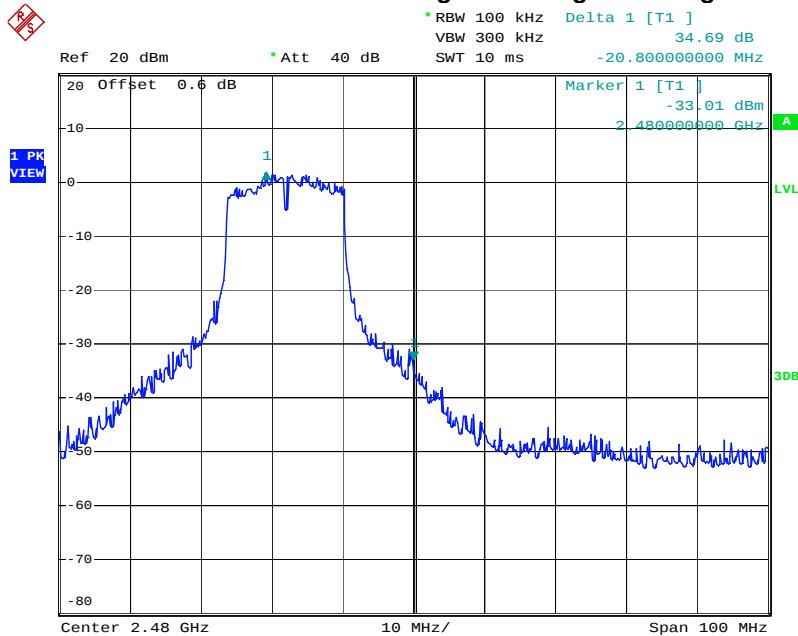
Date: 9.AUG.2011 15:11:07

Emissions Close to Band Edge - 802.11g Mode Low Channel



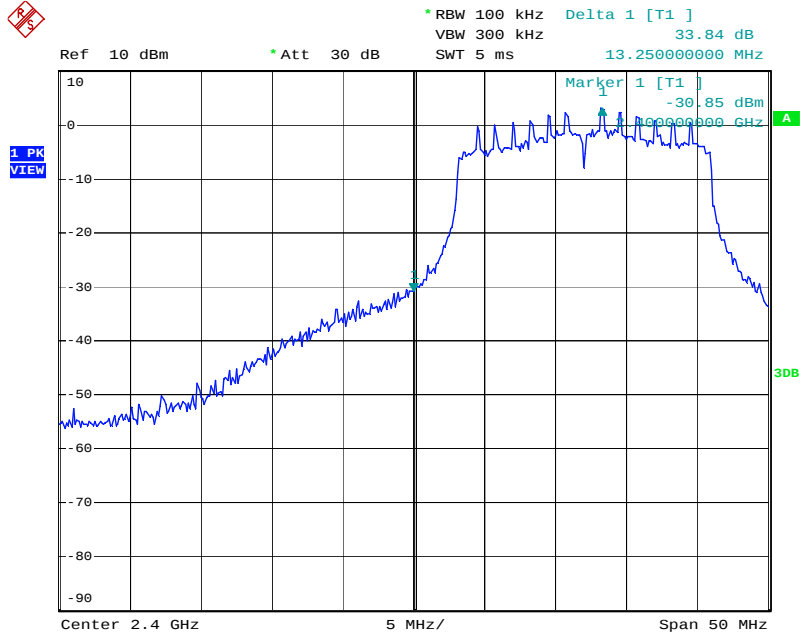
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Emissions Close to Band Edge - 802.11g Mode High Channel



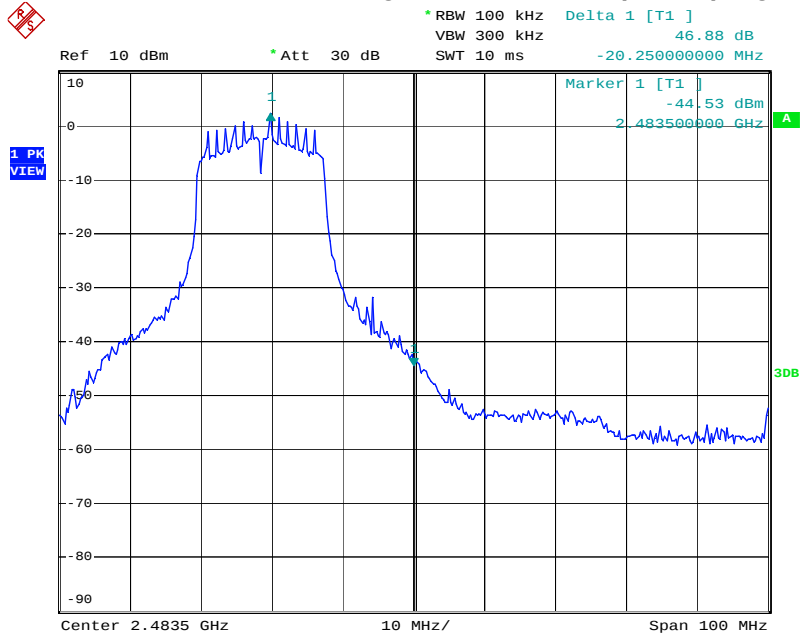
Date: 9.AUG.2011 15:10:07

Emissions Close to Band Edge - 802.11n Mode (20MHz) Low Channel



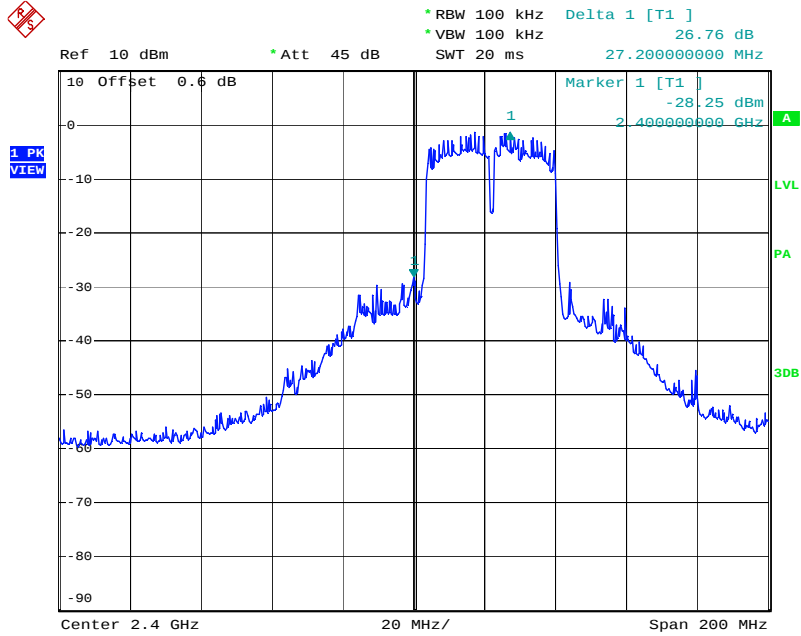
Date: 11.AUG.2011 10:00:21

Emissions Close to Band Edge - 802.11n Mode (20MHz) High Channel



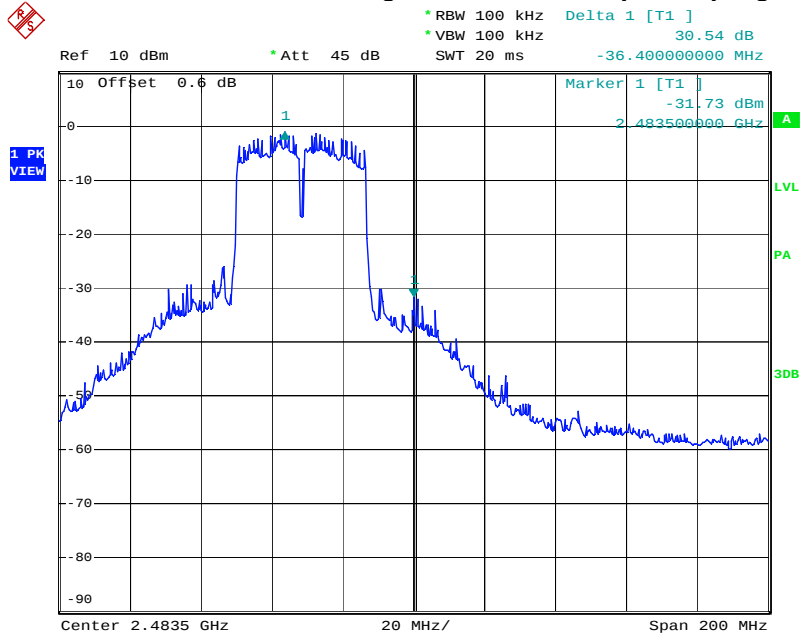
Date: 11.AUG.2011 10:04:22

Emissions Close to Band Edge - 802.11n Mode (40MHz) Low Channel



Date: 31.AUG.2011 13:38:33

Emissions Close to Band Edge - 802.11n Mode (40MHz) High Channel



Date: 31.AUG.2011 13:36:51

7 Power Spectral Density

7.1 Test Limits

§ 15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

7.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

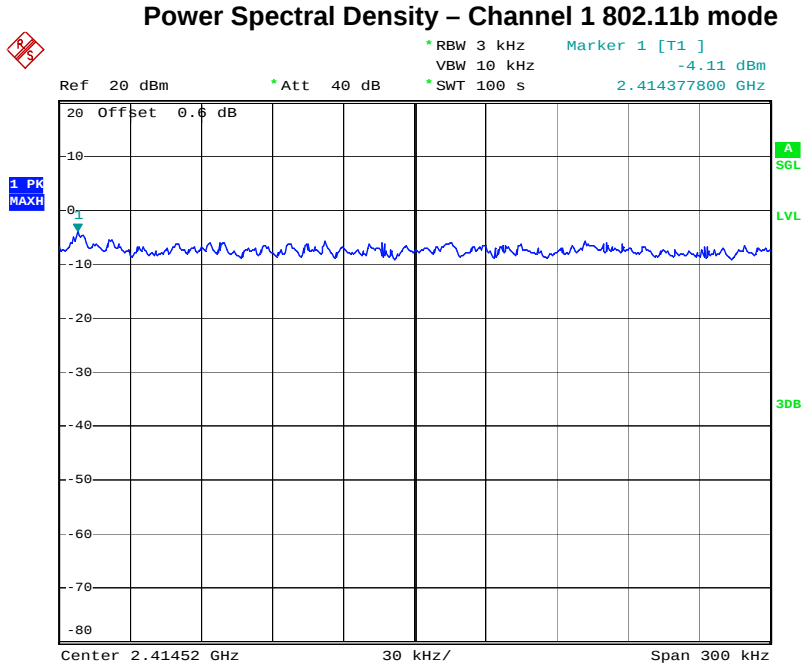
7.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	8/27/2010	8/27/2011
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	6/29/2011	6/29/2012

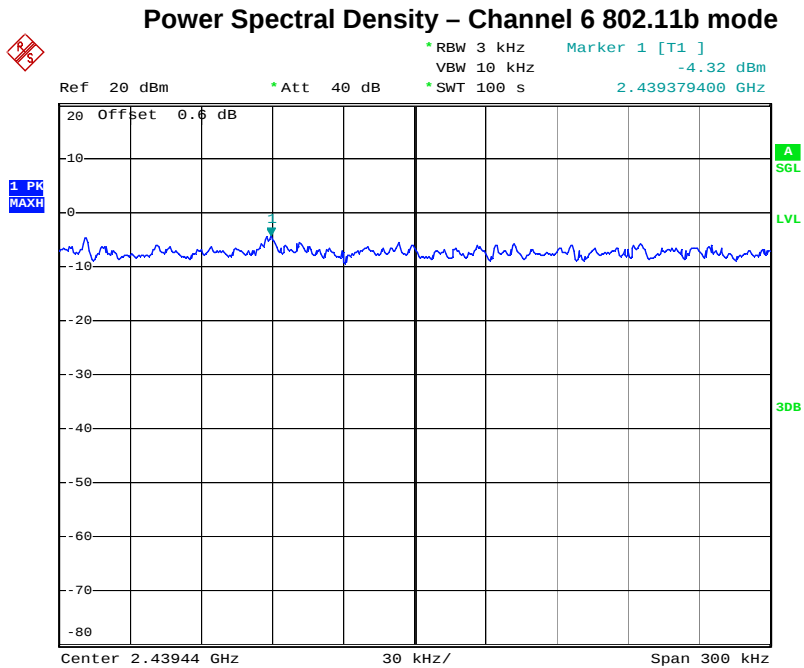
7.4 Results:

*PSD Option 1 Method

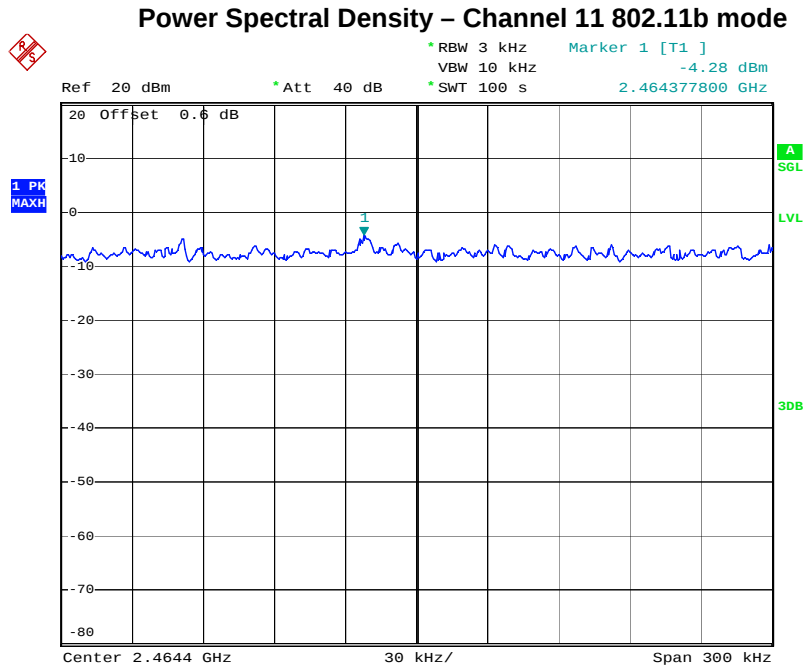
Mode	Channel Number	Frequency (MHz)	PSD in 3kHz BW (dBm)	Limit (dBm)	Margin (dBm)	Result
802.11b	1	2414.5	-4.11	8.0	-12.11	Pass
802.11b	6	2439.4	-4.32	8.0	-12.32	Pass
802.11b	11	2464.4	-4.28	8.0	-12.28	Pass
802.11g	1	2413.3	-7.4	8.0	-15.4	Pass
802.11g	6	2438.2	-7.99	8.0	-15.99	Pass
802.11g	11	2460.9	-8.00	8.0	-16.00	Pass
802.11n (20MHz)	1	2413.25	-11.82	8.0	-19.82	Pass
802.11n (20MHz)	6	2436.1	-12.53	8.0	-20.53	Pass
802.11n (20MHz)	11	2463.2	-12.09	8.0	-20.09	Pass
802.11n (40MHz)	3	2461.8	-14.58	8.0	-22.58	Pass
802.11n (40MHz)	6	2432	-12.6	8.0	-20.6	Pass
802.11n (40MHz)	9	2447	-13.32	8.0	-21.32	Pass



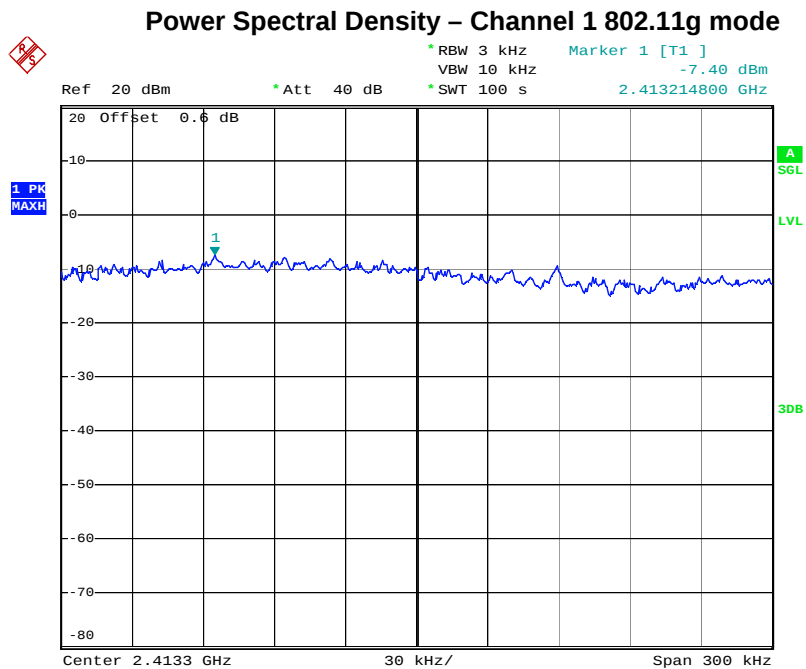
Date: 9.AUG.2011 15:03:37



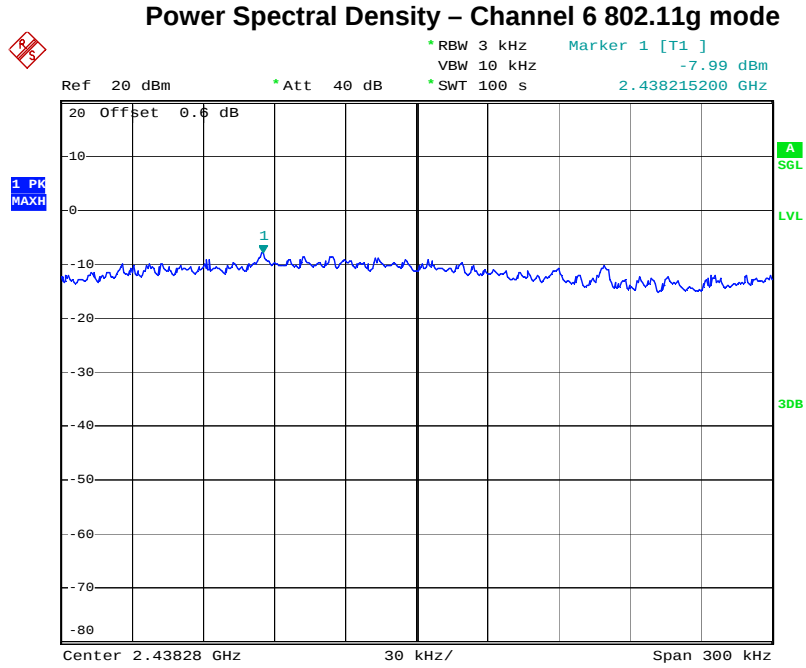
Date: 9.AUG.2011 15:00:16



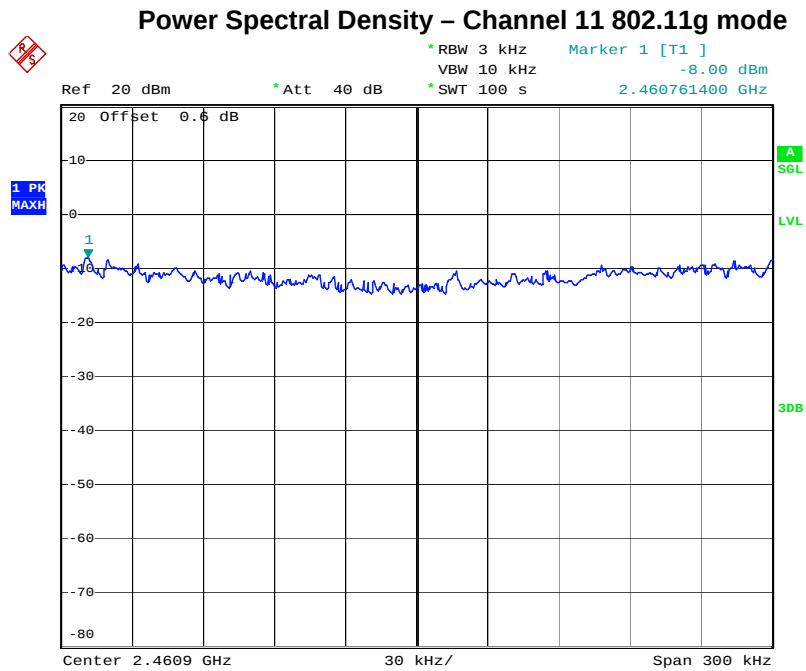
Date: 9.AUG.2011 14:54:39



Date: 9.AUG.2011 14:41:24

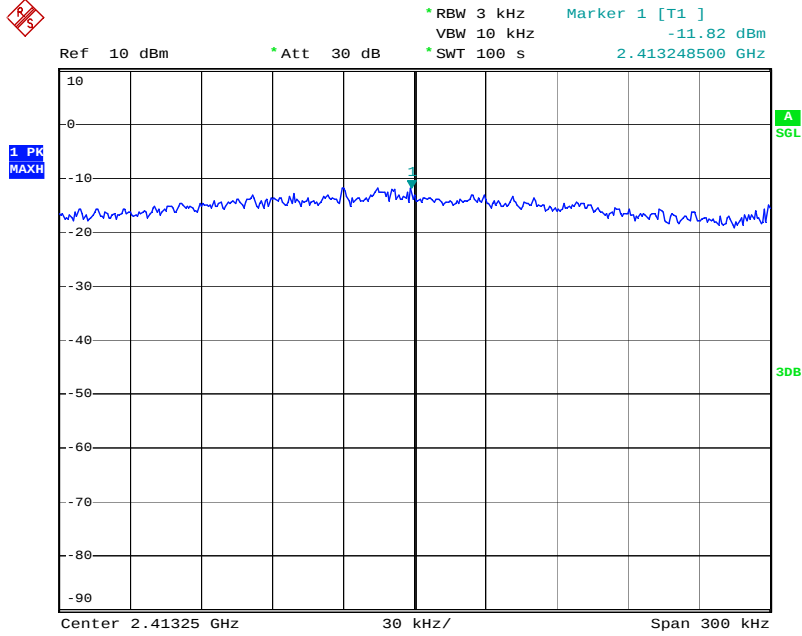


Date: 9.AUG.2011 14:46:16



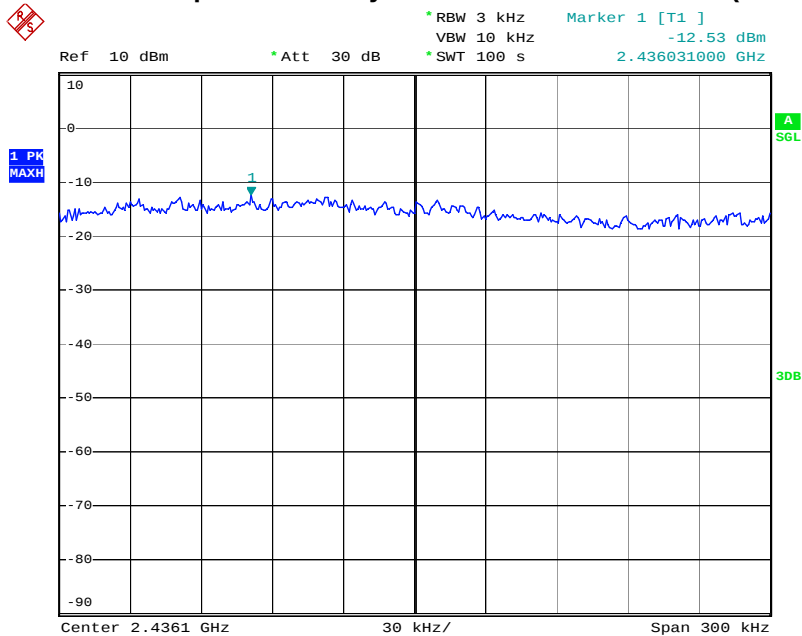
Date: 9.AUG.2011 14:49:42

Power Spectral Density – Channel 1 802.11n mode (20MHz)



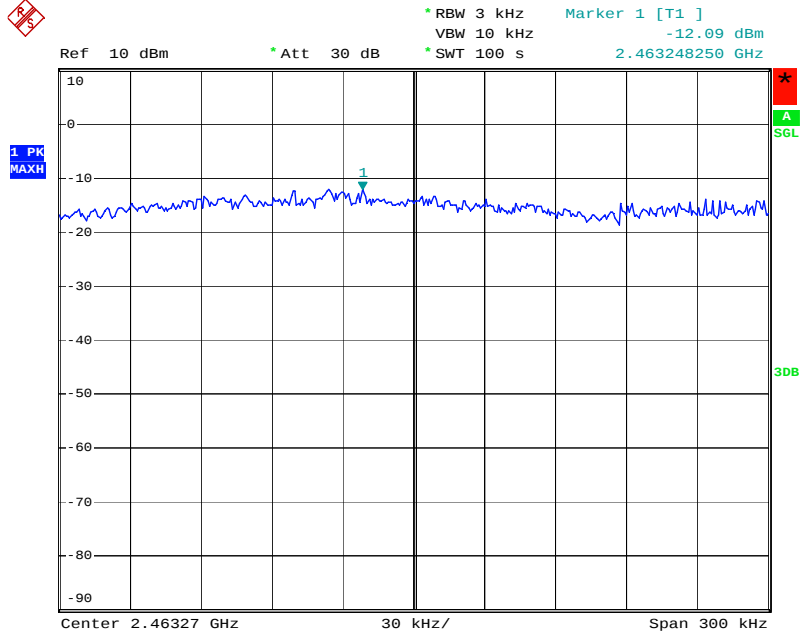
Date: 11.AUG.2011 09:54:45

Power Spectral Density – Channel 6 802.11n mode (20MHz)



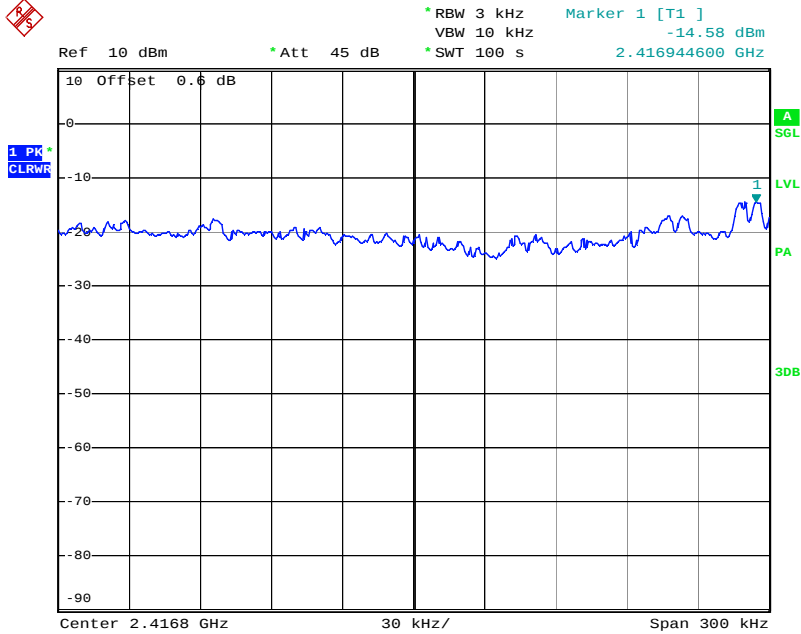
Date: 11.AUG.2011 09:58:39

Power Spectral Density – Channel 11 802.11n mode (20MHz)



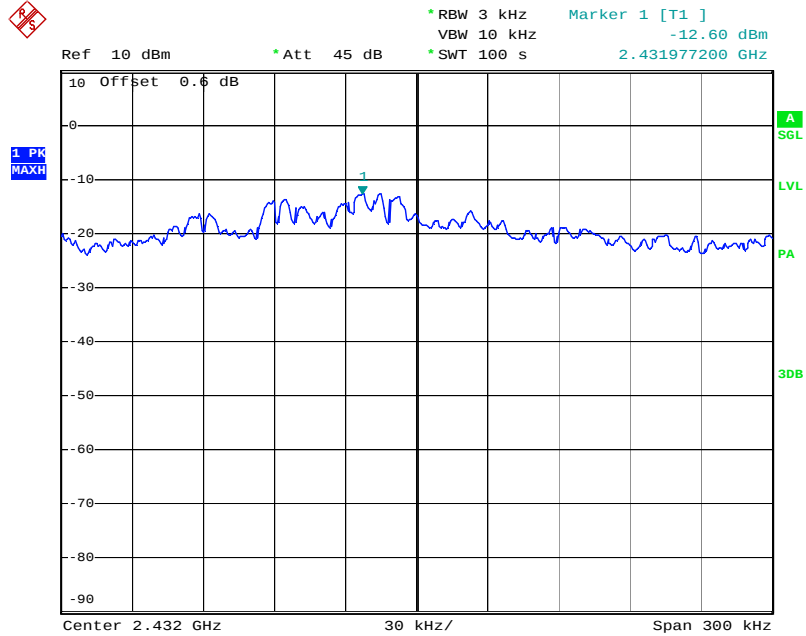
Date: 11.AUG.2011 09:49:51

Power Spectral Density – Channel 3 802.11n mode (40MHz)



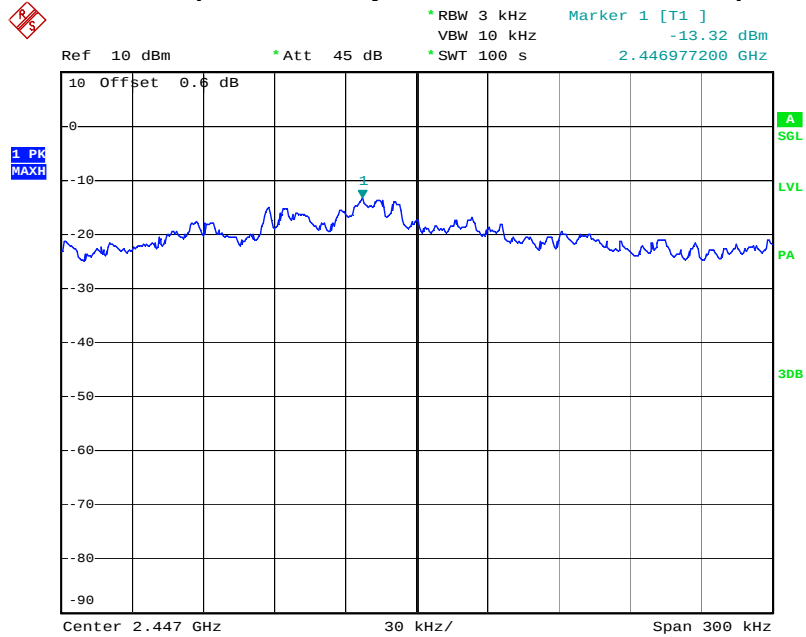
Date: 31.AUG.2011 14:06:57

Power Spectral Density – Channel 6 802.11n mode (40MHz)



Date: 31.AUG.2011 14:36:01

Power Spectral Density – Channel 9 802.11n mode (40MHz)



Date: 31.AUG.2011 14:40:29

8 Radiated Spurious Emissions (Transmitter)

8.1 Test Limits

§ 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Part 15.205(a): Restricted Bands of Operations

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
10.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(²)
13.36–13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

² Above 38.6

Part 15.209(a): Field Strength Limits for Restricted Bands of Operation

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

8.2 Test Procedure

ANSI C63.10: 2009 and KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

8.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dB μ V/m

RA = Receiver Amplitude in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dB μ V

AF = 18.52 dB

CF = 0.78 dB

FS = 19.48 + 18.52 + 0.78 = 38.78 dB μ V/m

Level in μ V/m = Common Antilogarithm [(38.78 dB μ V/m)/20] = 86.89 μ V/m

8.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	987410	Miteq	AFS44-00102000-30-10P-44	9/4/2012	9/4/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
Horn Antenna	6556	ETS	3115	9/13/2012	9/13/2013
System Controller	121701-1	Sunol Sciences	SC99V	Calibration Not Required	Calibration Not Required
High Pass Filter	3986-01 DC0408	Microwave Circuits, Inc.	H3G020G2	Calibrate at Time Of Use	Calibrate at Time Of Use

8.5 Results:

All spurious emissions were attenuated by at least 20dB below the level of the fundamental as required by Part 15.247(d). Additionally, all emissions falling within restricted bands of operation and at the band edges were found to be below the limit specified in Part 15.209(a). The spurious emissions listed in the following tables are the worst case emissions. Emissions not reported were at or below the measurement noise floor.

Worst Case Spurious Measurements (802.11b Mode)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results
1	4.824 GHz	V	35.393	26.123	74	54	Compliant
	7.236 GHz	V	41.152	32.262	74	54	Compliant
	12.06 GHz	V	44.542	35.922	74	54	Compliant
	4924	H	36.063	26.033	74	54	Compliant
	7.236 GHz	H	41.992	32.202	74	54	Compliant
	12.06 GHz	H	45.302	35.852	74	54	Compliant
6	4.874 GHz	V	48.202	44.532	74	54	Compliant
	7.311 GHz	V	39.506	31.016	74	54	Compliant
	12.185 GHz	V	49.746	36.586	74	54	Compliant
	3.2492 GHz	H	41.004	32.724	74	54	Compliant
	4.874 GHz	H	46.373	41.803	74	54	Compliant
	7.311 GHz	H	44.126	31.136	74	54	Compliant
11	12.185 GHz	H	48.926	35.625	74	54	Compliant
	4.9239 GHz	V	46.771	42.681	74	54	Compliant
	7.386 GHz	V	45.435	31.985	74	54	Compliant
	12.31 GHz	V	49.545	36.085	74	54	Compliant
	4.924 GHz	H	47.491	43.781	74	54	Compliant
	7.3861 GHz	H	44.905	32.115	74	54	Compliant
	12.311 GHz	H	52.891	41.011	74	54	Compliant

Worst Case Spurious Measurements (802.11g Mode)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results
1	4.824 GHz	V	43.463	28.653	74	54	Compliant
	7.236 GHz	V	44.152	31.262	74	54	Compliant
	12.06 GHz	V	52.162	36.082	74	54	Compliant
	4.824 GHz	H	43.733	30.123	74	54	Compliant
	7.2361 GHz	H	45.083	32.393	74	54	Compliant
	12.06 GHz	H	51.902	37.232	74	54	Compliant
6	4.874 GHz	V	45.023	30.893	74	54	Compliant
	7.3111 GHz	V	45.856	30.136	74	54	Compliant
	12.185 GHz	V	48.386	35.266	74	54	Compliant
	4.8741 GHz	H	43.903	30.613	74	54	Compliant
	7.311 GHz	H	46.256	32.066	74	54	Compliant
	12.185 GHz	H	49.346	37.806	74	54	Compliant
11	4.9239 GHz	V	38.111	28.041	74	54	Compliant
	7.386 GHz	V	42.745	32.365	74	54	Compliant
	12.31 GHz	V	48.185	37.355	74	54	Compliant
	4.9239 GHz	H	42.031	28.541	74	54	Compliant
	7.3861 GHz	H	42.045	32.315	74	54	Compliant
	12.31 GHz	H	45.005	36.115	74	54	Compliant

Worst Case Spurious Measurements (802.11n (20MHz) Mode)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results
1	4.824 GHz	V	43.063	28.073	74	54	Compliant
	7.2361 GHz	V	41.713	31.603	74	54	Compliant
	12.06 GHz	V	45.432	35.792	74	54	Compliant
	4.824 GHz	V	43.063	28.073	74	54	Compliant
	7.2361 GHz	V	41.713	31.603	74	54	Compliant
	12.06 GHz	V	45.432	35.792	74	54	Compliant
6	4.8741 GHz	V	35.833	26.953	74	54	Compliant
	7.3111 GHz	V	40.906	31.296	74	54	Compliant
	12.185 GHz	V	45.966	35.946	74	54	Compliant
	4.874 GHz	H	39.963	30.423	74	54	Compliant
	7.311 GHz	H	40.906	31.006	74	54	Compliant
	12.185 GHz	H	46.346	36.426	74	54	Compliant
11	4.924 GHz	V	37.981	27.181	74	54	Compliant
	7.3861 GHz	V	41.395	31.545	74	54	Compliant
	12.31 GHz	V	46.905	36.195	74	54	Compliant
	4.9241 GHz	H	39.101	29.061	74	54	Compliant
	7.386 GHz	H	41.785	31.455	74	54	Compliant
	12.31 GHz	H	47.675	36.975	74	54	Compliant

Worst Case Spurious Measurements (802.11n (40MHz)Mode)

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results
3	4.844 GHz	V	37.581	27.121	74	54	Compliant
	7.266 GHz	V	43.167	32.277	74	54	Compliant
	12.11 GHz	V	47.438	36.628	74	54	Compliant
	4.8439 GHz	H	37.19	36.745	74	54	Compliant
	7.2603 GHz	H	44.204	32.114	74	54	Compliant
	12.11 GHz	H	46.668	36.808	74	54	Compliant
6	4.874 GHz	V	36.893	27.093	74	54	Compliant
	7.3111 GHz	V	43.046	32.726	74	54	Compliant
	12.185 GHz	V	46.476	36.606	74	54	Compliant
	4.8739 GHz	H	37.022	27.172	74	54	Compliant
	7.3111 GHz	H	42.226	32.816	74	54	Compliant
	12.185 GHz	H	46.976	36.706	74	54	Compliant
9	4.9039 GHz	V	42.204	28.154	74	54	Compliant
	7.356 GHz	V	45.079	32.249	74	54	Compliant
	12.26 GHz	V	47.615	36.995	74	54	Compliant
	4.9041 GHz	H	37.915	27.455	74	54	Compliant
	7.356 GHz	H	41.809	32.319	74	54	Compliant
	12.245 GHz	H	49.631	37.211	74	54	Compliant

Low Channel Restricted Band Edge Emissions

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
1 (for b, g, n20MHz, 3 for n40MHz)	2.332 GHz	V	59.626	49.476	74	54	Compliant	802.11b
	2.39 GHz	V	61.653	50.043	74	54	Compliant	802.11b
	2.332 GHz	H	59.886	49.516	74	54	Compliant	802.11b
	2.39 GHz	H	60.153	50.133	74	54	Compliant	802.11b
	2.379 GHz	V	60.803	50.403	74	54	Compliant	802.11g
	2.39 GHz	V	61.783	50.673	74	54	Compliant	802.11g
	2.379 GHz	H	62.133	50.383	74	54	Compliant	802.11g
	2.39 GHz	H	60.433	50.033	74	54	Compliant	802.11g
	2.38 GHz	V	62.007	50.367	74	54	Compliant	802.11n (20MHz)
	2.39 GHz	V	60.153	50.323	74	54	Compliant	802.11n (20MHz)
	2.38 GHz	H	59.307	50.367	74	54	Compliant	802.11n (20MHz)
	2.39 GHz	H	59.753	50.063	74	54	Compliant	802.11n (20MHz)
	2.39 GHz	V	60.433	50.003	74	54	Compliant	802.11n (40MHz)
	2.39 GHz	H	60.023	50.003	74	54	Compliant	802.11n (40MHz)

High Channel Band Edge Emissions

TX Channel	Spurious Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
11 (for b, g, n20MHz, 9 for n40MHz)	2.4835 GHz	V	59.849	50.209	74	54	Compliant	802.11b
	2.487 GHz	V	60.138	50.288	74	54	Compliant	802.11b
	2.4835 GHz	H	60.929	50.199	74	54	Compliant	802.11b
	2.487 GHz	H	59.468	50.248	74	54	Compliant	802.11b
	2.4835 GHz	V	59.719	50.449	74	54	Compliant	802.11g
	2.484 GHz	V	60.251	50.391	74	54	Compliant	802.11g
	2.4835 GHz	H	60.519	50.329	74	54	Compliant	802.11g
	2.484 GHz	H	59.991	50.301	74	54	Compliant	802.11g
	2.4835 GHz	V	59.719	50.409	74	54	Compliant	802.11n (20MHz)
	2.486 GHz	V	59.732	50.262	74	54	Compliant	802.11n (20MHz)
	2.4835 GHz	H	59.849	50.239	74	54	Compliant	802.11n (20MHz)
	2.486 GHz	H	60.132	50.182	74	54	Compliant	802.11n (20MHz)
	2.4835 GHz	V	59.169	50.089	74	54	Compliant	802.11n (40MHz)
	2.4835 GHz	H	58.759	50.089	74	54	Compliant	802.11n (40MHz)

9 Radiated Spurious Emissions (Receiver)

9.1 Test Limits

§ 15.109: Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBuV/m)
30–88	100	40
88–216	150	43.5
216–960	200	46
Above 960	500	54

These limits are identical to those in RSS-GEN

9.2 Test Procedure

ANSI C63.4: 2009

9.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dBμV/m

RA = Receiver Amplitude in dBμV

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dBμV

AF = 18.52 dB

CF = 0.78 dB

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

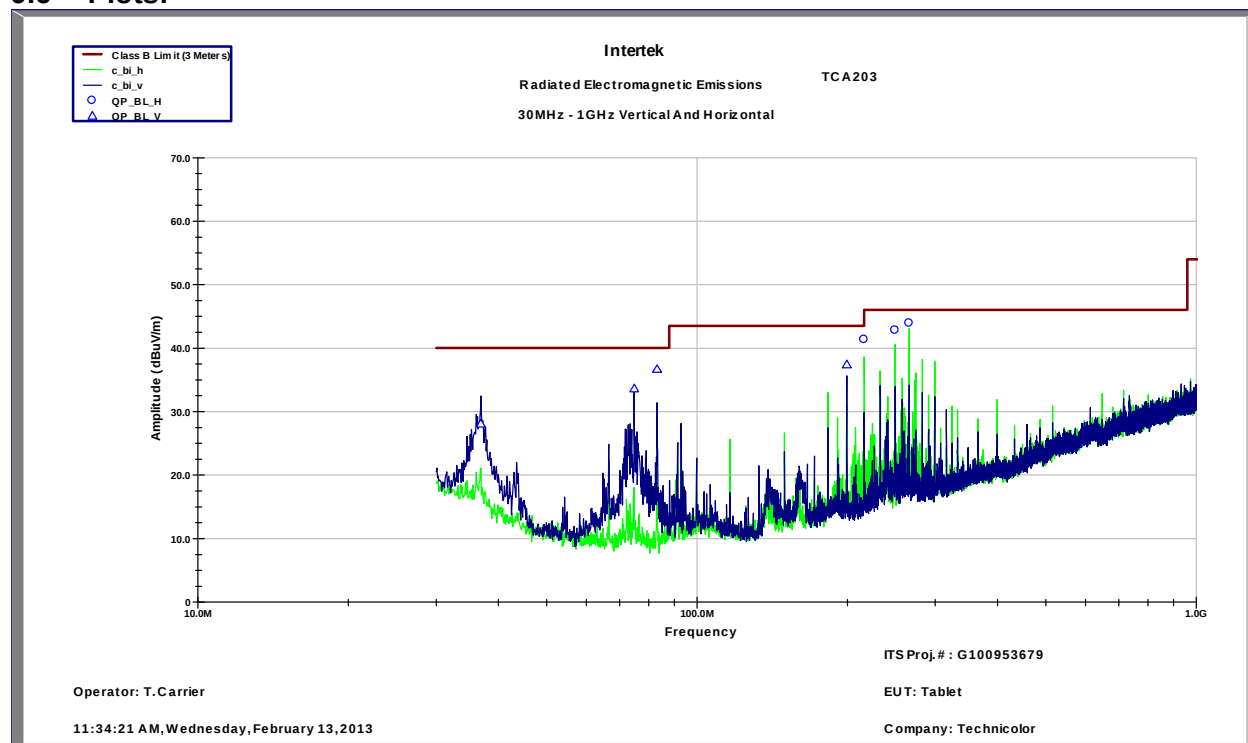
9.4 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESI26	9/15/2012	9/14/2013
Preamplifier	SF456200904	Mini-Circuits	ZX60-3018G-S+	9/4/2012	9/4/2013
Biconnilog Antenna	00051864	ETS	3142C	12/14/2012	12/14/2013
Horn Antenna	6556	ETS	3115	9/13/2012	9/13/2013
System Controller	121701-1	Sunol Sciences	SC99V	Time of Use	Time of Use

9.5 Results:

All spurious emissions with the test sample in receive mode were below the limits specified in Part 15.109 for a class B digital device and RSS-GEN Section 6.1.

9.6 Plots:



9.7 Test Data:

Radiated Emissions										
Test Engineer: Toby Carrier		Start Date: 2/13/2013		End Date: 2/13/2013						
Temperature: 24.7°C		Humidity: 26.80%		Pressure: 979.9 mbar						
Specification: FCC Part 15B		Test Limit: Class B								
Notes: Idle Mode										
A	B	C	D	E	F	G	H	I	J	K
Frequency	Polarity (H/V)	Raw Reading (dBuV)	Cab. (dB)	Ant. (dB)	Corr. Reading. (dBuV/m)	Limit (dBuV/m)	Delta (dB)	RBW / Detector	Test Distance	Results
36.89 MHz	V	13.3	0.79	13.99	28.08	40	-11.92	120kHz/QP	10m	Compliant
74.83 MHz	V	26.07	1.13	6.42	33.62	40	-6.38	120kHz/QP	10m	Compliant
83.118 MHz	V	28.58	1.19	6.9	36.67	40	-3.33	120kHz/QP	10m	Compliant
199.52 MHz	V	25.06	1.89	10.45	37.4	43.52	-6.12	120kHz/QP	10m	Compliant
216.13 MHz	H	28.15	1.96	11.22	41.33	46.02	-4.69	120kHz/QP	10m	Compliant
249.4 MHz	H	28.3	2.11	12.39	42.8	46.02	-3.22	120kHz/QP	10m	Compliant
265.99 MHz	H	28.7	2.21	13.02	43.93	46.02	-2.09	120kHz/QP	10m	Compliant
Calculations:				F = C + D + E			H = F - G			

Deviations, Additions, or Exclusions: None

10 AC Powerline Conducted Emissions

10.1 Test Limits

§ 15.107(e): Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	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.

10.2 Test Procedure

ANSI C63.4: 2003

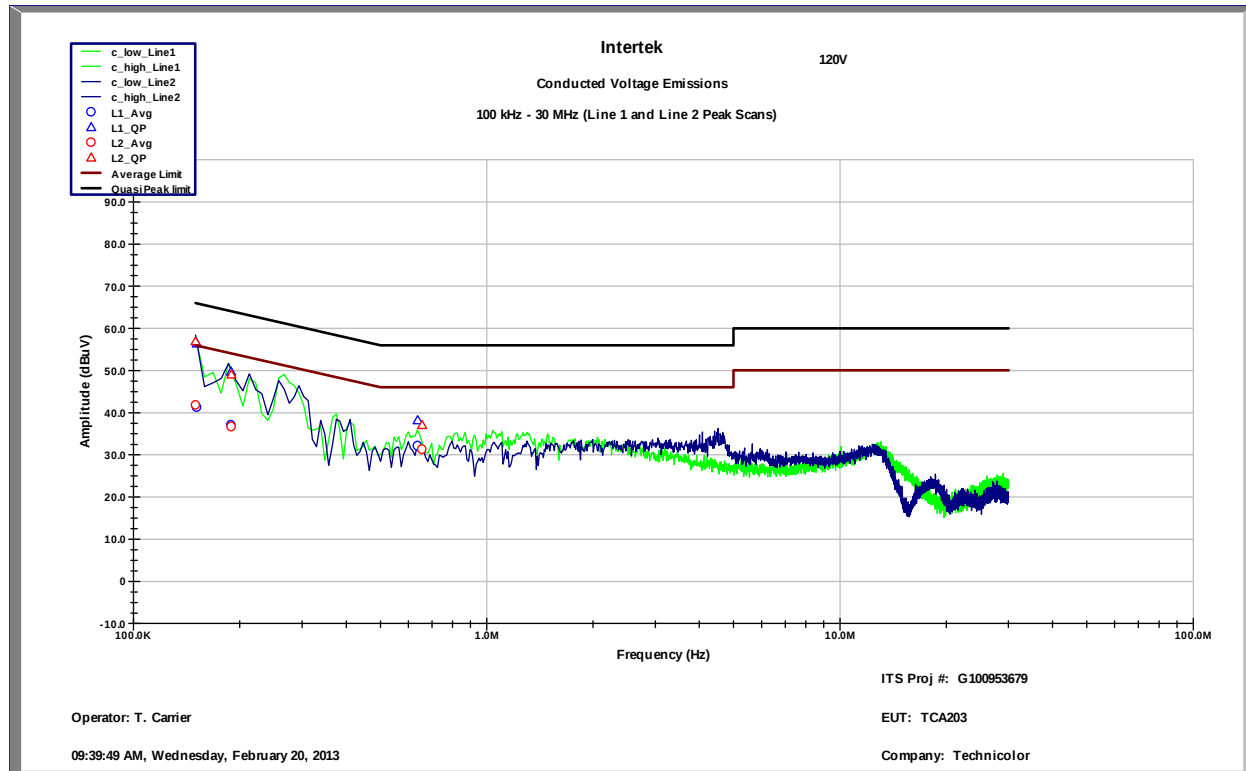
10.3 Test Equipment Used:

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
EMI Test Receiver	10887490.26	Rohde & Schwarz	ESi26	9/15/2012	9/14/2013
LISN	3333	Teseq	NNB52	3/8/2012	3/8/2013

10.4 Results:

The sample tested was found to Comply.

10.5 Data:



Conducted Voltage Emissions on Power Lines								
Test Engineer: Toby Carrier		Start Date: 2/20/2013		End Date: 2/20/2013				
Temperature: 26.3°C		Humidity: 14.20%		Pressure: 988.7 mbar				
Specification: FCC Part 15B		Test Limit: Class B		RBW: 9kHz				
Notes: TCA203 (120V)								
Line	Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Delta (dB)	Average (dBuV)	Average Limit (dBuV)	Average Delta (dB)	Results
L1	151.2 KHz	56.4	65.93	-9.54	41.21	55.93	-14.73	Compliant
L1	188.9 KHz	49.68	64.08	-14.41	37.05	54.08	-17.04	Compliant
L1	637.9 KHz	38.18	56	-17.82	32.06	46	-13.94	Compliant
L2	150.0 KHz	56.88	66	-9.12	41.77	56	-14.23	Compliant
L2	189.3 KHz	49.01	64.07	-15.06	36.66	54.07	-17.41	Compliant
L2	656.6 KHz	37.01	56	-18.99	31.28	46	-14.72	Compliant

Deviations, Additions, or Exclusions: None

11 Antenna Requirement per FCC Part 15.203

11.1 Test Limits

§ 15.203: 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 of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

11.2 Results:

The sample tested met the antenna requirement. The antenna utilized a U.fl connector for connection to the PCB.

12 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of $k = 2$, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

Parameter	Uncertainty	Notes
Radiated emissions, 30 to 1000 MHz	+3.9dB	
Radiated emissions, 1 to 18 GHz	+4.2dB	
Radiated emissions, 18 to 40 GHz	+4.3dB	
Power Port Conducted emissions, 150kHz to 30 MHz	+2.8dB	

13 Revision History

Revision Level	Date	Report Number	Notes
0	4/4/2013	100953679LEX-003	Original Issue
1	10/1/2011	100953679LEX-003	Editorial Corrections