FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

2.4GHz 11n Draft 2.0 1+4 Port WLAN Router

Model: WRT-383U

Trade Name: U-MEDIA

Issued to

U-MEDIA Communications, Inc.
9F, No. 1, Jin-Shan 7th ST.,
Hsinchu 300, Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,
Taoyuan Hsien, (338) Taiwan, R.O.C.
http://www.ccsemc.com.tw
service@tw.ccsemc.com

ACCREDITED
No. 0824-01

TAF
Testing Laboratory
0363

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION

Applicant: U-MEDIA Communications, Inc.
9F, No. 1, Jin-Shan 7th ST.,
Hsinchu 300, Taiwan, R.O.C.

Equipment Under Test: 2.4GHz 11n Draft 2.0 1+4 Port WLAN Router

Trade Name: U-MEDIA

Model: WRT-383U

Date of Test: July 18 ~ 21, 2007

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by: *Reviewed by:*

Johnny Liu
Section Manager
Compliance Certification Services Inc.

Amanda Wu
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	2.4GHz 11n Draft 2.0 1+4 Port WLAN Router
Trade Name	U-MEDIA
Model Number	WRT-383U
Model Discrepancy	N/A
Power Adapter	Model: MT12-4120100-A1 I/P: 120, 50-60Hz, 0.3A O/P: 12V, 1.0A
Frequency Range	2412 ~ 2462 MHz
Transmit Power	IEEE 802.11b mode: 21.48 dBm IEEE 802.11g mode: 19.27 dBm draft 802.11n Standard-20 MHz Channel mode: 19.44 dBm draft 802.11n Wide-40 MHz Channel mode: 20.00 dBm
Modulation Technique	IEEE 802.11b mode: DSSS (1, 2, 5.5 and 11 Mpbs) IEEE 802.11g mode: OFDM (6, 9, 12, 18, 24, 36, 48 and 54 Mpbs) draft 802.11n Standard-20 MHz Channel mode: OFDM (6.5, 7.2, 13, 14.4, 14.44, 19.5, 21.7, 26, 28.89, 28.9, 39, 43.3, 43.33 52, 57.78, 57.8, 58.5, 65.0, 72.2, 78, 86.67, 104, 115.56, 117, 130, 144.44 Mbps) draft 802.11n Wide-40 MHz Channel mode: OFDM (13.5, 15, 27, 30, 40.5, 45, 54, 60, 81, 90, 108, 120, 121.5, 135, 150, 162, 180, 216, 240, 243, 270, 300 Mbps)
Number of Channels	IEEE 802.11b/g mode: 11 Channels draft 802.11n Standard-20 MHz Channel mode: 11 Channels draft 802.11n Wide-40 MHz Channel mode: 7 Channels
Antenna Specification	Omni Antenna / Gain: 4dBi (including cable loss)

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **SI5WRT383U** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT (model: WRT-383U) had been tested under operating condition.

The EUT is a 2x3 configuration spatial MIMO (2Tx & 3Rx) without beam forming function but with cyclic delay diversity function that operate in double TX chains and triple RX chains. The 2x3 configuration is implemented with two outside TX & RX chains (Chain 1 and the middle RX chain (chain 0).

Software used to control the EUT for staying in continuous transmitting mode was programmed.

The worst case data rate is determined as the data rate with highest output power.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate and cyclic delay diversity were chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate and cyclic delay diversity were chosen for full testing.

draft 802.11n Standard-20 MHz Channel mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6.5Mbps data rate were chosen for full testing.

draft 802.11n Wide-40 MHz Channel mode:

Channel Low (2422MHz), Channel Mid (2437MHz) and Channel High (2452MHz) with 13.5Mbps data rate were chosen for full testing.

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year.*

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/30/2008

3M Semi Anechoic Chamber				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	08/02/2007
Test Receiver	Rohde&Schwarz	ESCI	100064	11/13/2007
Switch Controller	TRC	Switch Controller	SC94050010	05/04/2008
4 Port Switch	TRC	4 Port Switch	SC94050020	05/04/2008
Horn-Antenna	TRC	HA-0502	06	06/01/2008
Horn-Antenna	TRC	HA-0801	04	05/04/2008
Horn-Antenna	TRC	HA-1201A	01	07/03/2008
Horn-Antenna	TRC	HA-1301A	01	07/03/2008
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/29/2008
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC: 965860 IC: IC 6106	09/26/2008
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/-2.0065dB (30MHz ~ 1GHz), +/-3.0958dB (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

Powerline Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver 9kHz-30MHz	Rohde & Schwarz	ESHS30	828144/003	10/31/2007
TWO-Line V-Network 9kHz-30MHz	Schaffner	NNB41	03/10013	06/12/2008
LISN 10kHz-100MHz	EMCO	3825/2	9106-1809	04/01/2008
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/- 2.81dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2, EN 55022, EN 55015, CISPR 22, CISPR 15, AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18, CNS 13783-1, CNS 13439, CNS 13438, CNS 13803, CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4, IEC/EN 61000-3-2, IEC/EN 61000-3-3, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/ EN 61000-6-3, EN 50081-2/EN 61000-6-4, EN 50081-2/EN 61000-6-1: 2001	ACCREDITED 0824-01
USA	FCC	3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements	93105, 90471 965860
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	ELA 124a ELA 124b ELA 124c
Taiwan	TAF	EN 300 328, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3	Testing Laboratory 0363
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	3/10 meter Open Area Test Sites (IC 2324C-3, IC 2324C-5 / 3M Semi Anechoic Chamber (IC 6106) to perform RSS 212 Issue 1	IC 2324C-3 IC 2324C-5 IC 6106

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No	Equipment	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC (Remote)	IBM	2672 (X31)	9985H9M	WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	Notebook PC (Remote)	IBM	2672 (X31)	99PBTKB	WLAN: ANO20030400LEG Bluetooth: ANO20020100MTN	LAN Cable: Unshielded, 10m Line Cable: Unshielded, 10m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

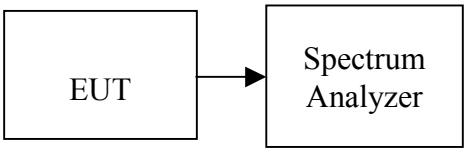
7. FCC PART 15.247 REQUIREMENTS

7.1 6DB BANDWIDTH

LIMIT

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100 kHz, VBW = RBW, Span = 50 MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	12.58	>500	PASS
Mid	2437	11.75		PASS
High	2462	11.83		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.50	>500	PASS
Mid	2437	16.50		PASS
High	2462	16.58		PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode / Chain 0

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.58	>500	PASS
Mid	2437	17.83		PASS
High	2462	17.67		PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.50	>500	PASS
Mid	2437	17.67		PASS
High	2462	17.75		PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode / Chain 0

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2422	36.33	>500	PASS
Mid	2437	36.42		PASS
High	2452	36.50		PASS

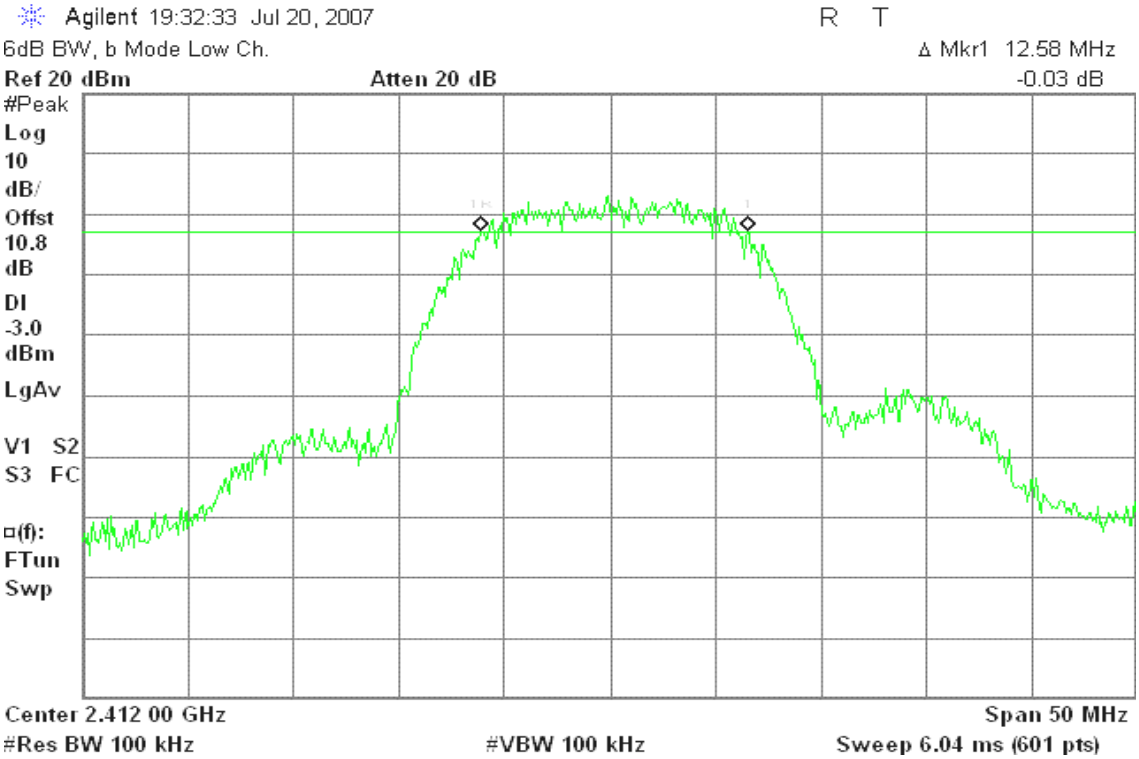
Test mode: draft 802.11n Wide-40 MHz Channel mode / Chain 1

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Result
Low	2422	36.33	>500	PASS
Mid	2437	35.33		PASS
High	2452	36.33		PASS

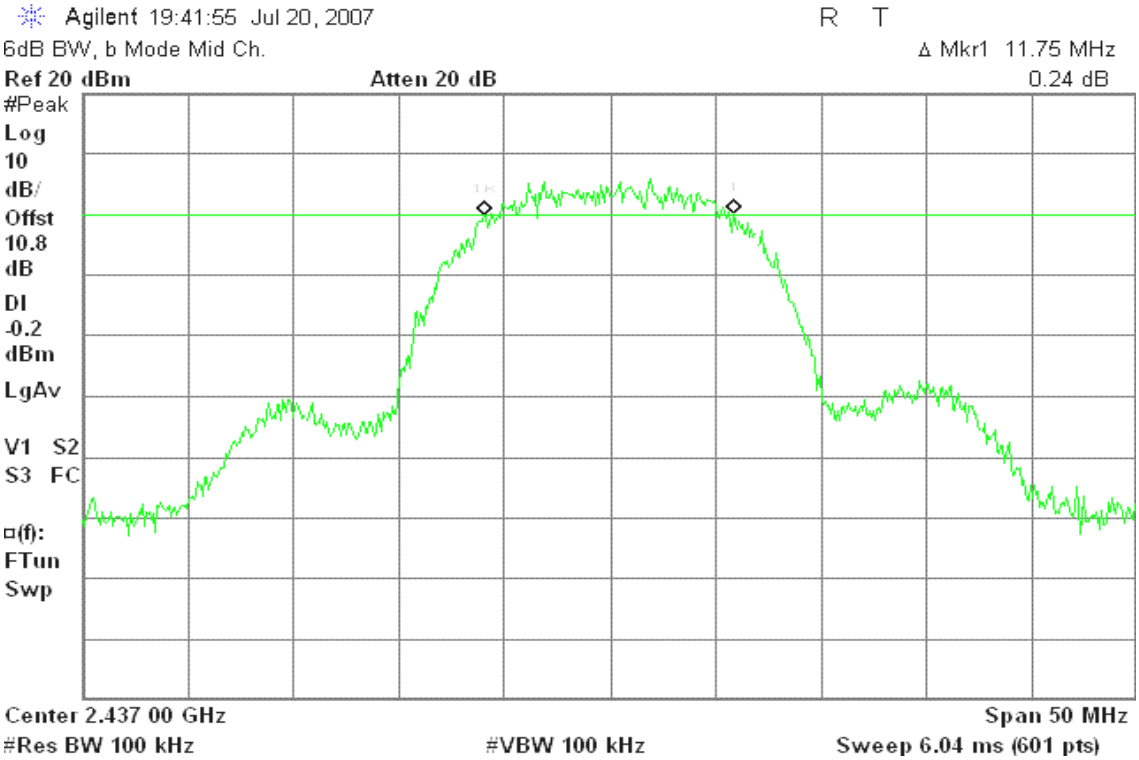
Test Plot

IEEE 802.11b mode

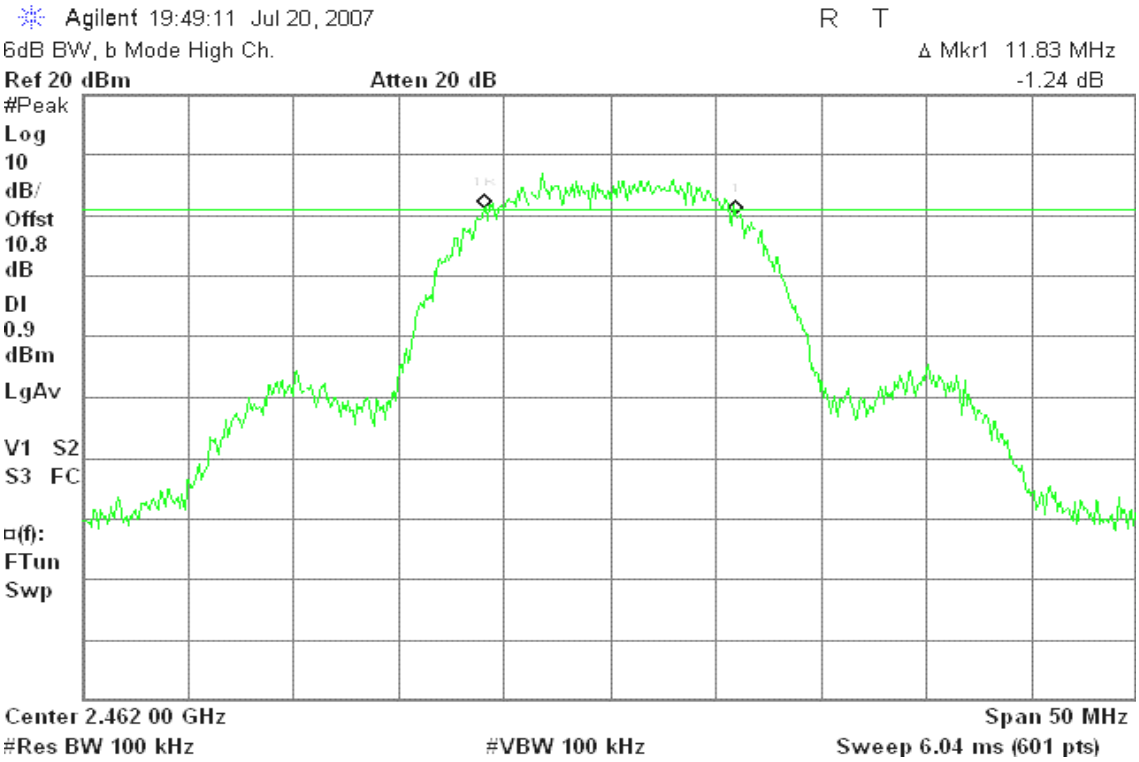
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

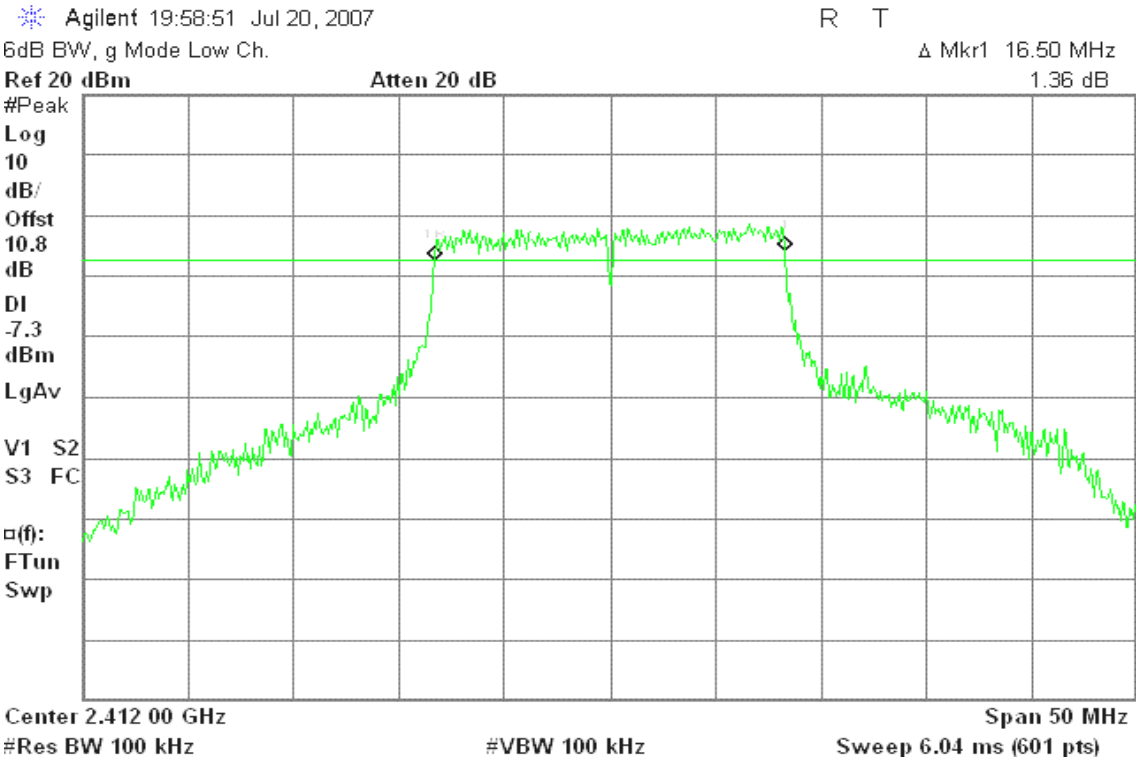


6dB Bandwidth (CH High)

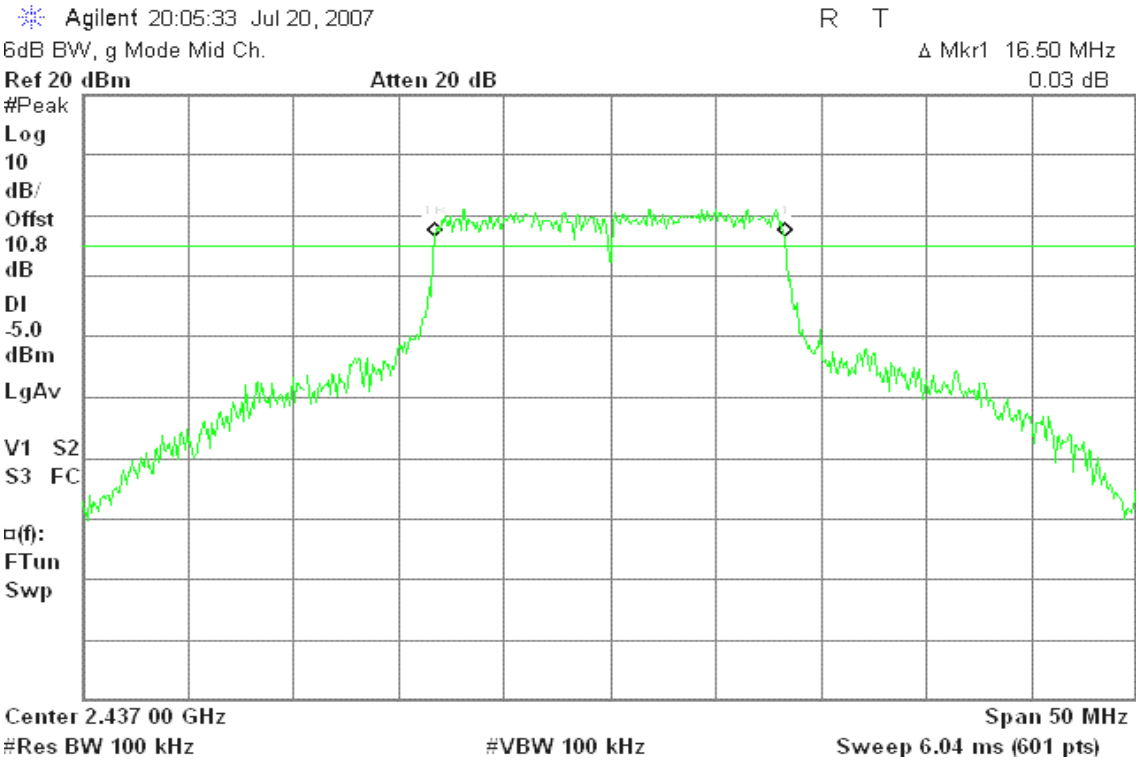


IEEE 802.11g mode

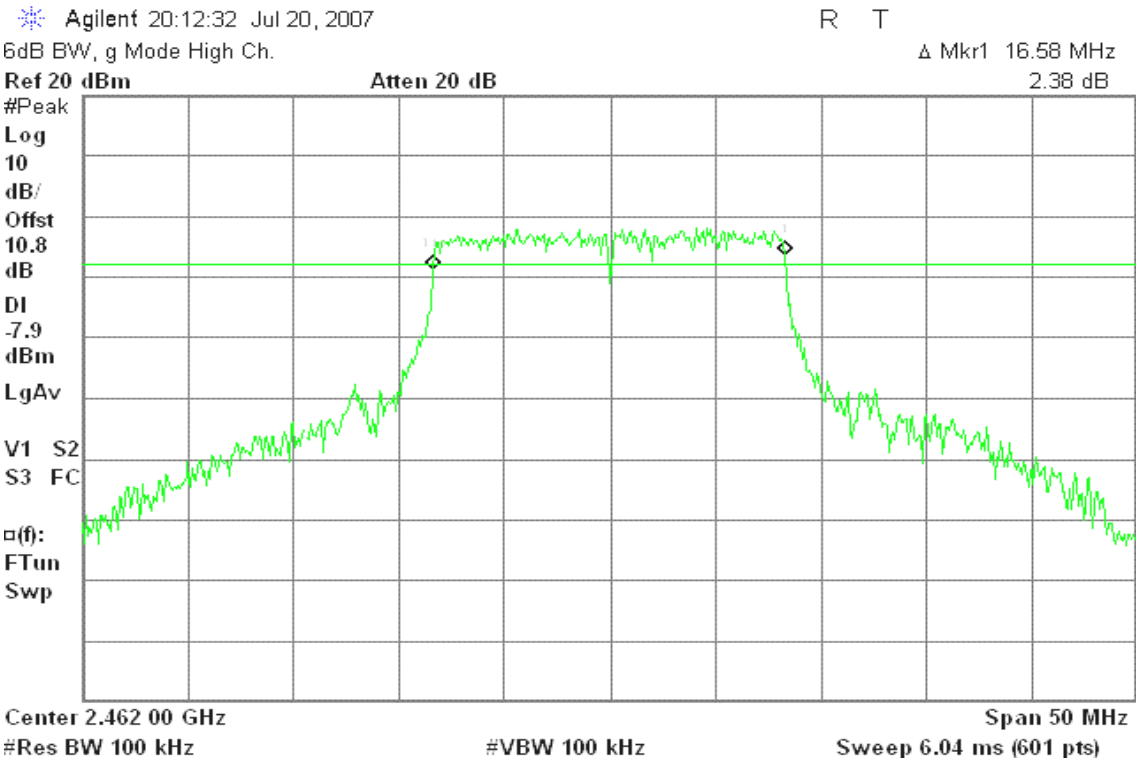
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

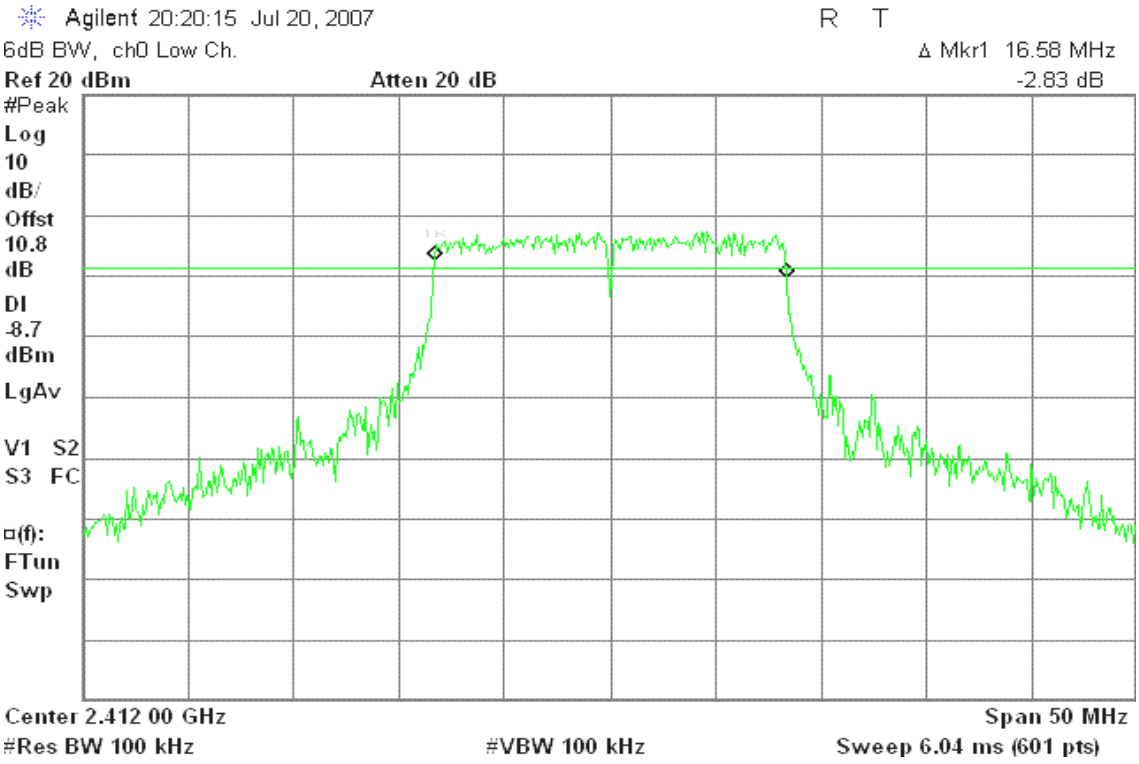


6dB Bandwidth (CH High)

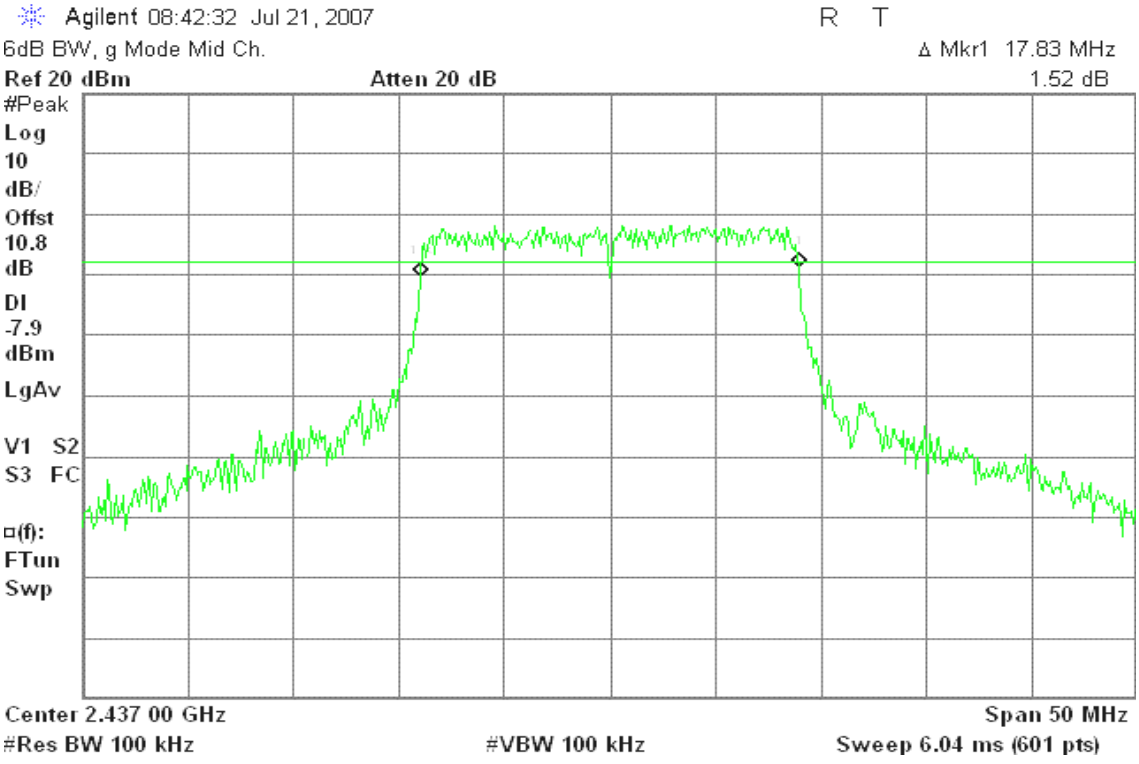


draft 802.11n Standard-20 MHz Channel mode / Chain 0

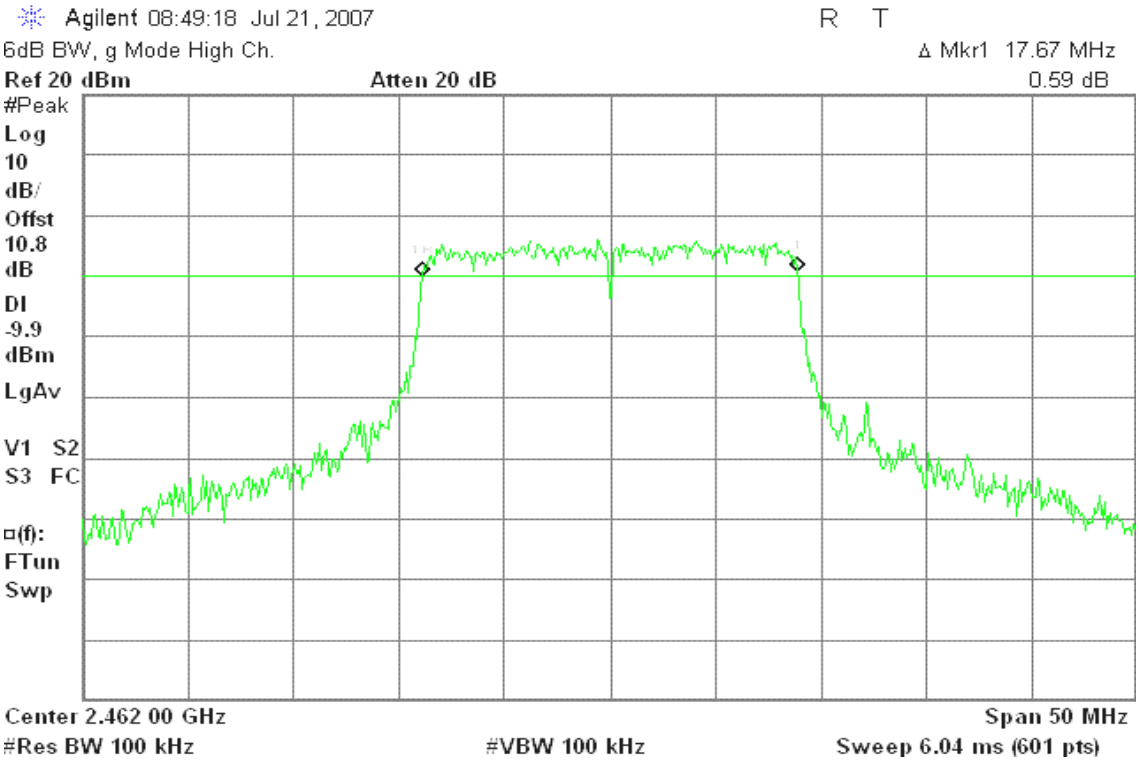
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

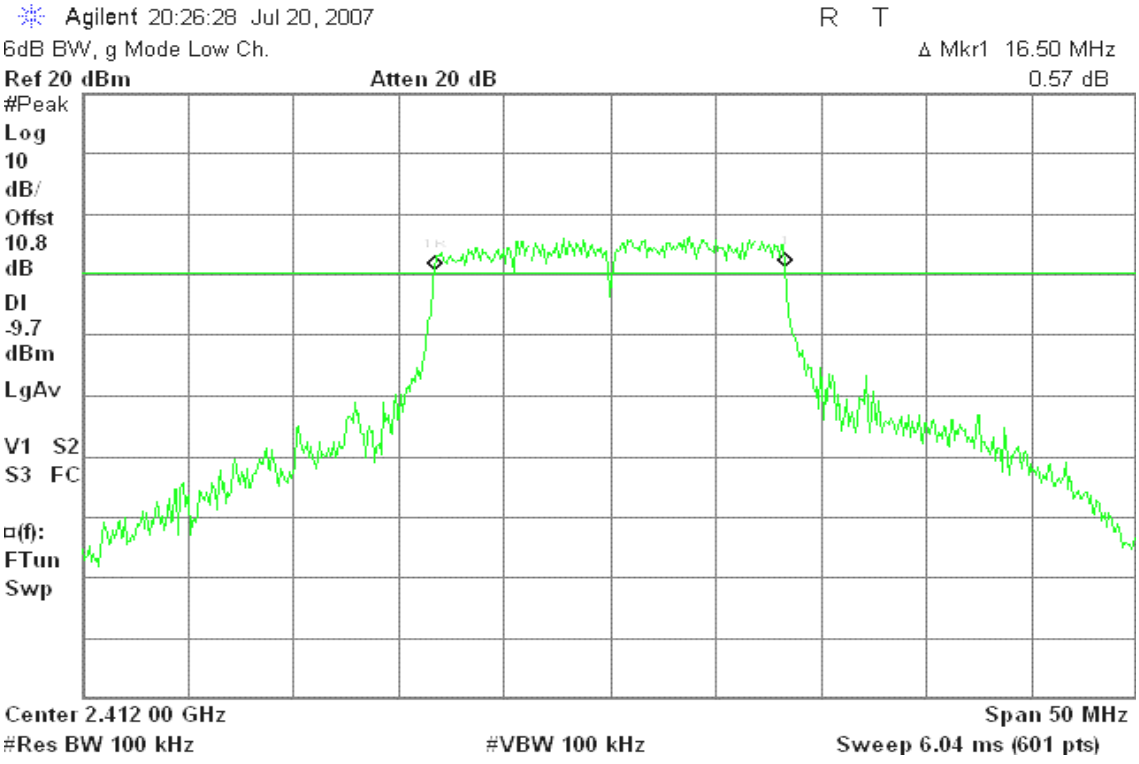


6dB Bandwidth (CH High)

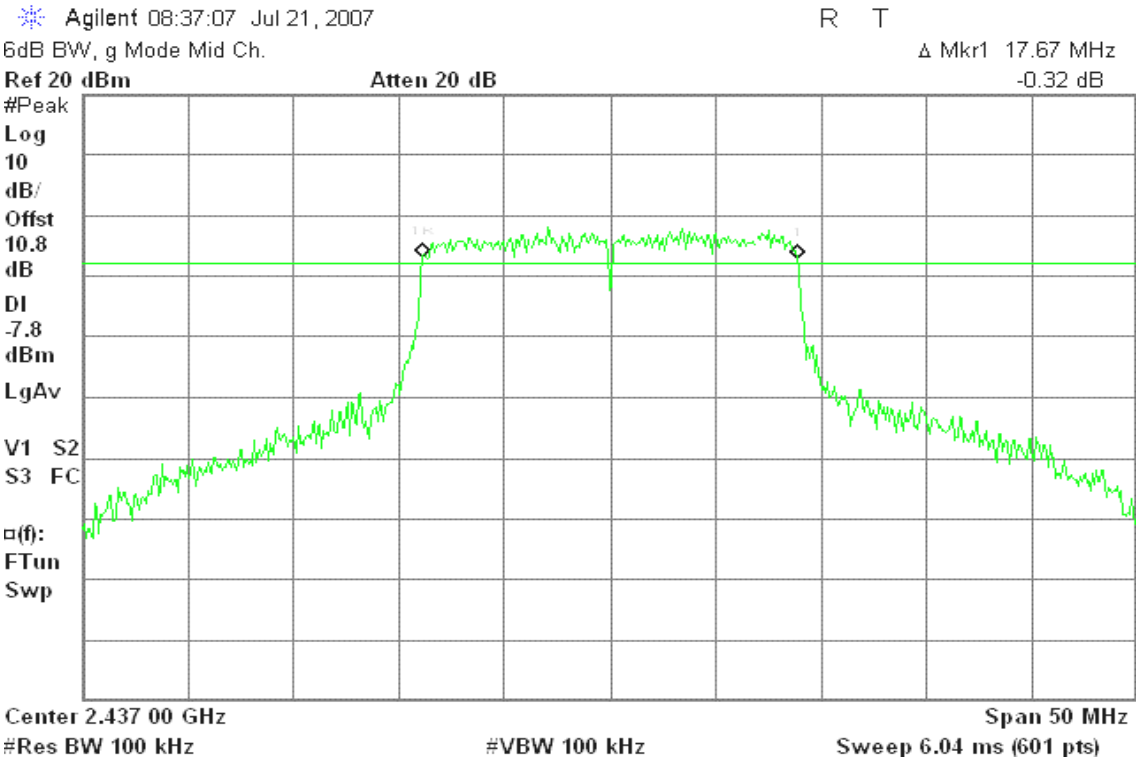


draft 802.11n Standard-20 MHz Channel mode / Chain 1

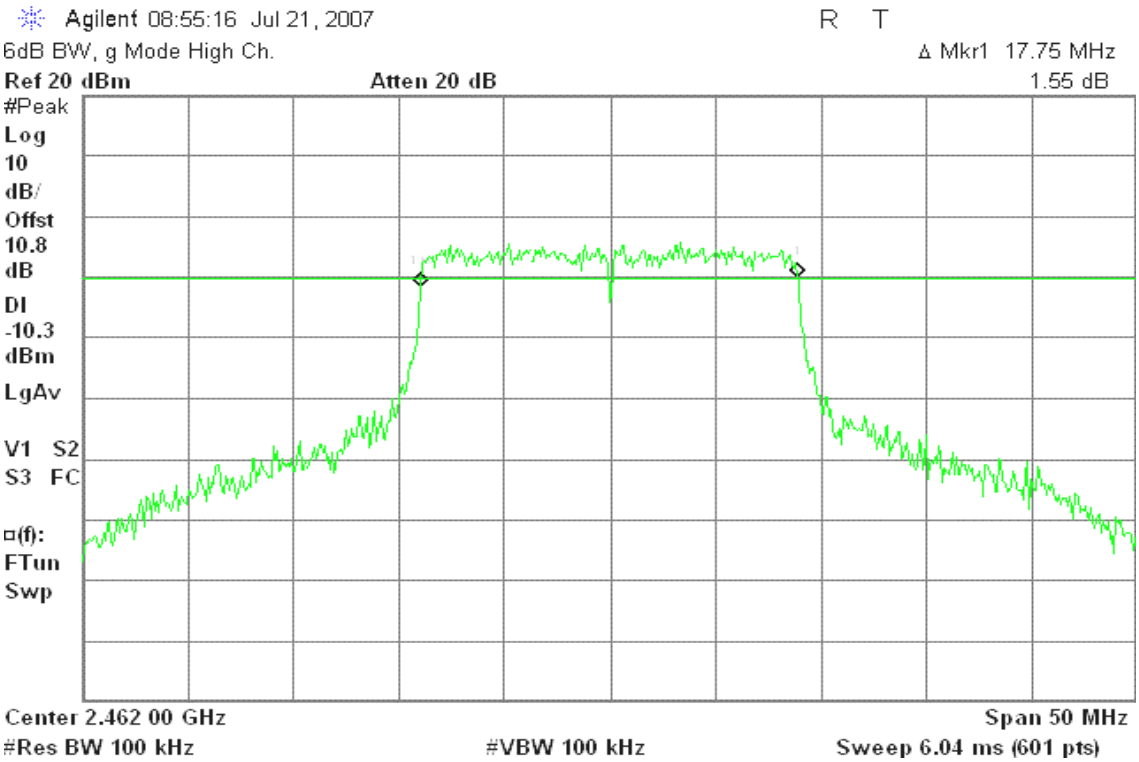
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

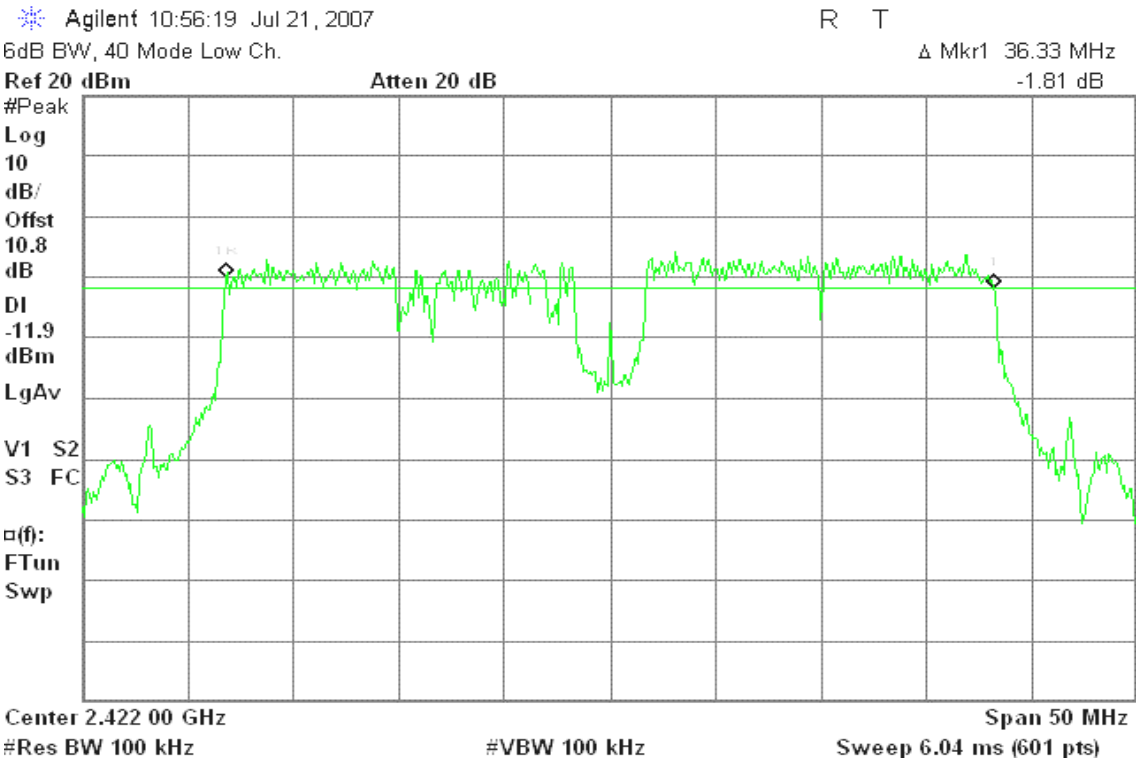


6dB Bandwidth (CH High)

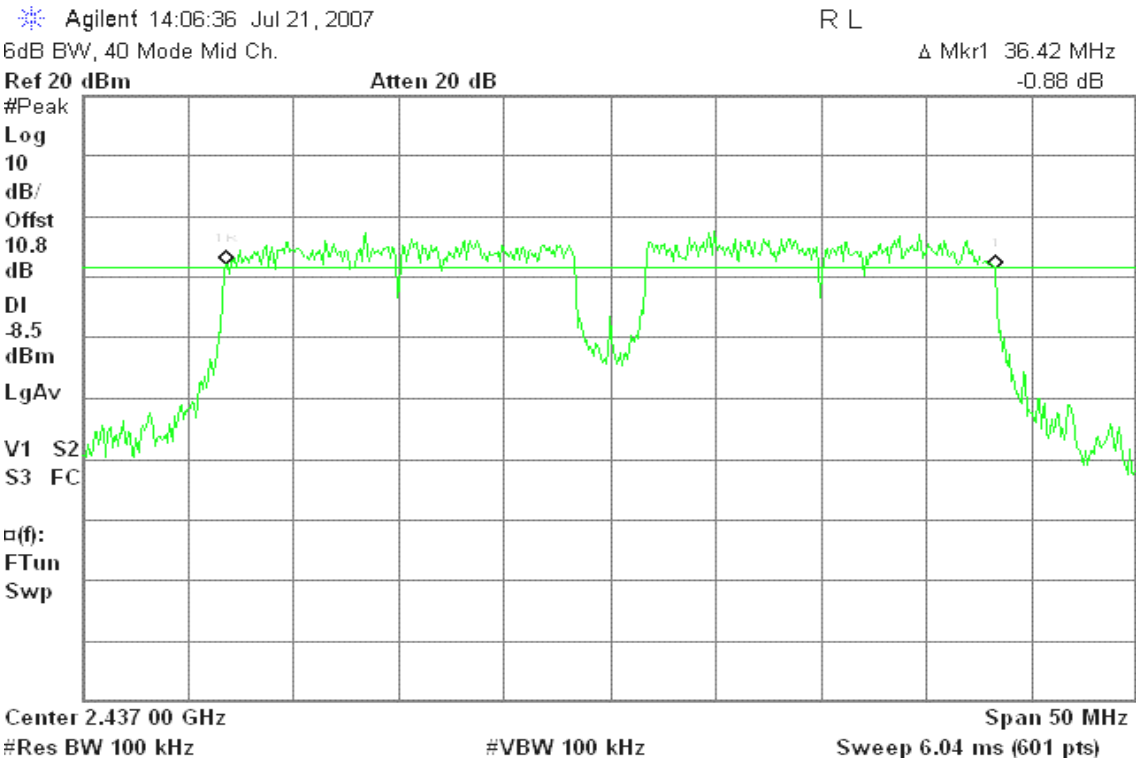


draft 802.11n Wide-40 MHz Channel mode / Chain 0

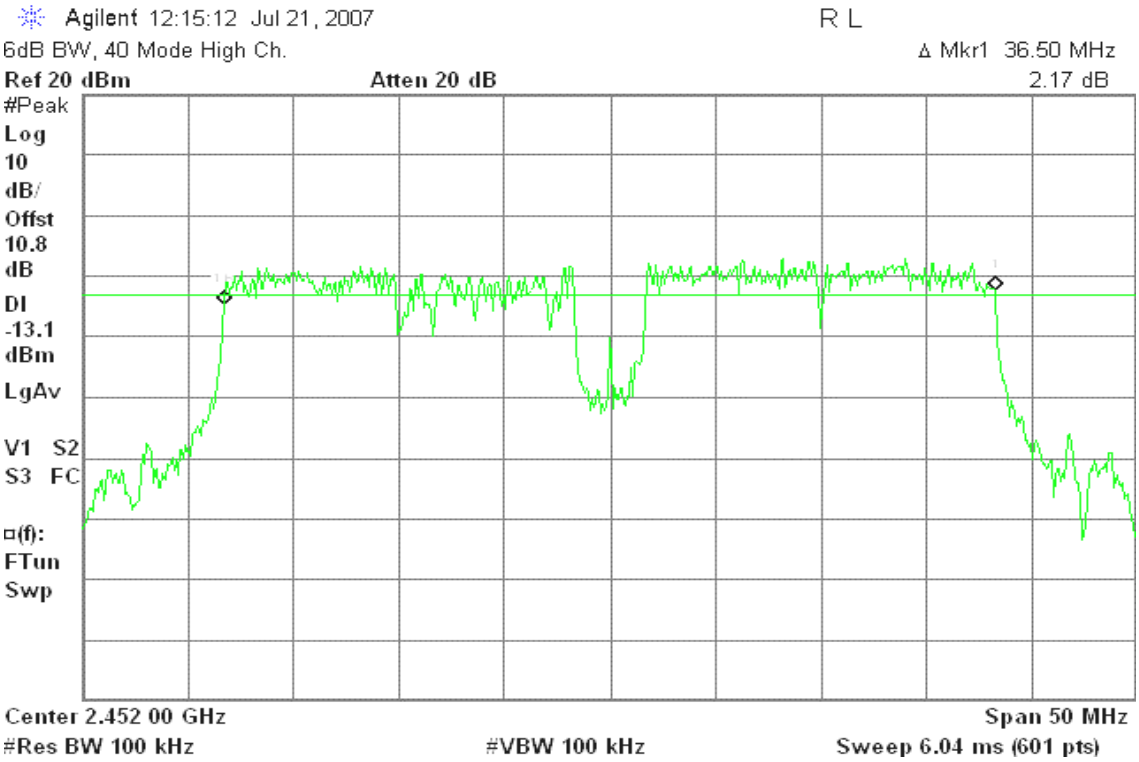
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)

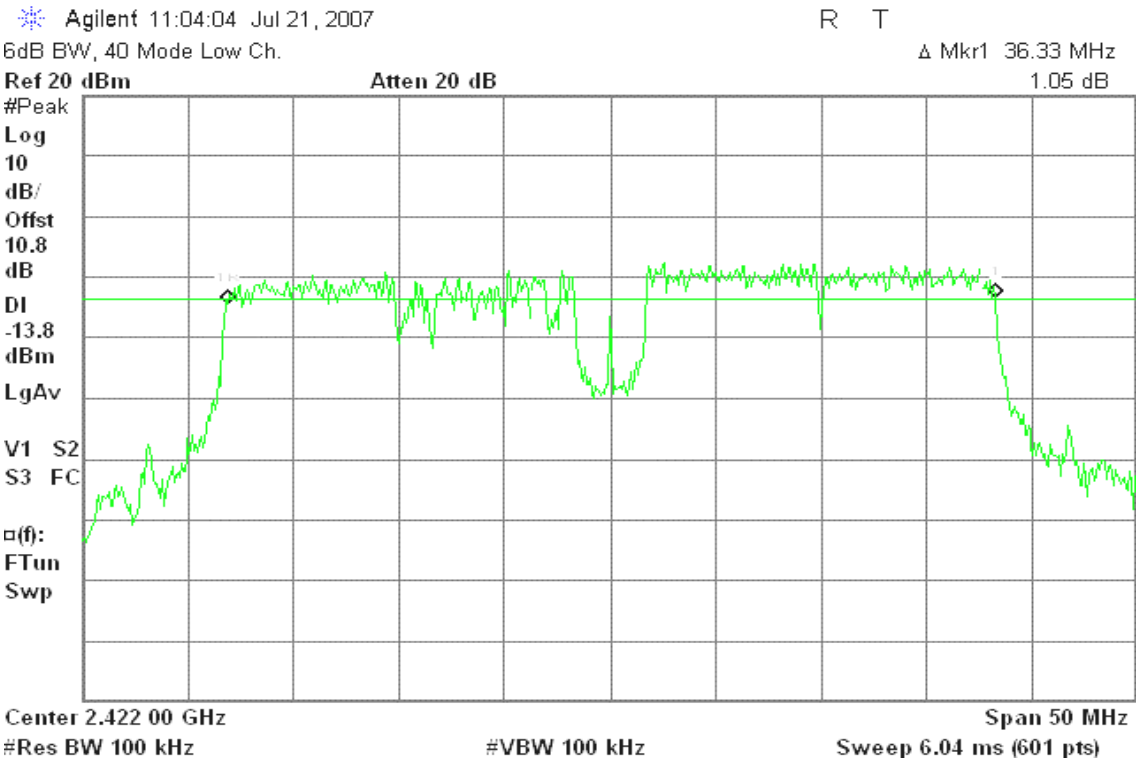


6dB Bandwidth (CH High)

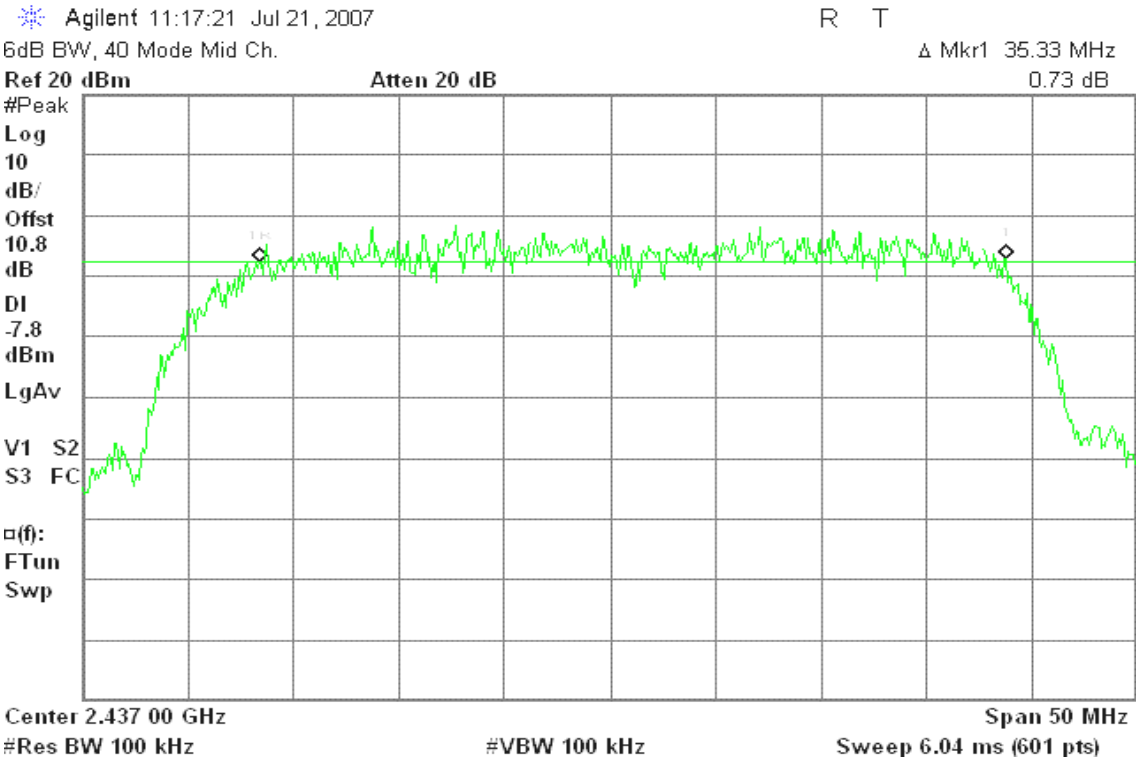


draft 802.11n Wide-40 MHz Channel mode / Chain 1

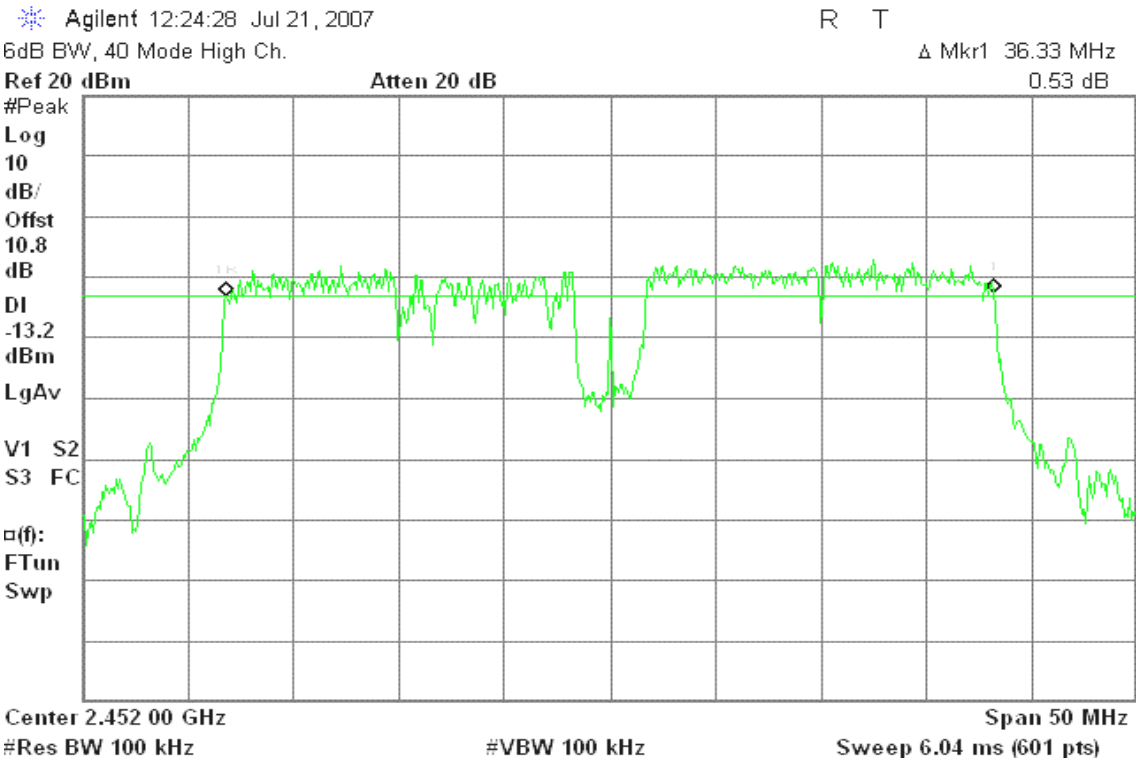
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



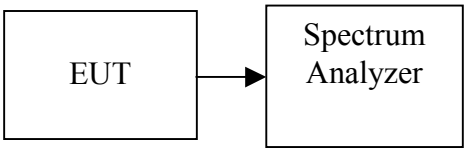
7.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §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.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 1 MHz, VBW >= 3 MHz. in “Channel Power ” measurement.
4. Record the max reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	18.48	0.0705	1.00	PASS
Mid	2437	20.26	0.1062		PASS
High	2462	21.48	0.1406		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	16.54	0.0451	1.00	PASS
Mid	2437	19.27	0.0845		PASS
High	2462	16.60	0.0457		PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	15.82	14.58	18.25	0.0669	1.00	PASS
Mid	2437	16.84	15.97	19.44	0.0878		PASS
High	2462	14.33	14.00	17.18	0.0522		PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode

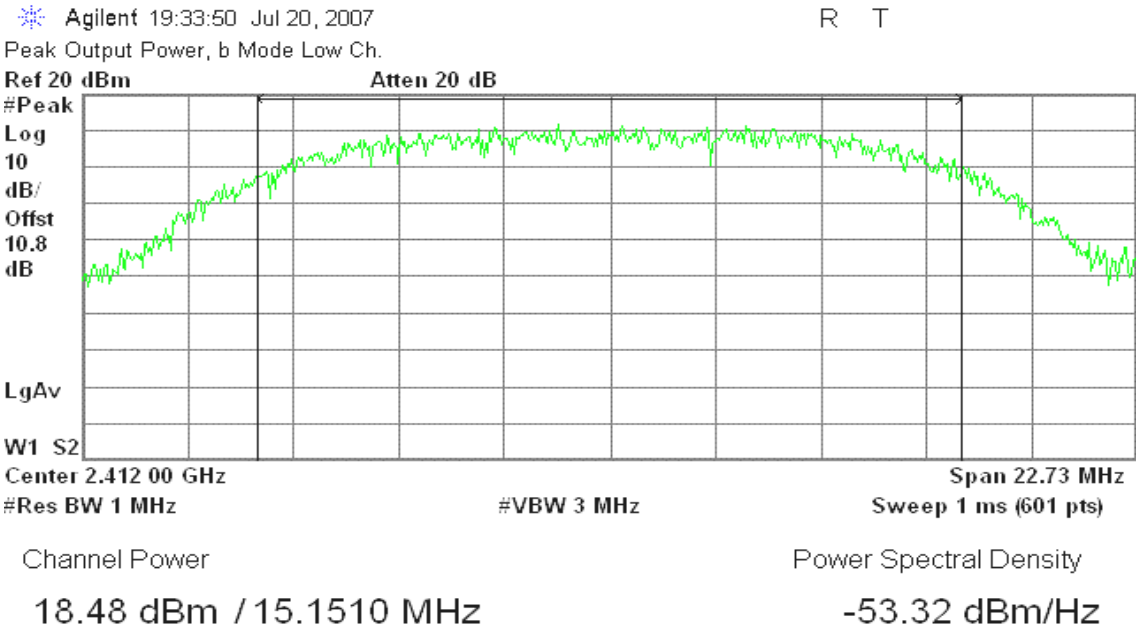
Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2422	14.20	12.55	16.46	0.0443	1.00	PASS
Mid	2437	17.43	16.50	20.00	0.1000		PASS
High	2452	13.20	12.61	15.93	0.0391		PASS

Remark: *Total Output Power (w) = Chain 1 (10^(Output Power /10)/1000)+ Chain 0 (10^(Output Power /10)/1000)*

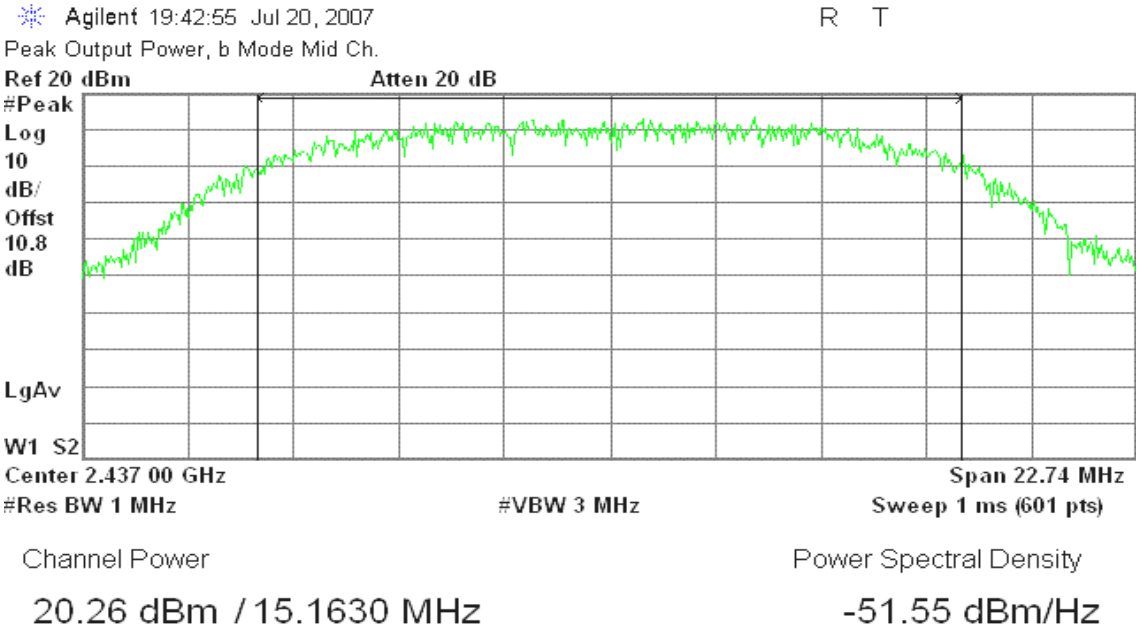
Test Plot

IEEE 802.11b mode

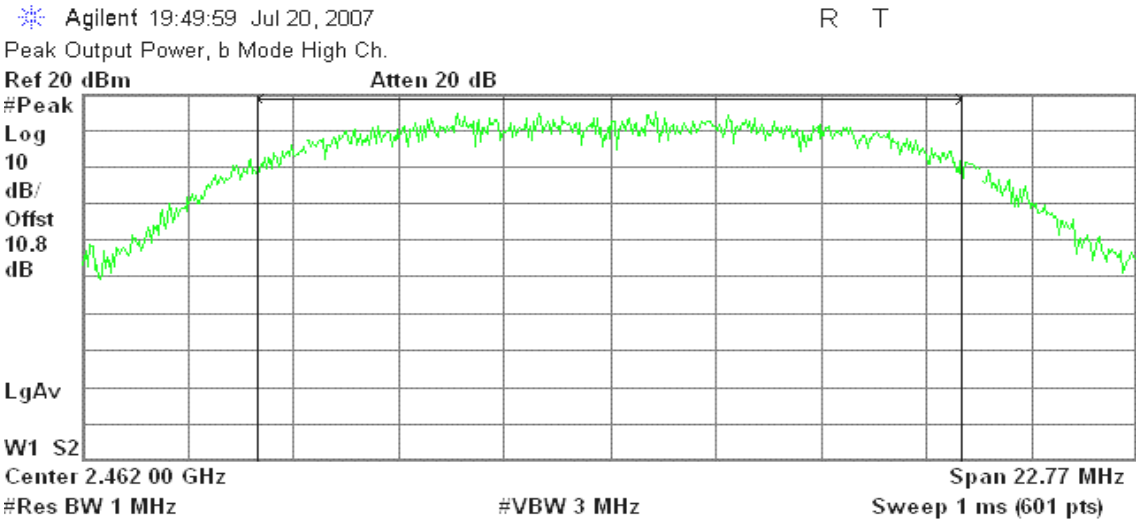
Peak Power (CH Low)



Peak Power (CH Mid)



Peak Power (CH High)

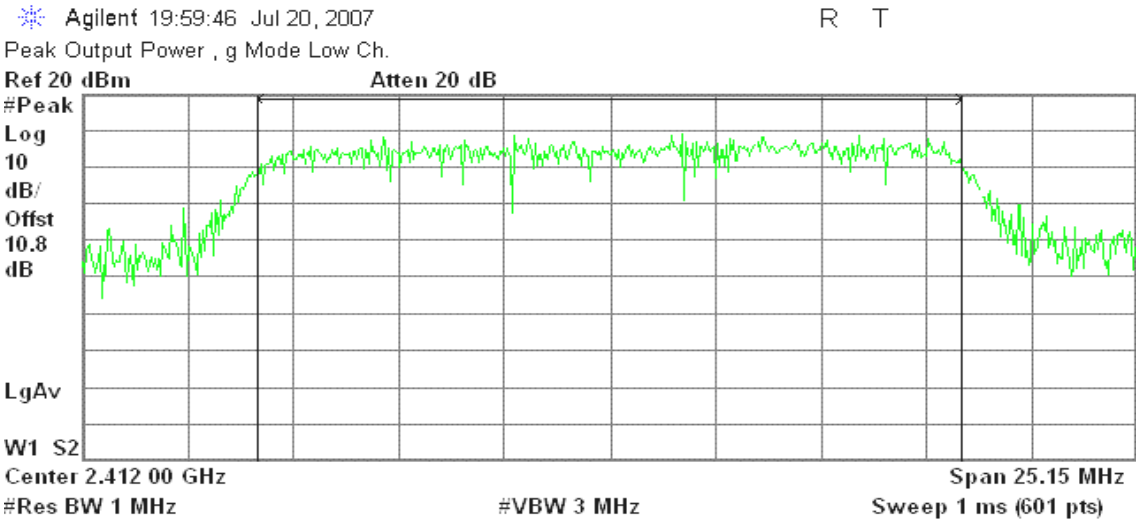


Channel Power
21.48 dBm / 15.1800 MHz

Power Spectral Density
-50.33 dBm/Hz

IEEE 802.11g mode

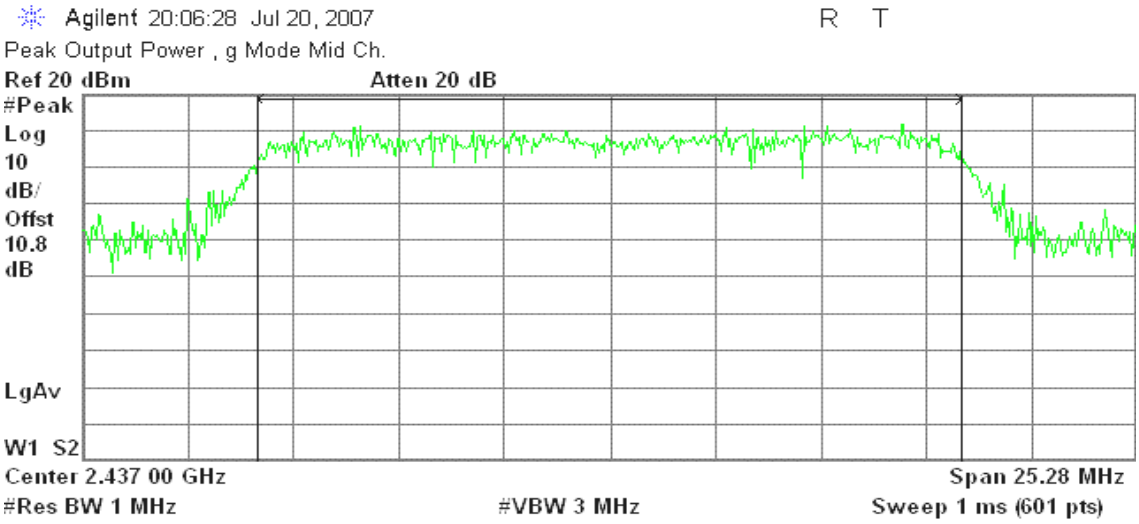
Peak Power (CH Low)



Channel Power
16.54 dBm / 16.7670 MHz

Power Spectral Density
-55.70 dBm/Hz

Peak Power (CH Mid)



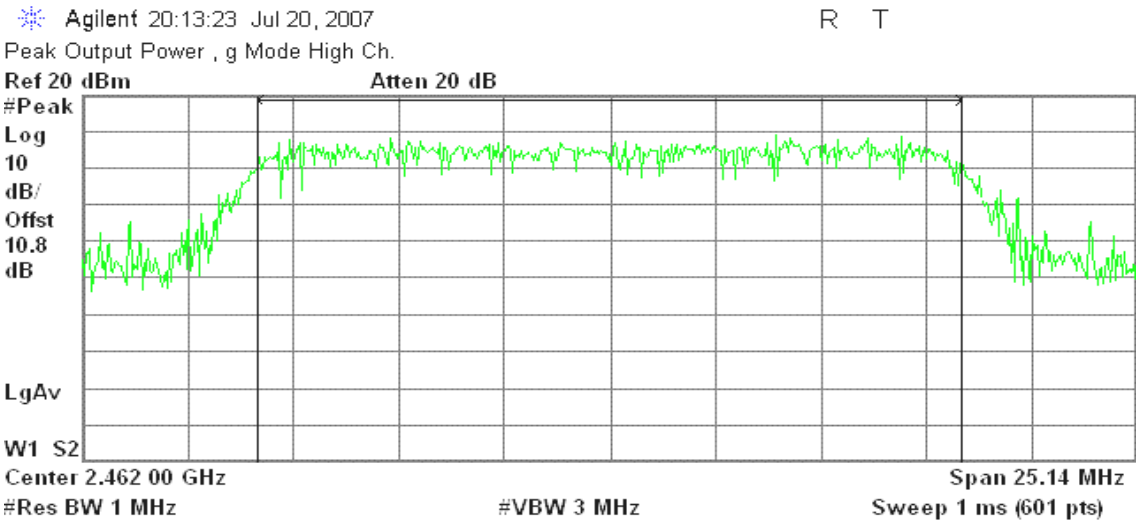
Channel Power

19.27 dBm / 16.8510 MHz

Power Spectral Density

-52.99 dBm/Hz

Peak Power (CH High)



Channel Power

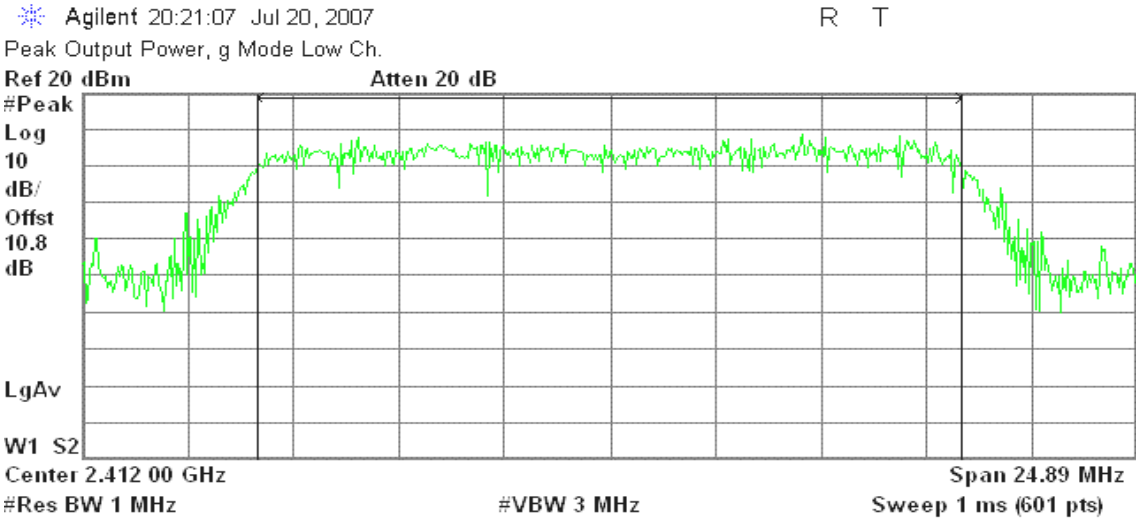
16.60 dBm / 16.7590 MHz

Power Spectral Density

-55.64 dBm/Hz

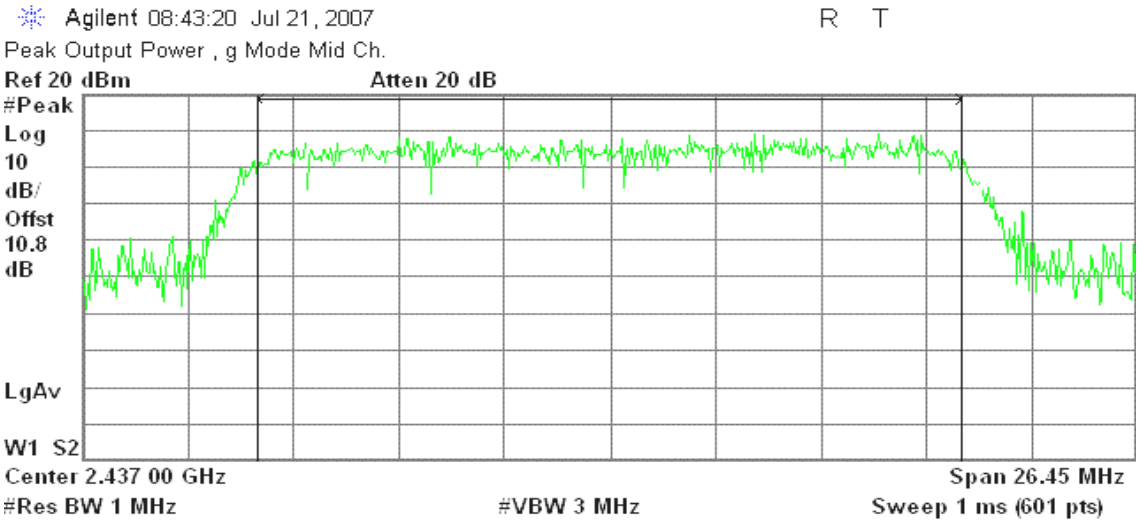
draft 802.11n Standard-20 MHz Channel mode / Chain 0

Peak Power (CH Low)



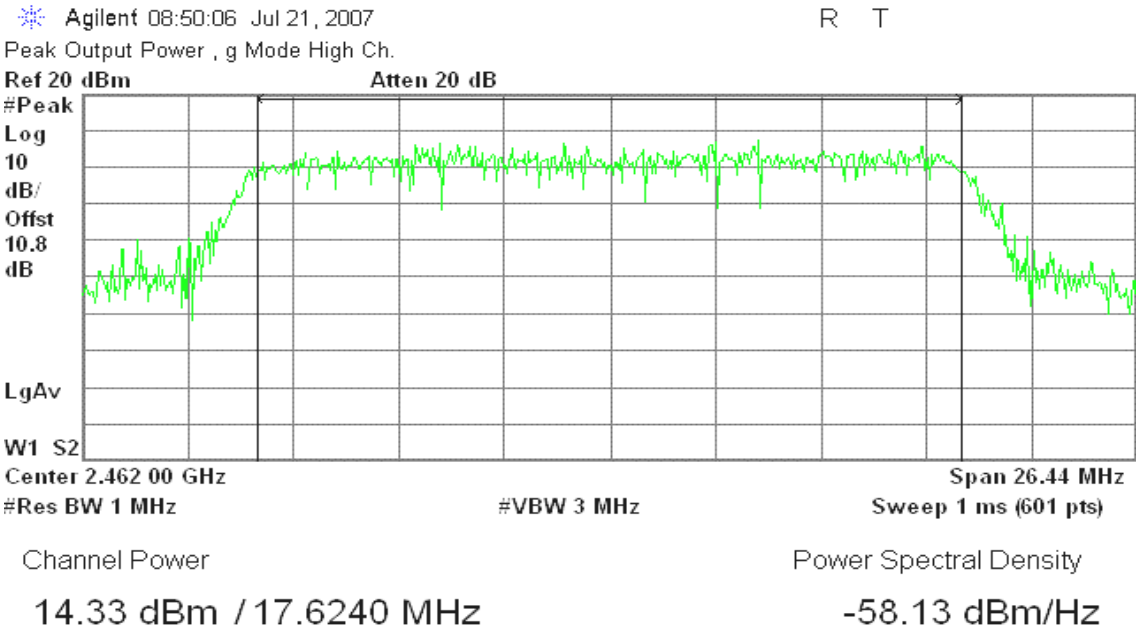
Channel Power	Power Spectral Density
15.82 dBm / 16.5940 MHz	-56.38 dBm/Hz

Peak Power (CH Mid)



Channel Power	Power Spectral Density
16.84 dBm / 17.6350 MHz	-55.62 dBm/Hz

Peak Power (CH High)

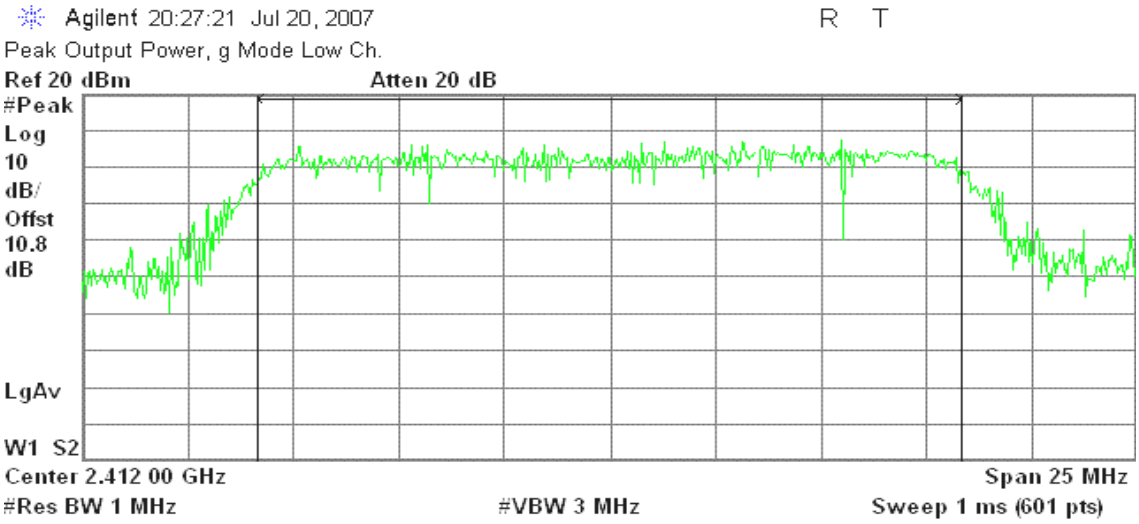


Channel Power
14.33 dBm / 17.6240 MHz

Power Spectral Density
-58.13 dBm/Hz

draft 802.11n Standard-20 MHz Channel mode / Chain 1

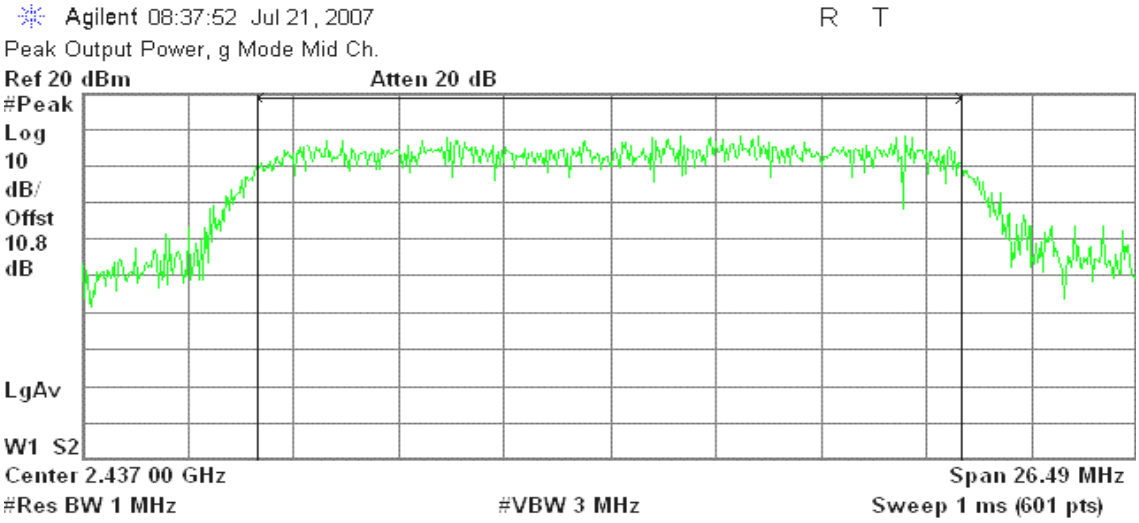
Peak Power (CH Low)



Channel Power
14.58 dBm / 16.6650 MHz

Power Spectral Density
-57.63 dBm/Hz

Peak Power (CH Mid)



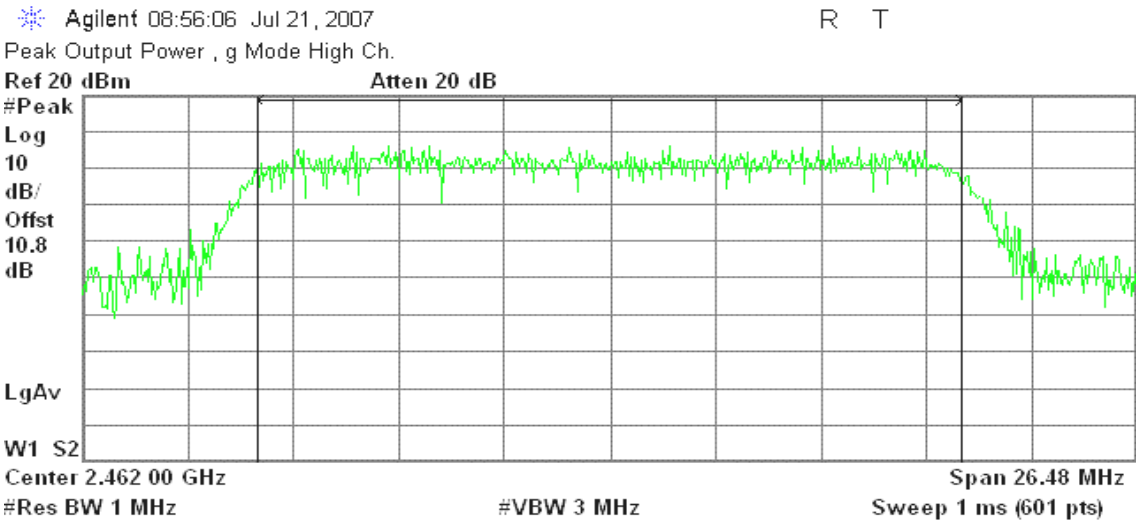
Channel Power

15.97 dBm / 17.6610 MHz

Power Spectral Density

-56.50 dBm/Hz

Peak Power (CH High)



Channel Power

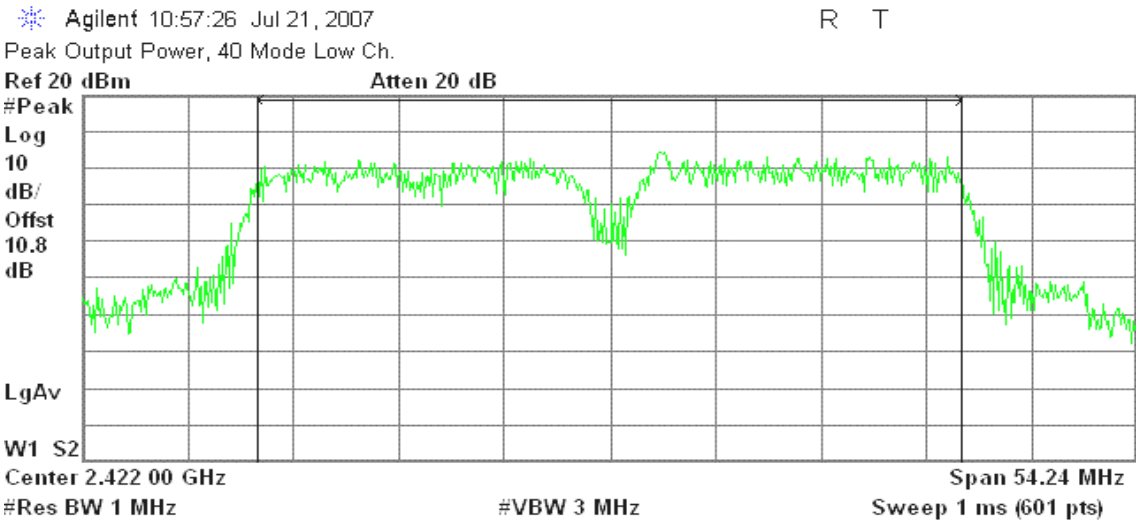
14.00 dBm / 17.6550 MHz

Power Spectral Density

-58.47 dBm/Hz

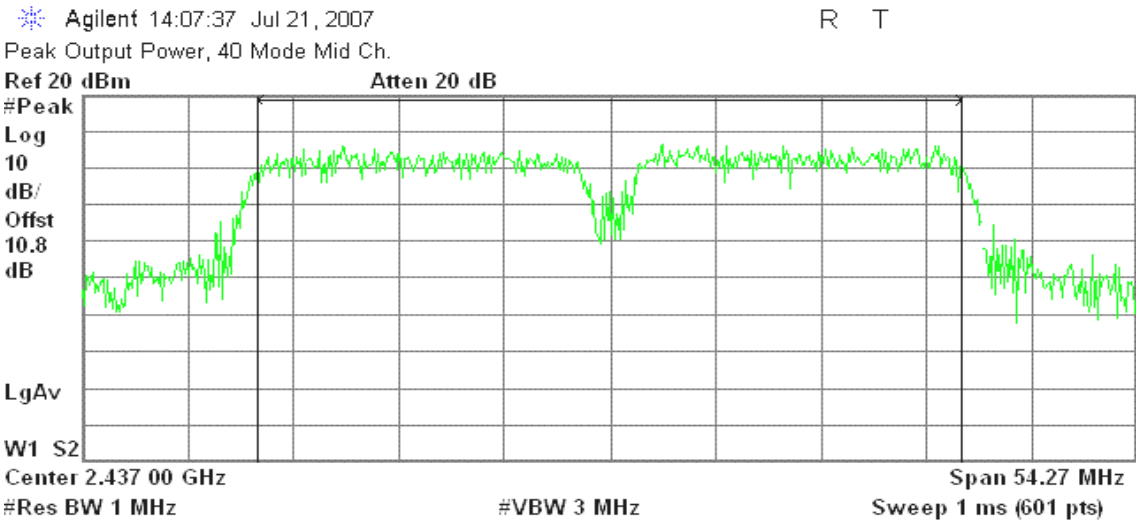
draft 802.11n Wide-40 MHz Channel mode / Chain 0

Peak Power (CH Low)



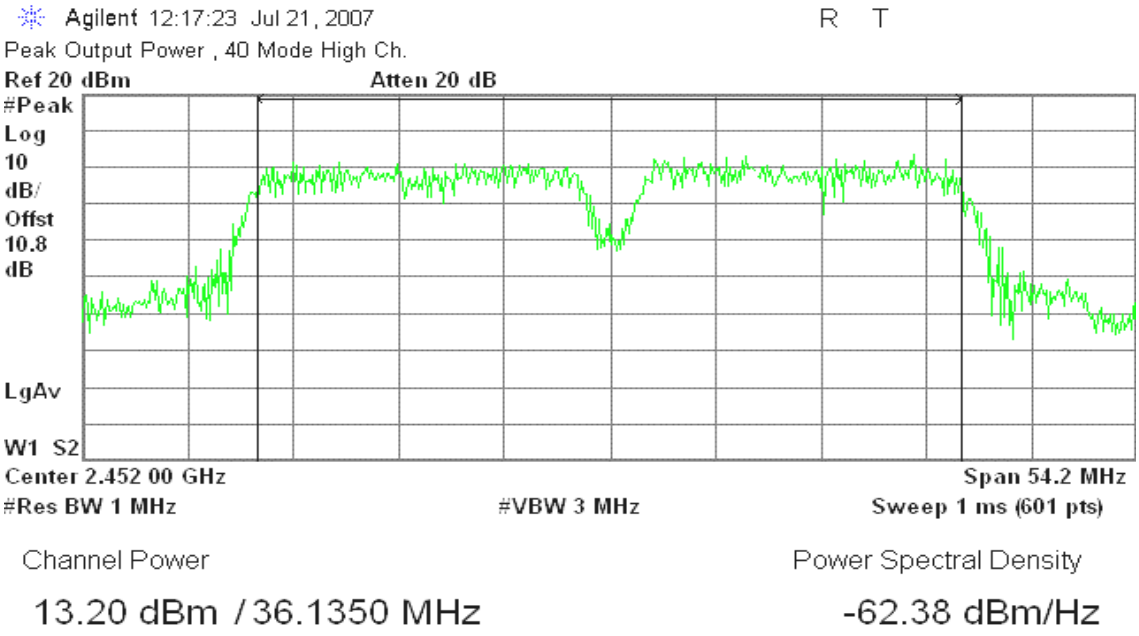
Channel Power	Power Spectral Density
14.20 dBm / 36.1610 MHz	-61.38 dBm/Hz

Peak Power (CH Mid)



Channel Power	Power Spectral Density
17.43 dBm / 36.1780 MHz	-58.15 dBm/Hz

Peak Power (CH High)

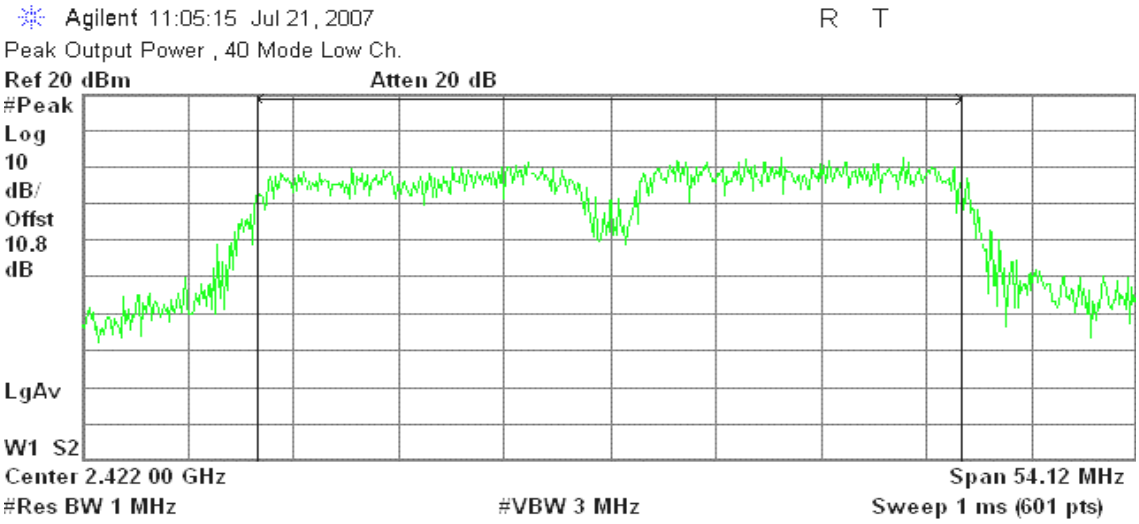


Channel Power
13.20 dBm / 36.1350 MHz

Power Spectral Density
-62.38 dBm/Hz

draft 802.11n Wide-40 MHz Channel mode / Chain 1

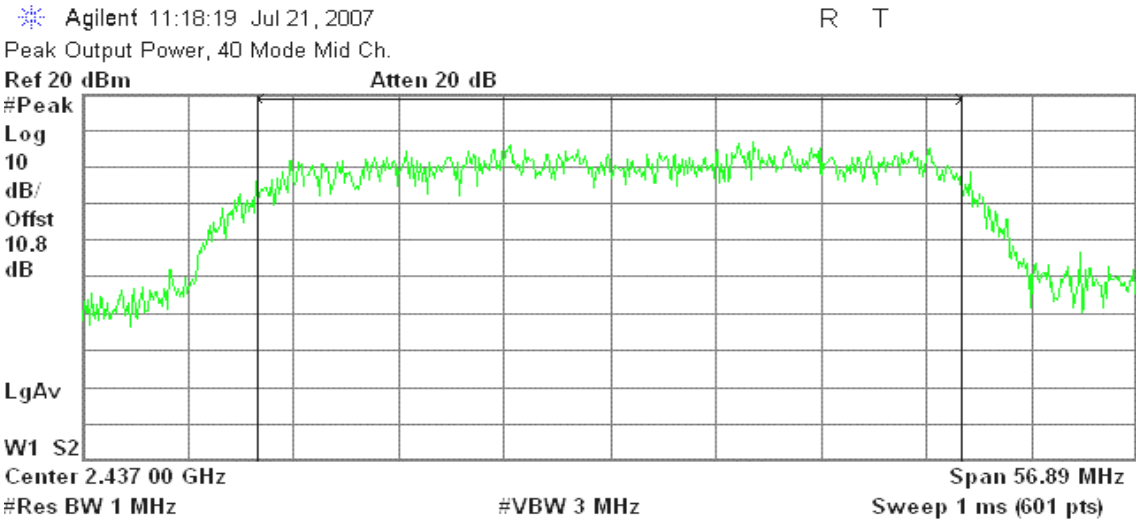
Peak Power (CH Low)



Channel Power
12.55 dBm / 36.0820 MHz

Power Spectral Density
-63.03 dBm/Hz

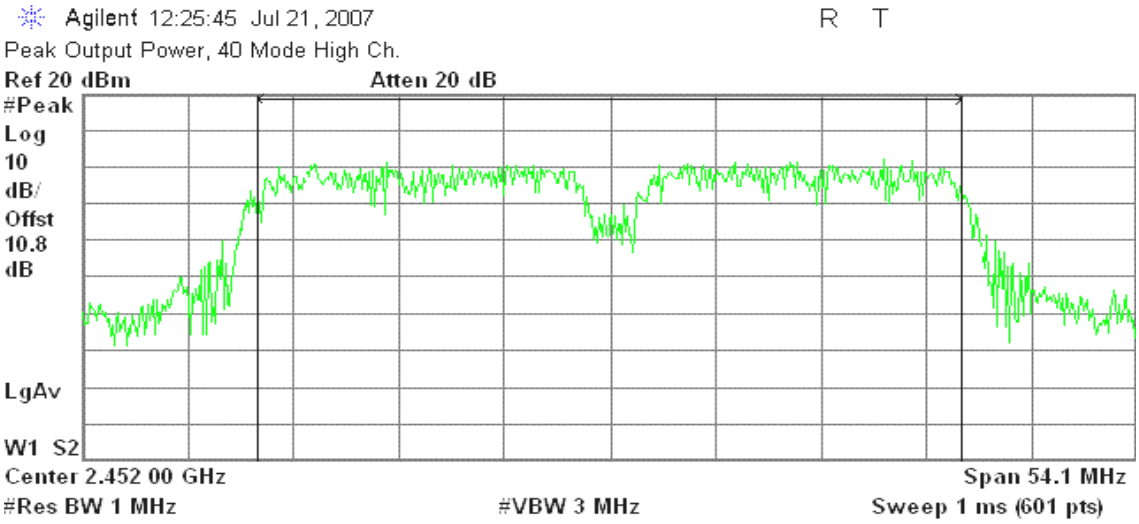
Peak Power (CH Mid)



Channel Power
16.50 dBm / 37.9250 MHz

Power Spectral Density
-59.29 dBm/Hz

Peak Power (CH High)



Channel Power
12.61 dBm / 36.0650 MHz

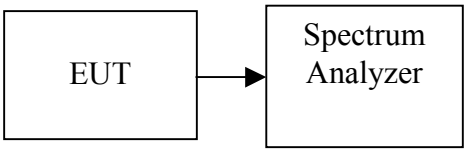
Power Spectral Density
-62.96 dBm/Hz

7.3 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the average power detection.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Result
Low	2412	15.62	0.0365	PASS
Mid	2437	17.26	0.0532	PASS
High	2462	18.55	0.0716	PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Result
Low	2412	13.32	0.0215	PASS
Mid	2437	15.93	0.0392	PASS
High	2462	13.07	0.0203	PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Result
Low	2412	12.44	11.17	14.86	0.0306	PASS
Mid	2437	13.18	12.50	15.86	0.0386	PASS
High	2462	10.86	10.34	13.62	0.0230	PASS

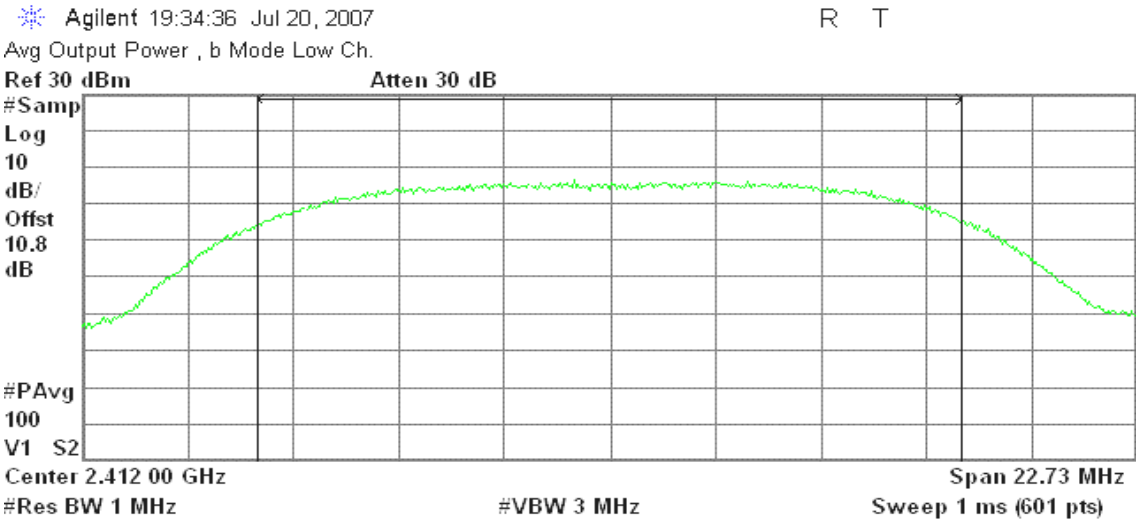
Test mode: draft 802.11n Wide-40 MHz Channel mode

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Result
Low	2422	9.86	9.22	12.56	0.0180	PASS
Mid	2437	13.63	12.83	16.26	0.0423	PASS
High	2452	9.63	8.62	12.16	0.0165	PASS

Test Plot

IEEE 802.11b mode

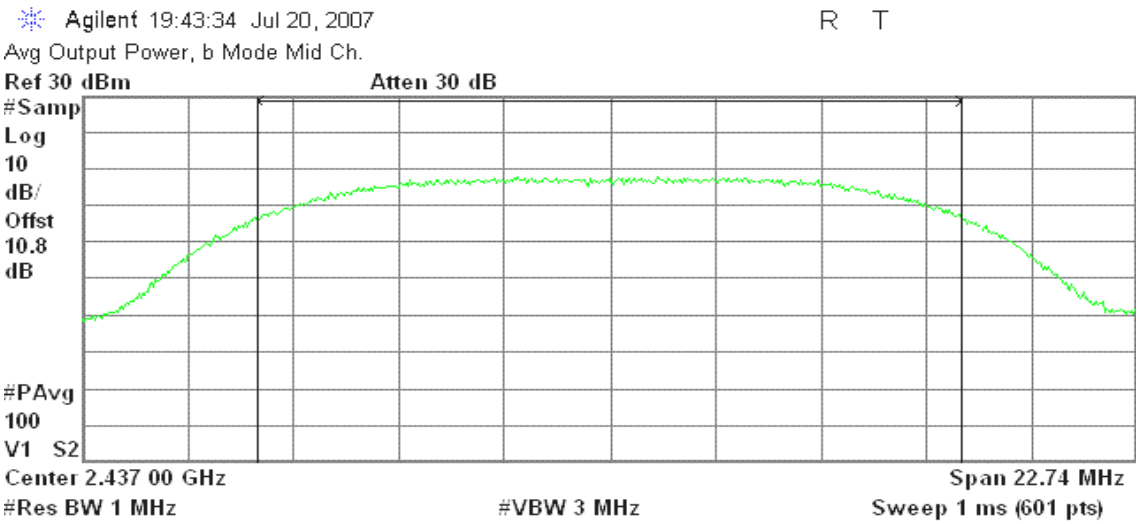
Average Power (CH Low)



Channel Power
15.62 dBm / 15.1510 MHz

Power Spectral Density
-56.19 dBm/Hz

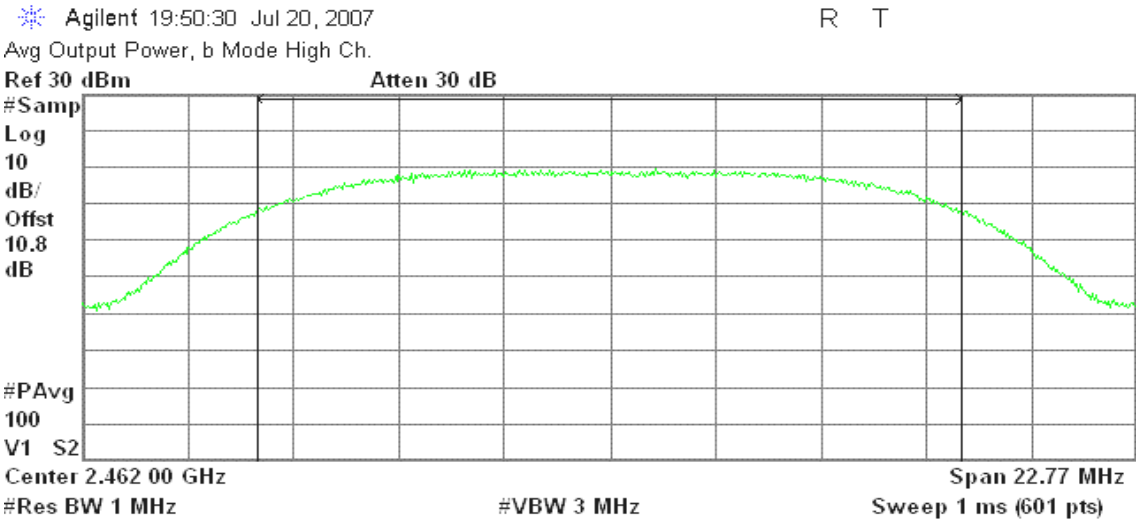
Average Power (CH Mid)



Channel Power
17.26 dBm / 15.1630 MHz

Power Spectral Density
-54.55 dBm/Hz

Average Power (CH High)

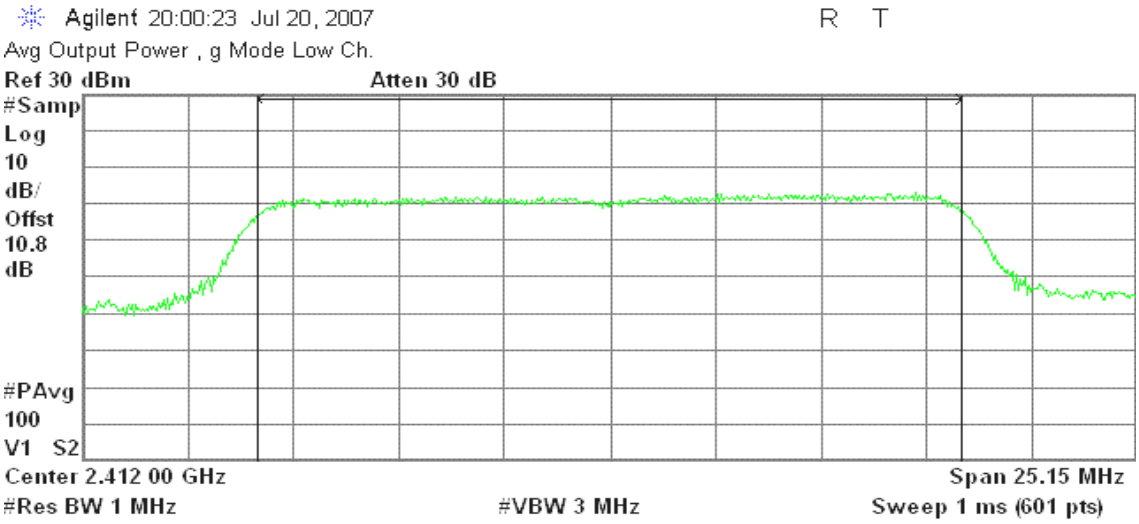


Channel Power
18.55 dBm / 15.1800 MHz

Power Spectral Density
-53.26 dBm/Hz

IEEE 802.11g mode

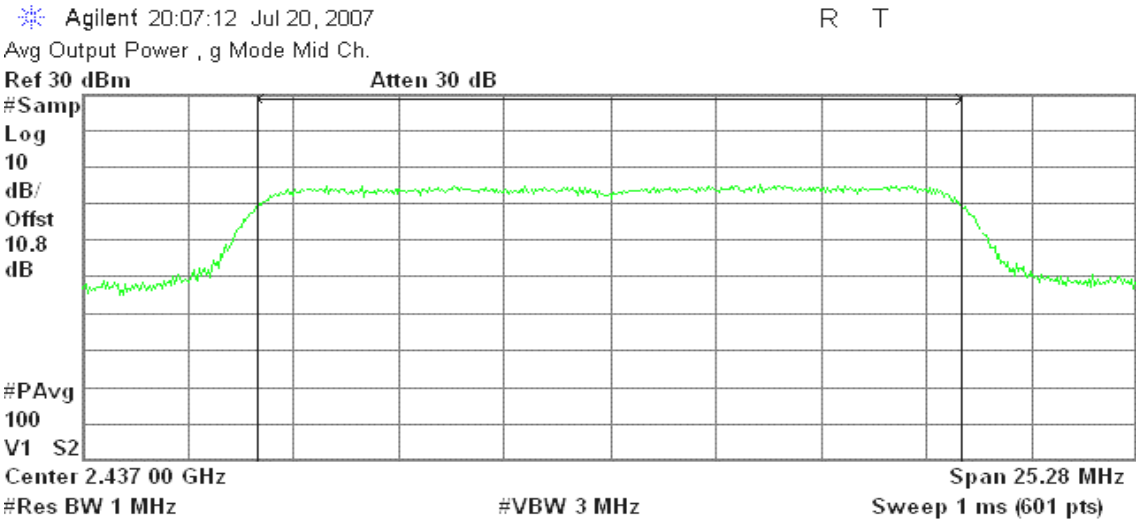
Average Power (CH Low)



Channel Power
13.32 dBm / 16.7670 MHz

Power Spectral Density
-58.92 dBm/Hz

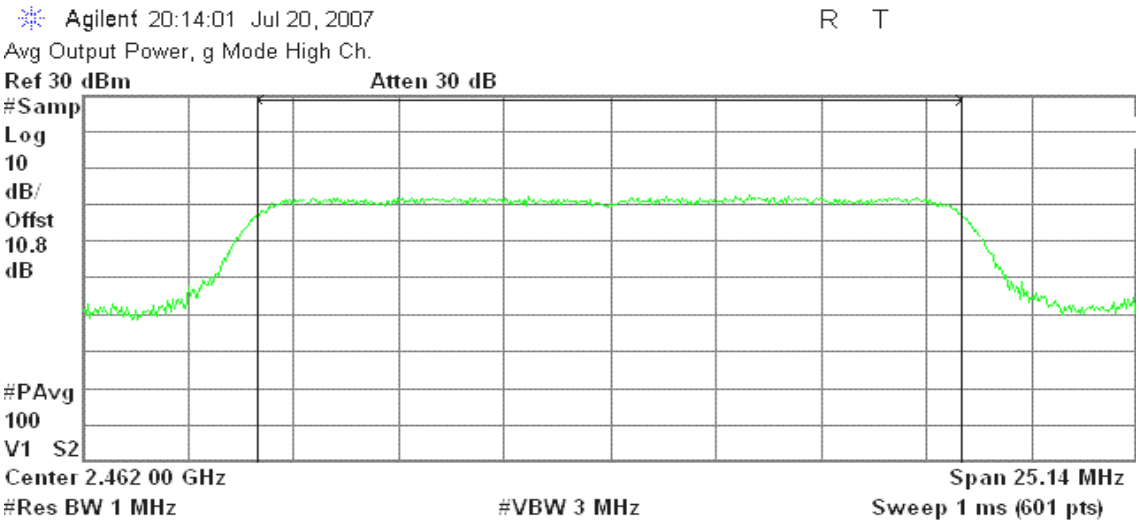
Average Power (CH Mid)



Channel Power
15.93 dBm / 16.8510 MHz

Power Spectral Density
-56.34 dBm/Hz

Average Power (CH High)

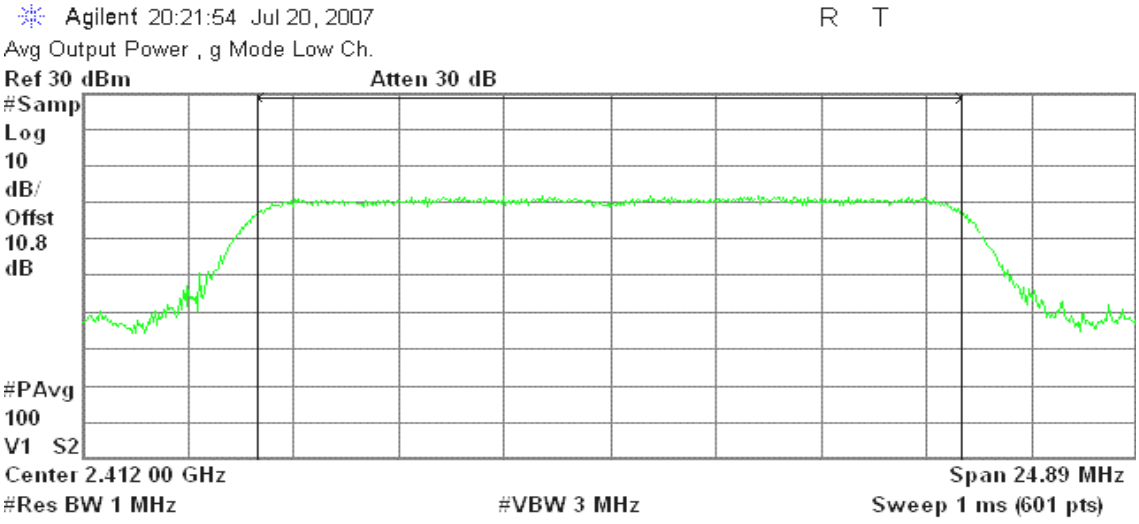


Channel Power
13.07 dBm / 16.7590 MHz

Power Spectral Density
-59.17 dBm/Hz

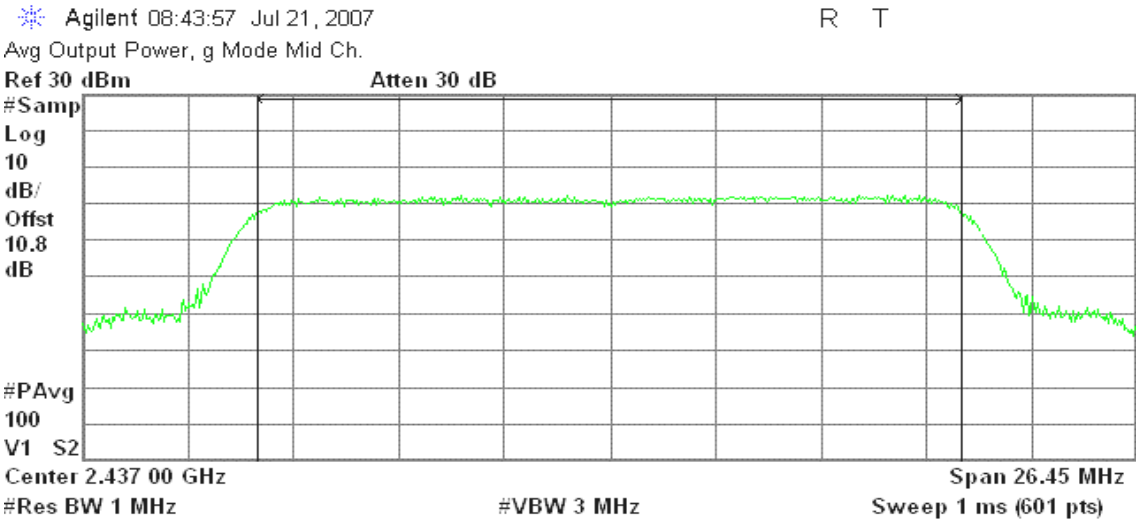
draft 802.11n Standard-20 MHz Channel mode / Chain 0

Average Power (CH Low)



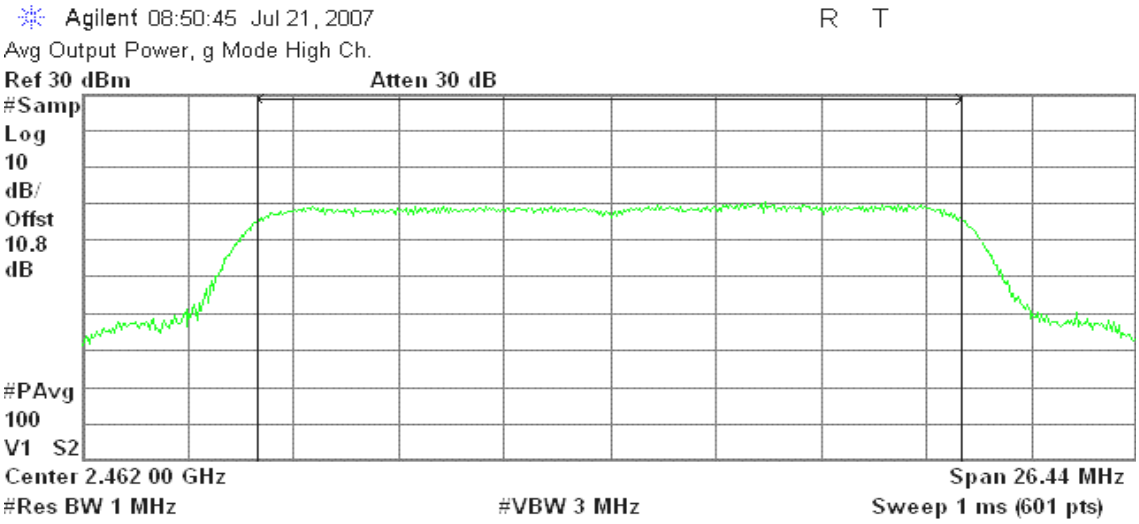
Channel Power	Power Spectral Density
12.44 dBm / 16.5940 MHz	-59.76 dBm/Hz

Average Power (CH Mid)



Channel Power	Power Spectral Density
13.18 dBm / 17.6350 MHz	-59.29 dBm/Hz

Average Power (CH High)

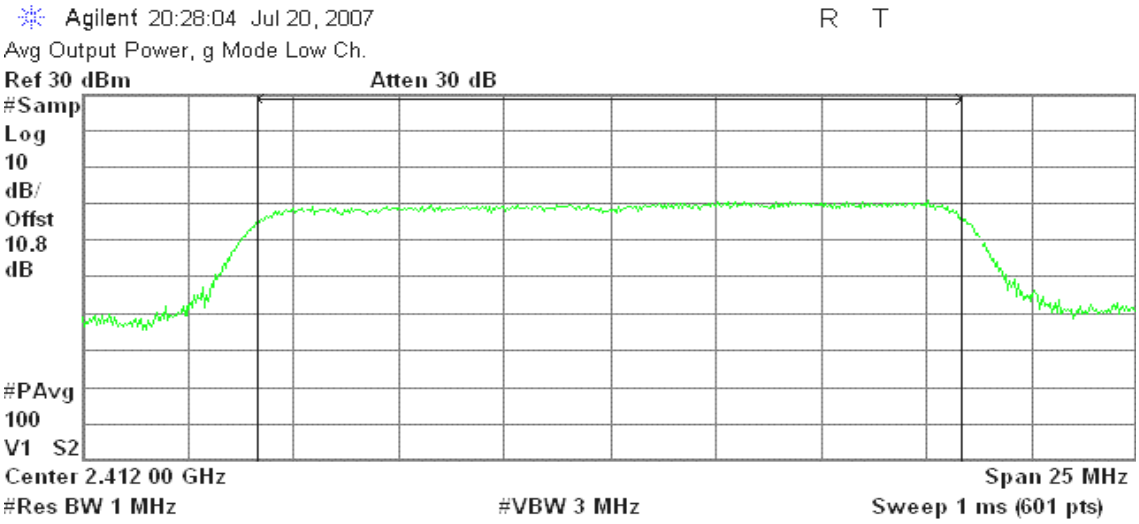


Channel Power
10.86 dBm / 17.6240 MHz

Power Spectral Density
-61.60 dBm/Hz

draft 802.11n Standard-20 MHz Channel mode / Chain 1

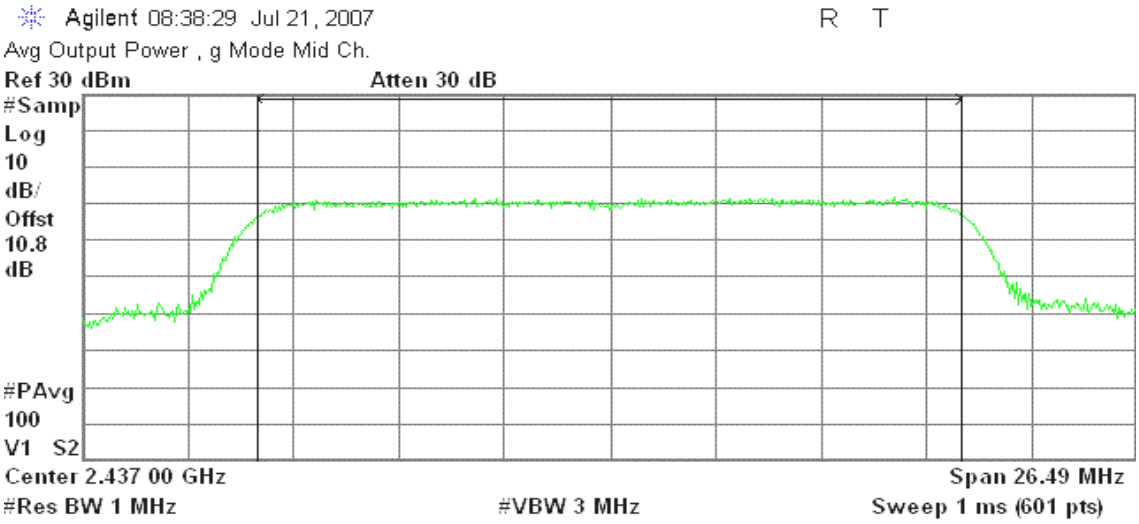
Average Power (CH Low)



Channel Power
11.17 dBm / 16.6650 MHz

Power Spectral Density
-61.05 dBm/Hz

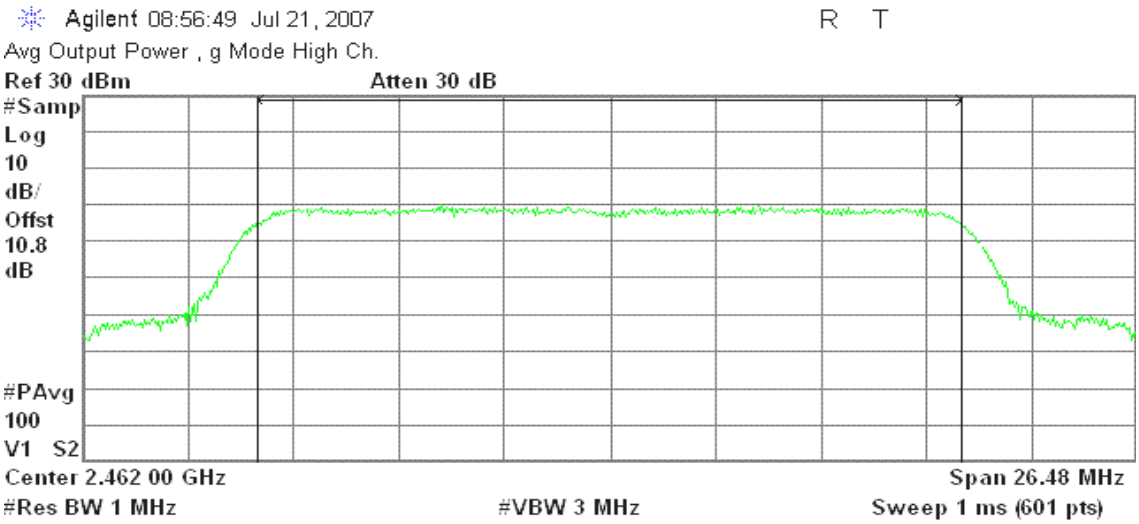
Average Power (CH Mid)



Channel Power
12.50 dBm / 17.6610 MHz

Power Spectral Density
-59.97 dBm/Hz

Average Power (CH High)

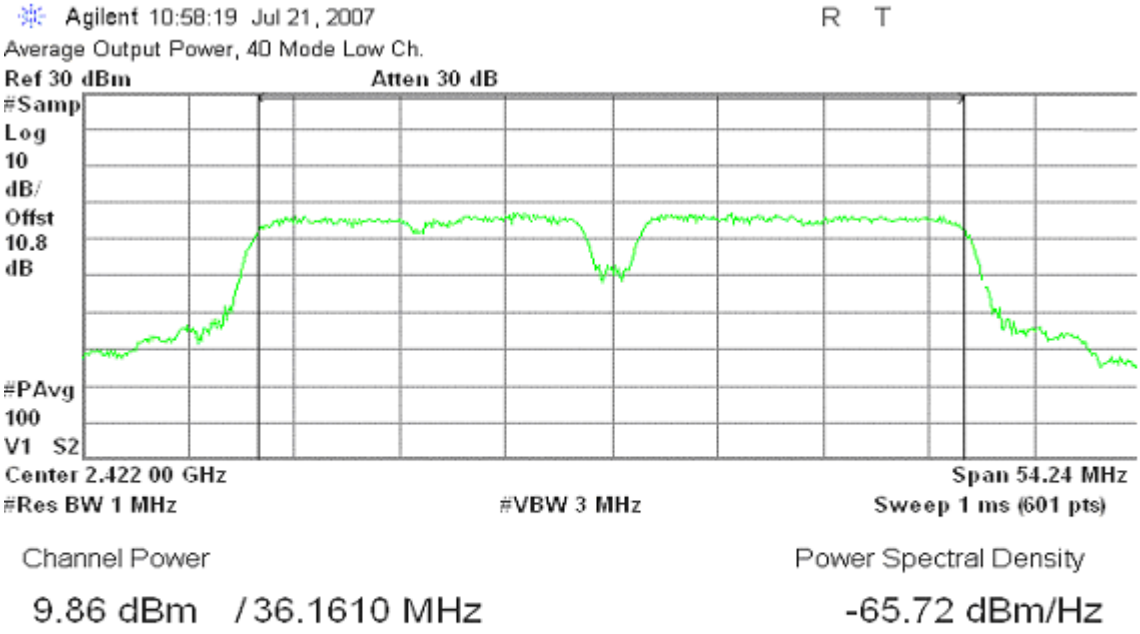


Channel Power
10.34 dBm / 17.6550 MHz

Power Spectral Density
-62.13 dBm/Hz

draft 802.11n Wide-40 MHz Channel mode / Chain 0

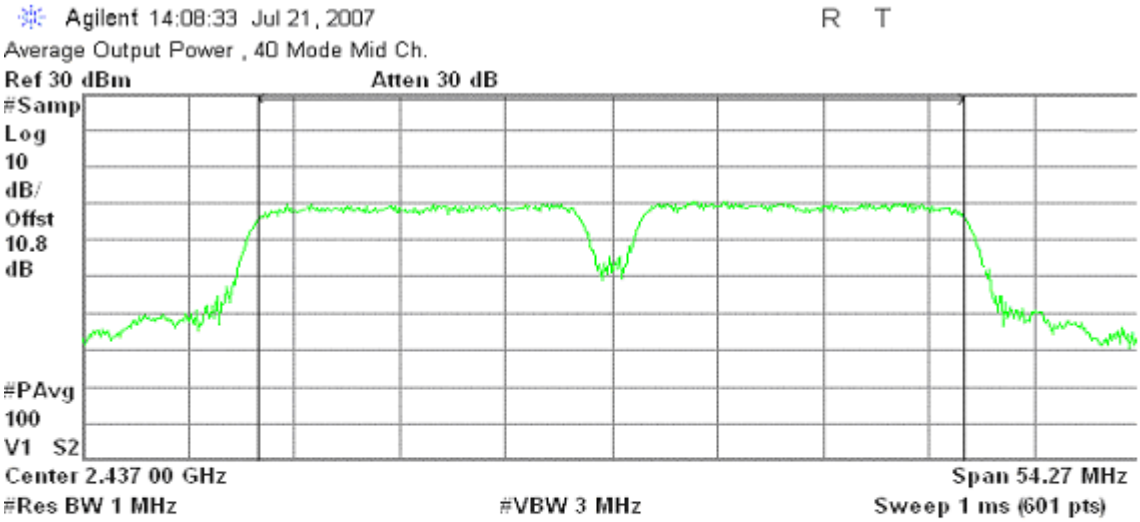
Average Power (CH Low)



Channel Power
9.86 dBm / 36.1610 MHz

Power Spectral Density
-65.72 dBm/Hz

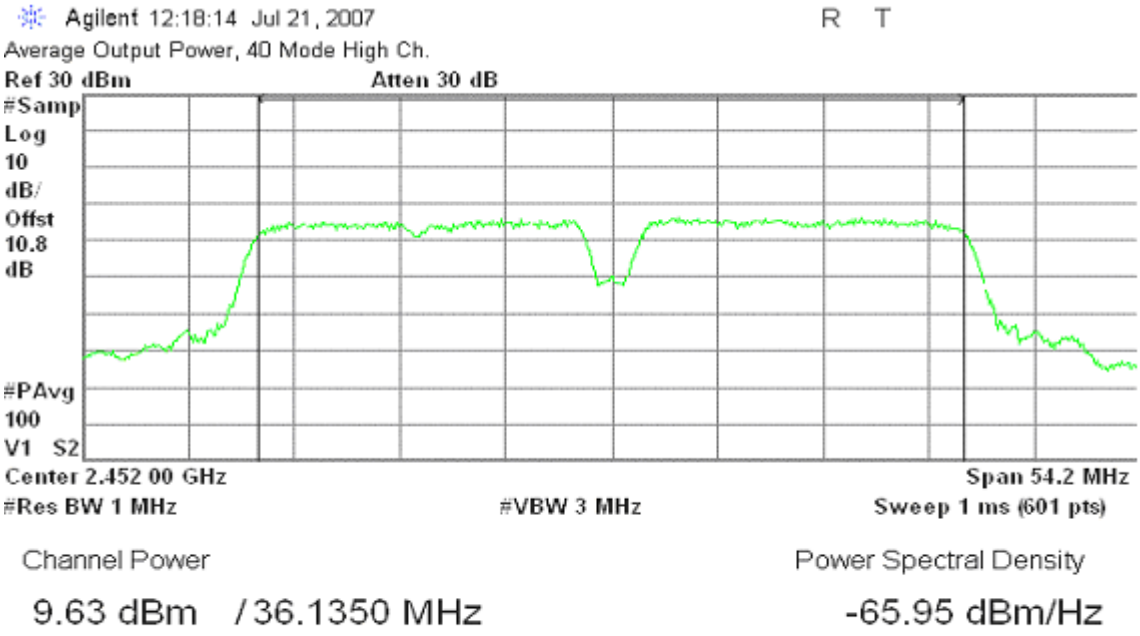
Average Power (CH Mid)



Channel Power
13.63 dBm / 36.1780 MHz

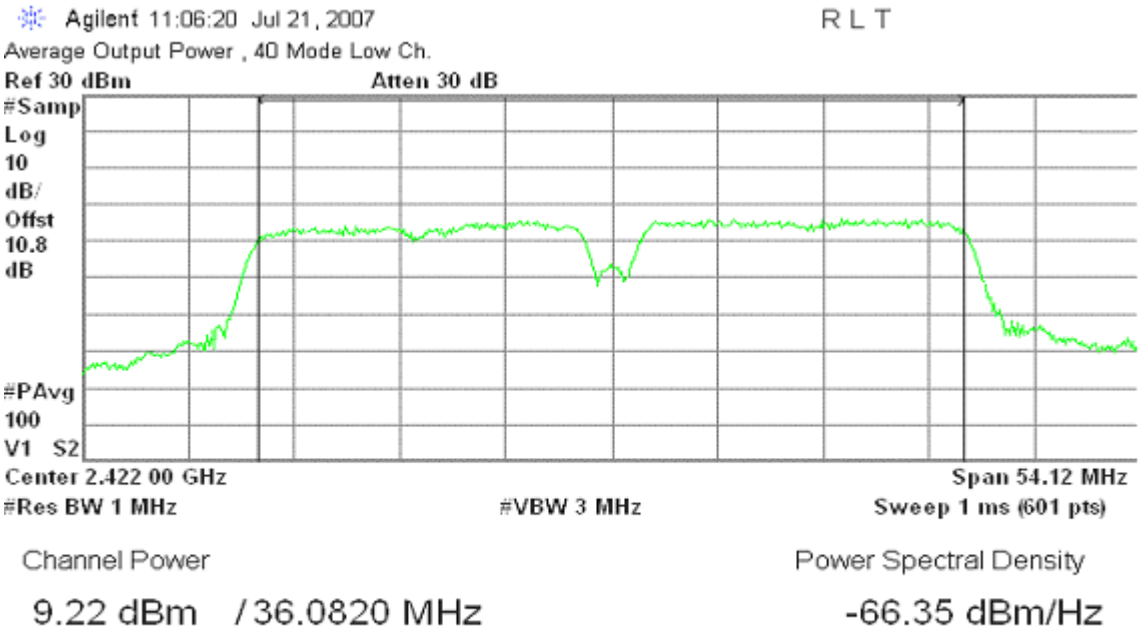
Power Spectral Density
-61.96 dBm/Hz

Average Power (CH High)

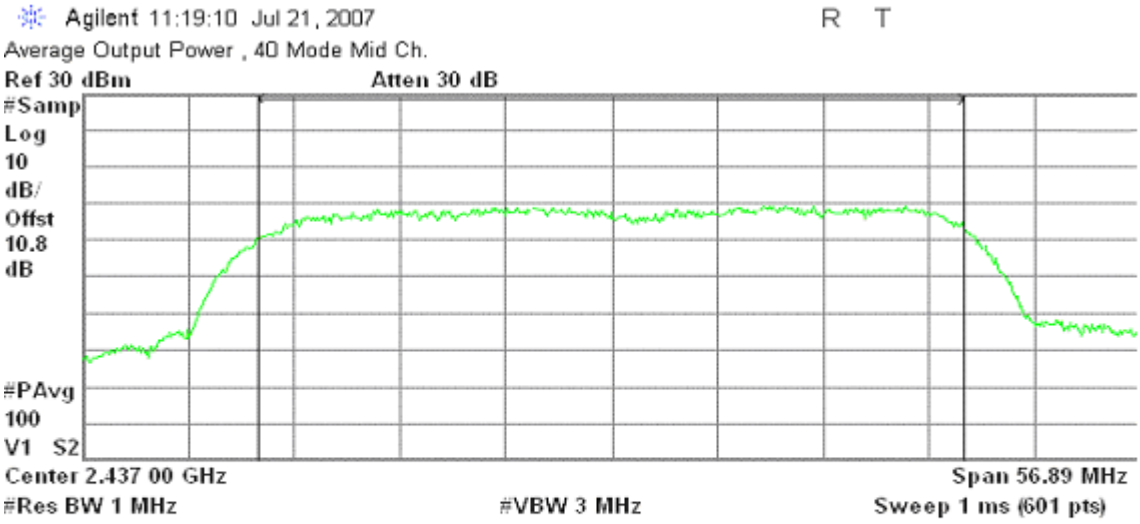


draft 802.11n Wide-40 MHz Channel mode / Chain 1

Average Power (CH Low)



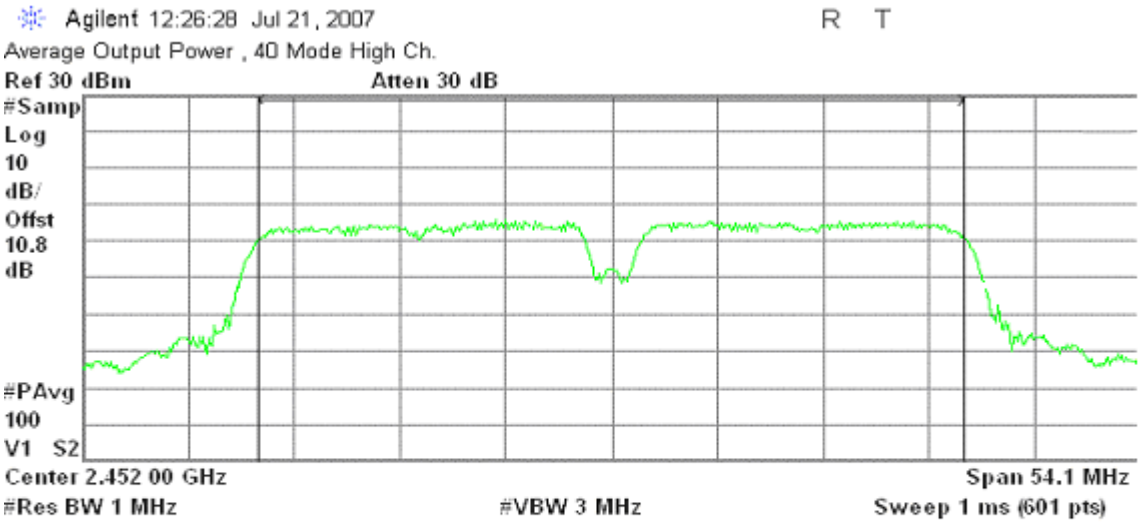
Average Power (CH Mid)



Channel Power
12.83 dBm / 37.9250 MHz

Power Spectral Density
-62.96 dBm/Hz

Average Power (CH High)



Channel Power
8.62 dBm / 36.0650 MHz

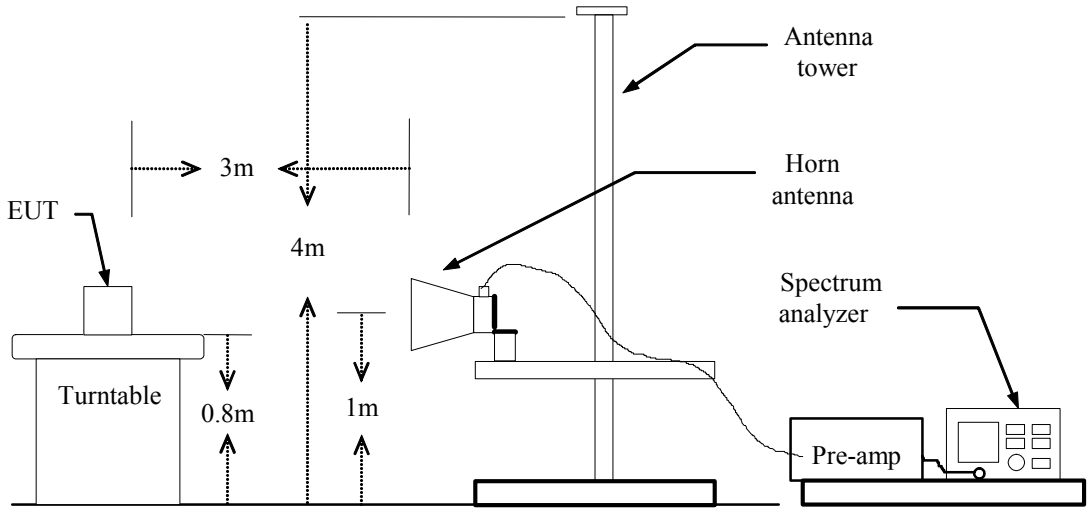
Power Spectral Density
-66.95 dBm/Hz

7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

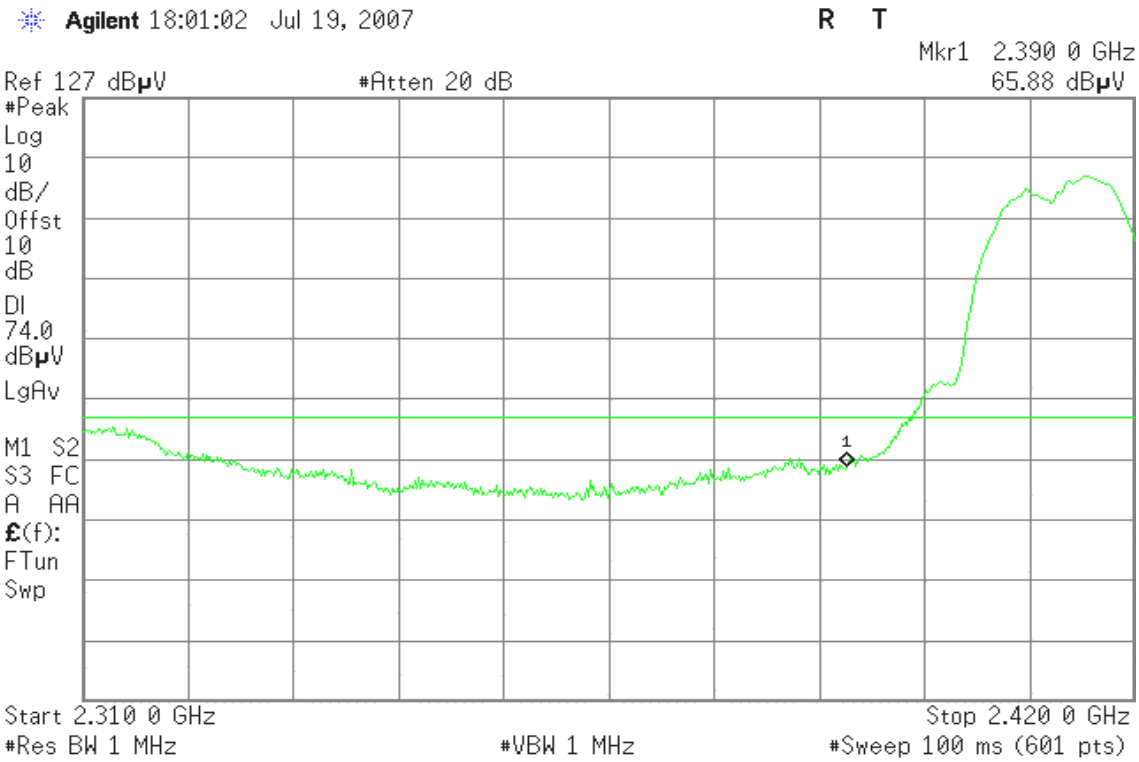
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

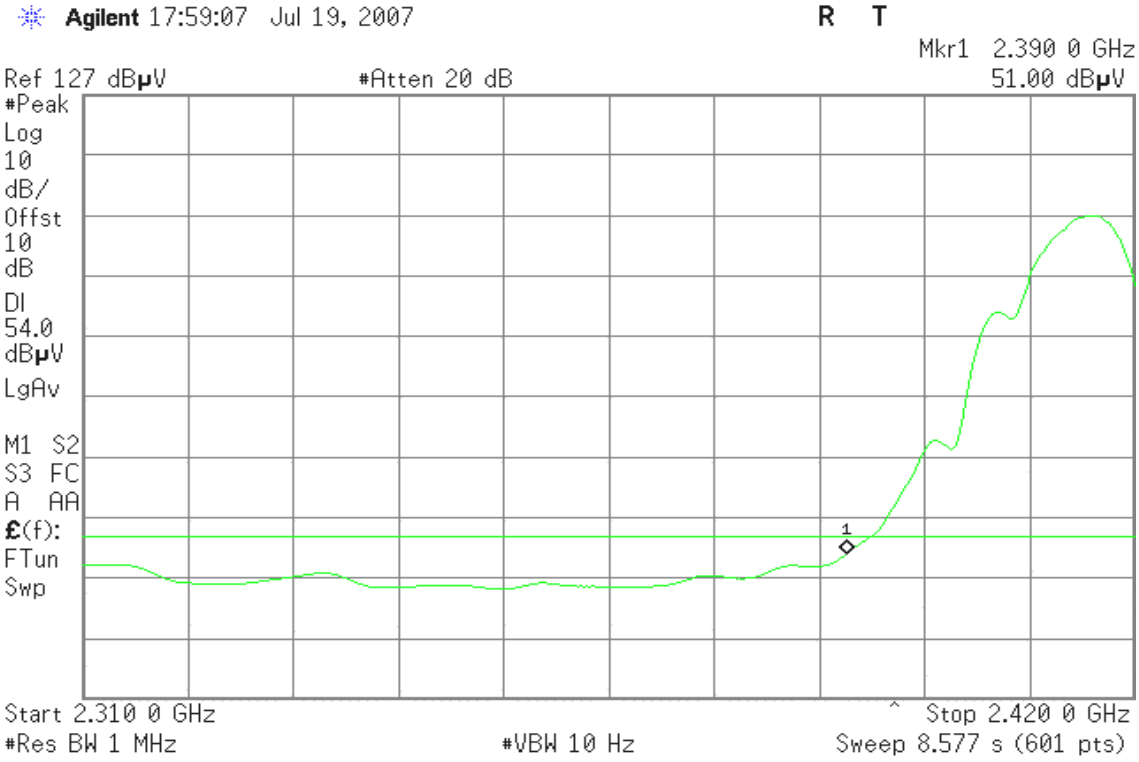
Refer to attach spectrum analyzer data chart.

Band Edges (IEEE 802.11b mode / CH Low)

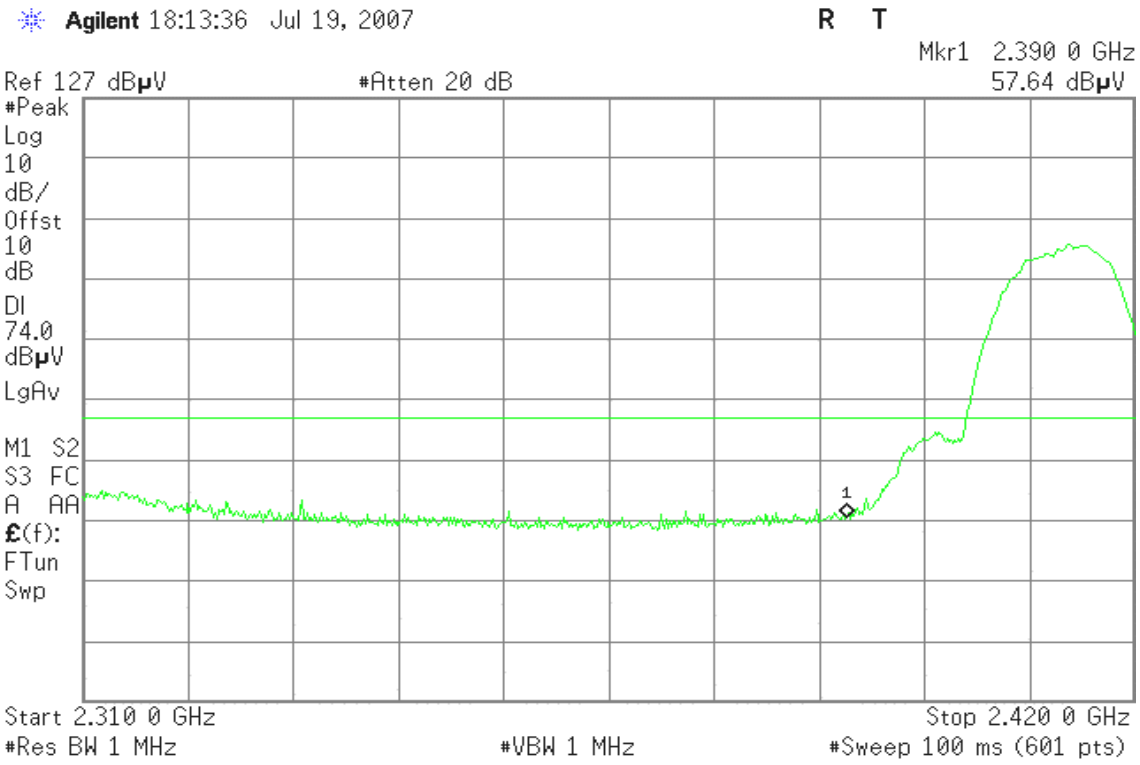
Detector mode: Peak Polarity: Vertical



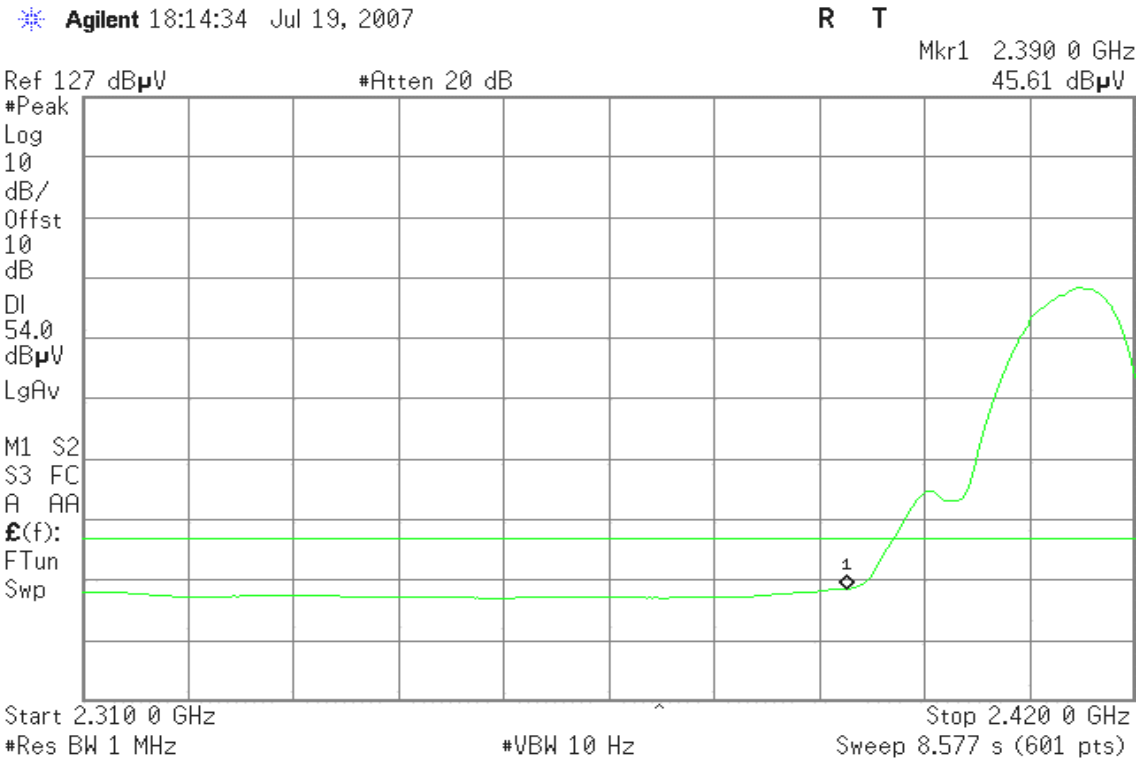
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

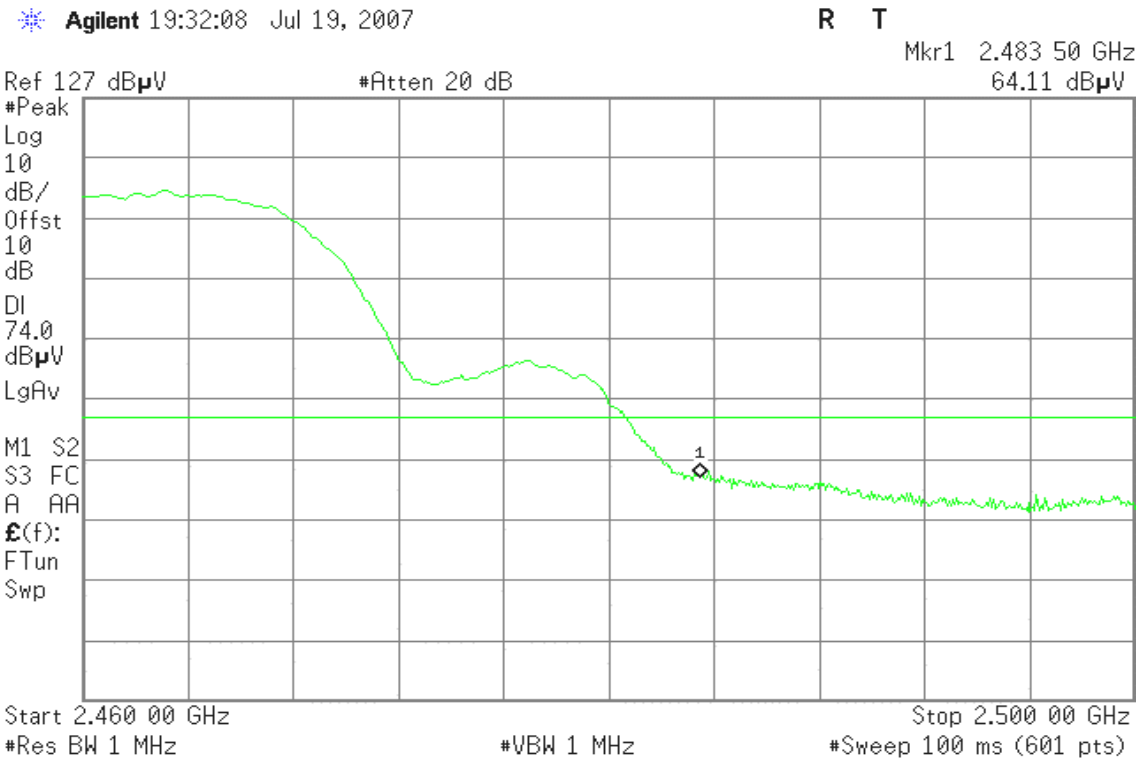


Detector mode: Average **Polarity: Horizontal**

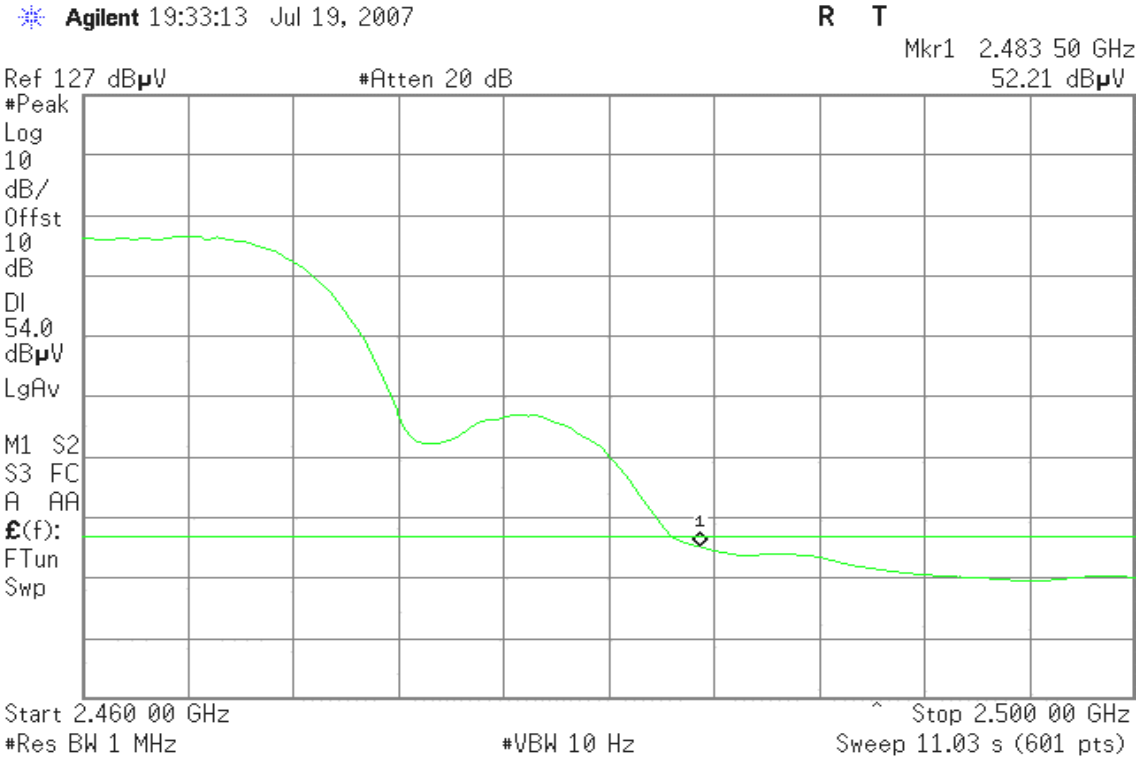


Band Edges (IEEE 802.11b mode / CH High)

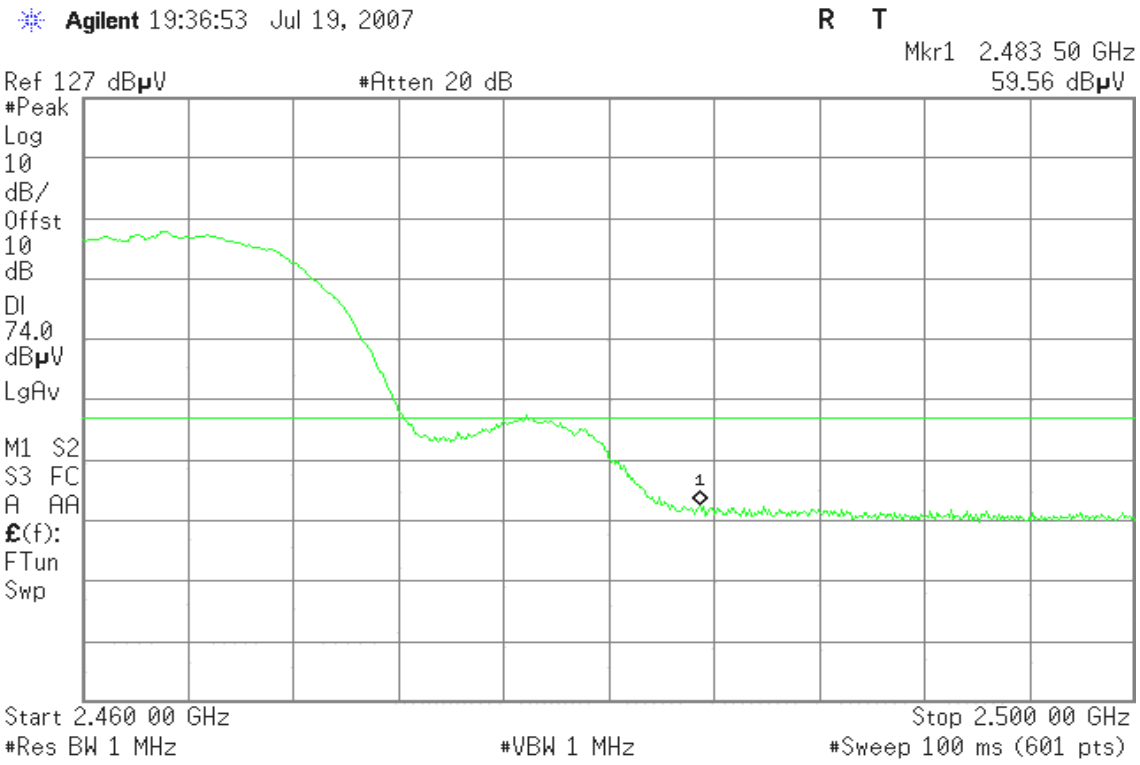
Detector mode: Peak Polarity: Vertical



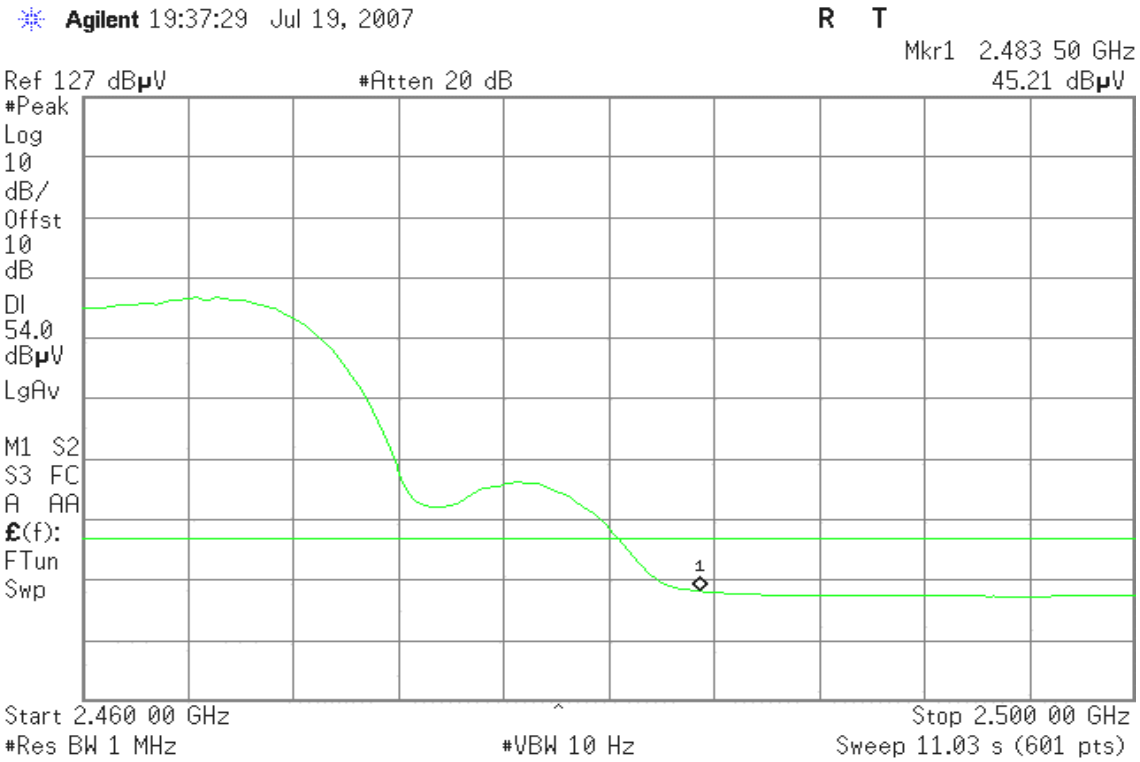
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

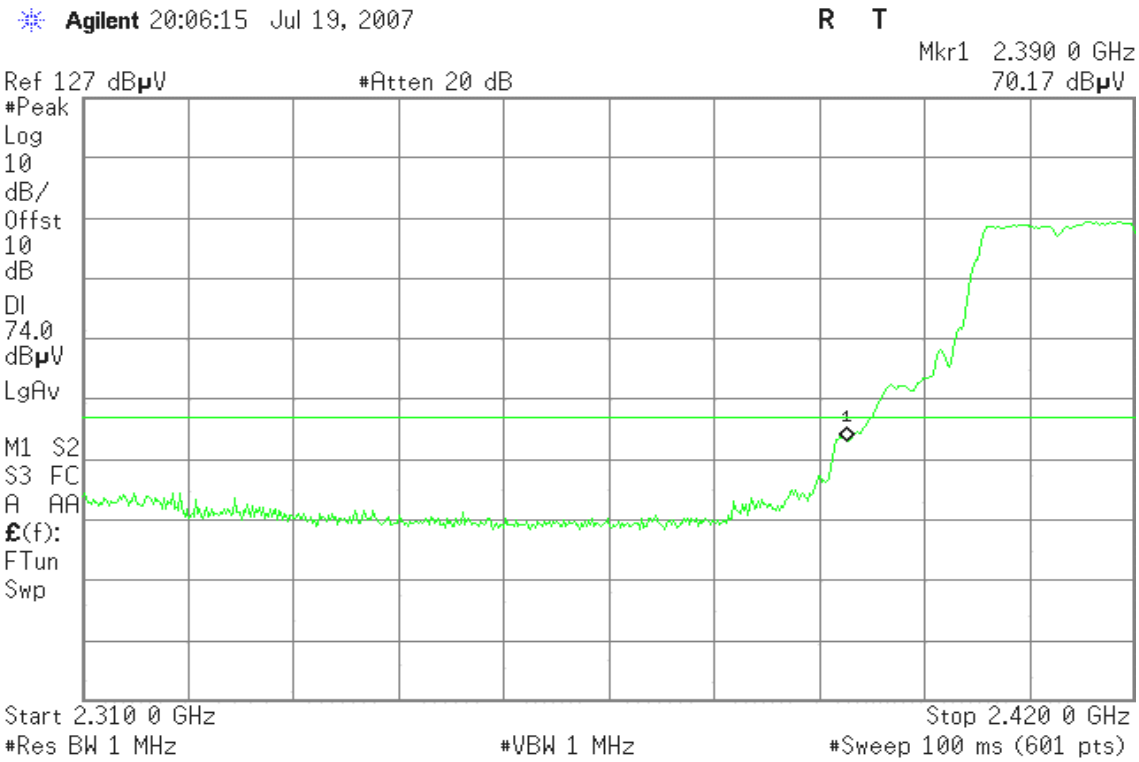


Detector mode: Average **Polarity: Horizontal**

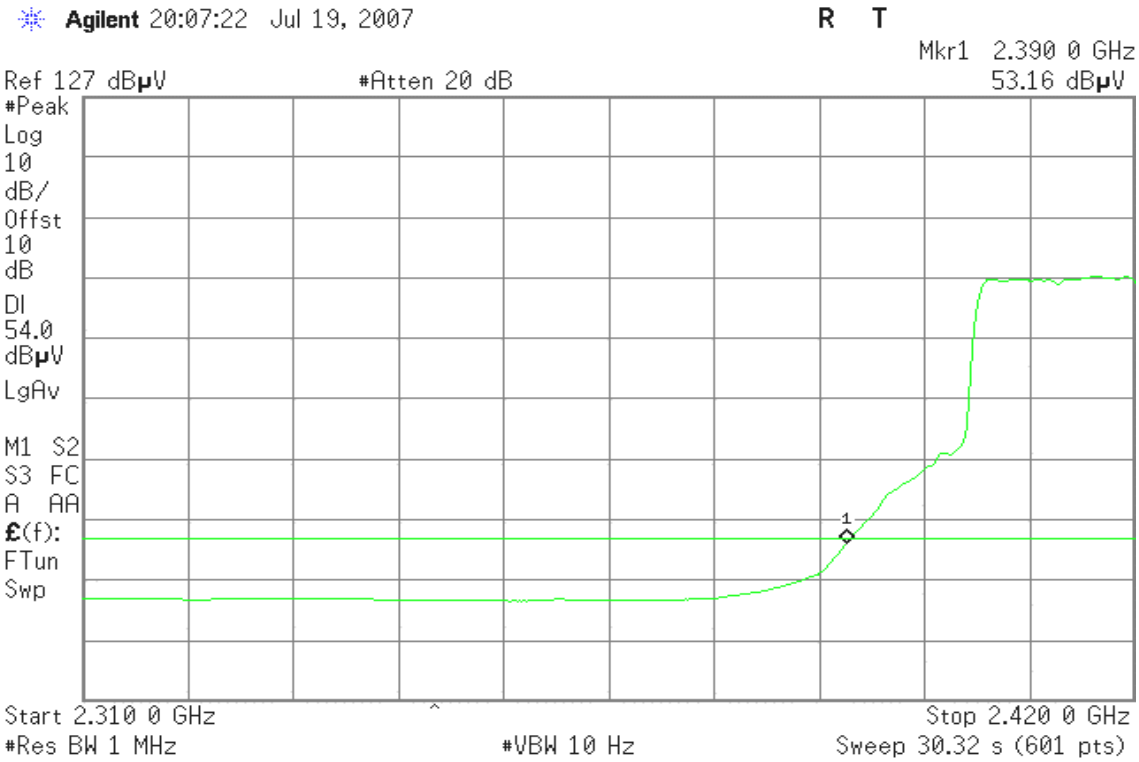


Band Edges (IEEE 802.11g mode / CH Low)

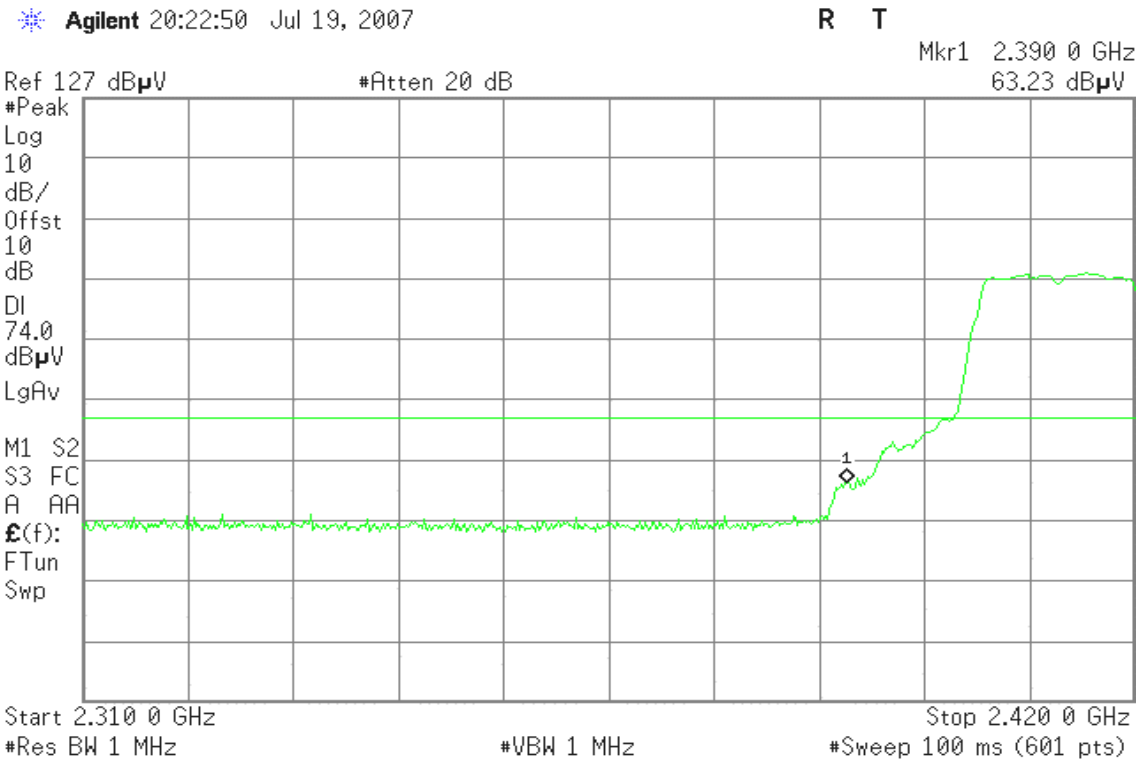
Detector mode: Peak Polarity: Vertical



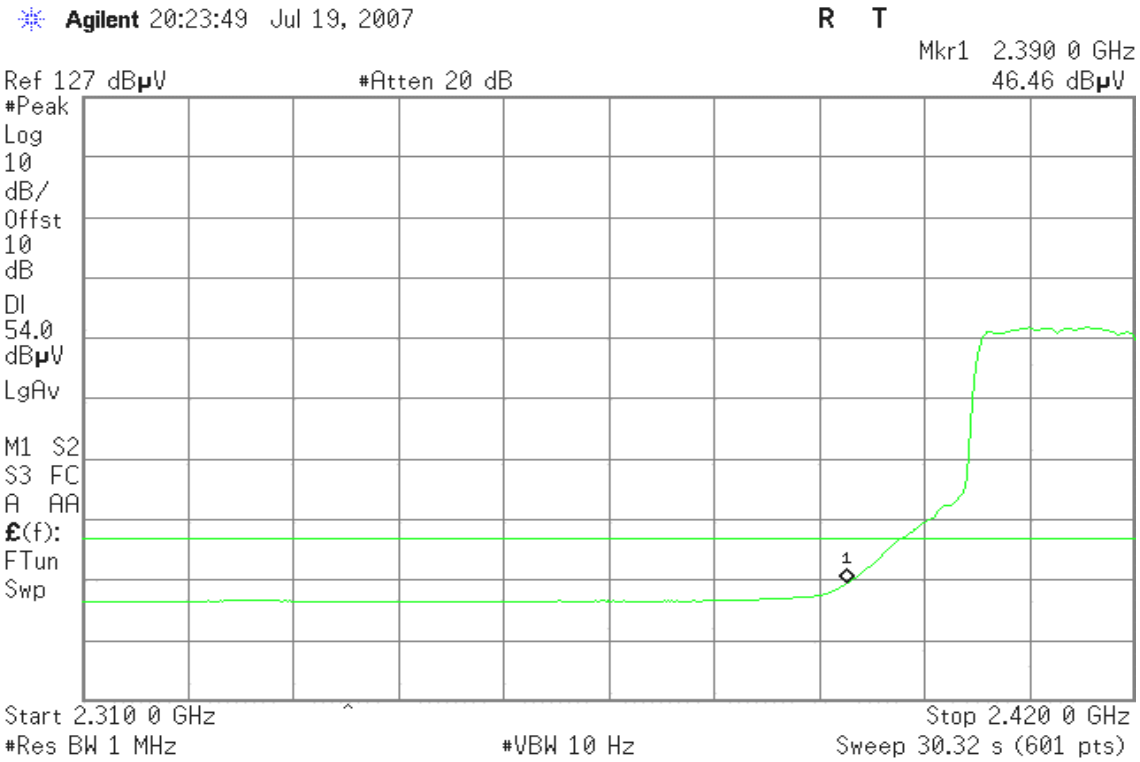
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

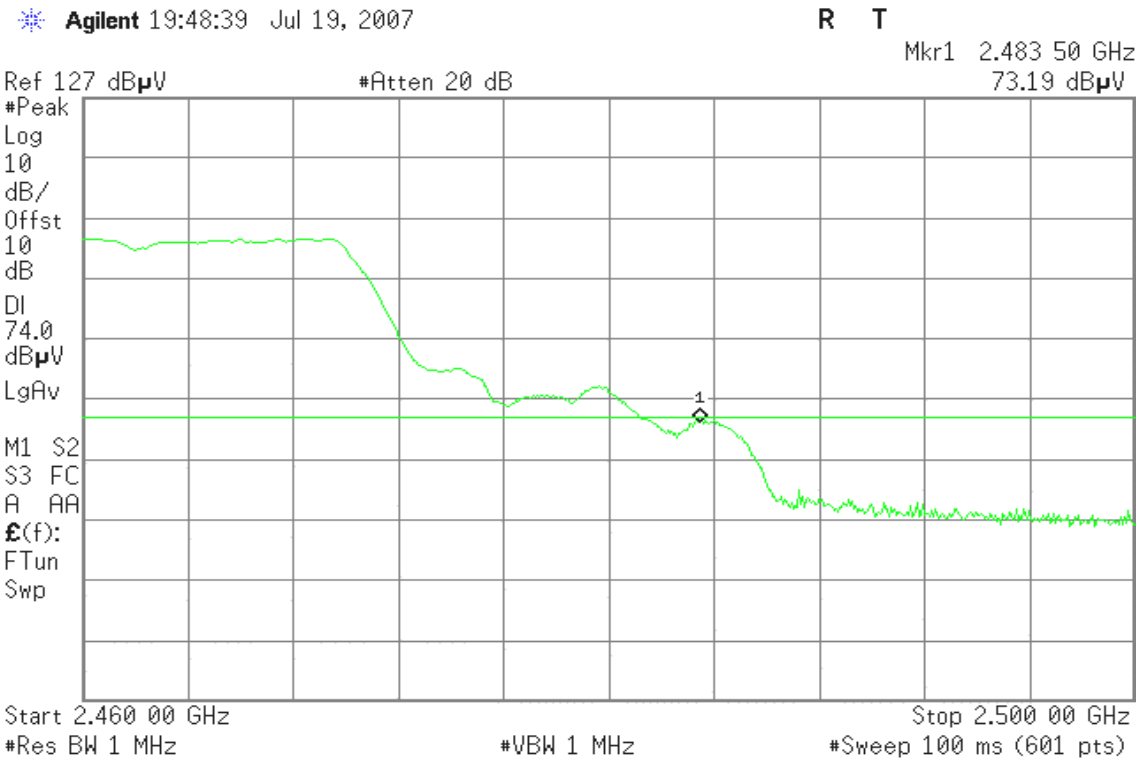


Detector mode: Average **Polarity: Horizontal**

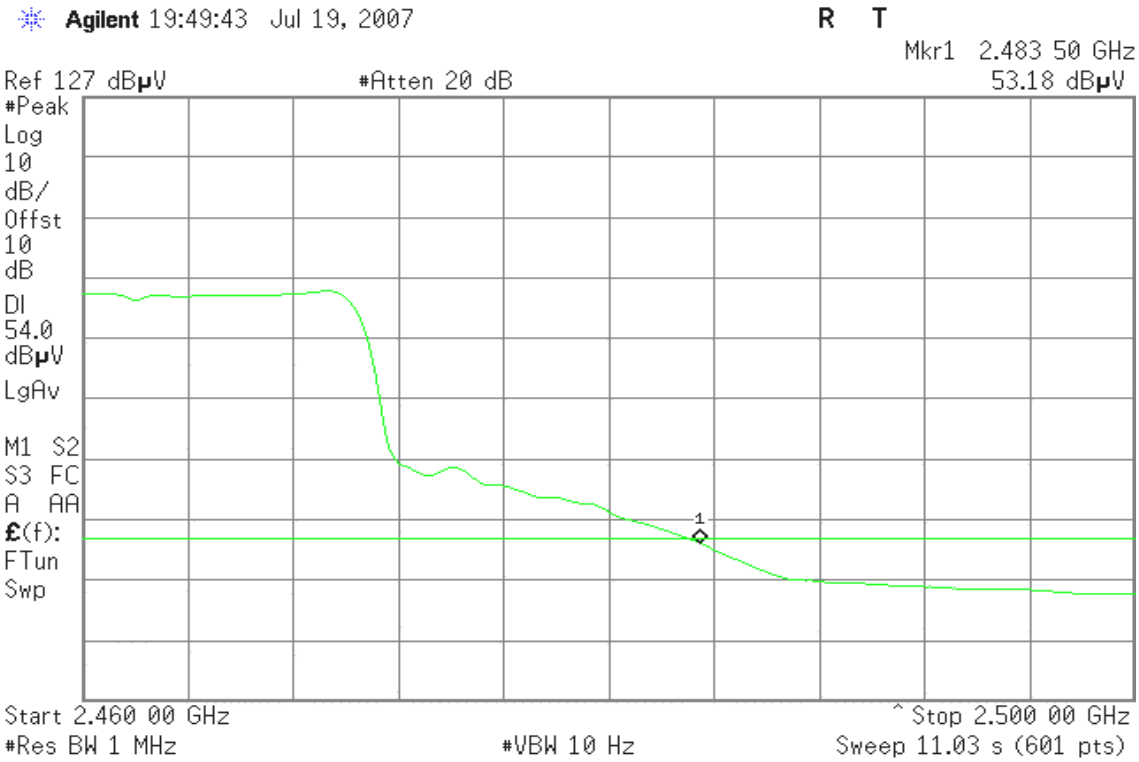


Band Edges (IEEE 802.11g mode / CH High)

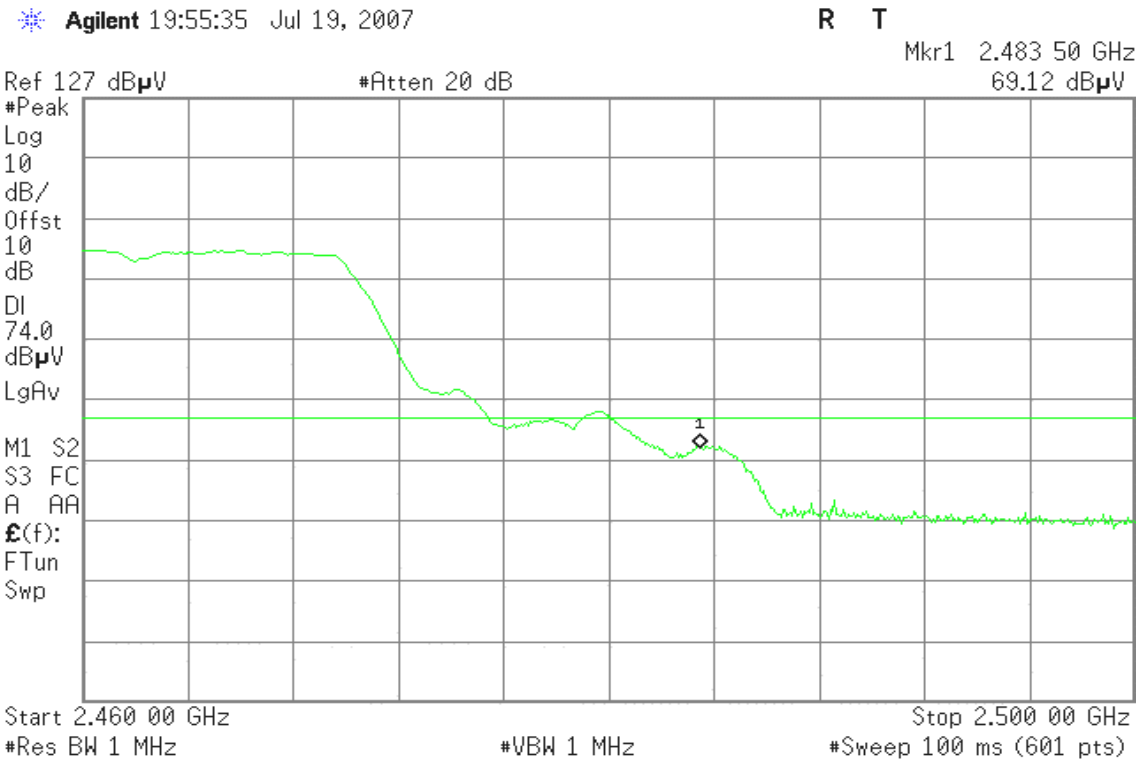
Detector mode: Peak Polarity: Vertical



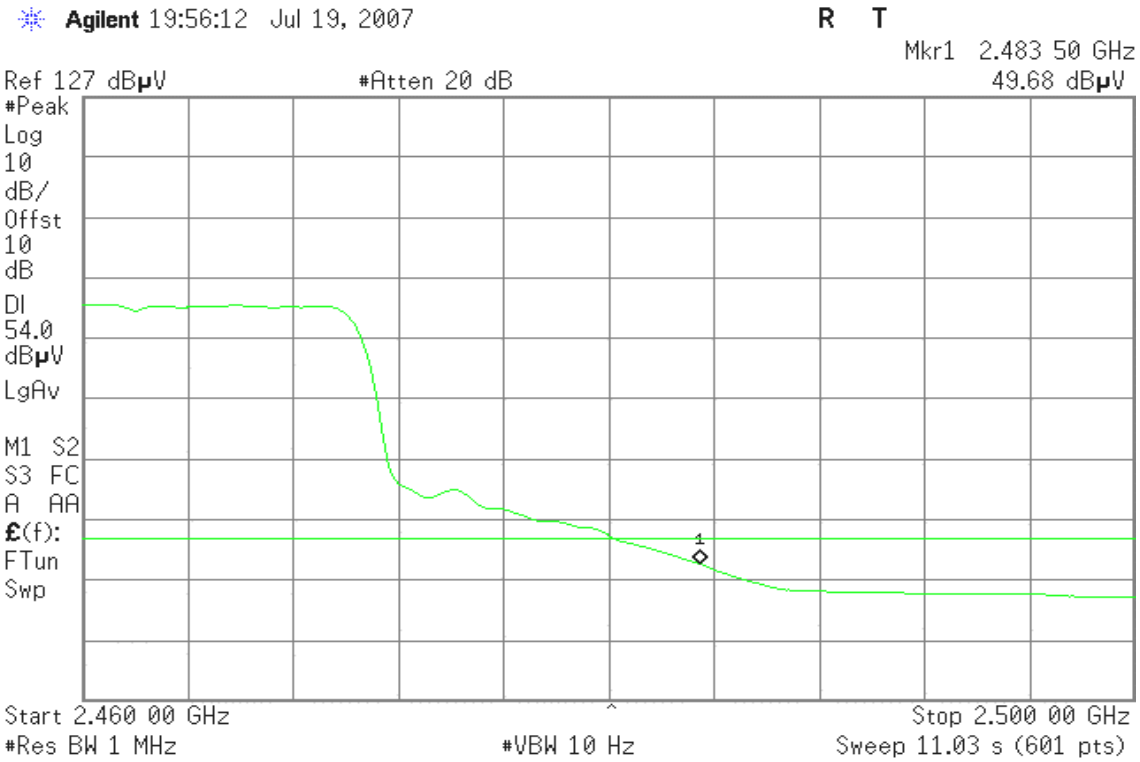
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

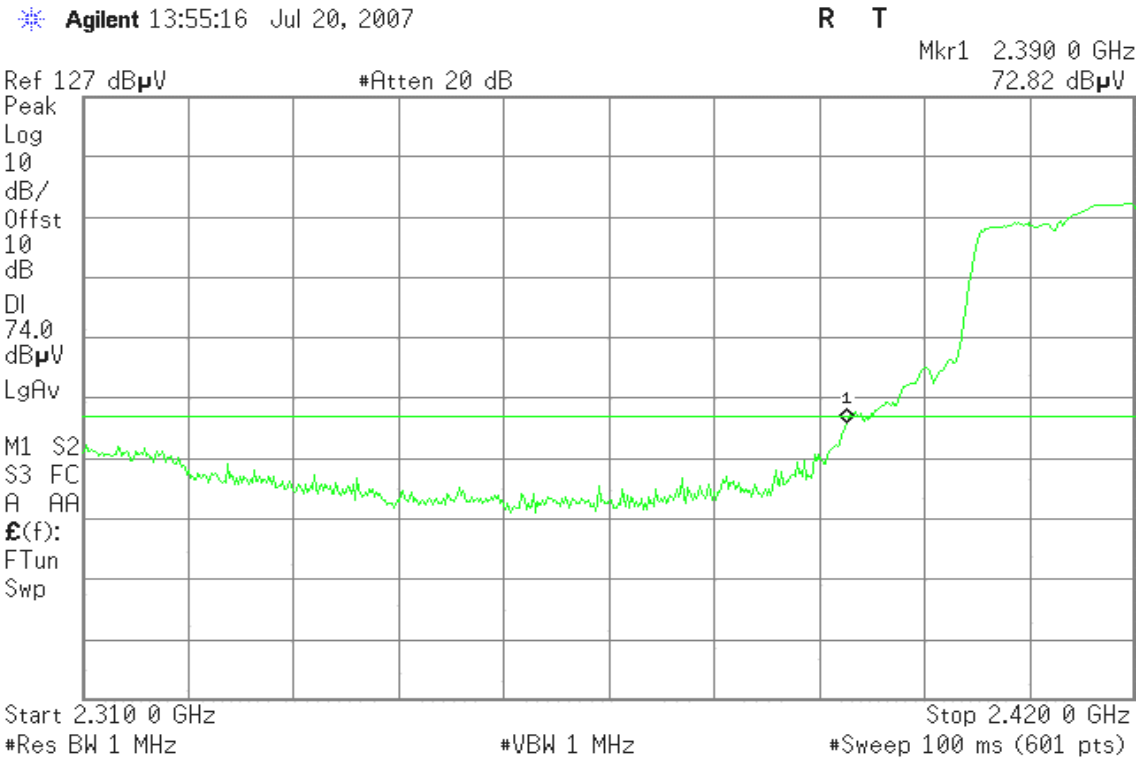


Detector mode: Average **Polarity: Horizontal**

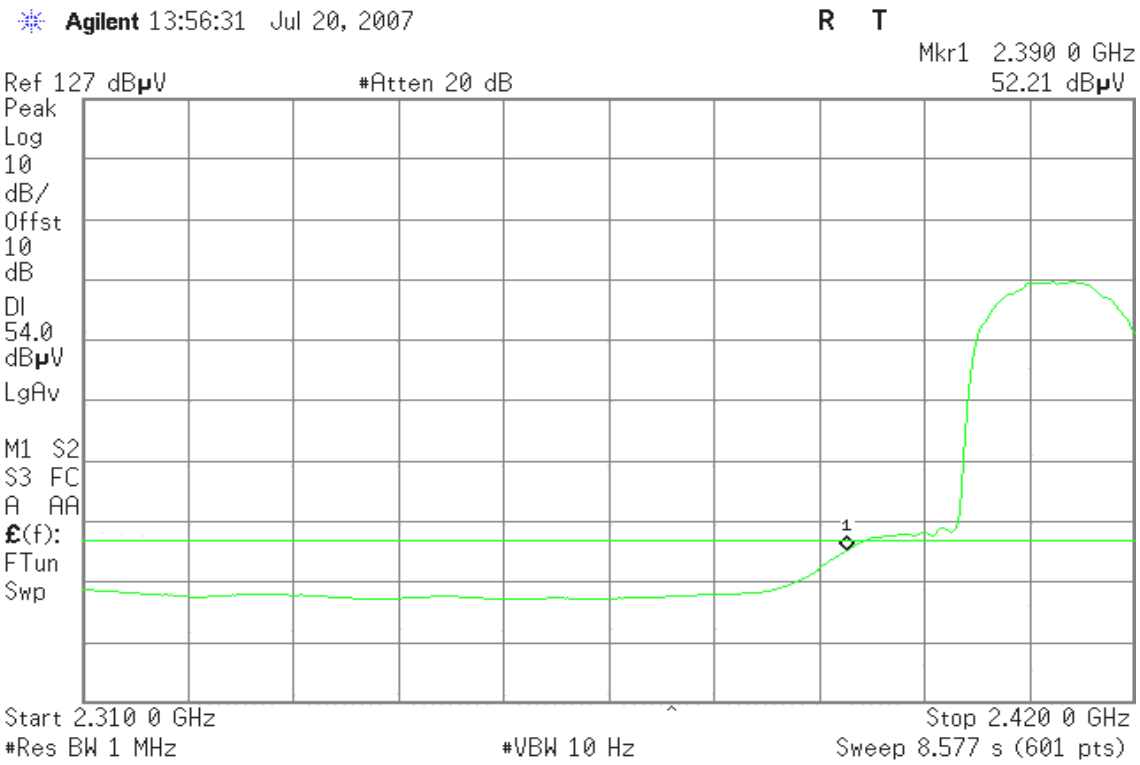


Band Edges (draft 802.11n Standard-20 MHz Channel mode / CH Low)

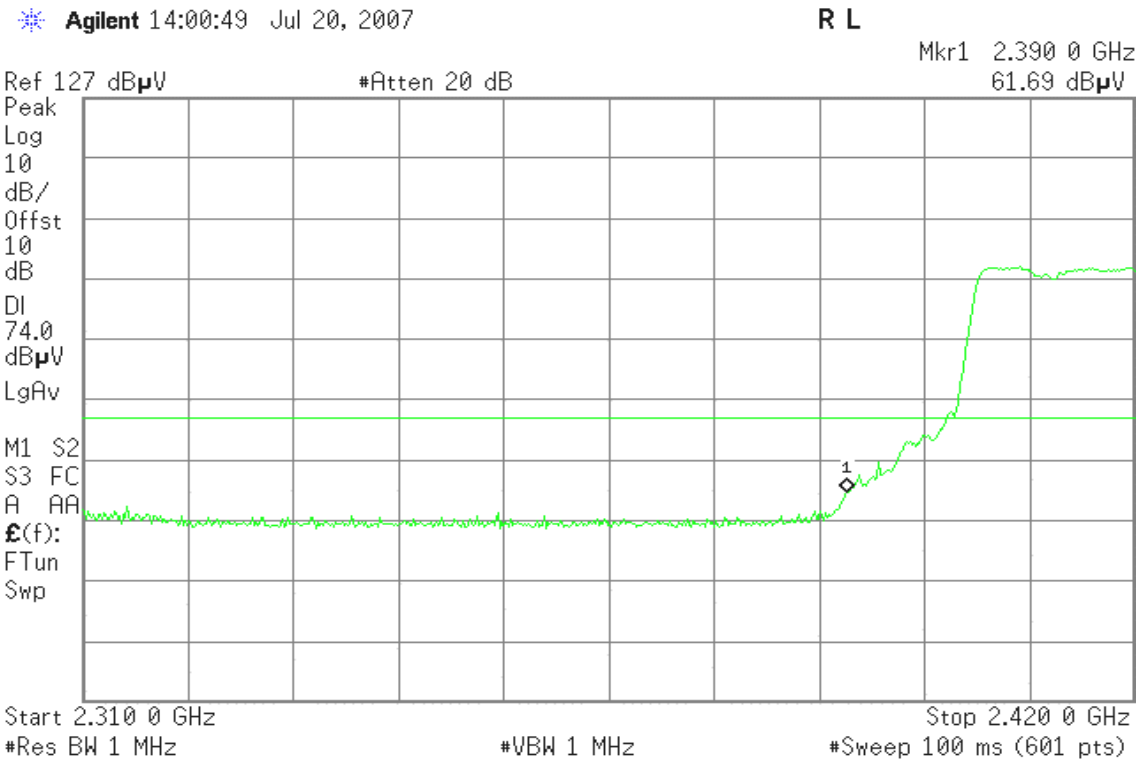
Detector mode: Peak **Polarity: Vertical**



Detector mode: Average **Polarity: Vertical**



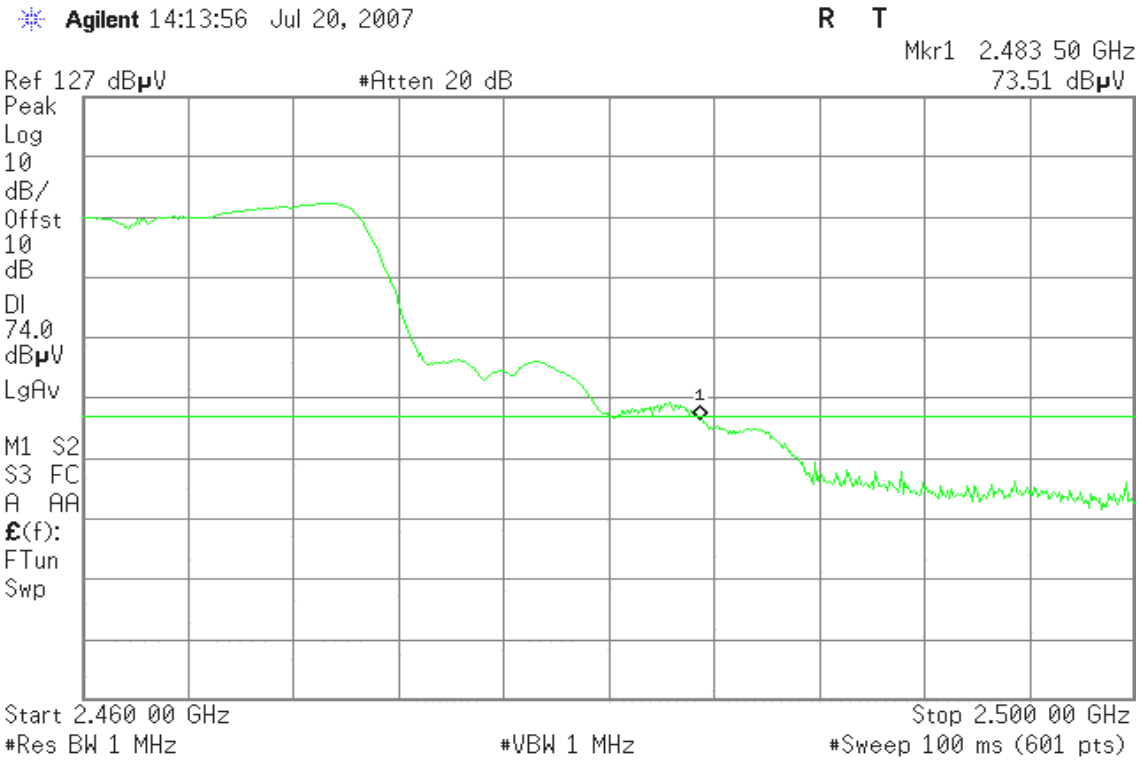
Detector mode: Peak **Polarity: Horizontal**



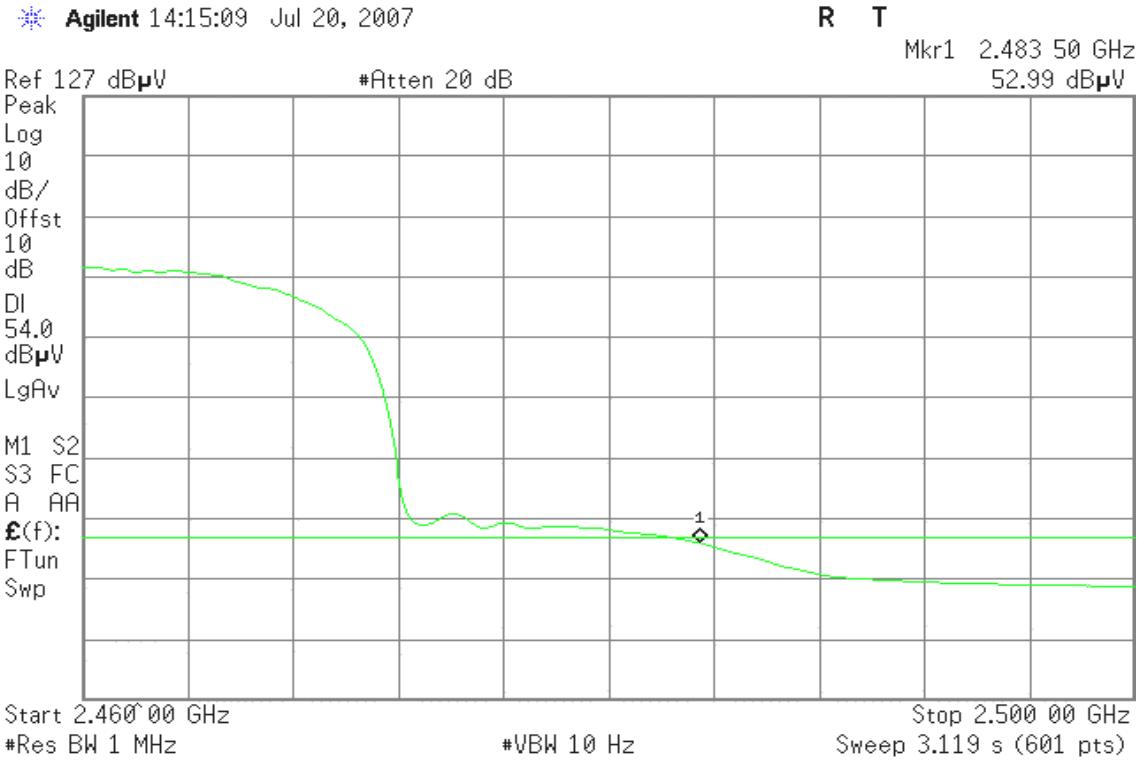
Detector mode: Average **Polarity: Horizontal**

Band Edges (draft 802.11n Standard-20 MHz Channel mode / CH High)

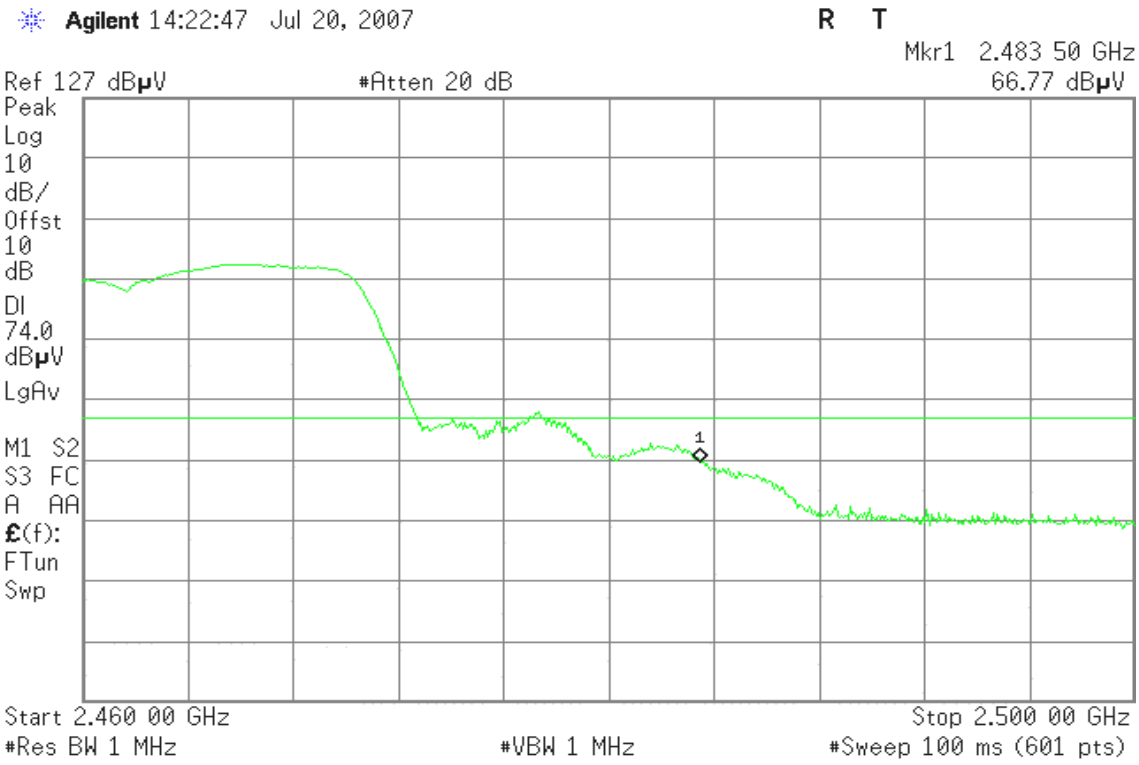
Detector mode: Peak **Polarity: Vertical**



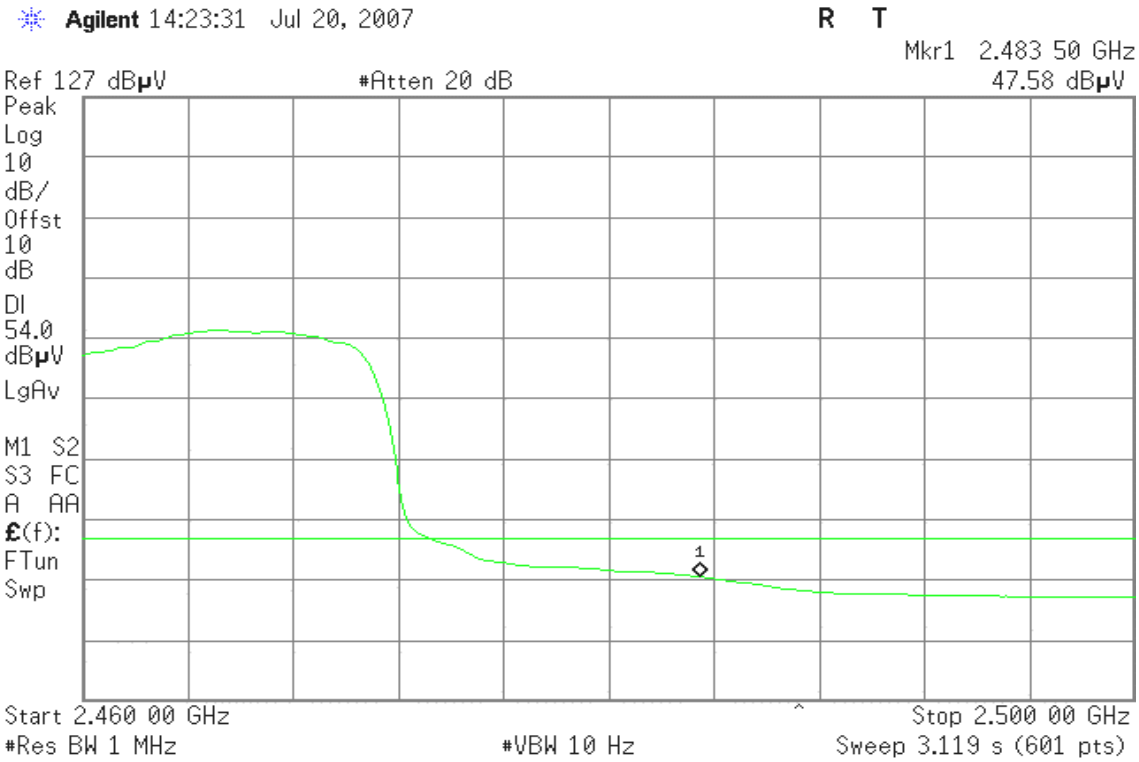
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

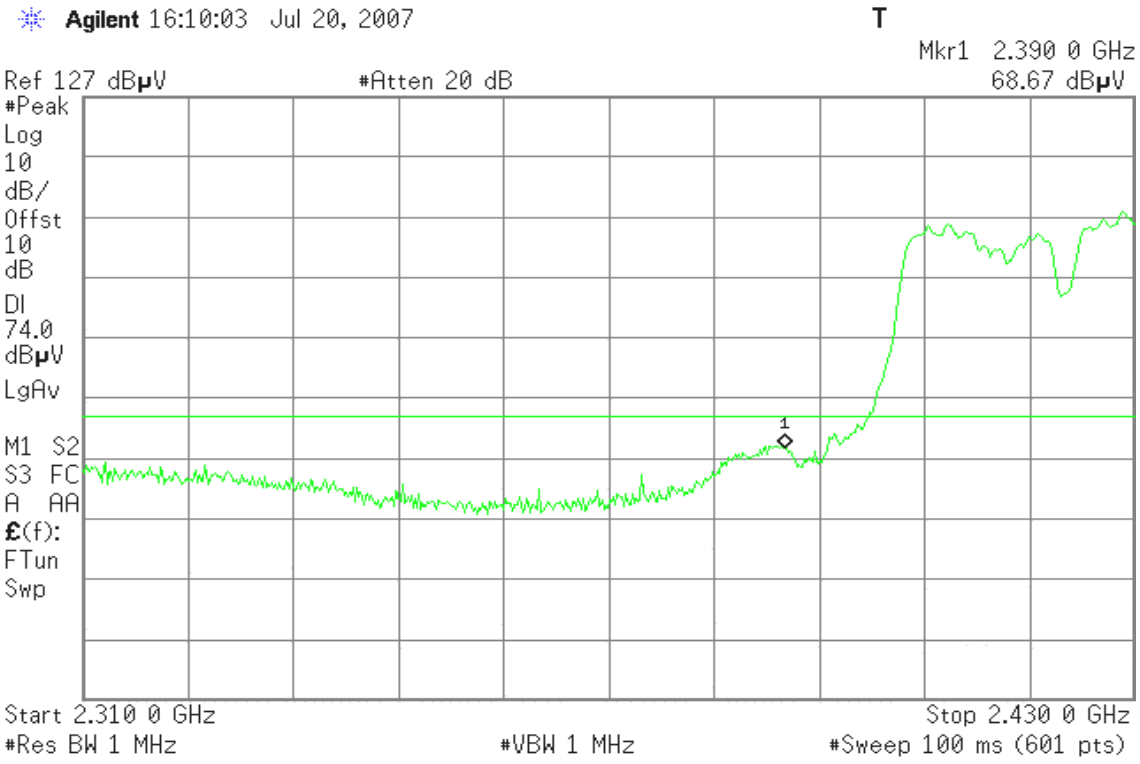


Detector mode: Average **Polarity: Horizontal**

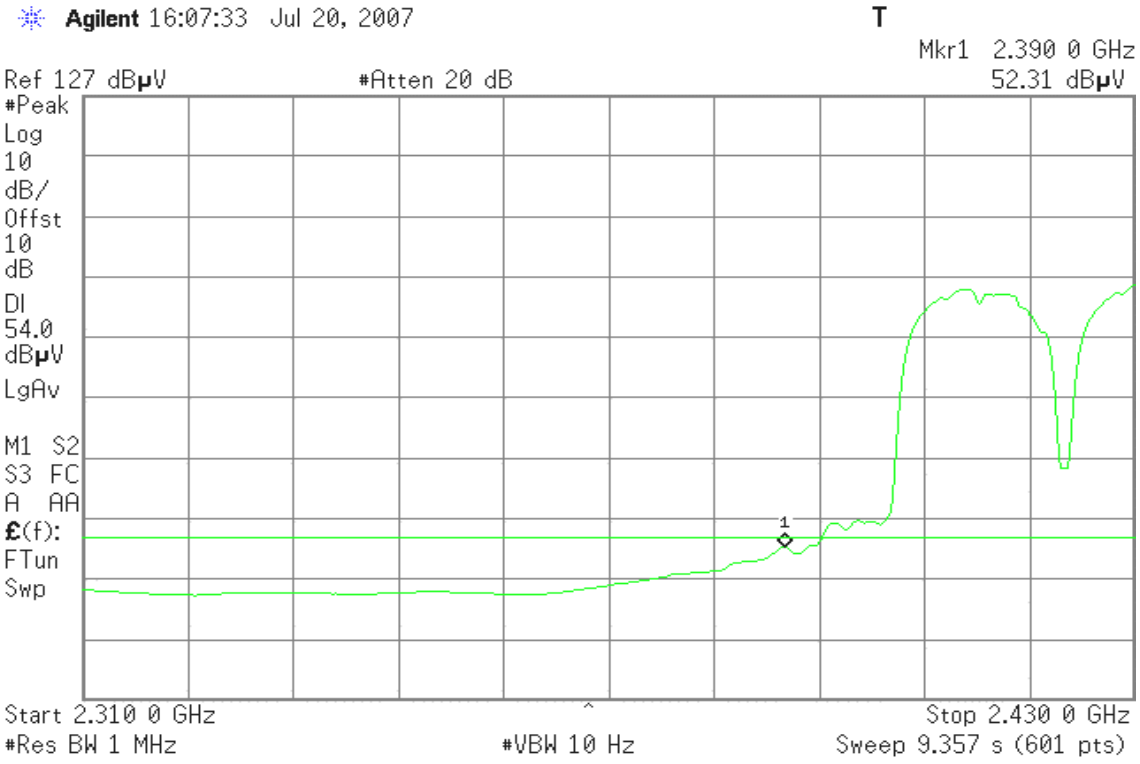


Band Edges (draft 802.11n Wide-40 MHz Channel mode / CH Low)

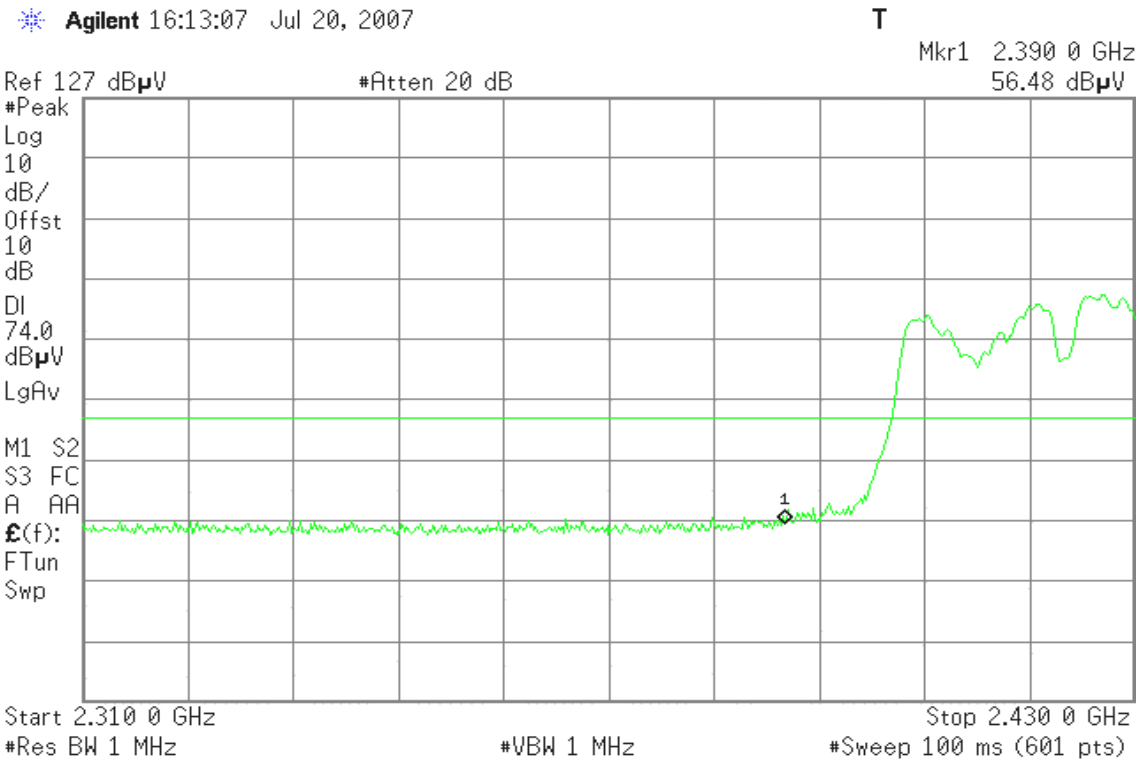
Detector mode: Peak **Polarity: Vertical**



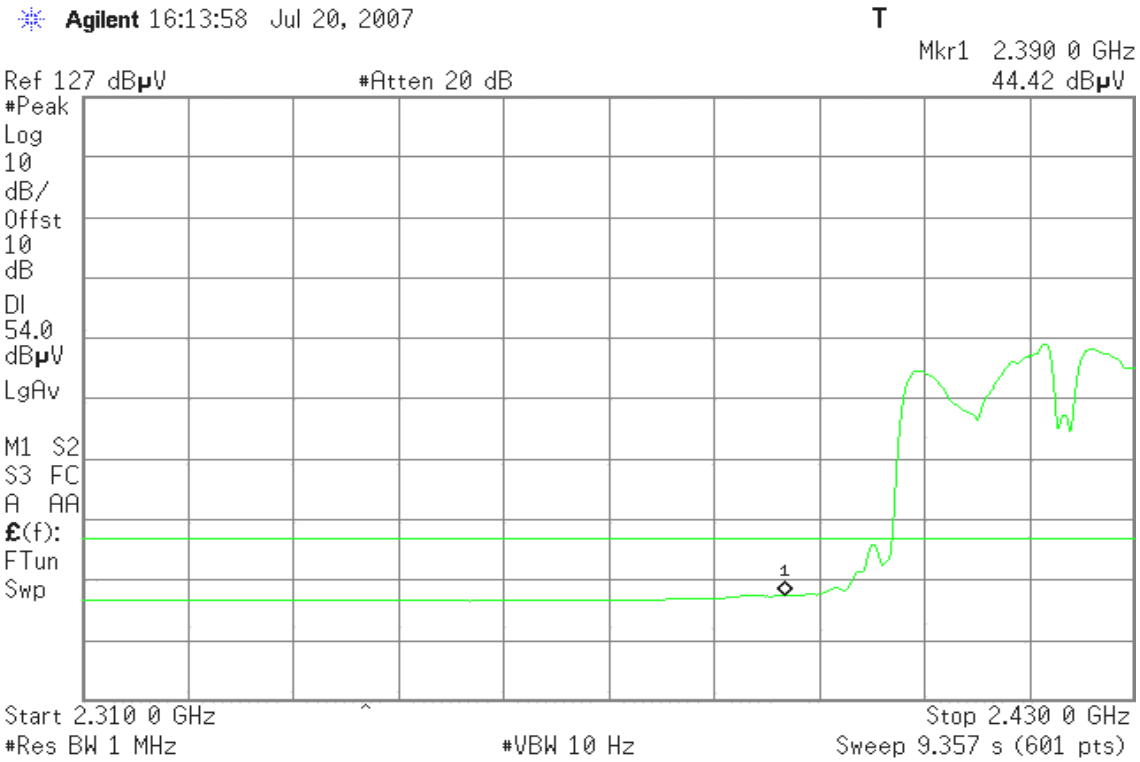
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**

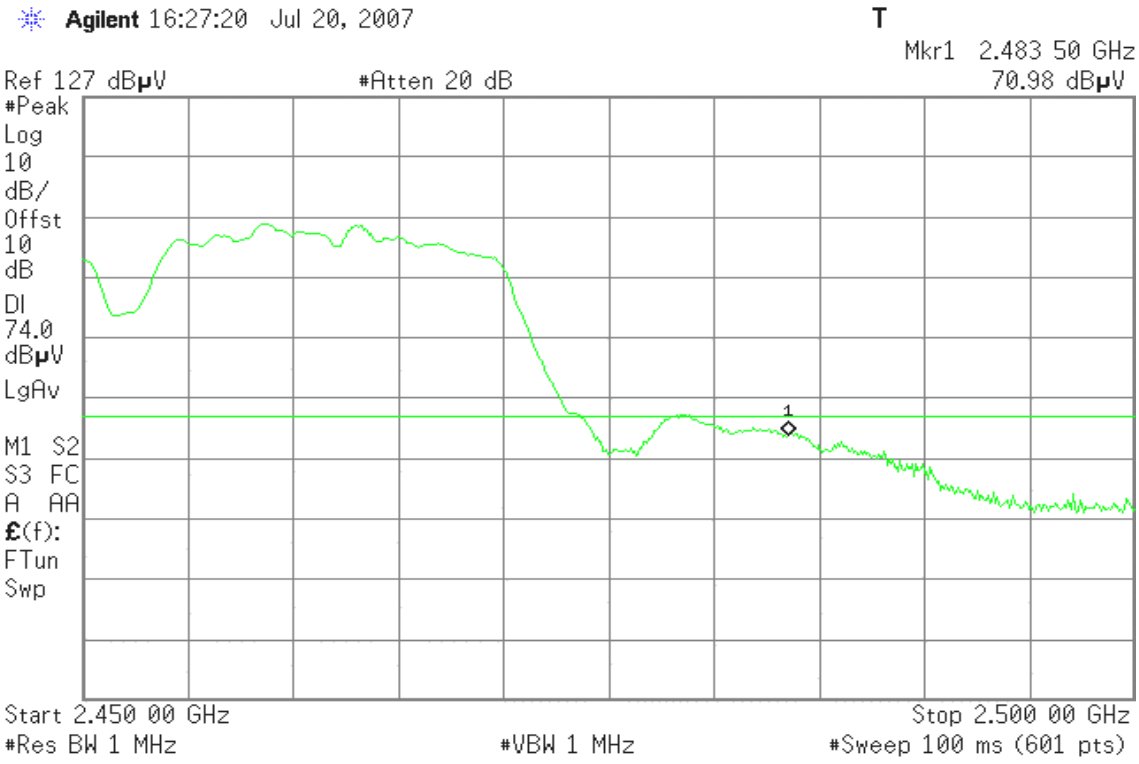


Detector mode: Average **Polarity: Horizontal**

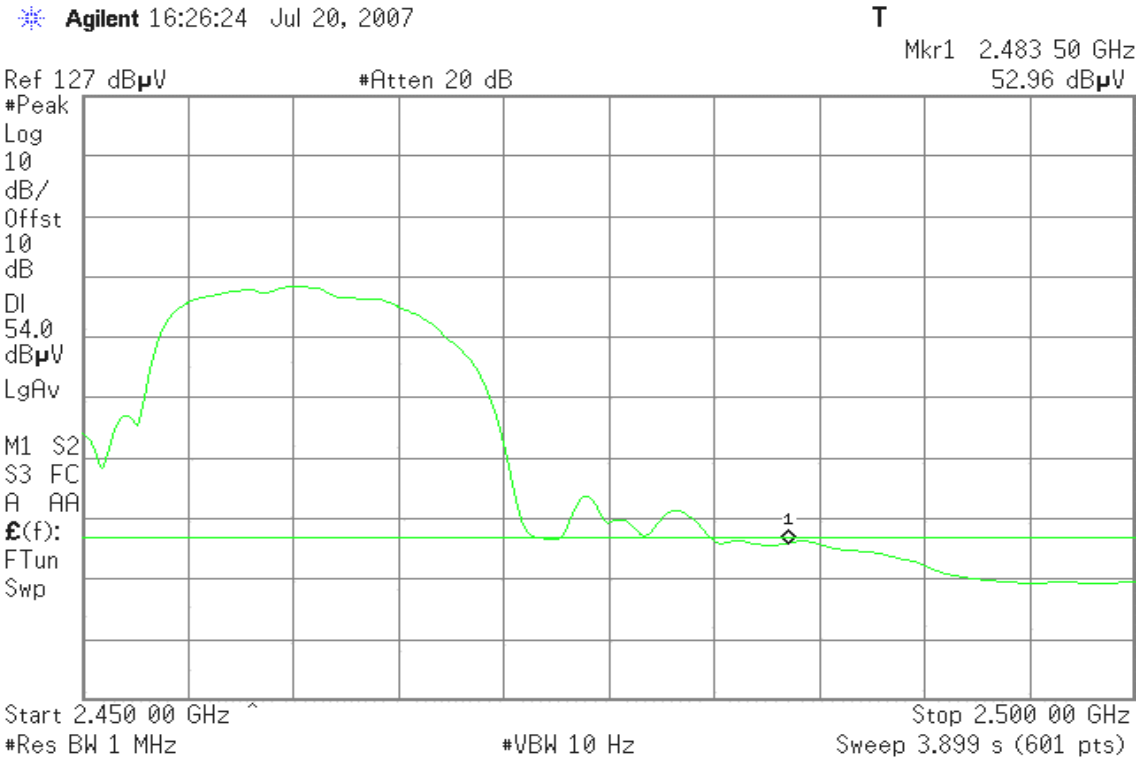


Band Edges (draft 802.11n Wide-40 MHz Channel mode / CH High)

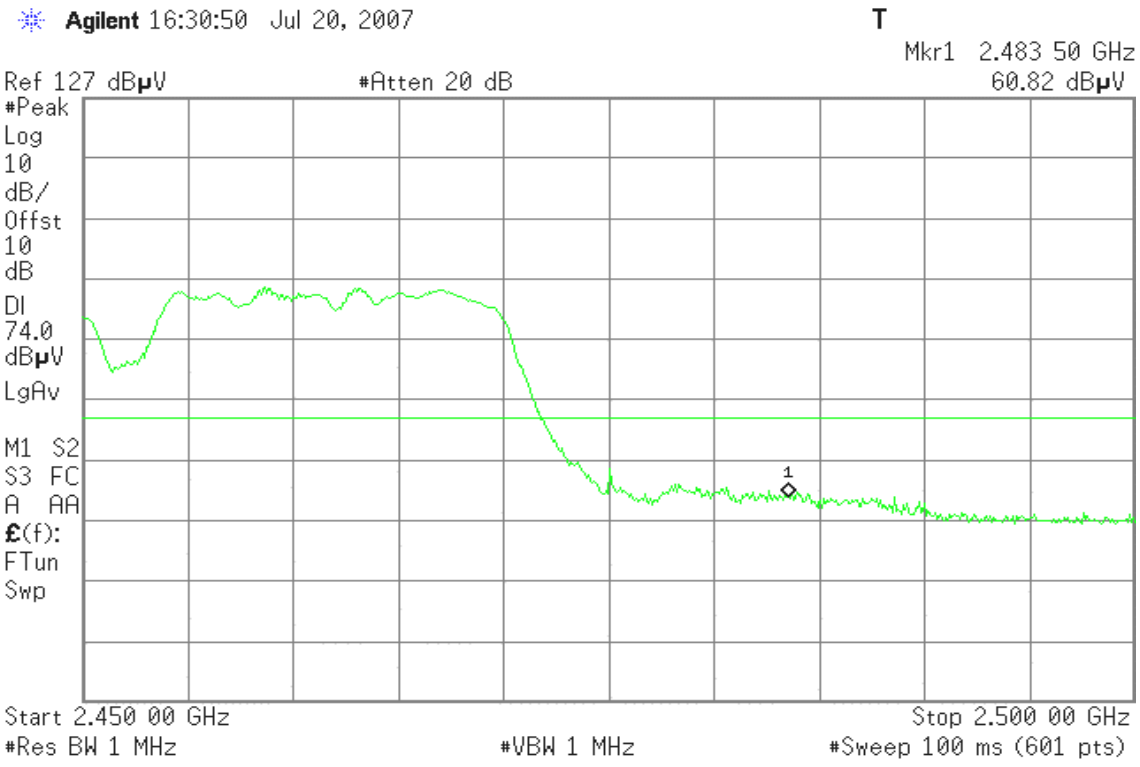
Detector mode: Peak **Polarity: Vertical**



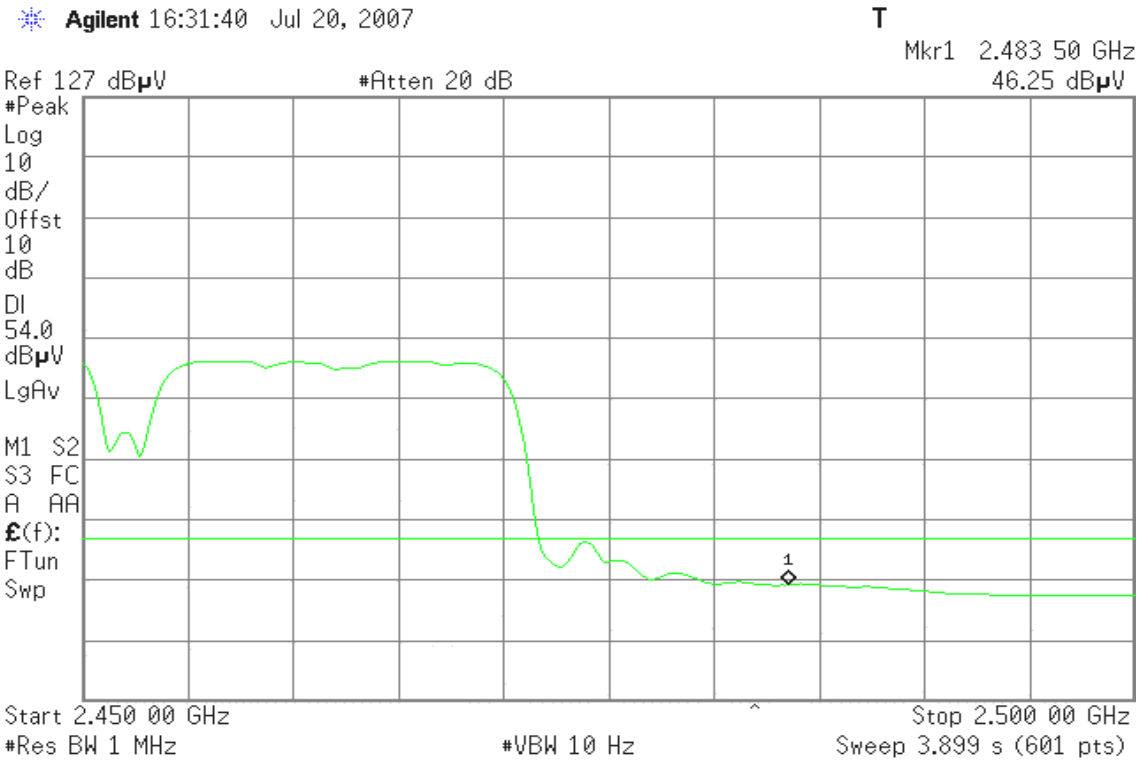
Detector mode: Average **Polarity: Vertical**



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**

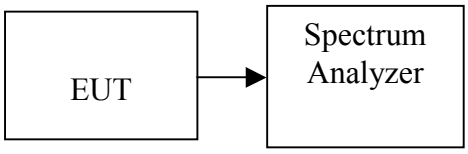


7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §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.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3 kHz, VBW = 10 kHz, Span = 300 kHz, Sweep time = 100 s
3. Record the max reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-9.15	8.00	PASS
Mid	2437	-7.37		PASS
High	2462	-5.92		PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-15.65	8.00	PASS
Mid	2437	-13.14		PASS
High	2462	-15.54		PASS

Test mode: draft 802.11n Standard-20 MHz Channel mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-16.90	-17.44	-14.15	8.00	PASS
Mid	2437	-14.15	-15.50	-11.76		PASS
High	2462	-16.68	-17.97	-14.27		PASS

Test mode: draft 802.11n Wide-40 MHz Channel mode

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	2422	-7.77	-9.33	-5.47	8.00	PASS
Mid	2437	-12.00	-7.20	-5.96		PASS
High	2452	-9.06	-9.55	-6.29		PASS

Remark: *Total PPSD (dBm) = 10*LOG(10^(Chain 1 PPSD / 10)+10^(Chain 0 PPSD /10))*

Test mode: draft 802.11n Standard-20 MHz Channel mode with combiner

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-11.44	8.00	PASS
Mid	2437	-10.53		PASS
High	2462	-12.67		PASS

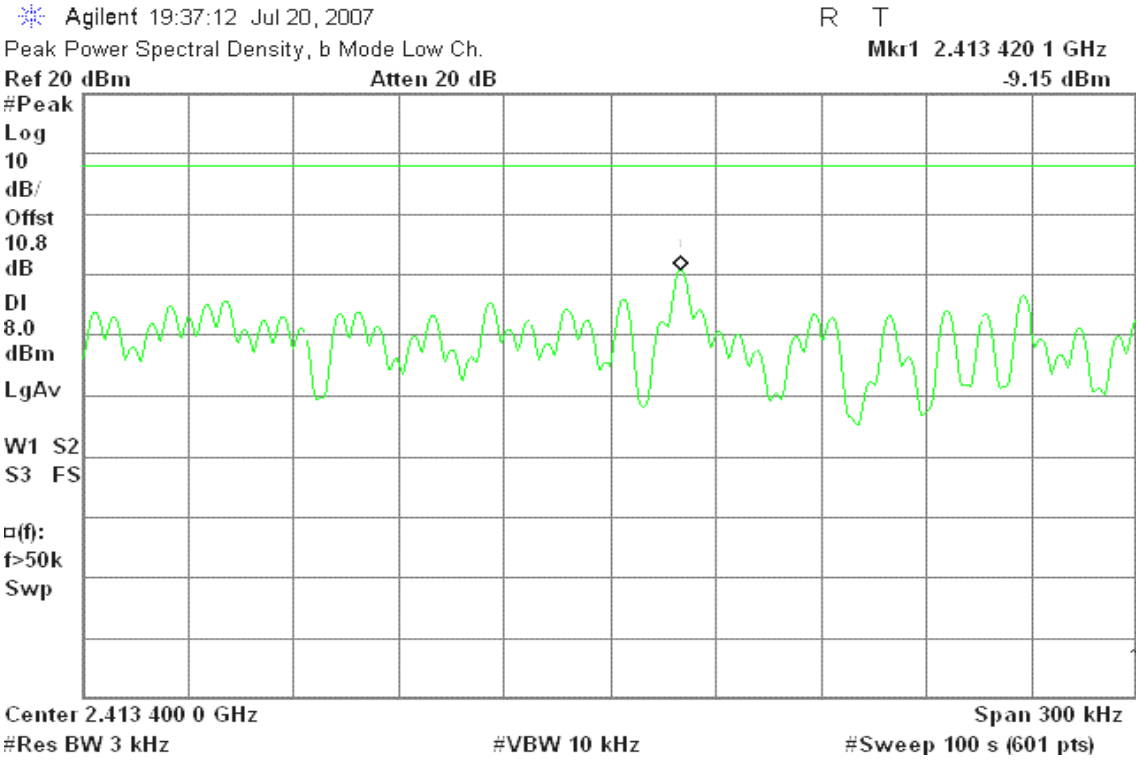
Test mode: draft 802.11n Wide-40 MHz Channel mode with combiner

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2422	-7.41	8.00	PASS
Mid	2437	-6.09		PASS
High	2452	-8.32		PASS

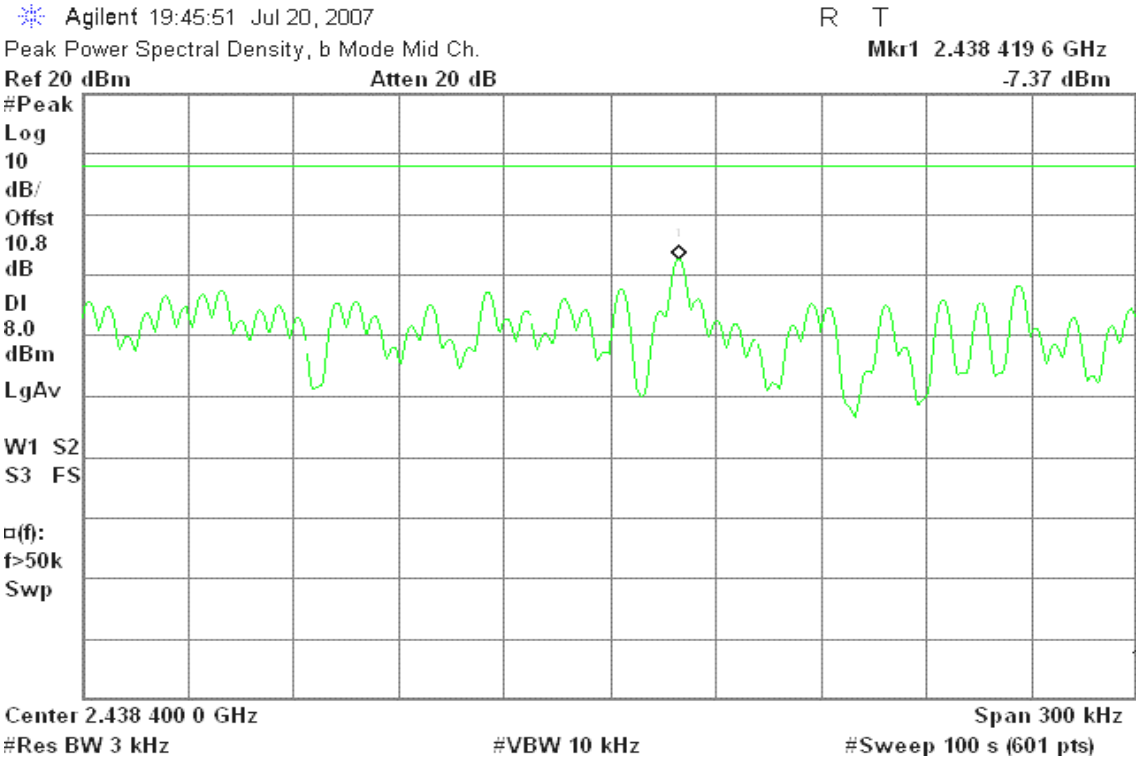
Test Plot

IEEE 802.11b mode

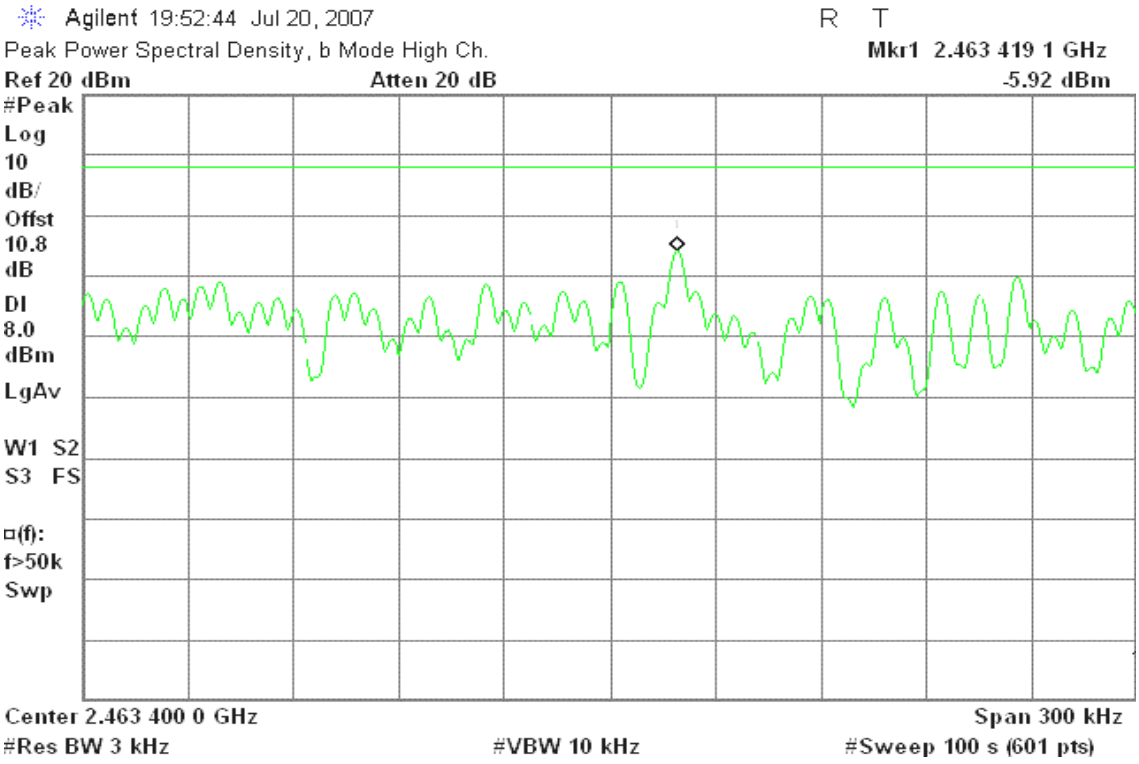
PPSD (CH Low)



PPSD (CH Mid)

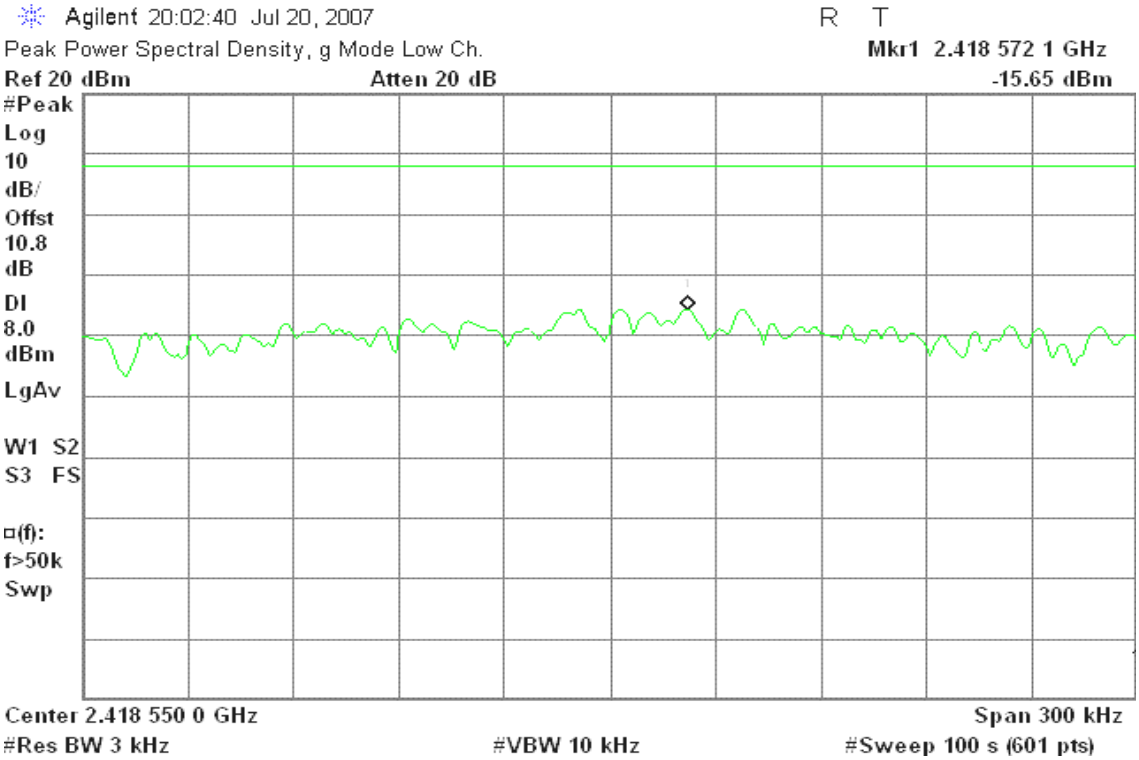


PPSD (CH High)

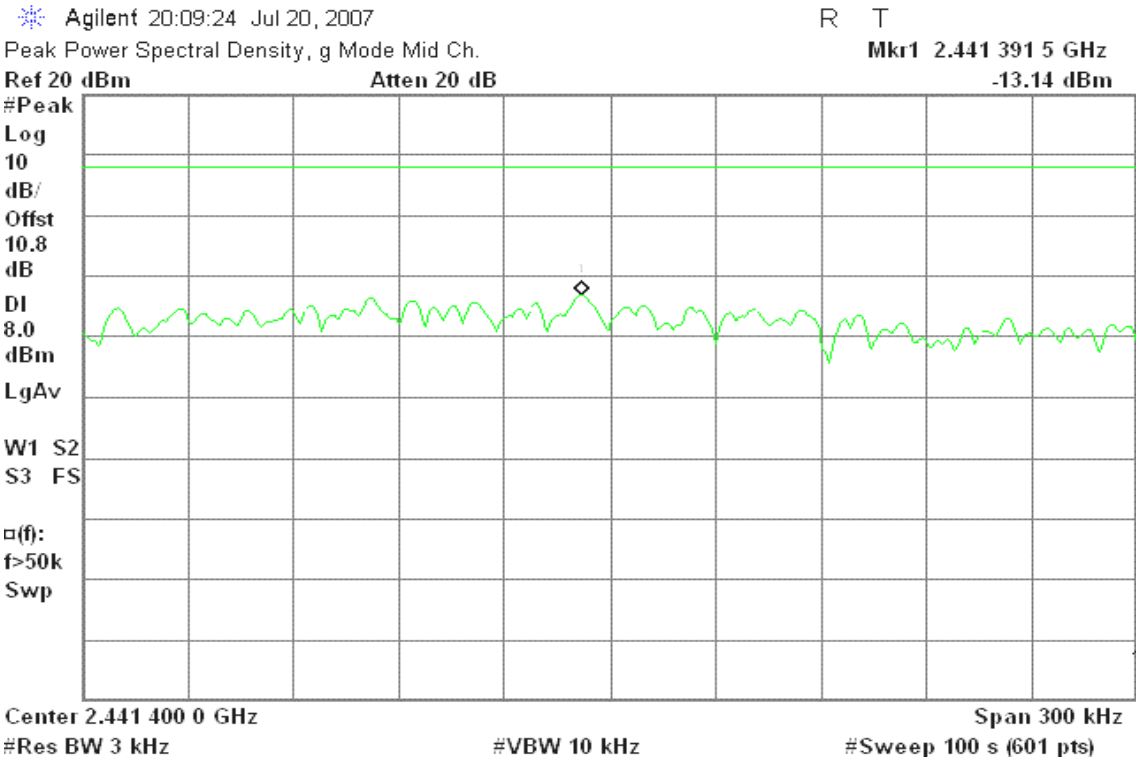


IEEE 802.11g mode

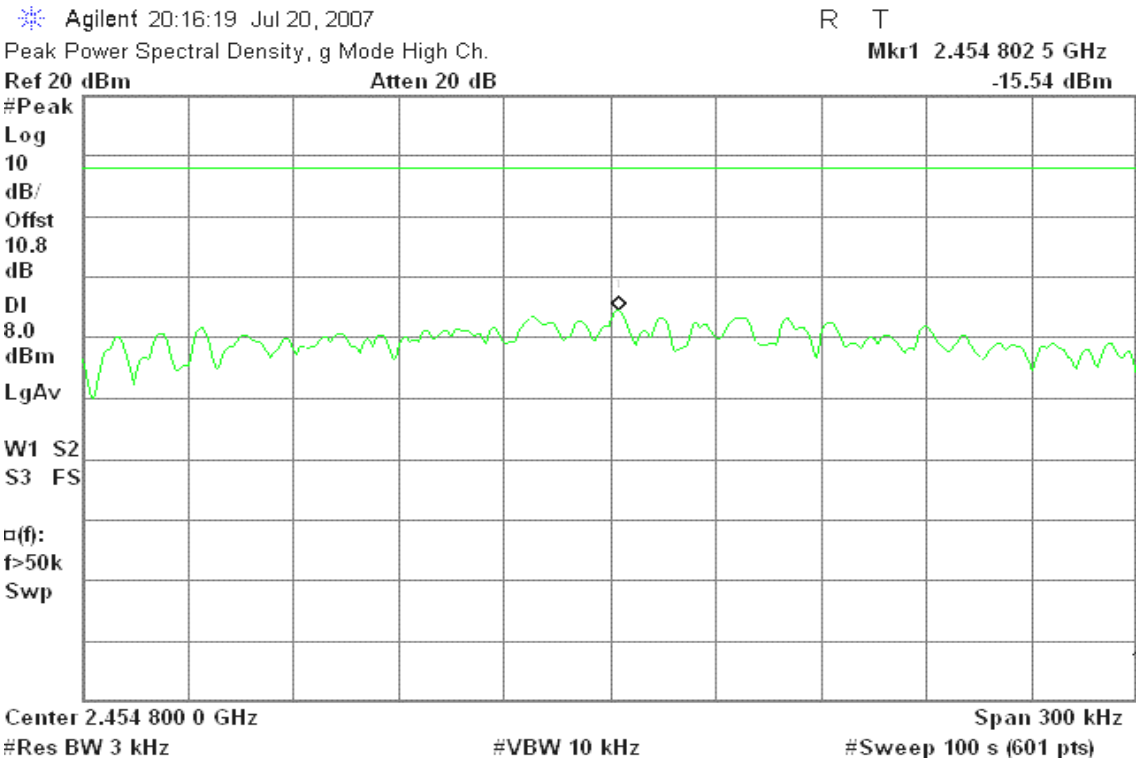
PPSD (CH Low)



PPSD (CH Mid)

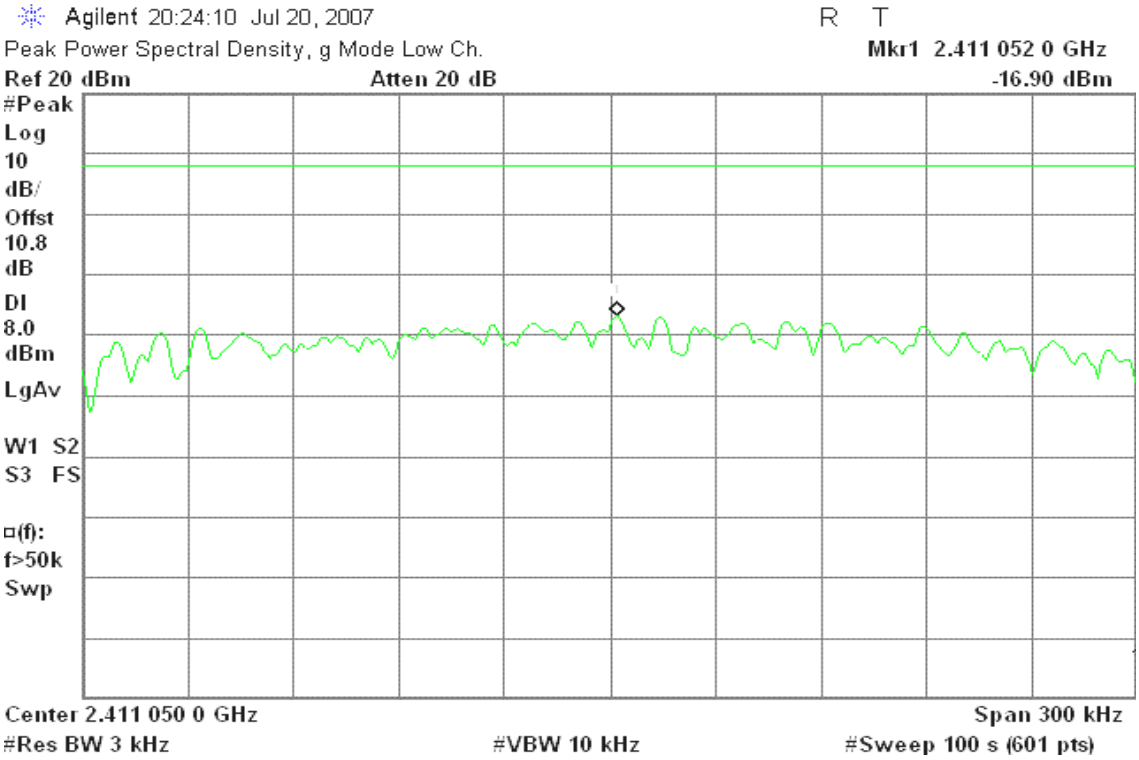


PPSD (CH High)

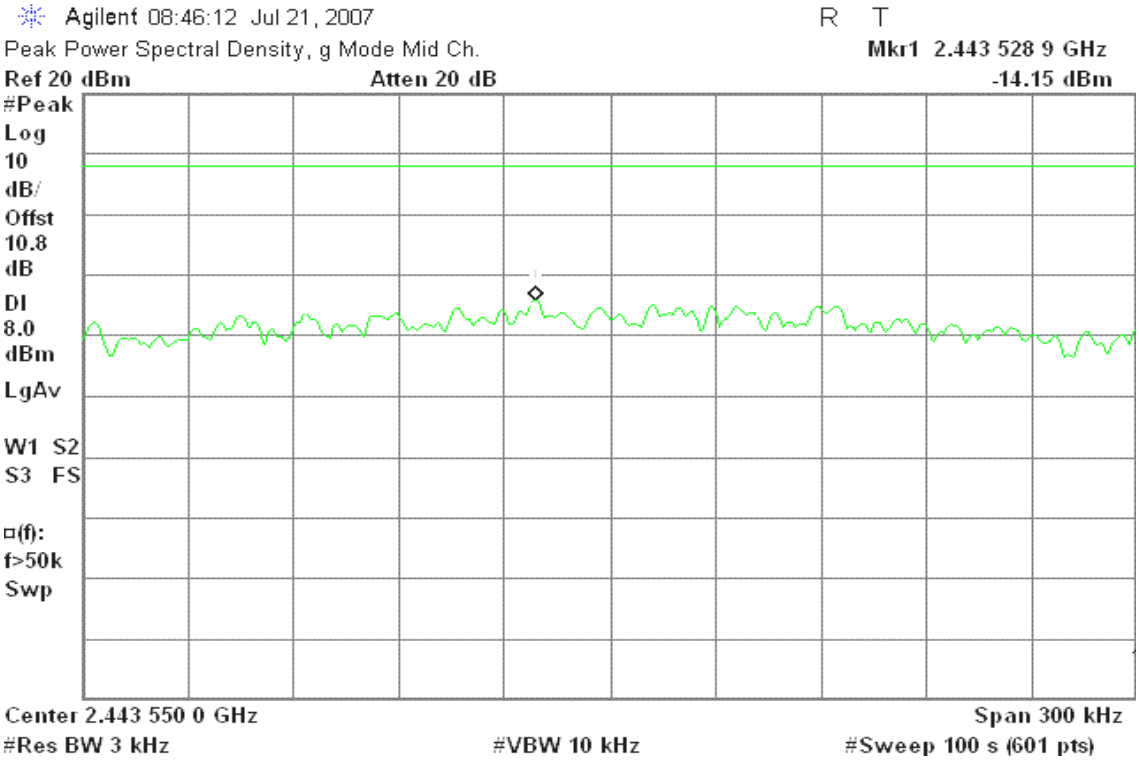


draft 802.11n Standard-20 MHz Channel mode / Chain 0

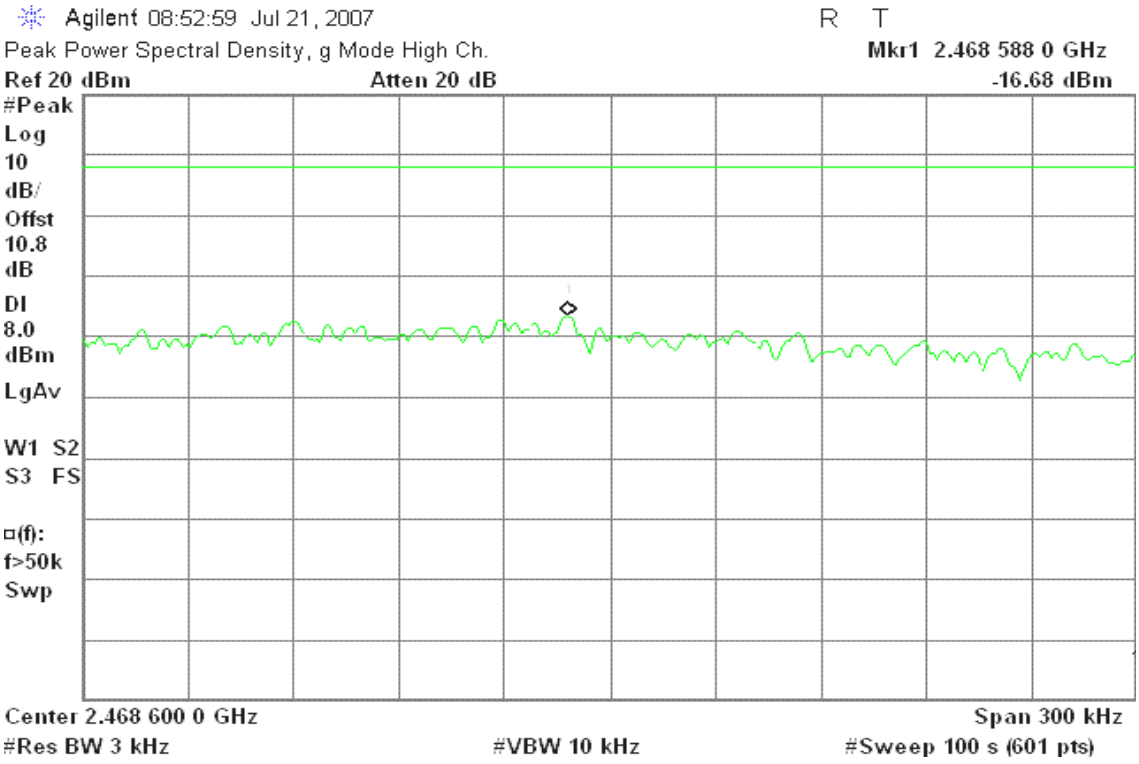
PPSD (CH Low)



PPSD (CH Mid)

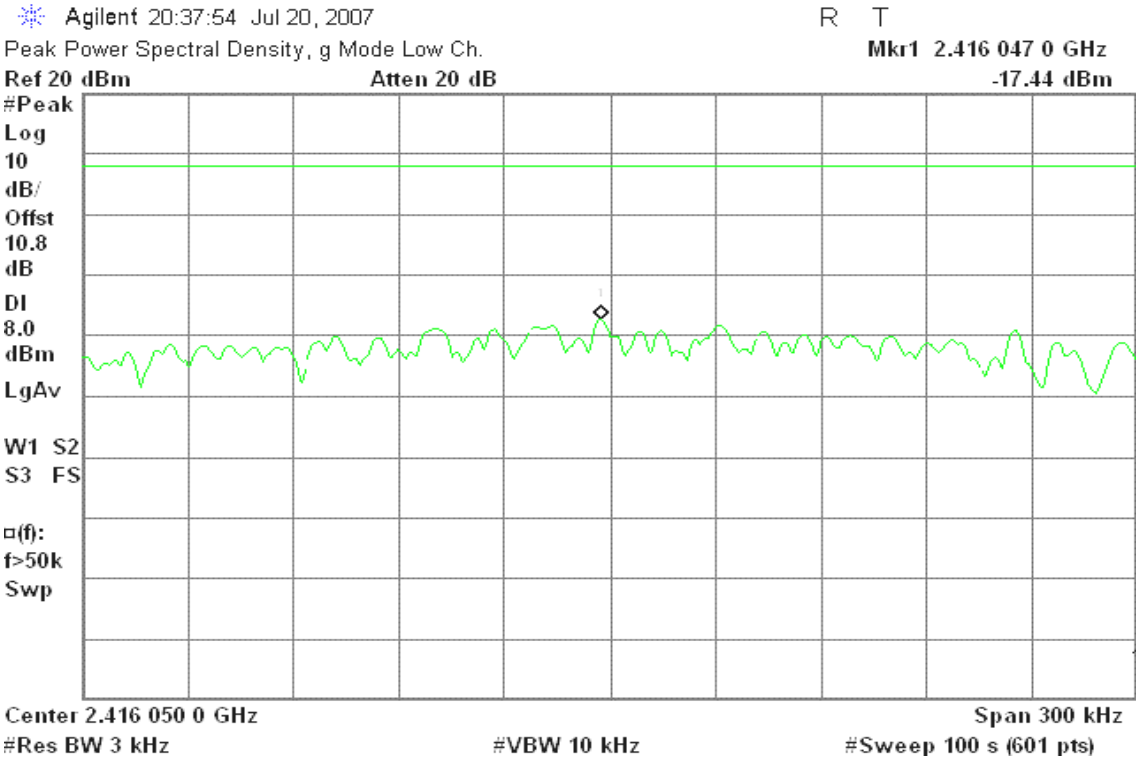


PPSD (CH High)

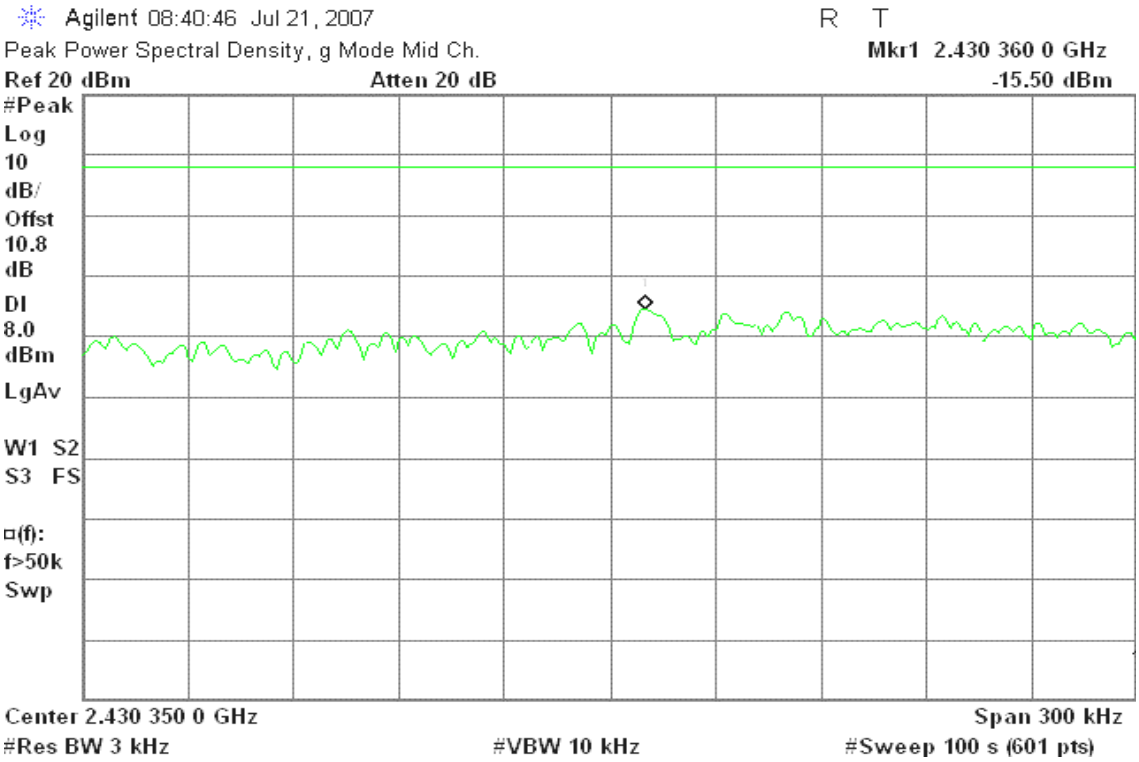


draft 802.11n Standard-20 MHz Channel mode / Chain 1

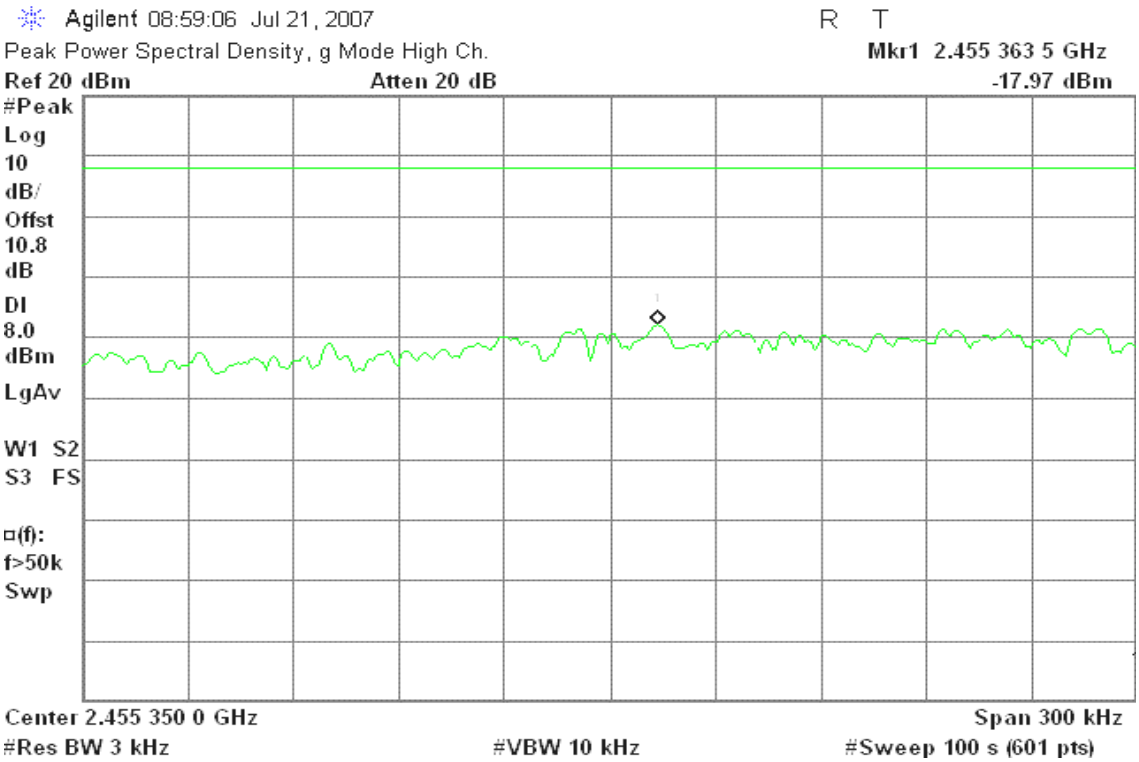
PPSD (CH Low)



PPSD (CH Mid)

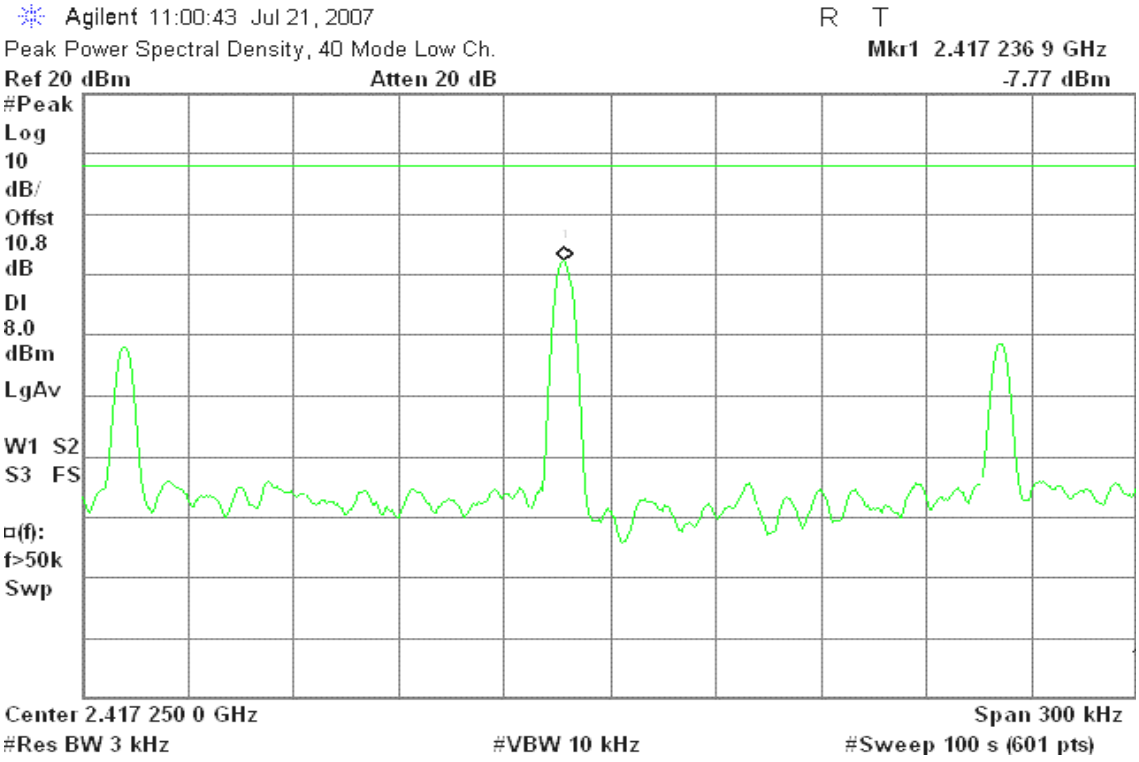


PPSD (CH High)

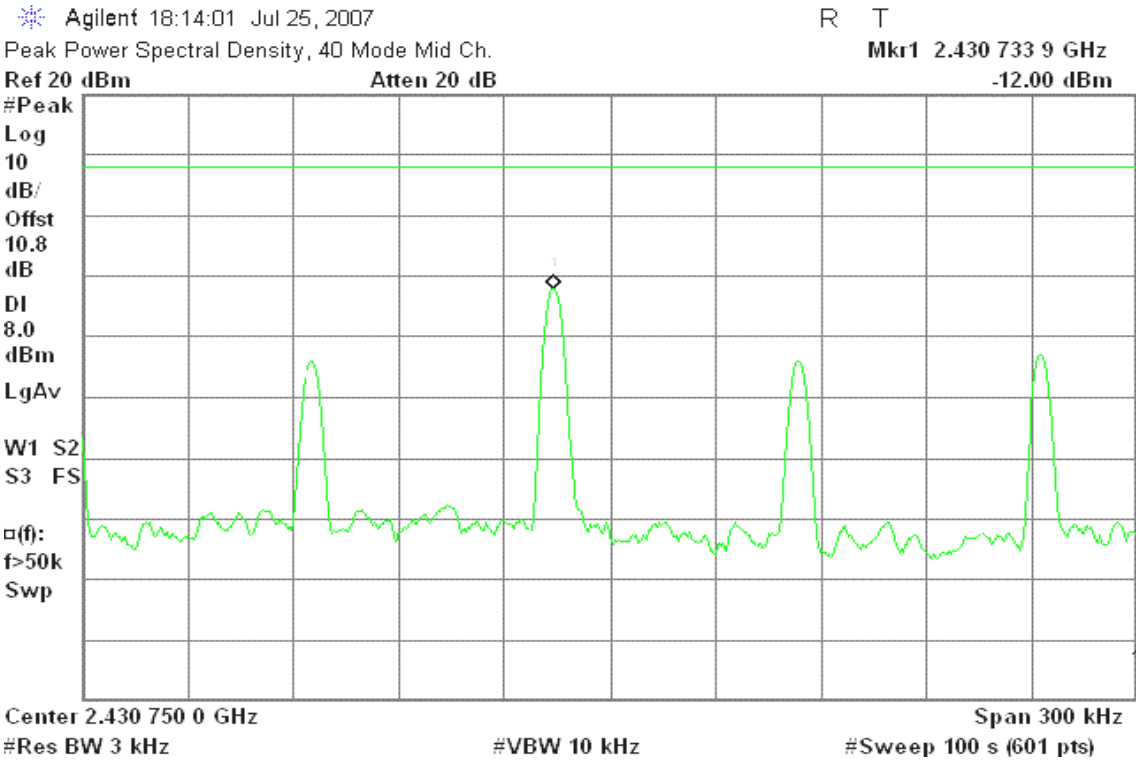


draft 802.11n Wide-40 MHz Channel mode Chain 0

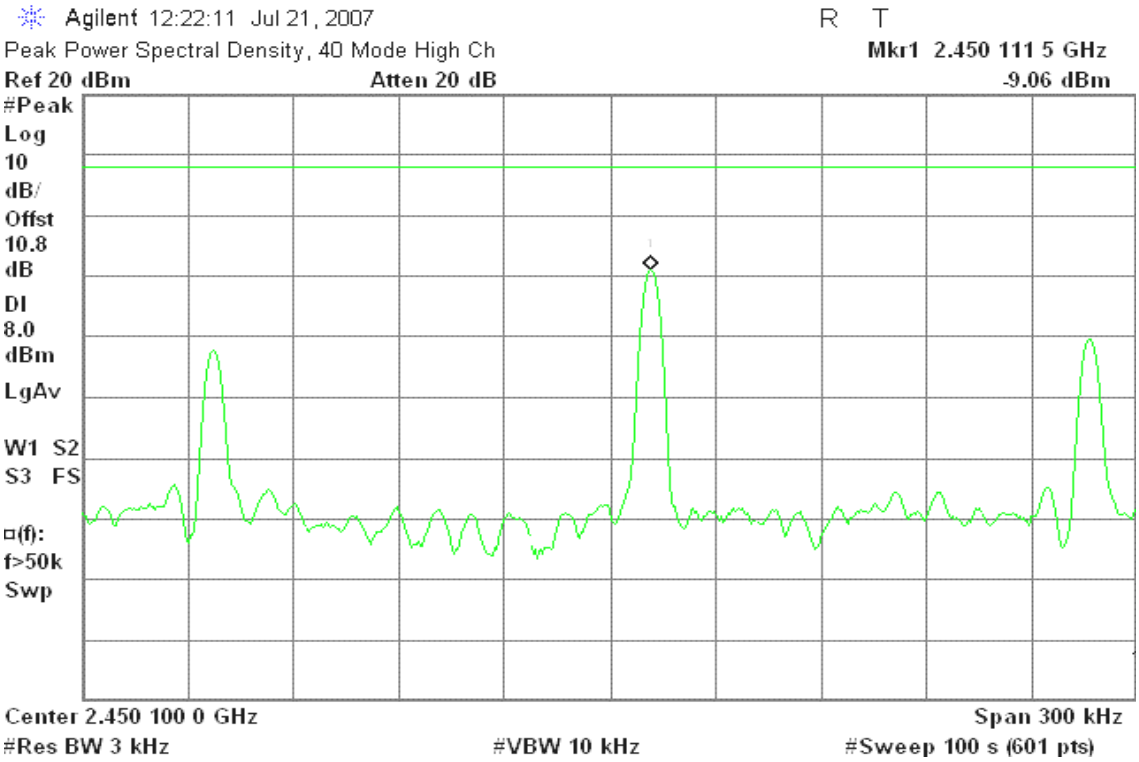
PPSD (CH Low)



PPSD (CH Mid)

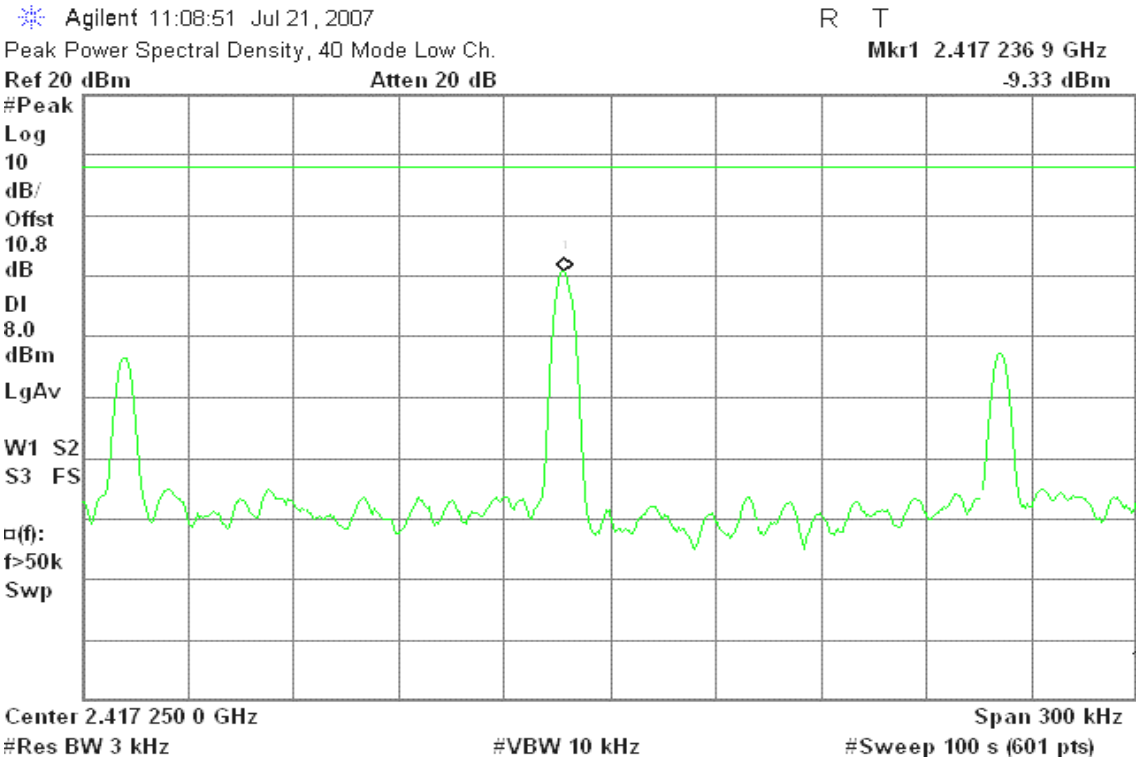


PPSD (CH High)

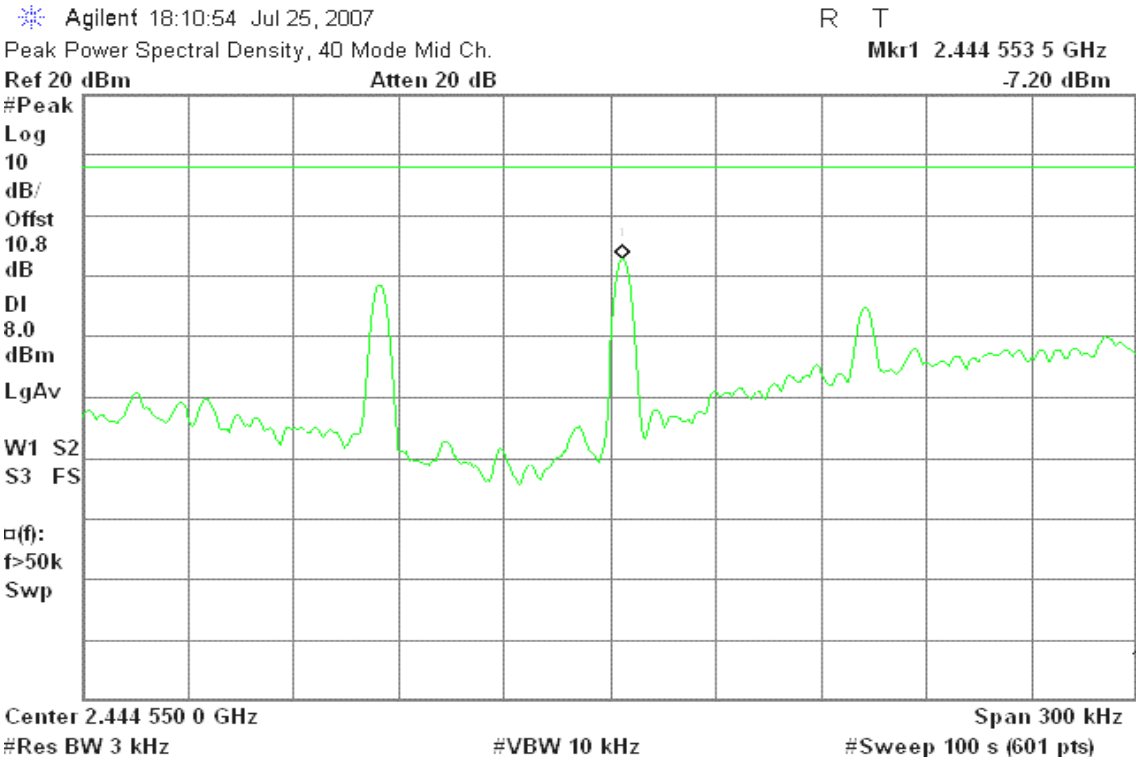


draft 802.11n Wide-40 MHz Channel mode Chain 1

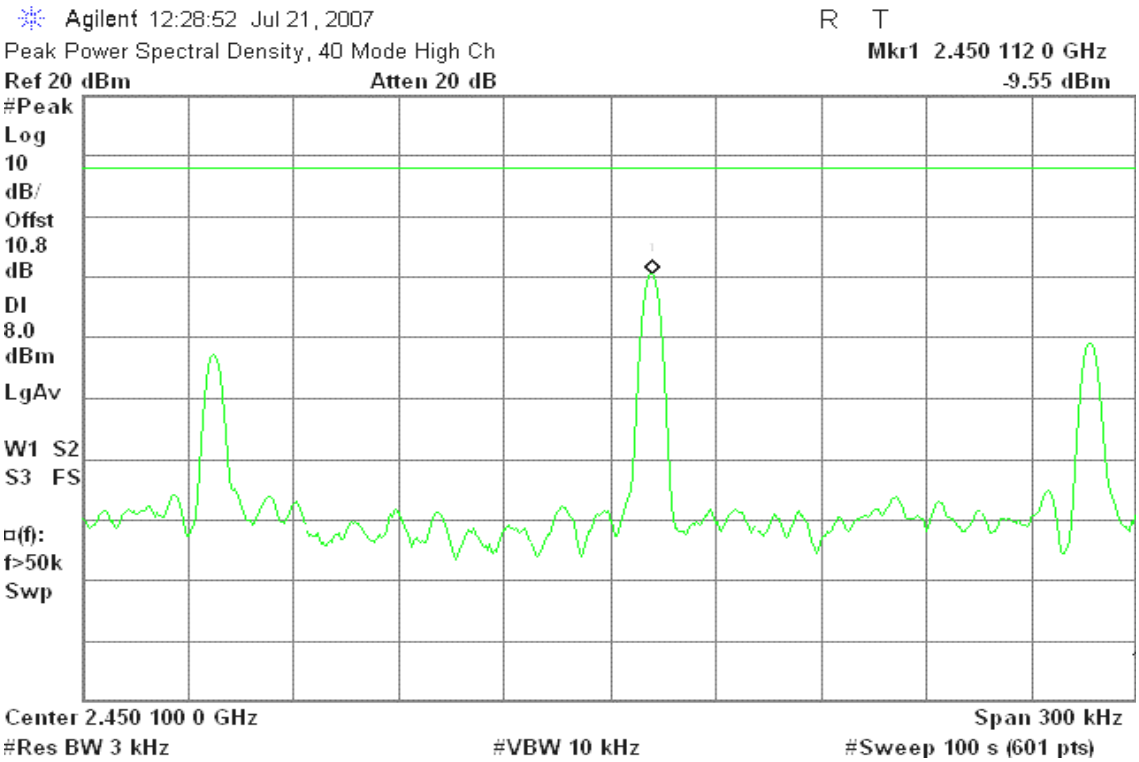
PPSD (CH Low)



PPSD (CH Mid)

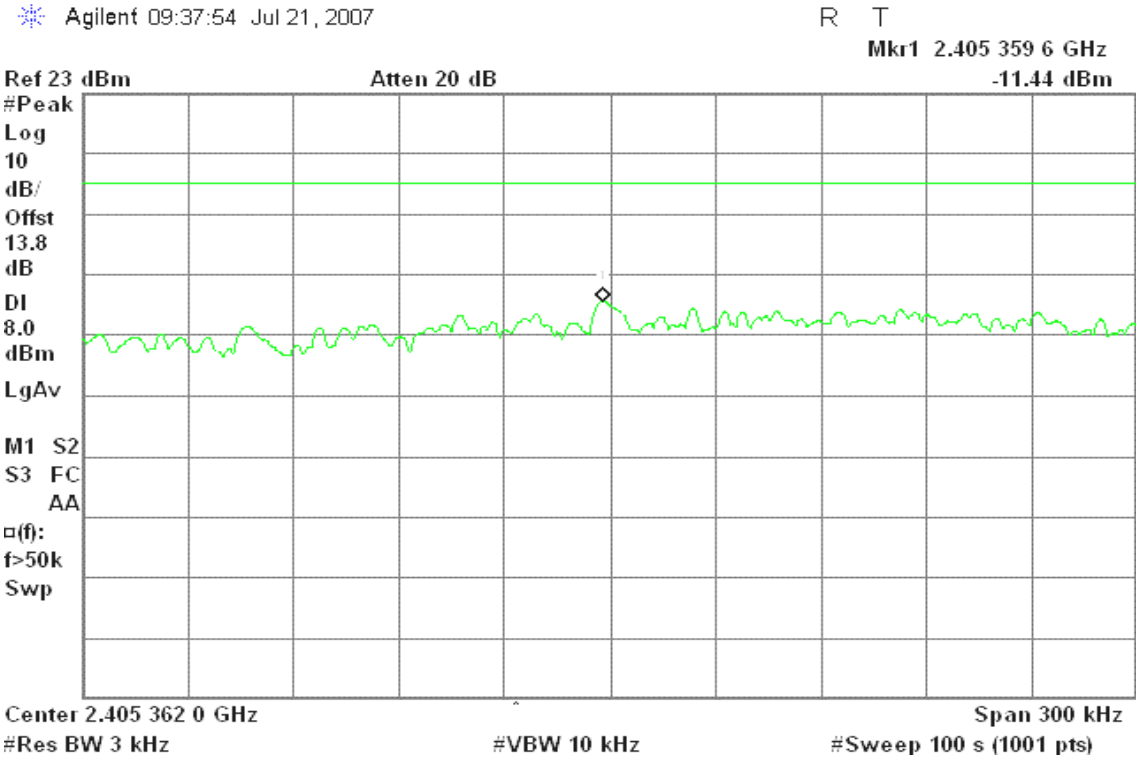


PPSD (CH High)

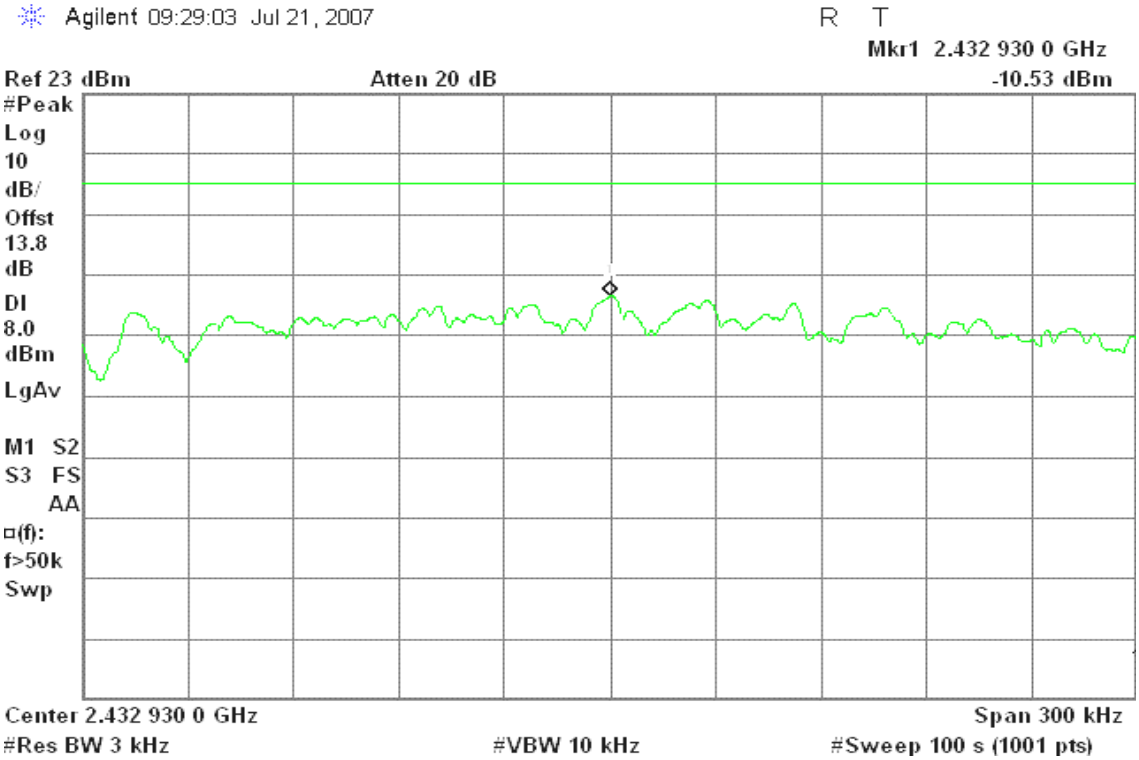


draft 802.11n Standard-20 MHz Channel mode with combiner

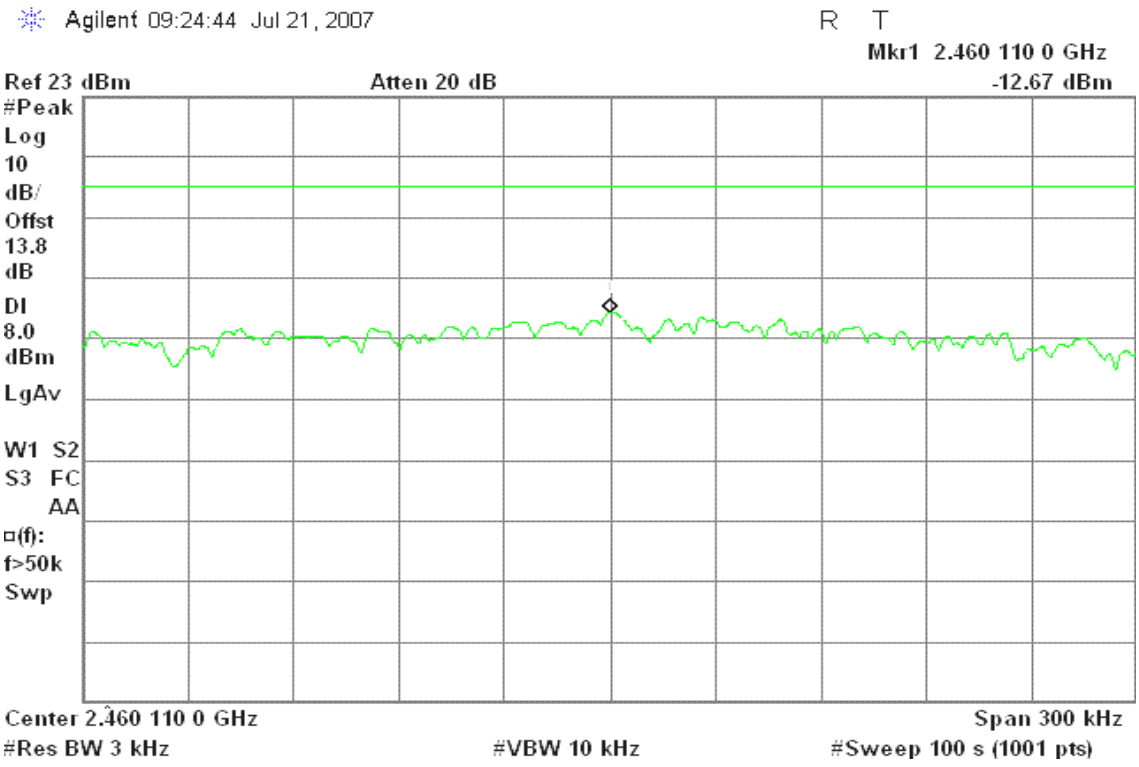
PPSD (CH Low)



PPSD (CH Mid)

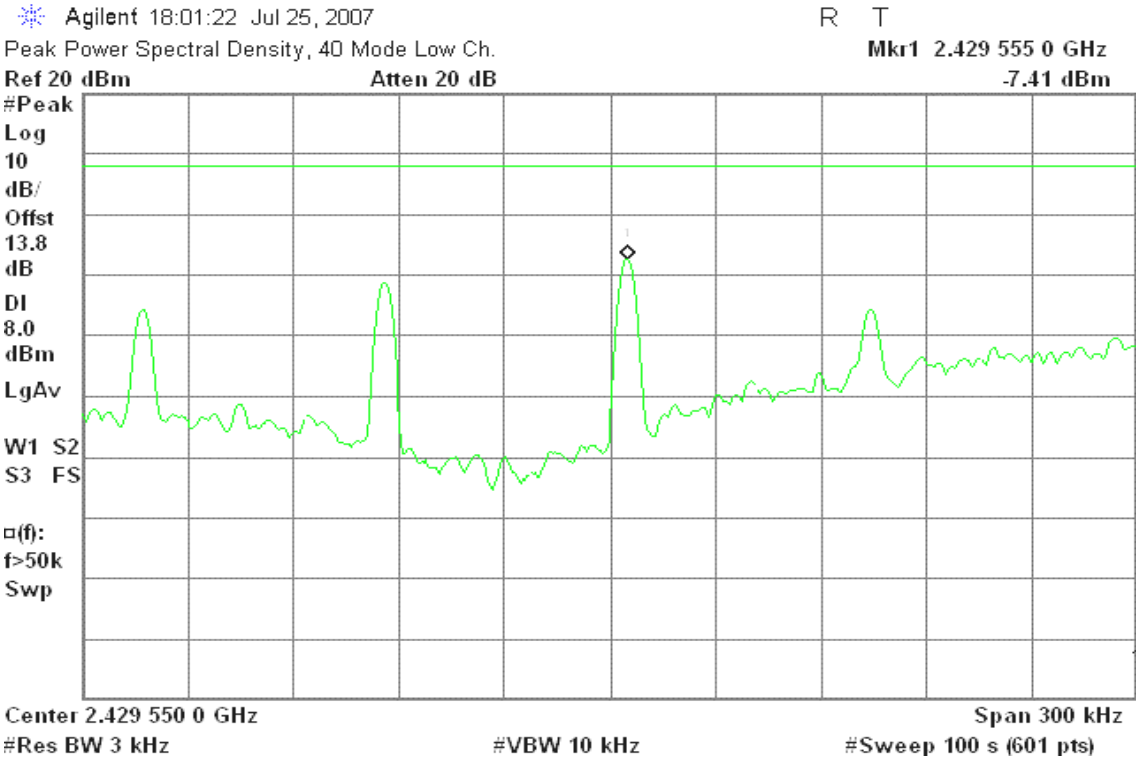


PPSD (CH High)

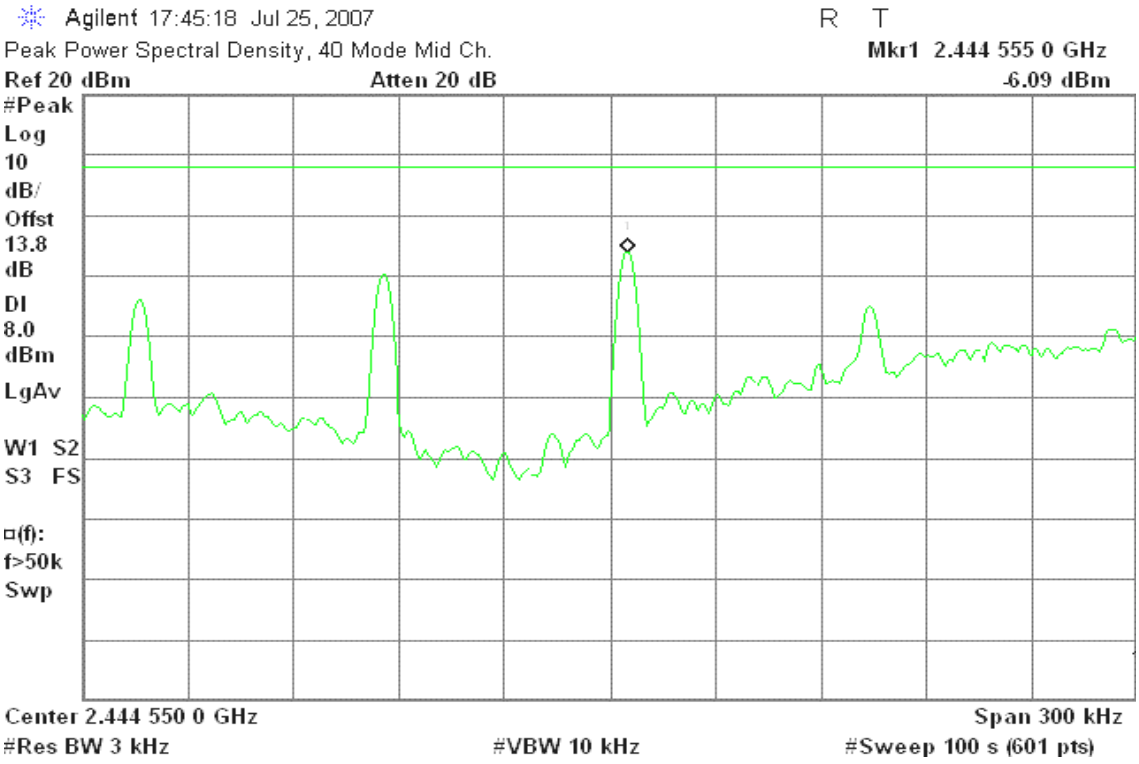


draft 802.11n Wide-40 MHz Channel mode with combiner

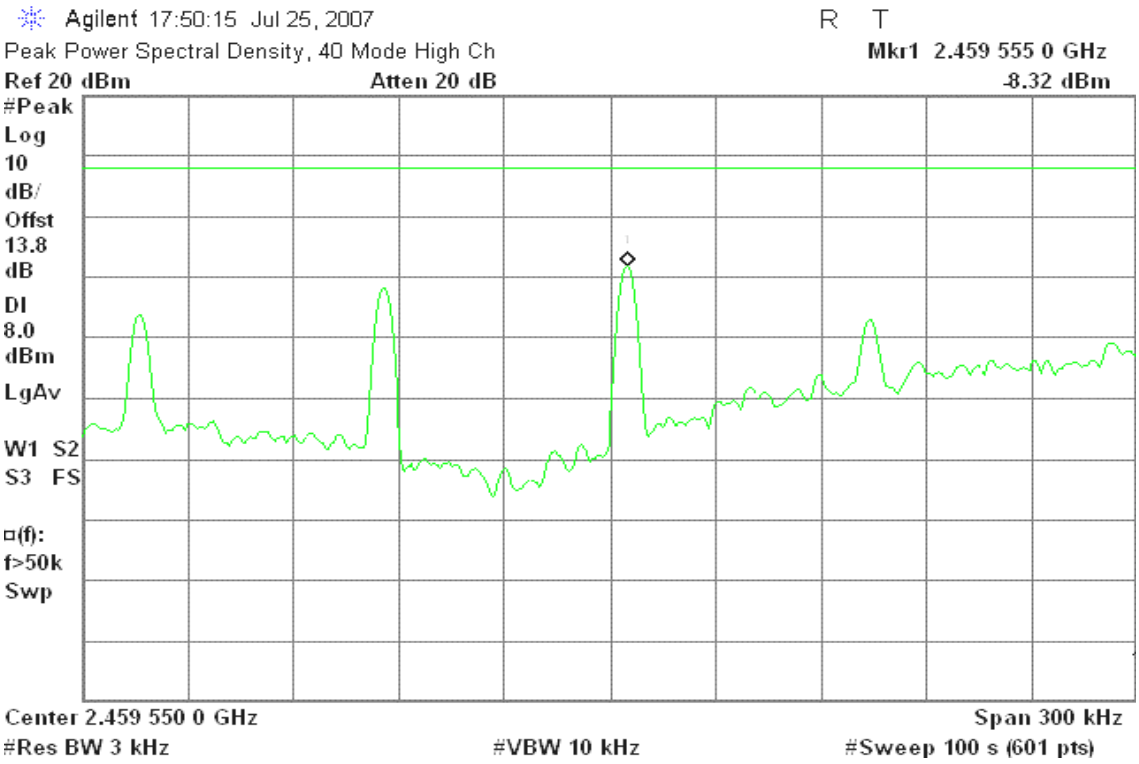
PPSD (CH Low)



PPSD (CH Mid)



PPSD (CH High)



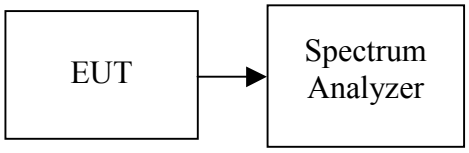
7.6 SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

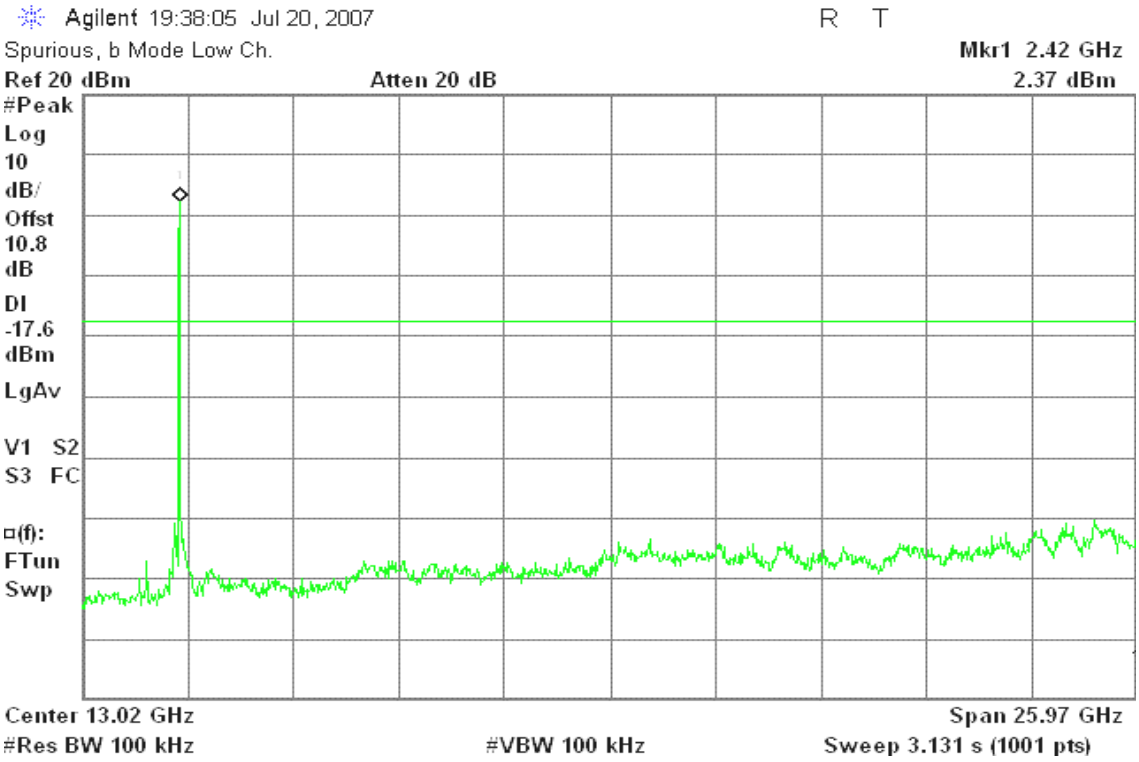
TEST RESULTS

No non-compliance noted

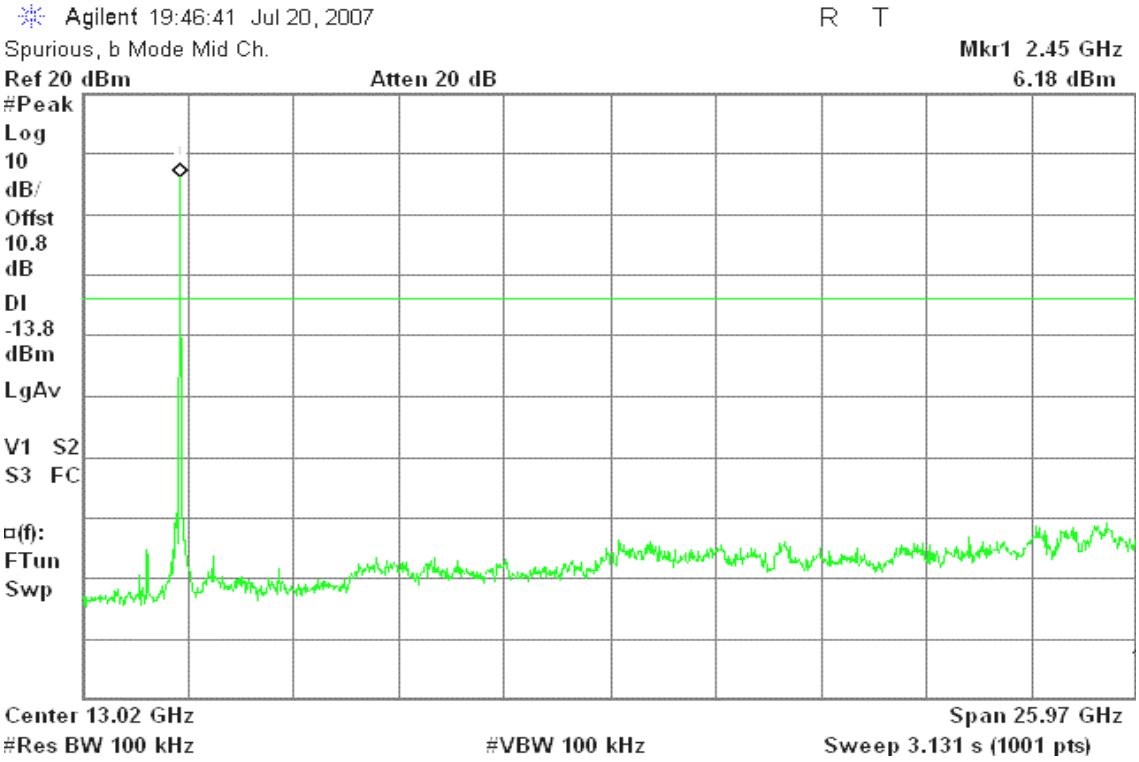
Test Plot

IEEE 802.11b mode

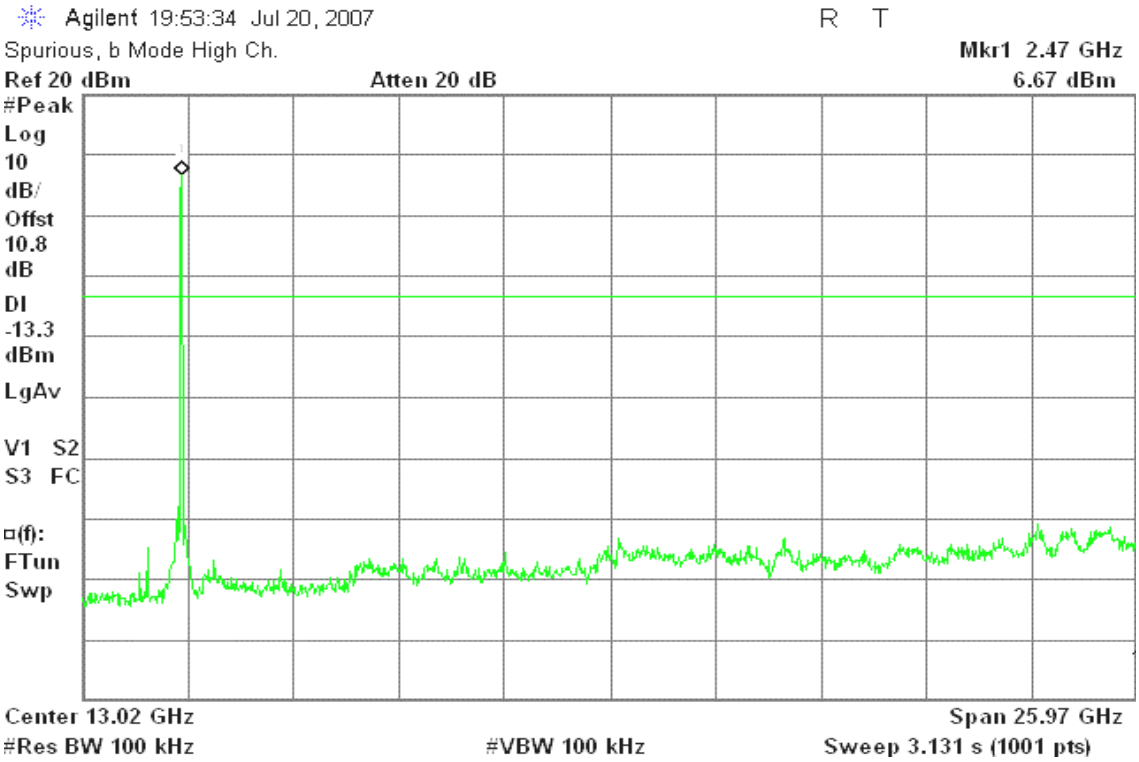
CH Low



CH Mid

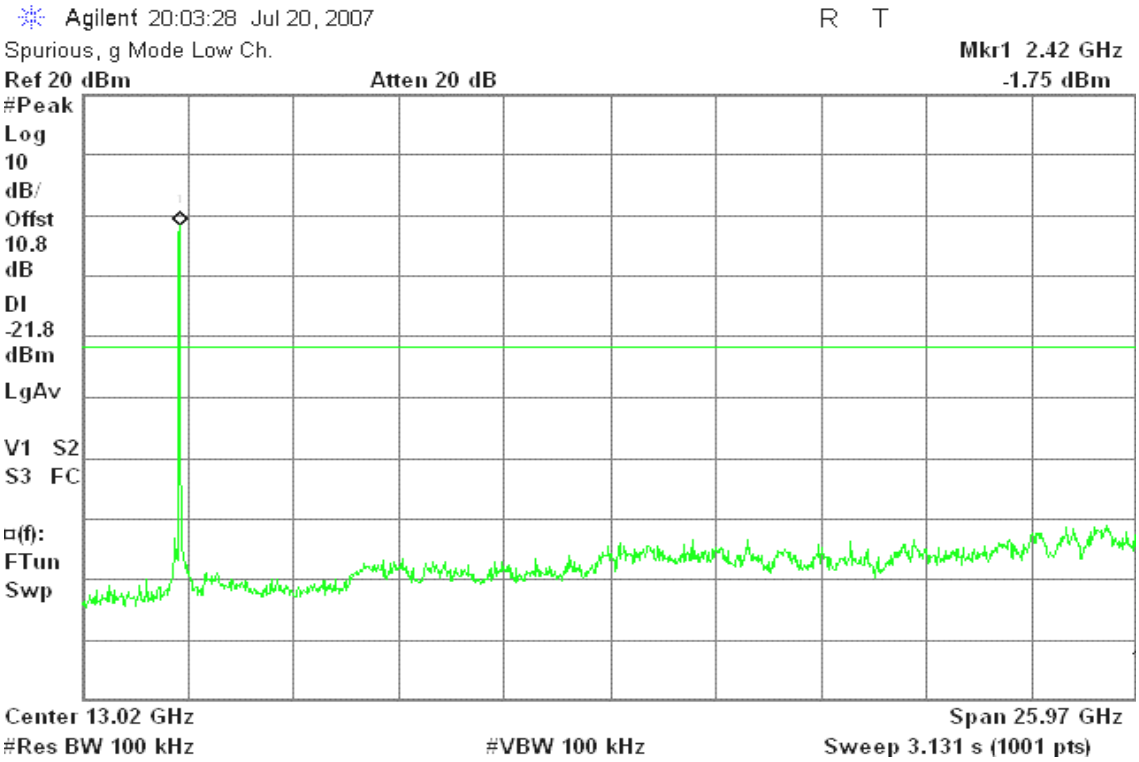


CH High

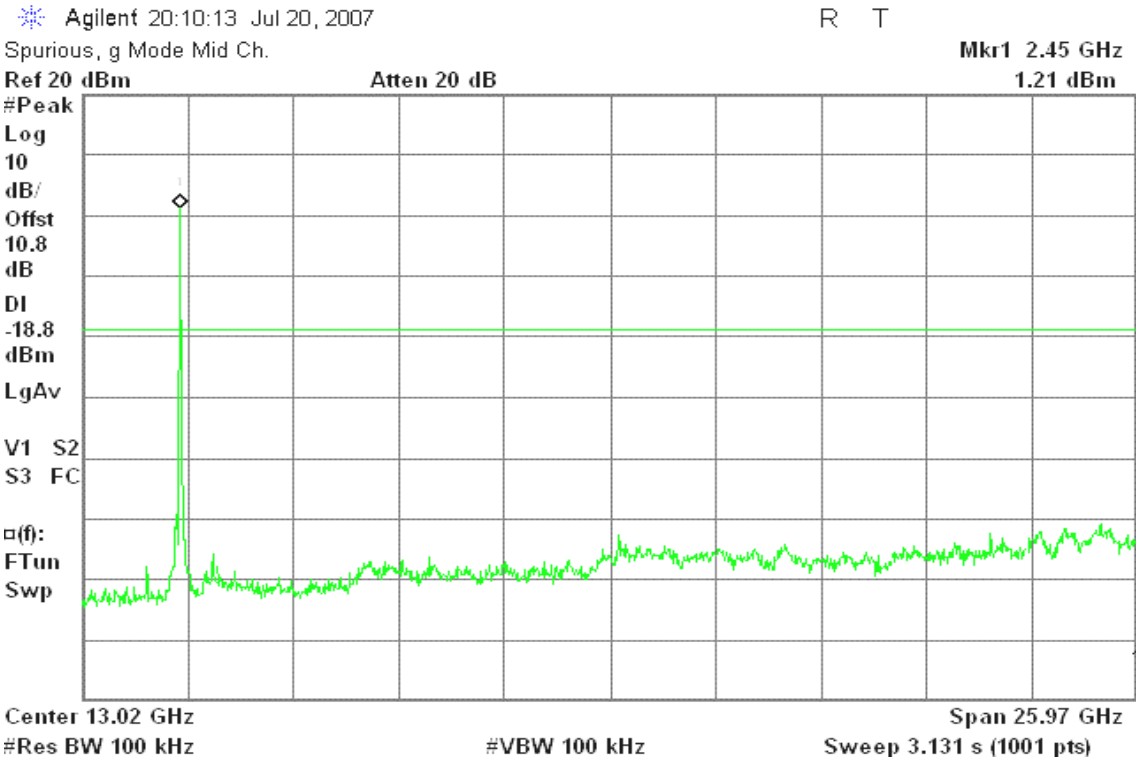


IEEE 802.11g mode

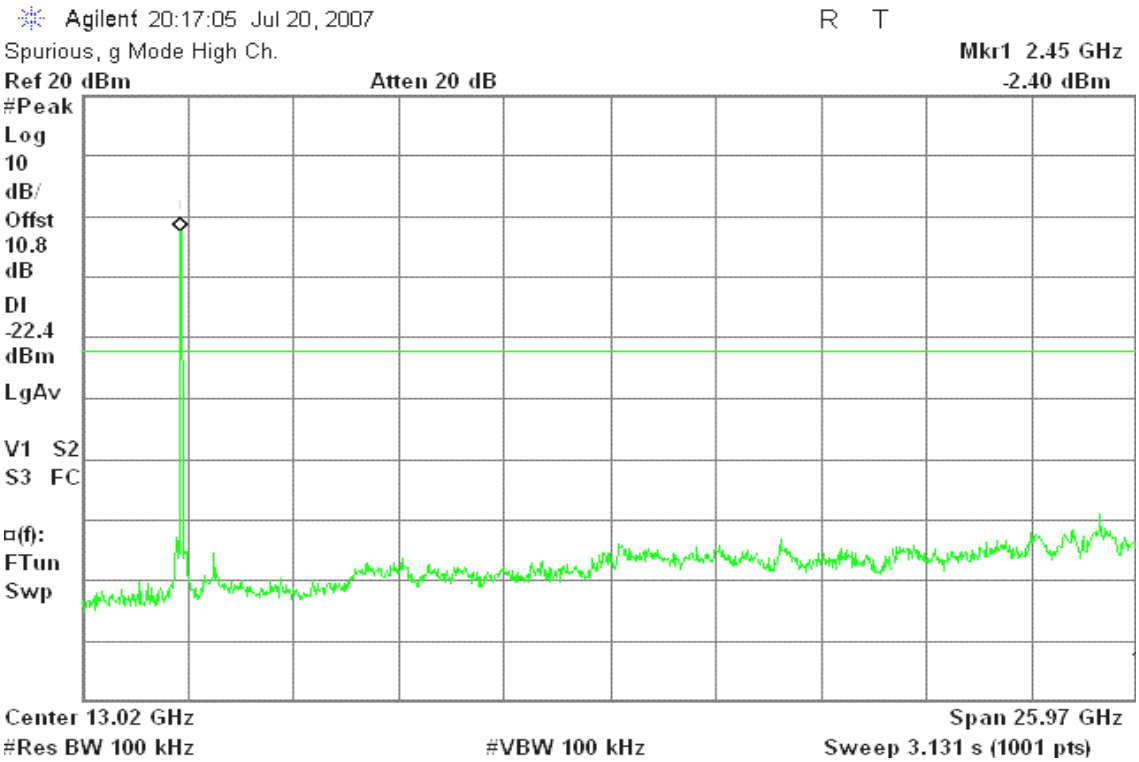
CH Low



CH Mid

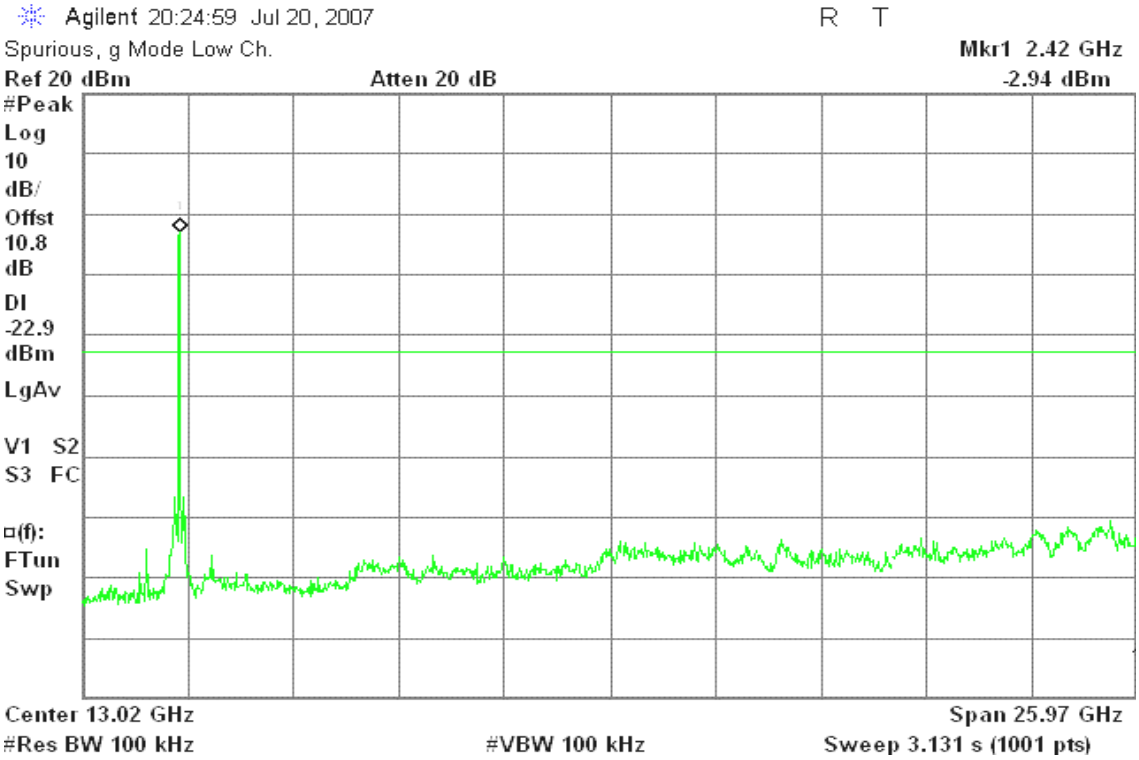


CH High

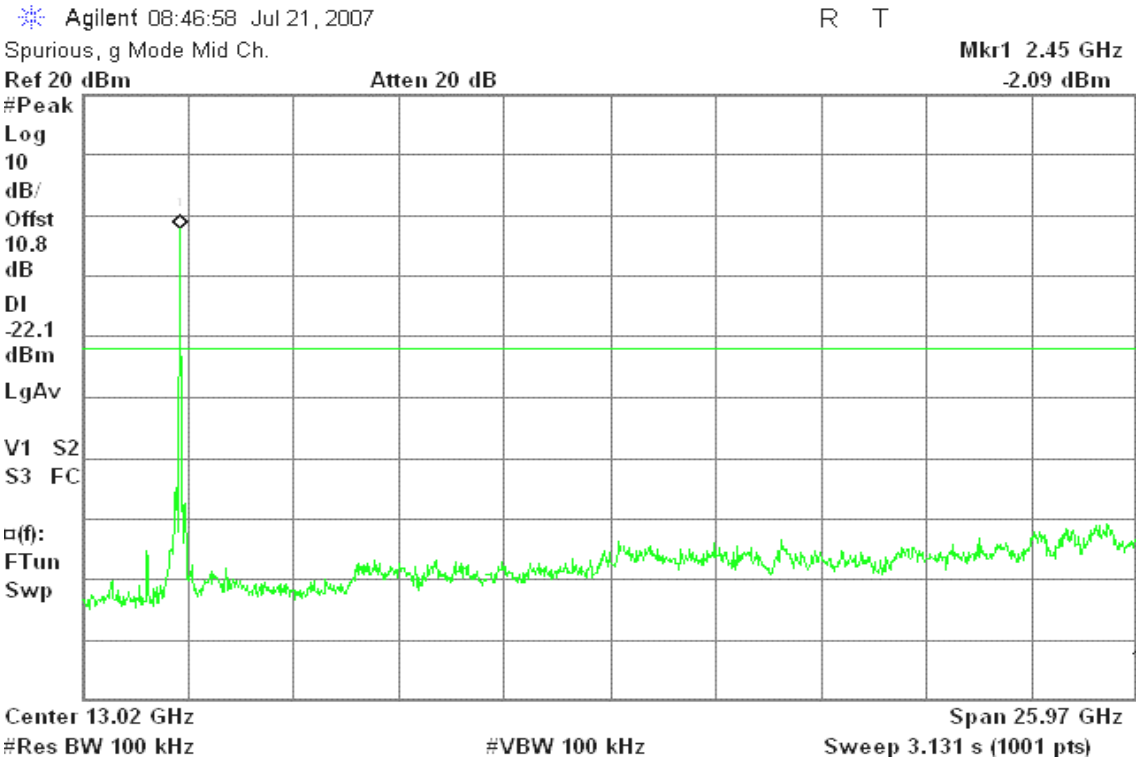


draft 802.11n Standard-20 MHz Channel mode / Chain 0

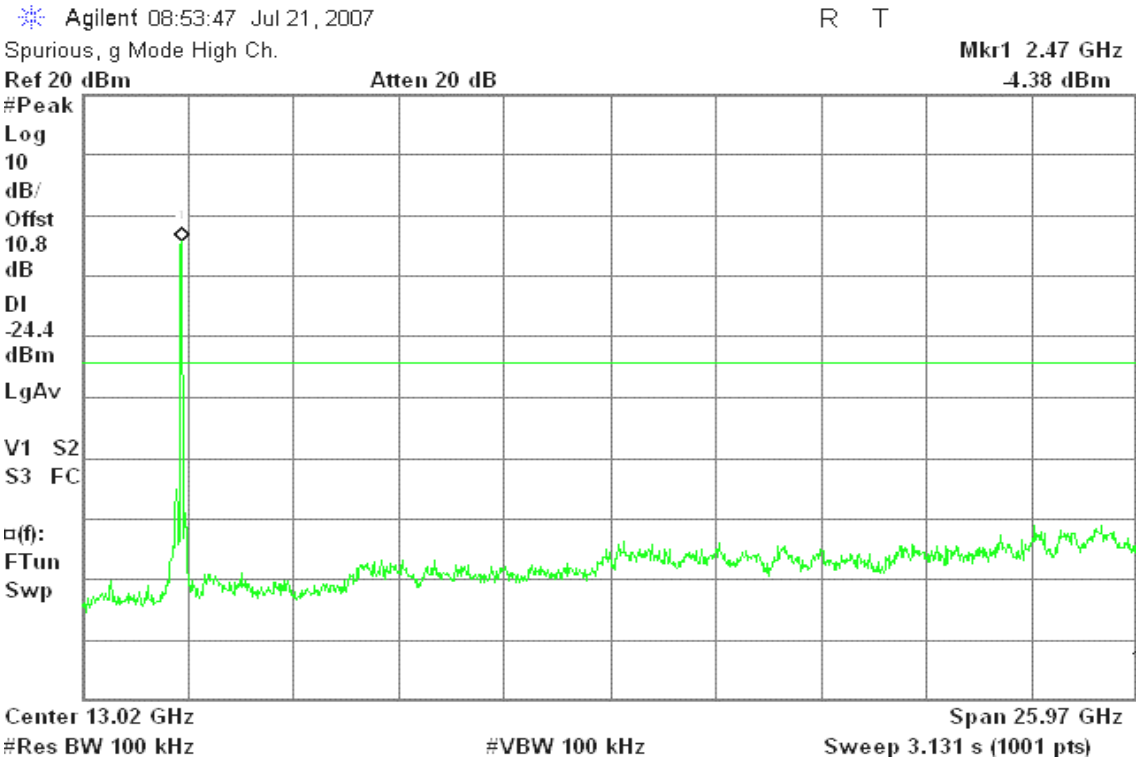
CH Low



CH Mid

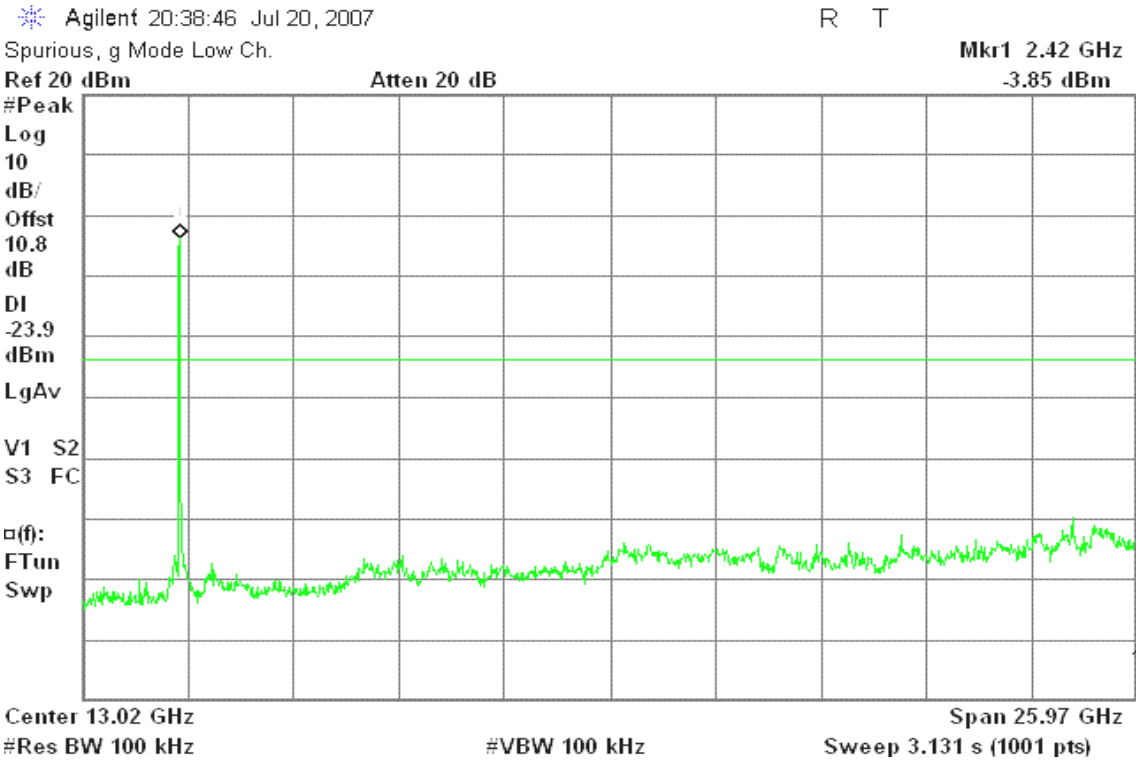


CH High

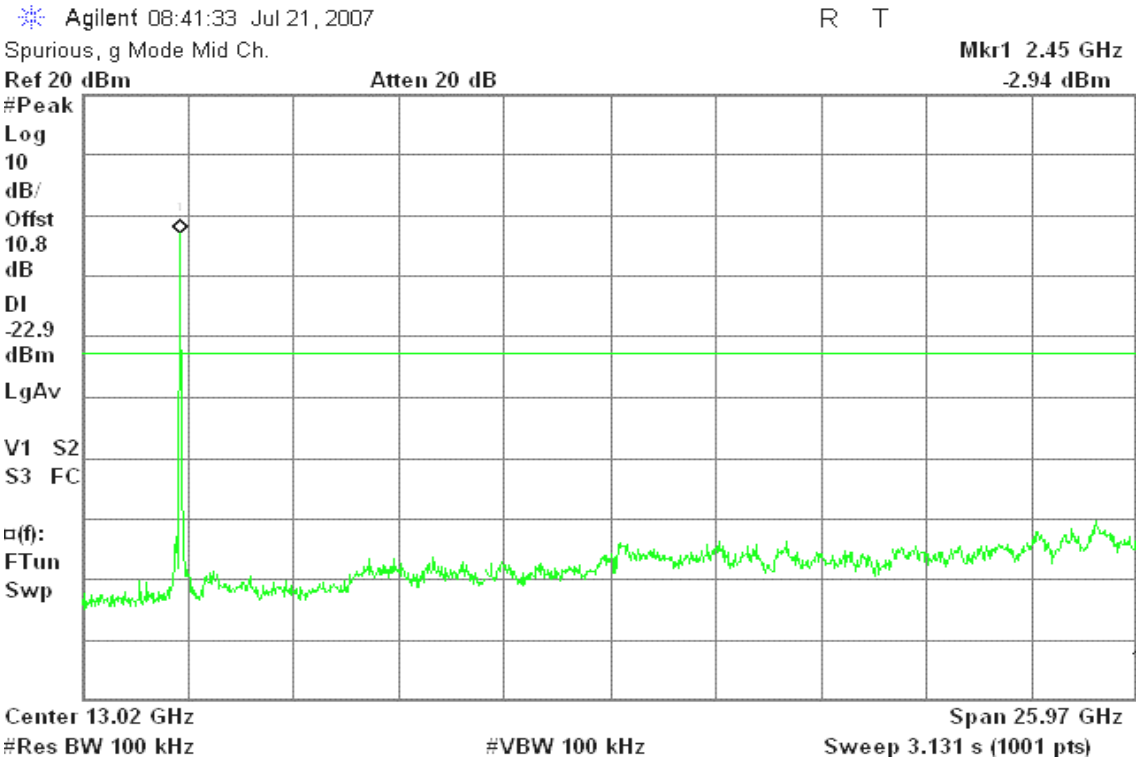


draft 802.11n Standard-20 MHz Channel mode / Chain 1

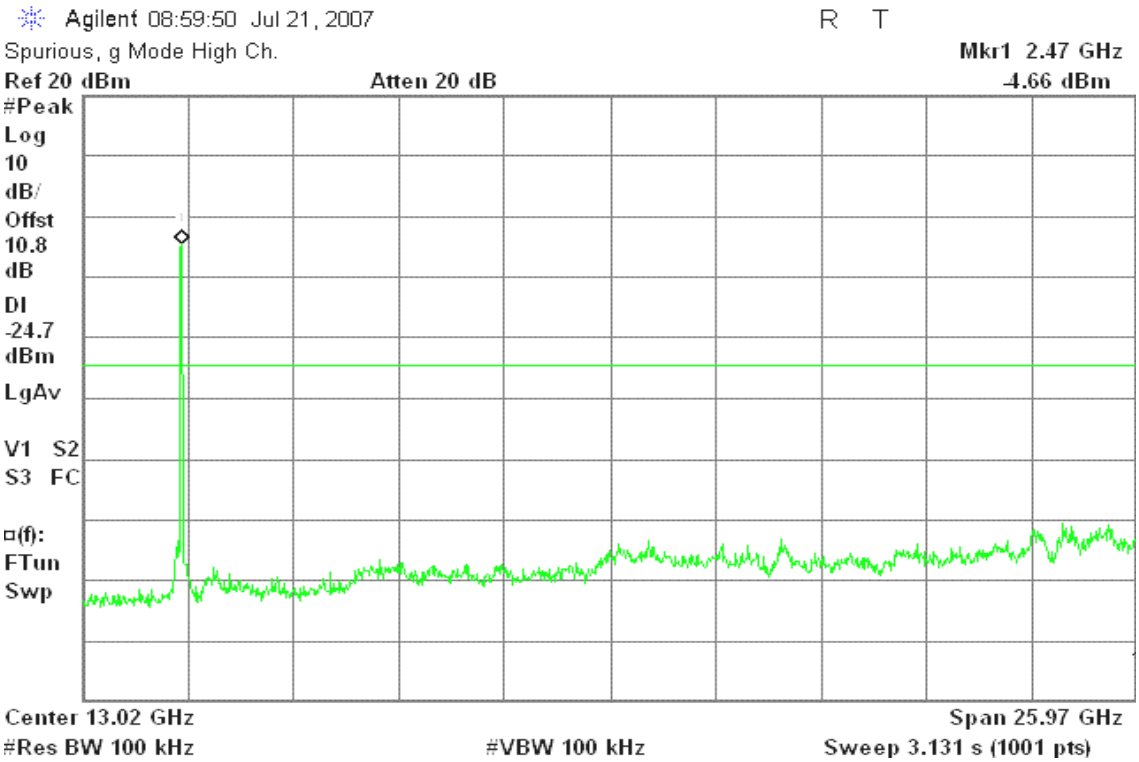
CH Low



CH Mid

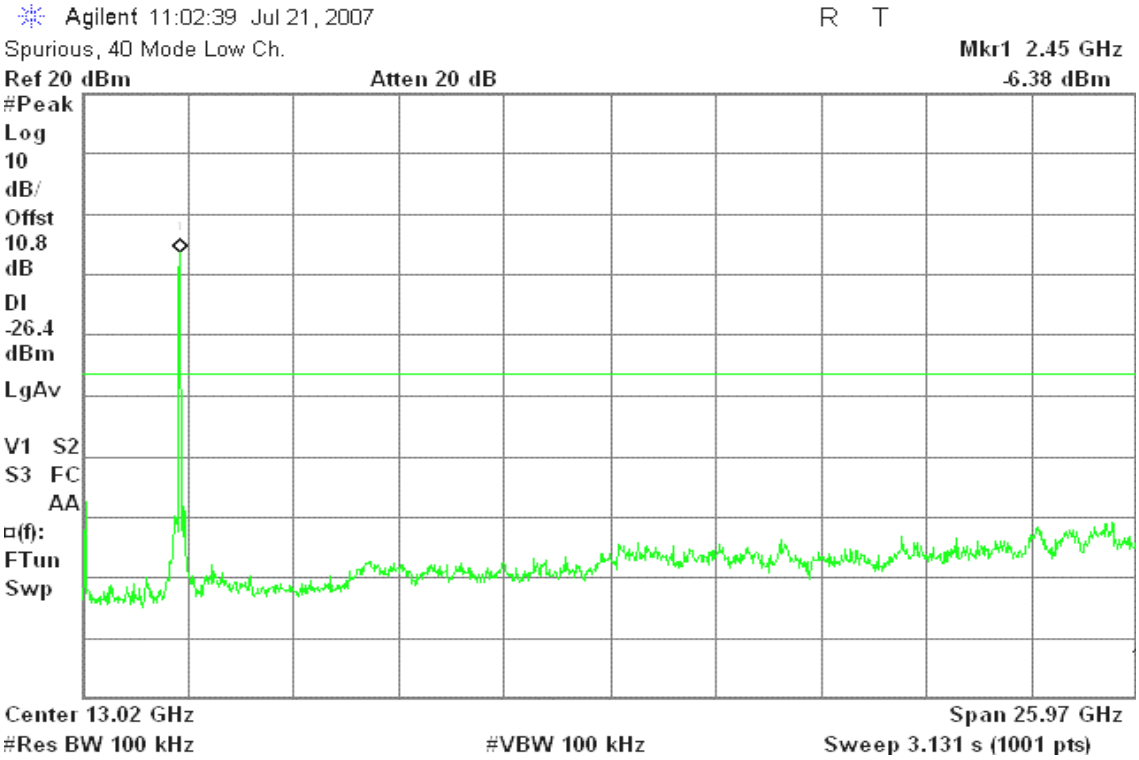


CH High

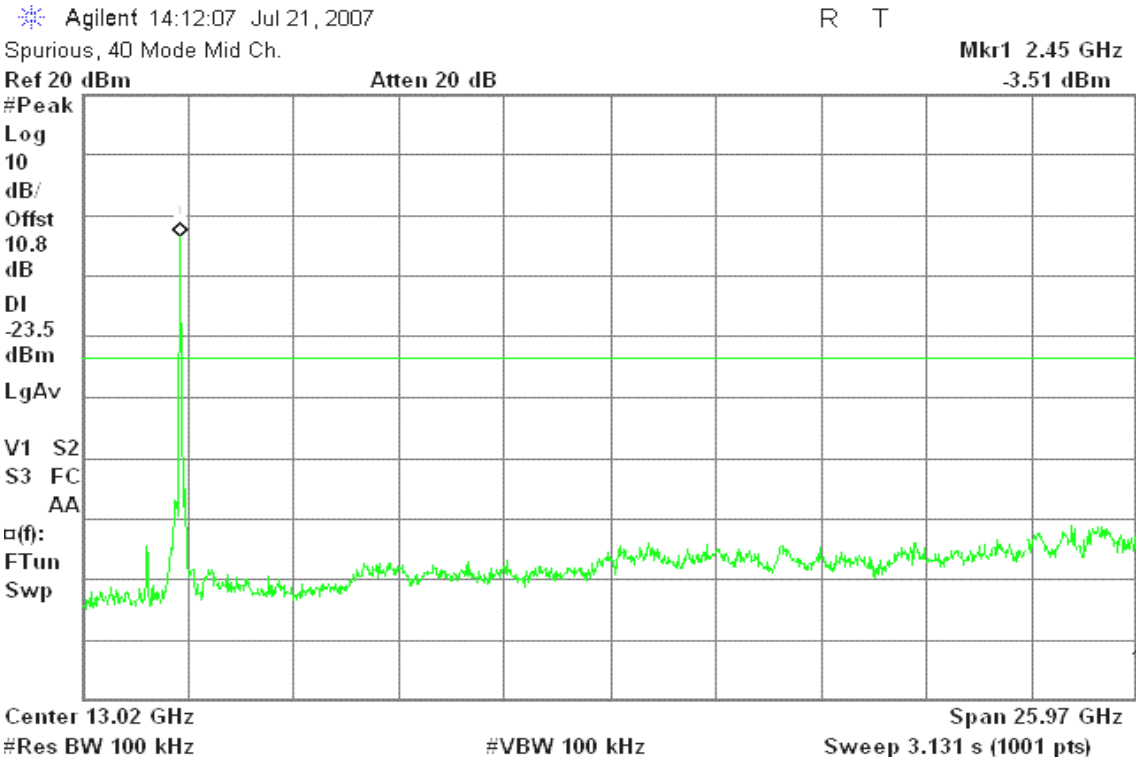


draft 802.11n Wide-40 MHz Channel mode / Chain 0

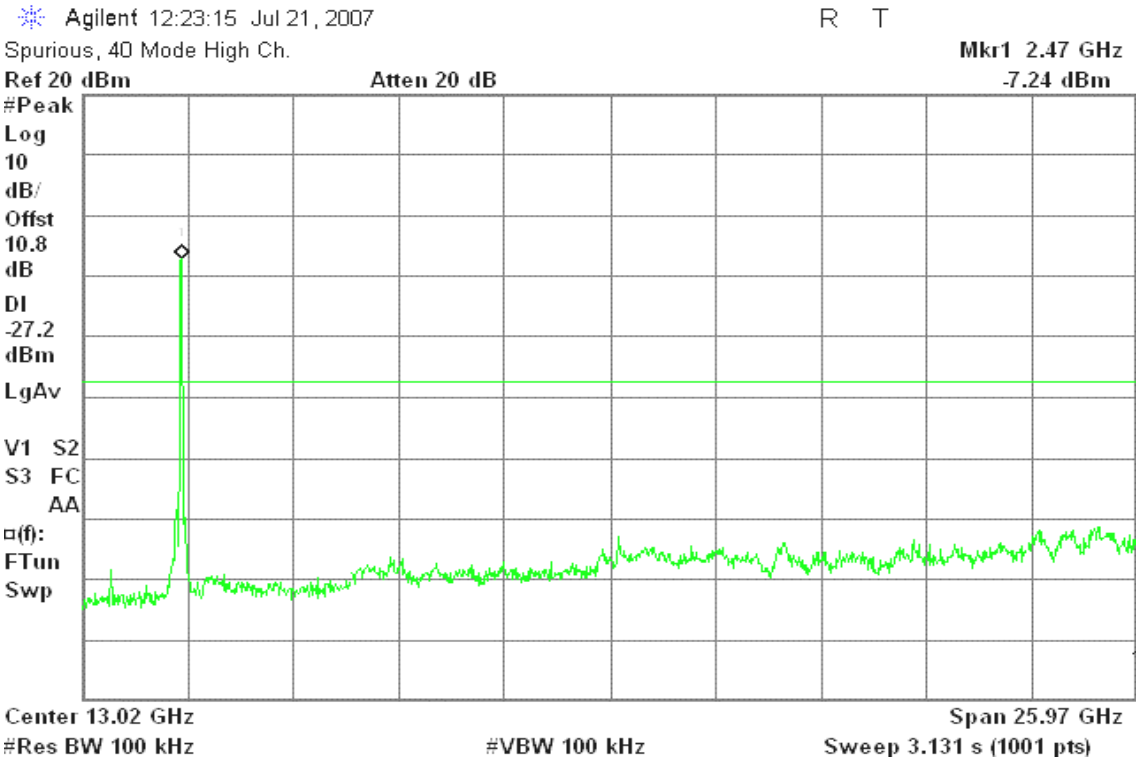
CH Low



CH Mid

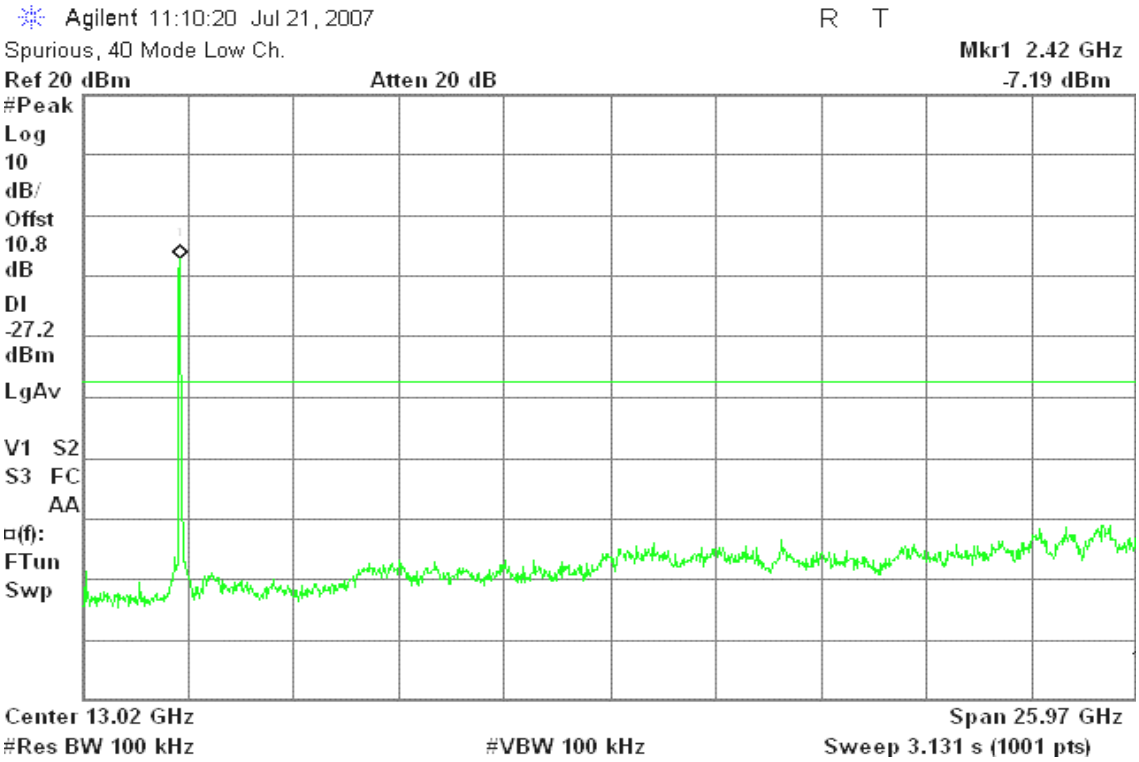


CH High

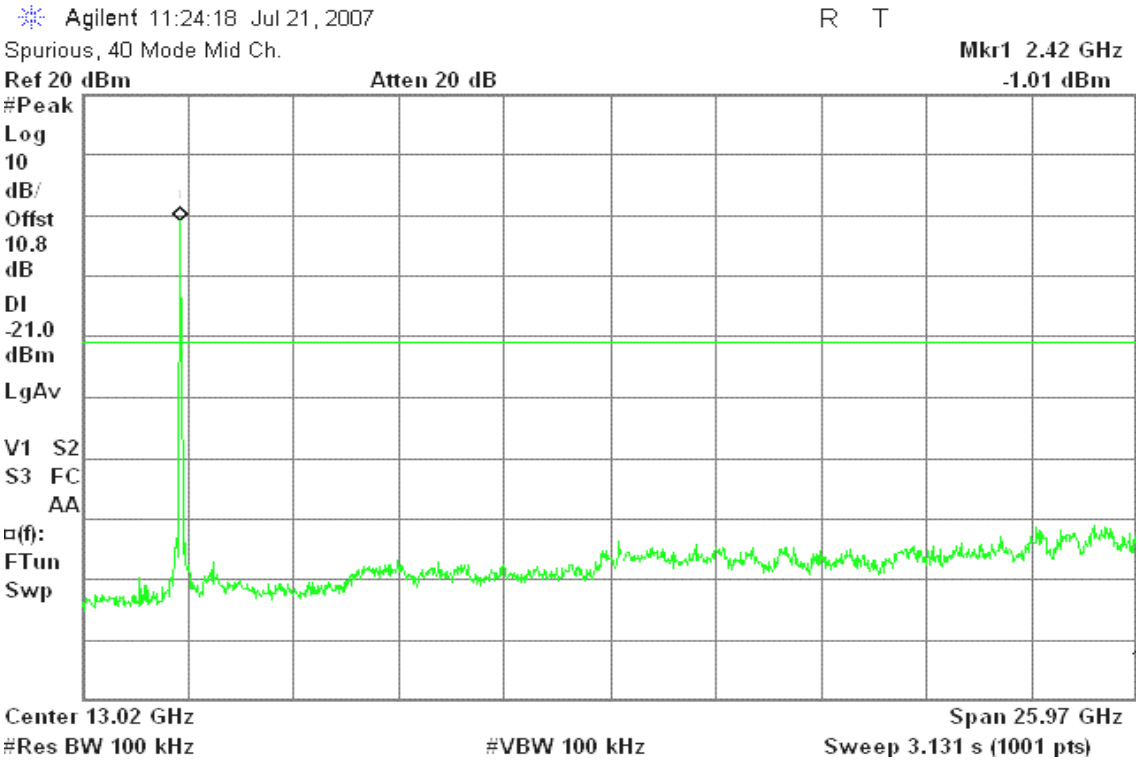


draft 802.11n Wide-40 MHz Channel mode / Chain 1

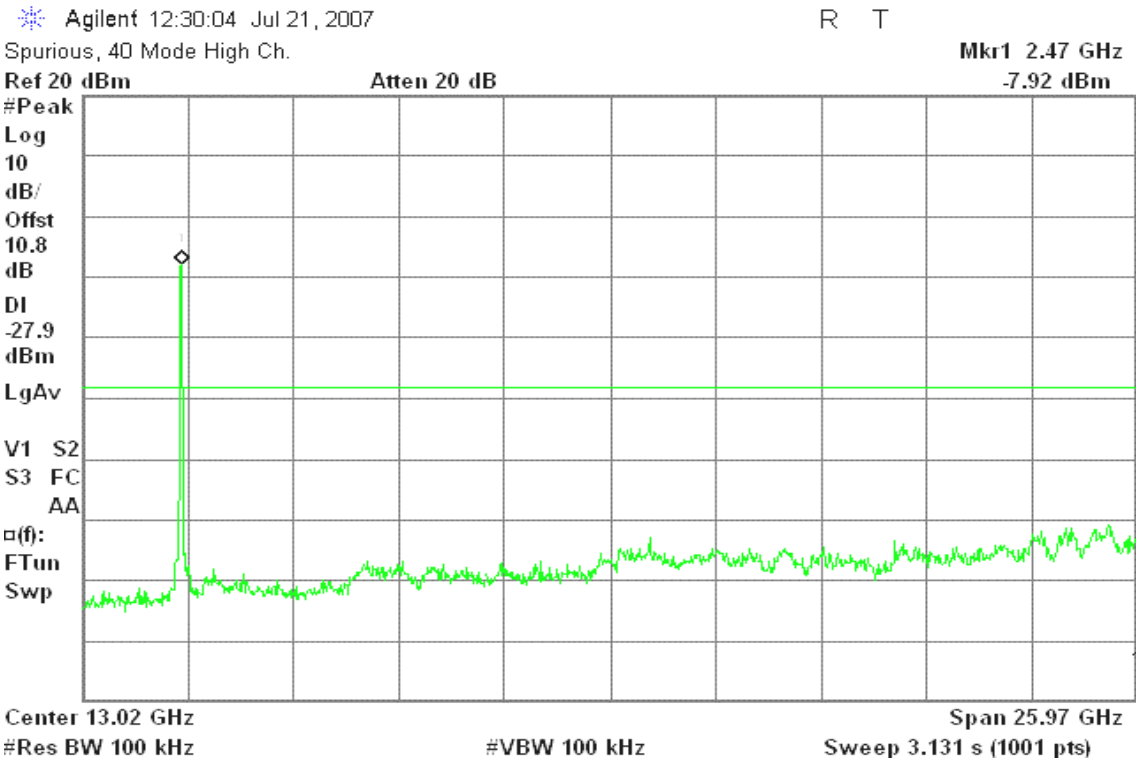
CH Low



CH Mid

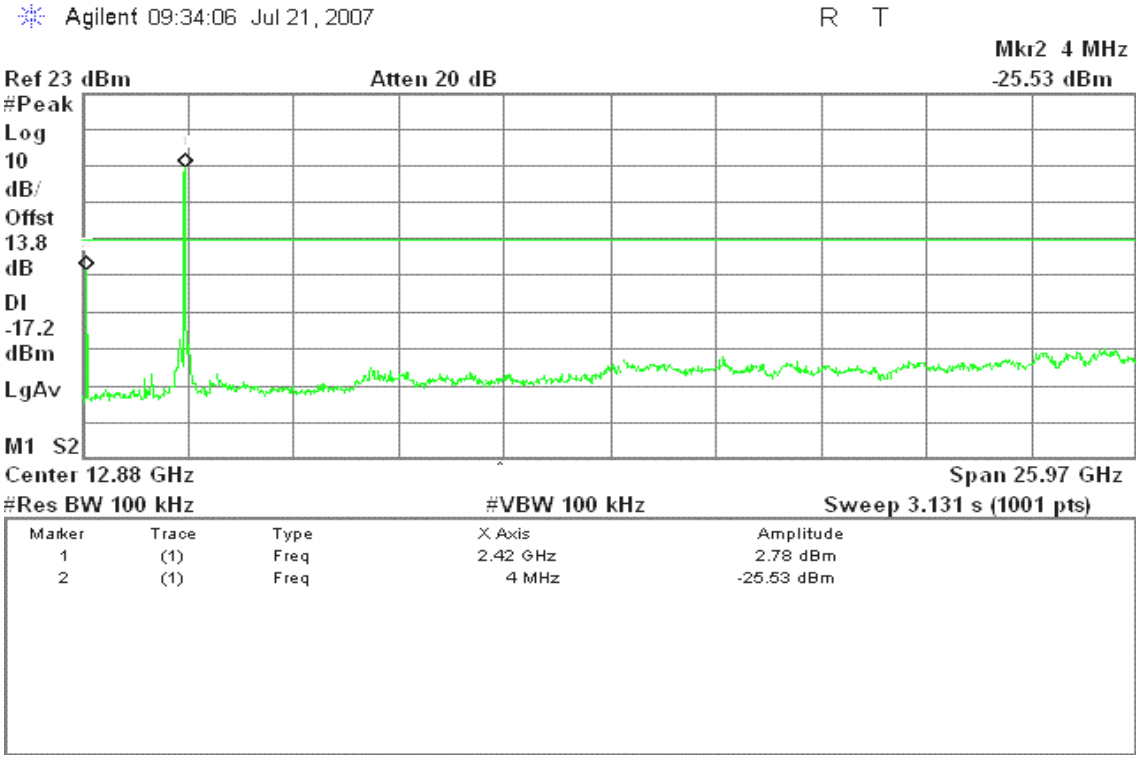


CH High

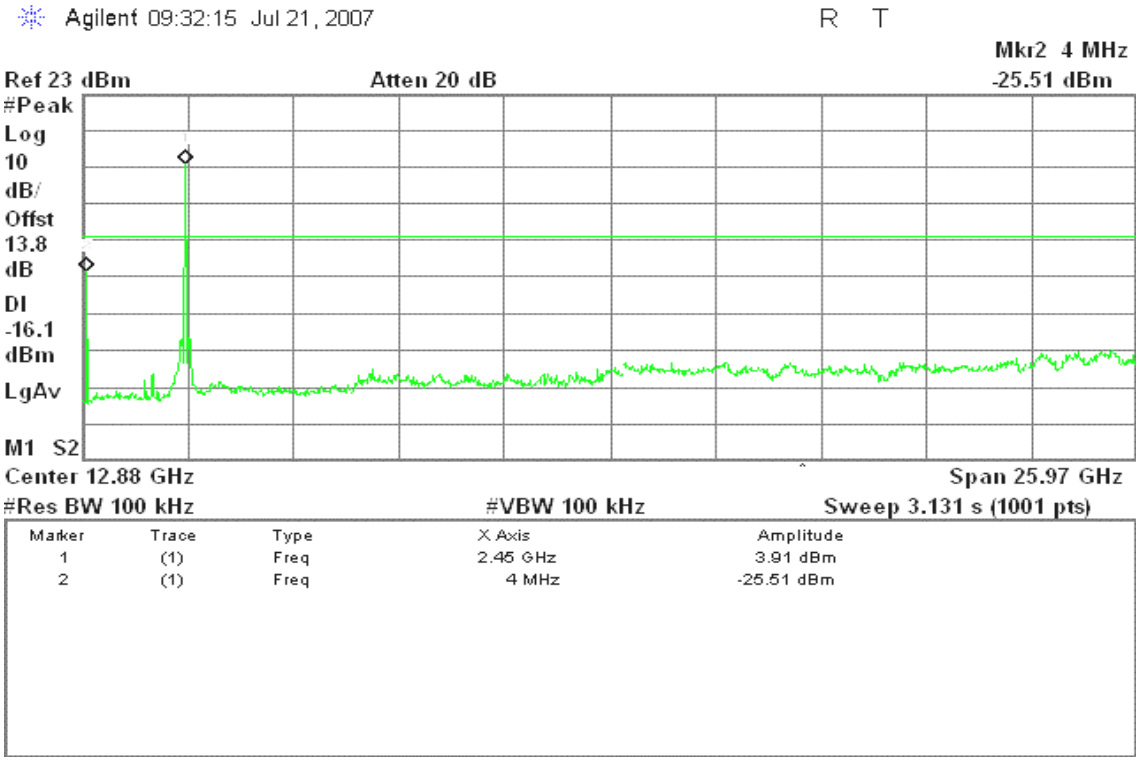


draft 802.11n Standard-20 MHz Channel mode with combiner

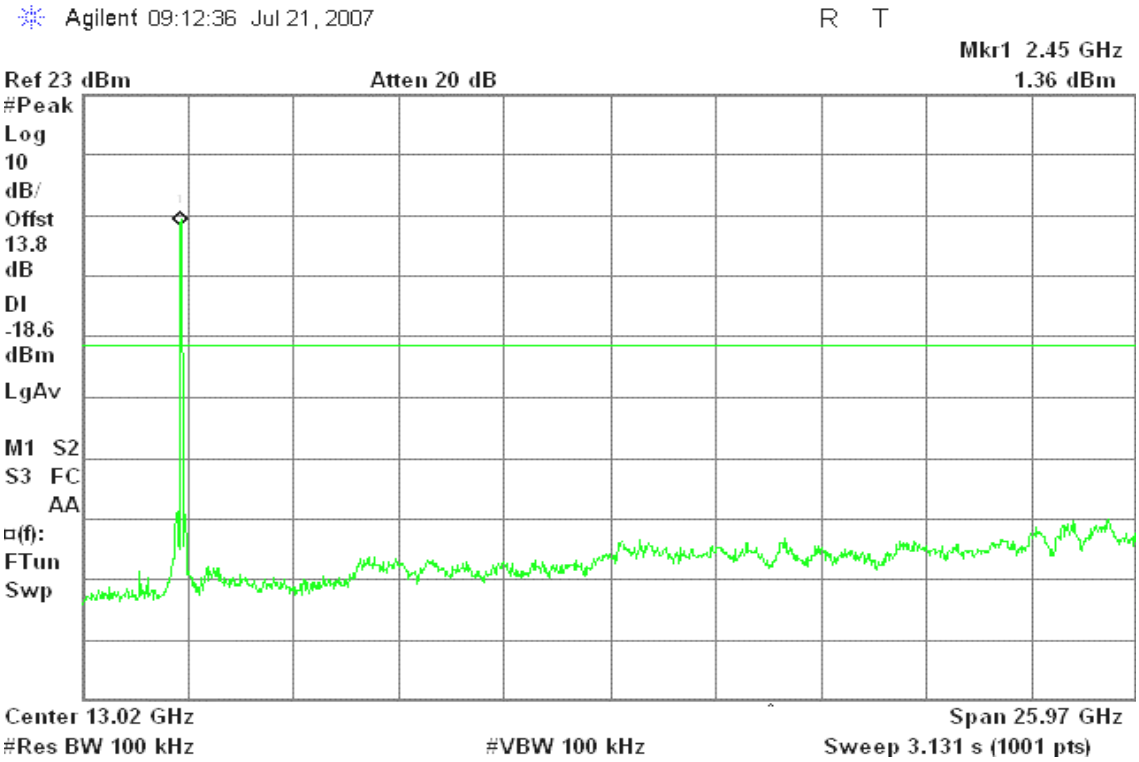
CH Low



CH Mid

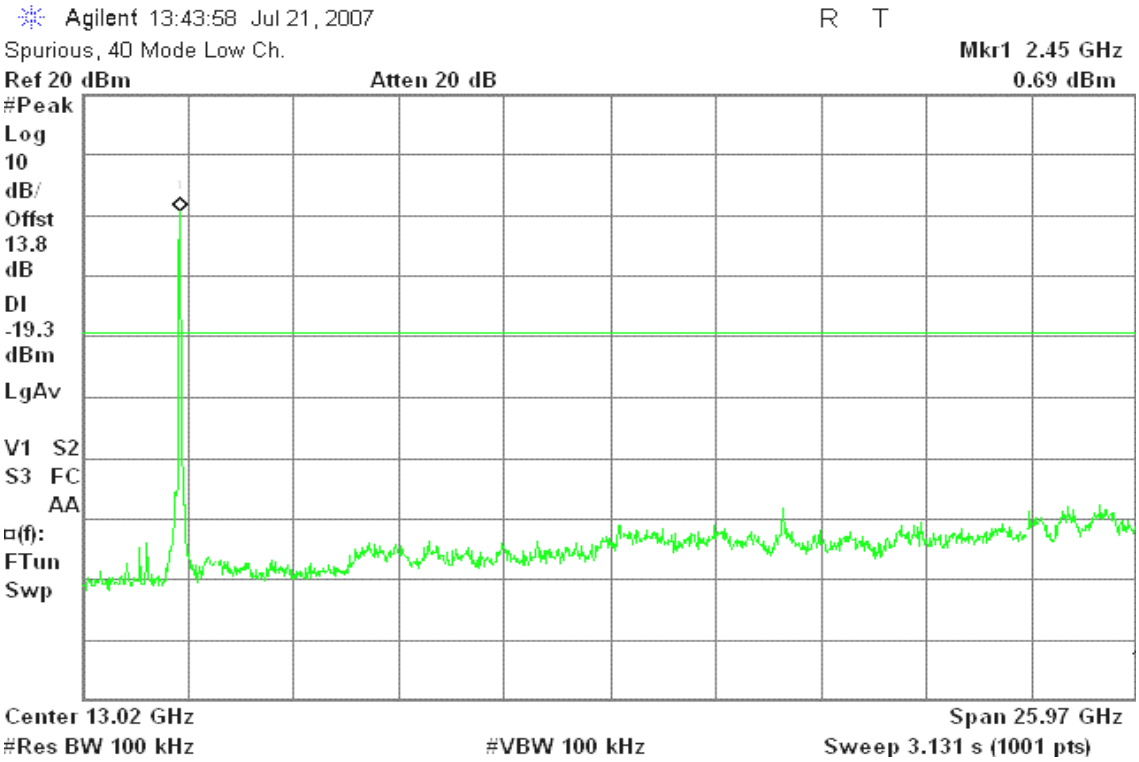


CH High

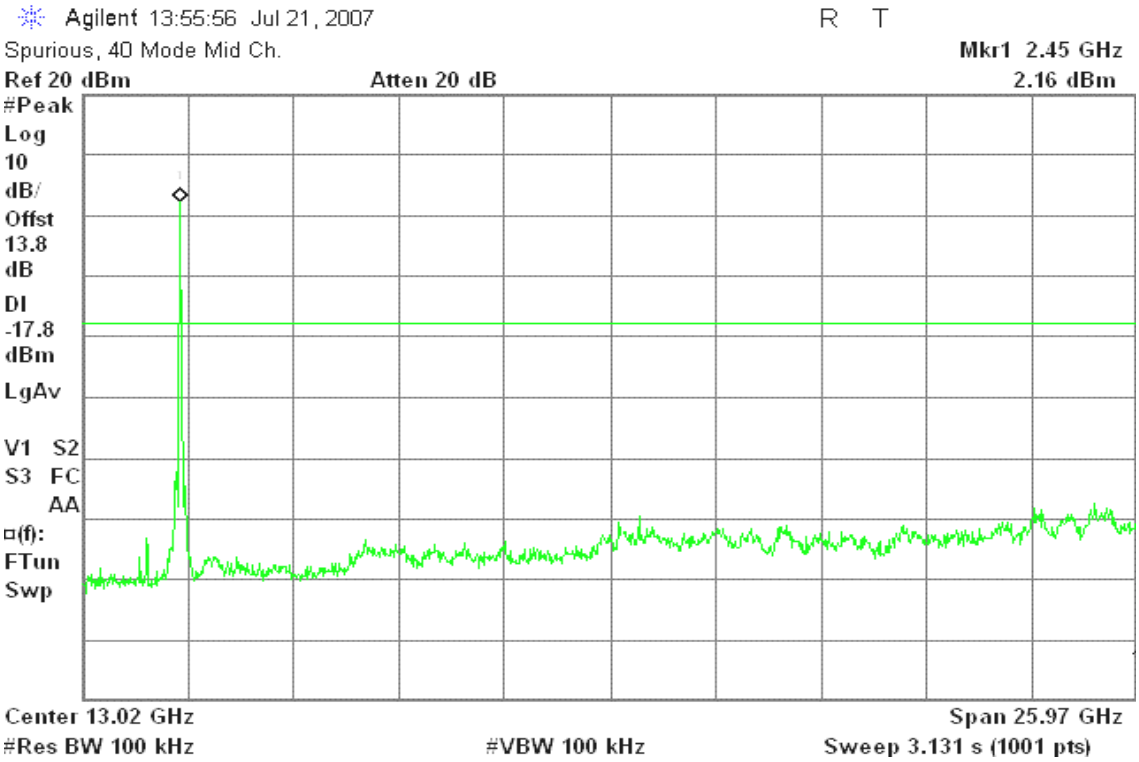


draft 802.11n Wide-40 MHz Channel mode with combiner

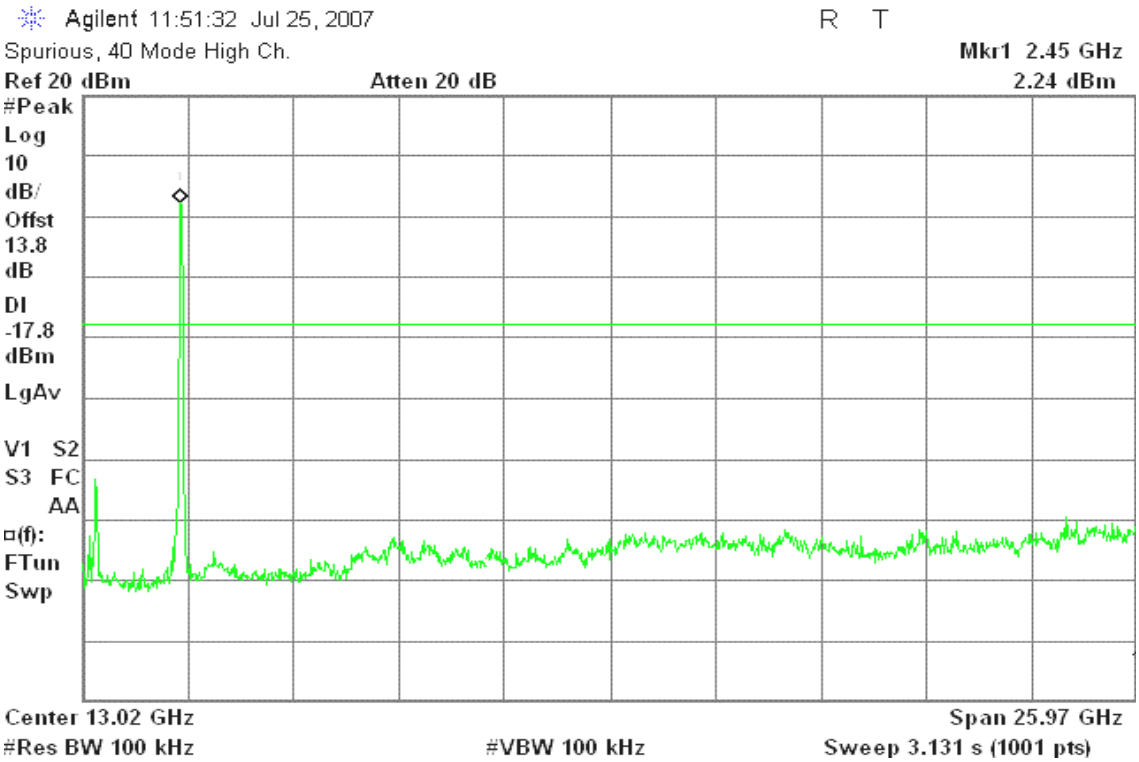
CH Low



CH Mid



CH High



7.7 RADIATED EMISSIONS

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

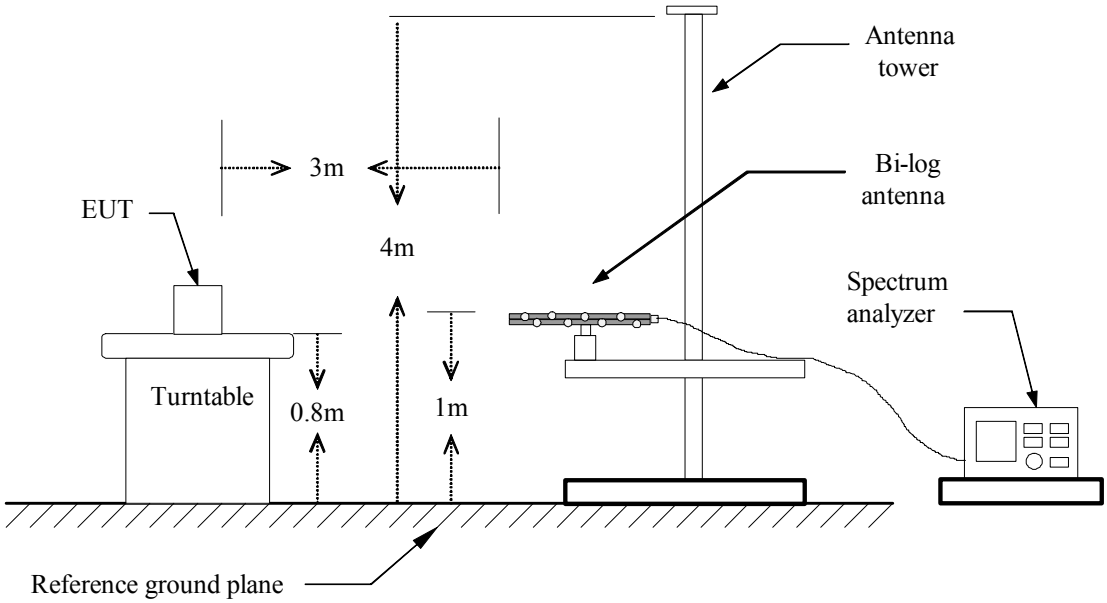
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

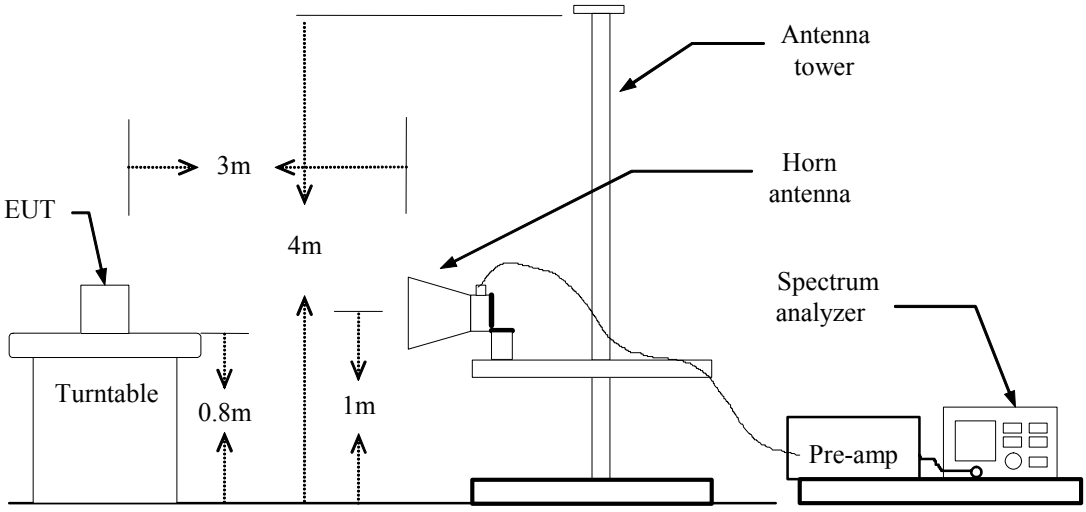
Frequency (MHz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

Below 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

TEST RESULTS

Below 1GHz

Operation Mode: Normal Link **Test Date:** July 20, 2007

Temperature: 25°C **Tested by:** Wolf Huang

Humidity: 50% RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
249.87	V	51.64	-14.56	37.08	46.00	-8.92	Peak
295.13	V	49.84	-12.56	37.29	46.00	-8.71	Peak
400.22	V	47.64	-10.00	37.64	46.00	-8.36	Peak
500.45	V	47.46	-7.86	39.60	46.00	-6.40	Peak
600.68	V	46.50	-6.19	40.32	46.00	-5.68	Peak
1000.00	V	49.14	-0.61	48.53	74.00	-25.47	Peak
249.87	H	60.00	-14.56	45.44	46.00	-0.56	QP
400.22	H	51.51	-10.00	41.51	46.00	-4.49	QP
434.17	H	48.78	-8.95	39.83	46.00	-6.17	Peak
500.45	H	48.08	-7.86	40.22	46.00	-5.78	Peak
899.77	H	45.22	-2.15	43.07	46.00	-2.93	Peak
1000.00	H	44.11	-0.61	43.50	74.00	-30.50	Peak

Remark:

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
4. *Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).*

Above 1 GHz

Operation Mode: TX / IEEE 802.11b / CH Low **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.43	---	-10.60	51.84	---	74.00	54.00	-2.16	Peak
3041.67	V	47.41	---	-2.39	45.02	---	74.00	54.00	-8.98	Peak
3216.67	V	47.17	---	-2.17	45.00	---	74.00	54.00	-9.00	Peak
4825.00	V	60.73	47.09	0.55	61.28	47.64	74.00	54.00	-6.36	AVG
N/A										
3216.67	H	47.18	---	-2.17	45.01	---	74.00	54.00	-8.99	Peak
4825.00	H	50.29	---	0.55	50.84	---	74.00	54.00	-3.16	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11b / CH Mid **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.36	---	-10.60	51.76	---	74.00	54.00	-2.24	Peak
3250.00	V	49.69	---	-2.13	47.55	---	74.00	54.00	-6.45	Peak
4875.00	V	65.01	51.99	0.60	65.61	52.59	74.00	54.00	-1.41	AVG
N/A										
3250.00	H	48.60	---	-2.13	46.47	---	74.00	54.00	-7.53	Peak
4875.00	H	62.93	49.84	0.60	63.53	50.44	74.00	54.00	-3.56	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11b / CH High **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	61.85	---	-10.60	51.25	---	74.00	54.00	-2.75	Peak
3041.67	V	46.80	---	-2.39	44.41	---	74.00	54.00	-9.59	Peak
3283.33	V	52.43	---	-2.09	50.34	---	74.00	54.00	-3.66	Peak
4925.00	V	66.79	52.33	0.65	67.44	52.98	74.00	54.00	-1.02	AVG
7383.33	V	45.51	---	3.27	48.78	---	74.00	54.00	-5.22	Peak
N/A										
3283.33	H	50.39	---	-2.09	48.30	---	74.00	54.00	-5.70	Peak
4925.00	H	51.76	---	0.65	52.41	---	74.00	54.00	-1.59	Peak
7275.00	H	44.78	---	3.47	48.26	---	74.00	54.00	-5.74	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g / CH Low **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.19	---	-10.60	51.59	---	74.00	54.00	-2.41	Peak
3216.67	V	47.90	---	-2.17	45.73	---	74.00	54.00	-8.27	Peak
4825.00	V	52.70	---	0.55	53.25	---	74.00	54.00	-0.75	Peak
N/A										
3216.67	H	47.67	---	-2.17	45.50	---	74.00	54.00	-8.50	Peak
4825.00	H	50.79	---	0.55	51.34	---	74.00	54.00	-2.66	Peak
7425.00	H	45.42	---	3.19	48.61	---	74.00	54.00	-5.39	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g / CH Mid **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.44	---	-10.60	51.84	---	74.00	54.00	-2.16	Peak
3250.00	V	48.34	---	-2.13	46.21	---	74.00	54.00	-7.79	Peak
4875.00	V	65.65	52.39	0.60	66.25	52.99	74.00	54.00	-1.01	AVG
N/A										
3250.00	H	49.10	---	-2.13	46.97	---	74.00	54.00	-7.03	Peak
4875.00	H	63.26	49.19	0.60	63.86	49.79	74.00	54.00	-4.21	AVG
7783.33	H	44.38	---	4.55	48.93	---	74.00	54.00	-5.07	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / IEEE 802.11g / CH High **Test Date:** July 19, 2007

Temperature: 26°C **Tested by:** Wolf Huang

Humidity: 55 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.61	---	-10.60	52.02	---	74.00	54.00	-1.98	Peak
3283.33	V	51.29	---	-2.09	49.20	---	74.00	54.00	-4.80	Peak
4916.67	V	45.88	---	0.64	46.53	---	74.00	54.00	-7.47	Peak
N/A										
3283.33	H	50.30	---	-2.09	48.21	---	74.00	54.00	-5.79	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Standard-20 MHz Channel mode / CH Low	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.13	---	-10.60	51.53	---	74.00	54.00	-2.47	Peak
2306.67	V	72.30	50.55	-4.24	68.06	46.31	74.00	54.00	-7.69	AVG
4825.00	V	65.48	46.48	0.55	66.03	47.03	74.00	54.00	-6.97	AVG
6433.33	V	49.73	---	2.87	52.59	---	74.00	54.00	-1.41	Peak
N/A										
3408.33	H	46.90	---	-1.93	44.97	---	74.00	54.00	-9.03	Peak
5200.00	H	45.45	---	1.00	46.44	---	74.00	54.00	-7.56	Peak
6308.33	H	46.77	---	2.64	49.42	---	74.00	54.00	-4.58	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Standard-20 MHz Channel mode / CH Mid	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.96	---	-10.60	52.36	---	74.00	54.00	-1.64	Peak
3250.00	V	3250.00	---	-8.68	47.06	---	74.00	54.00	-6.94	Peak
4875.00	V	4875.00	---	-6.25	47.25	---	74.00	54.00	-6.75	Peak
6500.00	V	6500.00	---	-2.13	46.95	---	74.00	54.00	-7.05	Peak
N/A										
3250.00	H	46.74	37.62	-2.13	44.61	35.49	74.00	54.00	-9.39	Peak
4875.00	H	52.83	---	0.60	53.43	---	74.00	54.00	-0.57	Peak
5658.33	H	45.48	---	1.62	47.10	---	74.00	54.00	-6.90	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Standard-20 MHz Channel mode / CH High	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.49	---	-10.60	51.89	---	74.00	54.00	-2.11	Peak
3283.33	V	49.60	---	-2.09	47.51	---	74.00	54.00	-6.49	Peak
4925.00	V	49.06	---	0.65	49.71	---	74.00	54.00	-4.29	Peak
6566.67	V	54.92	50.13	3.12	58.04	53.25	74.00	54.00	-0.75	AVG
N/A										
3283.33	H	47.48	---	-2.09	45.39	---	74.00	54.00	-8.61	Peak
4916.67	H	46.45	---	0.64	47.09	---	74.00	54.00	-6.91	Peak
7925.00	H	43.29	---	5.30	48.59	---	74.00	54.00	-5.41	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Wide-40 MHz Channel mode / CH Low	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.56	---	-10.60	51.97	---	74.00	54.00	-2.03	Peak
3233.33	V	47.09	---	-2.15	44.94	---	74.00	54.00	-9.06	Peak
4858.33	V	64.18	48.19	0.59	64.77	48.78	74.00	54.00	-5.22	AVG
6458.33	V	50.85	---	2.91	53.76	---	74.00	54.00	-0.24	Peak
N/A										
3233.33	H	45.58	---	-2.15	43.43	---	74.00	54.00	-10.57	Peak
7183.33	H	43.71	---	3.65	47.35	---	74.00	54.00	-6.65	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Wide-40 MHz Channel mode / CH Mid	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	62.65	---	-10.60	52.06	---	74.00	54.00	-1.94	Peak
2306.67	V	71.12	51.03	-4.24	66.88	46.79	74.00	54.00	-7.21	AVG
3041.67	V	46.30	---	-2.39	43.90	---	74.00	54.00	-10.10	Peak
3250.00	V	47.12	---	-2.13	44.99	---	74.00	54.00	-9.01	Peak
4875.00	V	47.26	---	0.60	47.86	---	74.00	54.00	-6.14	Peak
6500.00	V	54.13	49.07	2.99	57.12	52.06	74.00	54.00	-1.94	AVG
3250.00	H	46.02	---	-2.13	43.89	---	74.00	54.00	-10.11	Peak
3733.33	H	45.42	---	-1.26	44.16	---	74.00	54.00	-9.84	Peak
6341.67	H	45.33	---	2.70	48.03	---	74.00	54.00	-5.97	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode:	TX / draft 802.11n Wide-40 MHz Channel mode / CH High	**Test Date:**	July 20, 2007
Temperature:	26°C	**Tested by:**	Wolf Huang
Humidity:	55 % RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1120.00	V	63.09	---	-10.60	52.50	---	74.00	54.00	-1.50	Peak
3266.67	V	48.27	---	-2.11	46.16	---	74.00	54.00	-7.84	Peak
5558.33	V	45.77	---	1.49	47.26	---	74.00	54.00	-6.74	Peak
6541.67	V	54.12	49.34	3.07	57.19	52.41	74.00	54.00	-1.59	AVG
N/A										
3266.67	H	46.59	---	-2.11	44.48	---	74.00	54.00	-9.52	Peak
6375.00	H	45.10	---	2.76	47.86	---	74.00	54.00	-6.14	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.8 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), 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 μH/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 Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

** Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode:	Normal Link	**Test Date:**	July 18, 2007
Temperature:	26°C	**Tested by:**	Steven Young
Humidity:	55% RH		

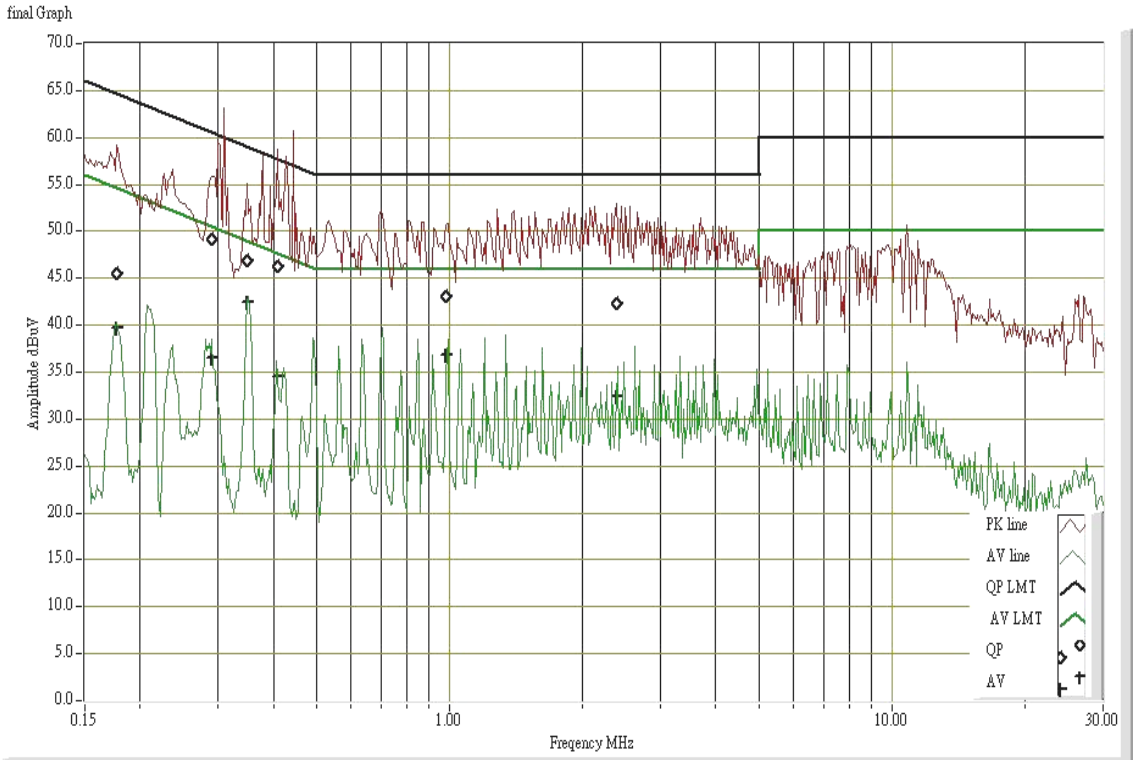
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.177	45.470	39.660	0.146	45.616	39.806	64.625	54.625	-19.009	-14.819	L1
0.291	49.200	36.570	0.100	49.300	36.670	60.496	50.496	-11.196	-13.826	L1
0.349	46.800	42.450	0.100	46.900	42.550	58.986	48.986	-12.086	-6.436	L1
0.409	46.190	34.470	0.100	46.290	34.570	57.669	47.669	-11.379	-13.099	L1
0.984	43.050	36.800	0.100	43.150	36.900	56.000	46.000	-12.850	-9.100	L1
2.382	42.310	32.390	0.100	42.410	32.490	56.000	46.000	-13.590	-13.510	L1
0.176	47.700	37.050	0.148	47.848	37.198	64.672	54.672	-16.824	-17.474	L2
0.211	44.480	37.680	0.100	44.580	37.780	63.166	53.166	-18.586	-15.386	L2
0.288	48.850	36.570	0.100	48.950	36.670	60.582	50.582	-11.632	-13.912	L2
0.349	46.250	39.510	0.100	46.350	39.610	58.986	48.986	-12.636	-9.376	L2
0.709	43.080	34.960	0.100	43.180	35.060	56.000	46.000	-12.820	-10.940	L2
0.923	39.060	31.550	0.100	39.160	31.650	56.000	46.000	-16.840	-14.350	L2

Remark:

1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10 kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9 kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)