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FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

For

Radio Unit

Model Number: RM-24/AP25

FCC ID: ZO7-RM24-AP25

Report Number: 0048-110513-01

Prepared for
Vihaan Networks Ltd.
21-B, Sec.18, Udyog Vihar
Gurgaon, Haryana 122015
India

Prepared by
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Date: 07/08/2011

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1. TEST RESULT CERTIFICATION

COMPANY NAME: VIHAAN NETWORKS LTD.
19 Microlab Road, Suite D
Livingston, NJ 07039, USA

EUT DESCRIPTION: Radio Unit

MODEL: RM-24/AP25

DATE TESTED: 05/13/2011 to 07/08/2011

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC Part 15 Sub Part C : 15.247	NO NON-COMPLIANCE NOTED

Advanced Compliance Laboratory, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Advanced Compliance Laboratory, Inc. (ACL) and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by ACL, Advanced Compliance Laboratory, Inc. will constitute fraud and shall nullify the document.

Approved & Released For ACL By:

Wei Li
Manager
Advanced Compliance Laboratory, Inc.

Tested By:

Edward Lee
EMC Engineer

2. EUT DESCRIPTION

The RM-24/AP25 platform deploys reliable and secure high-speed wireless IP connections between multiple remote locations through high-capacity Point to Point and Point to Multipoint links, using digital modulation & operating in the 2400-2483.5MHz band. It uses FCC approved RF Module following manufacturer's application requirements without any modification. Testing Information for this module can be found in QuieTek's File No.: 08BS044R-RF-US-P05V01 dated on 03/02/2009 under FCC ID: TK4-WLM200N2-26.

The transmitter has a maximum peak conducted output power at each port as follows:

Frequency (MHz)	**Max. P @ chain1 (dBm)**	**Max. P@Chain2 (dBm)**	**Max. Total Power (dBm) @P1+P2**
2412-2462	13.76	13.41	14.94 (0.031W)
2422-2452	11.13	10.64	13.90 (0.025W)

	802.11b/g/n(HT-20)	802.11n(HT-40)
Frequency Range	2412-2462MHz	2422-2452MHz
Channel Number	11 (Ch1- Ch11)	7 (Ch2-Ch9)
Max. Data Rate	11 Mbps for b / 54Mbps for g	135Mbps

The EUT will use the integrated Subscriber Antenna. The antenna data sheet is attached:
Antenna P/N: 401.00023.00
Antenna Type: Flat Panel
Antenna Frequency Range: 2.4-2.485GHz
Antenna Gain: 18 +/- 0.5dBi

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2003, FCC CFR 47 Part 2 & 15 and IC RSS-210 (if applicable).

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at Hillsborough, New Jersey, USA The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

ACL is accredited by NVLAP, Laboratory Code 200101-0. The full accreditation can be viewed at http://www.ac-lab.com

NVLAP Lab Code: 200101-0

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

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	±2.36	±2.99	±1.83

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Manufacture	Model	Serial No.	Description	Cal Due dd/mm/yy
Agilent	E4440A	US40420700	3Hz-26.5GHz Spec. Analyzer	4/08/11
R &S	ESPI7	6001	9KHz-7GHz EMI Receiver	17/06/12
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	5/01/12
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	15/01/12
EMCO	6502	2665	10KHz-30MHz Active Loop Antenna	27/02/12
EMCO	3115	4945	Double Ridge Guide Horn Antenna	12/03/12
HP	E8254A	US42110367	Signal Generator	23/03/12
Scientific-Atlanta	12A-18	441	Wave Guide Horn Antenna	04/08/11
Agilent	E4448A	MY45300108	3Hz-50GHz Spectrum Analyzer	05/09/11
Agilent	83650B	3844A01114	50G Swept Signal Generator	27/01/12
HP	5361B	3023A01322	20G Pulse/CW Microwave Counter	10/06/12
HP	4419A	US37292112	RF Power Meter w/ Sensor Probe	29/06/12
EMCO	3116	4943	Double Ridge Guide Horn Antenna	11/01/12
SUNSYS	EC127	96025	Temperature Test Chamber	30/06/12
Lorch Microwave	5NF-800/1000-S	AC3	Notch Filter	
Lorch Microwave	5NF-1800/2200-S	AE10	Notch Filter	
RES-NET	RFA500NFF30	0108	30dB in-line Power Attenuator	
Narda	3022	80986	Directional Coupler	

All Test Equipment Used are Calibrated Traceable to NIST Standards.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

ITEM	DESCRIPTION	ID or DOC
AC/DC Adaptor	HS50-48010003KA (for providing DC PoE to EUT)	
HP Notebook	CRVS1-T2-60 (for Software control)	

TEST SETUP

Testing Frequency/Channel/Port Selection/Mode:

- L(owest), M(iddle), H(ighest) Channels of 2.4G Band:
    1. L=2412MHz for 802.11b/g/n(HT-20); L=2422MHz for n(HT-40)
    2. M=2437 MHz for for 802.11b/g/n(HT-20) & n(HT-40)
    3. H=2462MHz for 802.11b/g/n(HT-20); H=2452MHz for n(HT-40)
- Modulations: DSSS for 802.11b & OFDM for 802.11/g/n
- Port Selection: Port 1 (Chain 1) ON/ Port 2 (Chain 2) OFF; Port 1 (Chain 1) OFF/ Port 2 (Chain 2) ON; Port 1 (Chain 1) ON+ Port 2 (Chain 2) ON.
- Measured at EUT's antenna port for conducted power. Other conducted measurements shall be referred to QuieTek report since higher Tx output power was tested in its application.
- Measured in chamber/OATS for radiated & AC conducted emission measurements

Based the worst case scenario and investigation results for all applicable operation configurations, following operation modes were documented in this report (also refer to QuieTek report, page 8 for same setting details):

- Mode 1: 802.11b
- Mode 2: 802.11g
- Mode 3: 802.11n(HT-20)
- Mode 4: 802.11n(HT-40)

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 6dB BANDWIDTH

LIMIT

§15.247 (a) (2) & RSS-210 A8.2(1): Min. 6dB bandwidth should be no less than 500KHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 6dB bandwidth. The VBW/RBW is set to one or three. The sweep time is coupled.

RESULTS

No non-compliance noted per QuieTek's File No.: 08BS044R-RF-US-P05V01 dated on 03/02/2009.

7.2. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b)(3) & RSS-210 A8.4(4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

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.

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.

The maximum antenna gain is 18.5dBi, which is higher than 6dBi. Therefore, the limit in (b)(3) is 30-(18.5-6)=+17.5dBm, i.e. 0.0562W.

TEST PROCEDURE

Per FCC KDB 558074, The transmitter output is connected to a spectrum analyzer and Power output Option 2, Method #1 was selected for peak power measurement since the device was set to transmit continuously.

RESULTS

No non-compliance noted.

Note:
* Completed test result for RF module with an antenna gain less than 6dBi is provided in QuieTek's File No.: 08BS044R-RF-US-P05V01 dated on 03/02/2009.

OUTPUT PEAK POWER

Summary of the testing result:
(Total power is linear sum of each transmitter chain power)

Mode 1: 802.11b

Channel	Frequency (MHz)	P @ chain1 (dBm)	P@Chain2 (dBm)	Limit (dBm)	Result
01-L	2412	13.76	13.47	17.5	Pass
06-M	2437	13.67	13.27	17.5	Pass
11-H	2462	13.62	12.88	17.5	Pass

Mode 2: 802.11g

Channel	Frequency (MHz)	P @ chain1 (dBm)	P@Chain2 (dBm)	Limit (dBm)	Result
01-L	2412	12.23	11.85	17.5	Pass
06-M	2437	12.09	11.98	17.5	Pass
11-H	2462	12.44	11.76	17.5	Pass

Mode 3: 802.11n (HT-20)

Channel	Frequency (MHz)	P @ chain1 (dBm) *	P@Chain2 (dBm)*	Total Power (dBm)	Limit (dBm)	Margin
01-L	2412	12.27	11.07	14.72	17.5	-2.78
06-M	2437	12.04	11.82	14.94	17.5	-2.56
11-H	2462	12.22	11.49	14.88	17.5	-2.62

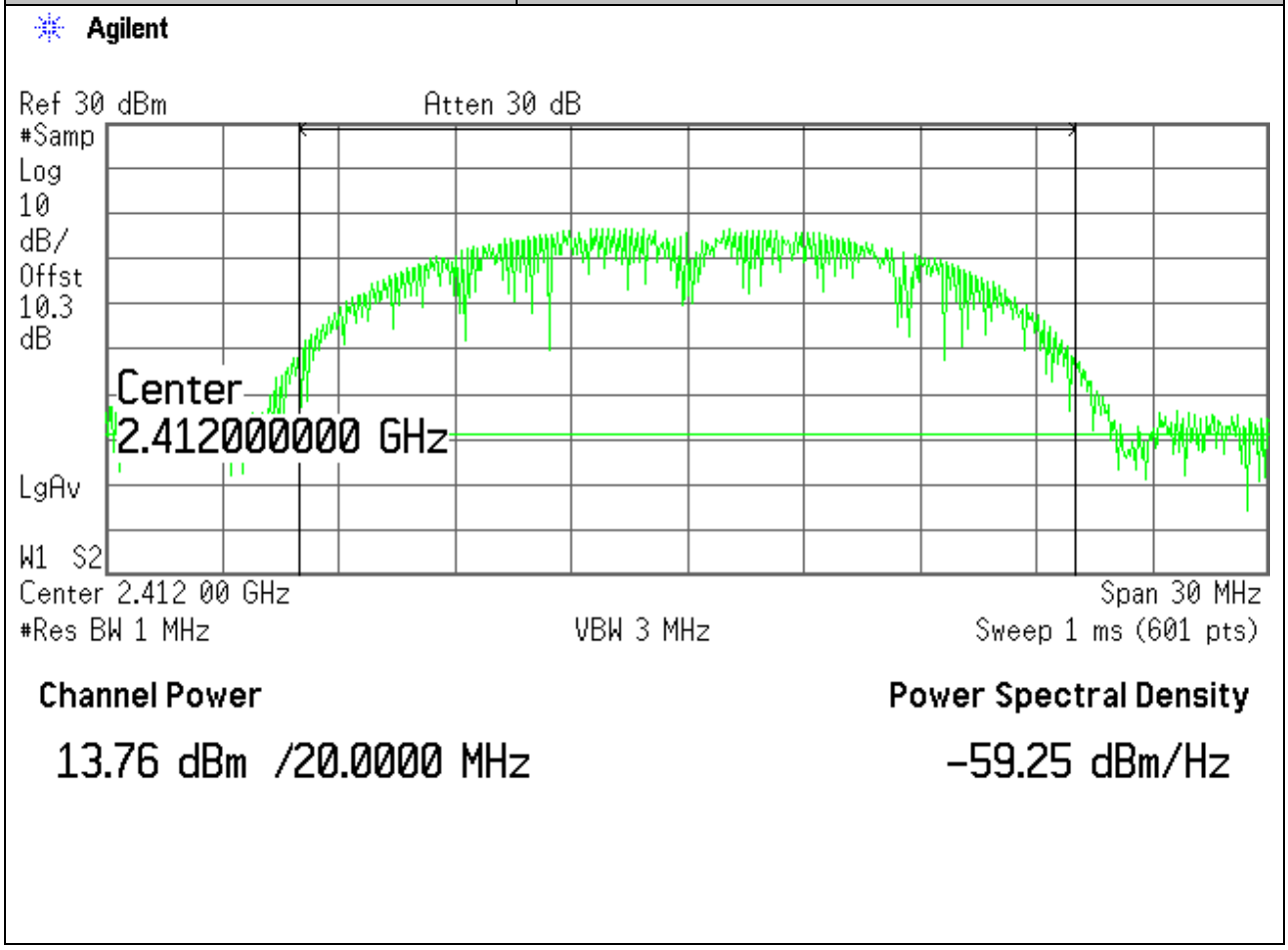
Mode 4: 802.11n (HT-40)

Channel	Frequency (MHz)	P @ chain1 (dBm)*	P@Chain2 (dBm)*	Total Power (dBm)	Limit (dBm)	Margin
03-L	2422	10.97	10.62	13.81	17.5	-3.69
06-M	2437	11.13	10.84	13.90	17.5	-3.60
09-H	2452	10.71	10.42	13.58	17.5	-3.92

* recorded levels represent the max power of each chain between one-chain operation or two-chain operation.

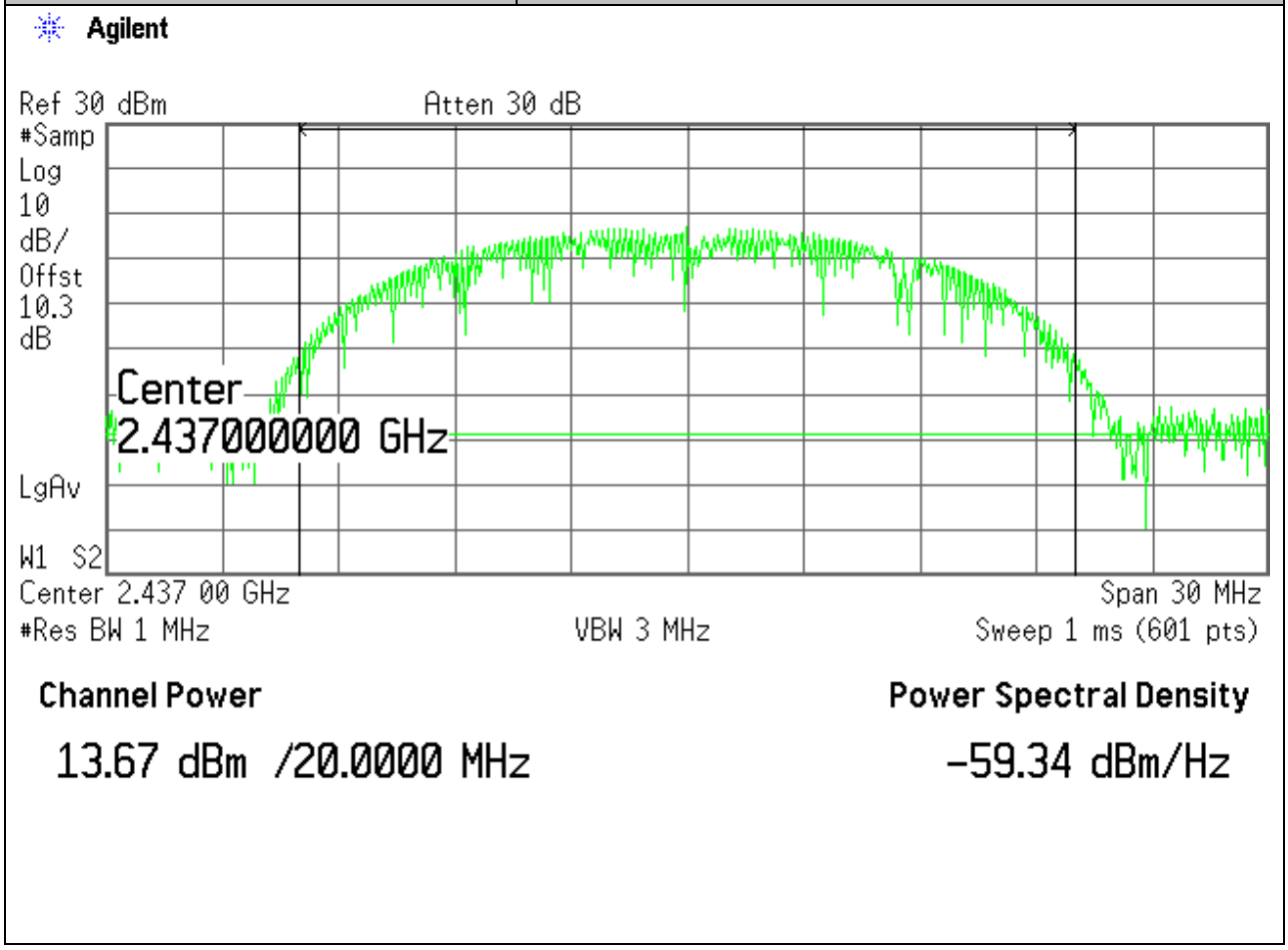
Mode 1: 802.11b / Chain 1

Plot Name:	Output Peak Power @ Low CH



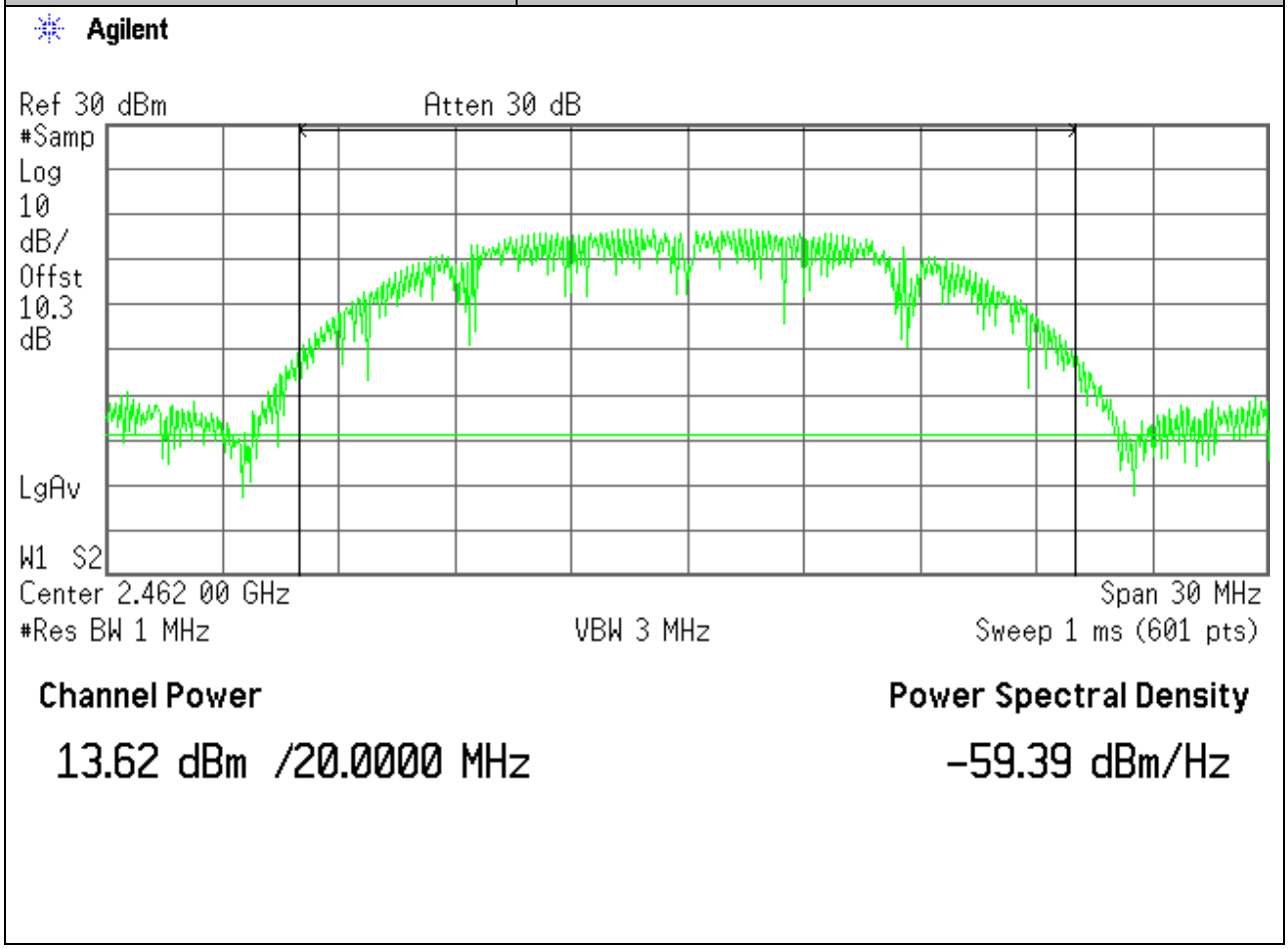
Mode 1: 802.11b / Chain 1

Plot Name:	Output Peak Power @ Middle CH



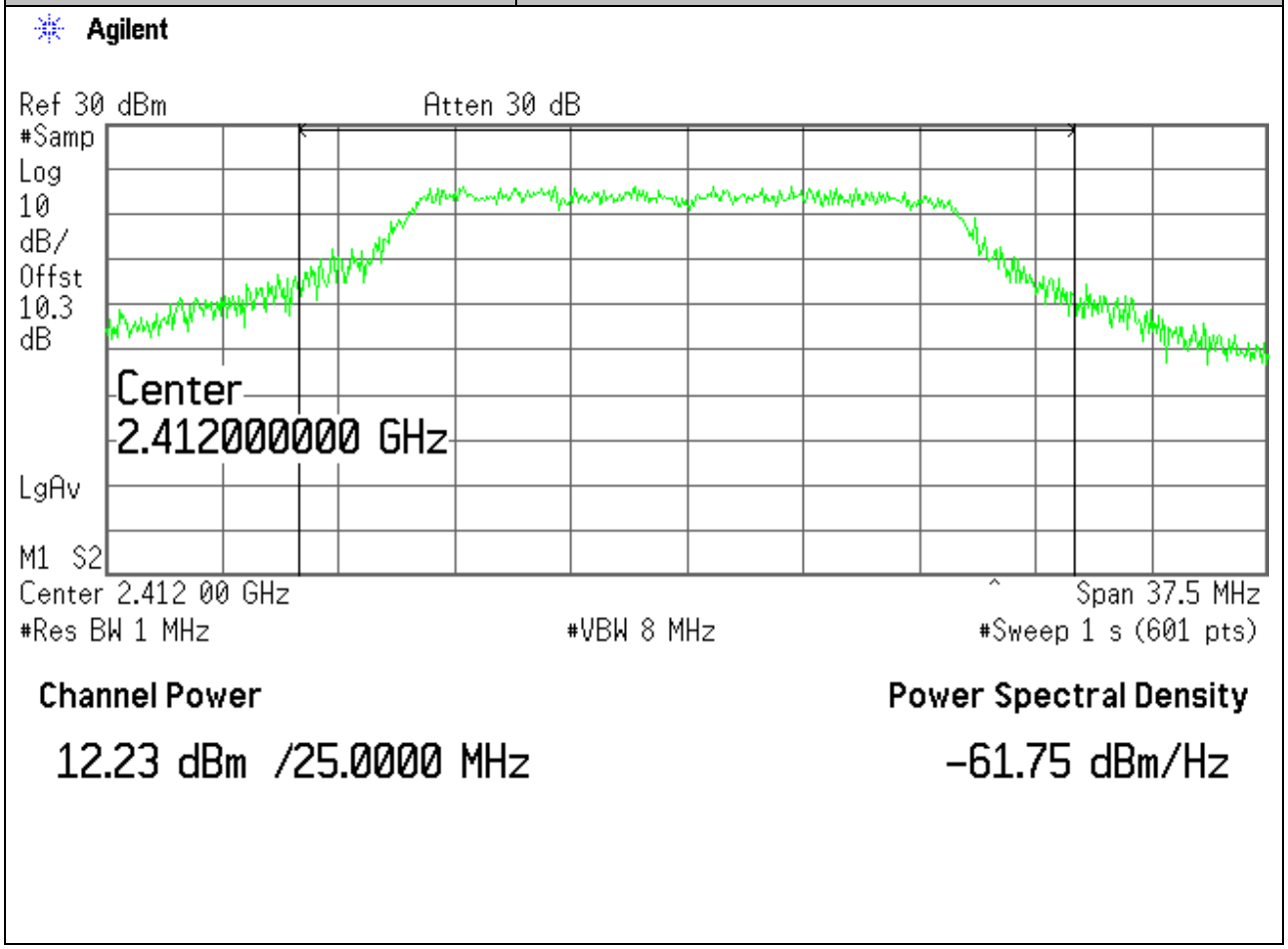
Mode 1: 802.11b / Chain 1

Plot Name:	Output Peak Power @ High CH



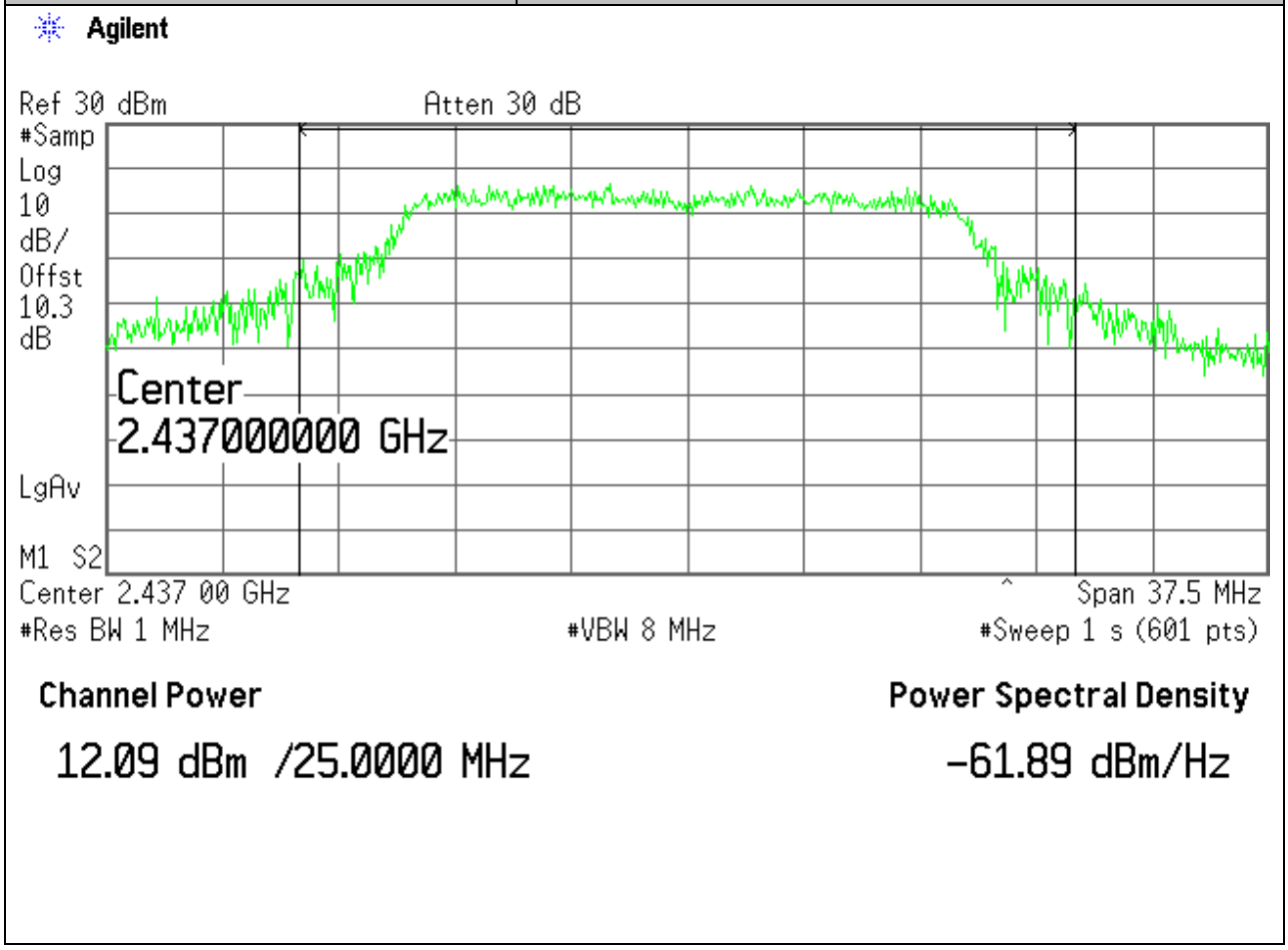
Mode 2: 802.11g / Chain 1

Plot Name:	Output Peak Power @ Low CH



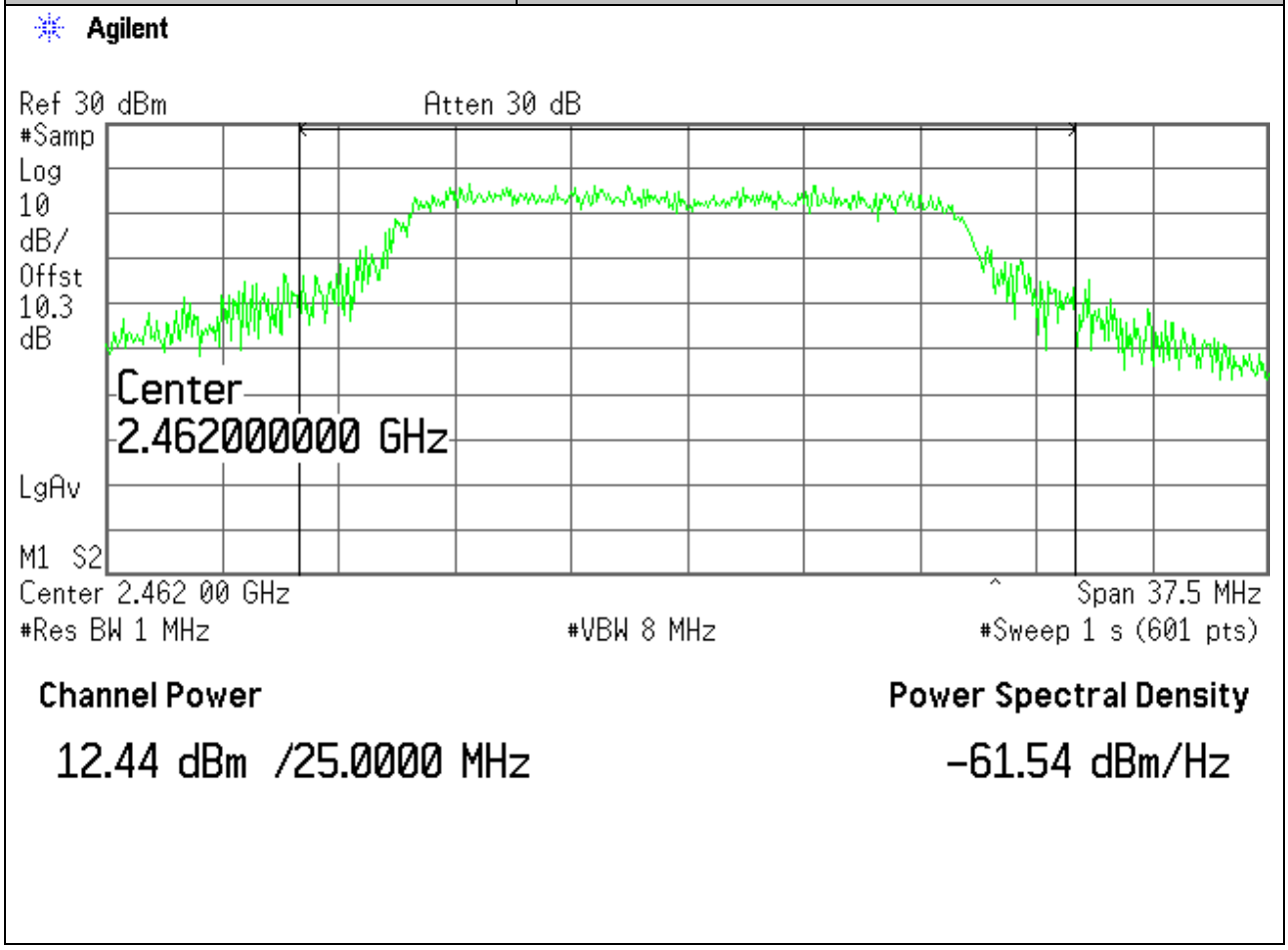
Mode 2: 802.11g / Chain 1

Plot Name:	Output Peak Power @ Middle CH



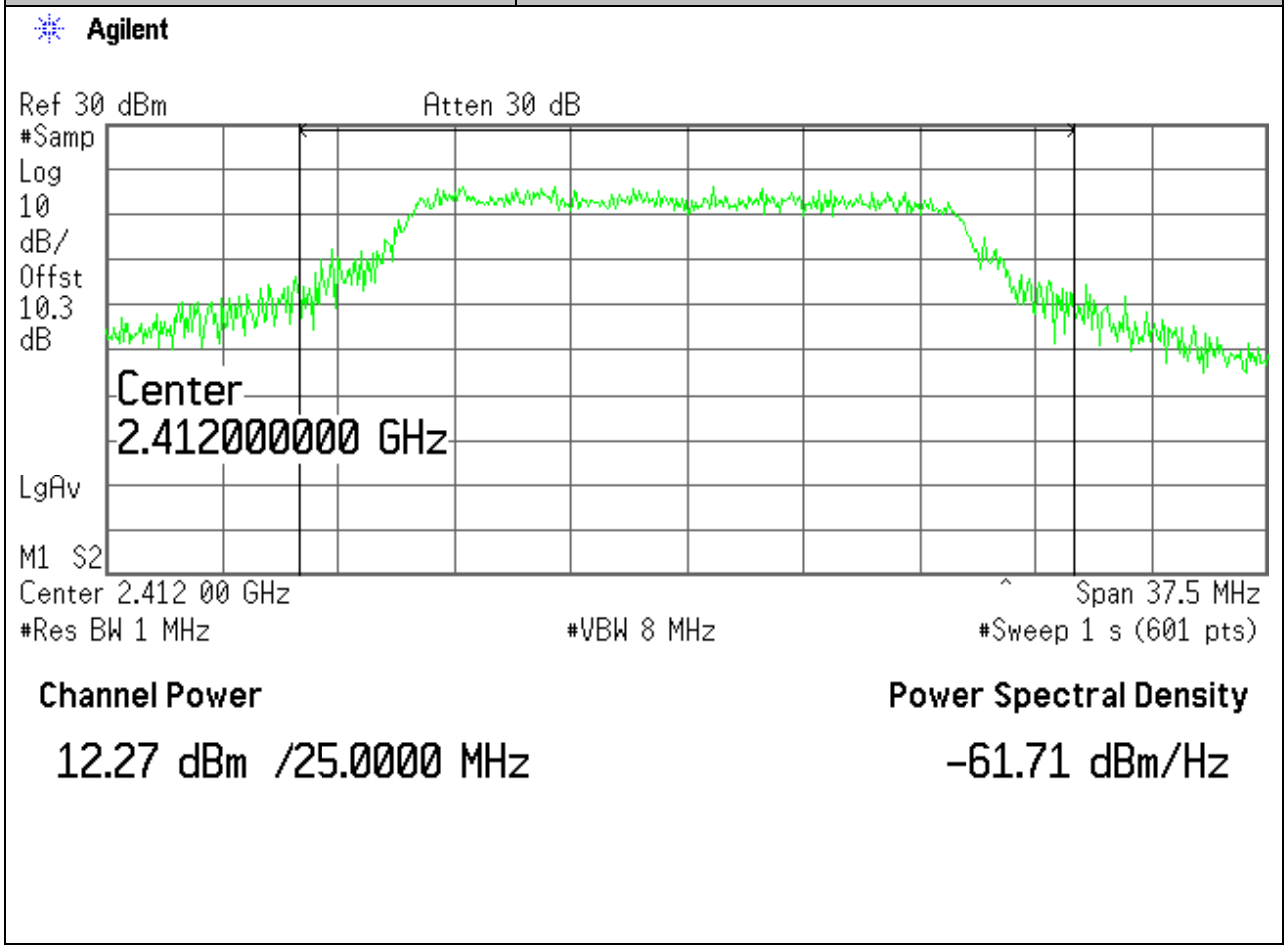
Mode 2: 802.11g / Chain 1

Plot Name:	Output Peak Power @ High CH



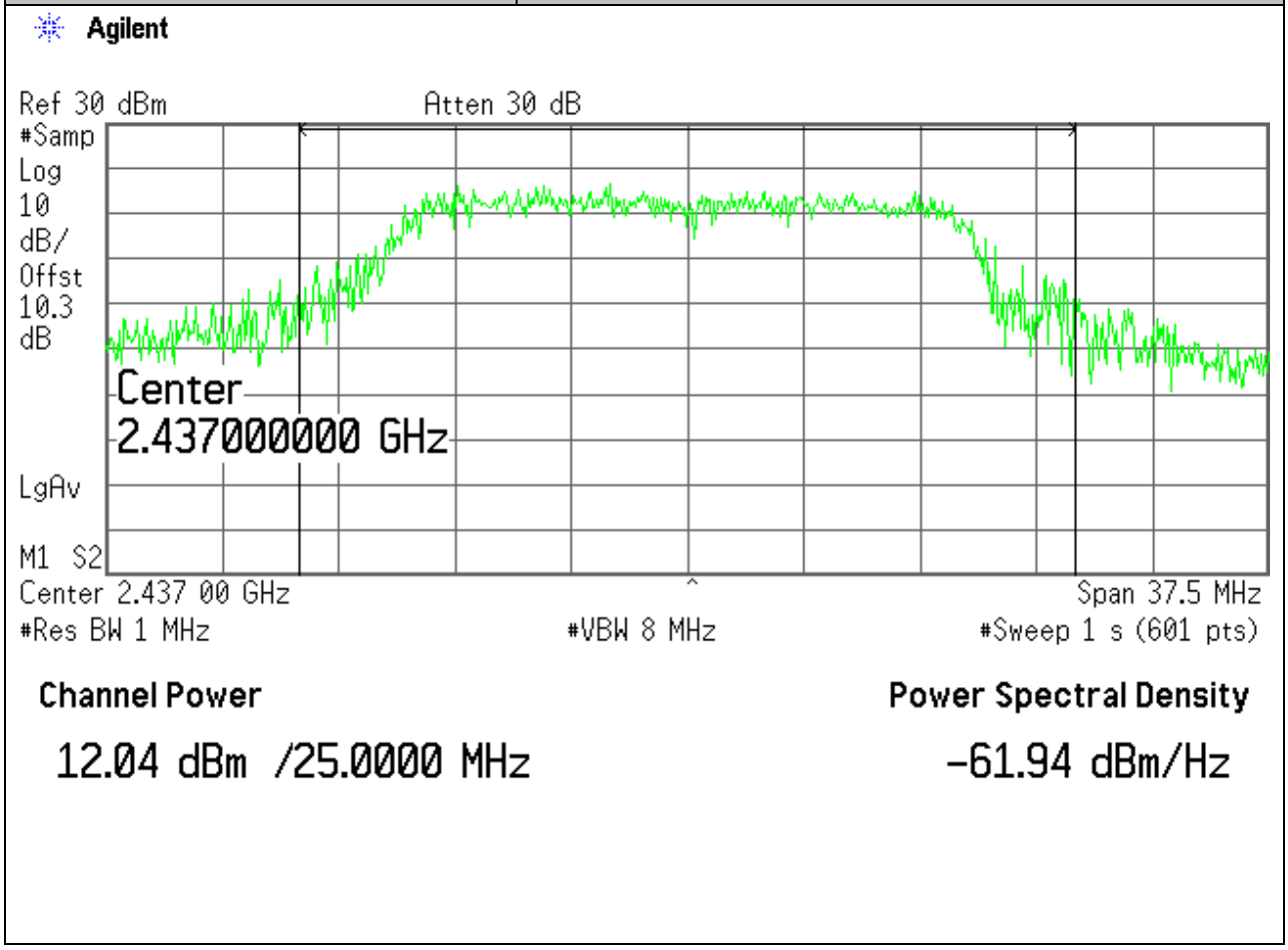
Mode 3: 802.11n (HT-20) / Chain 1

Plot Name:	Output Peak Power @ Low CH



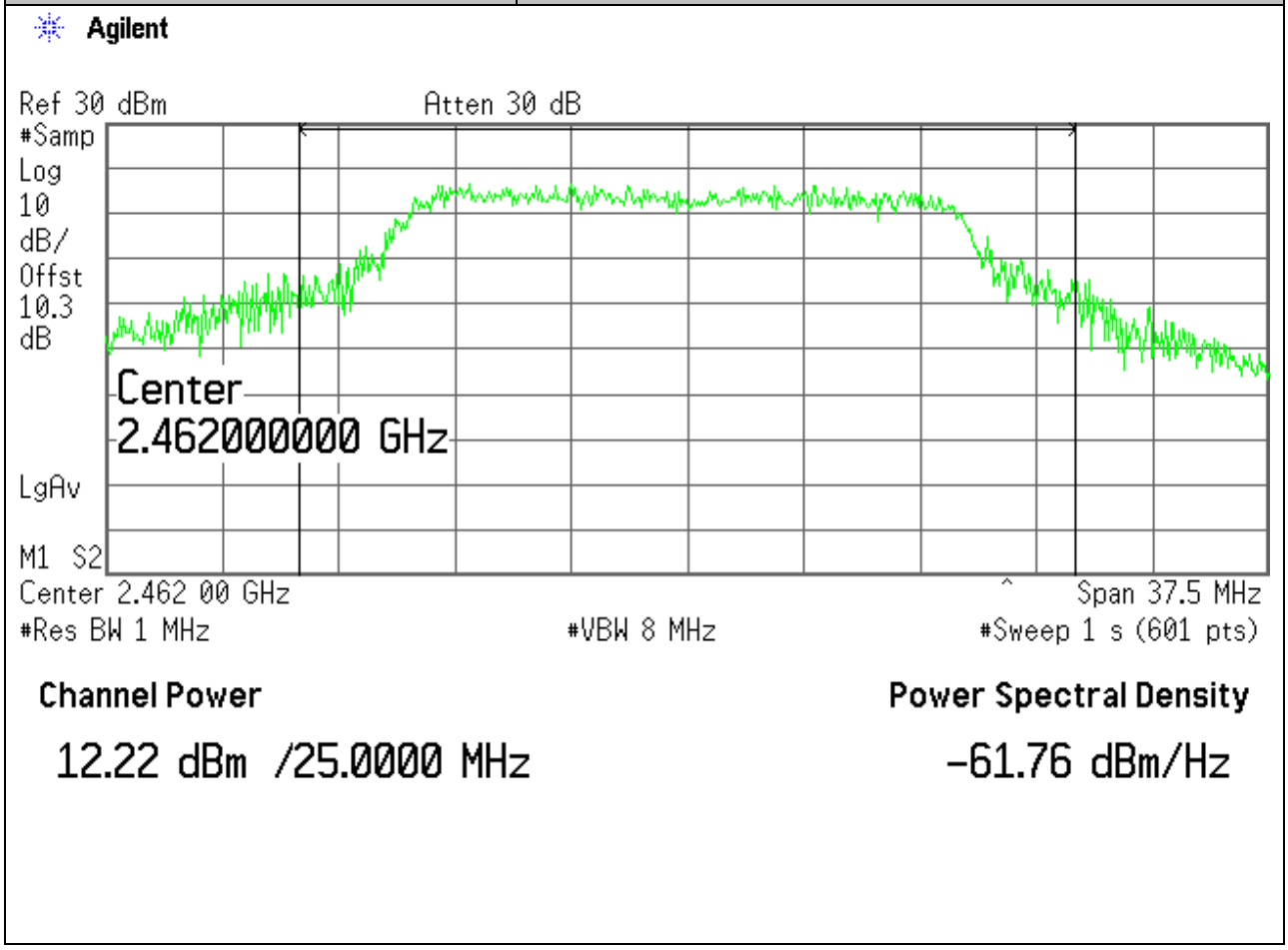
Mode 3: 802.11n (HT-20) / Chain 1

Plot Name:	Output Peak Power @ Middle CH



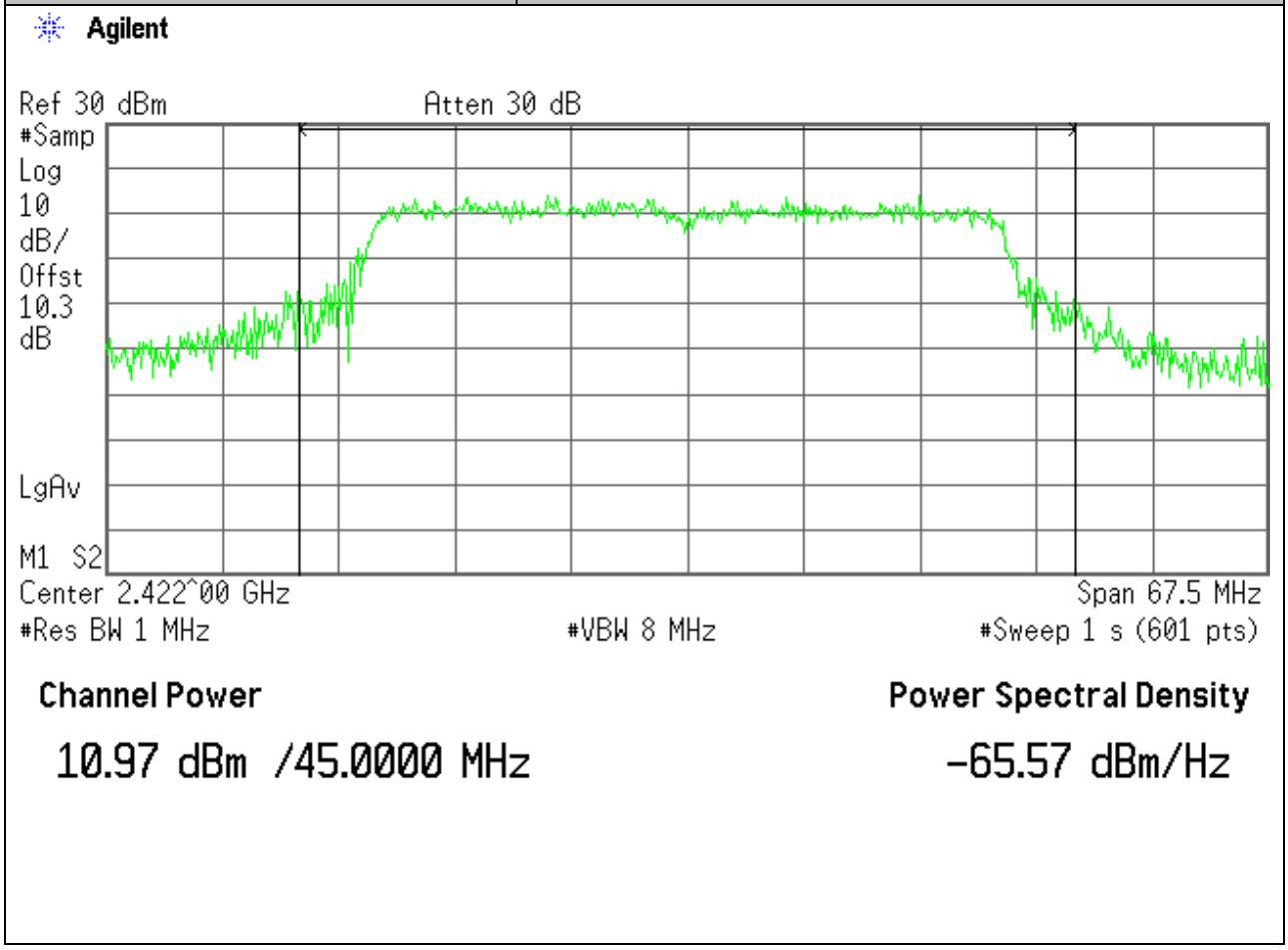
Mode 3: 802.11n (HT-20) / Chain 1

Plot Name:	Output Peak Power @ High CH



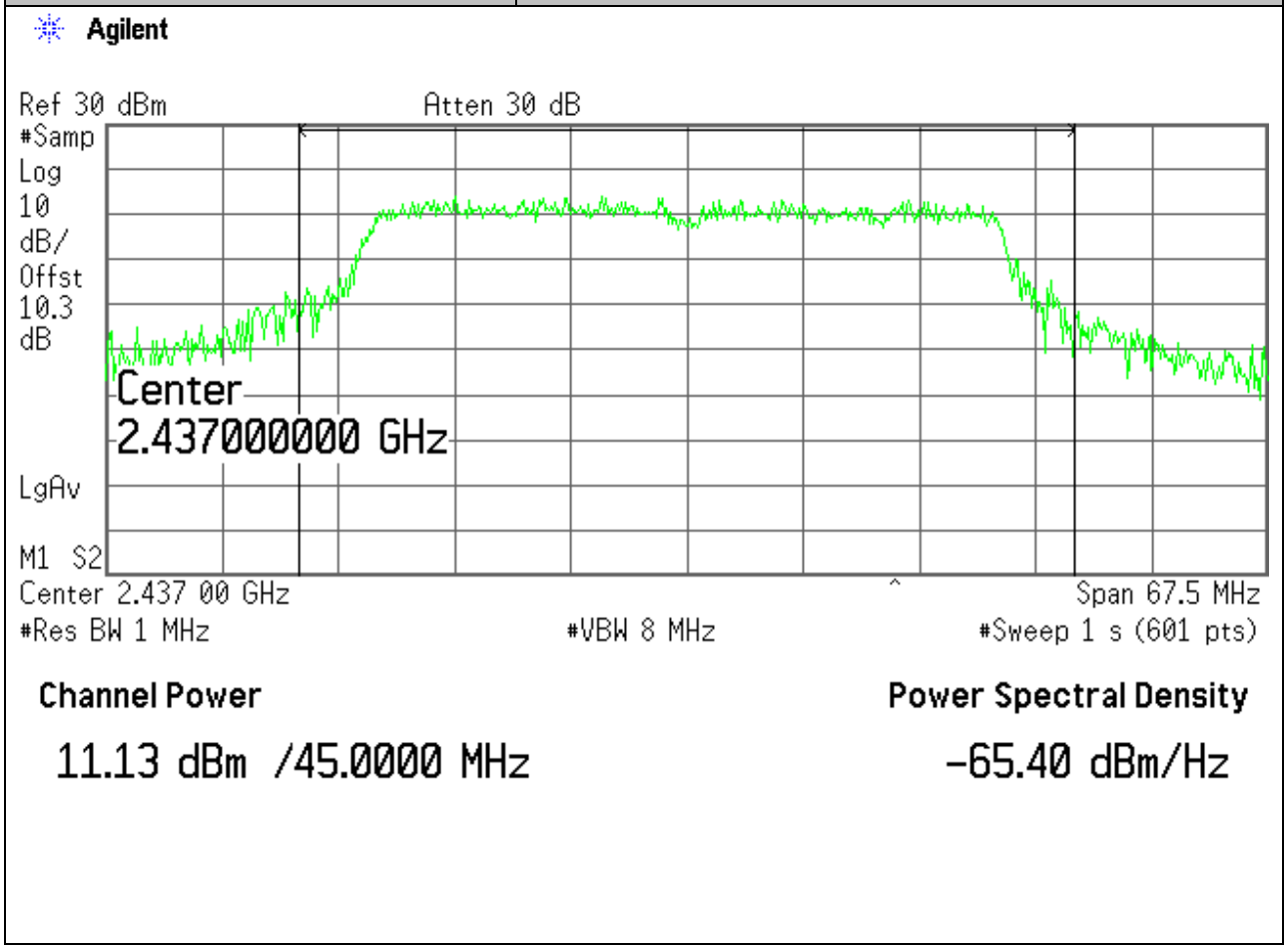
Mode 4: 802.11n (HT-40) / Chain 1

Plot Name:	Output Peak Power @ Low CH



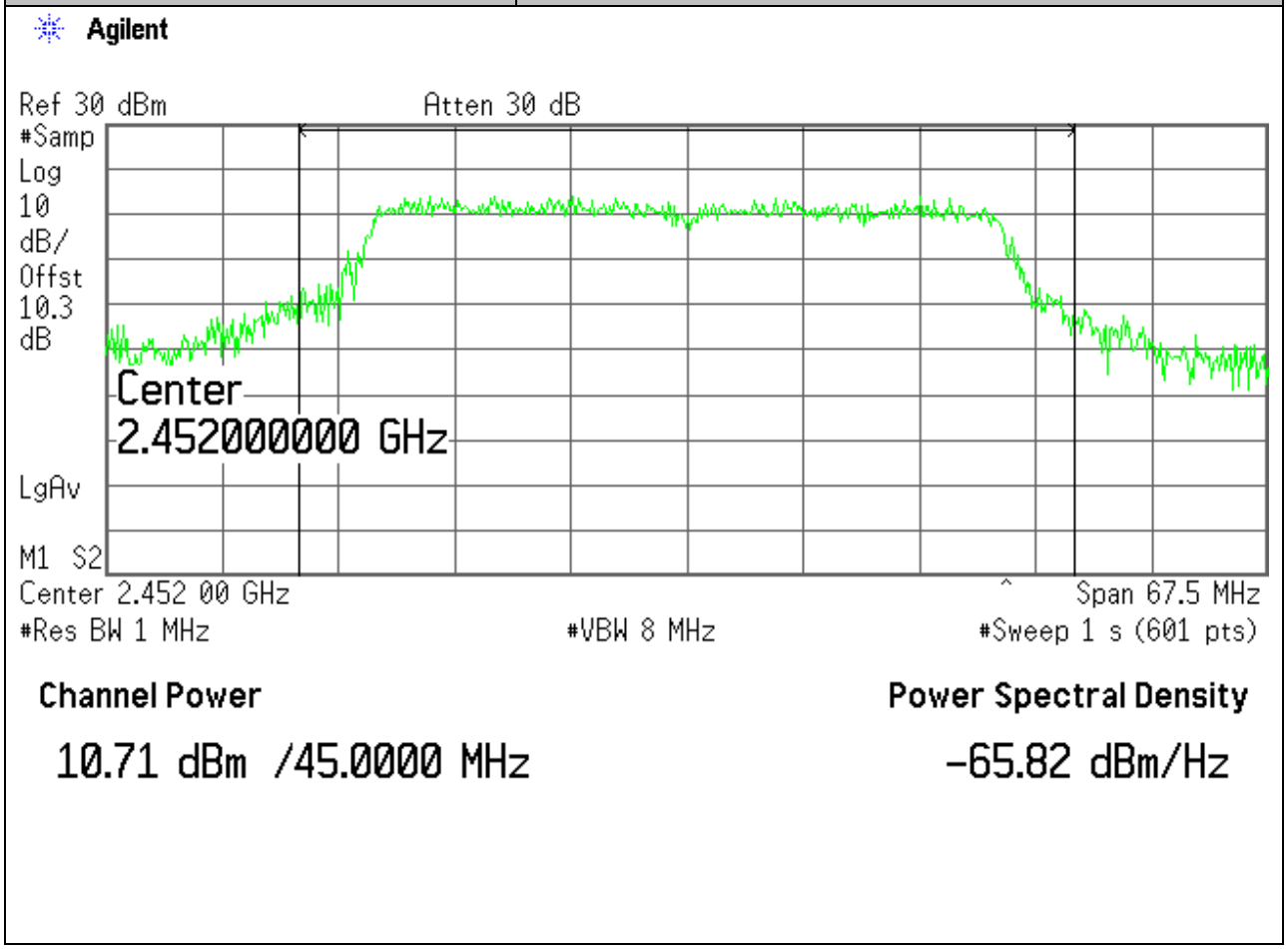
Mode 4: 802.11n (HT-40) / Chain 1

Plot Name:	Output Peak Power @ Middle CH



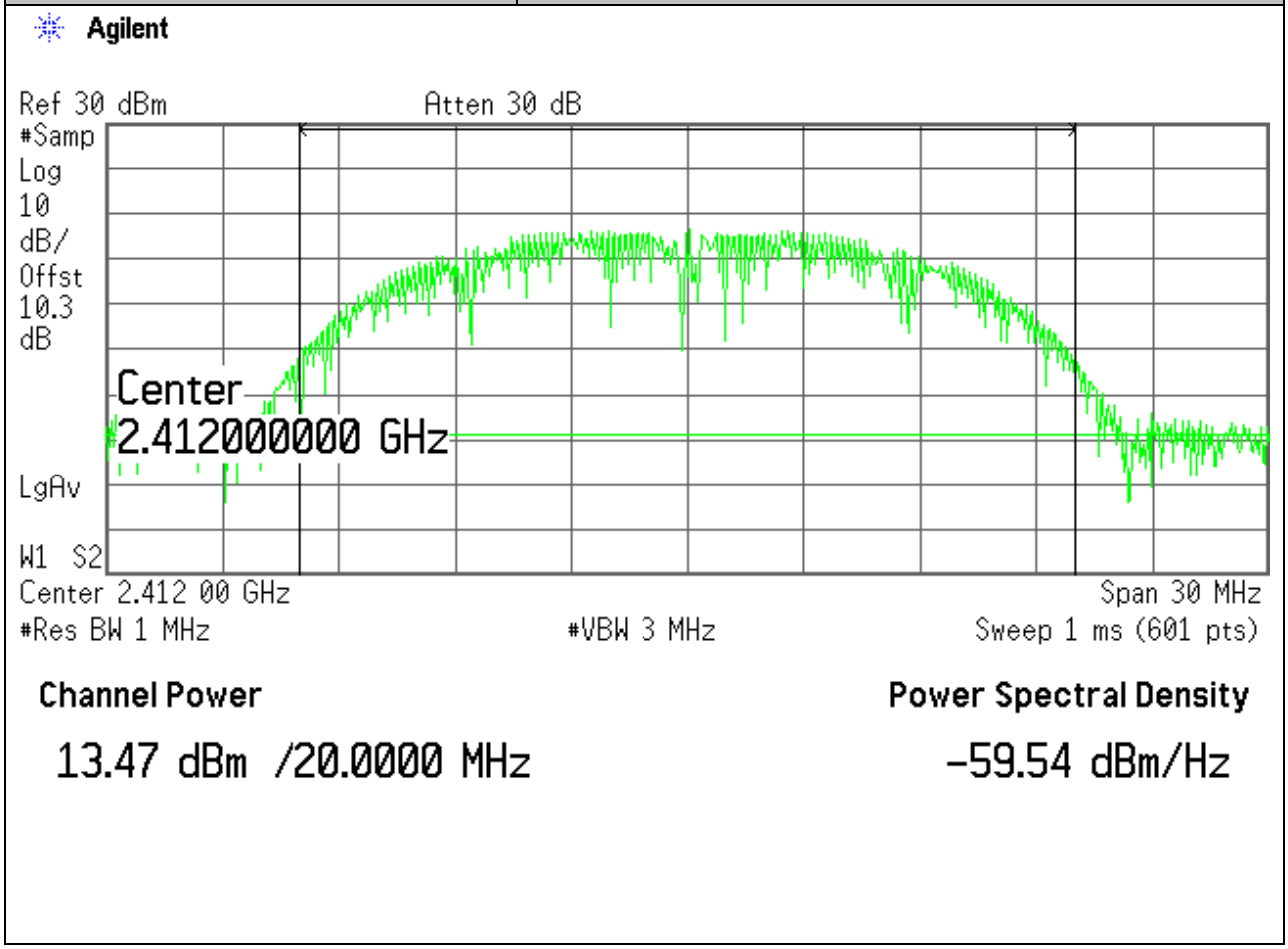
Mode 4: 802.11n (HT-40) / Chain 1

Plot Name:	Output Peak Power @ High CH



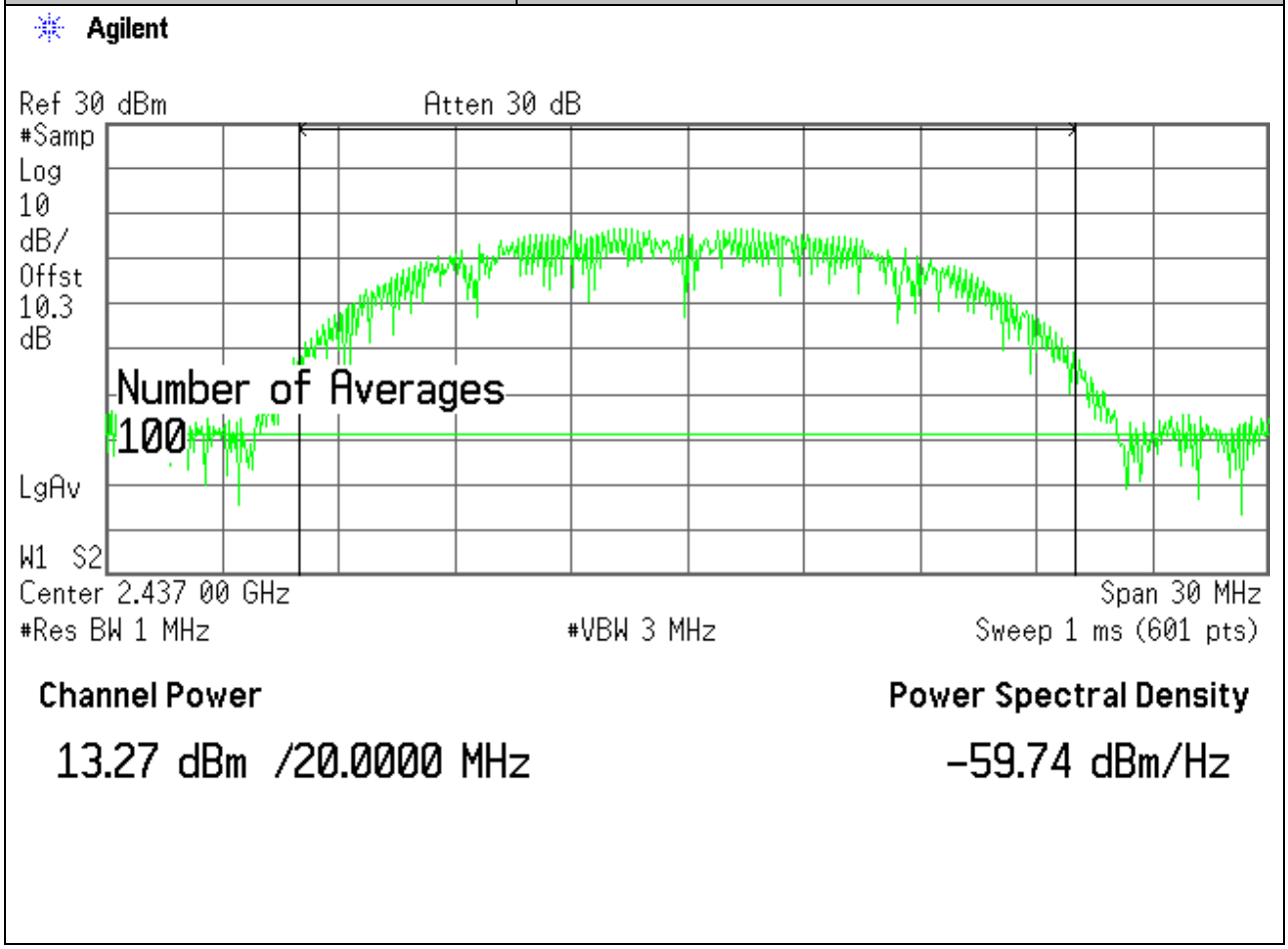
Mode 1: 802.11b / Chain 2

Plot Name:	Output Peak Power @ Low CH



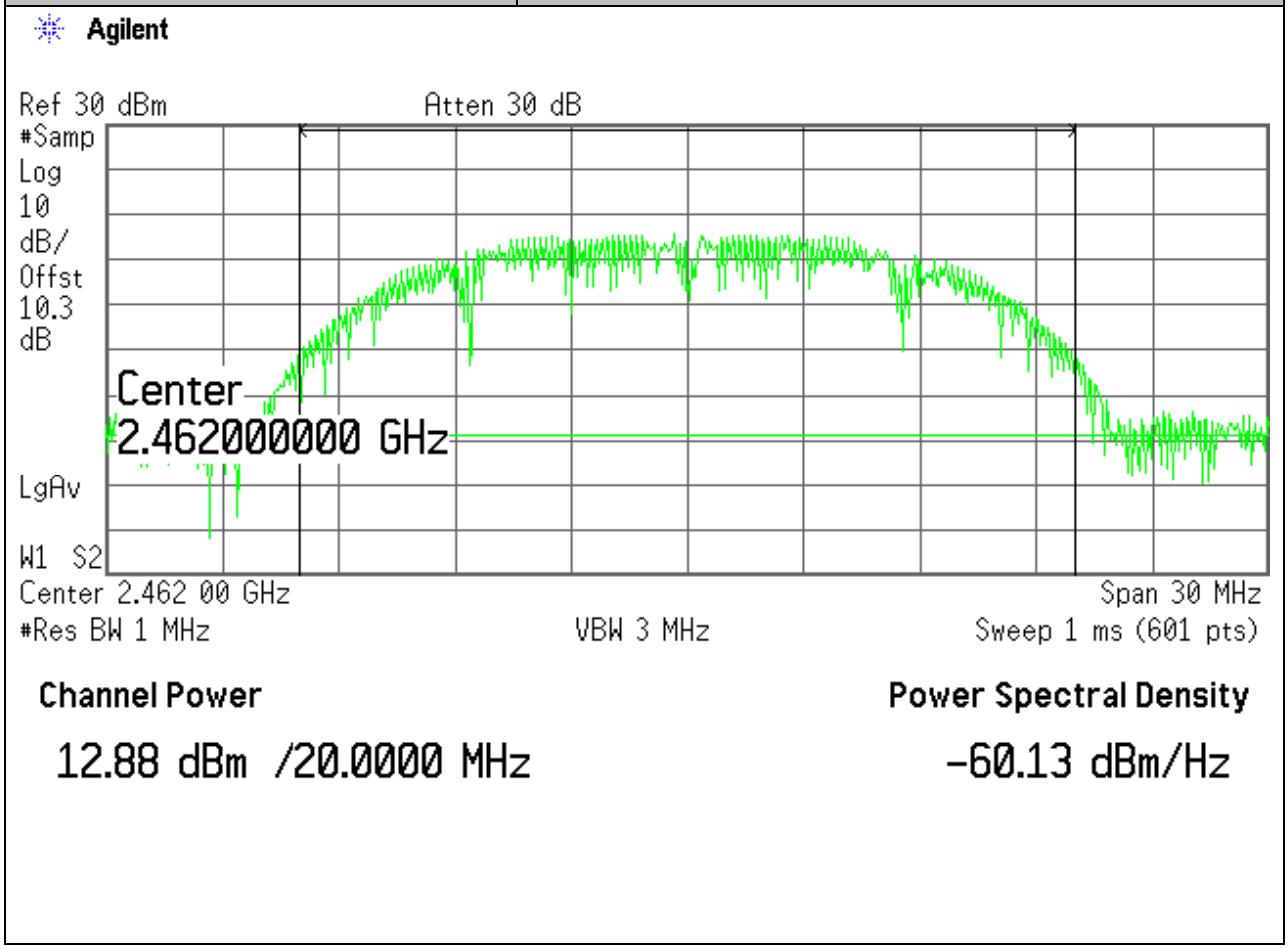
Mode 1: 802.11b / Chain 2

Plot Name:	Output Peak Power @ Middle CH



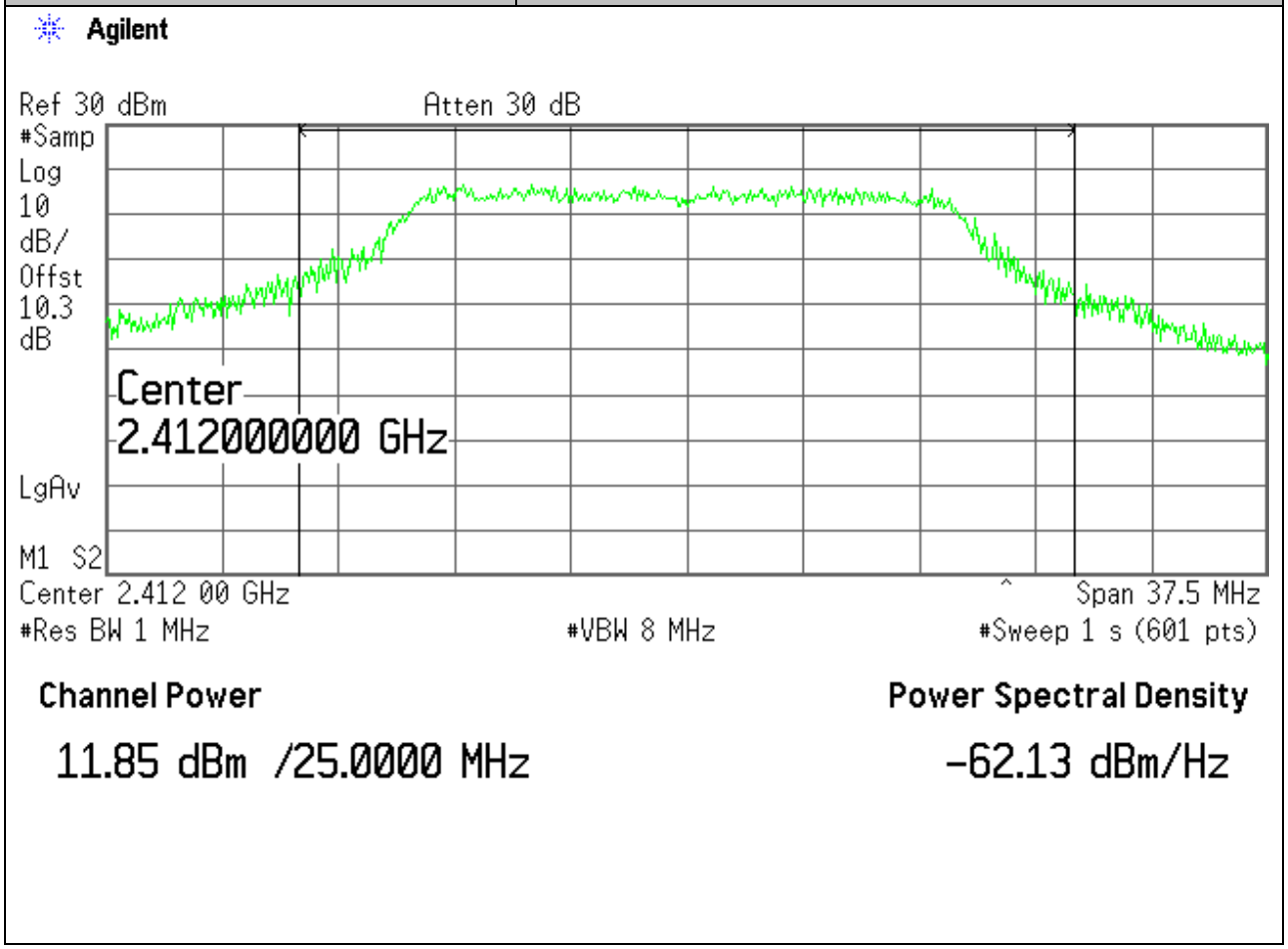
Mode 1: 802.11b / Chain 2

Plot Name:	Output Peak Power @ High CH



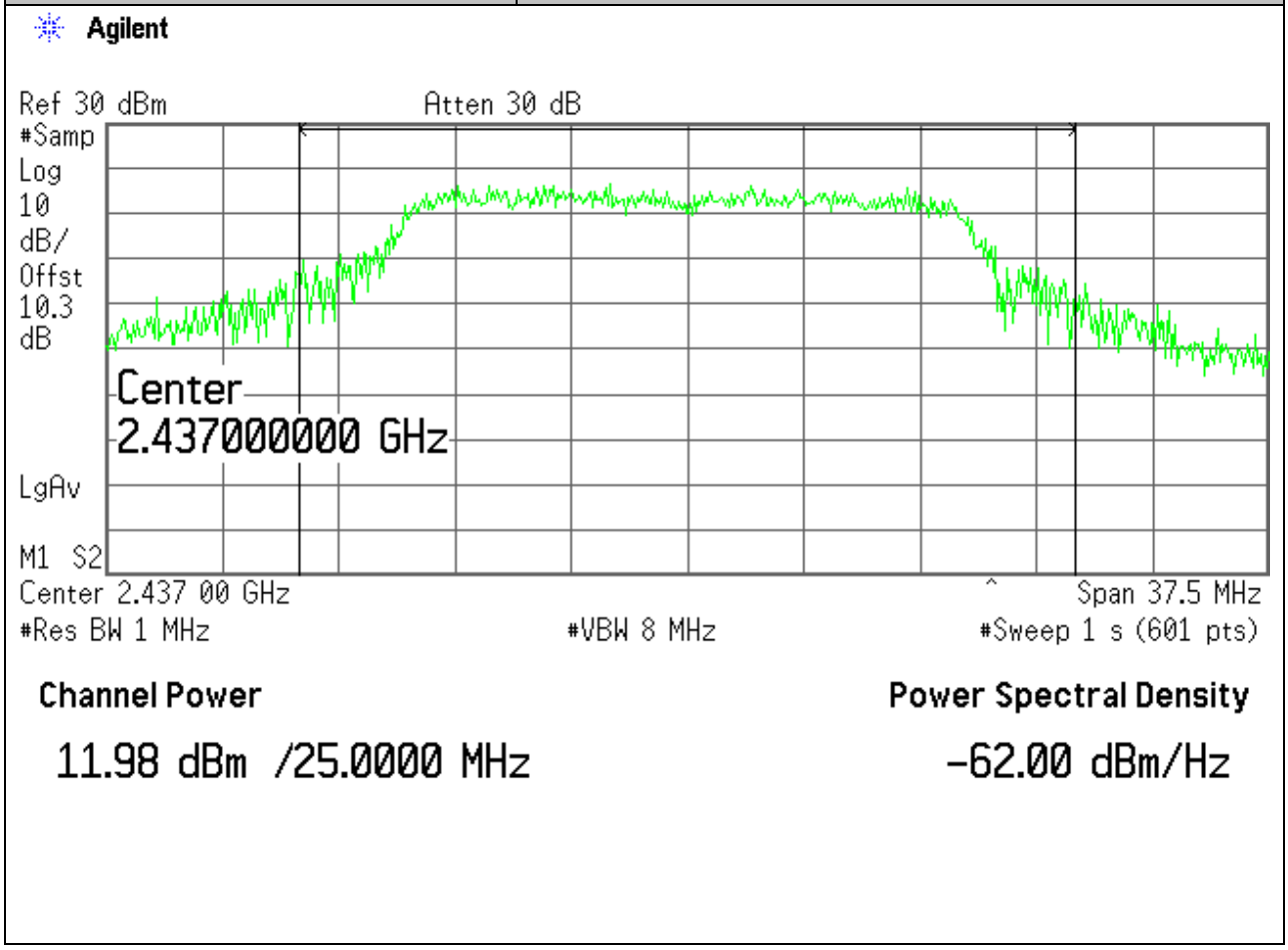
Mode 2: 802.11g / Chain 2

Plot Name:	Output Peak Power @ Low CH



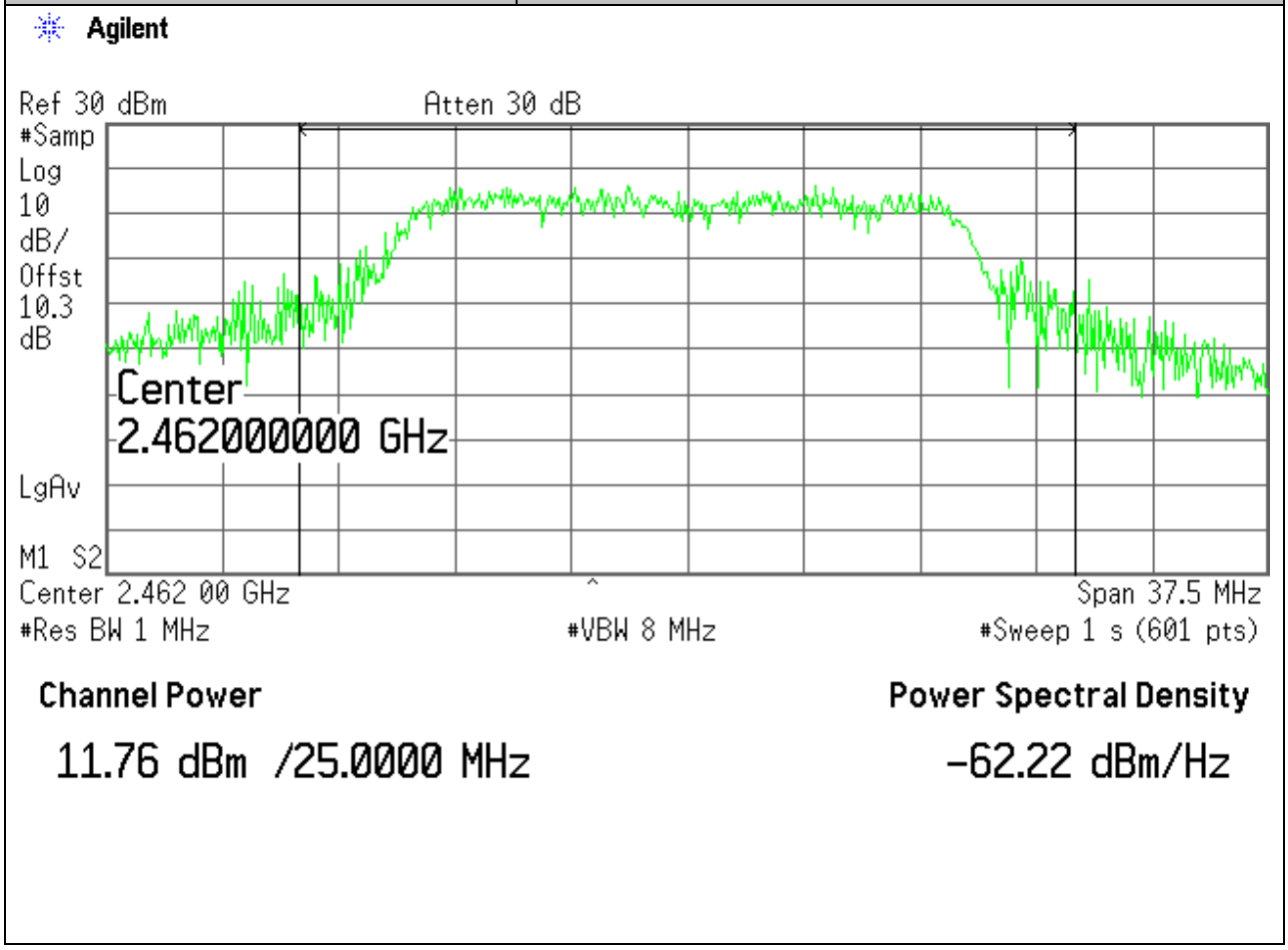
Mode 2: 802.11g / Chain 2

Plot Name:	Output Peak Power @ Middle CH



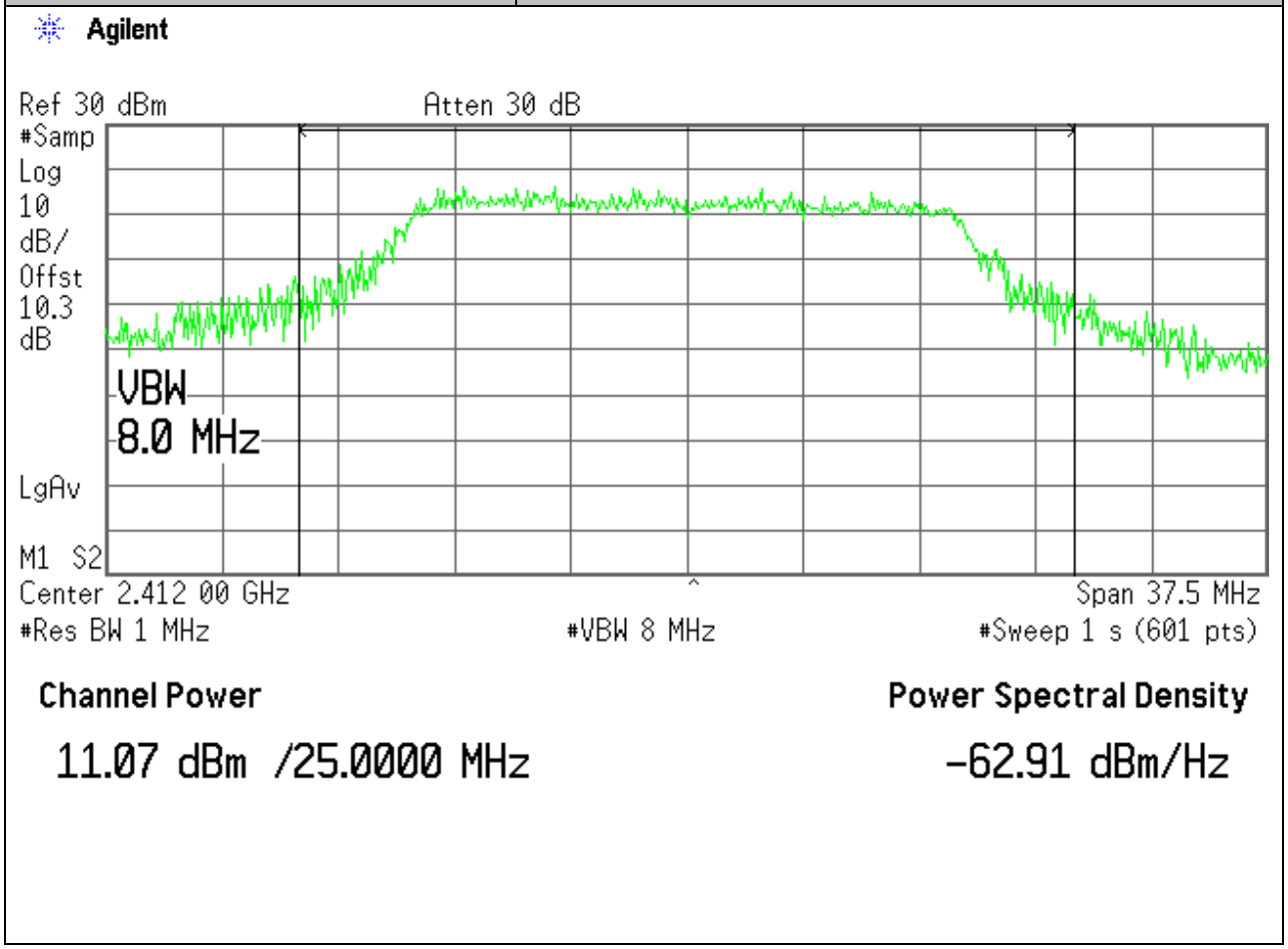
Mode 2: 802.11g / Chain 2

Plot Name:	Output Peak Power @ High CH



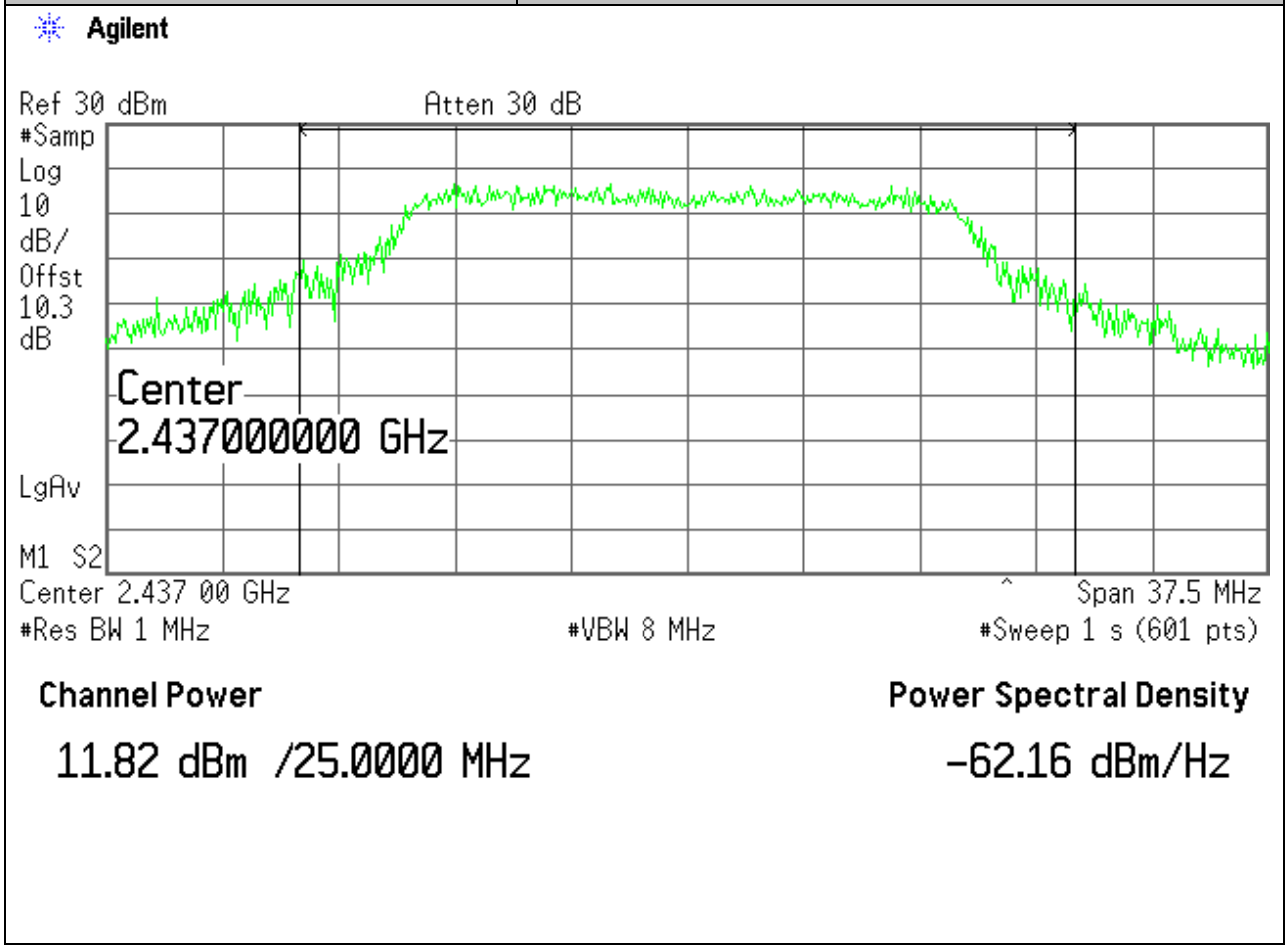
Mode 3: 802.11n (HT-20) / Chain 2

Plot Name:	Output Peak Power @ Low CH



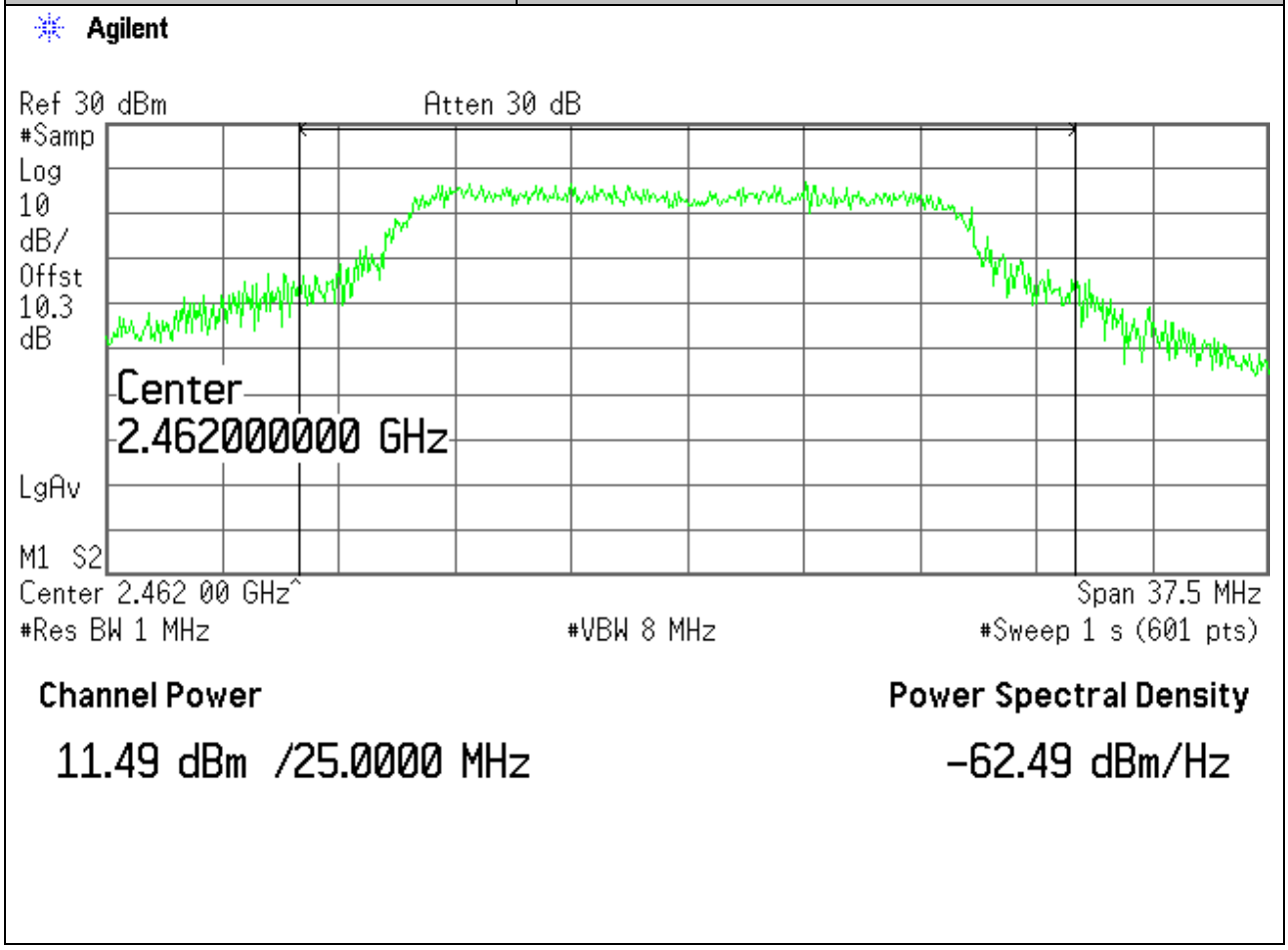
Mode 3: 802.11n (HT-20) / Chain 2

Plot Name:	Output Peak Power @ Middle CH



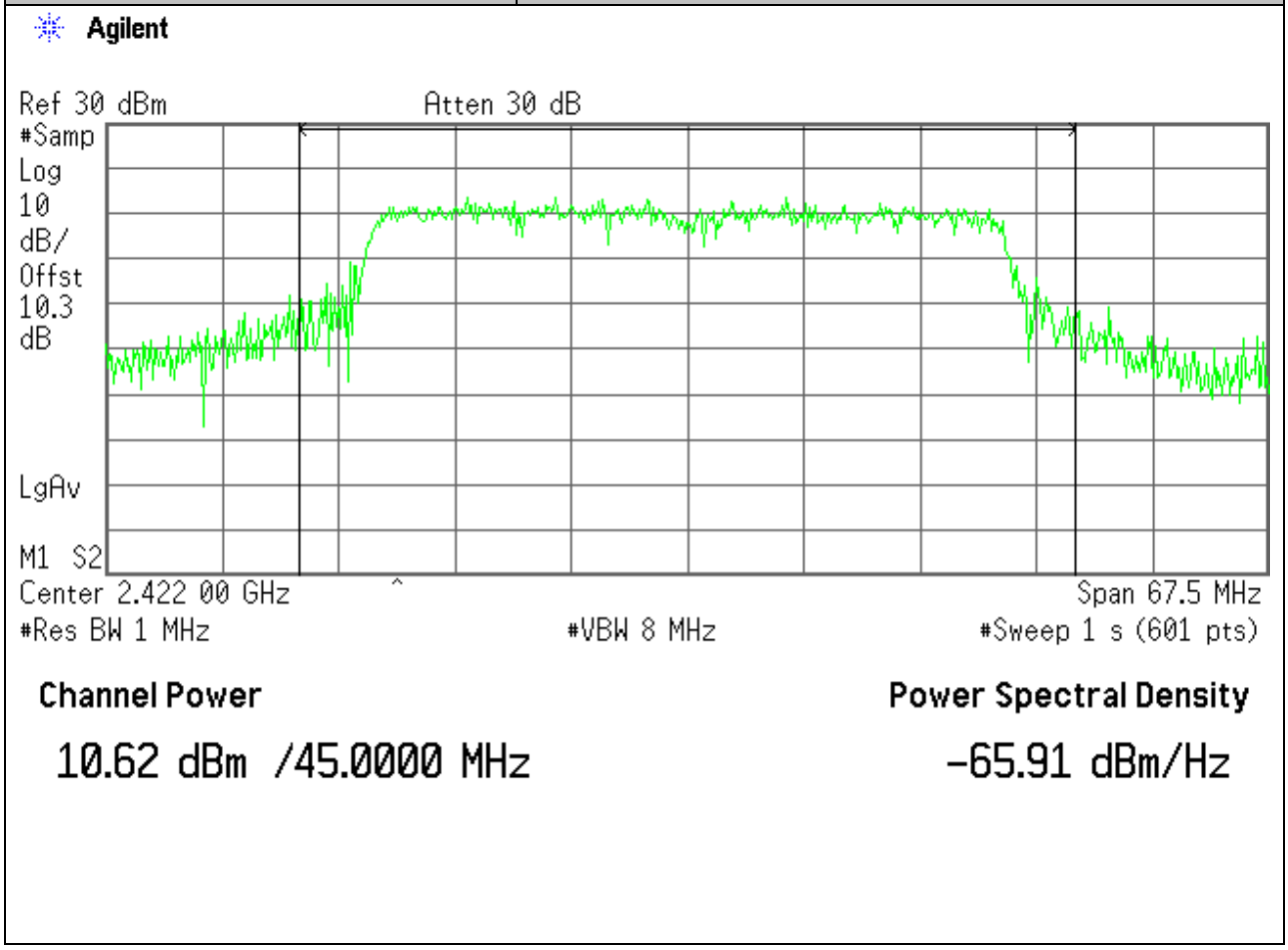
Mode 3: 802.11n (HT-20) / Chain 2

Plot Name:	Output Peak Power @ High CH



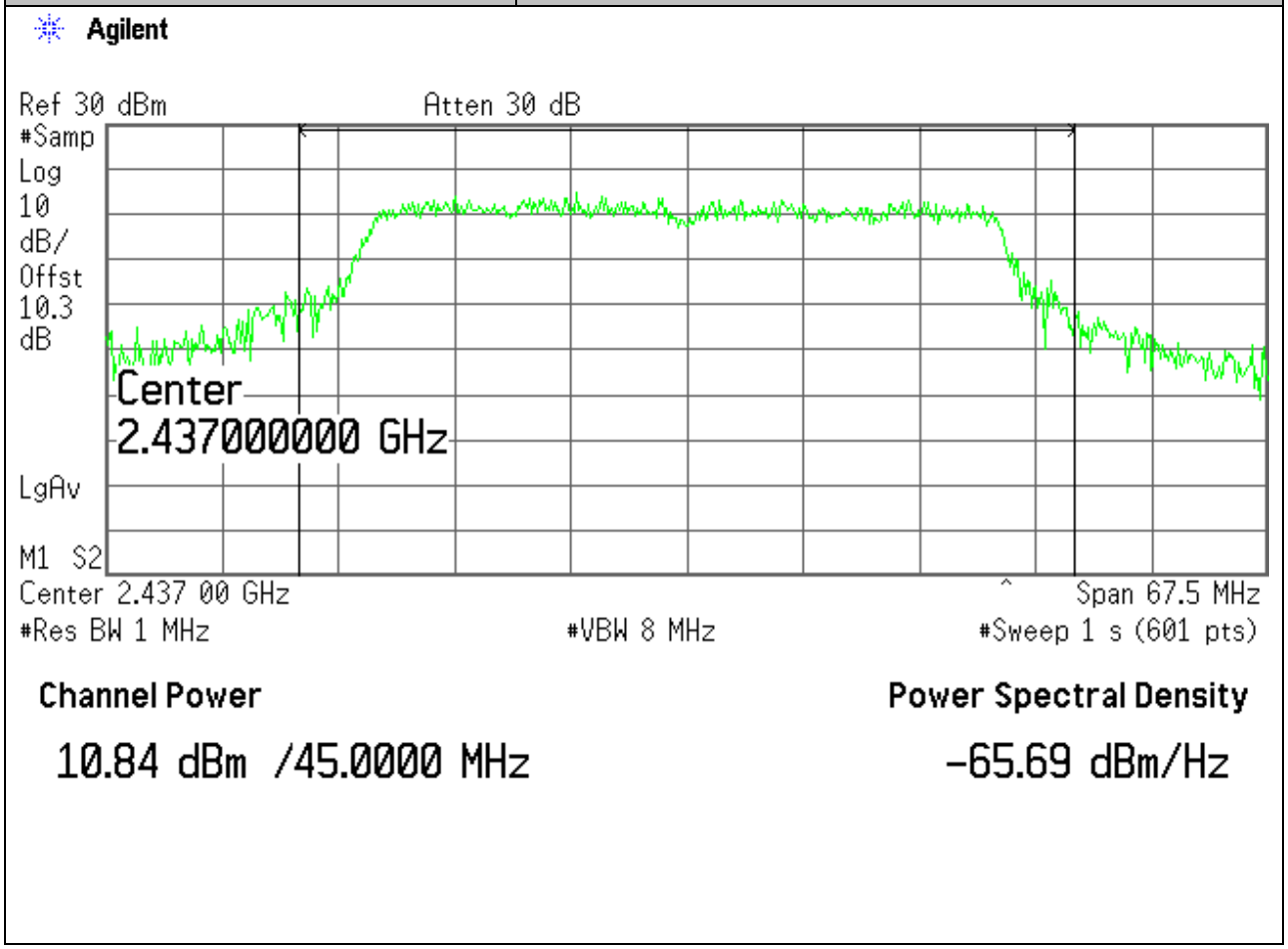
Mode 4: 802.11n (HT-40) / Chain 2

Plot Name:	Output Peak Power @ Low CH



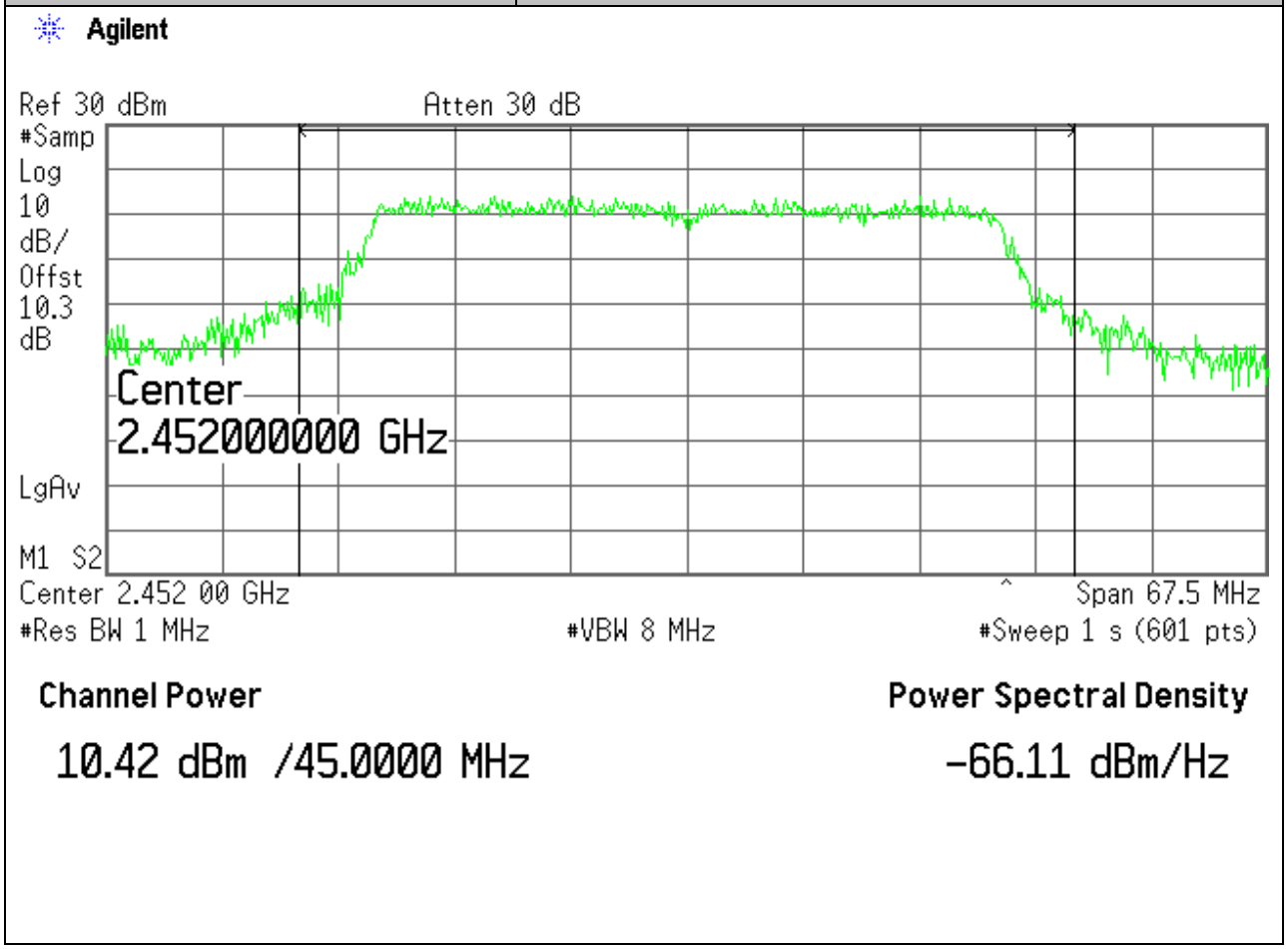
Mode 4: 802.11n (HT-40) / Chain 2

Plot Name:	Output Peak Power @ Middle CH



Mode 4: 802.11n (HT-40) / Chain 2

Plot Name:	Output Peak Power @ High CH



7.3. SAR & MAXIMUM PERMISSIBLE EXPOSURE

LIMITS & RSS-102

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$E = \sqrt{(30 * P * G) / d}$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using: P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$

$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using: P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S}$ Equation (1)

$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2$ Equation (2)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.
Equation (2) and the measured peak power is used to calculate the Power density.

LIMITS

From §1.1310 Table 1 (B),
for Public S = 1.0 mW/cm^2
for Professional, S = 5.0 mW/cm^2

RESULTS

No non-compliance noted:

For this EUT, Pmax= 14.94 dBm, Max G= 18.5 dBi, and d=20cm

Plug all three items into equation (2), and yields,

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
1.0/5.0	14.94	18.5	0.45

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

7.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted.

7.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (e) & RSS-210 A8.2(2)
For direct sequence systems, the peak 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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

RESULTS

No non-compliance noted per QuieTek's File No.: 08BS044R-RF-US-P05V01 dated on 03/02/2009.

7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (d) & RSS- 210 A8.5
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205 (a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

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

The spectrum from 30 MHz to 26.5 GHz (40GHz if applicable) was investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted per QuieTek's File No.: 08BS044R-RF-US-P05V01 dated on 03/02/2009.

7.7. RADIATED SPURIOUS EMISSIONS

7.7.1. EMISSION TESTING PROCEDURE

LIMITS

§15.205 (a) RSS-102 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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§15.205 (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.

§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 (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Per FCC KDB Publication No. 558074, for measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

The emissions are investigated with the transmitter set to the lowest, middle, and highest channels.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

No non-compliance noted.

7.7.2. EMISSION TESTING DATA

For WLM200N2-26 RF Module hosted in RM-24/AP25 Radio Unit

A. Harmonics & Spurious above 1GHz

Freq. (MHz)	Polarity &BW (H,V &M1,M2,M3,M4)**			Peak (dBuV/m)	Avg. (dBuV/m)		PK Lim (dBuV/m)	Avg.Lim (dBuV/m)	PK Mar (dBuV/m)	Avg.Mar. (dBuV/m)
Low Channel Harmonics										
4822	H, M1			**45.6**	**37.8**		74	54	-28.4	-16.2
4822	V, M1			**46.0**	**38.0**		74	54	-28	-16
4822	H, M2			**44.2**	**37.0**		74	54	-29.8	-23
4825	V, M2			**45.0**	**37.1**		74	54	-29	-22.9
4826	H, M3			**43.3**	**35.9**		74	54	-30.7	-24.1
4824	V, M3			**43.7**	**35.5**		74	54	-30.3	-24.5
4840*	H, M4			**40.8**	**34.3**		74	54	-33.2	-25.7
4842*	V, M4			**40.3**	**34.0**		74	54	-33.7	-26
Mid Channel Harmonics										
4874	H, M1			**45.0**	**37.4**		74	54	-29	-16.6
4874	V, M1			**45.3**	**37.6**		74	54	-28.7	-16.4
4874	H, M2			**44.0**	**36.5**		74	54	-30	-23.5
4876	V, M2			**45.7**	**37.2**		74	54	-28.3	-22.8
4870	H, M3			**43.5**	**36.0**		74	54	-30.5	-24
4872	V, M3			**43.6**	**36.1**		74	54	-30.4	-23.9
4868	H, M4			**41.5**	**35.0**		74	54	-32.5	-25
4875	V, M4			**41.8**	**35.2**		74	54	-32.2	-24.8
High Channel Harmonics										
4940	H, M1			**45.8**	**37.9**		74	54	-28.2	-16.1
4940	V, M1			**46.5**	**38.4**		74	54	-27.5	-15.6
4940	H, M2			**44.8**	**36.9**		74	54	-29.2	-23.1
4940	V, M2			**46.0**	**37.0**		74	54	-28	-23
4940	H, M3			**44.1**	**36.2**		74	54	-29.9	-23.8
4940	V, M3			**43.7**	**36.0**		74	54	-30.3	-24
4940	H, M4			**41.3**	**34.9**		74	54	-32.7	-25.1
4940	V, M4			**41.4**	**35.4**		74	54	-32.6	-24.6

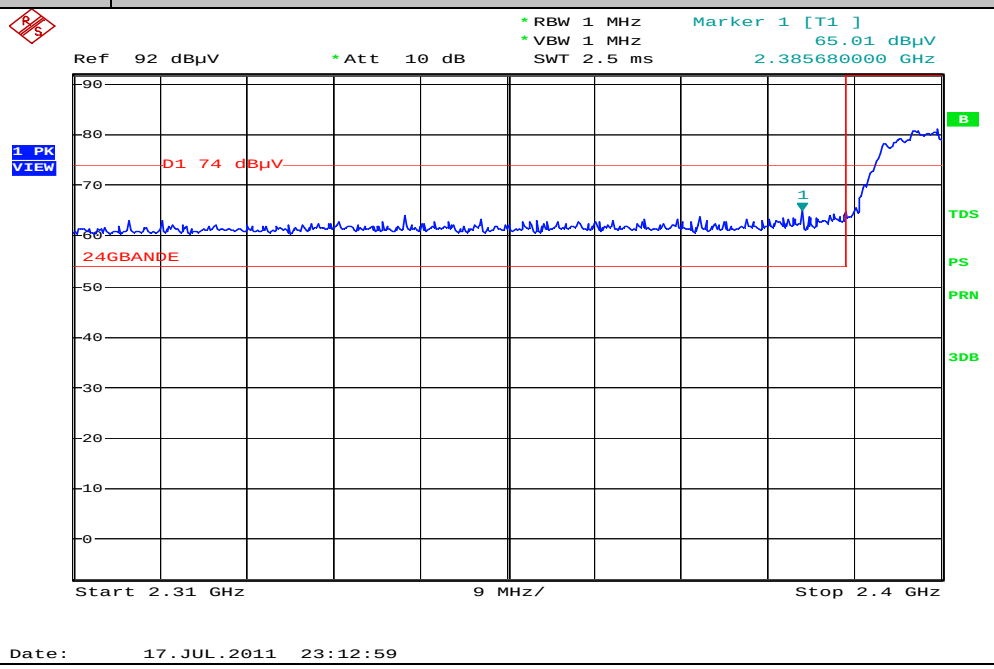
No other significant harmonics or spurious emissions were detected in the rest band above system floor, noise above -20dB to the limit.
* Measured @ noise level
**M1,M2,M3,M4 represent Mode 1, Mode 2, Mode 3, Mode4. Both Chain 1 and Chain 2 are turned on for worst case (as cross-polarized antenna is used and rated individual chain 1& chain 2 tx power is fed into each antenna's input port, respectively). Final results are documented in the report, based on pre-testing investigations for all modes.

In addition, the band-edge requirements are also verified. The testing results for worst case are shown as following and comply with the band-edge requirements for 2400-2483.5MHz DTS per FCC Part 15.247 & FCC KDB Publication No. 558074. Antenna with max gain (18.5dBi) was used for this testing.

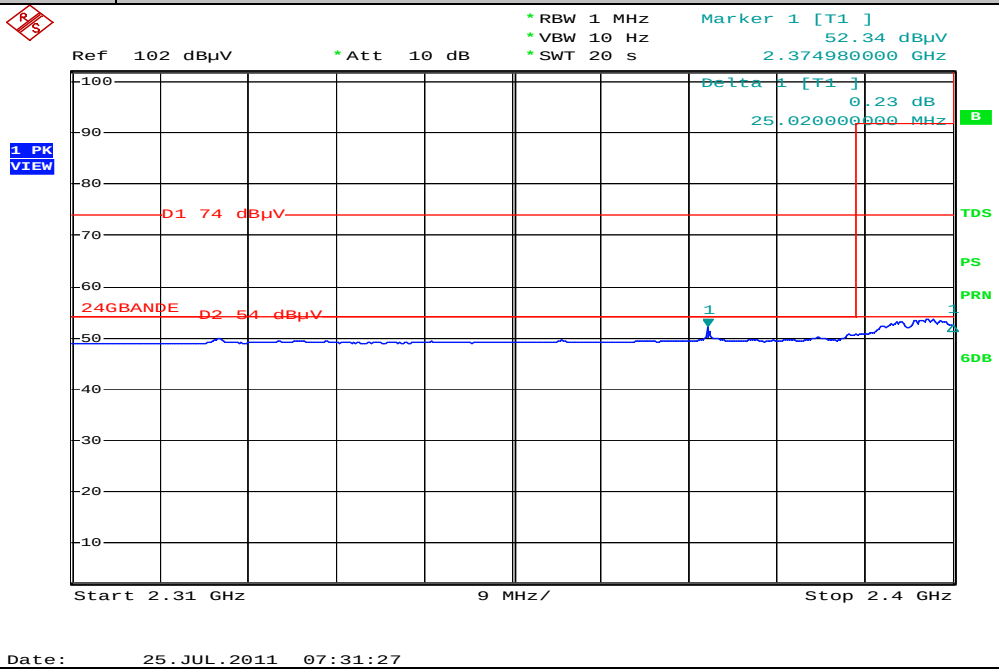
- H=Measurement antenna horizontal position
- V= Measurement antenna vertical position
- Both Chain 1 and Chain 2 are turned on for worst case (as cross-polarized antenna is used and rated individual chain 1& chain 2 tx power is fed into each antenna's input port, respectively). Final results are documented in the report, based on pre-testing investigations for all modes.
- Using conventional manner for measuring the radiated emissions that are removed by more than two measurement bandwidths from band-edge, such as the emissions in the restricted band 2310-2390MHz & 2483.5-2500MHz, etc.
- Using conventional manner or if needed, using "delta" measurement technique for measuring the radiated emissions that are up to two measurement bandwidths removed from band-edge, such as the restricted band that begins at 2483.5MHz.

Mode 1: 802.11b

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, H

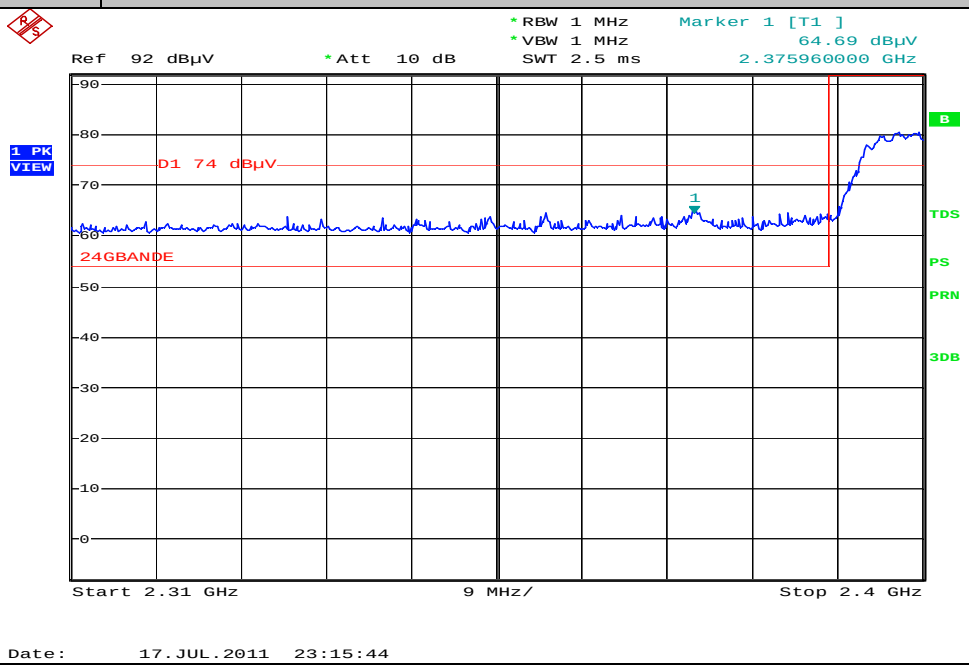


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, H

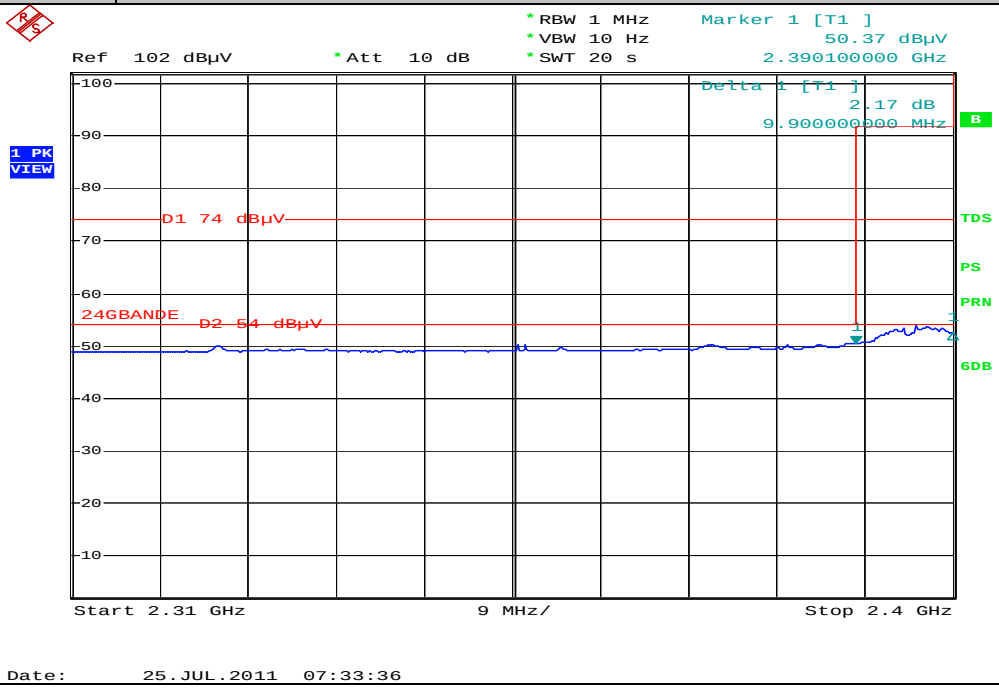


Mode 1: 802.11b

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, V

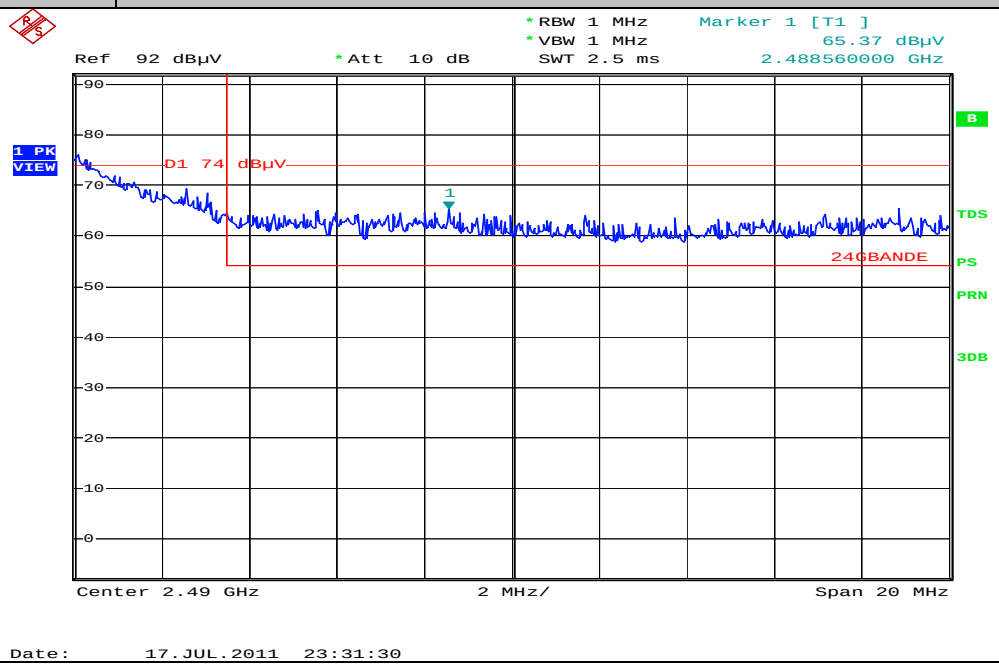


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, V

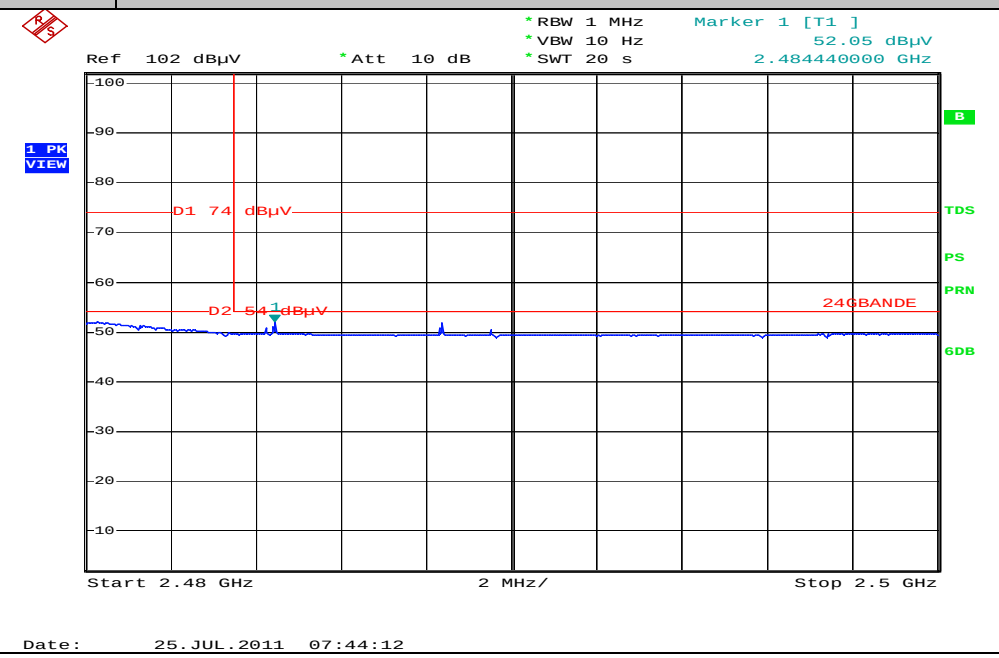


Mode 1: 802.11b

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, H

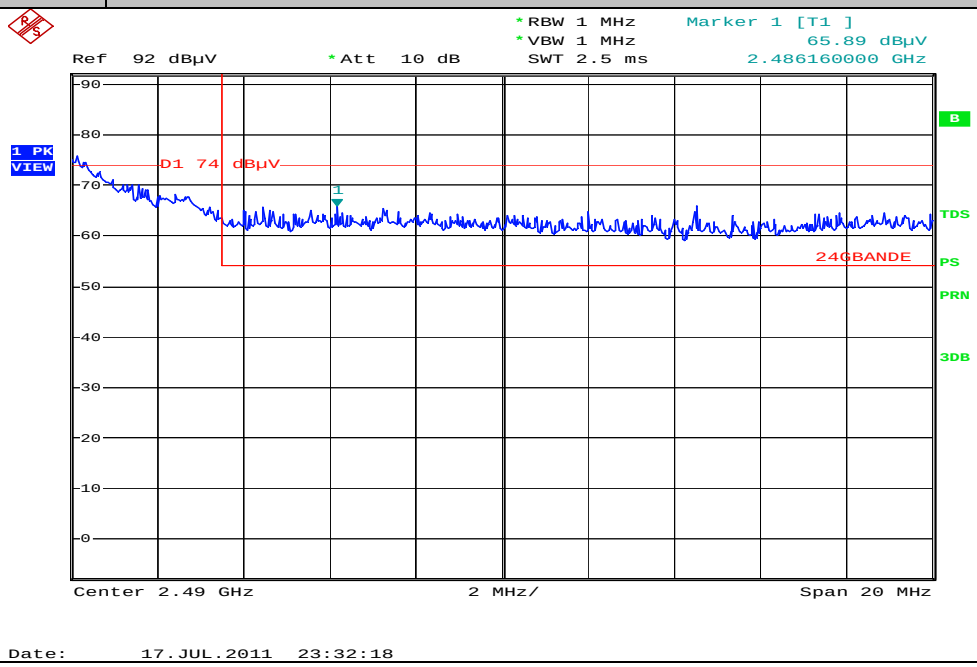


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, H

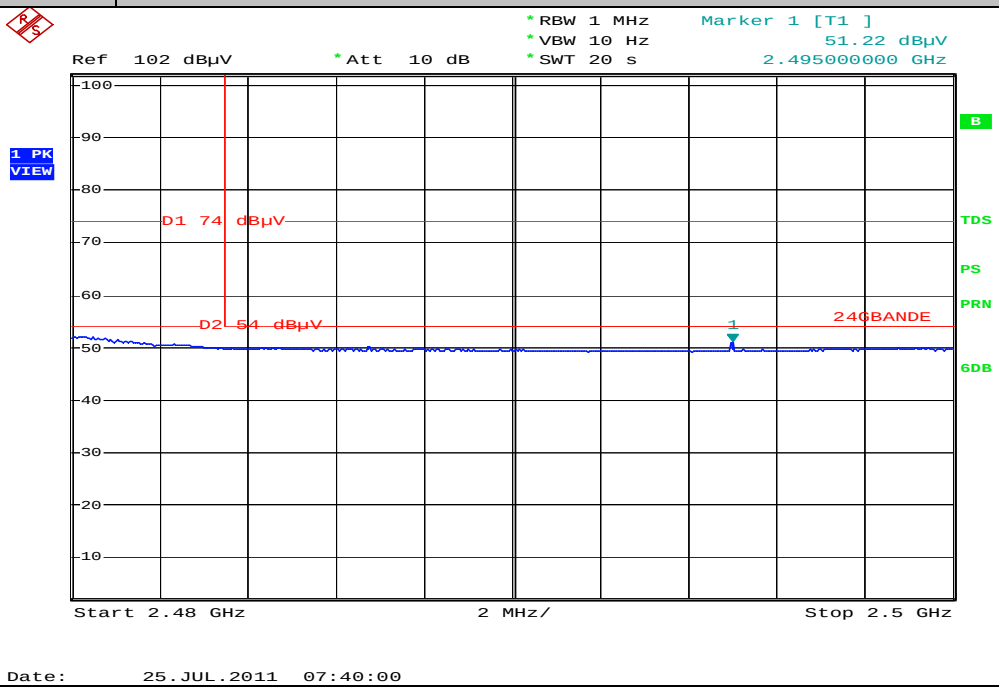


Mode 1: 802.11b

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, V

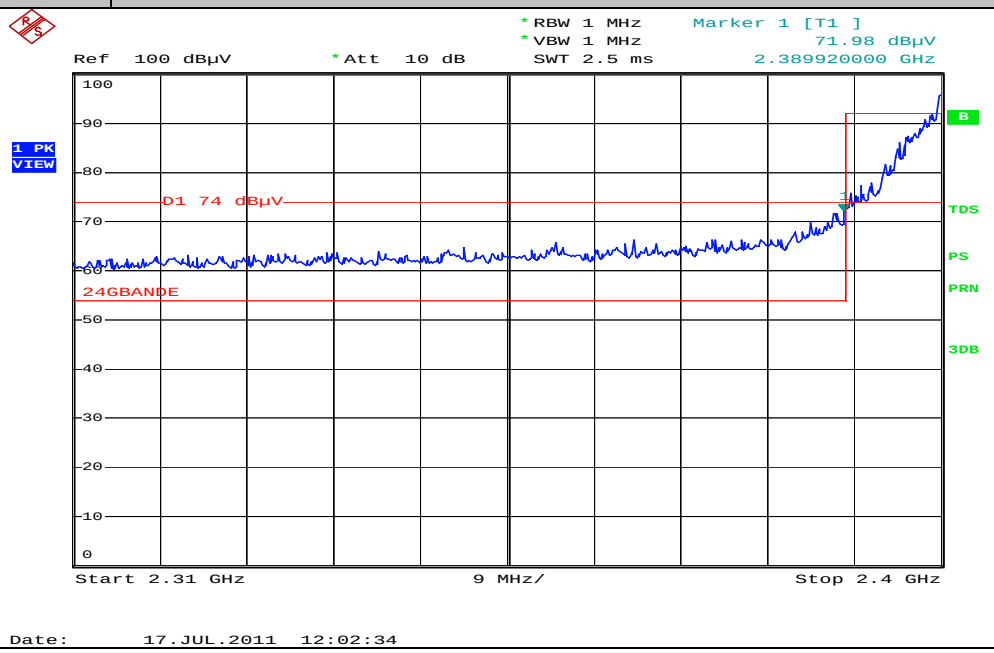


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, V

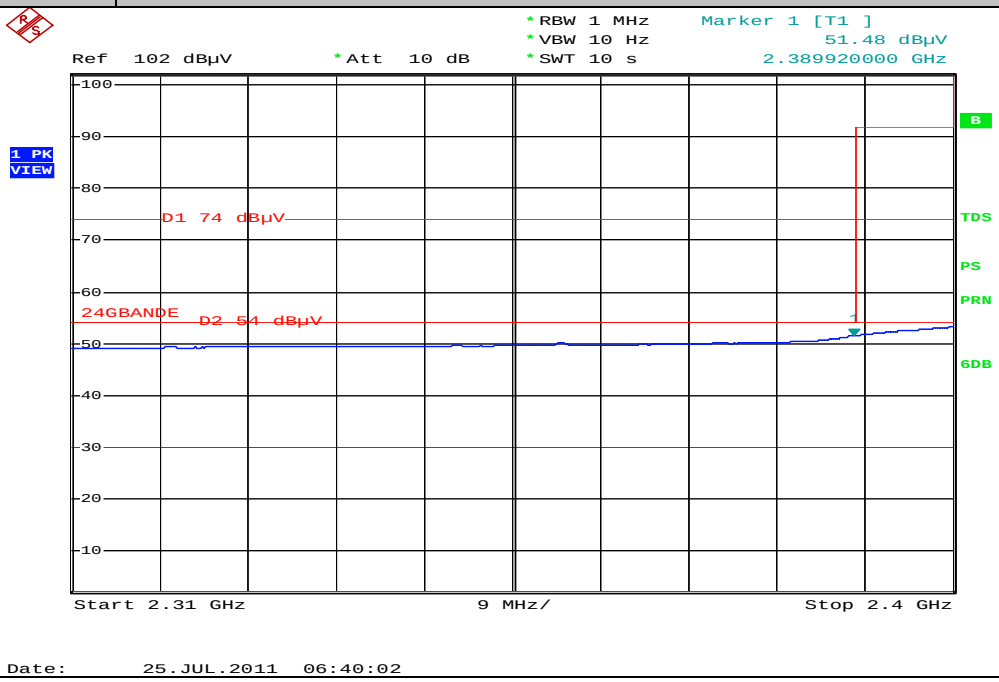


Mode 2: 802.11g

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, H

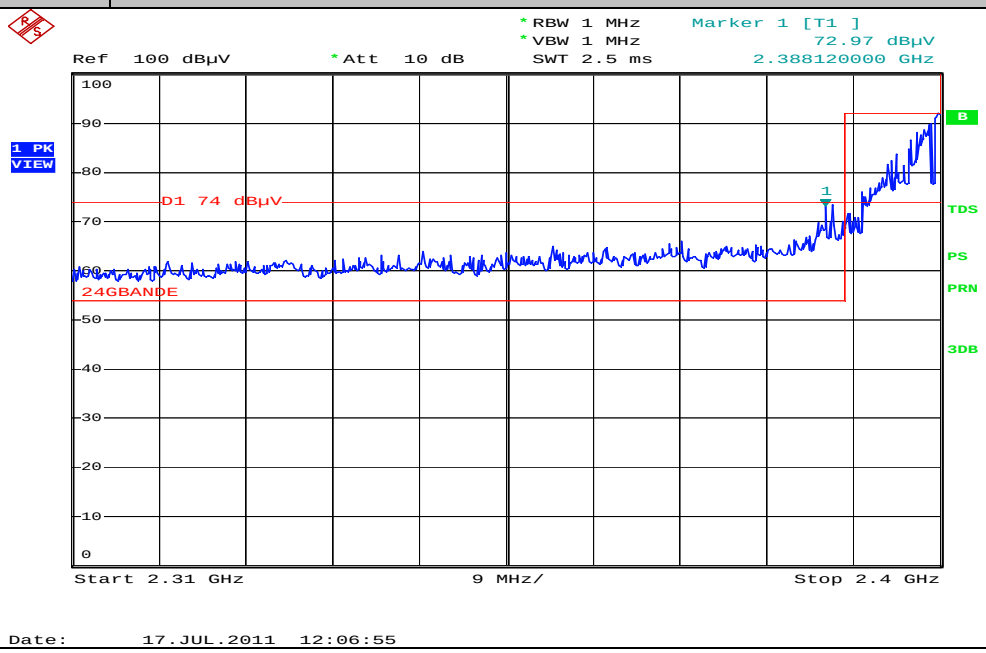


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, H

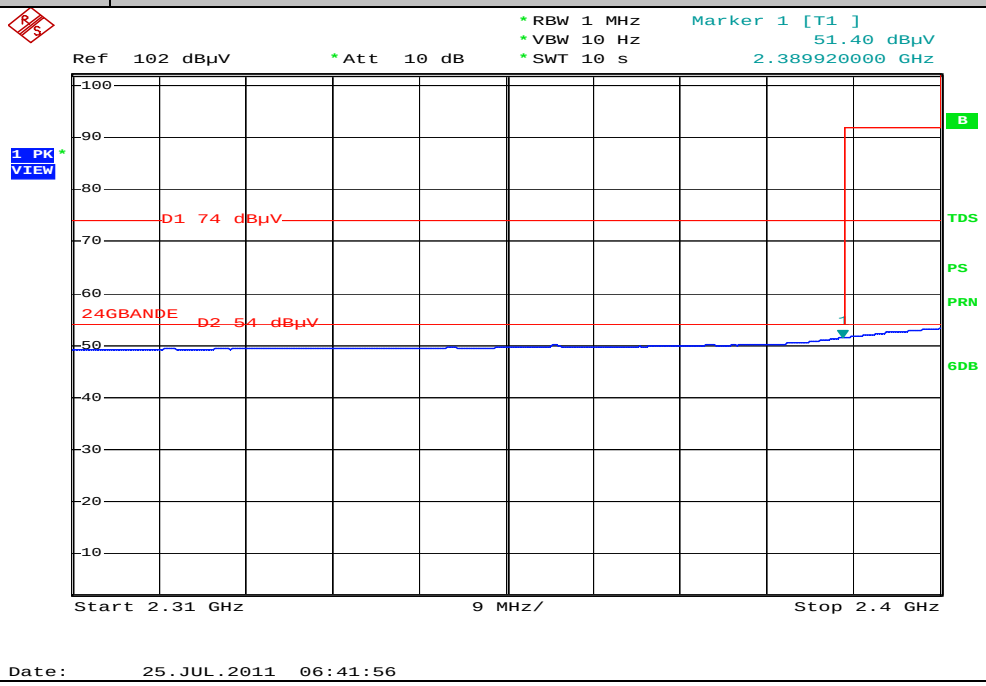


Mode 2: 802.11g

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, V

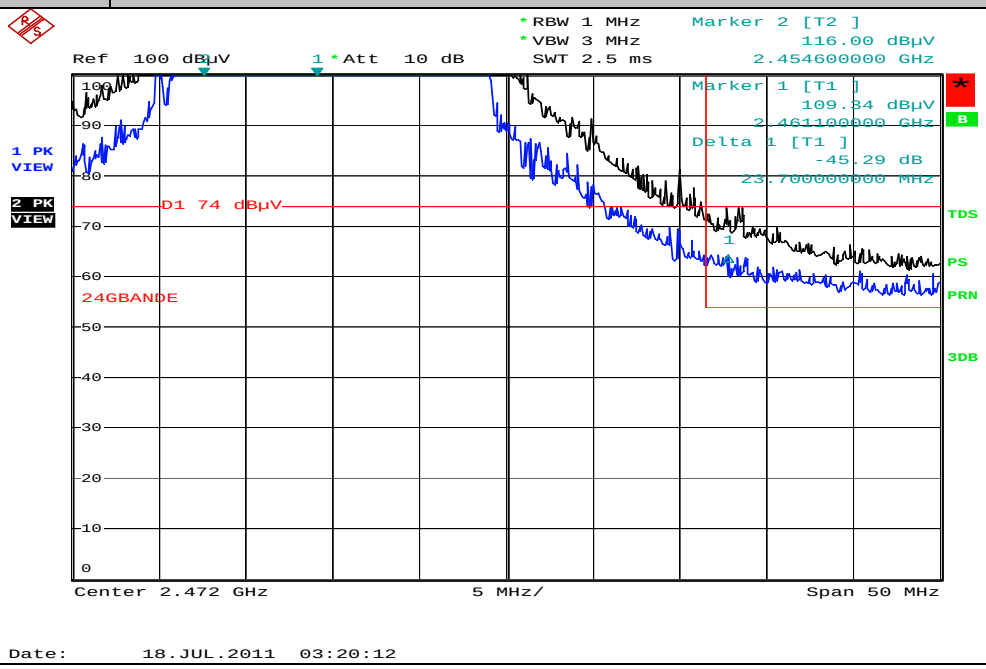


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, V



Mode 2: 802.11g

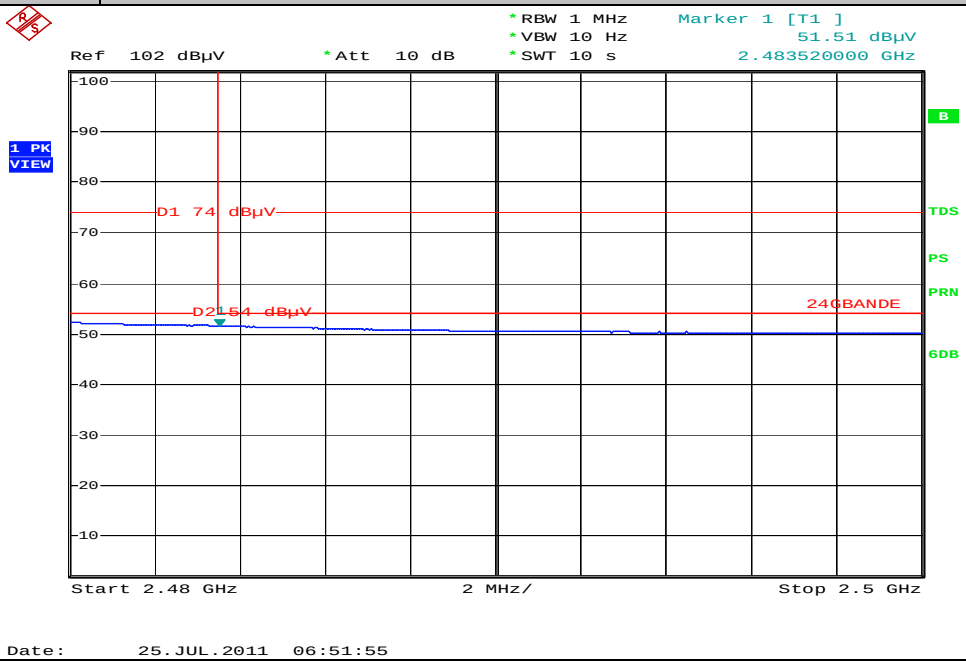
Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, H



Delta Method for Band Edge Emission: 500KHz RBW for Blue Trace; 1MHz RBW for Black Trace.

- Peak: 116.0dBuV/m-45.29dBuV/m=70.71dBuV/m (under 74dBuV/m limit)

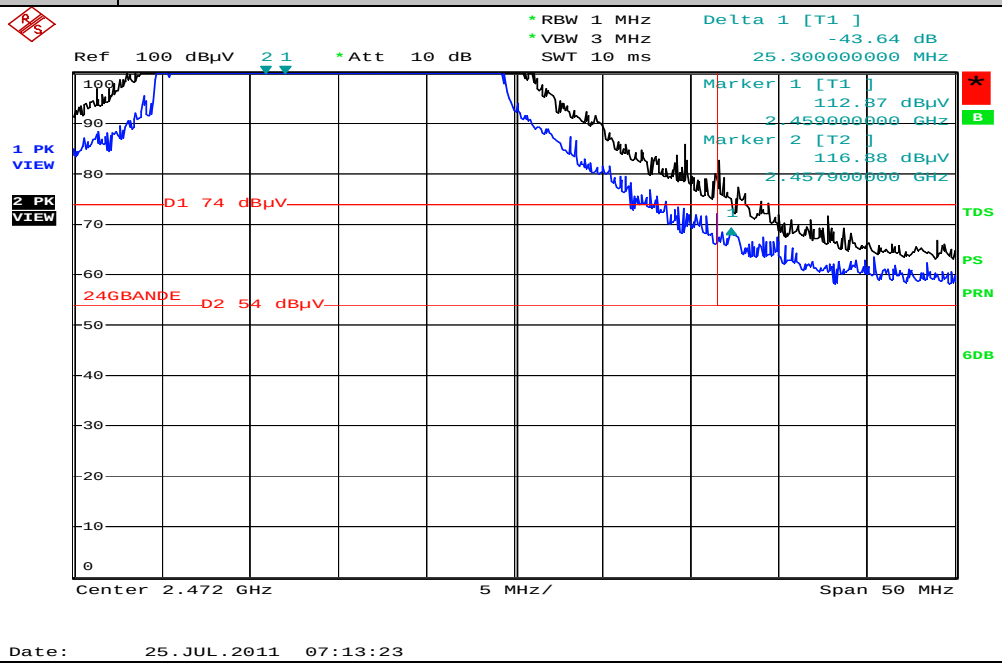
Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, H



Conventional Method used for Average Reading since it is already below the limit.

Mode 2: 802.11g

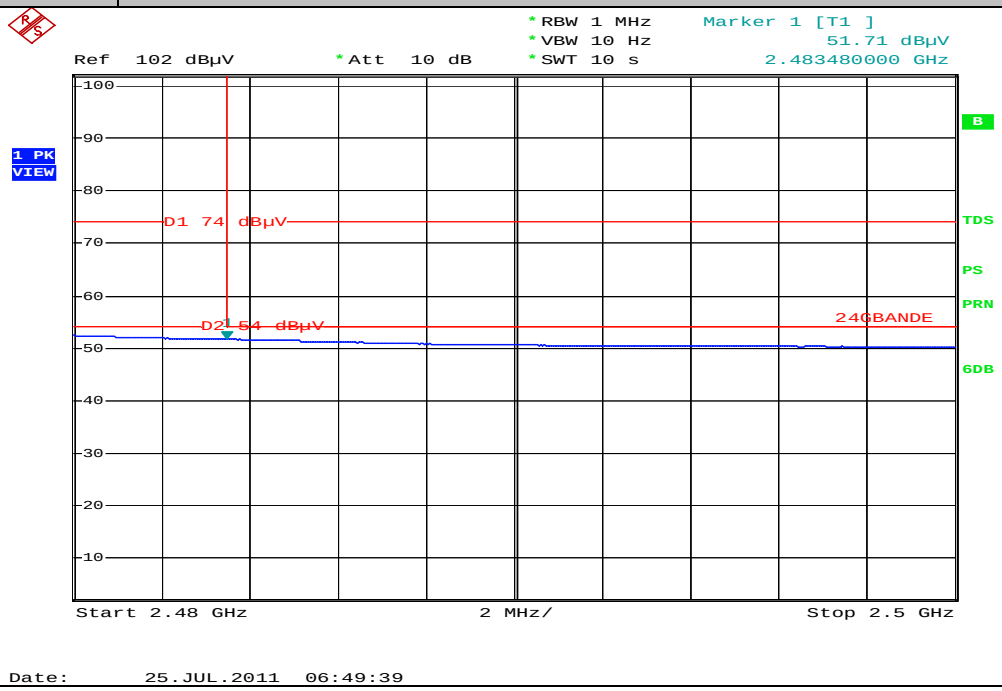
Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, V



Delta Method for Band Edge Emission:

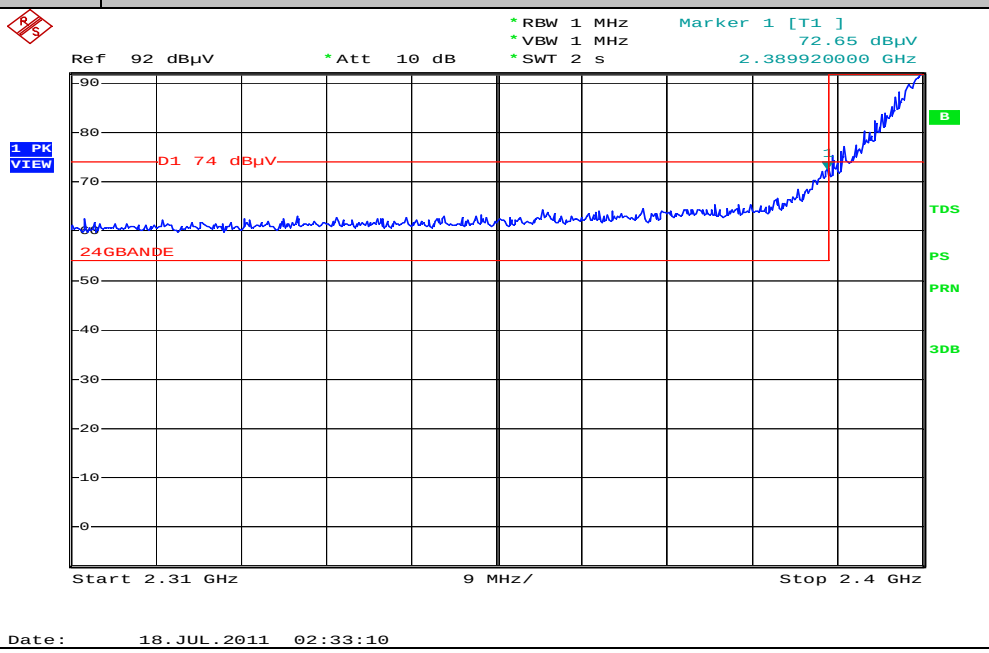
- Peak: 116.88dBuV/m-43.64dBuV/m=73.24dBuV/m (under 74dBuV/m limit)

Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, V

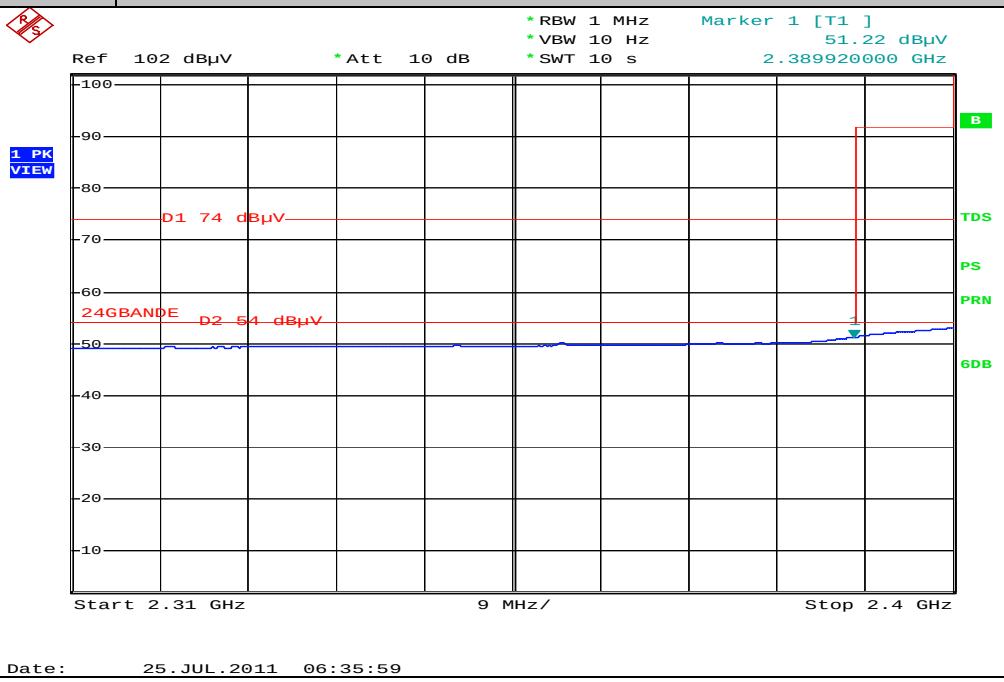


Mode 3: 802.11n(HT-20)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, H

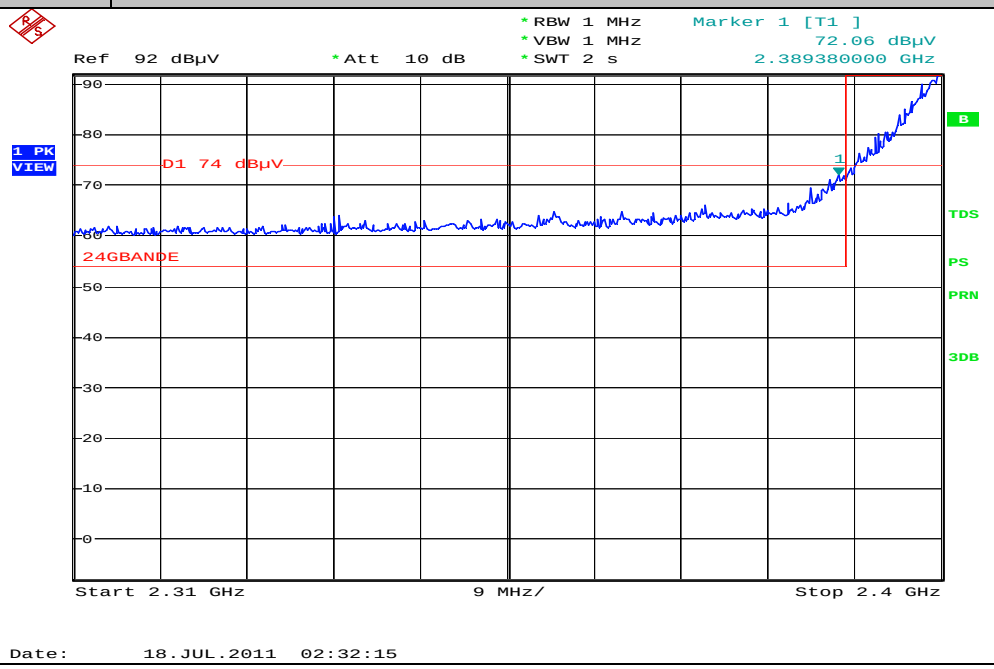


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, H

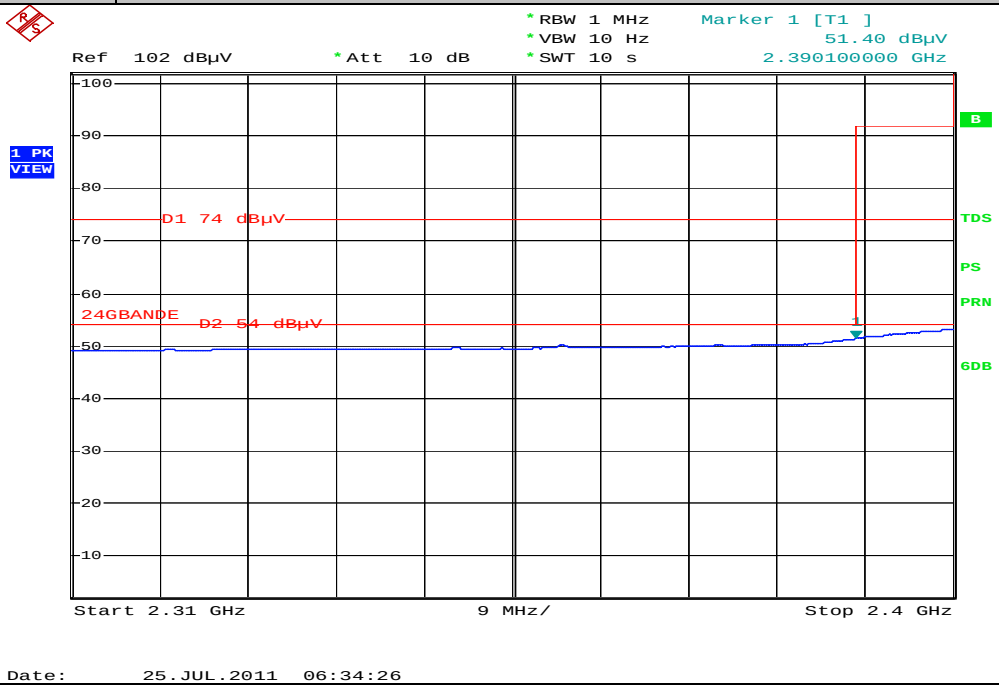


Mode 3: 802.11n(HT-20)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, V

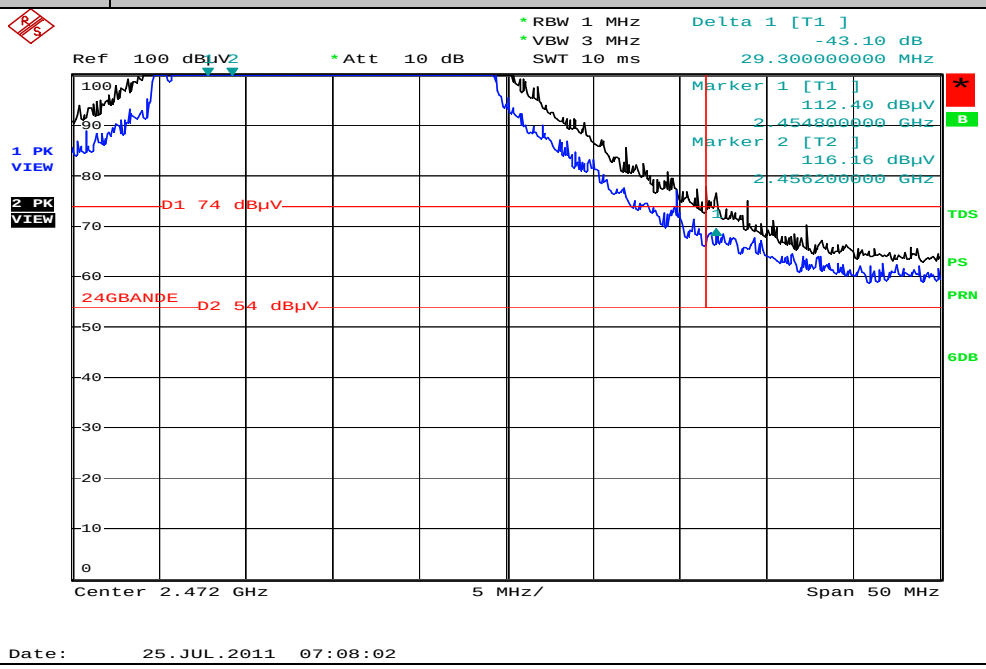


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, V



Mode 3: 802.11n(HT-20)

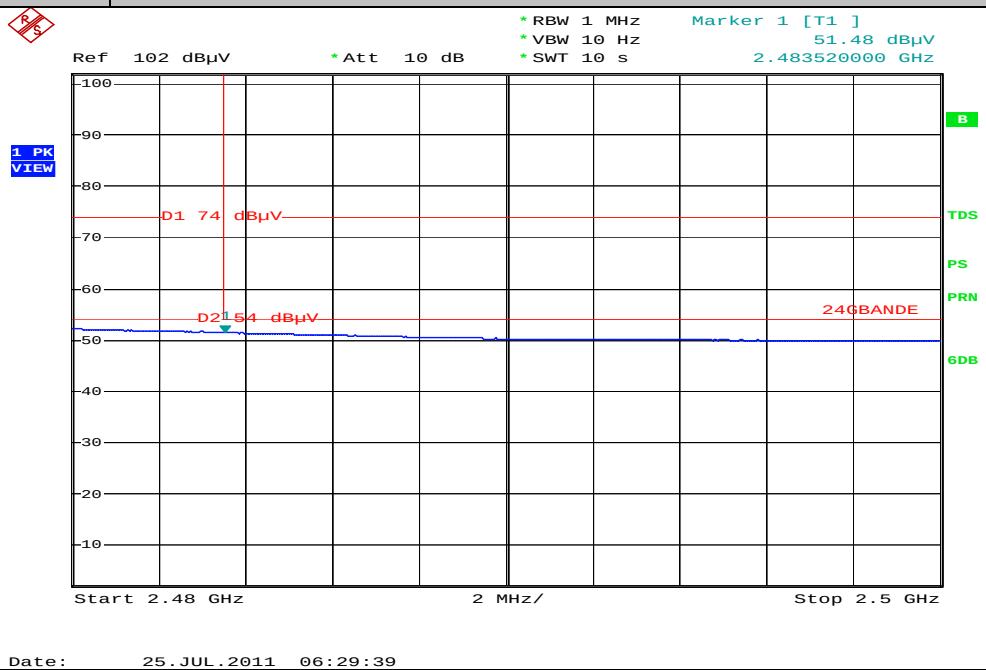
Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, H



Delta Method for Band Edge Emission:

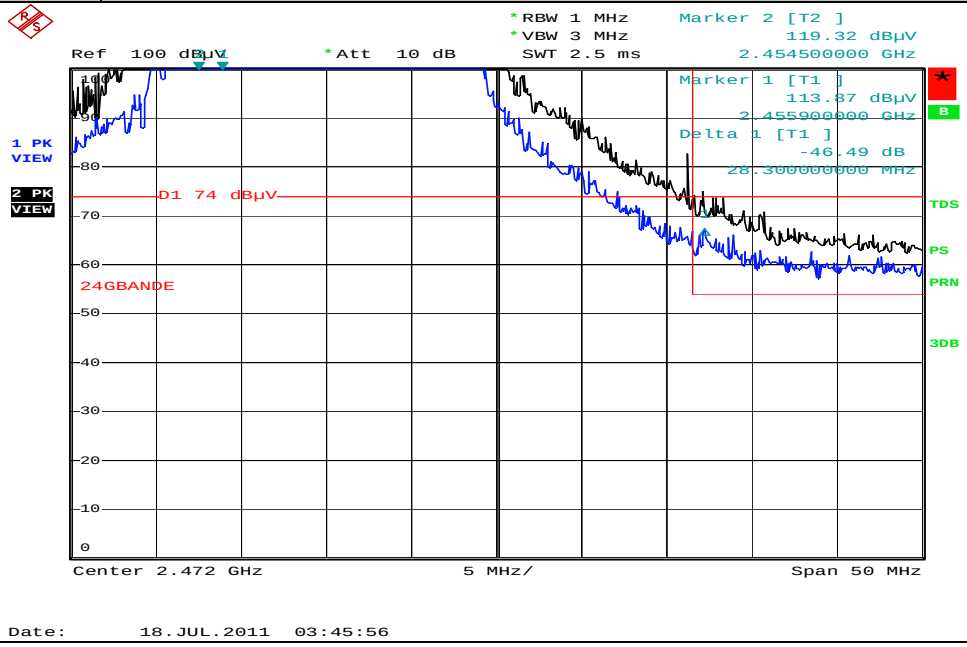
- Peak: 116.16dBuV/m-43.10dBuV/m=73.06dBuV/m (under 74dBuV/m limit)

Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, H



Mode 3: 802.11n(HT-20)

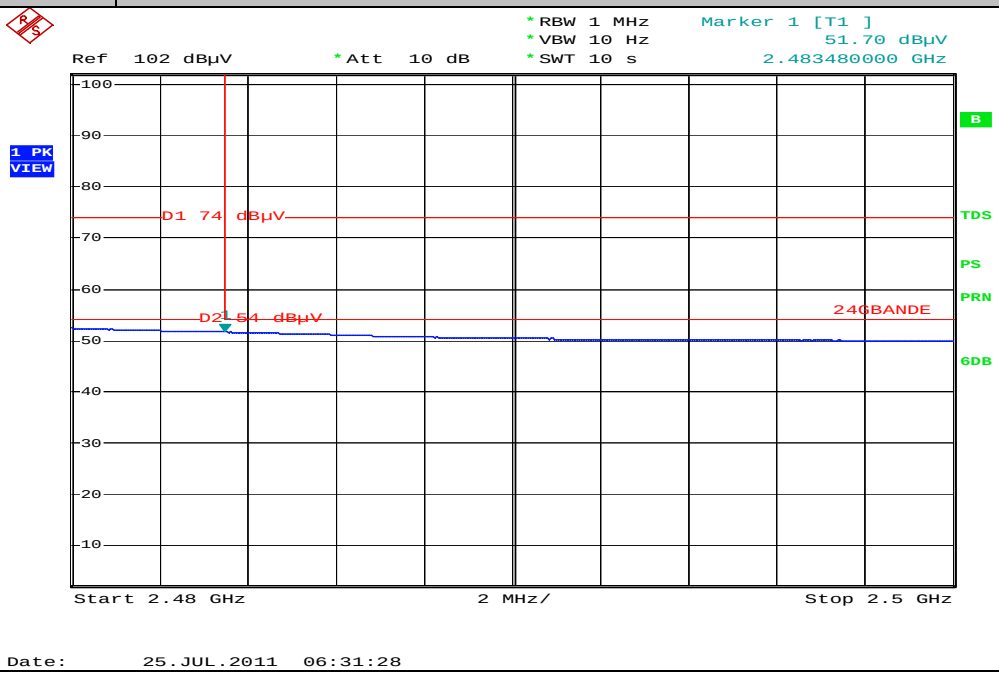
Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, V



Delta Method for Band Edge Emission:

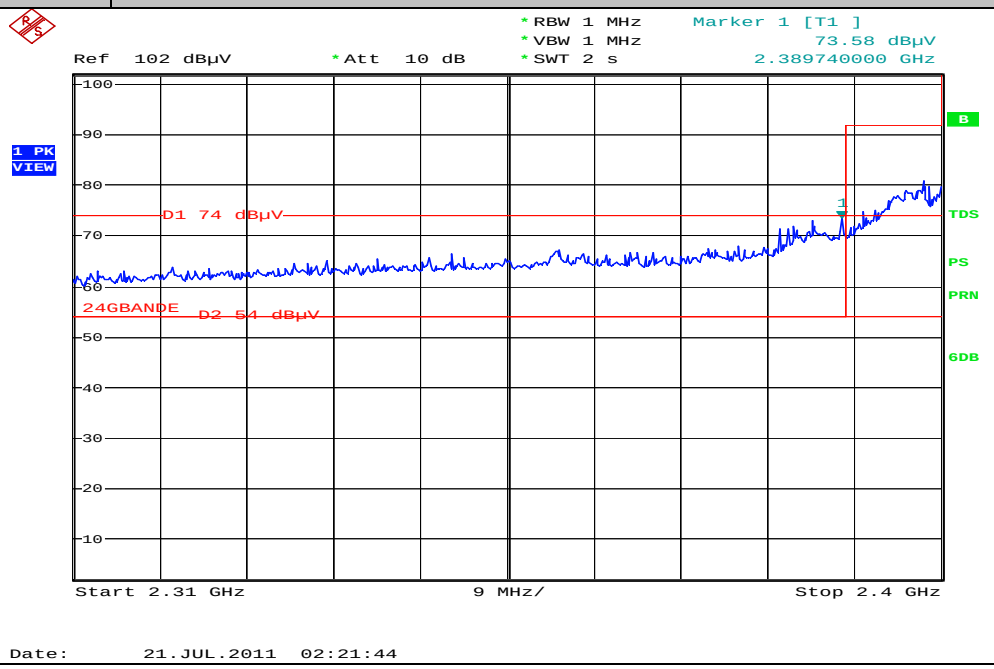
- Peak: 119.32dBuV/m-46.49dBuV/m=72.83dBuV/m (under 74dBuV/m limit)

Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, V

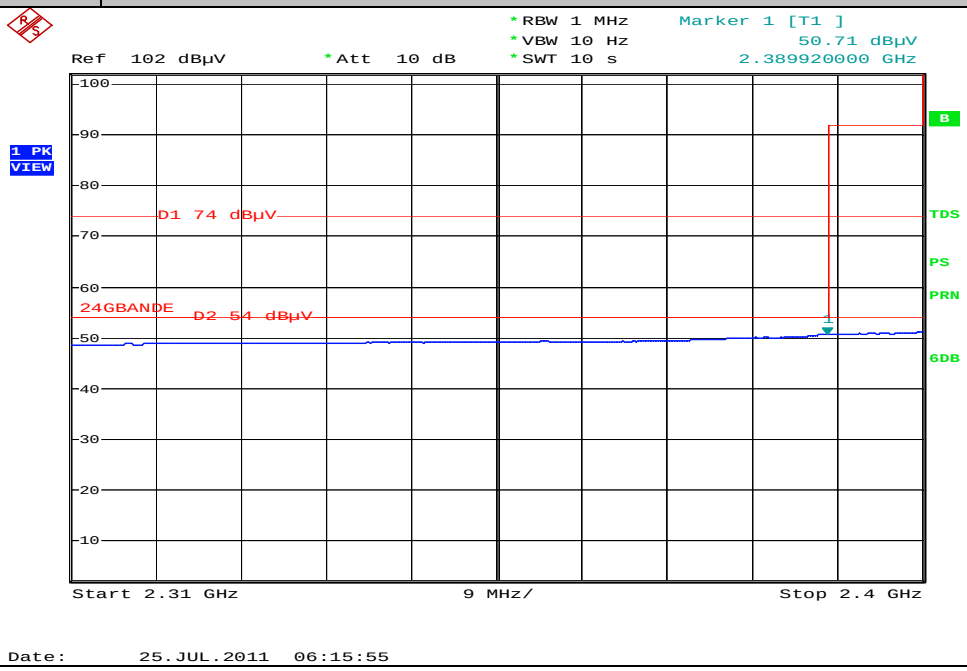


Mode 4: 802.11n(HT-40)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, H

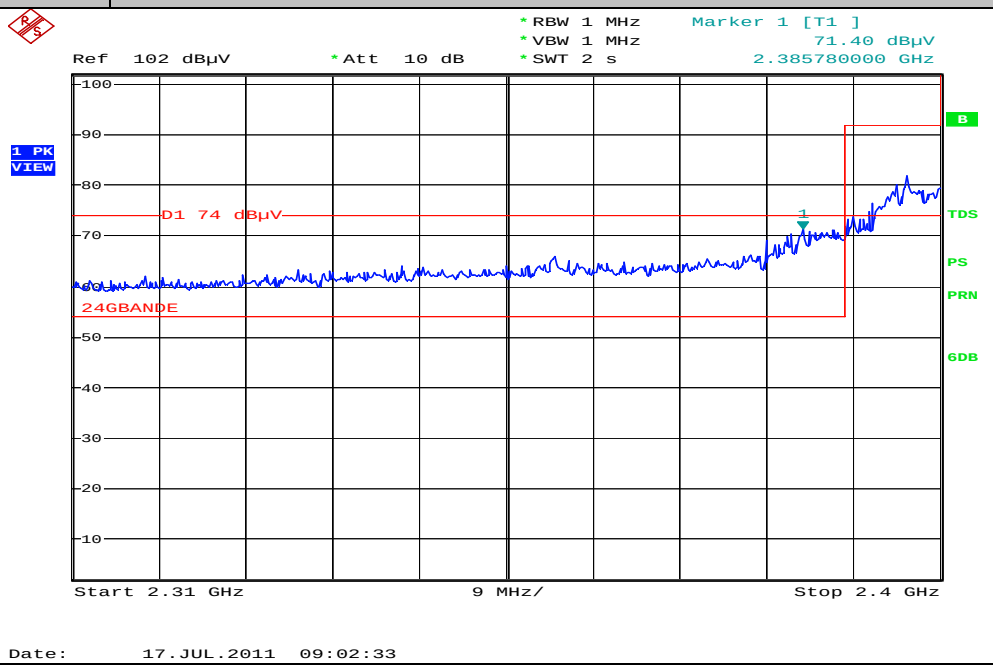


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, H

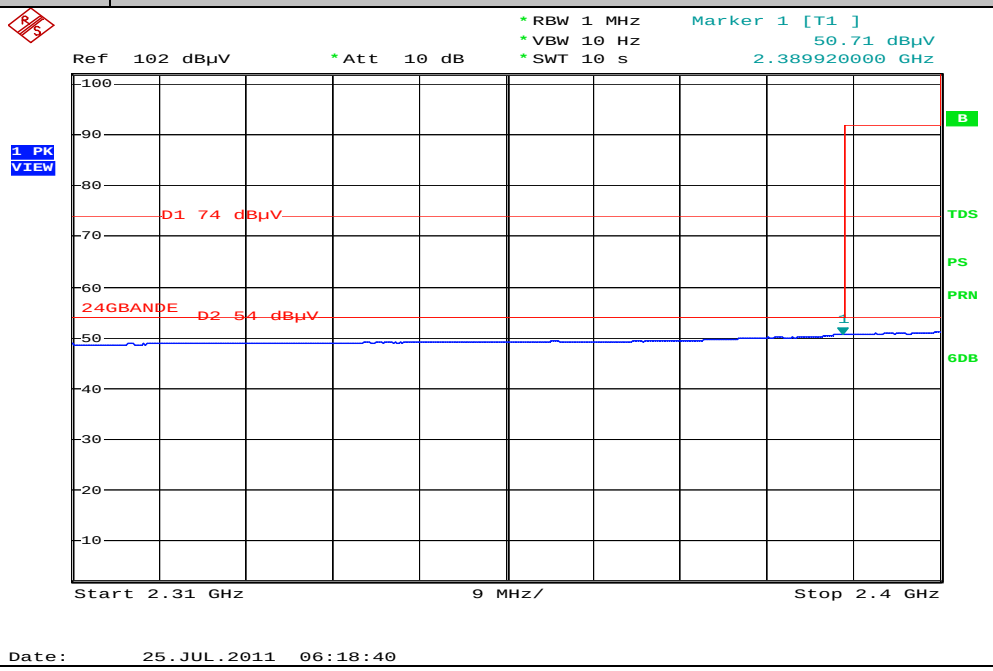


Mode 4: 802.11n(HT-40)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ Low End, V

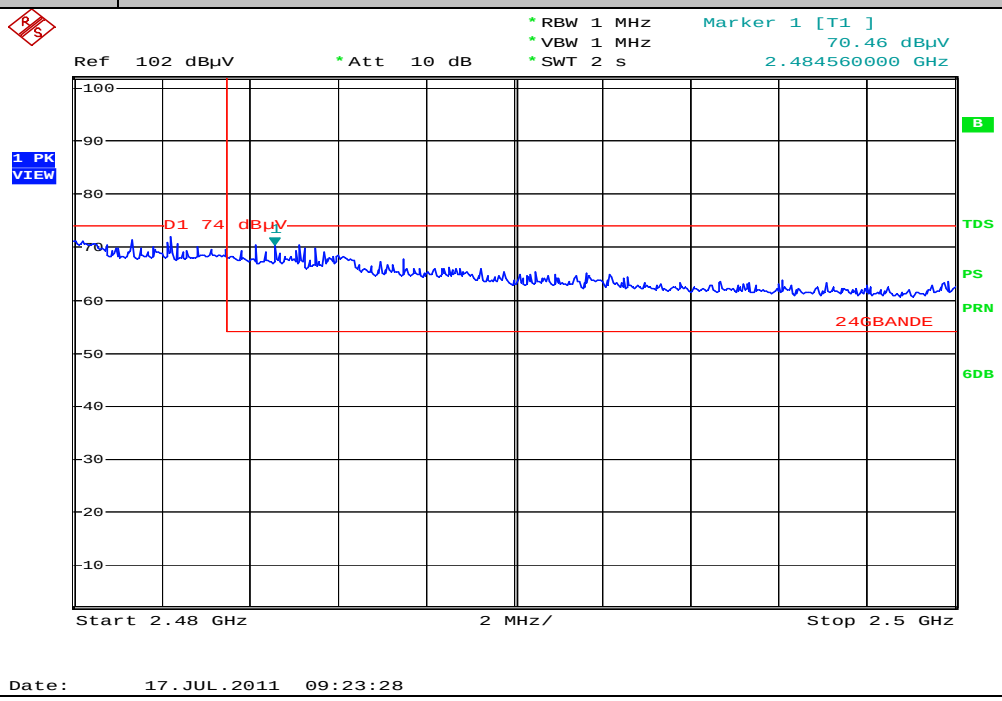


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ Low End, V

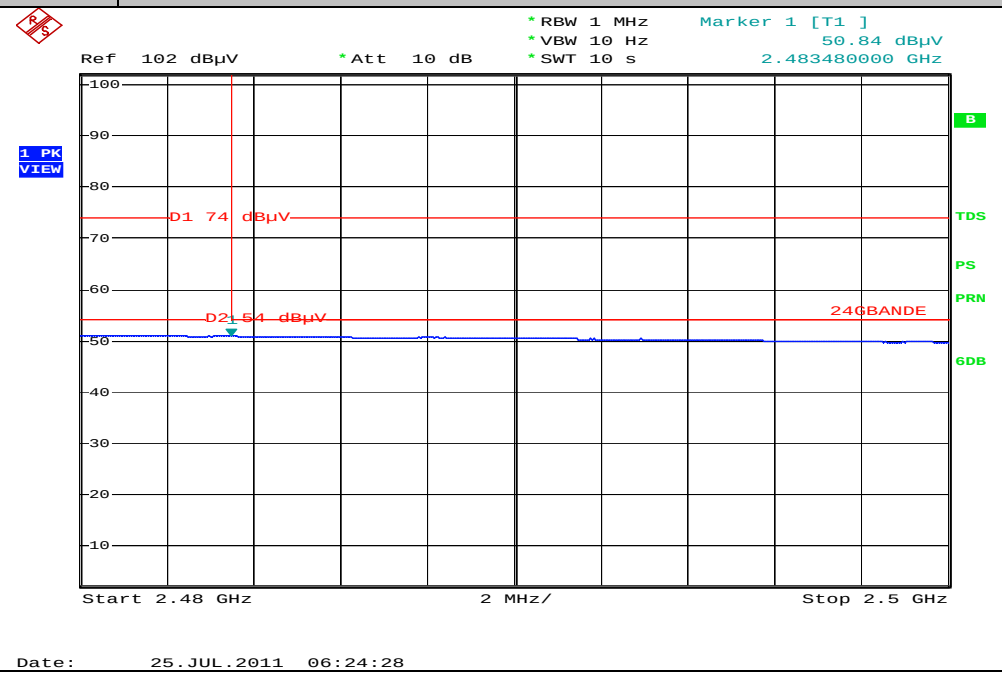


Mode 4: 802.11n(HT-40)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, H

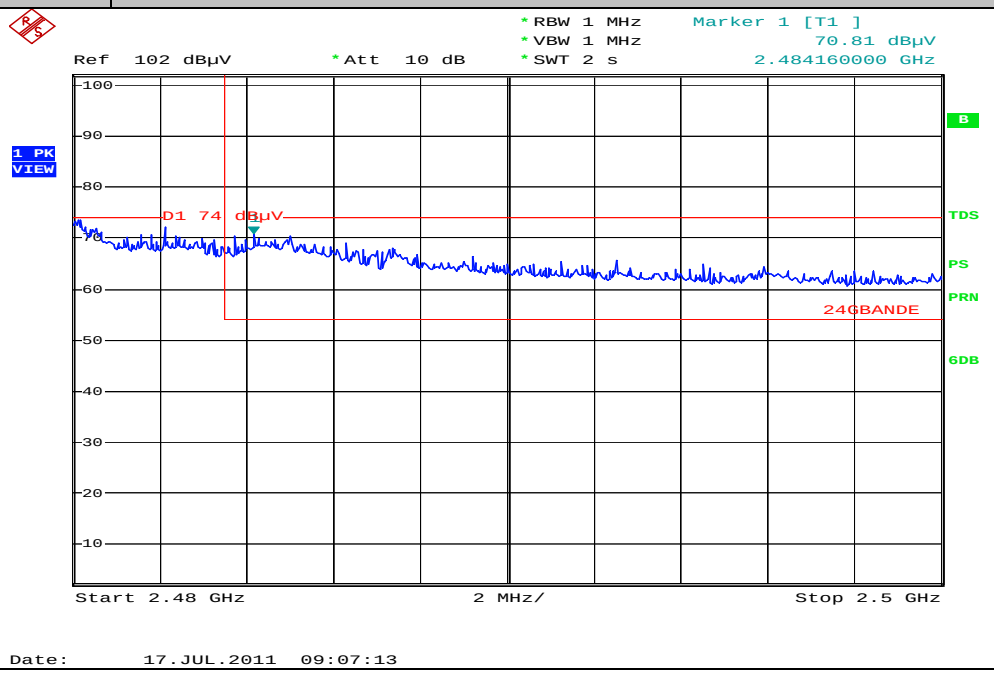


Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, H

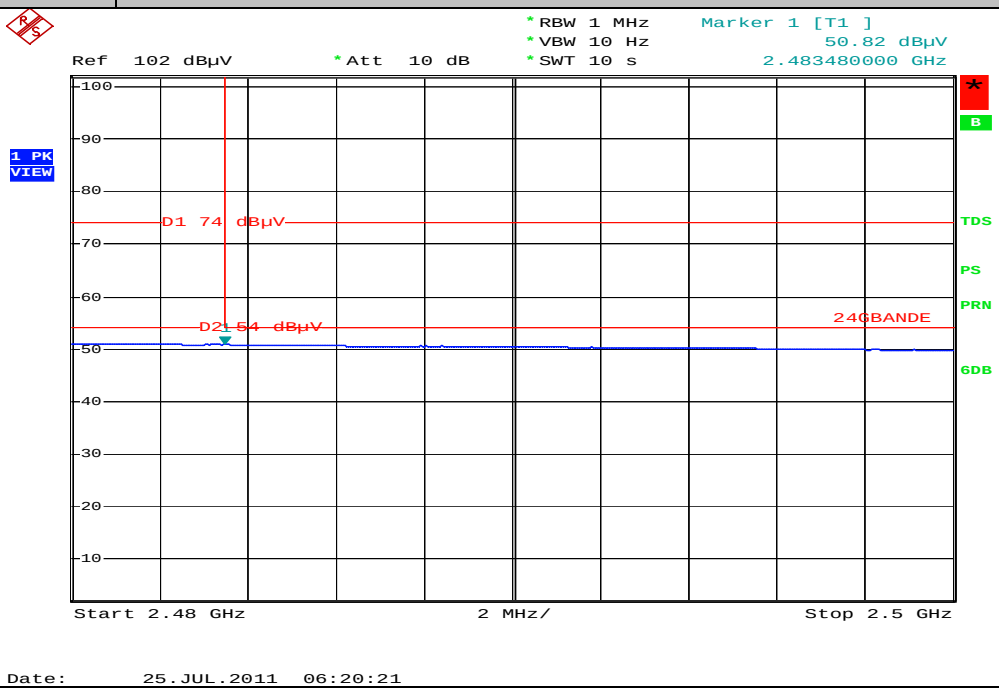


Mode 4: 802.11n(HT-40)

Plot Name:	Peak Reading for Band-Edge Radiated Emissions @ High End, V



Plot Name:	Average Reading for Band-Edge Radiated Emissions @ High End, V



B. Spurious under 1GHz

EUT with DC power via POE cable (worst case recorded)

Frequency (MHz)	Polarity [H, V]	Height (m)	Azimuth (Degree)	Amplitude Reading (dBµV)	Class B 3m Limit (dBµV/m)	Difference from limit (dB)
52.1	H	1.4	225	30.5	40.0	-9.5
90.8	H	1.4	225	28.1	43.5	-15.4
153.3	H	1.4	090	33.7	43.5	-9.8
738*	H	1.0	090	44.3	46.5	-2.2
804	H	1.0	090	42.7	46.5	-3.8
870	H	1.0	180	42.6	46.5	-3.9
39.8	V	1.1	315	34.6	40.0	-5.4
55.1	V	1.1	315	35.3	40.0	-4.7
61.0	V	1.1	270	34.5	40.0	-5.5
155.0	V	1.1	270	34.8	43.5	-8.7
738*	V	1.0	090	44.0	46.5	-2.5
804	V	1.0	090	42.7	46.5	-3.8
870	V	1.0	090	42.6	46.5	-3.9

No other significant spurious were detected in the rest <1Ghz band

*Peak reading. For emissions that have peak values close to (or over) the specification limit (if any) will be also measured in the quasi-peak or average mode to determine the compliance.

7.8. AC CONDUCTED EMISSIONS

The EUT was setup and located so that the distance between the boundary of the EUT and the closest surface to the LISN was 0.8m or more.

EUT test configuration was according to CISPR22 and Section 7 of ANSI C63.4/2003.

Conducted disturbance was measured between the phase lead and the ground, and between the neutral lead and the ground. The frequency 0.150 - 30 MHz was investigated.

The EMI receiver was set to PEAK detector setting, and swept continuously over the frequency range to be investigated. The resolution bandwidth was set to 9KHz minimum. The EMI receiver input cable was connected to LINE 1 RF measurement connection on the LISN. A 50ohm terminator was connected to the unused RF port on the LISN. For each mode of EUT operation, emissions readings were maximized by manipulating cable and wire positions. The configuration for each EUT power cord which produced emissions closest to the limit was recorded. The same procedure was repeated for LINE 2 of each EUT power cord.

Instrument Settings

Frequency Range	Peak	Quasi-Peak	Average
0.15 – 30 MHz	9 kHz	9 kHz	30 kHz

Limit: FCC Part 15 / CISPR22 Class B

Testing Data

The following plots show the neutral and line conducted emissions for the typical operation condition. The conducted test data shows the worst case emissions still below the FCC Part 15/CISPR22 Class B limits.

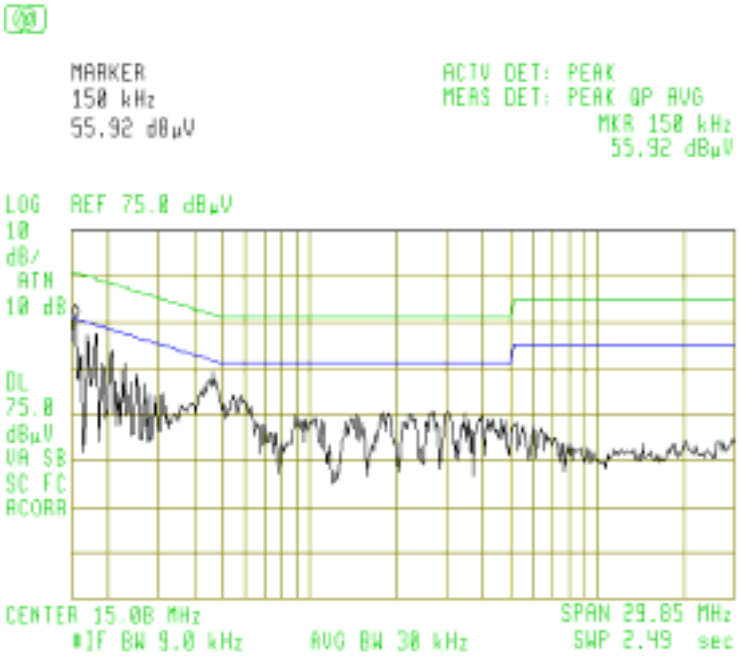
Highest Data for AC Line Conducted Emissions (w/ AC/DC PoE adaptor)						
Frequency (MHz)	0.150	0.180	0.190	0.210	0.450	3.045
Peak Reading (dBuV) from Line*	55.9	51.5	53.0	48.0	44.6	35.2
Frequency (MHz)	0.150	0.195	0.450	0.900	1.810	3.055
Peak Reading(dBuV) from Neural *	52.5	51.9	44.5	35.0	35.3	35.1

* No average reading is needed since the peak reading is already below average limit.

Result: No non-compliance noted

Tested @ AC Main of AC/DC PoE Adaptor

Line Conducted Emission



Neutral Conducted Emission