FCC Part 15C
Measurement and Test Report

For

ShenZhen HaiLingKe Electronic co., Ltd

3F Caiyue Mansion, No. 24 Liuxian blvd, LongHua District, Shenzhen,

Guangdong, China

FCC ID: 2AD56HLK-7628N

FCC Rule(s):	FCC Part 15C
Product Description:	WIFI module
Tested Model:	HLK-7628N
Report No.:	STR18038230I
Sample Receipt Date:	2018-03-27
Tested Date:	2018-03-28 to 2018-05-02
Issued Date:	2018-05-02
Tested By:	Mike Shi / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	ShenZhen HaiLingKe Electronic co., Ltd
Address of applicant:	3F Caiyue Mansion, No. 24 Liuxian blvd, LongHua District, Shenzhen, Guangdong, China
Manufacturer:	ShenZhen HaiLingKe Electronic co., Ltd
Address of manufacturer:	3F Caiyue Mansion, No. 24 Liuxian blvd, LongHua District, Shenzhen, Guangdong, China

General Description of EUT	
Product Name:	WIFI module
Trade Name:	HI-LINK
Model No.:	HLK-7628N
Adding Model(s):	/
Rated Voltage:	DC5V
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power:	18.41dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 300Mbps
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	External
Antenna Gain:	Antenna 1: 2dBi, Antenna 2: 2dBi
Lowest Internal Frequency	40MHz

1.2 Test Standards

The following report is prepared on behalf of the ShenZhen HaiLingKe Electronic co., Ltd in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 V04 for digital transmission systems and KDB 662911 D01 Multiple Transmitter Output v02r01 shall be performed also.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, with a duty cycle equal to 100%, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	2412MHz, 2437MHz, 2462MHz
TM2	802.11g	2412MHz, 2437MHz, 2462MHz
TM3	802.11n-HT20	2412MHz, 2437MHz, 2462MHz
TM4	802.11n-HT40	2422MHz, 2437MHz, 2452MHz
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
Network cable1	4.0	Shielded	Without Core
Network cable2	1.5	Unshielded	Without Core
Network cable3	1.0	Unshielded	Without Core
DC Cable	1.1	Unshielded Shielded	Without Core

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Computer	Lenovo	ThinkPad Edge E445	/
Adapter	WEEQU	WEEQU-0510	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2017-08-01	2020-07-31
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	Compliant
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.247(e)	Power Spectral Density	Compliant
§ 15.247(a)(2)	6 dB Bandwidth	Compliant
§ 15.247(b)(3)	RF Output Power	Compliant
§ 15.209(a)	Radiated Emission	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1091, the mobile transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

This product has two integral antennas, fulfill the requirement of this section.

5. Power Spectral Density

5.1 Standard Applicable

According to 15.247(a)(1)(iii), 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.

5.2 Test Procedure

According to the KDB 558074 D01 V04, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

a) Set instrument center frequency to DTS channel center frequency.
b) Set span to at least 1.5 times the OBW.
c) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz. .
d) Set VBW ≥3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
g) Sweep time = auto couple.
h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
i) Use the peak marker function to determine the maximum amplitude level.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

5.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

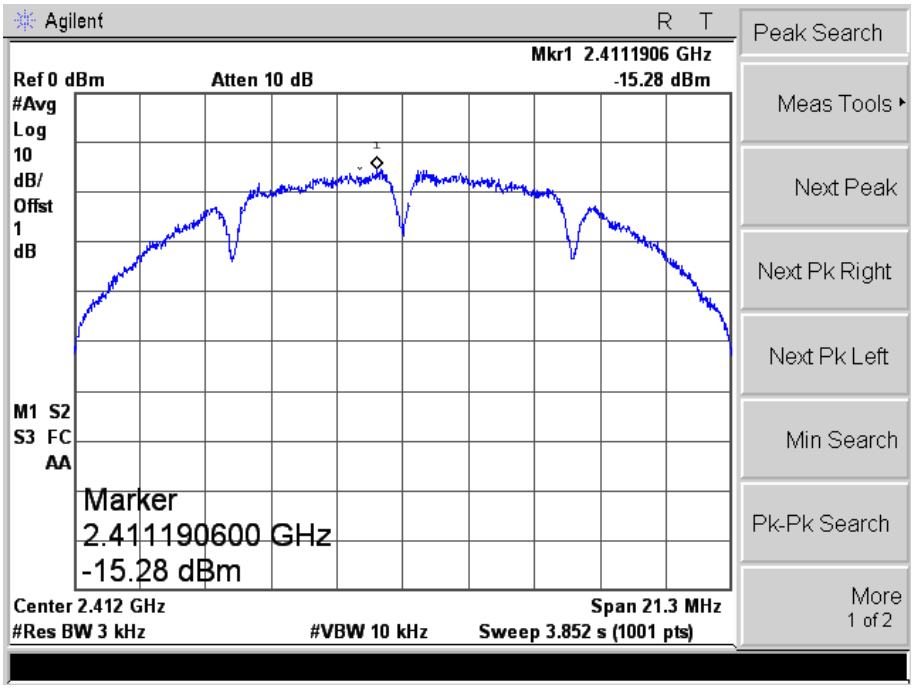
5.4 Summary of Test Results/Plots

Test Mode	Test Channel MHz	Power Spectral Density dBm/100kHz			Limit dBm/3kHz
		Chain 0	Chain 1	Total	
802.11b	2412	-15.28	-15.40	/	8
	2437	-15.14	-15.54	/	8
	2462	-15.64	-15.19	/	8
802.11g	2412	-17.66	-17.82	/	8
	2437	-17.65	-16.70	/	8
	2462	-17.36	-17.61	/	8
802.11n HT20	2412	-17.41	-18.48	-14.90	8
	2437	-17.26	-18.30	-14.74	8
	2462	-17.19	-17.62	-14.39	8
802.11n HT40	2422	-22.50	-22.11	-19.29	8
	2437	-21.57	-21.56	-18.55	8
	2452	-20.96	-20.49	-17.71	8

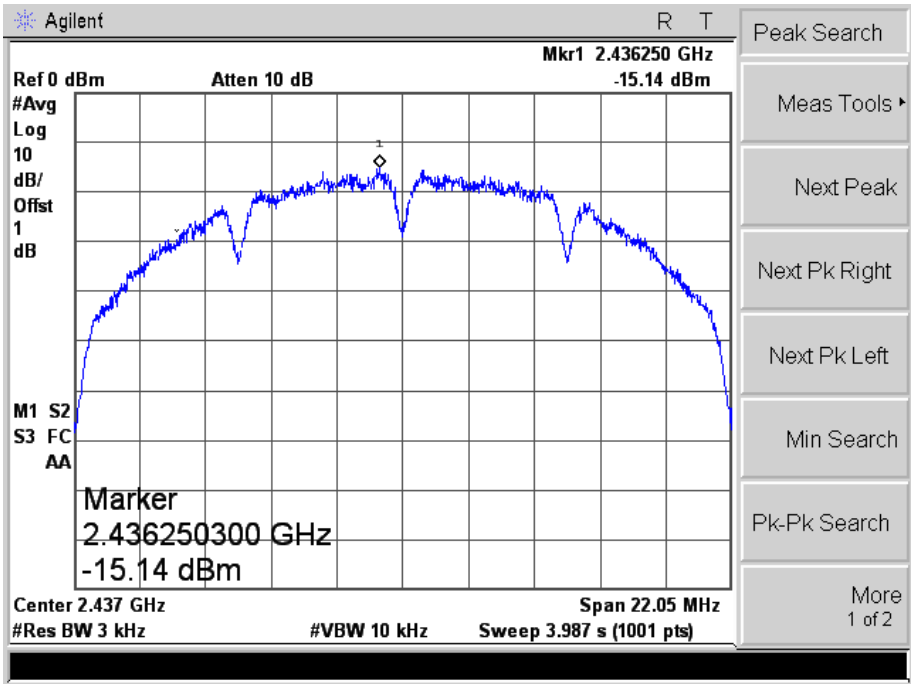
Please refer to the following test plots:

Antenna 0

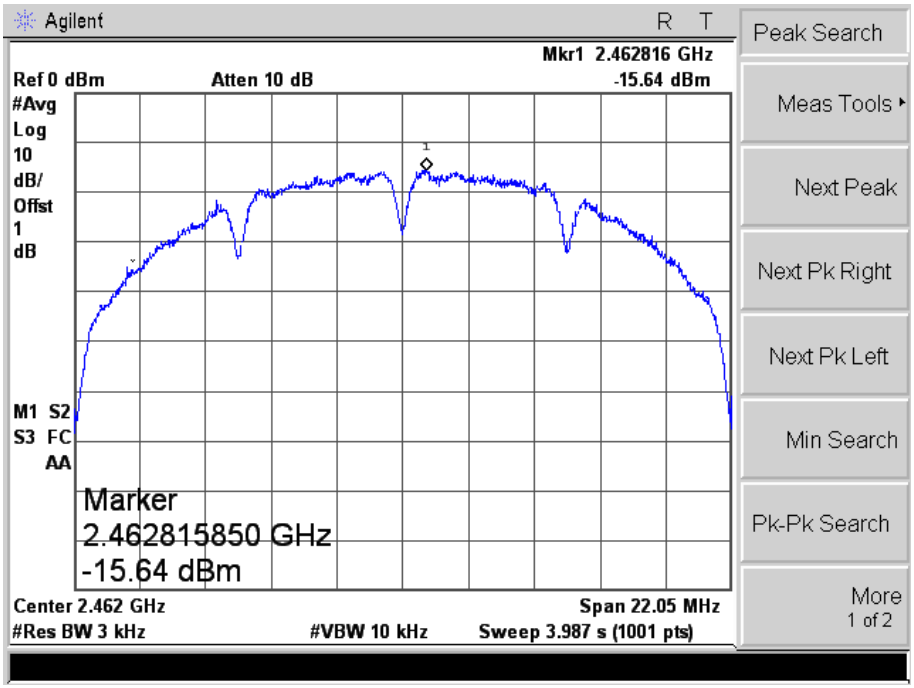
802.11b-Low Channel



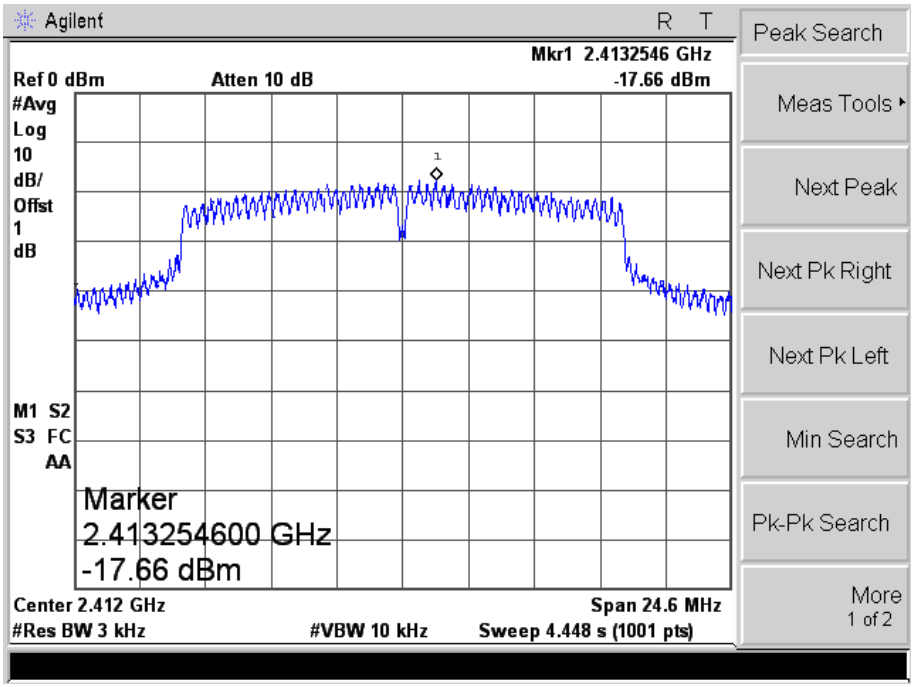
802.11b-Middle Channel



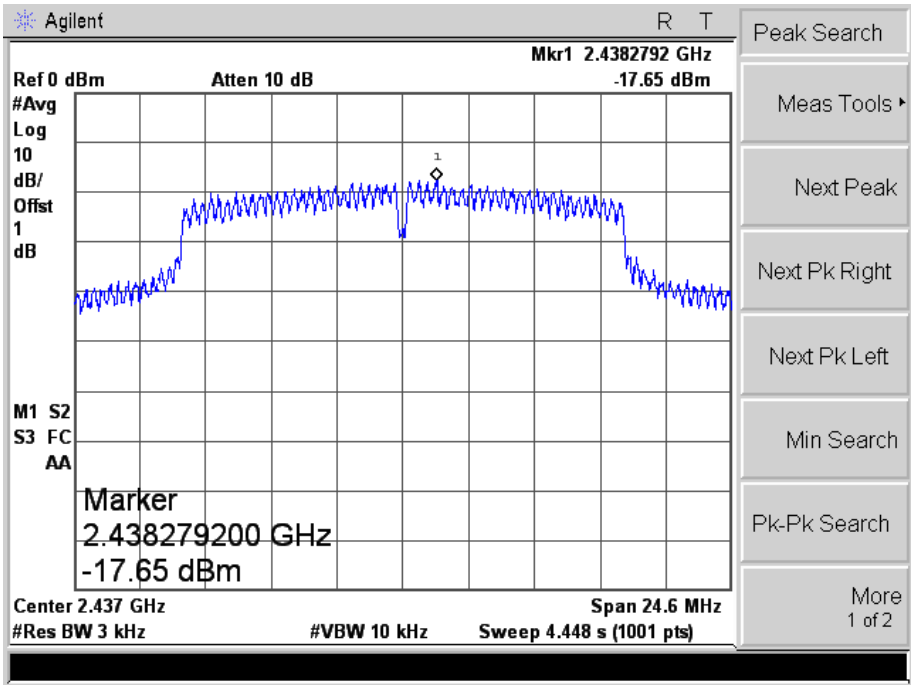
802.11b-High Channel



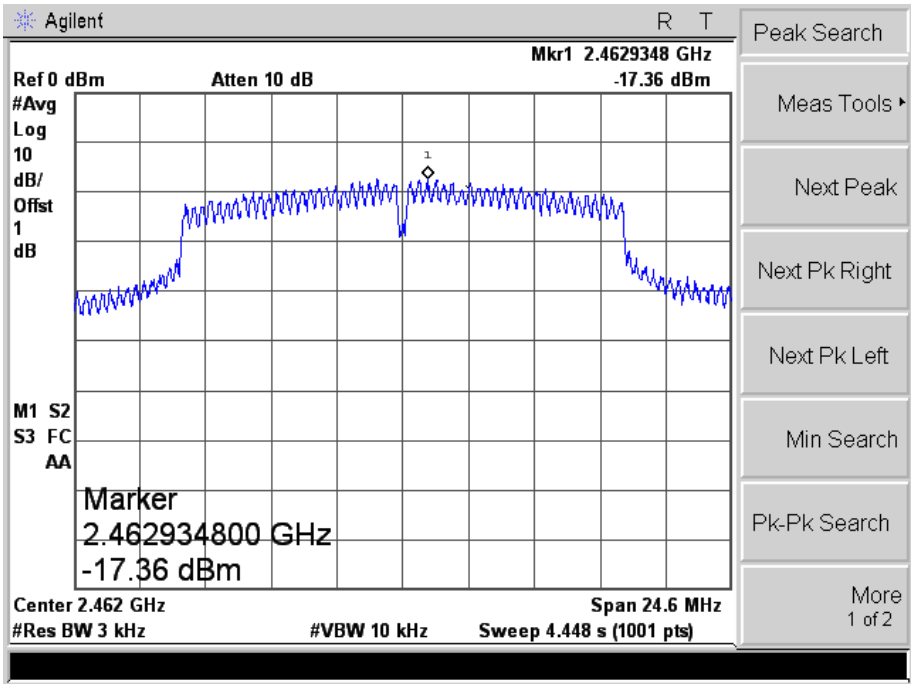
802.11g-Low Channel



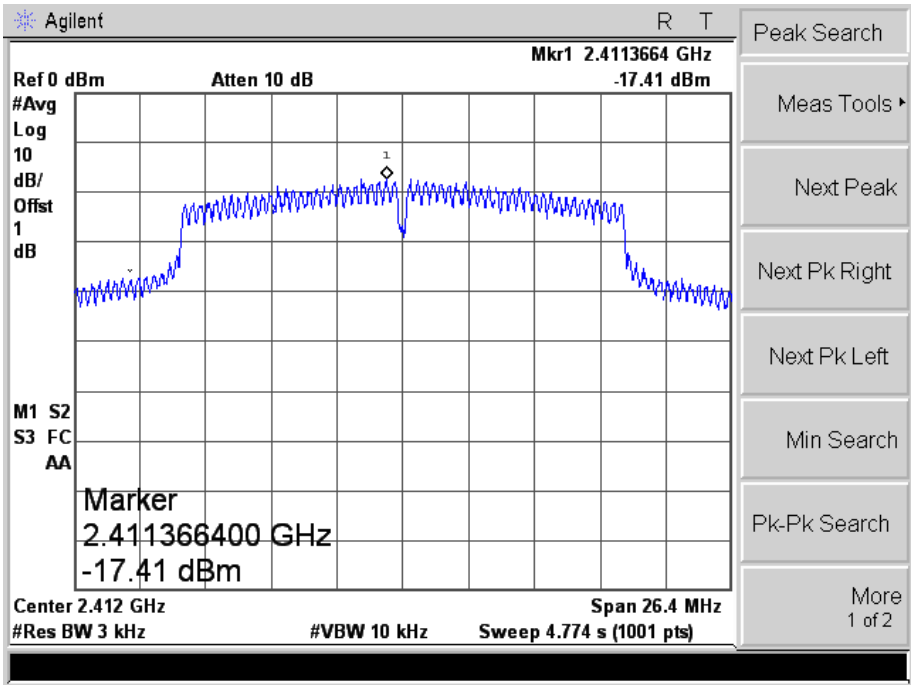
802.11g-Middle Channel



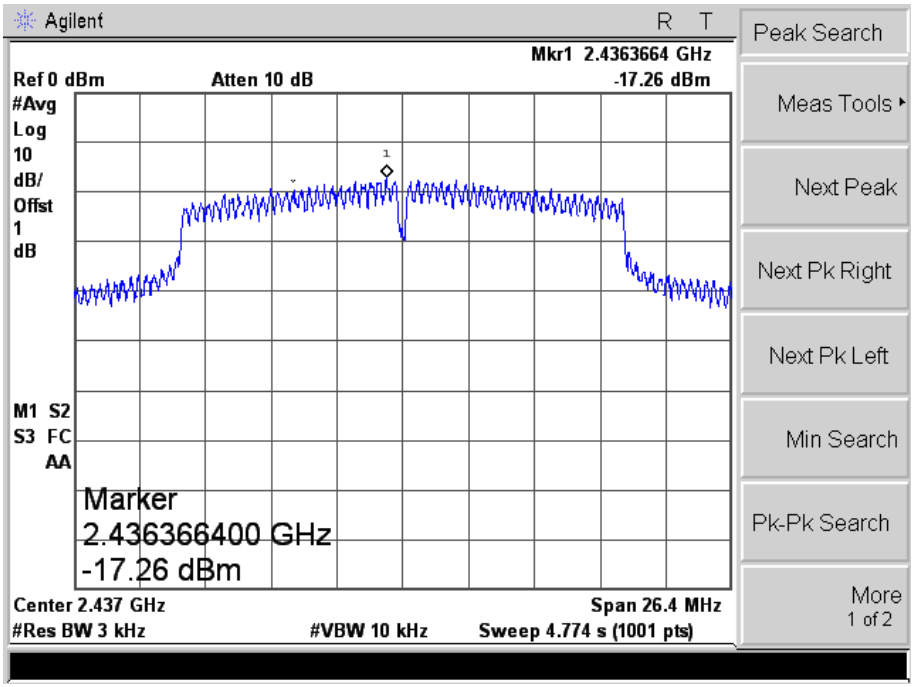
802.11g-High Channel



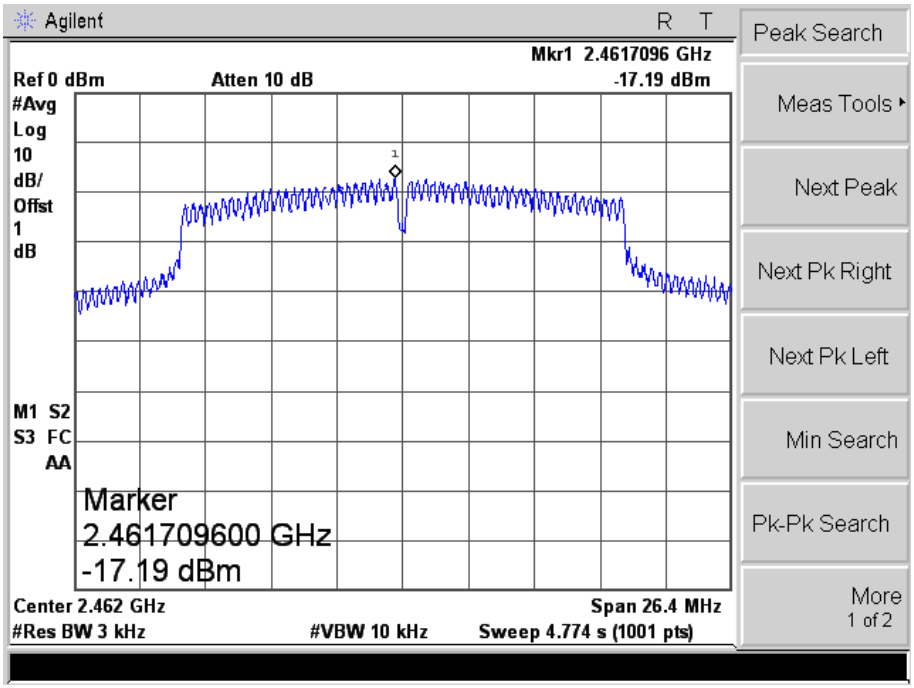
802.11n-HT20-Low Channel



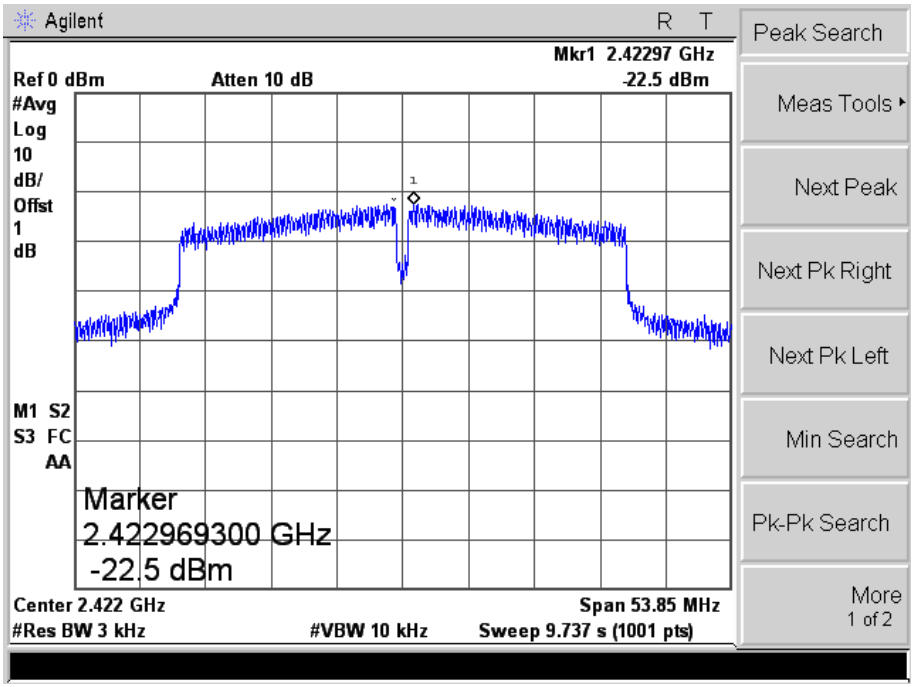
802.11n-HT20-Middle Channel



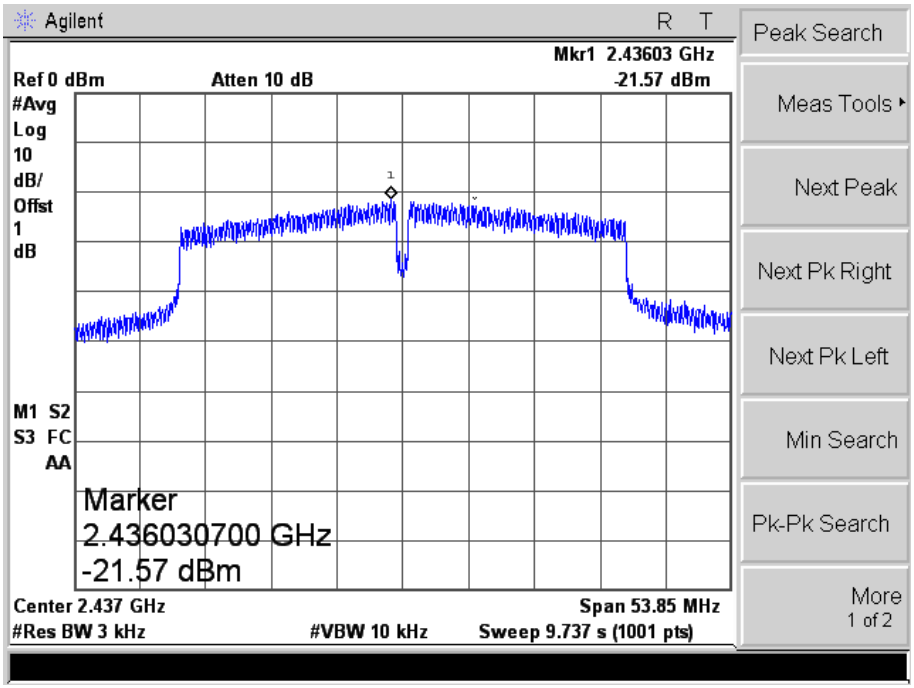
802.11n-HT20-High Channel



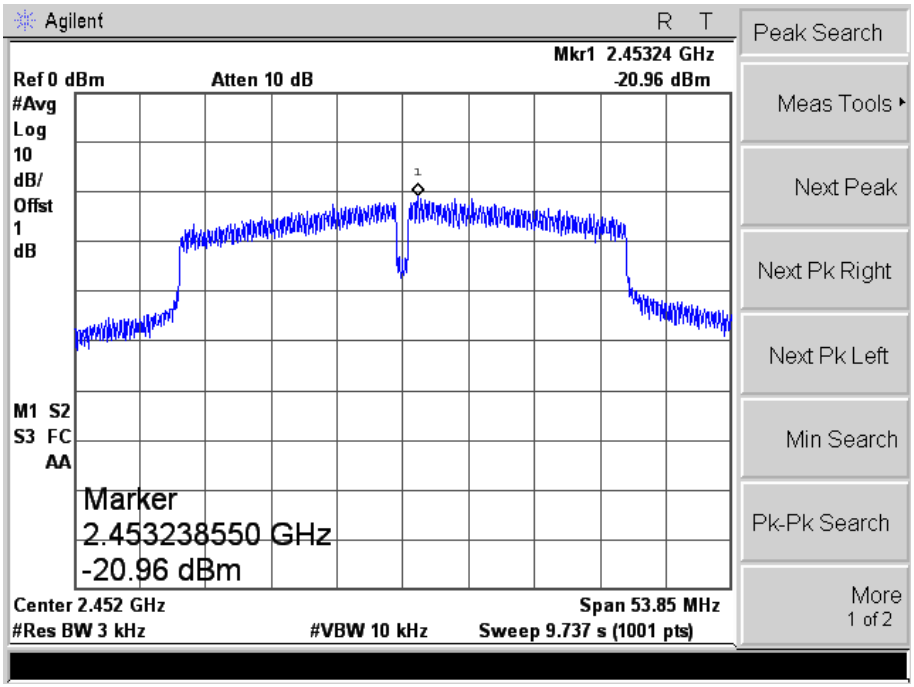
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel

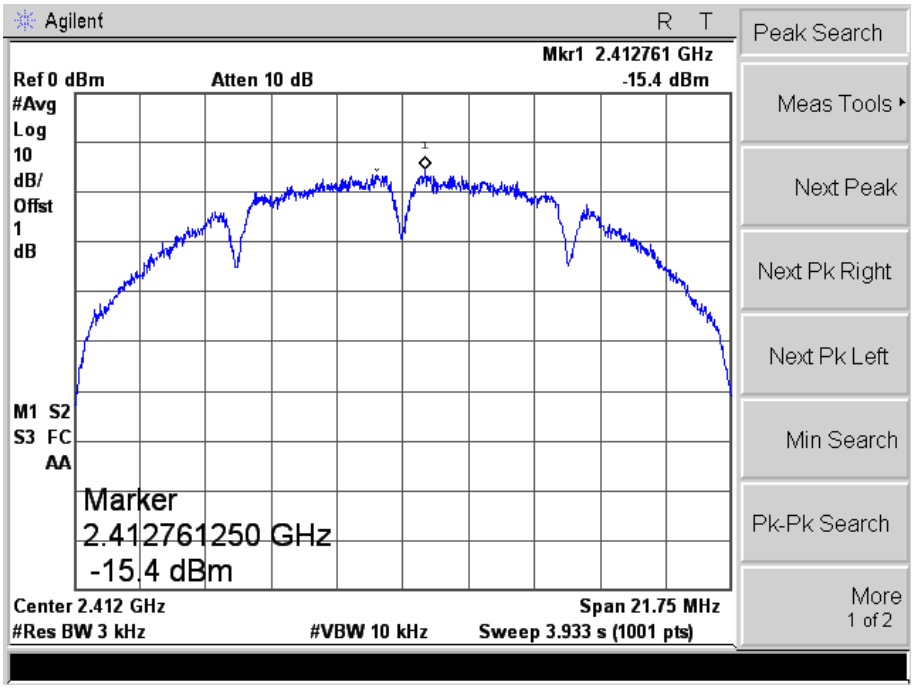


802.11n-HT40-High Channel

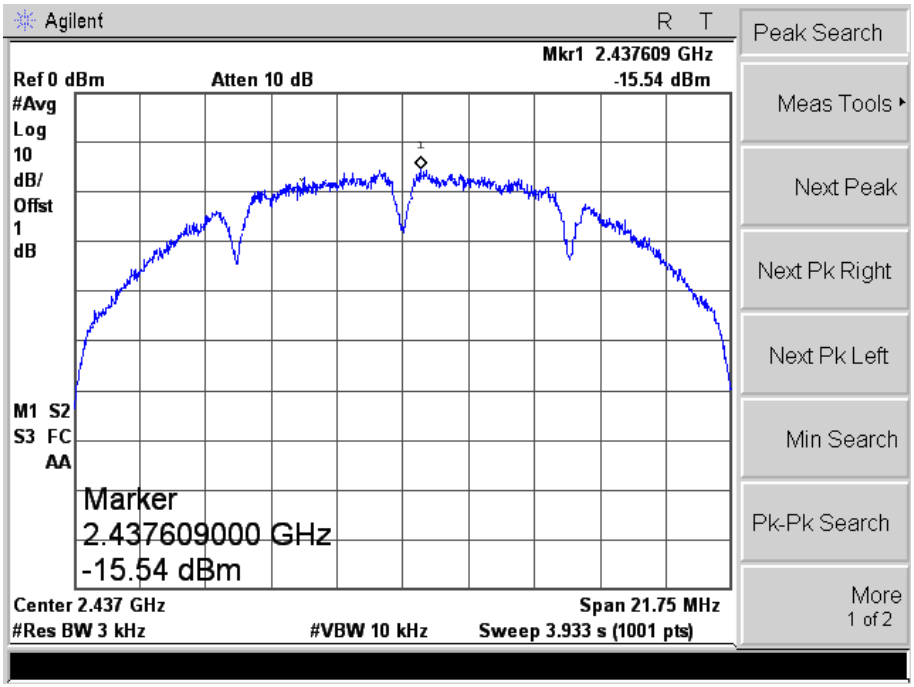


Antenna 1

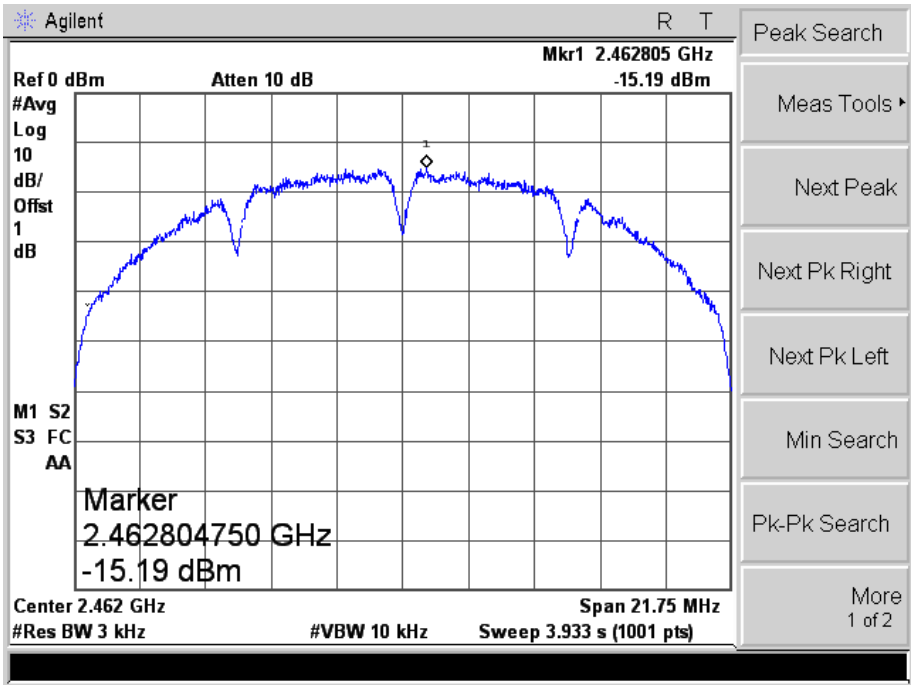
802.11b-Low Channel



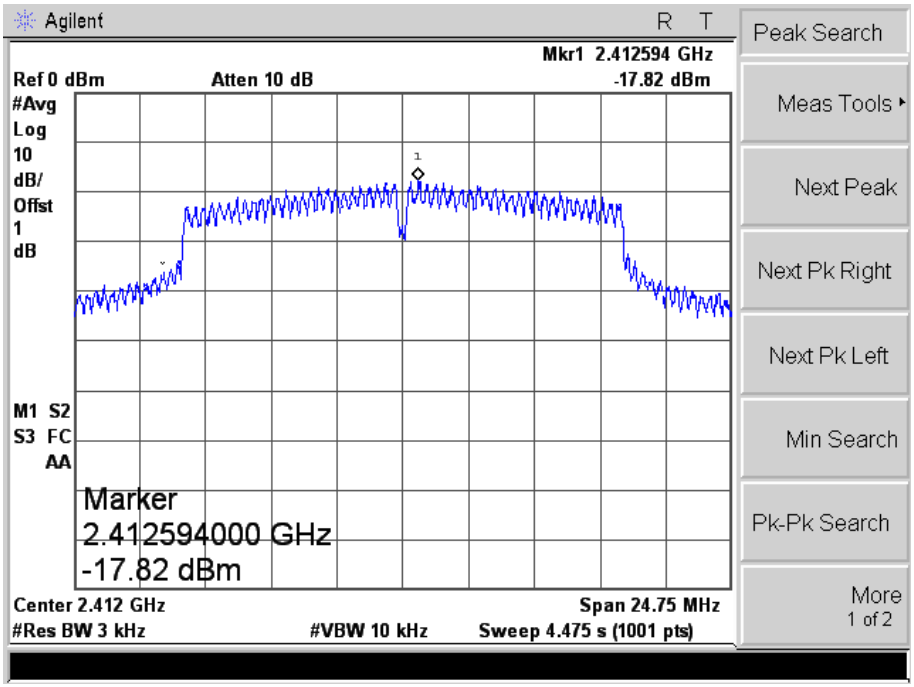
802.11b-Middle Channel



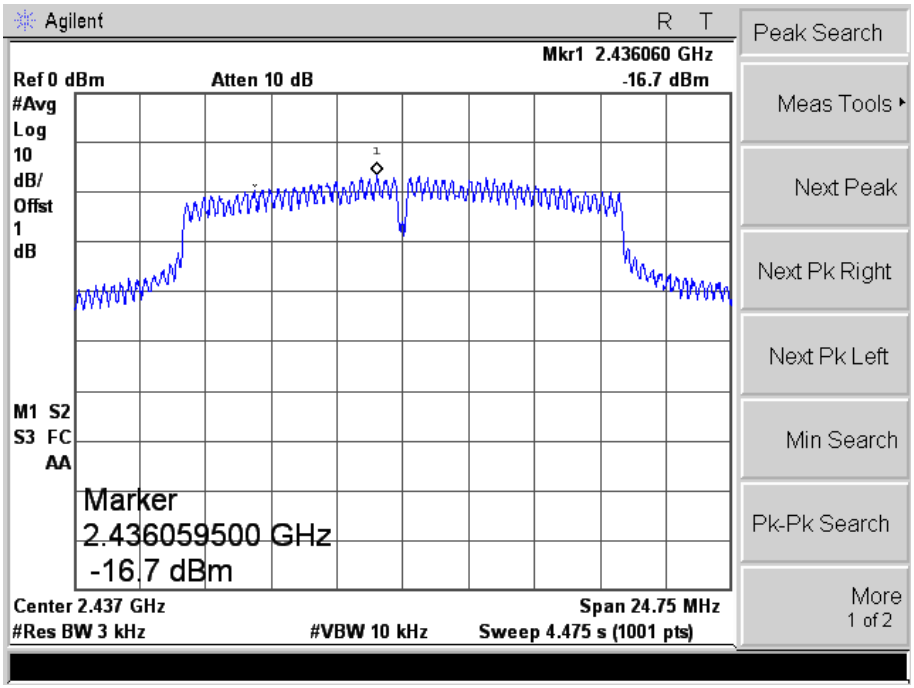
802.11b-High Channel



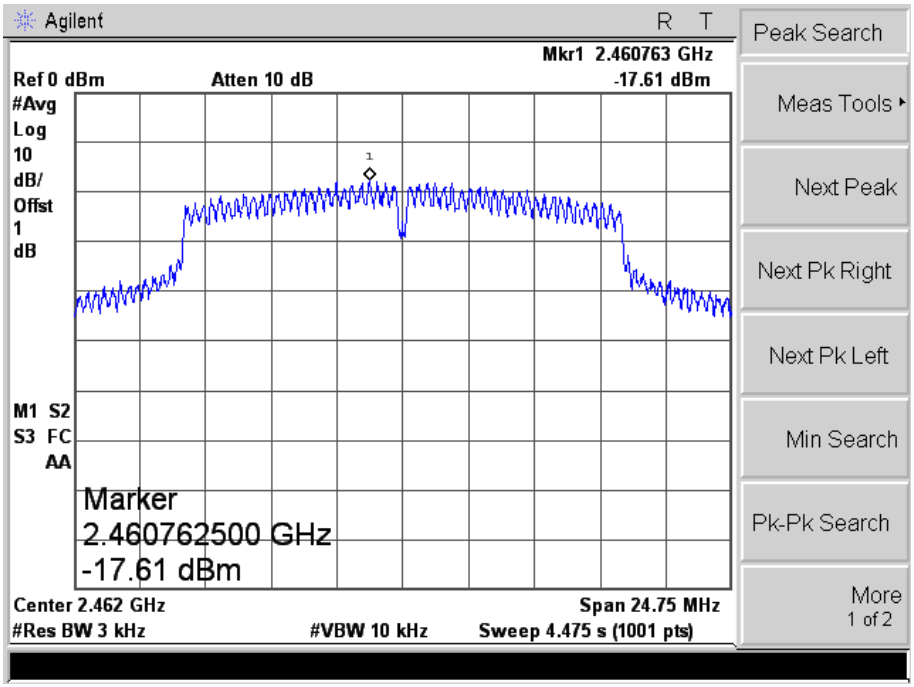
802.11g-Low Channel



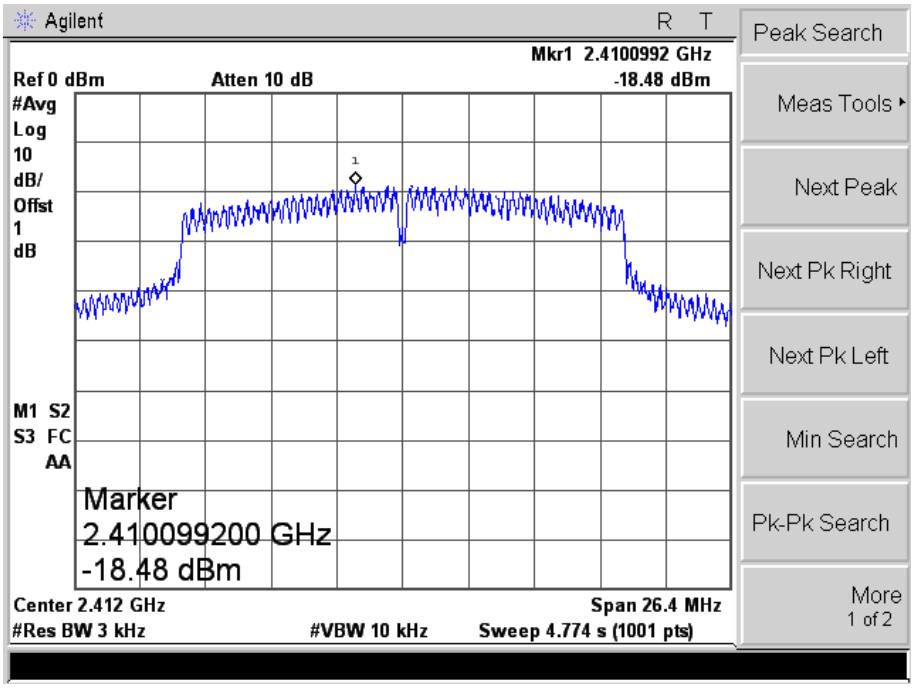
802.11g-Middle Channel



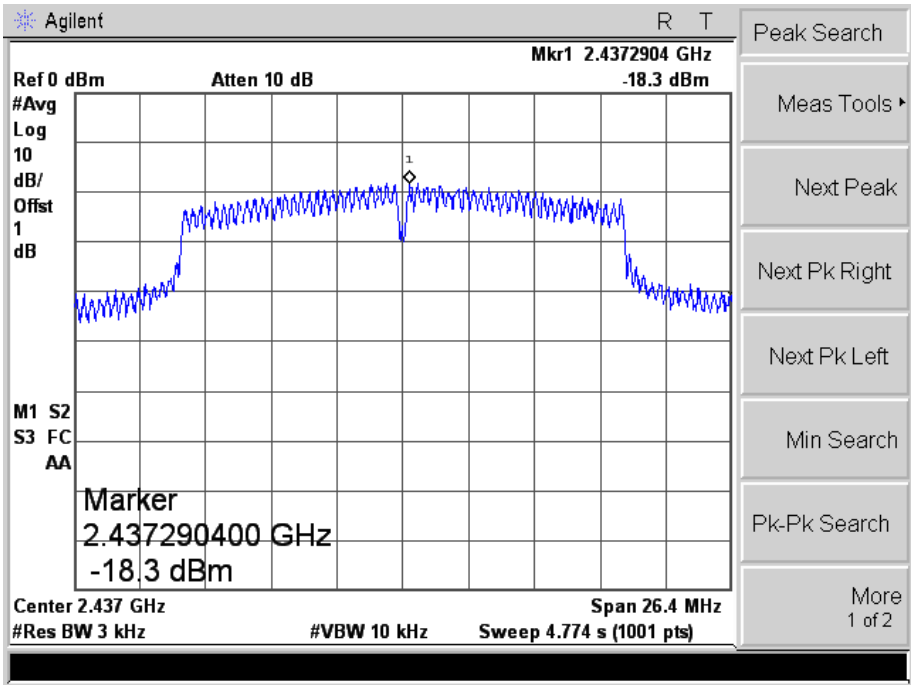
802.11g-High Channel



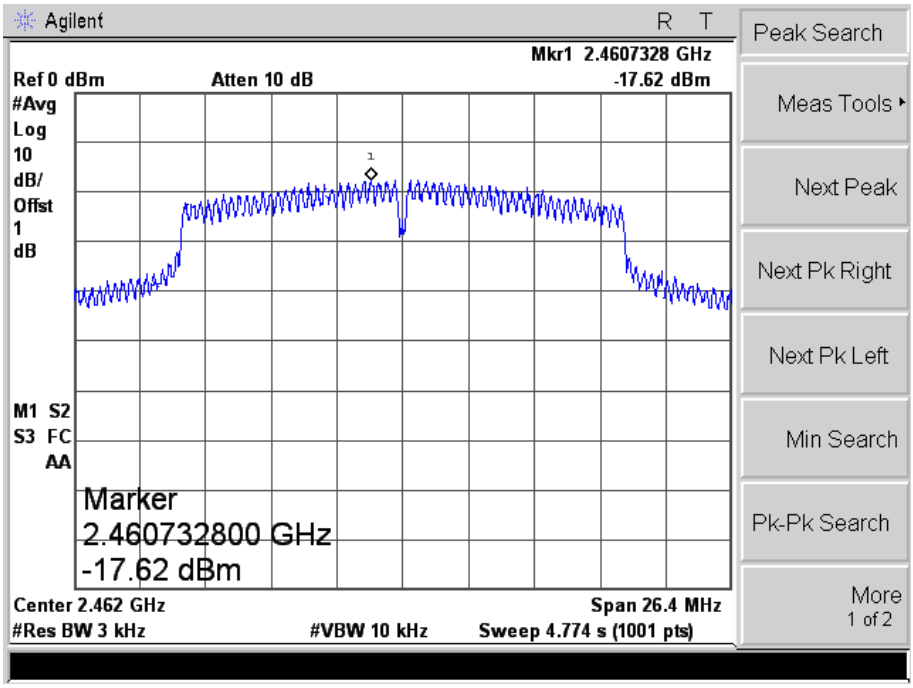
802.11n-HT20-Low Channel



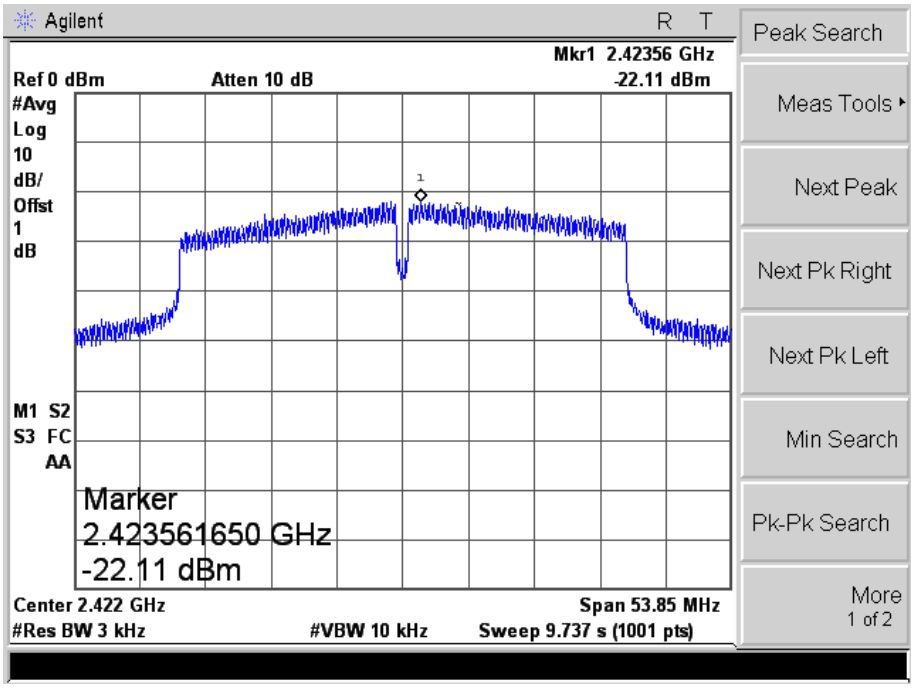
802.11n-HT20-Middle Channel



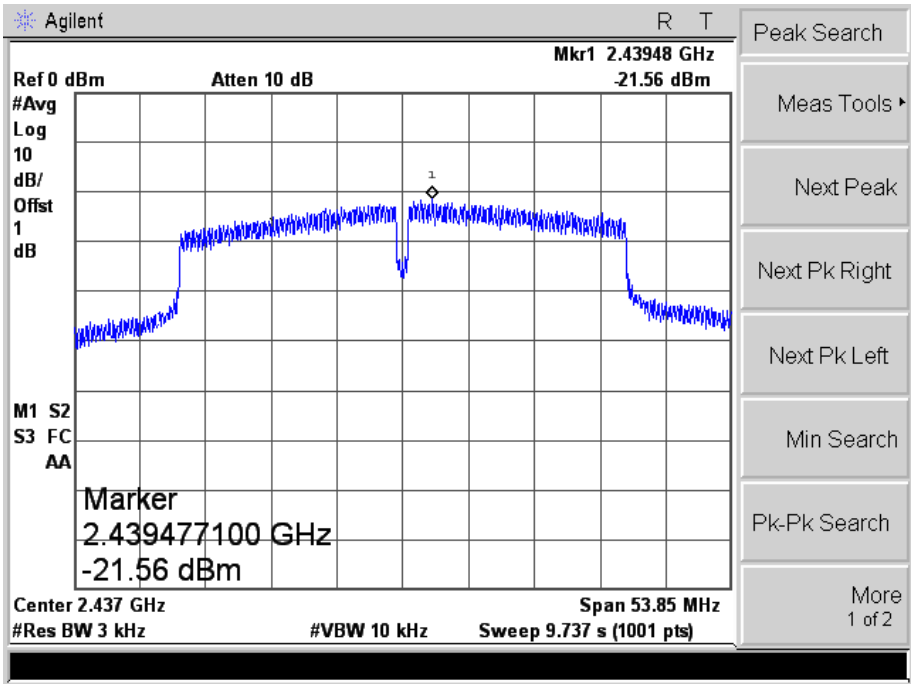
802.11n-HT20-High Channel



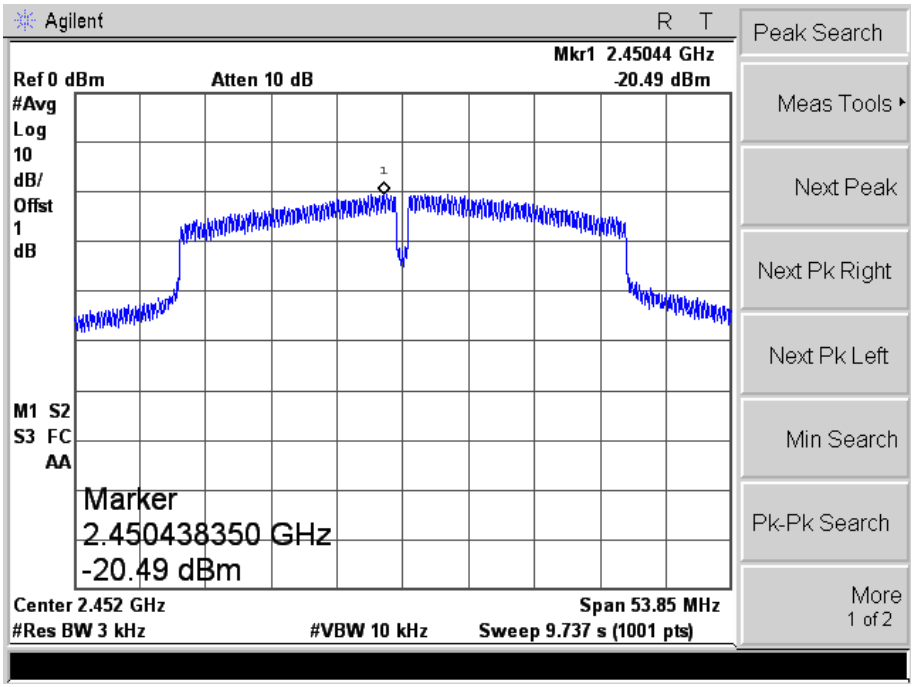
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel



802.11n-HT40-High Channel



6. 6dB Bandwidth

6.1 Standard Applicable

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 6 dB bandwidth shall be at least 500 kHz.

6.2 Test Procedure

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.3 Environmental Conditions

Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

Antenna 0

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	9.534	14.1499	≥500
	2437	9.541	14.6502	≥500
	2462	9.532	14.6045	≥500
802.11g	2412	16.060	16.3727	≥500
	2437	15.923	16.3662	≥500
	2462	16.314	16.3914	≥500
802.11n-HT20	2412	17.359	17.5913	≥500
	2437	17.139	17.5732	≥500
	2462	17.535	17.5668	≥500
802.11n-HT40	2422	35.298	35.8021	≥500
	2437	35.277	35.8546	≥500
	2452	35.171	35.8958	≥500

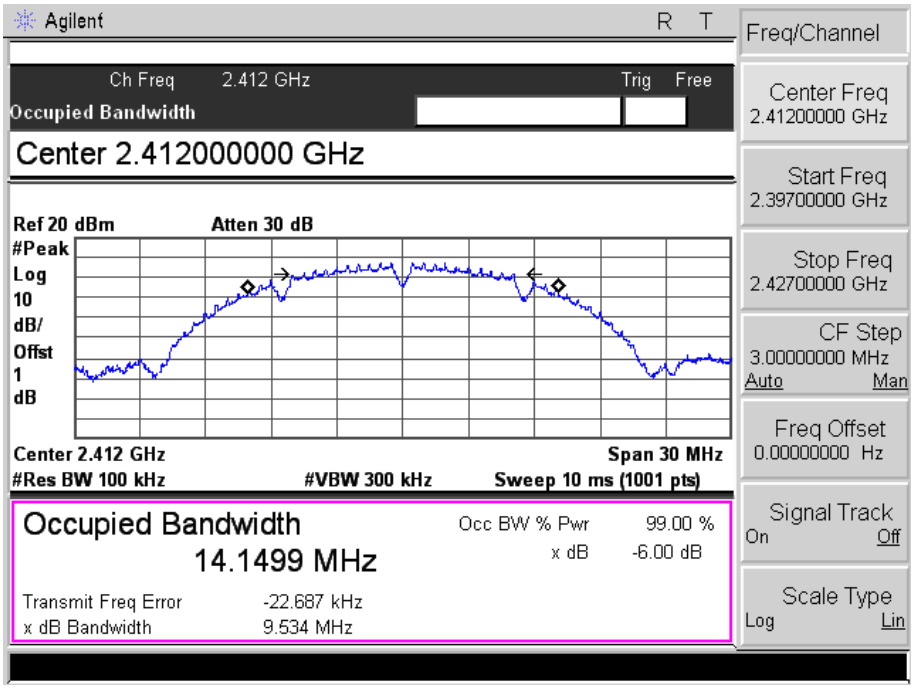
Antenna 1

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	9.066	14.4063	≥500
	2437	8.532	14.4039	≥500
	2462	10.027	14.4442	≥500
802.11g	2412	16.325	16.4004	≥500
	2437	16.292	16.4212	≥500
	2462	16.320	16.4082	≥500
802.11n-HT20	2412	17.531	17.5796	≥500
	2437	17.249	17.5889	≥500
	2462	17.558	17.5738	≥500
802.11n-HT40	2422	34.655	35.8424	≥500
	2437	35.668	35.8890	≥500
	2452	35.409	35.8481	≥500

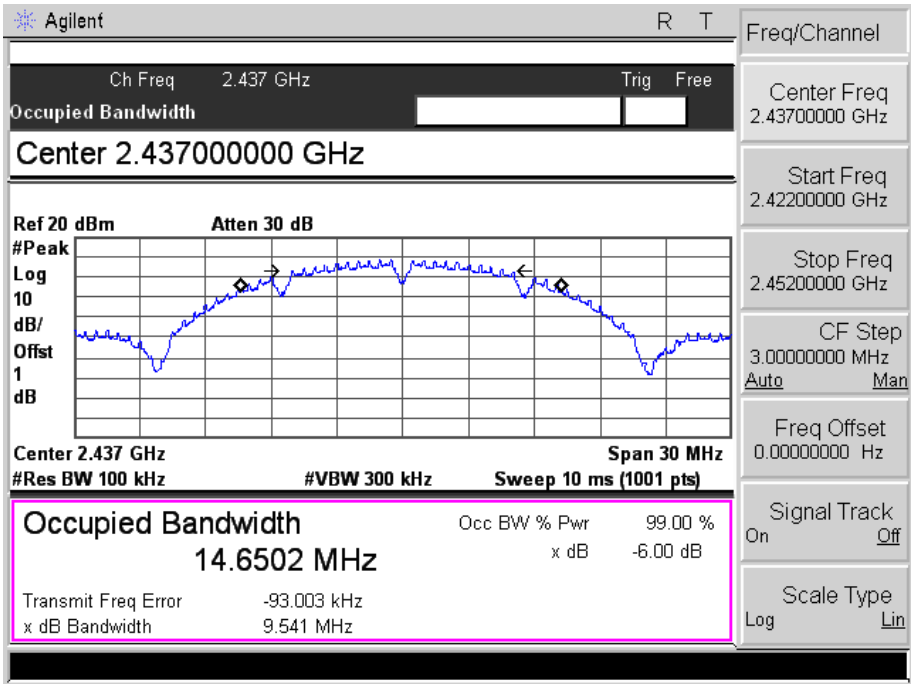
Please refer to the following test plots:

Antenna 0

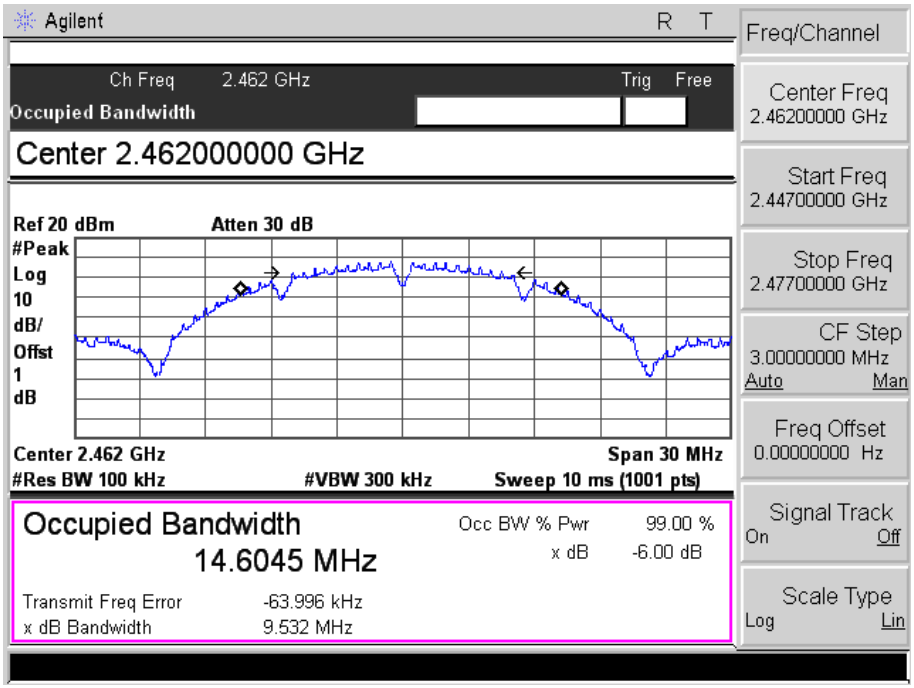
802.11b-Low Channel



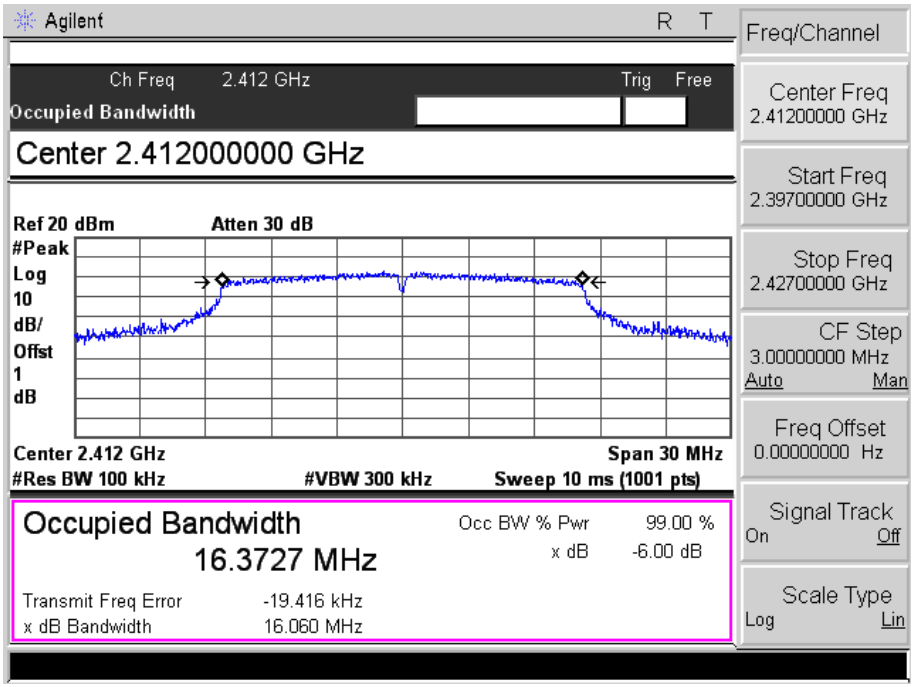
802.11b-Middle Channel



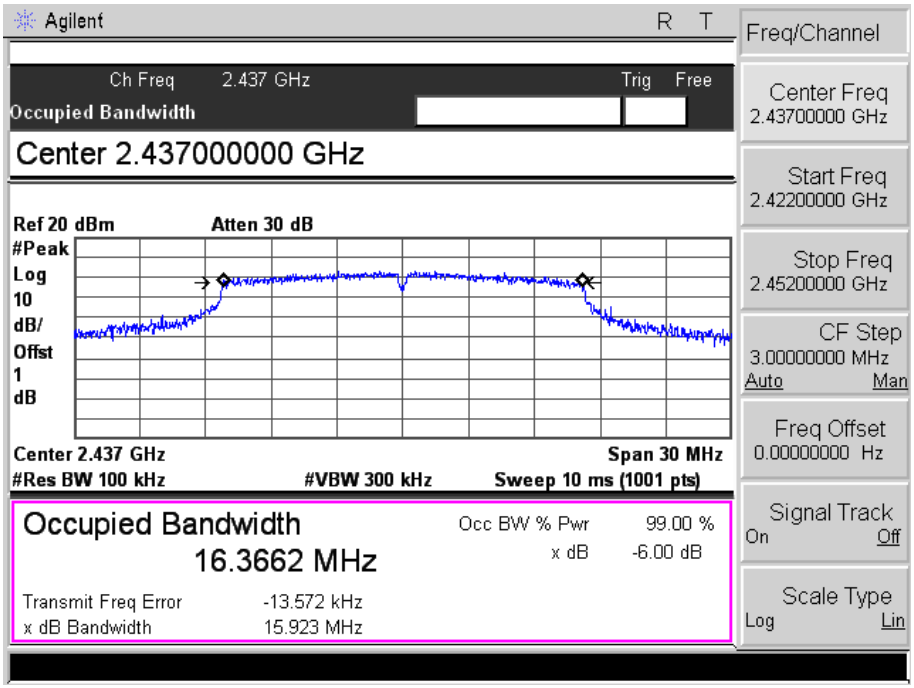
802.11b-High Channel



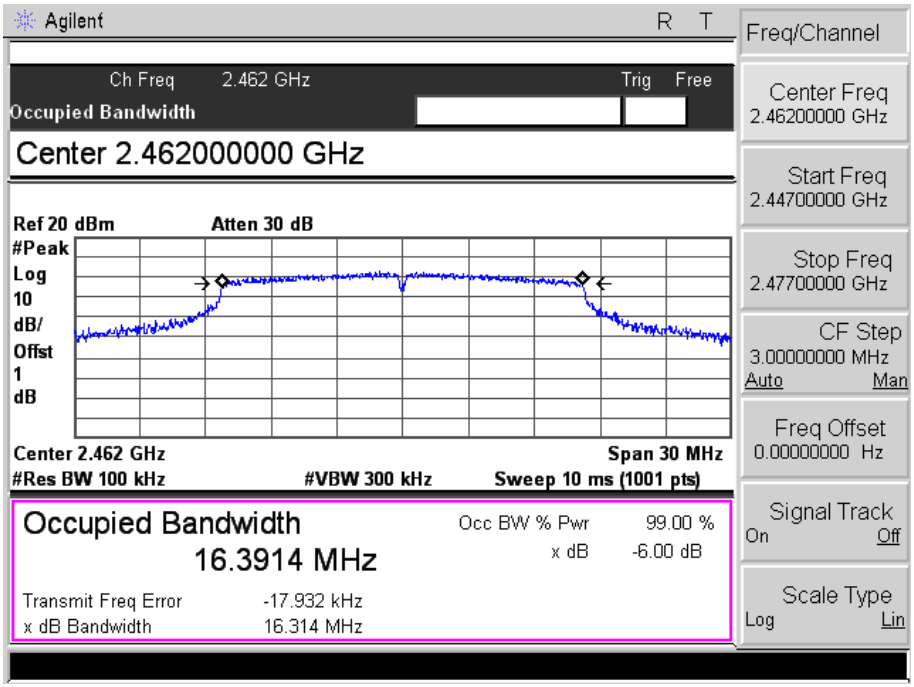
802.11g-Low Channel



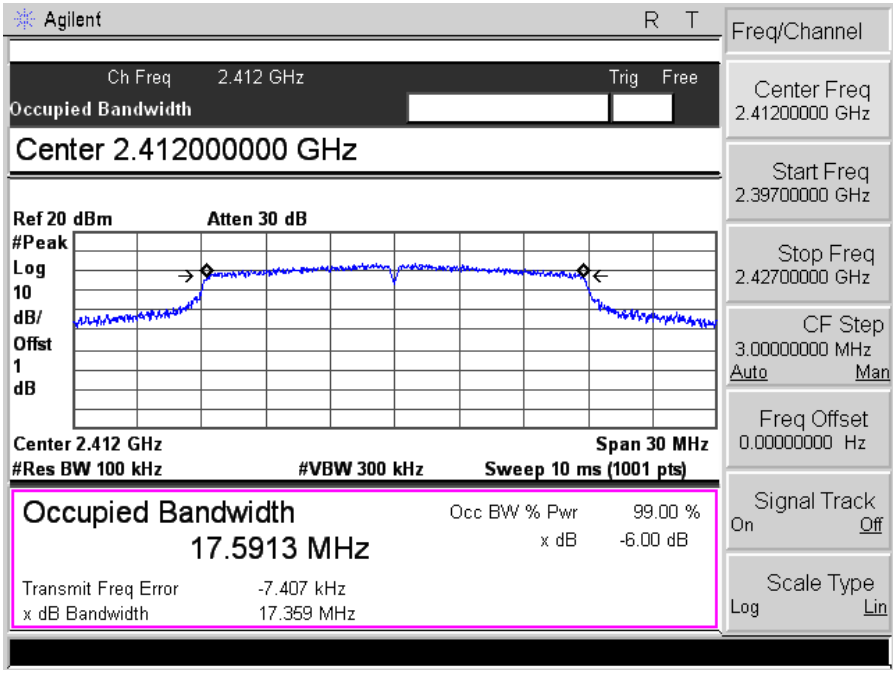
802.11g-Middle Channel



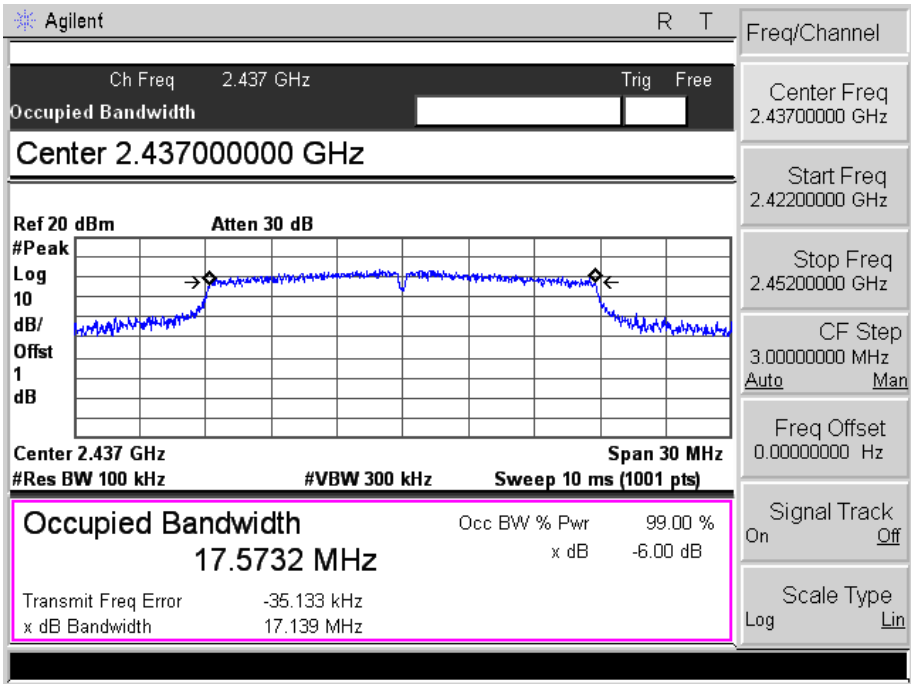
802.11g-High Channel



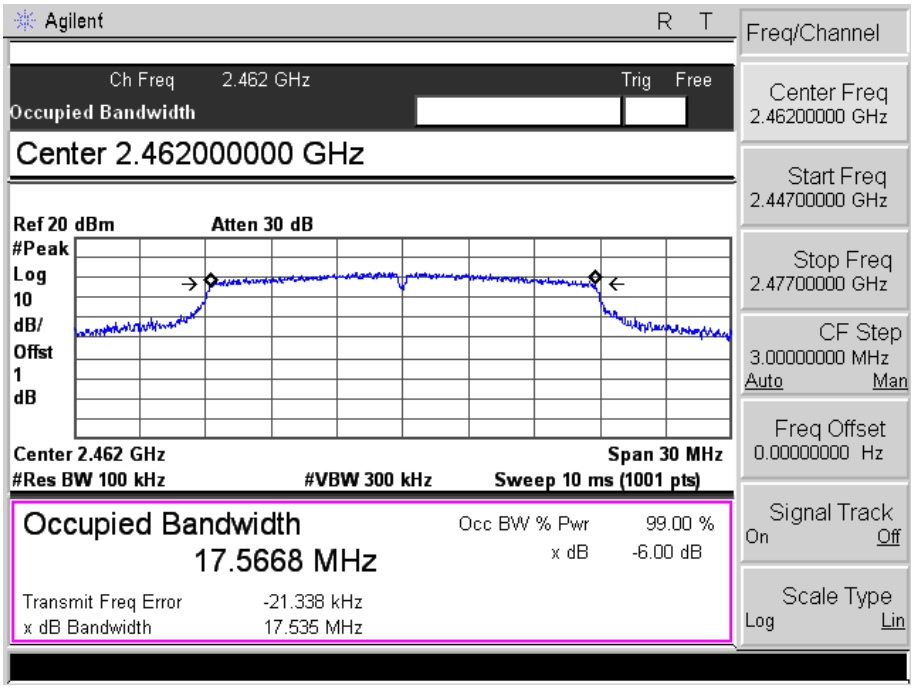
802.11n-HT20-Low Channel



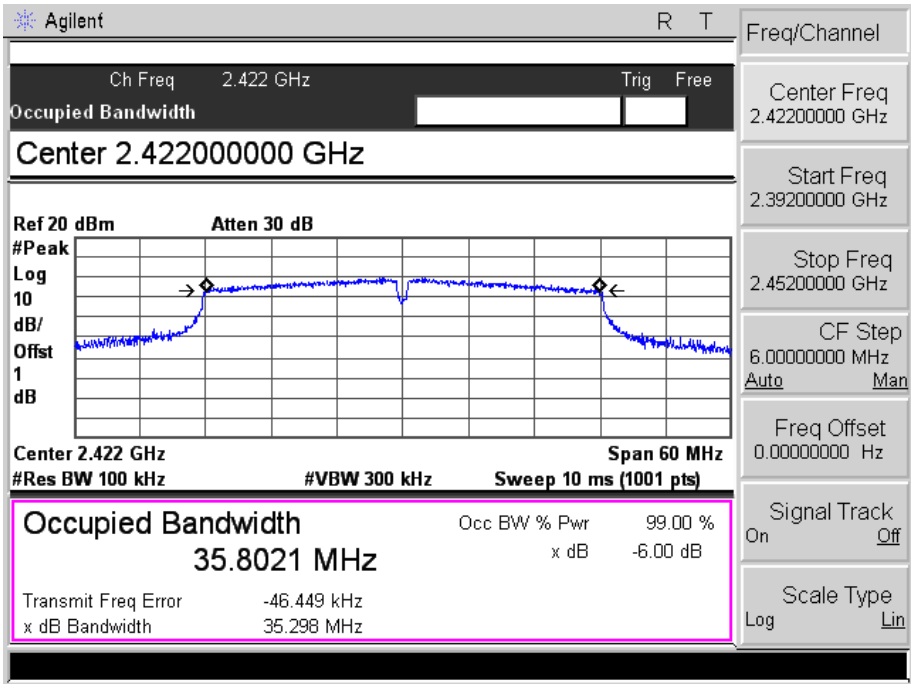
802.11n-HT20-Middle Channel



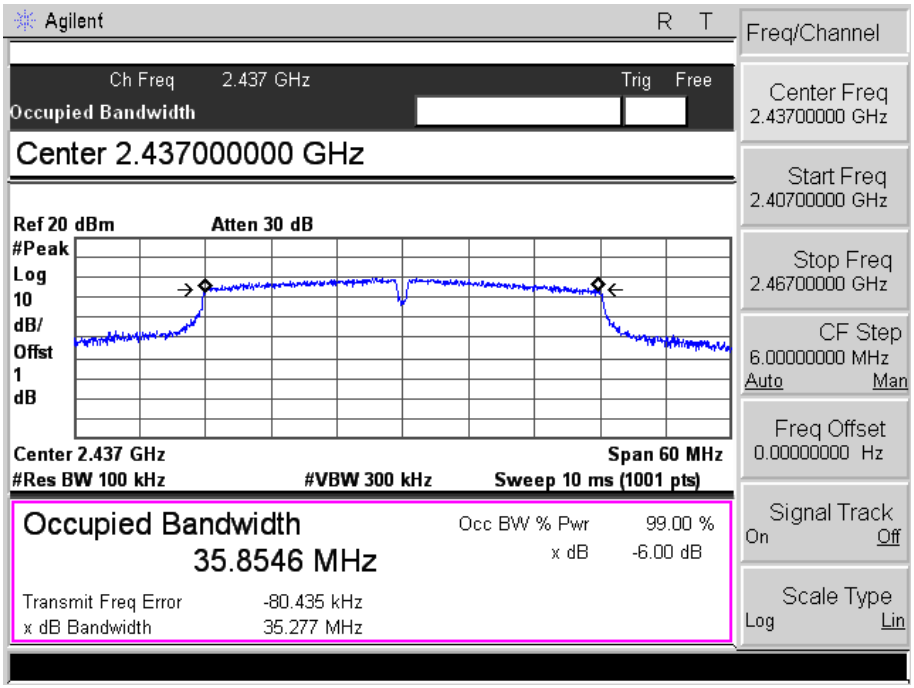
802.11n-HT20-High Channel



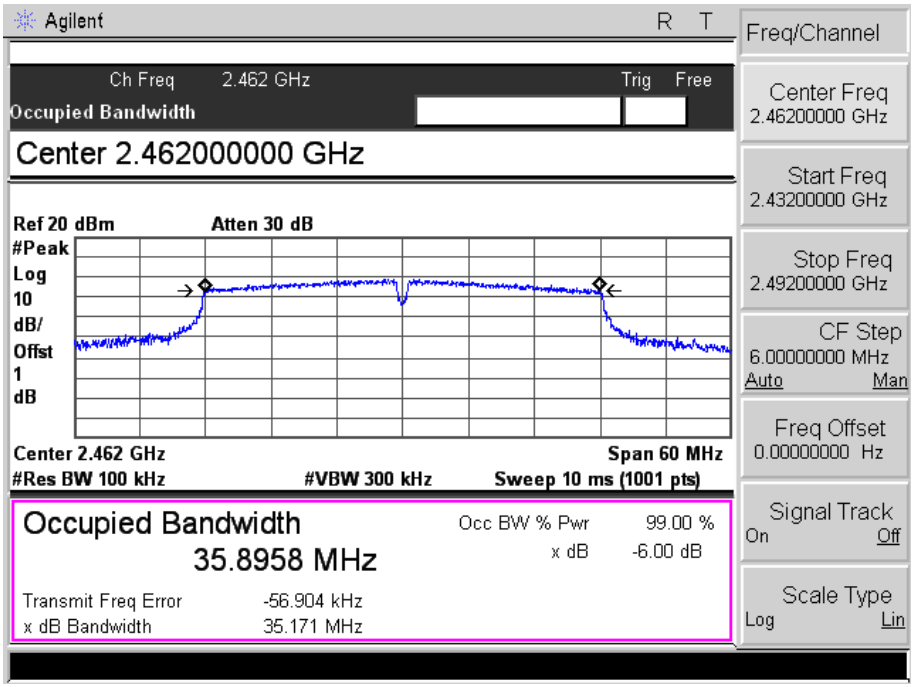
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel

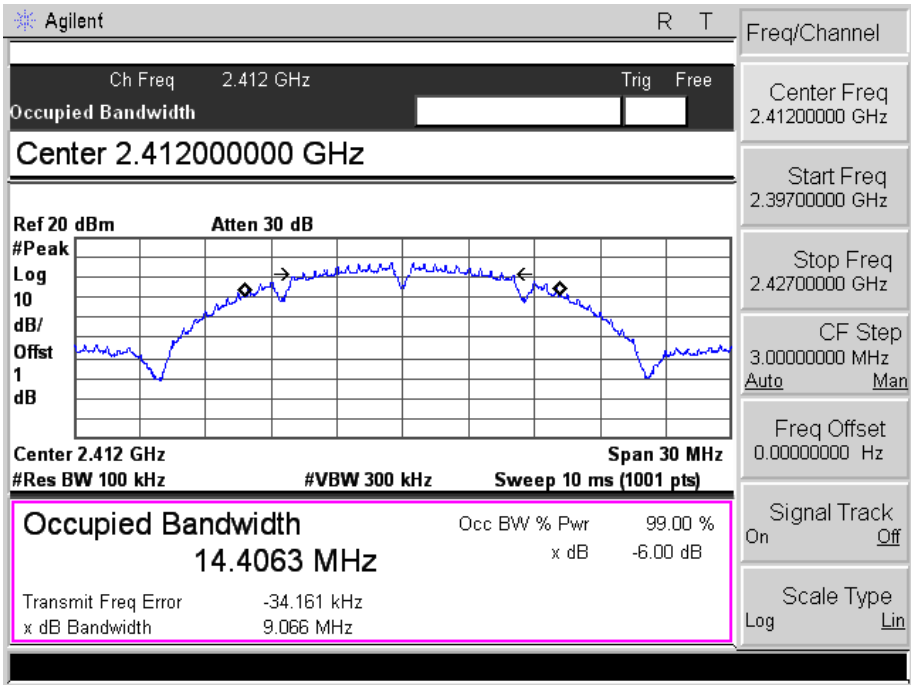


802.11n-HT40-High Channel

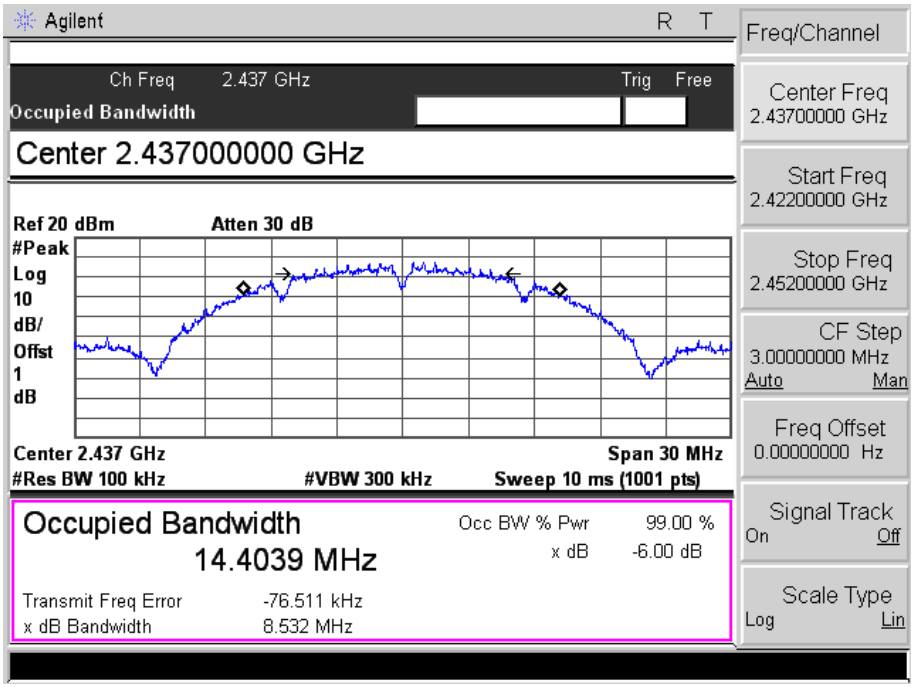


Antenna 1

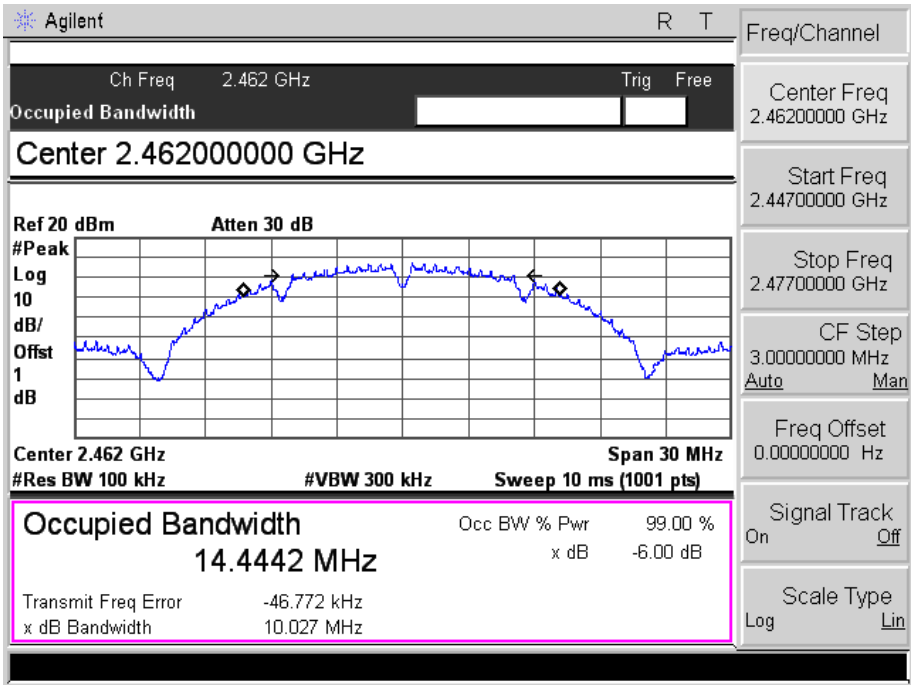
802.11b-Low Channel



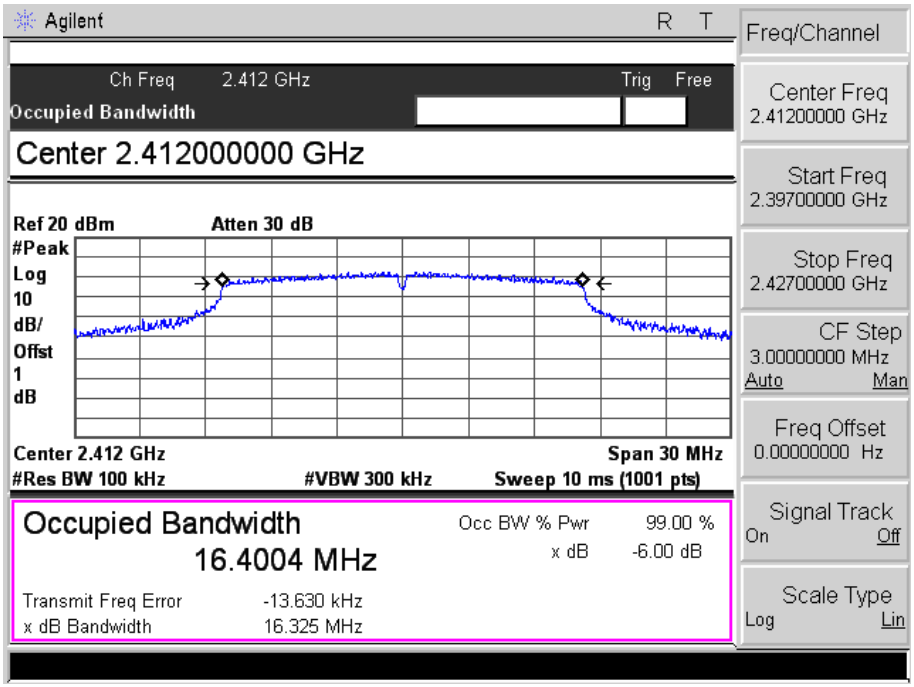
802.11b-Middle Channel



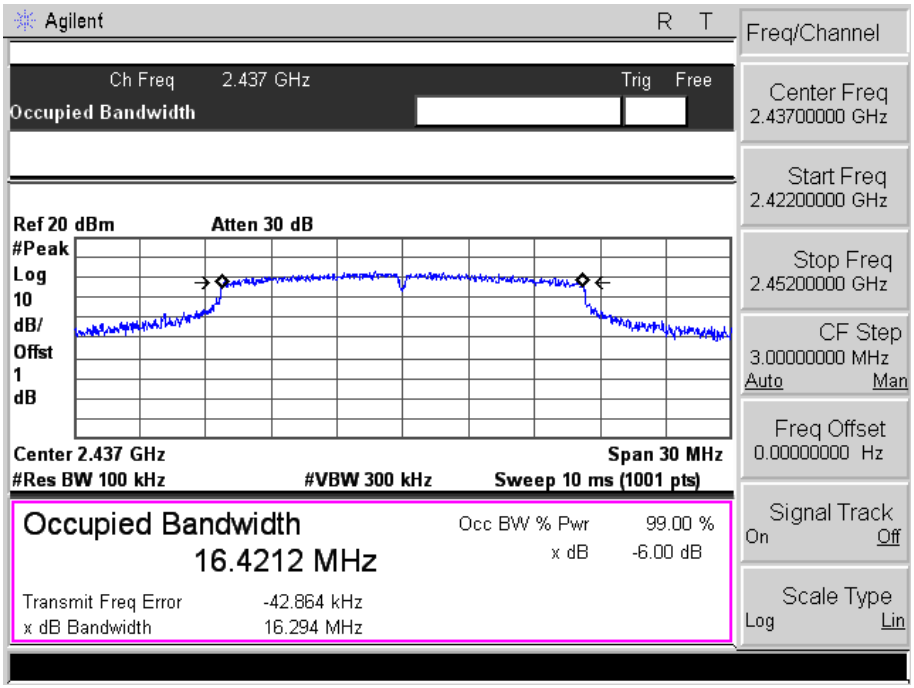
802.11b-High Channel



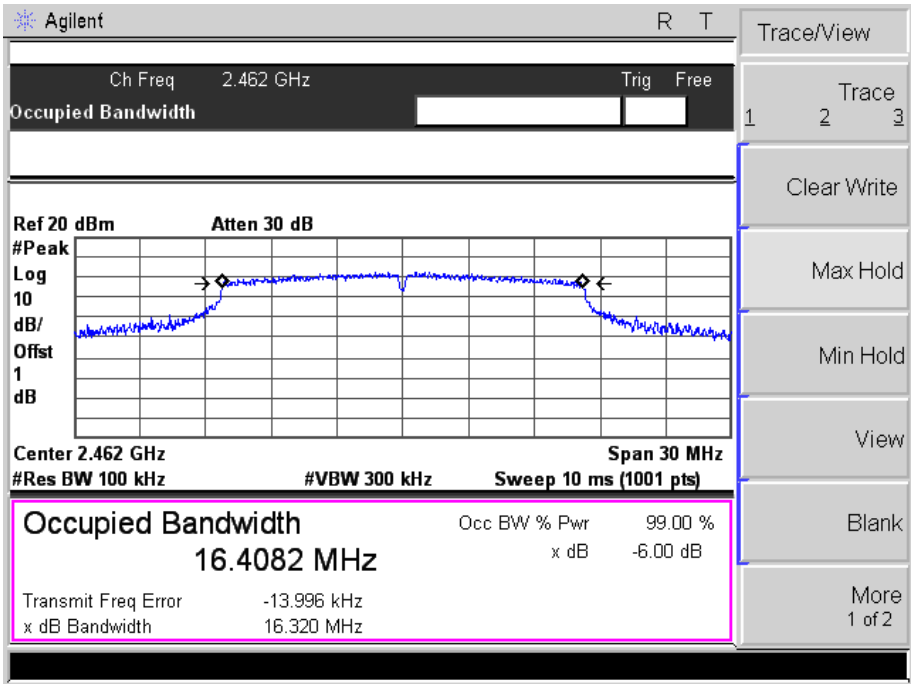
802.11g-Low Channel



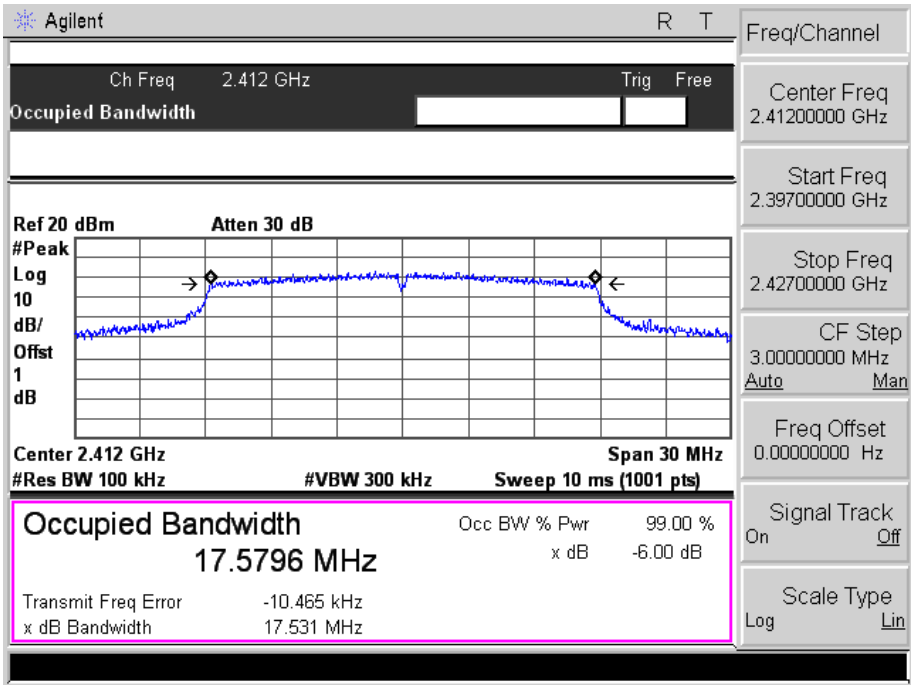
802.11g-Middle Channel



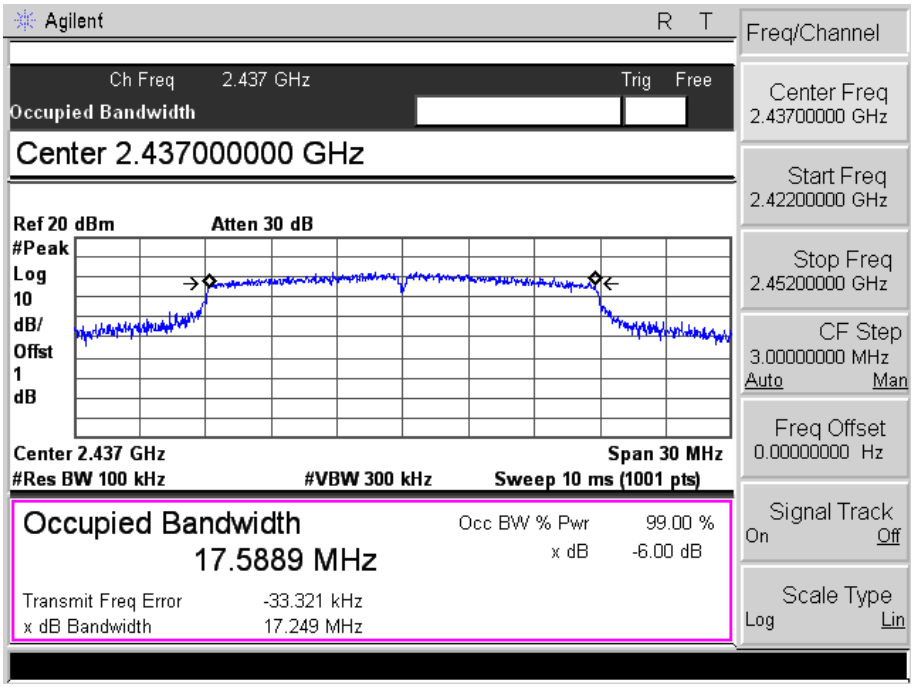
802.11g-High Channel



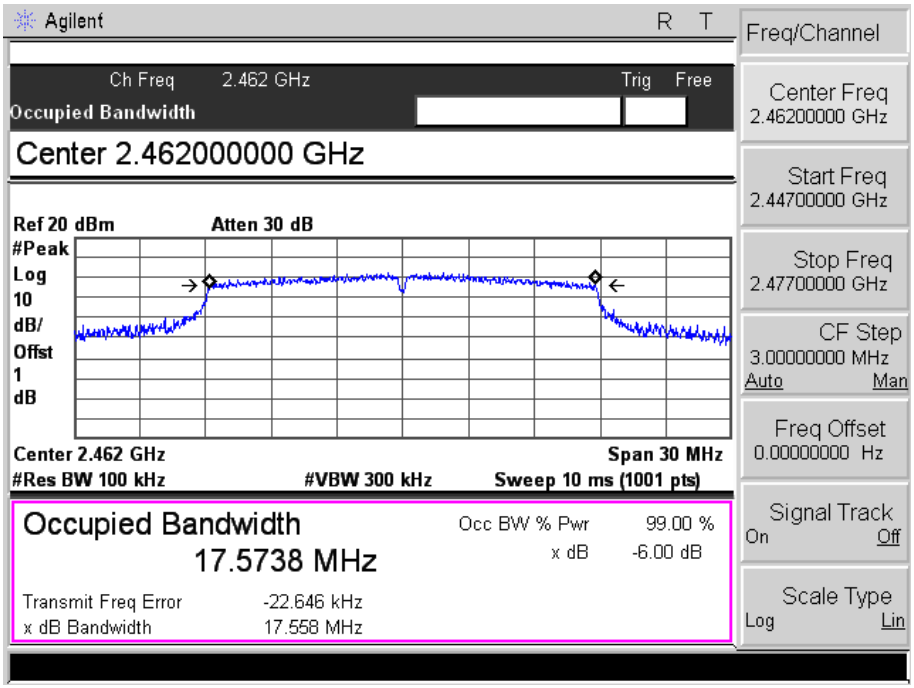
802.11n-HT20-Low Channel



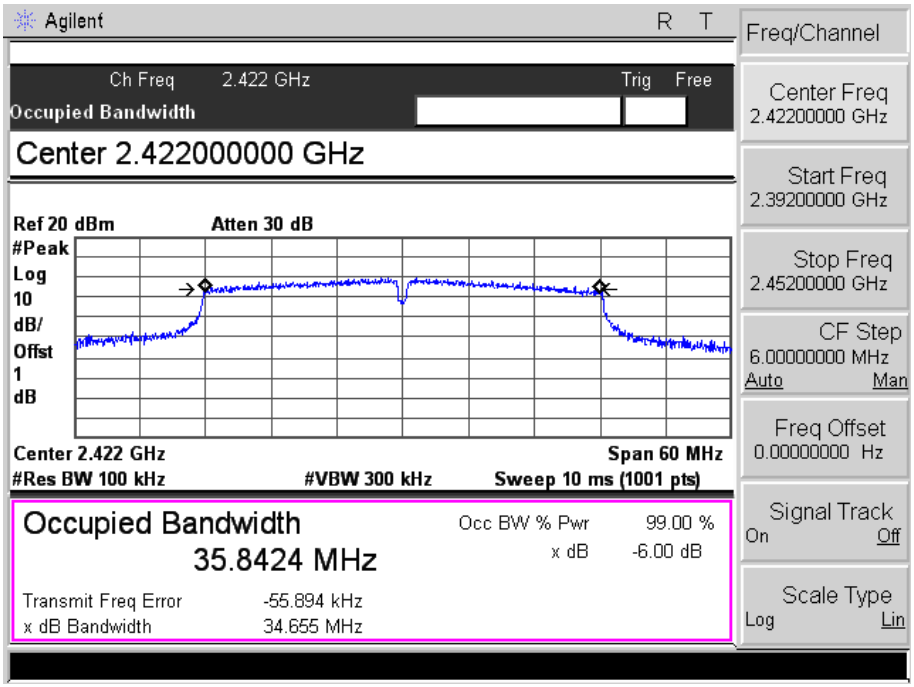
802.11n-HT20-Middle Channel



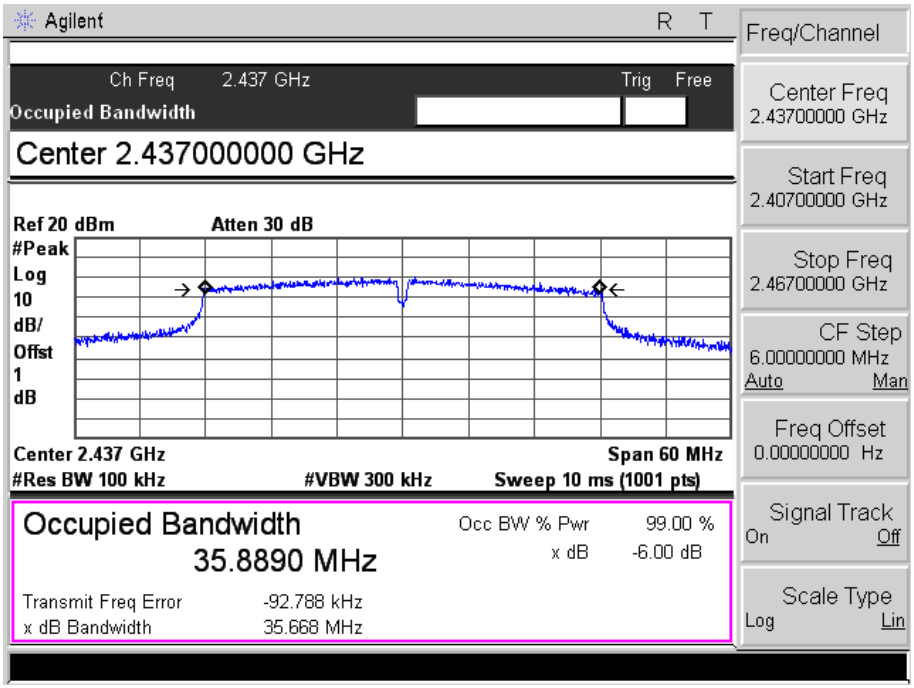
802.11n-HT20-High Channel



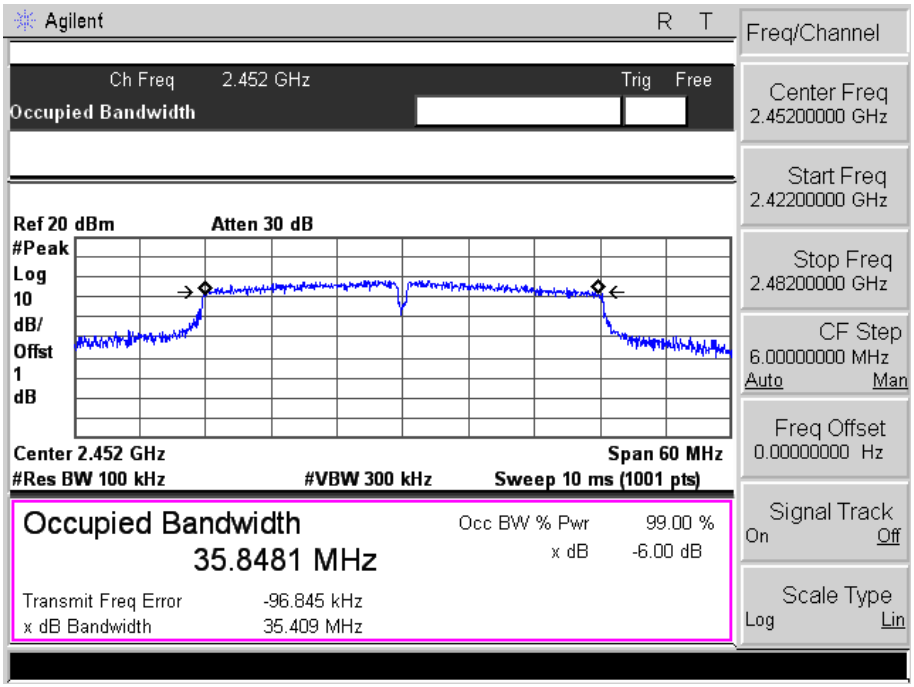
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel



802.11n-HT40-High Channel



7. RF Output Power

7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

7.2 Test Procedure

According to KDB-558074 D01 V04, (channel integration method) When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

a) Set span to at least 1.5 times the OBW.
b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
c) Set VBW ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
e) Sweep time = auto.
f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
g) If transmit duty cycle < 98 %, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 %, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

7.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

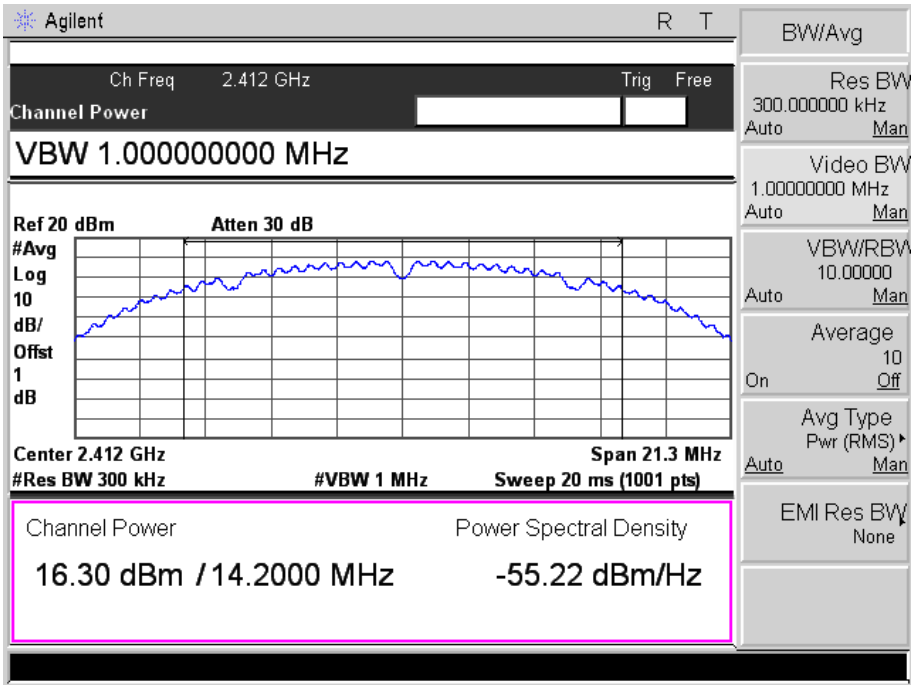
7.4 Summary of Test Results/Plots

Test Mode	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	16.30	16.00	/	/	1000
	2437	16.69	16.70	/	/	1000
	2462	16.35	15.99	/	/	1000
802.11g_54Mbps	2412	15.48	15.56	/	/	1000
	2437	15.74	15.56	/	/	1000
	2462	15.07	15.17	/	/	1000
802.11n HT20_MCS7	2412	15.04	14.31	17.70	58.89	1000
	2437	15.83	14.93	18.41	69.40	1000
	2462	15.13	14.21	17.70	58.95	1000
802.11n HT40_MCS7	2422	13.96	13.63	16.81	47.96	1000
	2437	14.62	13.49	17.10	51.31	1000
	2452	13.40	13.33	16.38	43.41	1000

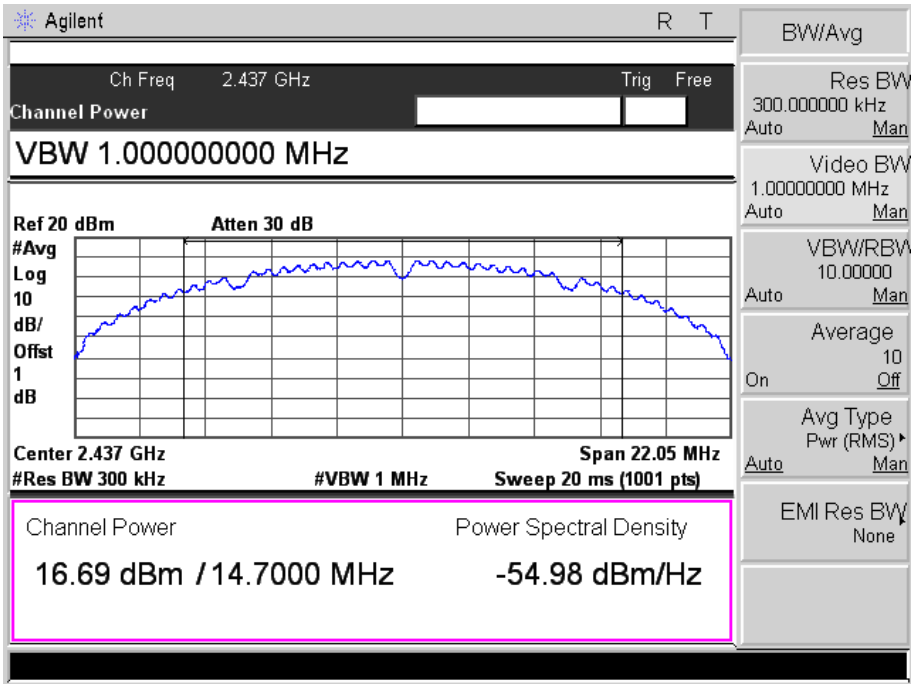
Please refer to the following test plots:

Antenna 0

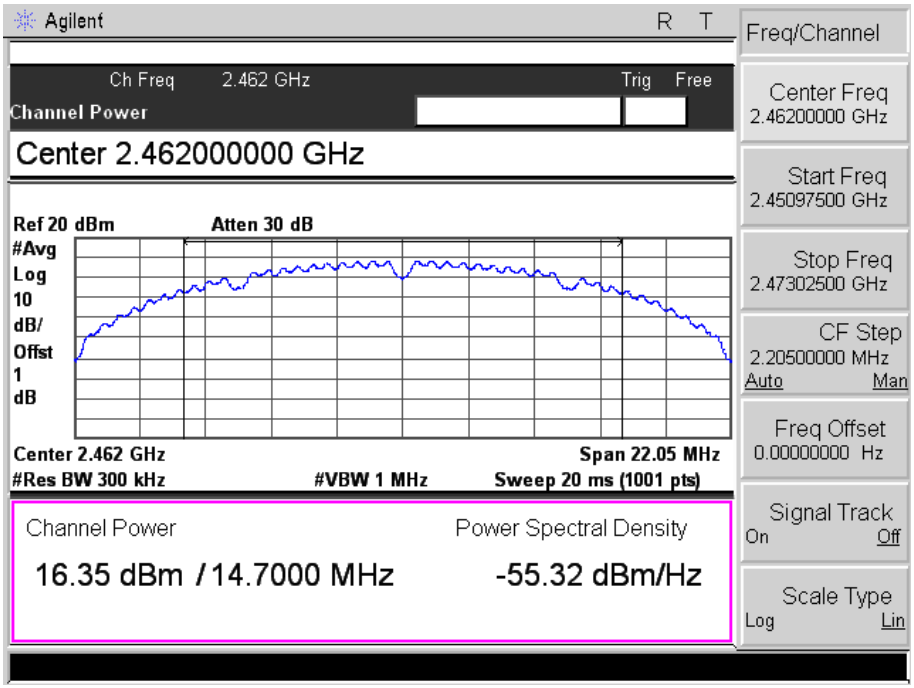
802.11b-11Mbps-Low Channel



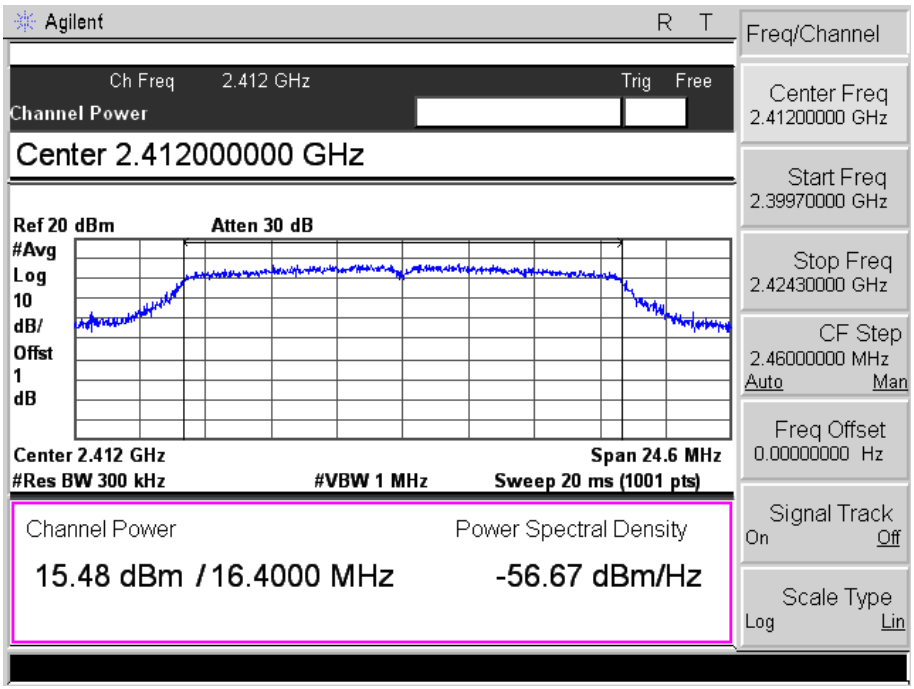
802.11b -11Mbps-Middle Channel



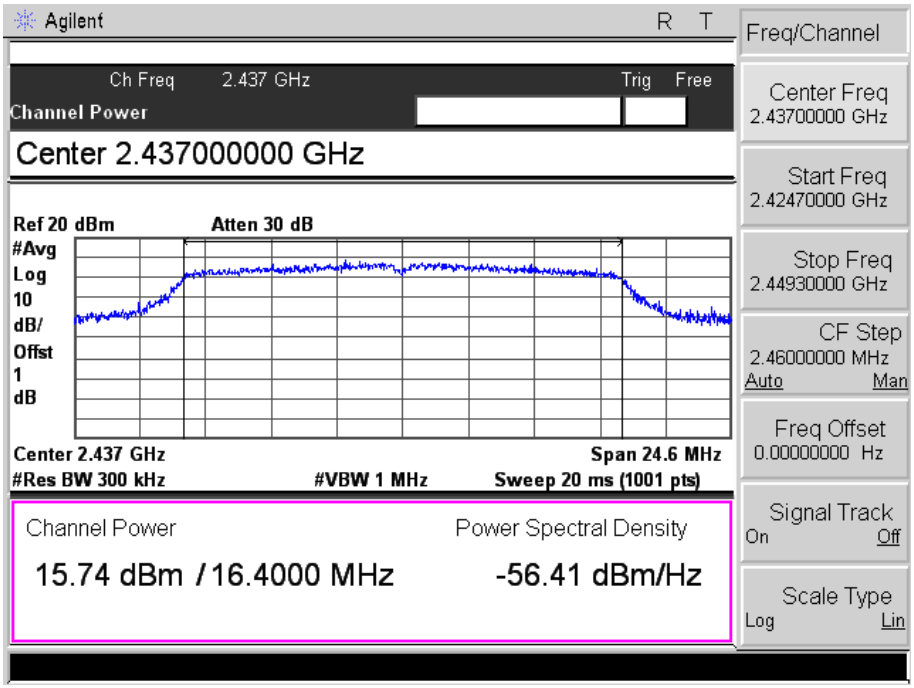
802.11b -11Mpbs-High Channel



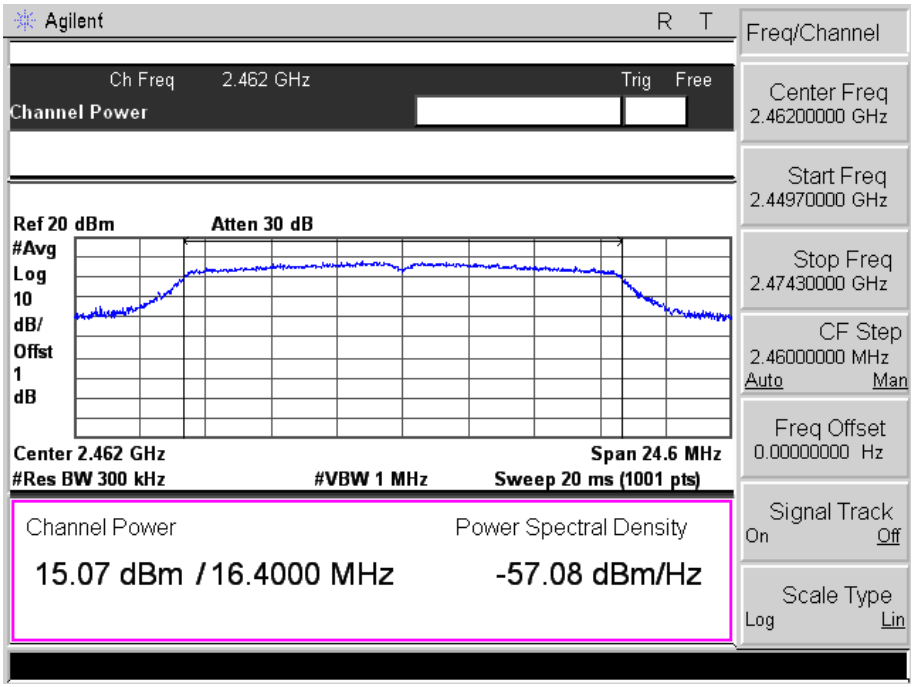
802.11g-54Mbps-Low Channel



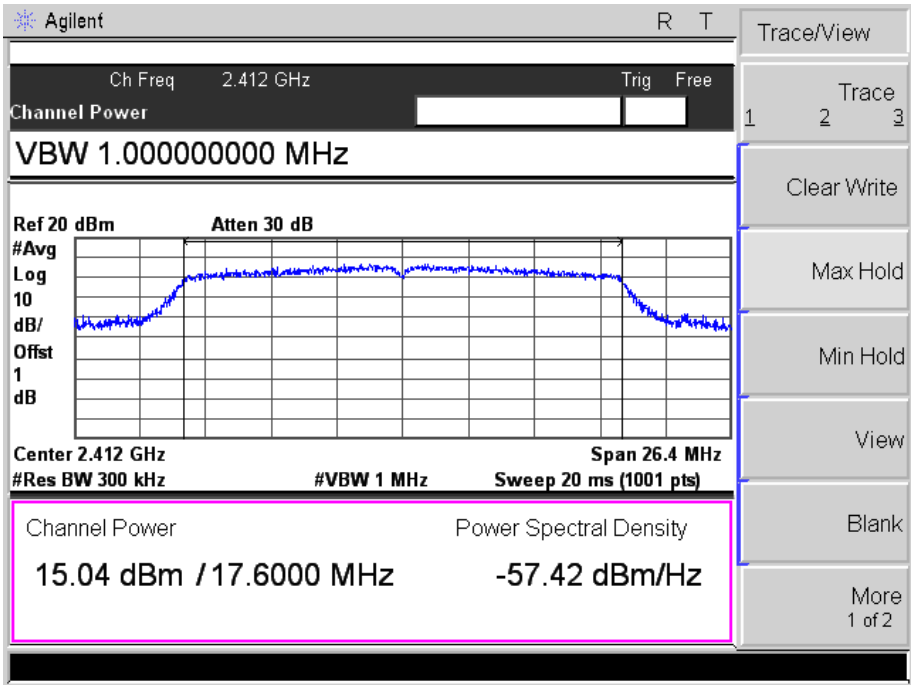
802.11g-54Mbps-Middle Channel



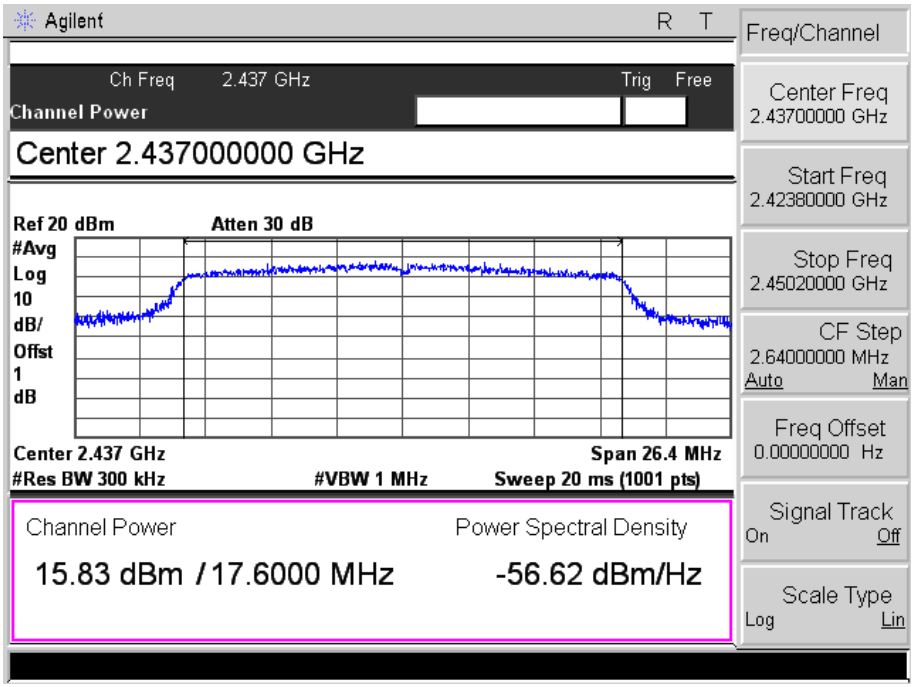
802.11g-54Mpbs-High Channel



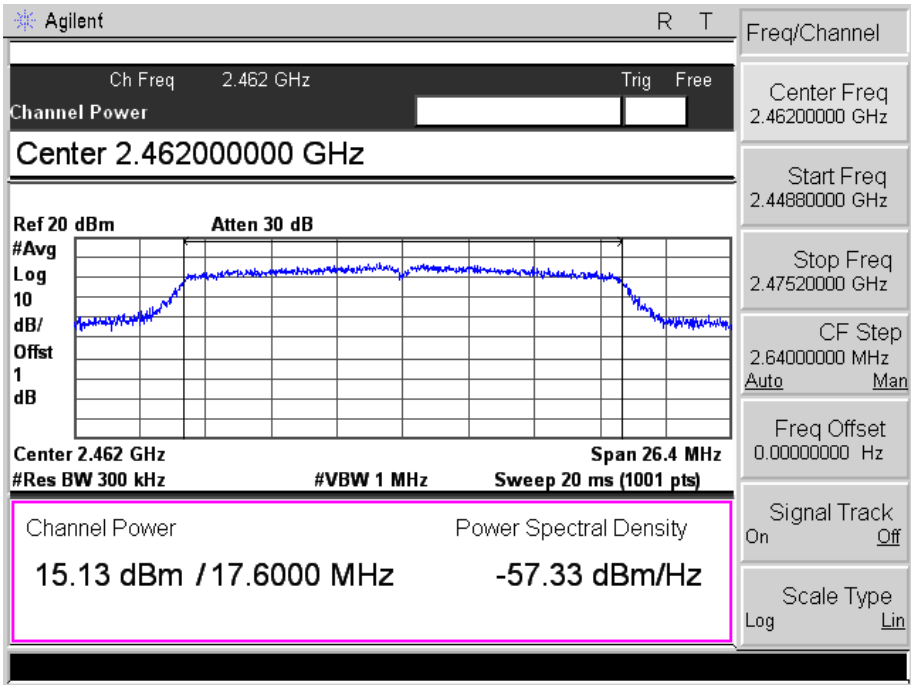
802.11n-HT20-MCS7-Low Channel



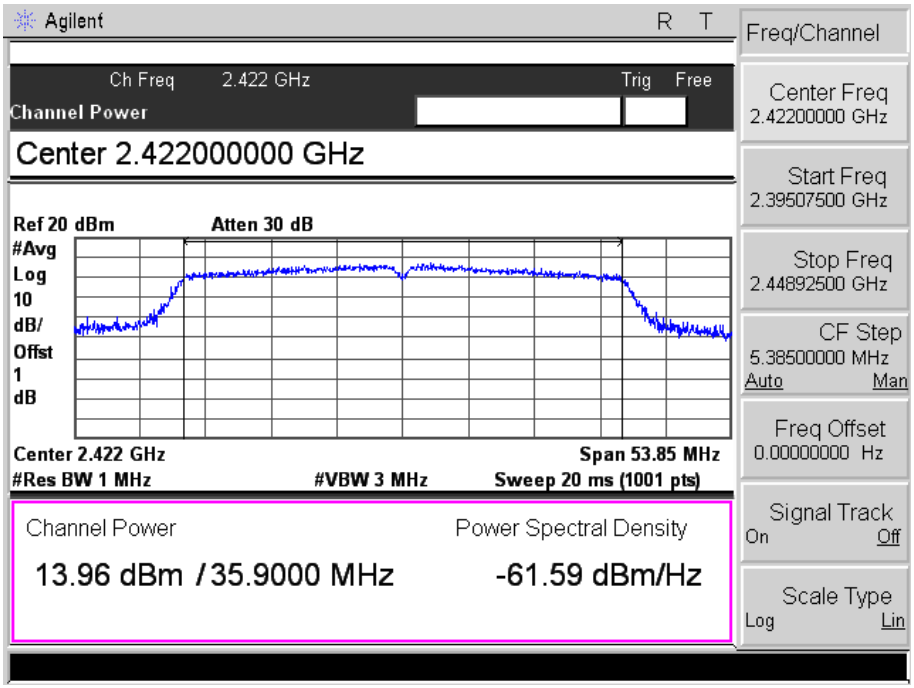
802.11n-HT20-MCS7-Middle Channel



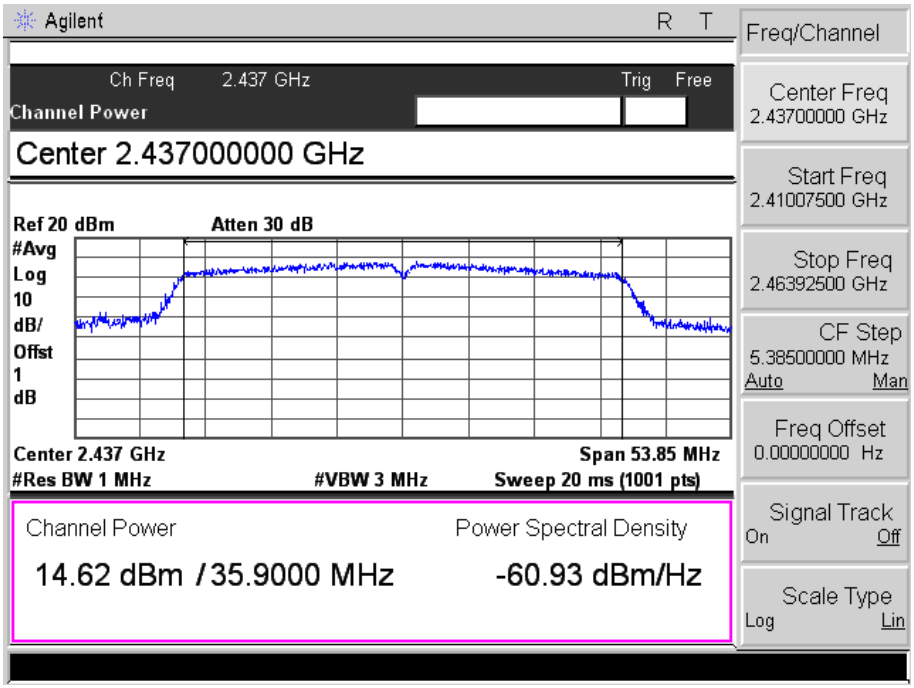
802.11n-HT20-MCS7-High Channel



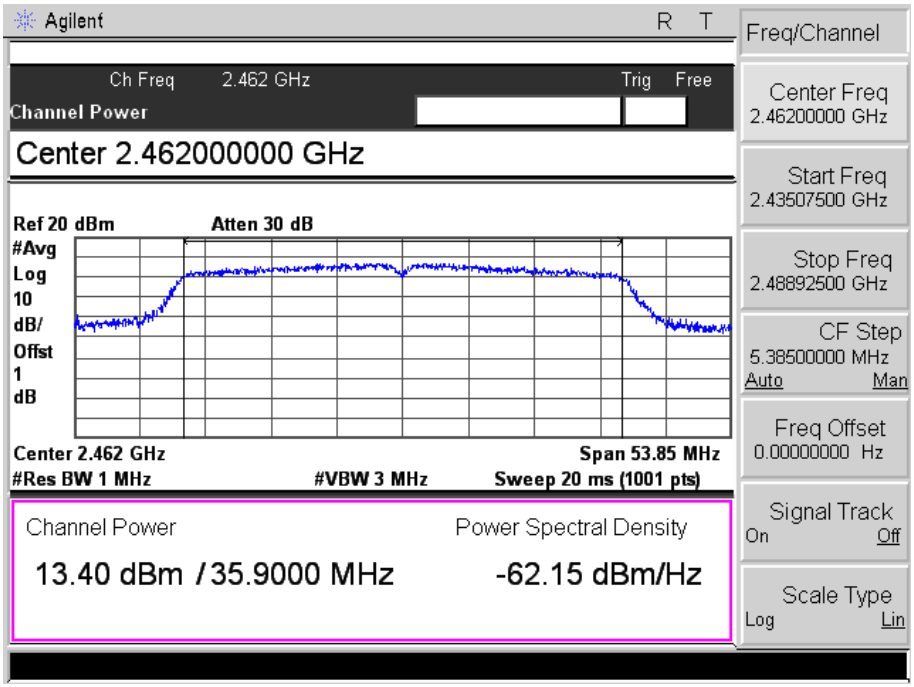
802.11n-HT40-MCS7-Low Channel



802.11n-HT40-MCS7-Middle Channel

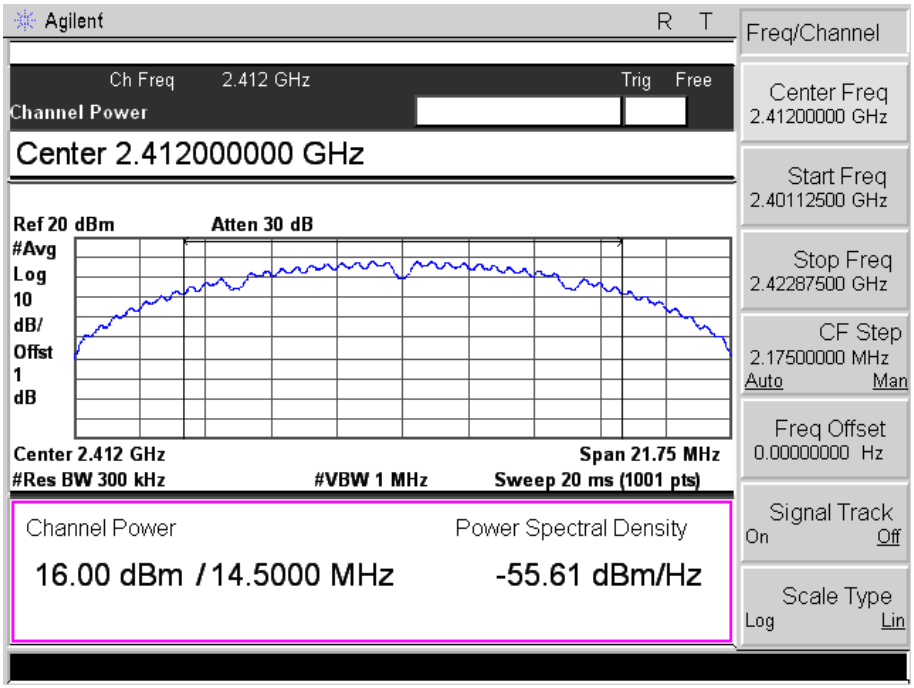


802.11n-HT40-MCS7-High Channel

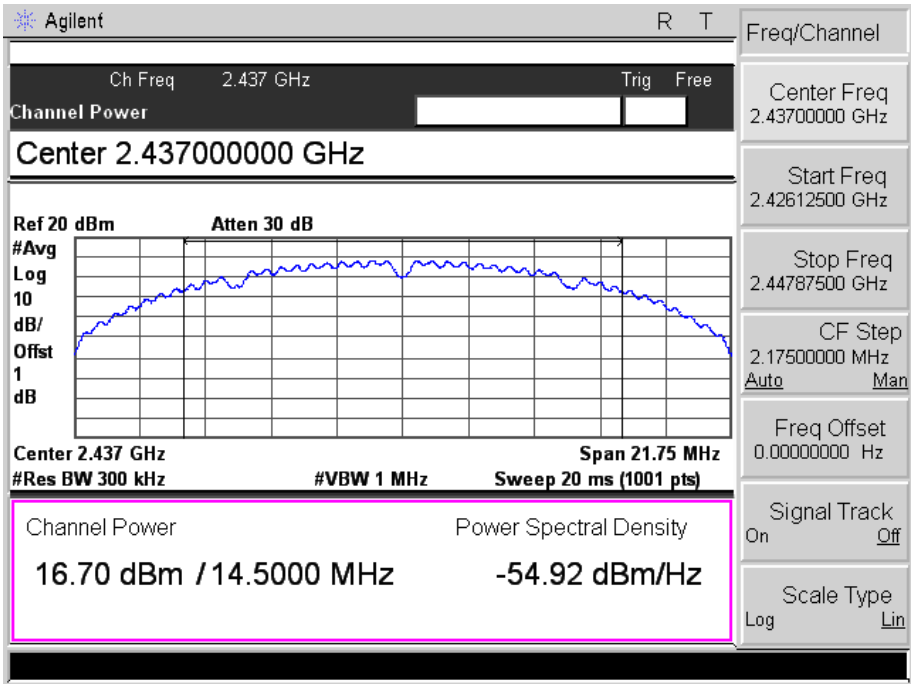


Antenna 1

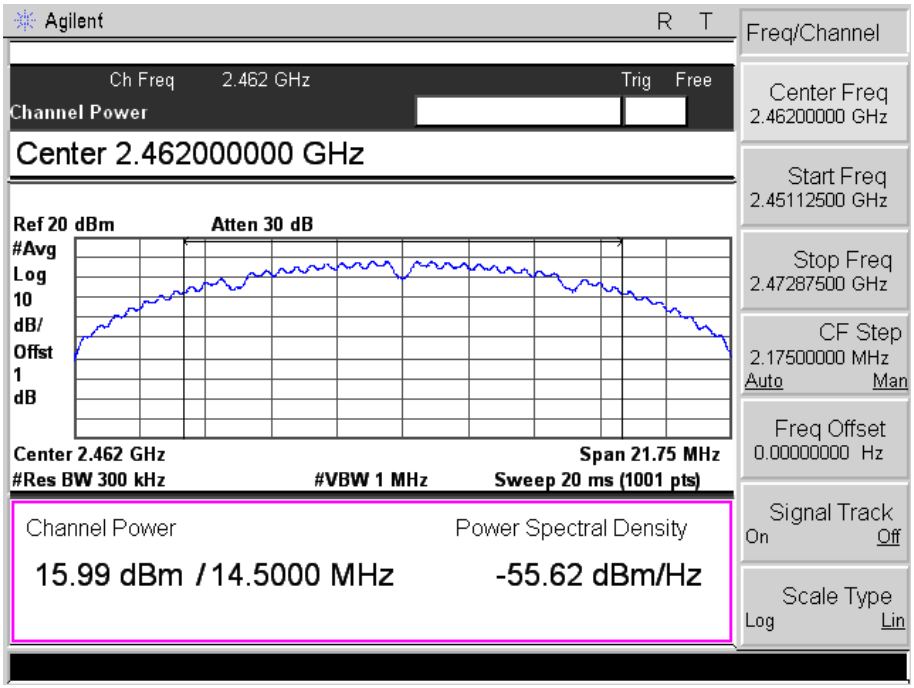
802.11b-11Mbps-Low Channel



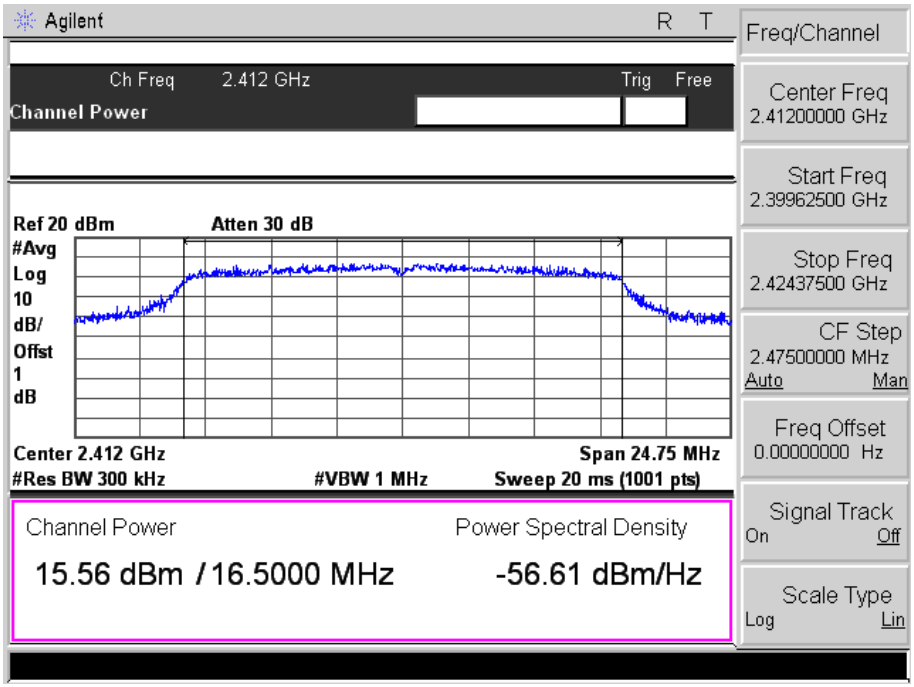
802.11b -11Mbps-Middle Channel



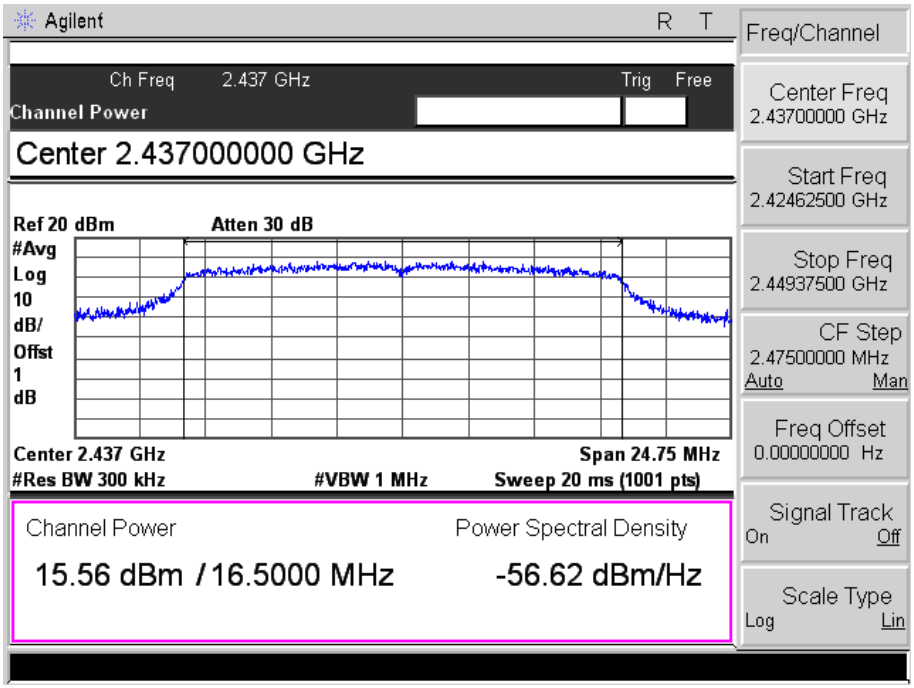
802.11b -11Mpbs-High Channel



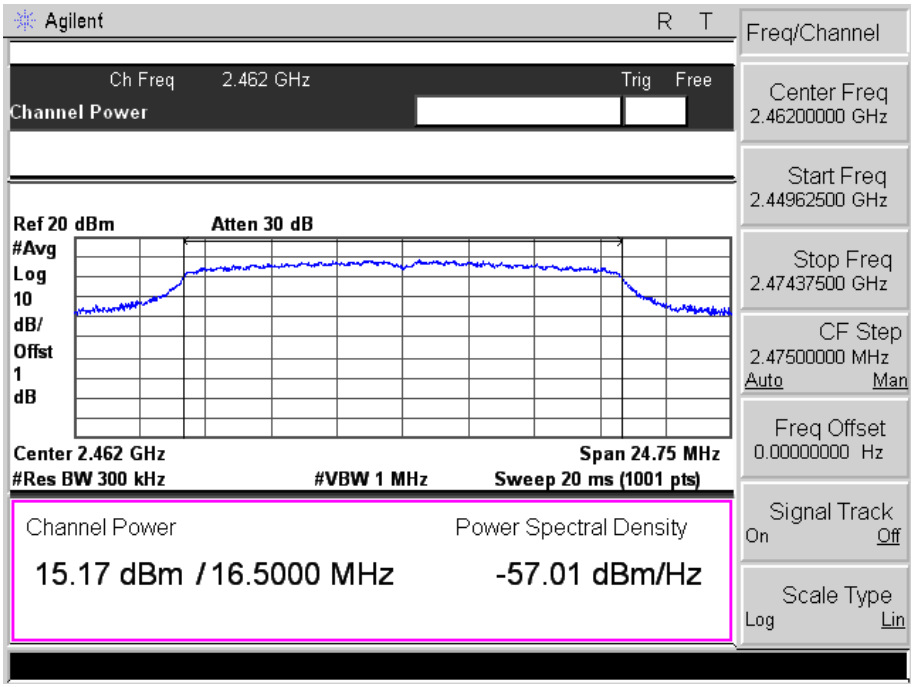
802.11g-54Mbps-Low Channel



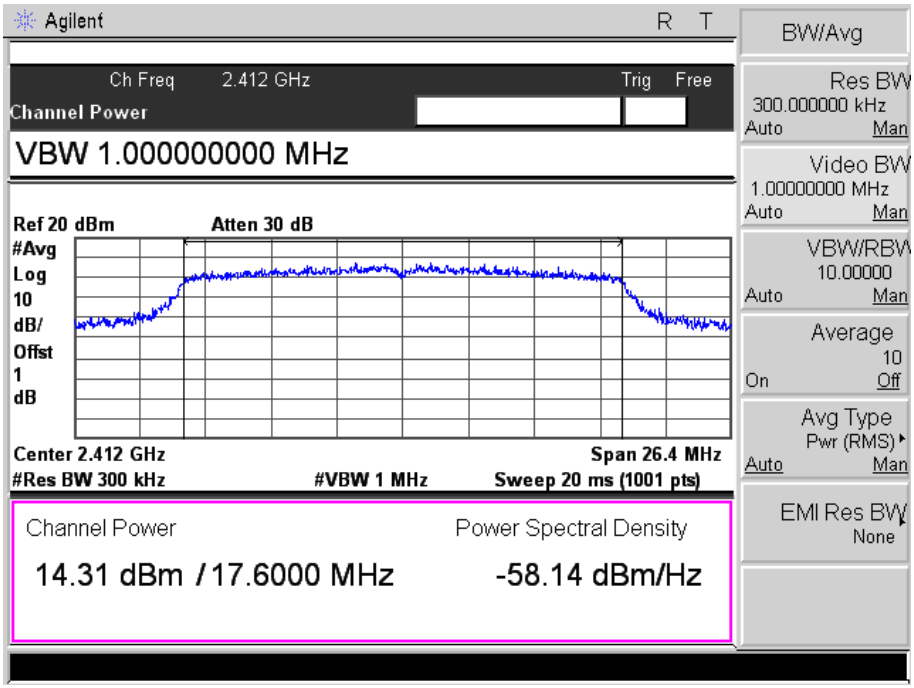
802.11g-54Mbps-Middle Channel



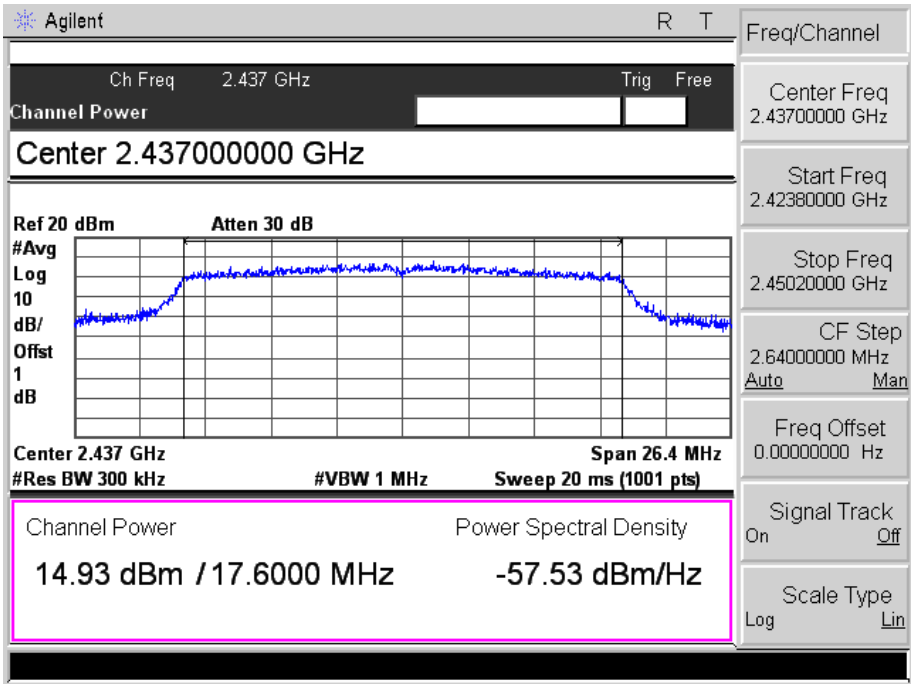
802.11g-54Mpbs-High Channel



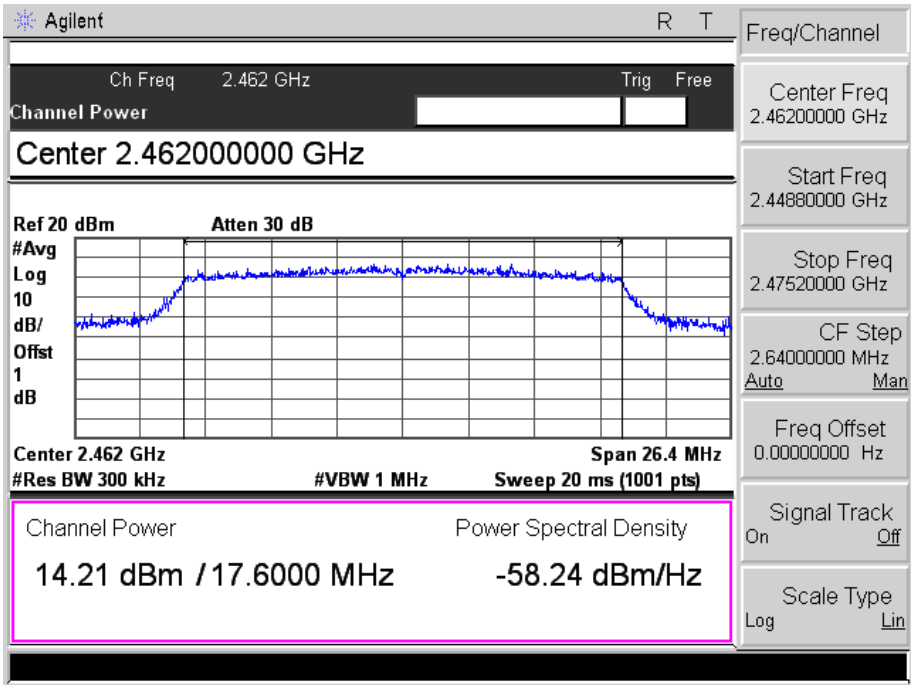
802.11n-HT20-MCS7-Low Channel



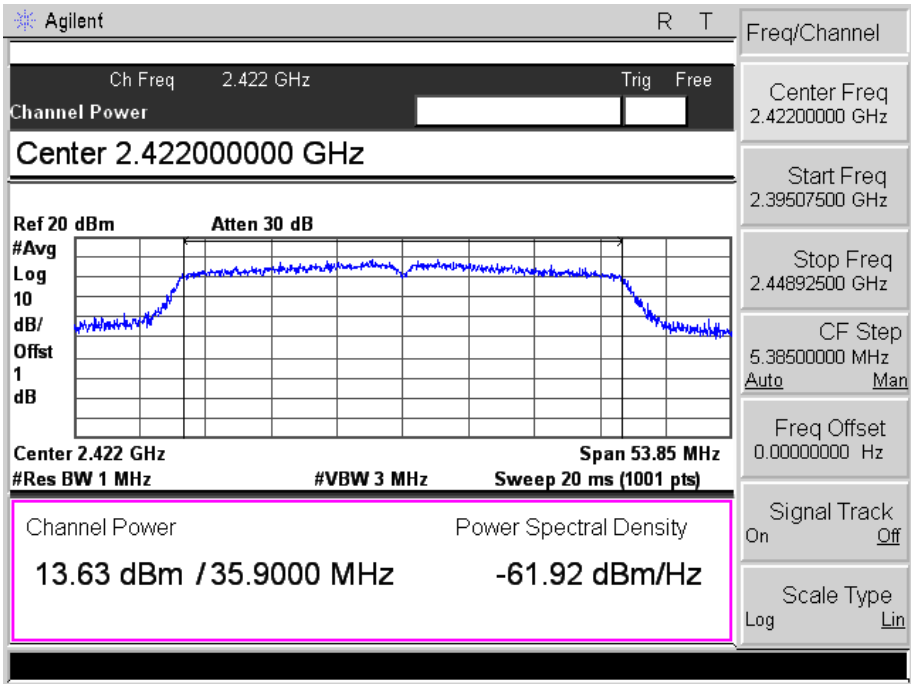
802.11n-HT20-MCS7-Middle Channel



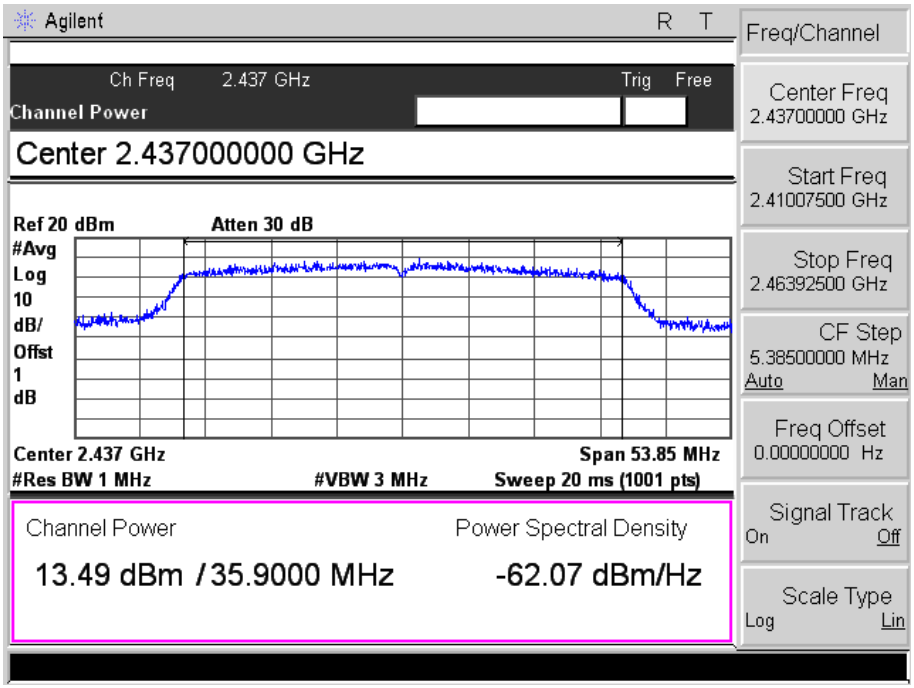
802.11n-HT20-MCS7-High Channel



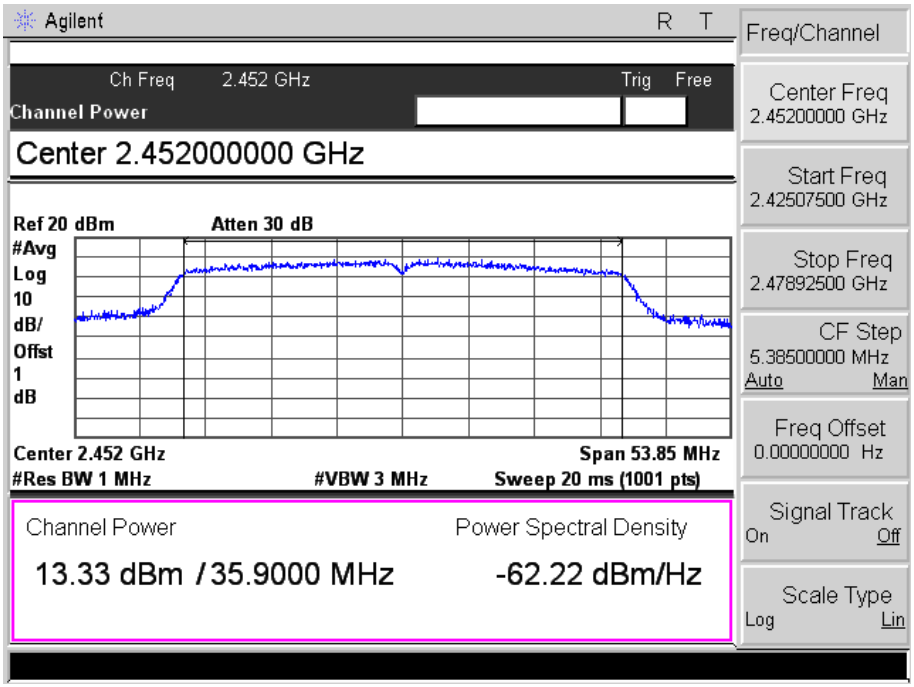
802.11n-HT40-MCS7-Low Channel



802.11n-HT40-MCS7-Middle Channel



802.11n-HT40-MCS7-High Channel



8. Field Strength of Spurious Emissions

8.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ±5.10 dB.

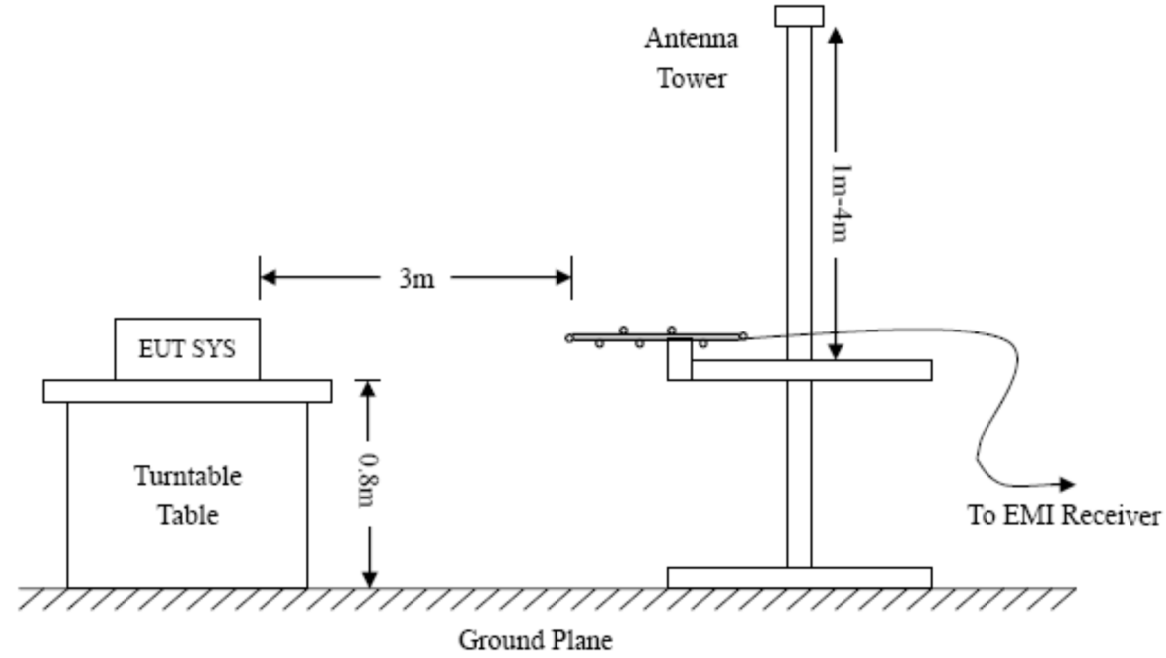
8.2 Standard Applicable

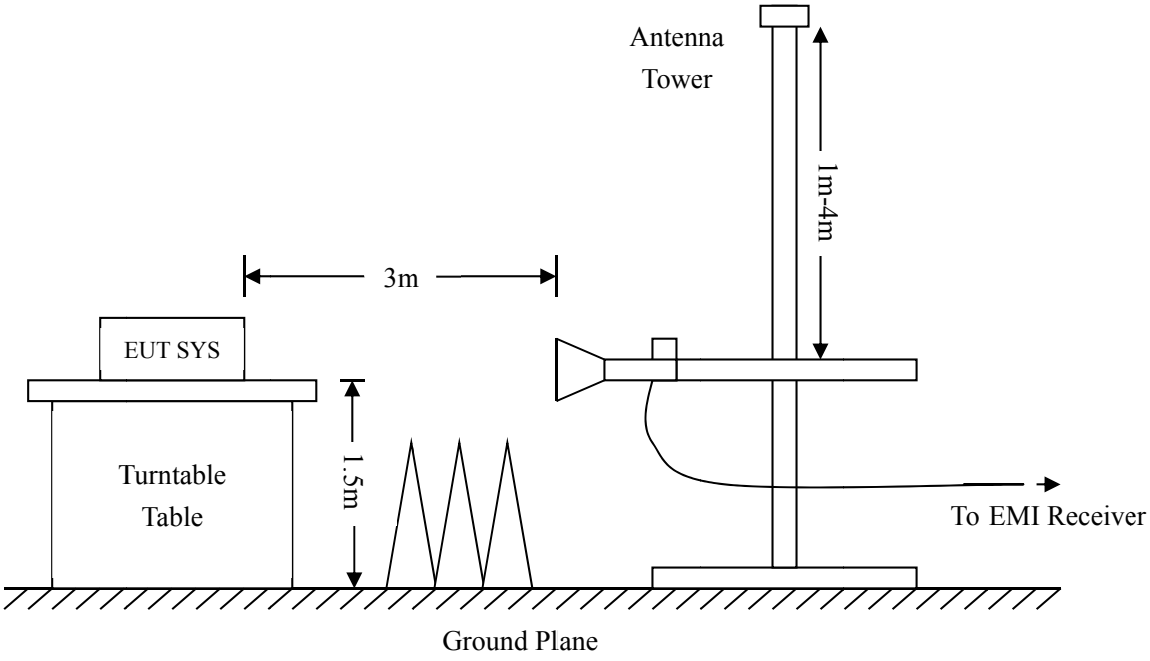
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within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

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

8.3 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

8.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15 Limit

8.5 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

8.6 Summary of Test Results/Plots

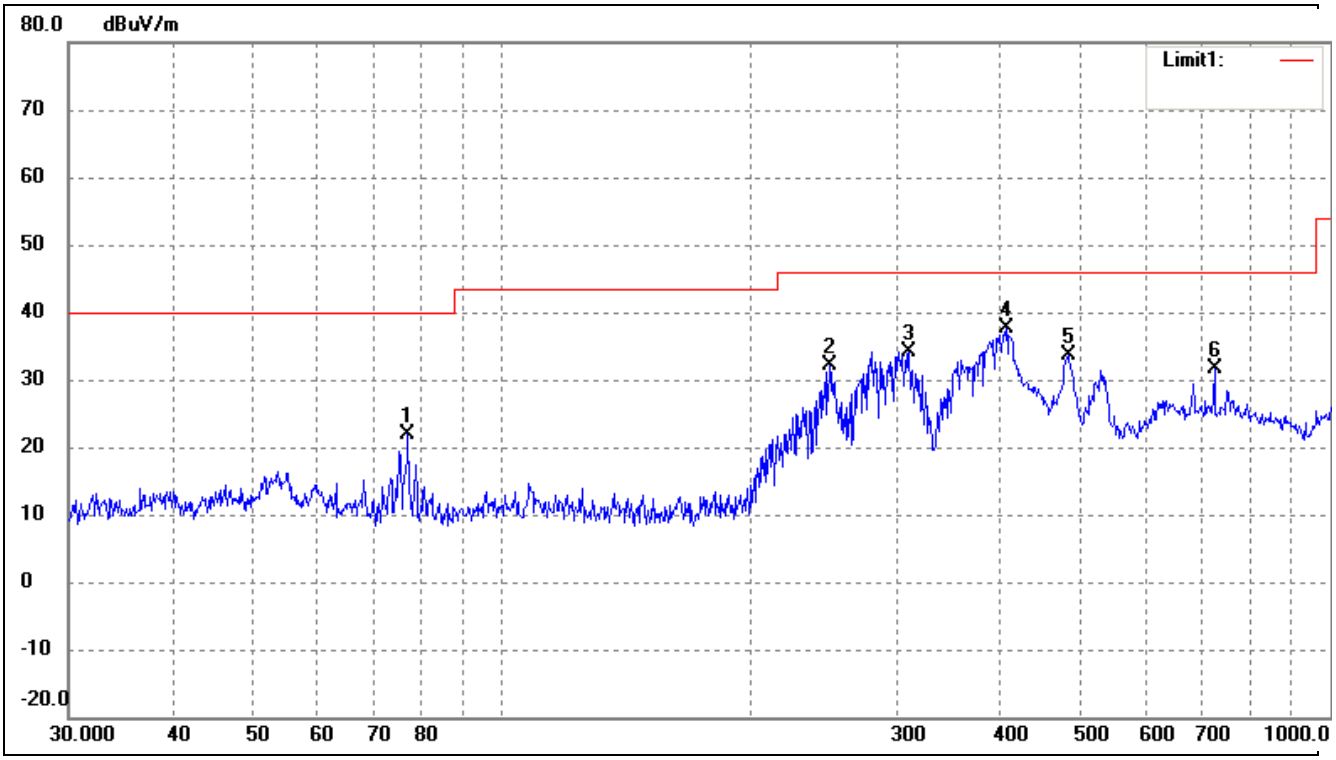
According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Plot of Radiated Emissions Test Data (30MHz to 1GHz)

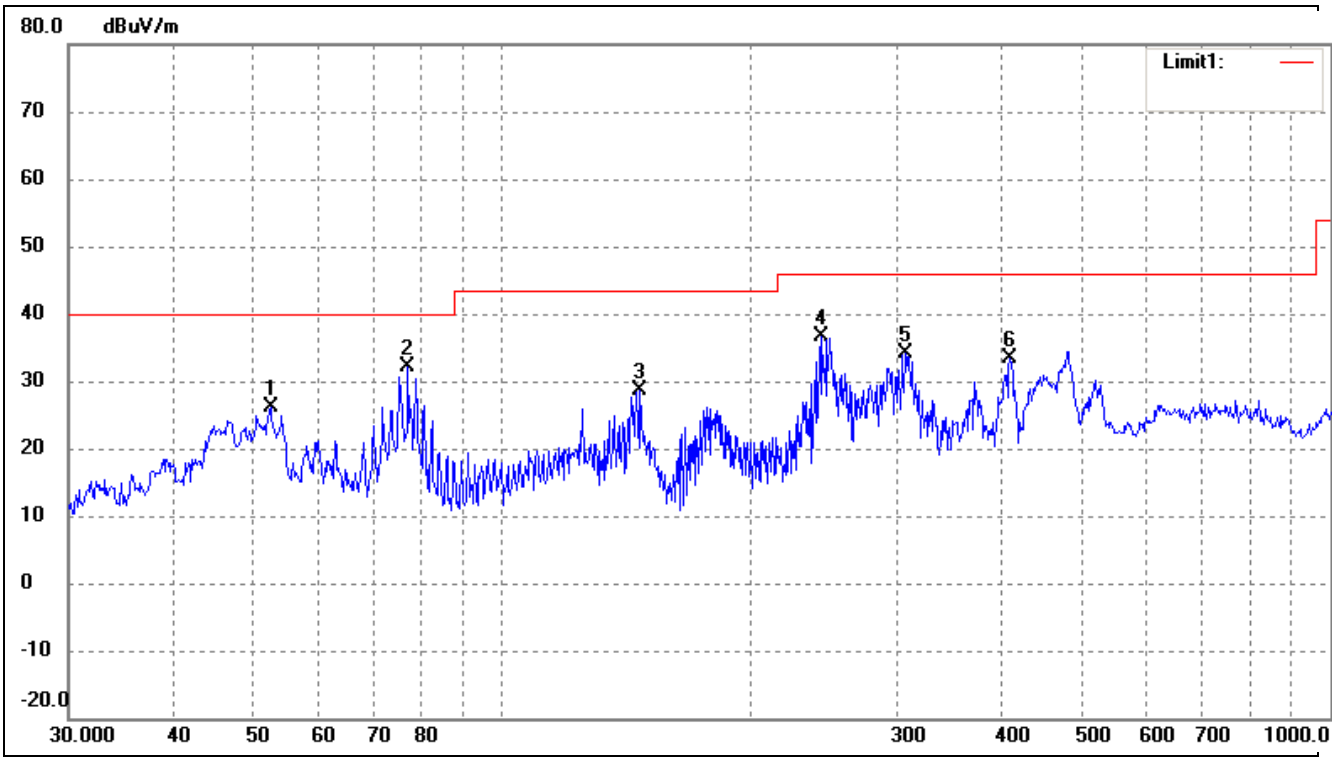
EUT: *WIFI module*
Tested Model: *HLK-7628N*
Operating Condition: *802.11n HT20 MIMO Transmitting Low Channel-2412MHz*
Comment: *DC5V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	77.0505	41.35	-19.50	21.85	40.00	-18.15	350	100	peak
2	248.5519	44.27	-12.20	32.07	46.00	-13.93	93	100	peak
3	309.9977	43.69	-9.46	34.23	46.00	-11.77	105	100	peak
4	406.0880	45.47	-7.95	37.52	46.00	-8.48	114	100	peak
5	482.2156	40.45	-6.75	33.70	46.00	-12.30	269	100	peak
6	724.2611	32.53	-0.84	31.69	46.00	-14.31	336	100	peak

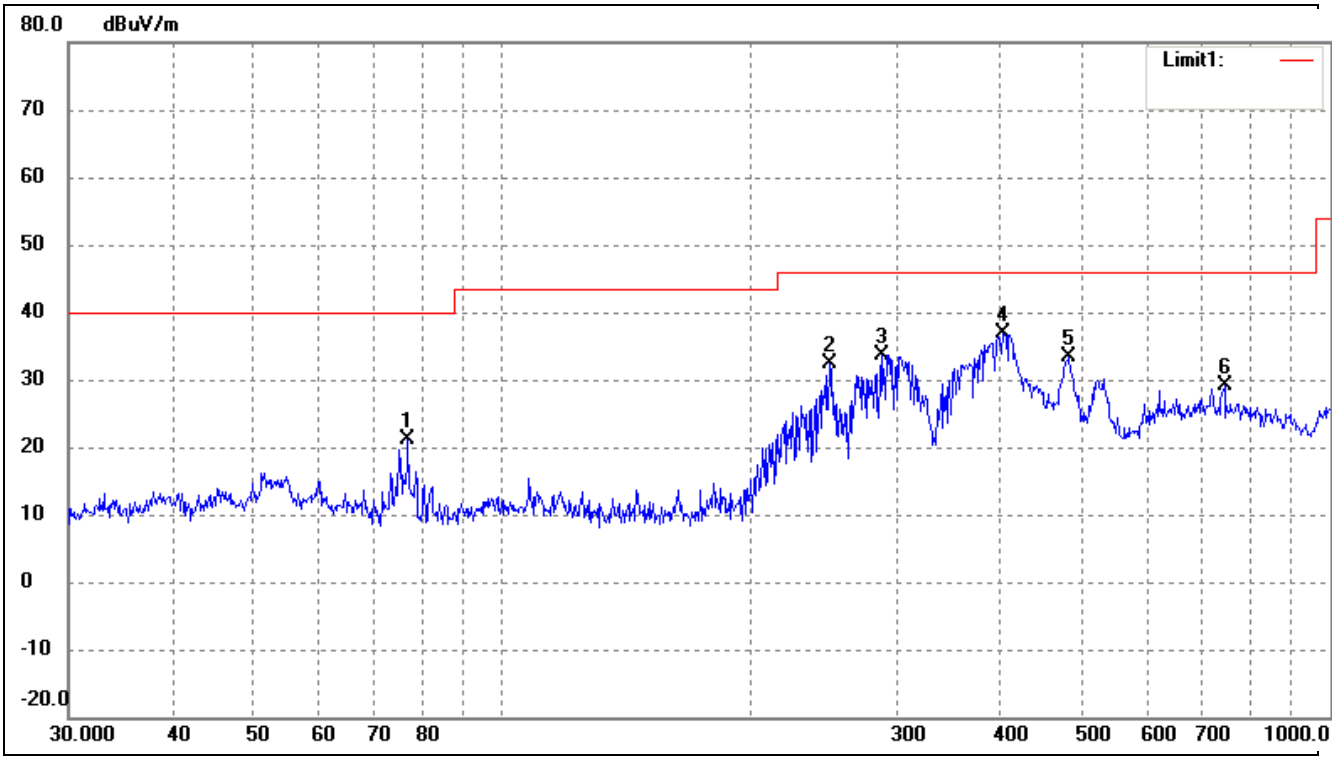
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	52.5753	42.70	-16.49	26.21	40.00	-13.79	339	100	peak
2	77.0505	51.66	-19.50	32.16	40.00	-7.84	98	100	peak
3	146.8877	47.30	-18.60	28.70	43.50	-14.80	163	100	peak
4	243.3772	49.01	-12.40	36.61	46.00	-9.39	96	100	peak
5	306.7537	43.56	-9.51	34.05	46.00	-11.95	62	100	peak
6	410.3825	41.33	-8.07	33.26	46.00	-12.74	275	100	peak

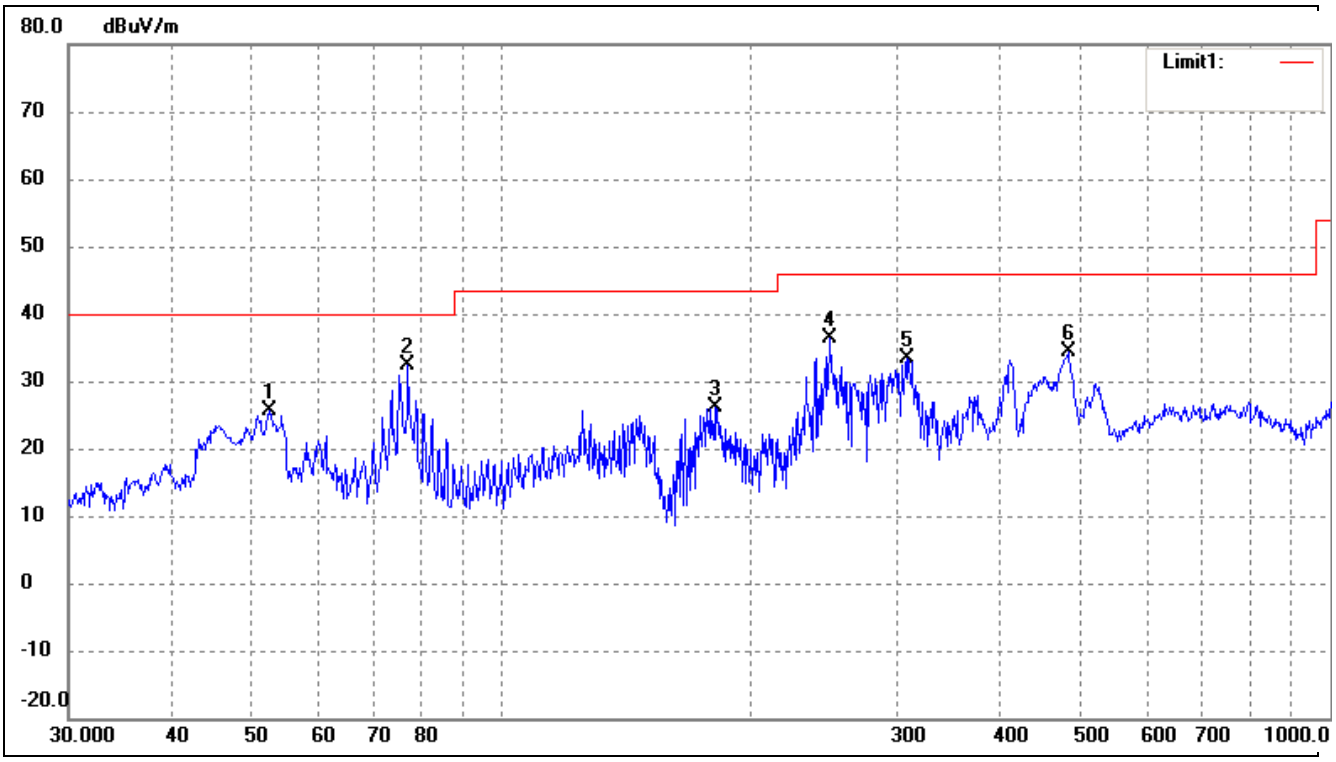
Operating Condition: *802.11n HT20 MIMO Transmitting Middle Channel-2437MHz*
Comment: *DC5V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	77.0505	40.61	-19.50	21.11	40.00	-18.89	231	100	peak
2	248.5519	44.47	-12.20	32.27	46.00	-13.73	280	100	peak
3	286.9823	43.82	-10.09	33.73	46.00	-12.27	57	100	peak
4	403.2500	44.77	-7.88	36.89	46.00	-9.11	236	100	peak
5	483.9094	40.15	-6.66	33.49	46.00	-12.51	271	100	peak
6	744.8661	29.16	-0.03	29.13	46.00	-16.87	133	100	peak

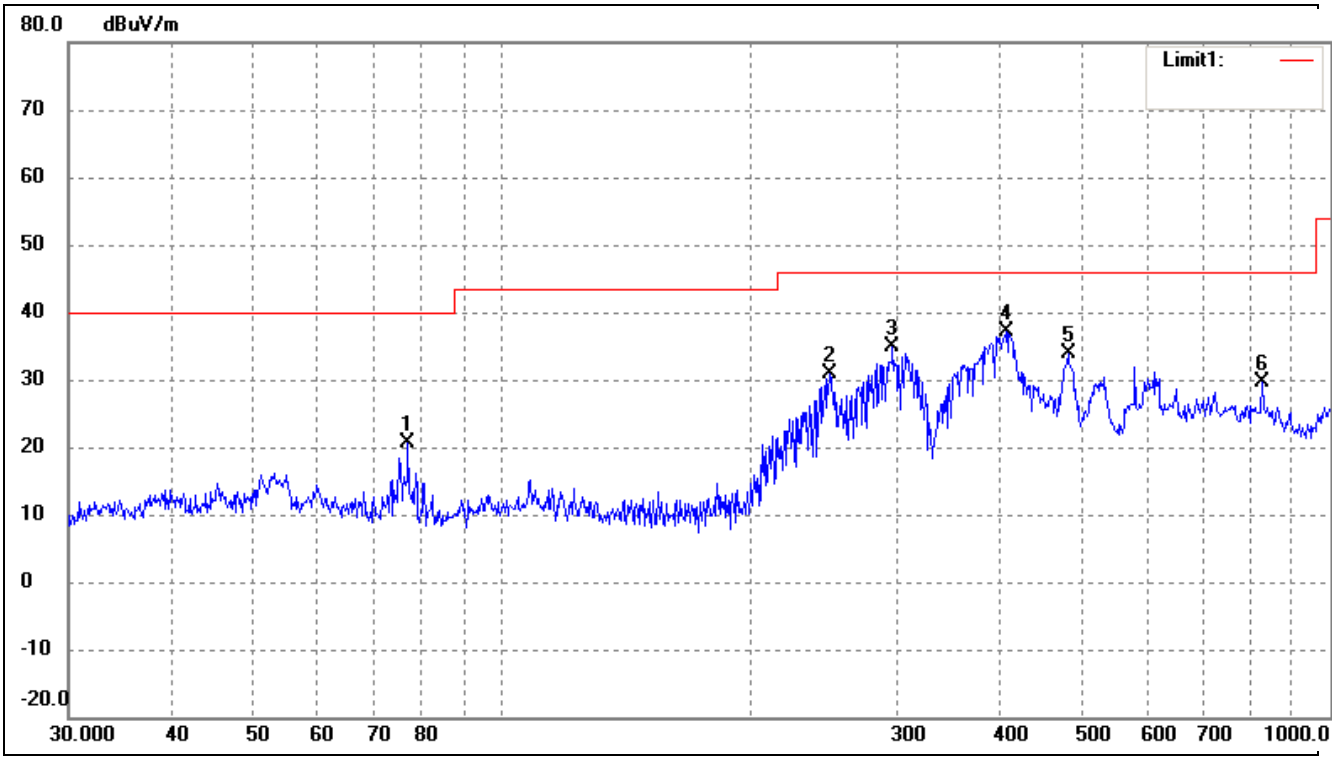
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	52.3913	42.22	-16.50	25.72	40.00	-14.28	339	100	peak
2	77.0505	51.95	-19.50	32.45	40.00	-7.55	128	100	peak
3	180.6488	45.30	-19.05	26.25	43.50	-17.25	70	100	peak
4	248.5519	48.49	-12.20	36.29	46.00	-9.71	276	100	peak
5	308.9126	42.96	-9.49	33.47	46.00	-12.53	94	100	peak
6	482.2156	41.07	-6.75	34.32	46.00	-11.68	191	100	peak

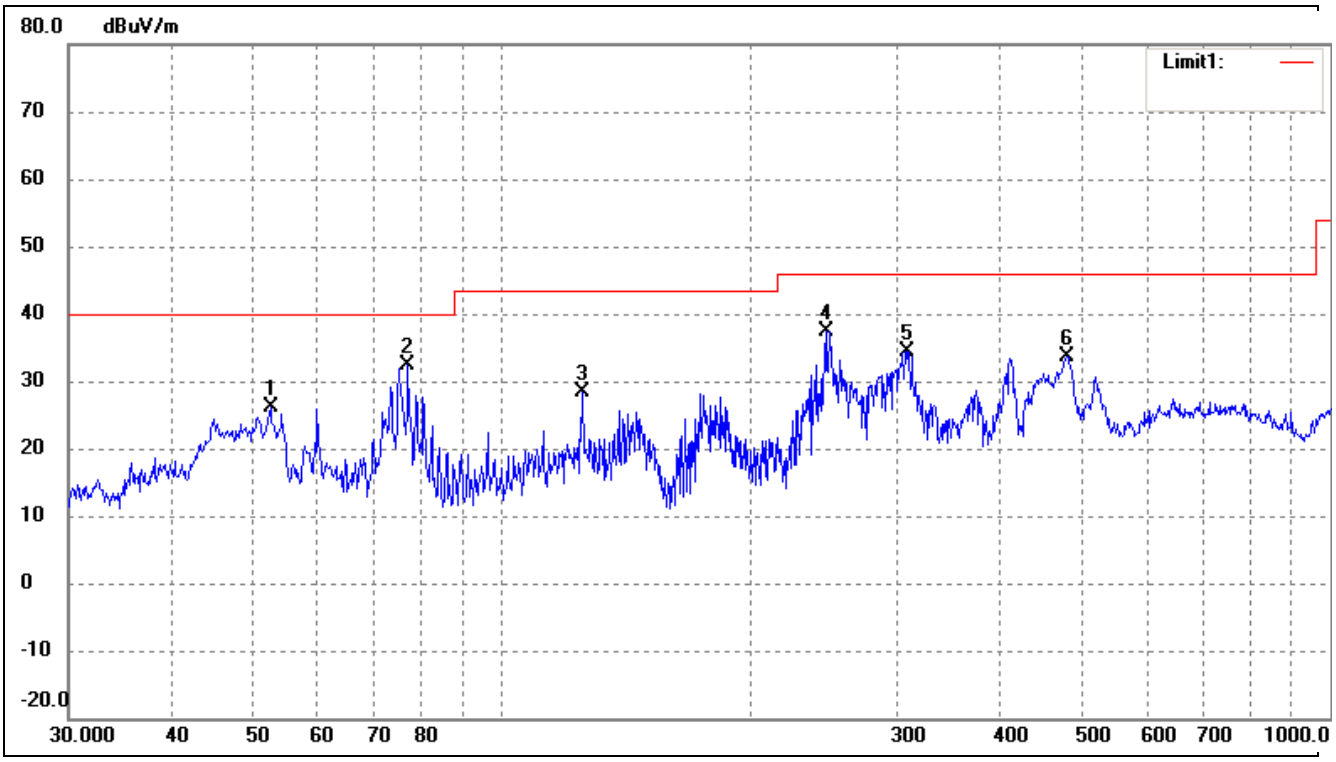
Operating Condition: *802.11n HT20 MIMO Transmitting High Channel-2462MHz*
Comment: *DC5V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	77.0505	40.22	-19.50	20.72	40.00	-19.28	185	100	peak
2	248.5519	42.97	-12.20	30.77	46.00	-15.23	117	100	peak
3	296.1836	44.66	-9.72	34.94	46.00	-11.06	105	100	peak
4	406.0880	45.06	-7.95	37.11	46.00	-8.89	93	100	peak
5	482.2156	40.60	-6.75	33.85	46.00	-12.15	345	100	peak
6	827.4934	32.18	-2.67	29.51	46.00	-16.49	201	100	peak

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	52.5753	42.61	-16.49	26.12	40.00	-13.88	95	100	peak
2	77.0505	51.98	-19.50	32.48	40.00	-7.52	164	100	peak
3	125.0066	45.37	-17.08	28.29	43.50	-15.21	141	100	peak
4	246.8149	49.71	-12.28	37.43	46.00	-8.57	103	100	peak
5	308.9126	43.83	-9.49	34.34	46.00	-11.66	171	100	peak
6	480.5276	40.51	-6.84	33.67	46.00	-12.33	187	100	peak

Spurious Emissions Above 1GHz

Test Mode: 802.11b

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	68.47	-3.87	64.60	74	-9.40	H	PK
4824.000	52.66	-3.87	48.79	54	-5.21	H	AV
7236.000	67.80	1.14	68.94	74	-5.06	H	PK
7236.000	44.18	1.19	45.37	54	-8.63	H	AV
4824.000	68.67	-3.86	64.81	74	-9.19	V	PK
4824.000	51.05	-3.86	47.19	54	-6.81	V	AV
7236.000	68.88	1.10	69.98	74	-4.02	V	PK
7236.000	44.94	1.10	46.04	54	-7.96	V	AV
Middle Channel-2437MHz							
4874.000	64.32	-3.74	60.58	74	-13.42	H	PK
4874.000	55.19	-3.74	51.45	54	-2.55	H	AV
7311.000	66.24	1.47	67.71	74	-6.29	H	PK
7311.000	47.41	1.47	48.88	54	-5.12	H	AV
4874.000	65.23	-3.74	61.49	74	-12.51	V	PK
4874.000	53.51	-3.74	49.77	54	-4.23	V	AV
7311.000	69.16	1.47	70.63	74	-3.37	V	PK
7311.000	46.00	1.47	47.47	54	-6.53	V	AV
High Channel-2462MHz							
4924.000	65.40	-3.59	61.81	74	-12.19	H	PK
4924.000	47.25	-3.59	43.66	54	-10.34	H	AV
7386.000	65.39	1.79	67.18	74	-6.82	H	PK
7386.000	48.19	1.79	49.98	54	-4.02	H	AV
4924.000	64.91	-3.59	61.32	74	-12.68	V	PK
4924.000	47.65	-3.59	44.06	54	-9.94	V	AV
7386.000	67.55	1.79	69.34	74	-4.66	V	PK
7386.000	48.55	1.79	50.34	54	-3.66	V	AV

802.11n HT20 MIMO

Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-2412MHz							
4824.000	65.80	-3.87	61.93	74	-12.07	H	PK
4824.000	53.31	-3.87	49.44	54	-4.56	H	AV
7236.000	66.19	1.14	67.33	74	-6.67	H	PK
7236.000	43.67	1.19	44.86	54	-9.14	H	AV
4824.000	66.50	-3.86	62.64	74	-11.36	V	PK
4824.000	51.75	-3.86	47.89	54	-6.11	V	AV
7236.000	64.29	1.10	65.39	74	-8.61	V	PK
7236.000	45.60	1.10	46.70	54	-7.30	V	AV
Middle Channel-2437MHz							
4874.000	65.67	-3.74	61.93	74	-12.07	H	PK
4874.000	51.97	-3.74	48.23	54	-5.77	H	AV
7311.000	64.53	1.47	66.00	74	-8.00	H	PK
7311.000	47.24	1.47	48.71	54	-5.29	H	AV
4874.000	66.74	-3.74	63.00	74	-11.00	V	PK
4874.000	52.69	-3.74	48.95	54	-5.05	V	AV
7311.000	64.40	1.47	65.87	74	-8.13	V	PK
7311.000	44.72	1.47	46.19	54	-7.81	V	AV
High Channel-2462MHz							
4924.000	67.54	-3.59	63.95	74	-10.05	H	PK
4924.000	51.10	-3.59	47.51	54	-6.49	H	AV
7386.000	68.45	1.79	70.24	74	-3.76	H	PK
7386.000	47.34	1.79	49.13	54	-4.87	H	AV
4924.000	64.28	-3.59	60.69	74	-13.31	V	PK
4924.000	47.34	-3.59	43.75	54	-10.25	V	AV
7386.000	65.09	1.79	66.88	74	-7.12	V	PK
7386.000	48.20	1.79	49.99	54	-4.01	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

9. Out of Band Emissions

9.1 Standard Applicable

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

9.2 Test Procedure

According to the KDB 558074D01 v04, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)
RBW = 1MHz, VBW = 1MHz for peak value measured
RBW = 1MHz, VBW = 10Hz for average value measured
Sweep = auto; Detector function = peak/average; Trace = max hold
All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 V04, the conducted spurious emissions test method as follows:
1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW ≥ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

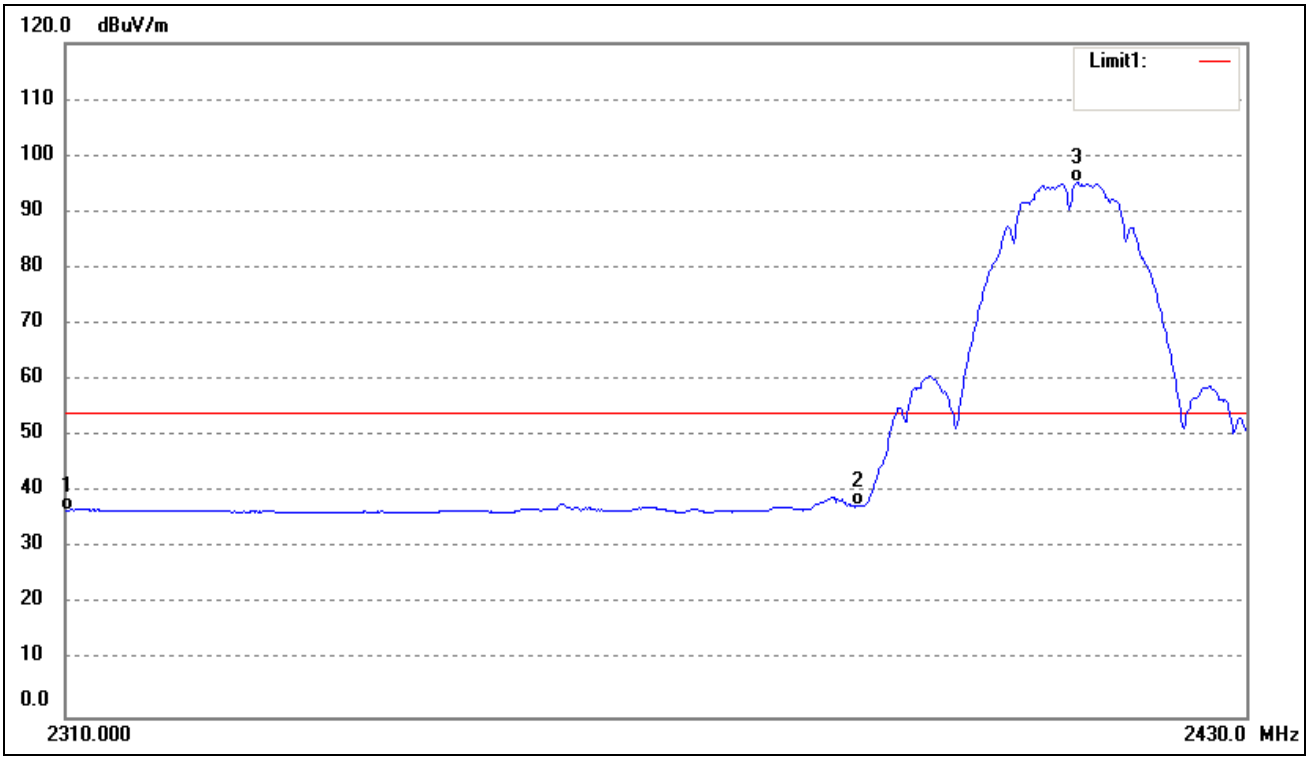
9.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

802.11b-Lowest Bandedge

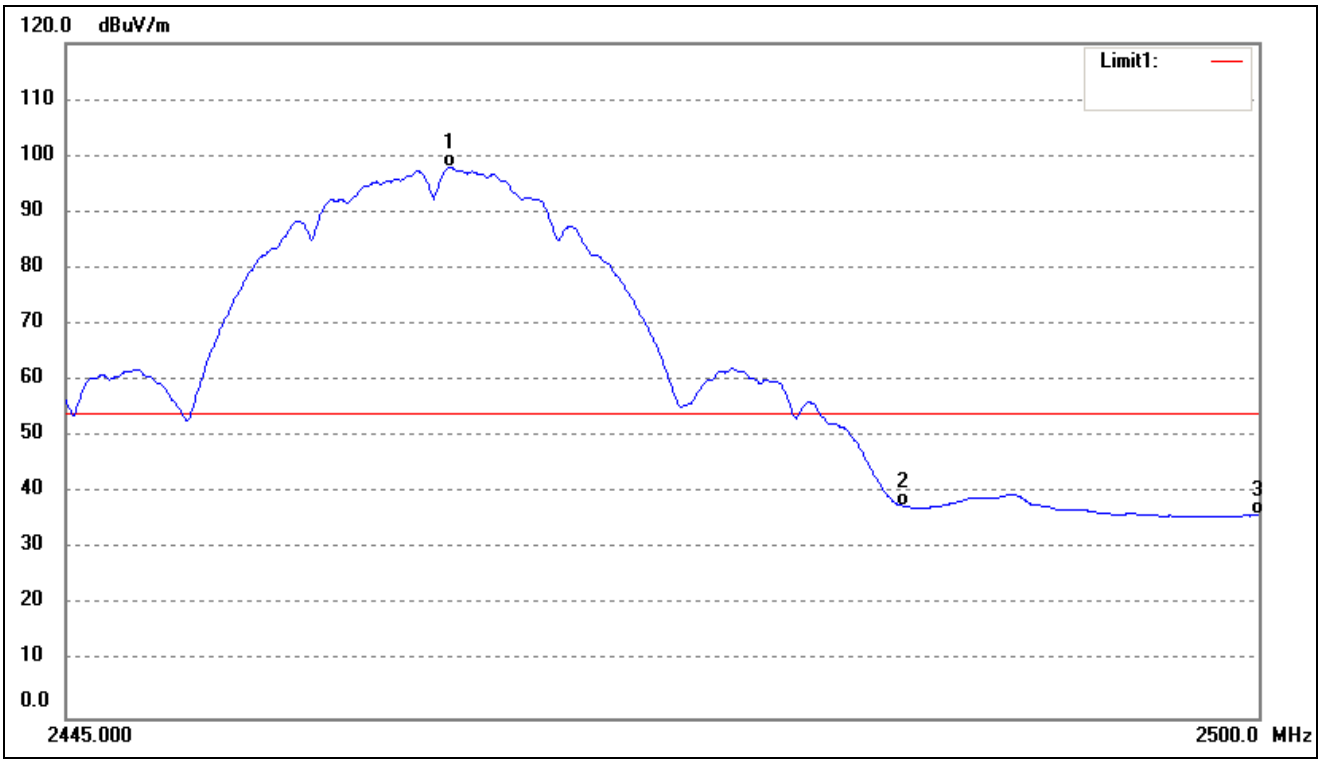
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	43.26	-6.38	36.88	54.00	-17.12	Average Detector
	2310.000	56.84	-6.38	50.46	74.00	-23.54	Peak Detector
2	2390.000	44.84	-7.26	37.58	54.00	-16.42	Average Detector
	2390.000	58.26	-7.26	51.00	74.00	-23.00	Peak Detector
3	2412.465	102.71	-7.41	95.30	/		Average Detector
4	2413.076	108.90	-7.40	101.50			Average Detector

802.11b-Highest Bandedge

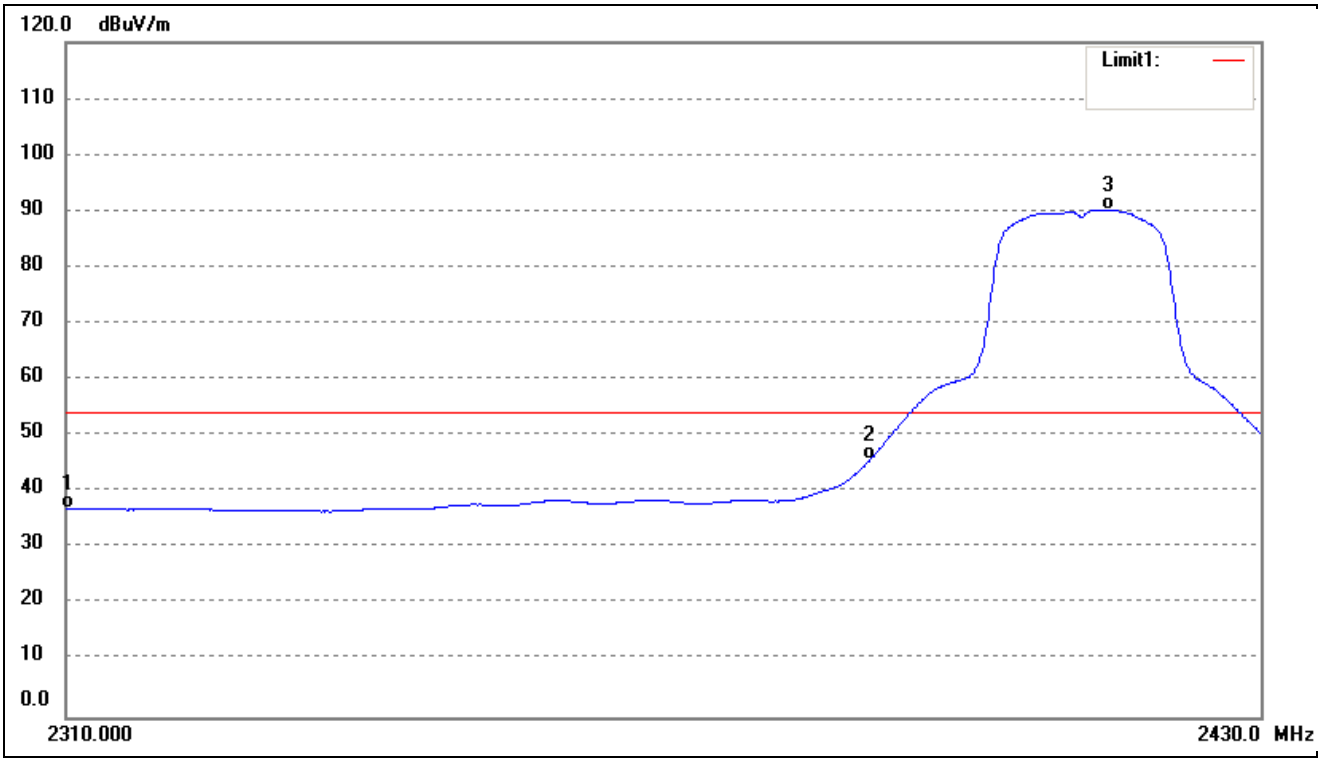
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2462.577	105.24	-7.31	97.93	/	/	Average Detector
	2463.179	109.93	-7.31	102.62	/	/	Peak Detector
2	2483.500	45.01	-7.28	37.73	54.00	-16.27	Average Detector
	2483.500	57.68	-7.28	50.40	74.00	-23.60	Peak Detector
3	2500.000	43.32	-7.25	36.07	54.00	-17.93	Average Detector
	2500.000	56.78	-7.25	49.53	74.00	-24.47	Peak Detector

802.11g-Lowest Bandedge

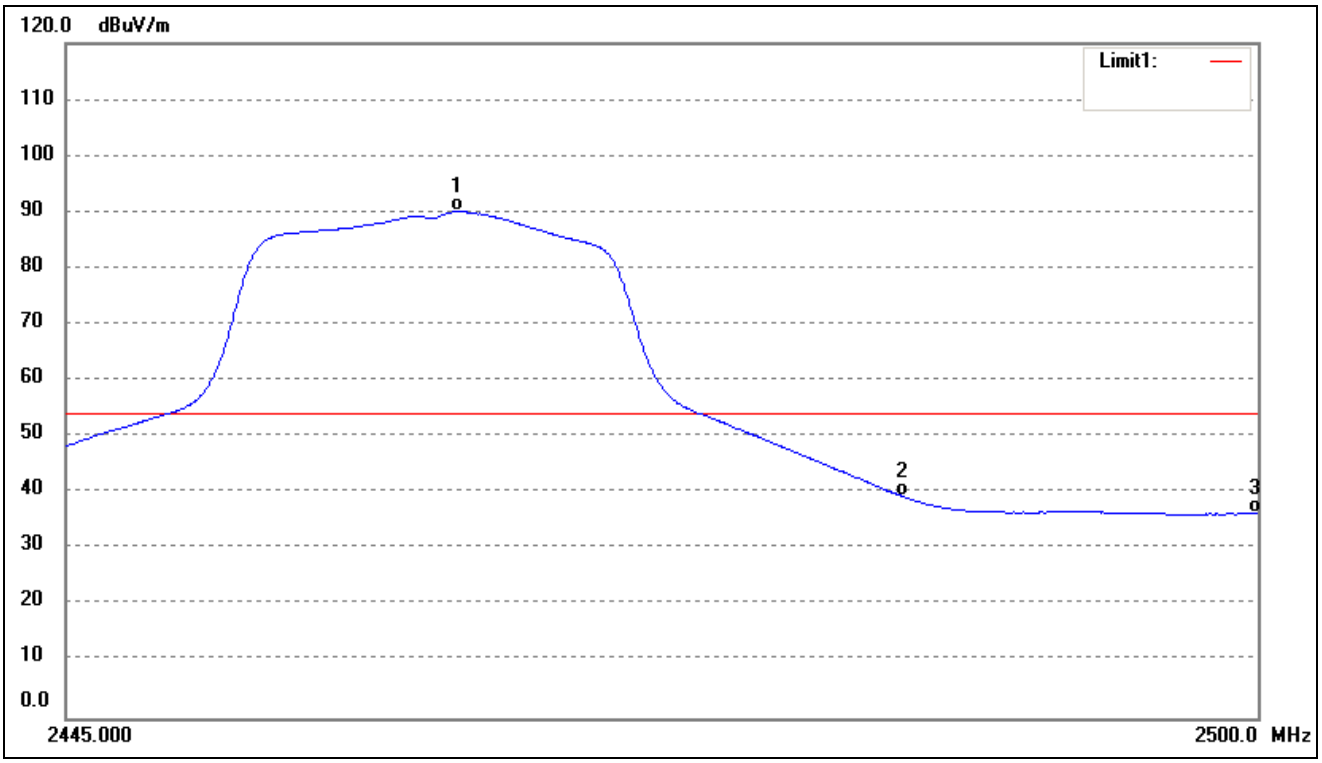
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	43.34	-6.38	36.96	54.00	-17.04	Average Detector
	2310.000	55.73	-6.38	49.35	74.00	-24.65	Peak Detector
2	2390.000	52.99	-7.26	45.73	54.00	-8.27	Average Detector
	2390.000	73.13	-7.26	65.87	74.00	-8.13	Peak Detector
3	2414.421	97.60	-7.40	90.20	Delta=33.78dBc		Average Detector
4	2409.291	109.67	-7.42	102.25			Average Detector

802.11g-Highest Bandedge

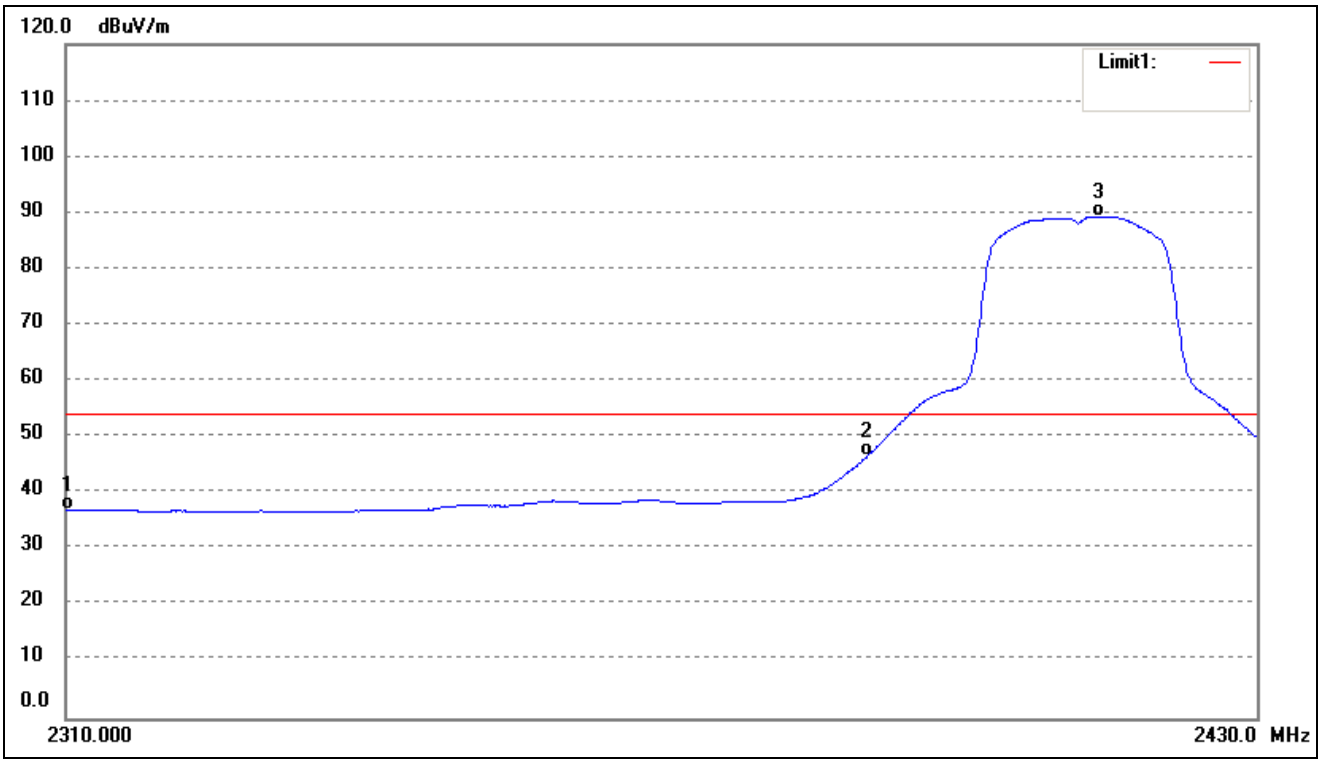
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
2	2462.905	97.40	-7.31	90.09	/	/	Average Detector
	2463.227	111.69	-7.31	104.38	/	/	Peak Detector
1	2483.500	46.66	-7.28	39.38	54.00	-14.62	Average Detector
	2483.500	70.60	-7.28	63.32	74.00	-10.68	Peak Detector
3	2500.000	43.62	-7.25	36.37	54.00	-17.63	Average Detector
	2500.000	57.34	-7.25	50.09	74.00	-23.91	Peak Detector

802.11n-HT20-Lowest Bandedge

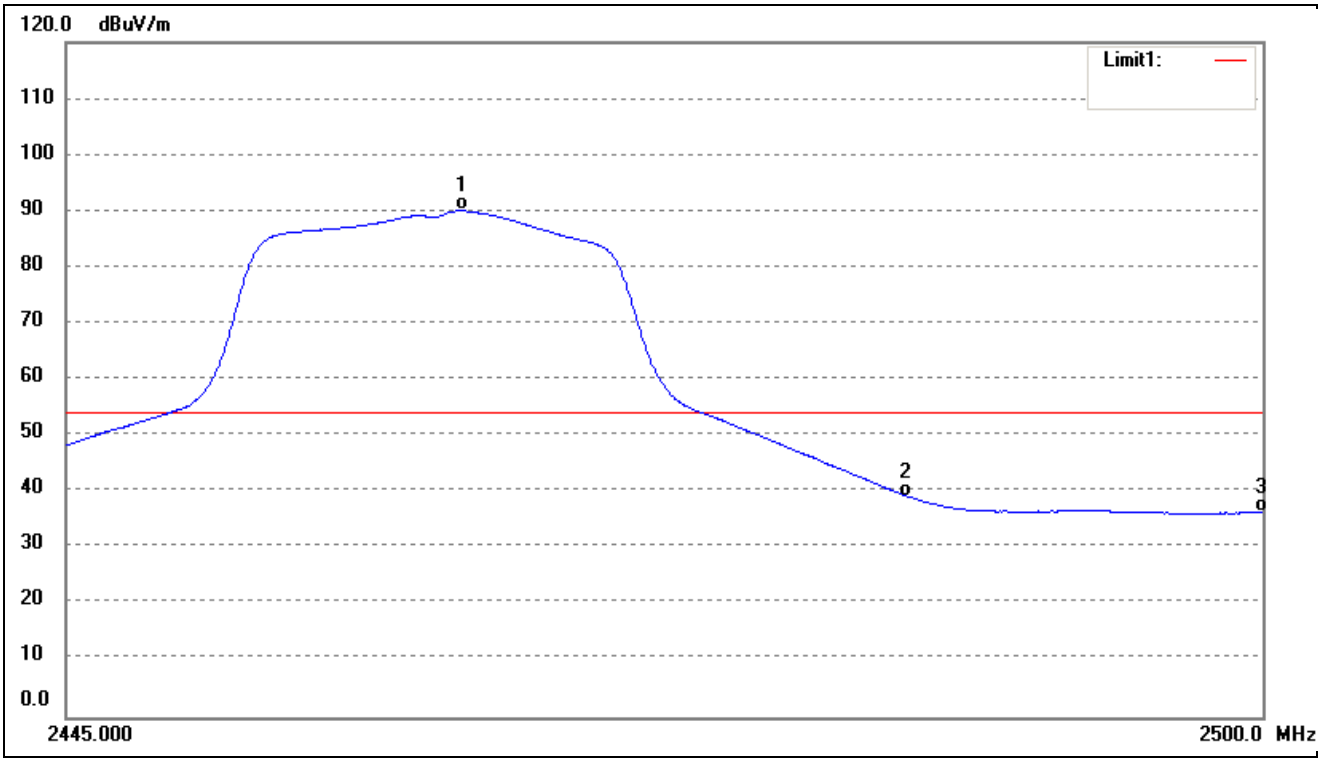
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	43.36	-6.38	36.98	54.00	-17.02	Average Detector
	2310.000	56.39	-6.38	50.01	74.00	-23.99	Peak Detector
2	2390.000	53.97	-7.26	46.71	54.00	-7.29	Average Detector
	2390.000	75.11	-7.26	67.85	74.00	-6.15	Peak Detector
3	2413.688	96.76	-7.40	89.36	/		Average Detector
4	2413.565	108.99	-7.40	101.59			Average Detector

802.11n-HT20-Highest Bandedge

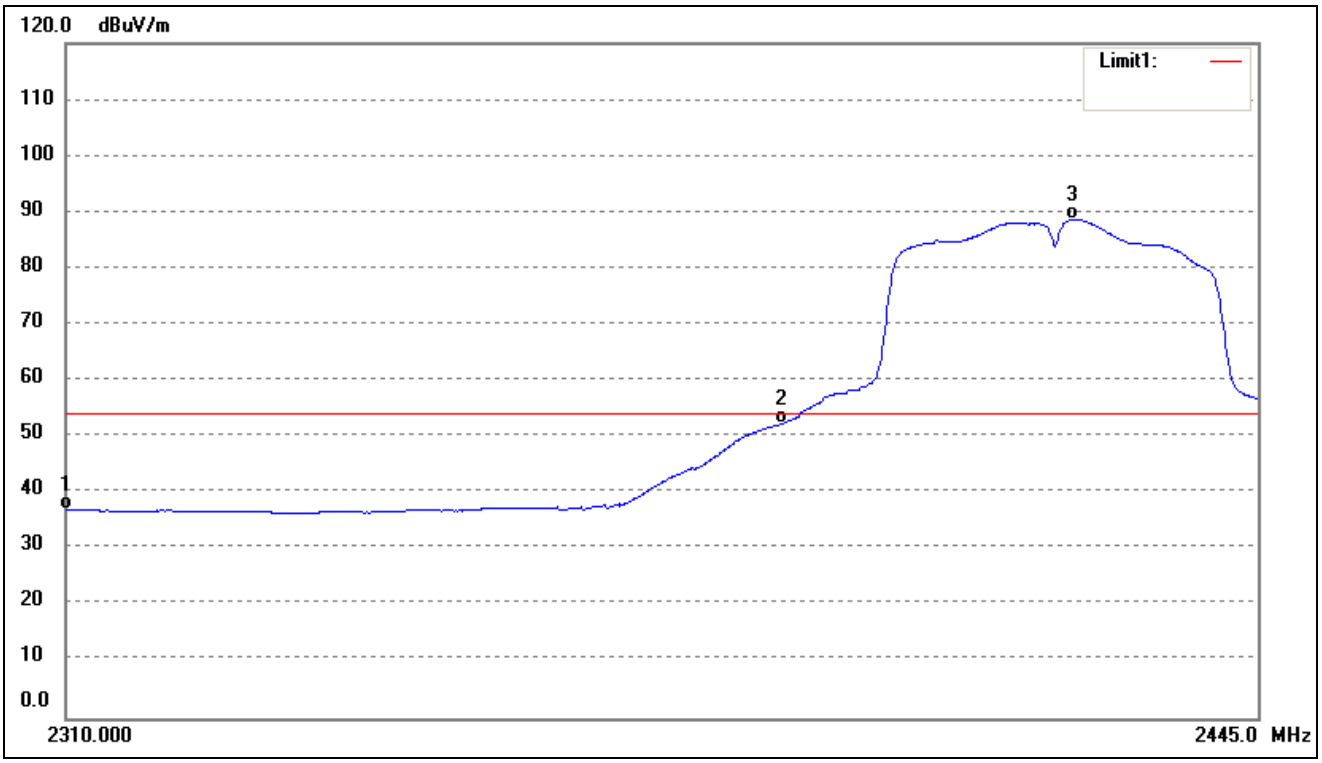
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2463.070	97.36	-7.31	90.05	/	/	Average Detector
	2463.344	109.34	-7.31	102.03	/	/	Peak Detector
2	2483.500	46.55	-7.28	39.27	54.00	-14.73	Average Detector
	2483.500	64.61	-7.28	57.33	74.00	-16.67	Peak Detector
3	2500.000	43.64	-7.25	36.39	54.00	-17.61	Average Detector
	2500.000	56.14	-7.25	48.89	74.00	-25.11	Peak Detector

802.11n-HT40-Lowest Bandedge

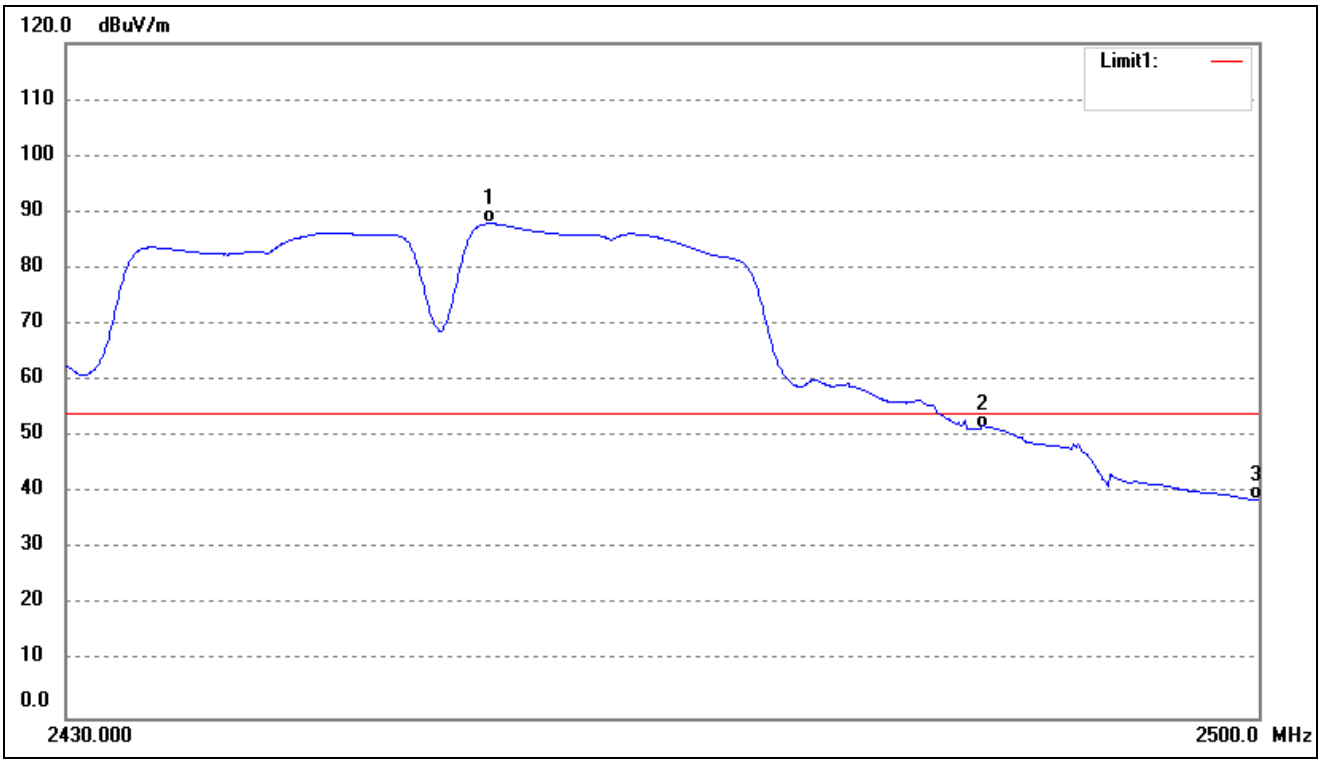
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	43.33	-6.38	36.95	54.00	-17.05	Average Detector
	2310.000	55.66	-6.38	49.28	74.00	-24.72	Peak Detector
2	2390.000	59.58	-7.26	52.32	54.00	-1.68	Average Detector
	2390.000	78.78	-7.26	71.52	74.00	-2.48	Peak Detector
3	2423.570	96.01	-7.38	88.63	/		Average Detector
4	2424.120	108.50	-7.38	101.12			Average Detector

802.11n-HT40-Highest Bandedge

Vertical (Worst case)



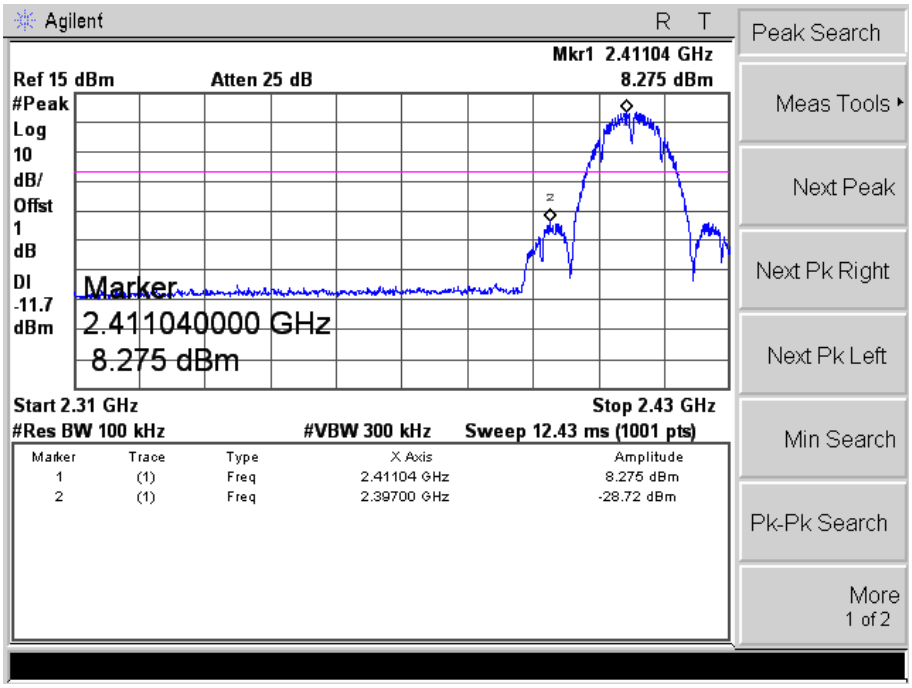
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2454.623	95.31	-7.33	87.98	/	/	Average Detector
	2456.506	106.93	-7.33	99.60	/	/	Peak Detector
2	2483.500	58.79	-7.28	51.51	54.00	-2.49	Average Detector
	2483.500	76.96	-7.28	69.68	74.00	-4.32	Peak Detector
3	2500.000	45.97	-7.25	38.72	54.00	-15.28	Average Detector
	2500.000	63.97	-7.25	56.72	74.00	-17.28	Peak Detector

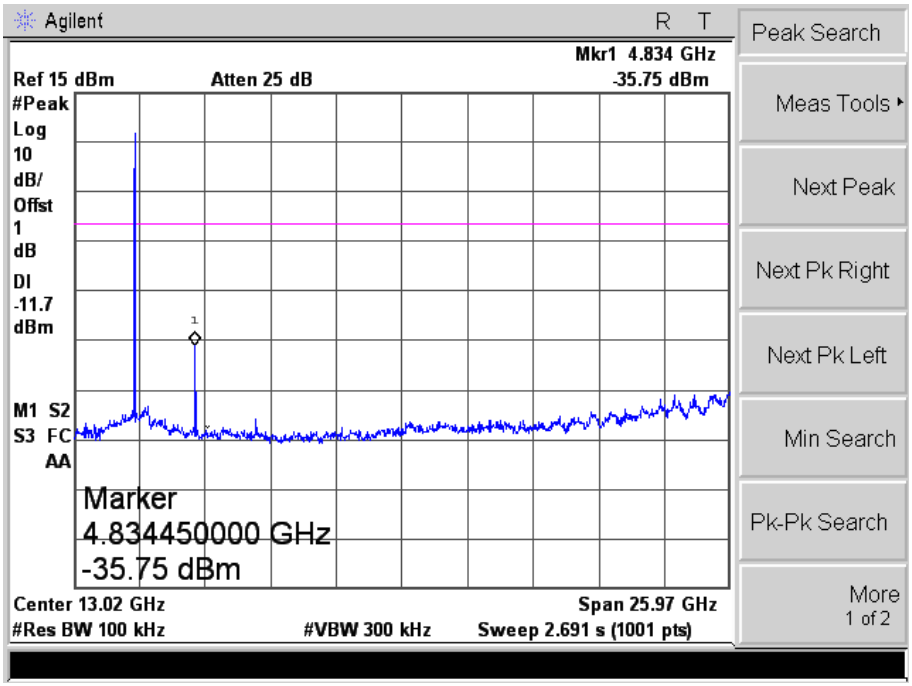
Ant. 0

Out-of-Band and Spurious Emission (Conducted)

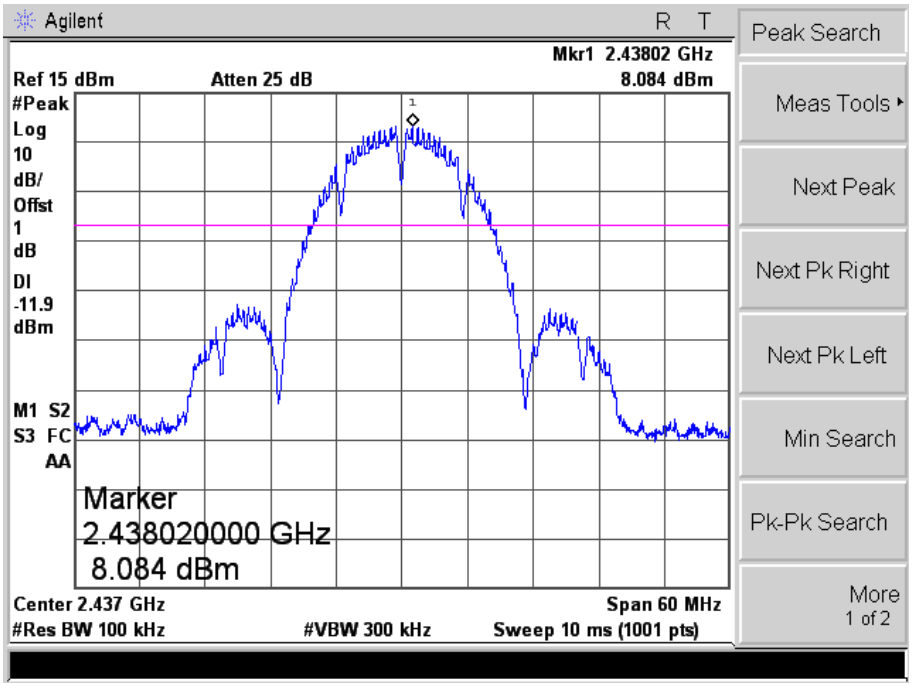
802.11b

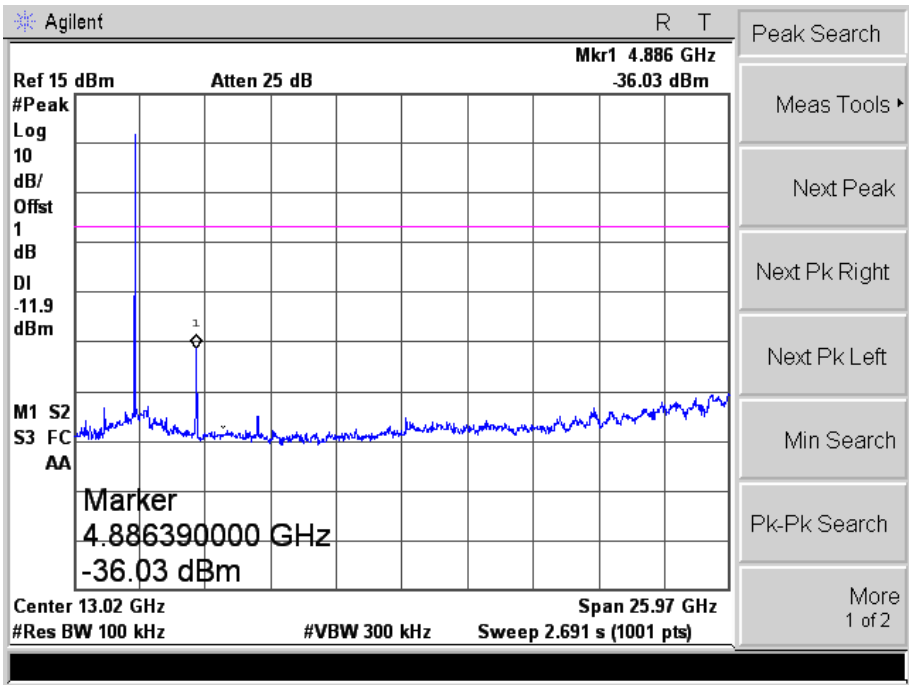
Low Channel



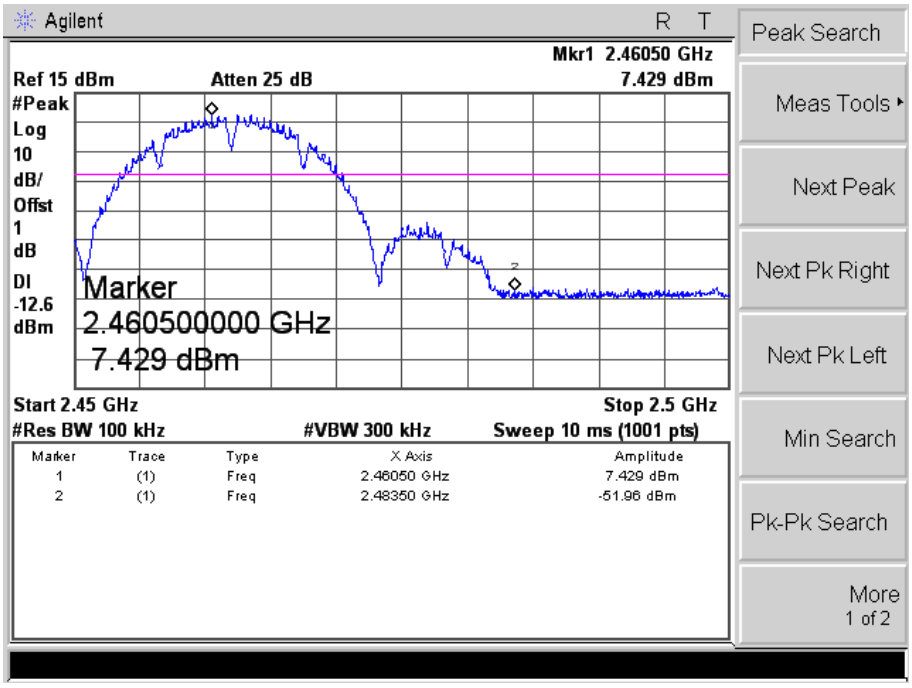


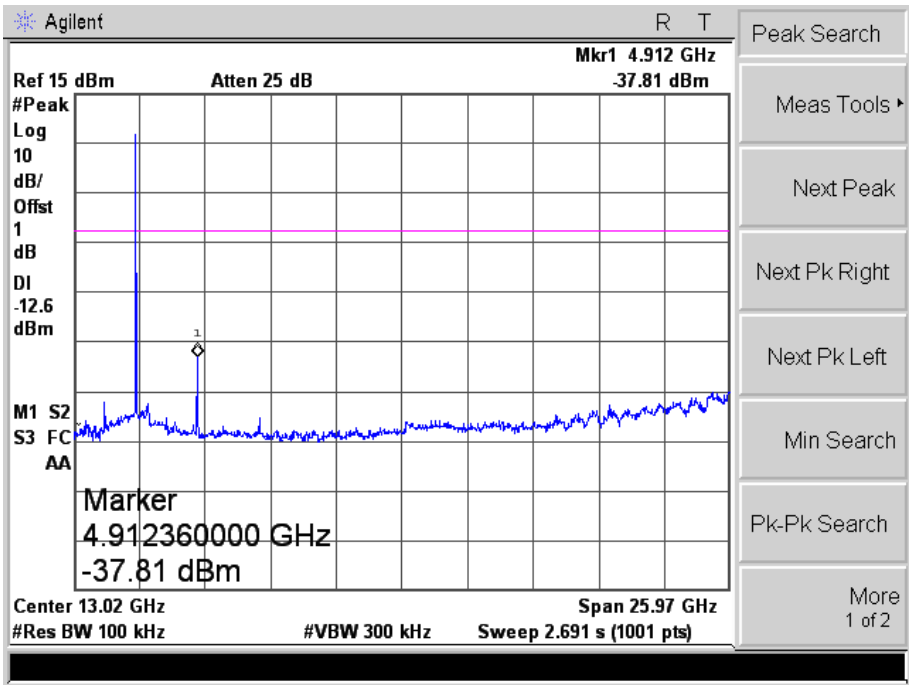
Middle Channel



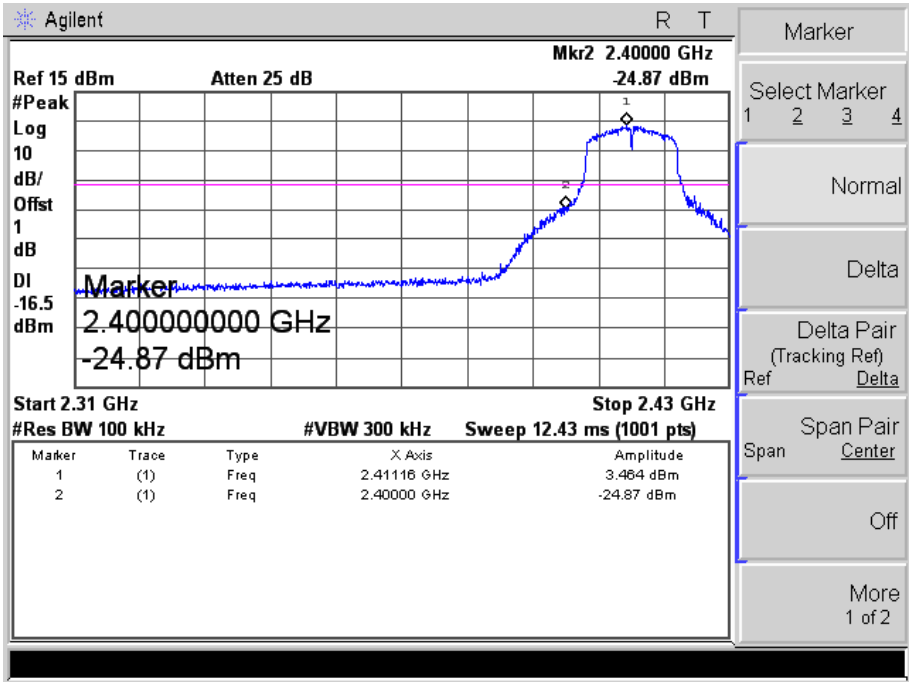


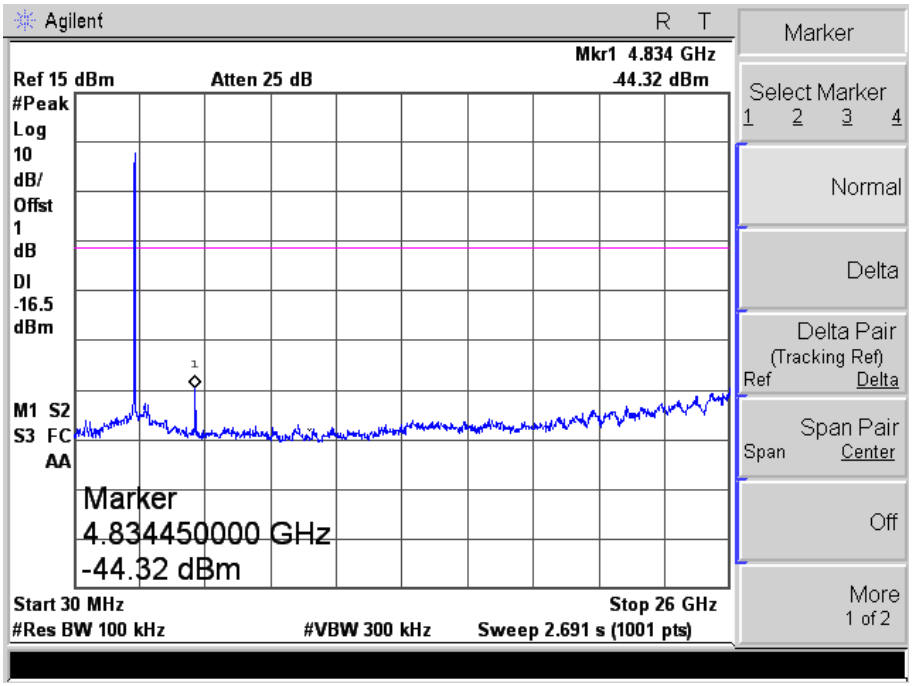
High Channel



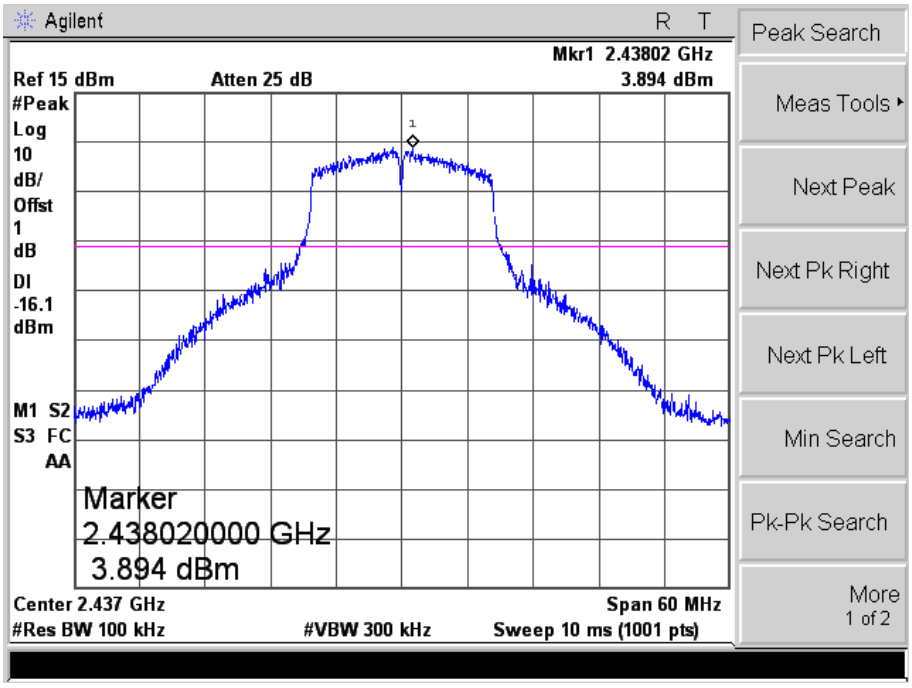


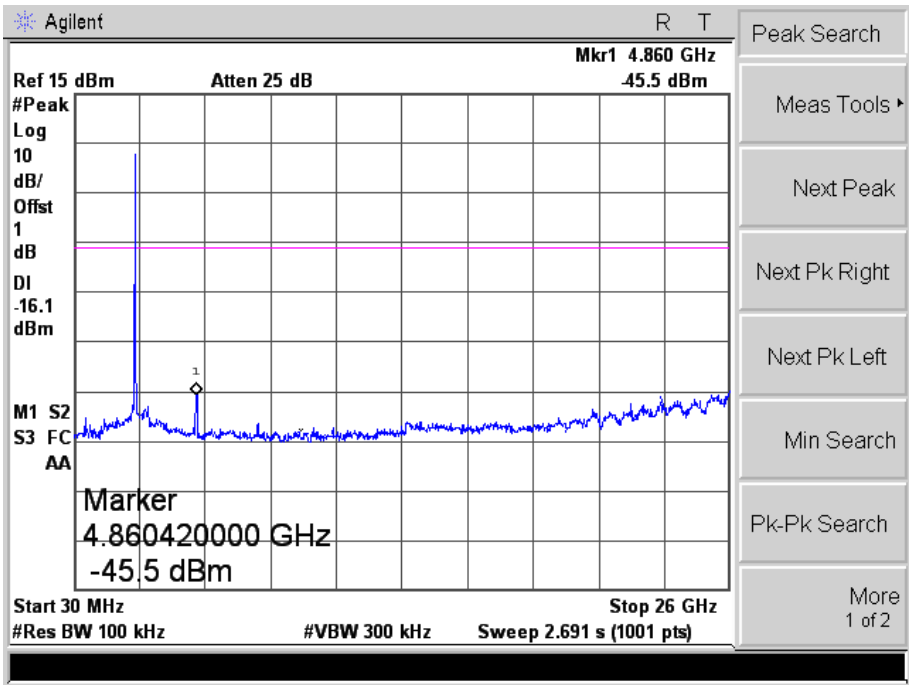
802.11g
Low Channel



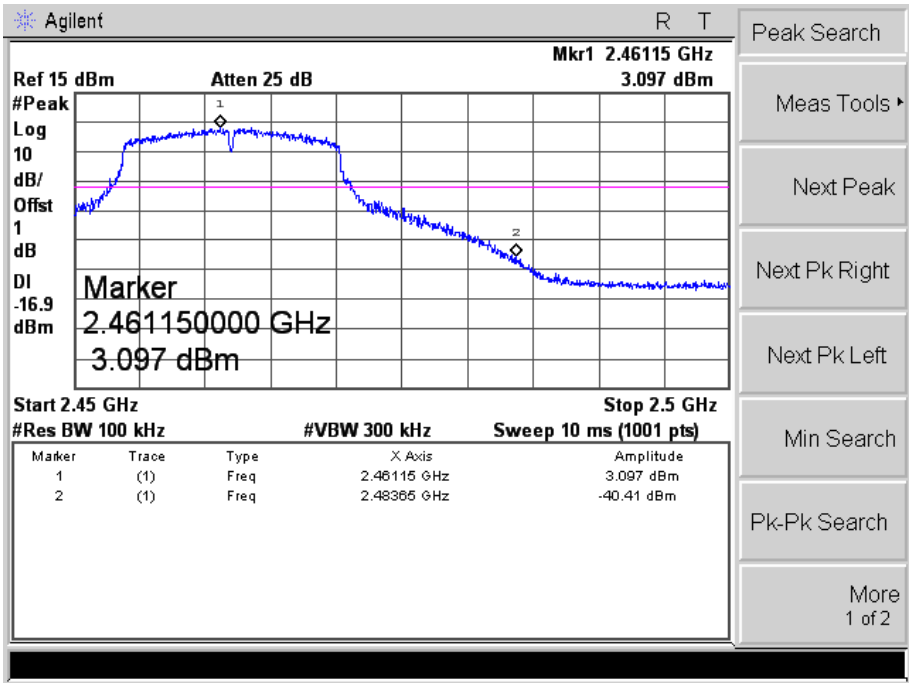


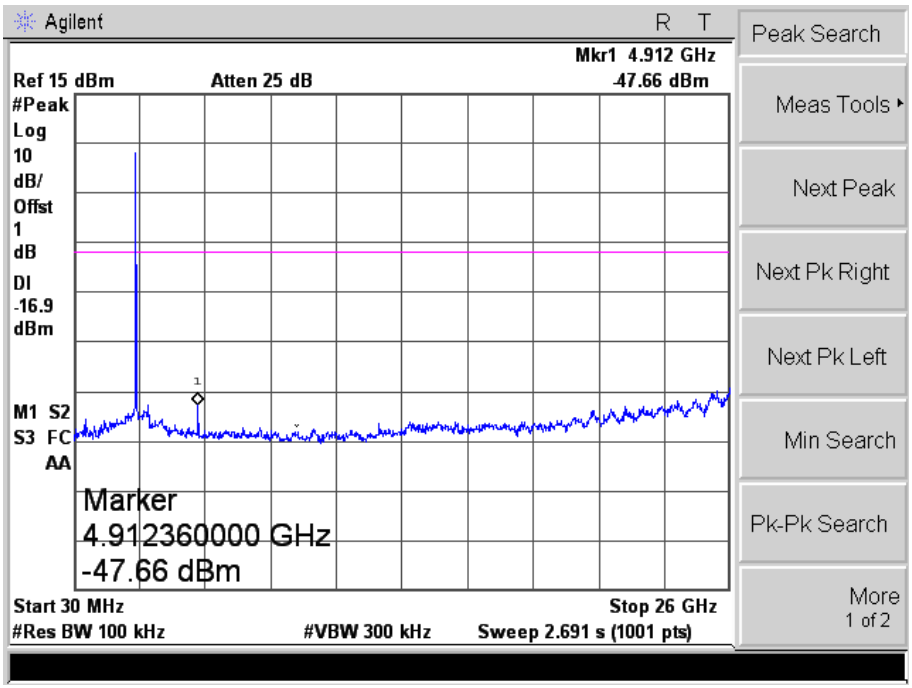
Middle Channel



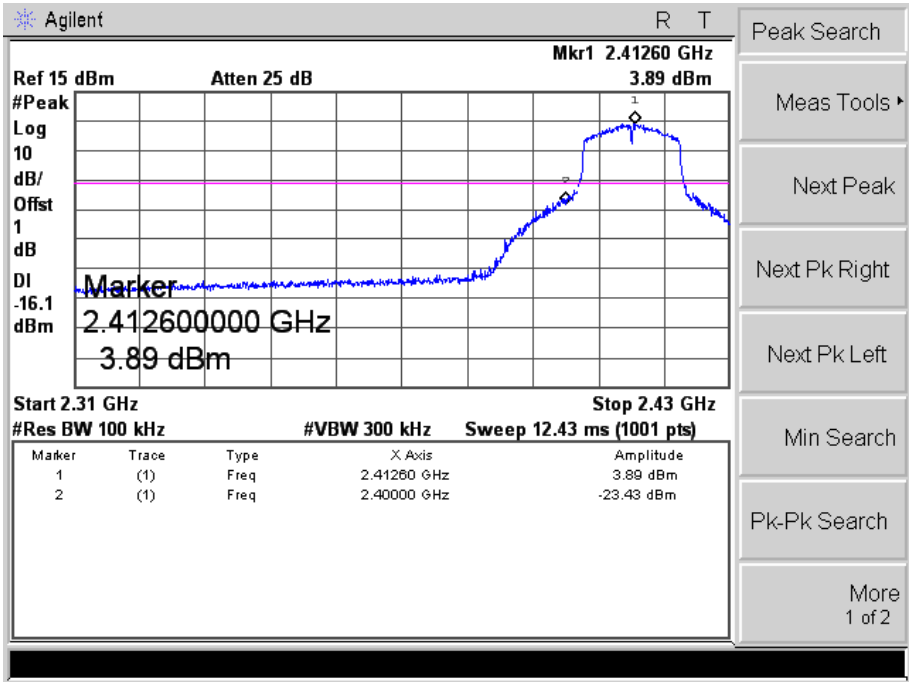


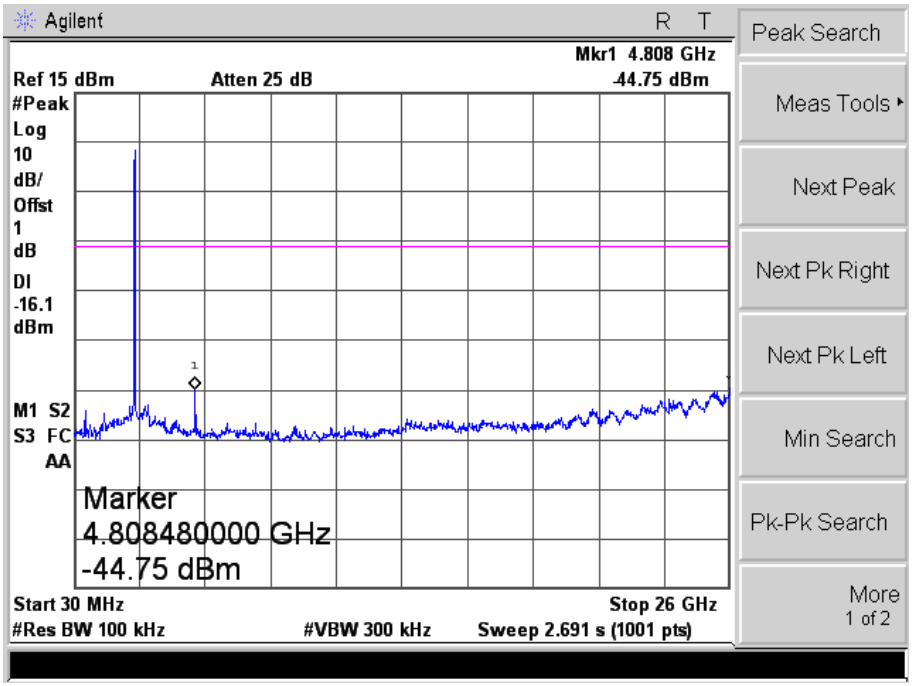
High Channel



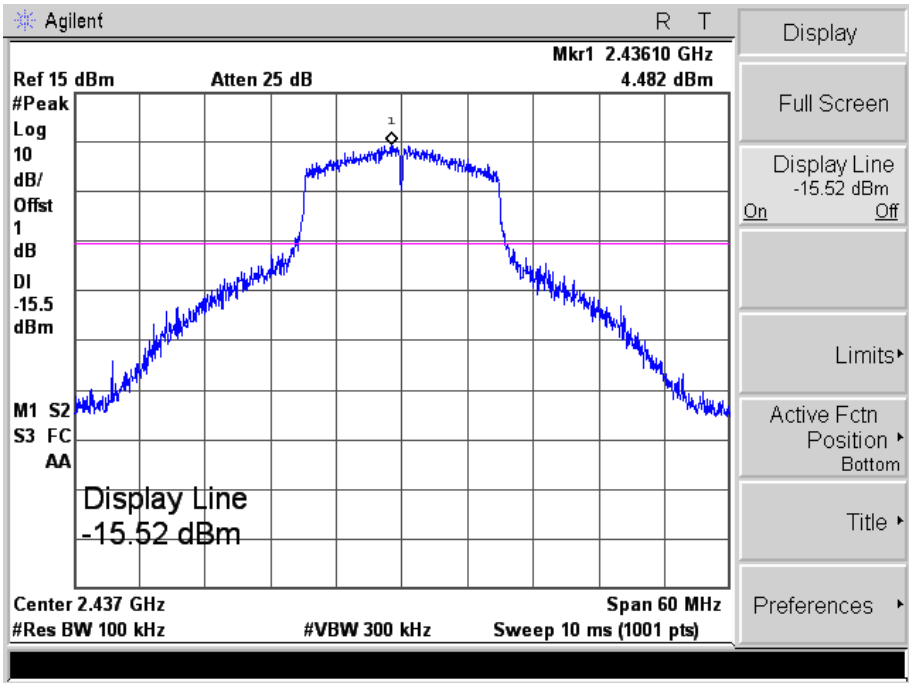


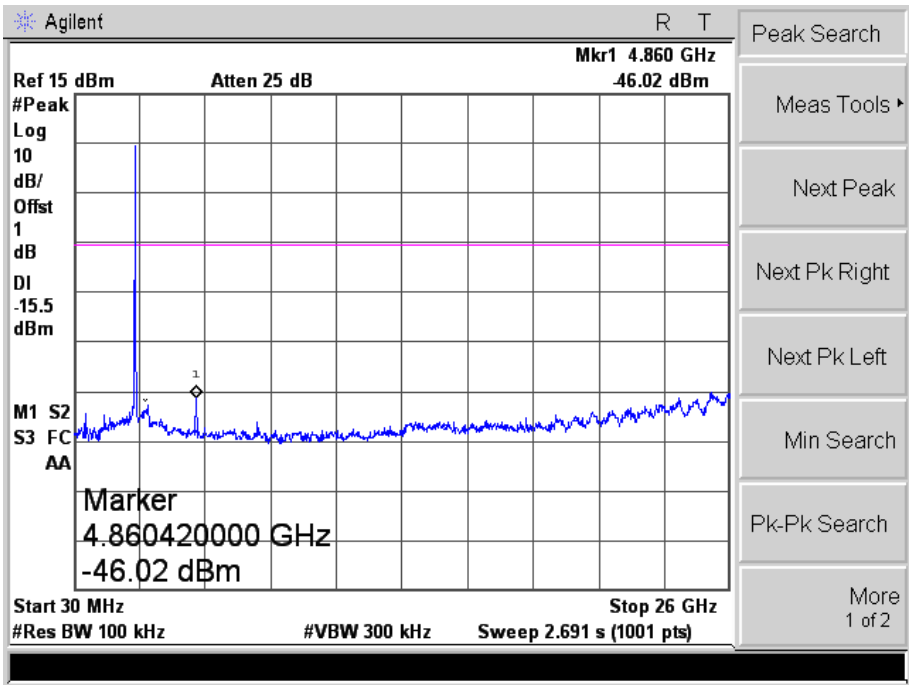
11n-HT20
Low Channel



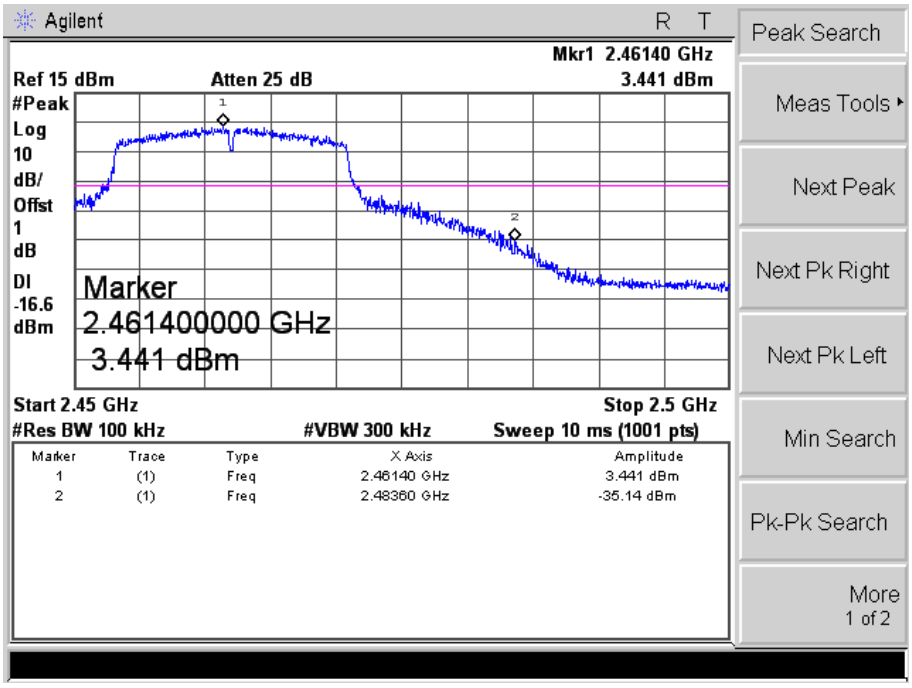


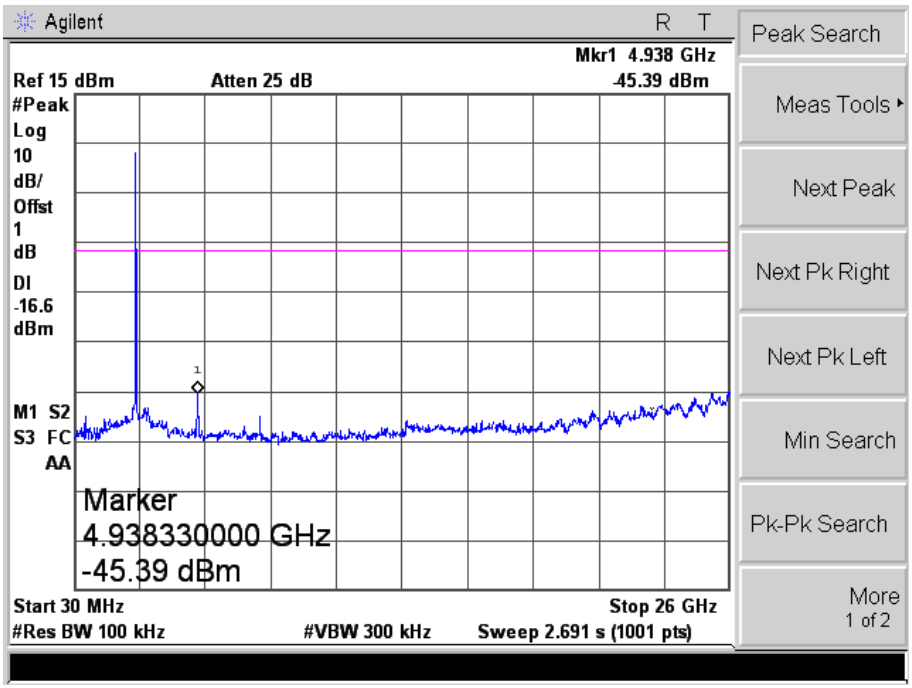
Middle Channel



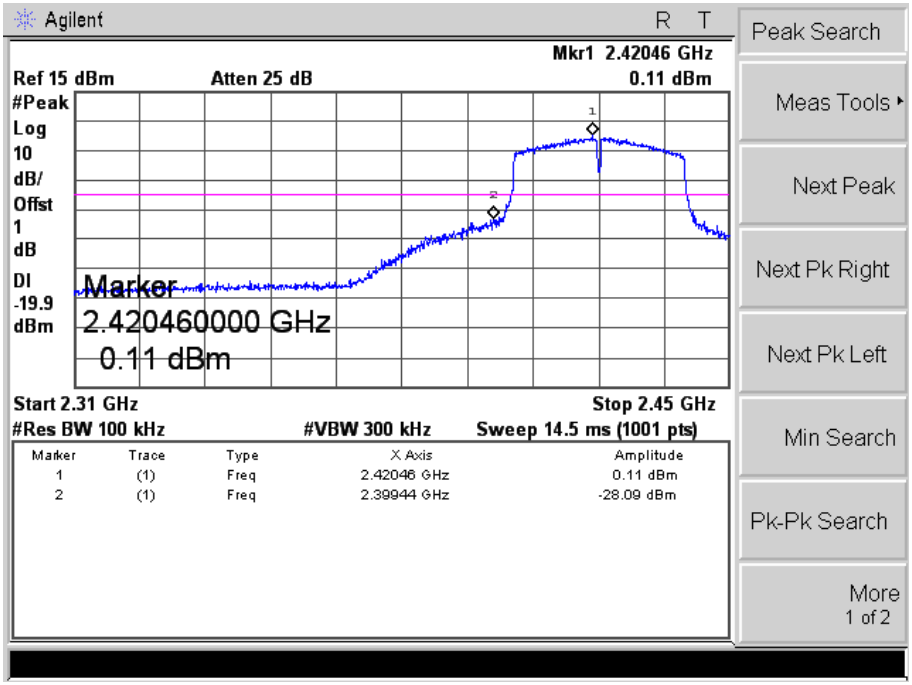


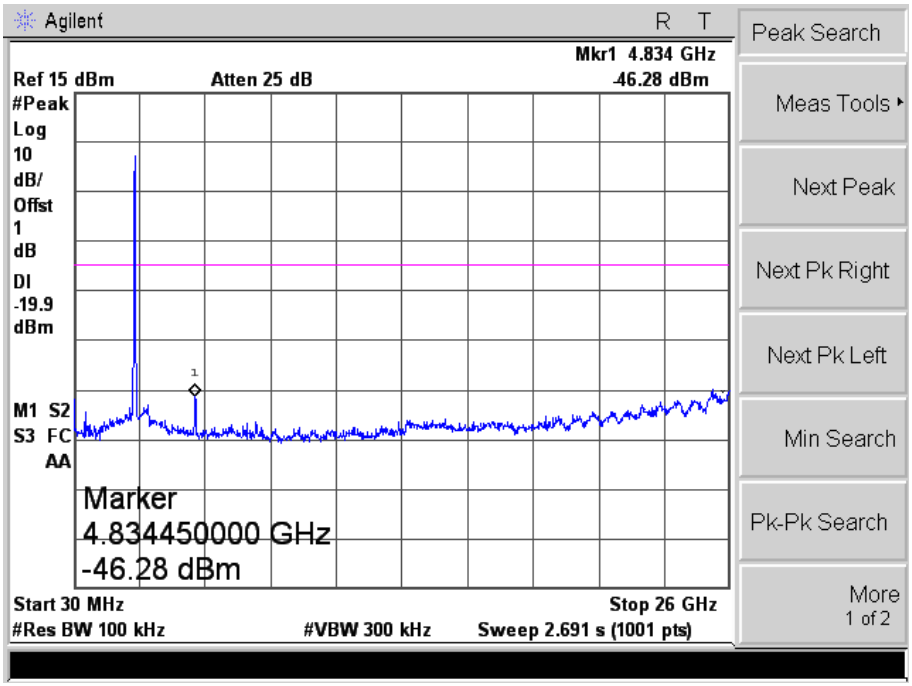
High Channel



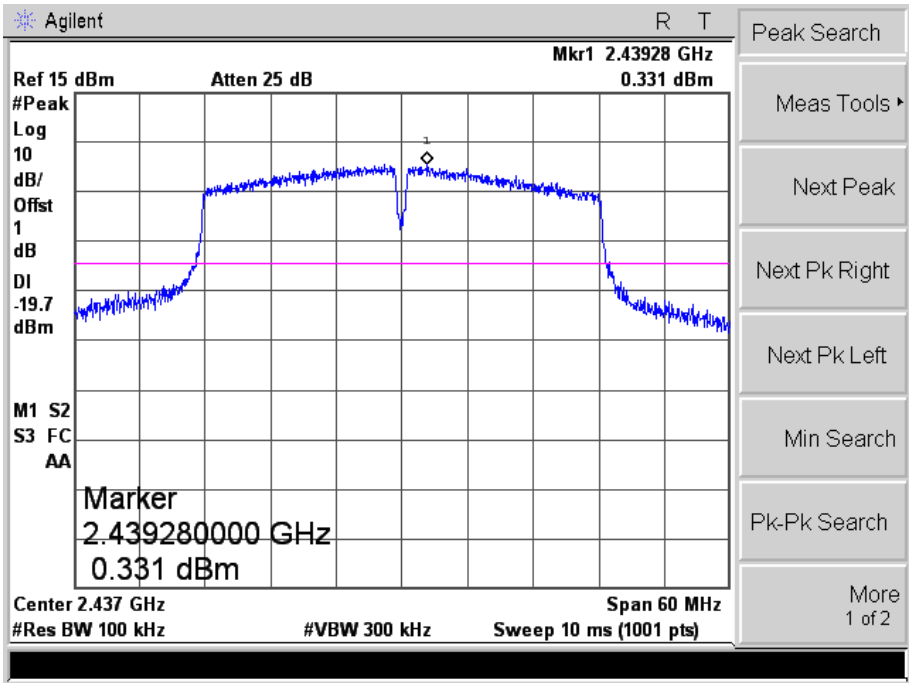


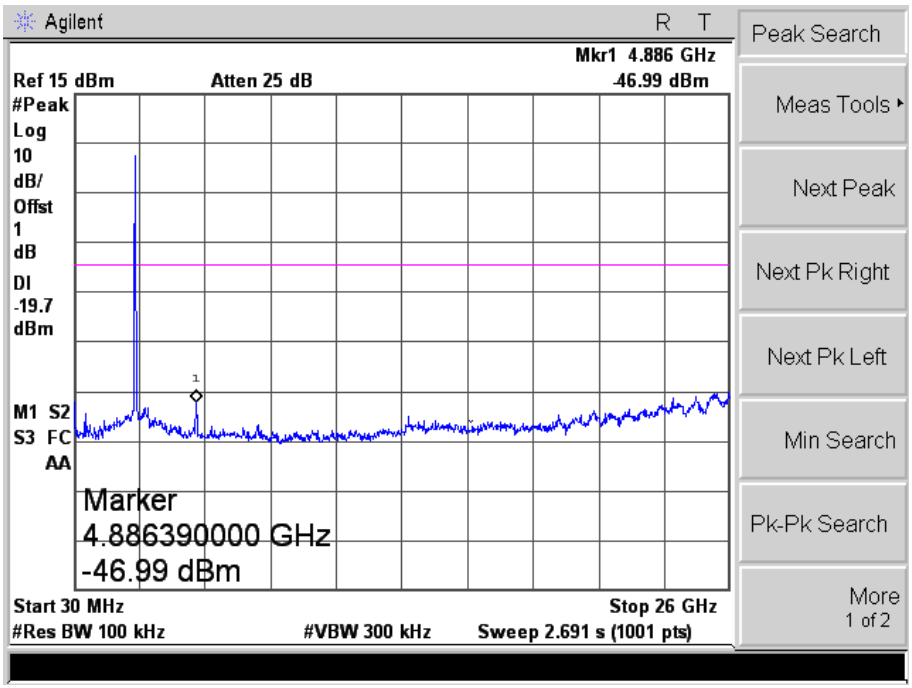
11n-HT40
Low Channel



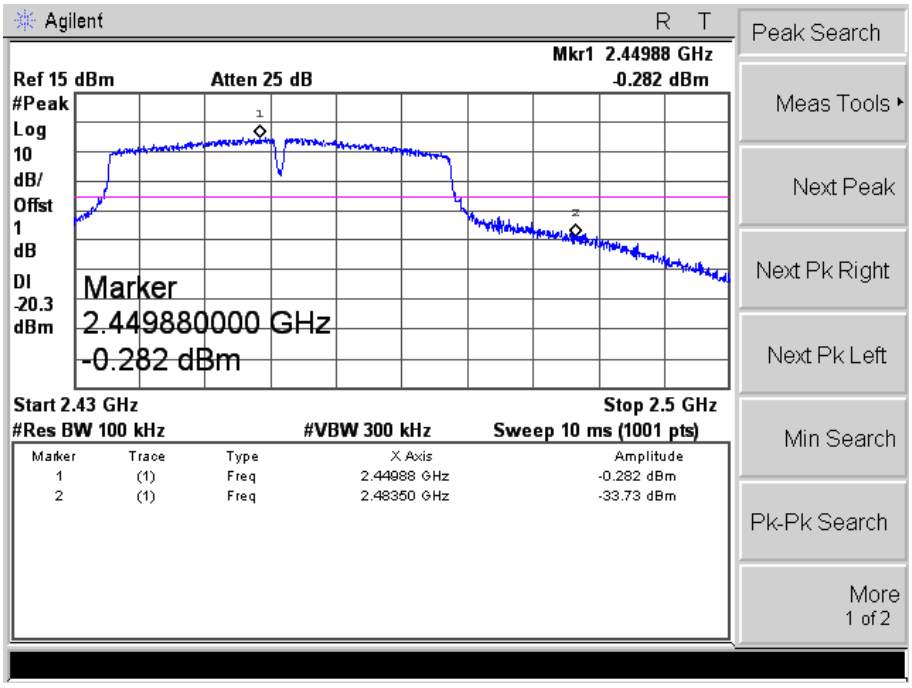


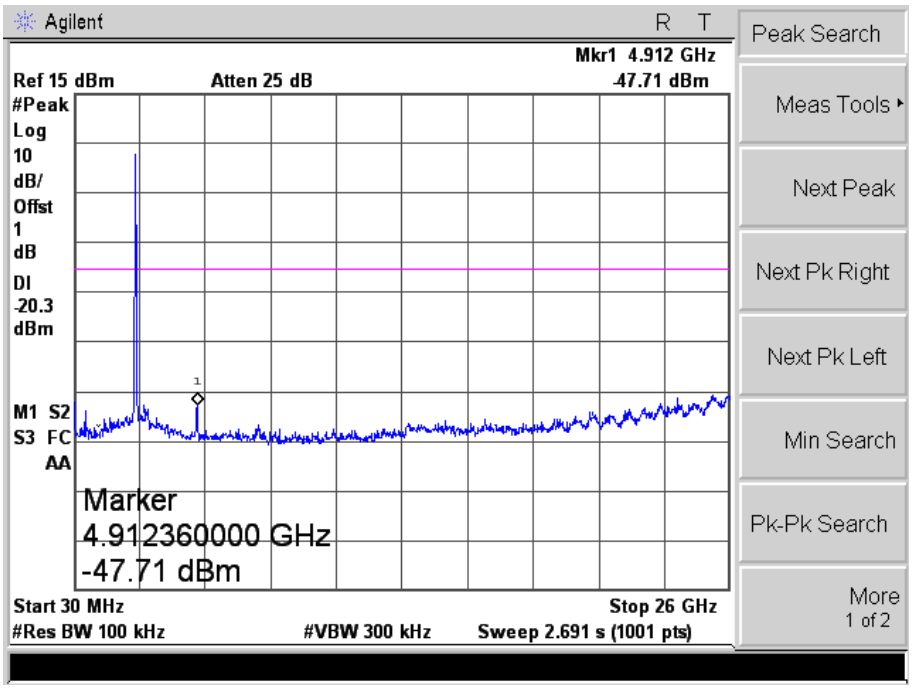
Middle Channel



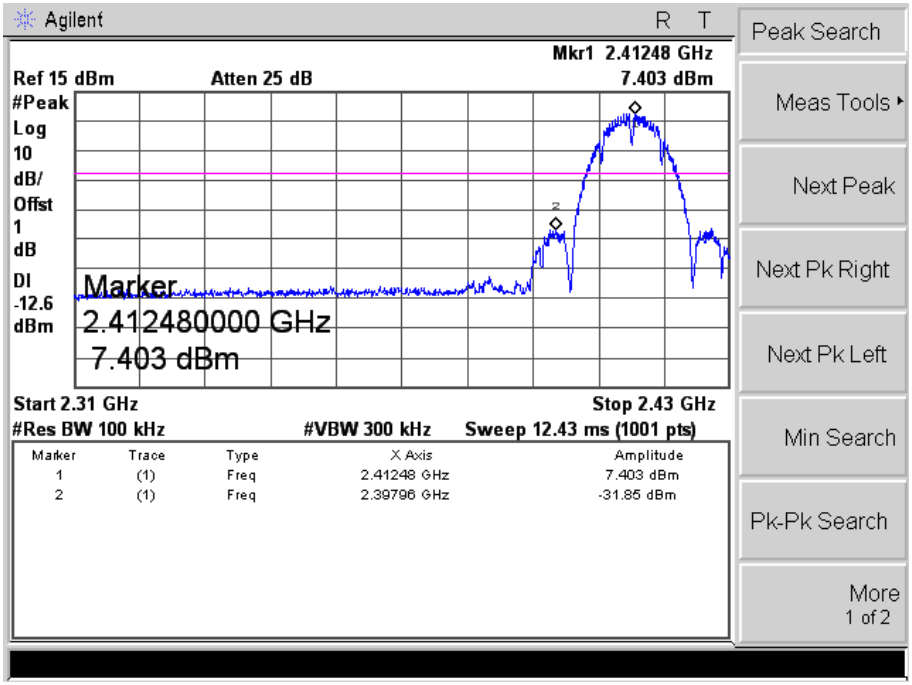


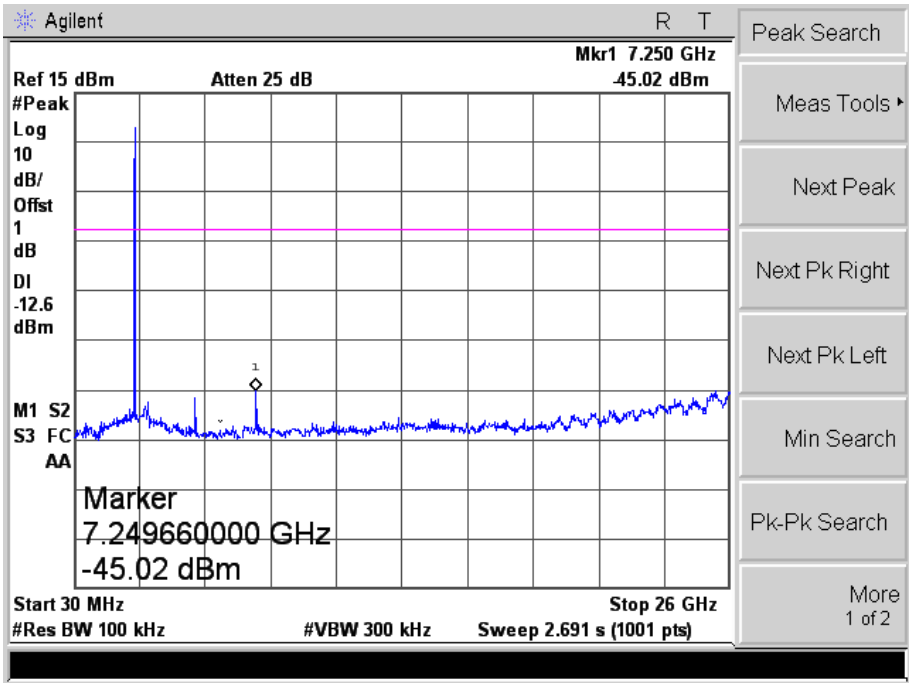
High Channel



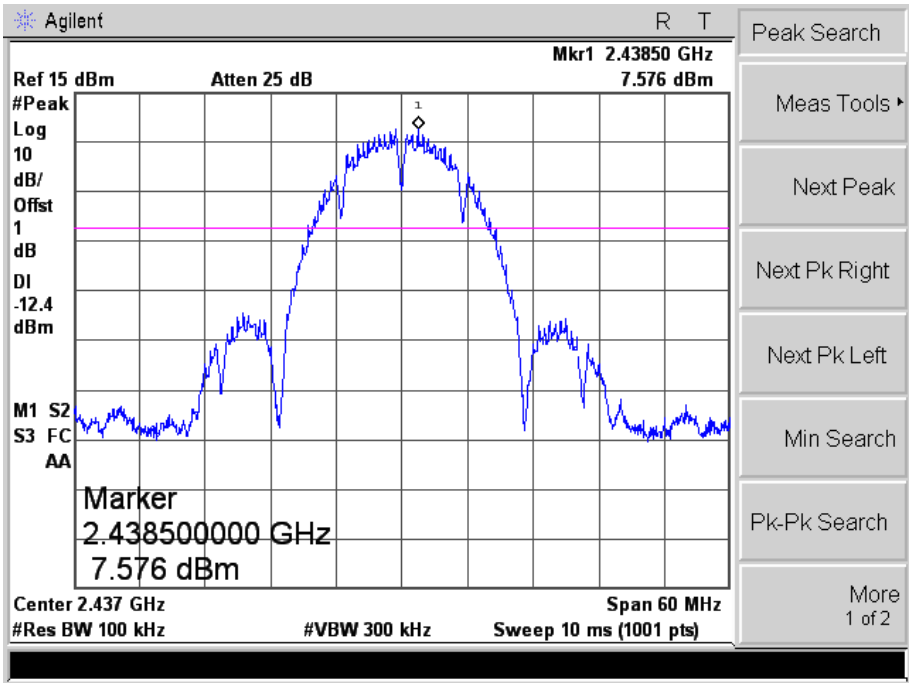


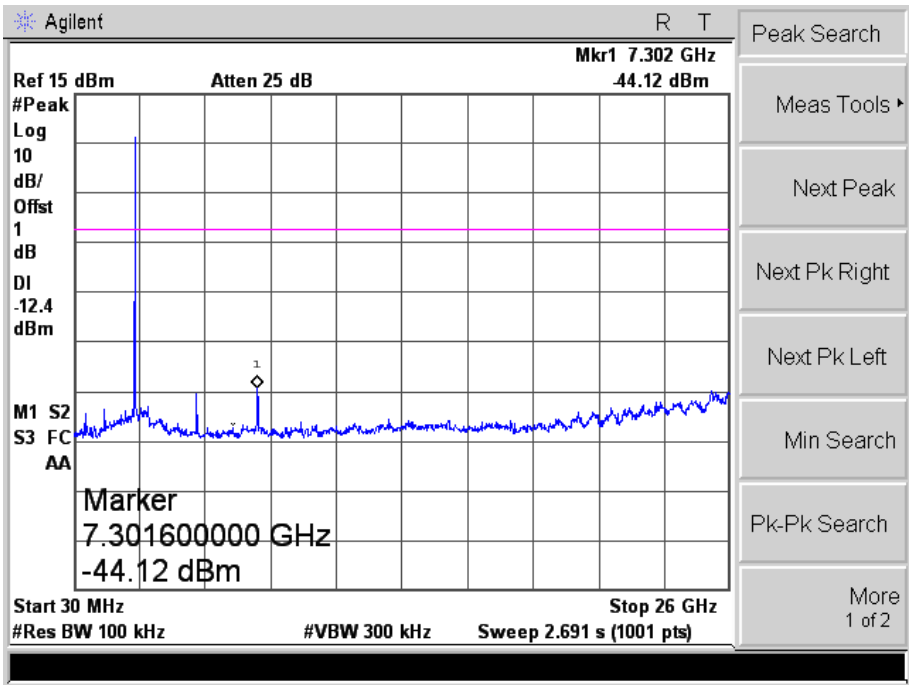
Ant. 1
802.11b
Low Channel



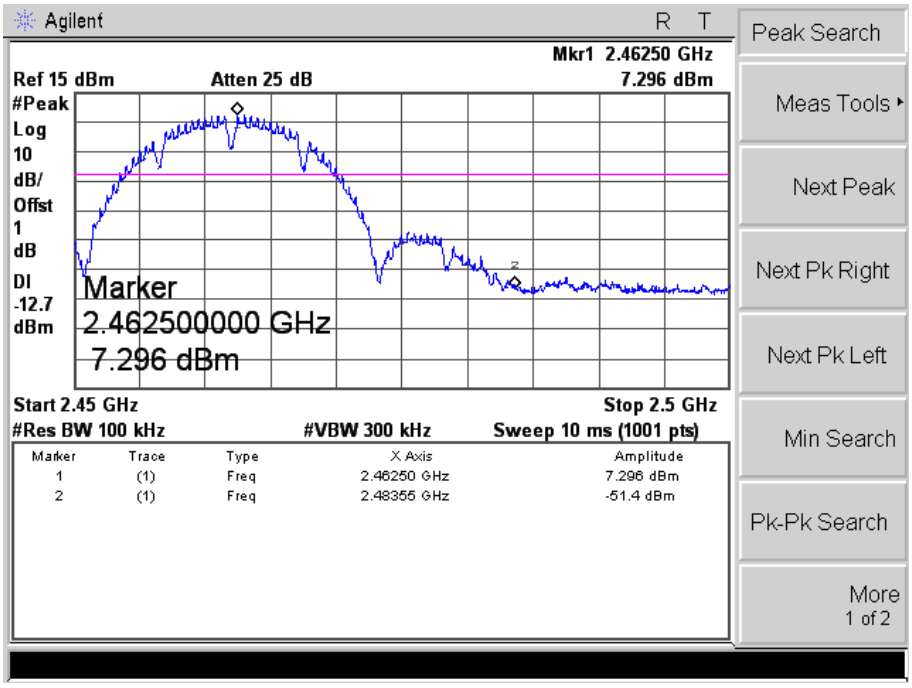


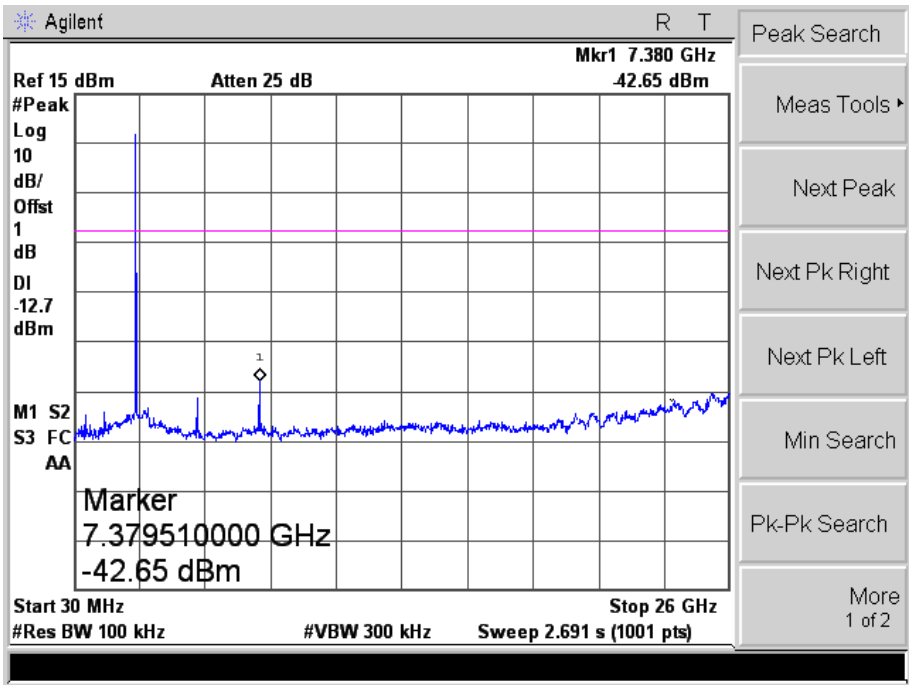
Middle Channel



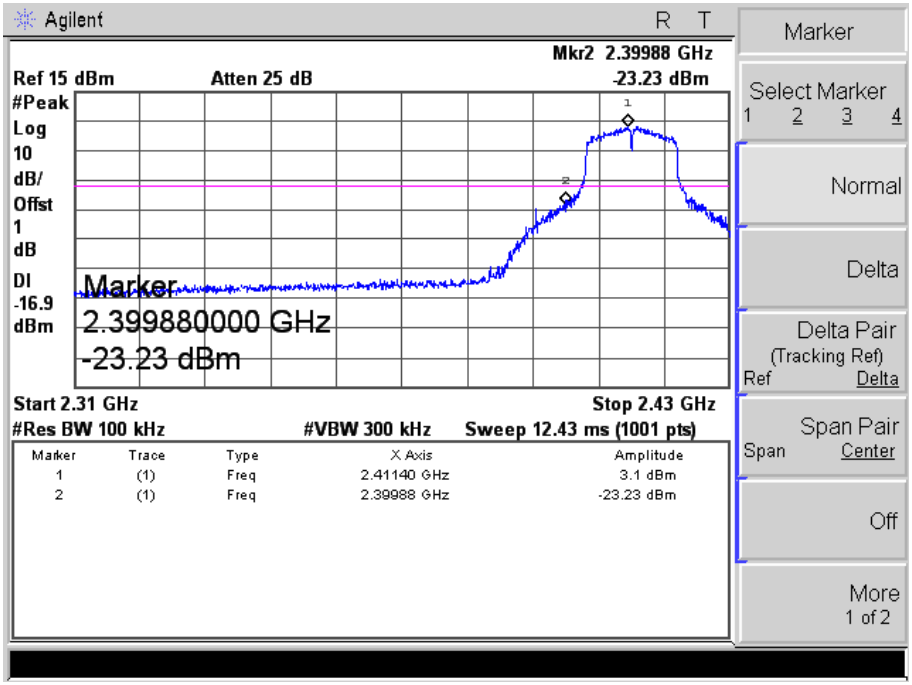


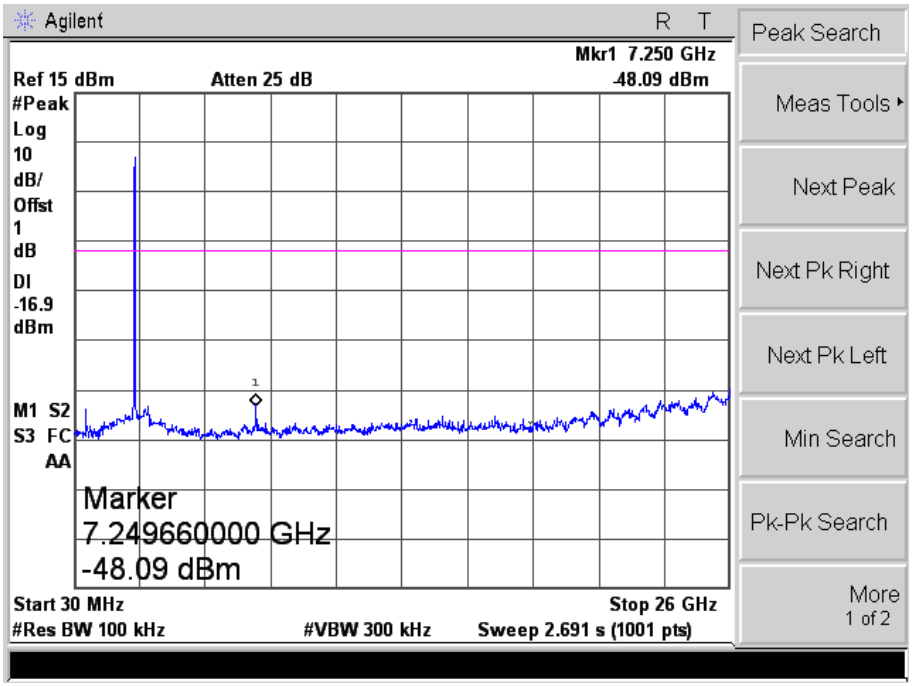
High Channel



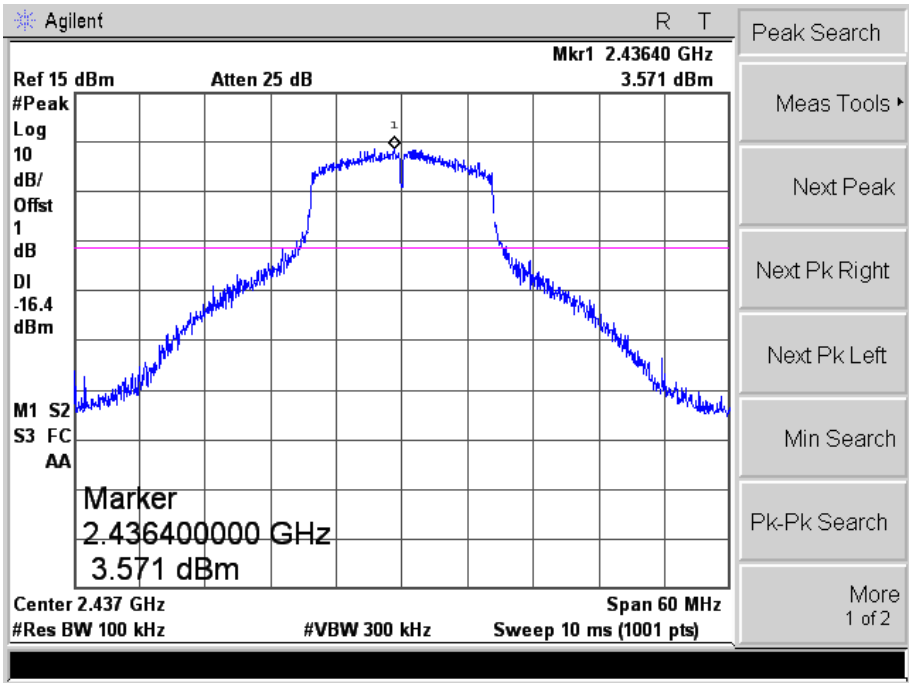


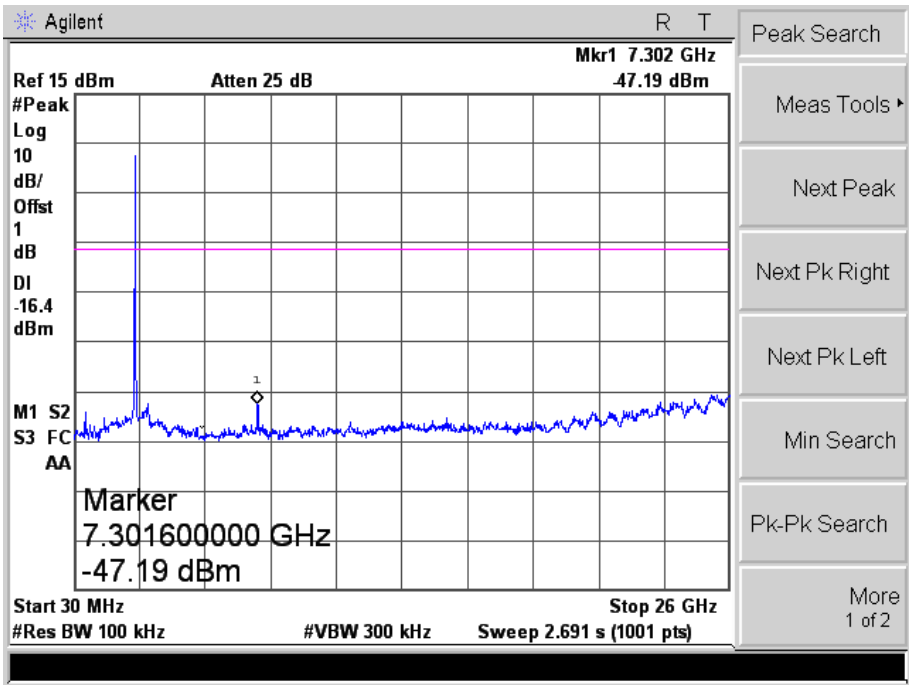
802.11g
Low Channel



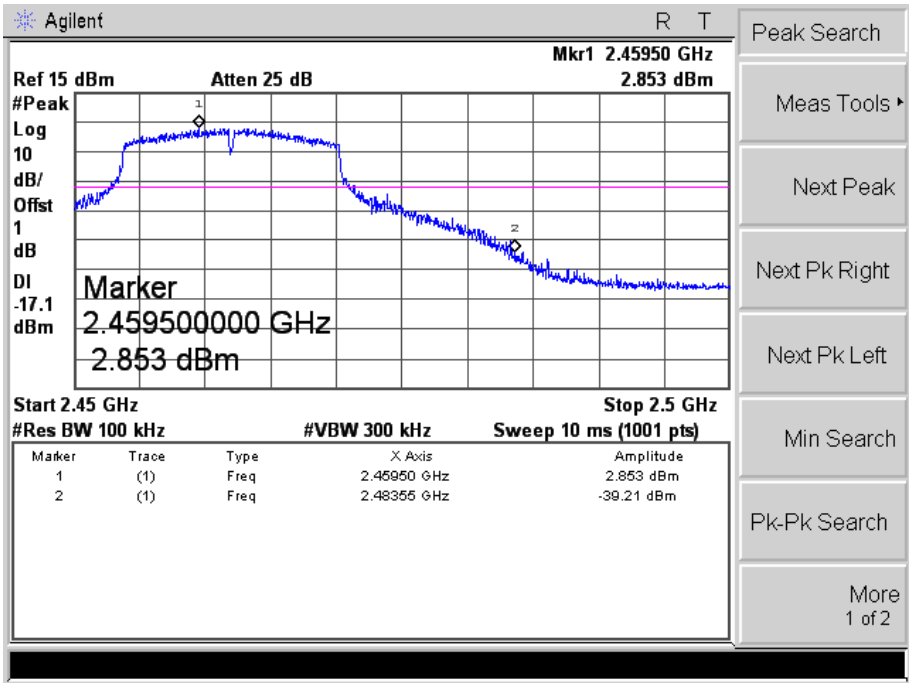


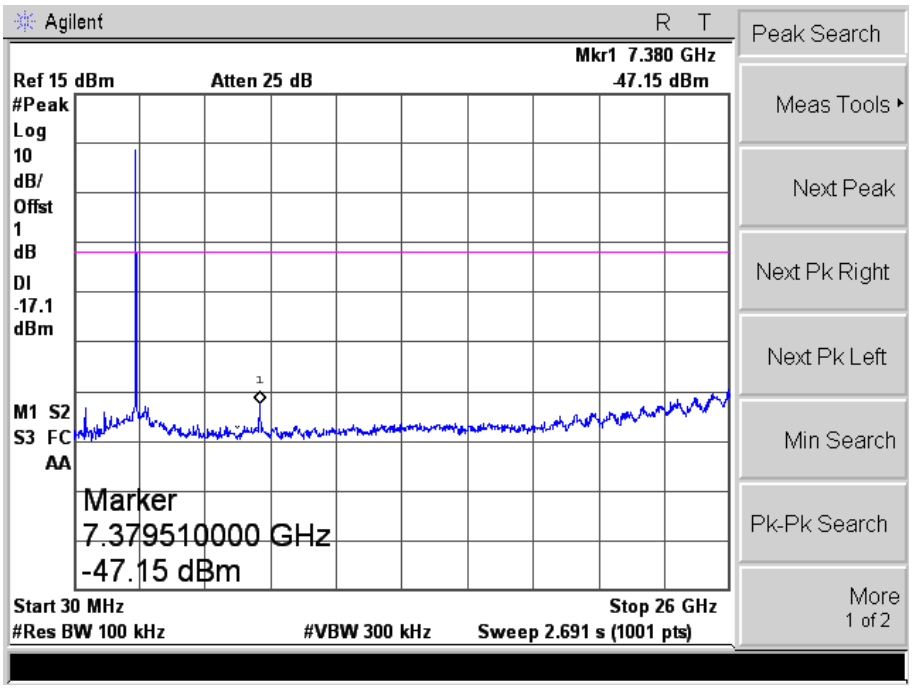
Middle Channel



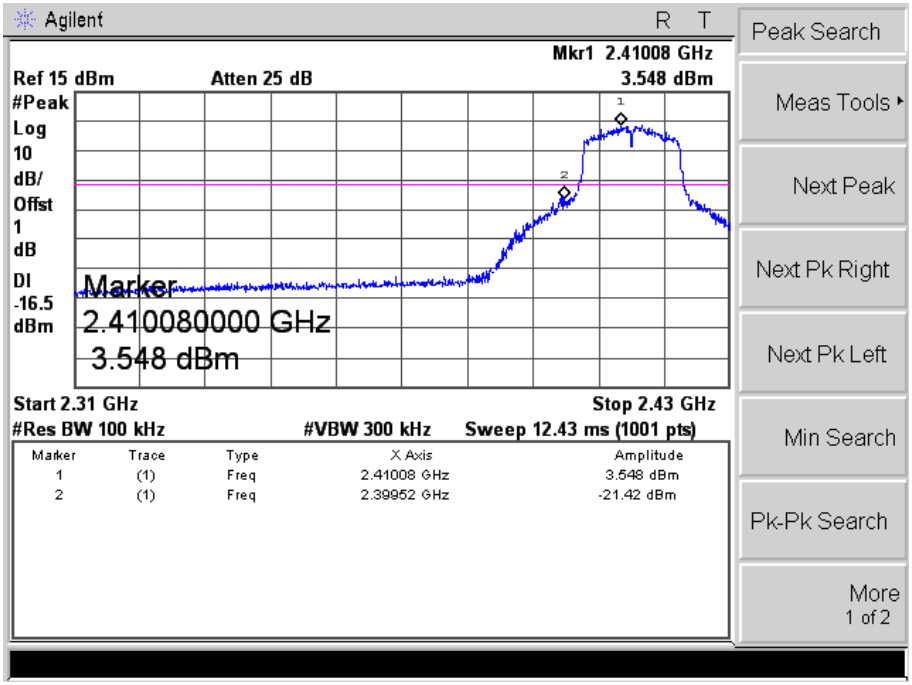


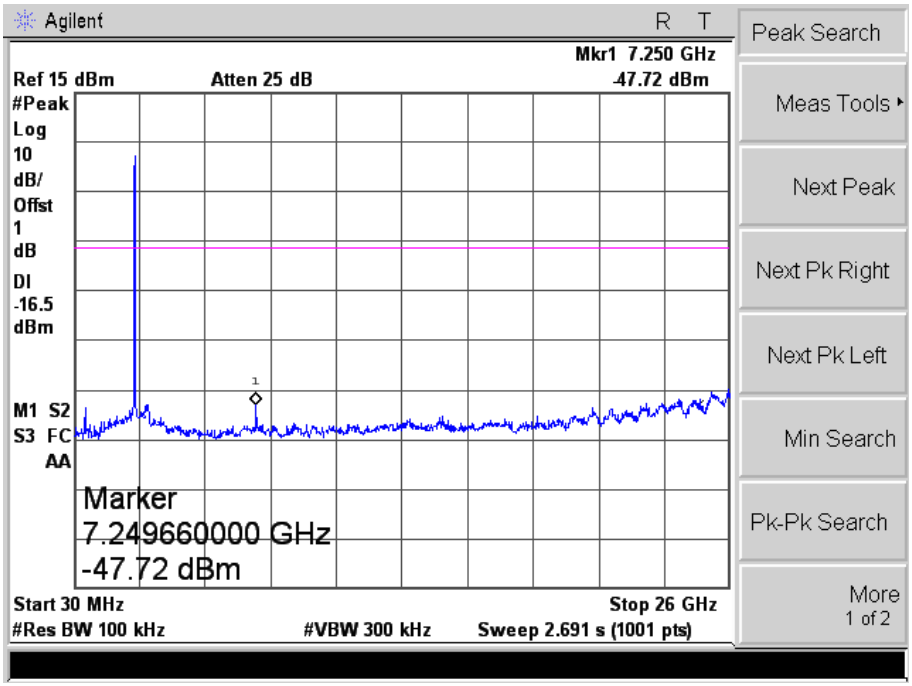
High Channel



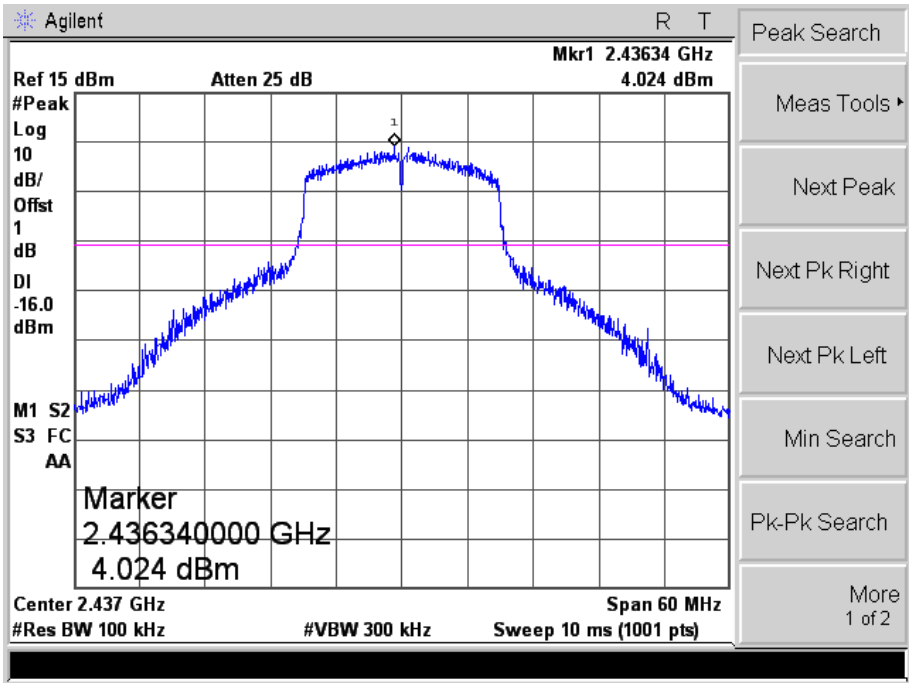


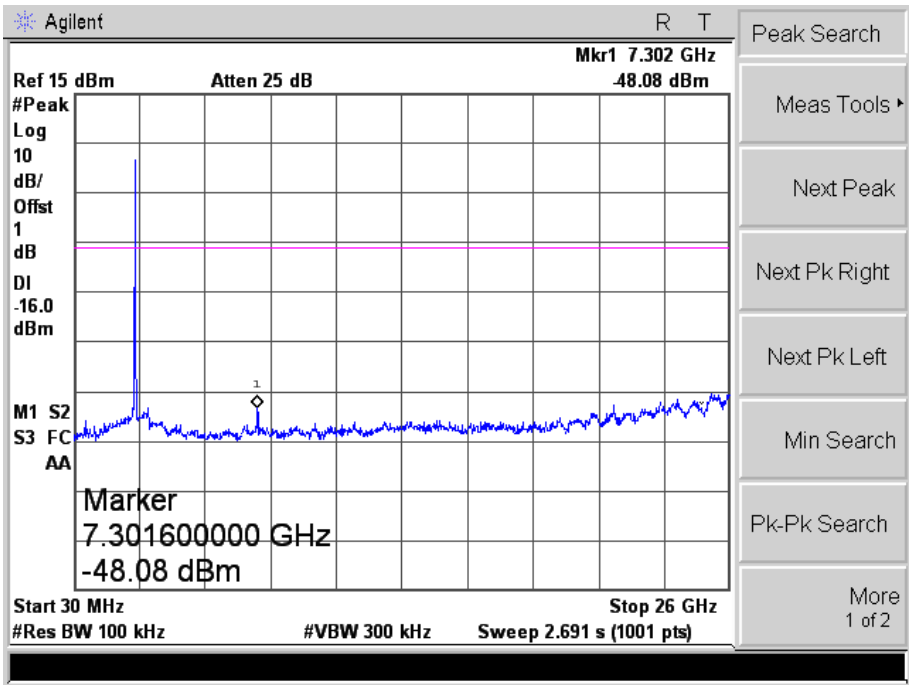
802.11n-HT20
Low Channel



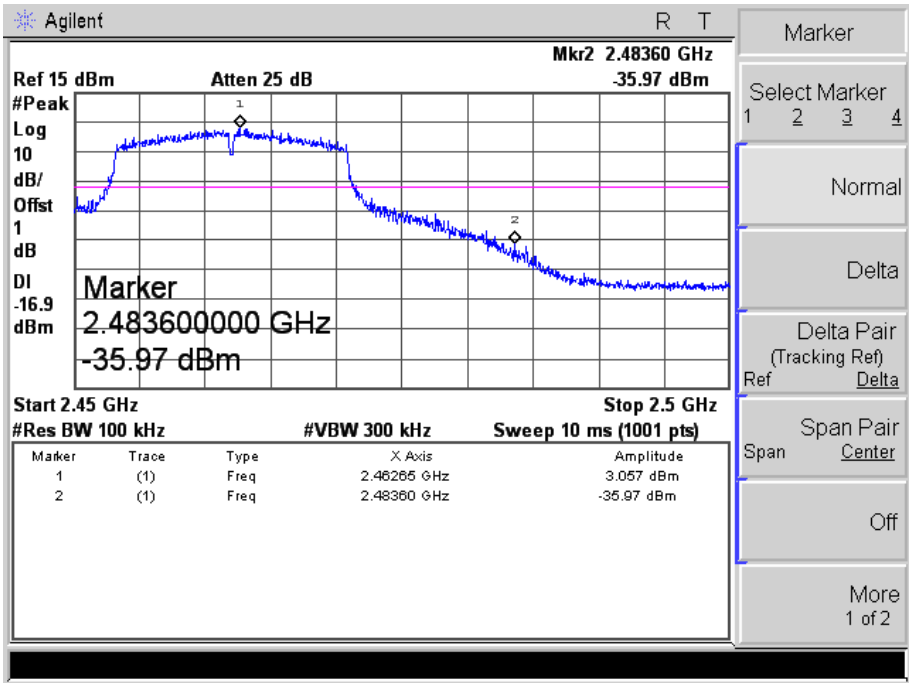


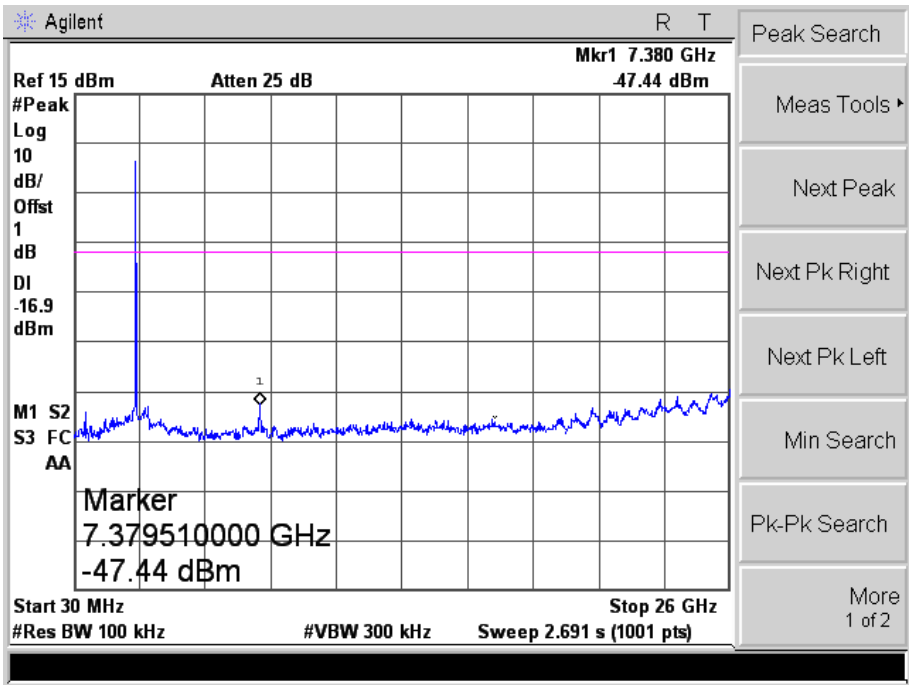
Middle Channel



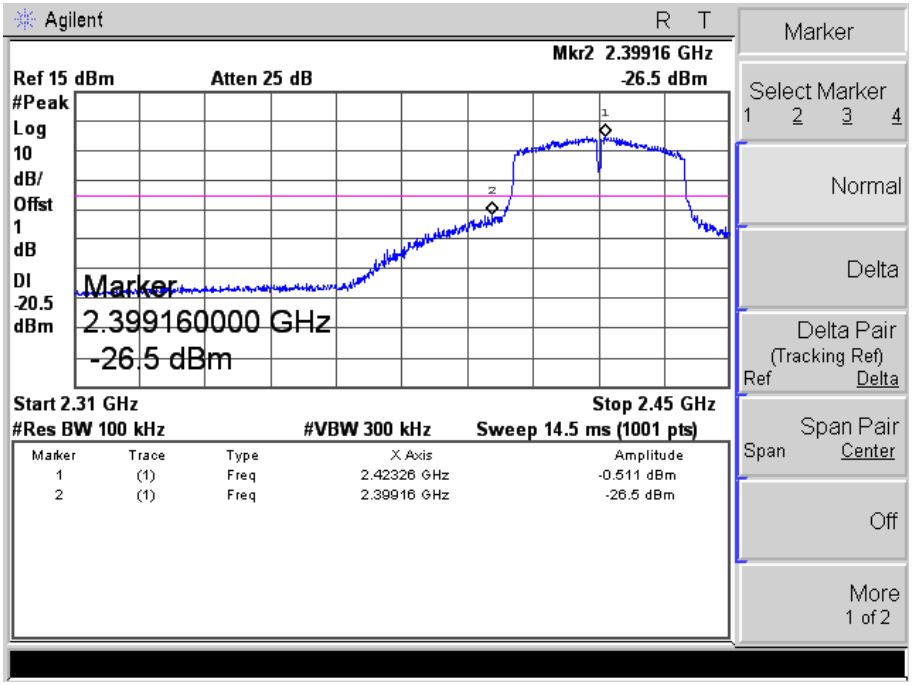


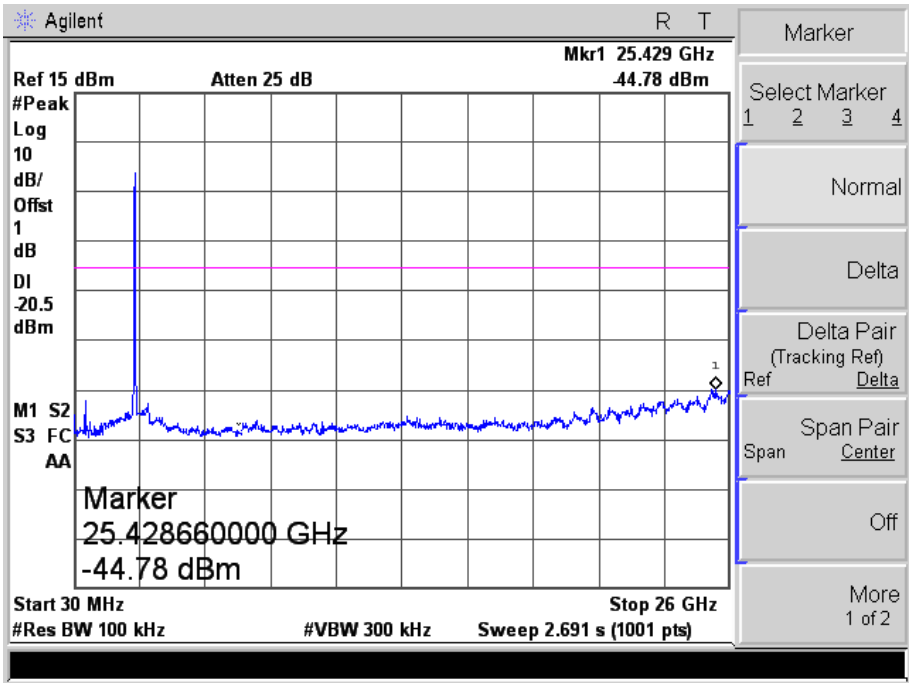
High Channel



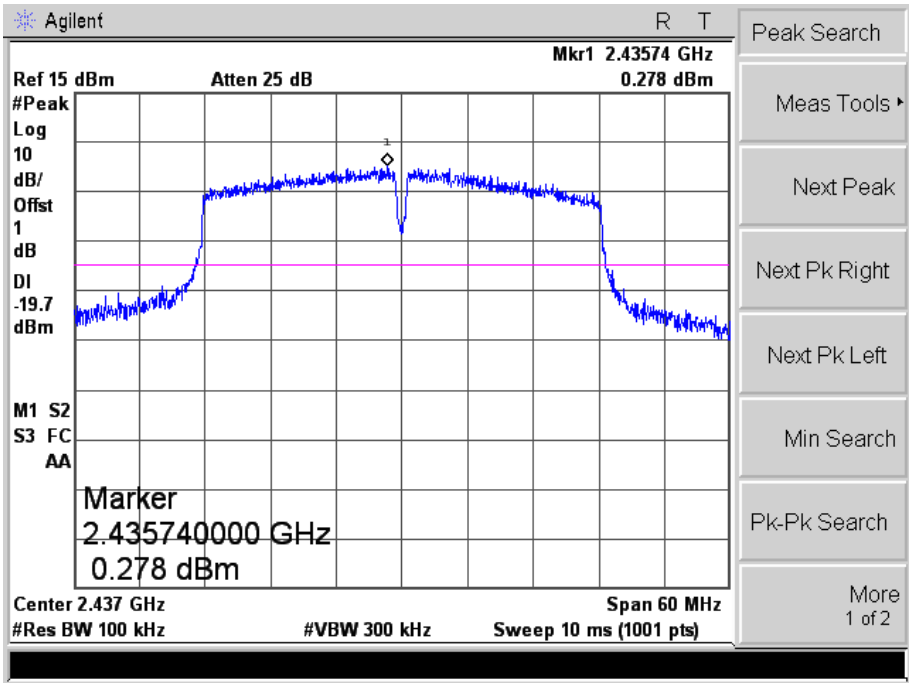


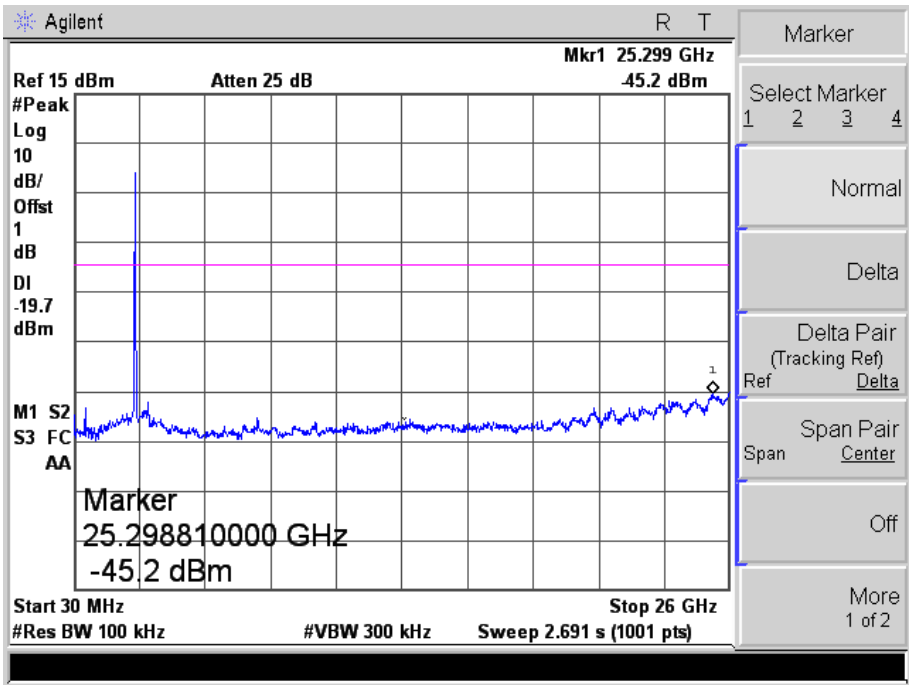
802.11n-HT40
Low Channel



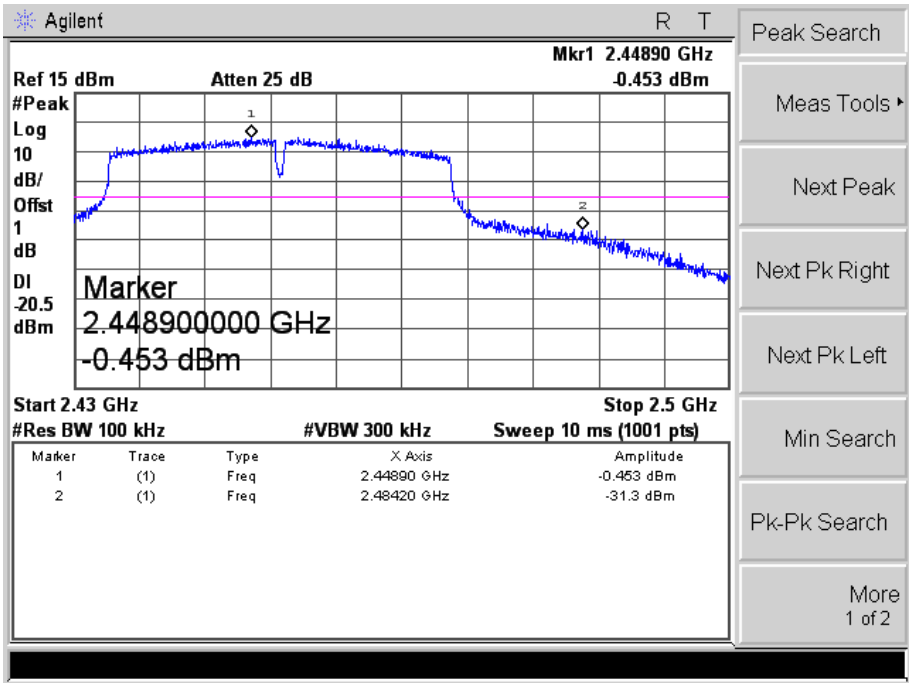


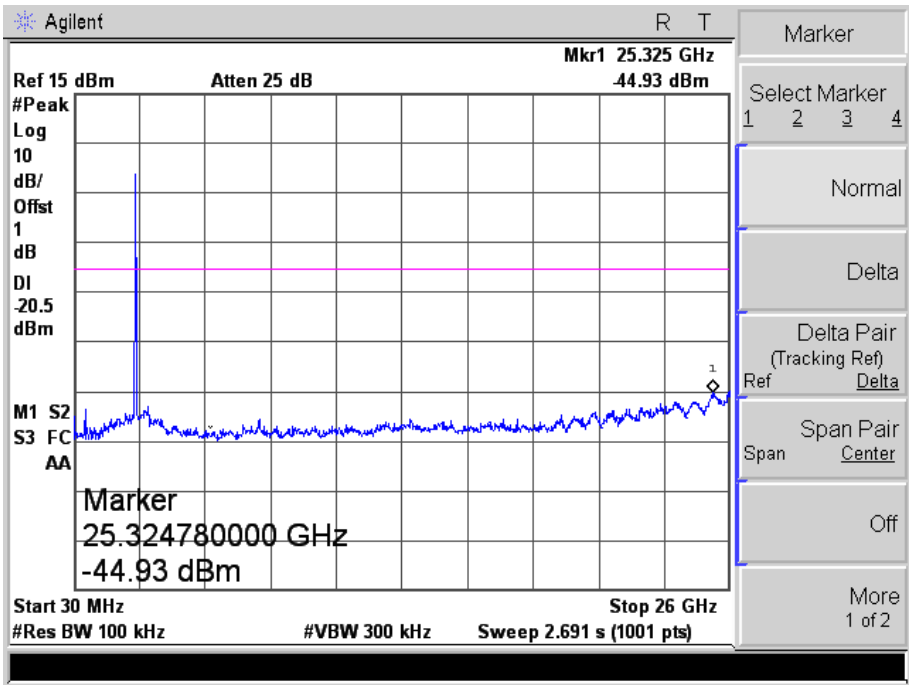
Middle Channel





High Channel





10. Conducted Emissions

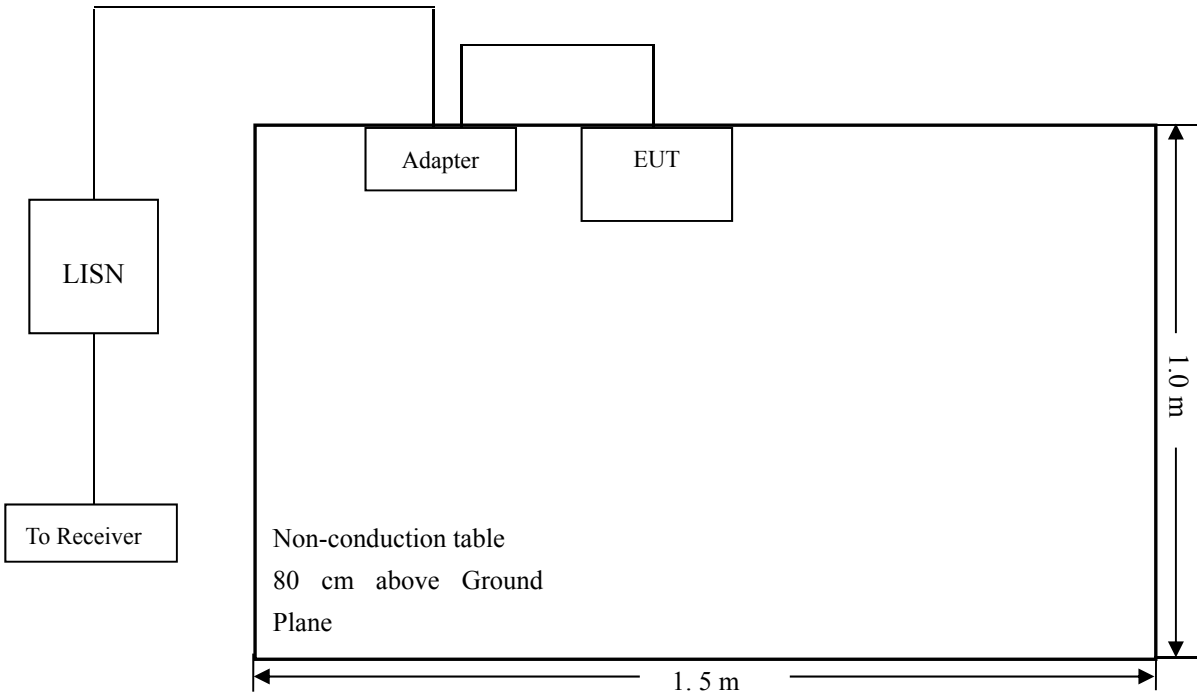
10.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

10.2 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

10.3 Basic Test Setup Block Diagram



10.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

10.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

10.6 Summary of Test Results/Plots

According to the data in section 10.7, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

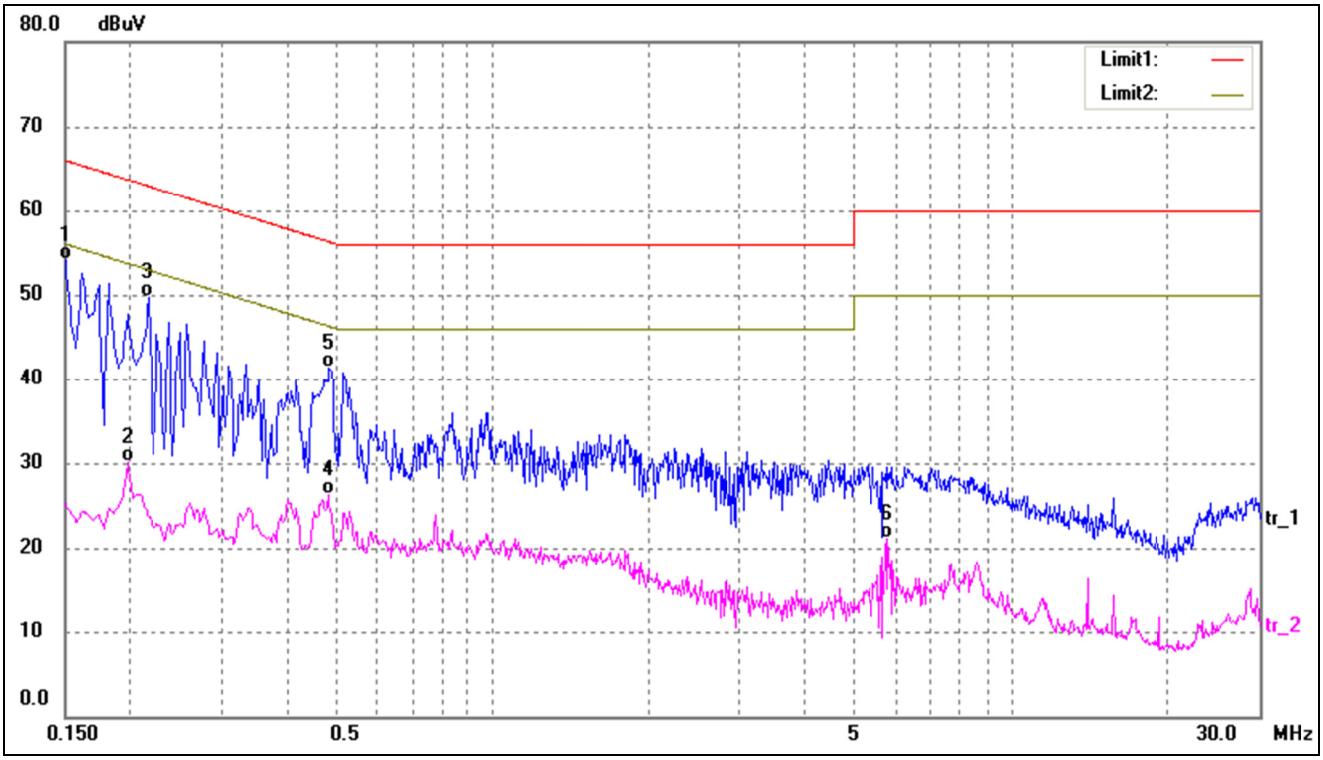
-11.59 dB at 0.1660MHz in the **Line** mode**, QP** detector, **0.15-30MHz**

10.7 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

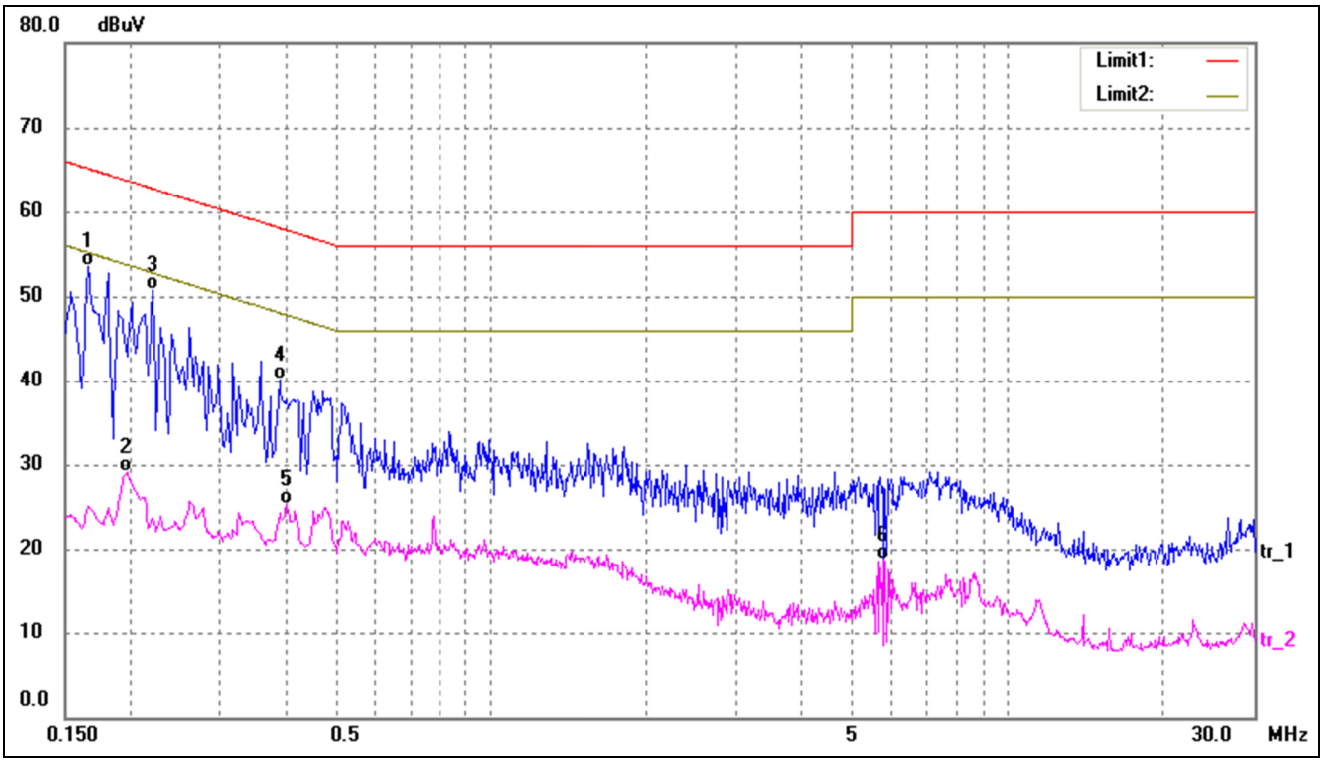
EUT: *WIFI module*
Tested Model: *HLK-7628N*
Operating Condition: *Transmitting(Wi-Fi)*
Comment: *Power Port:DC5V*

Test Specification: *Neutral*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.1500	44.26	9.85	54.11	66.00	-11.89	QP
2	0.1980	20.28	9.80	30.08	53.69	-23.61	AVG
3	0.2180	39.89	9.80	49.69	62.89	-13.20	QP
4	0.4820	16.43	9.80	26.23	46.30	-20.07	AVG
5	0.4860	31.54	9.80	41.34	56.24	-14.90	QP
6	5.7460	11.49	9.64	21.13	50.00	-28.87	AVG

Test Specification: *Line*



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1660	43.74	9.83	53.57	65.16	-11.59	QP
2	0.1980	19.38	9.80	29.18	53.69	-24.51	AVG
3	0.2220	40.87	9.80	50.67	62.74	-12.07	QP
4	0.3900	30.26	9.80	40.06	58.06	-18.00	QP
5	0.4020	15.55	9.80	25.35	47.81	-22.46	AVG
6	5.7500	9.00	9.64	18.64	50.00	-31.36	AVG

******* END OF REPORT *******