

FCC Part 15C Measurement and Test Report

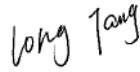
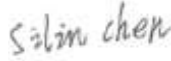

For

LM Technologies Ltd.

Unit19, Spectrum House, 32-34, Gordon House Road, London, NW5 1LP,

United Kingdom

FCC ID: VVXLM811-0451

FCC Rule(s):	<u>FCC Part 15C</u>
Product Description:	<u>LM811 Wi-Fi & BT SMT Module</u>
Tested Model:	<u>LM811-0451</u>
Report No.:	<u>STR18018275I-1</u>
Sample Receipt Date:	<u>2018-01-23</u>
Tested Date:	<u>2018-01-24 to 2018-02-06</u>
Issued Date:	<u>2018-02-06</u>
Tested By:	<u>Long Tang / Engineer</u> 
Reviewed By:	<u>Silin Chen / EMC Manager</u> 
Approved & Authorized By:	<u>Jandy So / PSQ Manager</u> 
Prepared By:	

Shenzhen SEM Test Technology Co., Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM Test Technology Co., Ltd.

TABLE OF CONTENTS

1. GENERAL INFORMATION	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
1.2 TEST STANDARDS	4
1.3 TEST METHODOLOGY	4
1.4 TEST FACILITY	4
1.5 EUT SETUP AND TEST MODE	5
1.6 MEASUREMENT UNCERTAINTY	5
1.7 TEST EQUIPMENT LIST AND DETAILS	6
2. SUMMARY OF TEST RESULTS	7
3. RF EXPOSURE	8
3.1 STANDARD APPLICABLE	8
3.2 TEST RESULT	8
4. ANTENNA REQUIREMENT	9
4.1 STANDARD APPLICABLE	9
4.2 EVALUATION INFORMATION	9
5. POWER SPECTRAL DENSITY	10
5.1 STANDARD APPLICABLE	10
5.2 TEST PROCEDURE	10
5.3 ENVIRONMENTAL CONDITIONS	10
5.4 SUMMARY OF TEST RESULTS/PLOTS	11
6. 6DB BANDWIDTH	18
6.1 STANDARD APPLICABLE	18
6.2 TEST PROCEDURE	18
6.3 ENVIRONMENTAL CONDITIONS	18
6.4 SUMMARY OF TEST RESULTS/PLOTS	18
7. RF OUTPUT POWER	25
7.1 STANDARD APPLICABLE	25
7.2 TEST PROCEDURE	25
7.3 ENVIRONMENTAL CONDITIONS	25
7.4 SUMMARY OF TEST RESULTS/PLOTS	26
8. FIELD STRENGTH OF SPURIOUS EMISSIONS	33
8.1 STANDARD APPLICABLE	33
8.2 TEST PROCEDURE	33
8.3 CORRECTED AMPLITUDE & MARGIN CALCULATION	34
8.4 ENVIRONMENTAL CONDITIONS	34
8.5 SUMMARY OF TEST RESULTS/PLOTS	35
9. OUT OF BAND EMISSIONS	42
9.1 STANDARD APPLICABLE	42
9.2 TEST PROCEDURE	42
9.3 ENVIRONMENTAL CONDITIONS	43
9.4 SUMMARY OF TEST RESULTS/PLOTS	43
10. CONDUCTED EMISSIONS	63
10.1 TEST PROCEDURE	63
10.2 BASIC TEST SETUP BLOCK DIAGRAM	63
10.3 ENVIRONMENTAL CONDITIONS	63
10.4 TEST RECEIVER SETUP	64
10.5 SUMMARY OF TEST RESULTS/PLOTS	64
10.6 CONDUCTED EMISSIONS TEST DATA	64

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: LM Technologies Ltd.
Address of applicant: Unit19, Spectrum House, 32-34, Gordon House Road,
London, NW5 1LP, United Kingdom

Manufacturer: LM Technologies Ltd.
Address of manufacturer: Unit19, Spectrum House, 32-34, Gordon House Road,
London, NW5 1LP, United Kingdom

General Description of EUT	
Product Name:	LM811 Wi-Fi & BT SMT Module
Brand Name:	LM Technologies
Model No.:	LM811-0451
Adding Model(s):	LM811-0453, LM811-0454
Rated Voltage:	USB DC 5V
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model LM811-0451, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 11b/g/n(HT20) 2422-2452MHz for 11n(HT40)
RF Output Power:	15.19dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11/7
Channel Separation:	5MHz
Type of Antenna:	External
Antenna Gain:	2dBi
Lowest Internal Frequency:	40MHz

1.2 Test Standards

The following report is prepared on behalf of the LM Technologies 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 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 the 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.

Accessories Equipment List and Details			
Description	Manufacturer	Model No.	Serial Number
Notebook	Lenovo	E445	/

Accessories Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With Core/Without Core
USB LINE	0.8	Unshielded	Without Core

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

1.6 Measurement Uncertainty

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

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	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
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	2017-03-09	2018-03-08

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 § 2.1093, the portable 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 an external antenna, 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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set VBW $\geq 3 \times \text{RBW}$.
- e) Detector = power averaging (RMS) or sample detector (when RMS not available).
- f) Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- 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

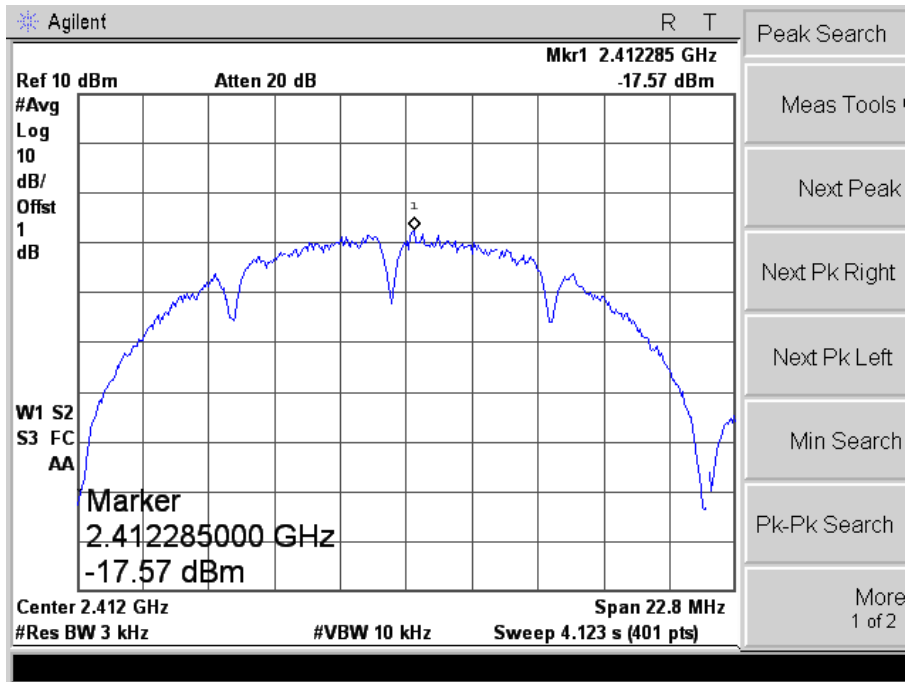
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

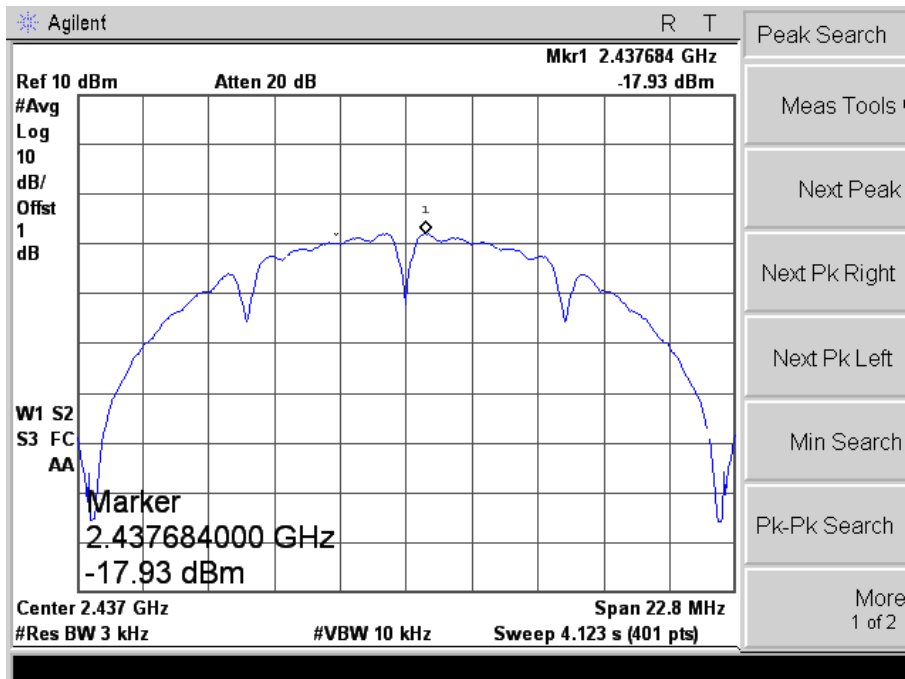
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b_1Mbps	2412	-17.57	8
	2437	-17.93	8
	2462	-17.72	8
802.11g_6Mbps	2412	-20.90	8
	2437	-20.85	8
	2462	-21.38	8
802.11n HT20_MCS0	2412	-21.13	8
	2437	-21.31	8
	2462	-20.63	8
802.11n HT40_MCS0	2422	-25.09	8
	2437	-24.62	8
	2452	-24.57	8

Please refer to the following test plots:

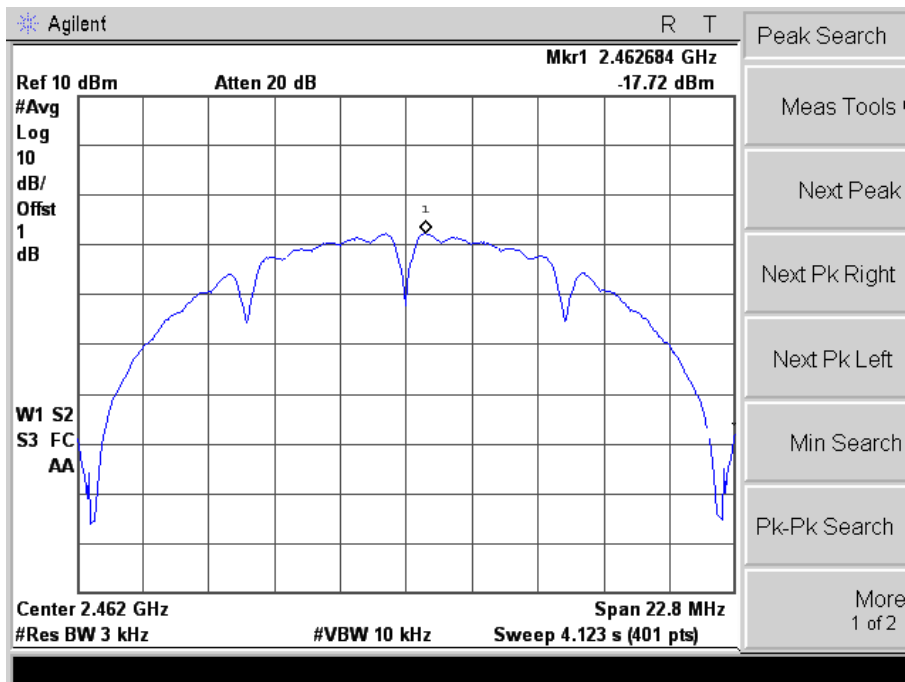
802.11b-Low Channel



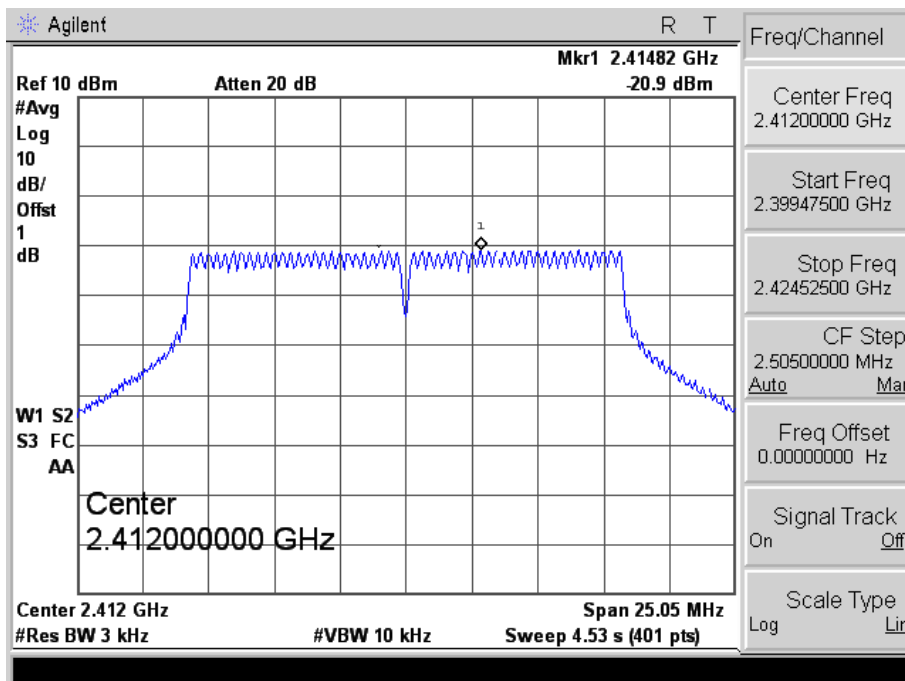
802.11b-Middle Channel



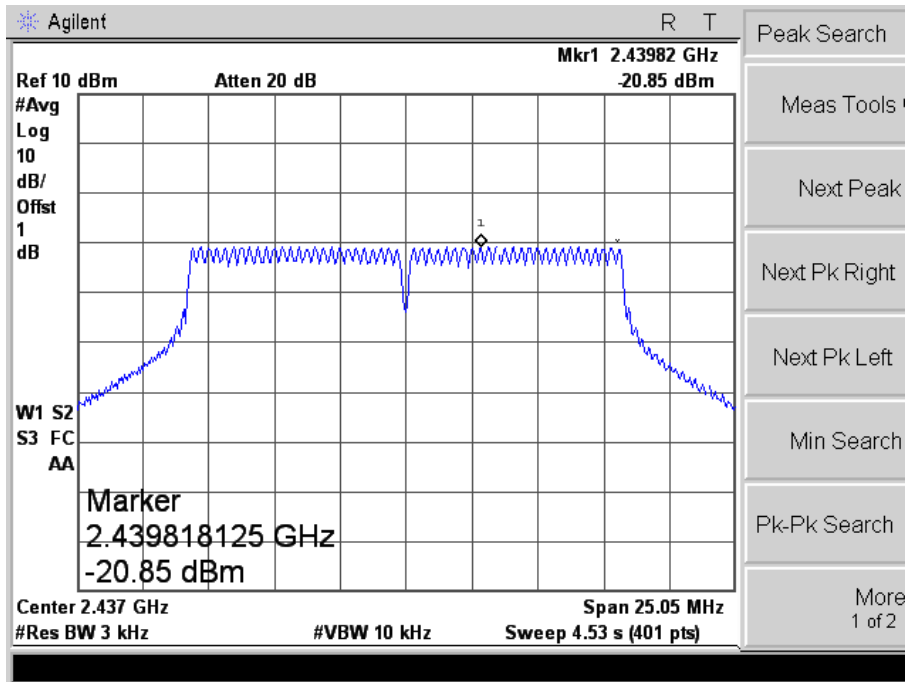
802.11b-High Channel



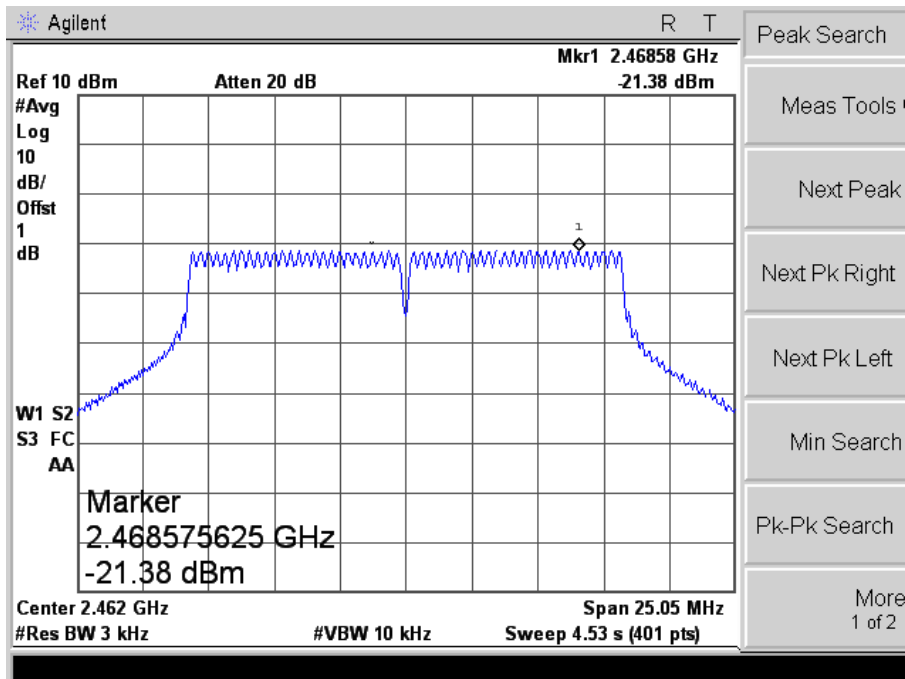
802.11g-Low Channel



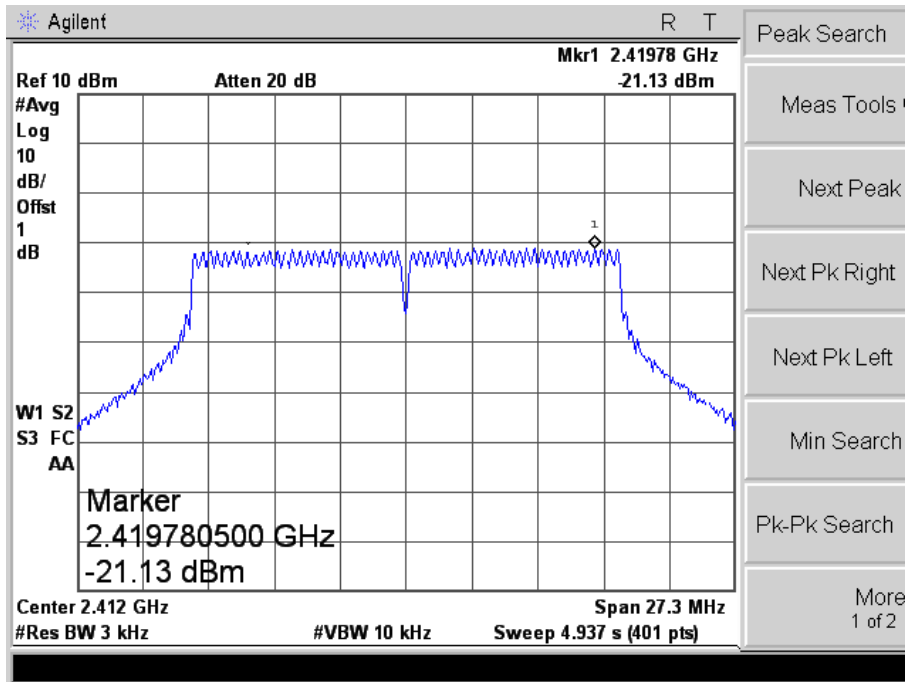
802.11g-Middle Channel



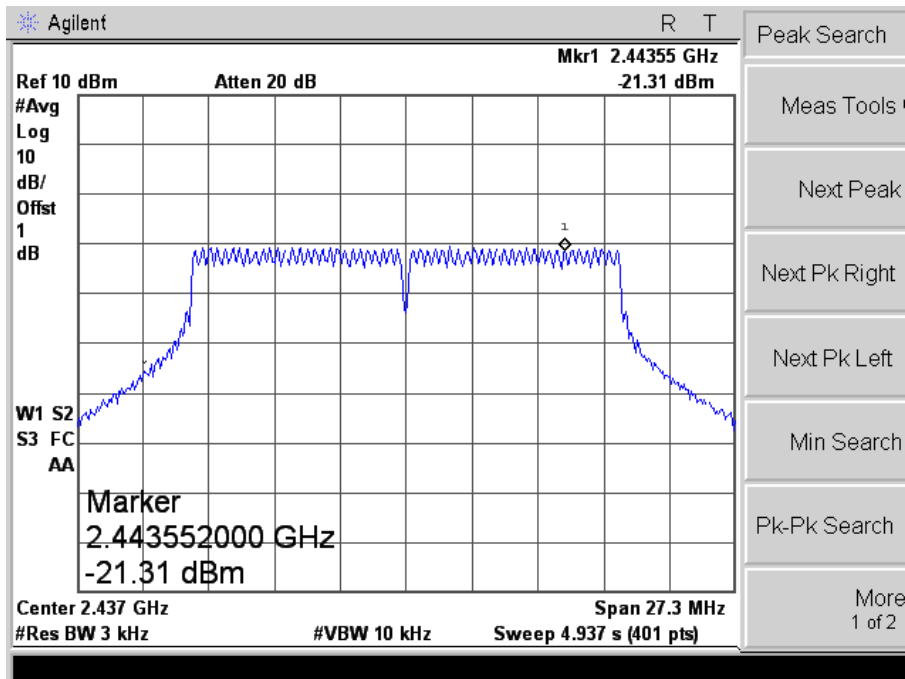
802.11g-High Channel



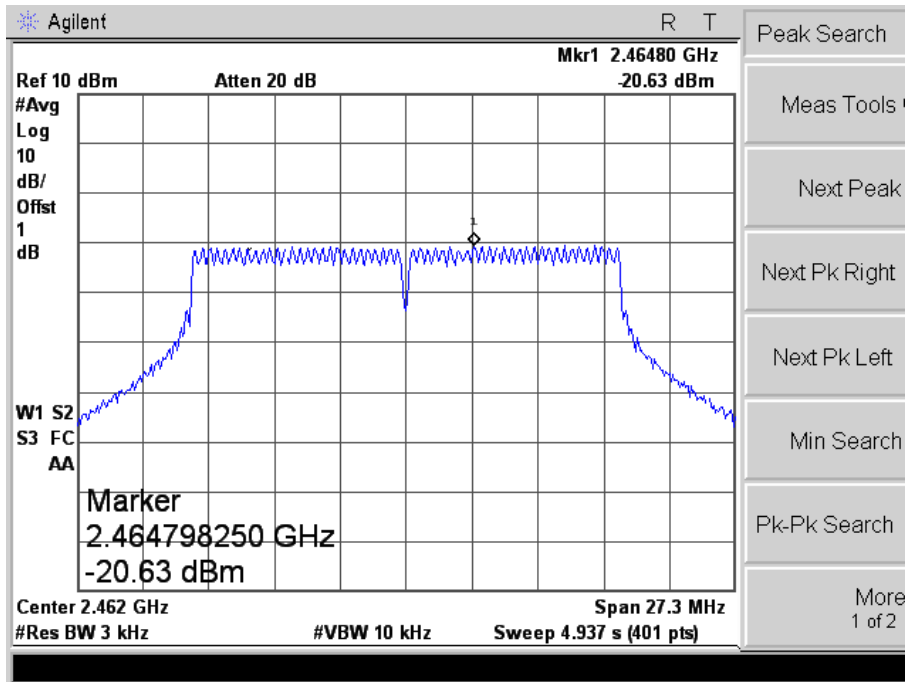
802.11n-HT20-Low Channel



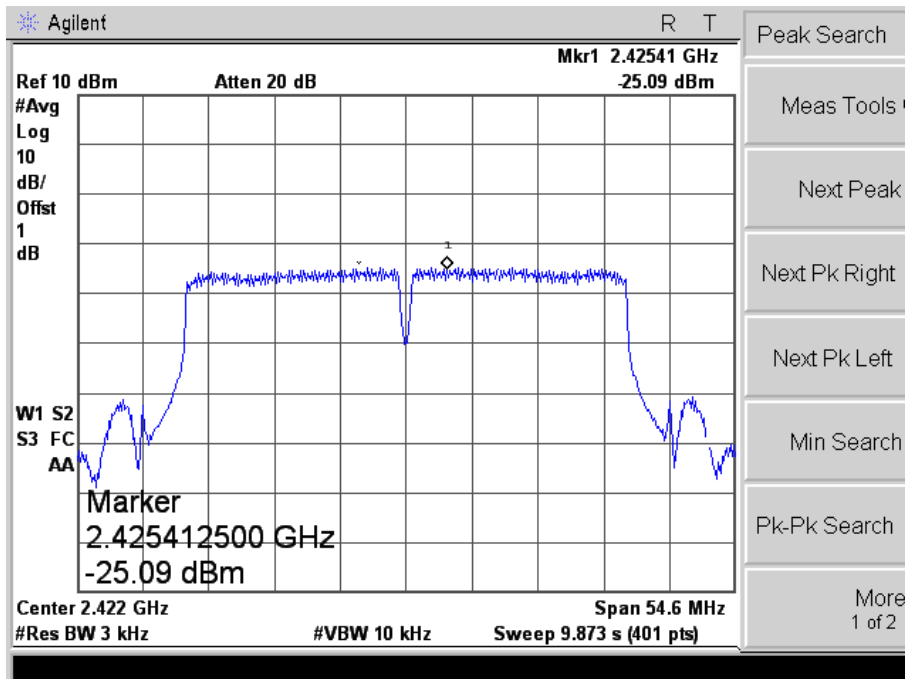
802.11n-HT20-Middle Channel



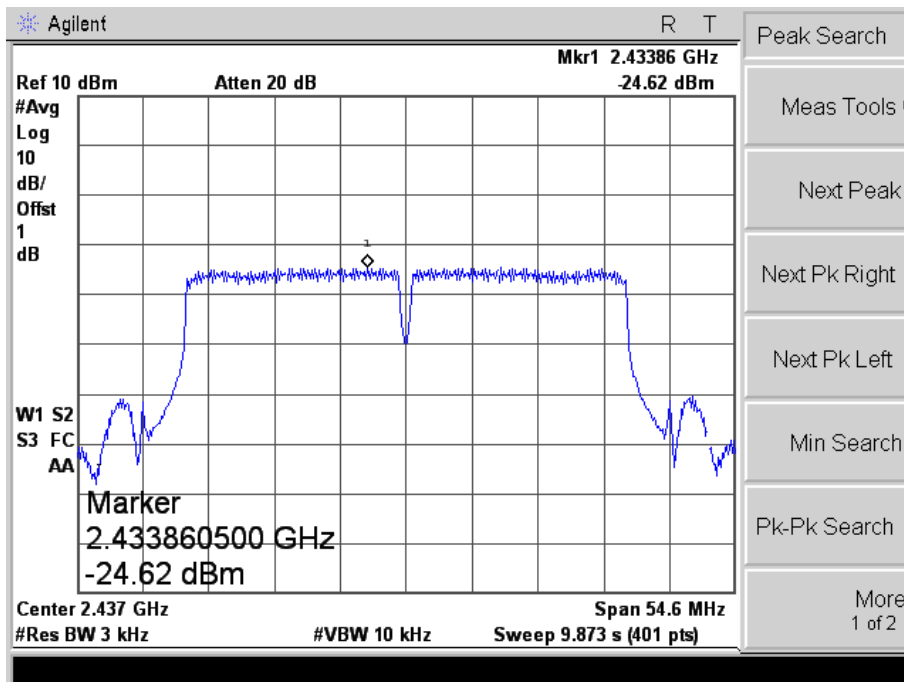
802.11n-HT20-High Channel



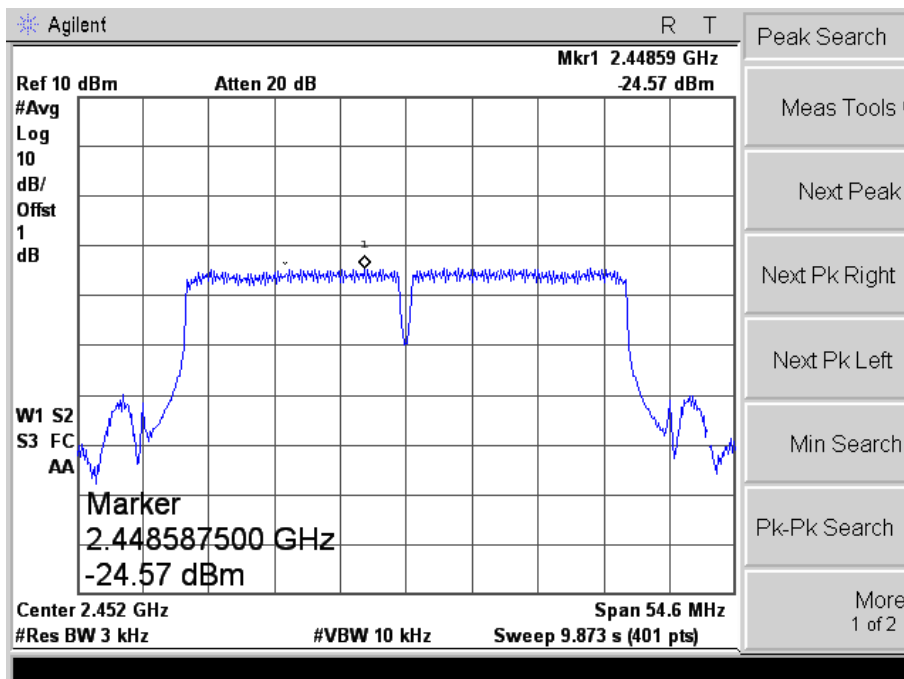
802.11n-HT40-Low Channel



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) $\geq 3 \times$ 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

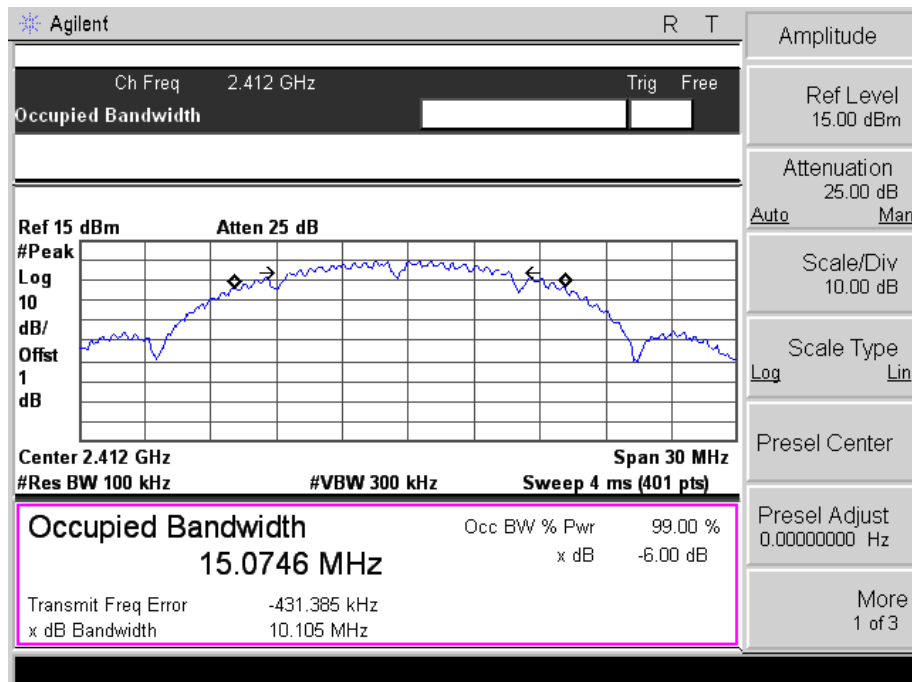
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

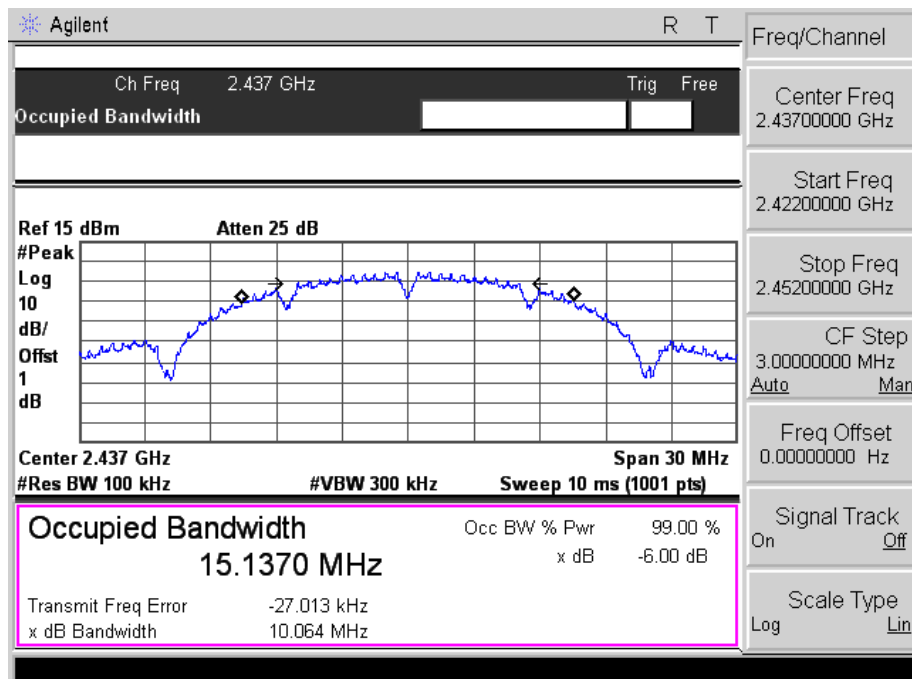
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b_1Mbps	2412	10.105	15.0746	≥ 500
	2437	10.064	15.1370	≥ 500
	2462	10.083	15.1065	≥ 500
802.11g_6Mbps	2412	16.522	16.6325	≥ 500
	2437	16.498	16.6742	≥ 500
	2462	16.534	16.6973	≥ 500
802.11n-HT20_MC S0	2412	17.829	18.1357	≥ 500
	2437	17.846	18.1231	≥ 500
	2462	17.852	18.1410	≥ 500
802.11n-HT40_MC S0	2422	36.396	36.2264	≥ 500
	2437	36.397	36.2200	≥ 500
	2452	36.348	36.3499	≥ 500

Please refer to the following test plots:

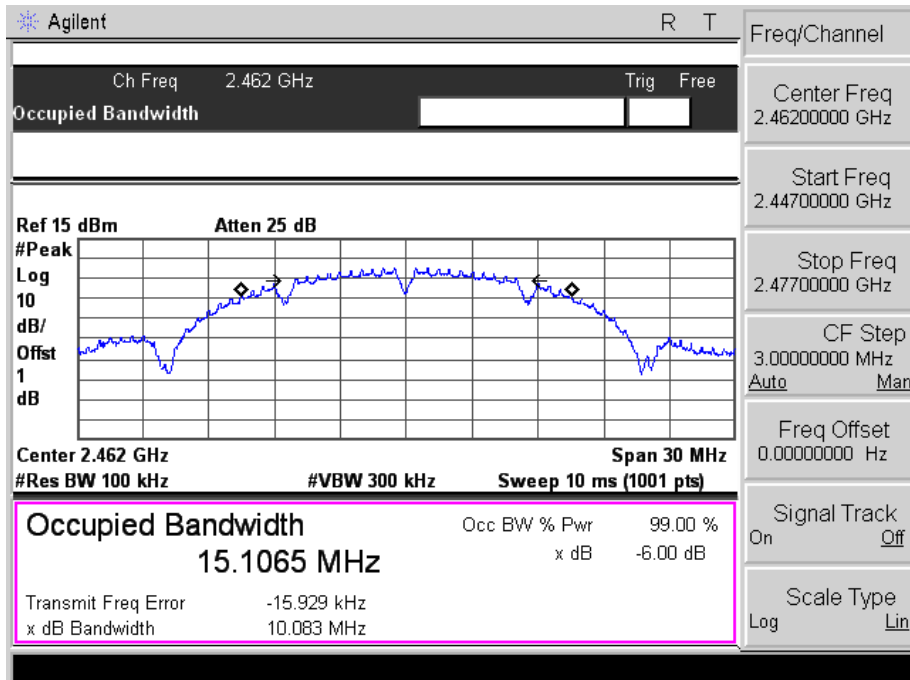
802.11b-Low Channel



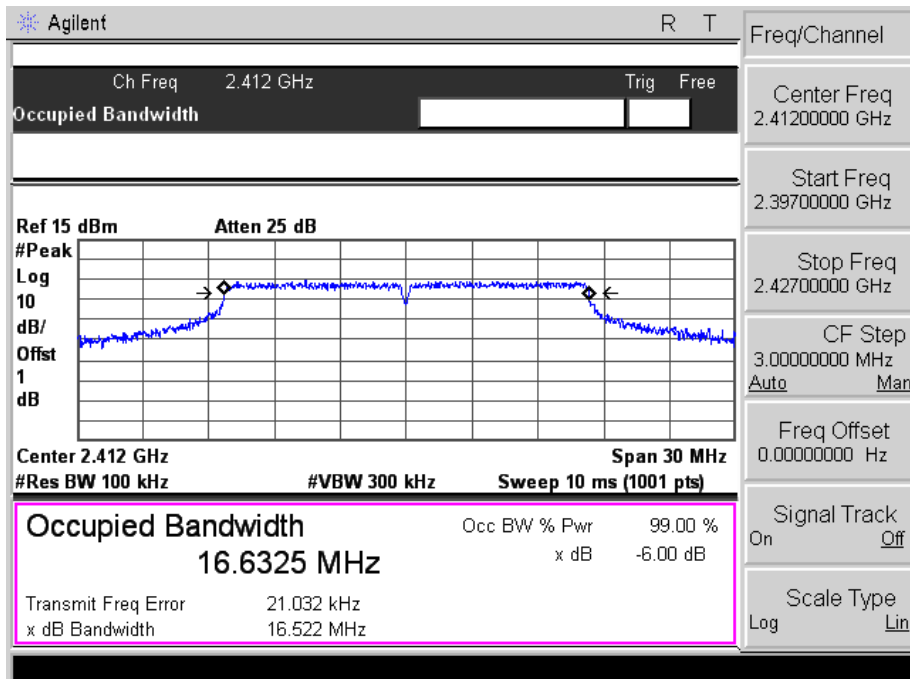
802.11b-Middle Channel



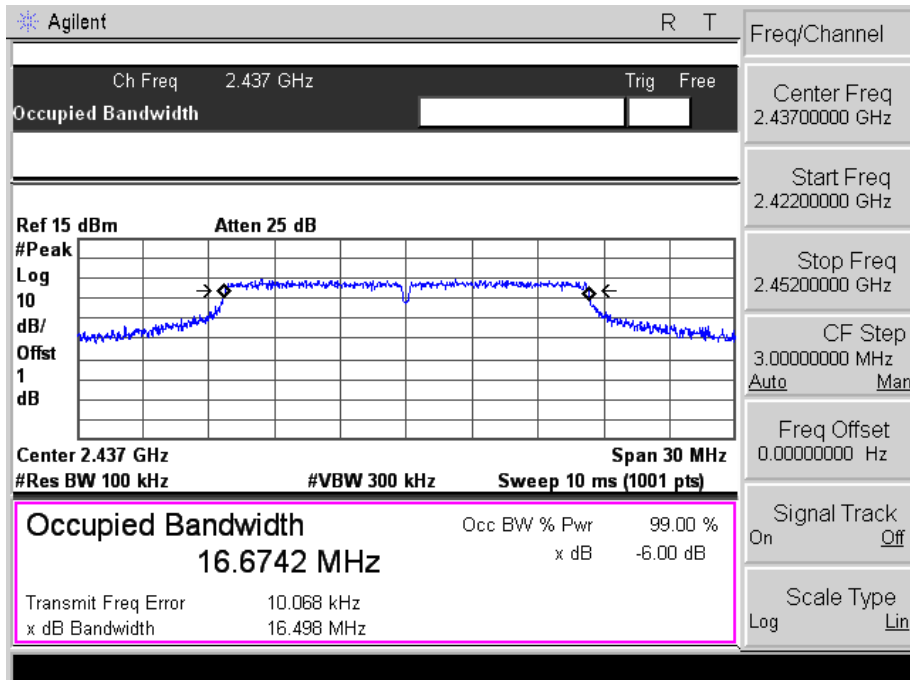
802.11b-High Channel



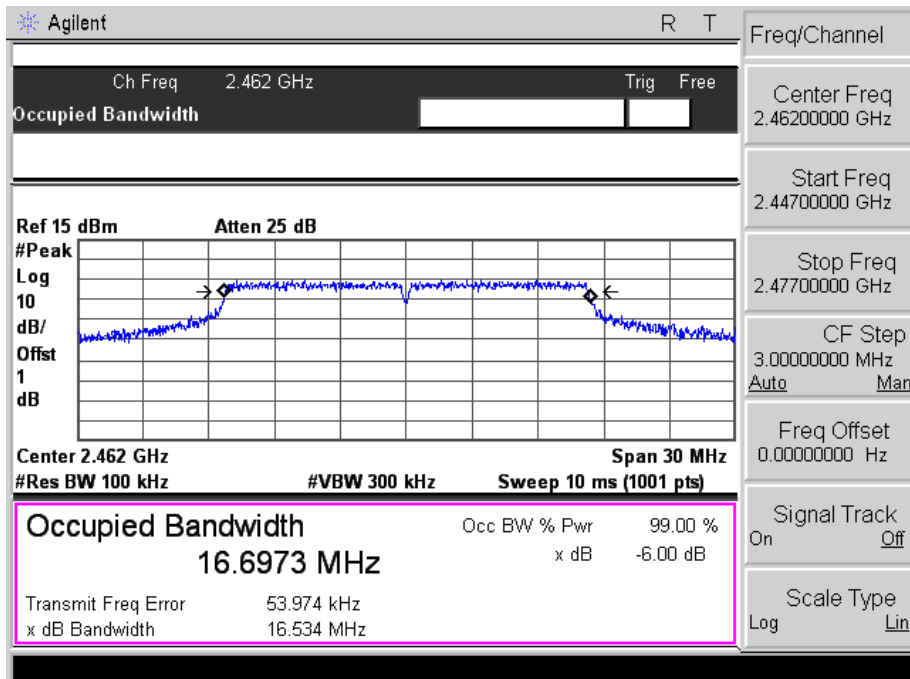
802.11g-Low Channel



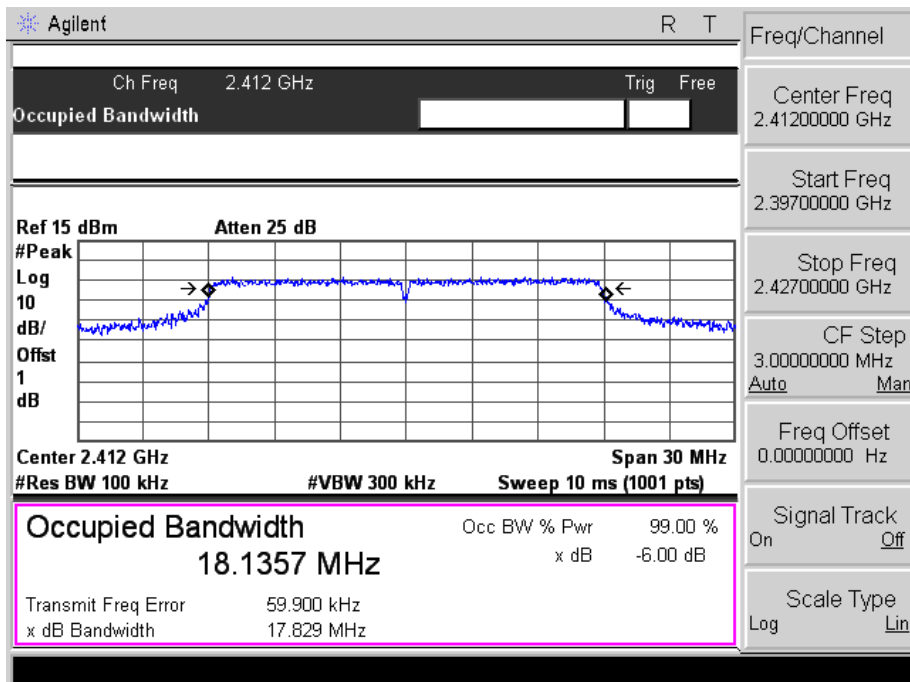
802.11g-Middle Channel



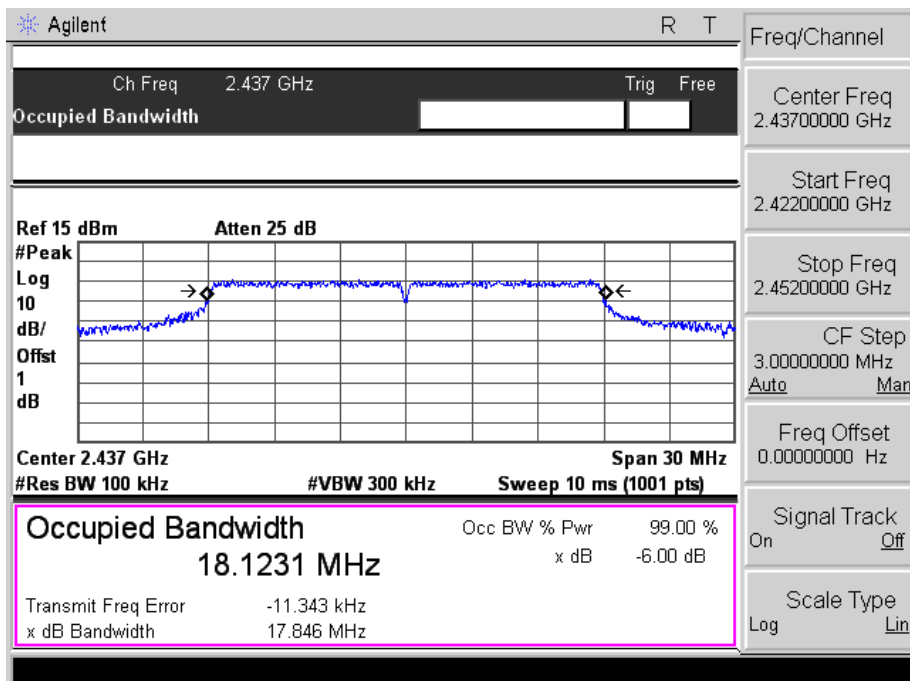
802.11g-High Channel



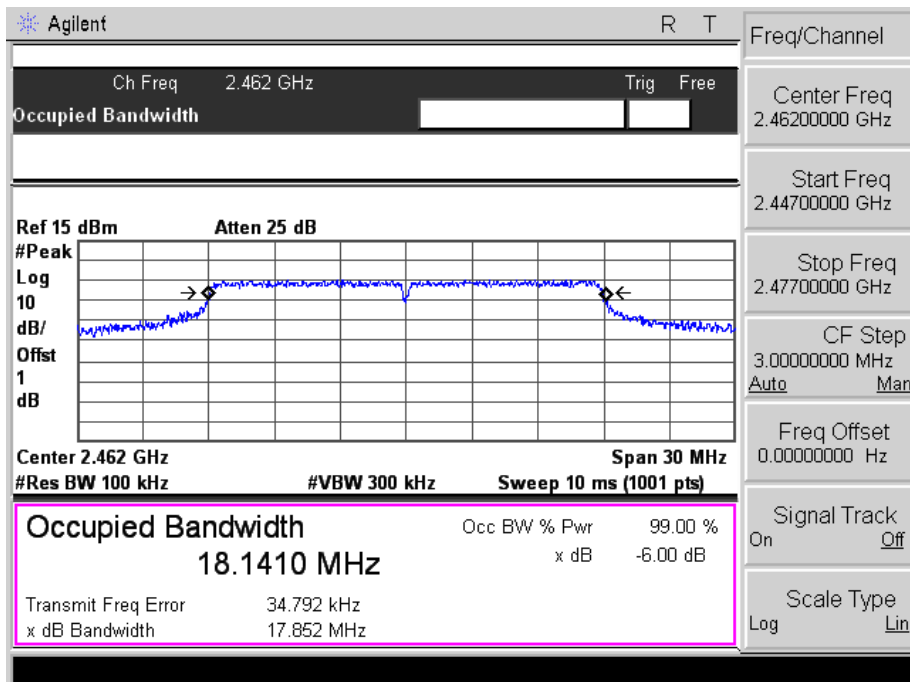
802.11n-HT20-Low Channel



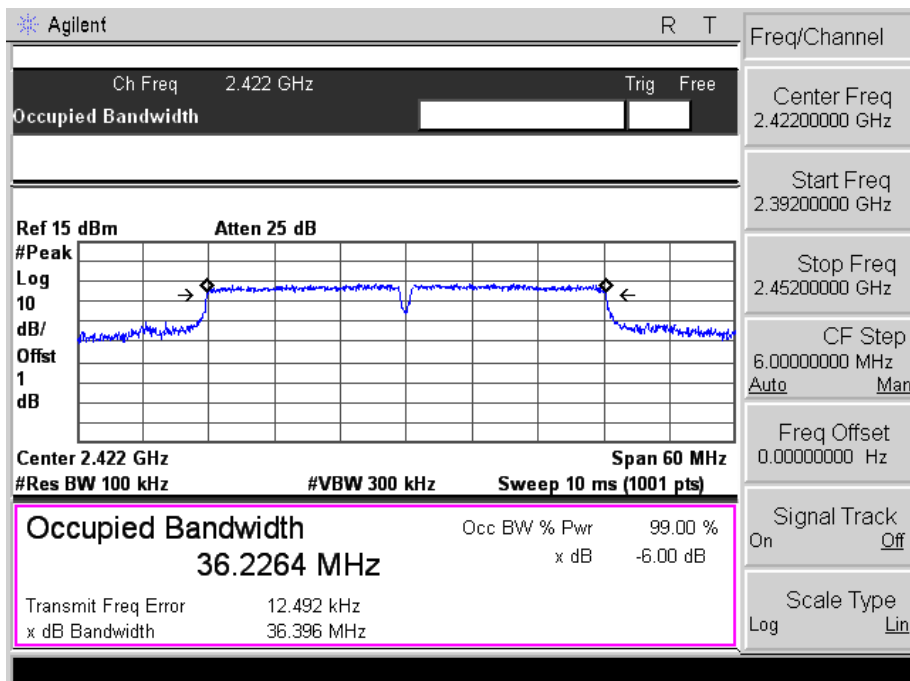
802.11n-HT20-Middle Channel



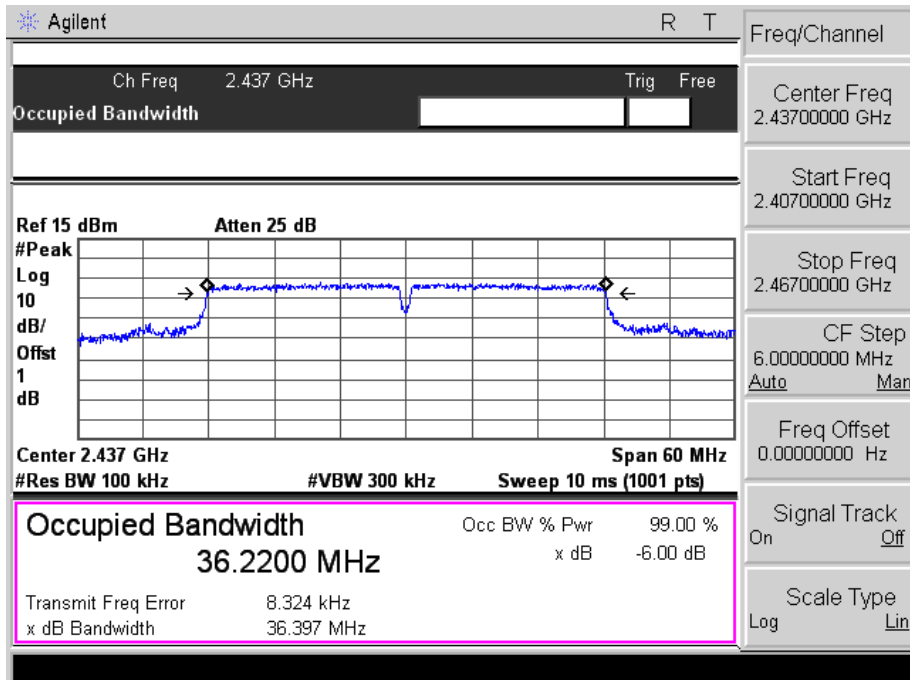
802.11n-HT20-High Channel



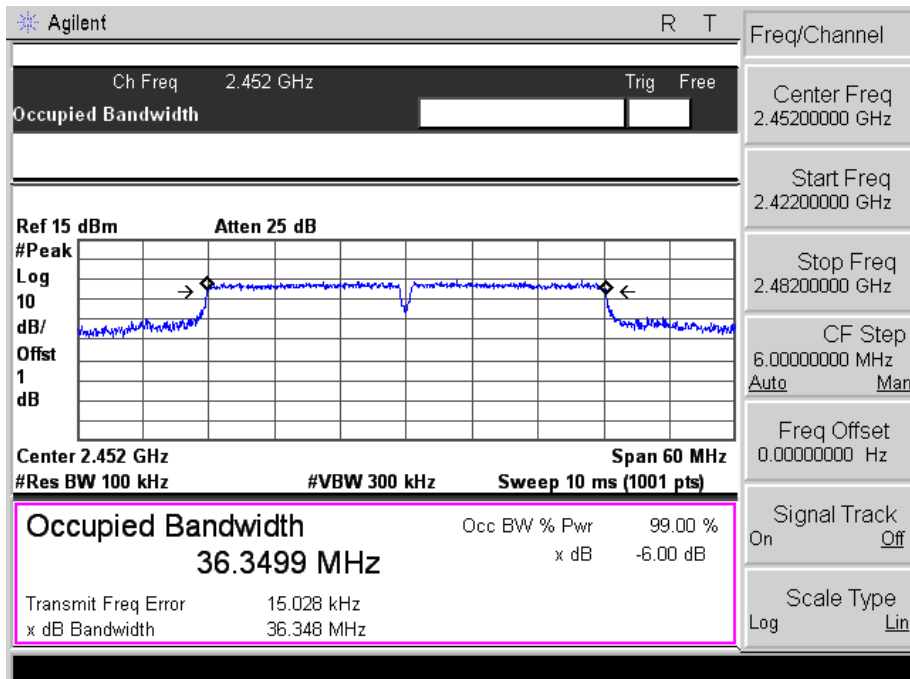
802.11n-HT40-Low Channel



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 the KDB-558074 D01 v04, 9.2.2.2, 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 $\geq 3 \times$ RBW.
- d) Number of points in sweep $\geq 2 \times$ span / RBW. (This gives bin-to-bin spacing \leq 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 $\geq 98 \%$, 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

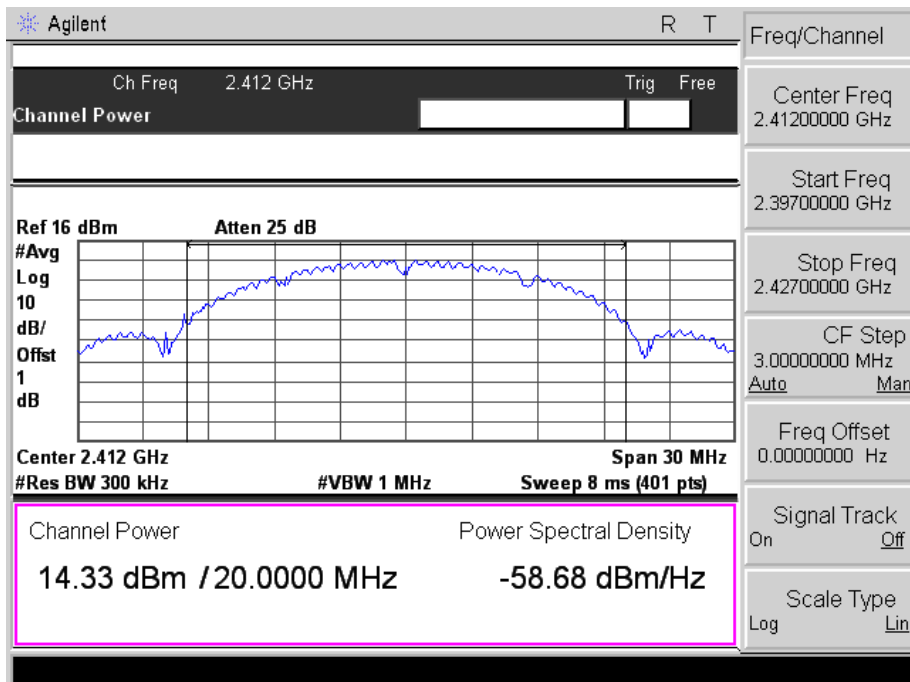
Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

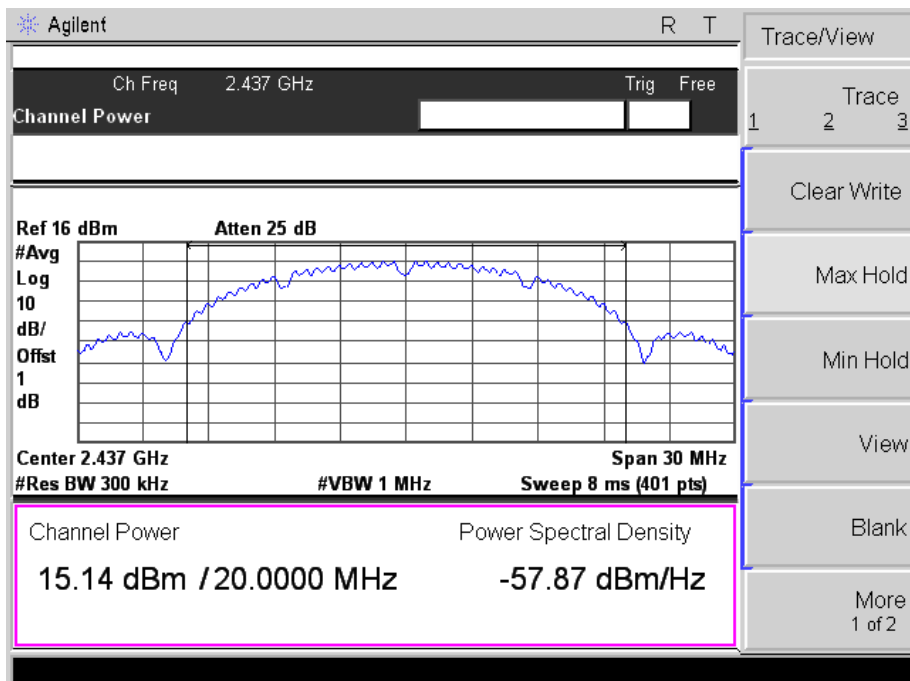
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b_1Mbps	2412	14.33	27.10	1000
	2437	15.14	32.66	1000
	2462	15.19	33.04	1000
802.11g_6Mbps	2412	12.64	18.37	1000
	2437	13.27	21.23	1000
	2462	13.54	22.59	1000
802.11n HT20_MCS0	2412	11.97	15.74	1000
	2437	12.25	16.79	1000
	2462	12.25	16.79	1000
802.11n HT40_MCS0	2422	10.77	11.94	1000
	2437	11.12	12.94	1000
	2452	11.20	13.18	1000

Please refer to the following test plots:

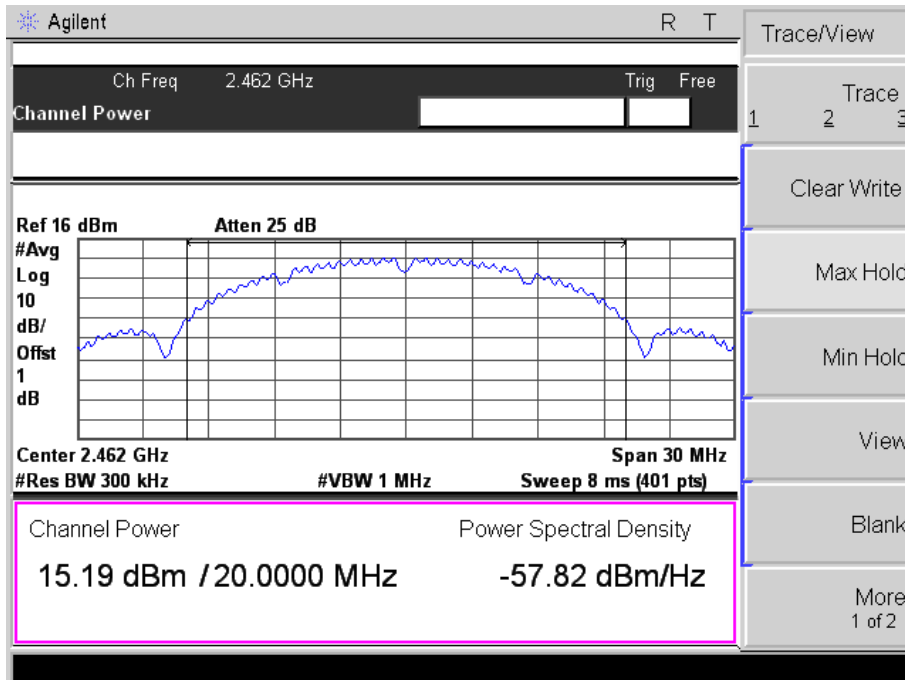
802.11b-1Mbps-Low Channel



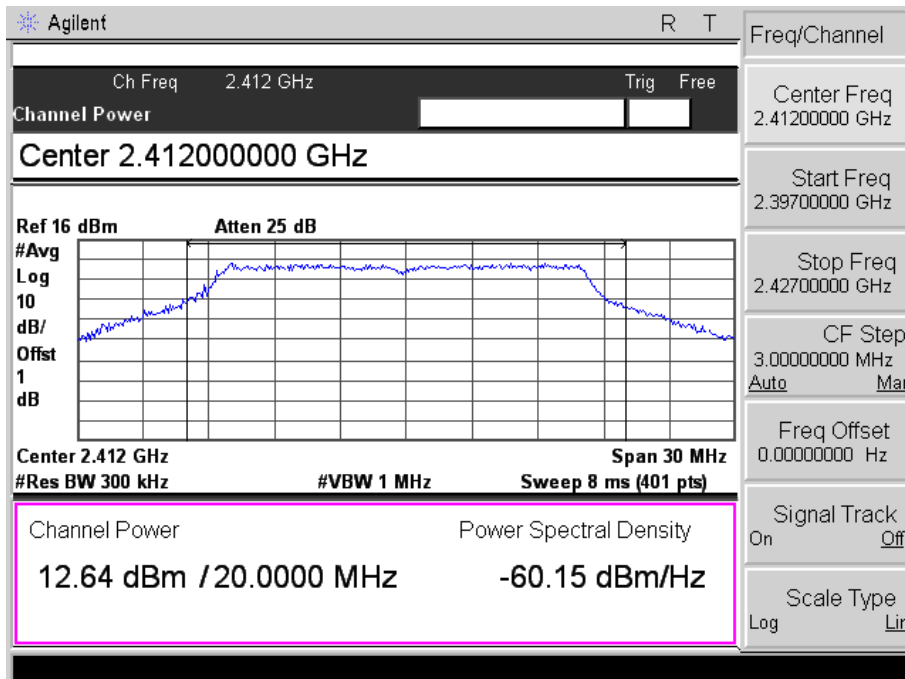
802.11b -1Mbps-Middle Channel



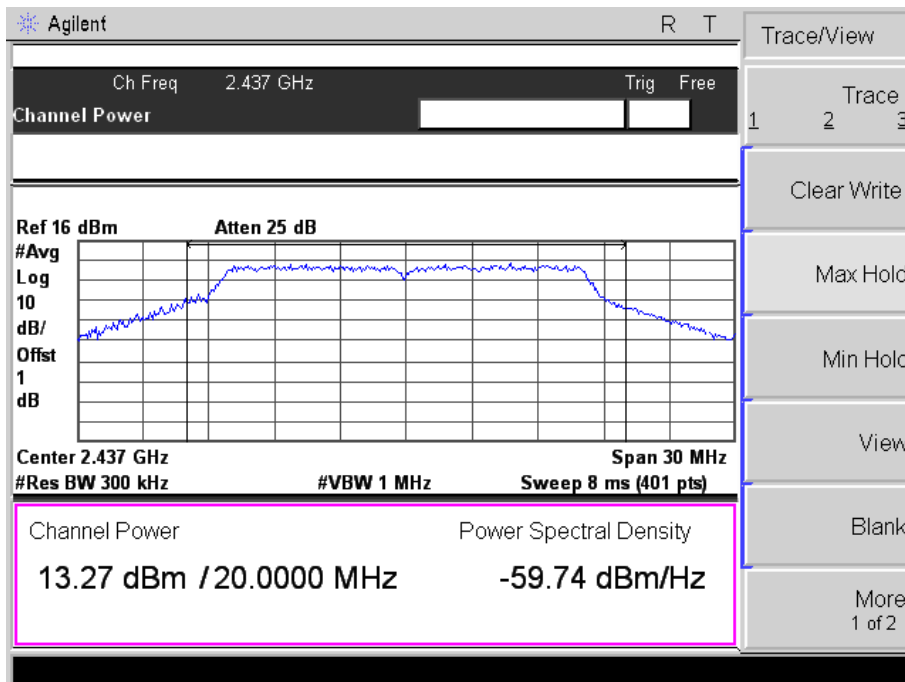
802.11b -1Mbps-High Channel



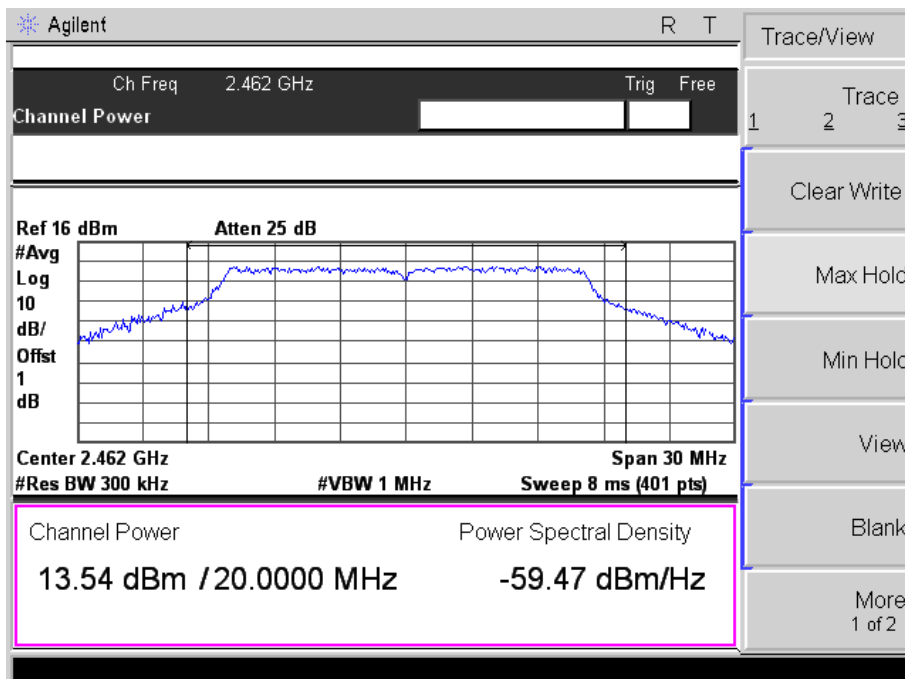
802.11g-6Mbps-Low Channel



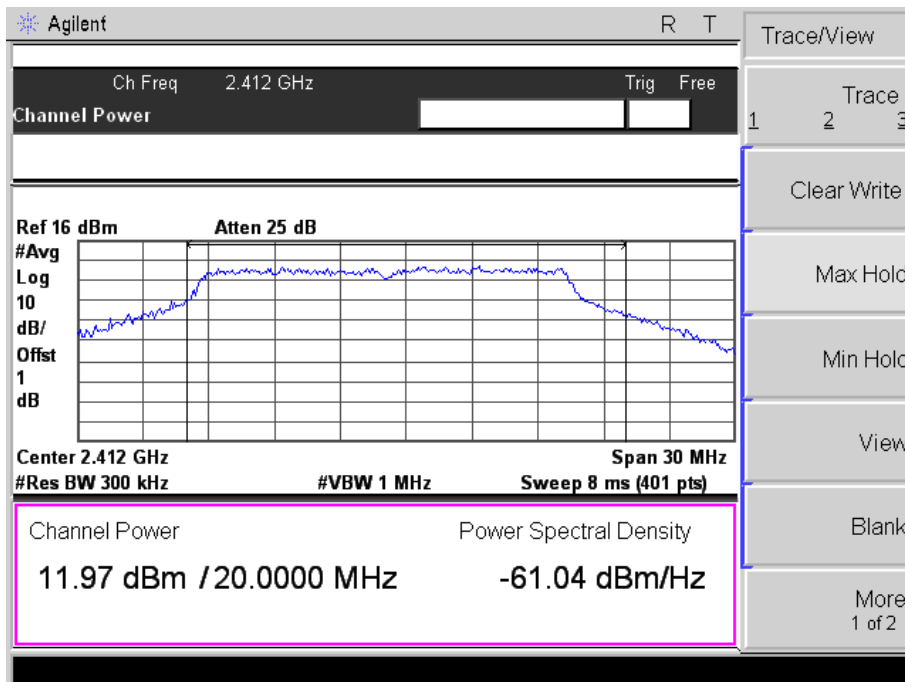
802.11g-6Mbps-Middle Channel



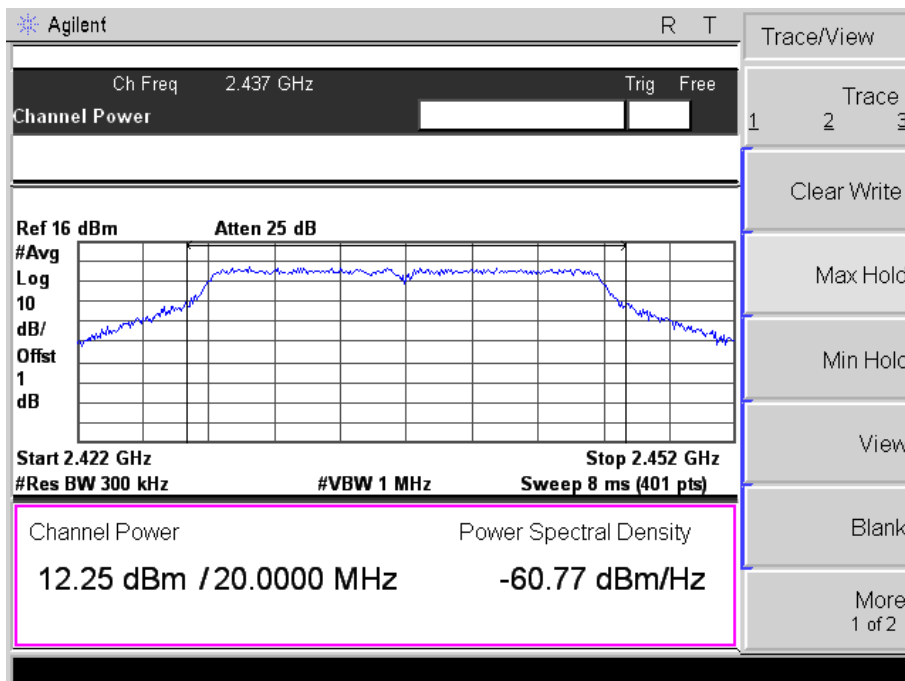
802.11g-6Mbps-High Channel



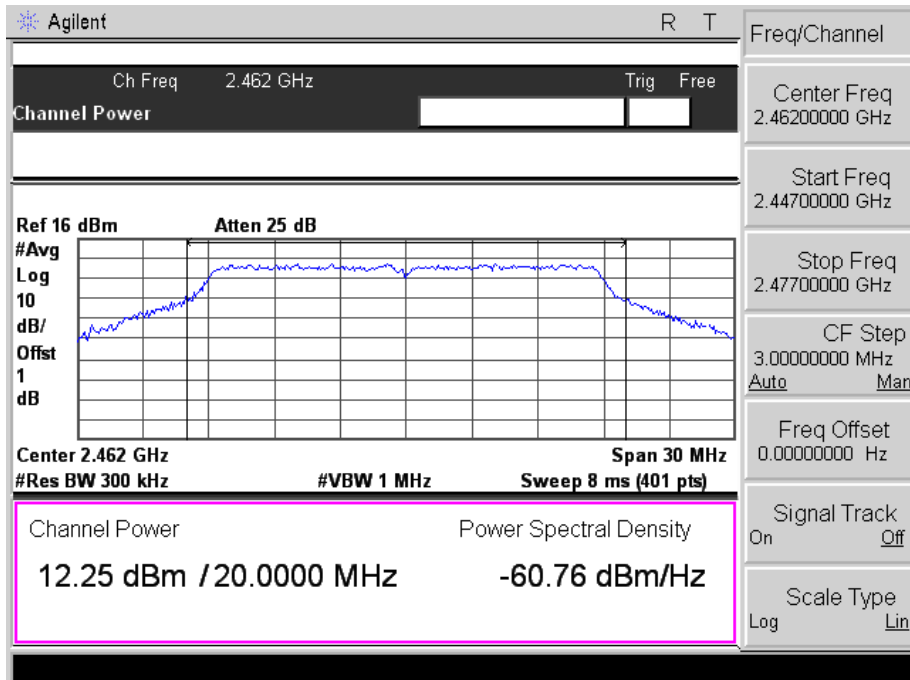
802.11n-HT20-MCS0-Low Channel



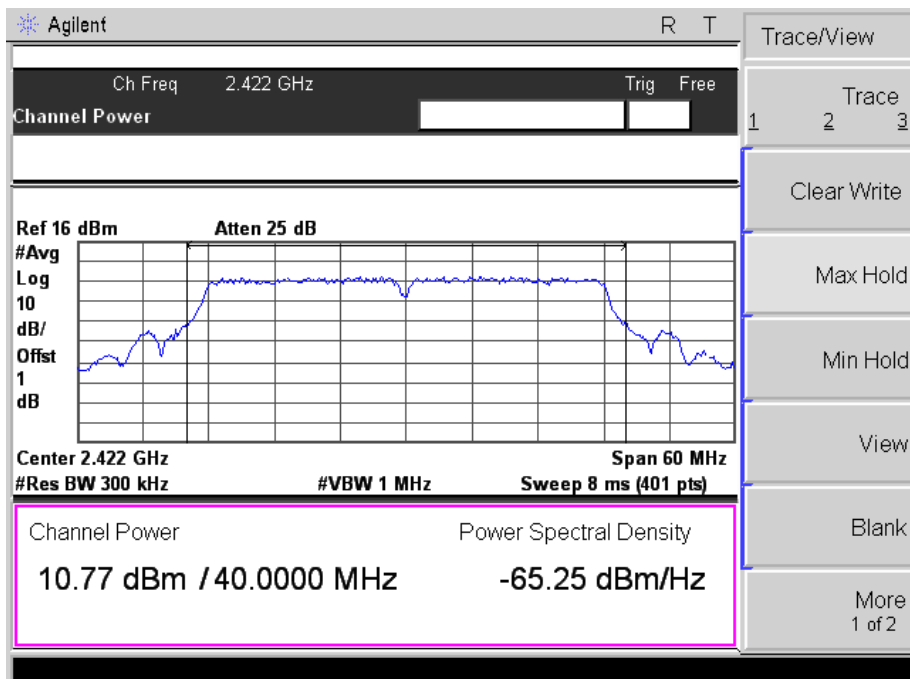
802.11n-HT20-MCS0-Middle Channel



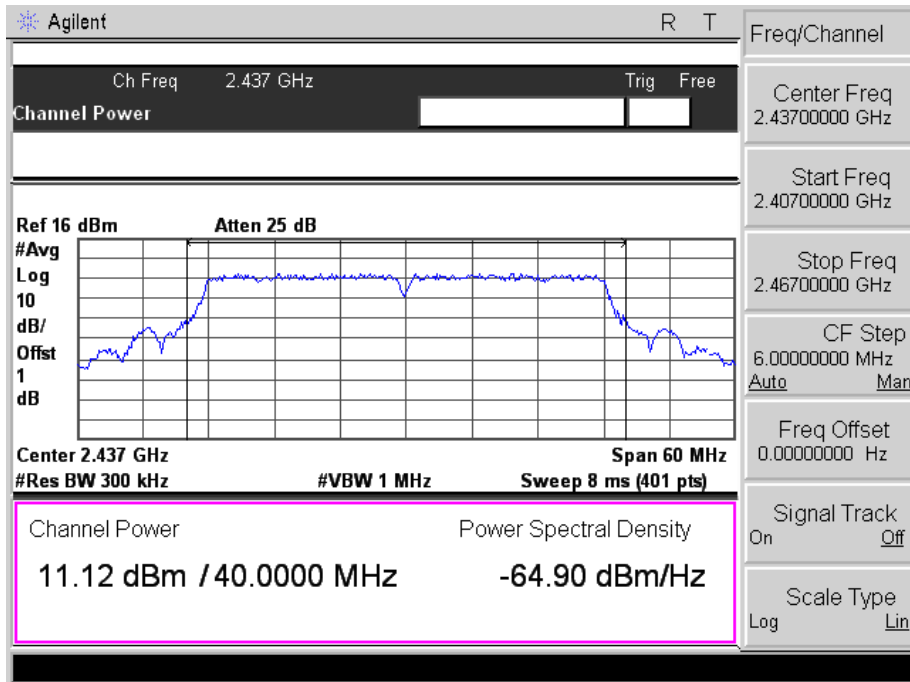
802.11n-HT20-MCS0-High Channel



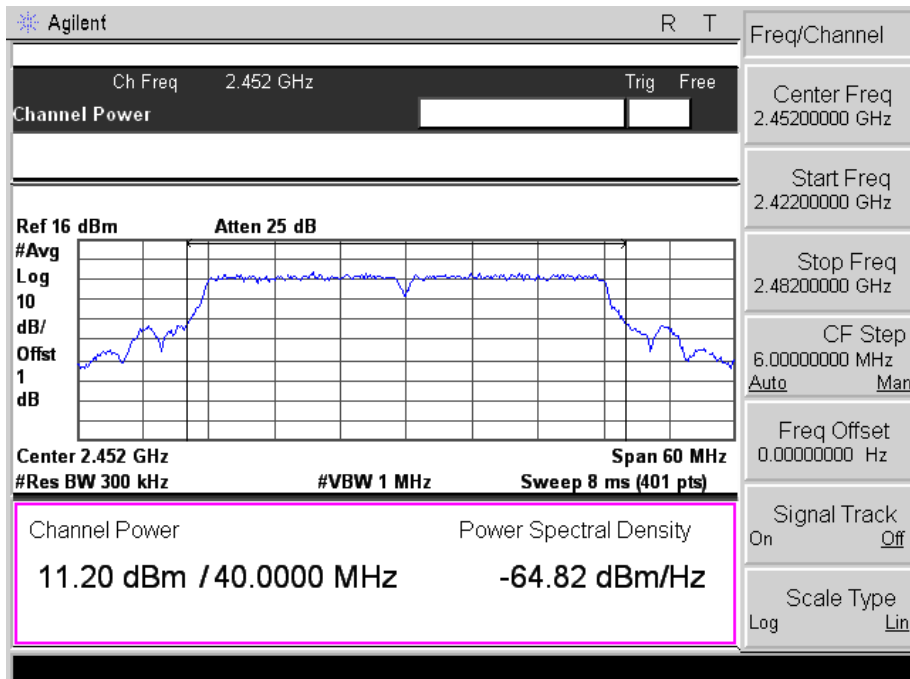
802.11n-HT40-MCS0-Low Channel



802.11n-HT40-MCS0-Middle Channel



802.11n-HT40-MCS0-High Channel



8. Field Strength of Spurious Emissions

8.1 Standard Applicable

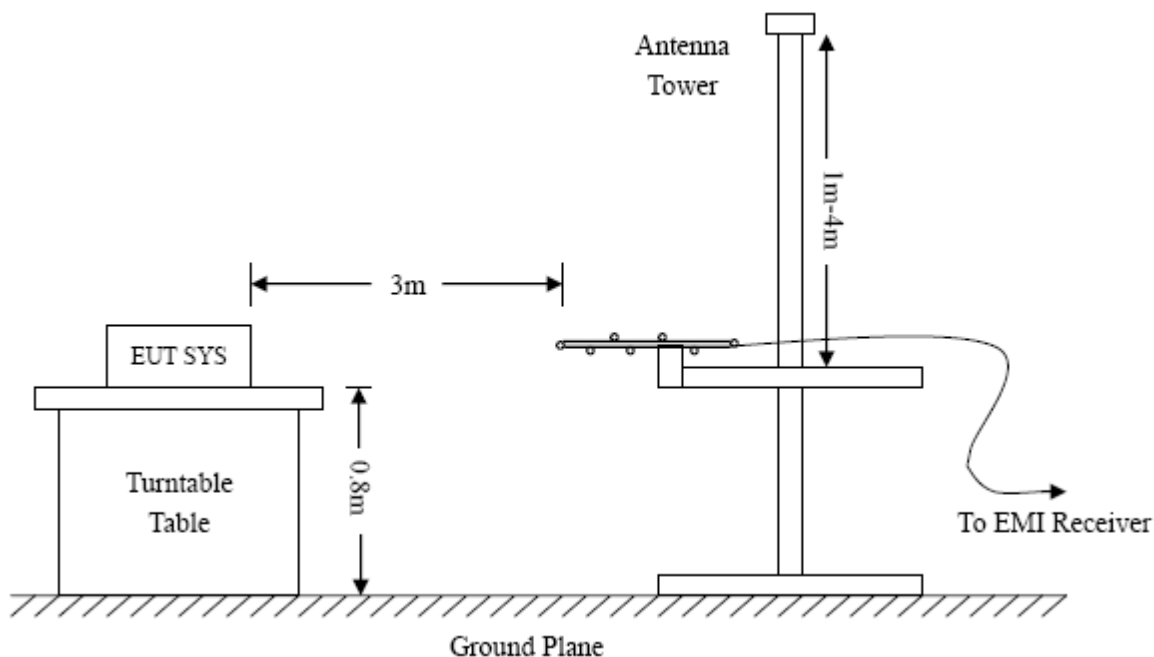
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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).

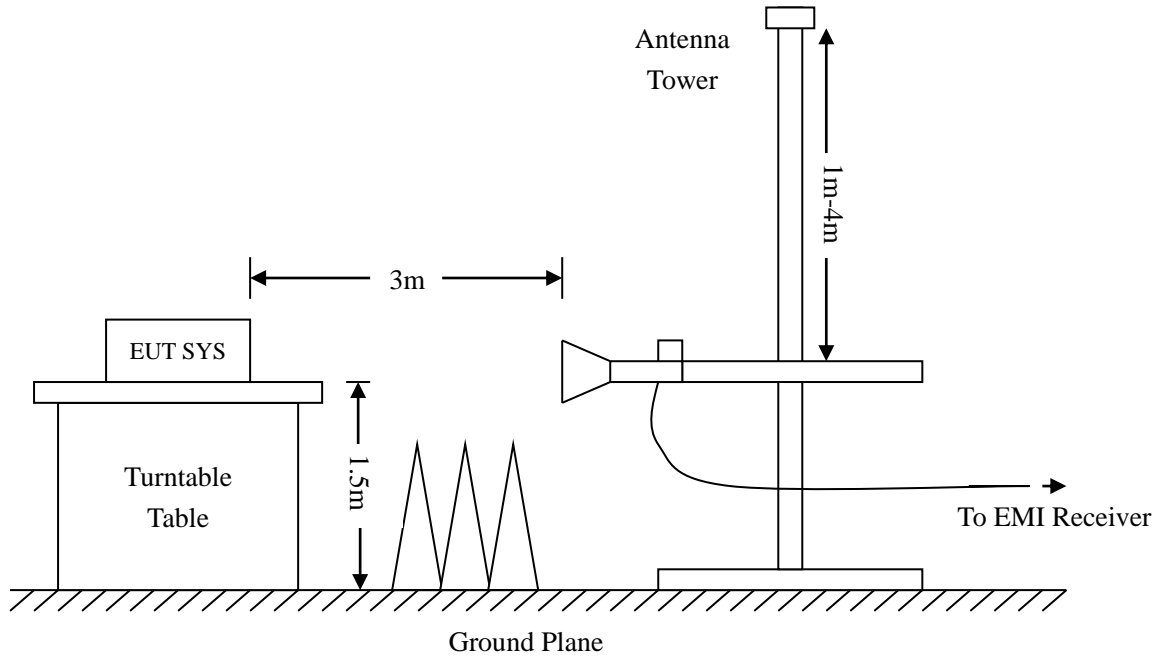
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

8.2 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
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=360KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz,
 VBW=3MHz(Peak), 10Hz(AV)
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, AV

8.3 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

8.4 Environmental Conditions

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

8.5 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)

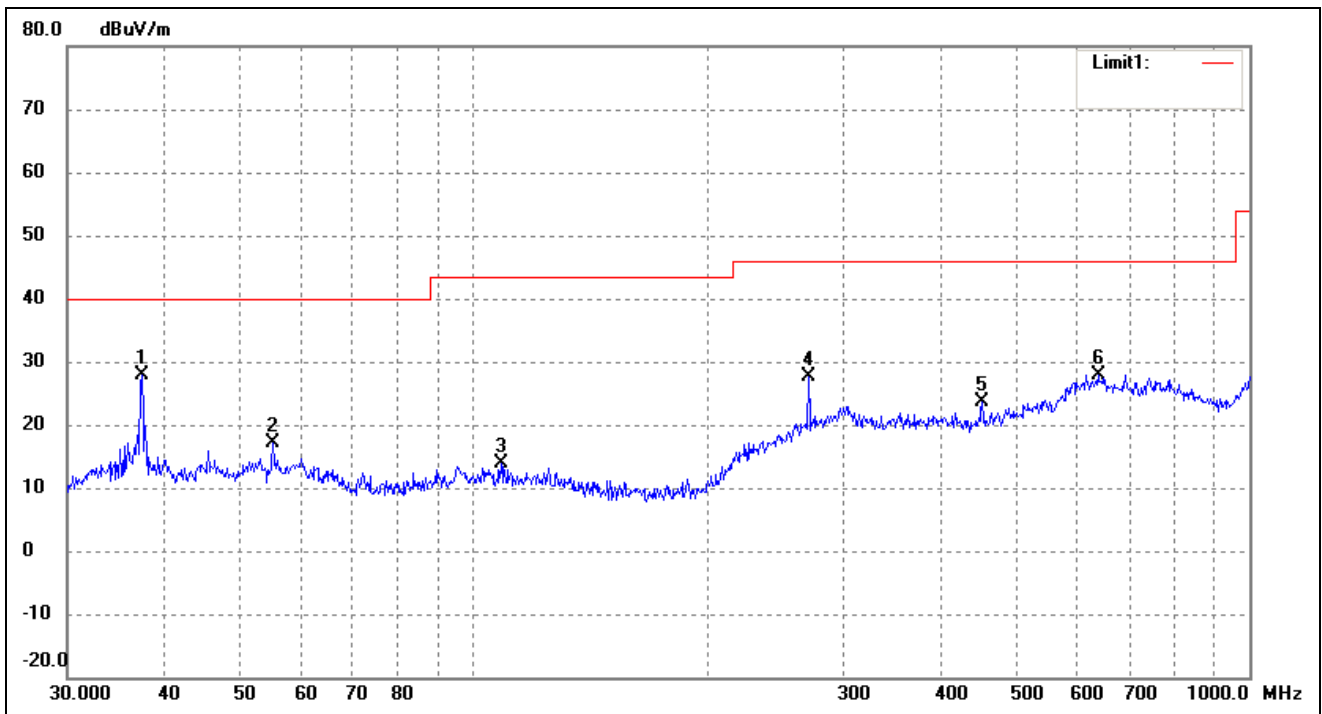
EUT: LM811 Wi-Fi & BT SMT Module

Tested Model: LM811-0451

Operating Condition: 802.11b_1Mbps Transmitting Low Channel-2412MHz(worst case)

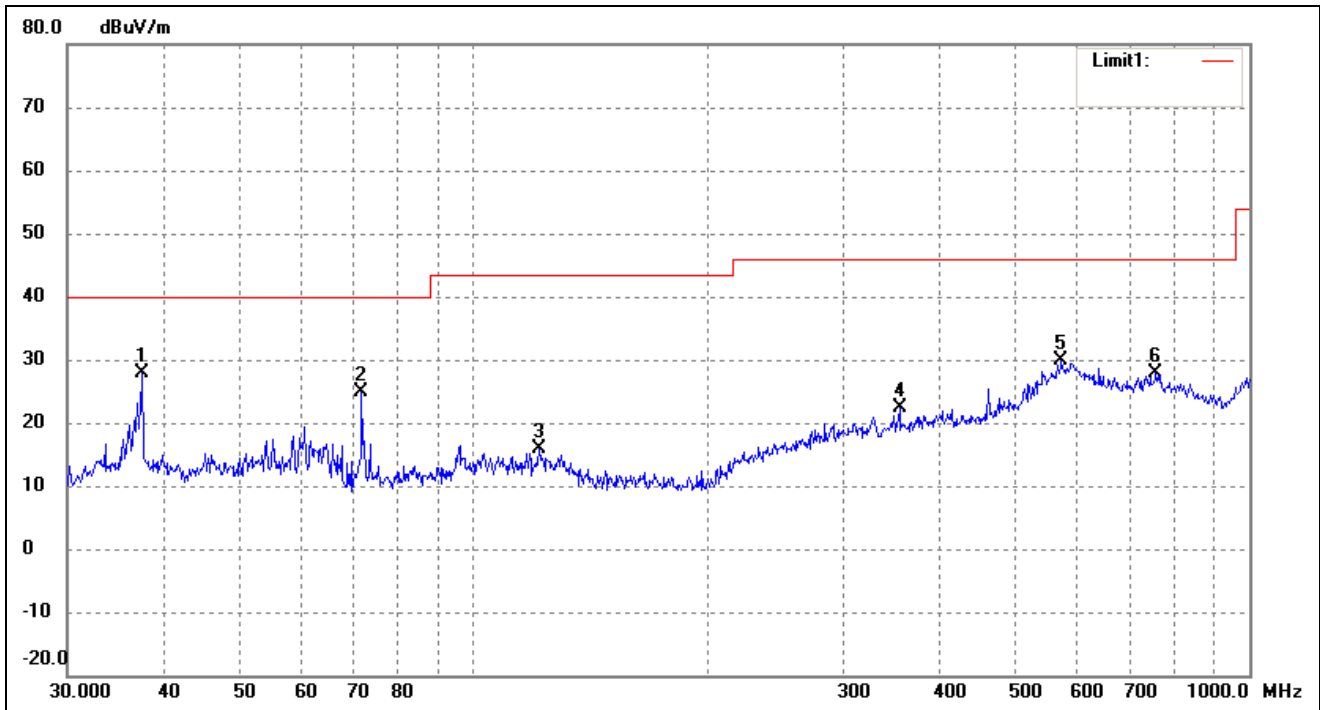
Comment: DC 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	37.4165	44.70	-16.94	27.76	40.00	-12.24	152	100	peak
2	55.2207	33.58	-16.51	17.07	40.00	-22.93	135	100	peak
3	108.6470	30.53	-16.62	13.91	43.50	-29.59	56	100	peak
4	270.3748	38.56	-11.05	27.51	46.00	-18.49	107	100	peak
5	452.7197	30.61	-6.98	23.63	46.00	-22.37	299	100	peak
6	638.3686	29.00	-1.06	27.94	46.00	-18.06	297	100	peak

Test Specification: Vertical

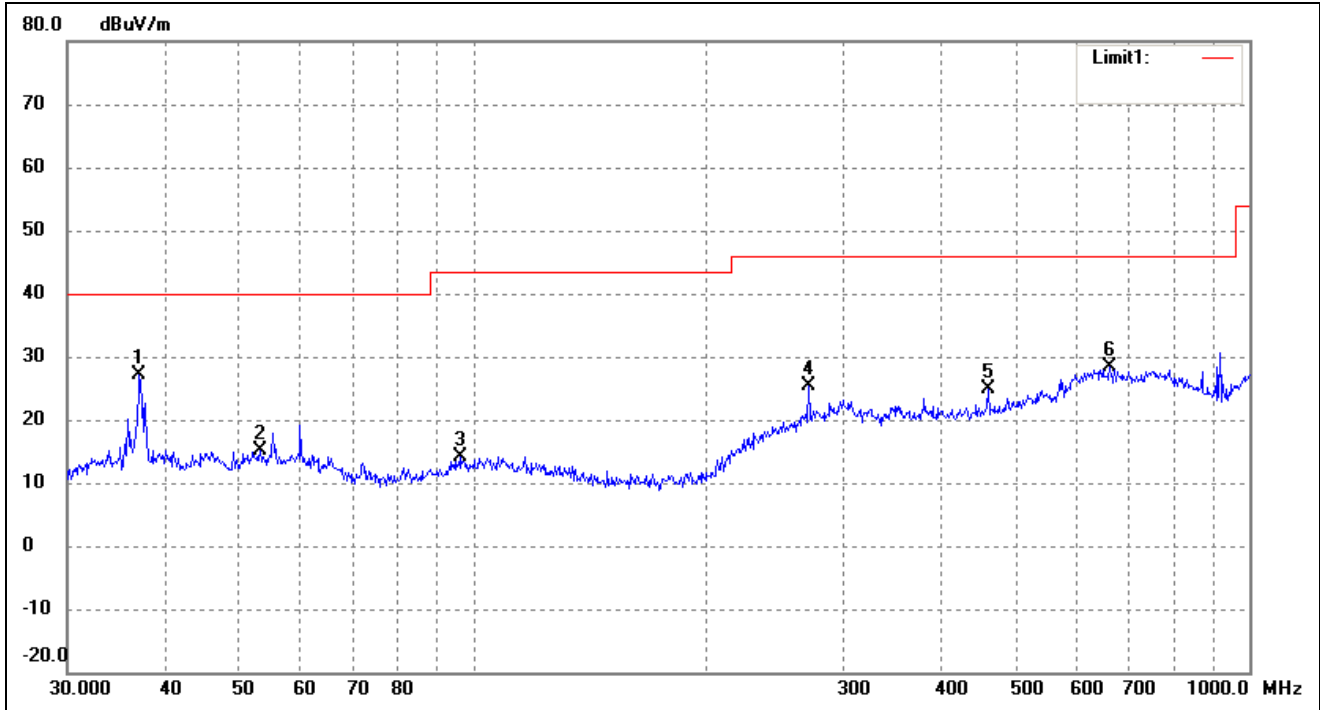


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	37.4165	44.89	-16.94	27.95	40.00	-12.05	80	100	peak
2	71.8320	43.91	-18.94	24.97	40.00	-15.03	156	100	peak
3	121.5486	32.65	-16.79	15.86	43.50	-27.64	86	100	peak
4	354.1831	31.56	-9.12	22.44	46.00	-23.56	148	100	peak
5	572.6144	34.21	-4.34	29.87	46.00	-16.13	119	100	peak
6	758.0408	28.34	-0.53	27.81	46.00	-18.19	316	100	peak

Operating Condition: 802.11b_1Mbps Transmitting Middle Channel-2437MHz(worst case)

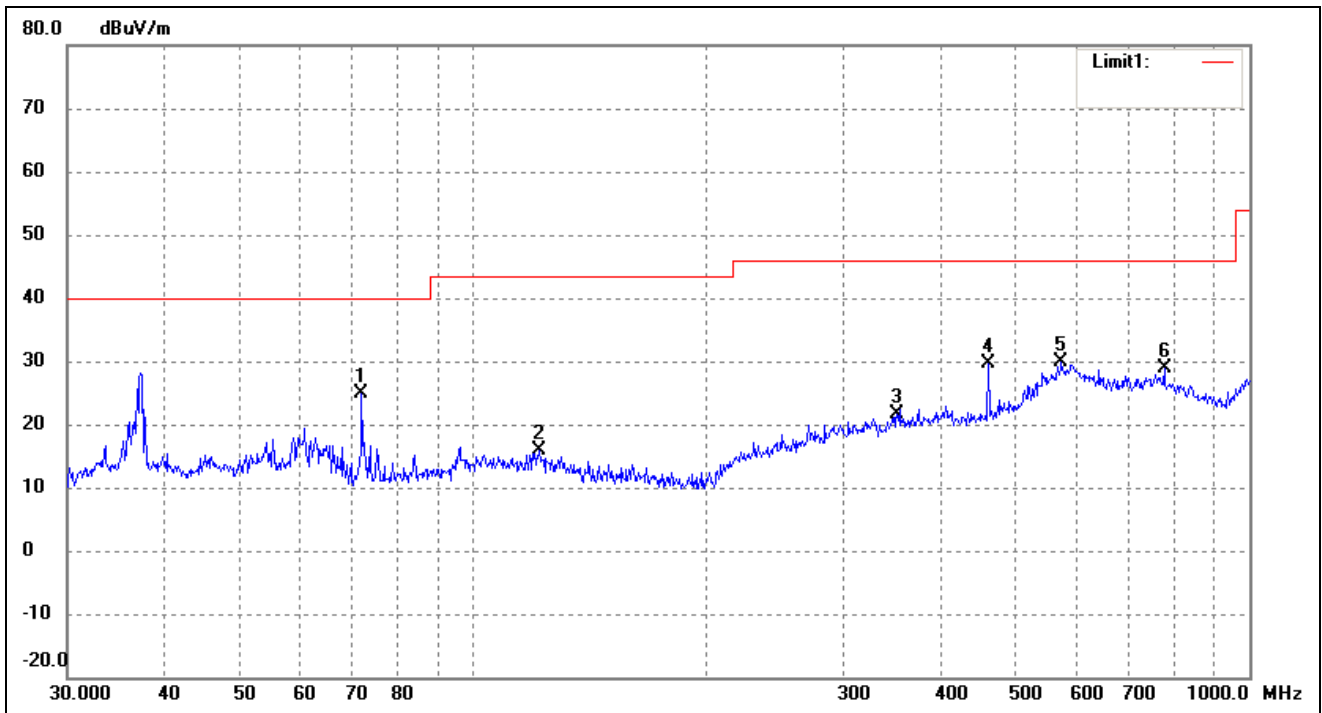
Comment: DC 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	37.1550	44.10	-16.98	27.12	40.00	-12.88	207	100	peak
2	53.1313	31.50	-16.48	15.02	40.00	-24.98	183	100	peak
3	96.4362	31.25	-17.08	14.17	43.50	-29.33	78	100	peak
4	270.3748	36.39	-11.05	25.34	46.00	-20.66	224	100	peak
5	460.7271	31.64	-6.69	24.95	46.00	-21.05	110	100	peak
6	661.1505	29.74	-1.44	28.30	46.00	-17.70	213	100	peak

Test Specification: Vertical

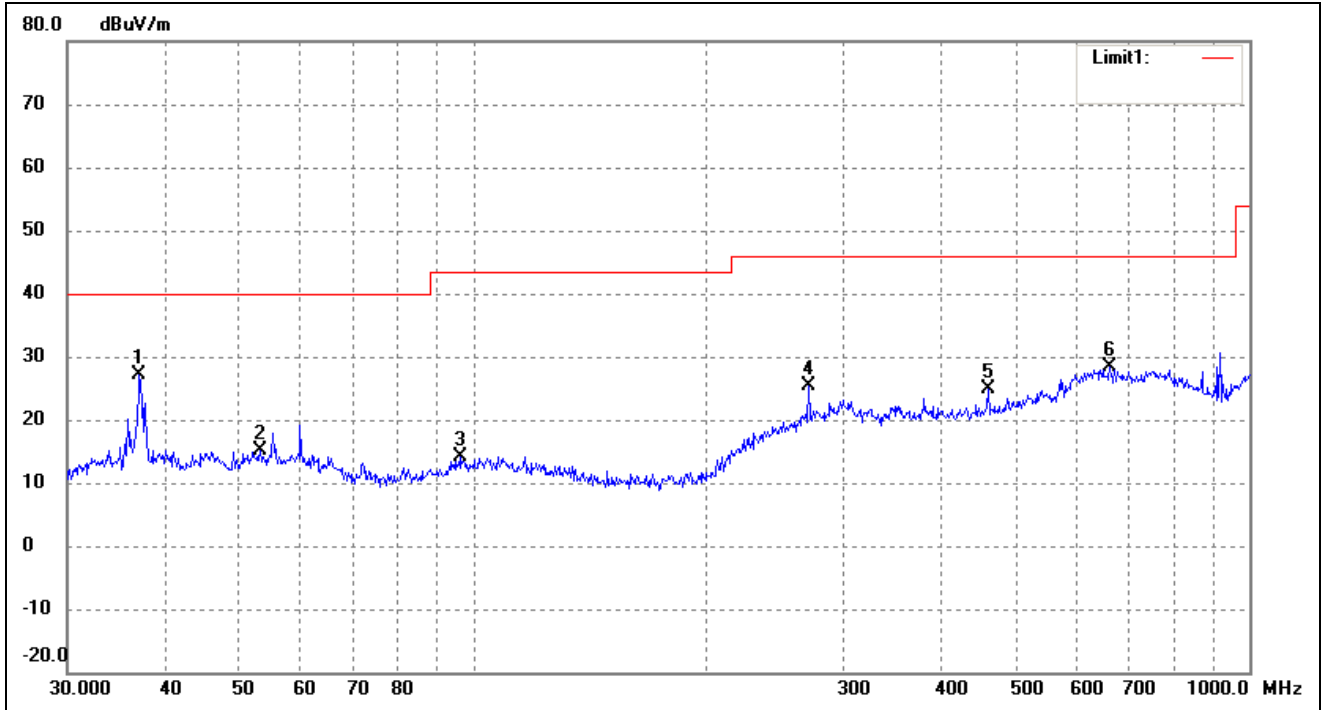


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	71.8320	43.91	-18.94	24.97	40.00	-15.03	233	100	peak
2	121.5486	32.65	-16.79	15.86	43.50	-27.64	90	100	peak
3	351.7079	30.85	-9.21	21.64	46.00	-24.36	350	100	peak
4	460.7271	36.38	-6.69	29.69	46.00	-16.31	94	100	peak
5	572.6144	34.21	-4.34	29.87	46.00	-16.13	101	100	peak
6	776.8778	30.58	-1.65	28.93	46.00	-17.07	285	100	peak

Operating Condition: 802.11b_1Mbps Transmitting High Channel-2462MHz(worst case)

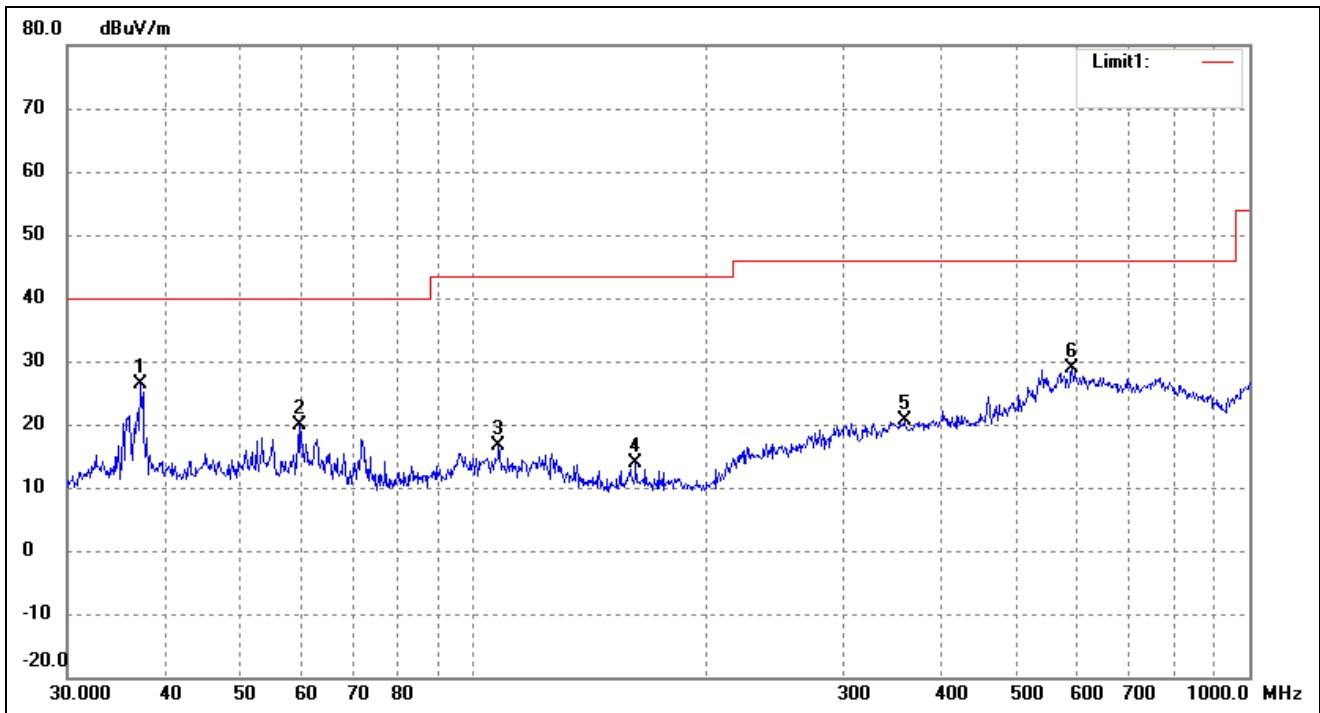
Comment: DC 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	37.1550	44.10	-16.98	27.12	40.00	-12.88	156	100	peak
2	53.1313	31.50	-16.48	15.02	40.00	-24.98	337	100	peak
3	96.4362	31.25	-17.08	14.17	43.50	-29.33	86	100	peak
4	270.3748	36.39	-11.05	25.34	46.00	-20.66	130	100	peak
5	460.7271	31.64	-6.69	24.95	46.00	-21.05	75	100	peak
6	661.1505	29.74	-1.44	28.30	46.00	-17.70	252	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	37.2855	43.38	-16.96	26.42	40.00	-13.58	333	100	peak
2	59.6493	36.48	-16.51	19.97	40.00	-20.03	90	100	peak
3	107.8877	33.28	-16.61	16.67	43.50	-26.83	281	100	peak
4	162.0414	32.91	-19.09	13.82	43.50	-29.68	102	100	peak
5	359.1860	29.64	-8.95	20.69	46.00	-25.31	63	100	peak
6	590.9737	30.87	-1.94	28.93	46.00	-17.07	178	100	peak

Spurious Emissions Above 1GHz
Test Mode: 802.11b_1Mbps (worst case)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	59.68	-3.59	56.09	74	-17.91	H	PK
4824.000	43.58	-3.59	39.99	54	-14.01	H	AV
7236.000	55.52	1.79	57.31	74	-16.69	H	PK
7236.000	42.12	1.79	43.91	54	-10.09	H	AV
4824.000	60.29	-3.59	56.7	74	-17.3	V	PK
4824.000	46.38	-3.59	42.79	54	-11.21	V	AV
7236.000	57.84	1.79	59.63	74	-14.37	V	PK
7236.000	43.58	1.79	45.37	54	-8.63	V	AV
Middle Channel-2437MHz							
4874.000	57.41	-3.74	53.67	74	-20.33	H	PK
4874.000	46.39	-3.74	42.65	54	-11.35	H	AV
7311.000	56.87	1.47	58.34	74	-15.66	H	PK
7311.000	46.38	1.47	47.85	54	-6.15	H	AV
4874.000	59.65	-3.74	55.91	74	-18.09	V	PK
4874.000	45.24	-3.74	41.5	54	-12.5	V	AV
7311.000	56.36	1.47	57.83	74	-16.17	V	PK
7311.000	43.58	1.47	45.05	54	-8.95	V	AV
High Channel-2462MHz							
4924.000	62.18	-3.87	58.31	74	-15.69	H	PK
4924.000	46.25	-3.87	42.38	54	-11.62	H	AV
7386.000	58.74	1.14	59.88	74	-14.12	H	PK
7386.000	42.29	1.19	43.48	54	-10.52	H	AV
4924.000	57.12	-3.86	53.26	74	-20.74	V	PK
4924.000	46.98	-3.86	43.12	54	-10.88	V	AV
7386.000	58.92	1.1	60.02	74	-13.98	V	PK
7386.000	43.24	1.1	44.34	54	-9.66	V	AV

Note: Testing is carried out with frequency rang 30MHz 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 \geq 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.

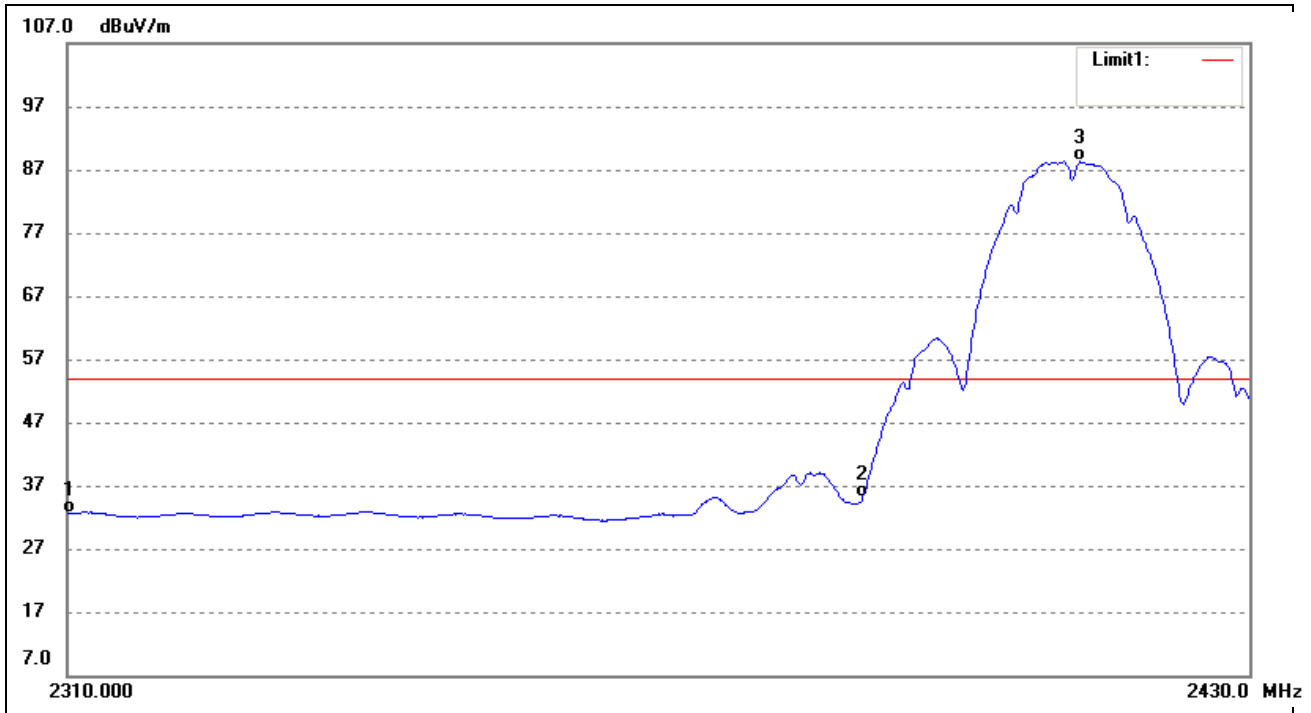
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

9.3 Environmental Conditions

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

9.4 Summary of Test Results/Plots

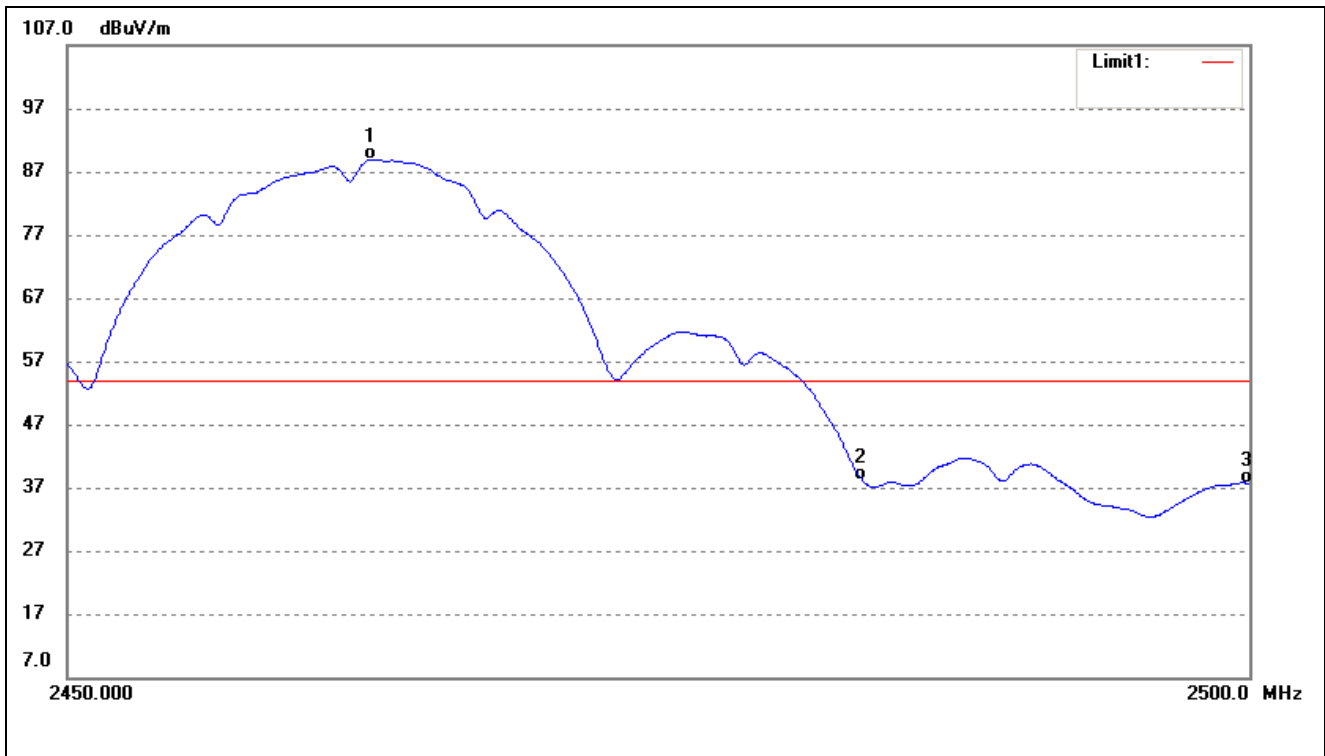
802.11b_1Mbps-Lowest Bandedge
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	38.96	-6.38	32.58	54.00	-21.42	Average Detector
	2310.00	51.26	-6.38	44.88	74.00	-29.12	Peak Detector
2	2390.00	42.39	-7.26	35.13	54.00	-18.87	Average Detector
	2390.00	53.44	-7.26	46.18	74.00	-27.82	Peak Detector
3	2412.47	95.67	-7.41	88.26	/	/	Average Detector
	2412.71	108.60	-7.40	101.20	/	/	Peak Detector

802.11b_1Mbps-Highest Bandedge

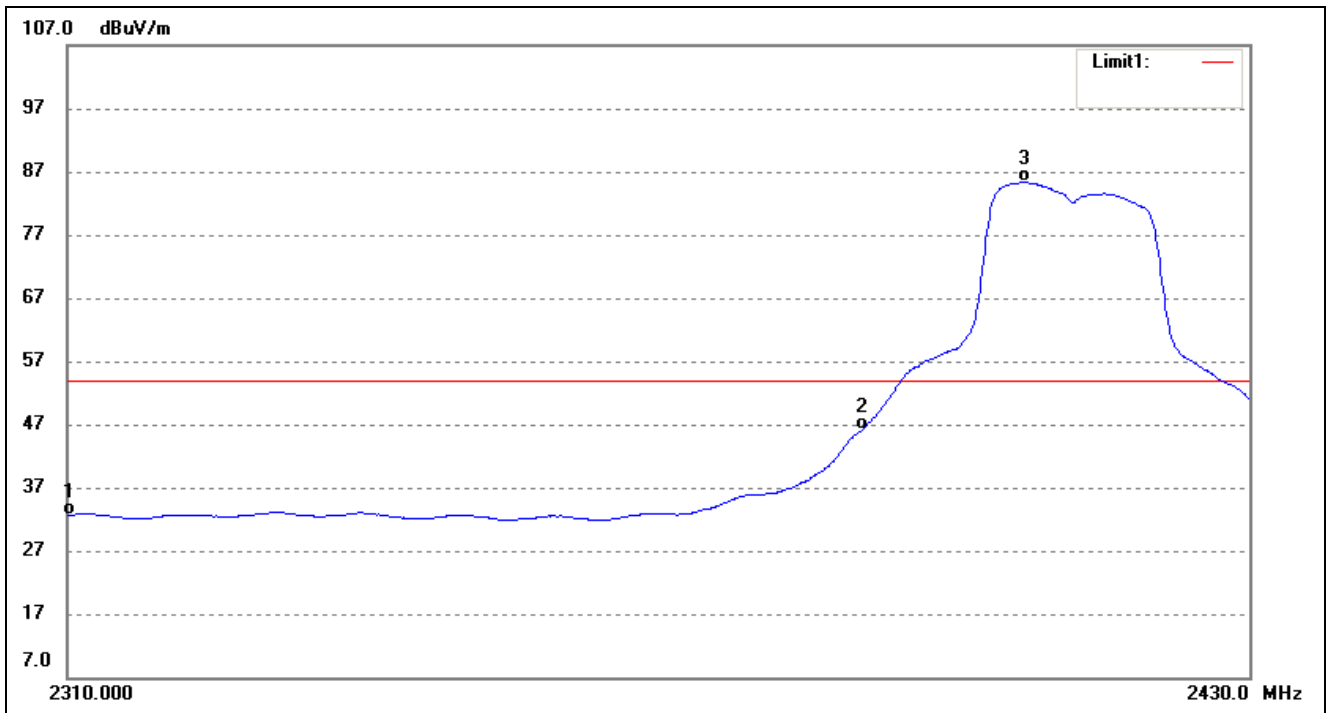
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2462.75	96.19	-7.31	88.88	/	/	Average Detector
	2462.95	104.31	-7.31	97.00	/	/	Peak Detector
2	2483.50	45.32	-7.28	38.04	54.00	-15.96	Average Detector
	2483.50	55.67	-7.28	48.39	74.00	-25.61	Peak Detector
3	2500.00	44.79	-7.25	37.54	54.00	-16.46	Average Detector
	2500.00	54.78	-7.25	47.53	74.00	-26.47	Peak Detector

802.11g_6Mbps-Lowest Bandedge

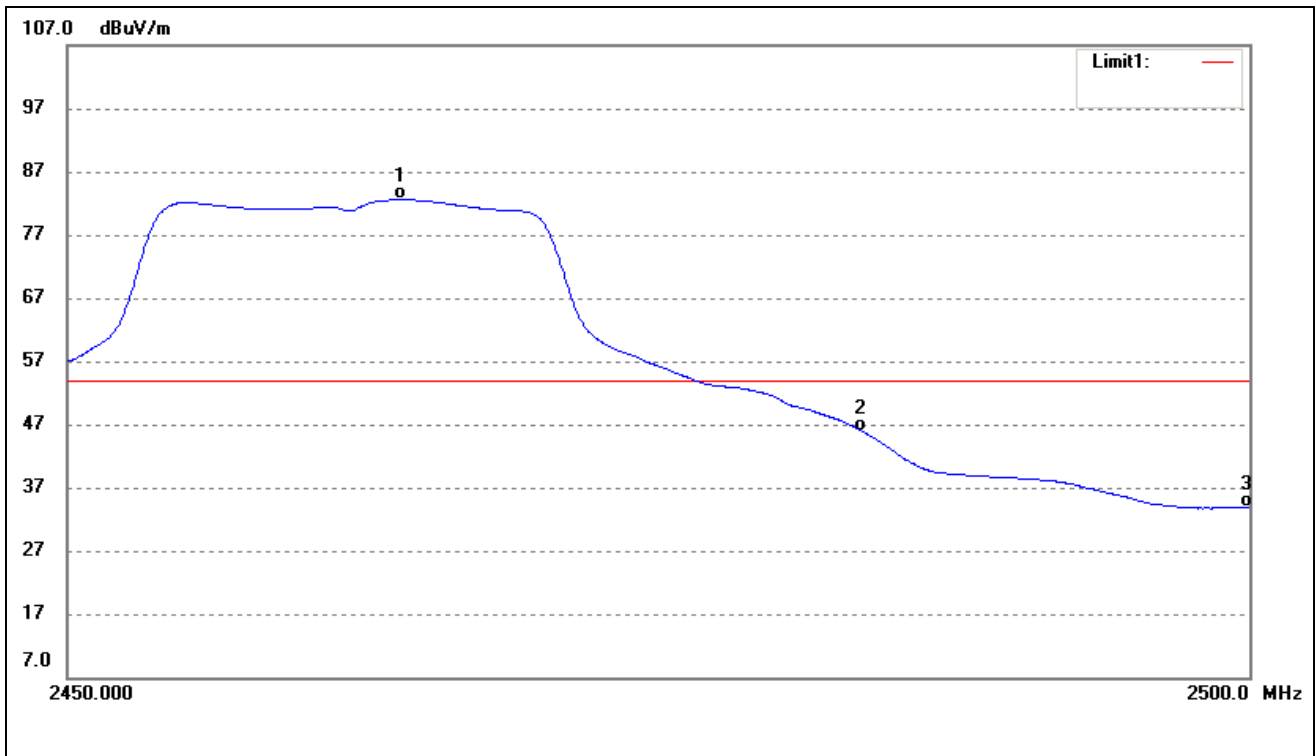
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	39.00	-6.38	32.62	54.00	-21.38	Average Detector
	2310.00	51.50	-6.38	45.12	74.00	-28.88	Peak Detector
2	2390.00	53.50	-7.26	46.24	54.00	-7.76	Average Detector
	2390.00	72.44	-7.26	65.18	74.00	-8.82	Peak Detector
3	2406.73	92.72	-7.42	85.30	/	/	Average Detector
	2405.39	103.86	-7.42	96.44	/	/	Peak Detector

802.11g_6Mbps-Highest Bandedge

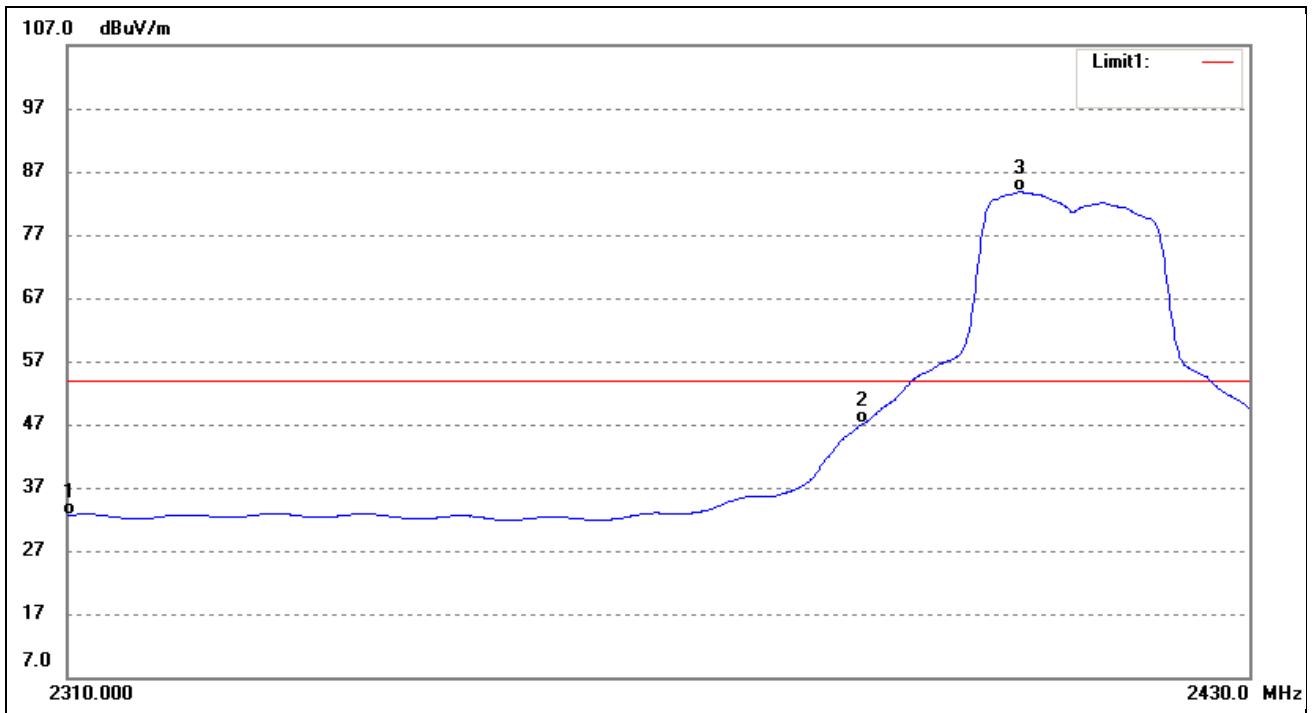
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2464.00	89.93	-7.31	82.62	/	/	Average Detector
	2463.45	104.78	-7.31	97.47	/	/	Peak Detector
2	2483.50	53.15	-7.28	45.87	54.00	-8.13	Average Detector
	2483.50	71.05	-7.28	63.77	74.00	-10.23	Peak Detector
3	2500.00	41.07	-7.25	33.82	54.00	-20.18	Average Detector
	2500.00	53.46	-7.25	46.21	74.00	-27.79	Peak Detector

802.11n-HT20_MCS0-Lowest Bandedge

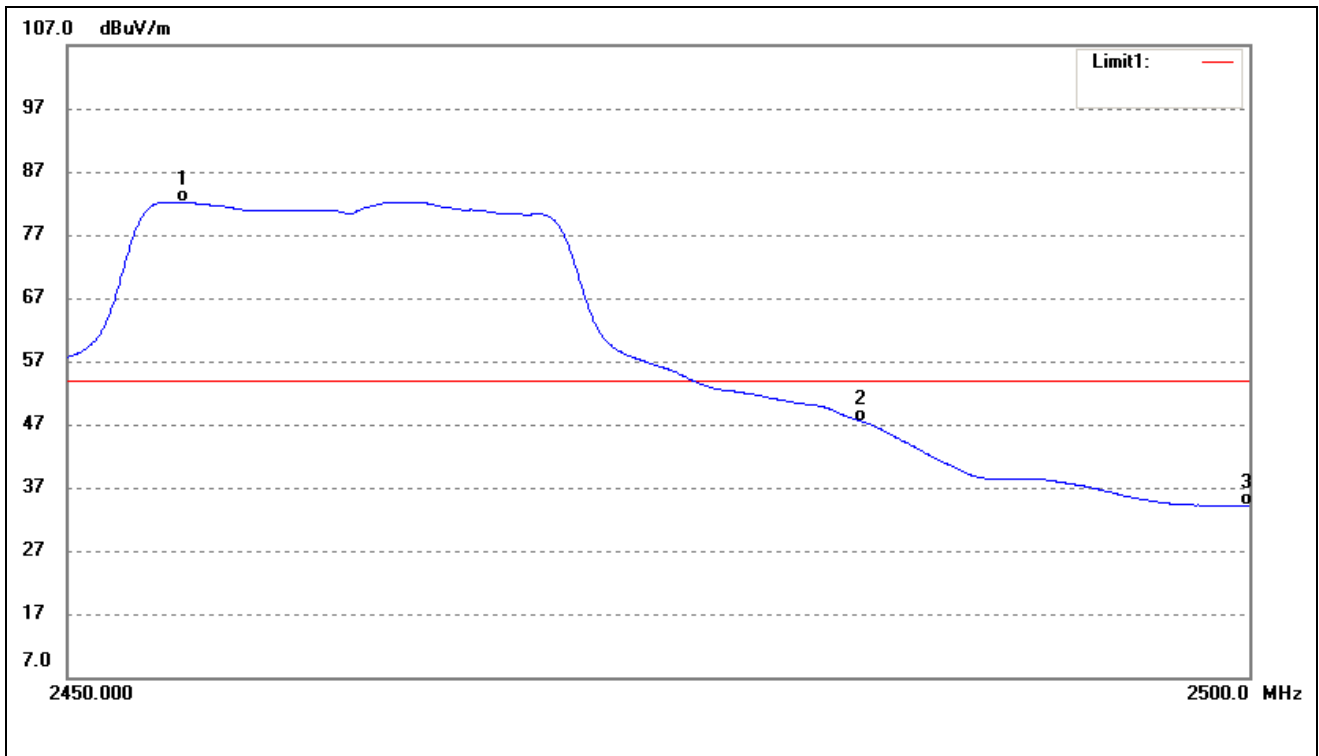
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	38.99	-6.38	32.61	54.00	-21.39	Average Detector
	2310.00	50.92	-6.38	44.54	74.00	-29.46	Peak Detector
2	2390.00	54.38	-7.26	47.12	54.00	-6.88	Average Detector
	2390.00	74.17	-7.26	66.91	74.00	-7.09	Peak Detector
3	2406.24	91.22	-7.42	83.80	/	/	Average Detector
	2405.76	104.40	-7.42	96.98	/	/	Peak Detector

802.11n-HT20_MCS0-Highest Bandedge

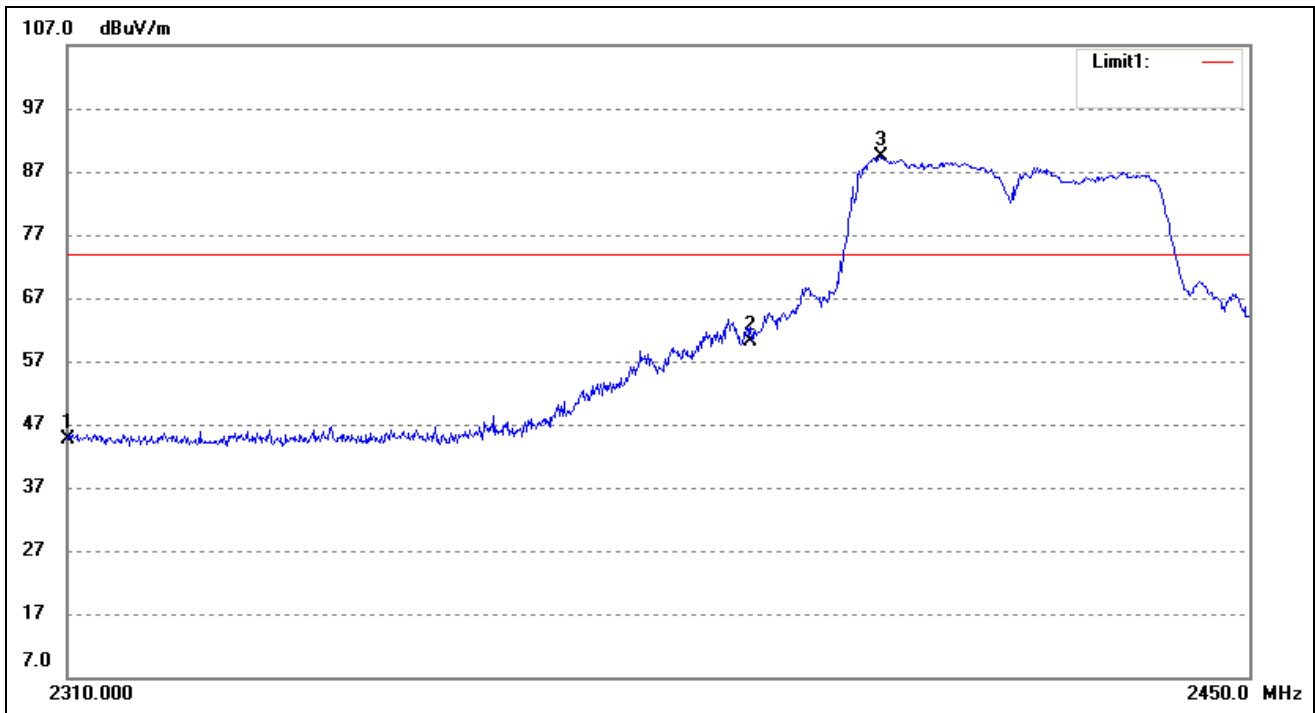
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.81	89.52	-7.33	82.19	/	/	Average Detector
	2467.64	105.27	-7.30	97.97	/	/	Peak Detector
2	2483.50	54.72	-7.28	47.44	54.00	-6.56	Average Detector
	2483.50	73.65	-7.28	66.37	74.00	-7.63	Peak Detector
3	2500.00	41.40	-7.25	34.15	54.00	-19.85	Average Detector
	2500.00	58.76	-7.25	51.51	74.00	-22.49	Peak Detector

802.11n-HT40_MCS0-Lowest Bandedge

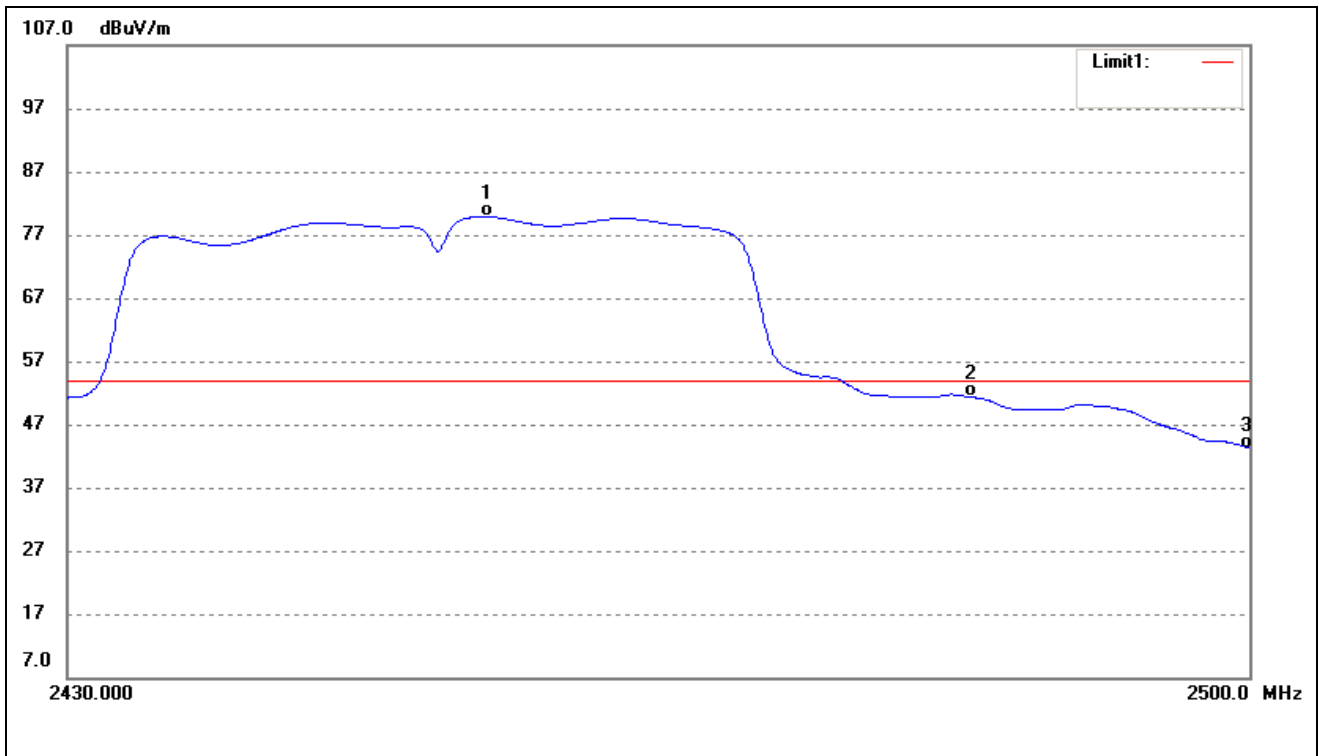
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	38.99	-6.38	32.61	54.00	-21.39	Average Detector
	2310.00	51.12	-6.38	44.74	74.00	-29.26	Peak Detector
2	2390.00	55.01	-7.26	47.75	54.00	-6.25	Average Detector
	2390.00	67.41	-7.26	60.15	74.00	-13.85	Peak Detector
3	2415.22	87.52	-7.40	80.12	/	/	Average Detector
	2405.43	96.75	-7.42	89.33	/	/	Peak Detector

802.11n-HT40_MCS0-Highest Bandedge

Vertical (Worst case)

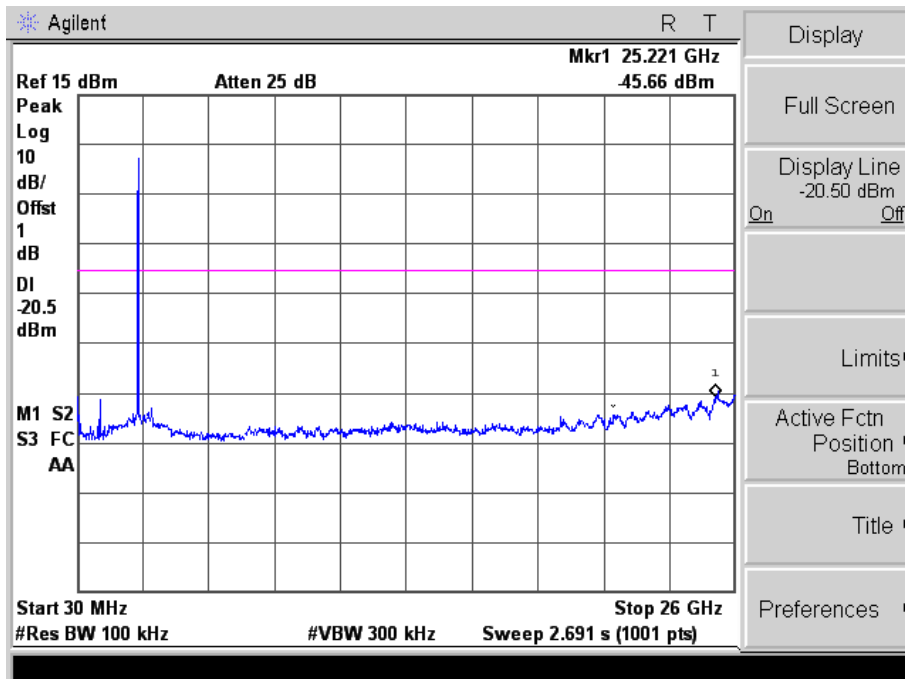
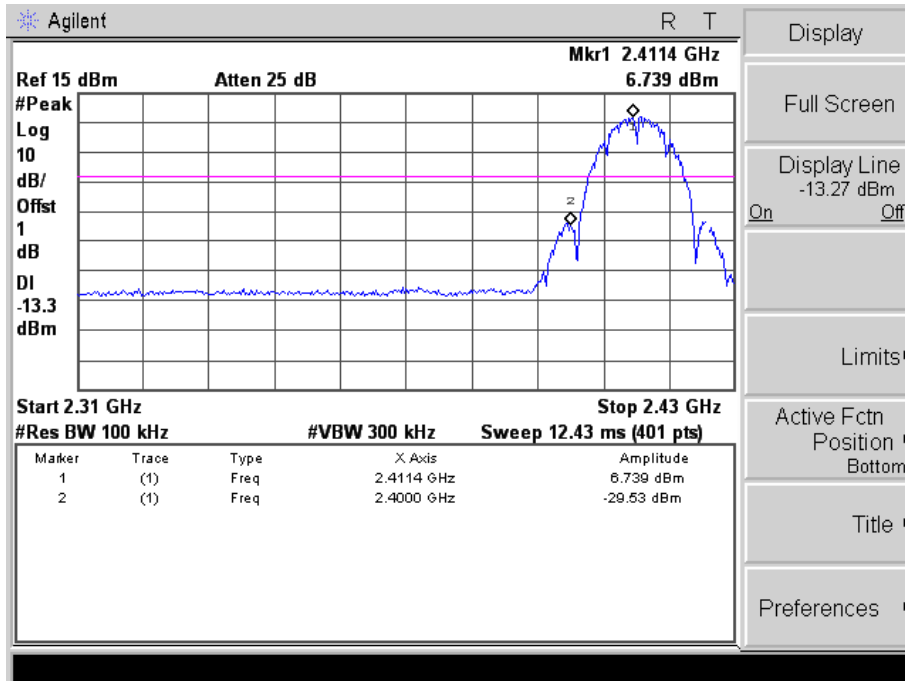


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.62	87.23	-7.33	79.90	/	/	Average Detector
	2454.62	100.49	-7.33	93.16	/	/	Peak Detector
2	2483.50	58.58	-7.28	51.30	54.00	-2.70	Average Detector
	2483.50	73.04	-7.28	65.76	74.00	-8.24	Peak Detector
3	2500.00	50.44	-7.25	43.19	54.00	-10.81	Average Detector
	2500.00	69.63	-7.25	62.38	74.00	-11.62	Peak Detector

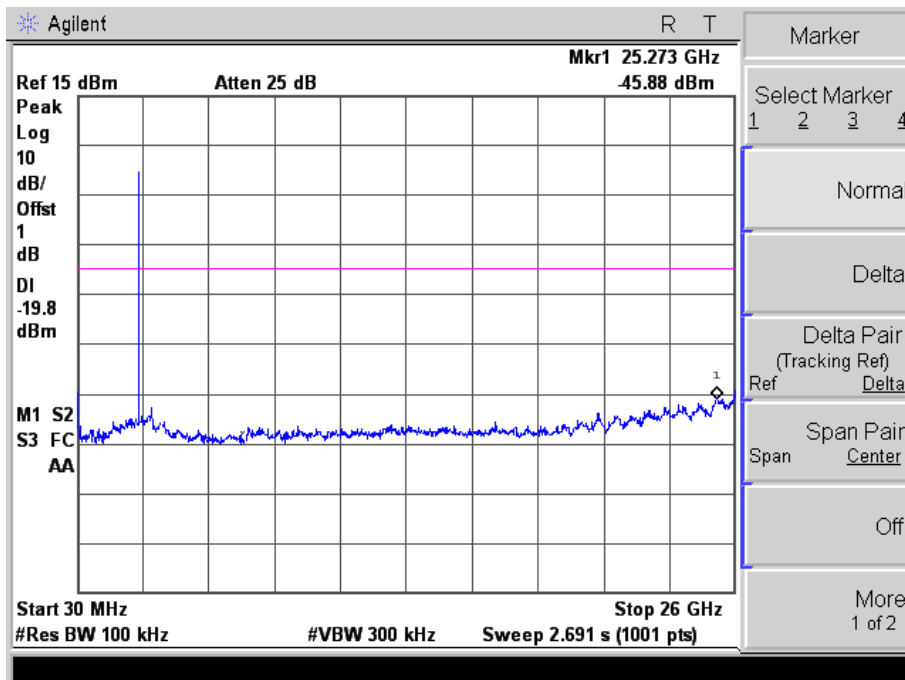
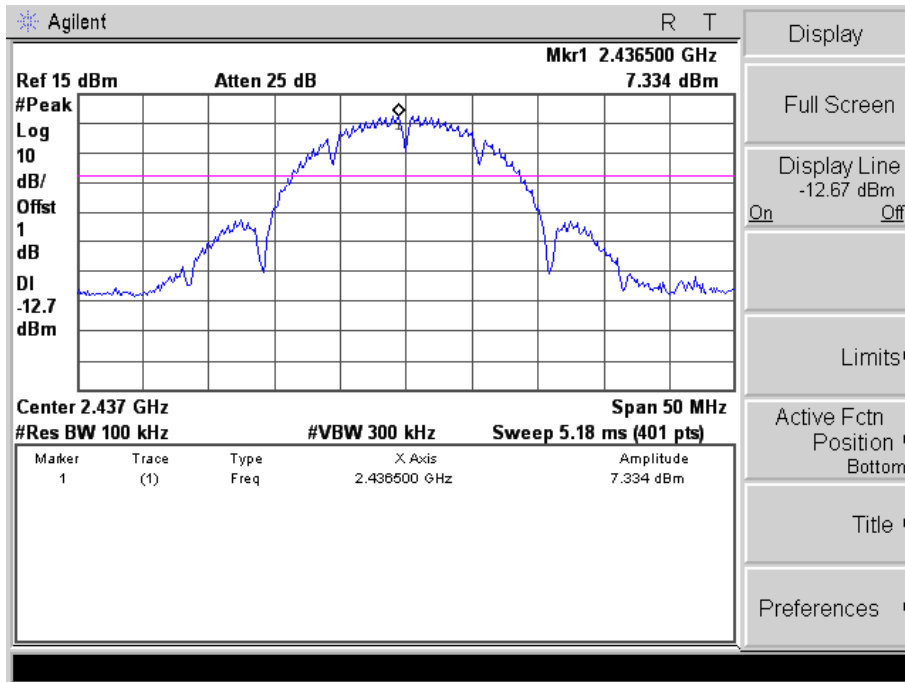
Spurious (Conducted)

802.11b_1Mbps

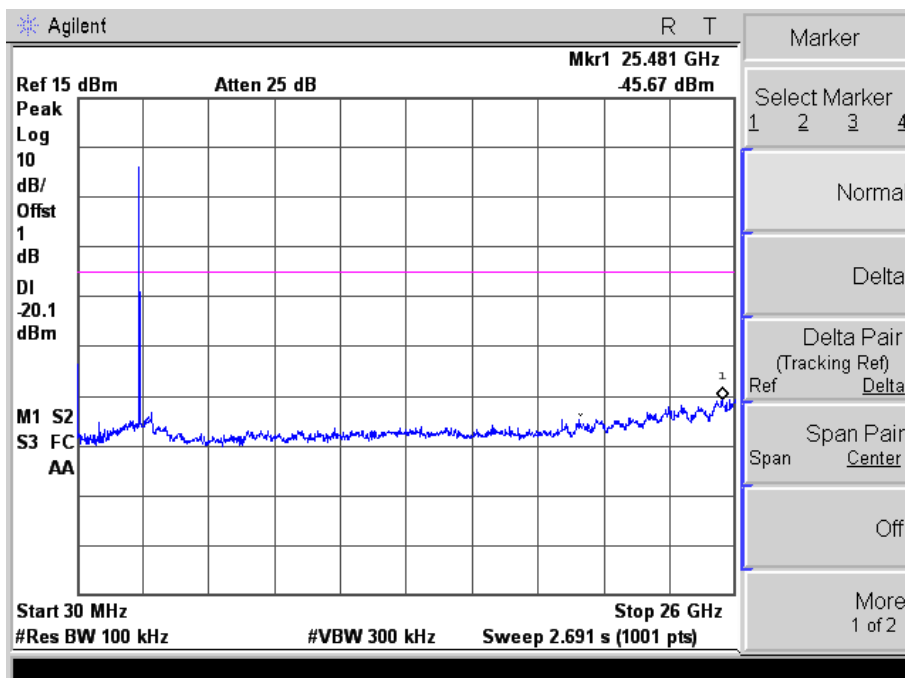
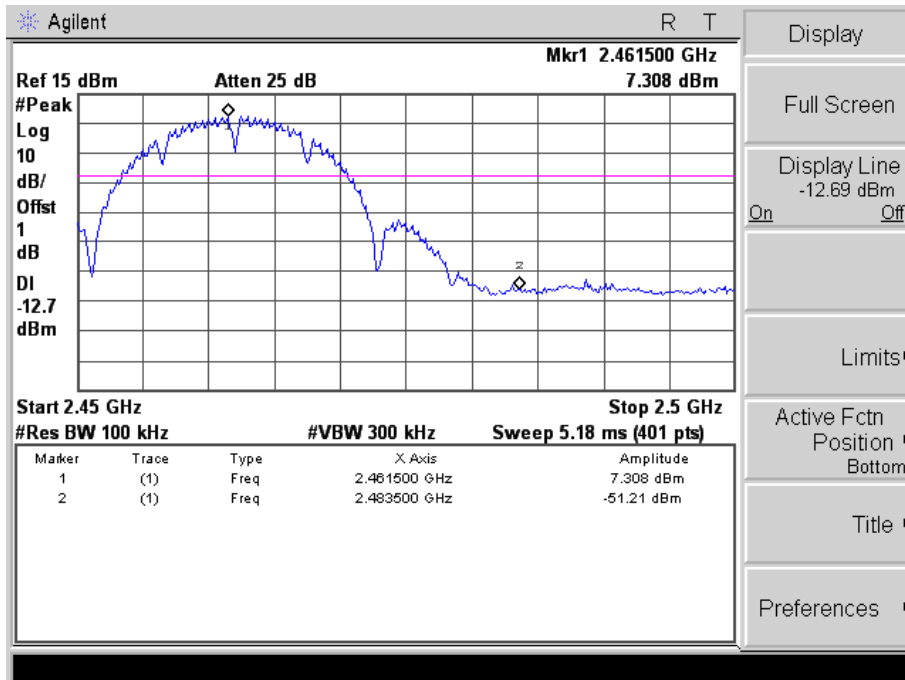
Lowest



Middle



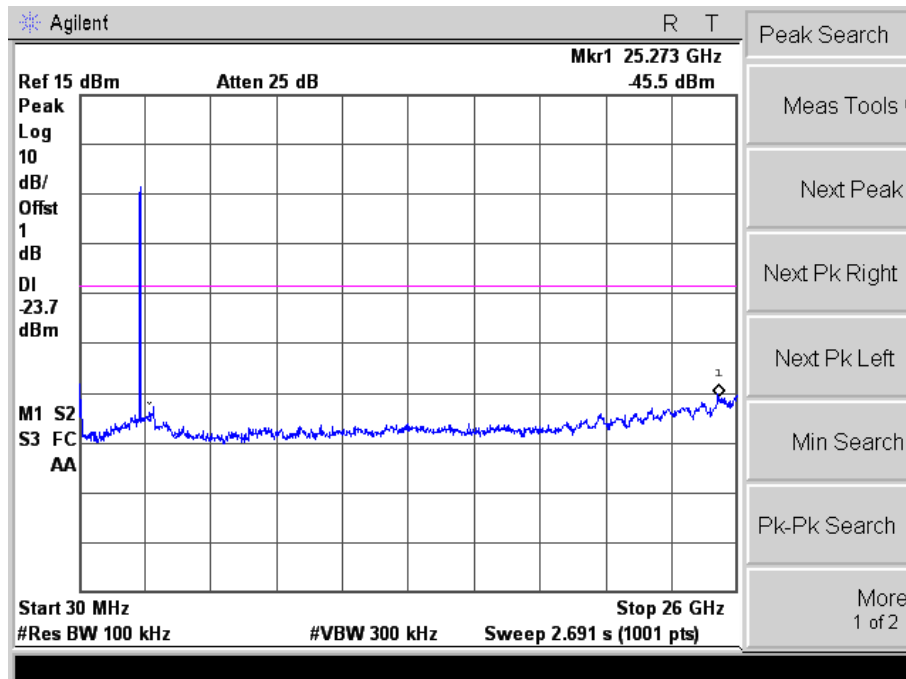
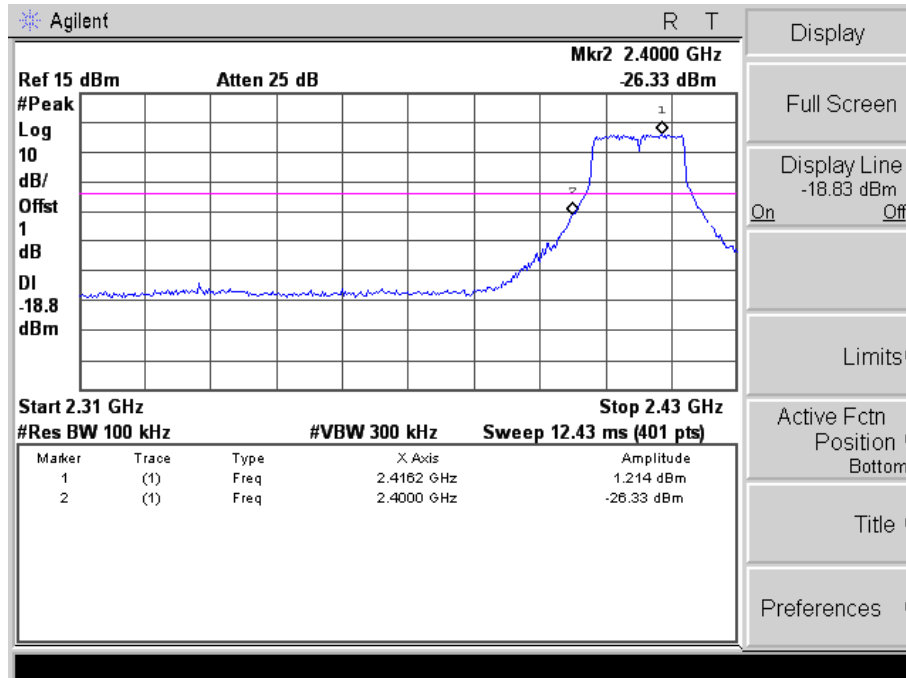
Highest



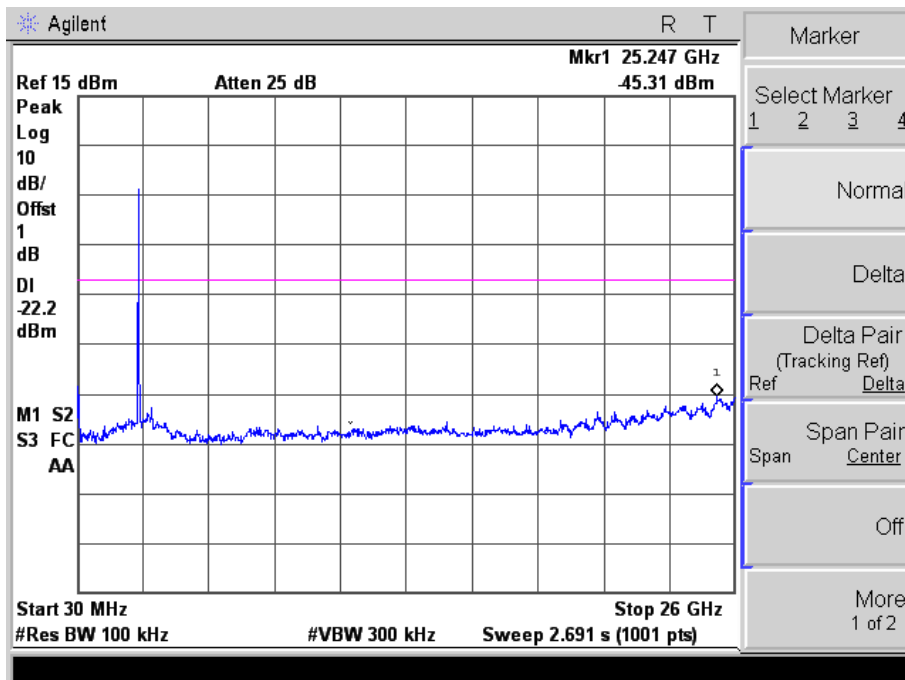
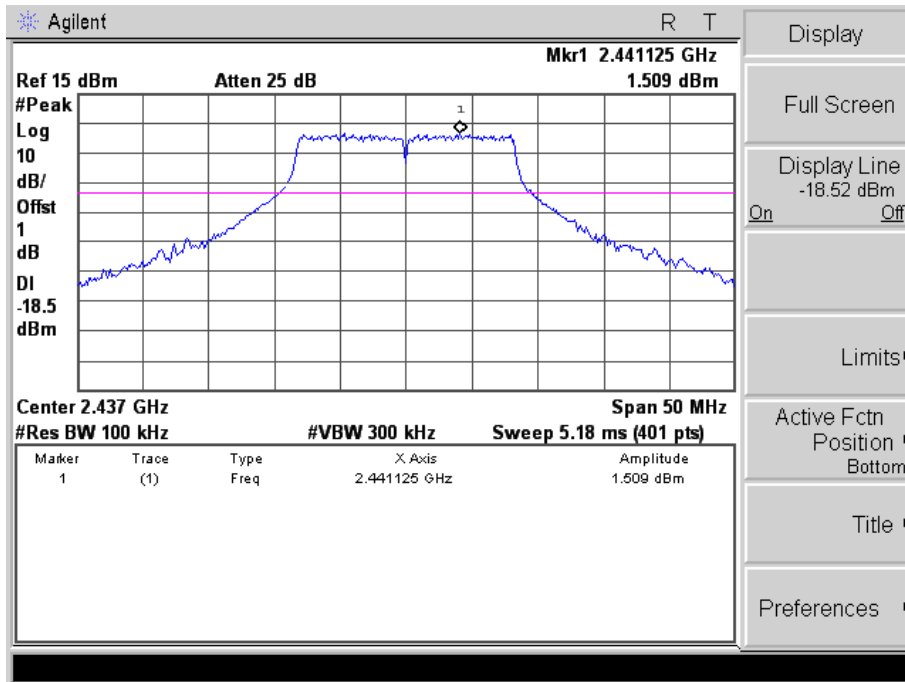
Spurious (Conducted)

802.11g_6Mbps

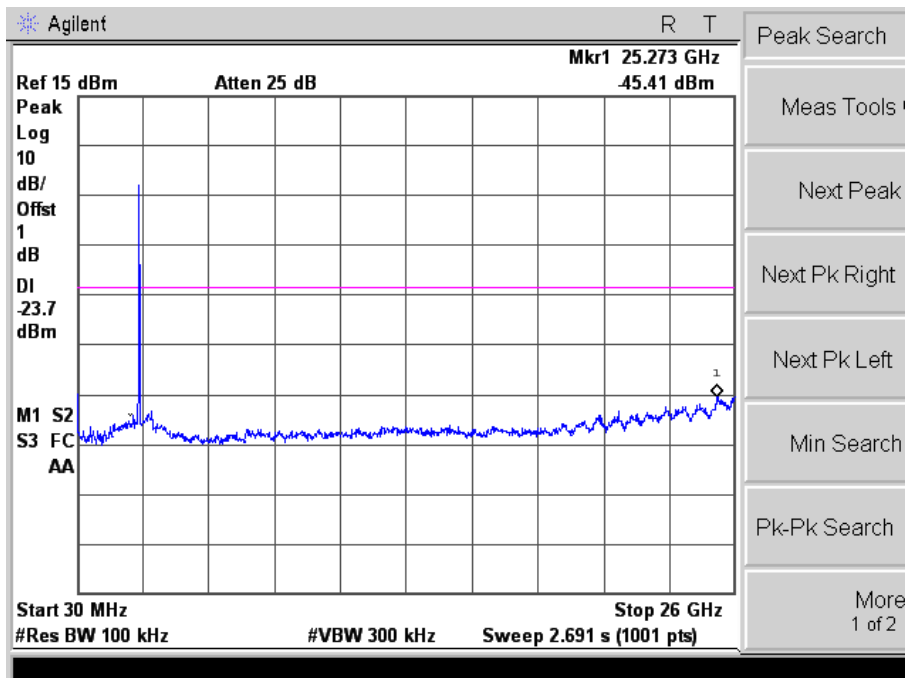
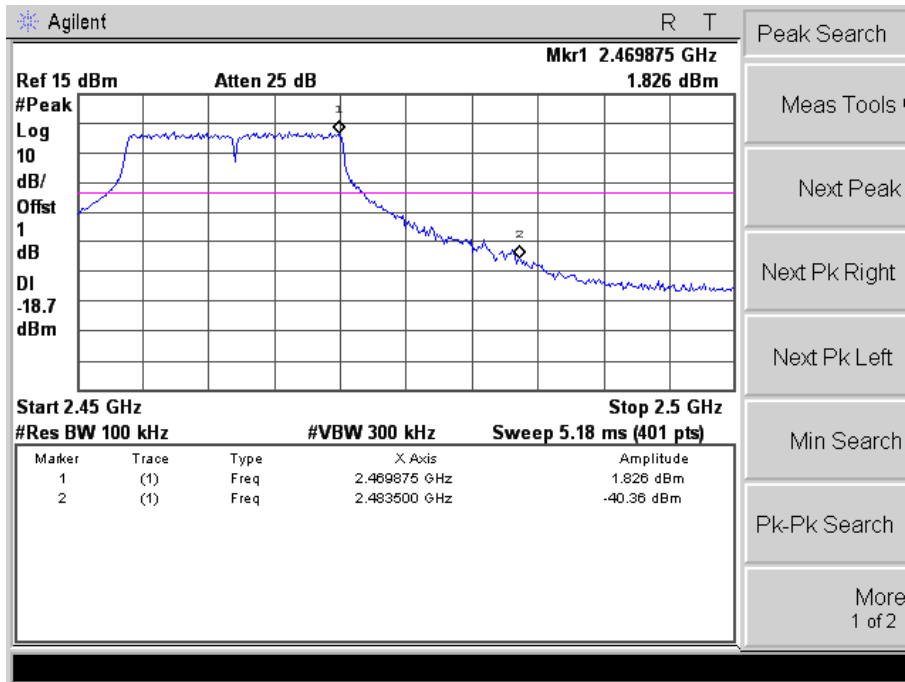
Lowest



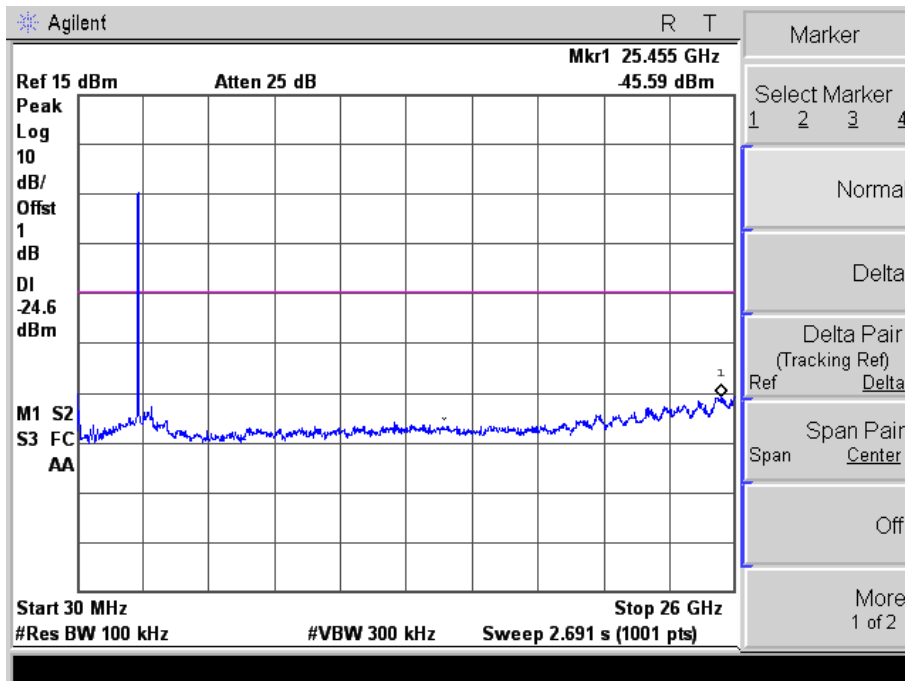
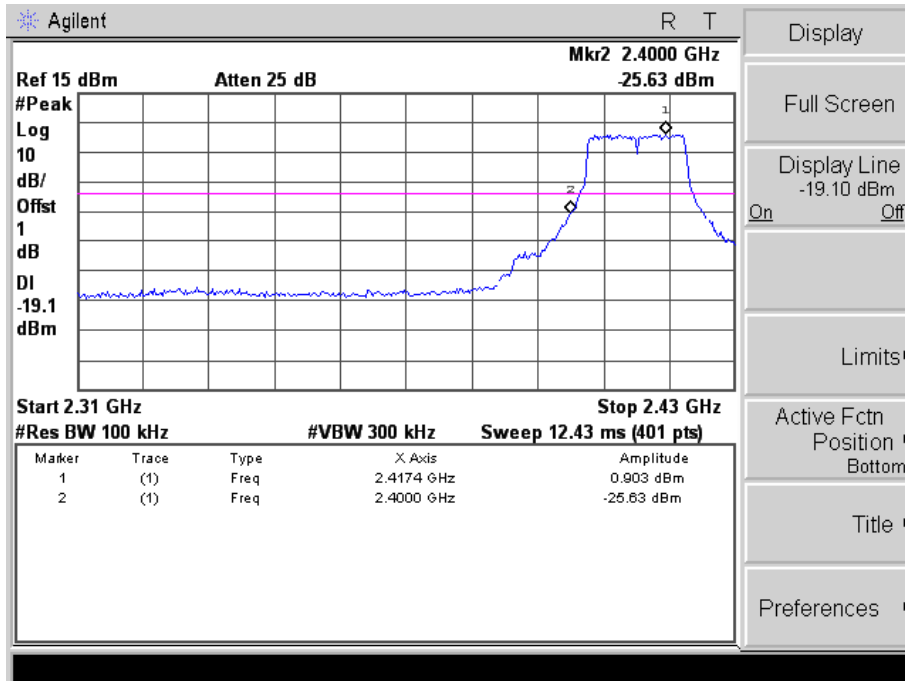
Middle



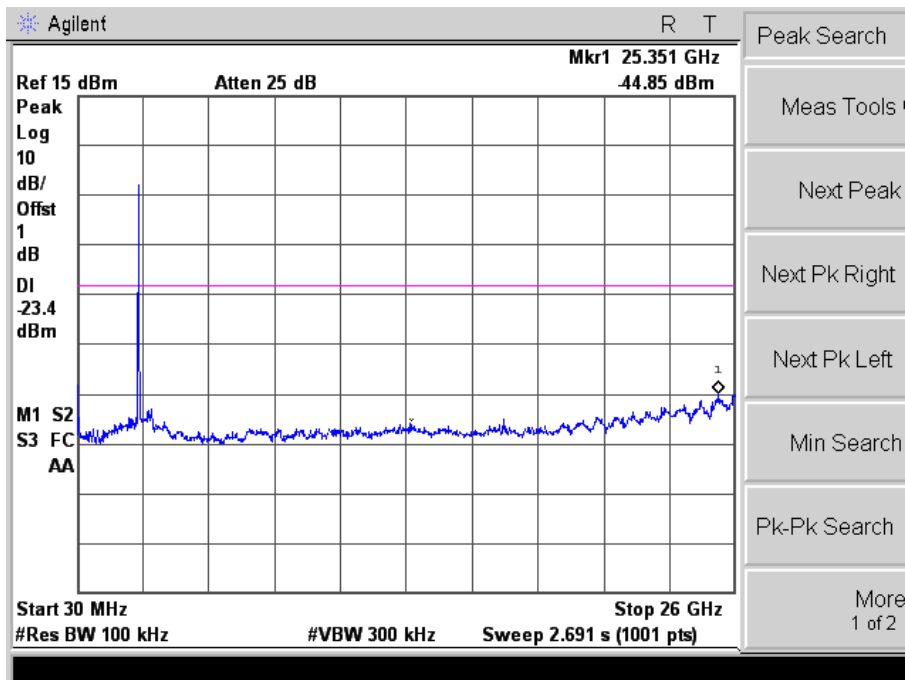
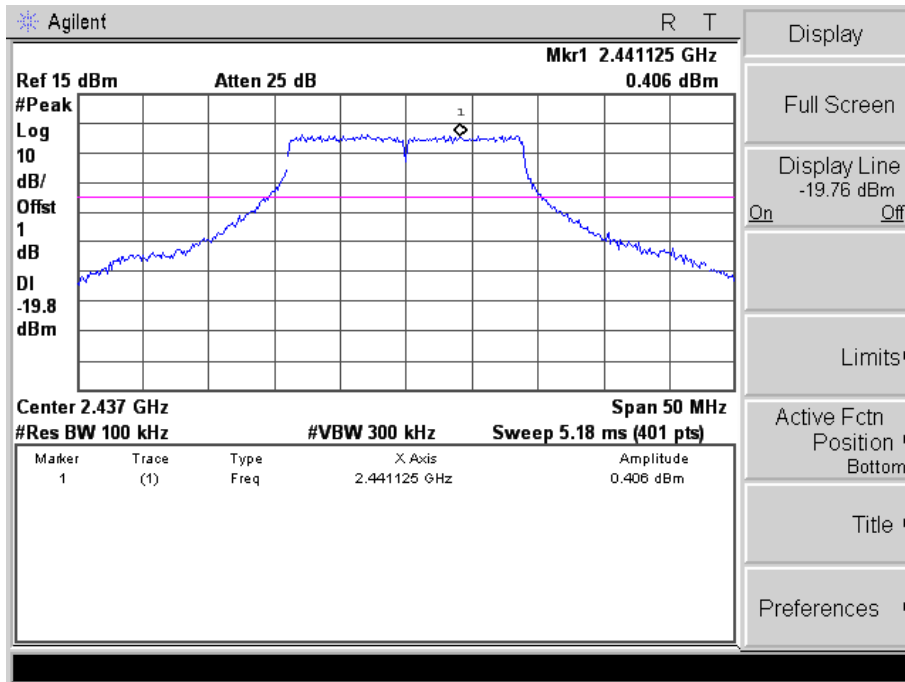
Highest



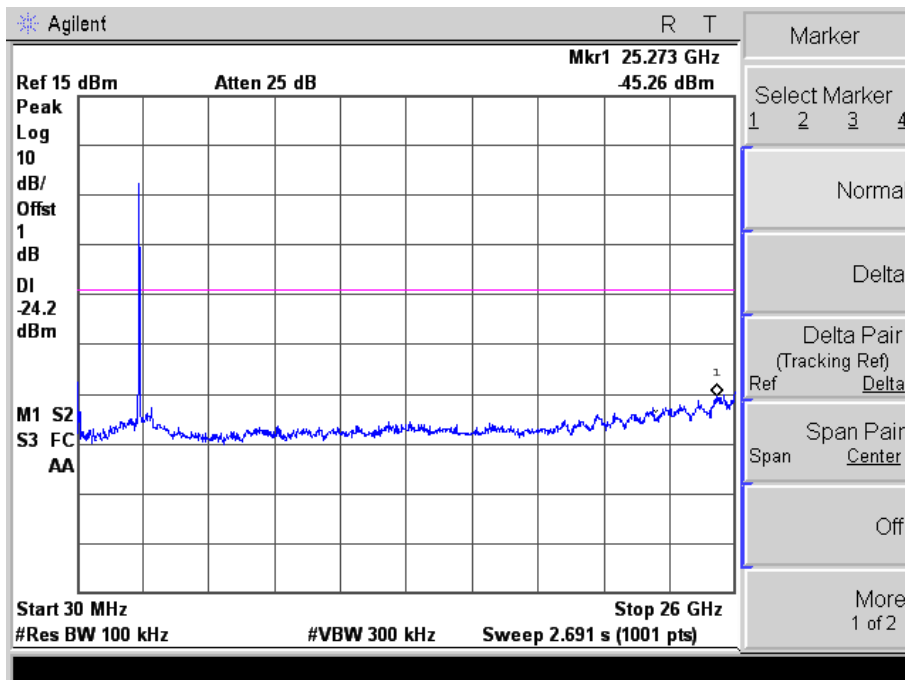
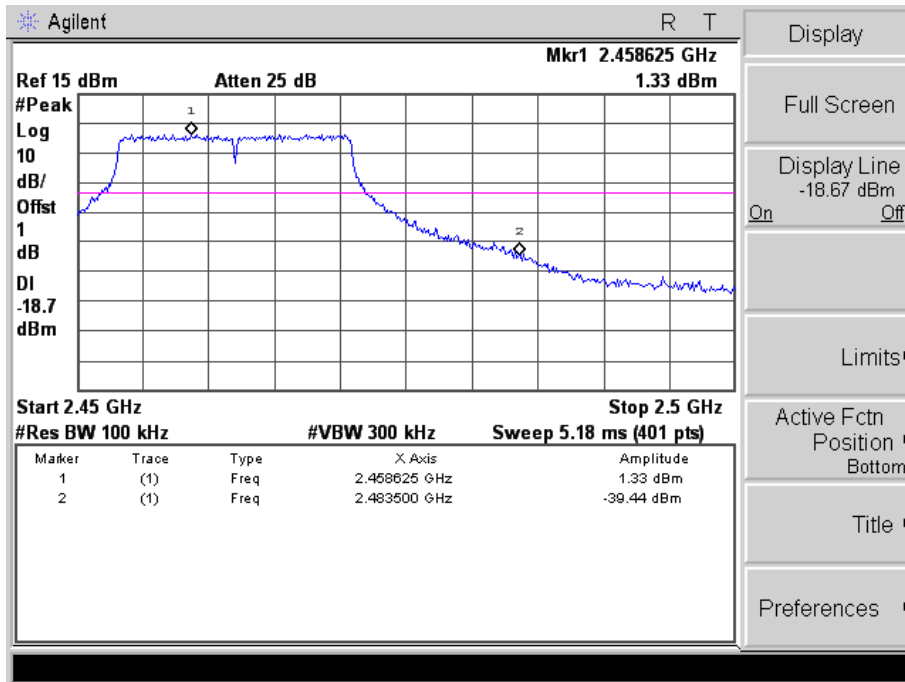
Spurious (Conducted)
 802.11n-HT20_MCS0
 Lowest



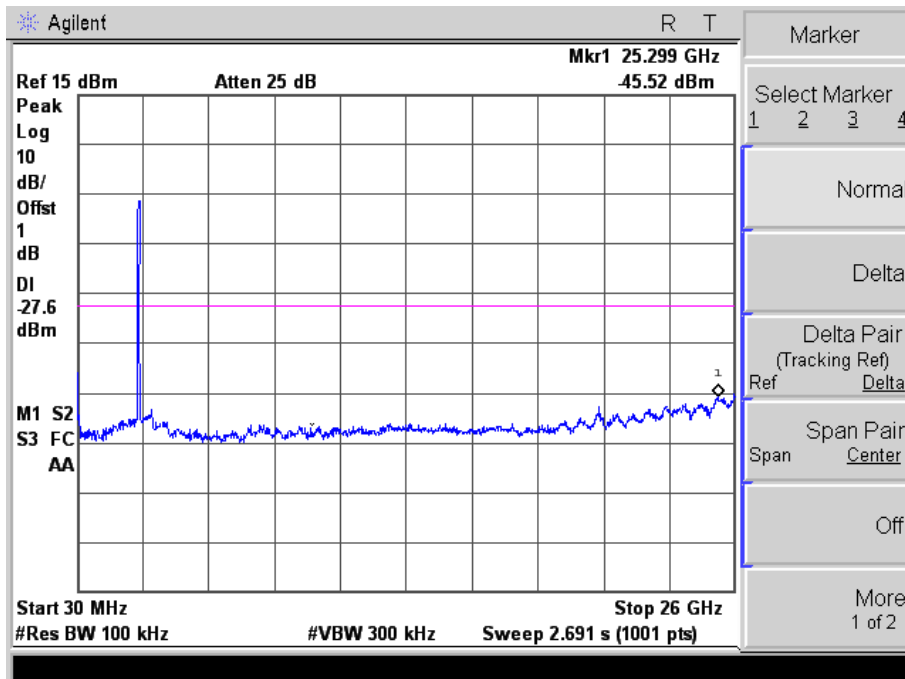
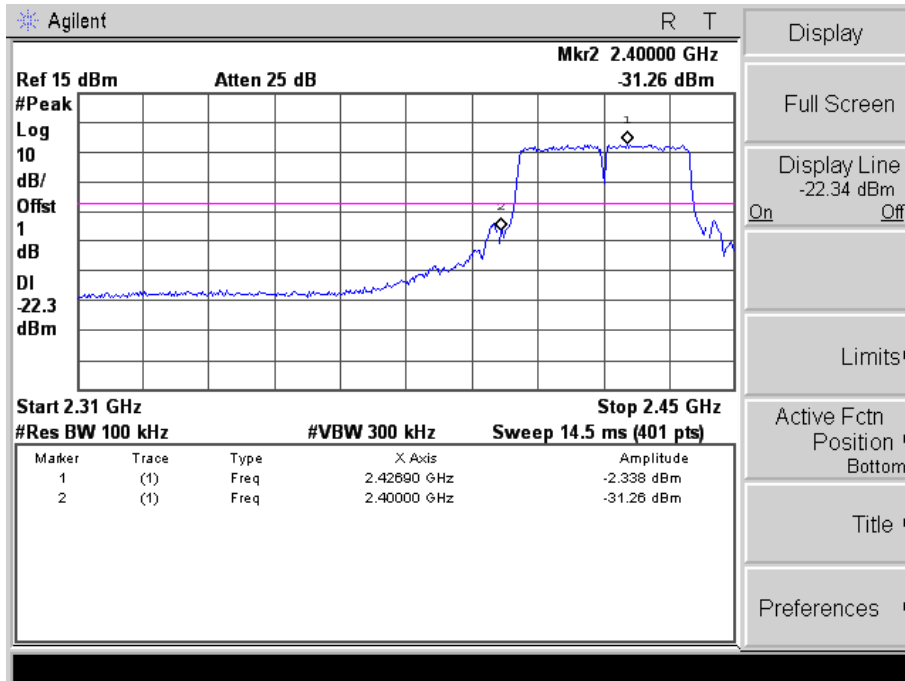
Middle



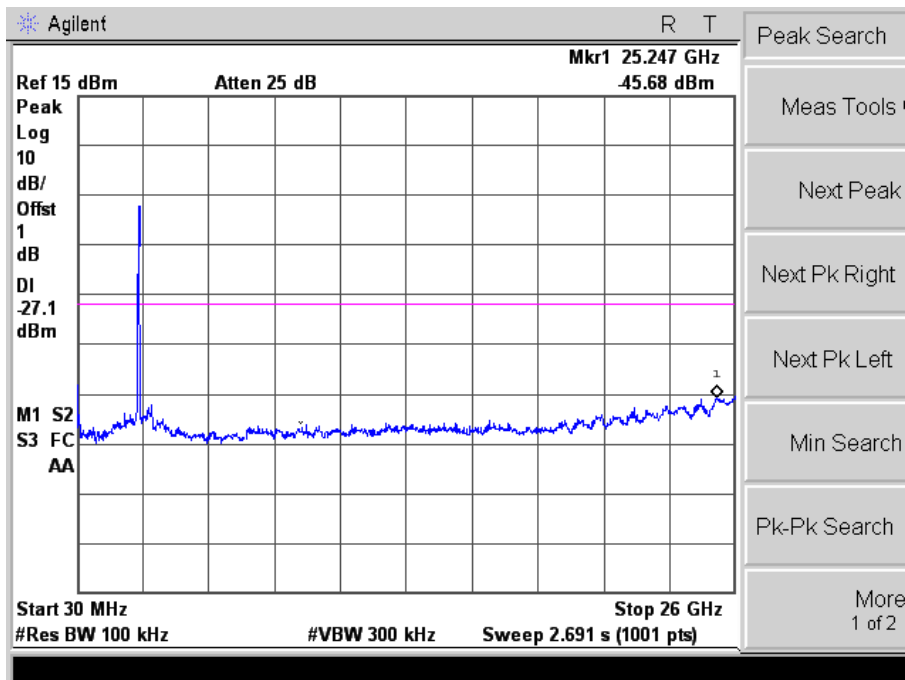
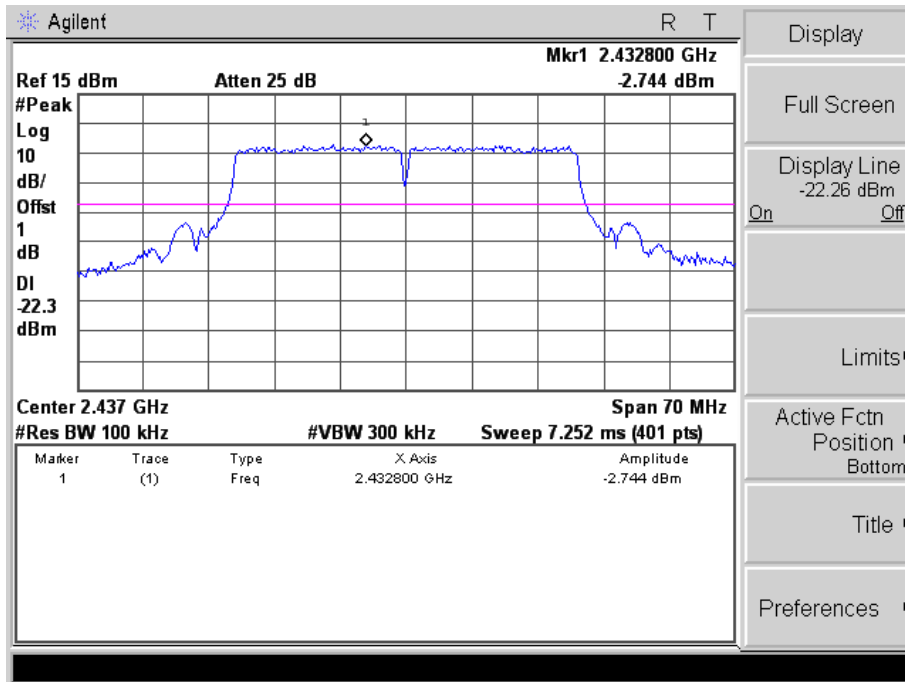
Highest



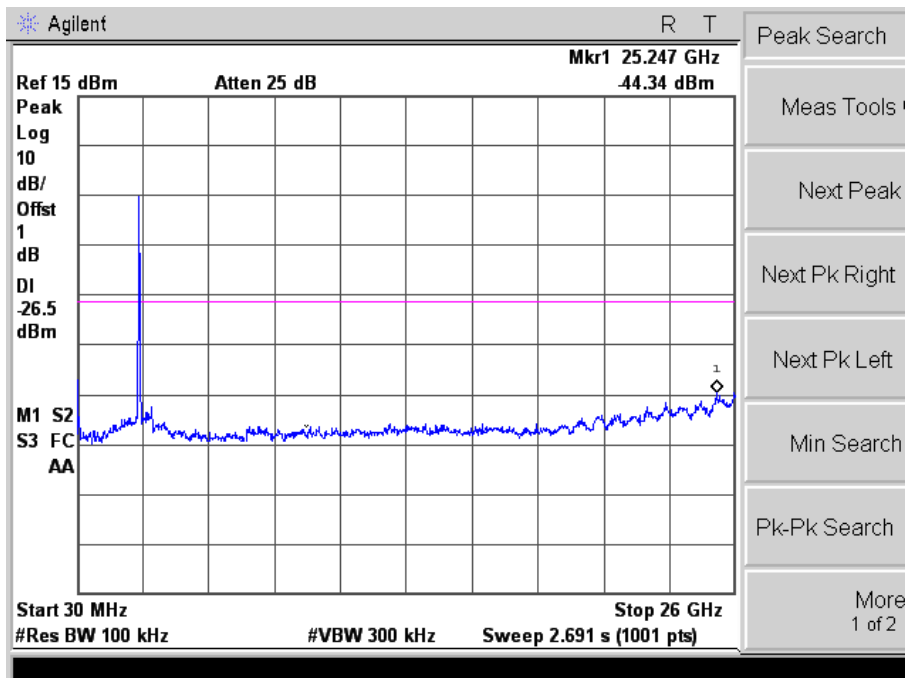
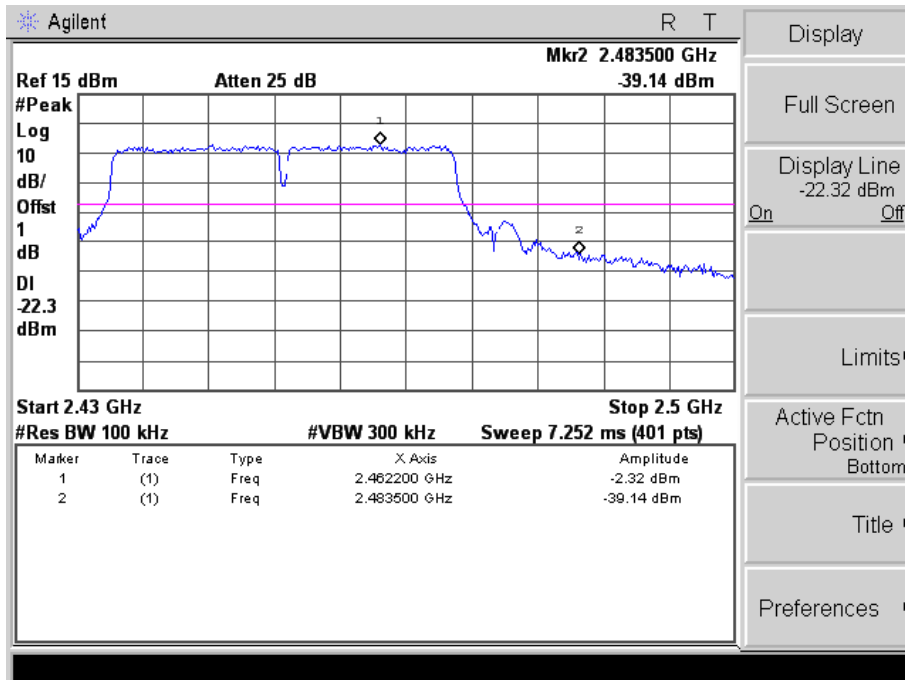
Spurious (Conducted)
 802.11n-HT40_MCS0
 Lowest



Middle



Highest



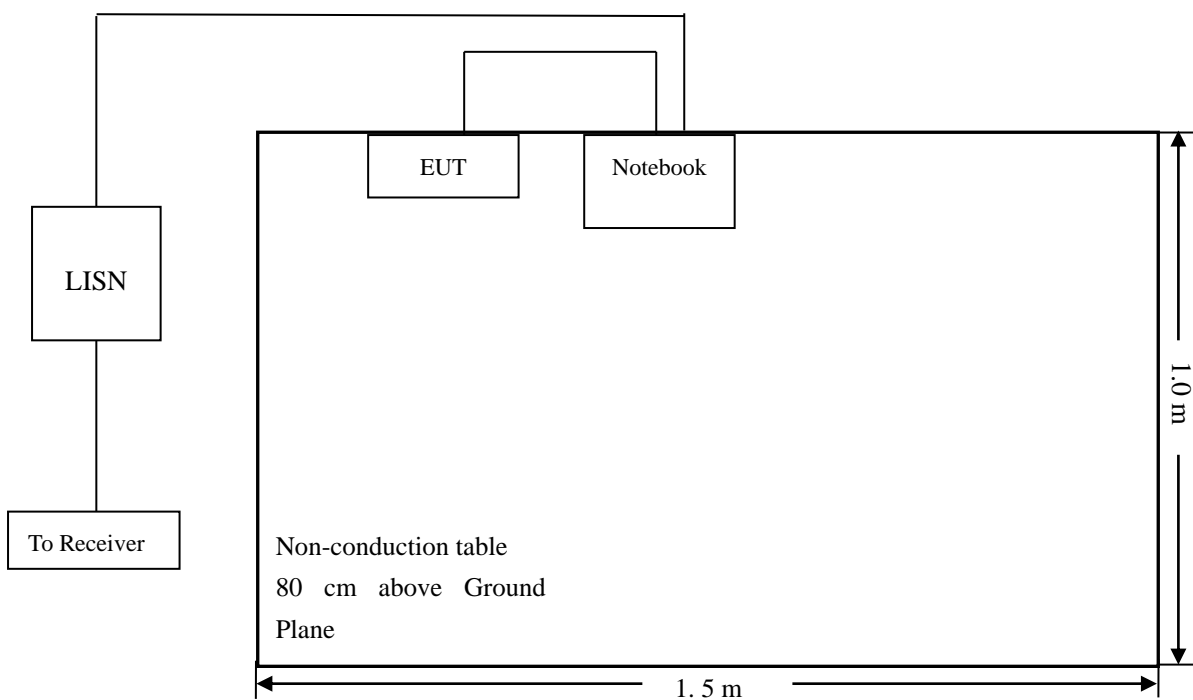
10. Conducted Emissions

10.1 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.

10.2 Basic Test Setup Block Diagram



10.3 Environmental Conditions

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

10.4 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

10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

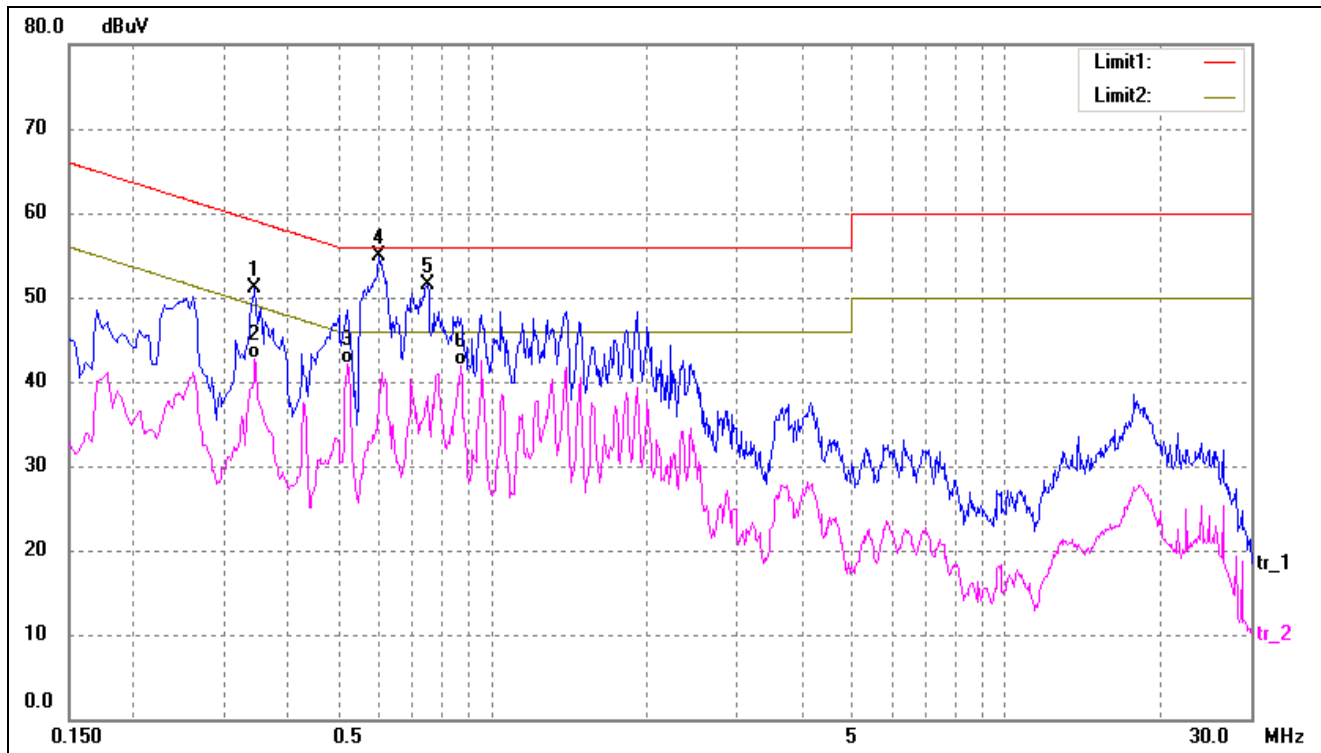
-1.19 dB at 0.6020 MHz in the Neutral mode, QP detector, 0.15-30MHz

10.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

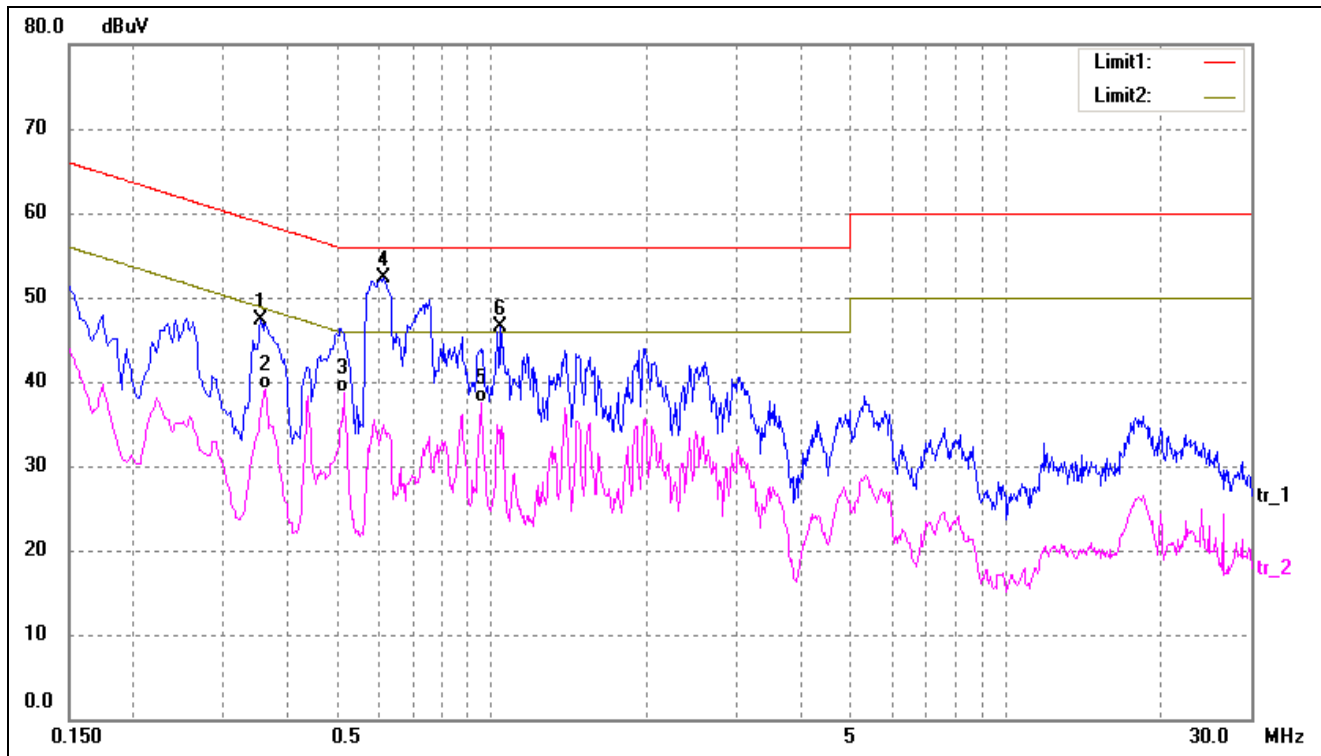
EUT: LM811 Wi-Fi & BT SMT Module
 Tested Model: LM811-0451
 Operating Condition: Transmitting(Wi-Fi)
 Comment: AC120V 60Hz; USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3460	41.35	9.80	51.15	59.06	-7.91	QP
2	0.3460	32.83	9.80	42.63	49.06	-6.43	AVG
3	0.5220	32.23	9.80	42.03	46.00	-3.97	AVG
4*	0.6020	45.02	9.79	54.81	56.00	-1.19	QP
5	0.7500	41.68	9.78	51.46	56.00	-4.54	QP
6	0.8700	32.19	9.77	41.96	46.00	-4.04	AVG

Test Specification: Live



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3540	37.41	9.80	47.21	58.87	-11.66	QP
2	0.3620	29.34	9.80	39.14	48.68	-9.54	AVG
3	0.5140	28.86	9.80	38.66	46.00	-7.34	AVG
4*	0.6140	42.49	9.79	52.28	56.00	-3.72	QP
5	0.9540	27.65	9.76	37.41	46.00	-8.59	AVG
6	1.0339	36.69	9.76	46.45	56.00	-9.55	QP

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