

# TEST REPORT

Reference No..... : WTX20X06038203W-1  
FCC ID ..... : 2AD56HLK-B30  
Applicant ..... : ShenZhen HaiLingKe Electronic co.,Ltd  
Address ..... : 3F Caiyue Mansion,No.24 Liuxian blvd,LongHua District, Shenzhen ,  
Guangdong, China  
Product Name ..... : WIFI module  
Test Model. .... : HLK-B30  
Standards ..... : FCC Part 15.247  
Date of Receipt sample .... : Jun.18, 2020  
Date of Test..... : Jun.18, 2020 to Aug.31, 2020  
Date of Issue ..... : Aug.31, 2020  
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

**Prepared By:**

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**Report version**

Version No.	Date of issue	Description
Rev.00	Aug.31, 2020	Original
/	/	/

## 1. GENERAL INFORMATION

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### 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-B30
Adding Model(s):	/
Rated Voltage:	DC 3.3V
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

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:	16.53dBm (Conducted)
Type of Modulation:	DBPSK, BPSK, DQPSK, QPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11 for 802.11b/g/n-HT20 7 for 802.11n-HT40
Channel Separation:	5MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	1dBi

## 1.2 Test Standards

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

**558074 D01 15.247 Meas Guidance v05r02:** Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under section 15.247 of the Fcc rules.

**ANSI C63.10-2013:** American National Standard for Testing Unlicensed Wireless Devices.

**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, KDB 558074 D01 15.247 Meas Guidance v05r02.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

## 1.4 Test Facility

### **Address of the test laboratory**

Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.

Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

### **FCC – Registration No.: 125990**

Waltek Testing Group (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

### **Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) 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:

<b>Test Mode List</b>		
Test Mode	Description	Remark
TM1	802.11b	Low:2412MHz, Middle:2437MHz,High:2462MHz
TM2	802.11g	Low:2412MHz, Middle:2437MHz,High:2462MHz
TM3	802.11n-HT20	Low:2412MHz, Middle:2437MHz,High:2462MHz
TM4	802.11n-HT40	Low:2422MHz, Middle:2437MHz,High:2452MHz

<b>Test Conditions</b>	
Temperature:	22~25 °C
Relative Humidity:	50~56 %.
ATM Pressure:	1019 mbar

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

<b>Accessories Cable List and Details</b>			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Cable	1.0	Unshielded	Without Ferrite

<b>Auxiliary Equipment List and Details</b>			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E445	EB12648265

## 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	2020-04-28	2021-04-27
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2020-04-28	2021-04-27
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2020-04-28	2021-04-27
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2020-04-28	2021-04-27
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2020-04-28	2021-04-27
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2019-05-05	2021-05-04
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2020-04-28	2021-04-27
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2020-04-28	2021-04-27
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2020-04-28	2021-04-27
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2020-04-28	2021-04-27
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2020-04-28	2021-04-27
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2020-04-28	2021-04-27
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2020-04-28	2021-04-27
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2020-04-28	2021-04-27
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2020-04-28	2021-04-27
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2020-03-17	2021-03-16
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2020-03-17	2021-03-16
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2020-03-17	2021-03-16
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2020-03-17	2021-03-16
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16



<b>Software List</b>			
<b>Description</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Version</b>
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

\*Remark: indicates software version used in the compliance certification testing

## 2. SUMMARY OF TEST RESULTS

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<b>FCC Rules</b>	<b>Description of Test Item</b>	<b>Result</b>
§2.1091	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)	DTS 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**

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#### **3.1 Standard Applicable**

According to §1.1307 and §2.1091, the mobile or fixed 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**

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### **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 a PCB antenna, fulfill the requirement of this section.

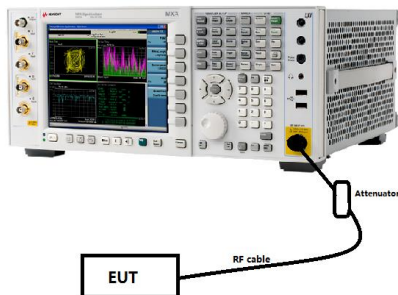
## 5. Power Spectral Density

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### 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 Setup Block Diagram



### 5.3 Test Procedure

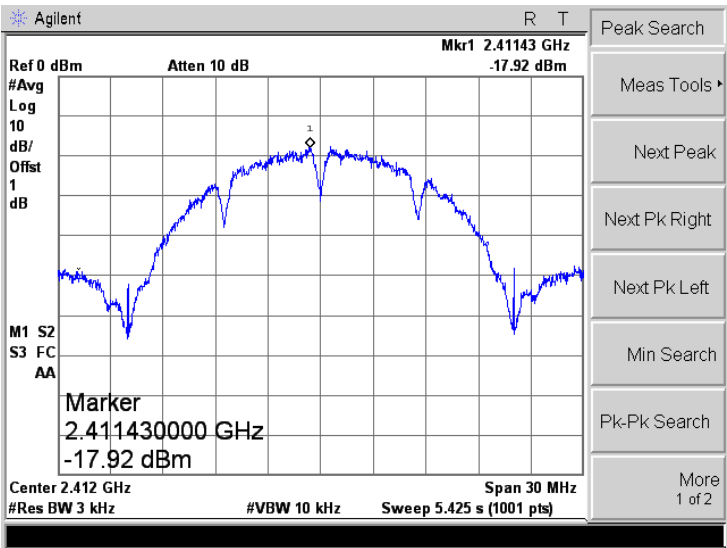
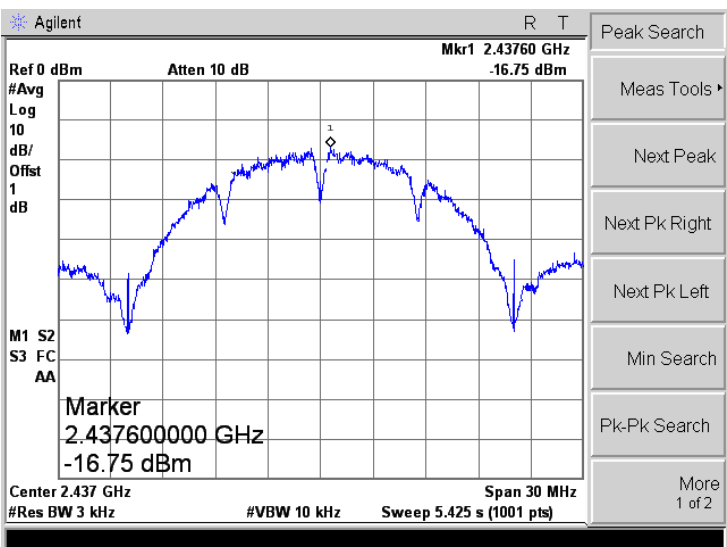
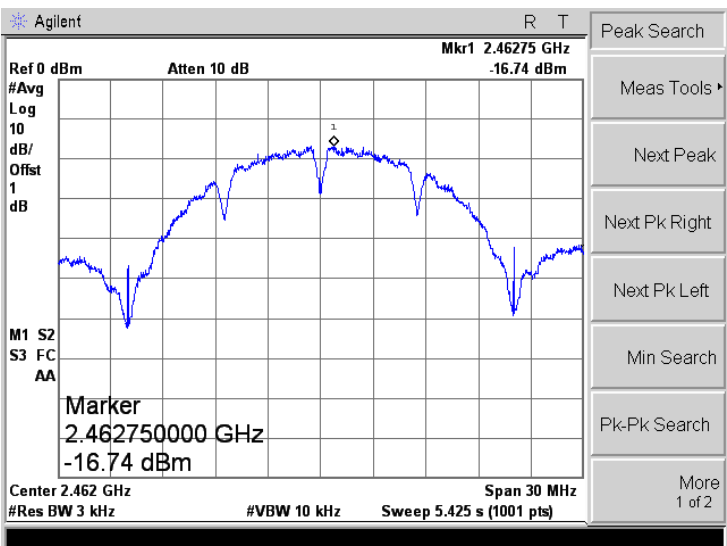
According to the KDB 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.10.3, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

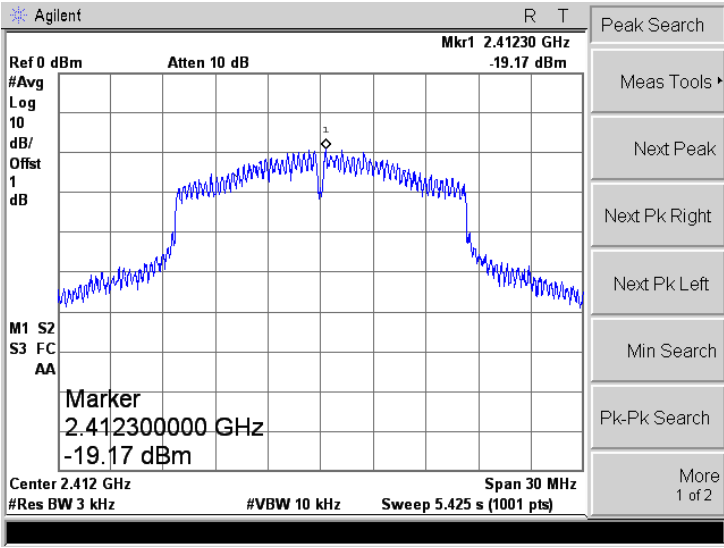
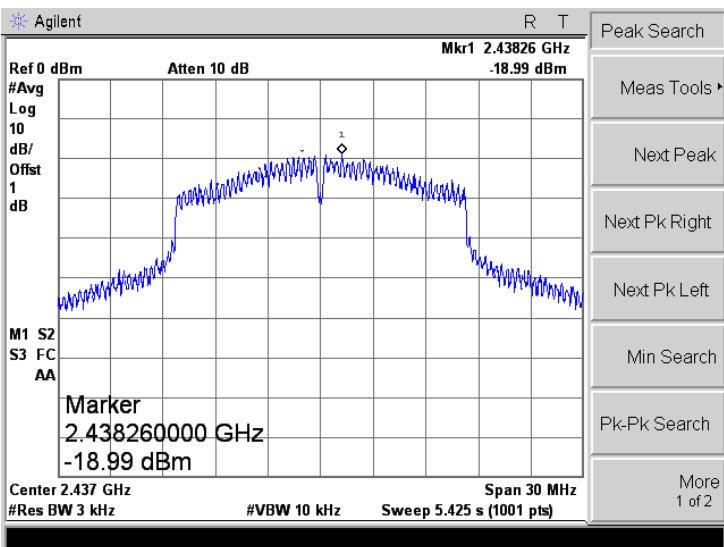
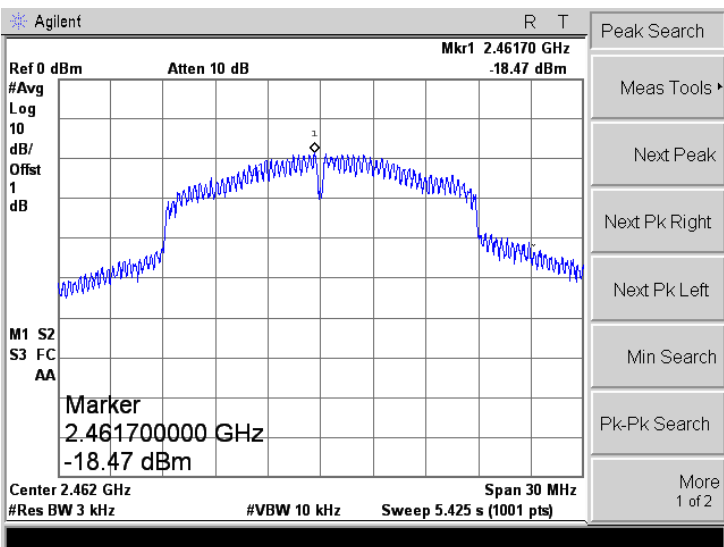
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = power averaging (RMS) or sample detector (when RMS not 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).

### 5.4 Summary of Test Results/Plots

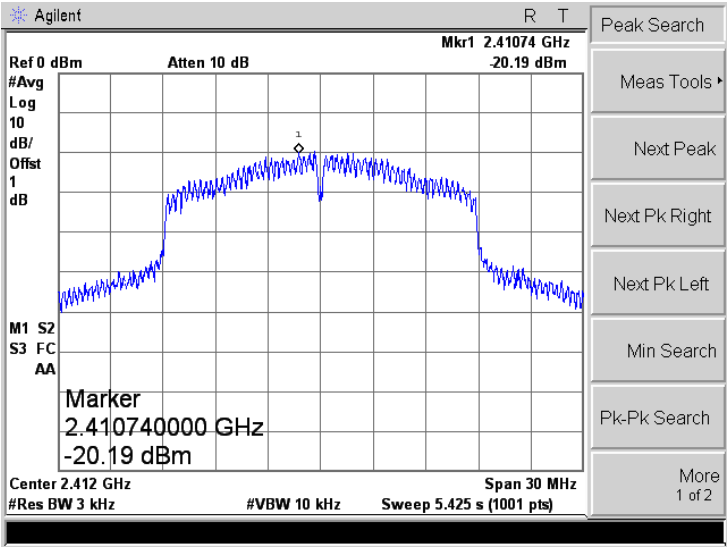
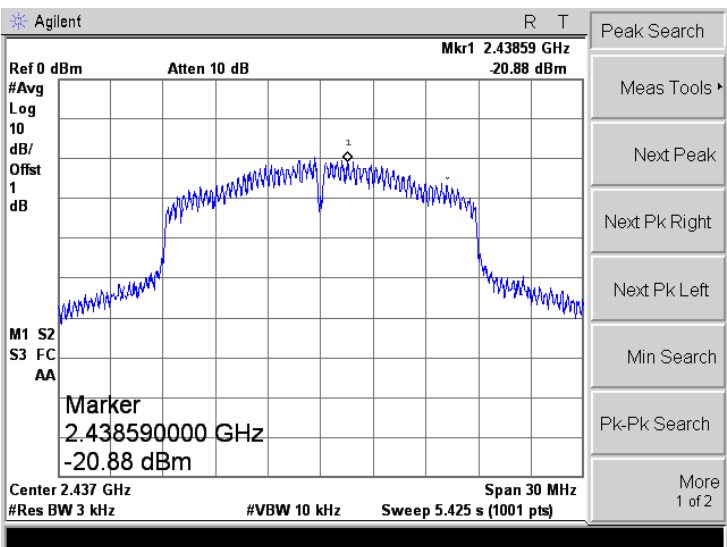
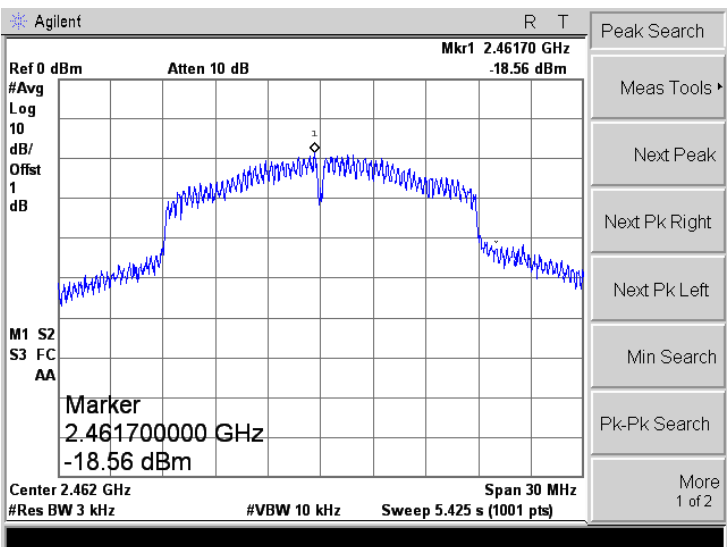
<b>Test Mode</b>	<b>Test Channel MHz</b>	<b>Power Spectral Density dBm/3kHz</b>	<b>Limit dBm/3kHz</b>
802.11b_11Mbps	2412	-17.92	8
	2437	-16.75	8
	2462	-16.74	8
802.11g_54Mbps	2412	-19.17	8
	2437	-18.99	8
	2462	-18.47	8
802.11n-HT20_MCS7	2412	-20.19	8
	2437	-20.88	8
	2462	-18.56	8
802.11n-HT40_MCS7	2422	-24.77	8
	2437	-24.28	8
	2452	-24.01	8

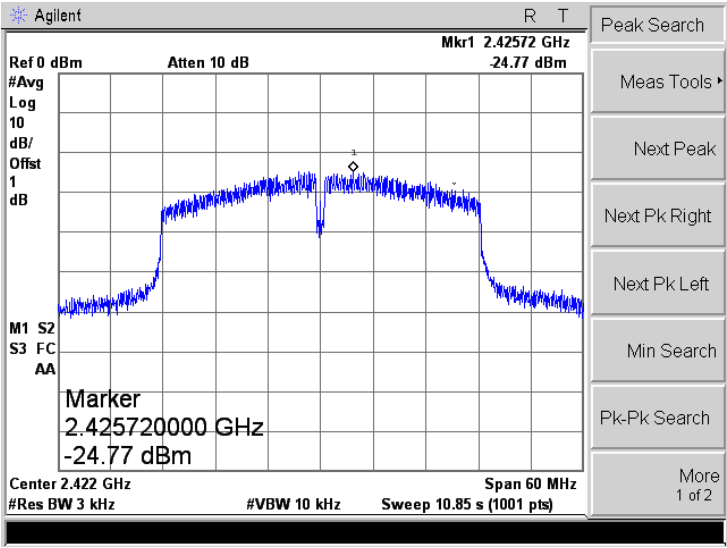
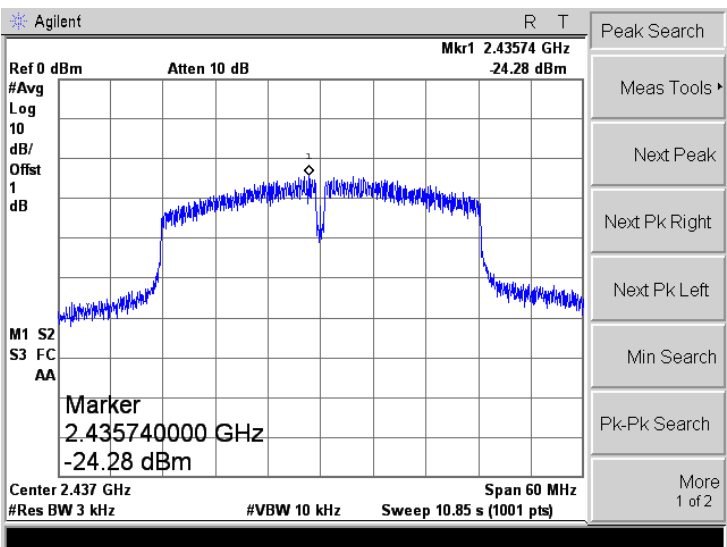
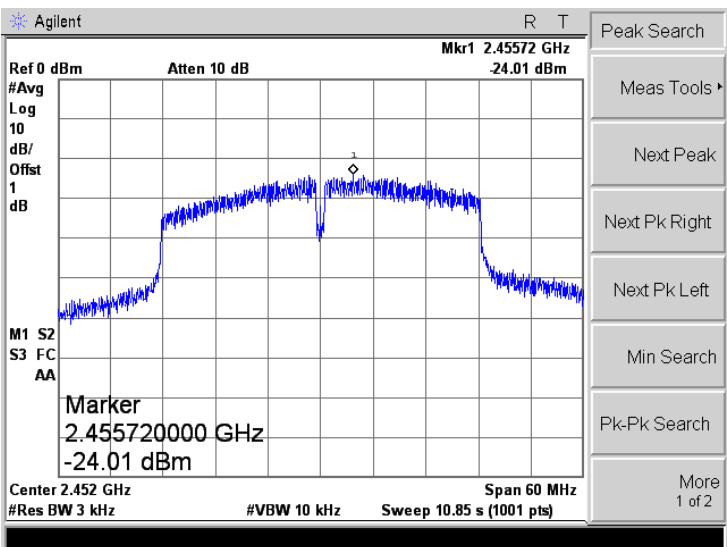
Please refer to the following test plots:

<p>802.11b-Low</p>	 <p>Agilent R T          Ref 0 dBm Atten 10 dB Mkr1 2.41143 GHz -17.92 dBm          #Avg 10          Log dB/ Offst 1 dB          M1 S2          S3 FC          AA          Marker          2.411430000 GHz          -17.92 dBm          Center 2.412 GHz Span 30 MHz          #Res BW 3 kHz #VBW 10 kHz Sweep 5.425 s (1001 pts)</p>
<p>802.11b-Middle</p>	 <p>Agilent R T          Ref 0 dBm Atten 10 dB Mkr1 2.43760 GHz -16.75 dBm          #Avg 10          Log dB/ Offst 1 dB          M1 S2          S3 FC          AA          Marker          2.437600000 GHz          -16.75 dBm          Center 2.437 GHz Span 30 MHz          #Res BW 3 kHz #VBW 10 kHz Sweep 5.425 s (1001 pts)</p>
<p>802.11b-High</p>	 <p>Agilent R T          Ref 0 dBm Atten 10 dB Mkr1 2.46275 GHz -16.74 dBm          #Avg 10          Log dB/ Offst 1 dB          M1 S2          S3 FC          AA          Marker          2.462750000 GHz          -16.74 dBm          Center 2.462 GHz Span 30 MHz          #Res BW 3 kHz #VBW 10 kHz Sweep 5.425 s (1001 pts)</p>

<p>802.11g-Low</p>	
<p>802.11g-Middle</p>	
<p>802.11g-High</p>	



<p>802.11n-HT20-Low</p>	
<p>802.11n-HT20-Middle</p>	
<p>802.11n-HT20-High</p>	

<p>802.11n-HT40-Low</p>	
<p>802.11n-HT40-Middle</p>	
<p>802.11n-HT40-High</p>	

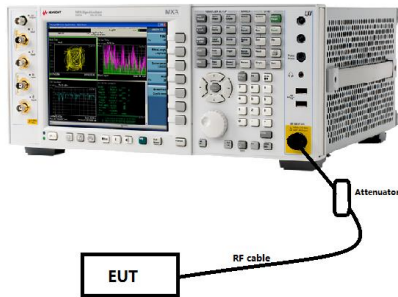
## 6. DTS Bandwidth

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### 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 Setup Block Diagram



### 6.3 Test Procedure

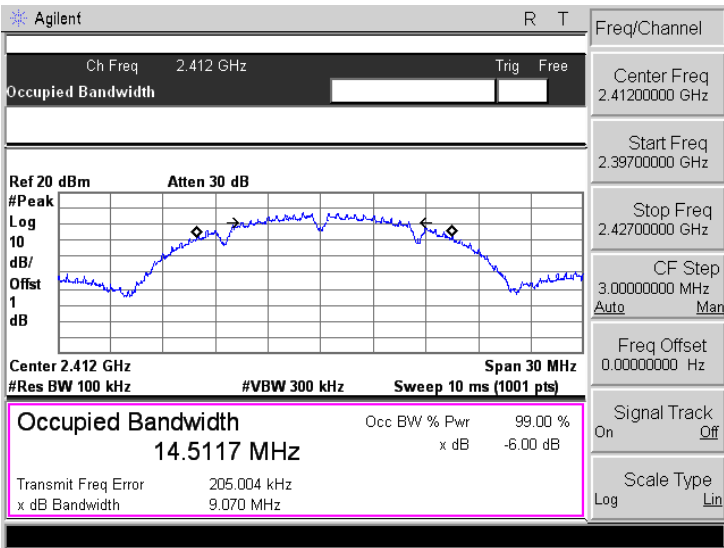
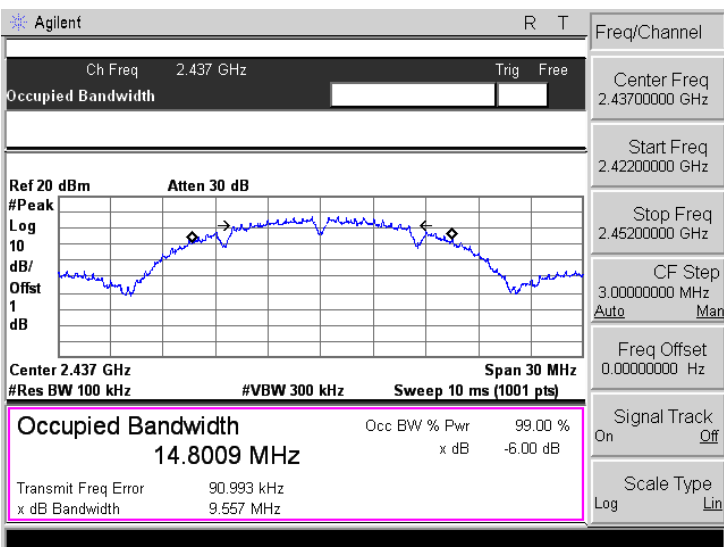
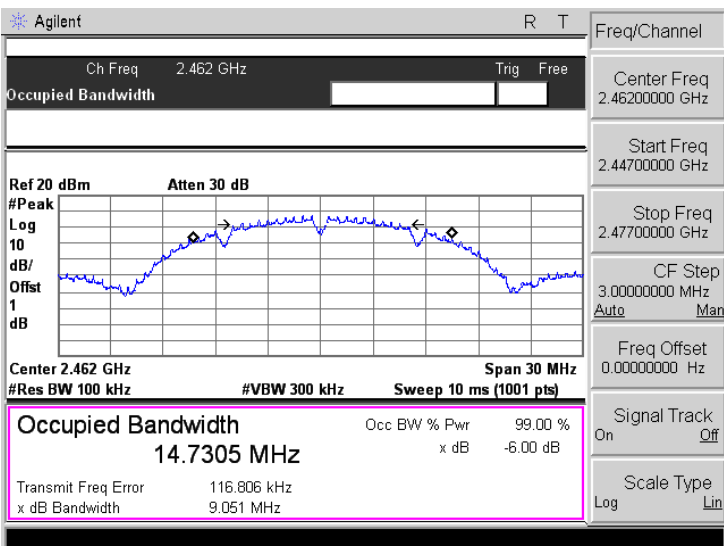
According to the KDB 558074 D01 v05r02 Subclause 8.2 and ANSI C63.10-2013 Subclause 11.8.1, the test method of DTS Bandwidth as below:

- 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.

### 6.4 Summary of Test Results/Plots

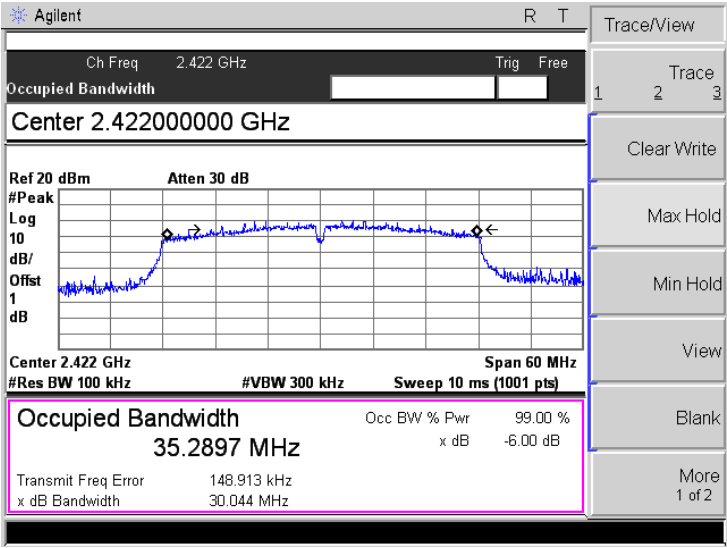
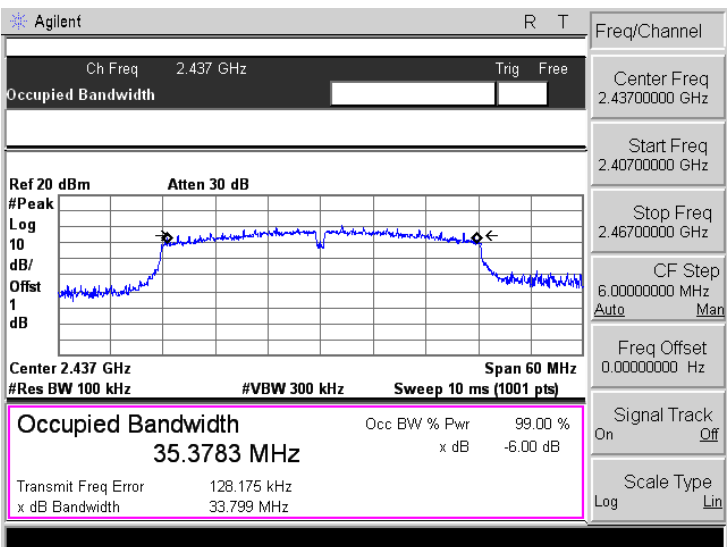
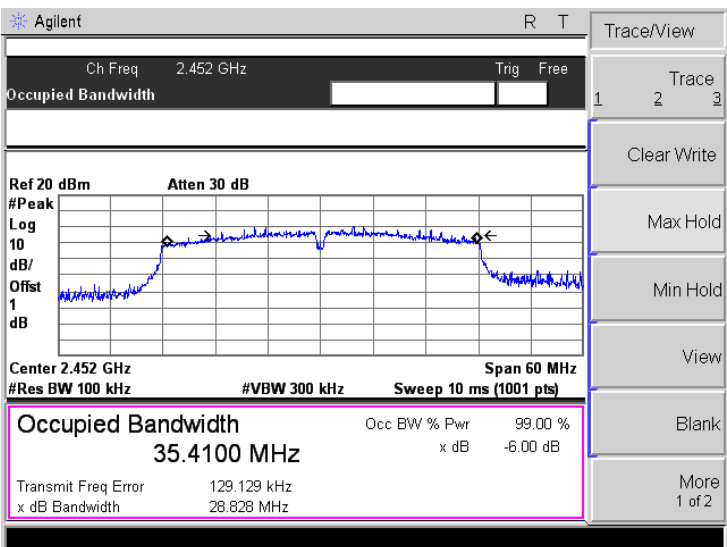
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b_11Mbps	2412	9.070	≥500
	2437	9.557	≥500
	2462	9.051	≥500
802.11g_54Mbps	2412	12.545	≥500
	2437	9.940	≥500
	2462	10.358	≥500
802.11n-HT20_MCS7	2412	12.501	≥500
	2437	10.114	≥500
	2462	11.294	≥500
802.11n-HT40_MCS7	2422	30.044	≥500
	2437	33.799	≥500
	2452	28.828	≥500

Please refer to the following test plots:

<p>802.11b-Low</p>	 <p>Agilent R T</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/ Offst 1 dB</p> <p>Center 2.412 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 14.5117 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 205.004 kHz</p> <p>x dB Bandwidth 9.070 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.41200000 GHz</p> <p>Start Freq 2.39700000 GHz</p> <p>Stop Freq 2.42700000 GHz</p> <p>CF Step 3.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
<p>802.11b-Middle</p>	 <p>Agilent R T</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/ Offst 1 dB</p> <p>Center 2.437 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 14.8009 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 90.993 kHz</p> <p>x dB Bandwidth 9.557 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.43700000 GHz</p> <p>Start Freq 2.42200000 GHz</p> <p>Stop Freq 2.45200000 GHz</p> <p>CF Step 3.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
<p>802.11b-High</p>	 <p>Agilent R T</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/ Offst 1 dB</p> <p>Center 2.462 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 14.7305 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 116.806 kHz</p> <p>x dB Bandwidth 9.051 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.46200000 GHz</p> <p>Start Freq 2.44700000 GHz</p> <p>Stop Freq 2.47700000 GHz</p> <p>CF Step 3.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

<p>802.11g-Low</p>	<p>Agilent R T</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.412 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <table border="1"> <tr> <td colspan="2"><b>Occupied Bandwidth</b></td> <td>Occ BW % Pwr</td> <td>99.00 %</td> </tr> <tr> <td colspan="2">15.9109 MHz</td> <td>x dB</td> <td>-6.00 dB</td> </tr> <tr> <td>Transmit Freq Error</td> <td>68.382 kHz</td> <td></td> <td></td> </tr> <tr> <td>x dB Bandwidth</td> <td>12.545 MHz</td> <td></td> <td></td> </tr> </table> <p>Trace/View</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>	<b>Occupied Bandwidth</b>		Occ BW % Pwr	99.00 %	15.9109 MHz		x dB	-6.00 dB	Transmit Freq Error	68.382 kHz			x dB Bandwidth	12.545 MHz		
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15.9109 MHz		x dB	-6.00 dB														
Transmit Freq Error	68.382 kHz																
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<p>802.11g-Middle</p>	<p>Agilent R T</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.437 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <table border="1"> <tr> <td colspan="2"><b>Occupied Bandwidth</b></td> <td>Occ BW % Pwr</td> <td>99.00 %</td> </tr> <tr> <td colspan="2">15.9268 MHz</td> <td>x dB</td> <td>-6.00 dB</td> </tr> <tr> <td>Transmit Freq Error</td> <td>57.608 kHz</td> <td></td> <td></td> </tr> <tr> <td>x dB Bandwidth</td> <td>9.940 MHz</td> <td></td> <td></td> </tr> </table> <p>Freq/Channel</p> <p>Center Freq 2.4370000 GHz</p> <p>Start Freq 2.4220000 GHz</p> <p>Stop Freq 2.4520000 GHz</p> <p>CF Step 3.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>	<b>Occupied Bandwidth</b>		Occ BW % Pwr	99.00 %	15.9268 MHz		x dB	-6.00 dB	Transmit Freq Error	57.608 kHz			x dB Bandwidth	9.940 MHz		
<b>Occupied Bandwidth</b>		Occ BW % Pwr	99.00 %														
15.9268 MHz		x dB	-6.00 dB														
Transmit Freq Error	57.608 kHz																
x dB Bandwidth	9.940 MHz																
<p>802.11g-High</p>	<p>Agilent R T</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.462 GHz Span 30 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <table border="1"> <tr> <td colspan="2"><b>Occupied Bandwidth</b></td> <td>Occ BW % Pwr</td> <td>99.00 %</td> </tr> <tr> <td colspan="2">15.9395 MHz</td> <td>x dB</td> <td>-6.00 dB</td> </tr> <tr> <td>Transmit Freq Error</td> <td>76.545 kHz</td> <td></td> <td></td> </tr> <tr> <td>x dB Bandwidth</td> <td>10.358 MHz</td> <td></td> <td></td> </tr> </table> <p>Freq/Channel</p> <p>Center Freq 2.4620000 GHz</p> <p>Start Freq 2.4470000 GHz</p> <p>Stop Freq 2.4770000 GHz</p> <p>CF Step 3.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>	<b>Occupied Bandwidth</b>		Occ BW % Pwr	99.00 %	15.9395 MHz		x dB	-6.00 dB	Transmit Freq Error	76.545 kHz			x dB Bandwidth	10.358 MHz		
<b>Occupied Bandwidth</b>		Occ BW % Pwr	99.00 %														
15.9395 MHz		x dB	-6.00 dB														
Transmit Freq Error	76.545 kHz																
x dB Bandwidth	10.358 MHz																

<p>802.11n-HT20-Low</p>	
<p>802.11n-HT20-Middle</p>	
<p>802.11n-HT20-High</p>	

<p>802.11n-HT40-Low</p>	 <p>Agilent R T</p> <p>Ch Freq 2.422 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.42200000 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.422 GHz Span 60 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 35.2897 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 148.913 kHz x dB Bandwidth 30.044 MHz</p> <p>Trace/View: Trace 1 2 3, Clear Write, Max Hold, Min Hold, View, Blank, More 1 of 2</p>
<p>802.11n-HT40-Middle</p>	 <p>Agilent R T</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.437 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.437 GHz Span 60 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 35.3783 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 128.175 kHz x dB Bandwidth 33.799 MHz</p> <p>Freq/Channel: Center Freq 2.43700000 GHz, Start Freq 2.40700000 GHz, Stop Freq 2.46700000 GHz, CF Step 6.00000000 MHz, Freq Offset 0.00000000 Hz, Signal Track On, Scale Type Log</p>
<p>802.11n-HT40-High</p>	 <p>Agilent R T</p> <p>Ch Freq 2.452 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.452 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Peak Log 10 dB/Offset 1 dB</p> <p>Center 2.452 GHz Span 60 MHz</p> <p>#Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 35.4100 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 129.129 kHz x dB Bandwidth 28.828 MHz</p> <p>Trace/View: Trace 1 2 3, Clear Write, Max Hold, Min Hold, View, Blank, More 1 of 2</p>



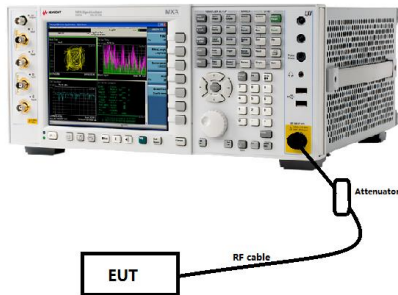
## 7. RF Output Power

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### 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 Setup Block Diagram



### 7.3 Test Procedure

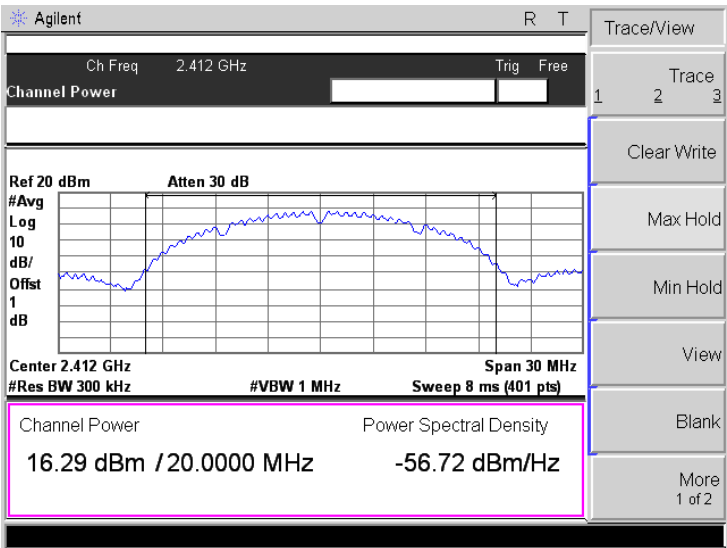
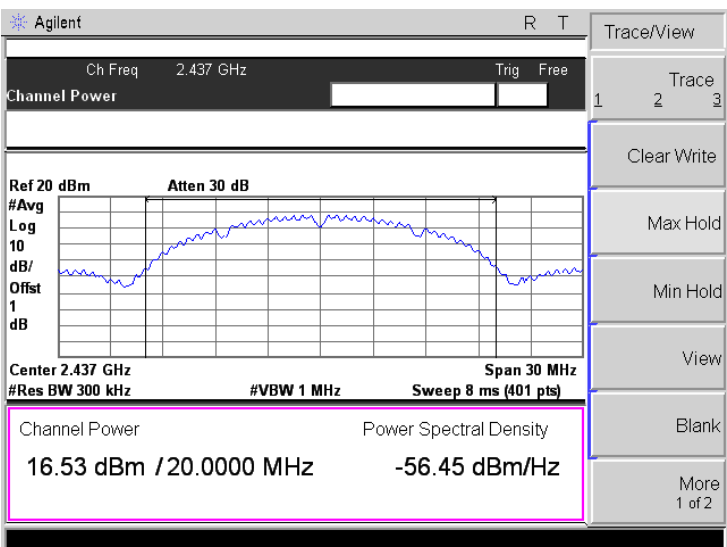
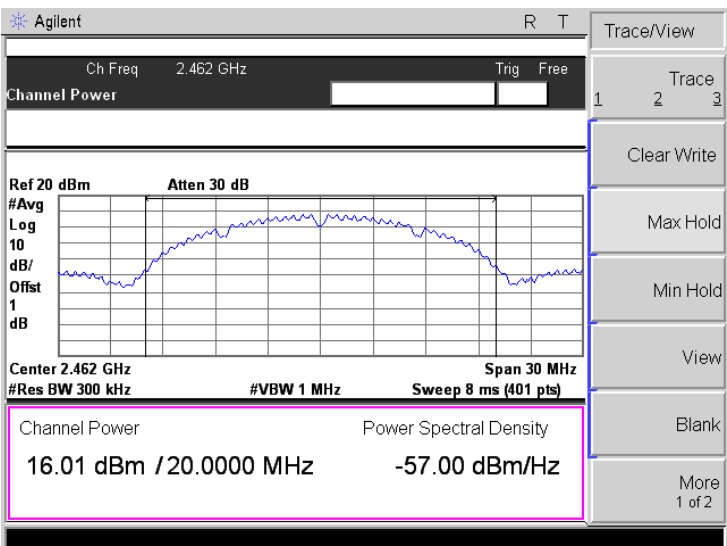
According to the KDB-558074 D01 v05r02 Subclause 8.3.2.2 and ANSI C63.10-2013 Subclause 11.9.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

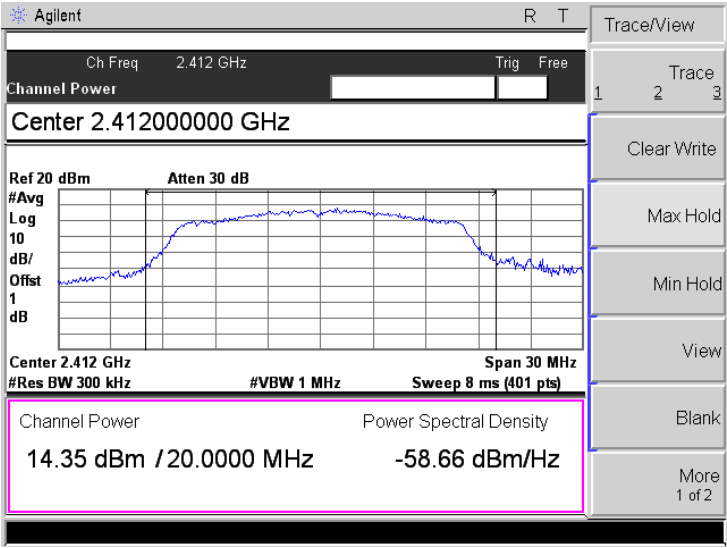
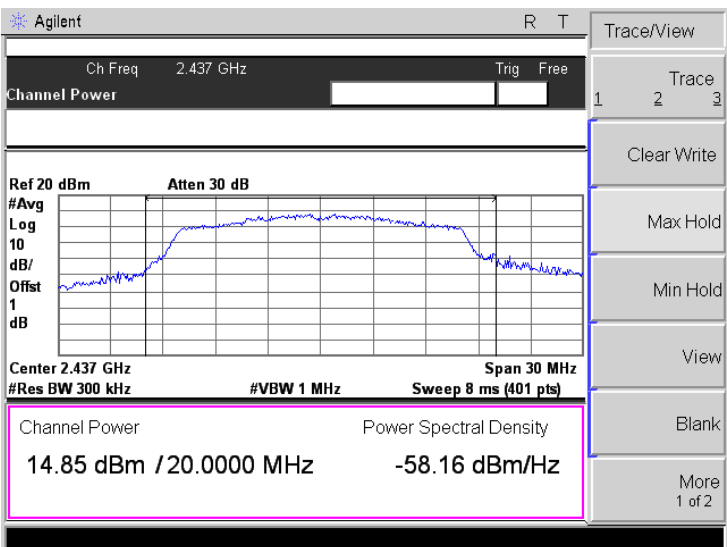
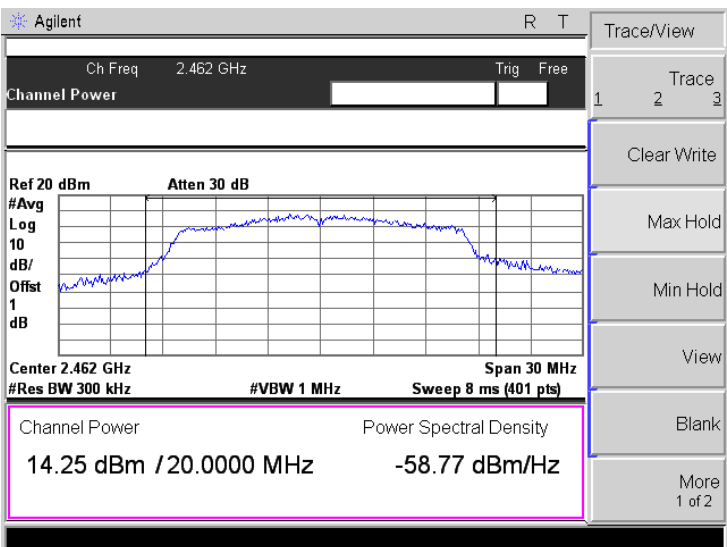
- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Number of points in sweep  $\geq 2 \times$  span / RBW. (This gives bin-to-bin spacing  $\leq$  RBW/2, so that narrowband signals are not lost between frequency bins.)
- 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.

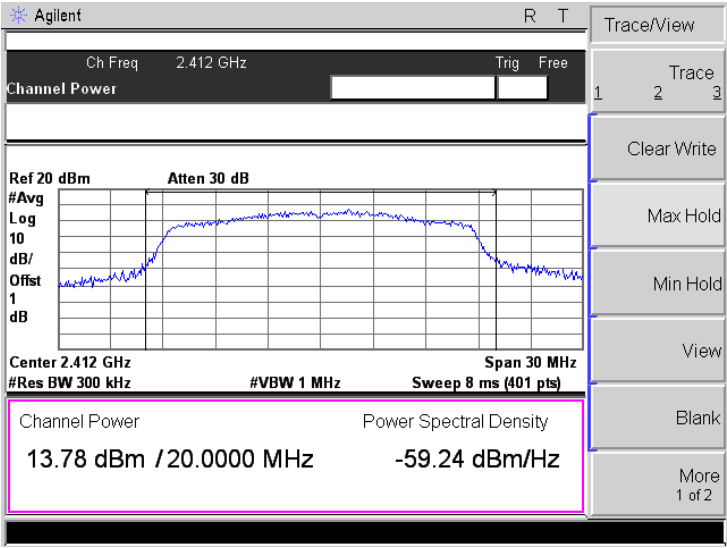
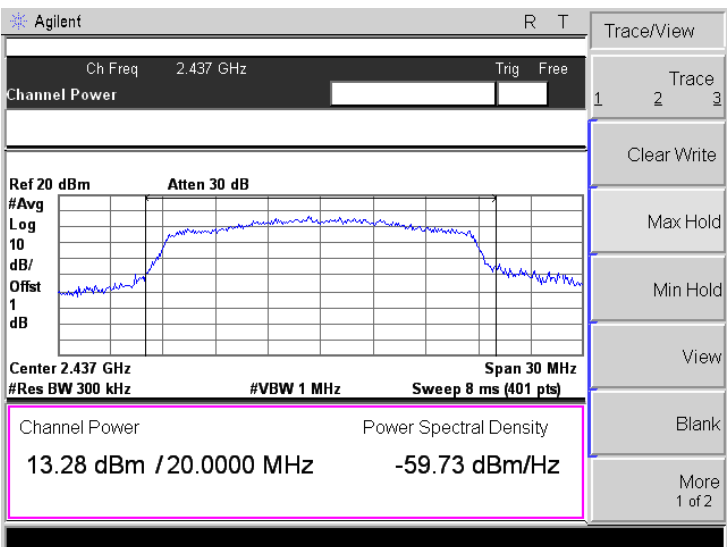
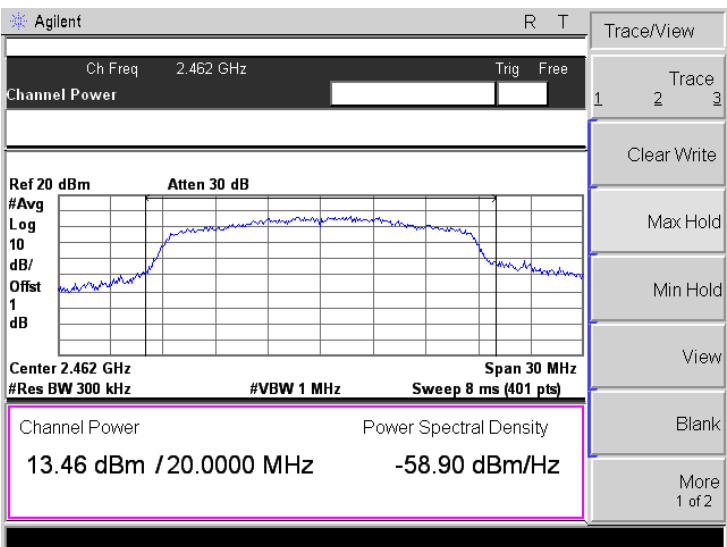
### 7.4 Summary of Test Results/Plots

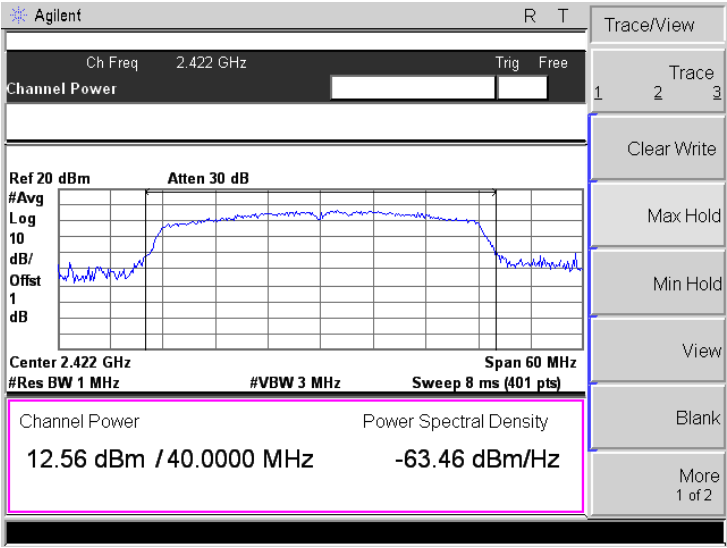
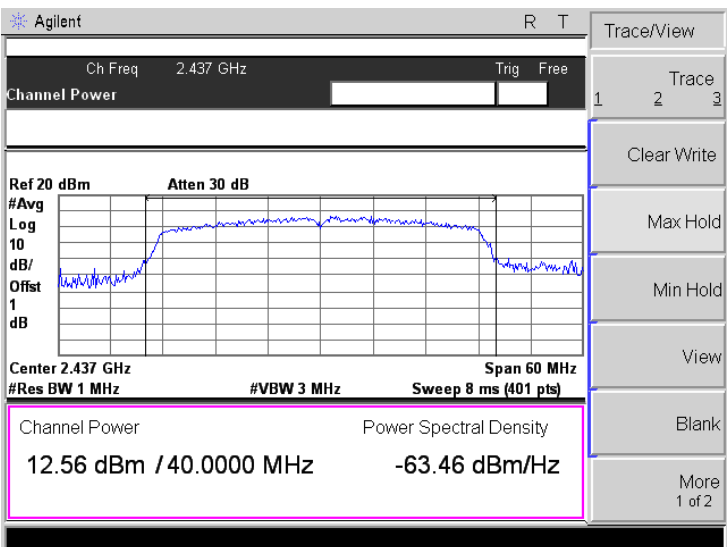
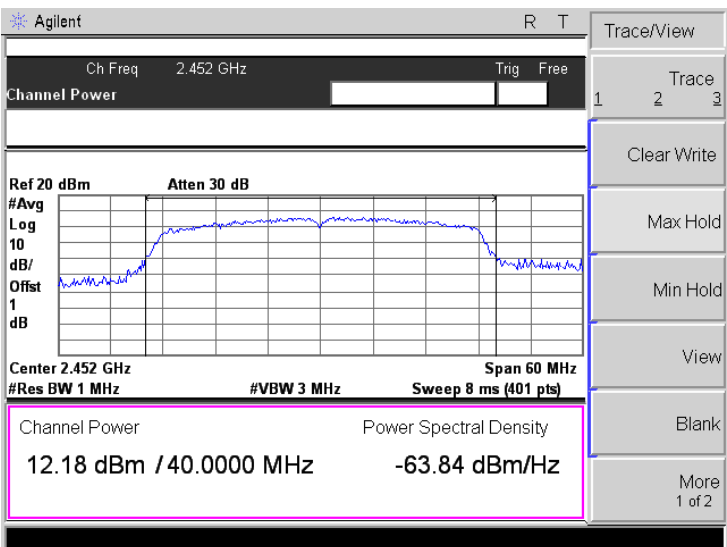
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b_11Mbps	2412	16.29	42.56	1000
	2437	16.53	44.98	1000
	2462	16.01	39.90	1000
802.11g_54Mbps	2412	14.35	27.23	1000
	2437	14.85	30.55	1000
	2462	14.25	26.61	1000
802.11n HT20_MCS7	2412	13.78	23.88	1000
	2437	13.28	21.28	1000
	2462	13.46	22.18	1000
802.11n HT40_MCS7	2422	12.56	18.03	1000
	2437	12.56	18.03	1000
	2452	12.18	16.52	1000

Please refer to the following test plots:

<p>802.11b-Low 11Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.412 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>16.29 dBm / 20.0000 MHz -56.72 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
<p>802.11b-Middle 11Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.437 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>16.53 dBm / 20.0000 MHz -56.45 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
<p>802.11b-High 11Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.462 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>16.01 dBm / 20.0000 MHz -57.00 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>

<p>802.11g-Low 54Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Channel Power</p> <p>Center 2.41200000 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.412 GHz Span 30 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density 14.35 dBm / 20.0000 MHz -58.66 dBm/Hz</p> <p>Trace 1 2 3 Clear Write Max Hold Min Hold View Blank More 1 of 2</p>
<p>802.11g-Middle 54Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Channel Power</p> <p>Center 2.437 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.437 GHz Span 30 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density 14.85 dBm / 20.0000 MHz -58.16 dBm/Hz</p> <p>Trace 1 2 3 Clear Write Max Hold Min Hold View Blank More 1 of 2</p>
<p>802.11g-High 54Mbps</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Channel Power</p> <p>Center 2.462 GHz</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.462 GHz Span 30 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density 14.25 dBm / 20.0000 MHz -58.77 dBm/Hz</p> <p>Trace 1 2 3 Clear Write Max Hold Min Hold View Blank More 1 of 2</p>

<p>802.11n-HT20-Low MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.412 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.412 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <table border="1"> <tr> <td>Channel Power</td> <td>Power Spectral Density</td> </tr> <tr> <td>13.78 dBm / 20.0000 MHz</td> <td>-59.24 dBm/Hz</td> </tr> </table> <p>Trace/View</p> <p>1 2 3 Trace</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>	Channel Power	Power Spectral Density	13.78 dBm / 20.0000 MHz	-59.24 dBm/Hz
Channel Power	Power Spectral Density				
13.78 dBm / 20.0000 MHz	-59.24 dBm/Hz				
<p>802.11n-HT20-Middle MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.437 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <table border="1"> <tr> <td>Channel Power</td> <td>Power Spectral Density</td> </tr> <tr> <td>13.28 dBm / 20.0000 MHz</td> <td>-59.73 dBm/Hz</td> </tr> </table> <p>Trace/View</p> <p>1 2 3 Trace</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>	Channel Power	Power Spectral Density	13.28 dBm / 20.0000 MHz	-59.73 dBm/Hz
Channel Power	Power Spectral Density				
13.28 dBm / 20.0000 MHz	-59.73 dBm/Hz				
<p>802.11n-HT20-High MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.462 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.462 GHz Span 30 MHz</p> <p>#Res BW 300 kHz #VBW 1 MHz Sweep 8 ms (401 pts)</p> <table border="1"> <tr> <td>Channel Power</td> <td>Power Spectral Density</td> </tr> <tr> <td>13.46 dBm / 20.0000 MHz</td> <td>-58.90 dBm/Hz</td> </tr> </table> <p>Trace/View</p> <p>1 2 3 Trace</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>	Channel Power	Power Spectral Density	13.46 dBm / 20.0000 MHz	-58.90 dBm/Hz
Channel Power	Power Spectral Density				
13.46 dBm / 20.0000 MHz	-58.90 dBm/Hz				

<p>802.11n-HT40-Low MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.422 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.422 GHz Span 60 MHz</p> <p>#Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>12.56 dBm / 40.0000 MHz -63.46 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
<p>802.11n-HT40-Middle MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.437 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.437 GHz Span 60 MHz</p> <p>#Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>12.56 dBm / 40.0000 MHz -63.46 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
<p>802.11n-HT40-High MCS7</p>	 <p>Agilent R T Trace/View</p> <p>Ch Freq 2.452 GHz Trig Free</p> <p>Channel Power</p> <p>Ref 20 dBm Atten 30 dB</p> <p>#Avg Log 10 dB/ Offst 1 dB</p> <p>Center 2.452 GHz Span 60 MHz</p> <p>#Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts)</p> <p>Channel Power Power Spectral Density</p> <p>12.18 dBm / 40.0000 MHz -63.84 dBm/Hz</p> <p>Trace 1 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>

## 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.

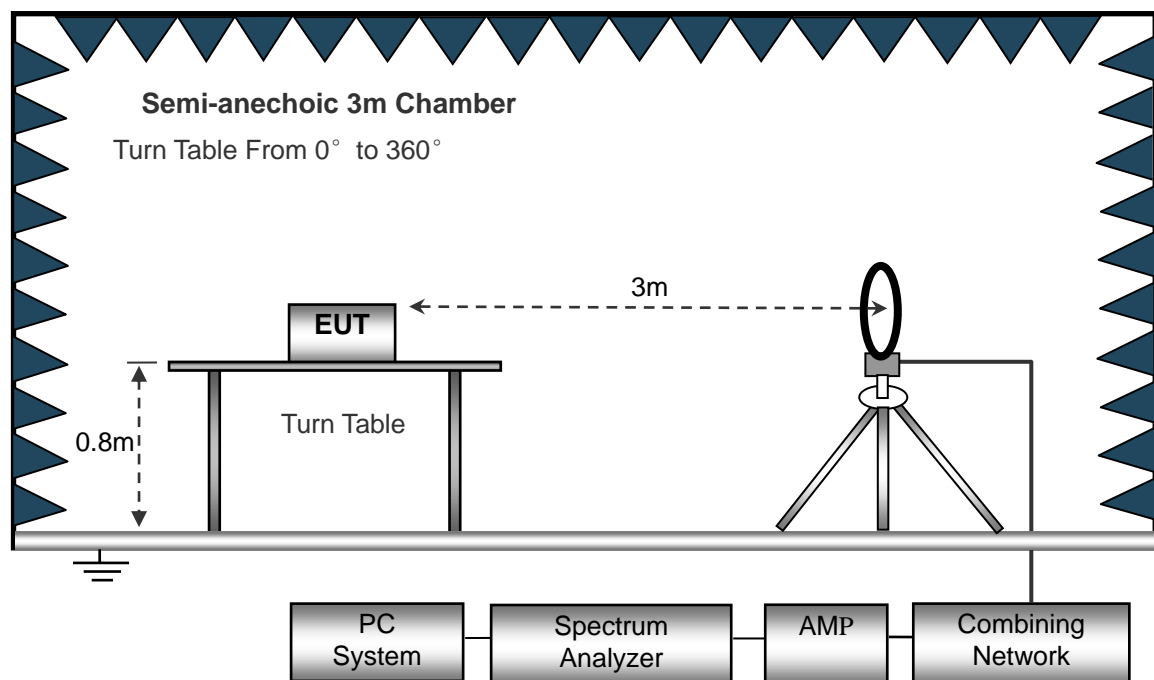
### 8.2 Test Procedure

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.

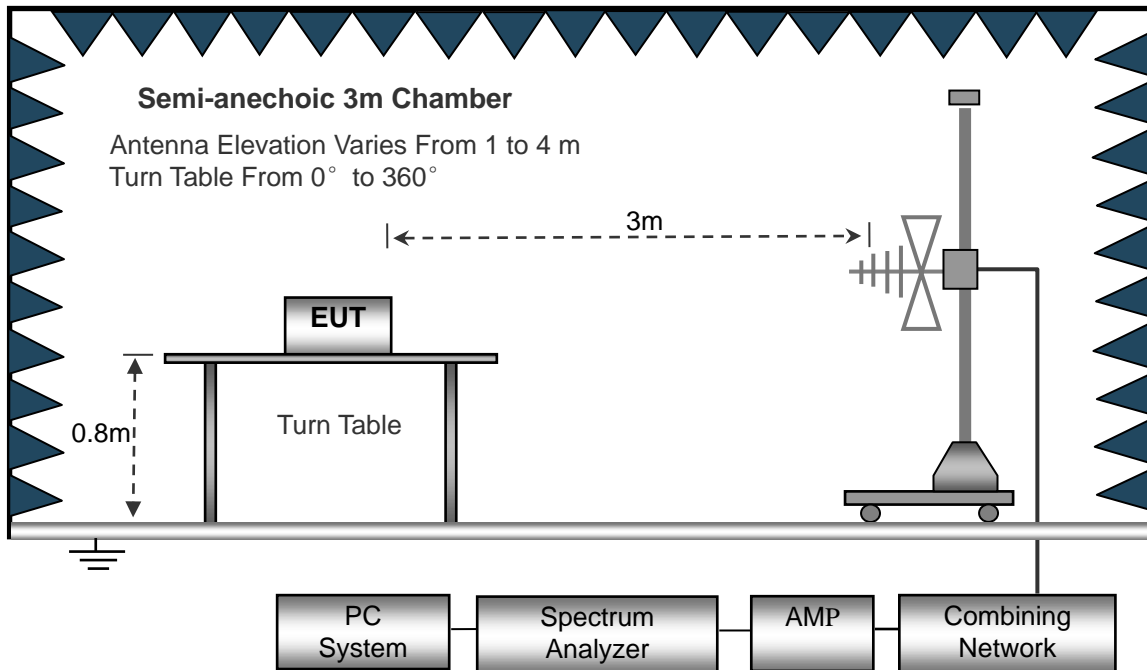
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

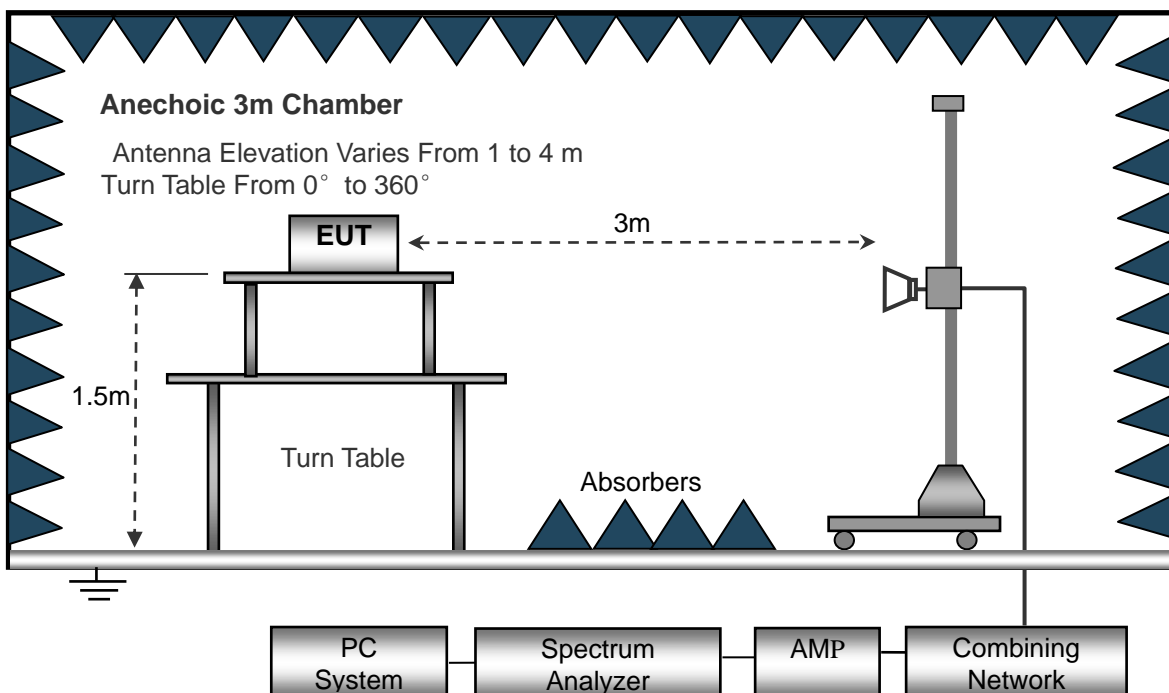
The test setup for emission measurement below 30MHz..



The test setup for emission measurement from 30 MHz to 1 GHz..



The test setup for emission measurement above 1 GHz..





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=360KHz	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

### 8.3 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 $\mu$ V means the emission is 6dB $\mu$ V below the maximum limit. The equation for margin calculation is as follows:

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

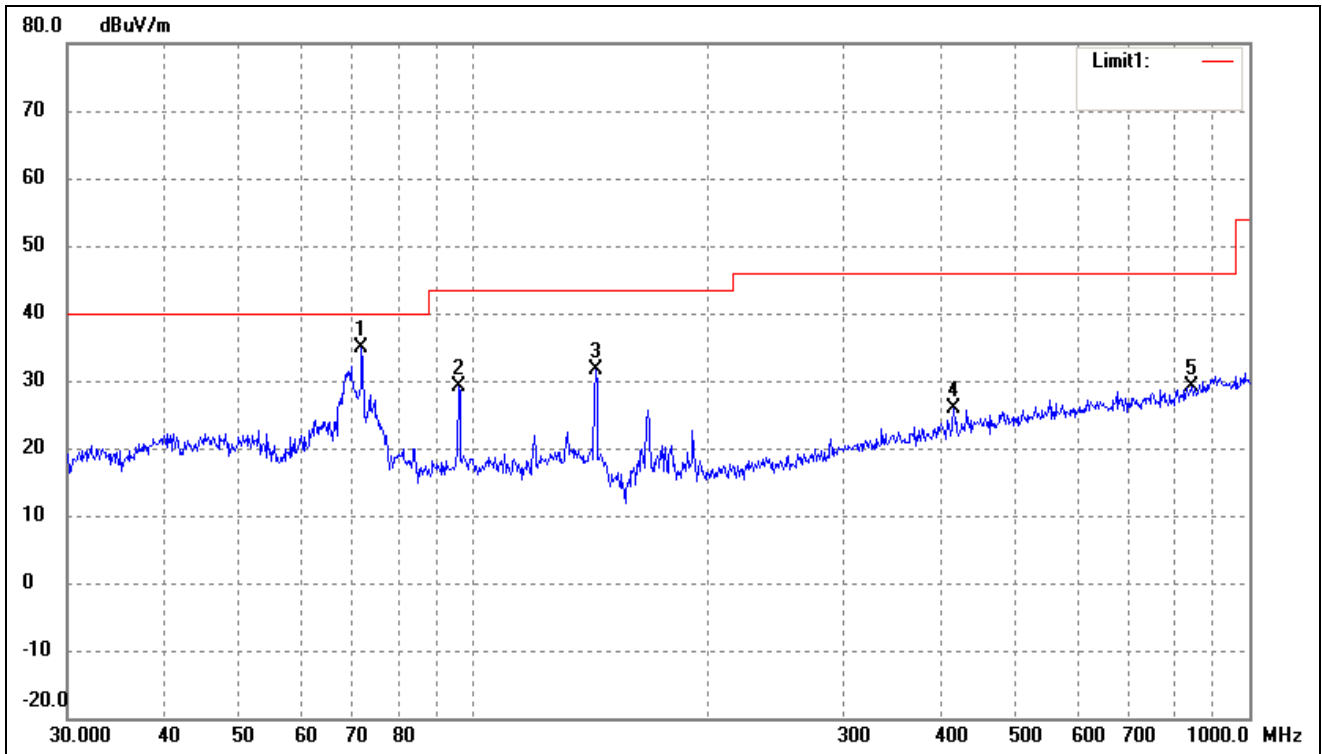
### 8.4 Summary of Test Results/Plots

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

*All test modes (different data rate and different modulation) are performed, but only the worst case(802.11b\_11Mbps) is recorded in this report.*

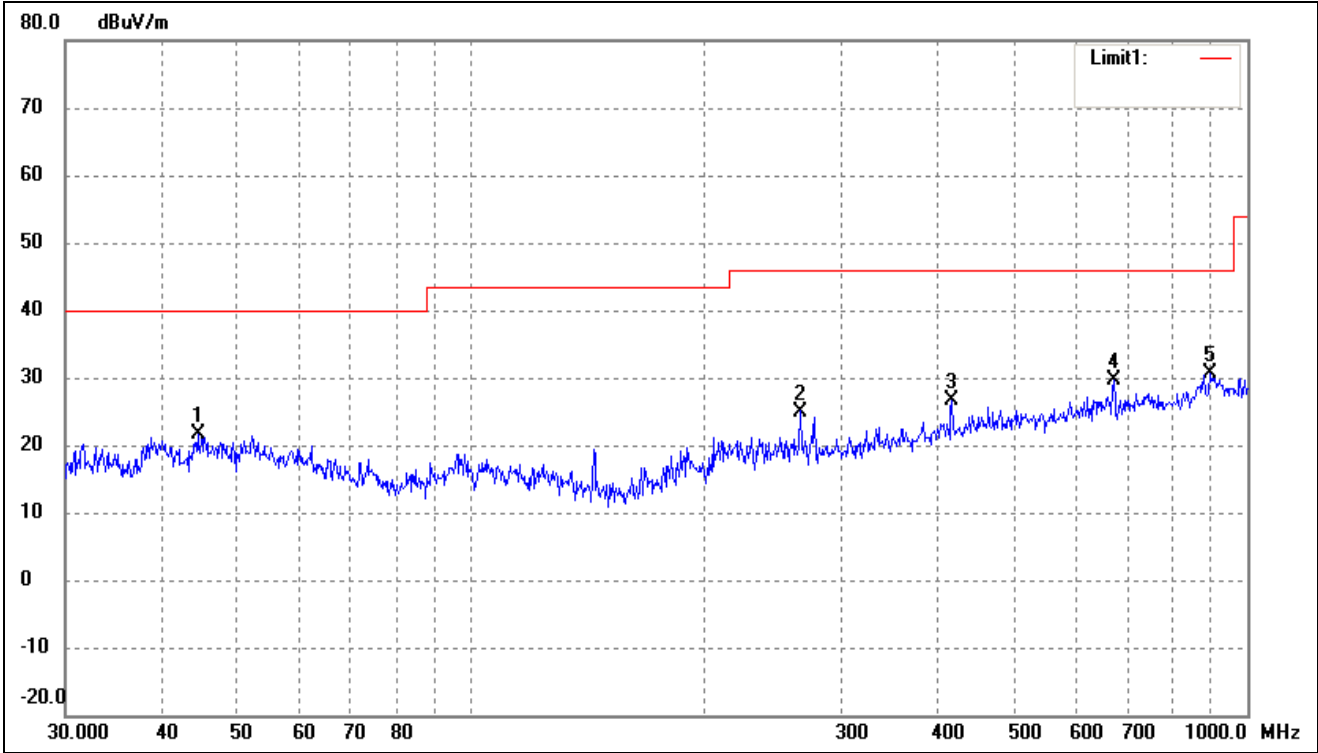
➤ Spurious Emissions Below 1GHz

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal



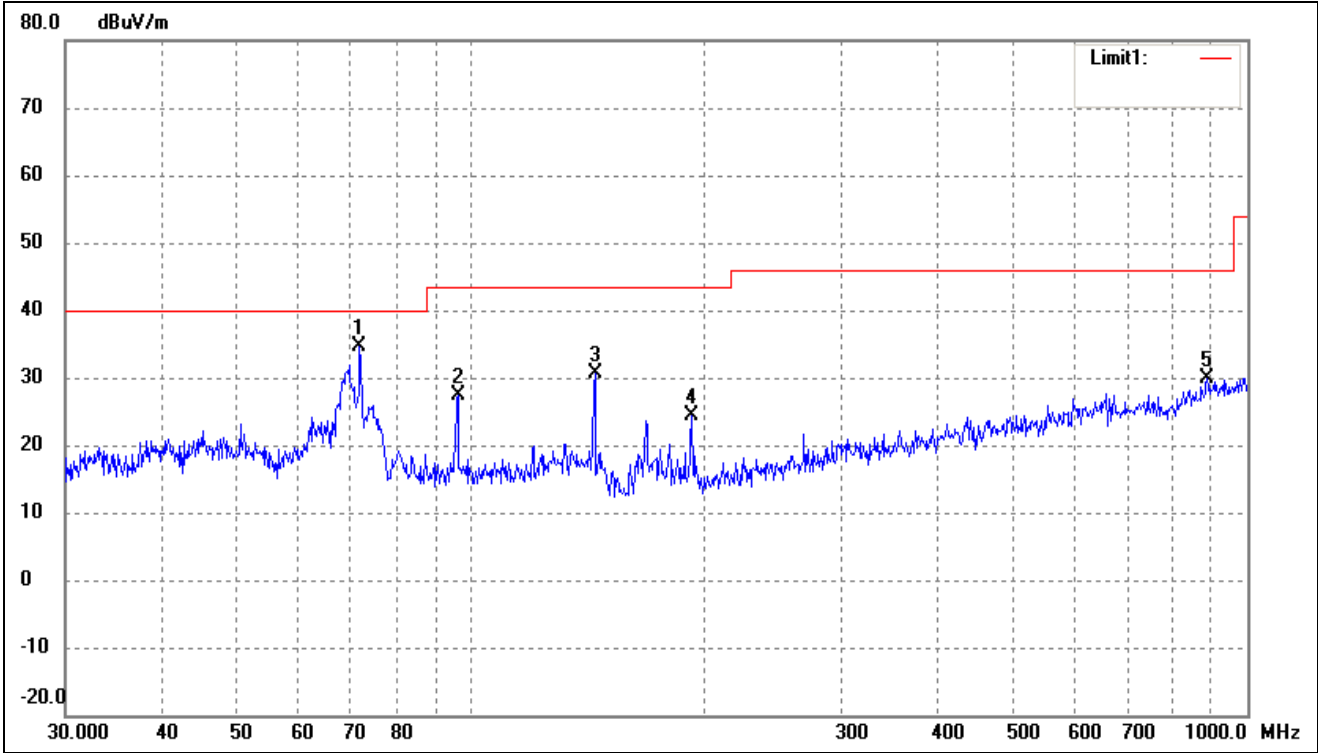
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	71.8320	49.92	-15.15	34.77	40.00	-5.23	-	-	peak
2	95.7622	43.19	-14.03	29.16	43.50	-14.34	-	-	peak
3	143.8295	47.55	-15.94	31.61	43.50	-11.89	-	-	peak
4	416.1791	31.87	-6.08	25.79	46.00	-20.21	-	-	peak
5	842.1296	28.80	0.22	29.02	46.00	-16.98	-	-	peak

802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical



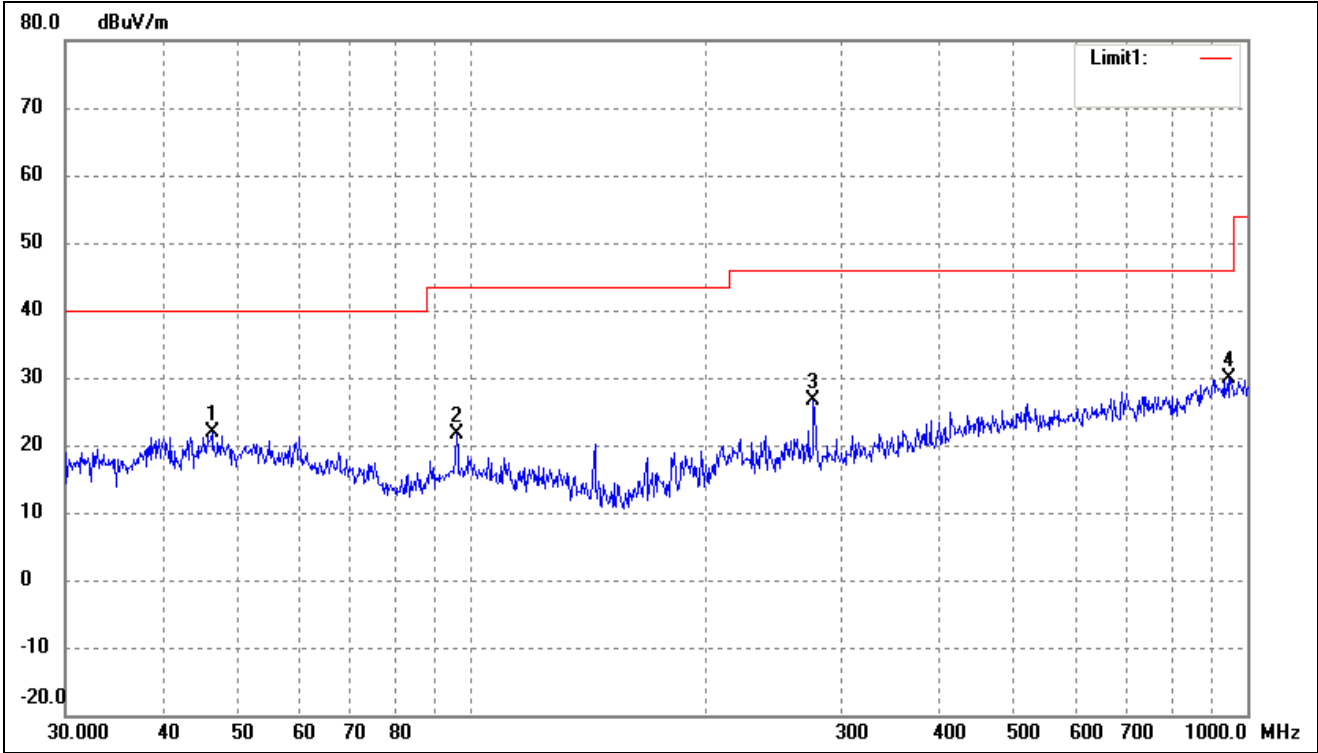
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	44.4308	33.48	-11.82	21.66	40.00	-18.34	-	-	peak
2	265.6757	35.80	-10.80	25.00	46.00	-21.00	-	-	peak
3	416.1791	32.77	-6.08	26.69	46.00	-19.31	-	-	peak
4	672.8445	31.49	-1.91	29.58	46.00	-16.42	-	-	peak
5	893.8567	29.45	1.30	30.75	46.00	-15.25	-	-	peak

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Horizontal



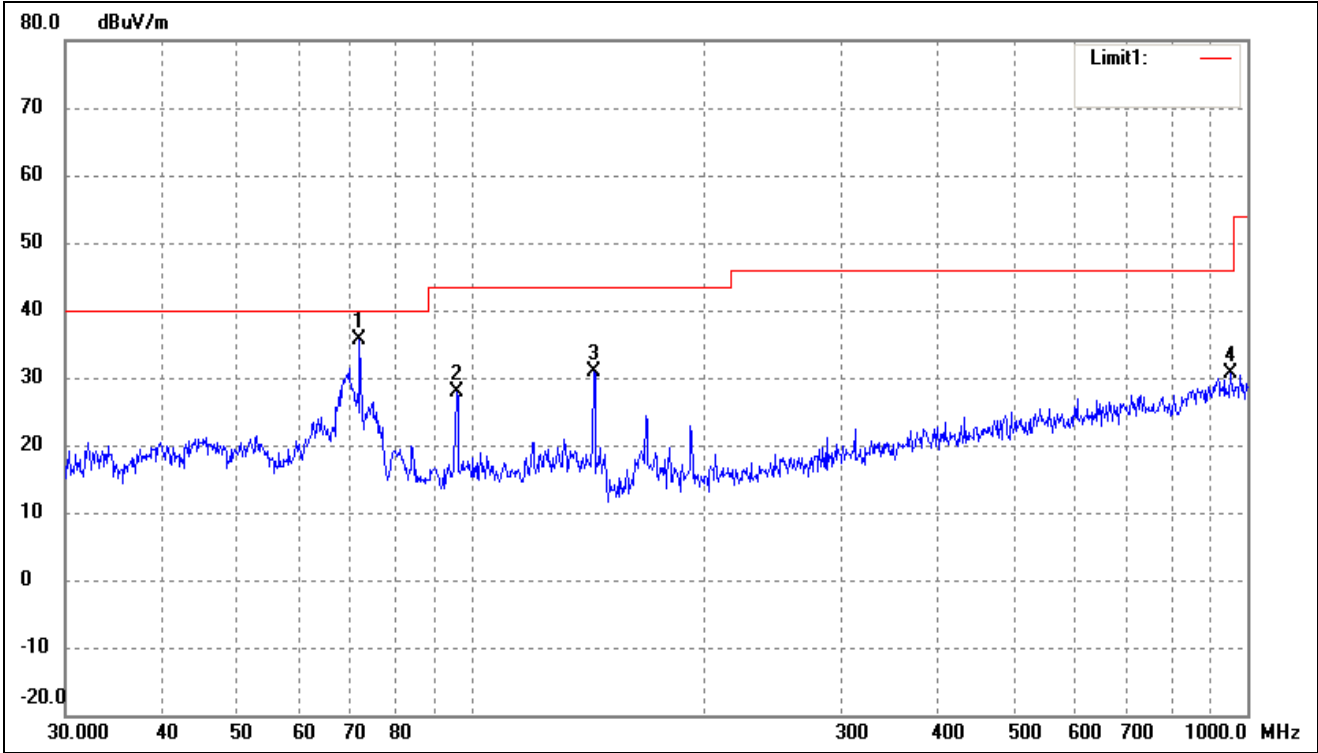
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	71.8319	49.68	-15.15	34.53	40.00	-5.47	-	-	peak
2	96.0986	41.26	-13.96	27.30	43.50	-16.20	-	-	peak
3	144.3348	46.47	-15.89	30.58	43.50	-12.92	-	-	peak
4	192.4185	37.24	-12.94	24.30	43.50	-19.20	-	-	peak
5	887.6099	28.92	1.05	29.97	46.00	-16.03	-	-	peak

802.11b_11Mbps			
Test Channel	Middle	Polarity:	Vertical



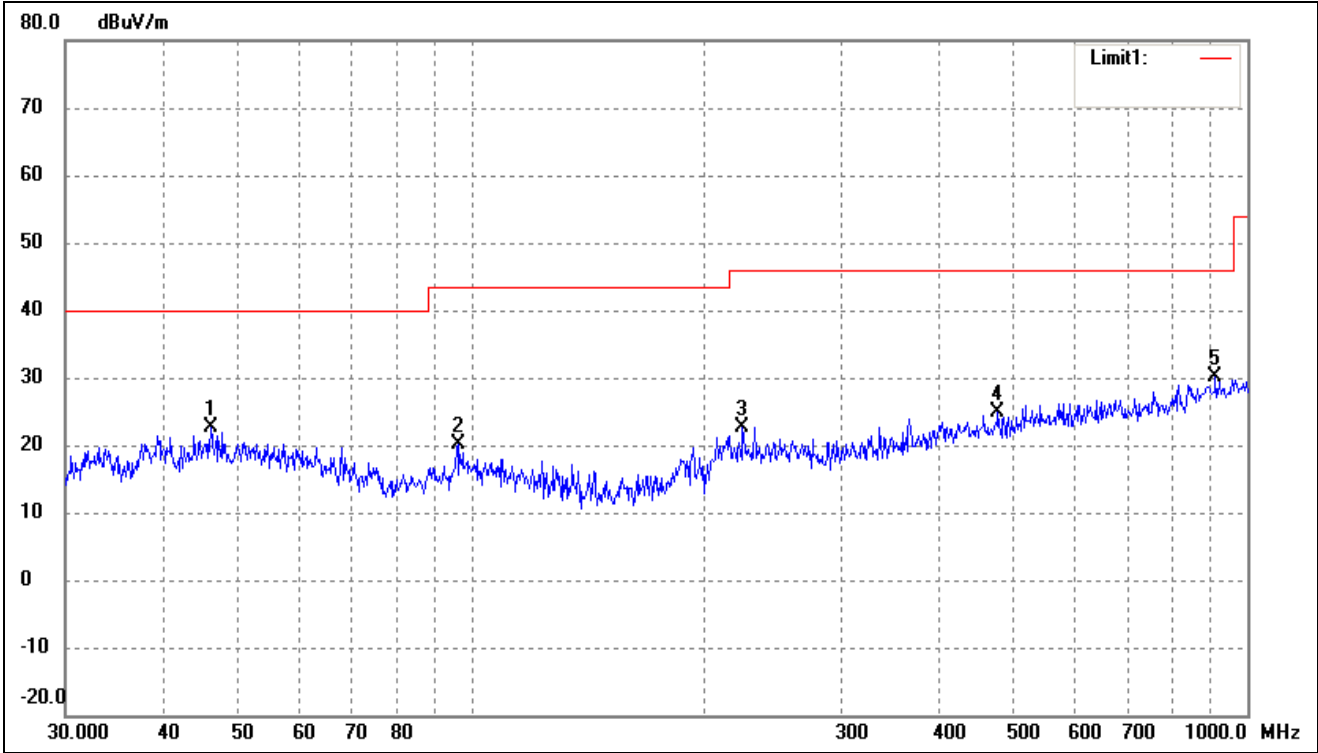
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	46.3402	33.50	-11.73	21.77	40.00	-18.23	-	-	peak
2	95.7622	35.77	-14.03	21.74	43.50	-21.76	-	-	peak
3	276.1236	37.32	-10.68	26.64	46.00	-19.36	-	-	peak
4	948.7610	28.58	1.39	29.97	46.00	-16.03	-	-	peak

802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	71.8320	50.77	-15.15	35.62	40.00	-4.38	-	-	peak
2	95.7622	41.79	-14.03	27.76	43.50	-15.74	-	-	peak
3	143.8295	46.81	-15.94	30.87	43.50	-12.63	-	-	peak
4	952.0937	29.27	1.37	30.64	46.00	-15.36	-	-	peak

802.11b_11Mbps			
Test Channel	High	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	46.1780	34.45	-11.73	22.72	40.00	-17.28	-	-	peak
2	96.0986	34.05	-13.96	20.09	43.50	-23.41	-	-	peak
3	223.7334	34.89	-12.15	22.74	46.00	-23.26	-	-	peak
4	477.1694	29.72	-4.74	24.98	46.00	-21.02	-	-	peak
5	909.6667	28.35	1.67	30.02	46.00	-15.98	-	-	peak

Remark: '-'Means' the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

- Spurious Emissions Above 1GHz
- Test Mode: 802.11b\_11Mbps (worst case)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4821.757	57.45	-4.50	52.95	74.00	-21.05	H	PK
7624.250	51.85	-1.72	50.13	74.00	-23.87	H	AV
9985.762	50.73	2.28	53.01	74.00	-20.99	H	PK
4821.257	46.66	-4.50	42.16	54.00	-11.84	V	AV
4821.757	61.15	-4.50	56.65	74.00	-17.35	V	PK
6544.350	52.19	-2.28	49.91	74.00	-24.09	V	PK
10011.213	50.17	2.32	52.49	74.00	-21.51	V	PK
Middle Channel-2437MHz							
4871.052	46.43	-4.47	41.96	54.00	-12.04	H	AV
4871.103	60.38	-4.47	55.91	74.00	-18.09	H	PK
7099.747	52.07	-2.24	49.83	74.00	-24.17	H	PK
9490.105	50.78	1.56	52.34	74.00	-21.66	H	PK
4863.683	46.45	-4.47	41.98	54.00	-12.02	V	AV
4871.103	59.00	-4.47	54.53	74.00	-19.47	V	PK
7154.172	52.03	-2.22	49.81	74.00	-24.19	V	PK
9960.375	50.84	2.25	53.09	74.00	-20.91	V	PK
High Channel-2462MHz							
4920.955	59.99	-4.44	55.55	74.00	-18.45	H	PK
4923.955	46.76	-4.44	42.32	54.00	-11.68	H	AV
6544.350	52.87	-2.28	50.59	74.00	-23.41	H	PK
9465.978	51.32	1.52	52.84	74.00	-21.16	H	PK
4920.955	57.61	-4.44	53.17	74.00	-20.83	V	PK
6544.350	52.24	-2.28	49.96	74.00	-24.04	V	PK
9587.228	50.94	1.70	52.64	74.00	-21.36	V	PK

Note: 1. 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.

2. Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.



## 9. Out of Band Emissions

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### 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 558074 D01 v05r02 Subclause 8.4 and ANSI C63.10-2013 Subclause 11.11, the emissions in nonrestricted frequency bands test method as follows:

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW  $\geq [3 \times \text{RBW}]$ .
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

According to the KDB 558074 D01 v05r02 Subclause 8.5 and ANSI C63.10-2013 Subclause 11.12, the emissions in restricted frequency bands test method as follows:

#### A. Radiated emission measurements:

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.

#### B. Antenna-port conducted measurements

Peak emission levels are measured by setting the instrument as follows:

- a) RBW = as specified in Table 9.
- b) VBW  $\geq$   $[3 \times \text{RBW}]$ .
- c) Detector = peak.
- d) Sweep time = auto.
- e) Trace mode = max hold.
- f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

**Table 9—RBW as a function of frequency**

Frequency	RBW
9 kHz to 150 kHz	200 Hz to 300 Hz
0.15 MHz to 30 MHz	9 kHz to 10 kHz
30 MHz to 1000 MHz	100 kHz to 120 kHz
>1000 MHz	1 MHz

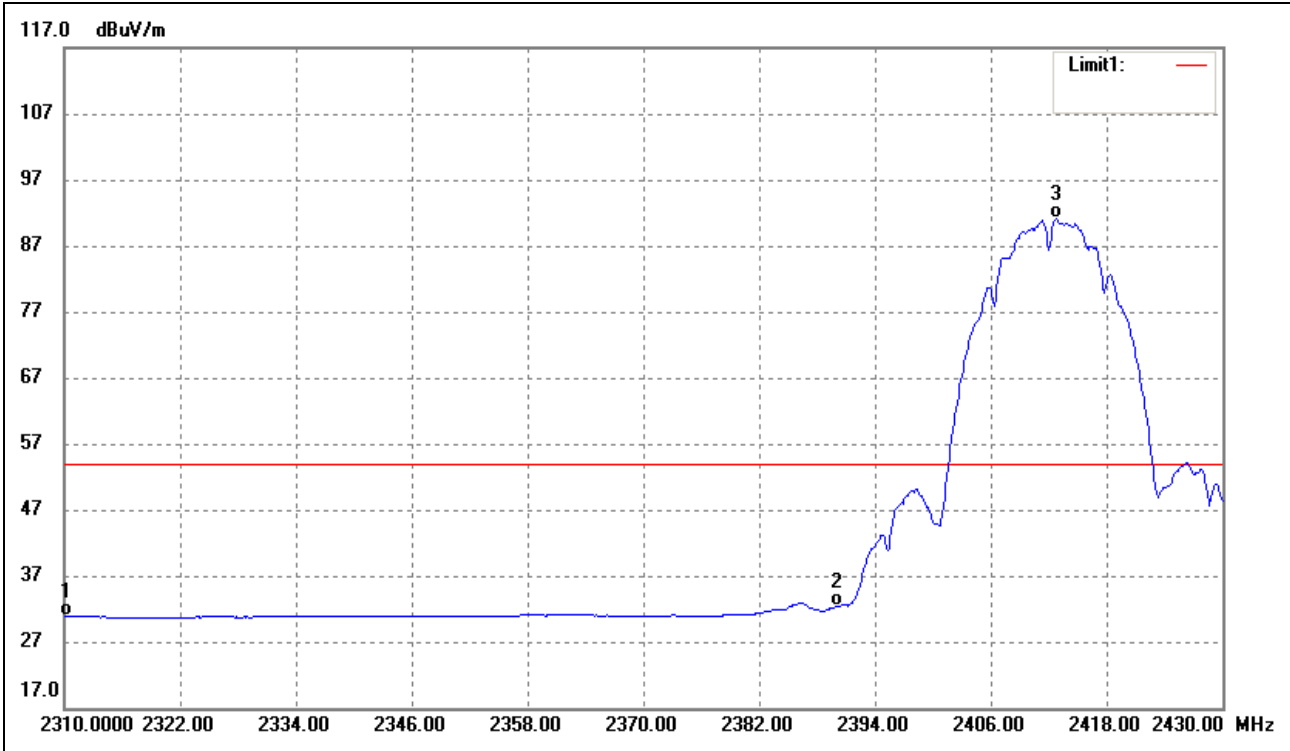
If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

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 Summary of Test Results/Plots

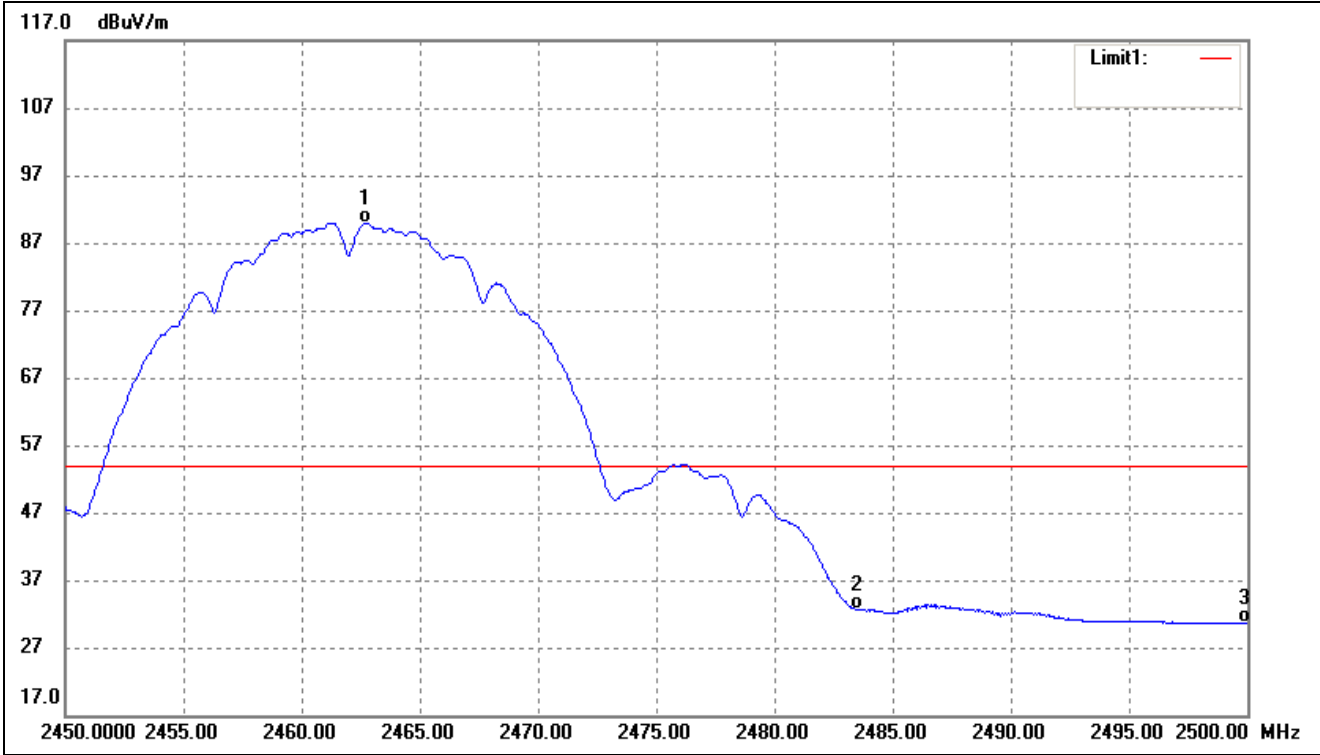
➤ Radiated test

802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal (worst case)



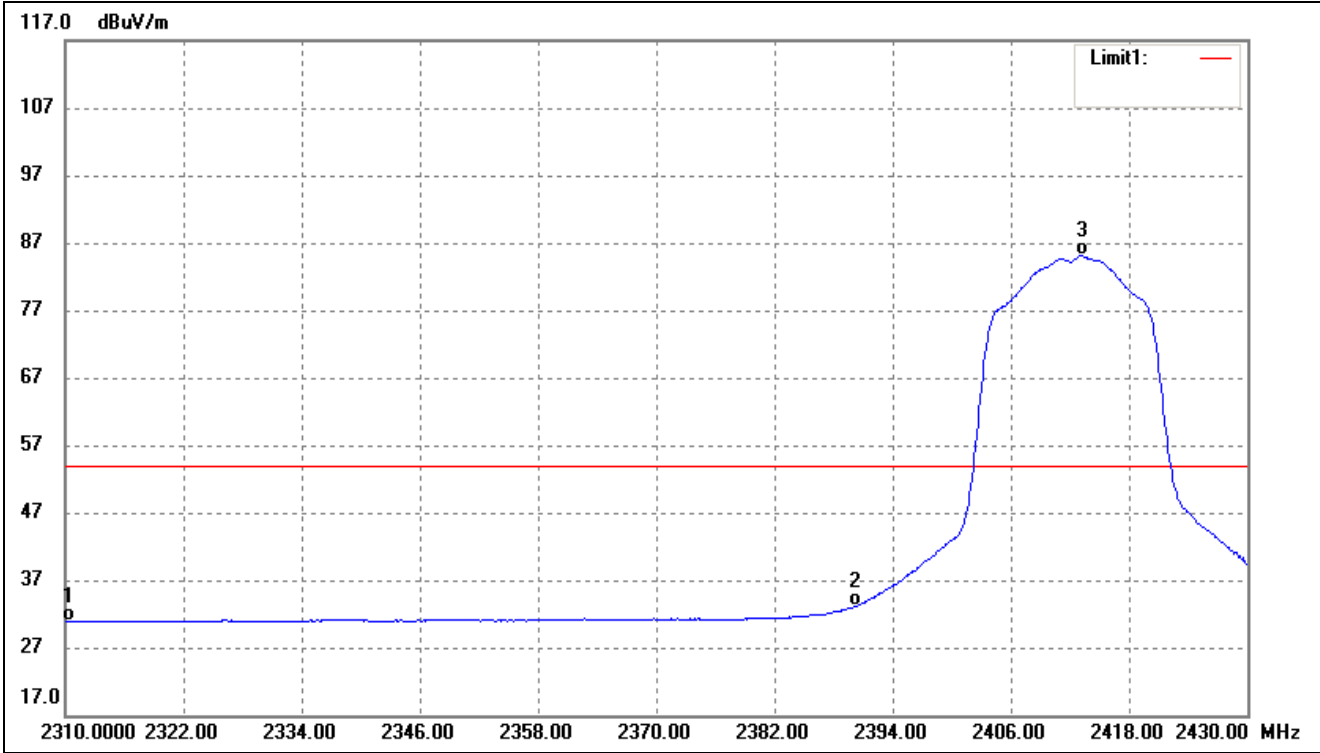
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	40.52	-9.66	30.86	54.00	-23.14	Average Detector
		52.05	-9.66	42.39	74.00	-31.61	Peak Detector
2	2390.000	41.85	-9.50	32.35	54.00	-21.65	Average Detector
		54.08	-9.50	44.58	74.00	-29.42	Peak Detector
3	2412.720	100.60	-9.46	91.14	/	/	Average Detector
		2412.120	107.79	-9.46	98.33	/	Peak Detector

802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal (worst case)



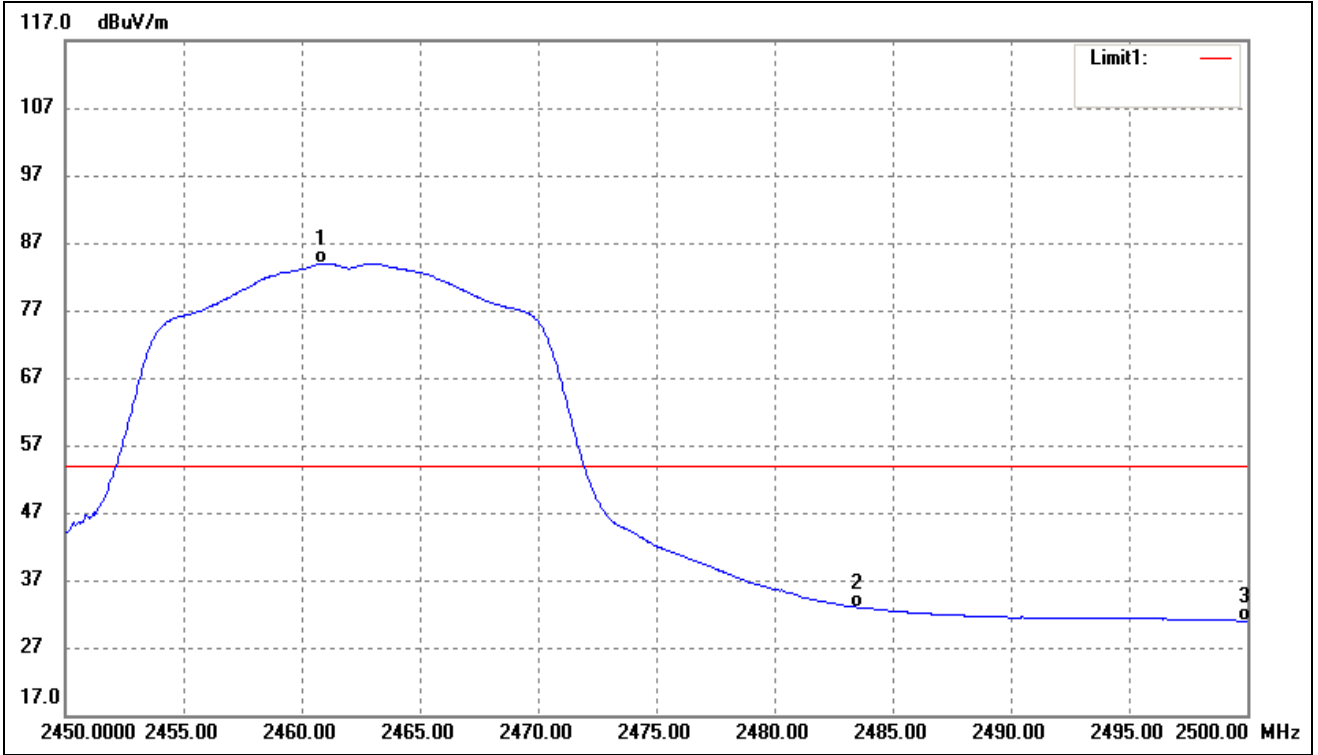
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2462.700	99.36	-9.36	90.00	/	/	Average Detector
	2462.000	106.73	-9.36	97.37	/	/	Peak Detector
2	2483.500	41.86	-9.31	32.55	54.00	-21.45	Average Detector
	2483.500	53.99	-9.31	44.68	74.00	-29.32	Peak Detector
3	2500.000	39.81	-9.28	30.53	54.00	-23.47	Average Detector
	2500.000	52.11	-9.28	42.83	74.00	-31.17	Peak Detector

802.11g_54Mbps			
Test Channel	Low	Polarity:	Horizontal (worst case)



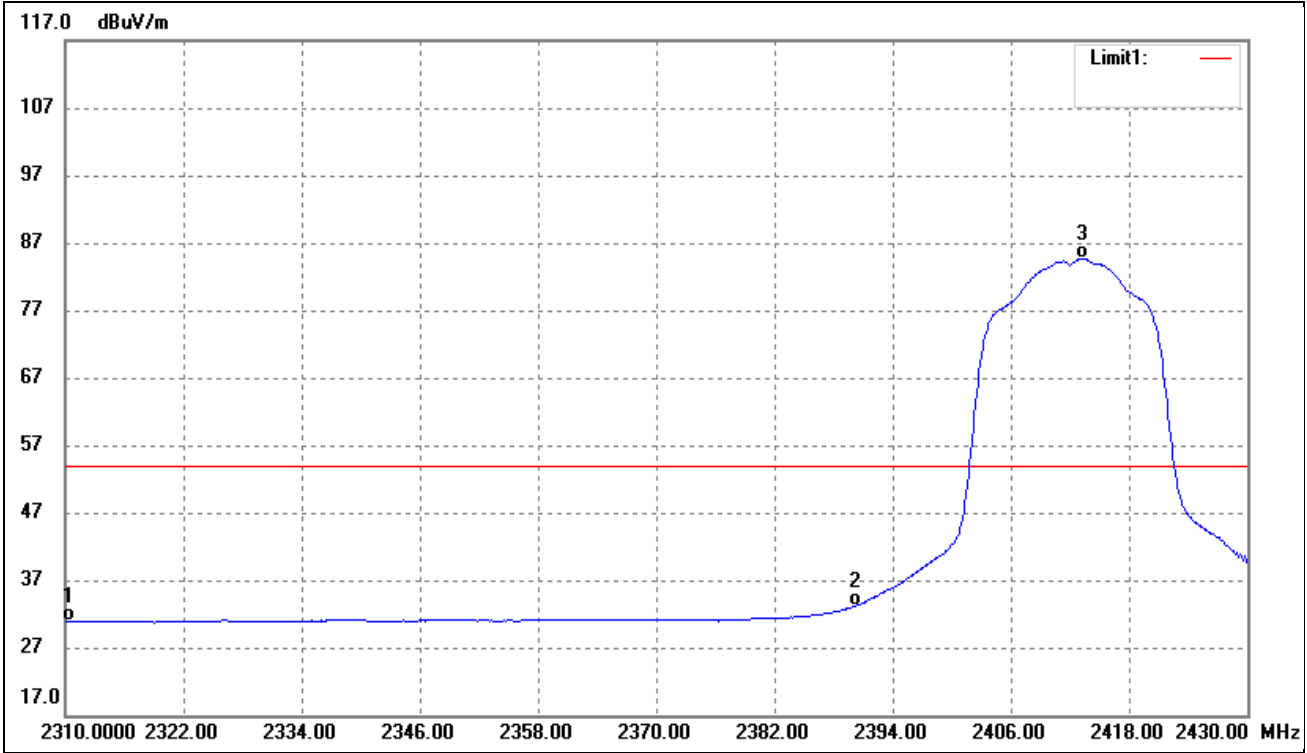
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	40.51	-9.66	30.85	54.00	-23.15	Average Detector
	2310.000	52.94	-9.66	43.28	74.00	-30.72	Peak Detector
2	2390.000	42.53	-9.50	33.03	54.00	-20.97	Average Detector
	2390.000	55.20	-9.50	45.70	74.00	-28.30	Peak Detector
3	2413.200	94.52	-9.46	85.06	/	/	Average Detector
	2413.080	105.97	-9.46	96.51	/	/	Peak Detector

802.11g_54Mbps			
Test Channel	High	Polarity:	Horizontal (worst case)



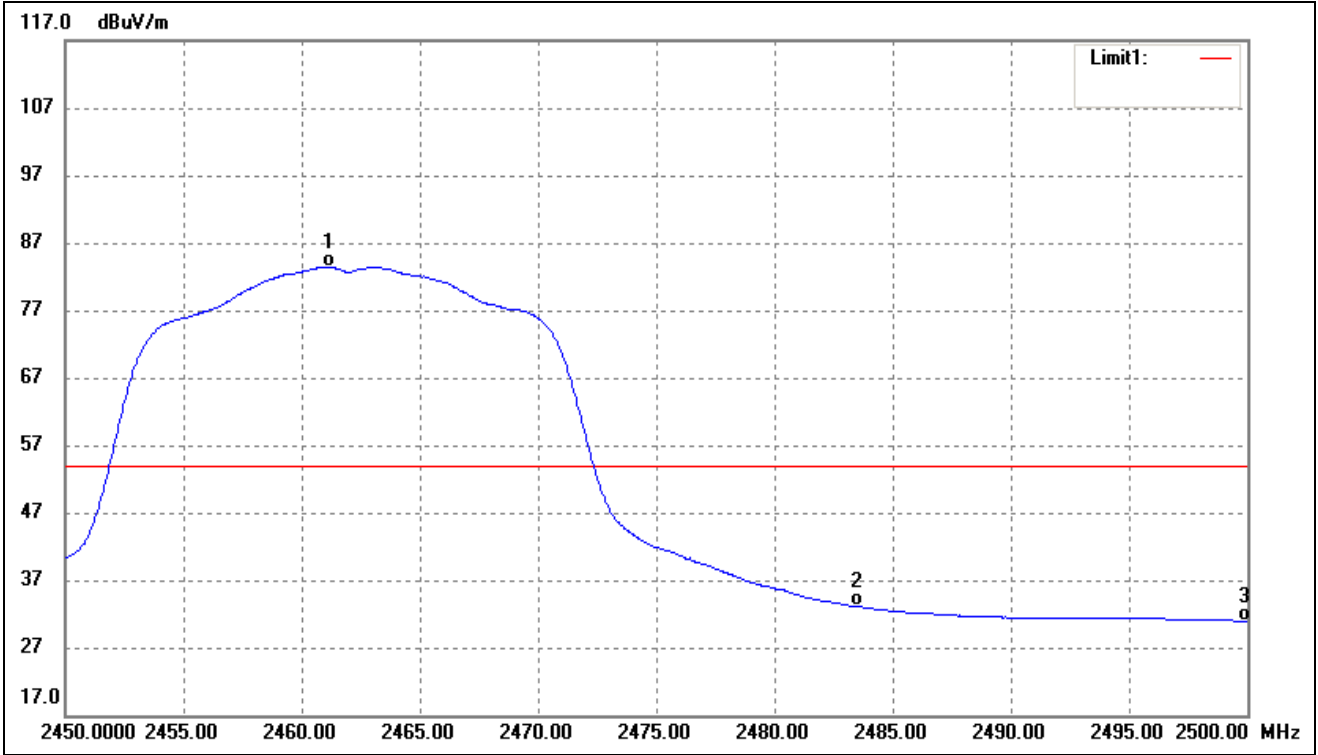
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2460.850	93.29	-9.36	83.93	/	/	Average Detector
	2462.850	104.76	-9.36	95.40	/	/	Peak Detector
2	2483.500	42.29	-9.31	32.98	54.00	-21.02	Average Detector
	2483.500	55.74	-9.31	46.43	74.00	-27.57	Peak Detector
3	2500.000	40.24	-9.28	30.96	54.00	-23.04	Average Detector
	2500.000	52.86	-9.28	43.58	74.00	-30.42	Peak Detector

802.11n-HT20_MCS7			
Test Channel	Low	Polarity:	Horizontal (worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	40.51	-9.66	30.85	54.00	-23.15	Average Detector
		52.29	-9.66	42.63	74.00	-31.37	Peak Detector
2	2390.000	42.63	-9.50	33.13	54.00	-20.87	Average Detector
		57.06	-9.50	47.56	74.00	-26.44	Peak Detector
3	2413.320	94.06	-9.46	84.60	/	/	Average Detector
		105.06	-9.46	95.60	/	/	Peak Detector

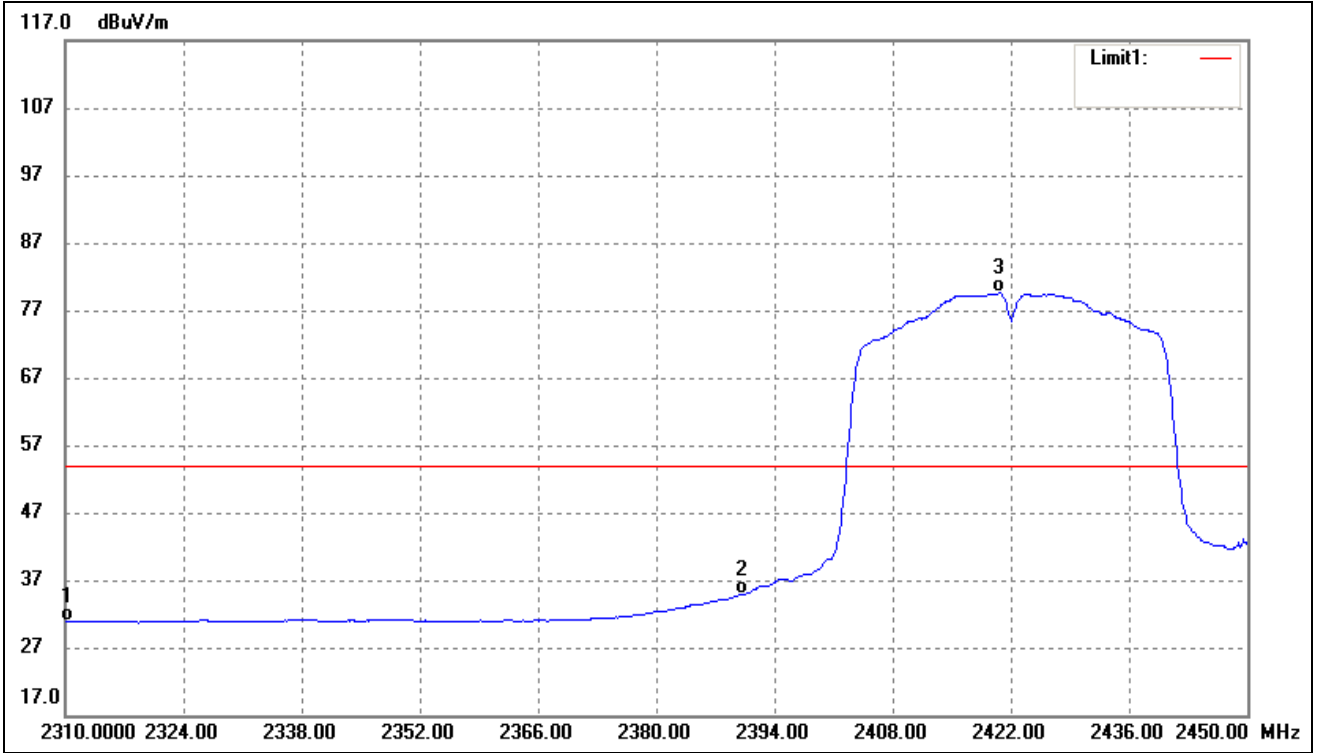
802.11n-HT20_MCS7			
Test Channel	High	Polarity:	Horizontal (worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2461.150	92.77	-9.36	83.41	/	/	Average Detector
	2463.250	103.72	-9.36	94.36	/	/	Peak Detector
2	2483.500	42.35	-9.31	33.04	54.00	-20.96	Average Detector
	2483.500	56.02	-9.31	46.71	74.00	-27.29	Peak Detector
3	2500.000	40.22	-9.28	30.94	54.00	-23.06	Average Detector
	2500.000	51.37	-9.28	42.09	74.00	-31.91	Peak Detector

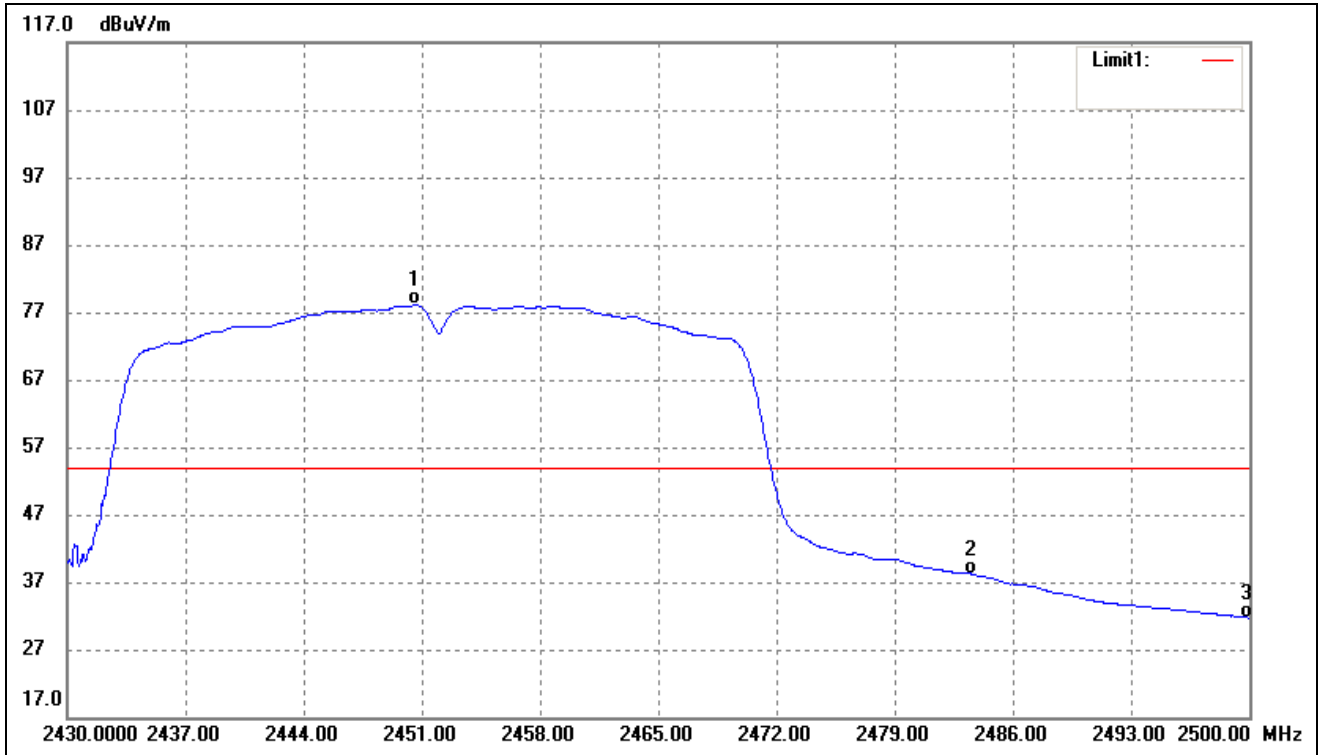


802.11n-HT40_MCS7			
Test Channel	Low	Polarity:	Horizontal (worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	40.44	-9.66	30.78	54.00	-23.22	Average Detector
		54.01	-9.66	44.35	74.00	-29.65	Peak Detector
2	2390.000	44.40	-9.50	34.90	54.00	-19.10	Average Detector
		65.94	-9.50	56.44	74.00	-17.56	Peak Detector
3	2420.600	88.96	-9.44	79.52	/	/	Average Detector
		100.54	-9.43	91.11	/	/	Peak Detector

802.11n-HT40_MCS7			
Test Channel	High	Polarity:	Horizontal (worst case)

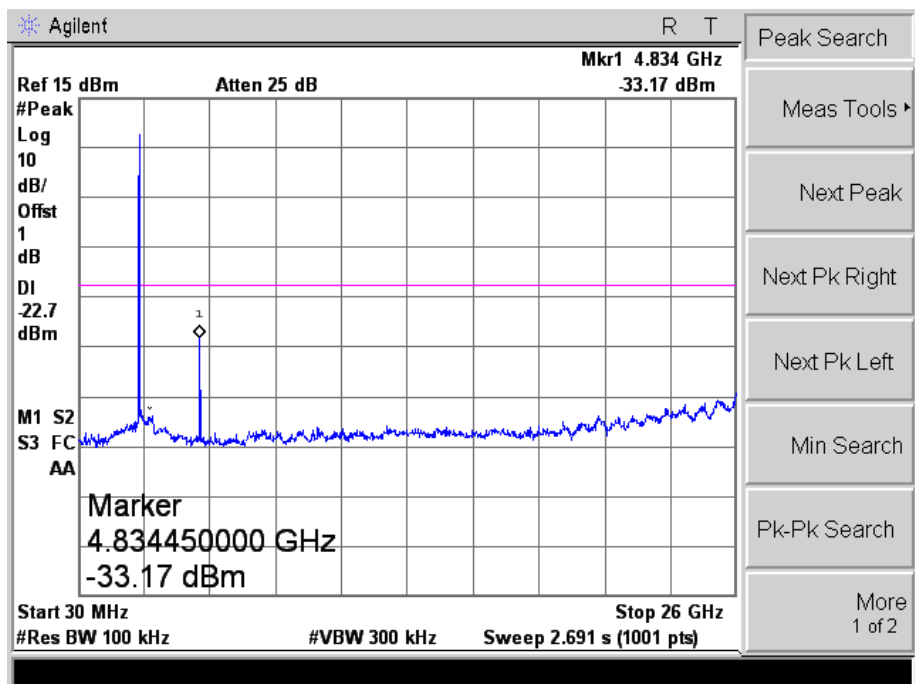
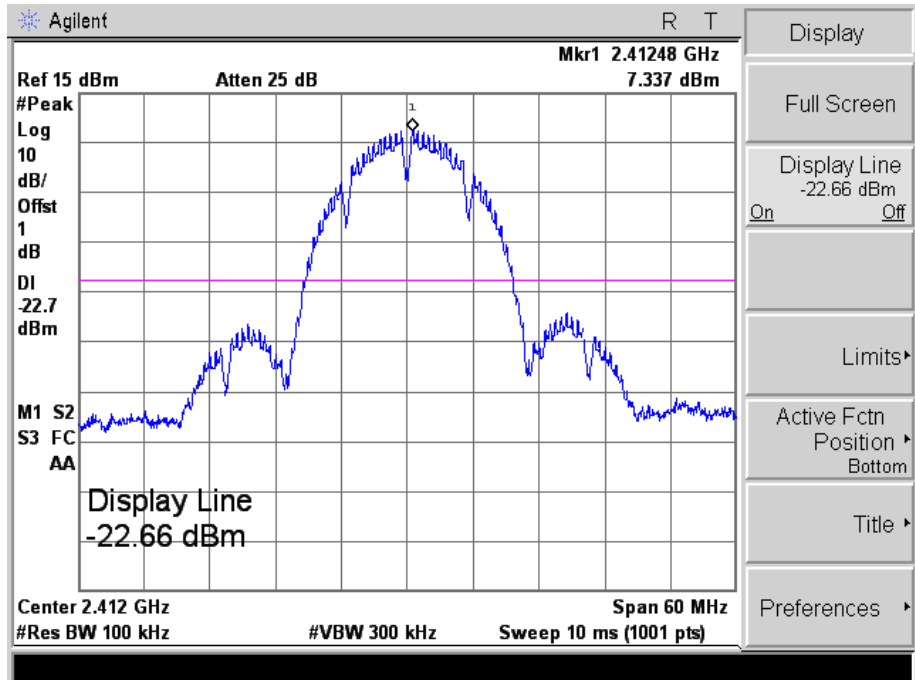


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2450.580	87.47	-9.38	78.09	/	/	Average Detector
	2454.150	99.46	-9.37	90.09	/	/	Peak Detector
2	2483.500	47.53	-9.31	38.22	54.00	-15.78	Average Detector
	2483.500	61.51	-9.31	52.20	74.00	-21.80	Peak Detector
3	2500.000	41.03	-9.28	31.75	54.00	-22.25	Average Detector
	2500.000	53.38	-9.28	44.10	74.00	-29.90	Peak Detector

➤ Conducted test

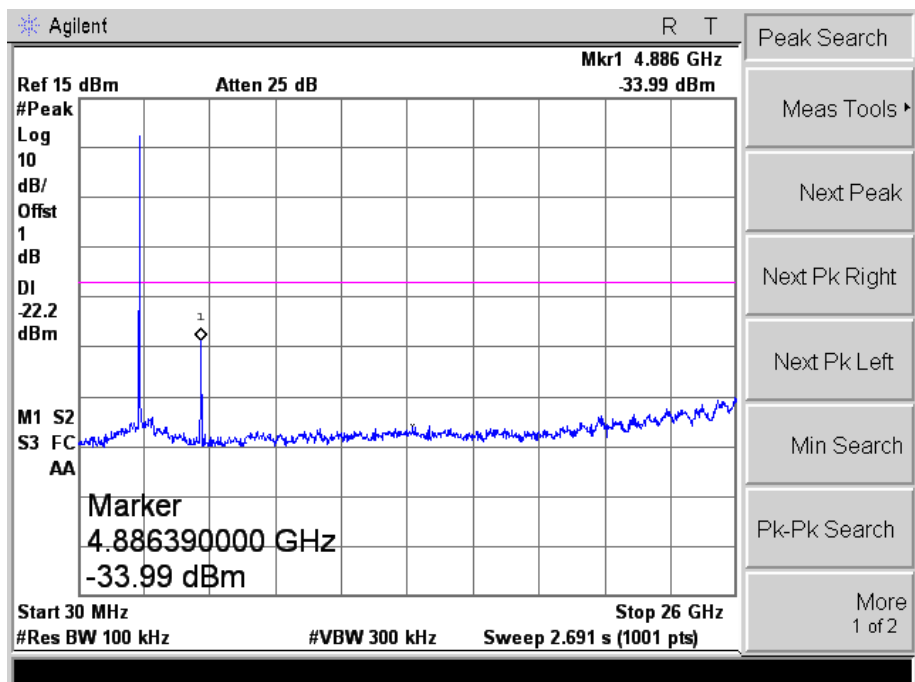
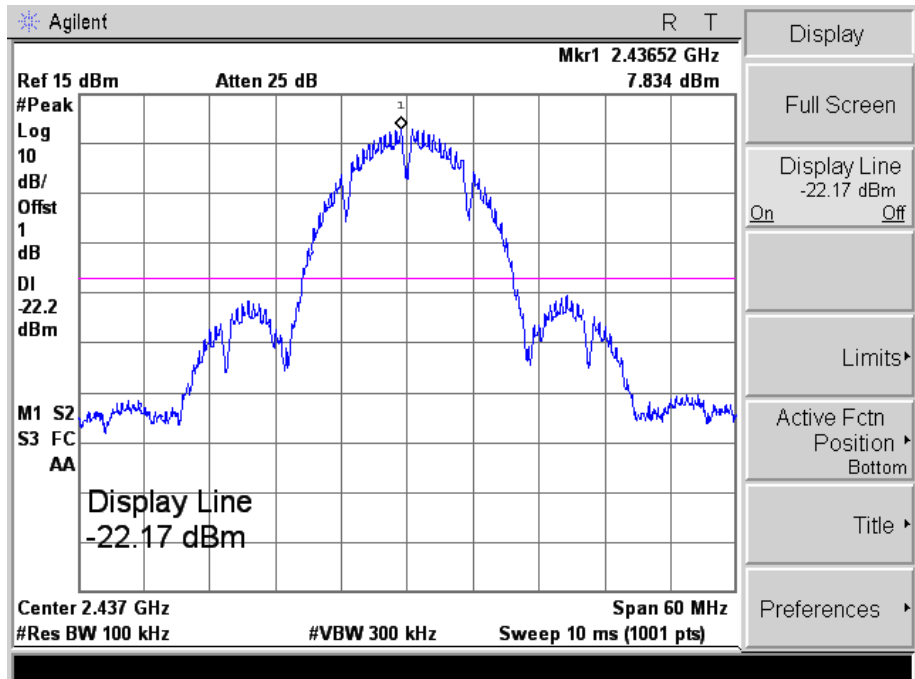
802.11b\_11Mbps

Low



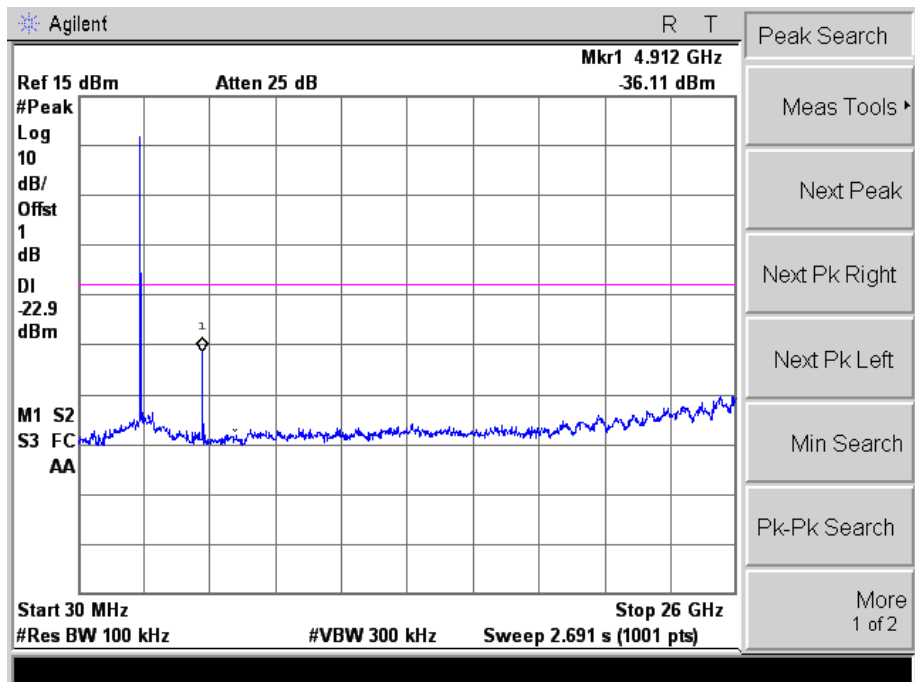
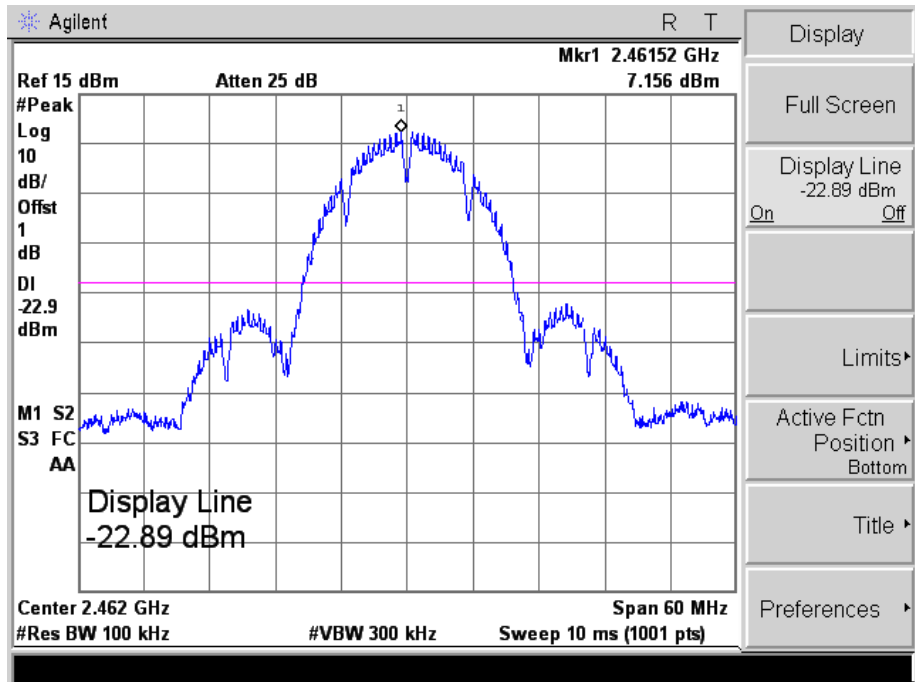
802.11b\_11Mbps

Middle



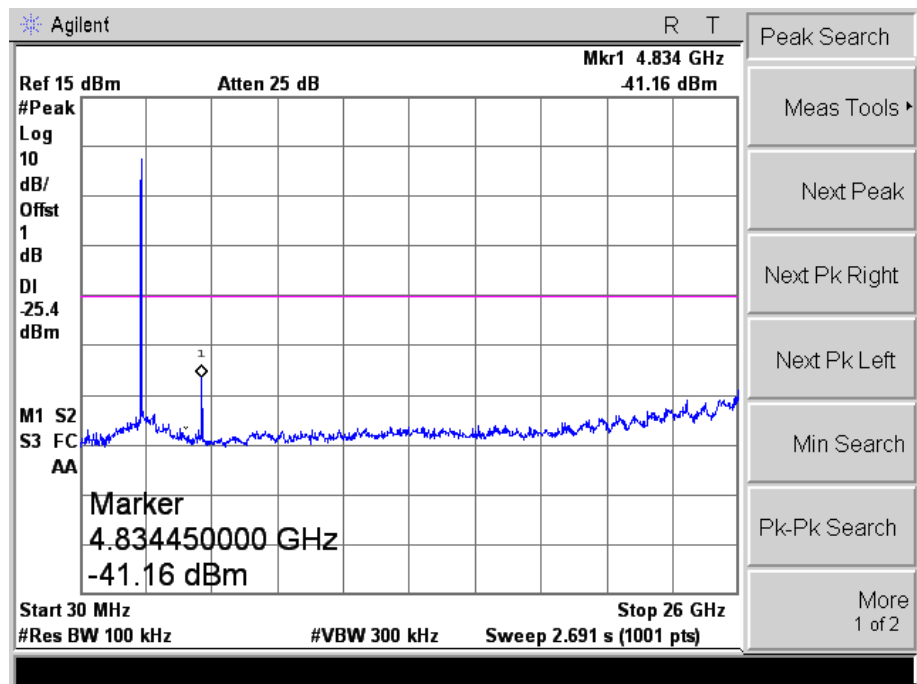
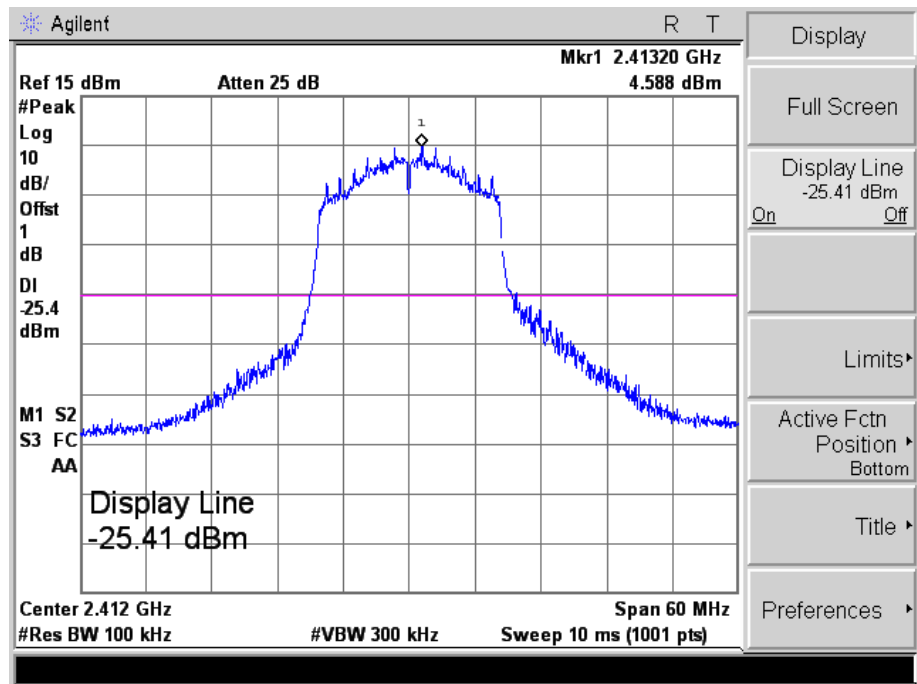
802.11b\_11Mbps

High



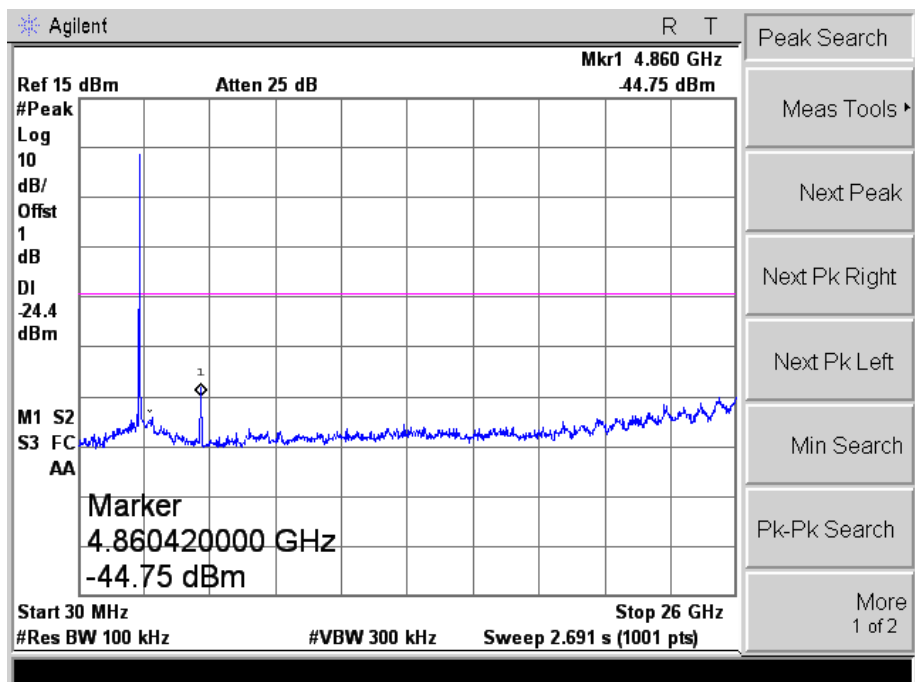
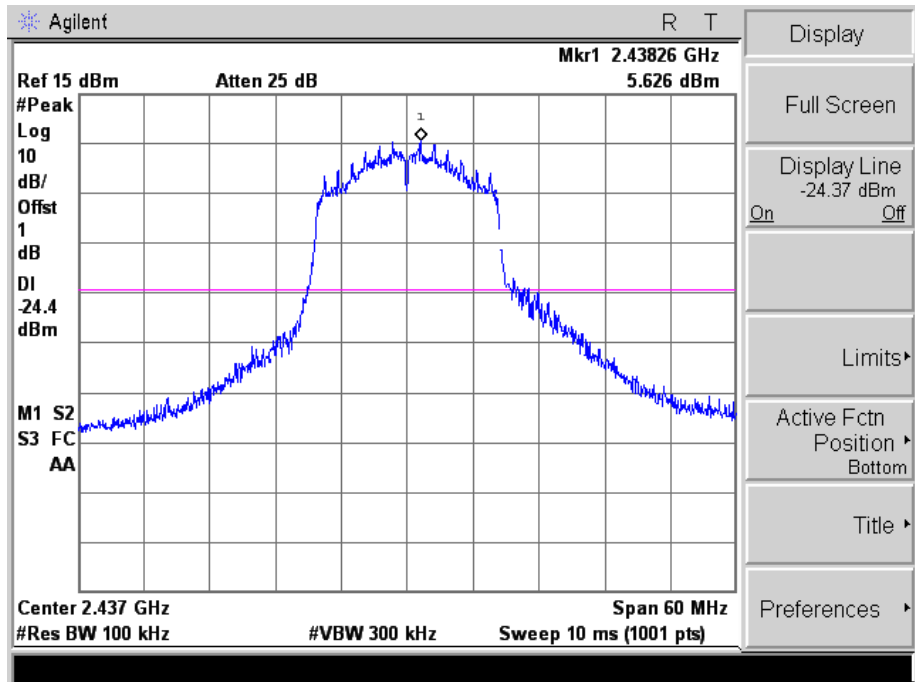
802.11g\_54Mbps

Low



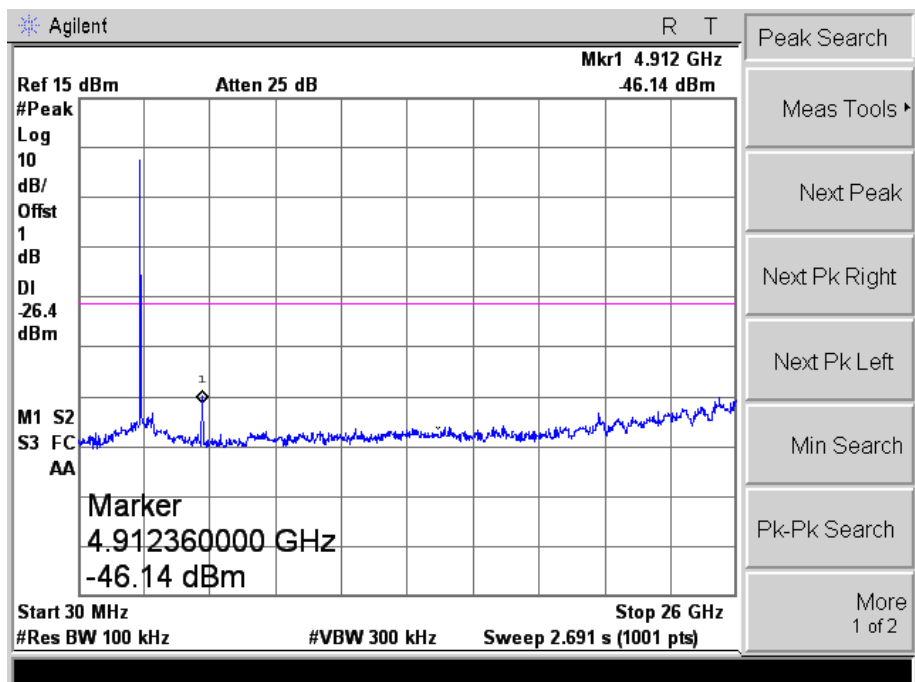
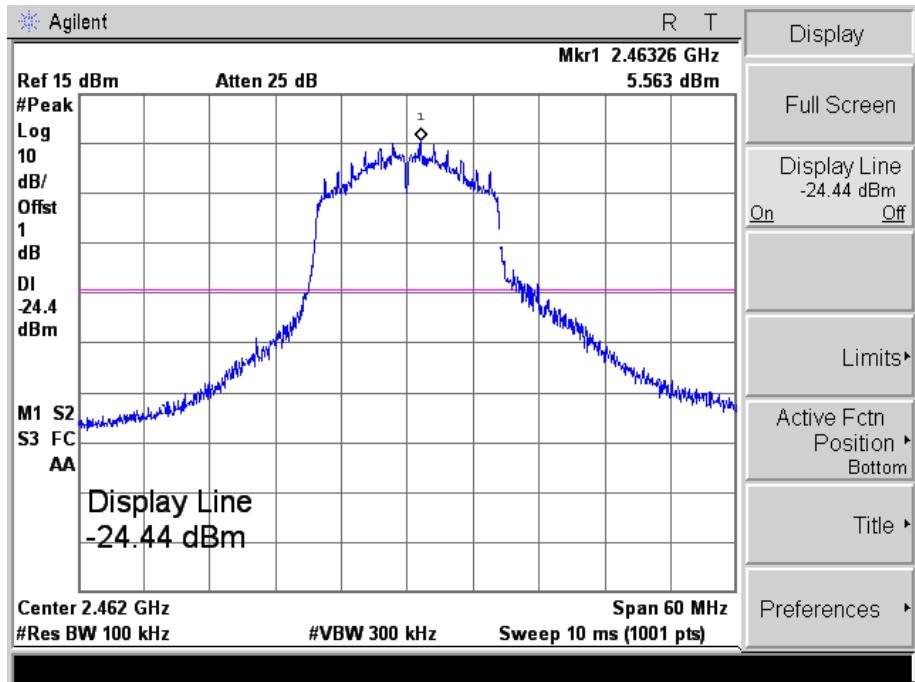
802.11g\_54Mbps

Middle



802.11g\_54Mbps

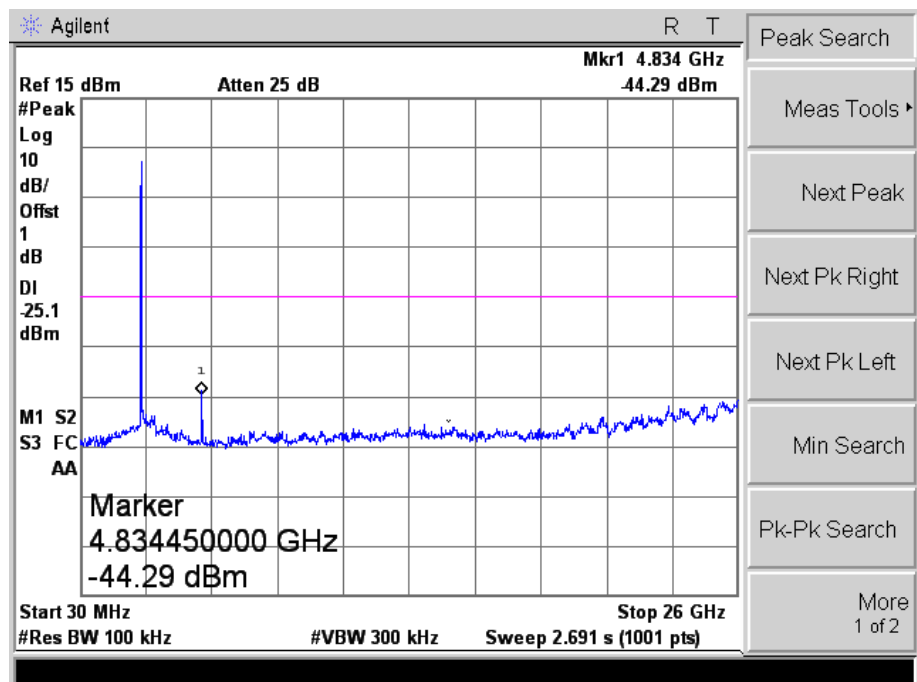
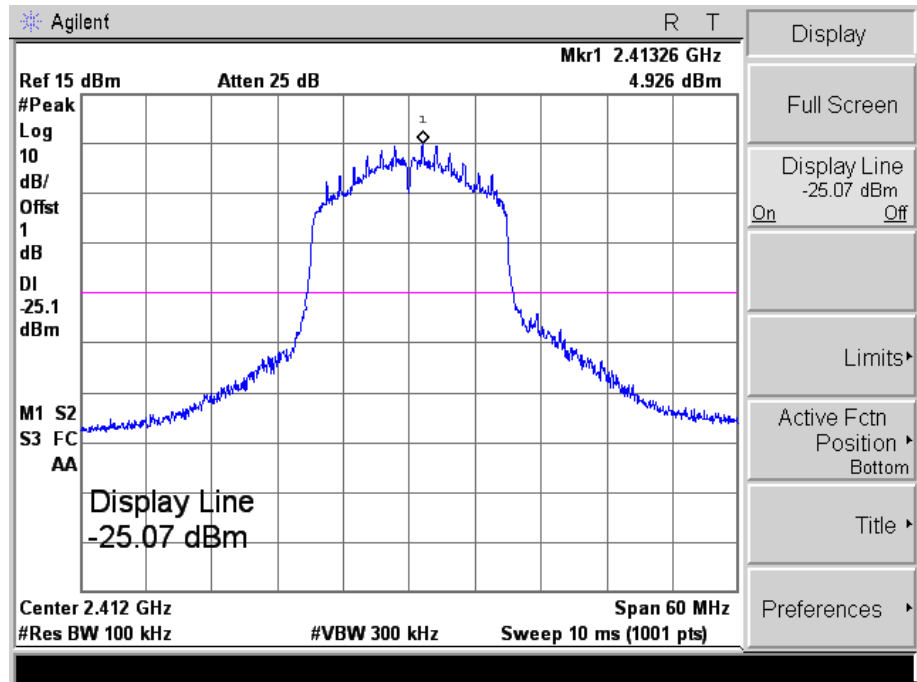
High





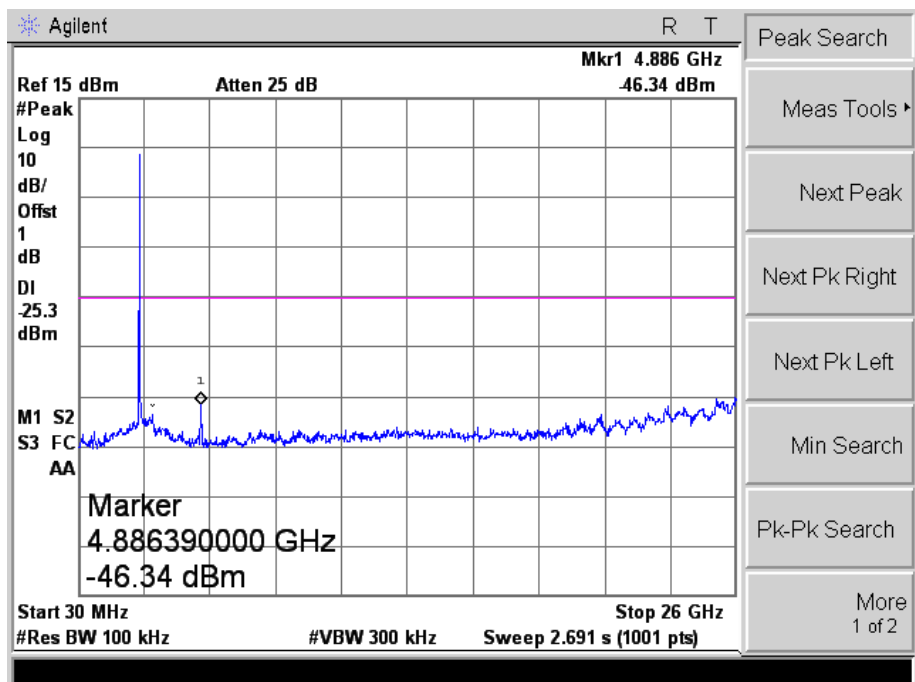
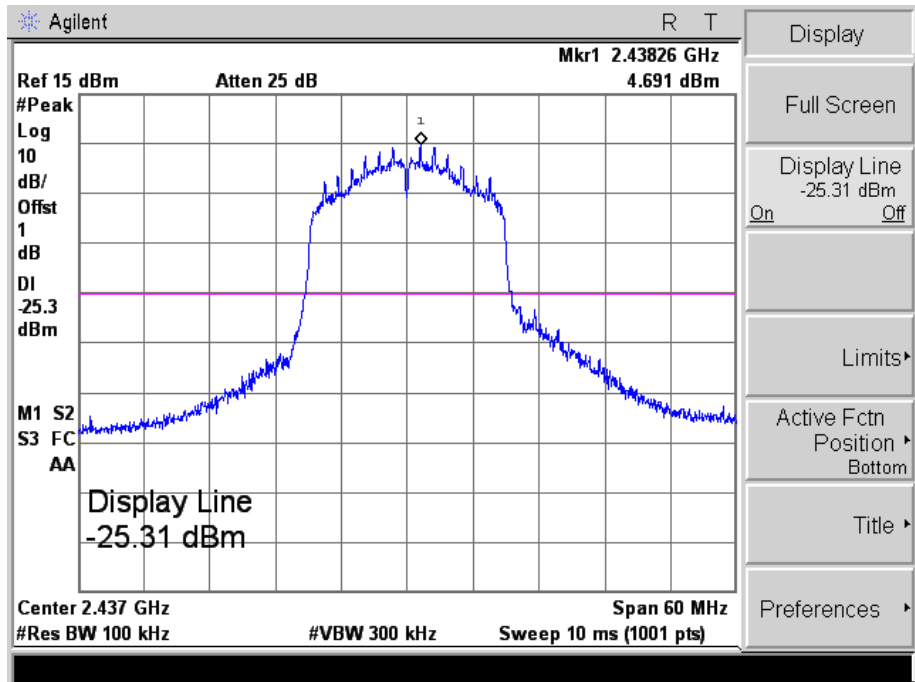
802.11n-HT20\_MCS7

Low



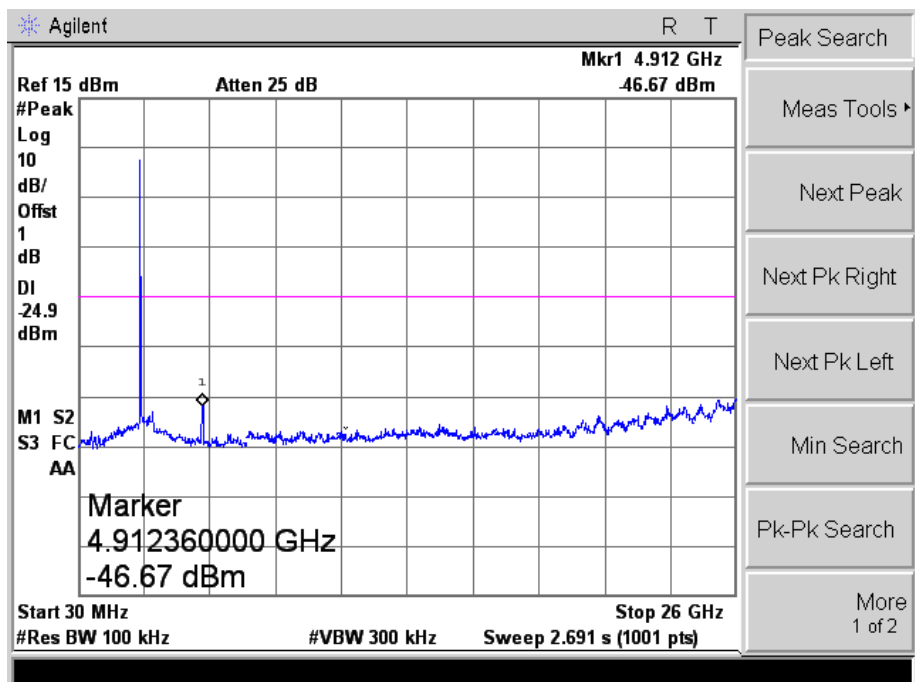
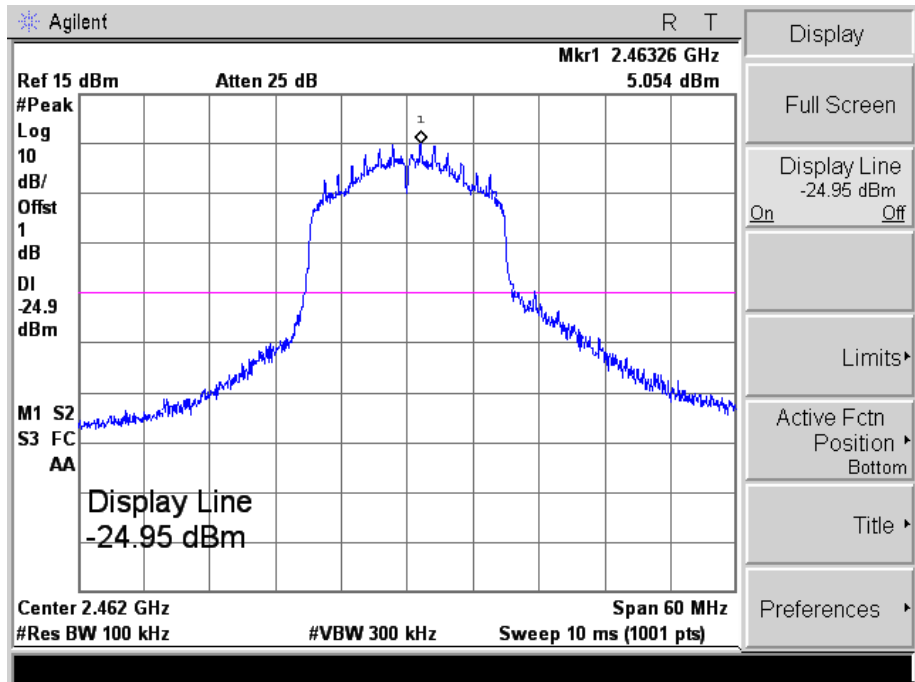
802.11n-HT20\_MCS7

Middle



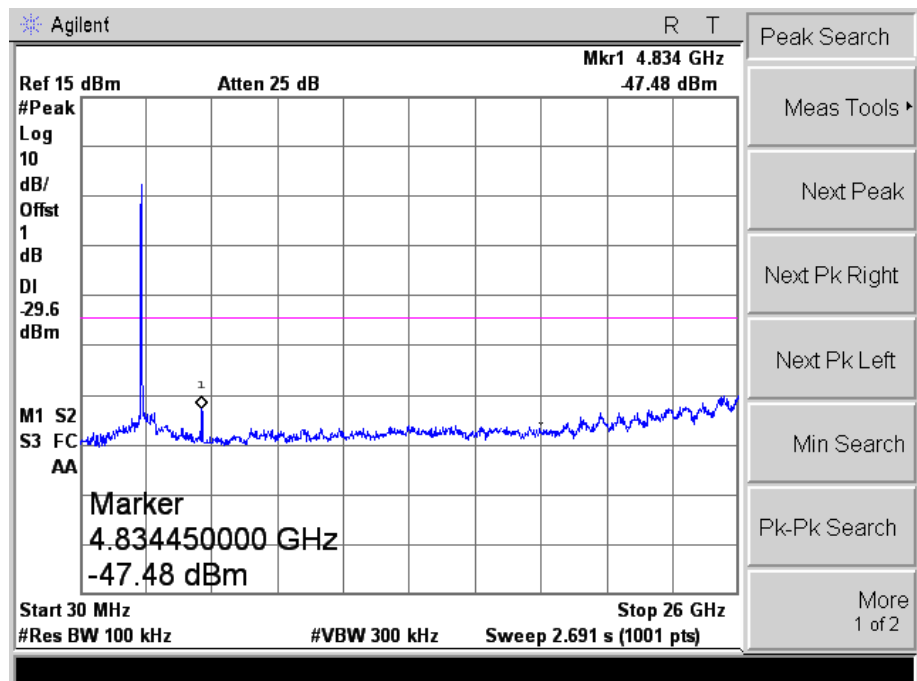
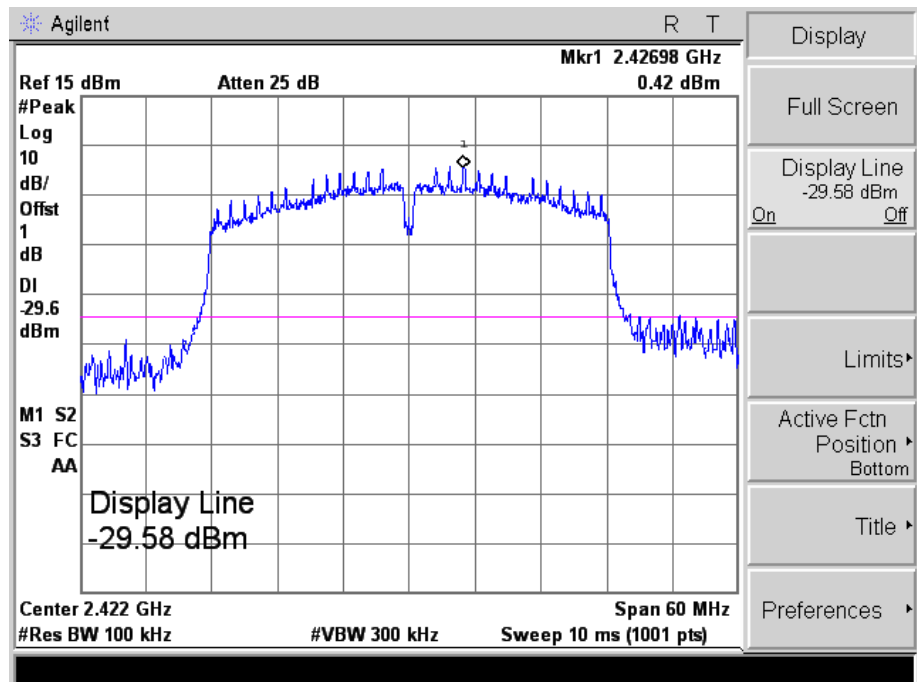
802.11n-HT20\_MCS7

High



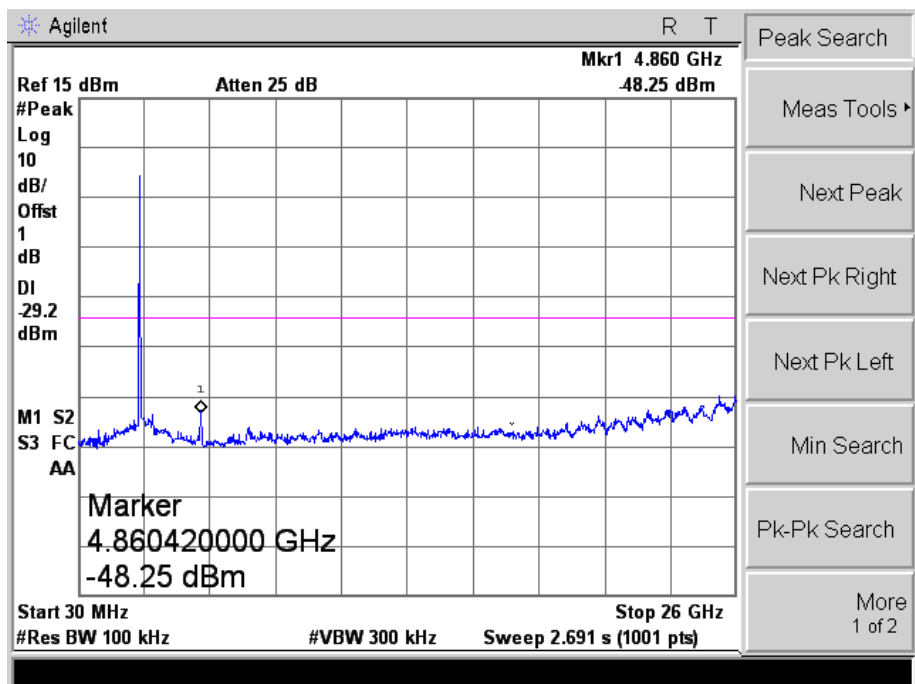
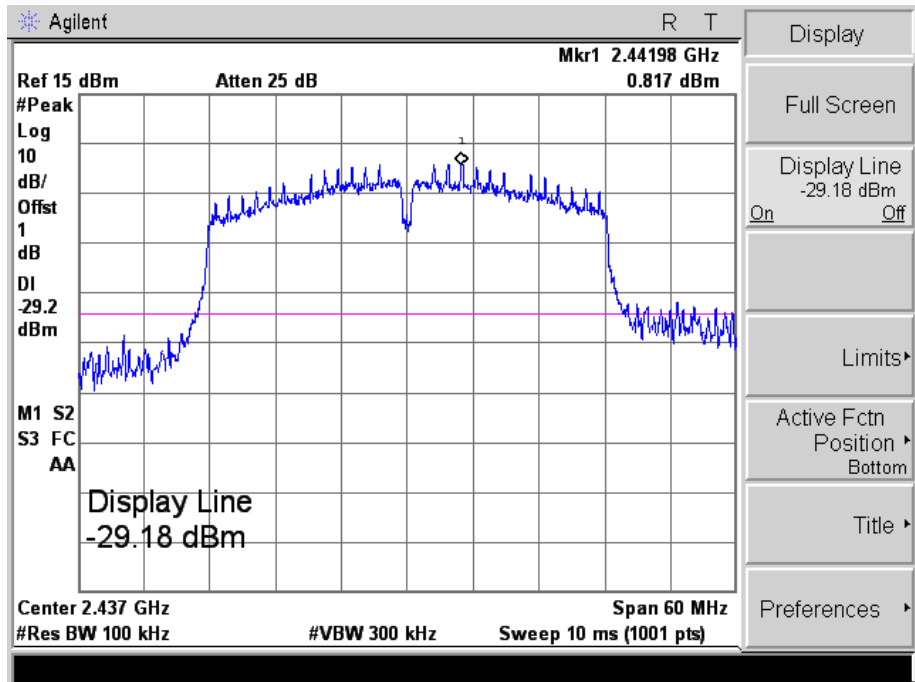
802.11n-HT40\_MCS7

Low



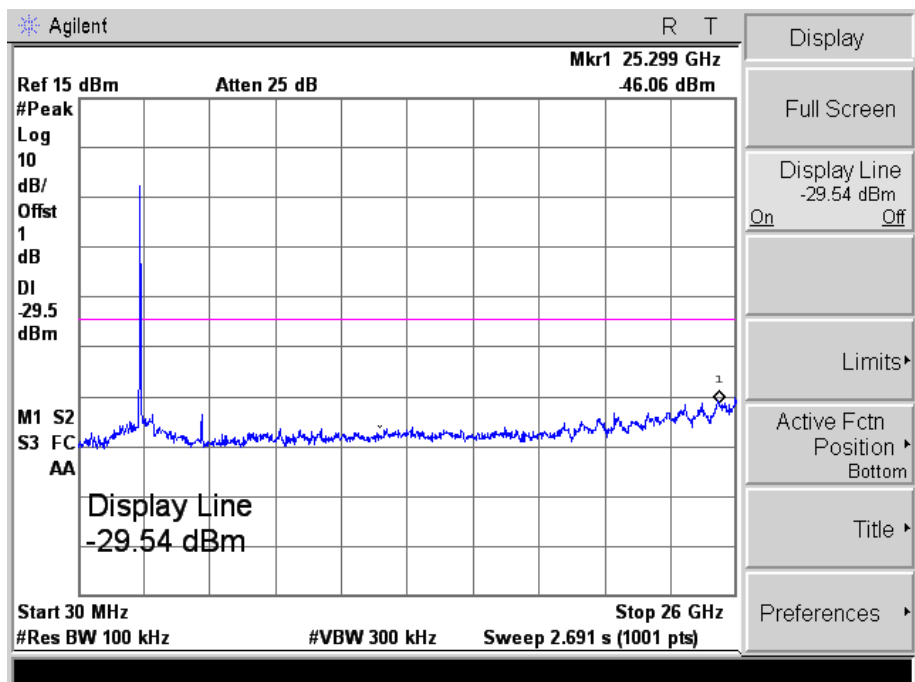
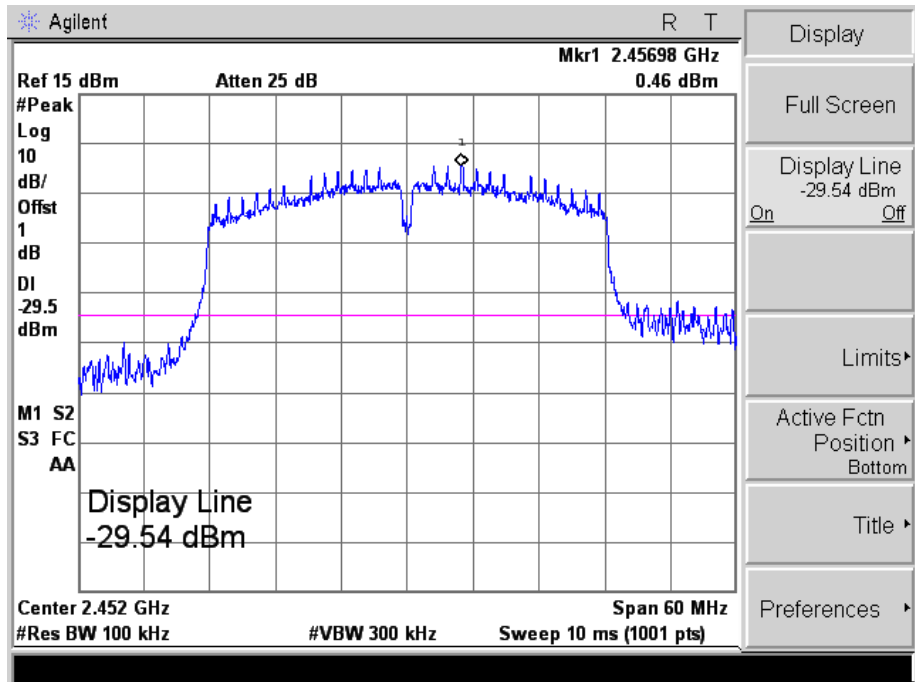
802.11n-HT40\_MCS7

Middle



802.11n-HT40\_MCS7

High



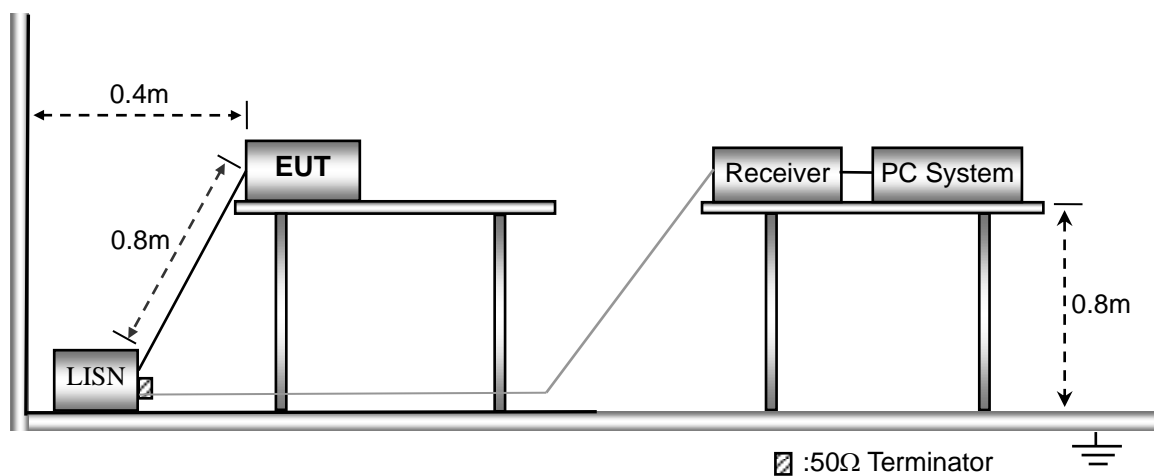
## 10. Conducted Emissions

### 10.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 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



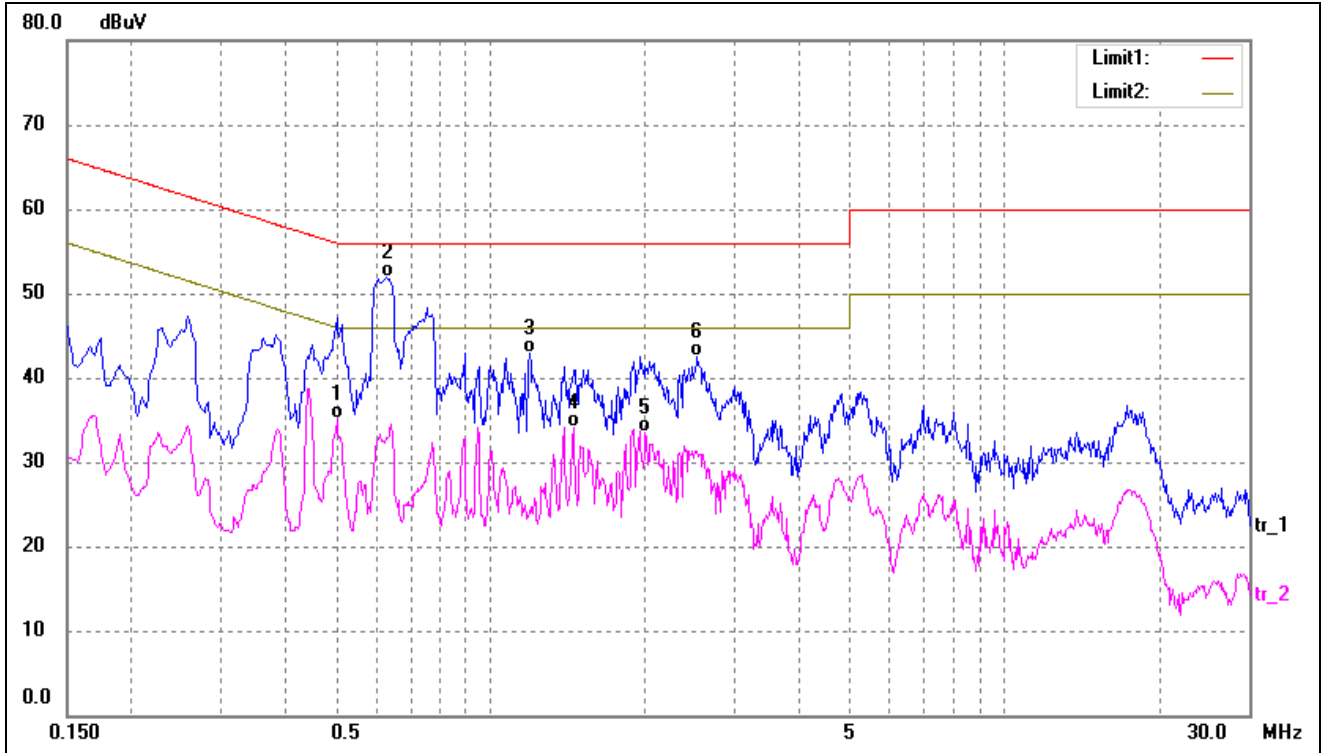
### 10.3 Test Receiver Setup

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

### 10.4 Summary of Test Results/Plots

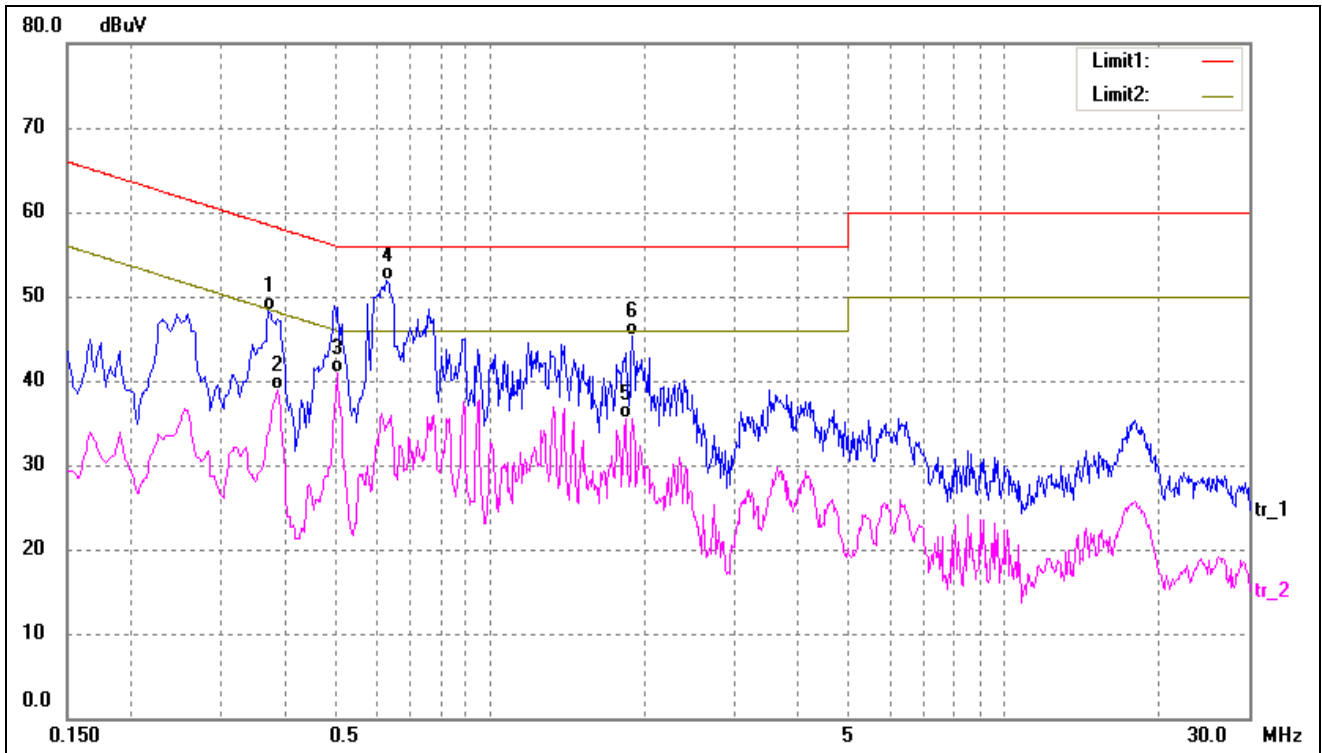
Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.5020	24.79	10.22	35.01	46.00	-10.99	AVG
2*	0.6300	41.78	10.19	51.97	56.00	-4.03	QP
3	1.1940	32.68	10.22	42.90	56.00	-13.10	QP
4	1.4500	23.93	10.23	34.16	46.00	-11.84	AVG
5	2.0020	23.18	10.29	33.47	46.00	-12.53	AVG
6	2.5340	32.19	10.29	42.48	56.00	-13.52	QP



Test Mode	Communication	AC120V 60Hz	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3700	38.00	10.24	48.24	58.50	-10.26	QP
2	0.3860	28.61	10.23	38.84	48.15	-9.31	AVG
3	0.5020	30.60	10.22	40.82	46.00	-5.18	AVG
4*	0.6300	41.66	10.19	51.85	56.00	-4.15	QP
5	1.8340	25.27	10.27	35.54	46.00	-10.46	AVG
6	1.8940	34.97	10.28	45.25	56.00	-10.75	QP

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