

# FCC Part 15C Measurement and Test Report

For

**Hangzhou BroadLink Technology Co., Ltd.**

**Unit C, Building 1, No.57 Jiang'er Road, Changhe Street, Binjiang**

**District, Hangzhou, Zhejiang, P.R. China**

**FCC ID: 2ATEV-BL3359-P**

**FCC Rule(s):** FCC Part 15.247  
**Product Description:** WiFi Module  
**Tested Model:** BL3359-P  
**Report No.:** WTX19X11082561W  
**Sample Receipt Date:** 2019-11-27  
**Tested Date:** 2019-11-27 to 2020-01-14  
**Issued Date:** 2020-01-14

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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.



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## Report version

Version No.	Date of issue	Description
Rev.00	2020-01-14	Original
/	/	/



## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Hangzhou BroadLink Technology Co., Ltd.  
 Address of applicant: Unit C, Building 1, No.57 Jiang'er Road, Changhe Street, Binjiang District, Hangzhou, Zhejiang, P.R.China

Manufacturer: Hangzhou BroadLink Technology Co., Ltd.  
 Address of manufacturer: Unit C, Building 1, No.57 Jiang'er Road, Changhe Street, Binjiang District, Hangzhou, Zhejiang, P.R.China

General Description of EUT	
Product Name:	WiFi Module
Trade Name:	BroadLink
Model No.:	BL3359-P
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
RF Output Power:	17.31dBm (Conducted)
Type of Modulation:	DBPSK, BPSK, DQPSK, QPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 72.2Mbps
Quantity of Channels:	11 for 802.11b/g/n-HT20
Channel Separation:	5MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	1.29dBi

## 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: Shenzhen SEM Test Technology Co., Ltd.

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

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

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



### 1.5 EUT Setup and Test Mode

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

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	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

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

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

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

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/



### 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	2019-04-30	2020-04-29
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2019-04-30	2020-04-29
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2019-04-30	2020-04-29
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2019-04-30	2020-04-29
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2019-04-30	2020-04-29
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	2019-04-30	2020-04-29
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2019-04-30	2020-04-29
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2019-04-30	2020-04-29
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2019-04-30	2020-04-29
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2019-04-30	2020-04-29
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2019-04-30	2020-04-29
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2019-05-05	2021-05-04
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2019-04-30	2020-04-29
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2019-04-30	2020-04-29
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2019-04-30	2020-04-29
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2019-03-18	2020-03-17
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2019-03-18	2020-03-17
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2019-03-18	2020-03-17
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2019-03-18	2020-03-17
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2019-03-18	2020-03-17
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2019-03-18	2020-03-17





<b>Software List</b>			
Description	Manufacturer	Model	Version
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>
§2.1093	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)	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 device 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

### 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 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  $\geq 2 \times \text{span/RBW}$ .
- 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 Summary of Test Results/Plots

Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b_11Mbps	2412	-16.52	8
	2437	-16.28	8
	2462	-17.09	8
802.11g_54Mbps	2412	-20.27	8
	2437	-20.50	8
	2462	-20.60	8
802.11n-HT20_MCS7	2412	-20.24	8
	2437	-20.89	8
	2462	-21.06	8

Please refer to the following test plots:



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





## 6. DTS 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

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.

### 6.3 Summary of Test Results/Plots

Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b_11Mbps	2412	9.067	$\geq 500$
	2437	8.115	$\geq 500$
	2462	9.051	$\geq 500$
802.11g_54Mbps	2412	16.364	$\geq 500$
	2437	16.396	$\geq 500$
	2462	16.343	$\geq 500$
802.11n-HT20_MCS7	2412	17.550	$\geq 500$
	2437	17.553	$\geq 500$
	2462	17.574	$\geq 500$

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> Occ BW % Pwr 99.00 % <b>12.9013 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -11.022 kHz x dB Bandwidth 9.067 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> Occ BW % Pwr 99.00 % <b>12.9370 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -44.586 kHz x dB Bandwidth 8.115 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> Occ BW % Pwr 99.00 % <b>12.9503 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -39.342 kHz 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</p> <p>Log 10</p> <p>dB/</p> <p>Offst 1</p> <p>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> Occ BW % Pwr 99.00 %</p> <p><b>16.5704 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -4.046 kHz</p> <p>x dB Bandwidth 16.364 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>802.11g-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</p> <p>Log 10</p> <p>dB/</p> <p>Offst 1</p> <p>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> Occ BW % Pwr 99.00 %</p> <p><b>16.5623 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -18.682 kHz</p> <p>x dB Bandwidth 16.396 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>802.11g-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</p> <p>Log 10</p> <p>dB/</p> <p>Offst 1</p> <p>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> Occ BW % Pwr 99.00 %</p> <p><b>16.5802 MHz</b> x dB -6.00 dB</p> <p>Transmit Freq Error -15.226 kHz</p> <p>x dB Bandwidth 16.343 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>802.11n-HT20-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 #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 17.6567 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error 6.487 kHz x dB Bandwidth 17.550 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>802.11n-HT20-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 #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 17.6516 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error -8.175 kHz x dB Bandwidth 17.553 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>802.11n-HT20-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 #Res BW 100 kHz #VBW 300 kHz Sweep 10 ms (1001 pts)</p> <p><b>Occupied Bandwidth</b> 17.6490 MHz</p> <p>Occ BW % Pwr 99.00 % x dB -6.00 dB</p> <p>Transmit Freq Error -6.251 kHz x dB Bandwidth 17.574 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>

## 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 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.

### 7.3 Summary of Test Results/Plots



Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	16.80	47.86	1000
	2437	17.31	53.83	1000
	2462	17.14	51.76	1000
802.11g_54Mbps	2412	15.49	35.40	1000
	2437	15.41	34.75	1000
	2462	15.01	31.70	1000
802.11n HT20_MCS7	2412	14.52	28.31	1000
	2437	14.51	28.25	1000
	2462	14.56	28.58	1000

Please refer to the following test plots:



<p>802.11b-Low 11Mbps</p>	
<p>802.11b-Middle 11Mbps</p>	
<p>802.11b-High 11Mbps</p>	



<p>802.11g-Low 54Mbps</p>	
<p>802.11g-Middle 54Mbps</p>	
<p>802.11g-High 54Mbps</p>	





<p>802.11n-HT20-Low MCS7</p>	
<p>802.11n-HT20-Middle MCS7</p>	
<p>802.11n-HT20-High MCS7</p>	

## 8. Field Strength of Spurious Emissions

### 8.1 Standard Applicable

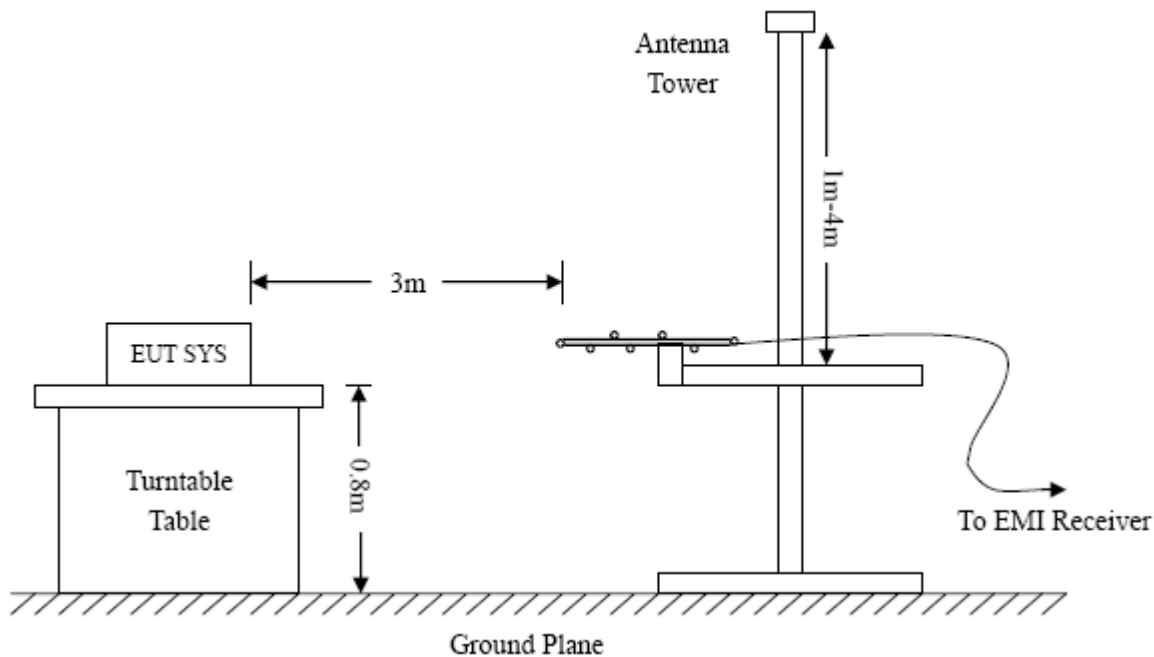
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within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

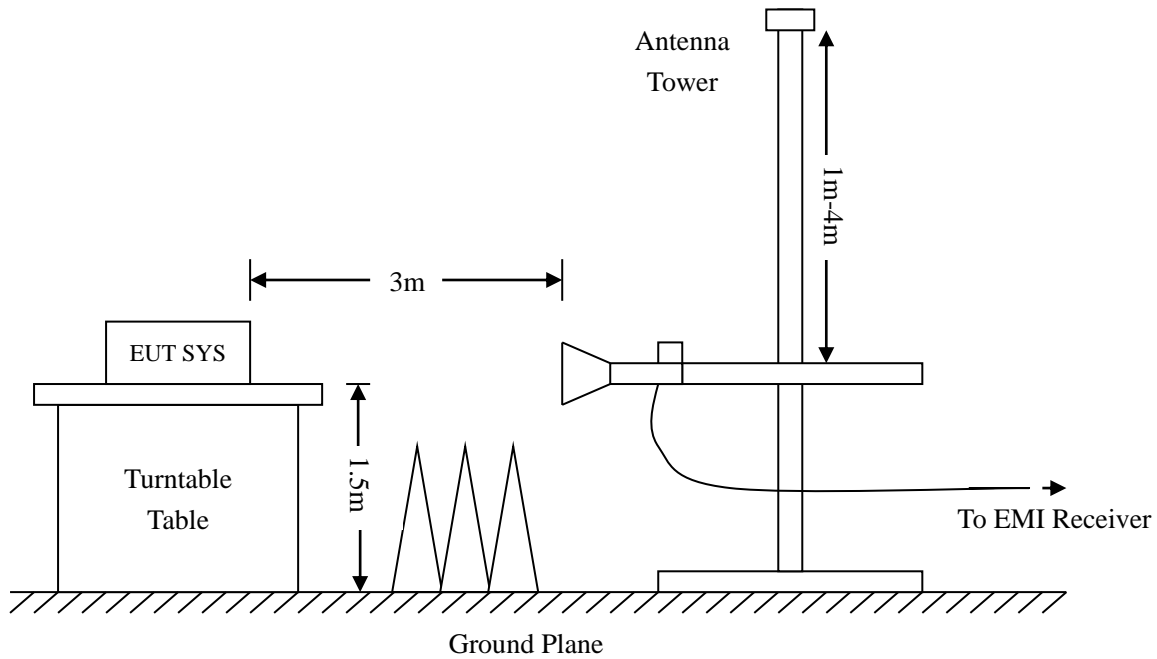
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 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.





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

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

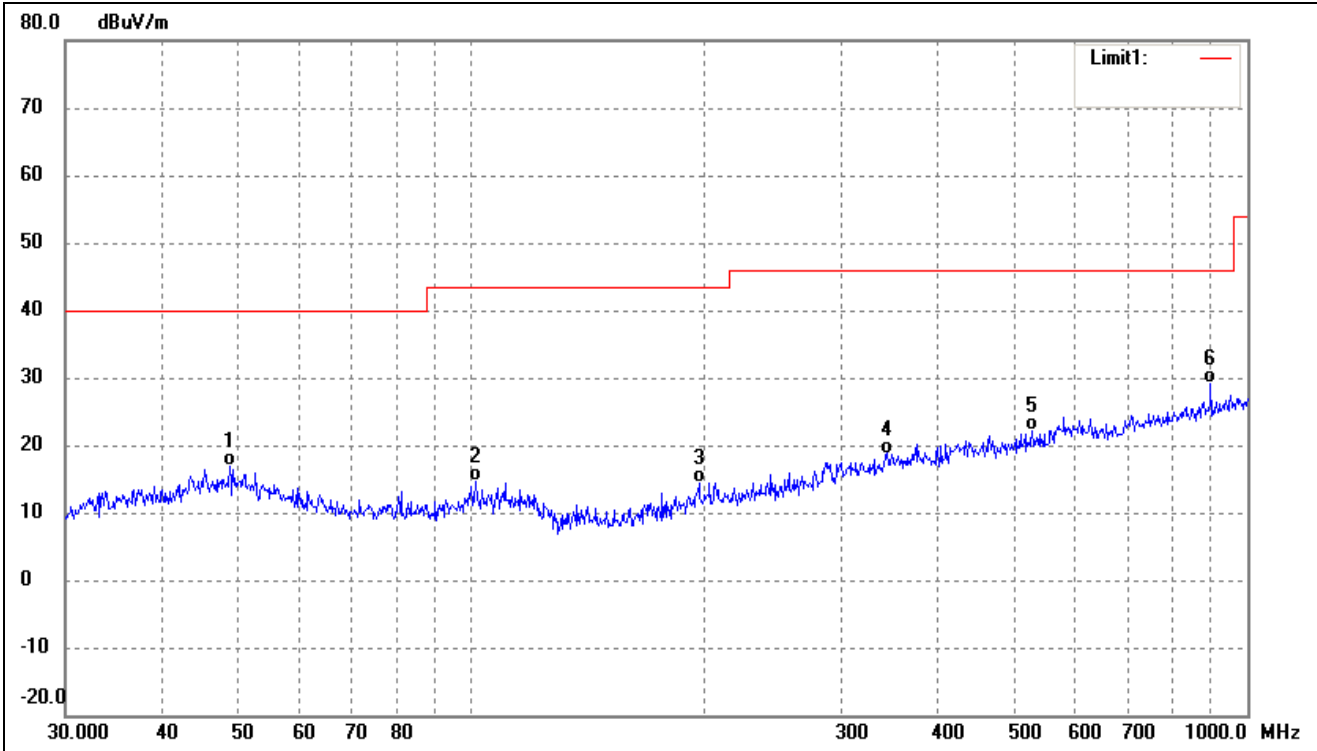
### 8.4 Summary of Test Results/Plots

*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 is recorded in this report.*



➤ Spurious Emissions Below 1GHz

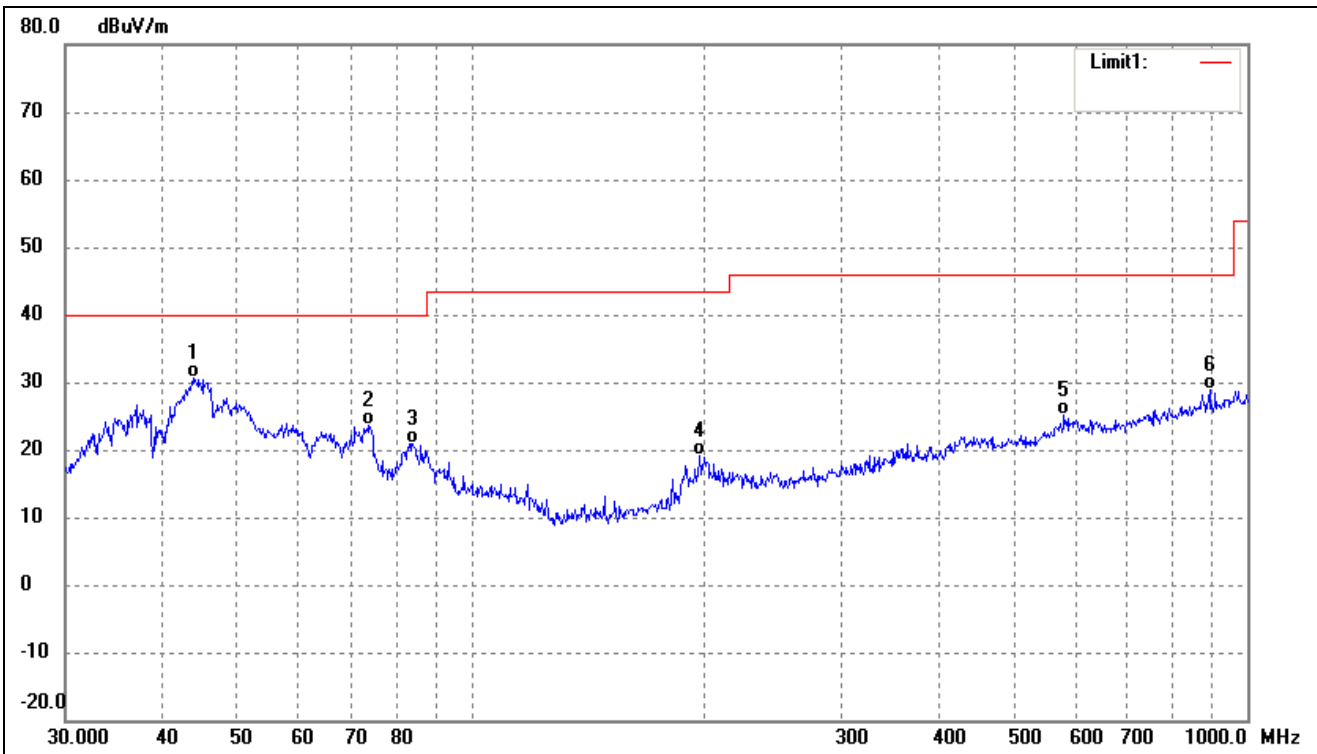
802.11b_11Mbps			
Test Channel	Low	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	48.8429	27.92	-11.07	16.85	40.00	-23.15	349	100	peak
2	101.2885	27.77	-13.17	14.60	43.50	-28.90	195	100	peak
3	196.5098	27.30	-12.94	14.36	43.50	-29.14	76	100	peak
4	343.1800	27.20	-8.45	18.75	46.00	-27.25	161	100	peak
5	528.2458	28.23	-6.06	22.17	46.00	-23.83	130	100	peak
6	896.9965	29.64	-0.62	29.02	46.00	-16.98	231	100	peak



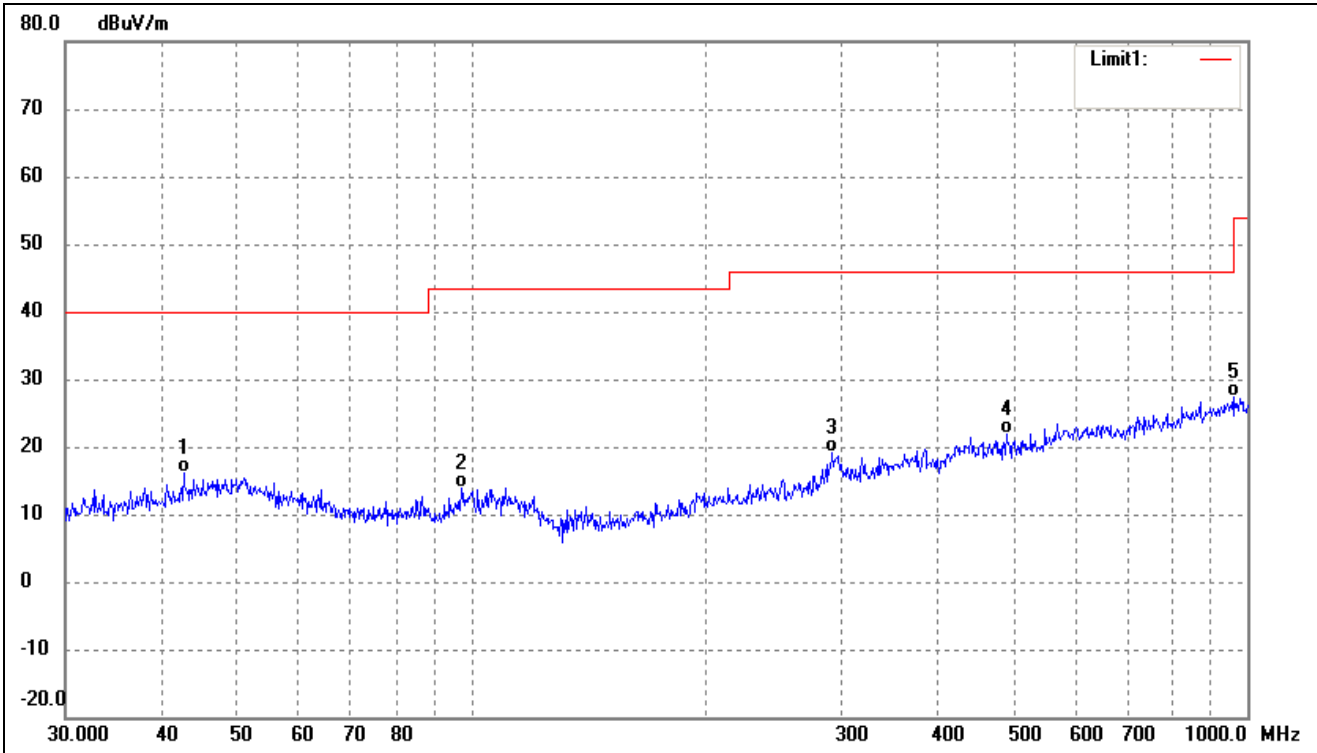
802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	43.8119	42.28	-11.61	30.67	40.00	-9.33	313	100	peak
2	73.8756	38.70	-15.16	23.54	40.00	-16.46	96	100	peak
3	84.1100	36.48	-15.56	20.92	40.00	-19.08	312	100	peak
4	197.2001	32.13	-12.90	19.23	43.50	-24.27	95	100	peak
5	580.7026	29.23	-4.20	25.03	46.00	-20.97	88	100	peak
6	893.8567	29.53	-0.67	28.86	46.00	-17.14	313	100	peak



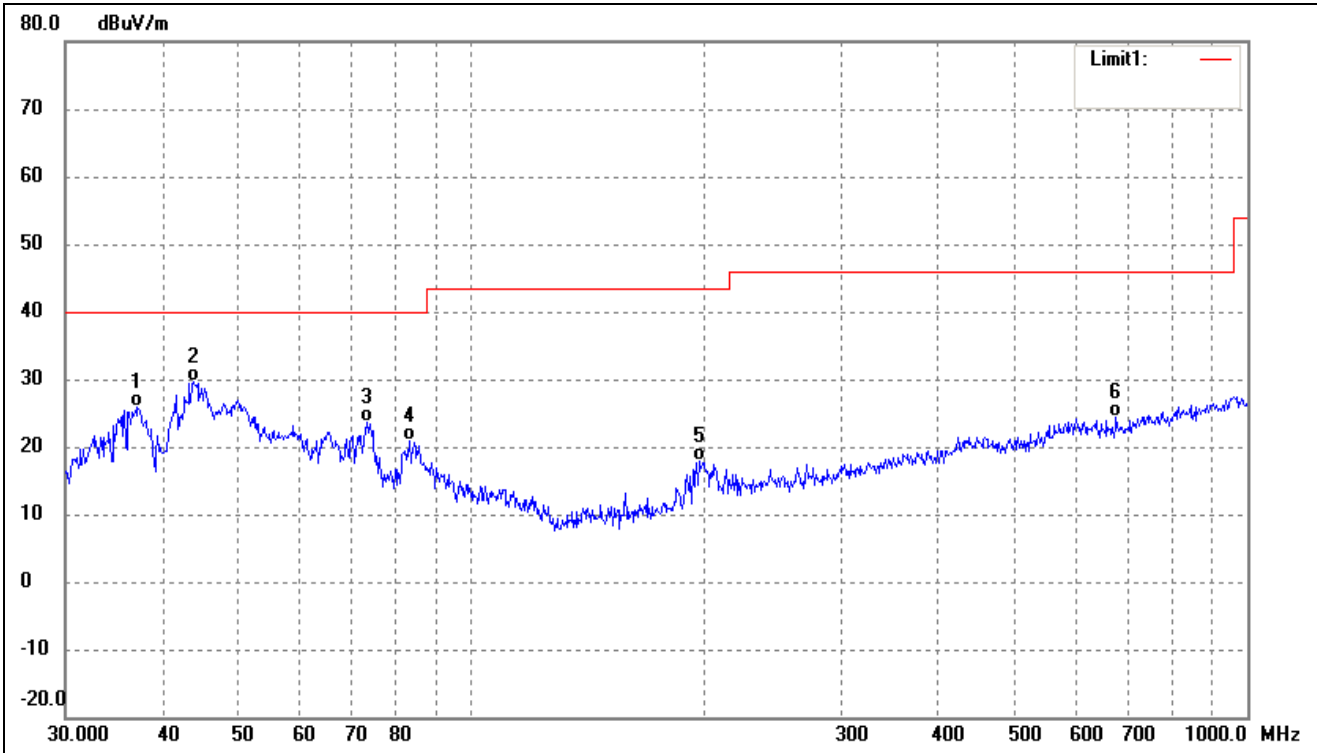
802.11b_11Mbps			
Test Channel	Middle	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	42.6000	28.12	-11.90	16.22	40.00	-23.78	330	100	peak
2	97.1148	27.72	-13.83	13.89	43.50	-29.61	97	100	peak
3	292.0583	28.67	-9.65	19.02	46.00	-26.98	299	100	peak
4	489.0269	28.32	-6.33	21.99	46.00	-24.01	113	100	peak
5	962.1623	27.28	0.19	27.47	54.00	-26.53	199	100	peak



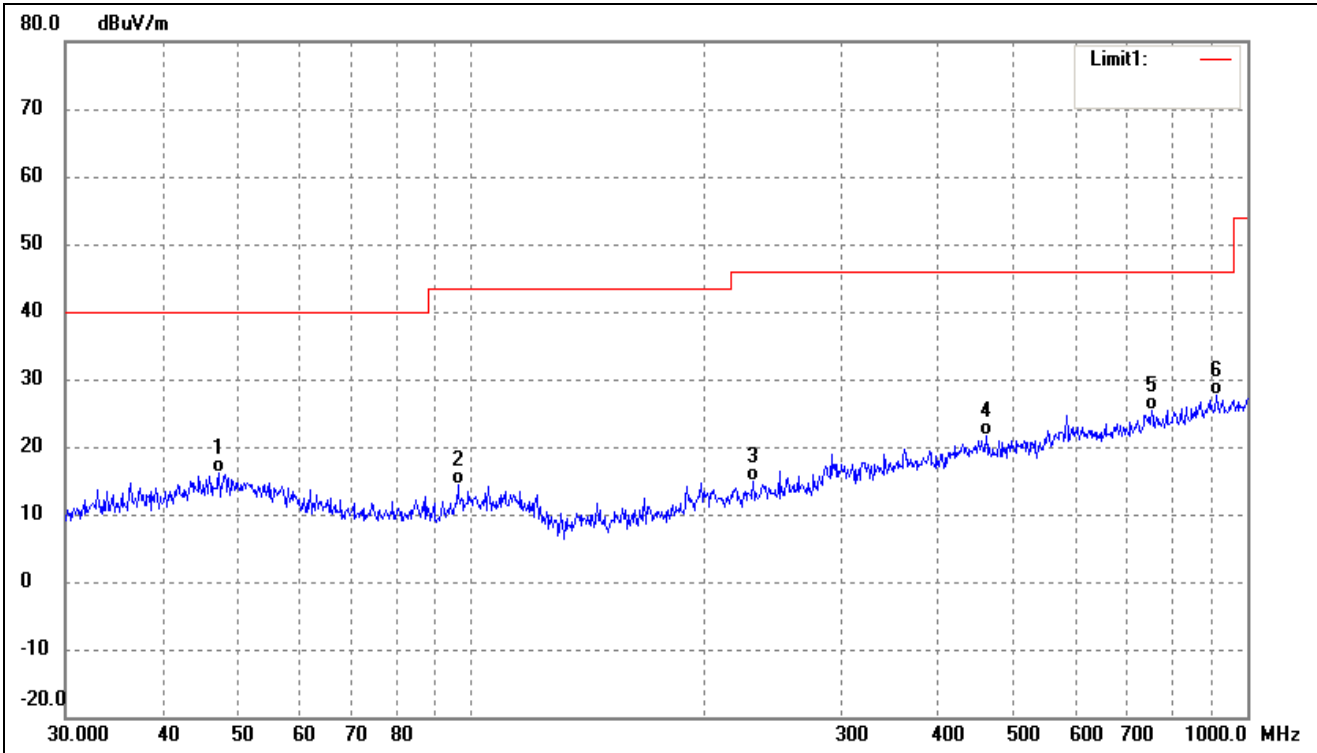
802.11b_11Mbps			
Test Channel	Middle	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	37.1550	38.79	-12.99	25.80	40.00	-14.20	234	100	peak
2	43.8119	41.31	-11.61	29.70	40.00	-10.30	192	100	peak
3	73.3593	38.80	-15.16	23.64	40.00	-16.36	78	100	peak
4	83.2298	36.30	-15.54	20.76	40.00	-19.24	264	100	peak
5	196.5098	30.94	-12.94	18.00	43.50	-25.50	268	100	peak
6	677.5798	28.61	-4.23	24.38	46.00	-21.62	224	100	peak



802.11b_11Mbps			
Test Channel	High	Polarity:	Horizontal

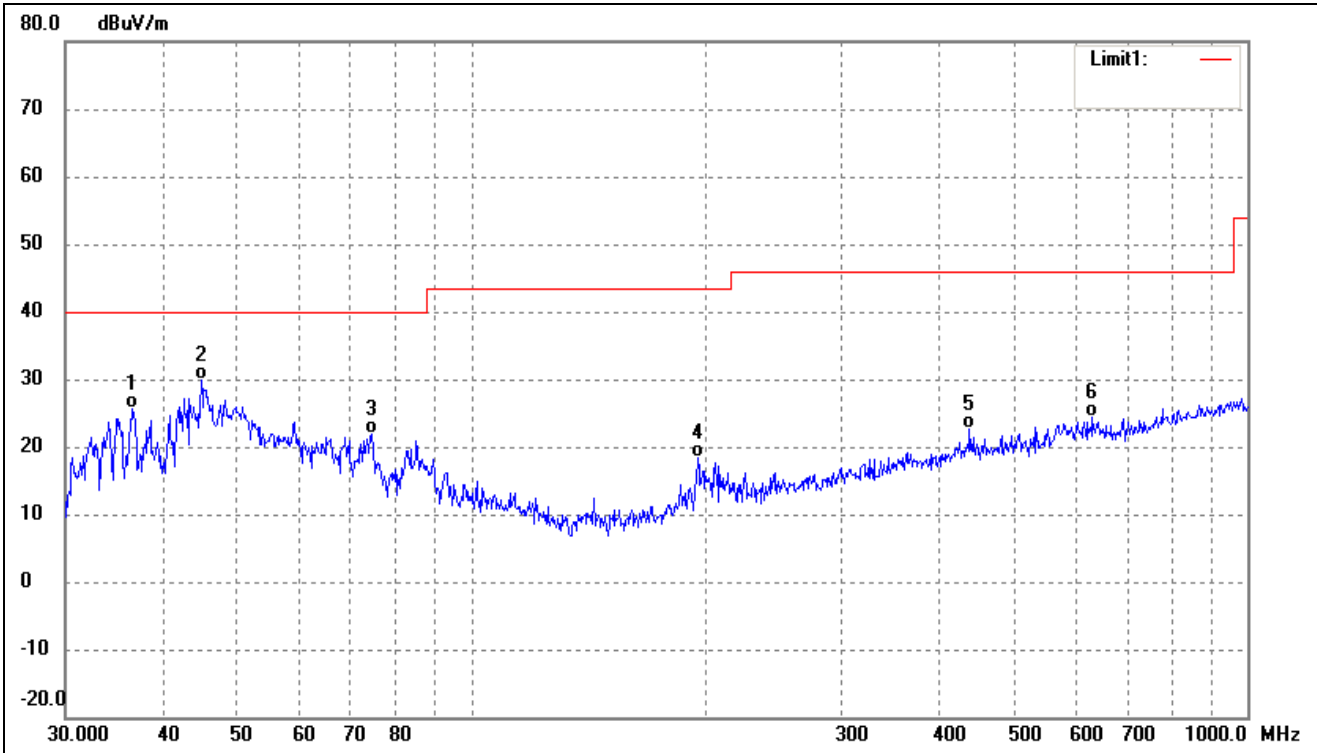


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	47.3255	27.41	-11.18	16.23	40.00	-23.77	322	100	peak
2	96.0986	28.37	-14.07	14.30	43.50	-29.20	95	100	peak
3	230.9068	26.99	-12.01	14.98	46.00	-31.02	134	100	peak
4	460.7271	28.19	-6.60	21.59	46.00	-24.41	113	100	peak
5	752.7432	27.92	-2.63	25.29	46.00	-20.71	357	100	peak
6	912.8620	27.93	-0.38	27.55	46.00	-18.45	296	100	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	36.6375	38.79	-13.07	25.72	40.00	-14.28	77	100	peak
2	44.9006	41.20	-11.36	29.84	40.00	-10.16	266	100	peak
3	74.3955	36.94	-15.14	21.80	40.00	-18.20	58	100	peak
4	195.8220	31.48	-12.99	18.49	43.50	-25.01	90	100	peak
5	438.6554	28.79	-6.20	22.59	46.00	-23.41	317	100	peak
6	631.6884	28.47	-4.14	24.33	46.00	-21.67	208	100	peak



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

Frequency (MHz)	Reading (dBuV/m)	Correct dB	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-2412MHz							
4824.00	63.06	-3.86	59.20	74	-14.80	H	PK
4824.00	45.52	-3.86	41.66	54	-12.34	H	AV
7236.00	57.53	1.10	58.63	74	-15.37	H	PK
7236.00	41.07	1.10	42.17	54	-11.83	H	AV
4824.00	62.02	-3.86	58.16	74	-15.84	V	PK
4824.00	42.04	-3.86	38.18	54	-15.82	V	AV
7236.00	56.45	1.10	57.55	74	-16.45	V	PK
7236.00	40.03	1.10	41.13	54	-12.87	V	AV
Middle Channel-2437MHz							
4874.00	61.28	-3.74	57.54	74	-16.46	H	PK
4874.00	41.29	-3.74	37.55	54	-16.45	H	AV
7311.00	57.19	1.47	58.66	74	-15.34	H	PK
7311.00	40.76	1.47	42.23	54	-11.77	H	AV
4874.00	63.09	-3.74	59.35	74	-14.65	V	PK
4874.00	45.09	-3.74	41.35	54	-12.65	V	AV
7311.00	55.41	1.47	56.88	74	-17.12	V	PK
7311.00	36.83	1.47	38.30	54	-15.70	V	AV
High Channel-2462MHz							
4924.00	62.66	-3.63	59.03	74	-14.97	H	PK
4924.00	42.90	-3.63	39.27	54	-14.73	H	AV
7386.00	56.78	1.62	58.40	74	-15.60	H	PK
7386.00	40.44	1.62	42.06	54	-11.94	H	AV
4924.00	61.68	-3.63	58.05	74	-15.95	V	PK
4924.00	41.38	-3.63	37.75	54	-16.25	V	AV
7386.00	58.00	1.62	59.62	74	-14.38	V	PK
7386.00	36.94	1.62	38.56	54	-15.44	V	AV

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

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## 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  $\times$  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.

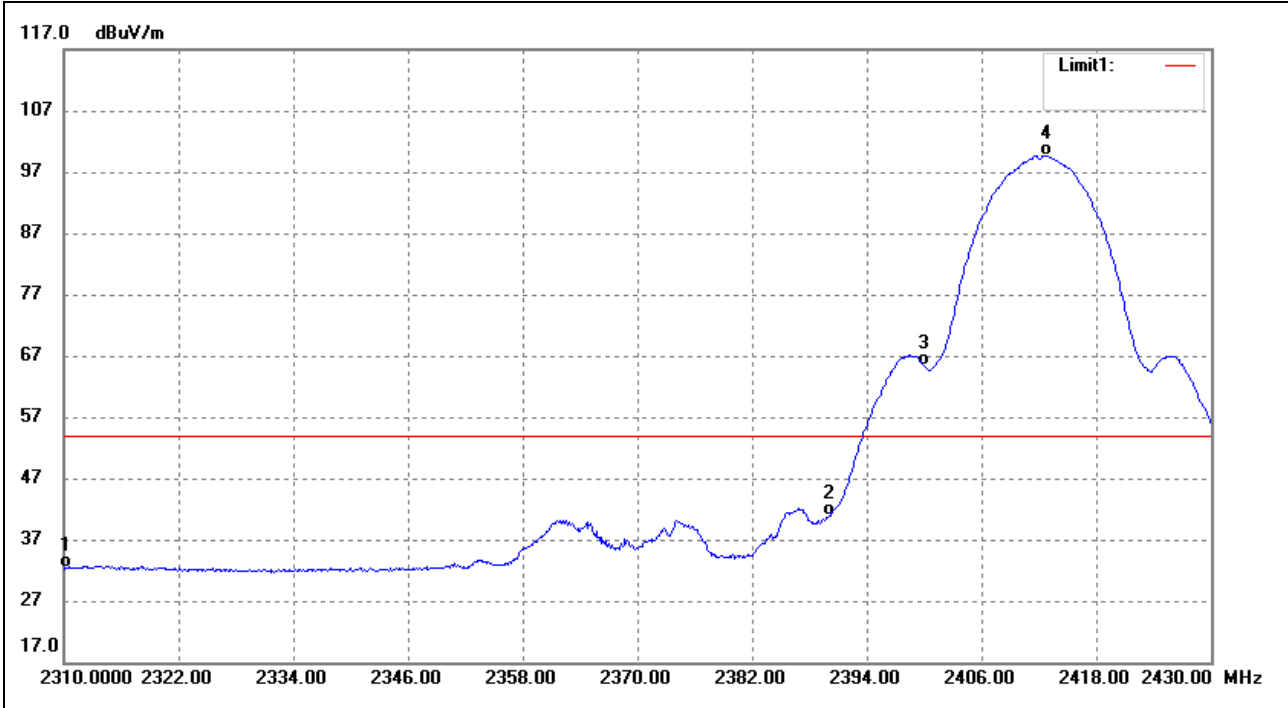
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

**9.3 Summary of Test Results/Plots**



➤ Radiated test

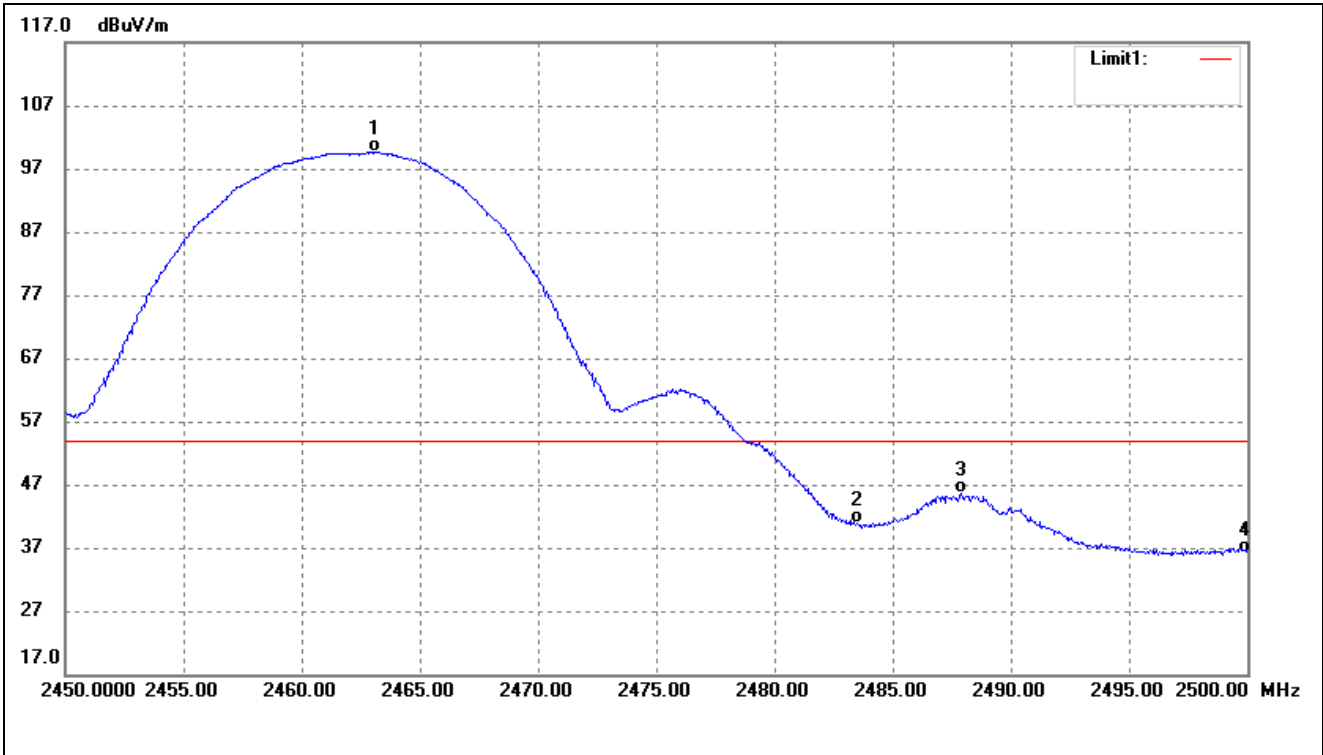
802.11b_11Mbps			
Test Channel	Low	Polarity:	Vertical(worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	42.07	-9.66	32.41	54.00	-21.59	Average Detector
	2310.000	53.84	-9.66	44.18	74.00	-29.82	Peak Detector
2	2390.000	50.27	-9.50	40.77	54.00	-13.23	Average Detector
	2390.000	61.62	-9.50	52.12	74.00	-21.88	Peak Detector
3	2400.000	74.76	-9.48	65.28	Delta=34.41dB		Average Detector
4	2412.720	109.15	-9.46	99.69			Average Detector



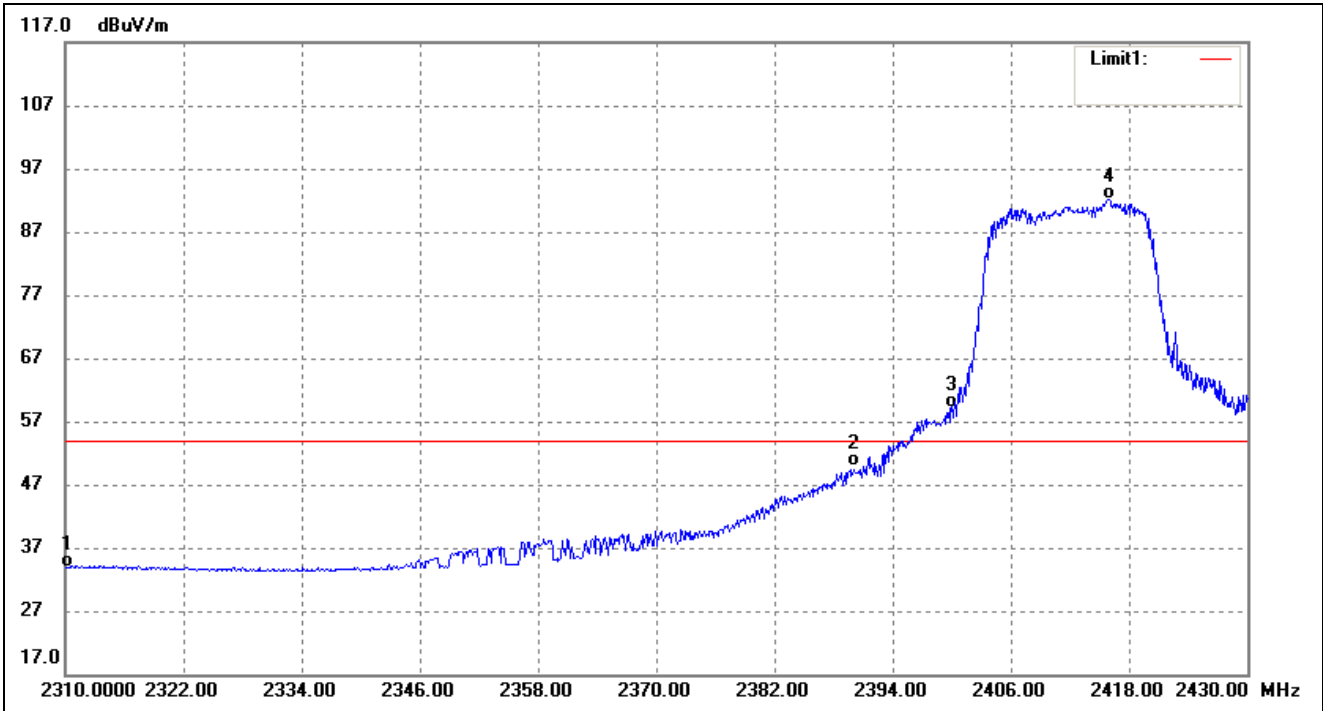
802.11b_11Mbps			
Test Channel	High	Polarity:	Vertical(worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2463.100	108.95	-9.36	99.59	/	/	Average Detector
	2460.650	115.83	-9.36	106.47	/	/	Peak Detector
2	2483.500	50.13	-9.31	40.82	54.00	-13.18	Average Detector
	2483.500	60.25	-9.31	50.94	74.00	-23.06	Peak Detector
3	2487.900	54.81	-9.30	45.51	54.00	-8.49	Average Detector
	2487.800	63.86	-9.30	54.56	74.00	-19.44	Peak Detector
4	2500.000	45.42	-9.28	36.14	54.00	-17.86	Average Detector
	2500.000	55.84	-9.28	46.56	74.00	-27.44	Peak Detector



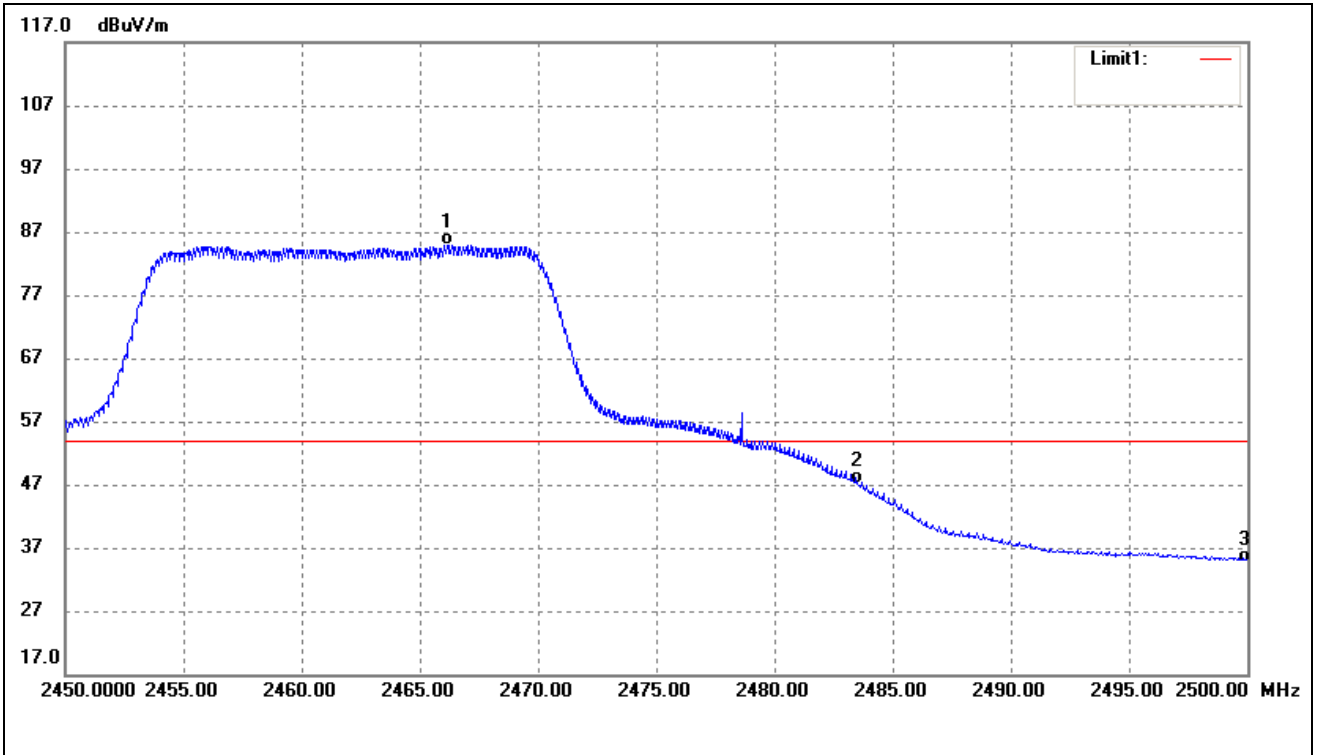
802.11g_54Mbps			
Test Channel	Low	Polarity:	Vertical(worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	43.59	-9.66	33.93	54.00	-20.07	Average Detector
	2310.000	53.72	-9.66	44.06	74.00	-29.94	Peak Detector
2	2390.000	59.48	-9.50	49.98	54.00	-4.02	Average Detector
	2390.000	78.11	-9.50	68.61	74.00	-5.39	Peak Detector
3	2400.000	68.73	-9.48	59.25	Delta=32.94dB		Average Detector
4	2415.960	101.65	-9.46	92.19			Average Detector



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

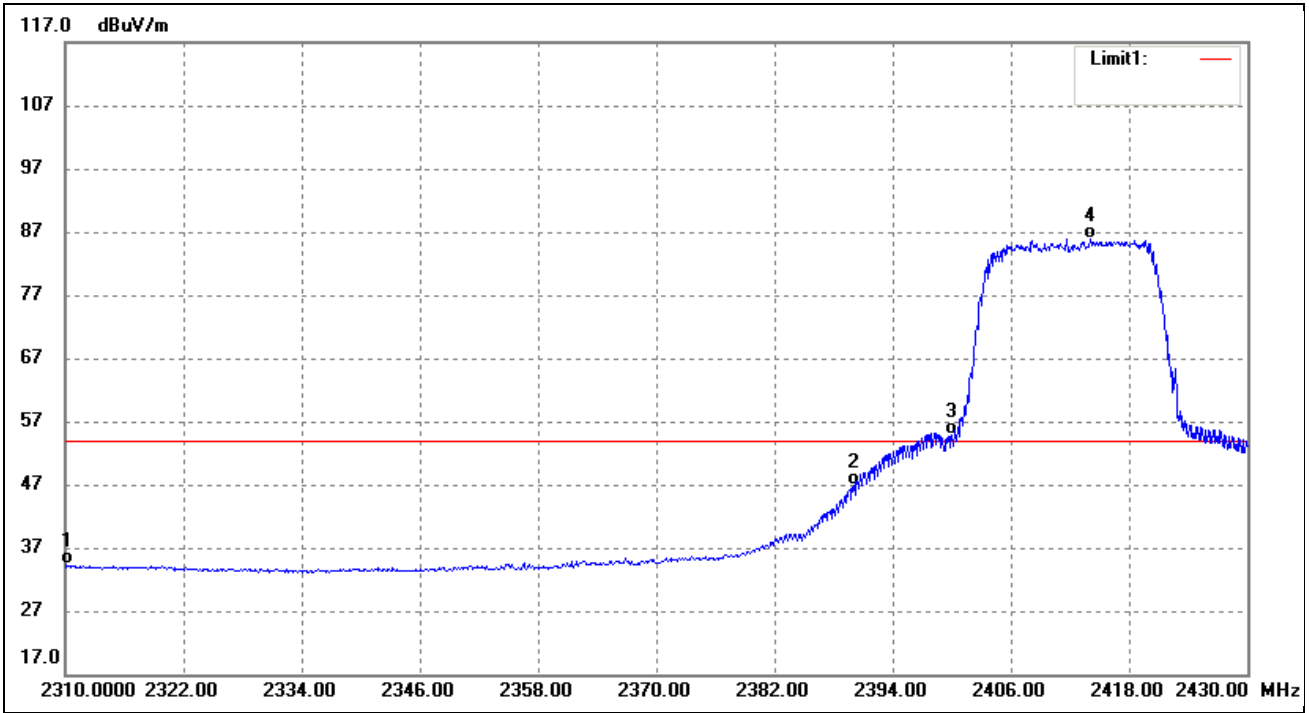


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2466.150	94.21	-9.35	84.86	/	/	Average Detector
	2455.350	111.78	-9.37	102.41	/	/	Peak Detector
2	2483.500	56.38	-9.31	47.07	54.00	-6.93	Average Detector
	2483.500	79.23	-9.31	69.92	74.00	-4.08	Peak Detector
3	2500.000	44.03	-9.28	34.75	54.00	-19.25	Average Detector
	2500.000	59.08	-9.28	49.80	74.00	-24.20	Peak Detector





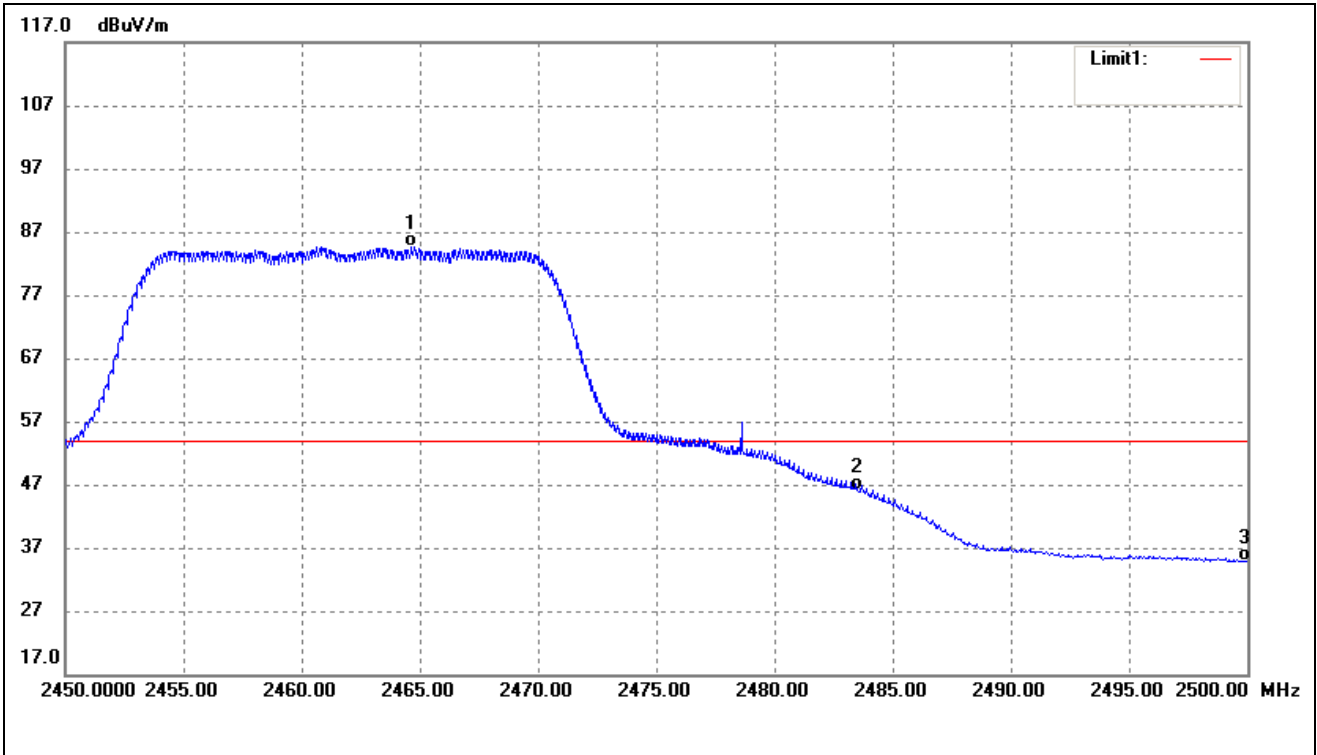
802.11n-HT20_MCS7			
Test Channel	Low	Polarity:	Vertical(worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	44.01	-9.66	34.35	54.00	-19.65	Average Detector
	2310.000	53.64	-9.66	43.98	74.00	-30.02	Peak Detector
2	2310.000	44.01	-9.66	34.35	54.00	-19.65	Average Detector
	2390.000	72.20	-9.50	62.70	74.00	-11.30	Peak Detector
3	2400.000	64.35	-9.48	54.87	Delta=31.07dB		Average Detector
4	2414.040	95.39	-9.45	85.94		Average Detector	



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

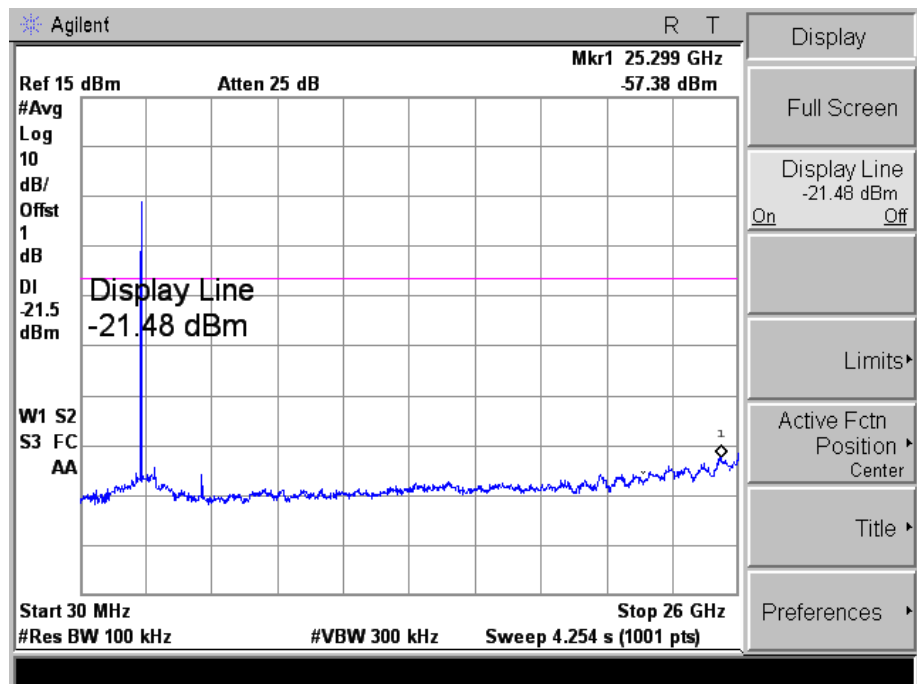
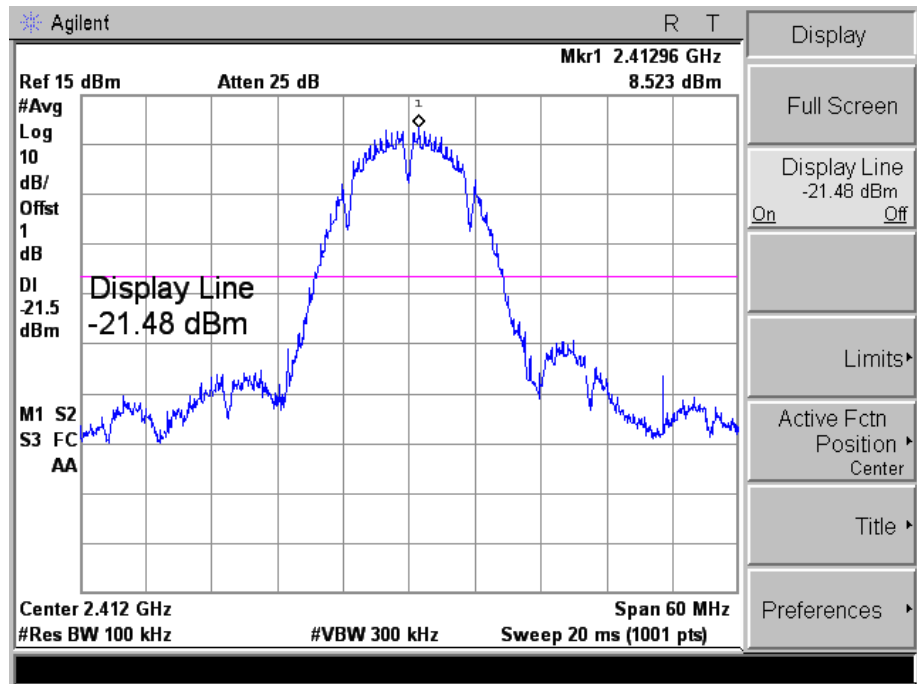


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2464.650	93.92	-9.35	84.57	/	/	Average Detector
	2454.400	111.18	-9.37	101.81	/	/	Peak Detector
2	2483.500	55.39	-9.31	46.08	54.00	-7.92	Average Detector
	2483.500	76.73	-9.31	67.42	74.00	-6.58	Peak Detector
3	2500.000	44.19	-9.28	34.91	54.00	-19.09	Average Detector
	2500.000	58.25	-9.28	48.97	74.00	-25.03	Peak Detector

➤ Conducted test

802.11b\_11Mbps

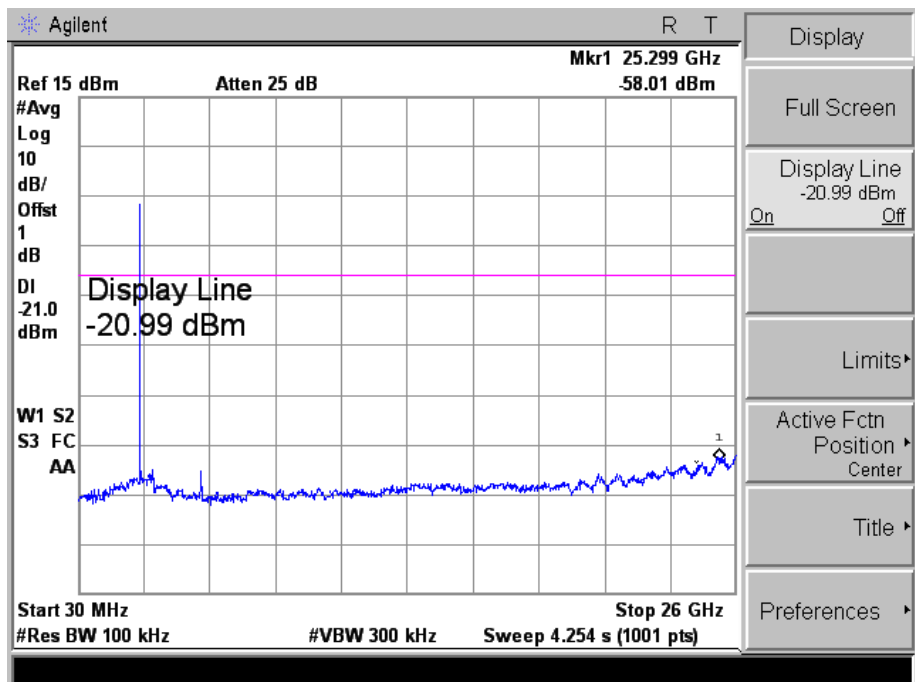
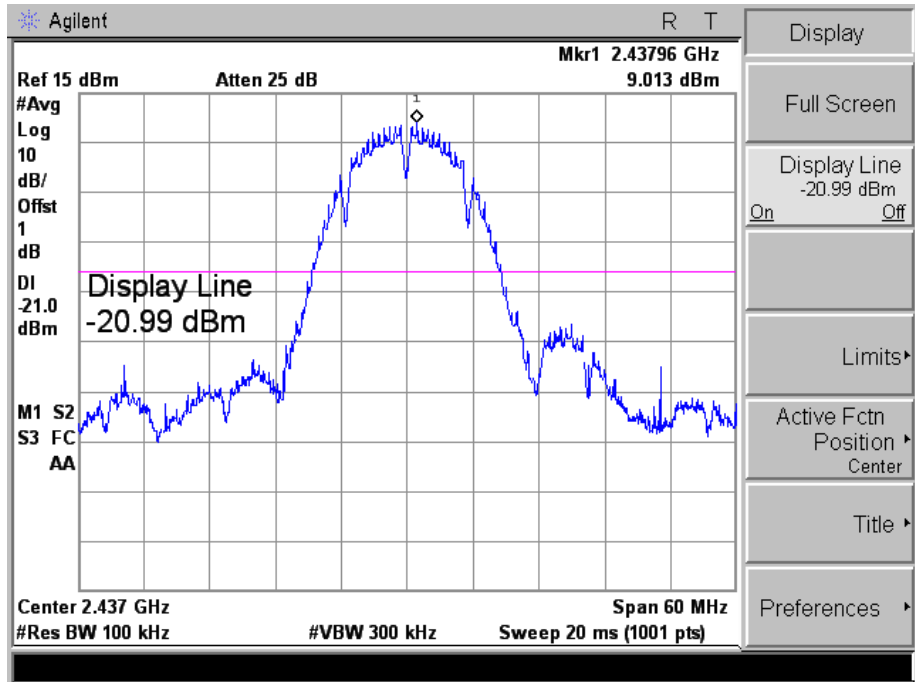
Low





802.11b\_11Mbps

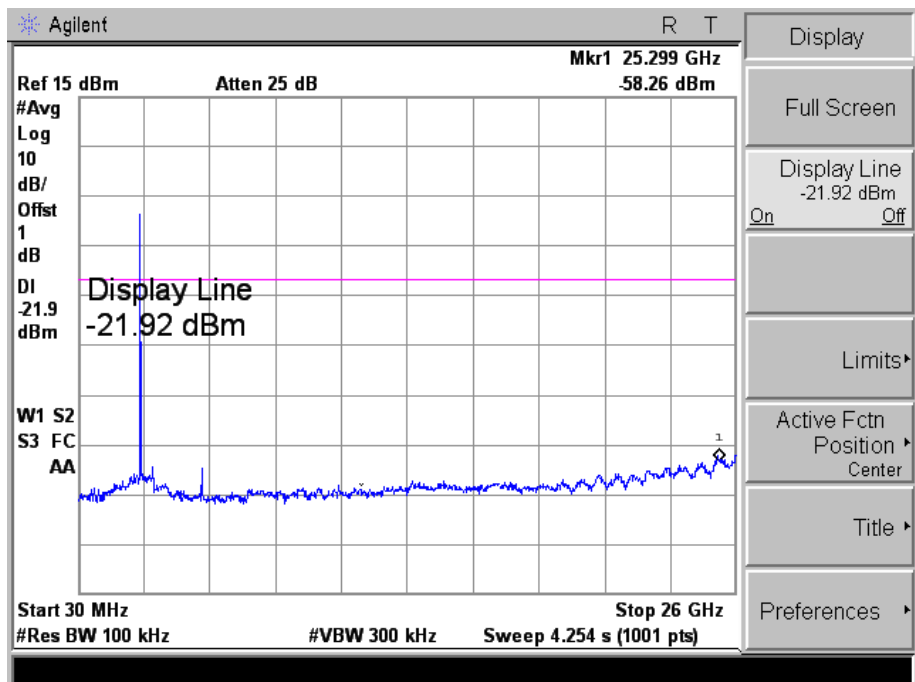
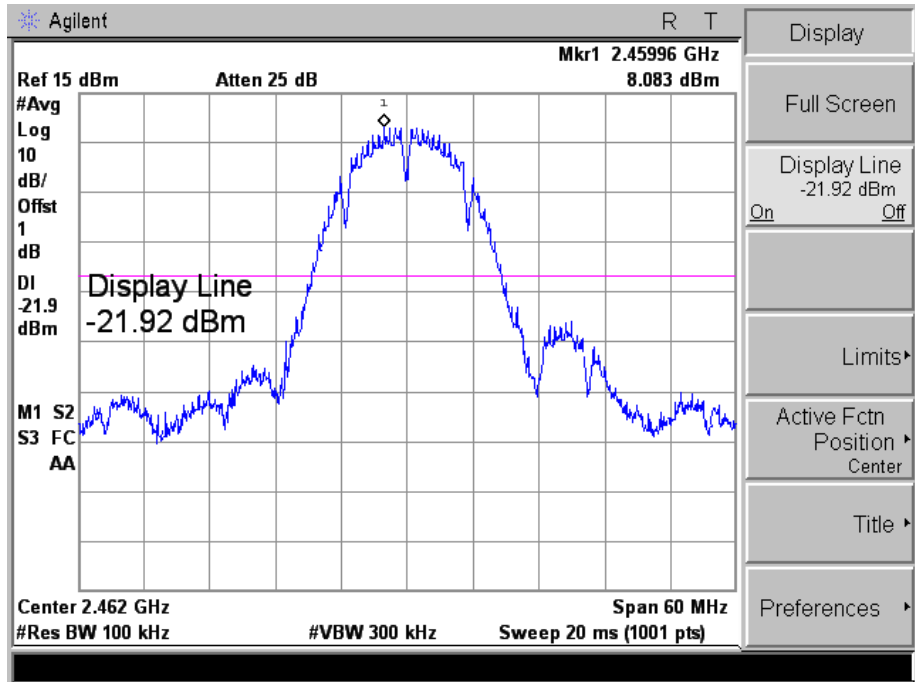
Middle





802.11b\_11Mbps

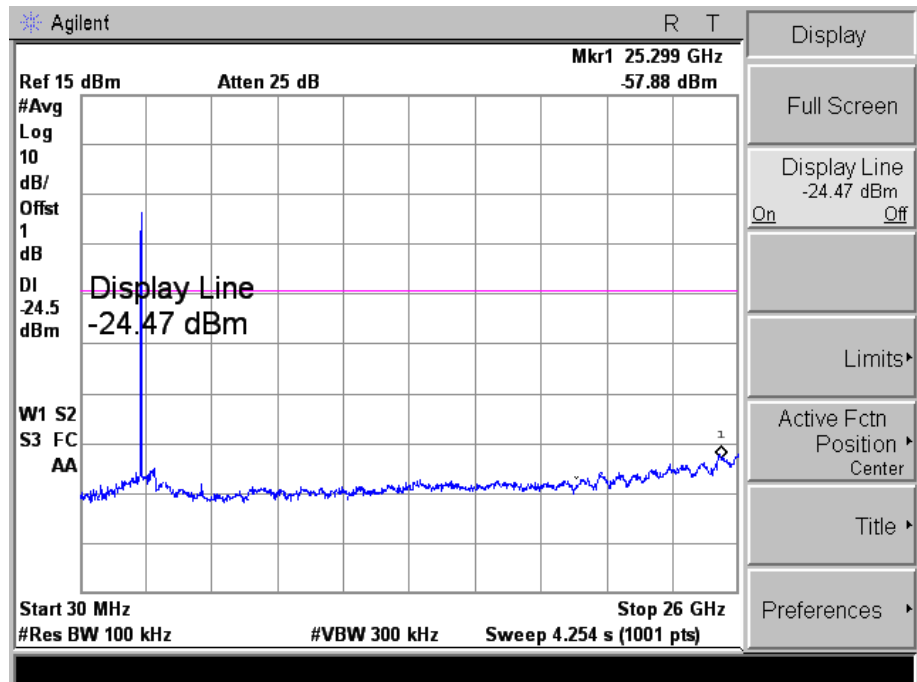
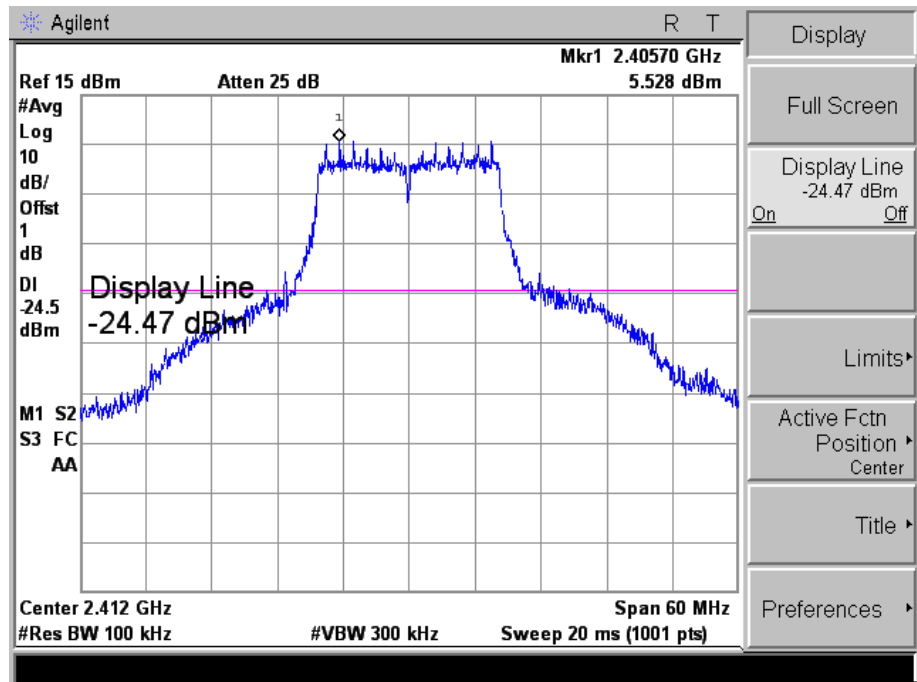
High





802.11g\_54Mbps

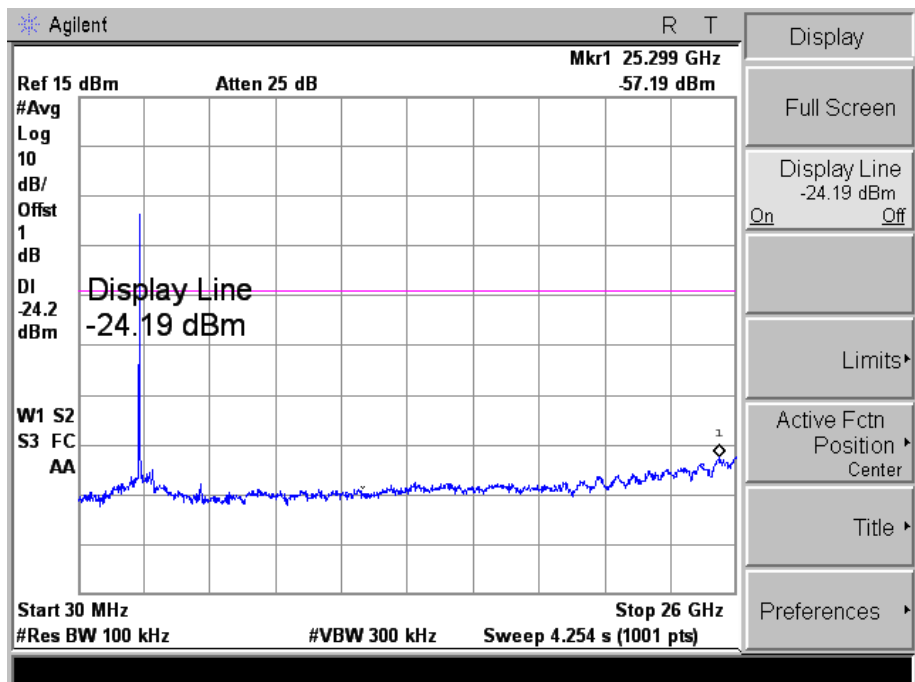
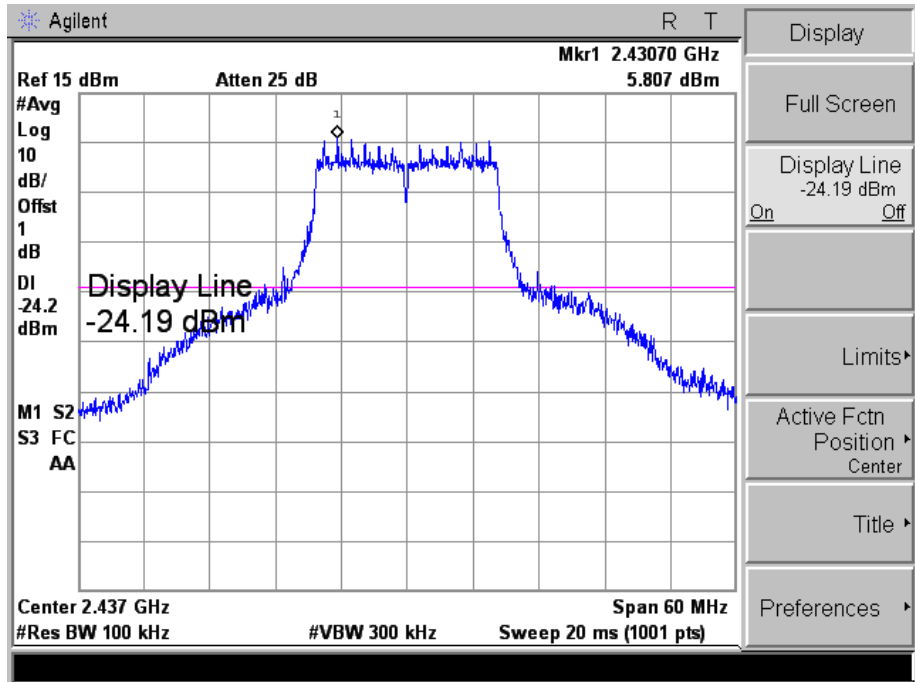
Low





802.11g\_54Mbps

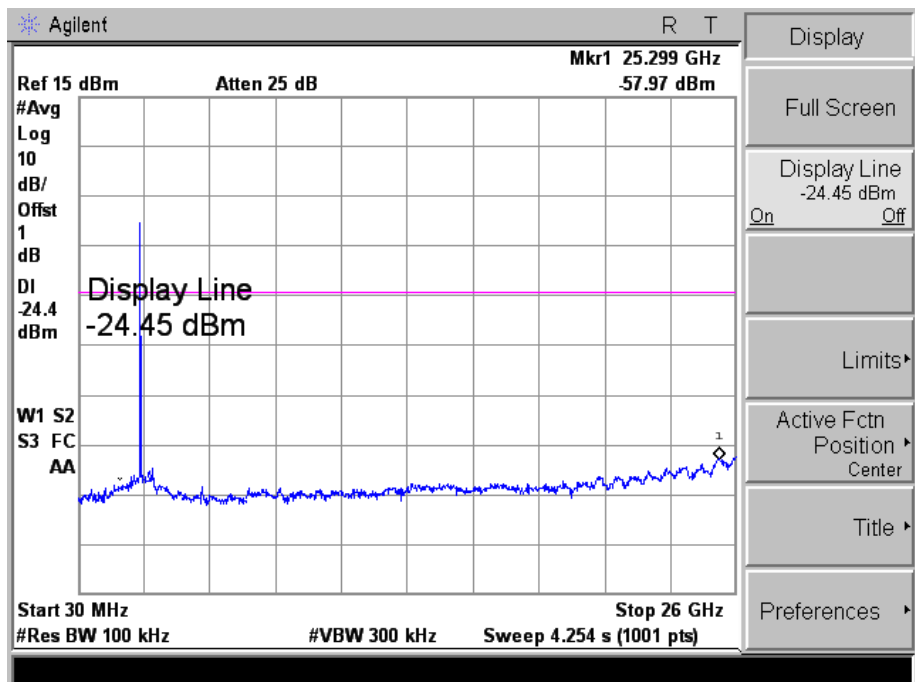
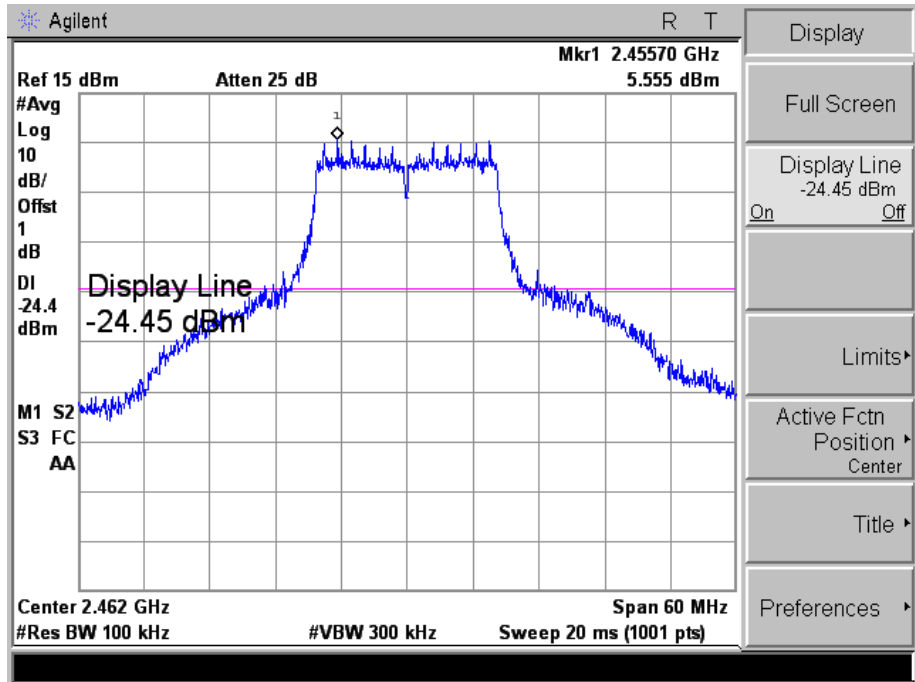
Middle





802.11g\_54Mbps

High

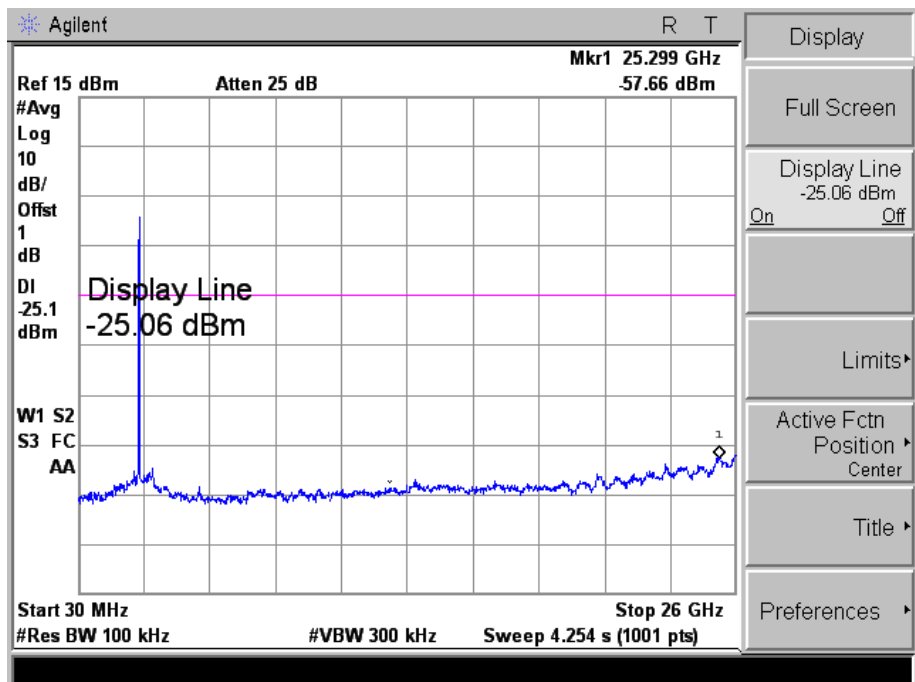
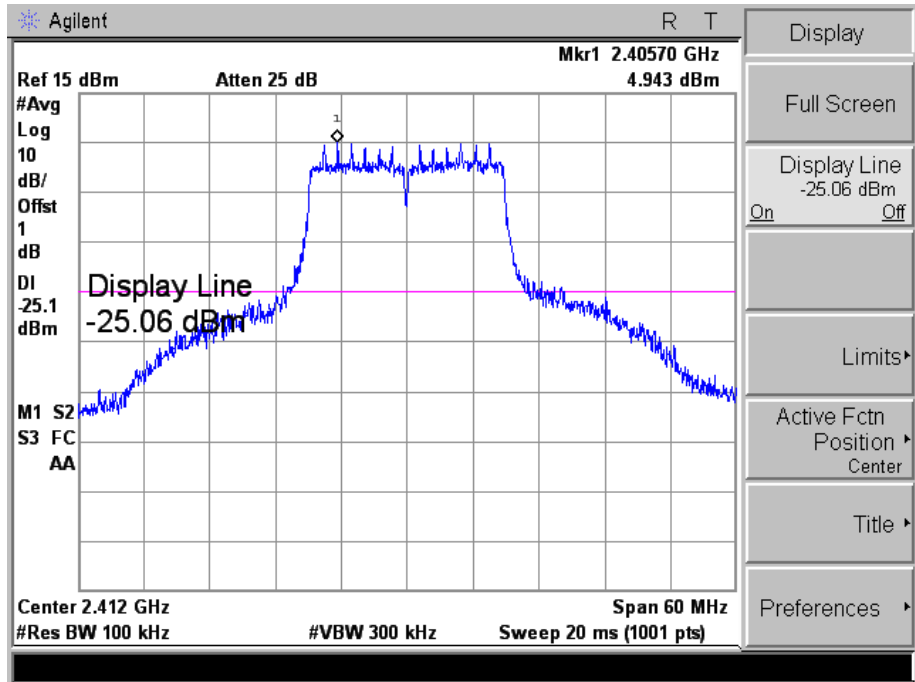






802.11n-HT20\_MCS7

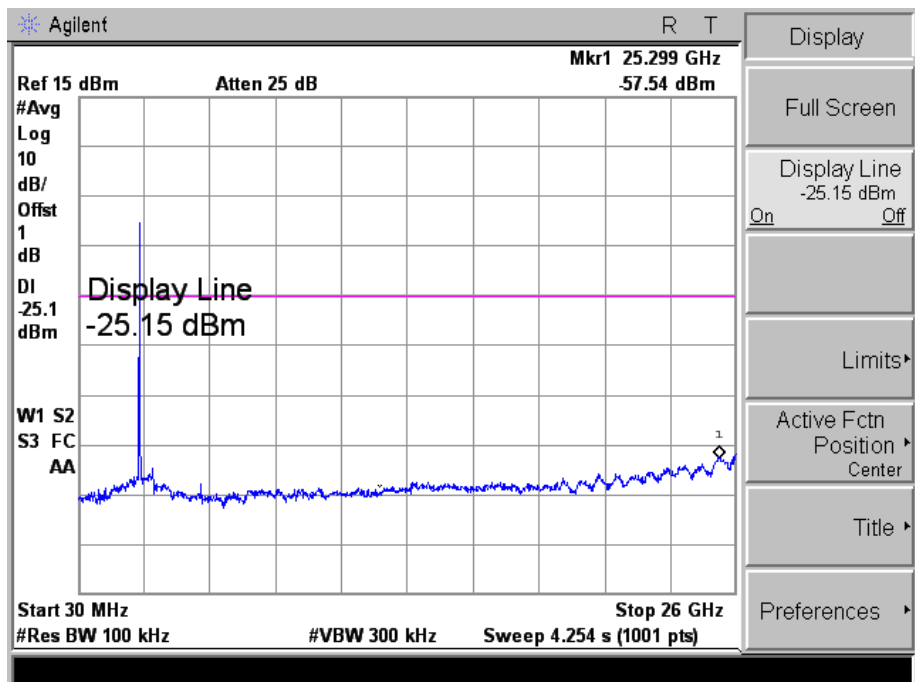
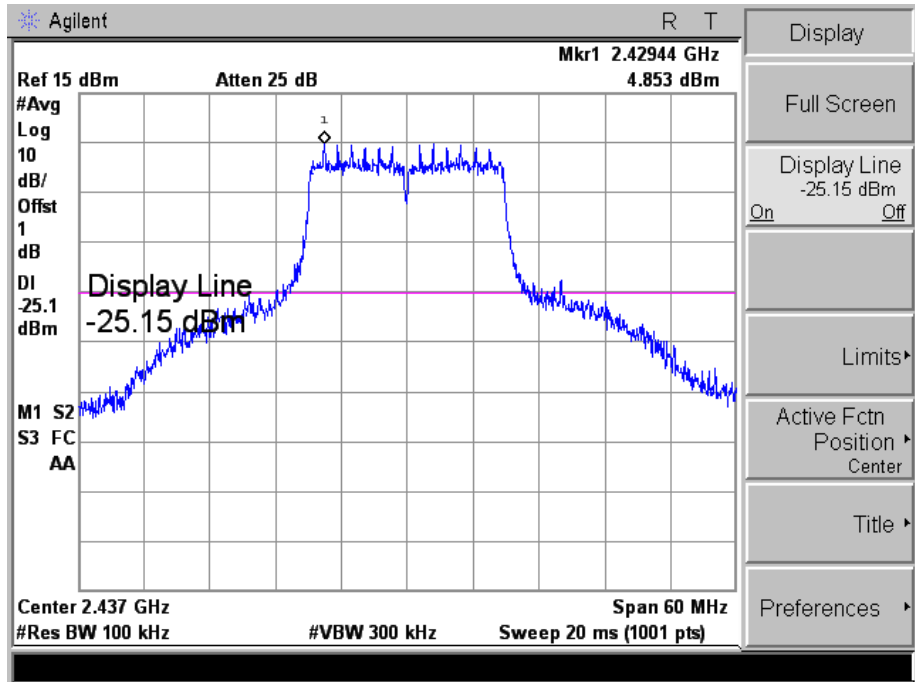
Low





802.11n-HT20\_MCS7

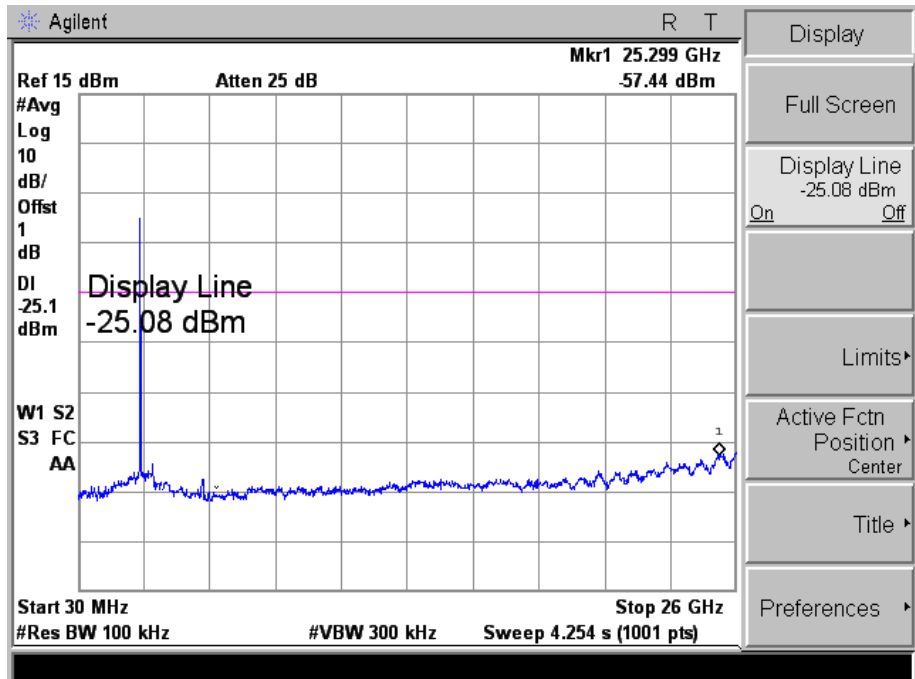
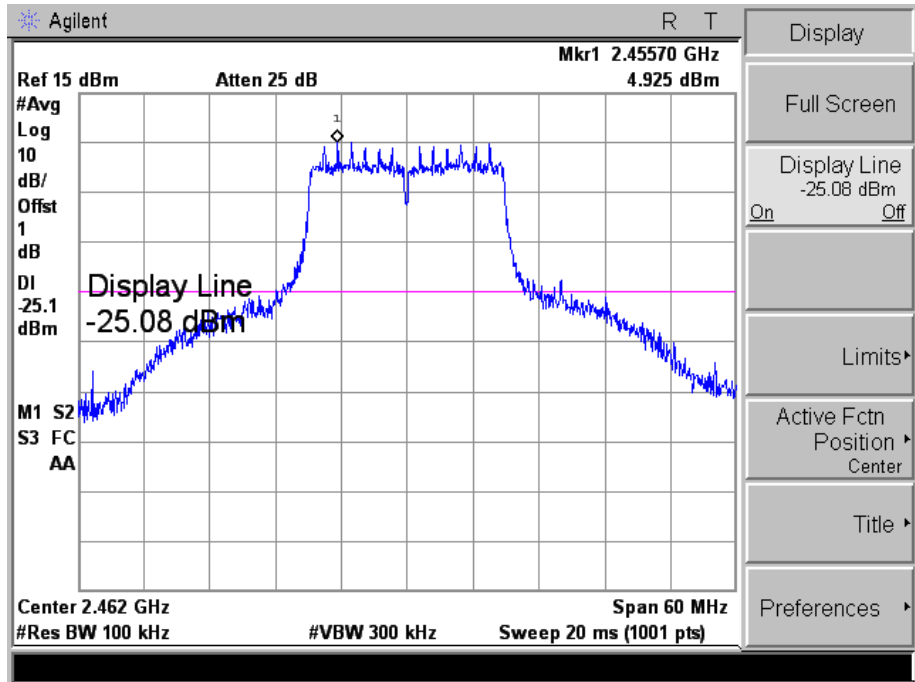
Middle





802.11n-HT20\_MCS7

High



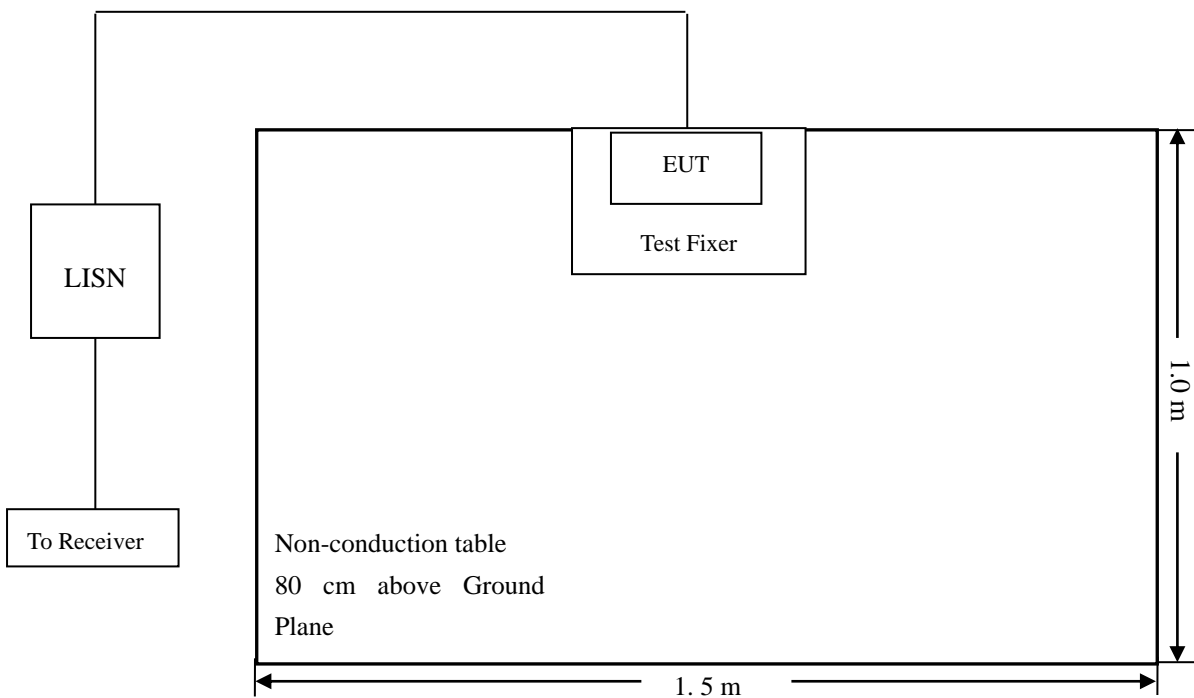
## 10. Conducted Emissions

### 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

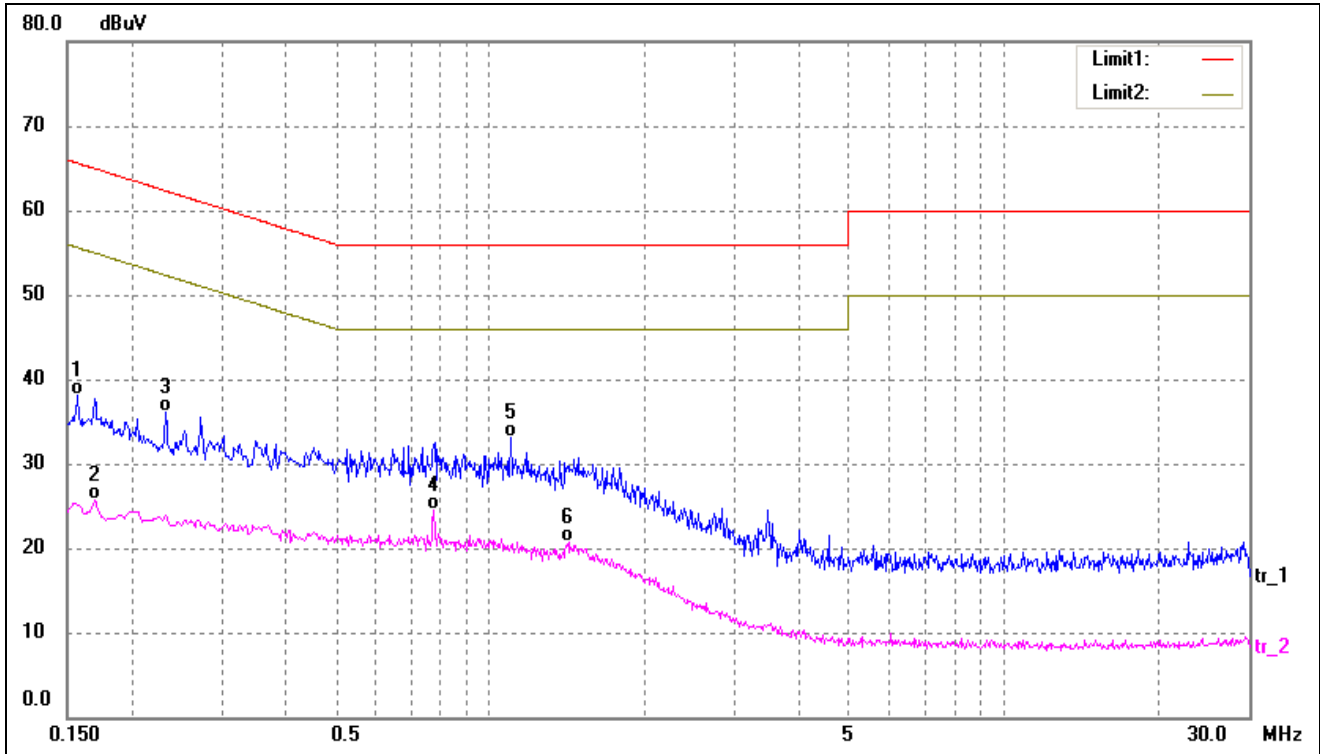
During the conducted emission test, the test receiver was set with the following configurations:

- 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



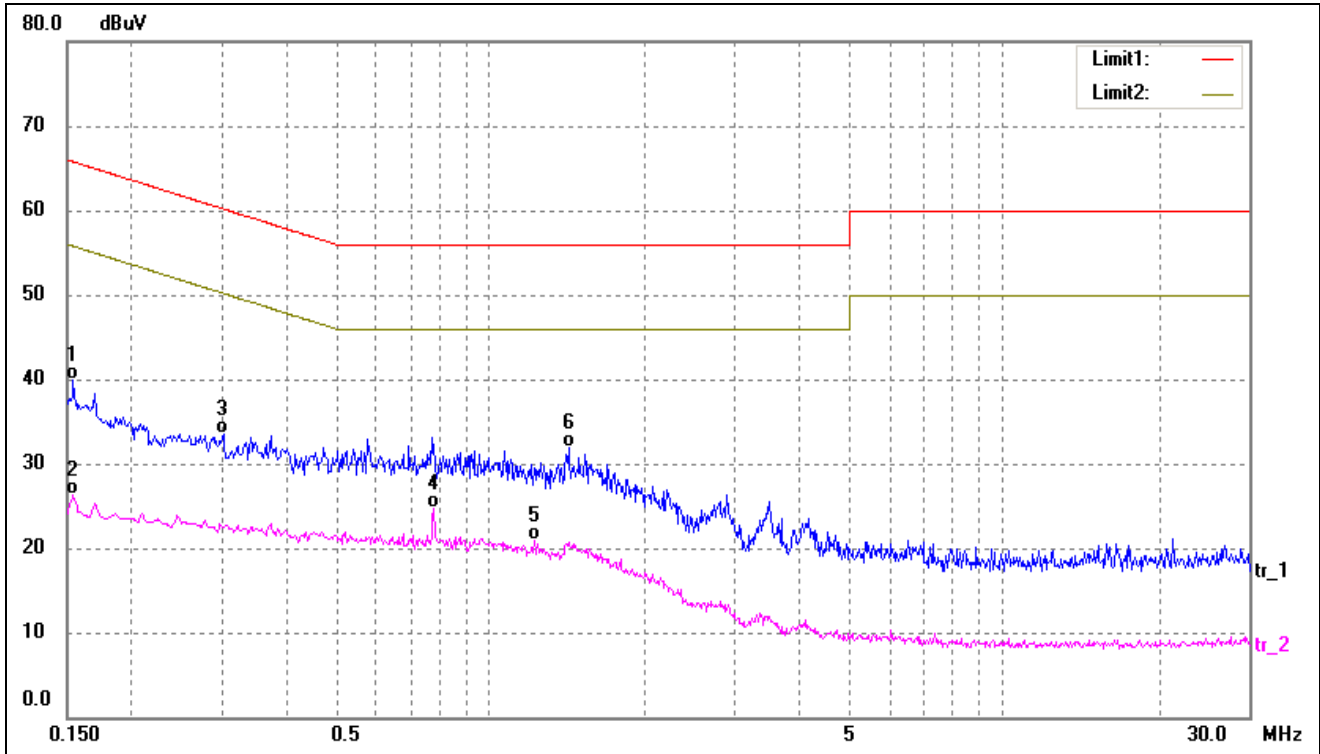
Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1580	28.08	9.95	38.03	65.57	-27.54	QP
2	0.1700	15.66	9.95	25.61	54.96	-29.35	AVG
3	0.2340	26.08	10.00	36.08	62.31	-26.23	QP
4*	0.7780	14.34	10.15	24.49	46.00	-21.51	AVG
5	1.0940	22.81	10.37	33.18	56.00	-22.82	QP
6	1.4220	10.36	10.37	20.73	46.00	-25.27	AVG



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	0.1540	29.87	9.95	39.82	65.78	-25.96	QP
2	0.1540	16.39	9.95	26.34	55.78	-29.44	AVG
3	0.3020	23.46	10.01	33.47	60.19	-26.72	QP
4*	0.7780	14.48	10.15	24.63	46.00	-21.37	AVG
5	1.2220	10.52	10.38	20.90	46.00	-25.10	AVG
6	1.4220	21.48	10.37	31.85	56.00	-24.15	QP

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