

# FCC Part 15C Measurement and Test Report

For

ATI Electronics (ShenZhen) Co. Ltd

1/F, B Tower, Shengdelan Industrial Park, Kukeng Village, Guanlan Town,  
Shenzhen, China.

**FCC ID: SF4-WE400**

<b>FCC Rule(s):</b>	<u>FCC Part 15.247</u>
<b>Product Description:</b>	<u>Plug-in Outdoor Smart Outlet</u>
<b>Tested Model:</b>	<u>WE400</u>
<b>Report No.:</b>	<u>STR18088091I</u>
<b>Sample Receipt Date:</b>	<u>2018-08-06</u>
<b>Tested Date:</b>	<u>2018-08-07 to 2018-08-27</u>
<b>Issued Date:</b>	<u>2018-08-28</u>
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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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## 1. GENERAL INFORMATION

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

#### Client Information

Applicant: ATI Electronics (ShenZhen) Co. Ltd  
Address of applicant: 1/F, B Tower, Shengdelan Industrial Park, Kukeng Village,  
Guanlan Town, Shenzhen, China.

Manufacturer: ATI Electronics (ShenZhen) Co. Ltd  
Address of manufacturer: 1/F, B Tower, Shengdelan Industrial Park, Kukeng Village,  
Guanlan Town, Shenzhen, China.

General Description of EUT	
Product Name:	Plug-in Outdoor Smart Outlet
Trade Name:	VIVITAR
Model No.:	WE400
Adding Model(s):	HA-1011
Rated Voltage:	AC 100-240V 50/60Hz
Battery:	/
Power Adapter Model:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model WE400, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n(HT20)
Frequency Range:	2412-2462MHz
RF Output Power:	17.88dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 72.2Mbps
Quantity of Channels:	11
Channel Separation:	5MHz
Type of Antenna:	PCB
Antenna Gain:	0dBi
Highest Internal Frequency of EUT:	26MHz

## 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 DTS Meas Guidance v04:** GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247

**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 DTS Meas Guidance v04

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

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

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

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

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

## 1.5 EUT Setup and Test Mode

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

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	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

Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

Test Conditions	
Temperature:	22~25 °C
Relative humidity	50~55 %.
ATM Pressure:	1019 mbar

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

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

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
iPhone6 Plus	Apple	MGAJ2ZP/A	FK1PQ4JBG5QW

## 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	2018-05-22	2019-05-21
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2018-05-22	2019-05-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2018-05-22	2019-05-21
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2018-05-22	2019-05-21
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2018-05-22	2019-05-21
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2018-05-22	2019-05-21
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2018-05-22	2019-05-21
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2018-05-22	2019-05-21
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2018-05-22	2019-05-21
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2018-05-22	2019-05-21
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2018-05-22	2019-05-21
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2018-05-22	2019-05-21
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2018-05-22	2019-05-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18

## 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)	6 dB Bandwidth	Compliant
§ 15.247(b)(3)	RF Output Power	Compliant
§ 15.209(a)	Radiated Emission	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: not applicable



### **3. RF Exposure**

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#### **3.1 Standard Applicable**

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

#### **3.2 Test Result**

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

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## 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

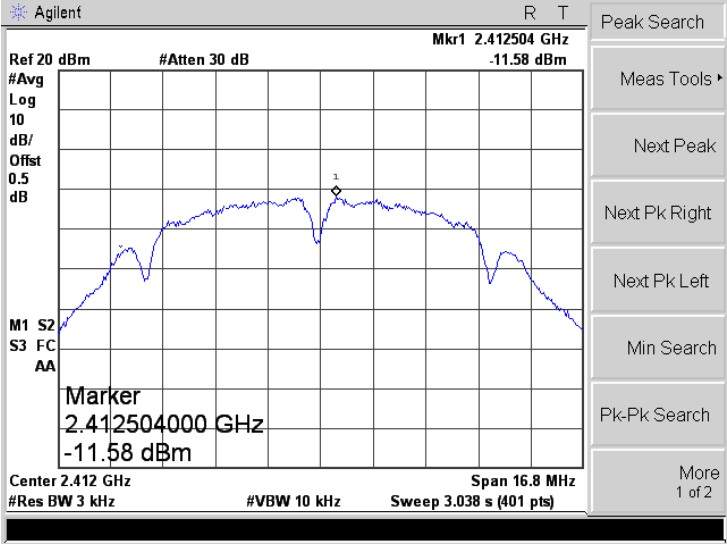
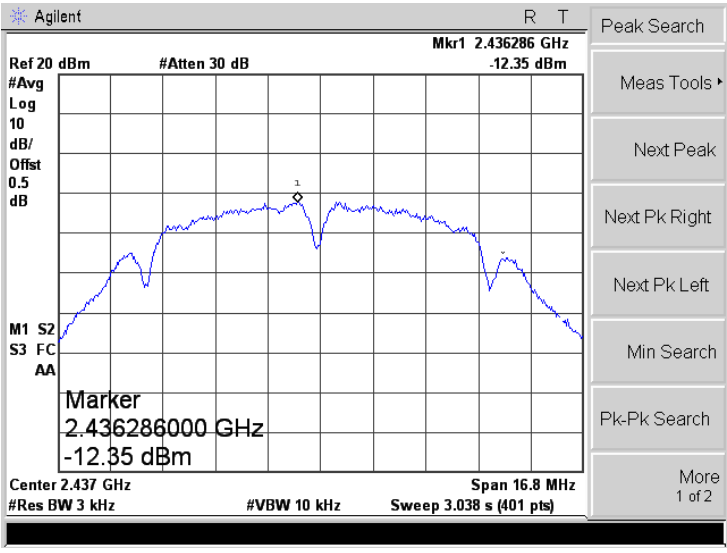
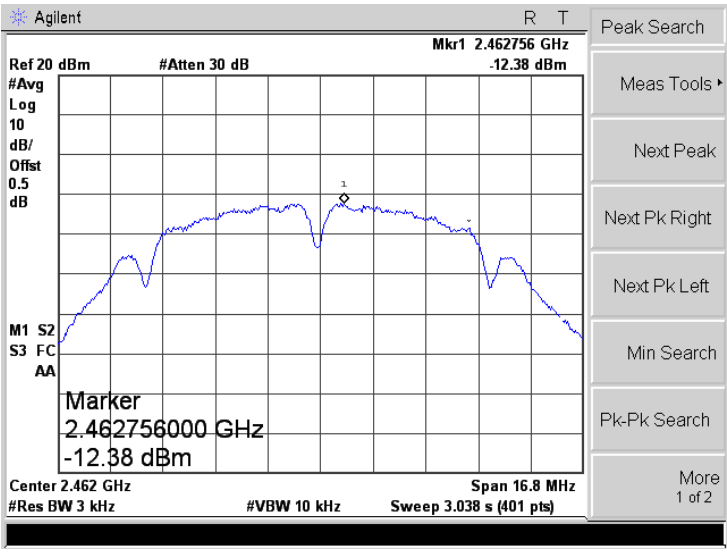
According to the KDB 558074 D01 v04, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

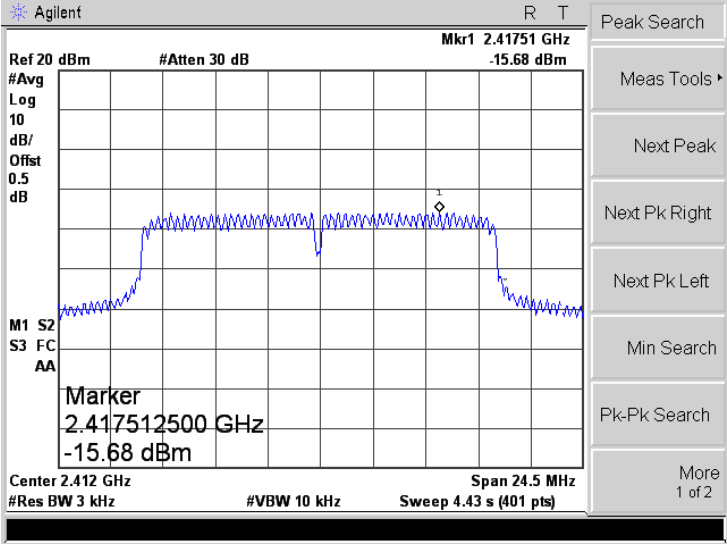
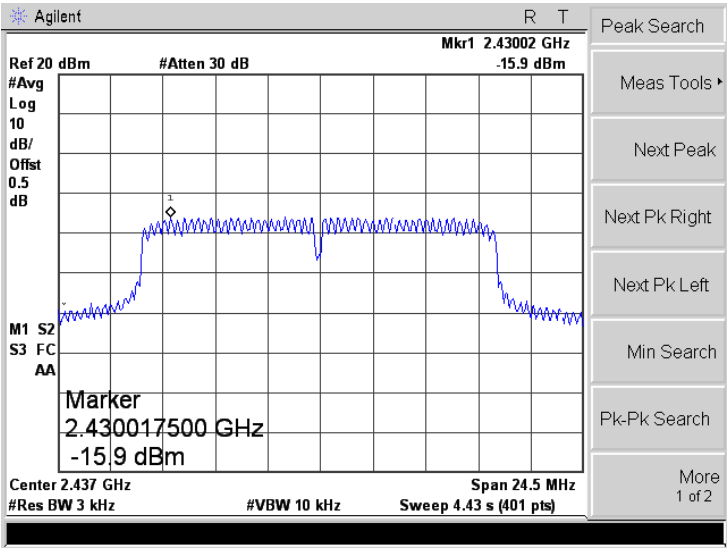
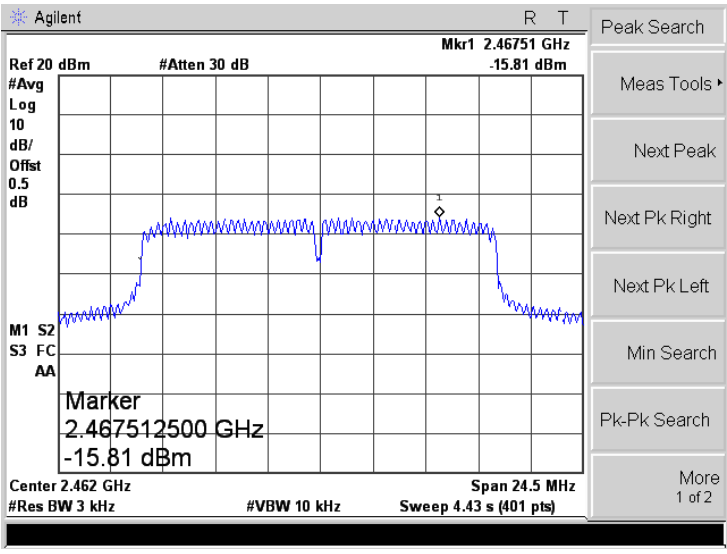
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = power averaging (RMS) or sample detector (when RMS not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

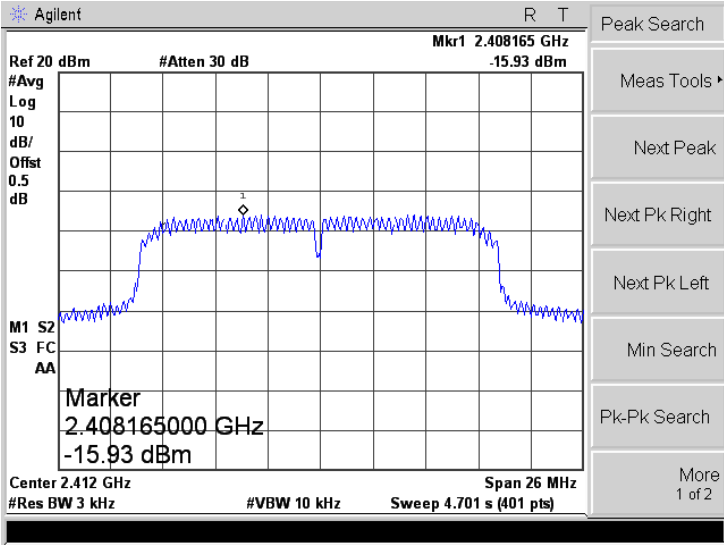
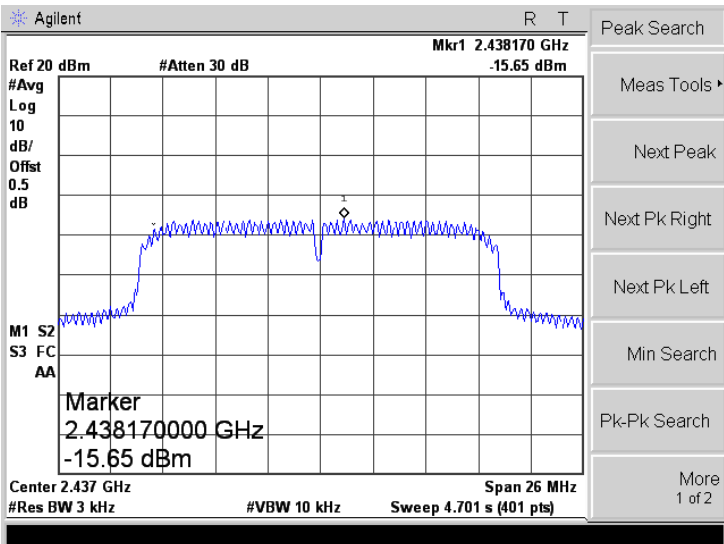
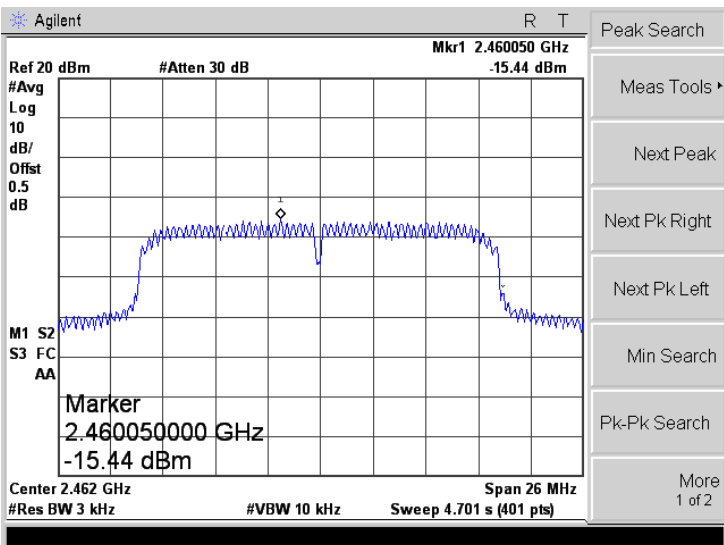
### 5.3 Summary of Test Results/Plots

Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-11.58	8
	2437	-12.35	8
	2462	-12.38	8
802.11g	2412	-15.68	8
	2437	-15.90	8
	2462	-15.81	8
802.11n-HT20	2412	-15.93	8
	2437	-15.65	8
	2462	-15.44	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. 6dB Bandwidth

### 6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

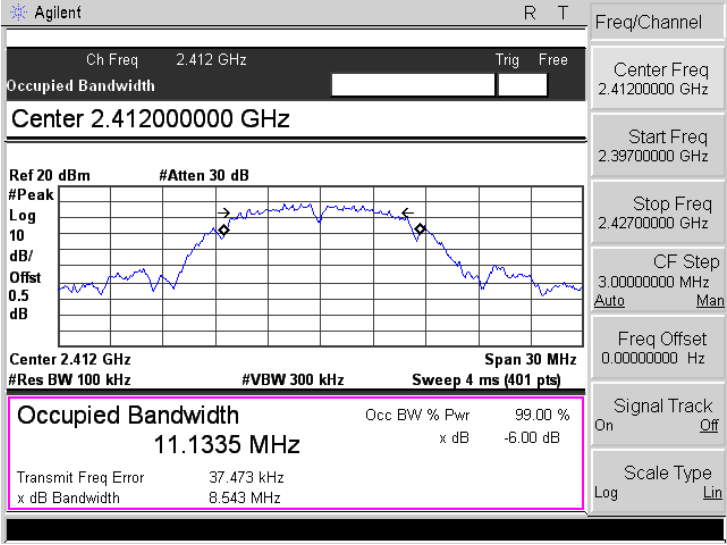
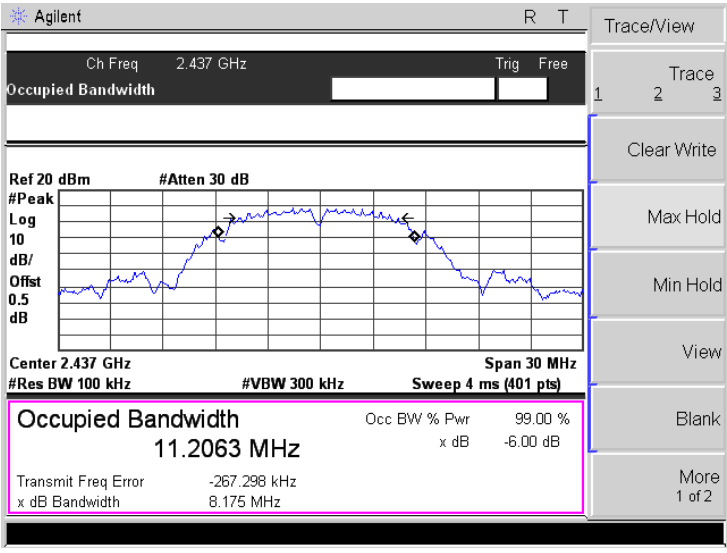
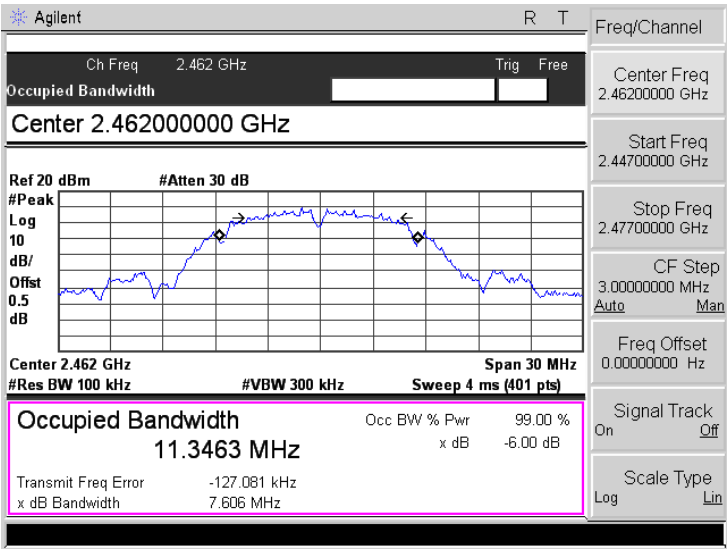
### 6.2 Test Procedure

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

### 6.3 Summary of Test Results/Plots

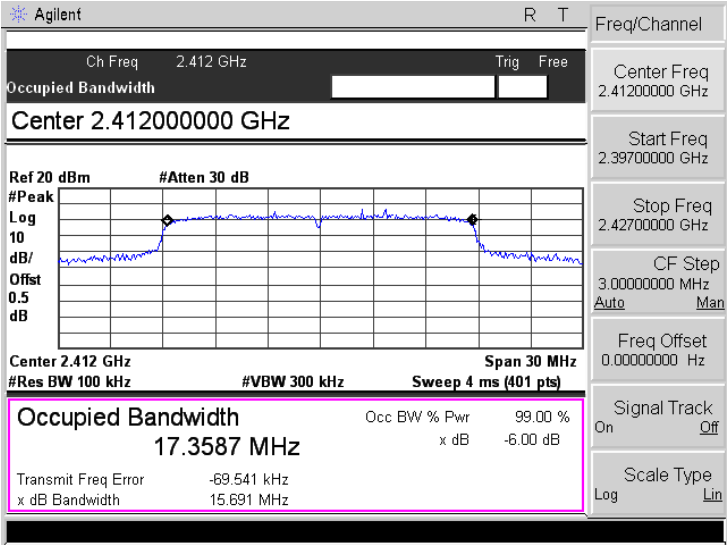
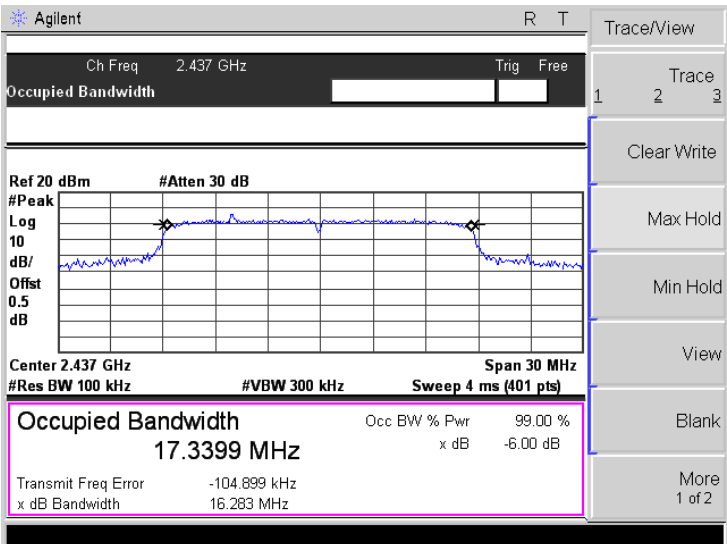
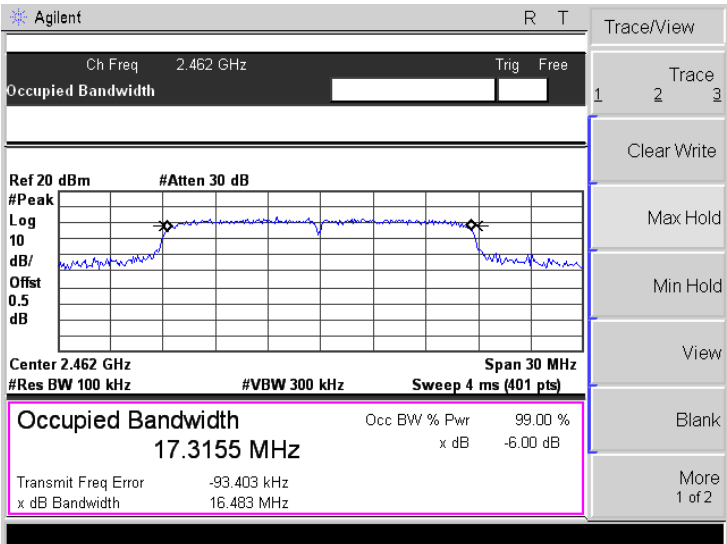
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	Limit kHz
802.11b	2412	8.543	$\geq 500$
	2437	8.175	$\geq 500$
	2462	7.606	$\geq 500$
802.11g	2412	16.385	$\geq 500$
	2437	16.391	$\geq 500$
	2462	15.390	$\geq 500$
802.11n-HT20	2412	15.691	$\geq 500$
	2437	16.283	$\geq 500$
	2462	16.483	$\geq 500$

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>	

## 7. RF Output Power

---

### 7.1 Standard Applicable

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

### 7.2 Test Procedure

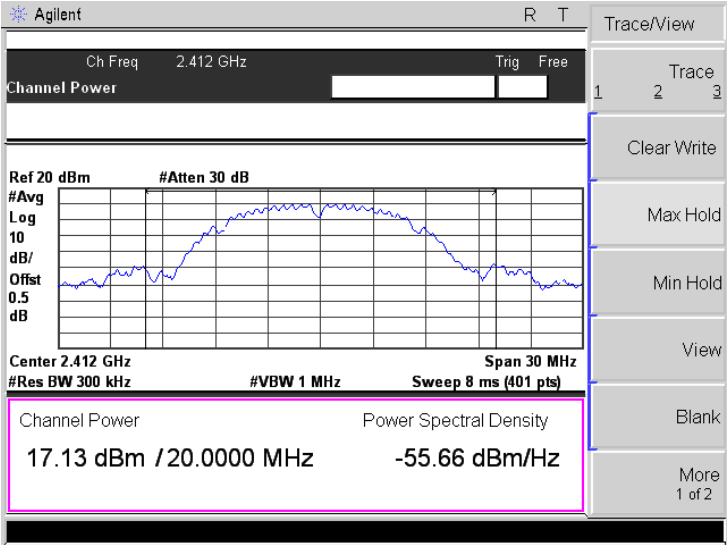
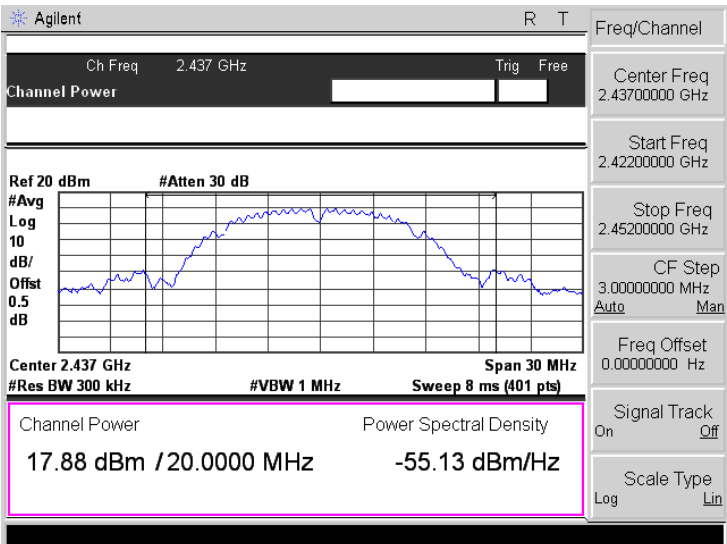
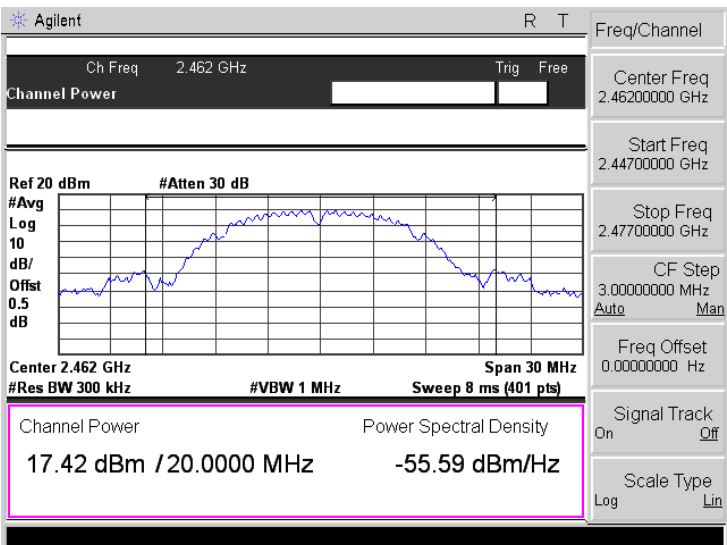
According to the KDB-558074 D01 v04, 9.2.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

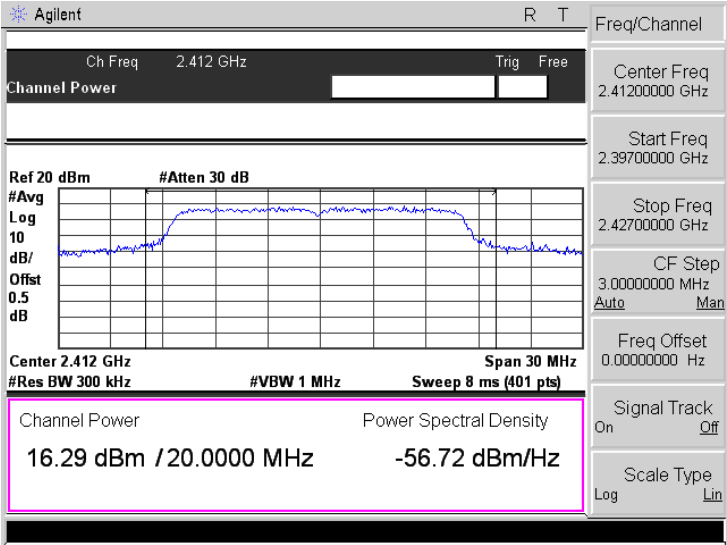
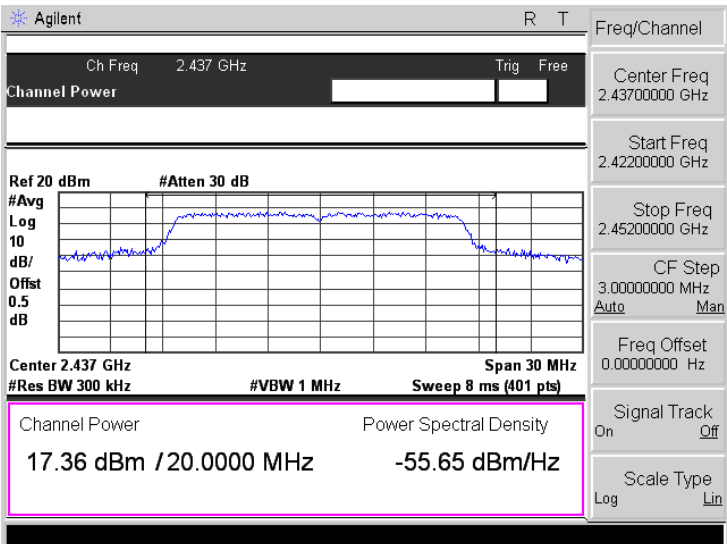
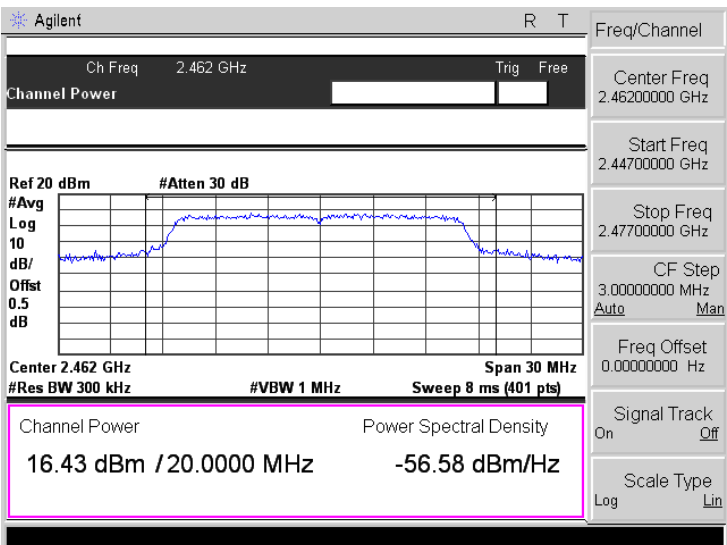
- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Number of points in sweep  $\geq 2 \times$  span / RBW. (This gives bin-to-bin spacing  $\leq$  RBW/2, so that narrowband signals are not lost between frequency bins.)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

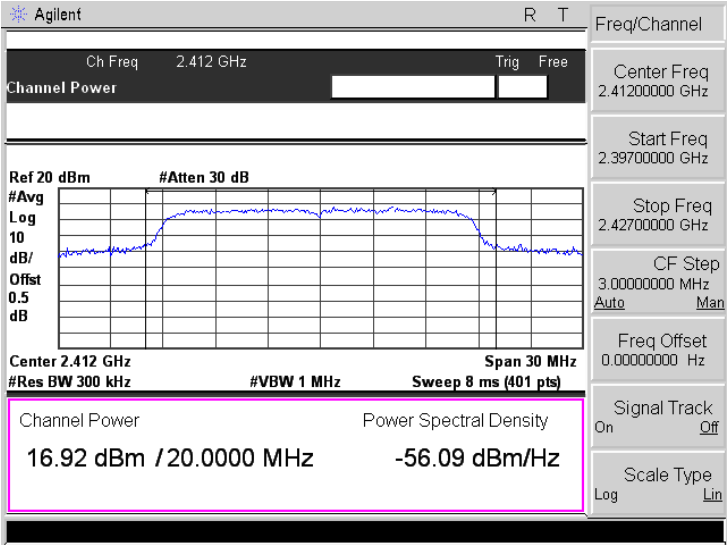
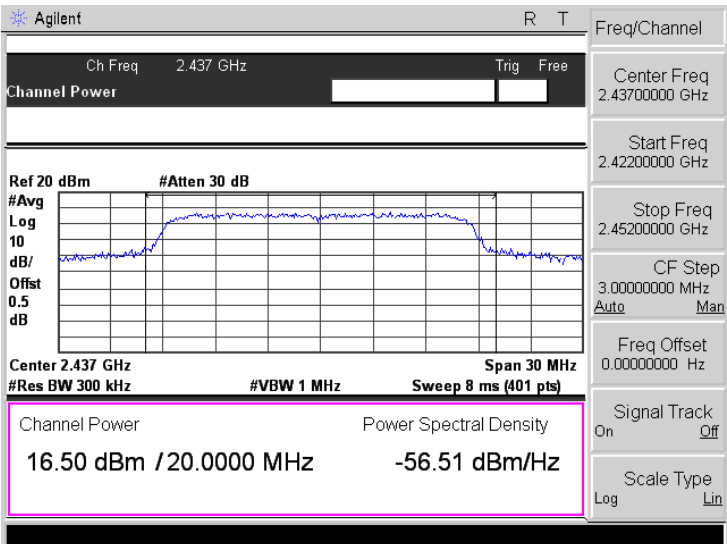
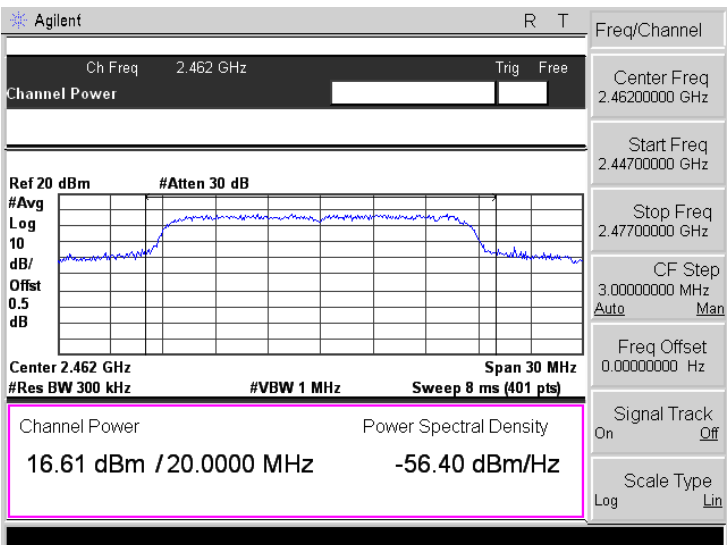
### 7.3 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b_11Mbps	2412	17.13	51.642	1000
	2437	17.88	61.376	1000
	2462	17.42	55.208	1000
802.11g_54Mbps	2412	16.29	42.560	1000
	2437	17.36	54.450	1000
	2462	16.43	43.954	1000
802.11n HT20_MCS7	2412	16.92	49.204	1000
	2437	16.50	44.668	1000
	2462	16.61	45.814	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 0.5 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>17.13 dBm / 20.0000 MHz -55.66 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 Freq/Channel</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 0.5 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>17.88 dBm / 20.0000 MHz -55.13 dBm/Hz</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 11Mbps</p>	 <p>Agilent R T Freq/Channel</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 0.5 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>17.42 dBm / 20.0000 MHz -55.59 dBm/Hz</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 54Mbps</p>	 <p>Agilent R T</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 0.5 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 16.29 dBm / 20.0000 MHz -56.72 dBm/Hz</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 54Mbps</p>	 <p>Agilent R T</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 0.5 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 17.36 dBm / 20.0000 MHz -55.65 dBm/Hz</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 54Mbps</p>	 <p>Agilent R T</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 0.5 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 16.43 dBm / 20.0000 MHz -56.58 dBm/Hz</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 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

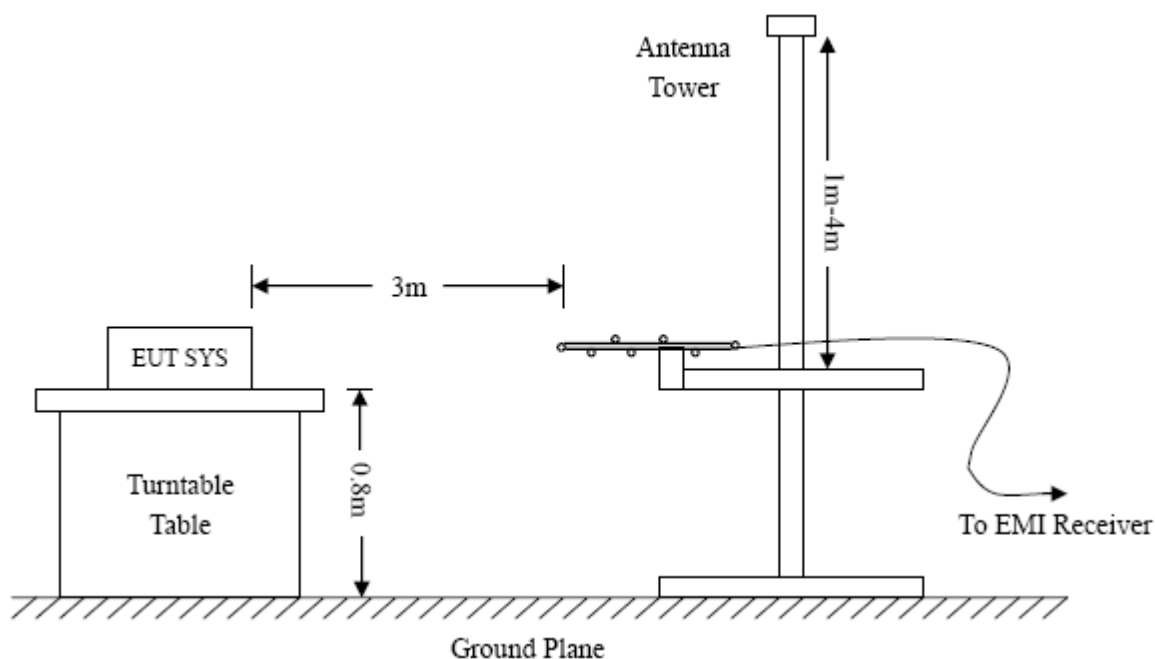
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within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

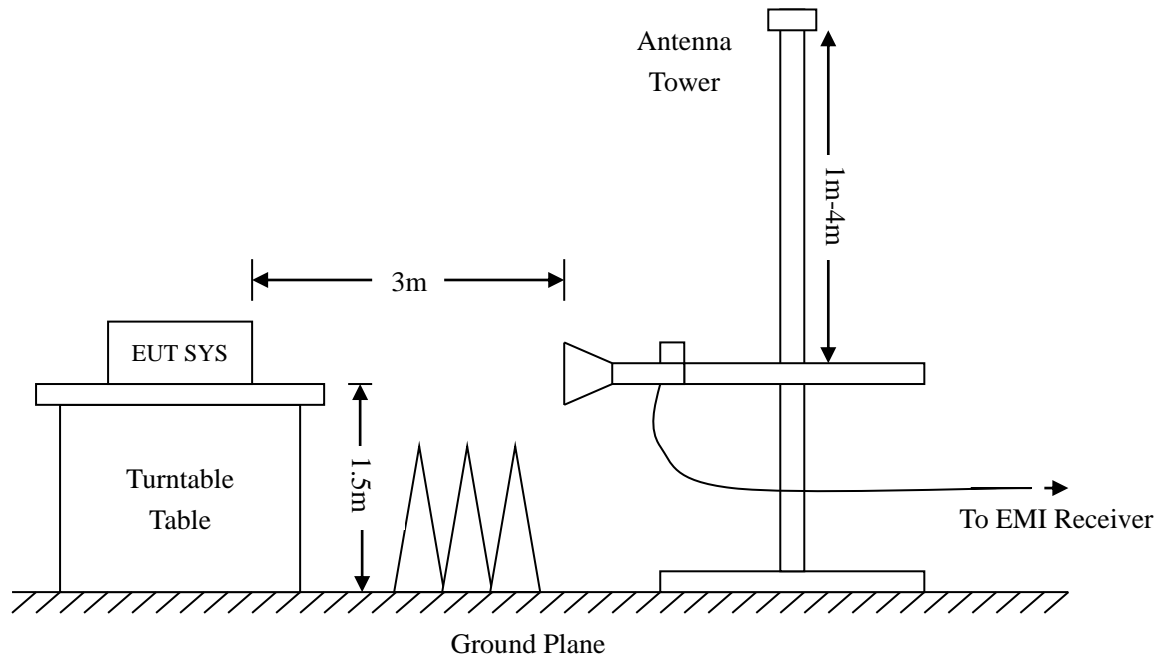
### 8.2 Test Procedure

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:

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

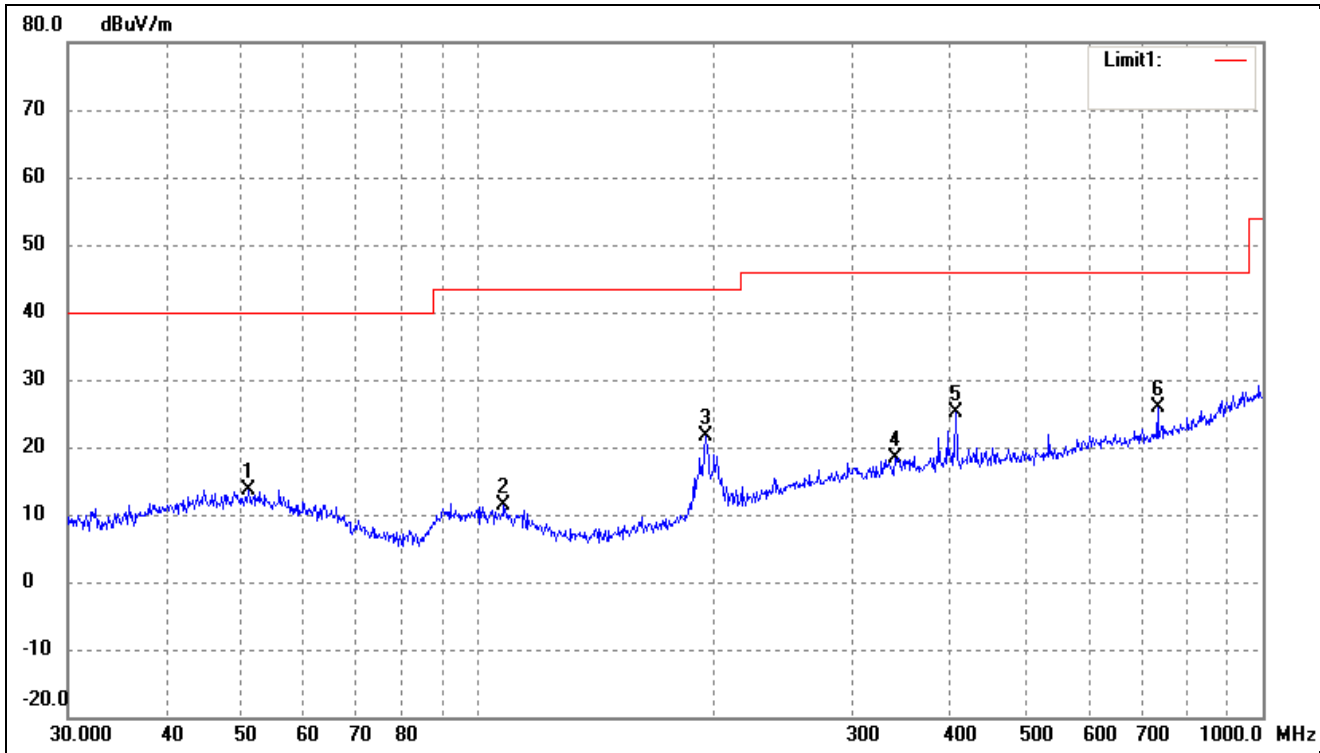
### 8.4 Summary of Test Results/Plots

*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.*

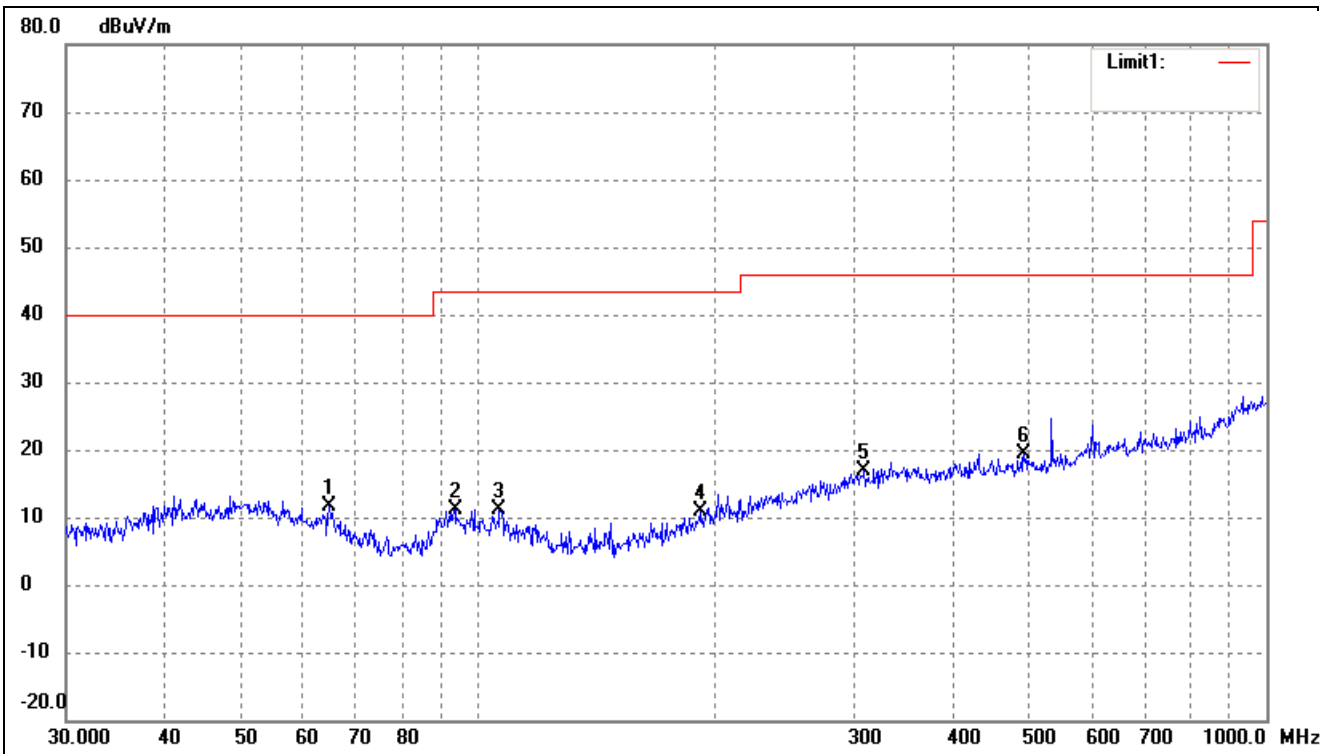
## ➤ Spurious Emissions Below 1GHz

802.11b			
Test Channel	Low	Polarity:	Horizontal



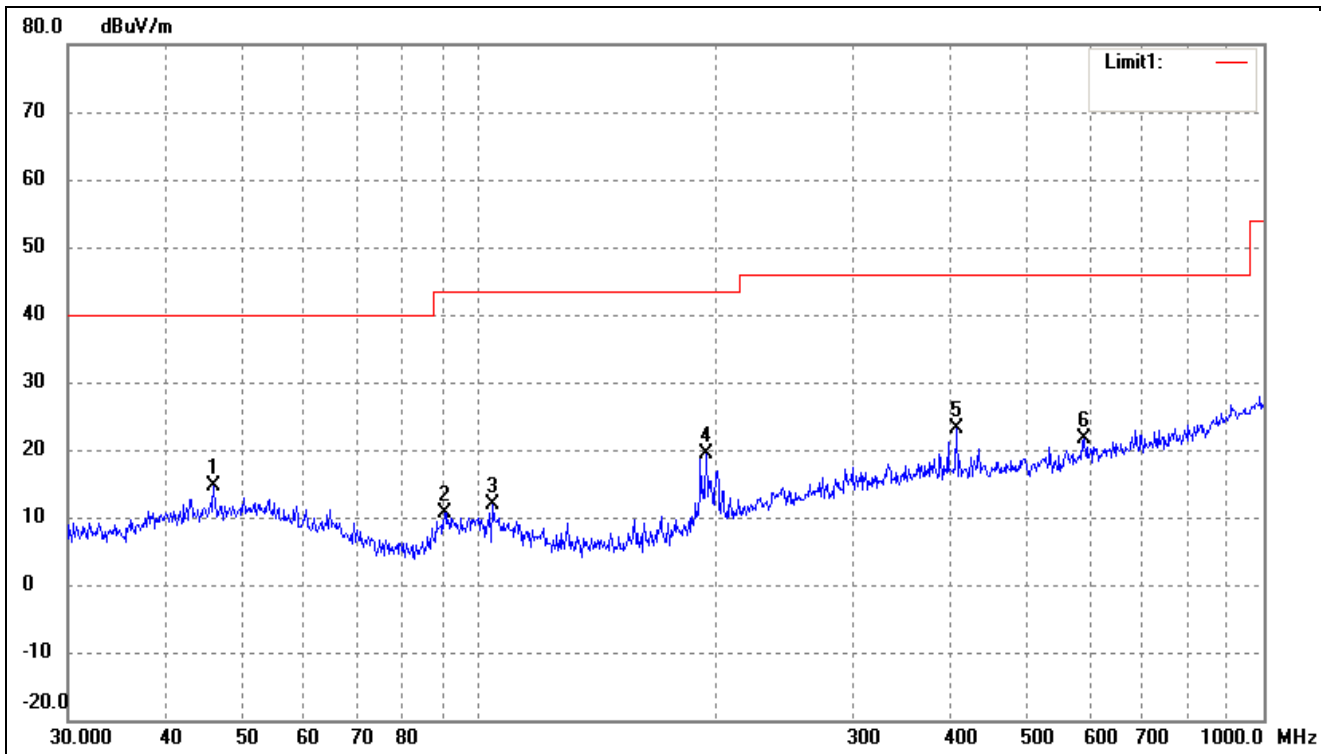
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	50.9420	27.28	-13.60	13.68	40.00	-26.32	74	100	peak
2	107.8877	26.88	-15.54	11.34	43.50	-32.16	321	100	peak
3	195.1365	35.99	-14.31	21.68	43.50	-21.82	70	100	peak
4	339.5888	27.11	-8.70	18.41	46.00	-27.59	131	100	peak
5	406.0880	33.85	-8.60	25.25	46.00	-20.75	235	100	peak
6	734.4913	30.91	-5.15	25.76	46.00	-20.24	232	100	peak

802.11b			
Test Channel	Low	Polarity:	Vertical



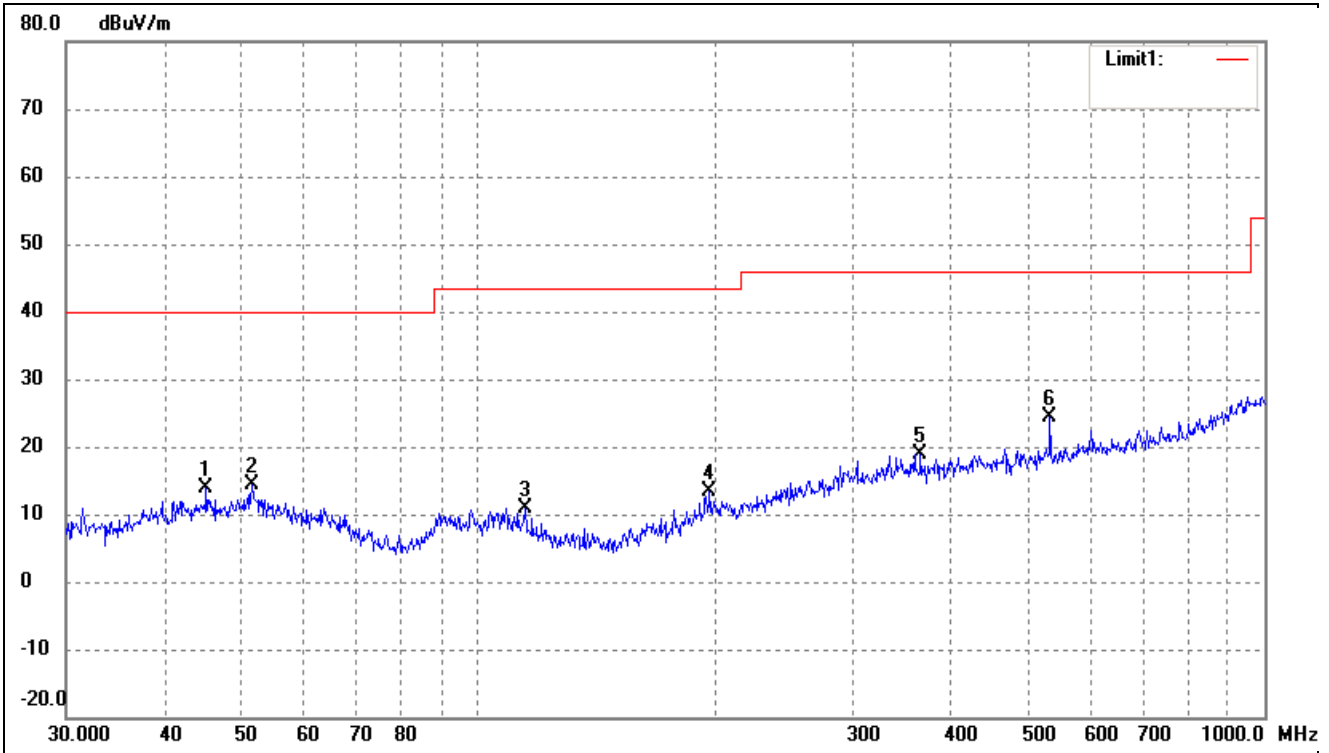
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	64.6594	27.64	-16.00	11.64	40.00	-28.36	81	100	peak
2	93.4402	27.24	-16.12	11.12	43.50	-32.38	113	100	peak
3	106.3850	26.45	-15.42	11.03	43.50	-32.47	85	100	peak
4	191.0738	25.69	-14.89	10.80	43.50	-32.70	109	100	peak
5	308.9126	26.37	-9.38	16.99	46.00	-29.01	352	100	peak
6	492.4685	27.80	-8.34	19.46	46.00	-26.54	231	100	peak

802.11b			
Test Channel	Middle	Polarity:	Horizontal



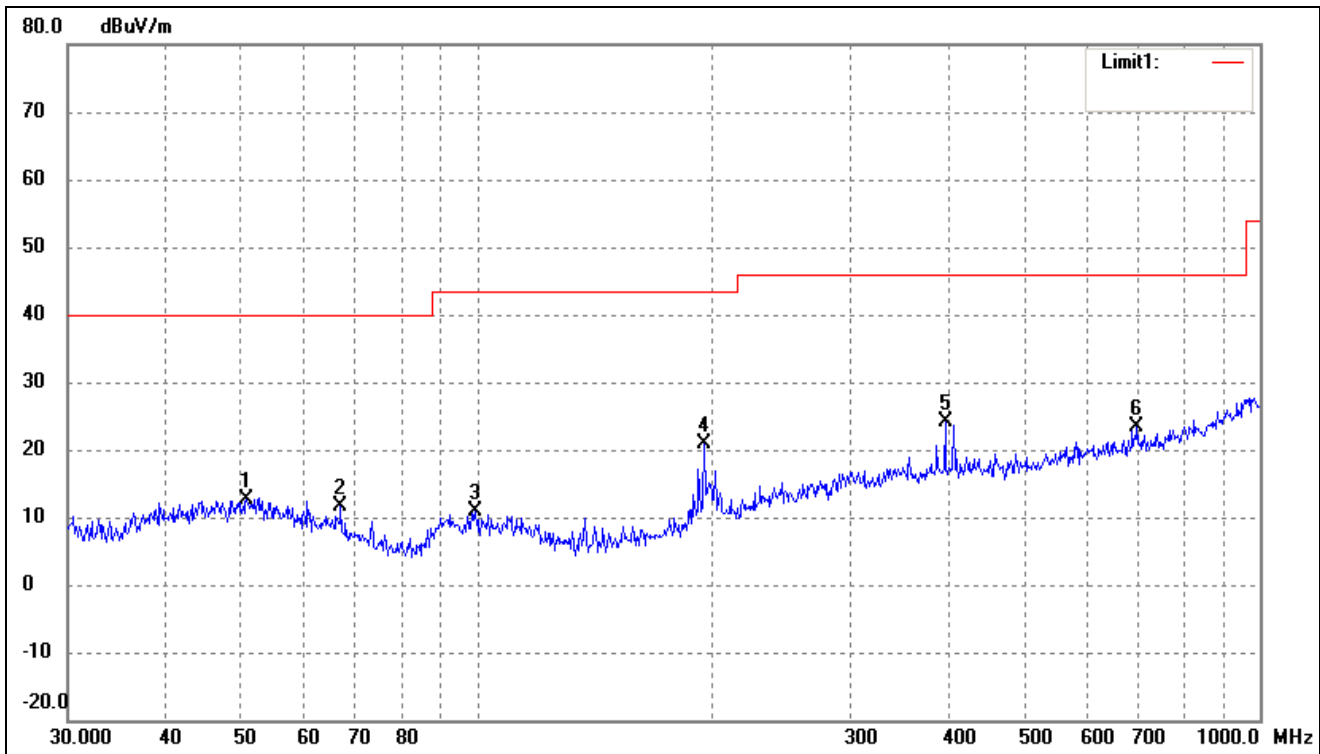
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	46.0164	28.41	-13.79	14.62	40.00	-25.38	357	100	peak
2	90.5374	26.26	-15.56	10.70	43.50	-32.80	288	100	peak
3	104.1701	27.30	-15.39	11.91	43.50	-31.59	68	100	peak
4	195.1365	33.62	-14.31	19.31	43.50	-24.19	323	100	peak
5	406.0880	31.78	-8.60	23.18	46.00	-22.82	115	100	peak
6	590.9737	28.19	-6.63	21.56	46.00	-24.44	262	100	peak

802.11b			
Test Channel	Middle	Polarity:	Vertical



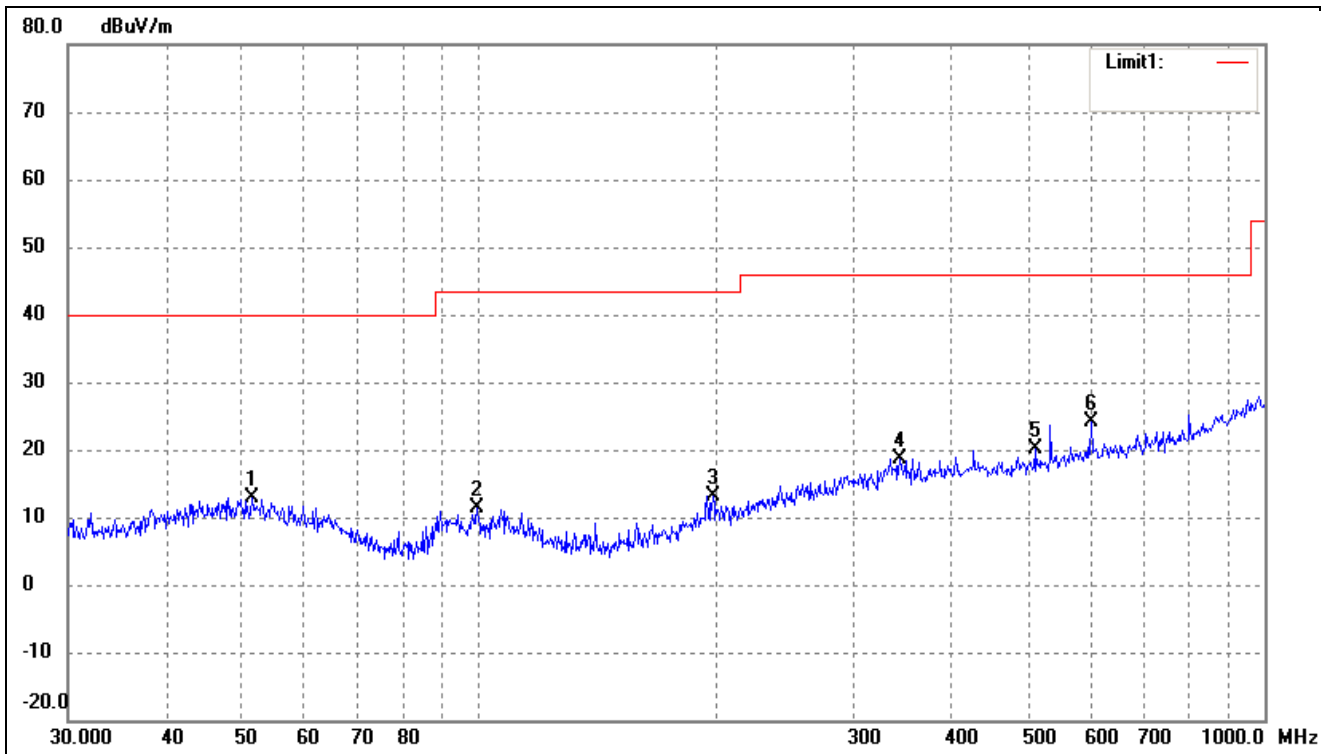
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	45.2166	27.82	-13.89	13.93	40.00	-26.07	187	100	peak
2	51.6616	27.95	-13.59	14.36	40.00	-25.64	305	100	peak
3	114.9169	27.44	-16.60	10.84	43.50	-32.66	94	100	peak
4	197.2001	27.51	-14.05	13.46	43.50	-30.04	137	100	peak
5	365.5391	27.78	-8.92	18.86	46.00	-27.14	84	100	peak
6	533.8321	32.33	-7.95	24.38	46.00	-21.62	179	100	peak

802.11b			
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	50.7637	26.30	-13.60	12.70	40.00	-27.30	269	100	peak
2	66.9669	28.32	-16.79	11.53	40.00	-28.47	94	100	peak
3	99.5281	26.63	-15.86	10.77	43.50	-32.73	299	100	peak
4	195.1365	35.19	-14.31	20.88	43.50	-22.62	121	100	peak
5	396.2415	32.94	-8.83	24.11	46.00	-21.89	231	100	peak
6	696.8567	28.84	-5.53	23.31	46.00	-22.69	285	100	peak

802.11b			
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	51.4807	26.42	-13.60	12.82	40.00	-27.18	343	100	peak
2	99.5281	27.23	-15.86	11.37	43.50	-32.13	90	100	peak
3	198.5880	27.09	-13.88	13.21	43.50	-30.29	349	100	peak
4	343.1800	27.27	-8.58	18.69	46.00	-27.31	107	100	peak
5	510.0436	28.75	-8.50	20.25	46.00	-25.75	217	100	peak
6	601.4265	30.73	-6.63	24.10	46.00	-21.90	301	100	peak

## ➤ Spurious Emissions Below 1GHz

## ➤ Test Mode: 802.11b (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	63.45	-3.87	59.58	74.00	-14.42	H	PK
4824.00	48.79	-3.87	44.92	54.00	-9.08	H	AV
7236.00	57.55	1.14	58.69	74.00	-15.31	H	PK
7236.00	42.59	1.19	43.78	54.00	-10.22	H	AV
4824.00	62.79	-3.86	58.93	74.00	-15.07	V	PK
4824.00	47.65	-3.86	43.79	54.00	-10.21	V	AV
7236.00	56.49	1.10	57.59	74.00	-16.41	V	PK
7236.00	42.31	1.10	43.41	54.00	-10.59	V	AV
Middle Channel-2437MHz							
4874.00	61.27	-3.74	57.53	74.00	-16.47	H	PK
4874.00	47.42	-3.74	43.68	54.00	-10.32	H	AV
7311.00	57.10	1.47	58.57	74.00	-15.43	H	PK
7311.00	42.66	1.47	44.13	54.00	-9.87	H	AV
4874.00	60.50	-3.74	56.76	74.00	-17.24	V	PK
4874.00	46.39	-3.74	42.65	54.00	-11.35	V	AV
7311.00	56.14	1.47	57.61	74.00	-16.39	V	PK
7311.00	41.56	1.47	43.03	54.00	-10.97	V	AV
High Channel-2462MHz							
4924.00	61.84	-3.59	58.25	74.00	-15.75	H	PK
4924.00	46.67	-3.59	43.08	54.00	-10.92	H	AV
7386.00	54.87	1.79	56.66	74.00	-17.34	H	PK
7386.00	40.93	1.79	42.72	54.00	-11.28	H	AV
4924.00	60.76	-3.59	57.17	74.00	-16.83	V	PK
4924.00	46.98	-3.59	43.39	54.00	-10.61	V	AV
7386.00	55.46	1.79	57.25	74.00	-16.75	V	PK
7440.00	41.51	1.79	43.30	54.00	-10.70	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 558074D01 v04, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak/average; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 v04, the conducted spurious emissions test method as follows:

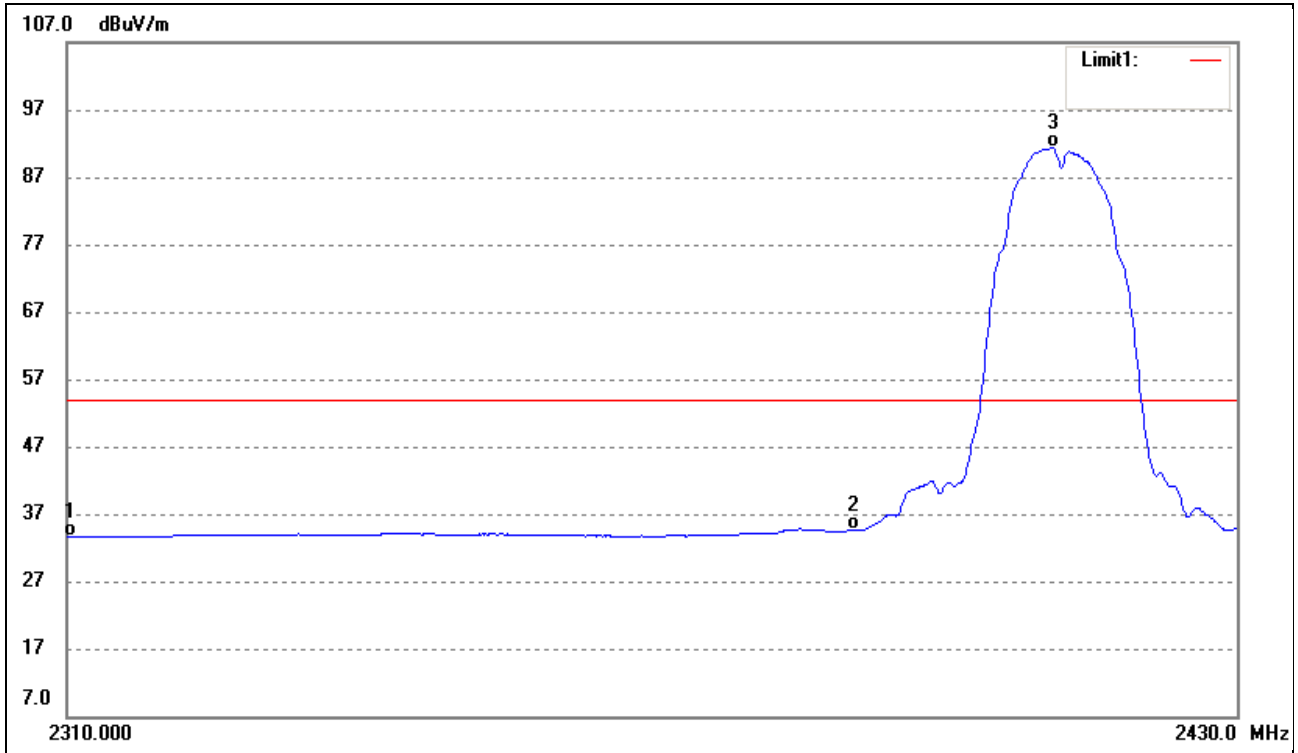
1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW  $\geq$  300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time,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

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

### 9.3 Summary of Test Results/Plots

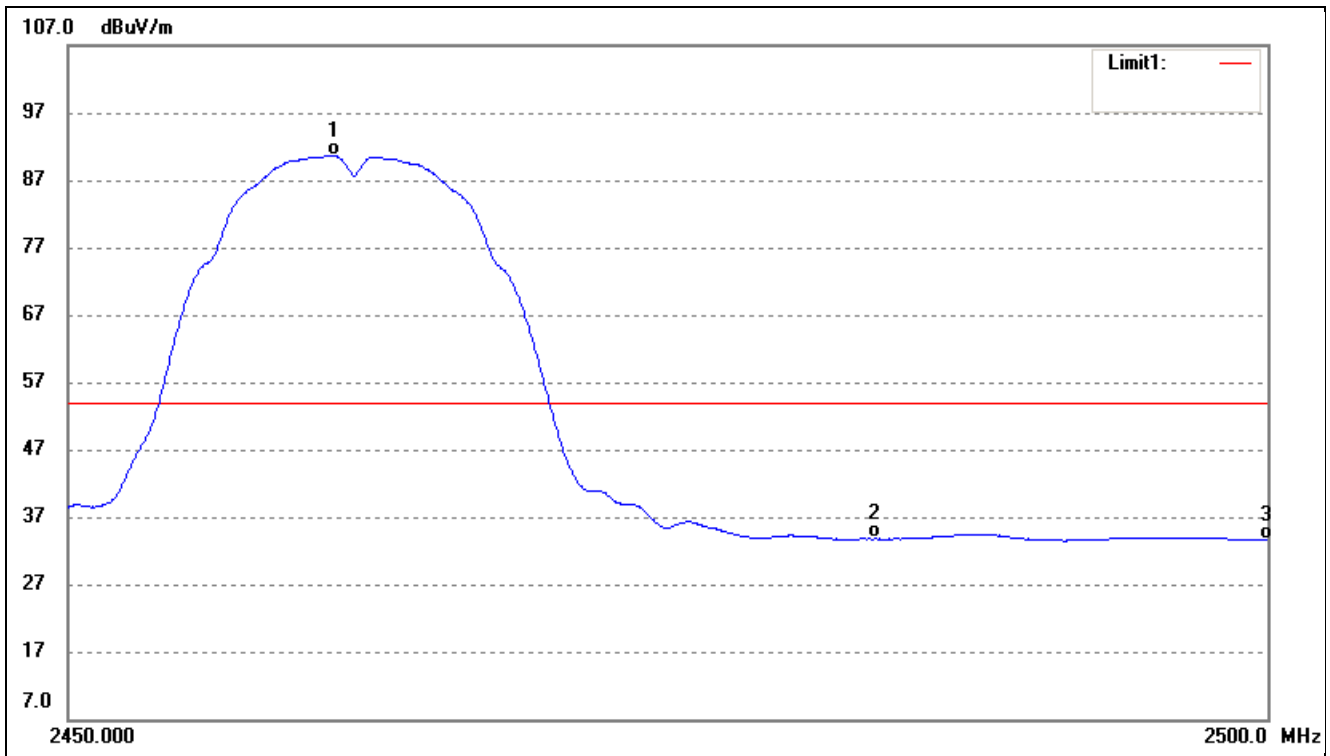
➤ Radiated test

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



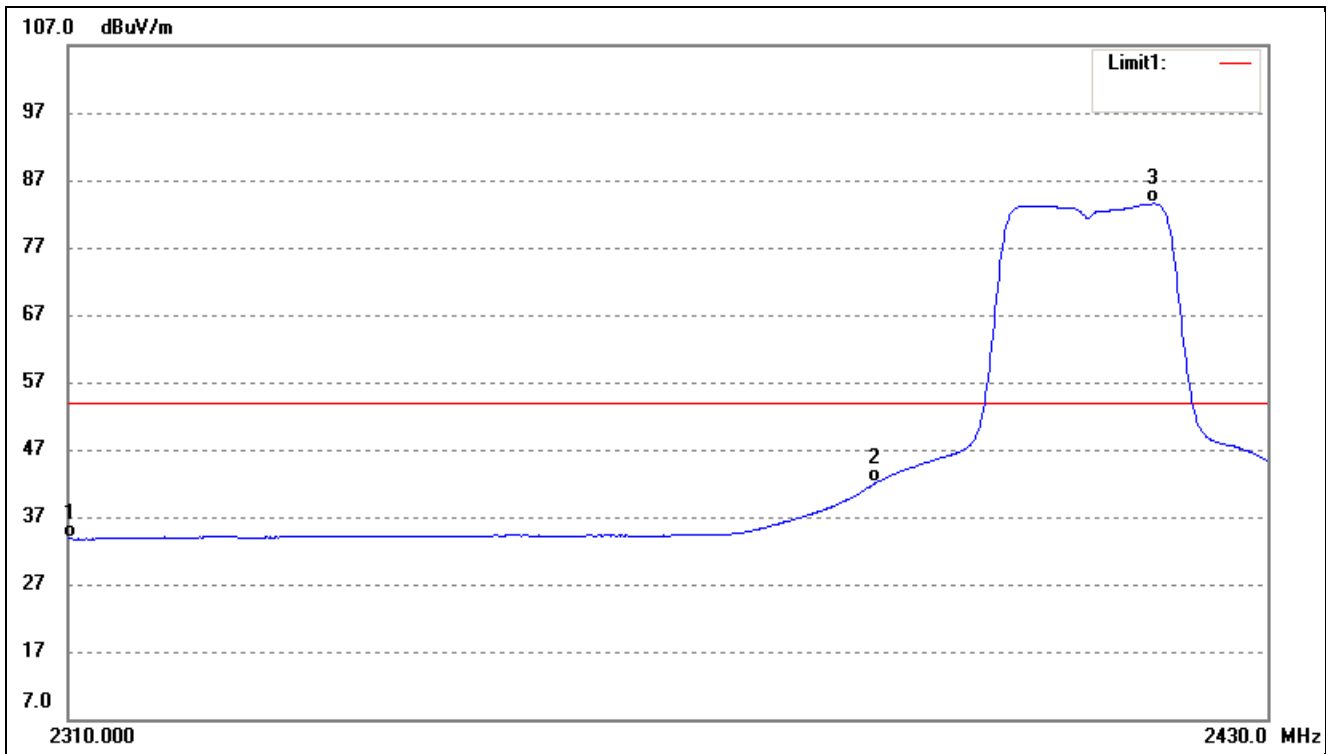
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	41.47	-7.78	33.69	54.00	-20.31	Average Detector
	2310.000	54.20	-7.78	46.42	74.00	-27.58	Peak Detector
2	2390.000	41.98	-7.32	34.66	54.00	-19.34	Average Detector
	2390.000	53.65	-7.32	46.33	74.00	-27.67	Peak Detector
3	2410.756	98.52	-7.19	91.33	/	/	Average Detector
	2410.145	103.33	-7.19	96.14	/	/	Peak Detector

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



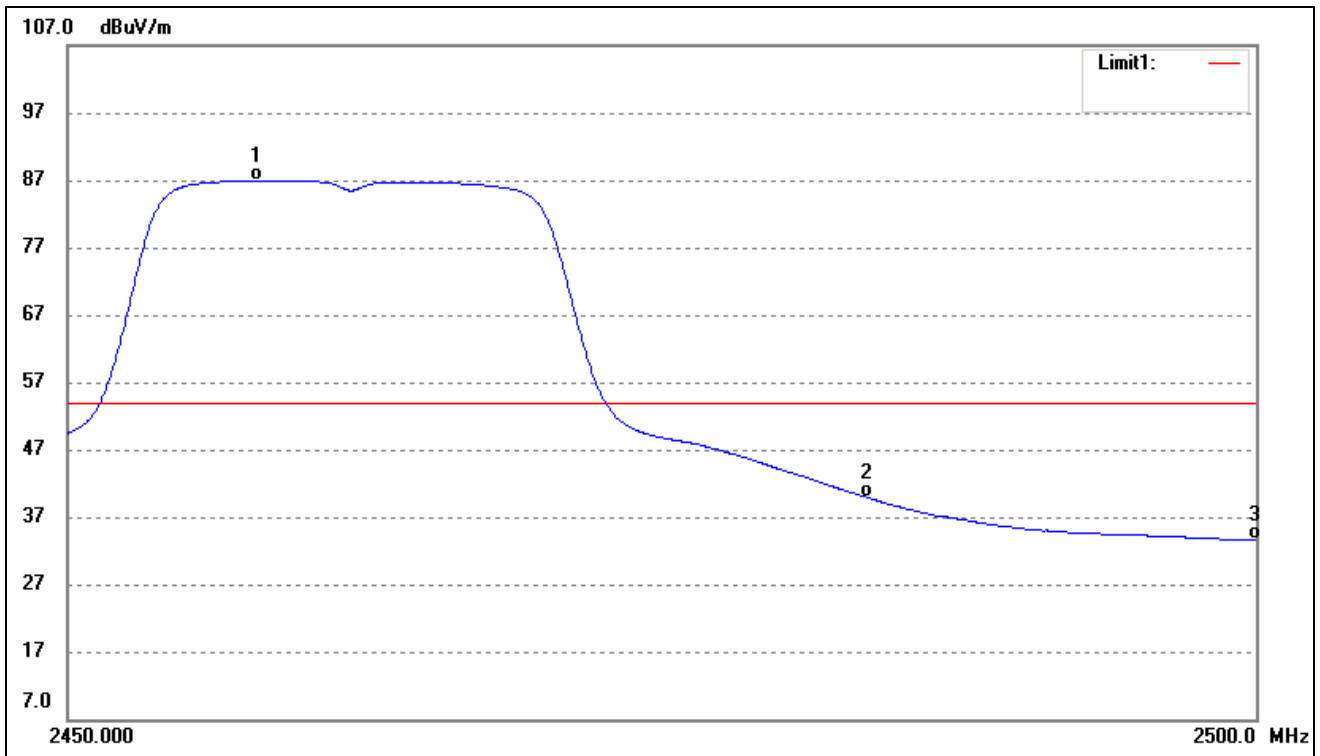
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2461.013	97.54	-6.90	90.64	/	/	Average Detector
	2460.715	102.41	-6.90	95.51	/	/	Peak Detector
2	2483.500	40.53	-6.77	33.76	54.00	-20.24	Average Detector
	2483.500	53.01	-6.77	46.24	74.00	-27.76	Peak Detector
3	2500.000	40.30	-6.67	33.63	54.00	-20.37	Average Detector
	2500.000	54.20	-6.67	47.53	74.00	-26.47	Peak Detector

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



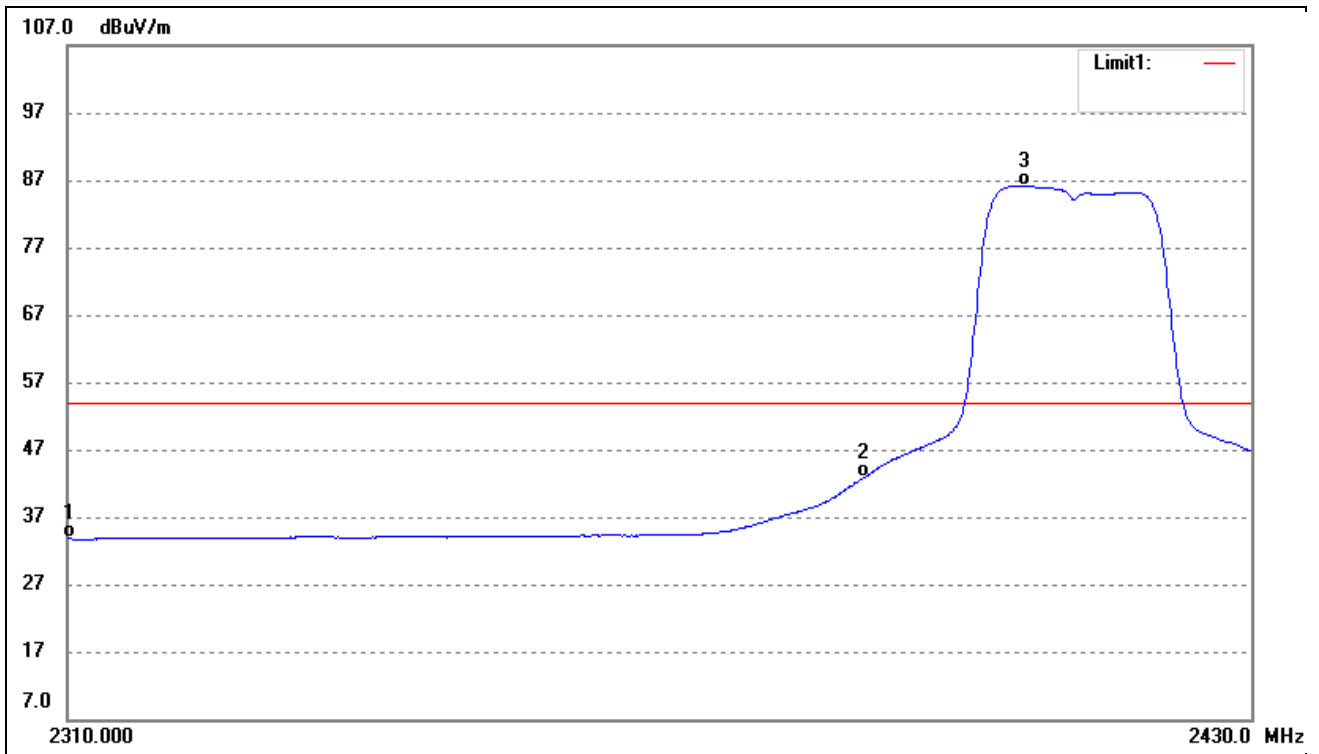
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	41.58	-7.78	33.80	54.00	-20.20	Average Detector
	2310.000	53.66	-7.78	45.88	74.00	-28.12	Peak Detector
2	2390.000	49.37	-7.32	42.05	54.00	-11.95	Average Detector
	2390.000	68.87	-7.32	61.55	74.00	-12.45	Peak Detector
3	2418.337	90.66	-7.15	83.51	/	/	Average Detector
	2407.583	104.84	-7.21	97.63	/	/	Peak Detector

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



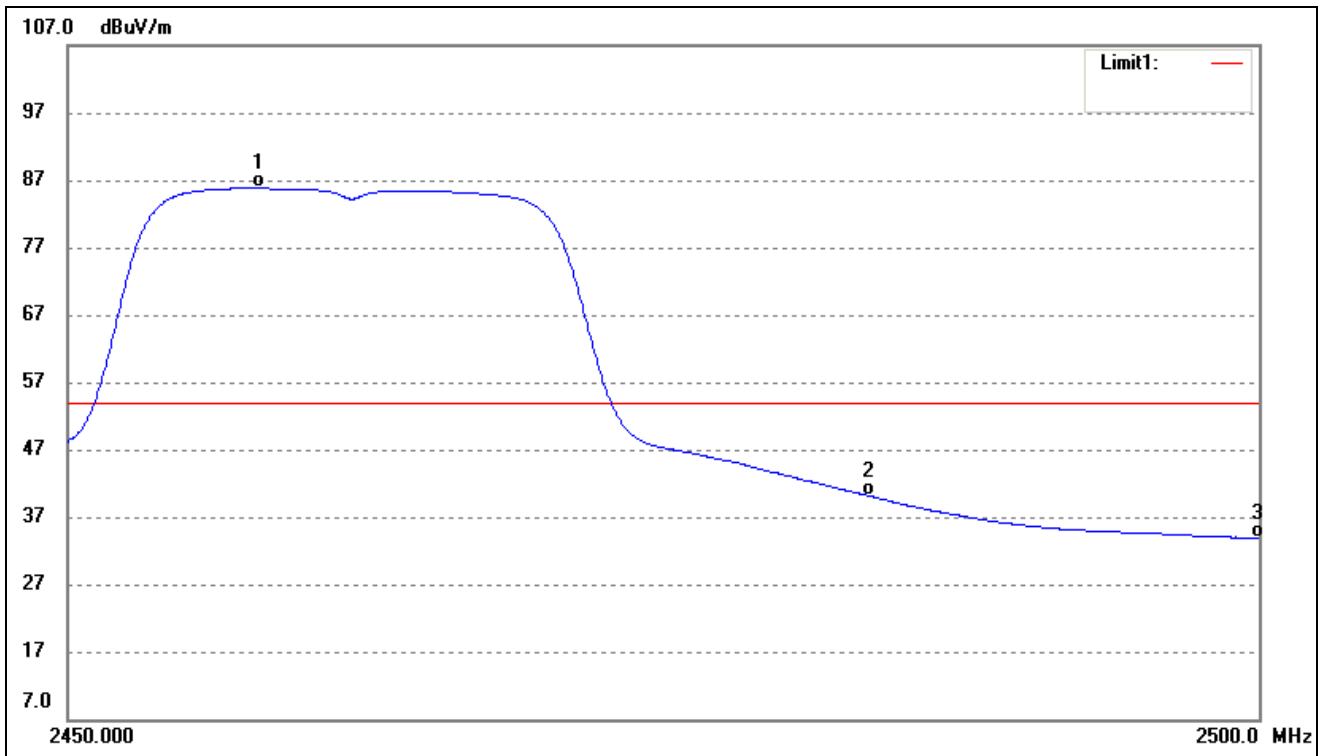
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2457.883	93.87	-6.92	86.95	/	/	Average Detector
	2464.048	103.71	-6.89	96.82	/	/	Peak Detector
2	2483.500	46.66	-6.77	39.89	54.00	-14.11	Average Detector
	2483.500	65.92	-6.77	59.15	74.00	-14.85	Peak Detector
3	2500.000	40.25	-6.67	33.58	54.00	-20.42	Average Detector
	2500.000	53.22	-6.67	46.55	74.00	-27.45	Peak Detector

802.11n-HT20			
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	41.56	-7.78	33.78	54.00	-20.22	Average Detector
	2310.000	52.38	-7.78	44.60	74.00	-29.40	Peak Detector
2	2390.000	50.20	-7.32	42.88	54.00	-11.12	Average Detector
	2390.000	67.55	-7.32	60.23	74.00	-13.77	Peak Detector
3	2406.486	93.30	-7.21	86.09	/	/	Average Detector
	2405.390	103.22	-7.22	96.00	/	/	Peak Detector

802.11n-HT20			
Test Channel	High	Polarity:	Vertical(worst case)

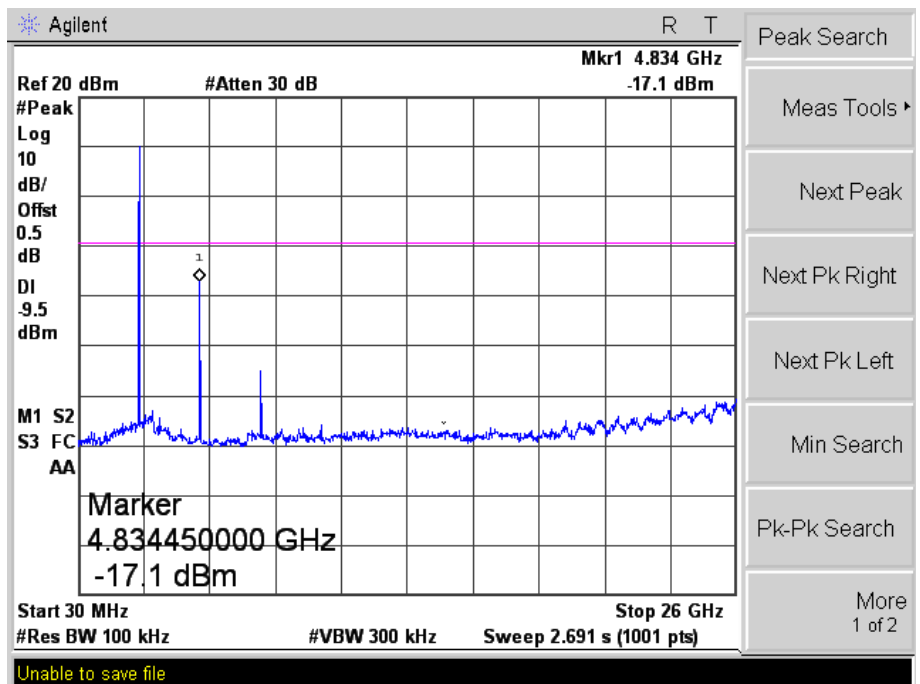
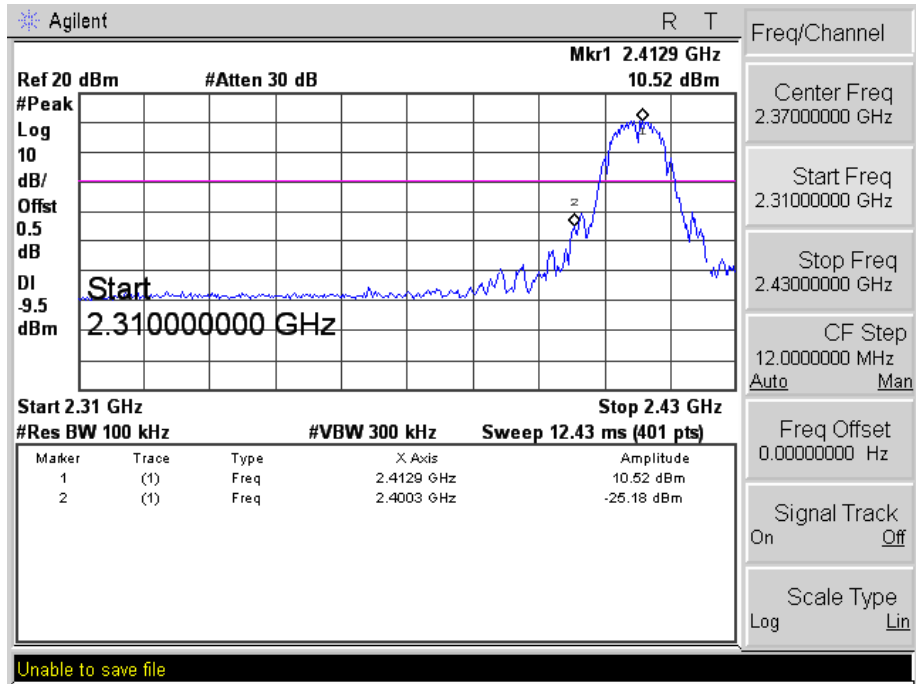


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2457.982	92.72	-6.92	85.80	/	/	Average Detector
	2458.032	103.56	-6.92	96.64	/	/	Peak Detector
2	2483.500	46.90	-6.77	40.13	54.00	-13.87	Average Detector
	2483.500	67.98	-6.77	61.21	74.00	-12.79	Peak Detector
3	2500.000	40.57	-6.67	33.90	54.00	-20.10	Average Detector
	2500.000	55.11	-6.67	48.44	74.00	-25.56	Peak Detector

➤ Conducted test

802.11b

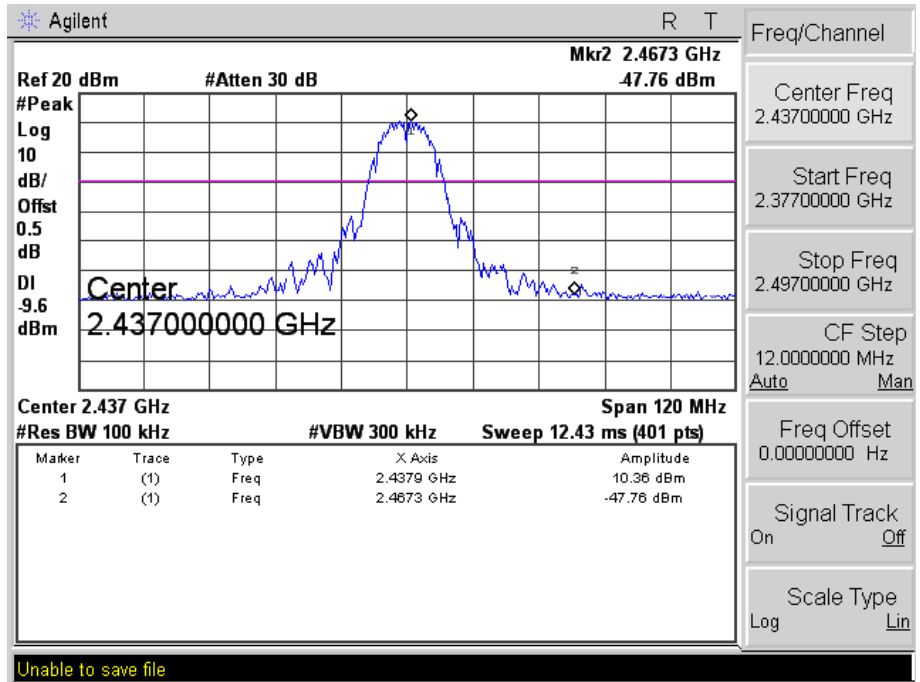
Low





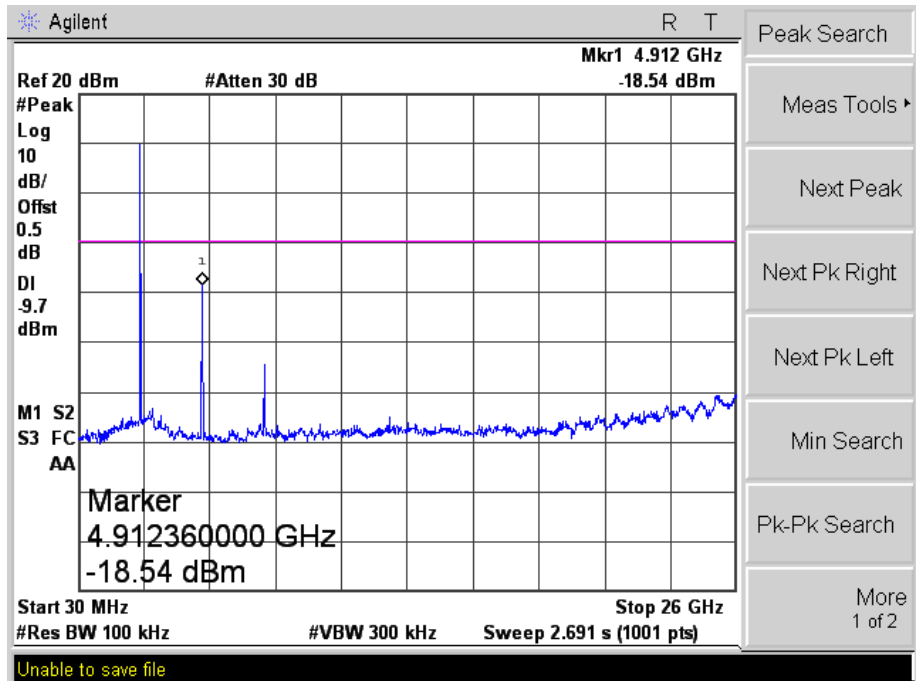
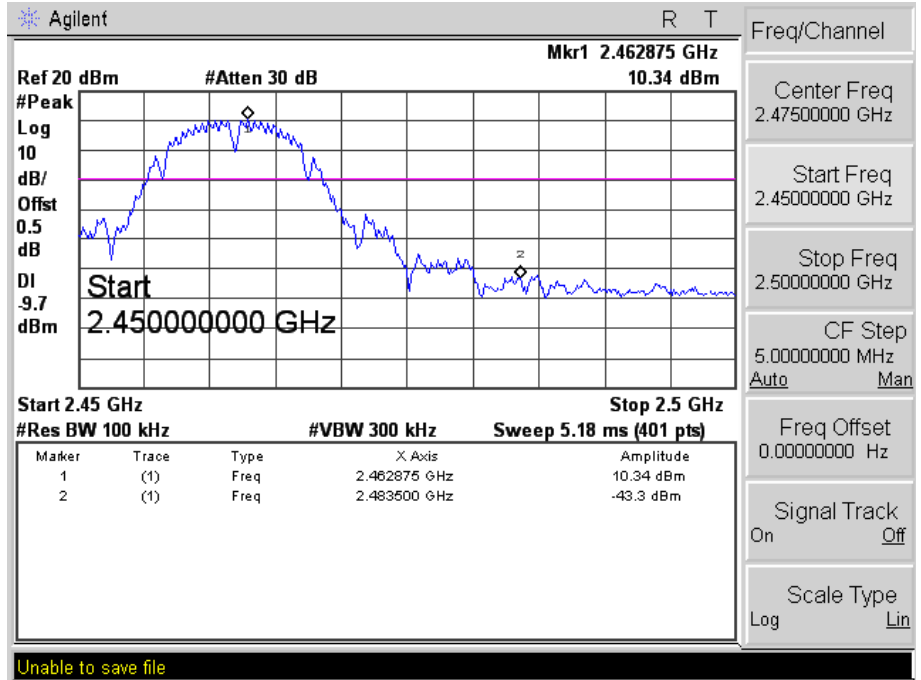
802.11b

Middle



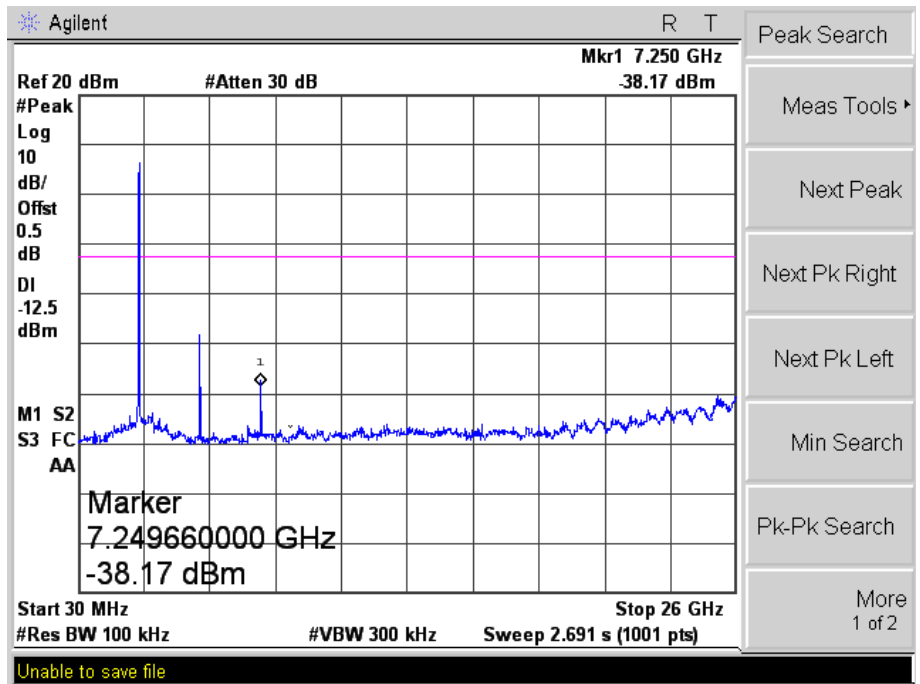
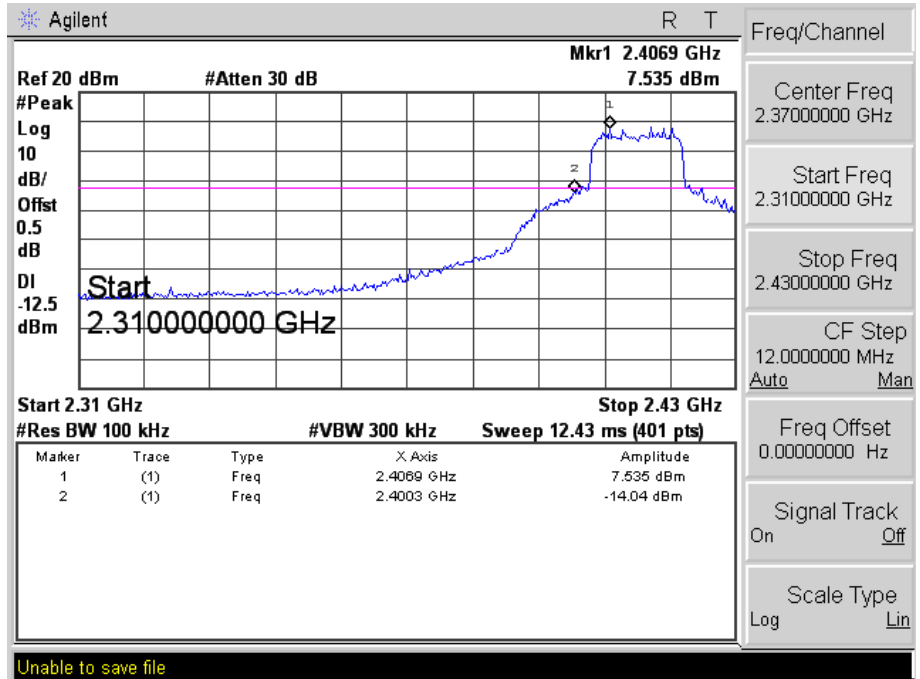
802.11b

High



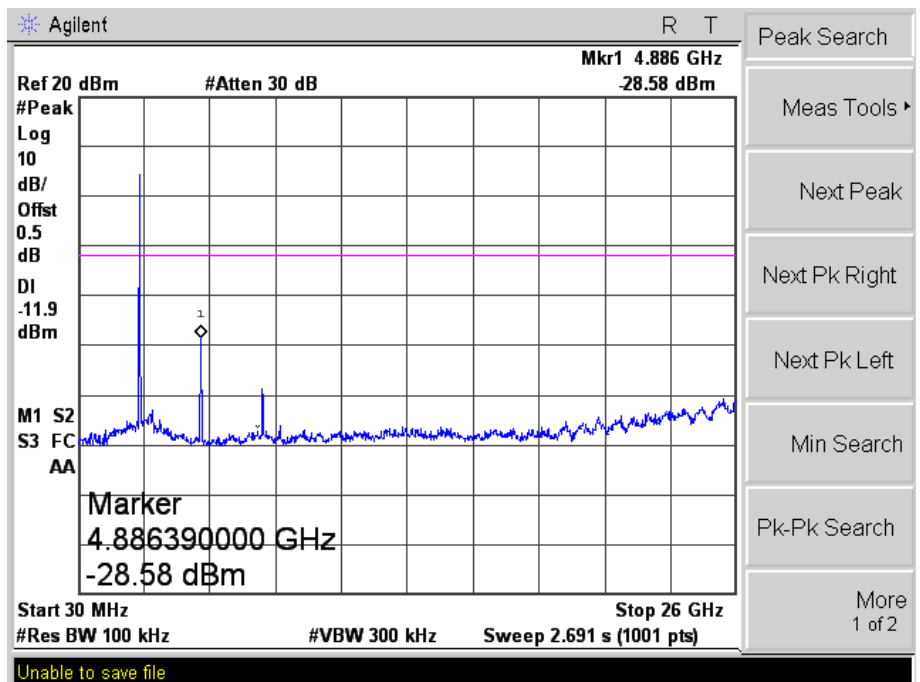
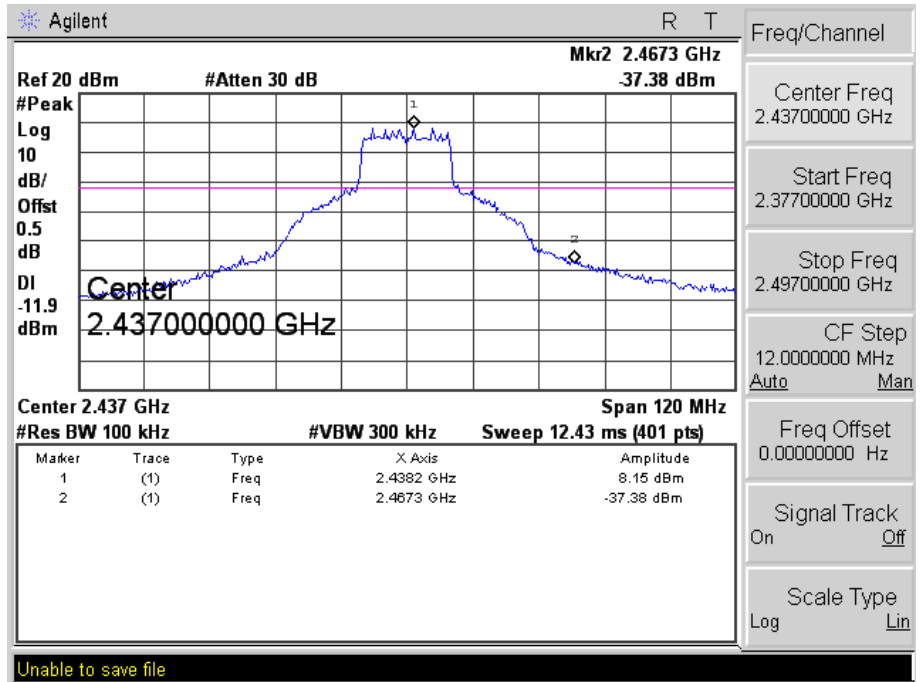
802.11g

Low



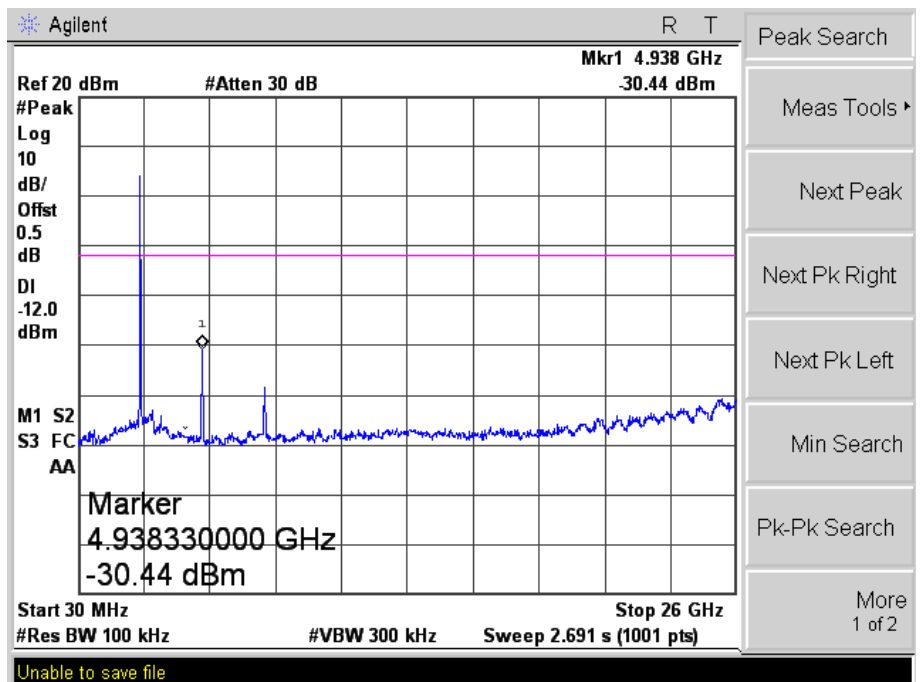
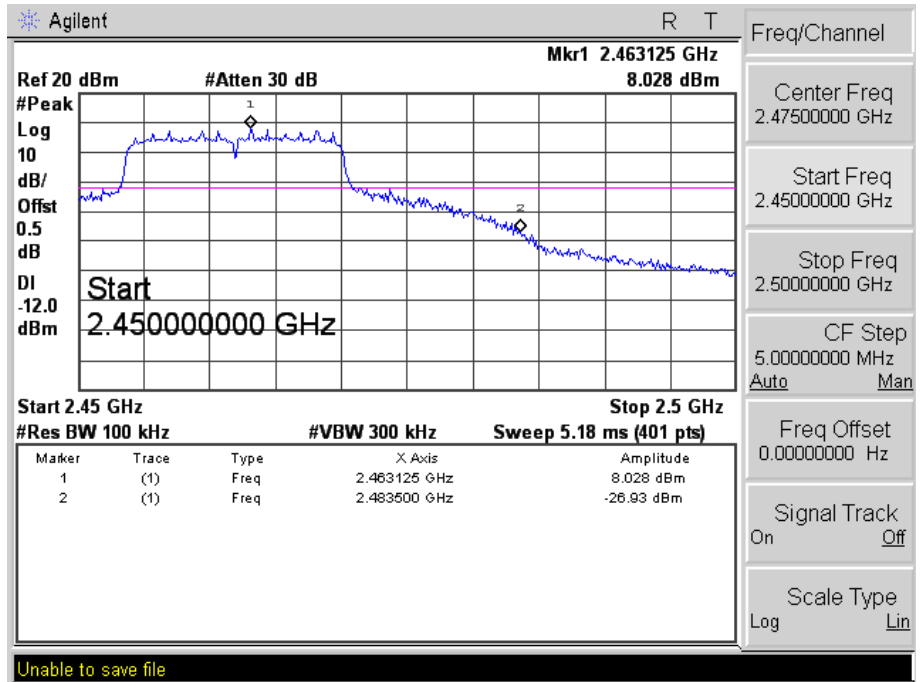
802.11g

Middle



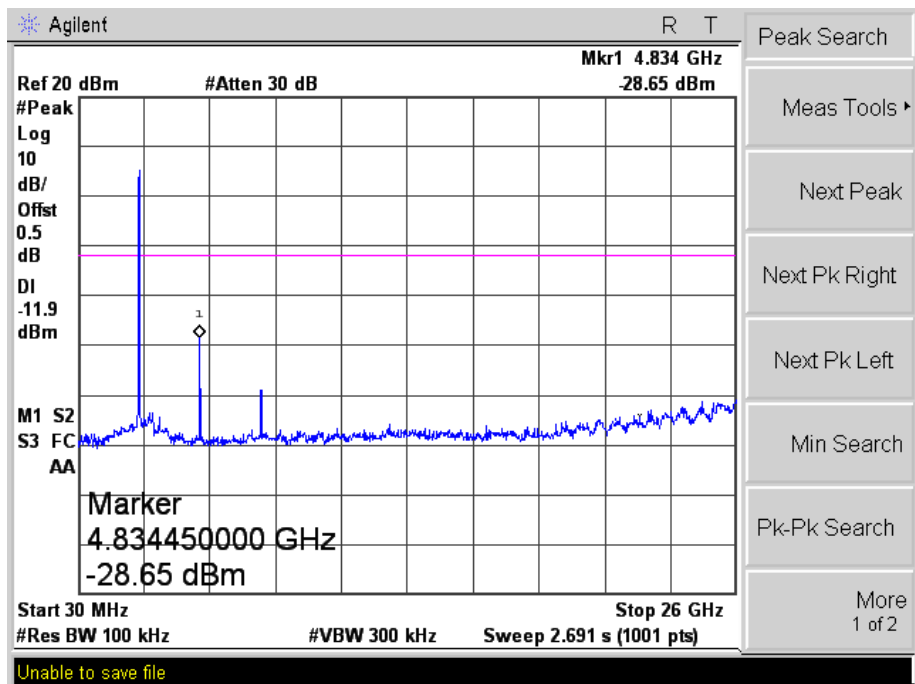
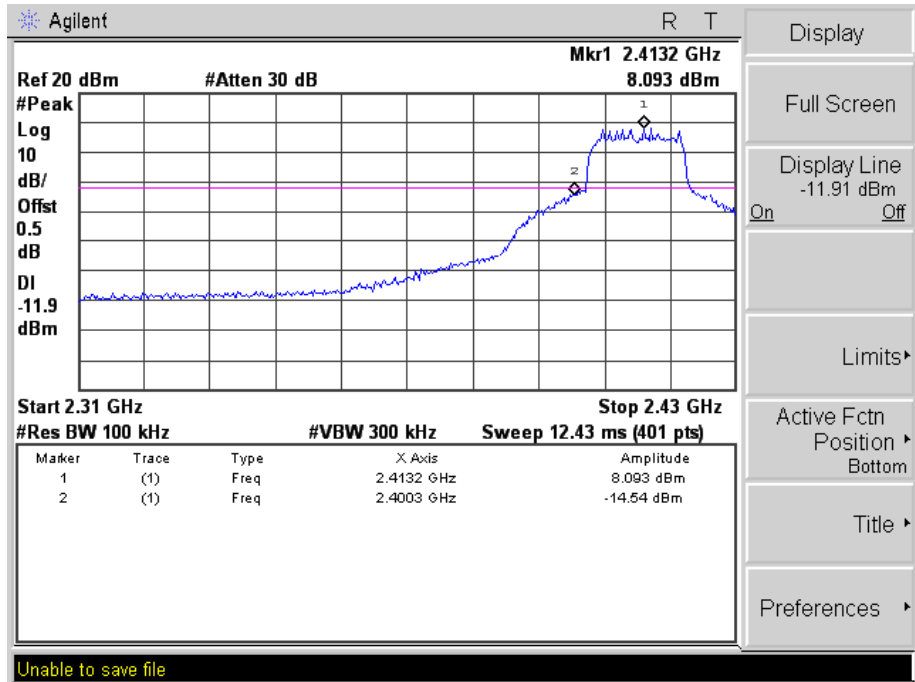
802.11g

High



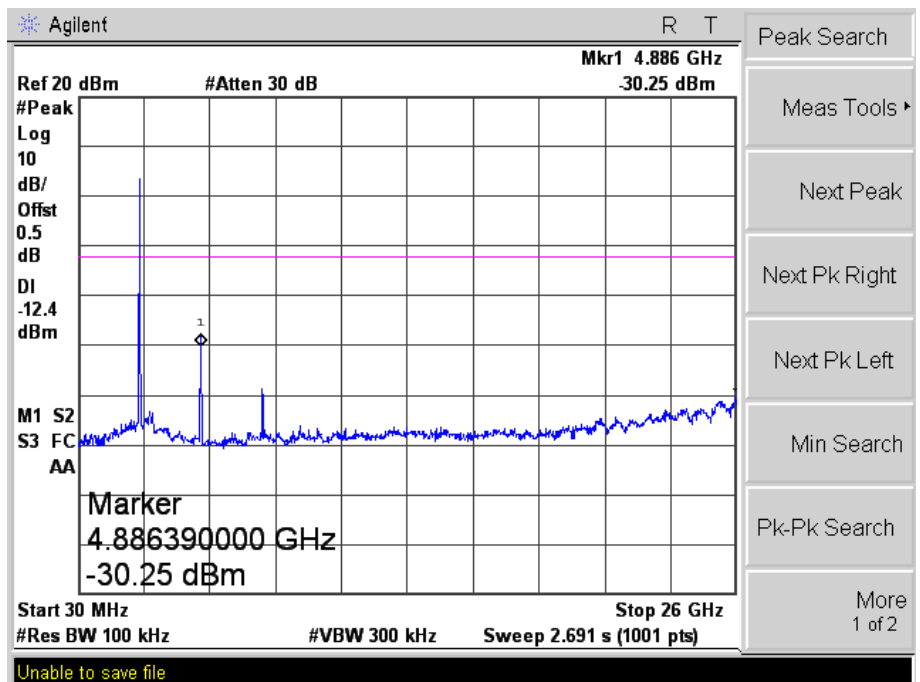
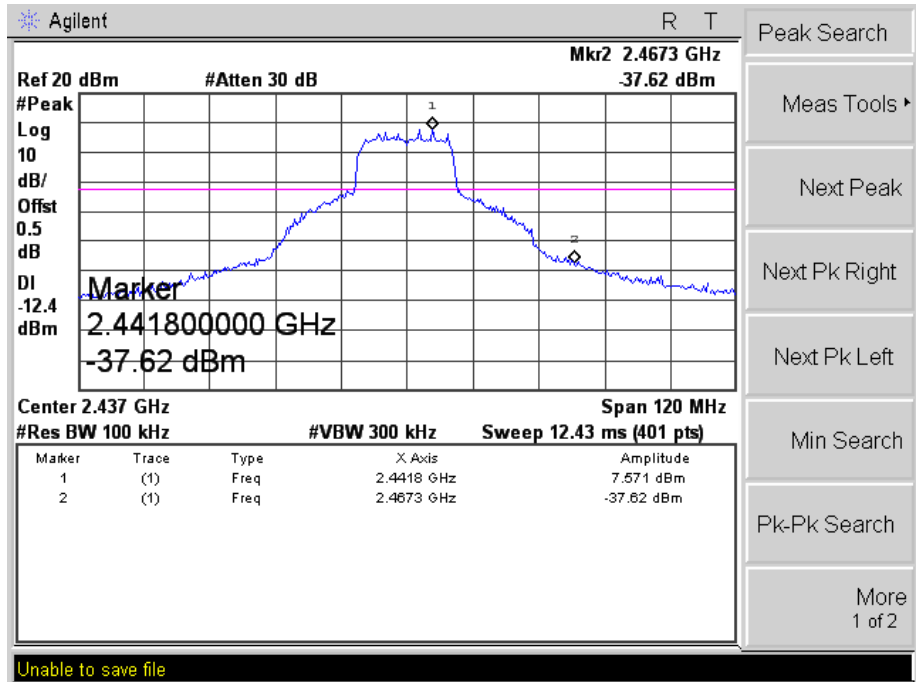
802.11n-HT20

Low



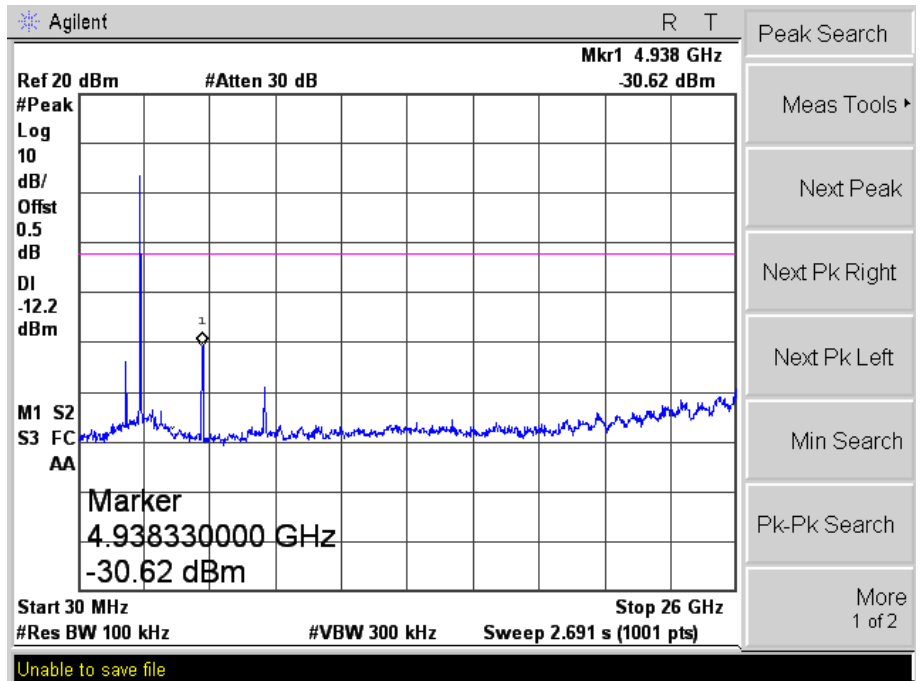
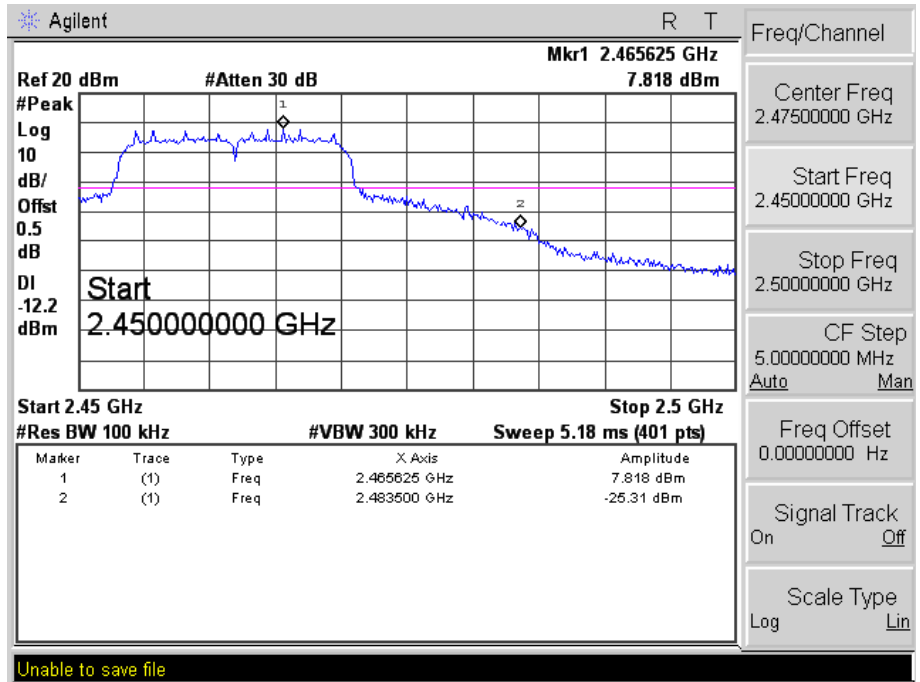
802.11n-HT20

Middle



802.11n-HT20

High





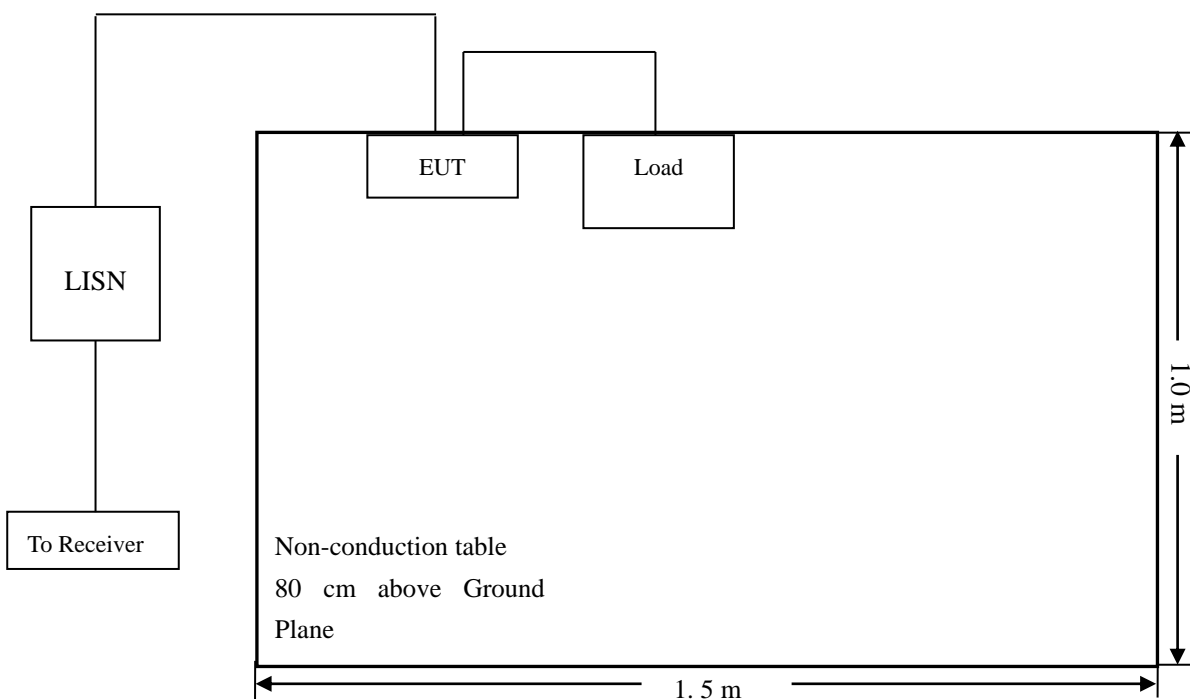
## 10. Conducted Emissions

### 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



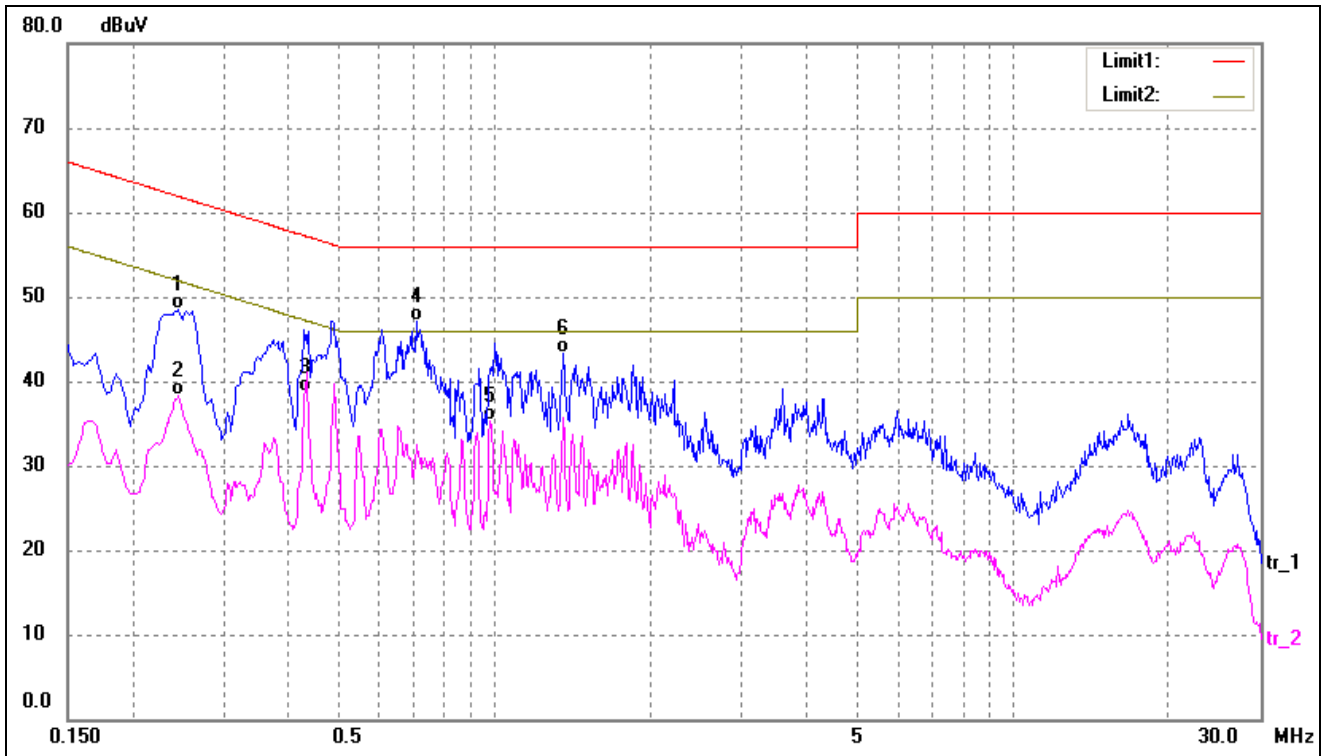
### 10.3 Test Receiver Setup

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

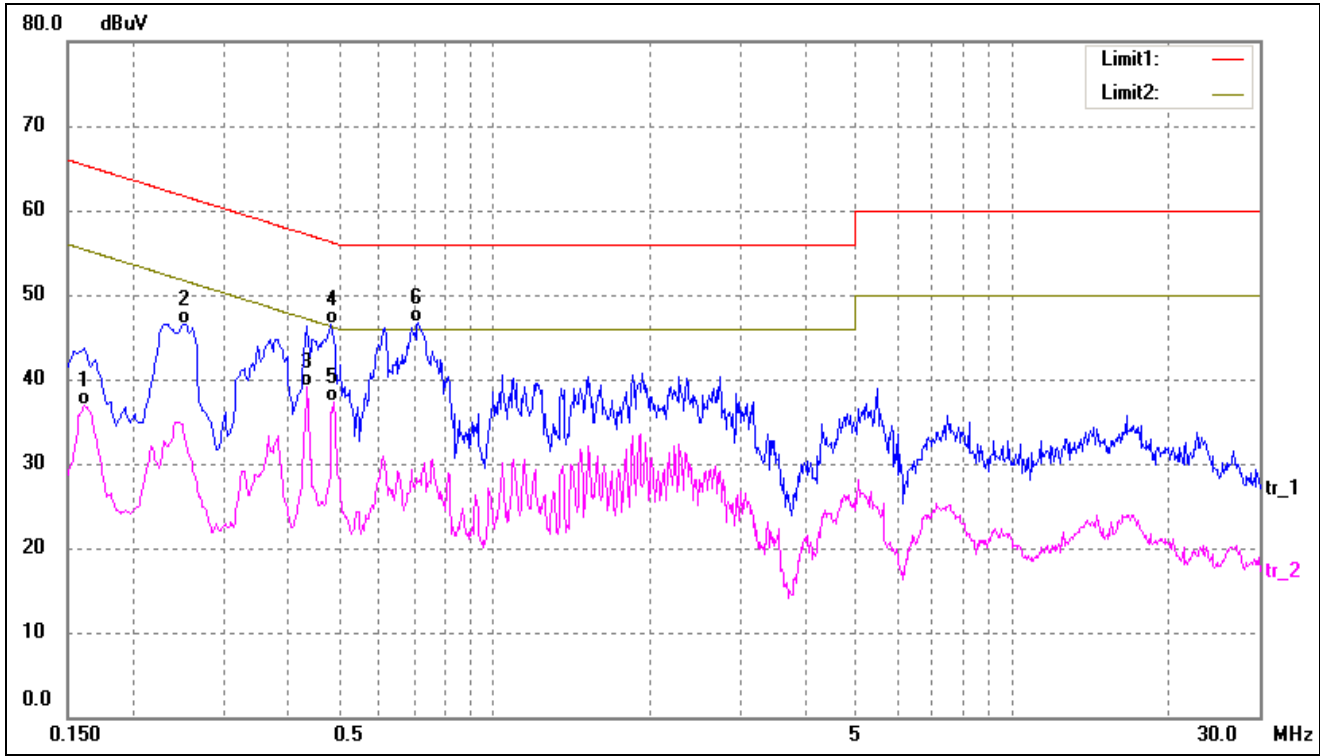
### 10.4 Summary of Test Results/Plots

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	0.2460	38.31	10.15	48.46	61.89	-13.43	QP
2	0.2460	28.09	10.15	38.24	51.89	-13.65	AVG
3*	0.4305	28.40	10.26	38.66	47.24	-8.58	AVG
4	0.7060	36.78	10.39	47.17	56.00	-8.83	QP
5	0.9820	24.77	10.50	35.27	46.00	-10.73	AVG
6	1.3540	32.67	10.54	43.21	56.00	-12.79	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	0.1620	26.76	10.10	36.86	55.36	-18.50	AVG
2	0.2540	36.43	10.16	46.59	61.63	-15.04	QP
3*	0.4340	28.86	10.26	39.12	47.18	-8.06	AVG
4	0.4860	36.25	10.28	46.53	56.24	-9.71	QP
5	0.4900	27.08	10.29	37.37	46.17	-8.80	AVG
6	0.7140	36.26	10.39	46.65	56.00	-9.35	QP

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