FCC Part 15C
Measurement and Test Report

For

E-safe Technology Limited

Room 210, Block B, Baoyuan huafeng Economic Building, Xixiang Avenue,

Bao'an District, Shenzhen, Guangdong China

FCC ID: 2APT2WL-03

FCC Rule(s):	FCC Part 15C
Product Description:	Smart Light
Tested Model:	WL-03
Report No.:	STR18058005I-1
Sample Receipt Date:	2018-05-23
Tested Date:	2018-05-23 to 2018-06-19
Issued Date:	2018-06-19
Tested By:	Mike Shi/ Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

Shenzhen SEM Test Technology Co., Ltd.
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C.（518101）
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

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

TABLE OF CONTENTS

1. GENERAL INFORMATION 3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) 3
1.2 TEST STANDARDS 5
1.3 TEST METHODOLOGY 5
1.4 TEST FACILITY 5
1.5 EUT SETUP AND TEST MODE 6
1.6 MEASUREMENT UNCERTAINTY 6
1.7 TEST EQUIPMENT LIST AND DETAILS 7
2. SUMMARY OF TEST RESULTS 8
3. RF EXPOSURE 9
3.1 STANDARD APPLICABLE 9
3.2 TEST RESULT 9
4. ANTENNA REQUIREMENT 10
4.1 STANDARD APPLICABLE 10
4.2 EVALUATION INFORMATION 10
5. POWER SPECTRAL DENSITY 11
5.1 STANDARD APPLICABLE 11
5.2 TEST PROCEDURE 11
5.3 ENVIRONMENTAL CONDITIONS 11
5.4 SUMMARY OF TEST RESULTS/PLOTS 12
6. 6DB BANDWIDTH 18
6.1 STANDARD APPLICABLE 18
6.2 TEST PROCEDURE 18
6.3 ENVIRONMENTAL CONDITIONS 18
6.4 SUMMARY OF TEST RESULTS/PLOTS 18
7. RF OUTPUT POWER 24
7.1 STANDARD APPLICABLE 24
7.2 TEST PROCEDURE 24
7.3 ENVIRONMENTAL CONDITIONS 24
7.4 SUMMARY OF TEST RESULTS/PLOTS 25
8. FIELD STRENGTH OF SPURIOUS EMISSIONS 31
8.1 STANDARD APPLICABLE 31
8.2 TEST PROCEDURE 31
8.3 CORRECTED AMPLITUDE & MARGIN CALCULATION 32
8.4 ENVIRONMENTAL CONDITIONS 32
8.5 SUMMARY OF TEST RESULTS/PLOTS 33
9. OUT OF BAND EMISSIONS 40
9.1 STANDARD APPLICABLE 40
9.2 TEST PROCEDURE 40
9.3 ENVIRONMENTAL CONDITIONS 41
9.4 SUMMARY OF TEST RESULTS/PLOTS 41
10. CONDUCTED EMISSIONS 56
10.1 TEST PROCEDURE 56
10.2 BASIC TEST SETUP BLOCK DIAGRAM 56
10.3 ENVIRONMENTAL CONDITIONS 56
10.4 TEST RECEIVER SETUP 57
10.5 SUMMARY OF TEST RESULTS/PLOTS 57
10.6 CONDUCTED EMISSIONS TEST DATA 57

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	E-safe Technology Limited
Address of applicant:	Room 210, Block B, Baoyuan huafeng Economic Building, Xixiang Avenue, Bao'an District, Shenzhen, Guangdong China
Manufacturer:	E-safe Technology Limited
Address of manufacturer:	Room 210, Block B, Baoyuan huafeng Economic Building, Xixiang Avenue, Bao'an District, Shenzhen, Guangdong China

General Description of EUT	
Product Name:	Smart Light
Trade Name:	E-safe
Model No.:	WL-03
Adding Model(s):	WL-03W
Rated Voltage:	Power Port:DC12V
Battery:	/
Power Adapter Model:	Model:NLB100120W1A5S58 Input:AC100-240V~50/60Hz 0.35A MAX Ouput:DC12V,1000mA
Software Version:	ac69_sdk_V2012_p1
Hardware Version:	2018.05.03
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 WL-03, but the circuit and the electronic construction do not change, declared by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz
RF Output Power:	9.35dBm (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:	Integral Antenna
Antenna Gain:	1.0dBi
Lowest Internal Frequency:	32.768 kHz

1.2 Test Standards

The following report is prepared on behalf of the E-safe Technology Limited in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

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

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

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v04 for digital transmission systems shall be performed also.

1.4 Test Facility

FCC – Registration No.: 125990

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

Industry Canada (IC) Registration No.: 11464A

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

1.5 EUT Setup and Test Mode

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

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

Accessories Equipment List and Details			
Description	**Manufacturer**	**Model No.**	**Serial Number**
iPhone6 Plus	Apple	MGAJ2ZP/A	FK1PQ4JBG5QW
Accessories Cable List and Details			
Cable Description	**Length (m)**	**Shielded/Unshielded**	**With Core/Without Core**
/	/	/	/
EUT Cable List and Details			
Cable Description	**Length (m)**	**Shielded/Unshielded**	**With Core/Without Core**
DC Cable	1.5	Unshielded Shielded	Without Core

1.6 Measurement Uncertainty

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

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	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

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

N/A: not applicable

3. RF Exposure

3.1 Standard Applicable

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

3.2 Test Result

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

4. Antenna Requirement

4.1 Standard Applicable

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

4.2 Evaluation Information

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

5.3 Environmental Conditions

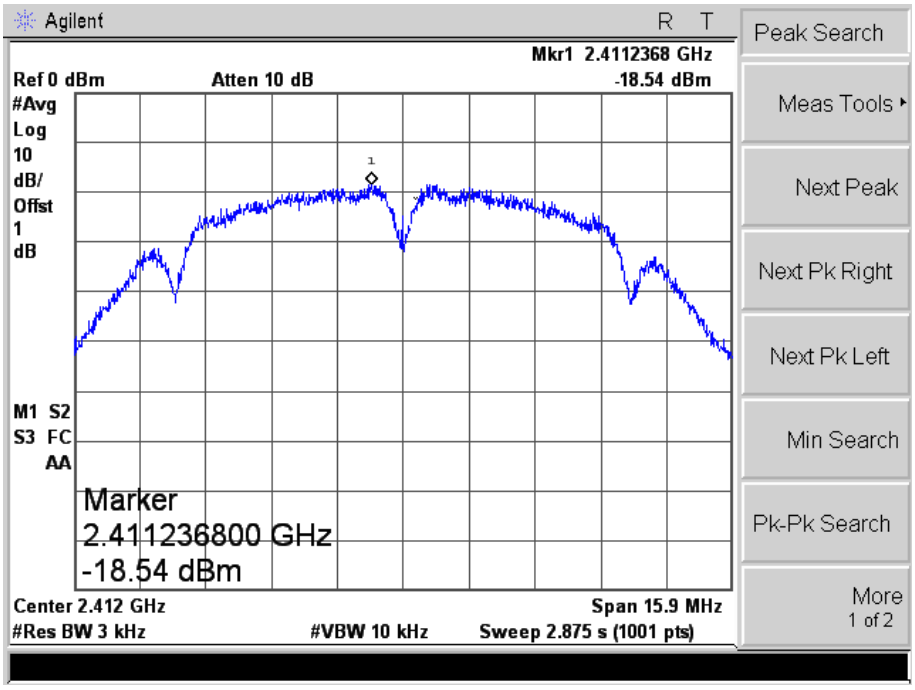
Temperature:	24° C
Relative Humidity:	56%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

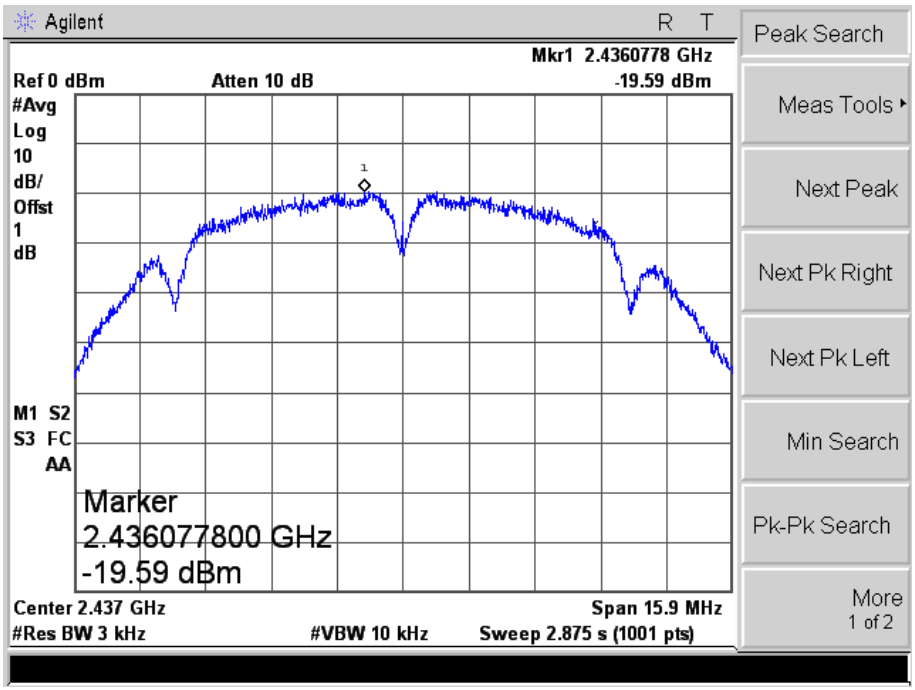
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-18.54	8
	2437	-19.59	8
	2462	-20.74	8
802.11g	2412	-23.05	8
	2437	-23.99	8
	2462	-24.75	8
802.11n HT20	2412	-23.59	8
	2437	-25.16	8
	2462	-25.73	8

Please refer to the following test plots:

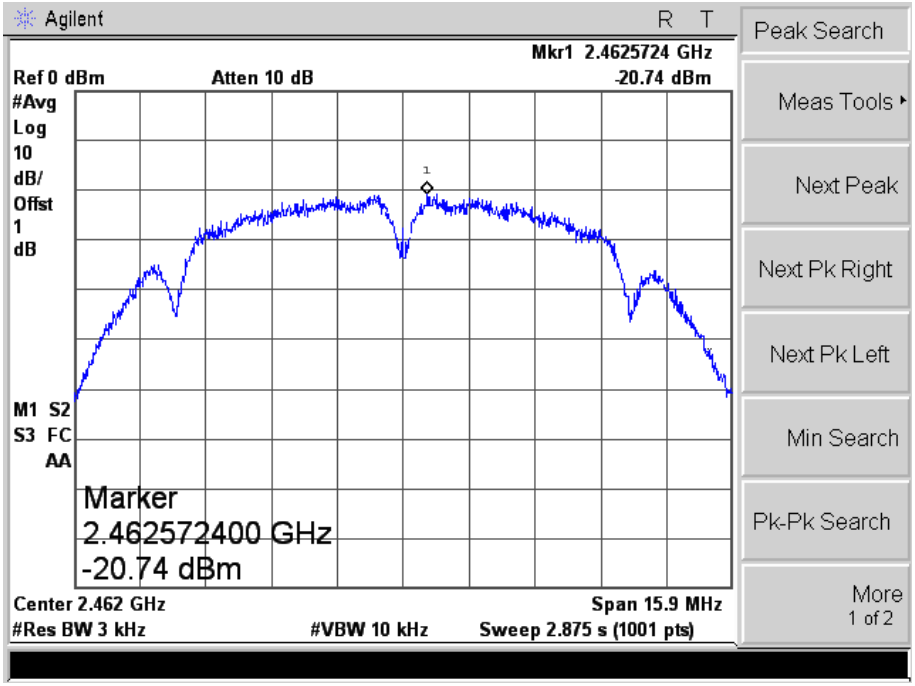
802.11b-Low Channel



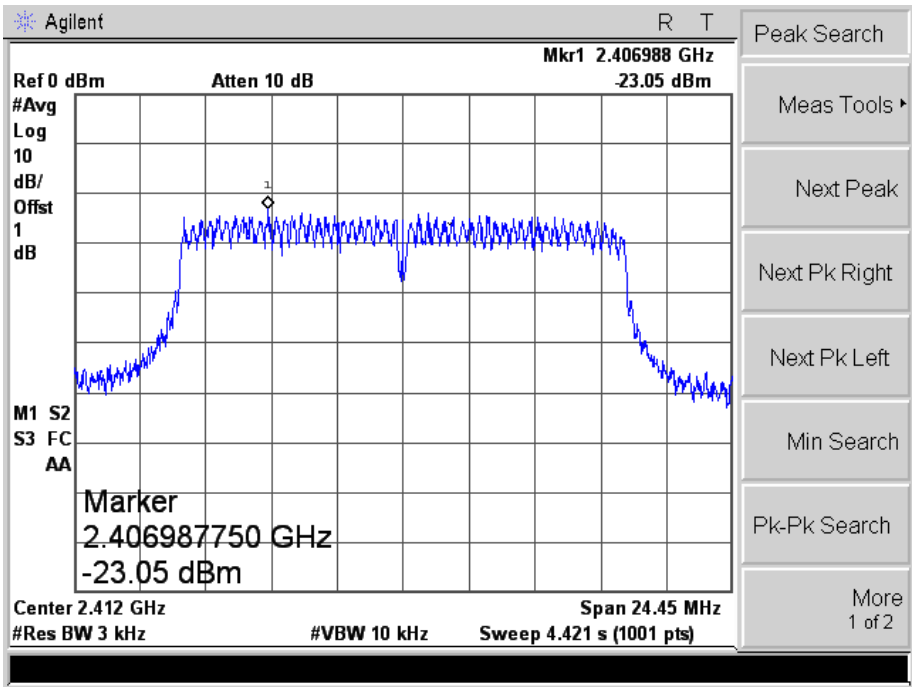
802.11b-Middle Channel



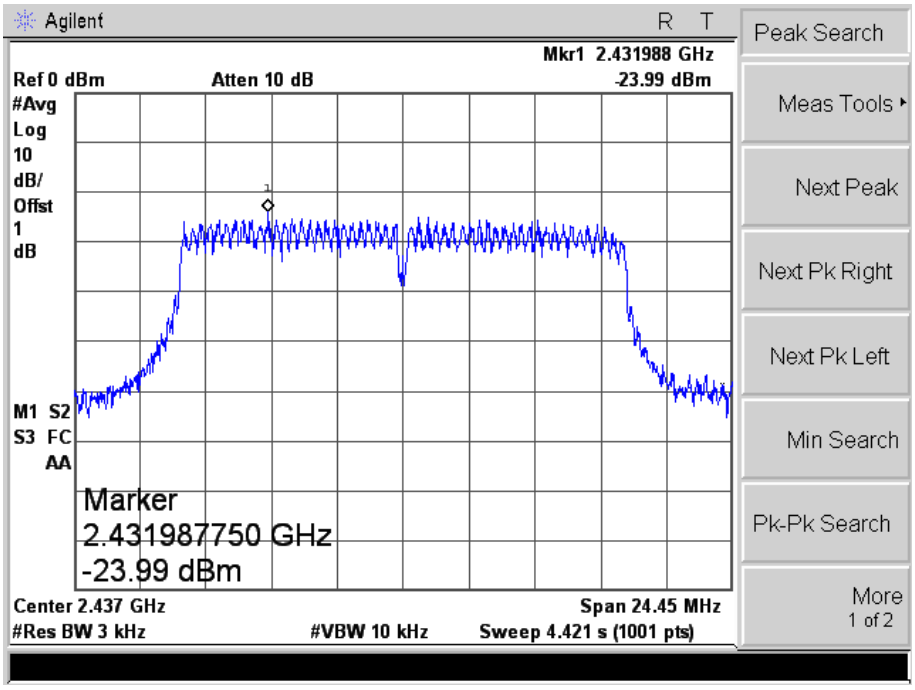
802.11b-High Channel



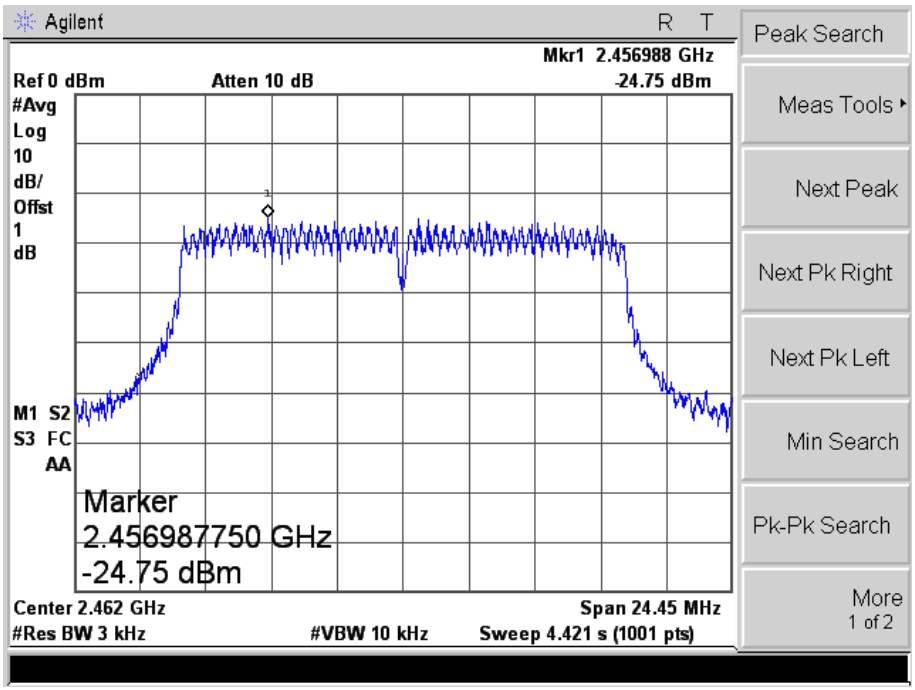
802.11g-Low Channel



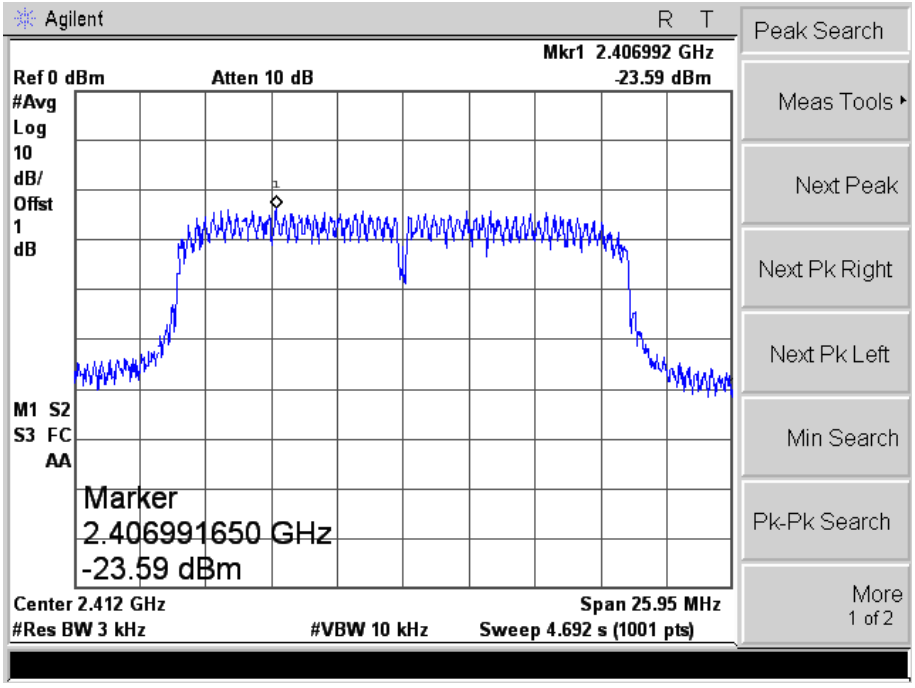
802.11g-Middle Channel



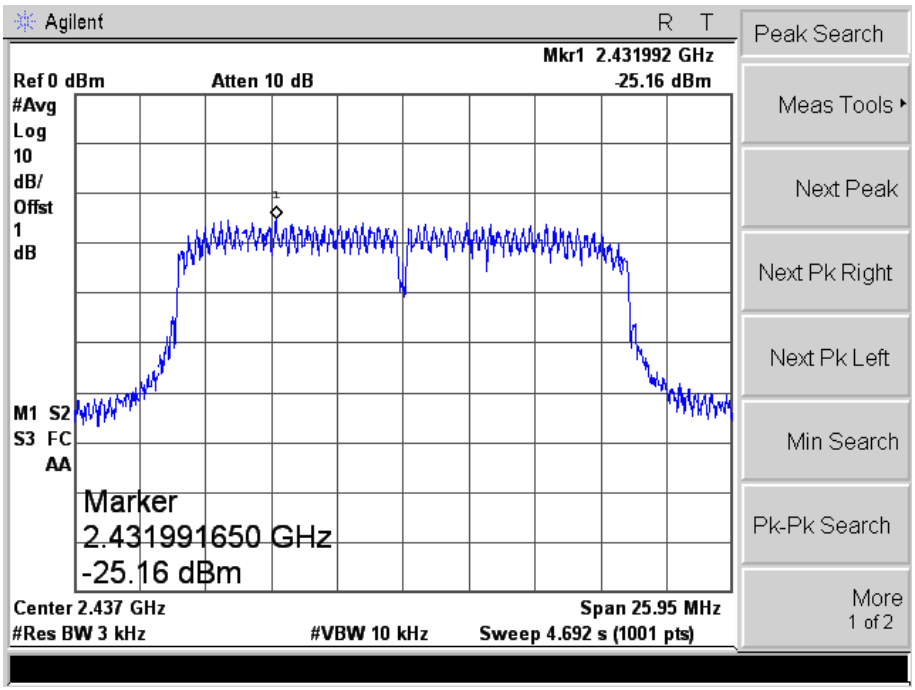
802.11g-High Channel



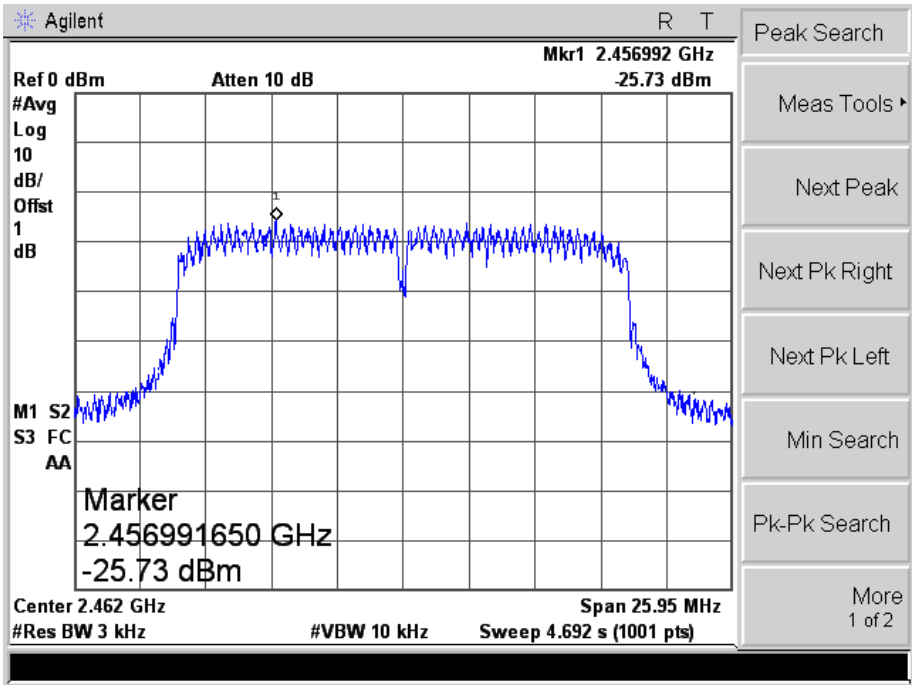
802.11n-HT20-Low Channel



802.11n-HT20-Middle Channel



802.11n-HT20-High Channel



6. 6dB Bandwidth

6.1 Standard Applicable

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

6.2 Test Procedure

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

6.3 Environmental Conditions

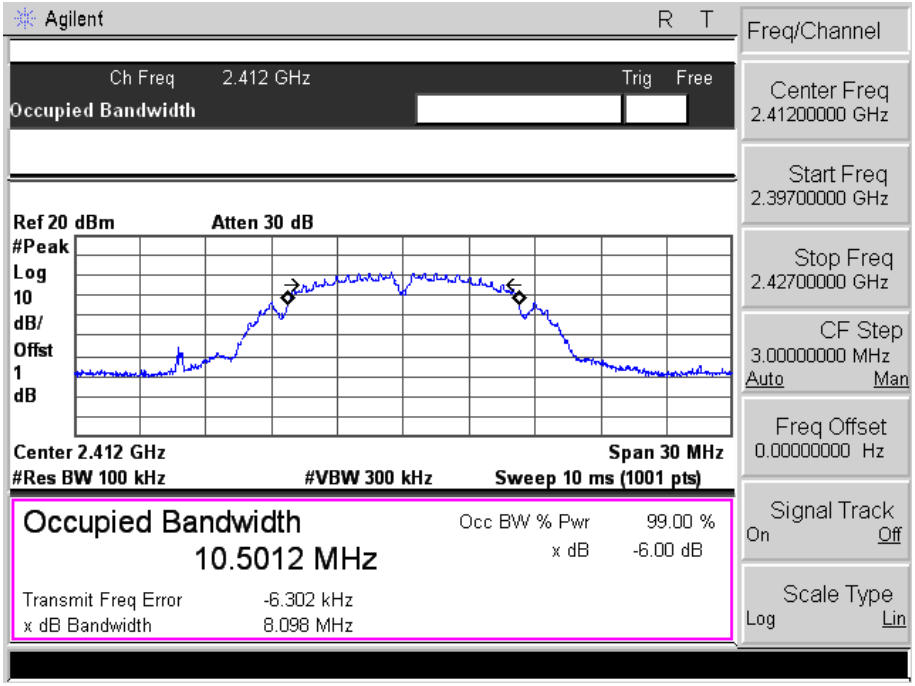
Temperature:	24° C
Relative Humidity:	56%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

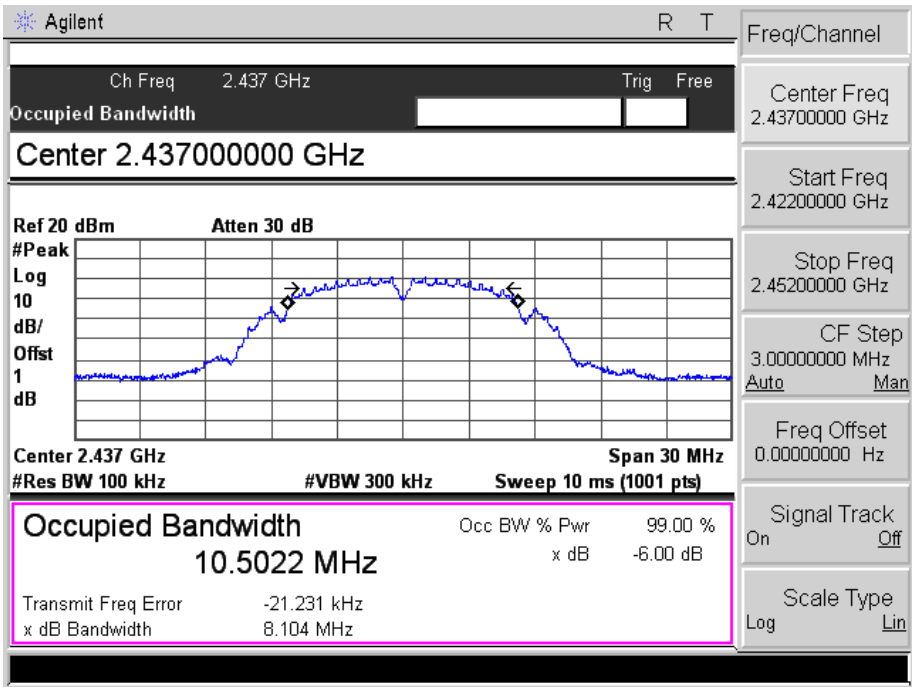
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	8.098	10.5012	≥500
	2437	8.104	10.5022	≥500
	2462	8.495	10.5084	≥500
802.11g	2412	16.296	16.2590	≥500
	2437	16.117	16.2624	≥500
	2462	16.290	16.2555	≥500
802.11n-HT20	2412	16.224	17.2074	≥500
	2437	16.071	17.2197	≥500
	2462	16.268	17.2404	≥500

Please refer to the following test plots:

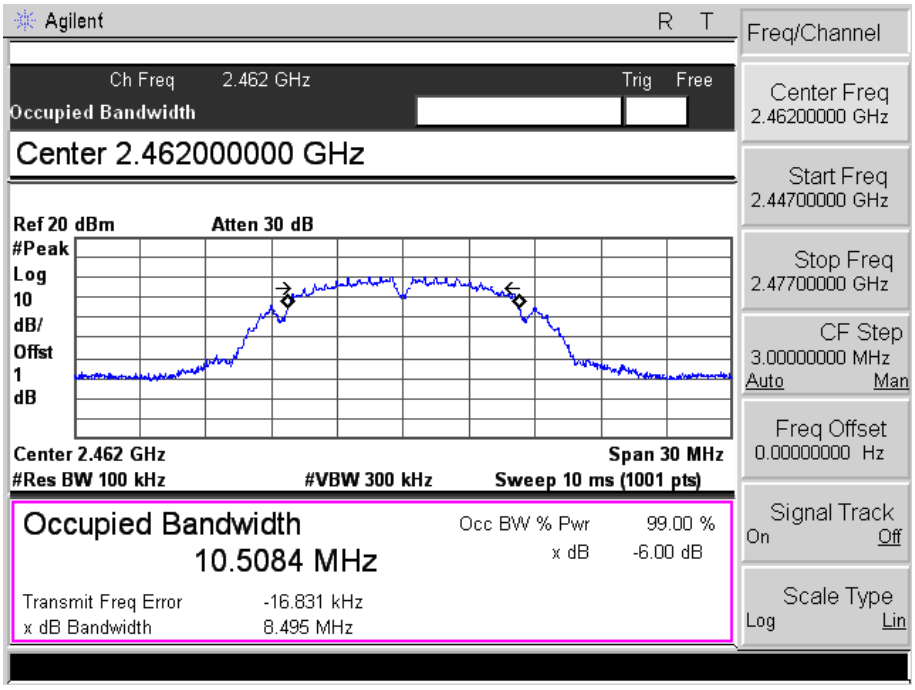
802.11b-Low Channel



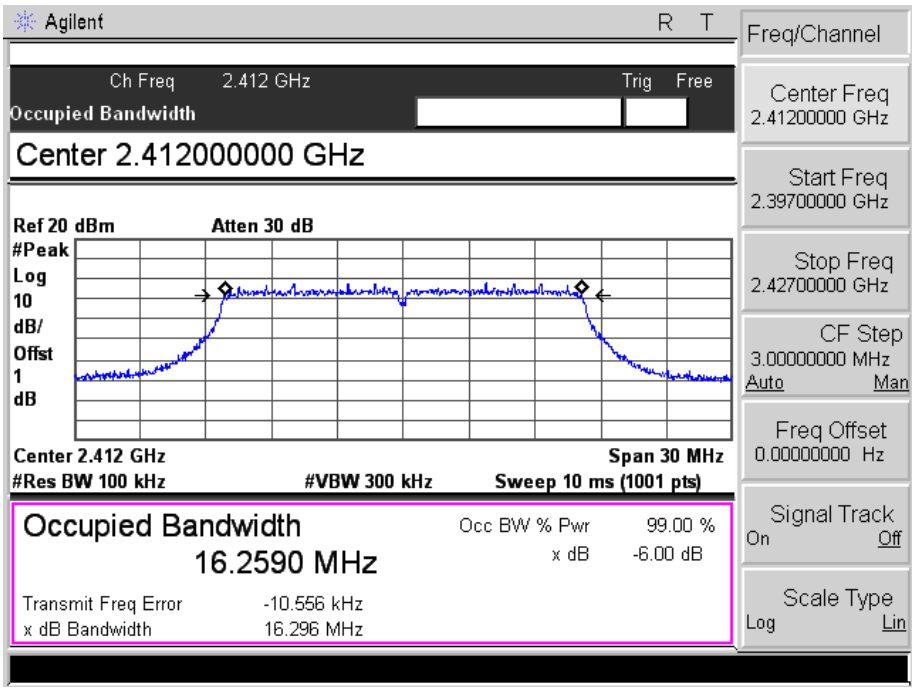
802.11b-Middle Channel



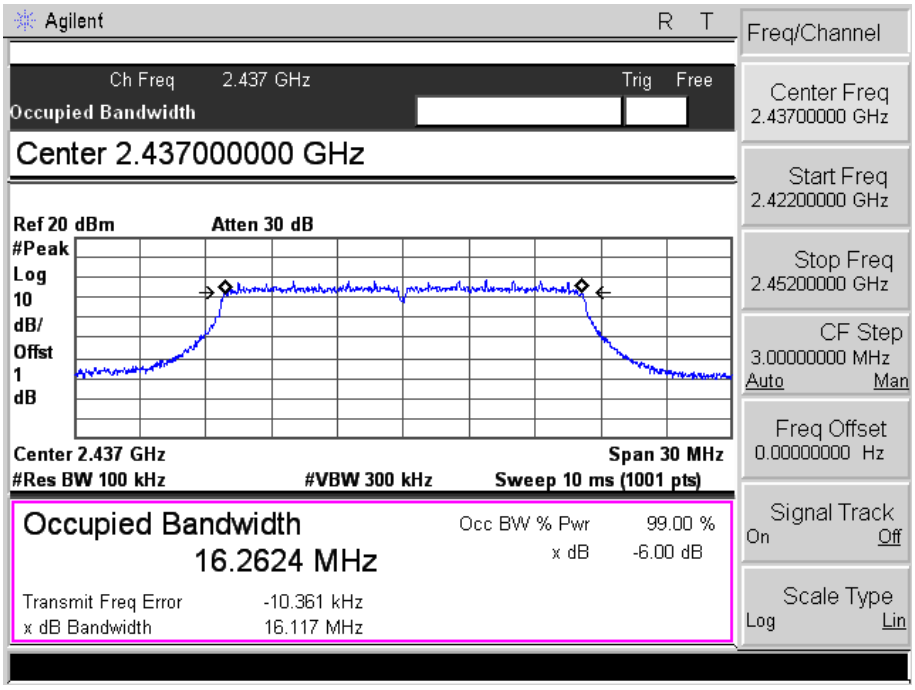
802.11b-High Channel



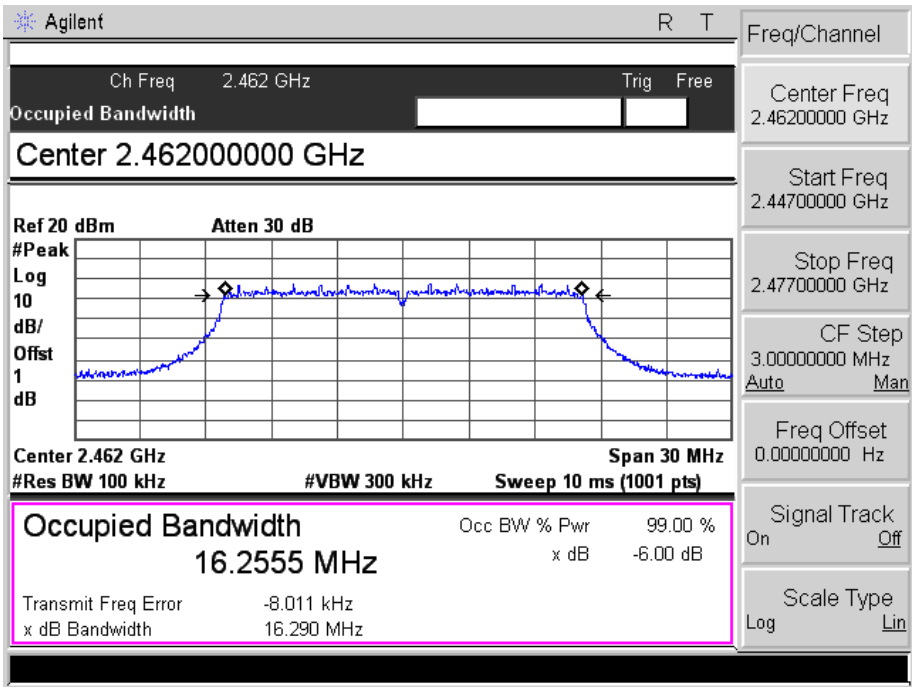
802.11g-Low Channel



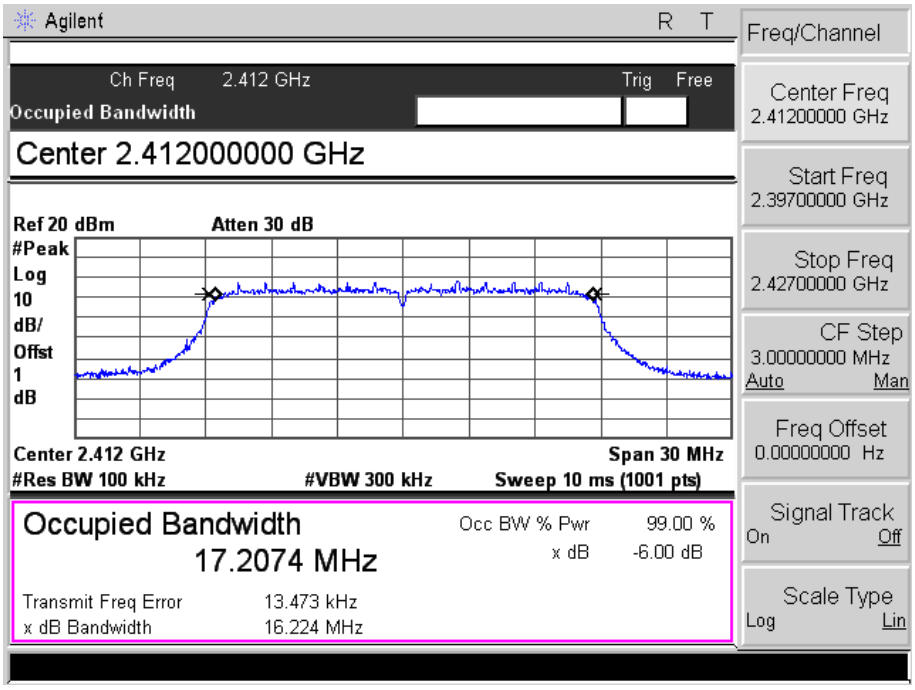
802.11g-Middle Channel



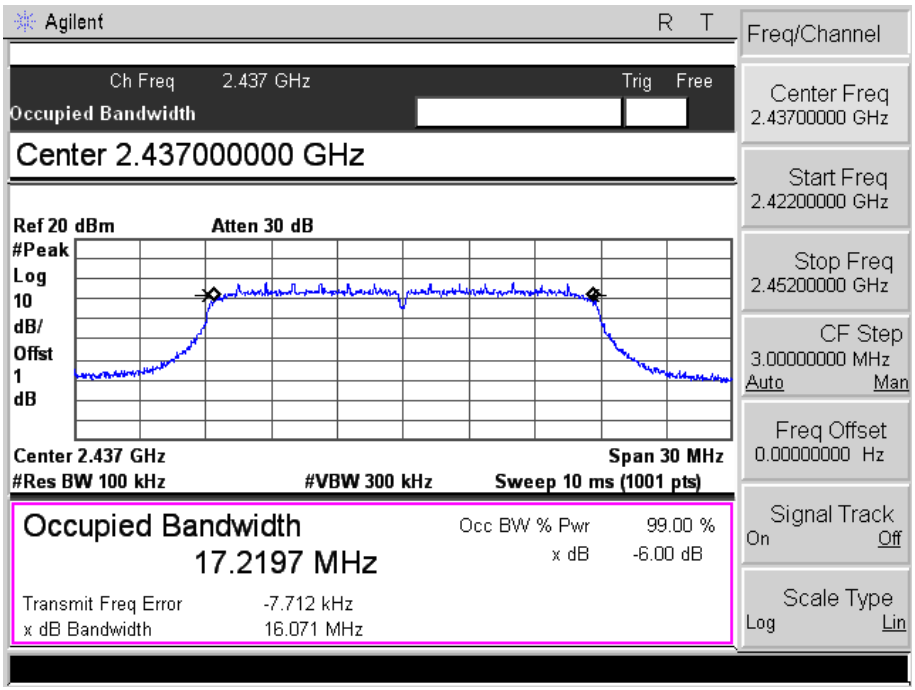
802.11g-High Channel



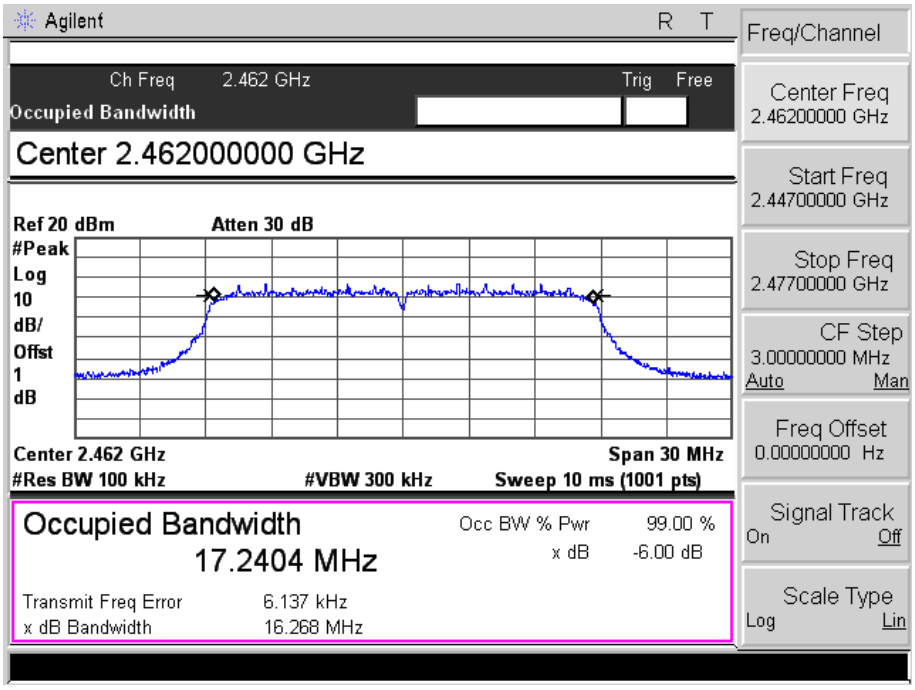
802.11n-HT20-Low Channel



802.11n-HT20-Middle Channel



802.11n-HT20-High Channel



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

7.3 Environmental Conditions

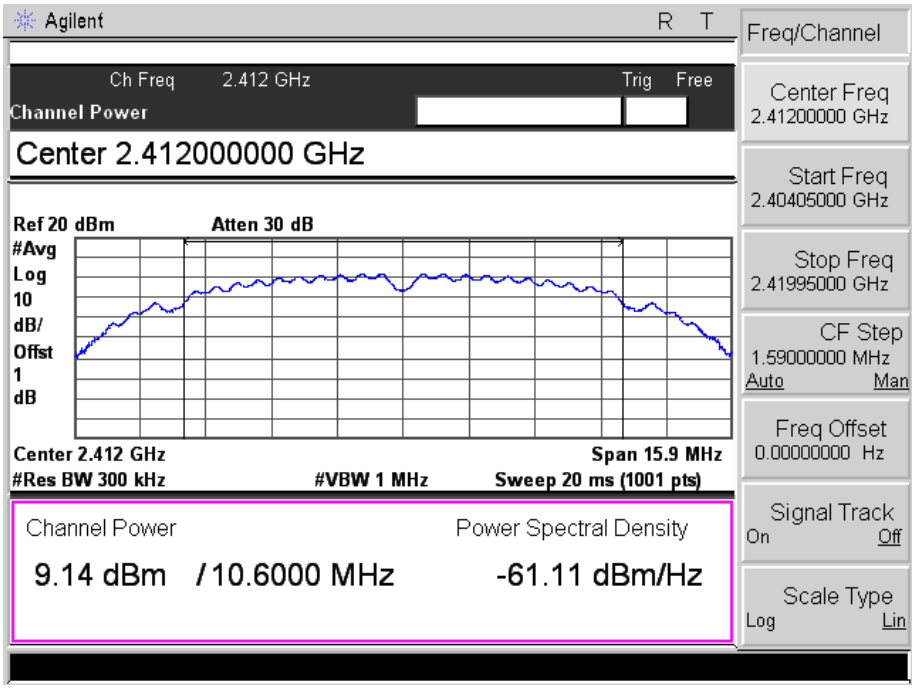
Temperature:	24° C
Relative Humidity:	56%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

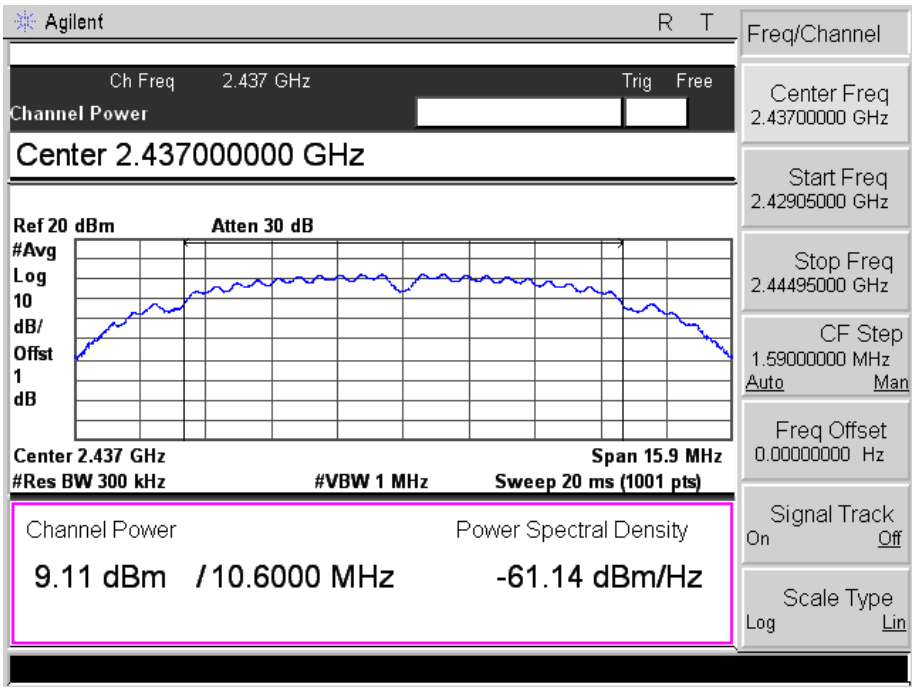
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	9.14	8.20	1000
	2437	9.11	8.15	1000
	2462	9.35	8.61	1000
802.11g_54Mbps	2412	8.55	7.16	1000
	2437	8.72	7.45	1000
	2462	8.47	7.03	1000
802.11n HT20_MCS7	2412	8.57	7.19	1000
	2437	8.47	7.03	1000
	2462	8.07	6.41	1000

Please refer to the following test plots:

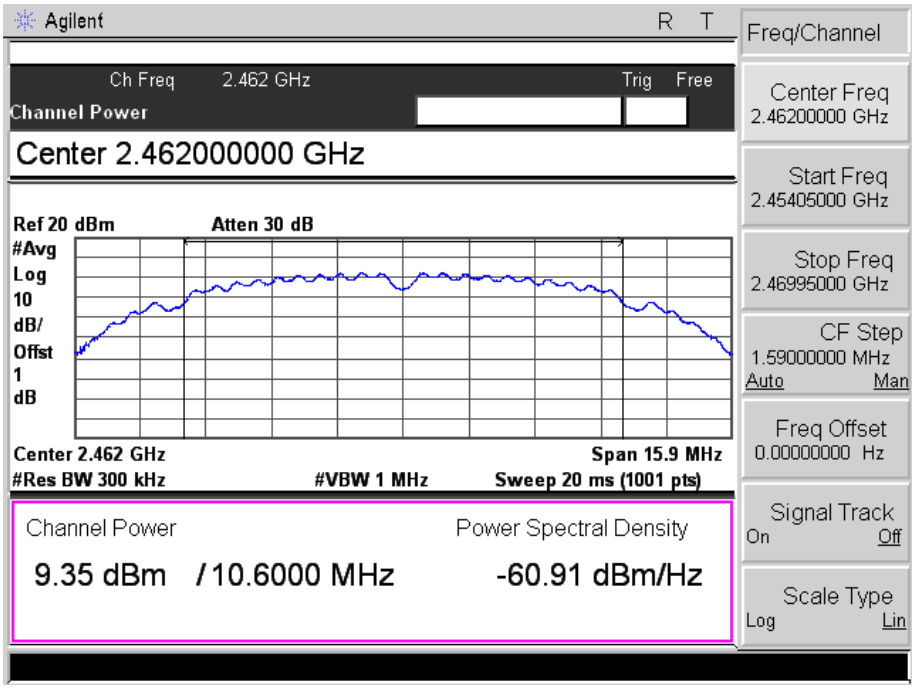
802.11b-11Mbps-Low Channel



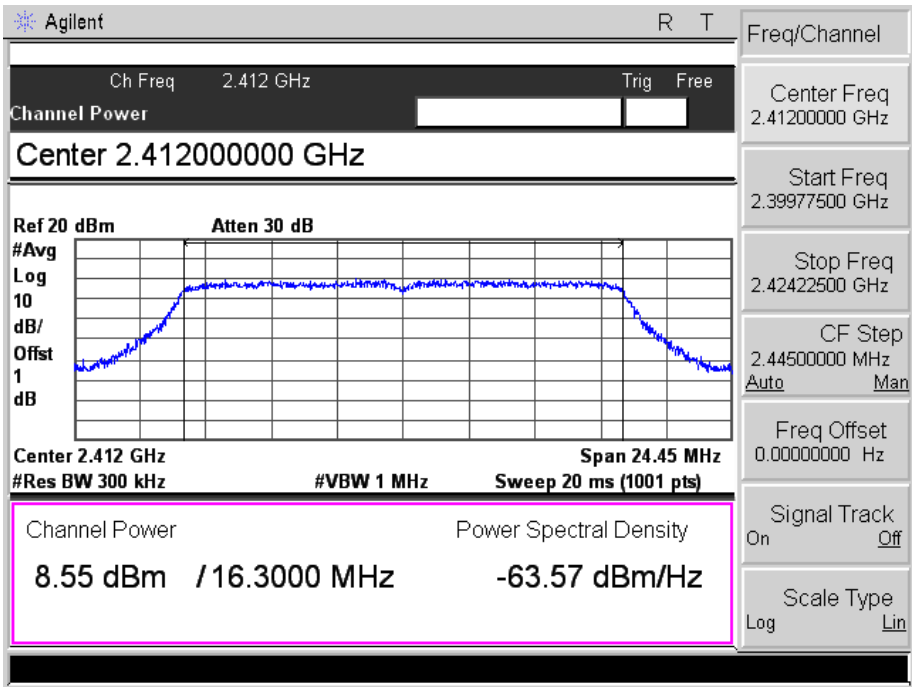
802.11b -11Mbps-Middle Channel



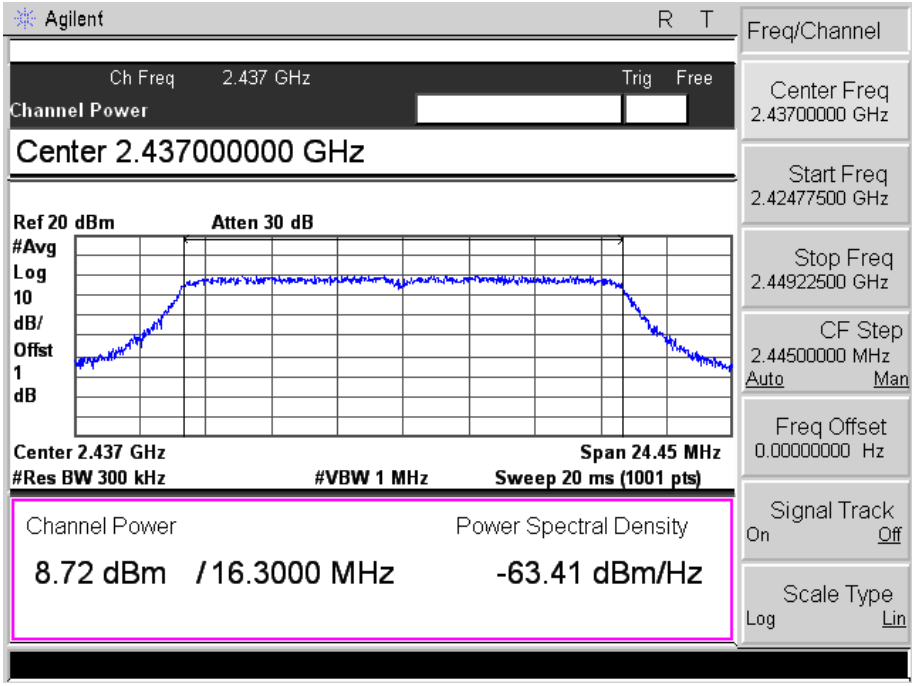
802.11b -11Mpbs-High Channel



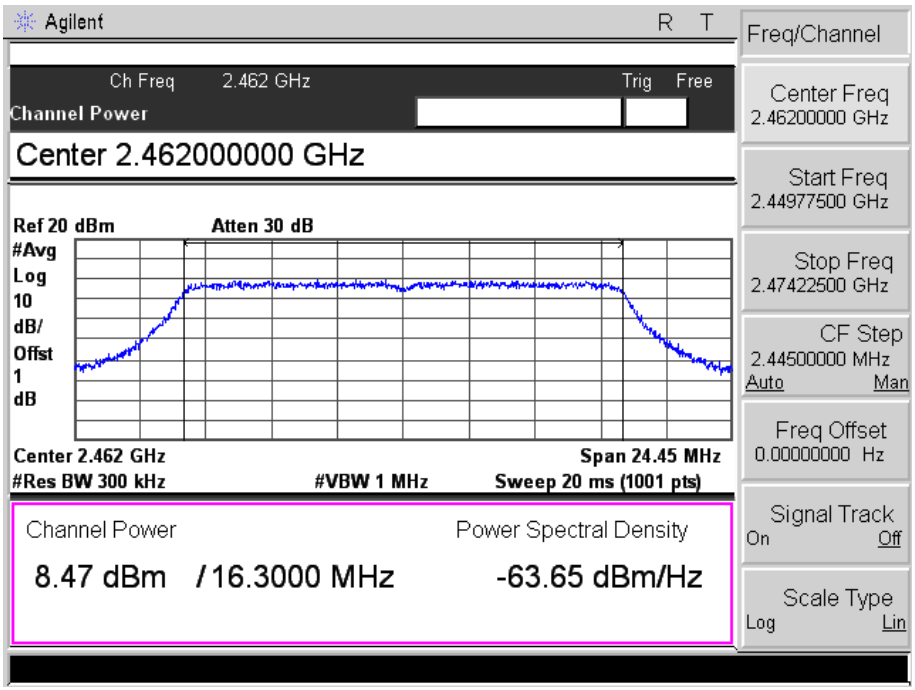
802.11g-54Mbps-Low Channel



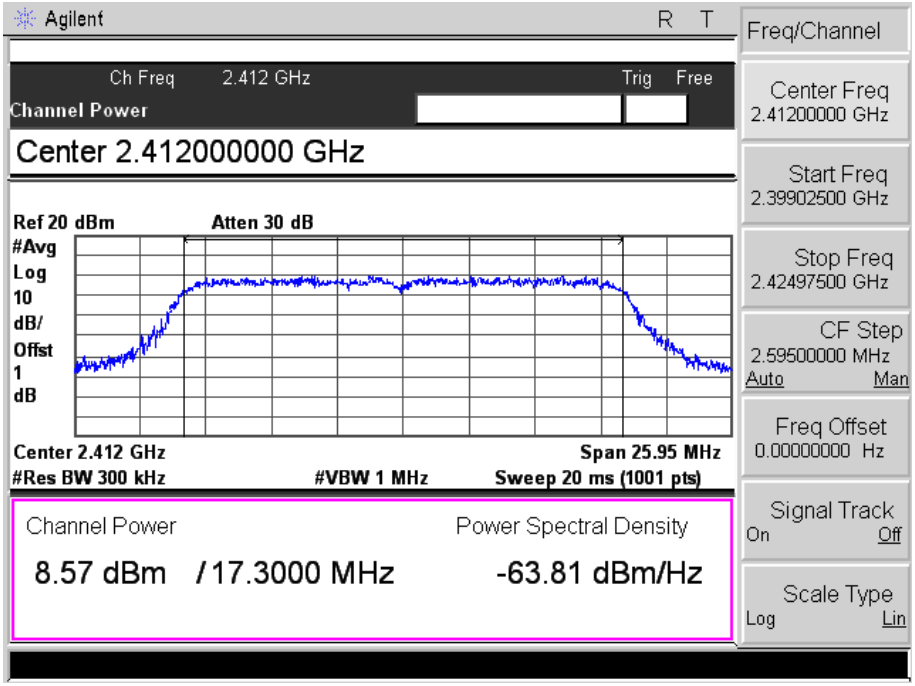
802.11g-54Mbps-Middle Channel



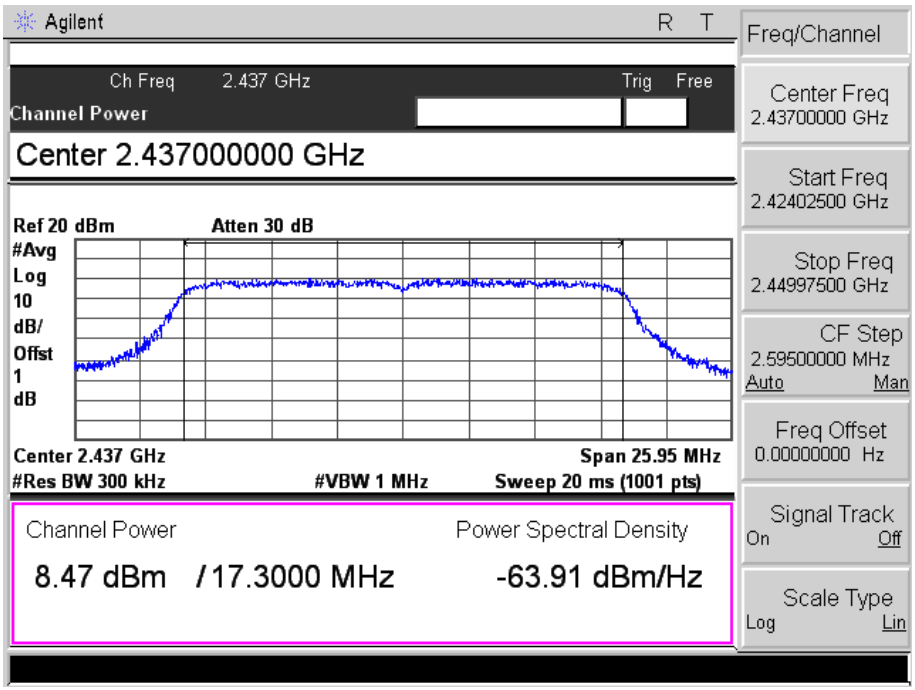
802.11g-54Mpbs-High Channel



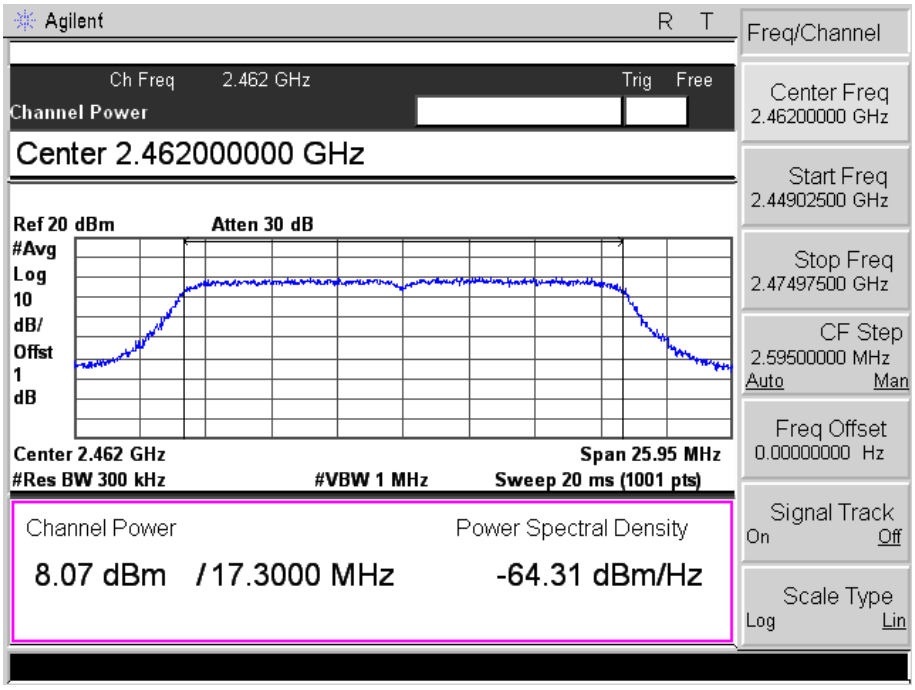
802.11n-HT20-MCS7-Low Channel



802.11n-HT20-MCS7-Middle Channel



802.11n-HT20-MCS7-High Channel



8. Field Strength of Spurious Emissions

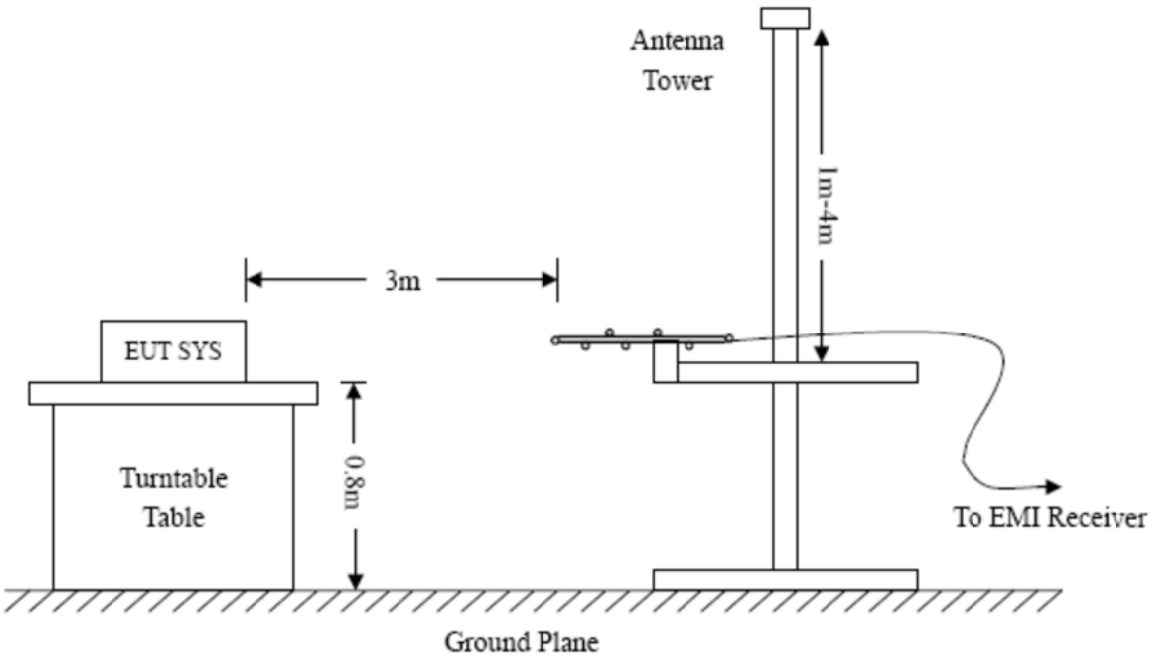
8.1 Standard Applicable

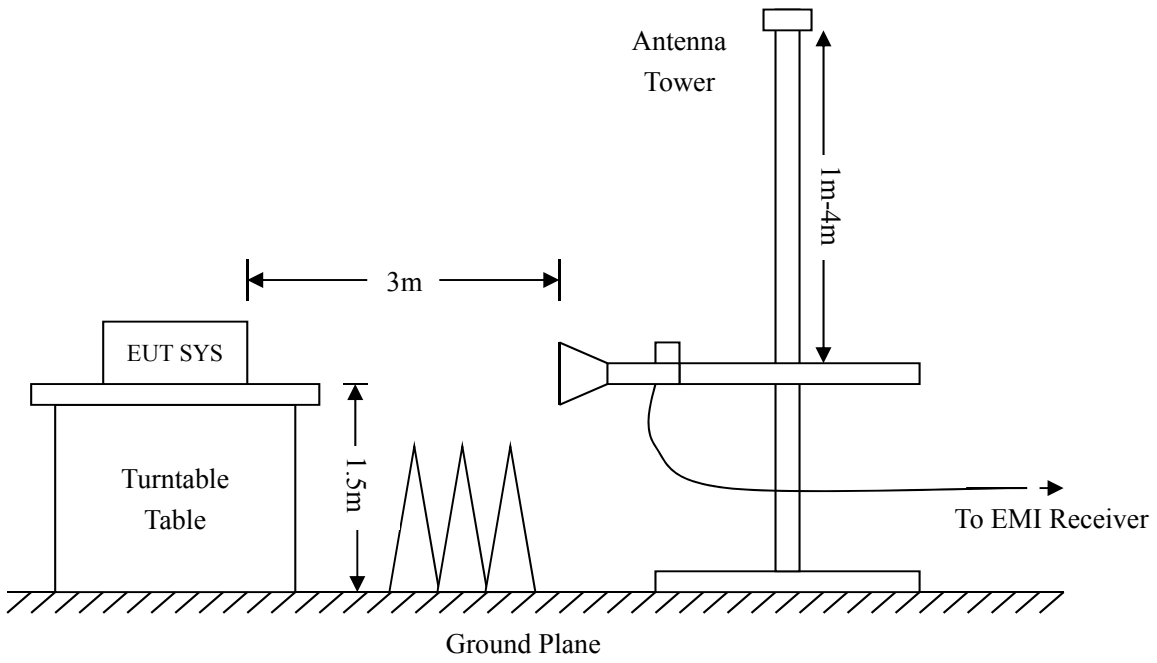
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=360KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

8.3 Corrected Amplitude & Margin Calculation

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

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

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

Margin = Corr. Ampl. – FCC Part 15 Limit

8.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56%
ATM Pressure:	1012 mbar

8.5 Summary of Test Results/Plots

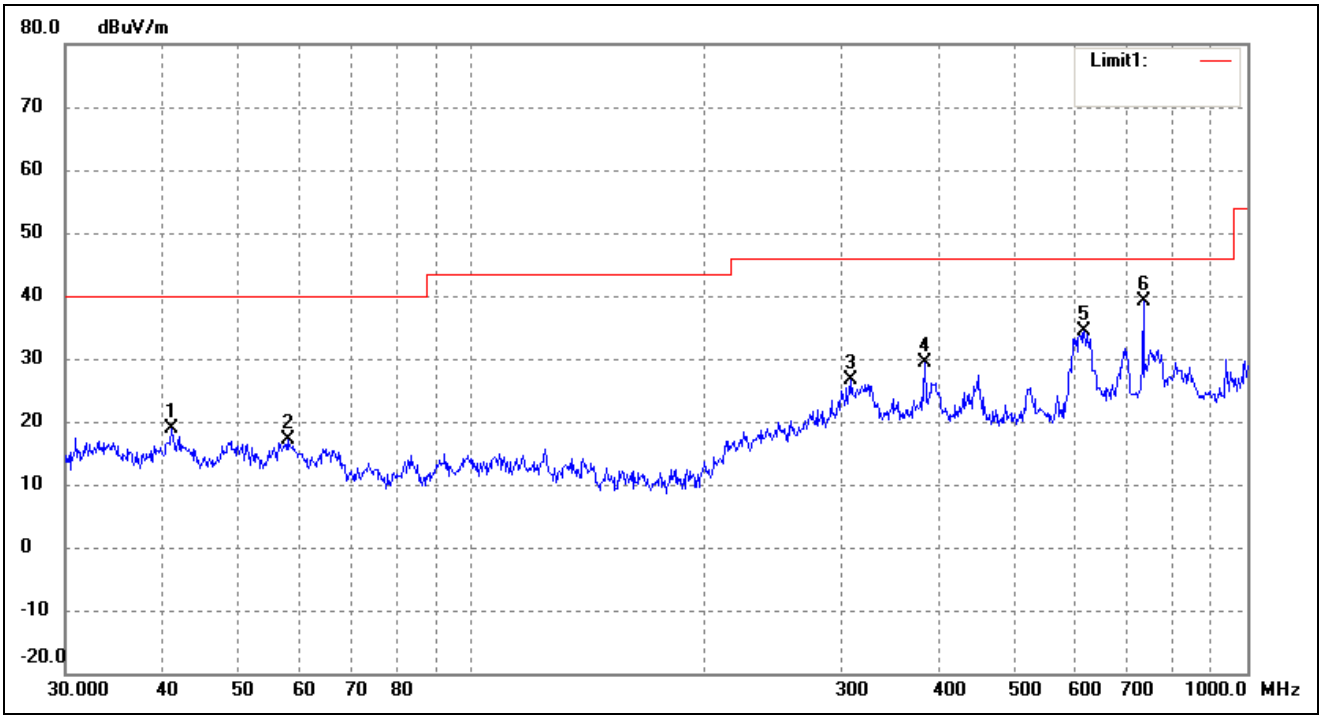
According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

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

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

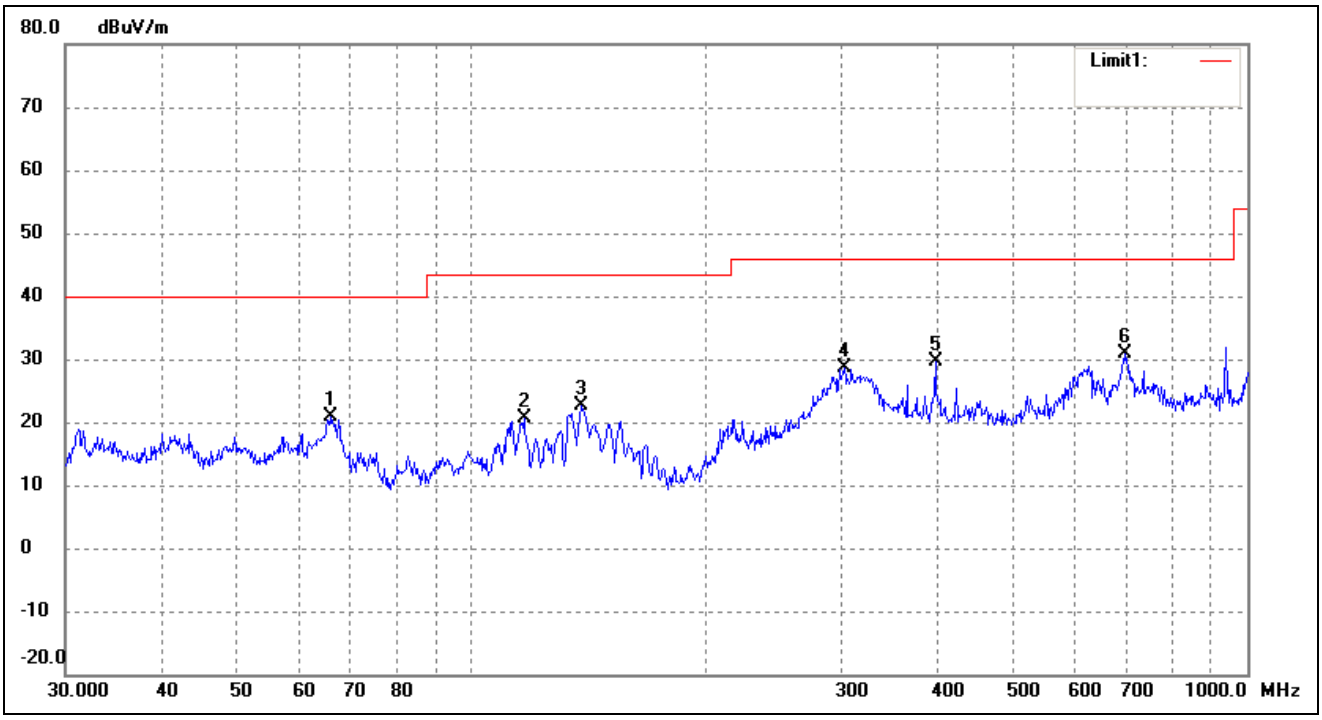
EUT: *Smart Light*
Tested Model: *WL-03*
Operating Condition: *802.11b Transmitting Low Channel-2412MHz(worst case)*
Comment: *Power Port:DC12V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	41.1320	37.35	-18.53	18.82	40.00	-21.18	262	100	peak
2	57.9993	35.29	-18.28	17.01	40.00	-22.99	93	100	peak
3	308.9126	34.55	-7.92	26.63	46.00	-19.37	277	100	peak
4	383.9318	37.62	-8.31	29.31	46.00	-16.69	91	100	peak
5	616.3718	38.03	-3.70	34.33	46.00	-11.67	308	100	peak
6	734.4913	41.93	-2.70	39.23	46.00	-6.77	208	100	peak

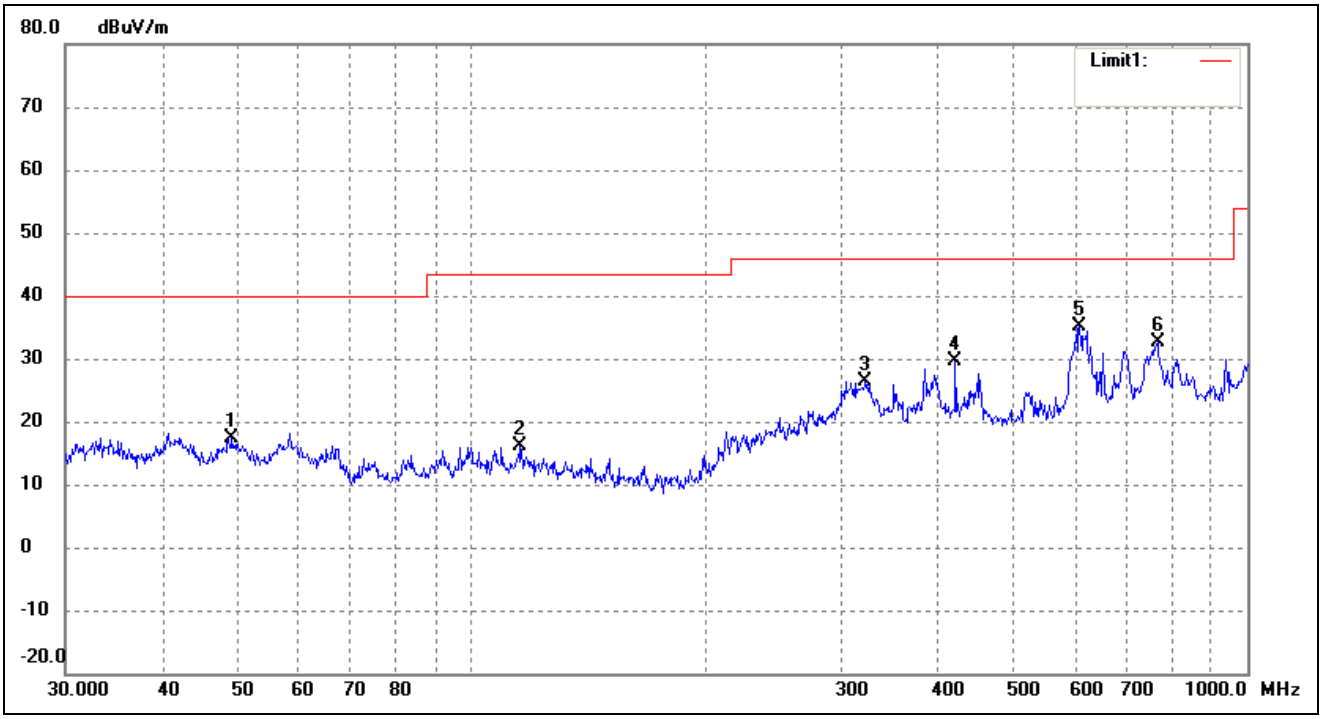
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	65.8031	40.28	-19.50	20.78	40.00	-19.22	287	100	peak
2	116.9495	38.54	-17.90	20.64	43.50	-22.86	98	100	peak
3	138.8735	41.67	-19.06	22.61	43.50	-20.89	105	100	peak
4	302.4812	36.55	-7.91	28.64	46.00	-17.36	120	100	peak
5	396.2415	37.36	-7.83	29.53	46.00	-16.47	161	100	peak
6	696.8567	34.74	-3.91	30.83	46.00	-15.17	290	100	peak

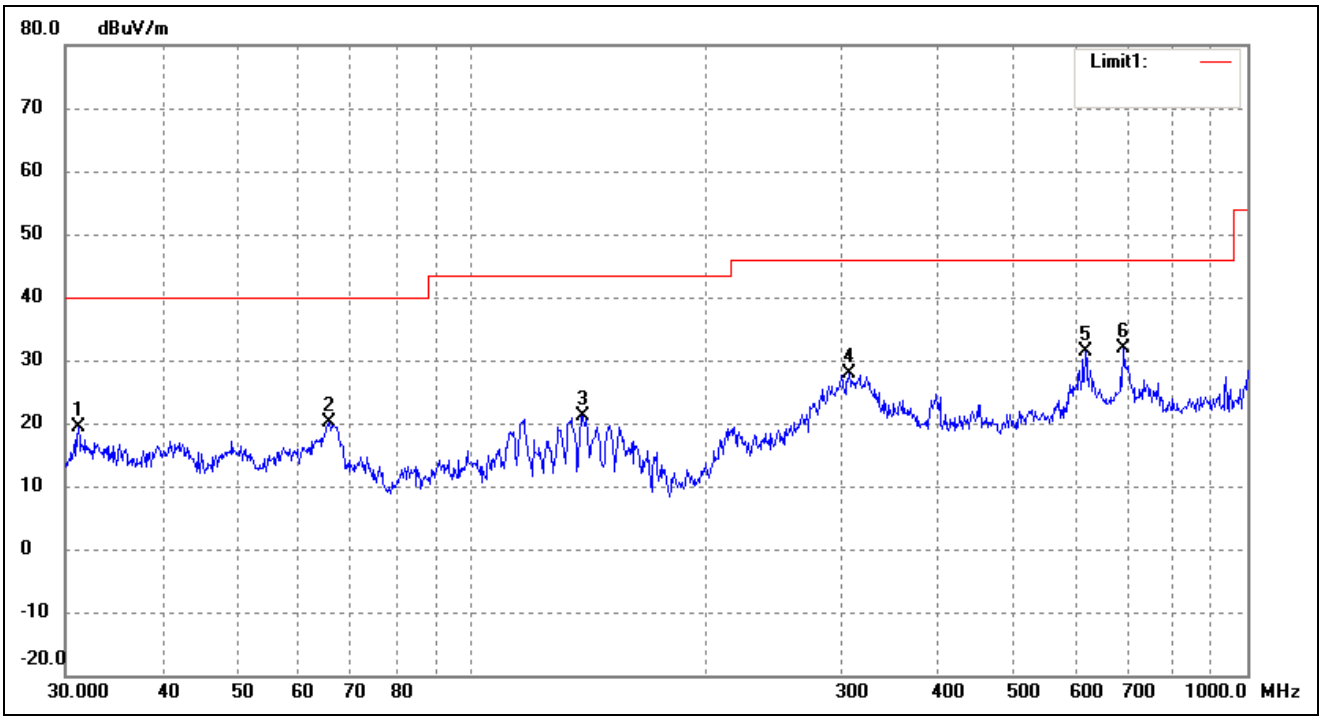
Operating Condition: *802.11b Transmitting Middle Channel-2437MHz(worst case)*
Comment: *Power Port:DC12V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	49.1866	36.00	-18.59	17.41	40.00	-22.59	212	100	peak
2	115.7256	34.12	-17.92	16.20	43.50	-27.30	122	100	peak
3	322.1886	34.47	-8.00	26.47	46.00	-19.53	61	100	peak
4	420.5803	38.09	-8.58	29.51	46.00	-16.49	217	100	peak
5	607.7867	38.22	-3.10	35.12	46.00	-10.88	224	100	peak
6	766.0572	36.20	-3.64	32.56	46.00	-13.44	297	100	peak

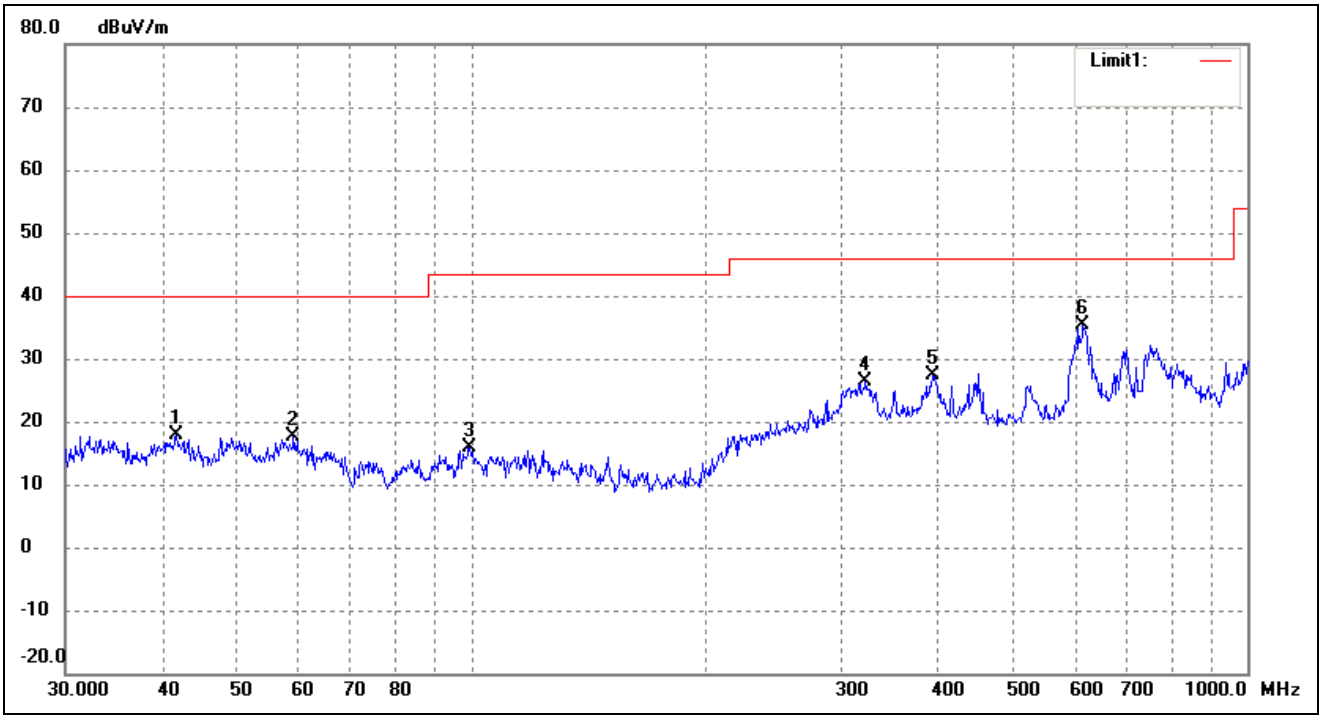
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	31.1798	39.31	-19.96	19.35	40.00	-20.65	129	100	peak
2	65.5727	39.70	-19.45	20.25	40.00	-19.75	146	100	peak
3	139.3613	40.32	-19.10	21.22	43.50	-22.28	103	100	peak
4	306.7537	35.84	-7.91	27.93	46.00	-18.07	128	100	peak
5	618.5369	35.22	-3.86	31.36	46.00	-14.64	154	100	peak
6	691.9867	35.37	-3.55	31.82	46.00	-14.18	274	100	peak

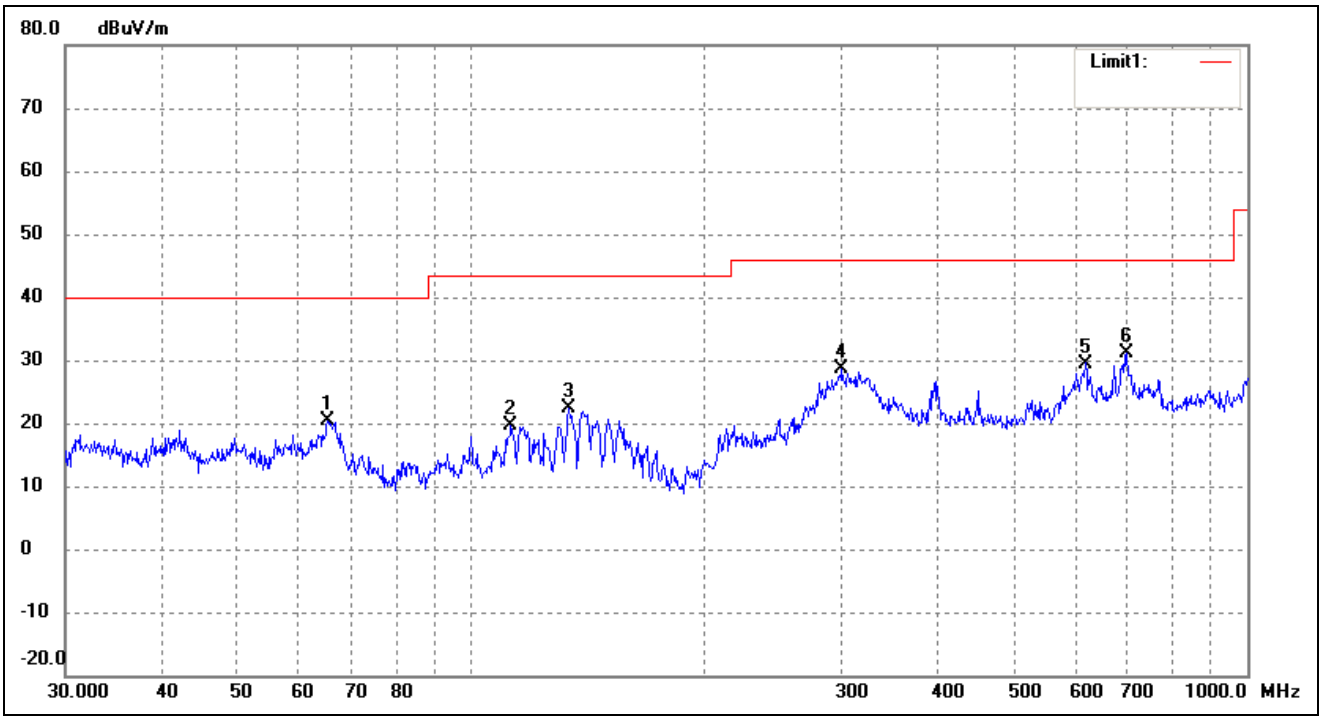
Operating Condition: *802.11b Transmitting High Channel-2462MHz(worst case)*
Comment: *Power Port:DC12V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	41.7130	36.52	-18.54	17.98	40.00	-22.02	287	100	peak
2	59.0251	35.78	-18.25	17.53	40.00	-22.47	98	100	peak
3	99.5281	34.13	-18.17	15.96	43.50	-27.54	105	100	peak
4	322.1886	34.26	-8.00	26.26	46.00	-19.74	120	100	peak
5	393.4724	35.30	-7.94	27.36	46.00	-18.64	161	100	peak
6	614.2142	38.90	-3.55	35.35	46.00	-10.65	290	100	peak

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	65.3432	39.68	-19.40	20.28	40.00	-19.72	116	100	peak
2	112.5244	37.51	-17.95	19.56	43.50	-23.94	91	100	peak
3	133.6188	41.23	-18.73	22.50	43.50	-21.00	79	100	peak
4	300.3673	36.55	-7.91	28.64	46.00	-17.36	123	100	peak
5	618.5369	33.36	-3.86	29.50	46.00	-16.50	109	100	peak
6	699.3046	35.12	-4.10	31.02	46.00	-14.98	145	100	peak

Spurious Emissions Above 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							
4824.000	55.68	-3.87	51.81	74	-22.19	H	PK
4824.000	40.56	-3.87	36.69	54	-17.31	H	AV
7236.000	60.82	1.14	61.96	74	-12.04	H	PK
7236.000	40.62	1.19	41.81	54	-12.19	H	AV
4824.000	60.40	-3.86	56.54	74	-17.46	V	PK
4824.000	45.87	-3.86	42.01	54	-11.99	V	AV
7236.000	61.35	1.10	62.45	74	-11.55	V	PK
7236.000	45.03	1.10	46.13	54	-7.87	V	AV
Middle Channel-2437MHz(802.11b)							
4874.000	58.46	-3.74	54.72	74	-19.28	H	PK
4874.000	40.99	-3.74	37.25	54	-16.75	H	AV
7311.000	59.23	1.47	60.70	74	-13.30	H	PK
7311.000	42.51	1.47	43.98	54	-10.02	H	AV
4874.000	64.36	-3.74	60.62	74	-13.38	V	PK
4874.000	50.57	-3.74	46.83	54	-7.17	V	AV
7311.000	65.15	1.47	66.62	74	-7.38	V	PK
7311.000	39.51	1.47	40.98	54	-13.02	V	AV
High Channel-2462MHz(802.11b)							
4924.000	56.33	-3.59	52.74	74	-21.26	H	PK
4924.000	40.35	-3.59	36.76	54	-17.24	H	AV
7386.000	56.97	1.79	58.76	74	-15.24	H	PK
7386.000	41.71	1.79	43.50	54	-10.50	H	AV
4924.000	65.72	-3.59	62.13	74	-11.87	V	PK
4924.000	48.77	-3.59	45.18	54	-8.82	V	AV
7386.000	62.88	1.79	64.67	74	-9.33	V	PK
7386.000	43.25	1.79	45.04	54	-8.96	V	AV

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

9. Out of Band Emissions

9.1 Standard Applicable

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

9.2 Test Procedure

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

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

According to the KDB 558074 D01 v04, the conducted spurious emissions test method as follows:
1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW ≥ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

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

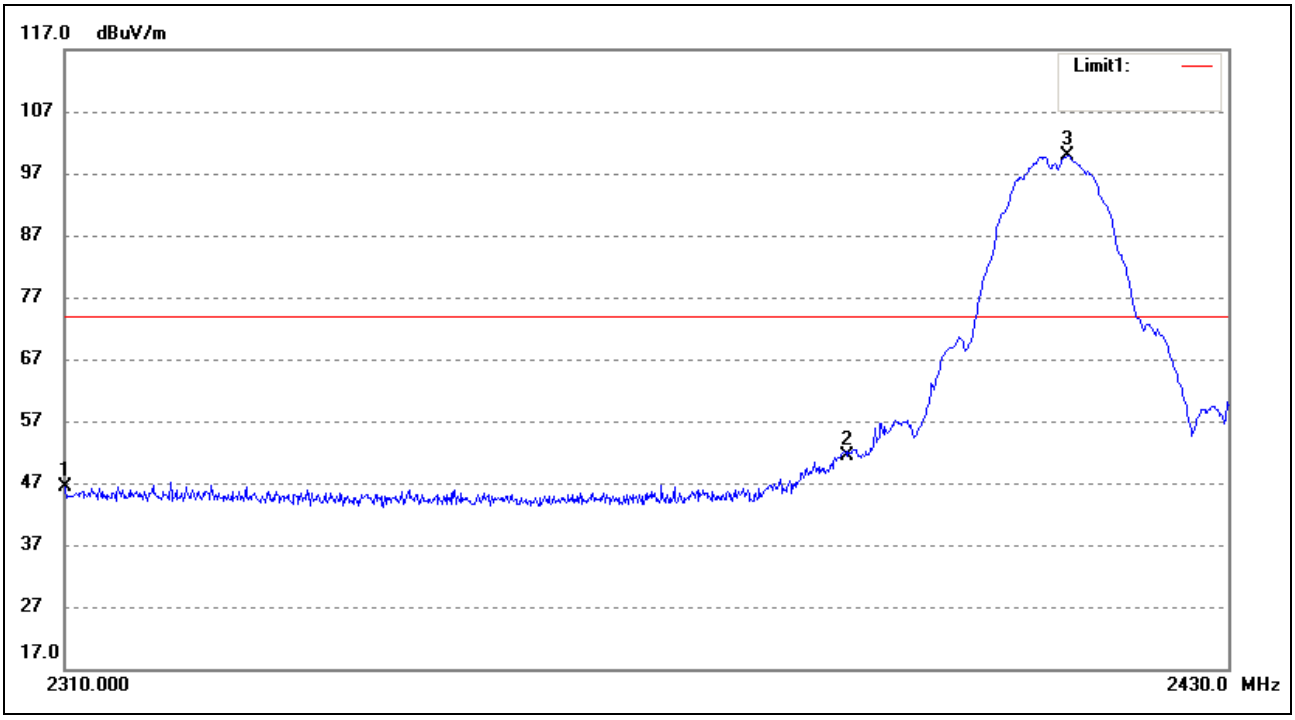
9.3 Environmental Conditions

Temperature:	24°C
Relative Humidity:	56%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

802.11b-Lowest Bandedge

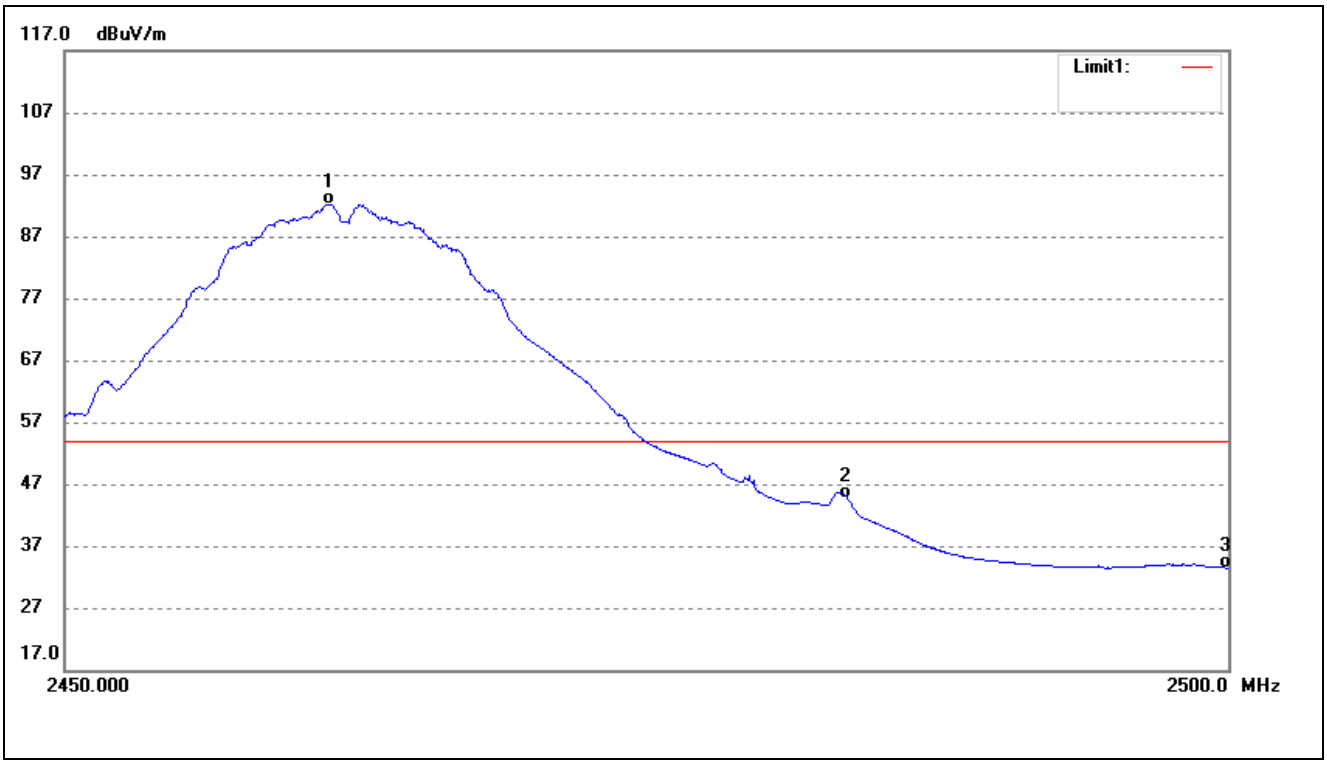
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	38.10	-5.28	32.82	54.00	-21.18	Average Detector
	2310.000	51.55	-5.28	46.27	74.00	-27.73	Peak Detector
2	2390.000	52.22	-6.12	46.10	54.00	-7.90	Average Detector
	2390.000	57.52	-6.12	51.40	74.00	-22.60	Peak Detector

802.11b-Highest Bandedge

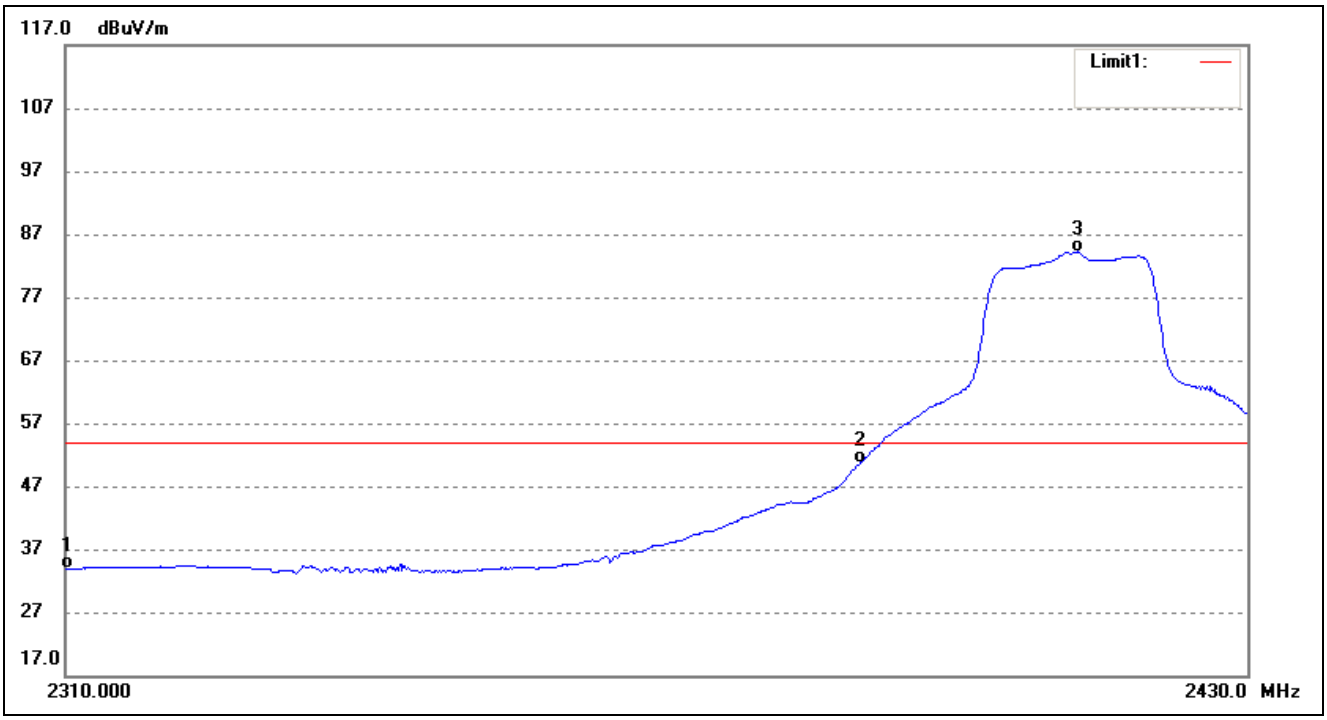
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	50.78	-6.08	44.70	54.00	-9.30	Average Detector
	2483.500	58.12	-6.08	52.04	74.00	-21.96	Peak Detector
2	2500.000	39.54	-6.04	33.50	54.00	-20.50	Average Detector
	2500.000	51.71	-6.04	45.67	74.00	-28.33	Peak Detector

802.11g-Lowest Bandedge

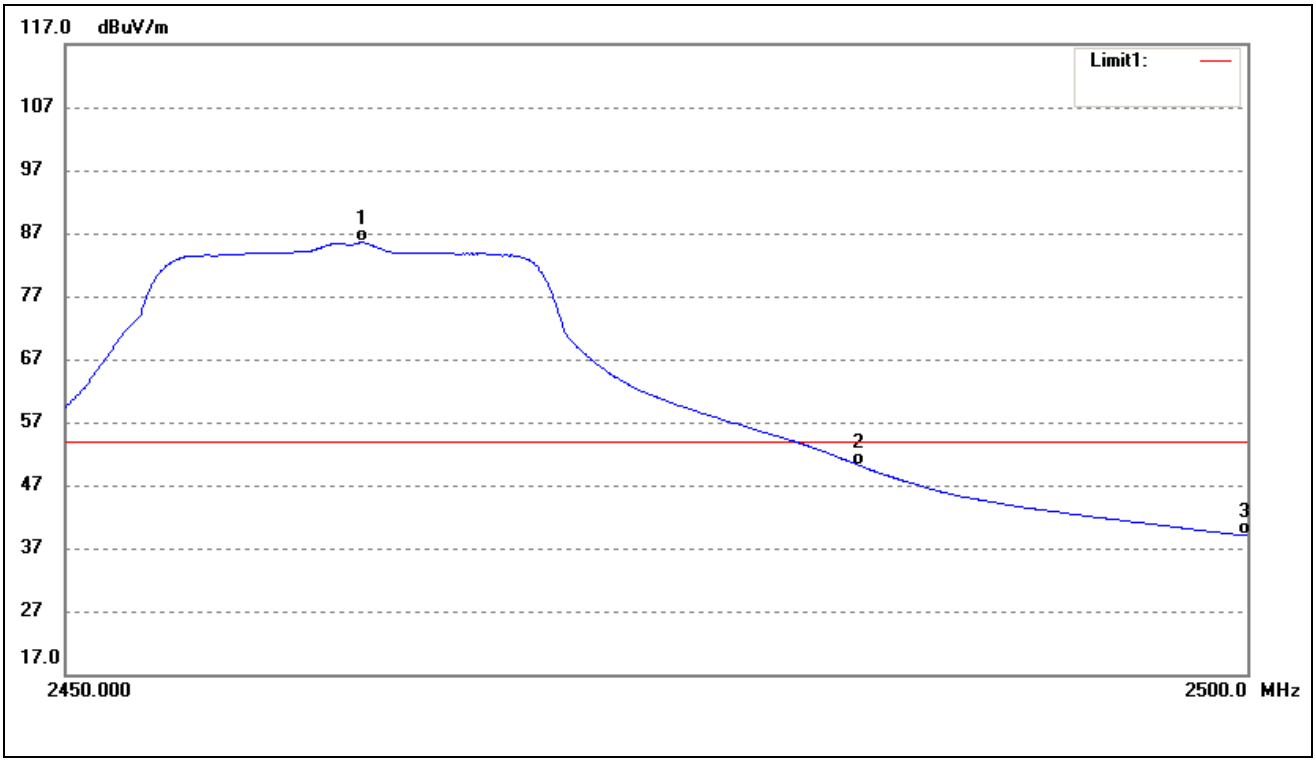
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	39.20	-5.28	33.92	54.00	-20.08	Average Detector
	2310.000	51.78	-5.28	46.50	74.00	-27.50	Peak Detector
2	2390.000	56.87	-6.12	50.75	54.00	-3.25	Average Detector
	2390.000	76.44	-6.12	70.32	74.00	-3.68	Peak Detector

802.11g-Highest Bandedge

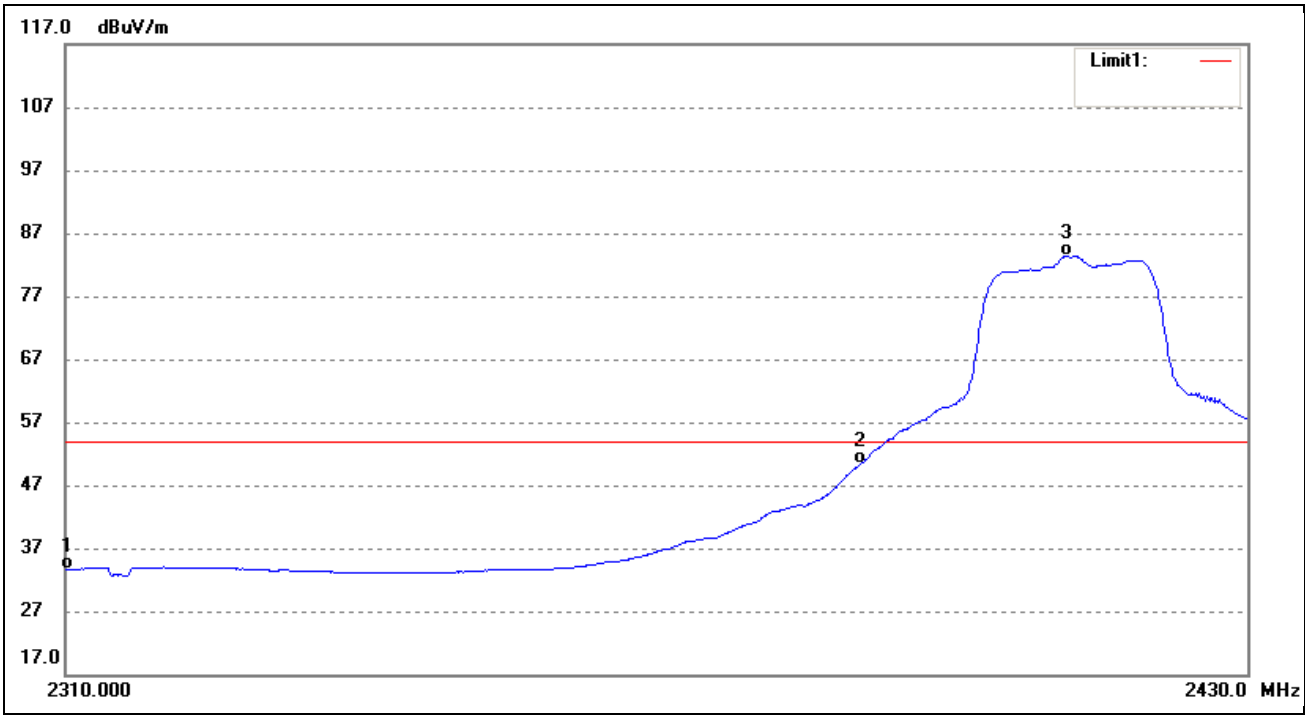
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	56.16	-6.08	50.08	54.00	-3.92	Average Detector
	2483.500	75.05	-6.08	68.97	74.00	-5.03	Peak Detector
2	2500.000	45.06	-6.04	39.02	54.00	-14.98	Average Detector
	2500.000	64.49	-6.04	58.45	74.00	-15.55	Peak Detector

802.11n-HT20-Lowest Bandedge

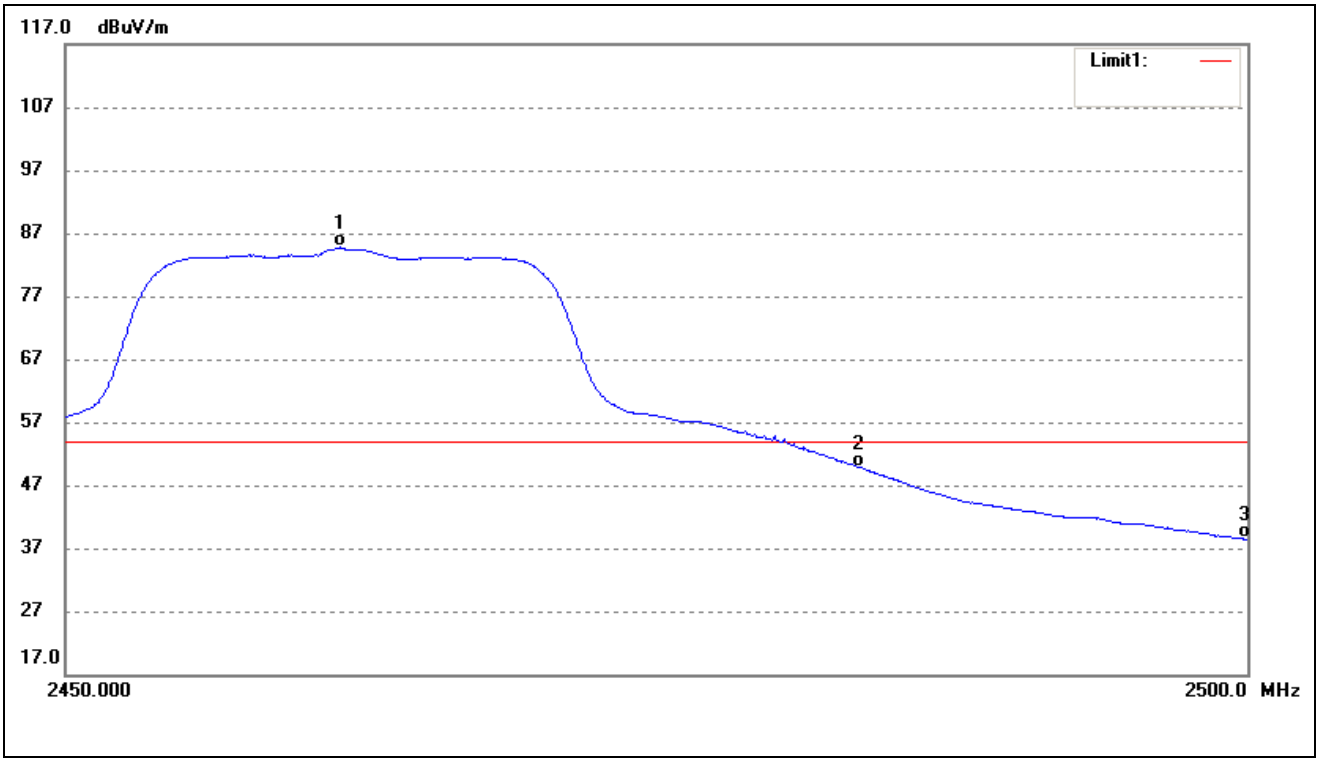
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	38.98	-5.28	33.70	54.00	-20.30	Average Detector
	2310.000	52.01	-5.28	46.73	74.00	-27.27	Peak Detector
2	2390.000	56.56	-6.12	50.44	54.00	-3.56	Average Detector
	2390.000	78.06	-6.12	71.94	74.00	-2.06	Peak Detector

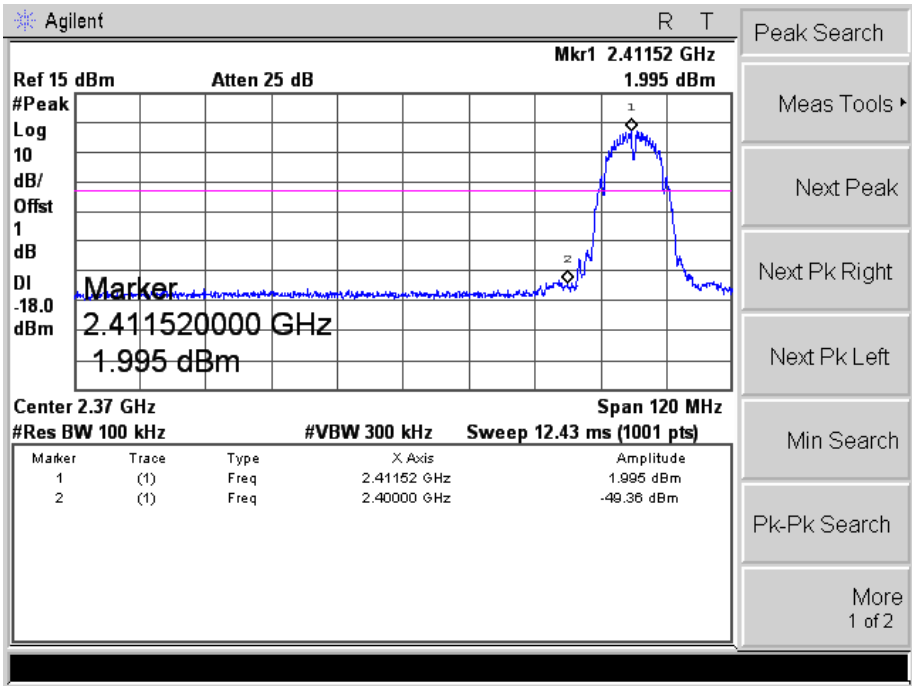
802.11n-HT20-Highest Bandedge

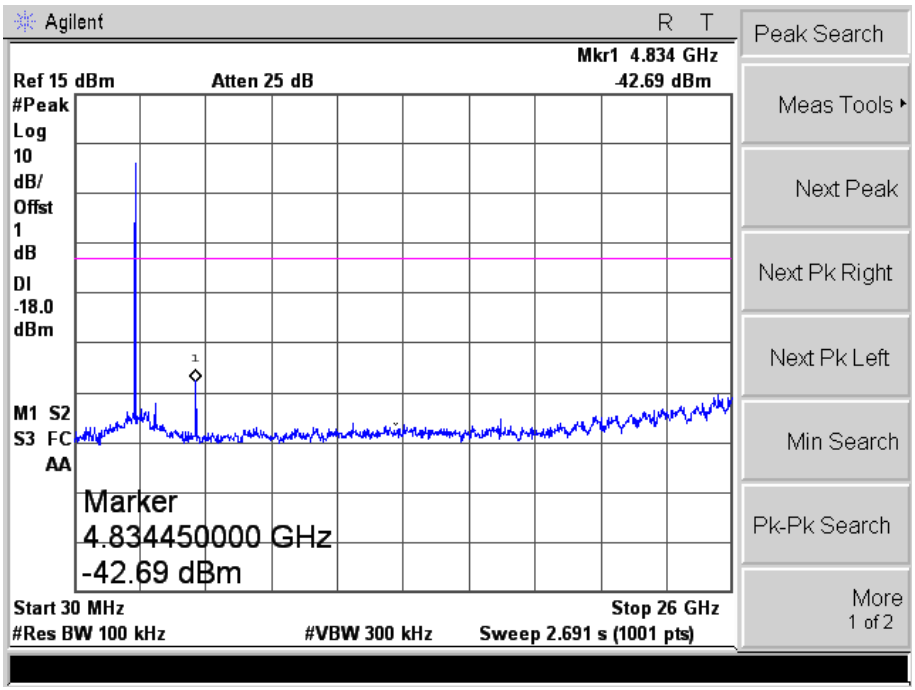
Vertical (Worst case)



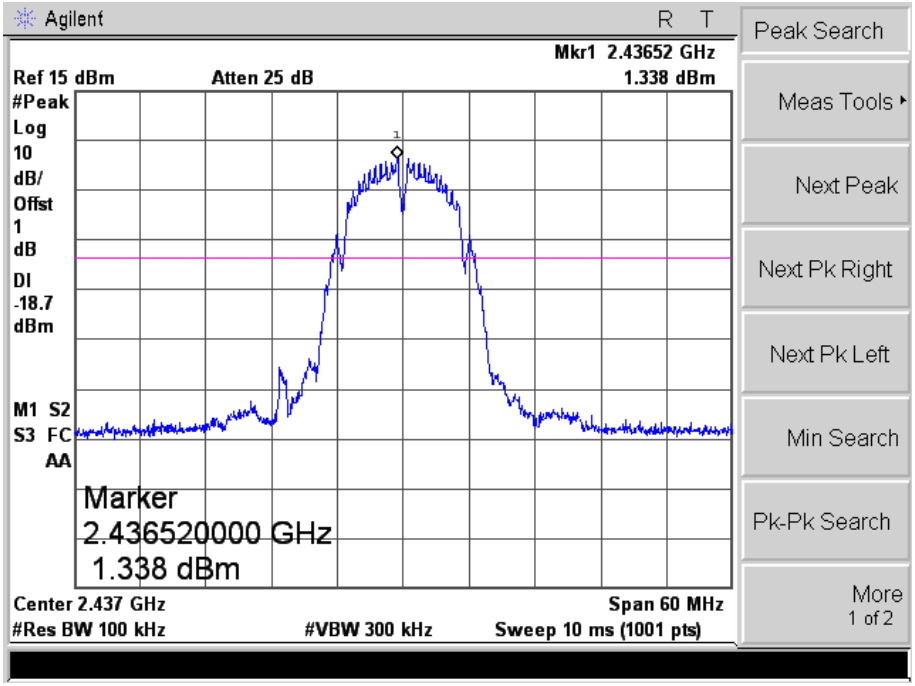
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	55.88	-6.08	49.80	54.00	-4.20	Average Detector
	2483.500	75.87	-6.08	69.79	74.00	-4.21	Peak Detector
2	2500.000	44.59	-6.04	38.55	54.00	-15.45	Average Detector
	2500.000	64.85	-6.04	58.81	74.00	-15.19	Peak Detector

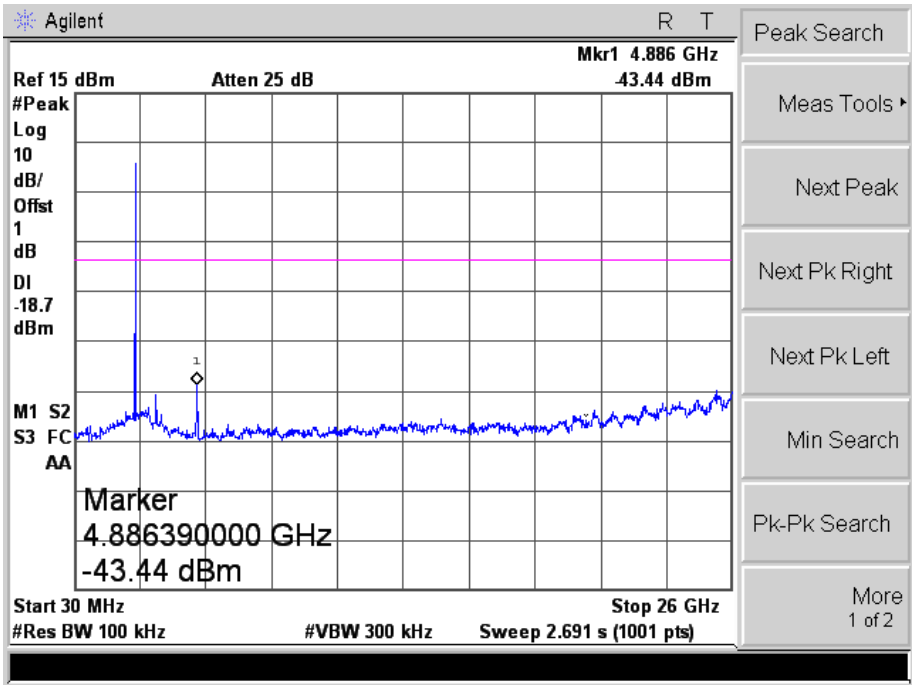
Spurious (Conducted)
802.11b-Lowest
Lowest



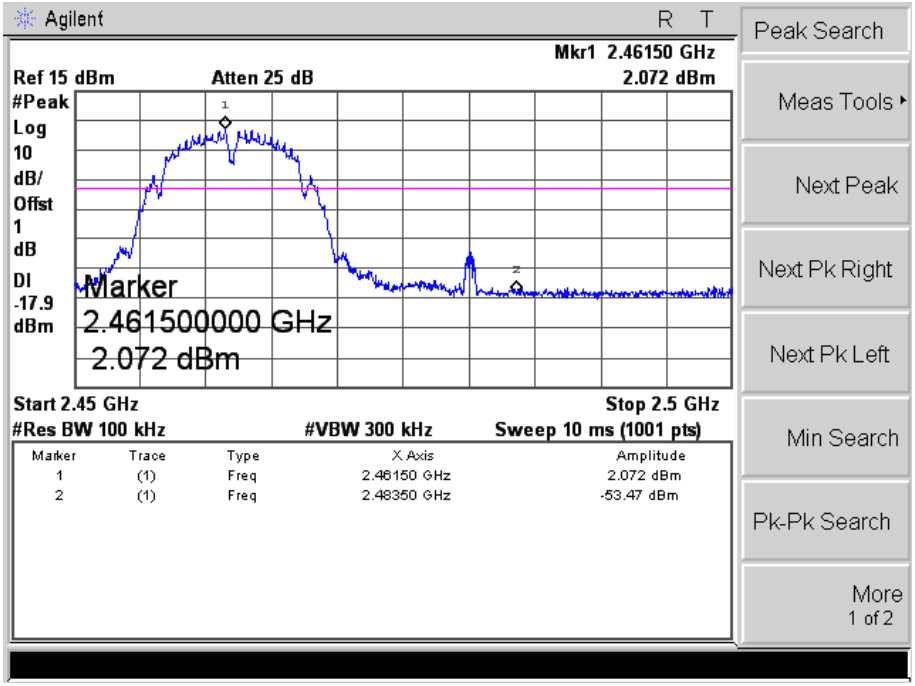


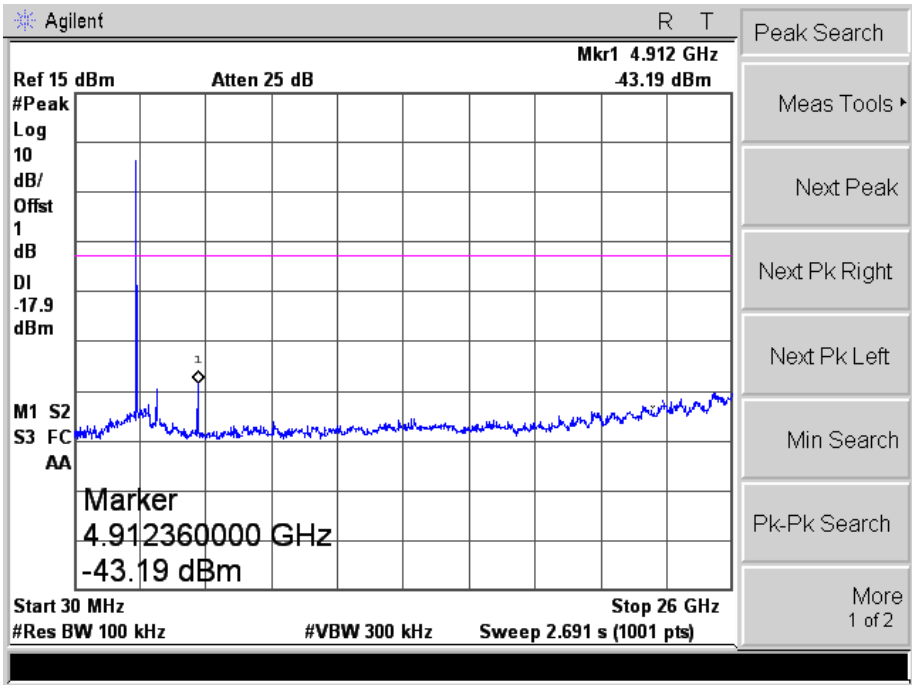
Middle


Agilent
R T
Mkr1 2.43652 GHz
Ref 15 dBm
Atten 25 dB
1.338 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-18.7
dBm
M1 S2
S3 FC
AA
Marker
2.436520000 GHz
1.338 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

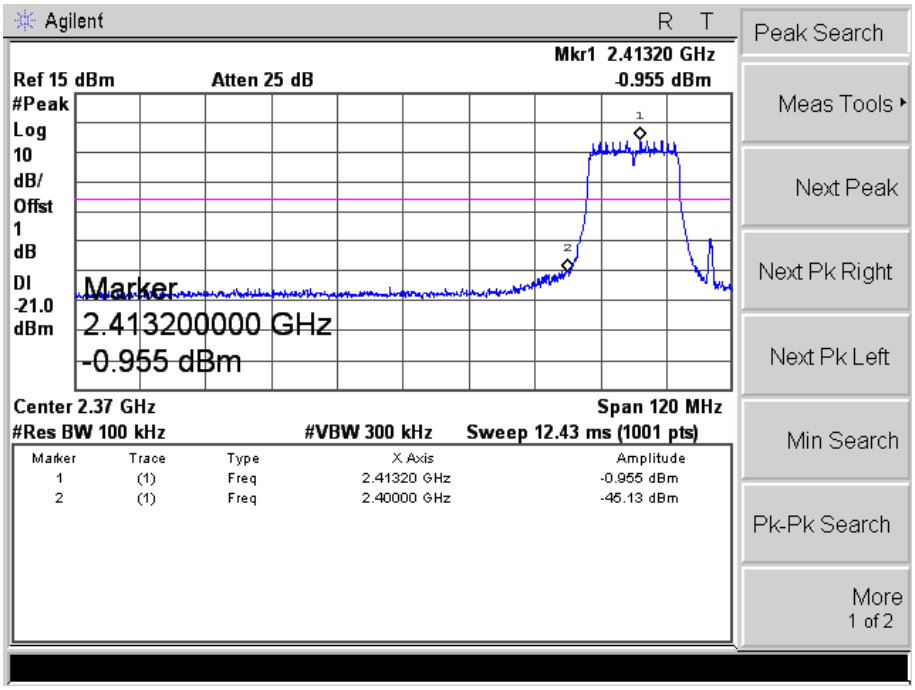

Agilent
R T
Mkr1 4.886 GHz
Ref 15 dBm
Atten 25 dB
-43.44 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-18.7
dBm
M1 S2
S3 FC
AA
Marker
4.886390000 GHz
-43.44 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

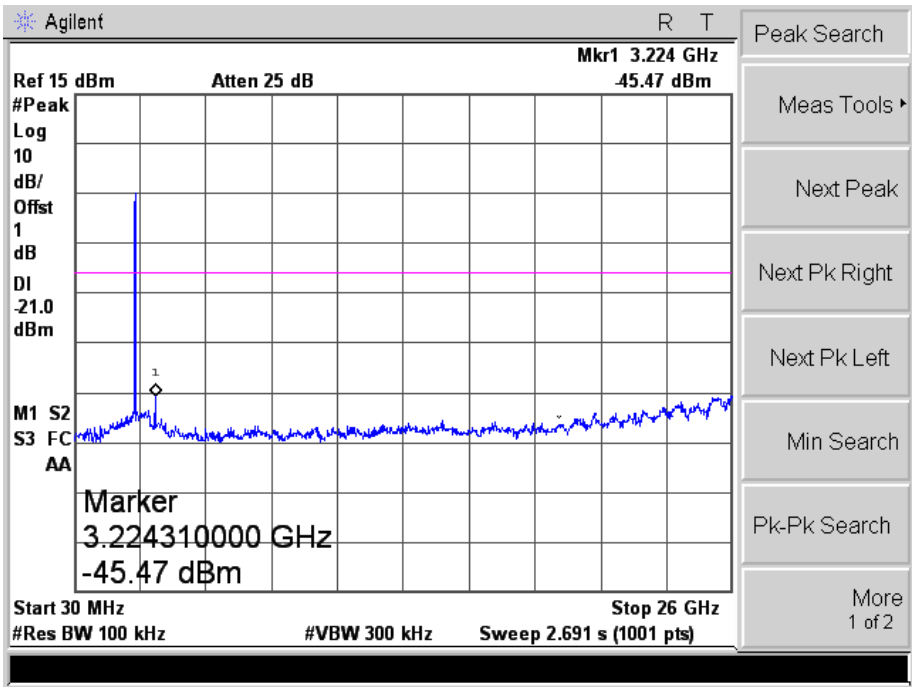
Highest


Agilent
R T
Mkr1 2.46150 GHz
Ref 15 dBm
Atten 25 dB
2.072 dBm
#Peak
Log
10
dB/
Offst
1
dB
DI
-17.9
dBm
Marker
2.461500000 GHz
2.072 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.46150 GHz 2.072 dBm
2 (1) Freq 2.48350 GHz -53.47 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

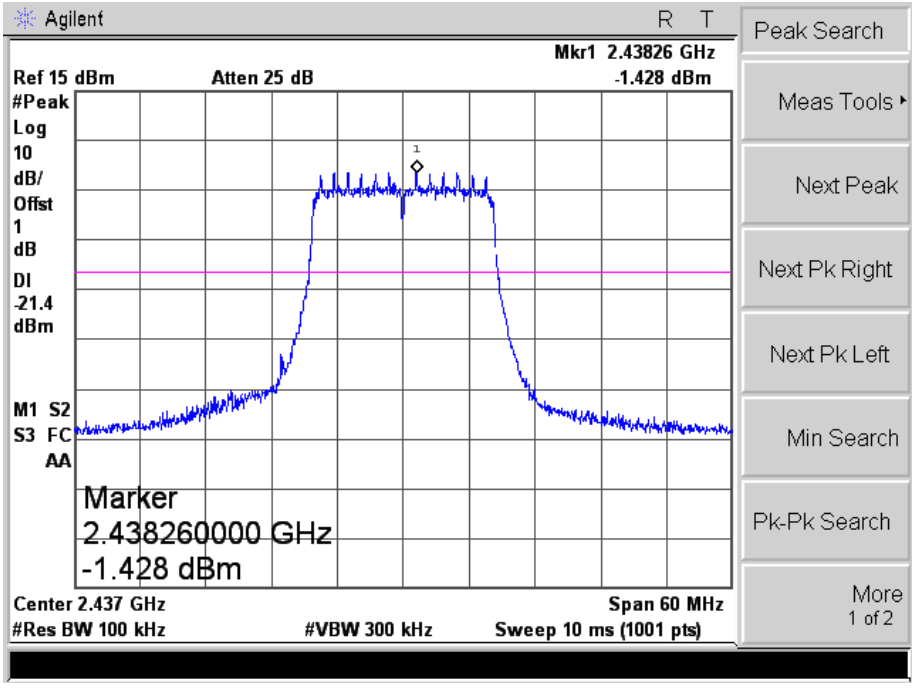

Agilent
R T
Mkr1 4.912 GHz
Ref 15 dBm
Atten 25 dB
-43.19 dBm
#Peak
Log
10
dB/
Offst
1
dB
DI
-17.9
dBm
M1 S2
S3 FC
AA
Marker
4.912360000 GHz
-43.19 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

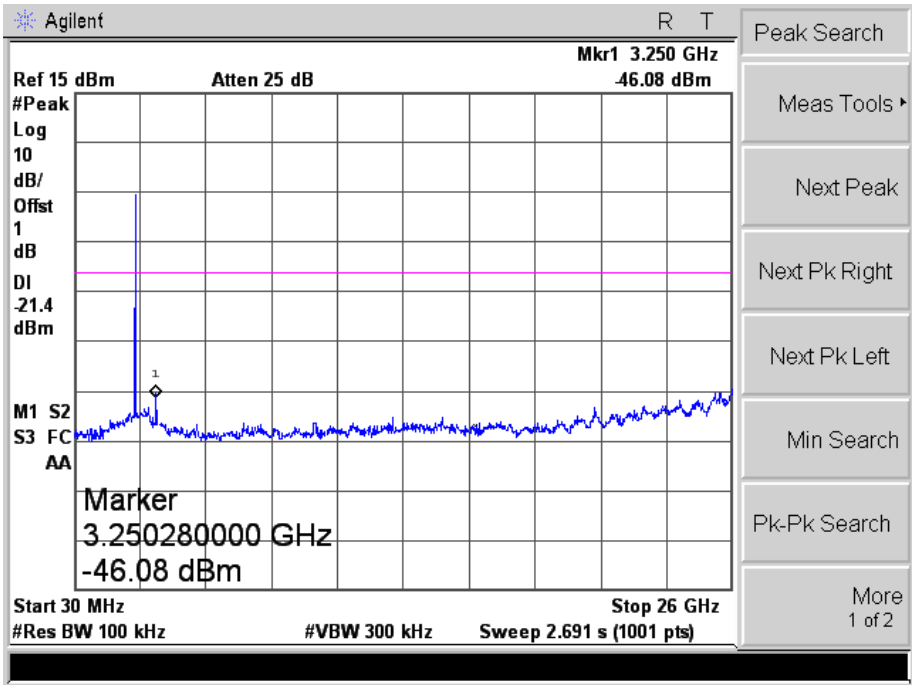
Spurious (Conducted)
802.11g-Lowest
Lowest



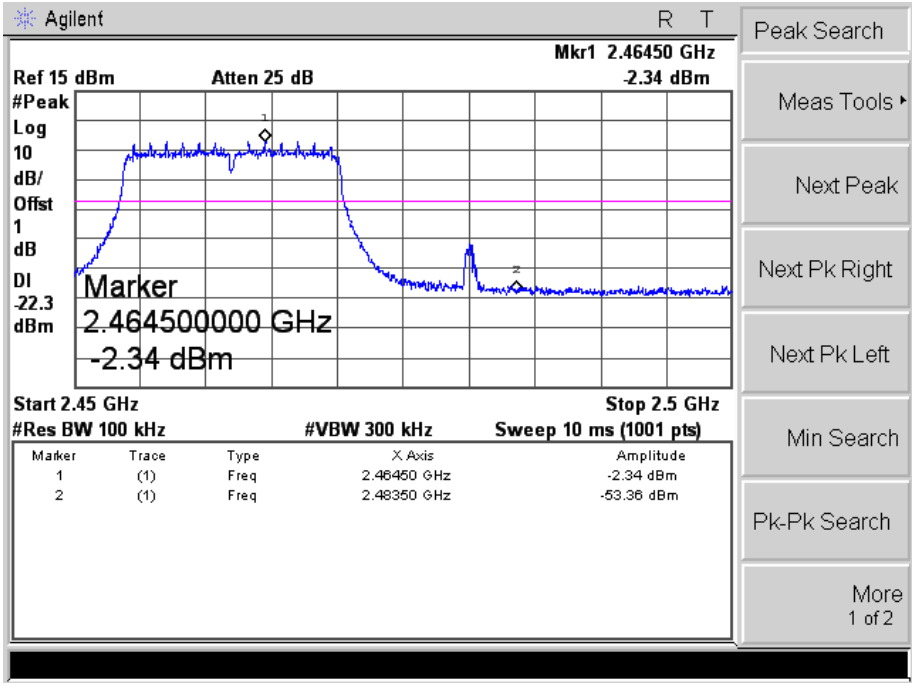


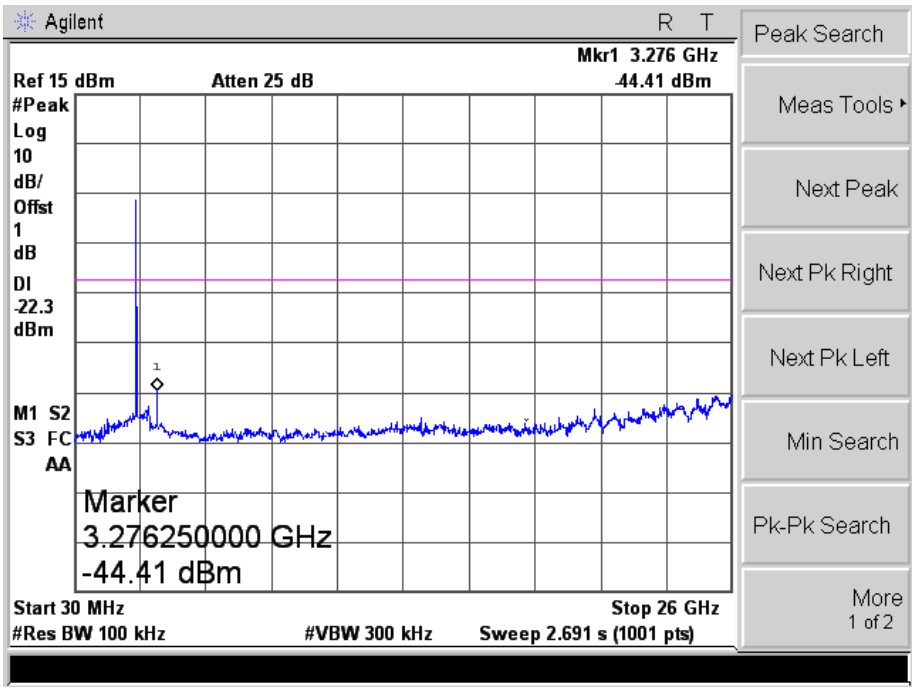
Middle


Agilent
R T
Mkr1 2.43826 GHz
Ref 15 dBm
Atten 25 dB
-1.428 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-21.4
dBm
M1 S2
S3 FC
AA
Marker
2.438260000 GHz
-1.428 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

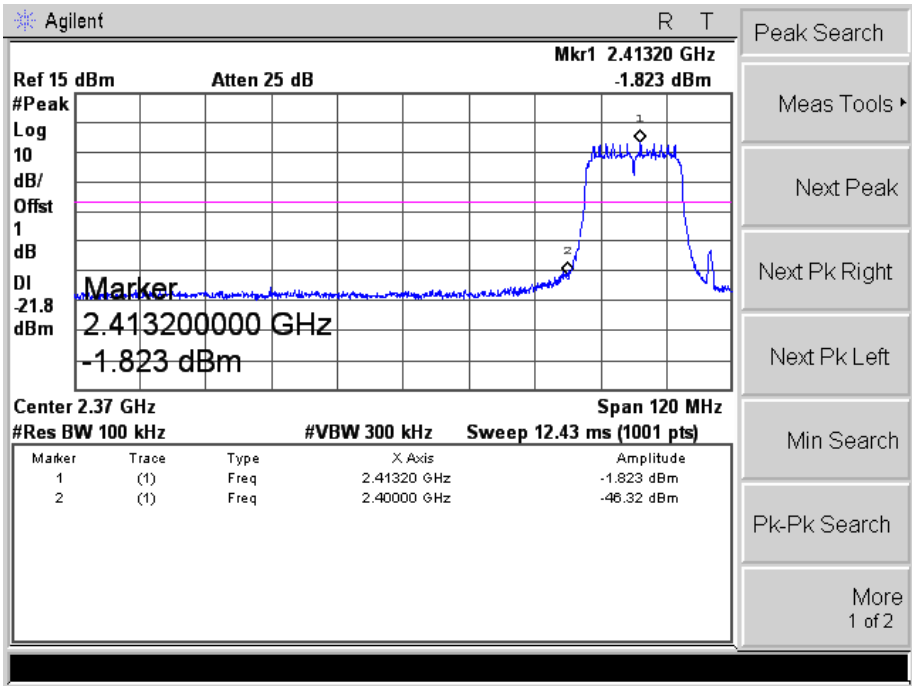

Agilent
R T
Mkr1 3.250 GHz
Ref 15 dBm
Atten 25 dB
-46.08 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-21.4
dBm
M1 S2
S3 FC
AA
Marker
3.250280000 GHz
-46.08 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

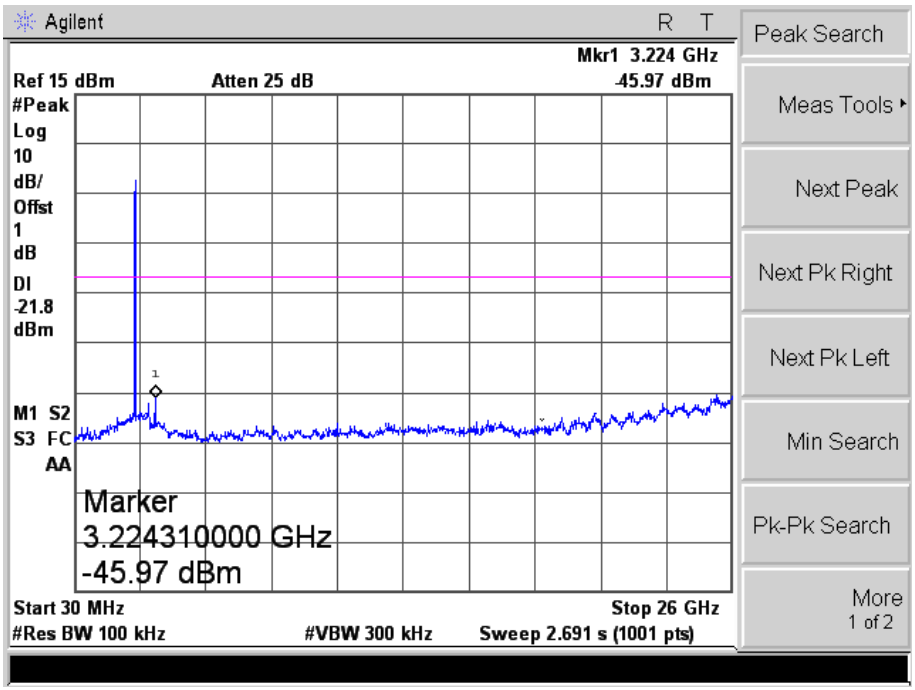
Highest


Agilent
R T
Peak Search
Mkr1 2.46450 GHz
Ref 15 dBm
Atten 25 dB
-2.34 dBm
#Peak
Log
10
dB/
Offst
1
dB
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2
Marker
2.464500000 GHz
-2.34 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.46450 GHz -2.34 dBm
2 (1) Freq 2.48350 GHz -53.36 dBm

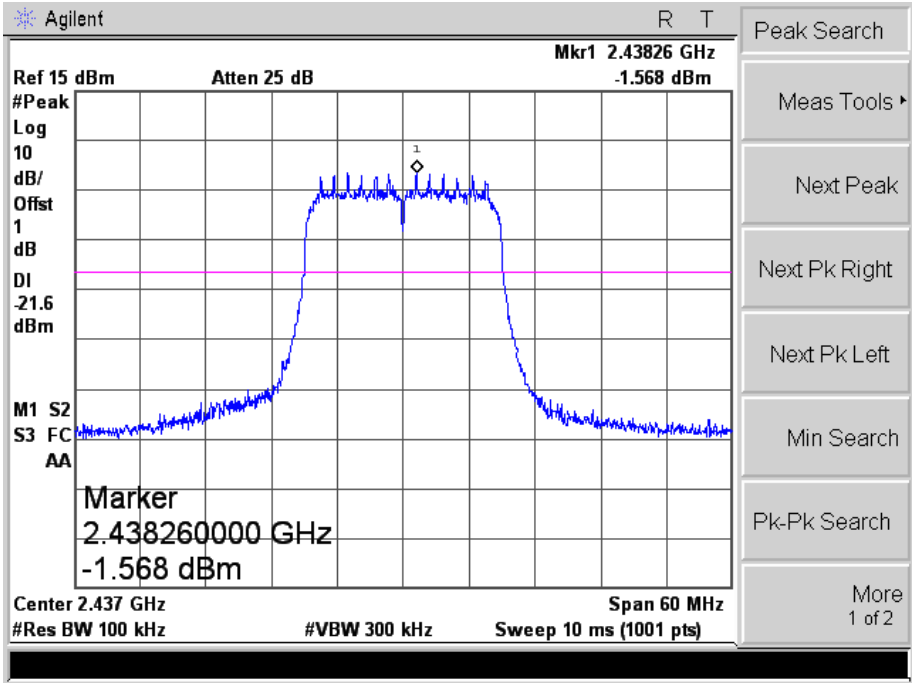

Agilent
R T
Peak Search
Mkr1 3.276 GHz
Ref 15 dBm
Atten 25 dB
-44.41 dBm
#Peak
Log
10
dB/
Offst
1
dB
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2
M1 S2
S3 FC
AA
Marker
3.276250000 GHz
-44.41 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)

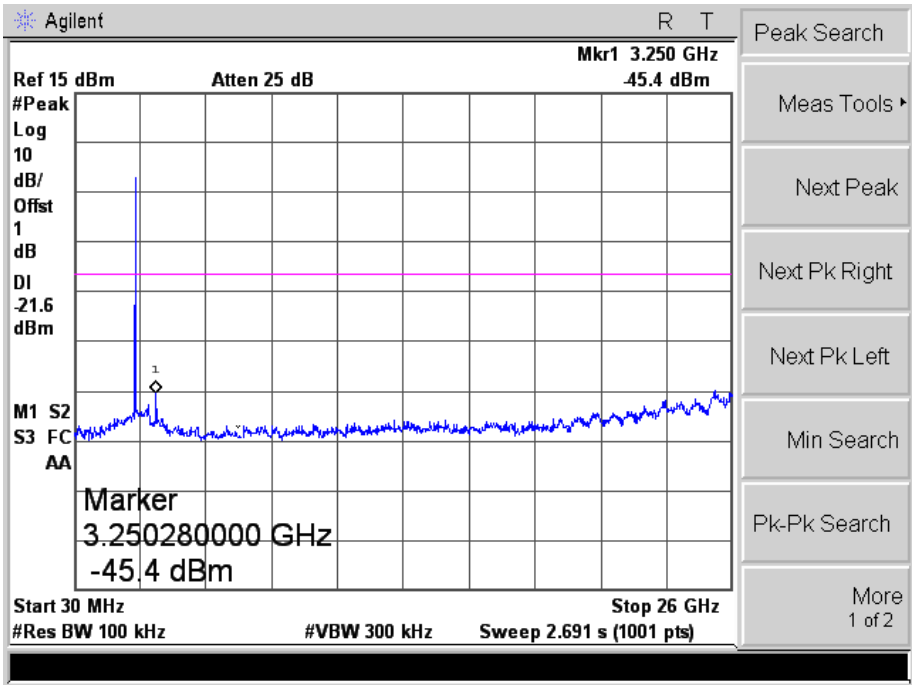
Spurious (Conducted)
802.11n-HT20-Lowest
Lowest



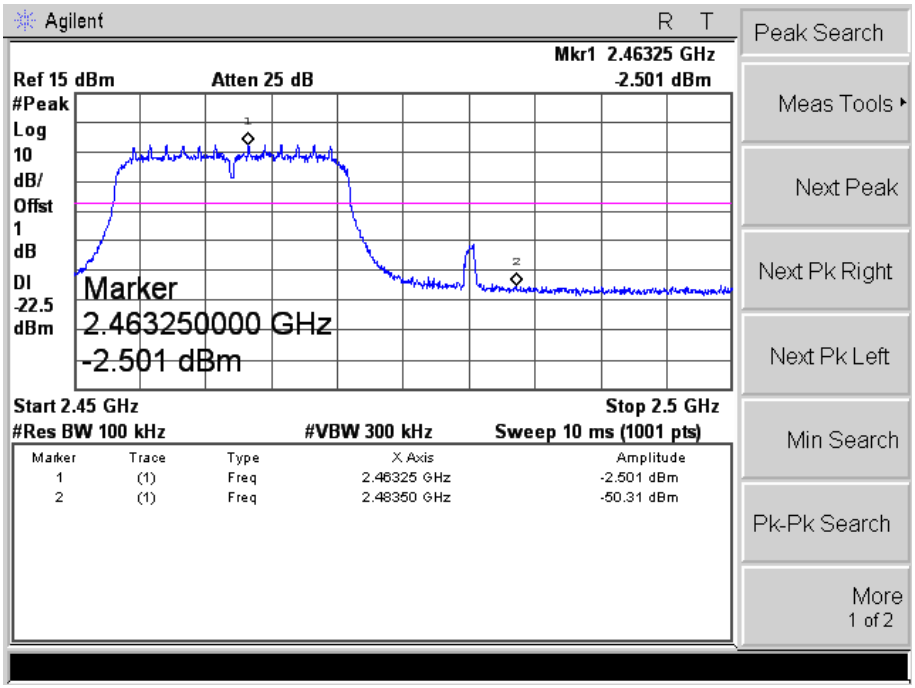


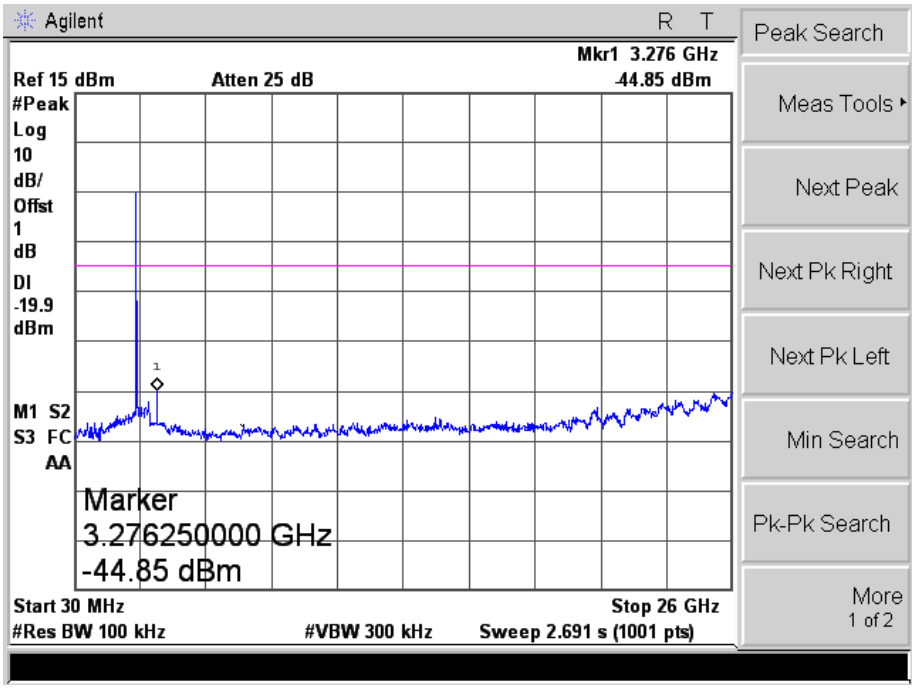
Middle


Agilent
R T
Mkr1 2.43826 GHz
Ref 15 dBm
Atten 25 dB
-1.568 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-21.6
dBm
M1 S2
S3 FC
AA
Marker
2.438260000 GHz
-1.568 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent
R T
Mkr1 3.250 GHz
Ref 15 dBm
Atten 25 dB
-45.4 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-21.6
dBm
M1 S2
S3 FC
AA
Marker
3.250280000 GHz
-45.4 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

Highest


Agilent
R T
Peak Search
Mkr1 2.46325 GHz
Ref 15 dBm
Atten 25 dB
-2.501 dBm
#Peak
Log
10
dB/
Offst
1
dB
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2
Marker
2.463250000 GHz
-2.501 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.46325 GHz -2.501 dBm
2 (1) Freq 2.48350 GHz -50.31 dBm

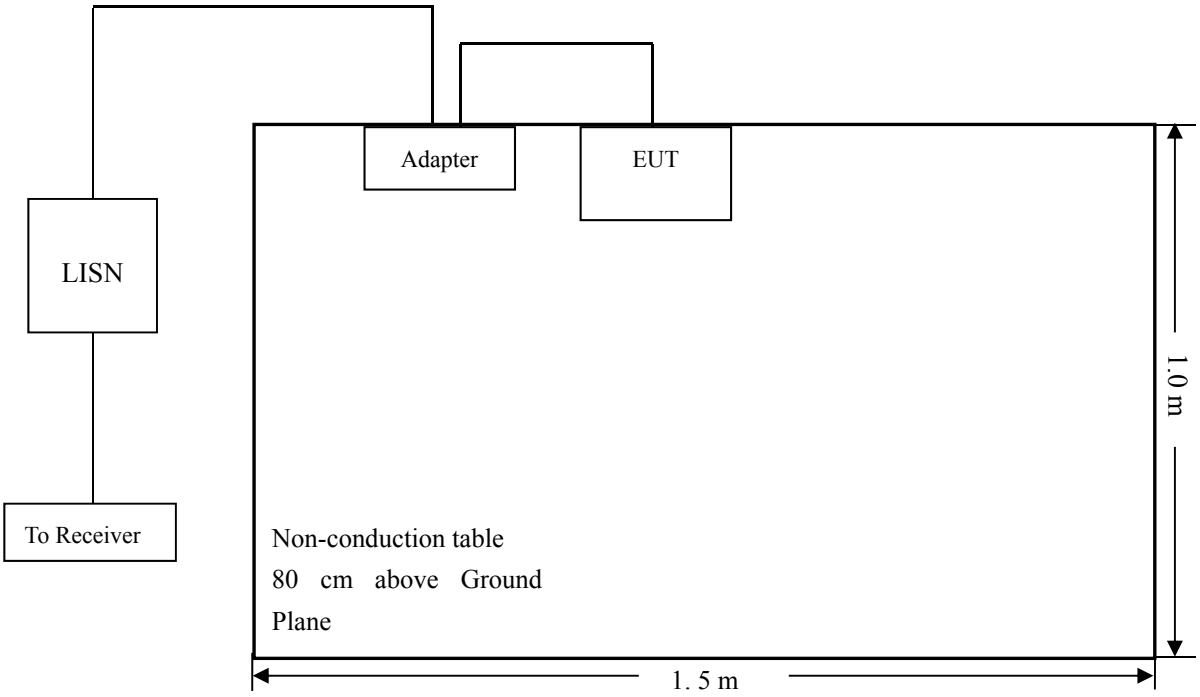

Agilent
R T
Peak Search
Mkr1 3.276 GHz
Ref 15 dBm
Atten 25 dB
-44.85 dBm
#Peak
Log
10
dB/
Offst
1
dB
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2
M1 S2
S3 FC
AA
Marker
3.276250000 GHz
-44.85 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)

10. Conducted Emissions

10.1 Test Procedure

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

10.2 Basic Test Setup Block Diagram



10.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	56%
ATM Pressure:	1012 mbar

10.4 Test Receiver Setup

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

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

10.5 Summary of Test Results/Plots

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

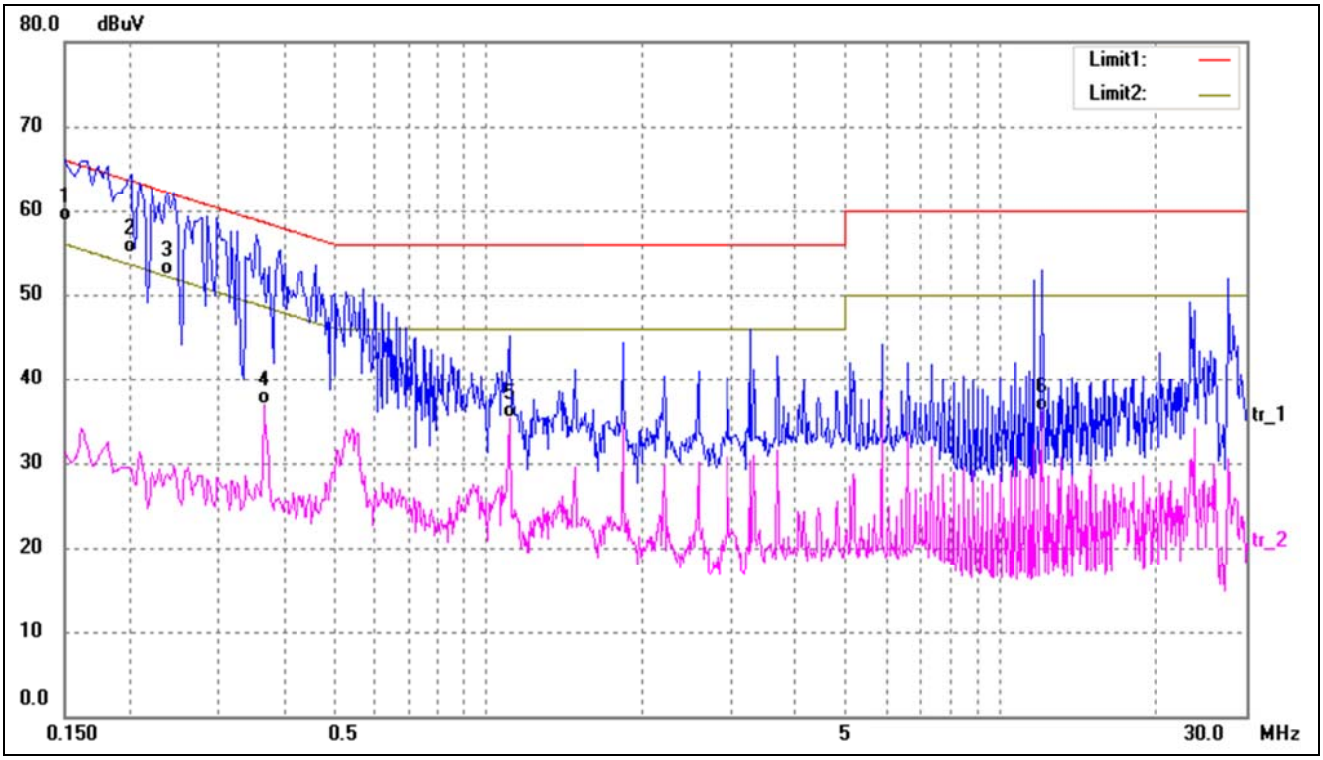
-6.95 dB at 0.1500 MHz in the **Line** mode**, QP** detector, **0.15-30MHz**

10.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

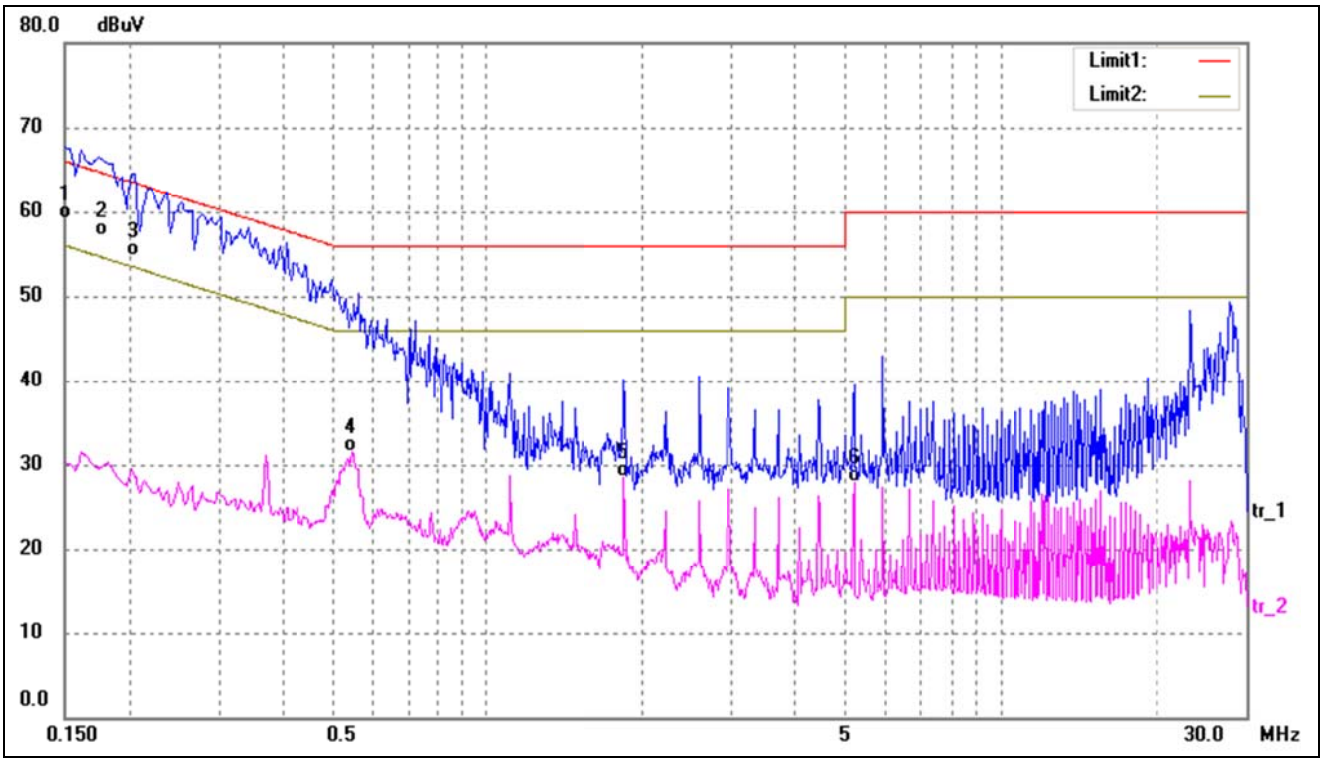
EUT: *Smart Light*
Tested Model: *WL-03*
Operating Condition: *Transmitting(Wi-Fi)*
Comment: *AC120V 60Hz*

Test Specification: *Neutral*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.1500	48.68	10.10	58.78	66.00	-7.22	QP
2	0.2020	44.70	10.12	54.82	63.53	-8.71	QP
3	0.2380	42.06	10.15	52.21	62.17	-9.96	QP
4	0.3660	26.73	10.23	36.96	48.59	-11.63	AVG
5	1.1020	24.89	10.51	35.40	46.00	-10.60	AVG
6	12.0460	25.05	10.98	36.03	50.00	-13.97	AVG

Test Specification: *Line*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.1500	48.95	10.10	59.05	66.00	-6.95	QP
2	0.1749	47.03	10.11	57.14	64.72	-7.58	QP
3	0.2060	44.66	10.12	54.78	63.37	-8.59	QP
4	0.5460	21.12	10.32	31.44	46.00	-14.56	AVG
5	1.8460	17.91	10.59	28.50	46.00	-17.50	AVG
6	5.1700	17.14	10.77	27.91	50.00	-22.09	AVG

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