

FCC Part 15C Measurement and Test Report



For

Ocean Digital Technology Ltd.

Flat B, 12/F., Yeung Yiu Chung (No.8) Ind. Bldg., 20 Wang Hoi Road,

Kowloon Bay, HongKong.

FCC ID: 2ABD3-MS238D0000

FCC Rule(s):	<u>FCC Part 15C</u>
Product Description:	<u>Internet Radio with DAB</u>
Tested Model:	<u>MS-238D</u>
Report No.:	<u>STR17088029I-1</u>
Tested Date:	<u>2017-06-20 to 2017-07-09</u>
Issued Date:	<u>2017-08-08</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: Ocean Digital Technology Ltd.
 Address of applicant: Flat B, 12/F., Yeung Yiu Chung (No.8) Ind. Bldg.,
 20 Wang Hoi Road, Kowloon Bay, HongKong.

Manufacturer: Ocean Digital Technology Ltd.
 Address of manufacturer: Flat B, 12/F., Yeung Yiu Chung (No.8) Ind. Bldg.,
 20 Wang Hoi Road, Kowloon Bay, HongKong.

General Description of EUT	
Product Name:	Internet Radio with DAB
Trade Name:	/
Model No.:	MS-238D
Adding Model(s):	WR-238CD, MS-238C, MS-238CD
Rated Voltage:	DC 5V
Power Adapter Model:	Model: DYS605-050120W-1 Input:100-240V,50/60Hz,0.2A Max; Output:5.0V,1.2A
<p><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 MS-238D, but the circuit and the electronic construction do not change, declared by the manufacturer.</i></p>	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20) 2422-2452MHz for 802.11n(HT40)
RF Output Power:	9.64dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11 for 802.11b/g/n(HT20); 7 for 802.11n(HT40)
Channel Separation:	5MHz
Type of Antenna:	PCB
Antenna Gain:	0dBi

1.2 Test Standards

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

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

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

1.3 Test Methodology

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

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

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, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	2412MHz, 2437MHz, 2462MHz
TM2	802.11g	2412MHz, 2437MHz, 2462MHz
TM3	802.11n-HT20	2412MHz, 2437MHz, 2462MHz
TM4	802.11n-HT40	2422MHz, 2437MHz, 2452MHz

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

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

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	1.4	Unshielded	Without Core

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

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 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 $\geq 2 \times \text{span/RBW}$.
- g) Sweep time = auto couple.
- h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- i) Use the peak marker function to determine the maximum amplitude level.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

5.3 Environmental Conditions

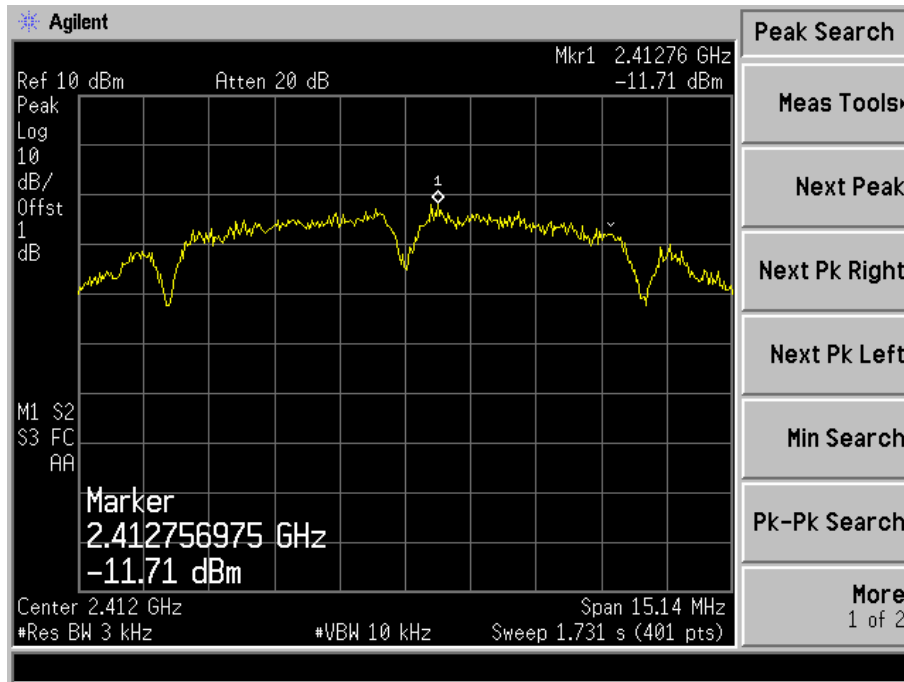
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

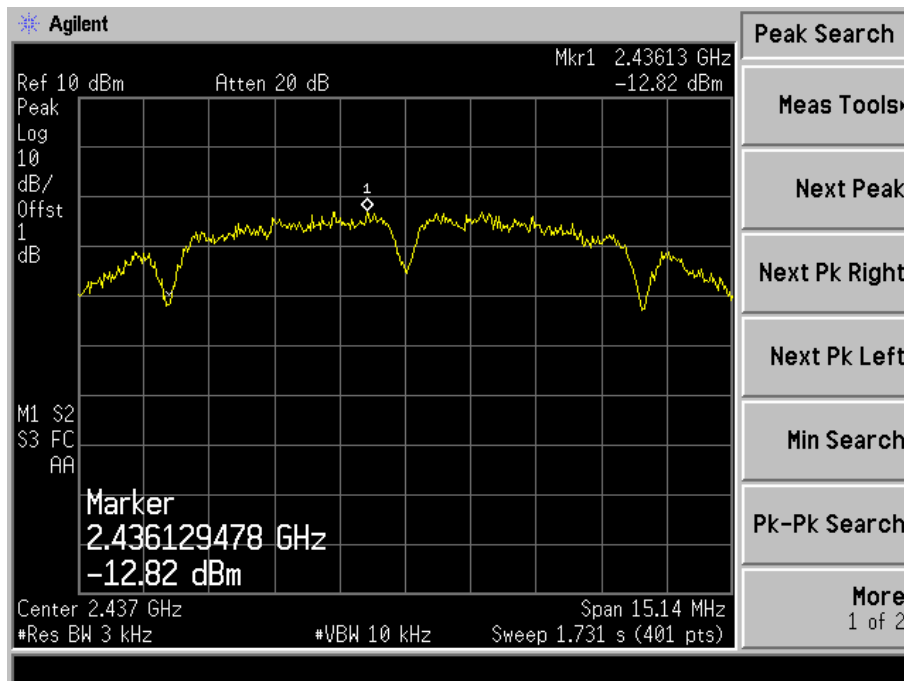
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-11.71	8
	2437	-12.82	8
	2462	-12.19	8
802.11g	2412	-13.96	8
	2437	-14.70	8
	2462	-15.23	8
802.11n HT20	2412	-14.69	8
	2437	-14.78	8
	2462	-13.80	8
802.11n HT40	2422	-14.73	8
	2437	-16.45	8
	2452	-17.56	8

Please refer to the following test plots:

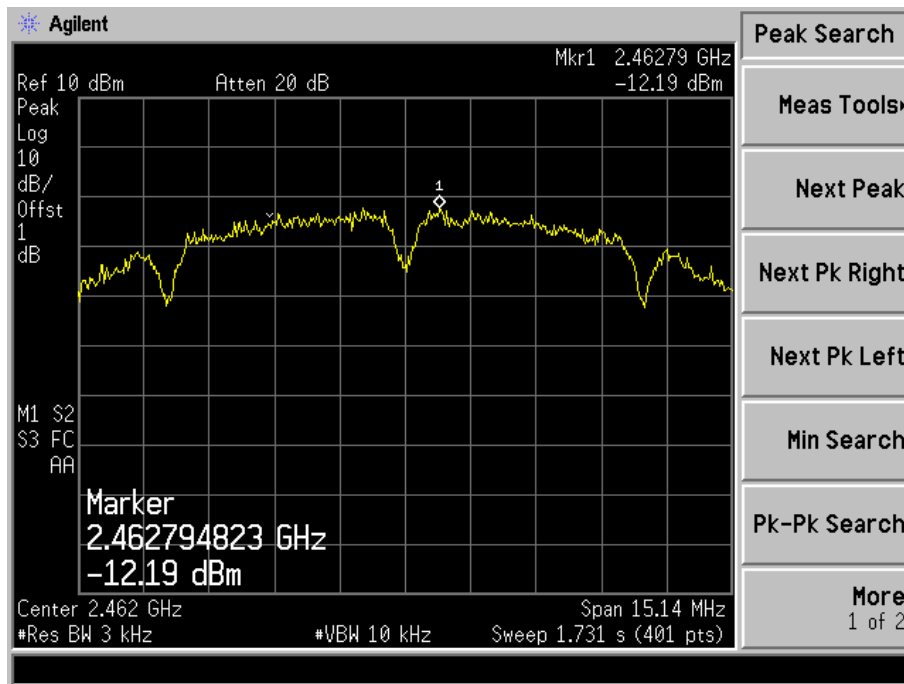
802.11b-Low Channel



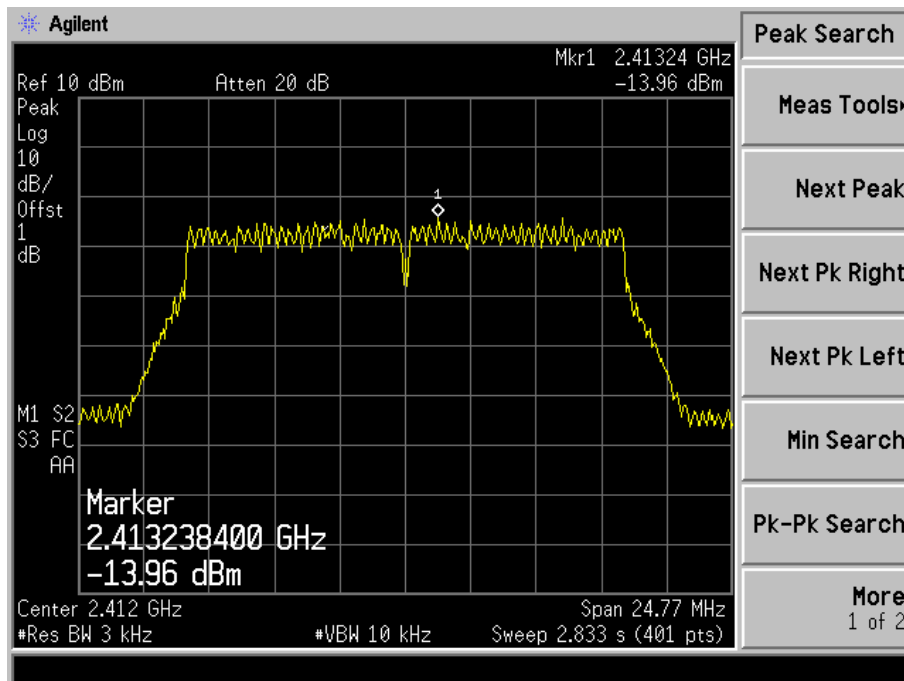
802.11b-Middle Channel



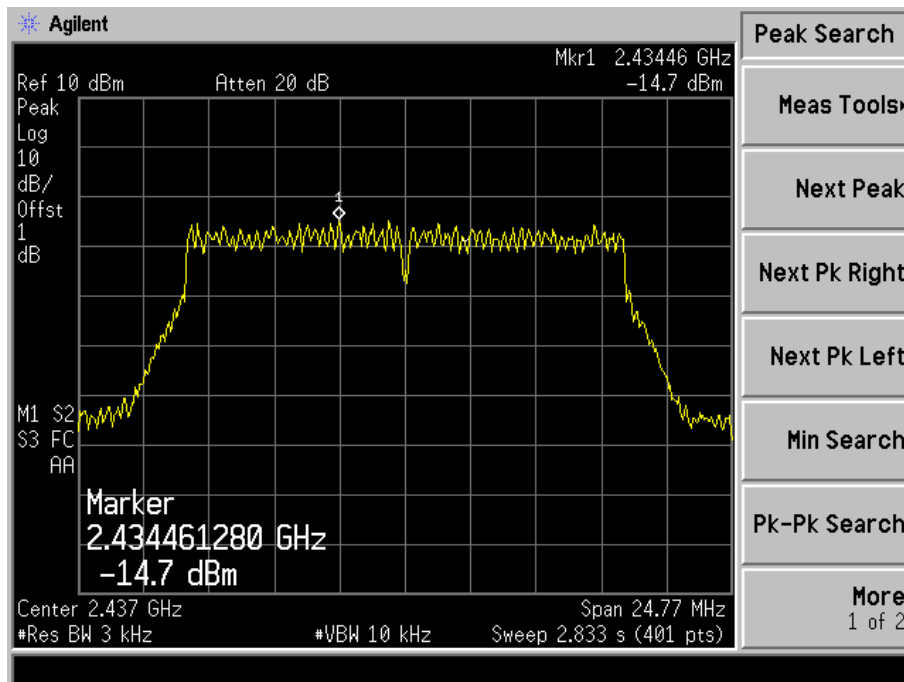
802.11b-High Channel



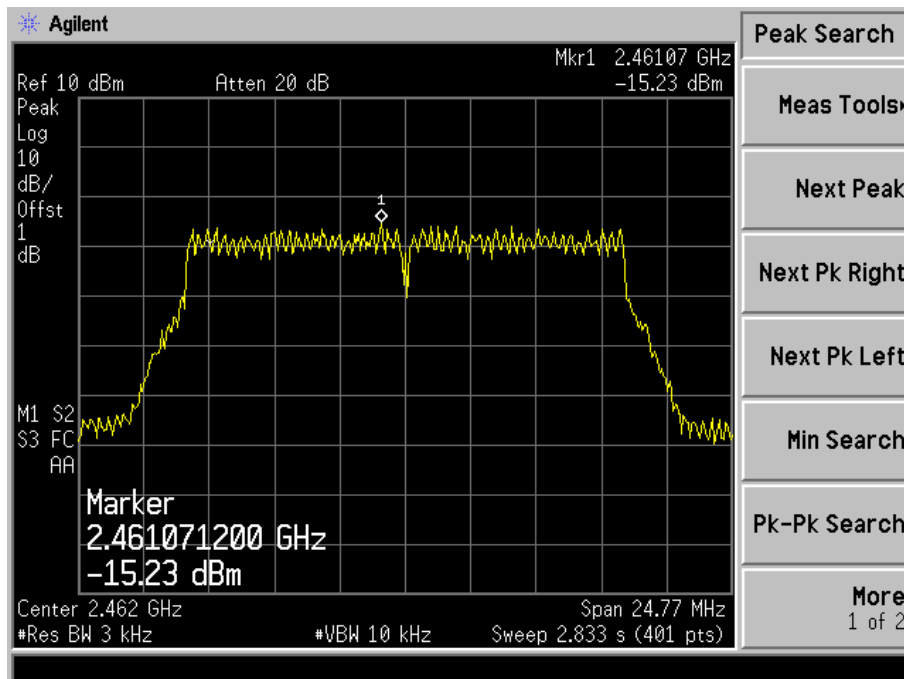
802.11g-Low Channel



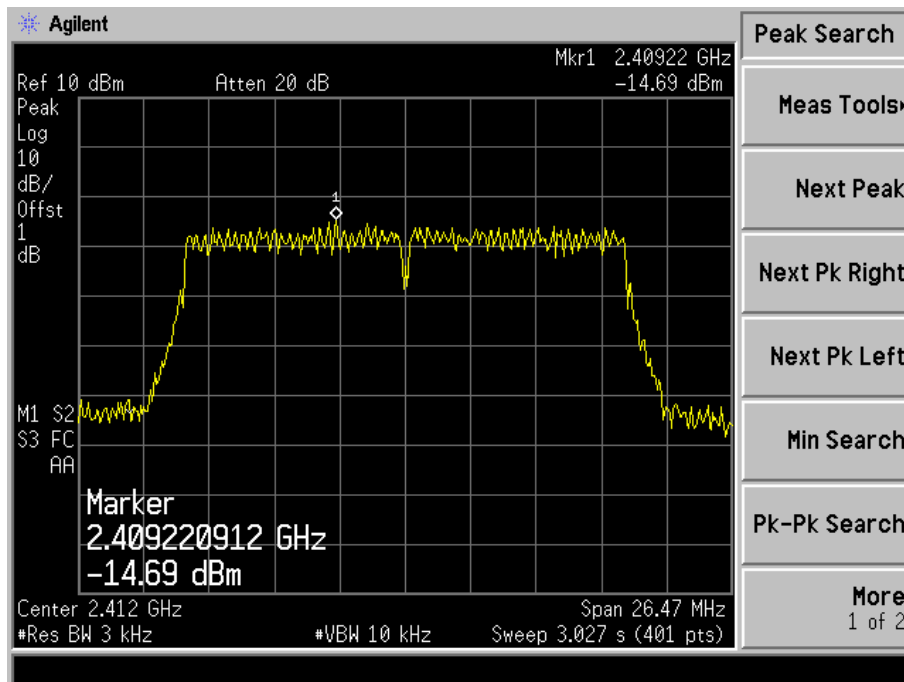
802.11g-Middle Channel



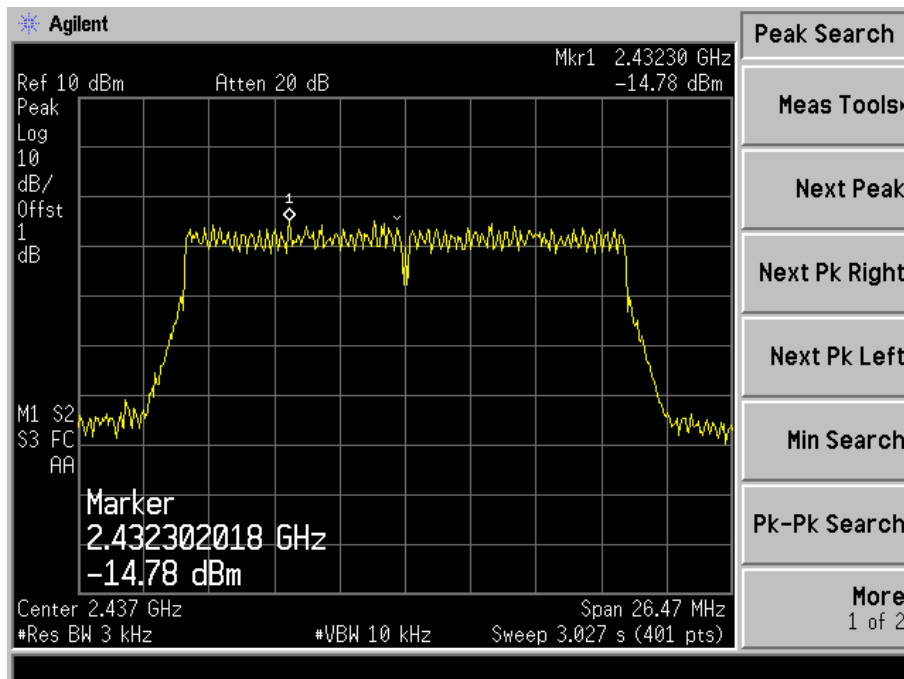
802.11g-High Channel



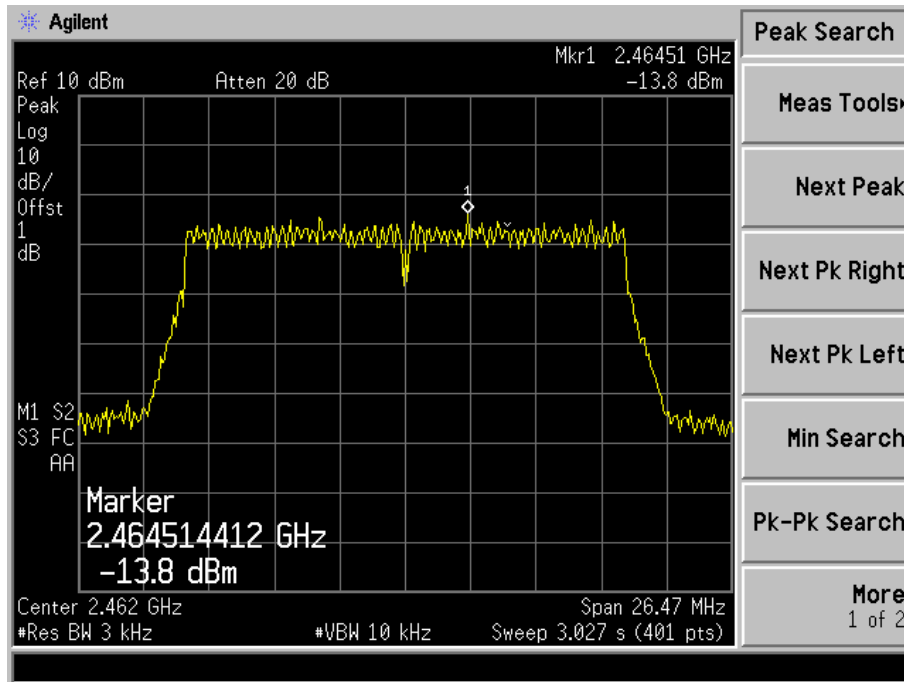
802.11n-HT20-Low Channel



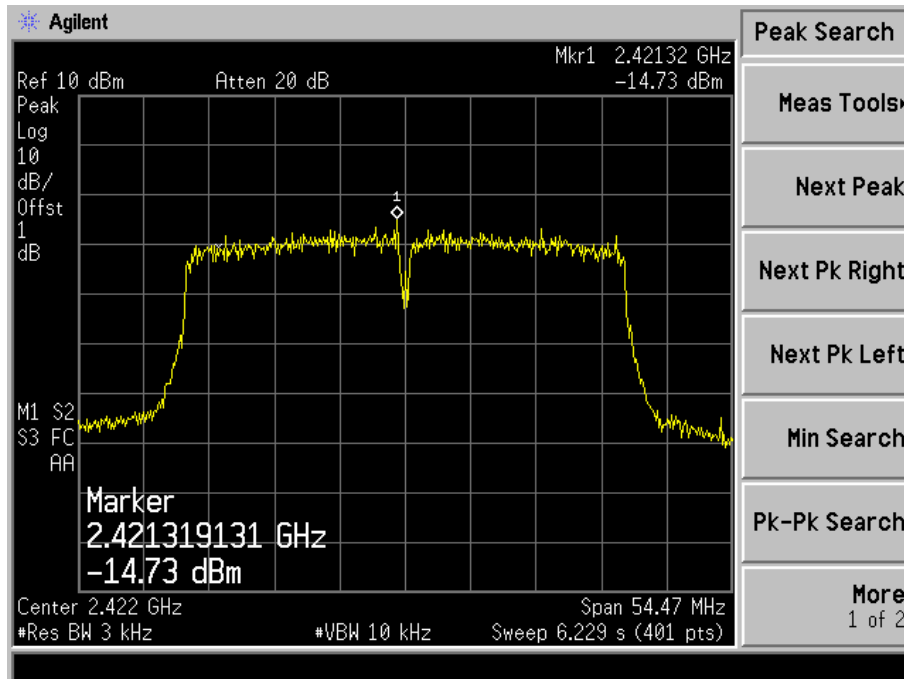
802.11n-HT20-Middle Channel



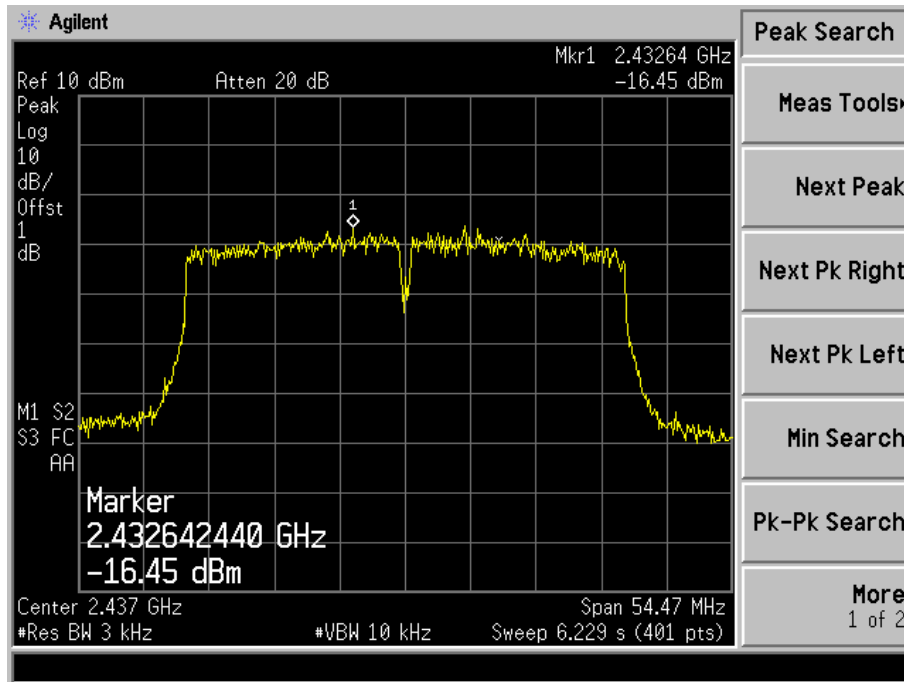
802.11n-HT20-High Channel



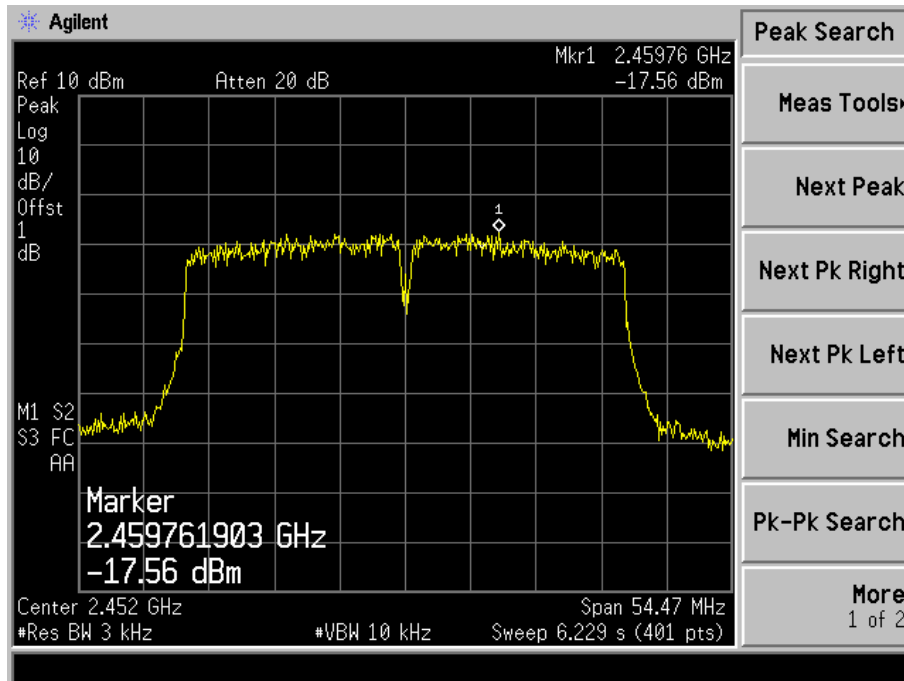
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel



802.11n-HT40-High Channel



6. 6dB Bandwidth

6.1 Standard Applicable

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

6.2 Test Procedure

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

6.3 Environmental Conditions

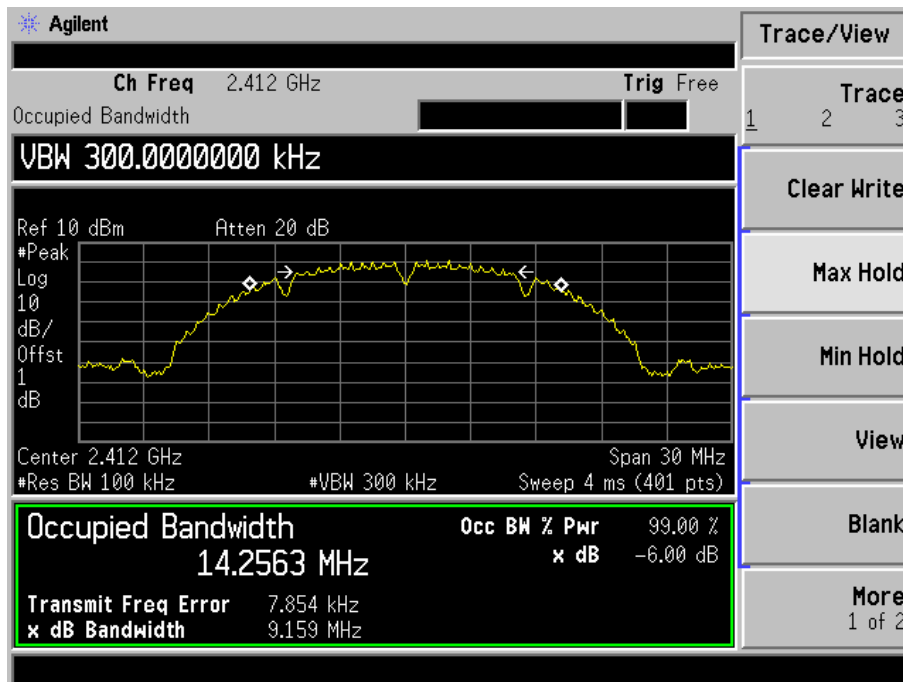
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

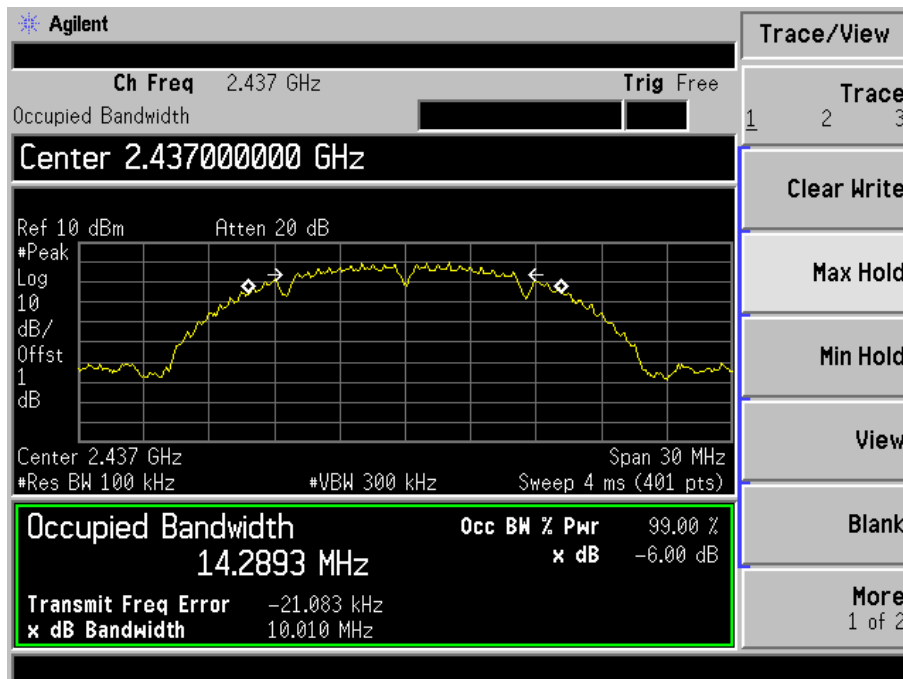
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	9.159	14.2563	≥ 500
	2437	10.010	14.2893	≥ 500
	2462	10.093	14.3438	≥ 500
802.11g	2412	16.512	16.4842	≥ 500
	2437	16.456	16.5031	≥ 500
	2462	16.418	16.4596	≥ 500
802.11n-HT20	2412	17.640	17.6323	≥ 500
	2437	17.645	17.6121	≥ 500
	2462	17.637	17.6125	≥ 500
802.11n-HT40	2422	36.313	35.9979	≥ 500
	2437	36.168	35.9920	≥ 500
	2452	35.211	35.7420	≥ 500

Please refer to the following test plots:

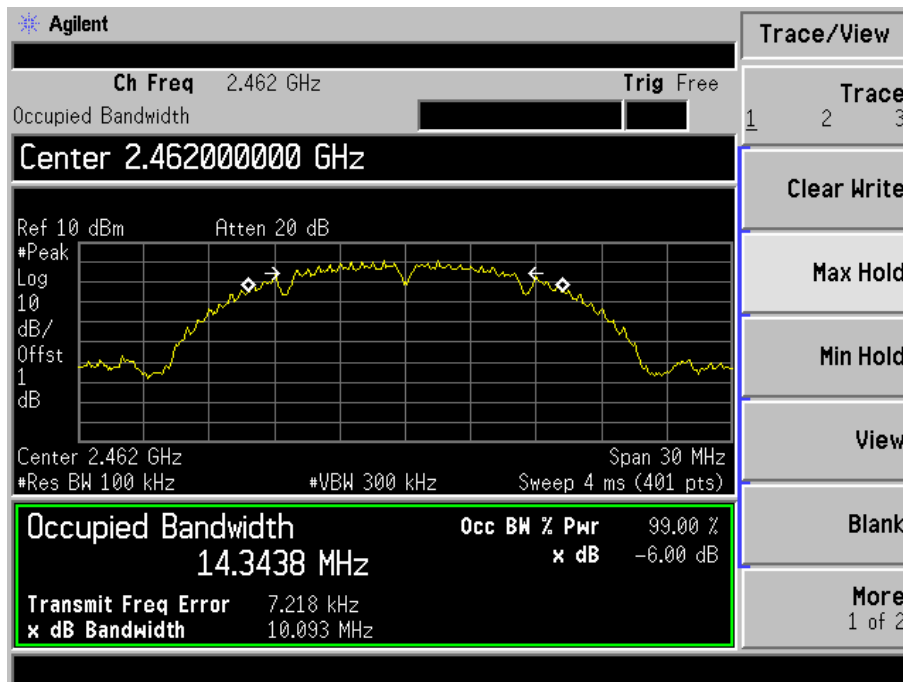
802.11b-Low Channel



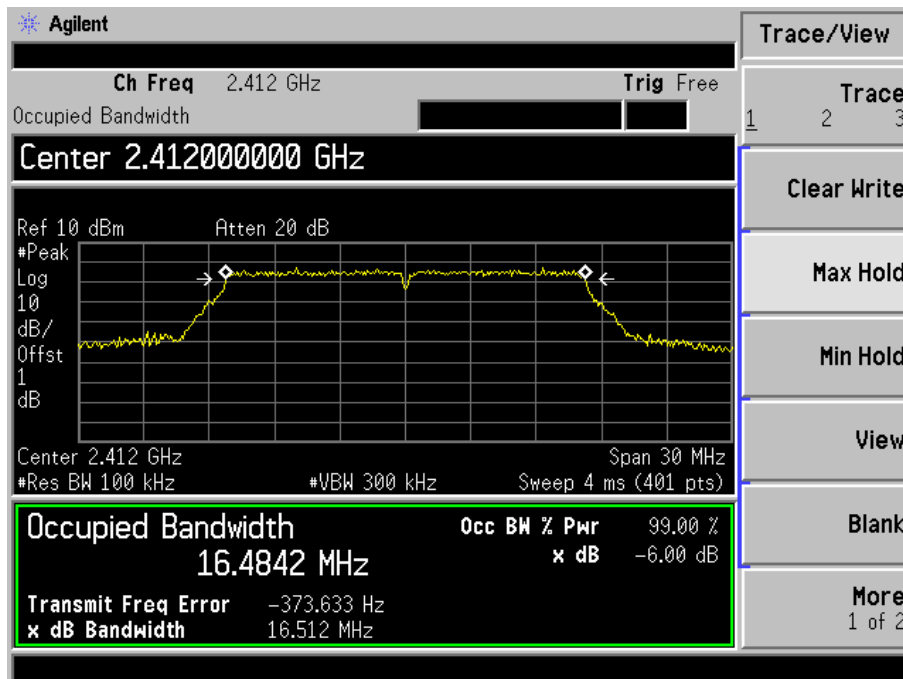
802.11b-Middle Channel



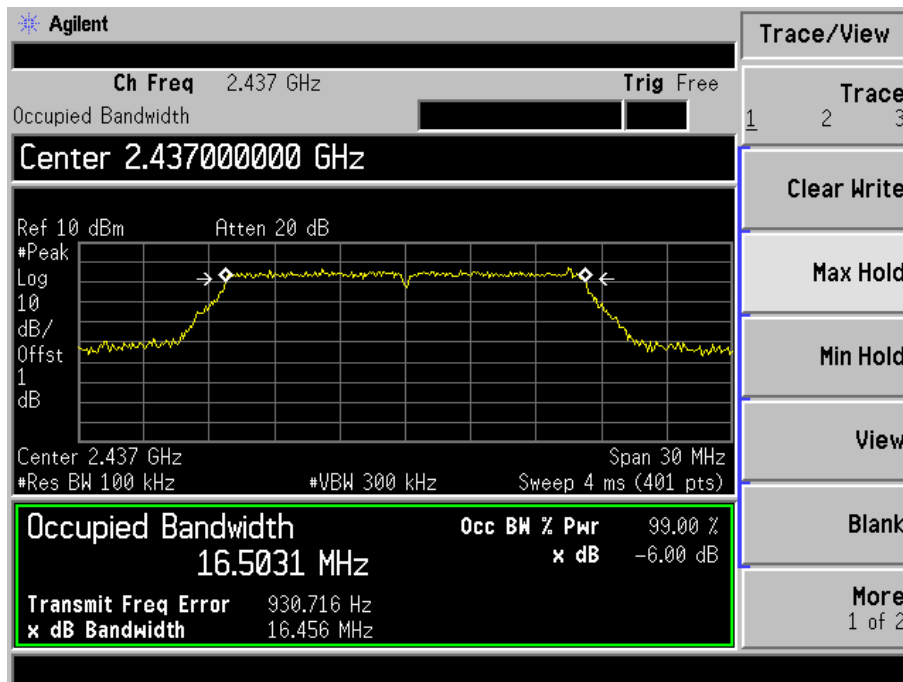
802.11b-High Channel



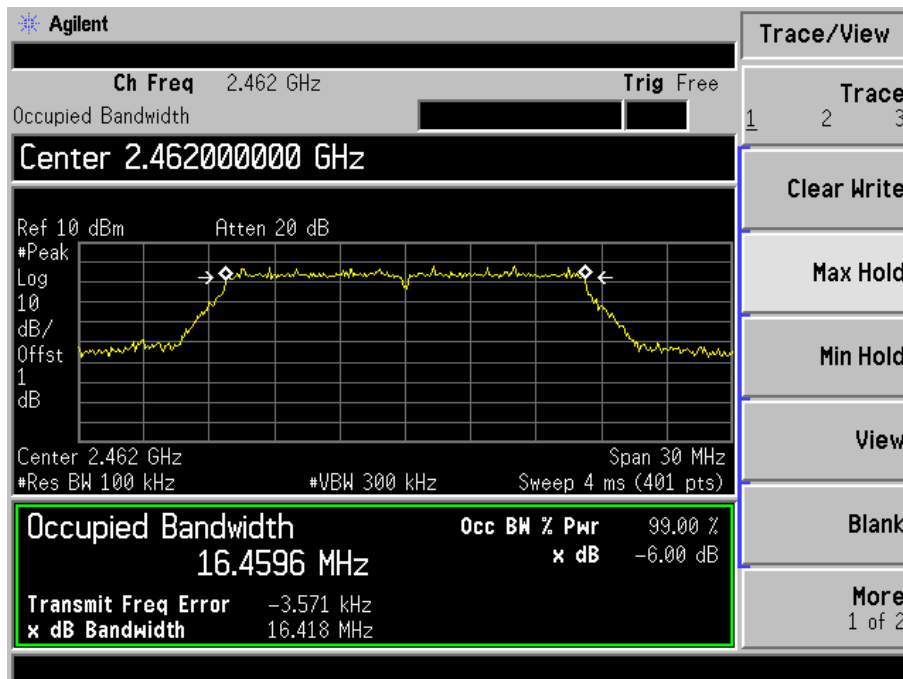
802.11g-Low Channel



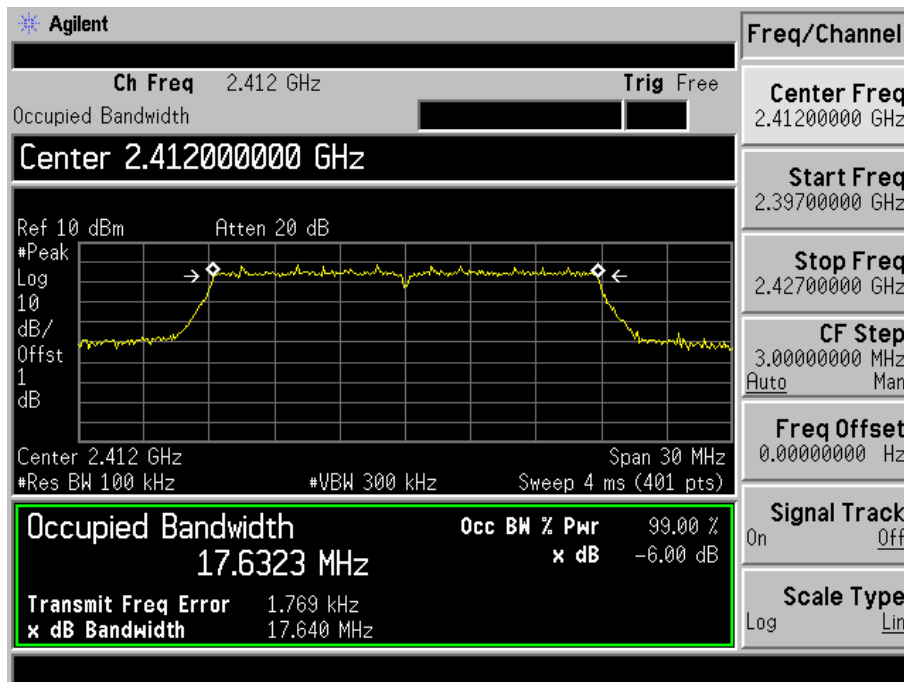
802.11g-Middle Channel



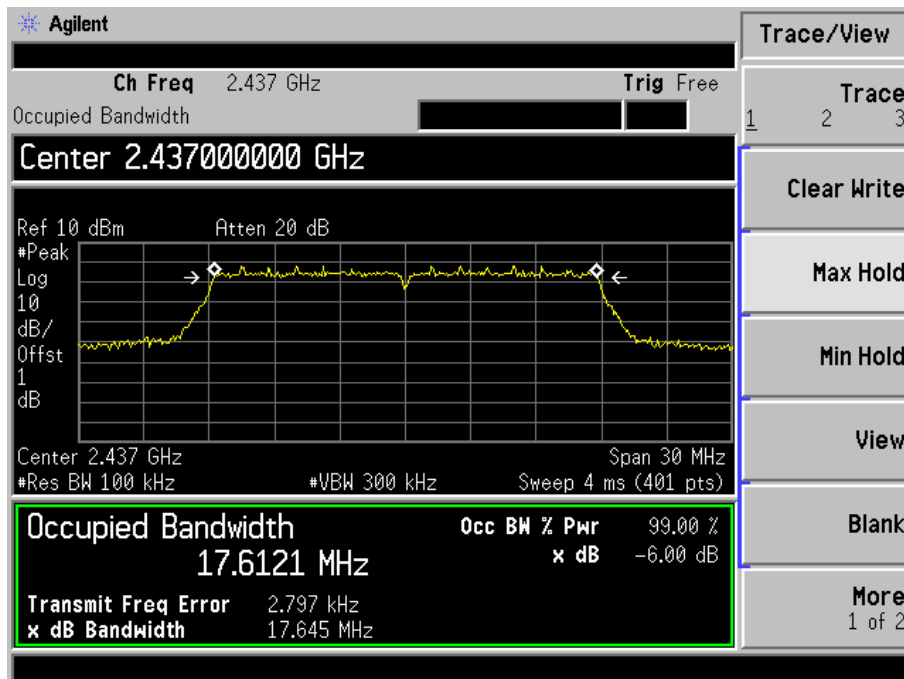
802.11g-High Channel



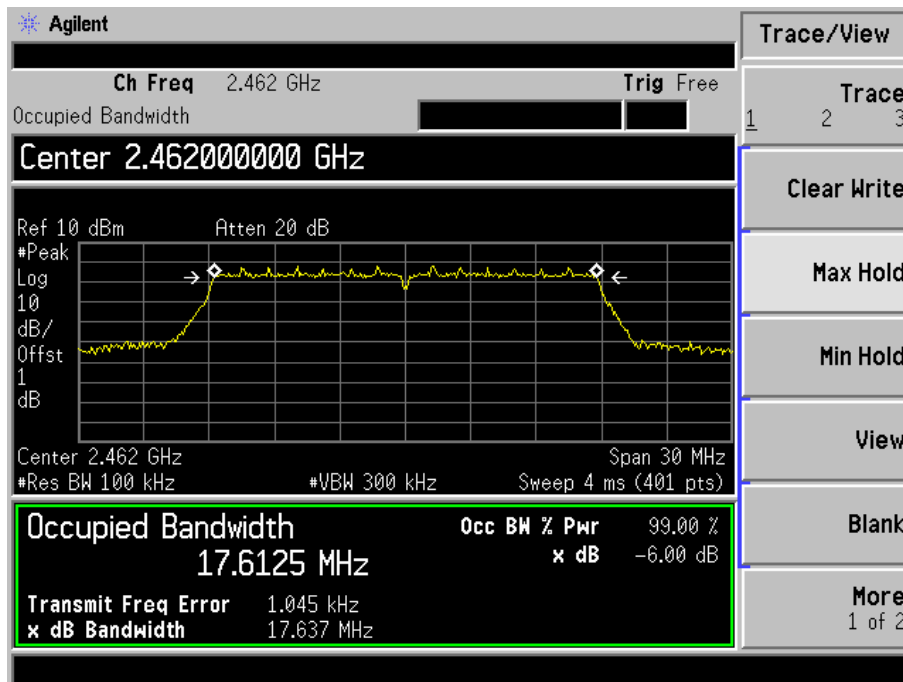
802.11n-HT20-Low Channel



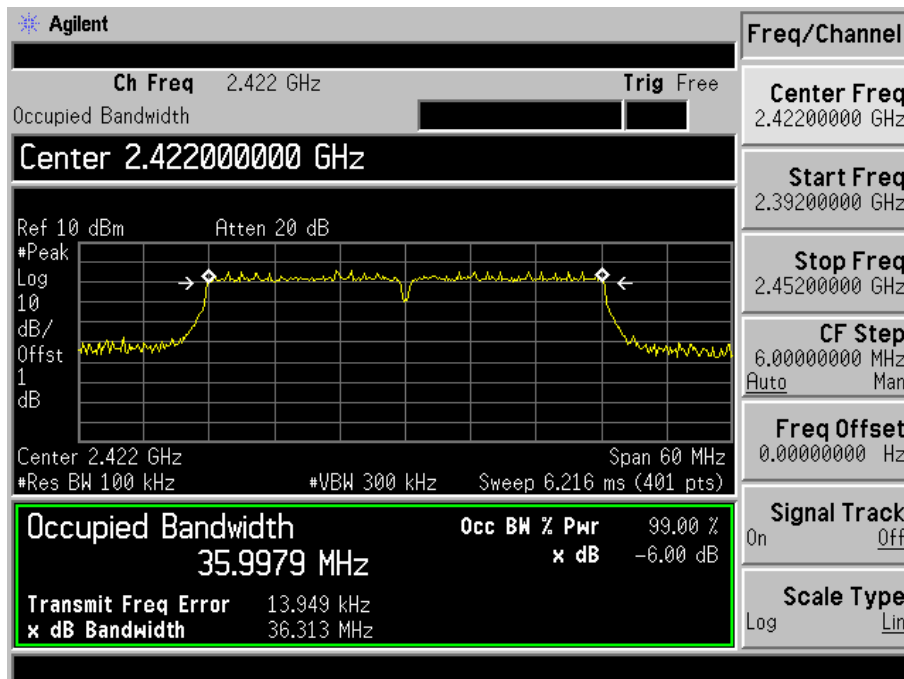
802.11n-HT20-Middle Channel



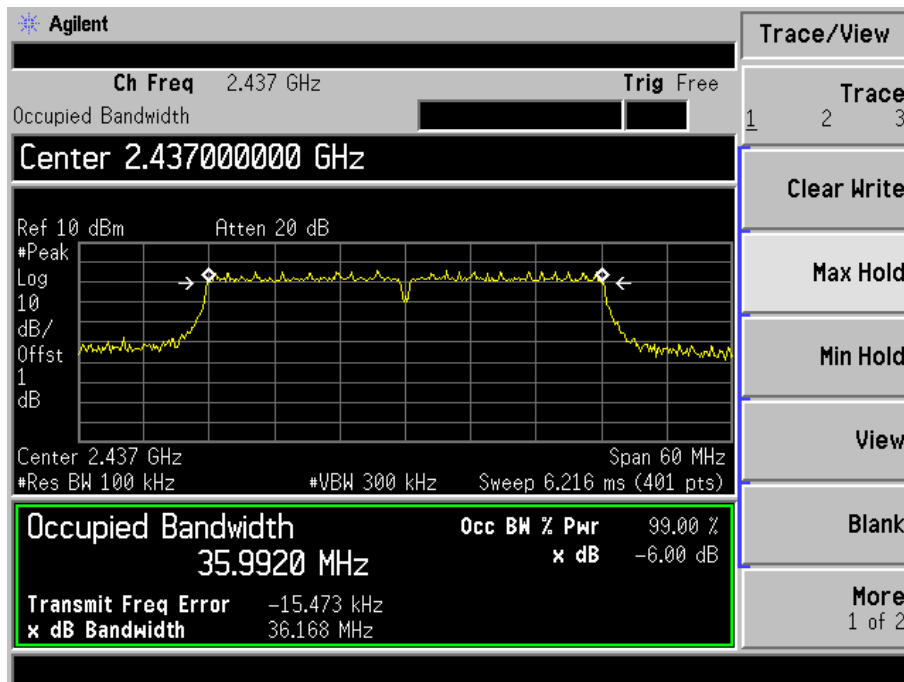
802.11n-HT20-High Channel



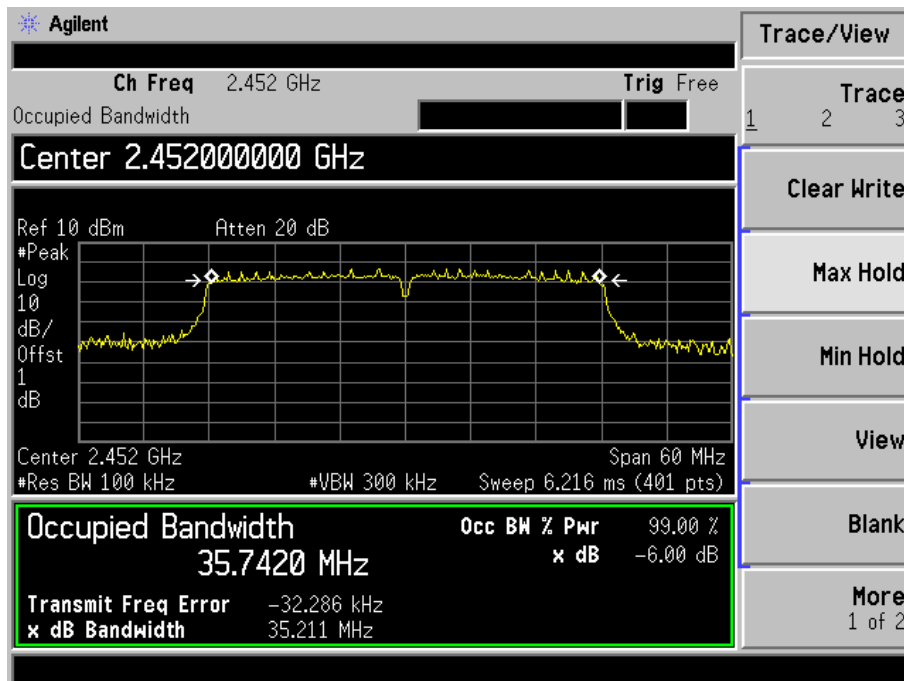
802.11n-HT40-Low Channel



802.11n-HT40-Middle Channel



802.11n-HT40-High Channel



7. RF Output Power

7.1 Standard Applicable

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

7.2 Test Procedure

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

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

7.3 Environmental Conditions

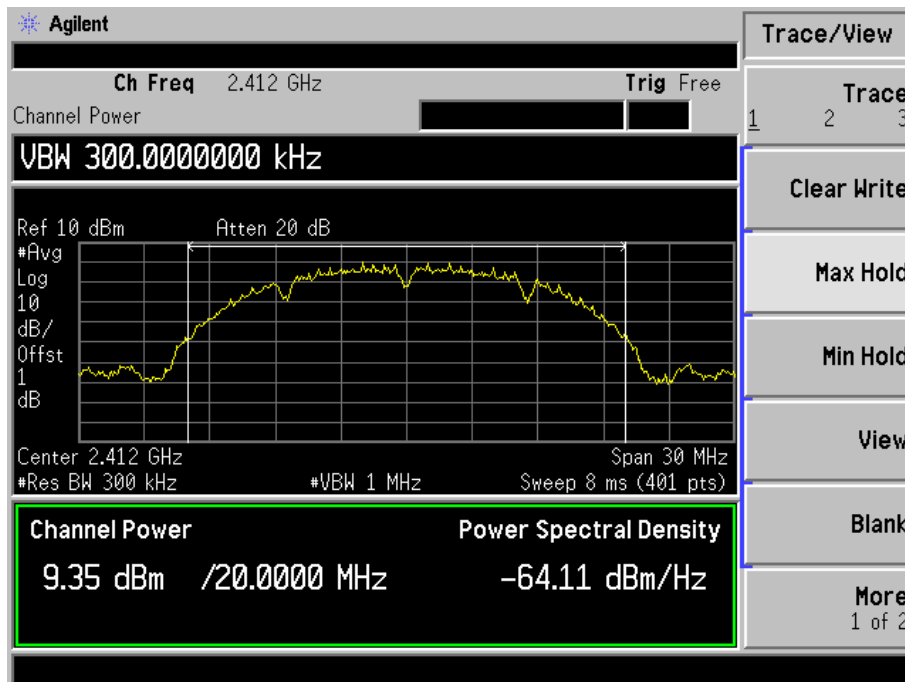
Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

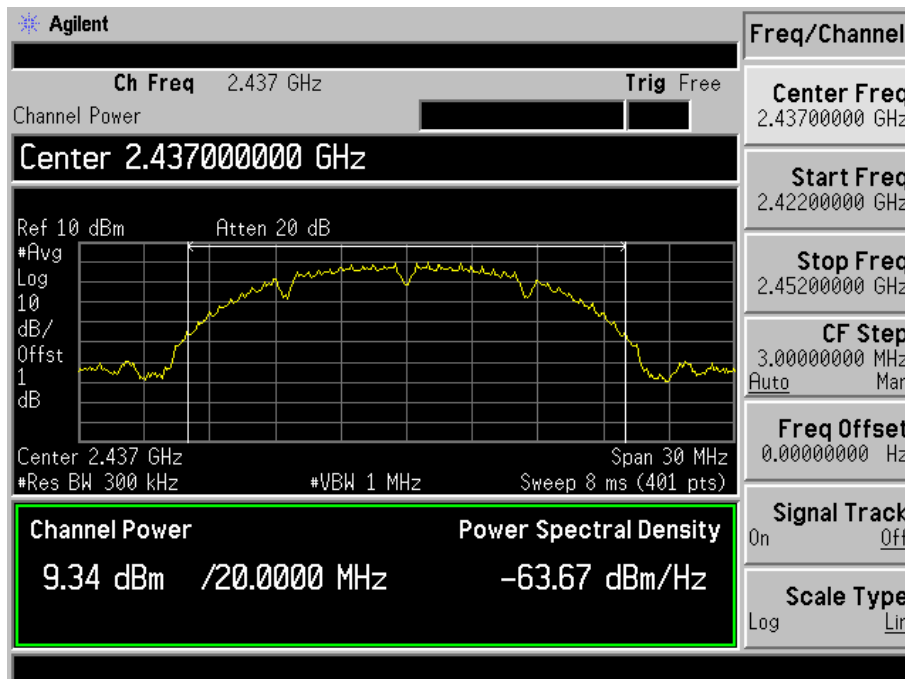
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b_11Mbps	2412	9.35	8.610	1000
	2437	9.34	8.590	1000
	2462	9.50	8.913	1000
802.11g_54Mbps	2412	9.54	8.995	1000
	2437	9.64	9.204	1000
	2462	9.59	9.099	1000
802.11n HT20_MCS7	2412	9.50	8.913	1000
	2437	9.32	8.551	1000
	2462	9.33	8.570	1000
802.11n HT40_MCS7	2422	8.23	6.653	1000
	2437	8.59	7.228	1000
	2452	8.51	7.096	1000

Please refer to the following test plots:

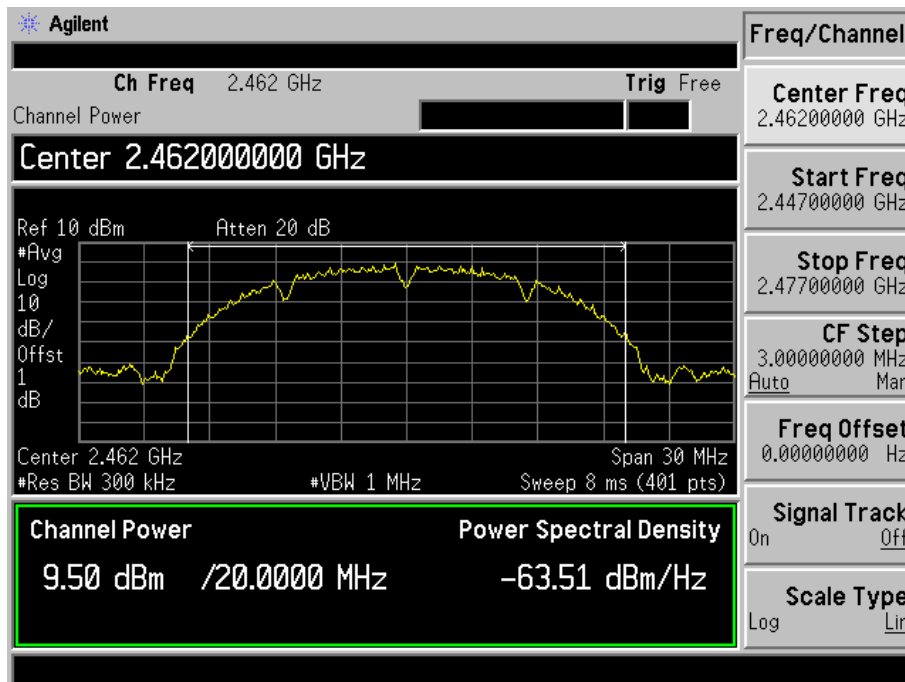
802.11b-11Mbps-Low Channel



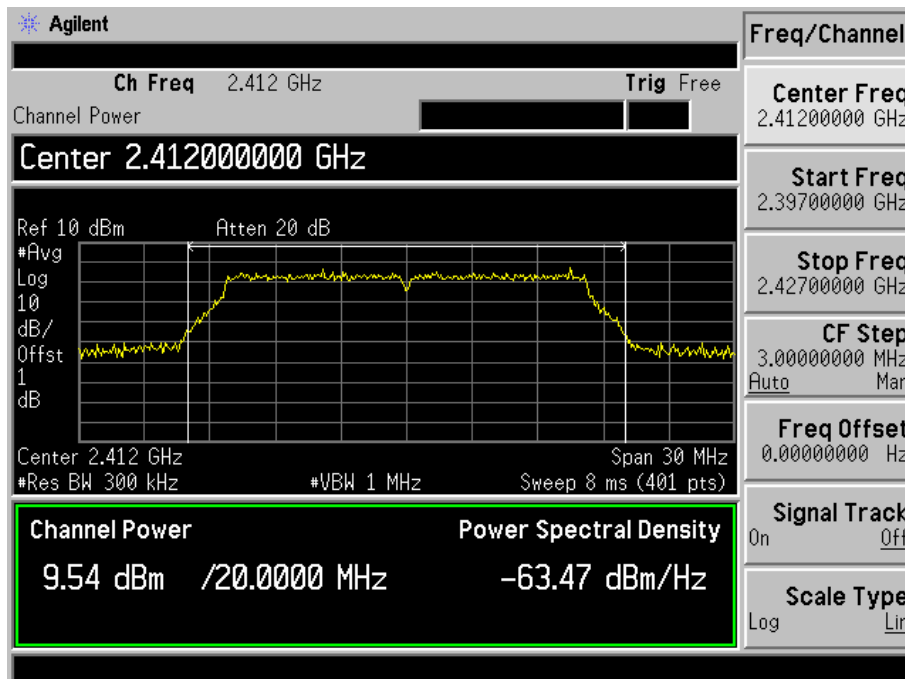
802.11b -11Mbps-Middle Channel



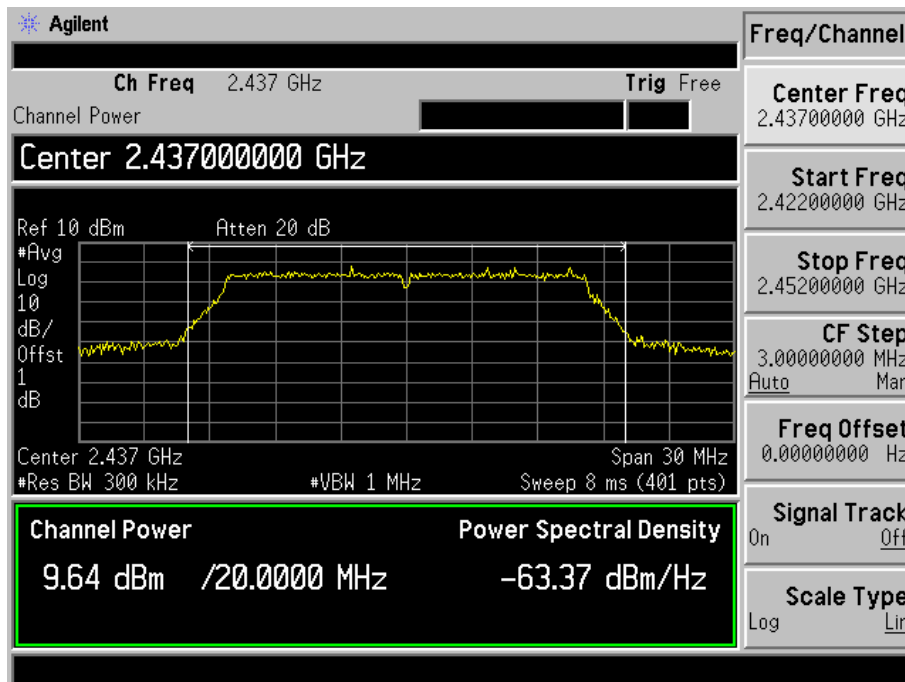
802.11b -11Mbps-High Channel



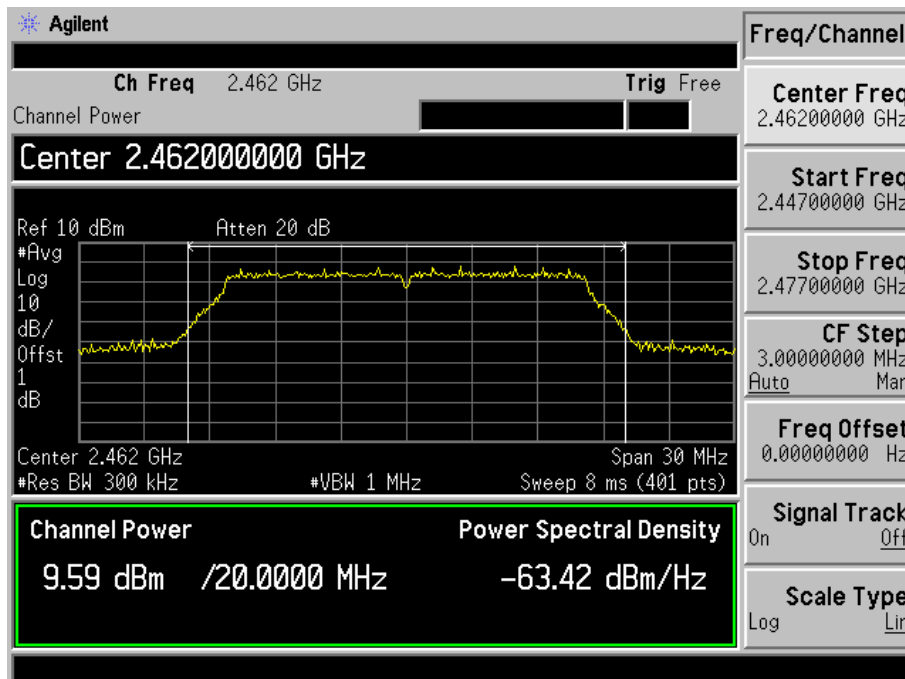
802.11g-54Mbps-Low Channel



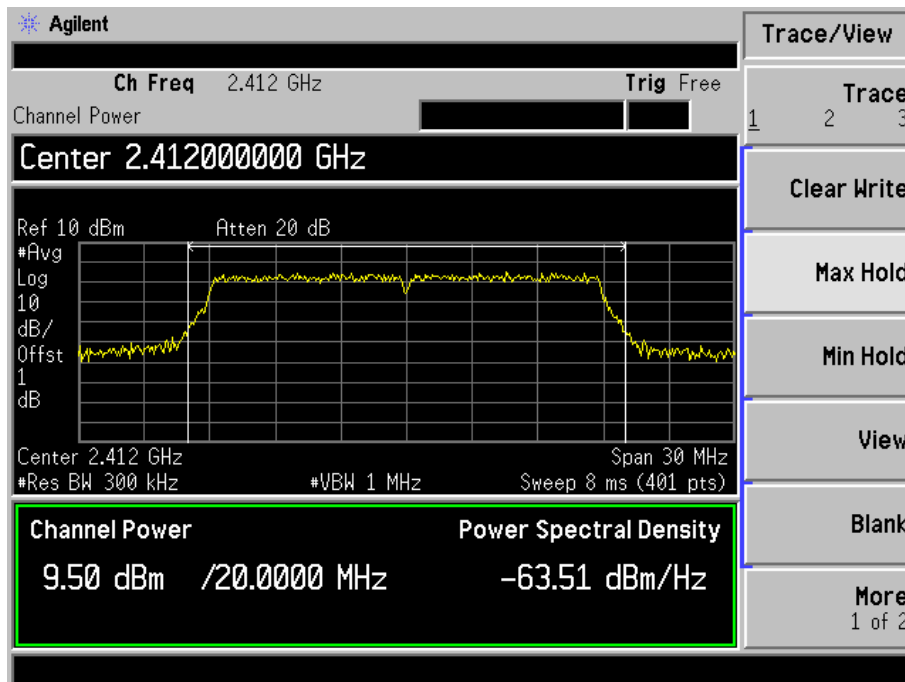
802.11g-54Mbps-Middle Channel



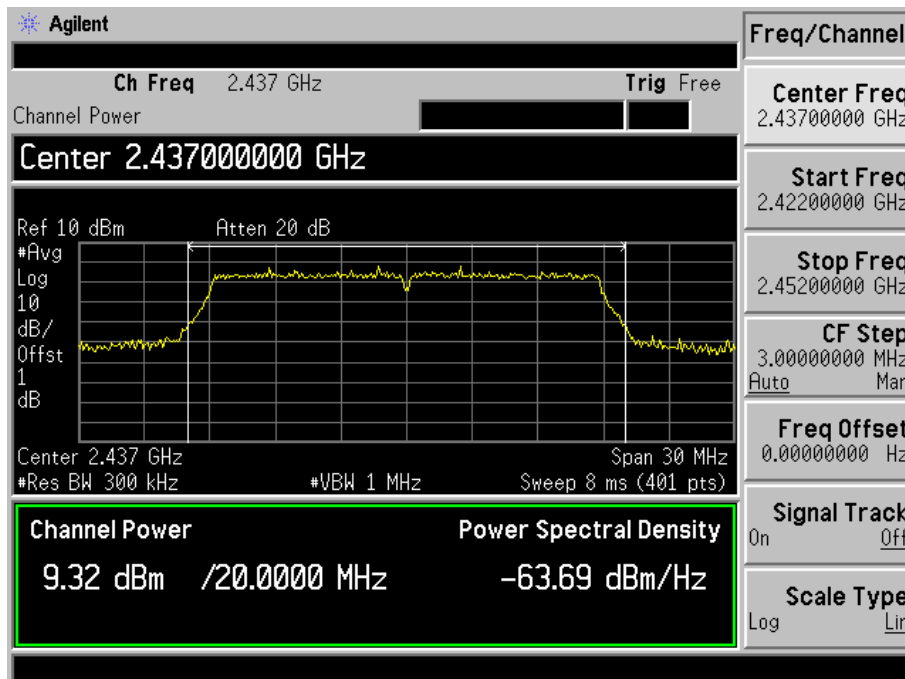
802.11g-54Mbps-High Channel



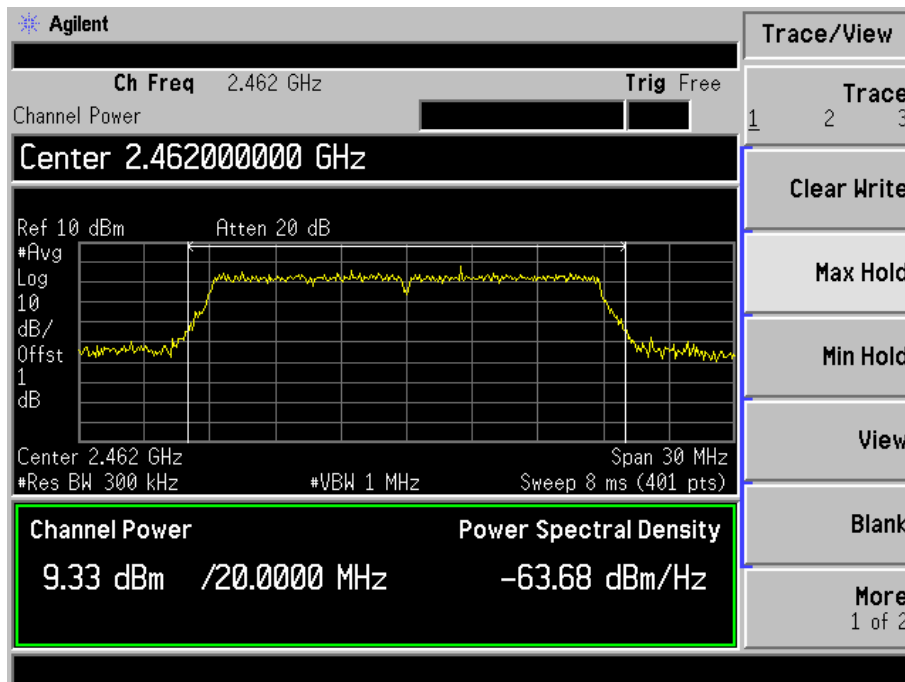
802.11n-HT20-MCS7-Low Channel



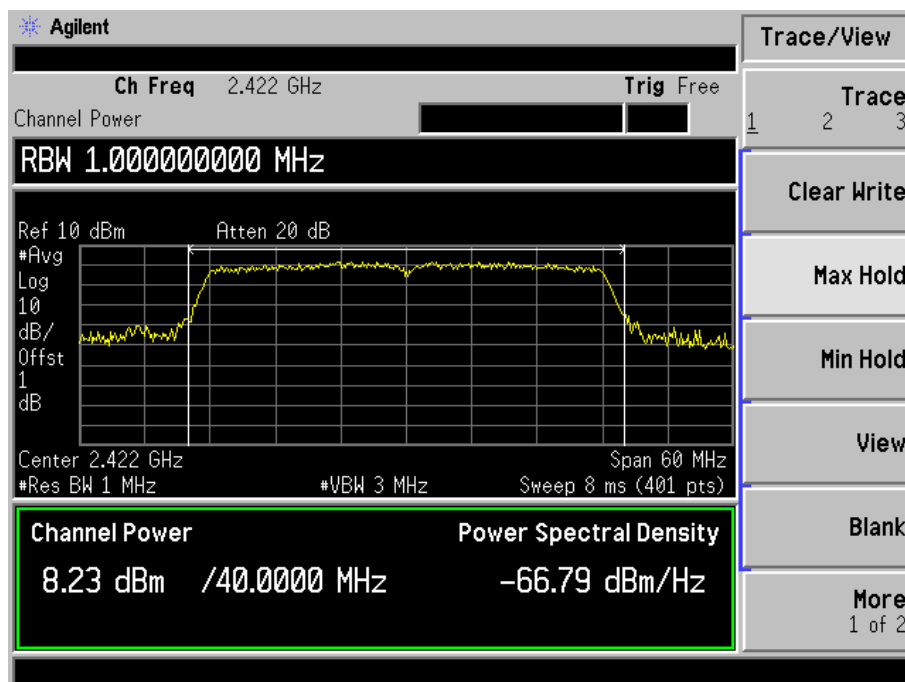
802.11n-HT20-MCS7-Middle Channel



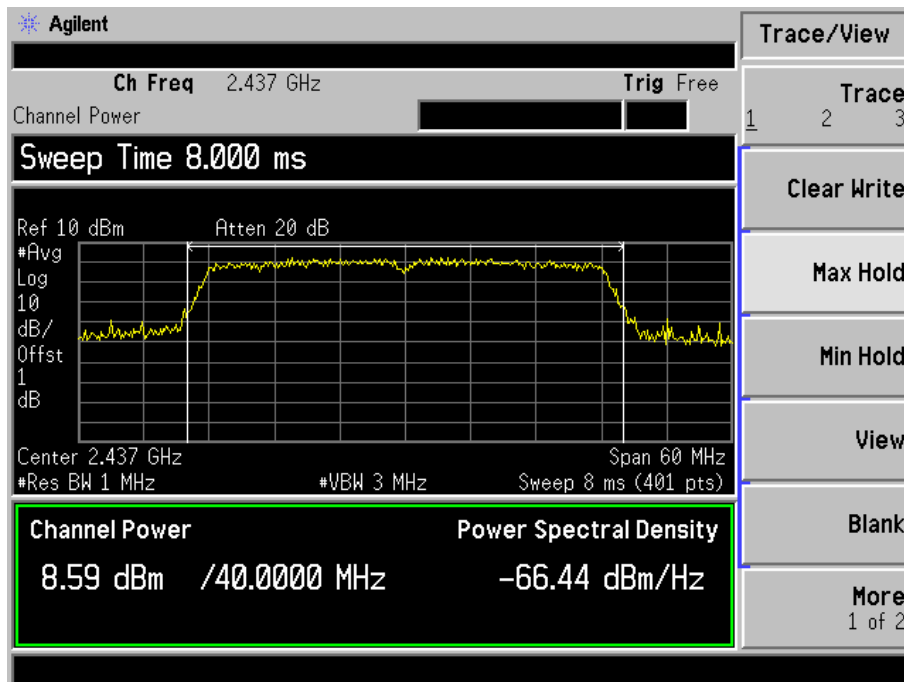
802.11n-HT20-MCS7-High Channel



802.11n-HT40-MCS7-Low Channel



802.11n-HT40-MCS7-Middle Channel



802.11n-HT40-MCS7-High Channel



8. Field Strength of Spurious Emissions

8.1 Standard Applicable

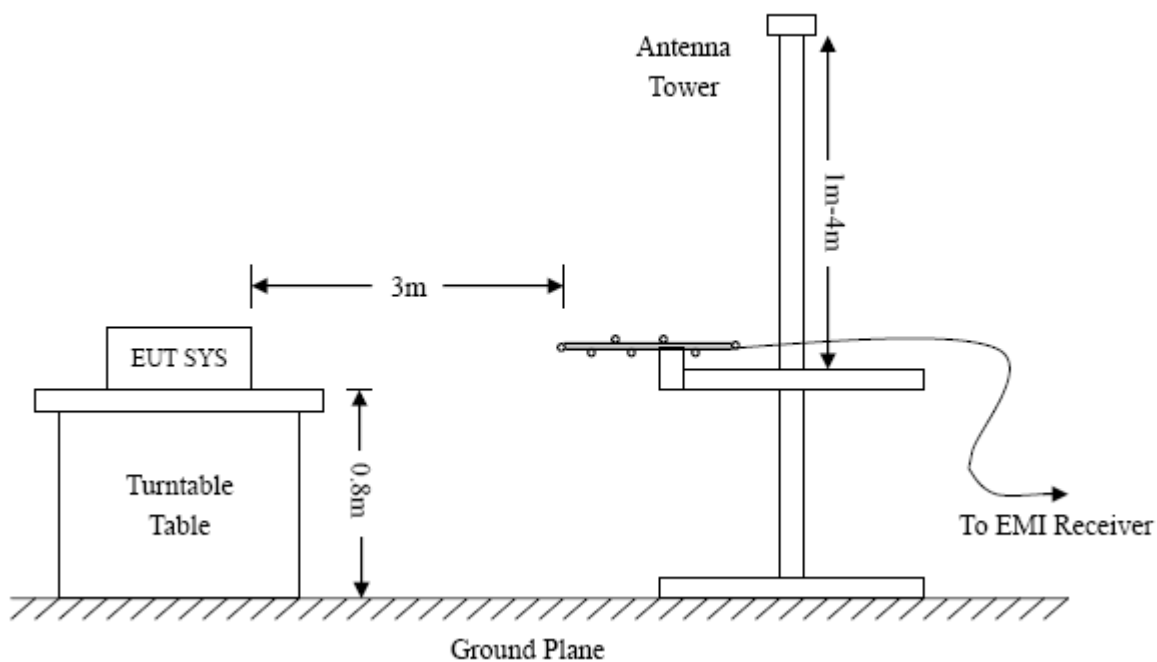
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within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

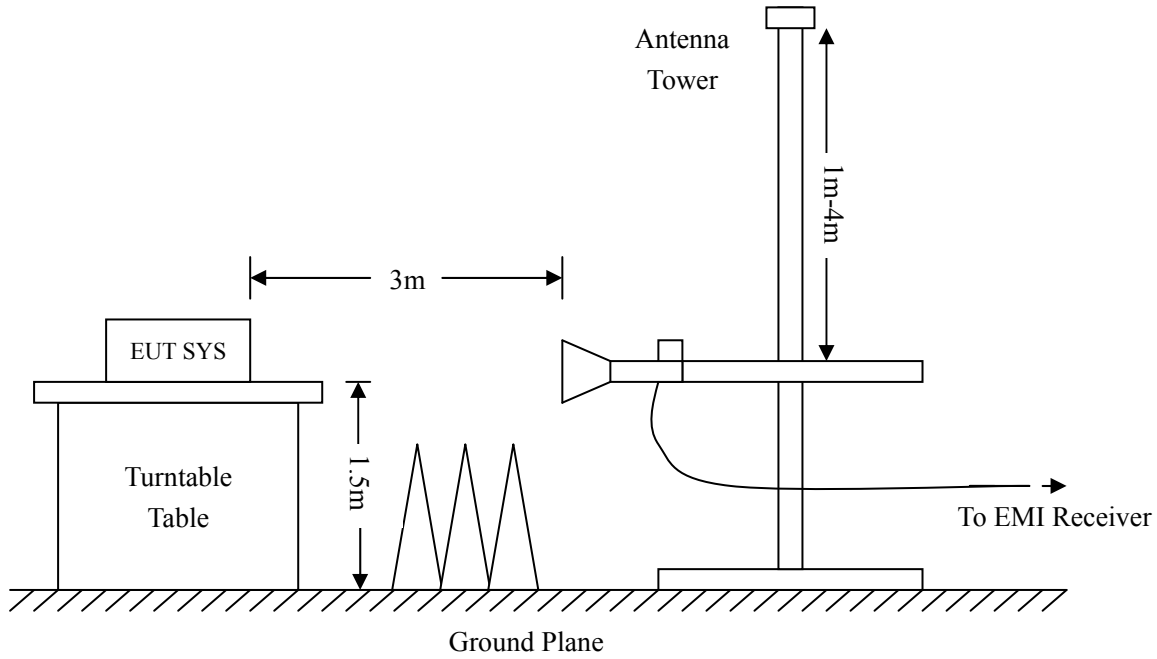
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

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

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=300KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

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

8.3 Corrected Amplitude & Margin Calculation

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

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

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

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

8.4 Environmental Conditions

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

8.5 Summary of Test Results/Plots

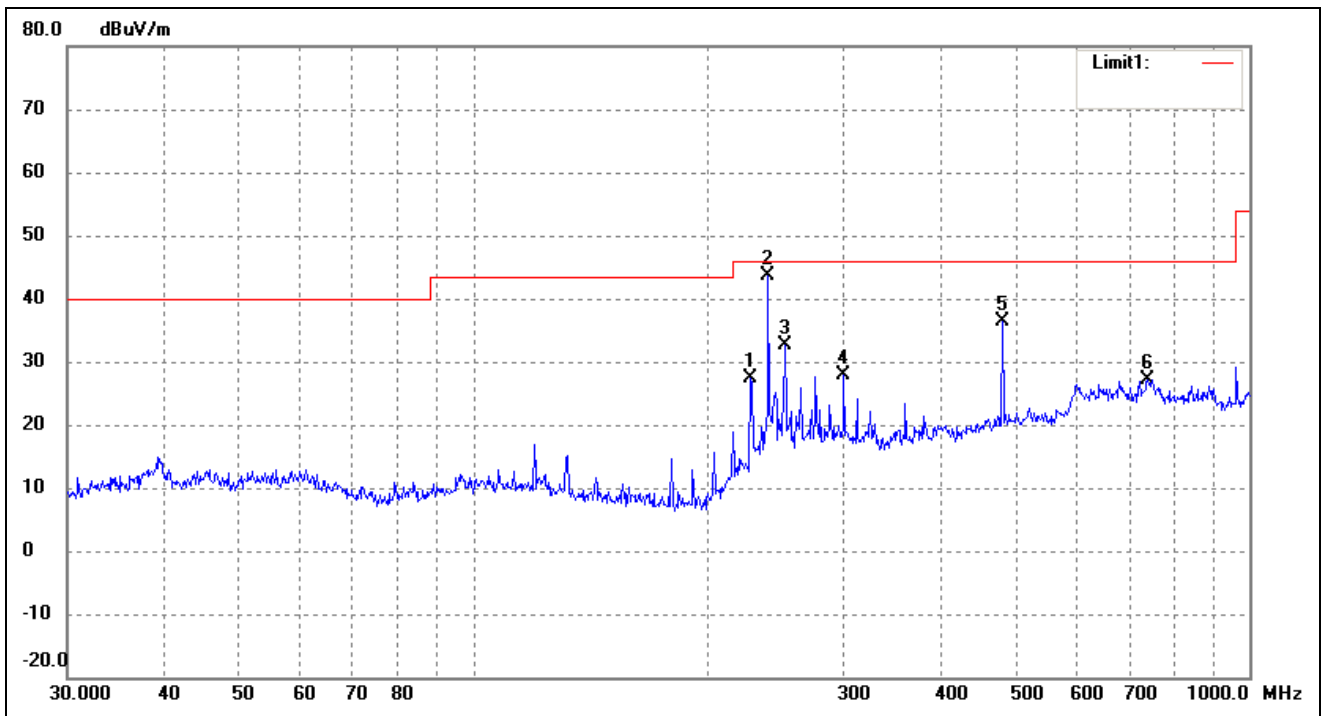
According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

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

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

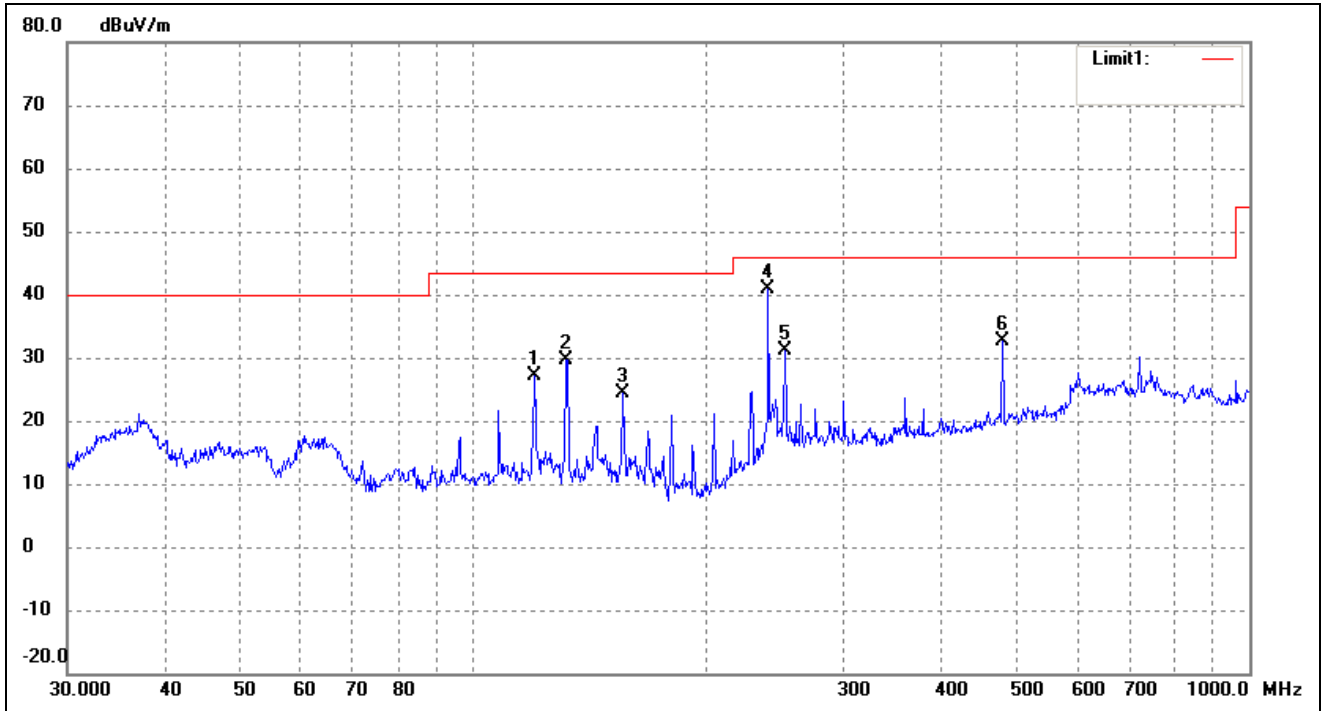
EUT: *Internet Radio with DAB*
 Tested Model: *MS-238D*
 Operating Condition: *802.11b Transmitting Low Channel-2412MHz (worst case)*
 Comment: *Adapter DC 5V*

Test Specification: *Horizontal*



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	227.6906	42.66	-15.29	27.37	46.00	-18.63	211	100	peak
2	239.9874	58.08	-14.35	43.73	46.00	-2.27	93	100	peak
3	252.0627	46.37	-13.77	32.60	46.00	-13.40	290	100	peak
4	300.3673	39.09	-11.32	27.77	46.00	-18.23	107	100	peak
5	480.5276	44.66	-8.30	36.36	46.00	-9.64	134	100	peak
6	739.6605	28.48	-1.33	27.15	46.00	-18.85	299	100	peak

Test Specification: Vertical

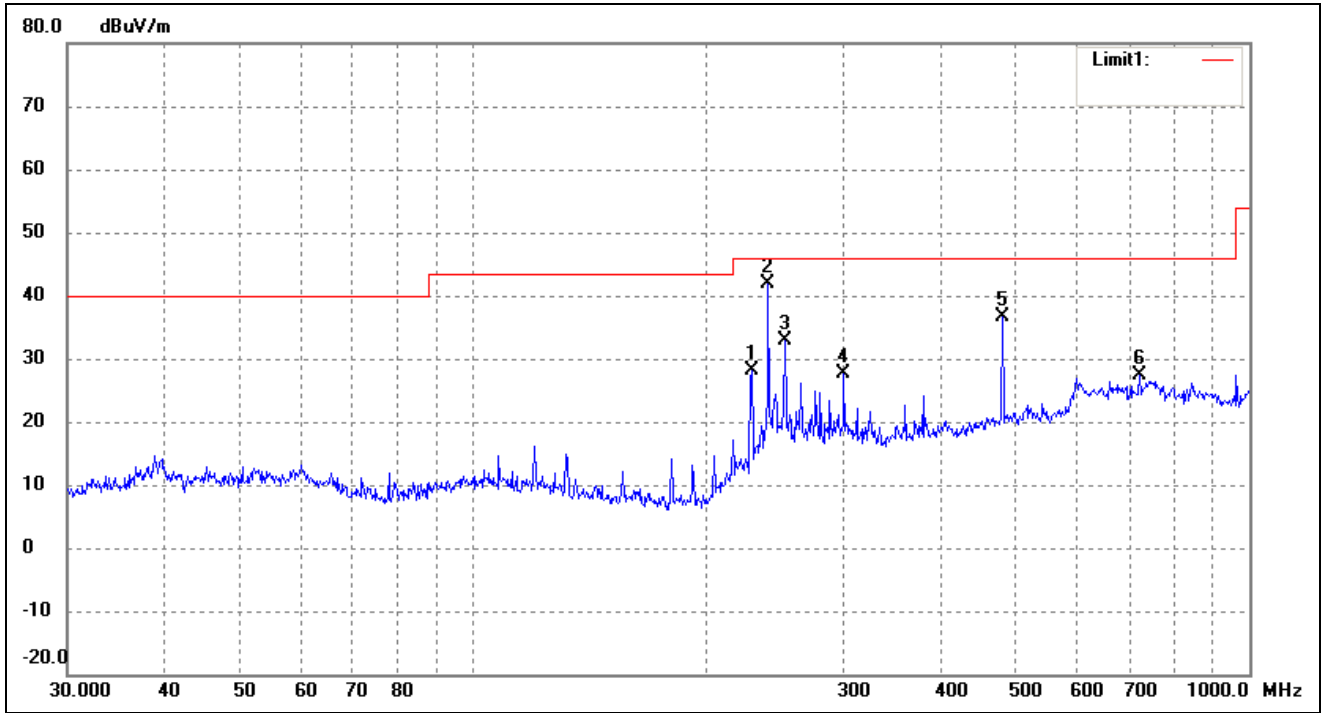


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	119.8555	45.72	-18.48	27.24	43.50	-16.26	316	100	peak
2	131.7576	49.11	-19.41	29.70	43.50	-13.80	98	100	peak
3	155.9100	45.21	-20.77	24.44	43.50	-19.06	274	100	peak
4	239.9874	55.17	-14.35	40.82	46.00	-5.18	108	100	peak
5	252.0627	44.84	-13.77	31.07	46.00	-14.93	106	100	peak
6	480.5276	40.98	-8.30	32.68	46.00	-13.32	294	100	peak

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

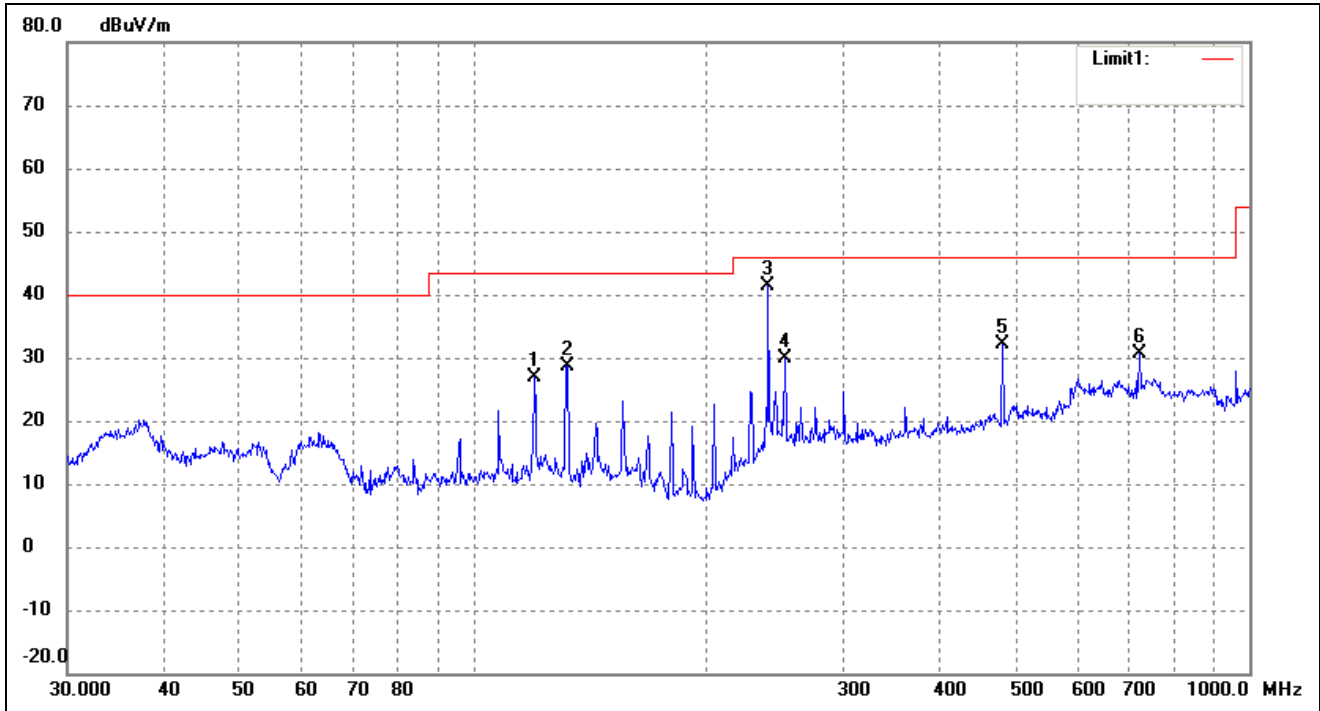
Comment: Adapter DC 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	228.4904	43.40	-15.22	28.18	46.00	-17.82	231	100	peak
2	239.9874	56.13	-14.35	41.78	46.00	-4.22	91	100	peak
3	252.0627	46.65	-13.77	32.88	46.00	-13.12	75	100	peak
4	300.3673	38.89	-11.32	27.57	46.00	-18.43	112	100	peak
5	480.5276	44.99	-8.30	36.69	46.00	-9.31	218	100	peak
6	721.7259	29.88	-2.50	27.38	46.00	-18.62	176	100	peak

Test Specification: Vertical

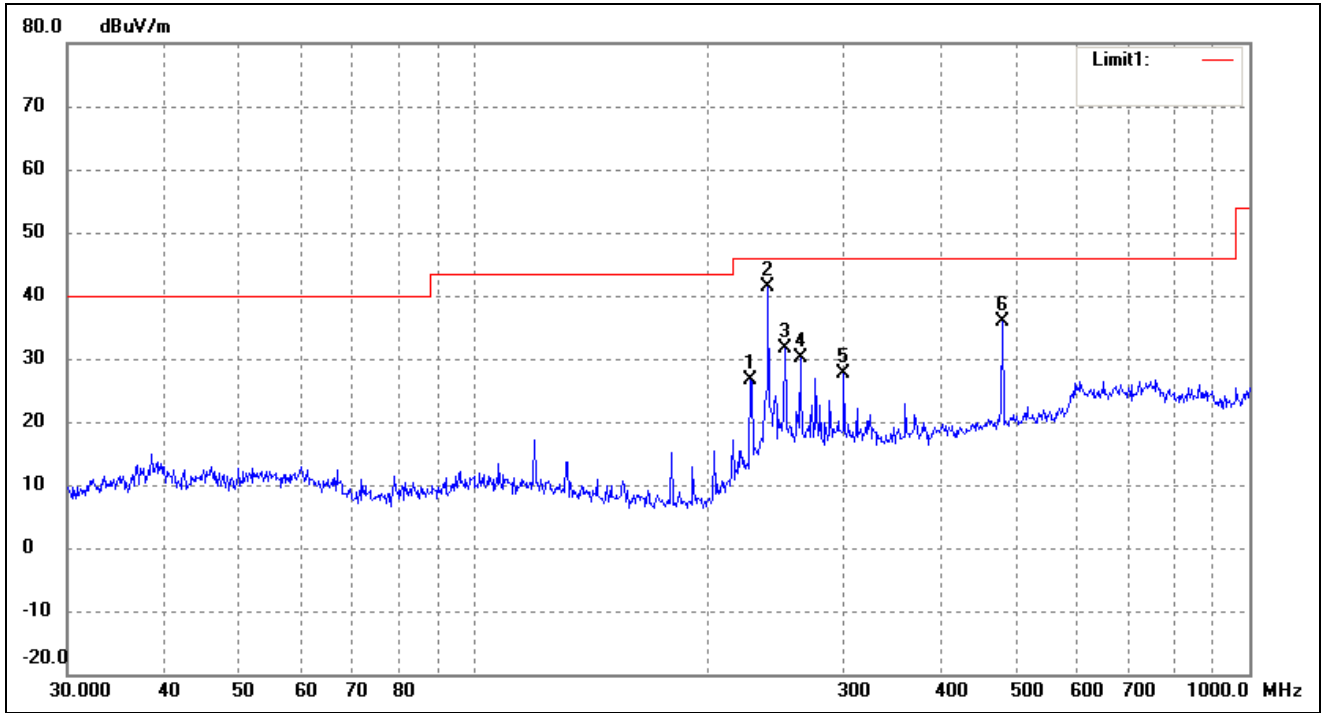


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	119.8556	45.32	-18.48	26.84	43.50	-16.66	164	100	peak
2	132.2206	48.07	-19.45	28.62	43.50	-14.88	248	100	peak
3	239.9874	55.81	-14.35	41.46	46.00	-4.54	60	100	peak
4	252.0627	43.59	-13.77	29.82	46.00	-16.18	181	100	peak
5	480.5276	40.52	-8.30	32.22	46.00	-13.78	99	100	peak
6	721.7259	33.09	-2.50	30.59	46.00	-15.41	133	100	peak

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

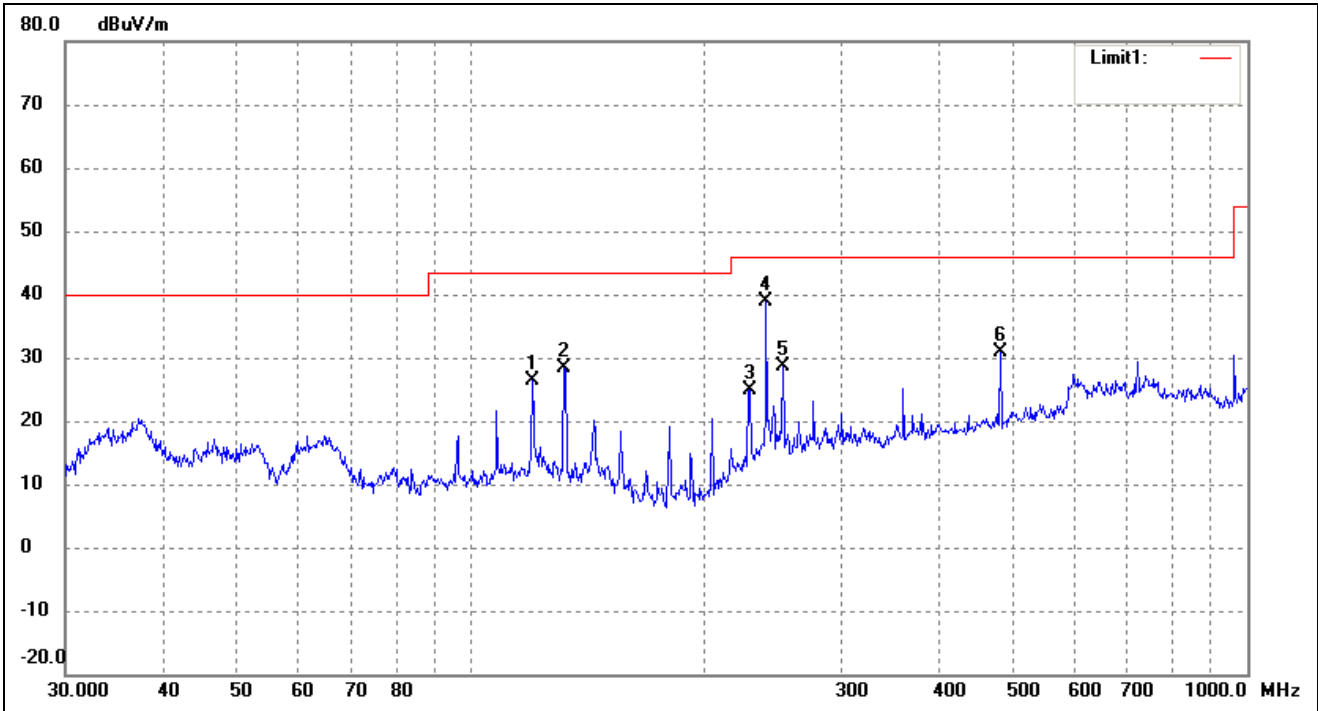
Comment: Adapter DC 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	227.6906	41.83	-15.29	26.54	46.00	-19.46	152	100	peak
2	239.9874	55.65	-14.35	41.30	46.00	-4.70	107	100	peak
3	252.0627	45.38	-13.77	31.61	46.00	-14.39	82	100	peak
4	263.8190	43.48	-13.23	30.25	46.00	-15.75	97	100	peak
5	300.3673	38.95	-11.32	27.63	46.00	-18.37	57	100	peak
6	480.5276	44.25	-8.30	35.95	46.00	-10.05	325	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	119.8556	44.82	-18.48	26.34	43.50	-17.16	78	100	peak
2	131.7577	47.69	-19.41	28.28	43.50	-15.22	167	100	peak
3	228.4904	40.15	-15.22	24.93	46.00	-21.07	92	100	peak
4	239.9874	53.23	-14.35	38.88	46.00	-7.12	133	100	peak
5	252.0627	42.29	-13.77	28.52	46.00	-17.48	91	100	peak
6	480.5276	39.16	-8.30	30.86	46.00	-15.14	242	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	54.55	-3.87	50.68	74.00	-23.32	H	PK
4824.000	43.98	-3.87	40.11	54.00	-13.89	H	AV
7236.000	47.25	1.14	48.39	74.00	-25.61	H	PK
7236.000	38.19	1.19	39.38	54.00	-14.62	H	AV
4824.000	53.65	-3.86	49.79	74.00	-24.21	V	PK
4824.000	41.28	-3.86	37.42	54.00	-16.58	V	AV
7236.000	44.21	1.10	45.31	74.00	-28.69	V	PK
7236.000	36.87	1.10	37.97	54.00	-16.03	V	AV
Middle Channel-2437MHz							
4874.000	57.26	-3.74	53.52	74.00	-20.48	H	PK
4874.000	45.15	-3.74	41.41	54.00	-12.59	H	AV
7311.000	46.69	1.47	48.16	74.00	-25.84	H	PK
7311.000	39.24	1.47	40.71	54.00	-13.29	H	AV
4874.000	54.15	-3.74	50.41	74.00	-23.59	V	PK
4874.000	44.35	-3.74	40.61	54.00	-13.39	V	AV
7311.000	44.17	1.47	45.64	74.00	-28.36	V	PK
7311.000	37.52	1.47	38.99	54.00	-15.01	V	AV
High Channel-2462MHz							
4924.000	55.23	-3.59	51.64	74.00	-22.36	H	PK
4924.000	42.26	-3.59	38.67	54.00	-15.33	H	AV
7386.000	44.45	1.79	46.24	74.00	-27.76	H	PK
7386.000	33.26	1.79	35.05	54.00	-18.95	H	AV
4924.000	54.18	-3.59	50.59	74.00	-23.41	V	PK
4924.000	41.36	-3.59	37.77	54.00	-16.23	V	AV
7386.000	44.12	1.79	45.91	74.00	-28.09	V	PK
7386.000	38.11	1.79	39.90	54.00	-14.10	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 \geq 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

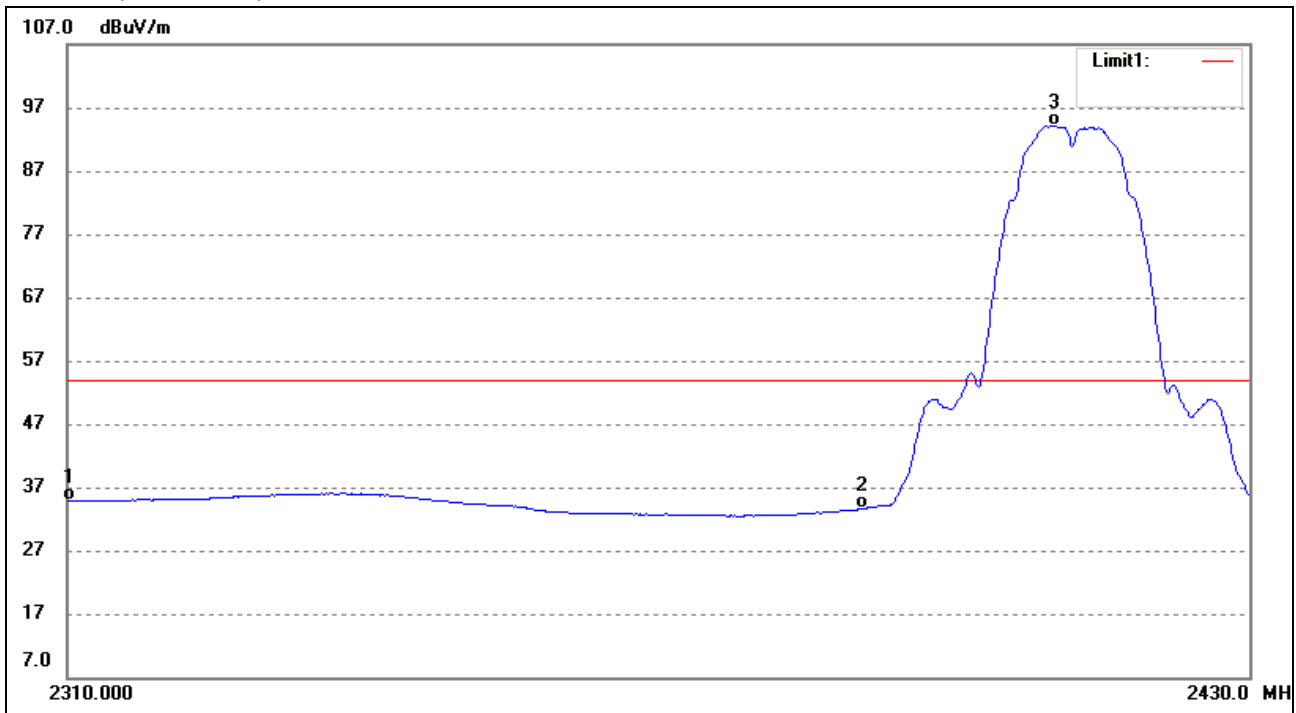
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

9.3 Environmental Conditions

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

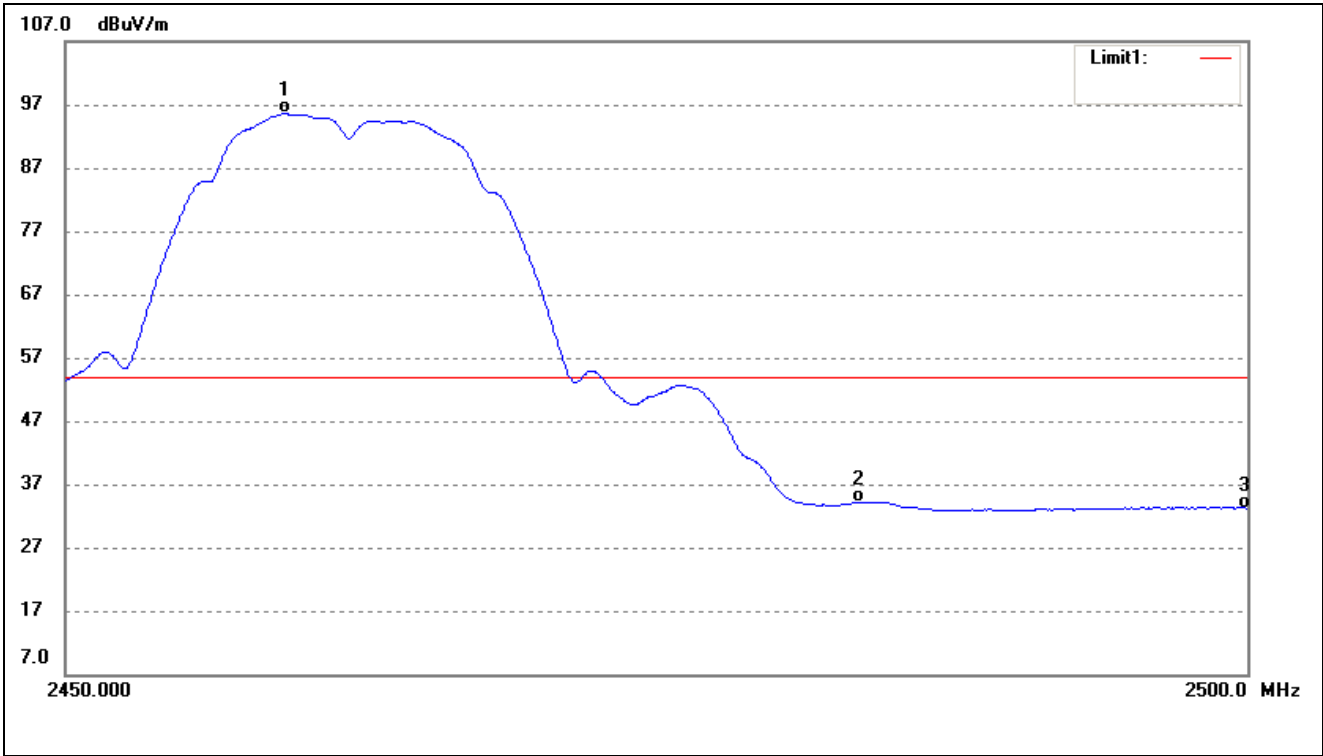
9.4 Summary of Test Results/Plots

802.11b-Lowest Bandedge
Vertical (Worst case)



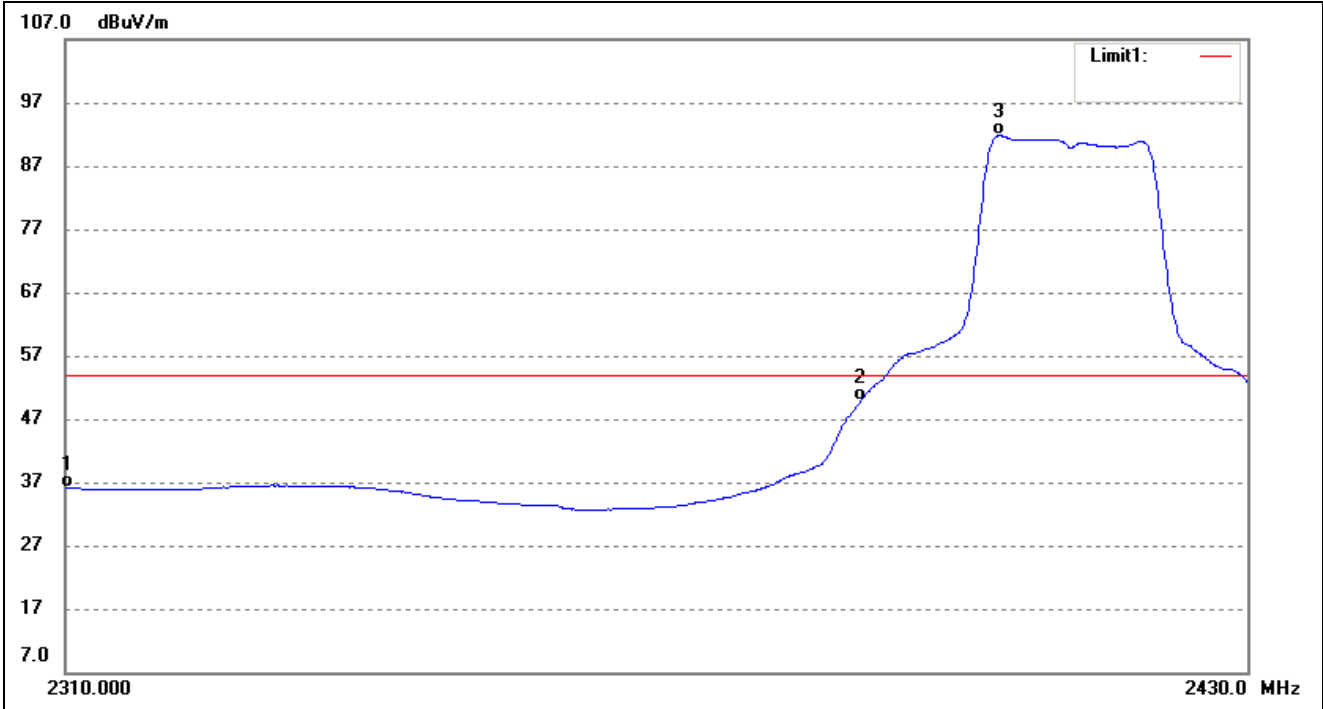
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	41.34	-6.38	34.96	54.00	-19.04	Average Detector
	2310.00	53.73	-6.38	47.35	74.00	-26.65	Peak Detector
2	2390.00	40.93	-7.26	33.67	54.00	-20.33	Average Detector
	2390.00	54.59	-7.26	47.33	74.00	-26.67	Peak Detector
3	2409.78	101.52	-7.41	94.11	/	/	Average Detector
	2409.78	107.61	-7.41	100.20	/	/	Peak Detector

802.11b-Highest Bandedge
Vertical (Worst case)



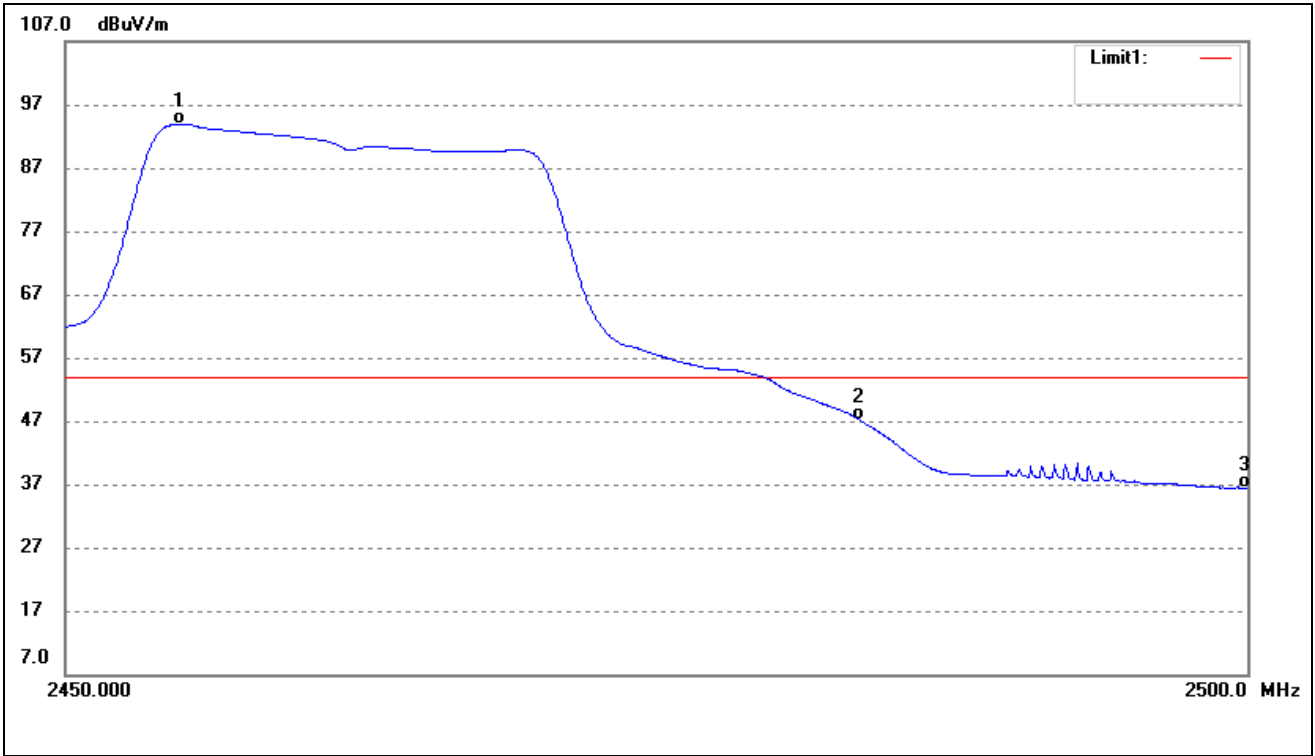
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2459.22	102.91	-7.33	95.58	/	/	Average Detector
		107.41	-7.32	100.09	/	/	Peak Detector
2	2483.50	41.36	-7.28	34.08	54.00	-19.92	Average Detector
		53.58	-7.28	46.30	74.00	-27.70	Peak Detector
3	2500.00	40.48	-7.25	33.23	54.00	-20.77	Average Detector
		53.19	-7.25	45.94	74.00	-28.06	Peak Detector

802.11g-Lowest Bandedge
Vertical (Worst case)



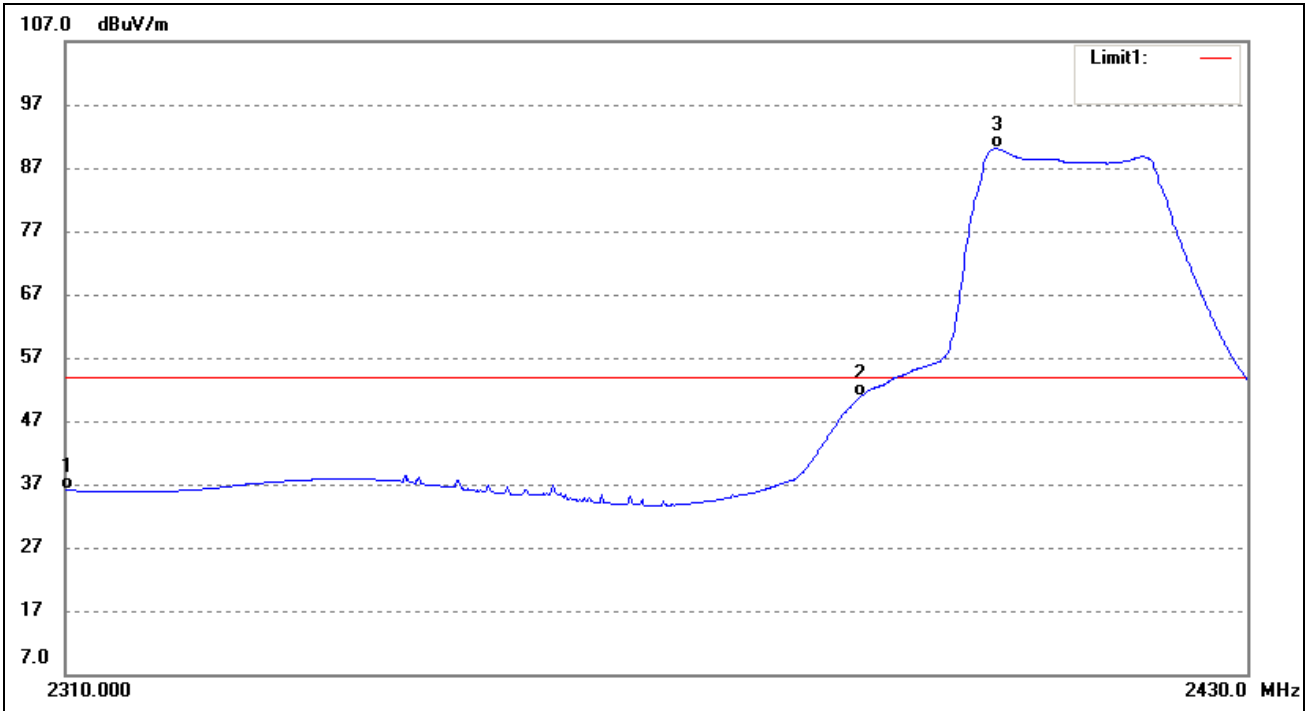
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	42.55	-6.38	36.17	54.00	-17.83	Average Detector
	2310.00	54.46	-6.38	48.08	74.00	-25.92	Peak Detector
2	2390.00	57.07	-7.26	49.81	54.00	-4.19	Average Detector
	2390.00	75.31	-7.26	68.05	74.00	-5.95	Peak Detector
3	2404.29	99.21	-7.41	91.80	/	/	Average Detector
	2404.29	108.55	-7.42	101.13	/	/	Peak Detector

802.11g-Highest Bandedge
Vertical (Worst case)



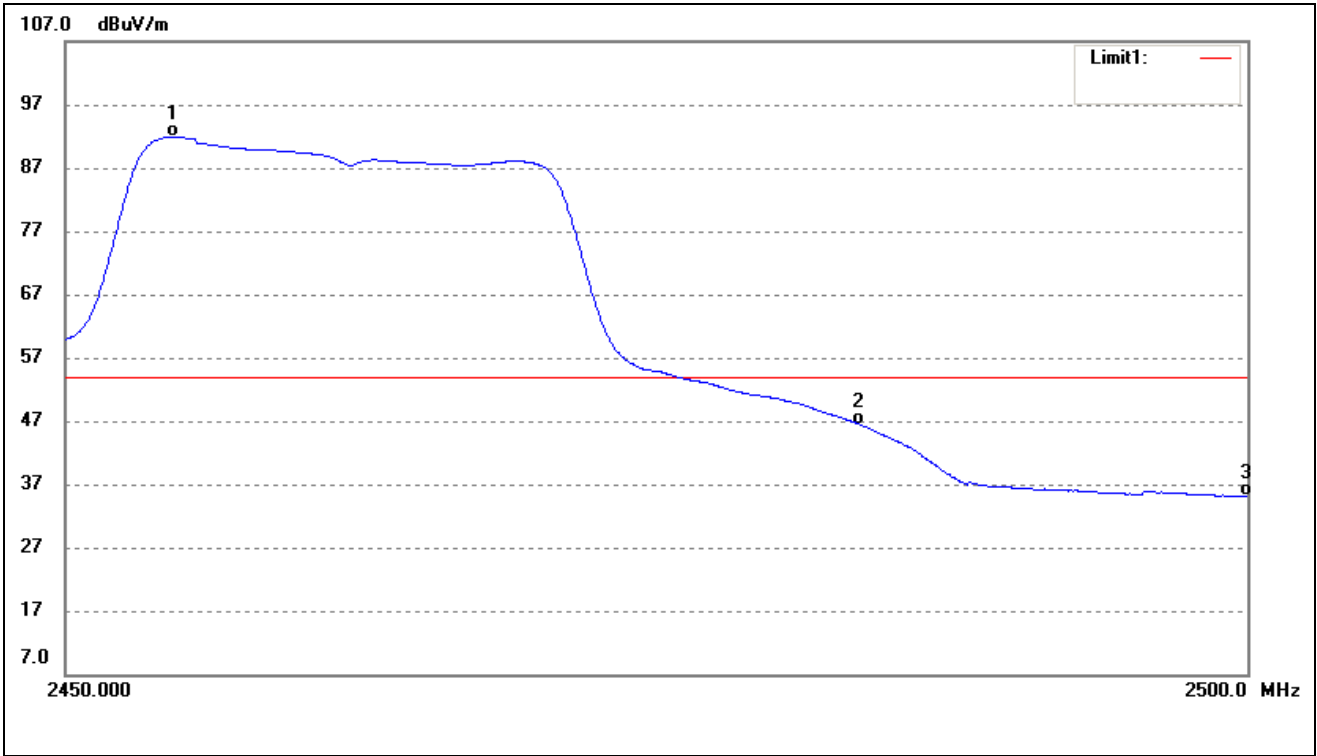
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.76	101.27	-7.33	93.94	/	/	Average Detector
	2454.76	110.68	-7.33	103.35	/	/	Peak Detector
2	2483.50	54.31	-7.28	47.03	54.00	-6.97	Average Detector
	2483.50	76.89	-7.28	69.61	74.00	-4.39	Peak Detector
3	2500.00	43.66	-7.25	36.41	54.00	-17.59	Average Detector
	2500.00	56.31	-7.25	49.06	74.00	-24.94	Peak Detector

802.11n-HT20-Lowest Bandedge
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	42.46	-6.38	36.08	54.00	-17.92	Average Detector
	2310.00	53.99	-6.38	47.61	74.00	-26.39	Peak Detector
2	2390.00	58.20	-7.26	50.94	54.00	-3.06	Average Detector
	2390.00	75.04	-7.26	67.78	74.00	-6.22	Peak Detector
3	2404.05	97.44	-7.41	90.03	/	/	Average Detector
	2404.05	108.63	-7.41	101.22	/	/	Peak Detector

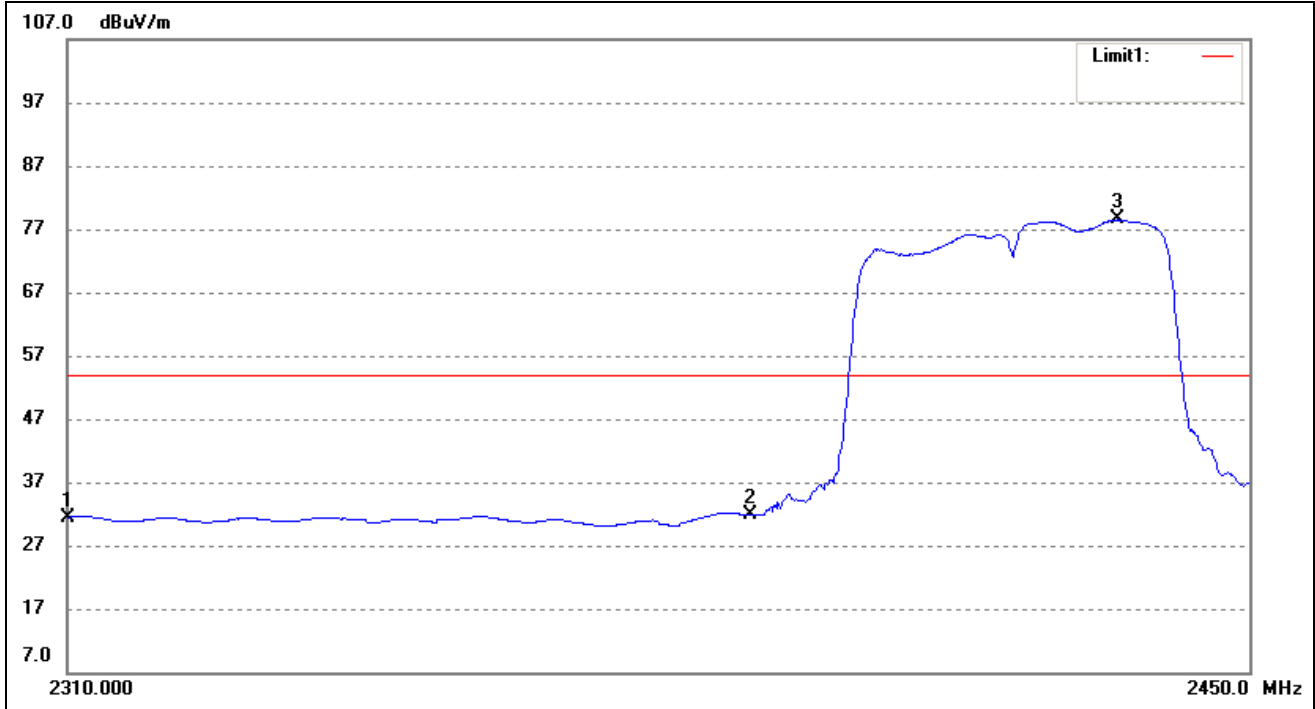
802.11n-HT20-Highest Bandedge
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.51	99.22	-7.33	91.89	/	/	Average Detector
	2454.51	106.42	-7.33	99.09	/	/	Peak Detector
2	2483.50	53.67	-7.28	46.39	54.00	-7.61	Average Detector
	2483.50	73.14	-7.28	65.86	74.00	-8.14	Peak Detector
3	2500.00	42.28	-7.25	35.03	54.00	-18.97	Average Detector
	2500.00	54.74	-7.25	47.49	74.00	-26.51	Peak Detector

802.11n-HT40-Lowest Bandedge

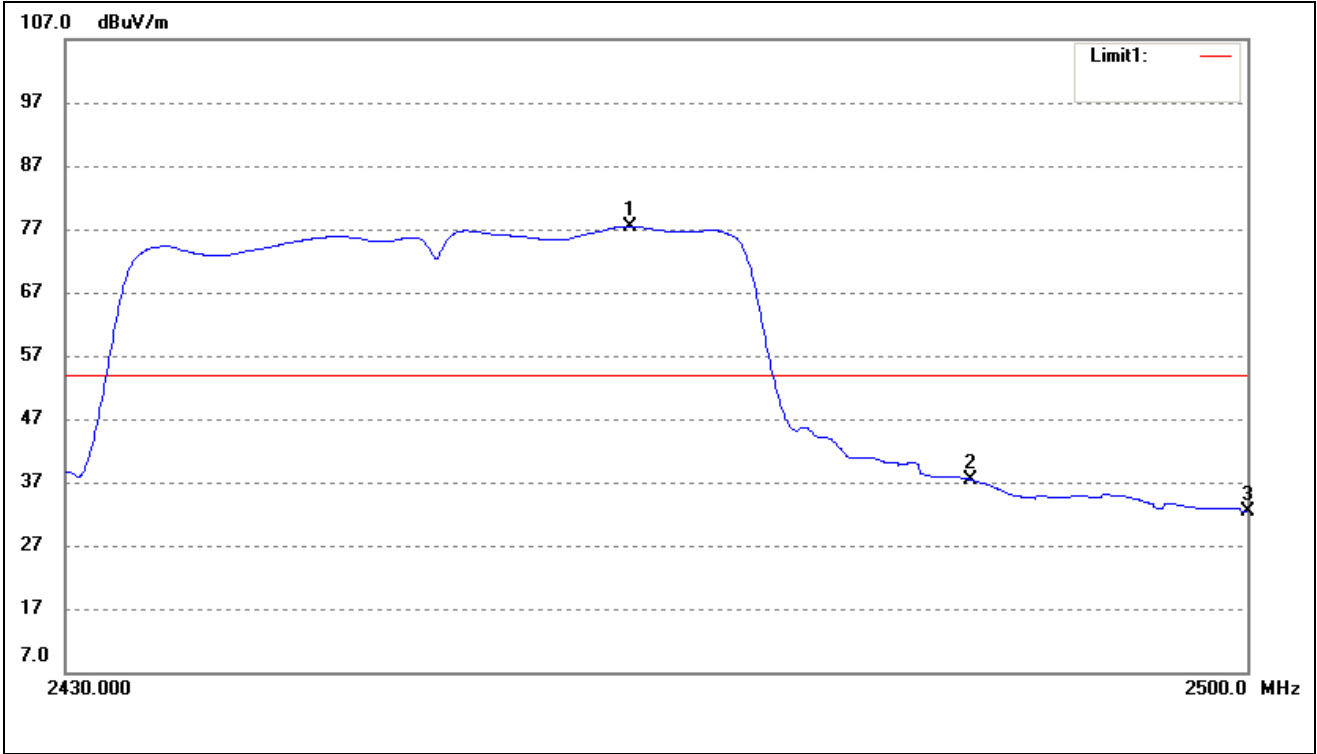
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.00	37.81	-6.38	31.43	54.00	-22.57	Average Detector
	2310.00	54.36	-6.38	47.98	74.00	-26.02	Peak Detector
2	2390.00	39.16	-7.26	31.90	54.00	-22.10	Average Detector
	2390.00	59.92	-7.26	52.66	74.00	-21.34	Peak Detector
3	2434.05	85.88	-7.37	78.51	/	/	Average Detector
	2434.05	96.38	-7.37	89.01	/	/	Peak Detector

802.11n-HT40-Highest Bandedge

Vertical (Worst case)

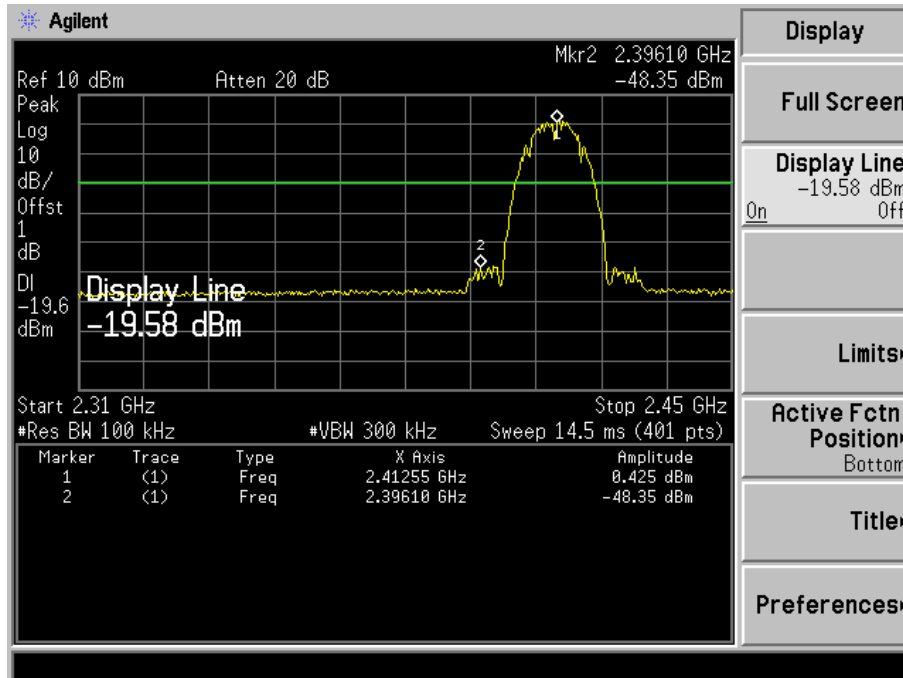


No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2463.21	84.77	-7.31	77.46	/	/	Average Detector
	2463.21	97.12	-7.31	89.81	/	/	Peak Detector
2	2483.50	44.68	-7.28	37.40	54.00	-16.60	Average Detector
	2483.50	64.70	-7.28	57.42	74.00	-16.58	Peak Detector
3	2500.00	39.66	-7.25	32.41	54.00	-21.59	Average Detector
	2500.00	54.29	-7.25	47.04	74.00	-26.96	Peak Detector

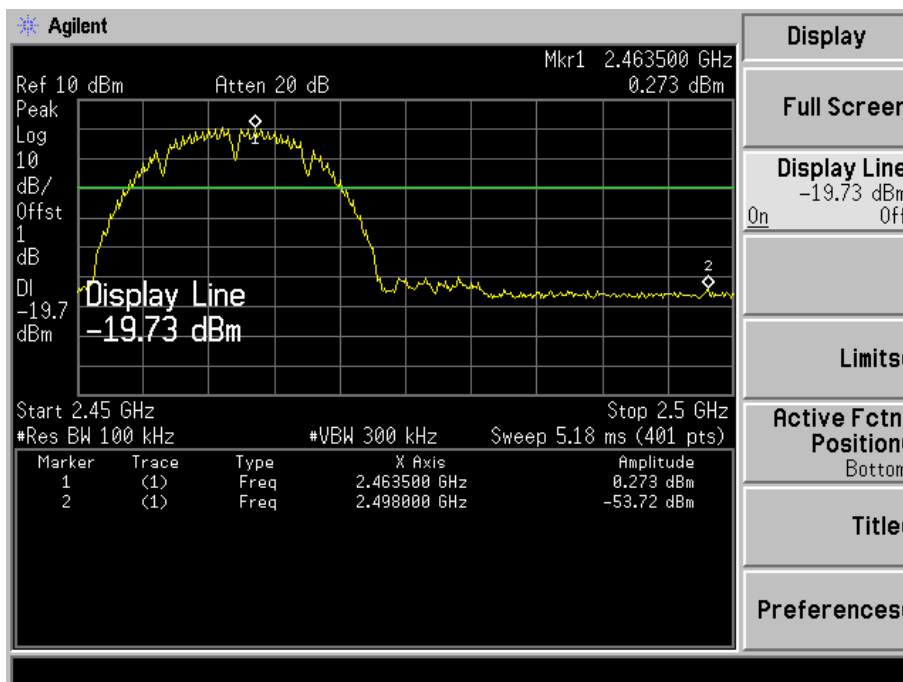
Spurious (Conducted)

802.11b-Lowest

Lowest



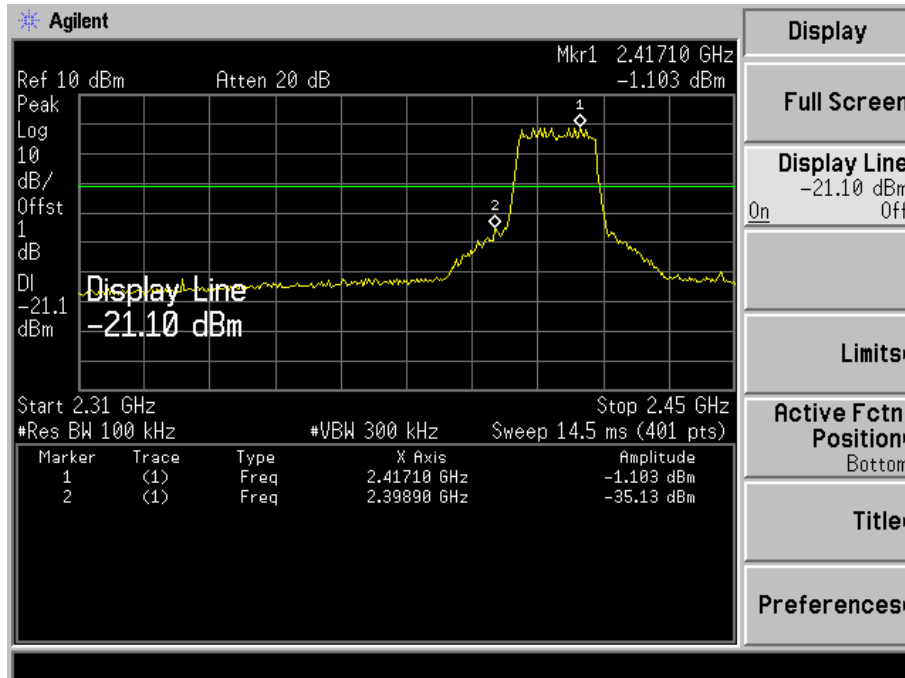
Highest



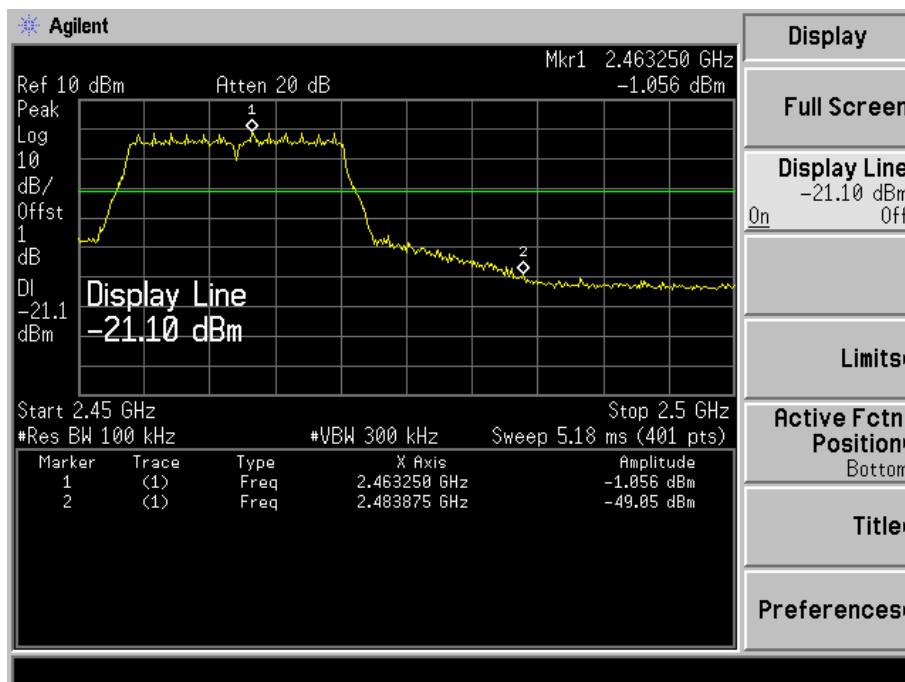
Spurious (Conducted)

802.11g-Lowest

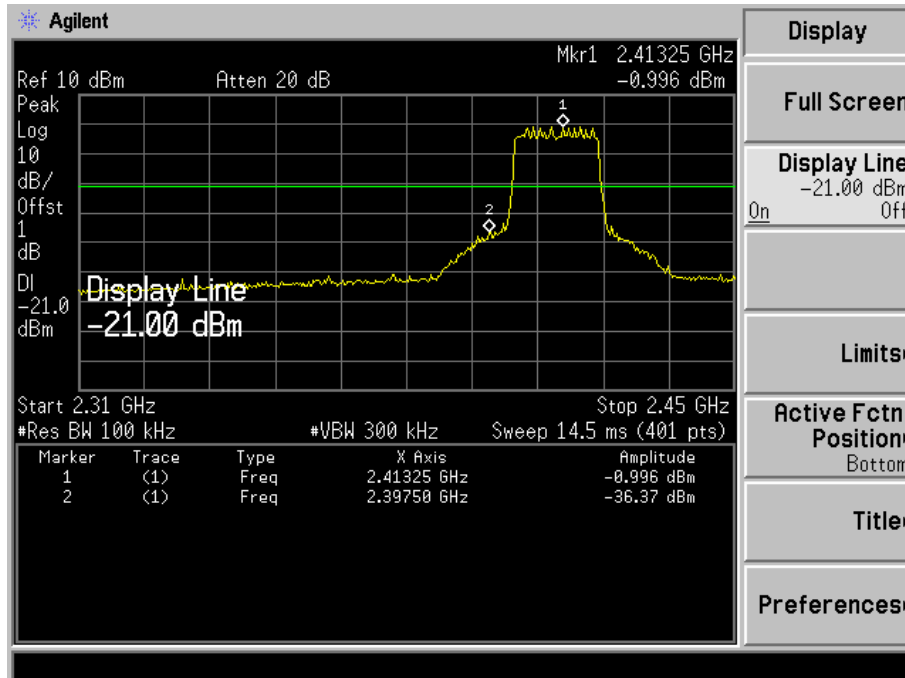
Lowest



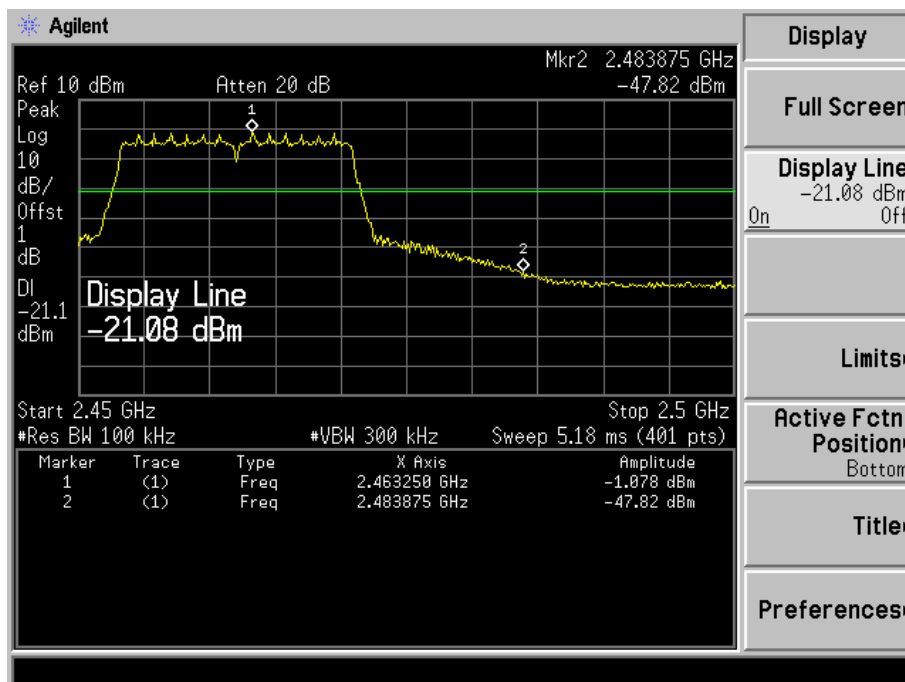
Highest



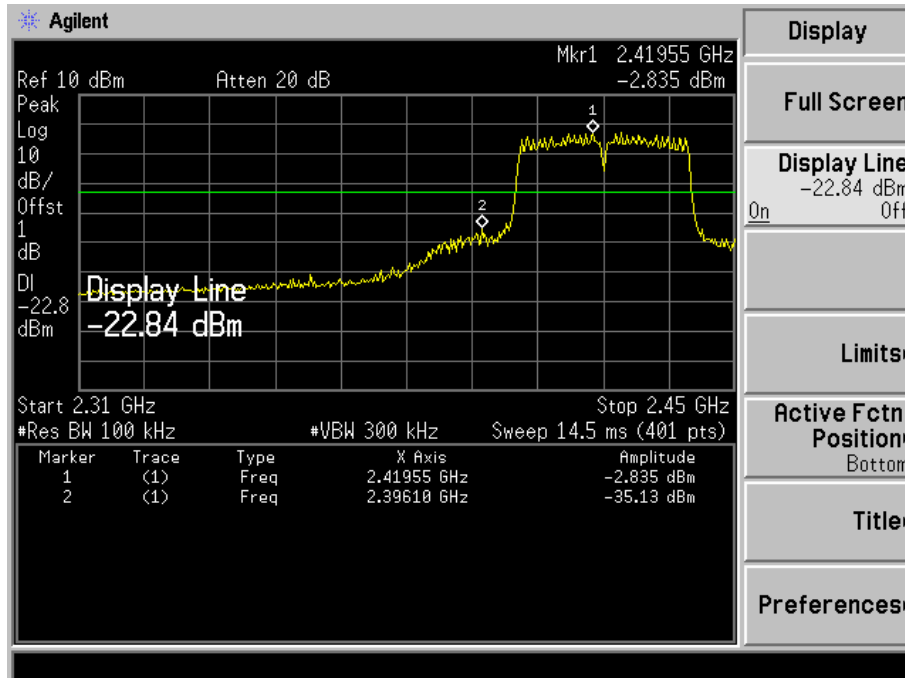
Spurious (Conducted)
 802.11n-HT20-Lowest
 Lowest



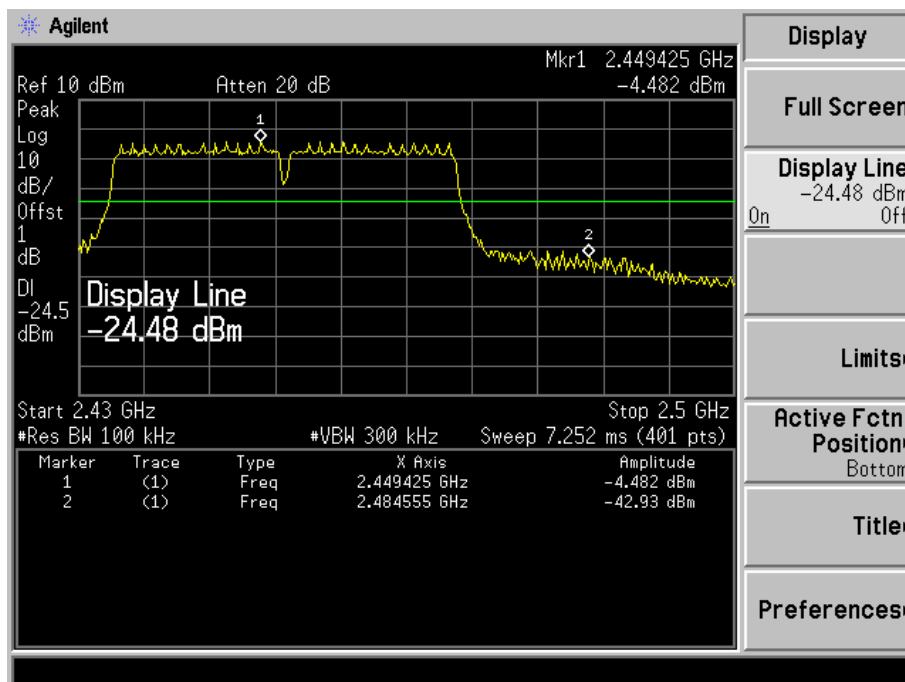
Highest



Spurious (Conducted)
 802.11n-HT40-Lowest
 Lowest



Highest



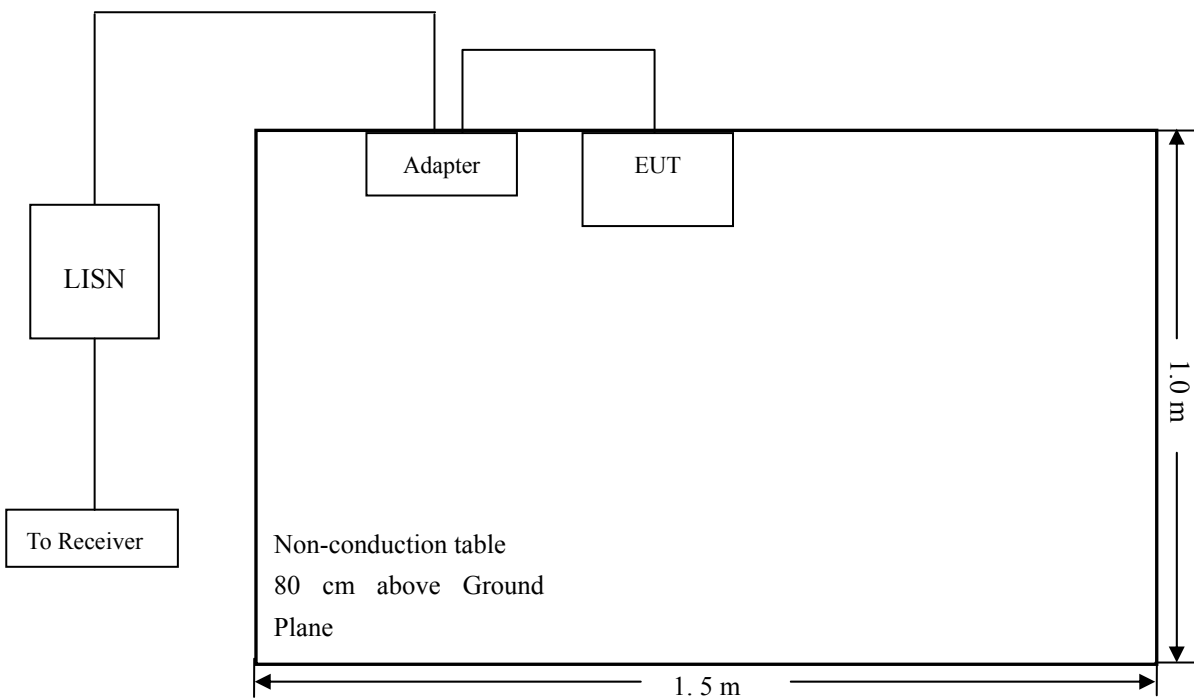
10. Conducted Emissions

10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

10.2 Basic Test Setup Block Diagram



10.3 Environmental Conditions

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

10.4 Test Receiver Setup

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

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

10.5 Summary of Test Results/Plots

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

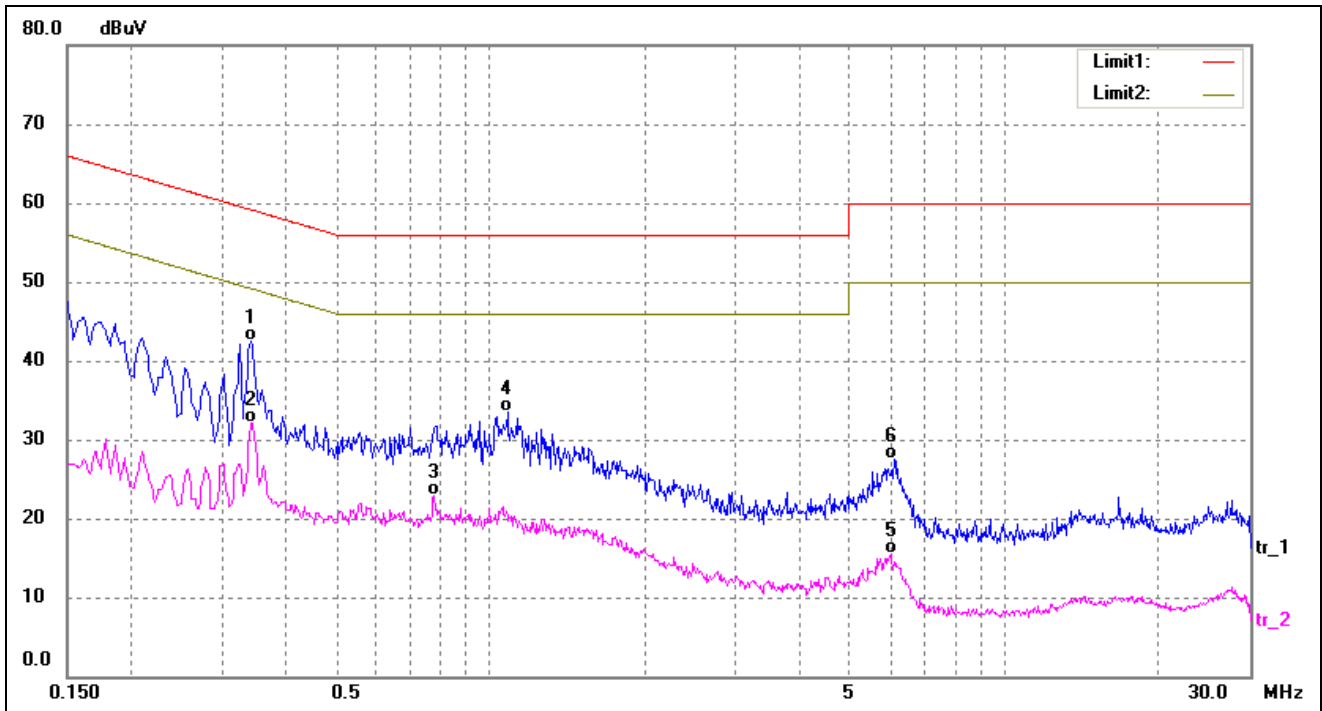
-12.58 dB at 0.3460 MHz in the Line mode, AVG detector, 0.15-30MHz

10.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

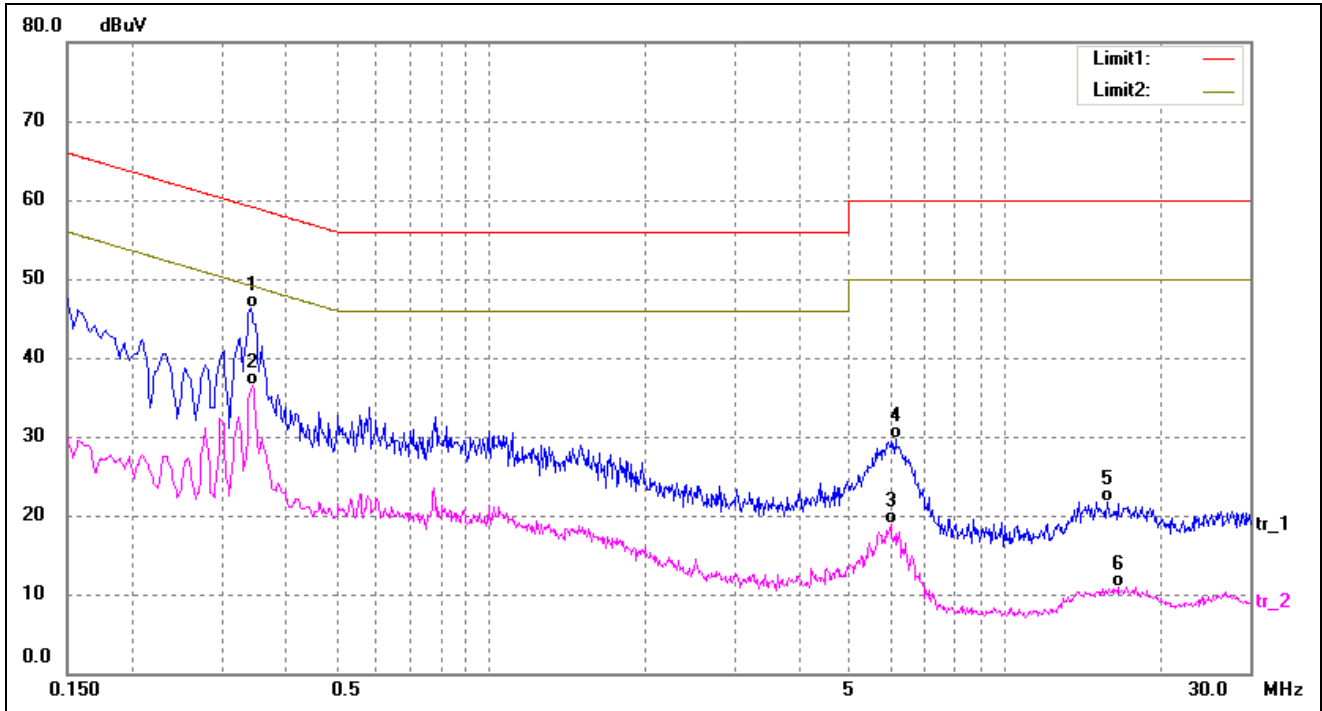
EUT: *Internet Radio with DAB*
 Tested Model: *MS-238D*
 Operating Condition: *Transmitting(Wi-Fi)*
 Comment: *AC 120V/60Hz; Adapter DC 5V*

Test Specification: *Neutral*



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.3420	32.66	9.80	42.46	59.15	-16.69	QP
2	0.3420	22.36	9.80	32.16	49.15	-16.99	AVG
3	0.7780	13.22	9.78	23.00	46.00	-23.00	AVG
4	1.0780	23.68	9.76	33.44	56.00	-22.56	QP
5	6.0020	5.80	9.63	15.43	50.00	-34.57	AVG
6	6.1060	17.87	9.63	27.50	60.00	-32.50	QP

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.3420	36.43	9.80	46.23	59.15	-12.92	QP
2*	0.3460	26.68	9.80	36.48	49.06	-12.58	AVG
3	5.9940	9.19	9.63	18.82	50.00	-31.18	AVG
4	6.1500	20.04	9.63	29.67	60.00	-30.33	QP
5	15.8740	12.01	9.62	21.63	60.00	-38.37	QP
6	16.5940	1.29	9.63	10.92	50.00	-39.08	AVG

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