

FCC TEST REPORT
for
High-Flying Electronics Technology Co., Ltd.

Embedded Wi-Fi Module
Model No.: HF-SH01

Prepared for : High-Flying Electronics Technology Co., Ltd.
Address : Room 1002, Building 1, No.3000, Longdong Avenue, Pudong
New Area, Shanghai, China, 201203

Prepared By : Shenzhen Anbotek Compliance Laboratory Limited
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Report Number : R011503376E
Date of Test : Mar. 18~ Apr. 08, 2015
Date of Report : Apr. 09, 2015

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TEST REPORT

Applicant : High-Flying Electronics Technology Co., Ltd.
Manufacturer : High-Flying Electronics Technology Co., Ltd.
EUT : Embedded Wi-Fi Module
Model No. : HF-SH01
Serial No. : N.A.
Trade Mark : High-Flying
Rating : DC 3.1V-3.6V, 240mA

Measurement Procedure Used:
FCC Part15 Subpart C, Paragraph 15.247

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Mar. 18~ Apr. 08, 2015

Kebo Zhang

Prepared by :

(Tested Engineer / Kebo Zhang)

Amy Ding

Reviewer :

(Project Manager / Amy Ding)

Approved & Authorized Signer :

Tom Chen

(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT : Embedded Wi-Fi Module

Model Number : HF-SH01

Test Power Supply : AC 120V/60Hz for adapter

RF Transmission : 2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20))
Frequency : 2422MHz~2452MHz (802.11n(HT40))

Channels : 11 For (802.11b/802.11g/802.11n(HT20))
7 For (802.11n(HT40))

Modulation : 802.11b CCK
802.11g OFDM
802.11n MCS

Antenna Gain: : 2dBi

Applicant : High-Flying Electronics Technology Co., Ltd.
Address : Room 1002, Building 1, No.3000, Longdong Avenue, Pudong New Area, Shanghai, China, 201203

Manufacturer : High-Flying Electronics Technology Co., Ltd.
Address : Room 1002, Building 1, No.3000, Longdong Avenue, Pudong New Area, Shanghai, China, 201203

Factory : China Dragon Technology Limited.
Address : B4 Bldg. Haosan No.1 Industry Park, Baoan Dist., Shenzhen, China

Date of receipt : Mar. 18, 2015

Date of Test : Mar. 18~ Apr. 08, 2015

1.2. Auxiliary Equipment Used during Test

N/A

1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS - LAB Code: L3503

Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

FCC-Registration No.: 752021

Shenzhen Anbotek Compliance Laboratory Limited, 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. Registration 752021, July 10, 2013.

IC-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

Test Location

All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

1.4. Measurement Uncertainty

Radiation Uncertainty : Ur = 4.1 dB (Horizontal)
Ur = 4.3 dB (Vertical)

Conduction Uncertainty : Uc = 3.4dB

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2014 and FCC Part 15, Paragraph 15.247.

2.1. Summary of Test Results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.107, 15.207	Conducted Emission Test	PASS	Complies
FCC Part 15, Paragraph 15.247(b)(1)	Peak Output Power	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(2)	6dB Bandwidth	PASS	Complies
FCC Part 15, Paragraph 15.247(c)	100kHz Bandwidth of Frequency Band Edges	PASS	Complies
FCC Part 15, Paragraph 15.209(a)(f)	Spurious Emission	PASS	Complies
FCC Part 15, Paragraph 15.247(a)(1)	Frequency Separation	-	N/A
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Number of Hopping Frequency	-	N/A
FCC Part 15, Paragraph 15.247(a)(1)(iii)	Time of Occupancy	-	N/A
FCC Part 15, Paragraph 15.247(c)	Peak Power Density	PASS	Complies

2.2. Description of Test Modes

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1 Mbps lowest data rate (worst case) are chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6 Mbps lowest data rate (the worst case) are chosen for the final testing.

IEEE802.11n (HT20): Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with MCS 0 Mbps lowest data rate (the worst case) are chosen for the final testing.

IEEE802.11n (HT40): Channel 3(2422MHz), Channel 6(2437MHz) and Channel 9(2452MHz) with MCS 0 Mbps lowest data rate (the worst case) are chosen for the final testing.

2.3. List of channels:

√ - available

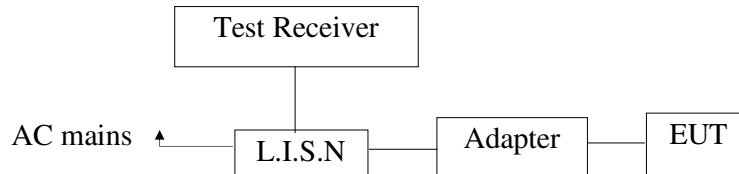
X - tested

Number	Frequency(MHz)		802.11 b/g/n (HT20)	802.11 b/g/n (HT40)
1	2412	√	X	
2	2417	√		
3	2422	√		X
4	2427	√		
5	2432	√		
6	2437	√	X	X
7	2442	√		
8	2447	√		
9	2452	√		X
10	2457	√		
11	2462	√	X	

3. Conducted Emission Test

3.1. Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



3.2. Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

3.3. Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4. Operating Condition of EUT

- 3.4.1. Setup the EUT and simulator as shown as Section 3.1.
- 3.4.2. Turn on the power of all equipment.
- 3.4.3. Let the EUT work in test mode (On) and measure it.

3.5. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.4-2014 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

3.6. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Two-Line V-network	Rohde & Schwarz	ENV216	100055	Apr. 22, 2014	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 22, 2014	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 22, 2014	1 Year

3.7. Power Line Conducted Emission Measurement Results

PASS.

The frequency range from 150KHz to 30 MHz is investigated.

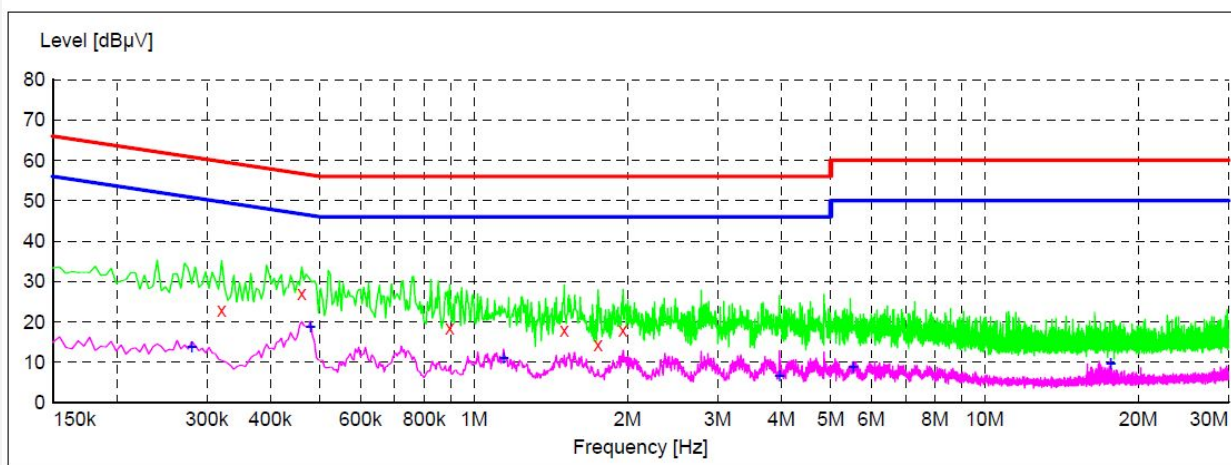
Please refer the following pages.

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: On
Test Specification: AC 120V/60Hz for adapter
Comment: Live Line
Tem:25°C Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"

Short Description: 150K-30M Disturbance Voltages



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.321000	22.90	20.1	60	36.8	QP	L1	GND
0.460500	27.10	20.1	57	29.6	QP	L1	GND
0.897000	18.50	20.1	56	37.5	QP	L1	GND
1.504000	17.90	20.3	56	38.1	QP	L1	GND
1.751500	14.30	20.3	56	41.7	QP	L1	GND
1.958500	18.00	20.3	56	38.0	QP	L1	GND

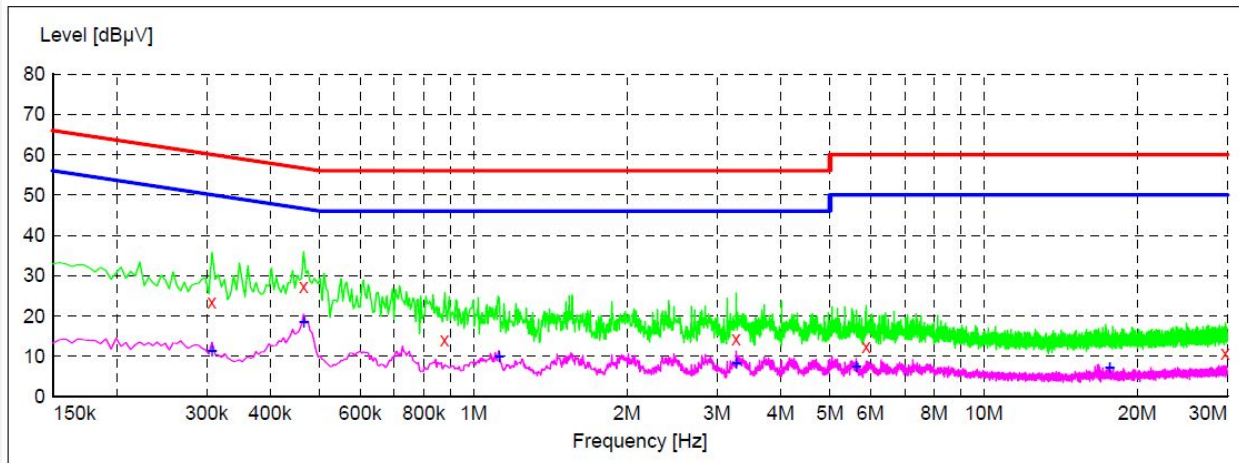
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.280500	13.80	20.1	51	37.0	AV	L1	GND
0.478500	18.80	20.1	46	27.6	AV	L1	GND
1.144000	11.10	20.2	46	34.9	AV	L1	GND
3.965500	6.60	20.4	46	39.4	AV	L1	GND
5.527000	8.90	20.5	50	41.1	AV	L1	GND
17.650000	9.70	20.8	50	40.3	AV	L1	GND

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: On
Test Specification: AC 120V/60Hz for adapter
Comment: Neutral Line
Tem:25°C Hum:50%

SCAN TABLE: "Voltage(150K~30M)FIN"

Short Description: 150K-30M Disturbance Voltages

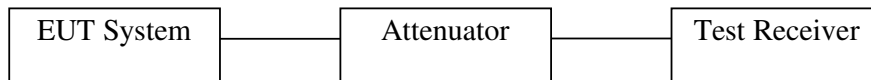


Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.307500	23.40	20.1	60	36.6	QP	N	GND
0.465000	27.20	20.1	57	29.4	QP	N	GND
0.879000	14.00	20.1	56	42.0	QP	N	GND
3.272500	14.40	20.4	56	41.6	QP	N	GND
5.887000	12.40	20.5	60	47.6	QP	N	GND
29.768500	10.80	20.9	60	49.2	QP	N	GND

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.307500	11.30	20.1	50	38.7	AV	N	GND
0.465000	18.60	20.1	47	28.0	AV	N	GND
1.121500	9.90	20.2	46	36.1	AV	N	GND
3.272500	8.30	20.4	46	37.7	AV	N	GND
5.626000	7.40	20.5	50	42.6	AV	N	GND
17.650000	7.30	20.8	50	42.7	AV	N	GND

4. FCC Part 15.247 Requirements for DSSS & OFDM Modulation

4.1 Test Setup



4.2 6dB Bandwidth

a. Limit

For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

b. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
RBW = 100kHz, VBW $\geq 3 \times$ RBW = 300kHz,
Detector= Peak
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

20dB Bandwidth:

C63.10

Occupied Bandwidth (OBW=20dB Bandwidth)

1. Set RBW=1%~5% OBW
2. Set the VBW $\geq 3 \times$ RBW
3. Set the span range between 2 times and 5 times of the OBW
4. Sweep Time= Auto
Detector= Peak
Trace= Max hold
5. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce the worst case (i.e. the widest) bandwidth. Unless otherwise specified for an unlicensed wireless device, measure the bandwidth at the -20dB levels with respect to the reference level.

c. Test Setup See 4.1

d. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Aug. 08, 2014	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Aug. 08, 2014	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 22, 2014	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 04, 2014	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 24, 2014	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Aug. 08, 2014	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A

e. Test Results

Pass.

f. Test Data
6dB Bandwidth

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	11.76	>500	Pass
Mid	2437	11.72		Pass
High	2462	11.76		Pass

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	16.48	>500	Pass
Mid	2437	16.48		Pass
High	2462	16.48		Pass

Test mode: IEEE 802.11n (HT20)

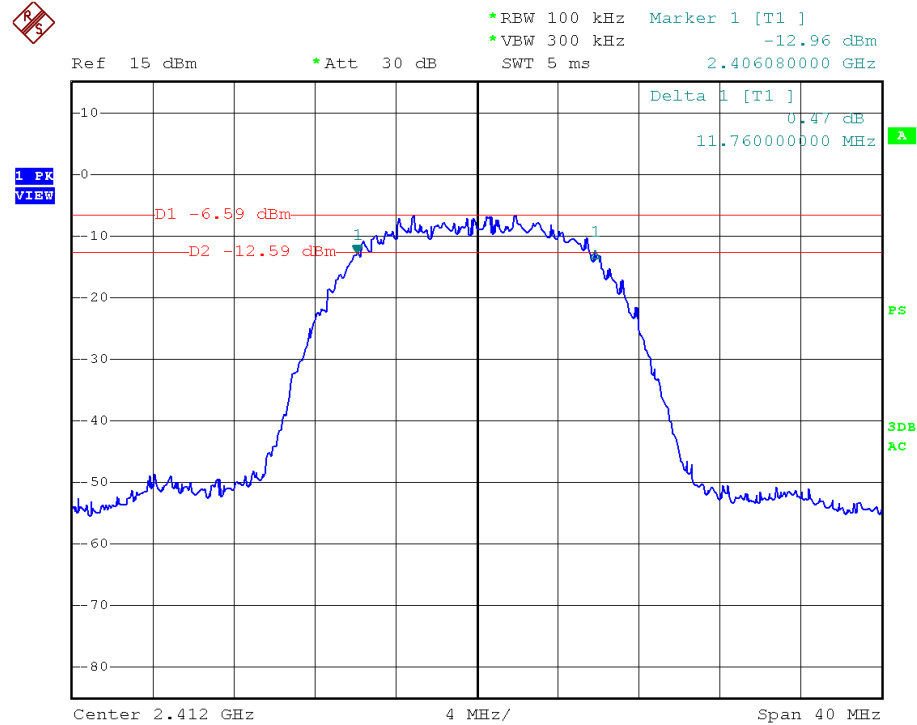
Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Results
Low	2412	17.68	>500	Pass
Mid	2437	17.68		Pass
High	2462	17.68		Pass

Test mode: IEEE 802.11n (HT40)

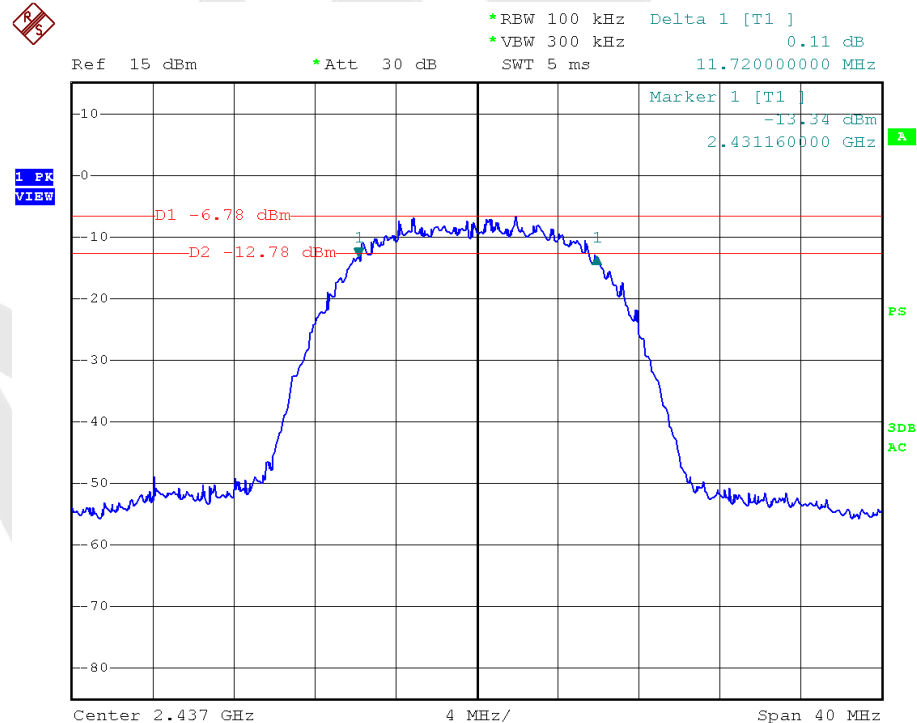
Channel	Frequency (MHz)	Bandwidth (MHz)	Limit (kHz)	Results
Low	2422	36.48	>500	Pass
Mid	2437	36.48		Pass
High	2452	36.48		Pass

Test Plots See the following page.

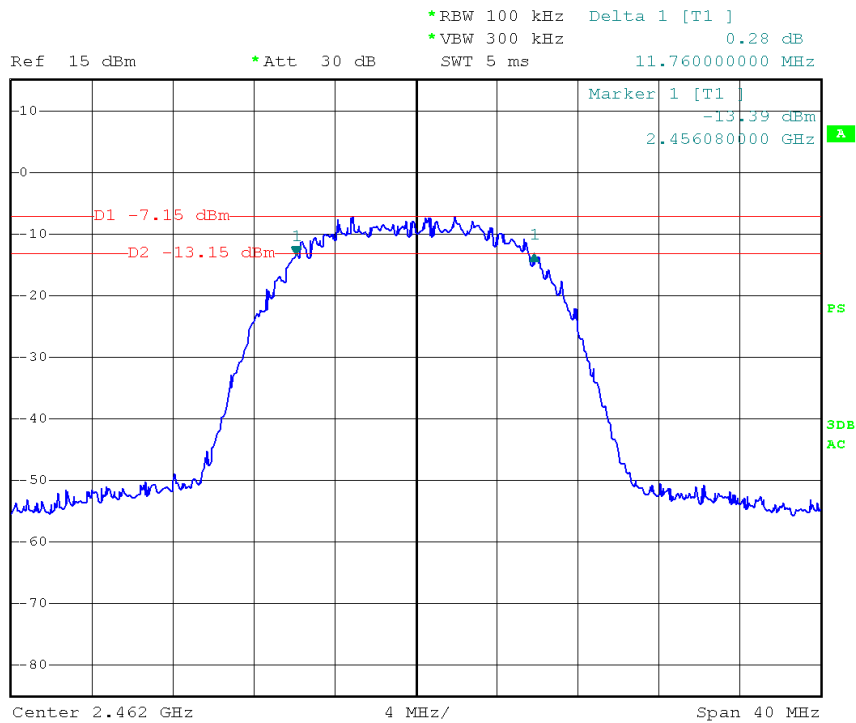
Test Mode: 802.11b---Low



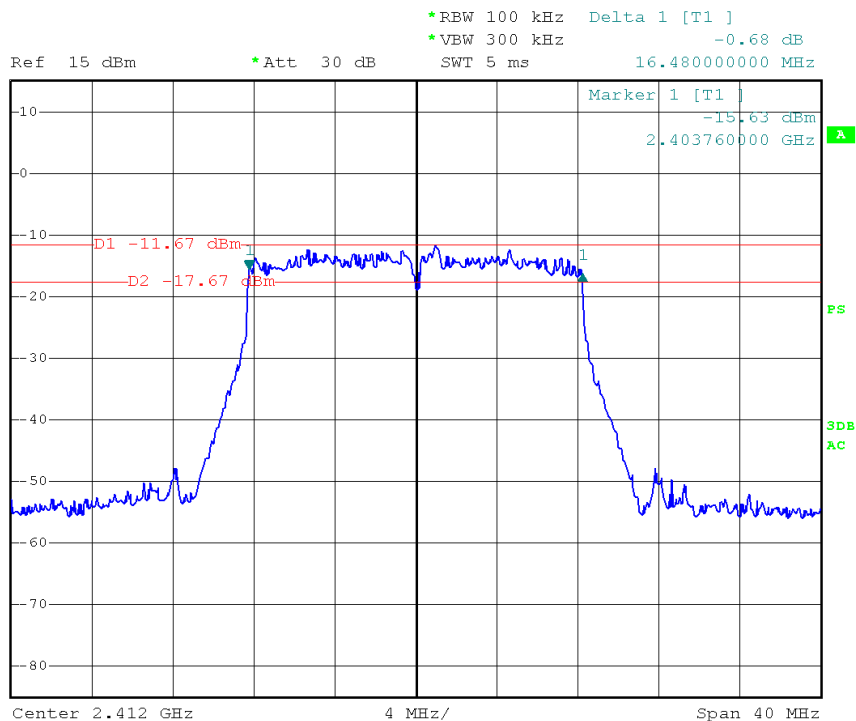
Test Mode: 802.11b---Mid



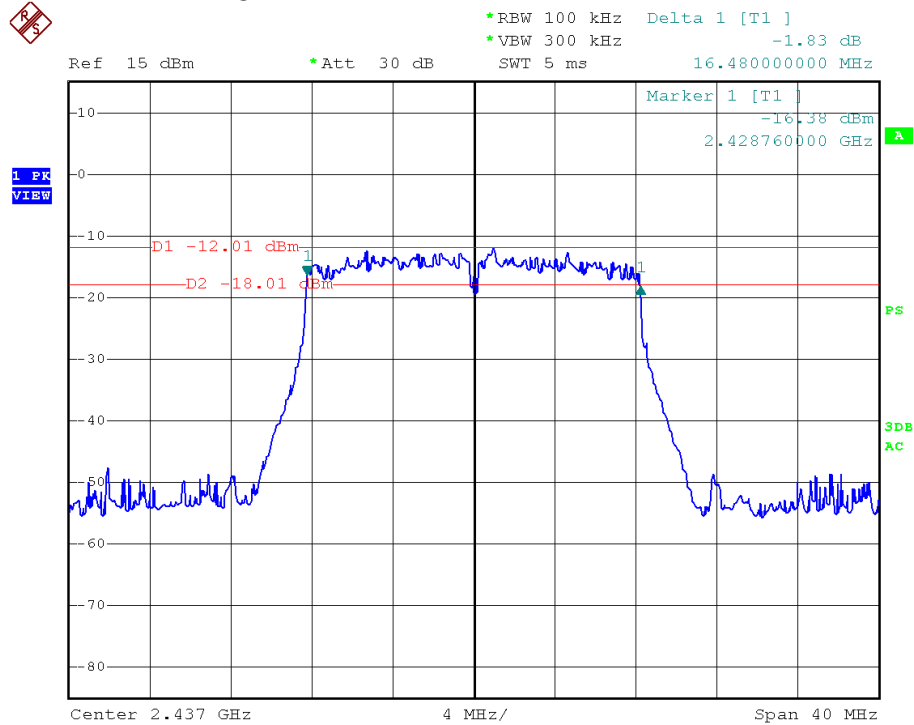
Test Mode: 802.11b---High



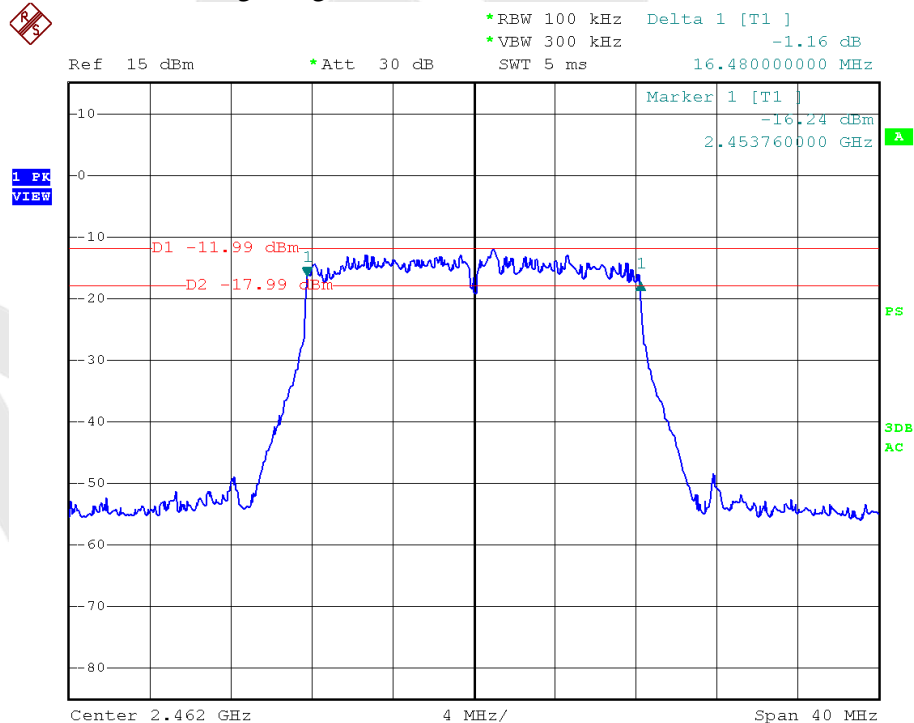
Test Mode: 802.11g---Low



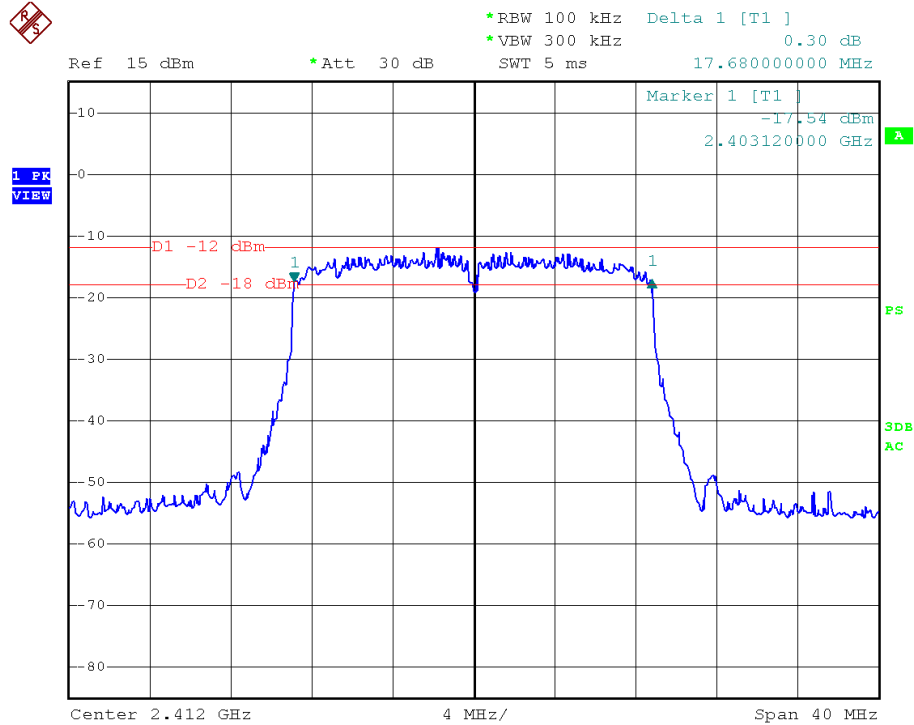
Test Mode: 802.11g---Mid



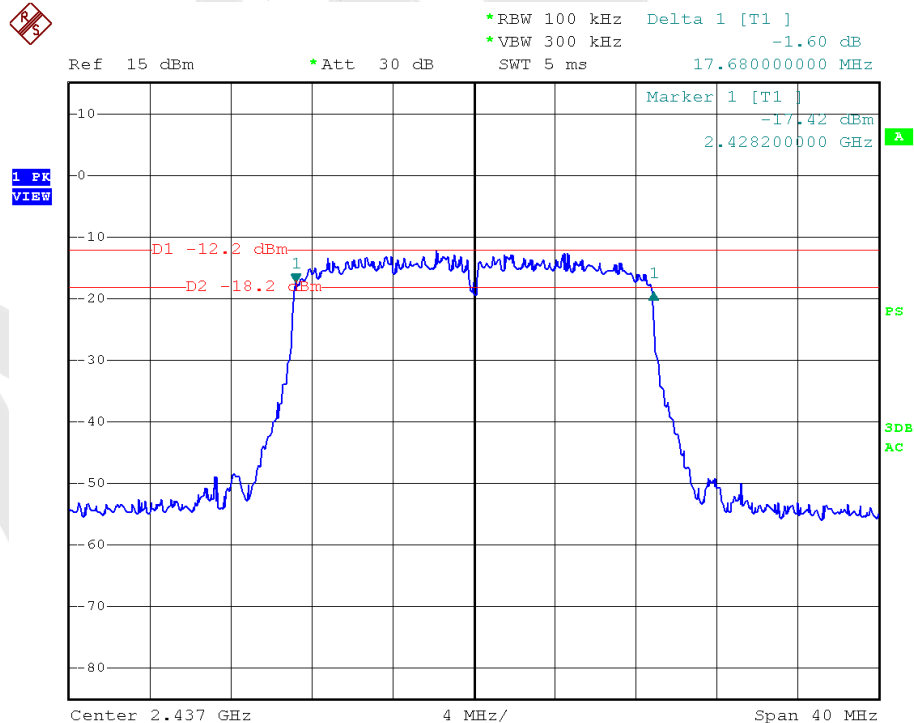
Test Mode: 802.11g---High



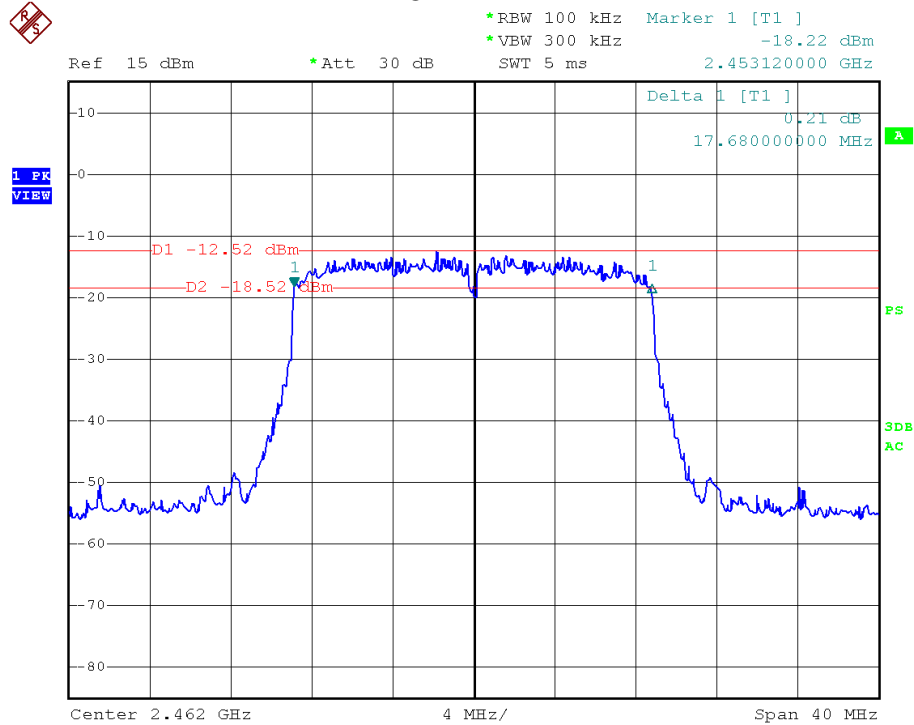
Test Mode: 802.11n (HT20)---Low



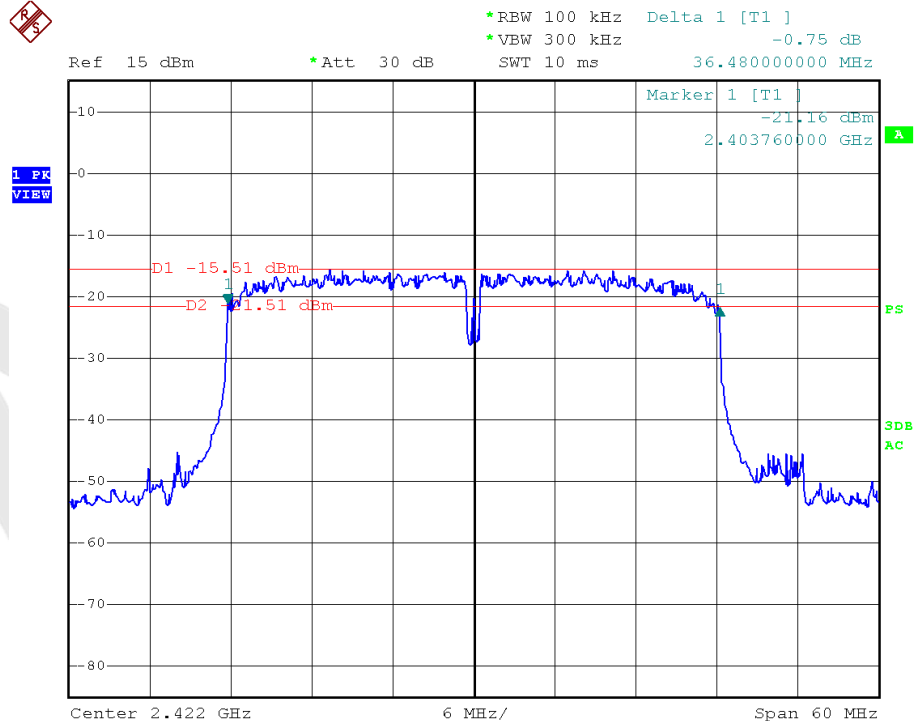
Test Mode: 802.11n (HT20)---Mid



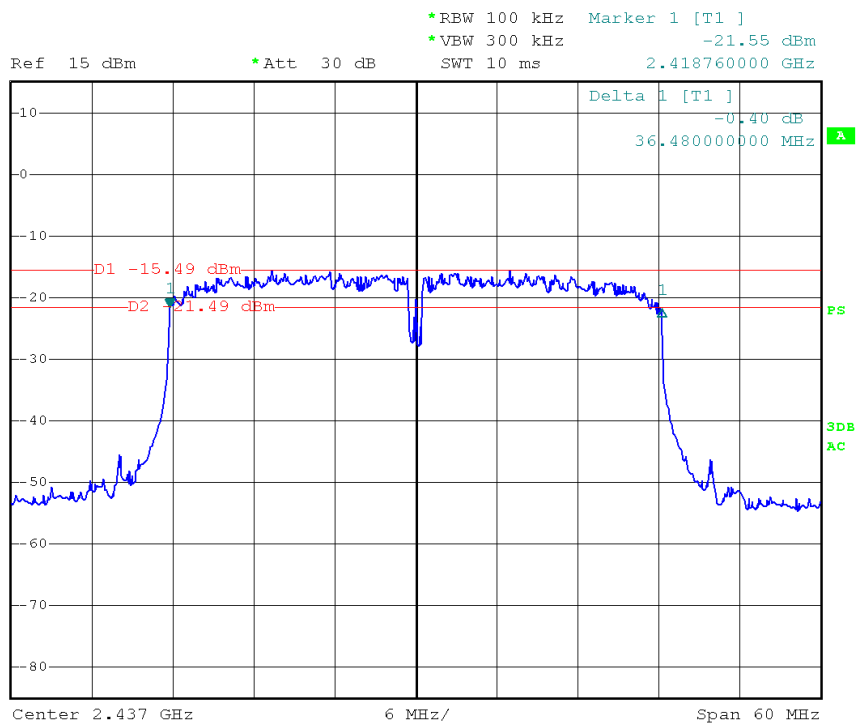
Test Mode: 802.11n (HT20)---High



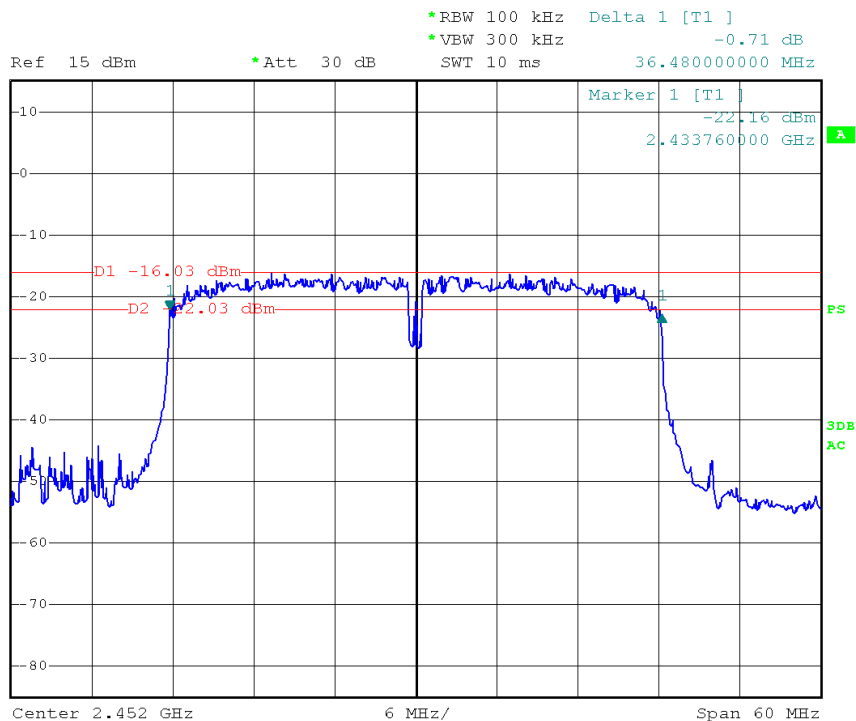
Test Mode: 802.11n (HT40)---Low



Test Mode: 802.11n (HT40)---Mid



Test Mode: 802.11n (HT40)---High



20dB Bandwidth

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (MHz)	Results
Low	2412	17.28	Pass
Mid	2437	17.28	Pass
High	2462	17.28	Pass

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Bandwidth (MHz)	Results
Low	2412	17.60	Pass
Mid	2437	17.60	Pass
High	2462	17.60	Pass

Test mode: IEEE 802.11n (HT20)

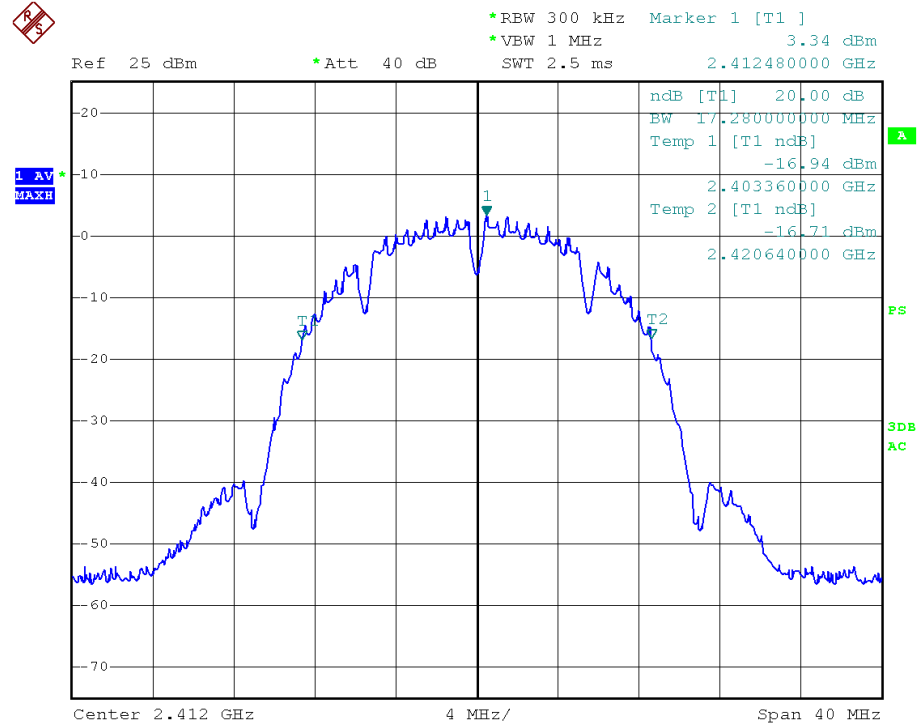
Channel	Frequency (MHz)	Bandwidth (MHz)	Results
Low	2412	18.88	Pass
Mid	2437	18.88	Pass
High	2462	18.88	Pass

Test mode: IEEE 802.11n (HT40)

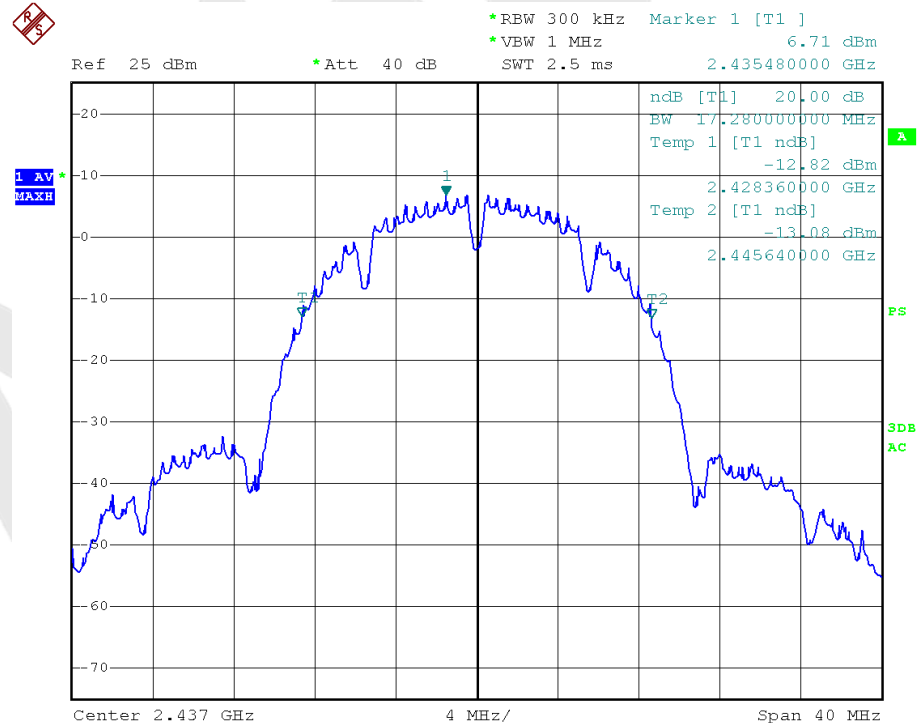
Channel	Frequency (MHz)	Bandwidth (MHz)	Results
Low	2422	37.76	Pass
Mid	2437	37.76	Pass
High	2452	37.92	Pass

Test Plots See the following page.

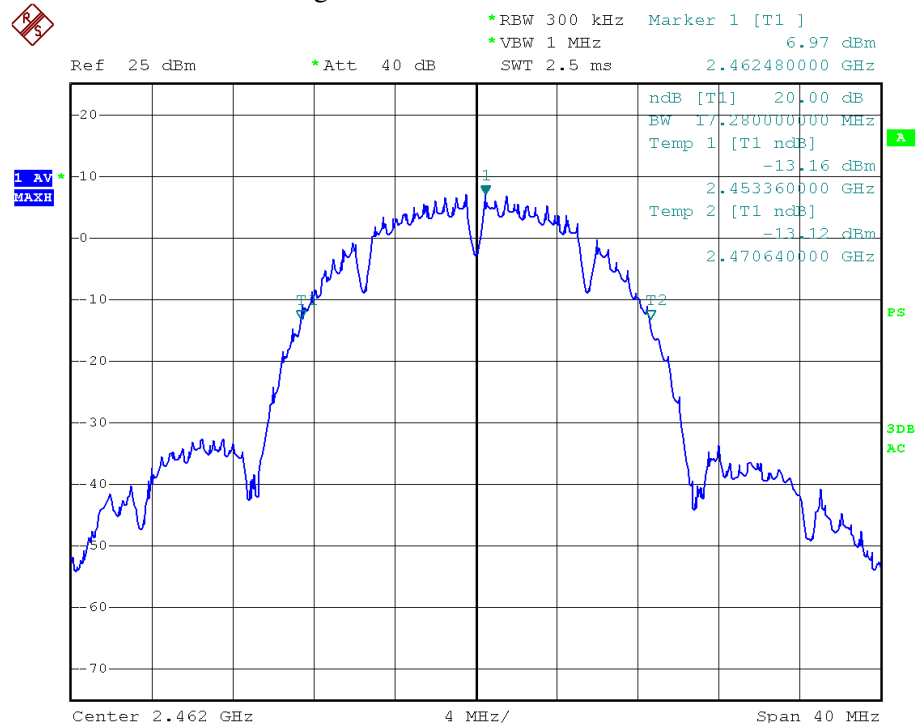
Test Mode: 802.11b---Low



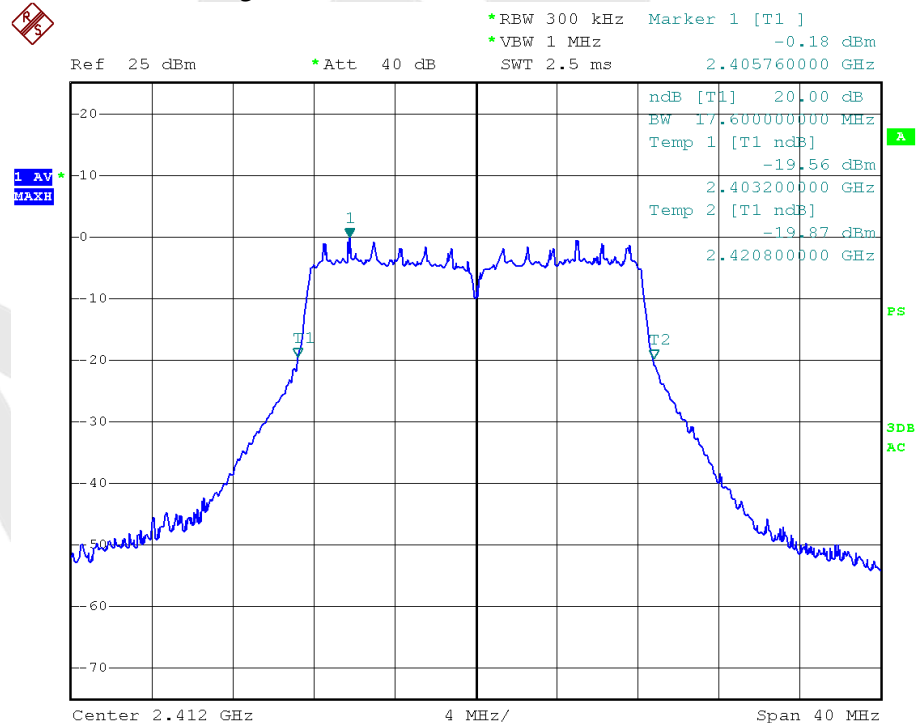
Test Mode: 802.11b---Mid



Test Mode: 802.11b---High



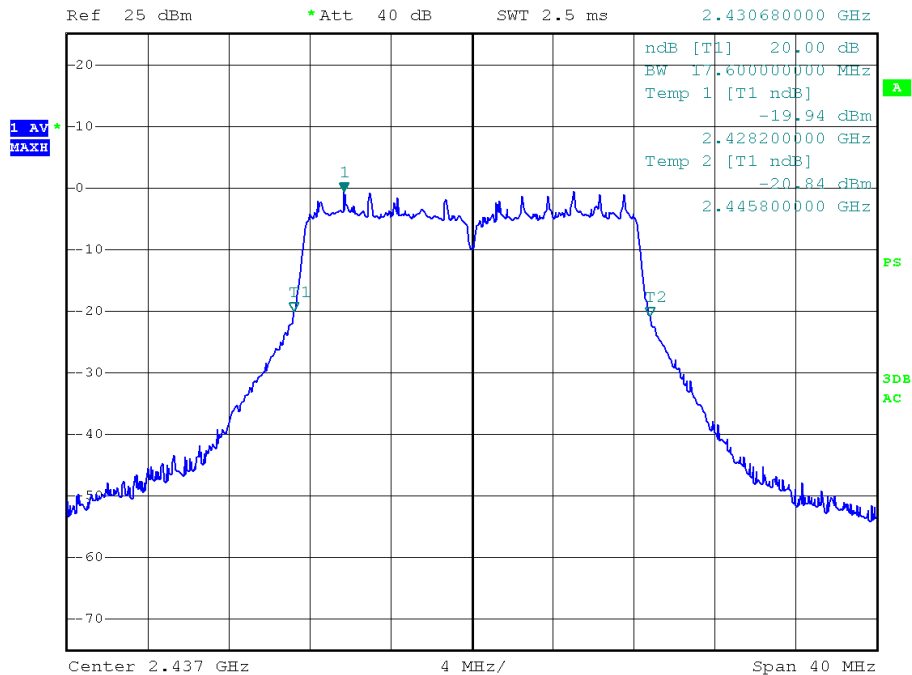
Test Mode: 802.11g---Low



Test Mode: 802.11g---Mid



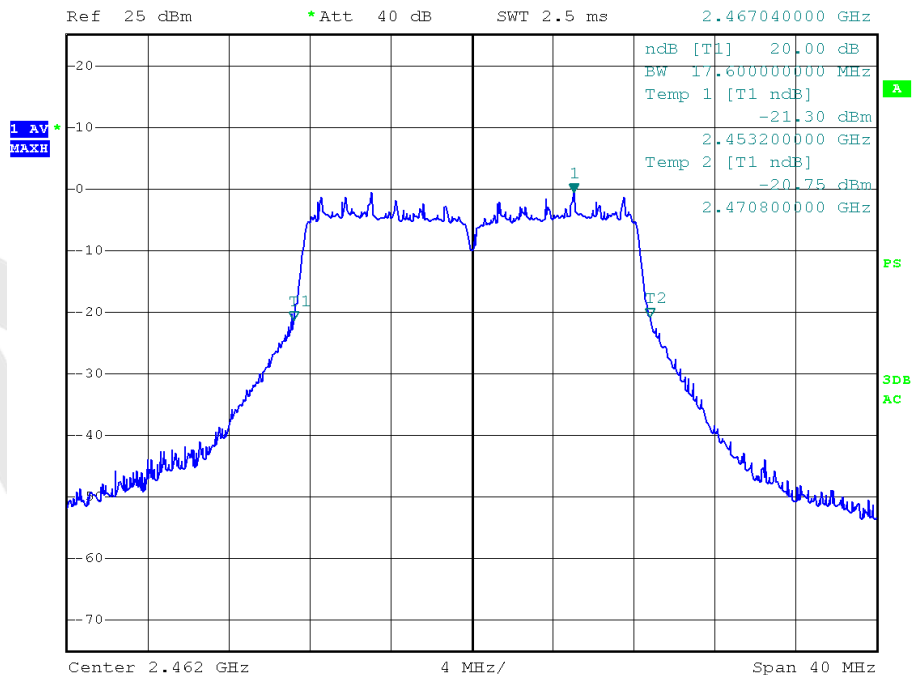
*RBW 300 kHz Marker 1 [T1]
*VBW 1 MHz -0.47 dBm
SWT 2.5 ms 2.43068000 GHz



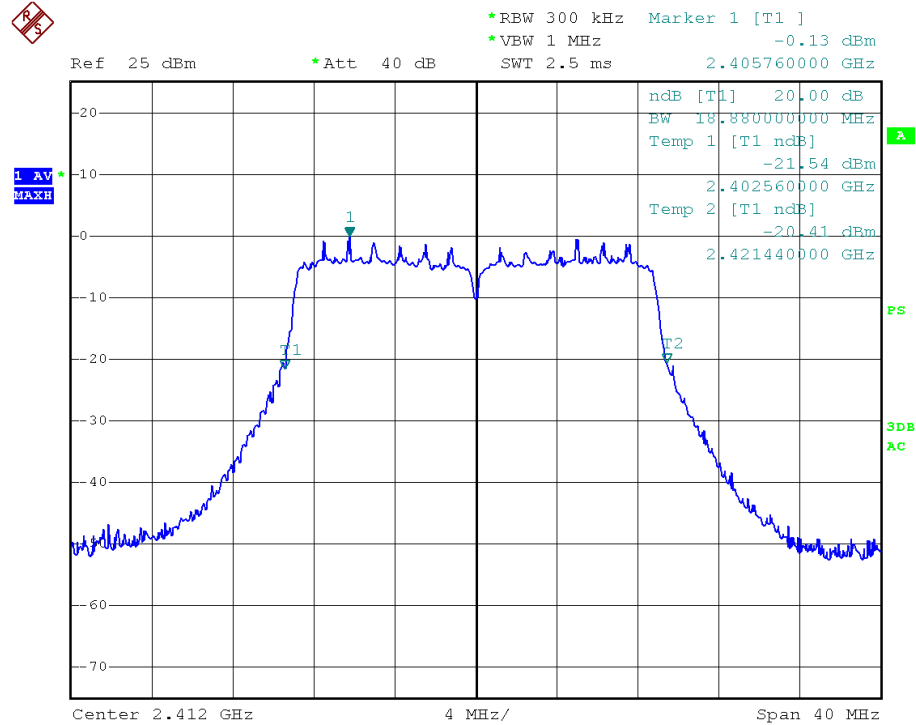
Test Mode: 802.11g---High



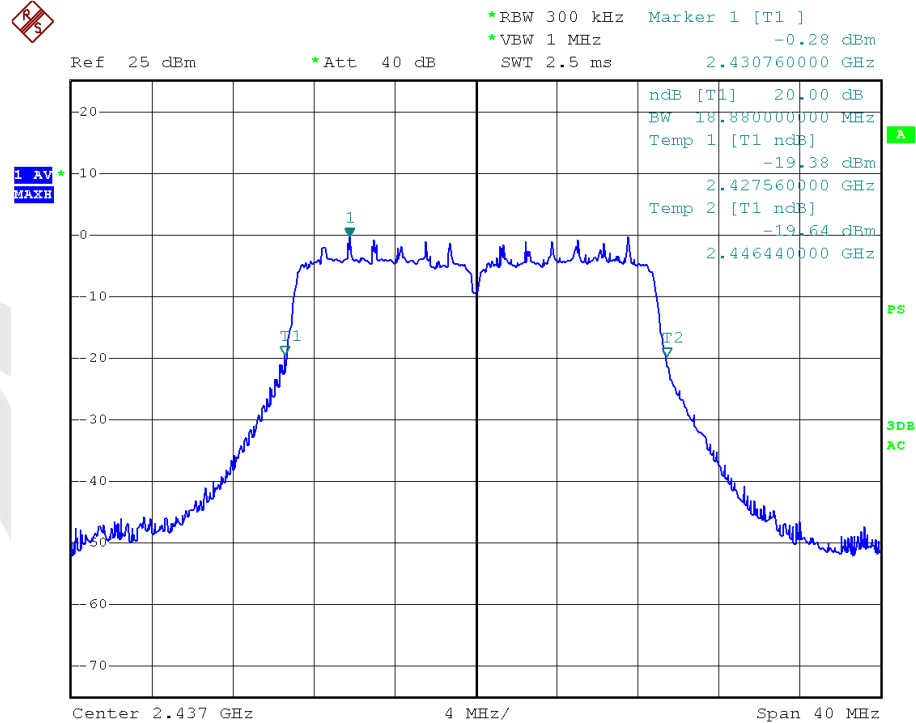
*RBW 300 kHz Marker 1 [T1]
*VBW 1 MHz -0.53 dBm
SWT 2.5 ms 2.467040000 GHz



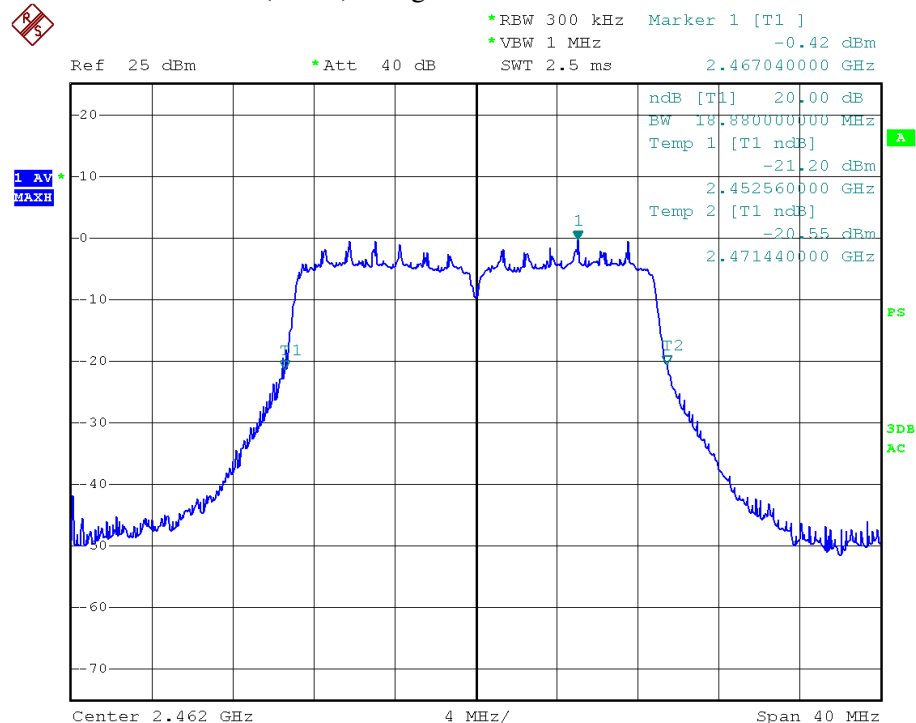
Test Mode: 802.11n (HT20)---Low



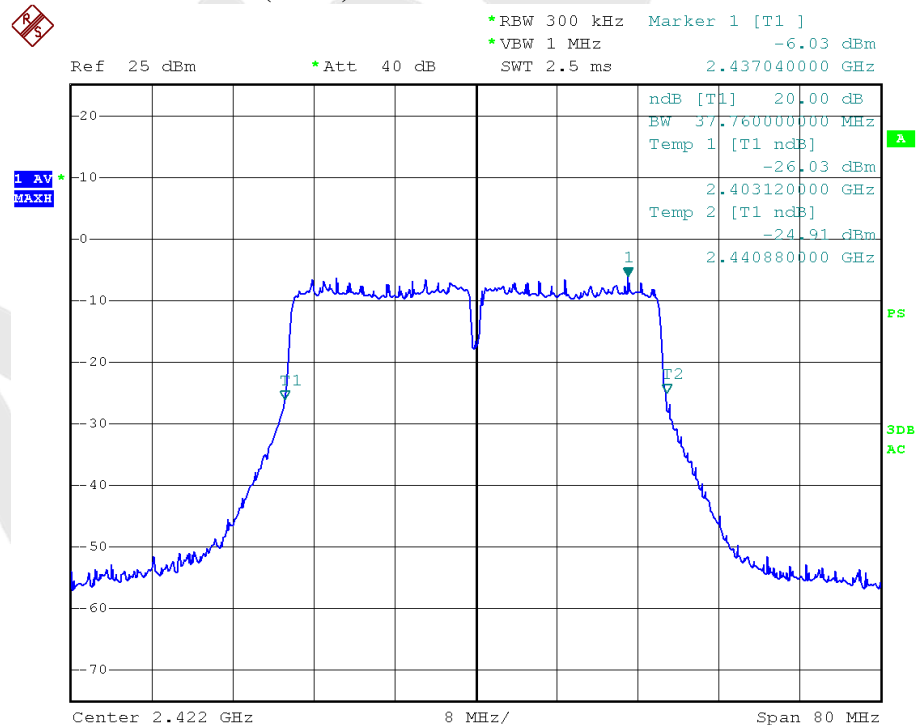
Test Mode: 802.11n (HT20)---Mid



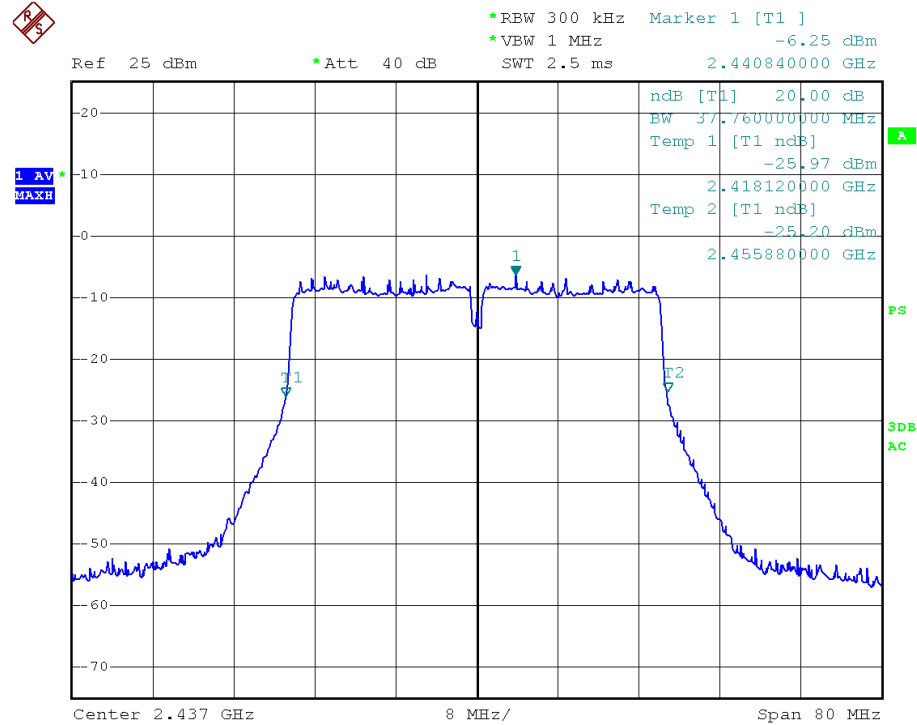
Test Mode: 802.11n (HT20)---High



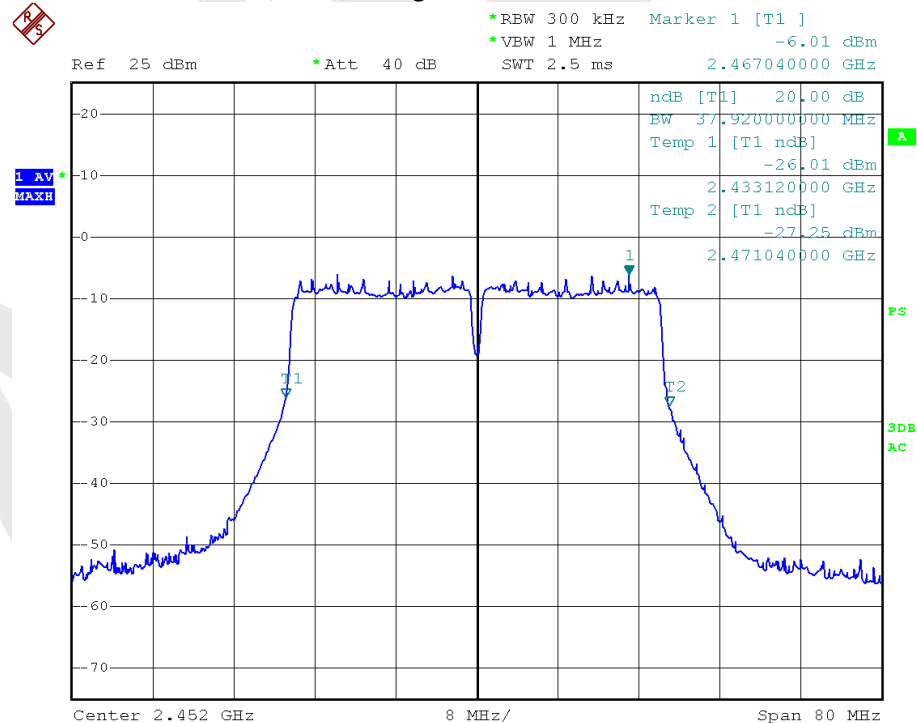
Test Mode: 802.11n (HT40)---Low



Test Mode: 802.11n (HT40)---Mid



Test Mode: 802.11n (HT40)---High



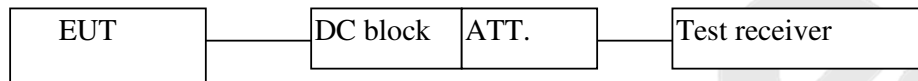
4.3. Maximum Output Power Test

a. Limit

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt (30dBm).
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antenna of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

b. Configuration of Measurement



c. Data Rates

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1 Mbps data rate (worst case) are chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6 Mbps data rate (the worst case) are chosen for the final testing.

IEEE802.11n (HT20: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6.5Mbps data rate (the worst case) are chosen for the final testing.

IEEE802.11n (HT40: Channel 3(2422MHz), Channel 6(2437MHz) and Channel 9(2452MHz) with 13.5Mbps data rate (the worst case) are chosen for the final testing.

d. Test Procedure

This test was according the kDB 558074 9.2.2:

1. Set span to at least 1.5 times the OBW.
2. Set the RBW =1~5% of the OBW, not to exceed 1MHz.
3. Set VBW $\geq 3 \times$ RBW.
4. Detector = Average.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

e. Test Equipment

Same as the equipment listed in 4.2.

f. Test Results

Pass.

g. Test Data

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Maximum transmit power	Limit		Result
		(dBm)	(dBm)	(watts)	
Low	2412	14.41	30	1	Pass
Mid	2437	14.94			Pass
High	2462	15.69			Pass

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	Maximum transmit power	Limit		Result
		(dBm)	(dBm)	(watts)	
Low	2412	10.72	30	1	Pass
Mid	2437	12.15			Pass
High	2462	12.40			Pass

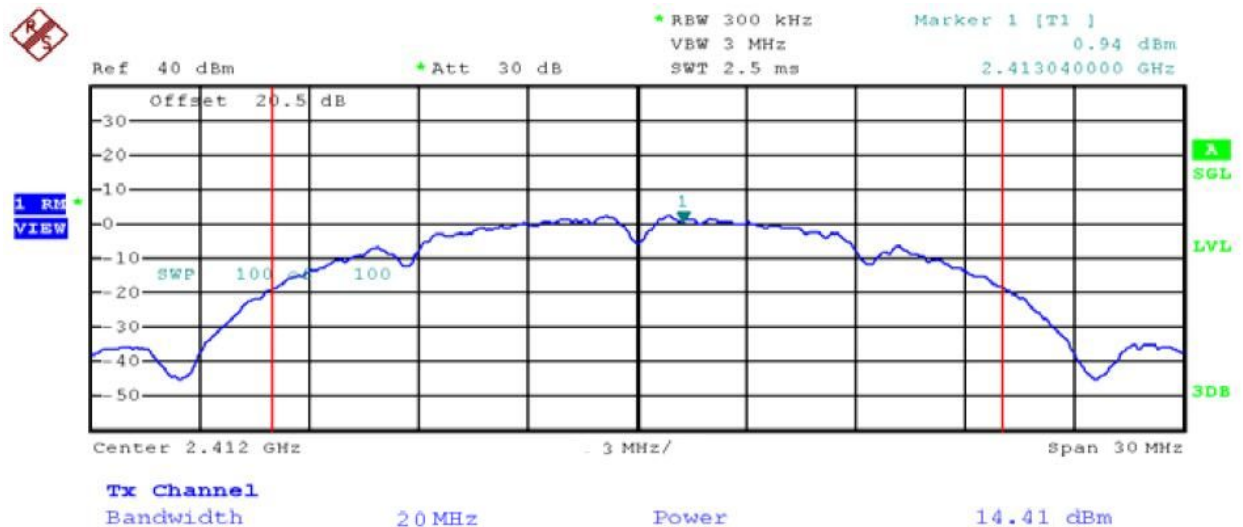
Test mode: IEEE 802.11n (HT20)

Channel	Frequency (MHz)	Maximum transmit power	Limit		Result
		(dBm)	(dBm)	(watts)	
Low	2412	10.97	30	1	Pass
Mid	2437	11.42			Pass
High	2462	12.20			Pass

Test mode: IEEE 802.11n (HT40)

Channel	Frequency (MHz)	Maximum transmit power	Limit		Result
		(dBm)	(dBm)	(watts)	
Low	2422	10.24	30	1	Pass
Mid	2437	10.77			Pass
High	2452	11.39			Pass

Test Mode: 802.11b---Low



Test Mode: 802.11b---Mid

