TEST REPORT

Reference No.	:	WTF19S11080817W001 V1
FCC ID	:	2AU8O-ICCWA1W
Applicant.....	:	HANGZHOU MULTI IR TECONOLOGY CO,.LTD.
Address.....	:	BULIDING 3, NO.503, XINGGUO ROAD, YUHANG, HANGZHOU, ZHEJIANG, CHINA
Manufacturer	:	The same as above
Address.....	:	The same as above
Product.....	:	Air Quality Monitor
Model(s).	:	IC-CWA1W
Brand Name.....	:	iClever
Standards.....	:	FCC CFR47 Part 15.247:2018
Date of Receipt sample	:	2019-11-21
Date of Test	:	2019-11-22 to 2019-12-16
Date of Issue.....	:	2019-12-19
Test Result.....	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:
Waltek Services (Shenzhen) Co., Ltd.
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400

Compiled by:

Ford Wang

Ford Wang / Project Engineer

Approved by:

Philo zhong

Philo Zhong / Manager

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF19S11080817W001	2019-11-21	2019-11-22 to 2019-12-16	2019-12-17	original	-	Replaced
WTF19S11080817W001 V1	2019-11-21	2019-11-22 to 2019-12-16	2019-12-19	Version 1	Updated	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Air Quality Monitor
Model(s):	IC-CWA1W
Model Description:	N/A
Wi-Fi Specification:	2.4G-802.11b/g/n HT20
Hardware Version:	MIR-PMT100-LED-A3P2 2018-04-23
Software Version:	ESP8266_RF_TEST_BIN_V130_26m_20190731

4.2 Details of E.U.T.

Operation Frequency:	802.11b/g/n HT20: 2412~2462MHz
Max. RF output power:	16.58dBm
Type of Modulation:	CCK, OFDM
Antenna installation:	internal permanent antenna
Antenna Gain:	2.0 dBi
Ratings:	DC 3.7V 1800mAh by battery

4.3 Channel List

WIFI

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462	12	-

4.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
Power Spectral Density	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
6dB Bandwidth	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
Band Edge	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
Transmitter Spurious Emissions	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX

Note :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product .

5 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.247(d) 15.205(a) 15.209(a)	PASS
Conducted Spurious Emissions	15.247(d)	PASS
Conducted Emissions	15.207(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS

Note：All test were performed that the device transmit continue of the 100% duty cycle.

6 Equipment Used during Test

6.1 Equipments List

Conducted Emissions Test Site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	100947	2019-09-12	2020-09-11
2.	LISN	R&S	ENV216	101215	2019-09-12	2020-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2019-09-12	2020-09-11
Conducted Emissions Test Site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	101155	2019-09-12	2020-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2019-09-12	2020-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2019-09-12	2020-09-11
4.	Cable	LARGE	RF300	-	2019-09-12	2020-09-11
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Spectrum Analyzer	R&S	FSP	100091	2019-04-29	2020-04-28
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2019-04-09	2020-04-08
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2019-04-09	2020-04-08
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2019-09-12	2020-09-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2019-04-09	2020-04-08
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2019-04-09	2020-04-08
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-13	2020-04-12
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2019-04-13	2020-04-12
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	2019-04-13	2020-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-04-09	2020-04-08
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2019-04-13	2020-04-12
4	Cable	HUBER+SUHNER	CBL2	525178	2019-04-13	2020-04-12

RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2019-09-12	2020-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2019-09-12	2020-09-11
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2019-09-12	2020-09-11

6.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

6.3 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	± 1 x 10^{-7}Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval：95%. Confidence factor:k=2	

6.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

7 Conducted Emission

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Class/Severity: Class B

Limit:

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15 to 0.	66 to 56*	56 to 46*
0.5 to 5	56	46
5 o 30	60	50

7.1 E.U.T. Operation

Operating Environment **:**

Temperature: 21.5 °C

Humidity: 51.9 % RH

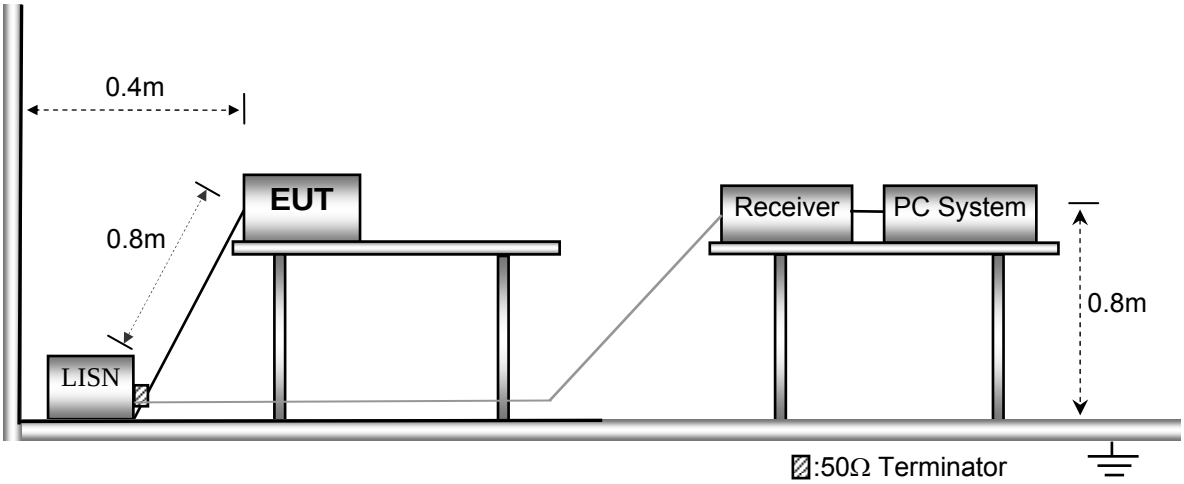
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

The test was performed in TX transmitting mode, the worst data were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10.



7.3 Measurement Description

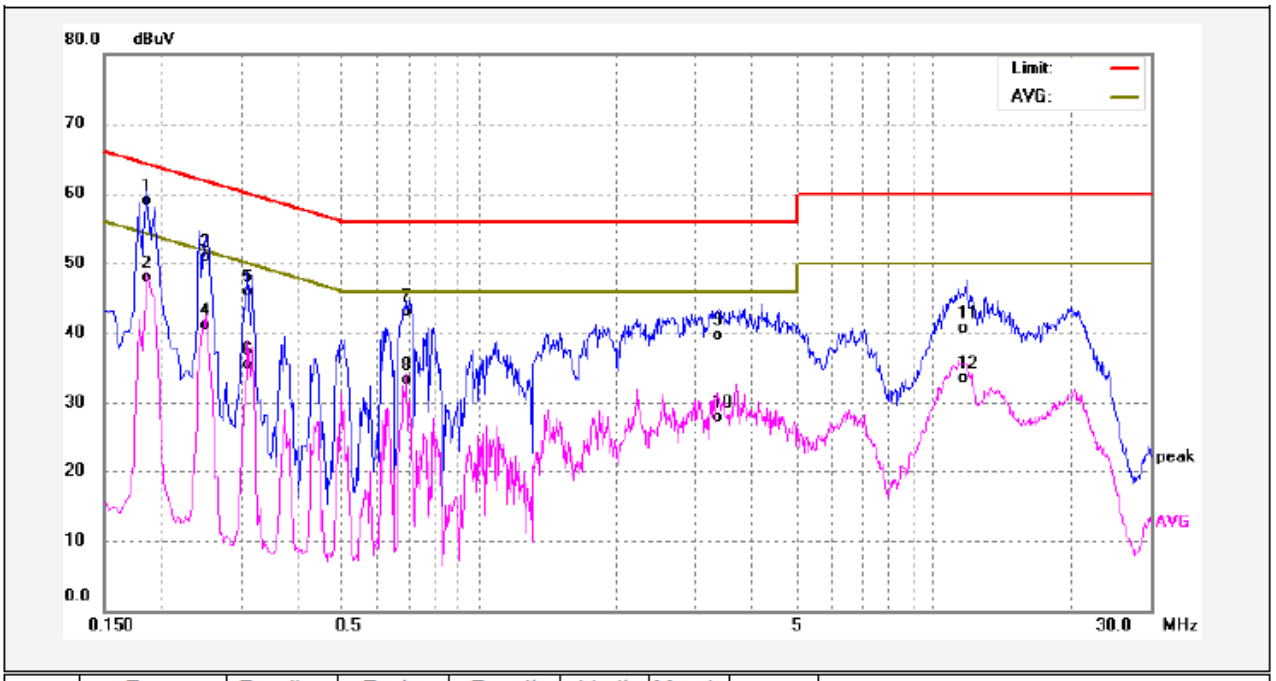
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

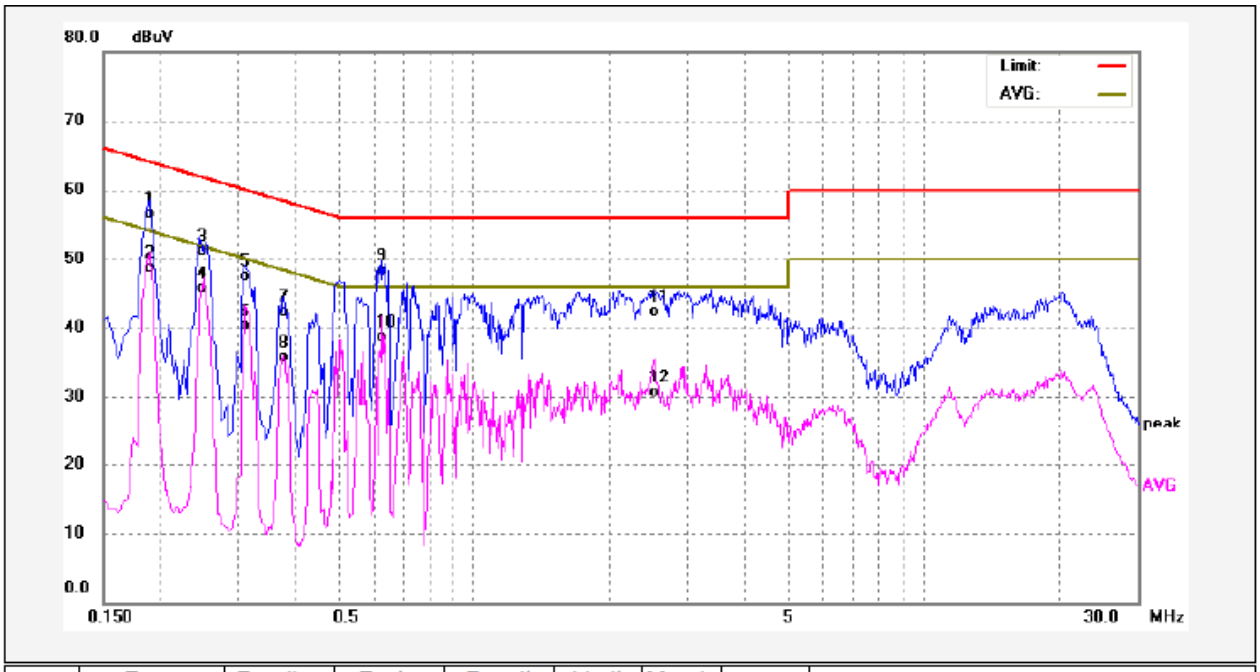
Worst Mode: WIFI mode (802.11b mode low channel)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1860	49.22	9.77	58.99	64.21	-5.22	QP	
2	0.1860	38.20	9.77	47.97	54.21	-6.24	AVG	
3	0.2500	41.20	9.76	50.96	61.75	-10.79	QP	
4	0.2500	31.44	9.76	41.20	51.75	-10.55	AVG	
5	0.3100	36.04	9.82	45.86	59.97	-14.11	QP	
6	0.3100	25.68	9.82	35.50	49.97	-14.47	AVG	
7	0.6940	33.29	9.83	43.12	56.00	-12.88	QP	
8	0.6940	23.45	9.83	33.28	46.00	-12.72	AVG	
9	3.3660	29.69	9.93	39.62	56.00	-16.38	QP	
10	3.3660	17.91	9.93	27.84	46.00	-18.16	AVG	
11	11.7820	30.54	10.09	40.63	60.00	-19.37	QP	
12	11.7820	23.49	10.09	33.58	50.00	-16.42	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1900	46.76	9.77	56.53	64.03	-7.50	QP	
2	0.1900	38.92	9.77	48.69	54.03	-5.34	AVG	
3	0.2500	41.27	9.76	51.03	61.75	-10.72	QP	
4	0.2500	35.92	9.76	45.68	51.75	-6.07	AVG	
5	0.3100	37.63	9.82	47.45	59.97	-12.52	QP	
6	0.3100	30.43	9.82	40.25	49.97	-9.72	AVG	
7	0.3780	32.39	9.82	42.21	58.32	-16.11	QP	
8	0.3780	25.95	9.82	35.77	48.32	-12.55	AVG	
9	0.6260	38.39	9.84	48.23	56.00	-7.77	QP	
10	0.6260	28.91	9.84	38.75	46.00	-7.25	AVG	
11	2.5380	32.30	9.94	42.24	56.00	-13.76	QP	
12	2.5380	20.75	9.94	30.69	46.00	-15.31	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019; ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

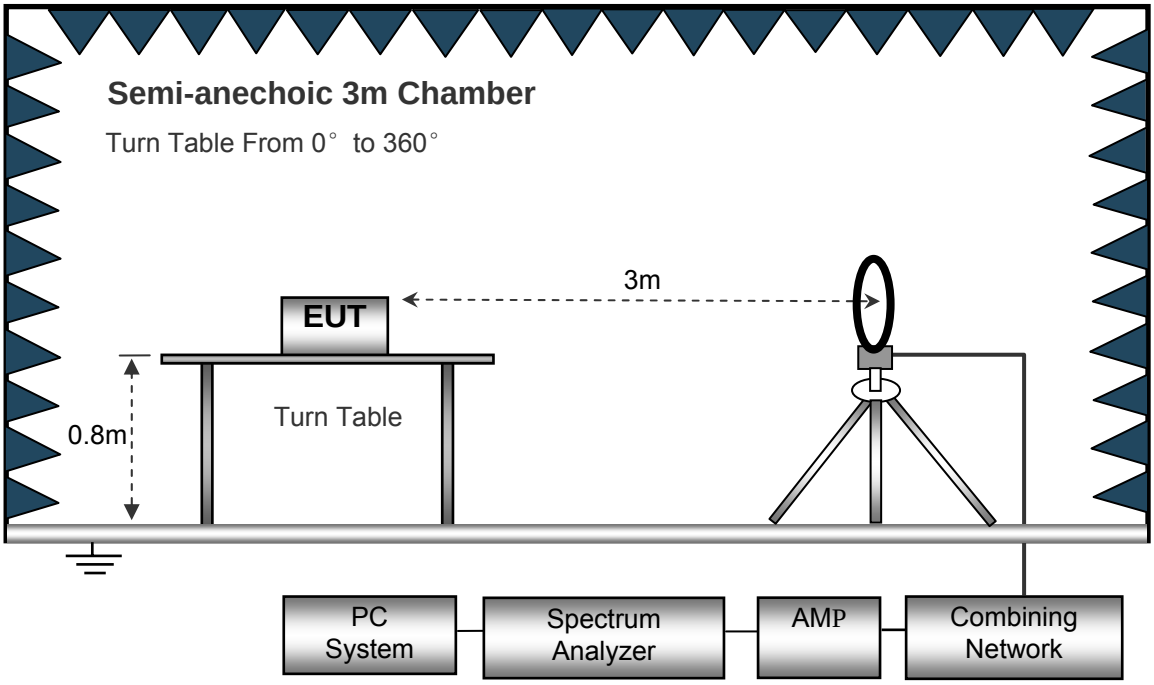
EUT Operation :

The test was performed in TX transmitting mode, the test data were shown in the report.

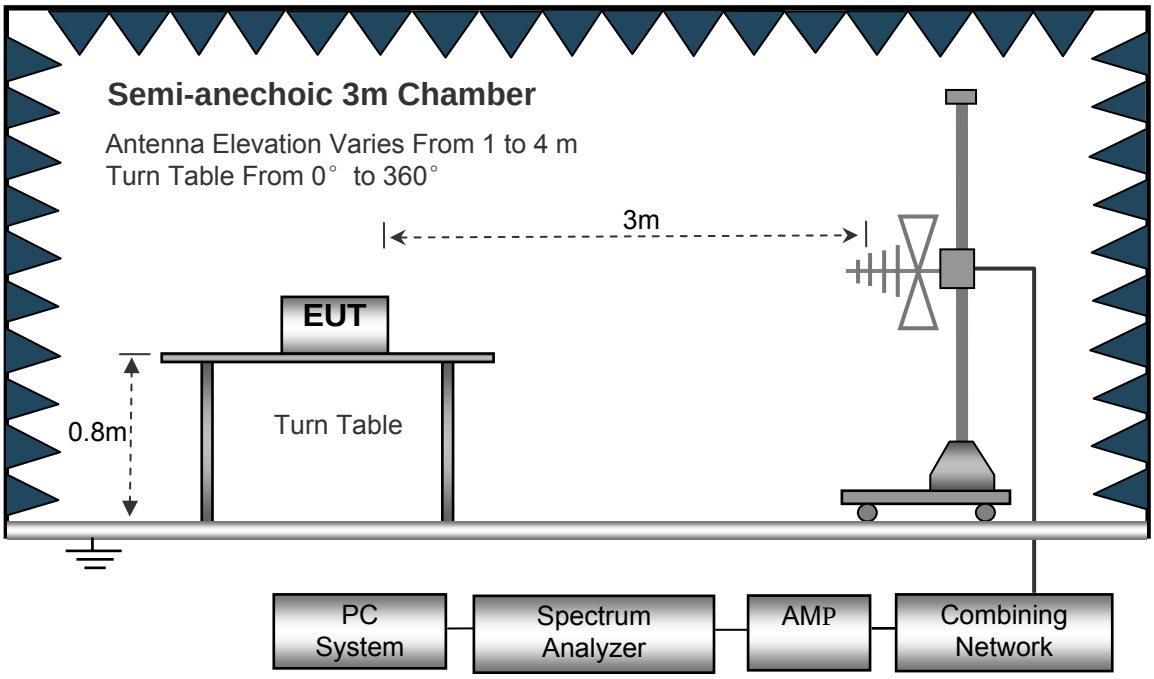
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10.

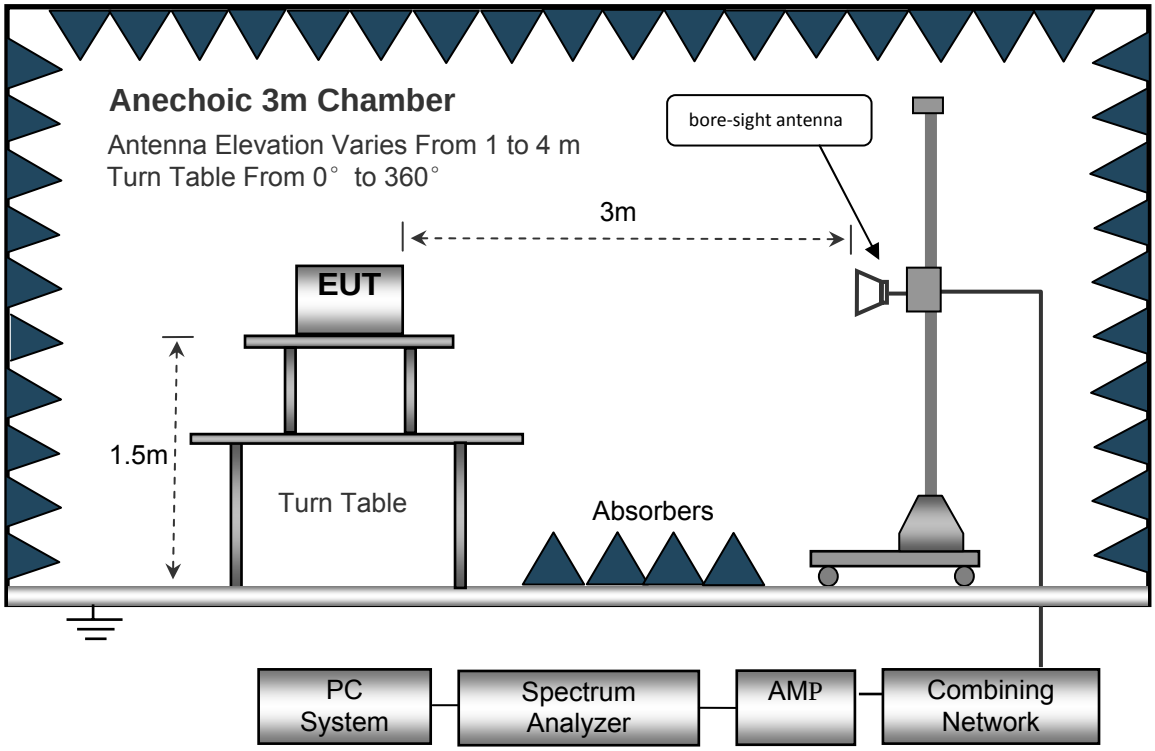
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz
Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in Z axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used druing radiated emissions above 1GHz measurement.

8.5 Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

8.6 Summary of Test Results

Wifi:
Test Frequency: 9KHz~30MHz

Remark: only the worst data (802.11b/g/n Low channel mode) were recorded.

Frequency	Measurement results dBμV @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dBμV/m @30m	Limits dBμV/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
802.11b							
6.021	25.10	QP	21.84	40.00	6.94	29.54	-22.60
15.730	24.66	QP	21.35	40.00	6.01	29.54	-23.53
25.680	25.39	QP	20.67	40.00	6.06	29.54	-23.48
802.11g							
6.021	25.93	QP	21.84	40.00	7.77	29.54	-21.77
15.730	24.61	QP	21.35	40.00	5.96	29.54	-23.58
25.680	25.10	QP	20.67	40.00	5.77	29.54	-23.77
802.11n(HT20)							
6.021	24.85	QP	21.84	40.00	6.69	29.54	-22.85
15.730	25.44	QP	21.35	40.00	6.79	29.54	-22.75
25.680	26.57	QP	20.67	40.00	7.24	29.54	-22.30

Test Frequency : 30MHz ~ 8GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Low Channel 2412MHz									
223.45	39.77	QP	15	2.0	H	-11.62	28.15	46.00	-17.85
223.45	37.85	QP	79	1.8	V	-11.62	26.23	46.00	-19.77
4824.00	50.87	PK	142	2.0	V	-1.06	49.81	74.00	-24.19
4824.00	46.35	Ave	142	2.0	V	-1.06	45.29	54.00	-8.71
7236.00	41.17	PK	228	1.8	H	1.33	42.50	74.00	-31.50
7236.00	43.64	Ave	228	1.8	H	1.33	44.97	54.00	-9.03
2334.42	45.03	PK	262	1.4	V	-13.19	31.84	74.00	-42.16
2334.42	37.64	Ave	262	1.4	V	-13.19	24.45	54.00	-29.55
2356.74	43.51	PK	340	1.0	H	-13.14	30.37	74.00	-43.63
2356.74	36.32	Ave	340	1.0	H	-13.14	23.18	54.00	-30.82
2485.80	42.15	PK	187	1.4	V	-13.08	29.07	74.00	-44.93
2485.80	37.45	Ave	187	1.4	V	-13.08	24.37	54.00	-29.63

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Middle Channel 2437MHz									
223.45	39.47	QP	135	1.4	H	-11.62	27.85	46.00	-18.15
223.45	39.10	QP	59	2.0	V	-11.62	27.48	46.00	-18.52
4874.00	50.82	PK	170	1.2	V	-0.62	50.20	74.00	-23.80
4874.00	47.30	Ave	170	1.2	V	-0.62	46.68	54.00	-7.32
7311.00	40.17	PK	337	1.7	H	2.21	42.38	74.00	-31.62
7311.00	43.35	Ave	337	1.7	H	2.21	45.56	54.00	-8.44
2317.23	46.87	PK	302	1.1	V	-13.19	33.68	74.00	-40.32
2317.23	39.83	Ave	302	1.1	V	-13.19	26.64	54.00	-27.36
2352.68	44.12	PK	218	1.2	H	-13.14	30.98	74.00	-43.02
2352.68	38.48	Ave	218	1.2	H	-13.14	25.34	54.00	-28.66
2489.82	44.10	PK	132	1.3	V	-13.08	31.02	74.00	-42.98
2489.82	37.83	Ave	132	1.3	V	-13.08	24.75	54.00	-29.25

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: High Channel 2462MHz									
223.45	38.79	QP	268	1.2	H	-11.62	27.17	46.00	-18.83
223.45	39.63	QP	86	1.7	V	-11.62	28.01	46.00	-17.99
4924.00	50.23	PK	333	1.7	V	-0.24	49.99	74.00	-24.01
4924.00	46.94	Ave	333	1.7	V	-0.24	46.70	54.00	-7.30
7386.00	40.01	PK	230	1.5	H	2.84	42.85	74.00	-31.15
7386.00	42.22	Ave	230	1.5	H	2.84	45.06	54.00	-8.94
2324.70	46.94	PK	229	1.1	V	-13.19	33.75	74.00	-40.25
2324.70	37.52	Ave	229	1.1	V	-13.19	24.33	54.00	-29.67
2355.30	42.07	PK	77	1.5	H	-13.14	28.93	74.00	-45.07
2355.30	36.67	Ave	77	1.5	H	-13.14	23.53	54.00	-30.47
2498.25	42.75	PK	279	1.5	V	-13.08	29.67	74.00	-44.33
2498.25	36.34	Ave	279	1.5	V	-13.08	23.26	54.00	-30.74

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: Low Channel 2412MHz									
223.45	37.95	QP	123	1.4	H	-11.62	26.33	46.00	-19.67
223.45	40.59	QP	301	1.6	V	-11.62	28.97	46.00	-17.03
4824.00	48.84	PK	117	1.3	V	-1.06	47.78	74.00	-26.22
4824.00	47.71	Ave	117	1.3	V	-1.06	46.65	54.00	-7.35
7236.00	39.55	PK	289	1.8	H	1.33	40.88	74.00	-33.12
7236.00	42.56	Ave	289	1.8	H	1.33	43.89	54.00	-10.11
2337.92	46.10	PK	8	1.2	V	-13.19	32.91	74.00	-41.09
2337.92	37.00	Ave	8	1.2	V	-13.19	23.81	54.00	-30.19
2373.21	42.57	PK	148	1.9	H	-13.14	29.43	74.00	-44.57
2373.21	36.79	Ave	148	1.9	H	-13.14	23.65	54.00	-30.35
2493.87	42.61	PK	99	1.5	V	-13.08	29.53	74.00	-44.47
2493.87	38.18	Ave	99	1.5	V	-13.08	25.10	54.00	-28.90

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: Middle Channel 2437MHz									
223.45	36.93	QP	171	1.1	H	-11.62	25.31	46.00	-20.69
223.45	39.24	QP	63	1.4	V	-11.62	27.62	46.00	-18.38
4874.00	49.01	PK	292	1.4	V	-0.62	48.39	74.00	-25.61
4874.00	49.03	Ave	292	1.4	V	-0.62	48.41	54.00	-5.59
7311.00	38.33	PK	289	1.5	H	2.21	40.54	74.00	-33.46
7311.00	42.57	Ave	289	1.5	H	2.21	44.78	54.00	-9.22
2315.12	45.40	PK	93	1.8	V	-13.19	32.21	74.00	-41.79
2315.12	39.29	Ave	93	1.8	V	-13.19	26.10	54.00	-27.90
2365.76	44.65	PK	216	1.4	H	-13.14	31.51	74.00	-42.49
2365.76	38.06	Ave	216	1.4	H	-13.14	24.92	54.00	-29.08
2495.89	43.48	PK	315	2.0	V	-13.08	30.40	74.00	-43.60
2495.89	38.84	Ave	315	2.0	V	-13.08	25.76	54.00	-28.24

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: High Channel 2462MHz									
223.45	38.28	QP	190	1.6	H	-11.62	26.66	46.00	-19.34
223.45	38.27	QP	70	2.0	V	-11.62	26.65	46.00	-19.35
4924.00	49.13	PK	175	1.5	V	-0.24	48.89	74.00	-25.11
4924.00	48.92	Ave	175	1.5	V	-0.24	48.68	54.00	-5.32
7386.00	37.13	PK	237	1.3	H	2.84	39.97	74.00	-34.03
7386.00	43.60	Ave	237	1.3	H	2.84	46.44	54.00	-7.56
2320.08	45.29	PK	253	1.8	V	-13.19	32.10	74.00	-41.90
2320.08	37.24	Ave	253	1.8	V	-13.19	24.05	54.00	-29.95
2362.65	42.94	PK	54	1.8	H	-13.14	29.80	74.00	-44.20
2362.65	36.55	Ave	54	1.8	H	-13.14	23.41	54.00	-30.59
2493.24	42.46	PK	220	2.0	V	-13.08	29.38	74.00	-44.62
2493.24	38.73	Ave	220	2.0	V	-13.08	25.65	54.00	-28.35

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: Low Channel 2412MHz									
223.45	39.44	QP	341	2.0	H	-11.62	27.82	46.00	-18.18
223.45	36.86	QP	351	1.4	V	-11.62	25.24	46.00	-20.76
4824.00	49.58	PK	189	1.6	V	-1.06	48.52	74.00	-25.48
4824.00	49.56	Ave	189	1.6	V	-1.06	48.50	54.00	-5.50
7236.00	37.93	PK	246	1.8	H	1.33	39.26	74.00	-34.74
7236.00	43.05	Ave	246	1.8	H	1.33	44.38	54.00	-9.62
2312.57	46.65	PK	79	1.1	V	-13.19	33.46	74.00	-40.54
2312.57	39.54	Ave	79	1.1	V	-13.19	26.35	54.00	-27.65
2358.60	43.37	PK	274	1.7	H	-13.14	30.23	74.00	-43.77
2358.60	37.83	Ave	274	1.7	H	-13.14	24.69	54.00	-29.31
2498.49	43.78	PK	296	1.0	V	-13.08	30.70	74.00	-43.30
2498.49	36.81	Ave	296	1.0	V	-13.08	23.73	54.00	-30.27

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: Middle Channel 2437MHz									
223.45	39.43	QP	289	1.0	H	-11.62	27.81	46.00	-18.19
223.45	36.04	QP	76	1.3	V	-11.62	24.42	46.00	-21.58
4874.00	48.67	PK	167	1.1	V	-0.62	48.05	74.00	-25.95
4874.00	49.31	Ave	167	1.1	V	-0.62	48.69	54.00	-5.31
7311.00	38.41	PK	274	1.7	H	2.21	40.62	74.00	-33.38
7311.00	43.66	Ave	274	1.7	H	2.21	45.87	54.00	-8.13
2341.89	45.73	PK	86	1.9	V	-13.19	32.54	74.00	-41.46
2341.89	37.38	Ave	86	1.9	V	-13.19	24.19	54.00	-29.81
2365.96	44.40	PK	122	1.7	H	-13.14	31.26	74.00	-42.74
2365.96	38.13	Ave	122	1.7	H	-13.14	24.99	54.00	-29.01
2499.34	44.94	PK	288	1.9	V	-13.08	31.86	74.00	-42.14
2499.34	38.65	Ave	288	1.9	V	-13.08	25.57	54.00	-28.43

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: High Channel 2462MHz									
223.45	38.58	QP	291	1.6	H	-11.62	26.96	46.00	-19.04
223.45	36.80	QP	193	1.2	V	-11.62	25.18	46.00	-20.82
4924.00	47.55	PK	255	1.9	V	-0.24	47.31	74.00	-26.69
4924.00	50.49	Ave	255	1.9	V	-0.24	50.25	54.00	-3.75
7386.00	37.23	PK	159	1.6	H	2.84	40.07	74.00	-33.93
7386.00	42.59	Ave	159	1.6	H	2.84	45.43	54.00	-8.57
2325.69	46.26	PK	291	1.2	V	-13.19	33.07	74.00	-40.93
2325.69	37.78	Ave	291	1.2	V	-13.19	24.59	54.00	-29.41
2385.72	42.51	PK	326	1.4	H	-13.14	29.37	74.00	-44.63
2385.72	38.76	Ave	326	1.4	H	-13.14	25.62	54.00	-28.38
2496.82	42.32	PK	206	1.6	V	-13.08	29.24	74.00	-44.76
2496.82	37.56	Ave	206	1.6	V	-13.08	24.48	54.00	-29.52

Test Frequency: 8GHz~25GHz

The measurements were more than 20 dB below the limit and not reported.

9 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

Test Result: PASS

Limit:

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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

9.1 Test Procedure

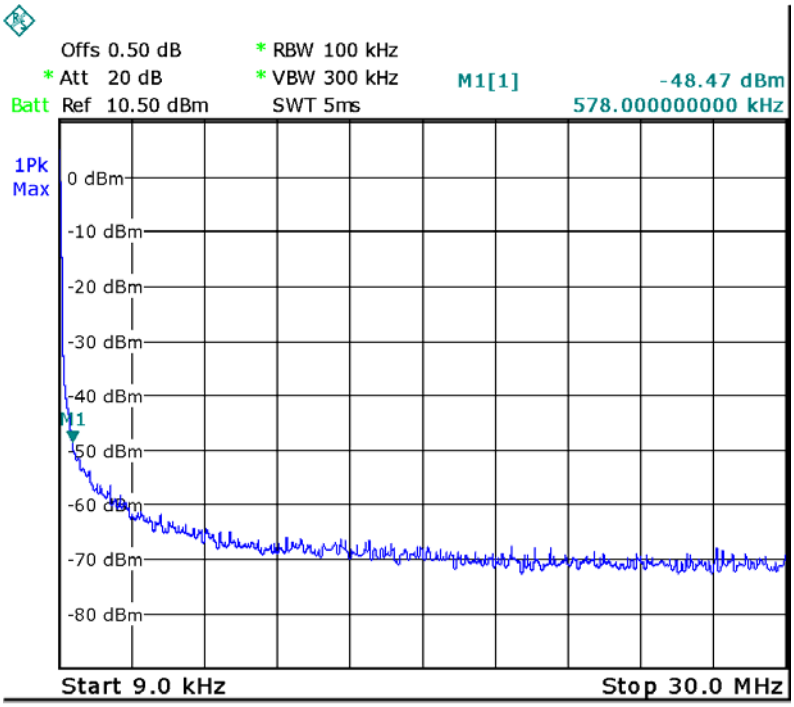
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
   a) Set instrument center frequency to DTS channel center frequency.
   b) Set the span to _ 1.5 times the DTS bandwidth.
   c) Set the RBW = 100 kHz.
   d) Set the VBW _ [3 × RBW].
   e) Detector = peak.
   f) Sweep time = auto couple.
   g) Trace mode = max hold.
   h) Allow trace to fully stabilize.
   i) Use the peak marker function to determine the maximum PSD level.
   Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

9.2 Test Result

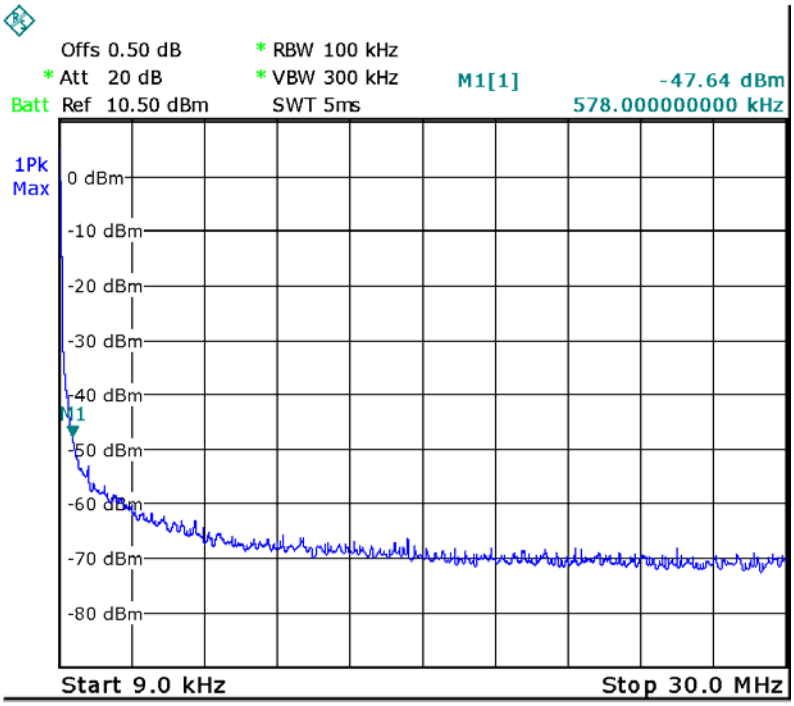
9KHz – 30MHz

802.11b

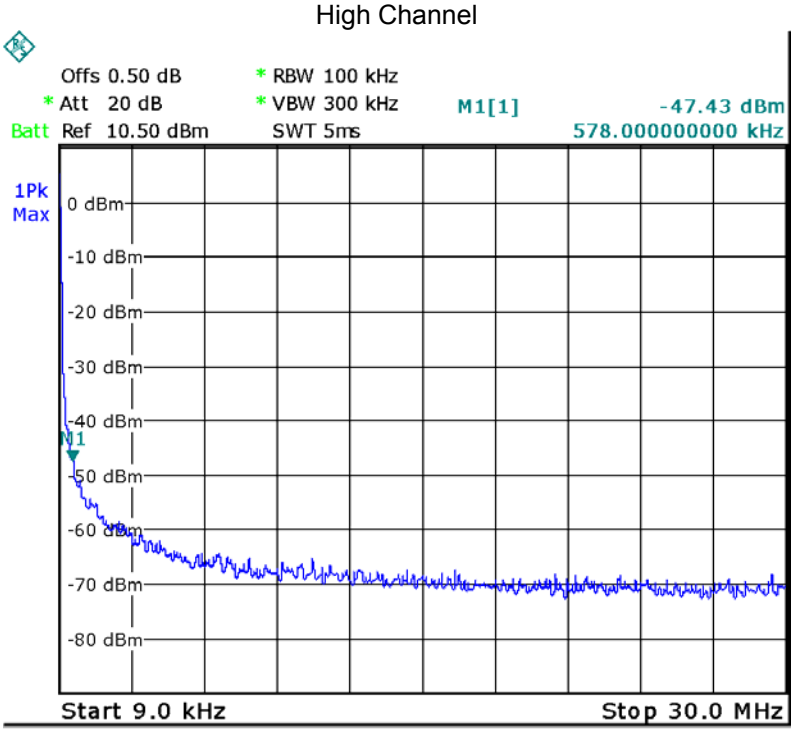
Low Channel



Middle Channel

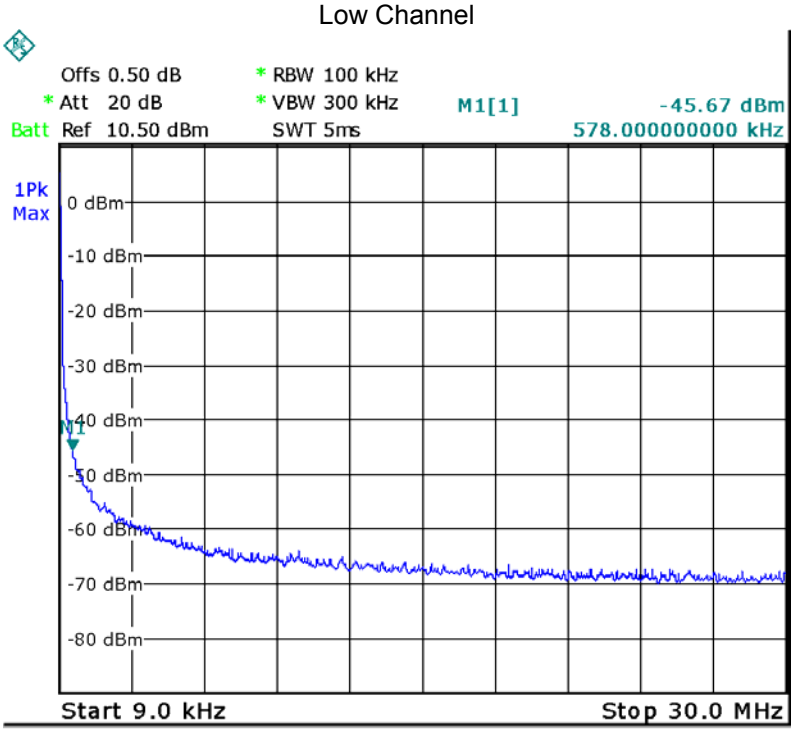


High Channel

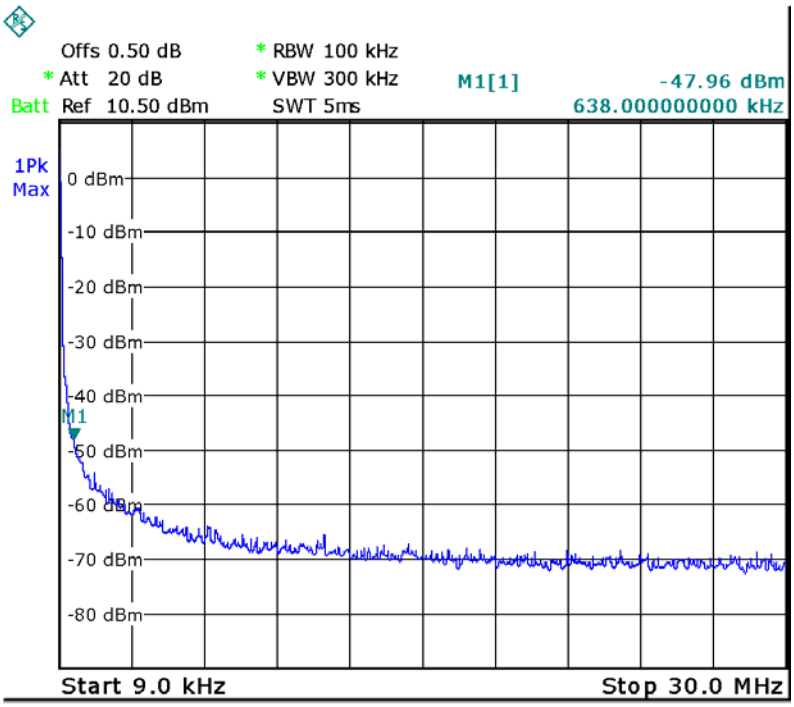


802.11g

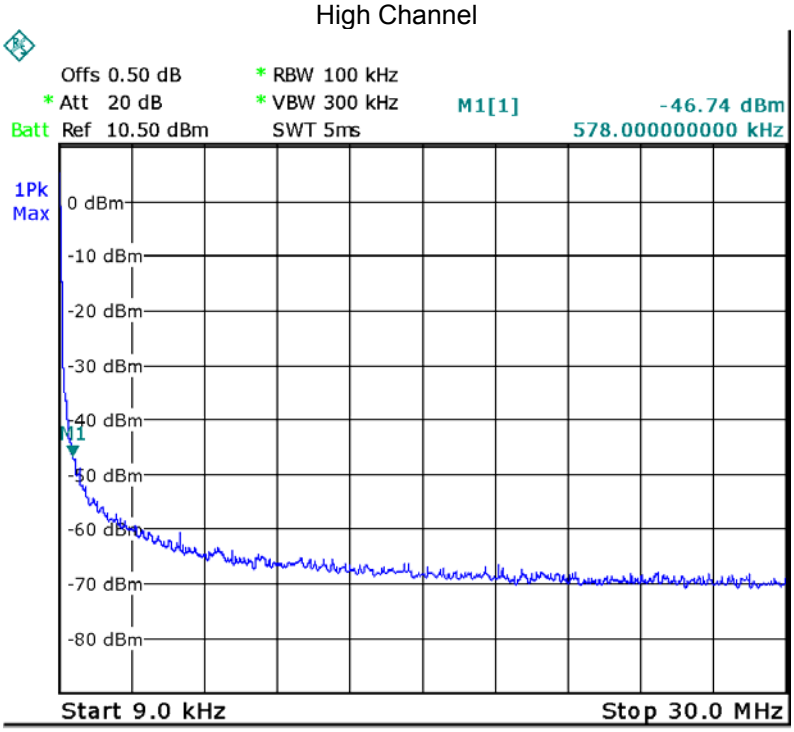
Low Channel



Middle Channel

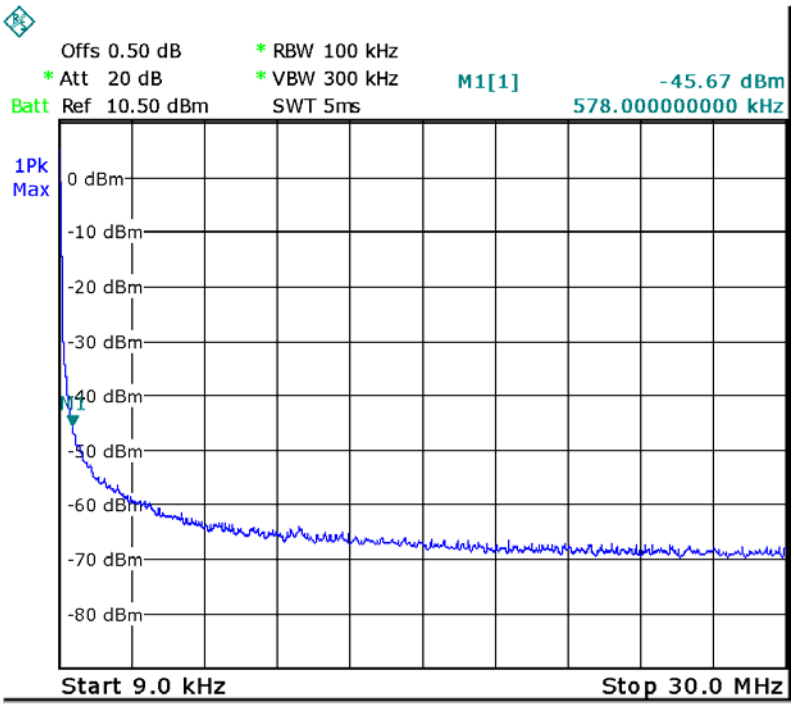


High Channel

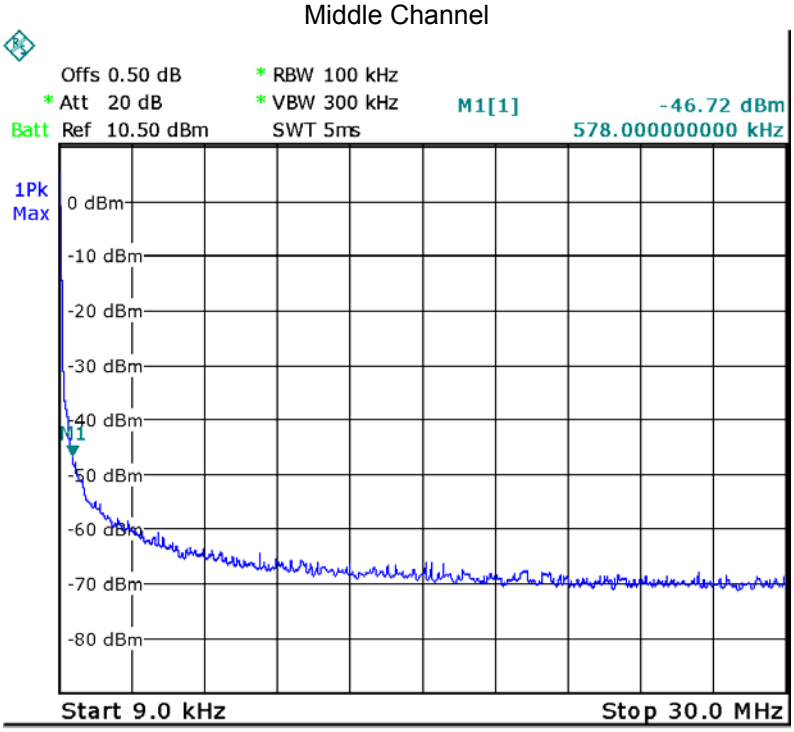


802.11n HT20

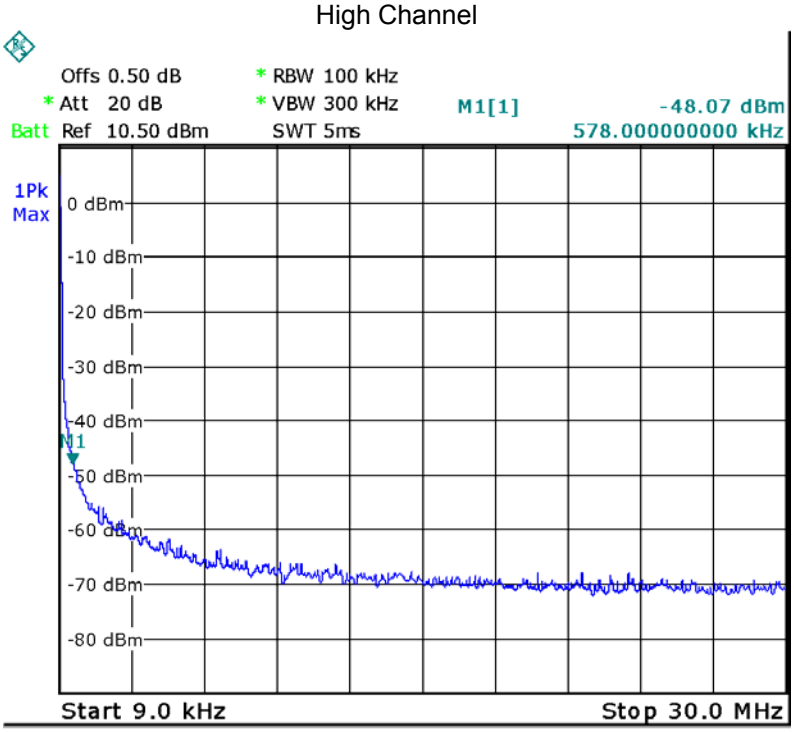
Low Channel



Middle Channel



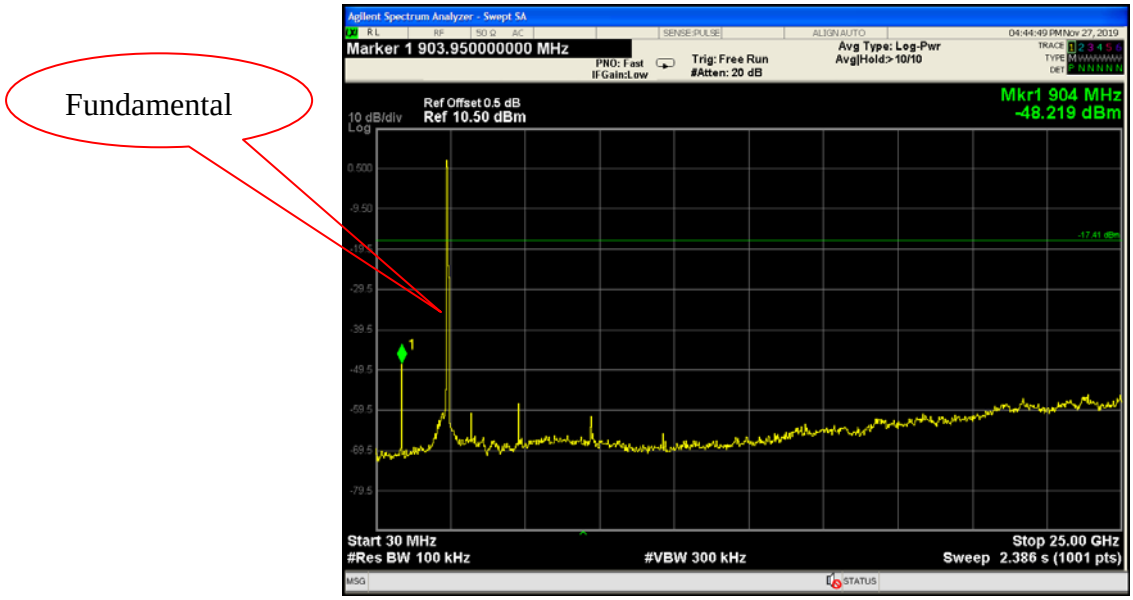
High Channel



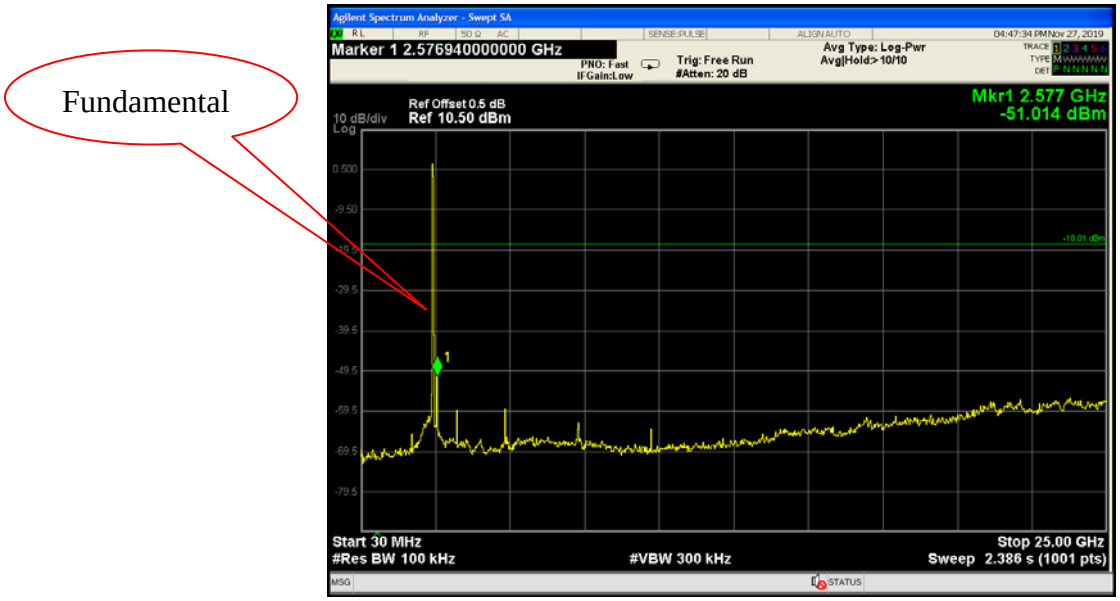
Above 30MHz

802.11b

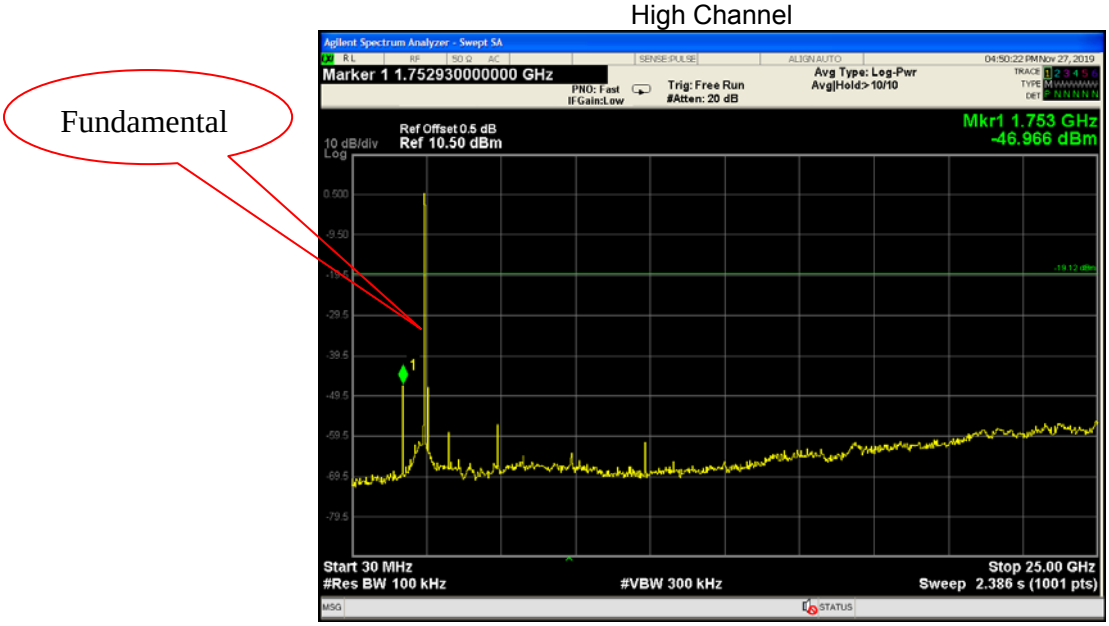
Low Channel



Middle Channel

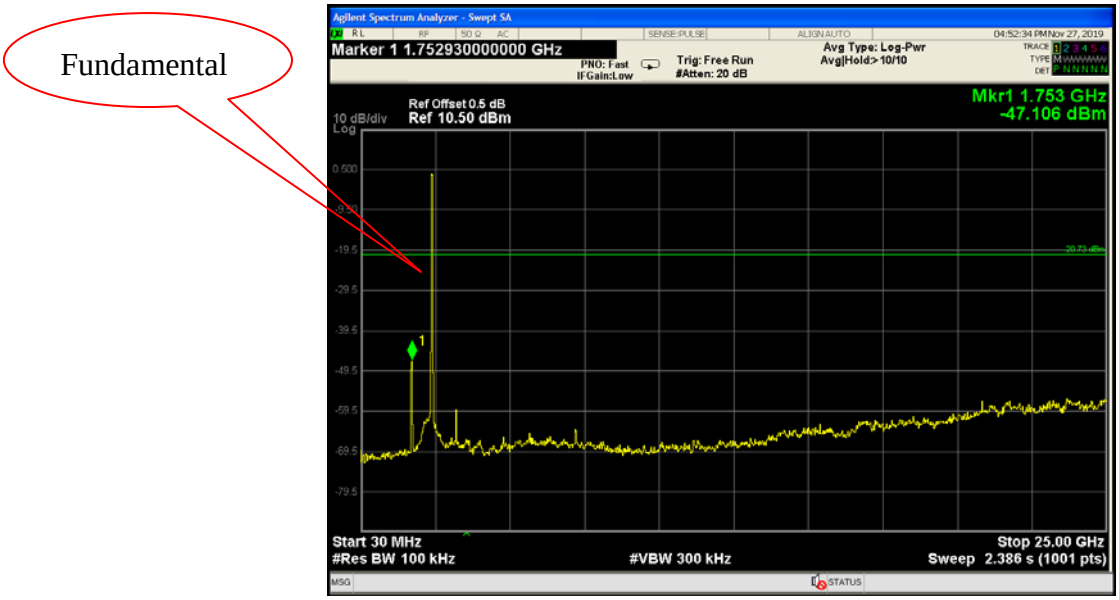


High Channel

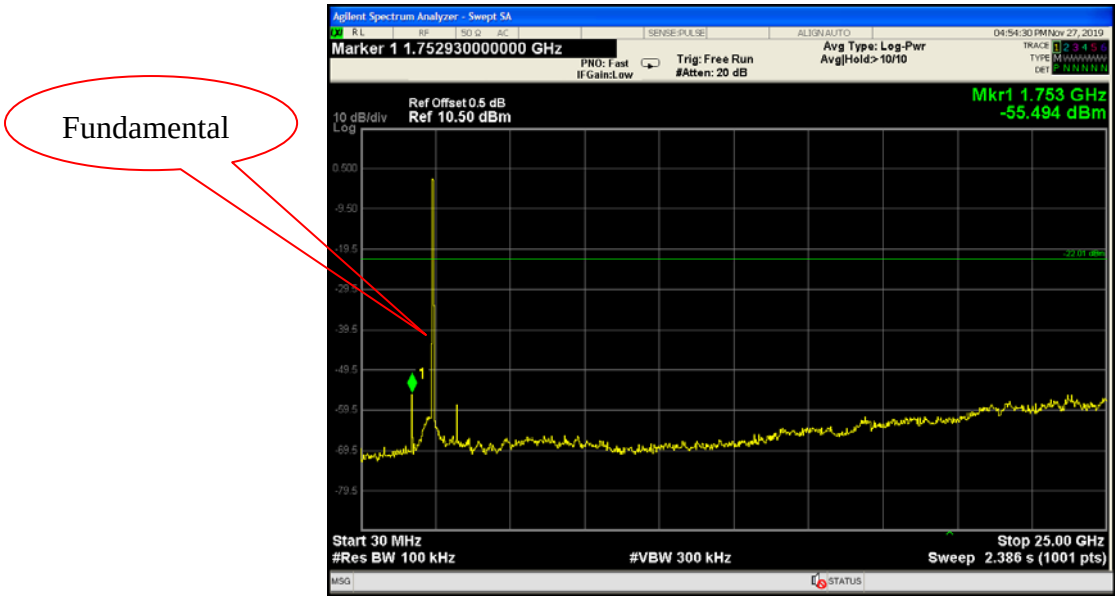


802.11g

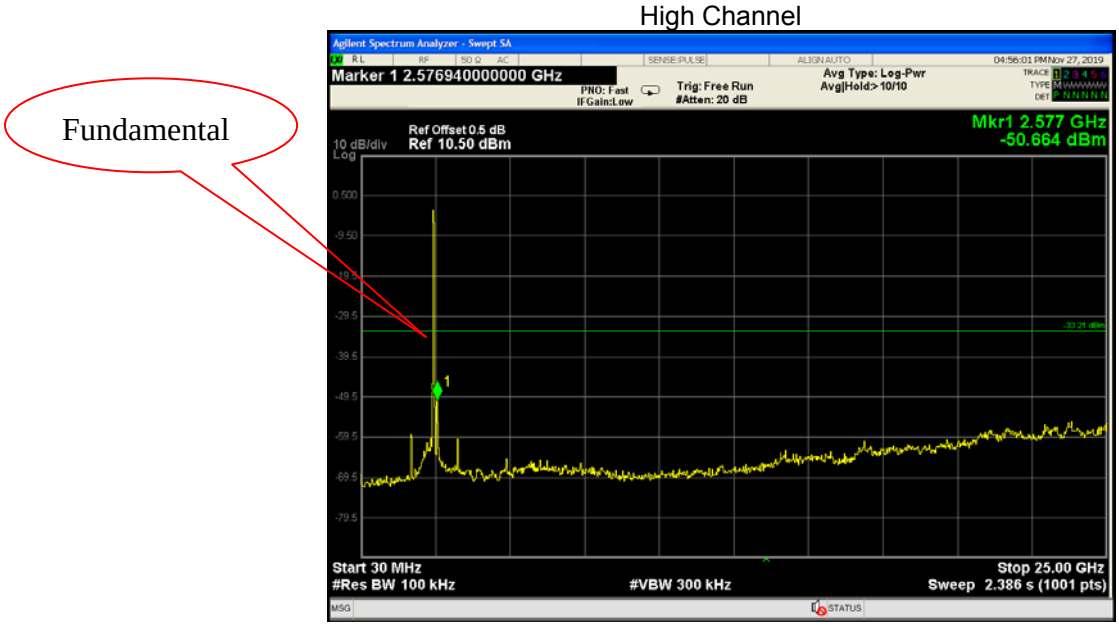
Low Channel



Middle Channel

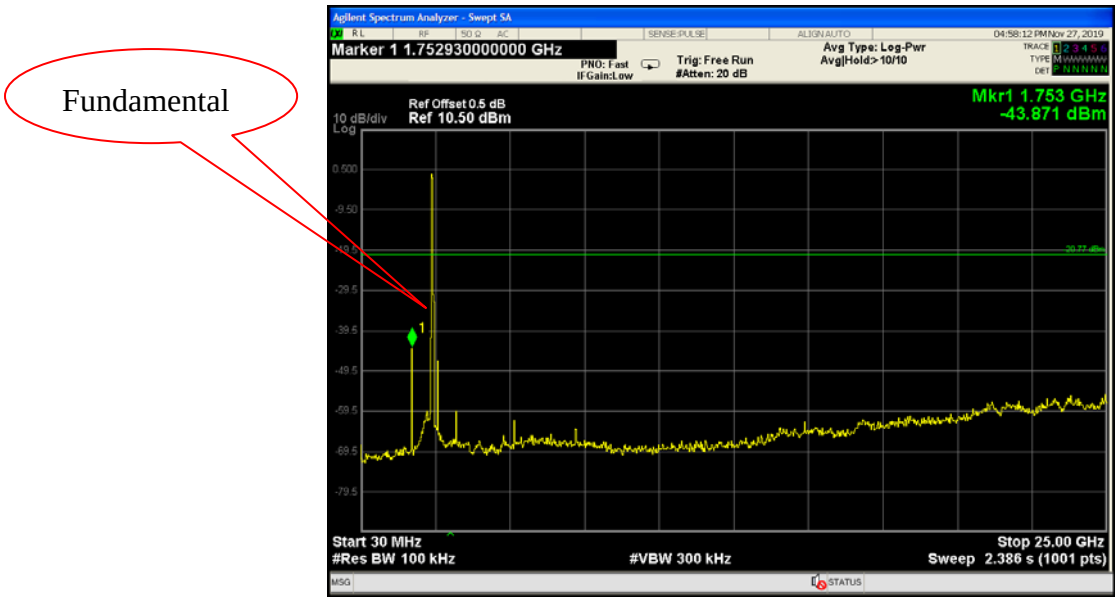


High Channel

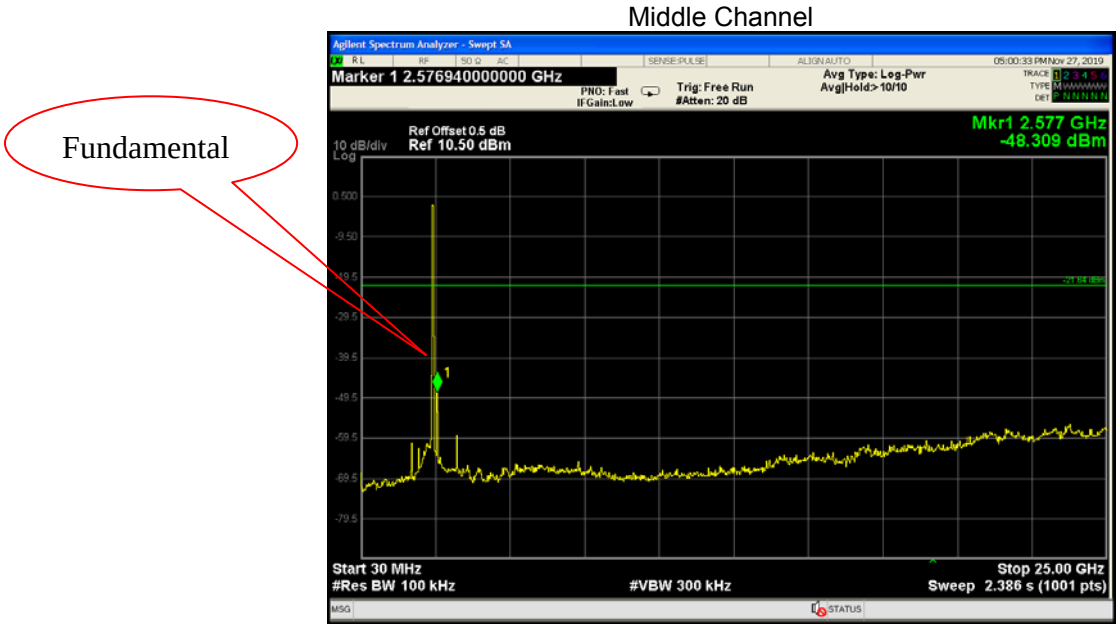


802.11n HT20

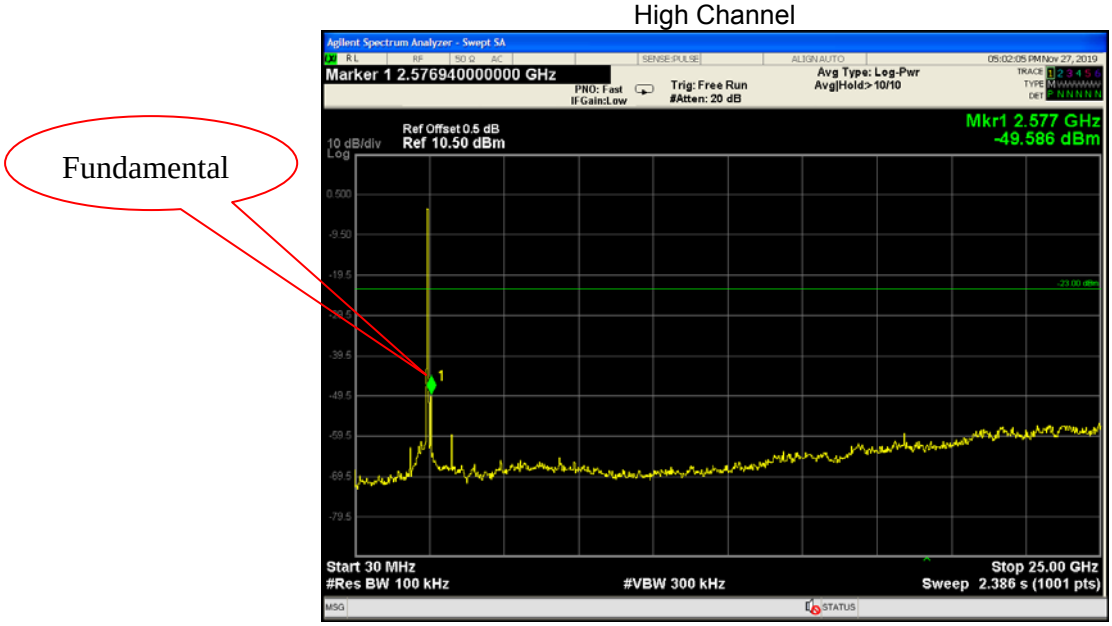
Low Channel



Middle Channel



High Channel



10 Band Edge Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

Test Limit: Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band 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) (see §15.205(c)).

Test Mode: Transmitting

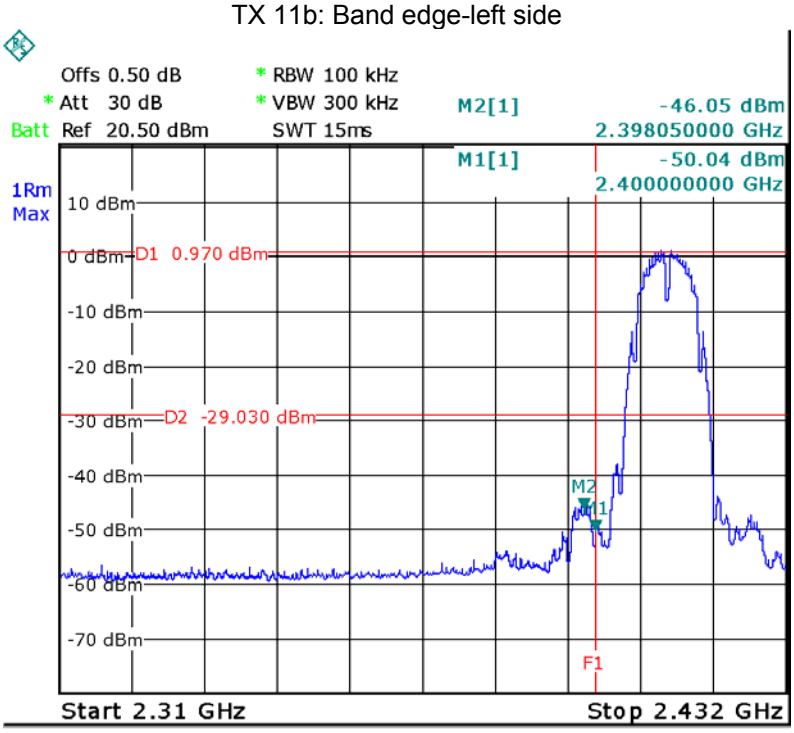
10.1 Test Produce

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

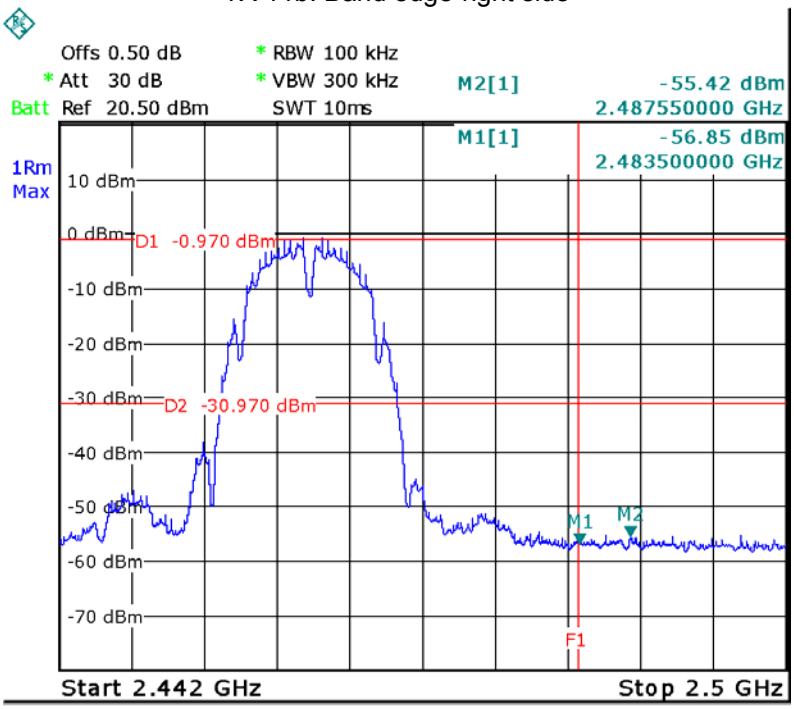
10.2 Test Result

Test result plots shown as follows:

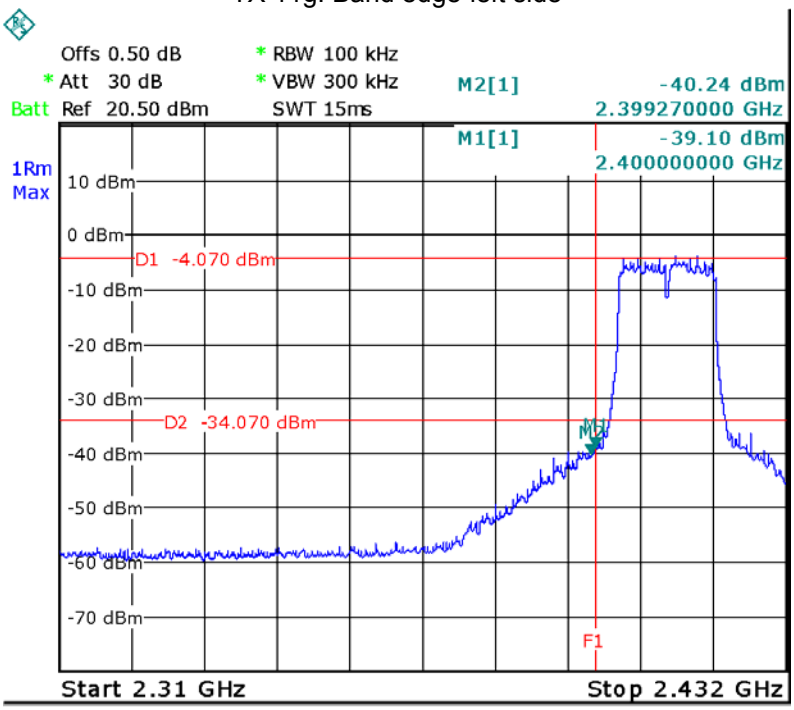
TX 11b: Band edge-left side



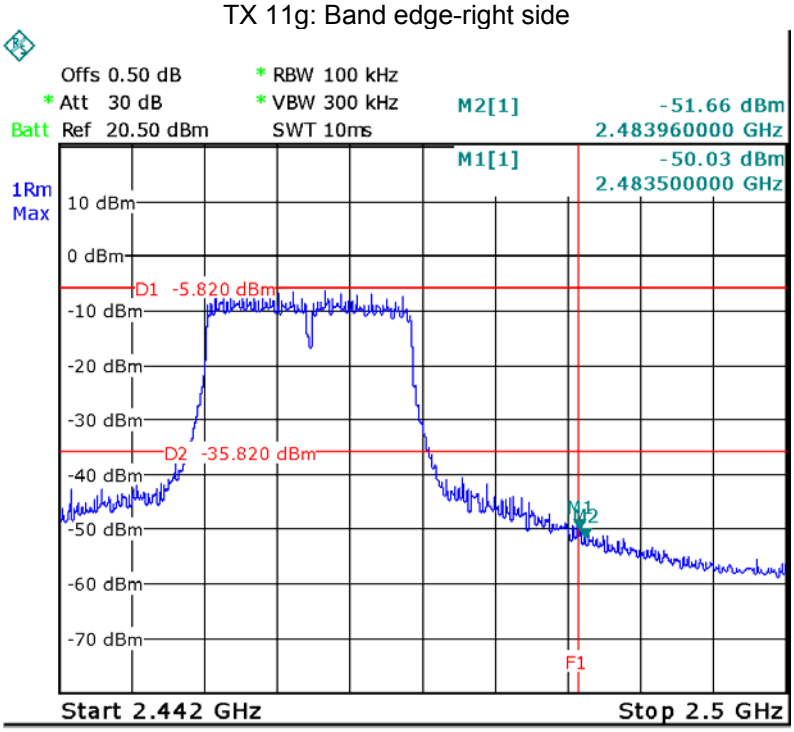
TX 11b: Band edge-right side



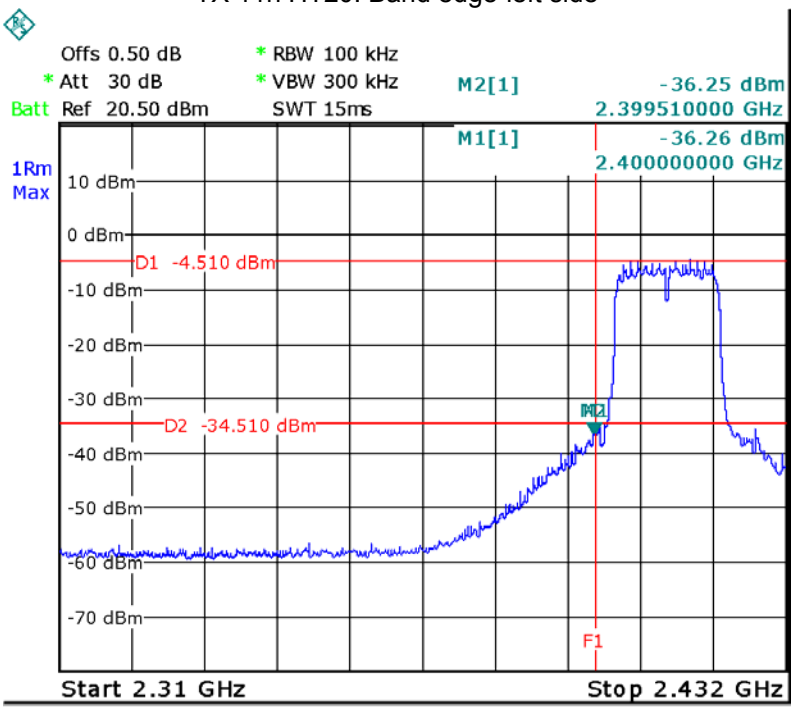
TX 11g: Band edge-left side



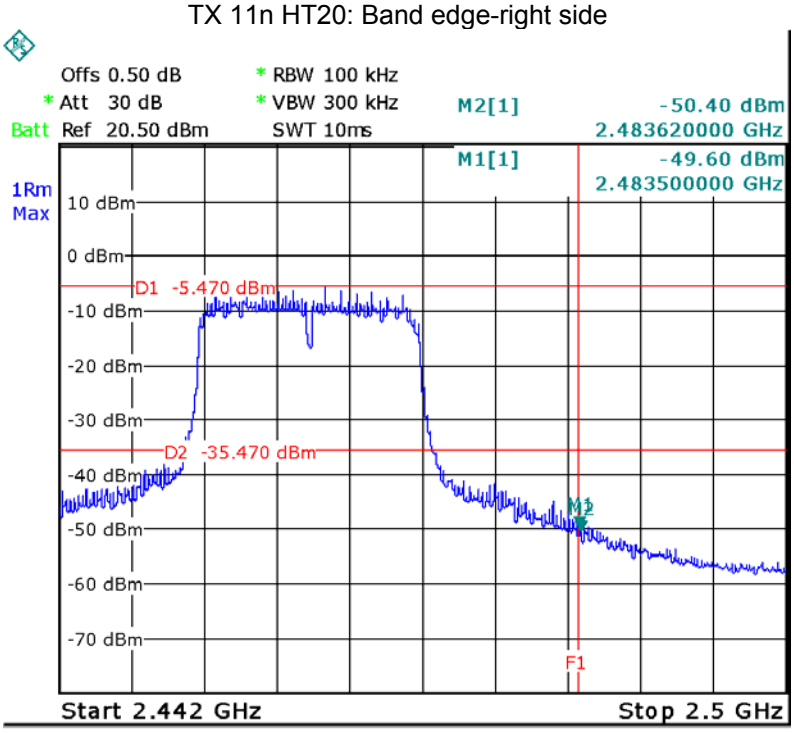
TX 11g: Band edge-right side



TX 11n HT20: Band edge-left side



TX 11n HT20: Band edge-right side



11 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

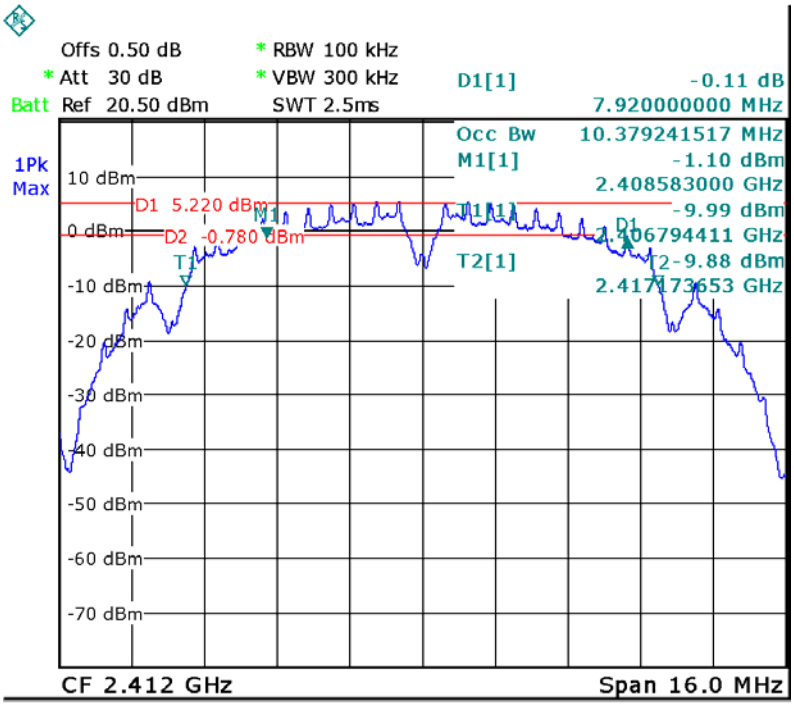
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

11.2 Test Result:

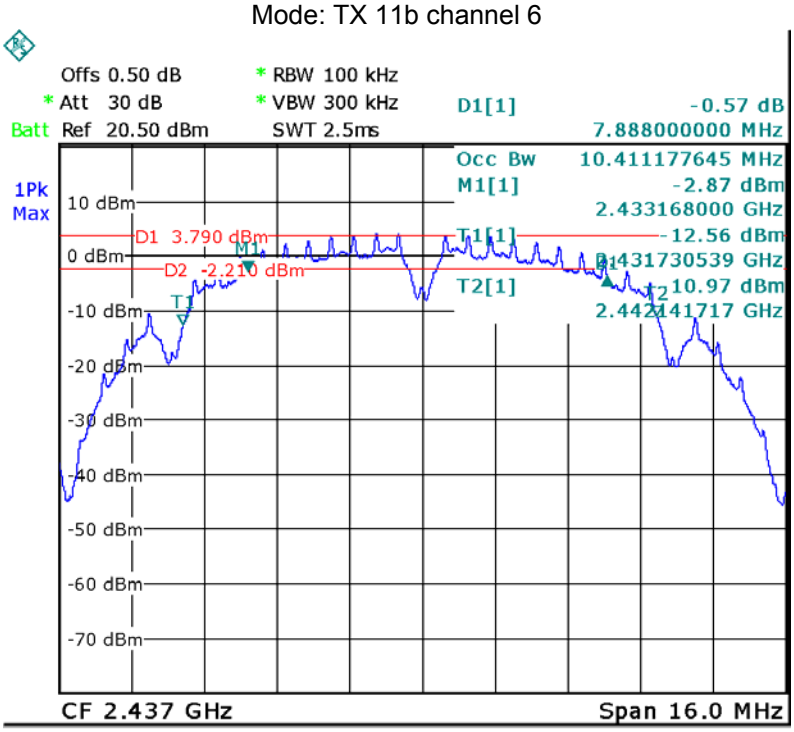
Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	7.920	10.379
	Channel 6	7.888	10.411
	Channel 11	9.038	10.443
TX 11g	Channel 1	16.317	16.367
	Channel 6	16.317	16.367
	Channel 11	16.118	16.367
TX 11n HT20	Channel 1	16.599	17.407
	Channel 6	16.599	17.407
	Channel 11	16.383	17.407

Test result plot:

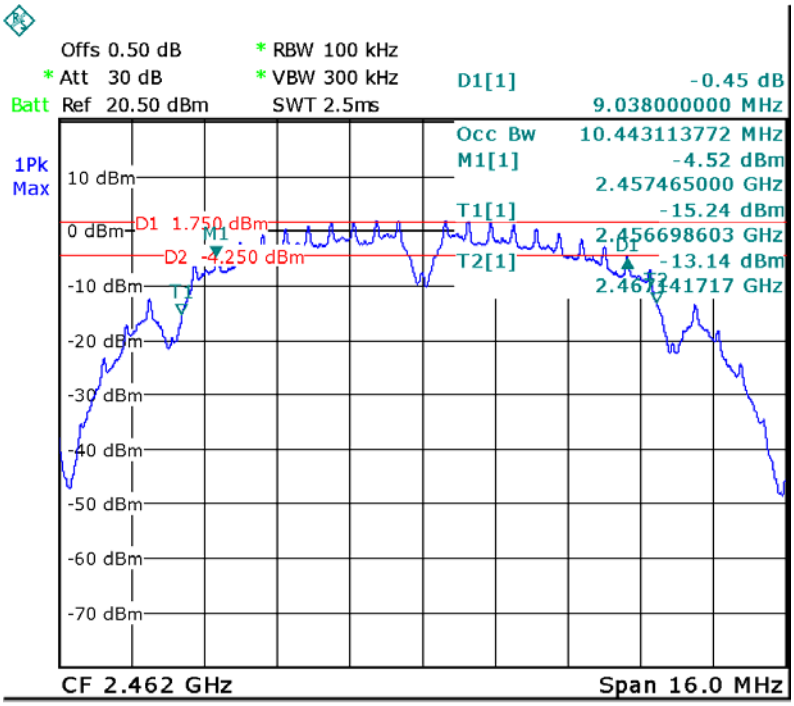
Mode: TX 11b channel 1



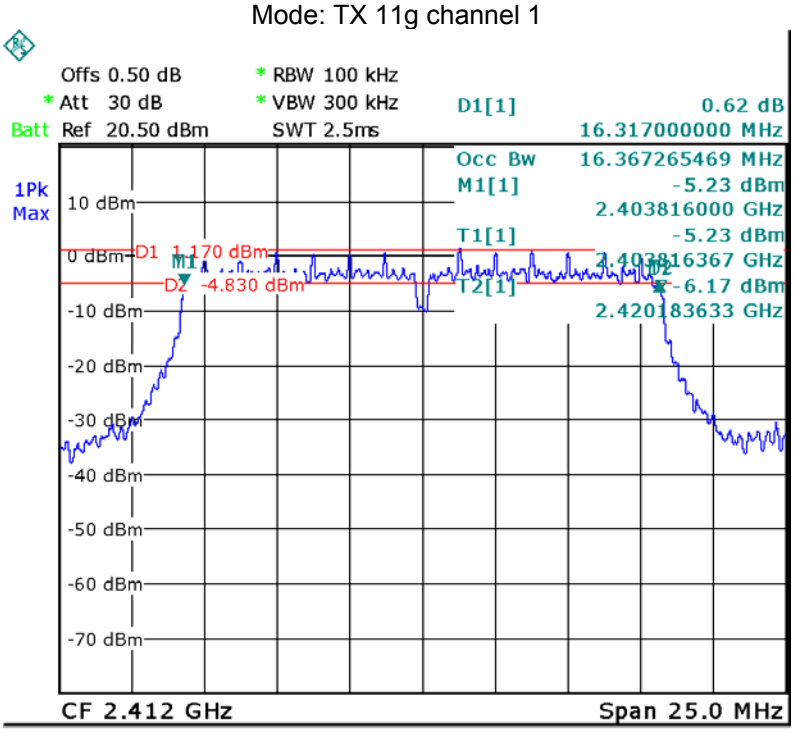
Mode: TX 11b channel 6



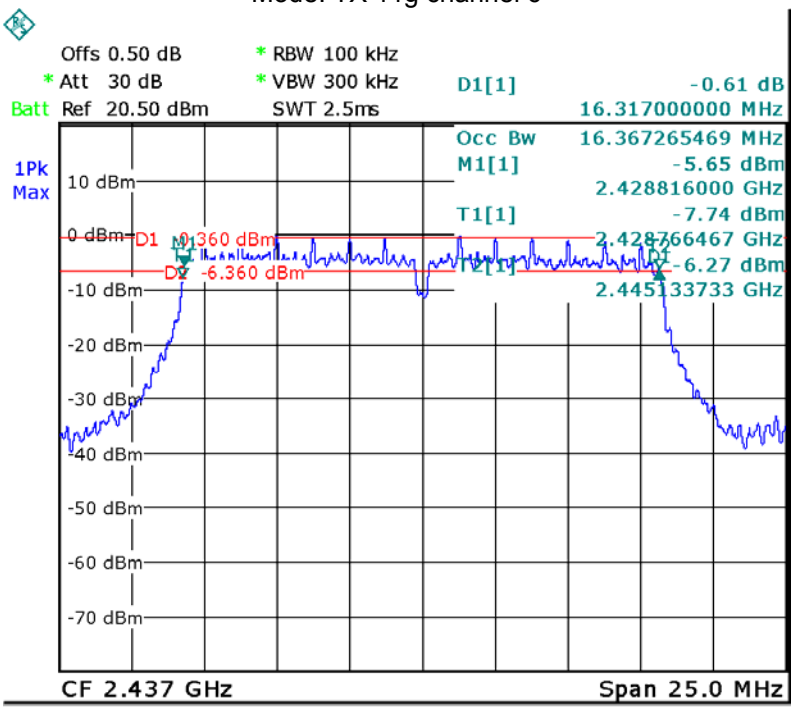
Mode: TX 11b channel 11



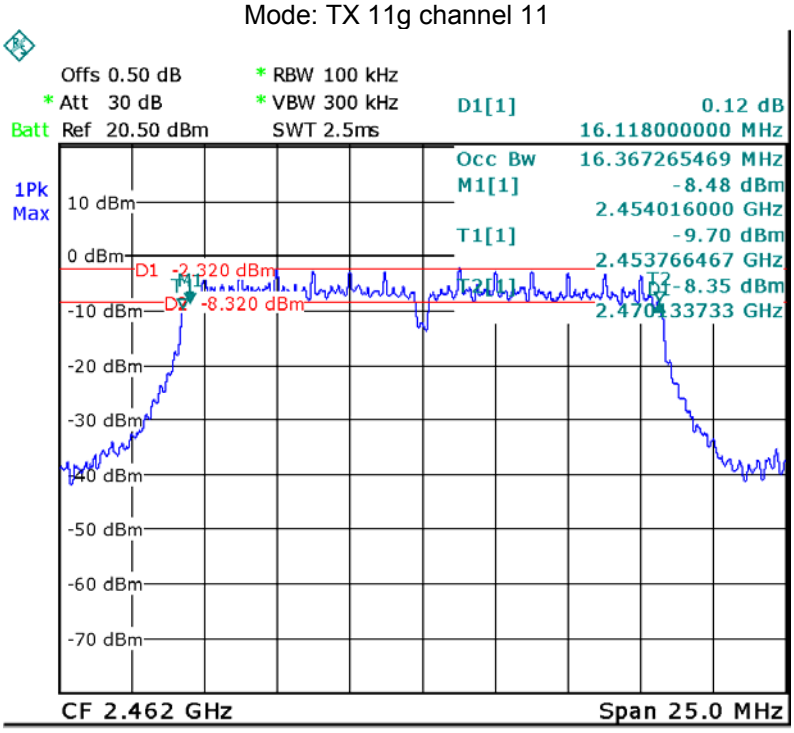
Mode: TX 11g channel 1



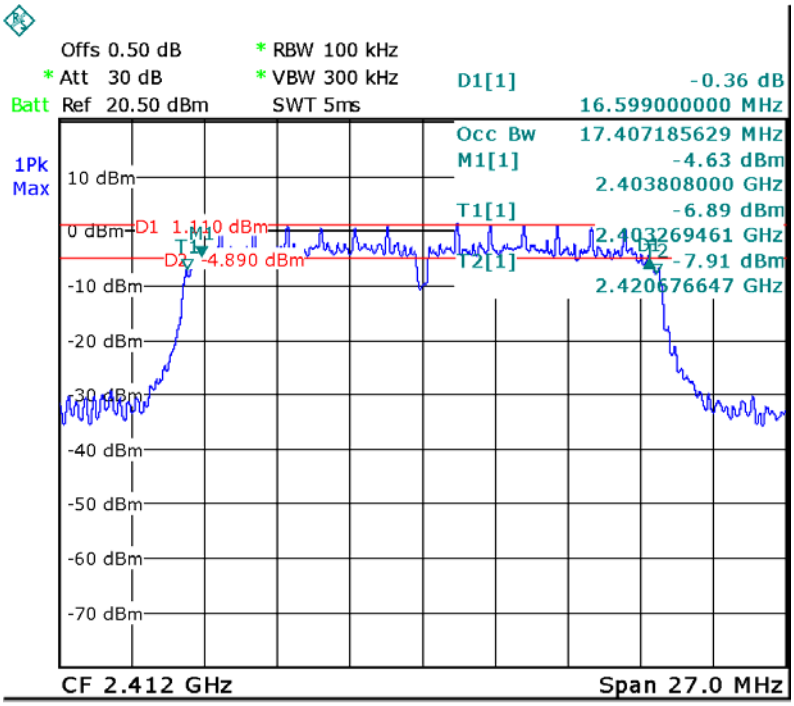
Mode: TX 11g channel 6



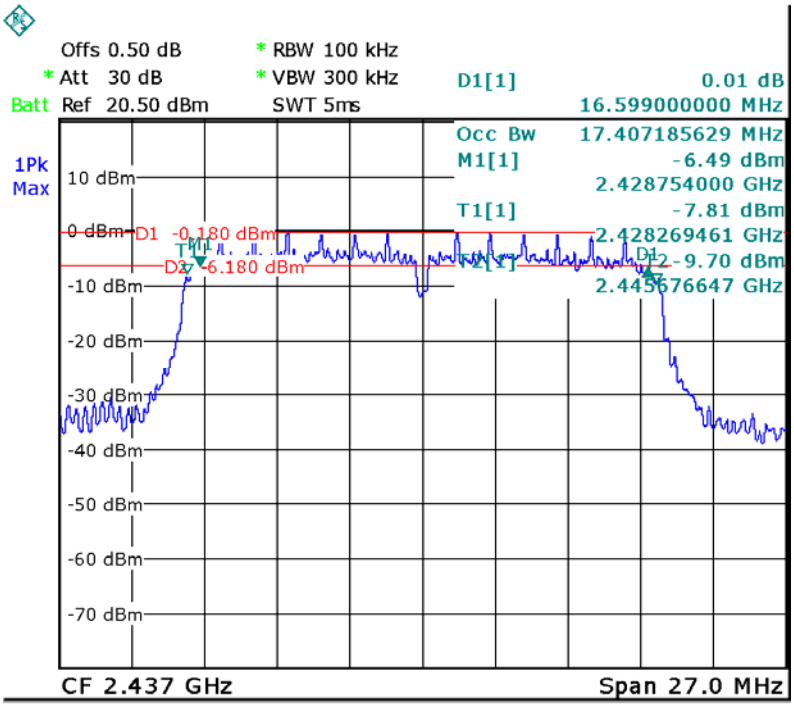
Mode: TX 11g channel 11



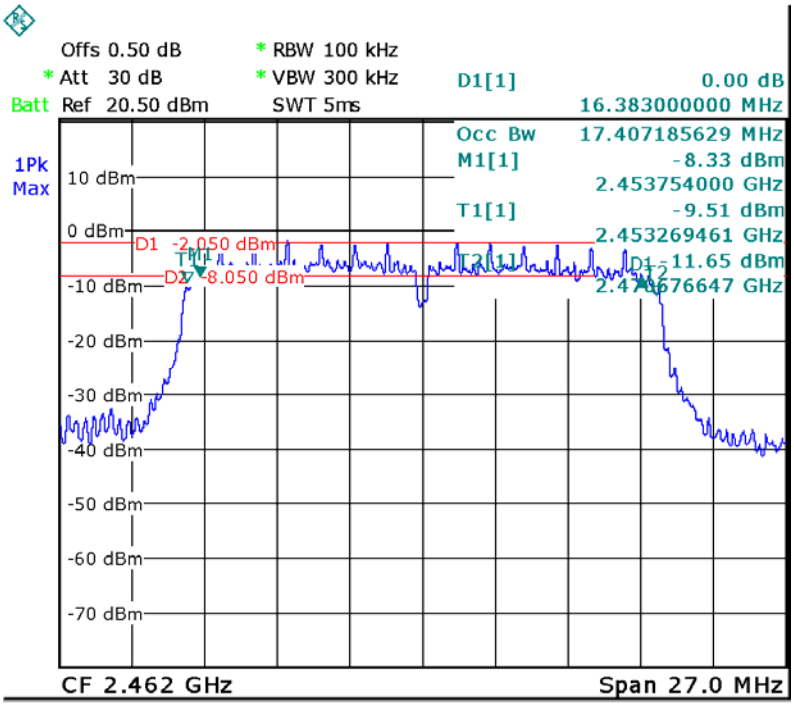
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



12 Maximum Peak conducted Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

12.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

section 8.3.1.1 (For BLE)

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a)Set the RBW ≥ DTS bandwidth.

b)Set VBW ≥ 3 RBW.

c)Set span ≥ 3 x RBW

d)Sweep time = auto couple.

e)Detector = peak.

f)Trace mode = max hold.

g)Allow trace to fully stabilize.

h)Use peak marker function to determine the peak amplitude level.

section 8.3.1.2 (For WIFI)

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

a)Set the RBW = 1% to 5% of the OBW, not to exceed 1 MHz..

b)Set the VBW ≥ 3 x RBW

c)Set the span ≥ 1.5 x OBW.

d)Detector = RMS.

e)Sweep time = auto couple.

f) trigger = free run..

g) 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.)

h) Trace average at least 100 traces in power averaging (rms) mode.

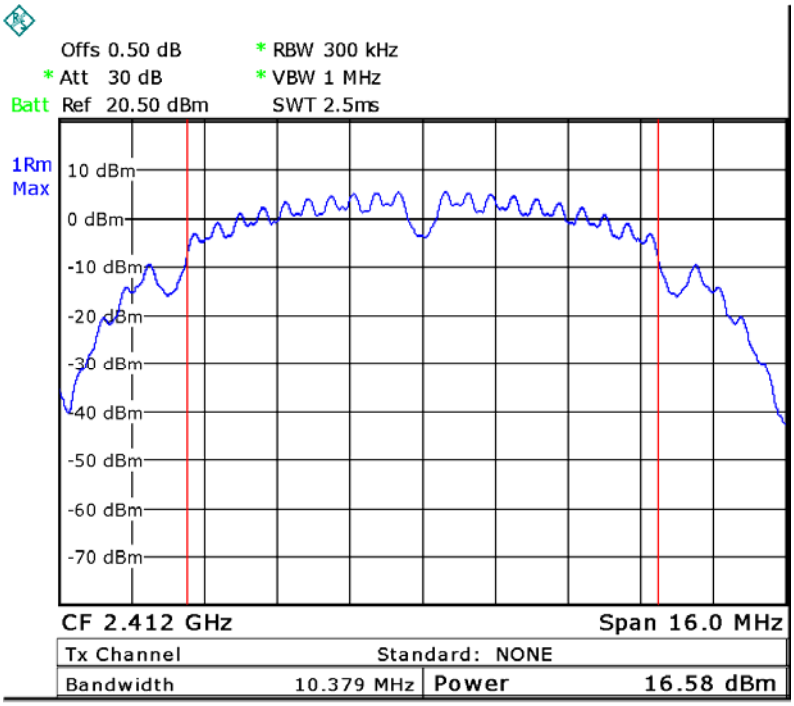
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum..

12.2 Test Result:

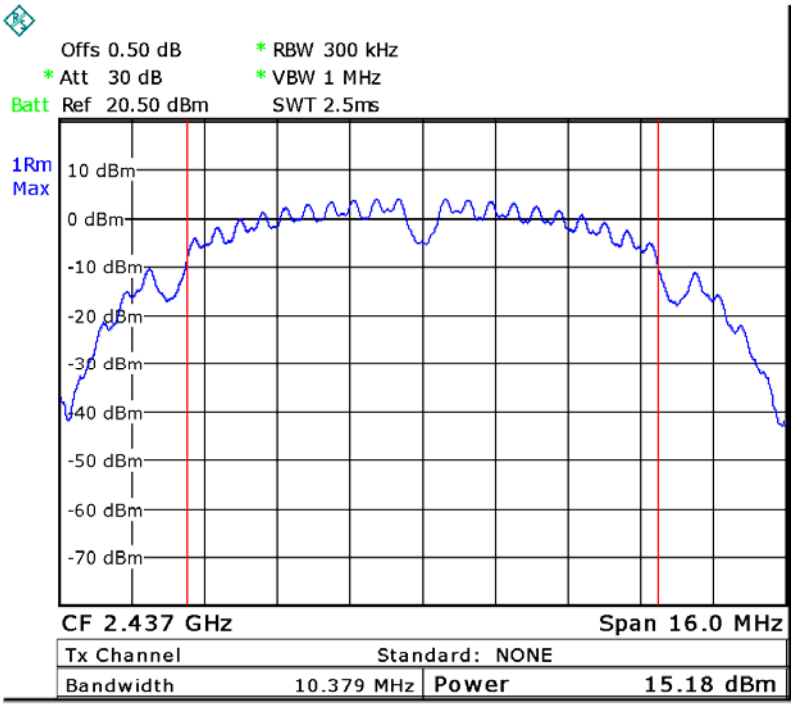
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	**16.58**	1W/30dBm
	Middle-2437	15.18	1W/30dBm
	High-2462	13.25	1W/30dBm
TX 11g	Low-2412	16.34	1W/30dBm
	Middle-2437	15.31	1W/30dBm
	High-2462	13.12	1W/30dBm
TX 11n HT20	Low-2412	15.76	1W/30dBm
	Middle-2437	14.90	1W/30dBm
	High-2462	13.23	1W/30dBm

Test Plot

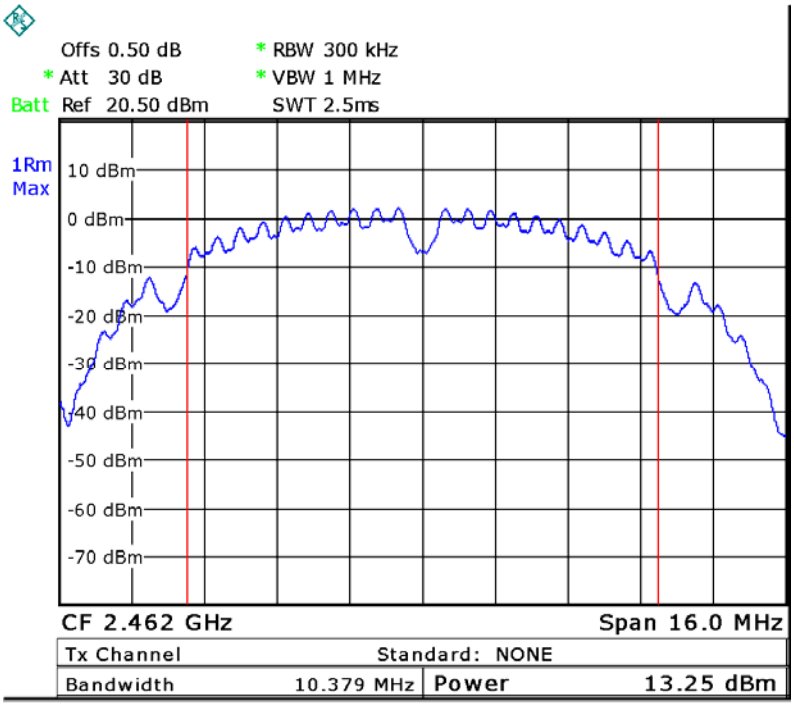
Mode: TX 11b channel 1



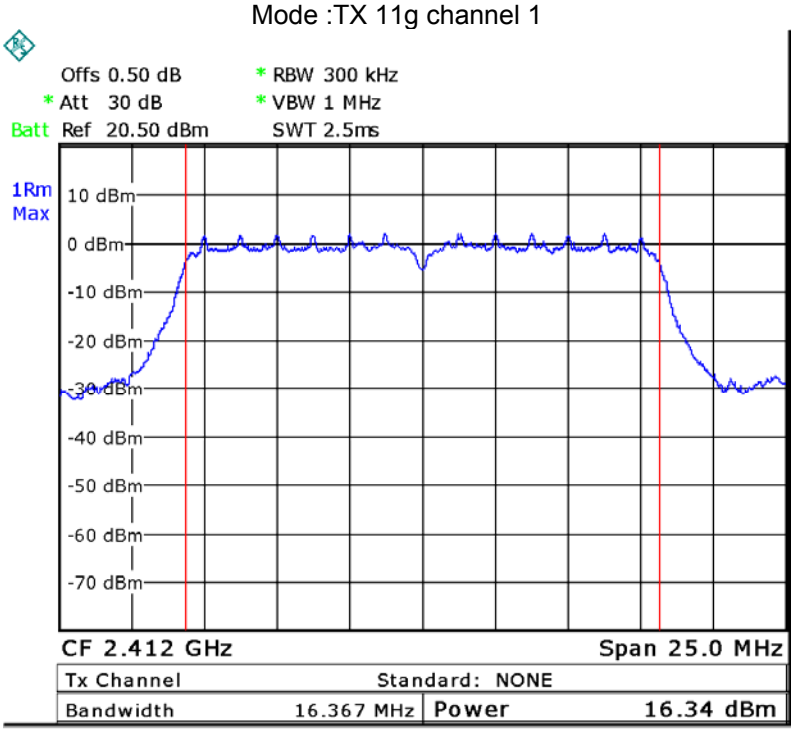
Mode: TX 11b channel 6



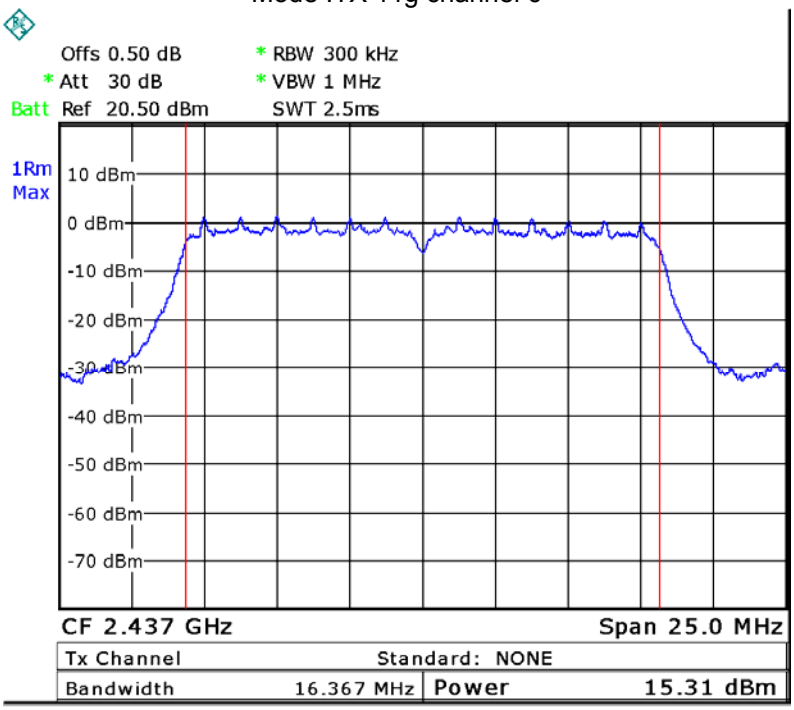
Mode: TX 11b channel 11



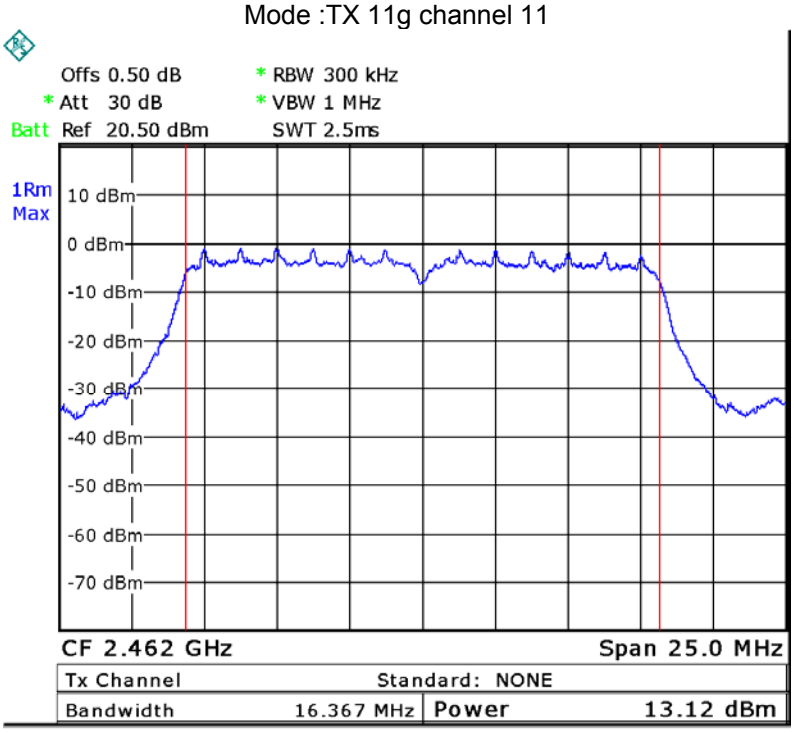
Mode :TX 11g channel 1



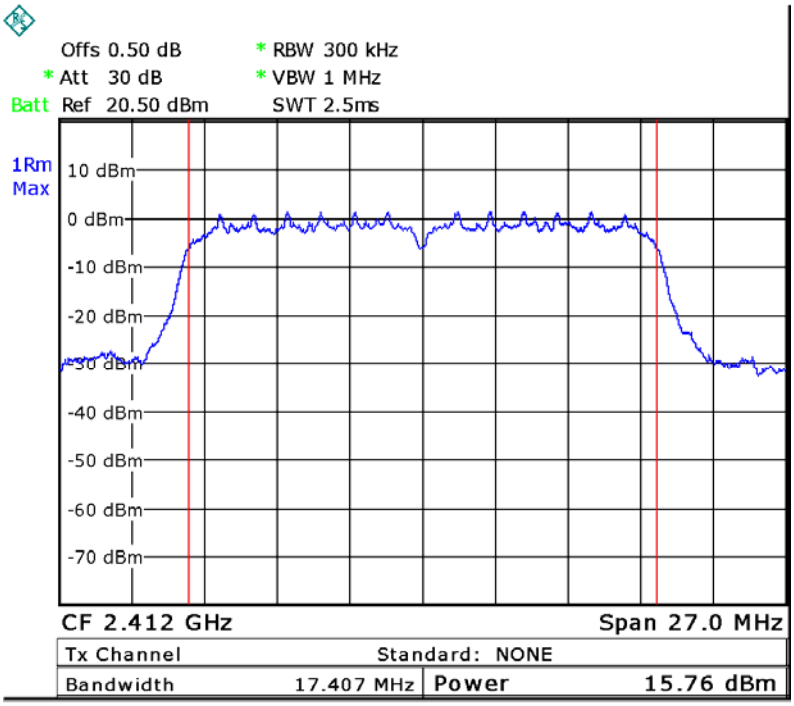
Mode :TX 11g channel 6



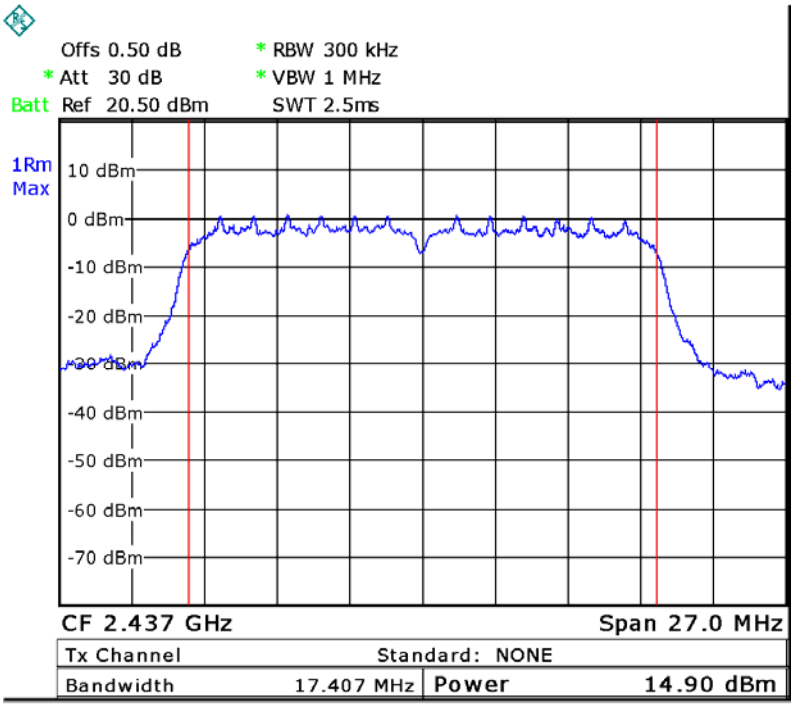
Mode :TX 11g channel 11



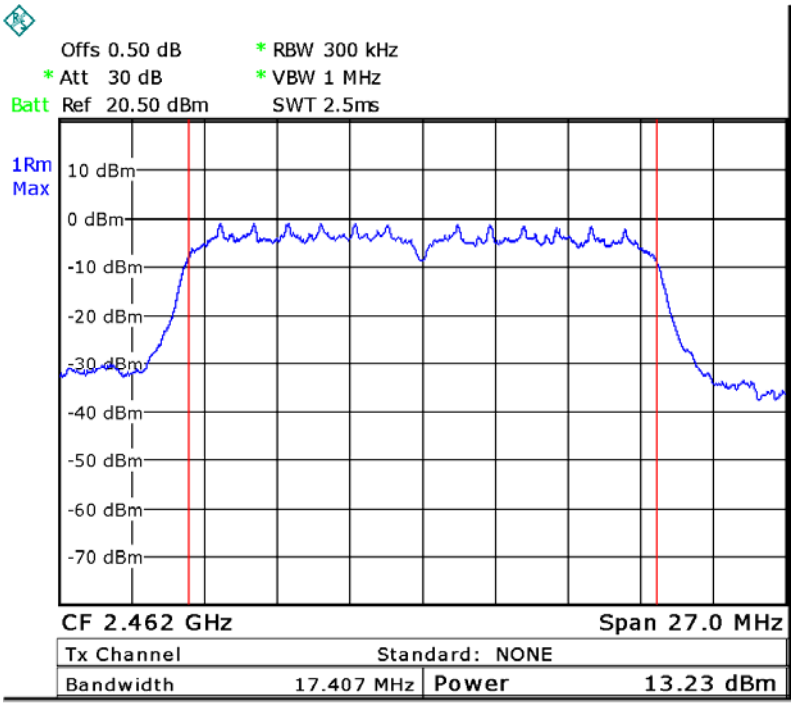
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



13 Duty cycle

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10: 2013
Test Limit:	N/A
Test Result:	PASS
Remark:	EUT transmitting continuously

14 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

14.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 section 10.2

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.

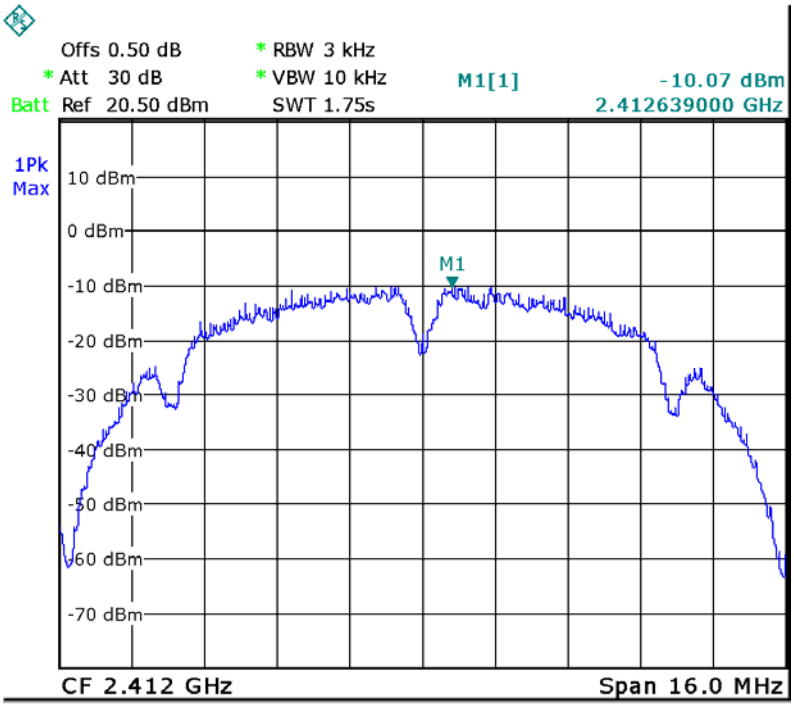
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

14.2 Test Result:

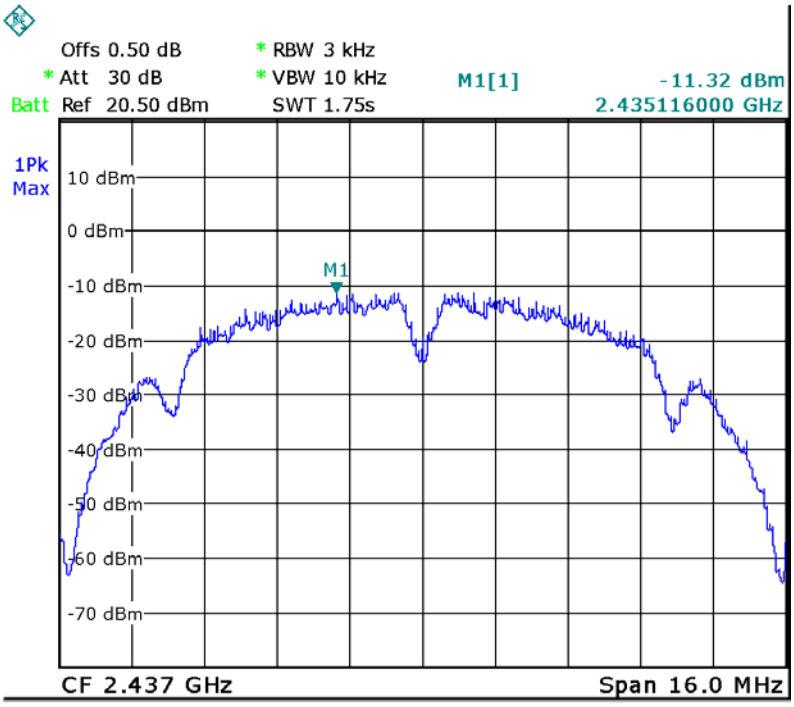
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-10.07	8dBm per 3kHz
	Middle-2437	-11.32	8dBm per 3kHz
	High-2462	-13.47	8dBm per 3kHz
TX 11g	Low-2412	-12.57	8dBm per 3kHz
	Middle-2437	-13.99	8dBm per 3kHz
	High-2462	-16.32	8dBm per 3kHz
TX 11n HT20	Low-2412	-13.50	8dBm per 3kHz
	Middle-2437	-14.65	8dBm per 3kHz
	High-2462	-16.50	8dBm per 3kHz

Test Plot

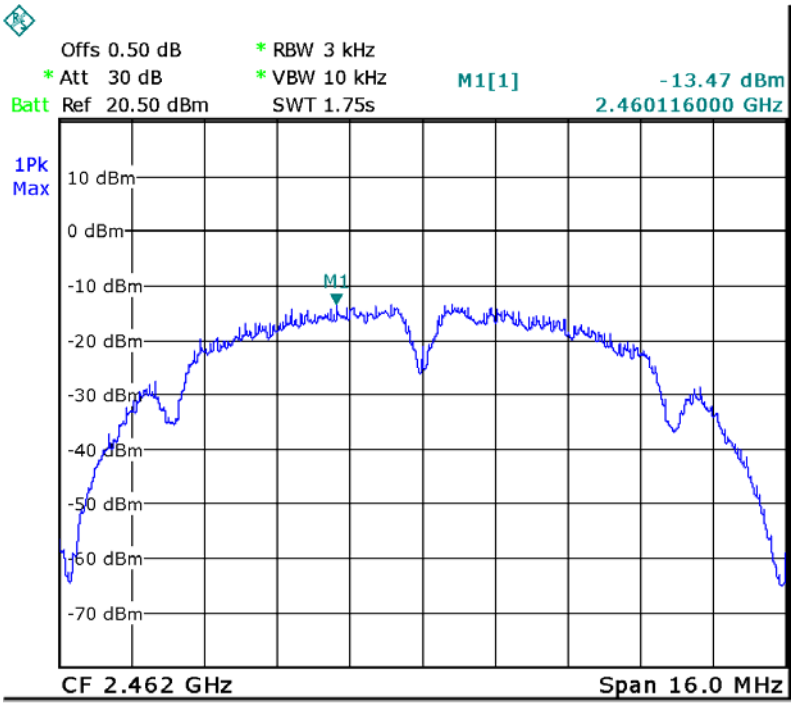
Mode: TX 11b channel 1



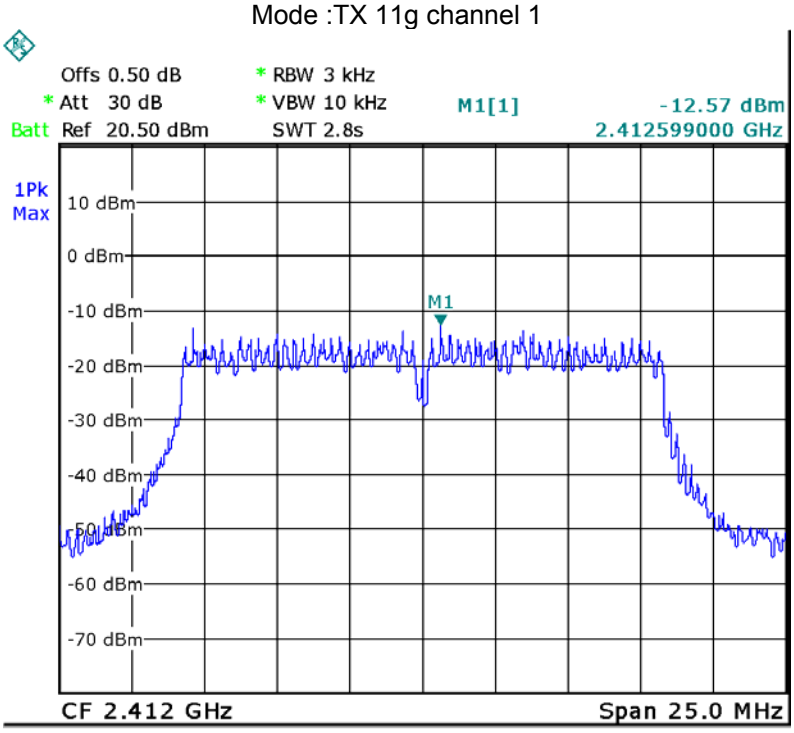
Mode: TX 11b channel 6



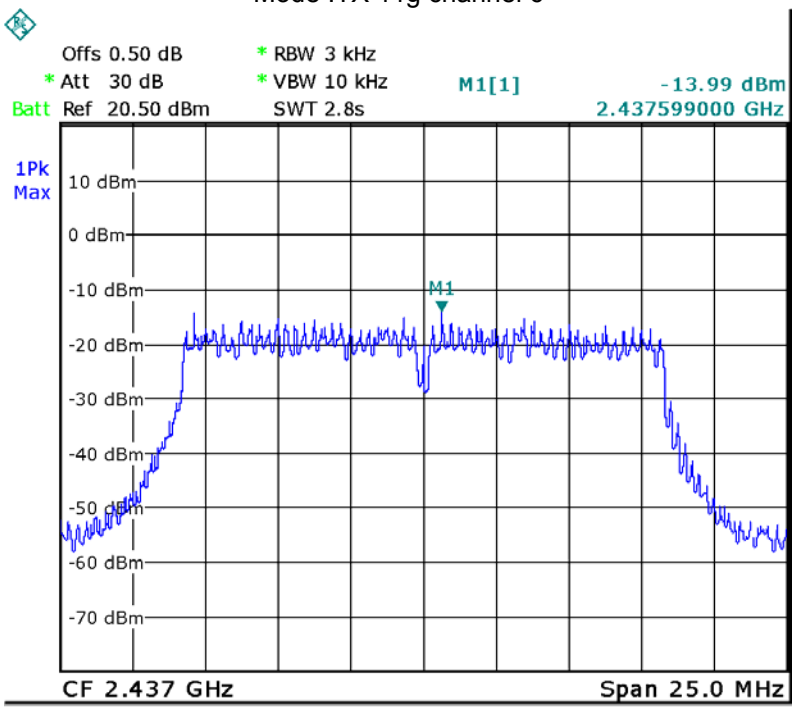
Mode: TX 11b channel 11



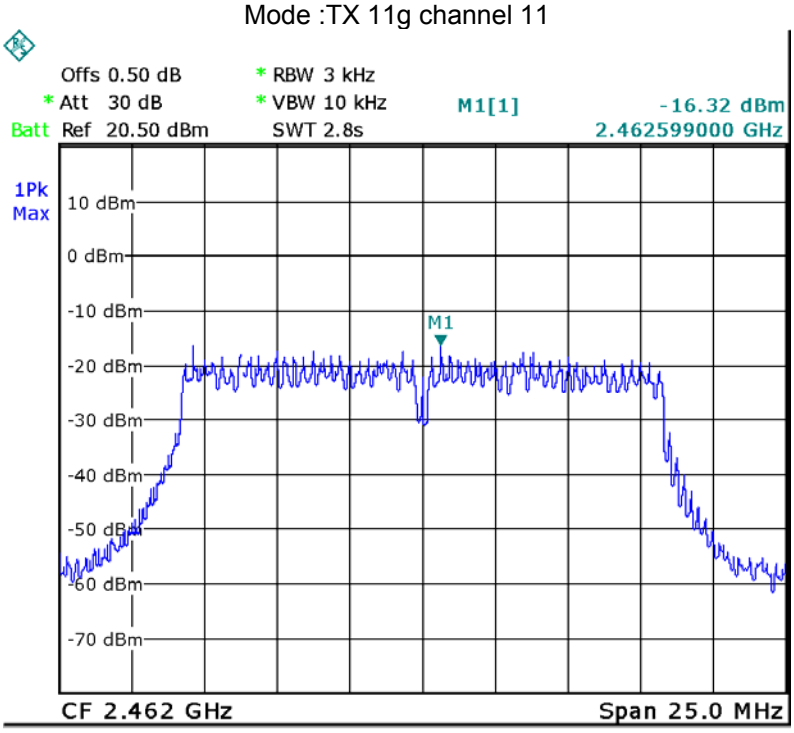
Mode :TX 11g channel 1



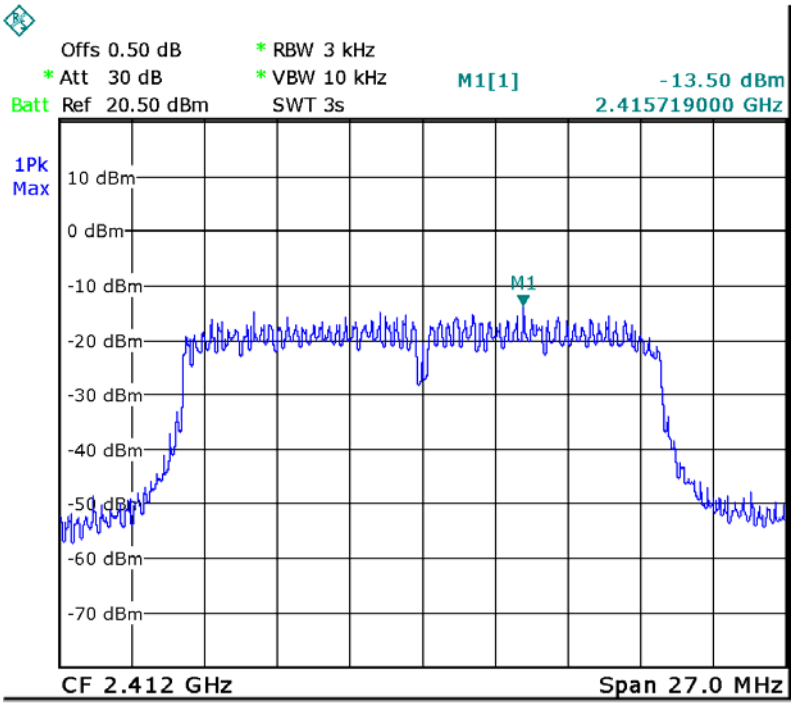
Mode :TX 11g channel 6



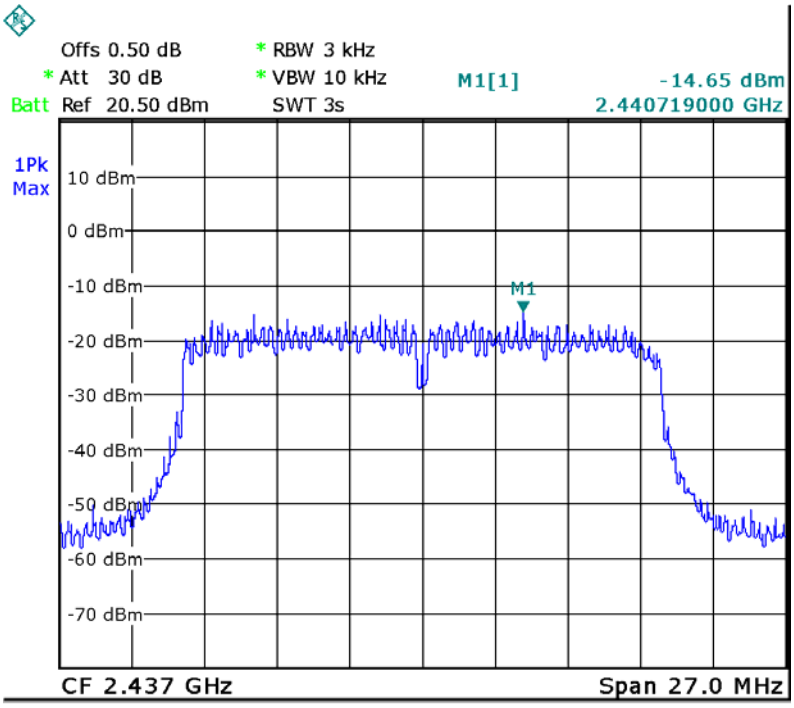
Mode :TX 11g channel 11



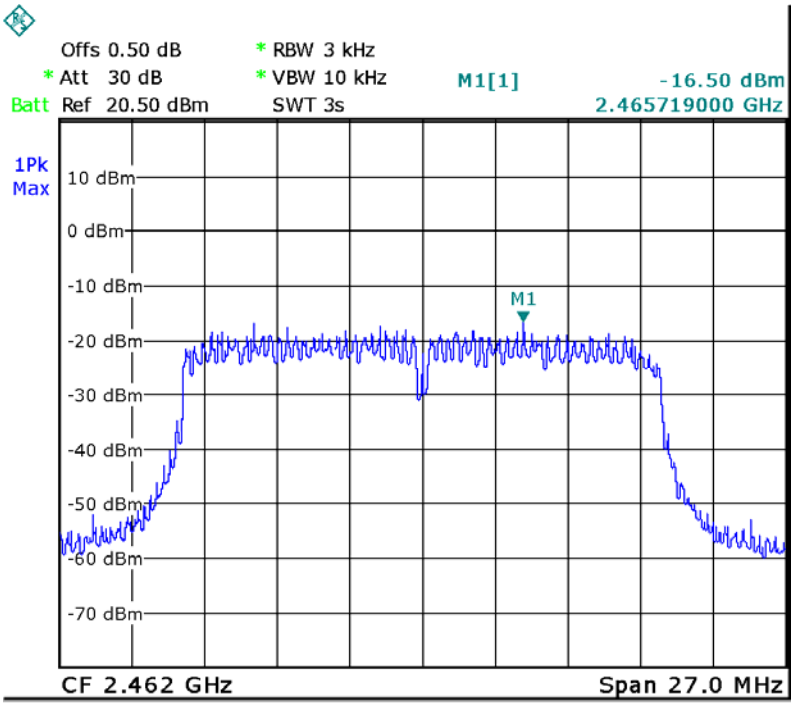
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



15 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has an integrated antenna fulfill the requirement of this section.

16 RF Exposure

Remark: refer to MPE report: WTF19S11080817W002.

17 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-IC-CWA1W-Photos.

======End of Report======