

TEST REPORT

Reference No...... : WTS19S02008374-1W V1
FCC ID : ZLZ-EPM
Applicant..... : Shenzhen Mindray BIO-Medical electronics Co.,LTD.
Address..... : Mindray Building, Keji 12th Road South, Hi-tech Ind, Shenzhen, China
Manufacturer : The same as above
Address..... : The same as above
Product..... : Patient Monitor
Model(s) : ePM 15M, ePM 12M, ePM 10M, ePM 15, ePM 12, ePM 10
Brand Name..... : Mindray
Standards..... : FCC CFR47 Part 15.247:2018
Date of Receipt sample : 2019-02-20
Date of Test : 2019-02-21 to 2019-03-26
Date of Issue..... : 2019-05-17
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.

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Approved by:

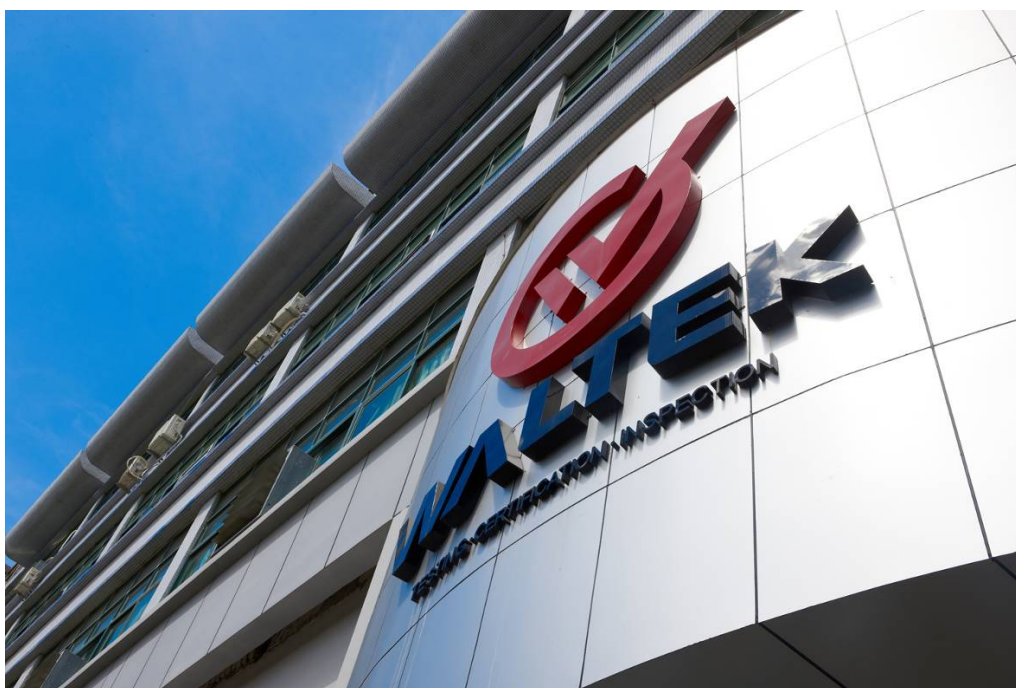


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Philo Zhang / Manager

2 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC (The Federal Communications Commission), CEC (California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek (ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.



Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. Electro Magnetic Compatibility (EMC), and energy performance, wireless radio. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

Test Facility:**A. Accreditations for Conformity Assessment (International)**

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. ISED CAB identifier: CN0013			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S02008 374-1W	2019-02-20	2019-02-21 to 2019-03- 26	2019-03-27	original	-	Replaced
WTS19S02008 374-1W V1	2019-02-20	2019-02-21 to 2019-03- 26	2019-05-17	Version 1	Updated	Valid

5 General Information

5.1 General Description of E.U.T.

Product:	Patient Monitor
Model(s):	ePM 15M, ePM 12M, ePM 10M, ePM 15, ePM 12, ePM 10
Model Description:	Only the model names and antenna connect line length are different.
Wi-Fi Specification:	2.4G-802.11b/g/n HT20 5G-802.11a/n HT20
Hardware Version:	2.0
Software Version:	01.06.00.01

5.2 Details of E.U.T.

Operation Frequency:	WiFi: 802.11b/g/n HT20: 2412~2462MHz
Max. RF output power:	WiFi(2.4G): 19.08dBm
Type of Modulation:	WiFi: CCK, OFDM
Antenna installation:	WiFi: internal permanent antenna
Antenna Gain:	WiFi(2.4G): 2.79dBi
Ratings:	Input: AC 100~240V~ 50/60Hz, 2.0~0.9A

5.3 Channel List

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		

5.4 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 .

6 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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

7 Equipment Used during Test

7.1 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	2018-09-12	2019-09-11
2.	LISN	R&S	ENV216	101215	2018-09-12	2019-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2018-09-12	2019-09-11
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	2018-09-12	2019-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2018-09-12	2019-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2018-09-12	2019-09-11
4.	Cable	LARGE	RF300	-	2018-09-12	2019-09-11
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	2018-04-29	2019-04-28
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)	-	2018-09-12	2019-09-11
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	2018-09-12	2019-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2018-09-12	2019-09-11
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2018-09-12	2019-09-11

7.2 Description of Support Units

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

7.3 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	$\pm 1 \times 10^{-7}$ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7 dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

7.4 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.

8 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 (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

8.1 E.U.T. Operation

Operating Environment :

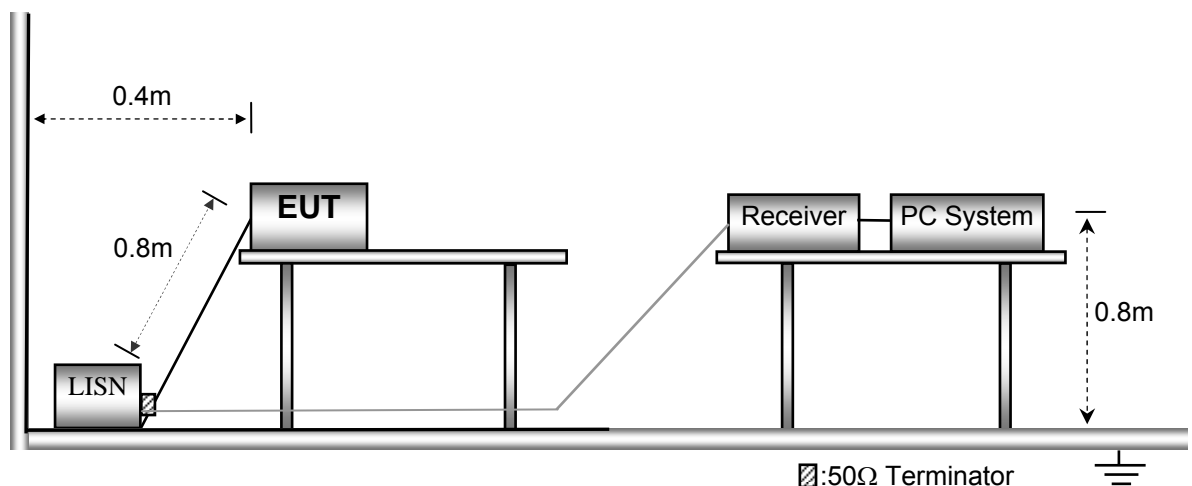
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

8.2 EUT Setup

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



8.3 Measurement Description

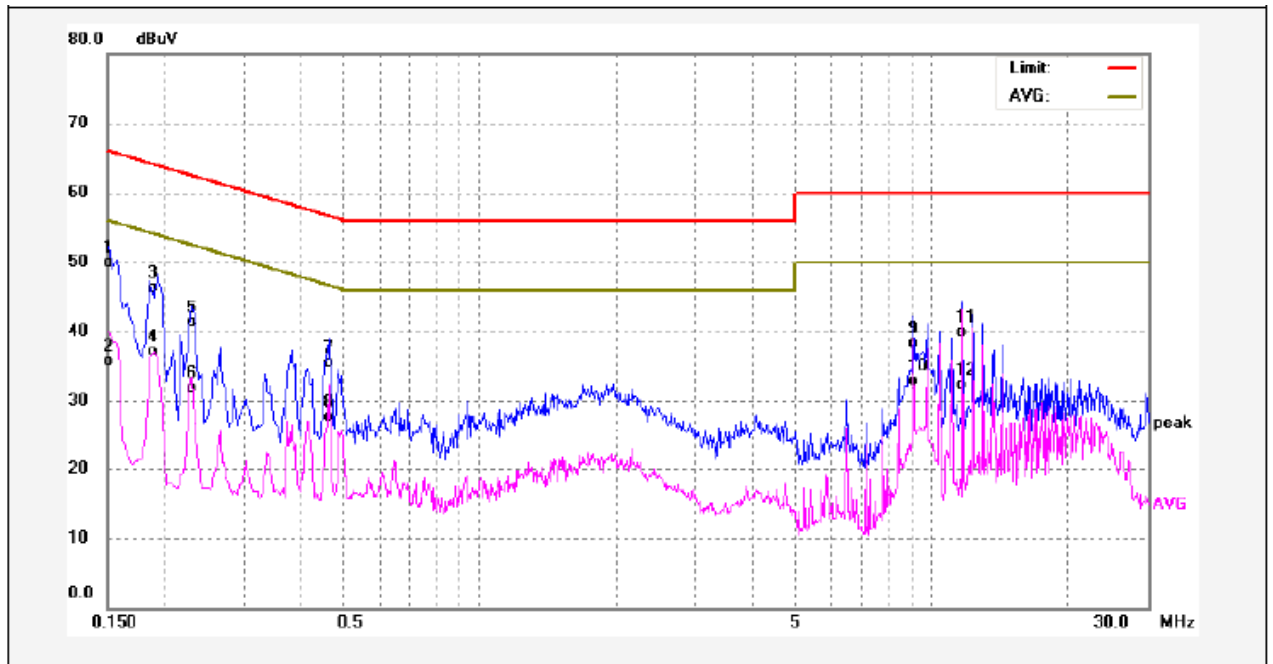
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

8.4 Conducted Emission Test Result

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

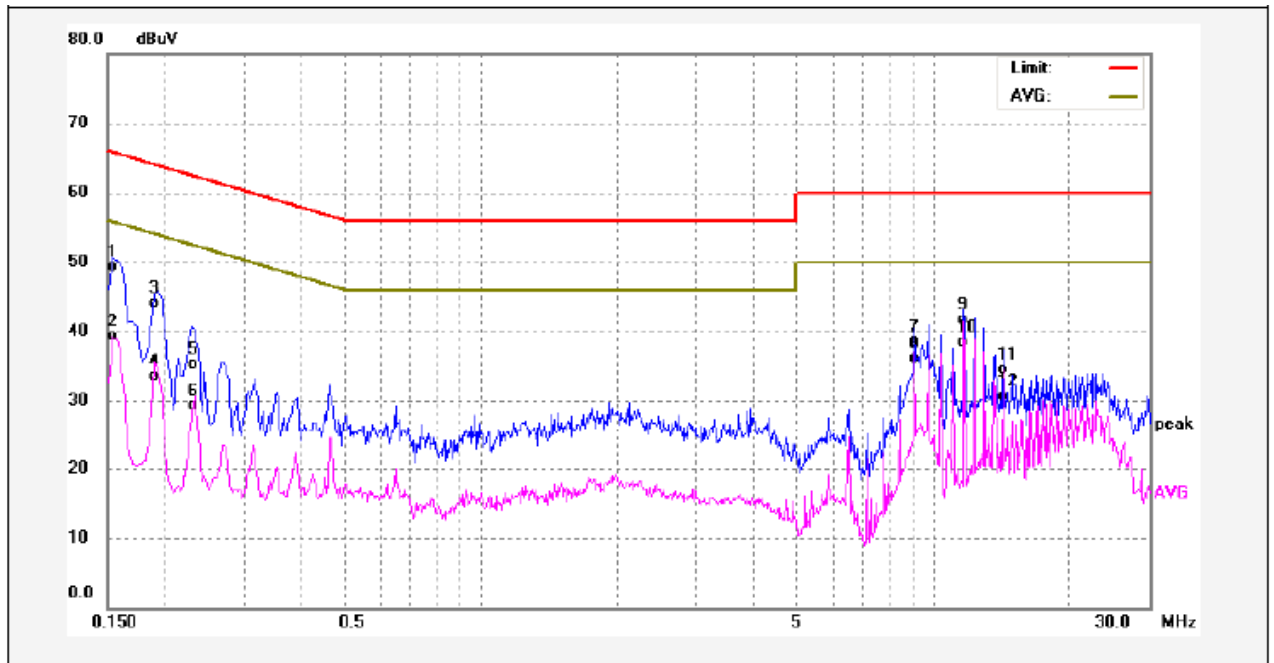
Worst Mode: WIFI mode (802.11b mode low channel)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	39.61	10.26	49.87	65.99	-16.12	QP	
2	0.1500	25.50	10.26	35.76	55.99	-20.23	AVG	
3	0.1900	35.98	10.31	46.29	64.03	-17.74	QP	
4	0.1900	26.71	10.31	37.02	54.03	-17.01	AVG	
5	0.2300	30.95	10.36	41.31	62.45	-21.14	QP	
6	0.2300	21.46	10.36	31.82	52.45	-20.63	AVG	
7	0.4620	25.11	10.42	35.53	56.66	-21.13	QP	
8	0.4620	17.35	10.42	27.77	46.66	-18.89	AVG	
9	9.0740	27.14	11.16	38.30	60.00	-21.70	QP	
10	9.0740	21.75	11.16	32.91	50.00	-17.09	AVG	
11	11.6660	28.71	11.11	39.82	60.00	-20.18	QP	
12	11.6660	21.28	11.11	32.39	50.00	-17.61	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	39.02	10.27	49.29	65.78	-16.49	QP	
2	0.1539	28.95	10.27	39.22	55.78	-16.56	AVG	
3	0.1900	33.83	10.31	44.14	64.03	-19.89	QP	
4	0.1900	23.16	10.31	33.47	54.03	-20.56	AVG	
5	0.2340	24.93	10.37	35.30	62.30	-27.00	QP	
6	0.2340	18.90	10.37	29.27	52.30	-23.03	AVG	
7	9.0860	27.31	11.16	38.47	60.00	-21.53	QP	
8	9.0860	24.90	11.16	36.06	50.00	-13.94	AVG	
9	11.6820	30.62	11.11	41.73	60.00	-18.27	QP	
10	11.6820	27.33	11.11	38.44	50.00	-11.56	AVG	
11	14.2780	23.54	10.93	34.47	60.00	-25.53	QP	
12	14.2780	19.78	10.93	30.71	50.00	-19.29	AVG	

9 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 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	$20\log^{(500)}$

9.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

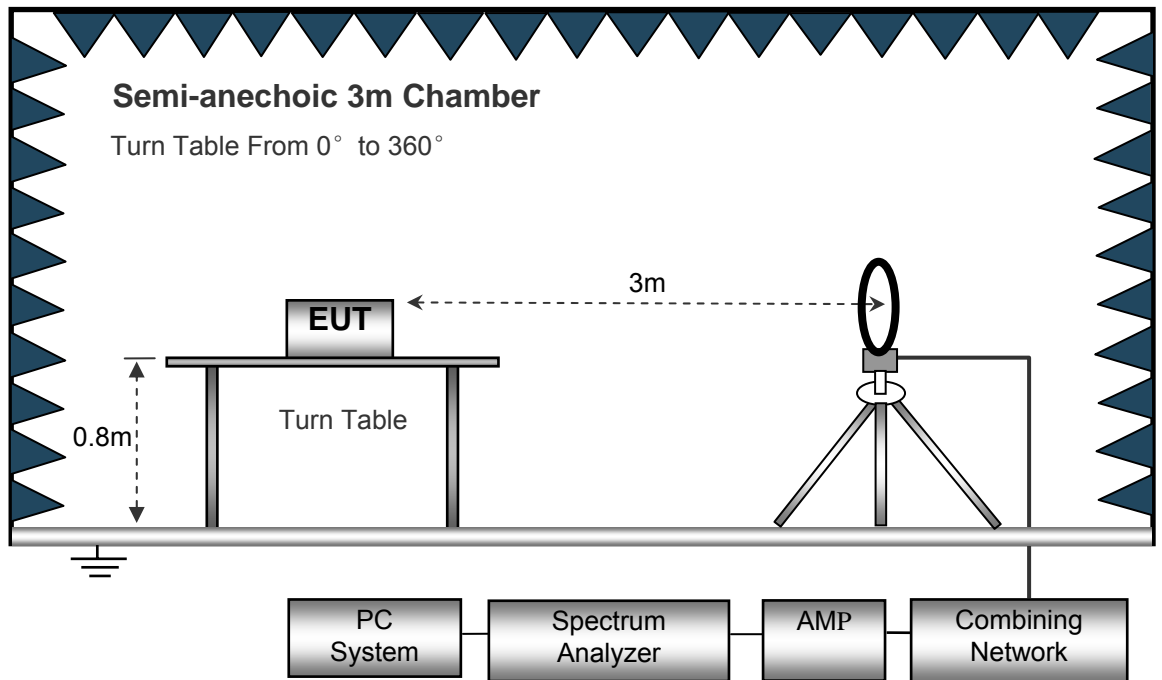
EUT Operation :

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

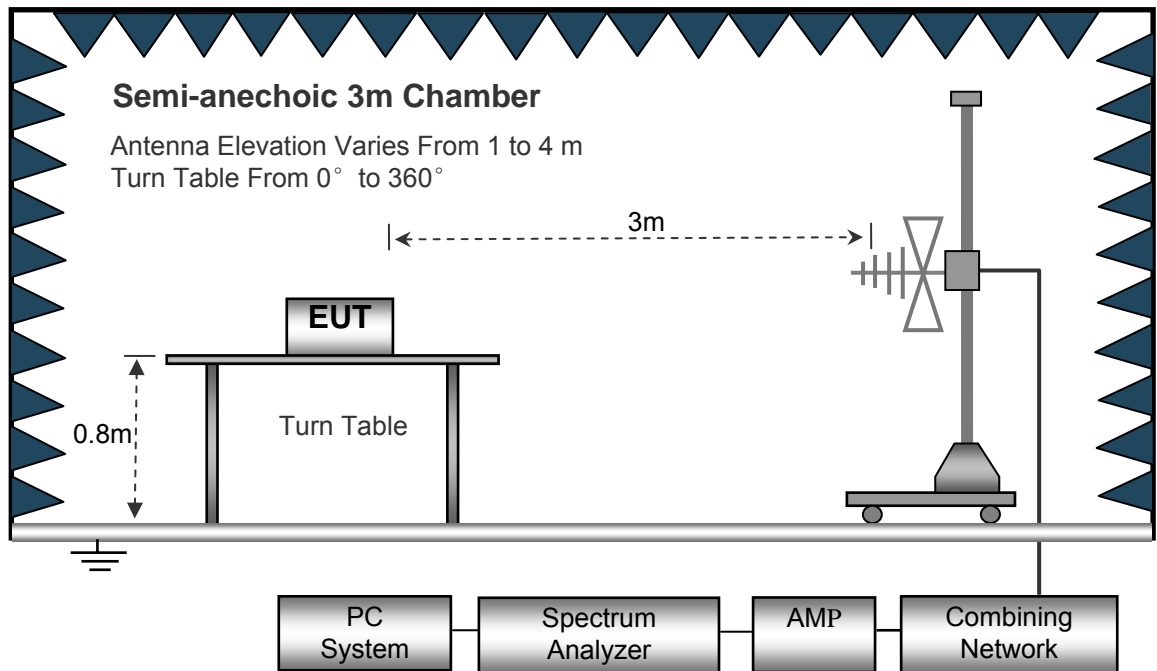
9.2 Test Setup

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

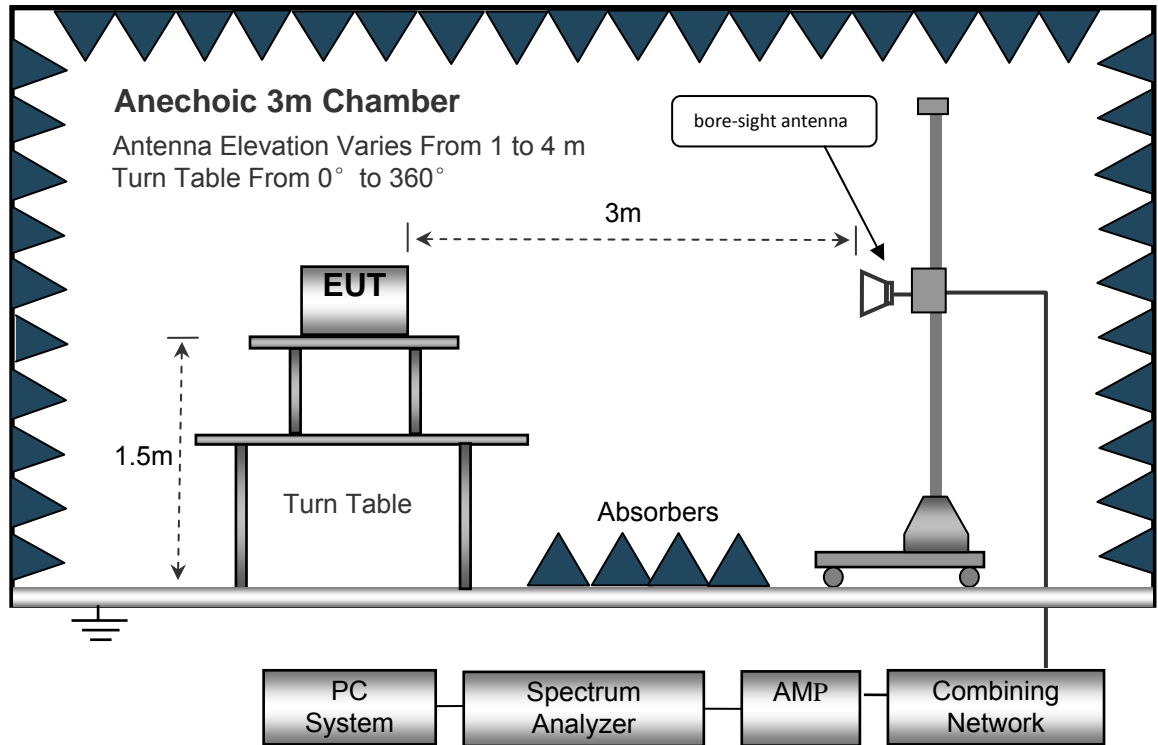
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



9.3 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

9.4 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 during radiated emissions above 1GHz measurement.

9.5 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:

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

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:

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

9.6 Summary of Test Results

Wifi:

Test Frequency: 9KHz~30MHz

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

Frequency	Measurement results dB μ V @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dB μ V/m @30m	Limits dB μ V/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
802.11b							
6.021	25.12	QP	21.84	40.00	6.96	29.54	-22.58
15.730	25.41	QP	21.35	40.00	6.76	29.54	-22.78
25.680	24.66	QP	20.67	40.00	5.33	29.54	-24.21
802.11g							
6.021	25.04	QP	21.84	40.00	6.88	29.54	-22.66
15.730	25.18	QP	21.35	40.00	6.53	29.54	-23.01
25.680	24.98	QP	20.67	40.00	5.65	29.54	-23.89
802.11n(HT20)							
6.021	25.82	QP	21.84	40.00	7.66	29.54	-21.88
15.730	24.75	QP	21.35	40.00	6.10	29.54	-23.44
25.680	25.11	QP	20.67	40.00	5.78	29.54	-23.76

Test Frequency : 30MHz ~ 18GHz

Remark: only the worst data (Long antenna prototype) were recorded.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: Low Channel 2412MHz									
223.45	42.70	QP	3	1.1	H	-11.62	31.08	46.00	-14.92
223.45	34.86	QP	6	1.7	V	-11.62	23.24	46.00	-22.76
4824.00	49.69	PK	16	1.4	V	-1.06	48.63	74.00	-25.37
4824.00	47.67	Ave	16	1.4	V	-1.06	46.61	54.00	-7.39
7236.00	39.82	PK	329	1.8	H	1.33	41.15	74.00	-32.85
7236.00	43.75	Ave	329	1.8	H	1.33	45.08	54.00	-8.92
2330.99	45.84	PK	192	1.6	V	-13.19	32.65	74.00	-41.35
2330.99	39.55	Ave	192	1.6	V	-13.19	26.36	54.00	-27.64
2355.11	44.37	PK	205	1.7	H	-13.14	31.23	74.00	-42.77
2355.11	37.58	Ave	205	1.7	H	-13.14	24.44	54.00	-29.56
2496.50	45.00	PK	79	1.4	V	-13.08	31.92	74.00	-42.08
2496.50	37.59	Ave	79	1.4	V	-13.08	24.51	54.00	-29.49

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: Middle Channel 2437MHz									
223.45	41.57	QP	321	1.1	H	-11.62	29.95	46.00	-16.05
223.45	36.12	QP	176	1.0	V	-11.62	24.50	46.00	-21.50
4874.00	48.25	PK	148	1.0	V	-0.62	47.63	74.00	-26.37
4874.00	48.46	Ave	148	1.0	V	-0.62	47.84	54.00	-6.16
7311.00	39.27	PK	55	1.5	H	2.21	41.48	74.00	-32.52
7311.00	44.39	Ave	55	1.5	H	2.21	46.60	54.00	-7.40
2349.44	46.39	PK	77	1.4	V	-13.19	33.20	74.00	-40.80
2349.44	37.56	Ave	77	1.4	V	-13.19	24.37	54.00	-29.63
2383.03	43.72	PK	318	1.3	H	-13.14	30.58	74.00	-43.42
2383.03	37.62	Ave	318	1.3	H	-13.14	24.48	54.00	-29.52
2496.11	44.15	PK	156	1.4	V	-13.08	31.07	74.00	-42.93
2496.11	38.25	Ave	156	1.4	V	-13.08	25.17	54.00	-28.83

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: High Channel 2462MHz									
223.45	42.04	QP	11	2.0	H	-11.62	30.42	46.00	-15.58
223.45	35.04	QP	169	1.6	V	-11.62	23.42	46.00	-22.58
4924.00	47.38	PK	145	1.4	V	-0.24	47.14	74.00	-26.86
4924.00	48.30	Ave	145	1.4	V	-0.24	48.06	54.00	-5.94
7386.00	38.07	PK	20	1.5	H	2.84	40.91	74.00	-33.09
7386.00	45.66	Ave	20	1.5	H	2.84	48.50	54.00	-5.50
2341.73	45.90	PK	338	1.6	V	-13.19	32.71	74.00	-41.29
2341.73	37.78	Ave	338	1.6	V	-13.19	24.59	54.00	-29.41
2366.58	44.35	PK	45	1.2	H	-13.14	31.21	74.00	-42.79
2366.58	36.04	Ave	45	1.2	H	-13.14	22.90	54.00	-31.10
2492.07	42.94	PK	181	2.0	V	-13.08	29.86	74.00	-44.14
2492.07	37.04	Ave	181	2.0	V	-13.08	23.96	54.00	-30.04

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: Low Channel 2412MHz									
223.45	43.05	QP	182	1.8	H	-11.62	31.43	46.00	-14.57
223.45	35.28	QP	39	1.5	V	-11.62	23.66	46.00	-22.34
4824.00	47.55	PK	302	2.0	V	-1.06	46.49	74.00	-27.51
4824.00	49.12	Ave	302	2.0	V	-1.06	48.06	54.00	-5.94
7236.00	39.22	PK	287	1.9	H	1.33	40.55	74.00	-33.45
7236.00	45.09	Ave	287	1.9	H	1.33	46.42	54.00	-7.58
2331.25	46.83	PK	351	1.3	V	-13.19	33.64	74.00	-40.36
2331.25	37.05	Ave	351	1.3	V	-13.19	23.86	54.00	-30.14
2383.19	44.02	PK	343	1.1	H	-13.14	30.88	74.00	-43.12
2383.19	36.72	Ave	343	1.1	H	-13.14	23.58	54.00	-30.42
2490.97	42.68	PK	22	2.0	V	-13.08	29.60	74.00	-44.40
2490.97	38.33	Ave	22	2.0	V	-13.08	25.25	54.00	-28.75

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	43.79	QP	292	1.5	H	-11.62	32.17	46.00	-13.83
223.45	34.93	QP	286	1.1	V	-11.62	23.31	46.00	-22.69
4874.00	47.28	PK	34	1.9	V	-0.62	46.66	74.00	-27.34
4874.00	49.66	Ave	34	1.9	V	-0.62	49.04	54.00	-4.96
7311.00	39.12	PK	120	1.3	H	2.21	41.33	74.00	-32.67
7311.00	45.21	Ave	120	1.3	H	2.21	47.42	54.00	-6.58
2349.92	46.36	PK	273	1.1	V	-13.19	33.17	74.00	-40.83
2349.92	39.93	Ave	273	1.1	V	-13.19	26.74	54.00	-27.26
2384.48	43.11	PK	140	1.8	H	-13.14	29.97	74.00	-44.03
2384.48	37.39	Ave	140	1.8	H	-13.14	24.25	54.00	-29.75
2488.36	43.85	PK	64	1.8	V	-13.08	30.77	74.00	-43.23
2488.36	36.36	Ave	64	1.8	V	-13.08	23.28	54.00	-30.72

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: High Channel 2462MHz									
223.45	43.49	QP	225	1.4	H	-11.62	31.87	46.00	-14.13
223.45	35.84	QP	162	1.9	V	-11.62	24.22	46.00	-21.78
4924.00	47.03	PK	297	1.6	V	-0.24	46.79	74.00	-27.21
4924.00	48.77	Ave	297	1.6	V	-0.24	48.53	54.00	-5.47
7386.00	39.76	PK	19	1.3	H	2.84	42.60	74.00	-31.40
7386.00	46.71	Ave	19	1.3	H	2.84	49.55	54.00	-4.45
2343.73	46.70	PK	198	1.1	V	-13.19	33.51	74.00	-40.49
2343.73	38.06	Ave	198	1.1	V	-13.19	24.87	54.00	-29.13
2353.00	42.66	PK	41	1.6	H	-13.14	29.52	74.00	-44.48
2353.00	38.52	Ave	41	1.6	H	-13.14	25.38	54.00	-28.62
2498.71	44.14	PK	220	1.8	V	-13.08	31.06	74.00	-42.94
2498.71	37.28	Ave	220	1.8	V	-13.08	24.20	54.00	-29.80

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n20: Low Channel 2412MHz									
223.45	43.78	QP	220	1.1	H	-11.62	32.16	46.00	-13.84
223.45	34.36	QP	221	1.6	V	-11.62	22.74	46.00	-23.26
4824.00	46.24	PK	259	1.7	V	-1.06	45.18	74.00	-28.82
4824.00	47.88	Ave	259	1.7	V	-1.06	46.82	54.00	-7.18
7236.00	39.98	PK	163	1.6	H	1.33	41.31	74.00	-32.69
7236.00	48.02	Ave	163	1.6	H	1.33	49.35	54.00	-4.65
2345.38	45.08	PK	240	1.6	V	-13.19	31.89	74.00	-42.11
2345.38	39.19	Ave	240	1.6	V	-13.19	26.00	54.00	-28.00
2387.89	44.51	PK	305	1.5	H	-13.14	31.37	74.00	-42.63
2387.89	37.97	Ave	305	1.5	H	-13.14	24.83	54.00	-29.17
2490.68	43.37	PK	344	1.4	V	-13.08	30.29	74.00	-43.71
2490.68	37.74	Ave	344	1.4	V	-13.08	24.66	54.00	-29.34

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n20: Middle Channel 2437MHz									
223.45	39.68	QP	298	1.2	H	-11.62	28.06	46.00	-17.94
223.45	37.22	QP	101	1.5	V	-11.62	25.60	46.00	-20.40
4874.00	51.48	PK	45	2.0	V	-0.62	50.86	74.00	-23.14
4874.00	45.99	Ave	45	2.0	V	-0.62	45.37	54.00	-8.63
7311.00	42.19	PK	155	1.1	H	2.21	44.40	74.00	-29.60
7311.00	39.67	Ave	155	1.1	H	2.21	41.88	54.00	-12.12
2328.55	46.53	PK	237	1.7	V	-13.19	33.34	74.00	-40.66
2328.55	37.67	Ave	237	1.7	V	-13.19	24.48	54.00	-29.52
2355.98	43.38	PK	111	1.8	H	-13.14	30.24	74.00	-43.76
2355.98	37.96	Ave	111	1.8	H	-13.14	24.82	54.00	-29.18
2486.04	42.25	PK	287	1.6	V	-13.08	29.17	74.00	-44.83
2486.04	38.00	Ave	287	1.6	V	-13.08	24.92	54.00	-29.08

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n20: High Channel 2462MHz									
223.45	40.54	QP	264	1.1	H	-11.62	28.92	46.00	-17.08
223.45	35.90	QP	67	1.1	V	-11.62	24.28	46.00	-21.72
4924.00	52.10	PK	9	1.4	V	-0.24	51.86	74.00	-22.14
4924.00	46.81	Ave	9	1.4	V	-0.24	46.57	54.00	-7.43
7386.00	40.73	PK	284	1.8	H	2.84	43.57	74.00	-30.43
7386.00	41.04	Ave	284	1.8	H	2.84	43.88	54.00	-10.12
2325.82	45.88	PK	146	1.8	V	-13.19	32.69	74.00	-41.31
2325.82	39.44	Ave	146	1.8	V	-13.19	26.25	54.00	-27.75
2374.19	44.97	PK	107	1.3	H	-13.14	31.83	74.00	-42.17
2374.19	37.55	Ave	107	1.3	H	-13.14	24.41	54.00	-29.59
2498.95	44.23	PK	351	1.8	V	-13.08	31.15	74.00	-42.85
2498.95	38.17	Ave	351	1.8	V	-13.08	25.09	54.00	-28.91

Test Frequency: 18GHz~25GHz

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

10 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 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)).

10.1 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 $\approx [3 \times \text{RBW}]$.
 - 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.

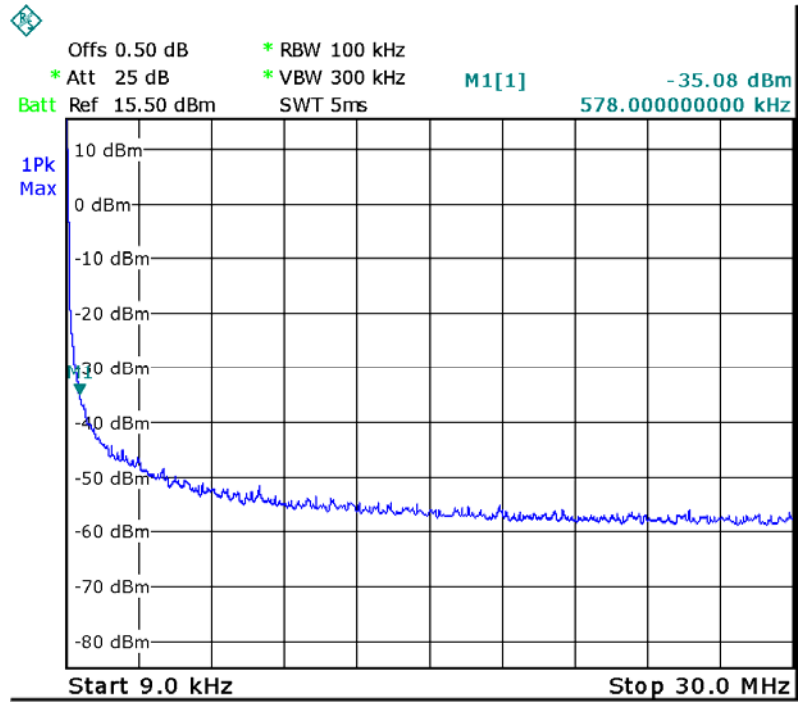
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

10.2 Test Result

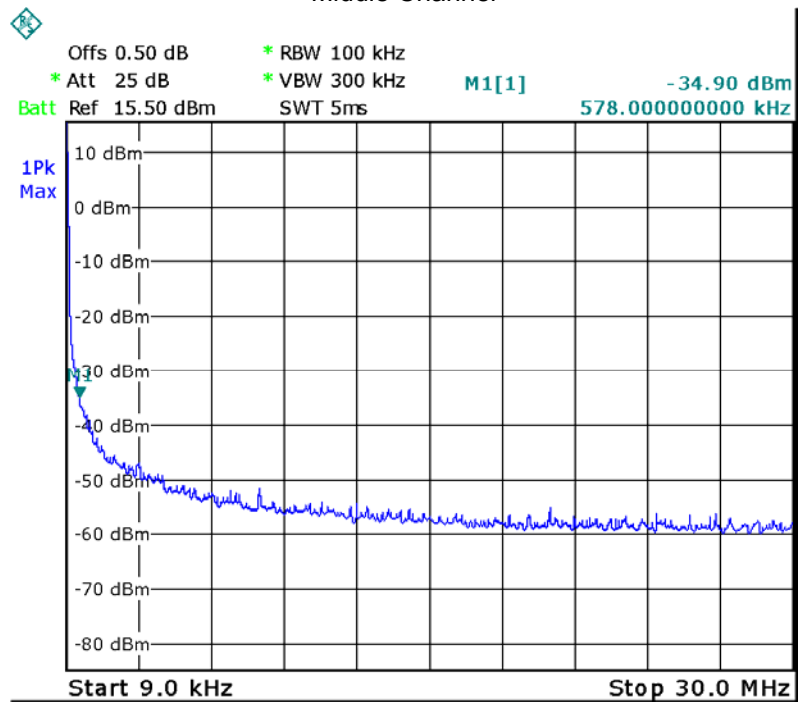
9KHz – 30MHz

802.11b

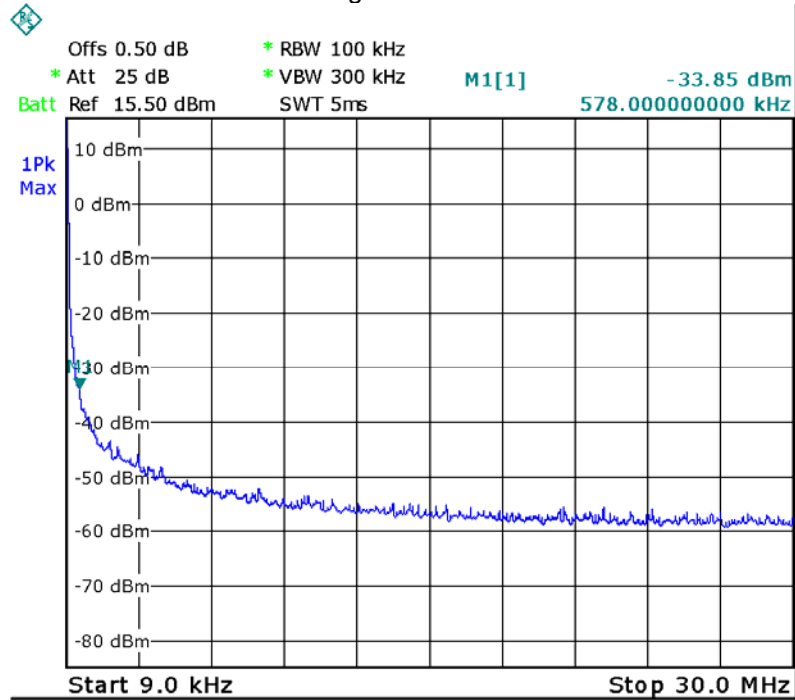
Low Channel



Middle Channel

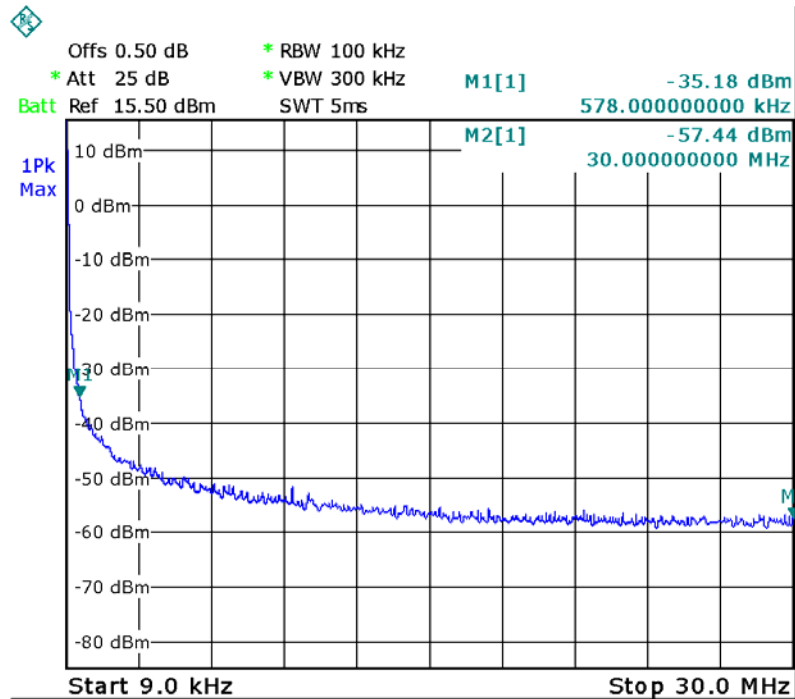


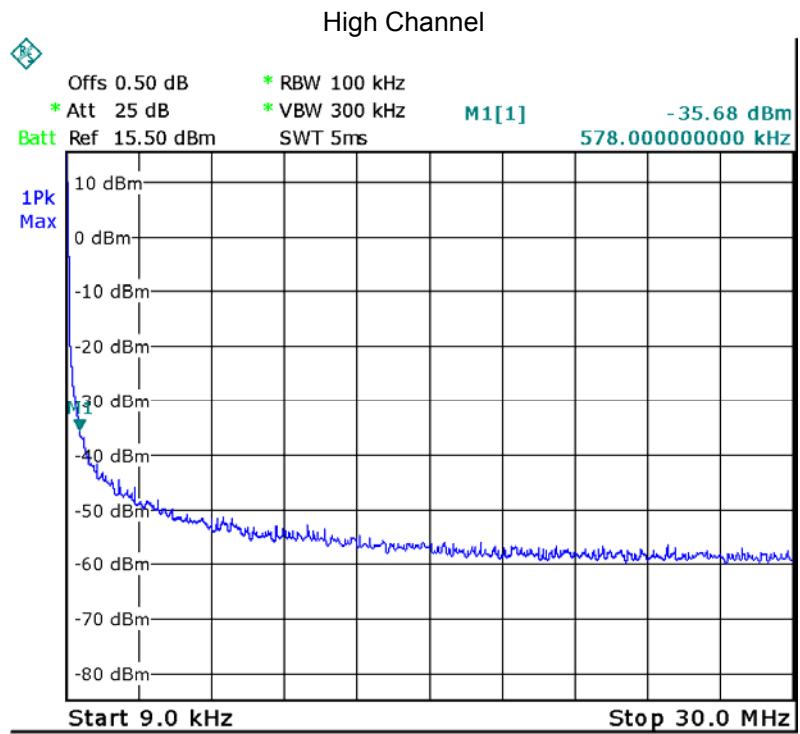
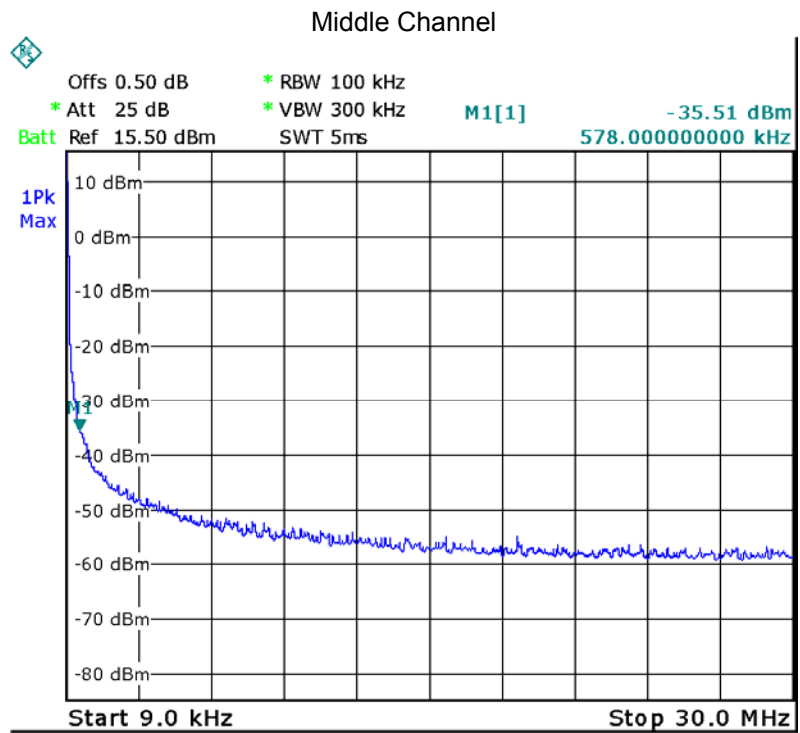
High Channel



802.11g

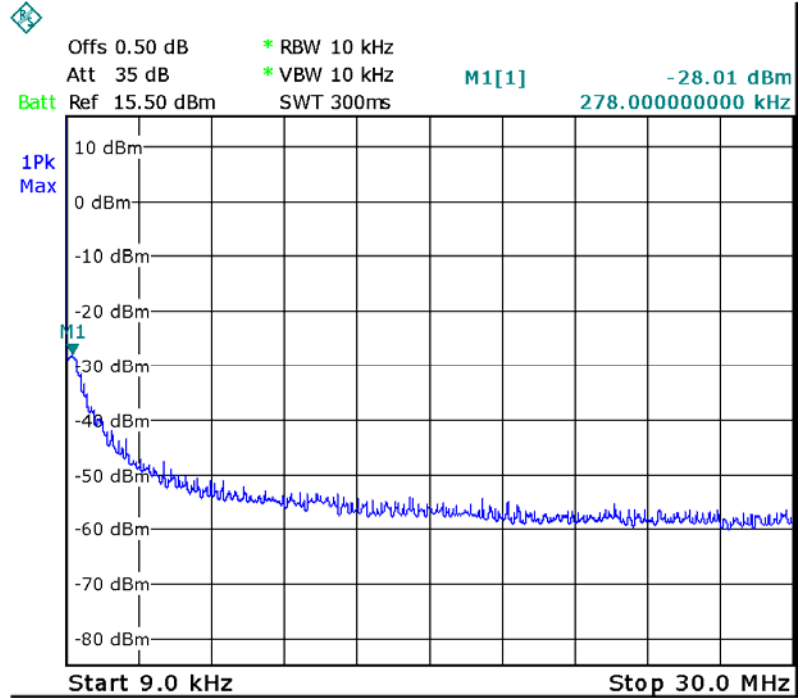
Low Channel



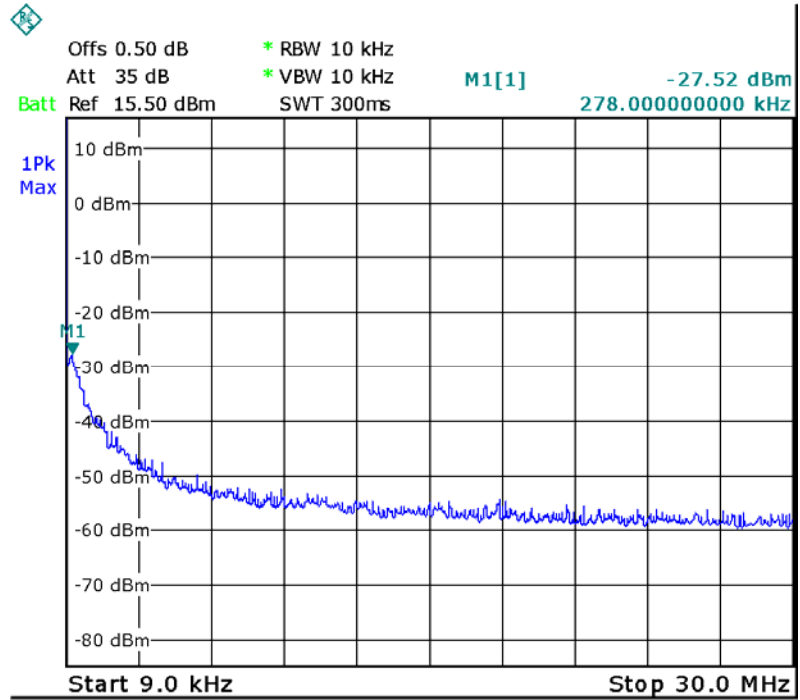


802.11n HT20

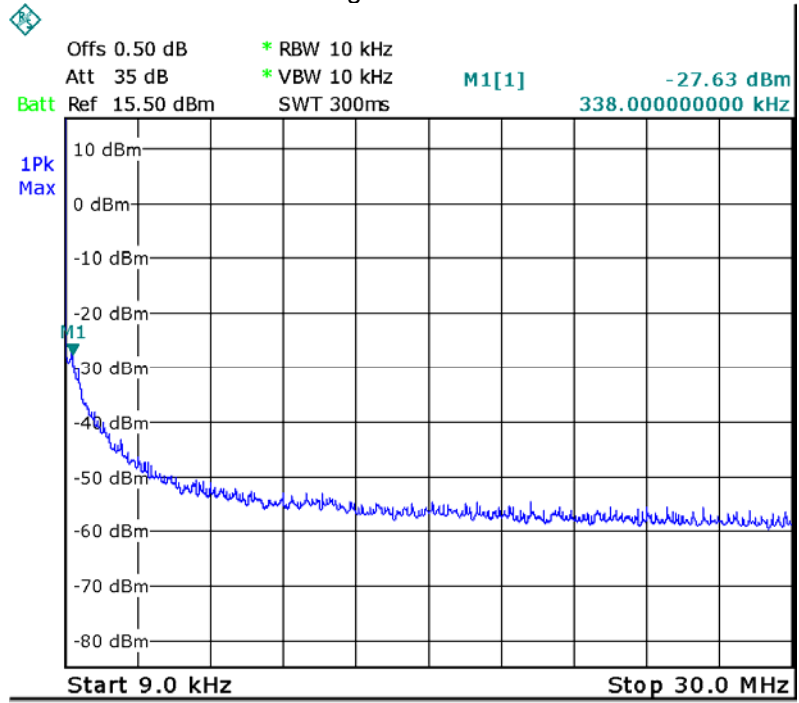
Low Channel



Middle Channel



High Channel



Above 30MHz

802.11b

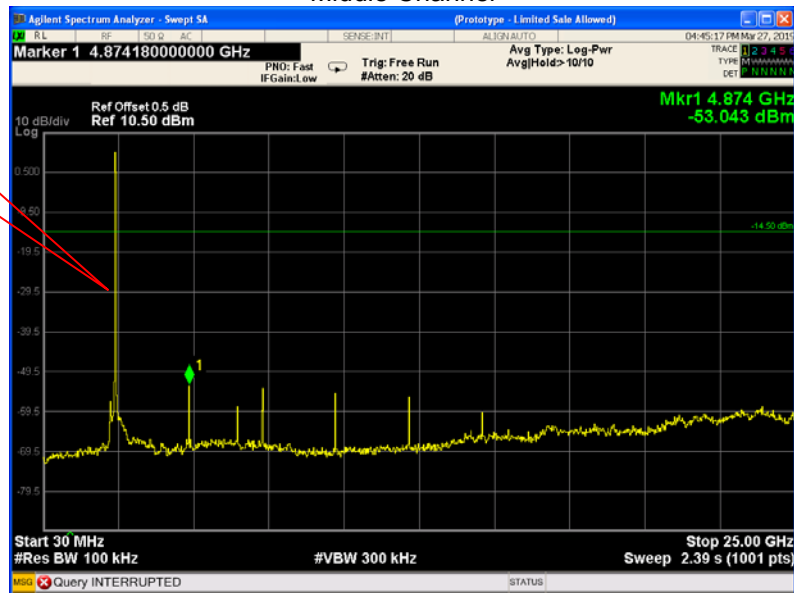
Low Channel

Fundamental



Middle Channel

Fundamental



High Channel

Fundamental



802.11g

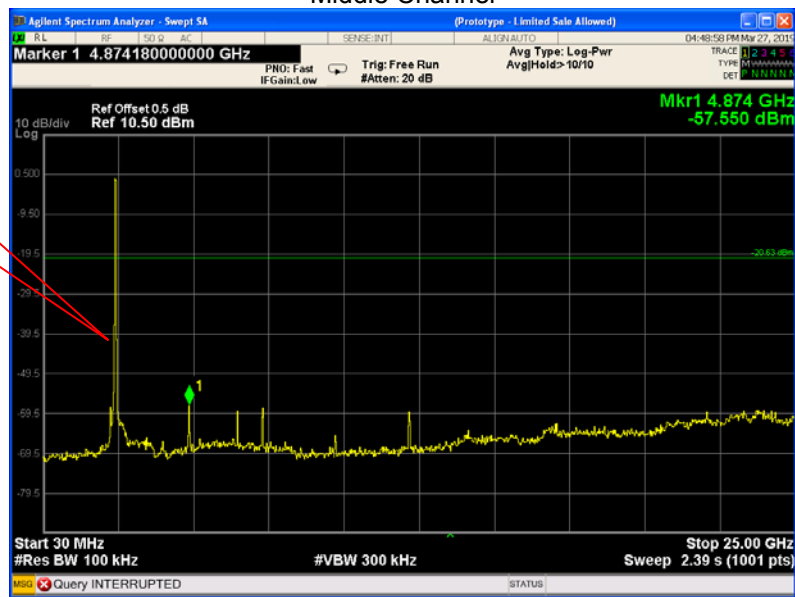
Low Channel

Fundamental



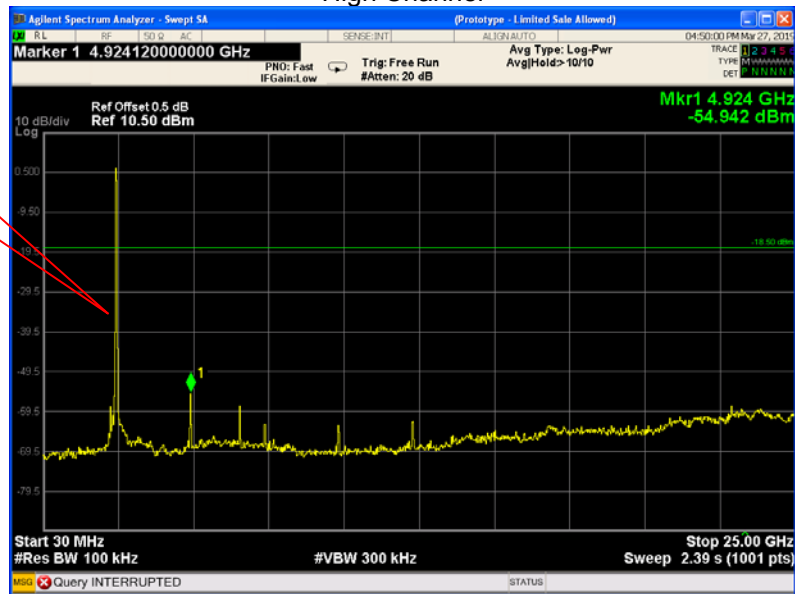
Middle Channel

Fundamental



High Channel

Fundamental



802.11n HT20

Low Channel

Fundamental



Middle Channel

Fundamental



High Channel

Fundamental



11 Band Edge Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 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)).

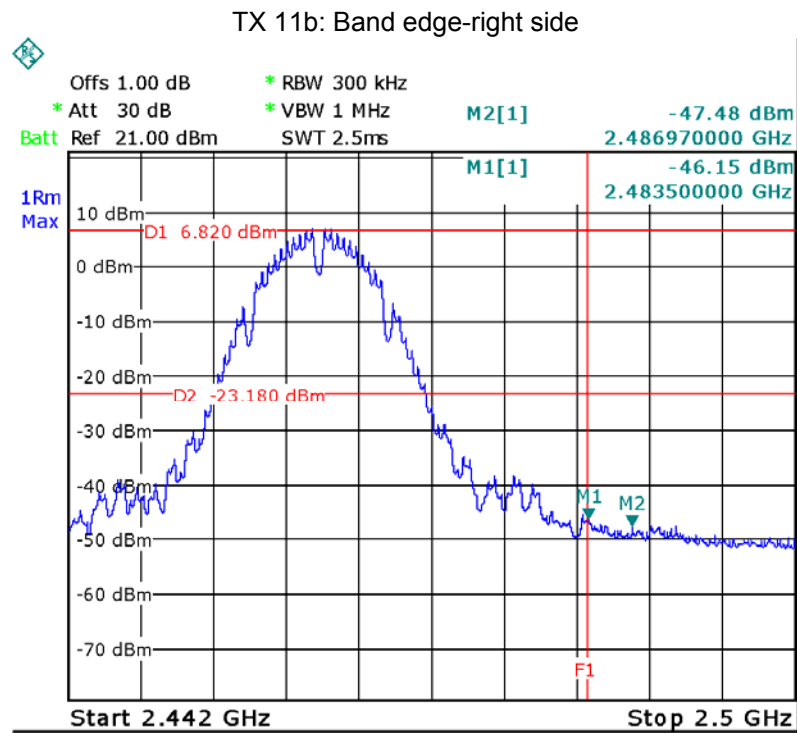
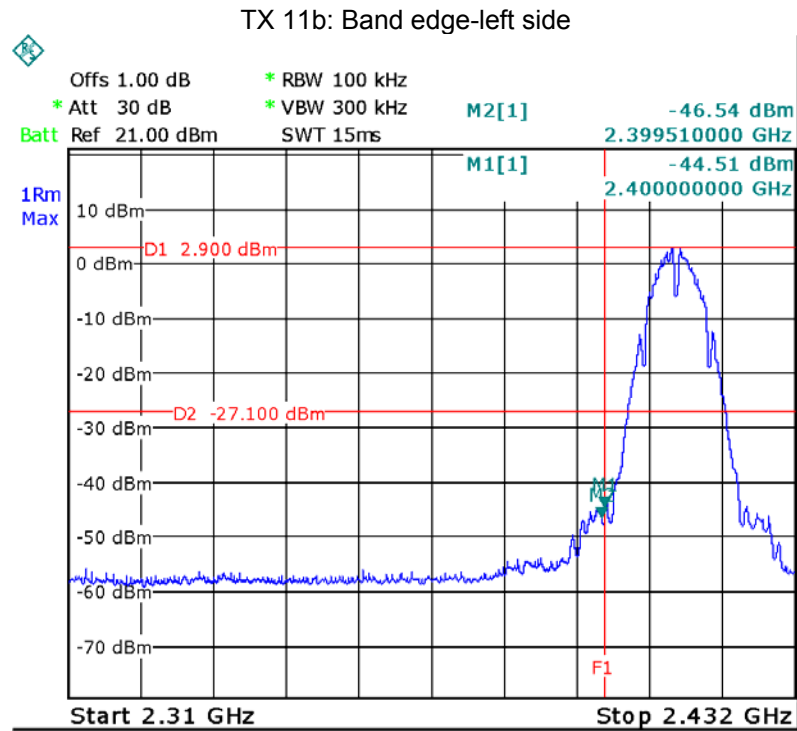
Test Mode: Transmitting

11.1 Test Produce

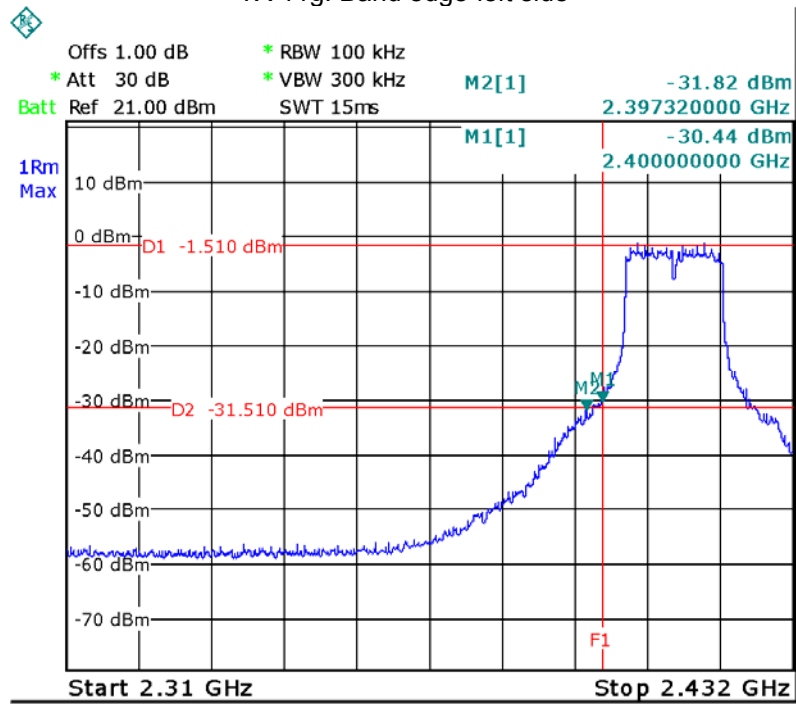
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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.

11.2 Test Result

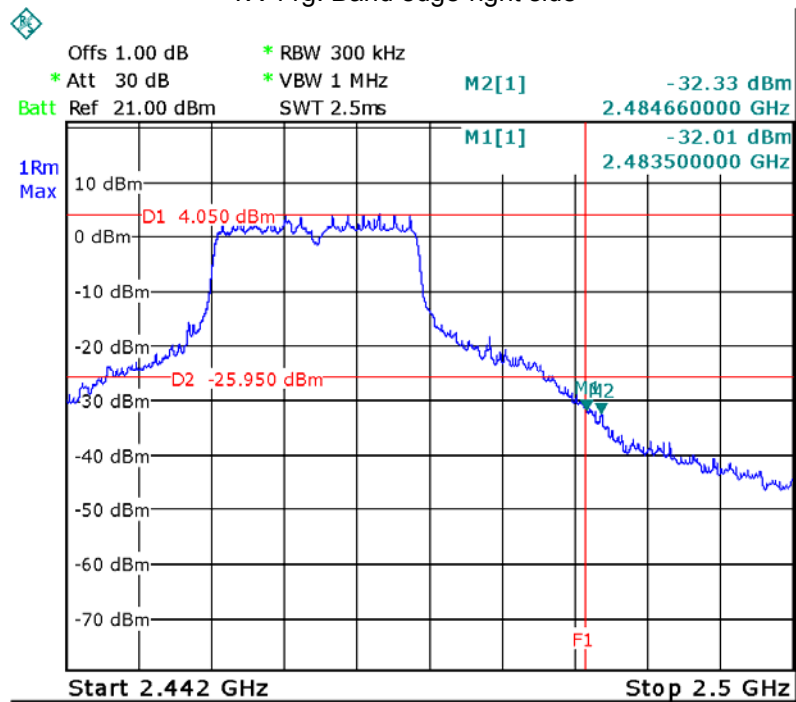
Test result plots shown as follows:



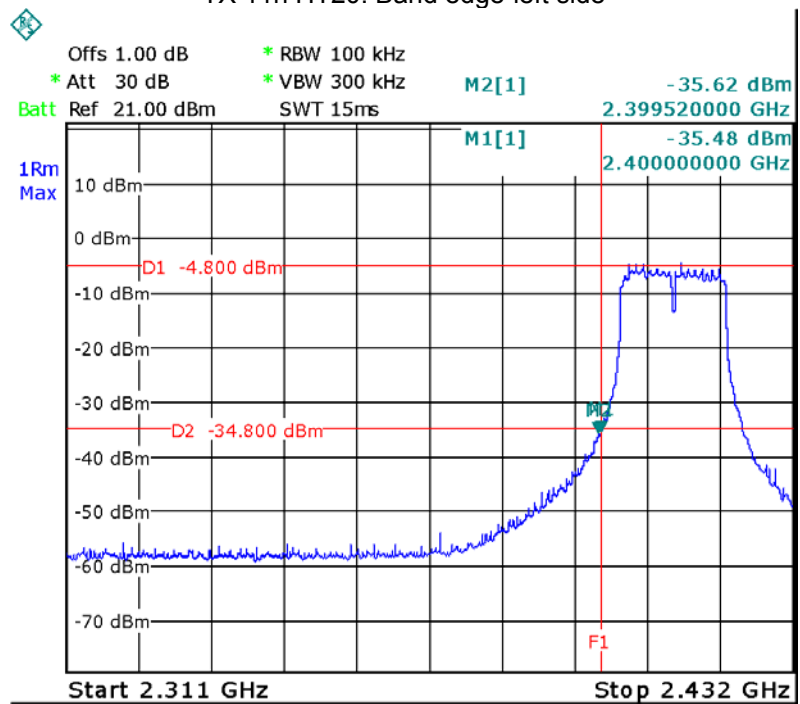
TX 11g: Band edge-left side



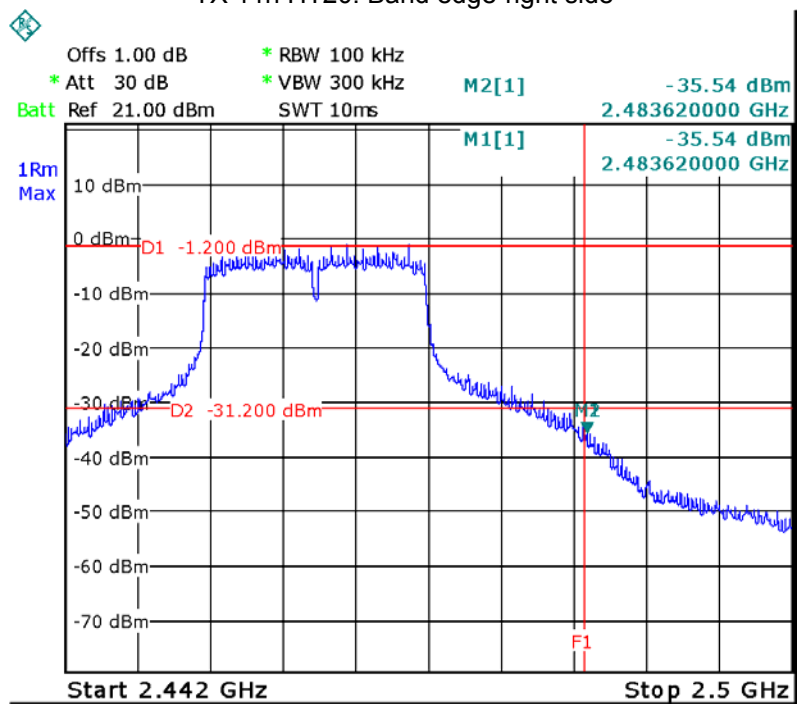
TX 11g: Band edge-right side



TX 11n HT20: Band edge-left side



TX 11n HT20: Band edge-right side



12 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 v05r01(February 11, 2019) ;
ANSI C63.10:2013

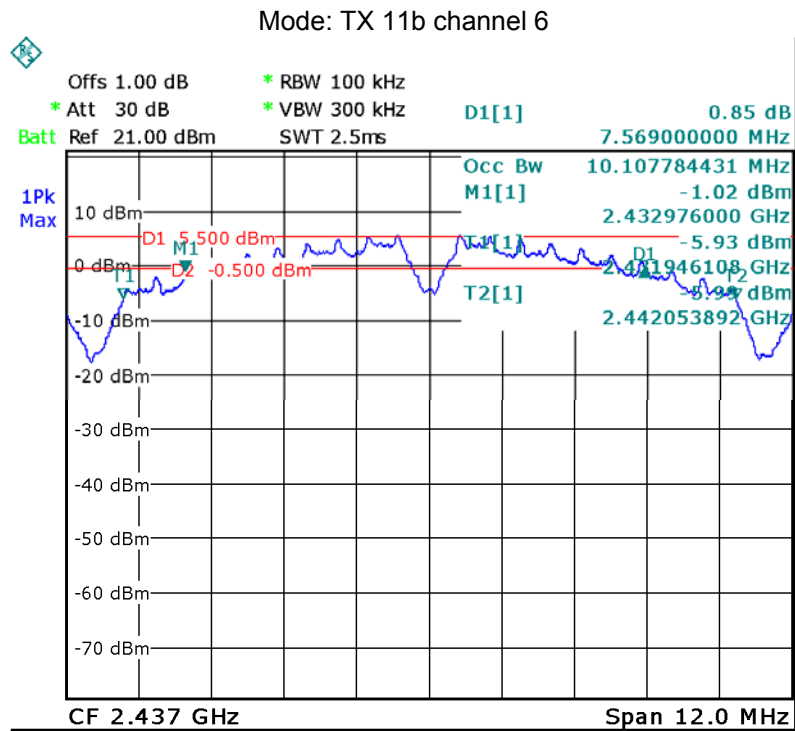
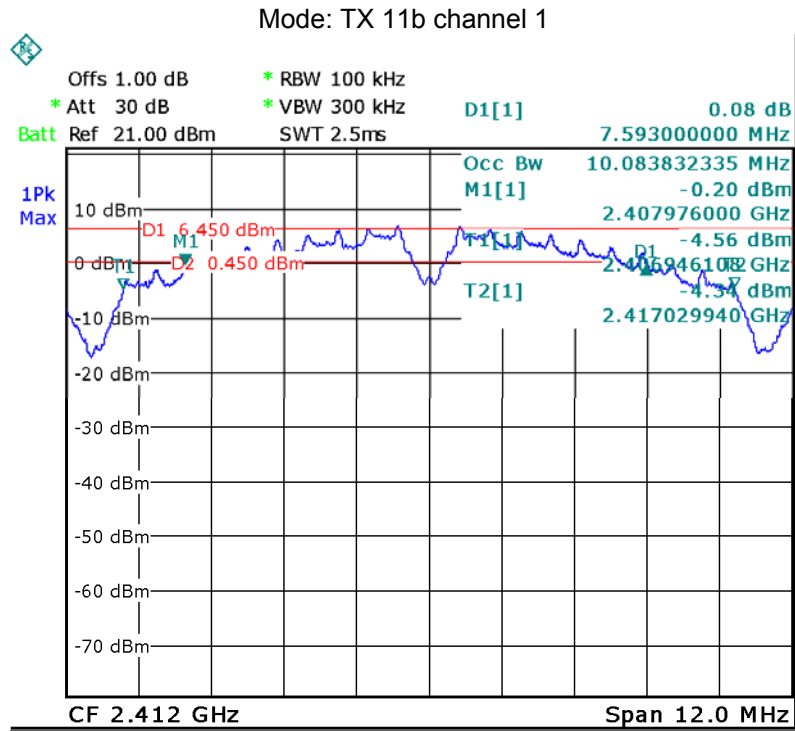
12.1 Test Procedure:

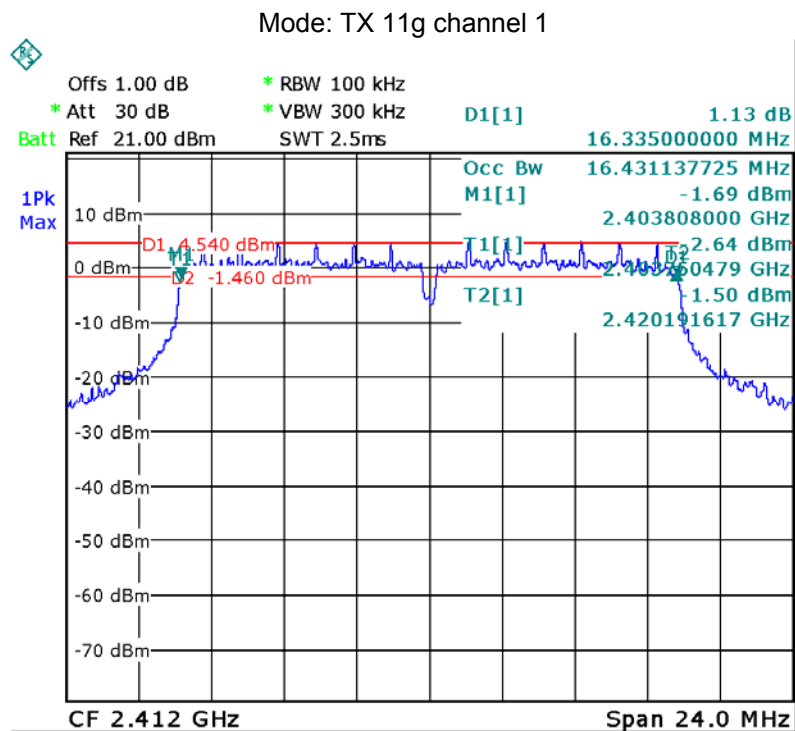
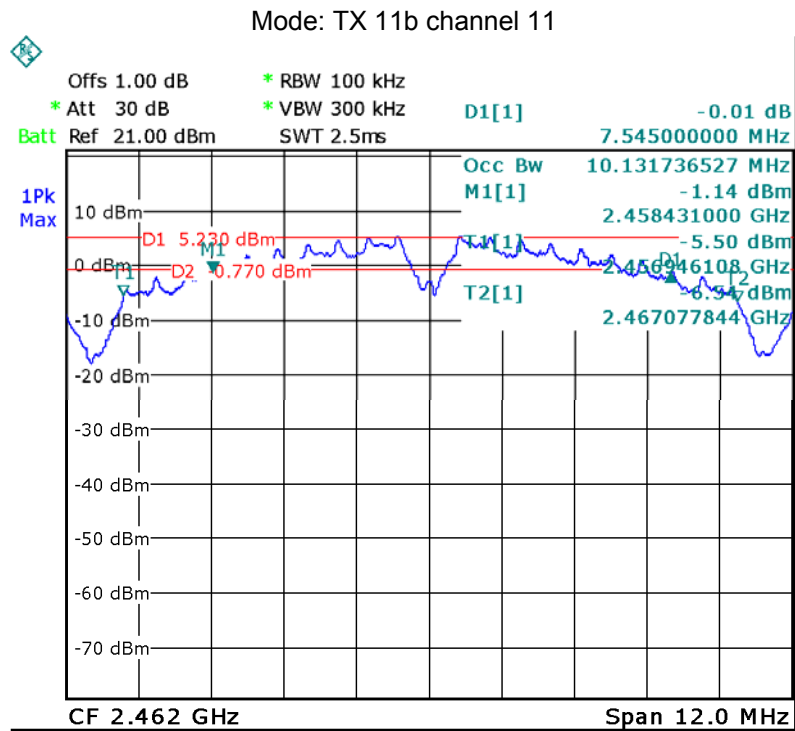
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

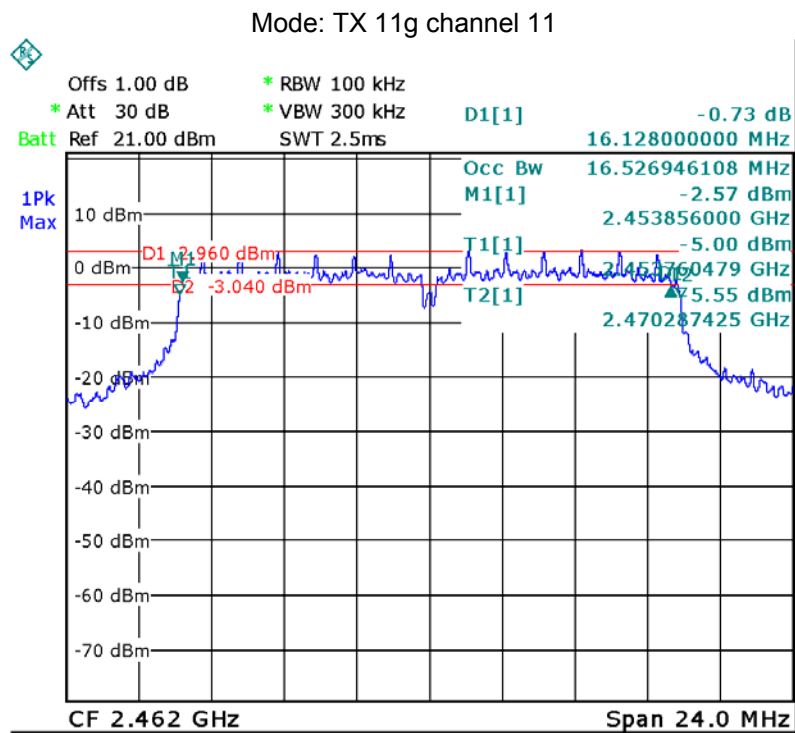
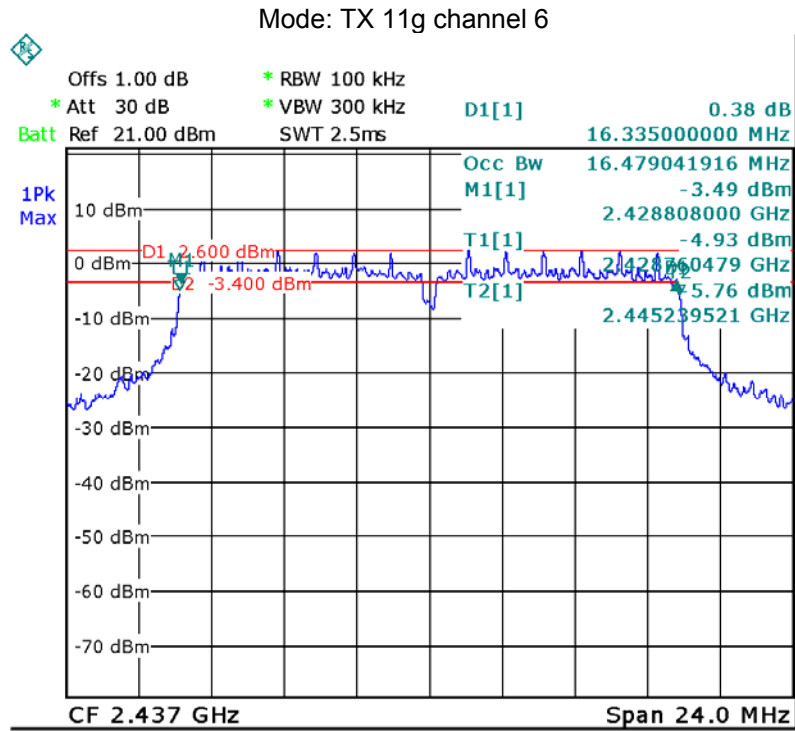
12.2 Test Result:

Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	7.593	10.084
	Channel 6	7.569	10.108
	Channel 11	7.545	10.132
TX 11g	Channel 1	16.335	16.431
	Channel 6	16.335	16.479
	Channel 11	16.128	16.527
TX 11n HT20	Channel 1	17.126	17.697
	Channel 6	17.385	17.697
	Channel 11	17.541	17.697

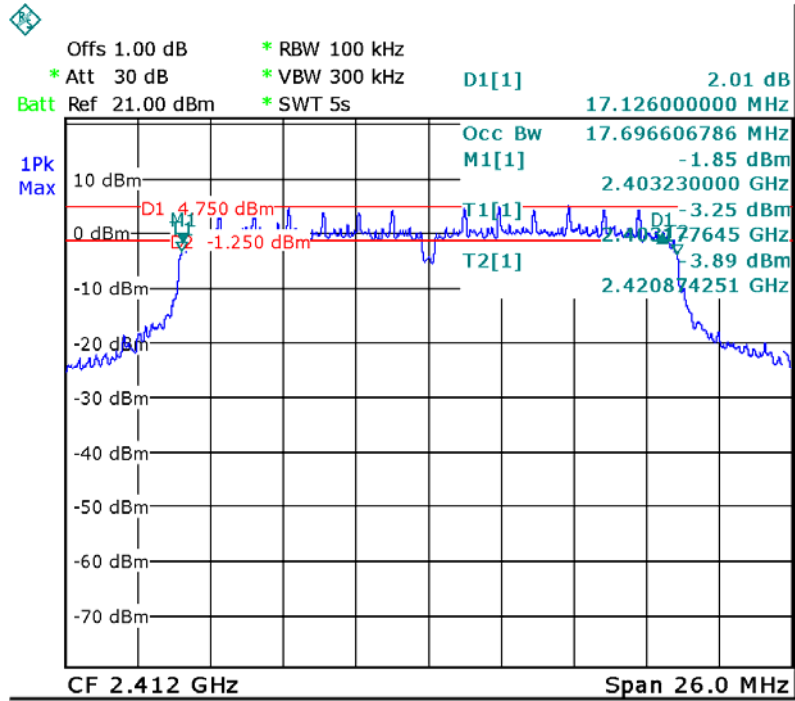
Test result plot:



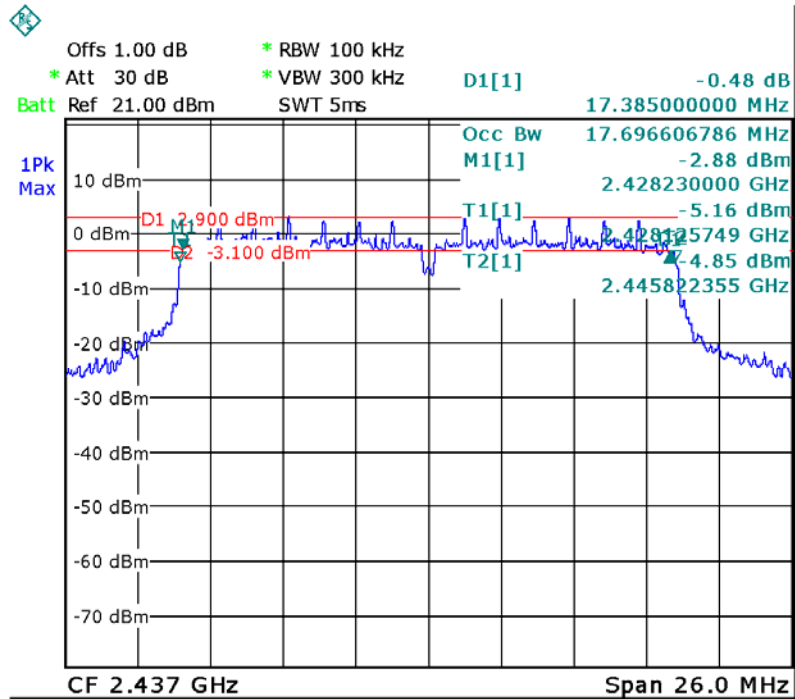




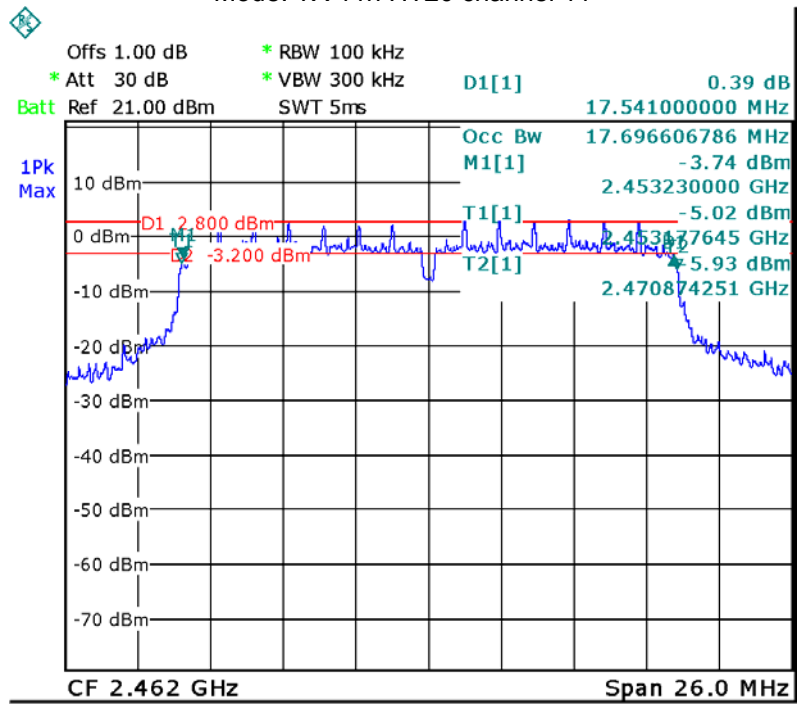
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



13 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 2019) ;
ANSI C63.10:2013

13.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 2019)

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.

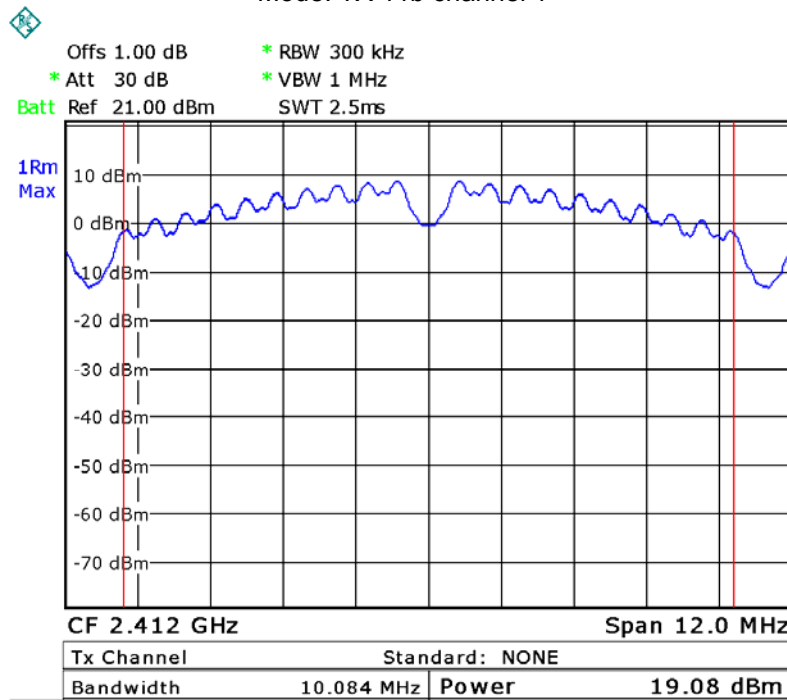
- a) Set the RBW = 1% to 5% of the OBW, not to exceed 1 MHz..
- b) Set the VBW $\geq 3 \times$ RBW
- c) Set the span $\geq 1.5 \times$ OBW.
- d) Detector = RMS.
- e) Sweep time = auto couple.
- f) trigger = free run..
- g) Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\geq \text{RBW} / 2$, 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..

13.2 Test Result:

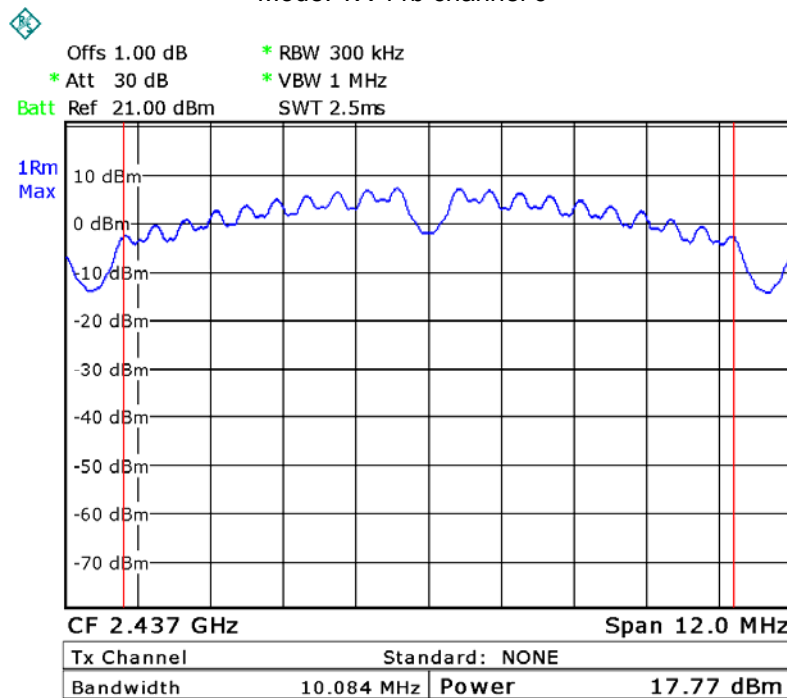
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	19.08	1W/30dBm
	Middle-2437	17.77	1W/30dBm
	High-2462	17.59	1W/30dBm
TX 11g	Low-2412	18.54	1W/30dBm
	Middle-2437	17.65	1W/30dBm
	High-2462	18.33	1W/30dBm
TX 11n HT20	Low-2412	15.57	1W/30dBm
	Middle-2437	18.36	1W/30dBm
	High-2462	17.74	1W/30dBm

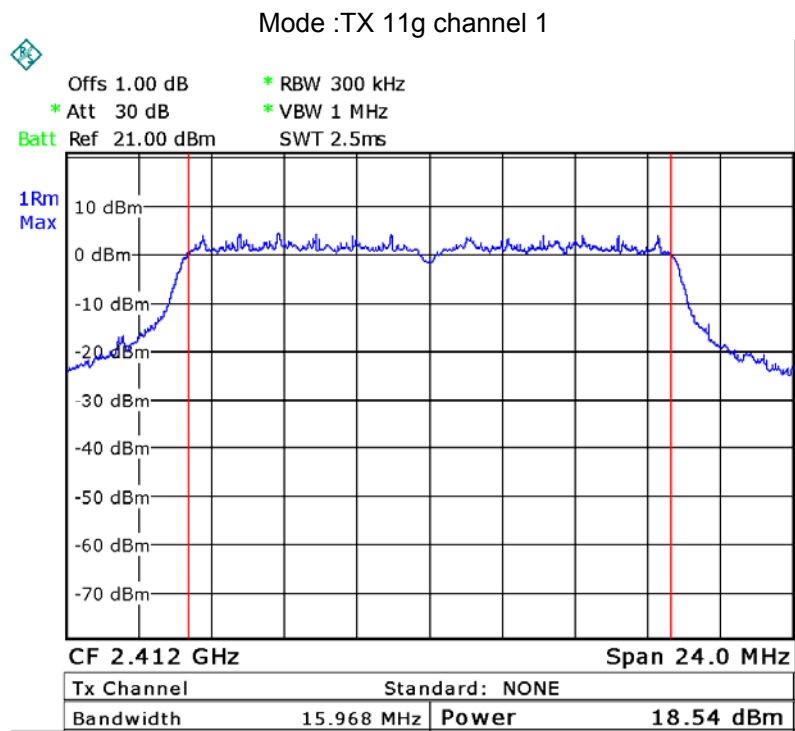
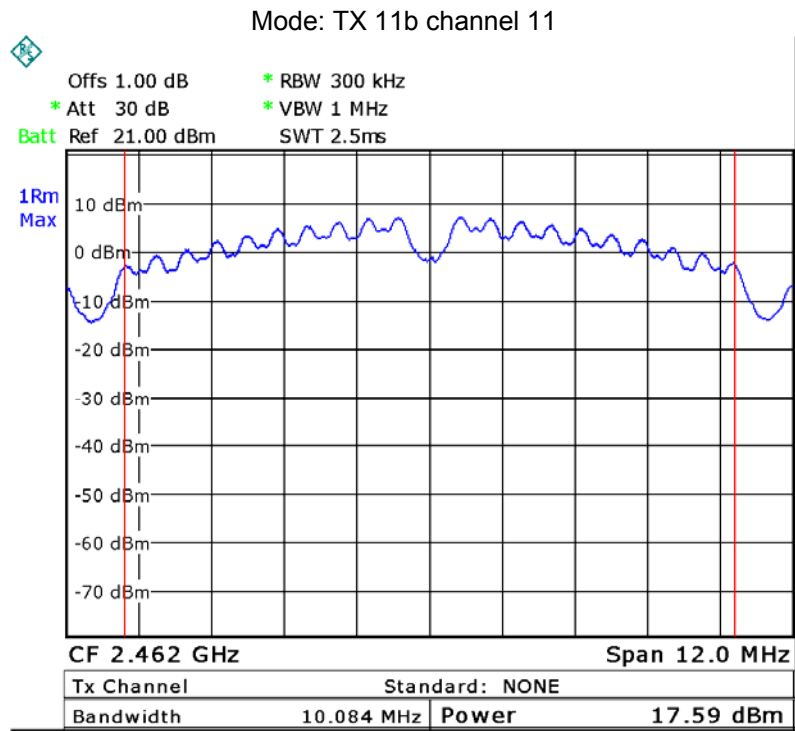
Test Plot

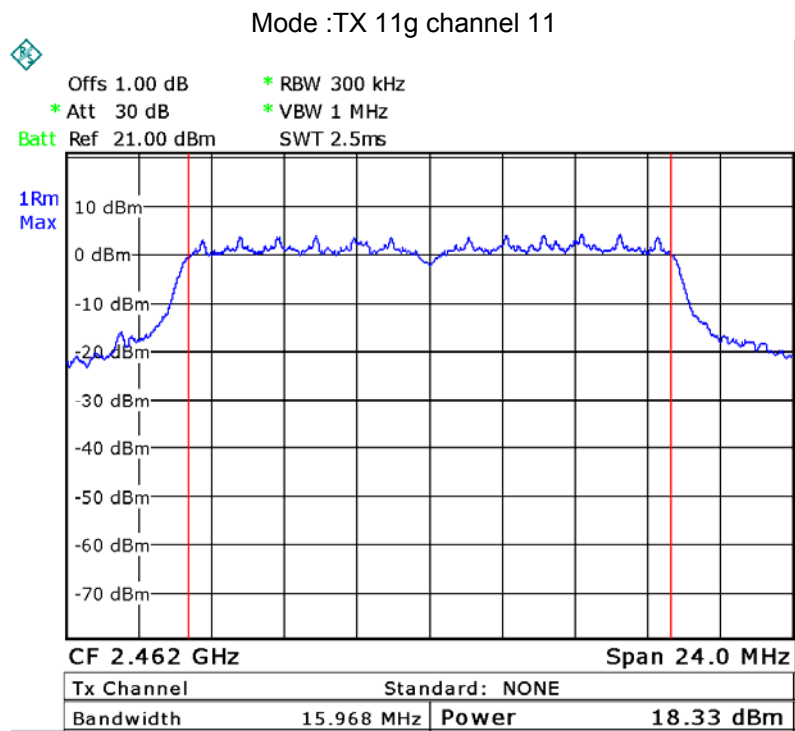
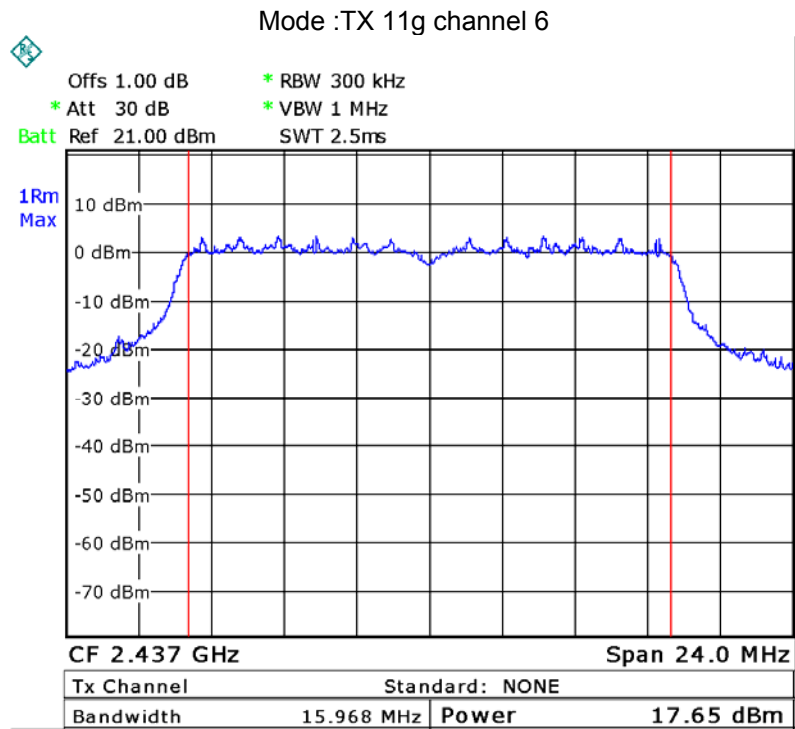
Mode: TX 11b channel 1



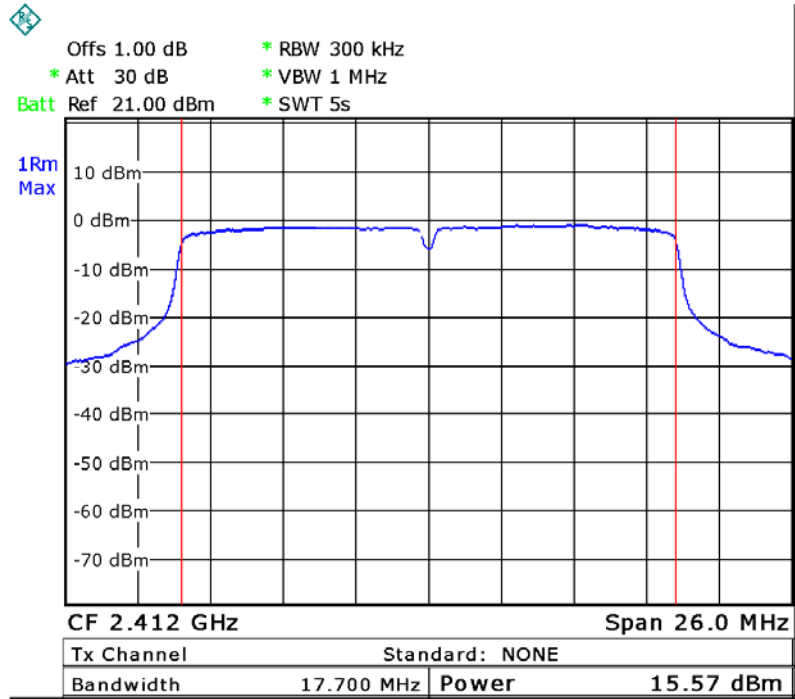
Mode: TX 11b channel 6



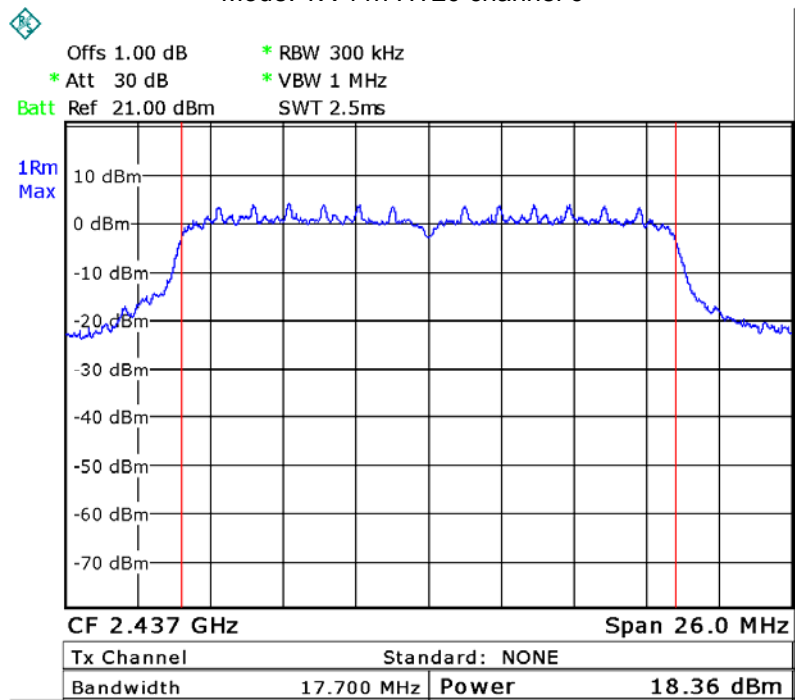


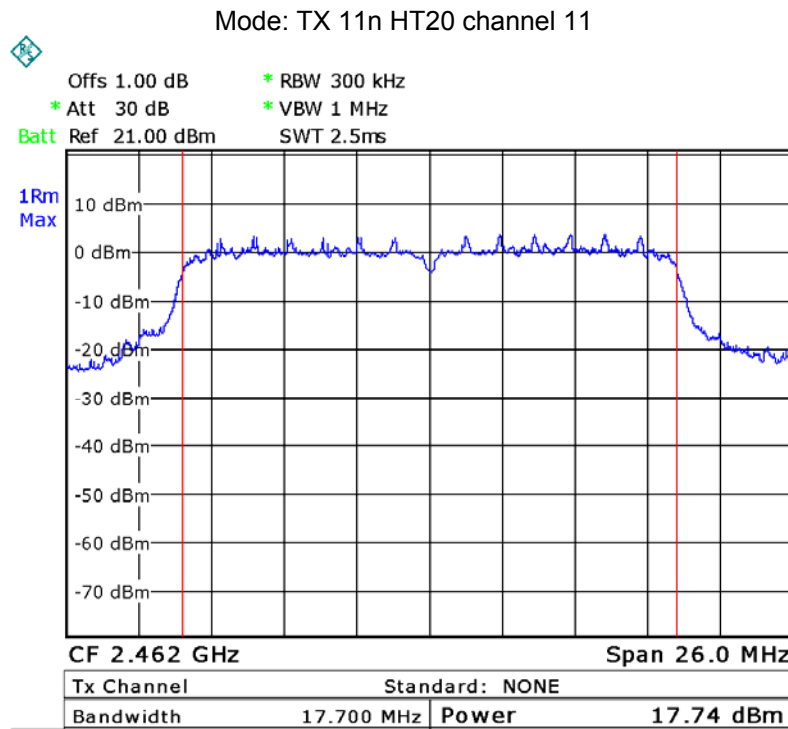


Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6





14 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 2019) ;
ANSI C63.10:2013

14.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r01(February 11, 2019) ; section 10.2

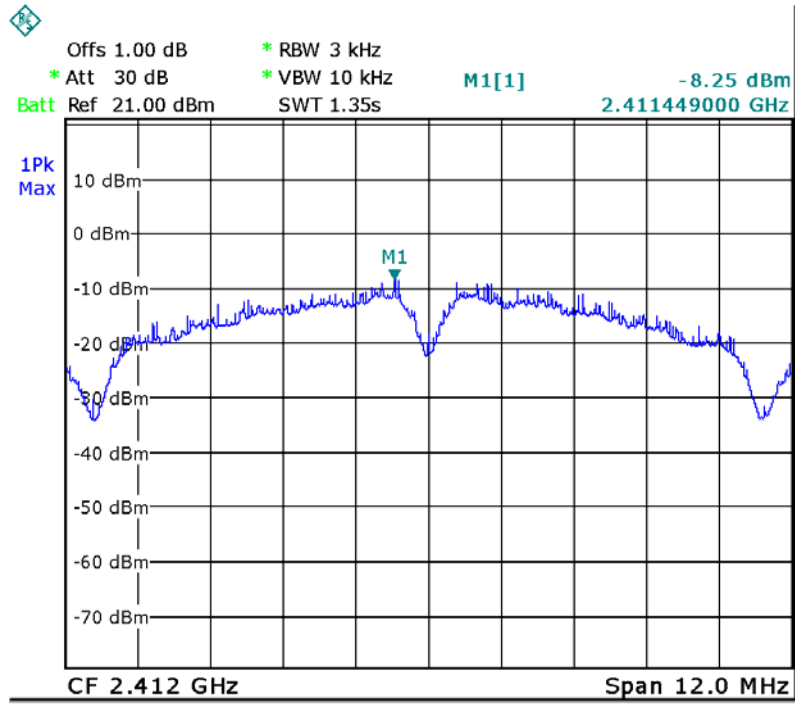
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to 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:

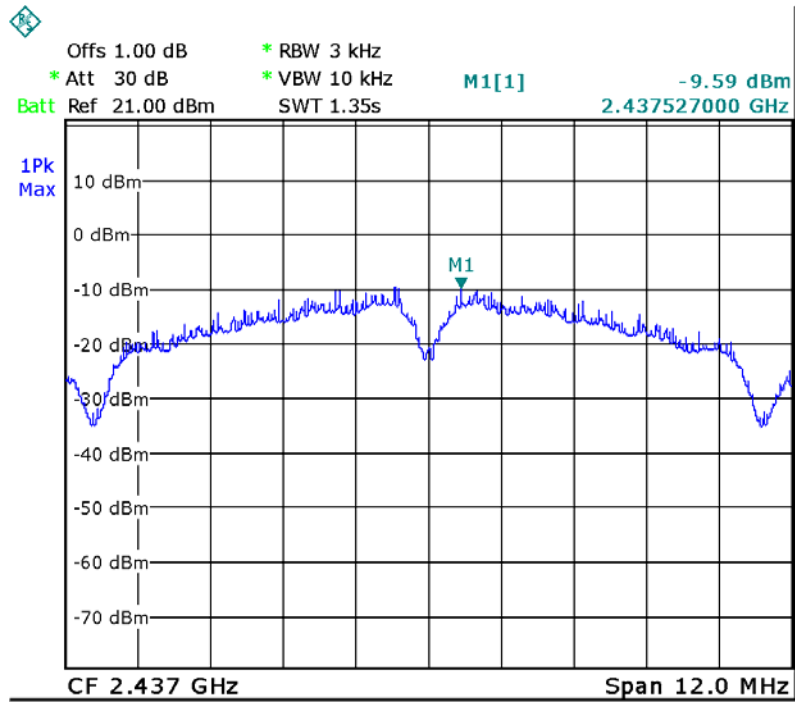
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-8.25	8dBm per 3kHz
	Middle-2437	-9.59	8dBm per 3kHz
	High-2462	-11.08	8dBm per 3kHz
TX 11g	Low-2412	-12.00	8dBm per 3kHz
	Middle-2437	-9.99	8dBm per 3kHz
	High-2462	-10.40	8dBm per 3kHz
TX 11n HT20	Low-2412	-11.34	8dBm per 3kHz
	Middle-2437	-12.12	8dBm per 3kHz
	High-2462	-12.71	8dBm per 3kHz

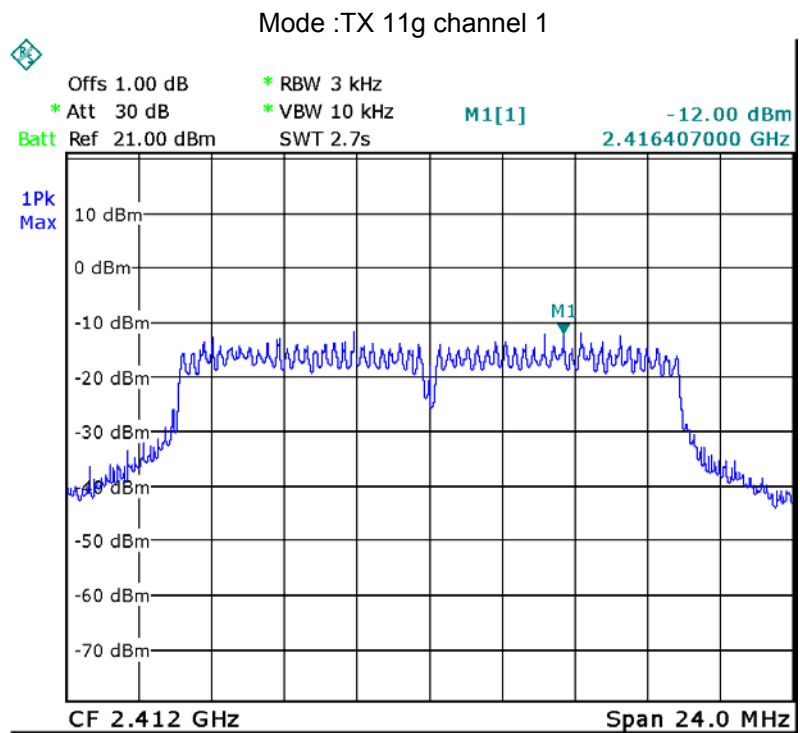
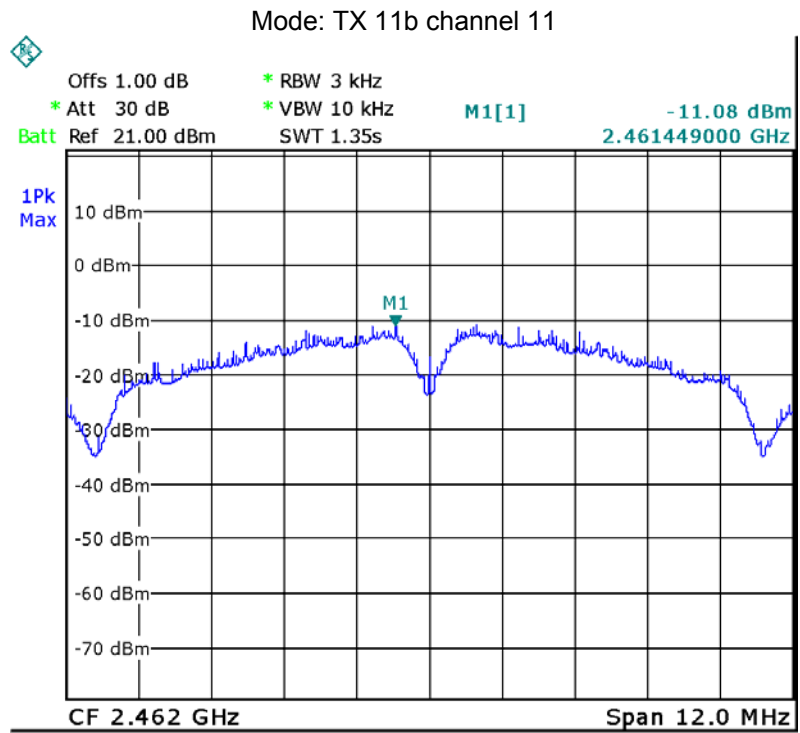
Test Plot

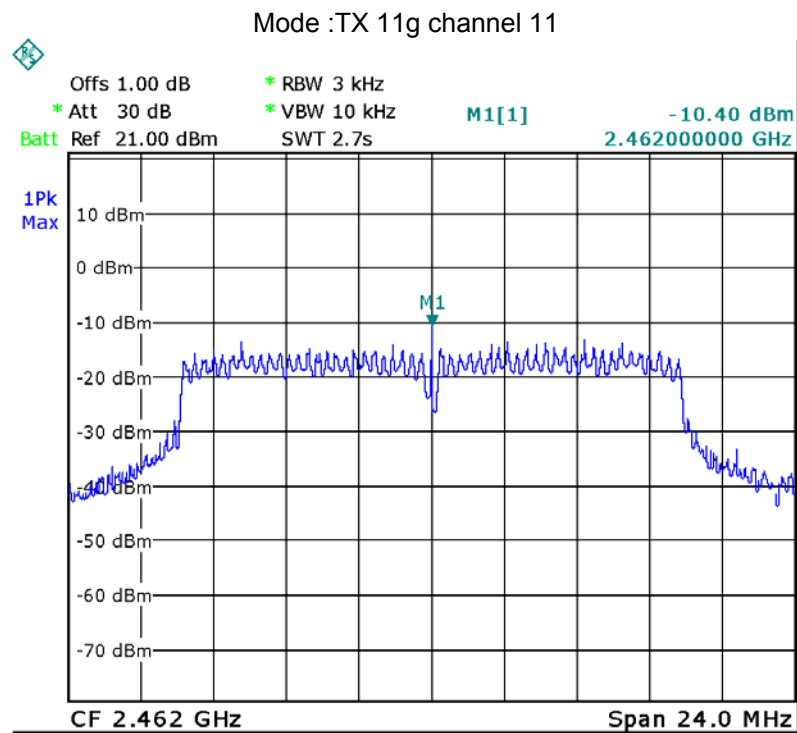
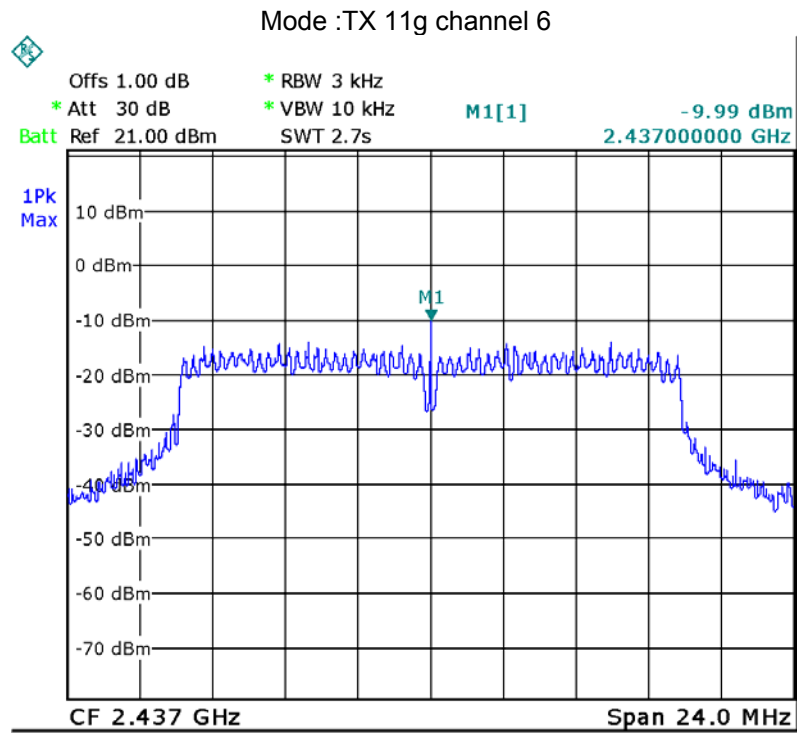
Mode: TX 11b channel 1



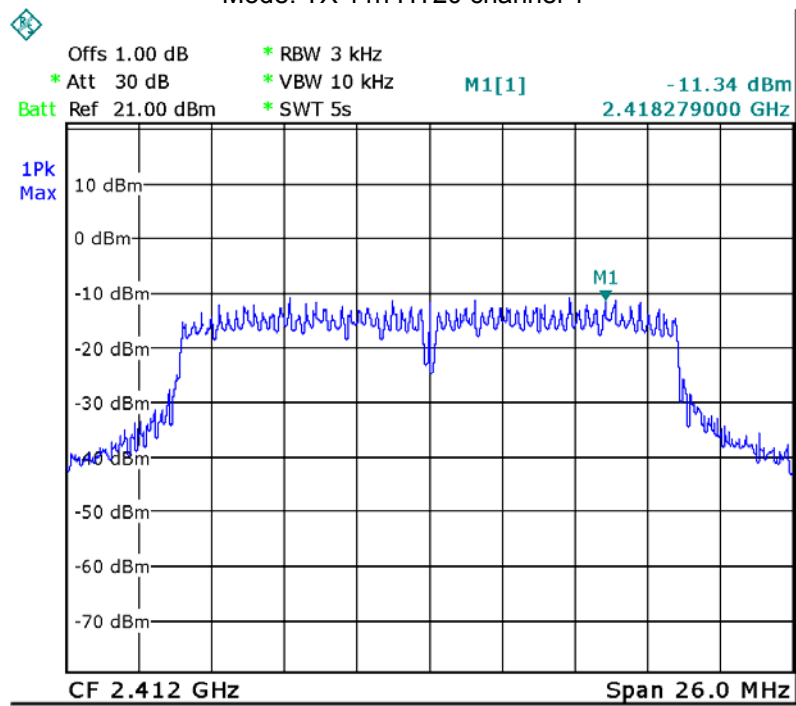
Mode: TX 11b channel 6



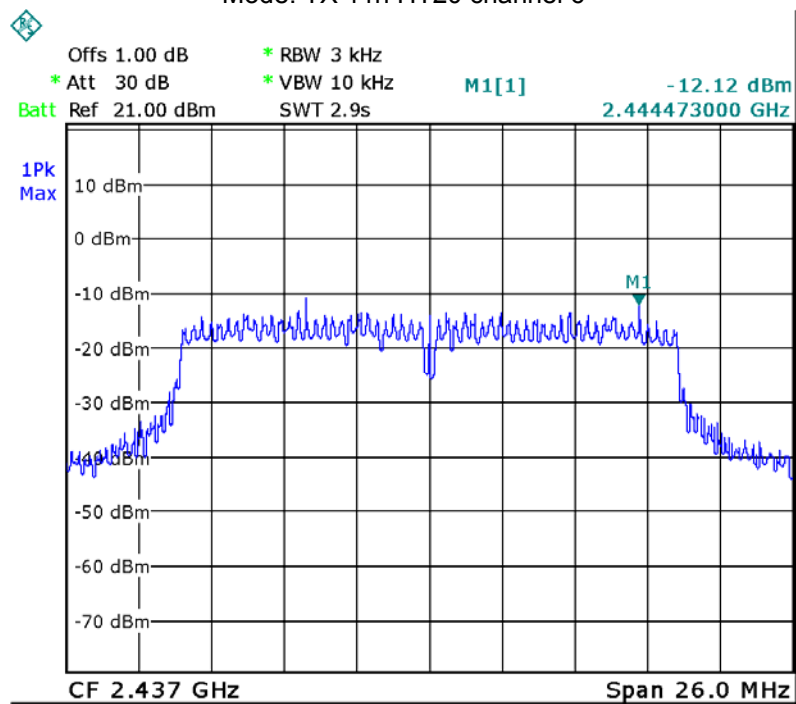


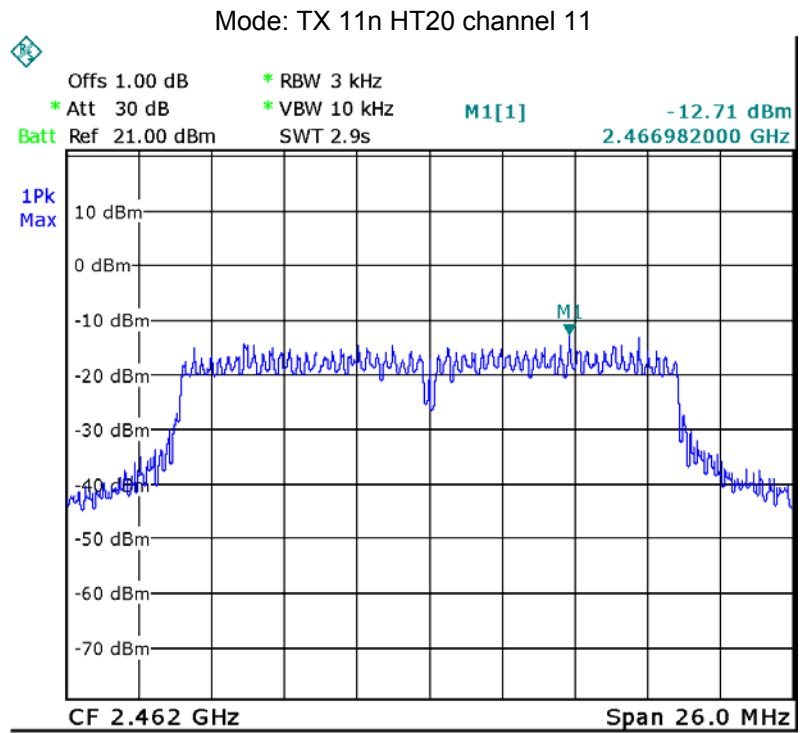


Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6





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 Photographs of test setup and EUT.

Note: Please refer to appendix: WTS19S02008374W_Photo.

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