

TEST REPORT

Reference No. : WTS16S0754770-2E V1
FCC ID..... : RR3SH-GWAYL40A
Applicant..... : Li Seng Technology Limited
Address : 9/F, Shiu Fung Hong Building, 239-241 Wing Lok Street, Sheung Wan, Hong Kong
Manufacturer : Li Seng Technology Limited
Address : 9/F, Shiu Fung Hong Building, 239-241 Wing Lok Street, Sheung Wan, Hong Kong
Product Name : IoT GateWay
Model No. : SH-GWAYL40A, SH-GWAYXXXX-XX, (where the first 'X'=L/C, the second 'X'=4-9, the third and forth 'X'=0A-ZZ, the fifth 'X'=A-Z, the sixth 'X'=1-9 or A-Z)
Brand : liseng
Standards..... : FCC CFR47 Part 15 C Section 15.247:2015
Date of Receipt sample..... : Jul. 02, 2016
Date of Test..... : Jul. 03 – Aug. 27, 2016
Date of Issue : Sep. 28, 2016
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.

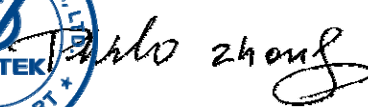
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Tested by:



Zero Zhou / Test Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Emissions	15.247 15.205(a) 15.209(a)	PASS
Conducted Emissions	15.207(a)	PASS
Conducted Spurious Emissions	15.247(d)	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

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4 Report Revision History

Report No.	Report Version	Description	Issue Date
WTS16S0754770-2E	NONE	Original	Aug. 30, 2016
WTS16S0754770-2E	V1	Version 1	Sep. 28, 2016

5 General Information

5.1 General Description of E.U.T.

Product Name:	IoT GateWay
Model No.:	SH-GWAYL40A, SH-GWAYXXXX-XX, (where the first 'X'=L/C, the second 'X'=4-9, the third and forth 'X'=0A-ZZ, the fifth 'X'=A-Z, the sixth 'X'=1-9 or A-Z)
Model Difference:	Only the model name is different, the model SH-GWAYL40A is the tested sample.
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz, 802.11n HT40: 2422MHz~2452MHz
The Lowest Oscillator:	25MHz
Antenna Gain:	2 dBi for WIFI
Type of modulation:	IEEE 802.11b (CCK/QPSK/BPSK, 11Mbps max.) IEEE 802.11g (BPSK/QPSK/16QAM/64QAM, 54Mbps max.) IEEE 802.11n (BPSK/QPSK/16QAM/64QAM, HT20: 108Mbps max., HT40: 150Mbps max.)

5.2 Details of E.U.T.

Technical Data:	DC 5V, 1.0A
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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	12	-

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	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Power Spectral Density	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Frequency Range	802.11b	11 Mbps	1/11	TX
	802.11g	54 Mbps	1/11	TX
	802.11n HT20	108 Mbps	1/11	TX
	802.11n HT40	150 Mbps	3/9	TX
Transmitter Spurious Emissions	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	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 .

5.5 Test Facility

The test facility has a test site registered with the following organizations:

- IC – Registration No.: 7760A-1**
 Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.
 Registration number 7760A-1, October 15, 2015.
- FCC Test Site 1#– Registration No.: 880581**
 Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, April 29, 2014.
- FCC Test Site 2#– Registration No.: 328995**
 Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

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	Sep.15,2015	Sep.14,2016
2.	LISN	R&S	ENV216	101215	Sep.15,2015	Sep.14,2016
3.	Cable	Top	TYPE16(3.5M)	-	Sep.15,2015	Sep.14,2016
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	Sep.15,2015	Sep.14,2016
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2015	Sep.14,2016
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2015	Sep.14,2016
4.	Cable	LARGE	RF300	-	Sep.15,2015	Sep.14,2016
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2015	Sep.14,2016
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2015	Sep.14,2016
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2015	Sep.14,2016
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2016	Apr.18,2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2016	Apr.18,2017
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2016	Mar.16,2017
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2016	Apr.09,2017
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	Sep.15,2015	Sep.14,2016
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2015	Sep.14,2016
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2015	Sep.14,2016
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2015	Sep.14,2016

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	Sep.15,2015	Sep.14,2016
2.	Spectrum Analyzer (9k~6GHz)	R&S	FSL6	100959	Sep.15,2015	Sep.14,2016
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.15,2015	Sep.14,2016

6.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
MacBook Air	APPLE	A1465	C17KTQDNF5N7

6.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

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:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment :

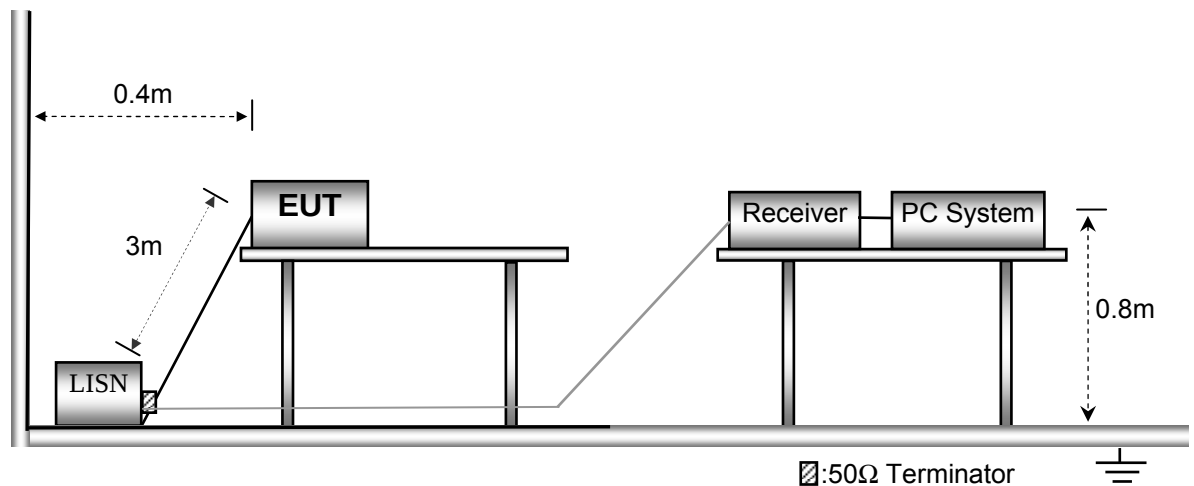
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

The test was performed in Transmitting mode, the test 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.



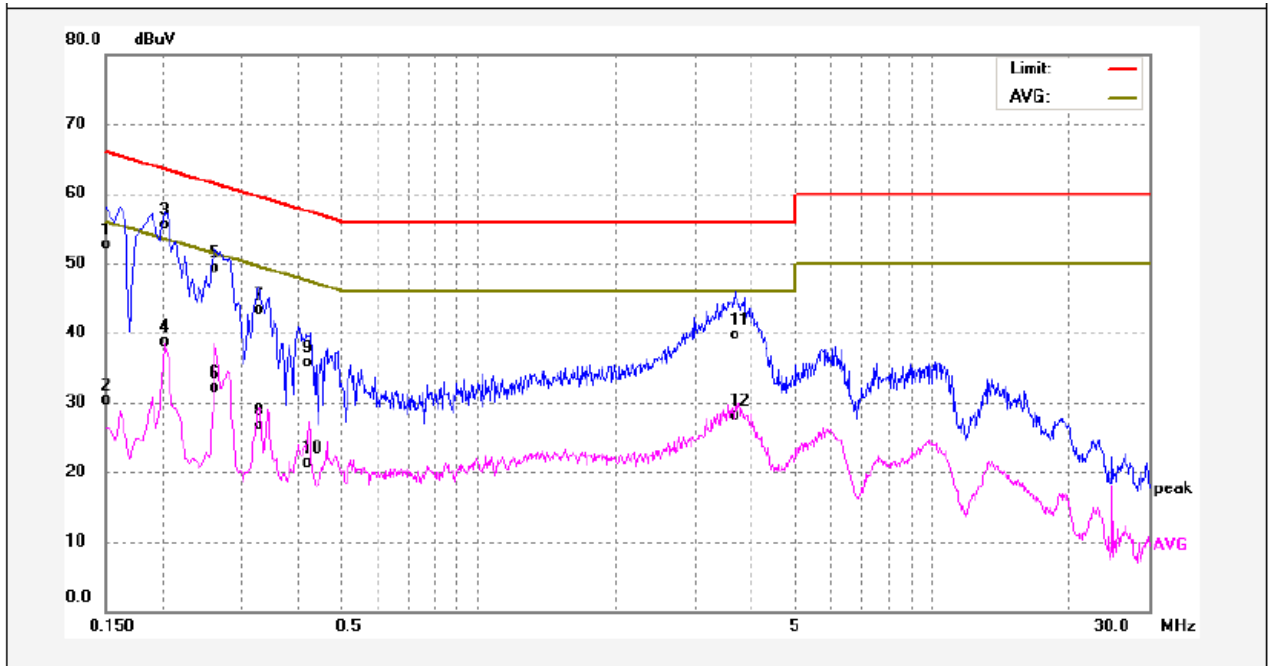
7.3 Measurement Description

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

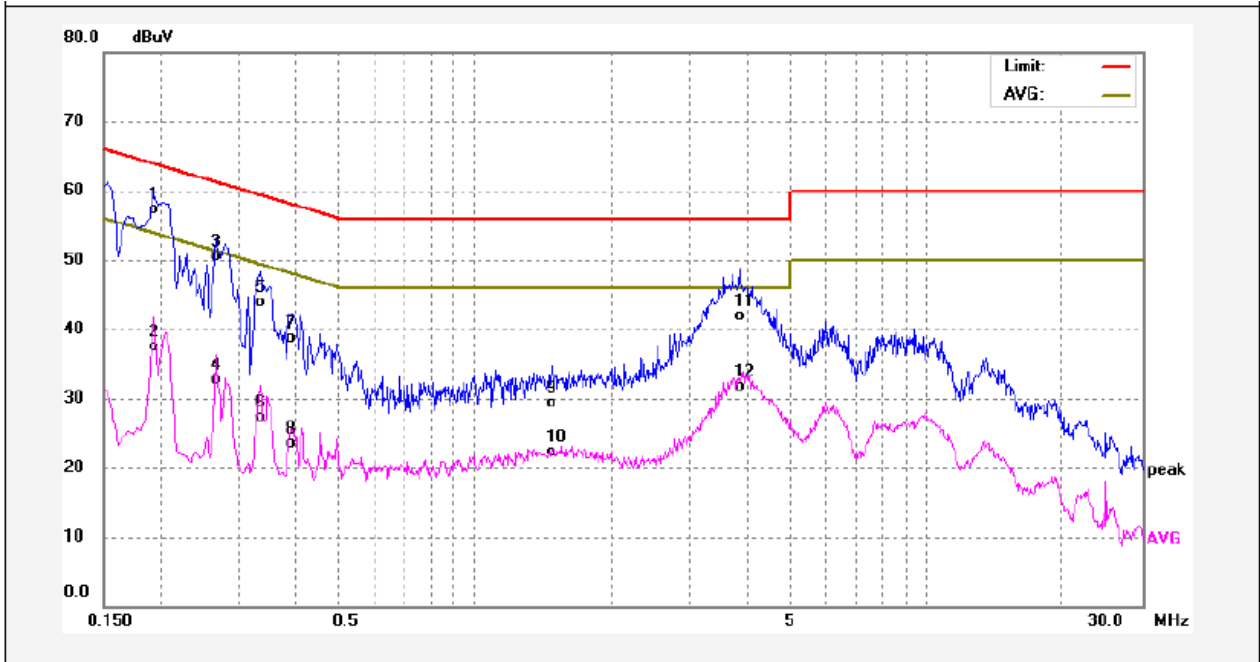
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	42.35	10.29	52.64	65.99	-13.35	QP	
2	0.1500	19.96	10.29	30.25	55.99	-25.74	AVG	
3	0.2020	45.25	10.26	55.51	63.52	-8.01	QP	
4	0.2020	28.53	10.26	38.79	53.52	-14.73	AVG	
5	0.2620	39.00	10.26	49.26	61.36	-12.10	QP	
6	0.2620	21.82	10.26	32.08	51.36	-19.28	AVG	
7	0.3260	33.04	10.28	43.32	59.55	-16.23	QP	
8	0.3260	16.42	10.28	26.70	49.55	-22.85	AVG	
9	0.4260	25.53	10.26	35.79	57.33	-21.54	QP	
10	0.4260	11.08	10.26	21.34	47.33	-25.99	AVG	
11	3.6740	29.20	10.51	39.71	56.00	-16.29	QP	
12	3.6740	17.53	10.51	28.04	46.00	-17.96	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1940	47.13	10.26	57.39	63.86	-6.47	QP	
2	0.1940	27.24	10.26	37.50	53.86	-16.36	AVG	
3	0.2660	40.19	10.27	50.46	61.24	-10.78	QP	
4	0.2660	22.42	10.27	32.69	51.24	-18.55	AVG	
5	0.3339	33.65	10.29	43.94	59.35	-15.41	QP	
6	0.3339	16.94	10.29	27.23	49.35	-22.12	AVG	
7	0.3940	28.42	10.27	38.69	57.98	-19.29	QP	
8	0.3940	13.31	10.27	23.58	47.98	-24.40	AVG	
9	1.4780	18.80	10.43	29.23	56.00	-26.77	QP	
10	1.4780	11.89	10.43	22.32	46.00	-23.68	AVG	
11	3.8500	31.31	10.51	41.82	56.00	-14.18	QP	
12	3.8500	21.20	10.51	31.71	46.00	-14.29	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: 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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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

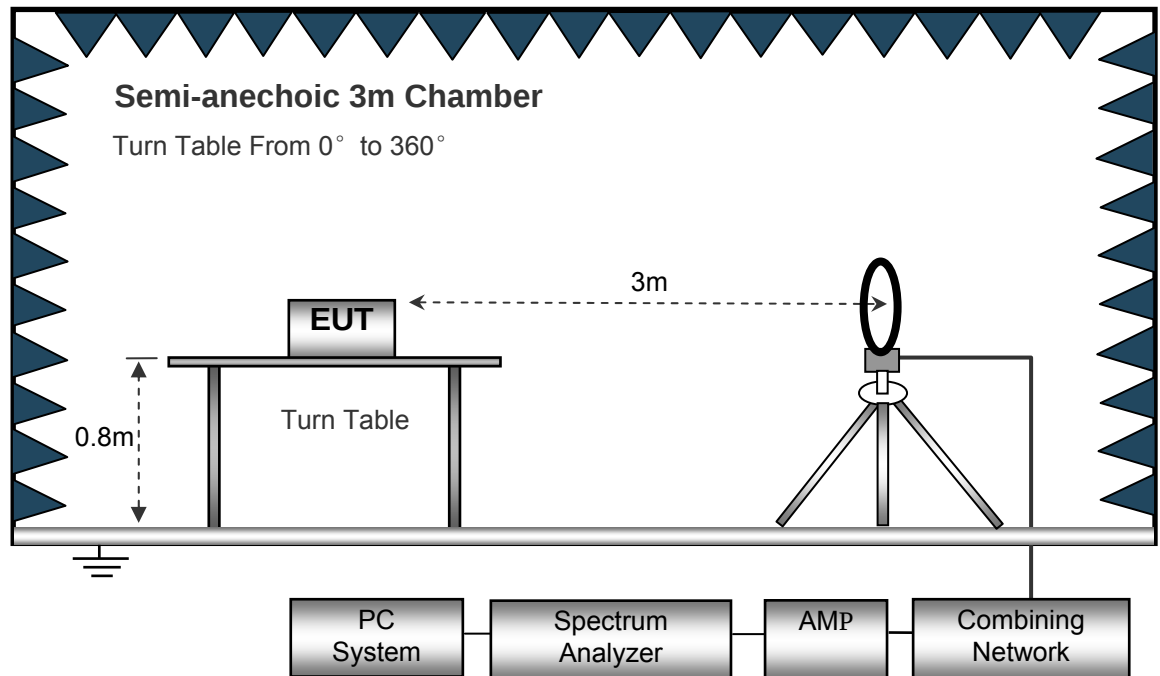
EUT Operation :

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

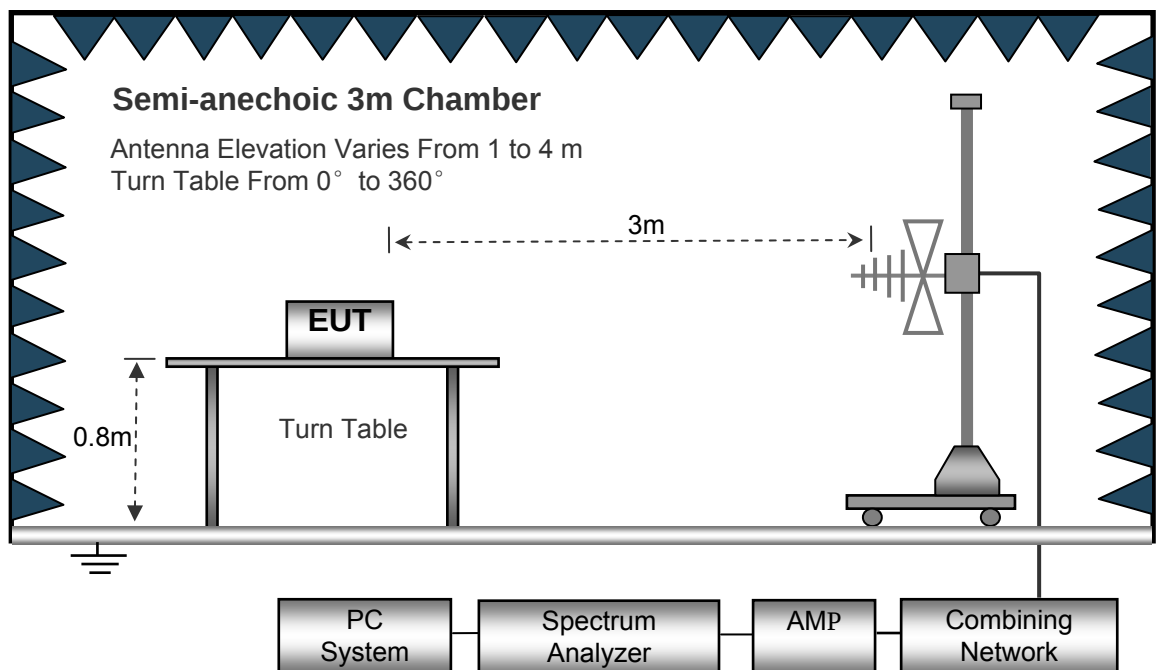
8.2 Test Setup

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

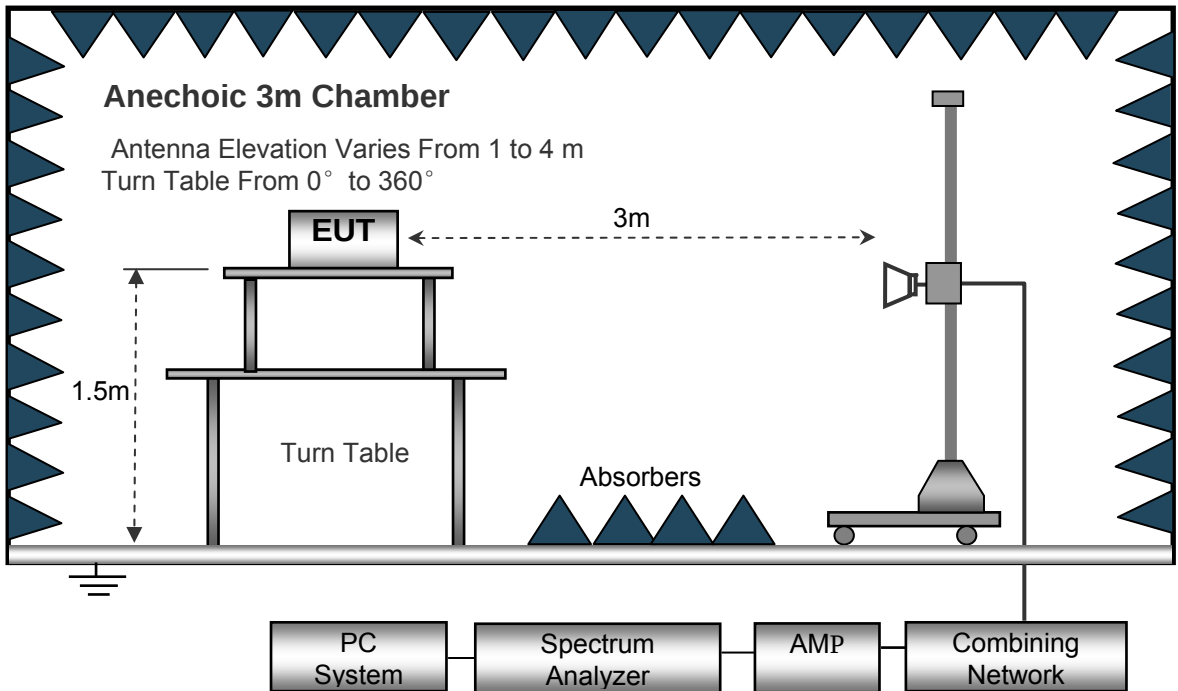
The test setup for emission measurement below 30MHz.



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
DetectorPK
Resolution Bandwidth.....100kHz
Video Bandwidth.....300kHz

Above 1GHz

Sweep Speed Auto
DetectorPK
Resolution Bandwidth.....1MHz
Video Bandwidth.....3MHz
DetectorAve.
Resolution Bandwidth.....1MHz
Video Bandwidth.....10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is above ground plane.
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 X axis,so the worst data were shown as follow.
8. A 2.4GHz high –pass filter is used during 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:

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

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:

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

8.6 Summary of Test Results

Test Frequency : 9kHz to 30MHz

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

Test Frequency : 30MHz ~ 18GHz

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									
178.05	20.29	QP	210	1.5	H	10.62	30.91	43.53	-12.62
178.05	20.48	QP	158	1.1	V	10.62	31.10	43.53	-12.43
4824.00	54.76	PK	347	1.6	V	-1.05	53.71	74.00	-20.29
4824.00	42.14	Ave	347	1.6	V	-1.05	41.09	54.00	-12.91
7236.00	53.55	PK	116	1.8	H	1.32	54.87	74.00	-19.13
7236.00	42.54	Ave	116	1.8	H	1.32	43.86	54.00	-10.14
2328.38	46.47	PK	83	1.7	V	-13.19	33.28	74.00	-40.72
2328.38	37.06	Ave	83	1.7	V	-13.19	23.87	54.00	-30.13
2369.64	43.83	PK	188	1.6	H	-13.11	30.72	74.00	-43.28
2369.64	37.39	Ave	188	1.6	H	-13.11	24.28	54.00	-29.72
2496.29	42.11	PK	305	1.1	V	-13.07	29.04	74.00	-44.96
2496.29	37.66	Ave	305	1.1	V	-13.07	24.59	54.00	-29.41

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									
178.05	21.87	QP	192	1.1	H	10.62	32.49	43.53	-11.04
178.05	18.39	QP	235	1.3	V	10.62	29.01	43.53	-14.52
4874.00	52.70	PK	287	1.6	V	-0.63	52.07	74.00	-21.93
4874.00	42.92	Ave	287	1.6	V	-0.63	42.29	54.00	-11.71
7311.00	52.75	PK	36	1.8	H	2.22	54.97	74.00	-19.03
7311.00	40.76	Ave	36	1.8	H	2.22	42.98	54.00	-11.02
2340.21	45.81	PK	71	1.9	V	-13.34	32.47	74.00	-41.53
2340.21	38.96	Ave	71	1.9	V	-13.34	25.62	54.00	-28.38
2384.19	43.65	PK	186	1.1	H	-13.27	30.38	74.00	-43.62
2384.19	37.07	Ave	186	1.1	H	-13.27	23.80	54.00	-30.20
2496.81	43.15	PK	187	1.4	V	-13.05	30.10	74.00	-43.90
2496.81	37.53	Ave	187	1.4	V	-13.05	24.48	54.00	-29.52

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									
178.05	22.53	QP	245	1.1	H	10.62	33.15	43.53	-10.38
178.05	18.63	QP	211	2.0	V	10.62	29.25	43.53	-14.28
4924.00	52.58	PK	322	1.5	V	-0.23	52.35	74.00	-21.65
4924.00	41.15	Ave	322	1.5	V	-0.23	40.92	54.00	-13.08
7386.00	50.53	PK	16	1.3	H	2.75	53.28	74.00	-20.72
7386.00	41.75	Ave	16	1.3	H	2.75	44.50	54.00	-9.50
2321.50	46.28	PK	323	1.9	V	-13.24	33.04	74.00	-40.96
2321.50	37.79	Ave	323	1.9	V	-13.24	24.55	54.00	-29.45
2353.62	43.27	PK	75	1.2	H	-13.19	30.08	74.00	-43.92
2353.62	37.29	Ave	75	1.2	H	-13.19	24.10	54.00	-29.90
2498.57	43.56	PK	233	1.9	V	-13.10	30.46	74.00	-43.54
2498.57	38.62	Ave	233	1.9	V	-13.10	25.52	54.00	-28.48

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									
178.05	20.21	QP	343	1.3	H	10.62	30.83	43.53	-12.70
178.05	20.39	QP	145	1.1	V	10.62	31.01	43.53	-12.52
4824.00	51.61	PK	130	1.2	V	-1.03	50.58	74.00	-23.42
4824.00	44.78	Ave	130	1.2	V	-1.03	43.75	54.00	-10.25
7236.00	54.29	PK	6	1.1	H	1.31	55.60	74.00	-18.40
7236.00	42.22	Ave	6	1.1	H	1.31	43.53	54.00	-10.47
2320.36	45.97	PK	155	1.2	V	-13.20	32.77	74.00	-41.23
2320.36	39.09	Ave	155	1.2	V	-13.20	25.89	54.00	-28.11
2361.50	44.64	PK	143	1.2	H	-13.12	31.52	74.00	-42.48
2361.50	37.06	Ave	143	1.2	H	-13.12	23.94	54.00	-30.06
2485.81	43.99	PK	145	1.1	V	-13.54	30.45	74.00	-43.55
2485.81	38.31	Ave	145	1.1	V	-13.54	24.77	54.00	-29.23

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									
178.05	22.23	QP	65	1.4	H	10.62	32.85	43.53	-10.68
178.05	19.79	QP	238	1.5	V	10.62	30.41	43.53	-13.12
4874.00	54.62	PK	308	1.7	V	-0.64	53.98	74.00	-20.02
4874.00	40.95	Ave	308	1.7	V	-0.64	40.31	54.00	-13.69
7311.00	52.95	PK	28	1.1	H	2.19	55.14	74.00	-18.86
7311.00	43.53	Ave	28	1.1	H	2.19	45.72	54.00	-8.28
2340.78	46.32	PK	341	2.0	V	-13.27	33.05	74.00	-40.95
2340.78	39.46	Ave	341	2.0	V	-13.27	26.19	54.00	-27.81
2368.61	42.76	PK	201	1.2	H	-13.19	29.57	74.00	-44.43
2368.61	37.86	Ave	201	1.2	H	-13.19	24.67	54.00	-29.33
2494.85	44.29	PK	68	1.9	V	-13.06	31.23	74.00	-42.77
2494.85	36.53	Ave	68	1.9	V	-13.06	23.47	54.00	-30.53

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									
178.05	20.82	QP	359	1.4	H	10.62	31.44	43.53	-12.09
178.05	18.43	QP	271	1.3	V	10.62	29.05	43.53	-14.48
4924.00	51.12	PK	8	1.0	V	-0.21	50.91	74.00	-23.09
4924.00	40.88	Ave	8	1.0	V	-0.21	40.67	54.00	-13.33
7386.00	51.64	PK	287	1.1	H	2.76	54.40	74.00	-19.60
7386.00	41.64	Ave	287	1.1	H	2.76	44.40	54.00	-9.60
2339.65	45.24	PK	235	1.1	V	-13.51	31.73	74.00	-42.27
2339.65	39.08	Ave	235	1.1	V	-13.51	25.57	54.00	-28.43
2354.25	43.16	PK	288	1.4	H	-13.25	29.91	74.00	-44.09
2354.25	38.77	Ave	288	1.4	H	-13.25	25.52	54.00	-28.48
2493.75	43.35	PK	274	1.4	V	-13.24	30.11	74.00	-43.89
2493.75	38.80	Ave	274	1.4	V	-13.24	25.56	54.00	-28.44

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)
n20: Low Channel 2412MHz									
178.05	22.61	QP	157	1.4	H	10.62	33.23	43.53	-10.30
178.05	20.07	QP	13	1.8	V	10.62	30.69	43.53	-12.84
4824.00	54.60	PK	293	1.9	V	-1.05	53.55	74.00	-20.45
4824.00	43.82	Ave	293	1.9	V	-1.05	42.77	54.00	-11.23
7236.00	51.06	PK	274	1.2	H	1.34	52.40	74.00	-21.60
7236.00	43.31	Ave	274	1.2	H	1.34	44.65	54.00	-9.35
2342.46	46.07	PK	67	1.9	V	-13.24	32.83	74.00	-41.17
2342.46	39.01	Ave	67	1.9	V	-13.24	25.77	54.00	-28.23
2386.92	42.60	PK	24	1.4	H	-13.15	29.45	74.00	-44.55
2386.92	37.59	Ave	24	1.4	H	-13.15	24.44	54.00	-29.56
2497.91	42.99	PK	304	1.5	V	-13.50	29.49	74.00	-44.51
2497.91	38.05	Ave	304	1.5	V	-13.50	24.55	54.00	-29.45

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)
n20: Middle Channel 2437MHz									
178.05	20.65	QP	216	1.0	H	10.62	31.27	43.53	-12.26
178.05	18.63	QP	99	2.0	V	10.62	29.25	43.53	-14.28
4874.00	51.62	PK	355	1.5	V	-0.62	51.00	74.00	-23.00
4874.00	40.57	Ave	355	1.5	V	-0.62	39.95	54.00	-14.05
7311.00	54.36	PK	303	1.1	H	2.14	56.50	74.00	-17.50
7311.00	40.90	Ave	303	1.1	H	2.14	43.04	54.00	-10.96
2316.63	46.62	PK	327	1.9	V	-13.24	33.38	74.00	-40.62
2316.63	37.30	Ave	327	1.9	V	-13.24	24.06	54.00	-29.94
2367.14	43.73	PK	333	1.1	H	-13.20	30.53	74.00	-43.47
2367.14	36.70	Ave	333	1.1	H	-13.20	23.50	54.00	-30.50
2488.77	44.67	PK	42	1.5	V	-13.05	31.62	74.00	-42.38
2488.77	38.38	Ave	42	1.5	V	-13.05	25.33	54.00	-28.67

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)
n20: High Channel 2462MHz									
178.05	21.30	QP	43	1.5	H	10.62	31.92	43.53	-11.61
178.05	20.47	QP	209	1.7	V	10.62	31.09	43.53	-12.44
4924.00	50.55	PK	180	1.9	V	-0.23	50.32	74.00	-23.68
4924.00	41.27	Ave	180	1.9	V	-0.23	41.04	54.00	-12.96
7386.00	53.75	PK	0	1.7	H	2.72	56.47	74.00	-17.53
7386.00	41.31	Ave	0	1.7	H	2.72	44.03	54.00	-9.97
2332.44	45.17	PK	276	1.2	V	-13.46	31.71	74.00	-42.29
2332.44	37.83	Ave	276	1.2	V	-13.46	24.37	54.00	-29.63
2384.52	43.69	PK	85	1.5	H	-13.17	30.52	74.00	-43.48
2384.52	36.04	Ave	85	1.5	H	-13.17	22.87	54.00	-31.13
2493.61	42.37	PK	265	1.4	V	-13.32	29.05	74.00	-44.95
2493.61	36.21	Ave	265	1.4	V	-13.32	22.89	54.00	-31.11

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)
n40: Low Channel 2422MHz									
178.05	22.61	QP	61	1.4	H	10.62	33.23	43.53	-10.30
178.05	20.68	QP	157	1.0	V	10.62	31.30	43.53	-12.23
4824.00	53.91	PK	243	1.2	V	1.06	54.97	74.00	-19.03
4824.00	42.15	Ave	243	1.2	V	1.06	43.21	54.00	-10.79
7236.00	54.26	PK	349	1.7	H	1.33	55.59	74.00	-18.41
7236.00	42.36	Ave	349	1.7	H	1.33	43.69	54.00	-10.31
2328.19	45.23	PK	210	1.6	V	-13.20	32.03	74.00	-41.97
2328.19	38.27	Ave	210	1.6	V	-13.20	25.07	54.00	-28.93
2388.00	42.21	PK	300	1.3	H	-13.16	29.05	74.00	-44.95
2388.00	36.91	Ave	300	1.3	H	-13.16	23.75	54.00	-30.25
2488.50	43.76	PK	230	1.7	V	-13.49	30.27	74.00	-43.73
2488.50	38.22	Ave	230	1.7	V	-13.49	24.73	54.00	-29.27

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)
n40: Middle Channel 2437MHz									
223.59	44.47	QP	256	1.1	H	-11.62	32.85	46.00	-13.15
223.59	35.31	QP	114	1.7	V	-11.62	23.69	46.00	-22.31
4874.00	47.77	PK	194	1.4	V	-0.62	47.15	74.00	-26.85
4874.00	41.78	Ave	194	1.4	V	-0.62	41.16	54.00	-12.84
7311.00	42.52	PK	72	1.9	H	2.21	44.73	74.00	-29.27
7311.00	39.79	Ave	72	1.9	H	2.21	42.00	54.00	-12.00
2325.32	45.59	PK	74	1.2	V	-13.19	32.40	74.00	-41.60
2325.32	38.54	Ave	74	1.2	V	-13.19	25.35	54.00	-28.65
2371.14	44.67	PK	179	1.3	H	-13.14	31.53	74.00	-42.47
2371.14	38.63	Ave	179	1.3	H	-13.14	25.49	54.00	-28.51
2490.72	44.19	PK	176	2.0	V	-13.08	31.11	74.00	-42.89
2490.72	38.59	Ave	176	2.0	V	-13.08	25.51	54.00	-28.49

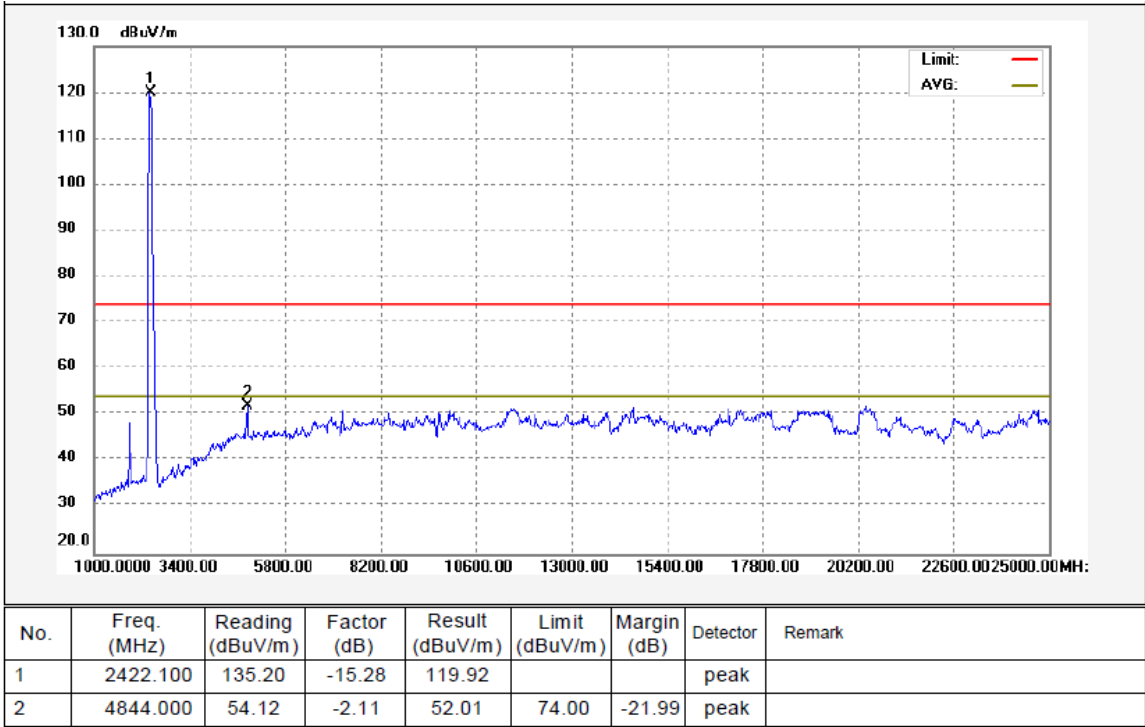
Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
n40: High Channel 2452MHz									
223.59	43.58	QP	284	1.3	H	-11.62	31.96	46.00	-14.04
223.59	36.11	QP	141	1.5	V	-11.62	24.49	46.00	-21.51
4904.00	47.65	PK	268	1.3	V	-0.24	47.41	74.00	-26.59
4904.00	41.40	Ave	268	1.3	V	-0.24	41.16	54.00	-12.84
7356.00	43.42	PK	309	1.2	H	2.84	46.26	74.00	-27.74
7356.00	40.29	Ave	309	1.2	H	2.84	43.13	54.00	-10.87
2315.80	45.02	PK	99	1.4	V	-13.19	31.83	74.00	-42.17
2315.80	37.61	Ave	99	1.4	V	-13.19	24.42	54.00	-29.58
2357.21	42.36	PK	327	1.0	H	-13.14	29.22	74.00	-44.78
2357.21	36.82	Ave	327	1.0	H	-13.14	23.68	54.00	-30.32
2483.55	43.02	PK	18	1.9	V	-13.08	29.94	74.00	-44.06
2483.55	37.12	Ave	18	1.9	V	-13.08	24.04	54.00	-29.96

Test Frequency: 18GHz~25GHz

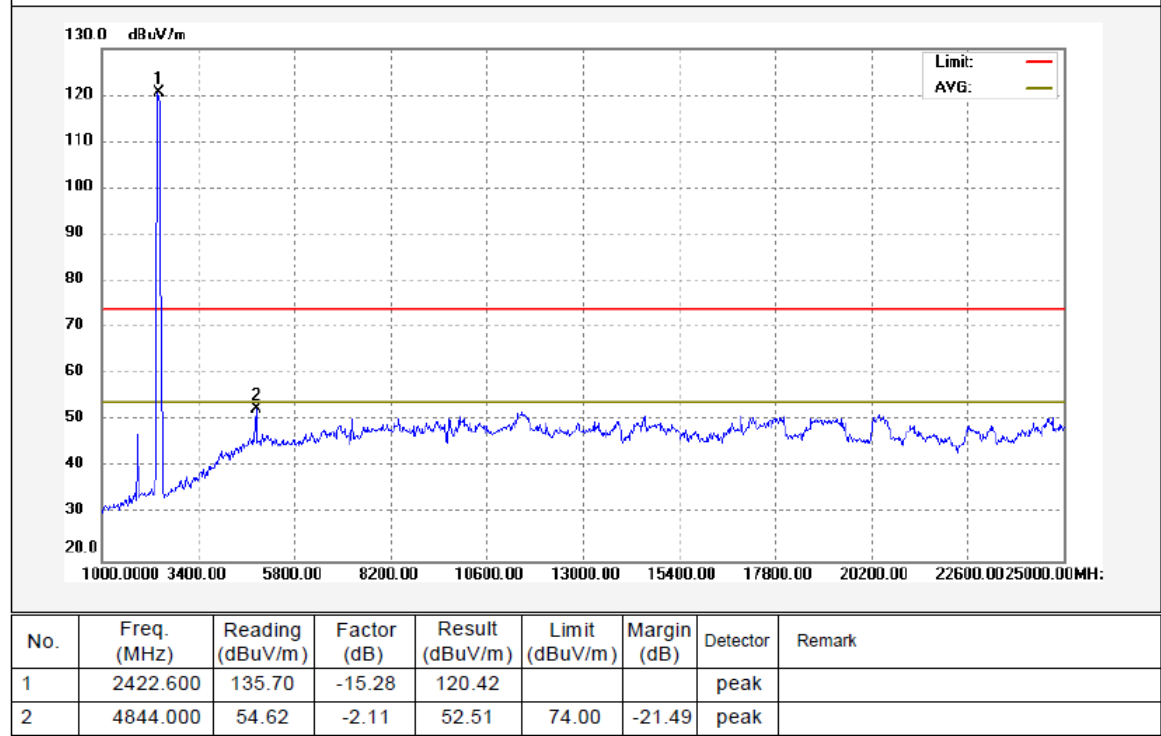
The measurements were more than 20 dB below the limit and not reported.

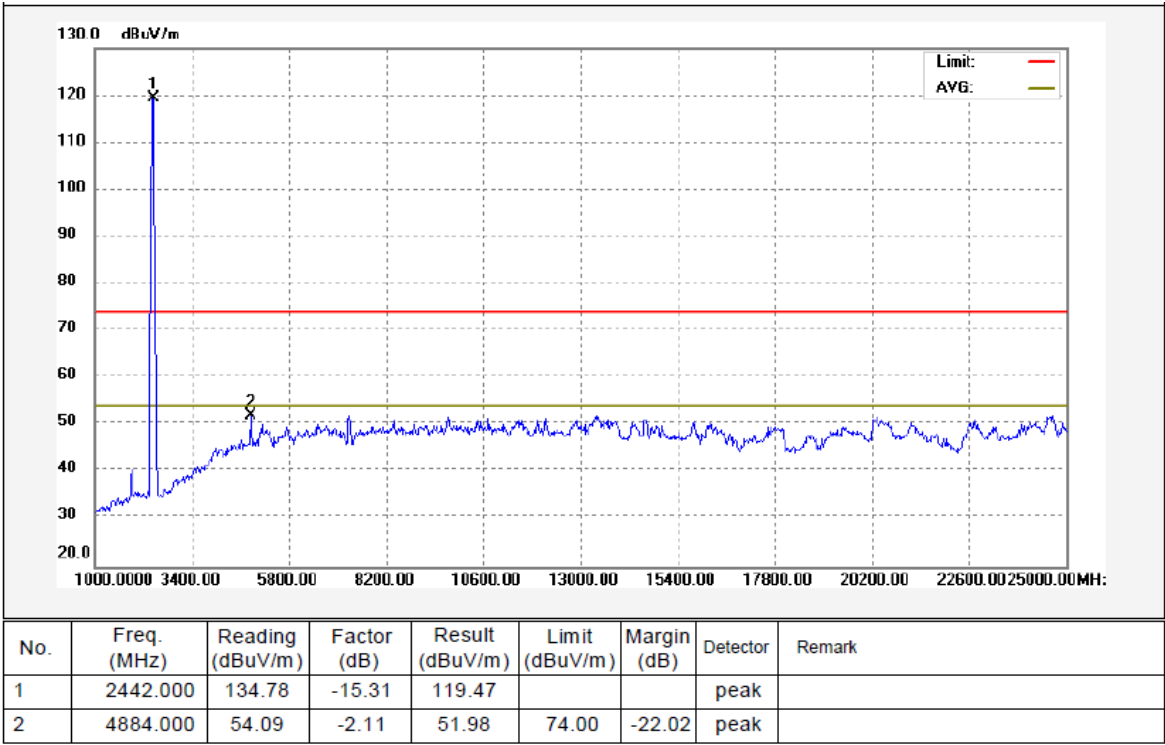
Test Frequency : Above 1GHzRemark: only the worst data (802.11n HT40 mode) were reported

Low Channel – Horizontal

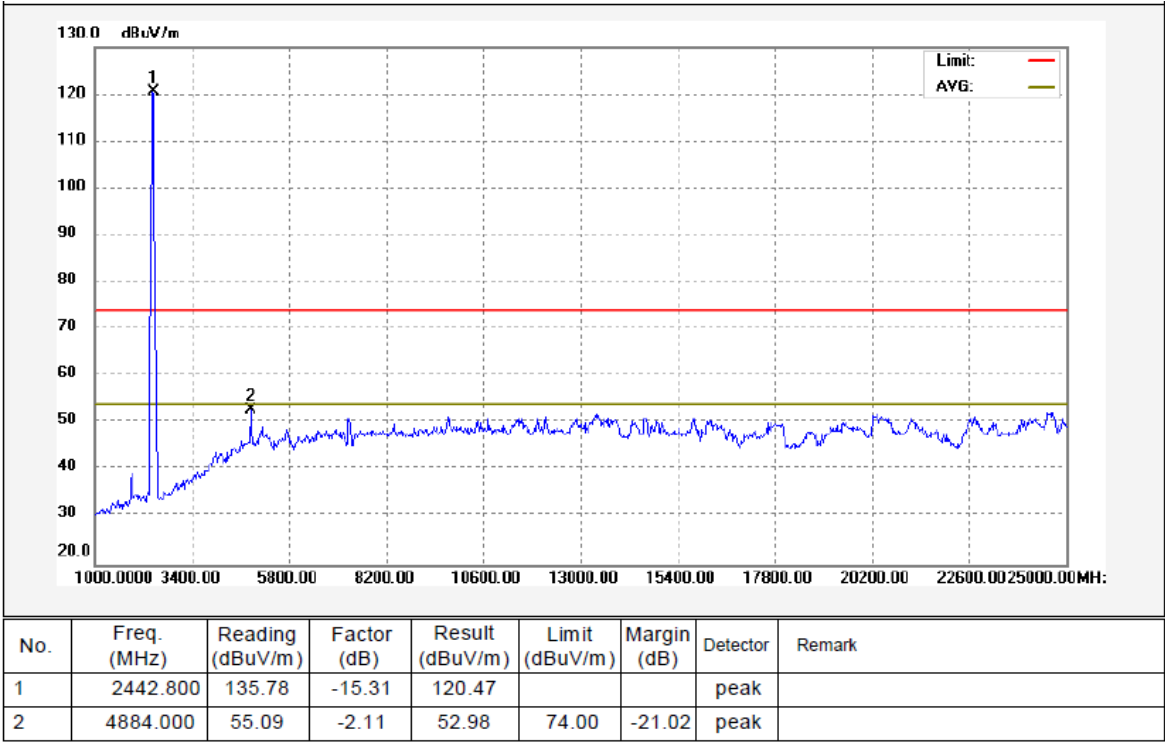


Low Channel – Vertical

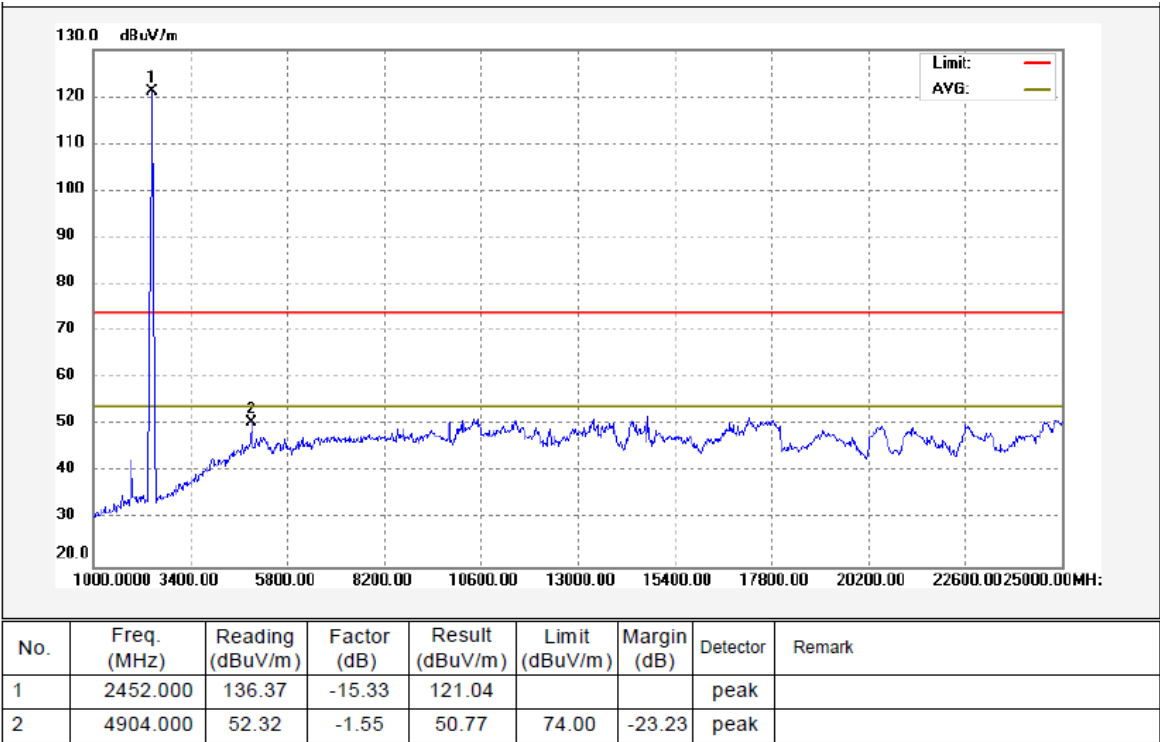




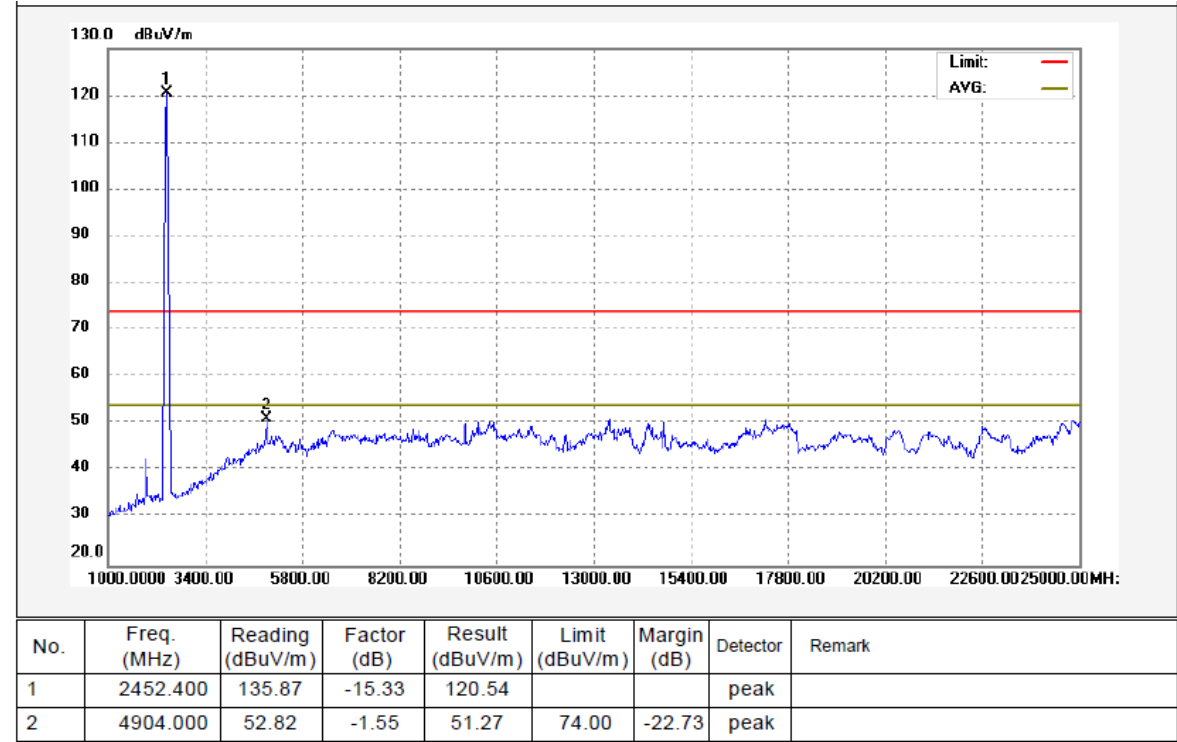
Middle Channel – Vertical



High Channel - Horizontal



High Channel - Vertical



9 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
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

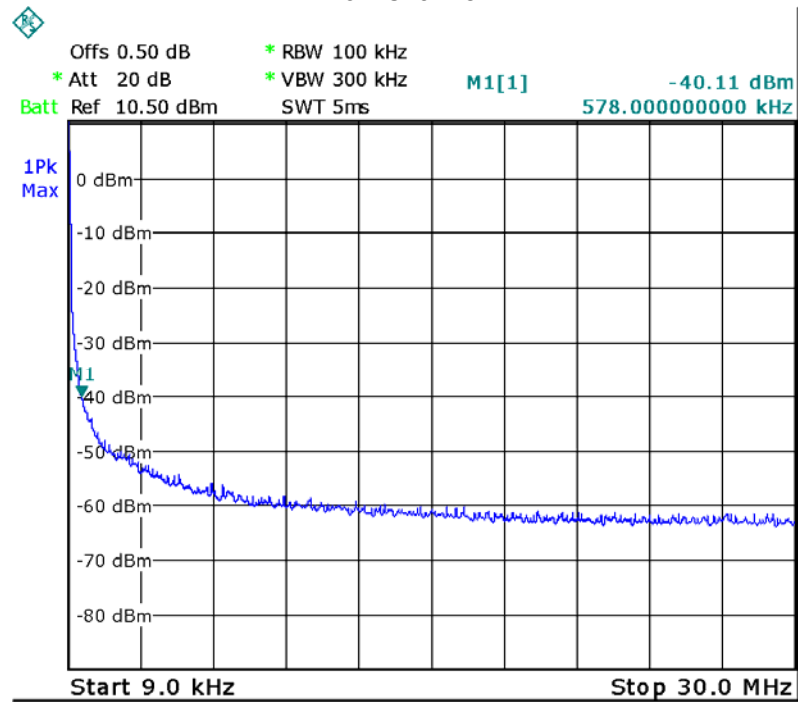
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

9.2 Test Result

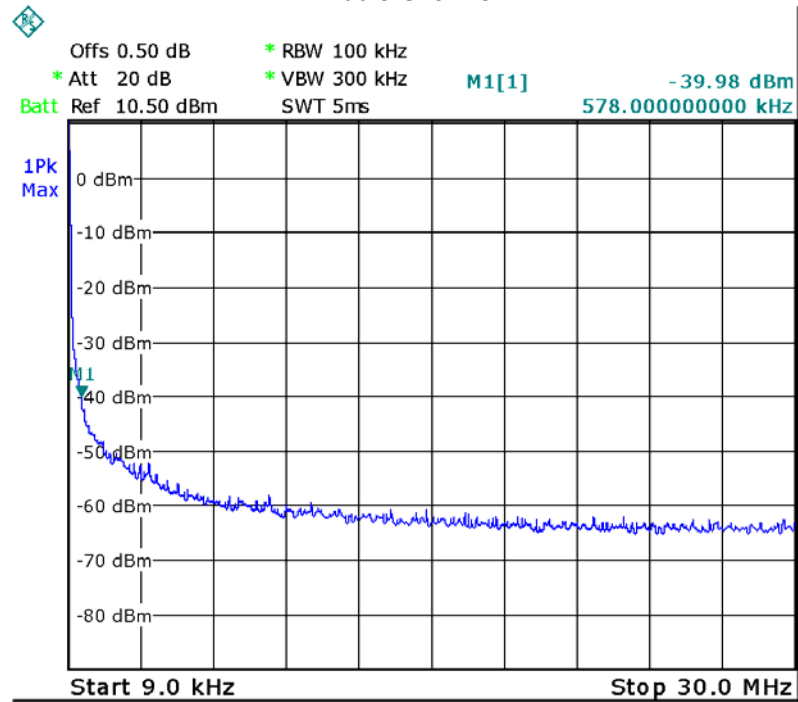
9KHz – 30MHz

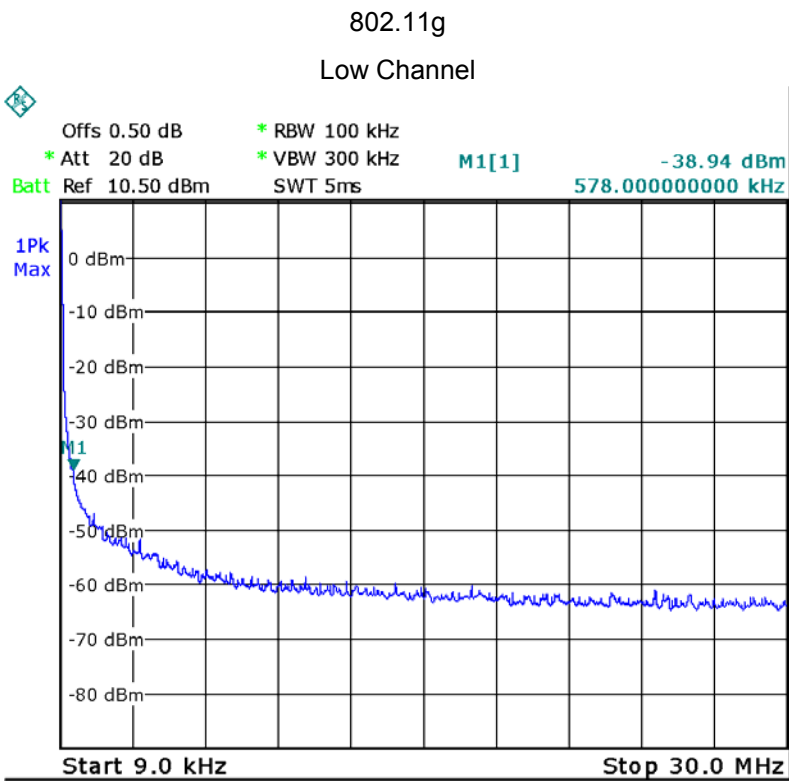
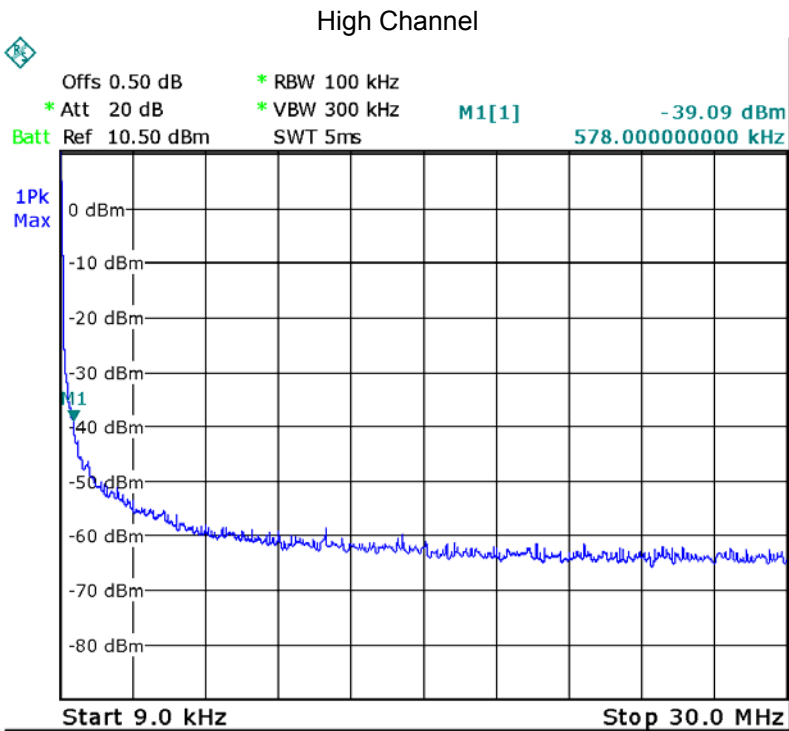
802.11b

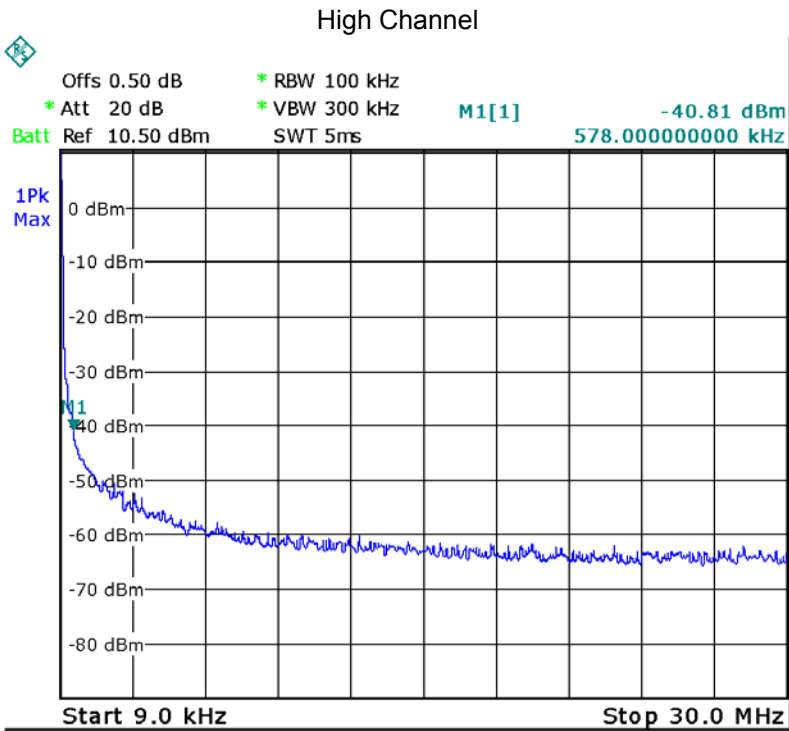
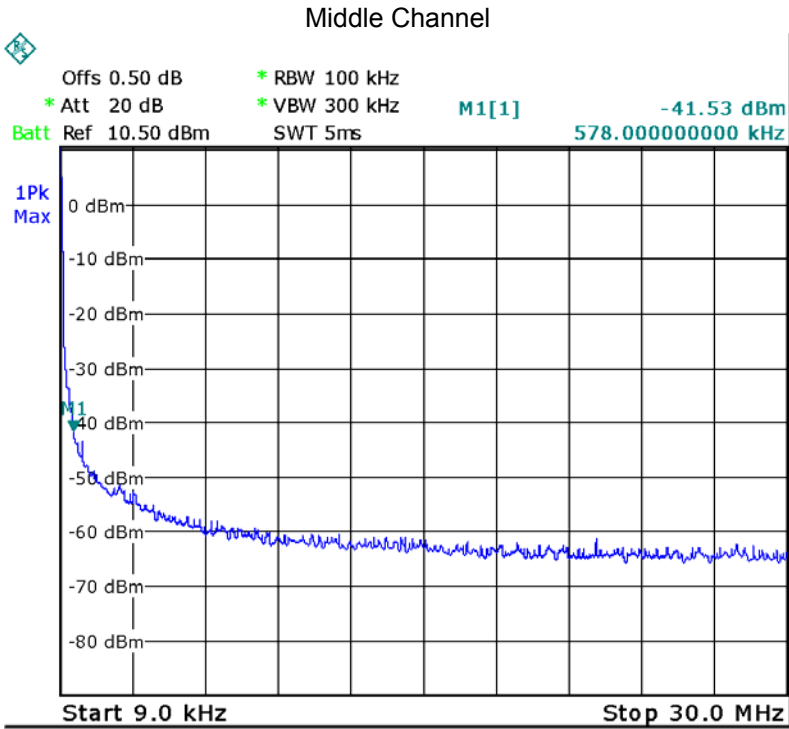
Low Channel



Middle Channel

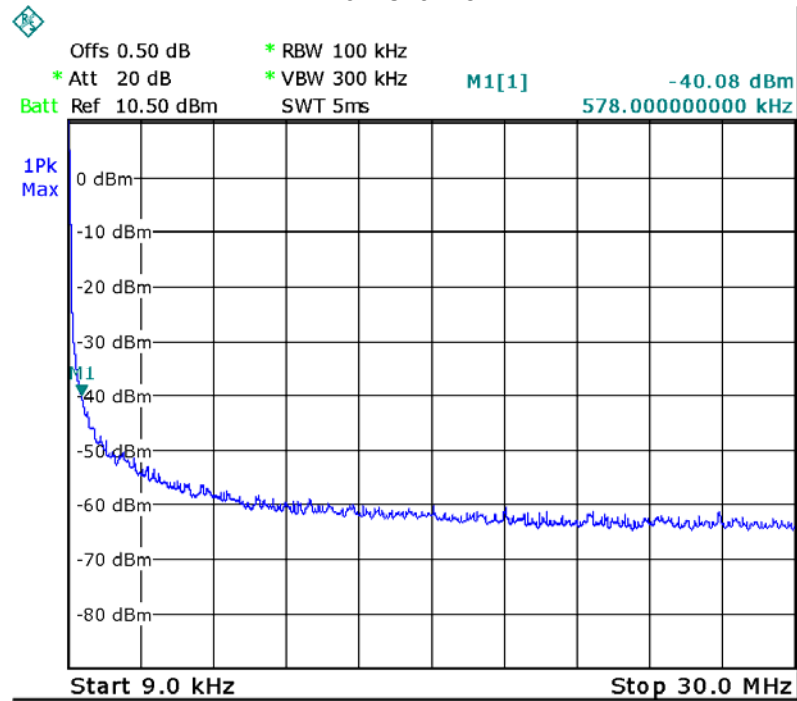




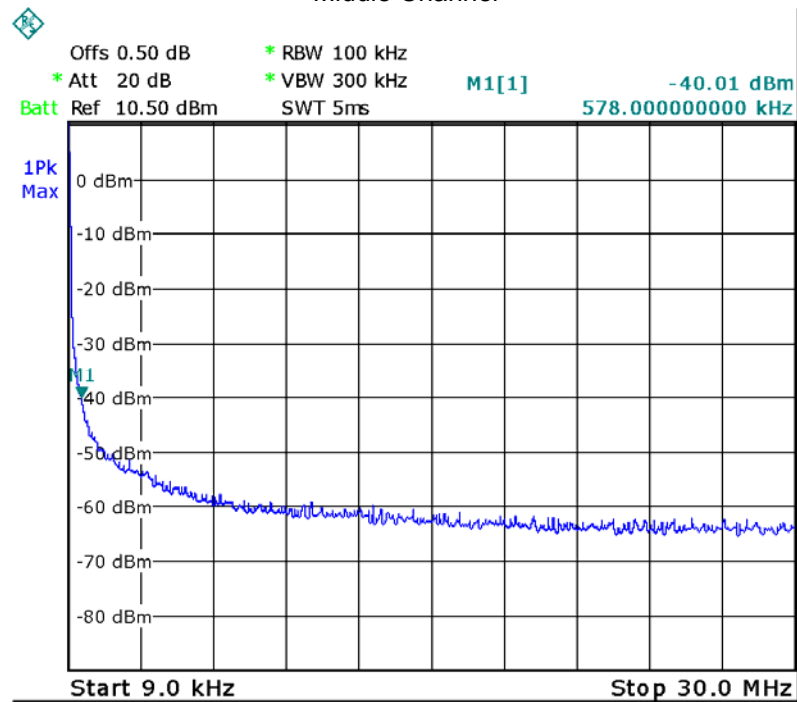


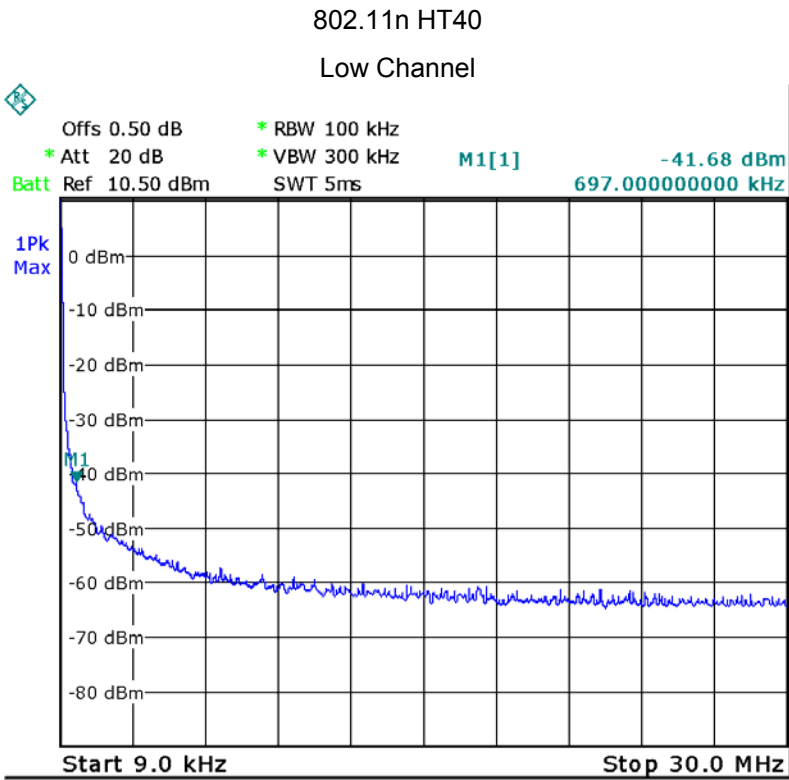
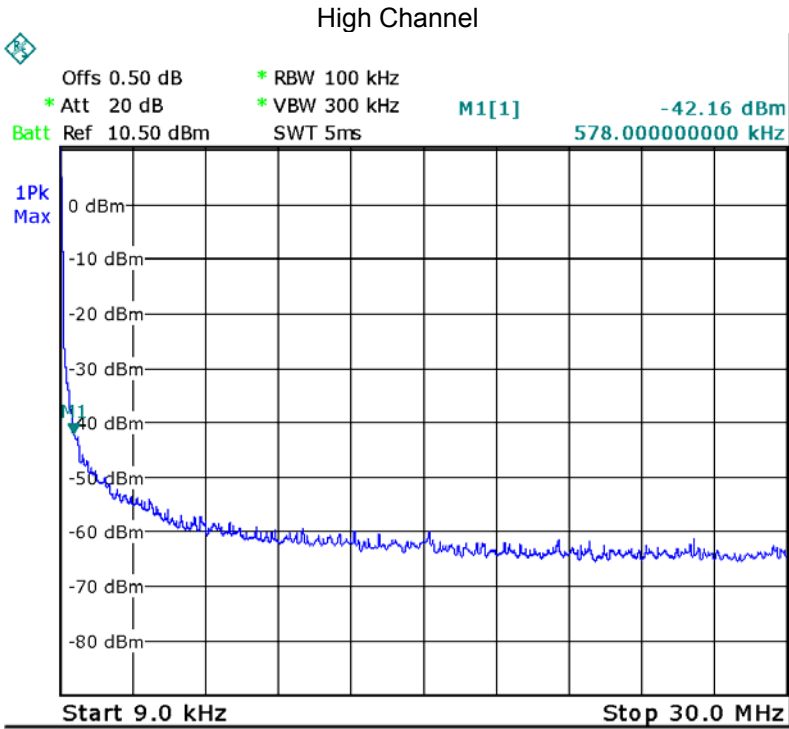
802.11n HT20

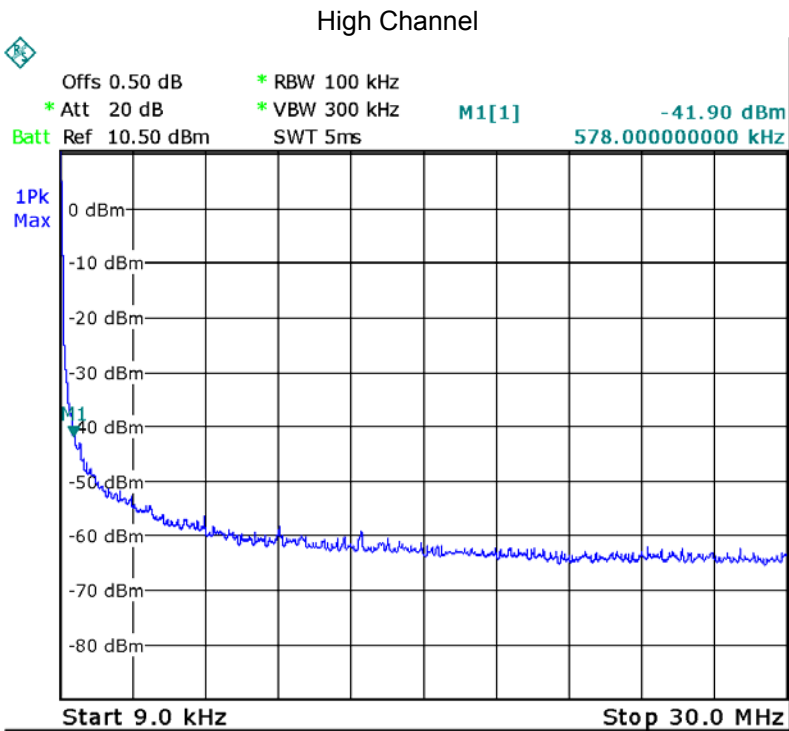
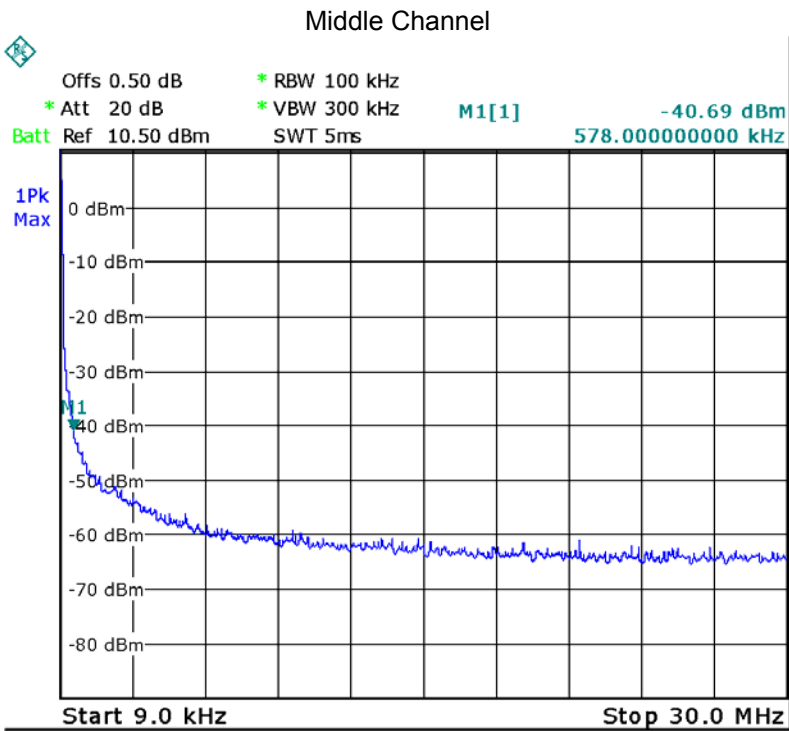
Low Channel



Middle Channel





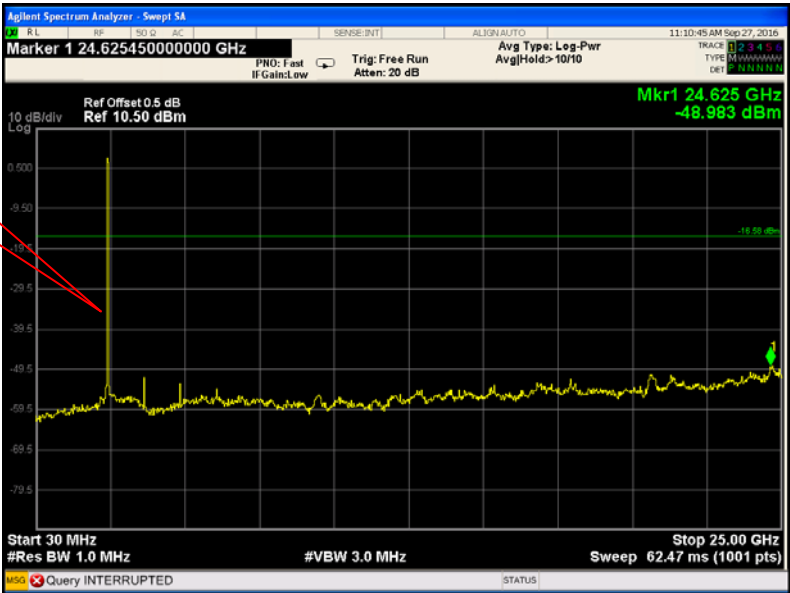


Above 30MHz

802.11b

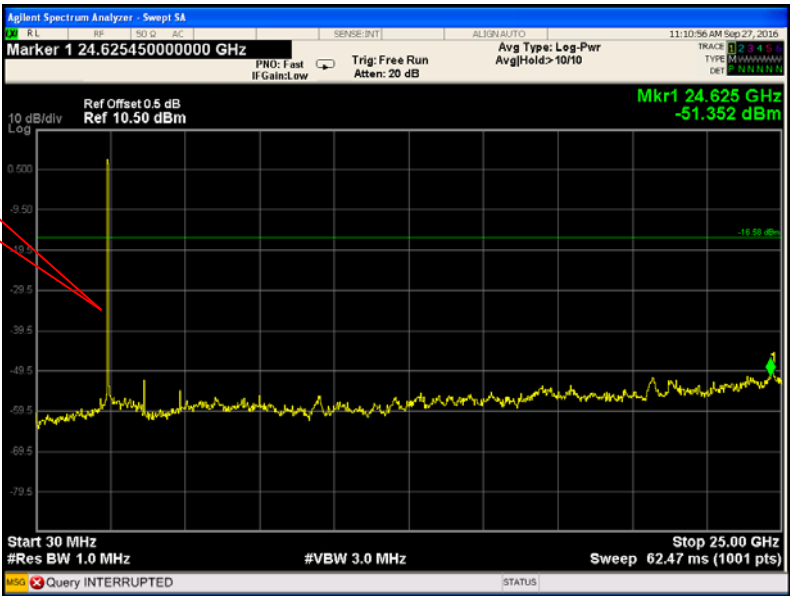
Low Channel

Fundamental

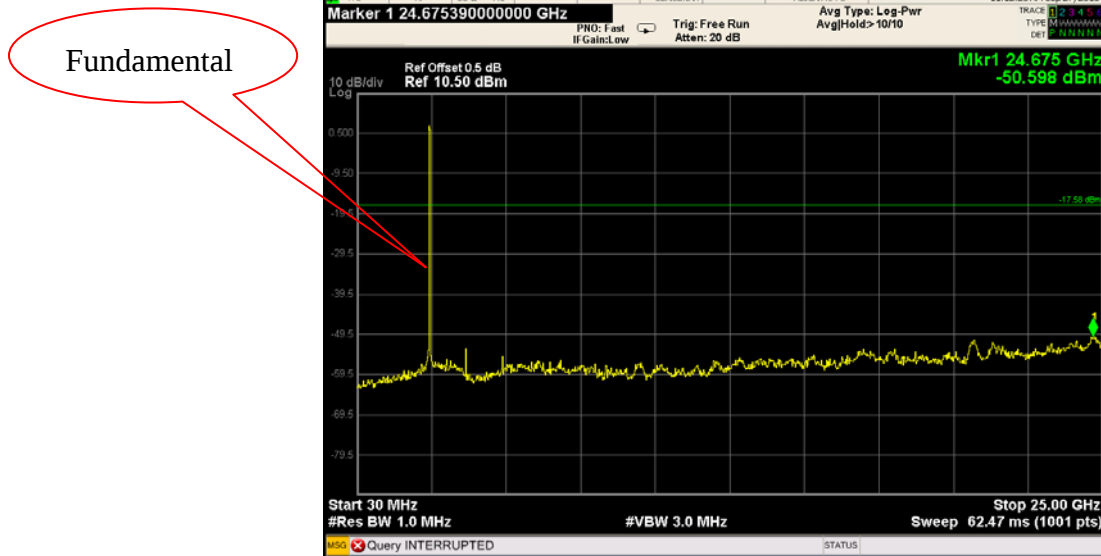


Middle Channel

Fundamental

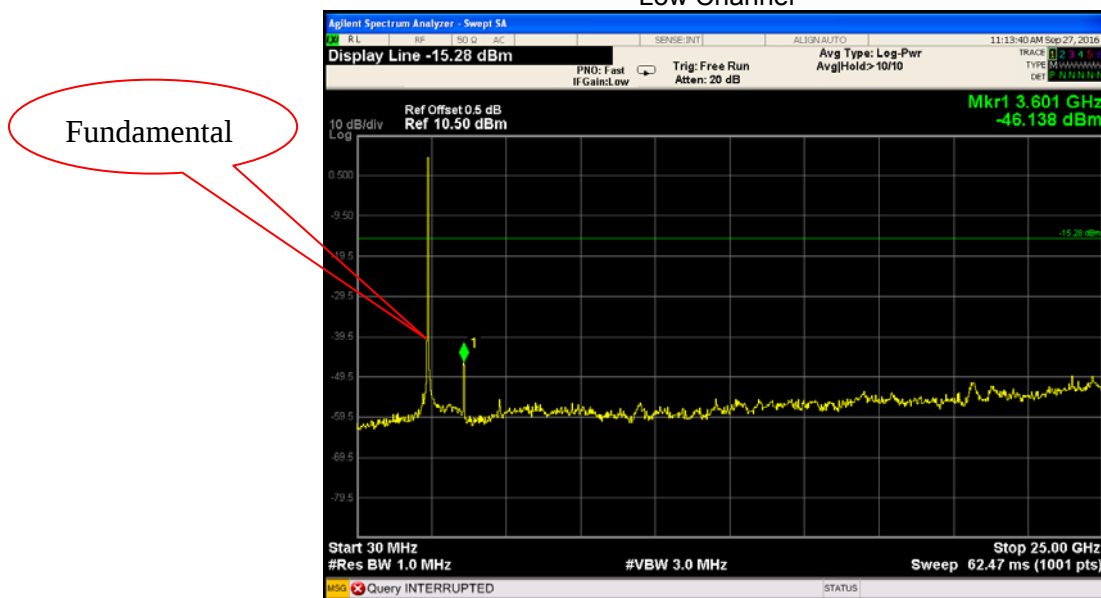


High Channel



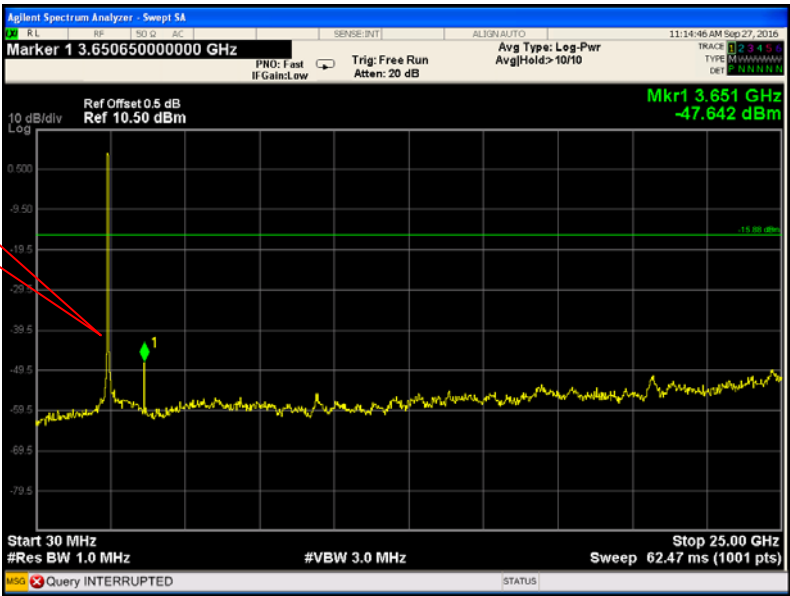
802.11g

Low Channel



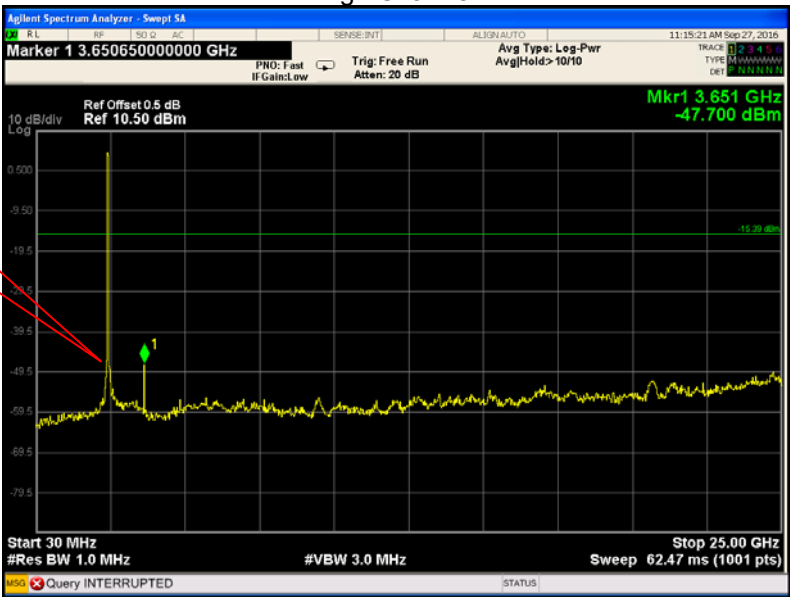
Middle Channel

Fundamental



High Channel

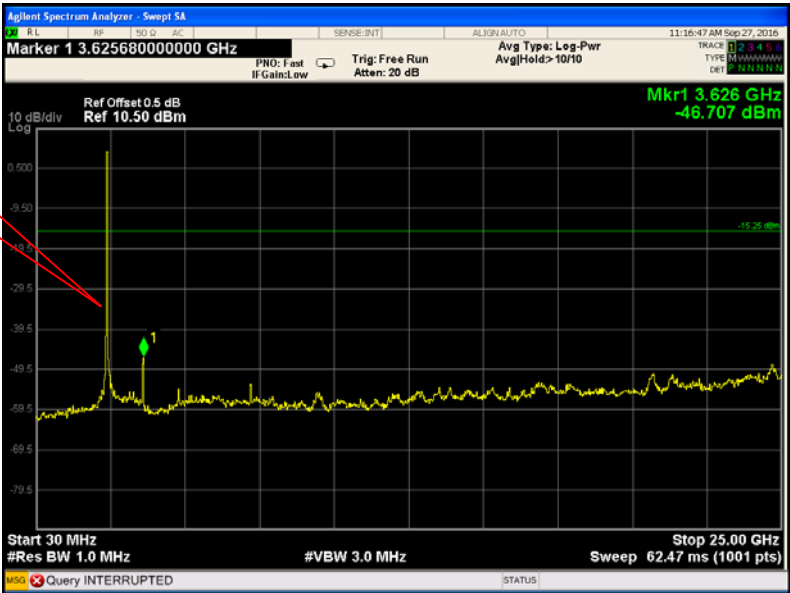
Fundamental



802.11n HT20

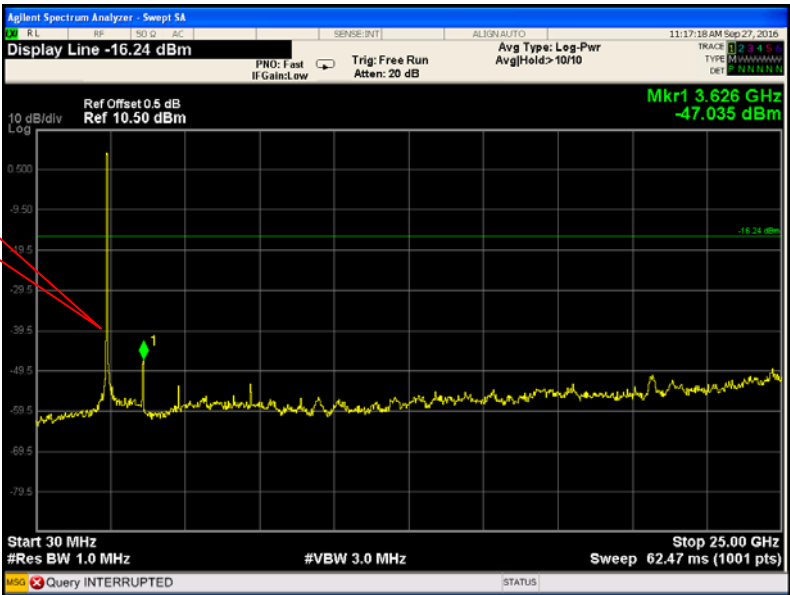
Low Channel

Fundamental



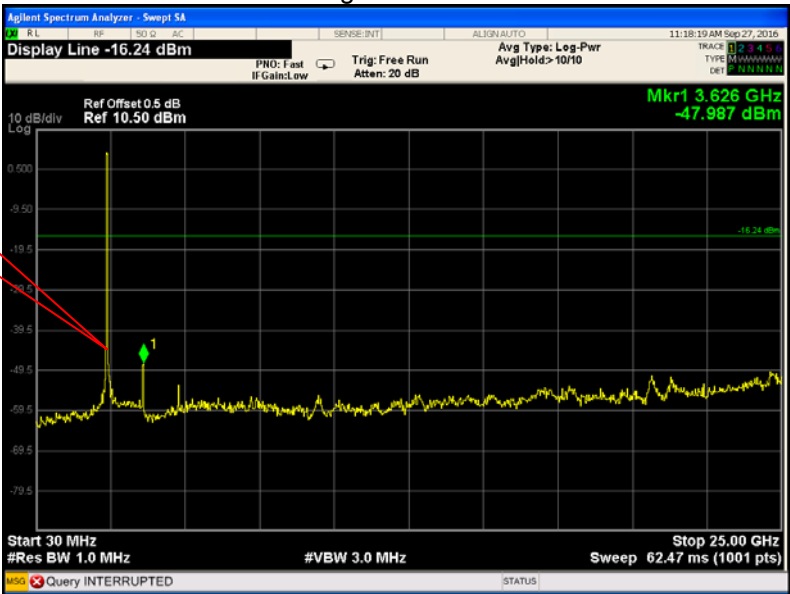
Middle Channel

Fundamental



High Channel

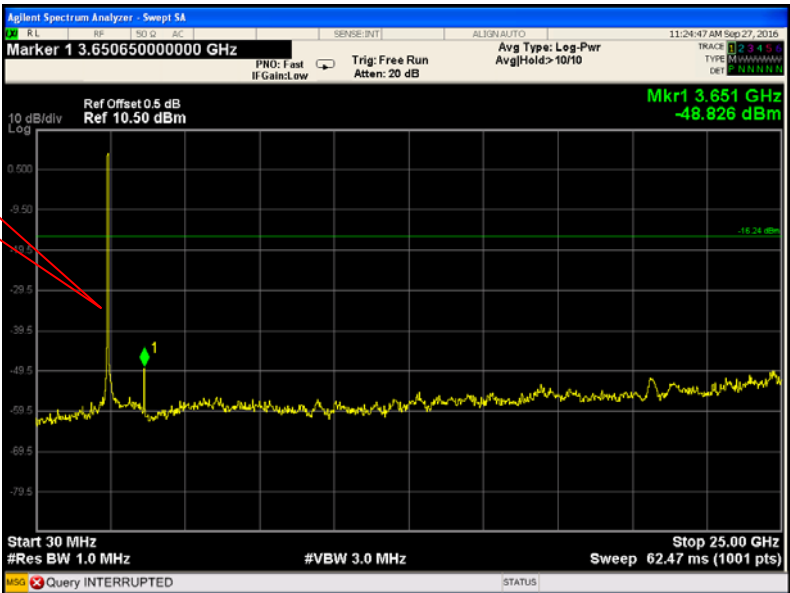
Fundamental



802.11n HT40

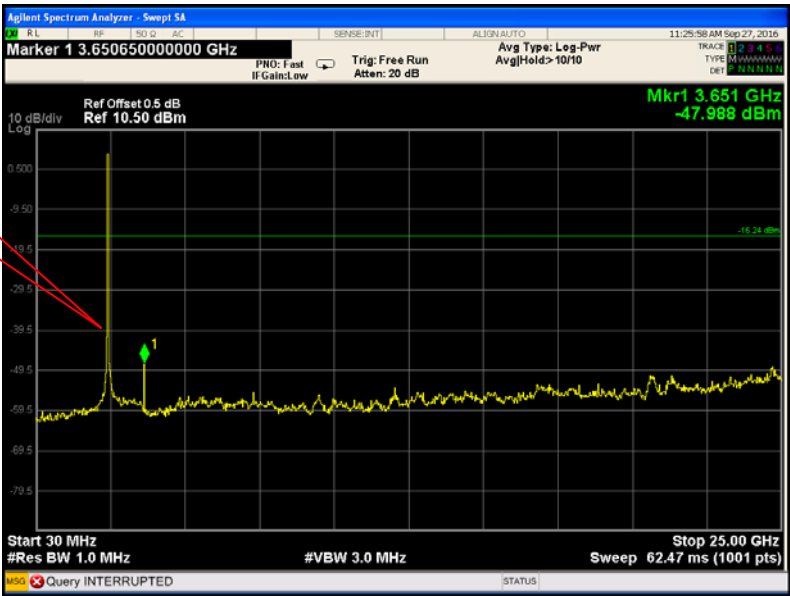
Low Channel

Fundamental



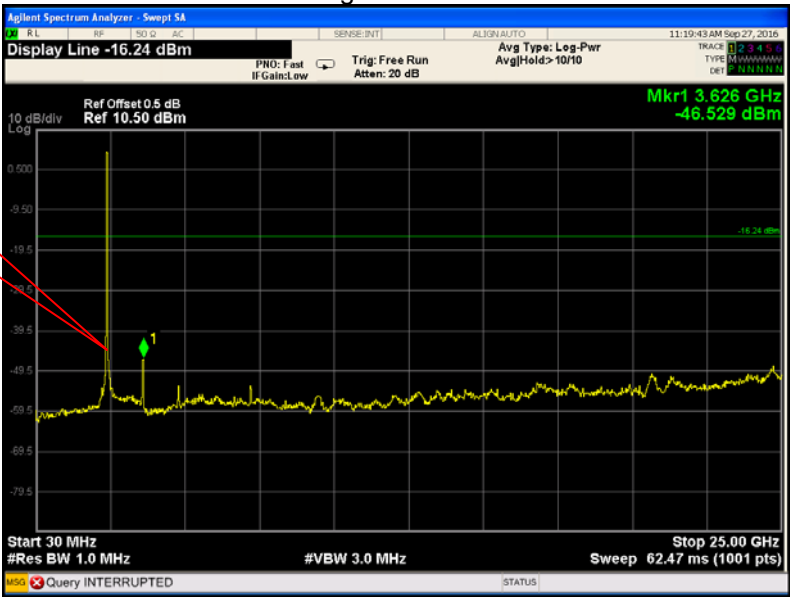
Middle Channel

Fundamental



High Channel

Fundamental



10 Band Edge Measurement

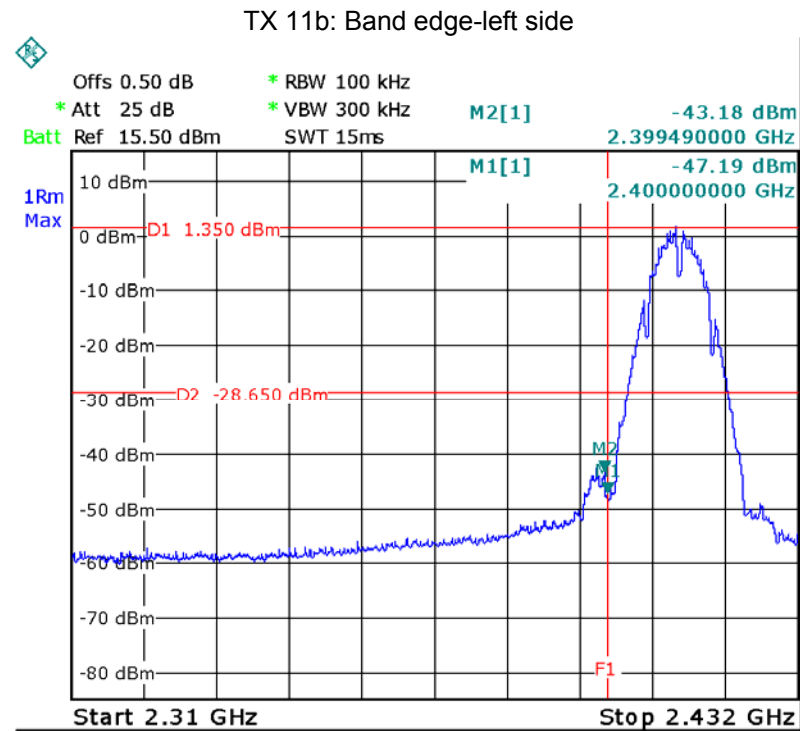
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	558074 D01 DTS Meas Guidance v03r05
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

10.1 Test Produce

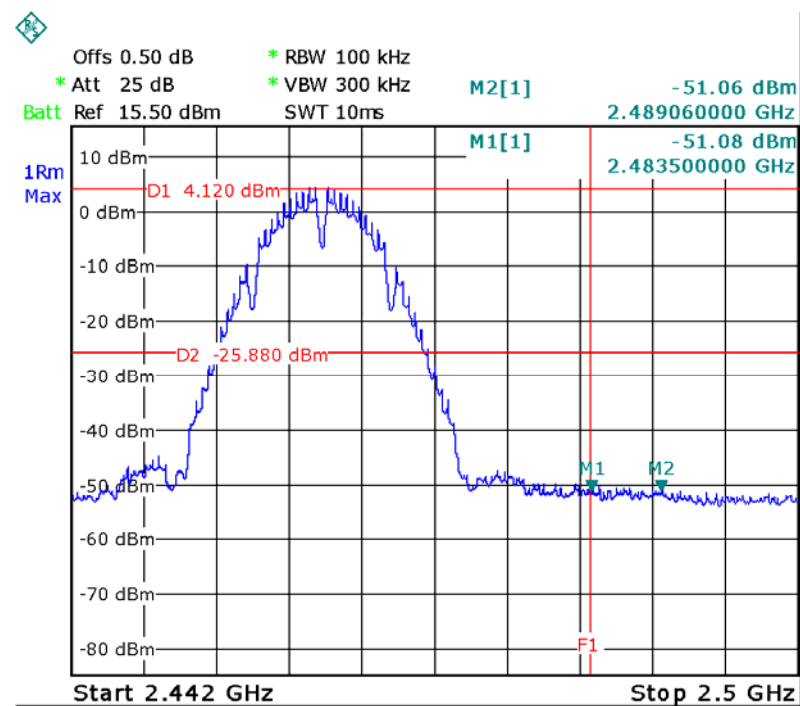
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

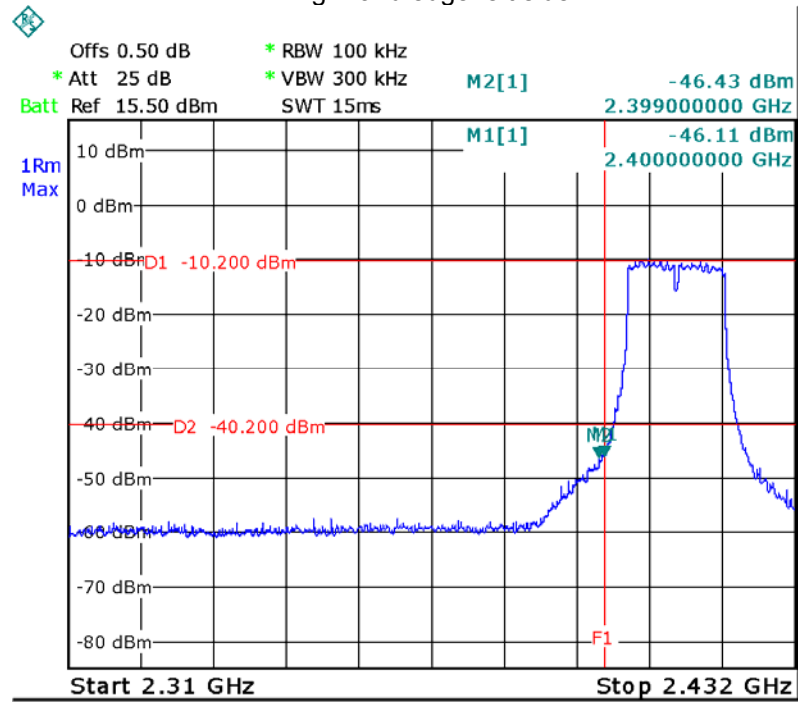
Test result plots shown as follows:



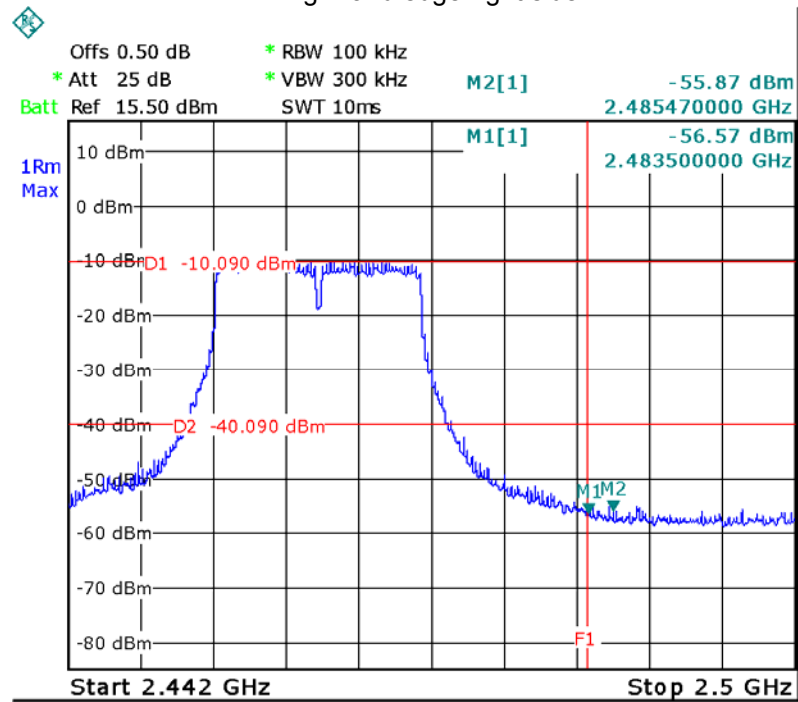
TX 11b: Band edge-right side



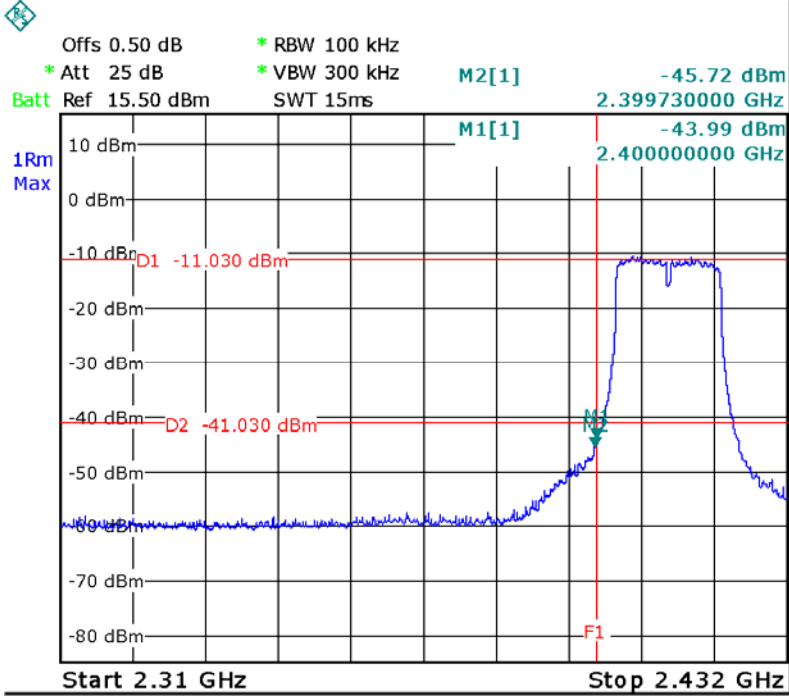
TX 11g: Band edge-left side



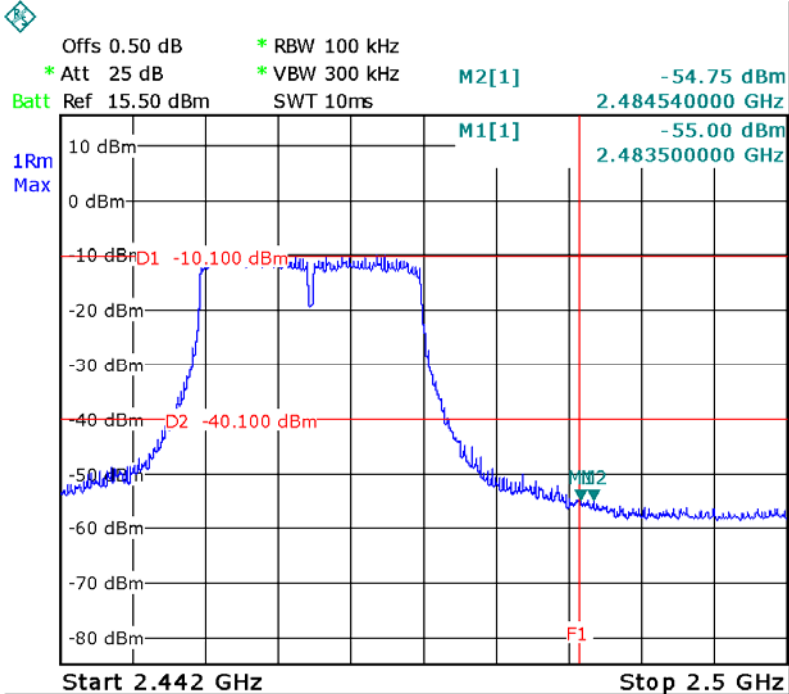
TX 11g: Band edge-right side

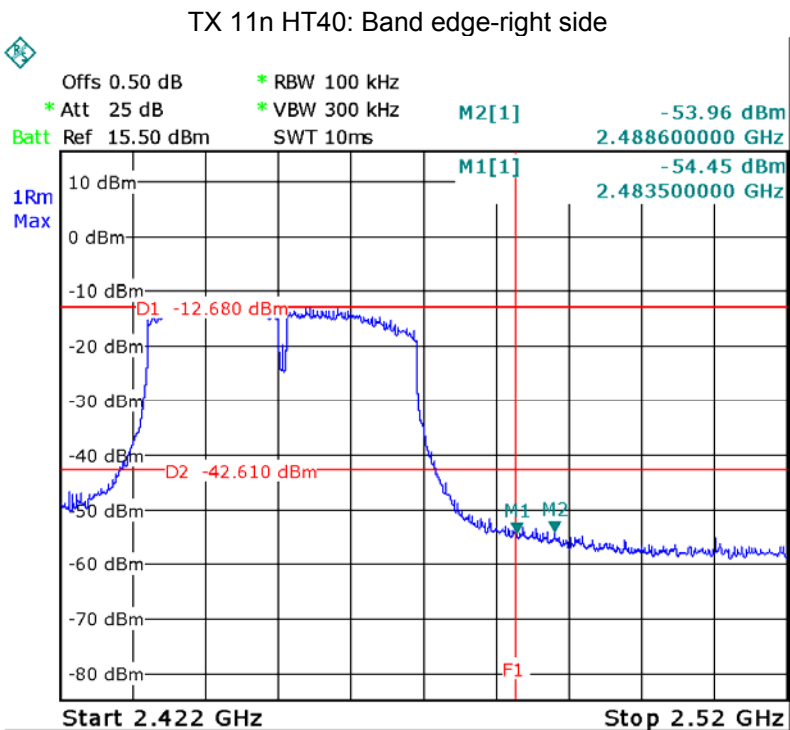
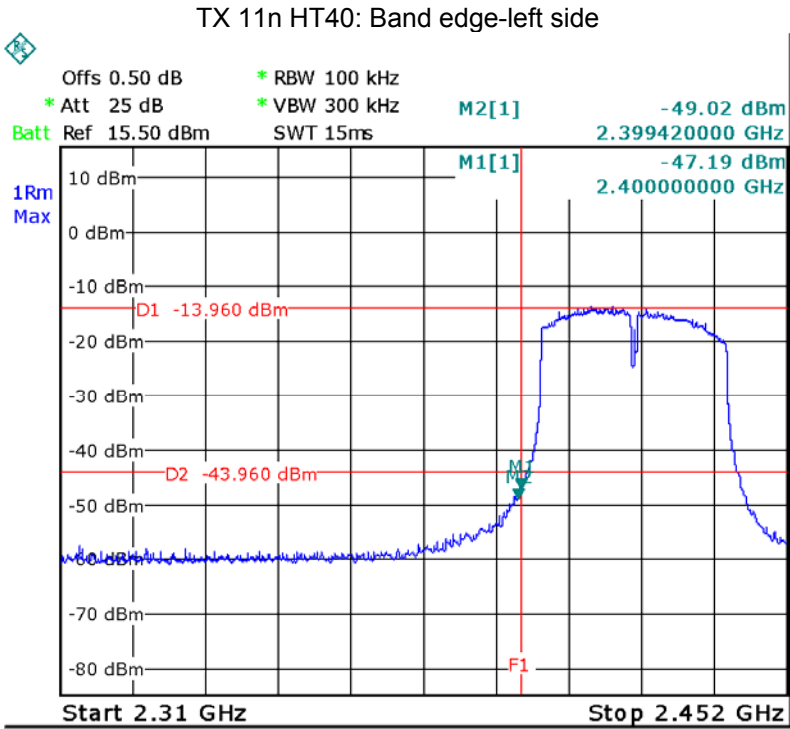


TX 11n HT20: Band edge-left side

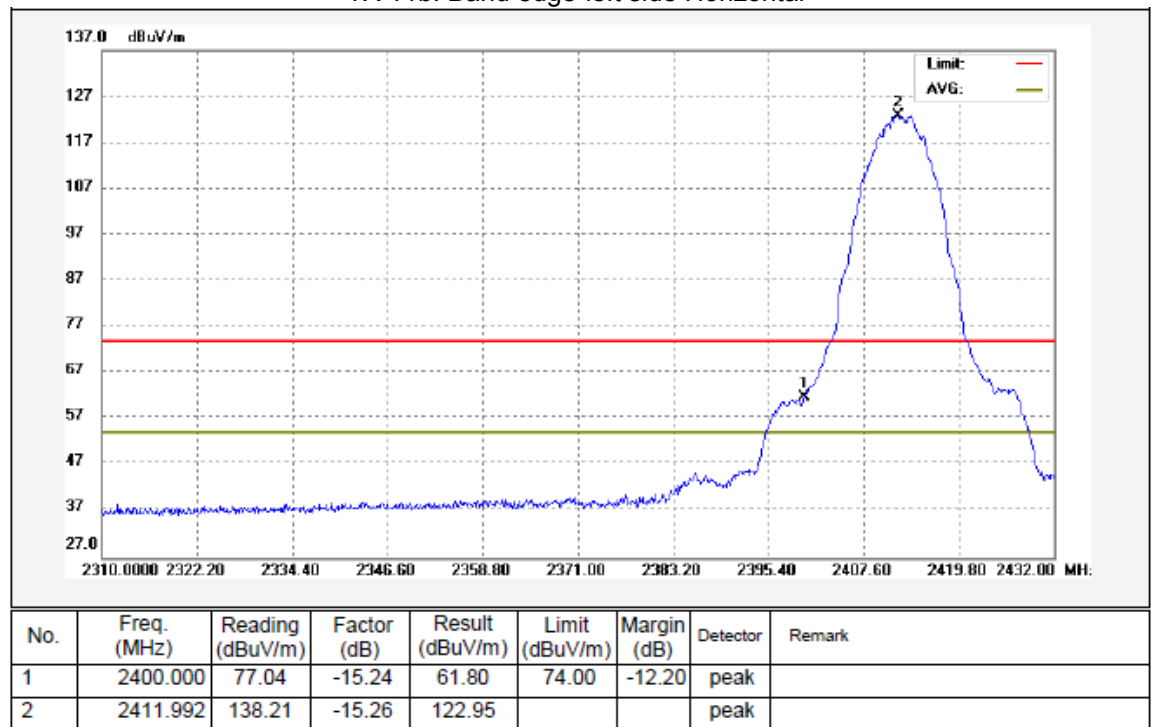


TX 11n HT20: Band edge-right side

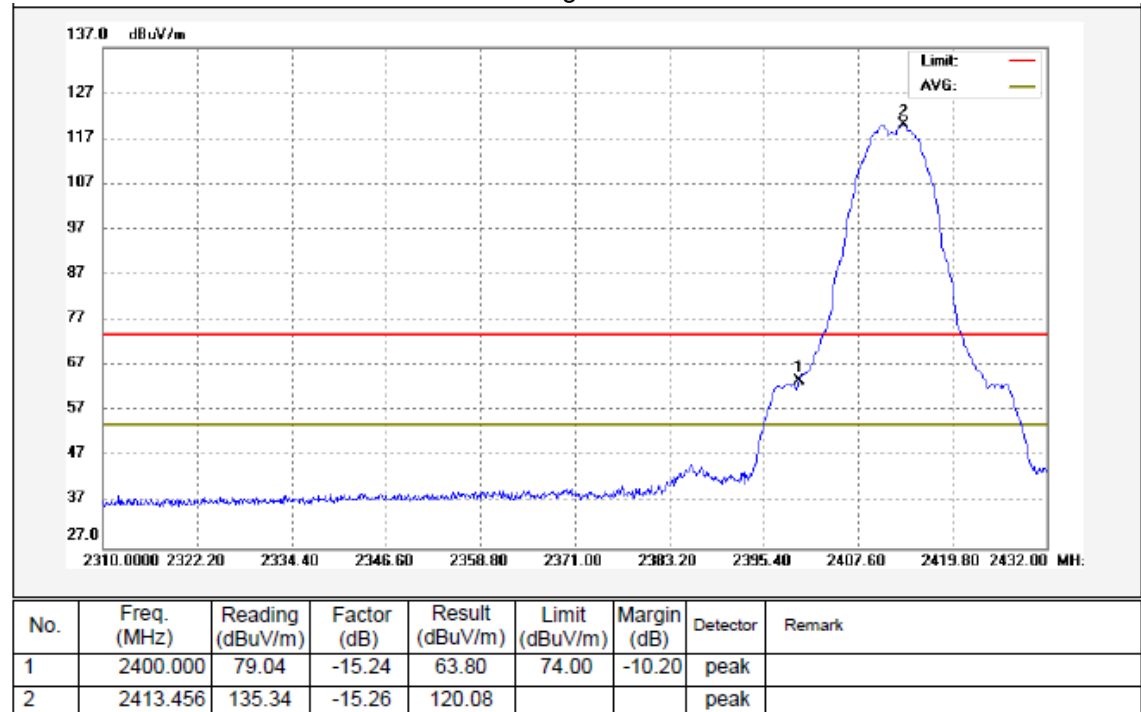




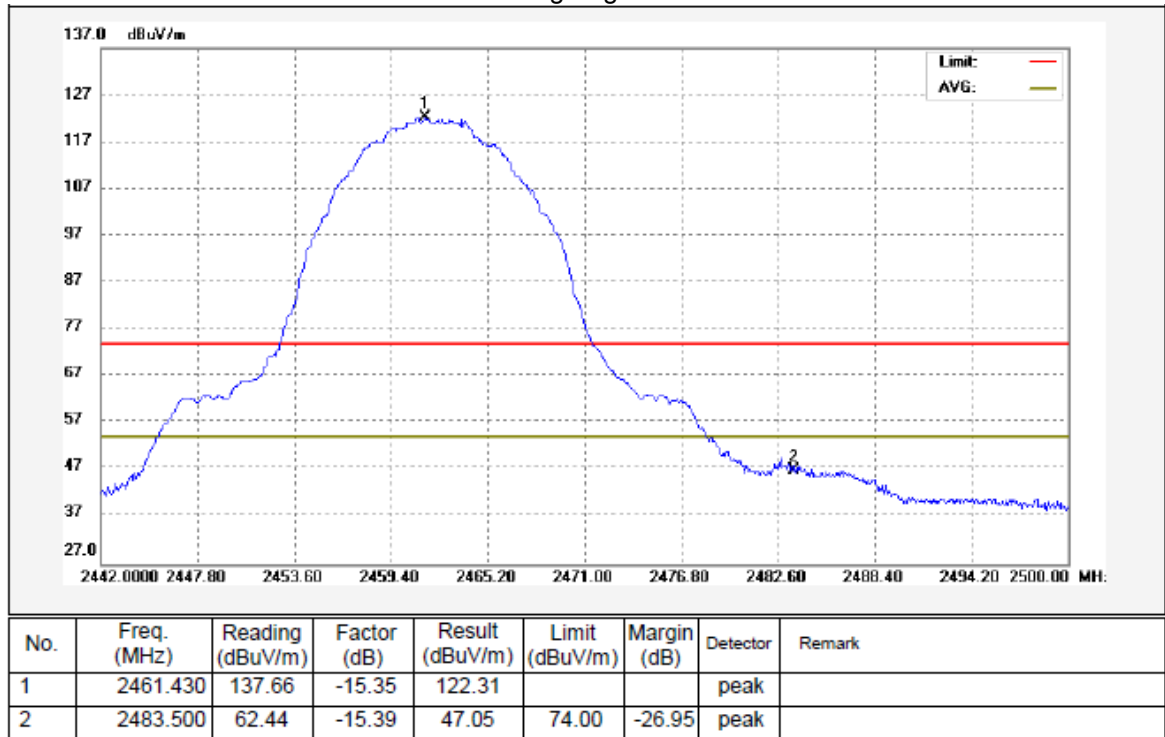
TX 11b: Band edge-left side Horizontal



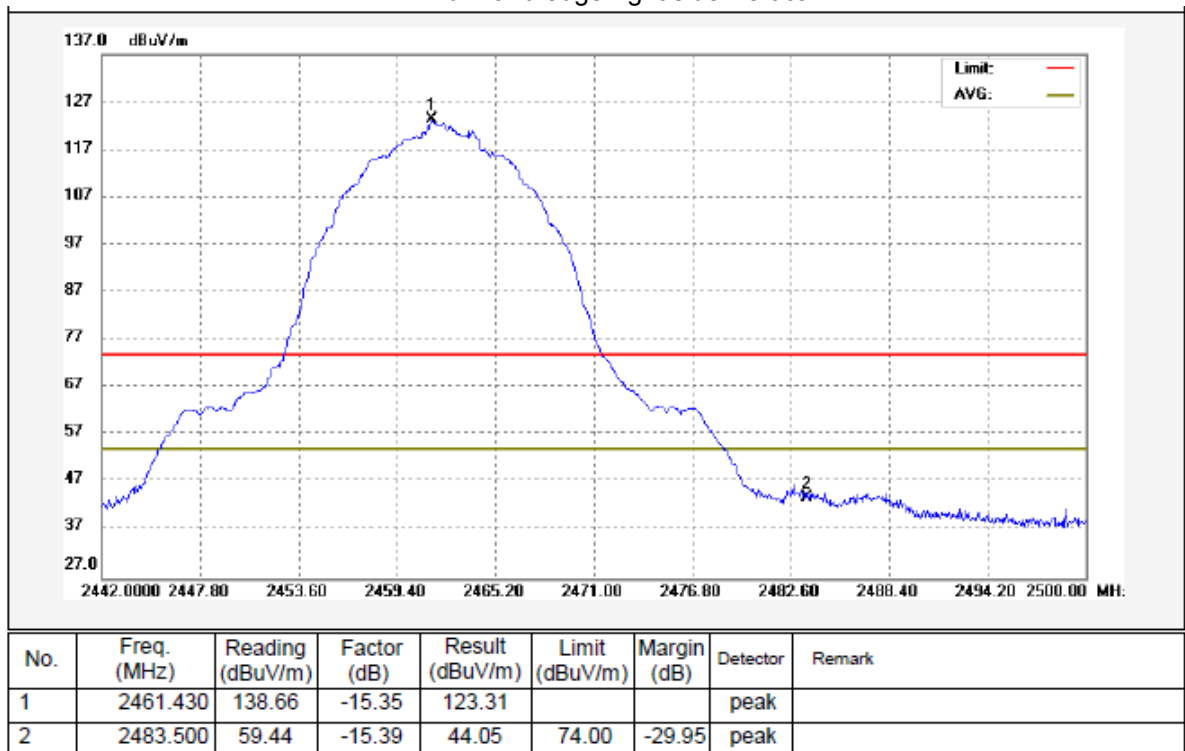
TX 11b: Band edge-left side Vertical



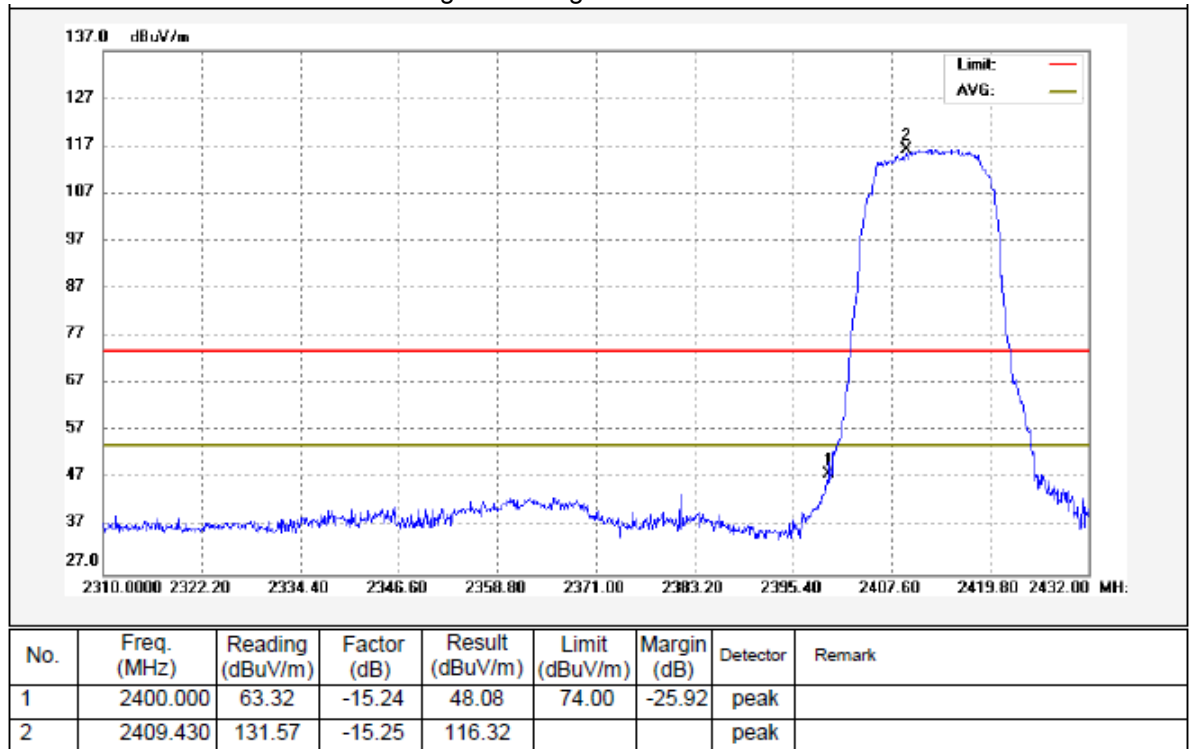
TX 11b: Band edge-right side Horizontal



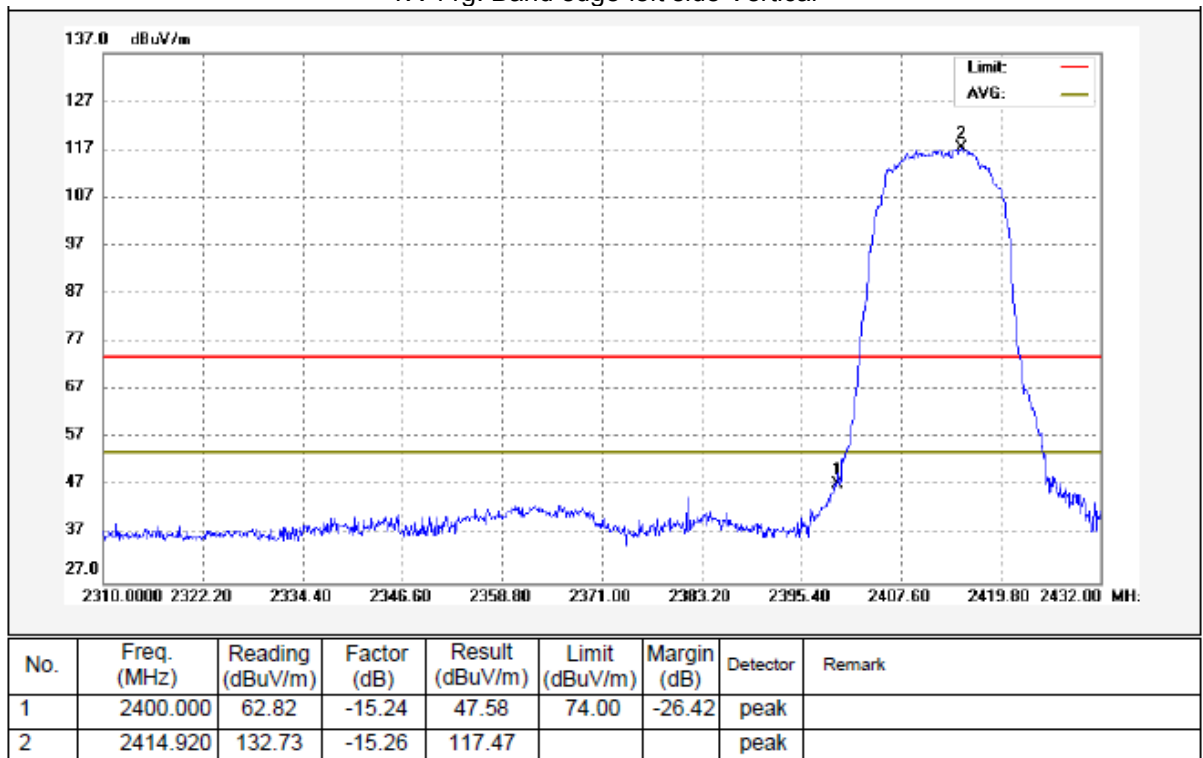
TX 11b: Band edge-right side Vertical



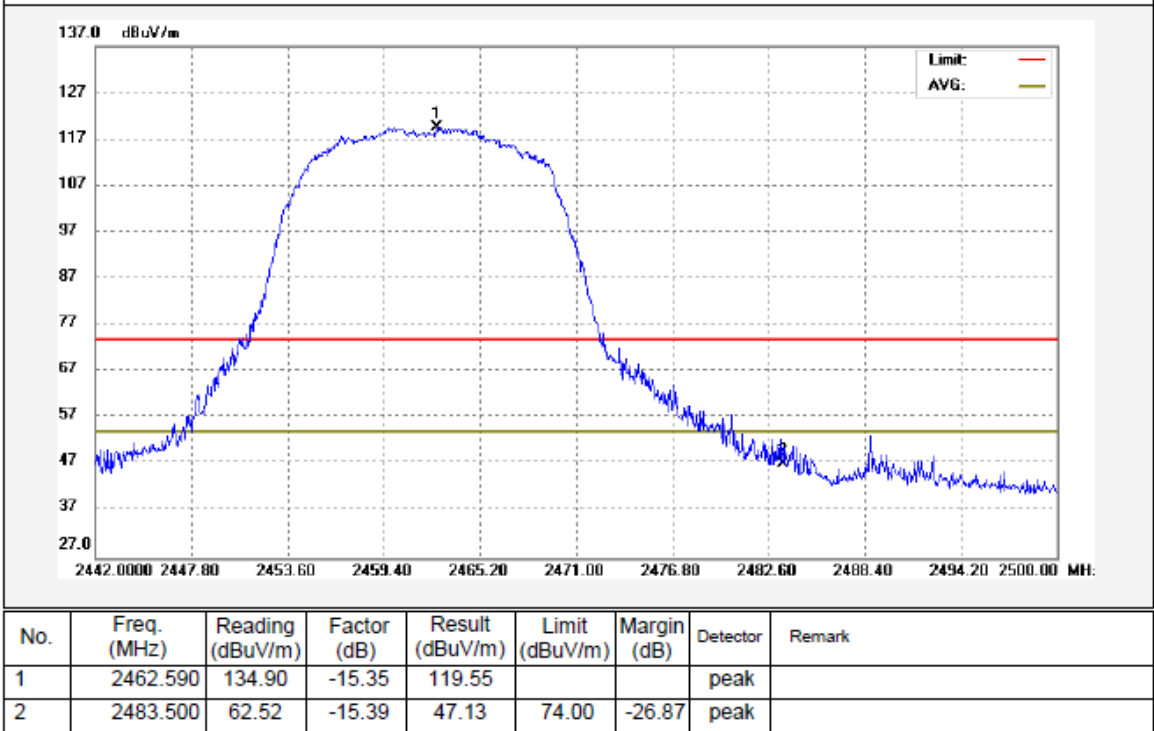
TX 11g: Band edge-left side Horizontal



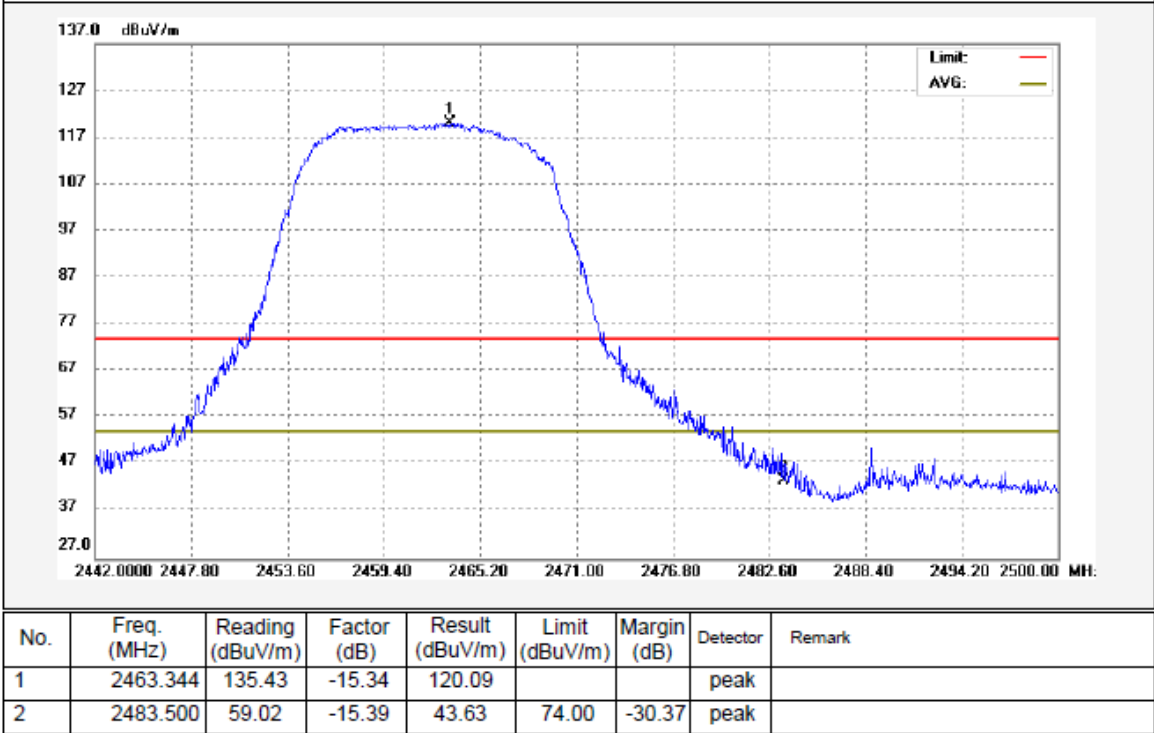
TX 11g: Band edge-left side Vertical



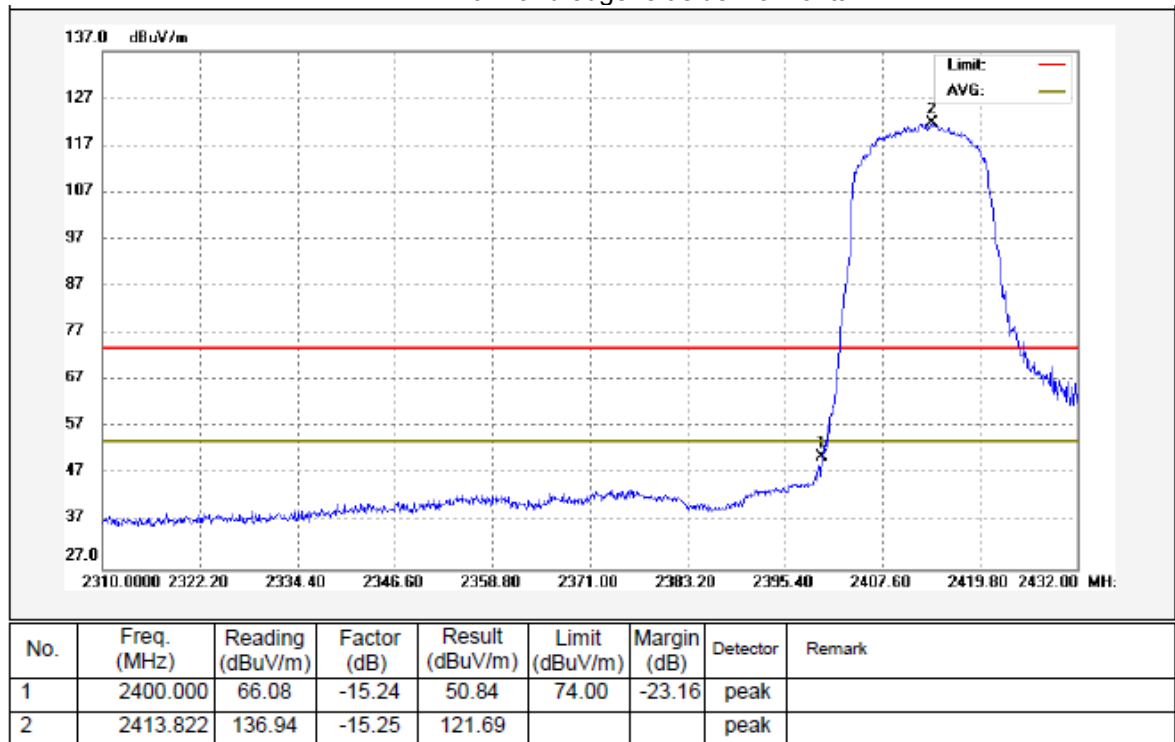
TX 11g: Band edge-right side Horizontal



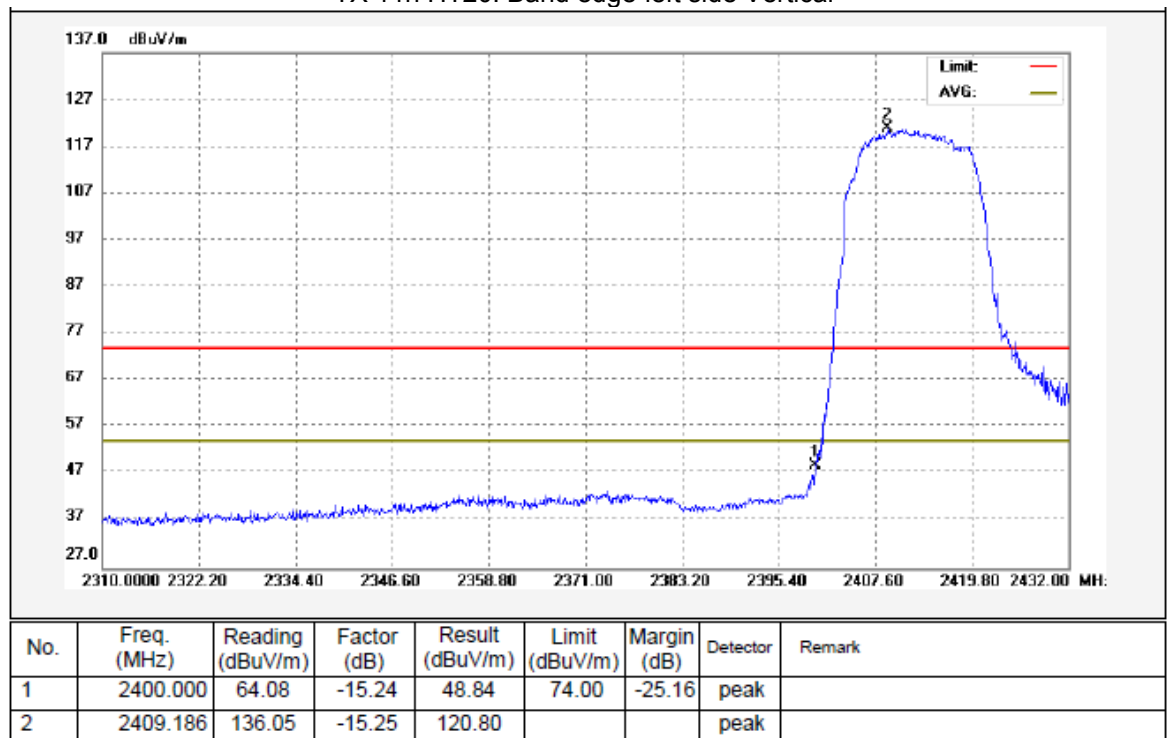
TX 11g: Band edge-right side Vertical



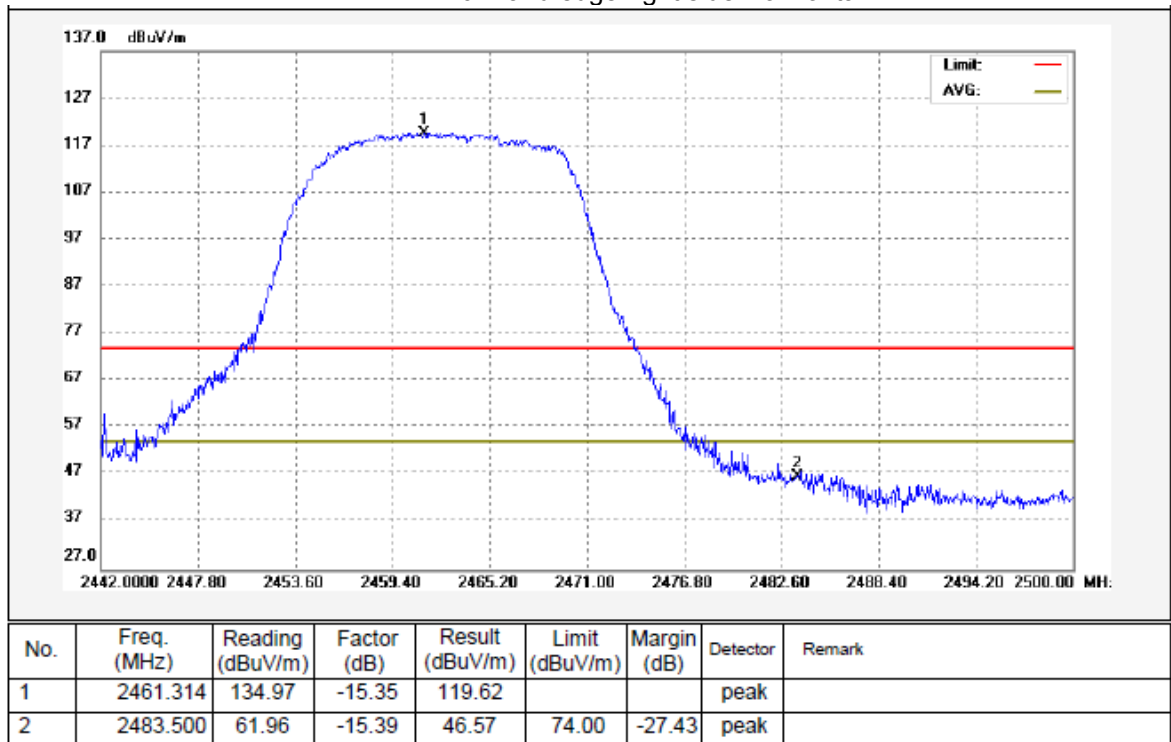
TX 11n HT20: Band edge-left side Horizontal



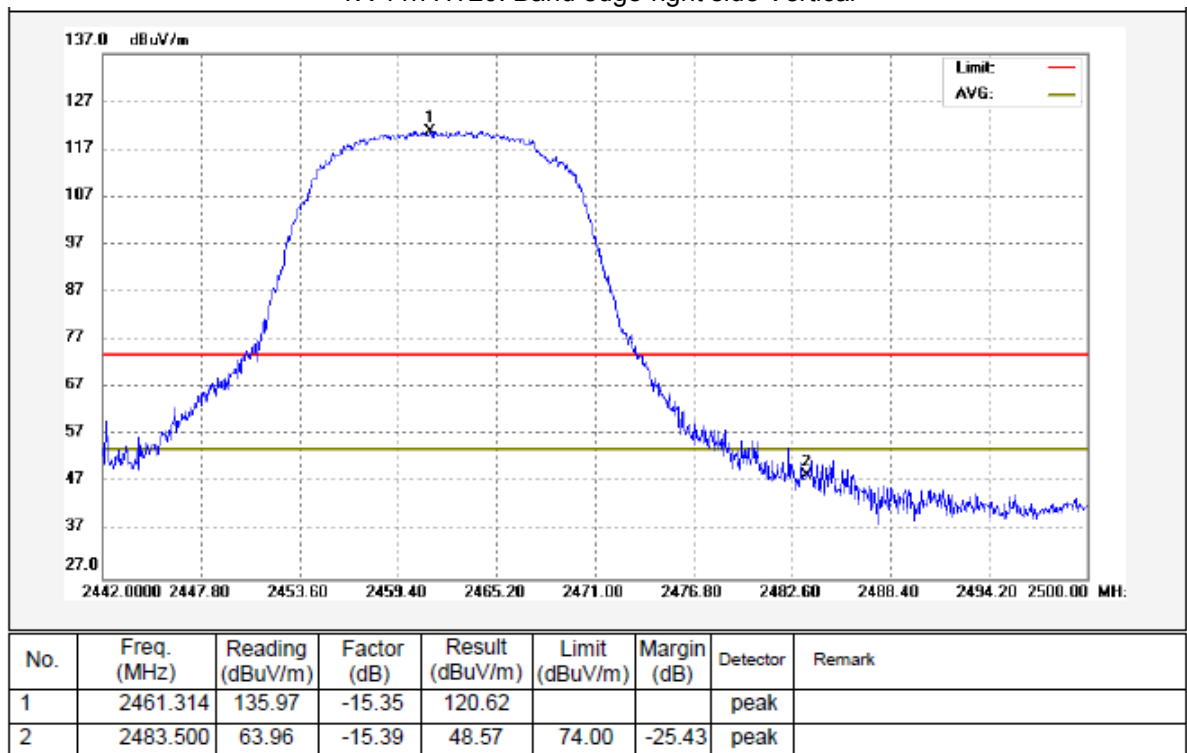
TX 11n HT20: Band edge-left side Vertical



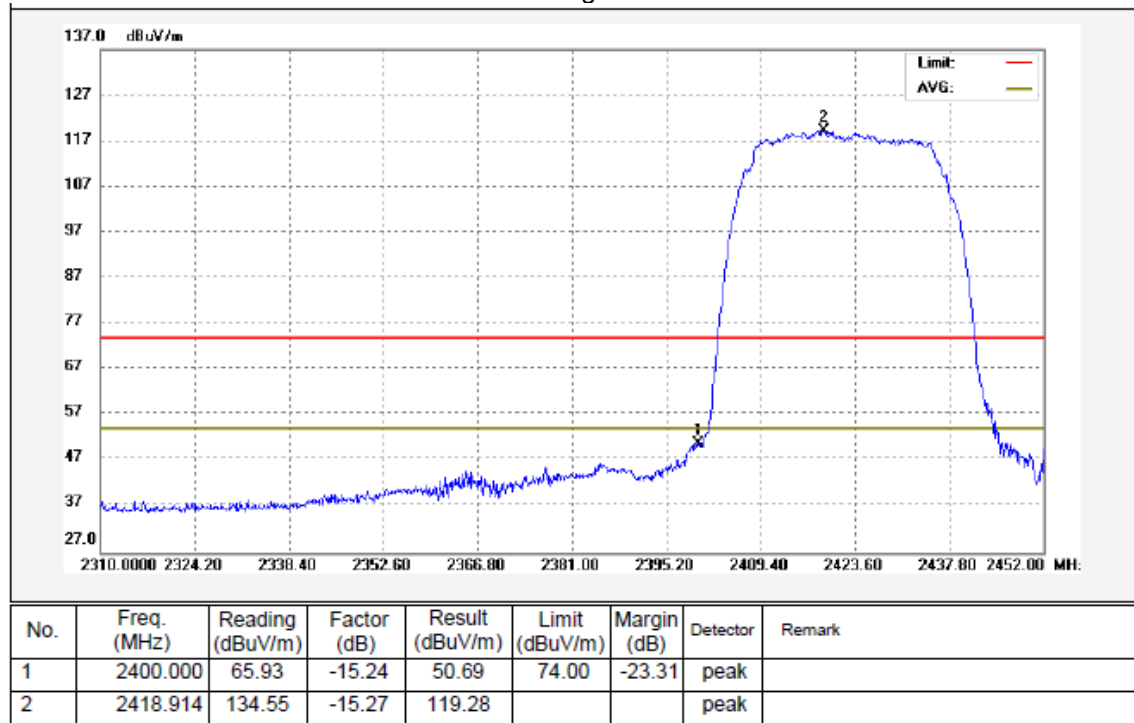
TX 11n HT20: Band edge-right side Horizontal



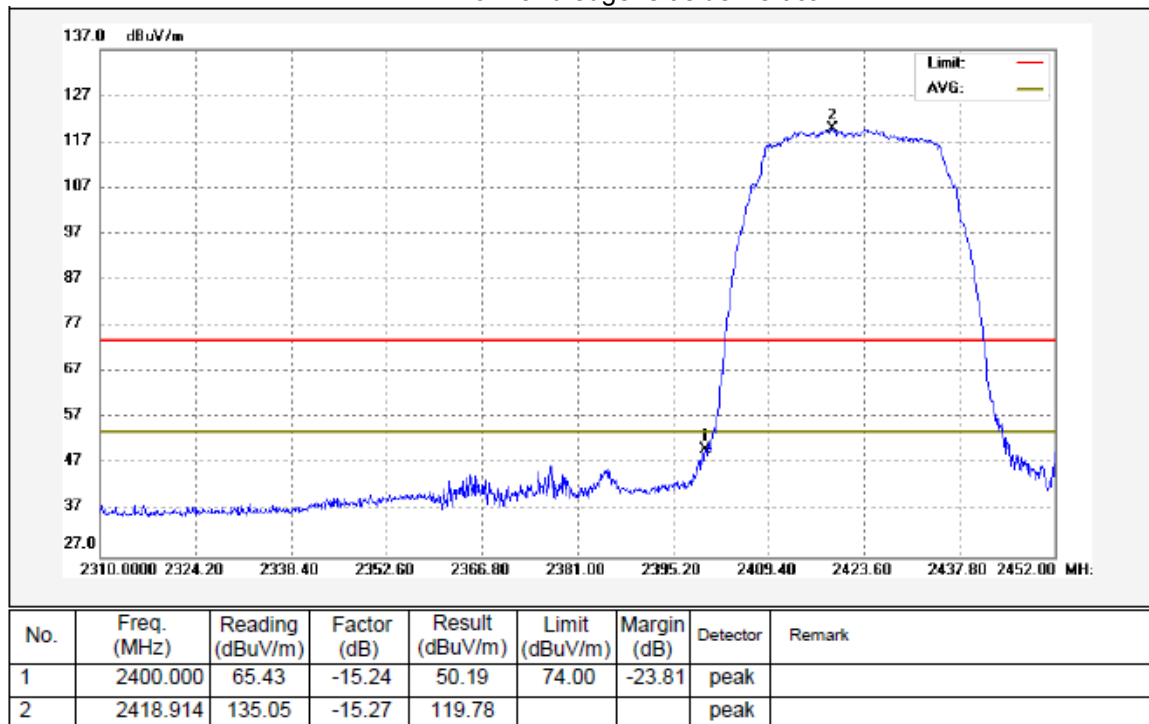
TX 11n HT20: Band edge-right side Vertical



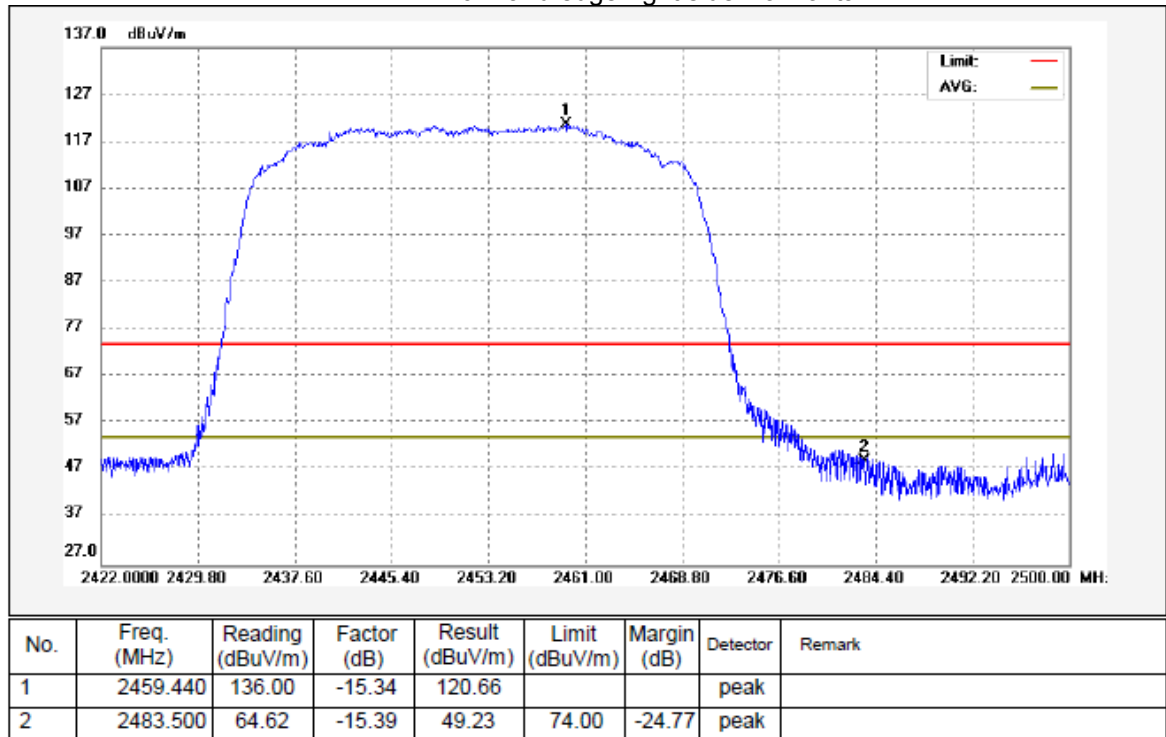
TX 11n HT40: Band edge-left side Horizontal



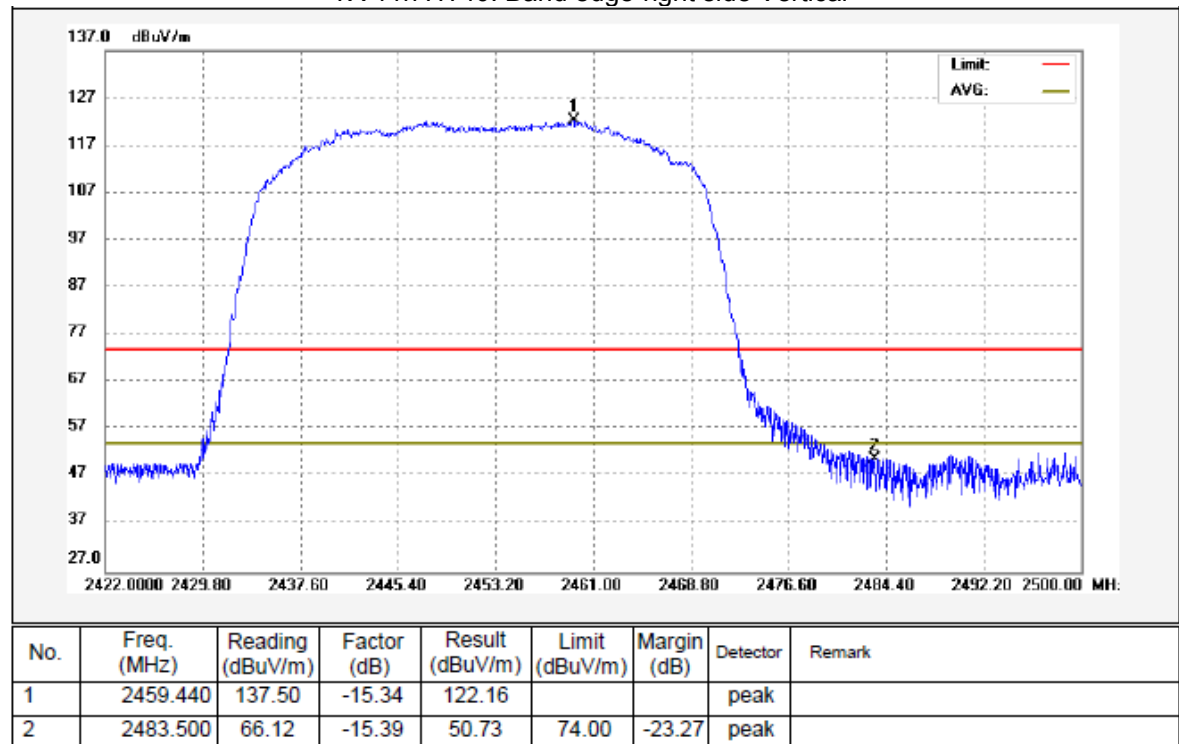
TX 11n HT40: Band edge-left side Vertical



TX 11n HT40: Band edge-right side Horizontal



TX 11n HT40: Band edge-right side Vertical



11 6 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r05

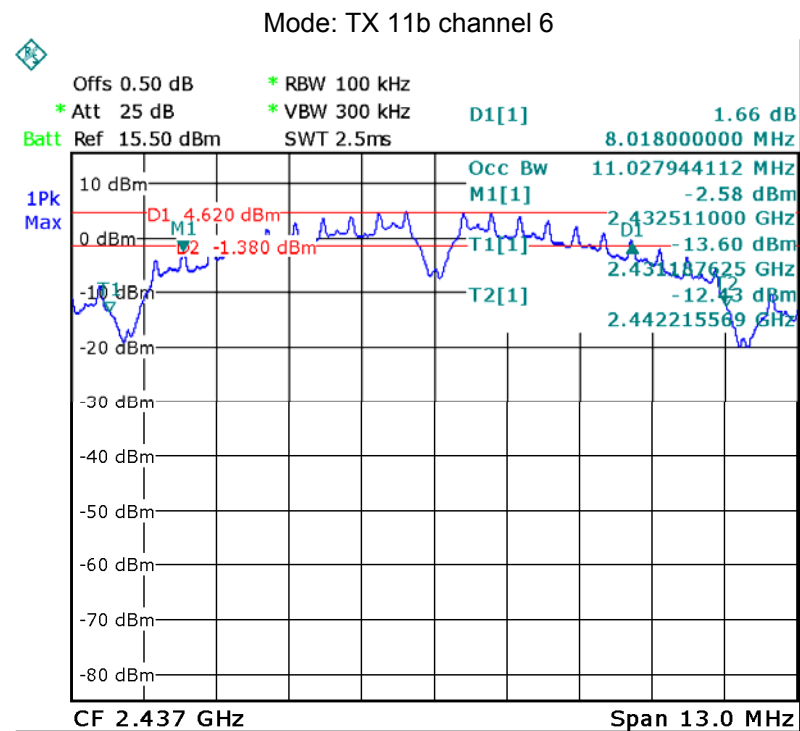
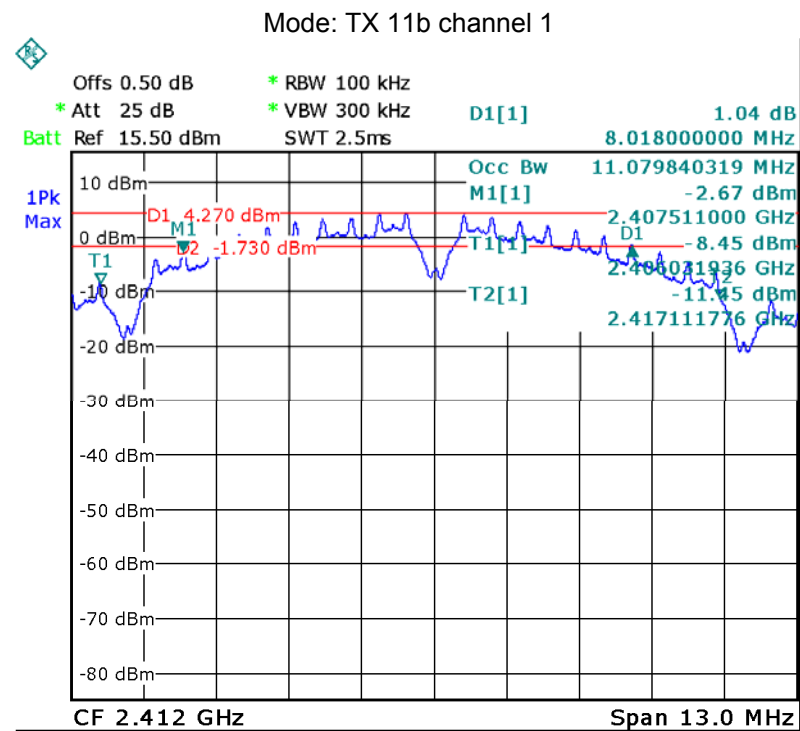
11.1 Test Procedure:

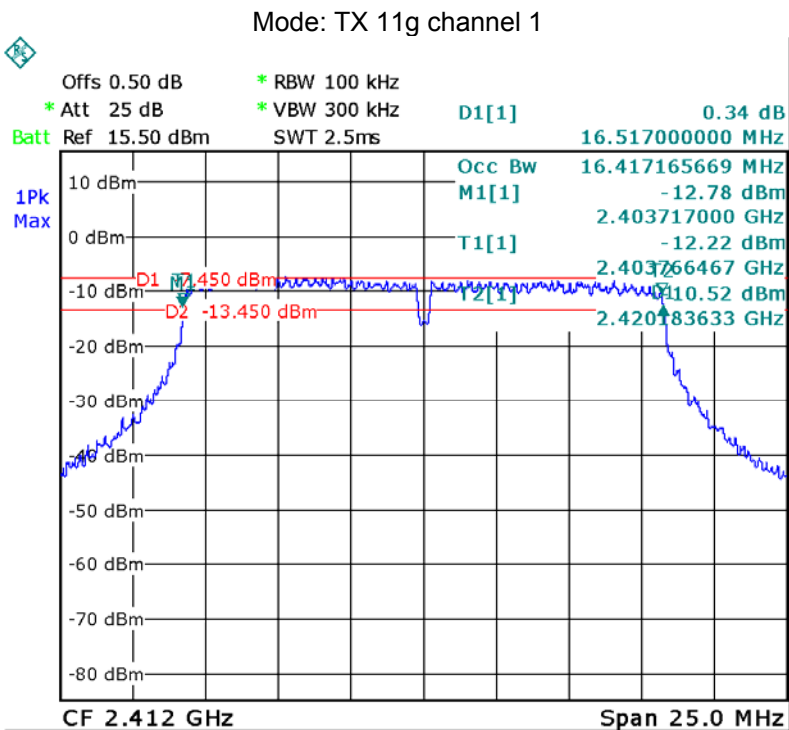
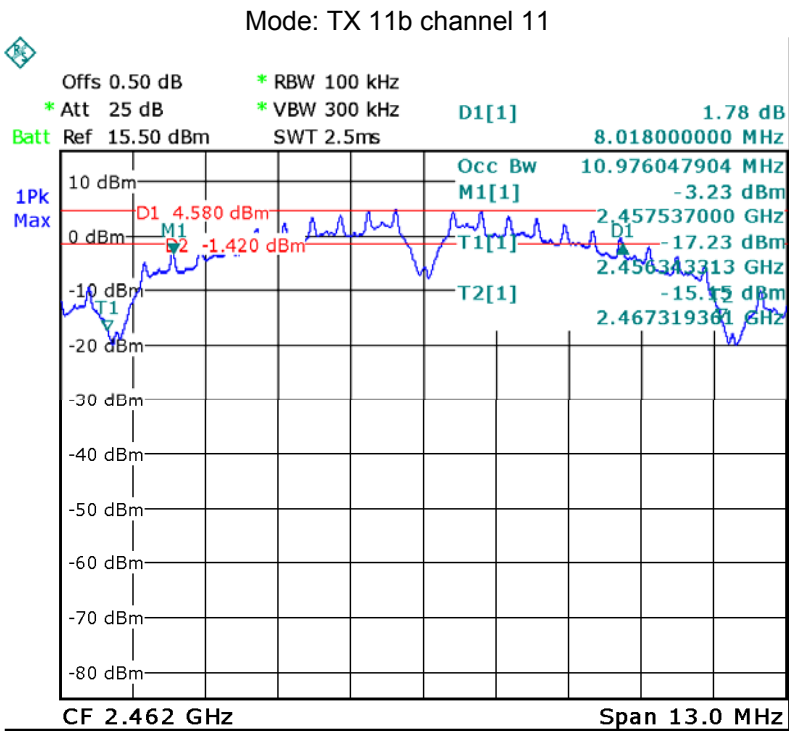
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

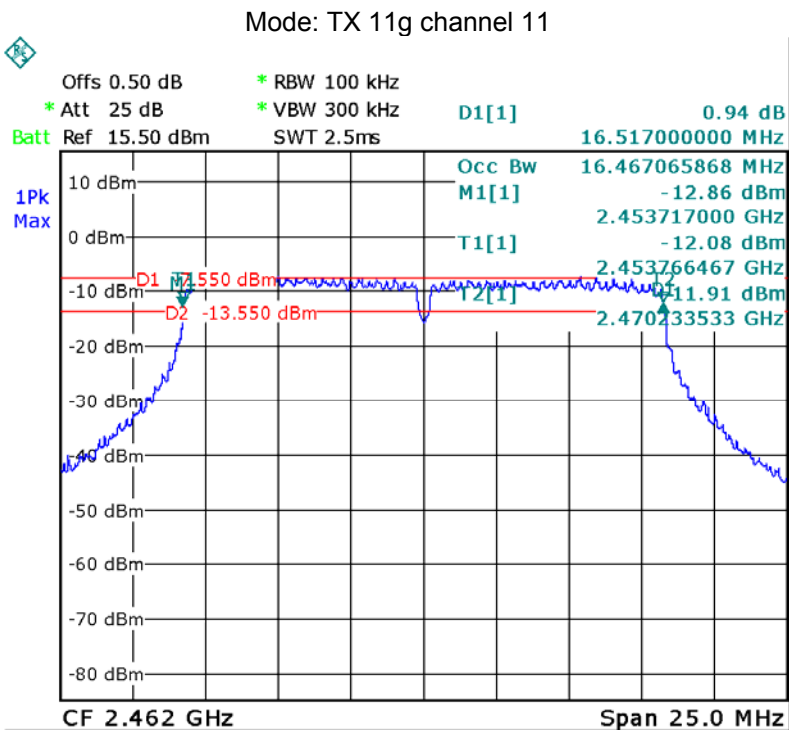
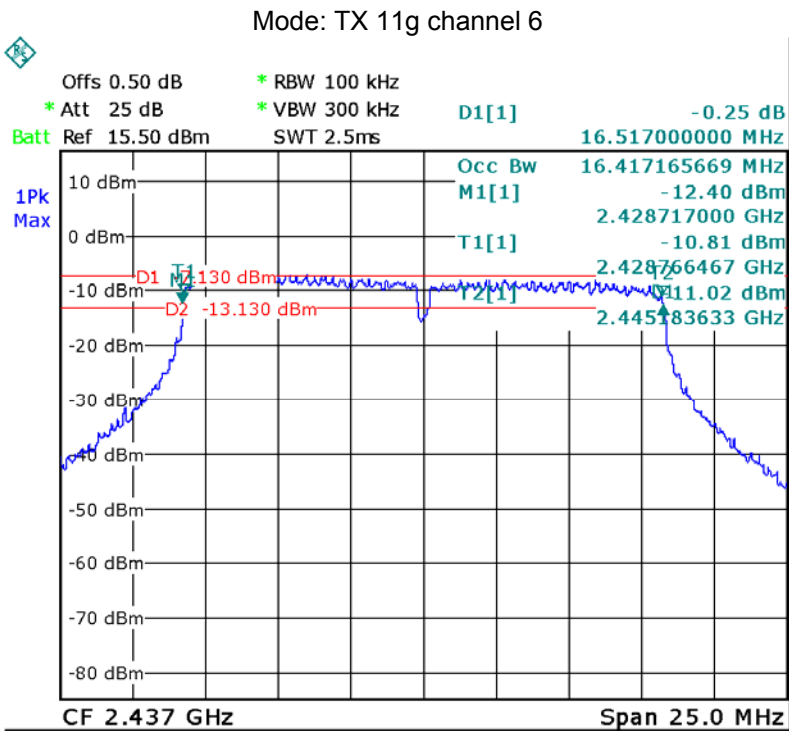
11.2 Test Result:

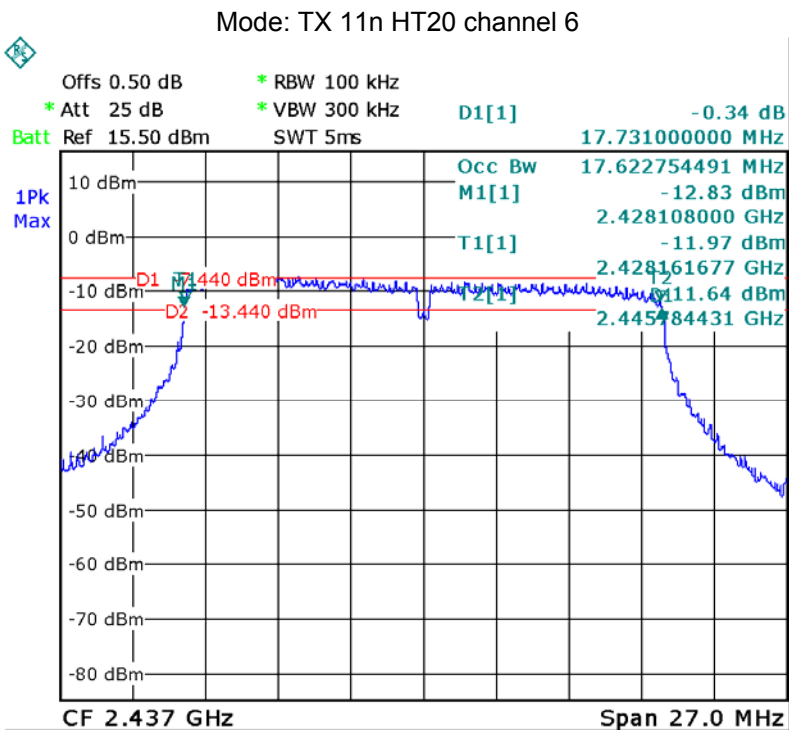
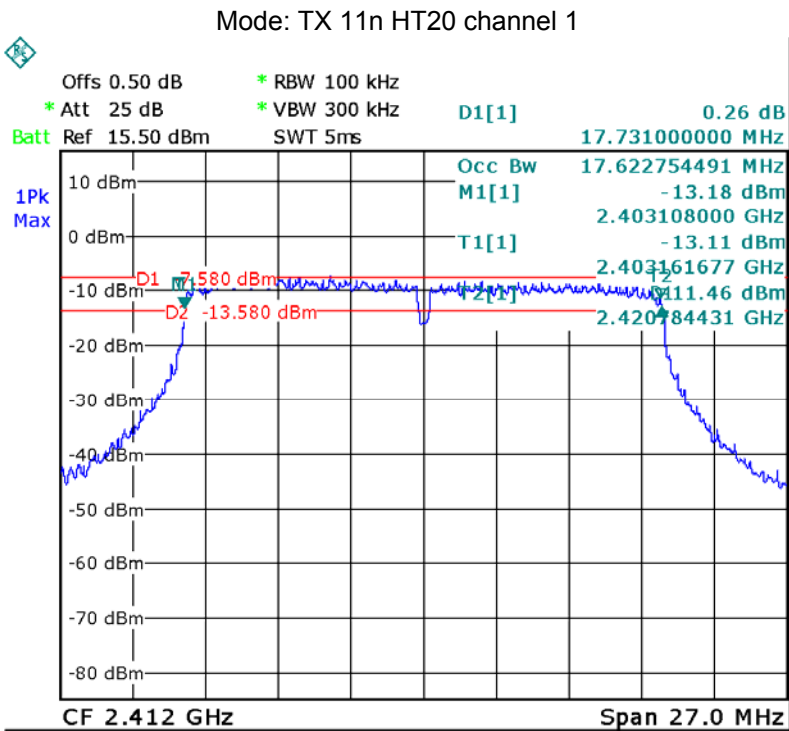
Operation mode	Bandwidth (MHz)		
TX 11b	Channel 1	Channel 6	Channel 11
	8.018	8.018	8.018
TX 11g	Channel 1	Channel 6	Channel 11
	16.517	16.517	16.517
TX 11n HT20	Channel 1	Channel 6	Channel 11
	17.731	17.731	17.731
TX 11n HT40	Channel 3	Channel 6	Channel 9
	35.780	35.780	35.780

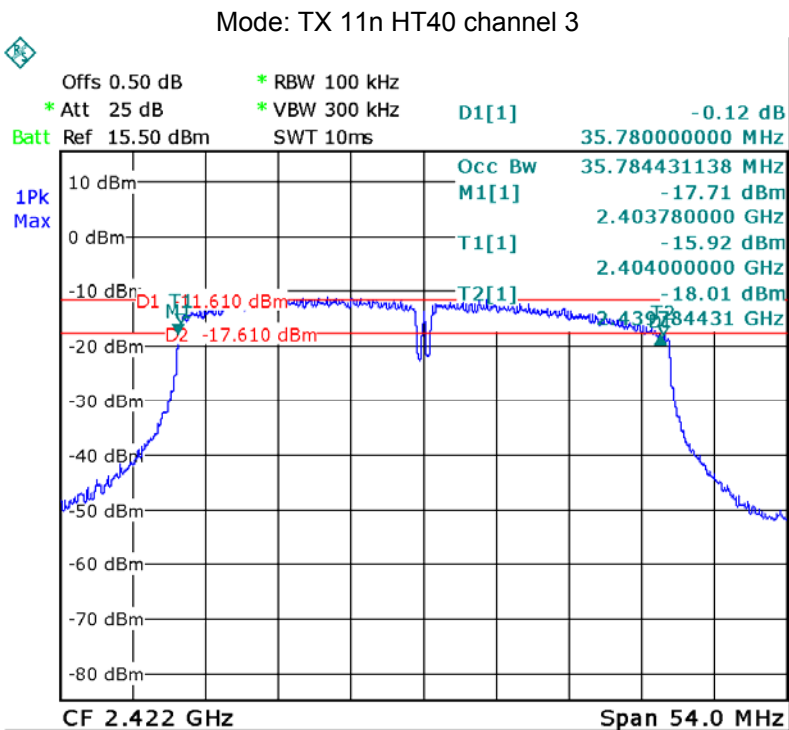
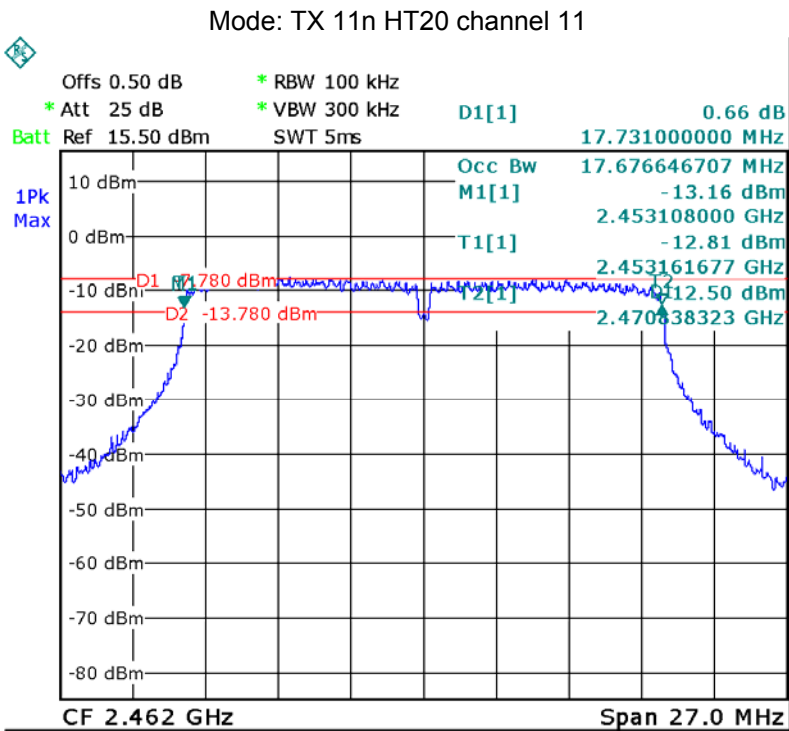
Test result plot as follows:

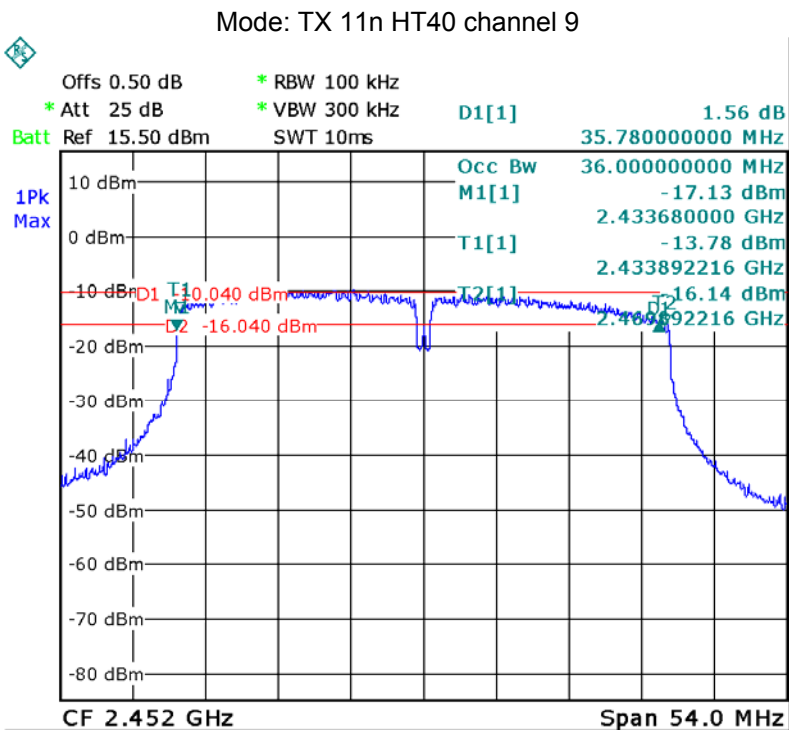
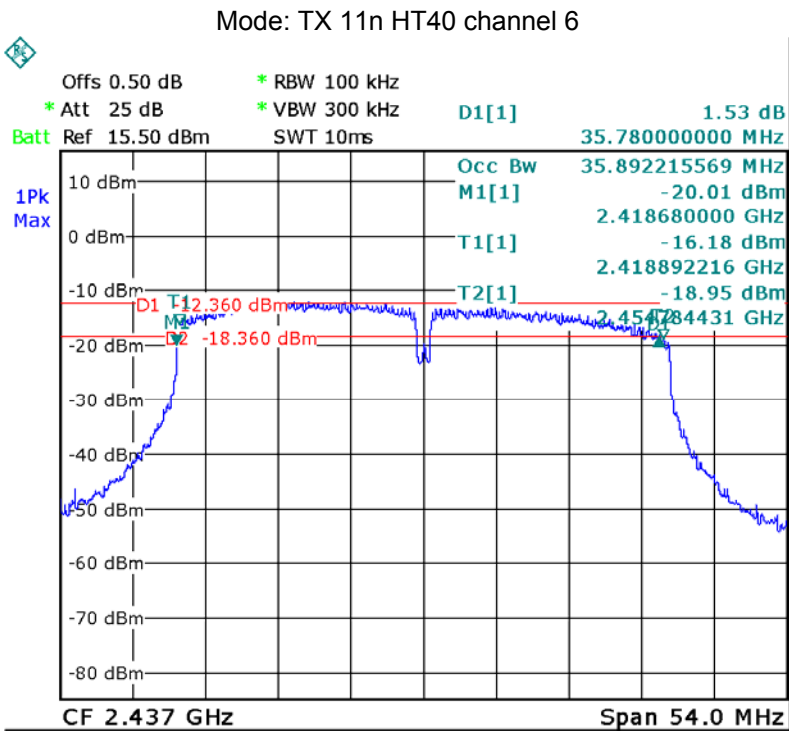












12 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

558074 D01 DTS Meas Guidance v03r05

12.1 Test Procedure:

558074 D01 DTS Meas Guidance v03r05 section 9.1.2

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 = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

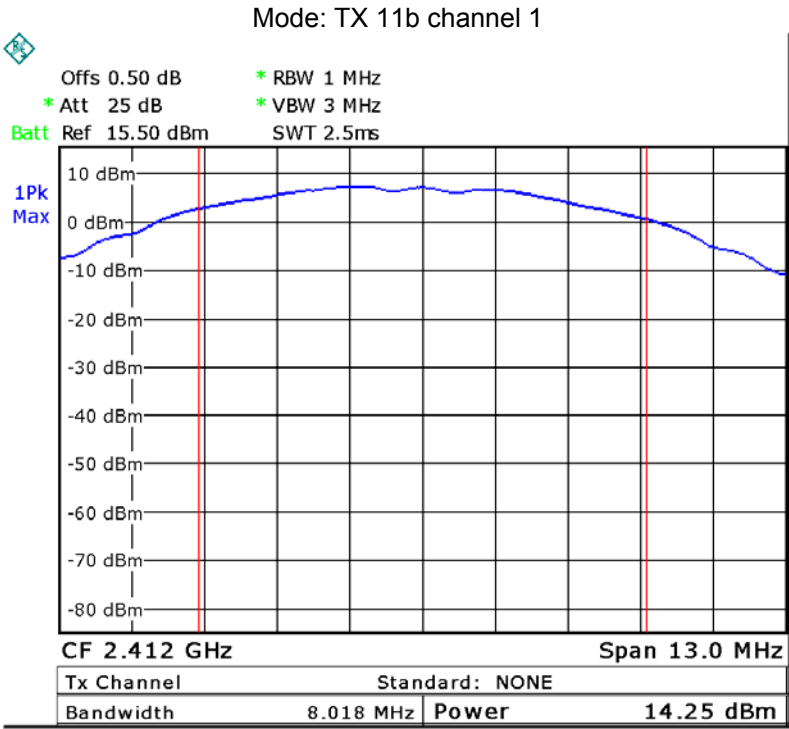
12.2 Test Result:

Test mode :TX 11b		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
14.25	14.92	14.61
Limit: 1W/30dBm		

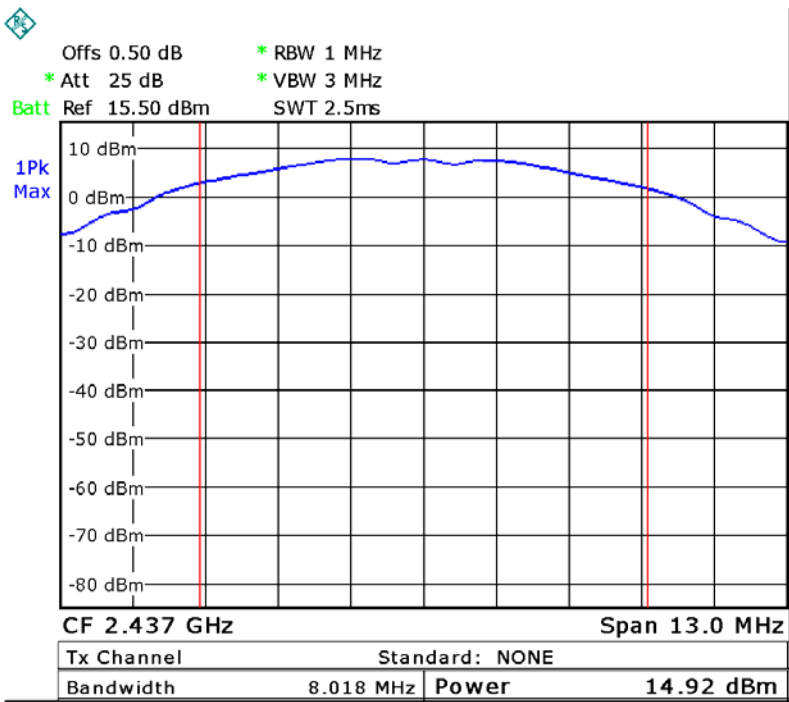
Test mode :TX 11g		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
15.67	14.32	14.42
Limit: 1W/30dBm		

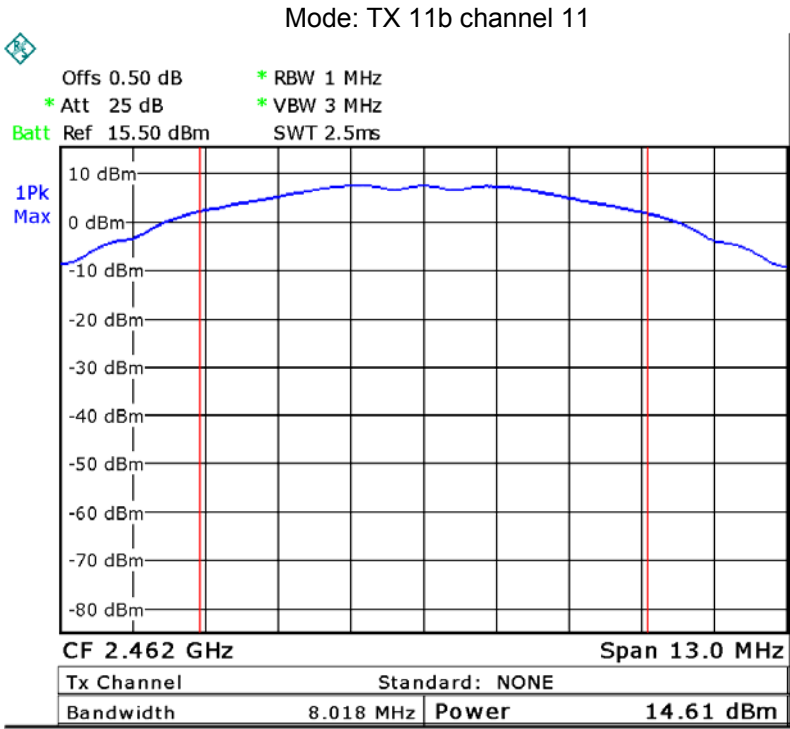
Test mode :TX 11n HT20		
10 Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
14.22	14.38	14.42
Limit: 1W/30dBm		

Test mode : TX 11n HT40		
10 Maximum Peak Output Power (dBm)		
2422MHz	2437MHz	2452MHz
14.02	14.19	15.03
Limit: 1W/30dBm		

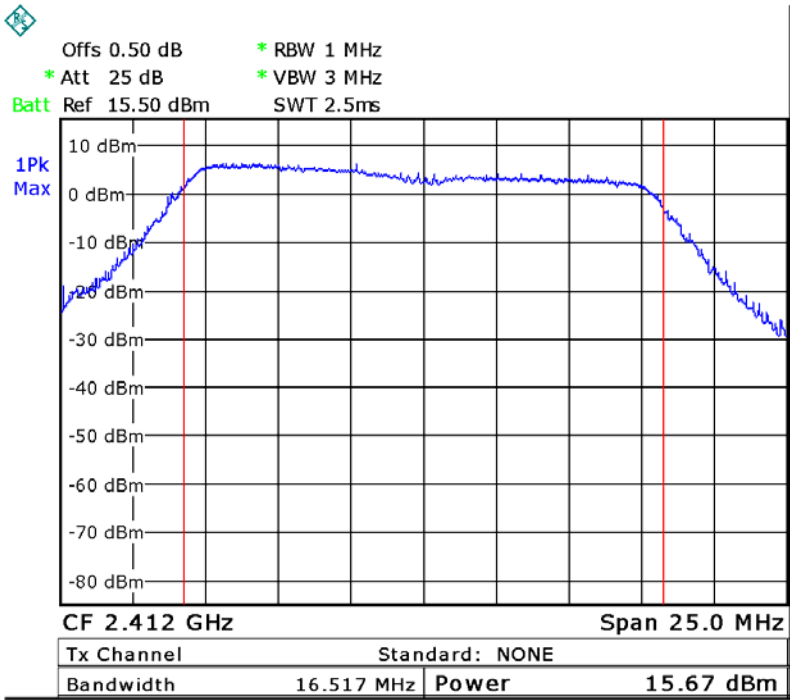


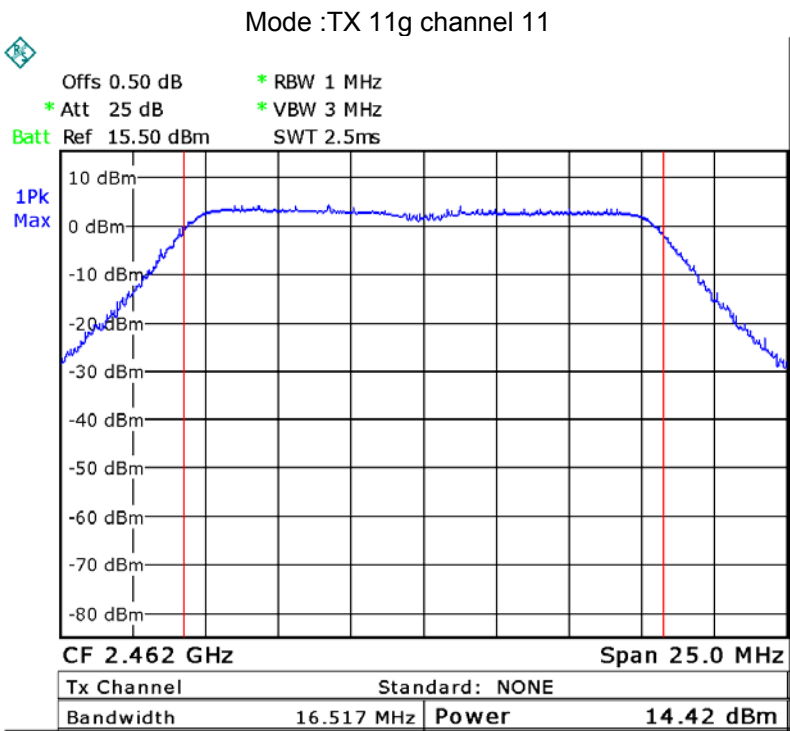
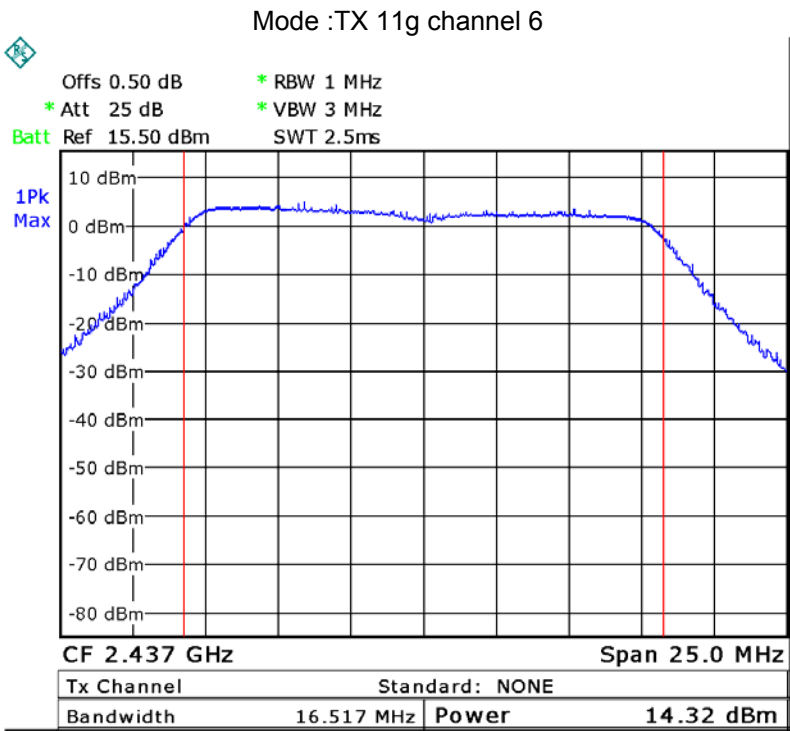
Mode: TX
11b channel 6



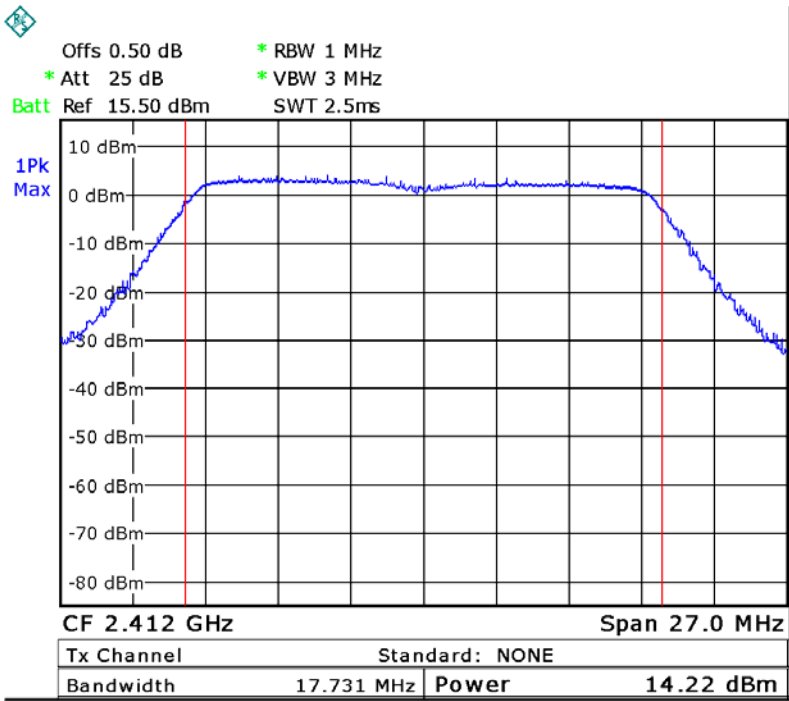


Mode :TX 11g channel 1

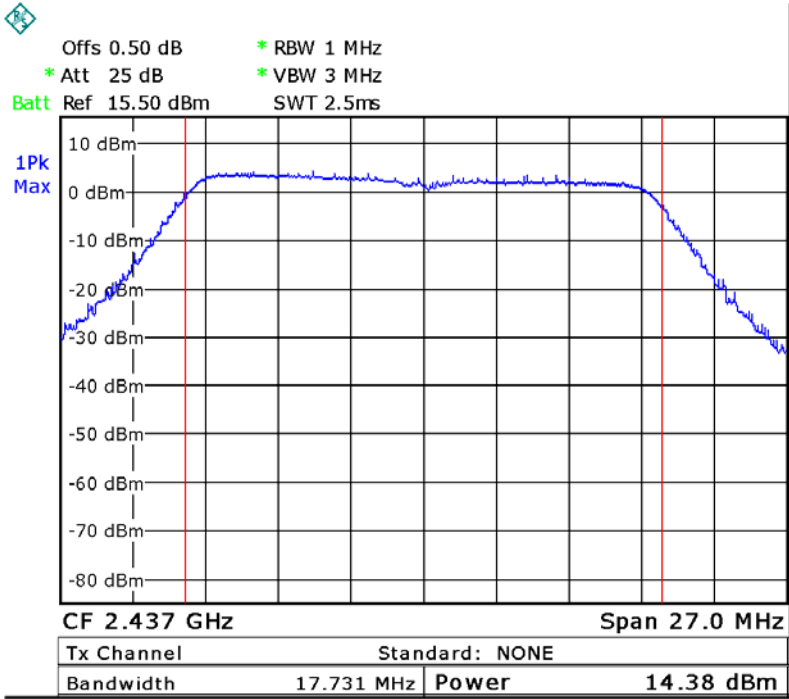


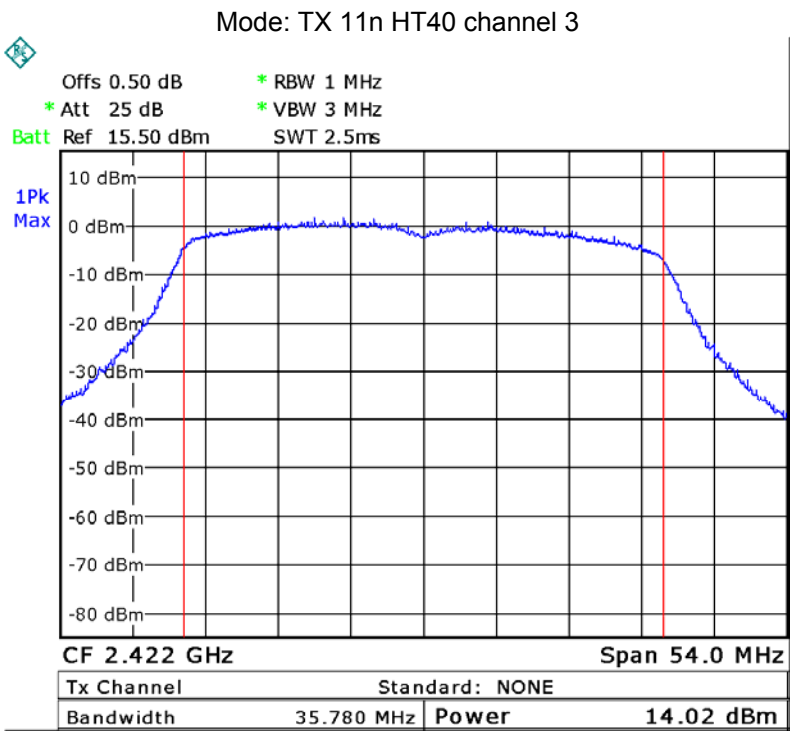
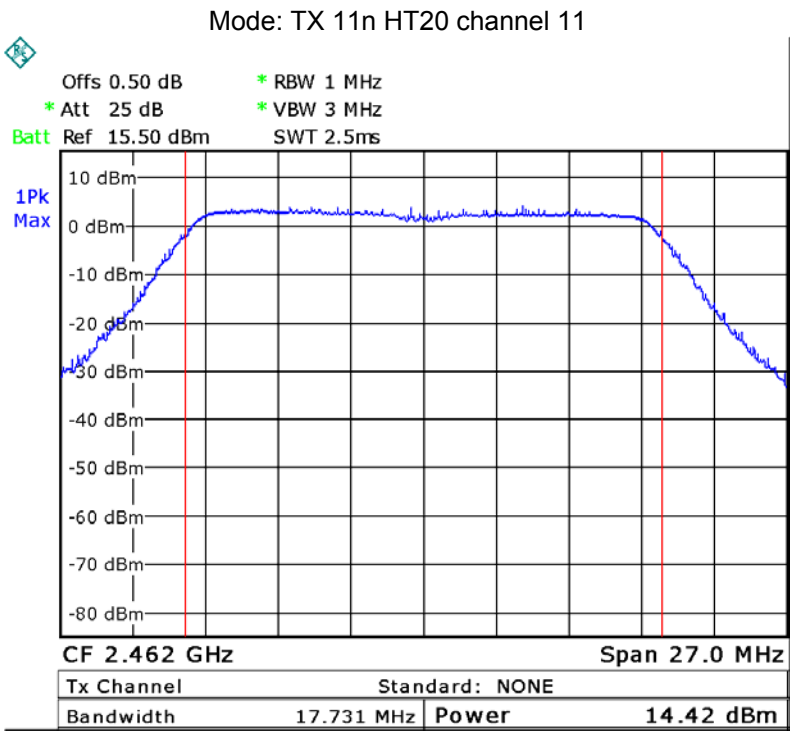


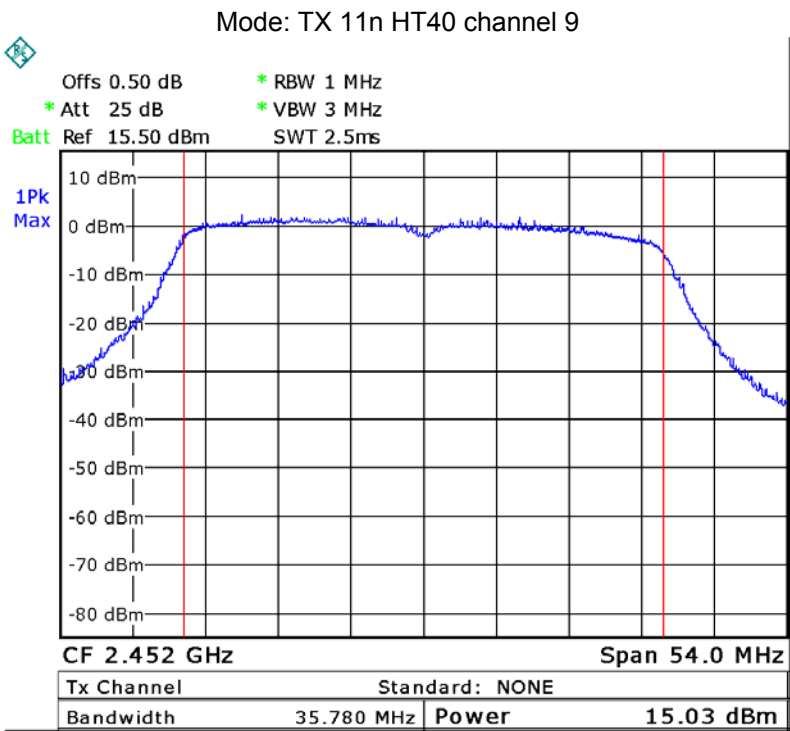
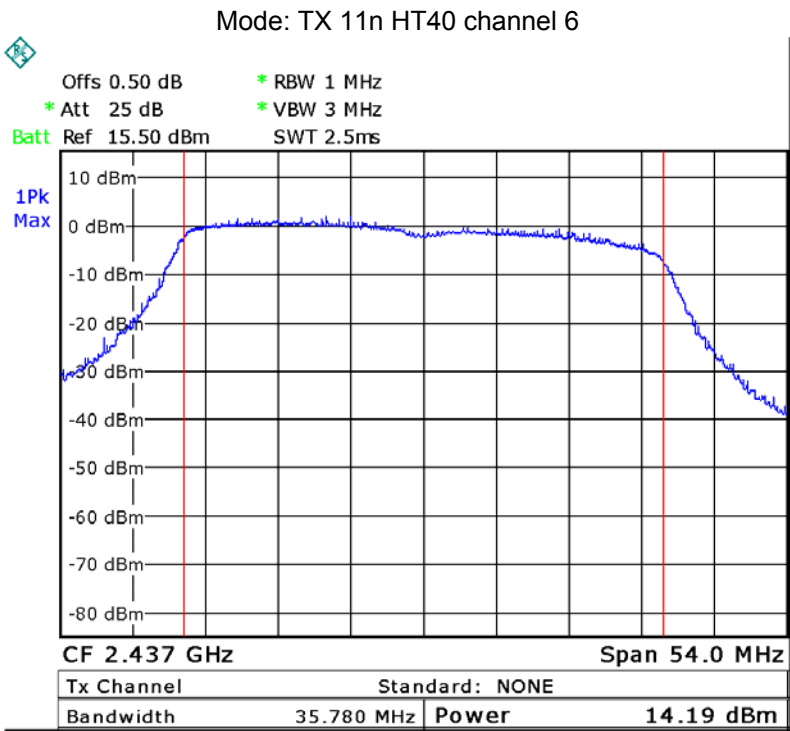
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6







13 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance v03r05

13.1 Test Procedure:

558074 D01 DTS Meas Guidance v03r05 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.

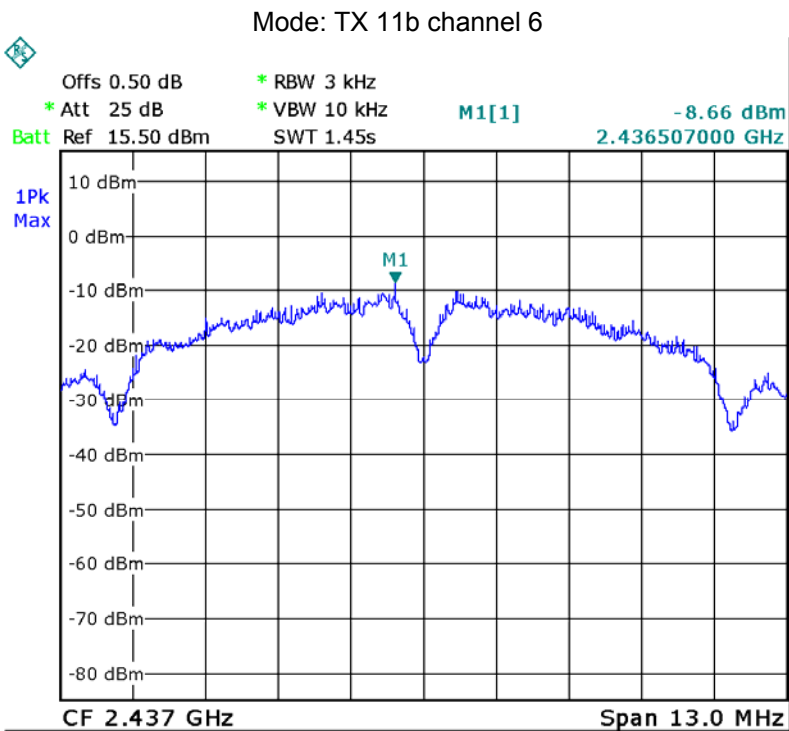
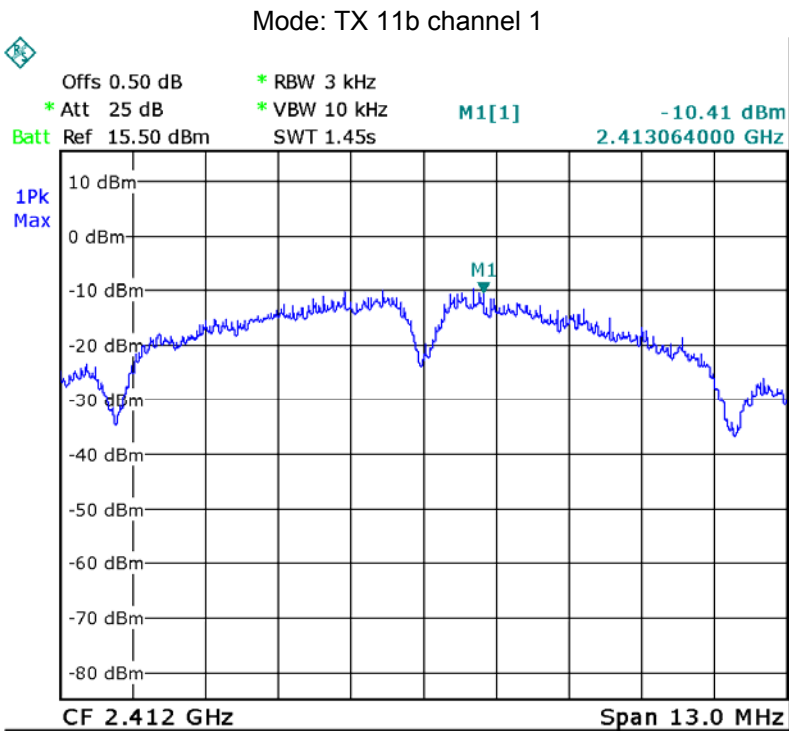
13.2 Test Result:

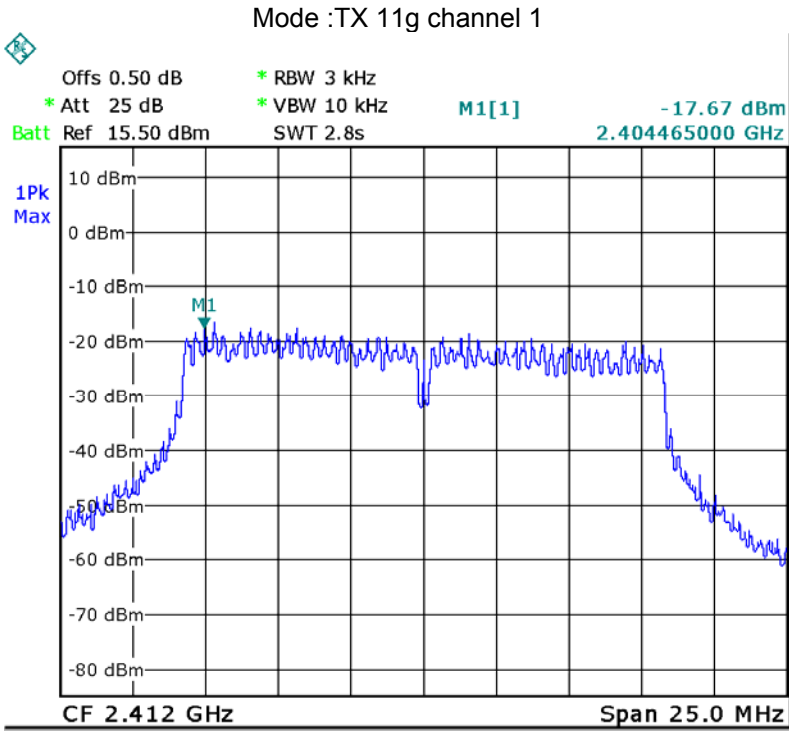
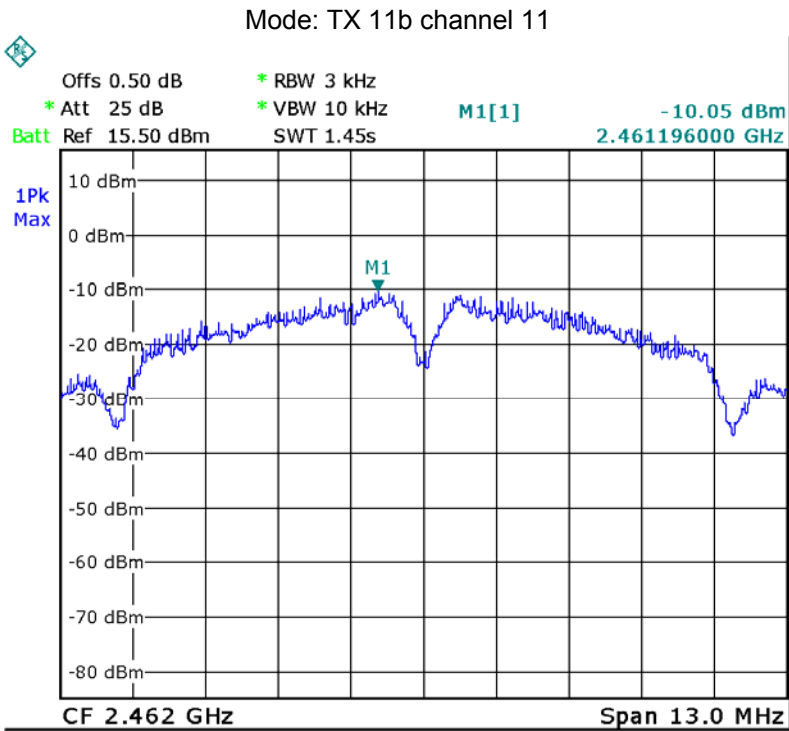
Test mode :TX 11b		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-10.41	-8.66	-10.05
Limit: 8dBm per 3kHz		

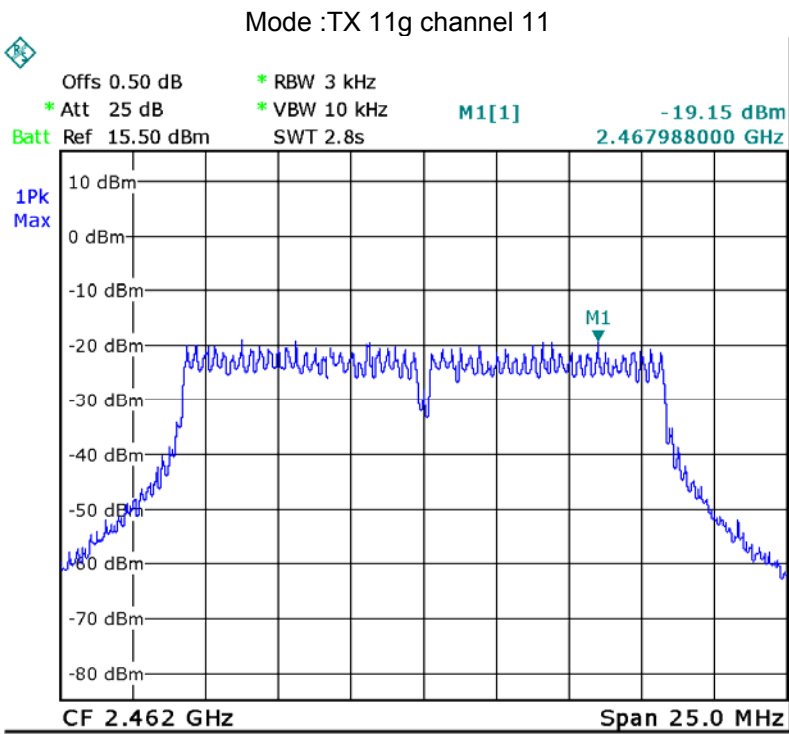
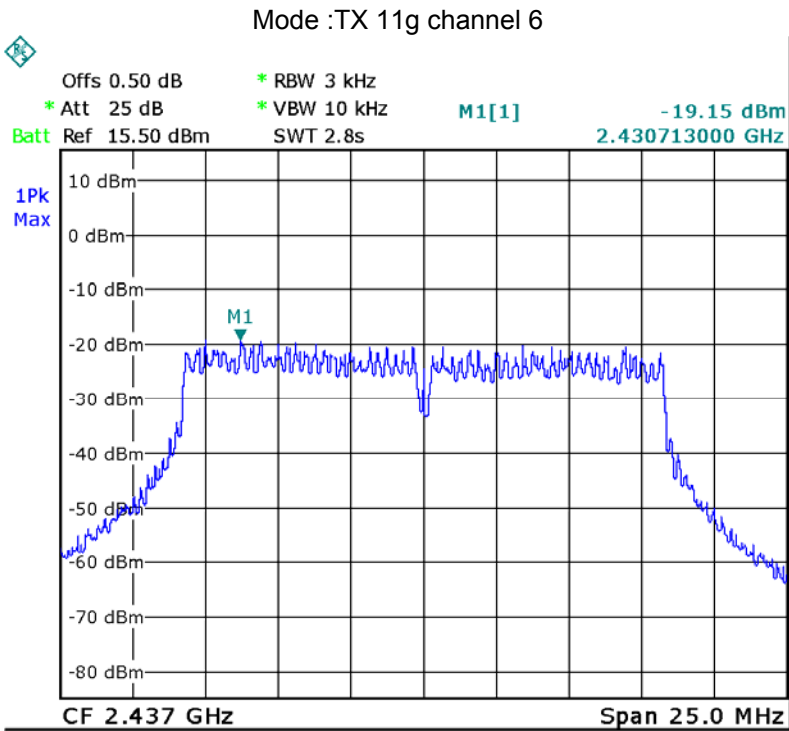
Test mode :TX 11g		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-17.67	-19.15	-19.15
Limit: 8dBm per 3kHz		

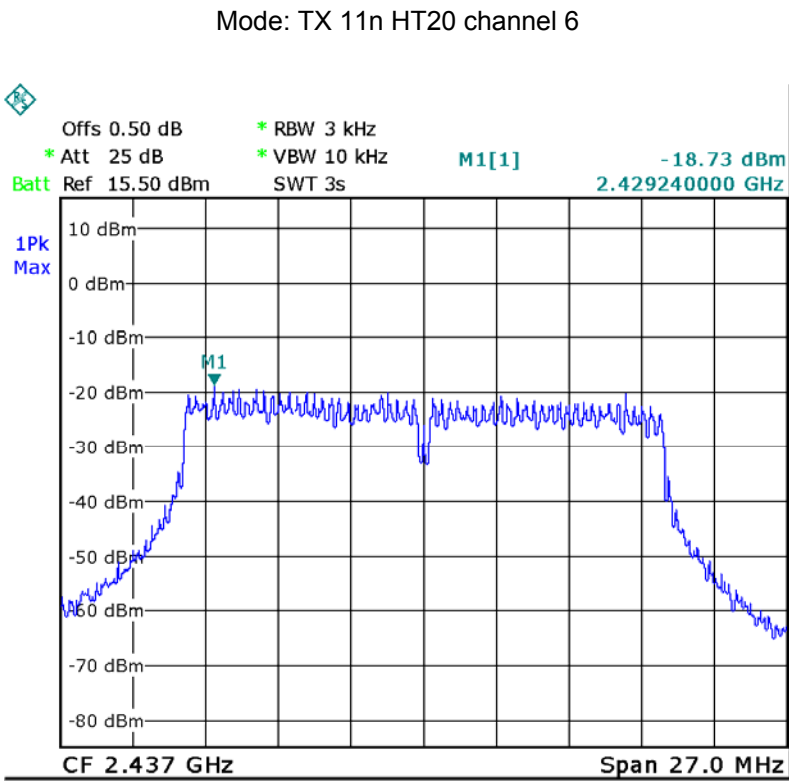
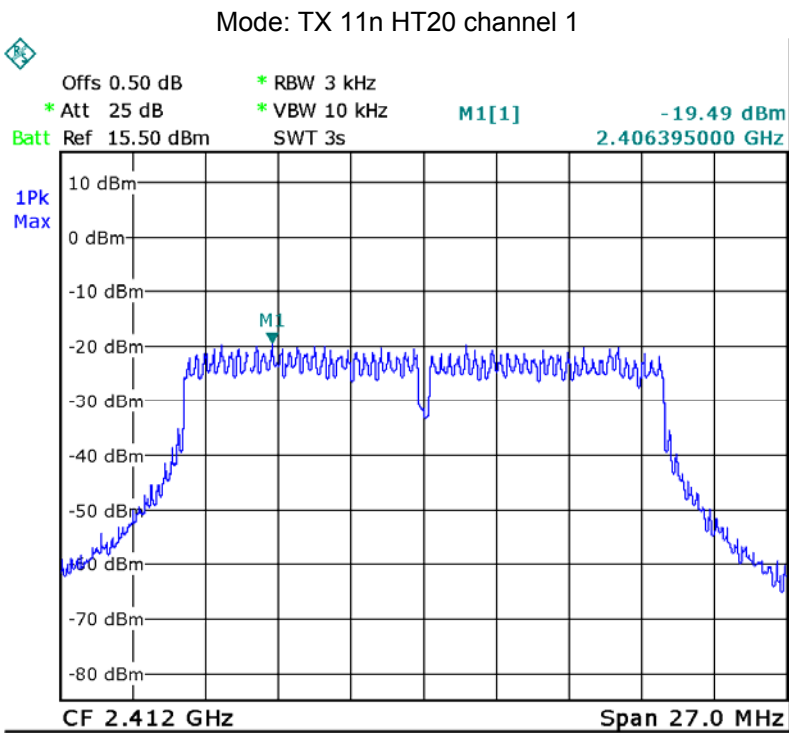
Test mode :TX 11n HT20		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-19.49	-18.73	-19.01
Limit: 8dBm per 3kHz		

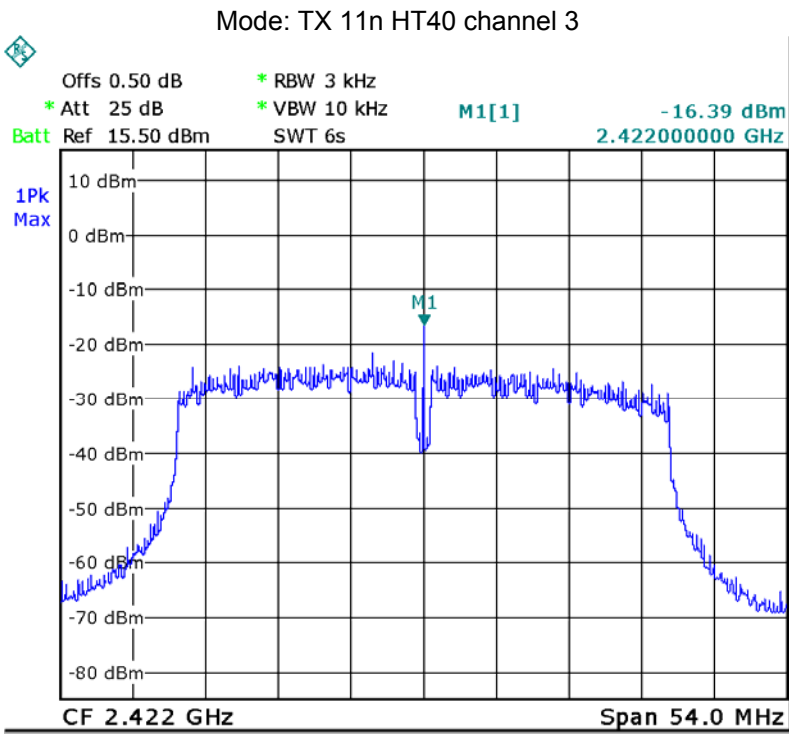
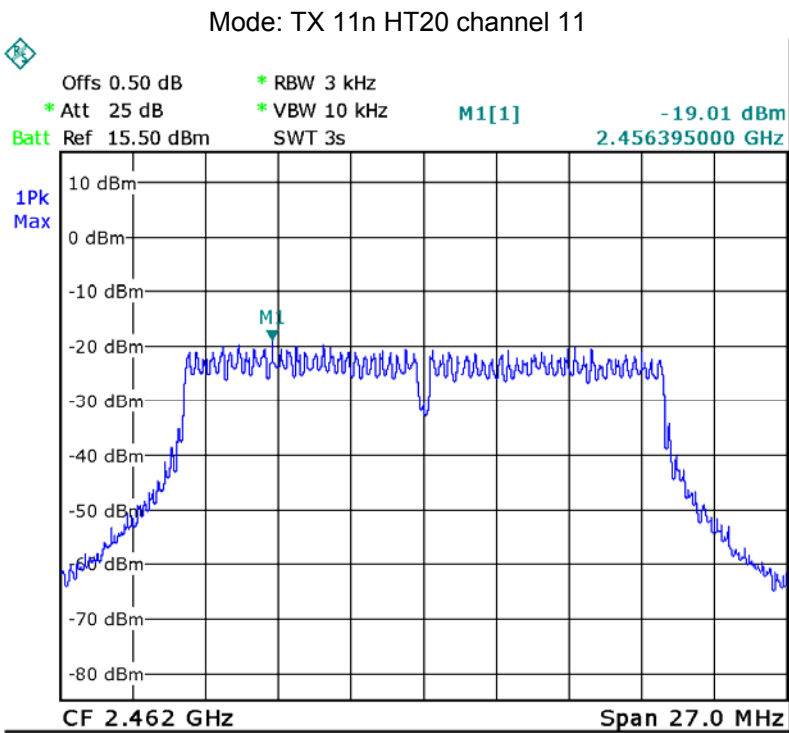
Test mode : TX 11n HT40		
Power Spectral (dBm per 3kHz)		
2422MHz	2437MHz	2452MHz
-16.39	-24.32	-21.98
Limit: 8dBm per 3kHz		

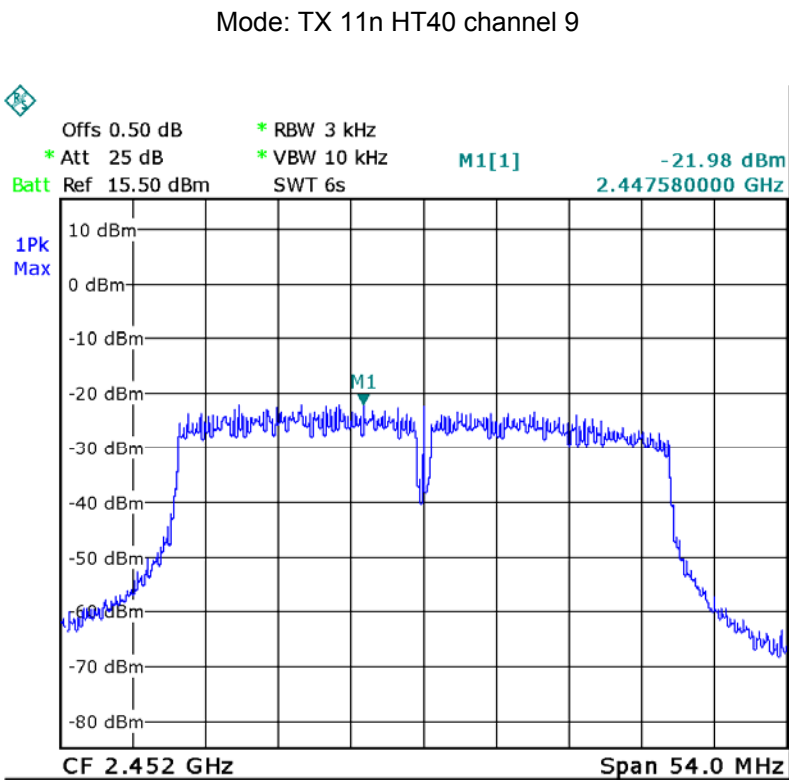
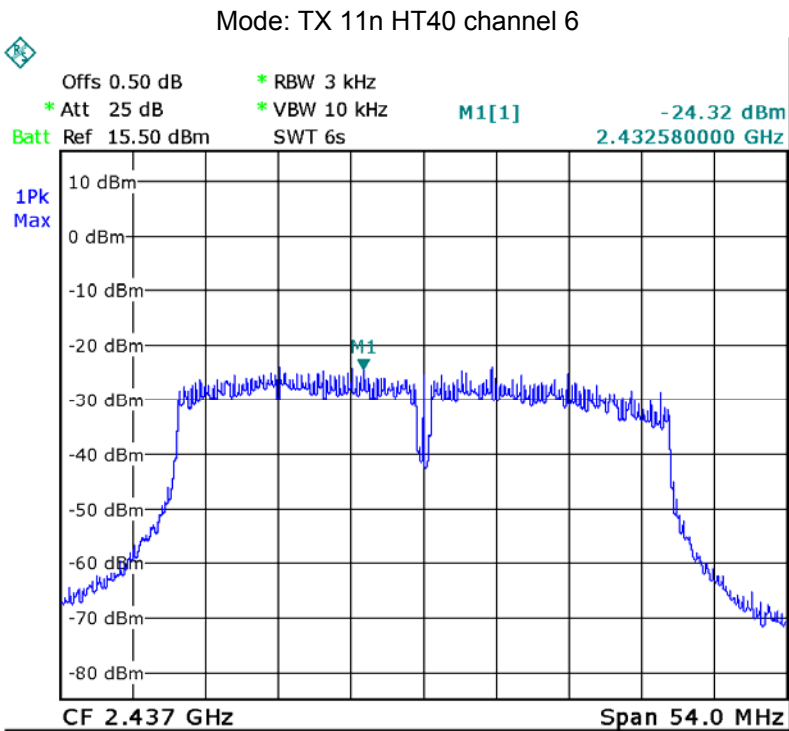












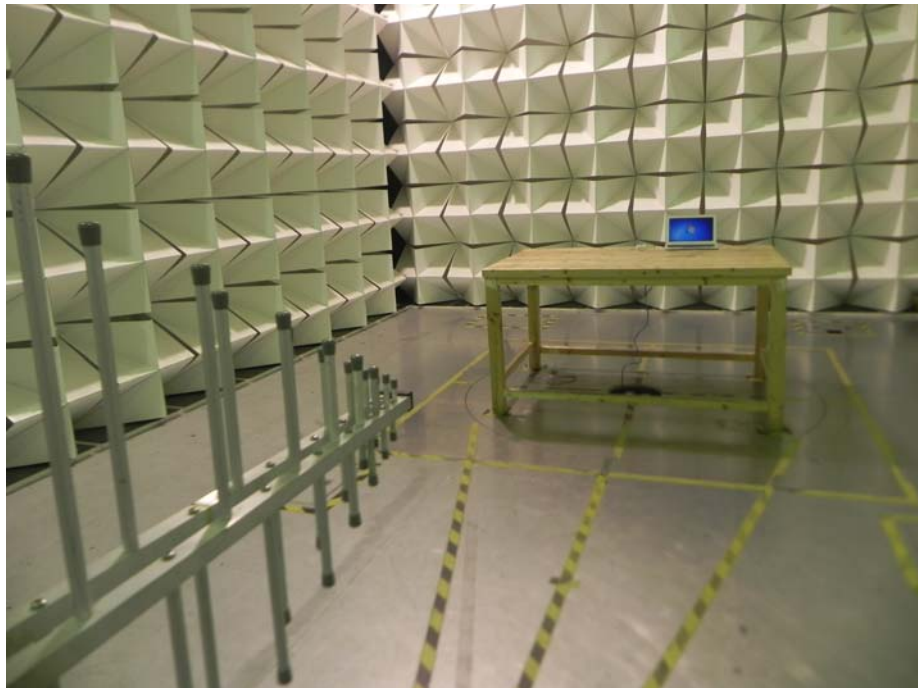
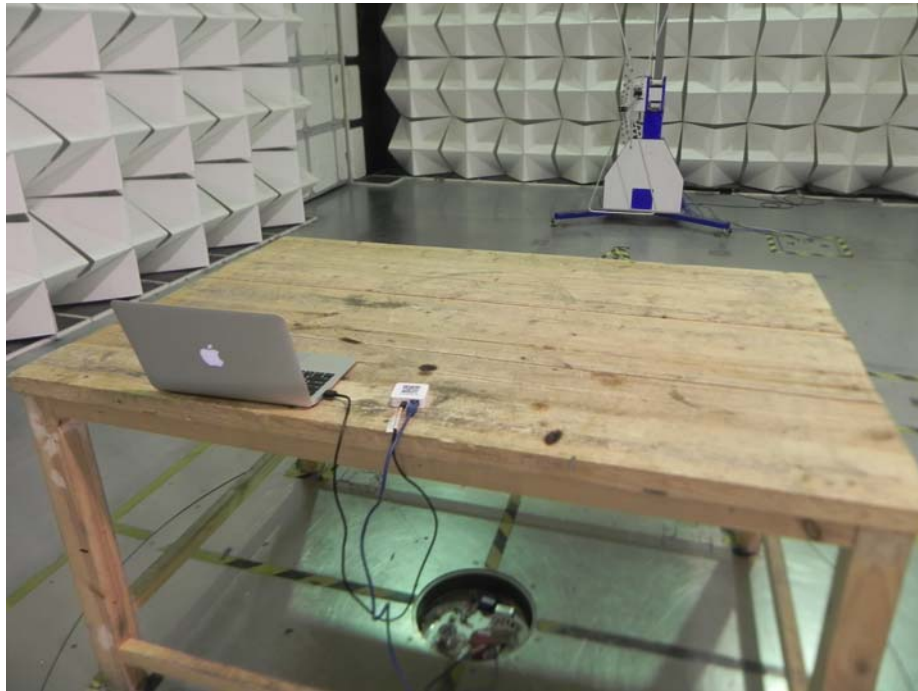
14 Antenna Requirement

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 a Internal integrated integrated Antenna fulfill the requirement of this section.

15 Photographs – Model SH-GWAYL40A Test Setup

2.1 Photograph - Radiated Emissions Test Setup

From 30MHz-1000MHz



Above 1GHz

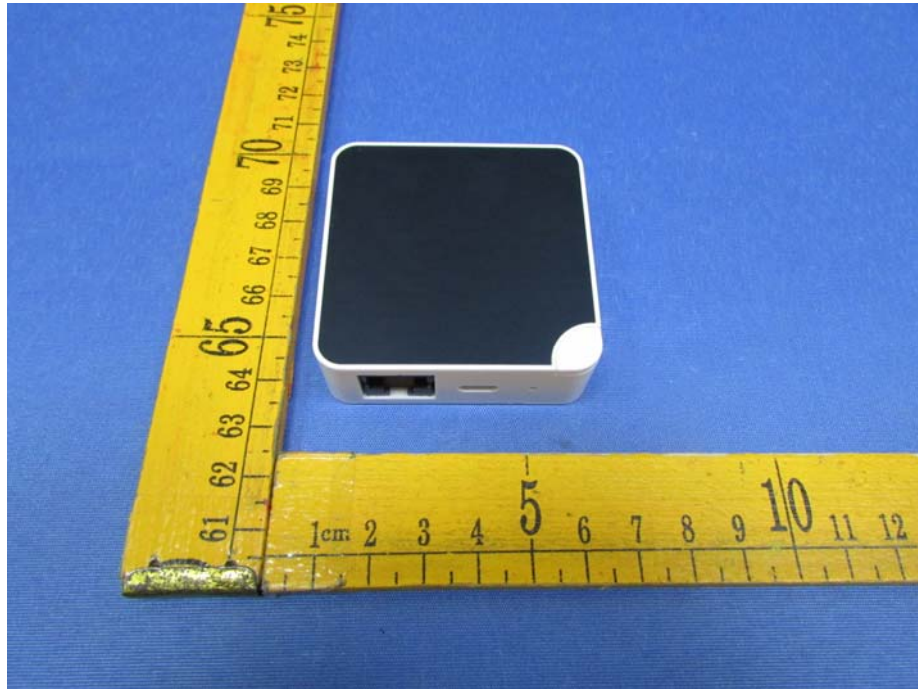


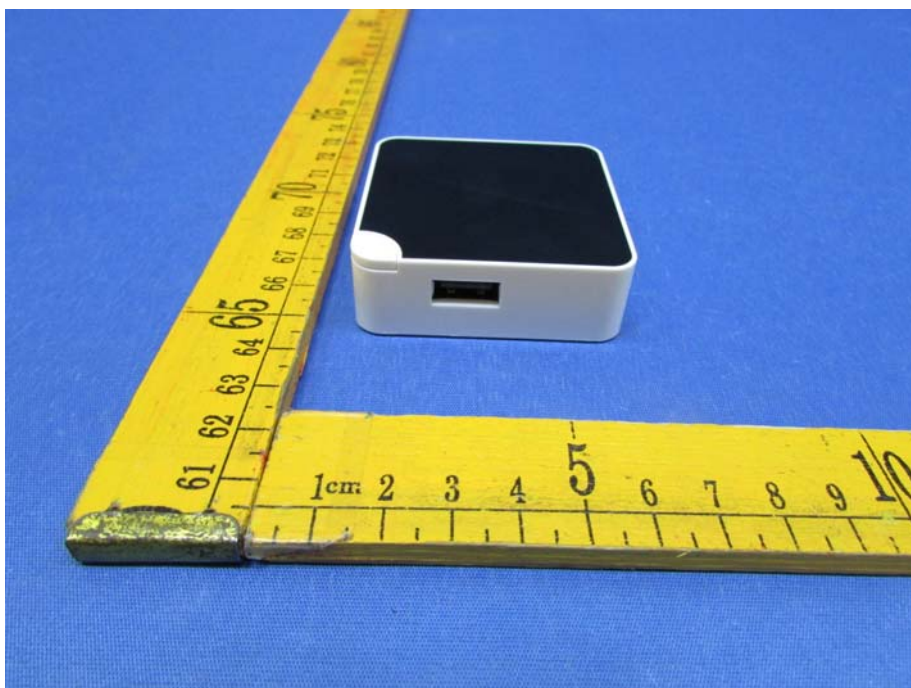
15.1 Conducted Emission at Test Site 1#



16 Photographs - Constructional Details

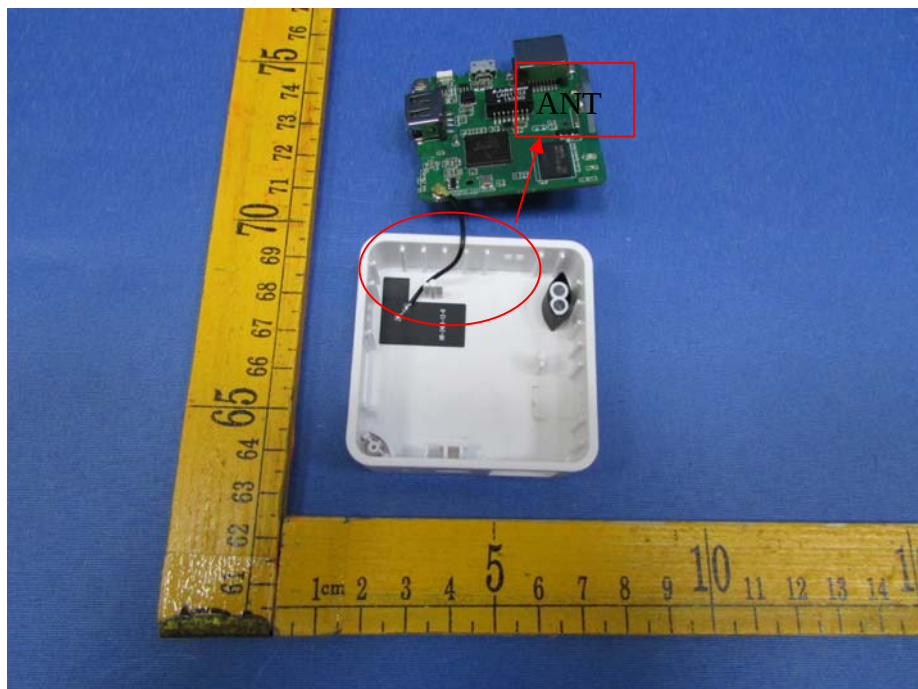
16.1 Model SH-GWAYL40A-External Photos

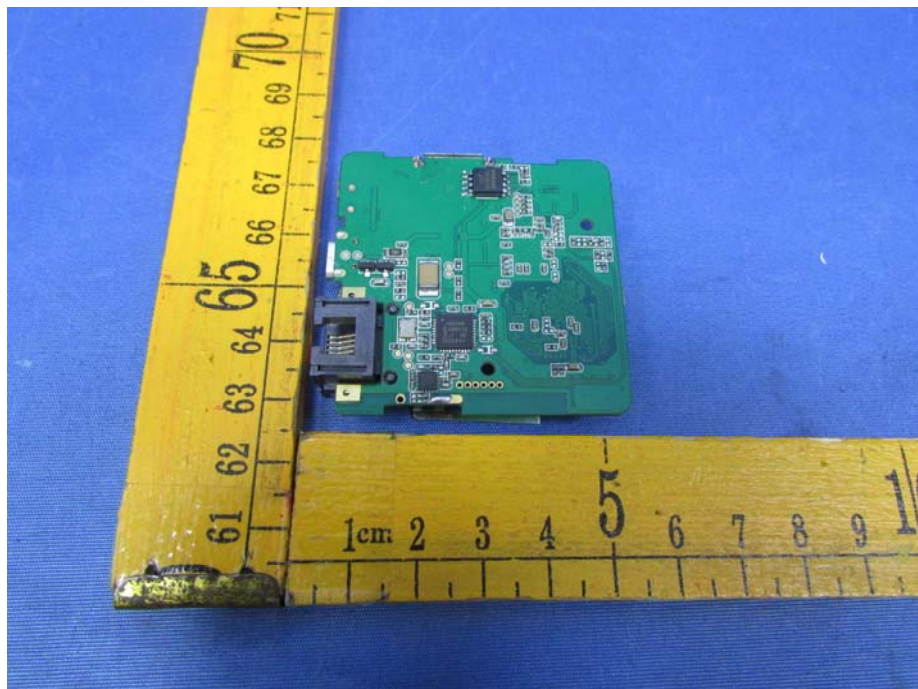






16.2 Model SH-GWAYL40A– Internal Photos





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