

TEST REPORT

Reference No...... : WTS17S0886317-1E V1
FCC ID : 2AOE2RG4100
Applicant..... : Zhejiang Raying IoT Technology Co., Ltd.
Address..... : 10F, North of Bld. No.10, Wellong Park, No.88 Jiangling Road,
Binjiang District, Hangzhou, Zhejiang, China
Manufacturer : The same as above
Address..... : The same as above
Product..... : ZigBee Router
Model(s) : RG4100+
Brand Name..... : REXENSE
Standards..... : FCC CFR47 Part 15.247:2016
Date of Receipt sample : 2017-08-01
Date of Test : 2017-11-17 to 2017-11-25
Date of Issue..... : 2017-12-14
Test Result..... : **Pass**

Remarks:

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

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:

Ford Wang

Ford Wang / Project Engineer

Approved by:



Philo Zhong

Philo Zhong / Manager

2 Laboratories Introduction

Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen (CNAS Registration No. L3110, A2LA Certificate Number: 4243.01) and have branches in Foshan (CNAS Registration No. L6478), Dongguan (CNAS Registration No. L9950), Zhongshan, Suzhou (CNAS Registration No. L7754), Ningbo and Hong Kong, Our test capability covered four large fields: safety test. Electronic Magnetic Compatibility(EMC), reliability and energy performance, Chemical test. 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), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc. 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.

Waltek Services (Shenzhen) Co., Ltd.

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	CNAS (Registration No.: L3110) A2LA (Certificate No.: 4243.01)	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		International Services	WPC
Thailand	NTC		-
Singapore	IDA		-
Note:			
1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.			
2. IC Canada Registration No.: 7760A			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
--------------------------------------	--------------------

Waltek Services (Shenzhen) Co.,Ltd.
<http://www.waltek.com.cn>

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

3 Contents

	Page
1 COVER PAGE.....	1
2 LABORATORIES INTRODUCTION.....	2
3 CONTENTS	4
4 REVISION HISTORY	6
5 GENERAL INFORMATION.....	7
5.1 GENERAL DESCRIPTION OF E.U.T.	7
5.2 DETAILS OF E.U.T.	7
5.3 CHANNEL LIST.....	8
5.4 TEST MODE	9
6 TEST SUMMARY	10
7 EQUIPMENT USED DURING TEST	11
7.1 EQUIPMENTS LIST	11
7.2 DESCRIPTION OF SUPPORT UNITS	12
7.3 MEASUREMENT UNCERTAINTY	12
7.4 TEST EQUIPMENT CALIBRATION	12
8 CONDUCTED EMISSION	13
8.1 E.U.T. OPERATION	13
8.2 EUT SETUP.....	13
8.3 MEASUREMENT DESCRIPTION	13
8.4 CONDUCTED EMISSION TEST RESULT	14
9 RADIATED EMISSIONS.....	17
9.1 EUT OPERATION.....	17
9.2 TEST SETUP	18
9.3 SPECTRUM ANALYZER SETUP	19
9.4 TEST PROCEDURE	20
9.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	20
9.6 SUMMARY OF TEST RESULTS	21
10 CONDUCTED SPURIOUS EMISSIONS.....	24
10.1 TEST PROCEDURE.....	24
10.2 TEST RESULT	25
11 BAND EDGE MEASUREMENT	37
11.1 TEST PRODUCE	37
11.2 TEST RESULT	38
12 6 DB BANDWIDTH MEASUREMENT	50
12.1 TEST PROCEDURE:.....	50
12.2 TEST RESULT:	50
13 MAXIMUM PEAK OUTPUT POWER	57
13.1 TEST PROCEDURE:.....	57
13.2 TEST RESULT:	58
14 POWER SPECTRAL DENSITY	65
14.1 TEST PROCEDURE:.....	65
14.2 TEST RESULT:	65
15 ANTENNA REQUIREMENT	72
16 PHOTOGRAPHS OF TEST SETUP	73
16.1 RADIATED EMISSIONS TEST SETUP - MODEL RG4100+.....	73

16.2 CONDUCTED EMISSION - MODEL RG4100+ 74

17 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS 75

17.1 EXTERNAL PHOTOS - MODEL RG4100+ 75

17.2 INTERNAL PHOTOS - MODEL: RG4100+ 80

4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S08863 17-1E	2017-08-01	2017-11-17 to 2017-11-25	2017-11-28	original	-	Replaced
WTS17S08863 17-1E V1	2017-08-01	2017-11-17 to 2017-11-25	2017-12-14	Version 1	Updated	Valid

5 General Information

5.1 General Description of E.U.T.

Product Name:	ZigBee Router
Model No.:	RG4100+
Model Difference:	NA
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz, 802.11n HT40: 2422MHz~2452MHz
The Lowest Oscillator:	25MHz
Antenna Gain:	-1dBi 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
-----------------	-------------

5.3 Channel List

WIFI

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

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
	802.11n HT40	MCS0	3/6/9	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
	802.11n HT40	MCS0	3/6/9	TX
Frequency Range	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
	802.11n HT40	MCS0	3/6/9	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
	802.11n HT40	MCS0	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 .

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

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	2017-09-12	2018-09-11
2.	LISN	R&S	ENV216	101215	2017-09-12	2018-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2017-09-12	2018-09-11
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	2017-09-12	2018-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2017-09-12	2018-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2017-09-12	2018-09-11
4.	Cable	LARGE	RF300	-	2017-09-12	2018-09-11
5	ISN	SCHWARZBECK	CAT5 8158	CAT5-8158-0051	2017-04-07	2018-04-06
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	2017-04-29	2018-04-28
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2017-04-09	2018-04-08
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2017-04-09	2018-04-08
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2017-09-12	2018-09-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2017-04-09	2018-04-08
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2017-04-09	2018-04-08
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2017-04-13	2018-04-12
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2017-04-13	2018-04-12
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	2017-04-13	2018-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2017-04-09	2018-04-08
3	Amplifier	Compliance pirection	PAP-0203	22024	2017-04-13	2018-04-12

		systems inc				
4	Cable	HUBER+SUHNER	CBL2	525178	2017-04-13	2018-04-12
5	Broad-band Horn Antenna(18-40G)	SCHWARZBECK	BBHA 9170	335	2017-10-25	2018-10-24
6	Amplifier	COM-MV	ZLNA-18-40G-021	1608001	2017-10-25	2018-10-24
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	2017-09-12	2018-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2017-09-12	2018-09-11
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-09-12	2018-09-11

7.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
Notebook	Acer	A1465	C17KTQDNF5N7

7.3 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)

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 (dBμV)	
	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

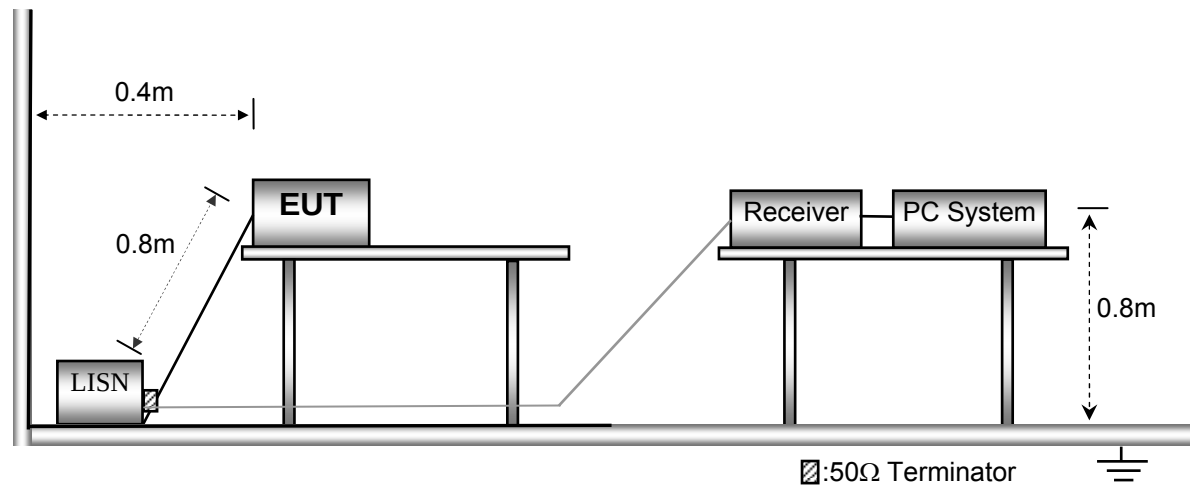
8.1 E.U.T. Operation

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

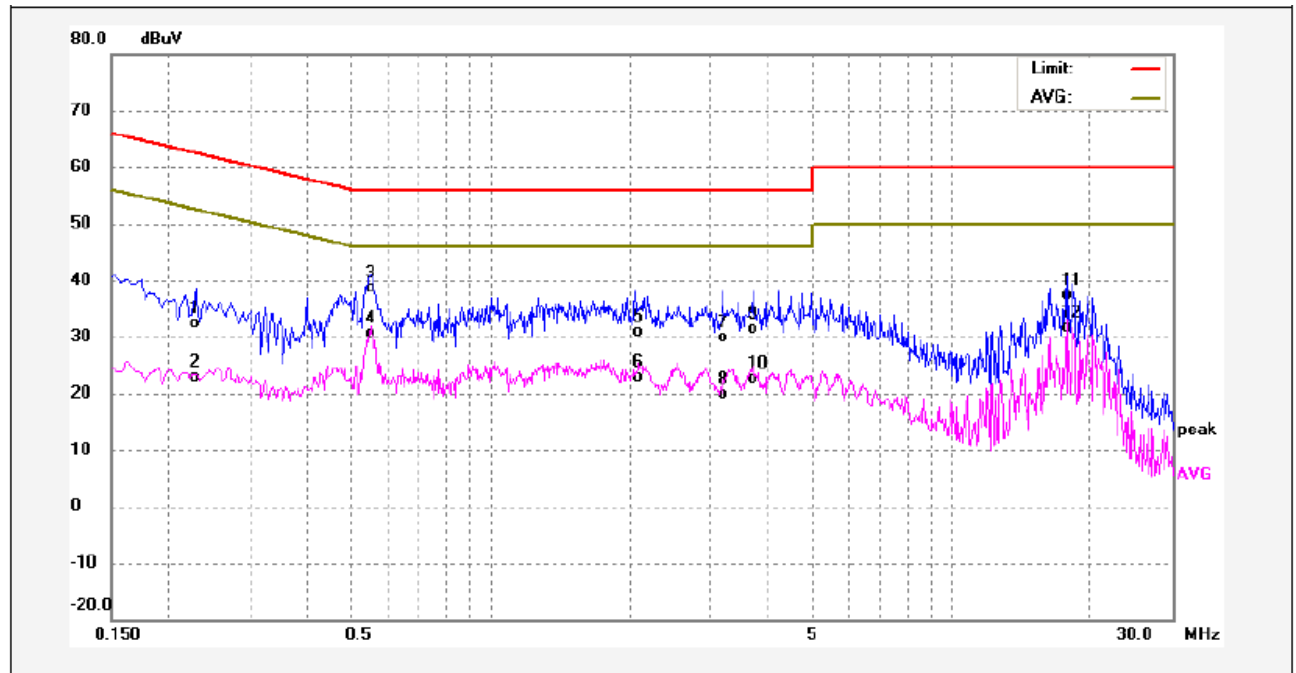
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

8.4 Conducted Emission Test Result

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

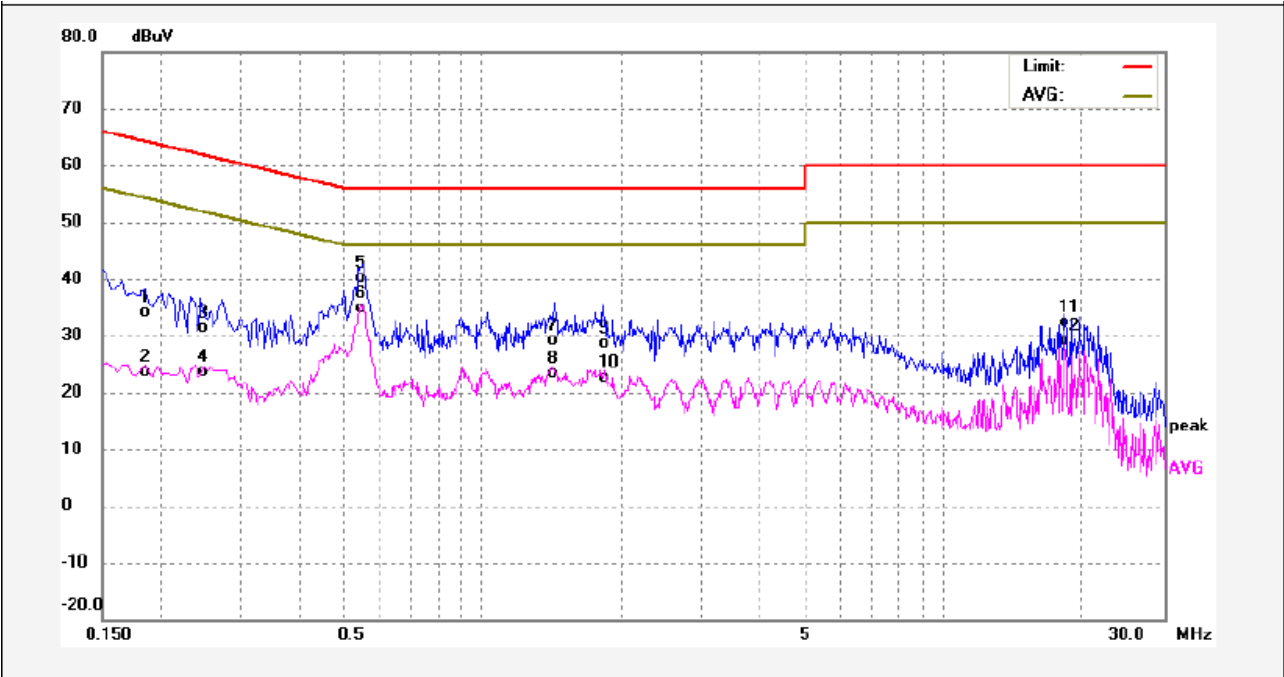
Worst Mode: WIFI mode (802.11b mode low channel)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2300	22.51	9.97	32.48	62.45	-29.97	QP	
2	0.2300	12.85	9.97	22.82	52.45	-29.63	AVG	
3	0.5500	28.68	10.07	38.75	56.00	-17.25	QP	
4	0.5500	20.60	10.07	30.67	46.00	-15.33	AVG	
5	2.0579	20.65	10.20	30.85	56.00	-25.15	QP	
6	2.0579	12.59	10.20	22.79	46.00	-23.21	AVG	
7	3.1820	19.56	10.25	29.81	56.00	-26.19	QP	
8	3.1820	9.73	10.25	19.98	46.00	-26.02	AVG	
9	3.6980	21.12	10.26	31.38	56.00	-24.62	QP	
10	3.6980	12.33	10.26	22.59	46.00	-23.41	AVG	
11	17.6940	26.97	10.43	37.40	60.00	-22.60	QP	
12	17.6940	21.23	10.43	31.66	50.00	-18.34	AVG	

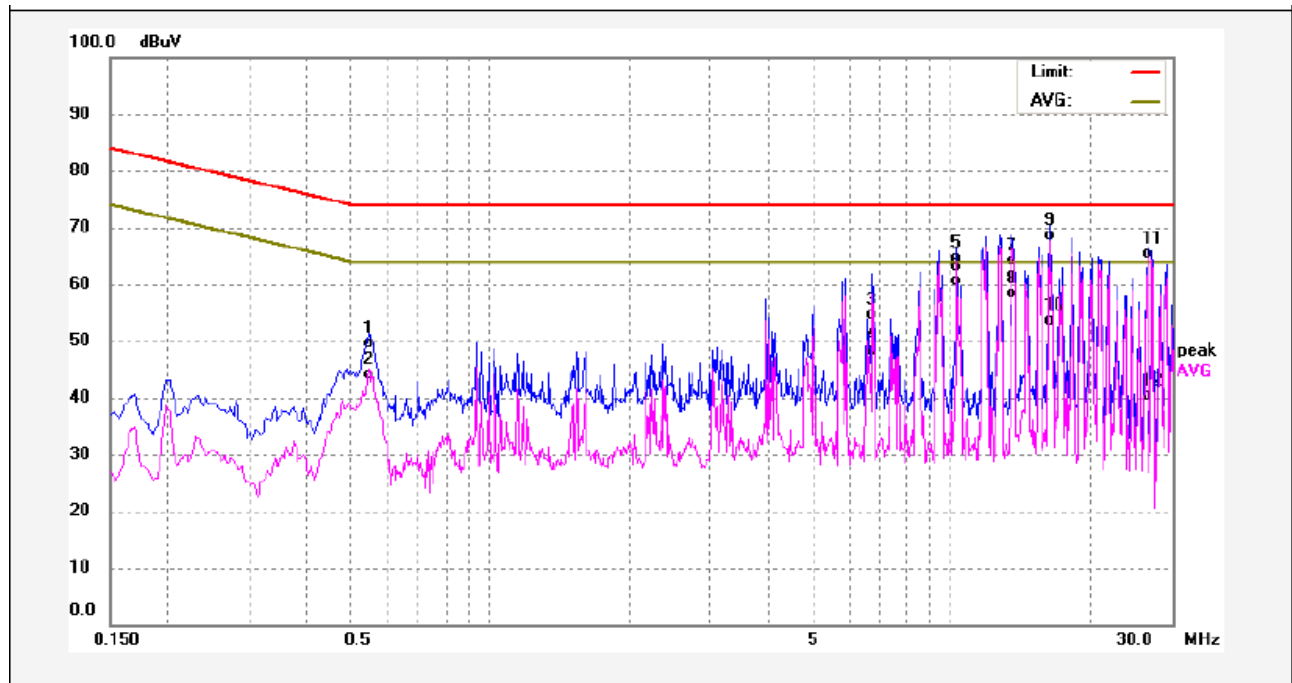
Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1860	24.29	9.89	34.18	64.21	-30.03	QP	
2	0.1860	13.62	9.89	23.51	54.21	-30.70	AVG	
3	0.2460	21.49	10.00	31.49	61.89	-30.40	QP	
4	0.2460	13.62	10.00	23.62	51.89	-28.27	AVG	
5	0.5500	29.96	10.07	40.03	56.00	-15.97	QP	
6	0.5500	24.85	10.07	34.92	46.00	-11.08	AVG	
7	1.4340	18.84	10.21	29.05	56.00	-26.95	QP	
8	1.4340	13.12	10.21	23.33	46.00	-22.67	AVG	
9	1.8220	18.33	10.18	28.51	56.00	-27.49	QP	
10	1.8220	12.52	10.18	22.70	46.00	-23.30	AVG	
11	18.2420	22.02	10.44	32.46	60.00	-27.54	QP	
12	18.2420	18.75	10.44	29.19	50.00	-20.81	AVG	

ISN

Remark: The test is completed for 10Mbps/100Mbps transmitting, the worst case for 100Mbps transmitting was shown follow:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.5460	39.73	10.00	49.73	74.00	-24.27	QP	
2	0.5460	34.21	10.00	44.21	64.00	-19.79	AVG	
3	6.7020	44.85	9.70	54.55	74.00	-19.45	QP	
4	6.7020	38.73	9.70	48.43	64.00	-15.57	AVG	
5	10.2420	54.91	9.70	64.61	74.00	-9.39	QP	
6	10.2420	50.88	9.70	60.58	64.00	-3.42	AVG	
7	13.4820	54.43	9.70	64.13	74.00	-9.87	QP	
8	13.4820	48.79	9.70	58.49	64.00	-5.51	AVG	
9	16.2300	58.83	9.72	68.55	74.00	-5.45	QP	
10	16.2300	43.82	9.72	53.54	64.00	-10.46	AVG	
11	26.4860	55.55	9.90	65.45	74.00	-8.55	QP	
12	26.4860	30.43	9.90	40.33	64.00	-23.67	AVG	

9 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(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

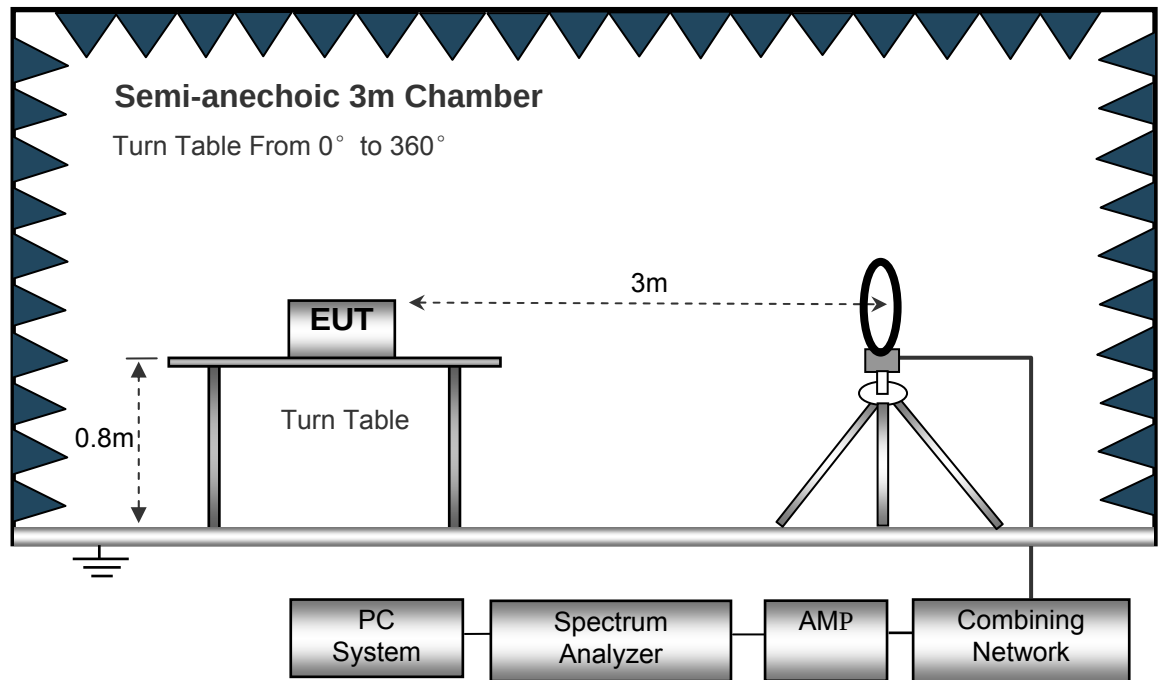
EUT Operation :

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

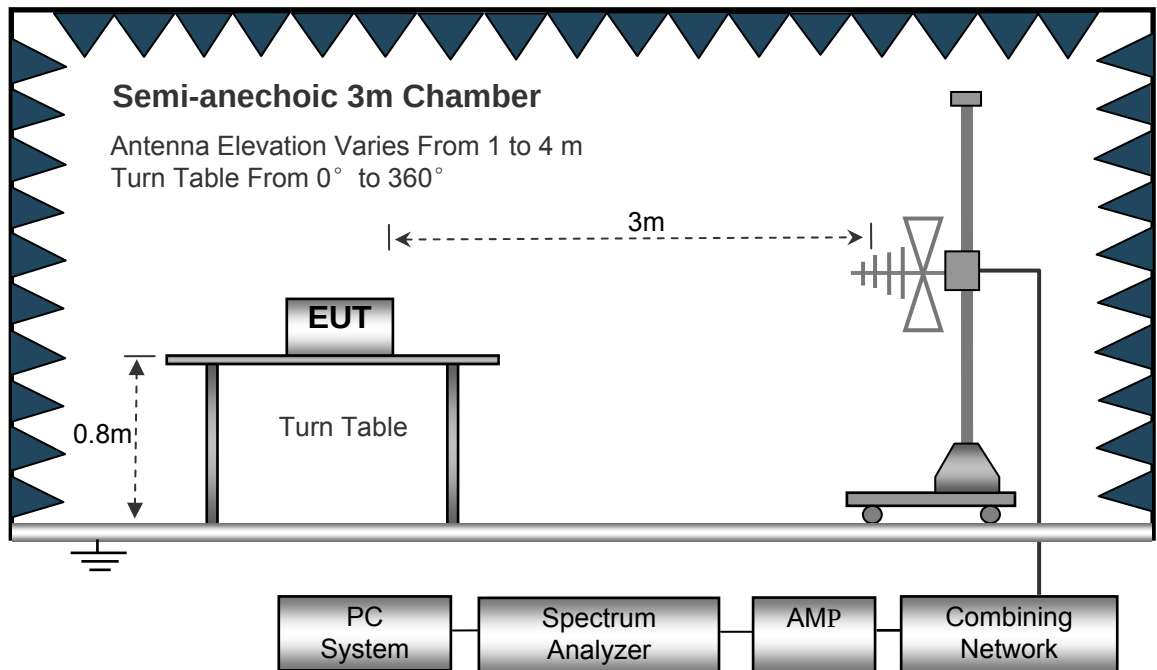
9.2 Test Setup

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

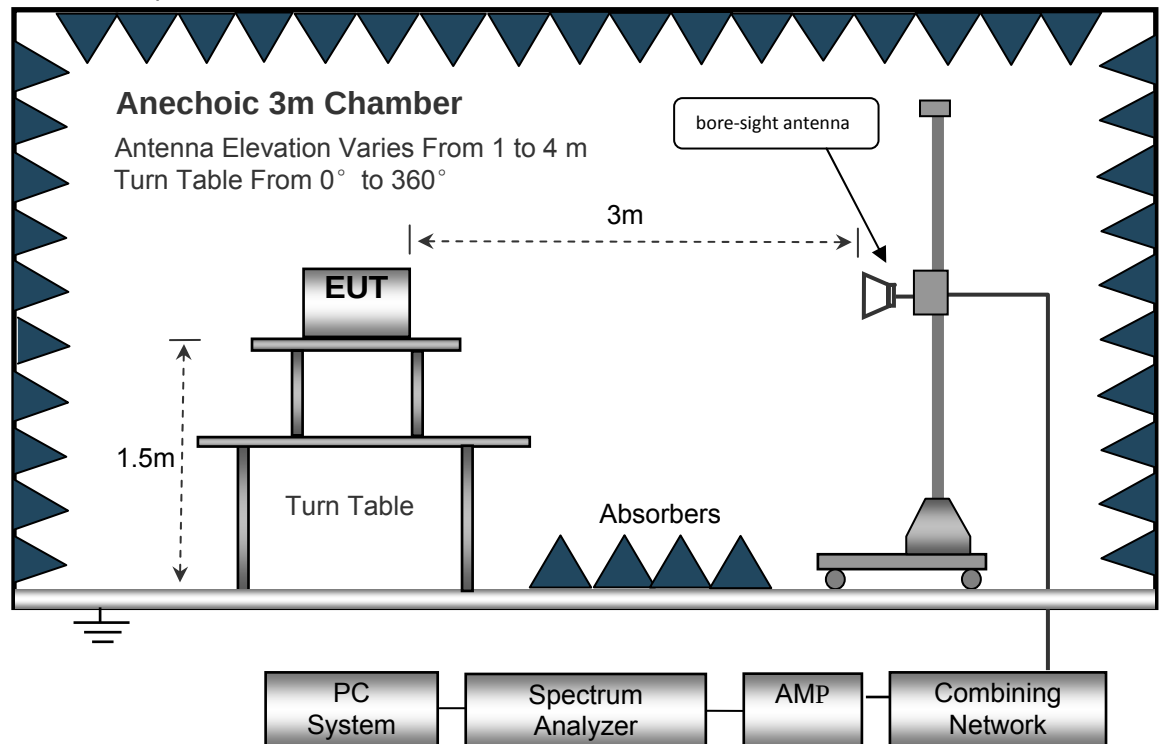
The test setup for emission measurement below 30MHz.



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
 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

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:

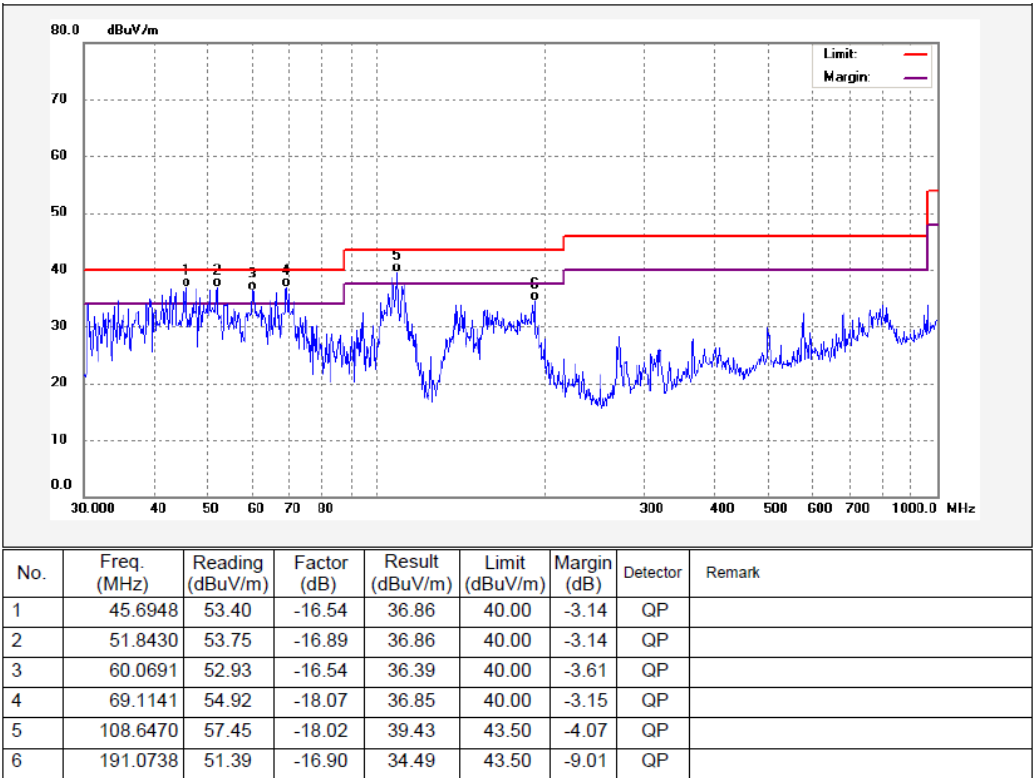
Test Frequency: 9KHz~30MHz

Remark: only the worst data (Low channel) were reported.

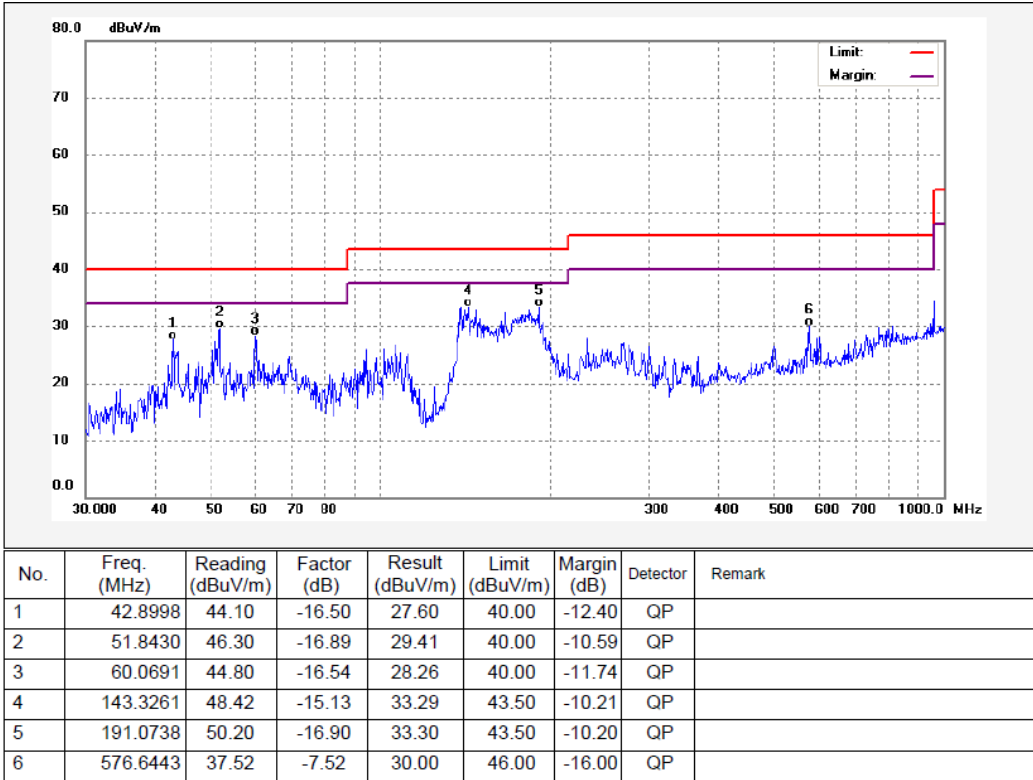
Frequency	Measurement results dBμV @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dBμV/m @30m	Limits dBμV/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
802.11b							
6.032	25.01	QP	21.84	40.00	6.85	29.54	-22.69
8.051	24.56	QP	21.02	40.00	5.58	29.54	-23.96
26.215	24.35	QP	20.55	40.00	4.90	29.54	-24.64
802.11g							
6.032	24.53	QP	21.84	40.00	6.37	29.54	-23.17
8.051	24.71	QP	21.02	40.00	5.73	29.54	-23.81
26.215	25.06	QP	20.55	40.00	5.61	29.54	-23.93
802.11n(HT20)							
6.032	25.17	QP	21.84	40.00	7.01	29.54	-22.53
8.051	25.03	QP	21.02	40.00	6.05	29.54	-23.49
26.215	24.42	QP	20.55	40.00	4.97	29.54	-24.57
802.11n(HT40)							
6.032	25.11	QP	21.84	40.00	6.95	29.54	-22.59
8.051	25.23	QP	21.02	40.00	6.25	29.54	-23.29
26.215	24.57	QP	20.55	40.00	5.12	29.54	-24.42

Test Frequency : 30MHz ~ 1GHz Remark: only the worst data (802.11n HT40 mode Low CH) were reported

Low Channel – Horizontal

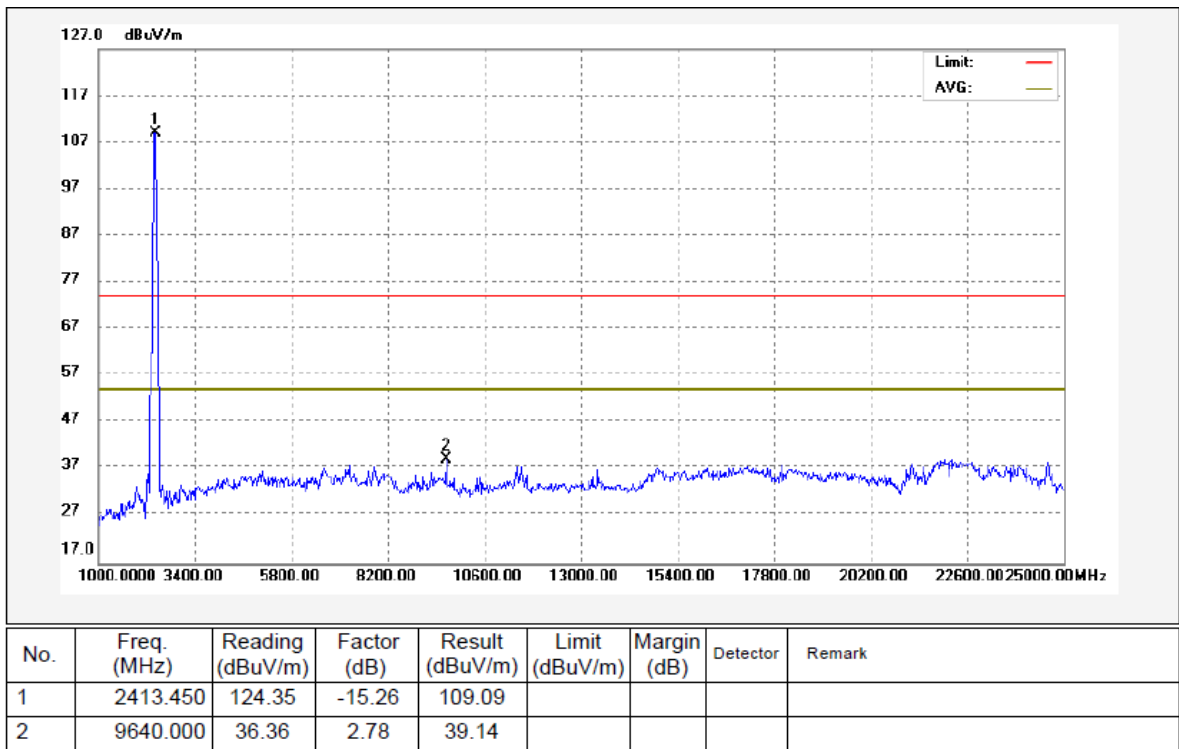


Low Channel – Vertical

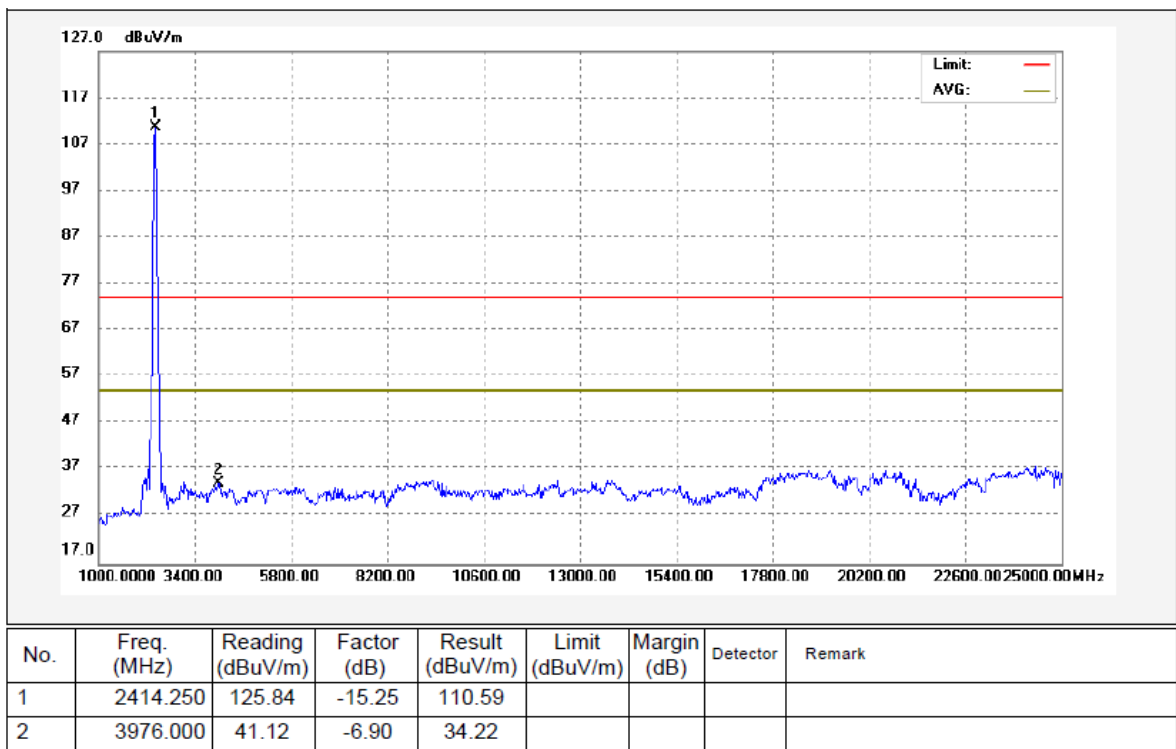


Test Frequency : Above 1GHz Remark: only the worst data (802.11b mode Low CH) were reported

Low Channel – Horizontal



Low Channel – Vertical



10 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017
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:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

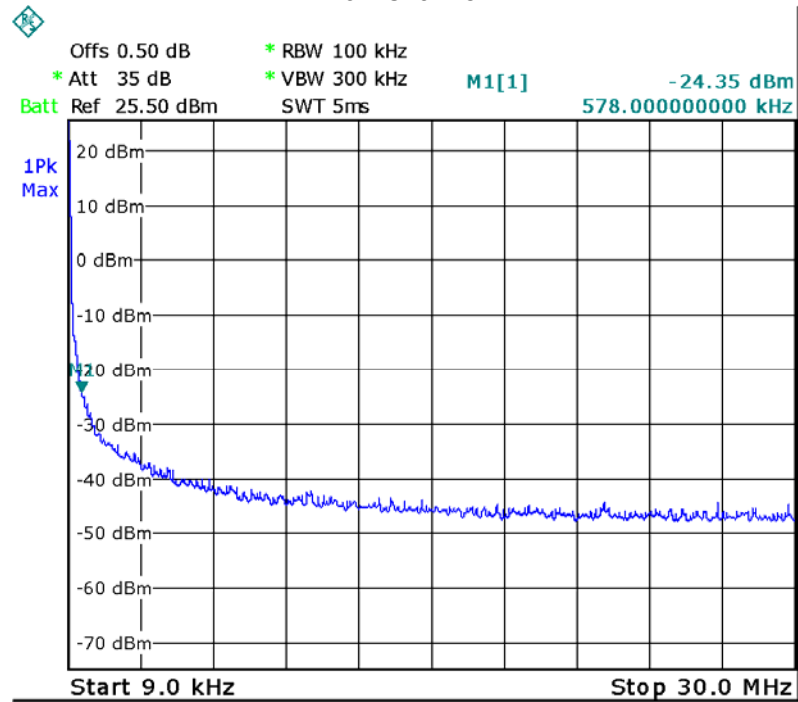
Detector function = peak, Trace = max hold

10.2 Test Result

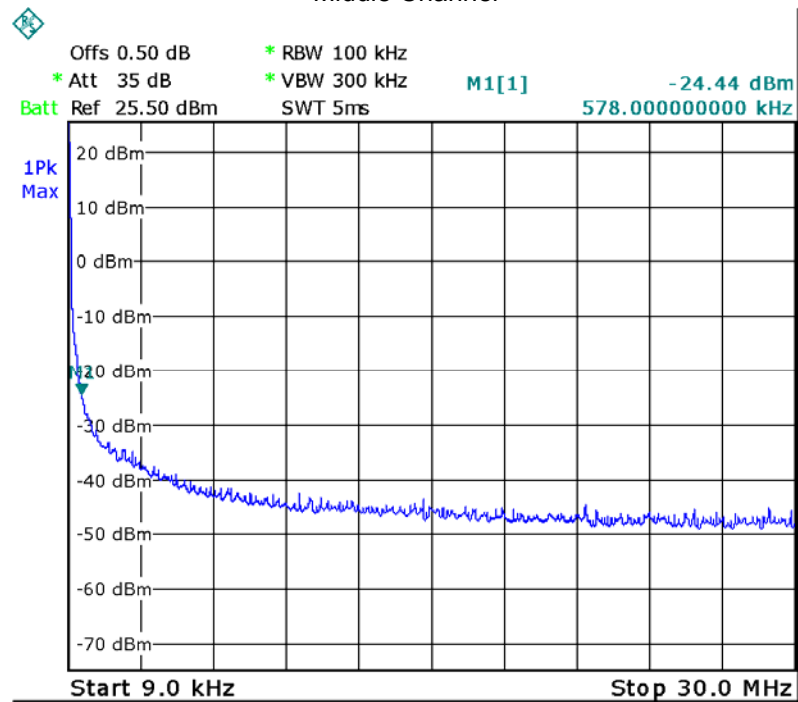
9KHz – 30MHz

802.11b

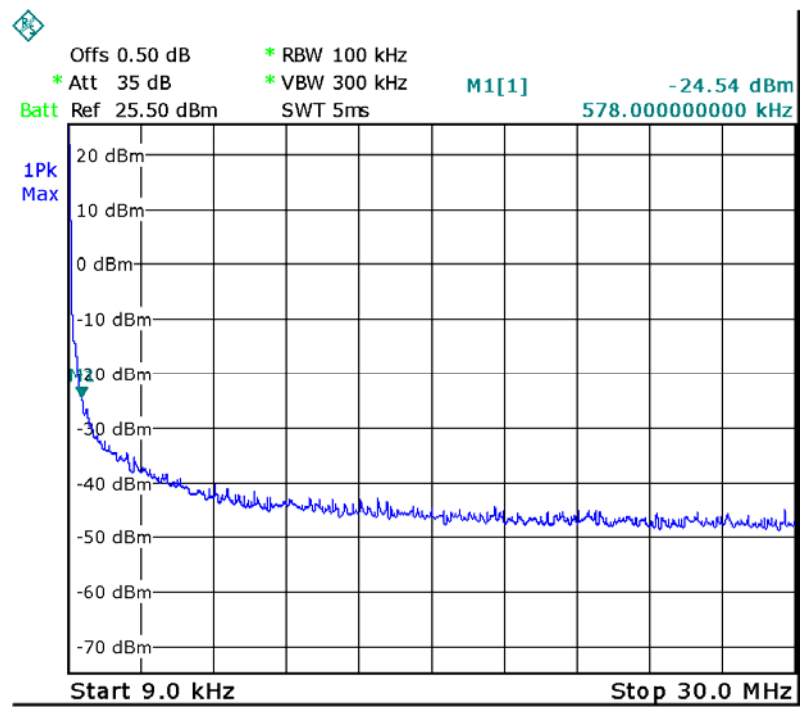
Low Channel



Middle Channel

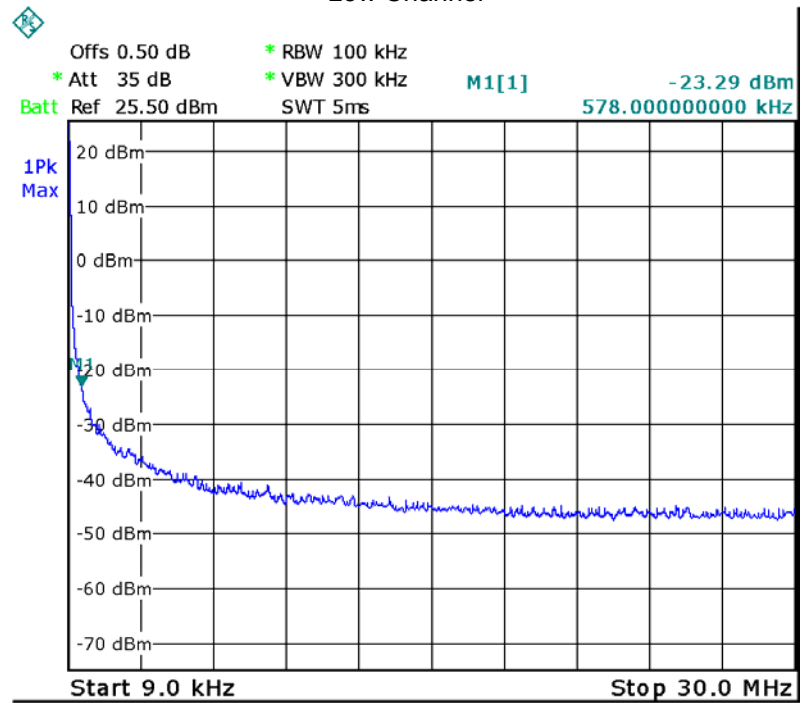


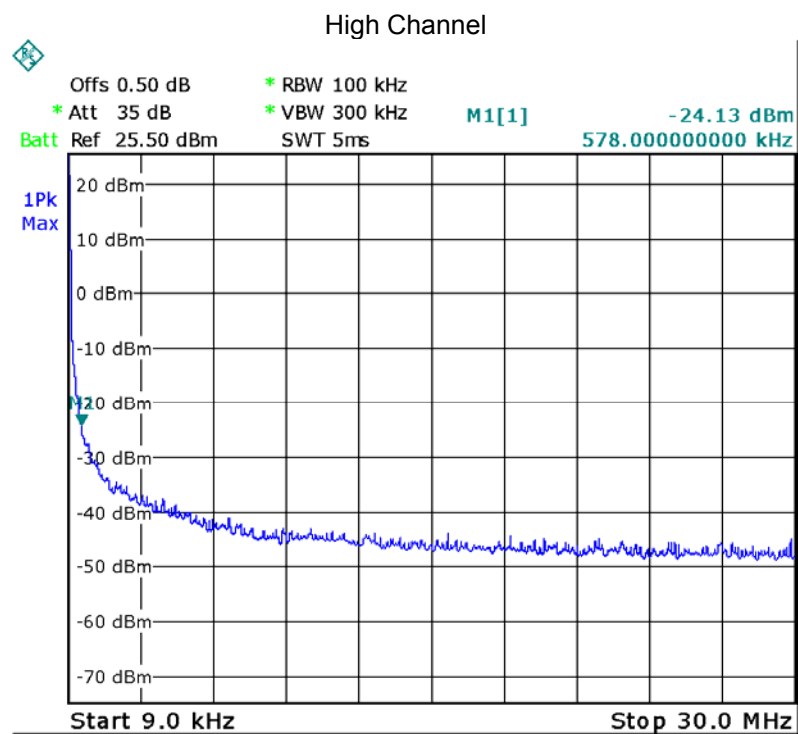
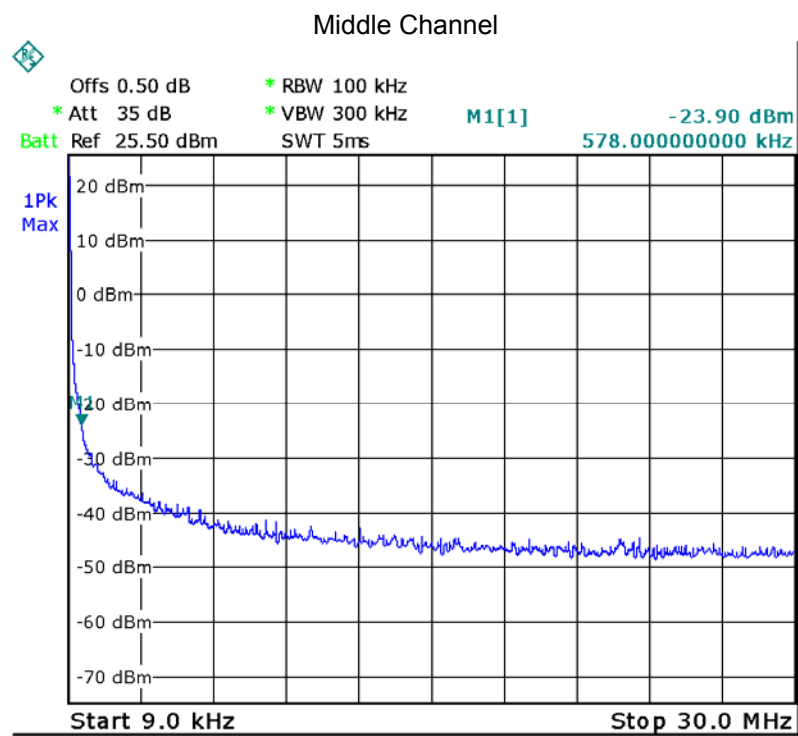
High Channel



802.11g

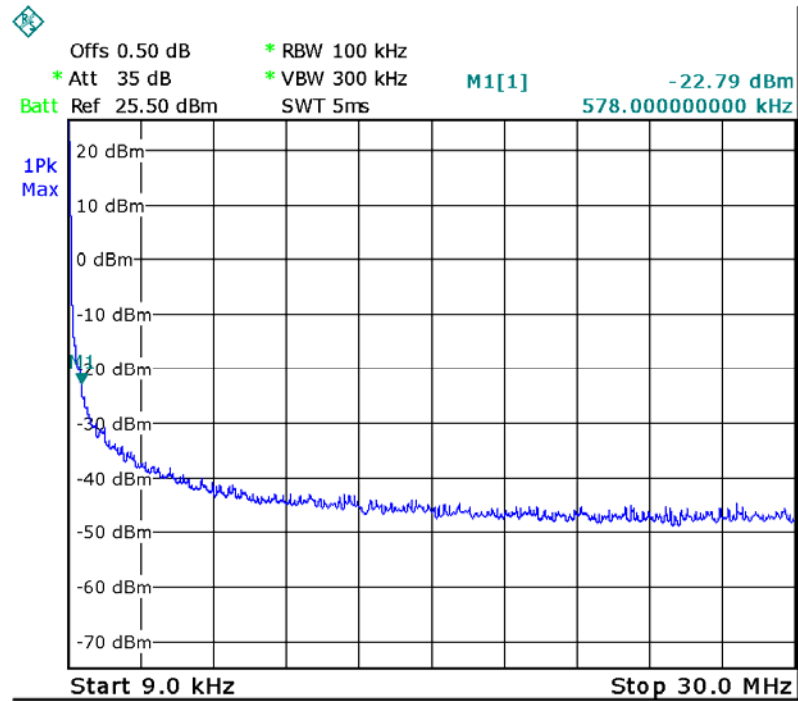
Low Channel



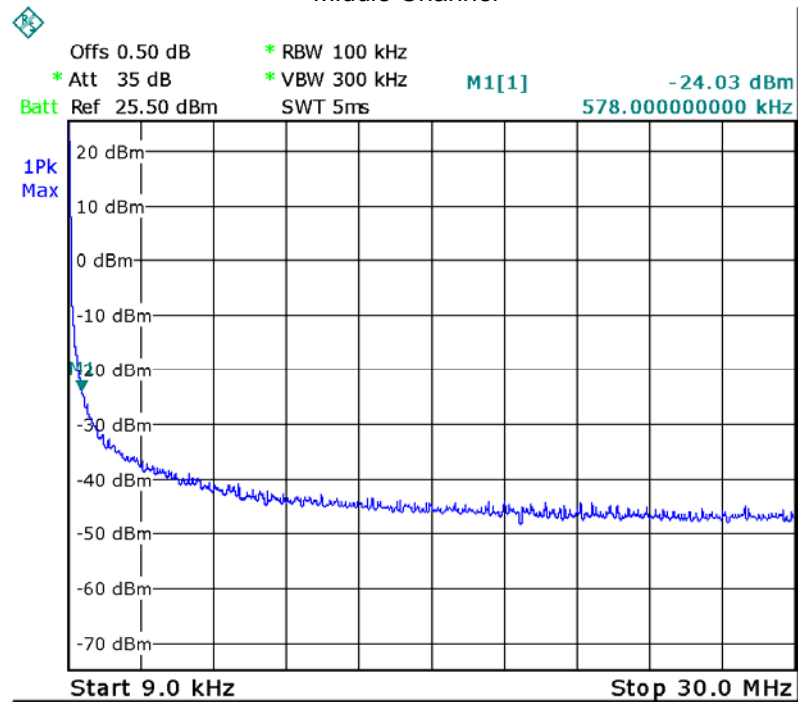


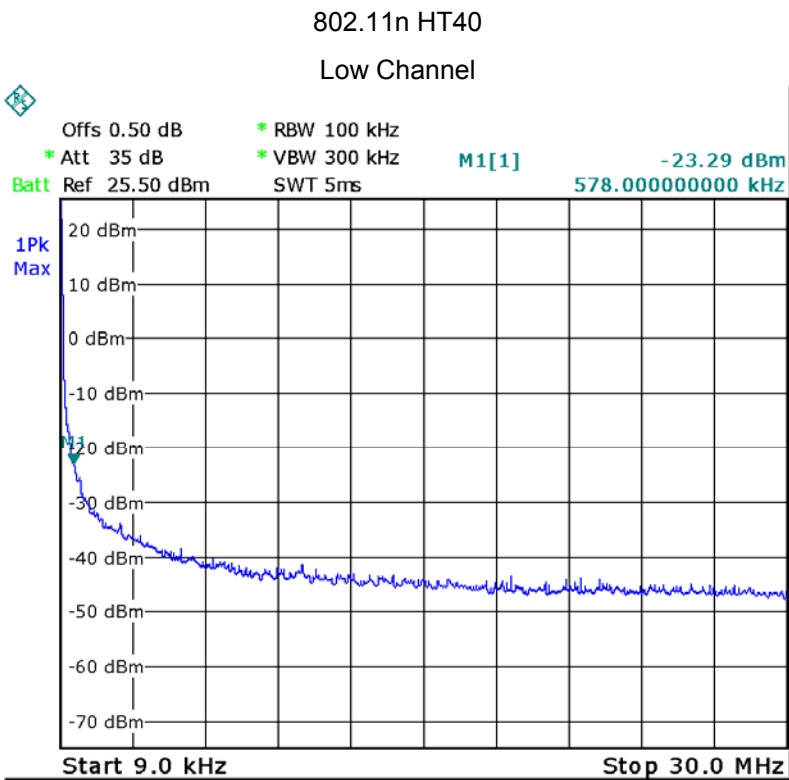
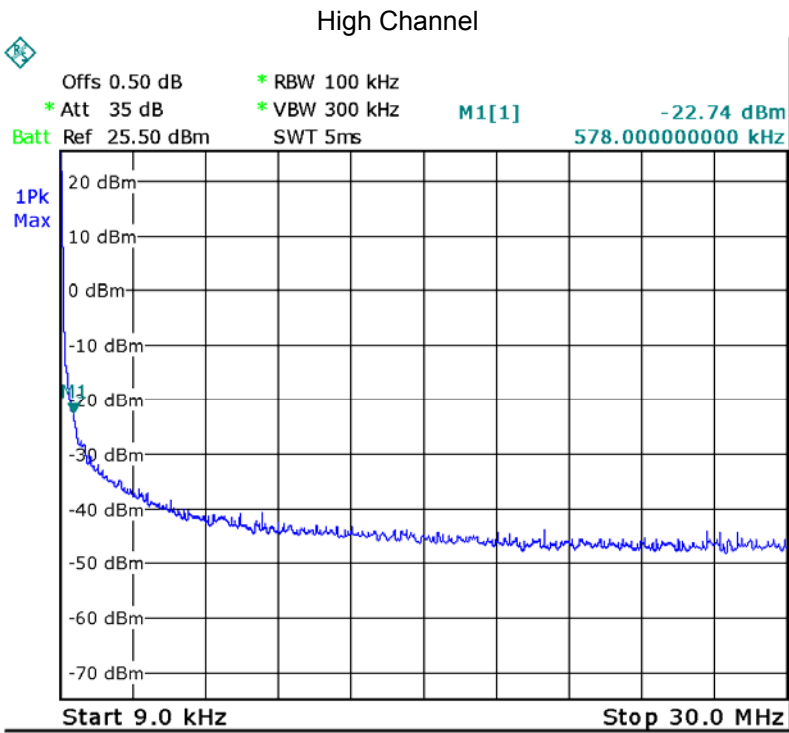
802.11n HT20

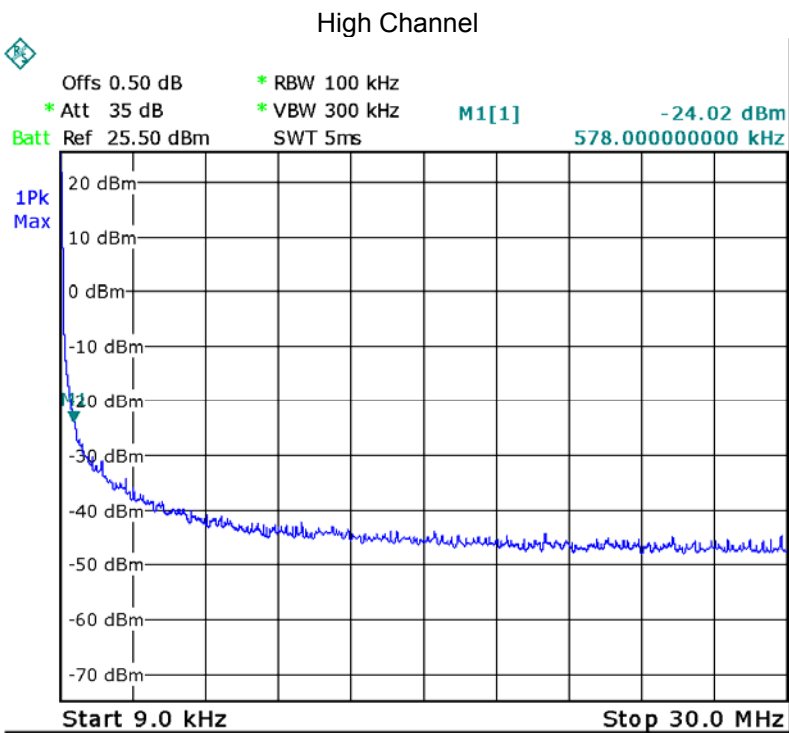
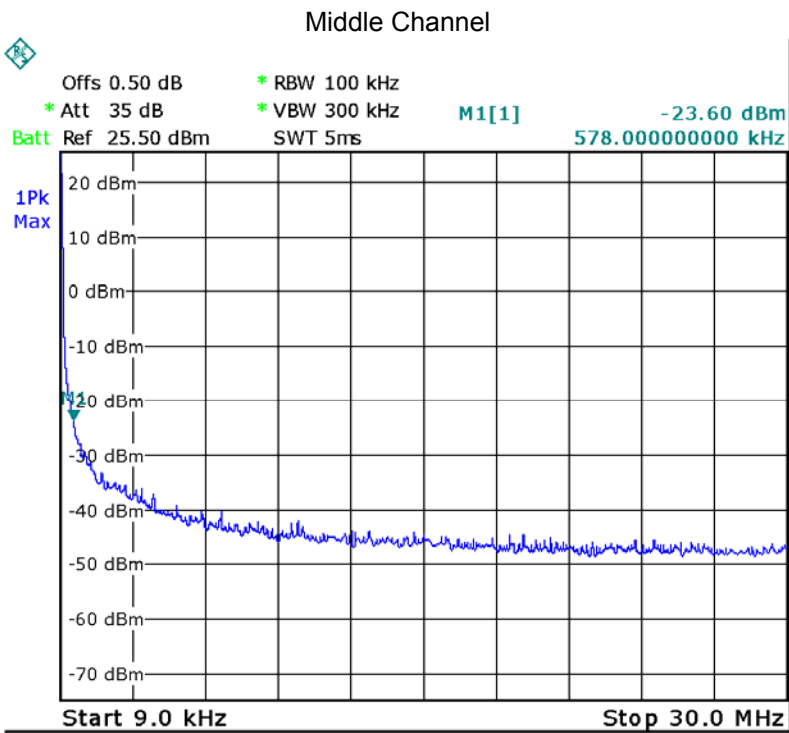
Low Channel



Middle Channel





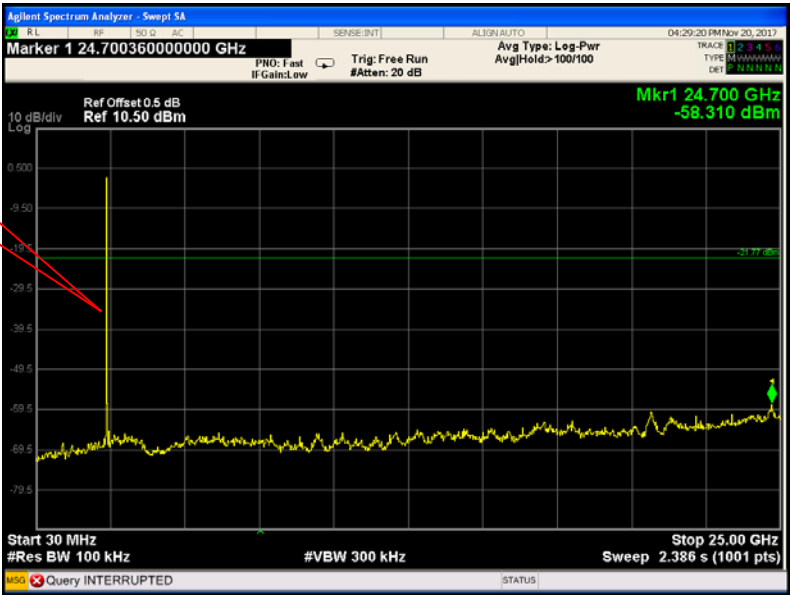


Above 30MHz

802.11b

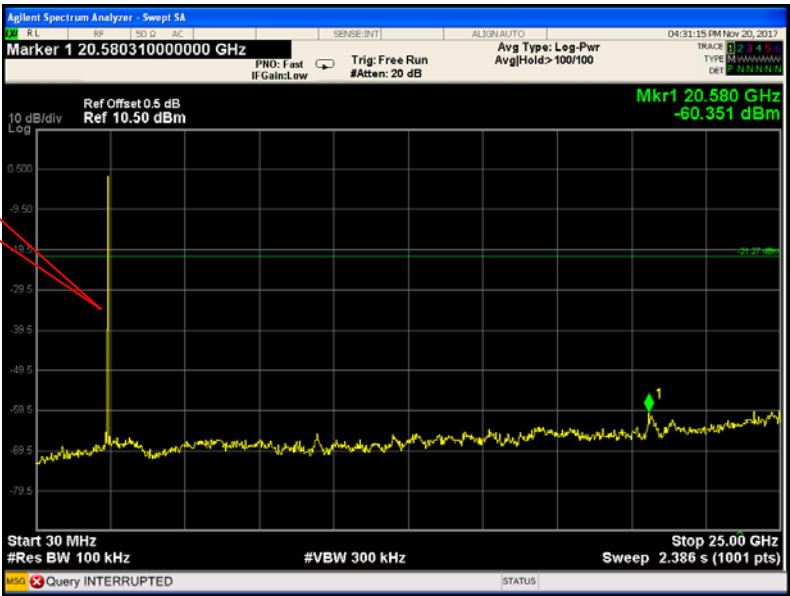
Low Channel

Fundamental



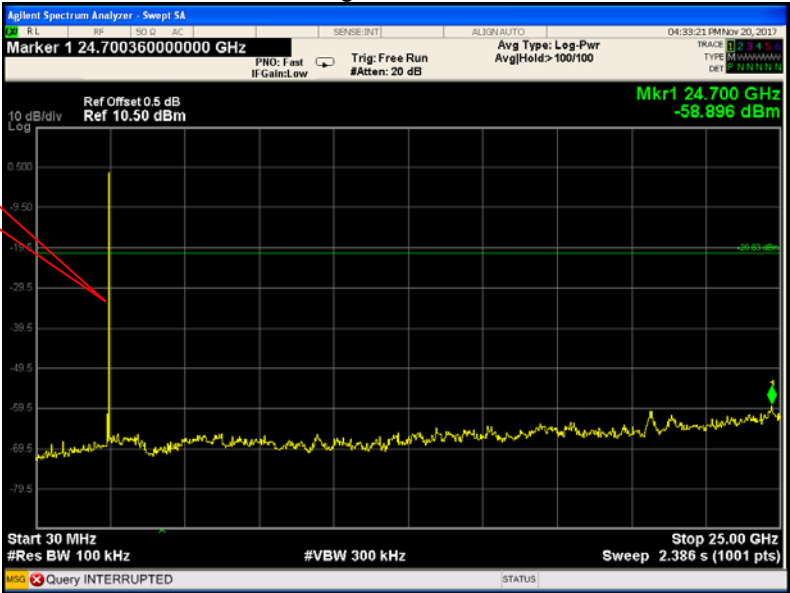
Middle Channel

Fundamental



High Channel

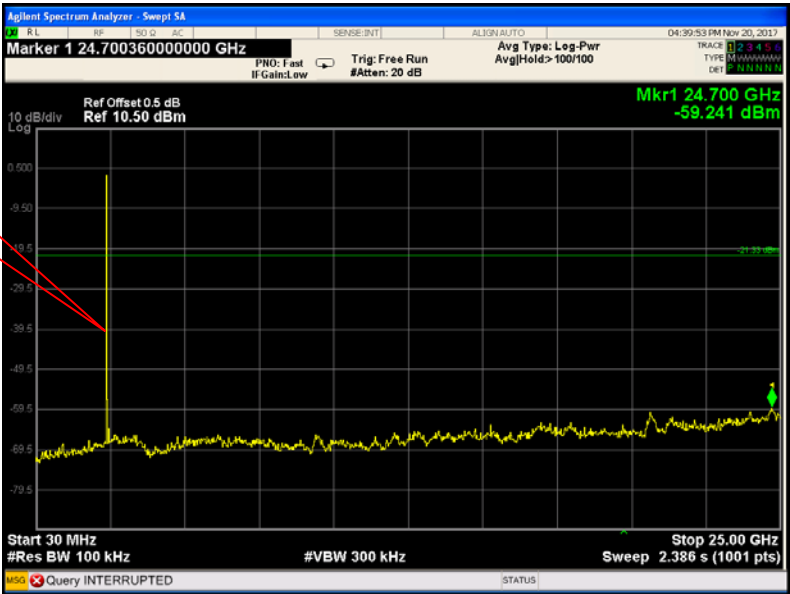
Fundamental



802.11g

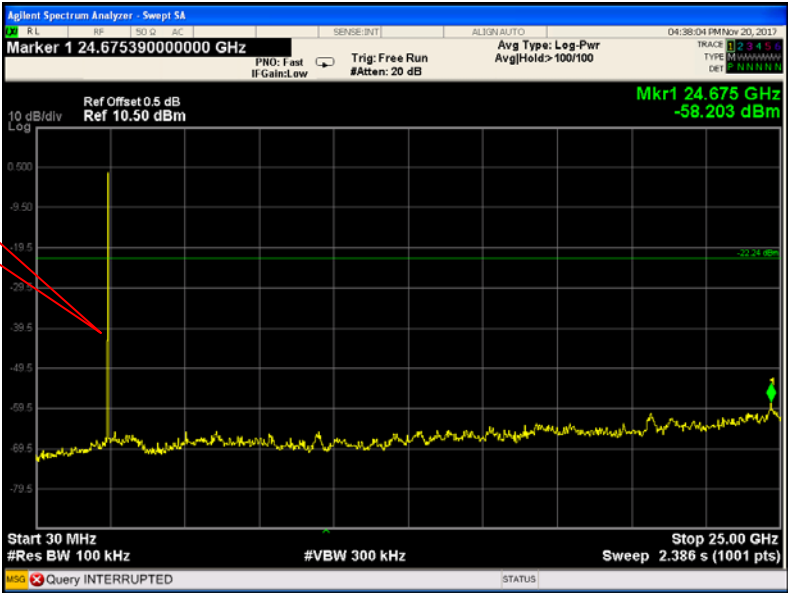
Low Channel

Fundamental



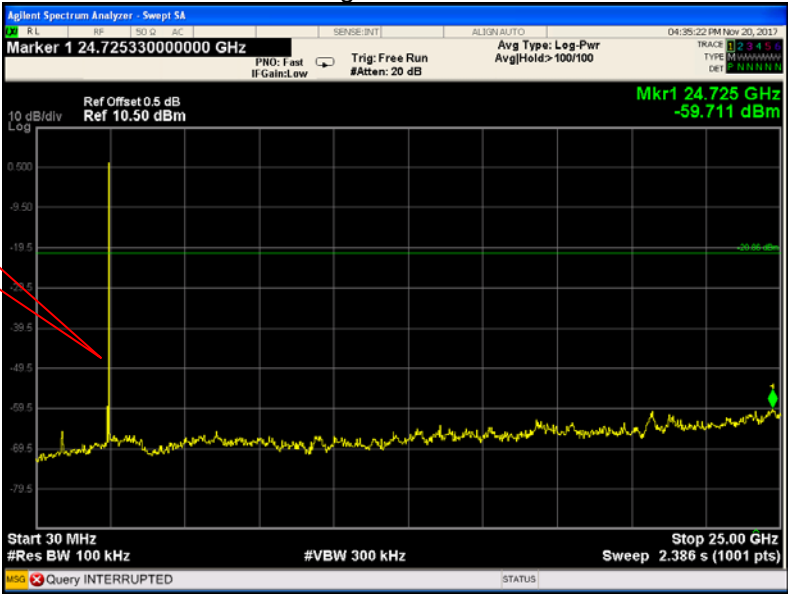
Middle Channel

Fundamental



High Channel

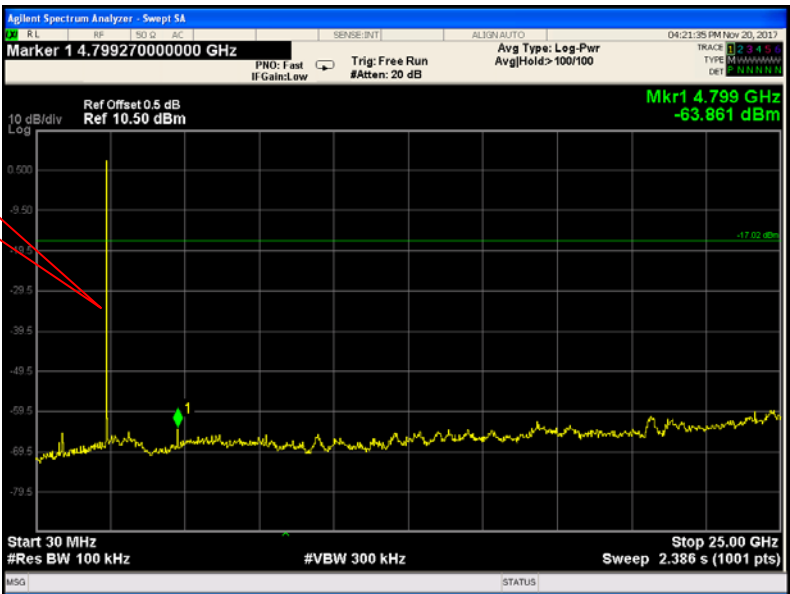
Fundamental



802.11n HT20

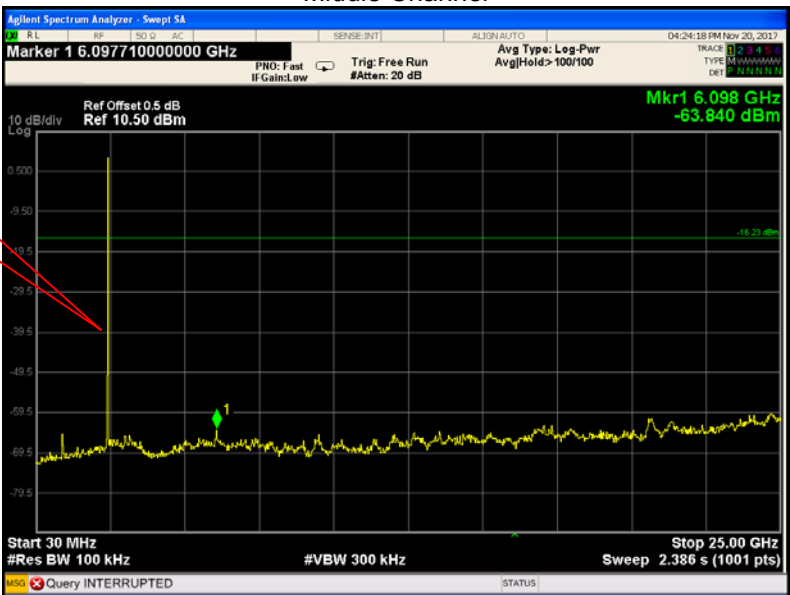
Low Channel

Fundamental



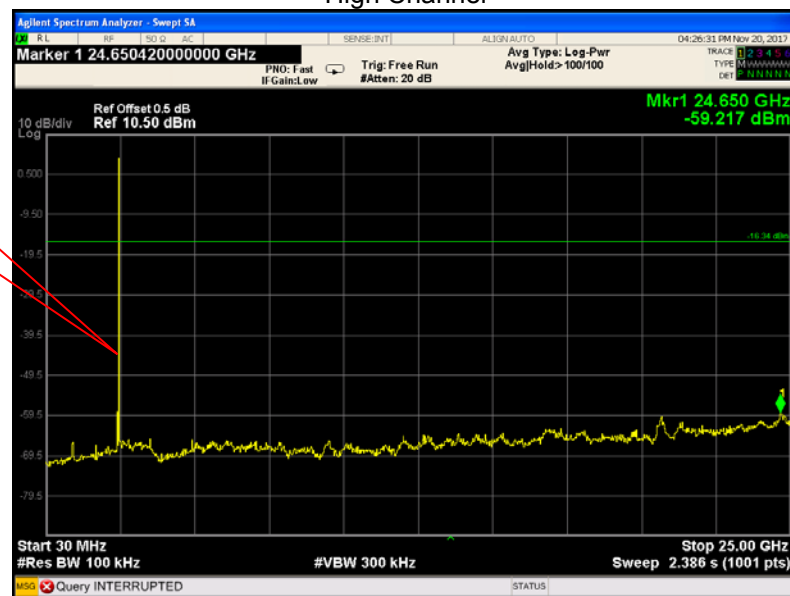
Middle Channel

Fundamental



High Channel

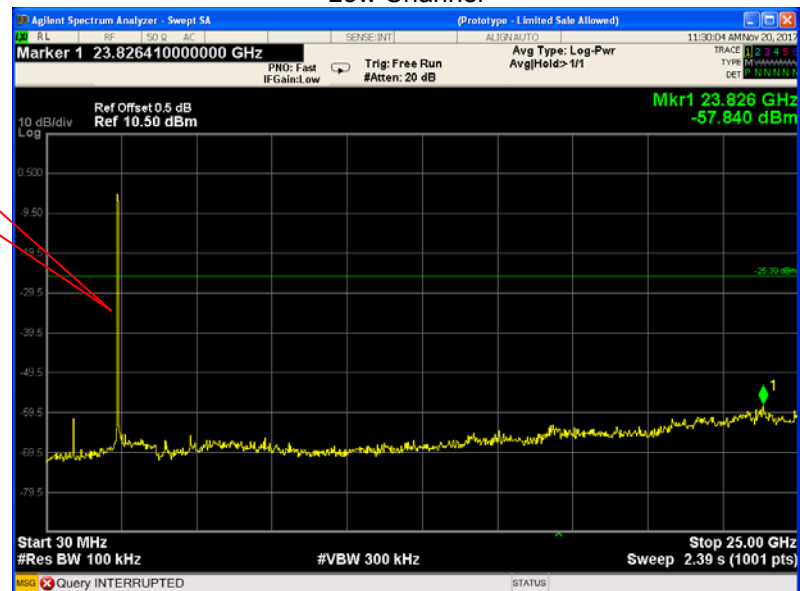
Fundamental



802.11n HT40

Low Channel

Fundamental



Middle Channel

Fundamental



High Channel

Fundamental



11 Band Edge Measurement

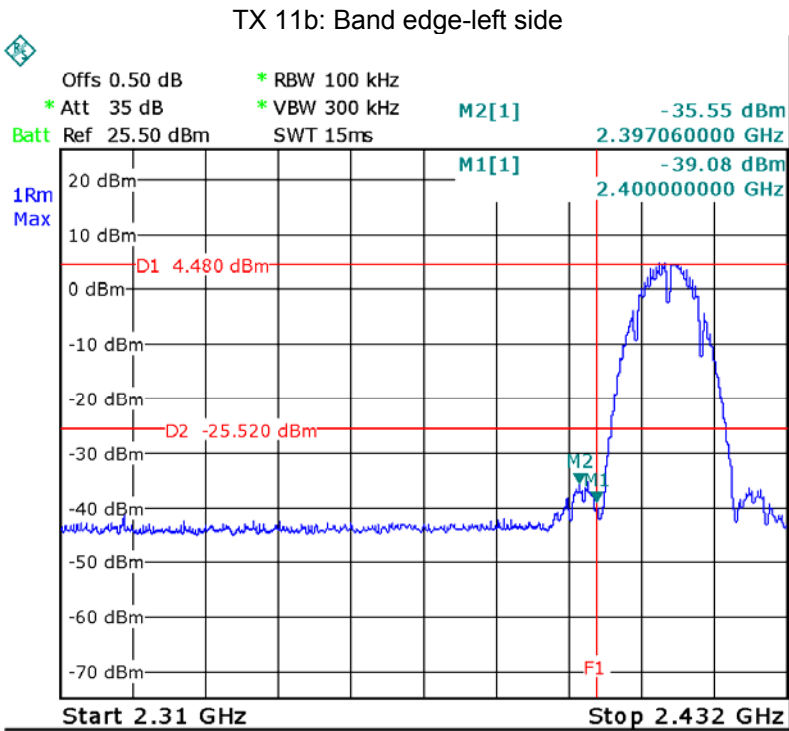
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency 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

11.1 Test Produce

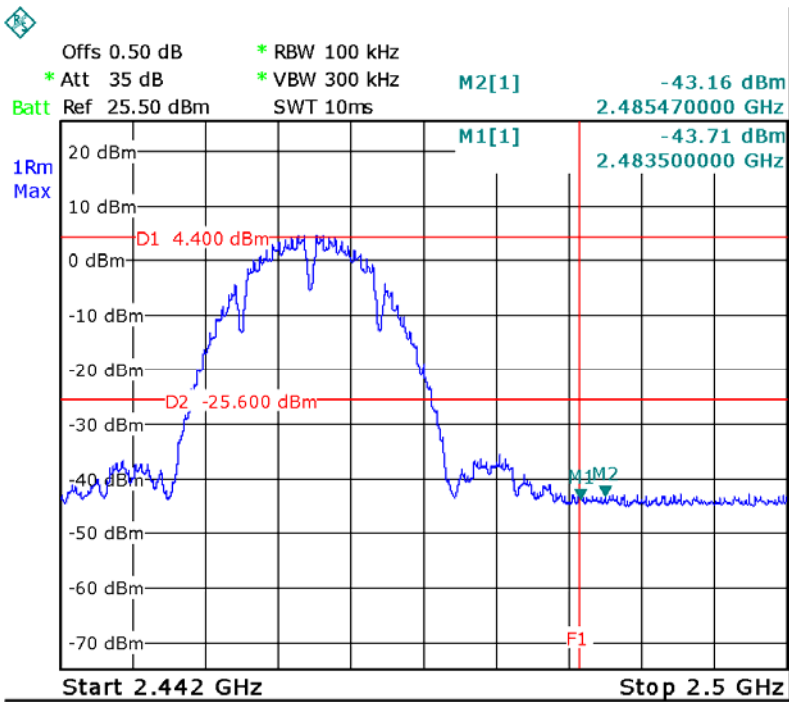
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

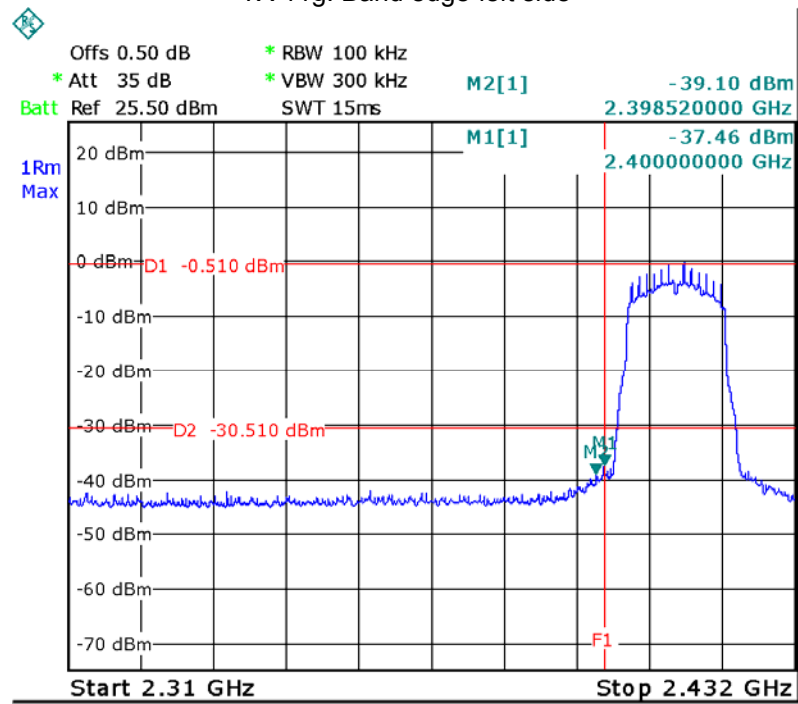
Test result plots shown as follows:



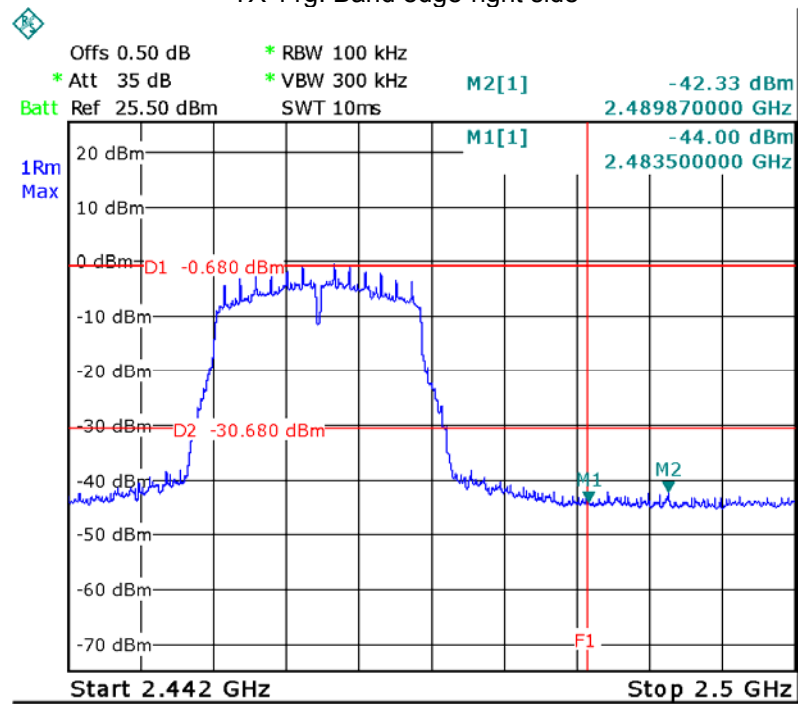
TX 11b: Band edge-right side

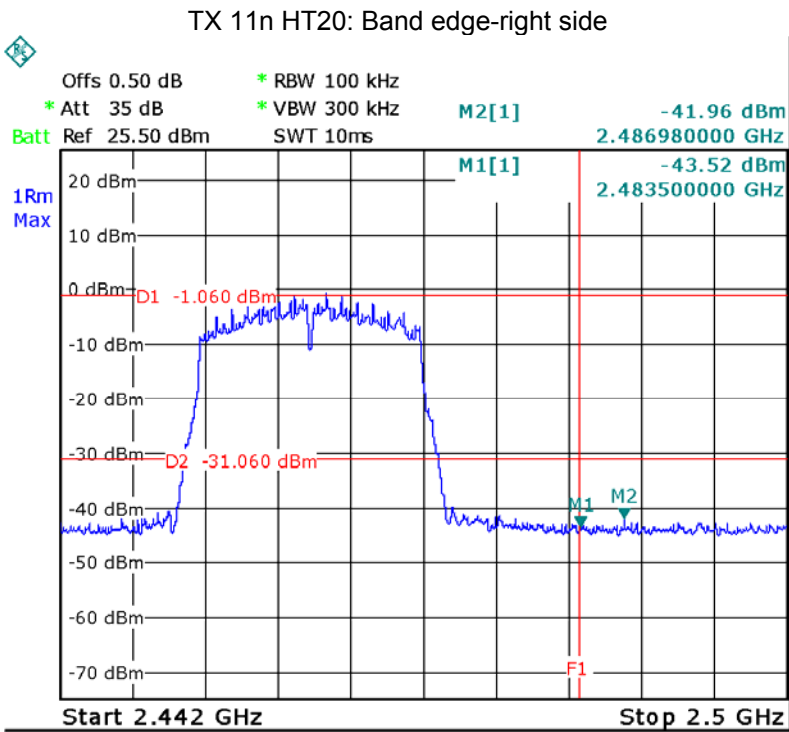
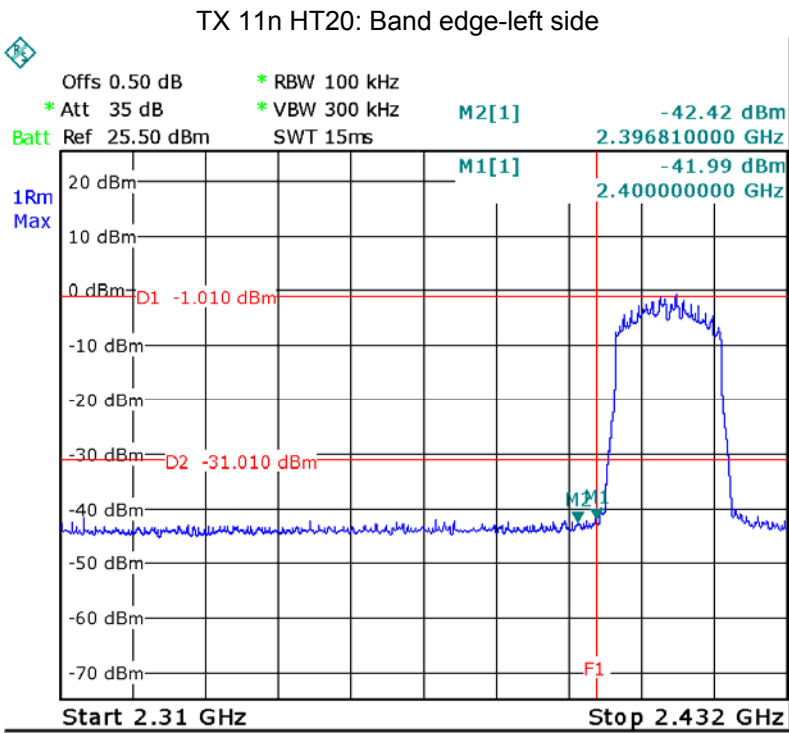


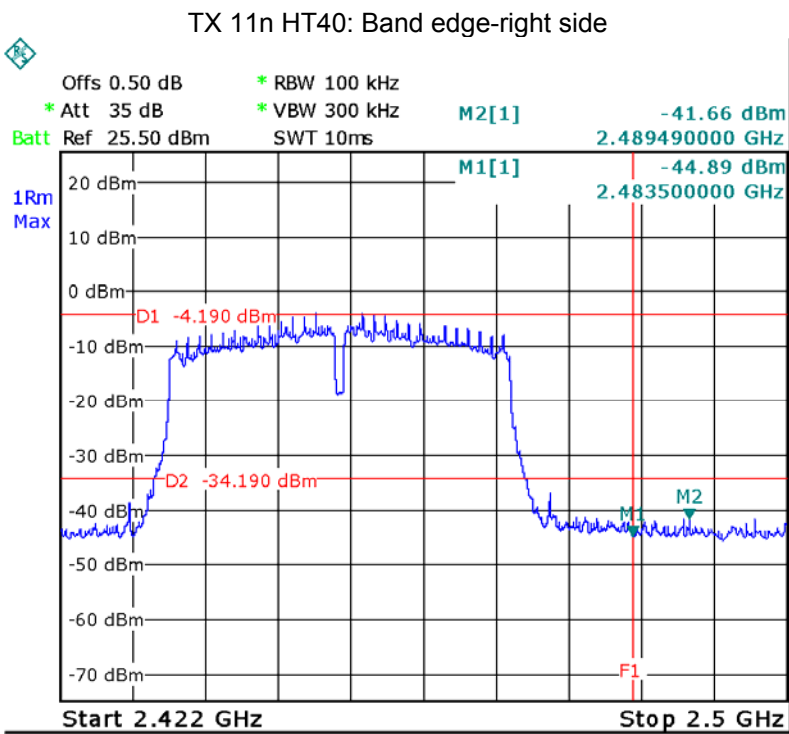
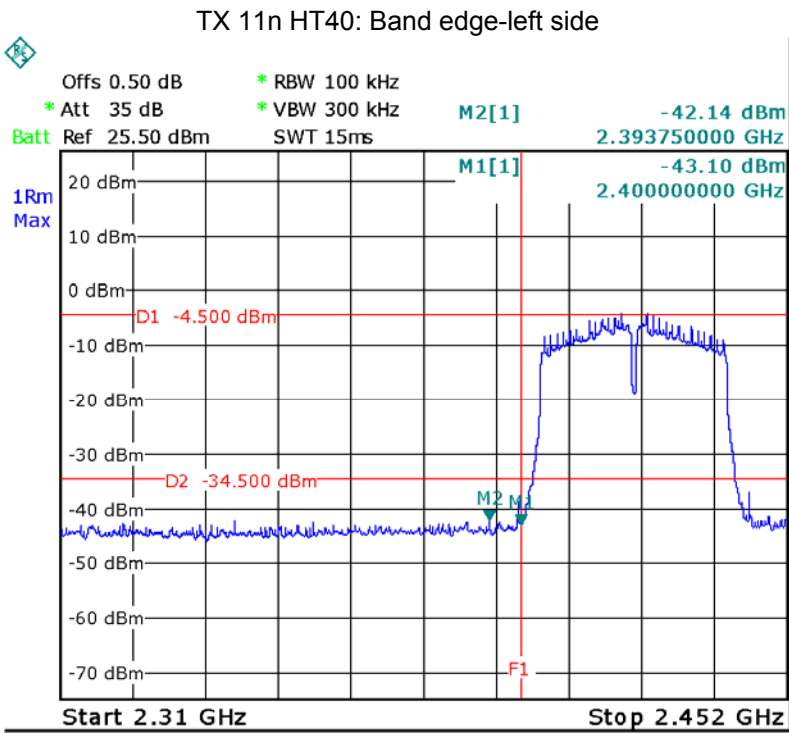
TX 11g: Band edge-left side



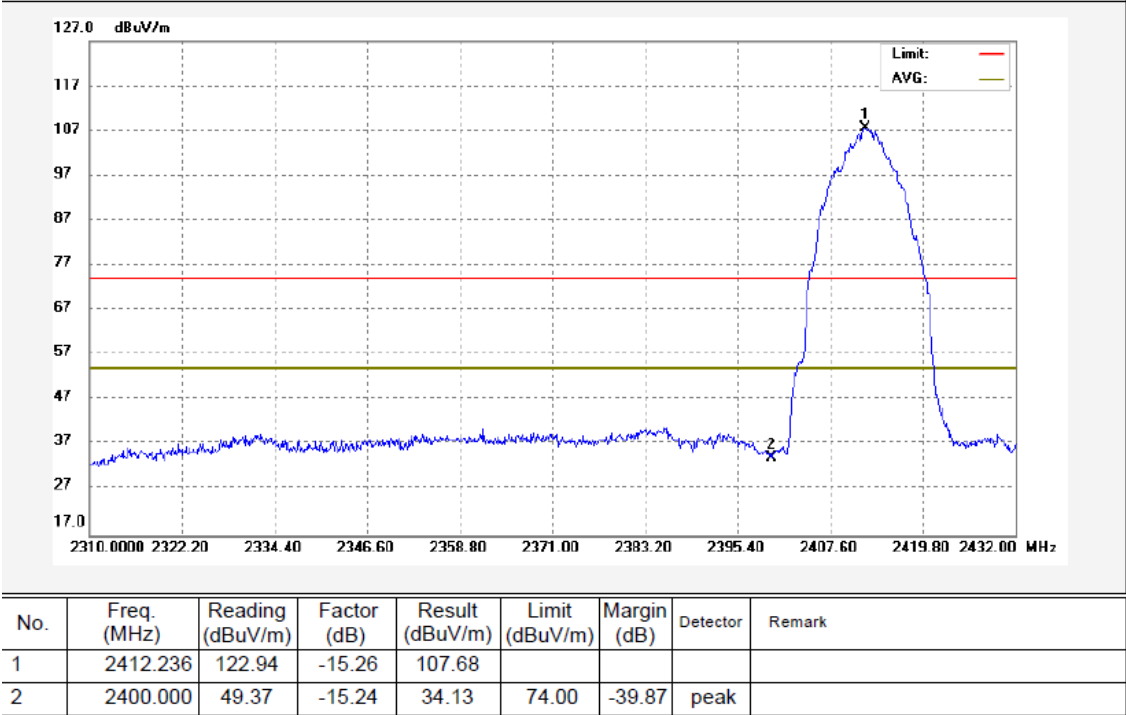
TX 11g: Band edge-right side



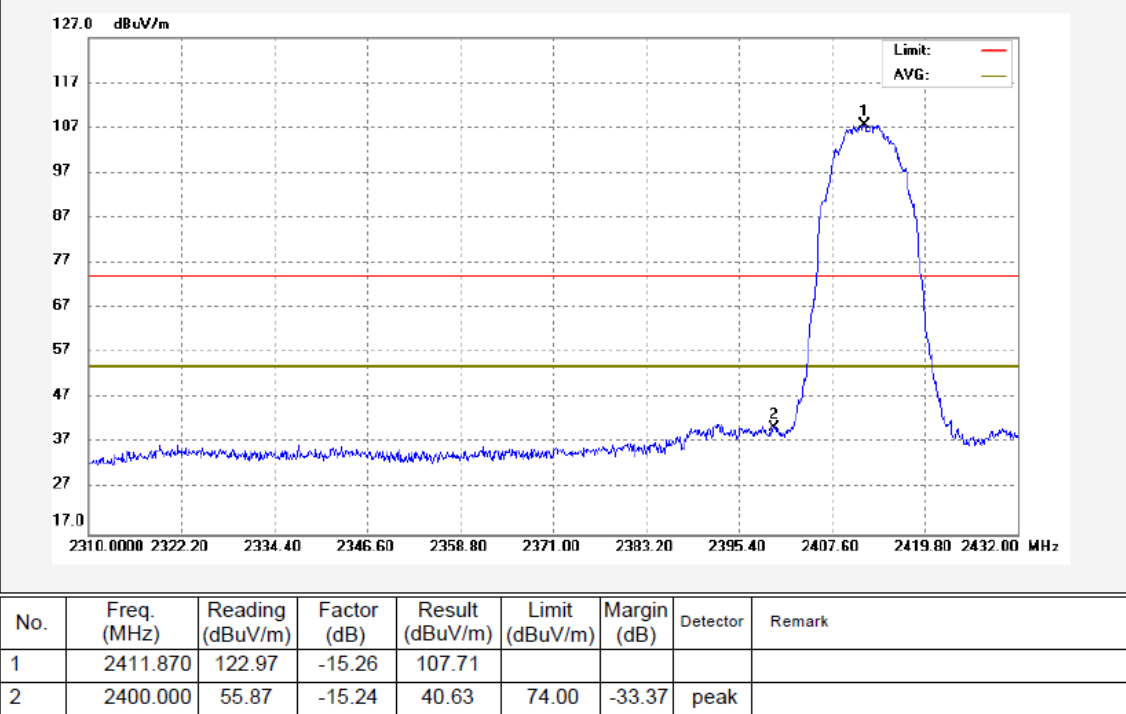




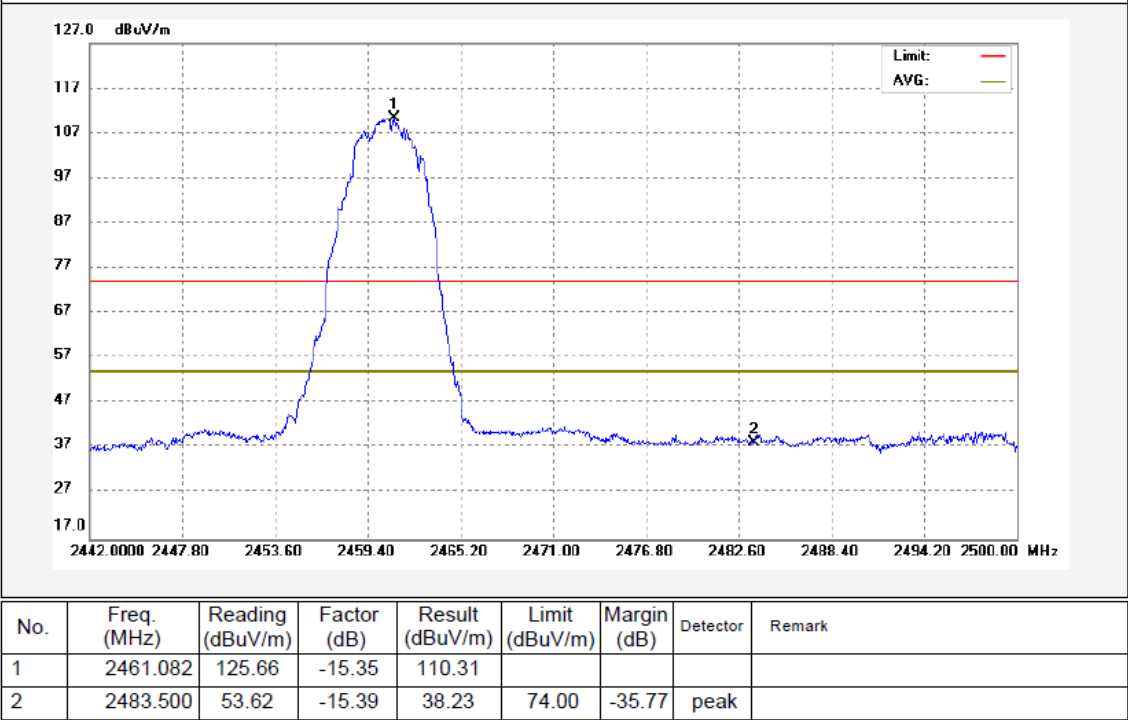
TX 11b: Band edge-left side Horizontal



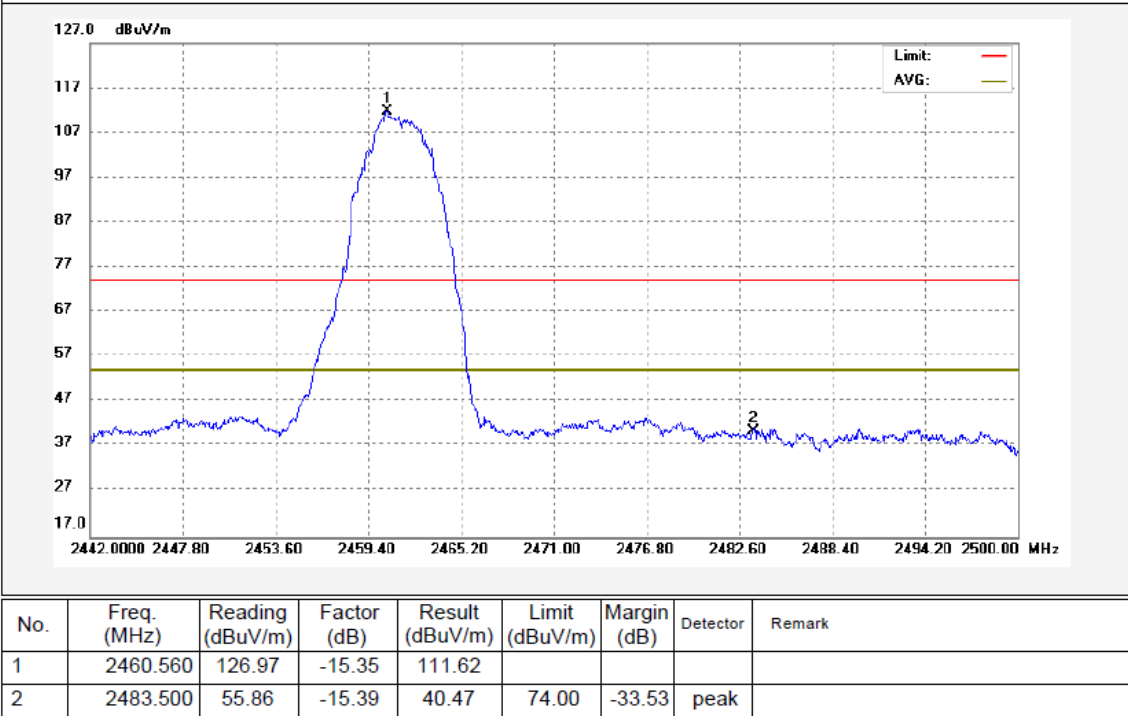
TX 11b: Band edge-left side Vertical



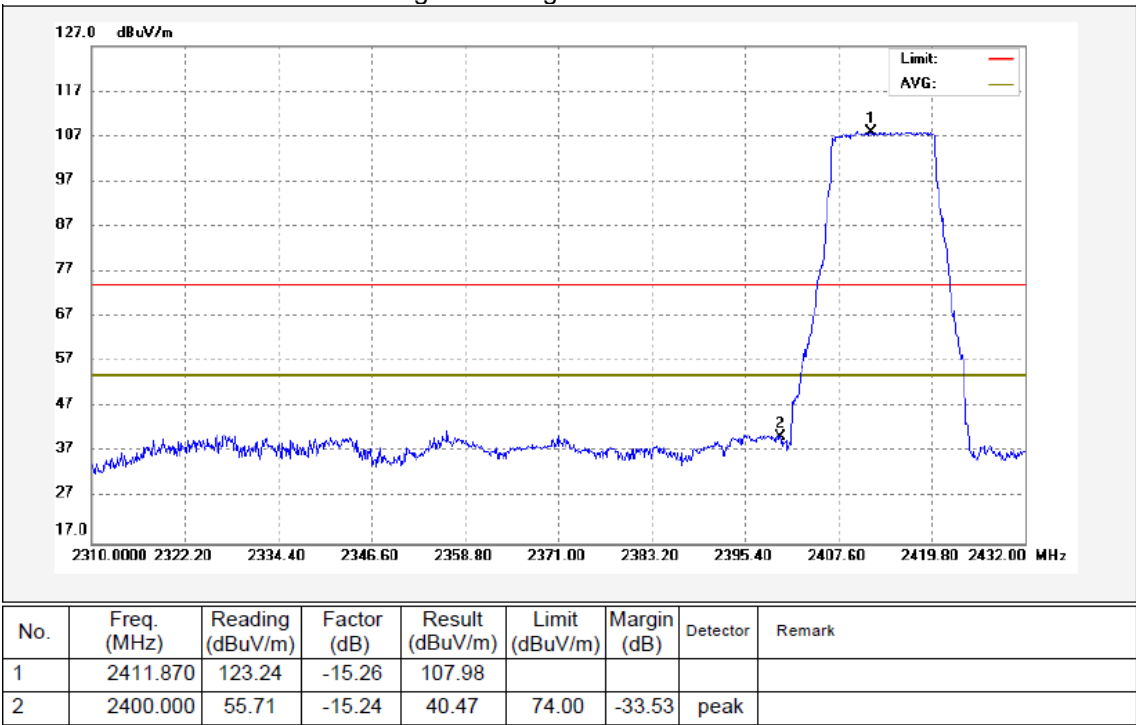
TX 11b: Band edge-right side Horizontal



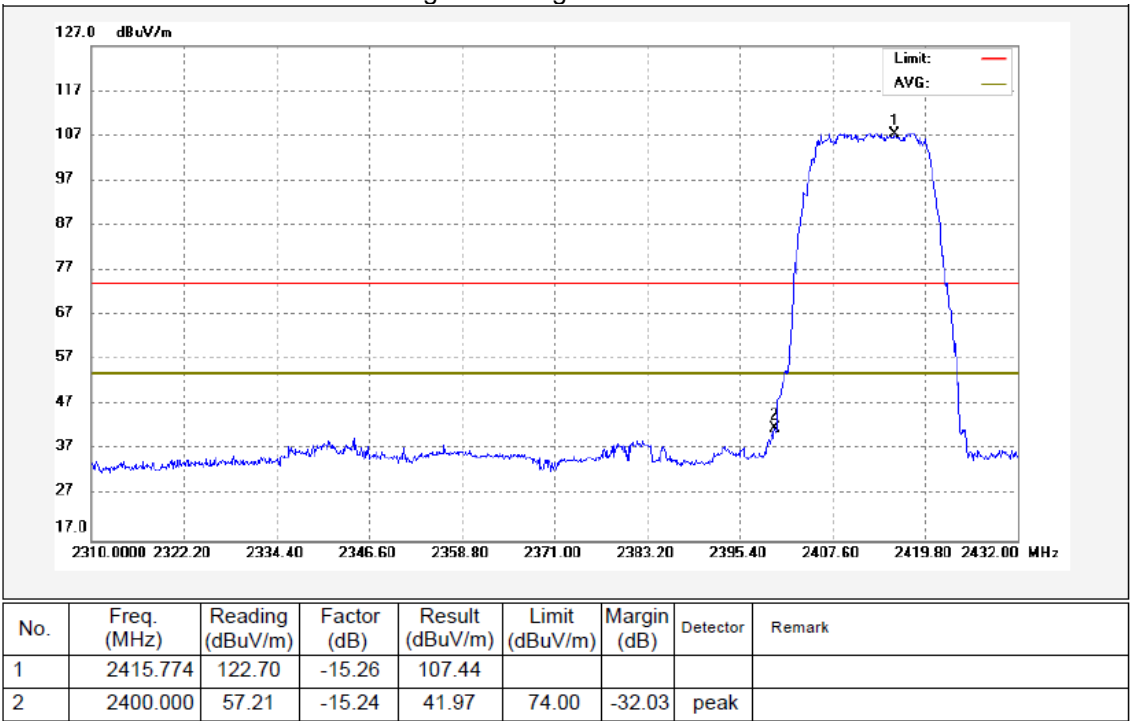
TX 11b: Band edge-right side Vertical



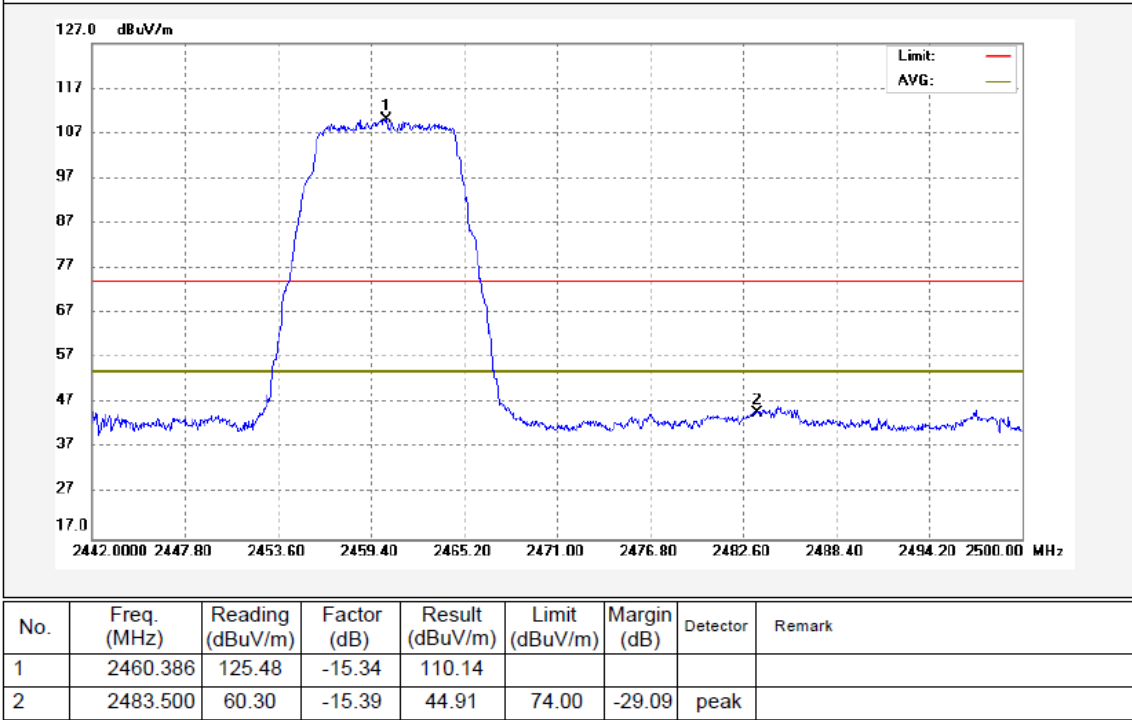
TX 11g: Band edge-left side Horizontal



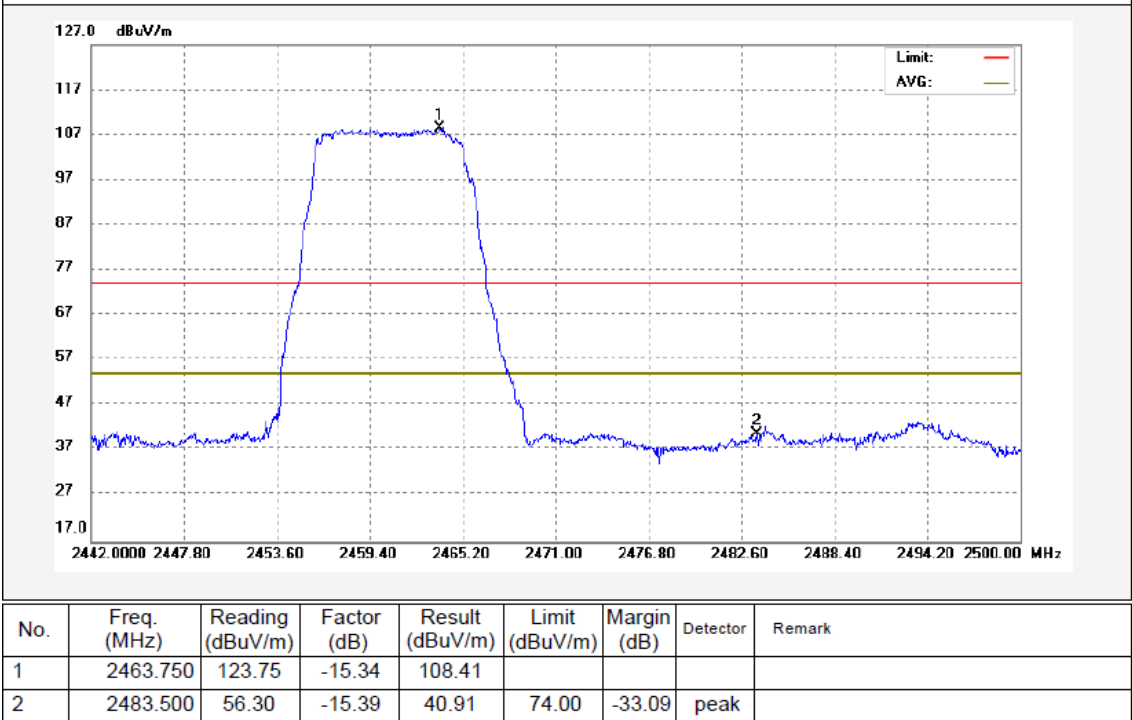
TX 11g: Band edge-left side Vertical



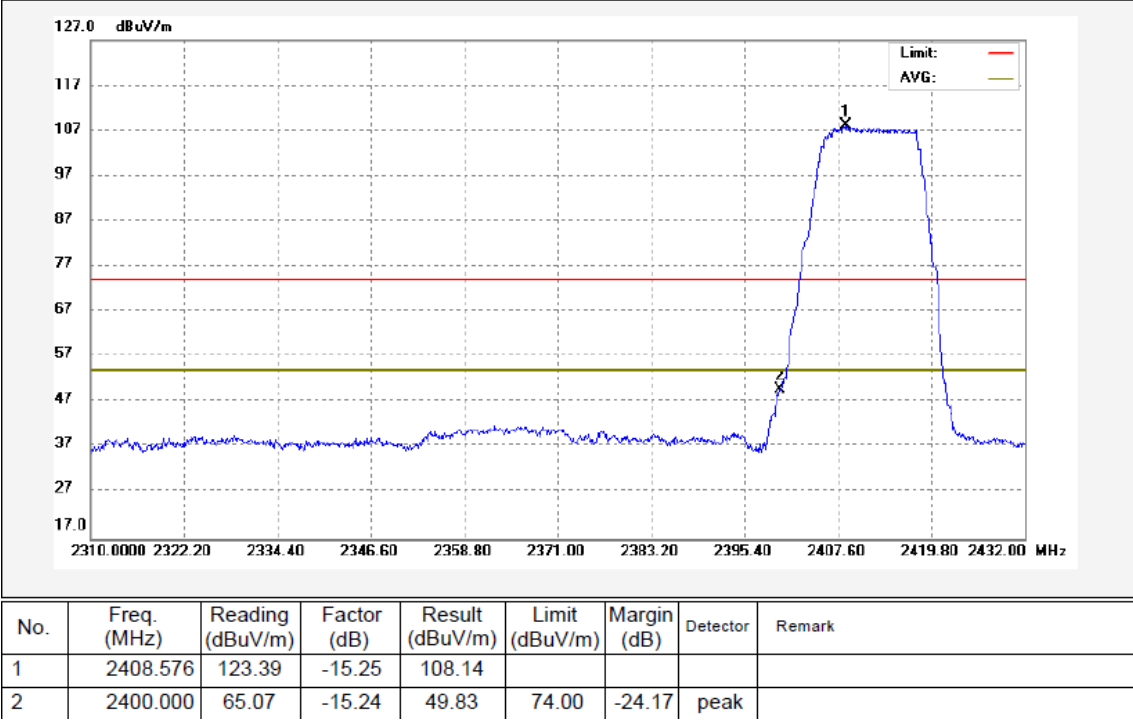
TX 11g: Band edge-right side Horizontal



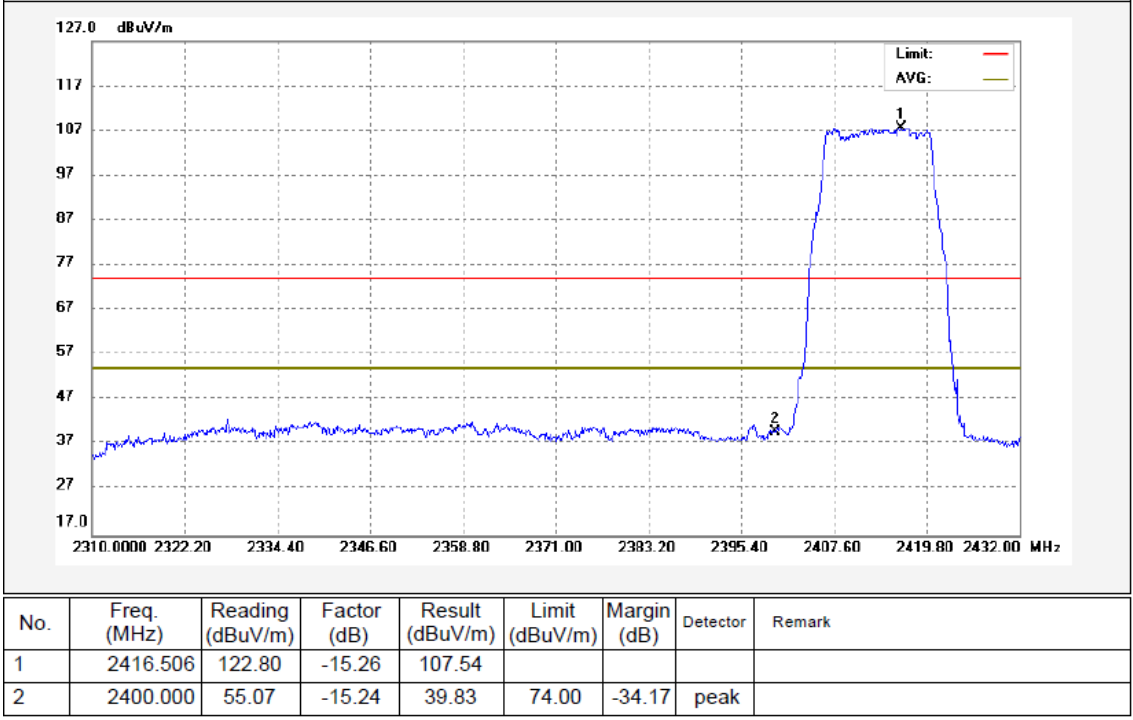
TX 11g: Band edge-right side Vertical



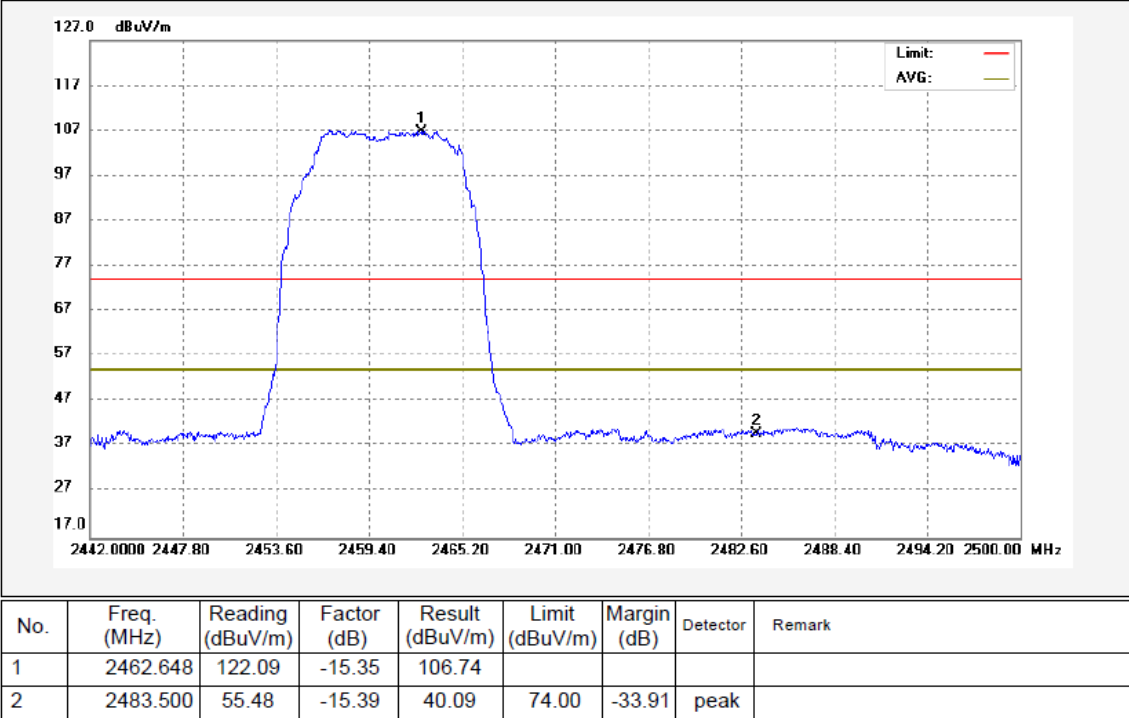
TX 11n HT20: Band edge-left side Horizontal



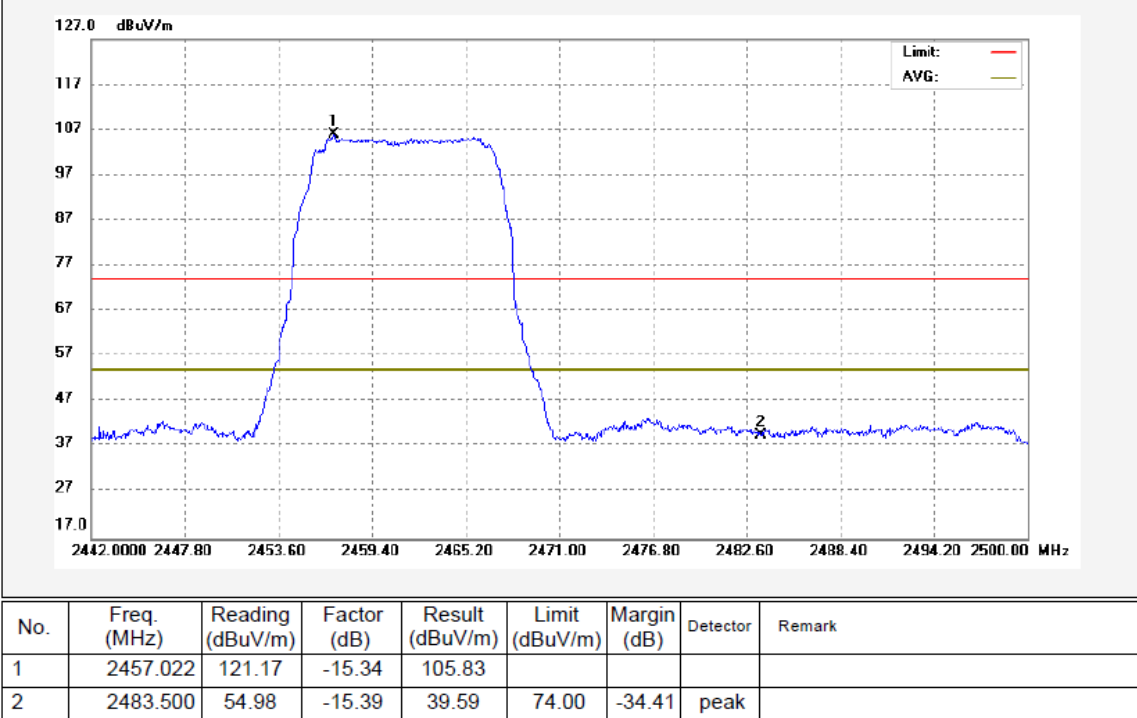
TX 11n HT20: Band edge-left side Vertical



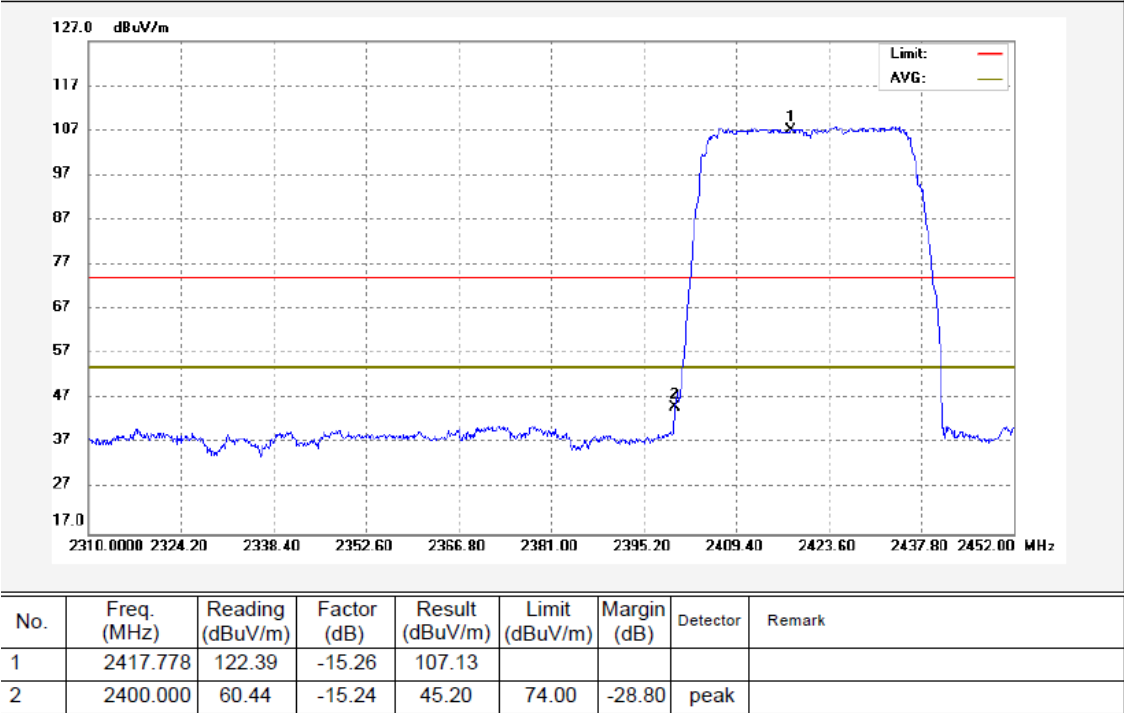
TX 11n HT20: Band edge-right side Horizontal



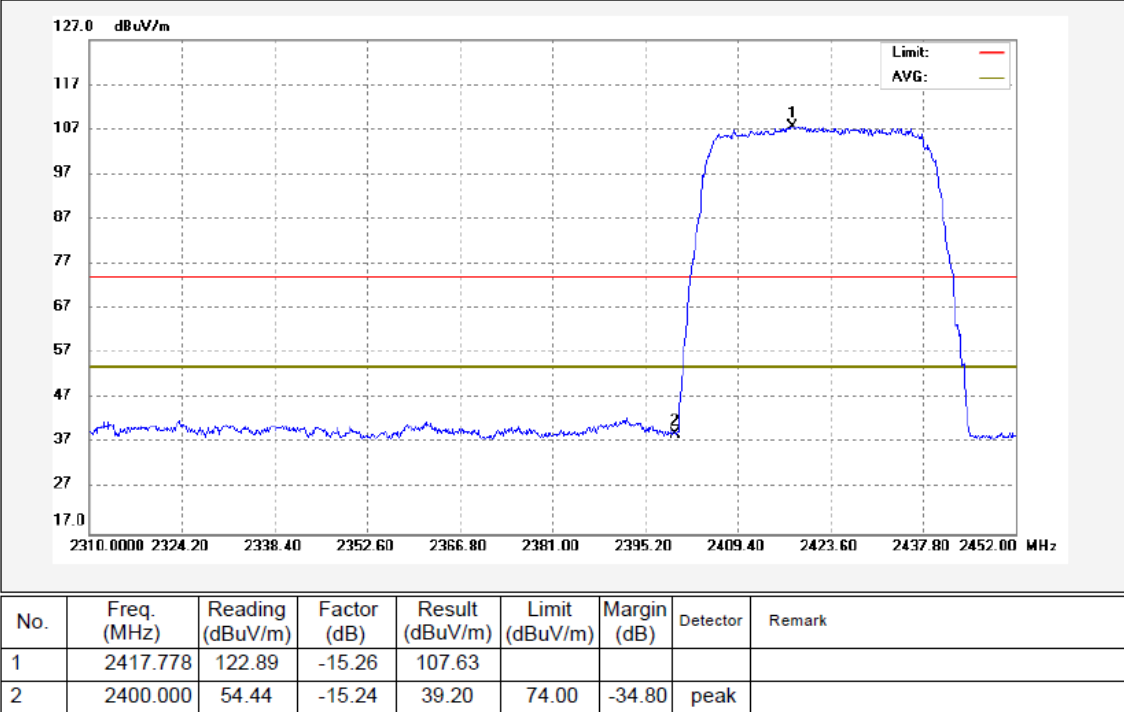
TX 11n HT20: Band edge-right side Vertical



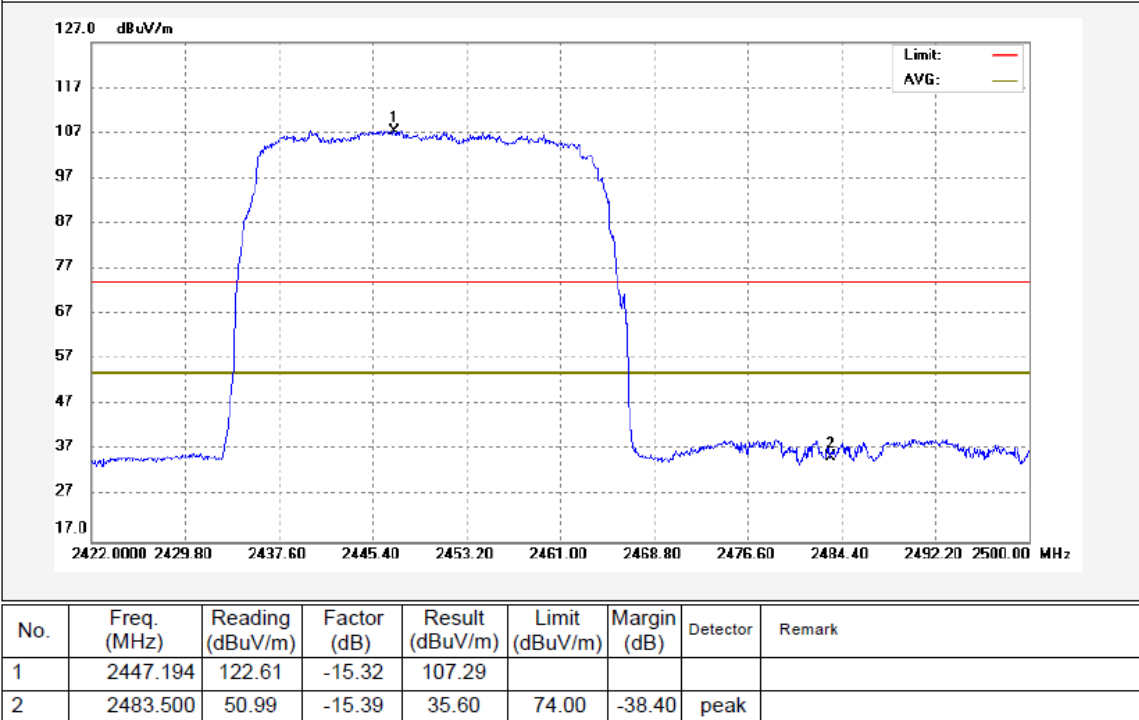
TX 11n HT40: Band edge-left side Horizontal



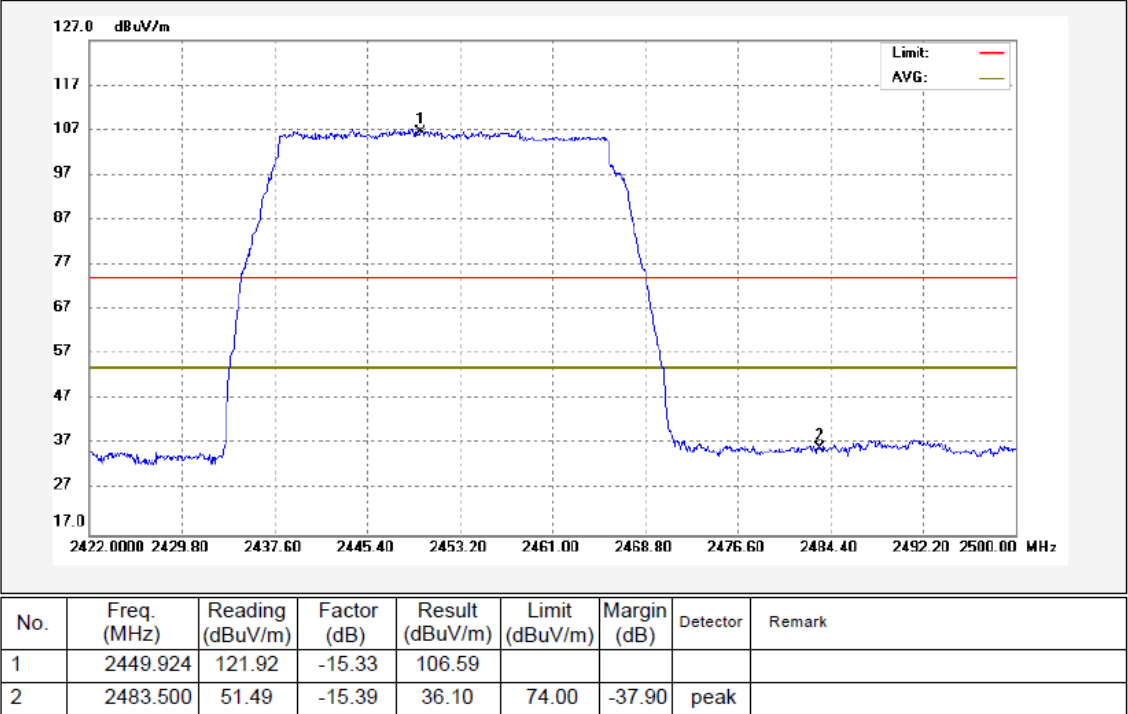
TX 11n HT40: Band edge-left side Vertical



TX 11n HT40: Band edge-right side Horizontal



TX 11n HT40: Band edge-right side Vertical



12 6 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017

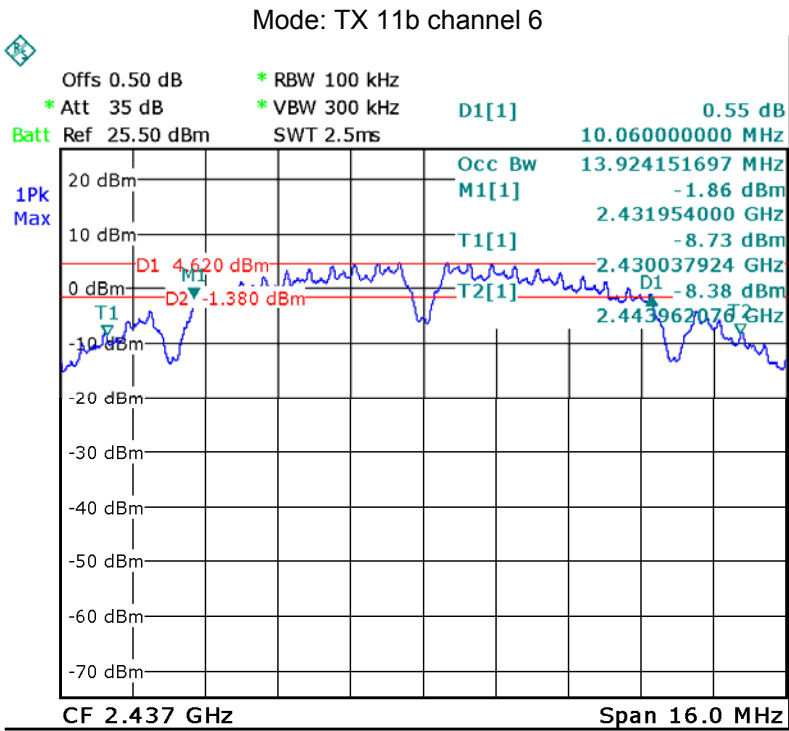
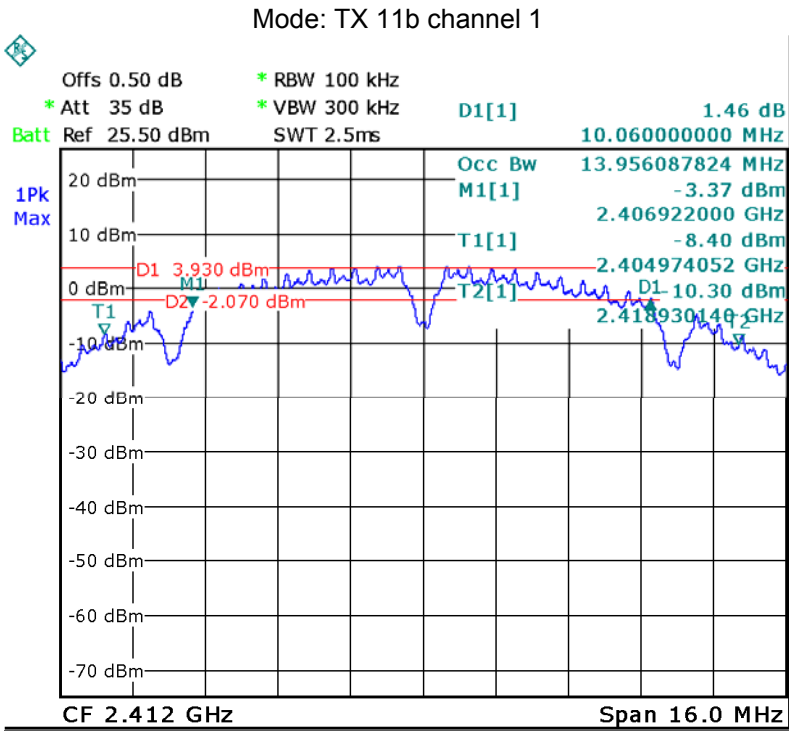
12.1 Test Procedure:

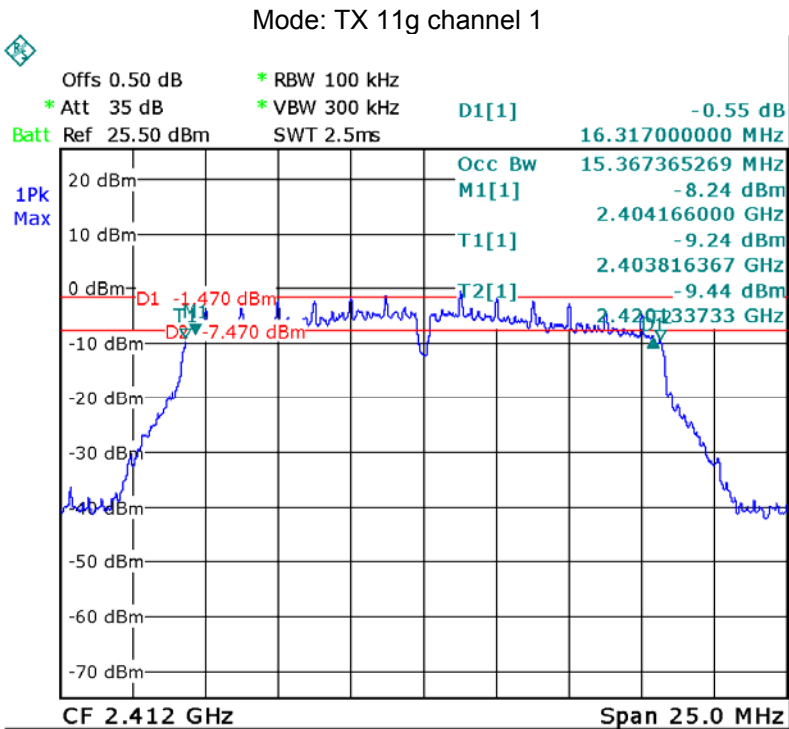
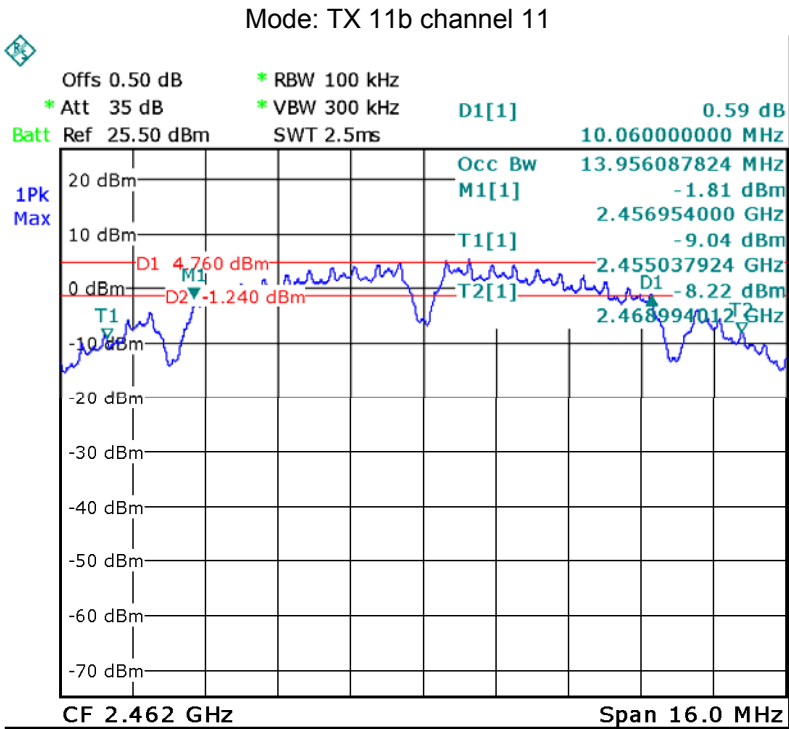
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

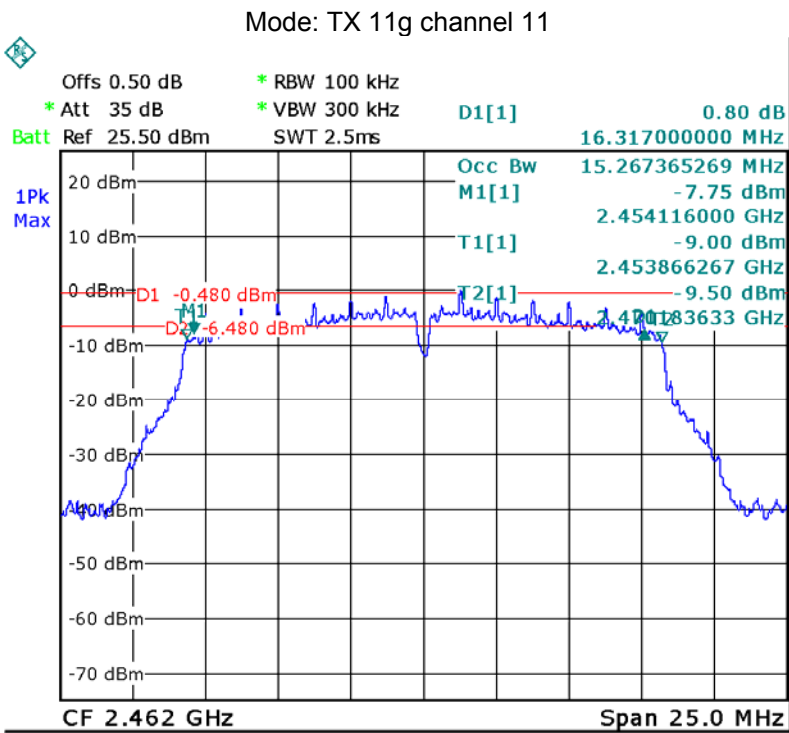
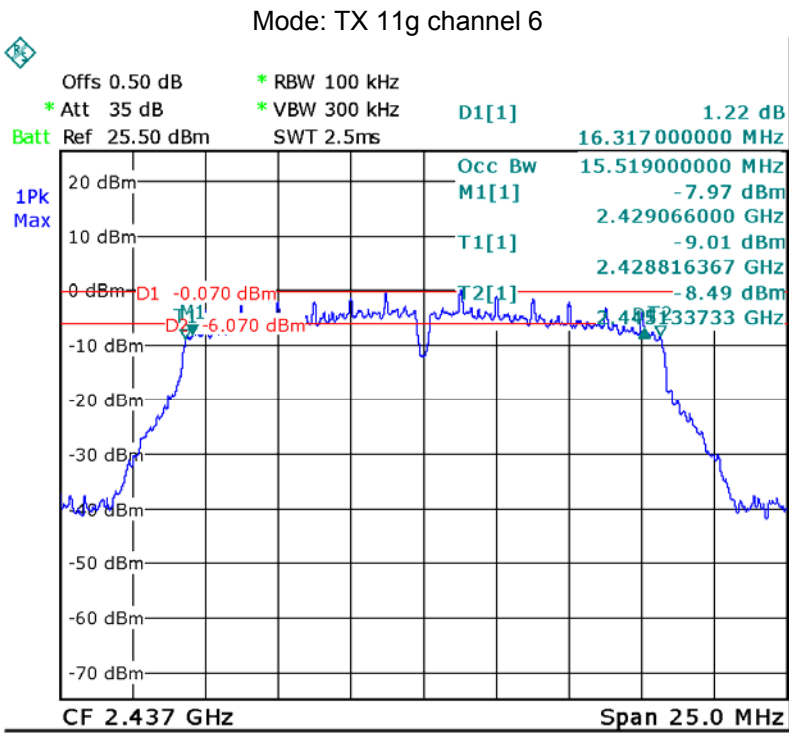
12.2 Test Result:

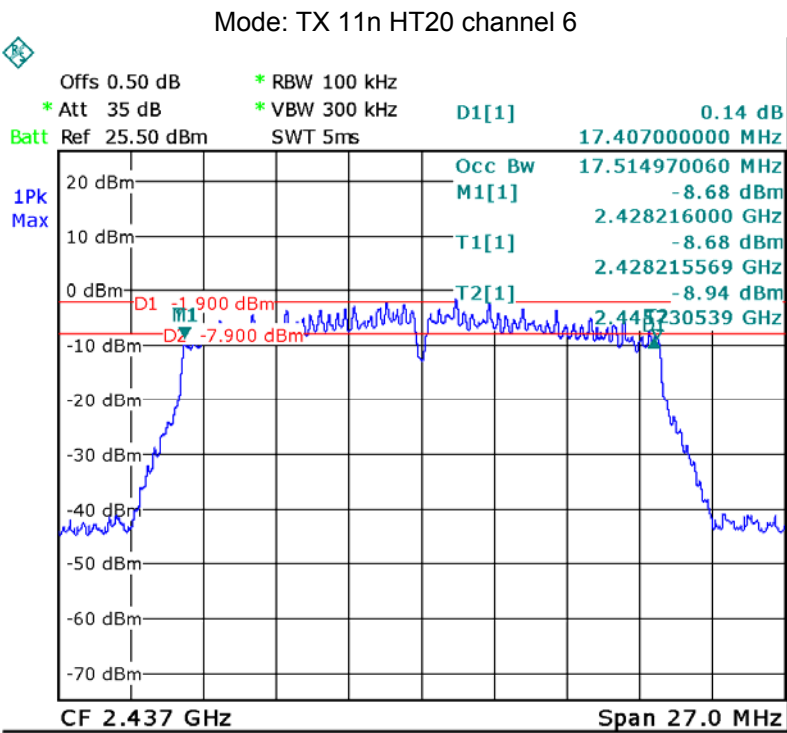
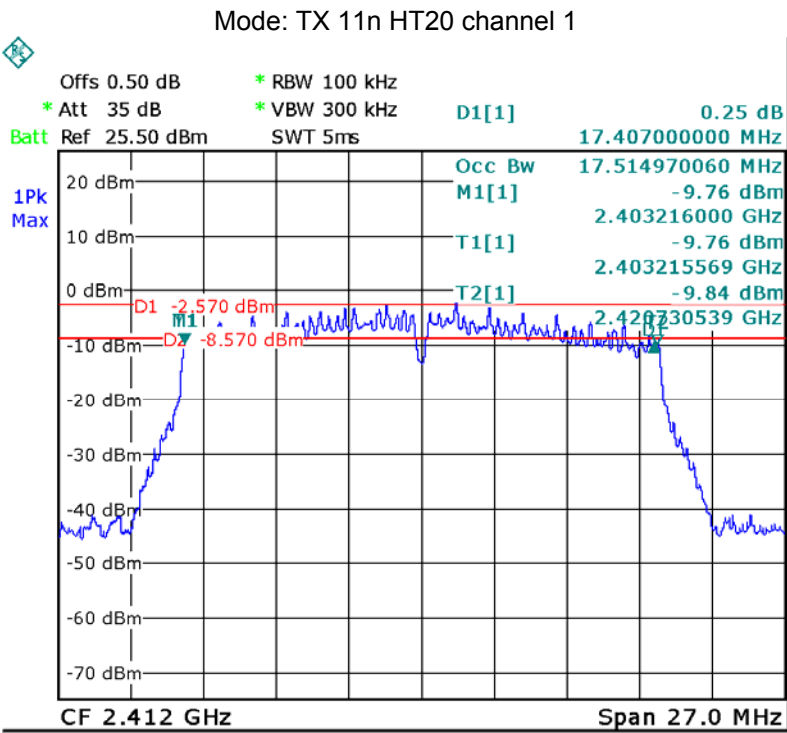
Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (kHz)
TX 11b	Channel 1	10.060	13.956	500
	Channel 6	10.060	13.924	500
	Channel 11	10.060	13.956	500
TX 11g	Channel 1	16.317	15.367	500
	Channel 6	16.317	15.519	500
	Channel 11	16.317	15.267	500
TX 11n HT20	Channel 1	17.407	17.515	500
	Channel 6	17.407	17.515	500
	Channel 11	17.407	17.515	500
TX 11n HT40	Channel 3	35.460	35.784	500
	Channel 6	35.330	35.784	500
	Channel 9	35.530	35.784	500

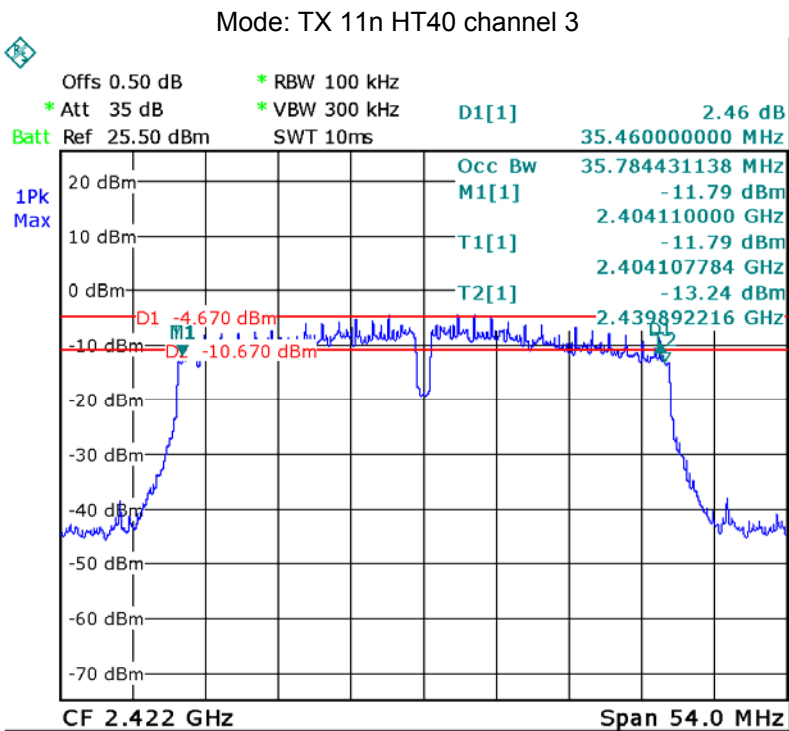
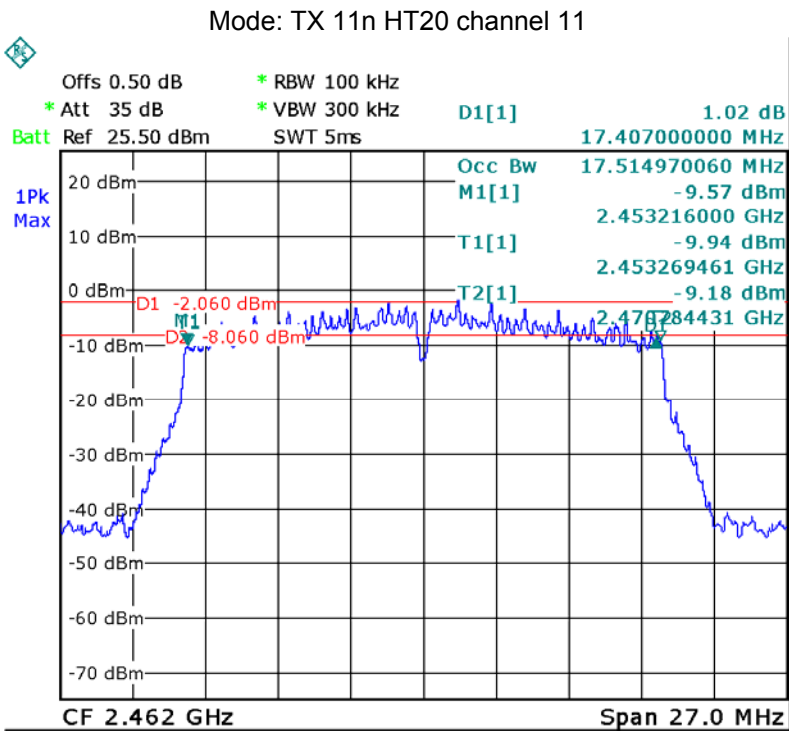
Test result plot:

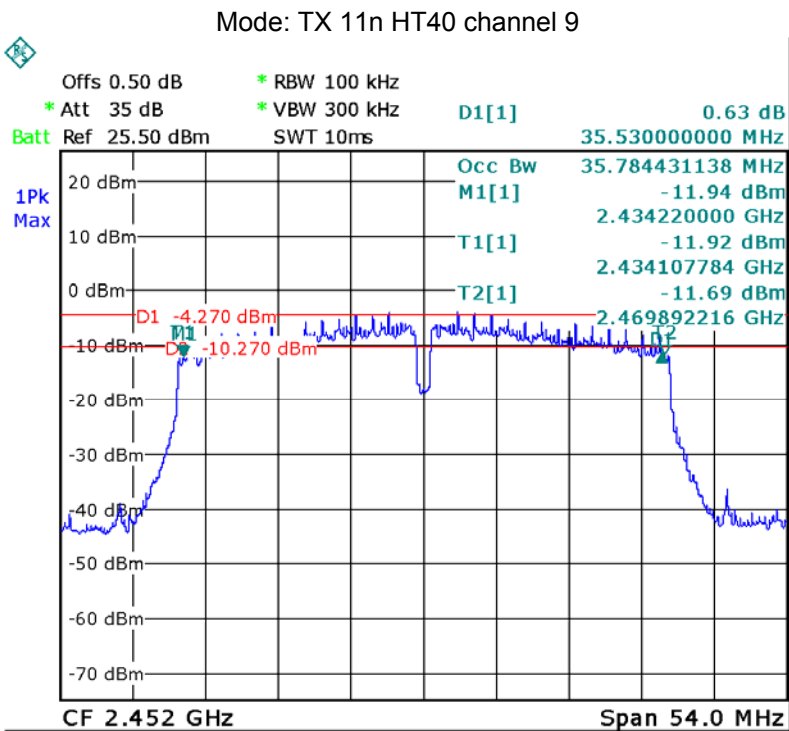
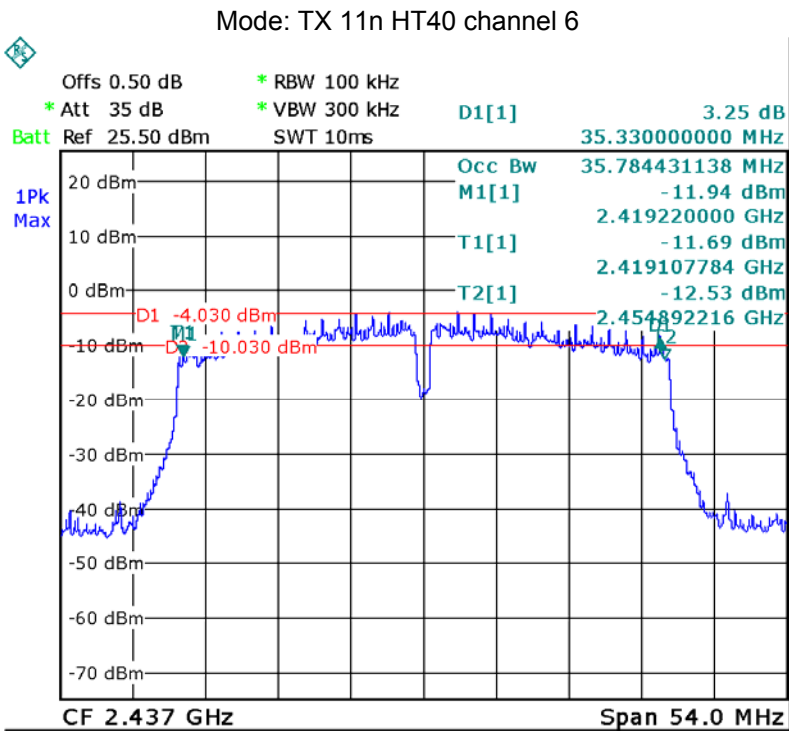












13 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017

13.1 Test Procedure:

KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017

section 9.1.1 (For BLE)

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

- a) Set the $RBW \geq DTS \text{ bandwidth}$.
- b) Set $VBW \geq 3 \times RBW$.
- c) Set $span \geq 3 \times RBW$
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

section 9.1.2 (For WIFI)

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

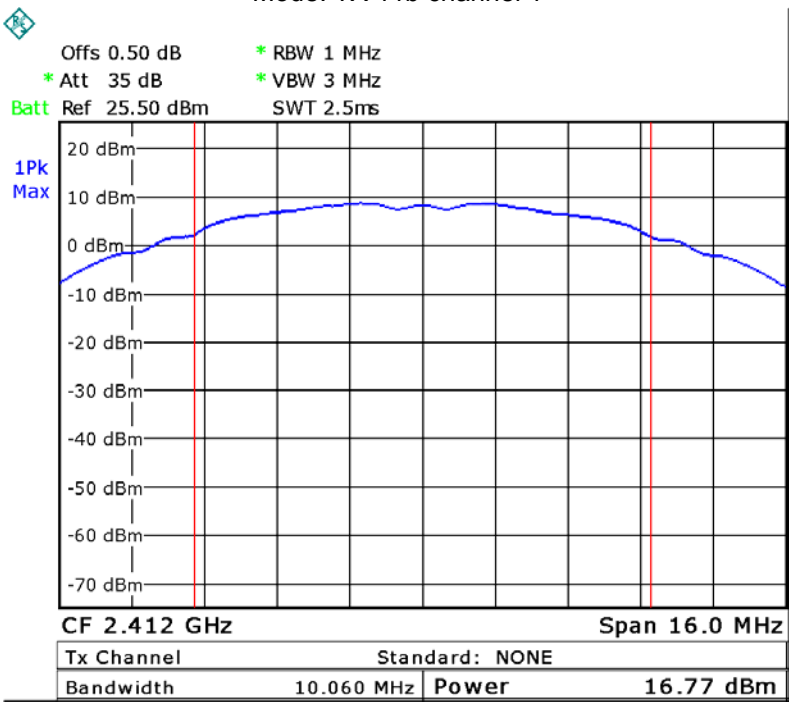
- a) Set the $RBW = 1 \text{ MHz}$.
- b) Set the $VBW \geq 3 \times RBW$
- c) Set the $span \geq 1.5 \times DTS \text{ bandwidth}$.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

13.2 Test Result:

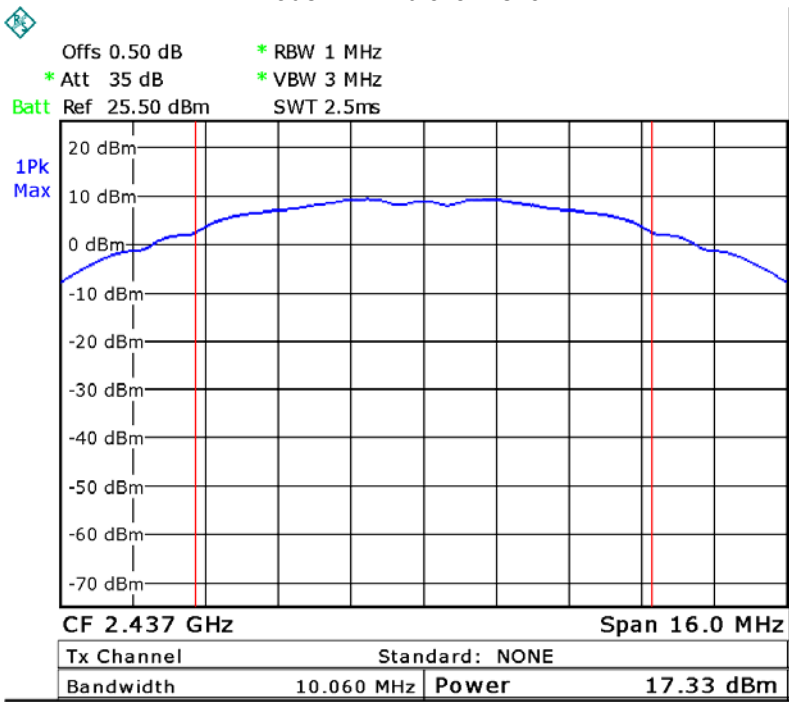
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	16.77	1W/30dBm
	Middle-2437	17.33	1W/30dBm
	High-2462	17.09	1W/30dBm
TX 11g	Low-2412	17.31	1W/30dBm
	Middle-2437	17.70	1W/30dBm
	High-2462	17.55	1W/30dBm
TX 11n HT20	Low-2412	17.10	1W/30dBm
	Middle-2437	17.39	1W/30dBm
	High-2462	17.03	1W/30dBm
TX 11n HT40	Low-2422	17.06	1W/30dBm
	Middle-2437	17.08	1W/30dBm
	High-2452	17.21	1W/30dBm

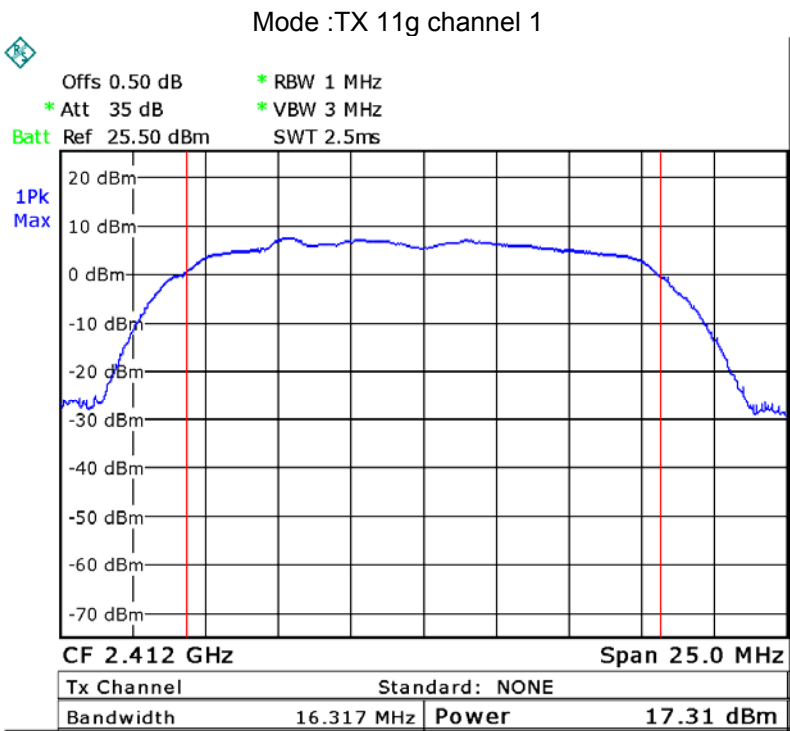
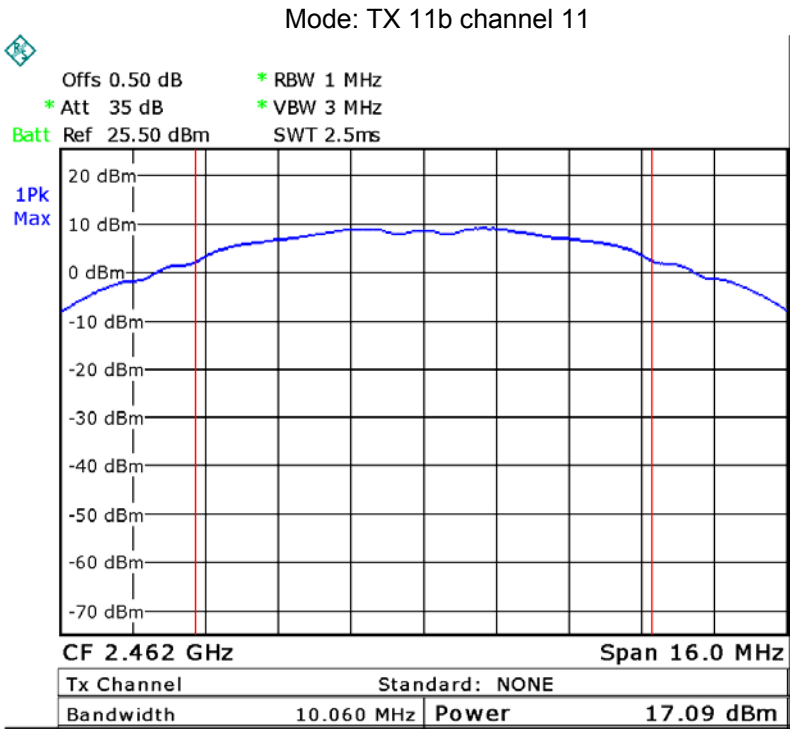
Test Plot

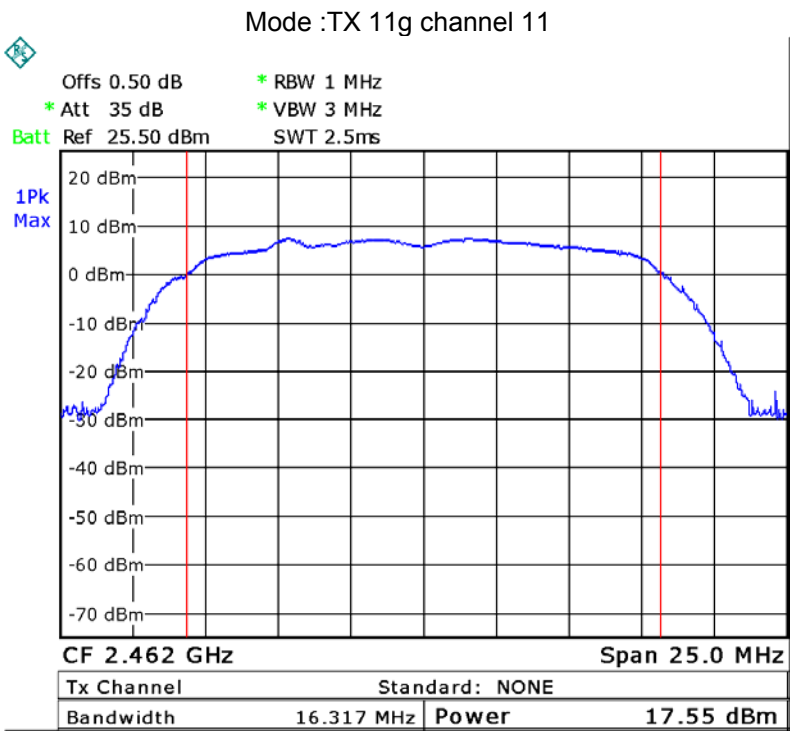
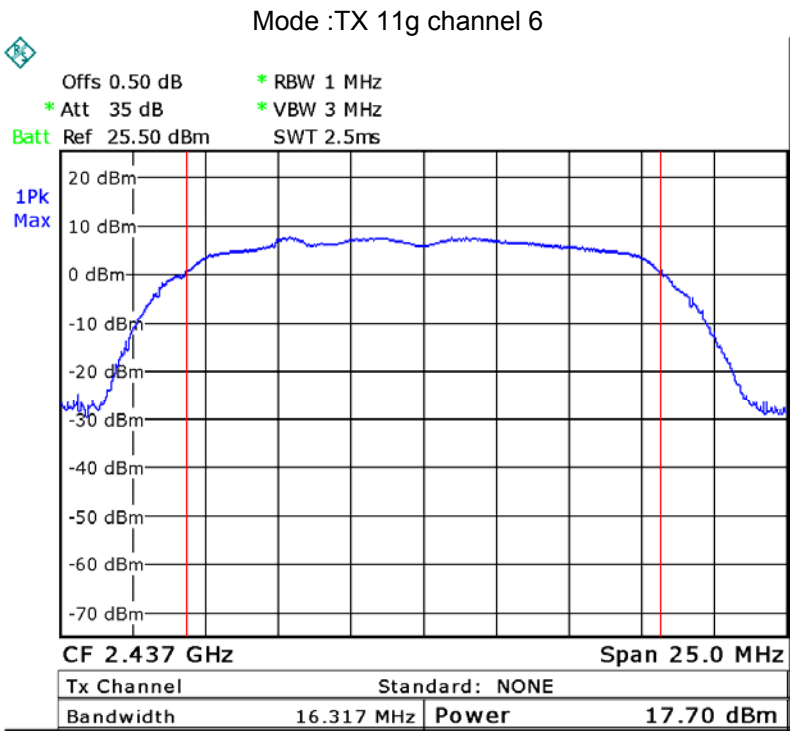
Mode: TX 11b channel 1

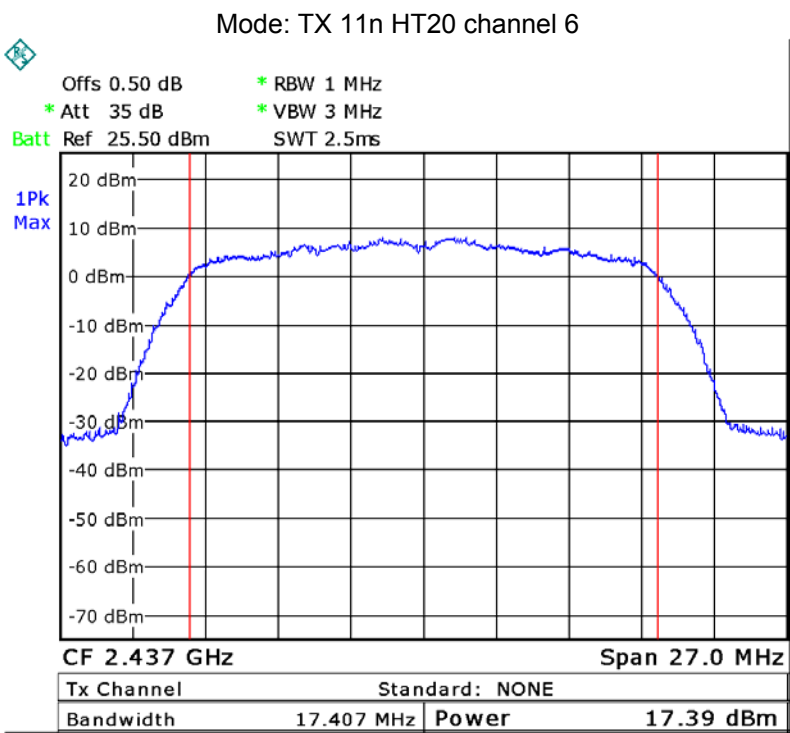
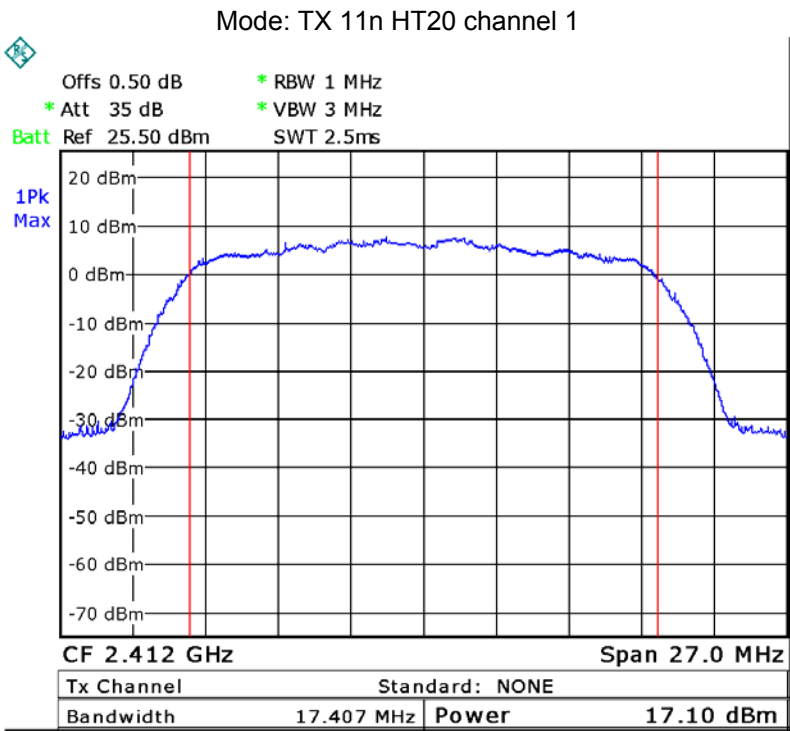


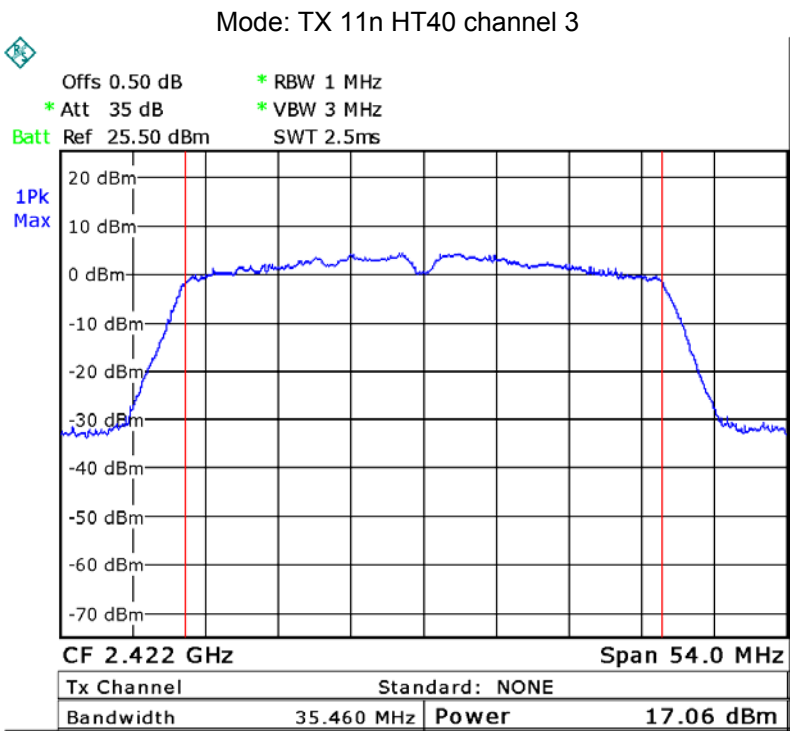
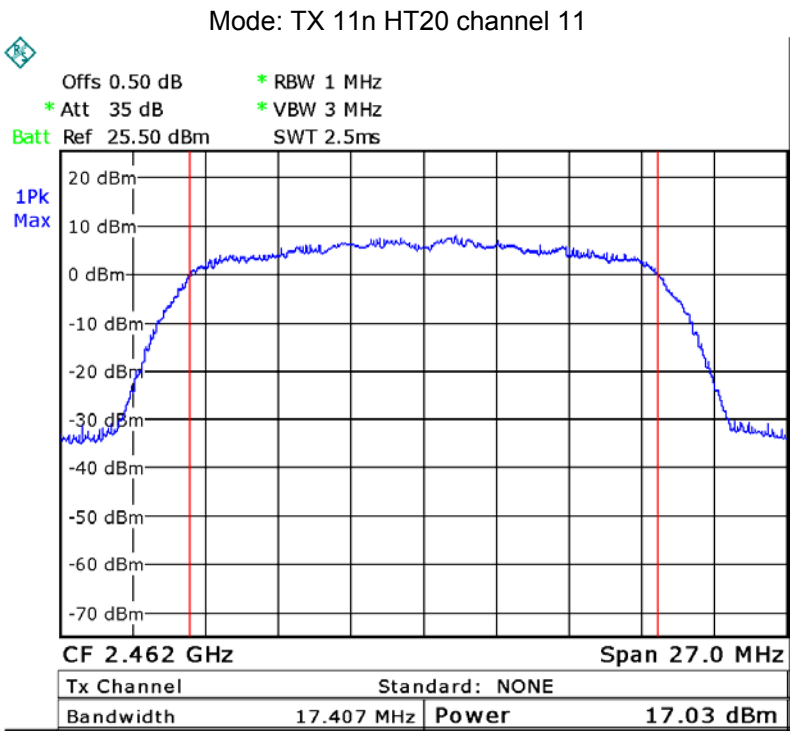
Mode: TX 11b channel 6

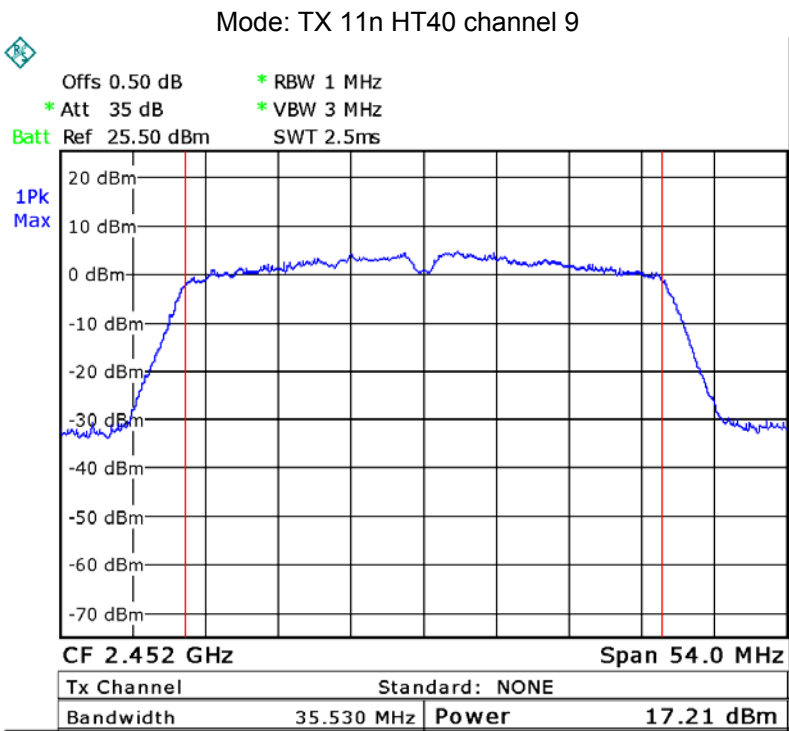
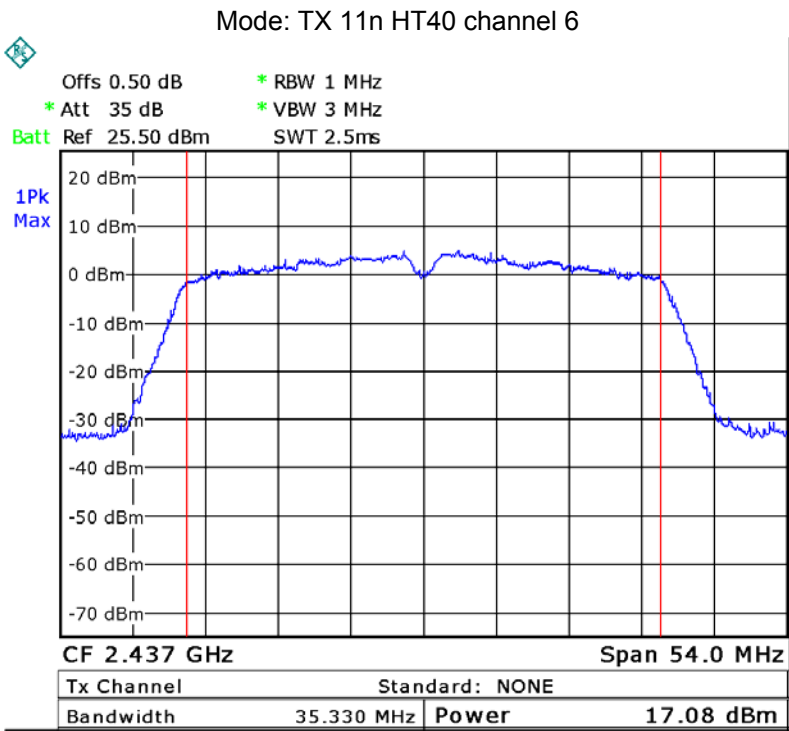












14 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017

14.1 Test Procedure:

KDB 558074 D01 DTS Meas Guidance v04 April 5, 2017 section 10.2

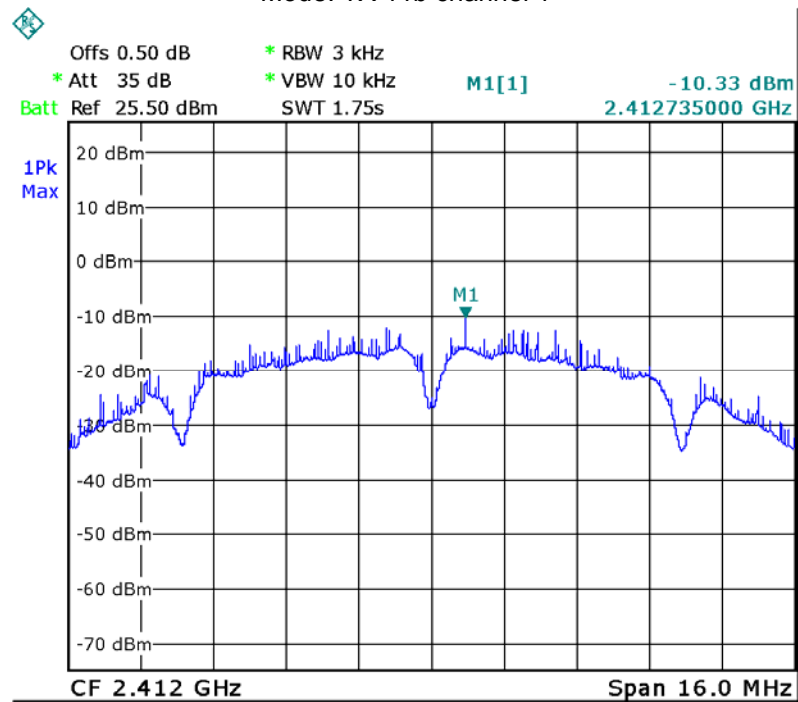
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

14.2 Test Result:

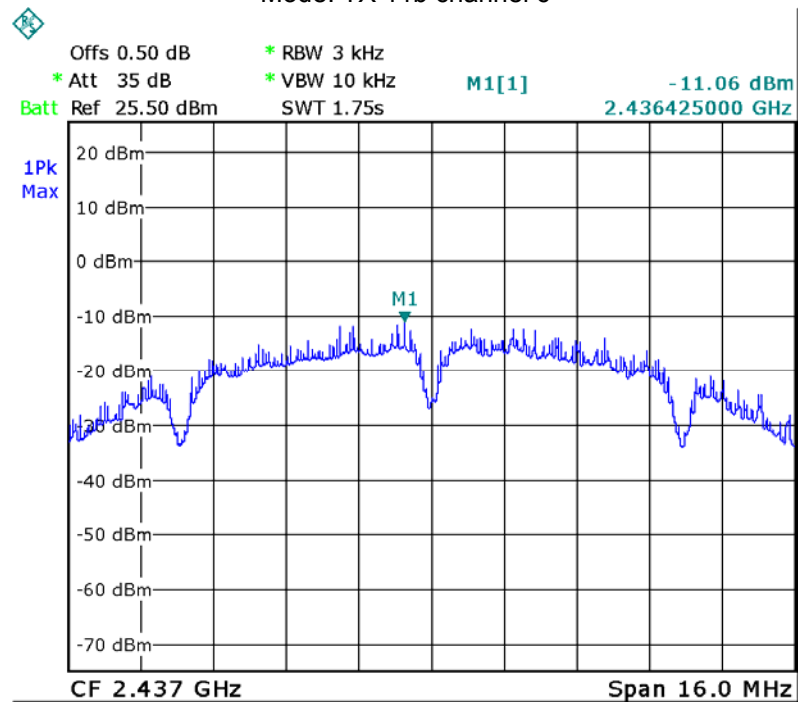
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-10.33	8dBm per 3kHz
	Middle-2437	-11.06	8dBm per 3kHz
	High-2462	-10.10	8dBm per 3kHz
TX 11g	Low-2412	-18.26	8dBm per 3kHz
	Middle-2437	-17.69	8dBm per 3kHz
	High-2462	-17.15	8dBm per 3kHz
TX 11n HT20	Low-2412	-17.51	8dBm per 3kHz
	Middle-2437	-18.46	8dBm per 3kHz
	High-2462	-17.91	8dBm per 3kHz
TX 11n HT40	Low-2422	-21.95	8dBm per 3kHz
	Middle-2437	-21.61	8dBm per 3kHz
	High-2452	-21.98	8dBm per 3kHz

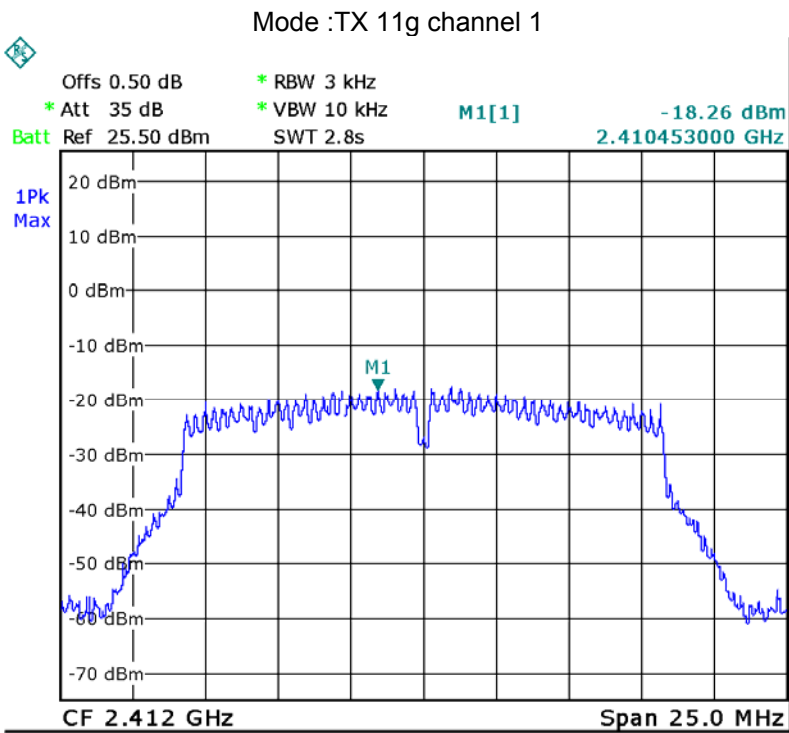
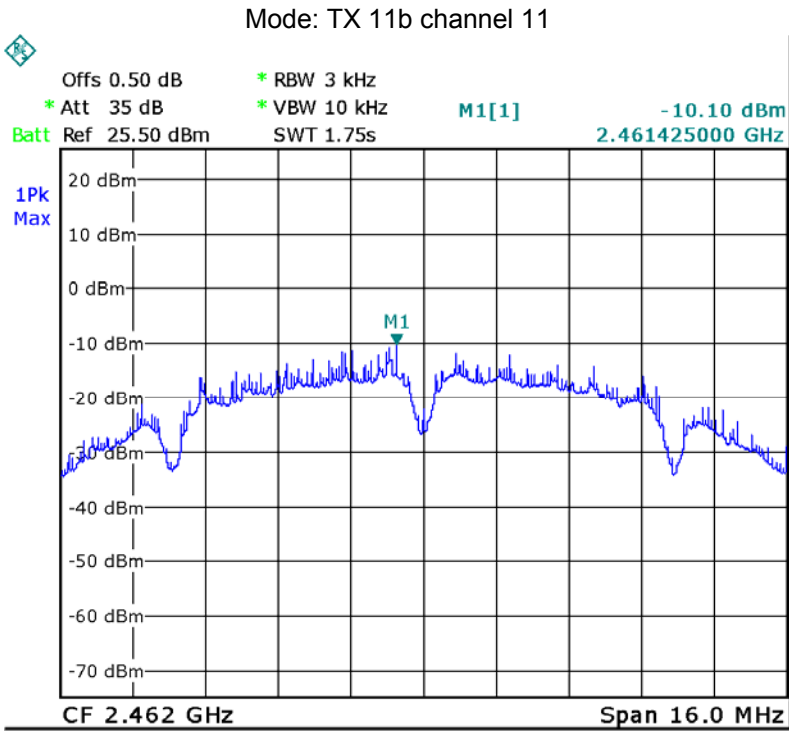
Test Plot

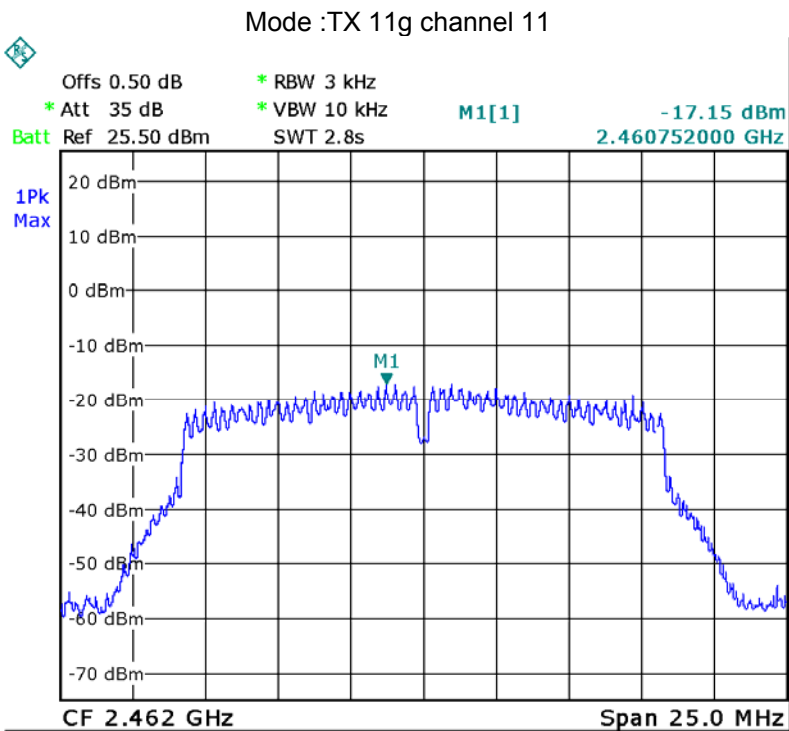
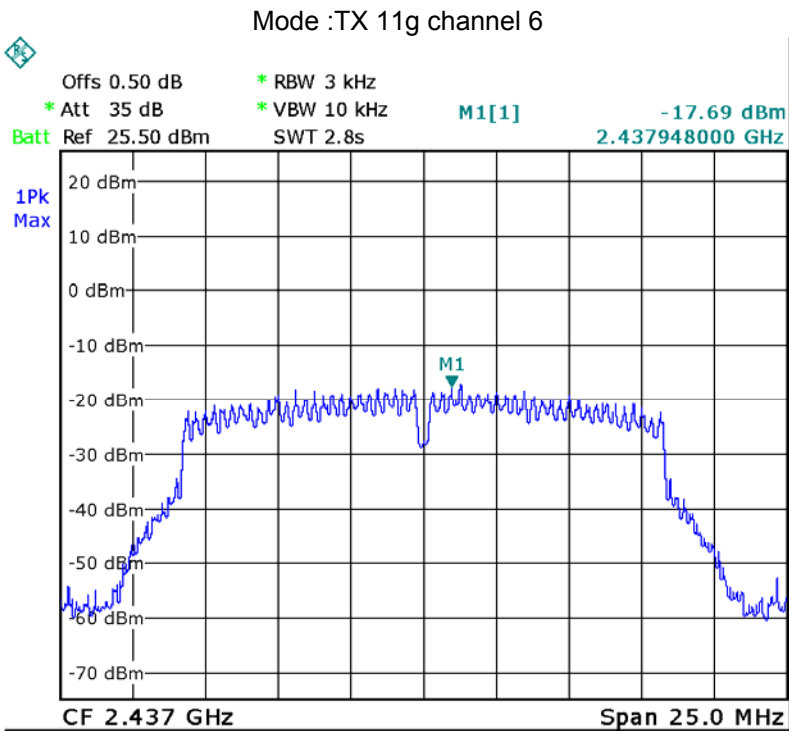
Mode: TX 11b channel 1

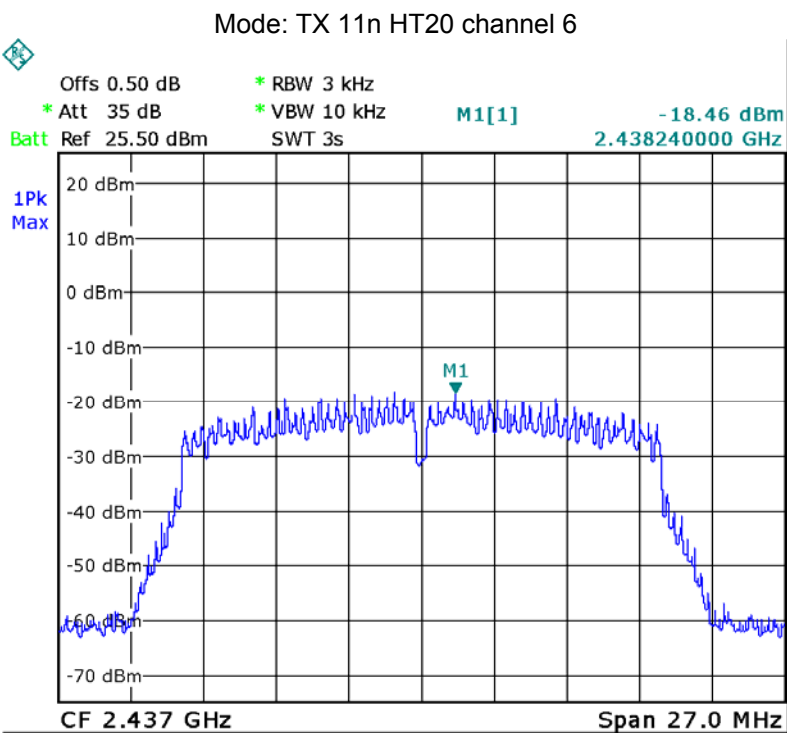
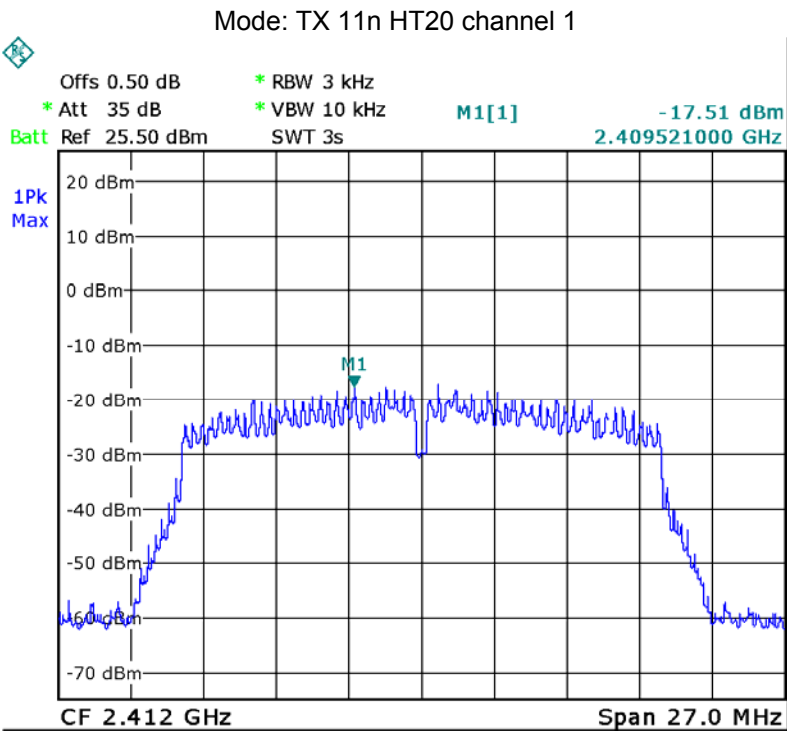


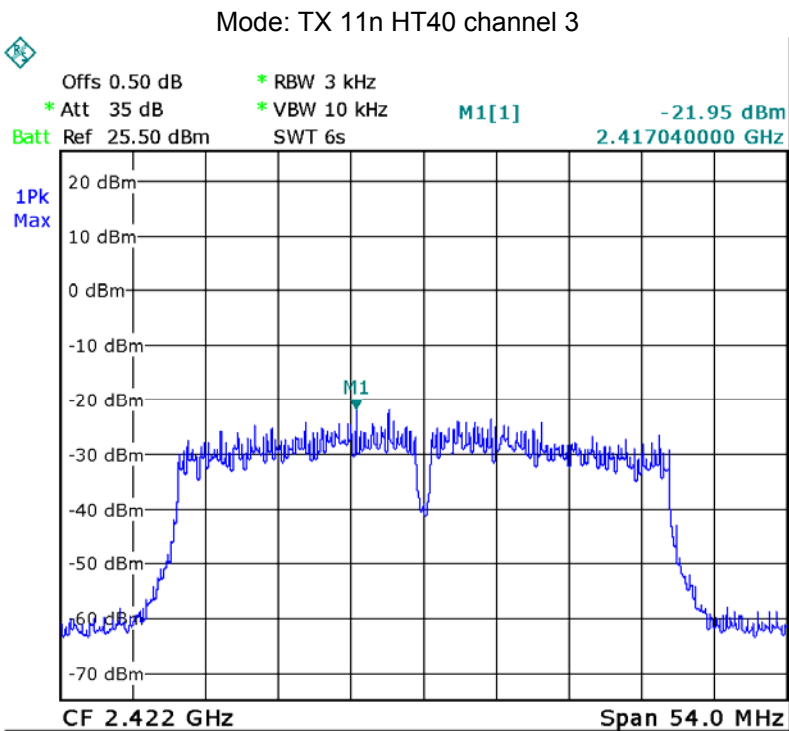
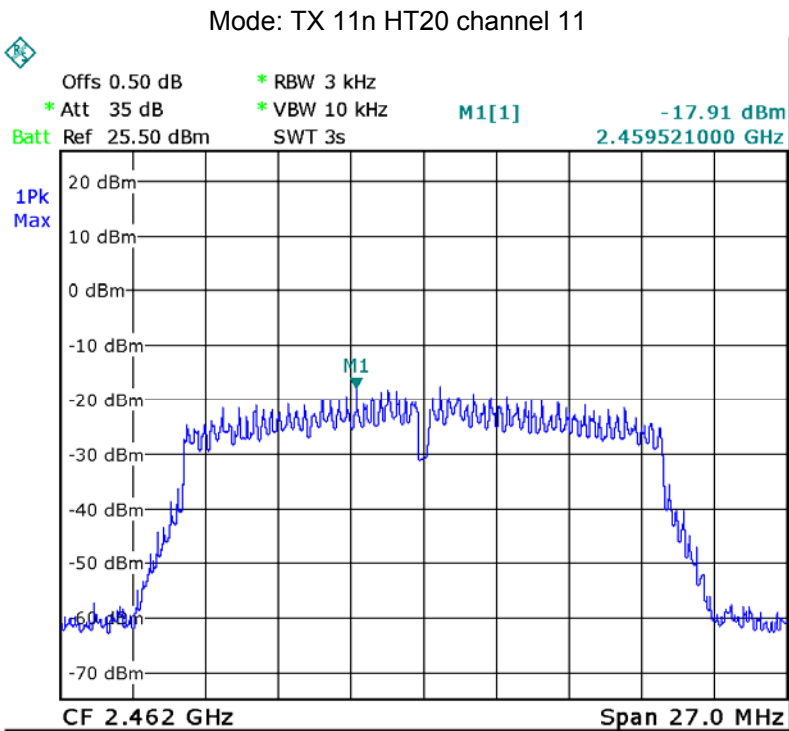
Mode: TX 11b channel 6

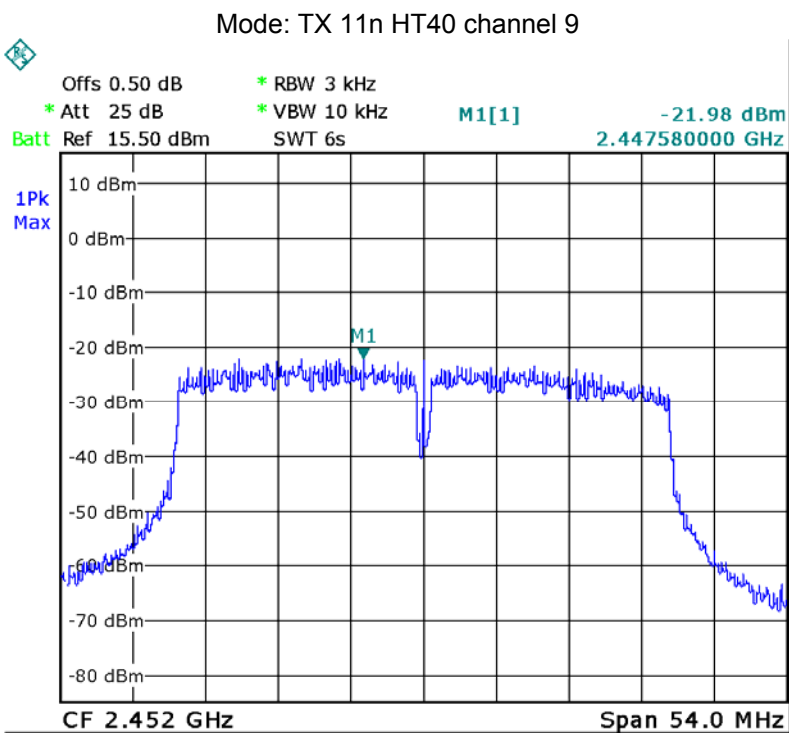
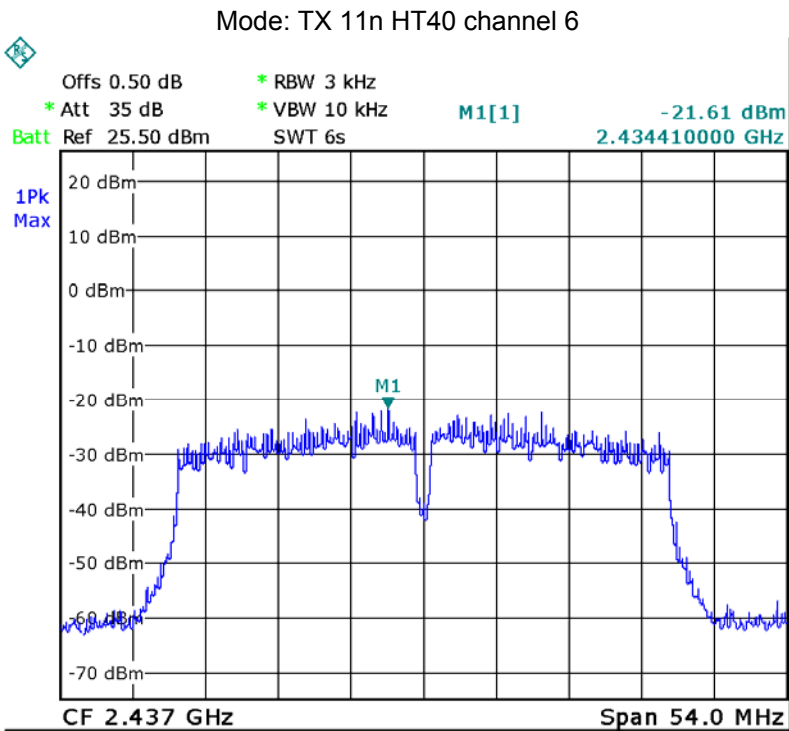












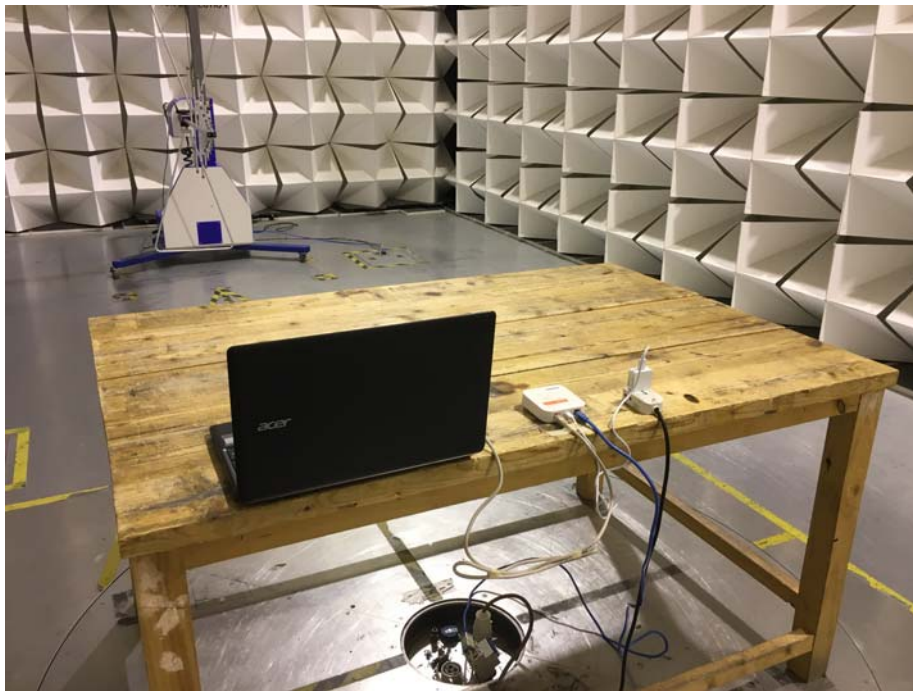
15 Antenna Requirement

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.

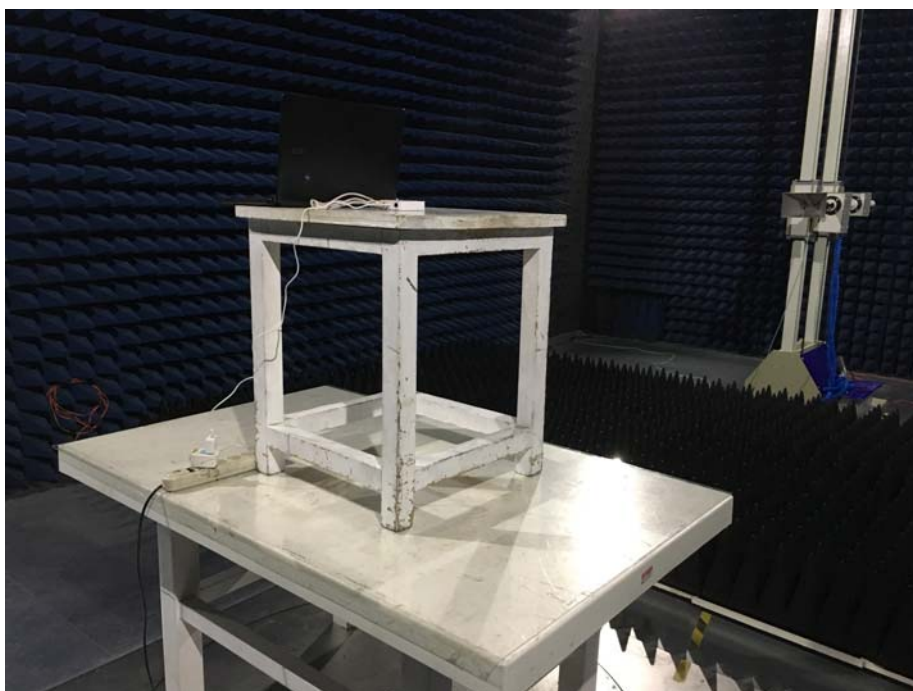
16 Photographs of Test Setup

16.1 Radiated Emissions Test Setup - Model RG4100+

From 30MHz-1000MHz



Above 1GHz



16.2 Conducted Emission - Model RG4100+



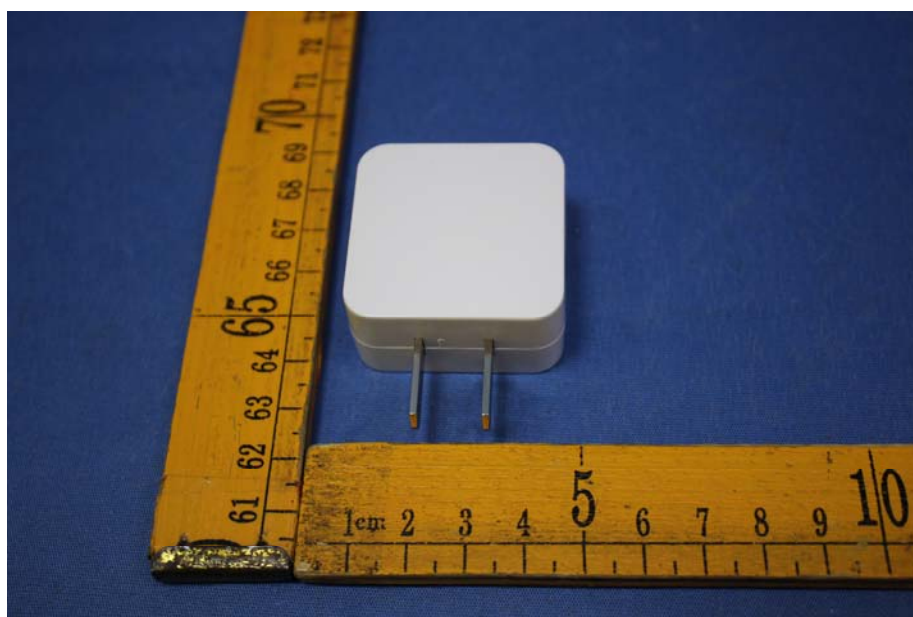
17 Photographs - Constructional Details

17.1 External Photos - Model RG4100+









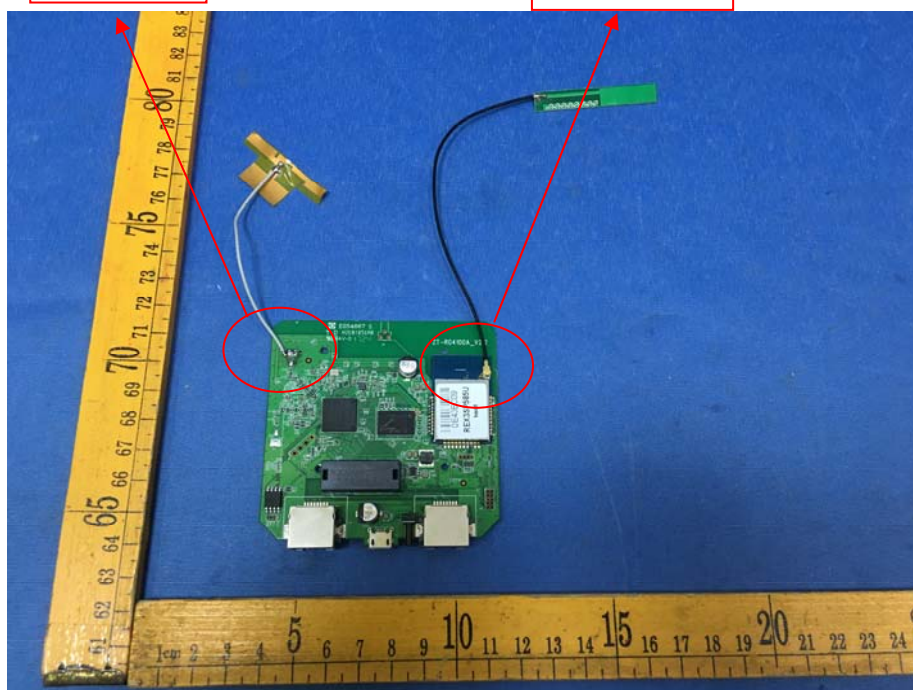


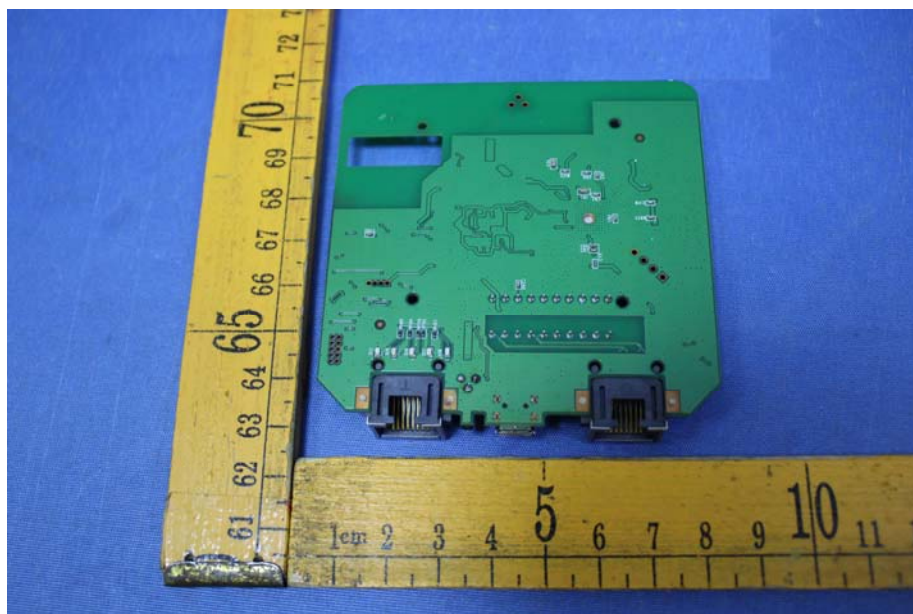
17.2 Internal Photos - Model: RG4100+



WIFI ANT.

Zigbee ANT.





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