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:
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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

TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0886317-1E	2017-08-01	2017-11-17 to 2017-11-25	2017-11-28	original	-	Replaced
WTS17S0886317-1E 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	± 1 x 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

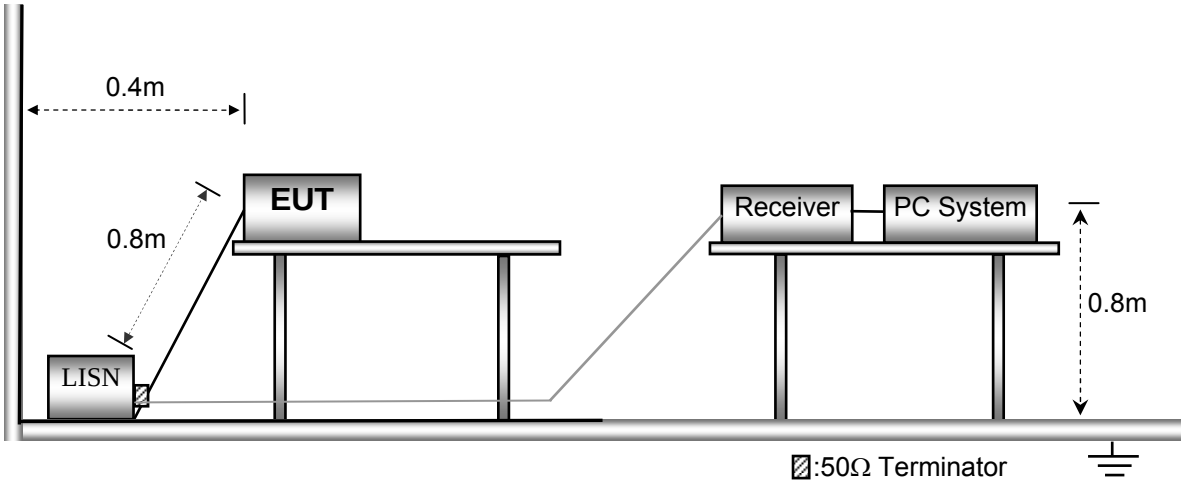
Atmospheric Pressure: 101.2kPa

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

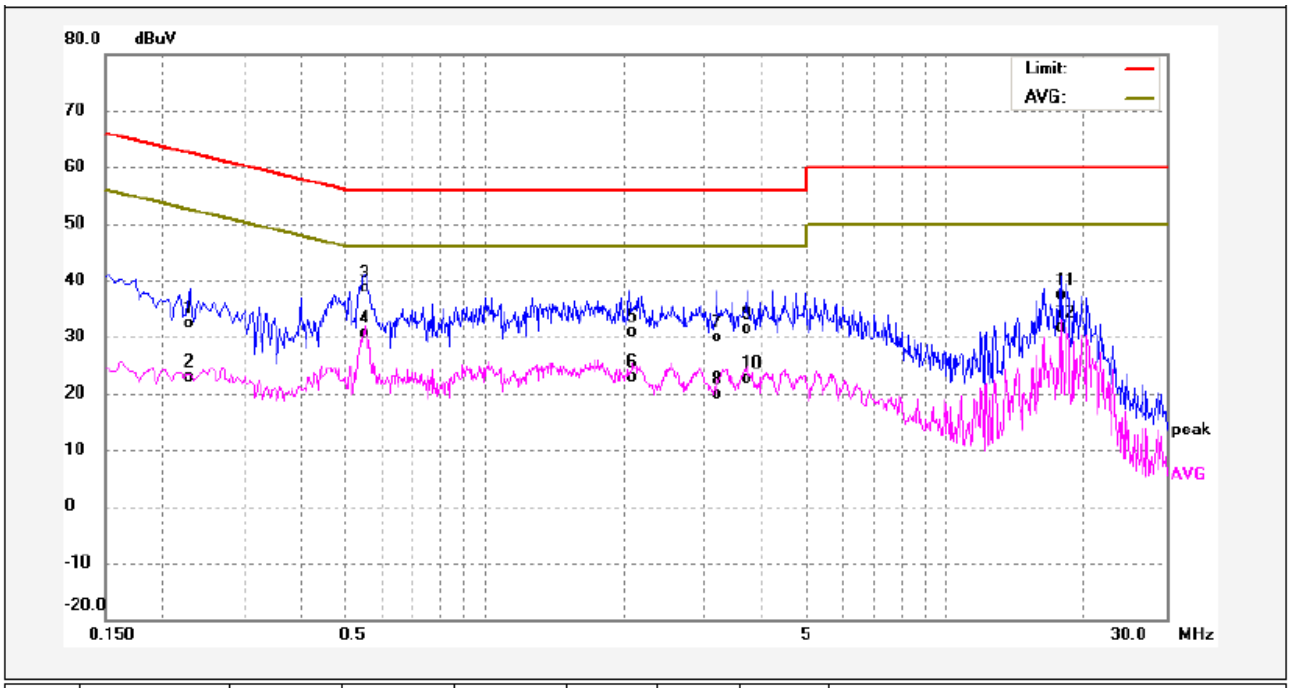
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

8.4 Conducted Emission Test Result

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

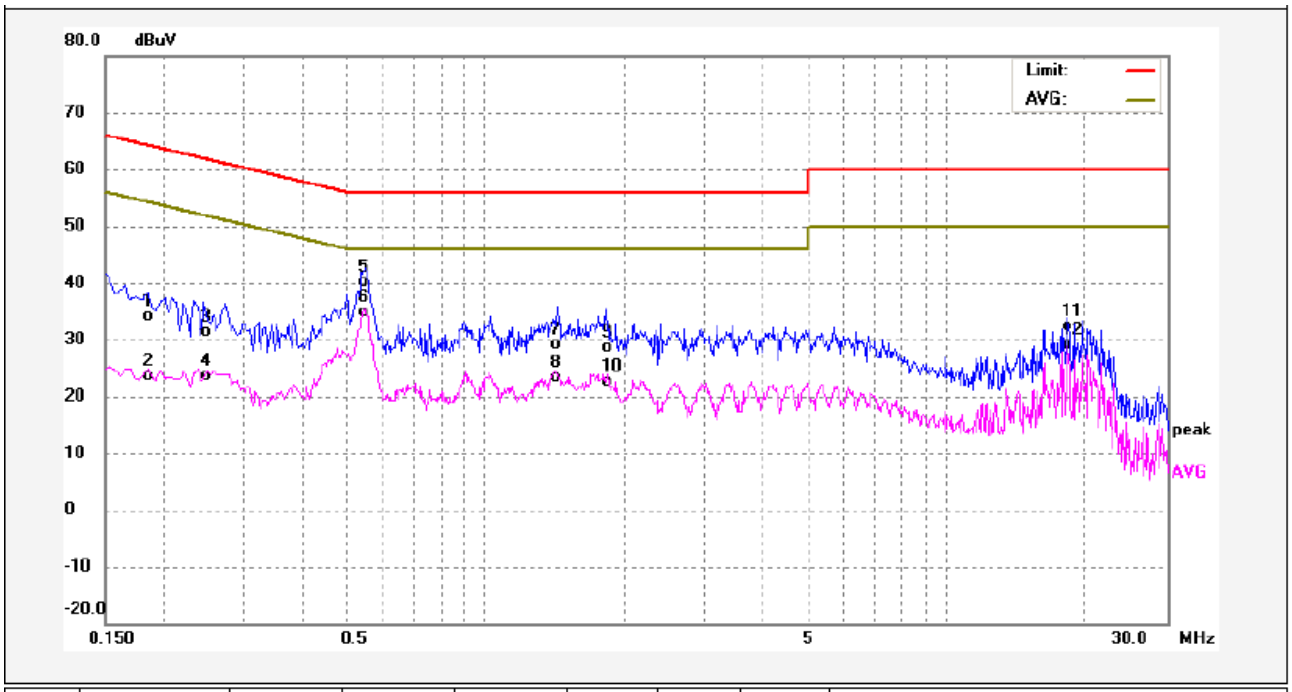
Worst Mode: WIFI mode (802.11b mode low channel)

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	

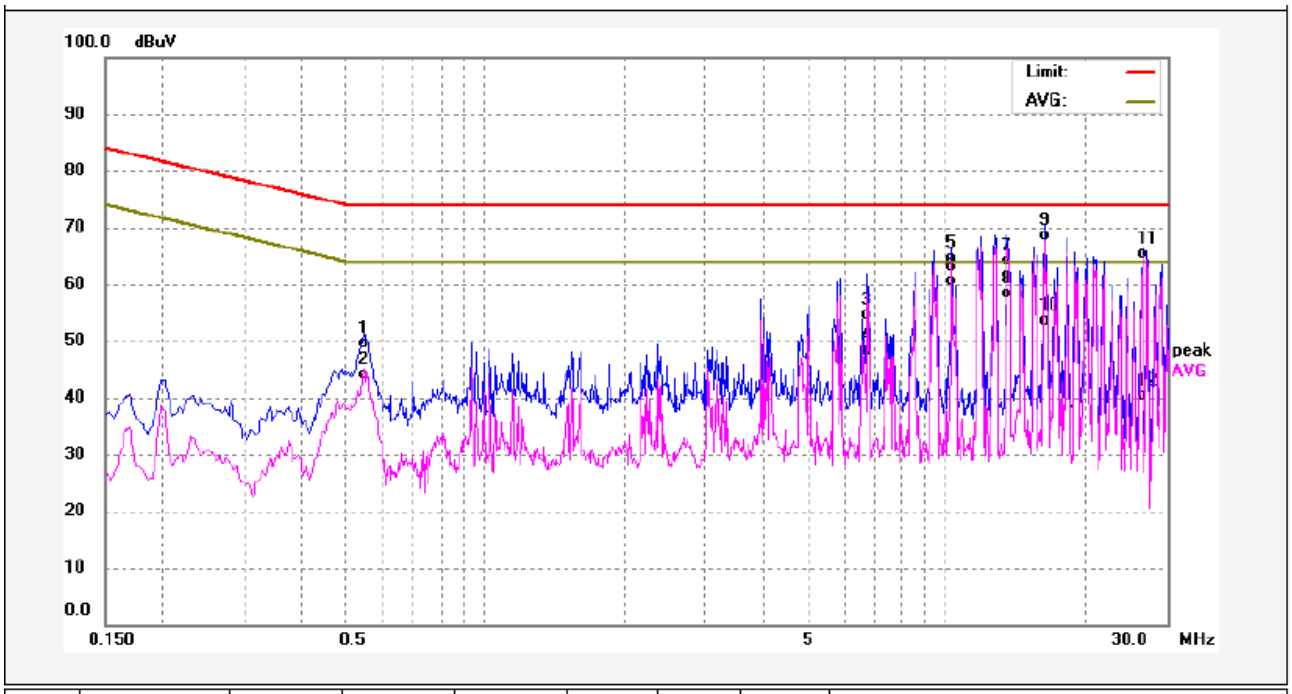
Neutral line:



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

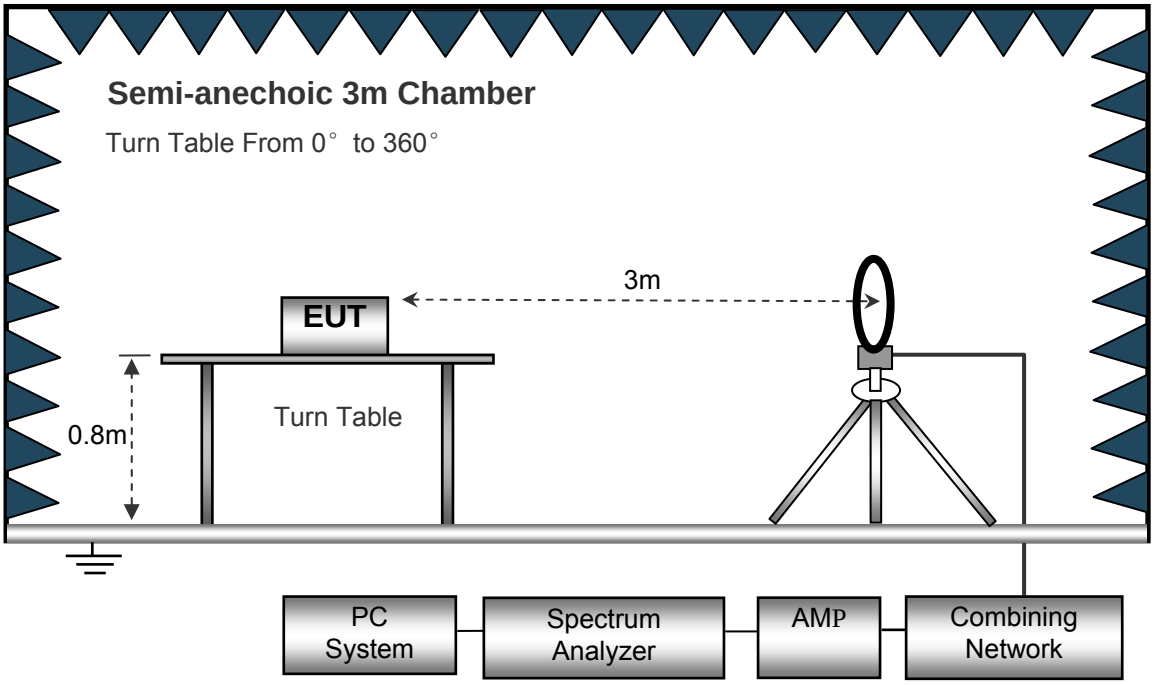
EUT Operation :

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

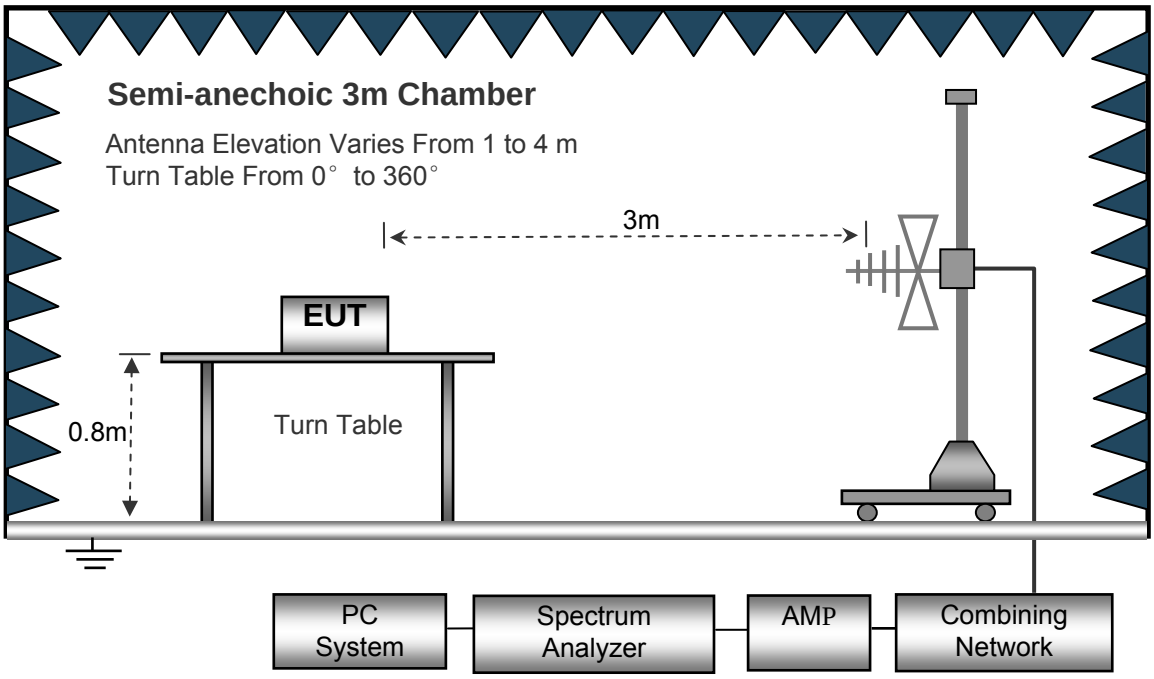
9.2 Test Setup

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

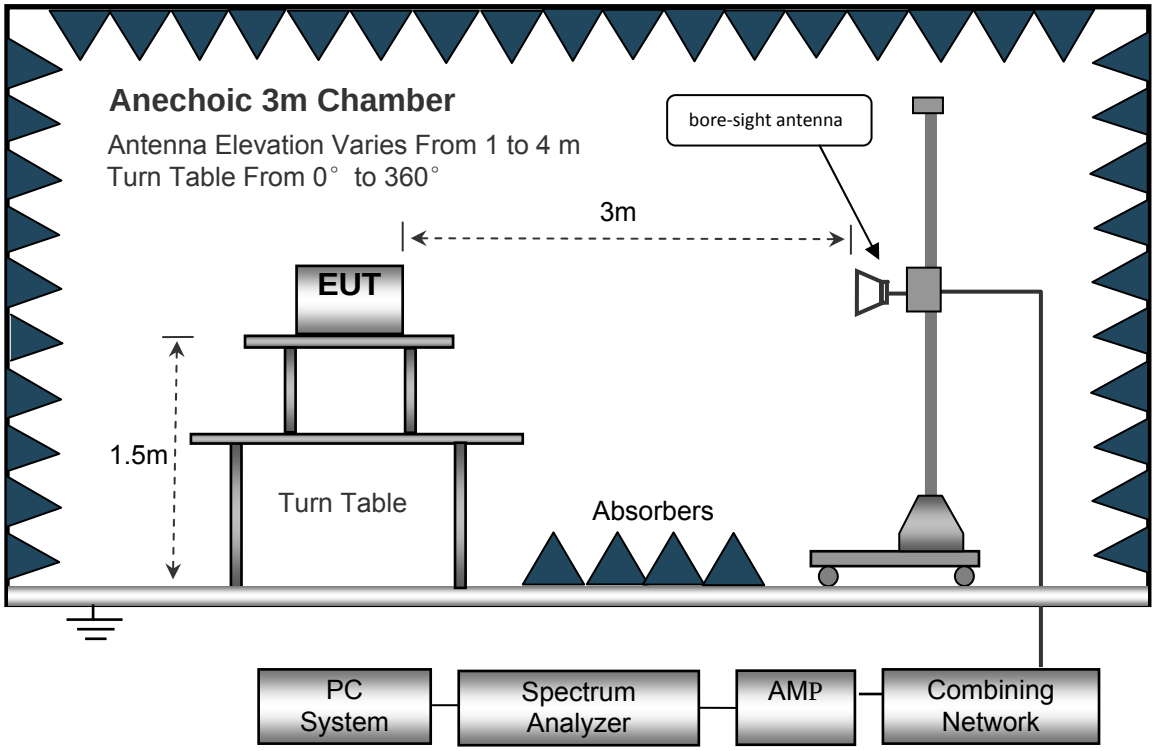
The test setup for emission measurement below 30MHz.



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
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

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

9.4 Test Procedure

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

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

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

Margin = Corr. Ampl. – Limit

9.6 Summary of Test Results

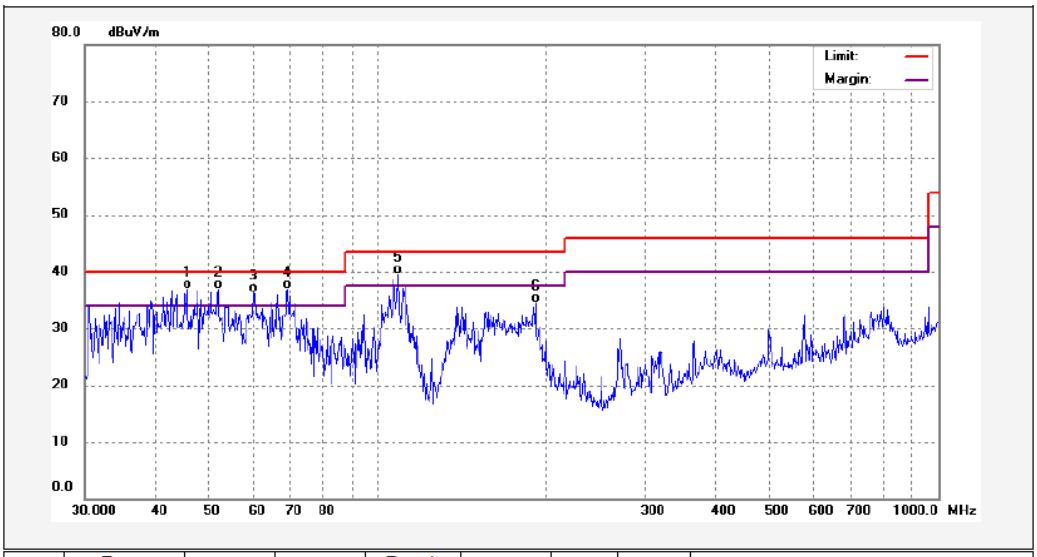
Wifi:
Test Frequency: 9KHz~30MHz

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

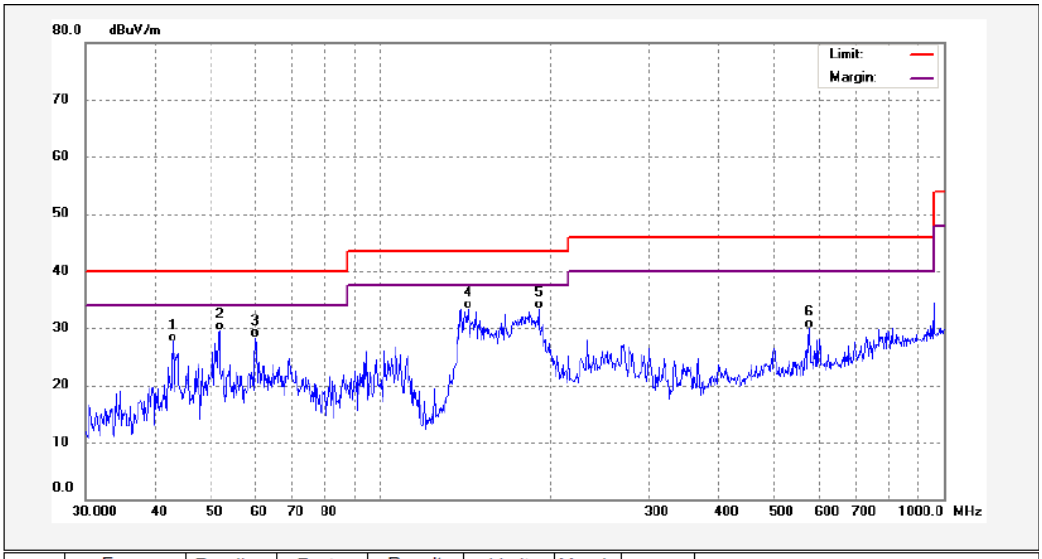
Test Frequency : 30MHz ~ 1GHz Remark: only the worst data (802.11n HT40 mode Low CH) were reported

Low Channel – Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	45.6948	53.40	-16.54	36.86	40.00	-3.14	QP	
2	51.8430	53.75	-16.89	36.86	40.00	-3.14	QP	
3	60.0691	52.93	-16.54	36.39	40.00	-3.61	QP	
4	69.1141	54.92	-18.07	36.85	40.00	-3.15	QP	
5	108.6470	57.45	-18.02	39.43	43.50	-4.07	QP	
6	191.0738	51.39	-16.90	34.49	43.50	-9.01	QP	

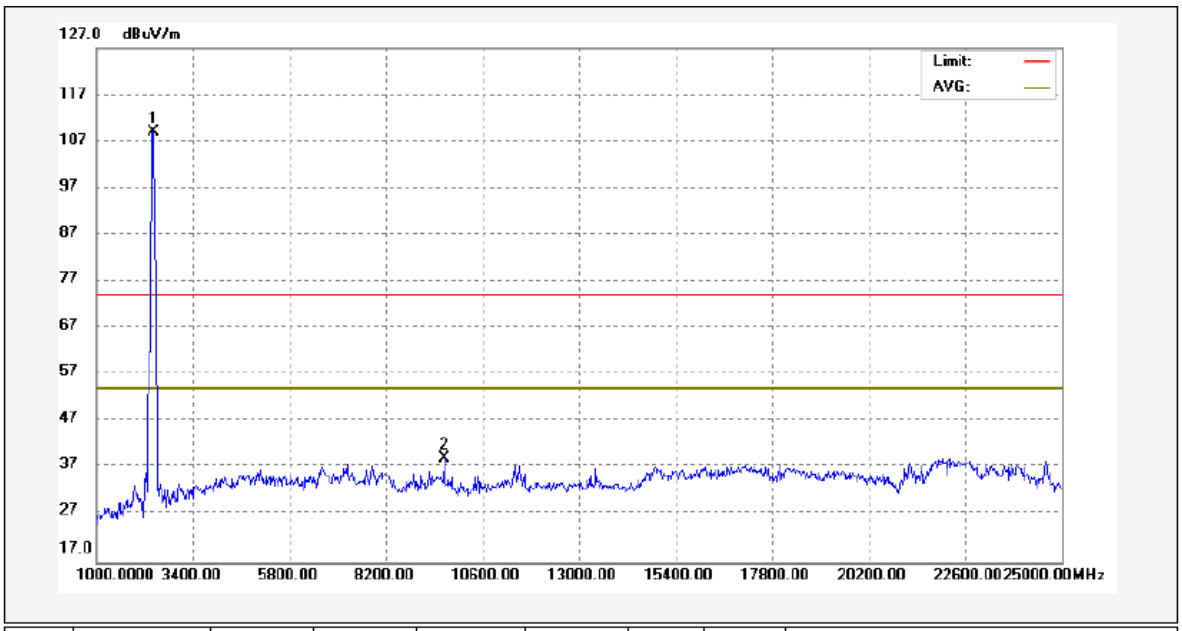
Low Channel – Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	42.8998	44.10	-16.50	27.60	40.00	-12.40	QP	
2	51.8430	46.30	-16.89	29.41	40.00	-10.59	QP	
3	60.0691	44.80	-16.54	28.26	40.00	-11.74	QP	
4	143.3261	48.42	-15.13	33.29	43.50	-10.21	QP	
5	191.0738	50.20	-16.90	33.30	43.50	-10.20	QP	
6	576.6443	37.52	-7.52	30.00	46.00	-16.00	QP	

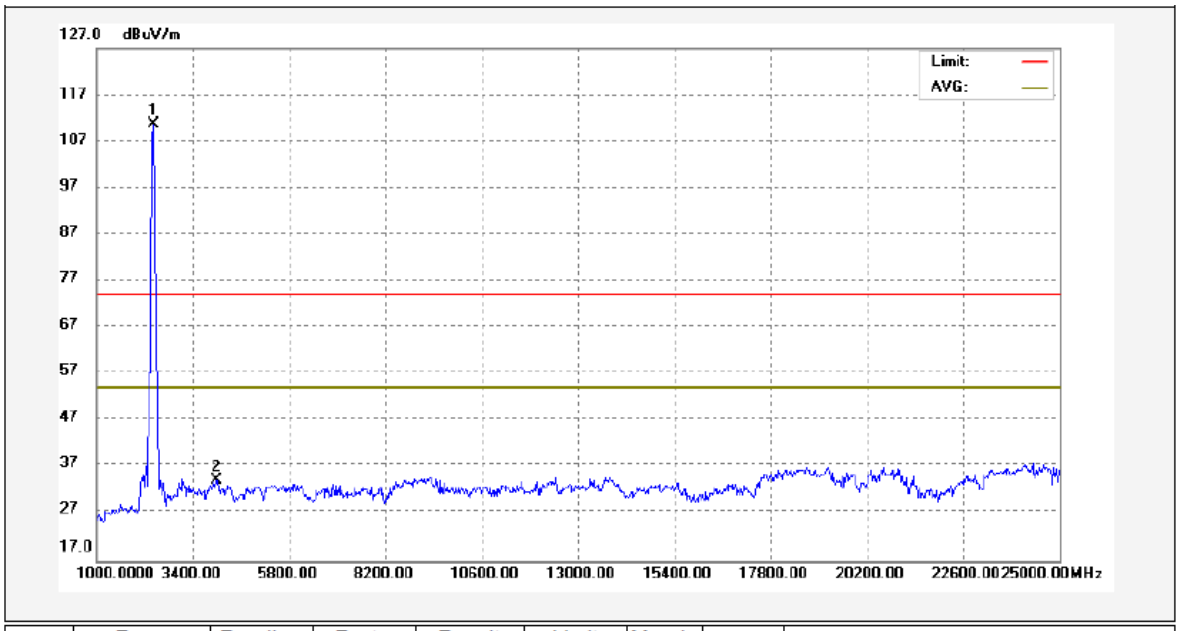
Test Frequency : Above 1GHz Remark: only the worst data (802.11b mode Low CH) were reported

Low Channel – Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2413.450	124.35	-15.26	109.09				
2	9640.000	36.36	2.78	39.14				

Low Channel – Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2414.250	125.84	-15.25	110.59				
2	3976.000	41.12	-6.90	34.22				

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:

Blow 30MHz:

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

Detector function = peak, Trace = max hold

Above 30MHz:

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

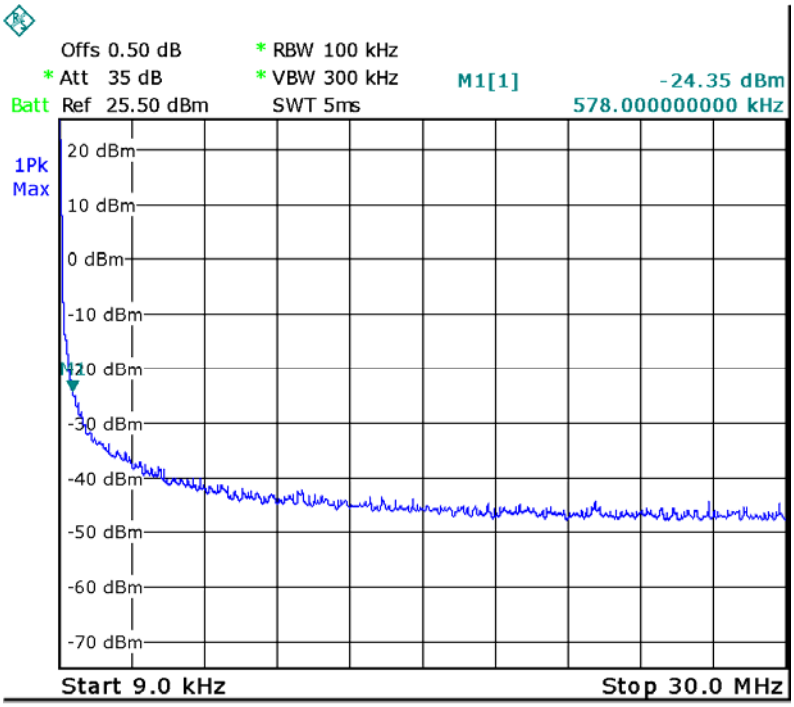
Detector function = peak, Trace = max hold

10.2 Test Result

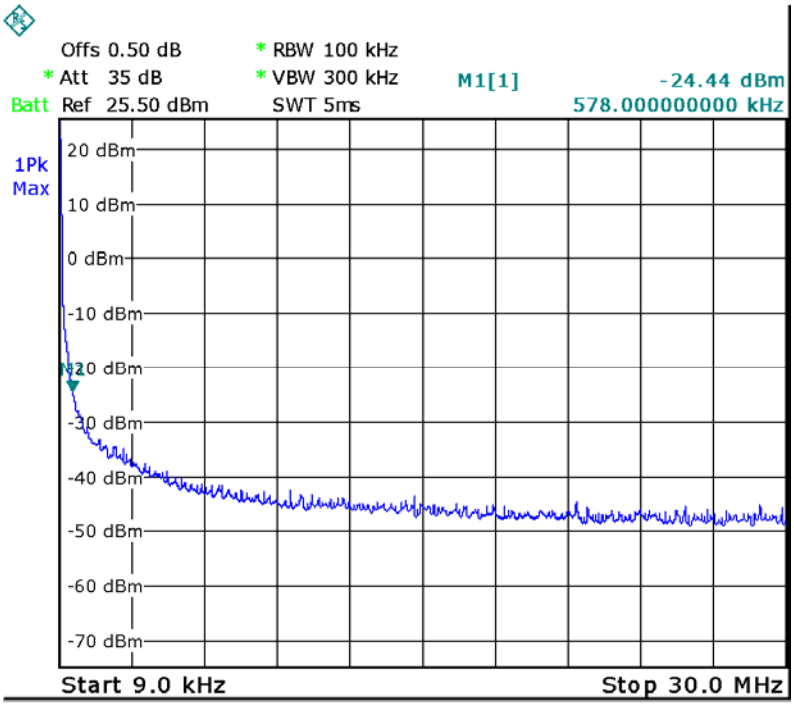
9KHz – 30MHz

802.11b

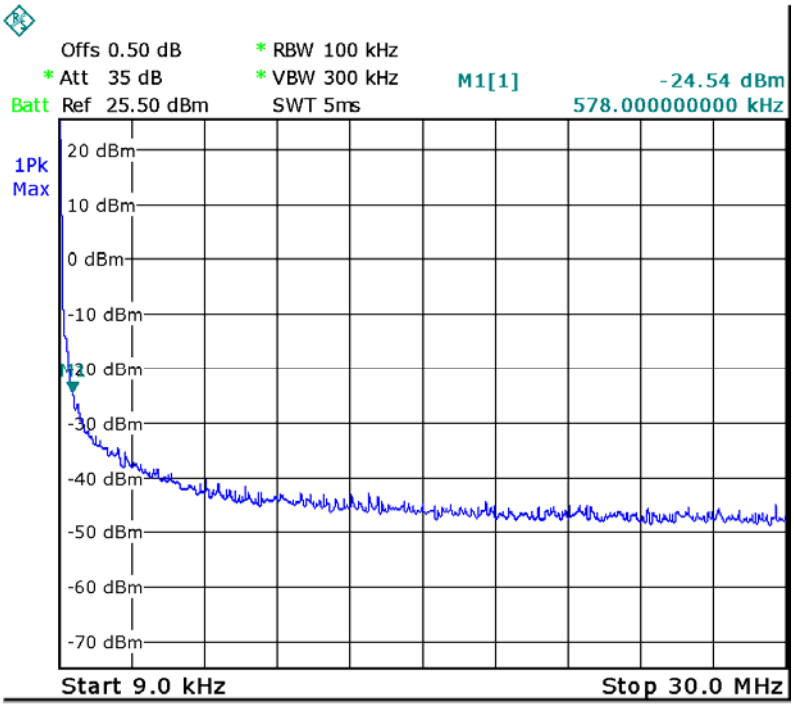
Low Channel



Middle Channel

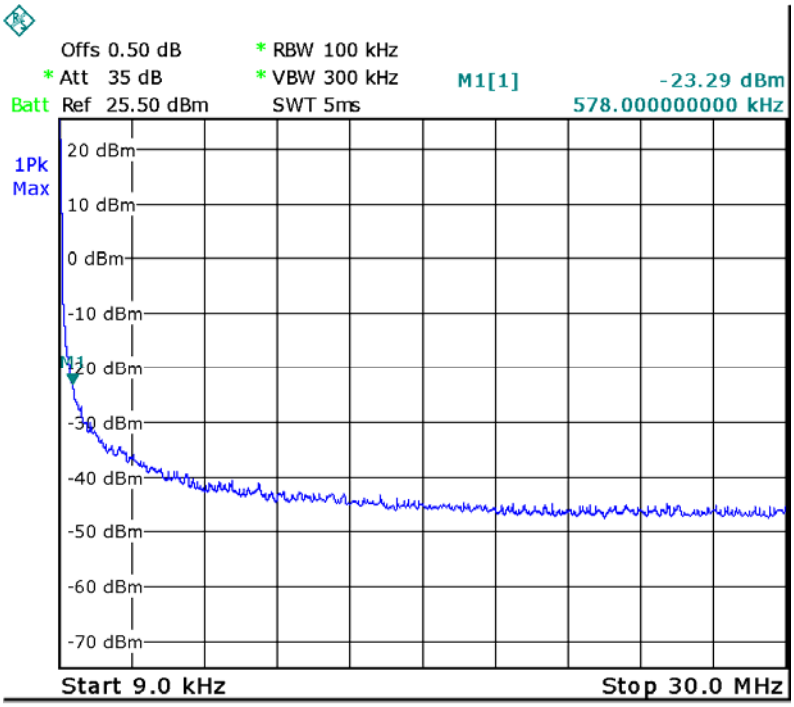


High Channel

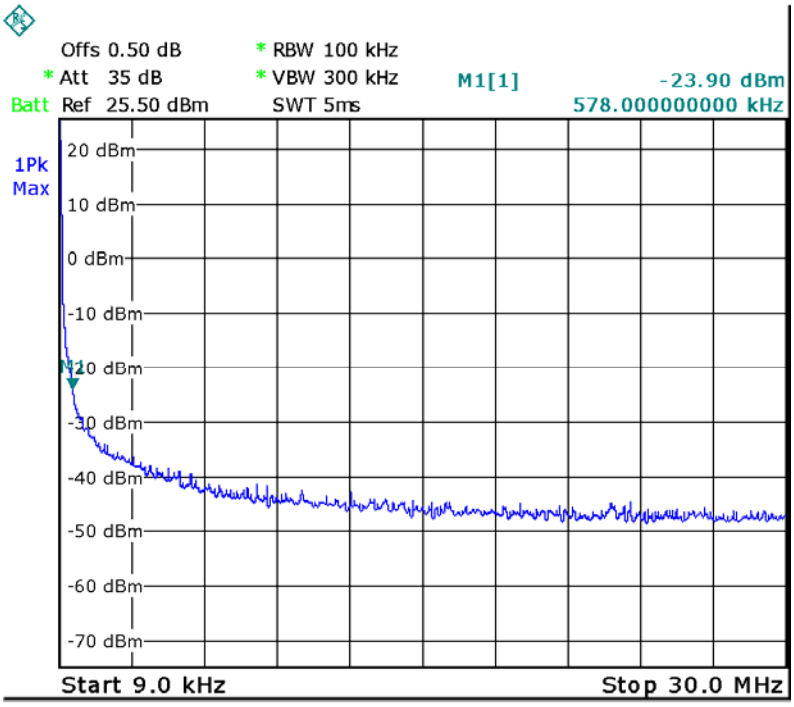


802.11g

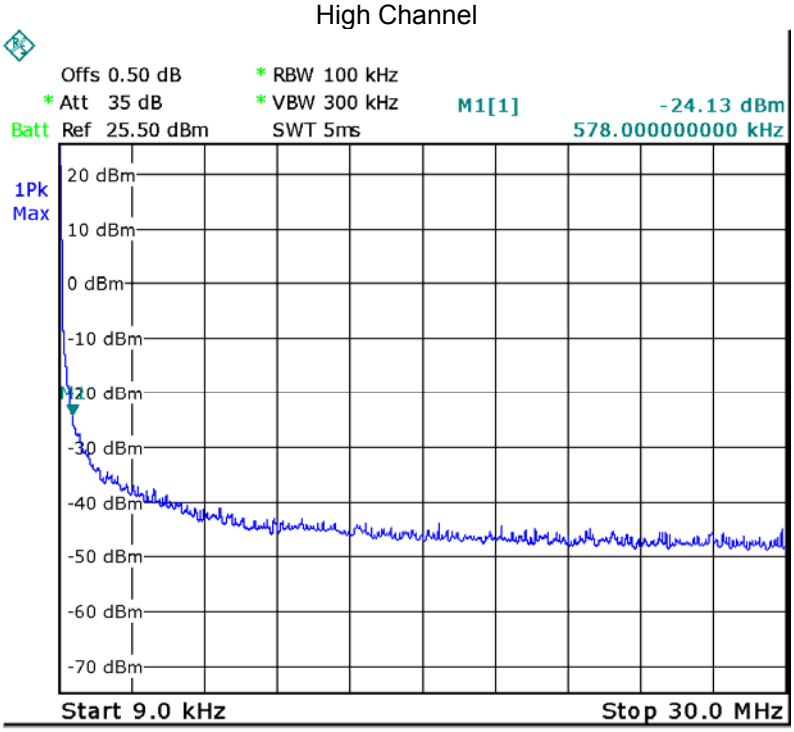
Low Channel



Middle Channel

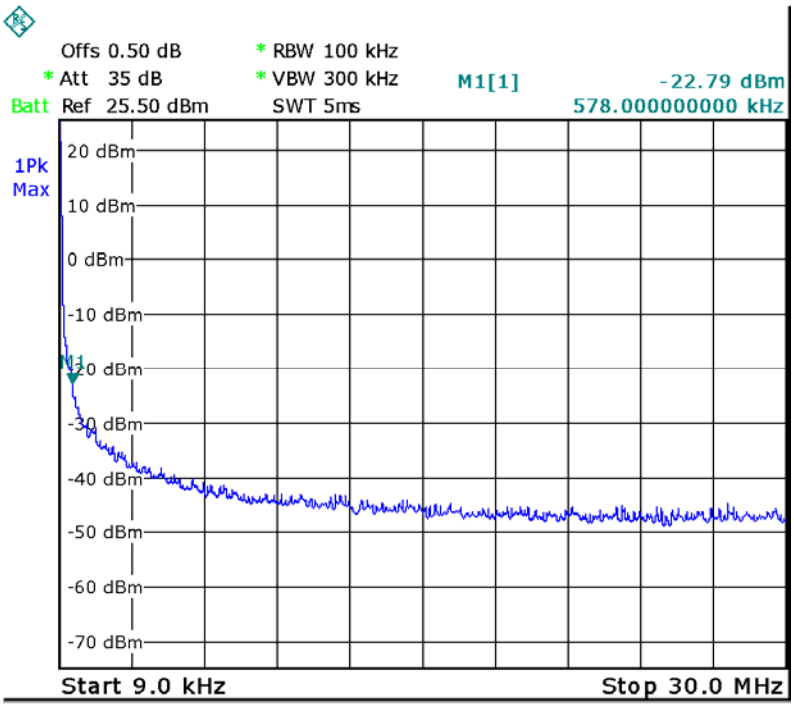


High Channel

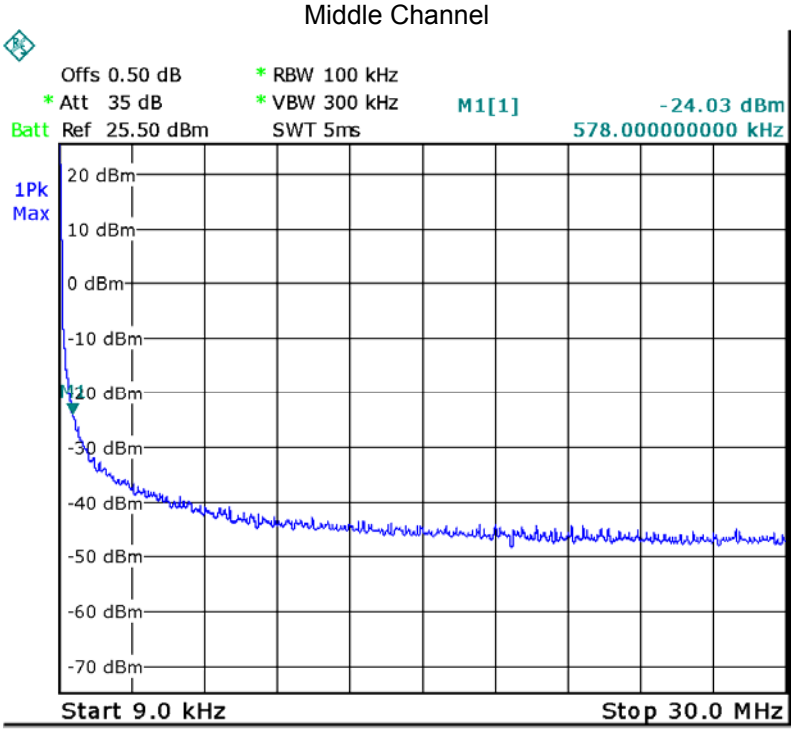


802.11n HT20

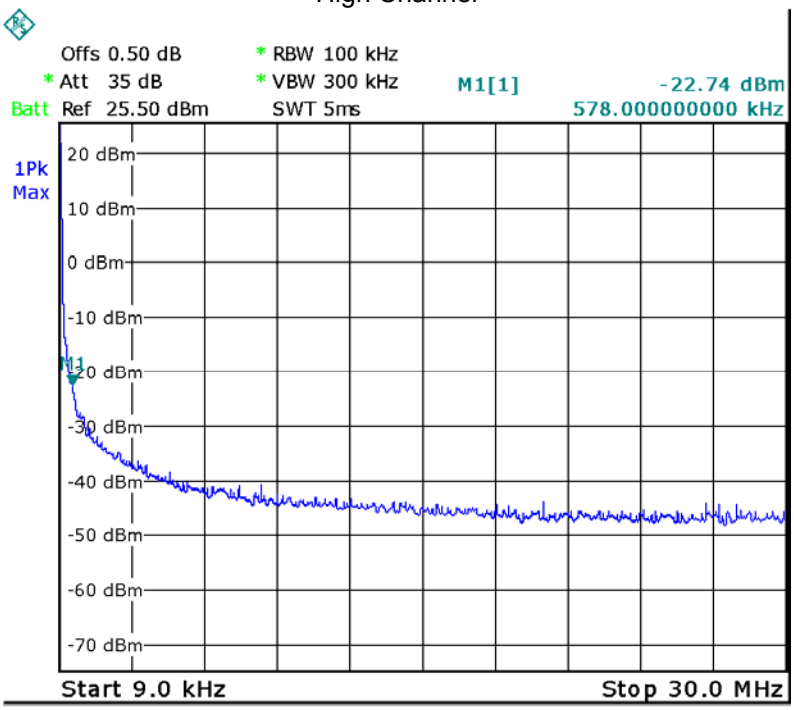
Low Channel



Middle Channel

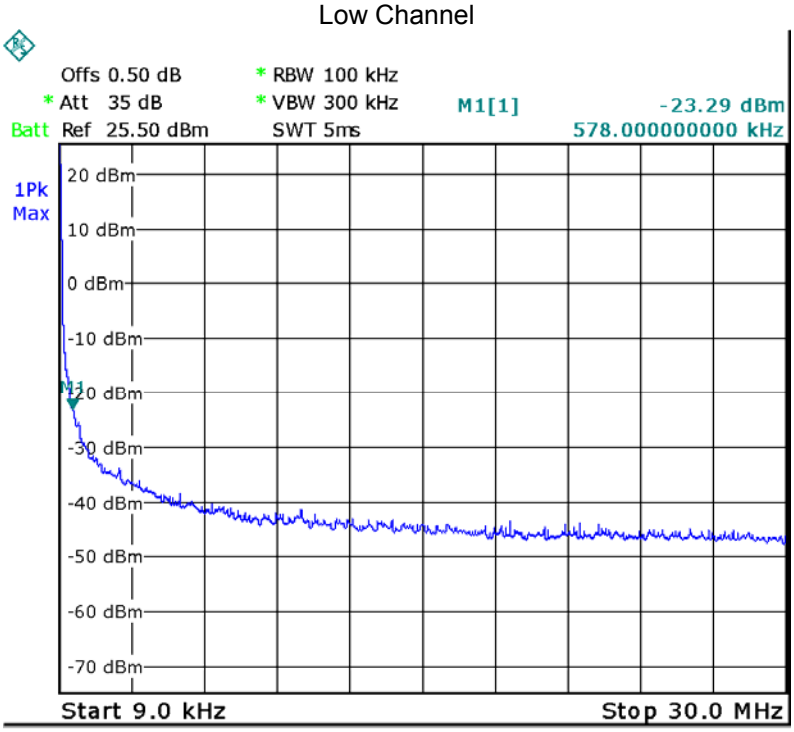


High Channel

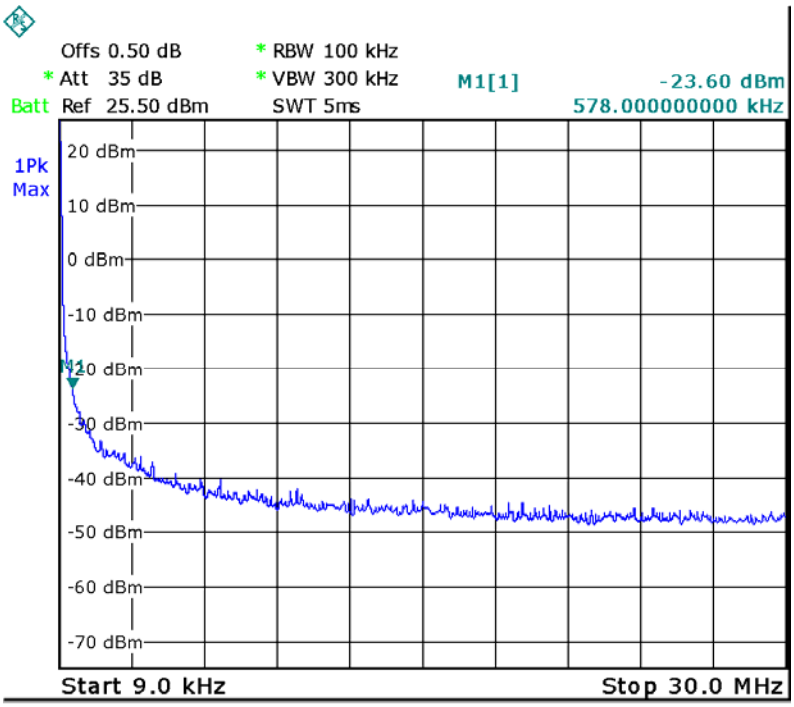


802.11n HT40

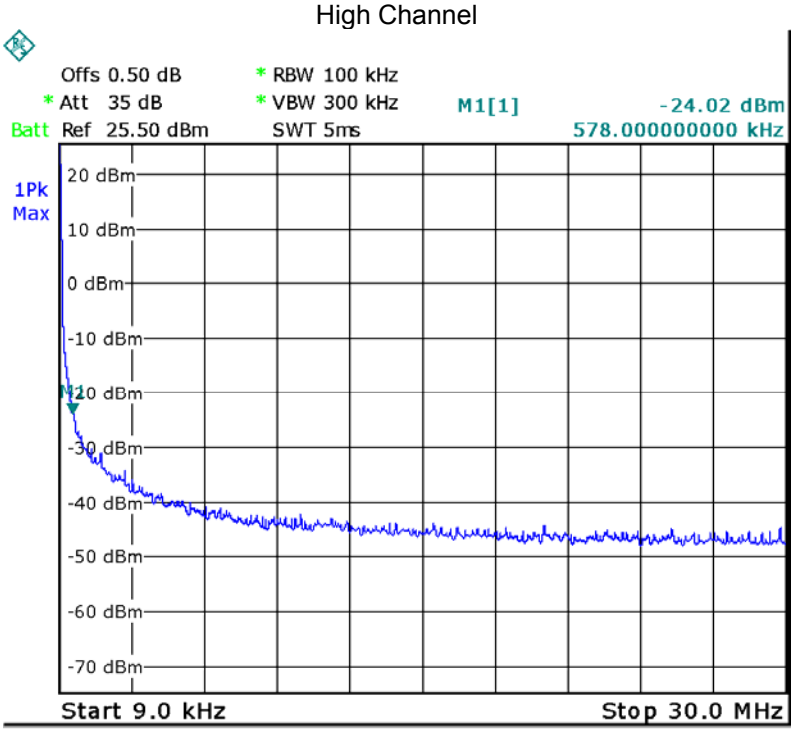
Low Channel



Middle Channel



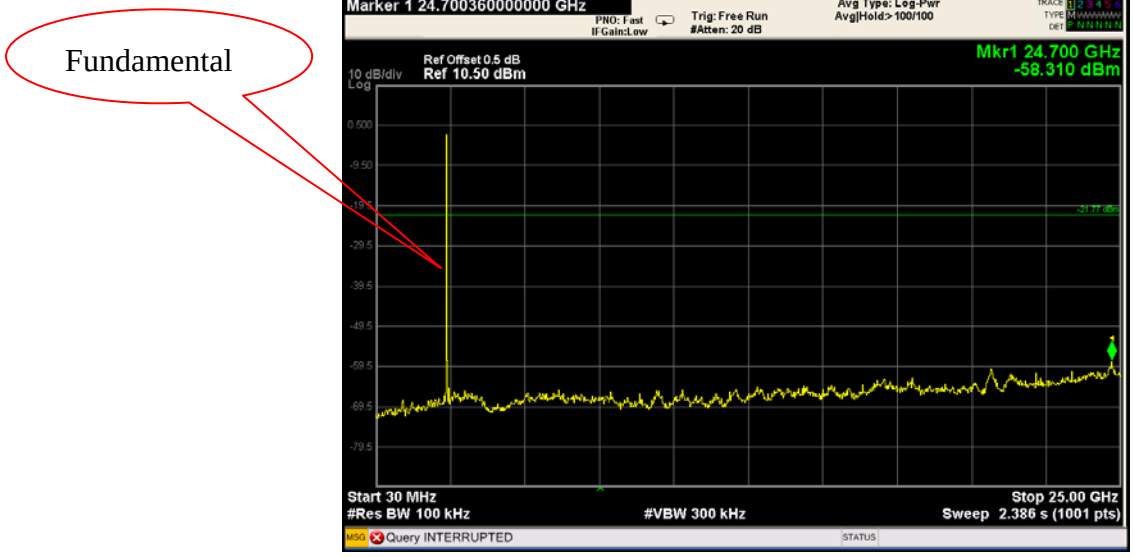
High Channel



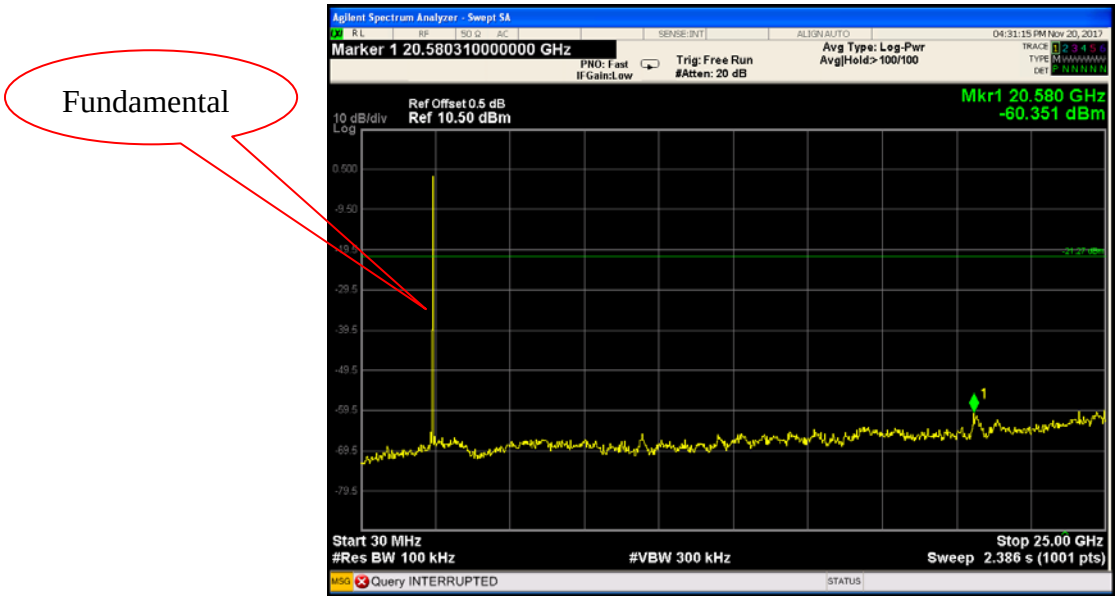
Above 30MHz

802.11b

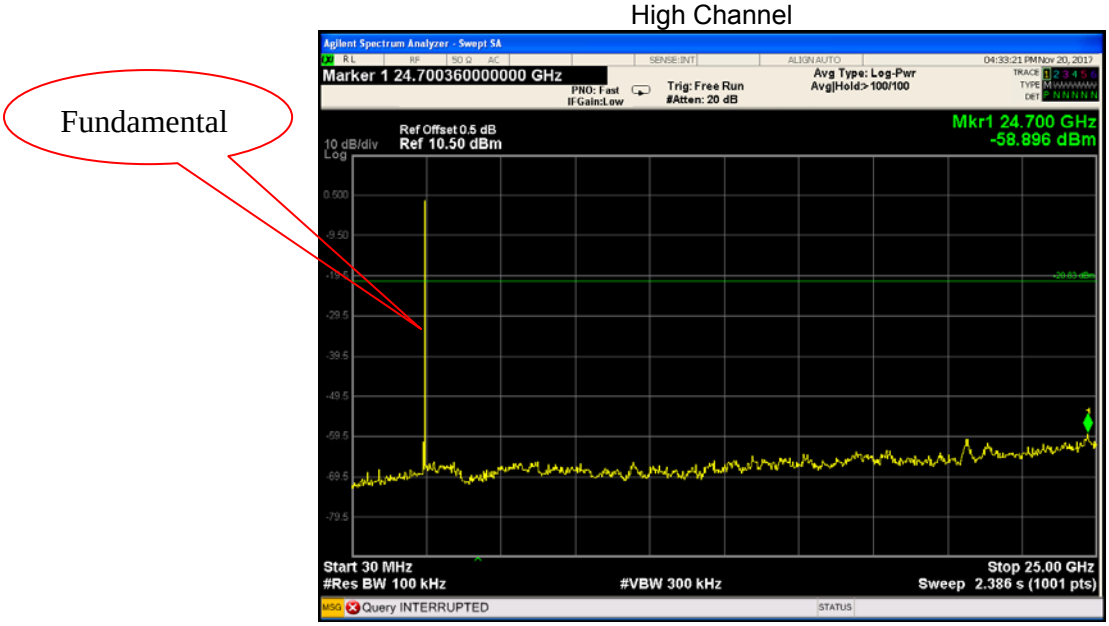
Low Channel



Middle Channel

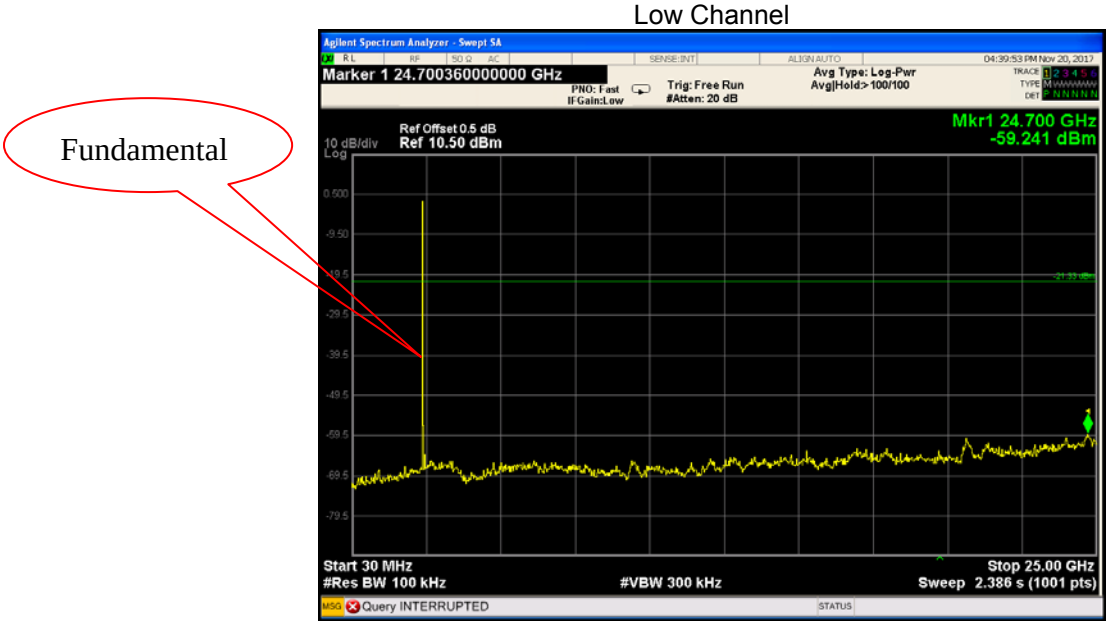


High Channel

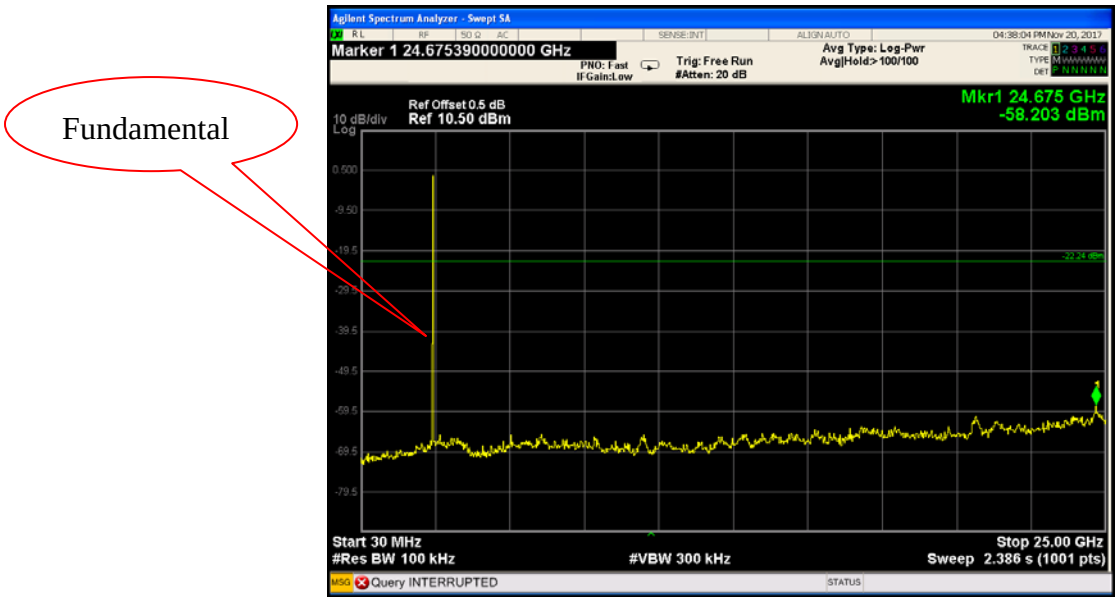


802.11g

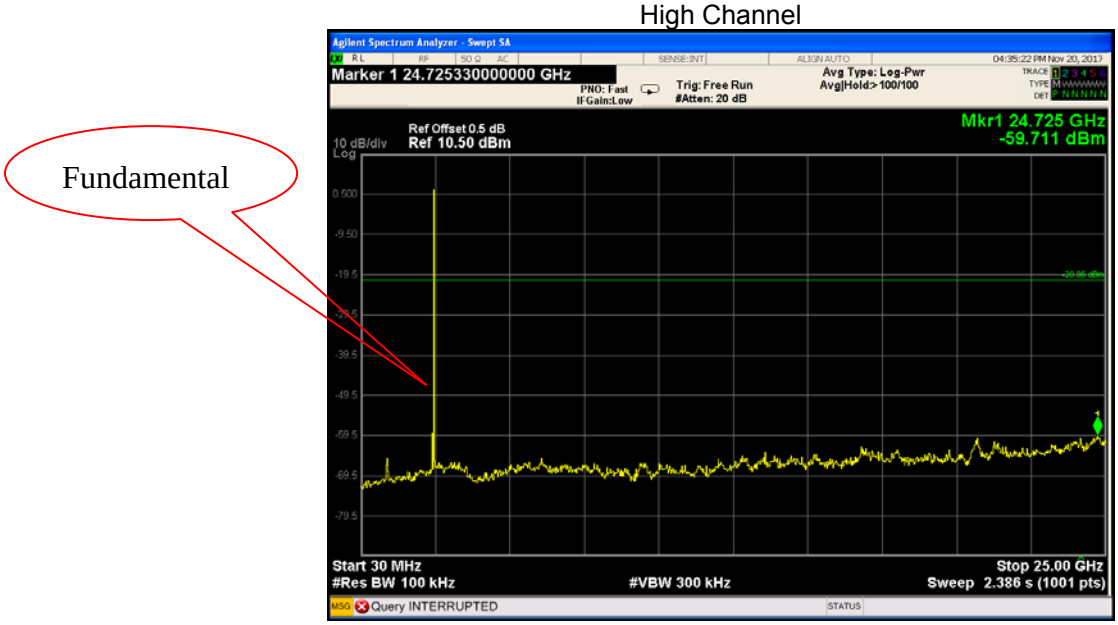
Low Channel



Middle Channel

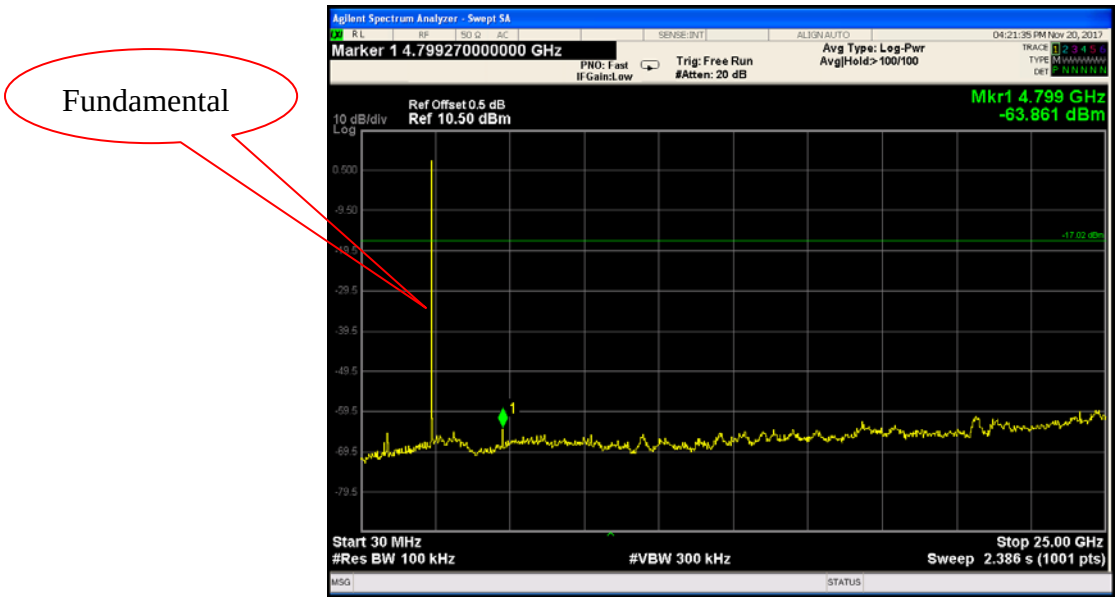


High Channel

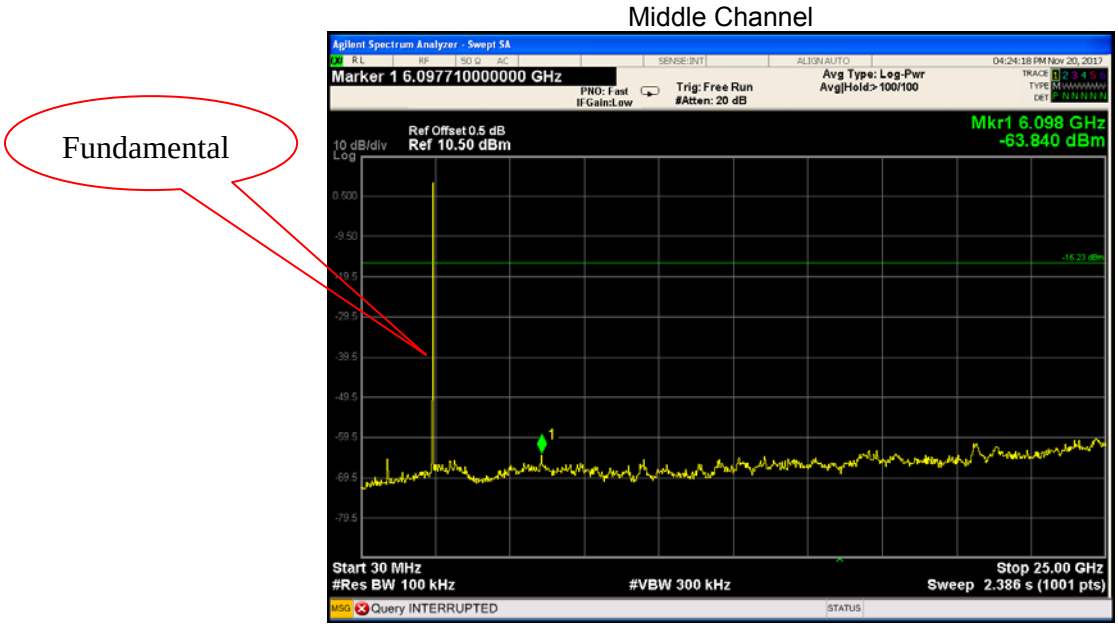


802.11n HT20

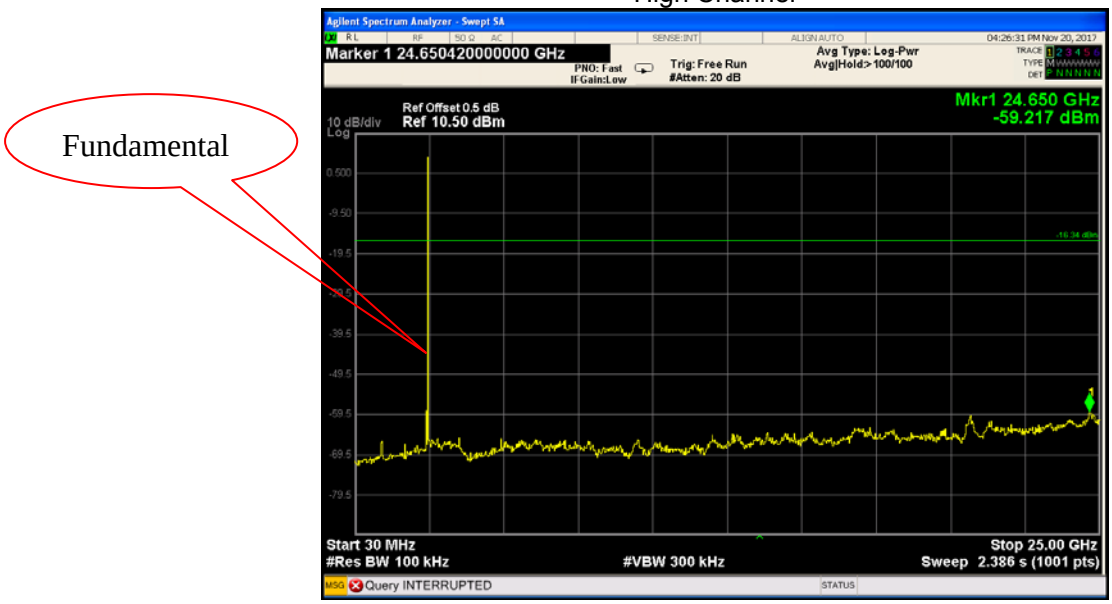
Low Channel



Middle Channel

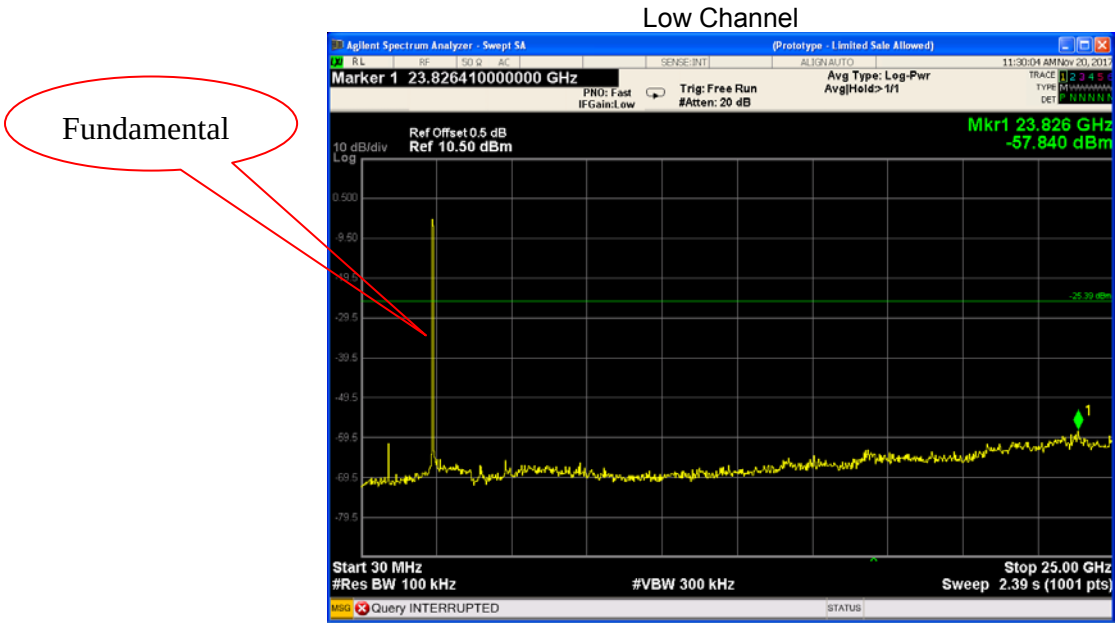


High Channel

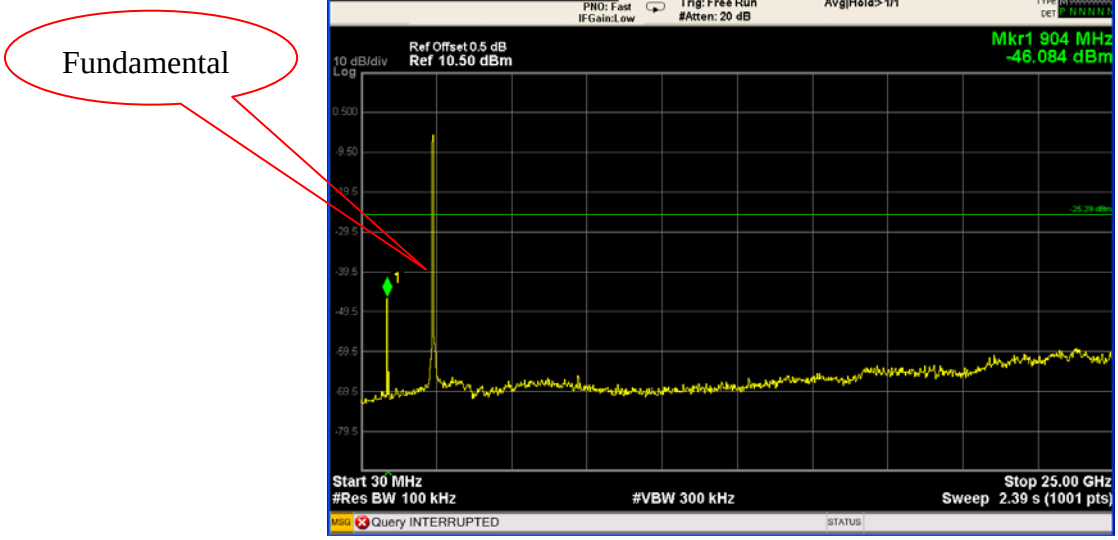


802.11n HT40

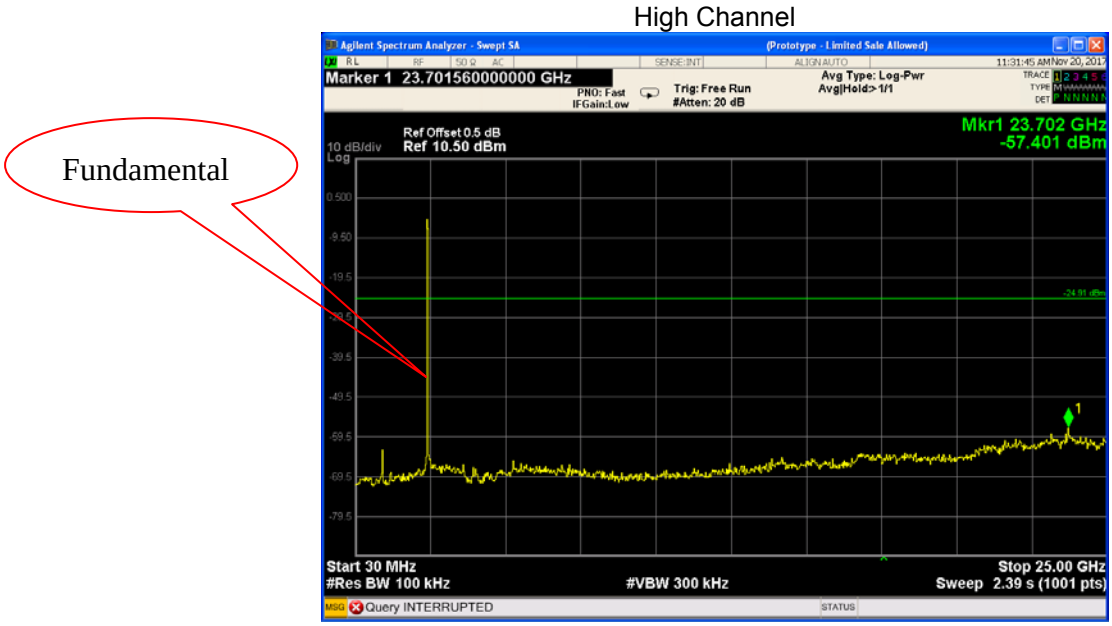
Low Channel



Middle Channel



High Channel



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

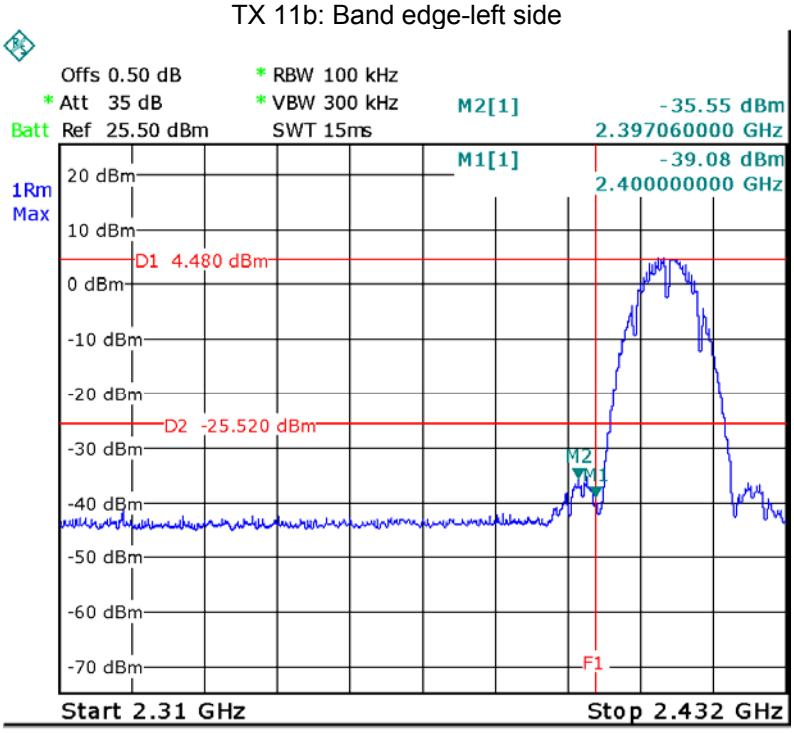
11.1 Test Produce

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.

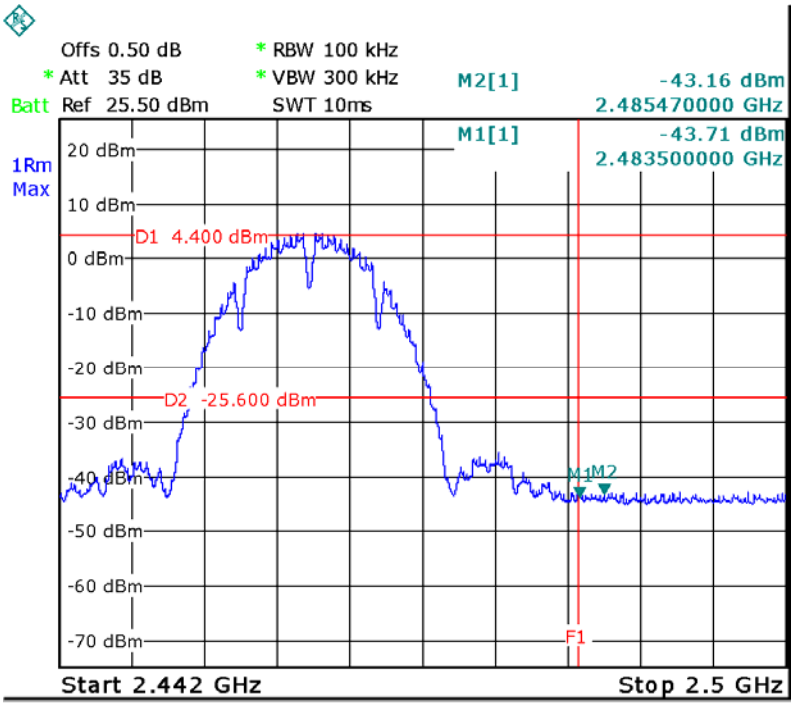
11.2 Test Result

Test result plots shown as follows:

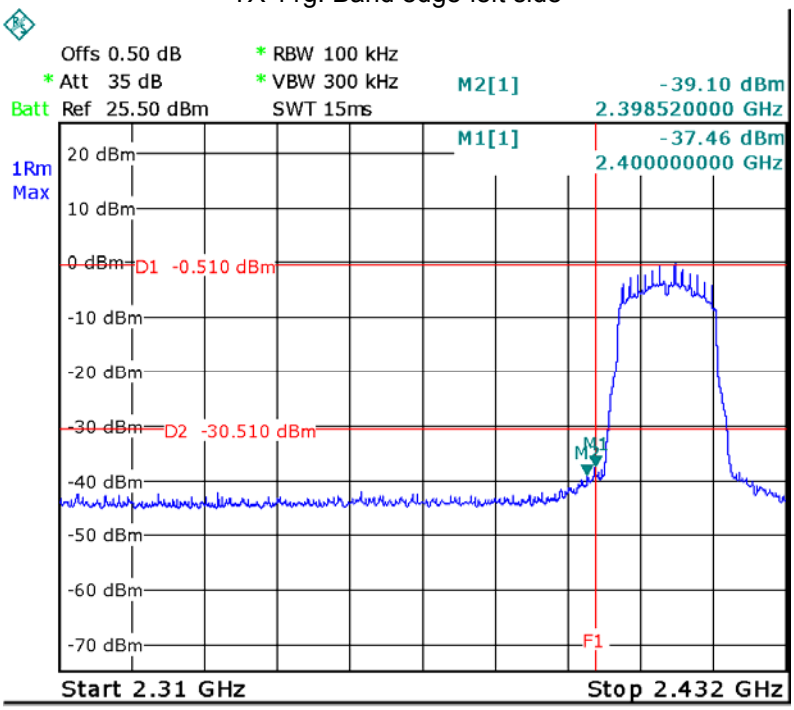
TX 11b: Band edge-left side



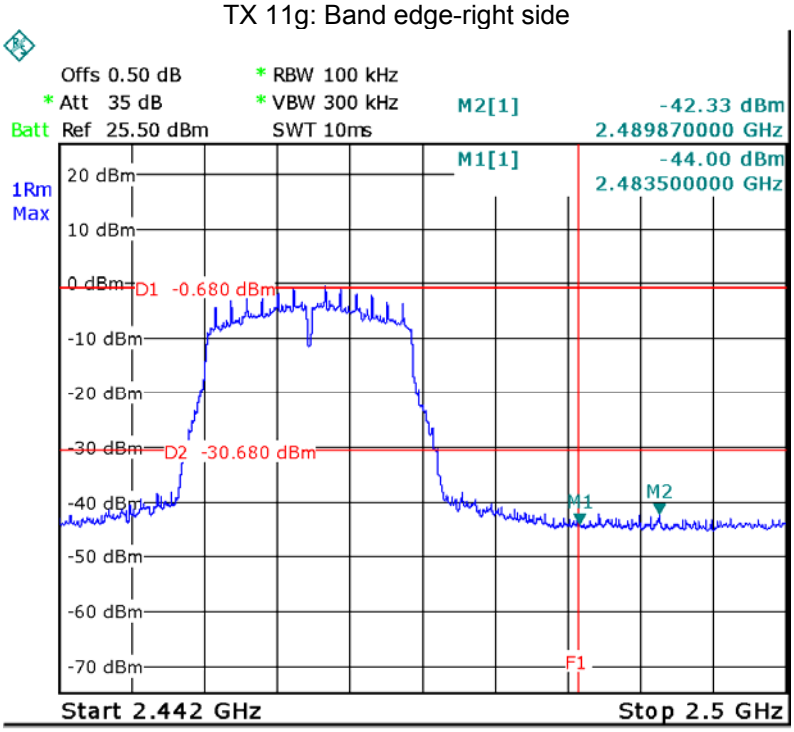
TX 11b: Band edge-right side



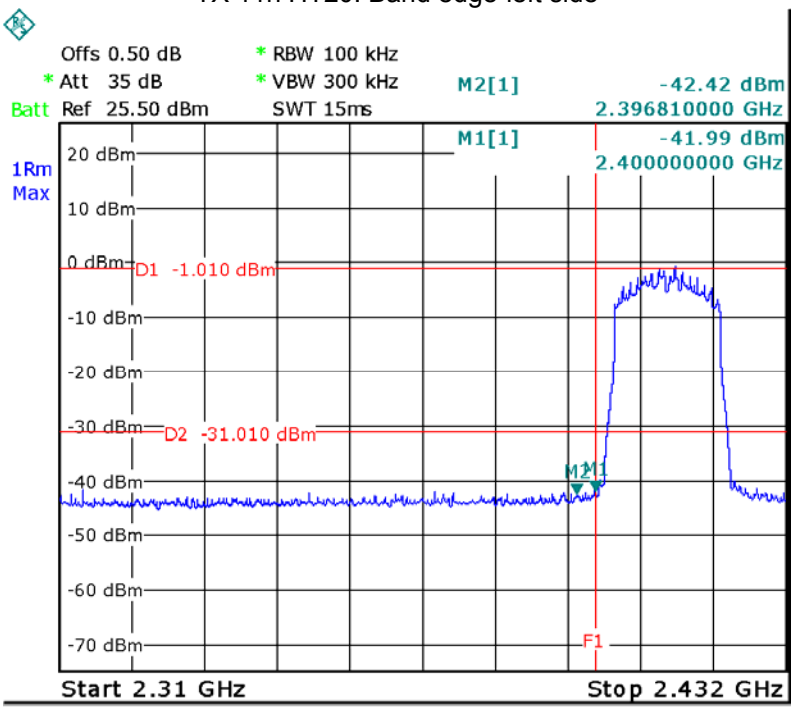
TX 11g: Band edge-left side



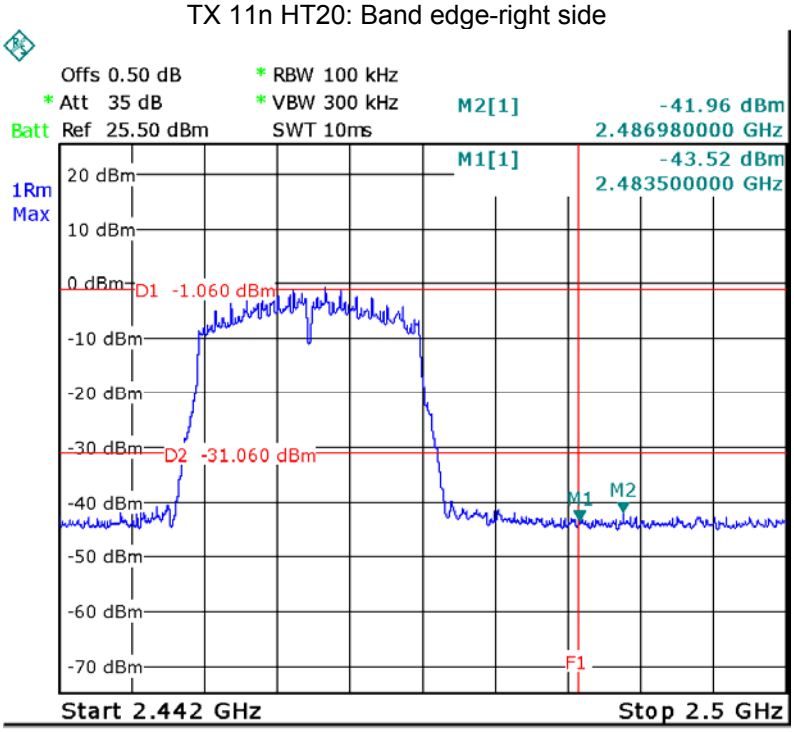
TX 11g: Band edge-right side



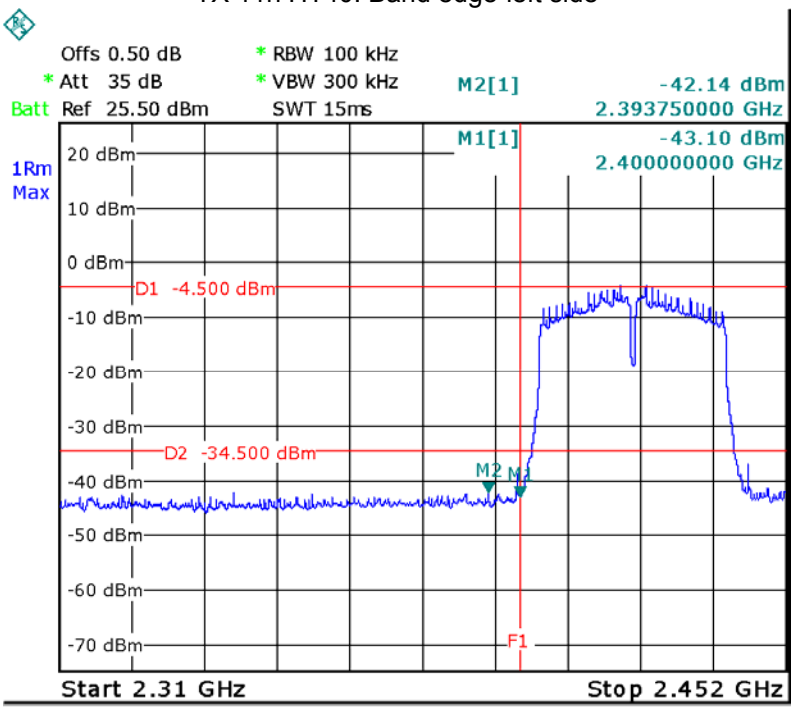
TX 11n HT20: Band edge-left side



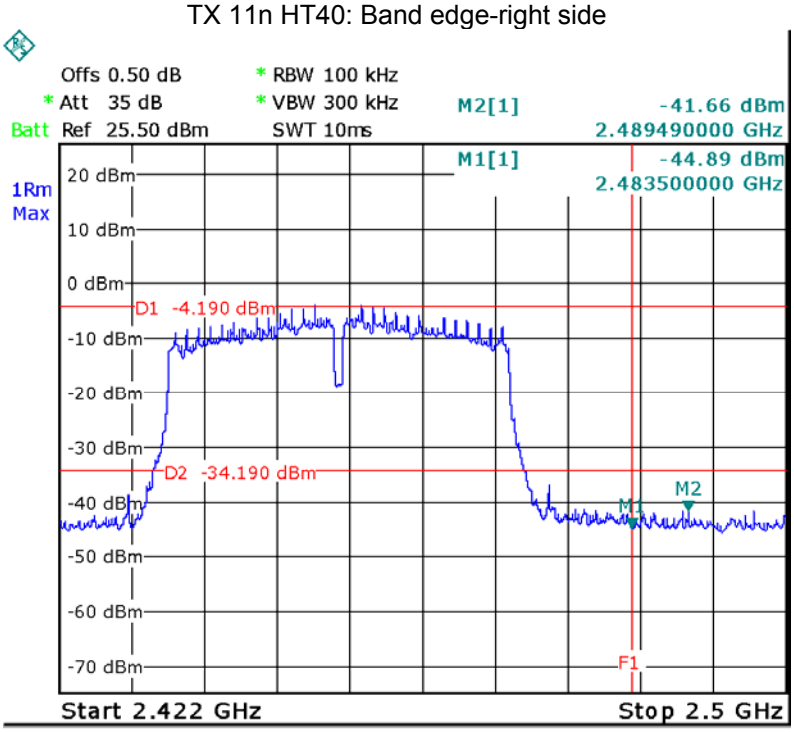
TX 11n HT20: Band edge-right side



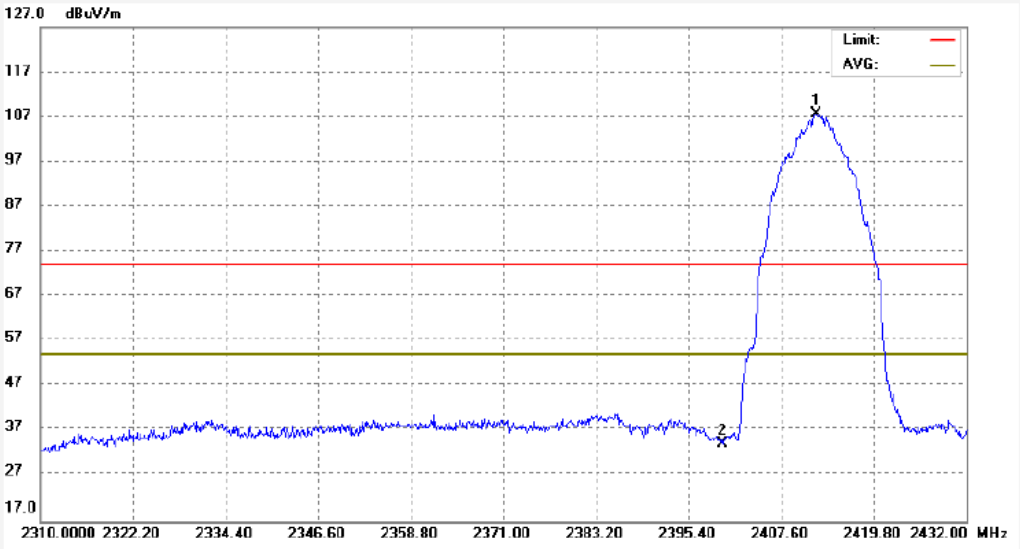
TX 11n HT40: Band edge-left side



TX 11n HT40: Band edge-right side

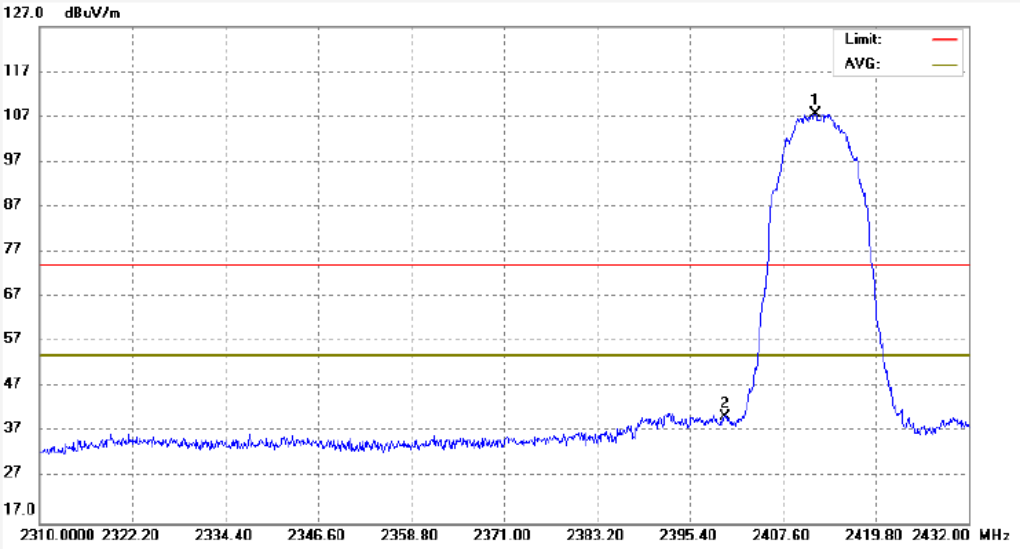


TX 11b: Band edge-left side Horizontal



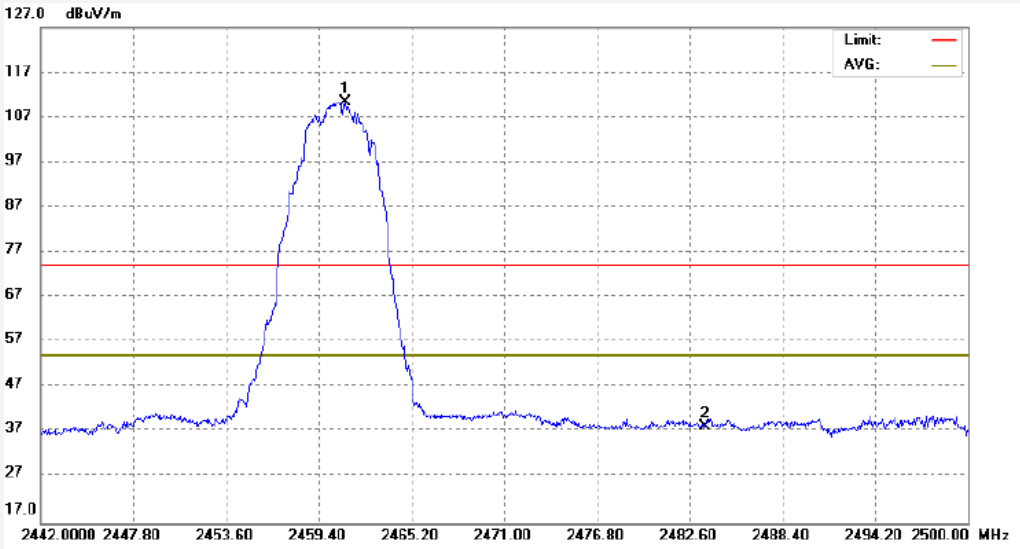
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2412.236	122.94	-15.26	107.68				
2	2400.000	49.37	-15.24	34.13	74.00	-39.87	peak	

TX 11b: Band edge-left side Vertical



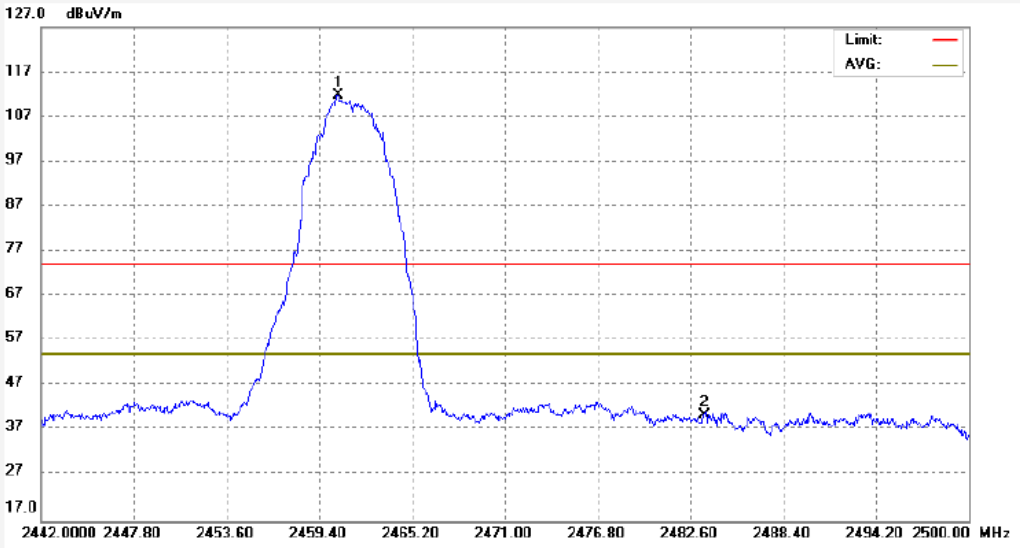
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2411.870	122.97	-15.26	107.71				
2	2400.000	55.87	-15.24	40.63	74.00	-33.37	peak	

TX 11b: Band edge-right side Horizontal



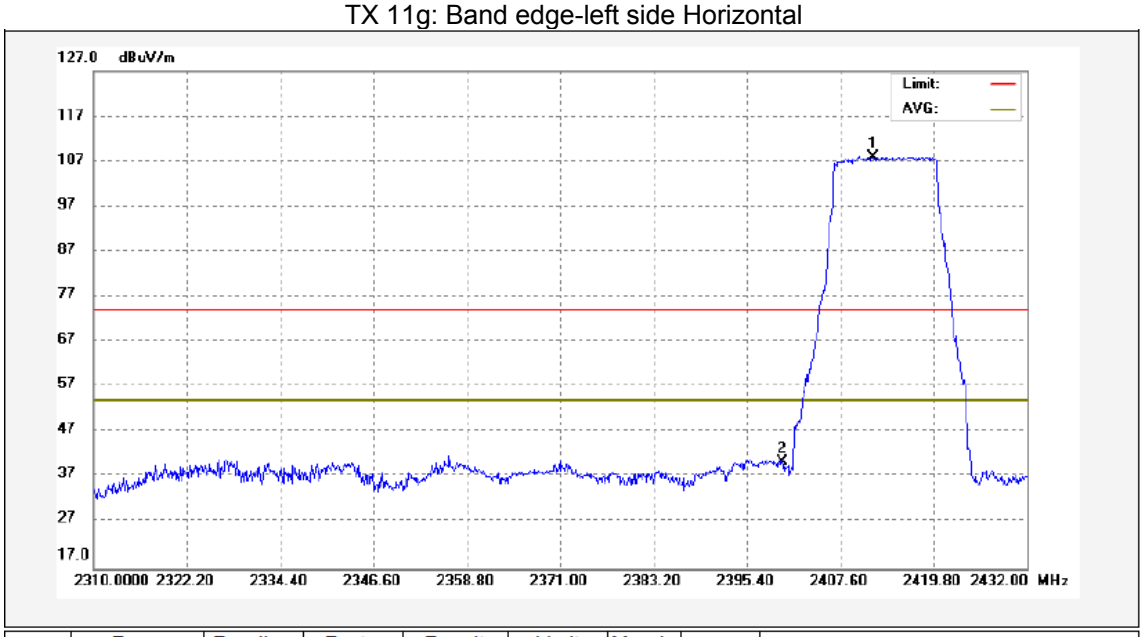
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2461.082	125.66	-15.35	110.31				
2	2483.500	53.62	-15.39	38.23	74.00	-35.77	peak	

TX 11b: Band edge-right side Vertical



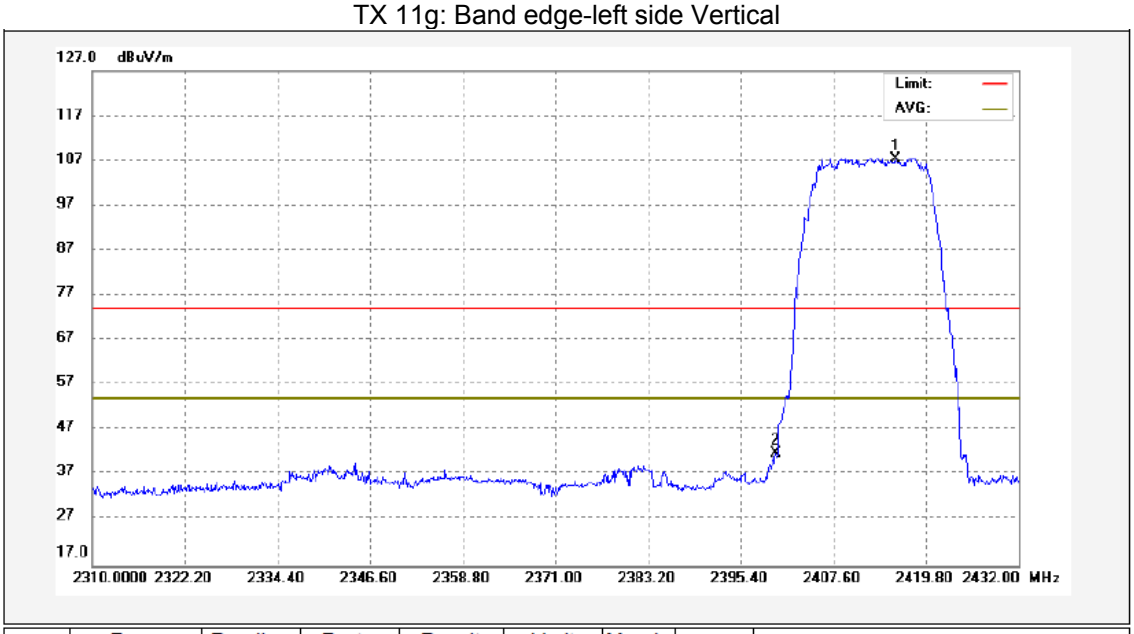
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2460.560	126.97	-15.35	111.62				
2	2483.500	55.86	-15.39	40.47	74.00	-33.53	peak	

TX 11g: Band edge-left side Horizontal



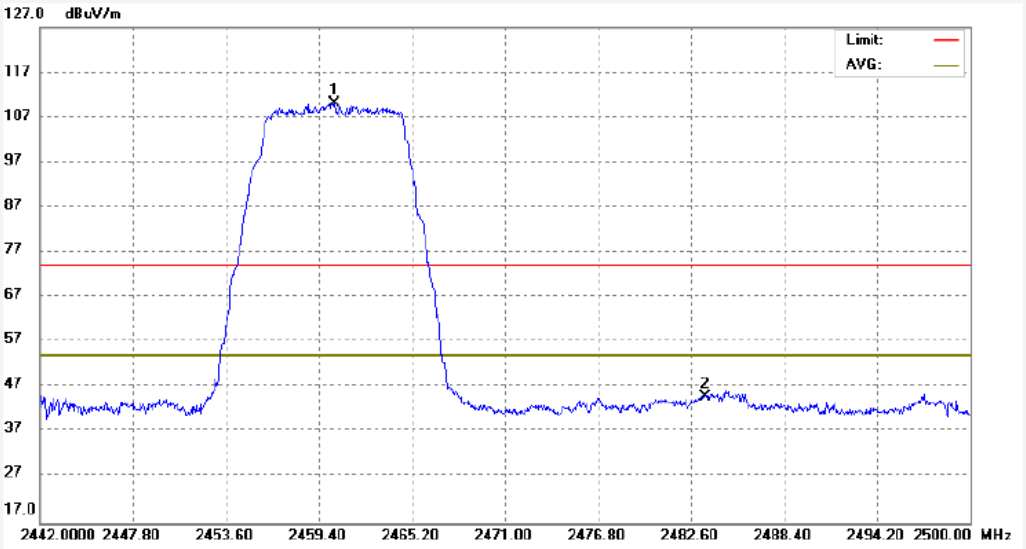
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2411.870	123.24	-15.26	107.98				
2	2400.000	55.71	-15.24	40.47	74.00	-33.53	peak	

TX 11g: Band edge-left side Vertical



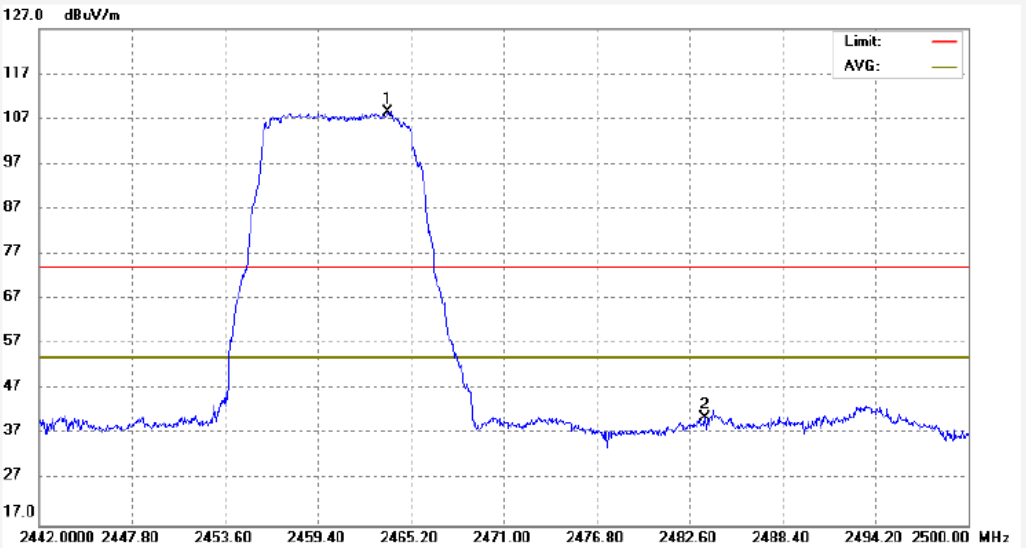
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2415.774	122.70	-15.26	107.44				
2	2400.000	57.21	-15.24	41.97	74.00	-32.03	peak	

TX 11g: Band edge-right side Horizontal



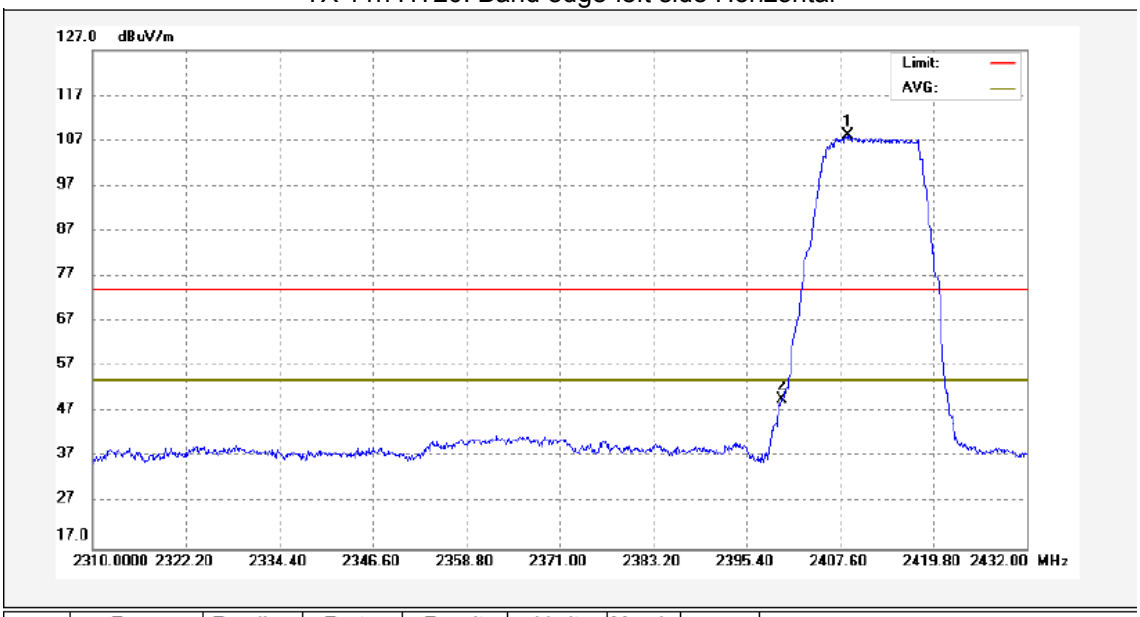
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2460.386	125.48	-15.34	110.14				
2	2483.500	60.30	-15.39	44.91	74.00	-29.09	peak	

TX 11g: Band edge-right side Vertical



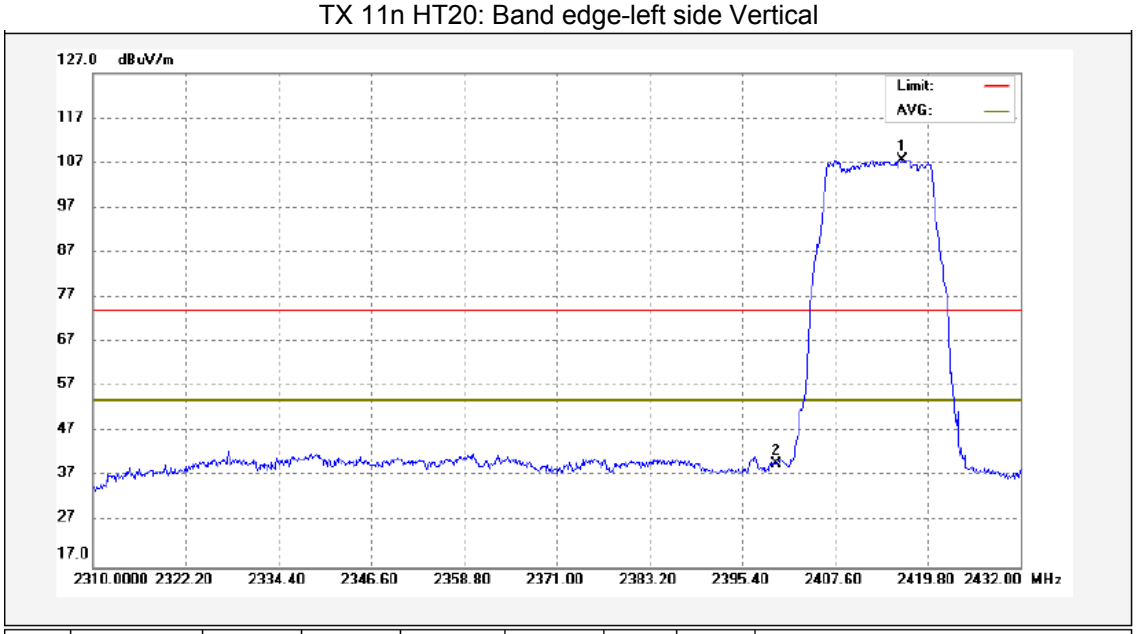
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2463.750	123.75	-15.34	108.41				
2	2483.500	56.30	-15.39	40.91	74.00	-33.09	peak	

TX 11n HT20: Band edge-left side Horizontal



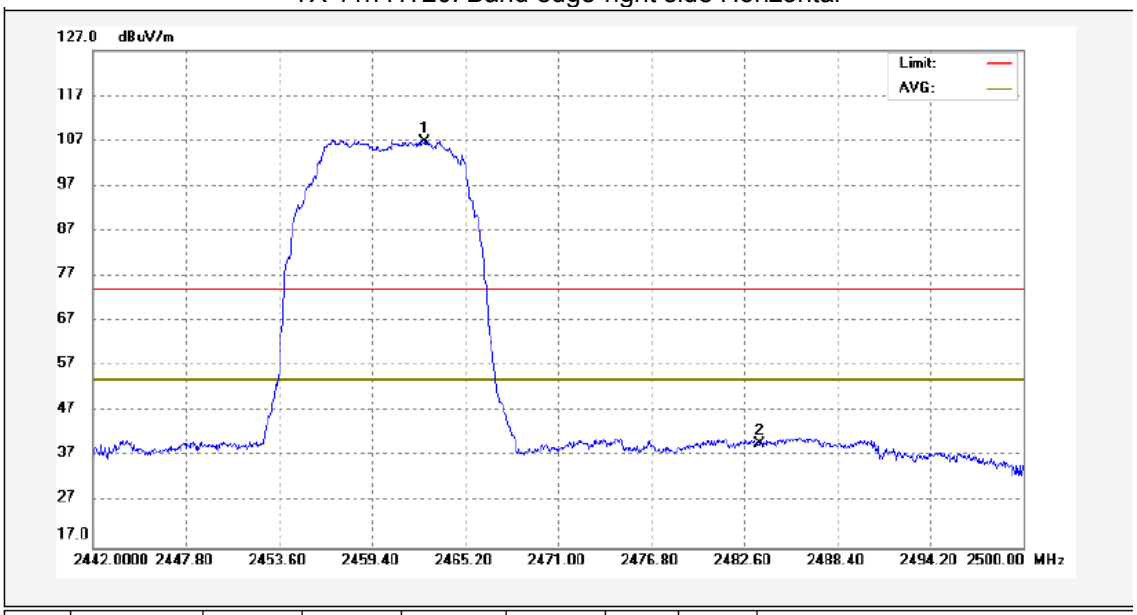
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2408.576	123.39	-15.25	108.14				
2	2400.000	65.07	-15.24	49.83	74.00	-24.17	peak	

TX 11n HT20: Band edge-left side Vertical



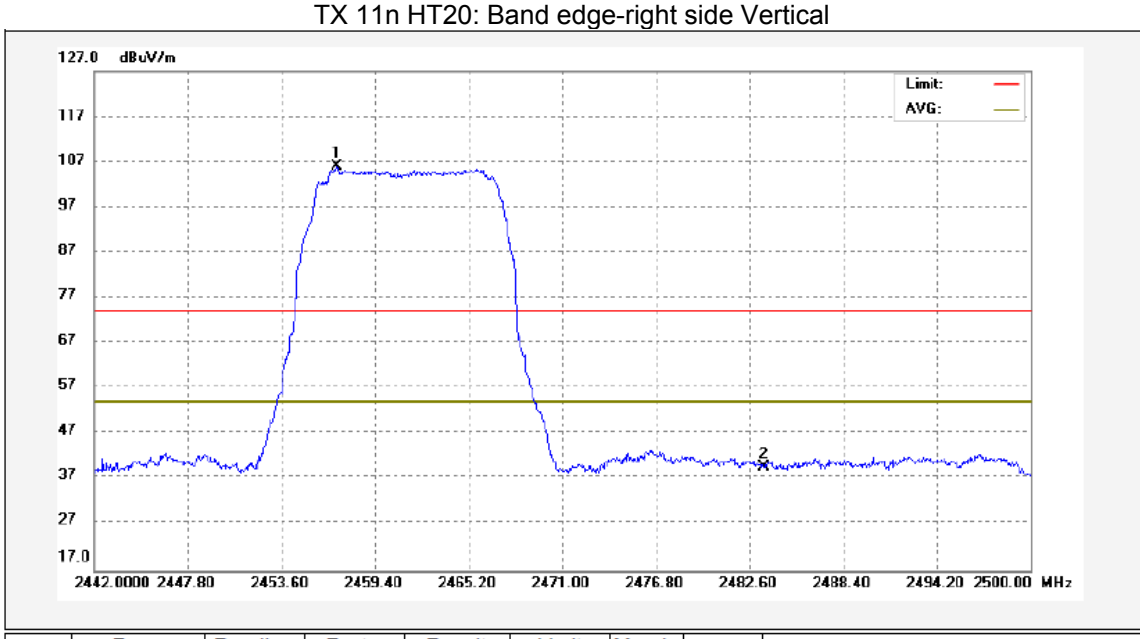
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2416.506	122.80	-15.26	107.54				
2	2400.000	55.07	-15.24	39.83	74.00	-34.17	peak	

TX 11n HT20: Band edge-right side Horizontal



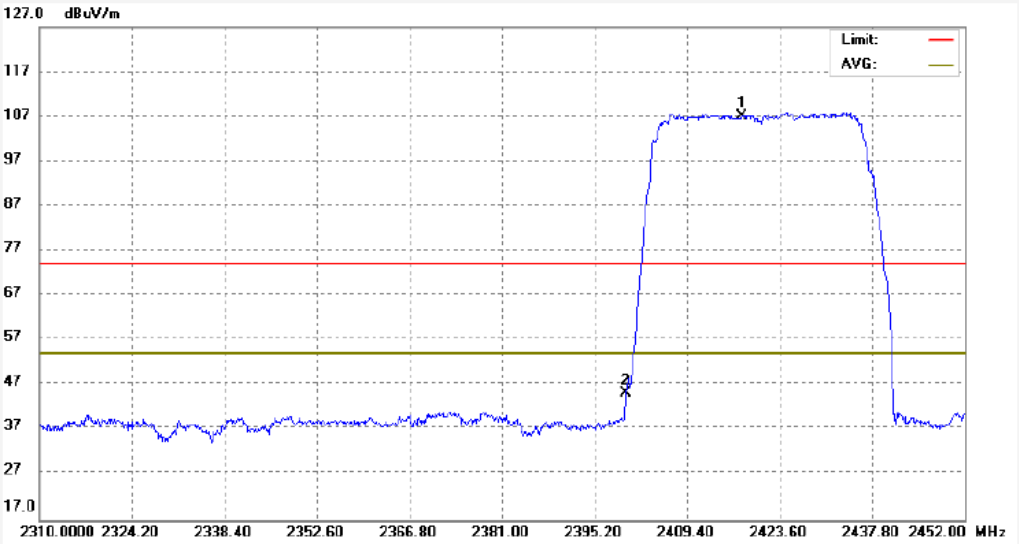
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2462.648	122.09	-15.35	106.74				
2	2483.500	55.48	-15.39	40.09	74.00	-33.91	peak	

TX 11n HT20: Band edge-right side Vertical



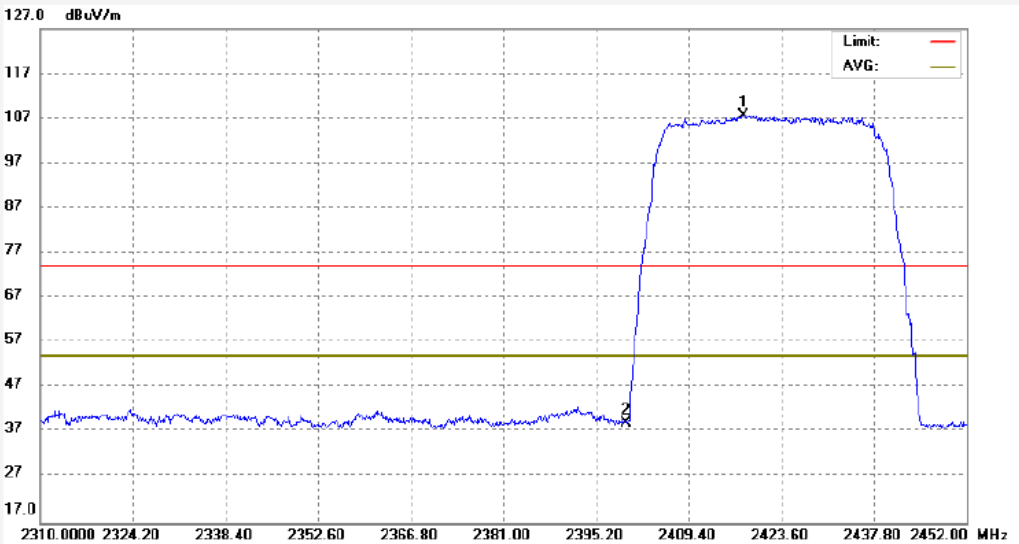
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2457.022	121.17	-15.34	105.83				
2	2483.500	54.98	-15.39	39.59	74.00	-34.41	peak	

TX 11n HT40: Band edge-left side Horizontal



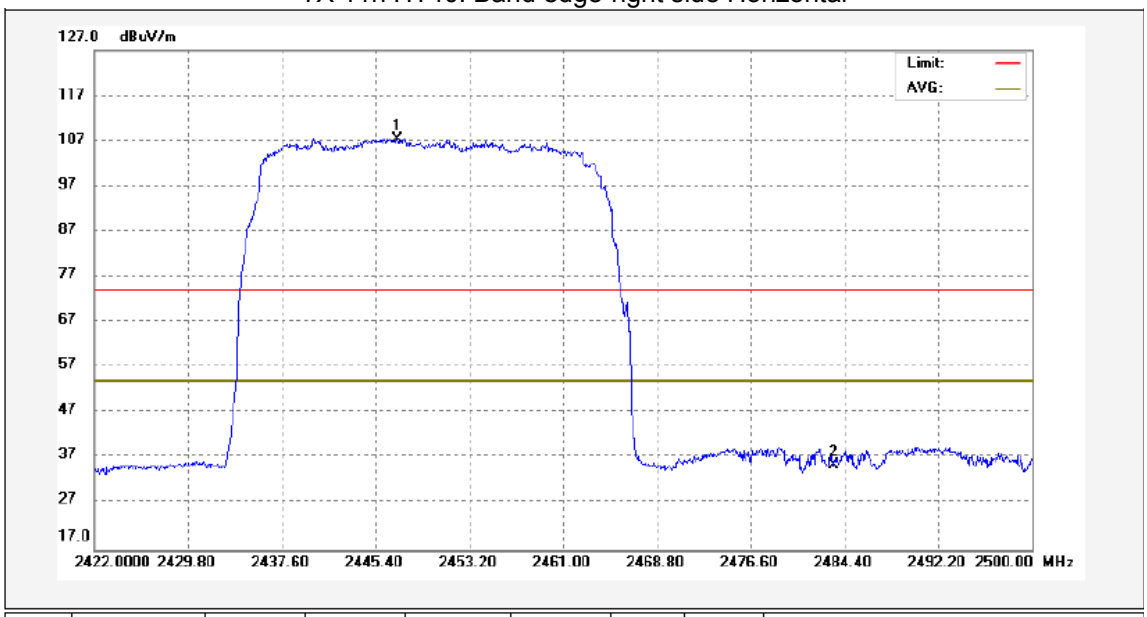
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2417.778	122.39	-15.26	107.13				
2	2400.000	60.44	-15.24	45.20	74.00	-28.80	peak	

TX 11n HT40: Band edge-left side Vertical



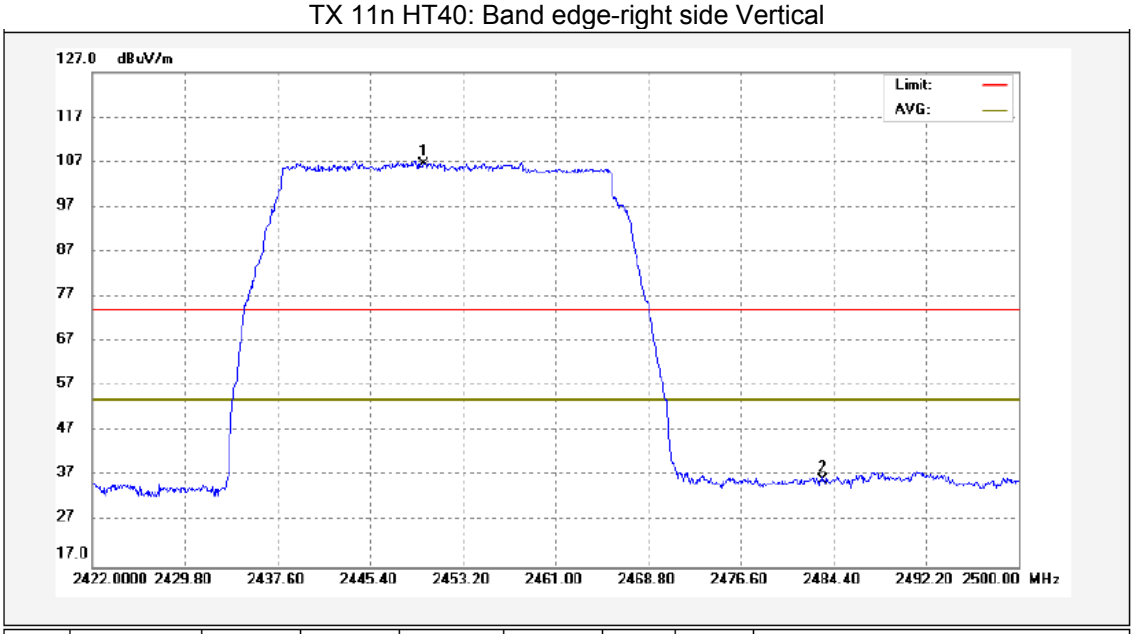
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2417.778	122.89	-15.26	107.63				
2	2400.000	54.44	-15.24	39.20	74.00	-34.80	peak	

TX 11n HT40: Band edge-right side Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2447.194	122.61	-15.32	107.29				
2	2483.500	50.99	-15.39	35.60	74.00	-38.40	peak	

TX 11n HT40: Band edge-right side Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2449.924	121.92	-15.33	106.59				
2	2483.500	51.49	-15.39	36.10	74.00	-37.90	peak	

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;

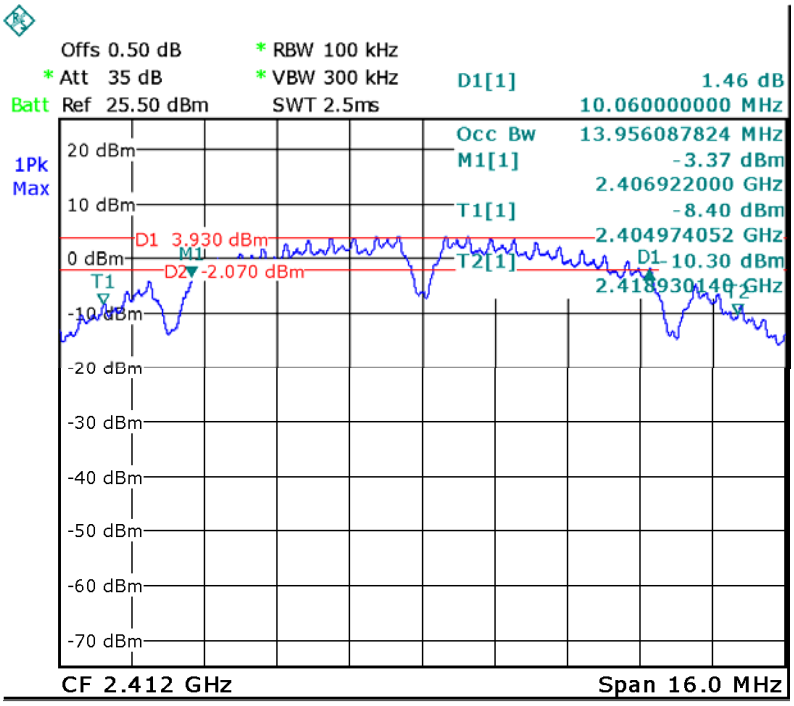
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

12.2 Test Result:

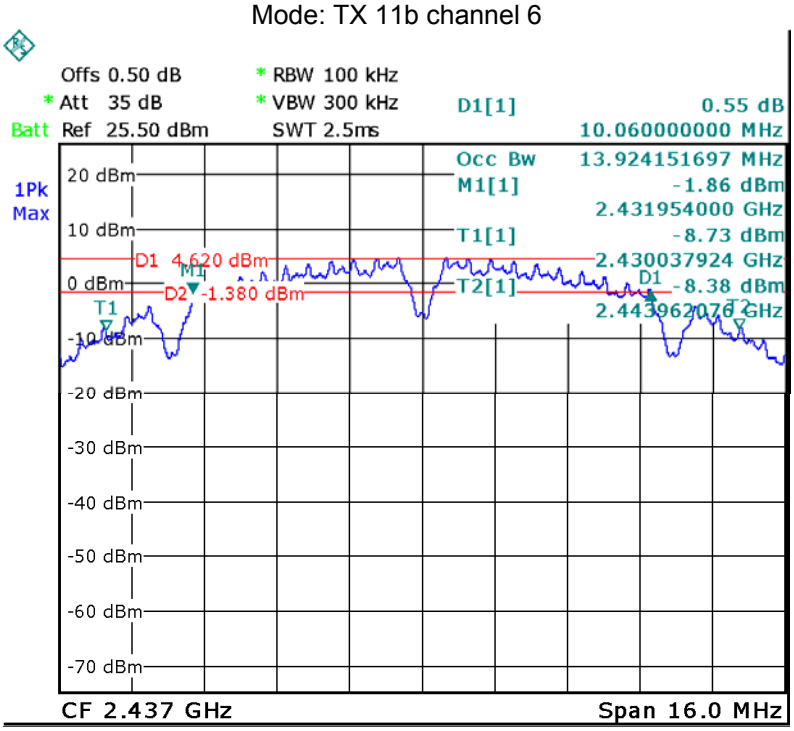
Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (kHz)
TX 11b	Channel 1	10.060	13.956	500
	Channel 6	10.060	13.924	500
	Channel 11	10.060	13.956	500
TX 11g	Channel 1	16.317	15.367	500
	Channel 6	16.317	15.519	500
	Channel 11	16.317	15.267	500
TX 11n HT20	Channel 1	17.407	17.515	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:

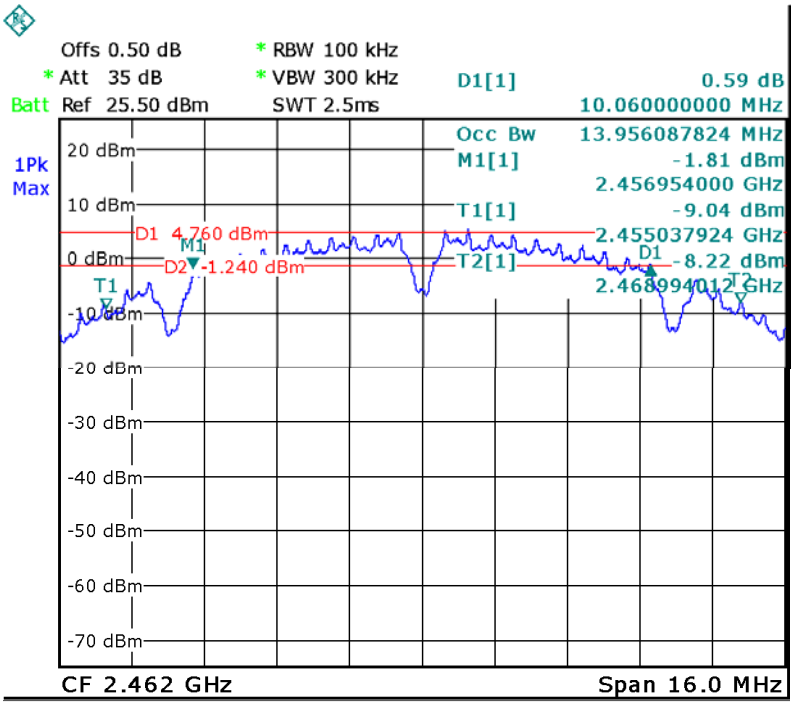
Mode: TX 11b channel 1



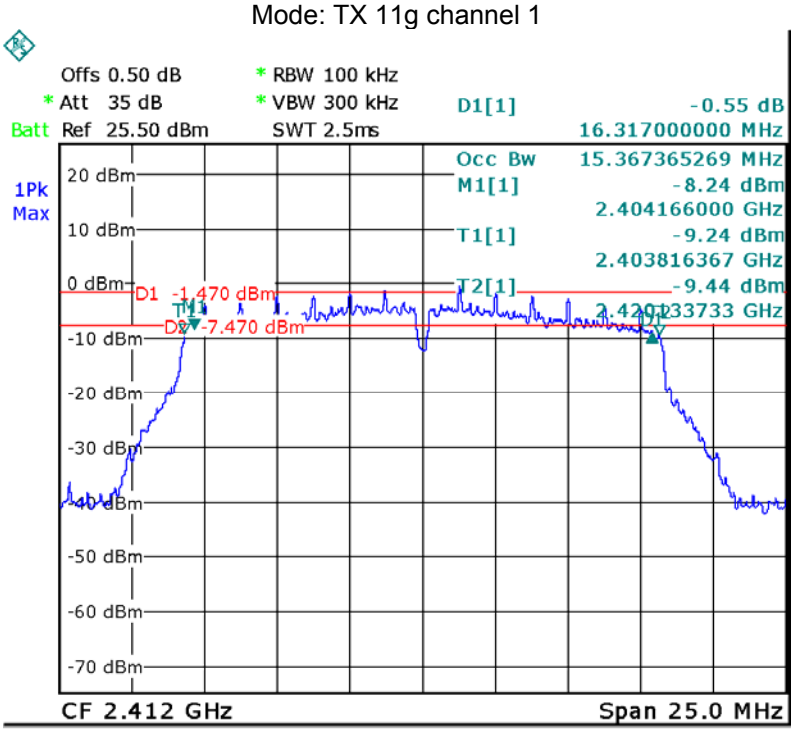
Mode: TX 11b channel 6



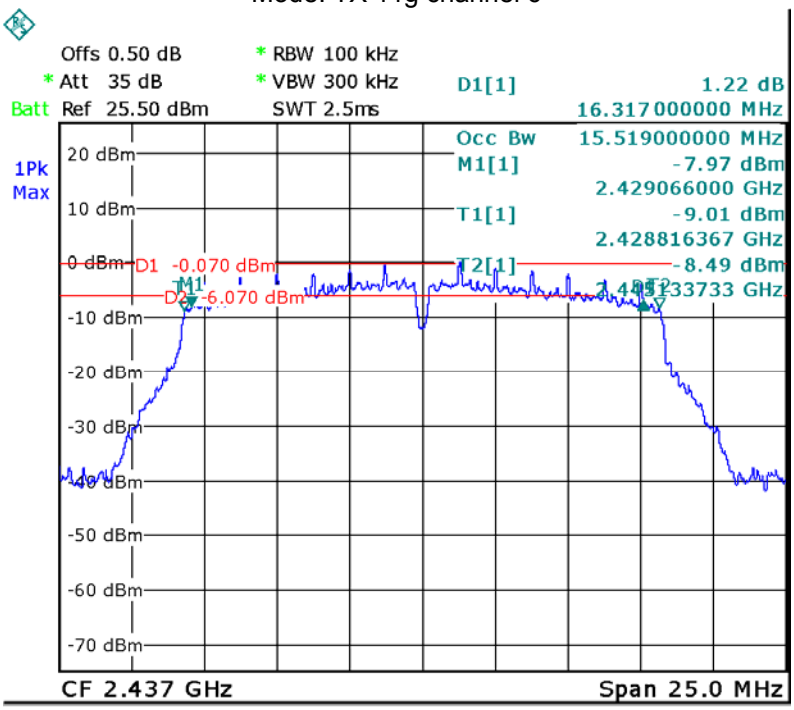
Mode: TX 11b channel 11



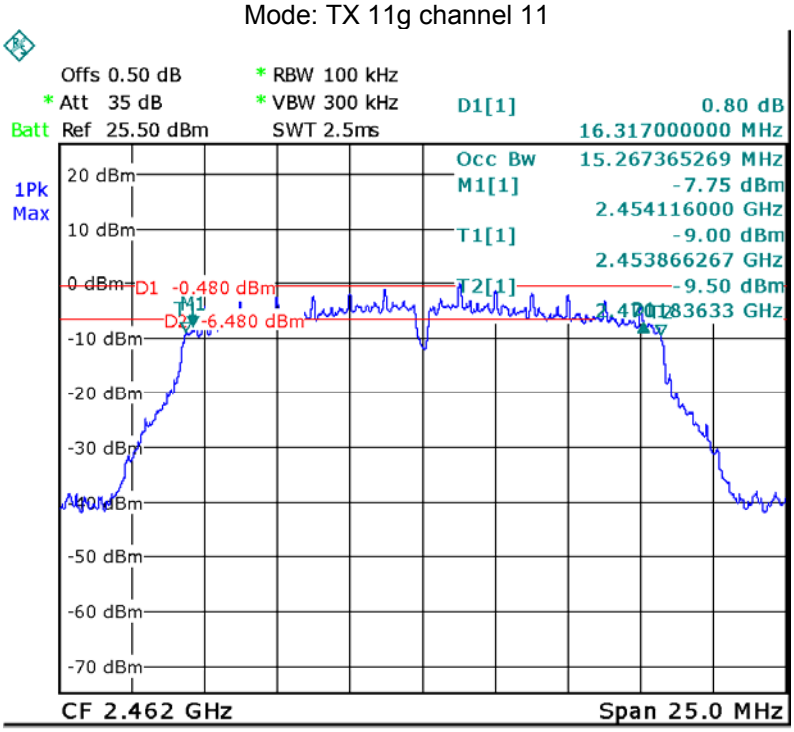
Mode: TX 11g channel 1



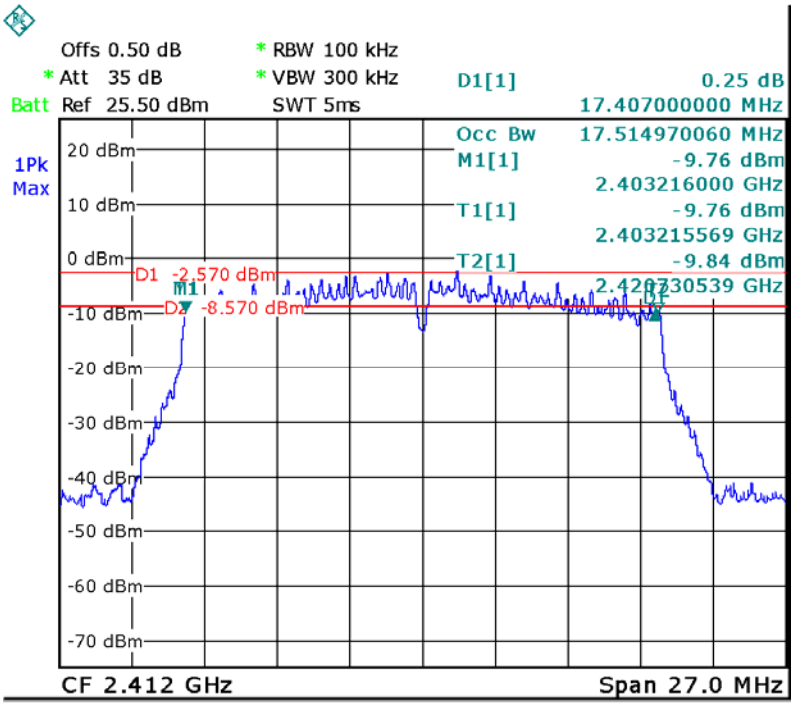
Mode: TX 11g channel 6



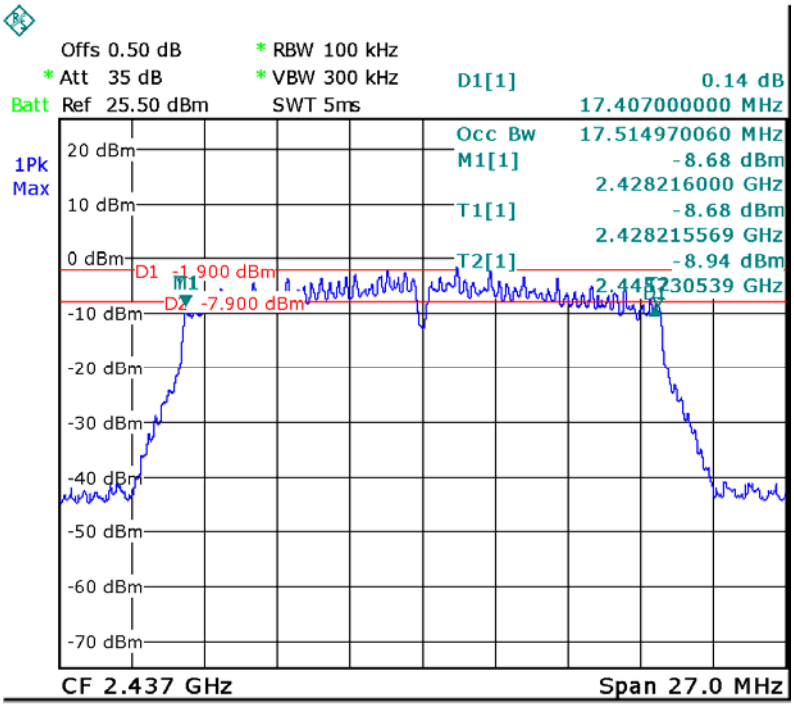
Mode: TX 11g channel 11



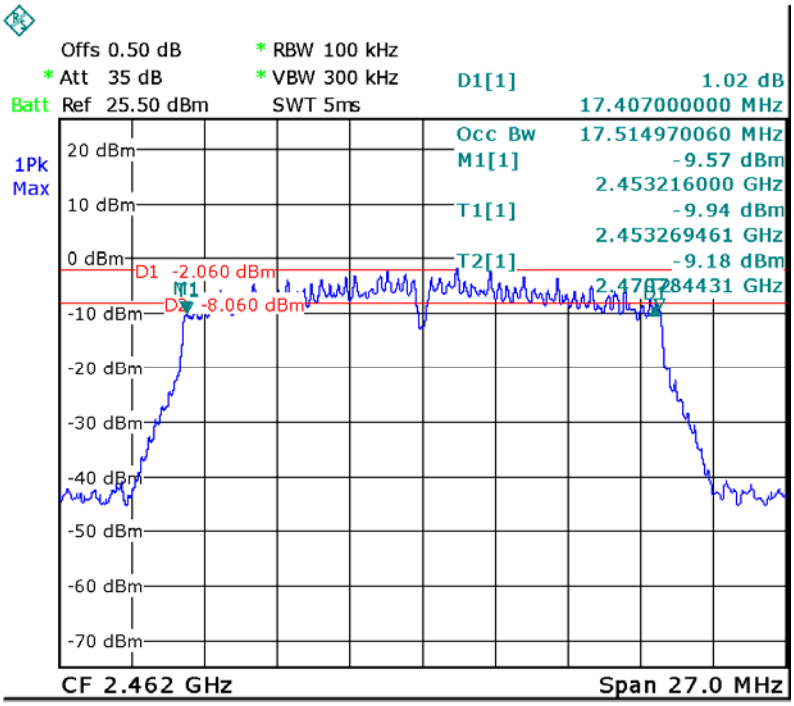
Mode: TX 11n HT20 channel 1



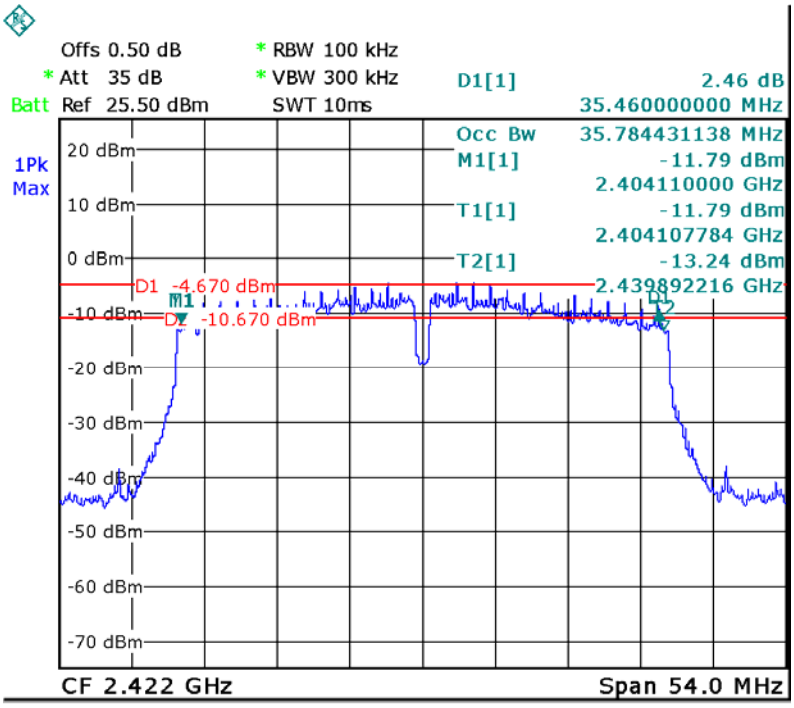
Mode: TX 11n HT20 channel 6



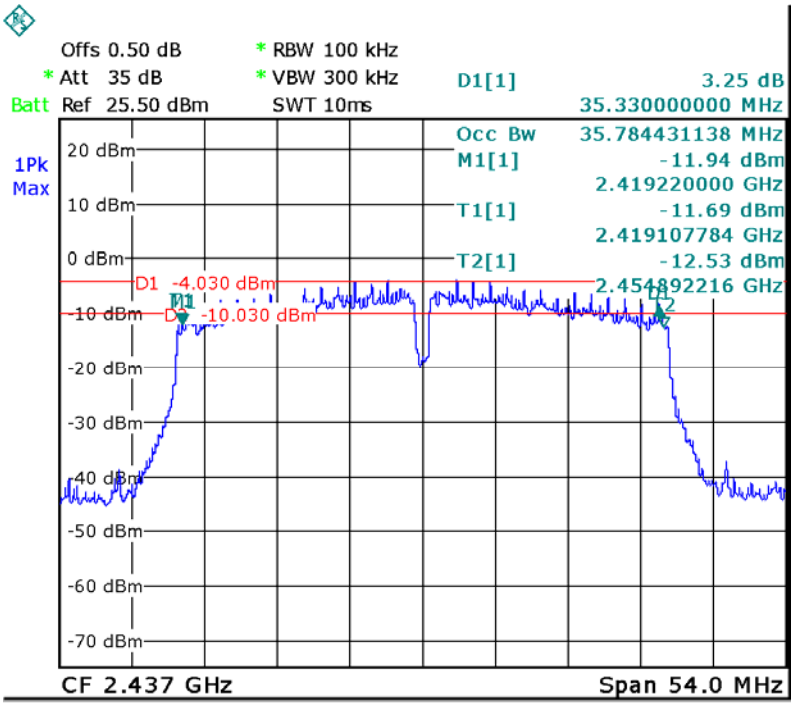
Mode: TX 11n HT20 channel 11



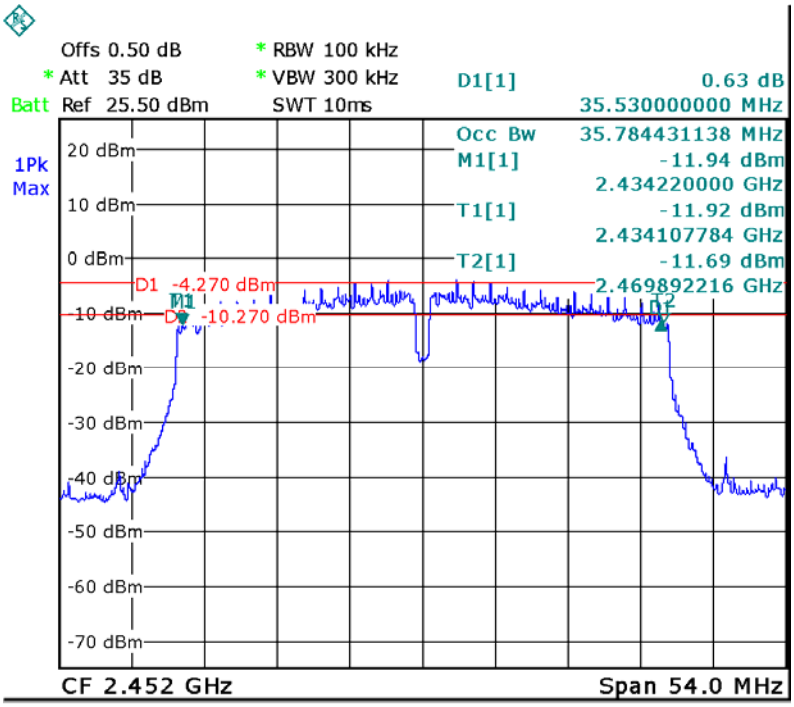
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



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 ≥ DTS bandwidth.

b)Set VBW ≥ 3 RBW.

c)Set span ≥ 3 x RBW

d)Sweep time = auto couple.

e)Detector = peak.

f)Trace mode = max hold.

g)Allow trace to fully stabilize.

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

section 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 MHz.

b)Set the VBW ≥ 3 RBW

c)Set the span ≥ 1.5 x DTS bandwidth.

d)Detector = peak.

e)Sweep time = auto couple.

f)Trace mode = max hold.

g)Allow trace to fully stabilize.

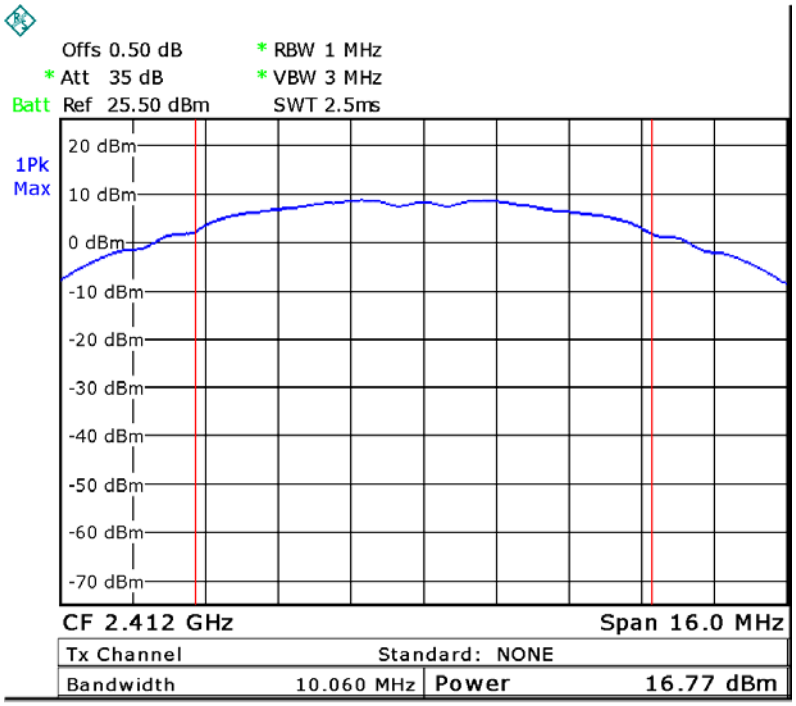
h)Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

13.2 Test Result:

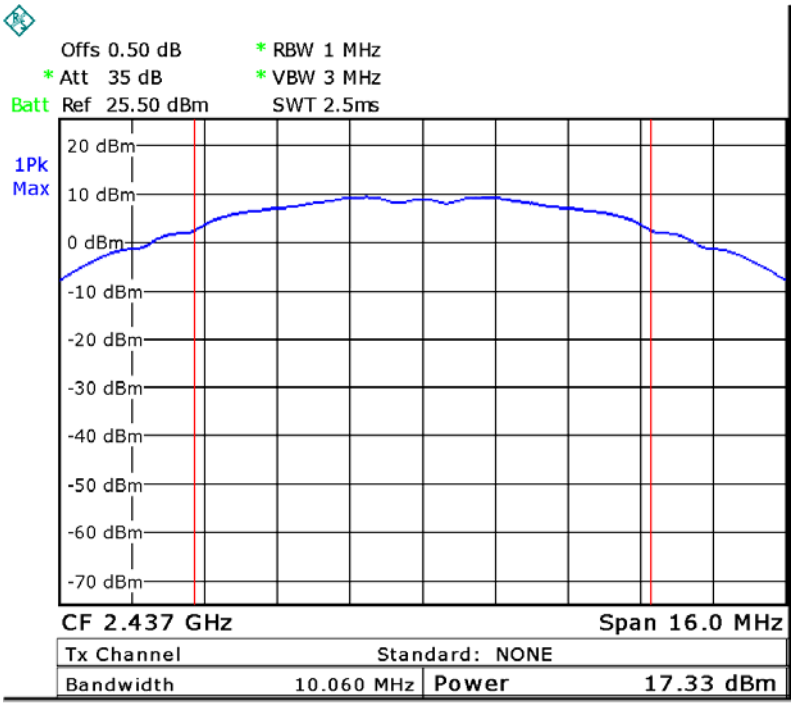
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	16.77	1W/30dBm
	Middle-2437	17.33	1W/30dBm
	High-2462	17.09	1W/30dBm
TX 11g	Low-2412	17.31	1W/30dBm
	Middle-2437	17.70	1W/30dBm
	High-2462	17.55	1W/30dBm
TX 11n HT20	Low-2412	17.10	1W/30dBm
	Middle-2437	17.39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

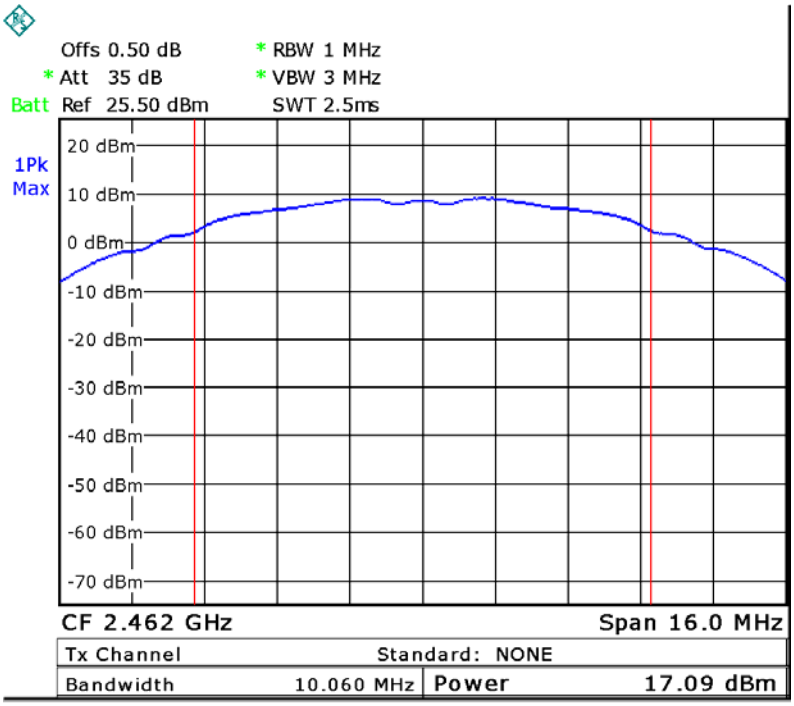
Mode: TX 11b channel 1



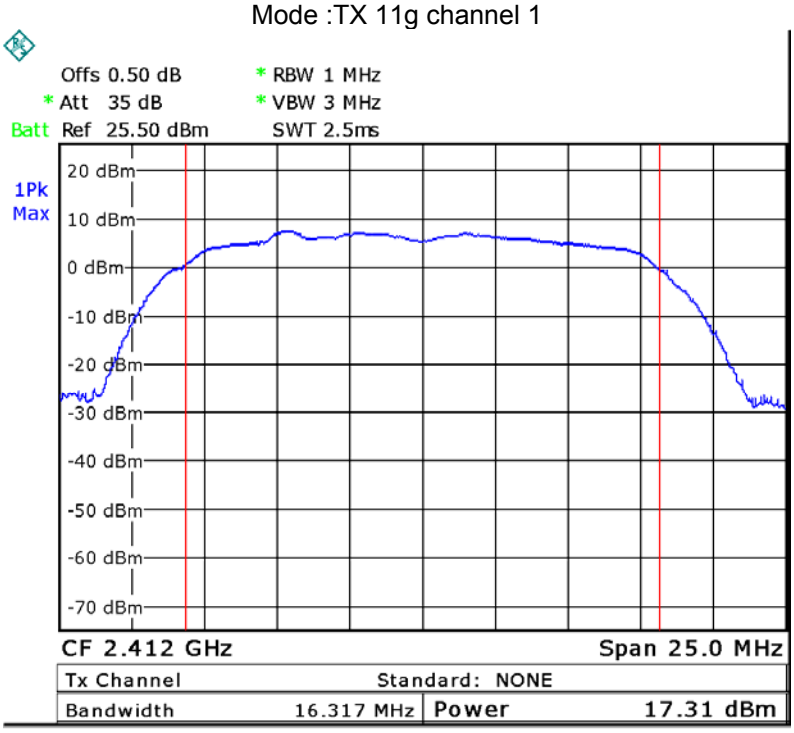
Mode: TX 11b channel 6



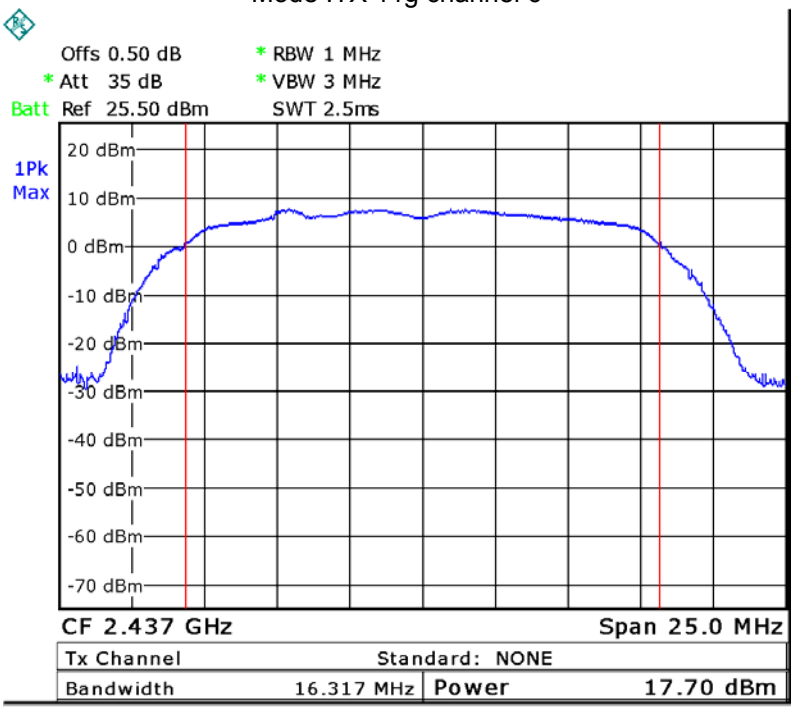
Mode: TX 11b channel 11



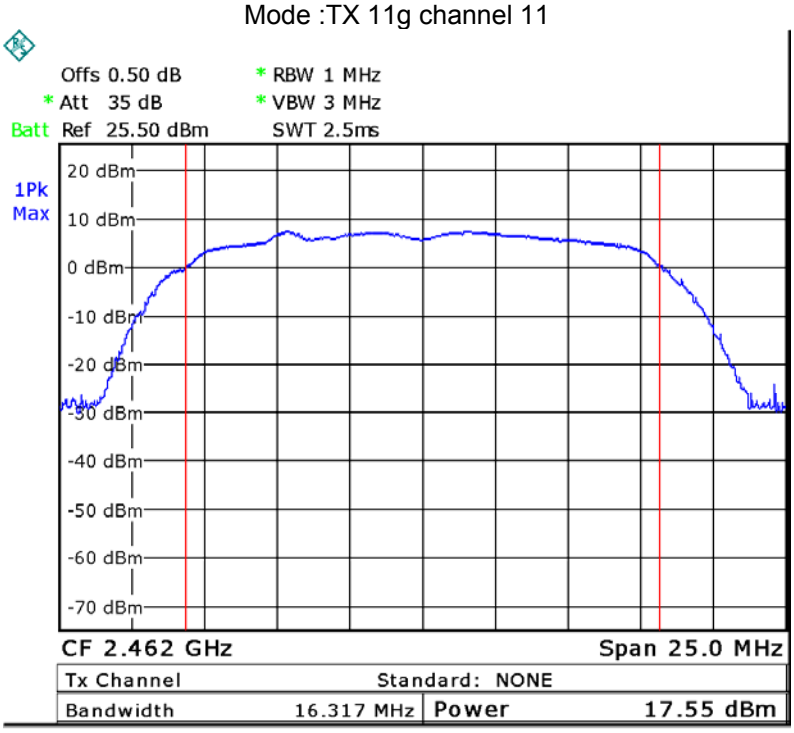
Mode :TX 11g channel 1



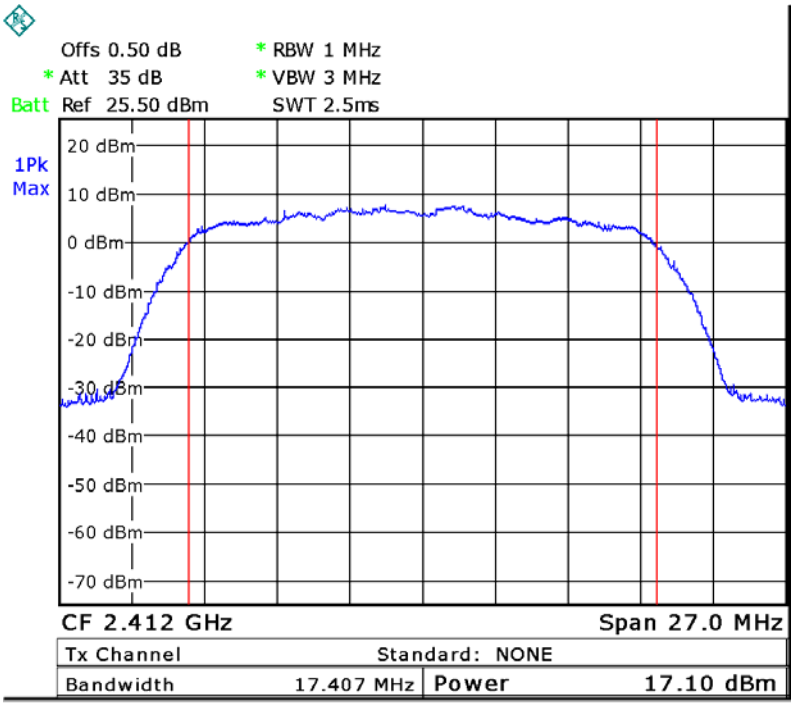
Mode :TX 11g channel 6



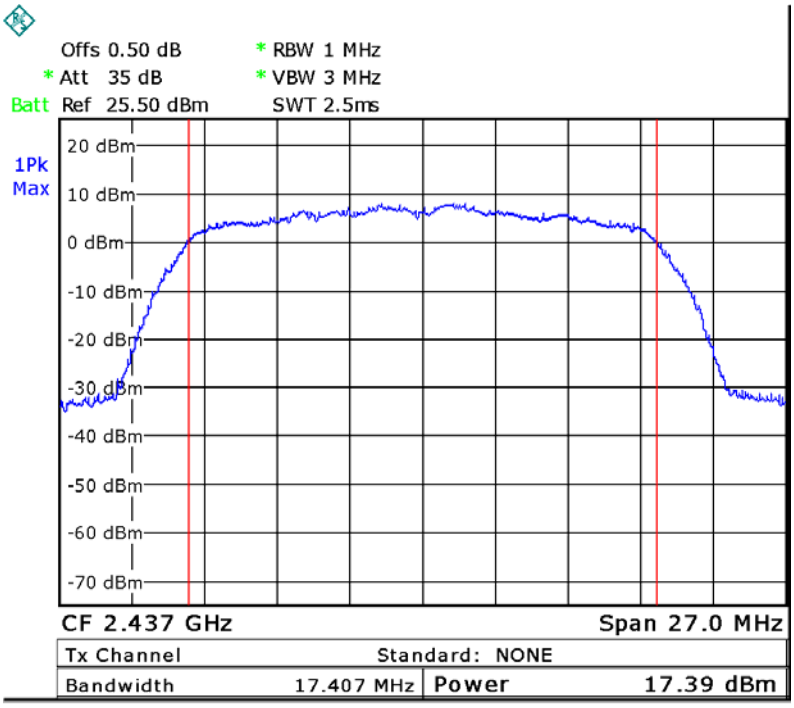
Mode :TX 11g channel 11



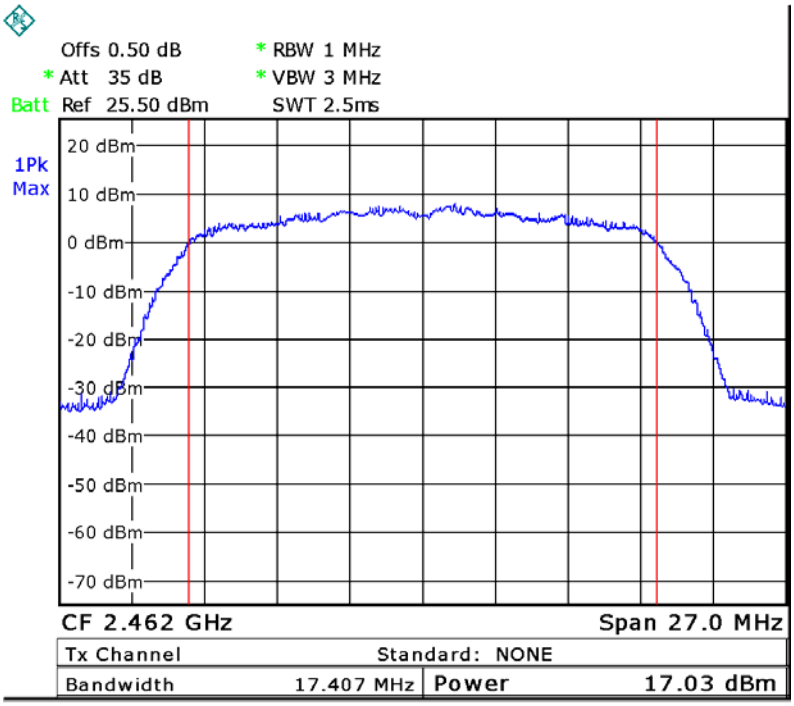
Mode: TX 11n HT20 channel 1



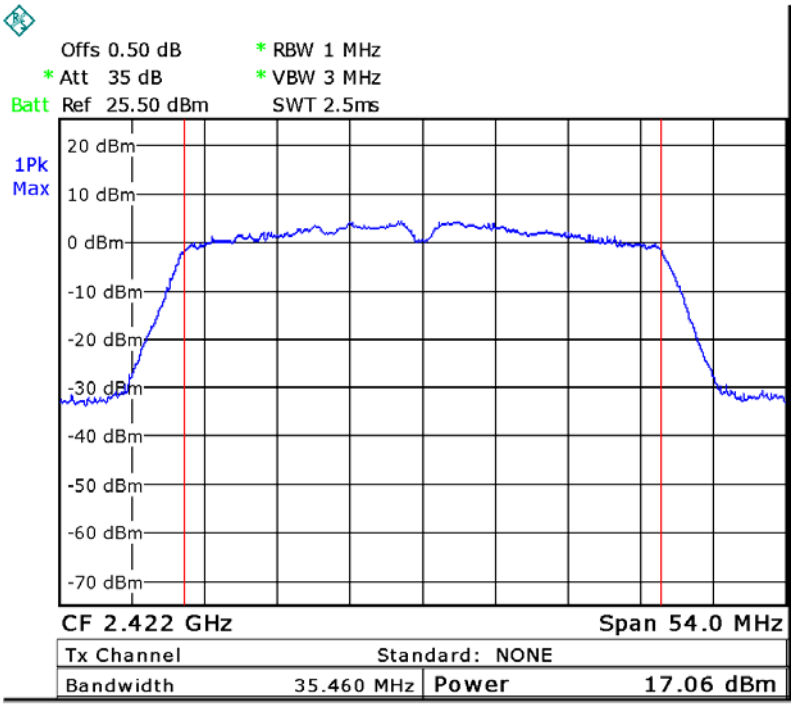
Mode: TX 11n HT20 channel 6



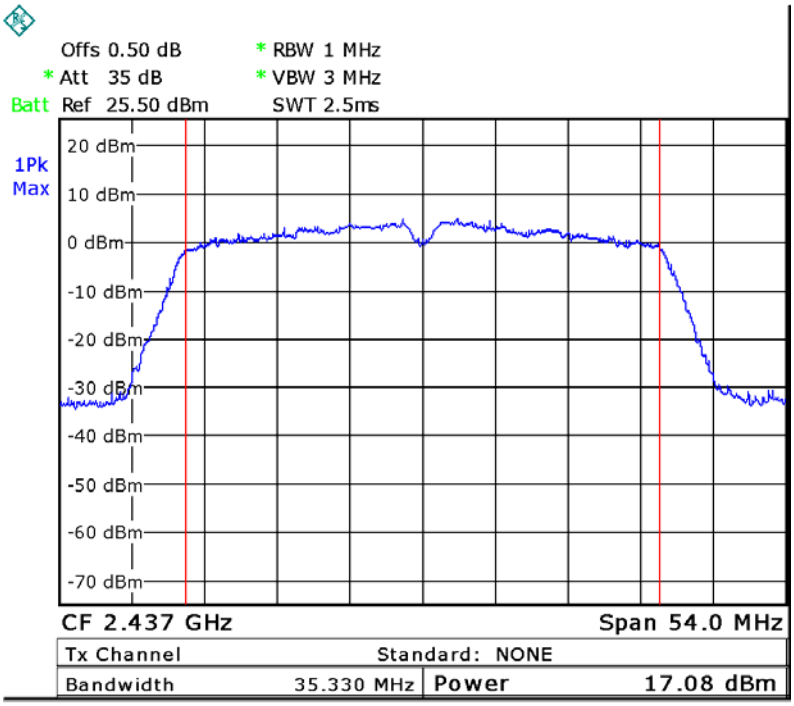
Mode: TX 11n HT20 channel 11



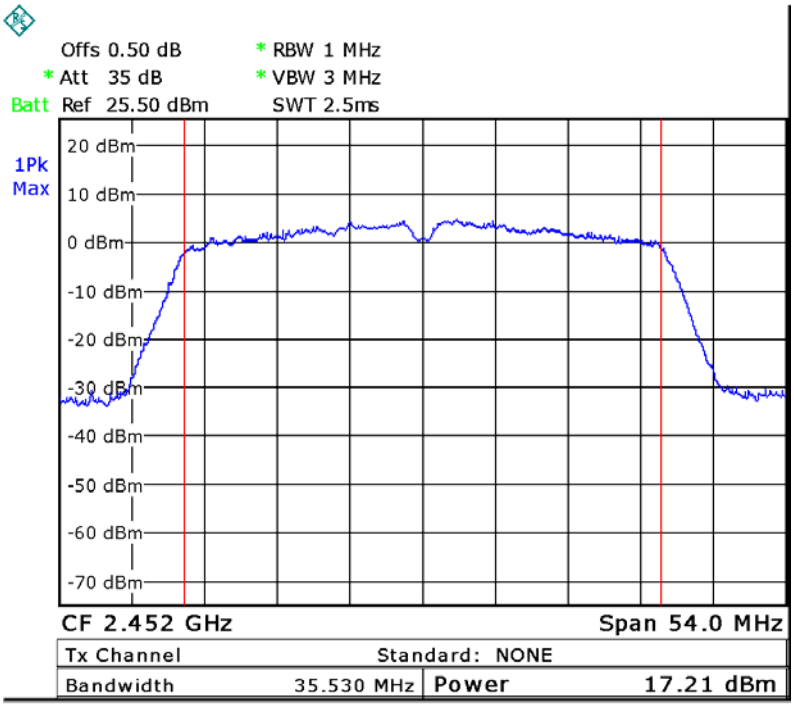
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



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.

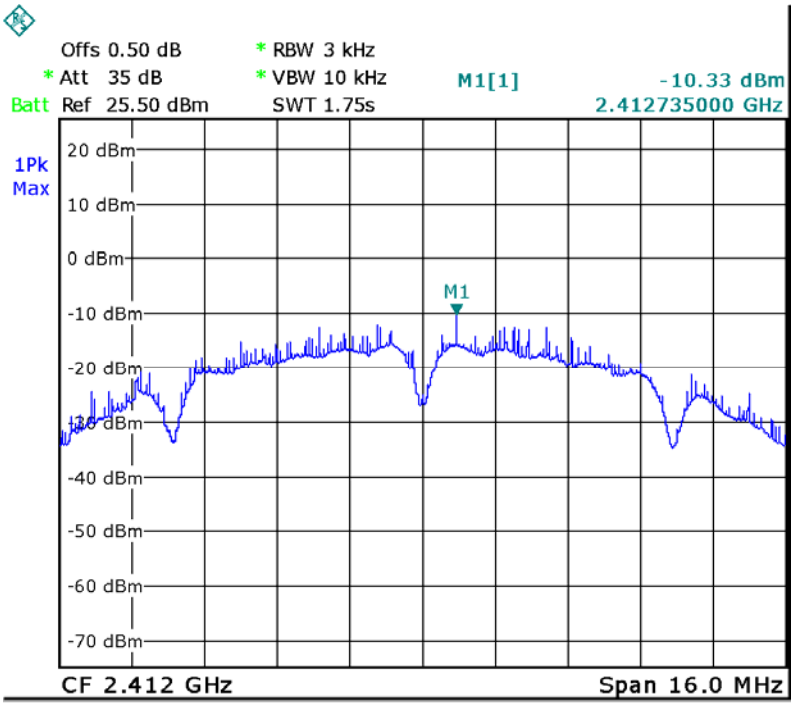
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

14.2 Test Result:

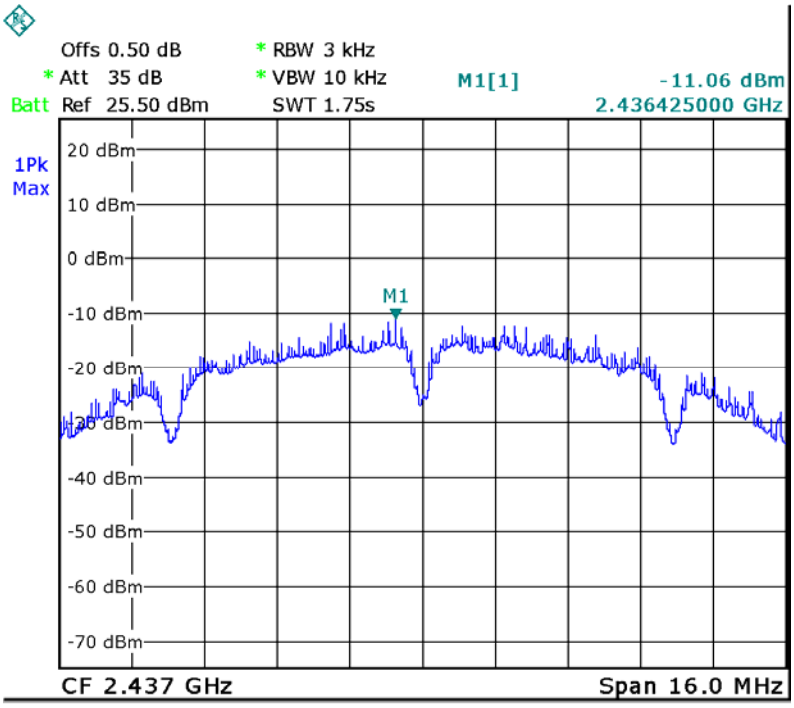
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-10.33	8dBm per 3kHz
	Middle-2437	-11.06	8dBm per 3kHz
	High-2462	-10.10	8dBm per 3kHz
TX 11g	Low-2412	-18.26	8dBm per 3kHz
	Middle-2437	-17.69	8dBm per 3kHz
	High-2462	-17.15	8dBm per 3kHz
TX 11n HT20	Low-2412	-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

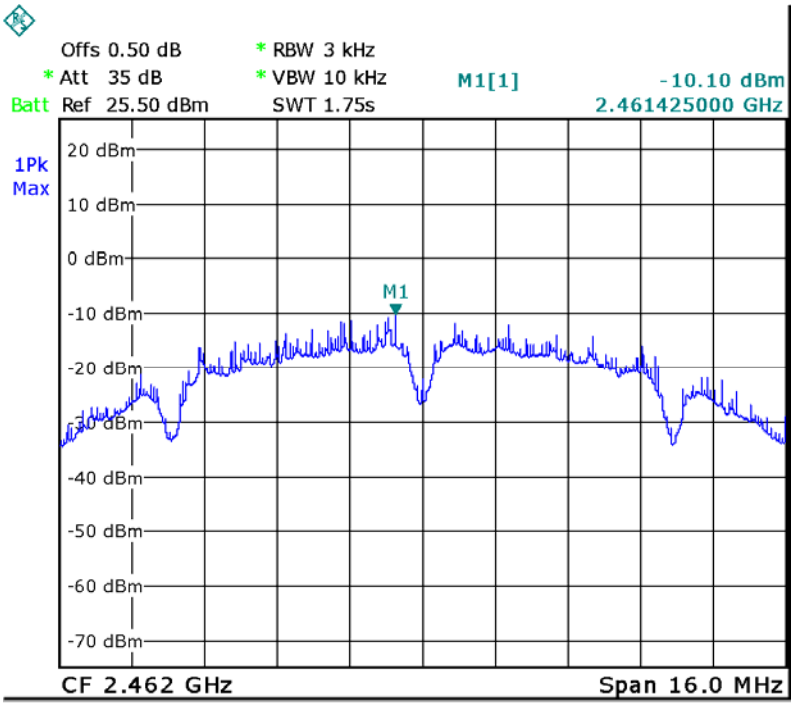
Mode: TX 11b channel 1



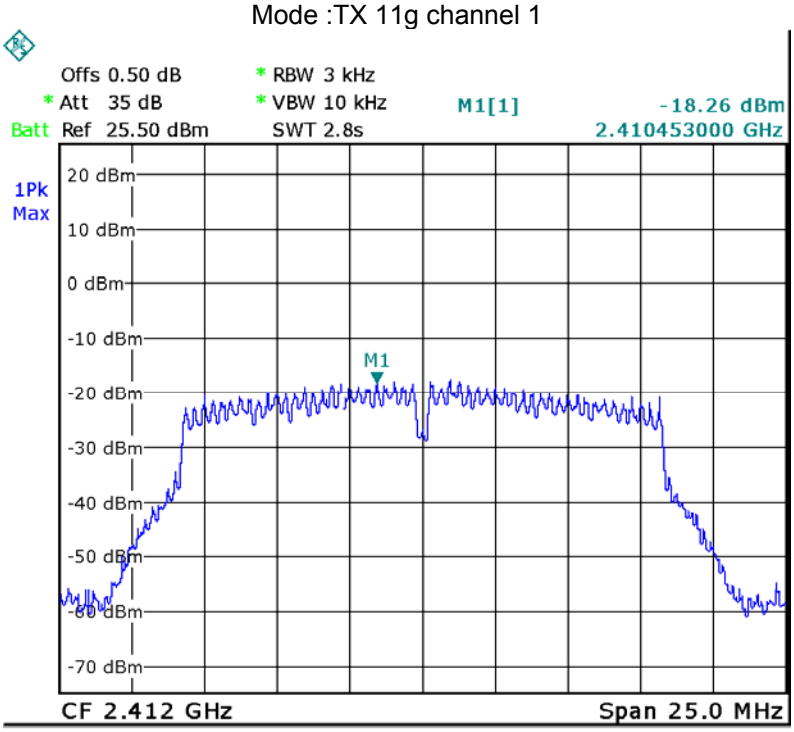
Mode: TX 11b channel 6



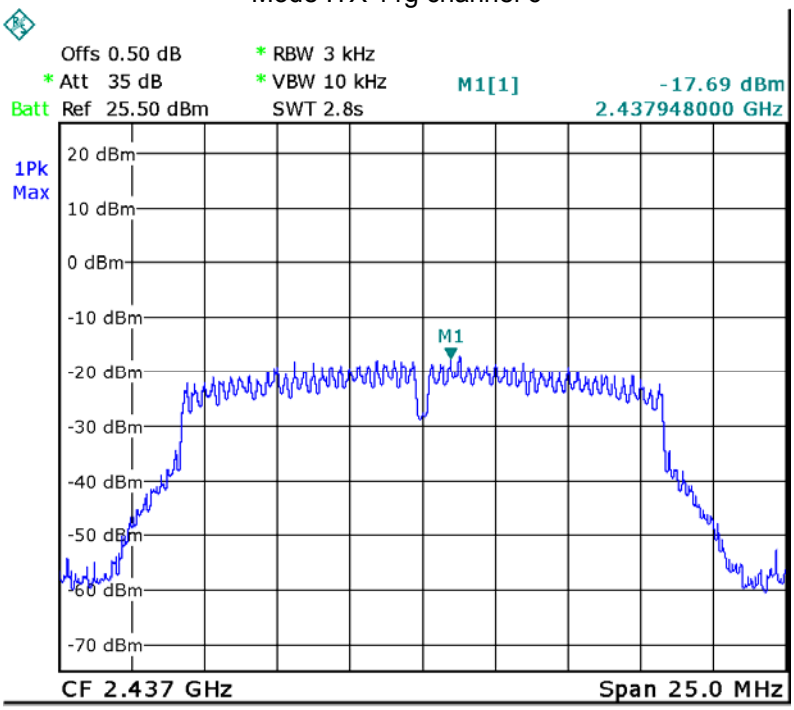
Mode: TX 11b channel 11



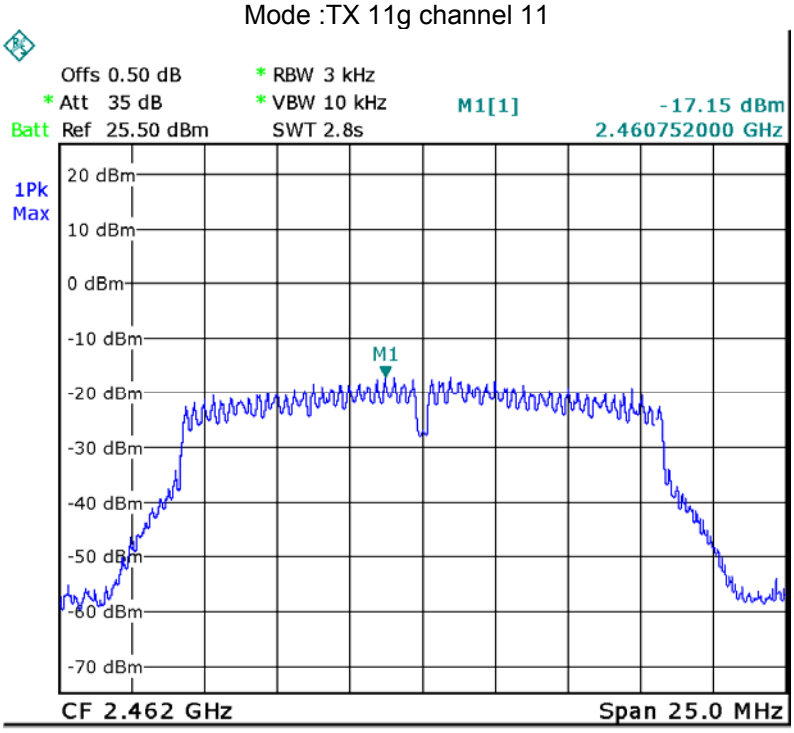
Mode :TX 11g channel 1



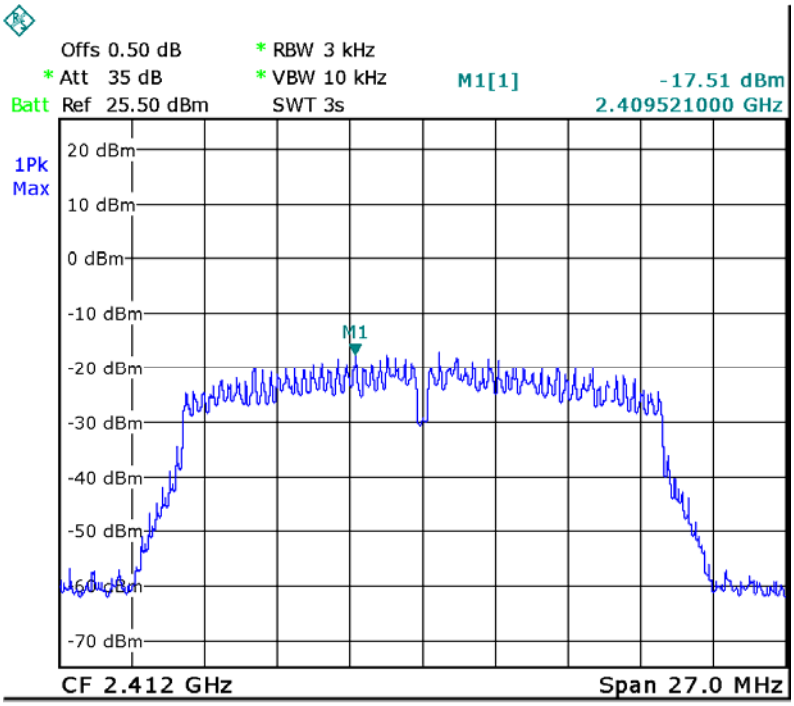
Mode :TX 11g channel 6



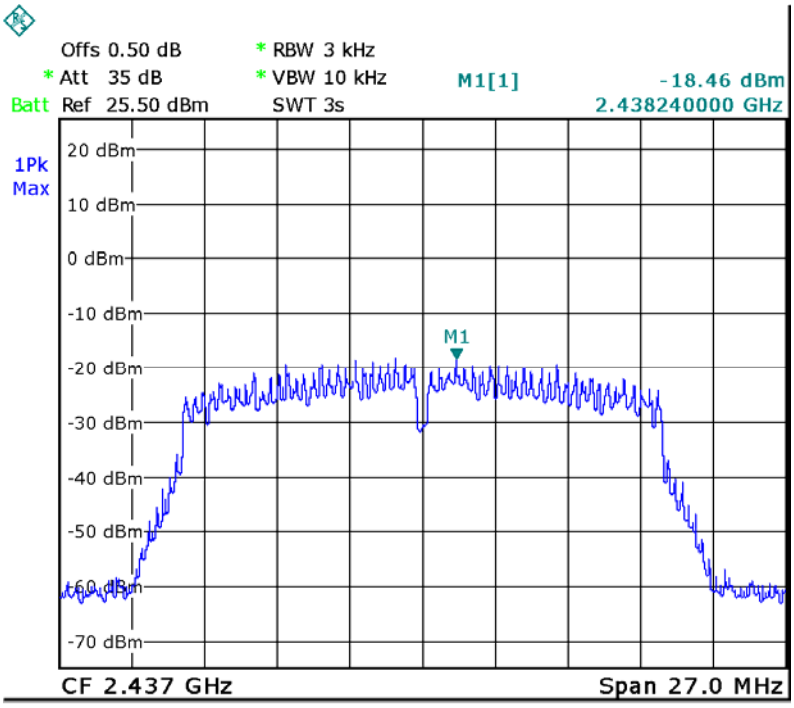
Mode :TX 11g channel 11



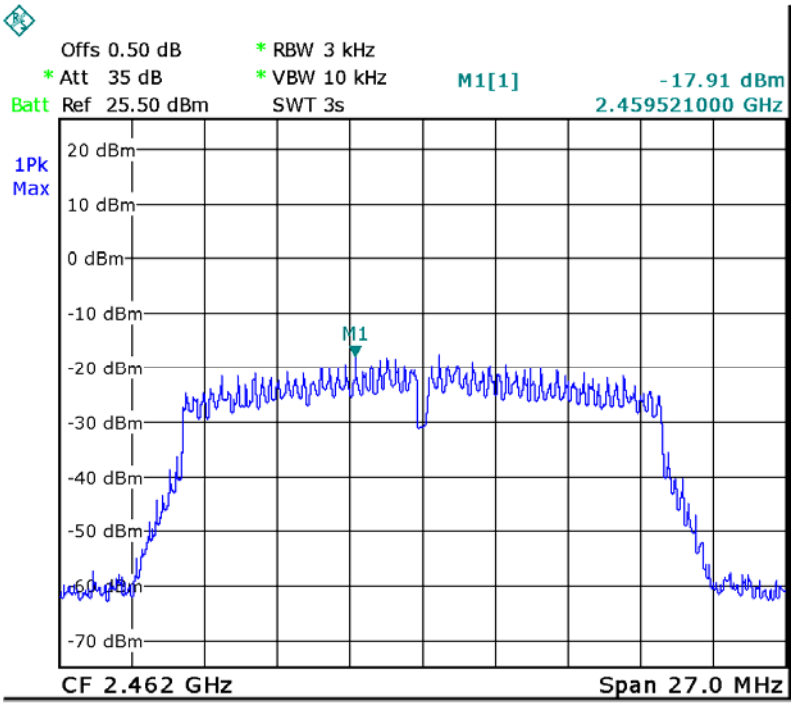
Mode: TX 11n HT20 channel 1



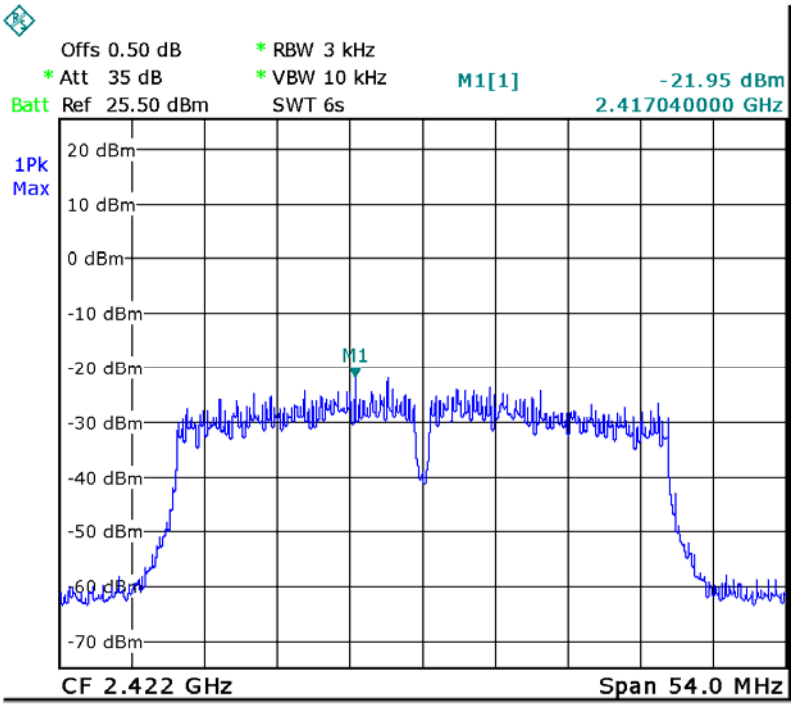
Mode: TX 11n HT20 channel 6



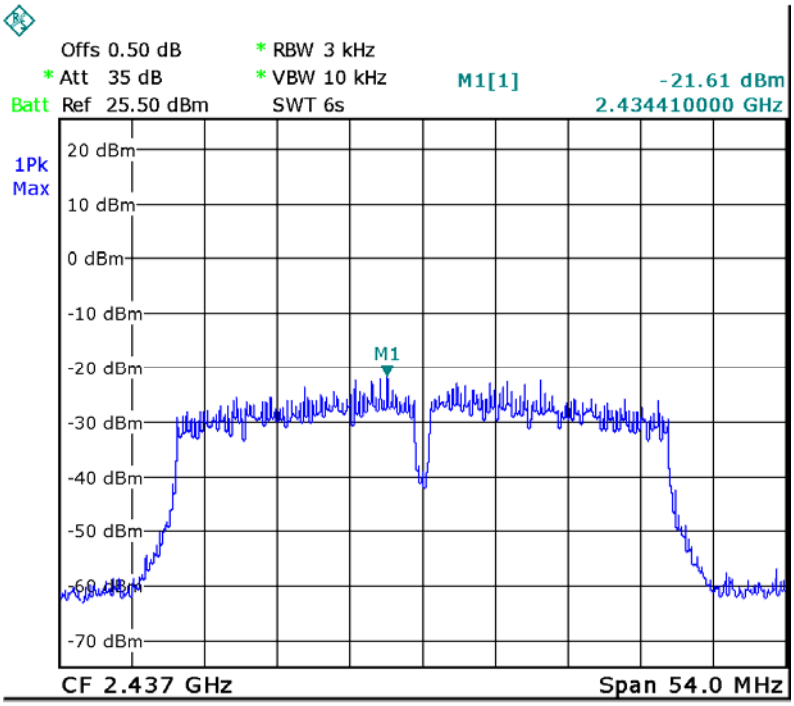
Mode: TX 11n HT20 channel 11



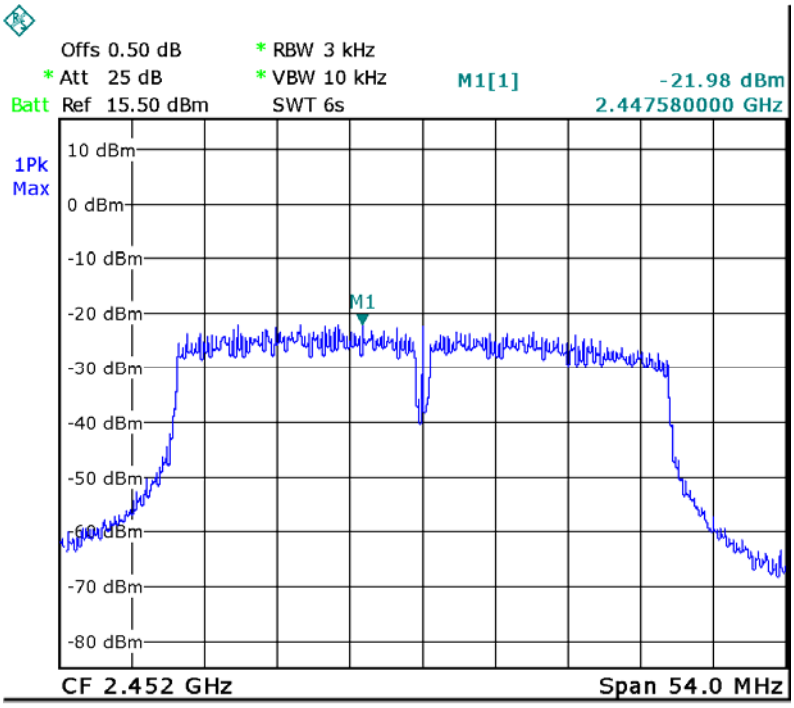
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



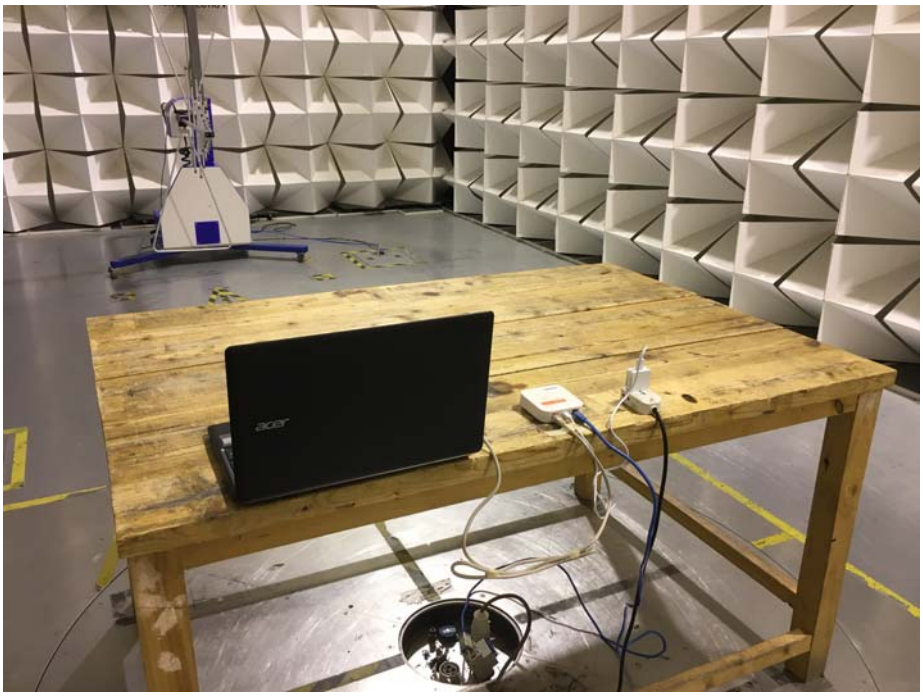
15 Antenna Requirement

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+

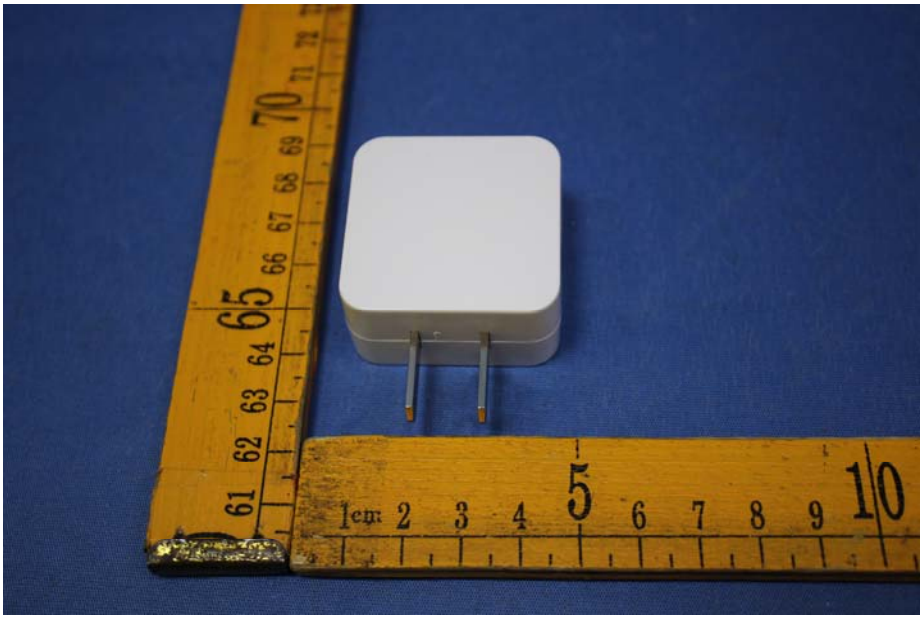
REXENSE

LAN
RESET
POWER
WAN

REXENSE
61 62 63 64 65 66 67 68 69 70
1cm 2 3 4 5 6 7 8 9 10 11 12

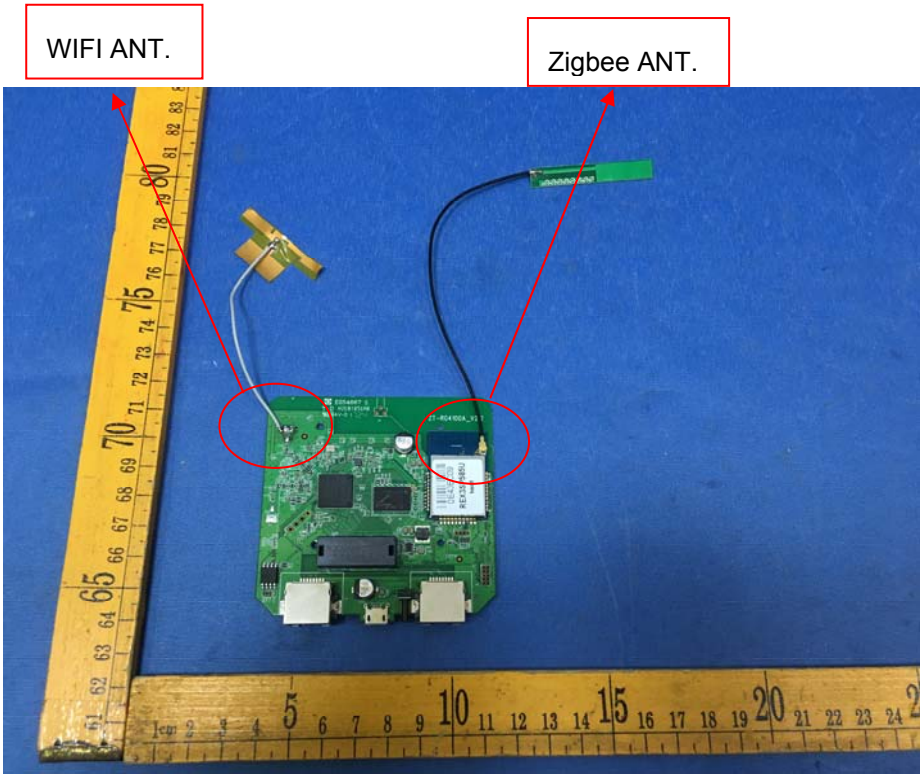
REXENSE
61 62 63 64 65 66 67 68 69 70
1cm 2 3 4 5 6 7 8 9 10 11 12

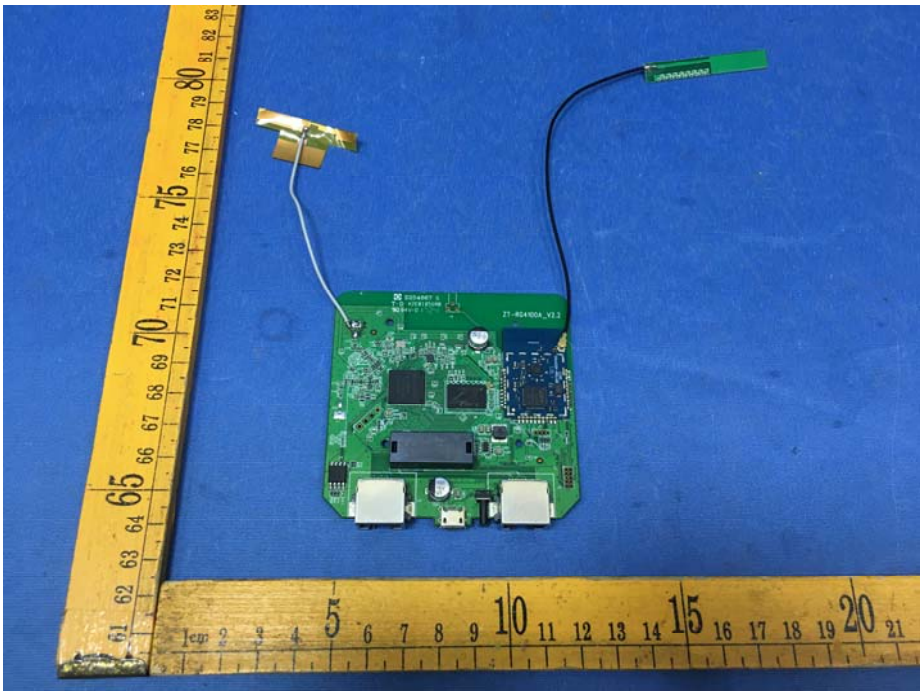
产品型号：RG4100+
默认网关：192.168.82.1
Web密码：admin
WIFI密码：87654321
SSID: WIFI-1FC0
ZigBee: 0E43EC09

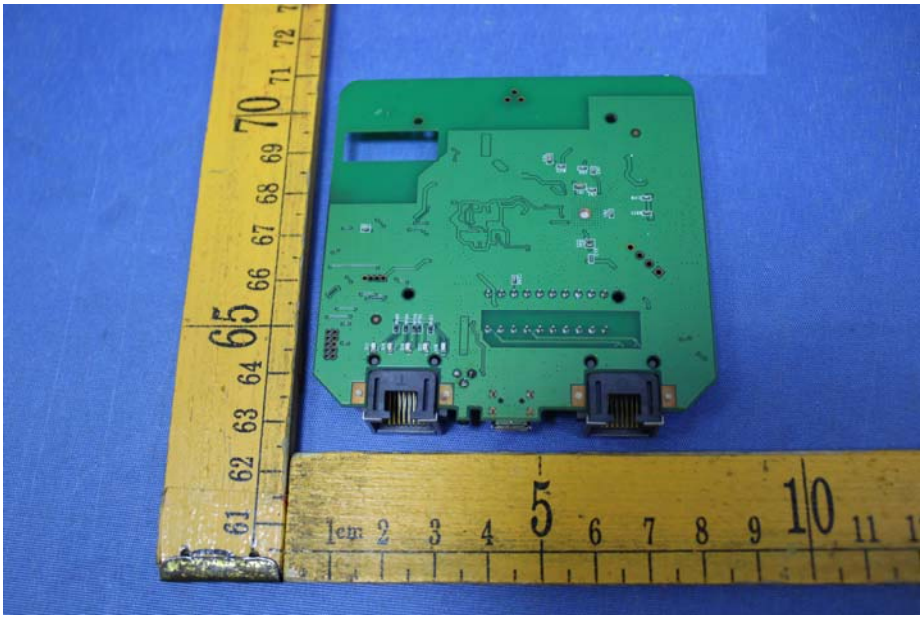


电源适配器
型号：ED1-050100UC
输入：100-240V~,50/60Hz 最大0.2A
输出：5V⎓1.0A 能效等级：V级别
生产者：迈思普电子有限公司制造 1701
监 制：浙江瑞素物联科技有限公司

17.2 Internal Photos - Model: RG4100+







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