TEST REPORT

Reference No.	:	WTD21D05049471W002
FCC ID	:	2AUKMMAXCRPROA
Applicant	:	Matco Tools
Address	:	4403 Allen Rd. Stow, OH 44224 USA
Manufacturer	:	The same as above
Address	:	The same as above
Product	:	Maximus Code Reader PROA
Model(s)	:	MAXCRPROA
Standards	:	FCC CFR47 Part 15.247
Date of Receipt sample	:	2021-05-27
Date of Test	:	2021-05-27 to 2021-06-07
Date of Issue	:	2021-06-07
Test Result	:	**Pass**

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

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2 Contents

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD21D05049471W002	2021-05-27	2021-05-27 to 2021-06-07	2021-06-07	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Maximus Code Reader PROA
Model(s):	MAXCRPROA
Model Description:	N/A
Wi-Fi Specification:	2.4G-802.11b/g/n HT20/n HT40
Hardware Version:	BSK-Y9-V3
Software Version:	YX_V100
Highest frequency (Exclude Radio):	26MHz
Storage Location:	Internal Storage
Note:	N/A

4.2 Details of E.U.T.

Operation Frequency:	WiFi: 802.11b/g/n HT20: 2412~2462MHz 802.11n HT40: 2422~2452MHz
Max. RF output power:	WiFi(2.4G): 17.20dBm
Type of Modulation:	WiFi: CCK, OFDM
Antenna installation:	WiFi: internal permanent antenna
Antenna Gain:	WiFi(2.4G): 5.37dBi
Ratings:	Input:12V⎓0.7A USB Input: 5V⎓1A

4.3 Channel List

WIFI

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

4.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Power Spectral Density	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
6dB Bandwidth	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Band Edge	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX
Transmitter Spurious Emissions	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
	802.11n HT40	150 Mbps	3/6/9	TX

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

5 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)	N/A
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

6 Equipment Used during Test

6.1 Equipments List

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	FSP30	100091	2021-04-19	2022-04-18
2	Amplifier	Agilent	8447D	2944A10178	2021-04-19	2022-04-18
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2020-08-22	2021-08-21
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2021-04-19	2022-04-18
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2021-04-24	2022-04-23
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2021-04-19	2022-04-18
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2021-04-19	2022-04-18
8	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	NA	2021-04-19	2022-04-18
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	2021-04-19	2022-04-18
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2021-04-24	2022-04-23
3	Active Loop Antenna	Com-Power Corp.	AL-130R	10160007	2021-05-05	2022-05-04
4	Amplifier	ANRITSU	MH648A	M43381	2021-04-19	2022-04-18
5	Cable	HUBER+SUHNER	CBL2	525178	2021-04-19	2022-04-18
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	2021-04-19	2022-04-18
2.	Spectrum Analyzer	R&S	FSP30	100091	2021-04-19	2022-04-18
3.	EXA Signal Analyzer	Malaysia Keysight	N9010A	MY50520207	2021-04-19	2022-04-18

6.2 Description of Support Units

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

6.3 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 (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Conducted Spurious Emissions test	± 3.12 dB (9kHz~30MHz)
	± 4.21 dB (30M~1000MHz)
	± 5.14 dB (1000M~26500MHz)

6.4 Test Equipment Calibration

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

7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018; 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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

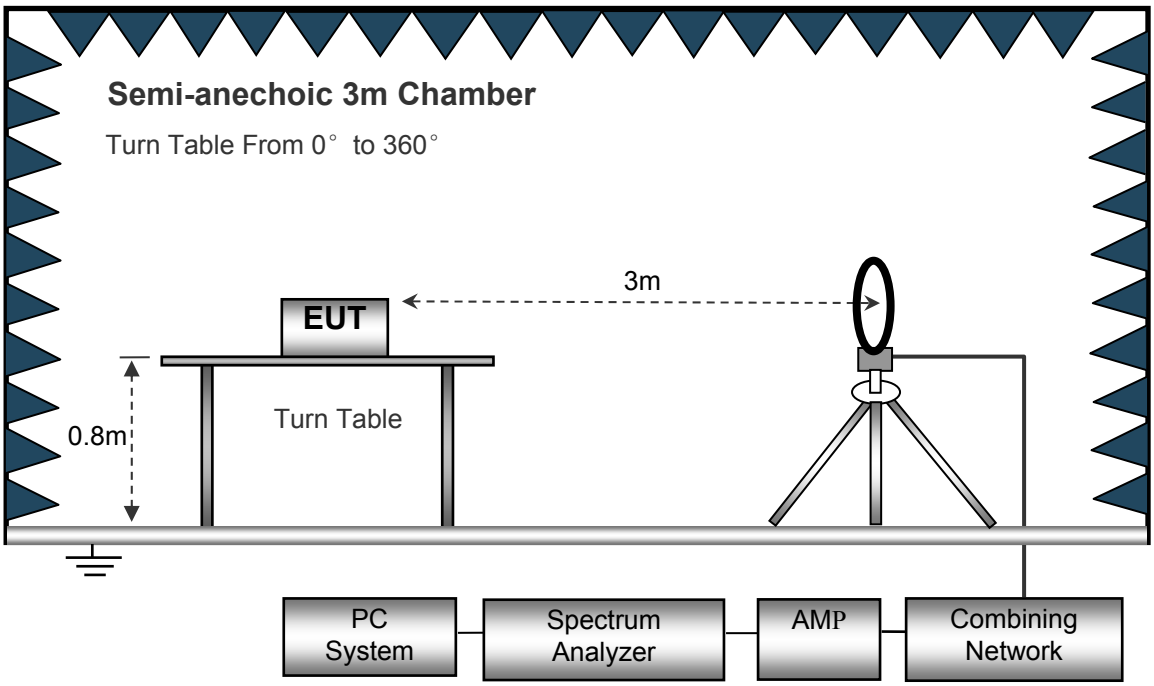
EUT Operation **:**

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

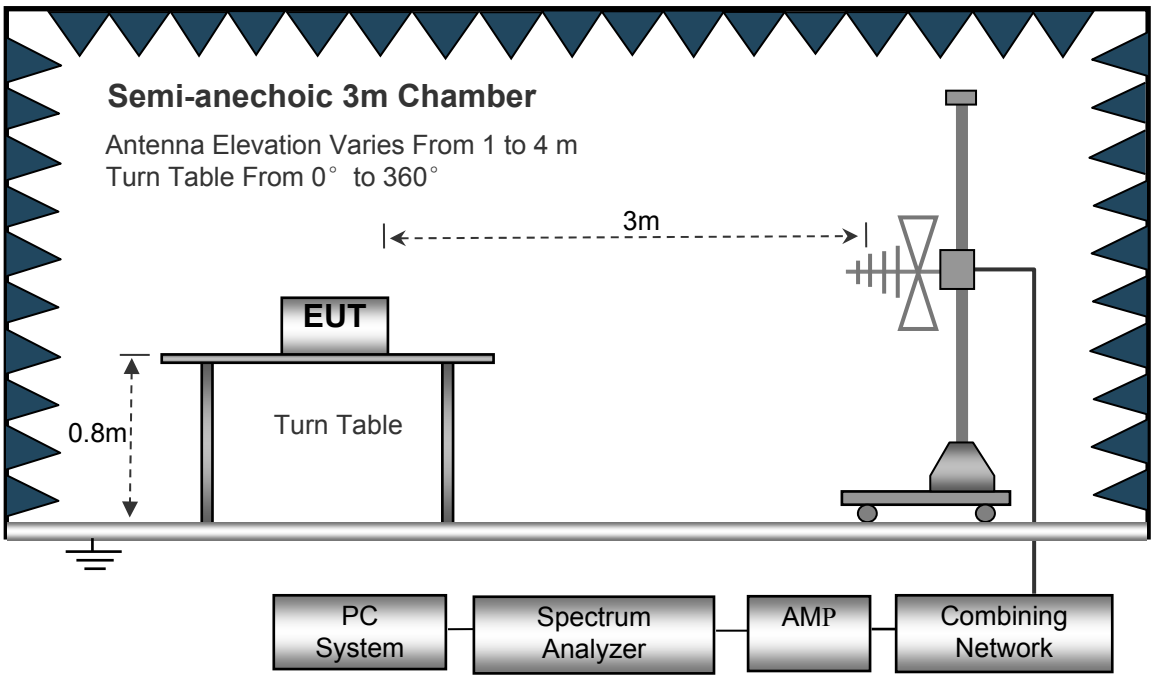
7.2 Test Setup

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

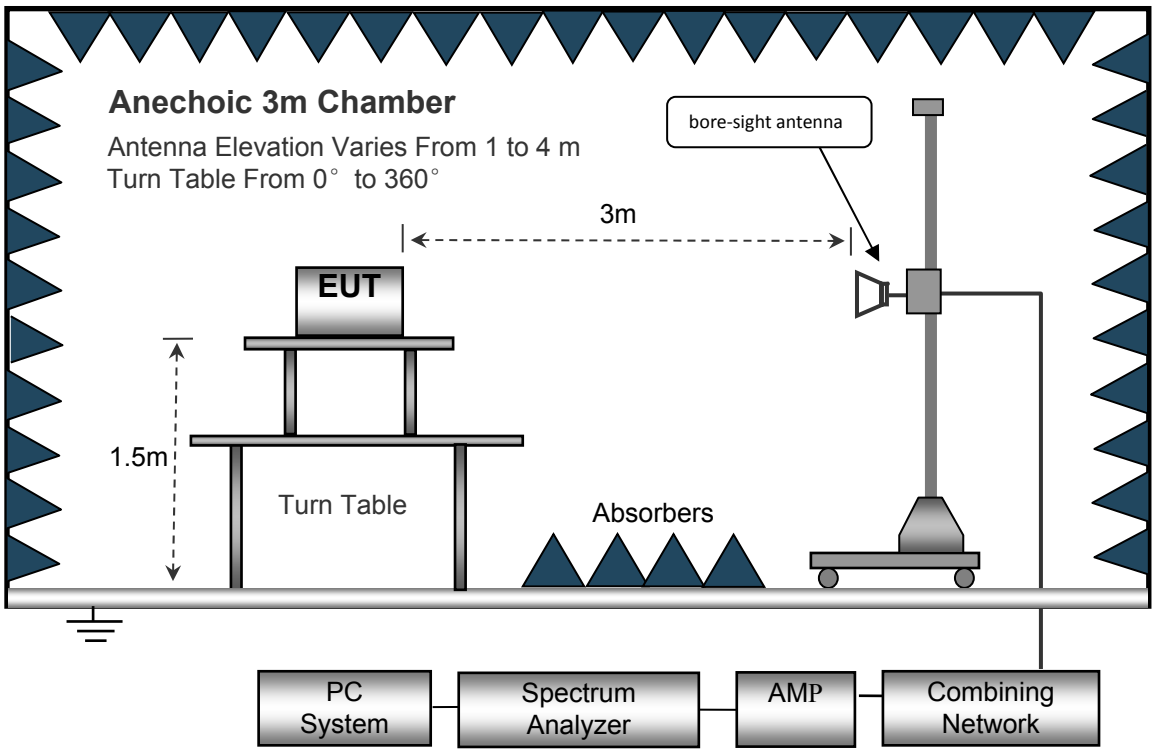
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 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

7.4 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.

7.5 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

7.6 Summary of Test Results

Wifi:
Test Frequency: 9KHz~30MHz

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

Frequency	Measurement results dBμV @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dBμV/m @30m	Limits dBμV/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
802.11b							
6.022	25.45	QP	21.84	40.00	7.29	29.54	-22.25
15.430	25.23	QP	21.35	40.00	6.58	29.54	-22.96
25.650	25.58	QP	20.67	40.00	6.25	29.54	-23.29
802.11g							
6.022	25.44	QP	21.84	40.00	7.28	29.54	-22.26
15.430	25.24	QP	21.35	40.00	6.59	29.54	-22.95
25.650	25.51	QP	20.67	40.00	6.18	29.54	-23.36
802.11n(HT20)							
6.022	25.43	QP	21.84	40.00	7.27	29.54	-22.27
15.430	25.26	QP	21.35	40.00	6.61	29.54	-22.93
25.650	25.57	QP	20.67	40.00	6.24	29.54	-23.30
802.11n(HT40)							
6.022	25.46	QP	21.84	40.00	7.30	29.54	-22.24
15.430	25.23	QP	21.35	40.00	6.58	29.54	-22.96
25.650	25.54	QP	20.67	40.00	6.21	29.54	-23.33

Test Frequency : 30MHz ~ 8GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Low Channel 2412MHz									
223.36	37.70	QP	288	1.5	H	-11.62	26.08	46.00	-19.92
223.36	32.04	QP	231	1.0	V	-11.62	20.42	46.00	-25.58
4824.00	51.97	PK	358	1.7	V	-1.06	50.91	74.00	-23.09
4824.00	47.44	Ave	358	1.7	V	-1.06	46.38	54.00	-7.62
7236.00	44.73	PK	60	1.2	H	1.33	46.06	74.00	-27.94
7236.00	42.44	Ave	60	1.2	H	1.33	43.77	54.00	-10.23
2342.23	45.04	PK	354	1.3	V	-13.19	31.85	74.00	-42.15
2342.23	37.32	Ave	354	1.3	V	-13.19	24.13	54.00	-29.87
2383.27	43.47	PK	24	1.4	H	-13.14	30.33	74.00	-43.67
2383.27	38.16	Ave	24	1.4	H	-13.14	25.02	54.00	-28.98
2499.95	42.76	PK	285	1.2	V	-13.08	29.68	74.00	-44.32
2499.95	37.40	Ave	285	1.2	V	-13.08	24.32	54.00	-29.68

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Middle Channel 2437MHz									
223.36	37.56	QP	316	1.9	H	-11.62	25.94	46.00	-20.06
223.36	33.18	QP	172	1.5	V	-11.62	21.56	46.00	-24.44
4874.00	52.00	PK	24	2.0	V	-0.62	51.38	74.00	-22.62
4874.00	47.63	Ave	24	2.0	V	-0.62	47.01	54.00	-6.99
7311.00	43.46	PK	233	1.1	H	2.21	45.67	74.00	-28.33
7311.00	43.06	Ave	233	1.1	H	2.21	45.27	54.00	-8.73
2329.33	45.54	PK	22	1.6	V	-13.19	32.35	74.00	-41.65
2329.33	39.38	Ave	22	1.6	V	-13.19	26.19	54.00	-27.81
2387.63	42.87	PK	149	1.3	H	-13.14	29.73	74.00	-44.27
2387.63	38.49	Ave	149	1.3	H	-13.14	25.35	54.00	-28.65
2489.44	42.63	PK	326	1.3	V	-13.08	29.55	74.00	-44.45
2489.44	36.16	Ave	326	1.3	V	-13.08	23.08	54.00	-30.92

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: High Channel 2462MHz									
223.36	37.87	QP	183	1.2	H	-11.62	26.25	46.00	-19.75
223.36	34.34	QP	135	1.0	V	-11.62	22.72	46.00	-23.28
4924.00	51.67	PK	283	1.9	V	-0.24	51.43	74.00	-22.57
4924.00	47.63	Ave	283	1.9	V	-0.24	47.39	54.00	-6.61
7386.00	43.45	PK	18	1.2	H	2.84	46.29	74.00	-27.71
7386.00	41.77	Ave	18	1.2	H	2.84	44.61	54.00	-9.39
2335.82	46.73	PK	86	1.6	V	-13.19	33.54	74.00	-40.46
2335.82	38.37	Ave	86	1.6	V	-13.19	25.18	54.00	-28.82
2377.71	43.91	PK	300	1.9	H	-13.14	30.77	74.00	-43.23
2377.71	37.73	Ave	300	1.9	H	-13.14	24.59	54.00	-29.41
2486.37	42.26	PK	187	1.1	V	-13.08	29.18	74.00	-44.82
2486.37	37.86	Ave	187	1.1	V	-13.08	24.78	54.00	-29.22

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: Low Channel 2412MHz									
223.36	38.73	QP	314	1.3	H	-11.62	27.11	46.00	-18.89
223.36	33.73	QP	28	1.3	V	-11.62	22.11	46.00	-23.89
4824.00	51.44	PK	276	1.5	V	-1.06	50.38	74.00	-23.62
4824.00	47.62	Ave	276	1.5	V	-1.06	46.56	54.00	-7.44
7236.00	42.65	PK	318	1.0	H	1.33	43.98	74.00	-30.02
7236.00	41.25	Ave	318	1.0	H	1.33	42.58	54.00	-11.42
2325.17	45.74	PK	102	1.9	V	-13.19	32.55	74.00	-41.45
2325.17	37.02	Ave	102	1.9	V	-13.19	23.83	54.00	-30.17
2374.22	44.63	PK	188	1.0	H	-13.14	31.49	74.00	-42.51
2374.22	38.36	Ave	188	1.0	H	-13.14	25.22	54.00	-28.78
2493.25	44.06	PK	57	1.6	V	-13.08	30.98	74.00	-43.02
2493.25	36.56	Ave	57	1.6	V	-13.08	23.48	54.00	-30.52

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: Middle Channel 2437MHz									
223.36	39.66	QP	269	1.3	H	-11.62	28.04	46.00	-17.96
223.36	33.96	QP	94	1.6	V	-11.62	22.34	46.00	-23.66
4874.00	52.14	PK	131	1.8	V	-0.62	51.52	74.00	-22.48
4874.00	47.29	Ave	131	1.8	V	-0.62	46.67	54.00	-7.33
7311.00	43.80	PK	153	1.9	H	2.21	46.01	74.00	-27.99
7311.00	42.07	Ave	153	1.9	H	2.21	44.28	54.00	-9.72
2346.63	46.81	PK	16	1.7	V	-13.19	33.62	74.00	-40.38
2346.63	38.09	Ave	16	1.7	V	-13.19	24.90	54.00	-29.10
2388.69	44.23	PK	180	1.2	H	-13.14	31.09	74.00	-42.91
2388.69	38.78	Ave	180	1.2	H	-13.14	25.64	54.00	-28.36
2483.67	42.00	PK	140	1.7	V	-13.08	28.92	74.00	-45.08
2483.67	37.44	Ave	140	1.7	V	-13.08	24.36	54.00	-29.64

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11g: High Channel 2462MHz									
223.36	40.05	QP	160	1.3	H	-11.62	28.43	46.00	-17.57
223.36	33.18	QP	143	1.3	V	-11.62	21.56	46.00	-24.44
4924.00	51.52	PK	154	1.6	V	-0.24	51.28	74.00	-22.72
4924.00	48.53	Ave	154	1.6	V	-0.24	48.29	54.00	-5.71
7386.00	43.33	PK	318	1.3	H	2.84	46.17	74.00	-27.83
7386.00	42.89	Ave	318	1.3	H	2.84	45.73	54.00	-8.27
2332.06	45.64	PK	179	1.8	V	-13.19	32.45	74.00	-41.55
2332.06	38.62	Ave	179	1.8	V	-13.19	25.43	54.00	-28.57
2361.77	42.53	PK	329	1.2	H	-13.14	29.39	74.00	-44.61
2361.77	37.06	Ave	329	1.2	H	-13.14	23.92	54.00	-30.08
2494.56	42.55	PK	116	1.5	V	-13.08	29.47	74.00	-44.53
2494.56	38.98	Ave	116	1.5	V	-13.08	25.90	54.00	-28.10

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: Low Channel 2412MHz									
223.36	40.01	QP	333	1.5	H	-11.62	28.39	46.00	-17.61
223.36	34.62	QP	199	1.6	V	-11.62	23.00	46.00	-23.00
4824.00	51.84	PK	90	1.8	V	-1.06	50.78	74.00	-23.22
4824.00	48.54	Ave	90	1.8	V	-1.06	47.48	54.00	-6.52
7236.00	43.17	PK	18	1.0	H	1.33	44.50	74.00	-29.50
7236.00	41.48	Ave	18	1.0	H	1.33	42.81	54.00	-11.19
2318.29	46.58	PK	0	1.8	V	-13.19	33.39	74.00	-40.61
2318.29	37.84	Ave	0	1.8	V	-13.19	24.65	54.00	-29.35
2361.66	43.15	PK	358	1.3	H	-13.14	30.01	74.00	-43.99
2361.66	37.89	Ave	358	1.3	H	-13.14	24.75	54.00	-29.25
2488.65	44.35	PK	244	1.5	V	-13.08	31.27	74.00	-42.73
2488.65	36.32	Ave	244	1.5	V	-13.08	23.24	54.00	-30.76

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: Middle Channel 2437MHz									
223.36	40.53	QP	348	1.3	H	-11.62	28.91	46.00	-17.09
223.36	34.93	QP	185	1.8	V	-11.62	23.31	46.00	-22.69
4874.00	53.23	PK	79	1.0	V	-0.62	52.61	74.00	-21.39
4874.00	47.18	Ave	79	1.0	V	-0.62	46.56	54.00	-7.44
7311.00	43.68	PK	175	1.4	H	2.21	45.89	74.00	-28.11
7311.00	41.64	Ave	175	1.4	H	2.21	43.85	54.00	-10.15
2333.58	45.30	PK	260	1.4	V	-13.19	32.11	74.00	-41.89
2333.58	39.47	Ave	260	1.4	V	-13.19	26.28	54.00	-27.72
2388.68	44.00	PK	23	1.9	H	-13.14	30.86	74.00	-43.14
2388.68	37.92	Ave	23	1.9	H	-13.14	24.78	54.00	-29.22
2487.96	43.46	PK	124	1.1	V	-13.08	30.38	74.00	-43.62
2487.96	37.86	Ave	124	1.1	V	-13.08	24.78	54.00	-29.22

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n20: High Channel 2462MHz									
223.36	40.68	QP	65	1.9	H	-11.62	29.06	46.00	-16.94
223.36	36.35	QP	93	1.4	V	-11.62	24.73	46.00	-21.27
4924.00	53.83	PK	143	1.4	V	-0.24	53.59	74.00	-20.41
4924.00	47.05	Ave	143	1.4	V	-0.24	46.81	54.00	-7.19
7386.00	44.28	PK	260	1.9	H	2.84	47.12	74.00	-26.88
7386.00	40.79	Ave	260	1.9	H	2.84	43.63	54.00	-10.37
2342.50	45.16	PK	138	1.3	V	-13.19	31.97	74.00	-42.03
2342.50	38.02	Ave	138	1.3	V	-13.19	24.83	54.00	-29.17
2356.27	44.52	PK	69	1.9	H	-13.14	31.38	74.00	-42.62
2356.27	36.02	Ave	69	1.9	H	-13.14	22.88	54.00	-31.12
2485.47	43.75	PK	104	1.9	V	-13.08	30.67	74.00	-43.33
2485.47	37.72	Ave	104	1.9	V	-13.08	24.64	54.00	-29.36

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n40: Low Channel 2422MHz									
223.36	39.84	QP	296	1.7	H	-11.62	28.22	46.00	-17.78
223.36	36.93	QP	288	1.5	V	-11.62	25.31	46.00	-20.69
4844.00	52.58	PK	94	1.3	V	-1.06	51.52	74.00	-22.48
4844.00	44.05	Ave	94	1.3	V	-1.06	42.99	54.00	-11.01
7266.00	42.74	PK	197	1.6	H	1.33	44.07	74.00	-29.93
7266.00	39.43	Ave	197	1.6	H	1.33	40.76	54.00	-13.24
2336.35	46.55	PK	141	1.8	V	-13.19	33.36	74.00	-40.64
2336.35	39.97	Ave	141	1.8	V	-13.19	26.78	54.00	-27.22
2386.82	44.64	PK	320	1.5	H	-13.14	31.50	74.00	-42.50
2386.82	36.61	Ave	320	1.5	H	-13.14	23.47	54.00	-30.53
2486.00	44.32	PK	286	1.1	V	-13.08	31.24	74.00	-42.76
2486.00	37.51	Ave	286	1.1	V	-13.08	24.43	54.00	-29.57

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n40: Middle Channel 2437MHz									
223.36	40.73	QP	215	1.8	H	-11.62	29.11	46.00	-16.89
223.36	36.56	QP	250	2.0	V	-11.62	24.94	46.00	-21.06
4874.00	53.01	PK	38	1.2	V	-0.62	52.39	74.00	-21.61
4874.00	43.54	Ave	38	1.2	V	-0.62	42.92	54.00	-11.08
7311.00	42.30	PK	211	1.7	H	2.21	44.51	74.00	-29.49
7311.00	38.46	Ave	211	1.7	H	2.21	40.67	54.00	-13.33
2347.89	46.74	PK	244	1.5	V	-13.19	33.55	74.00	-40.45
2347.89	39.96	Ave	244	1.5	V	-13.19	26.77	54.00	-27.23
2378.07	42.48	PK	329	1.5	H	-13.14	29.34	74.00	-44.66
2378.07	36.87	Ave	329	1.5	H	-13.14	23.73	54.00	-30.27
2490.61	43.20	PK	27	1.8	V	-13.08	30.12	74.00	-43.88
2490.61	38.03	Ave	27	1.8	V	-13.08	24.95	54.00	-29.05

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11n40: High Channel 2452MHz									
223.36	40.40	QP	100	1.1	H	-11.62	28.78	46.00	-17.22
223.36	36.96	QP	329	1.9	V	-11.62	25.34	46.00	-20.66
4904.00	53.86	PK	69	1.4	V	-0.24	53.62	74.00	-20.38
4904.00	44.35	Ave	69	1.4	V	-0.24	44.11	54.00	-9.89
7356.00	42.42	PK	134	1.6	H	2.84	45.26	74.00	-28.74
7356.00	39.44	Ave	134	1.6	H	2.84	42.28	54.00	-11.72
2330.41	45.91	PK	78	1.2	V	-13.19	32.72	74.00	-41.28
2330.41	37.82	Ave	78	1.2	V	-13.19	24.63	54.00	-29.37
2372.49	44.83	PK	0	1.8	H	-13.14	31.69	74.00	-42.31
2372.49	36.72	Ave	0	1.8	H	-13.14	23.58	54.00	-30.42
2484.89	44.27	PK	211	1.9	V	-13.08	31.19	74.00	-42.81
2484.89	38.81	Ave	211	1.9	V	-13.08	25.73	54.00	-28.27

Test Frequency: 8GHz~25GHz

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

8 Duty Cycle

Modulation	On time(ms)	Period(ms)	Duty Cycle(%)	Duty Cycle Factor(dB)	Average Factor(dB)
802.11b	8.38	8.44	99.29	0.031	-0.062

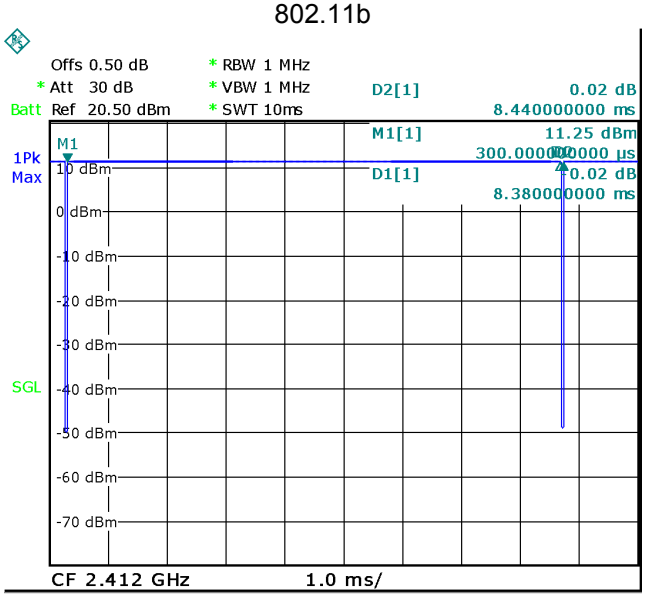
Remark:

1) Duty Cycle=On Time/Period

2) Duty Cycle Factor=10*log(1/Duty cycle)

3) Average Factor=20 log $_{10}$ Duty Cycle

802.11b



9 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

Test Result: PASS

Limit:

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

9.1 Test Procedure

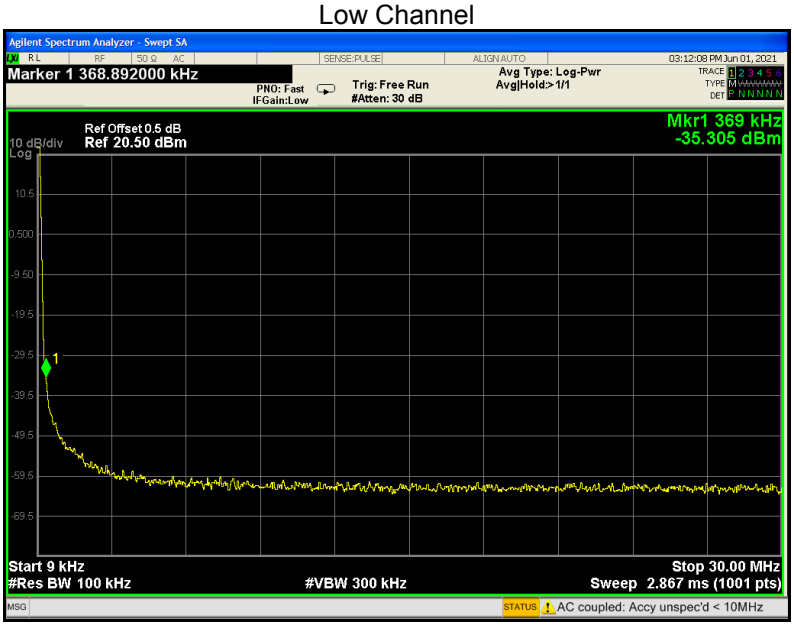
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
   a) Set instrument center frequency to DTS channel center frequency.
   b) Set the span to _ 1.5 times the DTS bandwidth.
   c) Set the RBW = 100 kHz.
   d) Set the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

9.2 Test Result

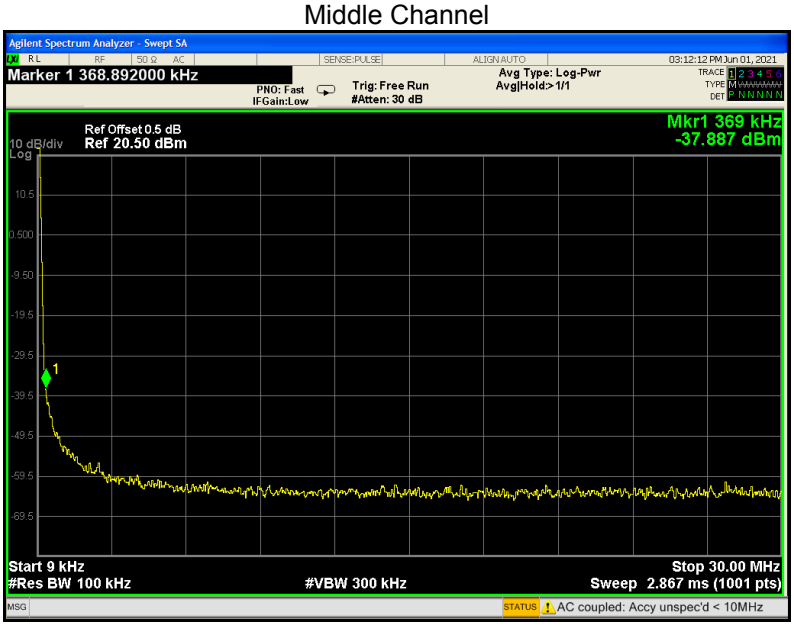
9KHz – 30MHz

802.11b

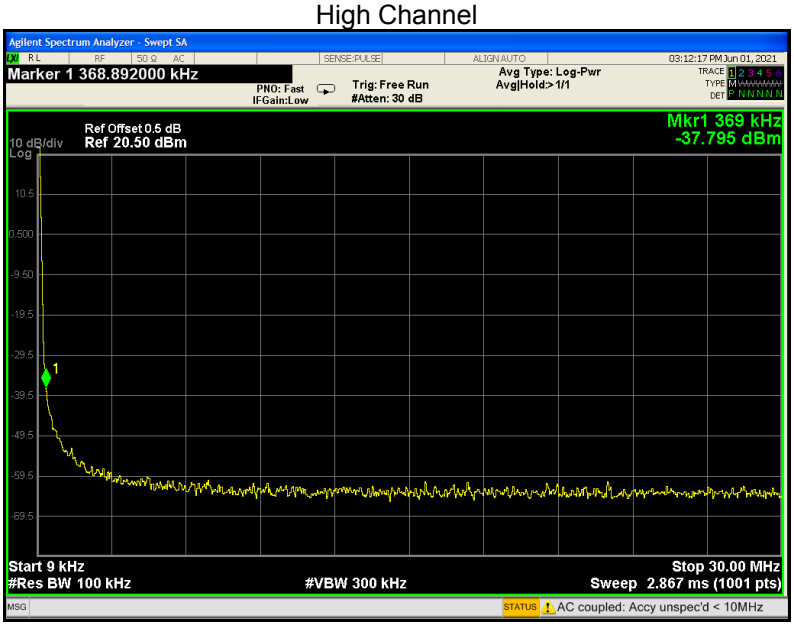
Low Channel



Middle Channel

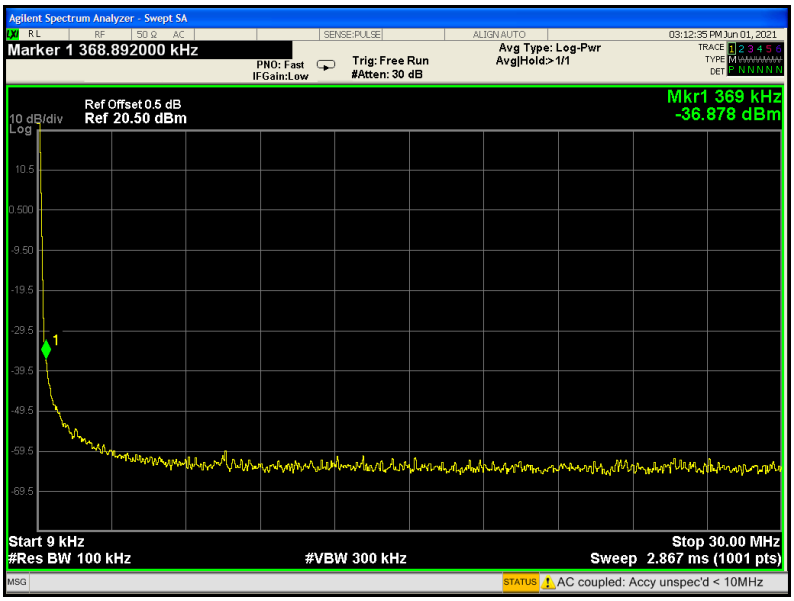


High Channel

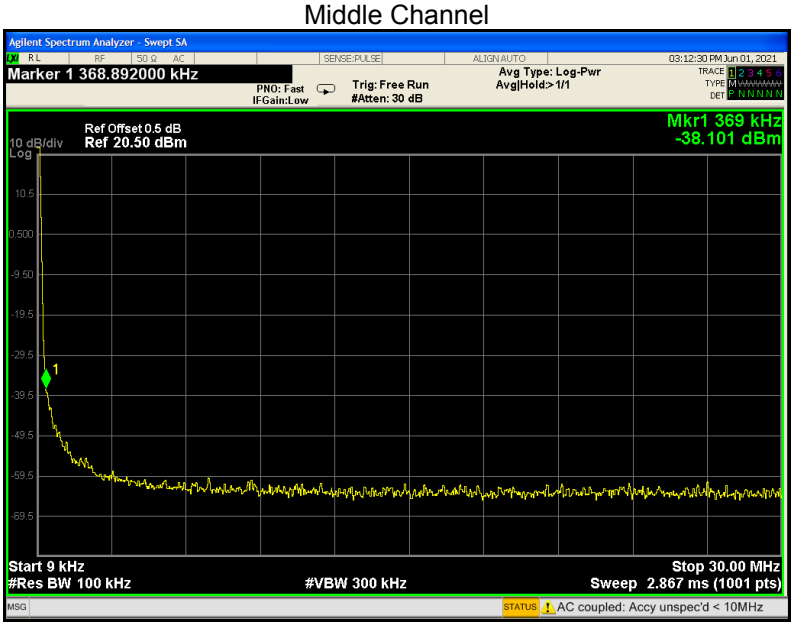


802.11g

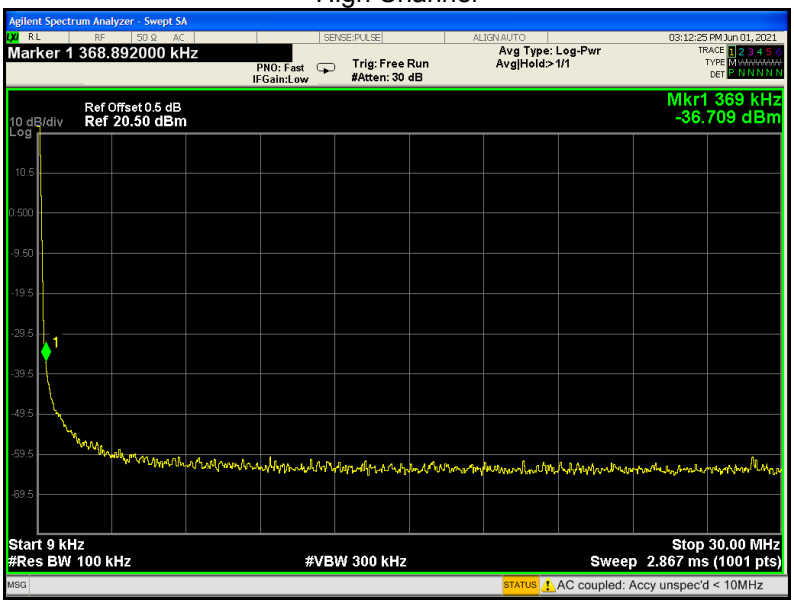
Low Channel



Middle Channel

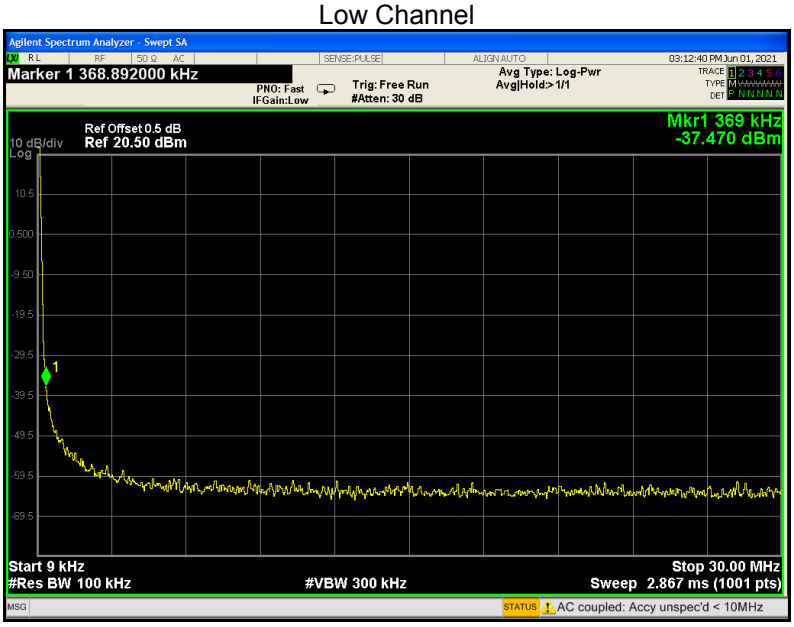


High Channel

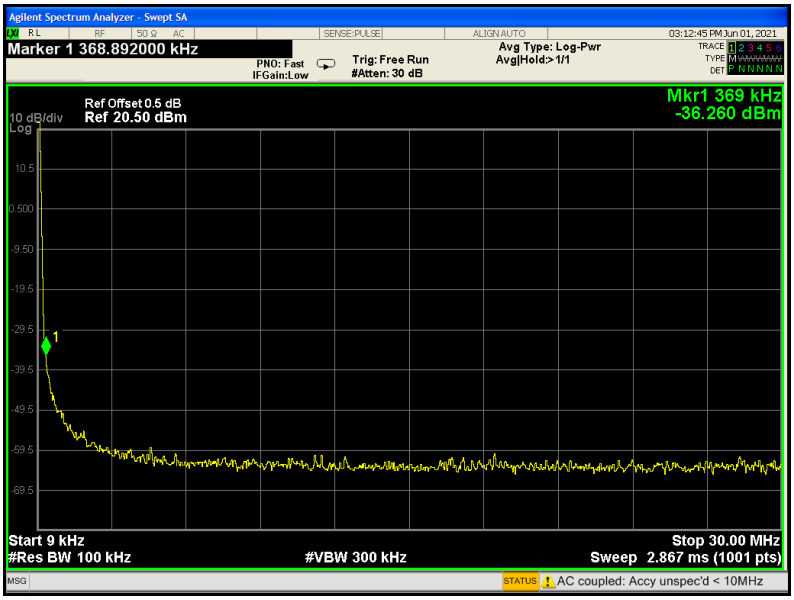


802.11n HT20

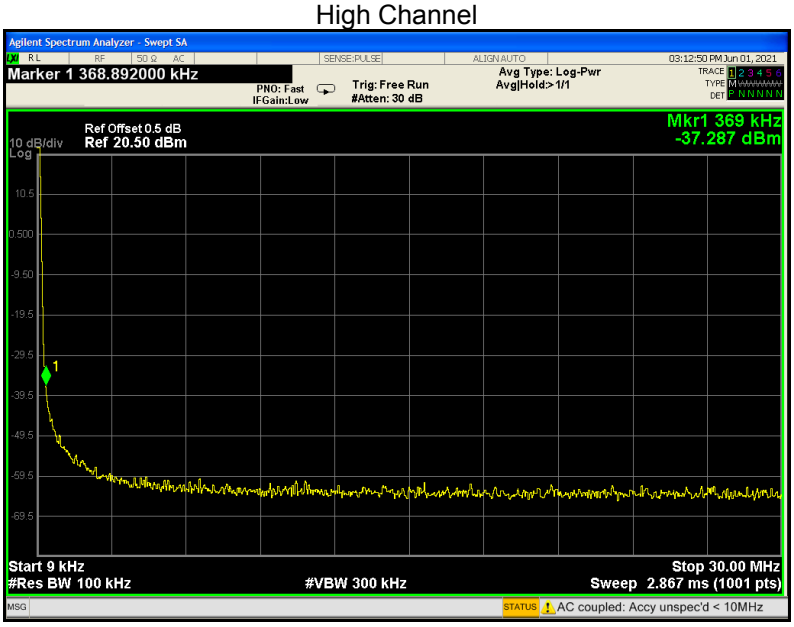
Low Channel



Middle Channel

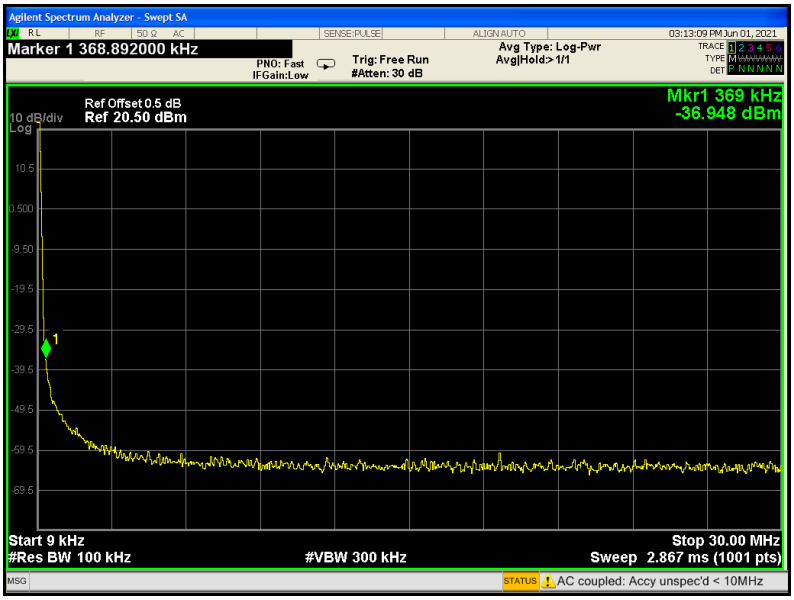


High Channel

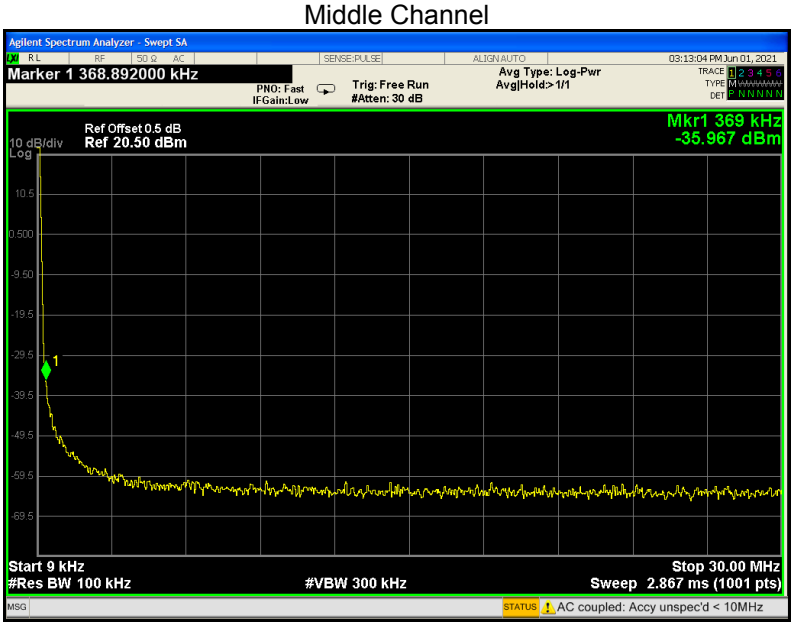


802.11n HT40

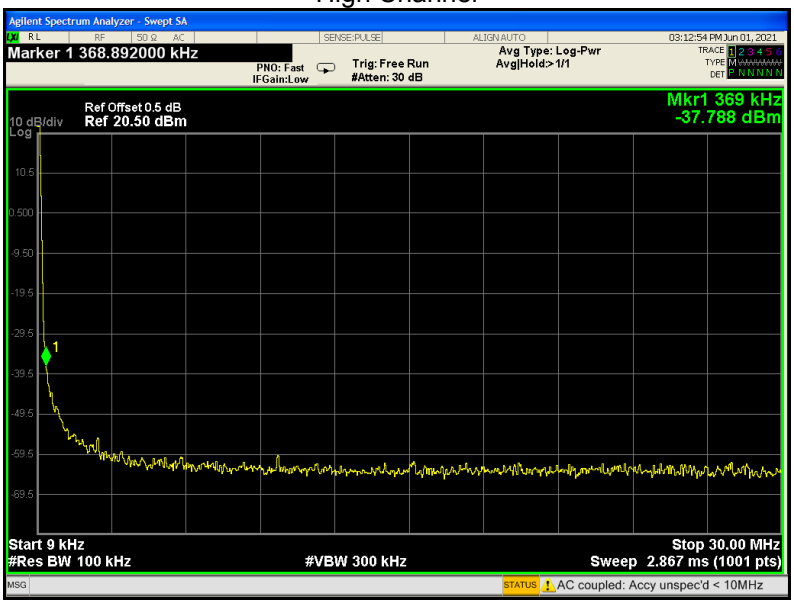
Low Channel



Middle Channel



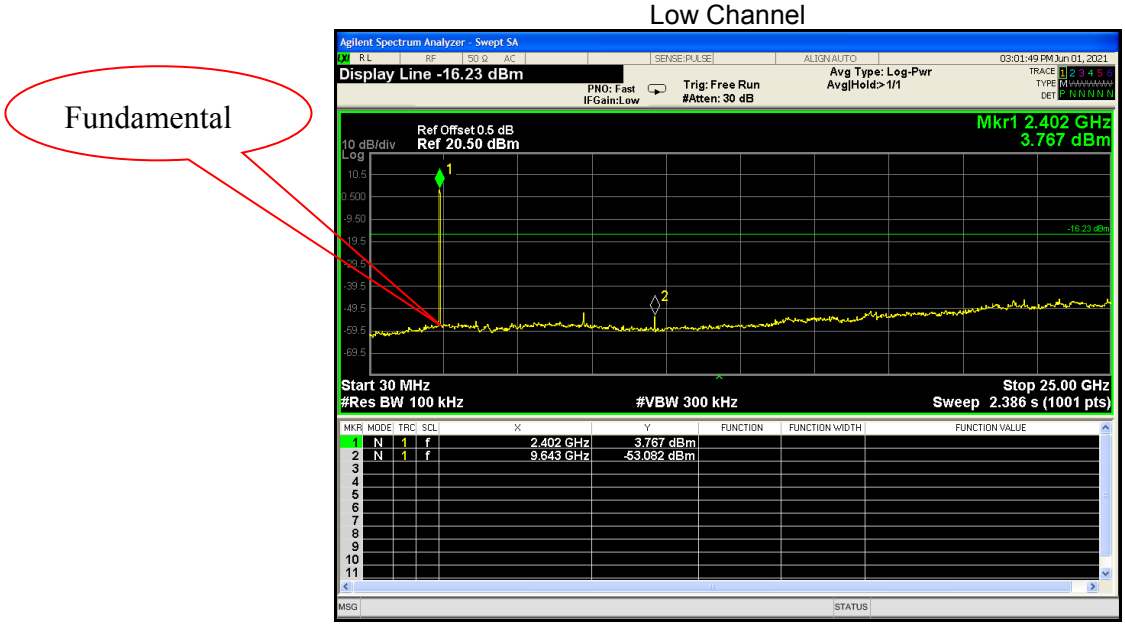
High Channel



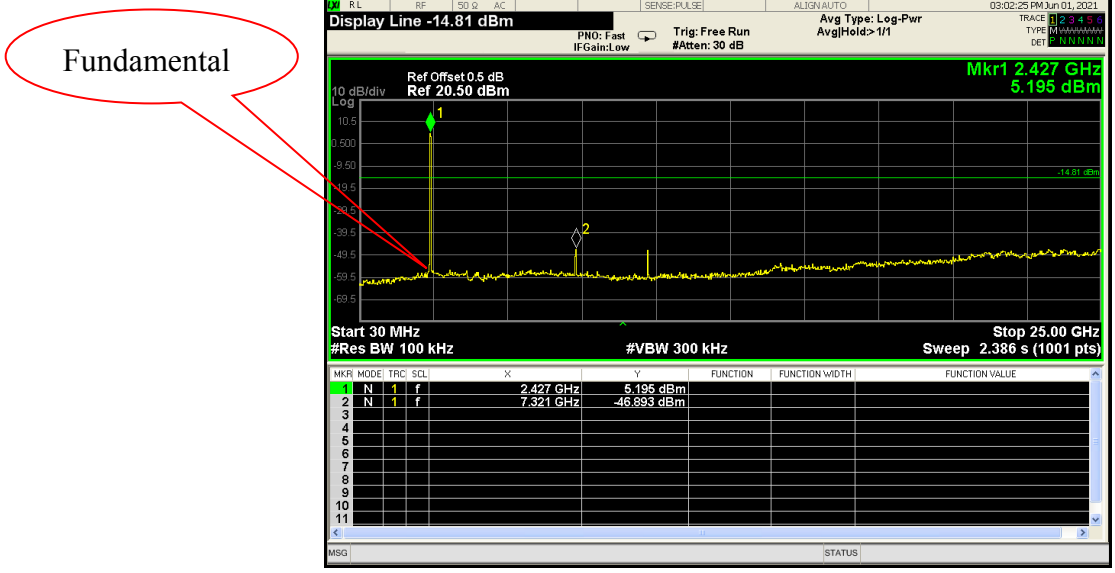
Above 30MHz

802.11b

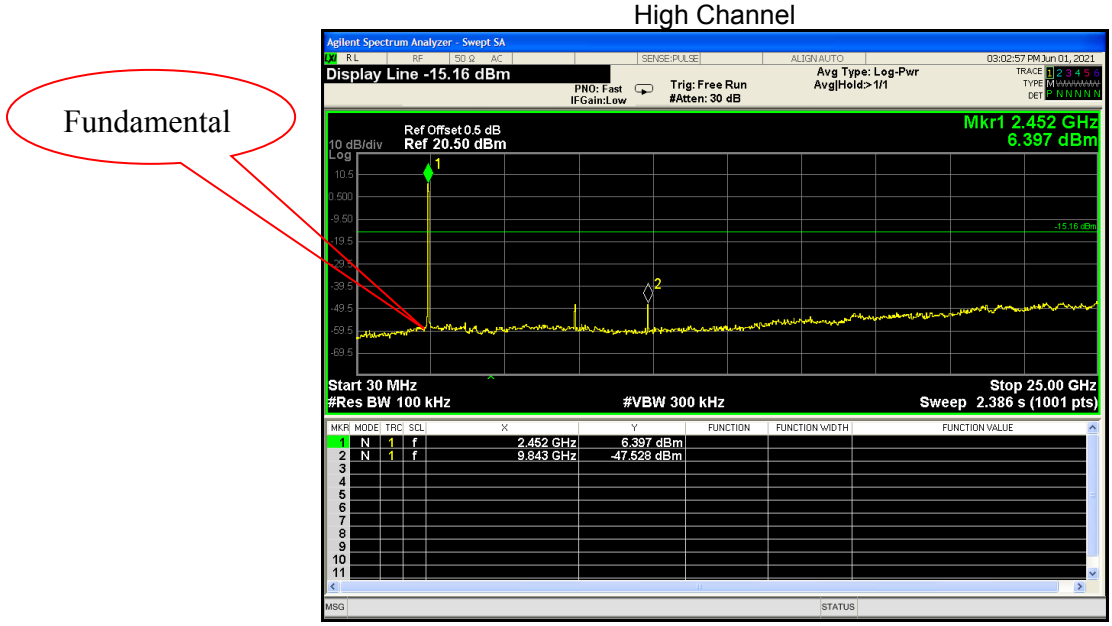
Low Channel



Middle Channel

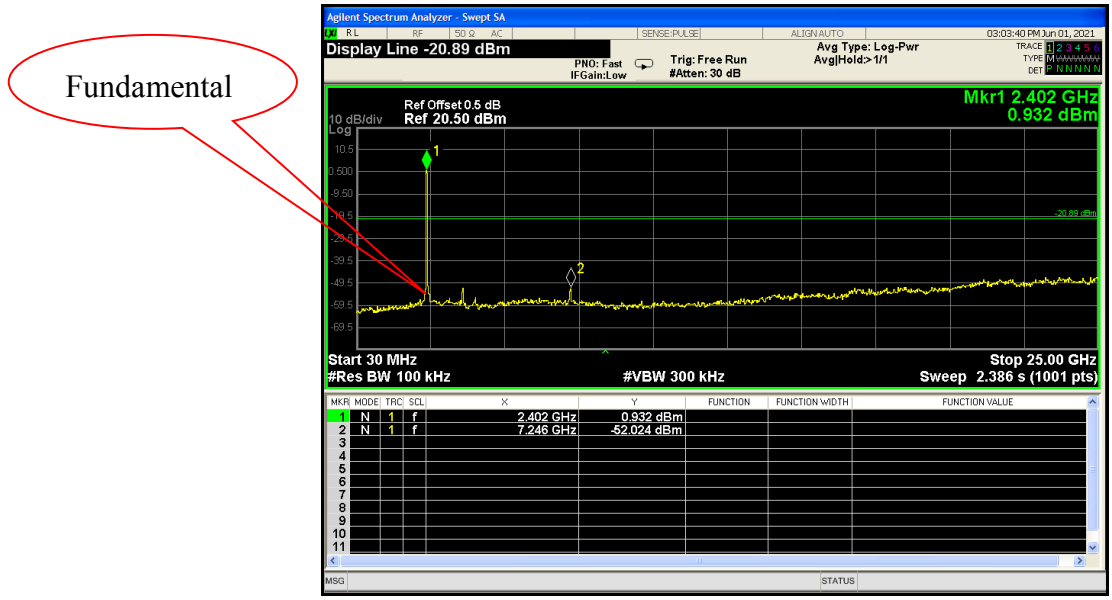


High Channel

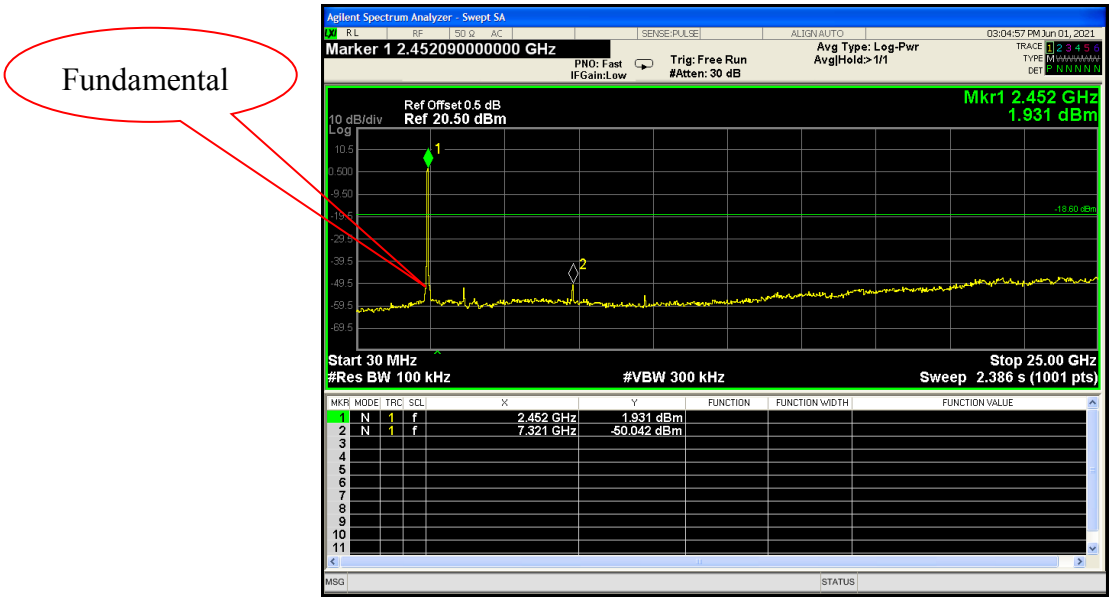


802.11g

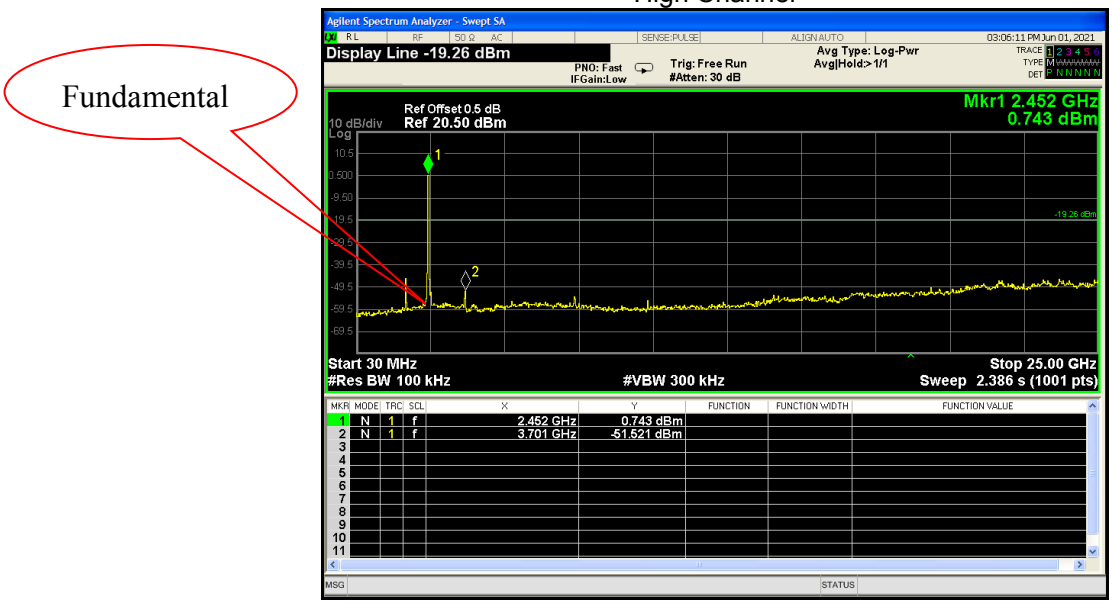
Low Channel



Middle Channel

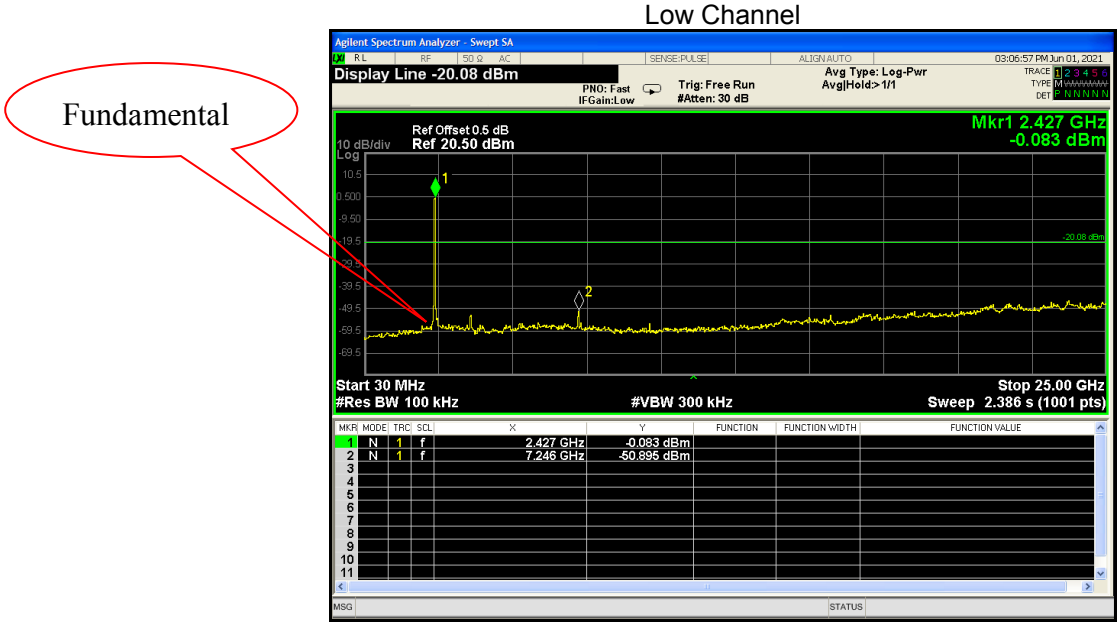


High Channel

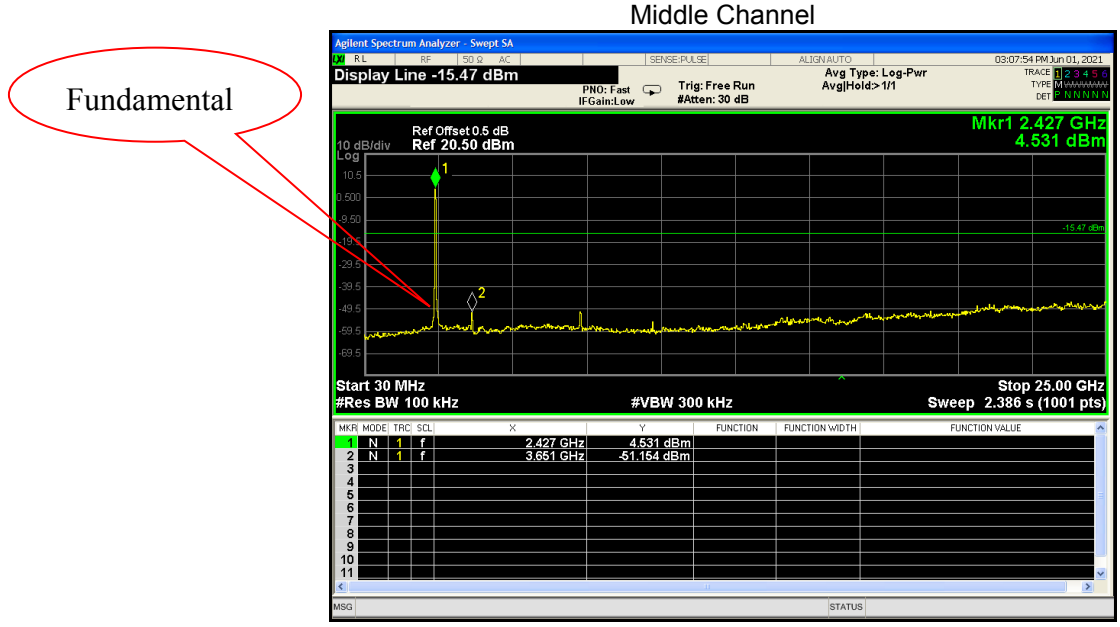


802.11n HT20

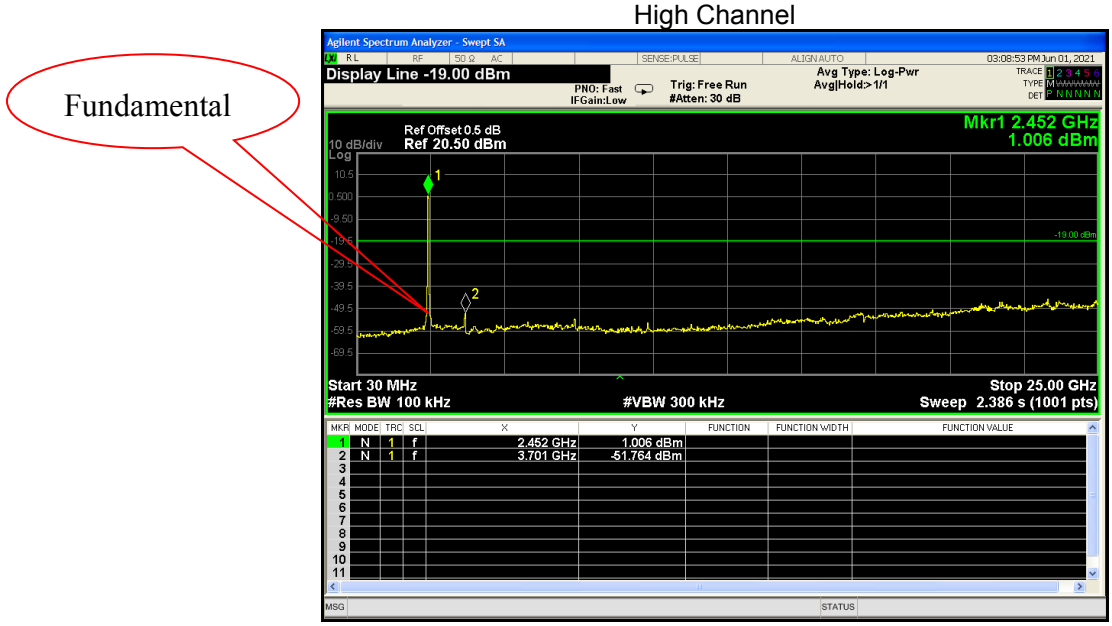
Low Channel



Middle Channel

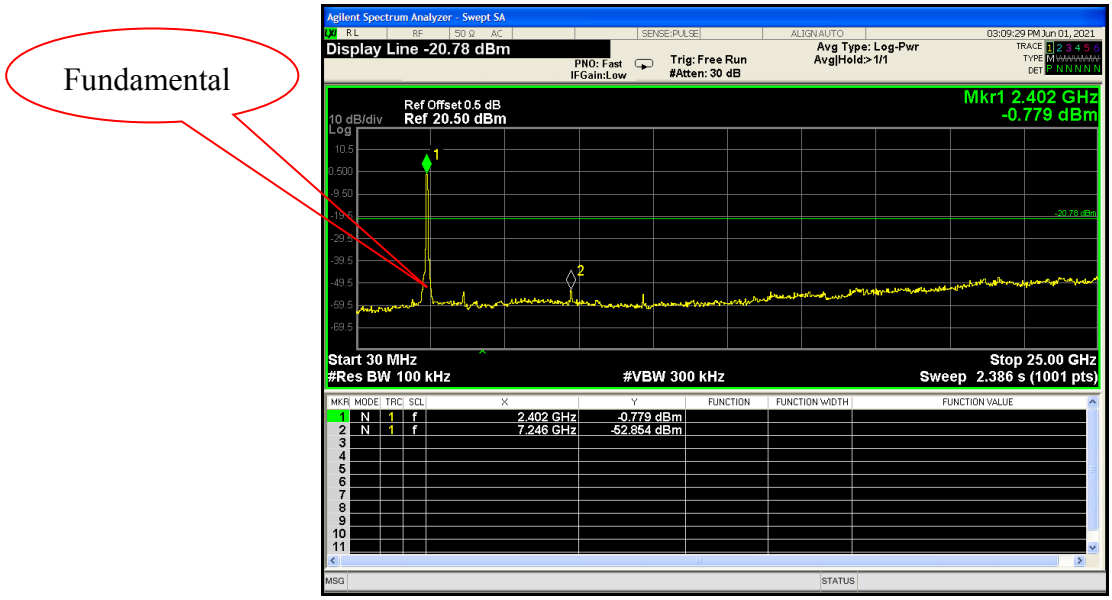


High Channel

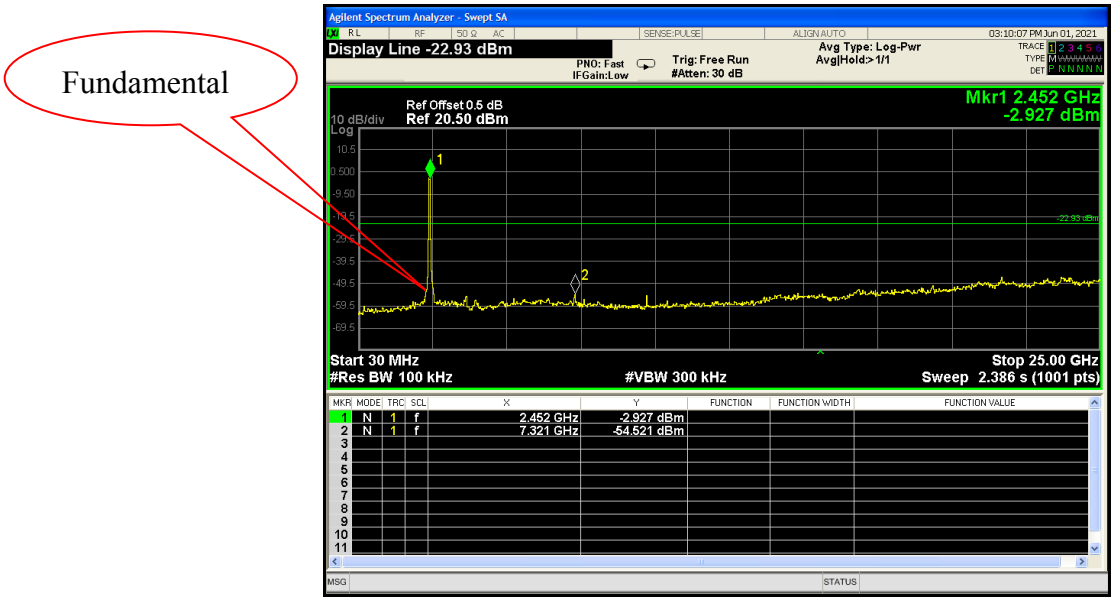


802.11n HT40

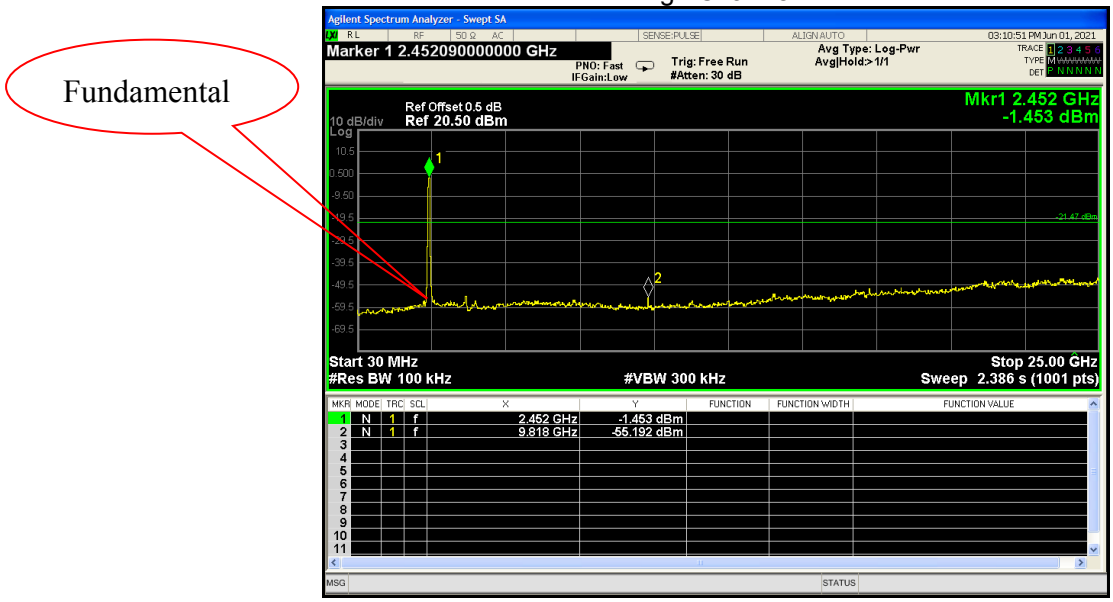
Low Channel



Middle Channel



High Channel



10 Band Edge Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

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

Test Mode: Transmitting

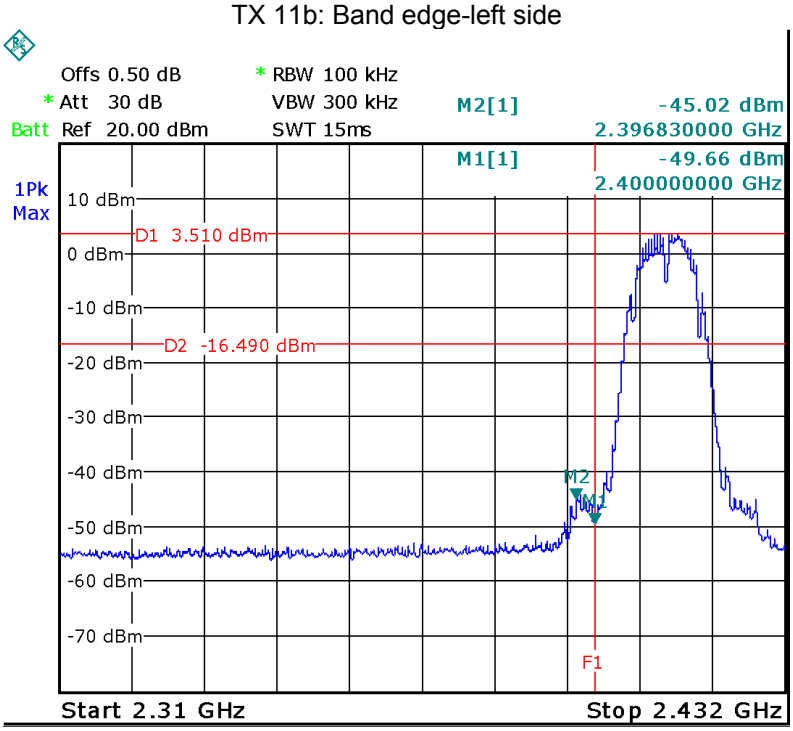
10.1 Test Produce

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

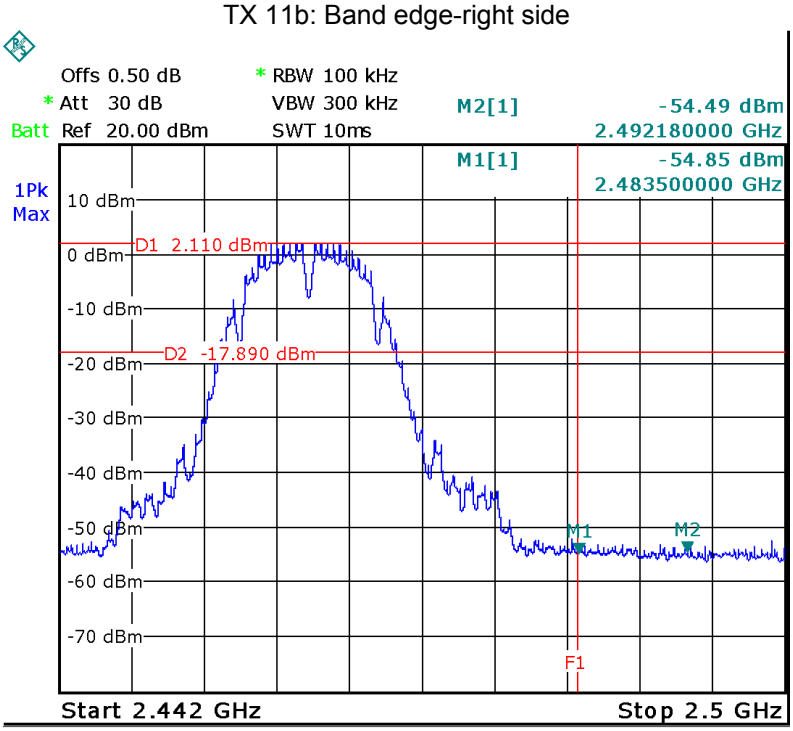
10.2 Test Result

Test result plots shown as follows:

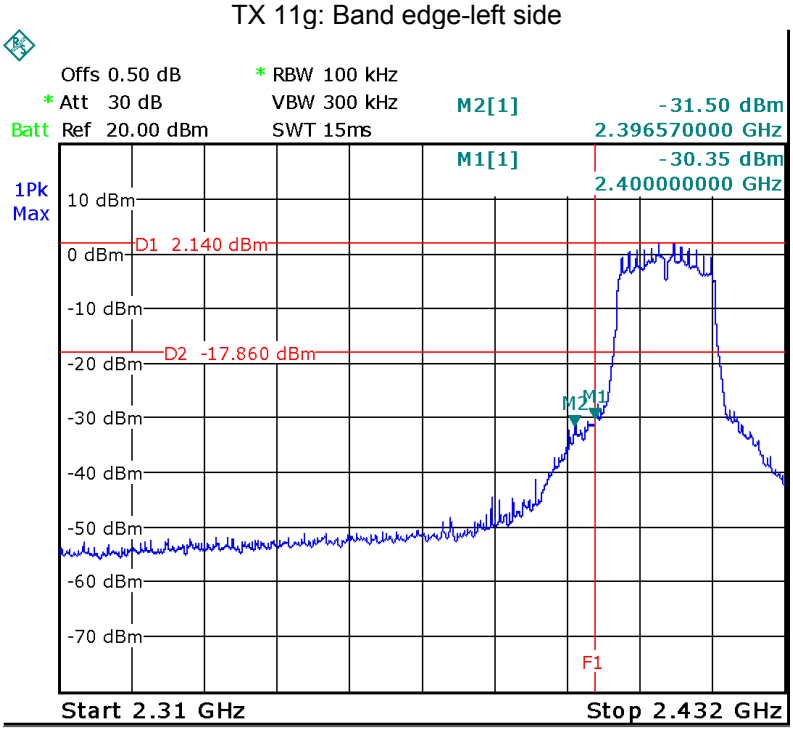
TX 11b: Band edge-left side



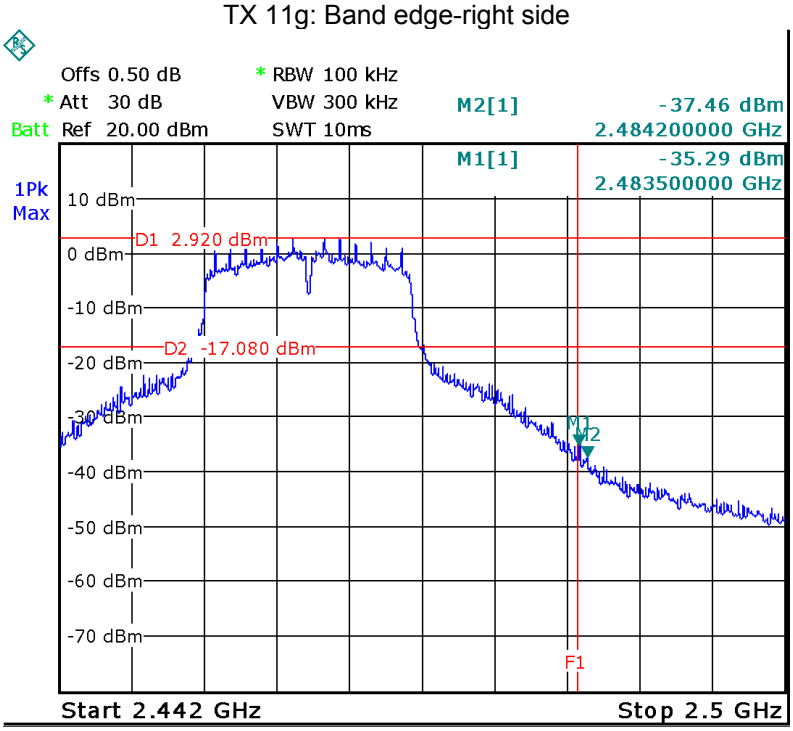
TX 11b: Band edge-right side



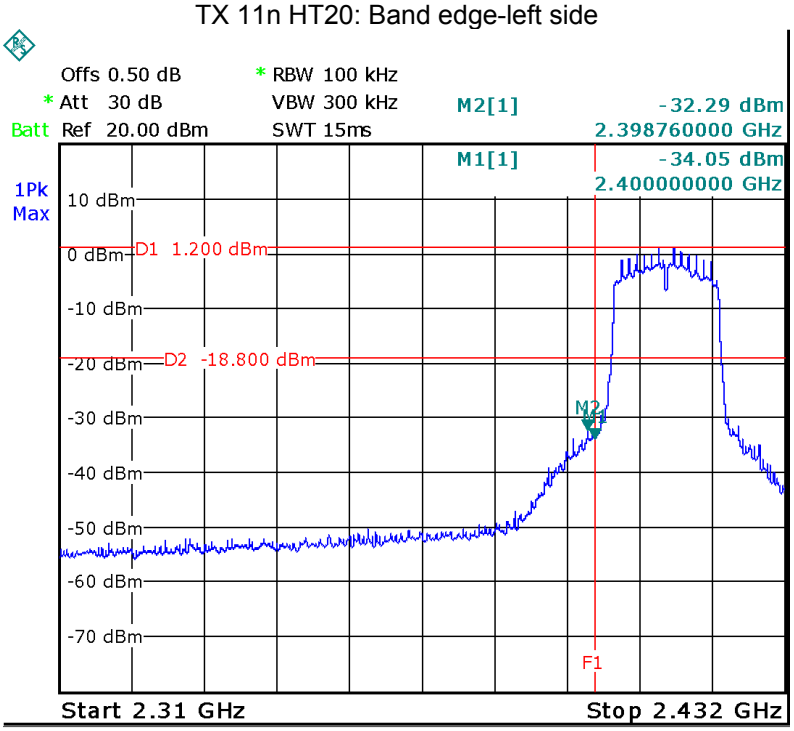
TX 11g: Band edge-left side



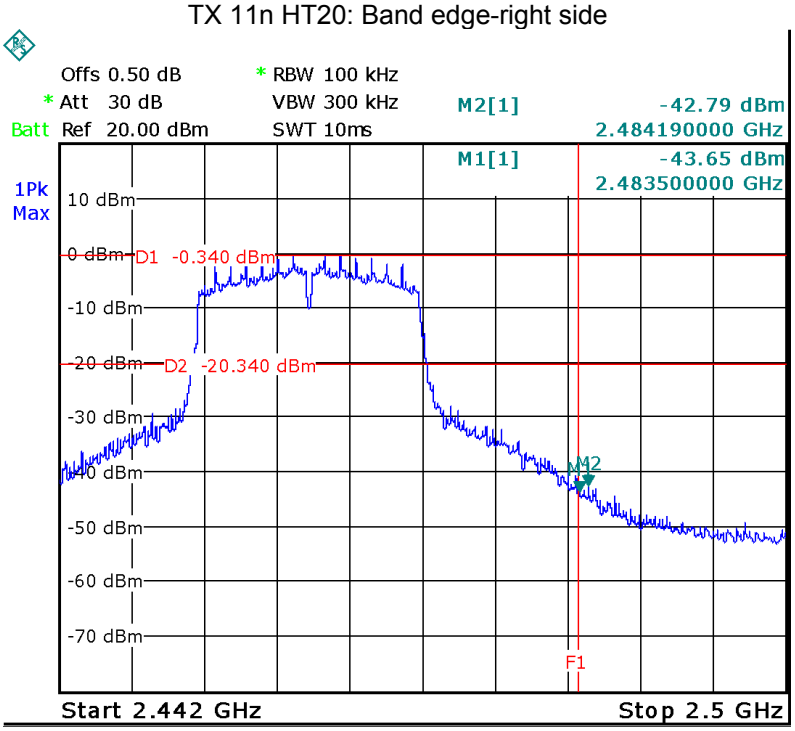
TX 11g: Band edge-right side



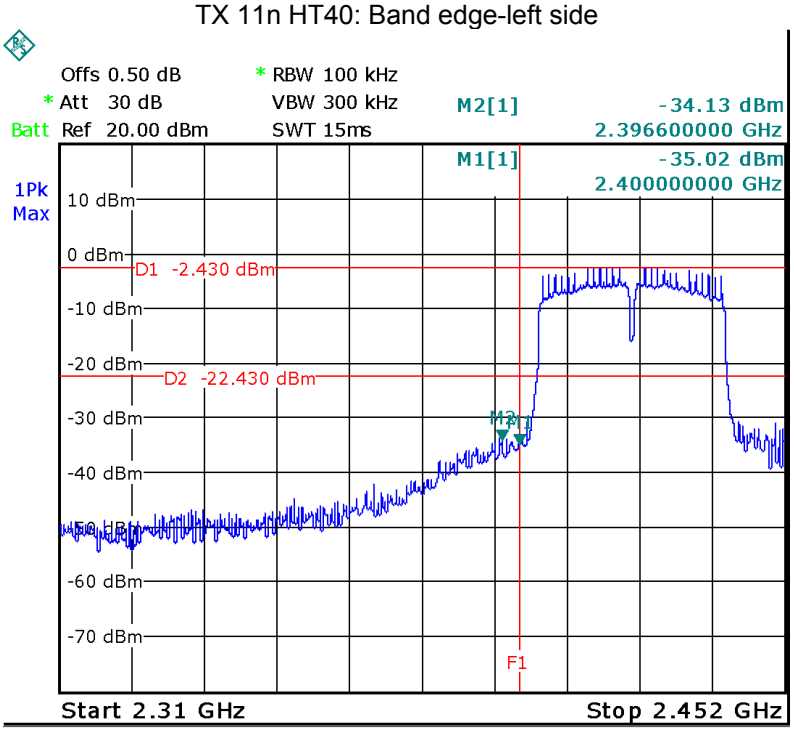
TX 11n HT20: Band edge-left side



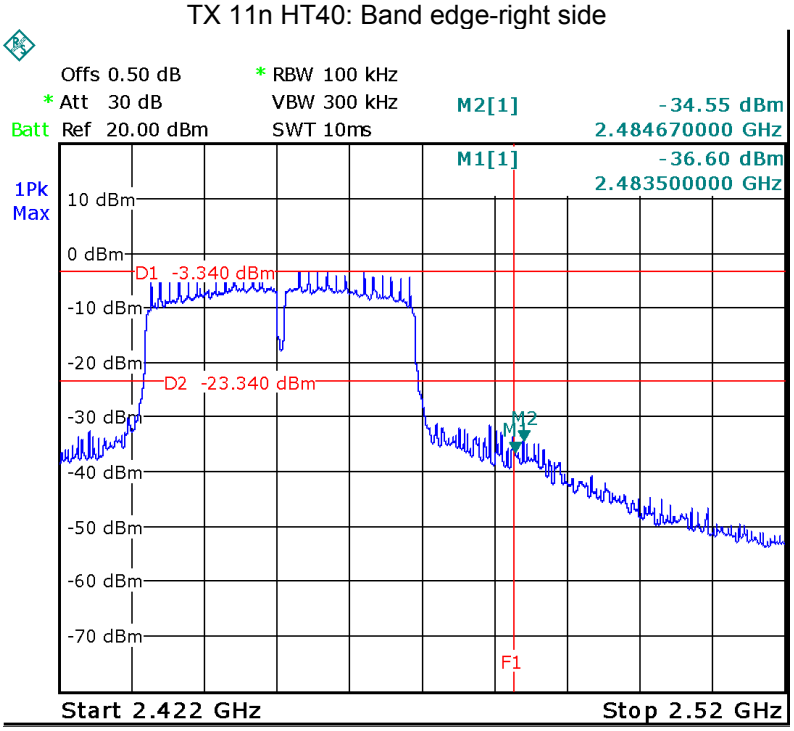
TX 11n HT20: Band edge-right side



TX 11n HT40: Band edge-left side



TX 11n HT40: Band edge-right side



11 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

11.1 Test Procedure:

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

2. 6dB Bandwidth Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

99% Bandwidth Set the spectrum analyzer: RBW = 1~5% DTS OBW, VBW = 3RBW

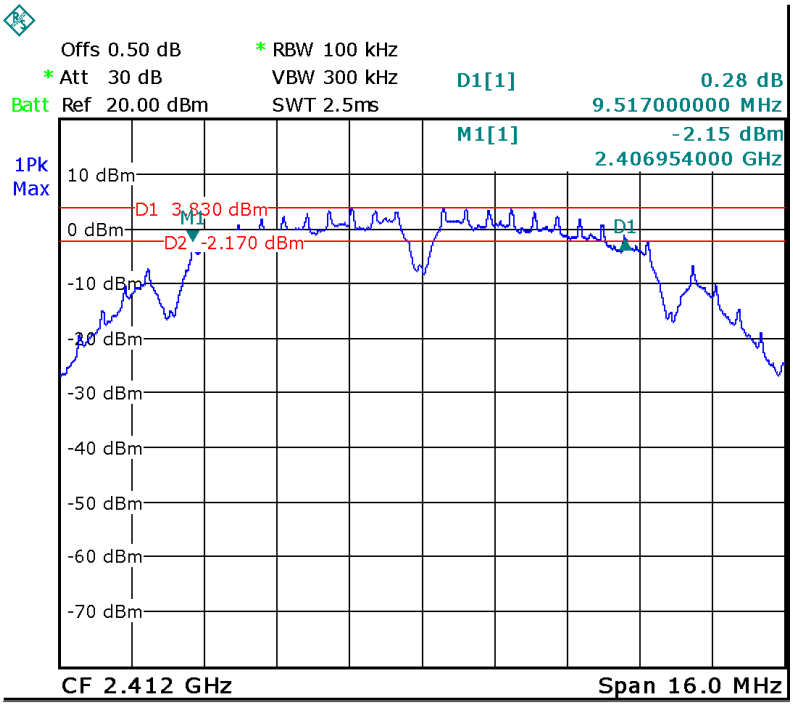
11.2 Test Result:

Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	9.517	12.615
	Channel 6	9.581	12.838
	Channel 11	9.134	13.030
TX 11g	Channel 1	15.070	16.766
	Channel 6	15.519	16.916
	Channel 11	15.469	17.016
TX 11n HT20	Channel 1	15.305	17.677
	Channel 6	15.144	17.731
	Channel 11	16.329	17.731
TX 11n HT40	Channel 3	35.350	36.447
	Channel 6	35.460	36.447
	Channel 9	35.460	36.557

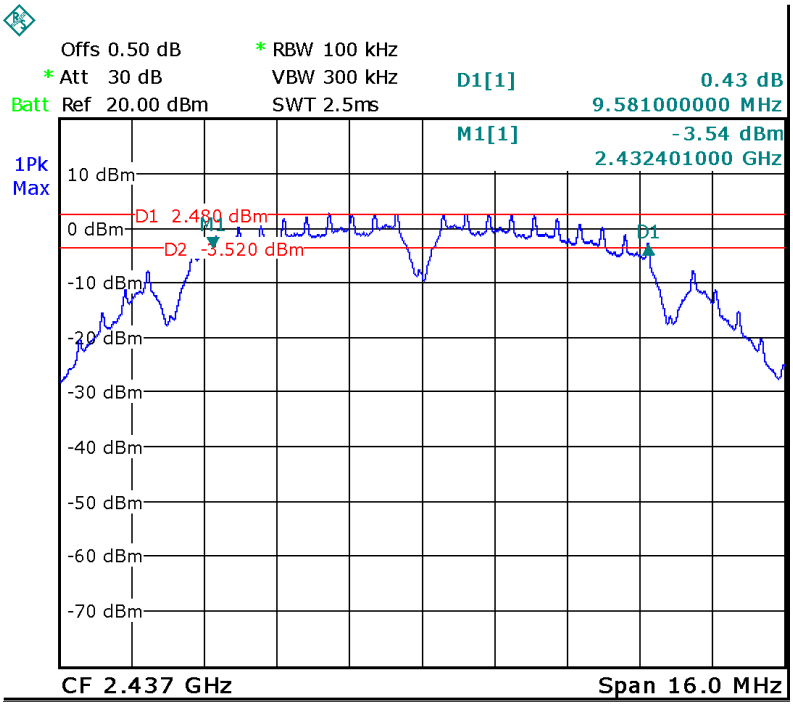
Test result plot:

6dB Bandwidth

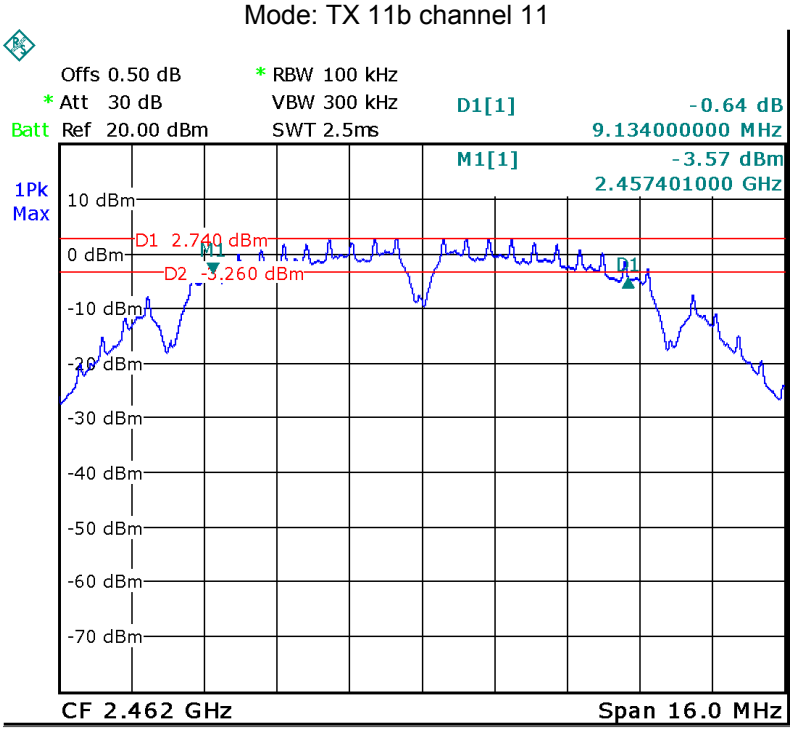
Mode: TX 11b channel 1



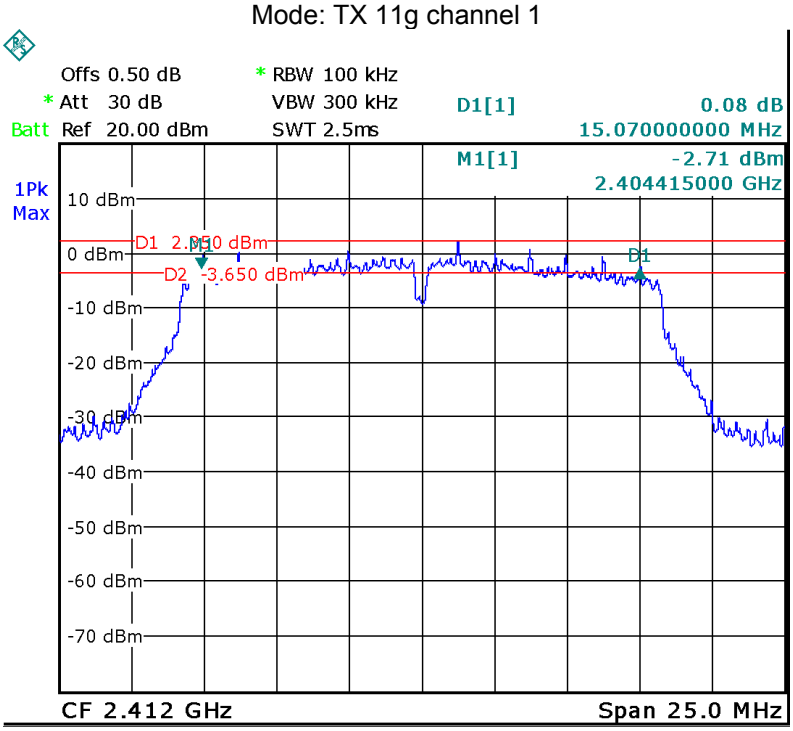
Mode: TX 11b channel 6



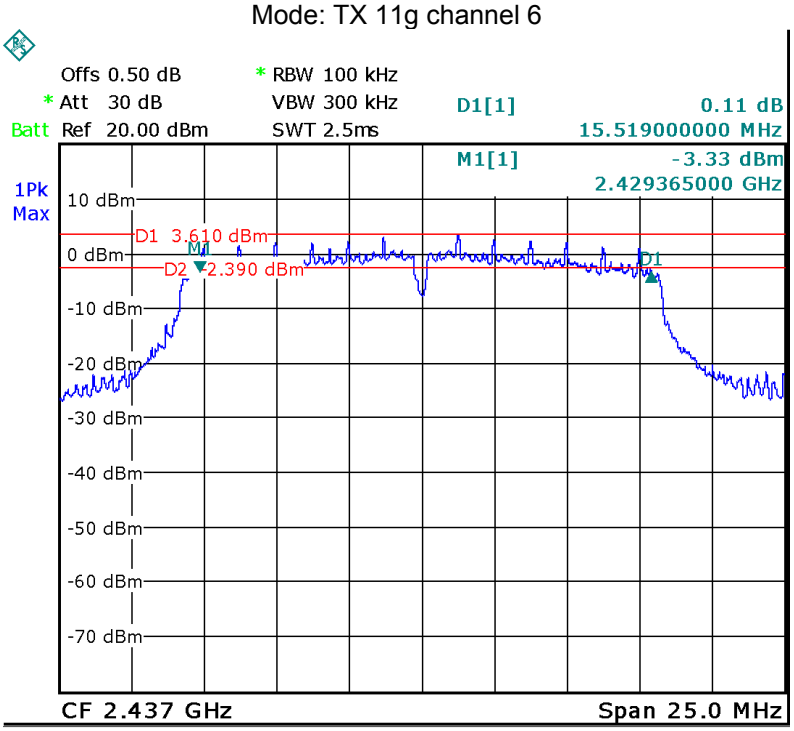
Mode: TX 11b channel 11



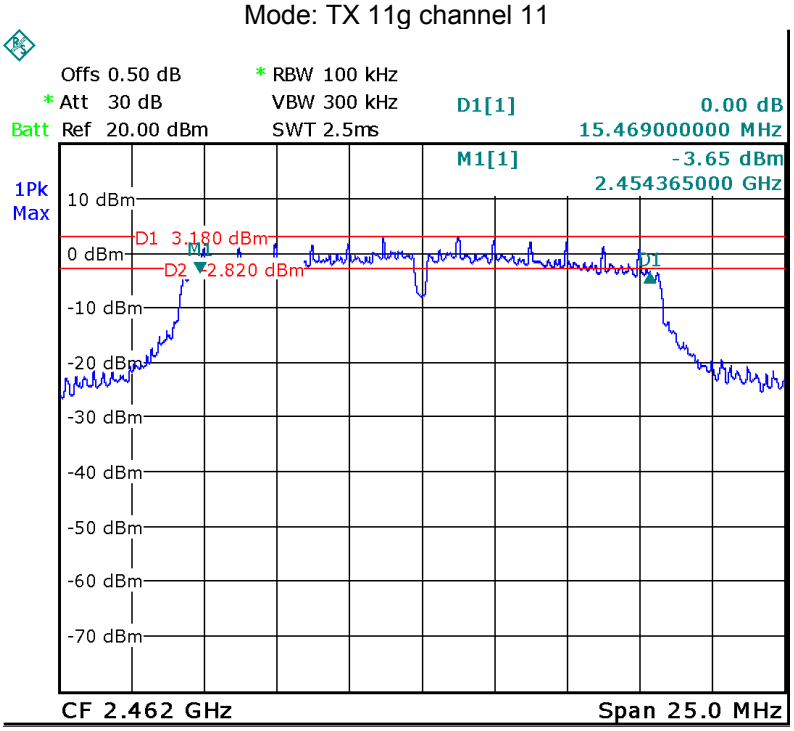
Mode: TX 11g channel 1



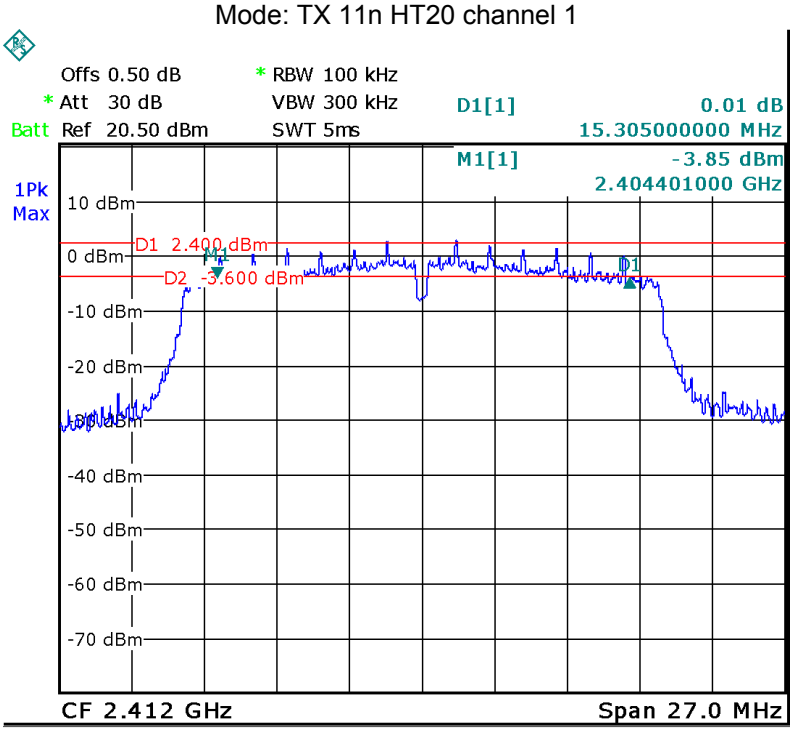
Mode: TX 11g channel 6



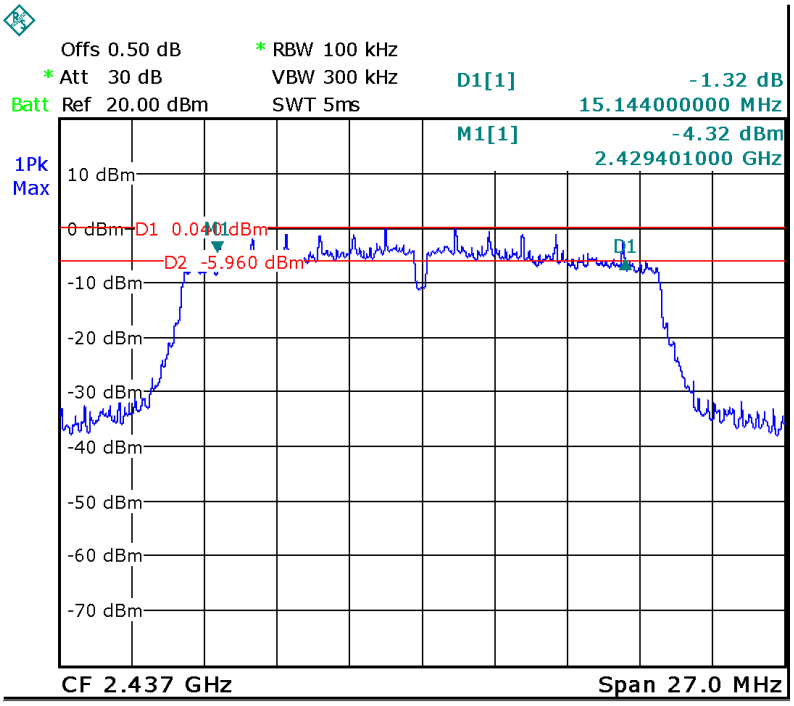
Mode: TX 11g channel 11



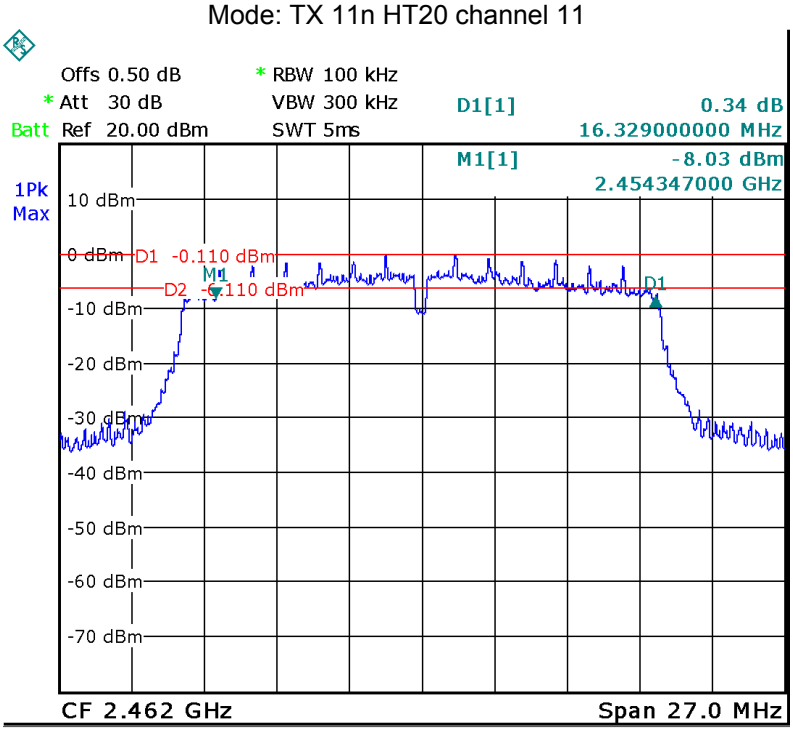
Mode: TX 11n HT20 channel 1



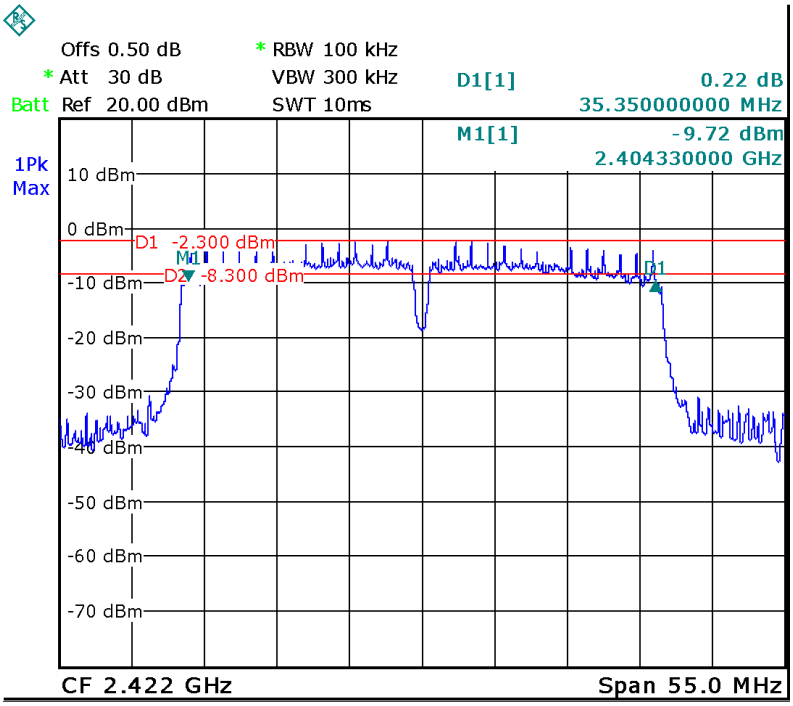
Mode: TX 11n HT20 channel 6



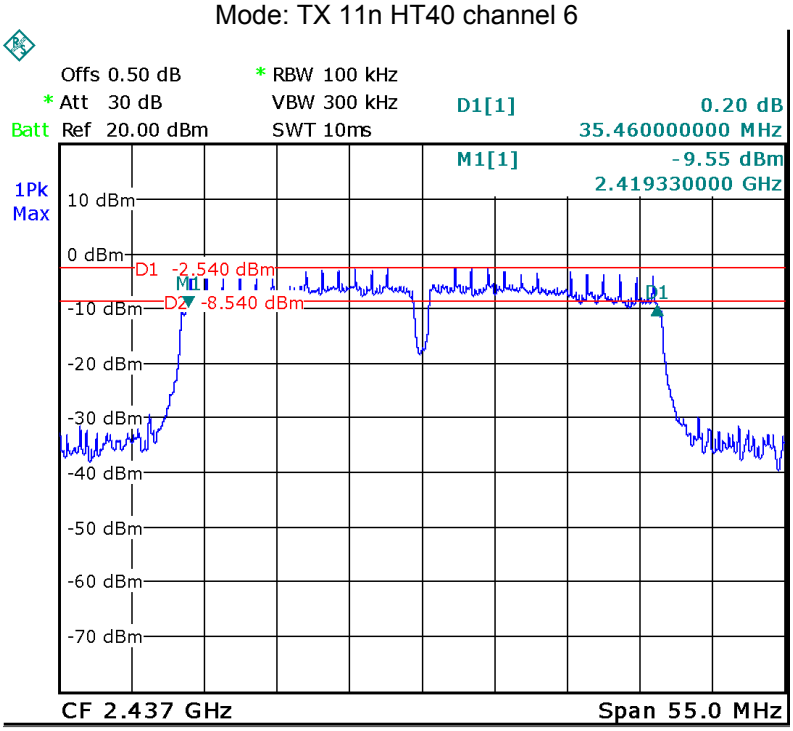
Mode: TX 11n HT20 channel 11



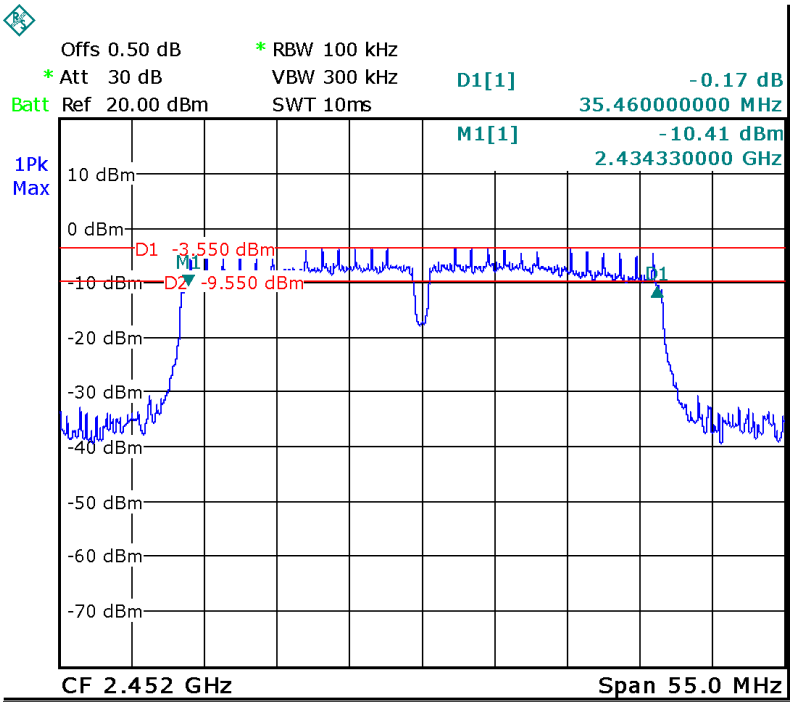
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6

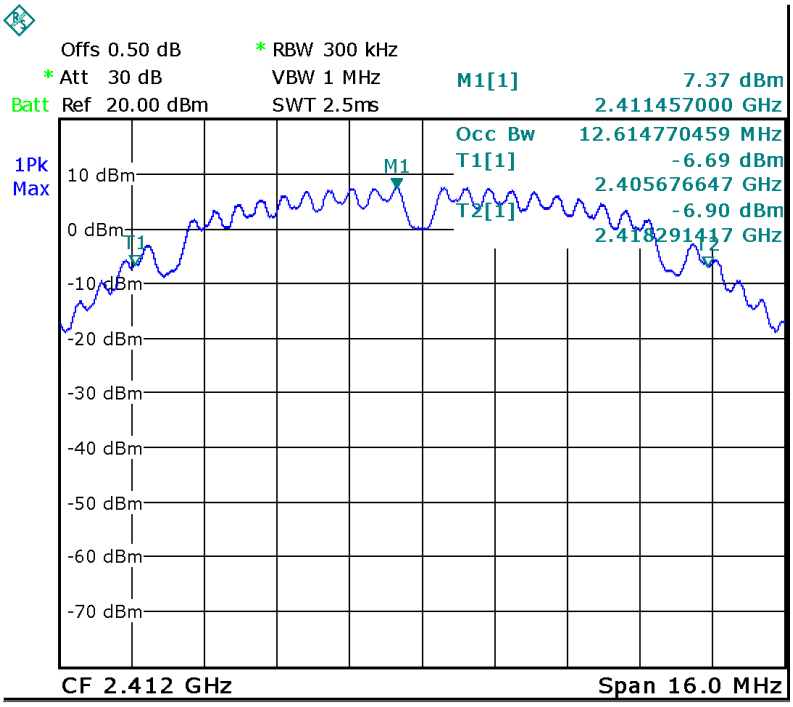


Mode: TX 11n HT40 channel 9

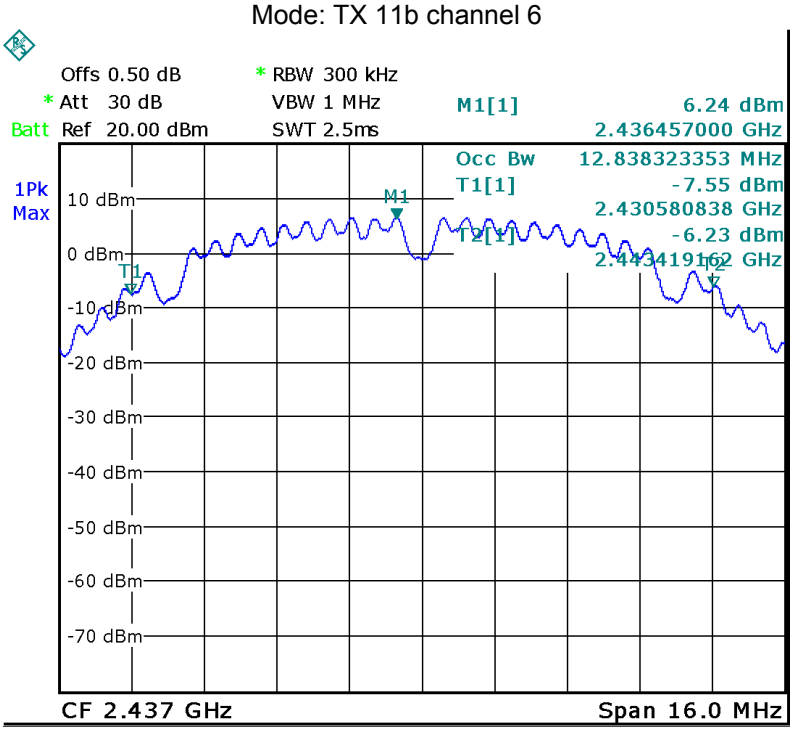


99% Bandwidth

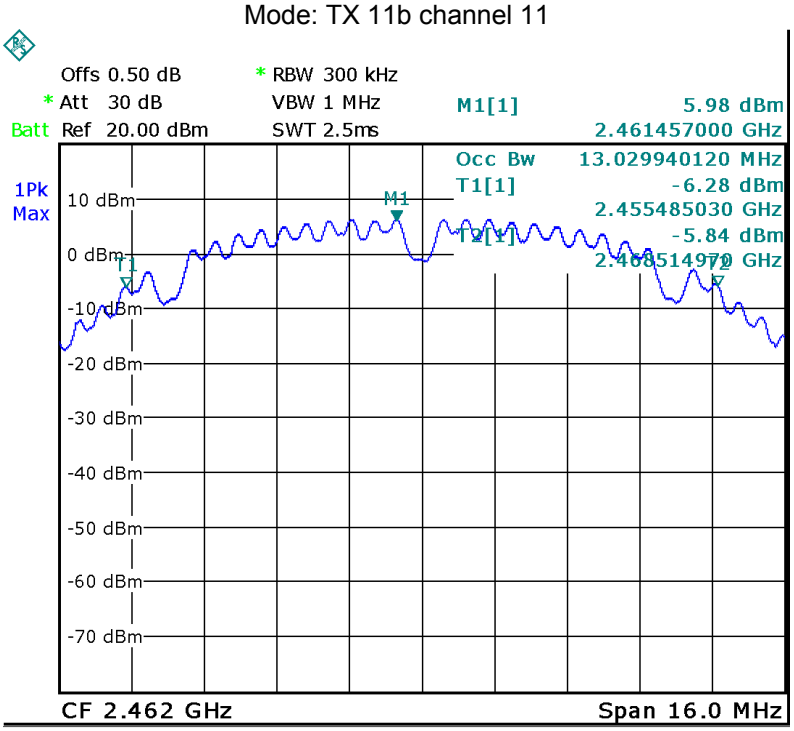
Mode: TX 11b channel 1



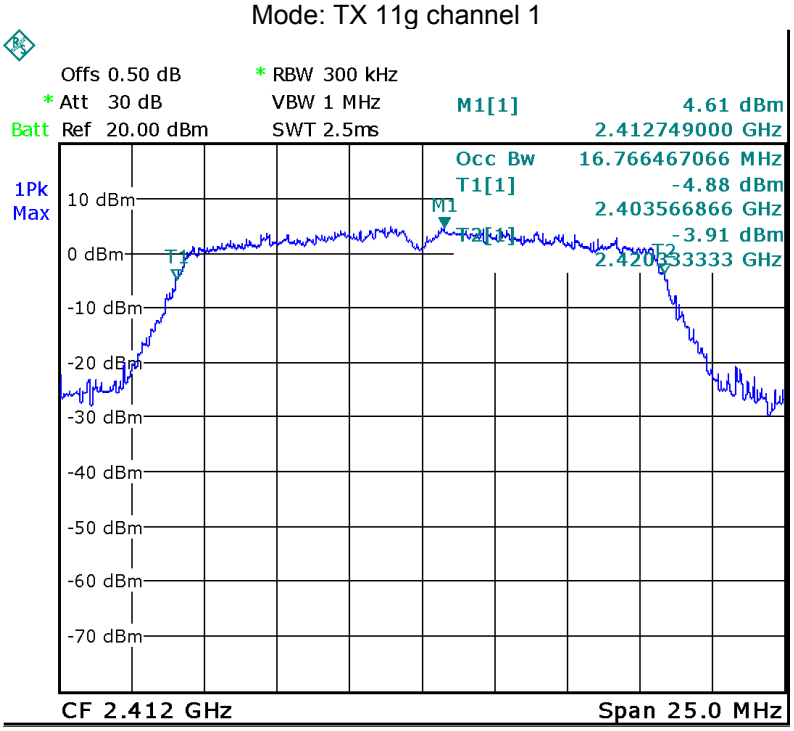
Mode: TX 11b channel 6



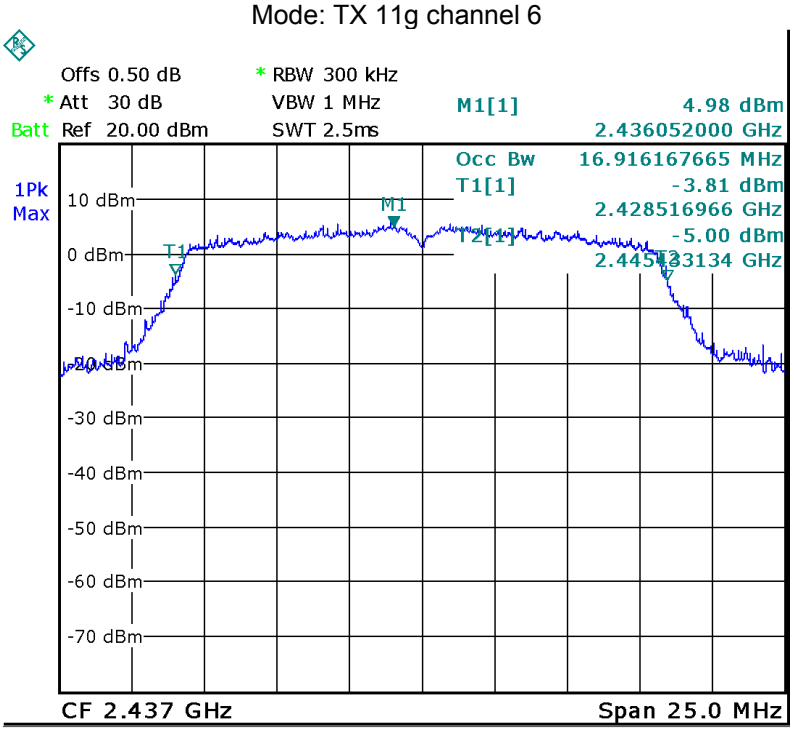
Mode: TX 11b channel 11



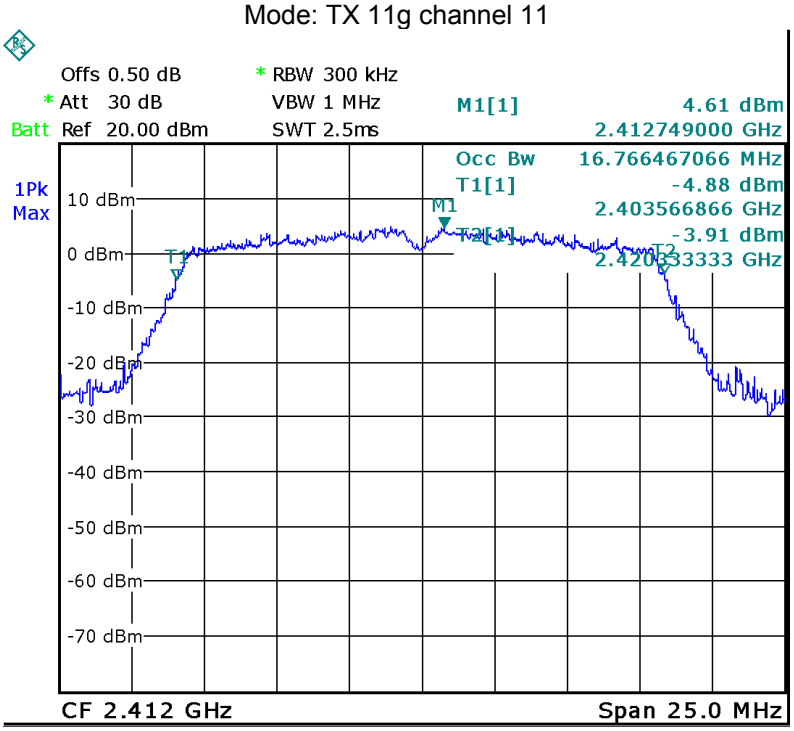
Mode: TX 11g channel 1



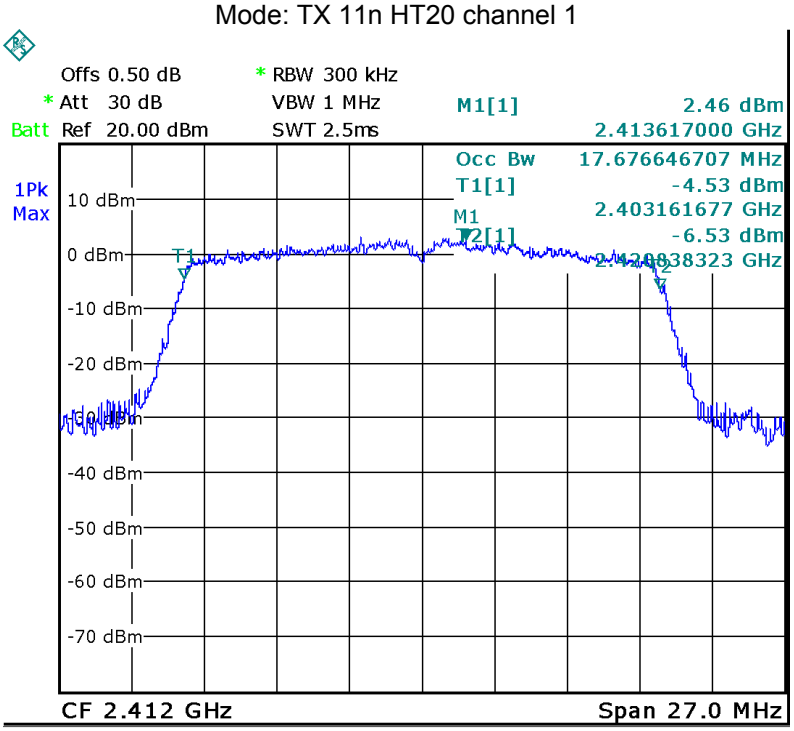
Mode: TX 11g channel 6



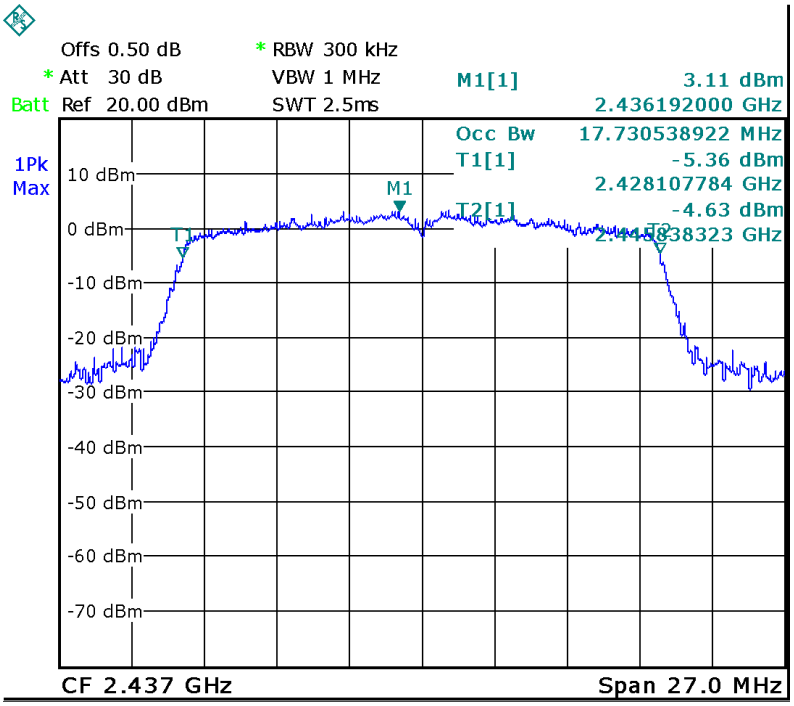
Mode: TX 11g channel 11



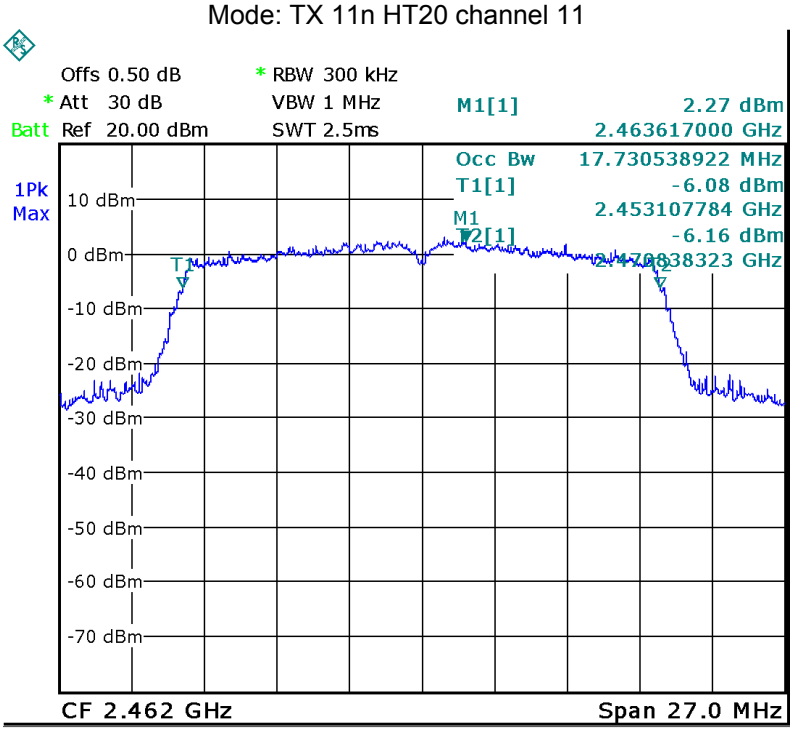
Mode: TX 11n HT20 channel 1



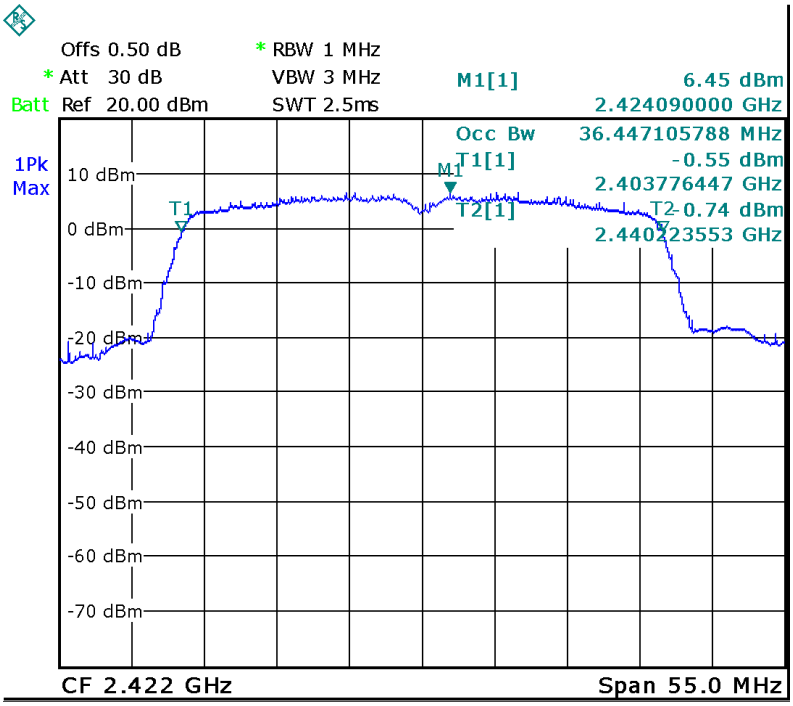
Mode: TX 11n HT20 channel 6



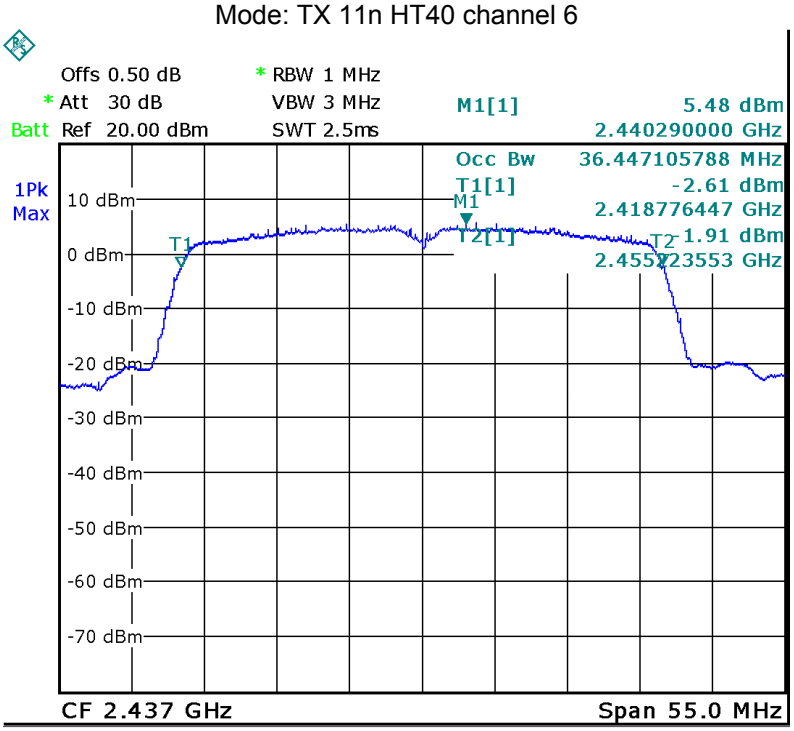
Mode: TX 11n HT20 channel 11



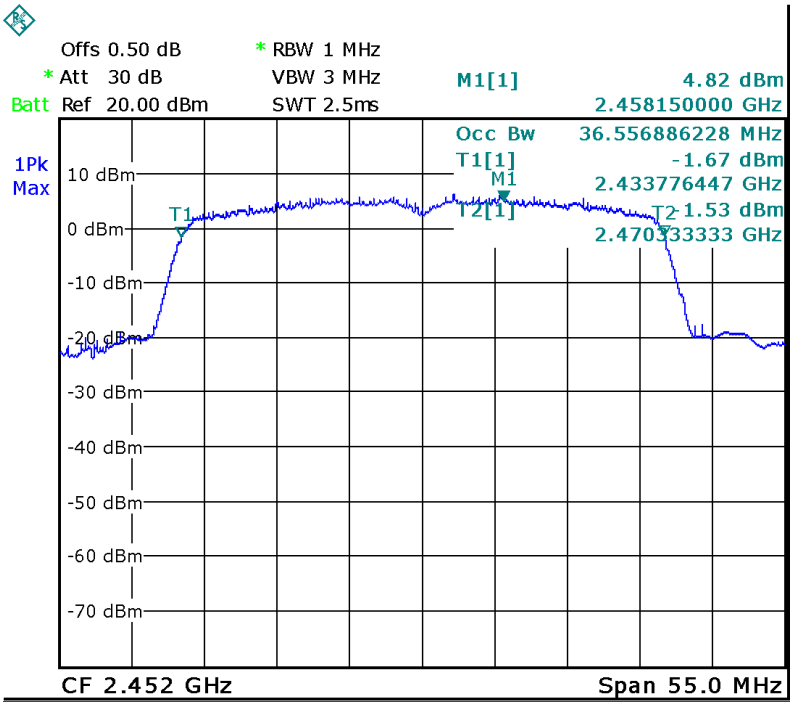
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



12 Maximum Peak Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

12.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018

section 8.3.1.1 (For BLE)

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

a)Set the RBW ≥ DTS bandwidth.

b)Set VBW ≥ 3 RBW.

c)Set span ≥ 3 x RBW

d)Sweep time = auto couple.

e)Detector = peak.

f)Trace mode = max hold.

g)Allow trace to fully stabilize.

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

section 8.3.1.2 (For WIFI)

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

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

b)Set the VBW ≥ 3 x RBW

c)Set the span ≥ 1.5 x OBW.

d)Detector = RMS.

e)Sweep time = auto couple.

f) trigger = free run..

g) Number of points in sweep _ [2 × span / RBW]. (This gives bin-to-bin spacing _ RBW / 2, so that narrowband signals are not lost between frequency bins.)

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

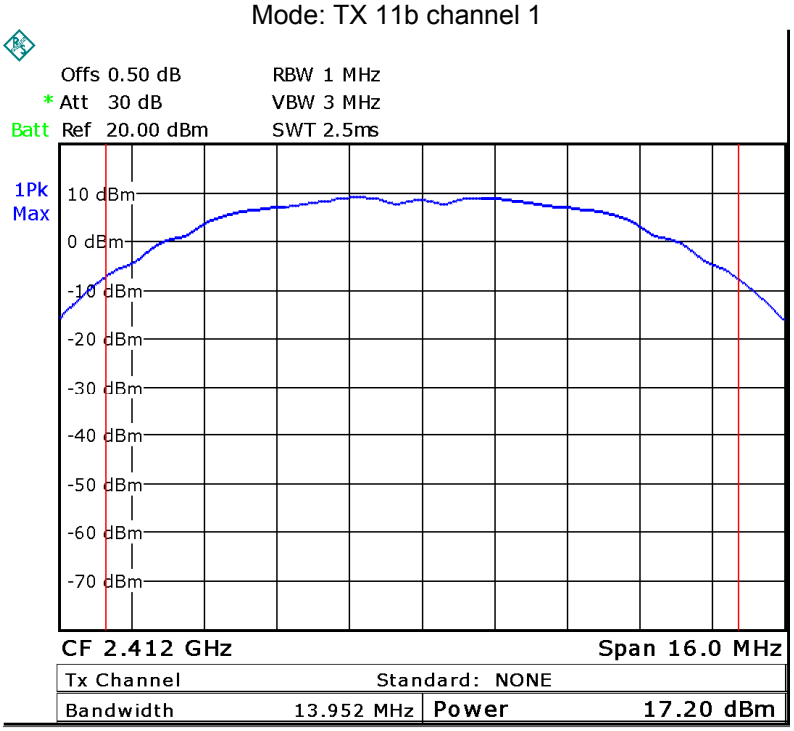
i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the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

12.2 Test Result:

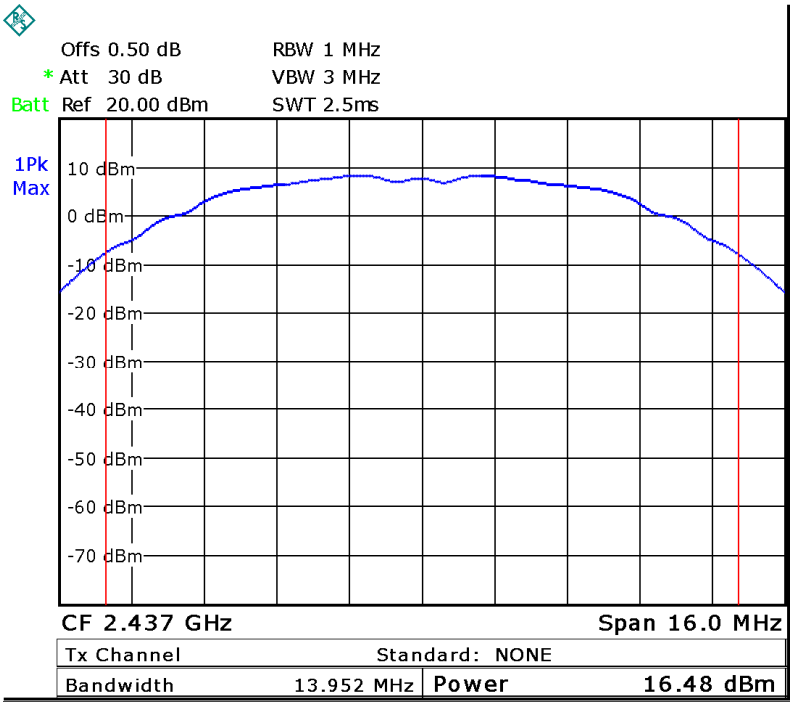
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	**17.20**	1W/30dBm
	Middle-2437	16.48	1W/30dBm
	High-2462	16.39	1W/30dBm
TX 11g	Low-2412	15.92	1W/30dBm
	Middle-2437	15.31	1W/30dBm
	High-2462	15.23	1W/30dBm
TX 11n HT20	Low-2412	15.39	1W/30dBm
	Middle-2437	14.35	1W/30dBm
	High-2462	14.77	1W/30dBm
TX 11n HT40	Low-2422	15.68	1W/30dBm
	Middle-2437	15.20	1W/30dBm
	High-2452	15.08	1W/30dBm

Test Plot

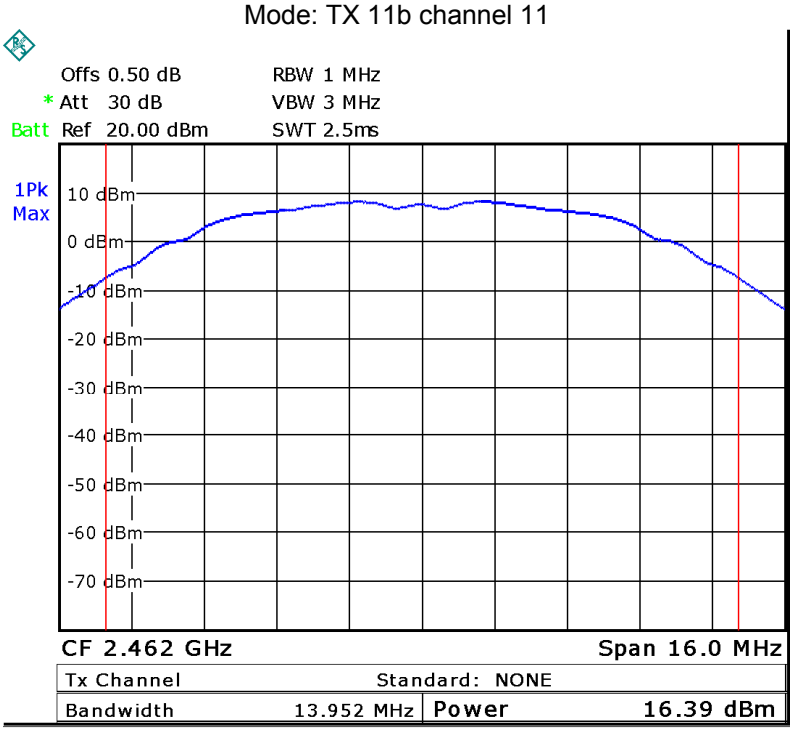
Mode: TX 11b channel 1



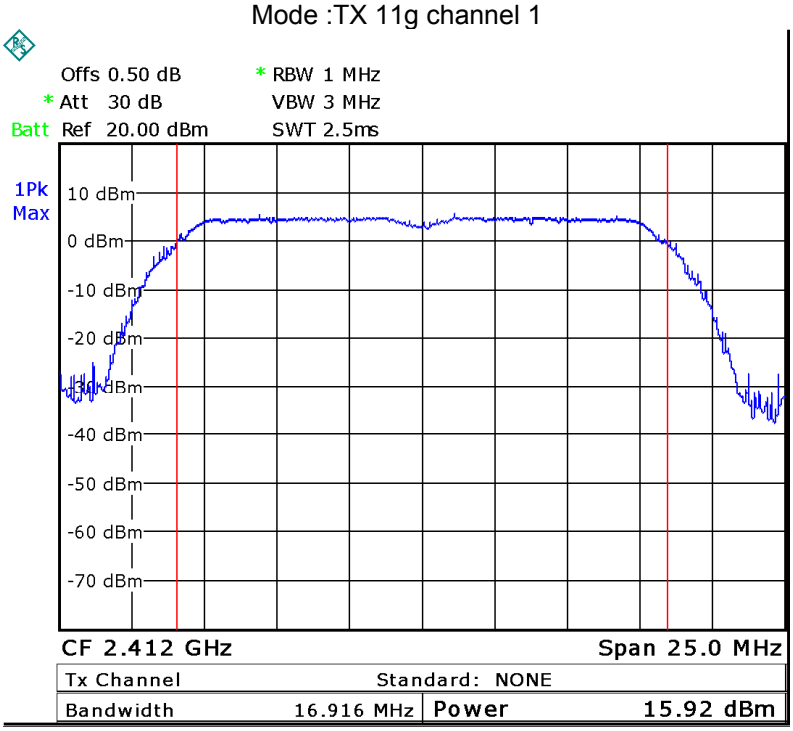
Mode: TX 11b channel 6



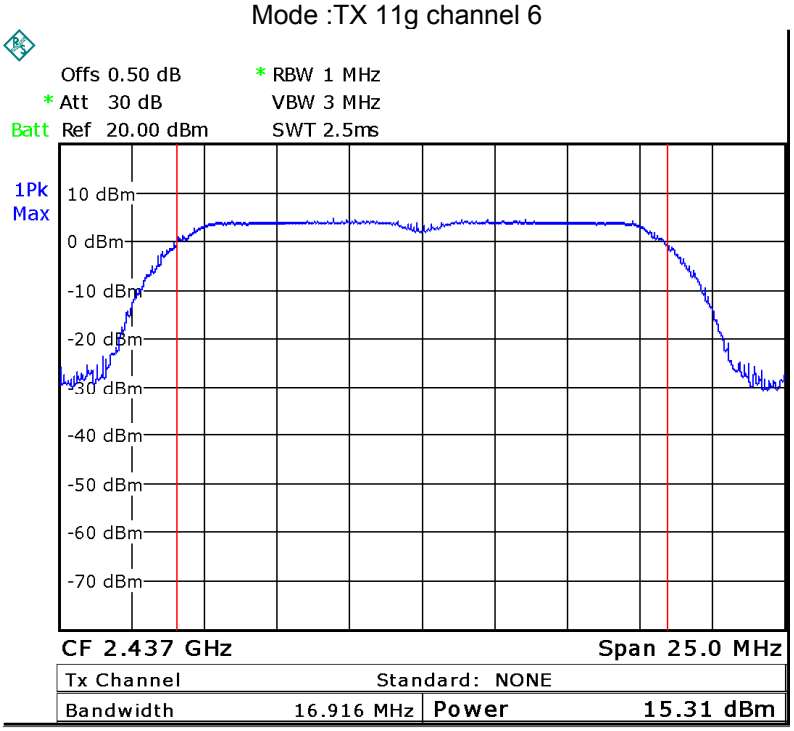
Mode: TX 11b channel 11



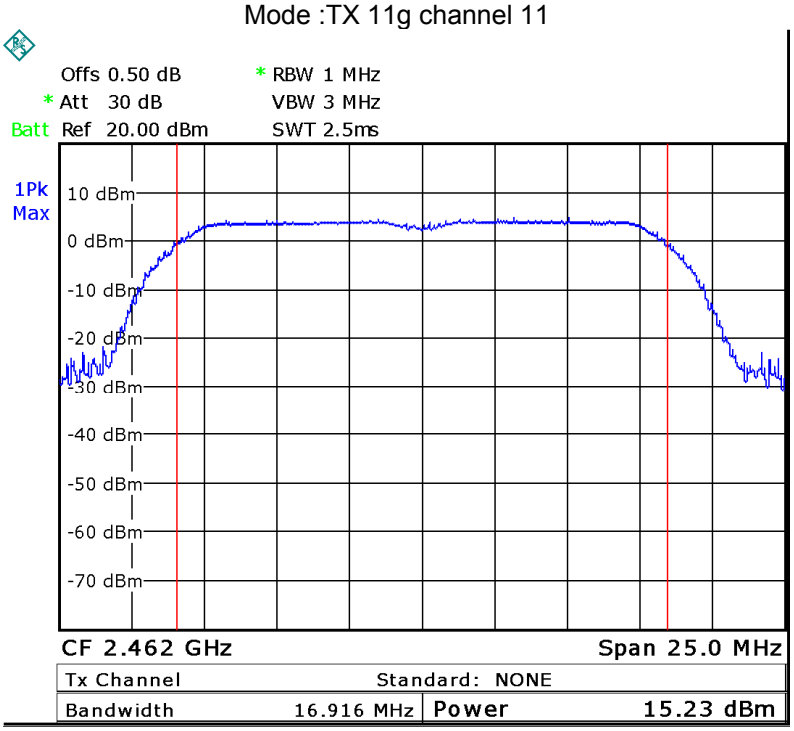
Mode :TX 11g channel 1



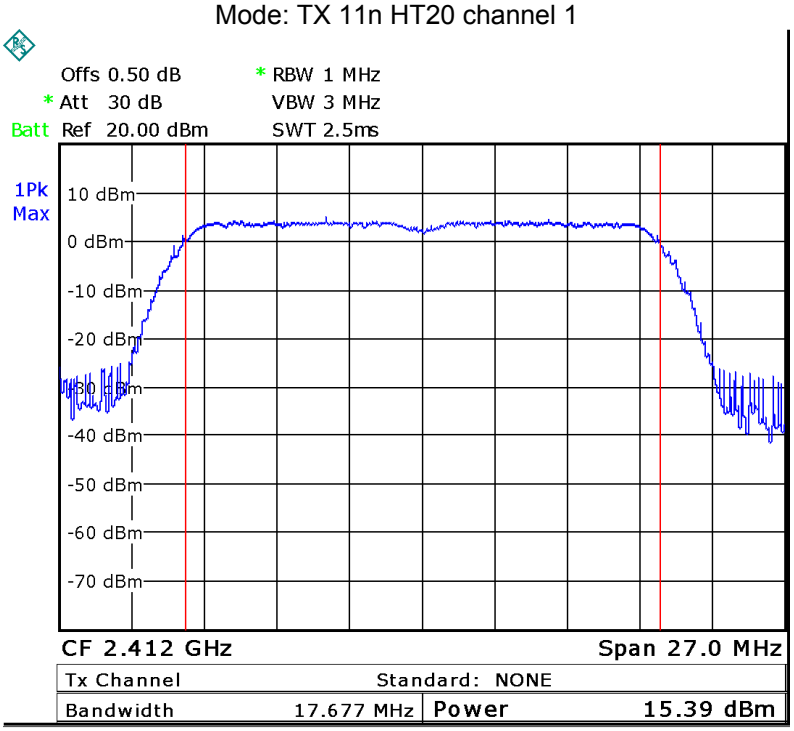
Mode :TX 11g channel 6



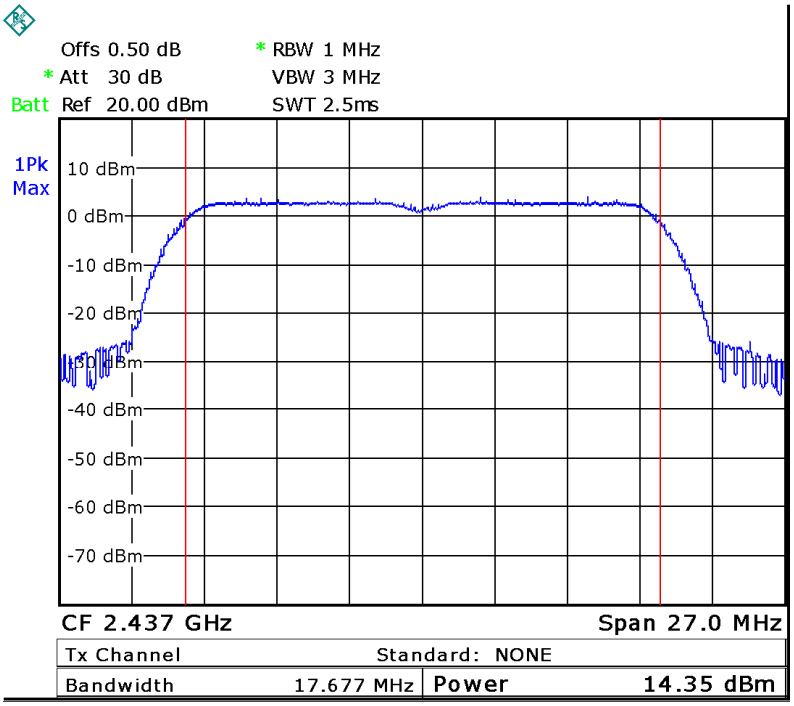
Mode :TX 11g channel 11



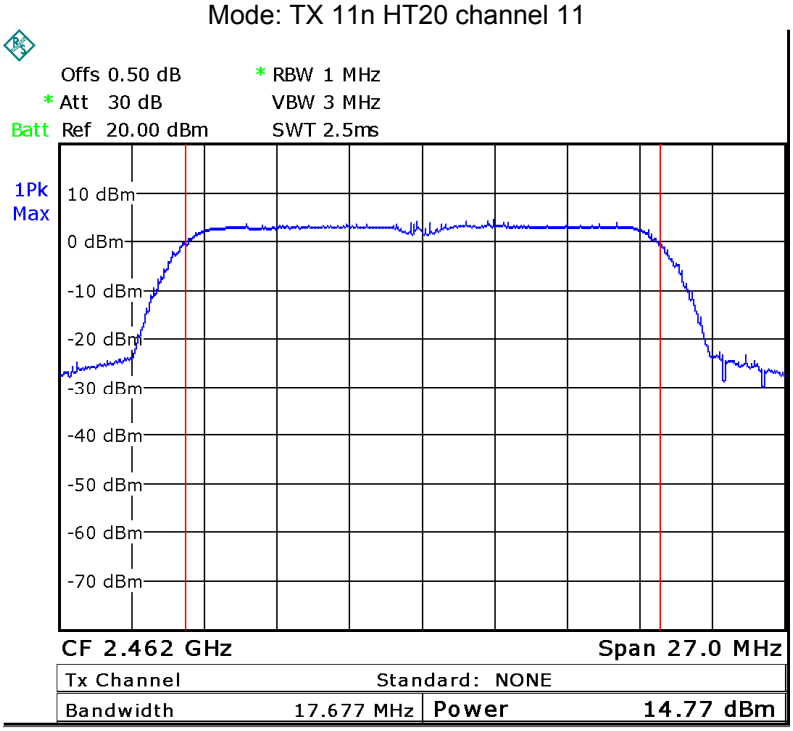
Mode: TX 11n HT20 channel 1



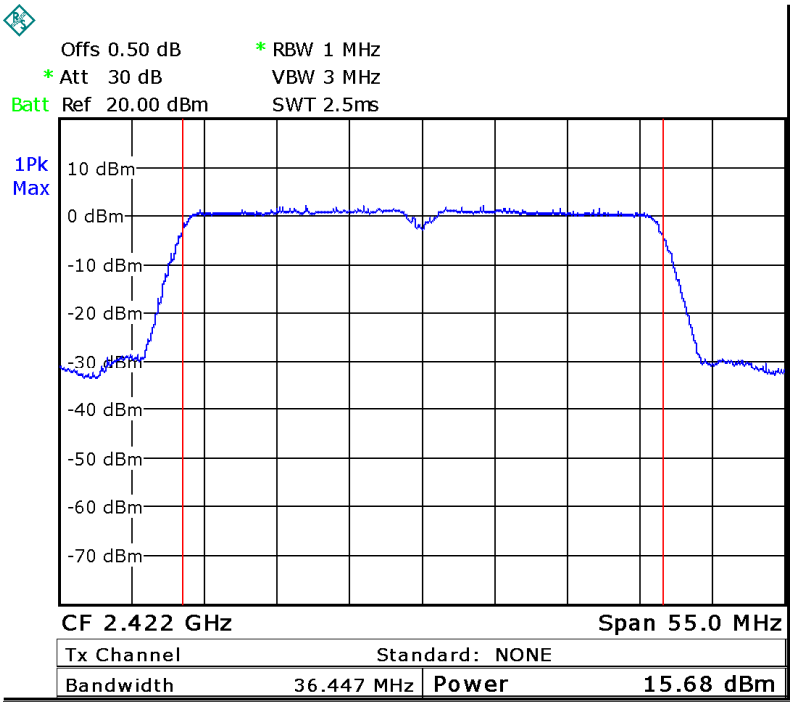
Mode: TX 11n HT20 channel 6



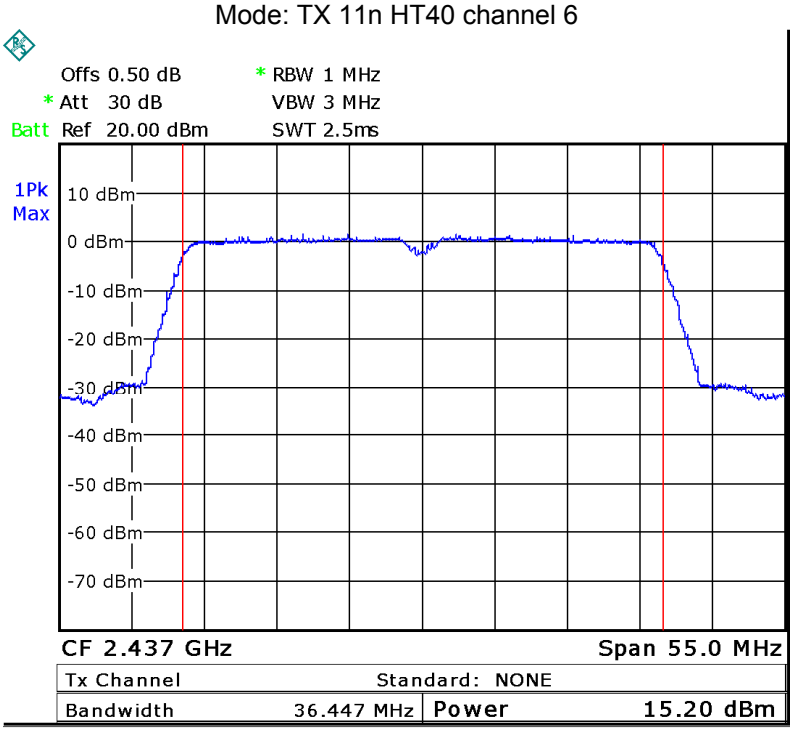
Mode: TX 11n HT20 channel 11



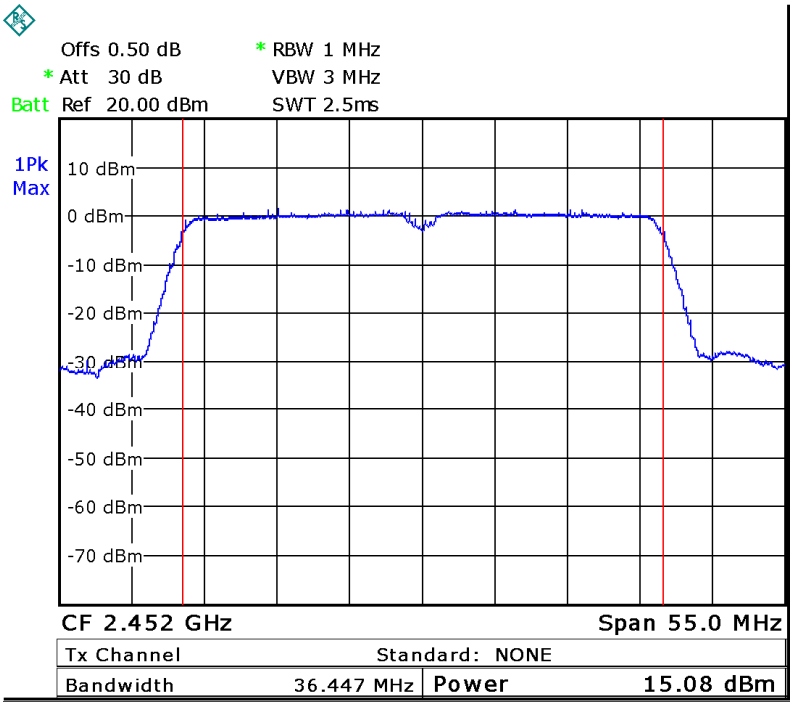
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



13 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018;
ANSI C63.10:2013

13.1 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.

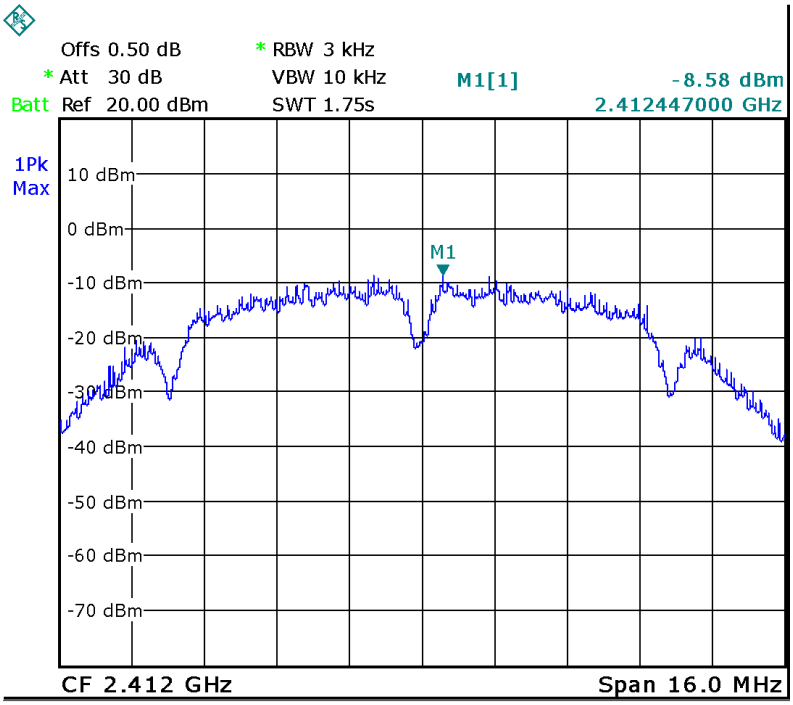
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

13.2 Test Result:

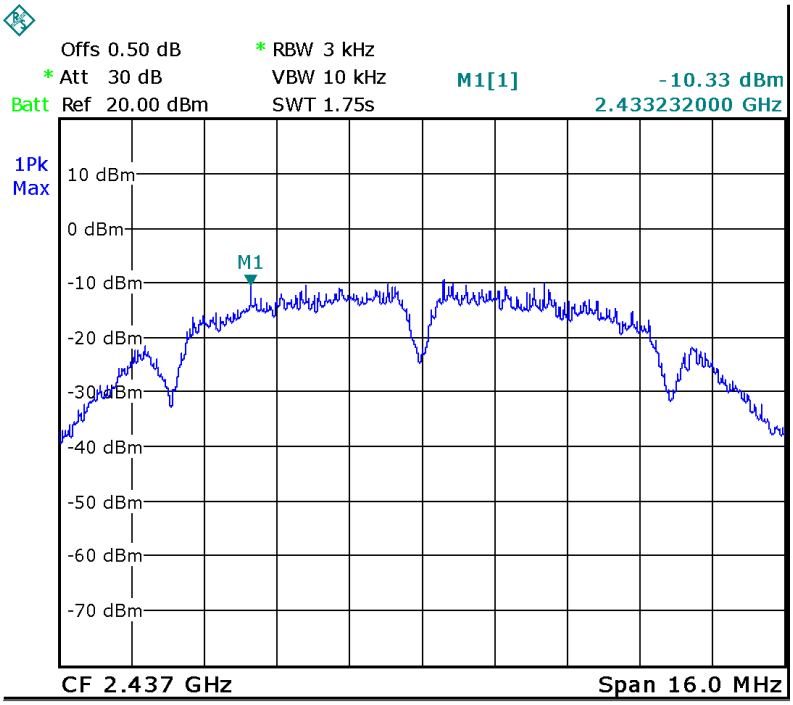
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-8.58	8dBm per 3kHz
	Middle-2437	-10.33	8dBm per 3kHz
	High-2462	-10.79	8dBm per 3kHz
TX 11g	Low-2412	-12.58	8dBm per 3kHz
	Middle-2437	-11.91	8dBm per 3kHz
	High-2462	-12.15	8dBm per 3kHz
TX 11n HT20	Low-2412	-13.49	8dBm per 3kHz
	Middle-2437	-11.84	8dBm per 3kHz
	High-2462	-12.83	8dBm per 3kHz
TX 11n HT40	Low-2422	-15.05	8dBm per 3kHz
	Middle-2437	-15.32	8dBm per 3kHz
	High-2452	-16.32	8dBm per 3kHz

Test Plot

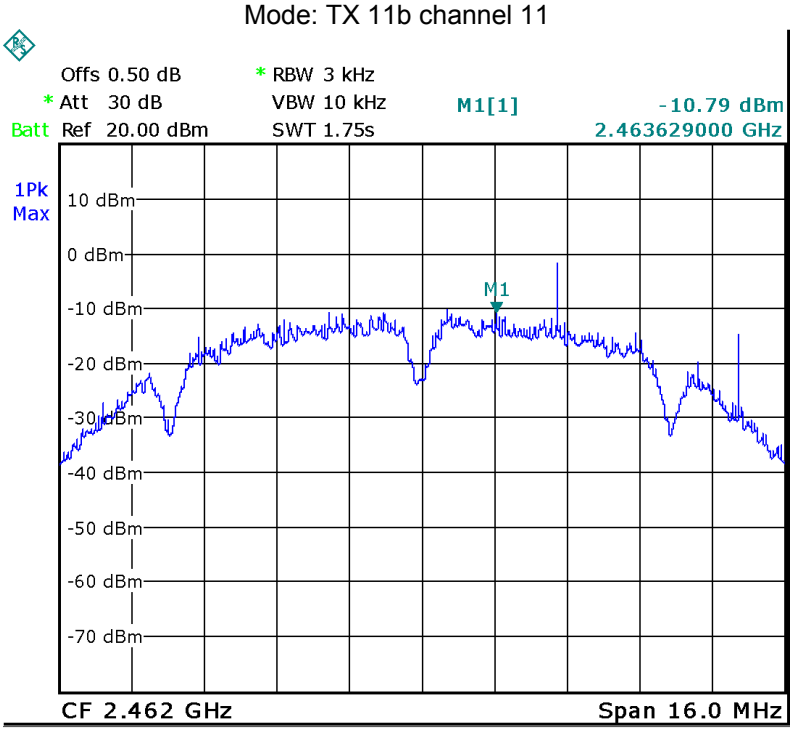
Mode: TX 11b channel 1



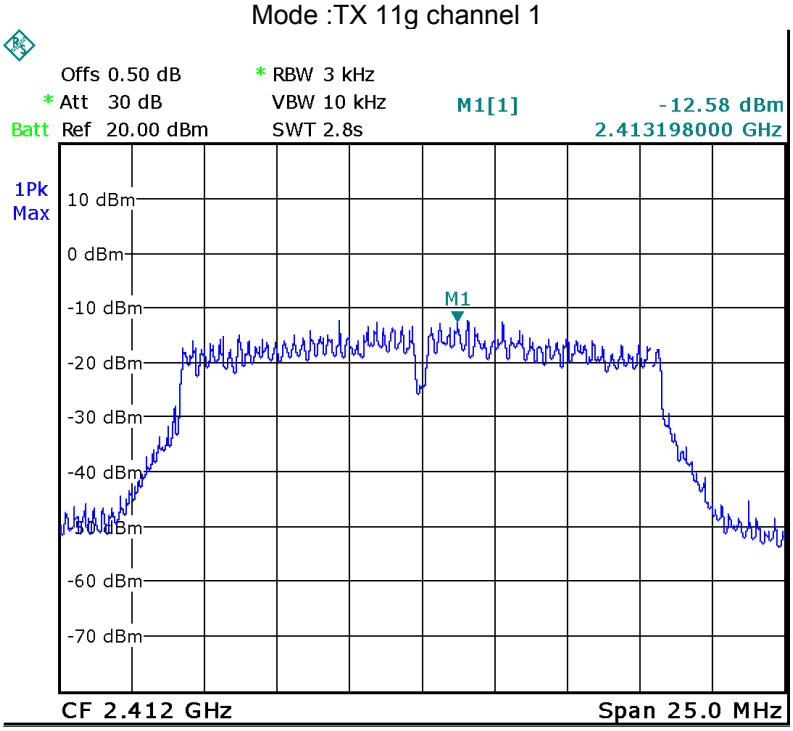
Mode: TX 11b channel 6



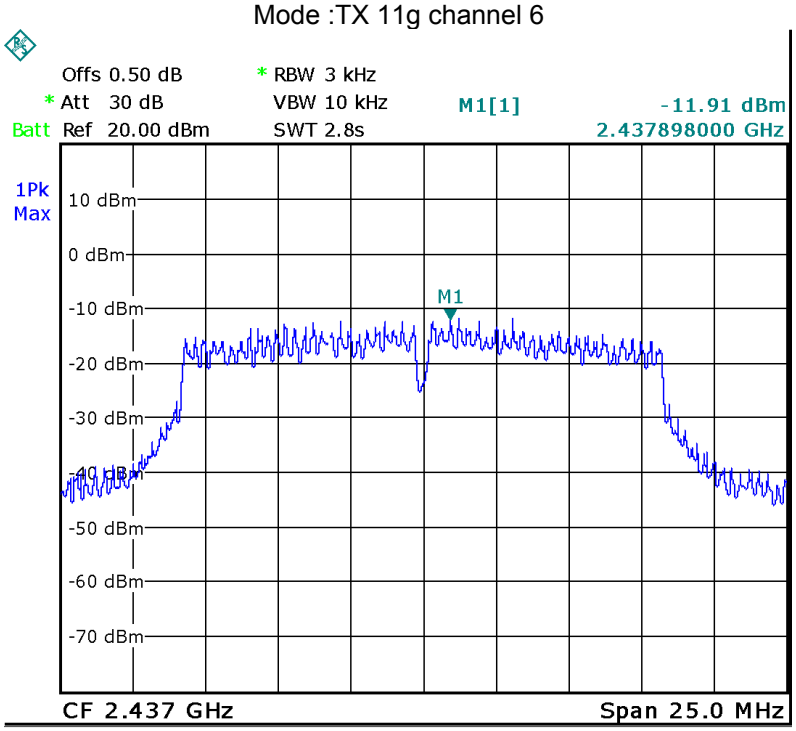
Mode: TX 11b channel 11



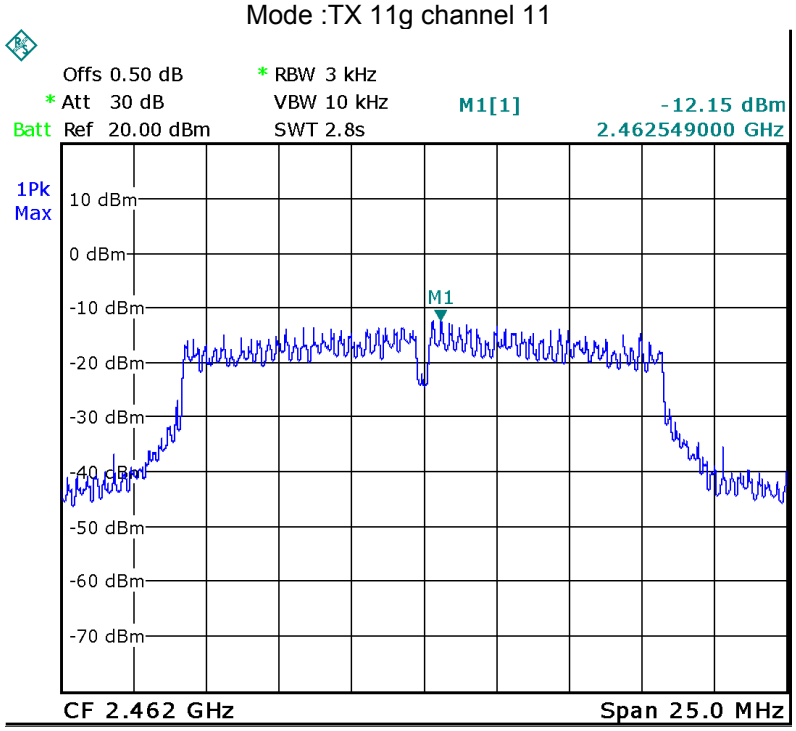
Mode :TX 11g channel 1



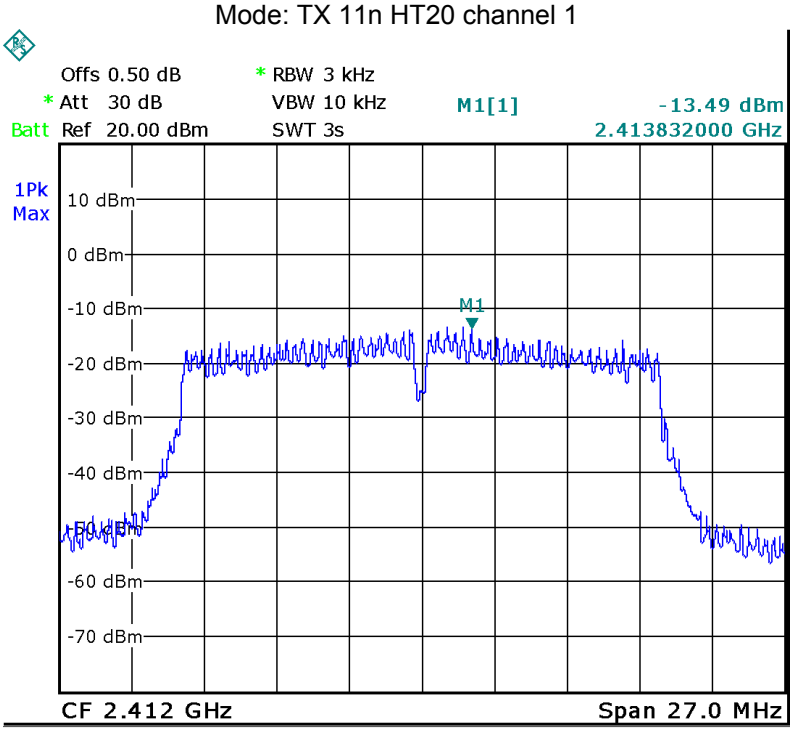
Mode :TX 11g channel 6



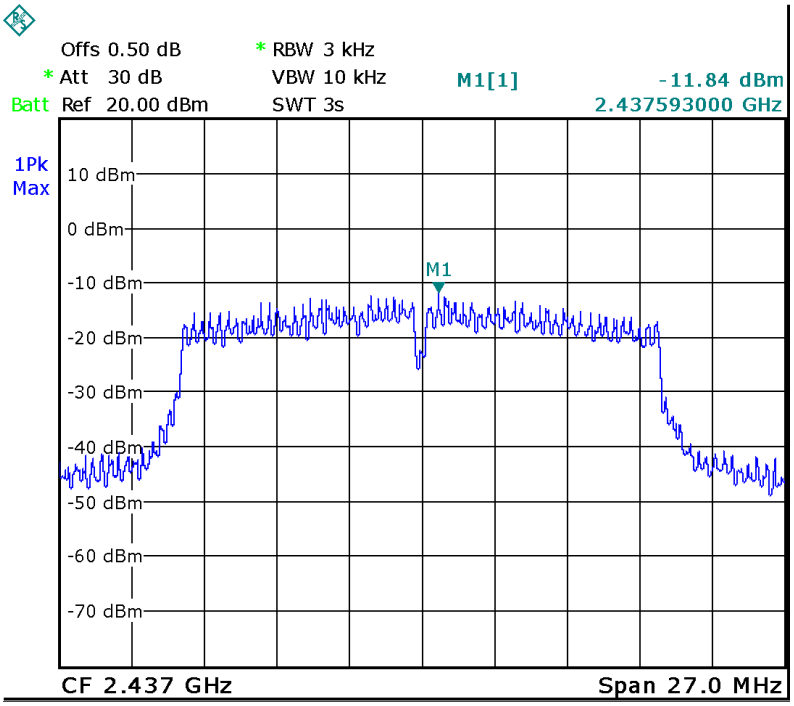
Mode :TX 11g channel 11



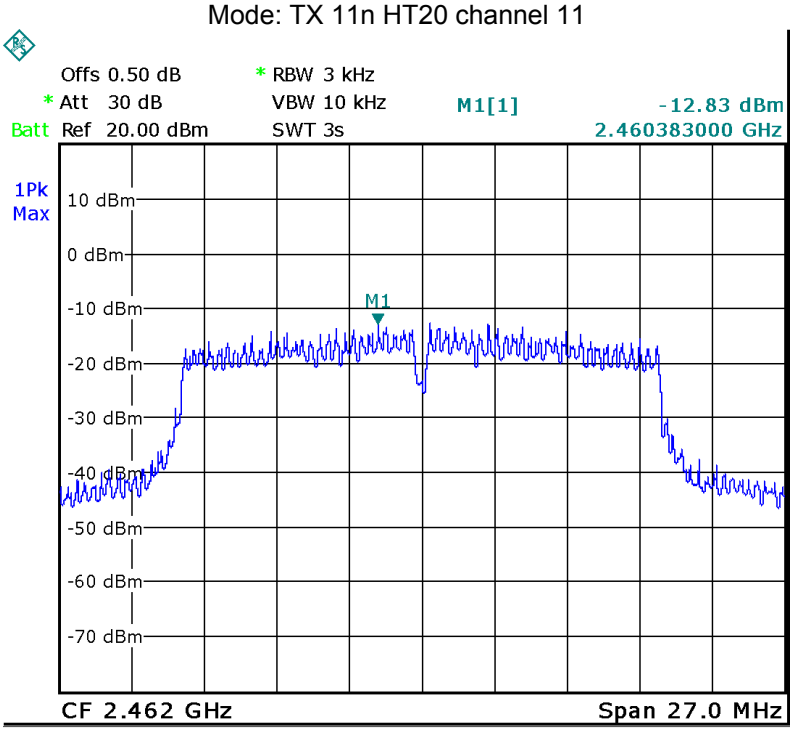
Mode: TX 11n HT20 channel 1



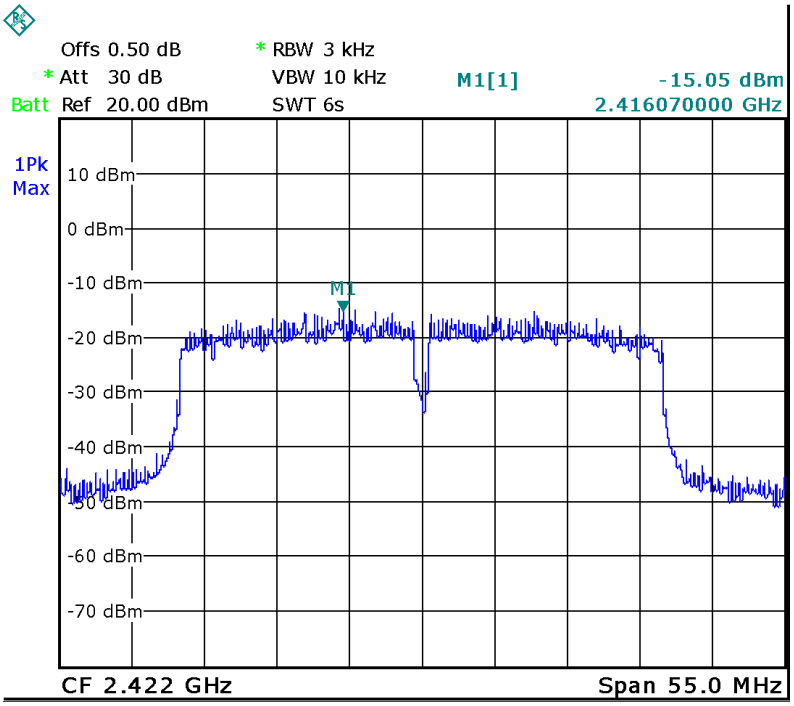
Mode: TX 11n HT20 channel 6



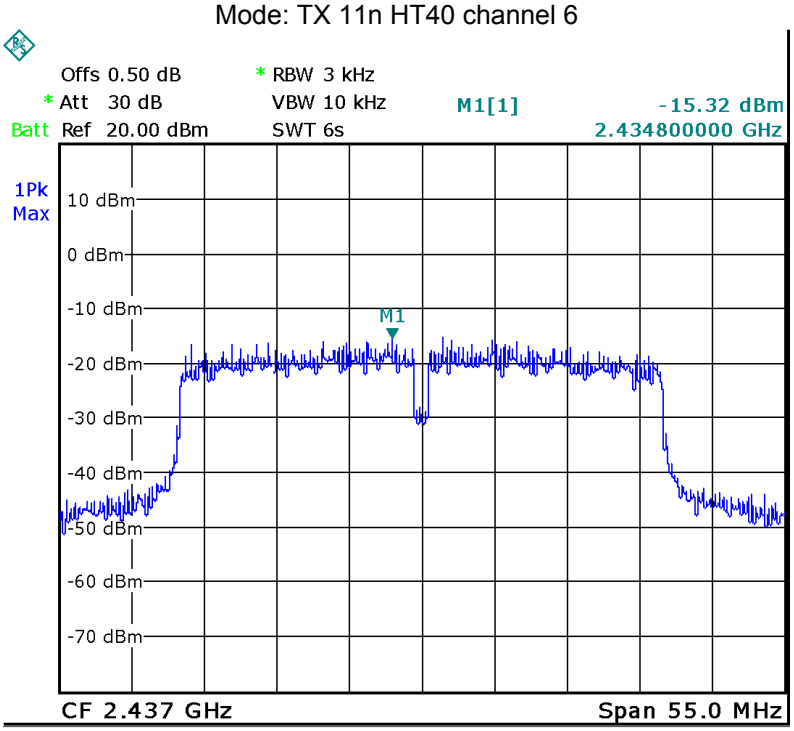
Mode: TX 11n HT20 channel 11



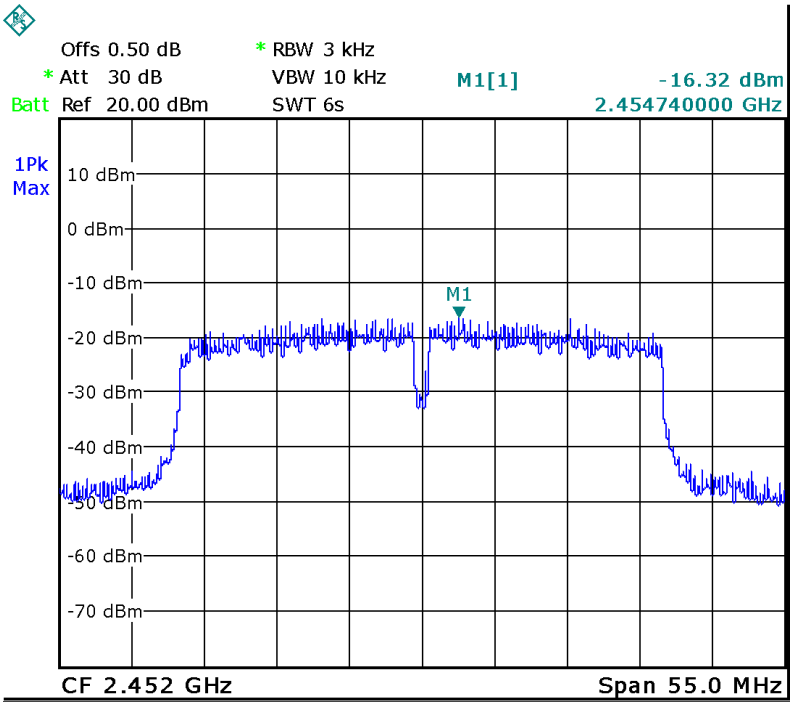
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6



Mode: TX 11n HT40 channel 9



14 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has an integrated antenna fulfill the requirement of this section.

15 RF Exposure

Remark: refer to SAR test report: WTD21D05049471W001.

16 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix- MAXCRPROA -Photos.

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