

TEST REPORT

Reference No...... : WTD22D09182203W002
FCC ID : 2AEPIELEMENT5PLUS
Applicant..... : COLOMBIANA DE COMERCIO S.A.
Address..... : Car. 43E No 8-71, Medellin, Colombia
Manufacturer : MOBIWIRE MOBILES (NINGBO) CO., LTD
Address..... : Ningbo Fenghua No.999, Dacheng East Road, Fenghua, Zhejiang, China
Product..... : SMARTPHONE
Model(s) : ELEMENT 5 PLUS
Brand Name : Kalley
Standards..... : FCC CFR47 Part 15.247
Date of Receipt sample : 2022-09-08
Date of Test : 2022-09-08 to 2022-09-19
Date of Issue..... : 2022-09-19
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

	Page
1 COVER PAGE.....	1
2 CONTENTS	2
3 REVISION HISTORY	3
4 GENERAL INFORMATION.....	4
4.1 GENERAL DESCRIPTION OF E.U.T.	4
4.2 DETAILS OF E.U.T.	4
4.3 CHANNEL LIST	5
4.4 TEST MODE	6
4.5 TEST FACILITY	7
5 TEST SUMMARY	8
6 EQUIPMENT USED DURING TEST	9
6.1 EQUIPMENTS LIST	9
6.2 DESCRIPTION OF SUPPORT UNITS	9
6.3 MEASUREMENT UNCERTAINTY	10
7 CONDUCTED EMISSION	11
7.1 E.U.T. OPERATION	11
7.2 EUT SETUP.....	11
7.3 MEASUREMENT DESCRIPTION	11
7.4 CONDUCTED EMISSION TEST RESULT	12
8 RADIATED EMISSIONS.....	16
8.1 EUT OPERATION.....	16
8.2 TEST SETUP	17
8.3 SPECTRUM ANALYZER SETUP	18
8.4 TEST PROCEDURE	19
8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION	19
8.6 SUMMARY OF TEST RESULTS	20
9 DUTY CYCLE.....	36
10 CONDUCTED SPURIOUS EMISSIONS.....	40
10.1 TEST PROCEDURE.....	40
10.2 TEST RESULT	41
11 BAND EDGE MEASUREMENT	57
11.1 TEST PROCEDURE	57
11.2 TEST RESULT	58
12 6 DB BANDWIDTH AND 99% BANDWIDTH MEASUREMENT	63
12.1 TEST PROCEDURE:.....	63
12.2 TEST RESULT:	63
14 MAXIMUM PEAK CONDUCTED OUTPUT POWER.....	78
14.1 TEST PROCEDURE:.....	78
14.2 TEST RESULT:	79
15 POWER SPECTRAL DENSITY	88
15.1 TEST PROCEDURE:.....	88
15.2 TEST RESULT:	88
16 ANTENNA REQUIREMENT	97
17 RF EXPOSURE.....	98
18 PHOTOGRAPHS OF TEST SETUP AND EUT.....	99

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD22D09182 203W002	2022-09-08	2022-09-08 to 2022-09-19	2022-09-19	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	SMARTPHONE
Model(s):	ELEMENT 5 PLUS
Model Description:	N/A
GSM Band(s):	GSM 850/900/1800/1900MHz
GPRS/EGPRS Class:	12
WCDMA Band(s):	FDD Band II/IV/V
LTE Band(s):	FDD Band 2/4/7/66
Wi-Fi Specification:	2.4G-802.11b/g/n HT20/n HT40
Bluetooth Version:	Bluetooth v5.0 with BLE
GPS:	Support
Hardware Version:	MMI_V01B
Software Version:	Kalley_ELEMENT_5_V04_20220824
Highest frequency (Exclude Radio):	1.8GHz
Storage Location:	Internal Storage

4.2 Details of E.U.T.

Operation Frequency:	WiFi: 802.11b/g/n HT20: 2412~2462MHz 802.11n HT40: 2422~2452MHz BLE:2402-2480MHz
Max. RF output power:	WiFi(2.4G): 15.65 Bm BLE: 5.76dBm
Type of Modulation:	WiFi: CCK, OFDM BLE:GFSK
Antenna installation:	WiFi: internal permanent antenna BLE: internal permanent antenna
Antenna Gain:	WiFi(2.4G): -0.98dBi BLE: -0.98dBi
Ratings:	Battery DC 3.8V, 2000mAh DC 5.0V===0.55A charging from adapter (Adapter Input: 100-240V~50-60Hz 250mA)
Adapter:	Manufacturer: SHENZHEN BAIJUNDA ELECTRONIC CO. LTD Model No.: UT-332A-5055

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	-

BT BLE

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

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	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
6dB Bandwidth	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
	802.11n HT40	MCS0	3/6/9	TX
Band Edge	802.11b	1 Mbps	1/6/11	TX
	802.11g	6 Mbps	1/6/11	TX
	802.11n HT20	MCS0	1/6/11	TX
	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

Table 2 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	BT BLE	1 Mbps	0/19/39	TX
Power Spectral Density	BT BLE	1 Mbps	0/19/39	TX
6dB Bandwidth	BT BLE	1 Mbps	0/19/39	TX
Band Edge	BT BLE	1 Mbps	0/19/39	TX
Transmitter Spurious Emissions	BT BLE	1 Mbps	0/19/39	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 .

4.5 Test Facility

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

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Testing Group Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Testing Group Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

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

Note: All test were performed that the device transmit continue of the 100% duty cycle.

6 Equipment Used during Test

6.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2022-07-26	2023-07-25
2.	LISN	R&S	ENV216	100115	2022-07-26	2023-07-25
3.	Cable	Top	TYPE16(3.5M)	-	2022-07-26	2023-07-25
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	2022-04-28	2023-04-27
2	Amplifier	Agilent	8447D	2944A10178	2022-07-26	2023-07-25
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2022-08-23	2023-08-22
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2022-04-28	2023-04-27
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2022-04-28	2023-04-27
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2022-07-30	2023-07-29
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2022-04-28	2023-04-27
8	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	NA	2022-07-26	2023-07-25
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	2022-04-28	2023-04-27
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2021-10-31	2022-10-30
3	Active Loop Antenna	Com-Power Corp.	AL-130R	10160007	2022-05-02	2023-05-01
4	Amplifier	ANRITSU	MH648A	M43381	2022-04-28	2023-04-27
5	Cable	HUBER+SUHNER	CBL2	525178	2022-04-28	2023-04-27
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	Spectrum Analyzer	R&S	FSP40	100501	2022-07-26	2023-07-25
2.	EXA Signal Analyzer	Malaysia Keysight	N9010A	MY50520207	2022-04-28	2023-04-27

6.2 Description of Support Units

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

6.3 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	± 1 x 10 ⁻⁷ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	

Frequency (MHz)	Limit (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50

7.1 E.U.T. Operation

Operating Environment :

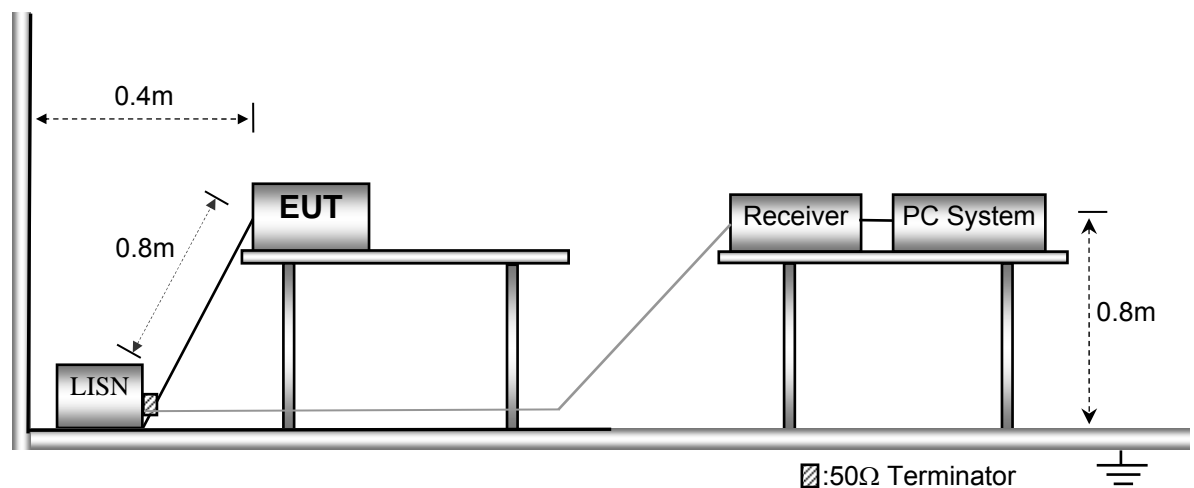
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

7.2 EUT Setup

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



7.3 Measurement Description

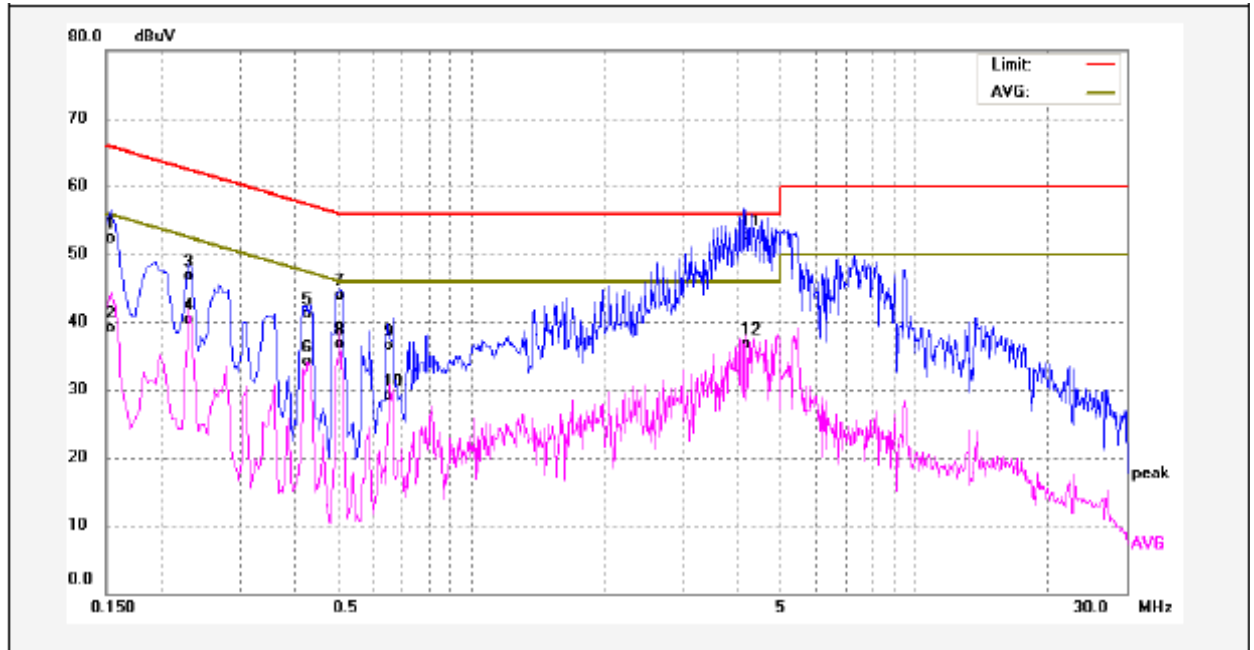
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

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

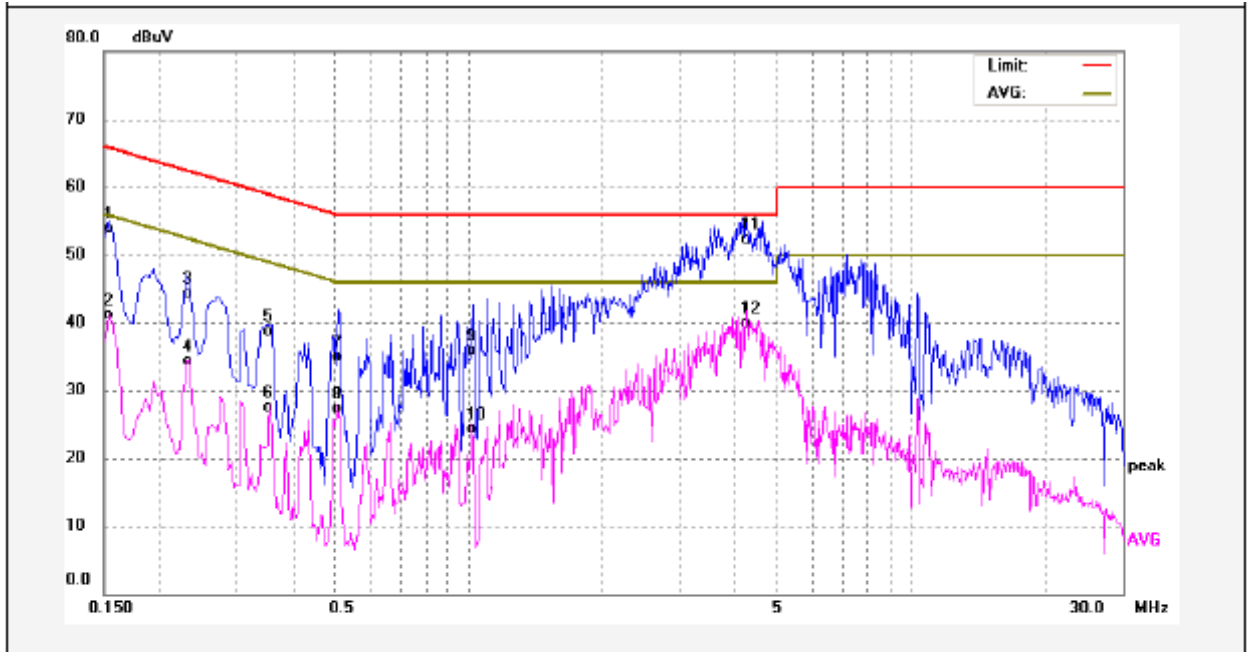
Worst Mode: WIFI mode (802.11b mode low channel)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	42.14	10.24	52.38	65.78	-13.40	QP	
2	0.1539	28.90	10.24	39.14	55.78	-16.64	AVG	
3	0.2300	36.57	10.20	46.77	62.45	-15.68	QP	
4	0.2300	30.18	10.20	40.38	52.45	-12.07	AVG	
5	0.4260	30.85	10.19	41.04	57.33	-16.29	QP	
6	0.4260	23.98	10.19	34.17	47.33	-13.16	AVG	
7	0.5060	33.75	10.20	43.95	56.00	-12.05	QP	
8	0.5060	26.57	10.20	36.77	46.00	-9.23	AVG	
9	0.6540	26.32	10.27	36.59	56.00	-19.41	QP	
10	0.6540	18.80	10.27	29.07	46.00	-16.93	AVG	
11	4.1700	42.27	10.45	52.72	56.00	-3.28	QP	
12	4.1700	26.17	10.45	36.62	46.00	-9.38	AVG	

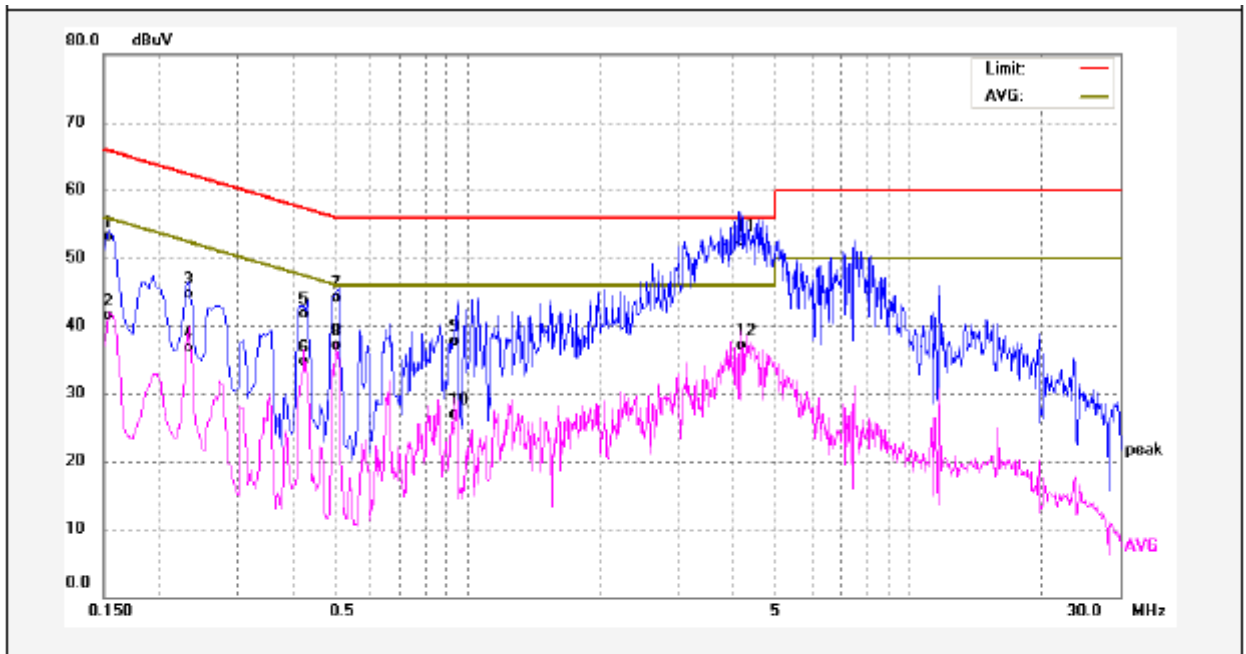
Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	43.60	10.26	53.86	65.78	-11.92	QP	
2	0.1539	30.82	10.26	41.08	55.78	-14.70	AVG	
3	0.2340	34.00	10.21	44.21	62.30	-18.09	QP	
4	0.2340	24.00	10.21	34.21	52.30	-18.09	AVG	
5	0.3500	28.53	10.20	38.73	58.96	-20.23	QP	
6	0.3500	17.33	10.20	27.53	48.96	-21.43	AVG	
7	0.5060	24.68	10.19	34.87	56.00	-21.13	QP	
8	0.5060	17.13	10.19	27.32	46.00	-18.68	AVG	
9	1.0180	25.57	10.30	35.87	56.00	-20.13	QP	
10	1.0180	13.95	10.30	24.25	46.00	-21.75	AVG	
11	4.2420	41.78	10.47	52.25	56.00	-3.75	QP	
12	4.2420	29.35	10.47	39.82	46.00	-6.18	AVG	

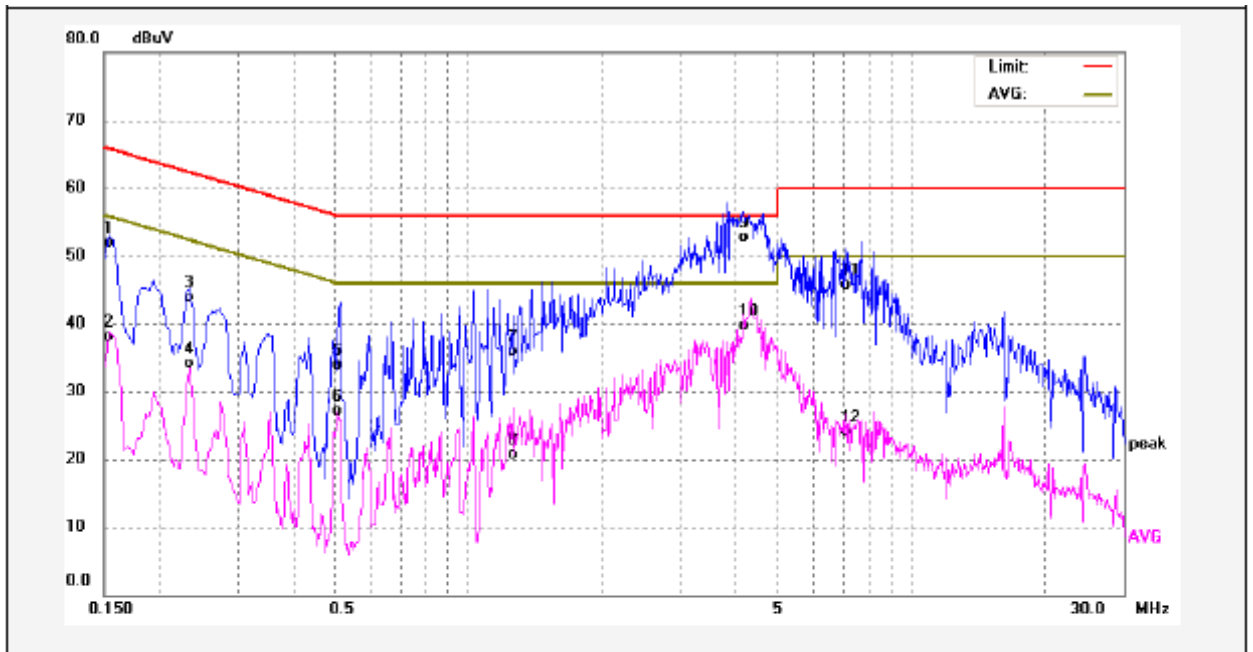
Worst Mode: BLE mode (low channel)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	42.81	10.24	53.05	65.78	-12.73	QP	
2	0.1539	31.18	10.24	41.42	55.78	-14.36	AVG	
3	0.2340	34.50	10.20	44.70	62.30	-17.60	QP	
4	0.2340	26.41	10.20	36.61	52.30	-15.69	AVG	
5	0.4260	31.58	10.19	41.77	57.33	-15.56	QP	
6	0.4260	24.53	10.19	34.72	47.33	-12.61	AVG	
7	0.5060	33.97	10.20	44.17	56.00	-11.83	QP	
8	0.5060	26.83	10.20	37.03	46.00	-8.97	AVG	
9	0.9340	27.43	10.29	37.72	56.00	-18.28	QP	
10	0.9340	16.61	10.29	26.90	46.00	-19.10	AVG	
11	4.1740	42.15	10.45	52.60	56.00	-3.40	QP	
12	4.1740	26.65	10.45	37.10	46.00	-8.90	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	41.65	10.26	51.91	65.78	-13.87	QP	
2	0.1539	27.94	10.26	38.20	55.78	-17.58	AVG	
3	0.2340	33.79	10.21	44.00	62.30	-18.30	QP	
4	0.2340	23.99	10.21	34.20	52.30	-18.10	AVG	
5	0.5060	23.70	10.19	33.89	56.00	-22.11	QP	
6	0.5060	16.97	10.19	27.16	46.00	-18.84	AVG	
7	1.2540	25.57	10.30	35.87	56.00	-20.13	QP	
8	1.2540	10.37	10.30	20.67	46.00	-25.33	AVG	
9	4.1740	42.33	10.47	52.80	56.00	-3.20	QP	
10	4.1740	29.30	10.47	39.77	46.00	-6.23	AVG	
11	7.0900	35.22	10.40	45.62	60.00	-14.38	QP	
12	7.0900	13.75	10.40	24.15	50.00	-25.85	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	20log ^{(2400/F(kHz))} + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log ^{(24000/F(kHz))} + 40
1.705 ~ 30	30	30	100 * 30	20log ⁽³⁰⁾ + 40
30 ~ 88	100	3	100	20log ⁽¹⁰⁰⁾
88 ~ 216	150	3	150	20log ⁽¹⁵⁰⁾
216 ~ 960	200	3	200	20log ⁽²⁰⁰⁾
Above 960	500	3	500	20log ⁽⁵⁰⁰⁾

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

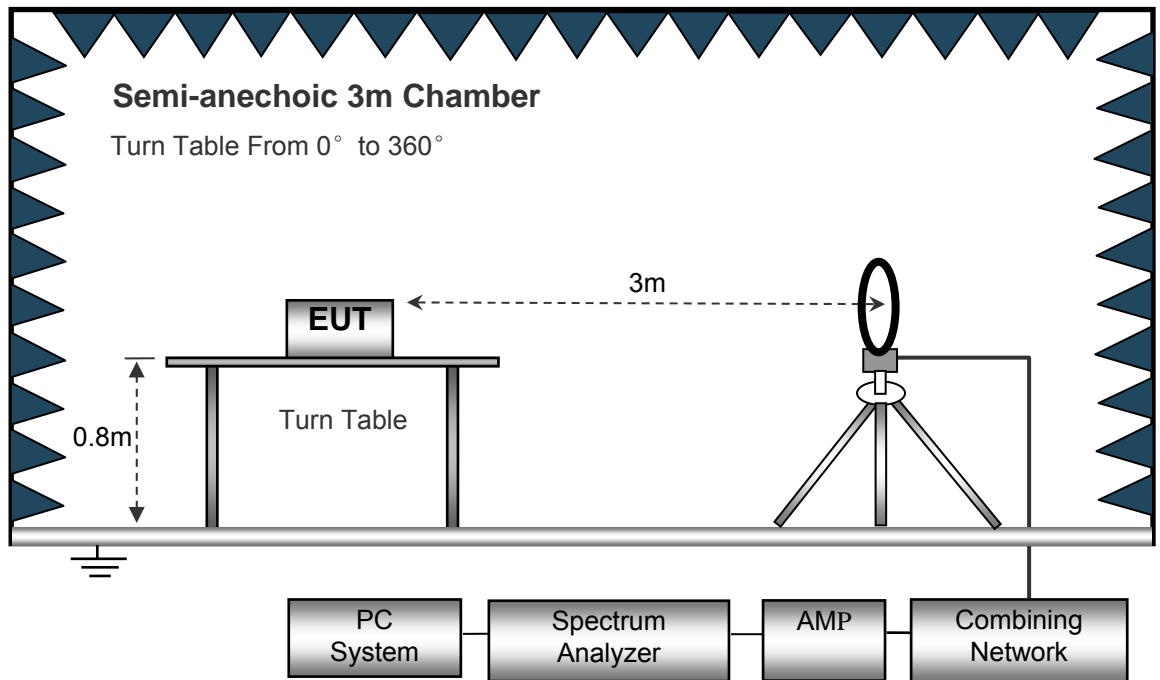
EUT Operation :

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

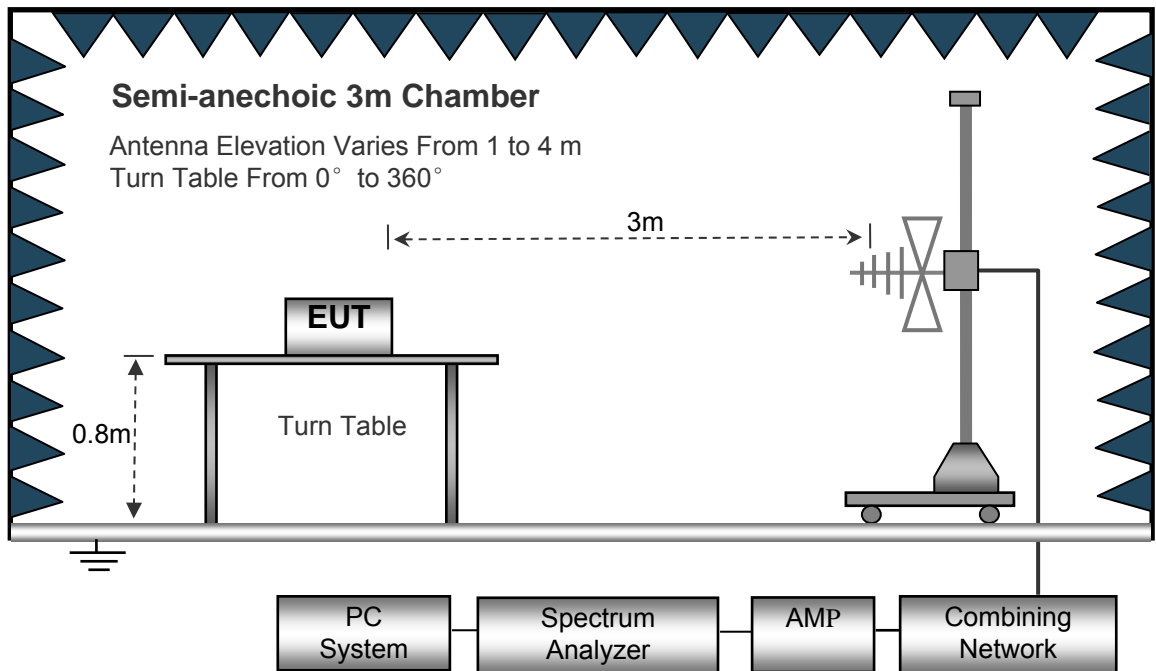
8.2 Test Setup

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

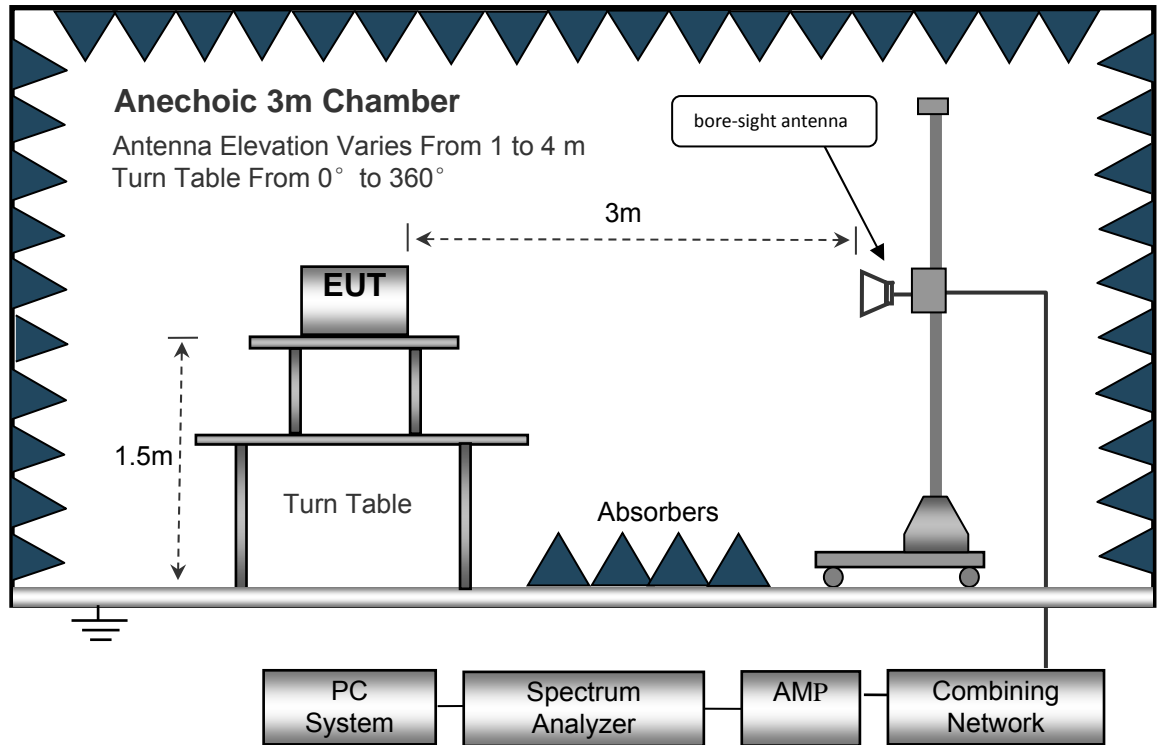
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
 IF Bandwidth..... 10kHz
 Video Bandwidth..... 10kHz
 Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
 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

8.4 Test Procedure

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

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

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

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

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

8.6 Summary of Test Results

Wifi:

Test Frequency: 9KHz~30MHz

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

Frequency	Measurement results dB μ V @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dB μ V/m @30m	Limits dB μ V/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
802.11b							
6.261	23.12	QP	21.84	40.00	4.96	29.54	-24.58
15.960	25.65	QP	21.35	40.00	7.00	29.54	-22.54
24.680	24.35	QP	20.67	40.00	5.02	29.54	-24.52
802.11g							
6.311	22.12	QP	21.84	40.00	3.96	29.54	-25.58
15.960	24.64	QP	21.35	40.00	5.99	29.54	-23.55
24.680	22.36	QP	20.67	40.00	3.03	29.54	-26.51
802.11n(HT20)							
6.311	24.12	QP	21.84	40.00	5.96	29.54	-23.58
15.960	23.54	QP	21.35	40.00	4.89	29.54	-24.65
24.680	25.26	QP	20.67	40.00	5.93	29.54	-23.61
802.11n(HT40)							
6.311	24.62	QP	21.84	40.00	6.46	29.54	-23.08
15.960	25.21	QP	21.35	40.00	6.56	29.54	-22.98
22.480	22.46	QP	20.67	40.00	3.13	29.54	-26.41

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)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: Low Channel 2412MHz									
223.45	36.40	QP	14	1.2	H	-11.62	24.78	46.00	-21.22
223.45	32.15	QP	359	1.7	V	-11.62	20.53	46.00	-25.47
4824.00	51.81	PK	358	1.4	V	-1.06	50.75	74.00	-23.25
4824.00	42.71	Ave	358	1.4	V	-1.06	41.65	54.00	-12.35
7236.00	46.80	PK	108	1.4	H	1.33	48.13	74.00	-25.87
7236.00	39.89	Ave	108	1.4	H	1.33	41.22	54.00	-12.78
2316.50	45.40	PK	122	1.5	V	-13.19	32.21	74.00	-41.79
2316.50	39.83	Ave	122	1.5	V	-13.19	26.64	54.00	-27.36
2353.87	42.42	PK	125	1.7	H	-13.14	29.28	74.00	-44.72
2353.87	36.83	Ave	125	1.7	H	-13.14	23.69	54.00	-30.31
2489.13	44.18	PK	271	1.8	V	-13.08	31.10	74.00	-42.90
2489.13	36.56	Ave	271	1.8	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)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: Middle Channel 2437MHz									
223.45	35.32	QP	269	1.4	H	-11.62	23.70	46.00	-22.30
223.45	31.78	QP	227	1.1	V	-11.62	20.16	46.00	-25.84
4874.00	51.03	PK	106	1.9	V	-0.62	50.41	74.00	-23.59
4874.00	43.22	Ave	106	1.9	V	-0.62	42.60	54.00	-11.40
7311.00	46.63	PK	332	1.4	H	2.21	48.84	74.00	-25.16
7311.00	38.92	Ave	332	1.4	H	2.21	41.13	54.00	-12.87
2311.39	46.47	PK	231	1.5	V	-13.19	33.28	74.00	-40.72
2311.39	37.25	Ave	231	1.5	V	-13.19	24.06	54.00	-29.94
2365.33	42.23	PK	203	1.9	H	-13.14	29.09	74.00	-44.91
2365.33	38.42	Ave	203	1.9	H	-13.14	25.28	54.00	-28.72
2494.21	43.33	PK	330	1.7	V	-13.08	30.25	74.00	-43.75
2494.21	38.47	Ave	330	1.7	V	-13.08	25.39	54.00	-28.61

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: High Channel 2462MHz									
223.45	33.84	QP	147	2.0	H	-11.62	22.22	46.00	-23.78
223.45	30.96	QP	327	1.8	V	-11.62	19.34	46.00	-26.66
4924.00	49.65	PK	330	1.3	V	-0.24	49.41	74.00	-24.59
4924.00	44.20	Ave	330	1.3	V	-0.24	43.96	54.00	-10.04
7386.00	45.97	PK	158	1.7	H	2.84	48.81	74.00	-25.19
7386.00	38.18	Ave	158	1.7	H	2.84	41.02	54.00	-12.98
2310.83	46.71	PK	122	1.2	V	-13.19	33.52	74.00	-40.48
2310.83	38.52	Ave	122	1.2	V	-13.19	25.33	54.00	-28.67
2355.01	44.16	PK	19	1.1	H	-13.14	31.02	74.00	-42.98
2355.01	36.05	Ave	19	1.1	H	-13.14	22.91	54.00	-31.09
2494.99	44.76	PK	343	1.9	V	-13.08	31.68	74.00	-42.32
2494.99	37.83	Ave	343	1.9	V	-13.08	24.75	54.00	-29.25

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: Low Channel 2412MHz									
223.45	34.75	QP	173	1.7	H	-11.62	23.13	46.00	-22.87
223.45	30.57	QP	84	1.4	V	-11.62	18.95	46.00	-27.05
4824.00	49.94	PK	201	1.4	V	-1.06	48.88	74.00	-25.12
4824.00	44.47	Ave	201	1.4	V	-1.06	43.41	54.00	-10.59
7236.00	45.21	PK	219	1.1	H	1.33	46.54	74.00	-27.46
7236.00	38.81	Ave	219	1.1	H	1.33	40.14	54.00	-13.86
2343.48	46.79	PK	41	1.4	V	-13.19	33.60	74.00	-40.40
2343.48	38.96	Ave	41	1.4	V	-13.19	25.77	54.00	-28.23
2357.80	42.74	PK	14	1.5	H	-13.14	29.60	74.00	-44.40
2357.80	38.51	Ave	14	1.5	H	-13.14	25.37	54.00	-28.63
2498.37	44.57	PK	48	1.9	V	-13.08	31.49	74.00	-42.51
2498.37	36.15	Ave	48	1.9	V	-13.08	23.07	54.00	-30.93

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: Middle Channel 2437MHz									
223.45	33.70	QP	124	1.3	H	-11.62	22.08	46.00	-23.92
223.45	29.51	QP	168	1.9	V	-11.62	17.89	46.00	-28.11
4874.00	49.93	PK	86	1.1	V	-0.62	49.31	74.00	-24.69
4874.00	44.22	Ave	86	1.1	V	-0.62	43.60	54.00	-10.40
7311.00	45.63	PK	250	1.4	H	2.21	47.84	74.00	-26.16
7311.00	39.37	Ave	250	1.4	H	2.21	41.58	54.00	-12.42
2348.88	45.55	PK	37	1.5	V	-13.19	32.36	74.00	-41.64
2348.88	39.42	Ave	37	1.5	V	-13.19	26.23	54.00	-27.77
2381.27	42.56	PK	39	1.4	H	-13.14	29.42	74.00	-44.58
2381.27	37.68	Ave	39	1.4	H	-13.14	24.54	54.00	-29.46
2489.42	42.00	PK	14	1.9	V	-13.08	28.92	74.00	-45.08
2489.42	38.08	Ave	14	1.9	V	-13.08	25.00	54.00	-29.00

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: High Channel 2462MHz									
223.45	32.72	QP	122	1.4	H	-11.62	21.10	46.00	-24.90
223.45	30.02	QP	36	1.9	V	-11.62	18.40	46.00	-27.60
4924.00	50.83	PK	212	1.4	V	-0.24	50.59	74.00	-23.41
4924.00	45.62	Ave	212	1.4	V	-0.24	45.38	54.00	-8.62
7386.00	44.32	PK	80	1.5	H	2.84	47.16	74.00	-26.84
7386.00	38.10	Ave	80	1.5	H	2.84	40.94	54.00	-13.06
2322.13	45.55	PK	31	1.3	V	-13.19	32.36	74.00	-41.64
2322.13	38.64	Ave	31	1.3	V	-13.19	25.45	54.00	-28.55
2353.99	42.22	PK	240	1.2	H	-13.14	29.08	74.00	-44.92
2353.99	36.35	Ave	240	1.2	H	-13.14	23.21	54.00	-30.79
2485.00	43.52	PK	53	1.0	V	-13.08	30.44	74.00	-43.56
2485.00	36.07	Ave	53	1.0	V	-13.08	22.99	54.00	-31.01

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n20: Low Channel 2412MHz									
223.45	33.95	QP	10	1.3	H	-11.62	22.33	46.00	-23.67
223.45	29.13	QP	40	1.7	V	-11.62	17.51	46.00	-28.49
4824.00	50.46	PK	343	1.1	V	-1.06	49.40	74.00	-24.60
4824.00	45.95	Ave	343	1.1	V	-1.06	44.89	54.00	-9.11
7236.00	43.61	PK	204	1.4	H	1.33	44.94	74.00	-29.06
7236.00	38.09	Ave	204	1.4	H	1.33	39.42	54.00	-14.58
2345.08	45.31	PK	103	1.9	V	-13.19	32.12	74.00	-41.88
2345.08	38.99	Ave	103	1.9	V	-13.19	25.80	54.00	-28.20
2372.88	42.64	PK	302	1.2	H	-13.14	29.50	74.00	-44.50
2372.88	36.52	Ave	302	1.2	H	-13.14	23.38	54.00	-30.62
2492.22	42.88	PK	292	1.1	V	-13.08	29.80	74.00	-44.20
2492.22	37.86	Ave	292	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)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n20: Middle Channel 2437MHz									
223.45	34.21	QP	175	1.0	H	-11.62	22.59	46.00	-23.41
223.45	30.32	QP	1	1.2	V	-11.62	18.70	46.00	-27.30
4874.00	49.66	PK	339	1.8	V	-0.62	49.04	74.00	-24.96
4874.00	46.42	Ave	339	1.8	V	-0.62	45.80	54.00	-8.20
7311.00	44.78	PK	171	1.0	H	2.21	46.99	74.00	-27.01
7311.00	38.00	Ave	171	1.0	H	2.21	40.21	54.00	-13.79
2335.59	46.00	PK	99	1.1	V	-13.19	32.81	74.00	-41.19
2335.59	39.35	Ave	99	1.1	V	-13.19	26.16	54.00	-27.84
2357.10	42.37	PK	36	1.0	H	-13.14	29.23	74.00	-44.77
2357.10	37.59	Ave	36	1.0	H	-13.14	24.45	54.00	-29.55
2491.40	44.50	PK	239	1.6	V	-13.08	31.42	74.00	-42.58
2491.40	37.49	Ave	239	1.6	V	-13.08	24.41	54.00	-29.59

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									
223.45	35.29	QP	87	1.5	H	-11.62	23.67	46.00	-22.33
223.45	29.79	QP	175	1.2	V	-11.62	18.17	46.00	-27.83
4924.00	50.22	PK	55	2.0	V	-0.24	49.98	74.00	-24.02
4924.00	47.71	Ave	55	2.0	V	-0.24	47.47	54.00	-6.53
7386.00	44.66	PK	326	1.2	H	2.84	47.50	74.00	-26.50
7386.00	39.34	Ave	326	1.2	H	2.84	42.18	54.00	-11.82
2335.60	45.29	PK	51	1.2	V	-13.19	32.10	74.00	-41.90
2335.60	39.89	Ave	51	1.2	V	-13.19	26.70	54.00	-27.30
2355.72	43.16	PK	212	1.6	H	-13.14	30.02	74.00	-43.98
2355.72	37.36	Ave	212	1.6	H	-13.14	24.22	54.00	-29.78
2487.73	43.16	PK	305	1.7	V	-13.08	30.08	74.00	-43.92
2487.73	38.77	Ave	305	1.7	V	-13.08	25.69	54.00	-28.31

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n40: Low Channel 2422MHz									
223.45	36.14	QP	39	1.4	H	-11.62	24.52	46.00	-21.48
223.45	30.05	QP	2	1.8	V	-11.62	18.43	46.00	-27.57
4844.00	48.54	PK	154	1.5	V	-1.06	47.48	74.00	-26.52
4844.00	45.66	Ave	154	1.5	V	-1.06	44.60	54.00	-9.40
7266.00	42.03	PK	80	1.8	H	1.33	43.36	74.00	-30.64
7266.00	38.27	Ave	80	1.8	H	1.33	39.60	54.00	-14.40
2319.86	46.44	PK	7	1.0	V	-13.19	33.25	74.00	-40.75
2319.86	39.89	Ave	7	1.0	V	-13.19	26.70	54.00	-27.30
2384.13	43.70	PK	55	1.8	H	-13.14	30.56	74.00	-43.44
2384.13	38.40	Ave	55	1.8	H	-13.14	25.26	54.00	-28.74
2499.14	43.11	PK	68	1.6	V	-13.08	30.03	74.00	-43.97
2499.14	38.42	Ave	68	1.6	V	-13.08	25.34	54.00	-28.66

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n40: Middle Channel 2437MHz									
223.45	35.39	QP	110	1.7	H	-11.62	23.77	46.00	-22.23
223.45	29.87	QP	271	1.8	V	-11.62	18.25	46.00	-27.75
4874.00	48.59	PK	112	1.9	V	-0.62	47.97	74.00	-26.03
4874.00	46.11	Ave	112	1.9	V	-0.62	45.49	54.00	-8.51
7311.00	41.10	PK	258	1.5	H	2.21	43.31	74.00	-30.69
7311.00	37.66	Ave	258	1.5	H	2.21	39.87	54.00	-14.13
2338.81	46.77	PK	93	1.5	V	-13.19	33.58	74.00	-40.42
2338.81	37.57	Ave	93	1.5	V	-13.19	24.38	54.00	-29.62
2378.91	44.24	PK	338	1.6	H	-13.14	31.10	74.00	-42.90
2378.91	37.82	Ave	338	1.6	H	-13.14	24.68	54.00	-29.32
2496.32	42.94	PK	305	1.5	V	-13.08	29.86	74.00	-44.14
2496.32	36.05	Ave	305	1.5	V	-13.08	22.97	54.00	-31.03

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n40: High Channel 2452MHz									
223.45	36.25	QP	163	1.3	H	-11.62	24.63	46.00	-21.37
223.45	30.68	QP	303	2.0	V	-11.62	19.06	46.00	-26.94
4904.00	49.10	PK	106	1.2	V	-0.24	48.86	74.00	-25.14
4904.00	45.33	Ave	106	1.2	V	-0.24	45.09	54.00	-8.91
7356.00	40.42	PK	45	1.9	H	2.84	43.26	74.00	-30.74
7356.00	37.64	Ave	45	1.9	H	2.84	40.48	54.00	-13.52
2345.52	46.66	PK	278	1.7	V	-13.19	33.47	74.00	-40.53
2345.52	38.71	Ave	278	1.7	V	-13.19	25.52	54.00	-28.48
2367.33	42.18	PK	288	1.3	H	-13.14	29.04	74.00	-44.96
2367.33	37.79	Ave	288	1.3	H	-13.14	24.65	54.00	-29.35
2488.87	43.35	PK	53	1.2	V	-13.08	30.27	74.00	-43.73
2488.87	36.69	Ave	53	1.2	V	-13.08	23.61	54.00	-30.39

Test Frequency: 8GHz~25GHz

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

BT BLE:**Test Frequency: 9KHz~26MHz**

Remark: only the worst data (GFSK modulation Low channel mode) were recorded.

Frequency	Measurement results dB μ V @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dB μ V/m @30m	Limits dB μ V/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
6.311	25.12	QP	21.84	40.00	6.96	29.54	-22.58
15.960	25.61	QP	21.35	40.00	6.96	29.54	-22.58
22.480	23.56	QP	20.67	40.00	4.23	29.54	-25.31

Test Frequency : 26MHz ~ 30MHz

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

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Low Channel 2402MHz									
269.33	36.50	QP	98	2.0	H	-13.35	23.15	46.00	-22.85
269.33	38.46	QP	241	1.5	V	-13.35	25.11	46.00	-20.89
4804.00	43.84	PK	218	1.4	V	-1.06	42.78	74.00	-31.22
4804.00	40.34	Ave	218	1.4	V	-1.06	39.28	54.00	-14.72
7206.00	43.85	PK	121	1.7	H	1.33	45.18	74.00	-28.82
7206.00	36.29	Ave	121	1.7	H	1.33	37.62	54.00	-16.38
2337.04	46.21	PK	268	1.1	V	-13.19	33.02	74.00	-40.98
2337.04	38.05	Ave	268	1.1	V	-13.19	24.86	54.00	-29.14
2366.43	43.60	PK	23	1.2	H	-13.14	30.46	74.00	-43.54
2366.43	36.65	Ave	23	1.2	H	-13.14	23.51	54.00	-30.49
2497.75	42.59	PK	258	1.7	V	-13.08	29.51	74.00	-44.49
2497.75	37.01	Ave	258	1.7	V	-13.08	23.93	54.00	-30.07

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Middle Channel 2440MHz									
269.33	36.63	QP	275	1.0	H	-13.35	23.28	46.00	-22.72
269.33	37.08	QP	214	1.1	V	-13.35	23.73	46.00	-22.27
4880.00	43.46	PK	12	1.1	V	-0.62	42.84	74.00	-31.16
4880.00	39.18	Ave	12	1.1	V	-0.62	38.56	54.00	-15.44
7320.00	43.52	PK	94	1.5	H	2.21	45.73	74.00	-28.27
7320.00	37.09	Ave	94	1.5	H	2.21	39.30	54.00	-14.70
2332.53	45.22	PK	238	1.8	V	-13.19	32.03	74.00	-41.97
2332.53	38.79	Ave	238	1.8	V	-13.19	25.60	54.00	-28.40
2382.39	43.29	PK	183	1.5	H	-13.14	30.15	74.00	-43.85
2382.39	39.00	Ave	183	1.5	H	-13.14	25.86	54.00	-28.14
2490.95	44.00	PK	131	1.3	V	-13.08	30.92	74.00	-43.08
2490.95	38.45	Ave	131	1.3	V	-13.08	25.37	54.00	-28.63

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK High Channel 2480MHz									
269.33	36.43	QP	270	1.9	H	-13.35	23.08	46.00	-22.92
269.33	38.46	QP	110	1.5	V	-13.35	25.11	46.00	-20.89
4960.00	43.98	PK	232	1.2	V	-0.24	43.74	74.00	-30.26
4960.00	38.45	Ave	232	1.2	V	-0.24	38.21	54.00	-15.79
7440.00	44.00	PK	303	1.9	H	2.84	46.84	74.00	-27.16
7440.00	36.29	Ave	303	1.9	H	2.84	39.13	54.00	-14.87
2313.32	46.32	PK	357	1.8	V	-13.19	33.13	74.00	-40.87
2313.32	38.06	Ave	357	1.8	V	-13.19	24.87	54.00	-29.13
2388.10	42.93	PK	345	1.3	H	-13.14	29.79	74.00	-44.21
2388.10	36.75	Ave	345	1.3	H	-13.14	23.61	54.00	-30.39
2498.75	43.30	PK	112	1.9	V	-13.08	30.22	74.00	-43.78
2498.75	38.71	Ave	112	1.9	V	-13.08	25.63	54.00	-28.37

Test Frequency: 18GHz~25GHz

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

9 Duty Cycle

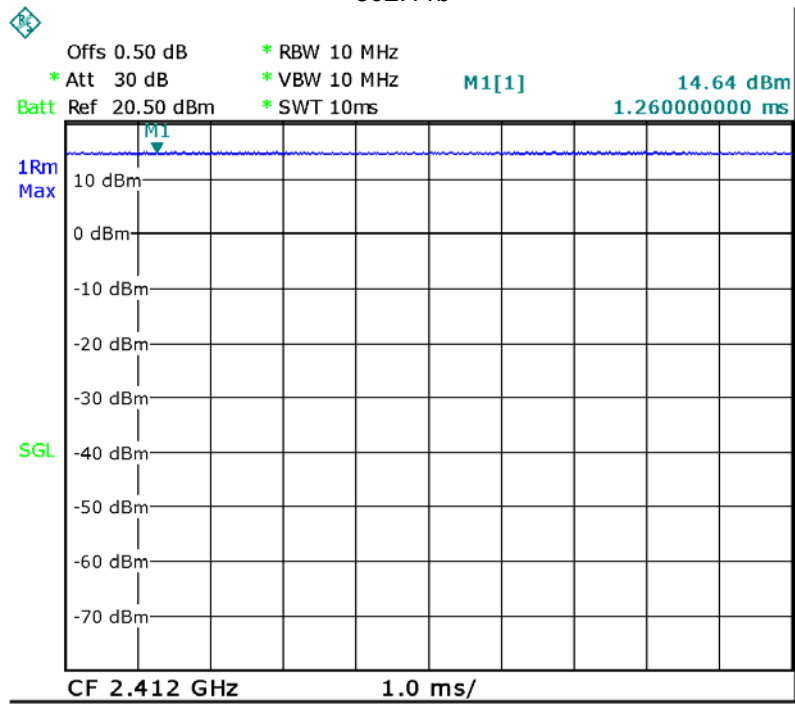
Modulation	On time(ms)	Period(ms)	Duty Cycle(%)	Duty Cycle Factor(dB)	Average Factor(dB)
802.11b	100	100	100	0	0
802.11g	100	100	100	0	0
802.11n20	100	100	100	0	0
802.11n40	100	100	100	0	0
BLE	0.6240	0.3800	164.21	-2.15	4.31

Remark:

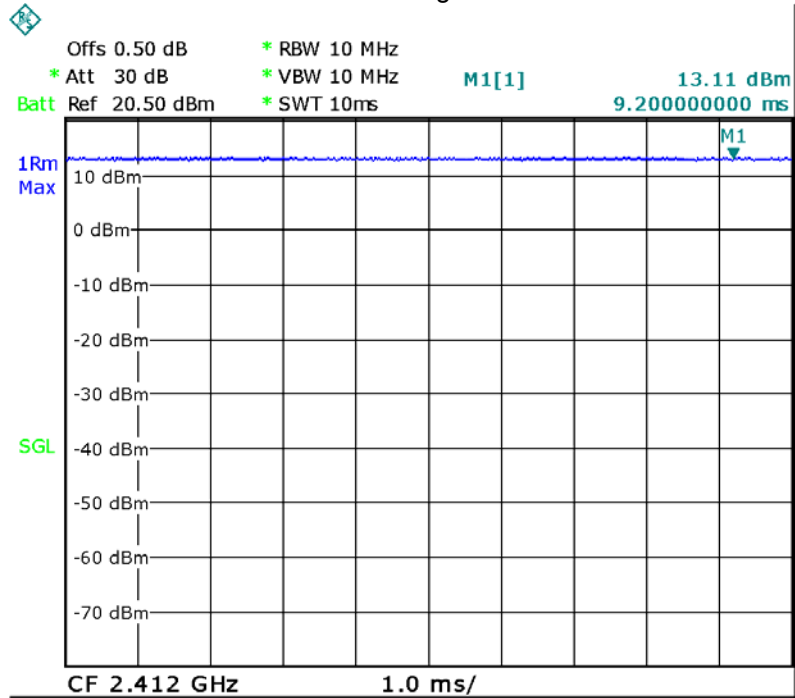
- 1) Duty Cycle=On Time/Period
- 2) Duty Cycle Factor= $10 \cdot \log(1/\text{Duty cycle})$
- 3) Average Factor= $20 \log_{10} \text{Duty Cycle}$

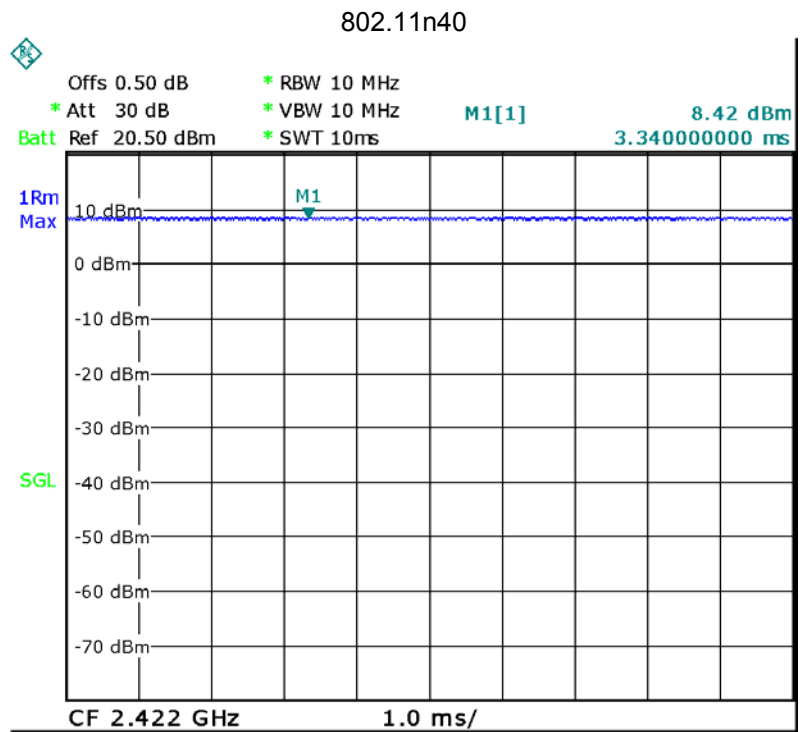
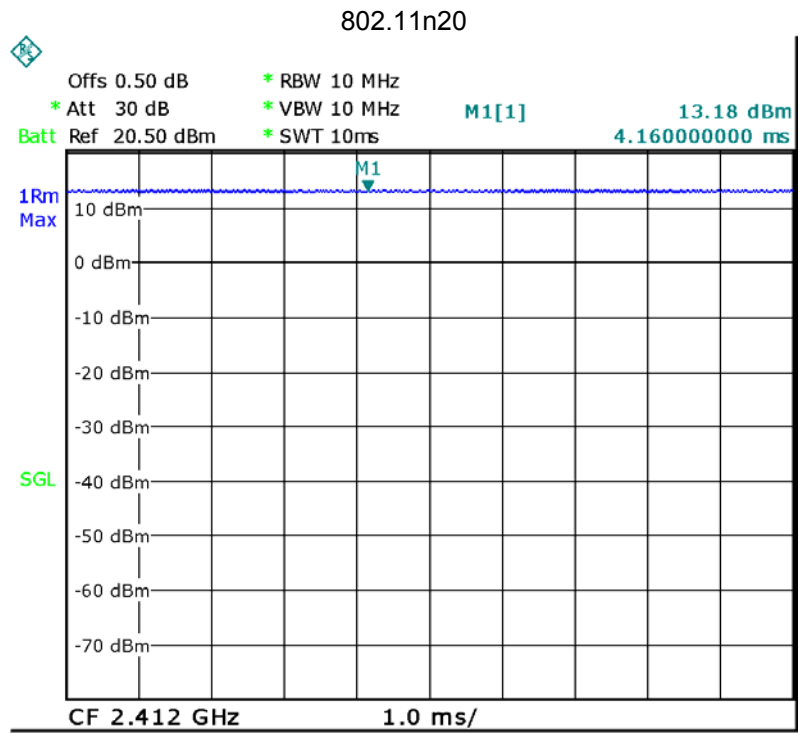
Test Plot

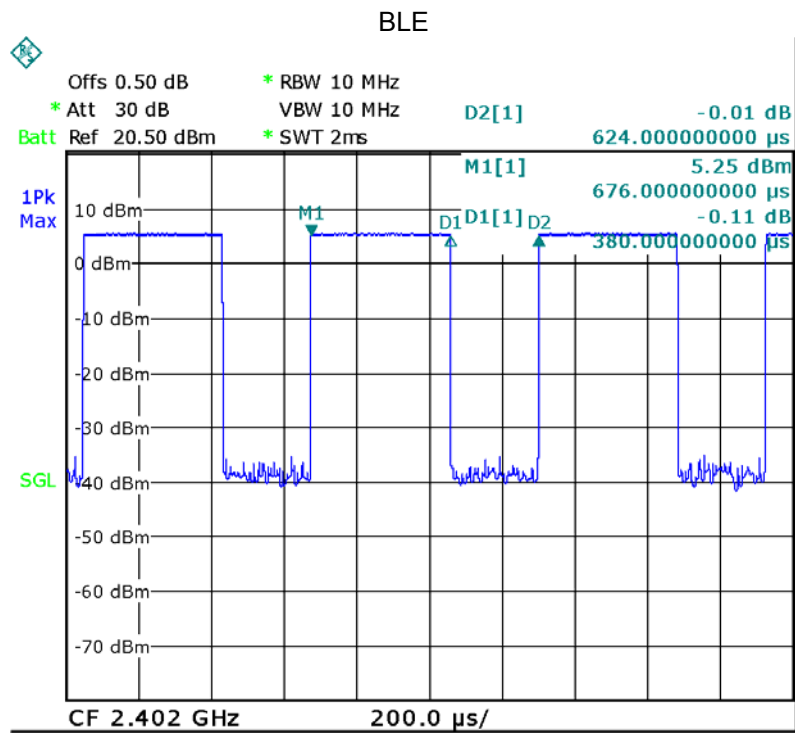
802.11b



802.11g







10 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

Test Result: PASS

Limit:

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

10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
 - a) Set instrument center frequency to DTS channel center frequency.
 - b) Set the span to ≈ 1.5 times the DTS bandwidth.
 - c) Set the RBW = 100 kHz.
 - d) Set the VBW $\approx [3 \times \text{RBW}]$.
 - e) Detector = peak.
 - f) Sweep time = auto couple.
 - g) Trace mode = max hold.
 - h) Allow trace to fully stabilize.
 - i) Use the peak marker function to determine the maximum PSD level.

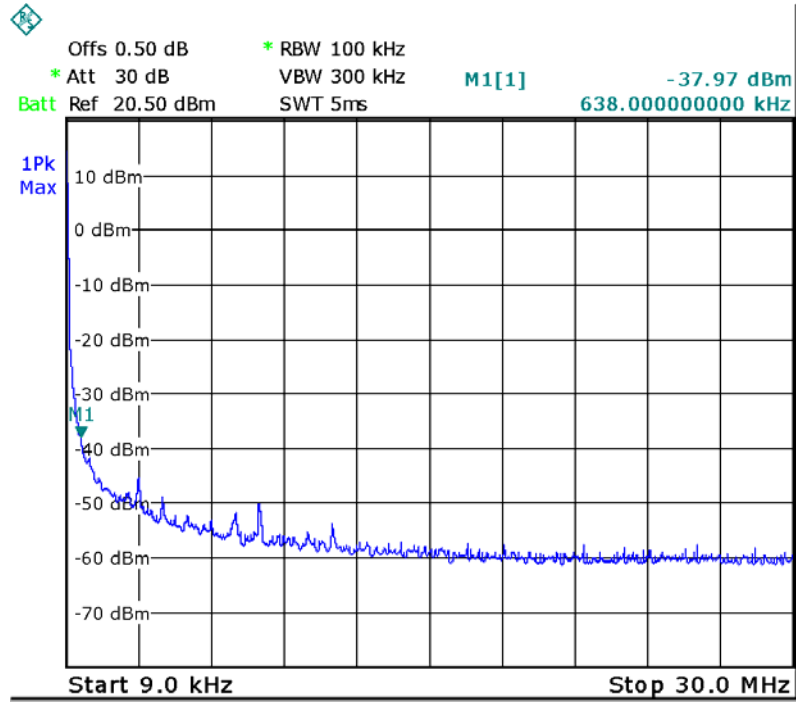
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

10.2 Test Result

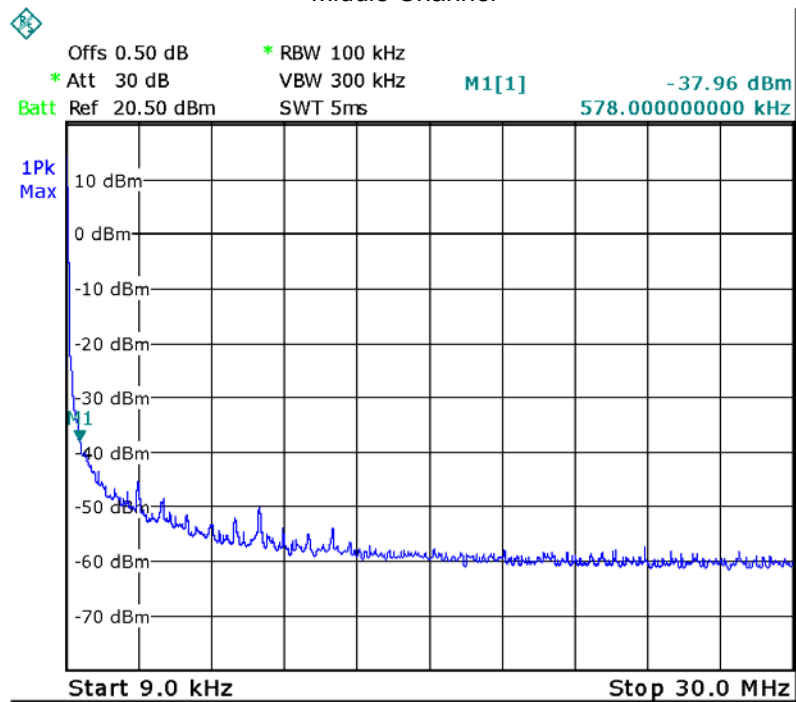
9KHz – 30MHz

802.11b

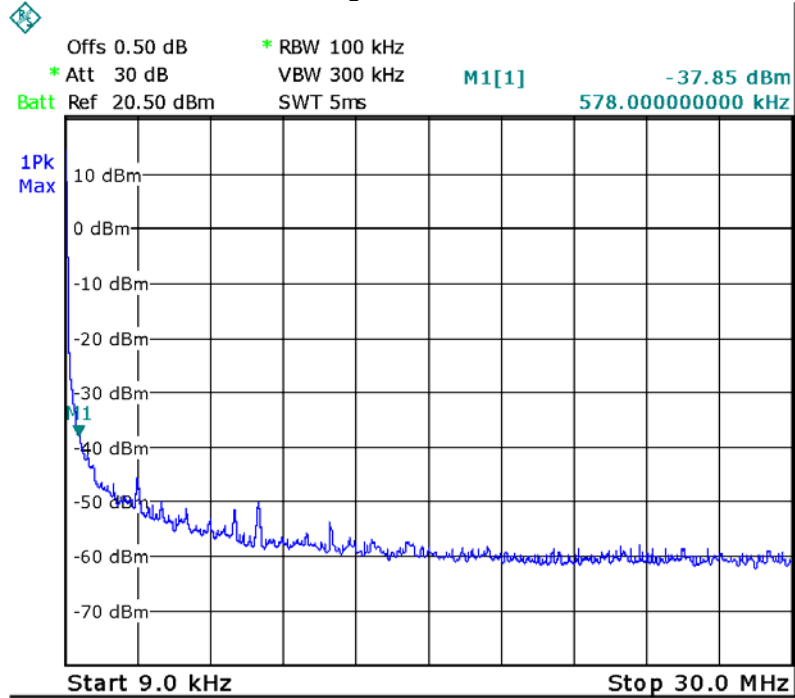
Low Channel



Middle Channel

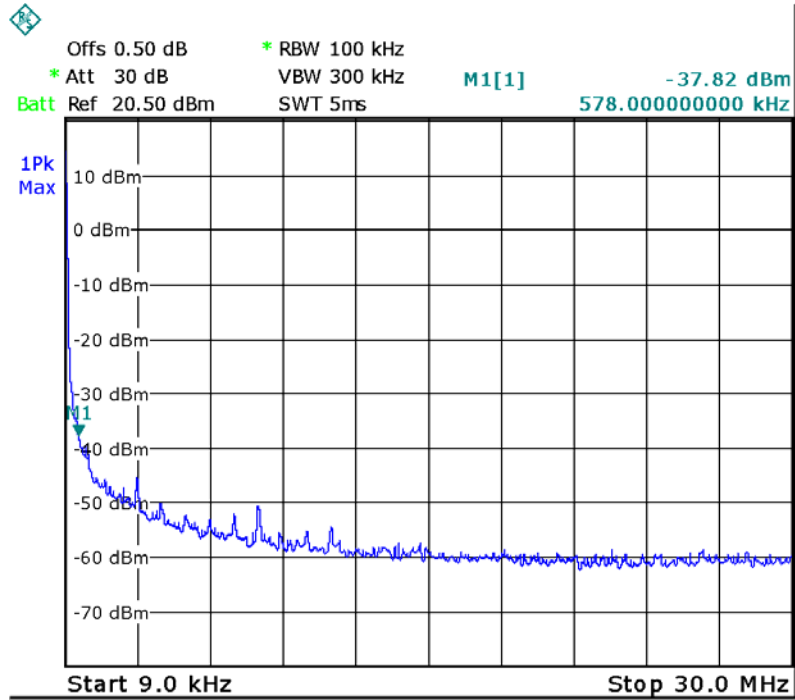


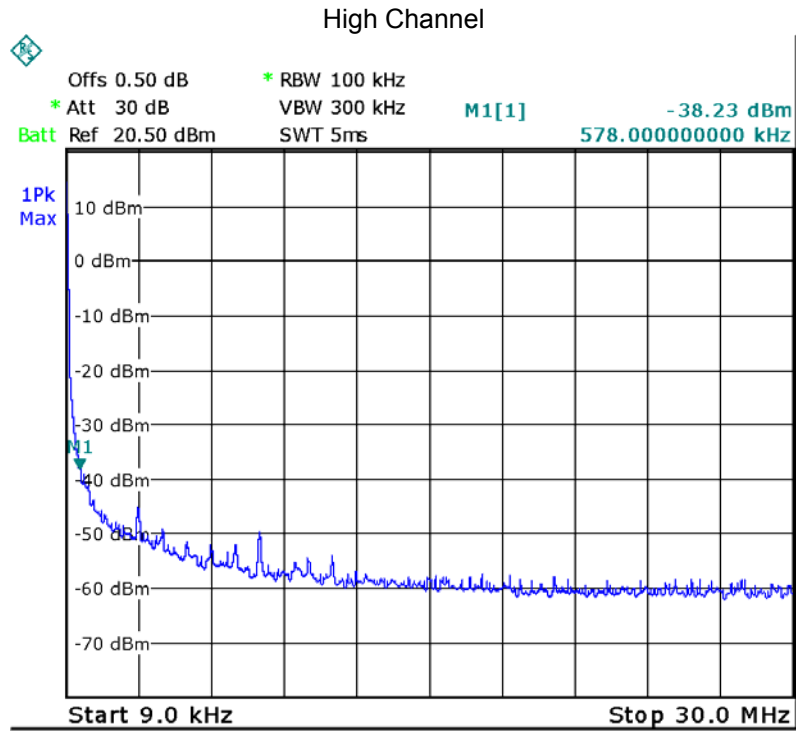
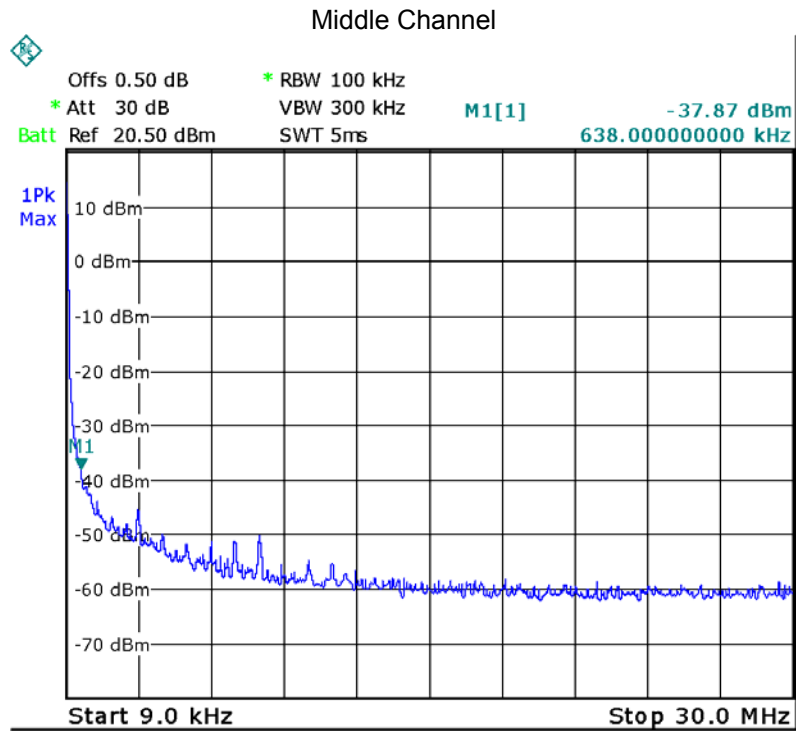
High Channel



802.11g

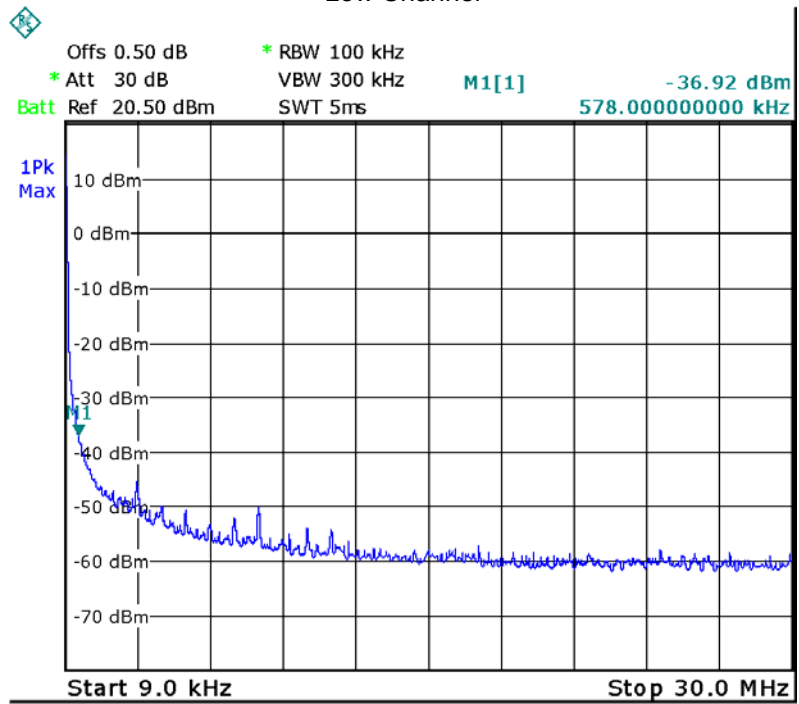
Low Channel



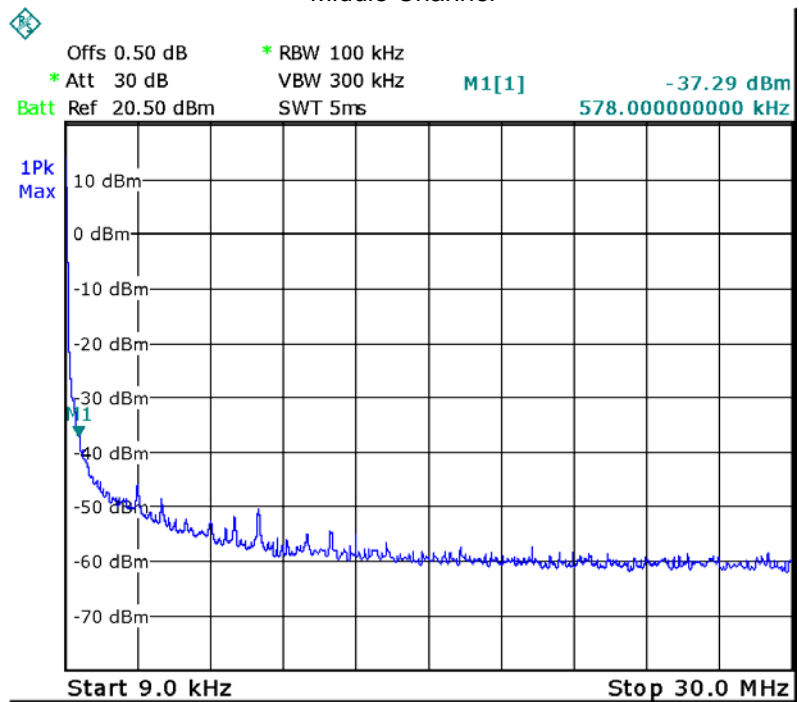


802.11n HT20

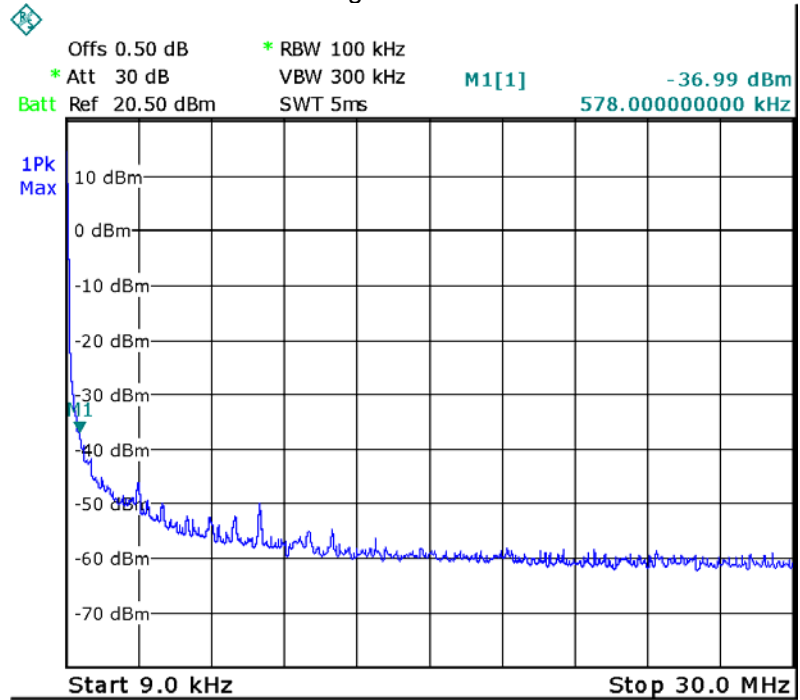
Low Channel



Middle Channel

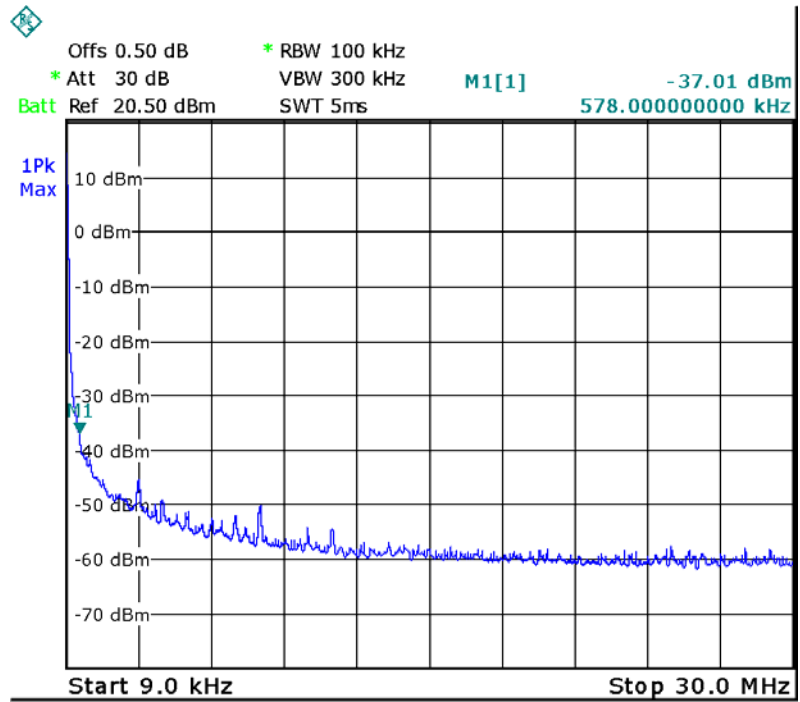


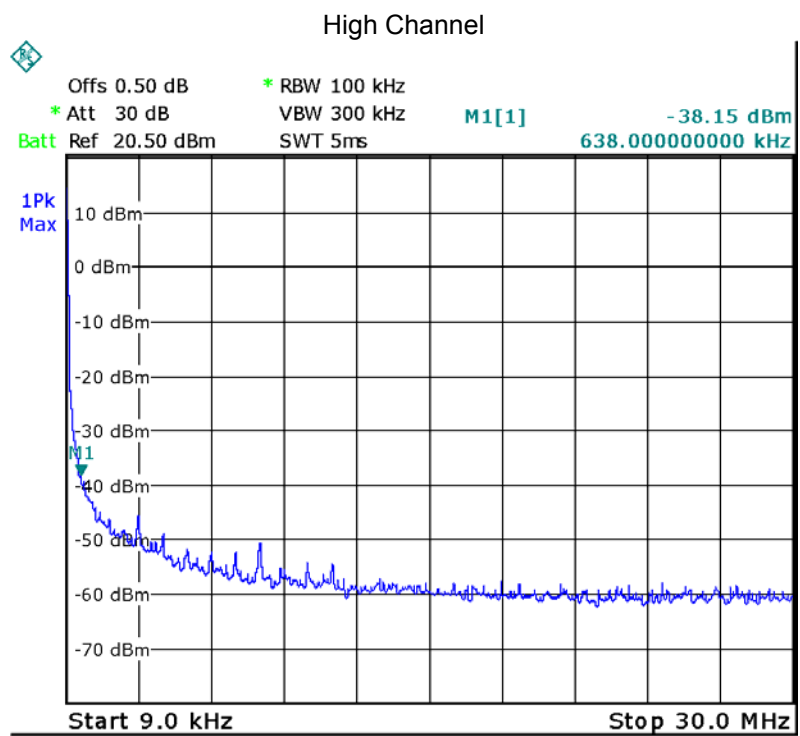
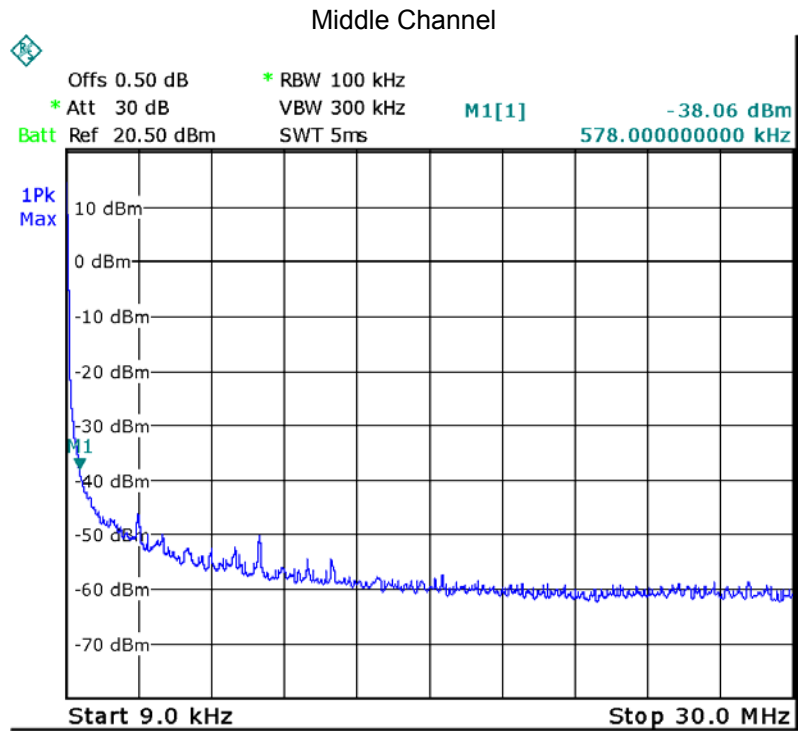
High Channel



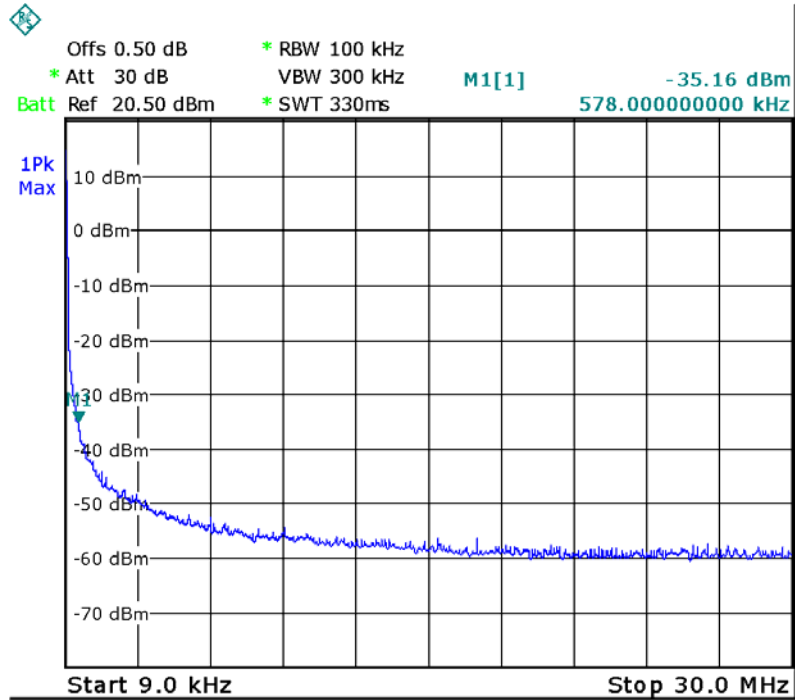
802.11n HT40

Low Channel

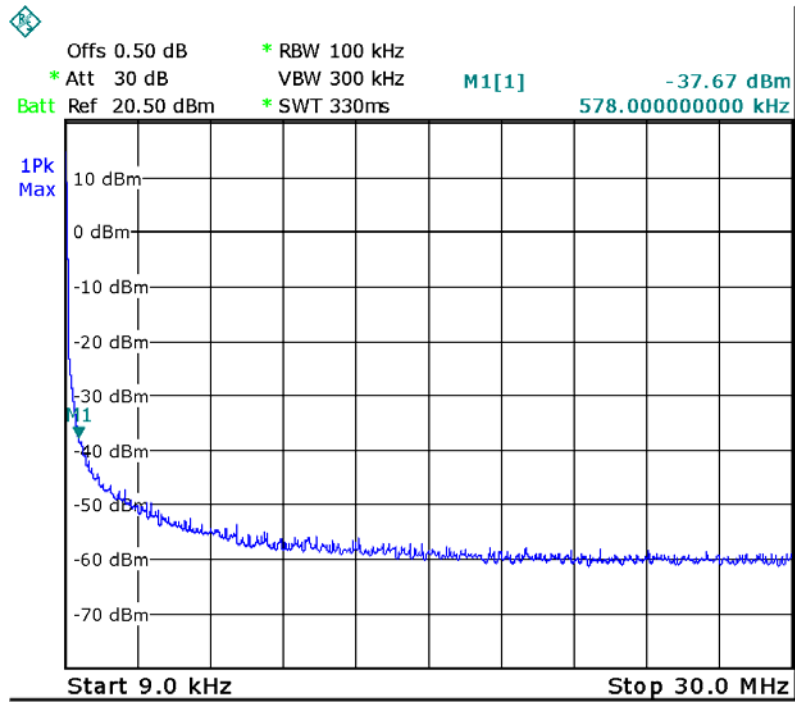




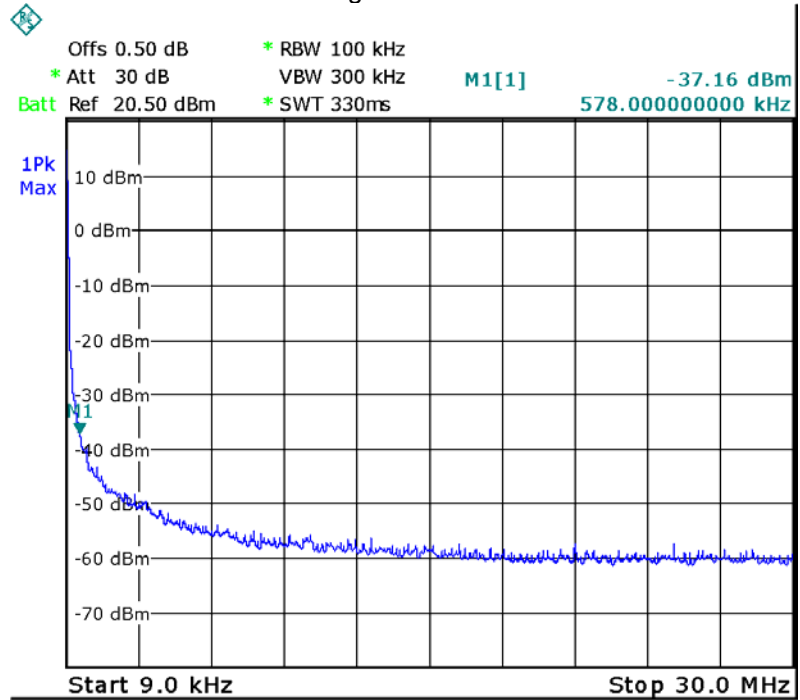
BLE Low Channel



Middle Channel



High Channel

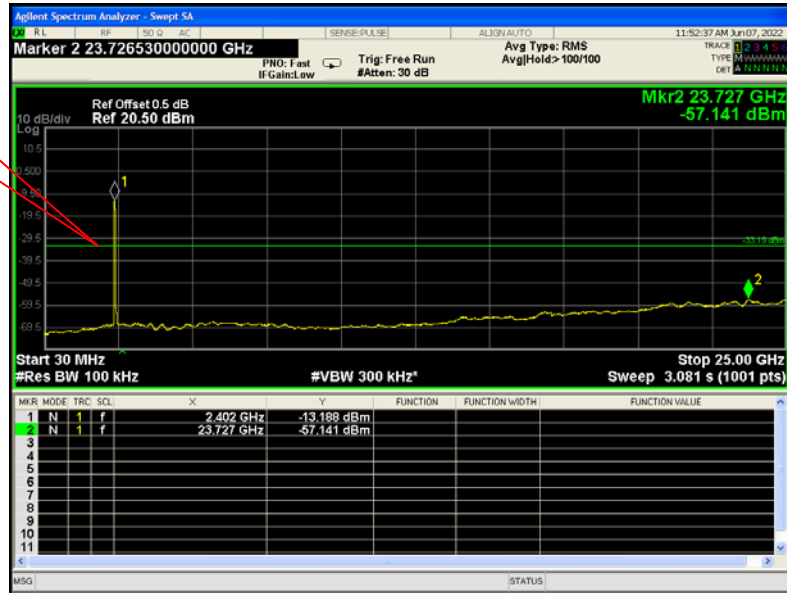


Above 30MHz

802.11b

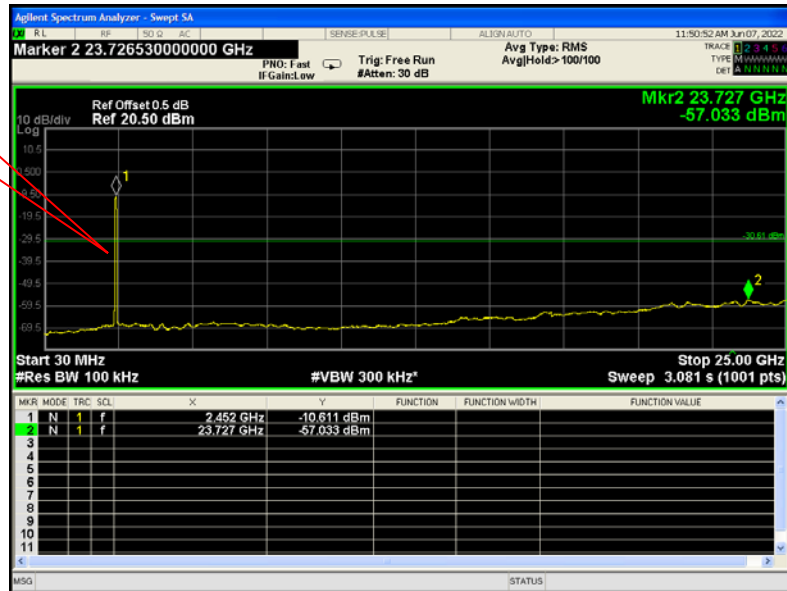
Low Channel

Fundamental



Middle Channel

Fundamental



High Channel

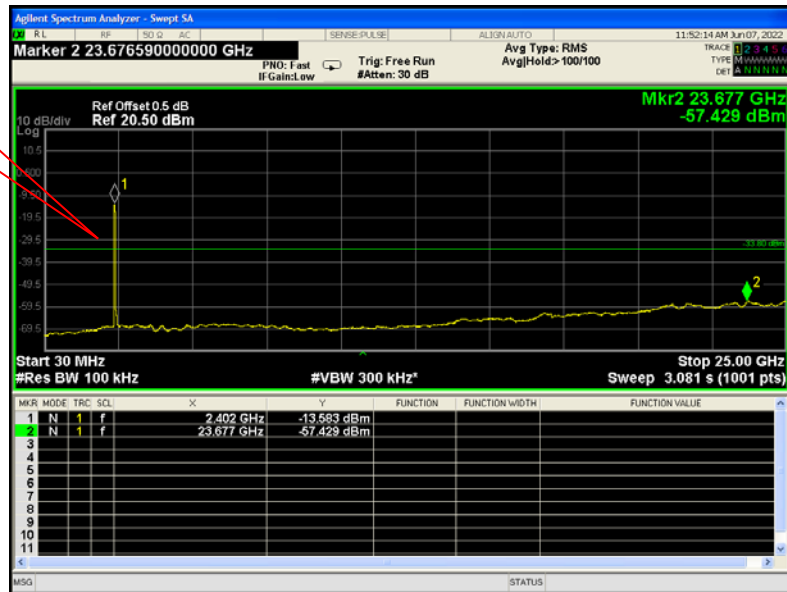
Fundamental



802.11g

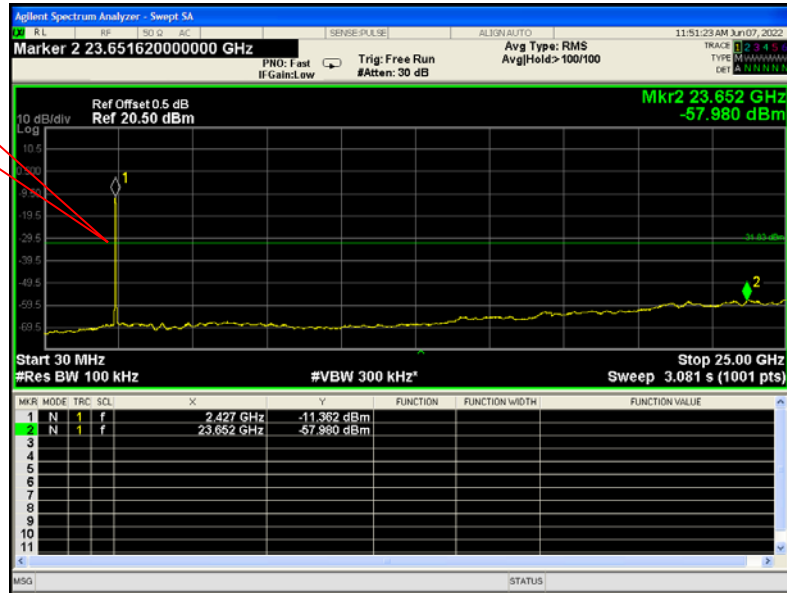
Low Channel

Fundamental



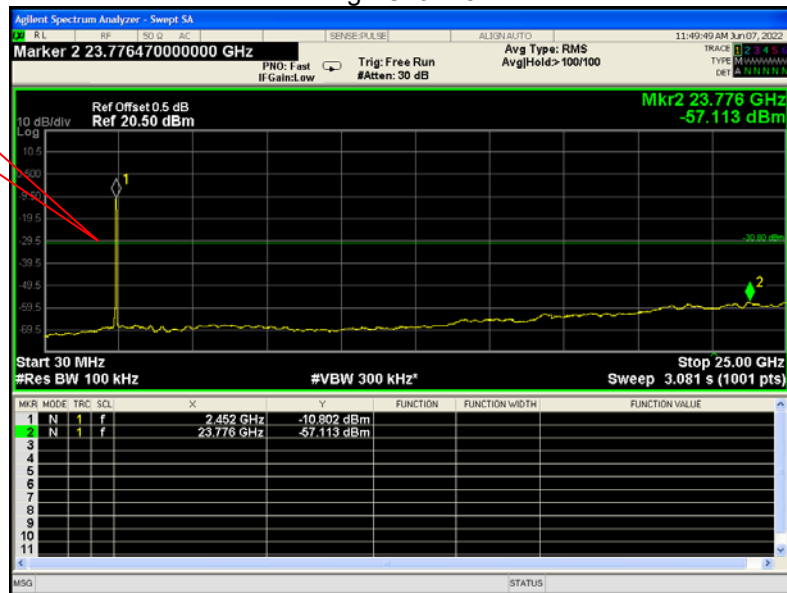
Middle Channel

Fundamental



High Channel

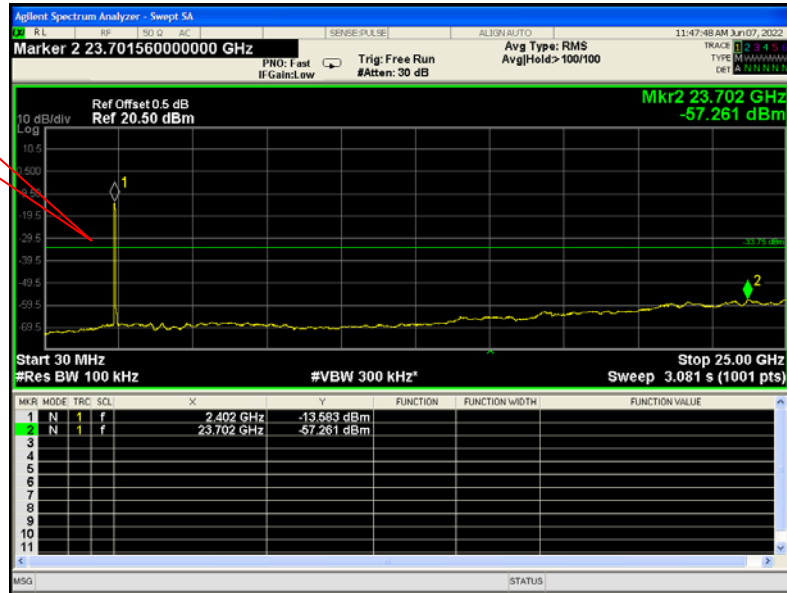
Fundamental



802.11n HT20

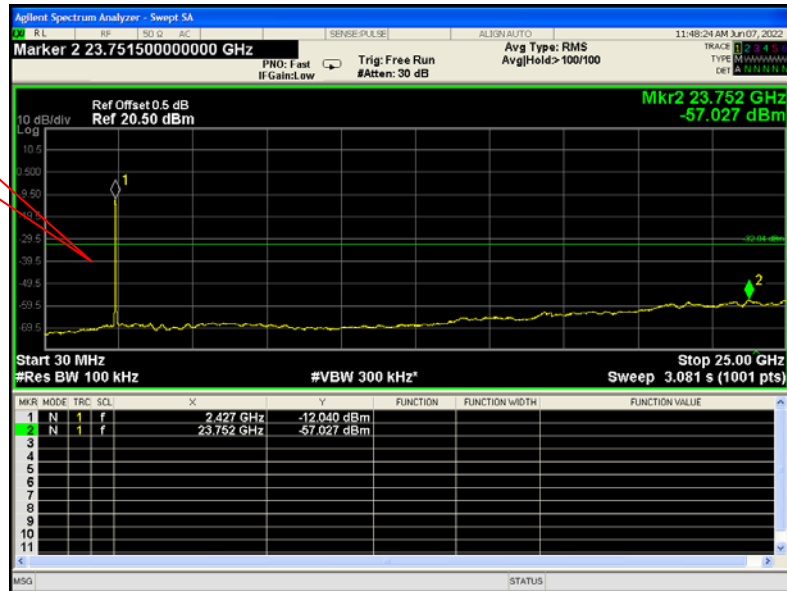
Low Channel

Fundamental



Middle Channel

Fundamental



High Channel

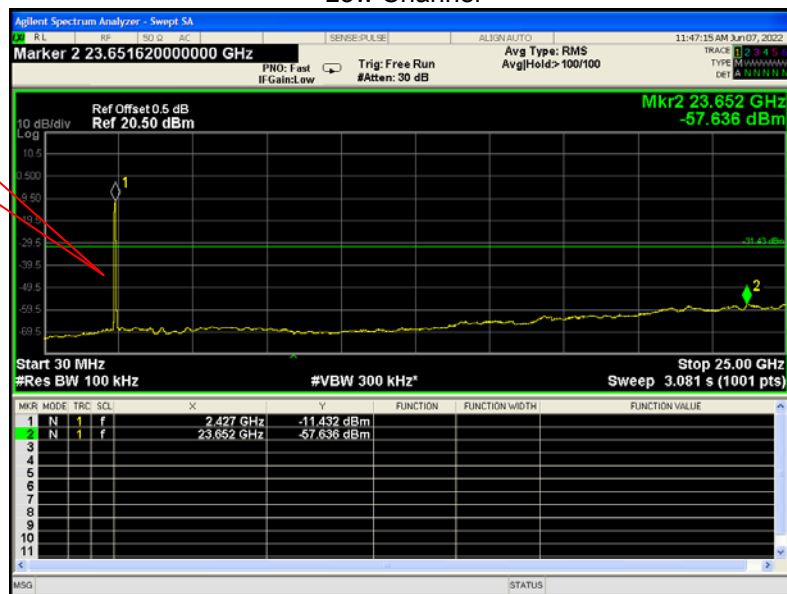
Fundamental



802.11n HT40

Low Channel

Fundamental



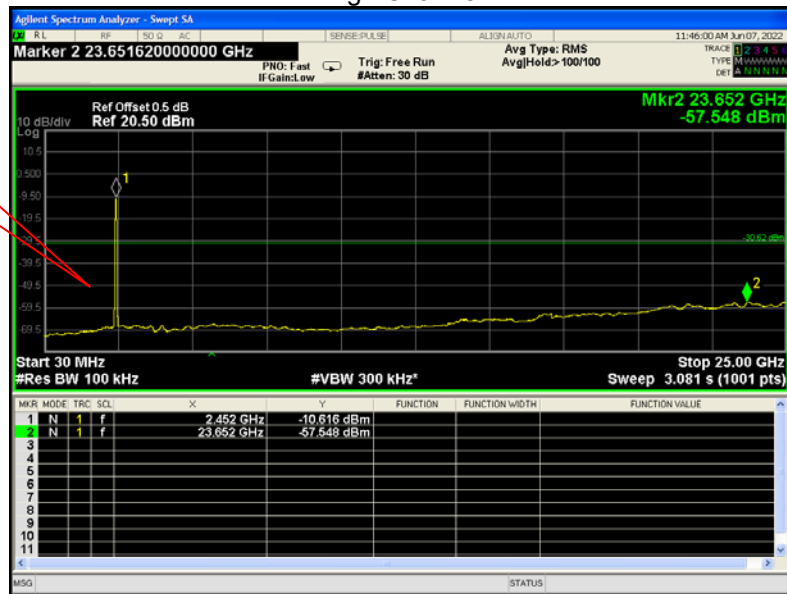
Middle Channel

Fundamental



High Channel

Fundamental



BLE

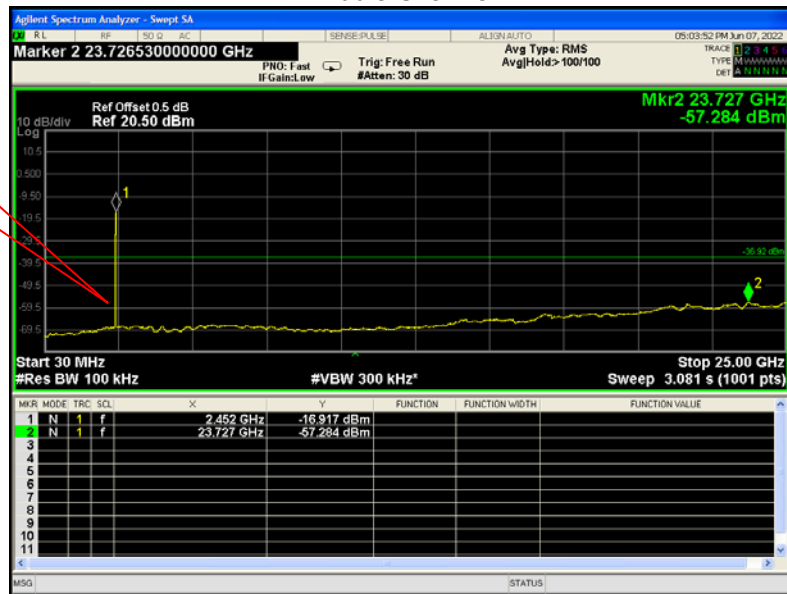
Low Channel

Fundamental



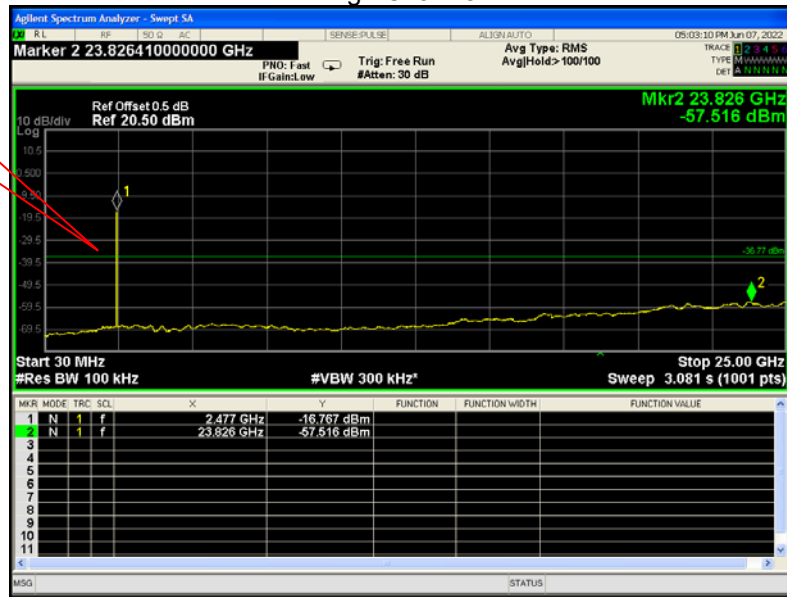
Middle Channel

Fundamental



High Channel

Fundamental



11 Band Edge Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

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

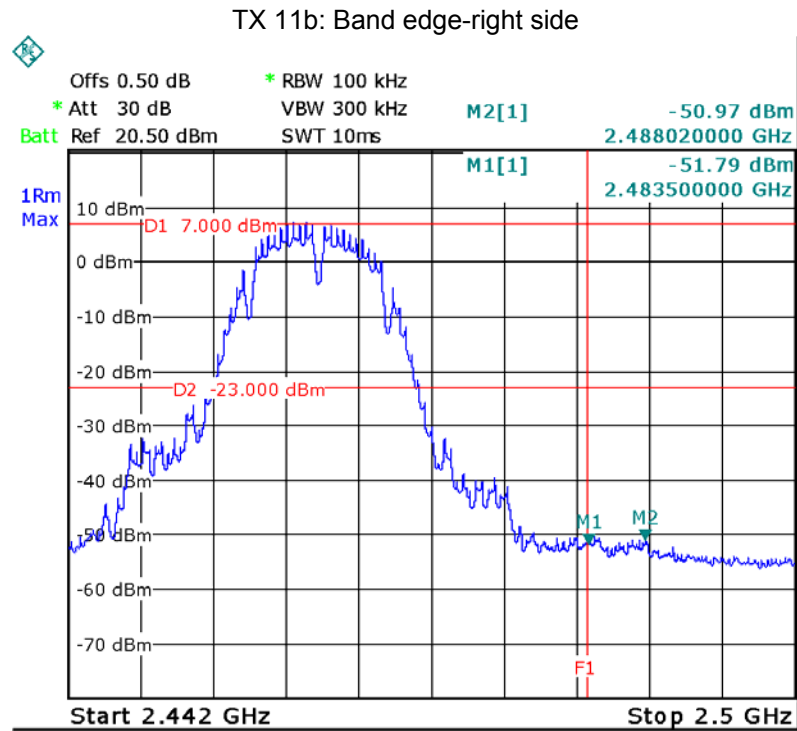
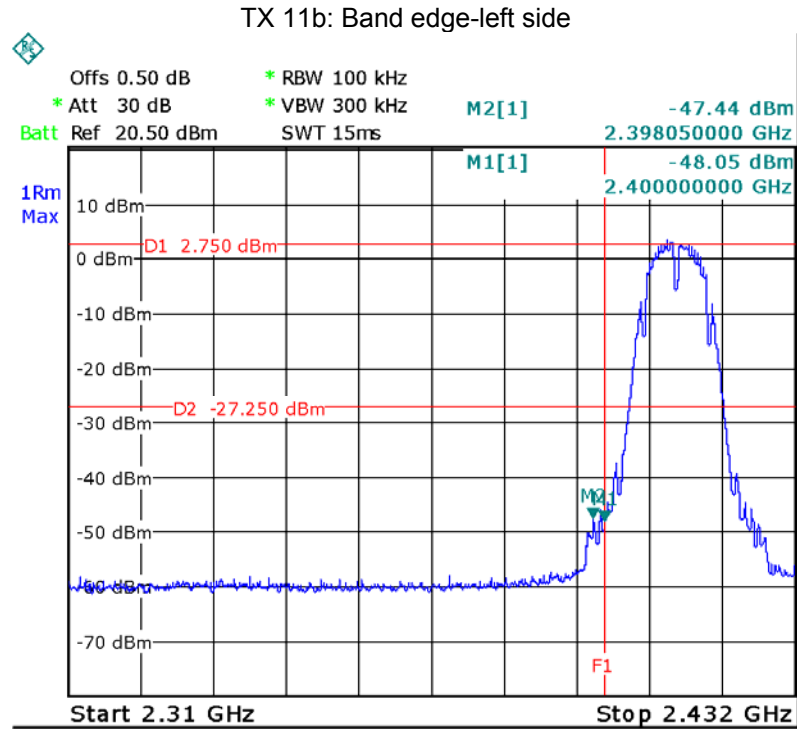
Test Mode: Transmitting

11.1 Test Procedure

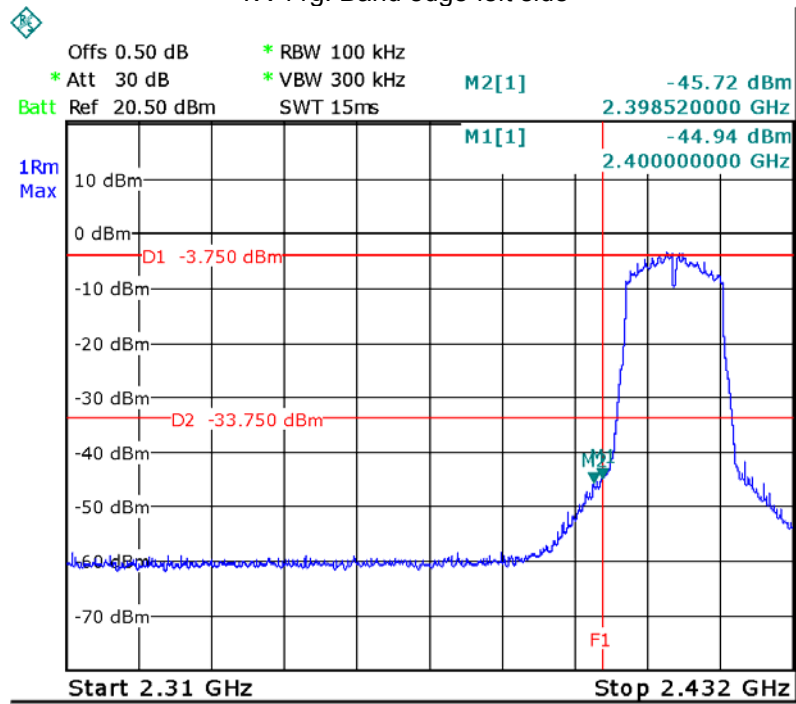
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

11.2 Test Result

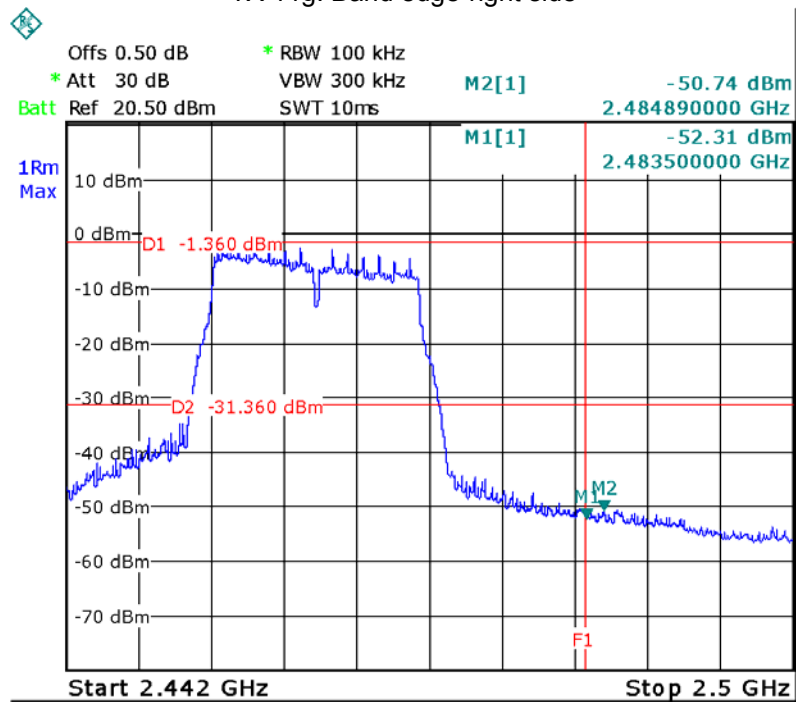
Test result plots shown as follows:



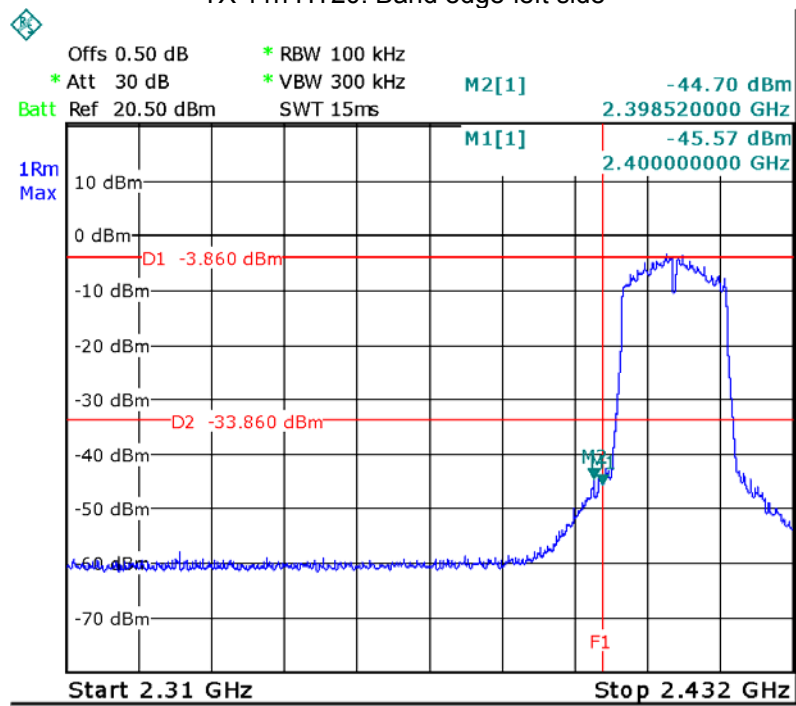
TX 11g: Band edge-left side



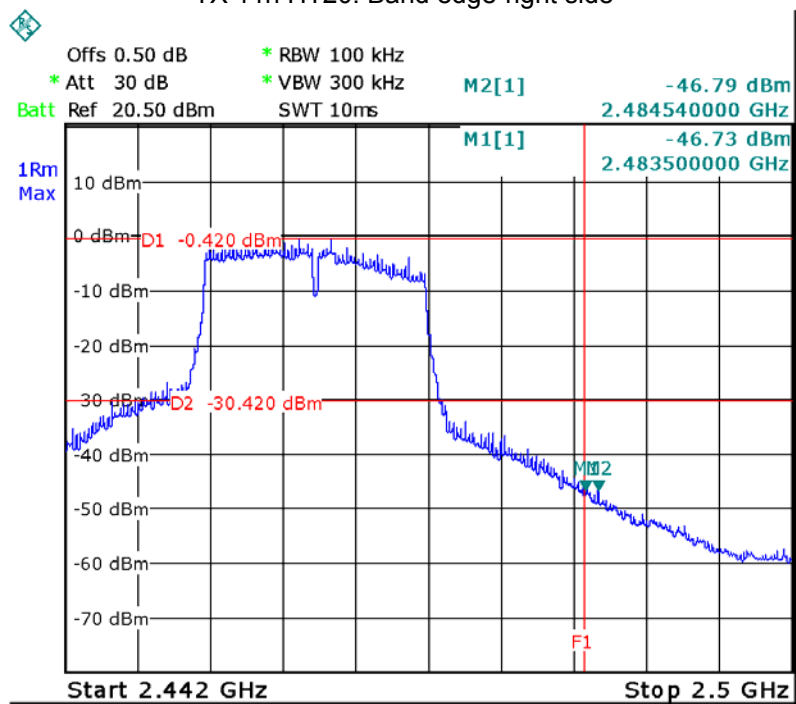
TX 11g: Band edge-right side



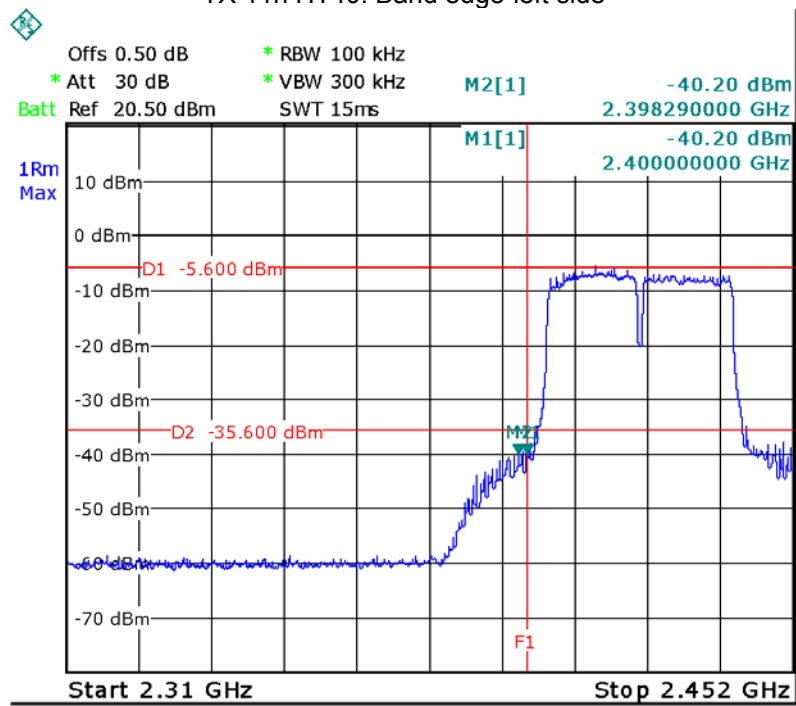
TX 11n HT20: Band edge-left side



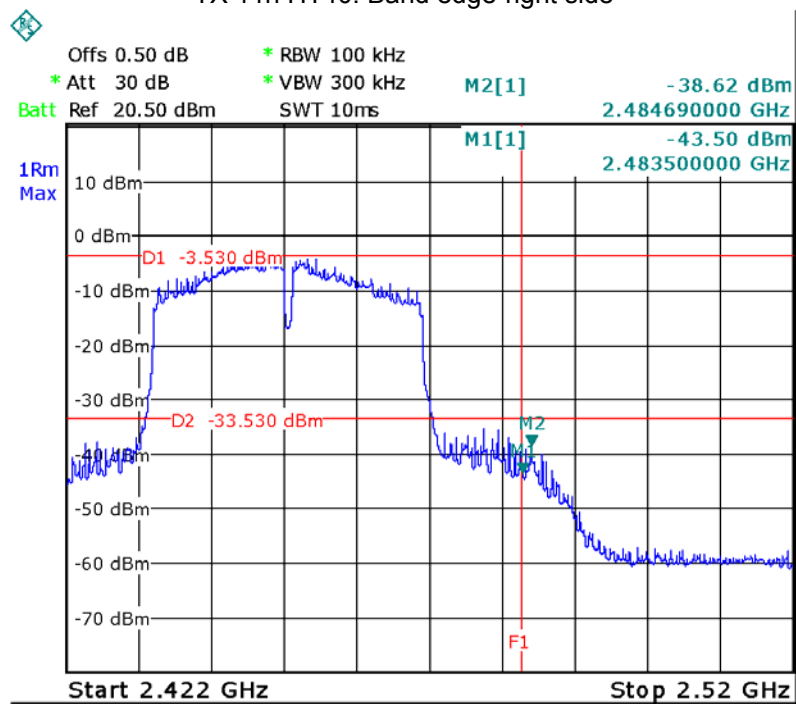
TX 11n HT20: Band edge-right side



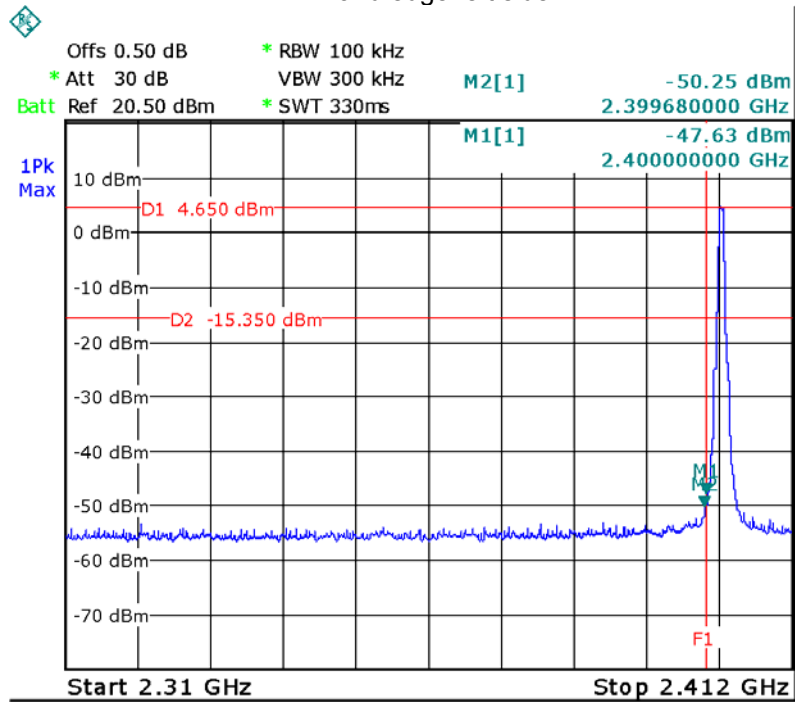
TX 11n HT40: Band edge-left side



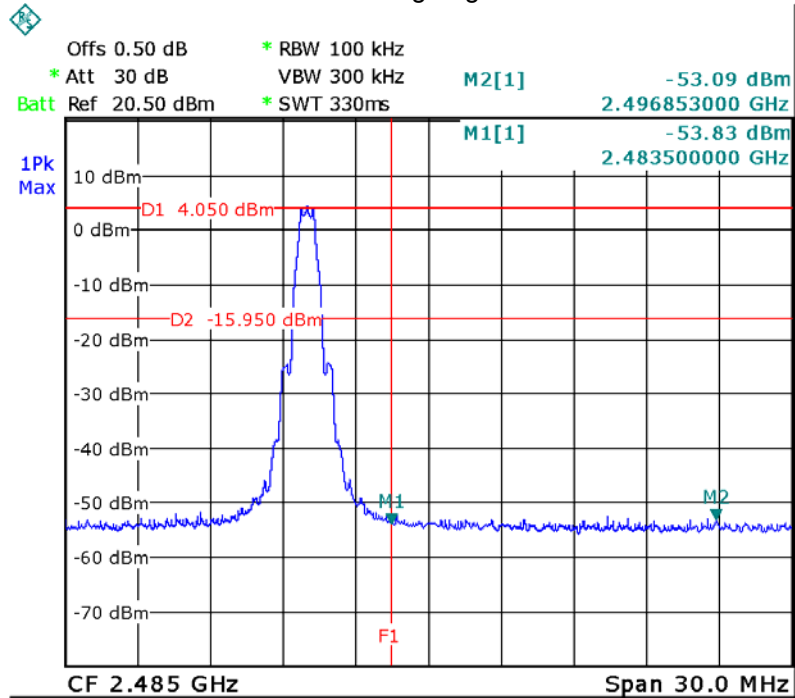
TX 11n HT40: Band edge-right side



BLE: Band edge-left side



BLE: Band edge-right side



12 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. 6dB Bandwidth Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz
99% Bandwidth Set the spectrum analyzer : RBW = 1~5% DTS OBW, VBW = 3 RBW

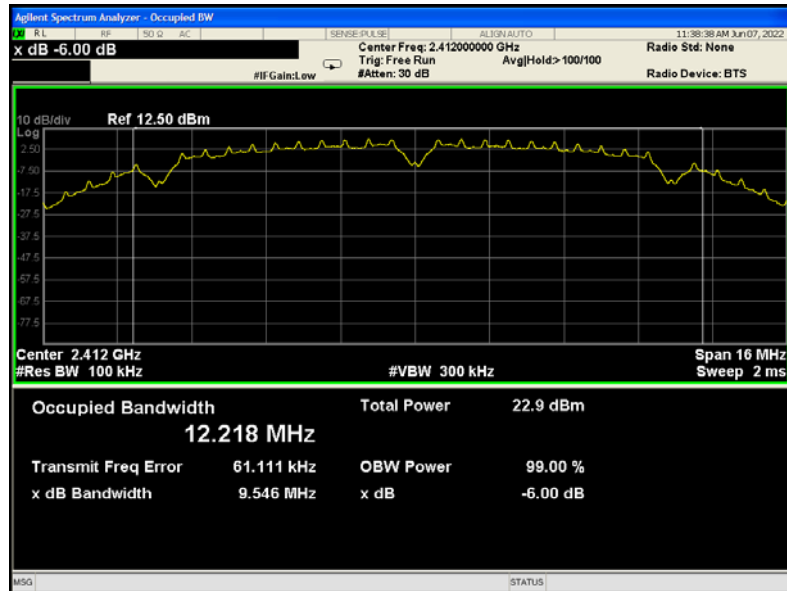
12.2 Test Result:

13	Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	9.546	12.224	
	Channel 6	9.526	12.384	
	Channel 11	9.510	12.384	
TX 11g	Channel 1	15.110	16.800	
	Channel 6	15.730	16.950	
	Channel 11	15.700	16.850	
TX 11n HT20	Channel 1	15.110	17.550	
	Channel 6	16.300	17.820	
	Channel 11	16.280	17.766	
TX 11n HT40	Channel 3	35.170	36.410	
	Channel 6	35.420	36.630	
	Channel 9	35.060	36.190	
BLE	Channel 0	0.670	1.048	
	Channel 19	0.665	1.045	
	Channel 39	0.684	1.043	

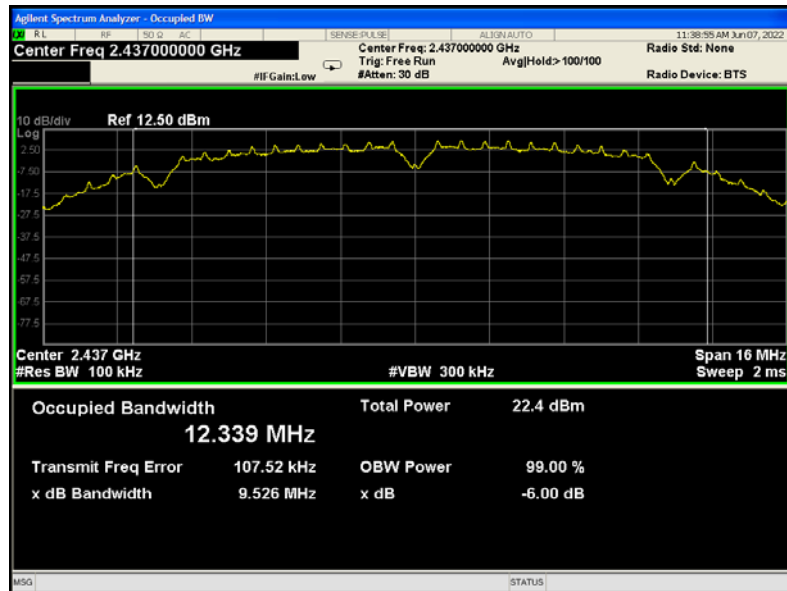
Test result plot:

6dB Bandwidth

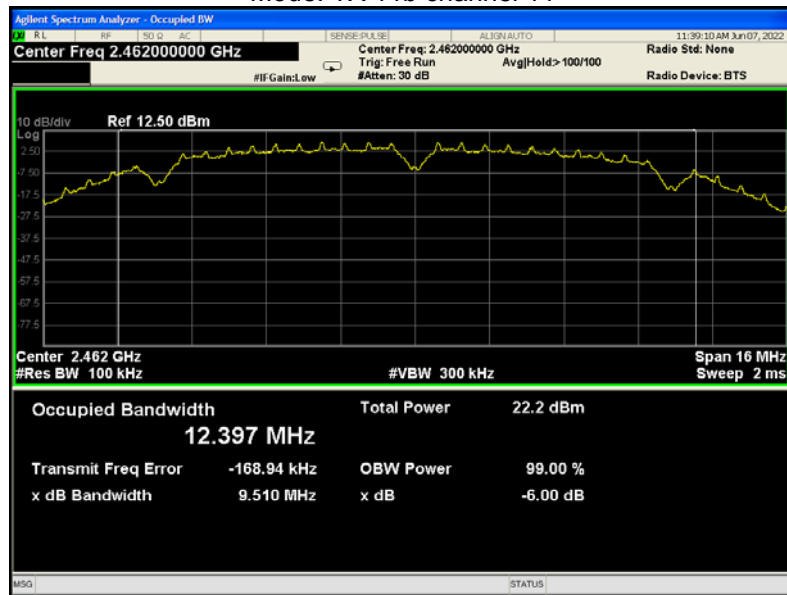
Mode: TX 11b channel 1



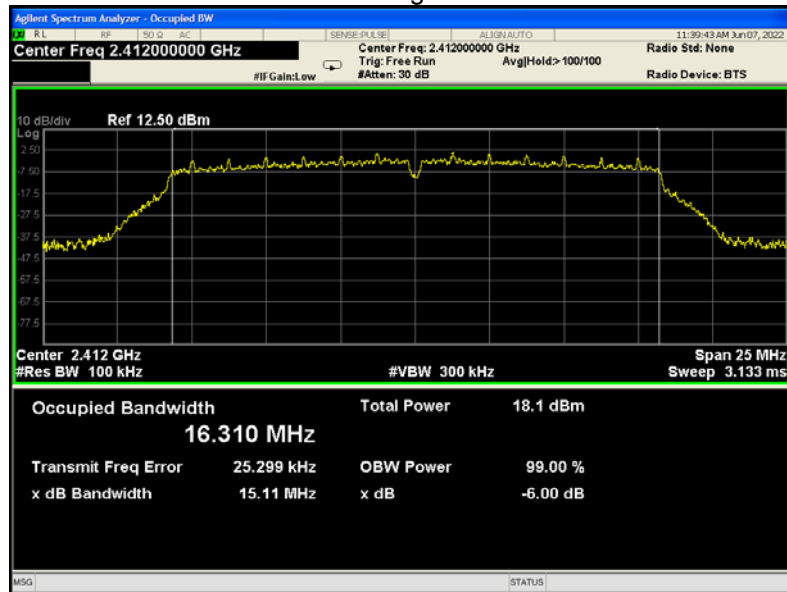
Mode: TX 11b channel 6



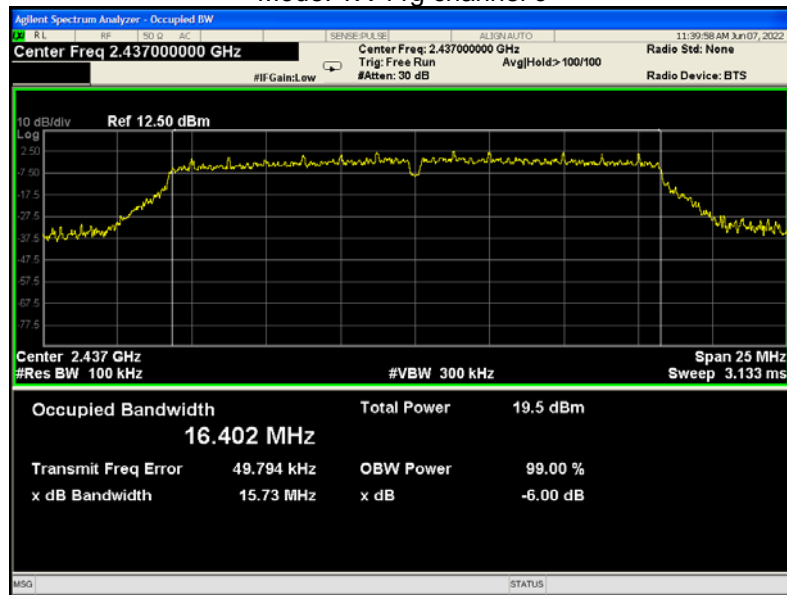
Mode: TX 11b channel 11



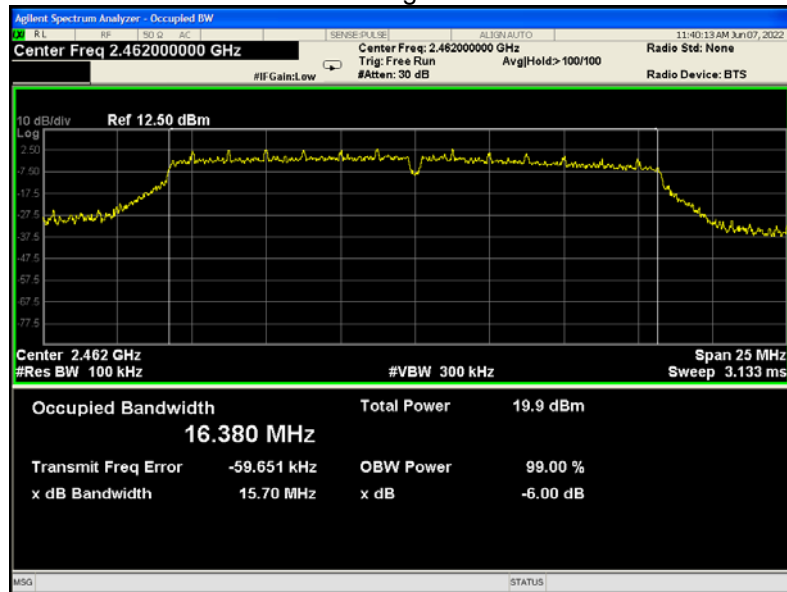
Mode: TX 11g channel 1



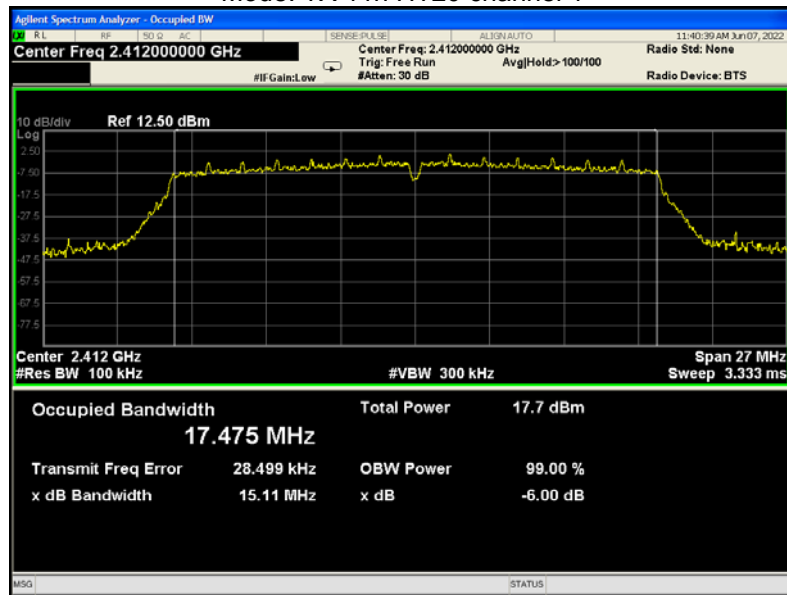
Mode: TX 11g channel 6



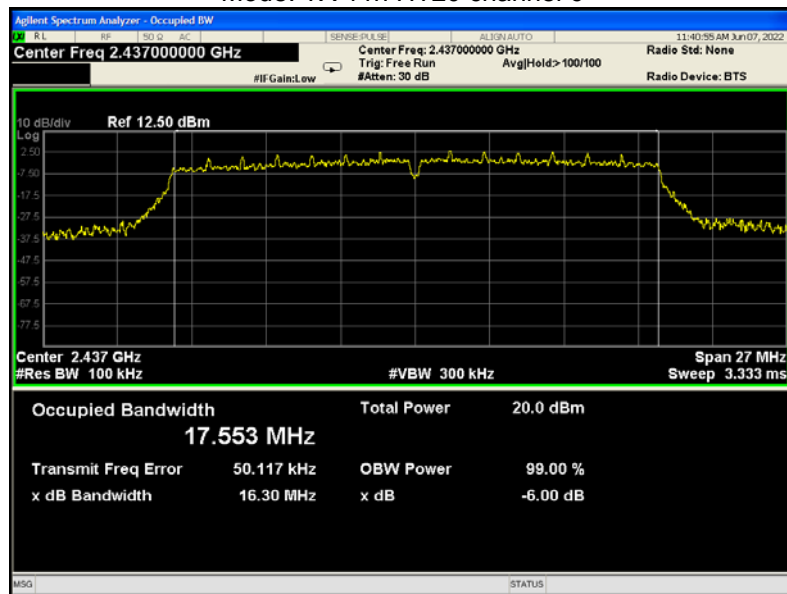
Mode: TX 11g channel 11



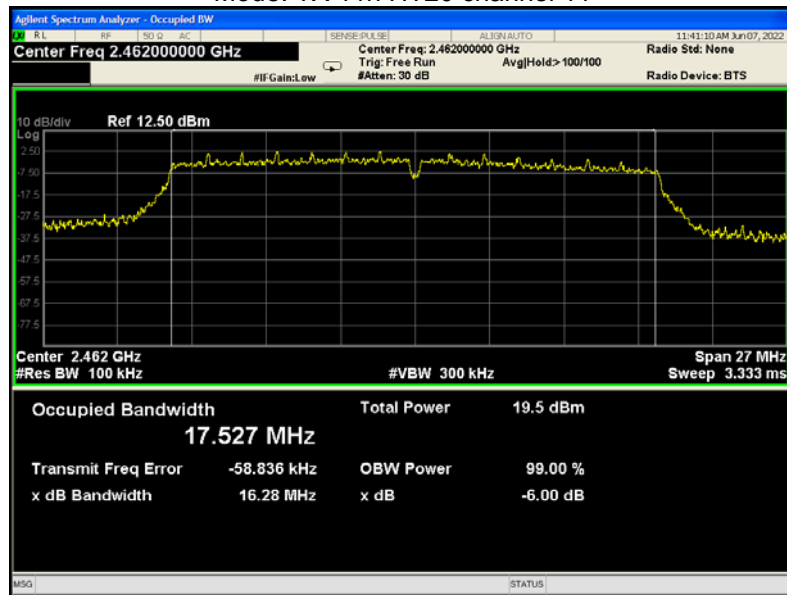
Mode: TX 11n HT20 channel 1



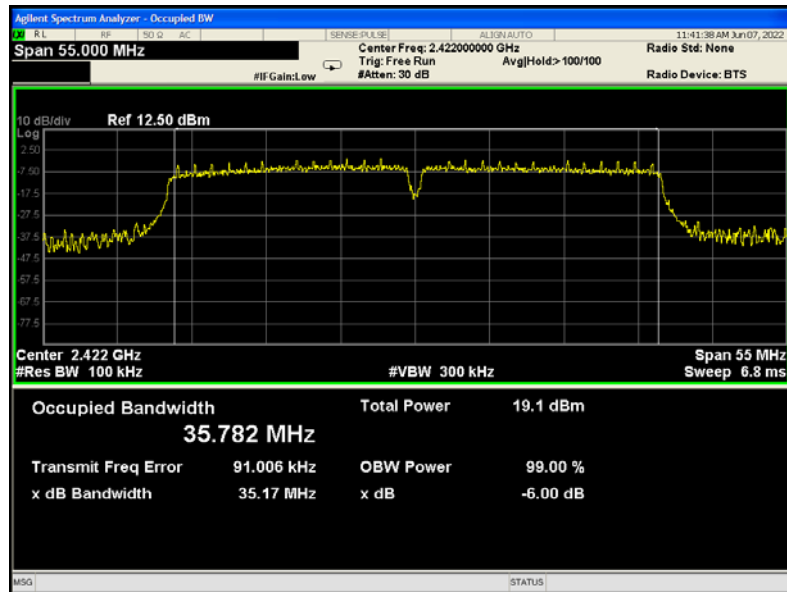
Mode: TX 11n HT20 channel 6



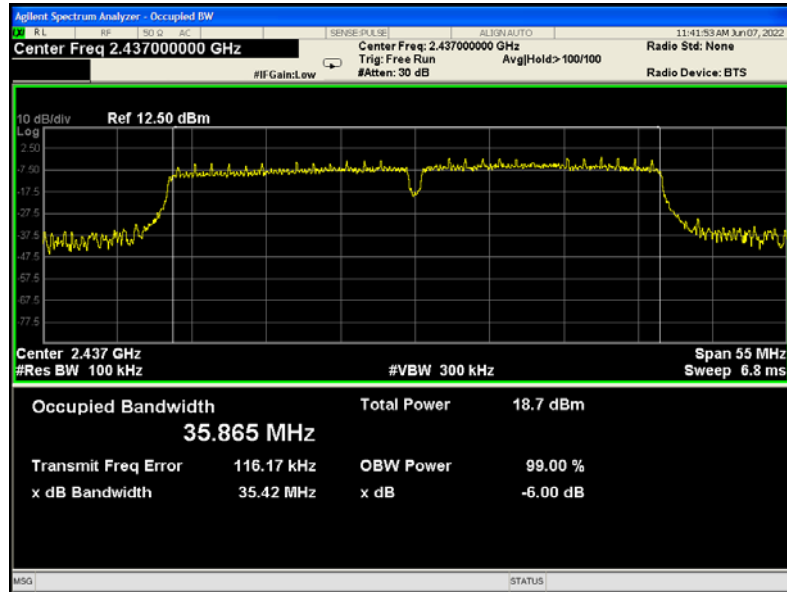
Mode: TX 11n HT20 channel 11



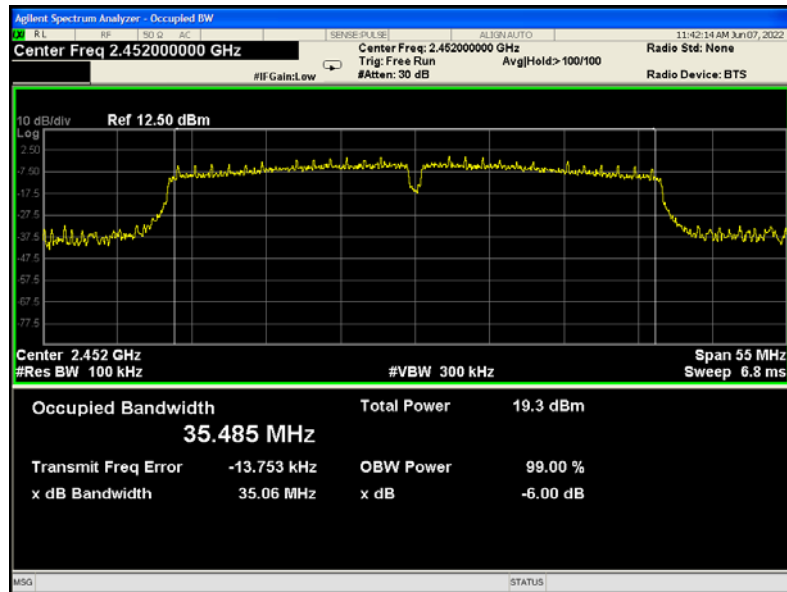
Mode: TX 11n HT40 channel 3



Mode: TX 11n HT40 channel 6

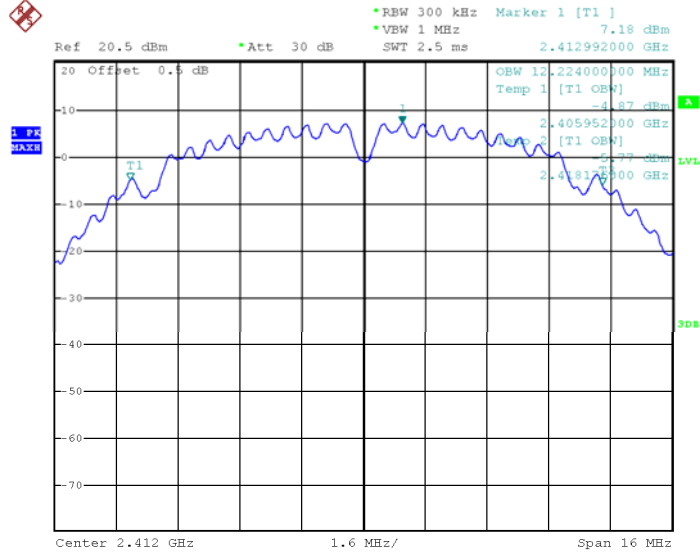


Mode: TX 11n HT40 channel 9



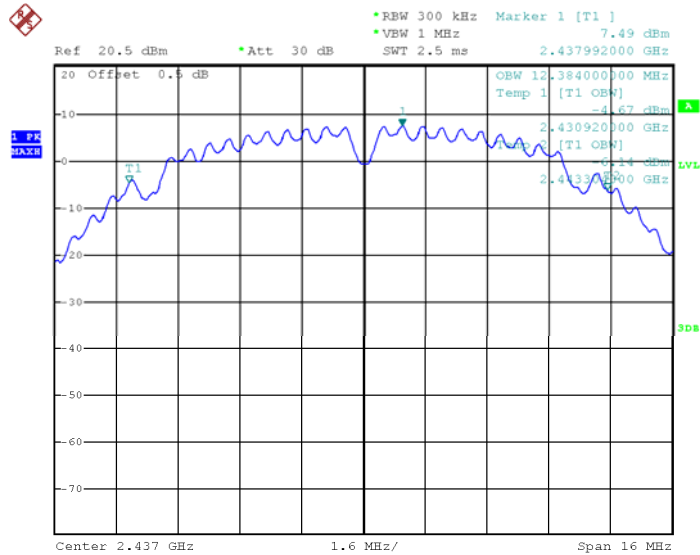
99% Bandwidth

Mode: TX 11b channel 1



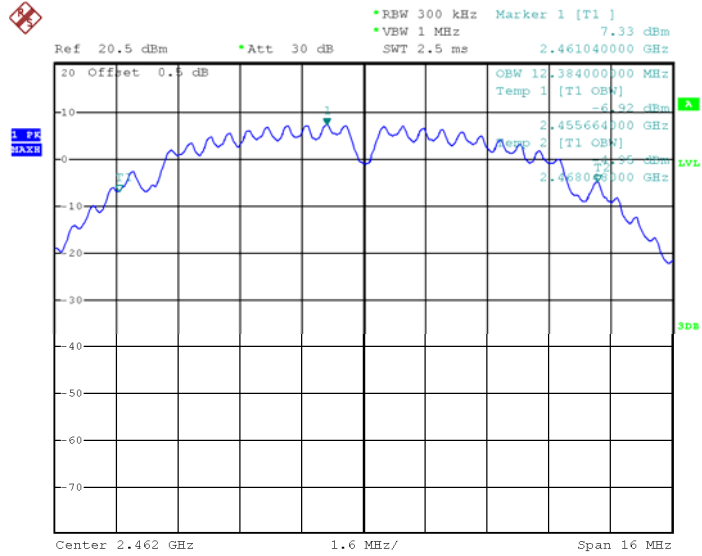
Date: 1.JUN.2022 16:54:59

Mode: TX 11b channel 6



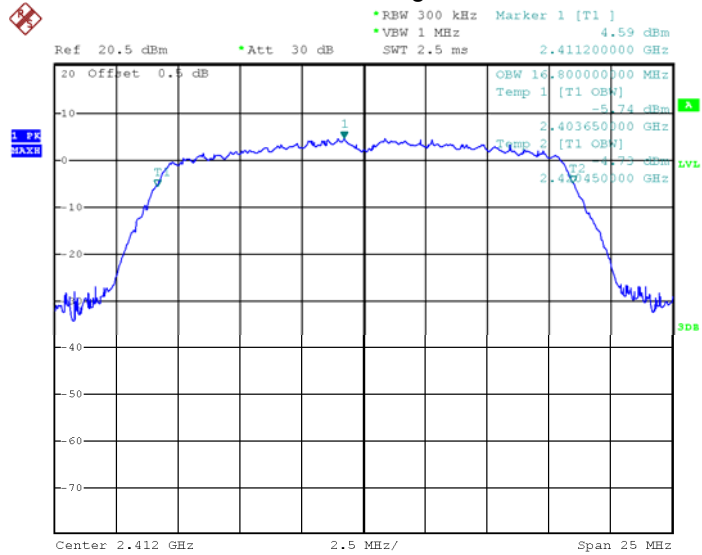
Date: 1.JUN.2022 16:56:47

Mode: TX 11b channel 11



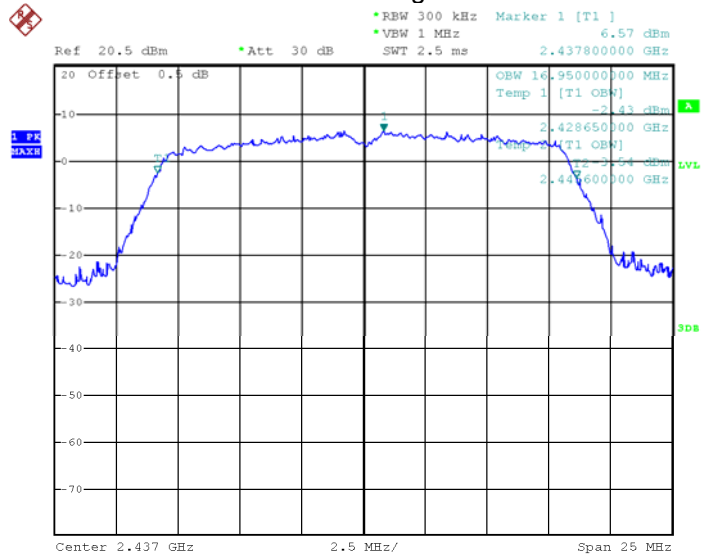
Date: 1.JUN.2022 16:57:15

Mode: TX 11g channel 1



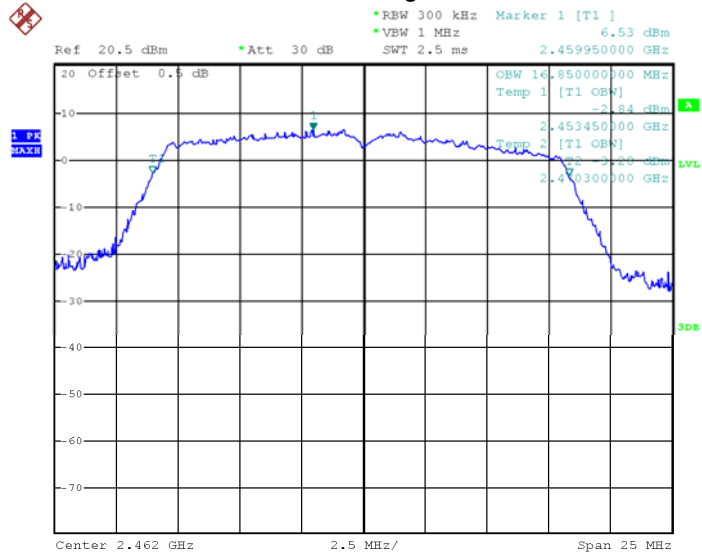
Date: 1.JUN.2022 16:53:14

Mode: TX 11g channel 6



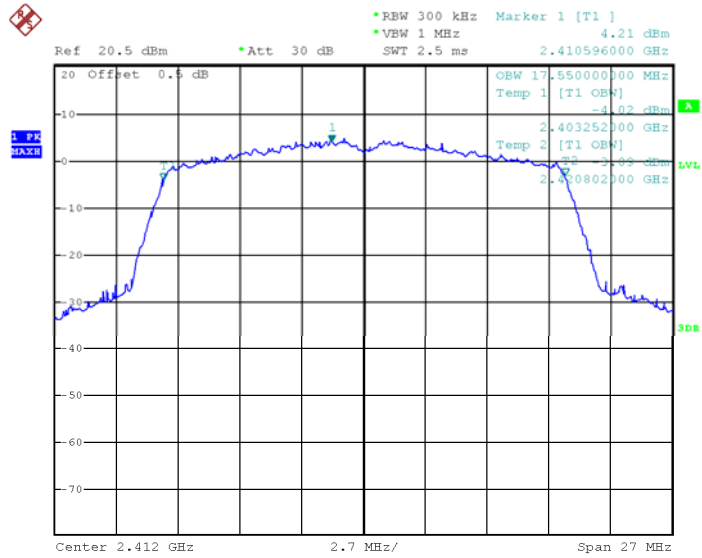
Date: 1.JUN.2022 16:53:47

Mode: TX 11g channel 11



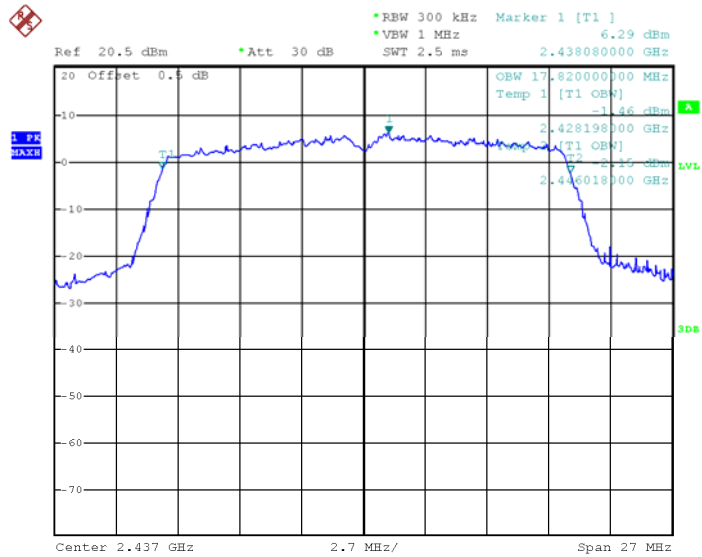
Date: 1.JUN.2022 16:54:23

Mode: TX 11n HT20 channel 1



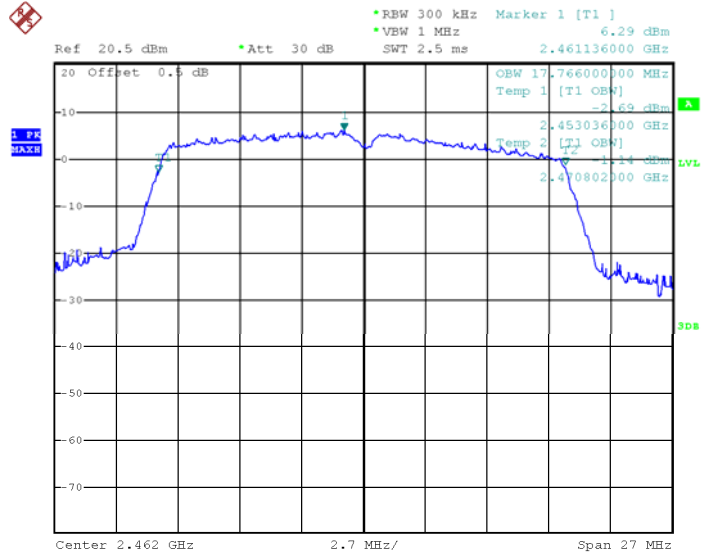
Date: 1.JUN.2022 16:45:18

Mode: TX 11n HT20 channel 6



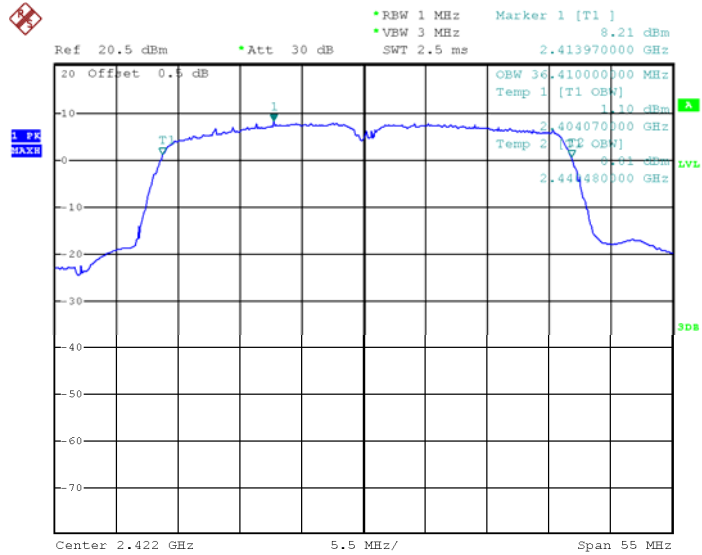
Date: 1.JUN.2022 16:48:40

Mode: TX 11n HT20 channel 11



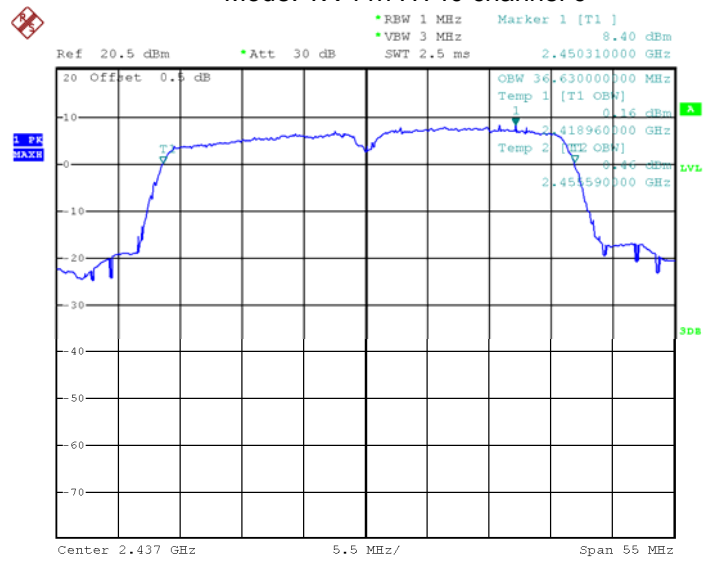
Date: 1.JUN.2022 16:49:10

Mode: TX 11n HT40 channel 3



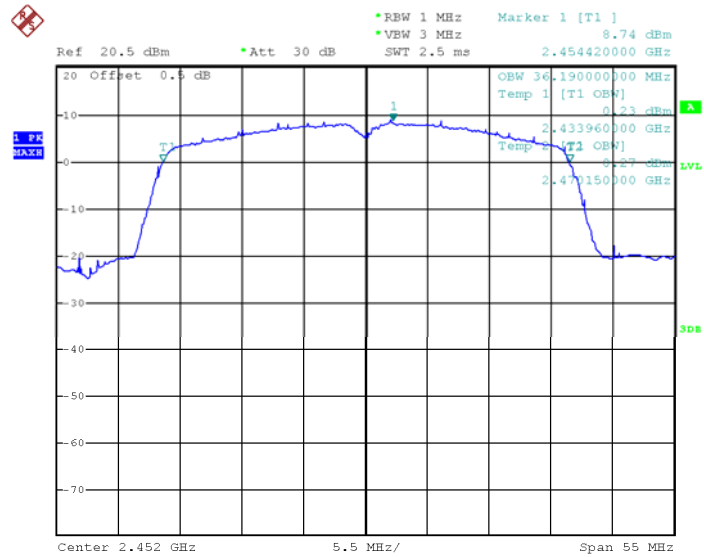
Date: 1.JUN.2022 16:50:26

Mode: TX 11n HT40 channel 6



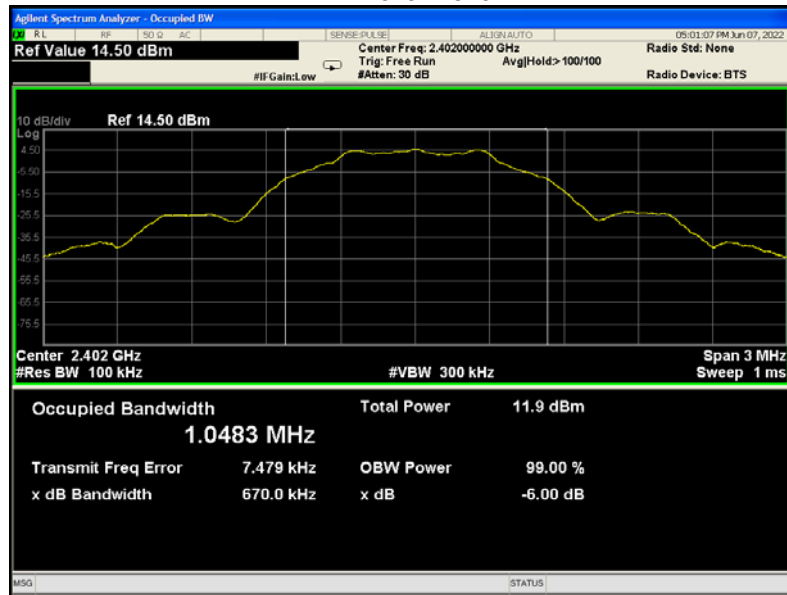
Date: 1.JUN.2022 16:50:56

Mode: TX 11n HT40 channel 9

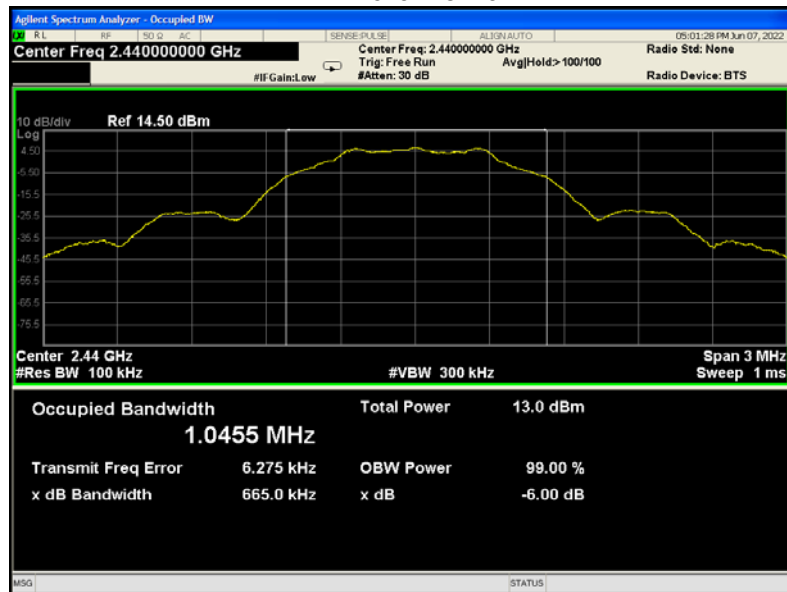


Date: 1.JUN.2022 16:51:44

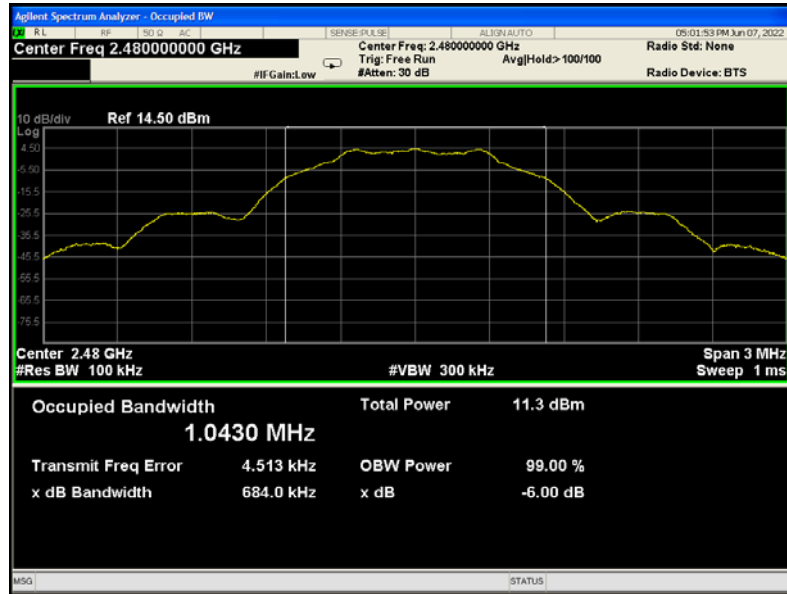
BLE: channel 0



BLE: channel 19



BLE: channel 39



14 Maximum Peak conducted Output Power

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

14.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

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

section 8.3.1.2 (For WIFI)

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

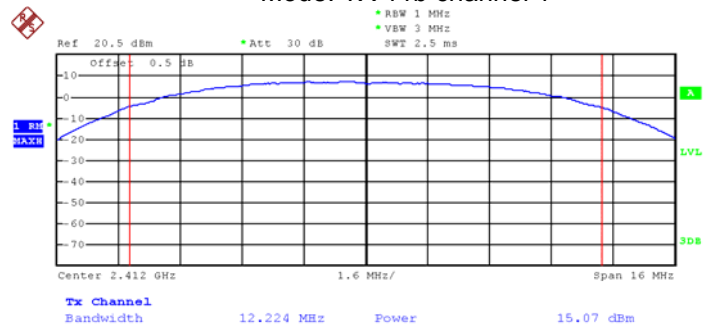
- a) Set the RBW = 1% to 5% of the OBW, not to exceed 1 MHz..
- b) Set the VBW $\geq 3 \times$ RBW
- c) Set the span $\geq 1.5 \times$ OBW.
- d) Detector = RMS.
- e) Sweep time = auto couple.
- f) trigger = free run..
- g) Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\geq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
- h) Trace average at least 100 traces in power averaging (rms) mode.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum..

14.2 Test Result:

Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
TX 11b	Low-2412	15.07	1W/30dBm
	Middle-2437	15.65	1W/30dBm
	High-2462	15.17	1W/30dBm
TX 11g	Low-2412	12.86	1W/30dBm
	Middle-2437	14.80	1W/30dBm
	High-2462	14.92	1W/30dBm
TX 11n HT20	Low-2412	12.91	1W/30dBm
	Middle-2437	15.61	1W/30dBm
	High-2462	14.99	1W/30dBm
TX 11n HT40	Low-2422	14.50	1W/30dBm
	Middle-2437	14.57	1W/30dBm
	High-2452	14.41	1W/30dBm
BLE	Low-2402	4.31	1W/30dBm
	Middle-2440	5.76	1W/30dBm
	High-2480	3.56	1W/30dBm

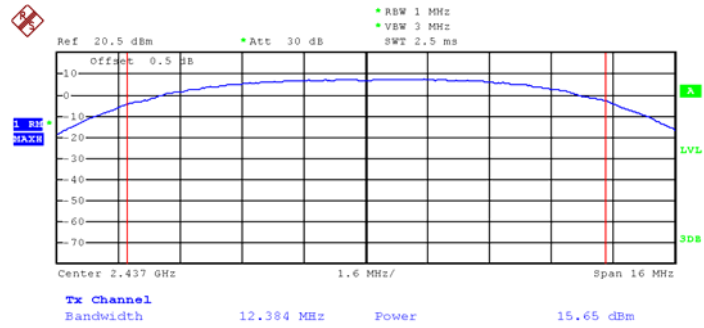
Test Plot

Mode: TX 11b channel 1

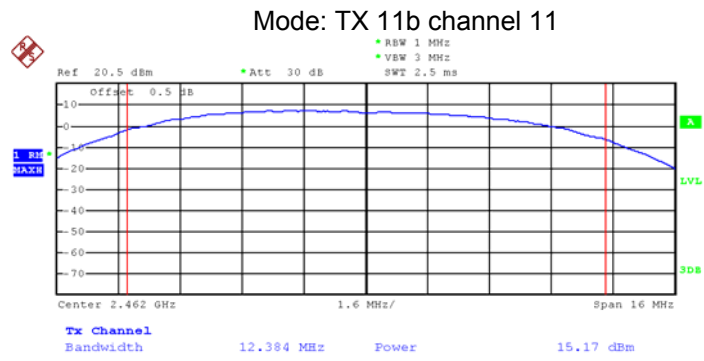


Date: 1.JUN.2022 17:01:36

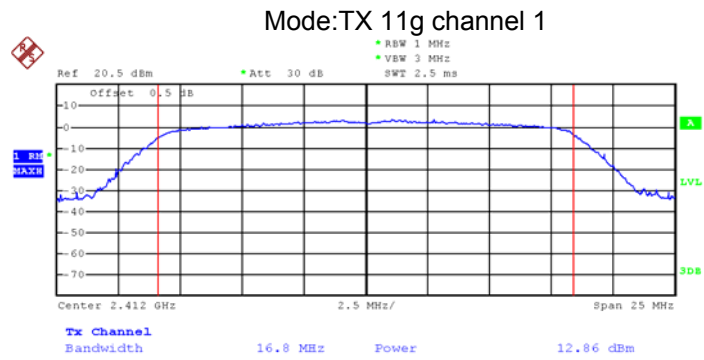
Mode: TX 11b channel 6



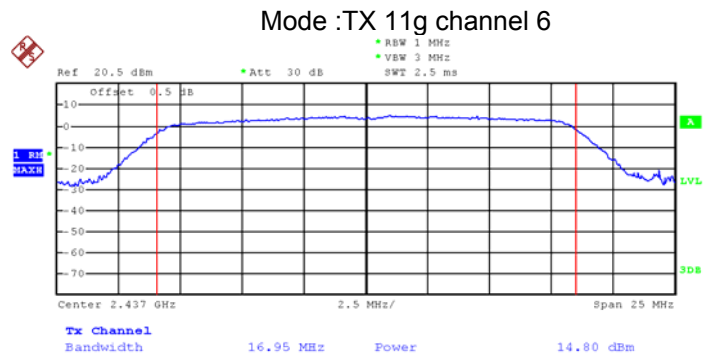
Date: 1.JUN.2022 17:02:55



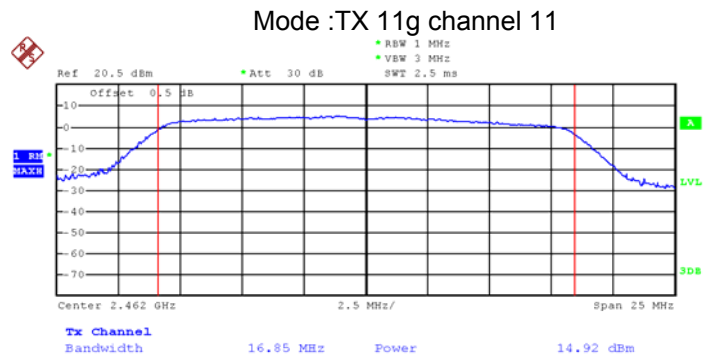
Date: 1.JUN.2022 17:00:52



Date: 1.JUN.2022 17:05:27

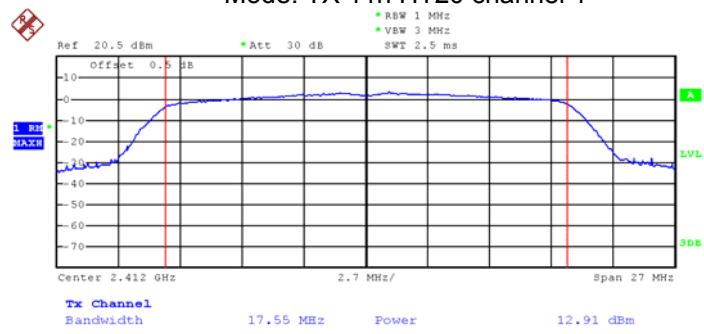


Date: 1.JUN.2022 17:04:29



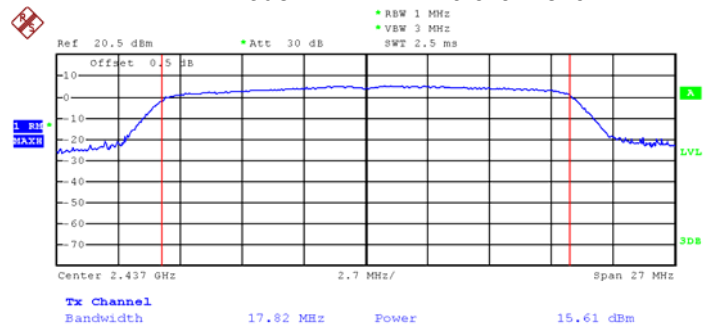
Date: 1.JUN.2022 17:06:17

Mode: TX 11n HT20 channel 1



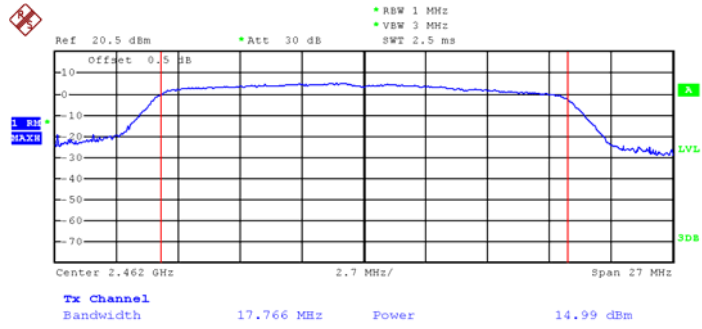
Date: 1.JUN.2022 17:13:00

Mode: TX 11n HT20 channel 6



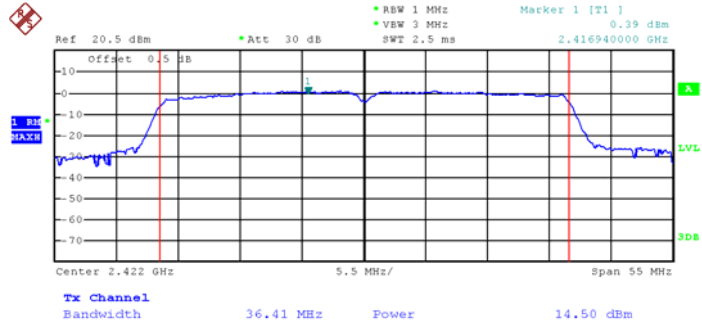
Date: 1.JUN.2022 17:11:43

Mode: TX 11n HT20 channel 11



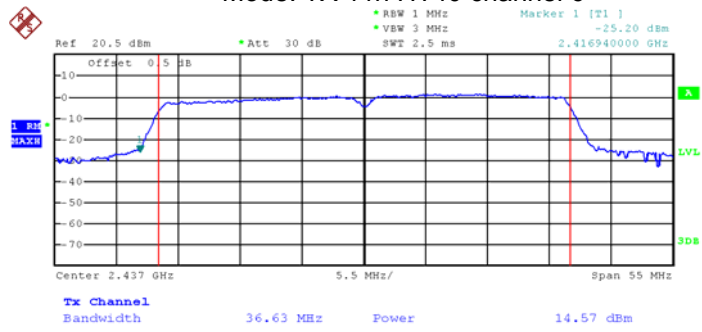
Date: 1.JUN.2022 17:09:24

Mode: TX 11n HT40 channel 3



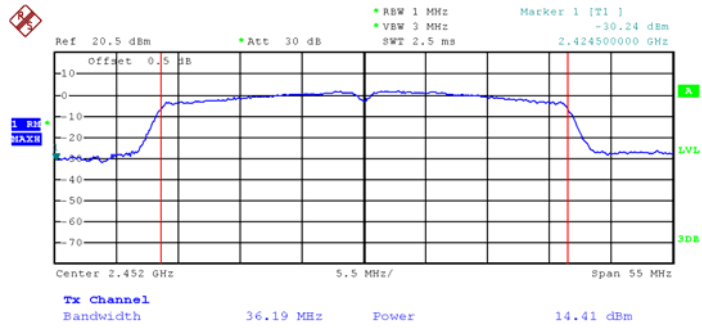
Date: 1.JUN.2022 17:15:34

Mode: TX 11n HT40 channel 6

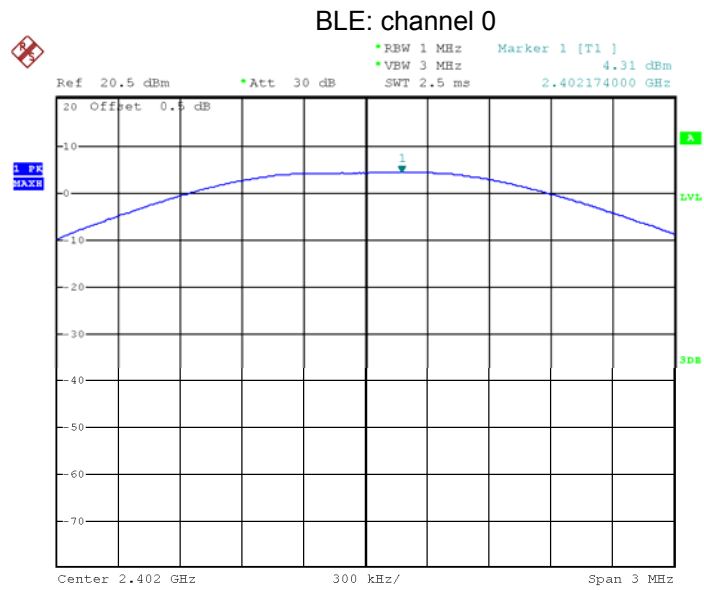


Date: 1.JUN.2022 17:16:22

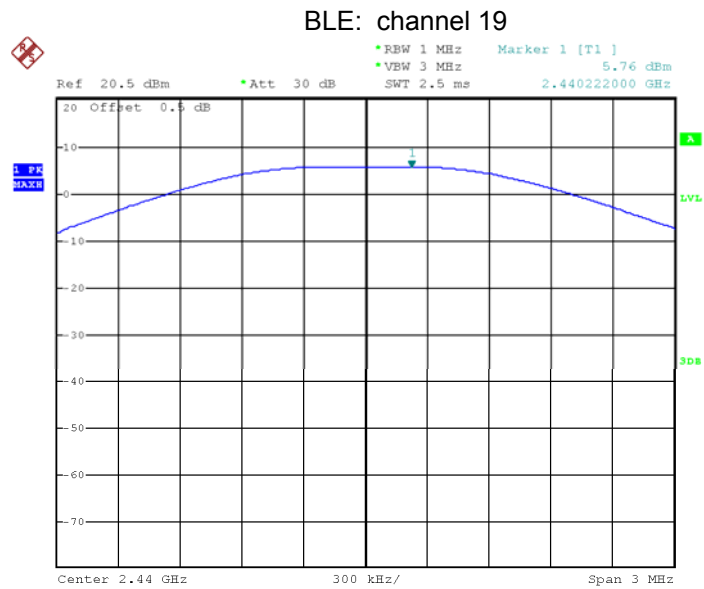
Mode: TX 11n HT40 channel 9



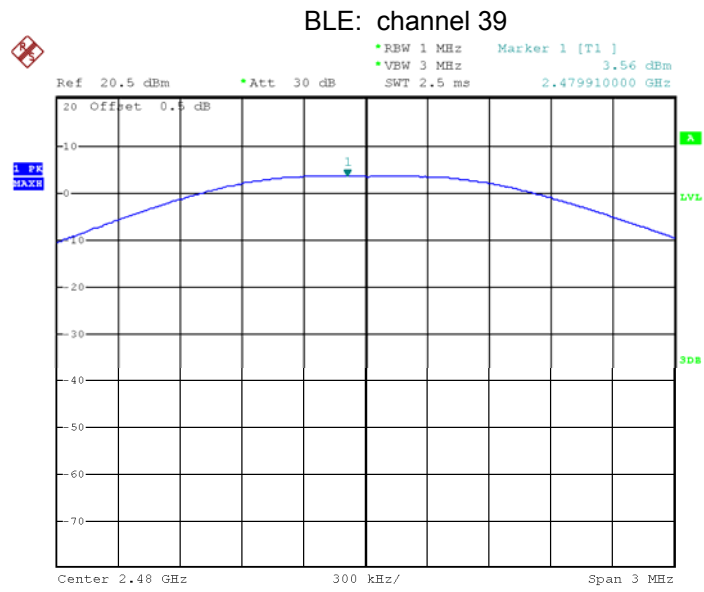
Date: 1.JUN.2022 17:17:04



Date: 1.JUN.2022 17:30:48



Date: 1.JUN.2022 17:31:12



Date: 1.JUN.2022 17:31:34

15 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
ANSI C63.10:2013

15.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 section 10.2

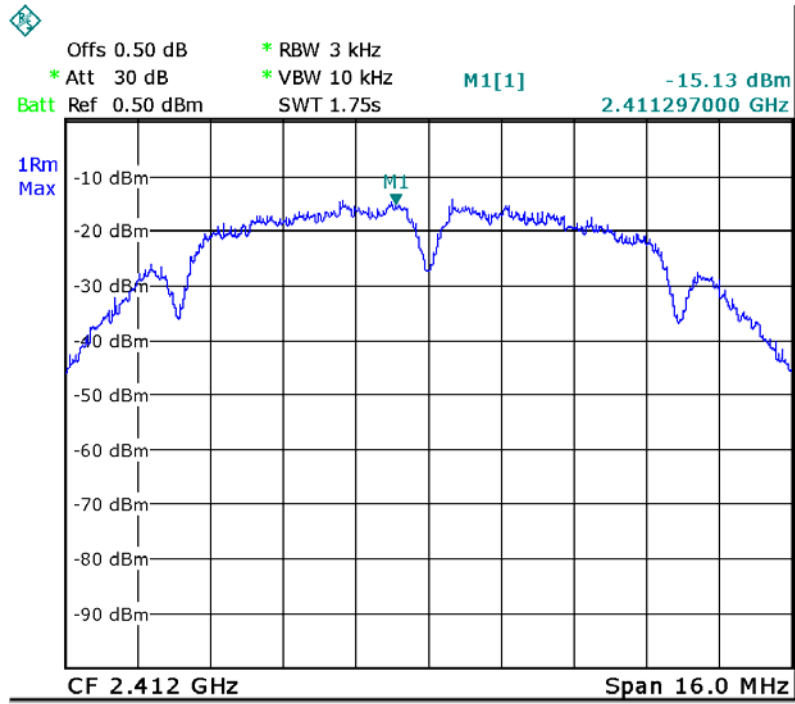
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to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

15.2 Test Result:

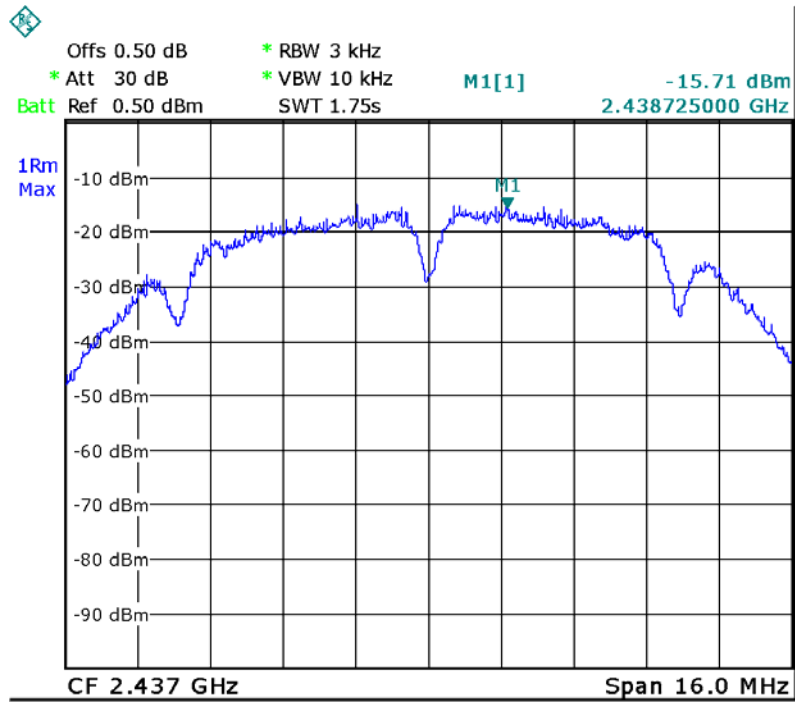
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
TX 11b	Low-2412	-15.13	8dBm per 3kHz
	Middle-2437	-15.71	8dBm per 3kHz
	High-2462	-15.00	8dBm per 3kHz
TX 11g	Low-2412	-21.06	8dBm per 3kHz
	Middle-2437	-19.05	8dBm per 3kHz
	High-2462	-19.07	8dBm per 3kHz
TX 11n HT20	Low-2412	-20.45	8dBm per 3kHz
	Middle-2437	-19.75	8dBm per 3kHz
	High-2462	-19.46	8dBm per 3kHz
TX 11n HT40	Low-2422	-23.55	8dBm per 3kHz
	Middle-2437	-22.97	8dBm per 3kHz
	High-2452	-22.14	8dBm per 3kHz
BLE	Low-2402	-9.60	8dBm per 3kHz
	Middle-2440	-8.91	8dBm per 3kHz
	High-2480	-10.57	8dBm per 3kHz

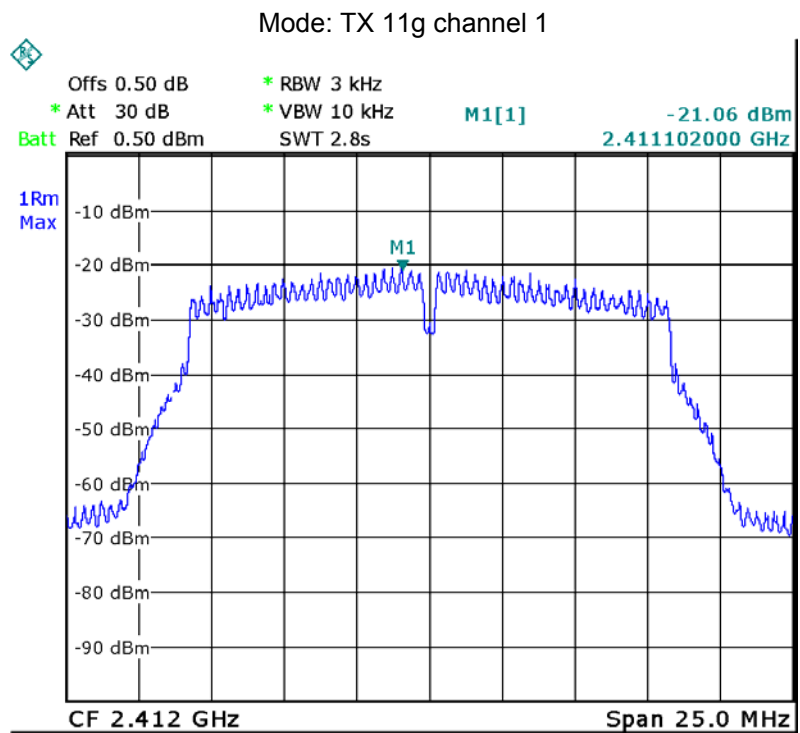
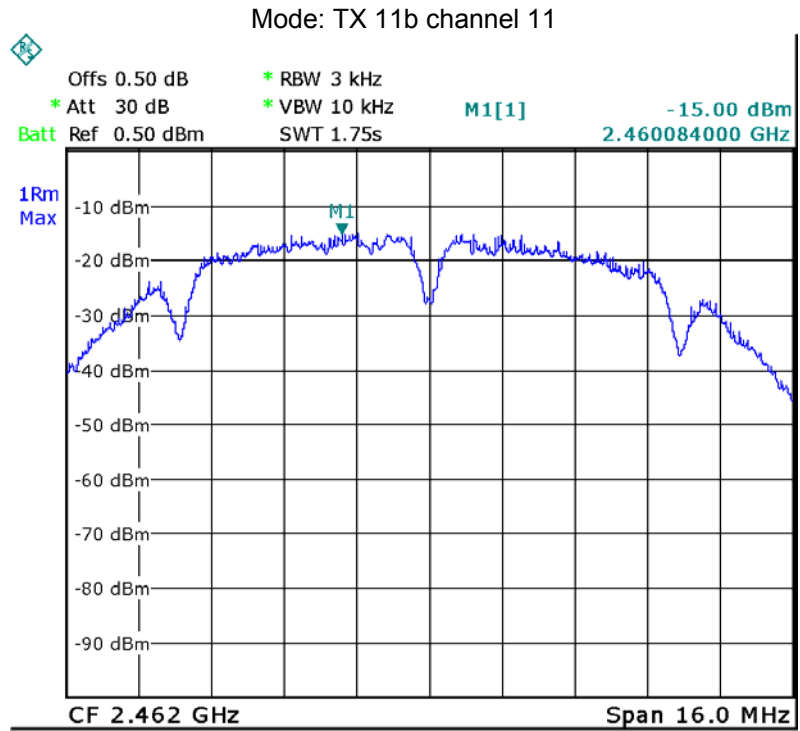
Test Plot

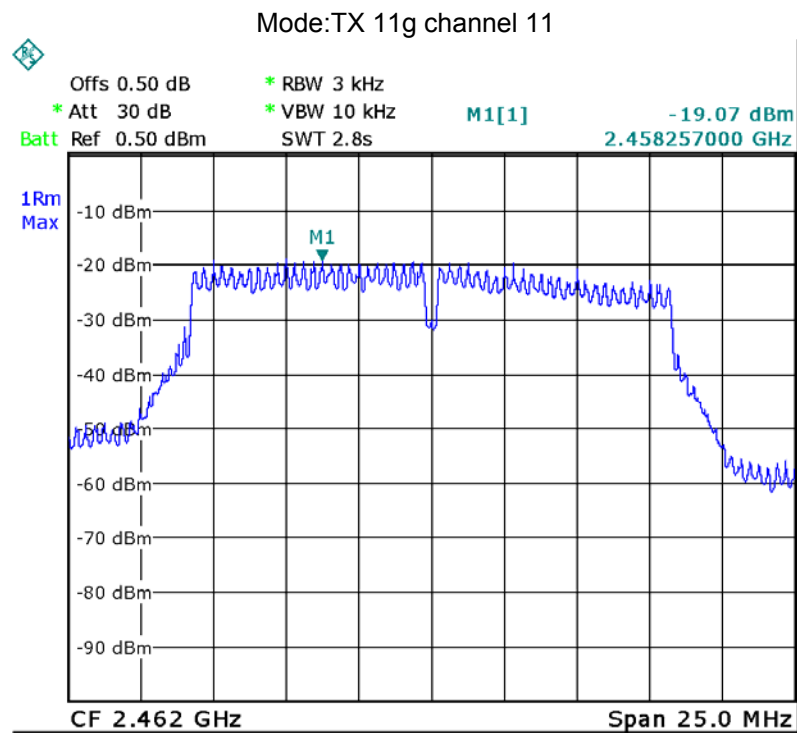
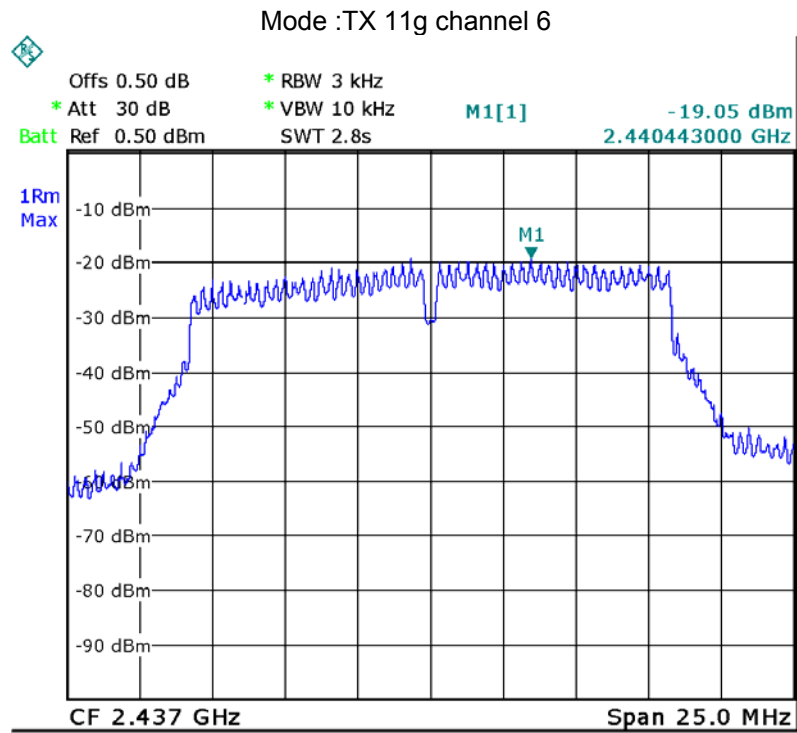
Mode: TX 11b channel 1

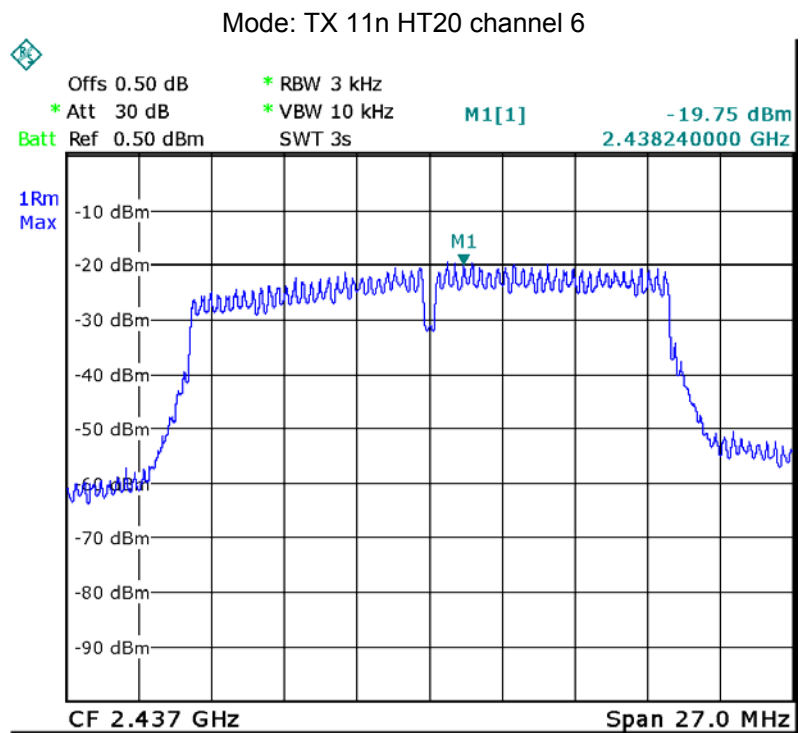
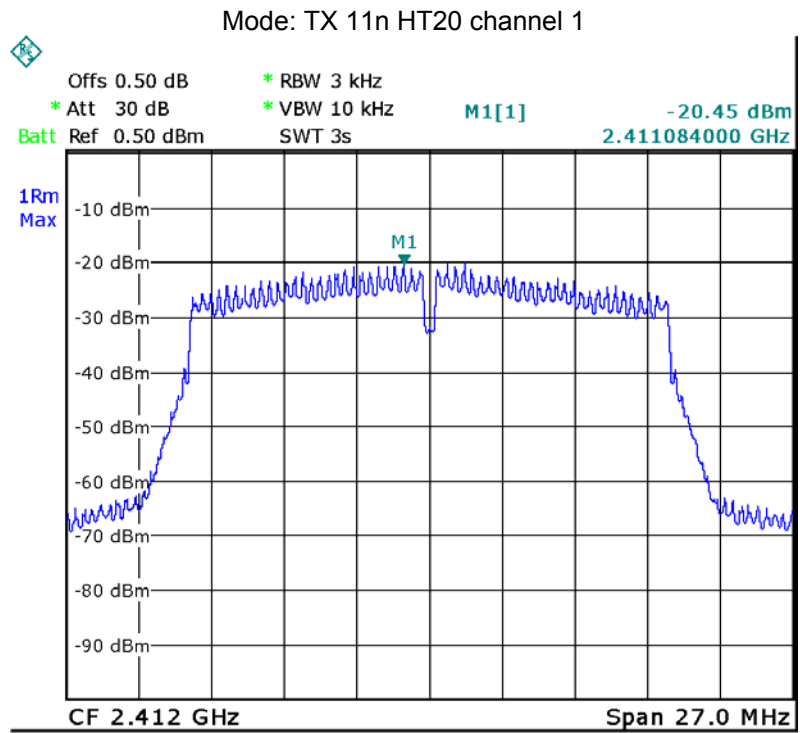


Mode: TX 11b channel 6

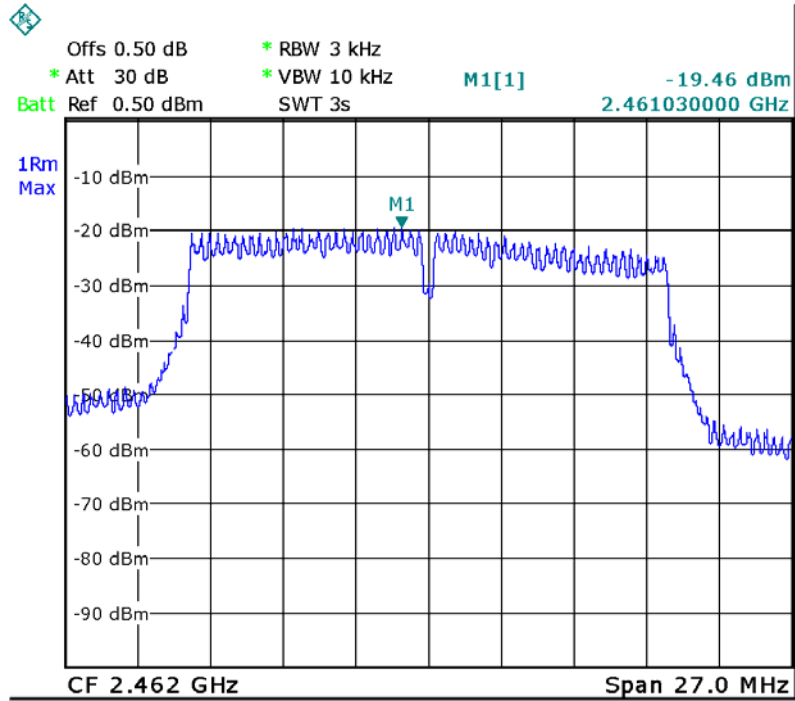




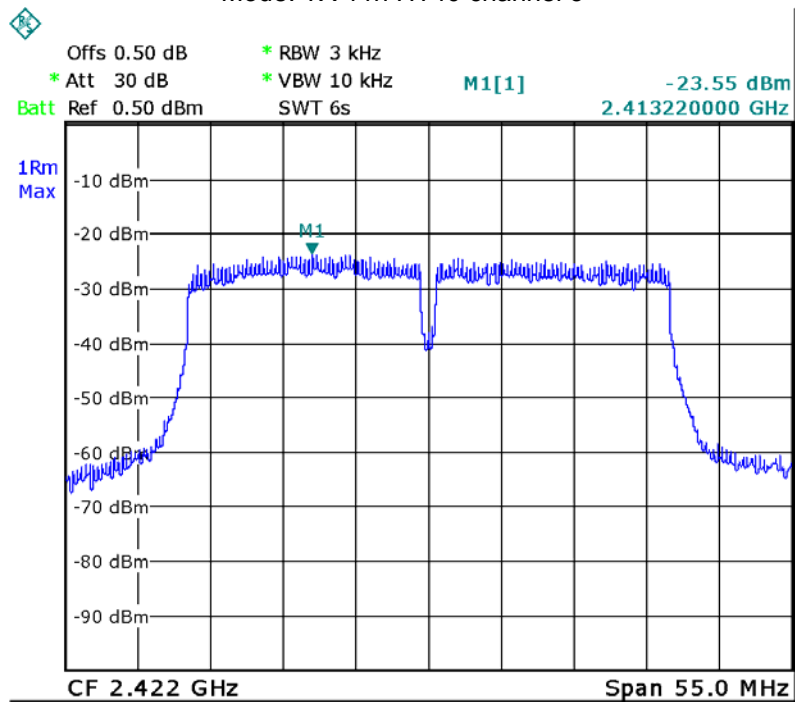




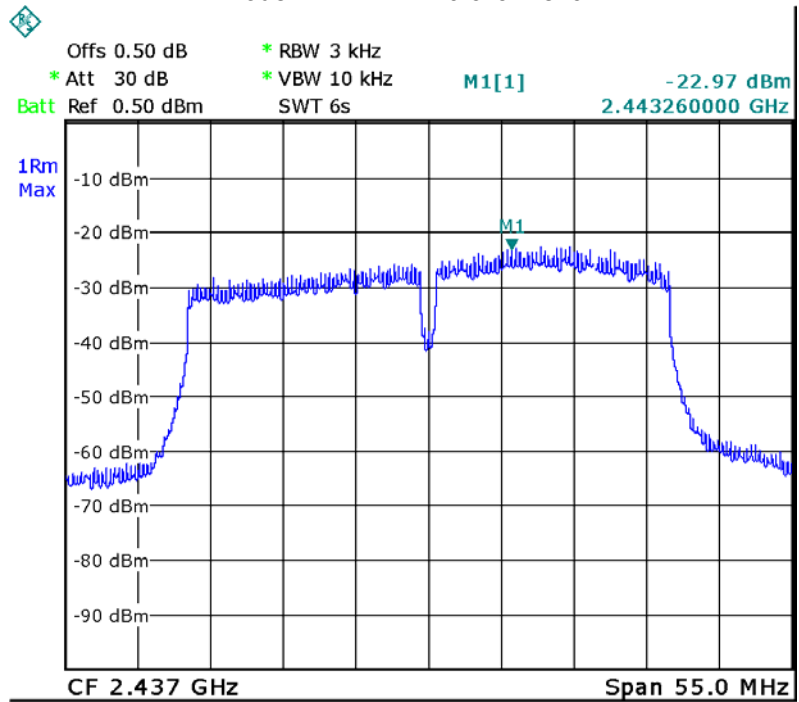
Mode: TX 11n HT20 channel 11



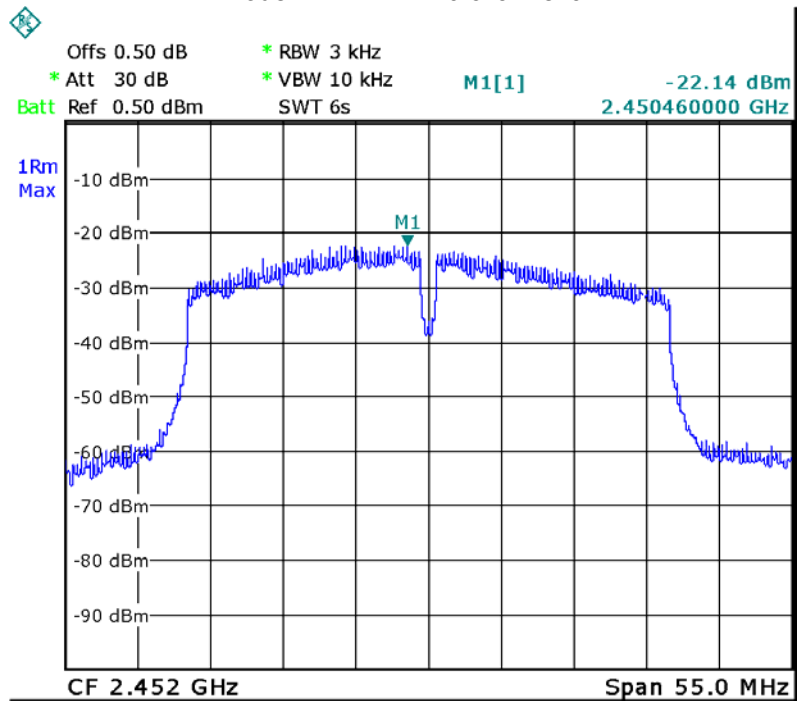
Mode: TX 11n HT40 channel 3



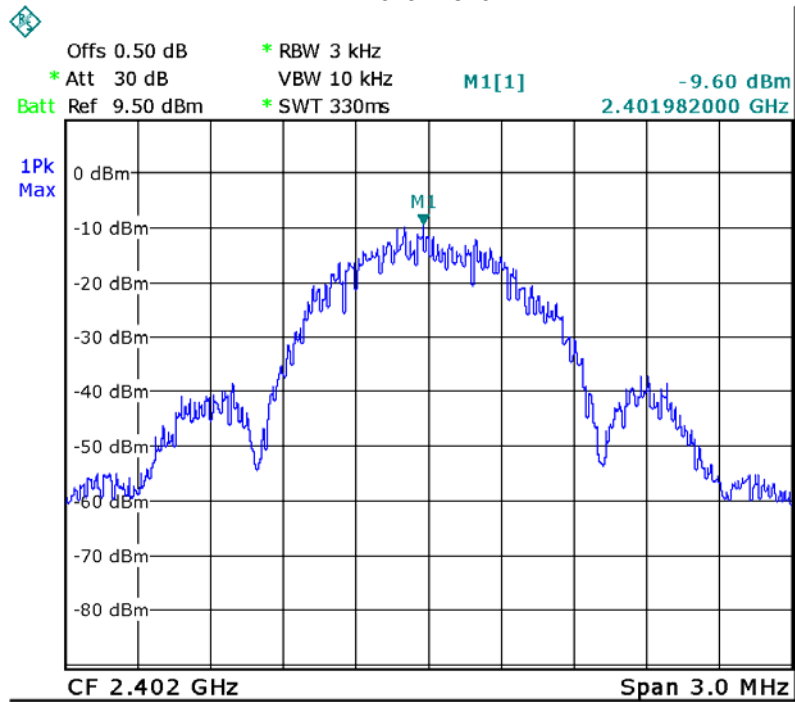
Mode: TX 11n HT40 channel 6



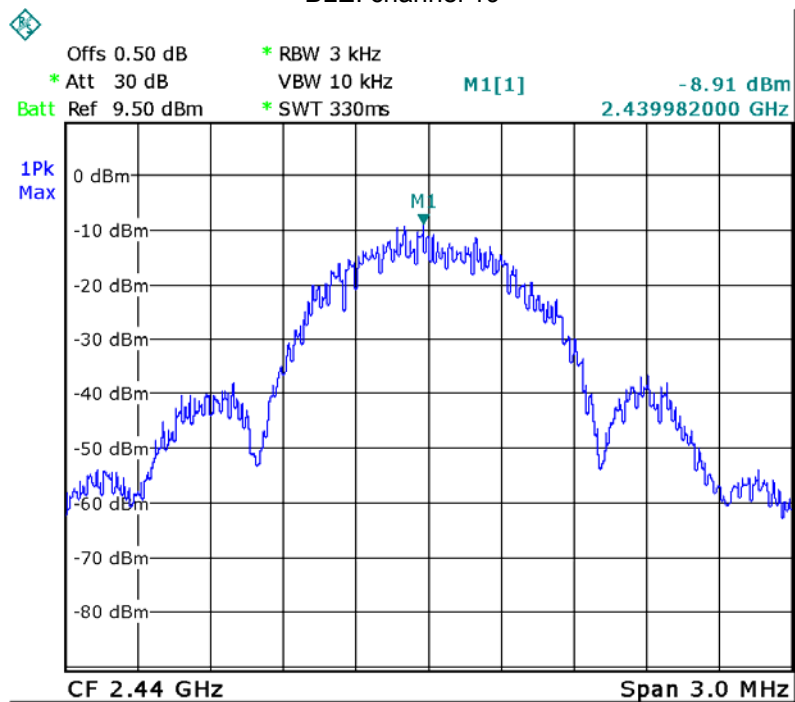
Mode: TX 11n HT40 channel 9



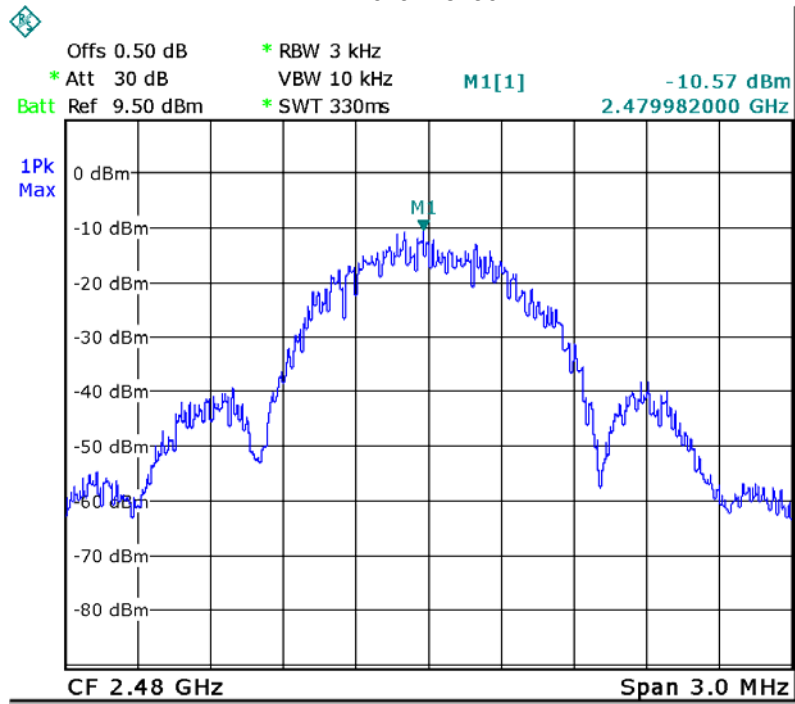
BLE: channel 0



BLE: channel 19



BLE: channel 39



16 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.

17 RF Exposure

Remark: refer to SAR test report: WTD22X09182242W001.

18 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-ELEMENT 5 PLUS-Photos.

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