TEST REPORT

Reference No.	:	WTD24D03055963W002
FCC ID	:	QCV-BTSU2
Applicant	:	Budderfly INC
Address	:	2 Trap Falls Rd. Ste. 310 Shelton, Connecticut United States 06484
Manufacturer	:	BB CONTROLS LIMITED
Address	:	Room 101, building 4-4, number 18, JINGXING Street NanShao, Changping District, Beijing, China
Product	:	Budderfly Thermostat
Model(s)	:	BTS-U2
Standards	:	FCC 47CFR Part 15.247
Date of Receipt sample	:	2024-03-20
Date of Test	:	2024-03-20 to 2024-03-29
Date of Issue	:	2024-03-29
Test Result	:	**Pass**

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

Prepared By:
Waltek Testing Group Co., Ltd.
Address: No. 77, Houjie Section, Guantai Road, Houjie Town, Dongguan City, Guangdong, China
Tel: +86-769-2267 6998
Fax: +86-769-2267 6828

Compiled by:

Ford Wang

Ford Wang / Project Engineer

Approved by:

Deval Qin

Deval Qin / Designated Reviewer

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3 Revision History

Test Report No.	Date of Receipt Sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD24D03055963W002	2024-03-20	2024-03-20 to 2024-03-29	2024-03-29	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Budderfly Thermostat
Model(s):	BTS-U2
Model Description:	There are two colors shells, the white shell was tested in the report.
Wi-Fi Specification:	802.11b/g/n
Hardware Version:	Bts-U2-1.10
Software Version:	1.24.6

4.2 Details of E.U.T.

Operation Frequency:	802.11b/g/n HT20: 2412~2462MHz 802.11n HT40: 2422~2452MHz
Max. RF output power:	21.21dBm
Type of Modulation:	DSSS, OFDM
Antenna installation:	PCB Antenna
Antenna Gain:	3.71dBi

Note:

#: The antenna gain is provided by the applicant, and the applicant should be responsible for its authenticity, WALTEK lab has not verified the authenticity of its information.

Ratings:	24VAC / 50-60 Hz, 1A

4.3 Channel List

Wi-Fi

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	-	-

4.4 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.

4.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

4.6 Abnormalities from Standard Conditions

None.

4.7 Test Mode

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

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
N/A: Power is supplied from the HVAC equipment, not the public power network, so conducted interference is not needed.		

6 Equipment Used during Test

6.1 Equipments List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date	Calibration Due Date
3m Semi-anechoic Chamber for Radiation Emissions 1#						
1	Spectrum Analyzer	R&S	FSP30	100091	2023-04-24	2024-04-23
2	Amplifier	Agilent	8447D	2944A10178	2023-07-27	2024-07-26
3	Tri-log Broadband Antenna	SCHWARZBECK	VULB9163	336	2023-08-07	2024-08-06
4	Coaxial Cable	Top	TYPE16(13M)	-	2023-04-24	2024-04-23
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120D	667	2024-01-23	2025-01-22
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2023-07-27	2024-07-26
7	Broadband Preamplifier	COMPLIANCE	PAP-1G18	2004	2023-08-08	2024-08-07
8	Coaxial Cable	Top	ZT26-NJ-NJ-8M/FA	-	2023-04-24	2024-04-23
9	Microwave Amplifier	SCHWARZBECK	BBV 9721	100472	2023-07-27	2024-07-26
10	Coaxial Cable	Top	ZT40-2.92J-2.92J-2.0M	17100919	2023-04-24	2024-04-23
3m Semi-anechoic Chamber for Radiation Emissions 2#						
1	Test Receiver	R&S	ESCI	101296	2023-04-24	2024-04-23
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2023-11-04	2024-11-03
3	Active Loop Antenna	Com-Power	AL-130R	10160007	2023-05-07	2024-05-06
4	Amplifier	ANRITSU	MH648A	M43381	2023-04-24	2024-04-23
5	Cable	HUBER+SUHNER	CBL2	525178	2023-04-24	2024-04-23
RF Conducted Testing						
1	Spectrum Analyzer	R&S	FSP40	100501	2023-07-27	2024-07-26
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	2023-07-27	2024-07-26

Test Software:

Test Item	Software name	Software version
Radiated Emission(3m)	EZ-EMC	EZ-EMC(RA-03A1-1)

6.2 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64dB (AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08dB (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 Duty Cycle

Type of Modulation	On time ms	Period ms	Duty Cycle linear	Duty Cycle %	Duty Cycle Factor(dB)	Average Factor(dB)
802.11b	1.014	2.250	0.45	45.07	3.46	-6.92
802.11g	0.618	2.064	0.30	29.94	5.24	-10.47
802.11n-HT20	0.618	2.052	0.30	30.12	5.21	-10.42
802.11n-HT40	0.618	2.052	0.30	30.12	5.21	-10.42

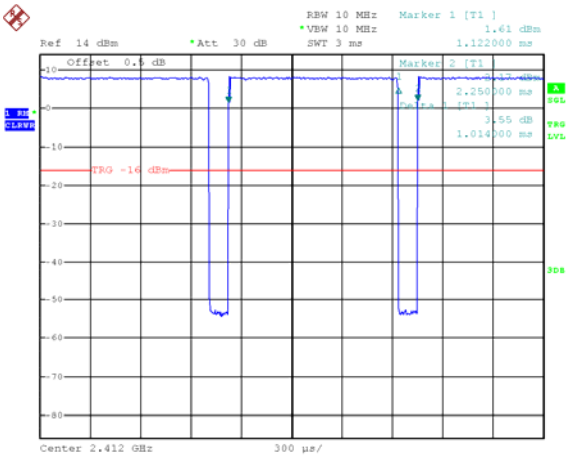
Remark:

Duty cycle=On Time/period;

Duty cycle factor=10*log (1/Duty cycle);

Average factor=$20\log_{10}$Duty cycle

Wi-Fi 802.11b



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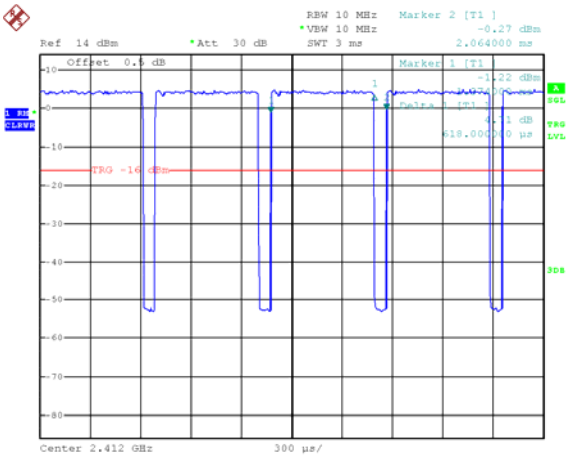
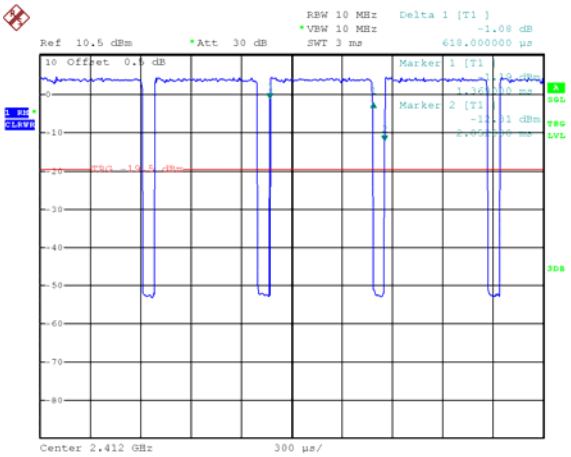
Wi-Fi 802.11g



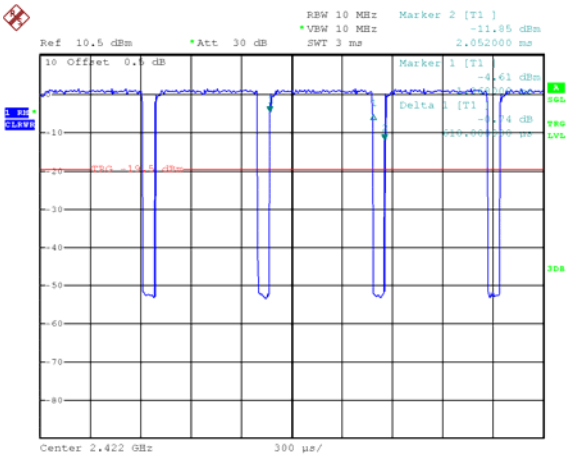
Date: 26.MAR.2024 14:04:31

Wi-Fi 802.11n-HT20



Date: 26.MAR.2024 14:03:08

Wi-Fi 802.11n-HT40



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8 Radiated Emissions

Test Requirement: 47CFR FCC Part15 Subpart C §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)	$20\log^{(2400/F(kHz))} + 80$
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	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment:

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

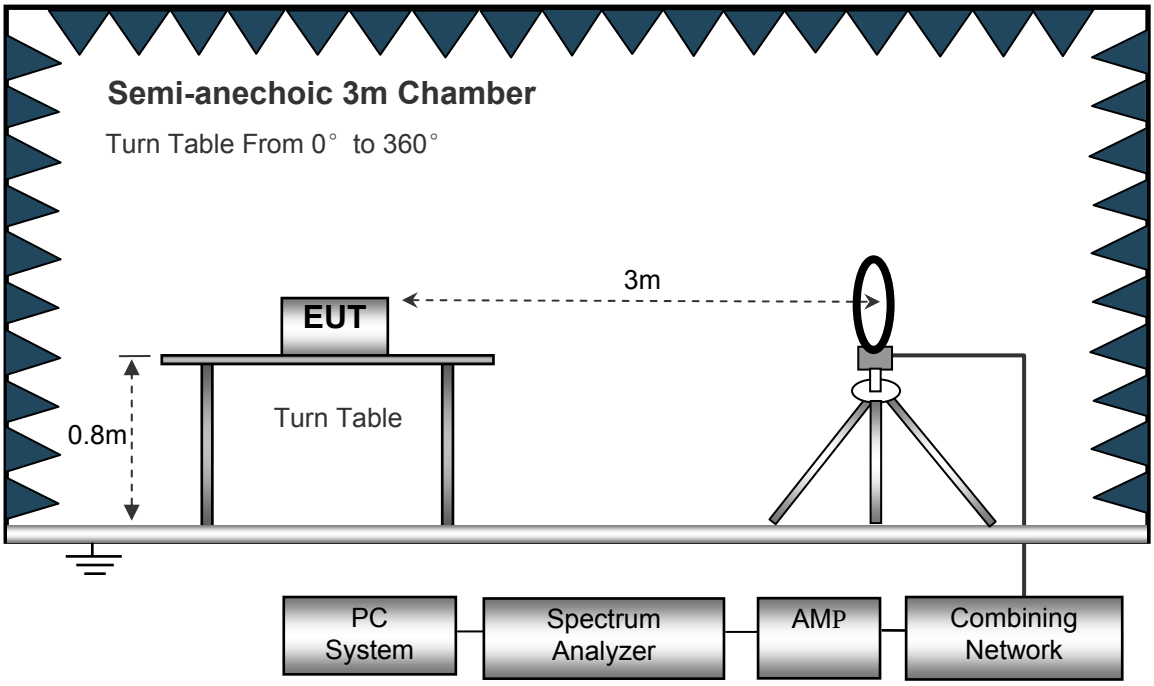
EUT Operation:

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

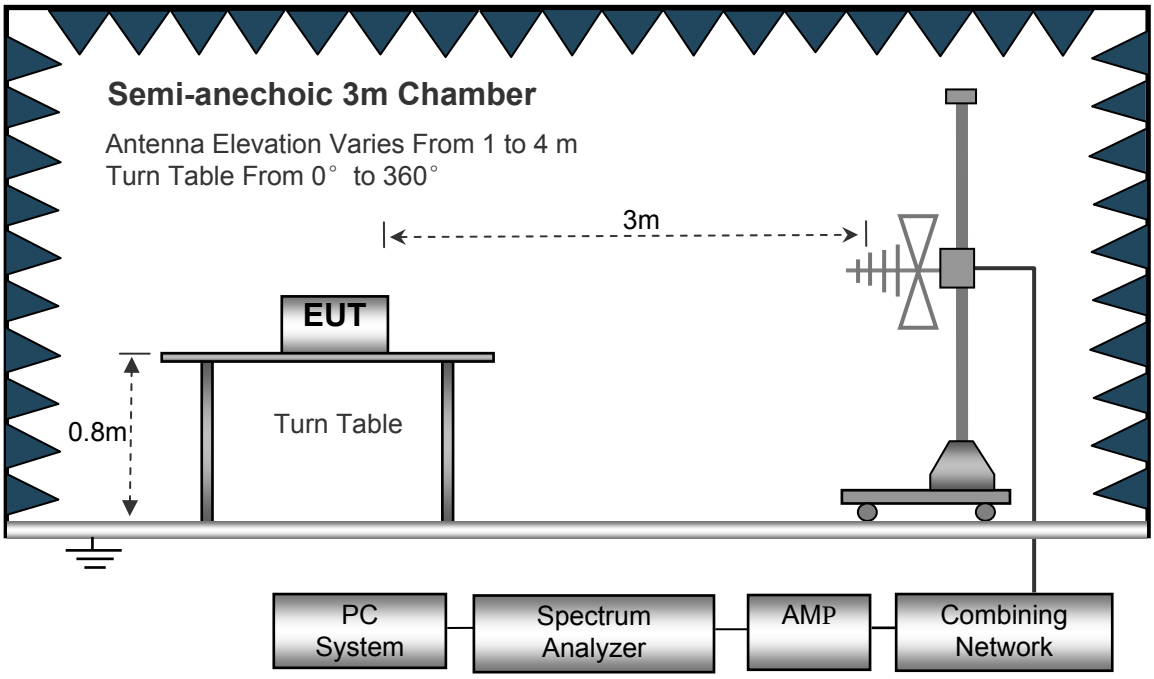
8.2 Test Setup

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

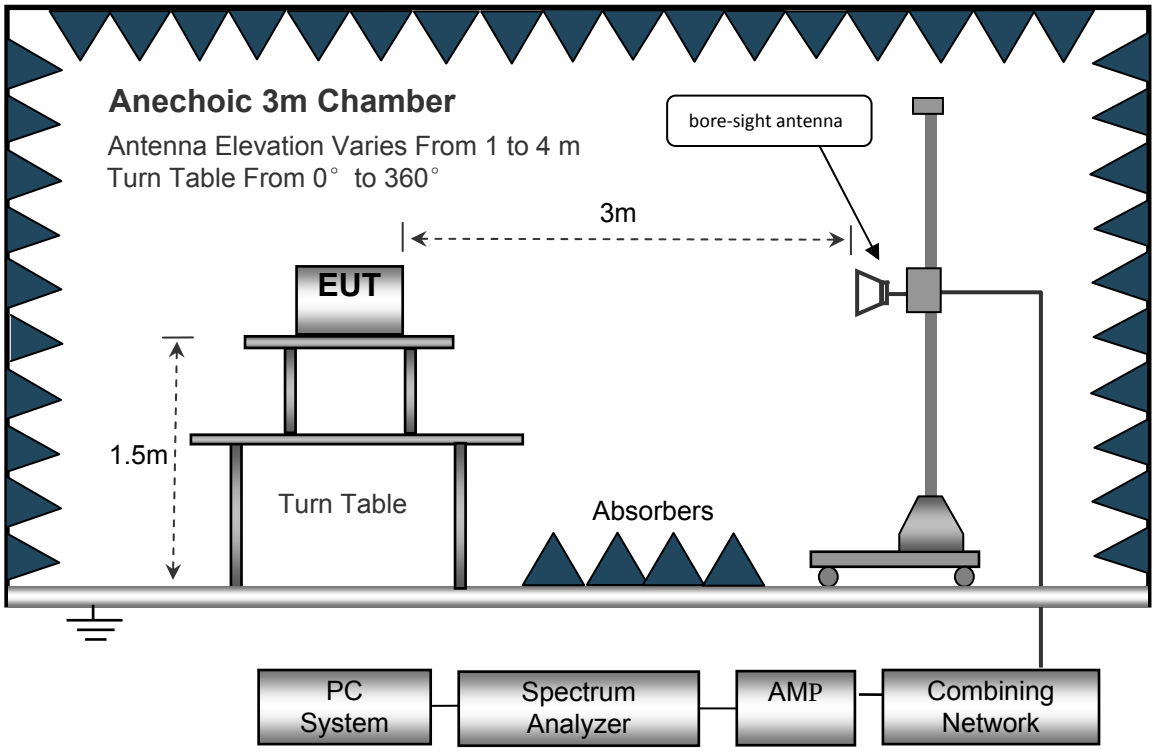
The test setup for emission measurement below 30MHz.



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 druing 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:

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

8.6 Summary of Test Results

Test Frequency: 9kHz ~ 30MHz

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

Test Frequency: 30MHz ~ 8GHz

Note: Only the worst-case 11b mode were record in the report.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Low Channel 2412MHz									
469.25	40.61	QP	314	1.0	H	-13.21	27.40	46.00	-18.60
469.25	46.53	QP	245	1.6	V	-13.21	33.32	46.00	-12.68
4824.00	52.96	PK	294	1.5	V	-1.06	51.90	74.00	-22.10
4824.00	41.12	Ave	294	1.5	V	-1.06	40.06	54.00	-13.94
7236.00	49.67	PK	265	1.4	H	1.33	51.00	74.00	-23.00
7236.00	38.52	Ave	265	1.4	H	1.33	39.85	54.00	-14.15
2317.89	47.75	PK	122	1.5	V	-13.19	34.56	74.00	-39.44
2317.89	38.85	Ave	122	1.5	V	-13.19	25.66	54.00	-28.34
2385.11	44.69	PK	11	1.5	H	-13.14	31.55	74.00	-42.45
2385.11	37.28	Ave	11	1.5	H	-13.14	24.14	54.00	-29.86
2484.50	42.50	PK	181	1.9	V	-13.08	29.42	74.00	-44.58
2484.50	37.08	Ave	181	1.9	V	-13.08	24.00	54.00	-30.00

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Middle Channel 2437MHz									
469.25	39.46	QP	44	1.9	H	-13.21	26.25	46.00	-19.75
469.25	47.56	QP	110	1.5	V	-13.21	34.35	46.00	-11.65
4874.00	51.97	PK	233	1.2	V	-0.62	51.35	74.00	-22.65
4874.00	40.36	Ave	233	1.2	V	-0.62	39.74	54.00	-14.26
7311.00	49.17	PK	11	1.4	H	2.21	51.38	74.00	-22.62
7311.00	39.12	Ave	11	1.4	H	2.21	41.33	54.00	-12.67
2342.49	45.01	PK	65	1.6	V	-13.19	31.82	74.00	-42.18
2342.49	37.95	Ave	65	1.6	V	-13.19	24.76	54.00	-29.24
2376.18	43.95	PK	163	1.7	H	-13.14	30.81	74.00	-43.19
2376.18	36.84	Ave	163	1.7	H	-13.14	23.70	54.00	-30.30
2489.74	43.80	PK	86	1.9	V	-13.08	30.72	74.00	-43.28
2489.74	36.98	Ave	86	1.9	V	-13.08	23.90	54.00	-30.10

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: High Channel 2462MHz									
469.25	38.15	QP	46	1.1	H	-13.21	24.94	46.00	-21.06
469.25	46.61	QP	278	1.0	V	-13.21	33.40	46.00	-12.60
4924.00	52.02	PK	213	2.0	V	-0.24	51.78	74.00	-22.22
4924.00	39.70	Ave	213	2.0	V	-0.24	39.46	54.00	-14.54
7386.00	49.50	PK	247	1.4	H	2.84	52.34	74.00	-21.66
7386.00	40.03	Ave	247	1.4	H	2.84	42.87	54.00	-11.13
2336.75	45.91	PK	80	1.0	V	-13.19	32.72	74.00	-41.28
2336.75	39.99	Ave	80	1.0	V	-13.19	26.80	54.00	-27.20
2377.18	43.47	PK	213	1.1	H	-13.14	30.33	74.00	-43.67
2377.18	38.21	Ave	213	1.1	H	-13.14	25.07	54.00	-28.93
2494.95	42.73	PK	130	2.0	V	-13.08	29.65	74.00	-44.35
2494.95	38.20	Ave	130	2.0	V	-13.08	25.12	54.00	-28.88

Test Frequency: 8GHz~25GHz

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

9 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)).

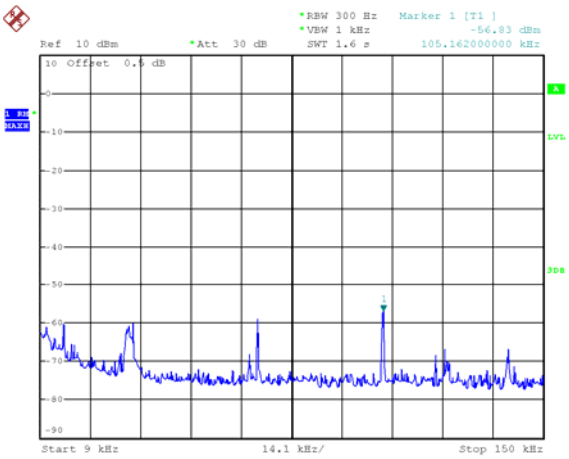
9.1 Test Procedure

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

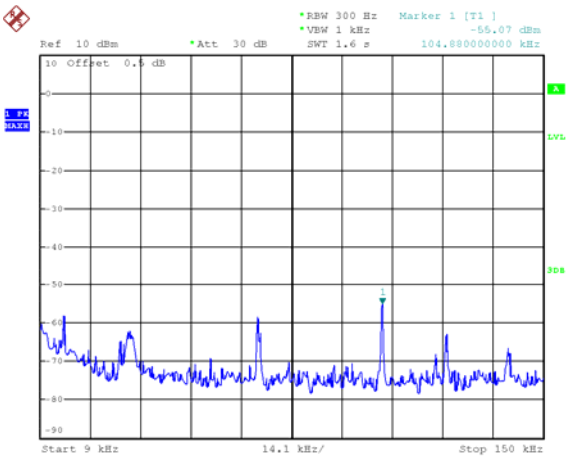
9KHz – 150KHz

Mode: TX 11b channel 1



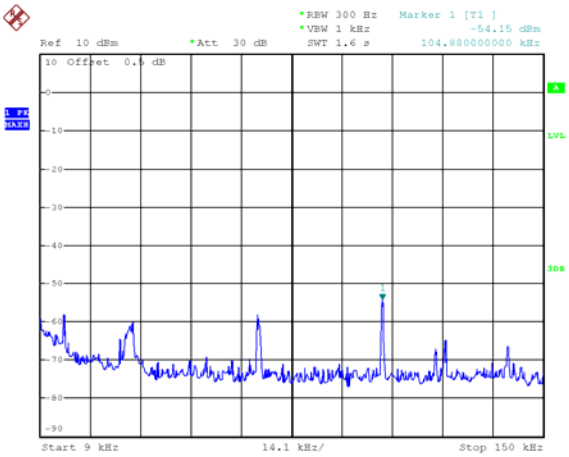
Date: 26.MAR.2024 10:16:49

Mode: TX 11b channel 6



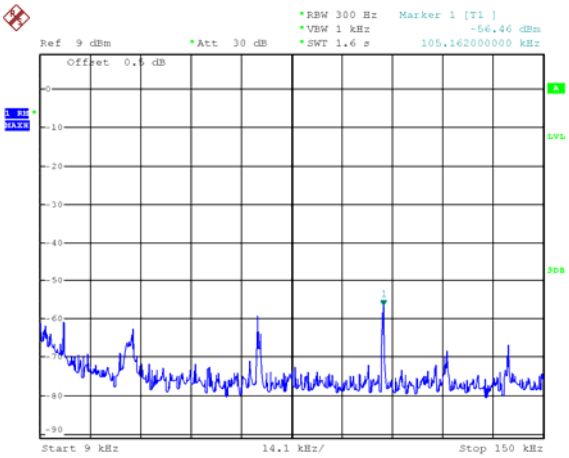
Date: 26.MAR.2024 11:17:41

Mode: TX 11b channel 11



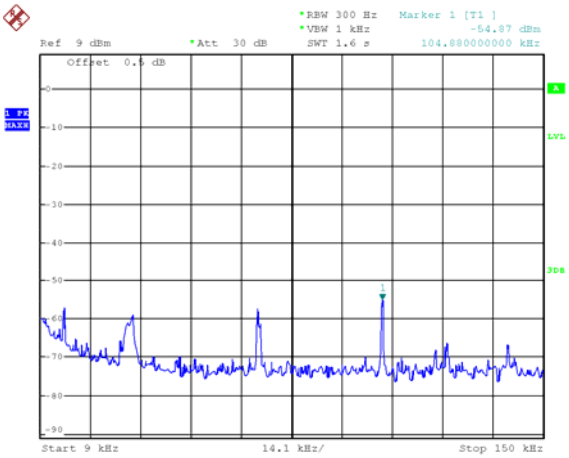
Date: 26.MAR.2024 11:18:45

Mode: TX 11g channel 1



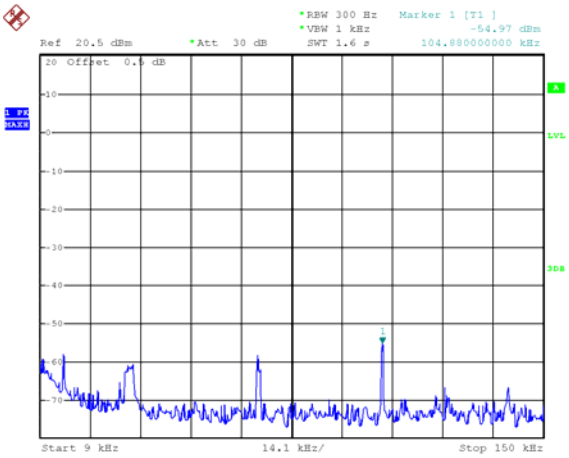
Date: 26.MAR.2024 13:21:20

Mode: TX 11g channel 6



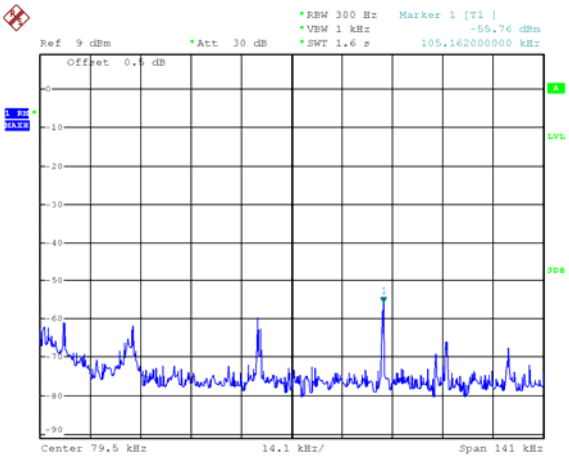
Date: 26.MAR.2024 11:29:58

Mode: TX 11g channel 11



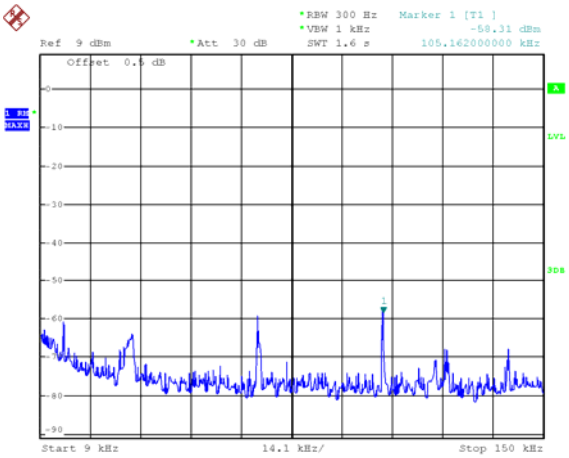
Date: 26.MAR.2024 11:28:27

Mode: TX 11n HT20 channel 1



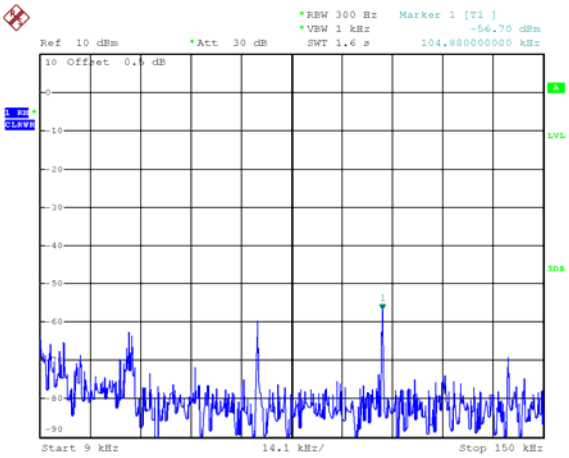
Date: 26.MAR.2024 13:22:41

Mode: TX 11 n HT20 channel 6



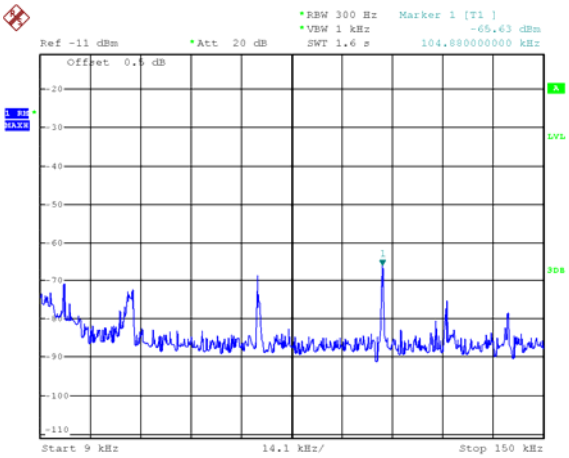
Date: 26.MAR.2024 13:28:03

Mode: TX 11 n HT20 channel 11



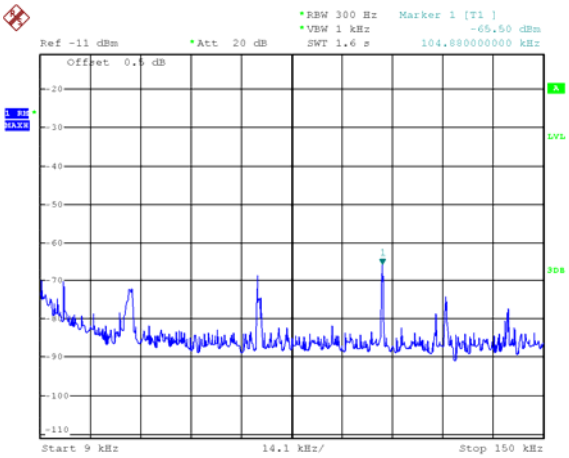
Date: 26.MAR.2024 14:17:36

Mode: TX 11n HT40 channel 3



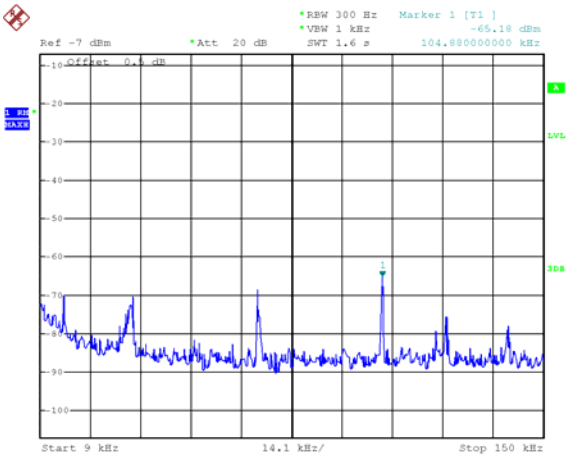
Date: 26.MAR.2024 13:43:10

Mode: TX 11 n HT40 channel 6



Date: 26.MAR.2024 13:43:46

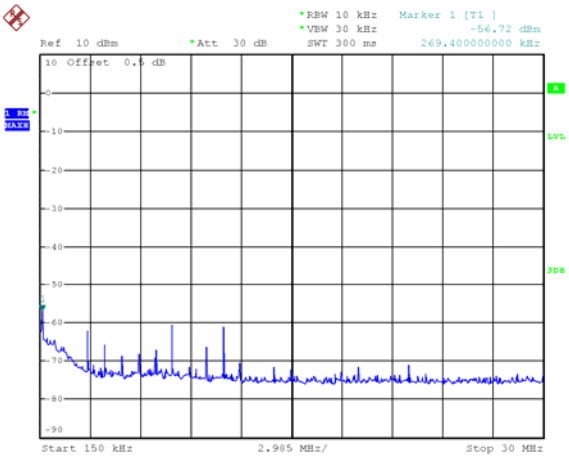
Mode: TX 11 n HT40 channel 9



Date: 26.MAR.2024 13:47:52

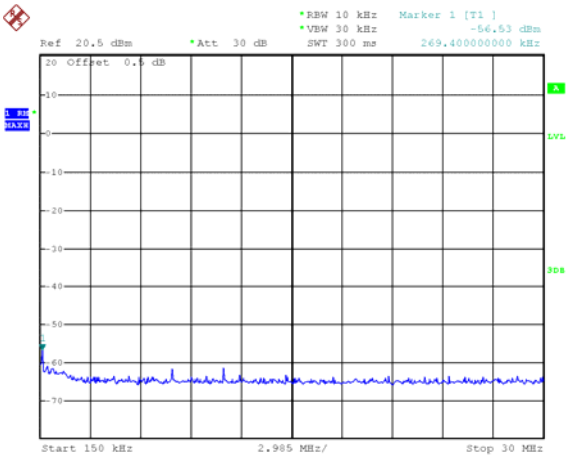
150KHz – 30MHz

Mode: TX 11b channel 1



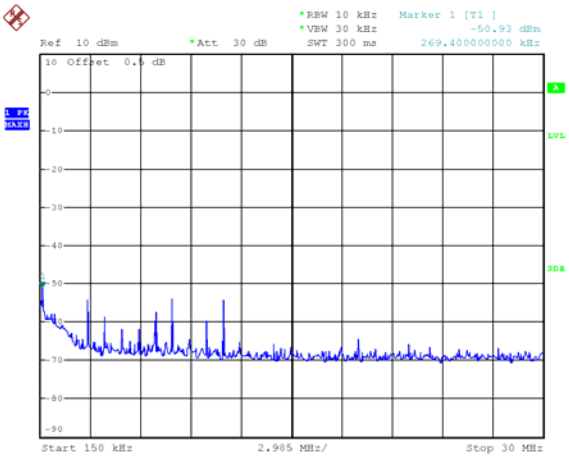
Date: 26.MAR.2024 10:17:53

Mode: TX 11b channel 6



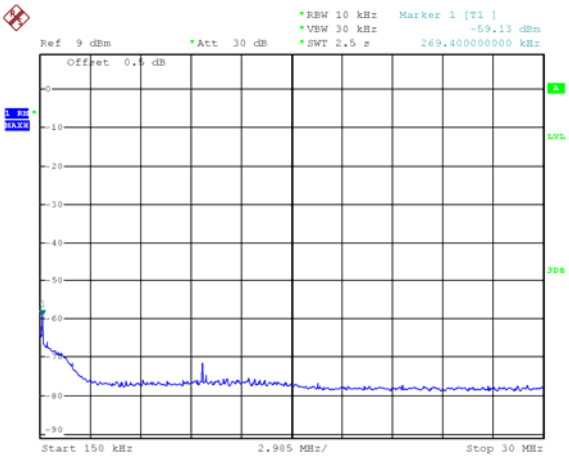
Date: 26.MAR.2024 11:13:25

Mode: TX 11b channel 11



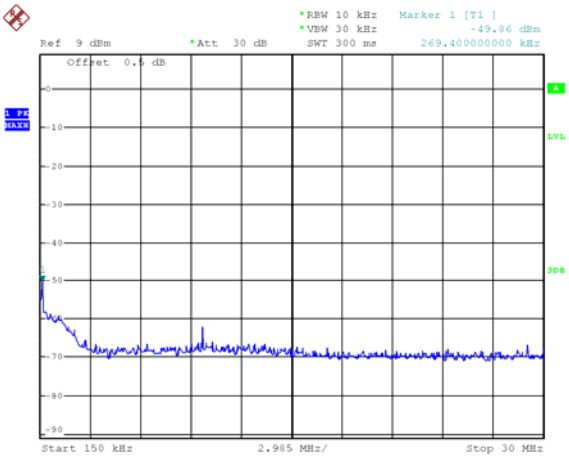
Date: 26.MAR.2024 11:19:45

Mode: TX 11g channel 1



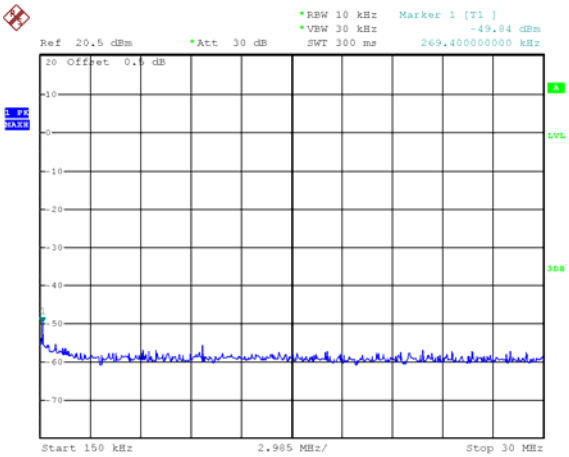
Date: 26.MAR.2024 13:19:35

Mode: TX 11g channel 6



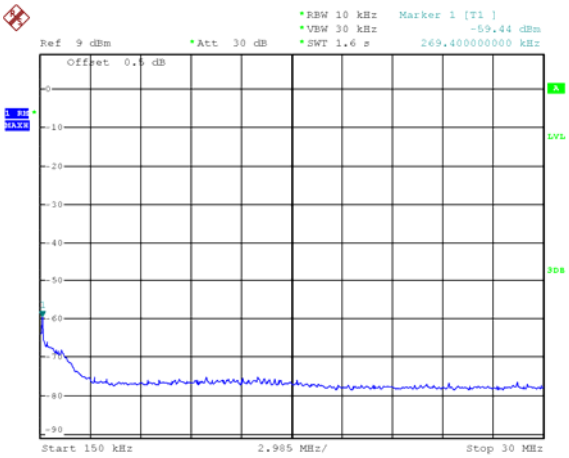
Date: 26.MAR.2024 11:31:10

Mode: TX 11g channel 11



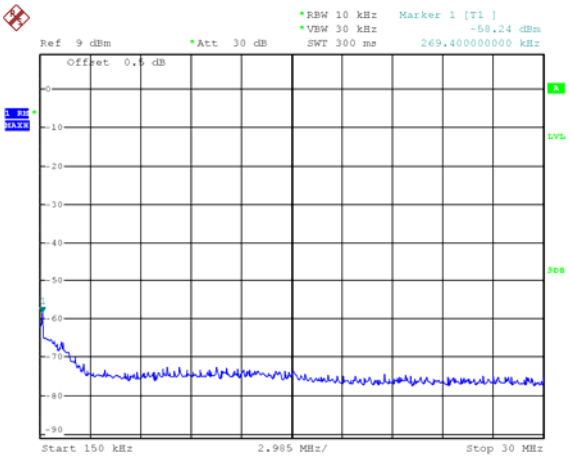
Date: 26.MAR.2024 11:27:49

Mode: TX 11n HT20 channel 1



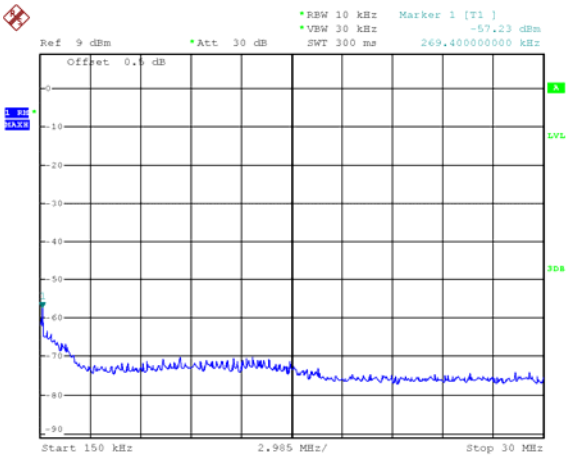
Date: 26.MAR.2024 13:23:30

Mode: TX 11 n HT20 channel 6



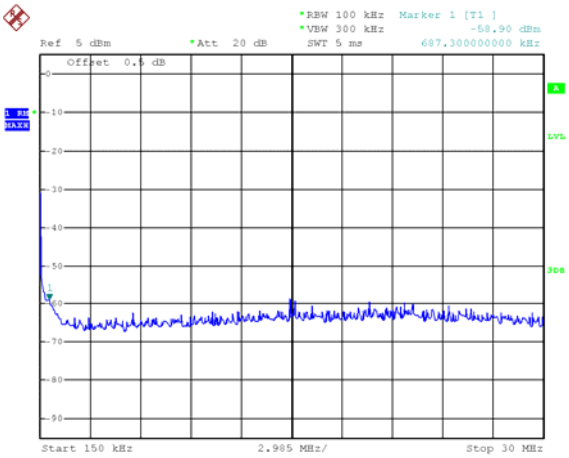
Date: 26.MAR.2024 13:27:21

Mode: TX 11 n HT20 channel 11



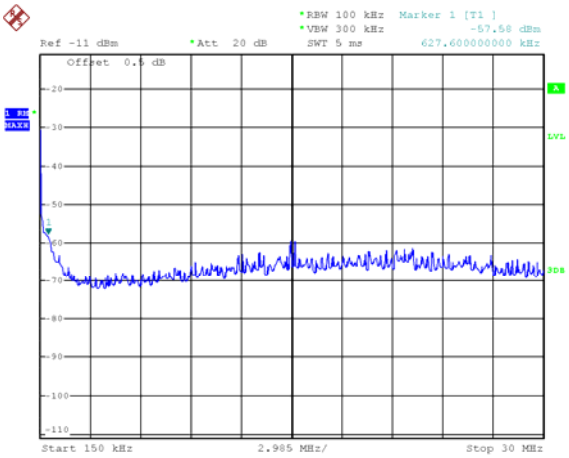
Date: 26.MAR.2024 13:29:51

Mode: TX 11n HT40 channel 3



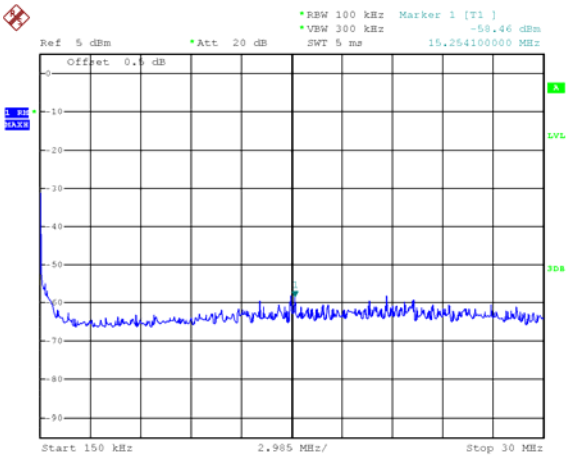
Date: 26.MAR.2024 13:45:12

Mode: TX 11 n HT40 channel 6



Date: 26.MAR.2024 13:44:39

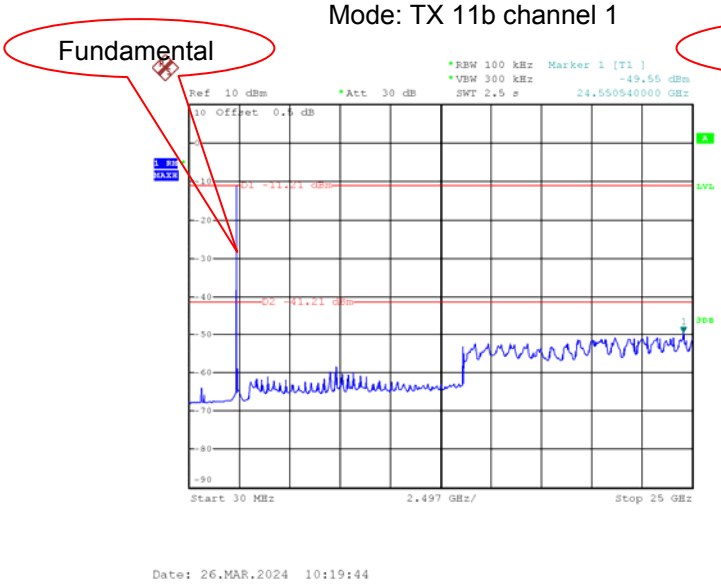
Mode: TX 11 n HT40 channel 9



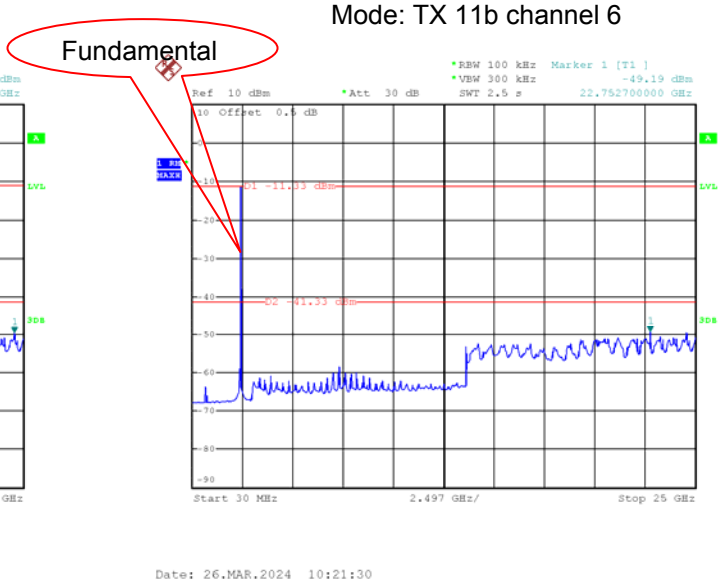
Date: 26.MAR.2024 13:46:54

Above 30MHz

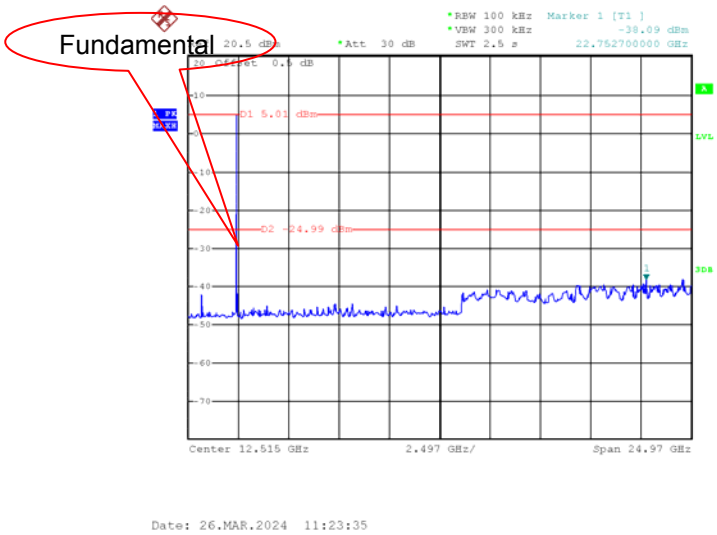
Mode: TX 11b channel 1



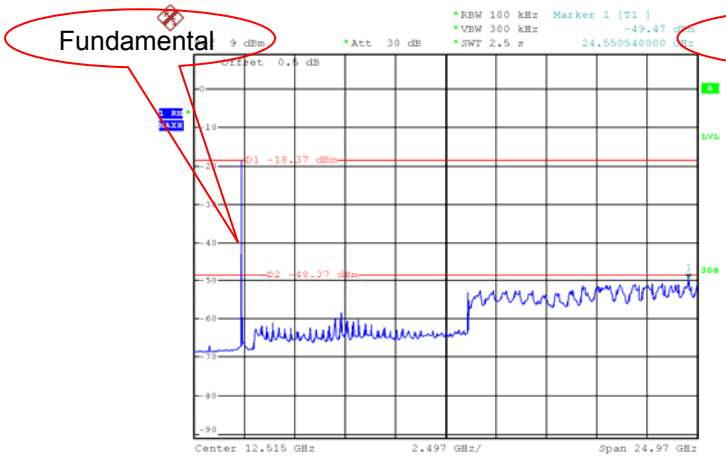
Mode: TX 11b channel 6



Mode: TX 11b channel 11

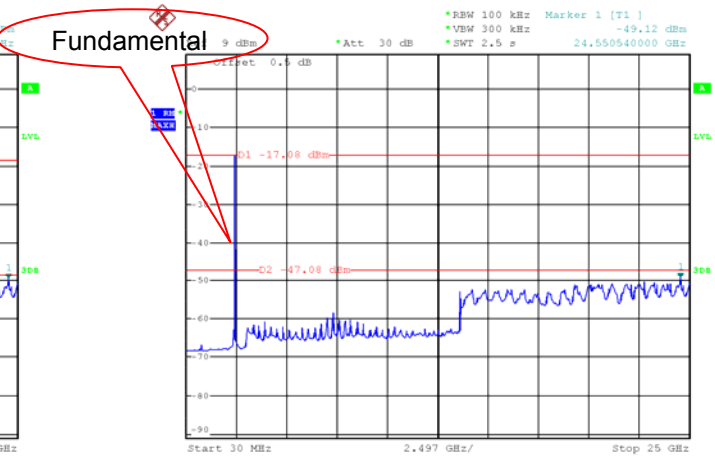


Mode: TX 11g channel 1



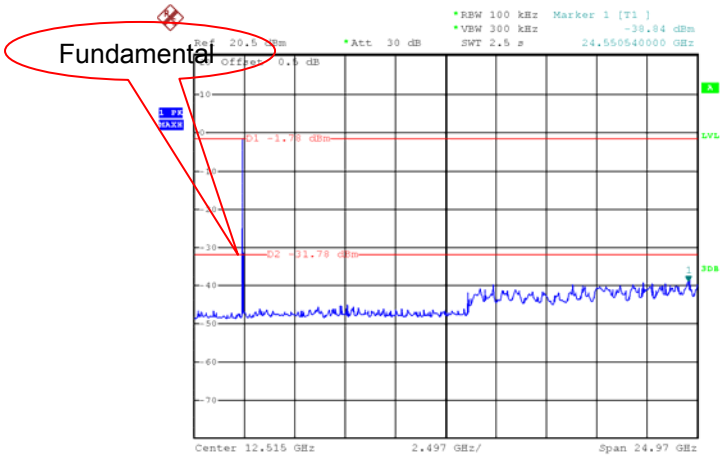
Date: 26.MAR.2024 13:18:34

Mode: TX 11g channel 6



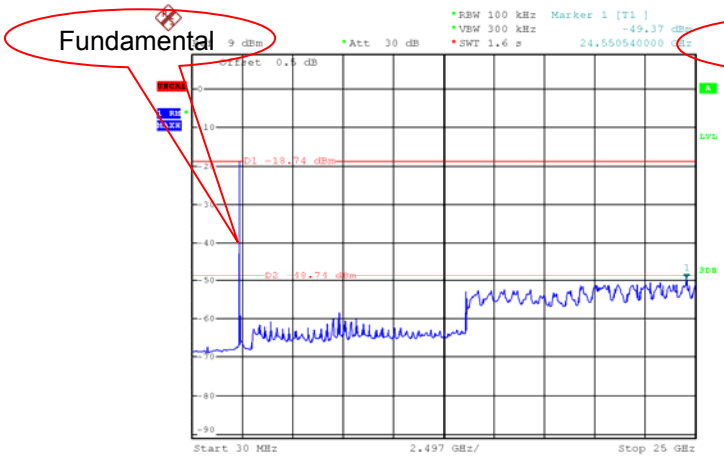
Date: 26.MAR.2024 13:16:23

Mode: TX 11g channel 11



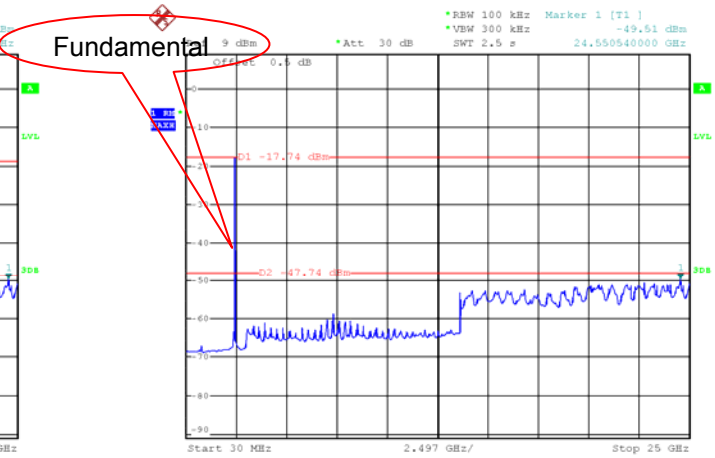
Date: 26.MAR.2024 11:26:34

Mode: TX 11n HT20 channel 1



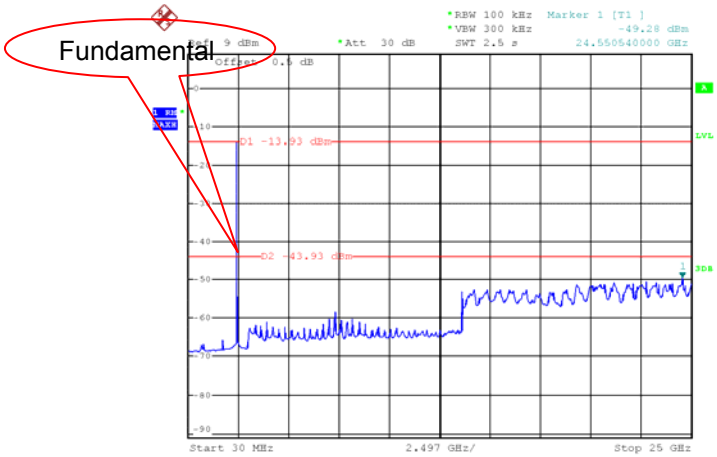
Date: 26.MAR.2024 13:24:50

Mode: TX 11 n HT20 channel 6



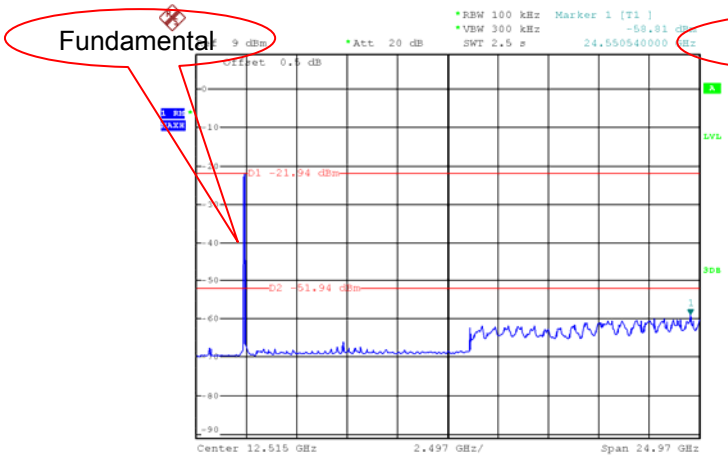
Date: 26.MAR.2024 13:26:42

Mode: TX 11 n HT20 channel 11



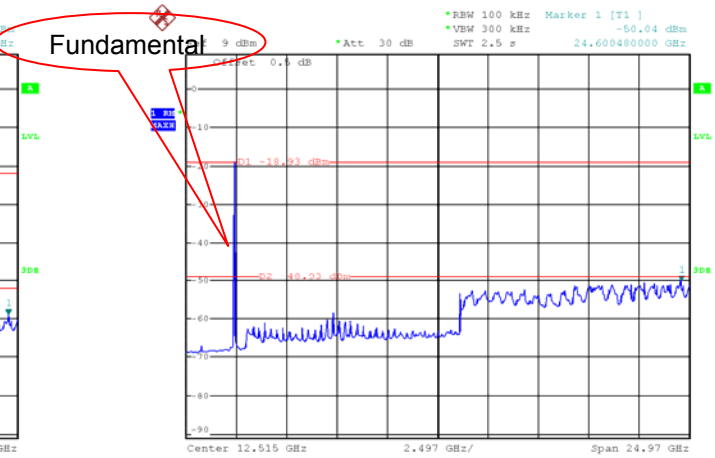
Date: 26.MAR.2024 13:31:35

Mode: TX 11n HT40 channel 3



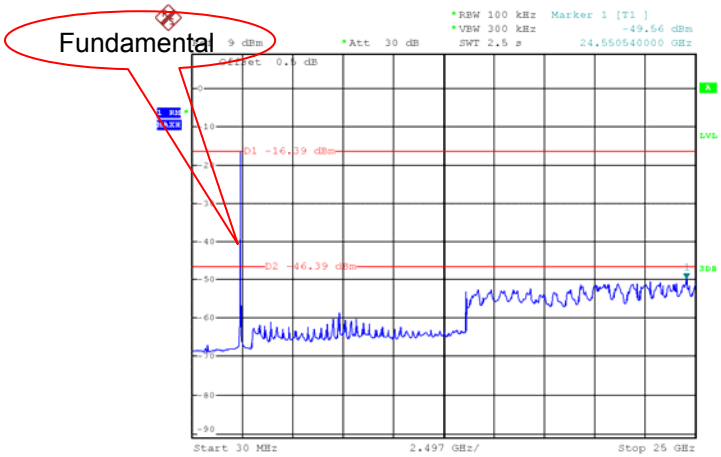
Date: 26.MAR.2024 13:37:59

Mode: TX 11 n HT40 channel 6



Date: 26.MAR.2024 13:34:03

Mode: TX 11 n HT40 channel 9



Date: 26.MAR.2024 13:32:56

10 Band Edge Measurement

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	Regulation 15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

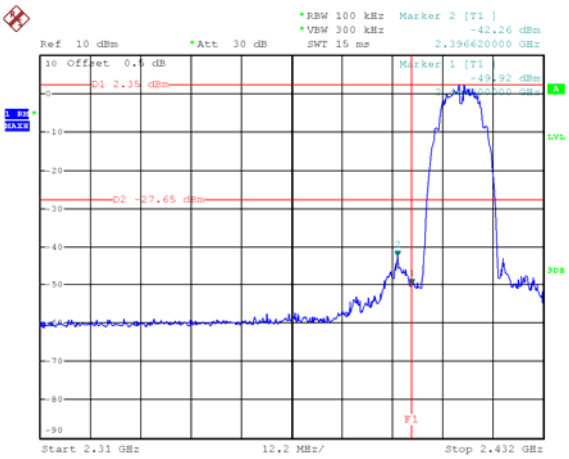
10.1 Test Produce

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

10.2 Test Result

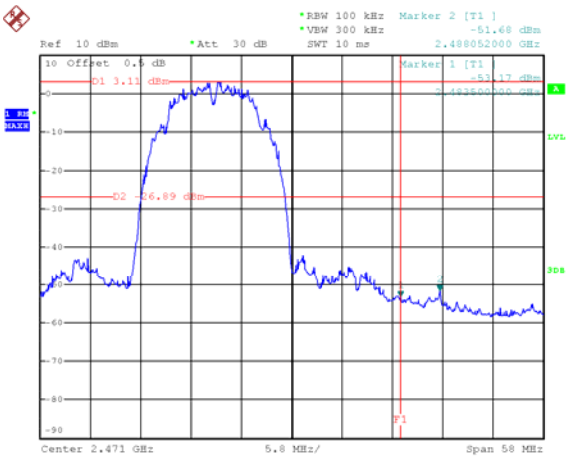
Test result plots shown as follows:

TX 11b: Band edge-left side



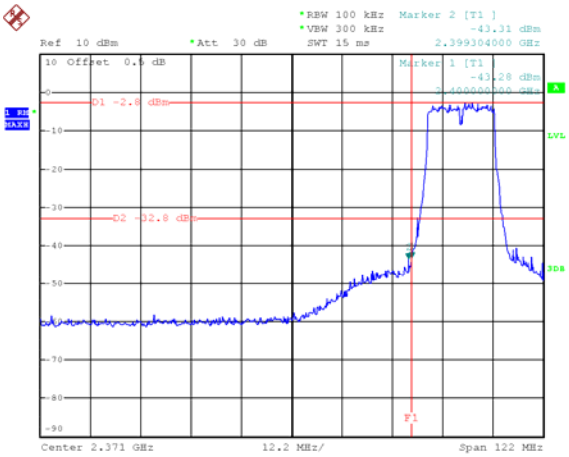
Date: 26.MAR.2024 10:13:30

TX 11b: Band edge-right side



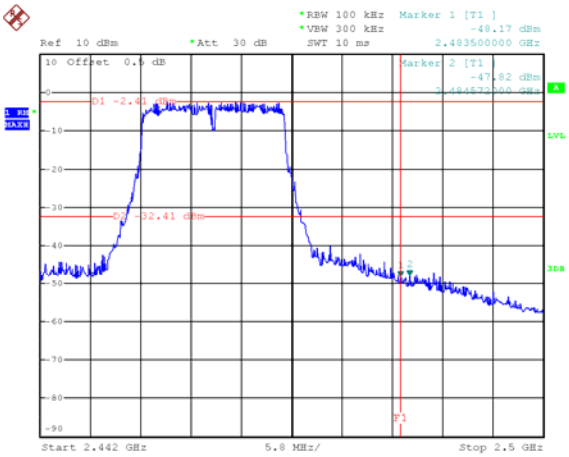
Date: 26.MAR.2024 10:11:30

TX 11g: Band edge-left side



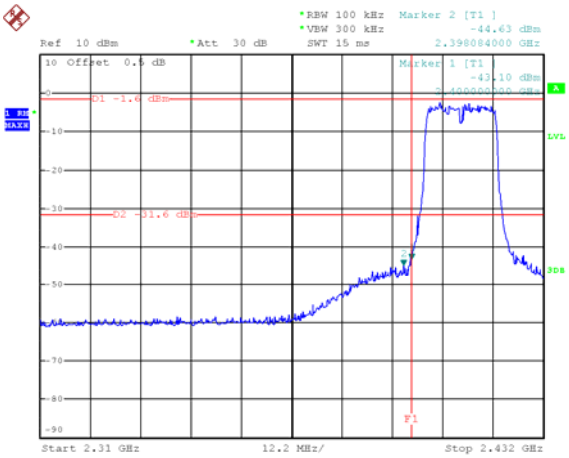
Date: 26.MAR.2024 10:05:53

TX 11g: Band edge-right side



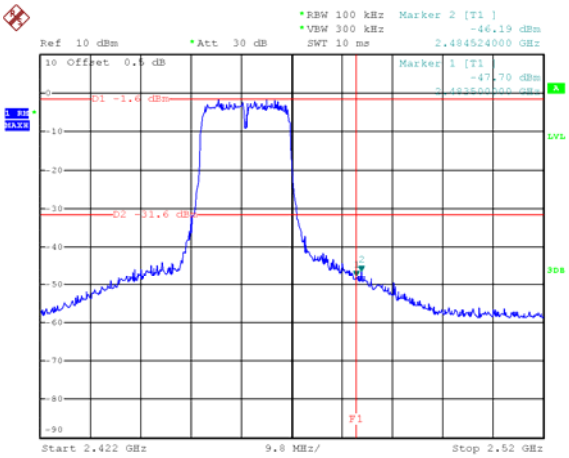
Date: 26.MAR.2024 10:08:54

TX 11n HT20: Band edge-left side



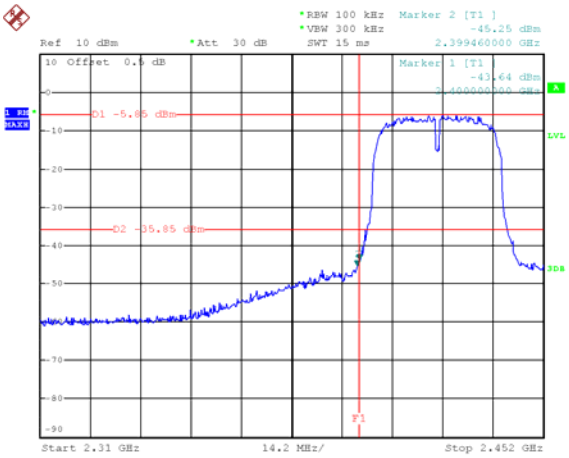
Date: 26.MAR.2024 10:04:25

TX 11n HT20: Band edge-right side



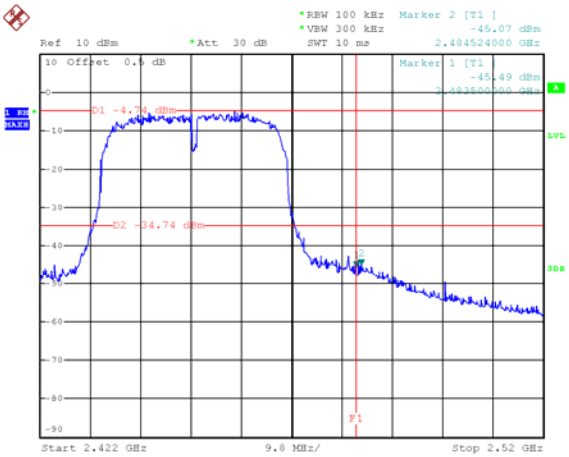
Date: 26.MAR.2024 10:02:05

TX 11n HT40: Band edge-left side



Date: 26.MAR.2024 09:57:37

TX 11n HT40: Band edge-right side



Date: 26.MAR.2024 09:59:58

11 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: 47CFR FCC Part15 Subpart C §15.247

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

Test Limit: §15.247(a)(2)
Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Mode: Transmitting

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: 1~5% of the OBW, VBW = 3 times the RBW

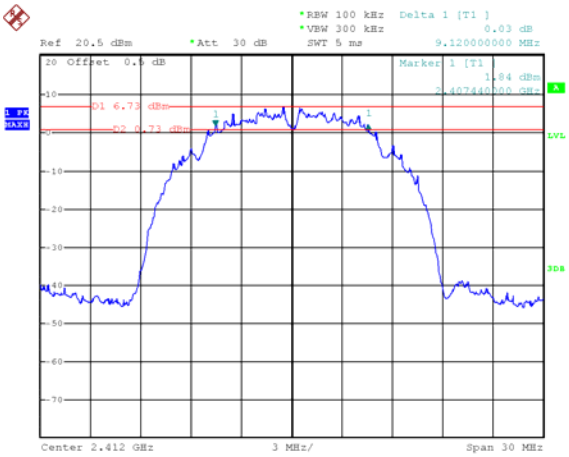
11.2 Test Result

Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX 11b	Channel 1	9.120	13.080
	Channel 6	9.060	13.080
	Channel 11	9.120	13.020
TX 11g	Channel 1	16.560	16.560
	Channel 6	16.500	16.560
	Channel 11	16.500	16.560
TX 11n HT20	Channel 1	17.400	17.340
	Channel 6	17.460	17.340
	Channel 11	17.460	17.400
TX 11n HT40	Channel 3	33.120	34.800
	Channel 6	33.120	34.800
	Channel 9	33.000	34.800

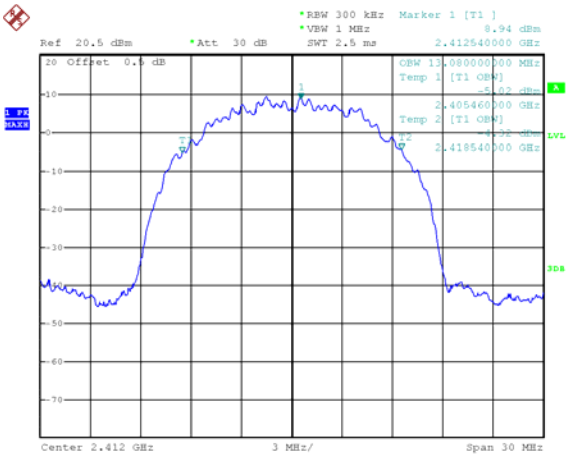
Test result plot:

6 dB Bandwidth 99% Bandwidth

Mode: TX 11b channel 1

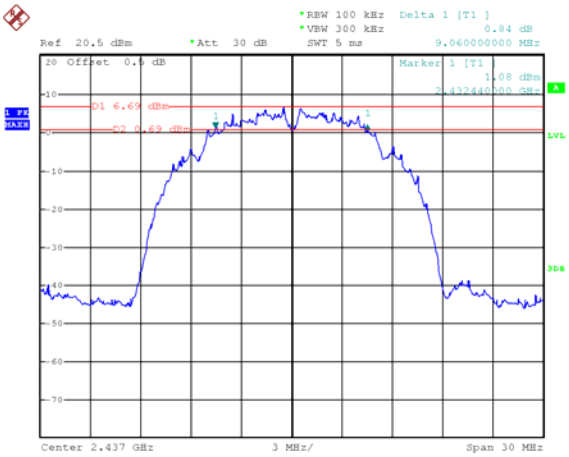


Date: 26.MAR.2024 08:56:59

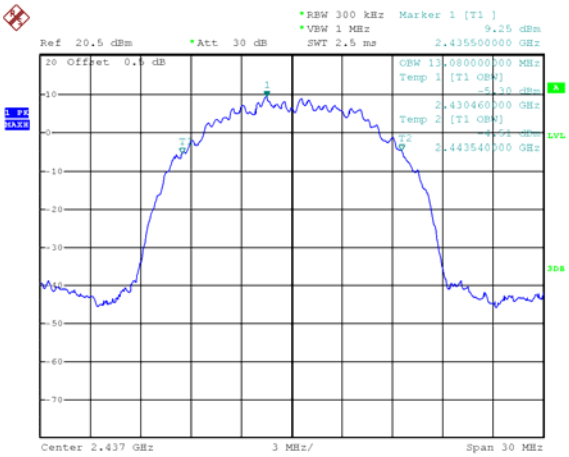


Date: 25.MAR.2024 17:25:02

Mode: TX 11b channel 6



Date: 26.MAR.2024 08:58:07

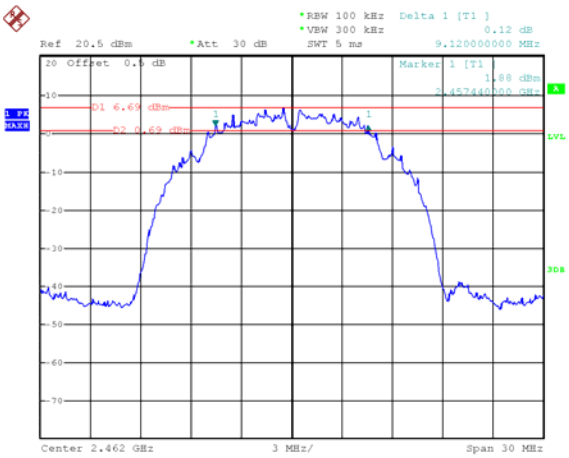


Date: 25.MAR.2024 17:24:20

6 dB Bandwidth

99% Bandwidth

Mode: TX 11b channel 11



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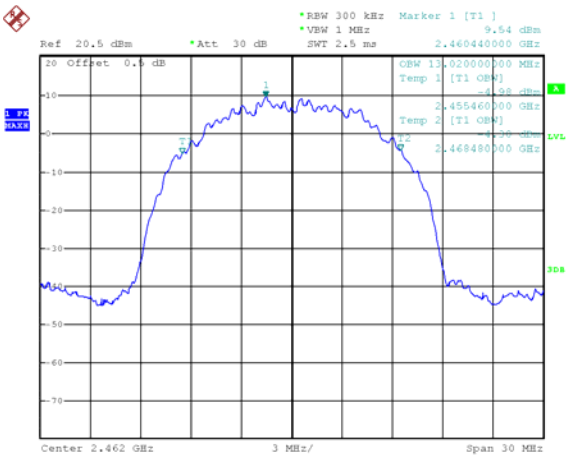
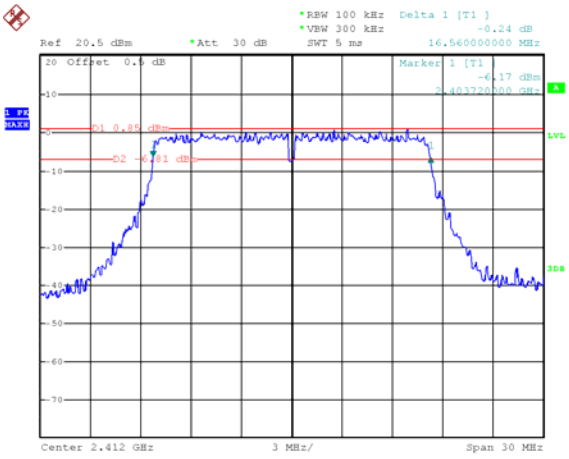
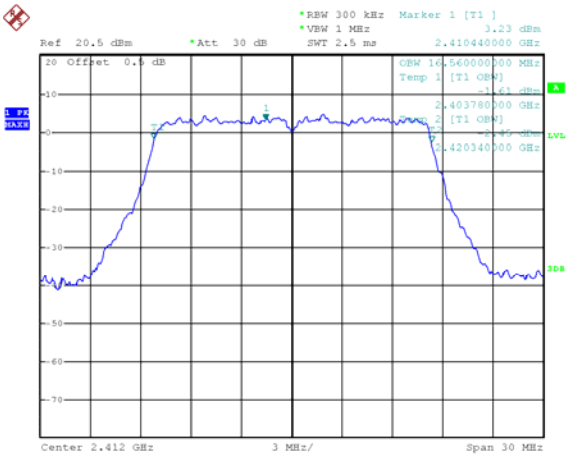


Date: 25.MAR.2024 17:23:26

Mode: TX 11g channel 1



Date: 26.MAR.2024 09:04:06

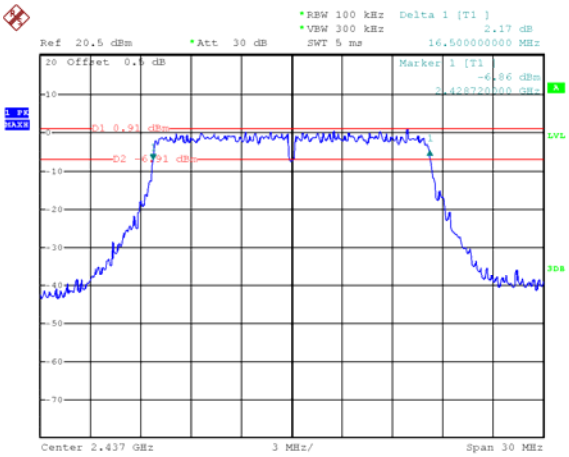


Date: 25.MAR.2024 17:25:53

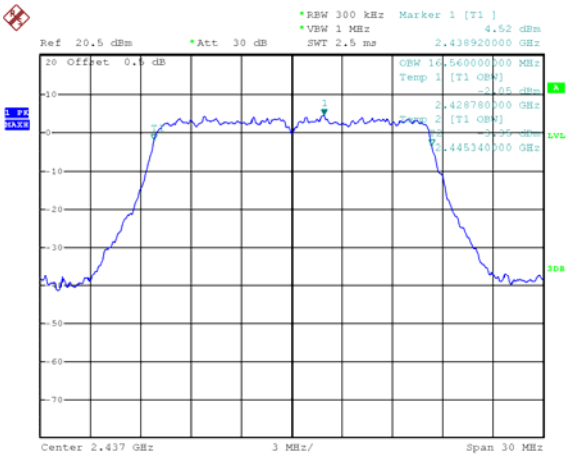
6 dB Bandwidth

99% Bandwidth

Mode: TX 11g channel 6

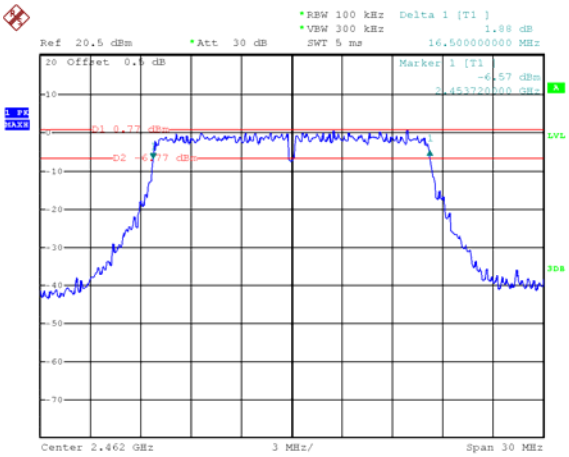


Date: 26.MAR.2024 09:02:51

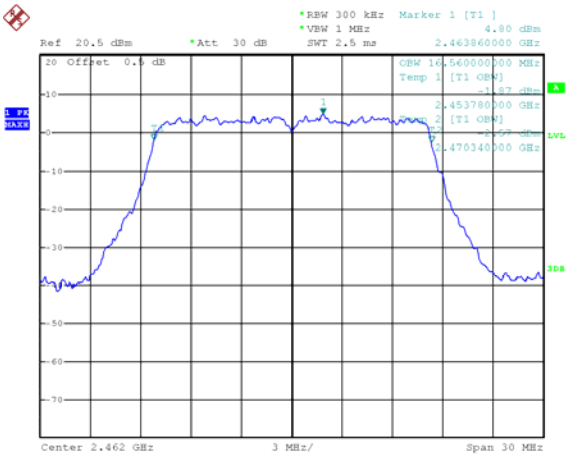


Date: 25.MAR.2024 17:26:34

Mode: TX 11g channel 11



Date: 26.MAR.2024 09:01:35

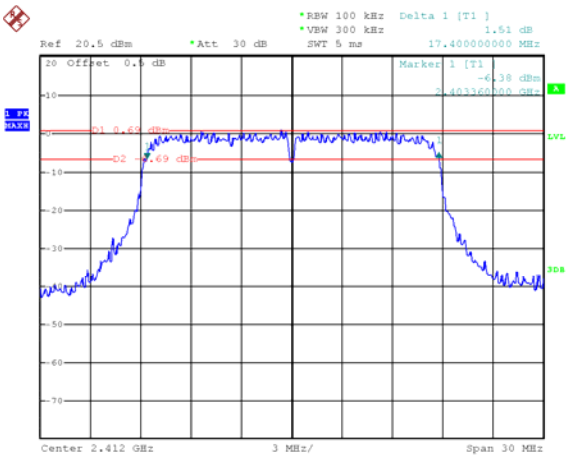


Date: 25.MAR.2024 17:27:30

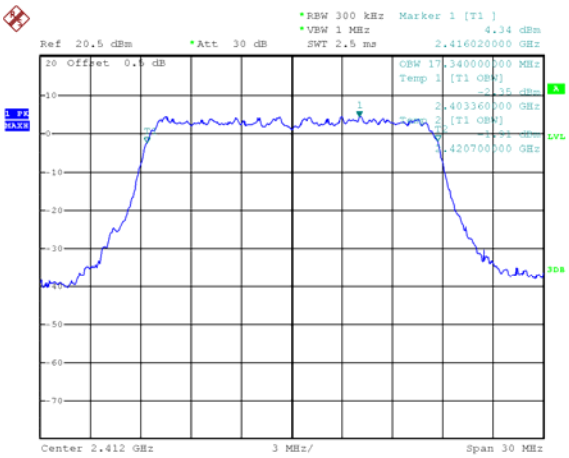
6 dB Bandwidth

99% Bandwidth

Mode: TX 11n HT20 channel 1

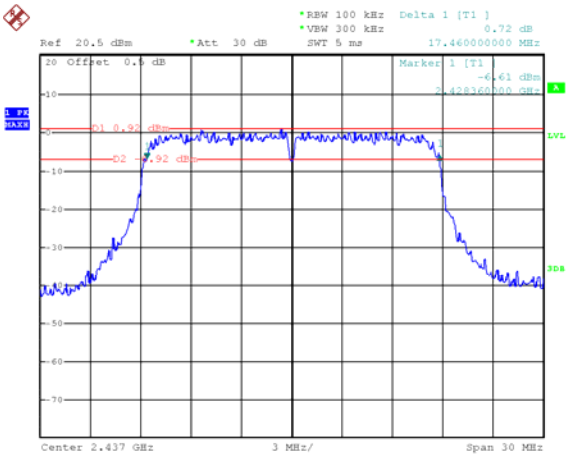


Date: 26.MAR.2024 09:05:46

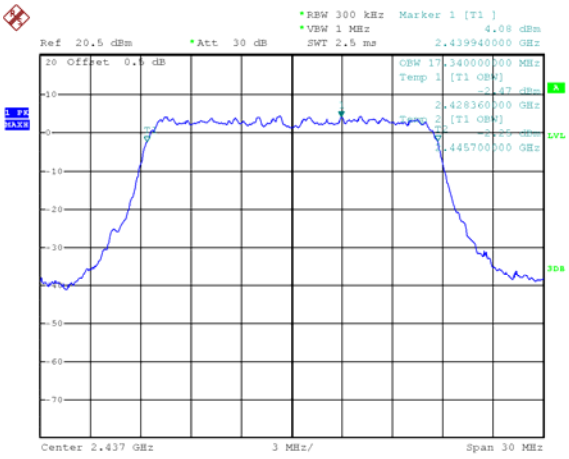


Date: 25.MAR.2024 17:31:07

Mode: TX 11n HT20 channel 6



Date: 26.MAR.2024 09:06:53

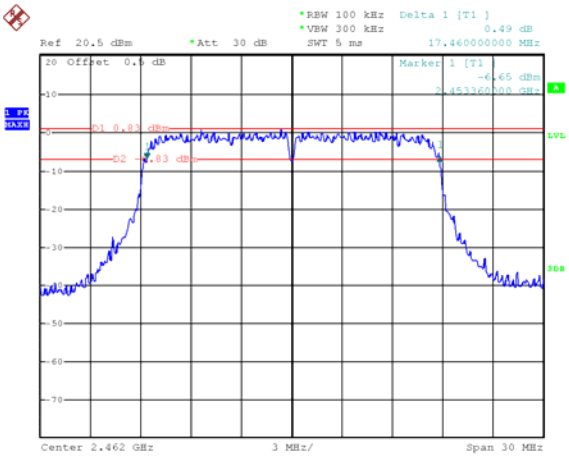


Date: 25.MAR.2024 17:30:14

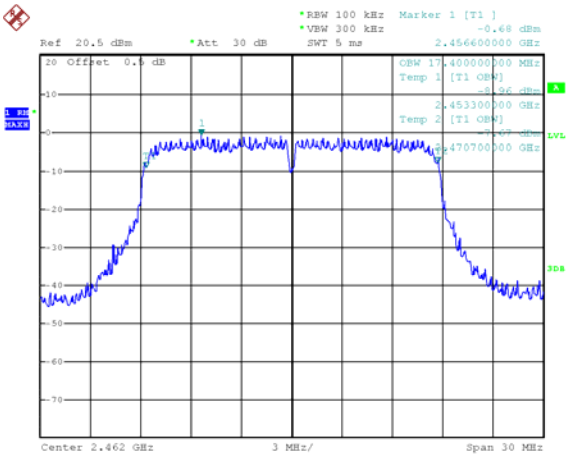
6 dB Bandwidth

99% Bandwidth

Mode: TX 11n HT20 channel 11

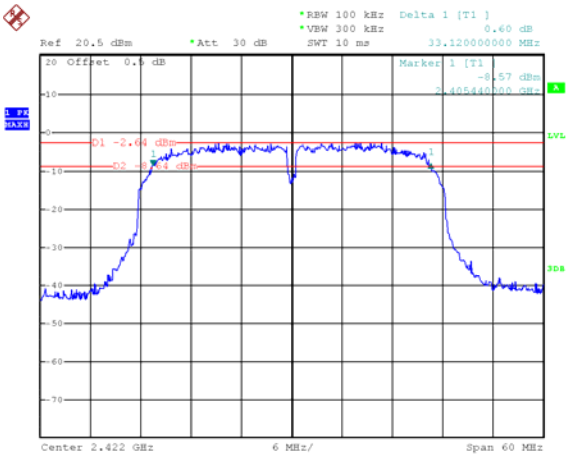


Date: 26.MAR.2024 09:07:56

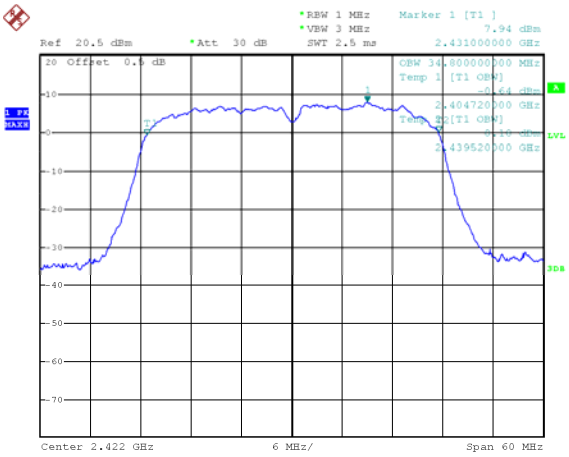


Date: 26.MAR.2024 09:38:25

Mode: TX 11n HT40 channel 3



Date: 26.MAR.2024 09:12:41

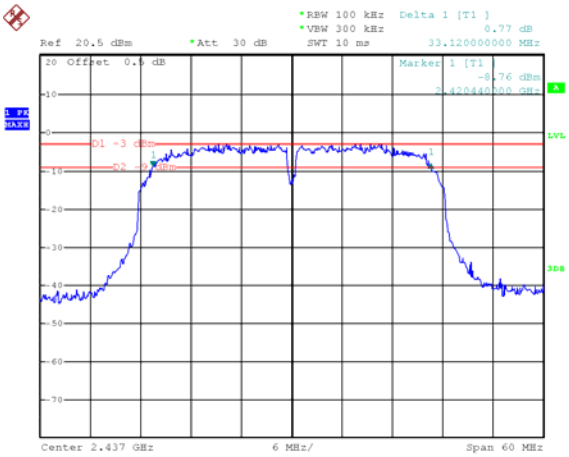


Date: 25.MAR.2024 17:32:27

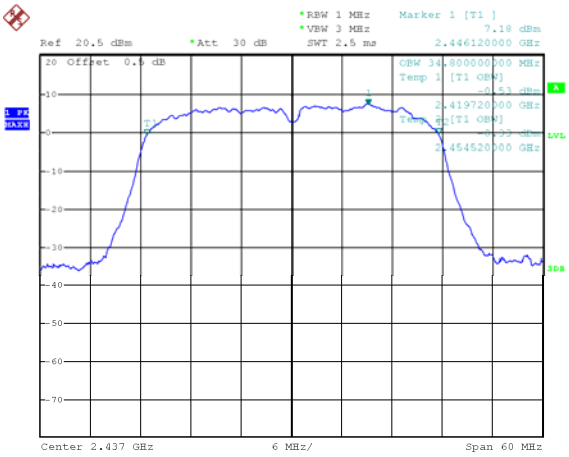
6 dB Bandwidth

99% Bandwidth

Mode: TX 11n HT40 channel 6

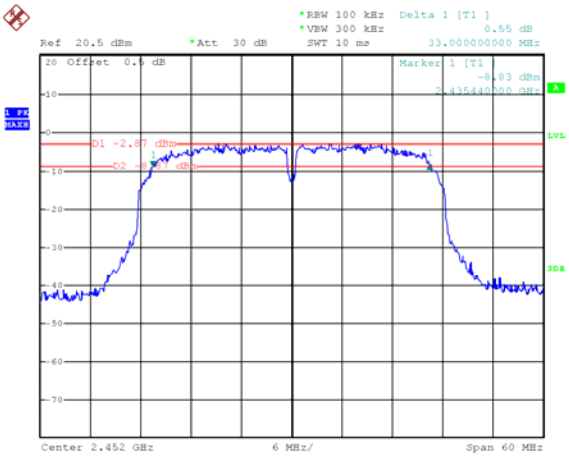


Date: 26.MAR.2024 09:11:22

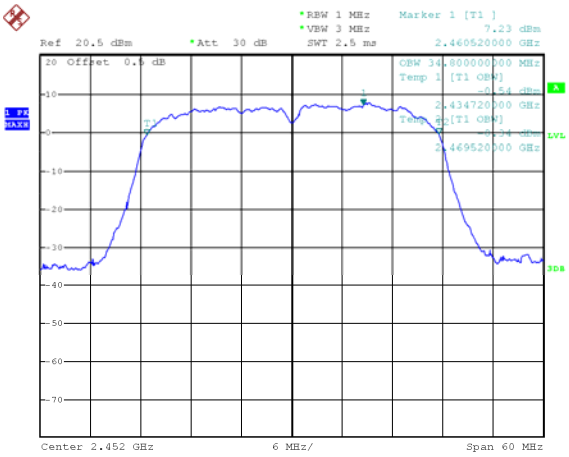


Date: 25.MAR.2024 17:33:26

Mode: TX 11n HT40 channel 9



Date: 26.MAR.2024 09:10:08



Date: 25.MAR.2024 17:34:14

12 Maximum Peak conducted Output Power

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	ANSI C63.10:2013 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	§15.247(b) The maximum peak conducted output power of the intentional radiator shall not exceed 1W.
Test Mode:	Transmitting

12.1 Test Procedure

According to KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019

Section 8.3.1.1 RBW ≥ DTS bandwidth

Subclause 11.9.1.1 of ANSI C63.10 is applicable.

Section 8.3.1.2 Integrated band power method

For measuring the output power of a device transmitting a wide-band noise-like signal where the peak power amplitude is a statistical parameter, the preferred methodology is to use an integrated average power measurement, as described in 8.3.2. The peak integrated band power method of 11.9.1 in ANSI C63.10 is not applicable.

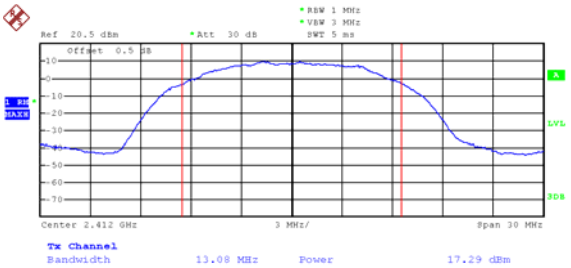
Subclause 11.9.2 of ANSI C63.10 is applicable.

12.2 Test Result

Operation mode	Channel Frequency (MHz)	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted Output Power (dBm)	Limit
TX 11b	Low-2412	17.29	3.46	20.75	1W/30dBm
	Middle-2437	17.32		20.78	1W/30dBm
	High-2462	17.34		20.80	1W/30dBm
TX 11g	Low-2412	15.94	5.24	21.18	1W/30dBm
	Middle-2437	15.91		21.15	1W/30dBm
	High-2462	15.80		21.04	1W/30dBm
TX 11n HT20	Low-2412	16.00	5.21	**21.21**	1W/30dBm
	Middle-2437	15.95		21.16	1W/30dBm
	High-2462	15.93		21.14	1W/30dBm
TX 11n HT40	Low-2422	15.68	5.21	20.89	1W/30dBm
	Middle-2437	15.39		20.60	1W/30dBm
	High-2452	15.36		20.57	1W/30dBm

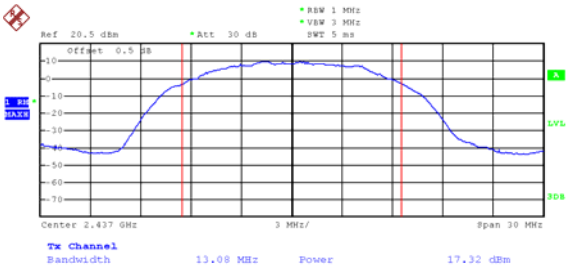
Test Plot:

Mode: TX 11b channel 1



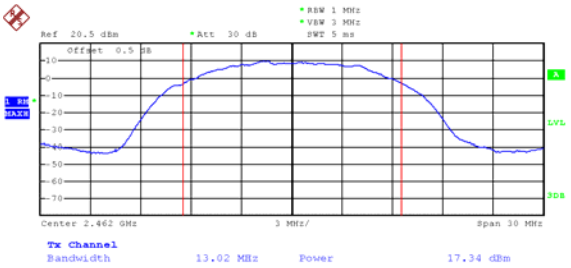
Date: 26.MAR.2024 09:35:30

Mode: TX 11b channel 6



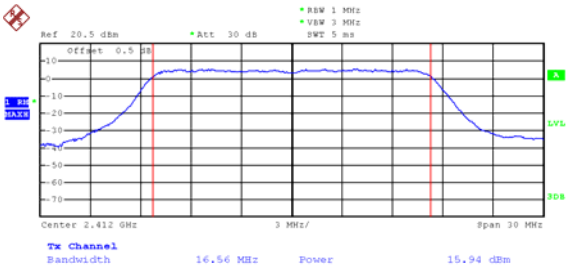
Date: 26.MAR.2024 09:34:56

Mode: TX 11b channel 11



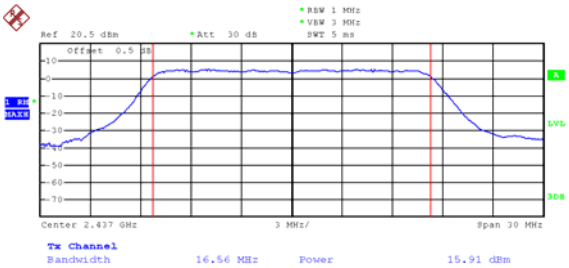
Date: 26.MAR.2024 09:36:31

Mode: TX 11g channel 1



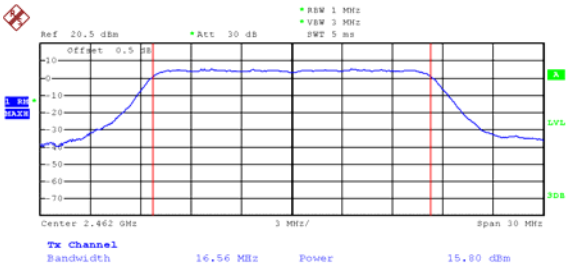
Date: 26.MAR.2024 09:31:03

Mode: TX 11g channel 6



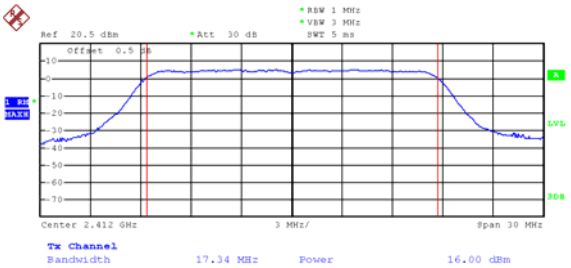
Date: 26.MAR.2024 09:32:11

Mode: TX 11g channel 11



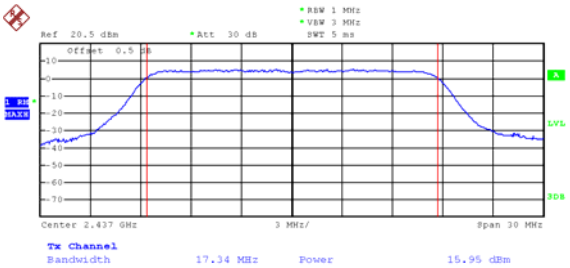
Date: 26.MAR.2024 09:32:47

Mode: TX 11n HT20 channel 1



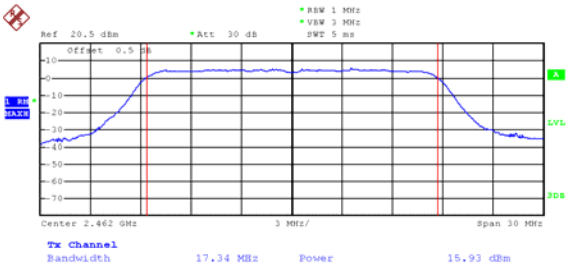
Date: 26.MAR.2024 09:26:21

Mode: TX 11n HT20 channel 6



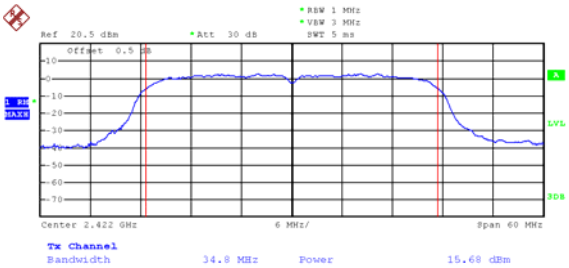
Date: 26.MAR.2024 09:27:09

Mode: TX 11n HT20 channel 11



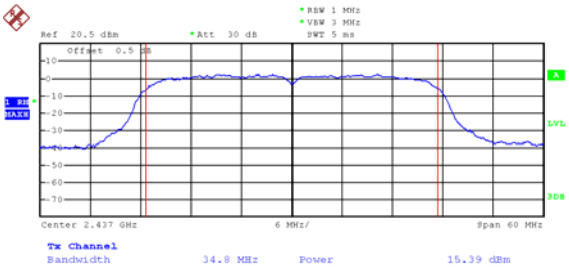
Date: 26.MAR.2024 09:27:47

Mode: TX 11n HT40 channel 3



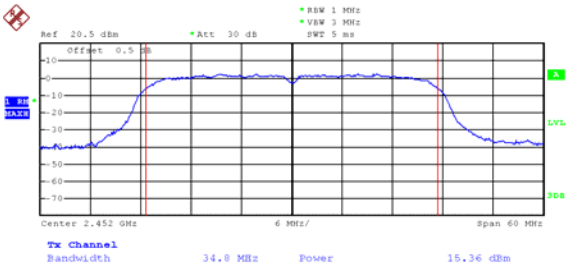
Date: 26.MAR.2024 09:22:02

Mode: TX 11n HT40 channel 6



Date: 26.MAR.2024 09:23:04

Mode: TX 11n HT40 channel 9



Date: 26.MAR.2024 09:24:12

13 Power Spectral density

Test Requirement:	47CFR FCC Part15 Subpart C §15.247
Test Method:	ANSI C63.10:2013 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	§15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
Test Mode:	Transmitting

13.1 Test Procedure

According to KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 section 8.4

Subclause 11.10 of ANSI C63.10 is applicable.

Choose the test procedure according to the product type

Peak PSD

Subclause 11.10.2 of ANSI C63.10 is applicable.

AVG PSD

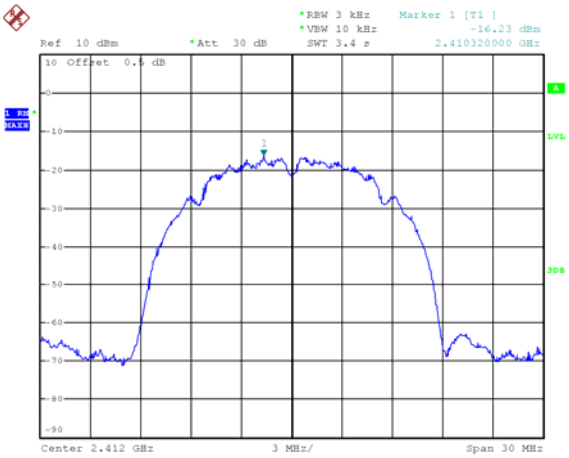
Subclause 11.10.3/4/5/6/7/8 of ANSI C63.10 is applicable.

13.2 Test Result

Operation mode	Channel Frequency (MHz)	Measurements (dBm per 3kHz)	Duty Cycle Factor (dB)	Power Spectral density (dBm per 3kHz)	Limit
TX 11b	Low-2412	-16.23	3.46	**-12.77**	8dBm per 3kHz
	Middle-2437	-16.64		-13.18	8dBm per 3kHz
	High-2462	-16.26		-12.80	8dBm per 3kHz
TX 11g	Low-2412	-20.47	5.24	-15.23	8dBm per 3kHz
	Middle-2437	-20.59		-15.35	8dBm per 3kHz
	High-2462	-20.70		-15.46	8dBm per 3kHz
TX 11n HT20	Low-2412	-20.43	5.21	-15.22	8dBm per 3kHz
	Middle-2437	-20.10		-14.89	8dBm per 3kHz
	High-2462	-20.76		-15.55	8dBm per 3kHz
TX 11n HT40	Low-2422	-24.32	5.21	-19.11	8dBm per 3kHz
	Middle-2437	-24.23		-19.02	8dBm per 3kHz
	High-2452	-24.66		-19.45	8dBm per 3kHz

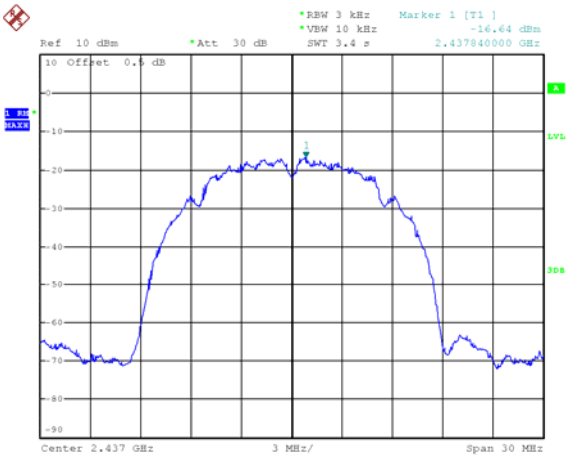
Test Plot:

Mode: TX 11b channel 1



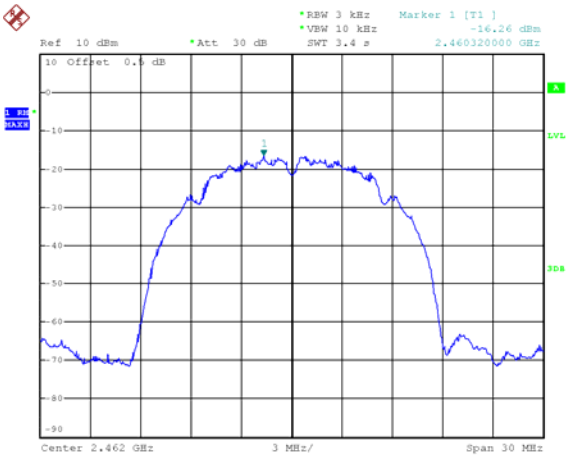
Date: 26.MAR.2024 09:42:32

Mode: TX 11b channel 6



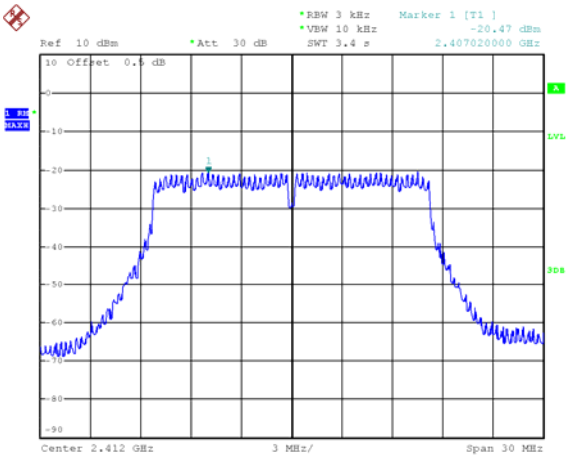
Date: 26.MAR.2024 09:43:04

Mode: TX 11b channel 11



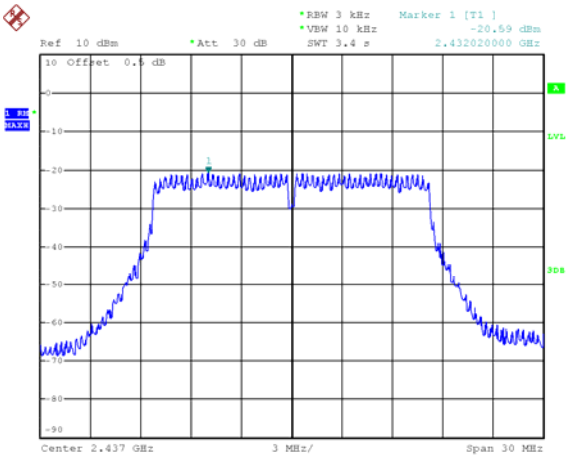
Date: 26.MAR.2024 09:43:43

Mode: TX 11g channel 1



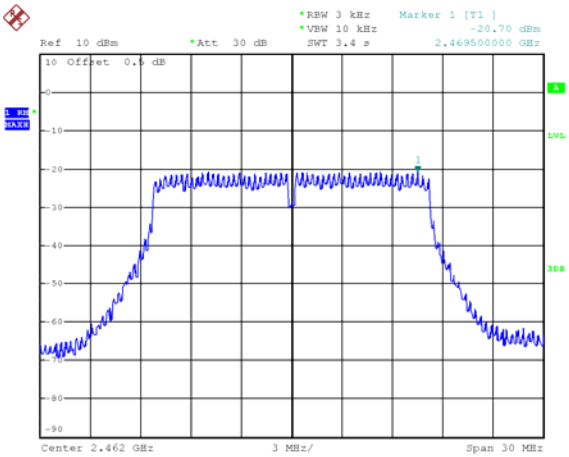
Date: 26.MAR.2024 09:45:58

Mode: TX 11g channel 6



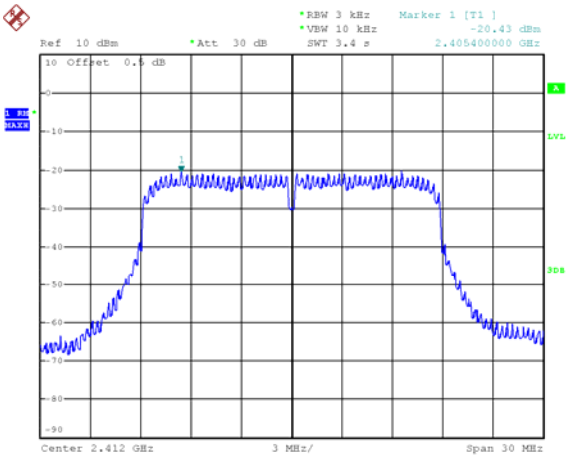
Date: 26.MAR.2024 09:45:18

Mode: TX 11g channel 11



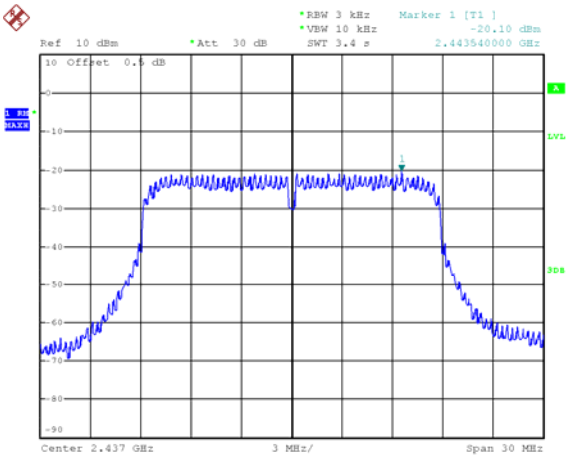
Date: 26.MAR.2024 09:44:32

Mode: TX 11n HT20 channel 1



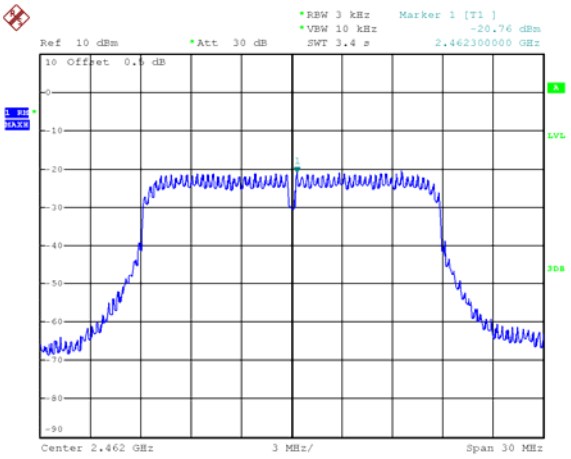
Date: 26.MAR.2024 09:46:58

Mode: TX 11n HT20 channel 6



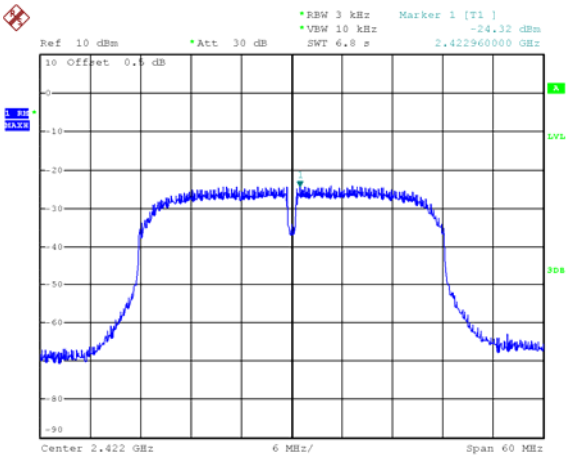
Date: 26.MAR.2024 09:47:40

Mode: TX 11n HT20 channel 11



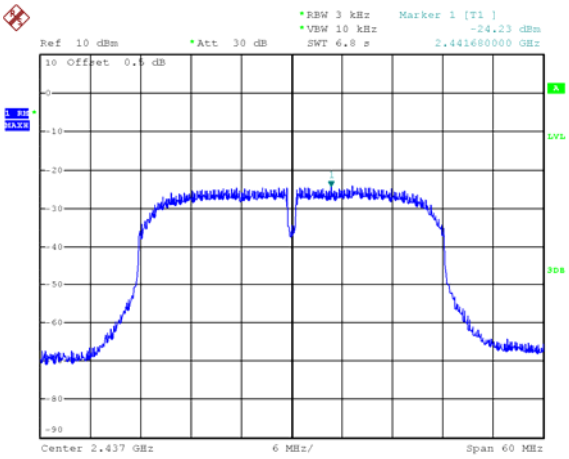
Date: 26.MAR.2024 09:48:13

Mode: TX 11n HT40 channel 3



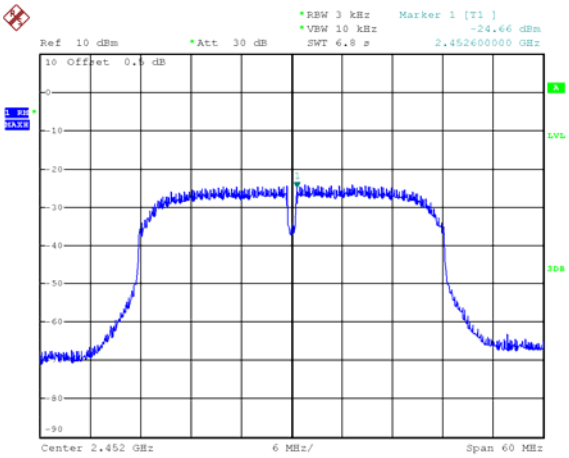
Date: 26.MAR.2024 09:51:19

Mode: TX 11n HT40 channel 6



Date: 26.MAR.2024 09:50:30

Mode: TX 11n HT40 channel 9



Date: 26.MAR.2024 09:49:42

14 Antenna Requirement

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

Note: Please refer to EUT photos for more details.

15 RF Exposure

Note: Please refer to RF Exposure Report: WTD24D03055963W003.

16 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-BTS-U2-Photos.

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