RADIO TEST REPORT

Product	:	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module
Model Name	:	WNFB-265AXI(BT)
Series Model	:	AP12275_M2P
FCC ID	:	RYK-WNFB265AXIBT
Test Regulation	:	FCC 47 CFR Part 15 Subpart E (Section 15.407)
Received Date	:	Jul. 22, 2020
Test Date	:	Nov. 16, 2020 ~ Jan. 29, 2021
Issued Date	:	Feb. 24, 2021
Applicant	:	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

REVISION HISTORY

Original Test Report No.: 4789558390-US-R1-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4789558390-US-R1-V0	Feb. 24, 2021	-	Initial issue

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1. Attestation of Test Results

APPLICANT:	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
MANUFACTURER	SparkLAN Communications, Inc. 8F., No.257, Sec. 2, Tiding Blvd., Neihu District, Taipei City 11493, Taiwan (R.O.C.)
EUT DESCRIPTION:	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module
MODEL:	WNFB-265AXI(BT)
SERIES MODEL:	AP12275_M2P
SAMPLE STAGE:	Identical Prototype
DATE of TESTED:	Nov. 16, 2020 ~ Jan. 29, 2021

APPLICABLE STANDARDS	
STANDARD	**Test Results**
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : Feb. 24, 2021
Project Handler

Approved and Authorized By:

Waternil Guan Date : Feb. 24, 2021
Engineer

2. Summary of Test Results

Summary of Test Results		
FCC Clause	**Test Items**	**Result**
15.407(e)	6dB Bandwidth	PASS
15.403(i)	26dB Bandwidth	PASS
2.1049	Occupied Bandwidth	See Note2
15.407(a)(1/2/3)	Conducted Output Power	PASS
15.407(a)(1/2/3)	Power Spectral Density	PASS
15.407(g)	Frequency Stability	PASS
15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS
15.407(b)(6)	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS
15.407(h)	Dynamic Frequency Selection	See Note3

Note:
1. For the Radiated Band Edge and OOBE test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.
2. The Occupied Bandwidth was reference only.
3. The "Dynamic Frequency Selection measurement" was recorded in Report No.: 4789558390-US-R2-V0.

3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.5
RF Conducted	9 kHz - 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz - 30 MHz	2	1.9
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.4
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.7

6. Equipment under Test

6.1. Description of EUT

Product	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module	
Model Name	WNFB-265AXI(BT)	
Series Model	AP12275_M2P	
Operating Frequency	5180 ~ 5240 MHz, 5260 ~ 5320 MHz, 5500 ~ 5720 MHz, 5745 ~ 5825 MHz	
Modulation	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK	
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to MCS15 802.11ac: up to MCS9 802.11ax: up to HE11	
Number of Channel	5180 ~ 5240 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5260 ~ 5320 MHz	4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
	5500 ~ 5720 MHz	12 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		6 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		3 for 802.11ac (VHT80), 802.11ax (HE80),

Number of Channel	5745 ~ 5825 MHz	5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20)
		2 for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40)
		1 for 802.11ac (VHT80), 802.11ax (HE80)
Maximum Output Power	Non-Beamforming mode: 5180 ~ 5240 MHz: 18.45 dBm 5260 ~ 5320 MHz: 18.49 dBm 5500 ~ 5720 MHz: 18.42 dBm 5745 ~ 5825 MHz: 18.49 dBm Beamforming mode: 5180 ~ 5240 MHz: 17.9 dBm 5260 ~ 5320 MHz: 17.88 dBm 5500 ~ 5720 MHz: 17.92dBm 5745 ~ 5825 MHz: 17.87 dBm	
Normal Voltage	3.3 Vdc	
S/N	20B65E2100031	
Software Version	N/A	

Note:

1. The models difference table as below:

Brand	Model	Difference
SparkLAN	WNFB-265AXI(BT)	-
Ampak	AP12275_M2P	Same as WNFB-265AXI(BT), marketing purpose only.

*Except above change, there are no change to technical construction that is included circuit diagram, PCB Layout, components and component layout, all electrical construction and mechanical construction.

2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11a	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX
802.11ac (VHT20)	2TX,2RX
802.11ac (VHT40)	2TX,2RX
802.11ac (VHT80)	2TX,2RX
802.11ax (HE20)	2TX,2RX
802.11ax (HE40)	2TX,2RX
802.11ax (HE80)	2TX,2RX

* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40 / VHT80 and 802.11ax mode for HE20 / HE40 / HE80, therefore investigated worst case to representative mode in test report.

3. Since the 802.11ax is the worst case, so the peak output power of 802.11n/ac will quote the value of 802.11ax.

4. The EUT contains following accessory devices.

Product	Brand	Model	Description
Dipole Antenna 1	SparkLAN	AD-103AG	2.4GHz: 2.02dBi 5GHz: 2.03dBi RP-SMA
Dipole Antenna 2	SparkLAN	AD-302N	2.4GHz: 3.14dBi 5GHz: 2.73dBi RP-SMA
Dipole Antenna 3	SparkLAN	AD-303N	2.4GHz: 3.14dBi 5GHz: 3.24dBi RP-SMA

5. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

6.2. Channel List

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
42	5210MHz

FOR 5260 ~ 5320MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
58	5290MHz

FOR 5500 ~ 5720MHz

12 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

6 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency	Channel	Frequency
106	5530MHz	138	5690MHz
122	5610MHz	-	-

FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	-	-

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80), 802.11ax (HE80):

Channel	Frequency
155	5775MHz

6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	23~26°C / 63~68%RH	120Vac / 60 Hz	Nov. 16, 2020 ~ Jan. 29, 2021	Mike Cai
Radiated Spurious Emission	966-2	22~26°C / 62~68%RH	120Vac / 60 Hz	Dec. 6, 2020 ~ Jan. 29, 2021	Mike Cai
AC power Line Conducted Emission	SR1	23~25°C / 63~68%RH	120Vac / 60 Hz	Dec. 6, 2020 ~ Jan. 29, 2021	Mike Cai

FCC Test Firm Registration Number: 498077

6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)	SparkLAN	AD-103AG	Dipole	2.4GHz: 2.02 5GHz: 2.03	Length of Antenna cable:150mm Connector type of Antenna cable: I-PEX/MHF4 to RP-SMA(F)
2	Chain (0)+(1)	SparkLAN	AD-302N	Dipole	2.4GHz: 3.14 5GHz: 2.73	
3	Chain (0)+(1)	SparkLAN	AD-303N	Dipole	2.4GHz: 3.14 5GHz: 3.24	

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

6.5. Test Mode Applicability and Tested Channel Detail

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For AC power line conducted emissions, the pre-scan has been determined by AC power 120Vac/60Hz (worst case)
- The antennas No.2/ No.3 has the highest gain, therefore, the fundamental of the EUT was investigated in two antennas, it was determined antenna No.3 was worst-case, the Antenna No.3 was selected for the final test.

Non-Beamforming mode:

Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ax20		OFDM/ OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ax20		OFDM/ OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11a	5500-5720	OFDM	100 to 144	100,116,140,144	6Mbps
	802.11ax20		OFDM/ OFDMA	100 to 144	100,116,140,144	HE0
	802.11ax40			102 to 142	102, 110, 134,142	HE0
	802.11ax80			106, 122,138	106, 122,138	HE0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ax20		OFDM/ OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0
Radiated Emissions (Below 1GHz)	802.11a	5180-5240	OFDM	36 to 48	36	6Mbps
AC Power Line Conducted Emission	802.11a	5180-5240	OFDM	36 to 48	36	6Mbps

Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11a	5180-5240	OFDM	36 to 48	36, 44, 48	6Mbps
	802.11ax20		OFDM/ OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11a	5260-5320	OFDM	52 to 64	52, 60, 64	6Mbps
	802.11ax20		OFDM/ OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11a	5500-5720	OFDM	100 to 144	100,116,140,144	6Mbps
	802.11ax20		OFDM/ OFDMA	100 to 144	100,116,140,144	HE0
	802.11ax40			102 to 142	102, 110, 134,142	HE0
	802.11ax80			106, 122,138	106, 122,138	HE0
	802.11a	5745-5825	OFDM	149 to 165	149, 157, 165	6Mbps
	802.11ax20		OFDM/ OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0

Beamforming mode:

Test item	Mode	Frequency Band (MHz)	Modulation Technology	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11ax20	5180-5240	OFDM/ OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11ax20	5260-5320	OFDM/ OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11ax20	5500-5720	OFDM/ OFDMA	100 to 144	100,116,140,144	HE0
	802.11ax40			102 to 142	102, 110, 134,142	HE0
	802.11ax80			106, 122,138	106, 122,138	HE0
	802.11ax20	5745-5825	OFDM/ OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0
Radiated Emissions (Below 1GHz)	802.11ax20	5180-5240	OFDM	36 to 48	36	HE0
AC Power Line Conducted Emission	802.11ax20	5180-5240	OFDM	36 to 48	36	HE0
Antenna Port Conducted Measurement	802.11ax20	5180-5240	OFDM/ OFDMA	36 to 48	36, 44, 48	HE0
	802.11ax40			38 to 46	38, 46	HE0
	802.11ax80			42	42	HE0
	802.11ax20	5260-5320	OFDM/ OFDMA	52 to 64	52, 60, 64	HE0
	802.11ax40			54 to 62	54, 62	HE0
	802.11ax80			58	58	HE0
	802.11ax20	5500-5720	OFDM/ OFDMA	100 to 144	100,116,140,144	HE0
	802.11ax40			102 to 142	102, 110, 134,142	HE0
	802.11ax80			106, 122,138	106, 122,138	HE0
	802.11ax20	5745-5825	OFDM/ OFDMA	149 to 165	149, 157, 165	HE0
	802.11ax40			151 to 159	151, 159	HE0
	802.11ax80			155	155	HE0

6.6. Duty cycle

Non-Beamforming mode

802.11a:

Duty cycle = 1.11/1.23 = 0.902, Duty factor(dB) = 10 * log(1/0.902) = 0.45 dB

802.11ax (HE20):

OFDM: Duty cycle = 0.83/0.94 = 0.883, Duty factor(dB) = 10 * log(1/0.883) = 0.55 dB
OFDMA: Duty cycle = 3.92/4.96 = 0.79, Duty factor(dB) = 10 * log(1/0.79) = 1.03 dB

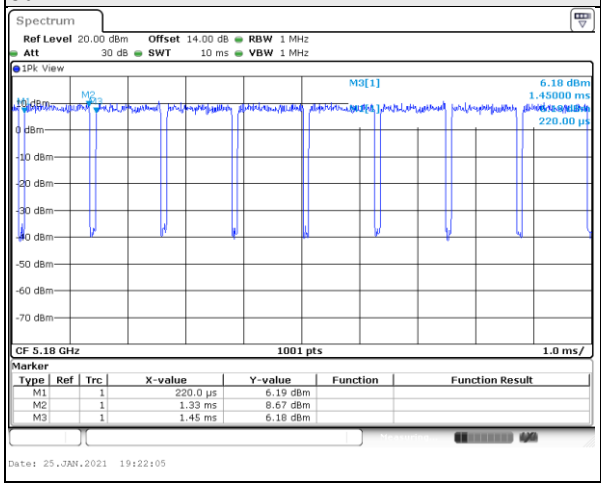
802.11ax (HE40):

OFDM: Duty cycle = 0.41/0.54 = 0.759, Duty factor(dB) = 10 * log(1/0.759) = 1.2 dB
OFDMA: Duty cycle = 1.95/3 = 0.65, Duty factor(dB) = 10 * log(1/0.65) = 1.88 dB

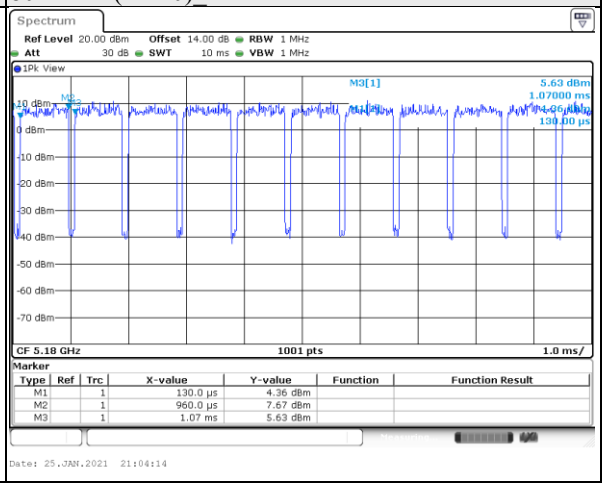
802.11ax (HE80):

OFDM: Duty cycle = 0.2/0.35 = 0.571, Duty factor(dB) = 10 * log(1/0.571) = 2.44 dB
OFDMA: Duty cycle = 0.95/2 = 0.475, Duty factor(dB) = 10 * log(1/0.475) = 3.24 dB

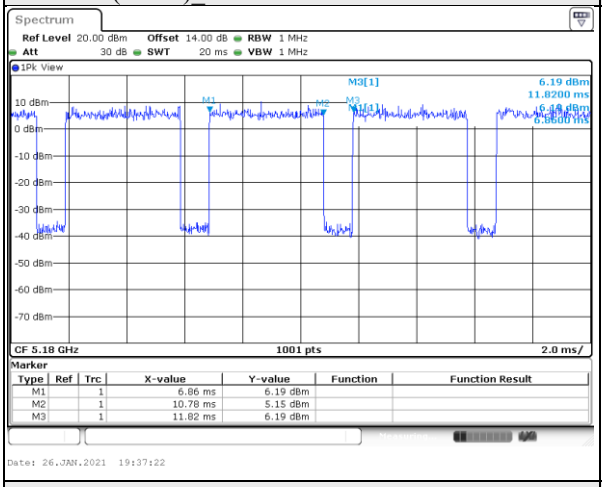
802.11a



802.11ax (HE20)_OFDM



802.11ax (HE20)_OFDMA



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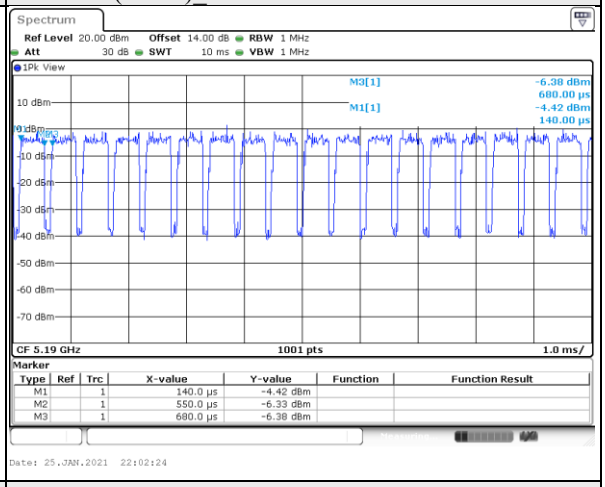
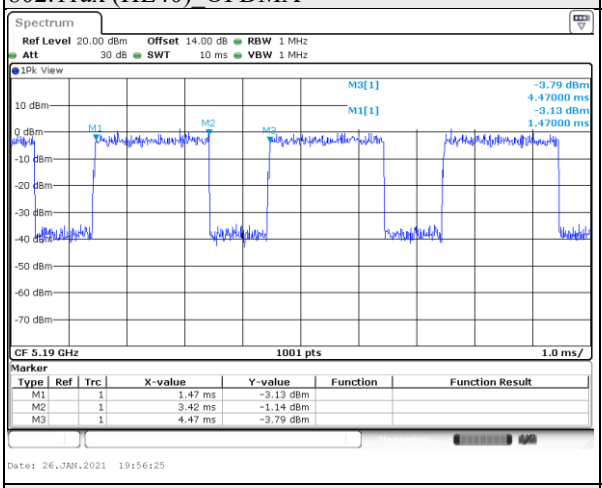
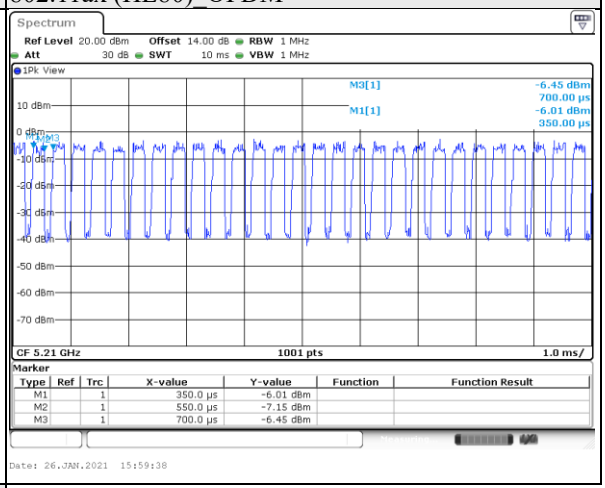


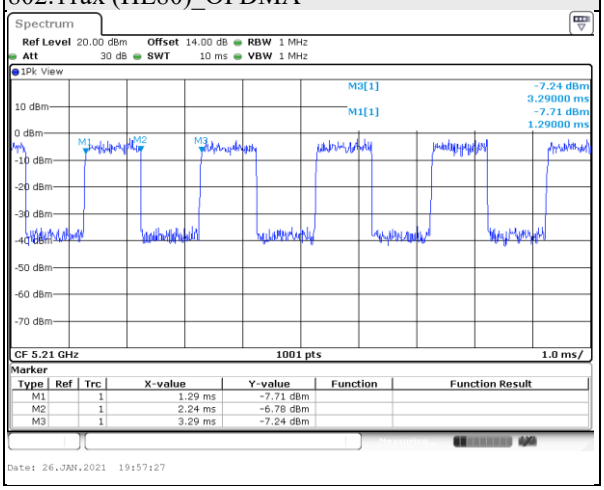
802.11ax (HE40)_OFDMA



802.11ax (HE80)_OFDM



802.11ax (HE80)_OFDMA



Beamforming mode

802.11ax (HE20):

OFDM: Duty cycle = 0.83/0.94 = 0.883, Duty factor(dB) = 10 * log(1/0.883) = 0.55 dB

OFDMA: Duty cycle = 3.88/4.96 = 0.782, Duty factor(dB) = 10 * log(1/0.782) = 1.07 dB

802.11ax (HE40):

OFDM: Duty cycle = 0.41/0.55 = 0.745, Duty factor(dB) = 10 * log(1/0.745) = 1.28 dB

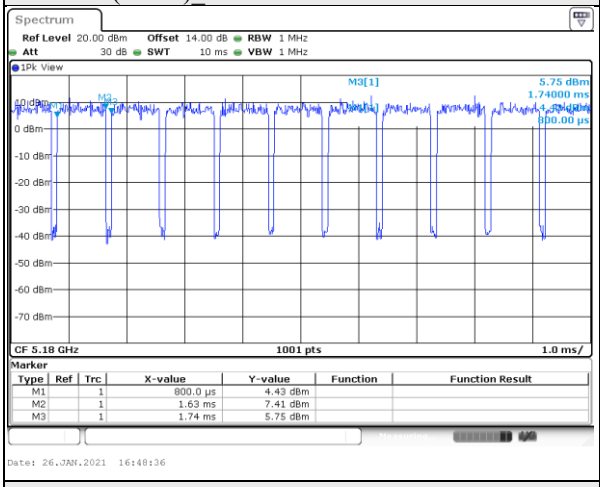
OFDMA: Duty cycle = 1.97/3.01 = 0.654, Duty factor(dB) = 10 * log(1/0.654) = 1.85 dB

802.11ax (HE80):

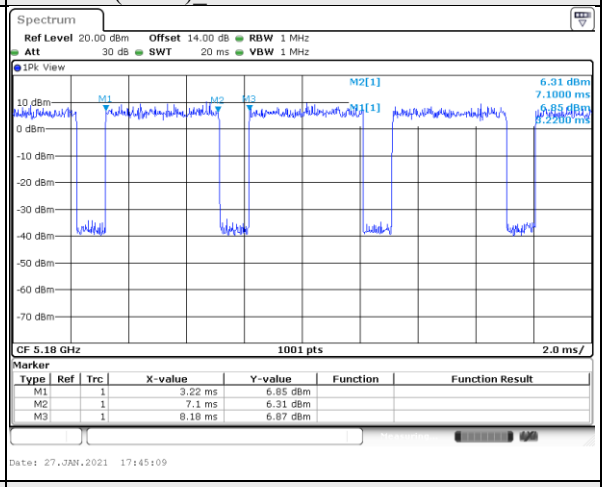
OFDM: Duty cycle = 0.21/0.35 = 0.6, Duty factor(dB) = 10 * log(1/0.6) = 2.22 dB

OFDMA: Duty cycle = 0.95/2 = 0.475, Duty factor(dB) = 10 * log(1/0.475) = 3.24 dB

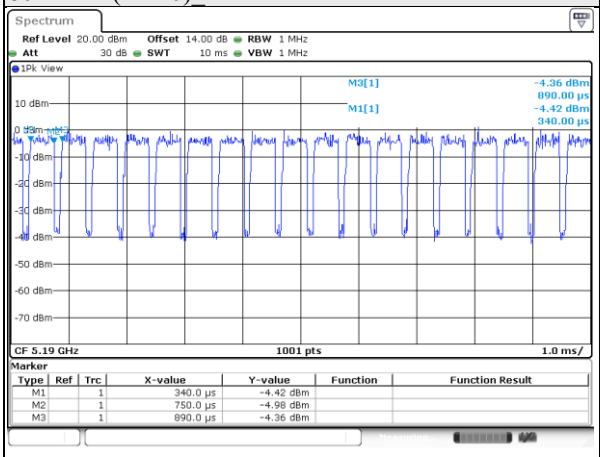
802.11ax (HE20)_OFDM



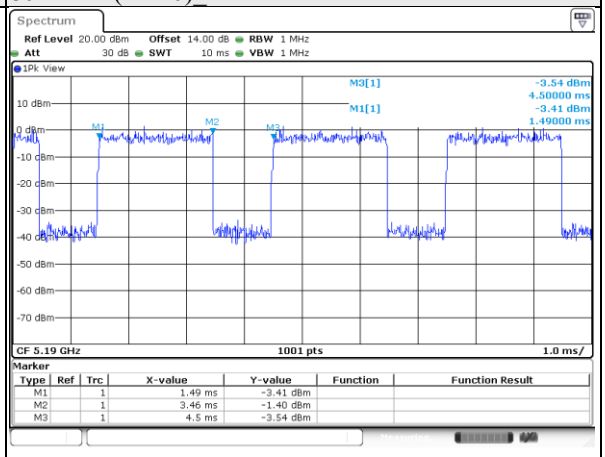
802.11ax (HE20)_OFDMA



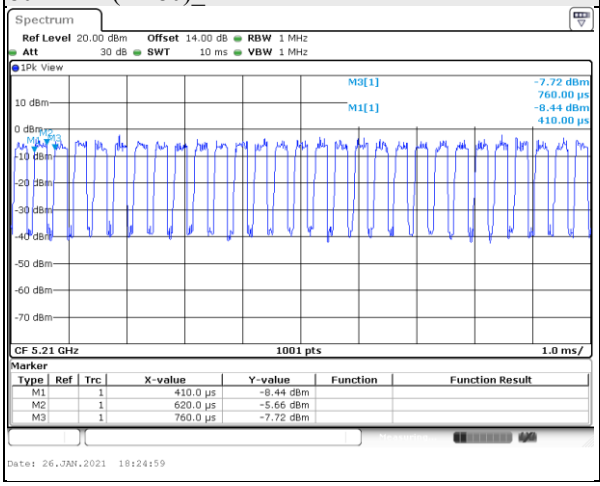
802.11ax (HE40)_OFDM



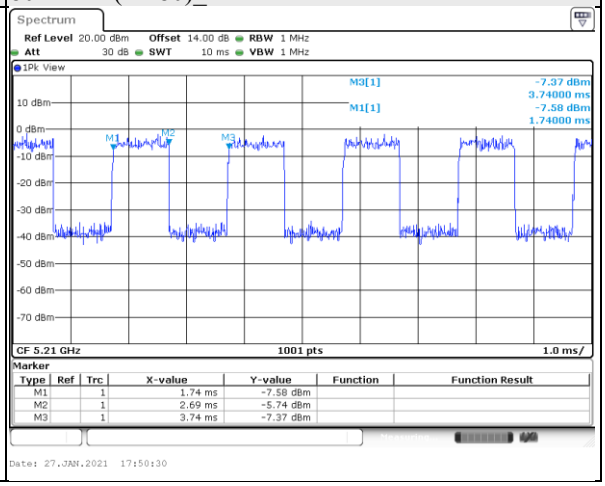
802.11ax (HE40)_OFDMA



802.11ax (HE80)_OFDM



802.11ax (HE80)_OFDMA



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2020/11/11	2021/11/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2019/12/17	2020/12/16
				2020/12/11	2021/12/10
Loop Antenna	ETS lindgren	6502	00213440	2019/12/19	2020/12/18
				2020/12/25	2021/12/24
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2020/1/3	2021/1/2
				2021/1/13	2022/1/12
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2020/1/3	2021/1/2
				2020/12/30	2021/12/29
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2019/12/27	2020/12/26
				2020/12/30	2021/12/29
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2020/6/9	2021/6/8
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2020/2/4	2021/2/2
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2020/5/19	2021/5/18
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2020/7/2	2021/7/1
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2020/1/8	2021/1/7
				2021/1/7	2022/1/6

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Expired date**
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2020/11/6	2021/11/5
Pulse Power Sensor	Anritsu	MA2411B	1531202	2019/12/23	2020/12/22
				2020/12/21	2021/12/20
Power Meter	Anritsu	ML2495A	1645002	2019/12/23	2020/12/22
				2020/12/21	2021/12/20
Temperature &Humidity Test Chamber	GIANT FORCE	GTH-150-40-CP-AR	MAA1701-010	2020/3/23	2021/3/22
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2020/11/17	2021/11/16
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2020/8/19	2021/8/18
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2020/8/12	2021/8/11
Cables	TITAN	CFD200	T0732ACFD20020A300-1	2020/9/1	2021/8/31

UL Software		
Description	**Name**	**Version**
Radiated measurement	EZ_EMC	1.1.4.2
Conducted measurement	Keysight.TestSystem	1.0.0.0
AC power Line Conducted Emission	EZ_EMC	1.1.4.2

8. Description of Test Setup

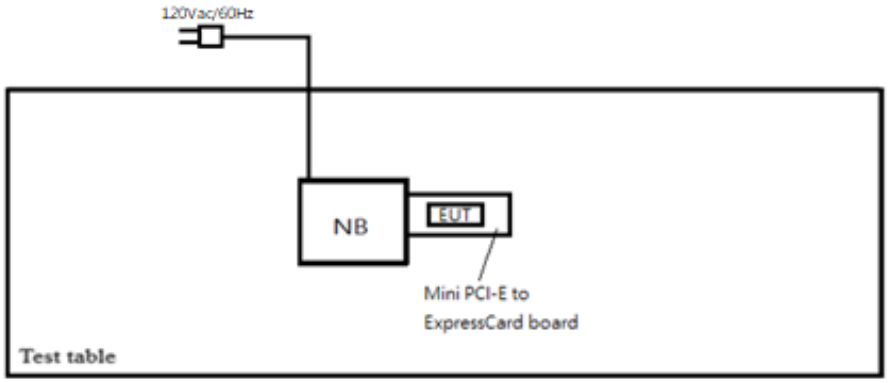
Support Equipment

Equipment	Brand Name	Model Name	S/N	Remark
Notebook	Lenovo	T430	PBE38AK	N/A
Mini PCI-E to ExpressCard board	N/A	N/A	N/A	N/A

Test Setup

The EUT was worked in engineering mode to transmit signal.

Setup Diagram for Test



9. Test Results

9.1. 6dB Bandwidth

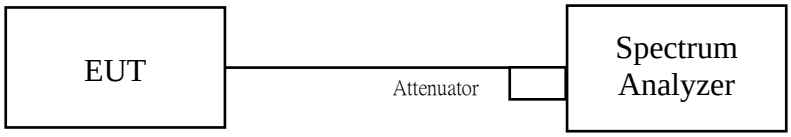
Requirements

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Non-Beamforming mode

802.11a

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
144 (U-NII-3 Band)	5720	2.55	2.55	0.5	Pass
149	5745	15.14	15.14	0.5	Pass
157	5785	15.14	15.14	0.5	Pass
165	5825	15.14	15.14	0.5	Pass

802.11ax (HE20)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
144 (U-NII-3 Band)	5720	4.15	3.83	0.5	Pass
149	5745	18.30	17.90	0.5	Pass
157	5785	18.74	17.50	0.5	Pass
165	5825	18.34	17.94	0.5	Pass

OFDMA

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
144 (U-NII-3 Band)	5720	4.51	4.55	0.5	Pass
149	5745	19.10	19.10	0.5	Pass
157	5785	19.06	18.94	0.5	Pass
165	5825	19.06	18.94	0.5	Pass

802.11ax (HE40)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
142 (U-NII-3 Band)	5710	3.78	3.86	0.5	Pass
151	5755	37.88	37.64	0.5	Pass
159	5795	37.48	37.24	0.5	Pass

OFDMA

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
142 (U-NII-3 Band)	5710	3.86	3.78	0.5	Pass
151	5755	37.88	37.64	0.5	Pass
159	5795	37.56	37.64	0.5	Pass

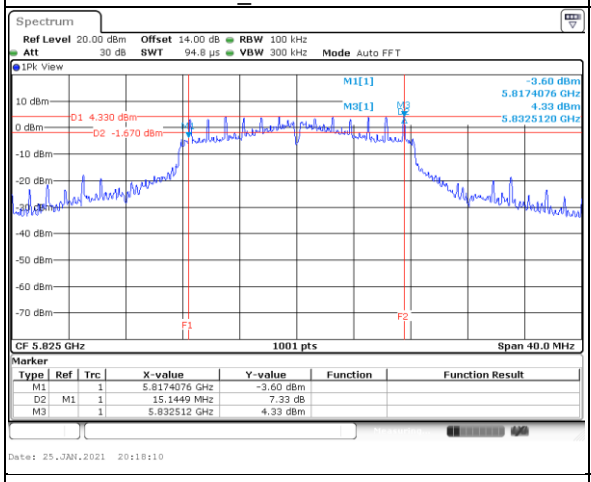
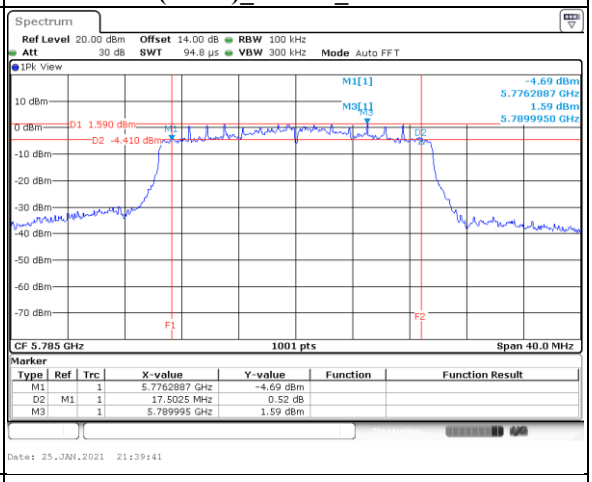
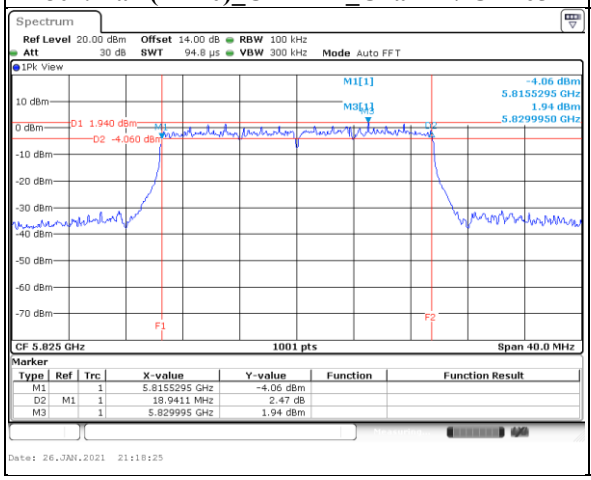
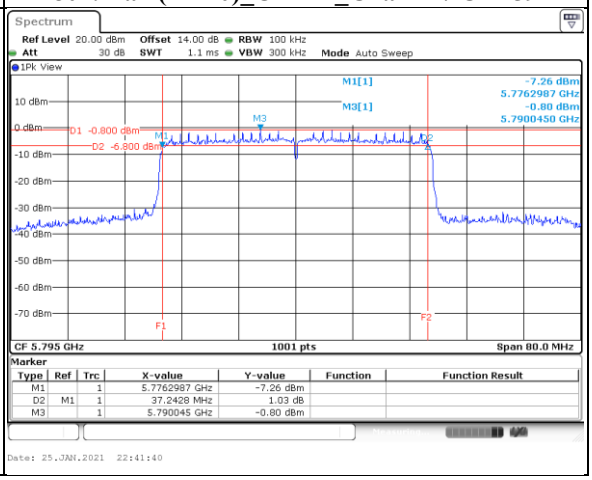
802.11ax (HE80)

OFDM

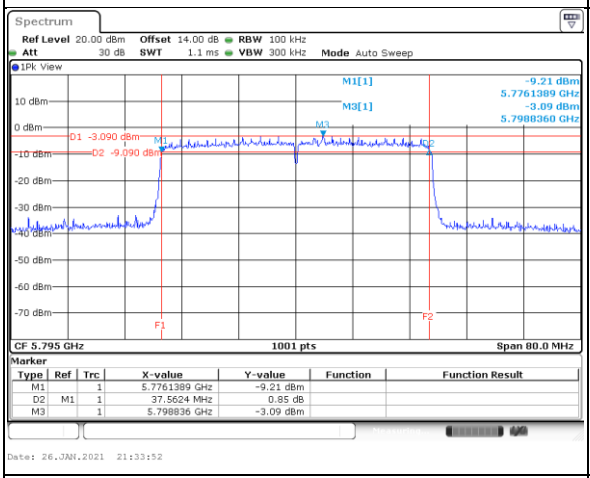
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.20	3.36	0.5	Pass
155	5775	76.88	75.13	0.5	Pass

OFDMA

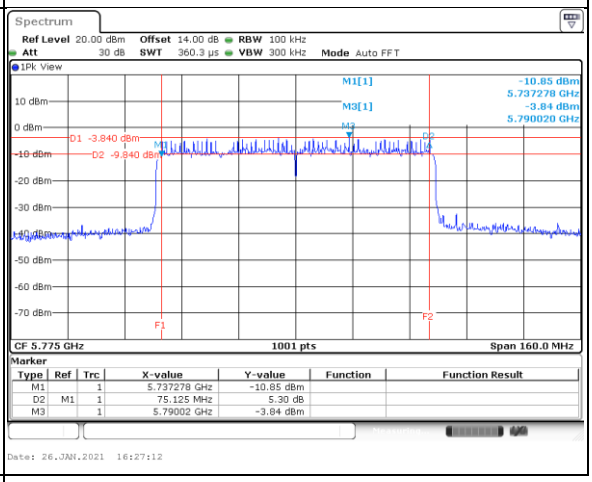
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.68	3.68	0.5	Pass
155	5775	77.84	77.52	0.5	Pass

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH165	**802.11ax (HE20)_OFDM_Chain 1 / CH157**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH165	**802.11ax (HE40)_OFDM_Chain 1 / CH159**
	

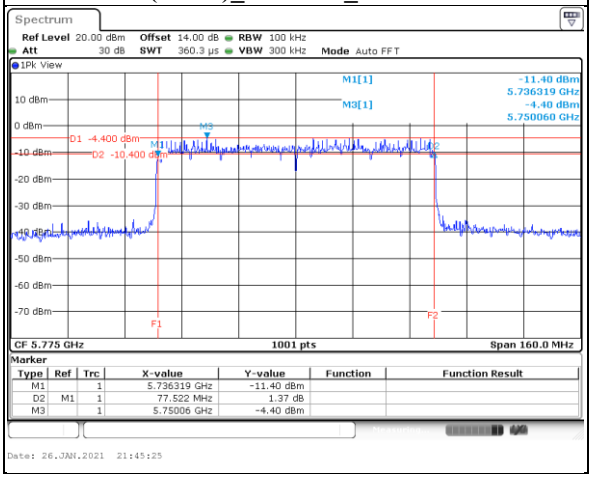
802.11ax (HE40)_OFDMA_Chain 0 / CH159

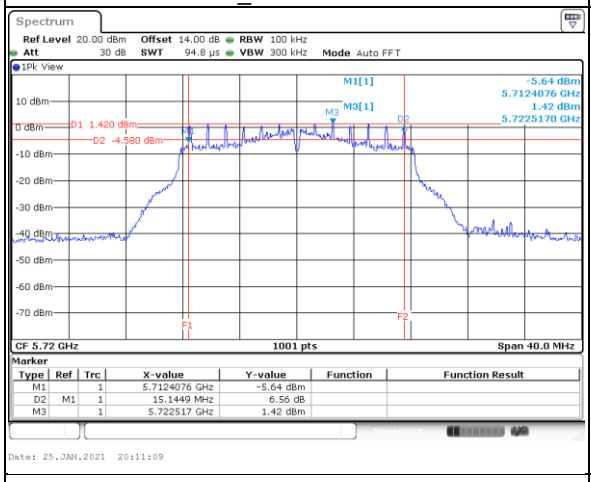
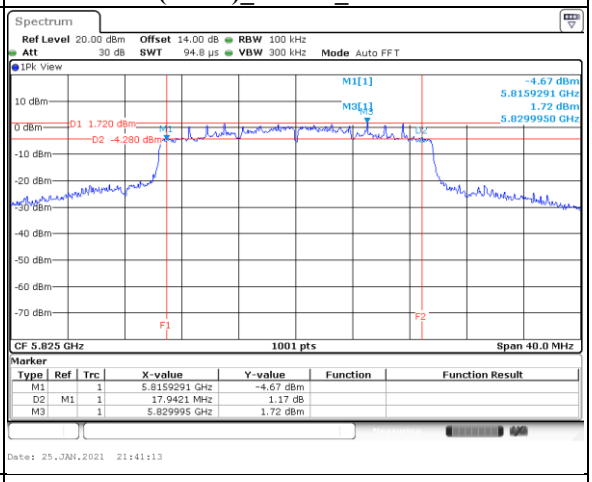
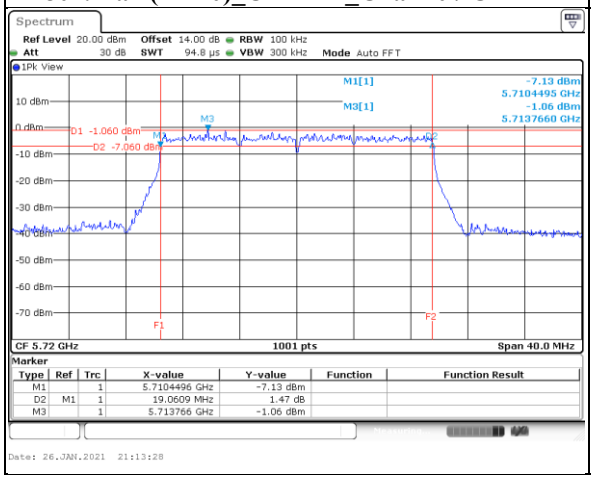
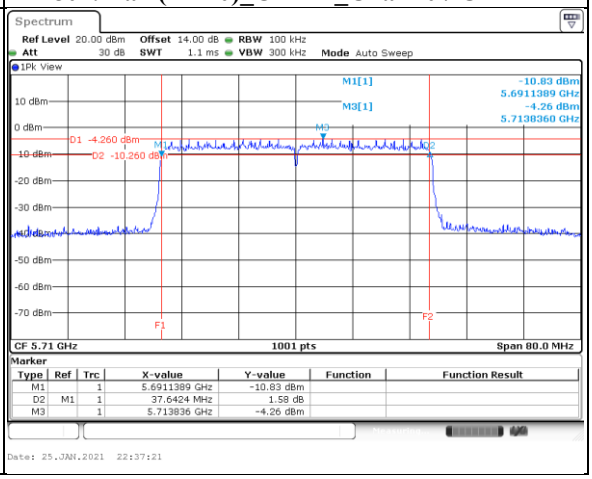


802.11ax (HE80)_OFDM_Chain 1 / CH155

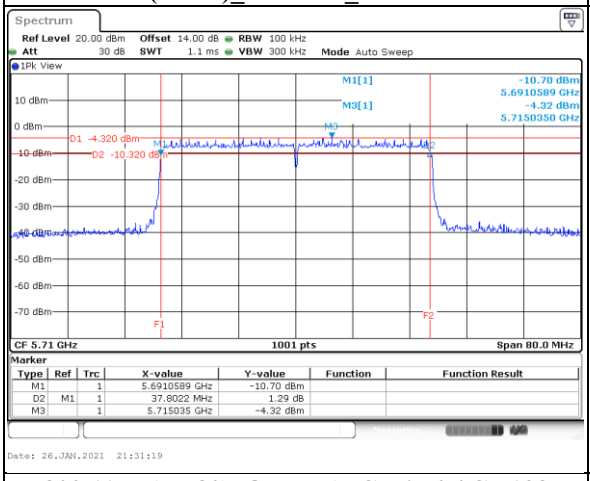


802.11ax (HE80)_OFDMA_Chain 1 / CH155

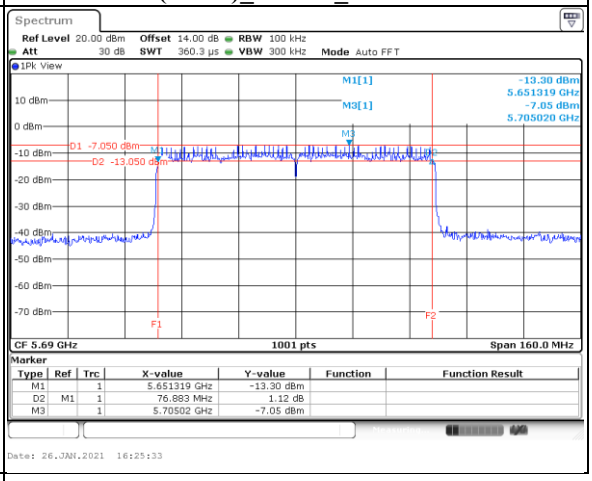


Worst Spectrum Plot of Straddle Channel	
802.11a_Chain 0 / CH144	**802.11ax (HE20)_OFDM_Chain 1 / CH144**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH144	**802.11ax (HE40)_OFDM_Chain 0 / CH142**
	

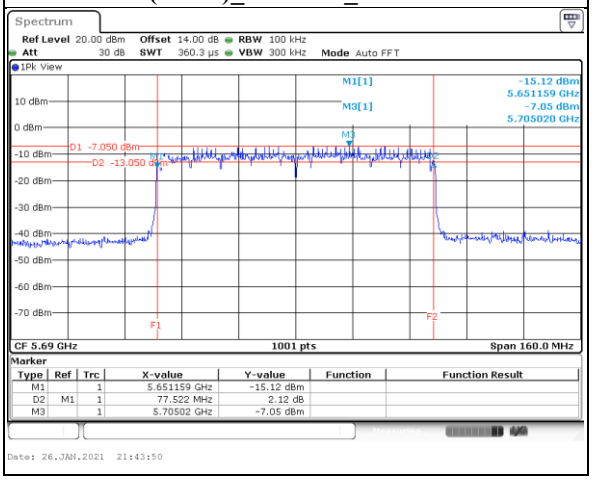
802.11ax (HE40)_OFDMA_Chain 0 / CH142



802.11ax (HE80)_OFDM_Chain 0 / CH138



802.11ax (HE80)_OFDMA_Chain 0 / CH138



Note: The bandwidth above 5725MHz = Marker 1 + Delta 2 – 5725MHz

Beamforming mode

802.11ax (HE20)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
144 (U-NII-3 Band)	5720	4.23	4.39	0.5	Pass
149	5745	18.70	17.58	0.5	Pass
157	5785	18.22	16.66	0.5	Pass
165	5825	18.30	17.82	0.5	Pass

OFDMA

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
144 (U-NII-3 Band)	5720	4.47	4.51	0.5	Pass
149	5745	19.02	18.94	0.5	Pass
157	5785	18.98	19.06	0.5	Pass
165	5825	19.02	18.98	0.5	Pass

802.11ax (HE40)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
142 (U-NII-3 Band)	5710	3.78	3.78	0.5	Pass
151	5755	37.72	37.56	0.5	Pass
159	5795	37.48	37.24	0.5	Pass

OFDMA

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
142 (U-NII-3 Band)	5710	3.78	3.94	0.5	Pass
151	5755	37.96	37.72	0.5	Pass
159	5795	37.80	37.64	0.5	Pass

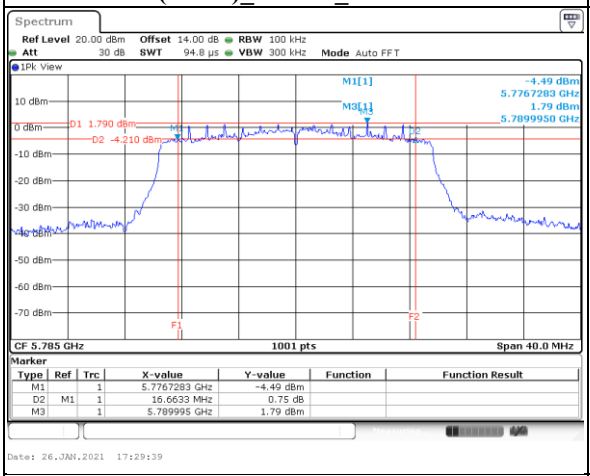
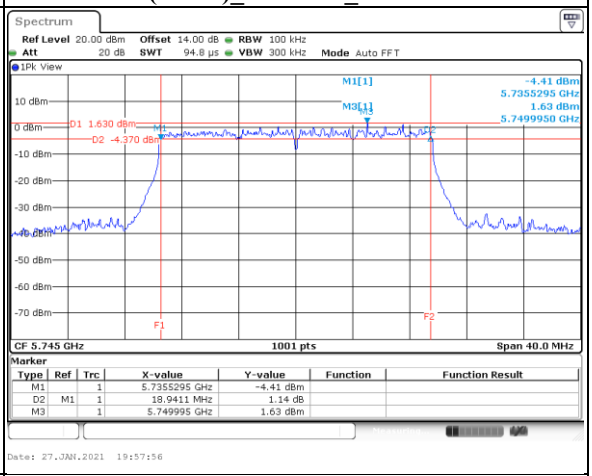
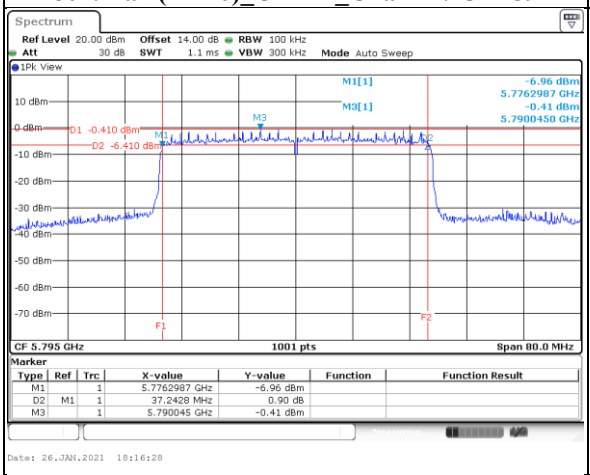
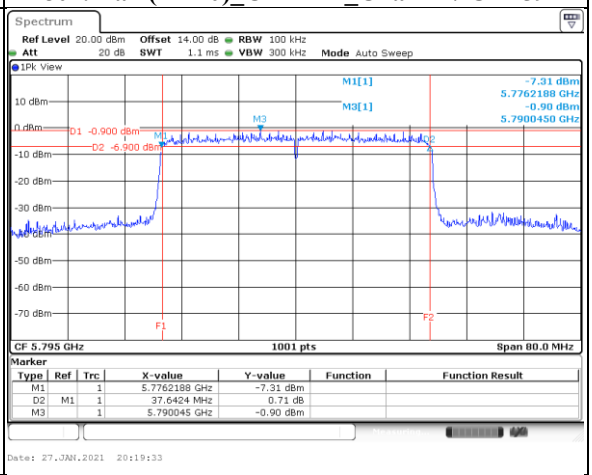
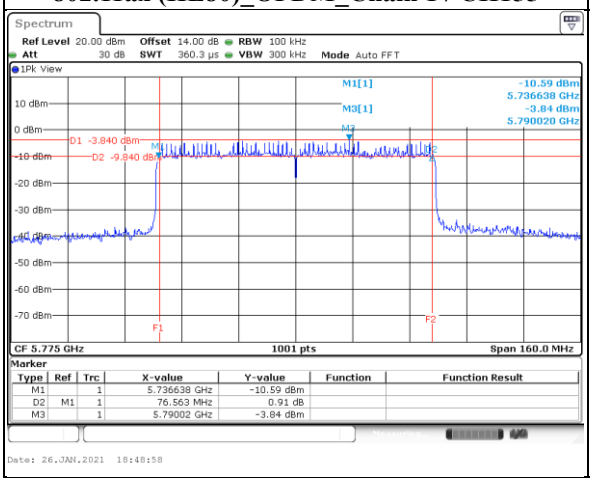
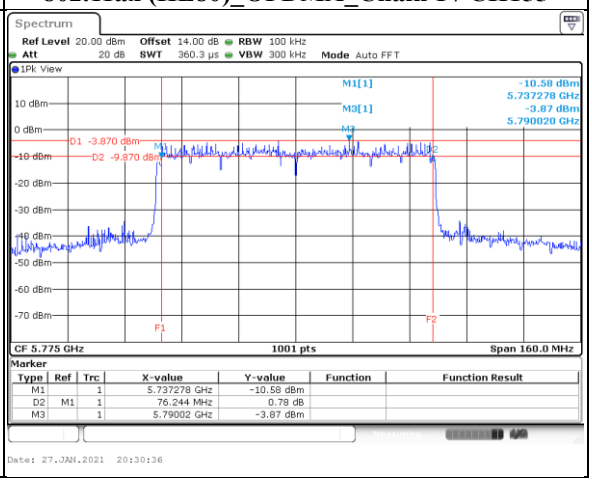
802.11ax (HE80)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.36	3.52	0.5	Pass
155	5775	76.88	76.56	0.5	Pass

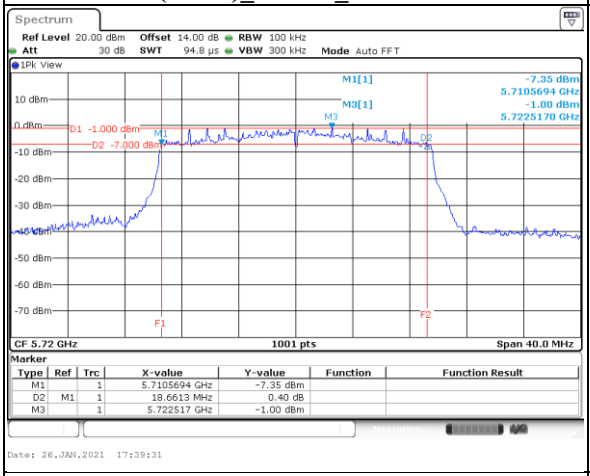
OFDMA

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.68	3.68	0.5	Pass
155	5775	77.04	76.24	0.5	Pass

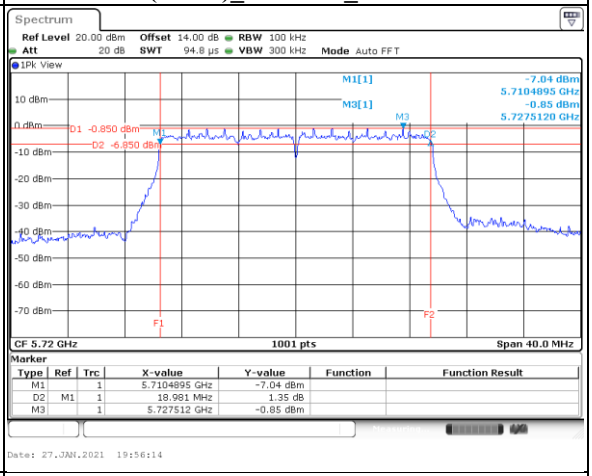
Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 1 / CH157	**802.11ax (HE20)_OFDMA_Chain 1 / CH149**
	
802.11ax (HE40)_OFDM_Chain 1 / CH159	**802.11ax (HE40)_OFDMA_Chain 1 / CH159**
	
802.11ax (HE80)_OFDM_Chain 1 / CH155	**802.11ax (HE80)_OFDMA_Chain 1 / CH155**
	

Worst Spectrum Plot of Straddle Channel

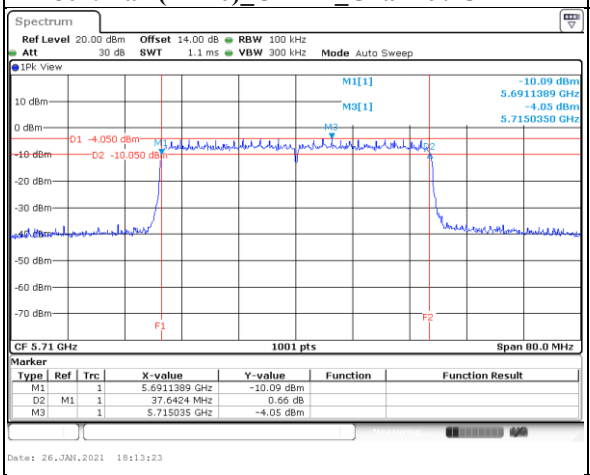
802.11ax (HE20)_OFDM_Chain 0 / CH144



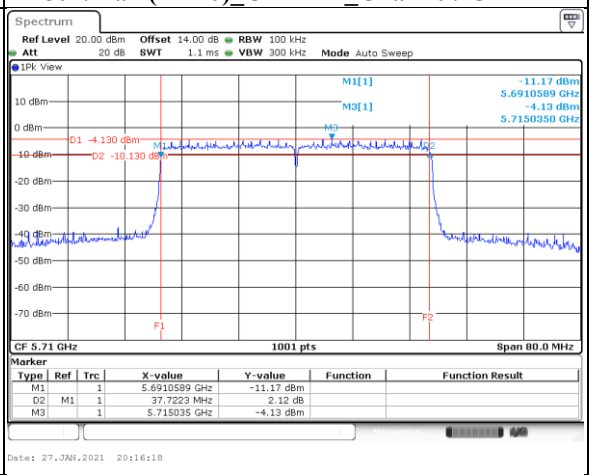
802.11ax (HE20)_OFDMA_Chain 0 / CH144



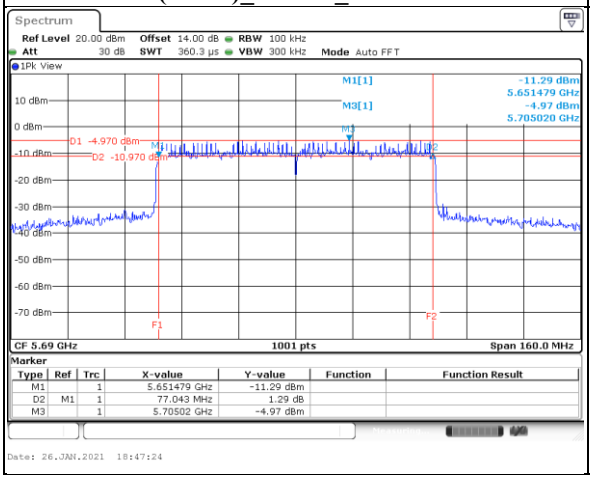
802.11ax (HE40)_OFDM_Chain 0 / CH142



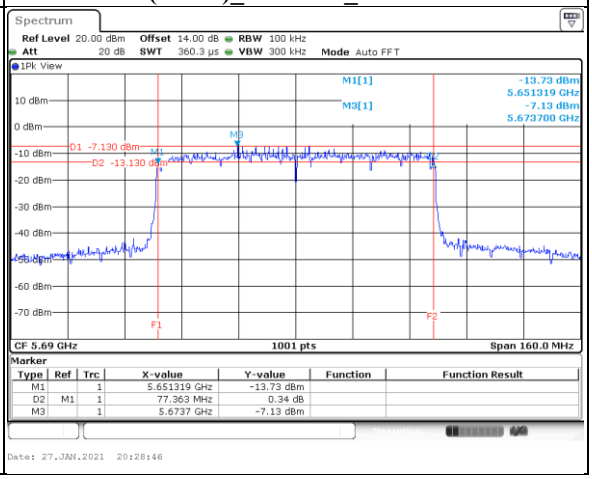
802.11ax (HE40)_OFDMA_Chain 0 / CH142



802.11ax (HE80)_OFDM_Chain 1 / CH138



802.11ax (HE80)_OFDMA_Chain 0 / CH138



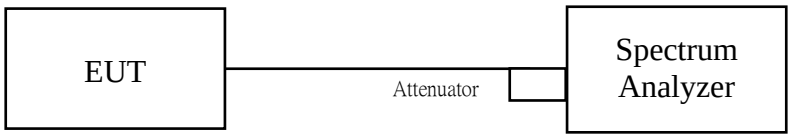
Note: The bandwidth above 5725MHz = Marker 1 + Delta 2 – 5725MHz

9.2. 26dB Bandwidth

Test procedure

a. Set RBW = approximately 1% of the emission bandwidth.
b. Set the VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.
e. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Non-Beamforming mode

802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.14	20.62
44	5220	21.10	20.78
48	5240	21.14	20.90
52	5260	22.50	21.26
60	5300	20.86	20.82
64	5320	20.94	22.58
100	5500	20.98	20.58
116	5580	21.10	20.94
140	5700	20.86	26.49
144	5720	20.86	21.10
144 (U-NII-2c Band)	5720	15.51	15.51

802.11ax (HE20)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.30	22.26
44	5220	21.18	21.78
48	5240	21.26	21.14
52	5260	21.38	21.50
60	5300	21.50	21.30
64	5320	21.30	25.73
100	5500	21.30	21.74
116	5580	21.38	21.26
140	5700	21.58	21.26
144	5720	21.26	21.26
144 (U-NII-2c Band)	5720	15.55	15.63

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.74	25.45
44	5220	21.70	21.66
48	5240	21.94	21.50
52	5260	22.34	21.62
60	5300	22.10	21.90
64	5320	21.90	21.66
100	5500	21.78	21.74
116	5580	21.74	21.86
140	5700	21.66	22.02
144	5720	21.86	21.62
144 (U-NII-2c Band)	5720	15.99	15.91

802.11ax (HE40)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.20	40.04
46	5230	40.52	40.92
54	5270	40.36	39.96
62	5310	40.36	40.20
102	5510	40.12	40.12
110	5550	40.04	39.96
134	5670	40.28	40.12
142	5710	40.28	40.20
142 (U-NII-2c Band)	5710	35.06	35.22

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.28	40.20
46	5230	40.28	40.20
54	5270	41.08	40.12
62	5310	40.28	40.28
102	5510	40.28	40.28
110	5550	40.04	40.12
134	5670	40.36	40.20
142	5710	40.44	40.28
142 (U-NII-2c Band)	5710	35.22	35.14

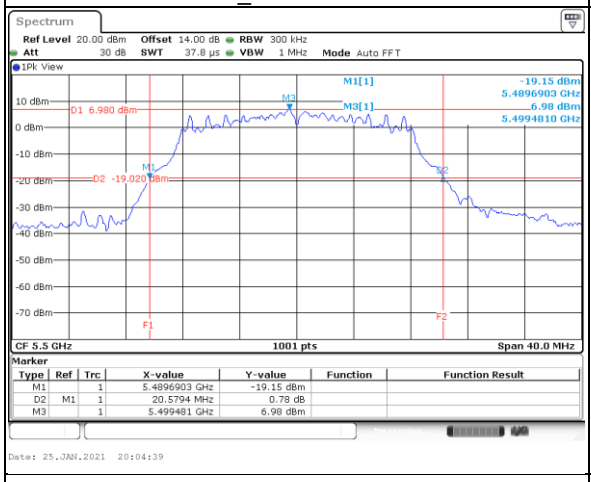
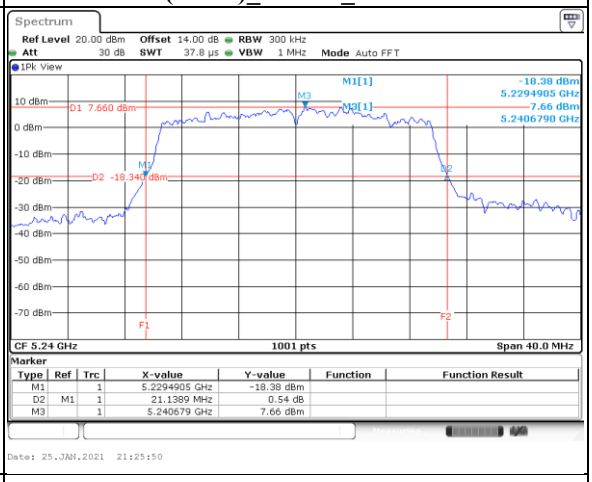
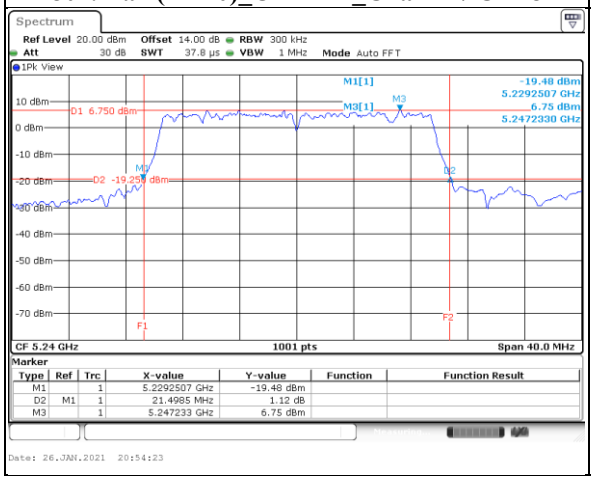
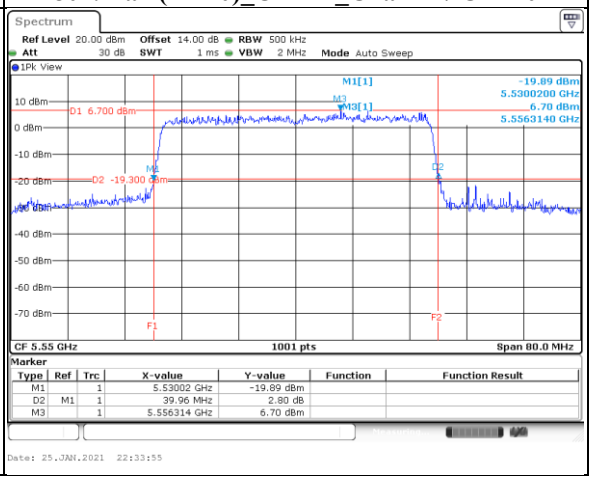
802.11ax (HE80)

OFDM

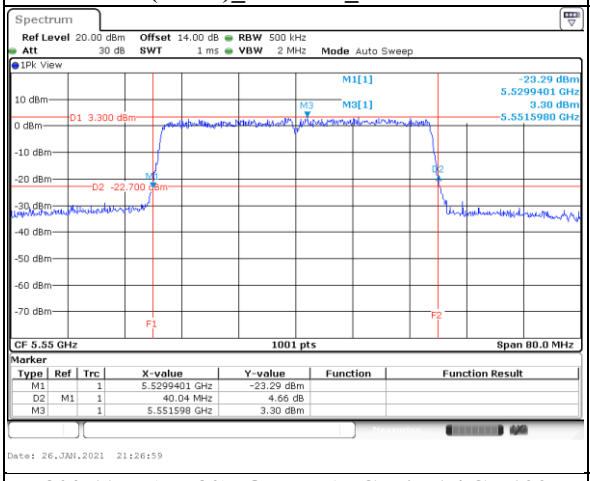
CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.84	82.48
58	5290	82.00	81.68
106	5530	81.84	82.32
122	5610	81.20	81.84
138	5690	82.00	84.72
138 (U-NII-2c Band)	5690	75.92	78.80

OFDMA

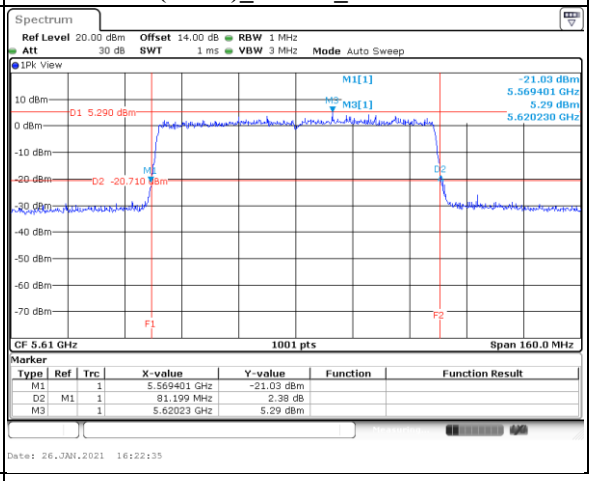
CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.84	101.18
58	5290	82.00	82.00
106	5530	82.00	82.00
122	5610	81.68	81.20
138	5690	81.68	81.84
138 (U-NII-2c Band)	5690	75.92	75.76

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH100	**802.11ax (HE20)_OFDM_Chain 1 / CH48**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH48	**802.11ax (HE40)_OFDM_Chain 1 / CH110**
	

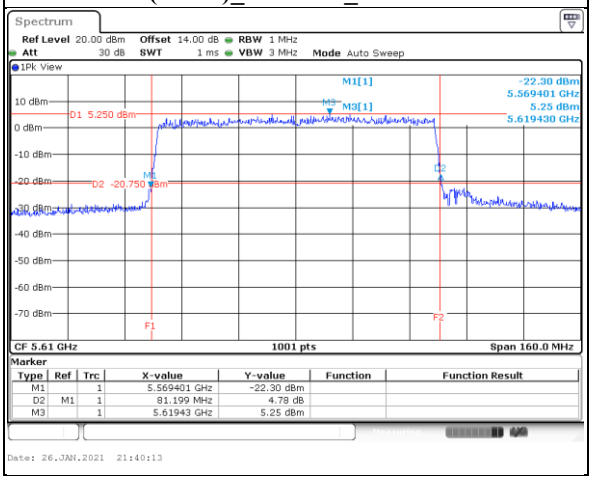
802.11ax (HE40)_OFDMA_Chain 0 / CH110

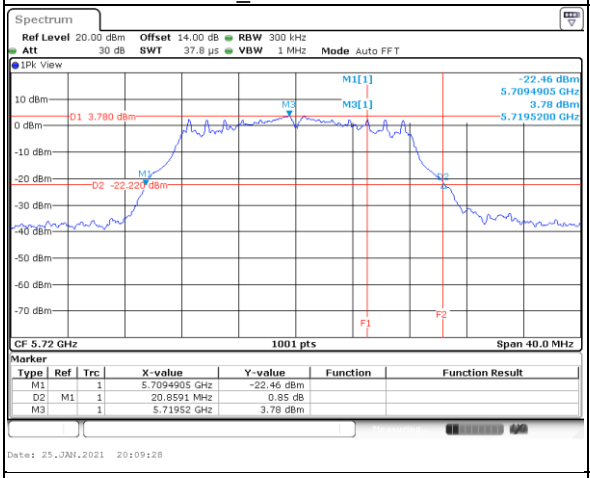
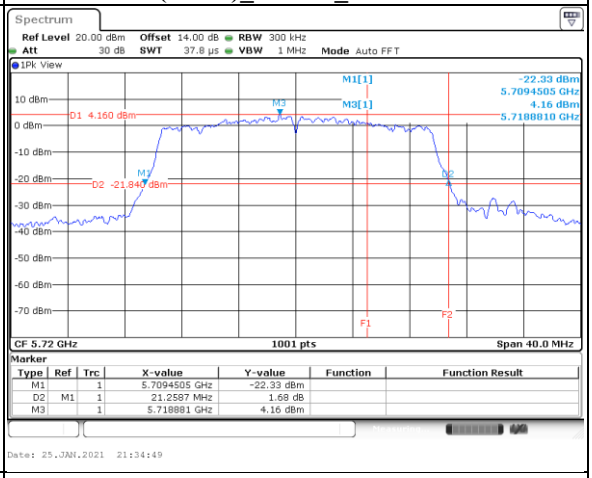
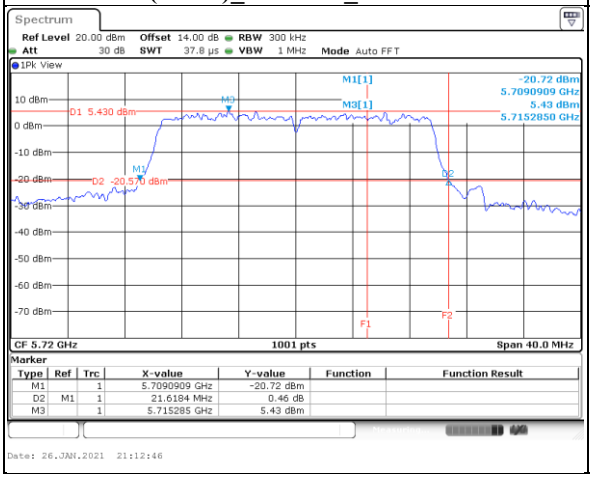
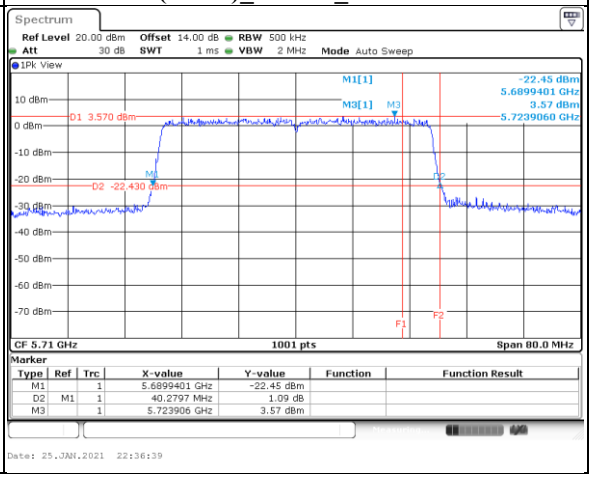


802.11ax (HE80)_OFDM_Chain 0 / CH122

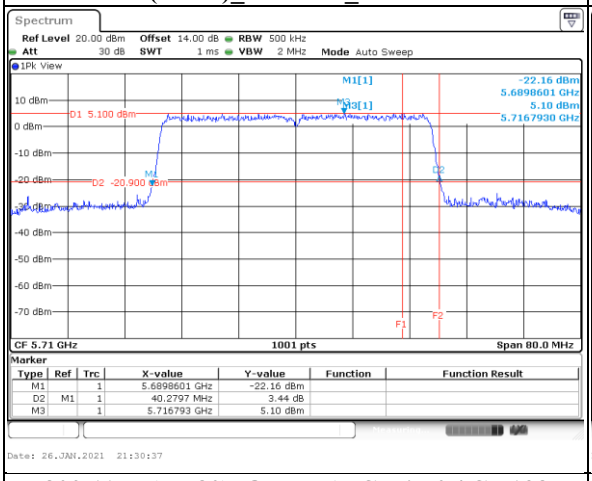


802.11ax (HE80)_OFDMA_Chain 1 / CH122

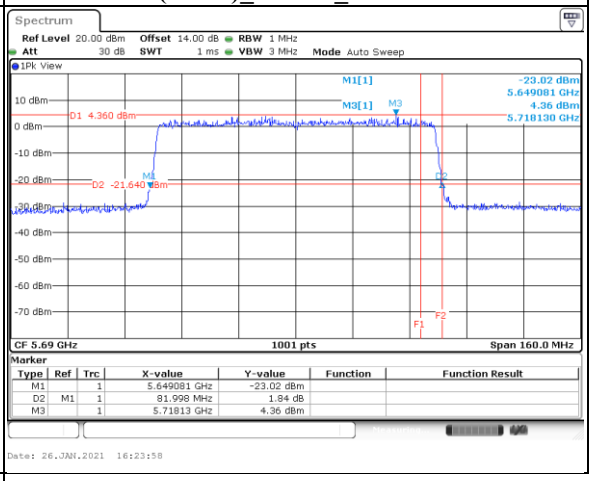


Worse Spectrum Plot of Straddle Channel	
802.11a_Chain 0 / CH144	**802.11ax (HE20)_OFDM_Chain 0 / CH144**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH144	**802.11ax (HE40)_OFDM_Chain 0 / CH144**
	

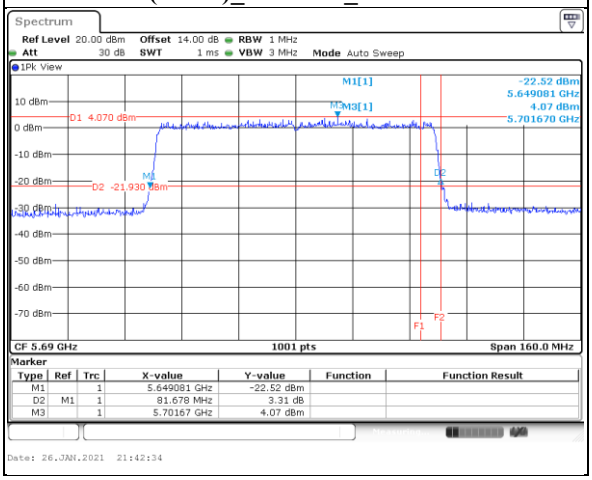
802.11ax (HE40)_OFDMA_Chain 1 / CH142



802.11ax (HE80)_OFDM_Chain 0 / CH142



802.11ax (HE80)_OFDMA_Chain 0 / CH138



Note: The bandwidth below 5725MHz = Delta 2 – (Marker 1 + Delta 2 – 5725MHz)

Beamforming mode

802.11ax (HE20)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.22	21.22
44	5220	21.62	21.34
48	5240	21.38	21.30
52	5260	21.02	21.50
60	5300	21.26	21.62
64	5320	21.30	21.58
100	5500	21.22	21.38
116	5580	21.18	21.42
140	5700	21.26	21.66
144	5720	21.42	21.38
144 (U-NII-2c Band)	5720	15.67	15.83

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	22.06	22.66
44	5220	21.82	21.94
48	5240	21.98	21.34
52	5260	26.41	21.66
60	5300	21.78	21.42
64	5320	22.02	21.54
100	5500	21.86	21.50
116	5580	21.98	21.90
140	5700	21.94	21.58
144	5720	21.78	21.50
144 (U-NII-2c Band)	5720	15.95	15.71

802.11ax (HE40)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.36	48.75
46	5230	40.60	40.20
54	5270	40.36	40.12
62	5310	40.12	40.12
102	5510	40.36	39.96
110	5550	40.36	40.20
134	5670	40.20	40.20
142	5710	40.36	40.04
142 (U-NII-2c Band)	5710	35.06	34.98

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.12	42.52
46	5230	40.52	40.12
54	5270	40.68	39.96
62	5310	40.28	40.12
102	5510	40.12	40.04
110	5550	40.44	40.28
134	5670	40.28	40.12
142	5710	40.44	40.44
142 (U-NII-2c Band)	5710	35.22	35.22

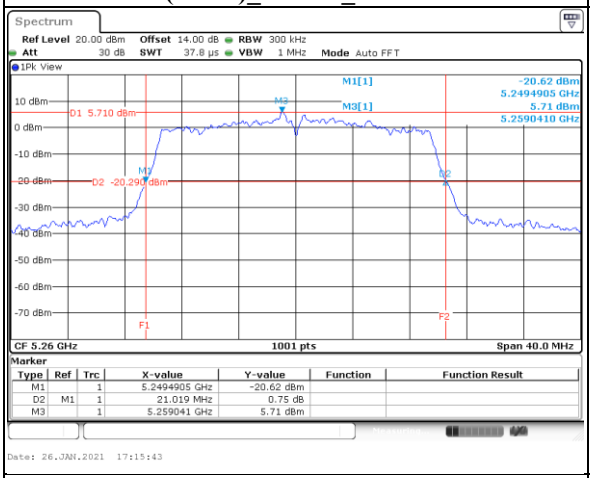
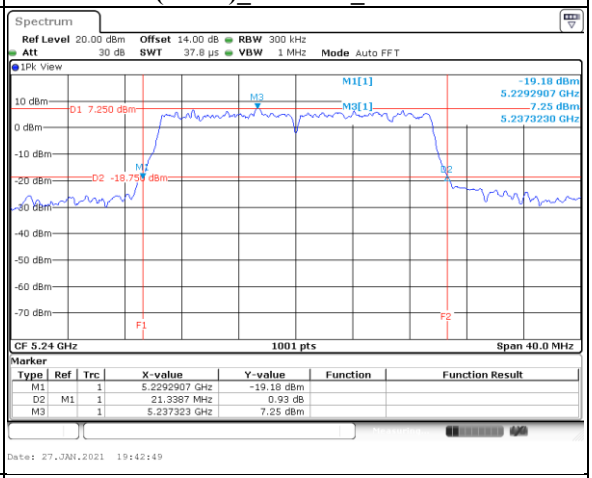
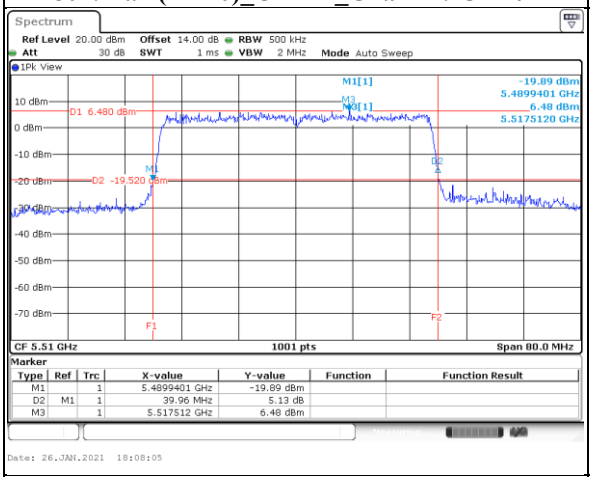
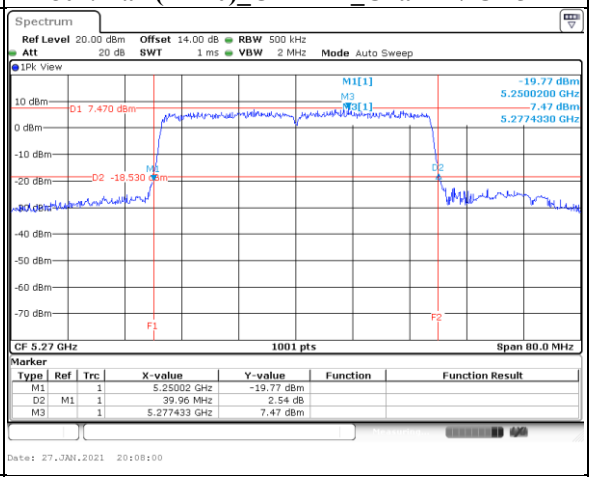
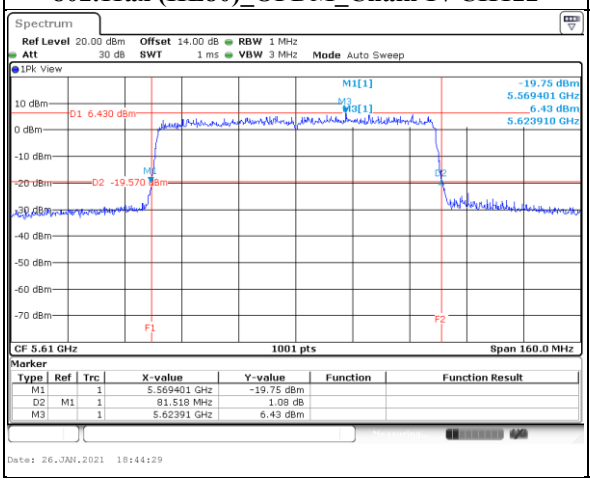
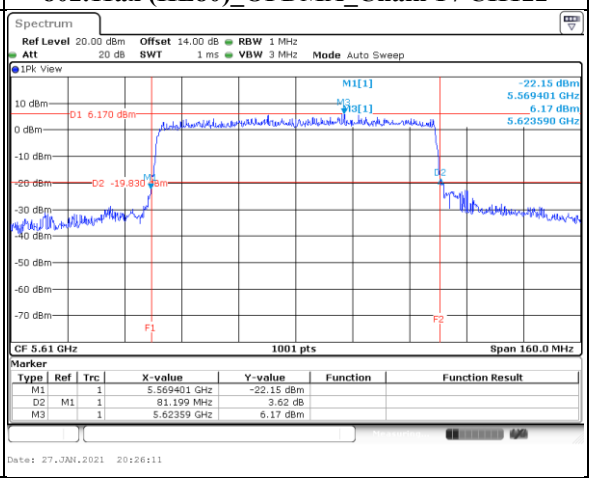
802.11ax (HE80)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.68	81.68
58	5290	81.68	81.84
106	5530	82.00	81.52
122	5610	81.68	81.52
138	5690	81.84	82.64
138 (U-NII-2c Band)	5690	75.92	77.04

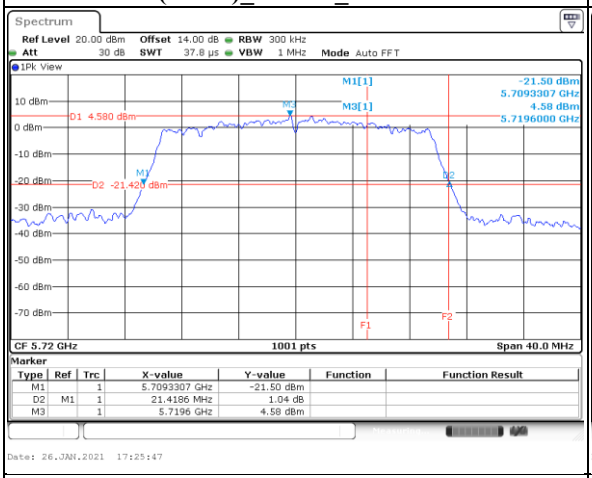
OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.84	81.52
58	5290	82.16	81.52
106	5530	82.00	82.00
122	5610	81.84	81.20
138	5690	81.84	90.79
138 (U-NII-2c Band)	5690	75.76	77.68

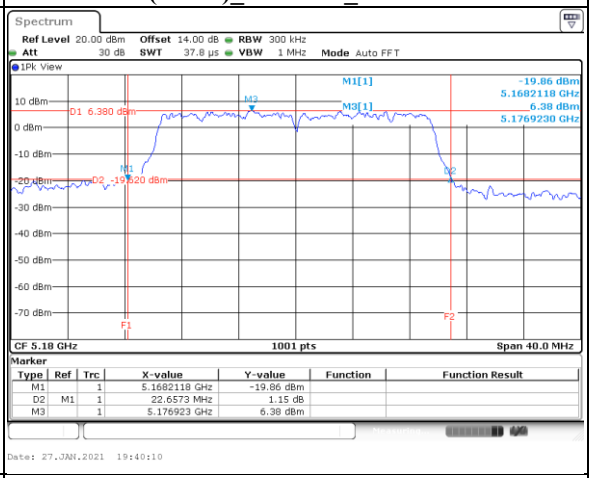
Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 0 / CH52	**802.11ax (HE20)_OFDMA_Chain 1 / CH48**
	
802.11ax (HE40)_OFDM_Chain 1 / CH102	**802.11ax (HE40)_OFDMA_Chain 1 / CH54**
	
802.11ax (HE80)_OFDM_Chain 1 / CH122	**802.11ax (HE80)_OFDMA_Chain 1 / CH122**
	

Worst Spectrum Plot of Straddle Channel

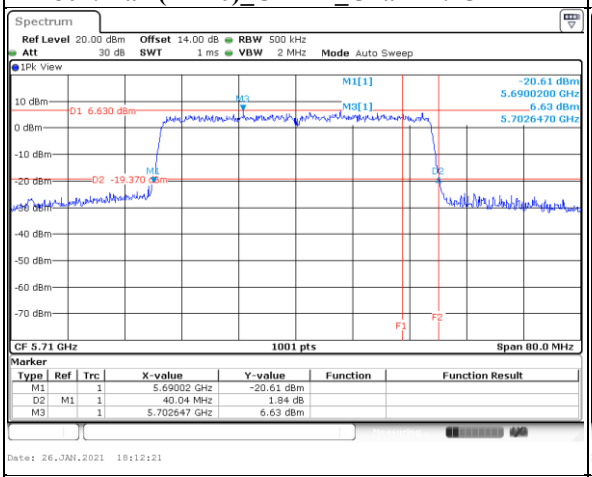
802.11ax (HE20)_OFDM_Chain 0 / CH144



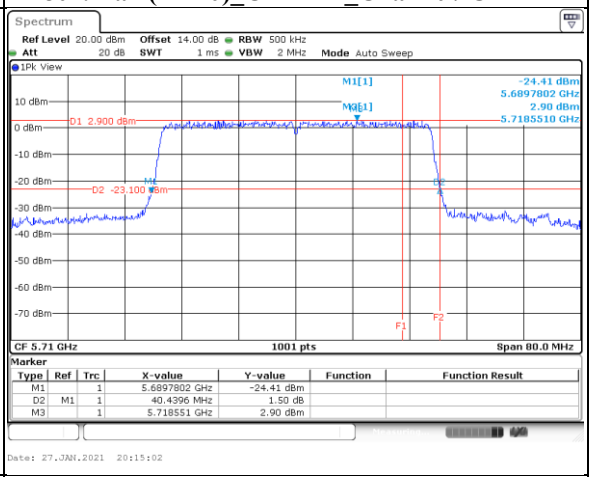
802.11ax (HE20)_OFDMA_Chain 1 / CH144



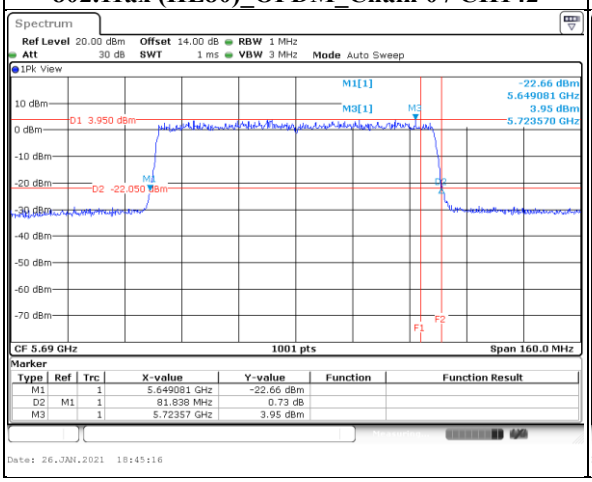
802.11ax (HE40)_OFDM_Chain 1 / CH142



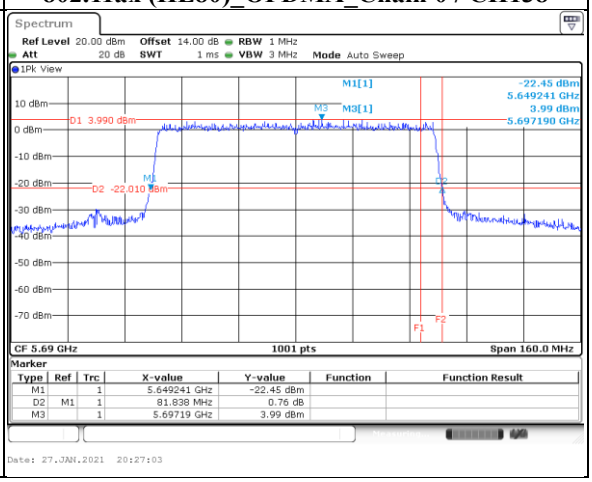
802.11ax (HE40)_OFDMA_Chain 0 / CH142



802.11ax (HE80)_OFDM_Chain 0 / CH142



802.11ax (HE80)_OFDMA_Chain 0 / CH138



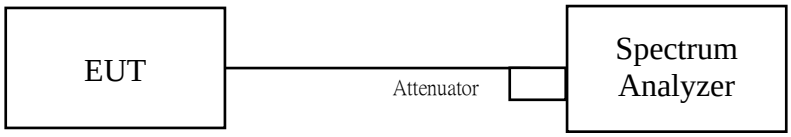
Note: The bandwidth below 5725MHz = Delta 2 – (Marker 1 + Delta 2 – 5725MHz)

9.3. Occupied Bandwidth

Test procedure

a. Set center frequency to the nominal EUT channel center frequency.
b. Set span = 1.5 times to 5.0 times the OBW.
c. Set RBW = 1% to 5% of the OBW
d. Set VBW ≥ 3 x RBW
e. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
f. Use the 99% power bandwidth function of the instrument (if available).
g. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Non-Beamforming mode

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	16.62	16.42
44	5220	16.54	16.66
48	5240	16.54	16.38
52	5260	16.70	16.70
60	5300	16.54	16.38
64	5320	16.62	16.94
100	5500	16.46	16.46
116	5580	16.70	16.58
140	5700	16.42	16.90
144	5720	16.42	16.46
149	5745	16.74	16.42
157	5785	16.62	16.66
165	5825	16.66	17.26

802.11ax (HE20)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	18.98	18.98
44	5220	19.02	19.06
48	5240	18.98	18.90
52	5260	18.94	18.98
60	5300	18.90	18.94
64	5320	18.98	19.14
100	5500	19.02	18.90
116	5580	18.90	18.94
140	5700	18.94	18.90
144	5720	19.10	18.94
149	5745	18.86	18.98
157	5785	18.98	18.90
165	5825	18.98	19.14

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	19.10	19.26
44	5220	19.14	19.22
48	5240	19.06	19.18
52	5260	19.18	19.14
60	5300	19.10	19.18
64	5320	19.14	19.10
100	5500	19.14	19.26
116	5580	19.10	19.18
140	5700	19.10	19.14
144	5720	19.18	19.18
149	5745	19.14	19.18
157	5785	19.10	19.14
165	5825	19.22	19.14

802.11ax (HE40)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.56	37.56
46	5230	37.64	37.72
54	5270	37.72	37.56
62	5310	37.56	37.72
102	5510	37.64	37.64
110	5550	37.64	37.56
134	5670	37.64	37.64
142	5710	37.72	37.64
151	5755	37.64	37.64
159	5795	37.56	37.56

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.64	37.64
46	5230	37.56	37.64
54	5270	37.64	37.56
62	5310	37.64	37.56
102	5510	37.64	37.72
110	5550	37.56	37.72
134	5670	37.64	37.56
142	5710	37.64	37.64
151	5755	37.64	37.56
159	5795	37.56	37.56

802.11ax (HE80)

OFDM

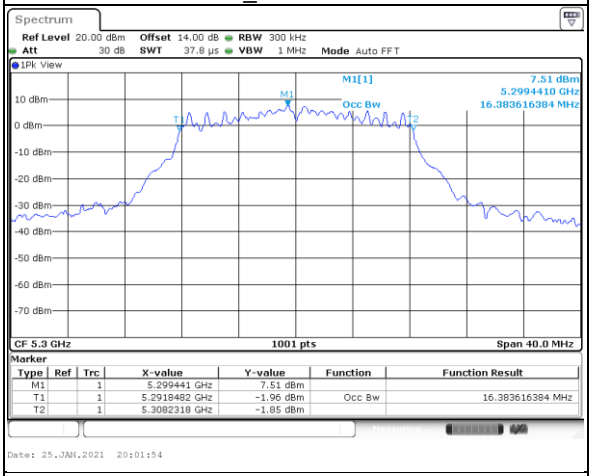
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.36	77.52
58	5290	77.36	77.36
106	5530	77.20	77.20
122	5610	77.36	77.20
138	5690	77.20	77.52
155	5775	77.36	77.20

OFDMA

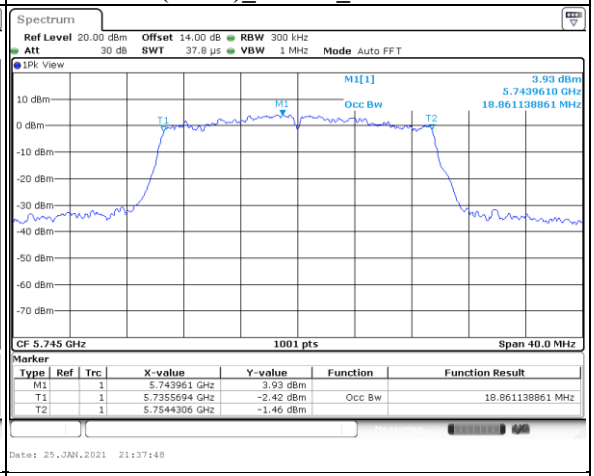
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.04	77.36
58	5290	77.20	77.20
106	5530	77.20	77.36
122	5610	77.20	77.36
138	5690	77.20	77.36
155	5775	77.36	77.20

Spectrum Plot of Worst Value

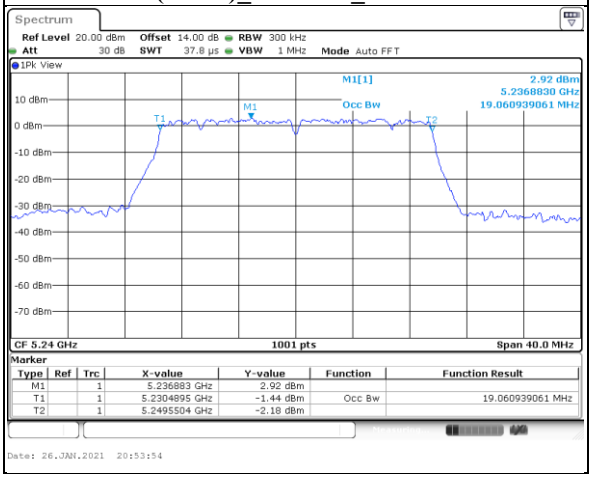
802.11a_Chain 1 / CH60



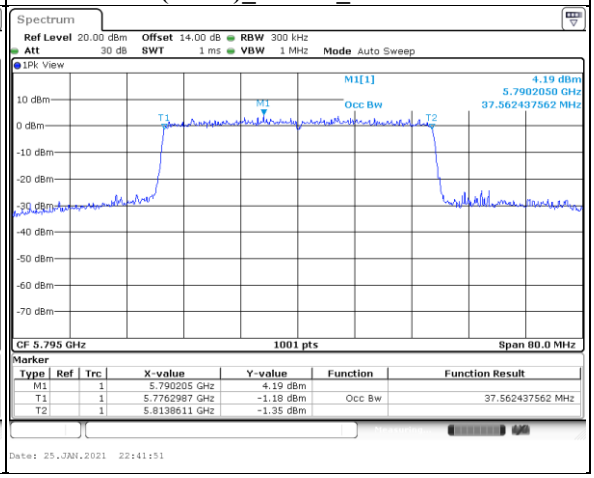
802.11ax (HE20)_OFDM_Chain 0 / CH149



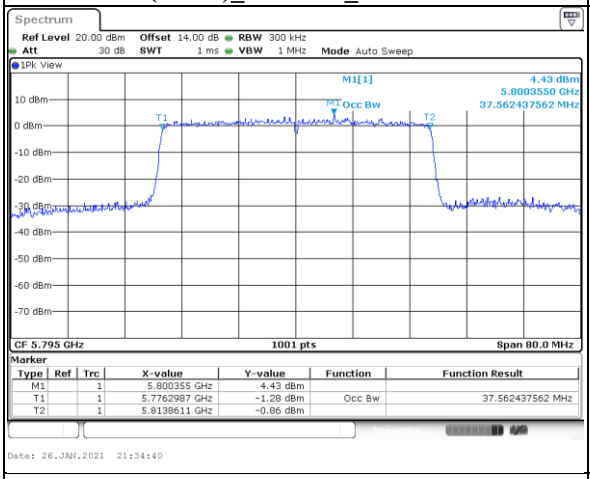
802.11ax (HE20)_OFDMA_Chain 0 / CH48



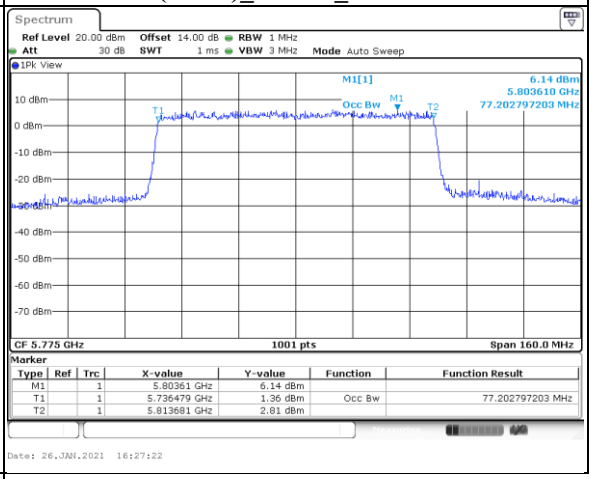
802.11ax (HE40)_OFDM_Chain 1 / CH159



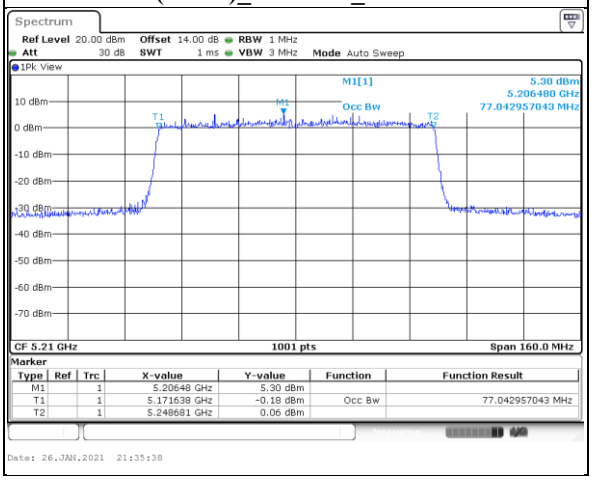
802.11ax (HE40)_OFDMA_Chain 1 / CH159

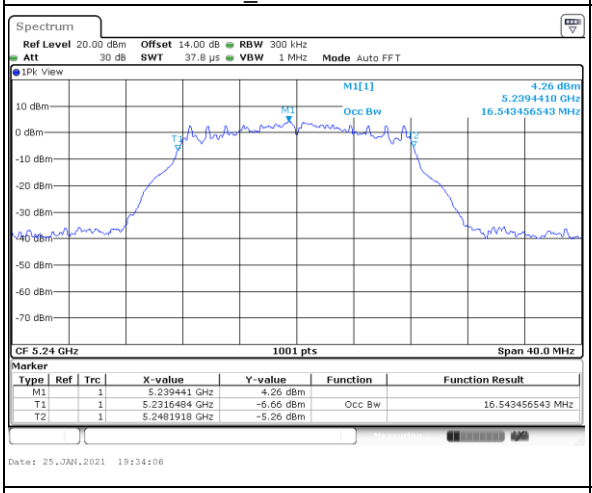
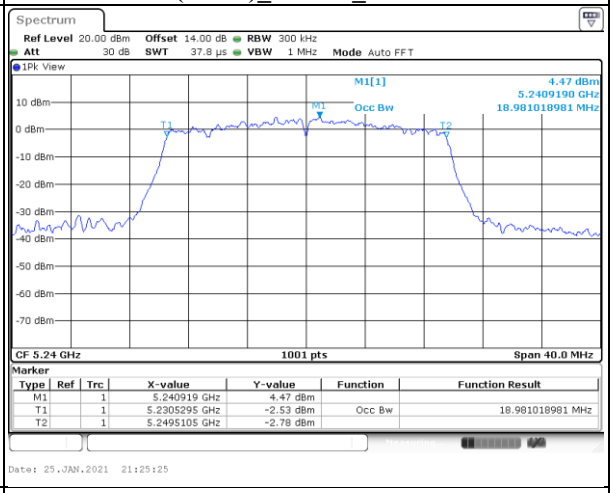
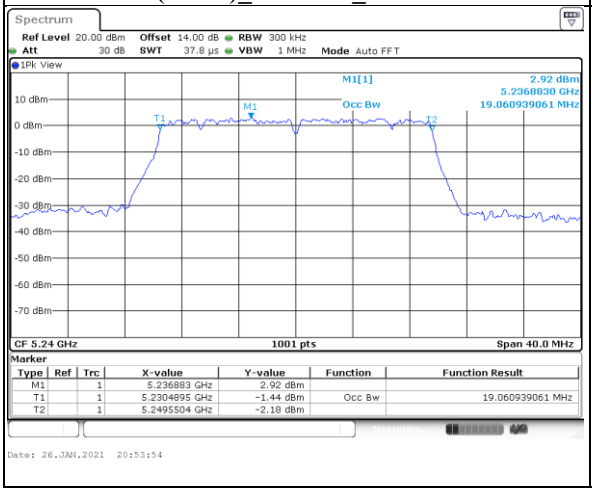
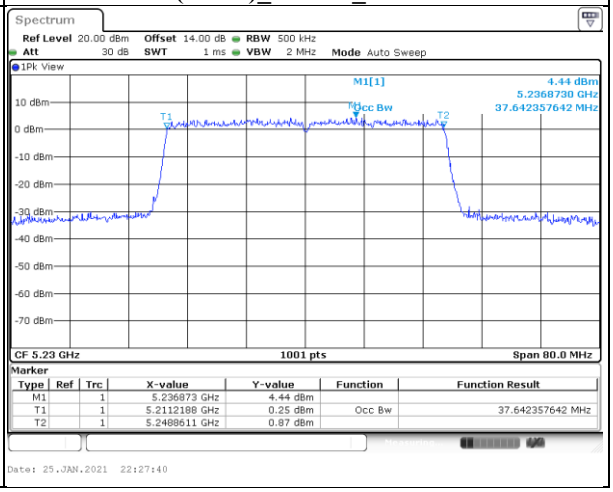


802.11ax (HE80)_OFDM_Chain 1 / CH155

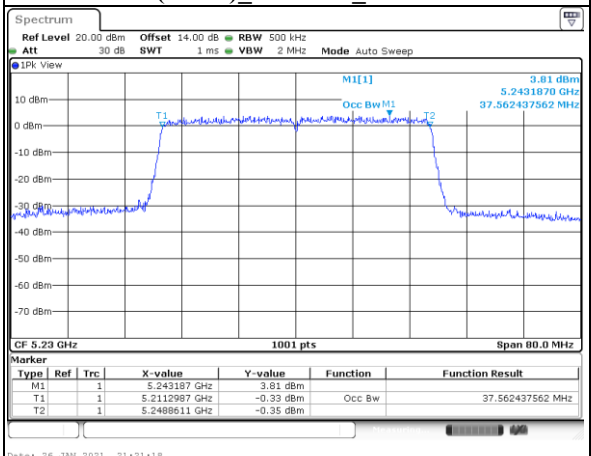


802.11ax (HE80)_OFDMA_Chain 0 / CH42

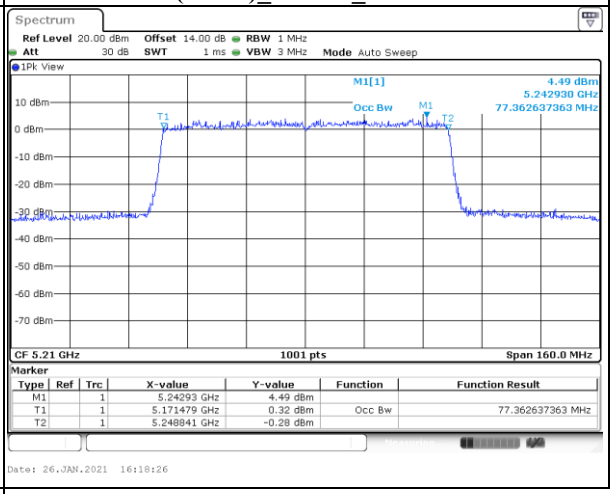


Spectrum Plot for nearby DFS band	
802.11a_Chain 0 / CH48	**802.11ax (HE20)_OFDM_Chain 0 / CH48**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH48	**802.11ax (HE40)_OFDM_Chain 0 / CH46**
	

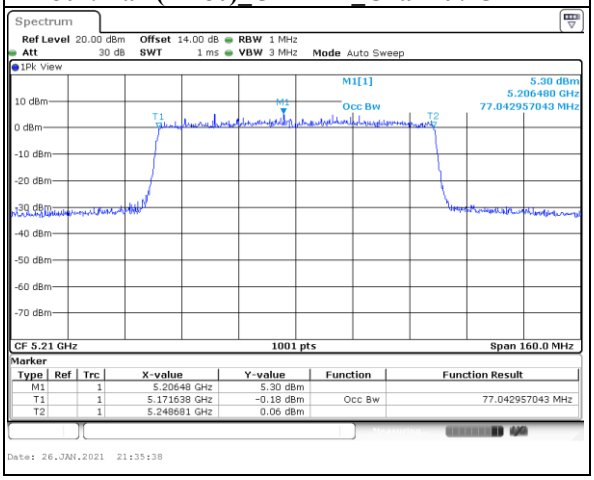
802.11ax (HE40)_OFDMA_Chain 0 / CH46



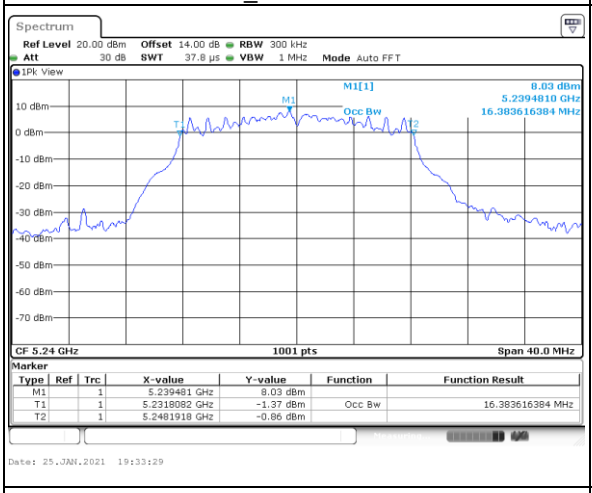
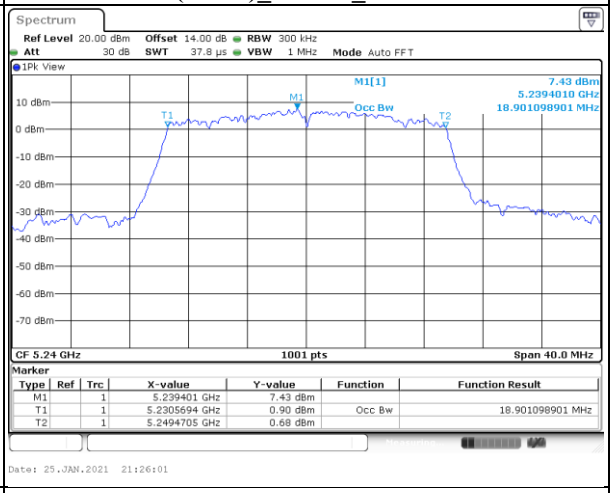
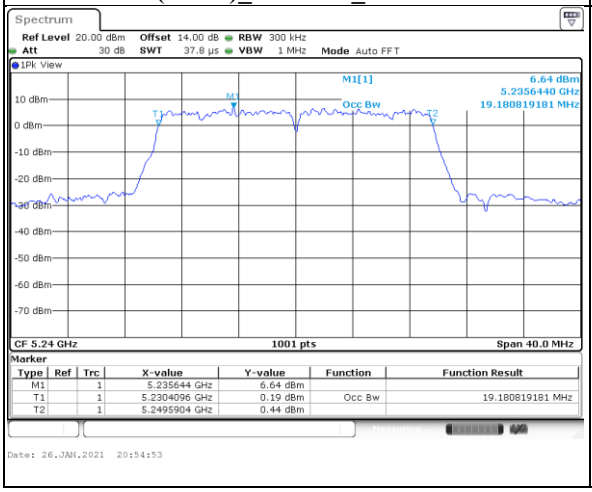
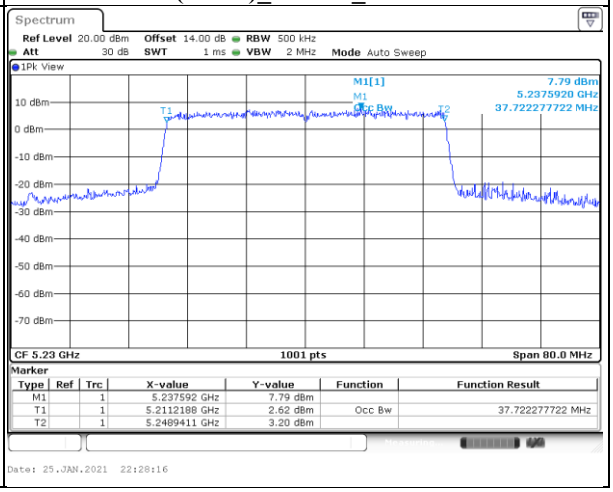
802.11ax (HE80)_OFDM_Chain 0 / CH42



802.11ax (HE80)_OFDMA_Chain 0 / CH42



Note: The observed T2 is all <5250 MHz, so in nearby DFS band channels no need for DFS function

Spectrum Plot for nearby DFS band	
802.11a_Chain 1 / CH48	**802.11ax (HE20)_OFDM_Chain 1 / CH48**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH48	**802.11ax (HE40)_OFDM_Chain 1 / CH46**
	

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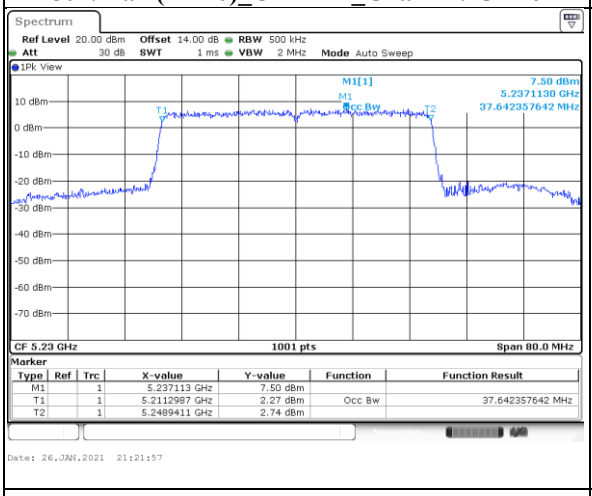
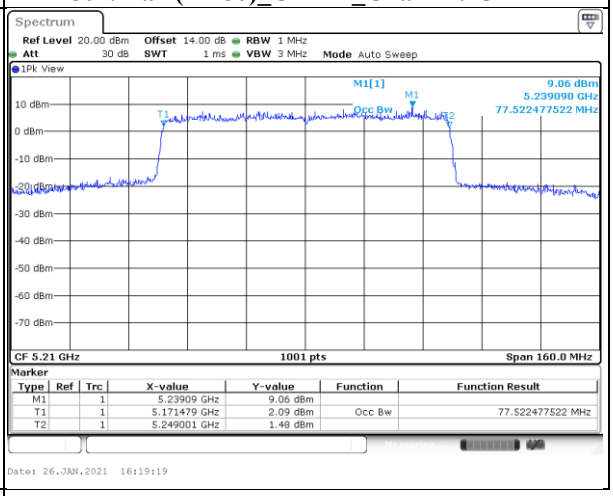
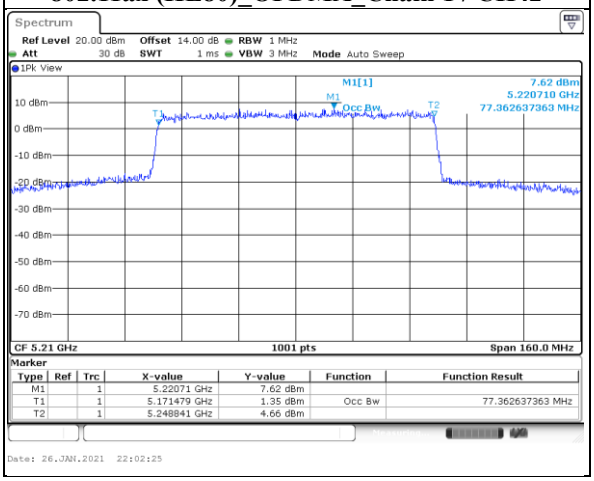
802.11ax (HE40)_OFDMA_Chain 1 / CH46



802.11ax (HE80)_OFDM_Chain 1 / CH42



802.11ax (HE80)_OFDMA_Chain 1 / CH42



Note: The observed T2 is all <5250 MHz, so in nearby DFS band channels no need for DFS function

Beamforming mode

802.11ax (HE20)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	19.02	18.98
44	5220	18.98	18.98
48	5240	19.02	18.94
52	5260	19.10	18.90
60	5300	18.94	19.02
64	5320	18.98	18.98
100	5500	18.90	18.94
116	5580	18.98	18.98
140	5700	19.10	18.94
144	5720	18.98	18.94
149	5745	18.94	19.02
157	5785	18.94	18.94
165	5825	18.90	19.10

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	19.38	19.14
44	5220	19.22	19.10
48	5240	19.02	19.10
52	5260	19.22	19.14
60	5300	19.06	19.22
64	5320	19.34	19.10
100	5500	19.22	19.06
116	5580	19.26	19.18
140	5700	19.10	19.14
144	5720	19.18	19.06
149	5745	19.14	19.22
157	5785	19.10	19.14
165	5825	19.14	19.30

802.11ax (HE40)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.64	37.72
46	5230	37.56	37.64
54	5270	37.64	37.64
62	5310	37.64	37.72
102	5510	37.72	37.72
110	5550	37.72	37.64
134	5670	37.64	37.72
142	5710	37.64	37.72
151	5755	37.64	37.56
159	5795	37.56	37.56

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.56	37.72
46	5230	37.56	37.64
54	5270	37.72	37.64
62	5310	37.56	37.64
102	5510	37.64	37.56
110	5550	37.72	37.64
134	5670	37.64	37.64
142	5710	37.64	37.64
151	5755	37.64	37.56
159	5795	37.56	37.56

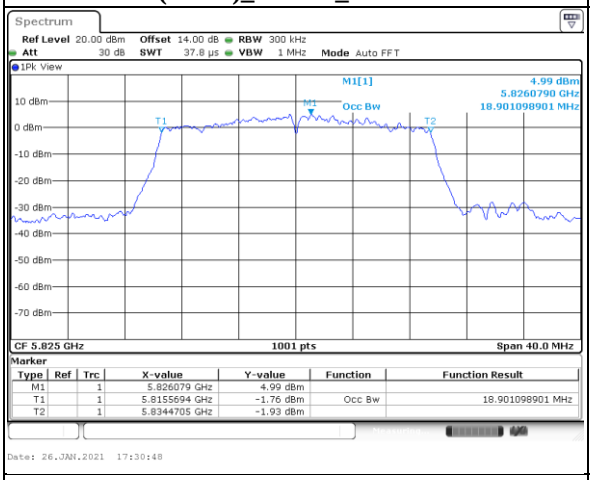
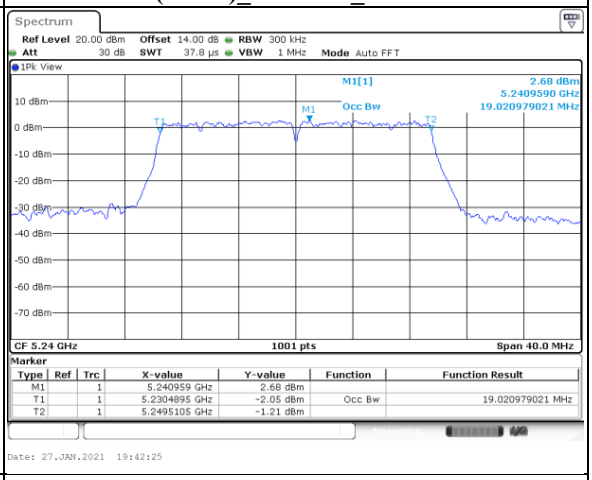
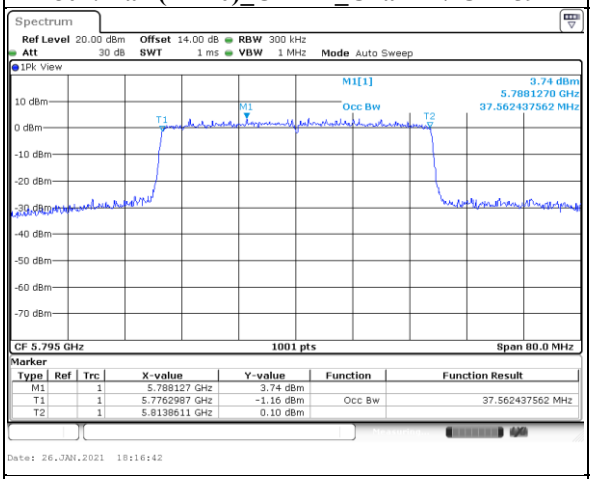
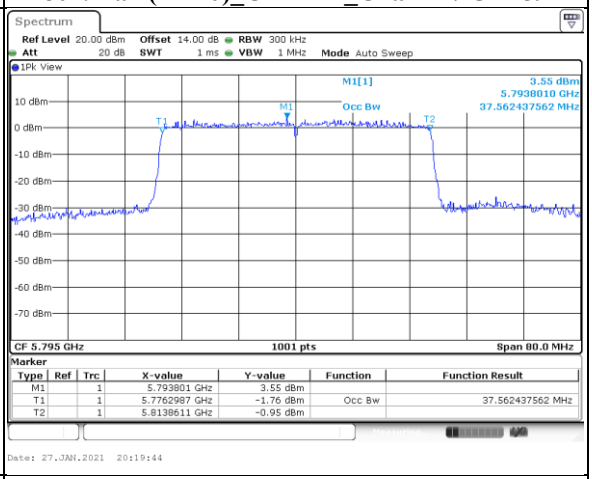
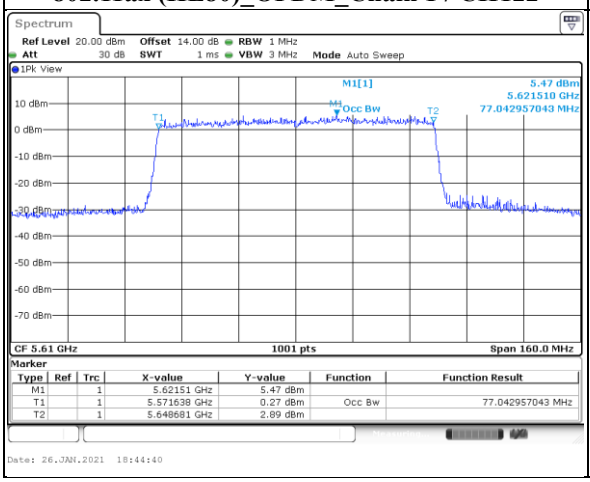
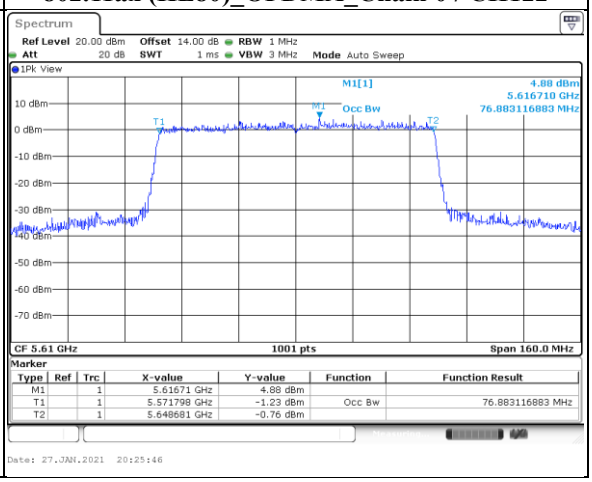
802.11ax (HE80)

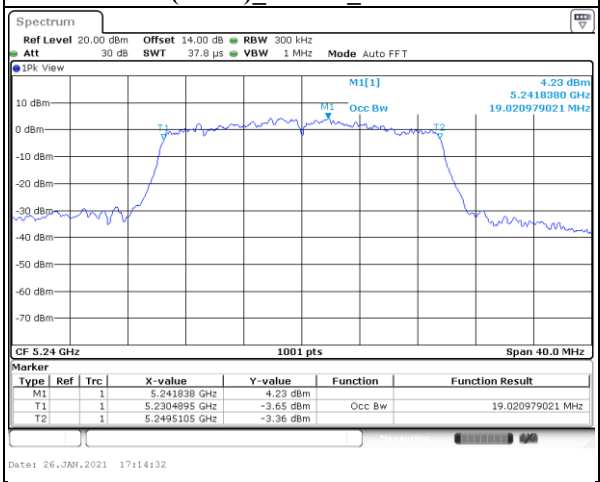
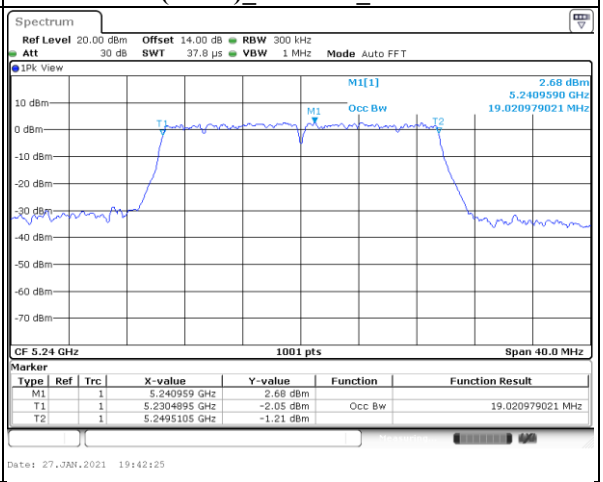
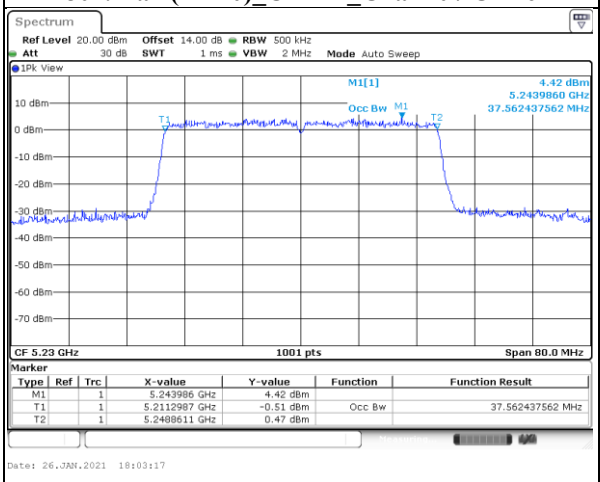
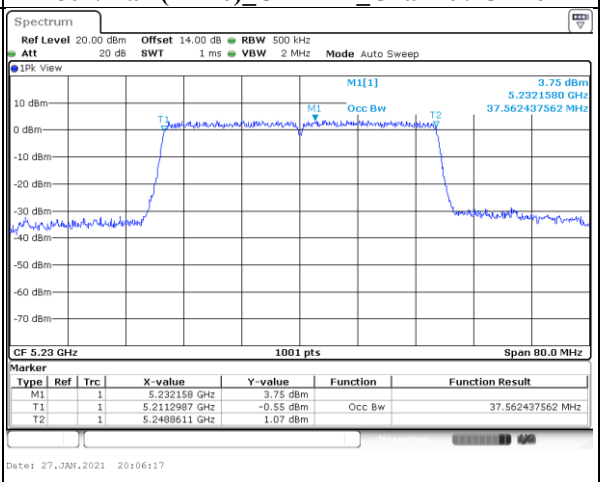
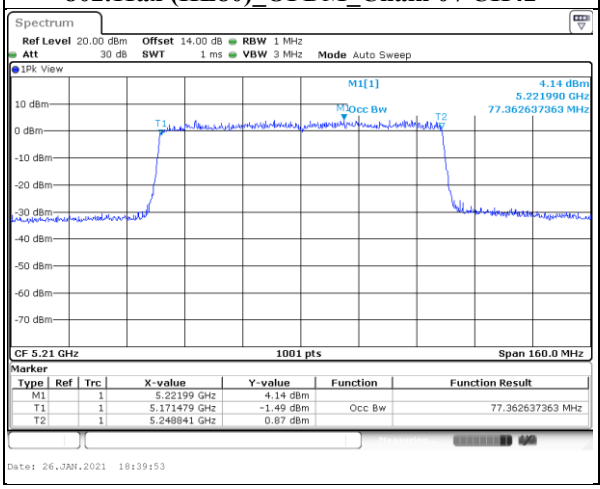
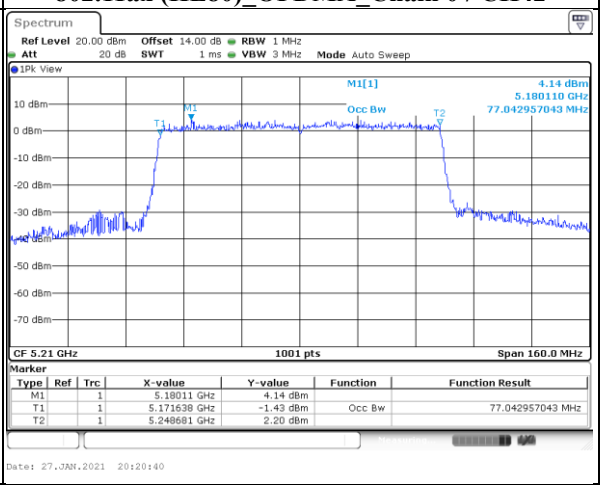
OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.36	77.20
58	5290	77.20	77.20
106	5530	77.20	77.20
122	5610	77.20	77.04
138	5690	77.20	77.36
155	5775	77.36	77.20

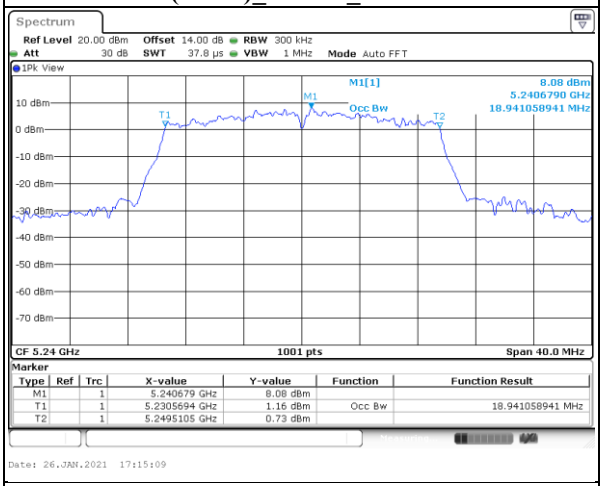
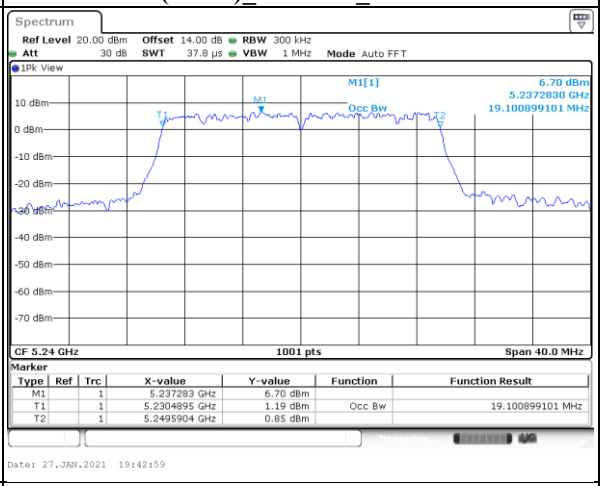
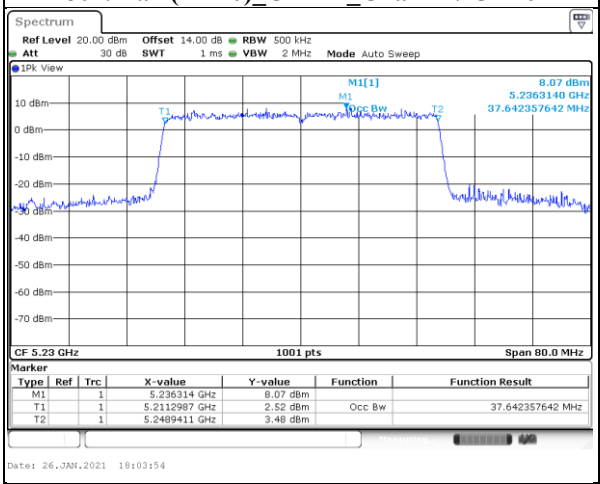
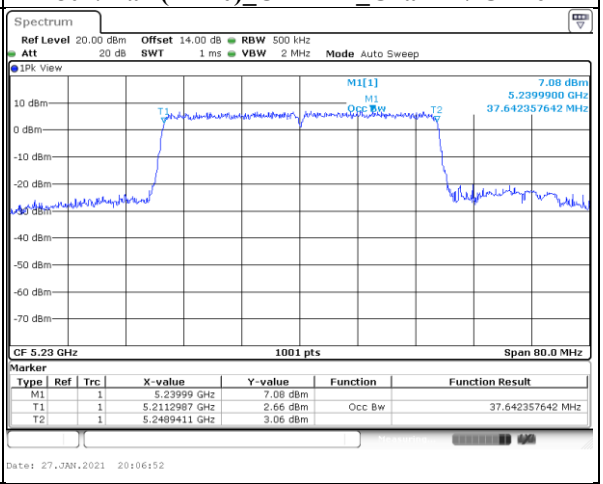
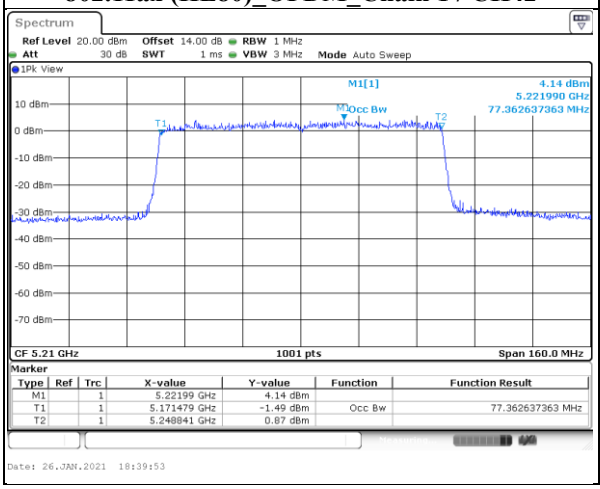
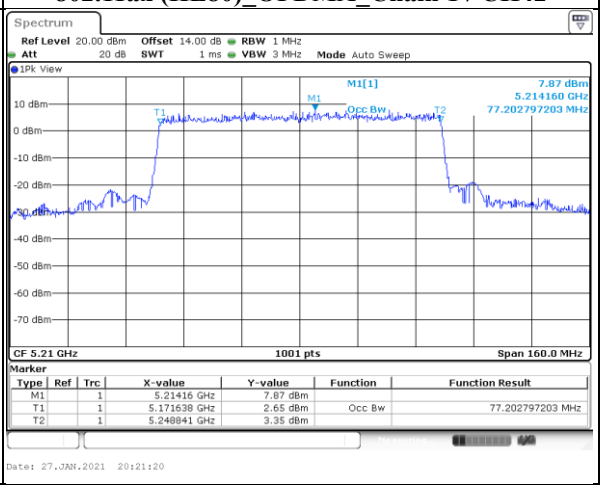
OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.04	77.20
58	5290	77.20	77.20
106	5530	77.36	77.36
122	5610	76.88	77.20
138	5690	77.36	77.36
155	5775	77.36	77.36

Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 0 / CH165	**802.11ax (HE20)_OFDMA_Chain 0 / CH48**
	
802.11ax (HE40)_OFDM_Chain 1 / CH159	**802.11ax (HE40)_OFDMA_Chain 1 / CH159**
	
802.11ax (HE80)_OFDM_Chain 1 / CH122	**802.11ax (HE80)_OFDMA_Chain 0 / CH122**
	

Spectrum Plot for nearby DFS band	
802.11ax (HE20)_OFDM_Chain 0 / CH48	**802.11ax (HE20)_OFDMA_Chain 0 / CH48**
	
802.11ax (HE40)_OFDM_Chain 0 / CH46	**802.11ax (HE40)_OFDMA_Chain 0 / CH46**
	
802.11ax (HE80)_OFDM_Chain 0 / CH42	**802.11ax (HE80)_OFDMA_Chain 0 / CH42**
	

Note: The observed T2 is all <5250 MHz, so in nearby DFS band channels no need for DFS function

Spectrum Plot for nearby DFS band	
802.11ax (HE20)_OFDM_Chain 1 / CH48	**802.11ax (HE20)_OFDMA_Chain 1 / CH48**
	
802.11ax (HE40)_OFDM_Chain 1 / CH46	**802.11ax (HE40)_OFDMA_Chain 1 / CH46**
	
802.11ax (HE80)_OFDM_Chain 1 / CH42	**802.11ax (HE80)_OFDMA_Chain 1 / CH42**
	

Note: The observed T2 is all <5250 MHz, so in nearby DFS band channels no need for DFS function

9.4. Conducted Output Power

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) Max. e.i.r.p ≦ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6)
		Fixed point-to-point Access Point	1 Watt (30 dBm) If G_{TX} > 23 dBi, then P_{Out} = 30 – (G_{TX} – 23)
		Indoor Access Point	1 Watt (30 dBm) If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6)
	√	Client device	250mW (23.98 dBm) If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6)
U-NII-2A	√		250mW (23.98 dBm) or 11 dBm+10 log B* If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6)
U-NII-2C	√		250mW (23.98 dBm) or 11 dBm+10 log B* If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6)
U-NII-3	√		For Point-to-multipoint systems (P2M): 1 Watt (30 dBm). If G_{TX} > 6 dBi, then P_{Out} = 30 – (G_{TX} – 6) For Point-to-point systems (P2P): 1 Watt (30 dBm)

Note:
1. P_{Out} = maximum conducted output power in dBm,
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ +...+$10^{Gn/20}$)^2 / Nant] dBi.

   N*a*nt: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas
4. B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

Test Procedure

For Average Power Measurement

Test method PM-G

For 802.11a, 802.11ax (HE20), 802.11ax (HE40)

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst and set the detector to AVERAGE. Duty factor is not added to measured value.

Test method SA-1

For 802.11ax (HE80), Channel Straddling (802.11a, 802.11ax (HE20/ HE40/ HE80))

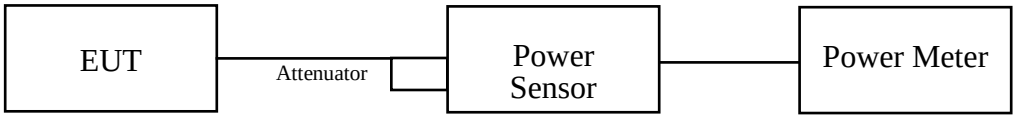
a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
b. Set sweep trigger*.
c. Set RBW = 1 MHz.
d. Set VBW ≥ 3 MHz
e. Number of points in sweep ≥ 2 Span / RBW.
f. Sweep time ≤ (number of points in sweep) * T
g. Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
h. Detector = RMS.
i. Trace mode = max hold.
j. Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

* If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

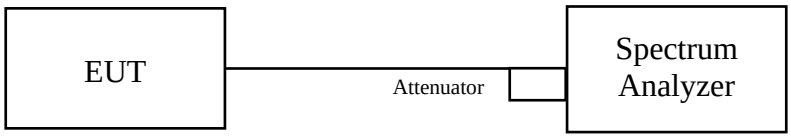
Note:
The straddling channel of (U-NII-2c Band) Power is Power meter value * (5725-(5720-(26 dBc BW/2))) / 26 dBc BW
The straddling channel of (U-NII-3 Band) Power is Power meter value * (5720+(26dBc BW/2)-5725) / 26 dBc BW

Test Setup

For Average Power Measurement



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

Non-Beamforming mode

802.11a

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
36	5180	13.33	15.36	55.847	17.47	23.98	PASS
44	5220	14.25	16.36	69.823	18.44	23.98	PASS
48	5240	14.50	16.22	69.984	18.45	23.98	PASS
52	5260	13.83	15.95	63.533	18.03	23.98	PASS
60	5300	14.75	16.09	70.469	18.48	23.98	PASS
64	5320	14.56	16.24	70.632	18.49	23.98	PASS
100	5500	14.46	15.84	66.222	18.21	23.98	PASS
116	5580	14.34	15.60	63.533	18.03	23.98	PASS
140	5700	13.66	15.15	55.976	17.48	23.98	PASS
144 (U-NII-2c Band)	5720	10.90	11.78	27.353	14.37	22.9	PASS
144 (U-NII-3 Band)	5720	3.83	4.21	5.047	7.03	30	PASS
149	5745	14.70	16.13	70.469	18.48	30	PASS
157	5785	14.85	16.03	70.632	18.49	30	PASS
165	5825	14.66	15.91	68.234	18.34	30	PASS

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
144	5720	14.73	15.99	69.502	18.42
Note: The total power was calculated through formula and record the value for reference only.					

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
36	5180	13.33	15.53	57.28	17.58	23.98	PASS
44	5220	13.47	15.44	57.28	17.58	23.98	PASS
48	5240	13.32	15.56	57.412	17.59	23.98	PASS
52	5260	13.21	15.43	55.847	17.47	23.98	PASS
60	5300	13.73	15.36	57.943	17.63	23.98	PASS
64	5320	13.64	15.70	60.256	17.80	23.98	PASS
100	5500	14.50	15.30	62.087	17.93	23.98	PASS
116	5580	14.22	15.55	62.373	17.95	23.98	PASS
140	5700	13.69	15.19	56.364	17.51	23.98	PASS
144 (U-NII-2c Band)	5720	10.04	11.32	23.659	13.74	22.91	PASS
144 (U-NII-3 Band)	5720	3.62	4.08	4.853	6.86	30	PASS
149	5745	13.93	15.49	60.117	17.79	30	PASS
157	5785	14.19	15.50	61.66	17.90	30	PASS
165	5825	13.84	15.22	57.412	17.59	30	PASS

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
144	5720	13.66	15.40	57.943	17.63
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
36	5180	13.56	15.89	61.518	17.89	23.98	PASS
44	5220	13.45	15.71	59.429	17.74	23.98	PASS
48	5240	13.62	15.93	62.23	17.94	23.98	PASS
52	5260	13.23	15.56	57.016	17.56	23.98	PASS
60	5300	13.82	15.87	62.806	17.98	23.98	PASS
64	5320	13.79	15.92	62.951	17.99	23.98	PASS
100	5500	13.73	15.72	60.954	17.85	23.98	PASS
116	5580	13.56	15.46	57.81	17.62	23.98	PASS
140	5700	13.70	15.25	56.885	17.55	23.98	PASS
144 (U-NII-2c Band)	5720	9.88	11.23	23.014	13.62	23.01	PASS
144 (U-NII-3 Band)	5720	3.68	4.12	4.92	6.92	30	PASS
149	5745	13.14	15.63	57.148	17.57	30	PASS
157	5785	13.45	15.45	57.148	17.57	30	PASS
165	5825	13.31	15.45	56.494	17.52	30	PASS

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
144	5720	13.56	15.35	57.016	17.56
Note: The total power was calculated through formula and record the value for reference only.					

802.11ax (HE40)

OFDM

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
38	5190	8.18	10.75	18.45	12.66	23.98	PASS
46	5230	13.09	15.56	56.364	17.51	23.98	PASS
54	5270	13.70	15.91	62.373	17.95	23.98	PASS
62	5310	9.99	12.12	26.242	14.19	23.98	PASS
102	5510	10.34	11.98	26.607	14.25	23.98	PASS
110	5550	14.02	15.67	62.087	17.93	23.98	PASS
134	5670	13.56	15.55	58.614	17.68	23.98	PASS
142 (U-NII-2c Band)	5710	11.59	13.59	37.239	15.71	23.98	PASS
142 (U-NII-3 Band)	5710	1.69	1.97	3.055	4.85	30	PASS
151	5755	13.54	15.79	60.534	17.82	30	PASS
159	5795	13.94	15.72	62.087	17.93	30	PASS

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
142	5710	13.28	15.56	57.28	17.58
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
38	5190	9.21	11.79	23.442	13.70	23.98	PASS
46	5230	13.23	15.58	57.148	17.57	23.98	PASS
54	5270	13.52	16.02	62.517	17.96	23.98	PASS
62	5310	10.02	12.21	26.669	14.26	23.98	PASS
102	5510	10.38	11.93	26.485	14.23	23.98	PASS
110	5550	13.65	16.00	62.951	17.99	23.98	PASS
134	5670	13.41	16.05	62.23	17.94	23.98	PASS
142 (U-NII-2c Band)	5710	11.67	13.89	39.174	15.93	23.98	PASS
142 (U-NII-3 Band)	5710	1.73	2.03	3.083	4.89	30	PASS
151	5755	13.36	16.03	61.802	17.91	30	PASS
159	5795	13.09	15.75	57.943	17.63	30	PASS

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
142	5710	13.40	15.92	60.954	17.85
Note: The total power was calculated through formula and record the value for reference only.					

802.11ax (HE80)

OFDM

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
42	5210	9.53	12.11	25.235	14.02	23.98	PASS
58	5290	10.78	13.36	33.651	15.27	23.98	PASS
106	5530	10.61	11.96	27.227	14.35	23.98	PASS
122	5610	13.88	15.39	59.02	17.71	23.98	PASS
138 (U-NII-2c Band)	5690	12.74	14.14	44.771	16.51	23.98	PASS
138 (U-NII-3 Band)	5690	1.01	1.34	2.624	4.19	30	PASS
155	5775	13.74	15.61	60.117	17.79	30	PASS

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
138	5690	13.75	15.48	59.02	17.71
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
42	5210	10.36	12.87	30.2	14.80	23.98	PASS
58	5290	10.67	13.25	32.81	15.16	23.98	PASS
106	5530	10.12	11.73	25.177	14.01	23.98	PASS
122	5610	13.62	16.02	62.951	17.99	23.98	PASS
138 (U-NII-2c Band)	5690	12.58	14.88	48.865	16.89	23.98	PASS
138 (U-NII-3 Band)	5690	0.97	1.16	2.559	4.08	30	PASS
155	5775	13.51	16.08	62.951	17.99	30	PASS

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
138	5690	13.55	16.04	62.806	17.98
Note: The total power was calculated through formula and record the value for reference only.					

Beamforming mode

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
36	5180	13.14	15.36	54.954	17.40	23.73	PASS
44	5220	13.41	15.36	56.234	17.50	23.73	PASS
48	5240	13.28	15.31	55.208	17.42	23.73	PASS
52	5260	13.07	15.31	54.2	17.34	23.73	PASS
60	5300	13.59	15.25	56.364	17.51	23.73	PASS
64	5320	13.41	15.59	58.21	17.65	23.73	PASS
100	5500	14.31	15.11	59.429	17.74	23.73	PASS
116	5580	14.05	15.44	60.395	17.81	23.73	PASS
140	5700	13.48	15.06	54.325	17.35	23.73	PASS
144 (U-NII-2c Band)	5720	10.02	11.20	23.227	13.66	22.7	PASS
144 (U-NII-3 Band)	5720	3.64	4.06	4.864	6.87	29.75	PASS
149	5745	13.68	15.48	58.614	17.68	29.75	PASS
157	5785	14.05	15.26	59.02	17.71	29.75	PASS
165	5825	13.63	15.07	55.208	17.42	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
144	5720	13.66	15.26	56.754	17.54
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
36	5180	13.33	15.80	59.566	17.75	23.73	PASS
44	5220	13.35	15.46	56.754	17.54	23.73	PASS
48	5240	13.53	15.92	61.66	17.90	23.73	PASS
52	5260	13.08	15.43	55.208	17.42	23.73	PASS
60	5300	13.61	15.85	61.376	17.88	23.73	PASS
64	5320	13.66	15.74	60.674	17.83	23.73	PASS
100	5500	13.58	15.72	60.117	17.79	23.73	PASS
116	5580	13.51	15.25	55.976	17.48	23.73	PASS
140	5700	13.62	15.02	54.828	17.39	23.73	PASS
144 (U-NII-2c Band)	5720	9.76	11.14	22.491	13.52	22.71	PASS
144 (U-NII-3 Band)	5720	3.62	4.07	4.853	6.86	29.75	PASS
149	5745	12.98	15.44	54.828	17.39	29.75	PASS
157	5785	13.39	15.23	55.208	17.42	29.75	PASS
165	5825	13.10	15.38	54.954	17.40	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
144	5720	13.38	15.21	54.954	17.40
Note: The total power was calculated through formula and record the value for reference only.					

802.11ax (HE40)

OFDM

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
38	5190	8.01	10.71	18.113	12.58	23.73	PASS
46	5230	12.97	15.52	55.463	17.44	23.73	PASS
54	5270	13.63	15.68	60.117	17.79	23.73	PASS
62	5310	9.77	11.88	24.889	13.96	23.73	PASS
102	5510	10.13	11.89	25.763	14.11	23.73	PASS
110	5550	13.97	15.58	61.094	17.86	23.73	PASS
134	5670	13.35	15.42	56.494	17.52	23.73	PASS
142 (U-NII-2c Band)	5710	11.44	13.56	36.559	15.63	23.73	PASS
142 (U-NII-3 Band)	5710	1.68	1.94	3.041	4.83	29.75	PASS
151	5755	13.47	15.68	59.156	17.72	29.75	PASS
159	5795	13.81	15.70	61.235	17.87	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
142	5710	13.12	15.50	55.976	17.48
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
38	5190	9.11	11.57	22.491	13.52	23.73	PASS
46	5230	13.01	15.49	55.335	17.43	23.73	PASS
54	5270	13.50	15.87	61.094	17.86	23.73	PASS
62	5310	9.86	11.96	25.41	14.05	23.73	PASS
102	5510	10.13	11.81	25.468	14.06	23.73	PASS
110	5550	13.54	15.89	61.376	17.88	23.73	PASS
134	5670	13.34	16.04	61.802	17.91	23.73	PASS
142 (U-NII-2c Band)	5710	11.50	13.70	37.584	15.75	23.73	PASS
142 (U-NII-3 Band)	5710	1.70	2.03	3.076	4.88	29.75	PASS
151	5755	13.36	15.80	59.704	17.76	29.75	PASS
159	5795	12.99	15.70	57.016	17.56	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

For Reference only – Power meter value

The power value was measured by power meter with average sensor.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
142	5710	13.20	15.73	58.345	17.66
Note: The total power was calculated through formula and record the value for reference only.					

802.11ax (HE80)

OFDM

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
42	5210	9.42	11.92	24.322	13.86	23.73	PASS
58	5290	10.65	13.36	33.266	15.22	23.73	PASS
106	5530	10.48	11.96	26.853	14.29	23.73	PASS
122	5610	13.73	15.30	57.544	17.60	23.73	PASS
138 (U-NII-2c Band)	5690	12.76	14.07	44.361	16.47	23.73	PASS
138 (U-NII-3 Band)	5690	0.99	1.16	2.564	4.09	29.75	PASS
155	5775	13.54	15.57	58.614	17.68	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
138	5690	13.75	15.23	57.016	17.56
Note: The total power was calculated through formula and record the value for reference only.					

OFDMA

CHAN.	CHAN. FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		Chain 0	Chain 1				
42	5210	10.34	12.71	29.512	14.70	23.73	PASS
58	5290	10.56	13.02	31.405	14.97	23.73	PASS
106	5530	9.89	11.54	23.988	13.80	23.73	PASS
122	5610	13.44	15.97	61.66	17.90	23.73	PASS
138 (U-NII-2c Band)	5690	12.55	14.12	43.853	16.42	23.73	PASS
138 (U-NII-3 Band)	5690	0.98	1.83	2.773	4.43	29.75	PASS
155	5775	13.46	15.92	61.235	17.87	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall be reduced.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		Chain 0	Chain 1		
138	5690	13.53	15.95	61.944	17.92
Note: The total power was calculated through formula and record the value for reference only.					

9.5. Power Spectral Density

Requirements

Operation Band	EUT Category		Limit
U-NII-1		Outdoor Access Point	17dBm/ MHz If G_{TX} > 6 dBi, then PSD = 17 – (G_{TX} – 6)
		Fixed point-to-point Access Point	17dBm/ MHz If G_{TX} > 23 dBi, then PSD = 17 – (G_{TX} – 23)
		Indoor Access Point	17dBm/ MHz If G_{TX} > 6 dBi, then PSD = 17 – (G_{TX} – 6)
	√	Client device	11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-2A	√		11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-2C	√		11dBm/ MHz If G_{TX} > 6 dBi, then PSD = 11 – (G_{TX} – 6)
U-NII-3	√		For Point-to-multipoint systems (P2M): 30dBm/ 500kHz. If G_{TX} > 6 dBi, then PSD = 30 – (G_{TX} – 6) For Point-to-point systems (P2P): 30dBm/ 500kHz

Note:
1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = 10 log[($10^{G1/20}$ + $10^{G2/20}$ +...+$10^{Gn/20}$)^2 / Nant] dBi.

   Nant: Number of Transmit Antennas
   G1, G2,..., Gn: Gain of Individual Antennas

Test procedure

For U-NII-1, U-NII-2A, U-NII-2C band:

Using method SA-2_with Duty cycle <98 %

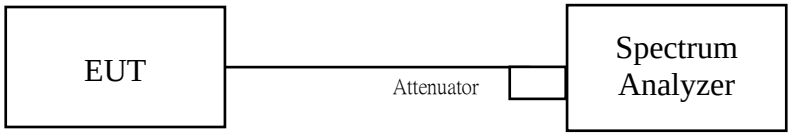
a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
c. Sweep time = auto, trigger set to "free run".
d. Trace average at least 100 traces in power averaging mode.
e. Record the max value and add 10 log (1/duty cycle)

For U-NII-3 band:

with Duty cycle <98 %

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 500 kHz, Set VBW ≥ 1 MHz, Detector = RMS
c. Use the peak marker function to determine the maximum power level in any 500 kHz band segment within the fundamental EBW.
d. Sweep time = auto, trigger set to "free run".
e. Trace average at least 100 traces in power averaging mode.
f. Record the max value and add 10 log (1/duty cycle)

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

Test Data

For U-NII-1, U-NII-2A, U-NII-2C band

Non-Beamforming mode

802.11a

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
36	5180	4.42	7.12	9.44	10.75	PASS
44	5220	5.04	8.48	10.55	10.75	PASS
48	5240	5.32	7.74	10.16	10.75	PASS
52	5260	5.07	7.40	9.85	10.75	PASS
60	5300	6.07	7.75	10.45	10.75	PASS
64	5320	6.01	7.75	10.43	10.75	PASS
100	5500	5.39	7.78	10.21	10.75	PASS
116	5580	5.91	7.34	10.14	10.75	PASS
140	5700	5.36	7.53	10.04	10.75	PASS
144 (U-NII-2c Band)	5720	6.03	8.19	10.7	10.75	PASS

Note:

1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
36	5180	2.99	5.59	8.04	10.75	PASS
44	5220	2.58	5.53	7.86	10.75	PASS
48	5240	2.56	5.39	7.76	10.75	PASS
52	5260	2.63	4.99	7.53	10.75	PASS
60	5300	3.70	5.44	8.22	10.75	PASS
64	5320	3.38	5.82	8.33	10.75	PASS
100	5500	4.02	6.37	8.91	10.75	PASS
116	5580	4.04	5.14	8.19	10.75	PASS
140	5700	3.96	5.98	8.65	10.75	PASS
144 (U-NII-2c Band)	5720	3.92	5.91	8.59	10.75	PASS

Note:

1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.

OFDMA

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
36	5180	0.88	3.41	6.37	10.75	PASS
44	5220	0.98	4.06	6.83	10.75	PASS
48	5240	1.01	3.81	6.67	10.75	PASS
52	5260	0.80	3.33	6.29	10.75	PASS
60	5300	1.59	4.06	7.04	10.75	PASS
64	5320	1.65	3.99	7.02	10.75	PASS
100	5500	1.61	3.47	6.68	10.75	PASS
116	5580	1.06	2.33	5.78	10.75	PASS
140	5700	1.32	2.69	6.1	10.75	PASS
144 (U-NII-2c Band)	5720	1.12	2.92	6.15	10.75	PASS

Note:

1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE40)

OFDM

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
38	5190	-6.91	-3.28	-0.52	10.75	PASS
46	5230	-2.12	0.24	3.43	10.75	PASS
54	5270	-1.33	1.56	4.56	10.75	PASS
62	5310	-5.01	-2.45	0.67	10.75	PASS
102	5510	-4.21	-1.97	1.26	10.75	PASS
110	5550	-0.49	1.55	4.86	10.75	PASS
134	5670	-0.73	0.73	4.27	10.75	PASS
142 (U-NII-2c Band)	5710	-0.68	1.50	4.76	10.75	PASS

OFDMA

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
38	5190	-6.63	-3.59	0.04	10.75	PASS
46	5230	-3.18	-0.15	3.48	10.75	PASS
54	5270	-2.15	0.52	4.28	10.75	PASS
62	5310	-6.43	-3.69	0.04	10.75	PASS
102	5510	-4.91	-3.07	1	10.75	PASS
110	5550	-1.43	0.31	4.42	10.75	PASS
134	5670	-1.72	-0.10	4.06	10.75	PASS
142 (U-NII-2c Band)	5710	-2.16	0.34	4.16	10.75	PASS

Note:

1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE80)

OFDM

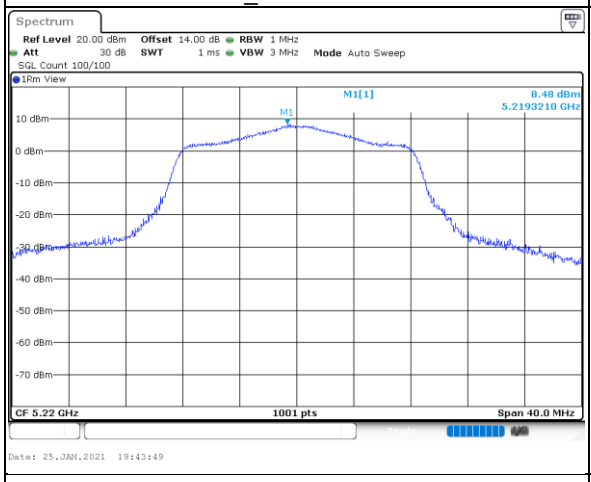
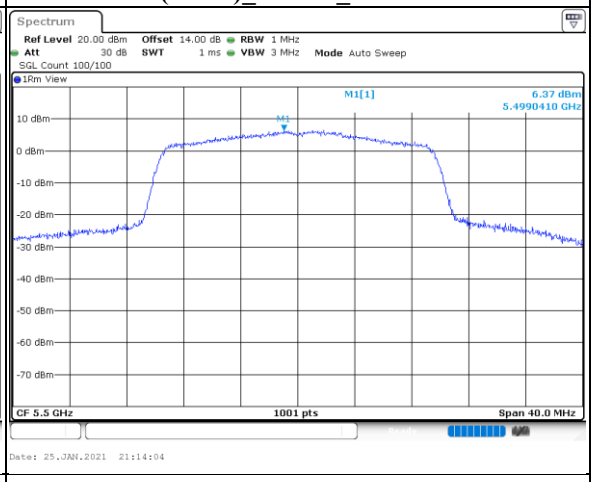
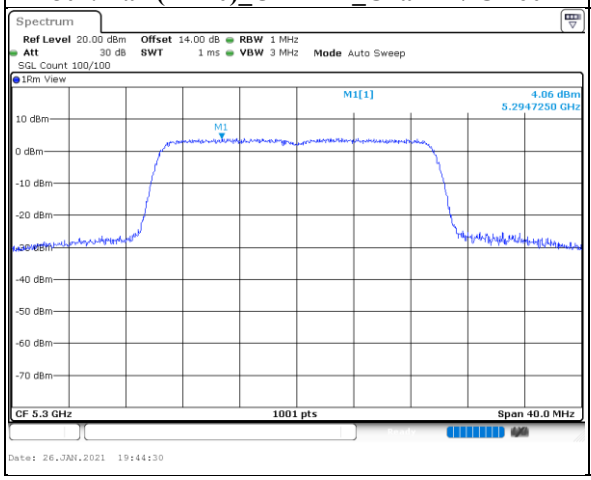
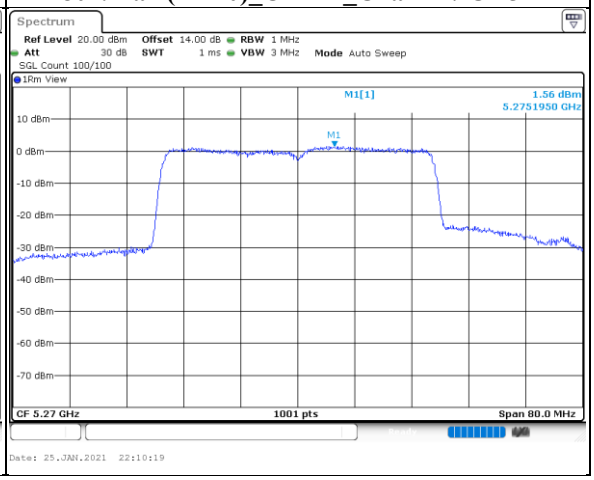
CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
42	5210	-9.47	-5.94	-1.91	10.75	PASS
58	5290	-7.93	-4.81	-0.65	10.75	PASS
106	5530	-7.44	-5.56	-0.95	10.75	PASS
122	5610	-3.93	-2.50	2.29	10.75	PASS
138 (U-NII-2c Band)	5690	-3.77	-2.48	2.37	10.75	PASS

OFDMA

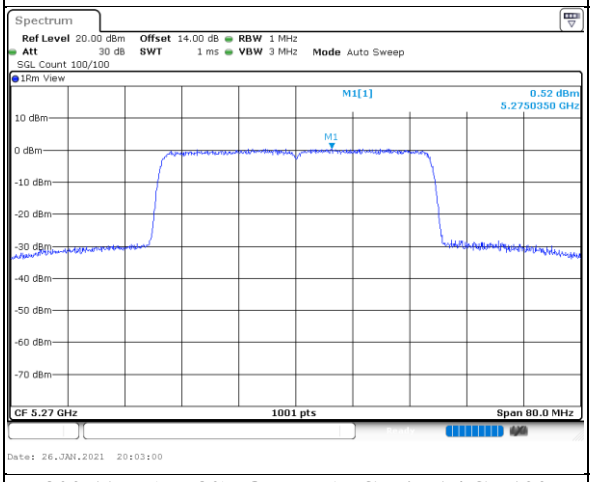
CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
42	5210	-10.25	-6.85	-1.98	10.75	PASS
58	5290	-9.98	-6.17	-1.42	10.75	PASS
106	5530	-9.79	-8.09	-2.61	10.75	PASS
122	5610	-5.76	-3.77	1.6	10.75	PASS
138 (U-NII-2c Band)	5690	-6.13	-4.00	1.31	10.75	PASS

Note:

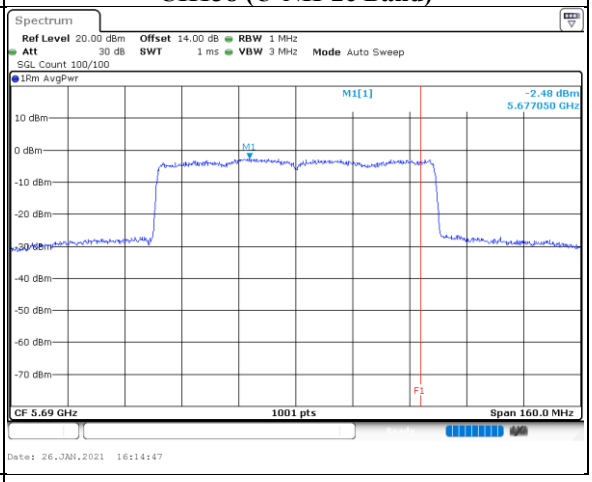
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH44	**802.11ax (HE20)_OFDM_Chain 1 / CH100**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH60	**802.11ax (HE40)_OFDM_Chain 1 / CH54**
	

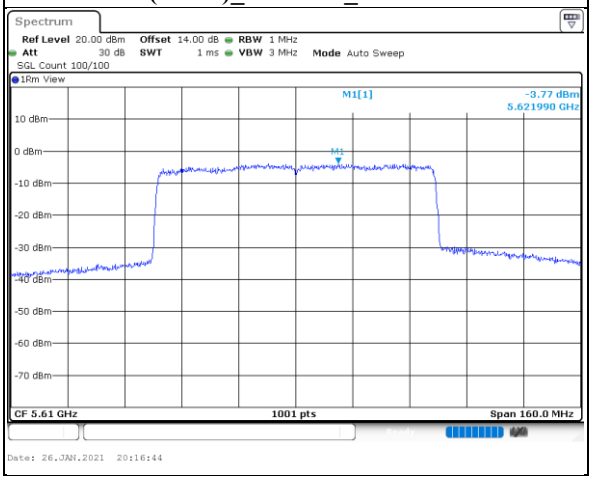
802.11ax (HE40)_OFDMA_Chain 1 / CH54



802.11ax (HE80)_OFDM_Chain 1 / CH138 (U-NII-2c Band)



802.11ax (HE80)_OFDMA_Chain 1 / CH122



Beamforming mode

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	PSD (dBm/MHz)		TOTAL PSD with duty factor (dBm/MHz)	MAX. LIMIT (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1			
36	5180	3.43	5.58	8.2	10.75	PASS
44	5220	2.70	5.85	8.11	10.75	PASS
48	5240	2.56	5.29	7.7	10.75	PASS
52	5260	2.64	4.91	7.48	10.75	PASS
60	5300	3.46	5.90	8.41	10.75	PASS
64	5320	3.35	5.87	8.35	10.75	PASS
100	5500	4.19	6.16	8.85	10.75	PASS
116	5580	4.08	5.23	8.25	10.75	PASS
140	5700	4.09	5.46	8.39	10.75	PASS
144 (U-NII-2c Band)	5720	3.87	5.60	8.38	10.75	PASS

Note:

1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer to section 6.6 for duty cycle spectrum plot.