RADIO TEST REPORT

Product	:	IEEE 802.11ax/ac/a/b/g/n 2x2 WiFi with Bluetooth5.0 Combo Module
Model Name	:	WPEB-265AXI(BT) [R33]
Series Model	:	WPEB-265AXI(BT) [B18], WPEB-265AXI(BT) [B33], WPEB-265AXI(BT) [R18], AP12275_PB18, AP12275_PB33, AP12275_PR18, AP12275_PR33
FCC ID	:	RYK-WPEB265AXIBT
Test Regulation	:	FCC 47 CFR Part 15 Subpart E (Section 15.407)
Received Date	:	Aug. 3, 2020
Test Date	:	Aug. 3, 2020 ~ Dec. 2, 2020
Issued Date	:	Jan. 8, 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.: 4789558386-US-R1-V0

Rev.	Test report No.	Date	Page revised	Contents
Original	4789558386-US-R1-V0	Dec. 8, 2020	-	Initial issue
-	4789558386-US-R1-V0	Dec. 22, 2020	P.11 P.14 P.15 P.26~P.35 P.37~P.46 P.48~P.53, P.59~P.62 P.66 P.68~P.80	Add Note 3. Modify section 6.4. Modify section 6.5. Update test data. Update test data and plots. Update test data and plots. Add the calculation formula. Update test data.
-	4789558386-US-R1-V0	Jan. 8, 2021	P.1, P.4, P.8, P.10	Removed model: AP6275P.

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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:	WPEB-265AXI(BT) [R33]
SERIES MODEL:	WPEB-265AXI(BT) [B18], WPEB-265AXI(BT) [B33], WPEB-265AXI(BT) [R18], AP12275_PB18, AP12275_PB33, AP12275_PR18, AP12275_PR33
SAMPLE STAGE:	Identical Prototype
DATE of TESTED:	Aug. 3, 2020 ~ Dec. 2, 2020

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 : Jan. 8, 2021
Project Handler

Approved and Authorized By:

Waternil Guan Date : Jan. 8, 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.: 4789558386-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	WPEB-265AXI(BT) [R33]	
Series Model	WPEB-265AXI(BT) [B18], WPEB-265AXI(BT) [B33], WPEB-265AXI(BT) [R18], AP12275_PB18, AP12275_PB33, AP12275_PR18, AP12275_PR33	
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: 18.31 dBm 5260 ~ 5320 MHz: 18.50 dBm 5500 ~ 5720 MHz: 18.28 dBm 5745 ~ 5825 MHz: 18.47 dBm Beamforming mode: 5180 ~ 5240 MHz: 17.92 dBm 5260 ~ 5320 MHz: 17.89 dBm 5500 ~ 5720 MHz: 17.88 dBm 5745 ~ 5825 MHz: 17.87 dBm	
Normal Voltage	3.3 Vdc	
S/N	20B65C2100002	
Software Version	N/A	

Note:

1. All model PCB layout and RF Module are the same, but some ICs and resistors are different. The configuration of all related components are shown in the table below.

Main Model Name		
Brand	Model	Components
SparkLAN	WPEB-265AXI(BT) [R33]	U3,U4: MULTI-VOLTAGE LEVEL TRANSLATOR R4,R17,R22,R23,R24,R25: 33K ohm R26,R27,R28,R29,R30,R31: 33K ohm R1,R13,R15,R16,R20,R21: 0 ohm
Series Model Name		
Brand	Model	Components
SparkLAN	WPEB-265AXI(BT) [B33]	U4: MULTI-VOLTAGE LEVEL TRANSLATOR R4,R17,R26,R27,R28,R29,R30,R31: 33K ohm R1,R13,R15,R16,R20,R21: 0 ohm U5: USB-TO-UART DATA TRANSFER
	WPEB-265AXI(BT) [B18]	R4,R17,R30,R31: 33K ohm R1,R13,R15,R16,R20,R21,R5,R7,R9,R11: 0 ohm U5: USB-TO-UART DATA TRANSFER
	WPEB-265AXI(BT) [R18]	R4,R17,R30,R31: 33K ohm R1,R13,R15,R16,R20,R21,R5:50m ohm R6,R7,R8,R9,R10,R11,R12: 50m ohm
Ampak	AP12275_PB33	Same as WPEB-265AXI(BT) [B33], marketing purpose only.
	AP12275_PB18	Same as WPEB-265AXI(BT) [B18], marketing purpose only.
	AP12275_PR33	Same as WPEB-265AXI(BT) [R33], marketing purpose only.
	AP12275_PR18	Same as WPEB-265AXI(BT) [R18], marketing purpose only.

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 OFDM (HE) is the worst case, so the peak output power of HT20 and HT40 will quote the value of OFDM (HE20 and HE40).

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	Aug. 3, 2020 ~ Dec. 2, 2020	Mike Cai
Radiated Spurious Emission	966-2	22~26°C / 62~68%RH	120Vac / 60 Hz	Aug. 3, 2020 ~ Nov. 26, 2020	Carlos Chen
AC power Line Conducted Emission	SR1	23~25°C / 63~68%RH	120Vac / 60 Hz	Nov. 12, 2020 ~ Nov. 13, 2020	Carlos Chen

FCC Test Firm Registration Number: 498077

6.4. Description Of Available Antennas

Ant. No.	Brand Name	Model Name	Ant. Type	Ant. Gain (dBi)	Remark
0	SparkLAN	AD-103AG	Dipole	2.03	Length of RF Cable:150mm Connector type of RF cable: I-PEX/MHF1 to RP-SMA(F)
1	SparkLAN	AD-302N	Dipole	2.73	
2	SparkLAN	AD-303N	Dipole	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

- The antenna AD-303N has the highest gain, the following tests are all carried out using this antenna.
- 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.
- The fundamental of the EUT was investigated in three orthogonal axes X/Y/Z, it was determined that Z axis was worst-case . Therefore, all final radiated testing was performed with the EUT in Z axis.
- 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)

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	6.0
	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	6.0
	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	6.0
	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	6.0
	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	5260-5320	OFDM	52 to 64	64	6.0
AC Power Line Conducted Emission	802.11a	5260-5320	OFDM	52 to 64	64	6.0

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	6.0
	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	6.0
	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	6.0
	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	6.0
	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	5260-5320	OFDM	52 to 64	64	HE0
AC Power Line Conducted Emission	802.11ax20	5260-5320	OFDM	52 to 64	64	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 = 1.37/1.83 = 0.749, Duty factor = 10 * log(1/0.667) = 1.26

802.11ax (HE20):

OFDM: Duty cycle = 1/1.12 = 0.893, Duty factor = 10 * log(1/0.893) = 0.49
OFDMA: Duty cycle = 3.9/4.96 = 0.786, Duty factor = 10 * log(1/0.786) = 1.04

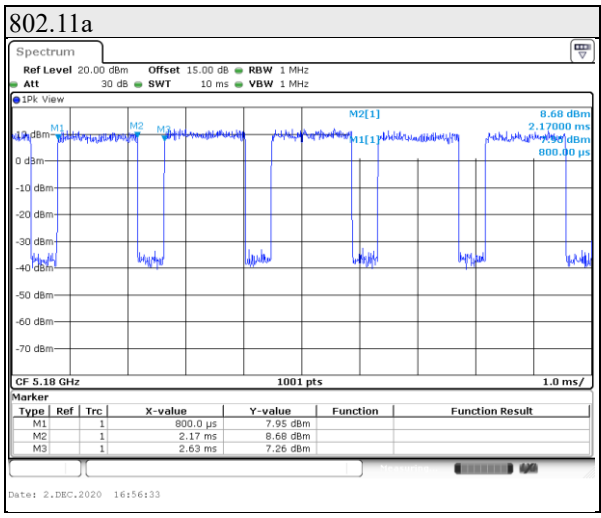
802.11ax (HE40):

OFDM: Duty cycle = 0.5/0.73 = 0.685, Duty factor = 10 * log(1/0.685) = 1.64
OFDMA: Duty cycle =1.95/3.01 = 0.648, Duty factor = 10 * log(1/0.648) = 1.89

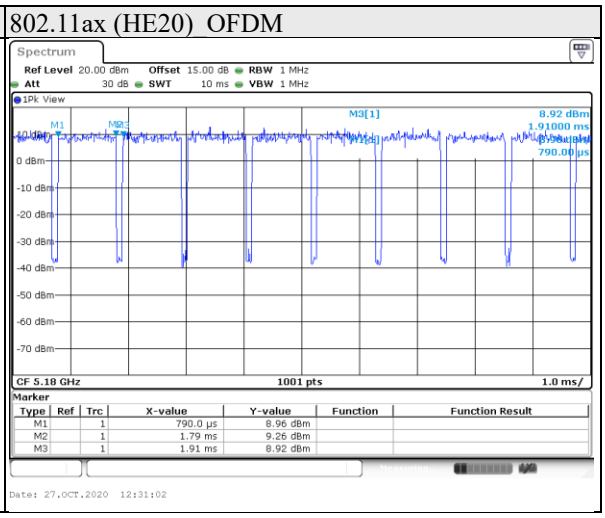
802.11ax (HE80):

OFDM: Duty cycle = 0.25/0.4 = 0.625, Duty factor = 10 * log(1/0.625) = 2.04
OFDMA: Duty cycle = 0.93/1.99 = 0.467, Duty factor = 10 * log(1/0.467) = 3.3

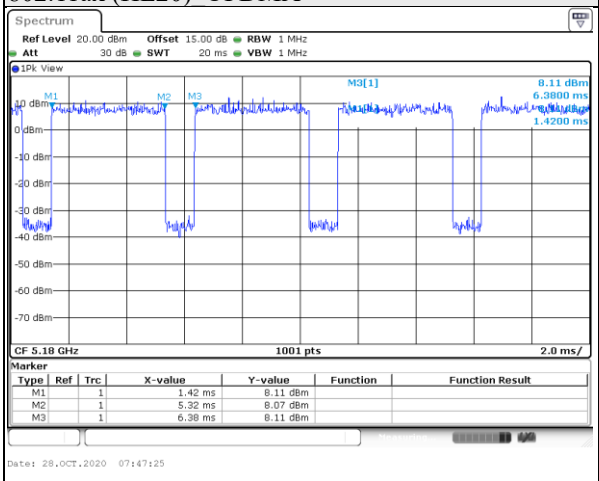
802.11a



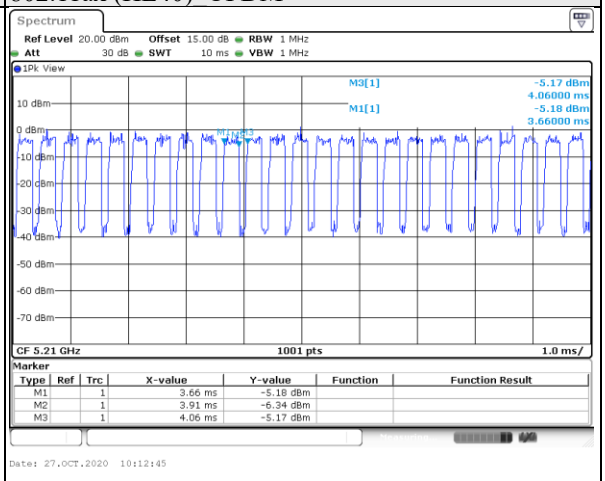
802.11ax (HE20) OFDM



802.11ax (HE20)_OFDMA



802.11ax (HE40)_OFDM



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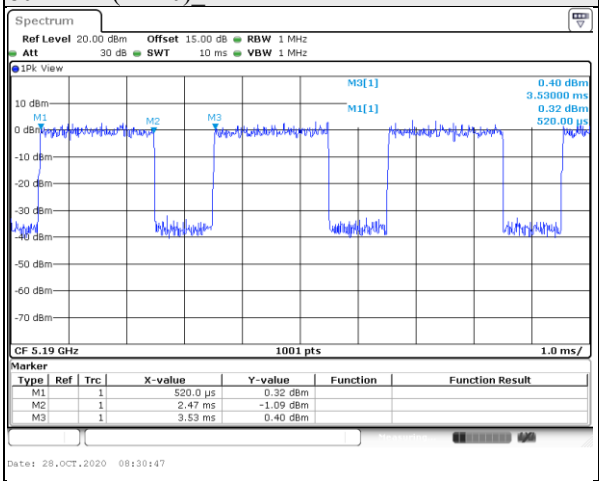
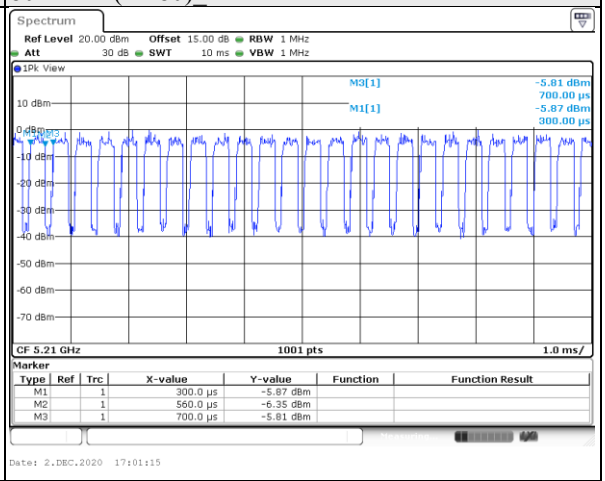
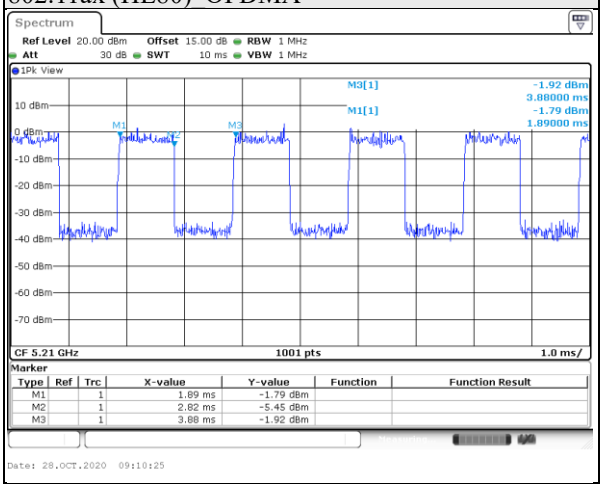


802.11ax (HE80)_OFDM



802.11ax (HE80)_OFDMA



Beamforming mode

802.11ax (HE20):

OFDM: Duty cycle = 1/1.13 = 0.885, Duty factor = 10 * log(1/0.885) = 0.53

OFDMA: Duty cycle = 3.92/4.94 = 0.794, Duty factor = 10 * log(1/0.794) = 1

802.11ax (HE40):

OFDM: Duty cycle = 0.5/0.64 = 0.781, Duty factor = 10 * log(1/0.781) = 1.07

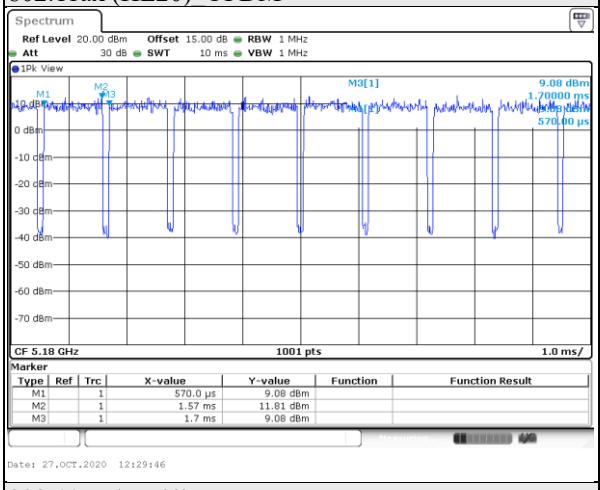
OFDMA: Duty cycle = 1.95/3 = 0.65, Duty factor = 10 * log(1/0.65) = 1.87

802.11ax (HE80):

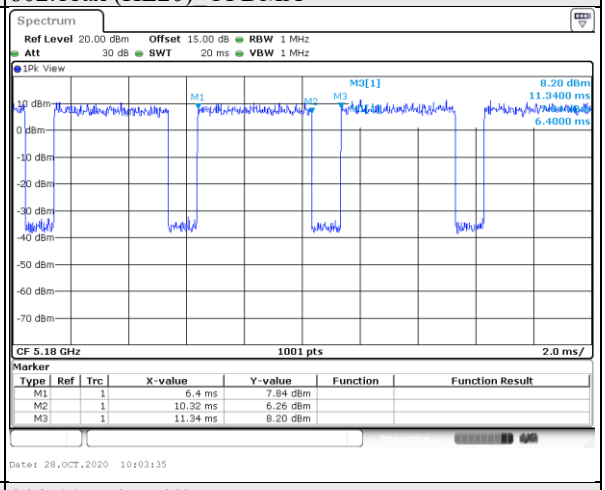
OFDM: Duty cycle = 0.24/0.41 = 0.585, Duty factor = 10 * log(1/0.585) = 2.33

OFDMA: Duty cycle = 0.93/1.99 = 0.467, Duty factor = 10 * log(1/0.467) = 3.3

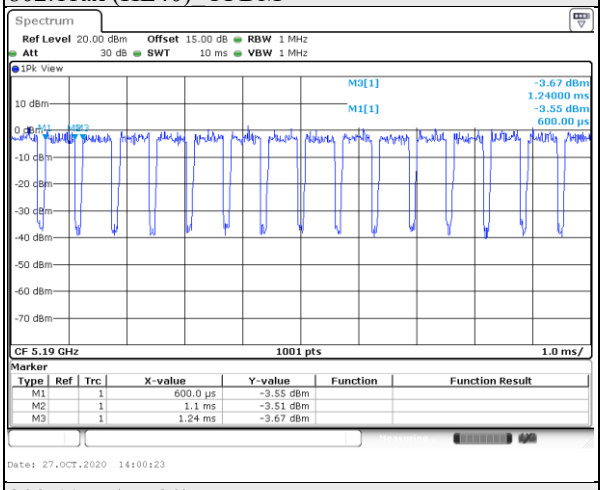
802.11ax (HE20) OFDM



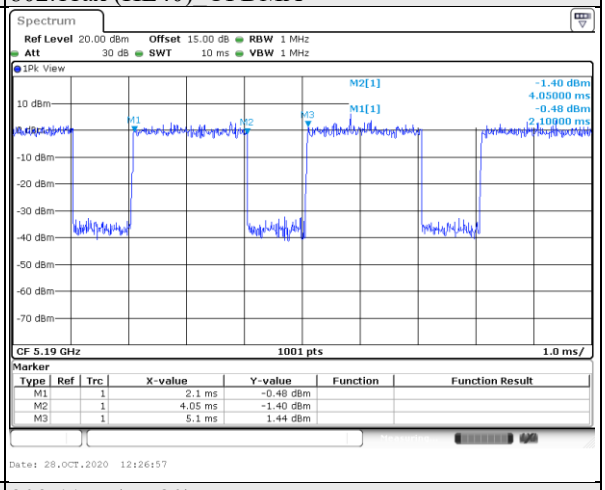
802.11ax (HE20) OFDMA



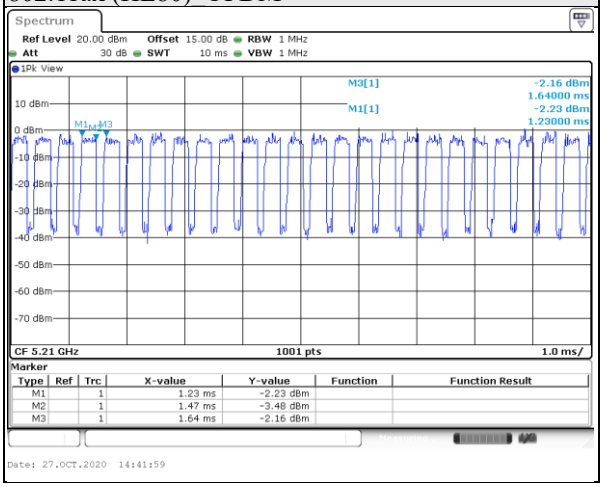
802.11ax (HE40) OFDM



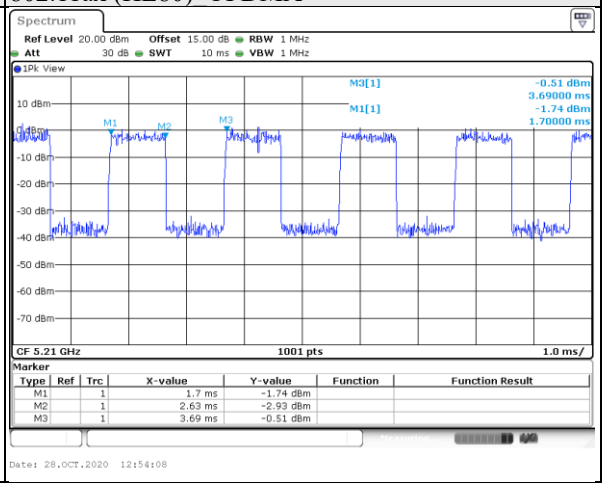
802.11ax (HE40) OFDMA



802.11ax (HE80) OFDM



802.11ax (HE80) OFDMA



7. Test Equipment

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Interval**
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 13, 2019 Nov. 11, 2020	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	Dec. 17, 2019	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 19, 2019	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	Jan. 3, 2020	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	Jan. 3, 2020	1 year
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	Dec. 27, 2019	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Jun. 9, 2020	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	Feb. 4, 2020	1 year
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	May 19, 2020	1 year
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	Jul. 2, 2020	1 year
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	Jan. 8, 2020	1 year

Test Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date**	**Cal. Interval**
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	Nov. 6, 2019 Nov. 6, 2020	1 year
Pulse Power Sensor	Anritsu	MA2411B	1531202	Dec. 23, 2019	1 year
Power Meter	Anritsu	ML2495A	1645002	Dec. 23, 2019	1 year
Temperature &Humidity Test Chamber	GIANT FORCE	GTH-150-40-CP-AR	MAA1701-010	Mar. 23,2020	1 year
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 19, 2019	1 year
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	Aug. 19, 2020	1 year
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	Aug. 12, 2020	1 year
Cables	HARBOUR INDUSTRIES	LL142	170205-5000-1	Feb. 5, 2020	1 year

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

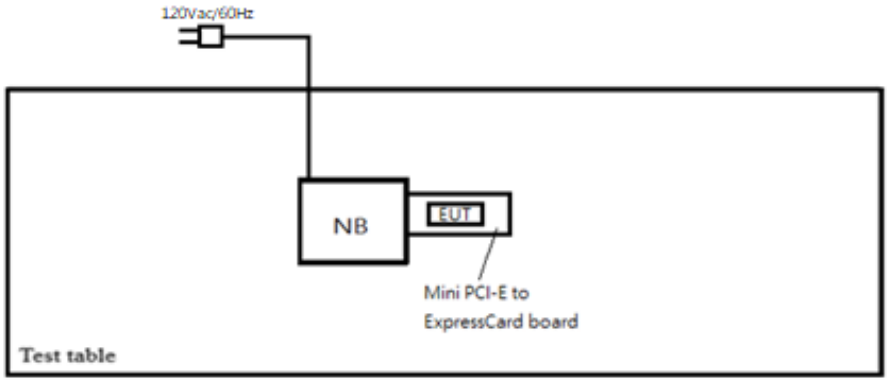
Support Equipment

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

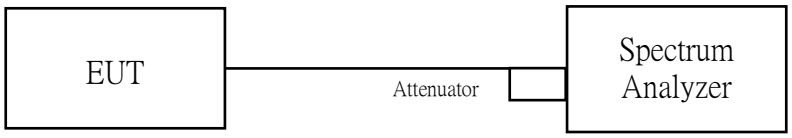
Requirements

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	2.5125	2.5125	0.5	Pass
149	5745	15.1449	15.1848	0.5	Pass
157	5785	15.0649	15.1848	0.5	Pass
165	5825	15.1449	15.1848	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	2.5524	4.2308	0.5	Pass
149	5745	16.983	18.3816	0.5	Pass
157	5785	15.8242	18.1419	0.5	Pass
165	5825	17.7423	18.3417	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	4.4706	4.4705	0.5	Pass
149	5745	18.9810	18.9810	0.5	Pass
157	5785	19.1009	18.9810	0.5	Pass
165	5825	18.9011	18.9411	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	3.6214	3.7812	0.5	Pass
151	5755	37.5624	37.5624	0.5	Pass
159	5795	37.4026	37.5624	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	3.7013	3.8611	0.5	Pass
151	5755	37.7223	37.6424	0.5	Pass
159	5795	37.5624	37.8022	0.5	Pass

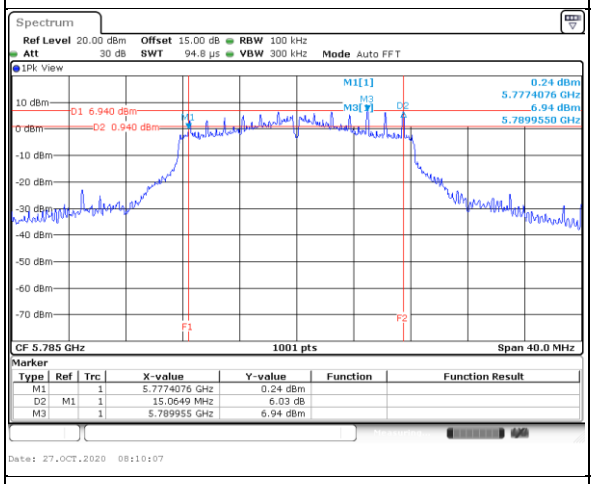
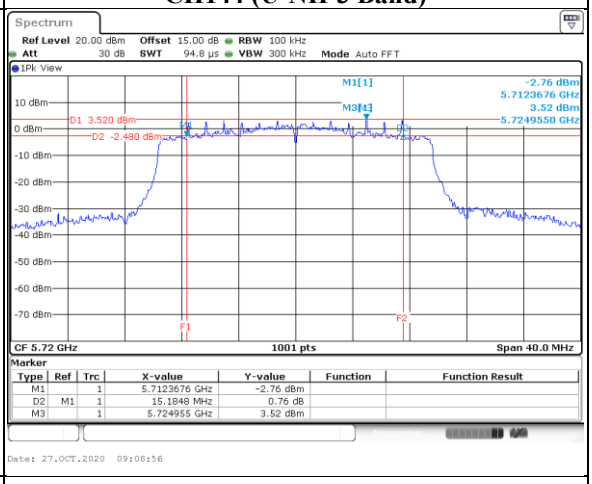
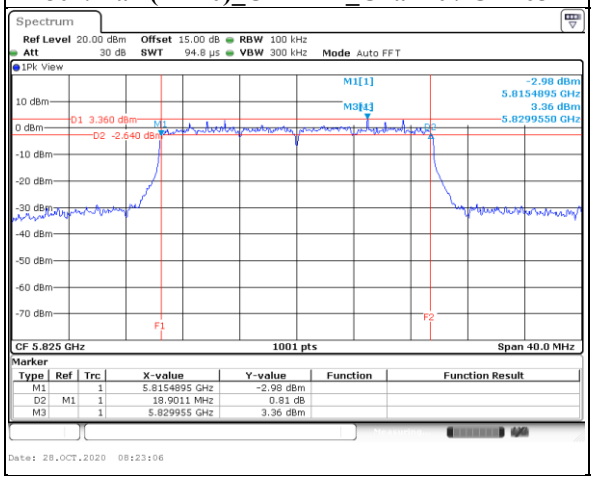
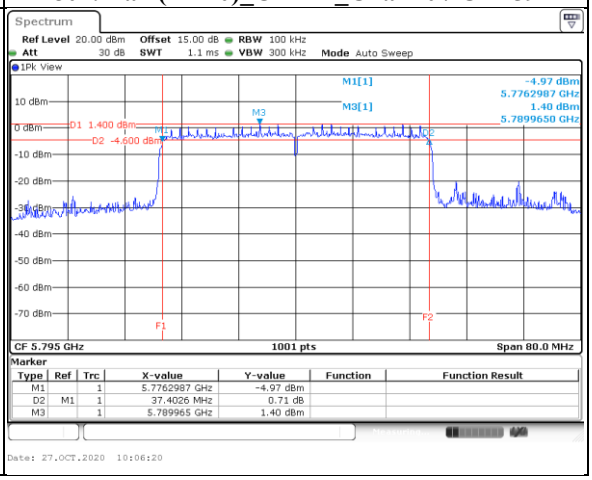
802.11ax (HE80)

OFDM

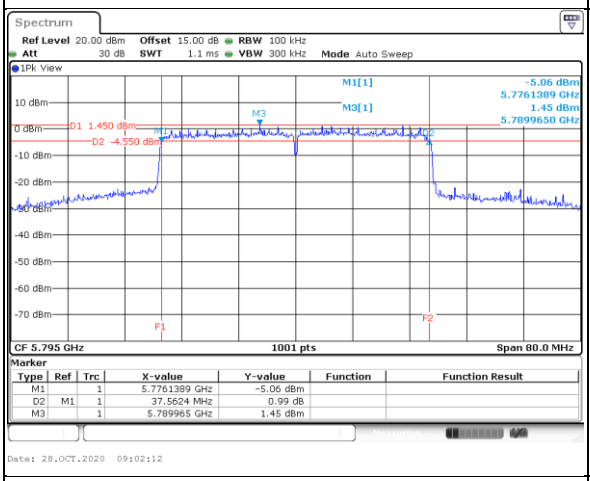
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.042	3.362	0.5	Pass
155	5775	77.363	77.043	0.5	Pass

OFDMA

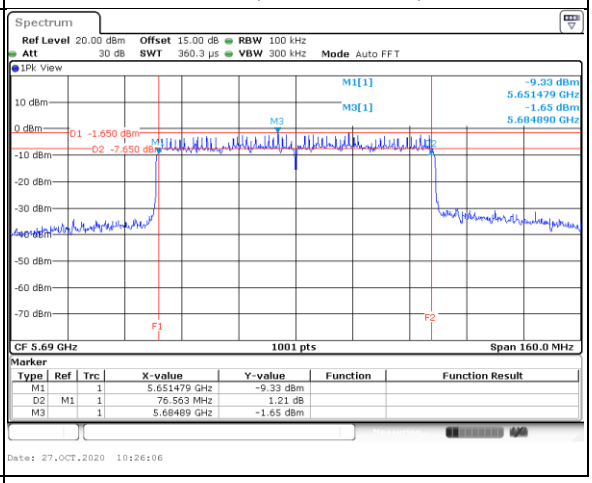
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.5220	3.6820	0.5	Pass
155	5775	77.2030	77.6820	0.5	Pass

Spectrum Plot of Worst Value	
802.11a_Chain 0 / CH157	**802.11ax (HE20)_OFDM_Chain 0 / CH144 (U-NII-3 Band)**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH165	**802.11ax (HE40)_OFDM_Chain 0 / CH159**
	

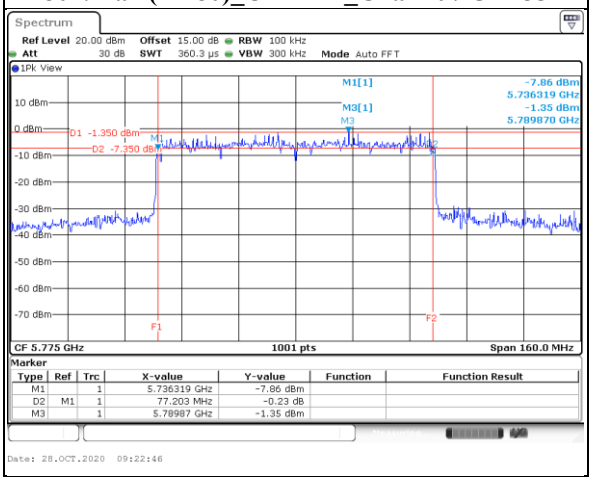
802.11ax (HE40)_OFDMA_Chain 0 / CH159



802.11ax (HE80)_OFDM_Chain 1 / CH138 (U-NII-3 Band)



802.11ax (HE80)_OFDMA_Chain 0 / CH155



Note: The 6dB 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	3.8711	4.1109	0.5	Pass
149	5745	17.1029	18.5015	0.5	Pass
157	5785	16.6234	18.5814	0.5	Pass
165	5825	16.9031	16.9431	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	4.4705	4.4705	0.5	Pass
149	5745	18.9810	19.0609	0.5	Pass
157	5785	18.9411	18.9810	0.5	Pass
165	5825	18.9411	19.0210	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	3.7013	3.8611	0.5	Pass
151	5755	37.5624	37.7223	0.5	Pass
159	5795	37.4026	37.003	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	3.7013	3.7812	0.5	Pass
151	5755	37.6424	37.8022	0.5	Pass
159	5795	37.7223	37.5624	0.5	Pass

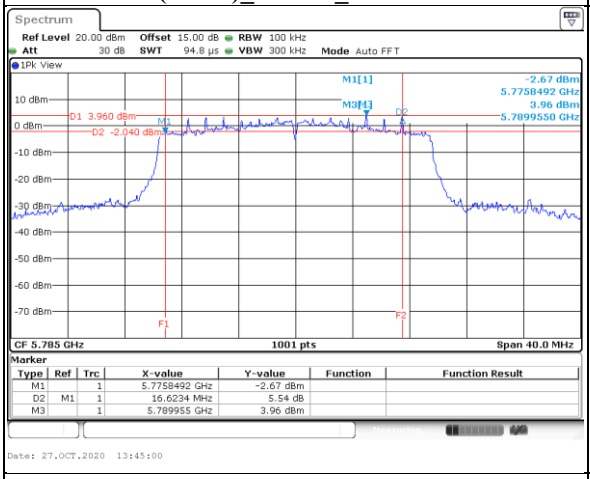
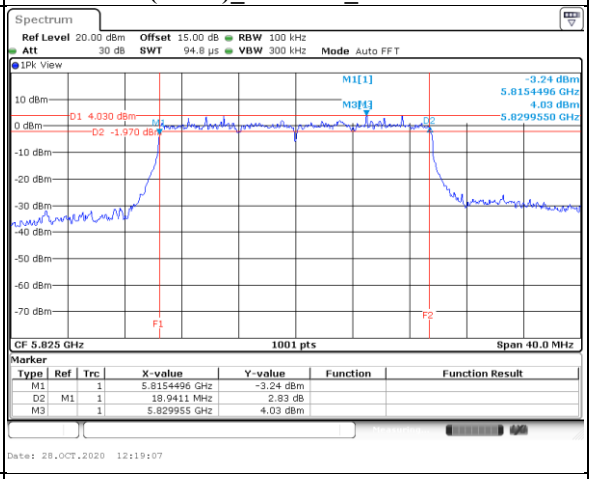
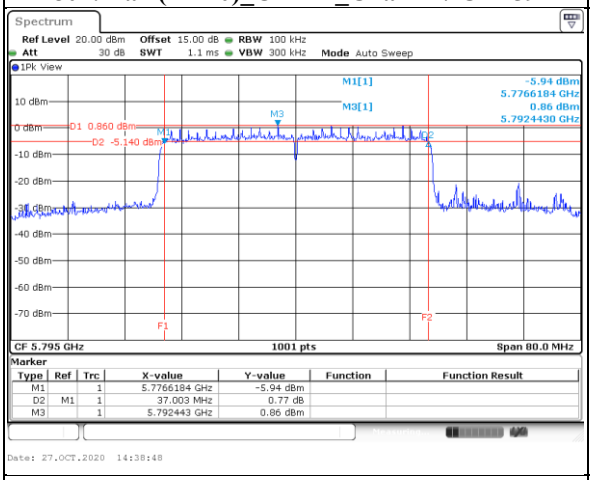
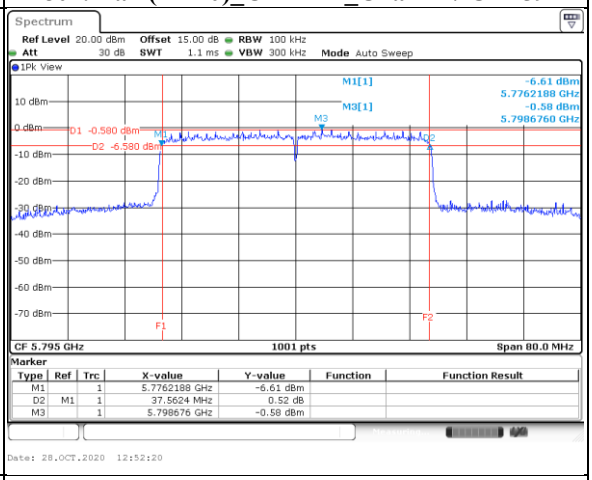
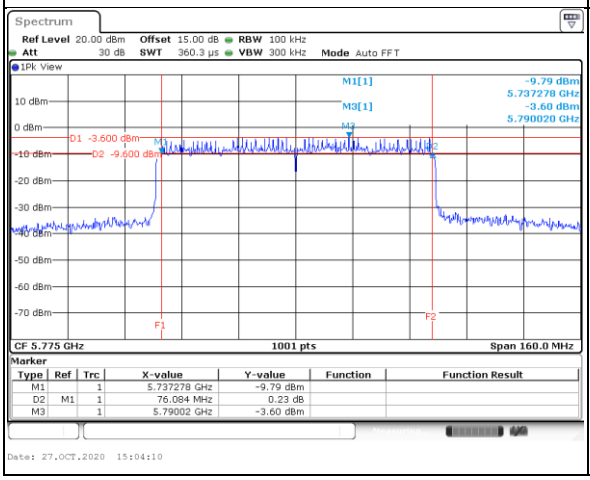
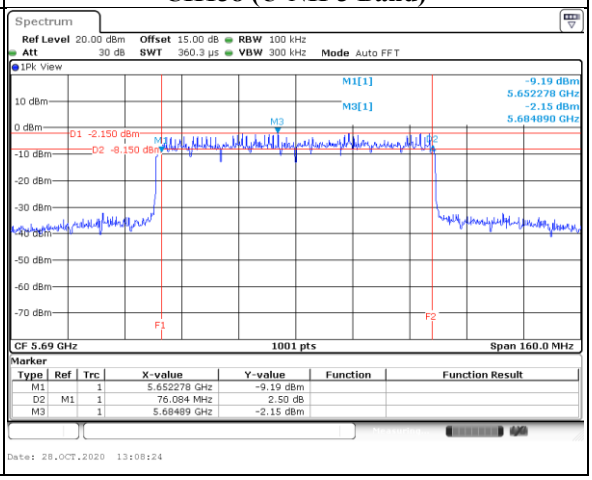
802.11ax (HE80)

OFDM

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
138 (U-NII-3 Band)	5690	3.362	3.362	0.5	Pass
155	5775	76.883	76.084	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	3.3620	3.5220	0.5	Pass
155	5775	77.2030	77.2030	0.5	Pass

Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 0 / CH157	**802.11ax (HE20)_OFDMA_Chain 0 / CH165**
	
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 / CH138 (U-NII-3 Band)**
	

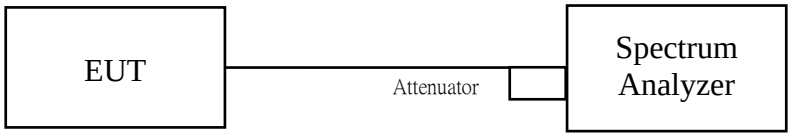
Note: The 6dB bandwidth above 5725MHz = Marker 1 + Delta 2 – 5725MHz

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	25.7343	21.1389
44	5220	21.2987	20.979
48	5240	21.019	21.5784
52	5260	20.7792	20.7792
60	5300	20.6593	21.019
64	5320	20.8591	21.1788
100	5500	21.0589	21.0989
116	5580	21.0989	21.1389
140	5700	20.6194	21.5784
144	5720	20.7792	21.4985
144 (U-NII-2c Band)	5720	15.5095	15.5495

802.11ax (HE20)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.1788	21.0989
44	5220	21.2987	21.4186
48	5240	21.1788	21.1389
52	5260	21.4585	21.2587
60	5300	21.1389	21.2987
64	5320	21.3786	21.4985
100	5500	21.4585	21.2987
116	5580	23.1369	21.2188
140	5700	21.2587	21.1788
144	5720	20.8192	21.4186
144 (U-NII-2c Band)	5720	15.5894	15.7093

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	22.018	21.8981
44	5220	24.1359	22.2577
48	5240	21.978	21.7383
52	5260	21.5784	21.7782
60	5300	21.7782	21.7782
64	5320	21.4585	21.8581
100	5500	21.6983	21.7782
116	5580	21.4186	22.0979
140	5700	21.4186	22.3377
144	5720	21.6184	23.7762
144 (U-NII-2c Band)	5720	15.8292	16.988

802.11ax (HE40)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.999	41.1588
46	5230	41.2388	41.2388
54	5270	44.036	44.036
62	5310	40.7592	41.0789
102	5510	40.7592	40.8392
110	5550	45.1548	51.9481
134	5670	52.1079	52.1079
142	5710	52.1878	58.1019
142 (U-NII-2c Band)	5710	35.4595	36.4985

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.7592	40.999
46	5230	41.0789	40.999
54	5270	40.999	40.999
62	5310	40.7592	40.9191
102	5510	40.7592	41.3187
110	5550	40.999	40.999
134	5670	40.9191	45.7143
142	5710	41.1588	50.2697
142 (U-NII-2c Band)	5710	35.6993	41.9331

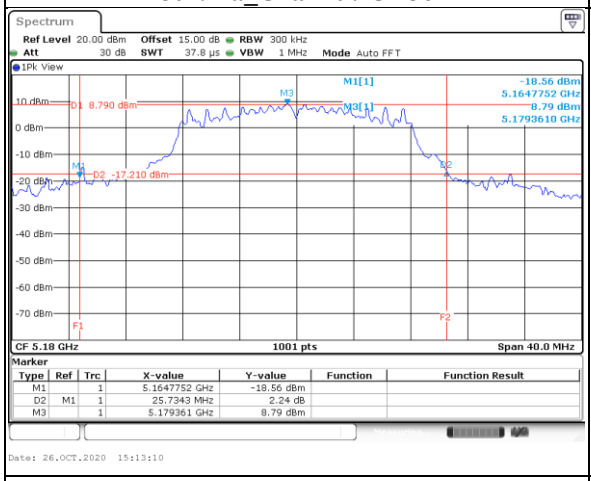
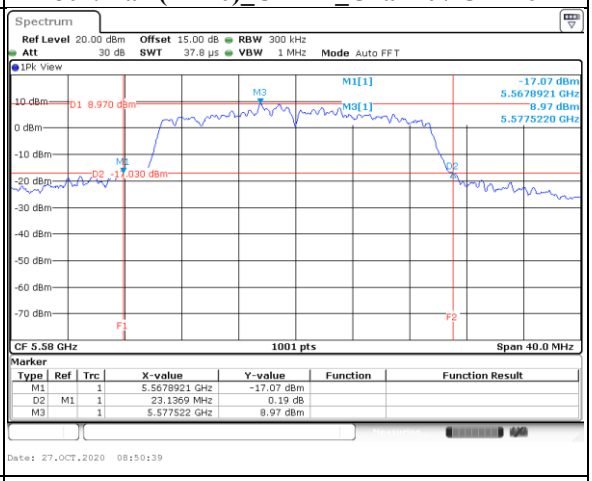
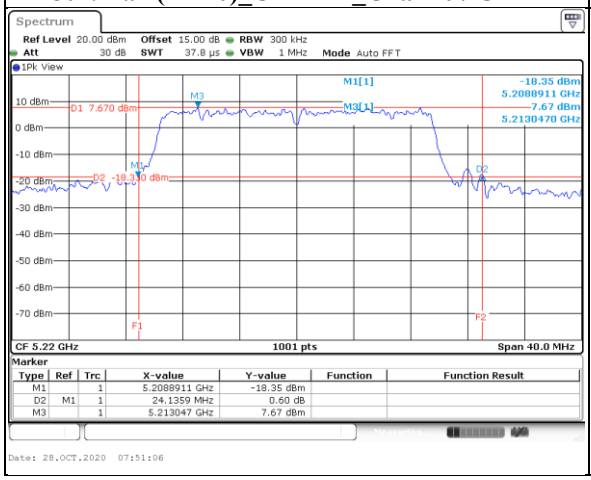
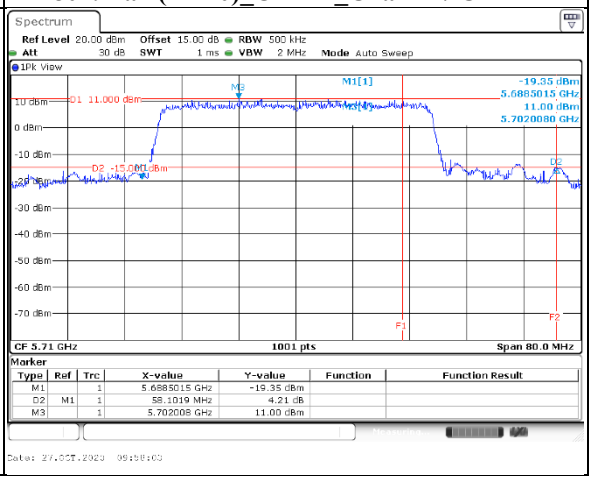
802.11ax (HE80)

OFDM

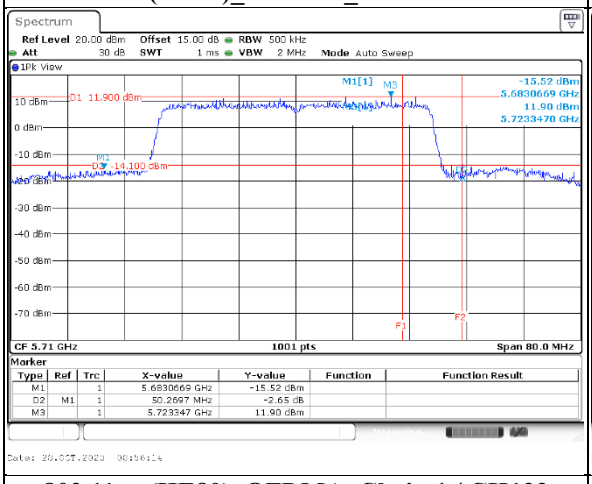
CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	82.158	81.518
58	5290	82.158	81.518
106	5530	81.838	81.518
122	5610	81.518	82.318
138	5690	82.158	89.031
138 (U-NII-2c Band)	5690	75.919	75.759

OFDMA

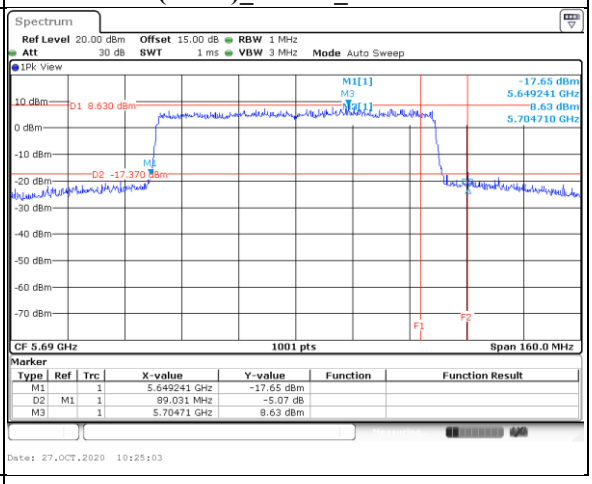
CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.518	81.678
58	5290	81.838	81.998
106	5530	81.359	81.998
122	5610	81.518	82.318
138	5690	81.678	82.158
138 (U-NII-2c Band)	5690	75.919	76.399

Spectrum Plot of Worst Value	
802.11a_Chain 0 / CH36	**802.11ax (HE20)_OFDM_Chain 0 / CH116**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH44	**802.11ax (HE40)_OFDM_Chain 1 / CH142**
	

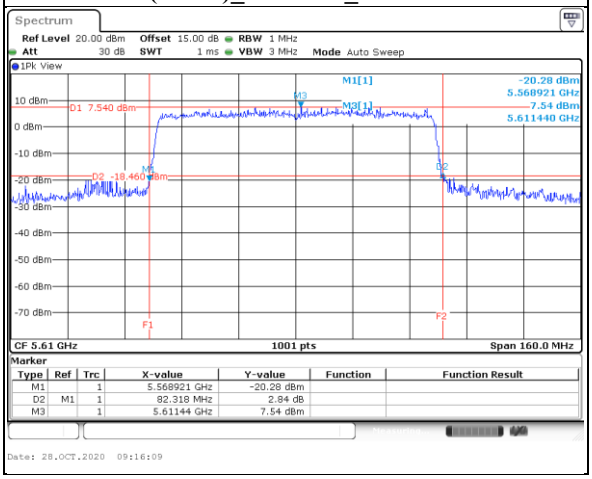
802.11ax (HE40)_OFDMA_Chain 1 / CH142



802.11ax (HE80)_OFDM_Chain 1 / CH138



802.11ax (HE80)_OFDMA_Chain 1 / CH122



Beamforming mode

802.11ax (HE20)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	21.6184	21.5385
44	5220	21.2987	22.8172
48	5240	21.4985	21.6184
52	5260	21.0989	21.0589
60	5300	20.8591	21.2987
64	5320	21.2987	21.2188
100	5500	21.2987	21.4186
116	5580	22.4575	21.2587
140	5700	21.2188	21.3387
144	5720	22.6573	21.6583
144 (U-NII-2c Band)	5720	16.8681	15.9491

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	22.0979	21.8182
44	5220	21.3786	22.018
48	5240	21.8182	21.8182
52	5260	21.8182	21.8981
60	5300	21.7383	22.0979
64	5320	21.4585	21.6983
100	5500	22.0579	22.2977
116	5580	21.6583	22.0579
140	5700	21.6583	24.6154
144	5720	21.7782	23.4166
144 (U-NII-2c Band)	5720	15.9491	16.1089

802.11ax (HE40)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.9191	41.0789
46	5230	44.5155	40.9191
54	5270	41.1588	43.7962
62	5310	40.8392	41.0789
102	5510	40.9191	40.999
110	5550	44.9151	51.5485
134	5670	52.2677	51.9481
142	5710	51.9481	52.028
142 (U-NII-2c Band)	5710	35.5395	35.5395

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	40.7592	40.999
46	5230	42.2777	40.999
54	5270	40.9191	47.2328
62	5310	40.6793	41.1588
102	5510	40.8392	40.8392
110	5550	40.7592	40.999
134	5670	40.999	46.9131
142	5710	45.3147	41.0789
142 (U-NII-2c Band)	5710	35.5395	35.4595

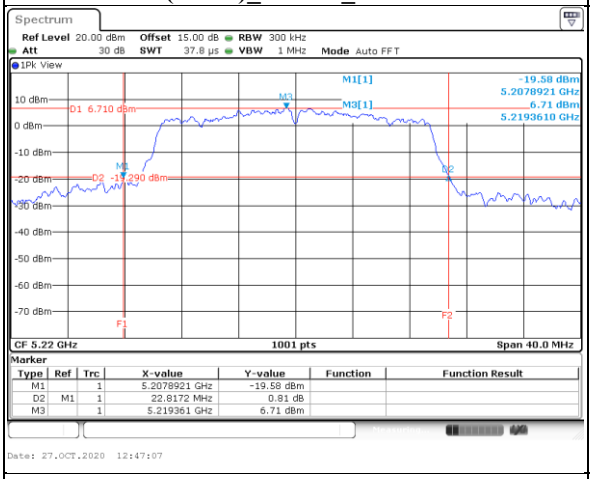
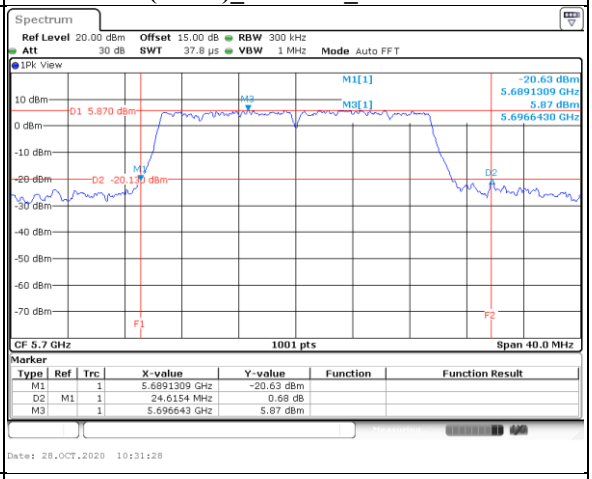
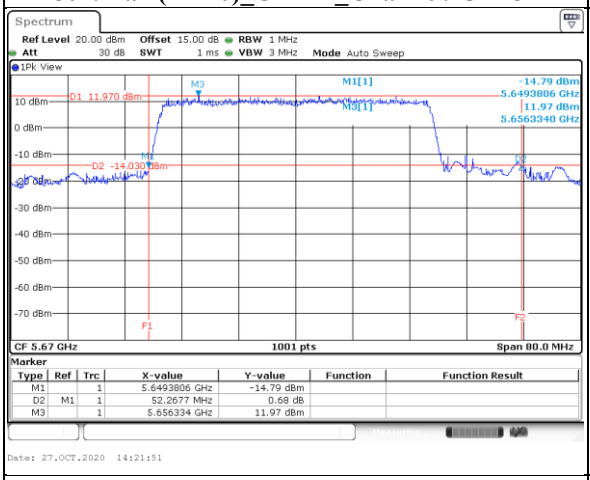
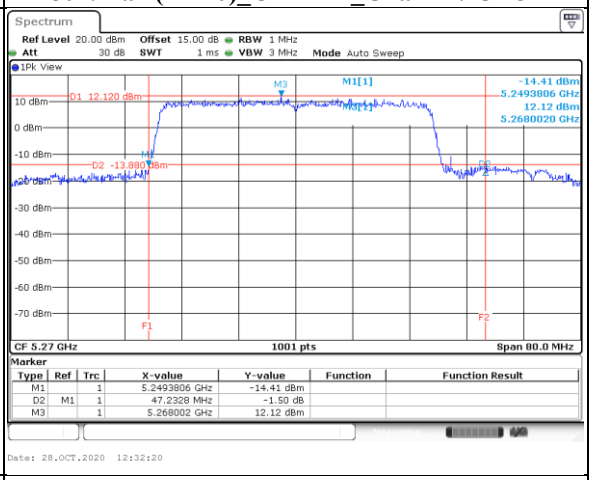
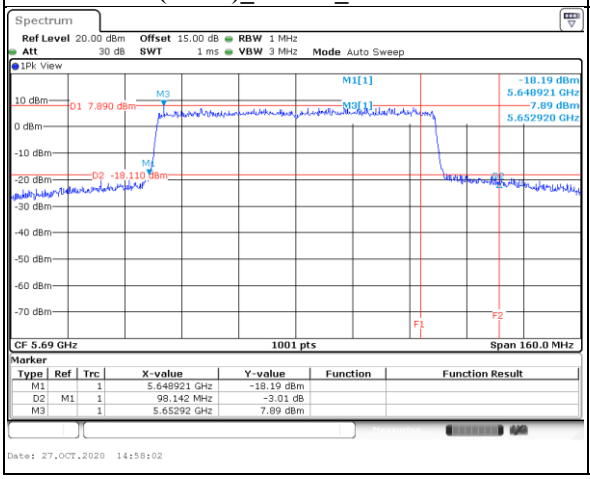
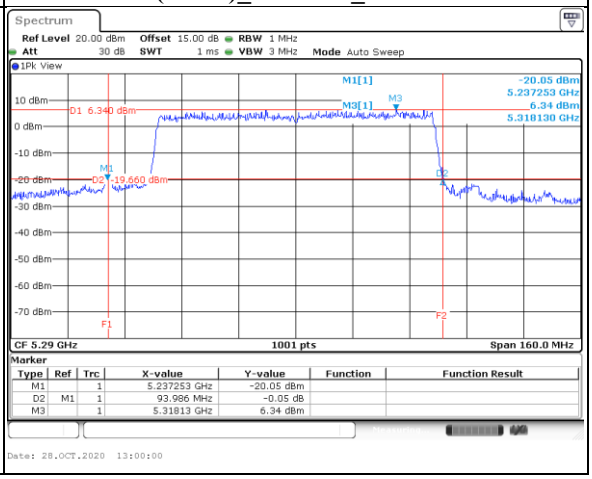
802.11ax (HE80)

OFDM

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.518	81.678
58	5290	81.838	81.838
106	5530	81.518	81.518
122	5610	81.678	81.838
138	5690	81.518	98.142
138 (U-NII-2c Band)	5690	75.919	76.079

OFDMA

CHANNEL	CHANNEL FREQUENCY (MHz)	26 dB Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	81.359	81.998
58	5290	81.518	93.986
106	5530	81.199	81.678
122	5610	81.678	81.678
138	5690	81.838	81.359
138 (U-NII-2c Band)	5690	75.759	75.599

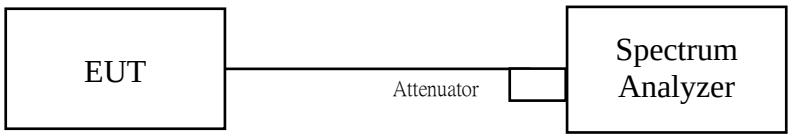
Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 1 / CH44	**802.11ax (HE20)_OFDMA_Chain 1 / CH140**
	
802.11ax (HE40)_OFDM_Chain 0 / CH134	**802.11ax (HE40)_OFDMA_Chain 1 / CH54**
	
802.11ax (HE80)_OFDM_Chain 1 / CH138	**802.11ax (HE80)_OFDMA_Chain 1 / CH58**
	

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	16.7832	16.4635
44	5220	16.7433	16.6234
48	5240	16.6234	16.6234
52	5260	16.4635	16.5435
60	5300	16.5435	16.4635
64	5320	16.5435	16.5035
100	5500	16.8631	17.3427
116	5580	16.8232	16.4635
140	5700	16.4635	16.7433
144	5720	16.7033	16.7033
149	5745	16.6234	16.6234
157	5785	16.5435	16.6234
165	5825	16.5035	16.5834

802.11ax (HE20)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	18.9810	18.9411
44	5220	18.9810	18.9810
48	5240	18.9011	18.9411
52	5260	18.9810	19.0609
60	5300	18.9411	18.9411
64	5320	18.9411	18.9810
100	5500	18.9411	19.0210
116	5580	19.3806	18.9411
140	5700	18.9810	18.9810
144	5720	18.9810	18.9411
149	5745	18.9411	18.9411
157	5785	18.9810	18.9810
165	5825	18.8611	18.9810

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	19.1409	19.2208
44	5220	19.1409	19.2208
48	5240	19.0609	19.1409
52	5260	19.1808	19.1808
60	5300	19.1808	19.2208
64	5320	19.0609	19.1009
100	5500	19.3007	19.3407
116	5580	19.1009	19.1808
140	5700	19.1009	19.1009
144	5720	19.1808	19.2607
149	5745	19.1808	19.2208
157	5785	19.1009	19.1009
165	5825	19.1409	19.2208

802.11ax (HE40)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.8022	37.8022
46	5230	37.9620	37.8821
54	5270	37.8022	37.8022
62	5310	37.8022	37.8821
102	5510	37.7223	37.8022
110	5550	37.8821	37.9620
134	5670	38.0420	38.1219
142	5710	38.0420	38.0420
151	5755	37.7223	37.6424
159	5795	37.6424	37.7223

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.8022	37.8022
46	5230	37.9620	37.8022
54	5270	37.8022	37.9620
62	5310	37.8022	37.8022
102	5510	37.8022	37.8821
110	5550	37.9620	37.8821
134	5670	37.8821	38.0420
142	5710	37.9620	37.9620
151	5755	37.6424	37.6424
159	5795	37.8022	37.6424

802.11ax (HE80)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.3626	77.2028
58	5290	77.2028	77.5225
106	5530	77.0430	77.0430
122	5610	77.3626	77.2028
138	5690	77.2028	77.3626
155	5775	77.3626	77.2028

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.3626	77.3626
58	5290	77.2028	77.3626
106	5530	77.0430	77.2028
122	5610	77.2028	77.2028
138	5690	77.2028	77.2028
155	5775	77.5225	77.3626

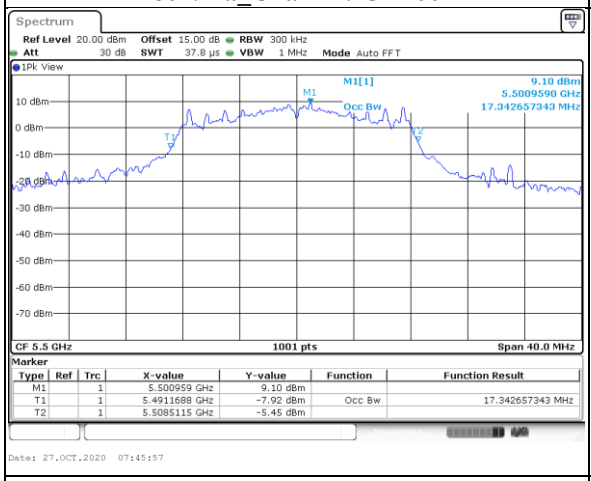
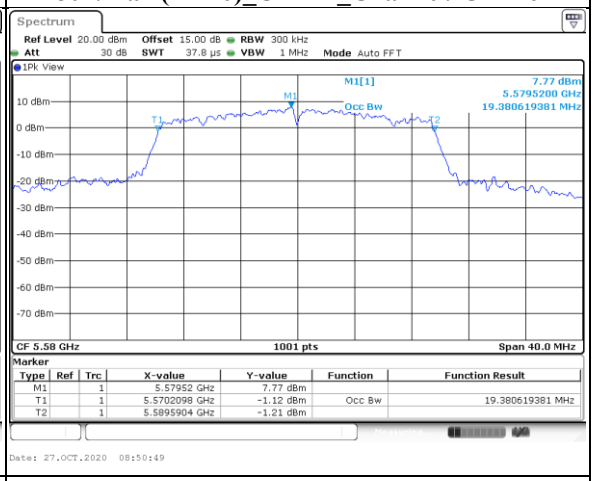
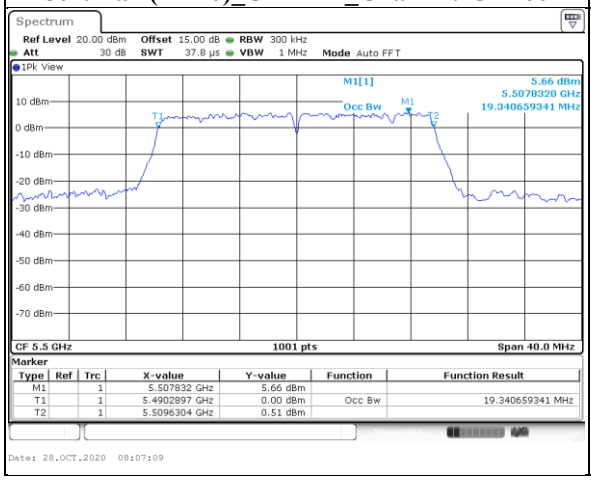
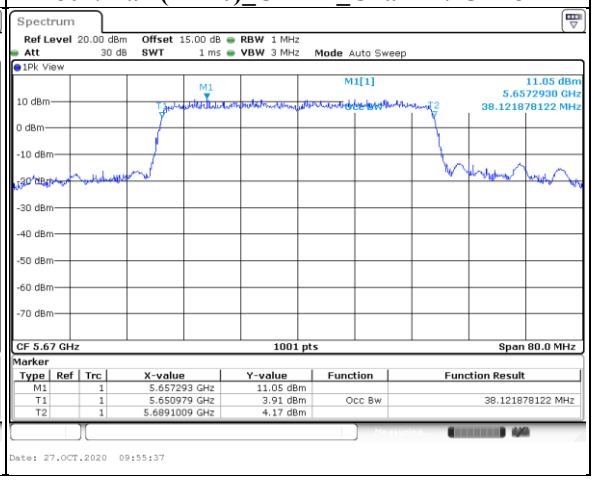
Additional Measurement for U-NII 1

OFDM

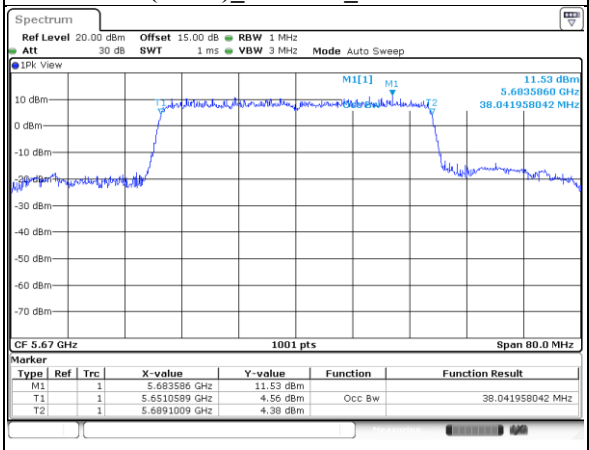
Mode	Channel	Frequency (MHz)	Chain 0 (MHz)	Chain 1 (MHz)	Limit (MHz)
802.11a	48	5240	5248.2717	5248.1918	< 5250
802.11ax20	48	5240	5249.4306	5249.4306	< 5250
802.11ax40	46	5230	5249.021	5248.9411	< 5250
802.11ax80	42	5210	5248.841	5248.681	< 5250

OFDMA

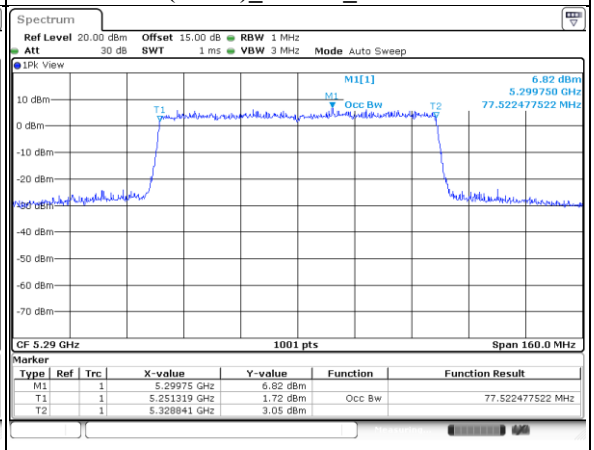
Mode	Channel	Frequency (MHz)	Chain 0 (MHz)	Chain 1 (MHz)	Limit (MHz)
802.11ax20	48	5240	5249.4705	5249.5105	< 5250
802.11ax40	46	5230	5249.021	5248.9411	< 5250
802.11ax80	42	5210	5248.841	5248.841	< 5250

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH100	**802.11ax (HE20)_OFDM_Chain 0 / CH116**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH100	**802.11ax (HE40)_OFDM_Chain 1 / CH134**
	

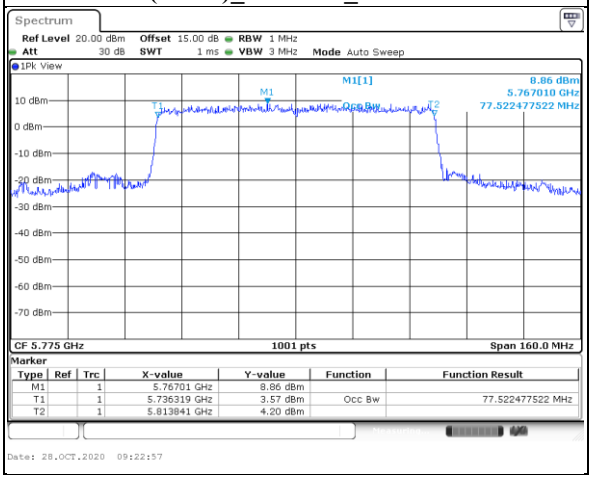
802.11ax (HE40)_OFDMA_Chain 1 / CH134

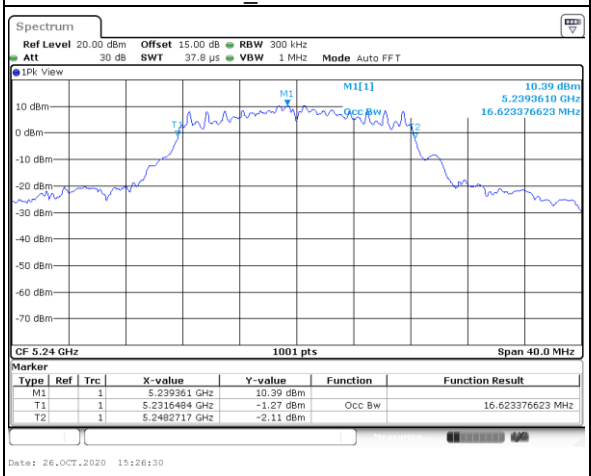
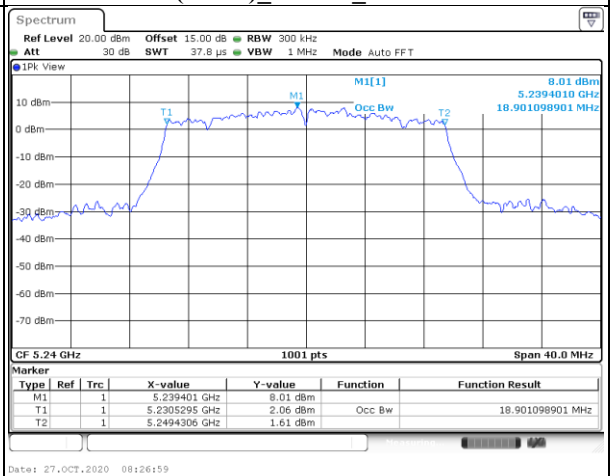
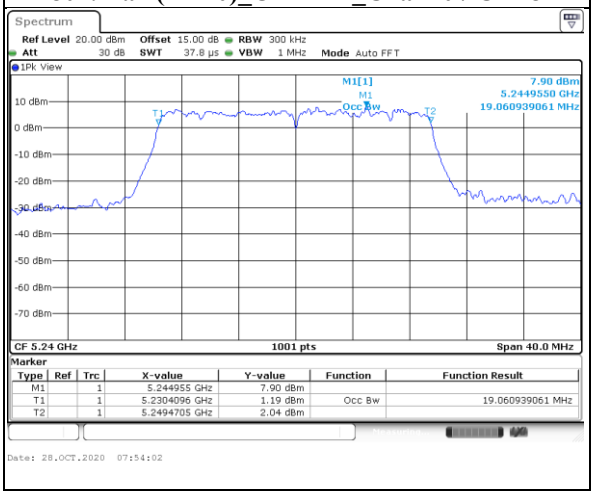
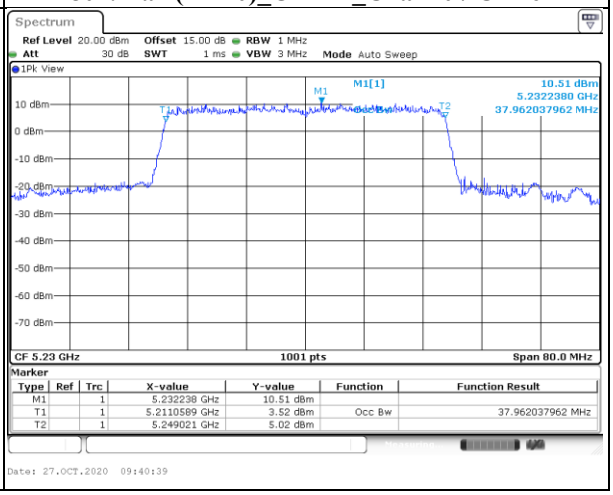


802.11ax (HE80)_OFDM_Chain 1 / CH58

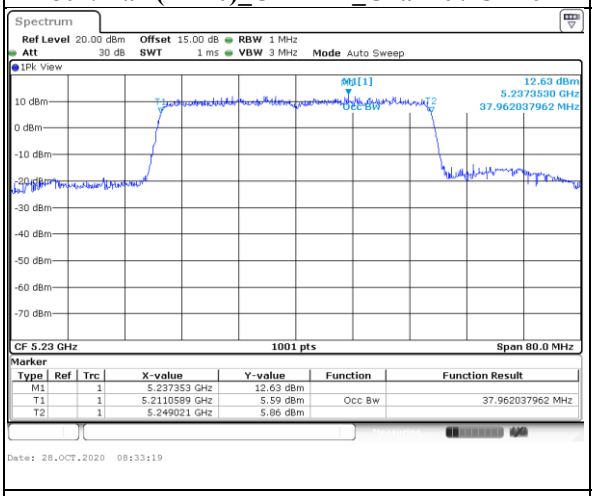


802.11ax (HE80)_OFDMA_Chain 0 / CH155

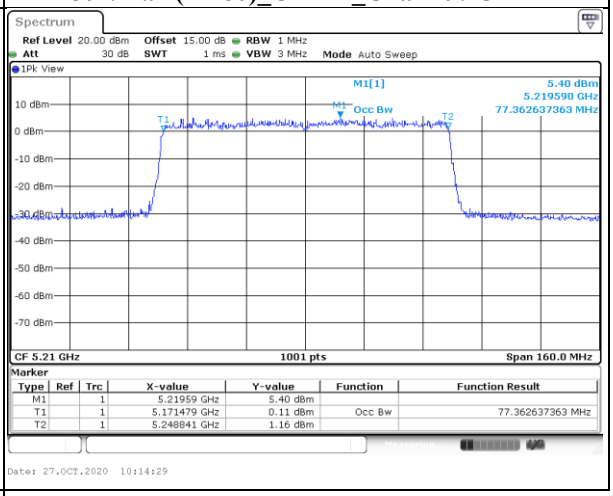


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A band)	
802.11a_Chain 0 / CH48	**802.11ax (HE20)_OFDM_Chain 0 / CH48**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH48	**802.11ax (HE40)_OFDM_Chain 0 / CH46**
	

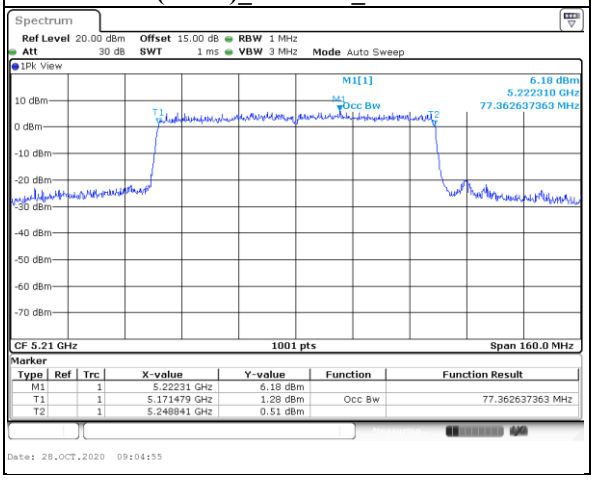
802.11ax (HE40)_OFDMA_Chain 0 / CH46

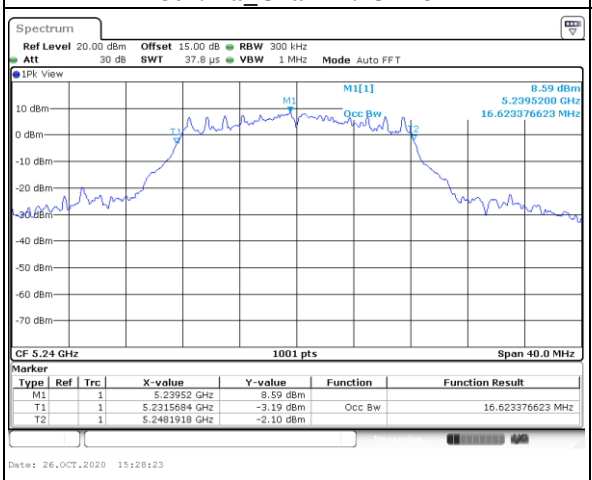
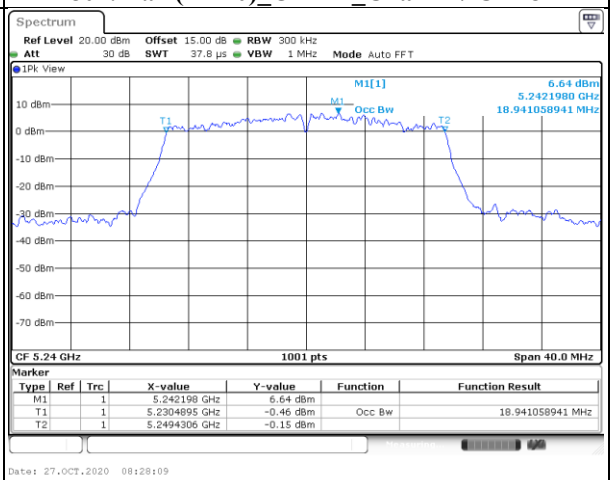
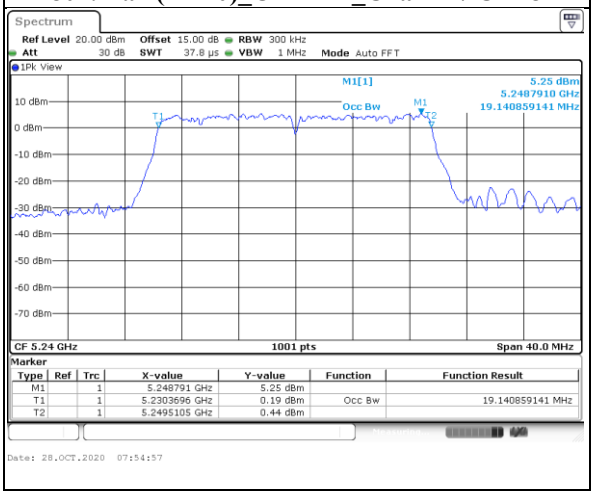
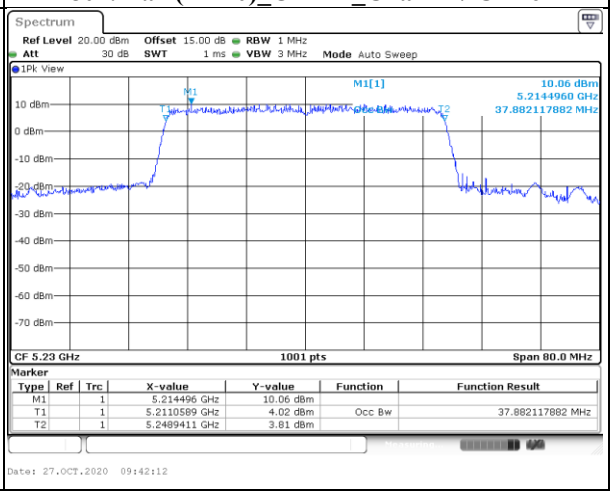


802.11ax (HE80)_OFDM_Chain 0 / CH42

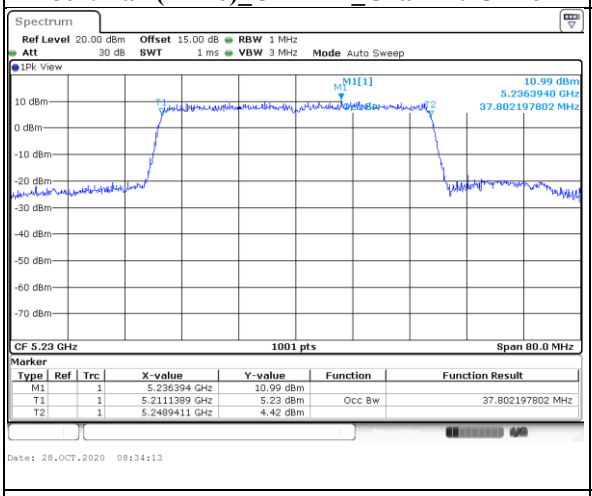


802.11ax (HE80)_OFDMA_Chain 0 / CH42

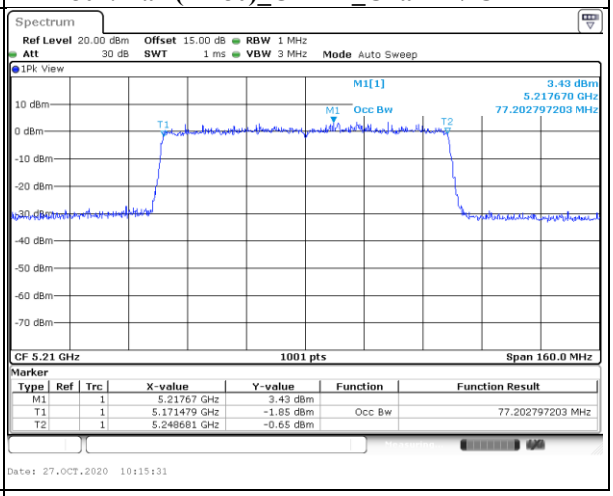


Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A band)	
802.11a_Chain 1 / CH48	**802.11ax (HE20)_OFDM_Chain 1 / CH48**
	
802.11ax (HE20)_OFDMA_Chain 1 / CH48	**802.11ax (HE40)_OFDM_Chain 1 / CH46**
	

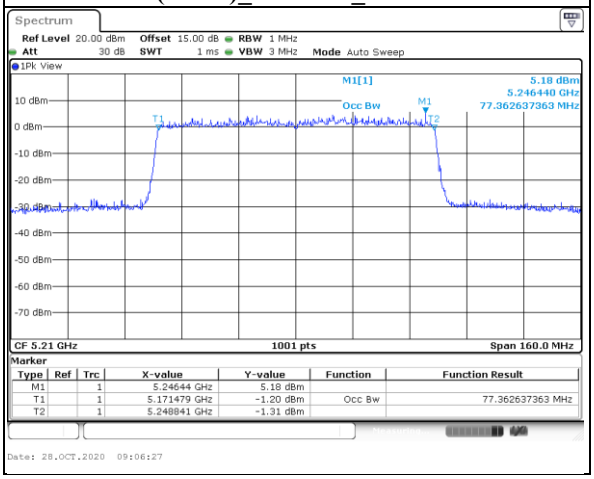
802.11ax (HE40)_OFDMA_Chain 1 / CH46



802.11ax (HE80)_OFDM_Chain 1 / CH42



802.11ax (HE80)_OFDMA_Chain 1 / CH42



Beamforming mode

802.11ax (HE20)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	18.9011	19.1009
44	5220	18.9810	18.9810
48	5240	18.9810	18.9810
52	5260	19.0609	18.9411
60	5300	18.9411	18.9810
64	5320	18.9011	19.1409
100	5500	18.9810	18.9011
116	5580	19.0210	18.9411
140	5700	18.9810	19.0210
144	5720	19.1409	18.9411
149	5745	19.0210	18.9810
157	5785	19.0210	19.0609
165	5825	19.0210	18.9411

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
36	5180	19.1808	19.1808
44	5220	19.1009	19.1009
48	5240	19.1808	19.1009
52	5260	19.1409	19.1409
60	5300	19.2208	19.2208
64	5320	19.0609	19.1009
100	5500	19.2208	19.3007
116	5580	19.1009	19.3007
140	5700	19.1009	19.1409
144	5720	19.1009	19.2208
149	5745	19.1409	19.2607
157	5785	19.1009	19.1009
165	5825	19.0609	19.1409

802.11ax (HE40)

OFDM

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.8022	37.8821
46	5230	37.8821	37.8821
54	5270	37.8022	37.8821
62	5310	37.8022	37.8022
102	5510	37.8022	37.8821
110	5550	37.9620	37.9620
134	5670	37.9620	37.9620
142	5710	37.9620	38.1219
151	5755	37.6424	37.6424
159	5795	37.6424	37.6424

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
38	5190	37.8022	37.8821
46	5230	37.8821	37.8022
54	5270	37.9620	37.9620
62	5310	37.8022	37.9620
102	5510	37.8022	37.8821
110	5550	37.8821	37.8821
134	5670	37.8821	37.9620
142	5710	38.0420	37.8821
151	5755	37.6424	37.6424
159	5795	37.5624	37.7223

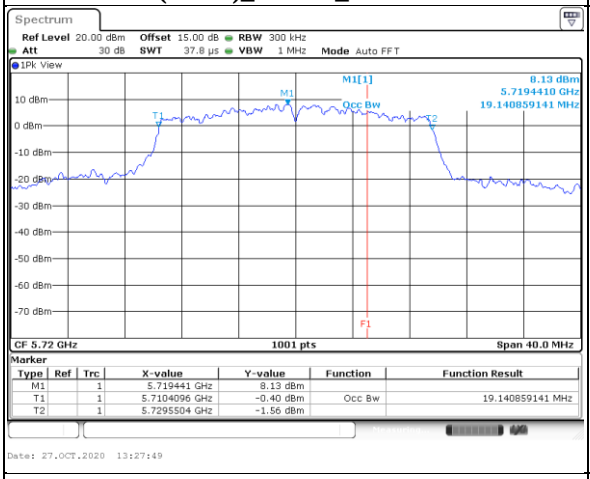
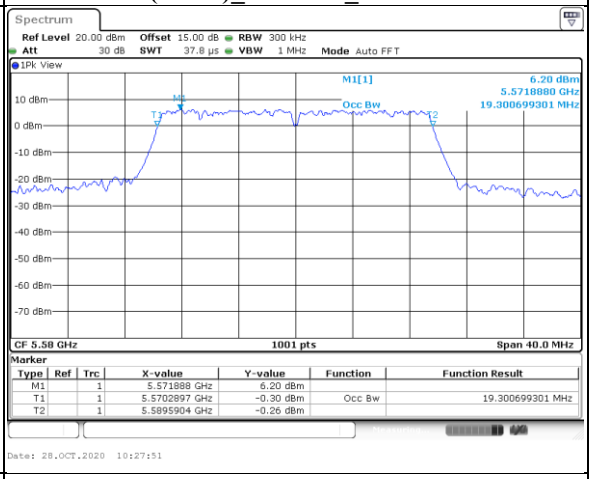
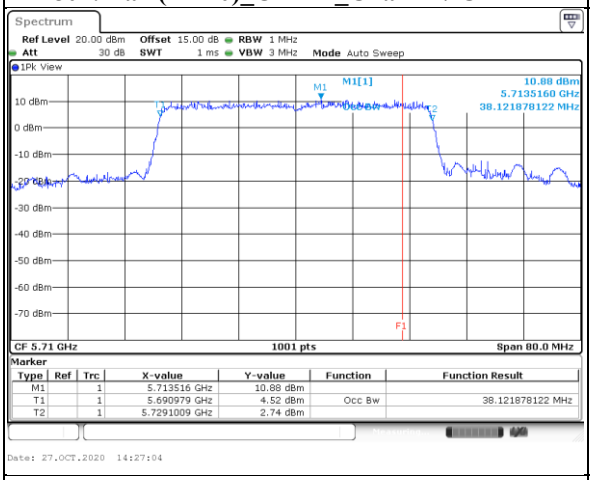
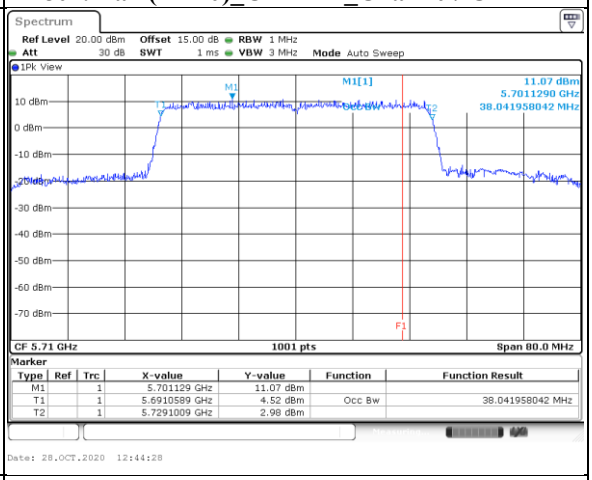
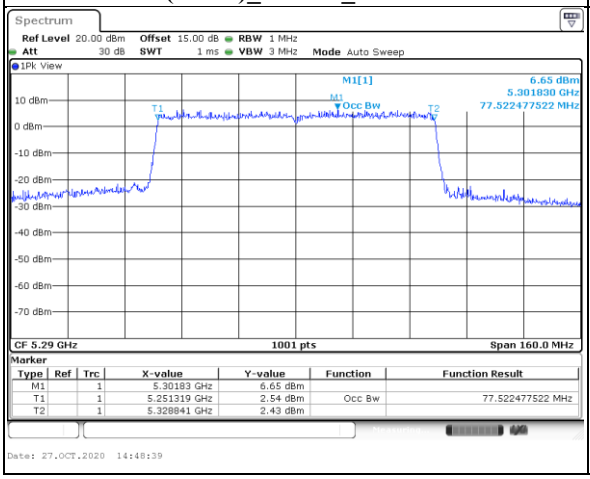
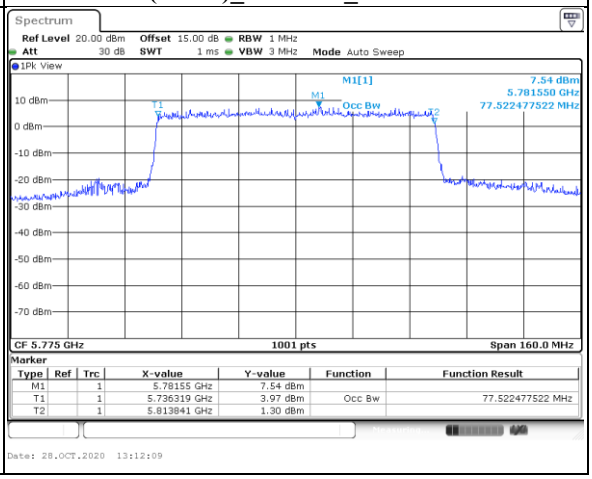
802.11ax (HE80)

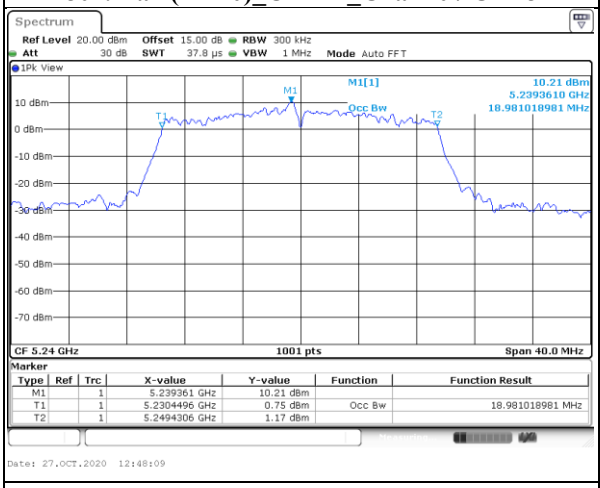
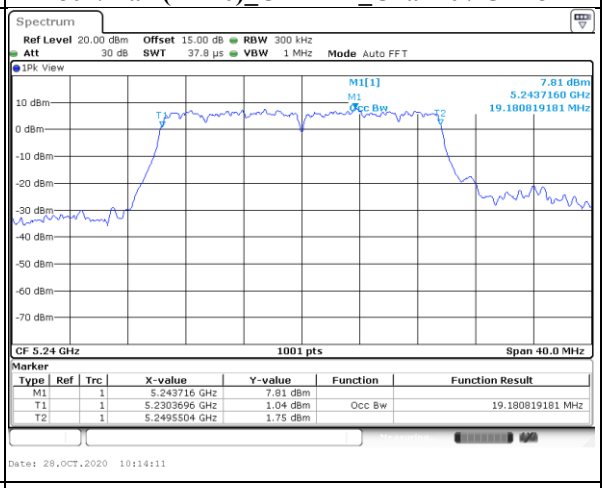
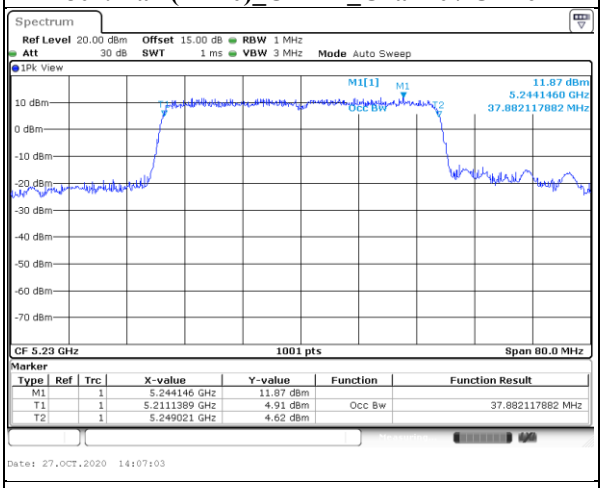
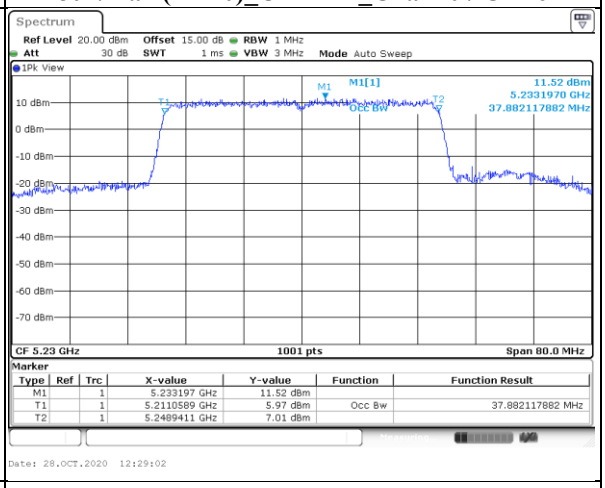
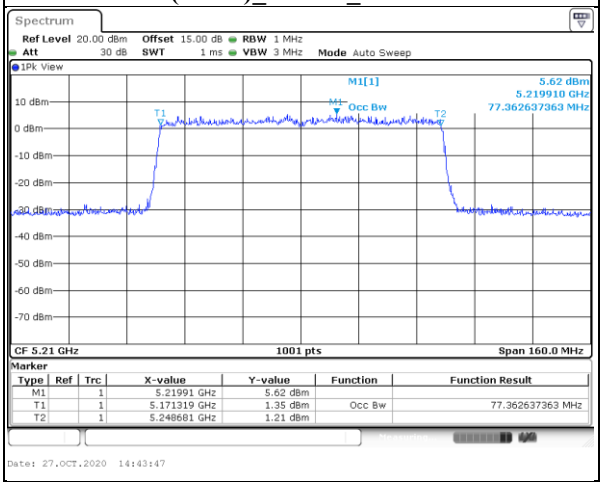
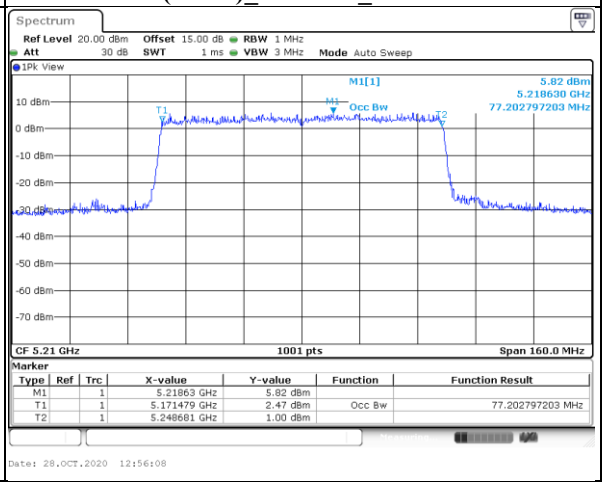
OFDM

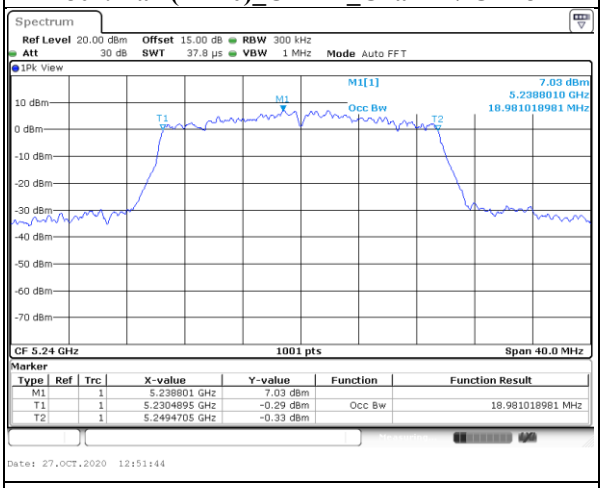
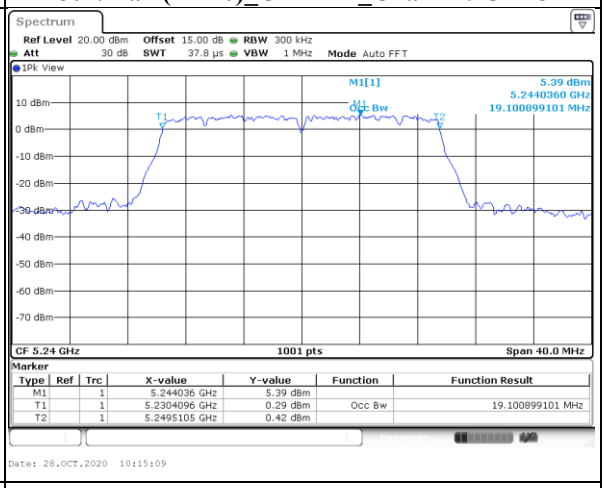
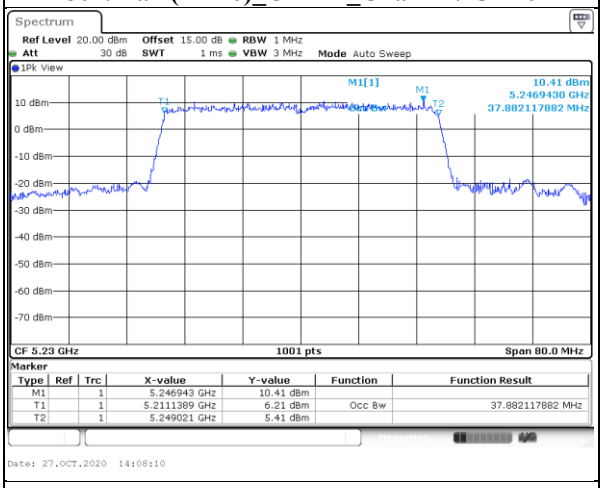
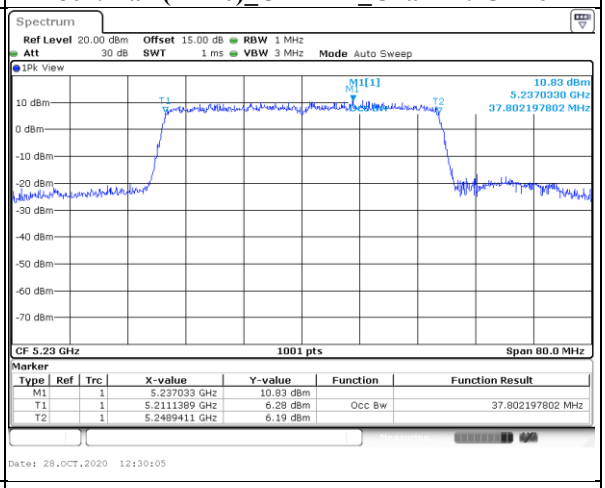
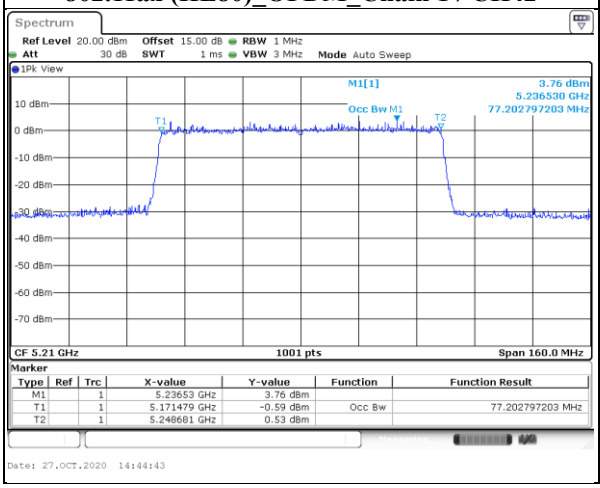
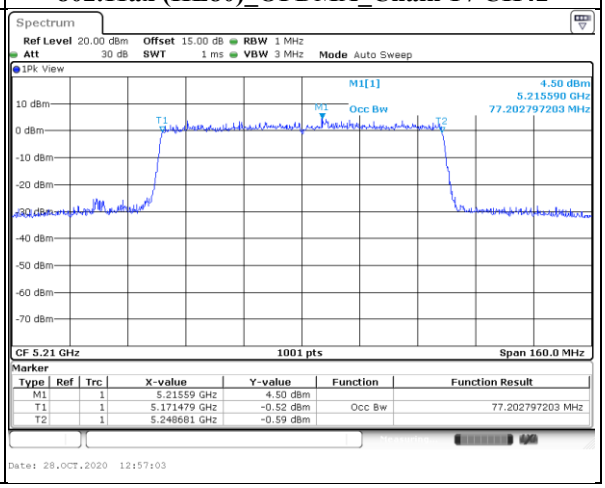
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.3626	77.2028
58	5290	77.2028	77.5225
106	5530	77.2028	77.3626
122	5610	77.3626	77.2028
138	5690	77.3626	77.2028
155	5775	77.3626	77.3626

OFDMA

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	
		CHAIN 0	CHAIN 1
42	5210	77.2028	77.2028
58	5290	77.2028	77.5225
106	5530	77.2028	77.3626
122	5610	77.2028	77.3626
138	5690	77.2028	77.3626
155	5775	77.3626	77.5225

Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 0 / CH144	**802.11ax (HE20)_OFDMA_Chain 1 / CH116**
	
802.11ax (HE40)_OFDM_Chain 1 / CH142	**802.11ax (HE40)_OFDMA_Chain 0 / CH142**
	
802.11ax (HE80)_OFDM_Chain 1 / CH58	**802.11ax (HE80)_OFDMA_Chain 1 / CH155**
	

Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A 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**
	

Spectrum Plot for near by DFS band (DFS is required, if 99% OCP straddle into U-NII-2A 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**
	

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 (24 dBm) If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6)
U-NII-2A	√		250mW (24 dBm) or 11 dBm+10 log B* If G_{TX} > 6 dBi, then P_{Out} = 24 – (G_{TX} – 6)
U-NII-2C	√		250mW (24 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))

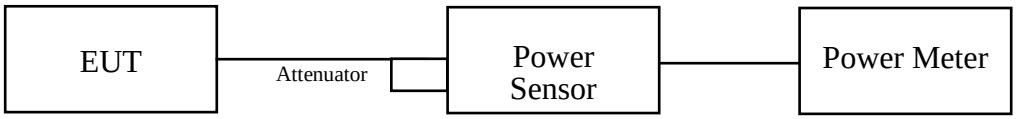
a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
b. Set sweep trigger*.
c. Set RBW = 1 MHz.
d. Set VBW ≥ 3 MHz
e. Number of points in sweep ≥ 2 Span / RBW.
f. Sweep time ≤ (number of points in sweep) * T
g. Using emission bandwidth to 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."

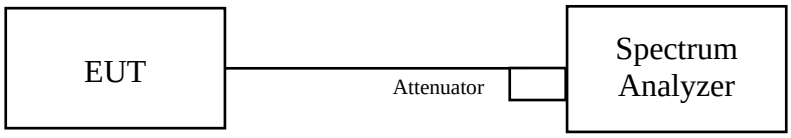
Note:
The straddling channel of (U-NII-2c Band) Power is Power meter value * (5725-(5720-(26 dBc BW/2))) / 26 dBc BW
The straddling channel of (U-NII-3 Band) Power is Power meter value * (5720+(26dBc BW/2)-5725) / 26 dBc BW

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	15.01	13.92	56.356	17.51	24	PASS
44	5220	15.82	14.71	67.774	18.31	24	PASS
48	5240	15.52	14.63	64.685	18.11	24	PASS
52	5260	14.65	16.18	70.669	18.49	24	PASS
60	5300	14.81	16.07	70.727	18.50	24	PASS
64	5320	14.8	16.02	70.194	18.46	24	PASS
100	5500	14.56	15.66	65.389	18.16	24	PASS
116	5580	14.72	15.44	64.643	18.11	24	PASS
140	5700	14.79	14.28	56.922	17.55	24	PASS
144 (U-NII-2c Band)	5720	13.43	14.39	49.532	16.95	22.9	PASS
144 (U-NII-3 Band)	5720	9.01	9.89	17.699	12.48	30	PASS
149	5745	14.92	15.63	67.605	18.30	30	PASS
157	5785	14.94	15.93	70.363	18.47	30	PASS
165	5825	14.78	15.35	64.338	18.08	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	14.77	15.71	67.231	18.28
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	15.17	14.07	58.412	17.67	24	PASS
44	5220	15.32	14.14	59.983	17.78	24	PASS
48	5240	15.36	14.11	60.119	17.79	24	PASS
52	5260	14.59	15.29	62.58	17.96	24	PASS
60	5300	14.42	15.05	59.658	17.76	24	PASS
64	5320	14.35	14.96	58.56	17.68	24	PASS
100	5500	15.13	14.6	61.424	17.88	24	PASS
116	5580	15.16	14.54	61.255	17.87	24	PASS
140	5700	14.89	14.45	58.693	17.69	24	PASS
144 (U-NII-2c Band)	5720	13.66	13.12	43.774	16.41	22.92	PASS
144 (U-NII-3 Band)	5720	9.12	8.73	15.621	11.94	30	PASS
149	5745	15.34	14.53	62.577	17.96	30	PASS
157	5785	15.26	14.43	61.307	17.88	30	PASS
165	5825	15.21	14.33	60.291	17.80	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	14.97	14.47	59.395	17.74
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	15.44	14.32	62.035	17.93	24	PASS
44	5220	15.61	14.25	62.999	17.99	24	PASS
48	5240	15.57	14.28	62.85	17.98	24	PASS
52	5260	14.43	15.05	59.722	17.76	24	PASS
60	5300	14.71	15.22	62.846	17.98	24	PASS
64	5320	14.56	15.01	60.272	17.80	24	PASS
100	5500	15.12	14.83	62.918	17.99	24	PASS
116	5580	15.28	14.65	62.903	17.99	24	PASS
140	5700	15.13	14.62	61.557	17.89	24	PASS
144 (U-NII-2c Band)	5720	13.87	13.19	45.249	16.56	22.99	PASS
144 (U-NII-3 Band)	5720	9.52	9.30	17.471	12.42	30	PASS
149	5745	15.07	14.3	59.052	17.71	30	PASS
157	5785	14.98	14.25	58.084	17.64	30	PASS
165	5825	15.22	14.47	61.256	17.87	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	15.23	14.68	62.719	17.97
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	10.77	8.20	18.547	12.68	24	PASS
46	5230	15.26	13.97	58.52	17.67	24	PASS
54	5270	14.62	15.25	62.47	17.96	24	PASS
62	5310	11.03	12.21	29.311	14.67	24	PASS
102	5510	11.89	11.53	29.676	14.72	24	PASS
110	5550	15.35	14.51	62.526	17.96	24	PASS
134	5670	15.31	14.33	61.065	17.86	24	PASS
142 (U-NII-2c Band)	5710	14.19	13.16	46.945	16.72	24	PASS
142 (U-NII-3 Band)	5710	8.51	8.20	13.688	11.36	30	PASS
151	5755	15.34	14.23	60.683	17.83	30	PASS
159	5795	15.33	14.11	59.882	17.77	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	15.23	14.36	60.633	17.83
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	11.61	9.90	24.26	13.85	24	PASS
46	5230	15.34	13.84	58.408	17.66	24	PASS
54	5270	14.47	15.21	61.179	17.87	24	PASS
62	5310	11.77	12.85	34.306	15.35	24	PASS
102	5510	12.61	12.17	34.721	15.41	24	PASS
110	5550	15.05	14.39	59.468	17.74	24	PASS
134	5670	15.12	14.14	58.451	17.67	24	PASS
142 (U-NII-2c Band)	5710	14.54	13.35	50.065	17.00	24	PASS
142 (U-NII-3 Band)	5710	6.49	7.38	9.922	9.97	30	PASS
151	5755	15.25	14.03	58.79	17.69	30	PASS
159	5795	15.52	13.88	60.079	17.79	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	15.17	14.33	59.987	17.78
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	11.85	10.07	25.473	14.06	24	PASS
58	5290	12.22	13.17	37.421	15.73	24	PASS
106	5530	11.64	11.36	28.265	14.51	24	PASS
122	5610	14.82	14.27	57.069	17.56	24	PASS
138 (U-NII-2c Band)	5690	14.80	14.08	55.754	17.46	24	PASS
138 (U-NII-3 Band)	5690	3.82	4.86	5.472	7.38	30	PASS
155	5775	15.07	14.03	57.43	17.59	30	PASS

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		chain 0	chain 1		
138	5690	15.13	14.57	61.226	17.87
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	12.73	11.11	31.662	15.01	24	PASS
58	5290	12.05	12.90	35.53	15.51	24	PASS
106	5530	11.66	11.37	28.364	14.53	24	PASS
122	5610	15.18	14.76	62.884	17.99	24	PASS
138 (U-NII-2c Band)	5690	15.01	14.20	57.959	17.63	24	PASS
138 (U-NII-3 Band)	5690	3.87	3.22	4.539	6.57	30	PASS
155	5775	15.51	14.33	62.665	17.97	30	PASS

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		chain 0	chain 1		
138	5690	15.33	14.53	62.498	17.96
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	15.15	13.94	57.508	17.60	23.75	PASS
44	5220	15.32	13.93	58.758	17.69	23.75	PASS
48	5240	15.13	13.95	57.415	17.59	23.75	PASS
52	5260	14.43	15.06	59.796	17.77	23.75	PASS
60	5300	14.3	14.8	57.115	17.57	23.75	PASS
64	5320	14.16	14.71	55.642	17.45	23.75	PASS
100	5500	15.04	14.51	60.164	17.79	23.75	PASS
116	5580	15.03	14.41	59.448	17.74	23.75	PASS
140	5700	14.69	14.33	56.546	17.52	23.75	PASS
144 (U-NII-2c Band)	5720	13.42	12.99	41.865	16.22	22.77	PASS
144 (U-NII-3 Band)	5720	9.30	8.65	15.841	12.00	29.75	PASS
149	5745	15.16	14.53	61.189	17.87	29.75	PASS
157	5785	15.26	14.36	60.864	17.84	29.75	PASS
165	5825	15.1	14.32	59.399	17.74	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not 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	14.84	14.35	57.706	17.61
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	15.44	14.23	61.48	17.89	23.75	PASS
44	5220	15.55	14.11	61.655	17.90	23.75	PASS
48	5240	15.53	14.19	61.969	17.92	23.75	PASS
52	5260	14.31	14.83	57.386	17.59	23.75	PASS
60	5300	14.54	15.07	60.582	17.82	23.75	PASS
64	5320	14.48	14.88	58.815	17.69	23.75	PASS
100	5500	15.12	14.61	61.416	17.88	23.75	PASS
116	5580	15.11	14.61	61.341	17.88	23.75	PASS
140	5700	14.92	14.55	59.556	17.75	23.75	PASS
144 (U-NII-2c Band)	5720	13.86	12.98	44.206	16.45	22.77	PASS
144 (U-NII-3 Band)	5720	9.55	9.02	16.998	12.30	29.75	PASS
149	5745	15.06	14.08	57.649	17.61	29.75	PASS
157	5785	14.9	14.17	57.025	17.56	29.75	PASS
165	5825	15.14	14.32	59.699	17.76	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not 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	15.23	14.45	61.204	17.87
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	10.73	8.15	18.361	12.64	23.75	PASS
46	5230	15.04	13.75	55.629	17.45	23.75	PASS
54	5270	14.49	15.23	61.462	17.89	23.75	PASS
62	5310	10.90	12.06	28.372	14.53	23.75	PASS
102	5510	11.64	11.38	28.328	14.52	23.75	PASS
110	5550	15.11	14.28	59.226	17.73	23.75	PASS
134	5670	15.16	14.11	58.573	17.68	23.75	PASS
142 (U-NII-2c Band)	5710	13.95	13.23	45.851	16.61	23.75	PASS
142 (U-NII-3 Band)	5710	8.23	7.52	12.296	10.90	29.75	PASS
151	5755	15.33	14.04	59.47	17.74	29.75	PASS
159	5795	15.16	13.87	57.188	17.57	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not 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	14.98	14.26	58.146	17.65
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	11.58	9.74	23.807	13.77	23.75	PASS
46	5230	15.24	13.69	56.808	17.54	23.75	PASS
54	5270	14.38	15.18	60.377	17.81	23.75	PASS
62	5310	11.66	12.74	33.448	15.24	23.75	PASS
102	5510	12.52	11.94	33.496	15.25	23.75	PASS
110	5550	14.90	14.23	57.388	17.59	23.75	PASS
134	5670	15.05	14.07	57.516	17.60	23.75	PASS
142 (U-NII-2c Band)	5710	14.23	13.67	49.747	16.97	23.75	PASS
142 (U-NII-3 Band)	5710	7.31	5.60	9.011	9.55	29.75	PASS
151	5755	15.13	13.78	56.462	17.52	29.75	PASS
159	5795	15.35	13.82	58.376	17.66	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not 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	15.03	14.30	58.757	17.69
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	11.60	9.92	24.271	13.85	23.75	PASS
58	5290	12.06	13.06	36.299	15.60	23.75	PASS
106	5530	11.51	11.14	27.16	14.34	23.75	PASS
122	5610	14.61	14.19	55.149	17.42	23.75	PASS
138 (U-NII-2c Band)	5690	14.75	13.85	54.12	17.33	23.75	PASS
138 (U-NII-3 Band)	5690	3.56	6.08	6.329	8.01	29.75	PASS
155	5775	14.93	13.83	55.272	17.43	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not be reduced.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		chain 0	chain 1		
138	5690	15.07	14.52	60.451	17.81
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	12.71	10.90	30.967	14.91	23.75	PASS
58	5290	11.80	12.71	33.8	15.29	23.75	PASS
106	5530	11.52	11.29	27.65	14.42	23.75	PASS
122	5610	14.96	14.56	59.909	17.77	23.75	PASS
138 (U-NII-2c Band)	5690	14.86	14.14	56.564	17.53	23.75	PASS
138 (U-NII-3 Band)	5690	3.78	2.89	4.334	6.37	29.75	PASS
155	5775	15.40	14.08	60.26	17.80	29.75	PASS

Note: The directional gain = 6.25 dBi > 6 dBi, so the power limit shall not be reduced.

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		chain 0	chain 1		
138	5690	15.19	14.45	60.898	17.85
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.

   N*a*nt: 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 %

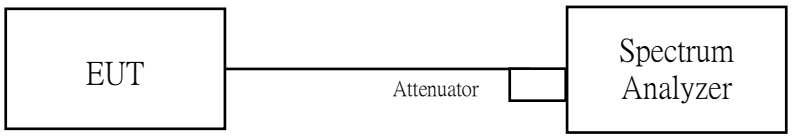
a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 RBW, Detector = RMS
c. Sweep time = auto, trigger set to "free run".
d. Trace average at least 100 traces in power averaging mode.
e. Record the max value and add 10 log (1/duty cycle)

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)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	5.05	4.62	9.61	10.75	PASS
44	5220	5.29	4.18	9.54	10.75	PASS
48	5240	5.31	3.80	9.39	10.75	PASS
52	5260	4.27	6.11	10.06	10.75	PASS
60	5300	4.80	6.56	10.54	10.75	PASS
64	5320	4.66	6.78	10.62	10.75	PASS
100	5500	5.20	6.19	10.49	10.75	PASS
116	5580	5.19	6.11	10.44	10.75	PASS
140	5700	5.87	5.11	10.28	10.75	PASS
144 (U-NII-2c Band)	5720	4.75	6.33	10.38	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.

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	2.85	1.37	5.68	10.75	PASS
44	5220	3.05	1.79	5.97	10.75	PASS
48	5240	2.93	2.21	6.09	10.75	PASS
52	5260	2.33	3.46	6.43	10.75	PASS
60	5300	1.92	3.64	6.37	10.75	PASS
64	5320	2.17	3.64	6.47	10.75	PASS
100	5500	3.42	1.83	6.20	10.75	PASS
116	5580	3.45	2.08	6.32	10.75	PASS
140	5700	3.46	3.41	6.94	10.75	PASS
144 (U-NII-2c Band)	5720	3.00	2.03	6.04	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)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	2.55	1.33	6.04	10.75	PASS
44	5220	2.98	1.64	6.42	10.75	PASS
48	5240	2.94	1.35	6.27	10.75	PASS
52	5260	1.25	2.24	5.83	10.75	PASS
60	5300	1.74	2.15	6.01	10.75	PASS
64	5320	1.72	2.10	5.97	10.75	PASS
100	5500	2.20	1.75	6.04	10.75	PASS
116	5580	2.12	2.00	6.12	10.75	PASS
140	5700	2.21	1.50	5.93	10.75	PASS
144 (U-NII-2c Band)	5720	2.31	1.56	6.01	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)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
38	5190	-5.61	-6.96	-1.58	10.75	PASS
46	5230	-0.36	-1.88	3.60	10.75	PASS
54	5270	-1.65	-0.75	3.48	10.75	PASS
62	5310	-4.48	-3.20	0.86	10.75	PASS
102	5510	-3.43	-3.68	1.10	10.75	PASS
110	5550	-0.11	-0.67	4.27	10.75	PASS
134	5670	-0.66	-0.88	3.88	10.75	PASS
142 (U-NII-2c Band)	5710	0.17	-0.76	4.38	10.75	PASS

OFDMA

CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
38	5190	-4.55	-6.57	-0.55	10.75	PASS
46	5230	-1.20	-2.56	3.07	10.75	PASS
54	5270	-1.75	-1.47	3.29	10.75	PASS
62	5310	-4.27	-3.01	1.30	10.75	PASS
102	5510	-3.47	-4.28	1.04	10.75	PASS
110	5550	-1.67	-2.27	2.93	10.75	PASS
134	5670	-1.40	-2.40	3.02	10.75	PASS
142 (U-NII-2c Band)	5710	-1.03	-2.26	3.29	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

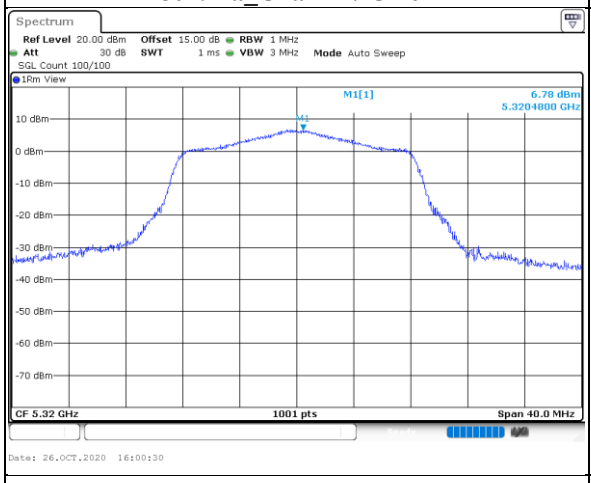
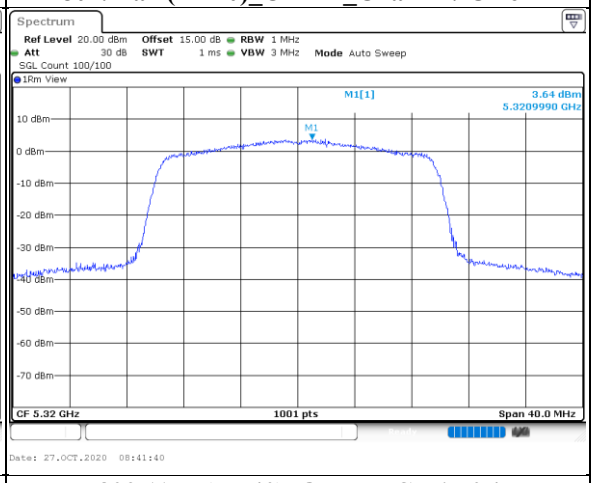
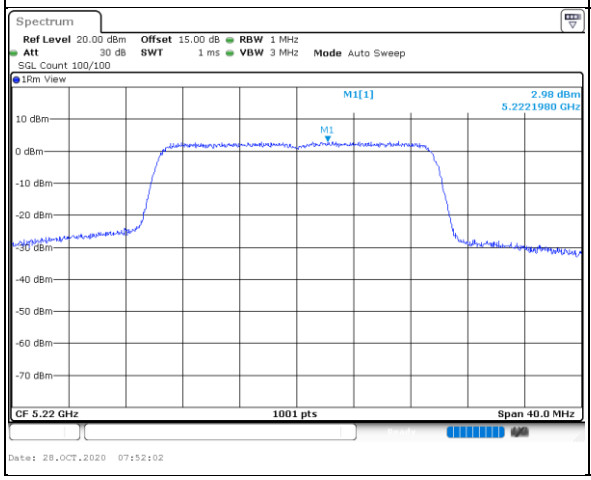
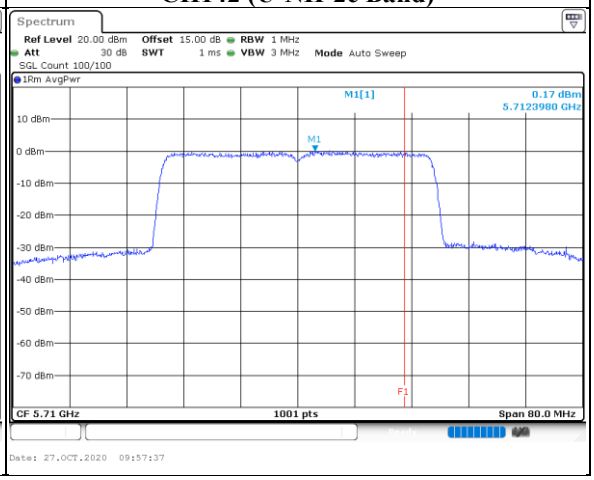
CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
42	5210	-6.70	-8.79	-2.57	10.75	PASS
58	5290	-6.11	-5.66	-0.83	10.75	PASS
106	5530	-6.85	-6.84	-1.79	10.75	PASS
122	5610	-3.92	-4.41	0.89	10.75	PASS
138 (U-NII-2c Band)	5690	-3.29	-4.15	1.35	10.75	PASS

OFDMA

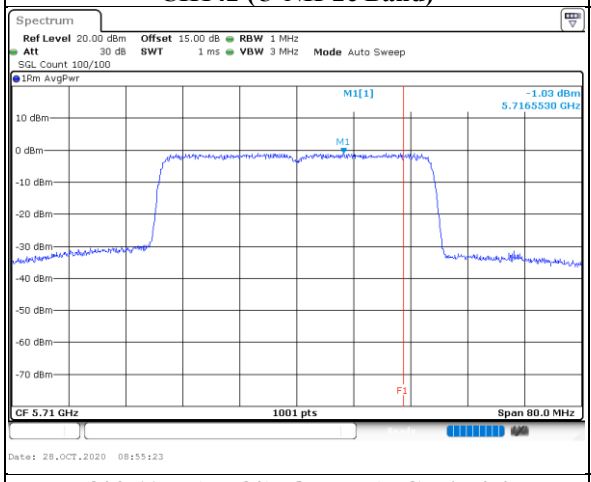
CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
42	5210	-7.17	-8.73	-1.56	10.75	PASS
58	5290	-7.82	-7.22	-1.19	10.75	PASS
106	5530	-8.37	-8.38	-2.06	10.75	PASS
122	5610	-4.99	-5.62	1.02	10.75	PASS
138 (U-NII-2c Band)	5690	-4.83	-5.77	1.04	10.75	PASS

Note:

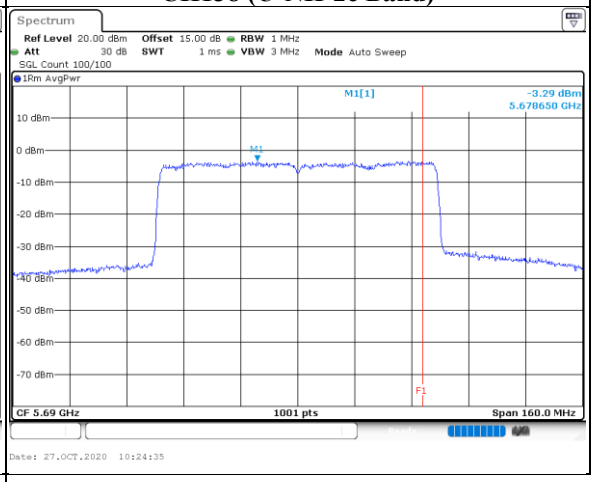
1. Method a) of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
3. Refer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

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH64	**802.11ax (HE20)_OFDM_Chain 1 / CH64**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH44	**802.11ax (HE40)_OFDM_Chain 0 / CH142 (U-NII-2c Band)**
	

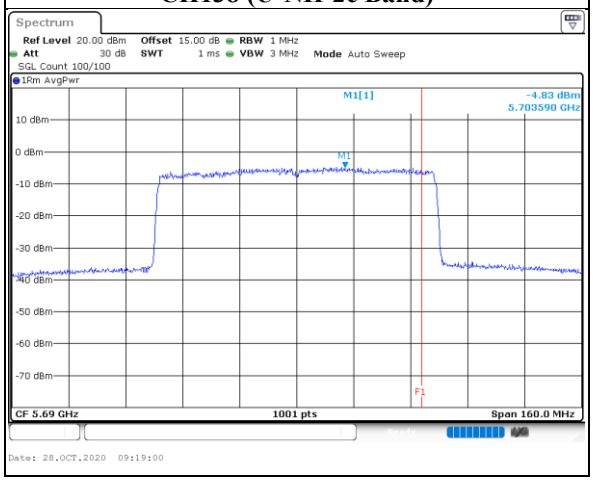
802.11ax (HE40)_OFDMA_Chain 0 / CH142 (U-NII-2c Band)



802.11ax (HE80)_OFDM_Chain 0 / CH138 (U-NII-2c Band)



802.11ax (HE80)_OFDMA_Chain 0 / CH138 (U-NII-2c Band)



Beamforming mode

802.11ax (HE20)

OFDM

CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	2.14	1.85	5.54	10.75	PASS
44	5220	3.28	1.51	6.03	10.75	PASS
48	5240	2.44	2.35	5.94	10.75	PASS
52	5260	2.11	3.60	6.46	10.75	PASS
60	5300	1.52	3.78	6.34	10.75	PASS
64	5320	2.55	3.42	6.55	10.75	PASS
100	5500	3.34	1.65	6.12	10.75	PASS
116	5580	2.78	1.53	5.74	10.75	PASS
140	5700	3.31	3.52	6.96	10.75	PASS
144 (U-NII-2c Band)	5720	2.77	2.50	6.18	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)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
36	5180	2.48	0.92	5.78	10.75	PASS
44	5220	2.76	1.37	6.13	10.75	PASS
48	5240	2.86	1.37	6.19	10.75	PASS
52	5260	1.52	2.11	5.84	10.75	PASS
60	5300	1.91	2.34	6.14	10.75	PASS
64	5320	1.84	2.29	6.08	10.75	PASS
100	5500	1.98	1.84	5.92	10.75	PASS
116	5580	2.24	2.09	6.18	10.75	PASS
140	5700	2.07	1.82	5.96	10.75	PASS
144 (U-NII-2c Band)	5720	1.88	1.60	5.75	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)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
38	5190	-6.06	-6.65	-2.26	10.75	PASS
46	5230	-0.09	-2.02	3.14	10.75	PASS
54	5270	-1.12	-0.78	3.14	10.75	PASS
62	5310	-4.08	-3.70	0.20	10.75	PASS
102	5510	-3.67	-4.24	0.14	10.75	PASS
110	5550	0.09	-0.50	3.89	10.75	PASS
134	5670	-0.78	-0.76	3.31	10.75	PASS
142 (U-NII-2c Band)	5710	0.11	-1.13	3.62	10.75	PASS

OFDMA

CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
38	5190	-4.21	-6.44	-0.30	10.75	PASS
46	5230	-0.74	-2.37	3.40	10.75	PASS
54	5270	-1.83	-1.34	3.30	10.75	PASS
62	5310	-4.16	-3.15	1.26	10.75	PASS
102	5510	-3.42	-4.19	1.09	10.75	PASS
110	5550	-1.14	-2.00	3.33	10.75	PASS
134	5670	-1.11	-2.15	3.28	10.75	PASS
142 (U-NII-2c Band)	5710	-0.79	-1.95	3.55	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

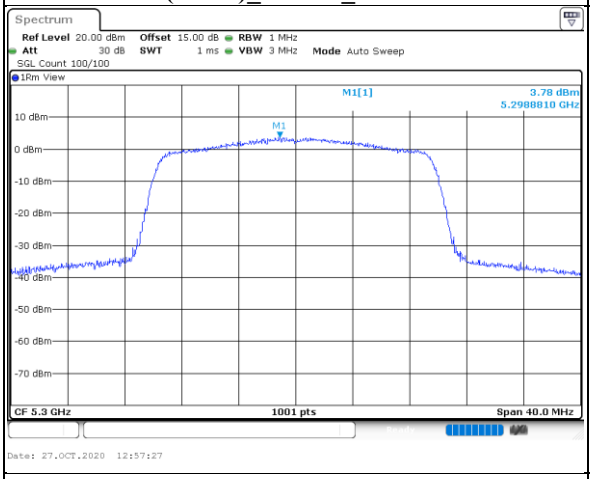
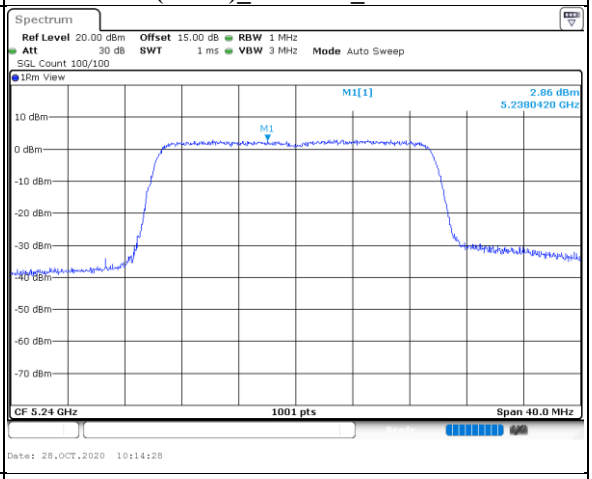
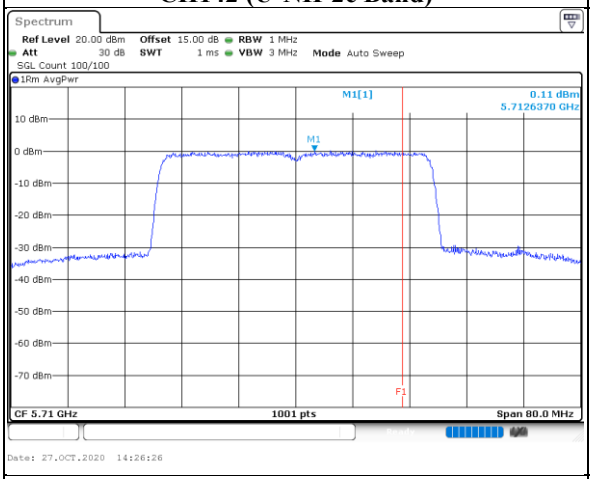
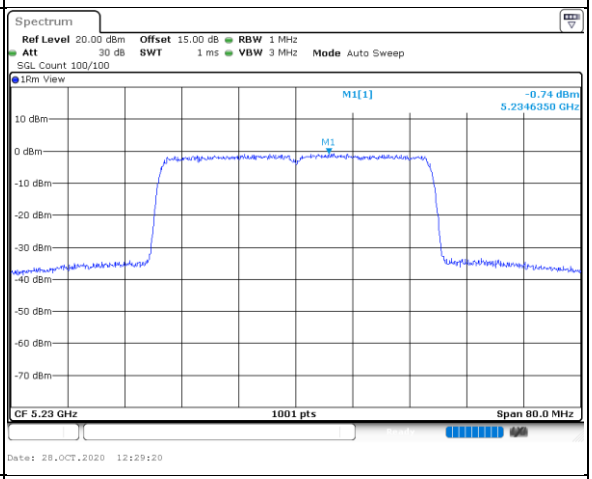
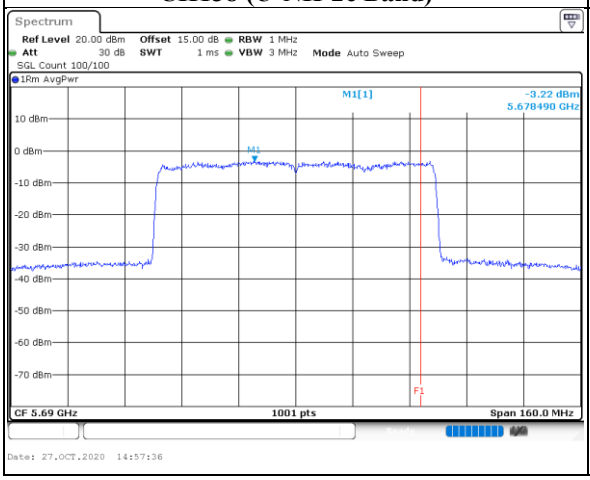
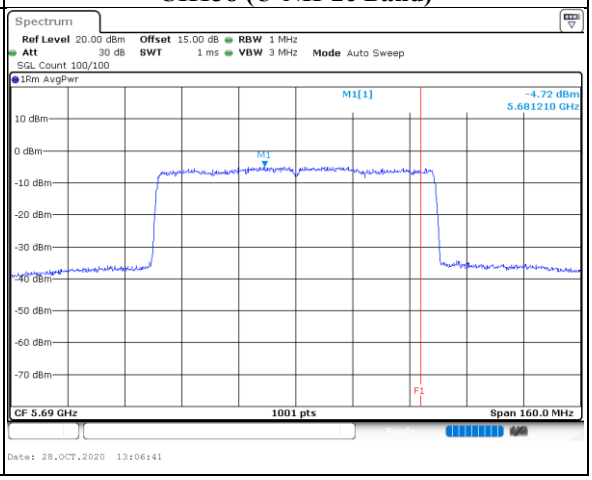
CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
42	5210	-6.58	-8.77	-2.20	10.75	PASS
58	5290	-6.17	-5.67	-0.57	10.75	PASS
106	5530	-6.85	-6.97	-1.57	10.75	PASS
122	5610	-3.75	-4.44	1.26	10.75	PASS
138 (U-NII-2c Band)	5690	-3.22	-4.18	1.66	10.75	PASS

OFDMA

CHAN.	FREQ. (MHz)	PSD (dBm)		TOTAL PSD with duty factor (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1			
42	5210	-6.99	-8.95	-1.54	10.75	PASS
58	5290	-8.07	-7.20	-1.30	10.75	PASS
106	5530	-8.61	-8.92	-2.45	10.75	PASS
122	5610	-5.36	-5.56	0.86	10.75	PASS
138 (U-NII-2c Band)	5690	-4.72	-5.57	1.19	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	
802.11ax (HE20)_OFDM_Chain 1 / CH60	**802.11ax (HE20)_OFDMA_Chain 0 / CH48**
	
802.11ax (HE40)_OFDM_Chain 0 / CH142 (U-NII-2c Band)	**802.11ax (HE40)_OFDMA_Chain 0 / CH46**
	
802.11ax (HE80)_OFDM_Chain 0 / CH138 (U-NII-2c Band)	**802.11ax (HE80)_OFDMA_Chain 0 / CH138 (U-NII-2c Band)**
	

For U-NII-3 band

Non-Beamforming mode

802.11a

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	144 (U-NII-3 Band)	5720	-1.73	3.01	2.54	29.75	Pass
	149	5745	4.83	3.01	9.10	29.75	Pass
	157	5785	5.07	3.01	9.34	29.75	Pass
	165	5825	5.06	3.01	9.33	29.75	Pass
1	144 (U-NII-3 Band)	5720	-1.39	3.01	2.88	29.75	Pass
	149	5745	5.33	3.01	9.6	29.75	Pass
	157	5785	5.22	3.01	9.49	29.75	Pass
	165	5825	5.37	3.01	9.64	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE20)

OFDM

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	144 (U-NII-3 Band)	5720	-0.47	3.01	3.03	29.75	Pass
	149	5745	0.73	3.01	4.23	29.75	Pass
	157	5785	0.95	3.01	4.45	29.75	Pass
	165	5825	1.15	3.01	4.65	29.75	Pass
1	144 (U-NII-3 Band)	5720	-0.51	3.01	2.99	29.75	Pass
	149	5745	-0.47	3.01	3.03	29.75	Pass
	157	5785	-0.87	3.01	2.63	29.75	Pass
	165	5825	-0.76	3.01	2.74	29.75	Pass

OFDMA

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	144 (U-NII-3 Band)	5720	-0.81	3.01	3.24	29.75	Pass
	149	5745	-0.49	3.01	3.56	29.75	Pass
	157	5785	-0.75	3.01	3.30	29.75	Pass
	165	5825	-0.64	3.01	3.41	29.75	Pass
1	144 (U-NII-3 Band)	5720	-1.69	3.01	2.36	29.75	Pass
	149	5745	-1.67	3.01	2.38	29.75	Pass
	157	5785	-1.64	3.01	2.41	29.75	Pass
	165	5825	-0.93	3.01	3.12	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE40)

OFDM

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	142 (U-NII-3 Band)	5710	-3.25	3.01	1.40	29.75	Pass
	151	5755	-2.69	3.01	1.96	29.75	Pass
	159	5795	-2.46	3.01	2.19	29.75	Pass
1	142 (U-NII-3 Band)	5710	-4.19	3.01	0.46	29.75	Pass
	151	5755	-2.73	3.01	1.92	29.75	Pass
	159	5795	-2.61	3.01	2.04	29.75	Pass

OFDMA

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	142 (U-NII-3 Band)	5710	-3.77	3.01	1.13	29.75	Pass
	151	5755	-3.61	3.01	1.29	29.75	Pass
	159	5795	-3.52	3.01	1.38	29.75	Pass
1	142 (U-NII-3 Band)	5710	-5.57	3.01	-0.67	29.75	Pass
	151	5755	-5.26	3.01	-0.36	29.75	Pass
	159	5795	-5.12	3.01	-0.22	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE80)

OFDM

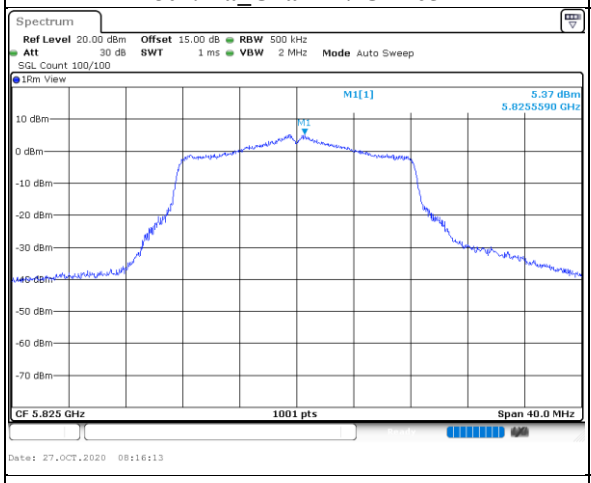
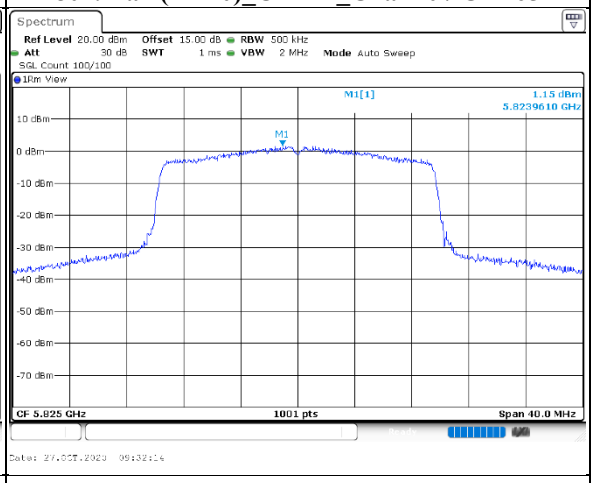
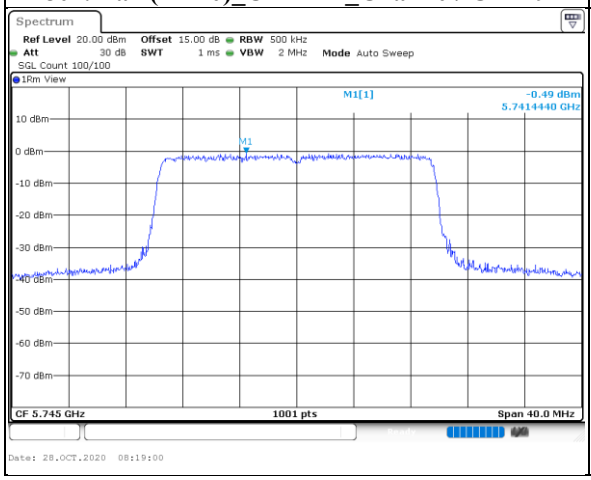
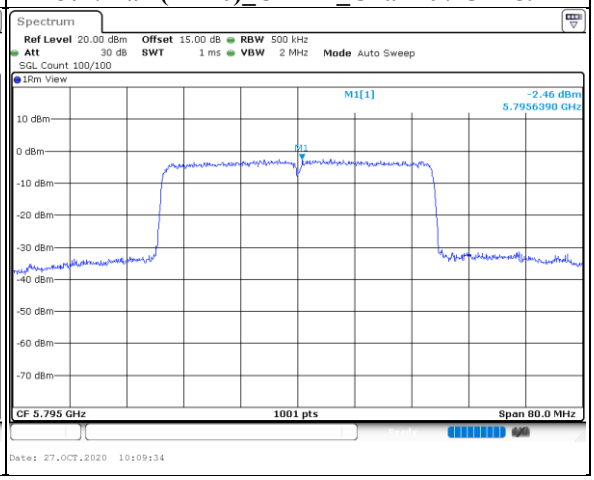
TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	138 (U-NII-3 Band)	5690	-6.38	3.01	-1.33	29.75	Pass
	155	5775	-6.18	3.01	-1.13	29.75	Pass
1	138 (U-NII-3 Band)	5690	-7.47	3.01	-2.42	29.75	Pass
	155	5775	-7.67	3.01	-2.62	29.75	Pass

OFDMA

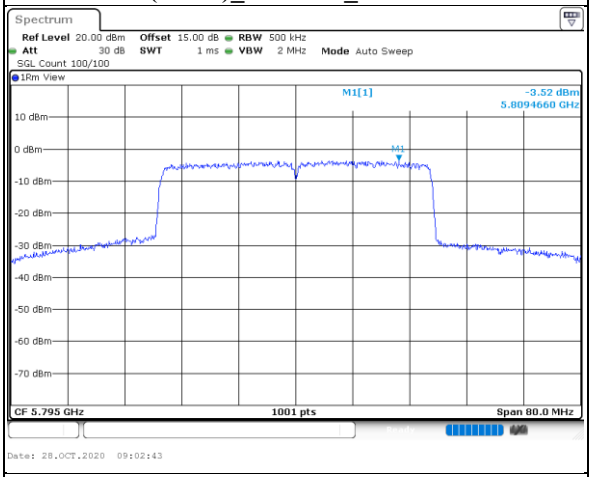
TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	138 (U-NII-3 Band)	5690	-8.36	3.01	-2.05	29.75	Pass
	155	5775	-7.09	3.01	-0.78	29.75	Pass
1	138 (U-NII-3 Band)	5690	-9.19	3.01	-2.88	29.75	Pass
	155	5775	-8.62	3.01	-2.31	29.75	Pass

Note:

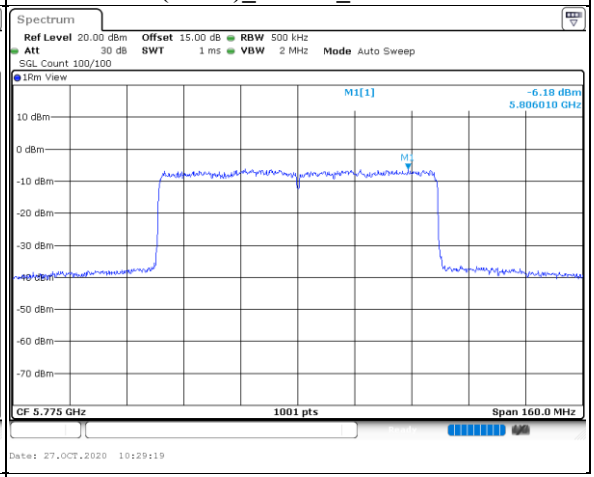
1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11a_Chain 1 / CH165	**802.11ax (HE20)_OFDM_Chain 0 / CH165**
	
802.11ax (HE20)_OFDMA_Chain 0 / CH149	**802.11ax (HE40)_OFDM_Chain 0 / CH159**
	

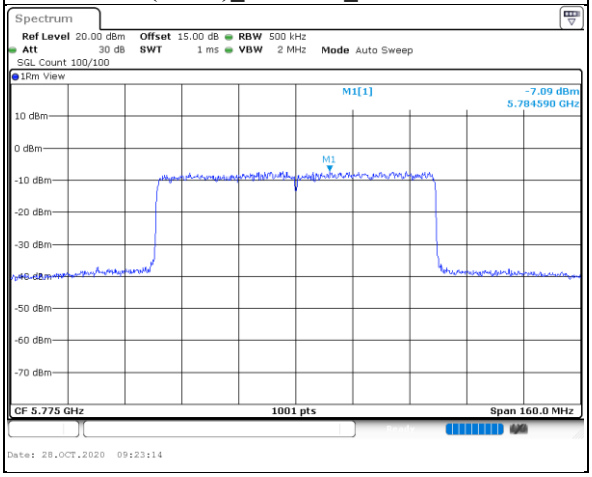
802.11ax (HE40)_OFDMA_Chain 0 / CH159



802.11ax (HE80)_OFDM_Chain 0 / CH155



802.11ax (HE80)_OFDMA_Chain 0 / CH155



Beamforming mode

802.11ax (HE20)

OFDM

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	144 (U-NII-3 Band)	5720	-0.49	3.01	3.05	29.75	Pass
	149	5745	0.91	3.01	4.45	29.75	Pass
	157	5785	0.62	3.01	4.16	29.75	Pass
	165	5825	1.38	3.01	4.92	29.75	Pass
1	144 (U-NII-3 Band)	5720	-1.55	3.01	1.99	29.75	Pass
	149	5745	-0.27	3.01	3.27	29.75	Pass
	157	5785	-0.54	3.01	3	29.75	Pass
	165	5825	-0.8	3.01	2.74	29.75	Pass

OFDMA

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	144 (U-NII-3 Band)	5720	-1.14	3.01	2.87	29.75	Pass
	149	5745	-0.66	3.01	3.35	29.75	Pass
	157	5785	-0.72	3.01	3.29	29.75	Pass
	165	5825	-0.21	3.01	3.80	29.75	Pass
1	144 (U-NII-3 Band)	5720	-1.4	3.01	2.61	29.75	Pass
	149	5745	-1.2	3.01	2.81	29.75	Pass
	157	5785	-1.15	3.01	2.86	29.75	Pass
	165	5825	-1.41	3.01	2.6	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE40)

OFDM

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	142 (U-NII-3 Band)	5710	-3.38	3.01	0.70	29.75	Pass
	151	5755	-2.69	3.01	1.39	29.75	Pass
	159	5795	-2.64	3.01	1.44	29.75	Pass
1	142 (U-NII-3 Band)	5710	-4.6	3.01	-0.52	29.75	Pass
	151	5755	-2.67	3.01	1.41	29.75	Pass
	159	5795	-2.57	3.01	1.51	29.75	Pass

OFDMA

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	142 (U-NII-3 Band)	5710	-3.63	3.01	1.25	29.75	Pass
	151	5755	-3.71	3.01	1.17	29.75	Pass
	159	5795	-3.32	3.01	1.56	29.75	Pass
1	142 (U-NII-3 Band)	5710	-5.23	3.01	-0.35	29.75	Pass
	151	5755	-4.95	3.01	-0.07	29.75	Pass
	159	5795	-5.08	3.01	-0.2	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

802.11ax (HE80)

OFDM

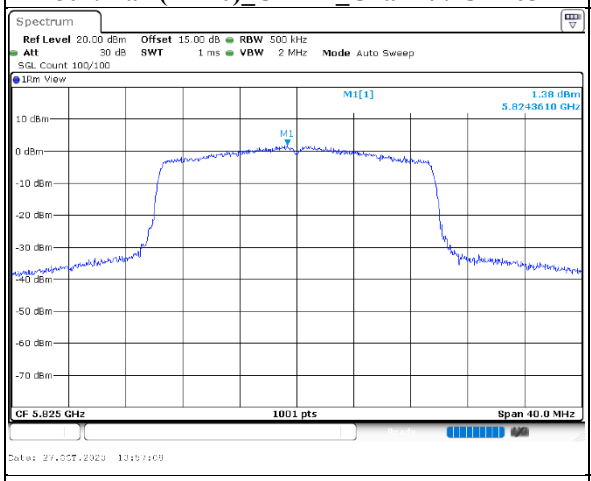
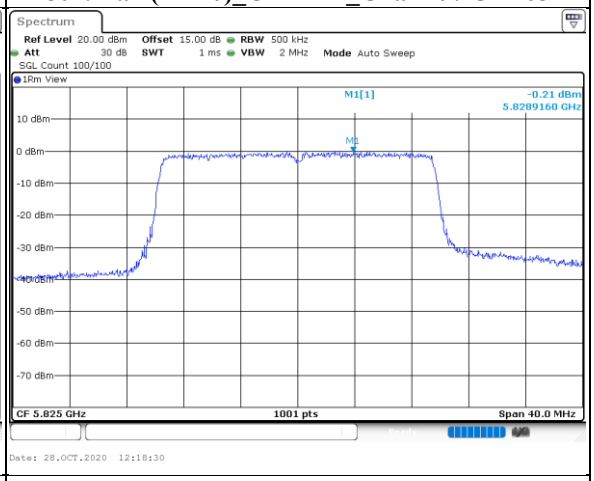
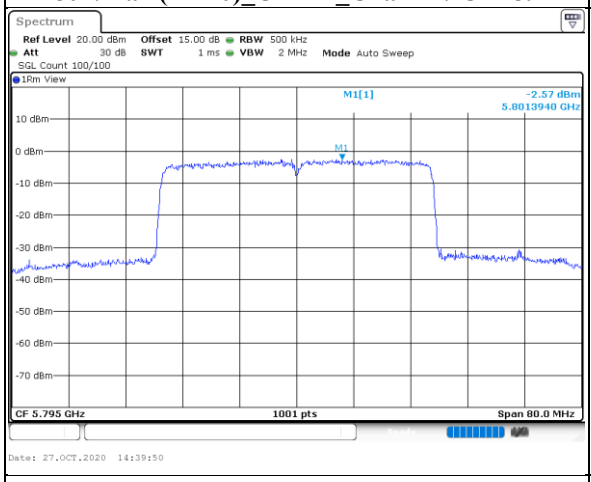
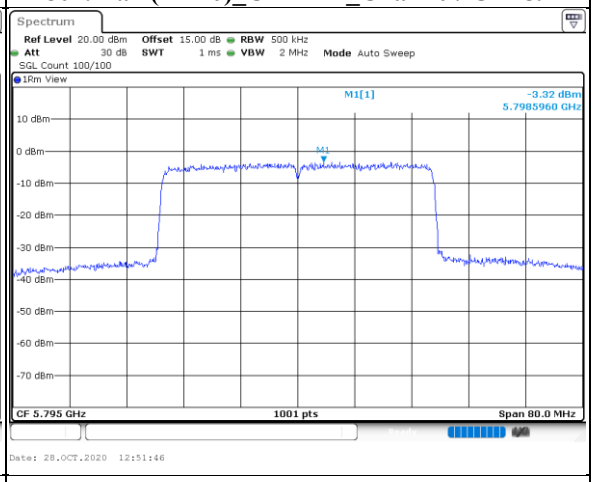
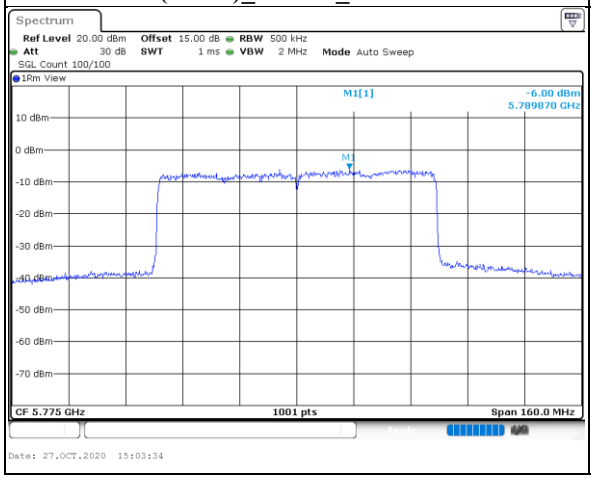
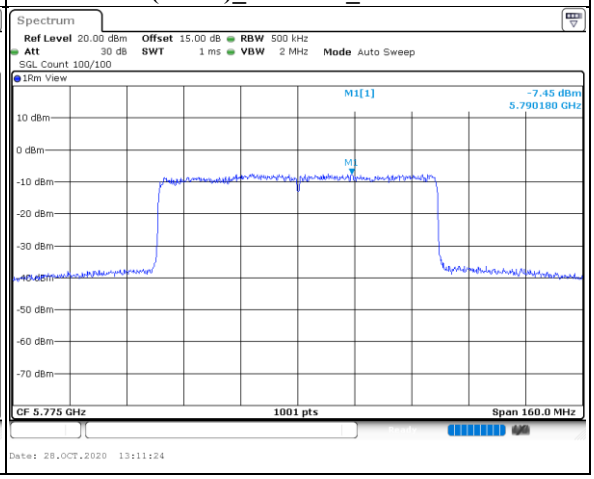
TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	138 (U-NII-3 Band)	5690	-6.37	3.01	-1.03	29.75	Pass
	155	5775	-6	3.01	-0.66	29.75	Pass
1	138 (U-NII-3 Band)	5690	V	3.01	-1.88	29.75	Pass
	155	5775	-7.87	3.01	-2.53	29.75	Pass

OFDMA

TX Chain	Channel	Frequency (MHz)	PSD w/o duty factor (dBm/500 kHz)	10 log (N=2) dB	Total PSD with Duty Factor (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	138 (U-NII-3 Band)	5690	-8.89	3.01	-2.58	29.75	Pass
	155	5775	-7.45	3.01	-1.14	29.75	Pass
1	138 (U-NII-3 Band)	5690	-8.84	3.01	-2.53	29.75	Pass
	155	5775	-8.94	3.01	-2.63	29.75	Pass

Note:

1. Directional gain = 6.25 dBi > 6 dBi , so the limit shall be reduced.
2. Refer to section 6.6 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11ax (HE20)_OFDM_Chain 0 / CH165	**802.11ax (HE20)_OFDMA_Chain 0 / CH165**
	
802.11ax (HE40)_OFDM_Chain 1 / CH159	**802.11ax (HE40)_OFDMA_Chain 0 / CH159**
	
802.11ax (HE80)_OFDM_Chain 0 / CH155	**802.11ax (HE80)_OFDMA_Chain 0 / CH155**
	

9.6. Frequency Stability

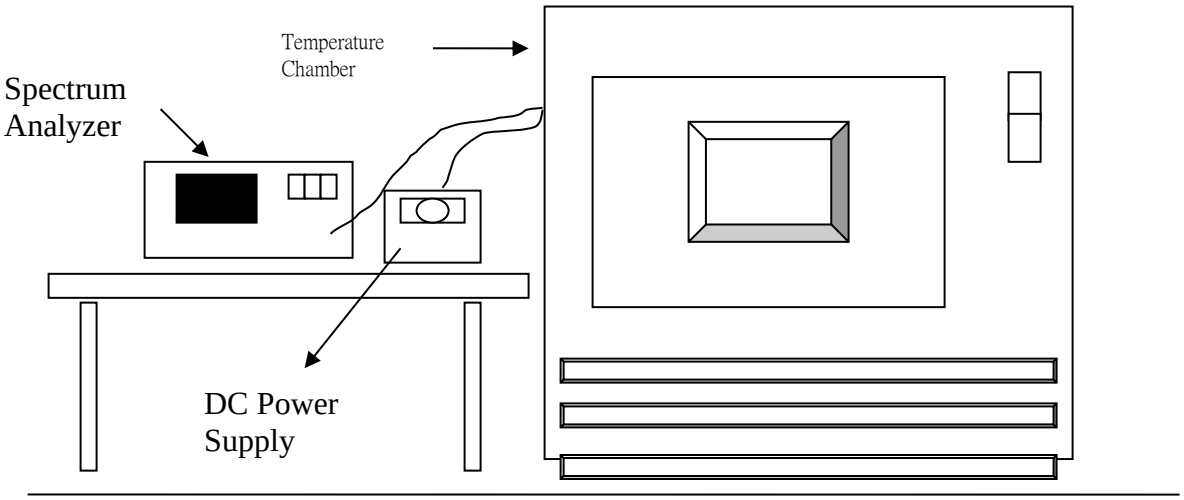
Requirements

The frequency of the carrier signal shall be maintained within band of operation.

Test procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
b. Turn the EUT on and couple its output to a spectrum analyzer.
c. Turn the EUT off and set the chamber to the highest temperature specified.
d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 Minutes.
e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 Minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

Test Setup



Test Data

Non-Beamforming mode

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
85	120	5180.03708	7.16	5179.943006	-11.00	5180.03257	6.29	5179.954419	-8.80
80	120	5179.950252	-9.60	5179.954601	-8.76	5180.01765	3.41	5180.055903	10.79
70	120	5179.954245	-8.83	5180.061757	11.92	5180.073381	14.17	5179.964294	-6.89
60	120	5179.953758	-8.93	5179.998217	-0.34	5180.040639	7.85	5179.982714	-3.34
50	120	5179.927714	-13.95	5180.000925	0.18	5180.019656	3.79	5179.96016	-7.69
40	120	5180.013909	2.69	5180.023308	4.50	5180.074765	14.43	5179.974997	-4.83
30	120	5180.013096	2.53	5179.989715	-1.99	5180.045541	8.79	5179.971464	-5.51
20	120	5179.923706	-14.73	5179.940497	-11.49	5179.990356	-1.86	5180.069901	13.49
10	120	5179.929436	-13.62	5179.997782	-0.43	5180.063223	12.21	5179.978773	-4.10
0	120	5180.027679	5.34	5179.987623	-2.39	5180.020768	4.01	5180.067818	13.09
-10	120	5179.954232	-8.84	5180.072603	14.02	5179.939199	-11.74	5179.94823	-9.99
-20	120	5180.023846	4.60	5179.992446	-1.46	5179.950119	-9.63	5179.958141	-8.08
-30	120	5180.024018	4.64	5180.051246	9.89	5179.974797	-4.87	5179.976093	-4.62
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
20	102	5179.980833	-3.70	5180.002921	0.56	5179.995684	-0.83	5180.026428	5.10
20	138	5180.018729	3.62	5180.028308	5.46	5179.96667	-6.43	5180.040607	7.84

Beamforming mode

Frequency Stability Versus Temp.									
Operating Frequency: 5180 MHz									
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
85	120	5180.041231	7.96	5180.042426	8.19	5179.985781	-2.75	5179.963415	-7.06
80	120	5179.963668	-7.01	5179.952962	-9.08	5180.01998	3.86	5179.933338	-12.87
70	120	5180.015965	3.08	5179.943393	-10.93	5179.994418	-1.08	5179.993244	-1.30
60	120	5180.04033	7.79	5179.953454	-8.99	5179.950233	-9.61	5179.944601	-10.69
50	120	5179.960791	-7.57	5180.028206	5.45	5180.036998	7.14	5180.044197	8.53
40	120	5179.947841	-10.07	5179.932604	-13.01	5179.956334	-8.43	5179.986294	-2.65
30	120	5179.998536	-0.28	5180.025339	4.89	5179.978414	-4.17	5180.008258	1.59
20	120	5180.040296	7.78	5179.955241	-8.64	5179.922301	-15.00	5180.041048	7.92
10	120	5180.022939	4.43	5180.004518	0.87	5180.056567	10.92	5179.944779	-10.66
0	120	5180.044614	8.61	5180.039105	7.55	5179.94592	-10.44	5179.936383	-12.28
-10	120	5180.023001	4.44	5179.96725	-6.32	5179.967521	-6.27	5180.013365	2.58
-20	120	5180.03548	6.85	5180.004753	0.92	5179.955973	-8.50	5179.991941	-1.56
-30	120	5180.027433	5.30	5179.997803	-0.42	5179.947504	-10.13	5179.98055	-3.75
TEMP. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)	Measured Frequency (MHz)	Freq. Drift (ppm)
20	102	5180.042794	8.26	5179.971969	-5.41	5179.947018	-10.23	5179.990183	-1.90
20	138	5180.040667	7.85	5179.979594	-3.94	5179.953059	-9.06	5179.965864	-6.59

9.7. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequency(MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	**Applicable To**	**EIRP Limit**	**Equivalent Field Strength at 3m**
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	15.407(b)(4)(i)	PK:-27 (dBm/MHz) *1 PK:10 (dBm/MHz) *2 PK:15.6 (dBm/MHz) *3 PK:27 (dBm/MHz) *4	PK: 68.2(dBµV/m) *1 PK:105.2 (dBµV/m) *2 PK: 110.8(dBµV/m) *3 PK:122.2 (dBµV/m) *4
*1 beyond 75 MHz or more above of the band edge. *2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above. *3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above. *4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.			

Note:
The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ µV/m, where P is the eirp (Watts).

Test Procedures

[For 9 kHz ~ 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.

c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

Configuration	Non-Beamforming mode		Beamforming mode	
	Average		Average	
	RBW	RBW	RBW	VBW
802.11a	1MHz	1 kHz	-	-
802.11ax (HE20)_OFDM		1 kHz	1MHz	1 kHz
802.11ax (HE20)_OFDMA		1 kHz		1 kHz
802.11ax (HE40)_OFDM		2 kHz		2 kHz
802.11ax (HE40)_OFDMA		1 kHz		1 kHz
802.11ax (HE80)_OFDM		4 kHz		5 kHz
802.11ax (HE80)_OFDMA		2 kHz		2 kHz

Note: Refer to section 6.6 for duty cycle.

d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported.

Test Setup

<Frequency Range 9 kHz ~ 30 MHz>