TEST REPORT

CERTIFICATE OF CONFORMITY

Standard:	**47 CFR FCC Part 15, Subpart E (Section 15.407)**
Report No.:	RFBBUI-WTW-P22100654-1
FCC ID:	TX2-RTL8851B
Product:	11ax RTL8851BE one antenna Combo module
Brand:	REALTEK
Model No.:	RTL8851B
Received Date:	2022/10/25
Test Date:	2022/12/20 ~ 2023/4/13
Issued Date:	2023/5/15
Applicant:	Realtek Semiconductor Corp.
Address:	No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

Approved by: _____ , **Date:** **2023/5/15**

May Chen / Manager

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Prepared by : Vito Lung / Specialist

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBBUI-WTW-P22100654-1	Original release.	2023/5/15

1 Certificate

Product:	11ax RTL8851BE one antenna Combo module
Brand:	REALTEK
Test Model:	RTL8851B
Sample Status:	Engineering sample
Applicant:	Realtek Semiconductor Corp.
Test Date:	2022/12/20 ~ 2023/4/13
Standard:	47 CFR FCC Part 15, Subpart E (Section 15.407)
Measurement procedure:	ANSI C63.10-2013 KDB 789033 D02 General UNII Test Procedure New Rules v02r01

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
Clause	Test Item	Result	Remark
15.407(a)(2)	26 dB Bandwidth	-	For U-NII-2A U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	RF Output Power	Pass	Meet the requirement of limit.
15.407(a)(1) 15.407(a)(2) 15.407(a)(3)	Power Spectral Density	Pass	Meet the requirement of limit.
15.407(e)	6 dB Bandwidth	Pass	Meet the requirement of limit. (U-NII-3 Band only)
---	Occupied Bandwidth	-	Reference only.
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.407(b)(9)	AC Power Conducted Emissions	Pass	Minimum passing margin is -10.29 dB at 0.18906 MHz
15.407(b)(9)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -7.7 dB at 42.70 MHz
15.407(b) (1/10) 15.407(b) (2/10) 15.407(b) (3/10) 15.407(b) (4(i)/10)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -0.3 dB at 5470.00 MHz
15.203	Antenna Requirement	Pass	Antenna connector is IPEX4 not a standard connector.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Parameter	Specification	Expanded Uncertainty (k=2) (±)
AC Power Conducted Emissions	150 kHz ~ 30 MHz	1.9 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.1 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	5.1 dB
	18 GHz ~ 40 GHz	5.3 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	11ax RTL8851BE one antenna Combo module
Brand	REALTEK
Test Model	RTL8851B
Status of EUT	Engineering sample
Power Supply Rating	3.3 Vdc Hz from host equipment
Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode 1024QAM for OFDMA in 11ax mode
Modulation Technology	OFDM, OFDMA
Transfer Rate	802.11a: up to 54 Mbps 802.11n: up to 150 Mbps 802.11ac: up to 433.3 Mbps 802.11ax: up to 600.4 Mbps
Operating Frequency	5.18 GHz ~ 5.24 GHz 5.26 GHz ~ 5.32 GHz 5.5 GHz ~ 5.72 GHz 5.745 GHz ~ 5.825 GHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 25 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 12 802.11ac (VHT80), 802.11ax (HE80): 6
Resource Unit (RU)	Single RU: 26-tone, 52-tone, 106-tone, 242-tone, 484-tone, 996-tone
Output Power	5.18 GHz ~ 5.24 GHz : 192.309 mW (22.84 dBm) 5.26 GHz ~ 5.32 GHz : 191.867 mW (22.83 dBm) 5.5 GHz ~ 5.72 GHz : 158.125 mW (21.99 dBm) 5.745 GHz ~ 5.825 GHz : 209.411 mW (23.21 dBm)
EUT Category	Client device

Note:

1. There are Bluetooth and WLAN (2.4 GHz & 5 GHz) technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (5 GHz)	Bluetooth
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

3. The EUT support OFDMA and Partial RU mode, therefore partial RU combination were investigated and the worst case scenario was identified.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Antenna NO.	RF Chain NO.	Brand	Model	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length (mm)
1	Chain 1	REALTEK	RTK-ANT-0022	3.4	2.4~2.4835GHz	PIFA	IPEX4	300
				5	5.15~5.895GHz			
2	Chain 1	Aristotle	RFA-27-C38H1-MHF4300	3	2.4~2.4835GHz	Dipole	IPEX4	300
				5	5.15~5.895GHz			
3	Chain 1	LYNwave	ALX22F-120AA0-00	3.2	2.4~2.4835GHz	Monopole	IPEX4	200
				4	5.15~5.895GHz			
Note: Max. gain was selected for the final test, except for Unwanted Emissions.								

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2. The EUT incorporates a SISO function:

5 GHz Band		
Modulation Mode	**TX & RX Configuration**	
802.11a	1TX	1RX
802.11n (HT20)	1TX	1RX
802.11n (HT40)	1TX	1RX
802.11ac (VHT20)	1TX	1RX
802.11ac (VHT40)	1TX	1RX
802.11ac (VHT80)	1TX	1RX
802.11ax (HE20)	1TX	1RX
802.11ax (HE40)	1TX	1RX
802.11ax (HE80)	1TX	1RX
802.11ax (RU26/52/106/242/484/996)	1TX	1RX

Note:
1. The modulation and bandwidth are similar for 802.11n mode for 20 MHz (40 MHz), 802.11ac mode for 20 MHz (40 MHz, 80 MHz) and 802.11ax mode for 20 MHz (40 MHz, 80 MHz), therefore the manufacturer will control the power for 802.11n/ac mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report.

3.3 Channel List

FOR 5180 ~ 5320 MHz

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

Channel	Frequency	Channel	Frequency
36	5180 MHz	52	5260 MHz
40	5200 MHz	56	5280 MHz
44	5220 MHz	60	5300 MHz
48	5240 MHz	64	5320 MHz

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

Channel	Frequency	Channel	Frequency
38	5190 MHz	54	5270 MHz
46	5230 MHz	62	5310 MHz

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

Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz

FOR 5500 ~ 5720 MHz

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	5530 MHz	138	5690 MHz
122	5610 MHz		

FOR 5745 ~ 5825 MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

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

Channel	Frequency
155	5775 MHz

3.4 Test Mode Applicability and Tested Channel Detail

Pre-Scan:	1. PIFA/Monopole ANT can be used in the following ways: X / Y / Z axis. Pre-scan in these ways and find the worst case as a representative test condition. 2. For Partial RU modes of 20MHz, 40MHz and 80MHz bandwidth needs to be pre-worst. 3. 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).
Worst Case:	1. PIFA/Monopole ANT the worst case was found when positioned on (X / Y / Z axis): Unwanted Emissions below 1 GHz Y axis worst,and Unwanted Emissions above 1 GHz Y axis worst for PIFA ANT; Unwanted Emissions below 1 GHz X axis worst,and Unwanted Emissions above 1 GHz X axis worst for Monopole ANT. 2. The worst case occurs in 20MHz bandwidth (partial RU 26/52/106). 3. Dipole ANT was used typical placement for the test: Y axis.

Following channel(s) was (were) selected for the final test as listed below:

Test Item	EUT Configure Mode	Mode	Tested Channel	Modulation	Data Rate Parameter	RU Configuration
26 dB Bandwidth	-	802.11a	52, 60, 64, 100, 116, 140, 144	BPSK	6Mb/s	-
		802.11ax (HE20)	52, 60, 64, 100, 116, 140, 144	BPSK	MCS0	-
		802.11ax (HE40)	54, 62, 102, 110, 134, 142	BPSK	MCS0	-
		802.11ax (HE80)	58, 106, 122, 138	BPSK	MCS0	-
		20 MHz Preamble 802.11ax (RU26)	52, 60, 64, 100, 116, 140, 144	BPSK	MCS0	26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/8
		20 MHz Preamble 802.11ax (RU52)	52, 60, 64, 100, 116, 140, 144	BPSK	MCS0	52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/40
		20 MHz Preamble 802.11ax (RU106)	52, 60, 64, 100, 116, 140, 144	BPSK	MCS0	106/53, 106/54, 106/54, 106/53, 106/53, 106/54, 106/54

RF Output Power	-	802.11a	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	6Mb/s	-
		802.11ac (VHT20)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	-
		802.11ac (VHT40)	38, 46, 54, 62, 102, 110, 134, 142, 151, 159	BPSK	MCS0	-
		802.11ac (VHT80)	42, 58, 106, 122, 138, 155	BPSK	MCS0	-
		802.11ax (HE20)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	-
		802.11ax (HE40)	38, 46, 54, 62, 102, 110, 134, 142, 151, 159	BPSK	MCS0	-
		802.11ax (HE80)	42, 58, 106, 122, 138, 155	BPSK	MCS0	-
		20 MHz Preamble 802.11ax (RU26)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/8, 26/0, 26/4, 26/8
		20 MHz Preamble 802.11ax (RU52)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/40, 52/37, 52/39, 52/40
		20 MHz Preamble 802.11ax (RU106)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	106/53, 106/53, 106/54, 106/53, 106/54, 106/54, 106/53, 106/53, 106/54, 106/54, 106/53, 106/54, 106/54

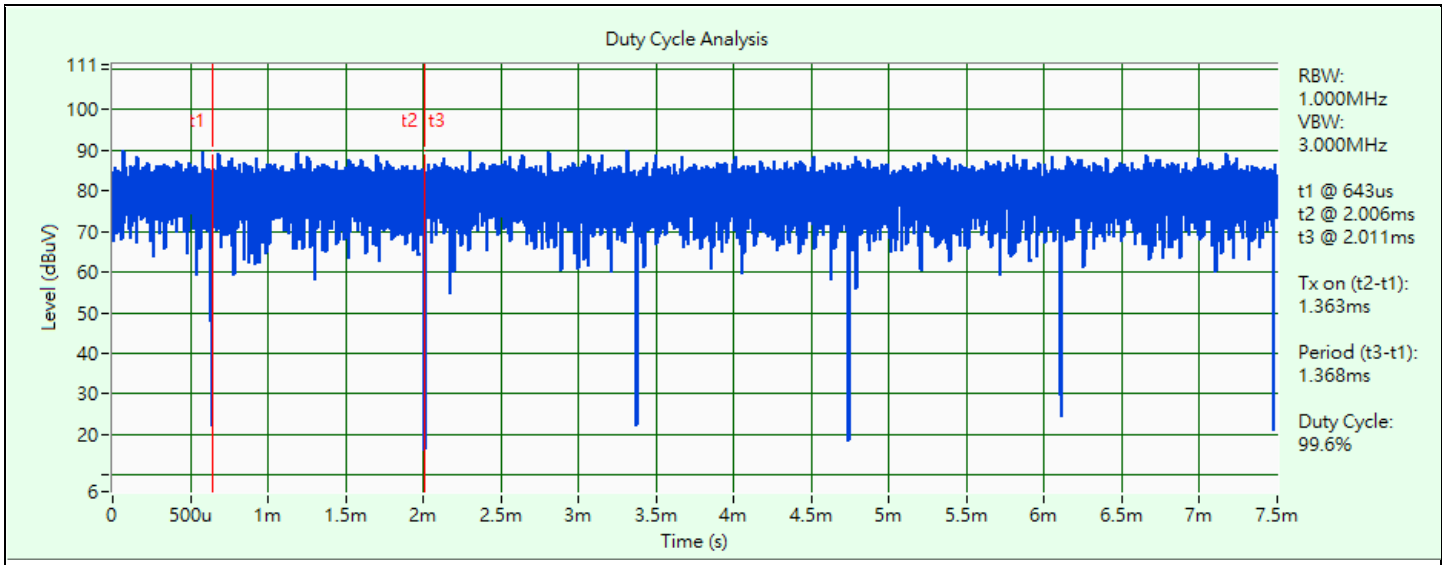
6 dB Bandwidth	-	802.11a	144 (U-NII-3 Band), 149, 157, 165	BPSK	6Mb/s	-
		802.11ax (HE20)	144 (U-NII-3 Band), 149, 157, 165	BPSK	MCS0	-
		802.11ax (HE40)	142 (U-NII-3 Band), 151, 159	BPSK	MCS0	-
		802.11ax (HE80)	138 (U-NII-3 Band), 155	BPSK	MCS0	-
		802.11ax (HE20) 26-tone RU	144 (U-NII-3 Band), 149, 157, 165	BPSK	MCS0	26/8, 26/0, 26/4, 26/8
		802.11ax (HE20) 52-tone RU	144 (U-NII-3 Band), 149, 157, 165	BPSK	MCS0	52/40, 52/37, 52/39, 52/40
		802.11ax (HE20) 106-tone RU	144 (U-NII-3 Band), 149, 157, 165	BPSK	MCS0	106/54, 106/53, 106/54, 106/54

Power Spectral Density / Occupied Bandwidth	-	802.11a	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	6Mb/s	-
		802.11ax (HE20)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	-
		802.11ax (HE40)	38, 46, 54, 62, 102, 110, 134, 142, 151, 159	BPSK	MCS0	-
		802.11ax (HE80)	42, 58, 106, 122, 138, 155	BPSK	MCS0	-
		20 MHz Preamble 802.11ax (RU26)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/8, 26/0, 26/4, 26/8
		20 MHz Preamble 802.11ax (RU52)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/40, 52/37, 52/39, 52/40
		20 MHz Preamble 802.11ax (RU106)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	106/53, 106/53, 106/54, 106/53, 106/54, 106/54, 106/53, 106/53, 106/54, 106/54, 106/53, 106/54,106/54
Frequency Stability	-	802.11a	36	un-modulation	-	-
AC Power Conducted Emissions	B	802.11ax (HE20)	165	BPSK	MCS0	-
Unwanted Emissions below 1 GHz	A, B, C	802.11ax (HE20)	165	BPSK	MCS0	-

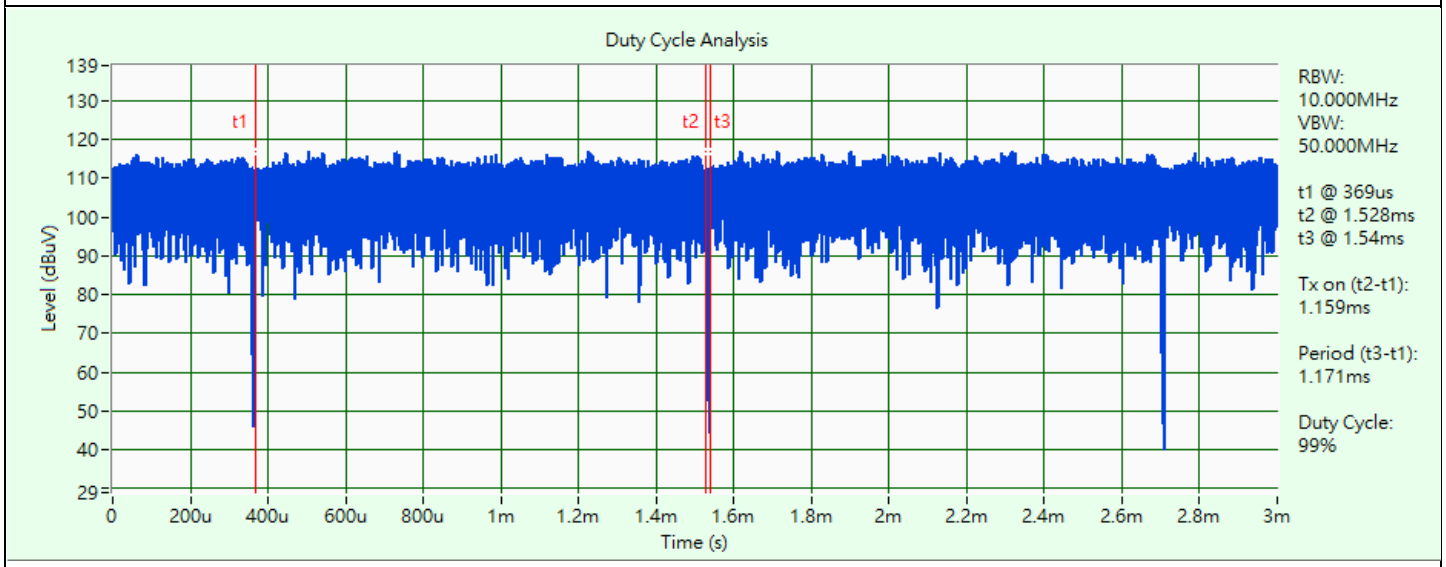
Unwanted Emissions above 1 GHz	A, B, C	802.11a	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	6Mb/s	-
		802.11ax (HE20)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	-
		802.11ax (HE40)	38, 46, 54, 62, 102, 110, 134, 142, 151, 159	BPSK	MCS0	-
		802.11ax (HE80)	42, 58, 106, 122, 138, 155	BPSK	MCS0	-
		20 MHz Preamble 802.11ax (RU26)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/0, 26/4, 26/8, 26/8, 26/0, 26/4, 26/8
		20 MHz Preamble 802.11ax (RU52)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/37, 52/39, 52/40, 52/40, 52/37, 52/39, 52/40
		20 MHz Preamble 802.11ax (RU106)	36, 40, 48, 52, 60, 64, 100, 116, 140, 144, 149, 157, 165	BPSK	MCS0	106/53, 106/53, 106/54, 106/53, 106/54, 106/54, 106/53, 106/53, 106/54, 106/54, 106/53, 106/54,106/54
EUT Configure Mode:	A	with Dipole Antenna				
	B	with PIFA Antenna				
	C	with Monopole Antenna				

3.5 Duty Cycle of Test Signal

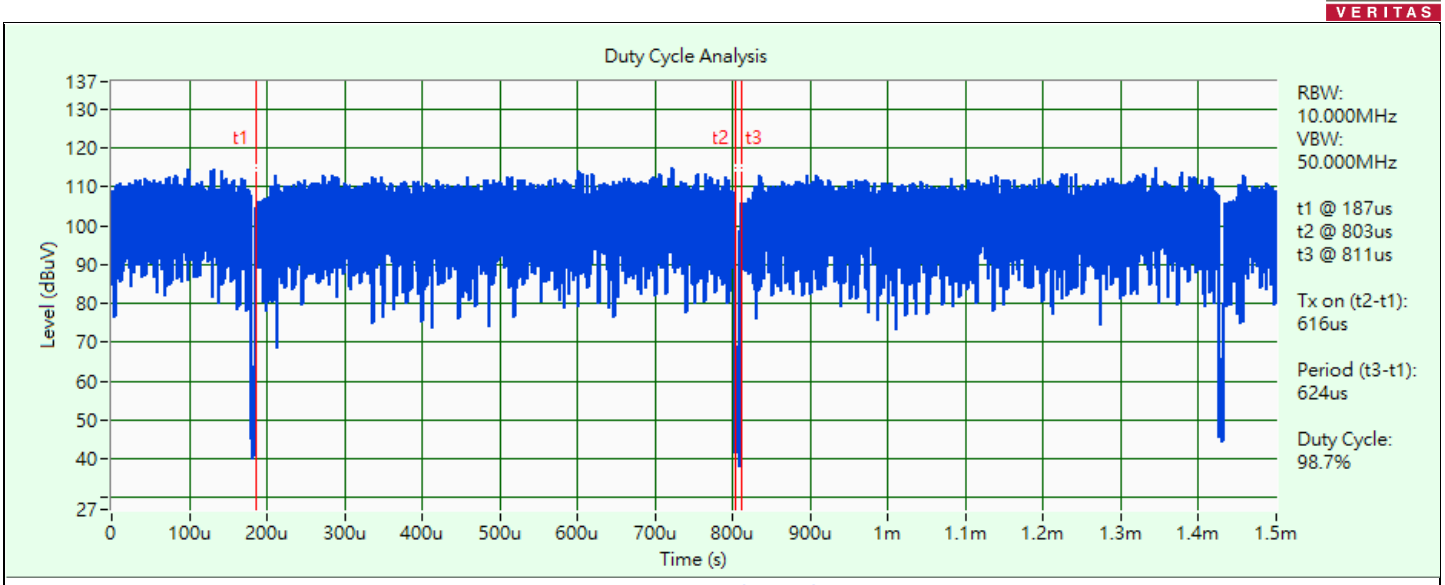
802.11a: Duty cycle = 1.363 ms / 1.368 ms x 100% = 99.6%
802.11ax (HE20): Duty cycle = 1.159 ms / 1.171 ms x 100% = 99.0%
802.11ax (HE40): Duty cycle = 0.616 ms / 0.624 ms x 100% = 98.7%
802.11ax (HE80): Duty cycle = 0.333 ms / 0.34 ms x 100% = 97.9%, duty factor = 10 * log (1/Duty cycle) = 0.09 dB
802.11ax (HE) 26-tone RU: Duty cycle = 5.434 ms / 5.439 ms x 100% = 99.9%
802.11ax (HE) 52-tone RU: Duty cycle = 2.757 ms / 2.763 ms x 100% = 99.8%
802.11ax (HE) 106-tone RU: Duty cycle = 1.328 ms / 1.336 ms x 100% = 99.4%



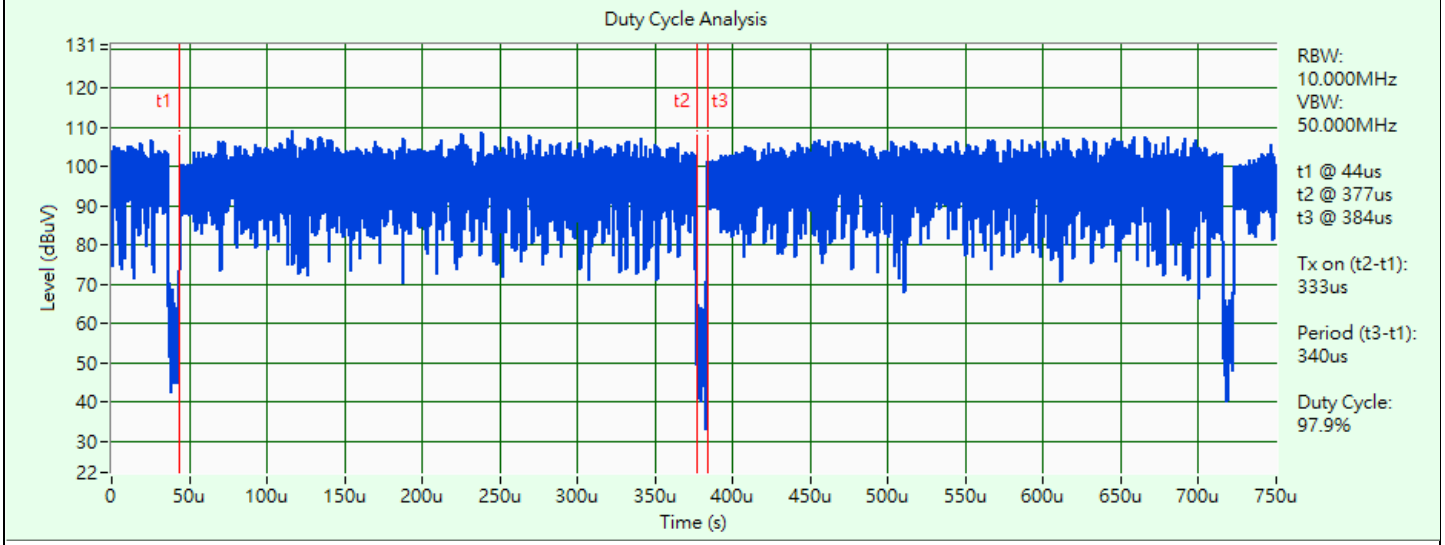
802.11a



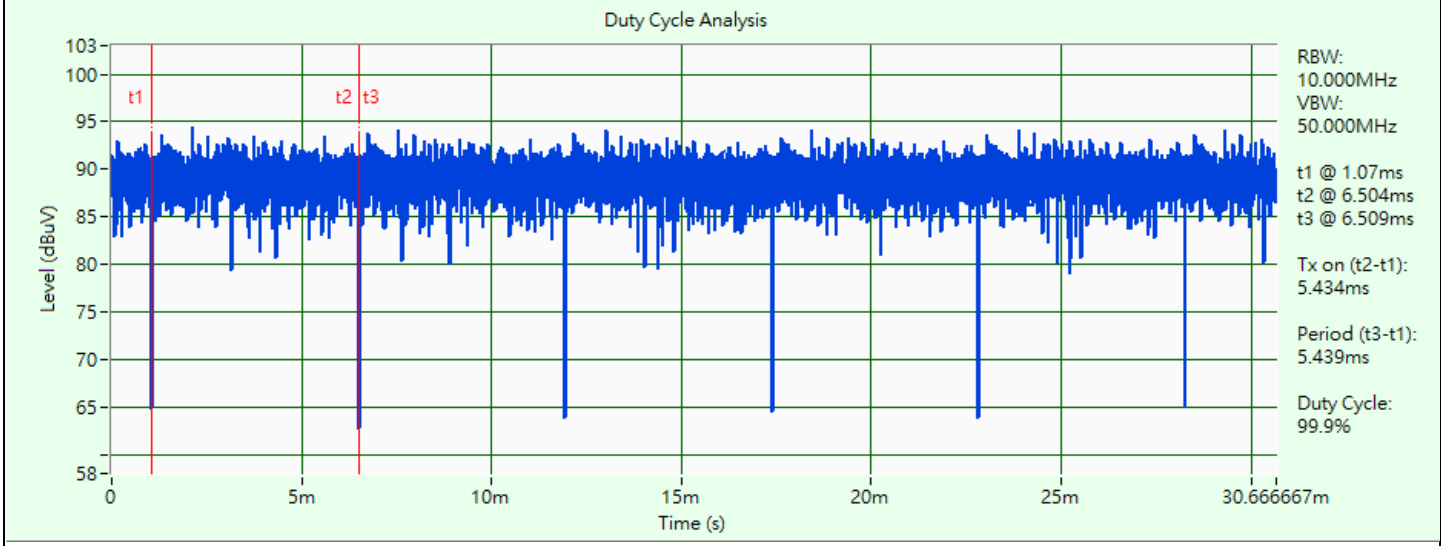
802.11ax (HE20)



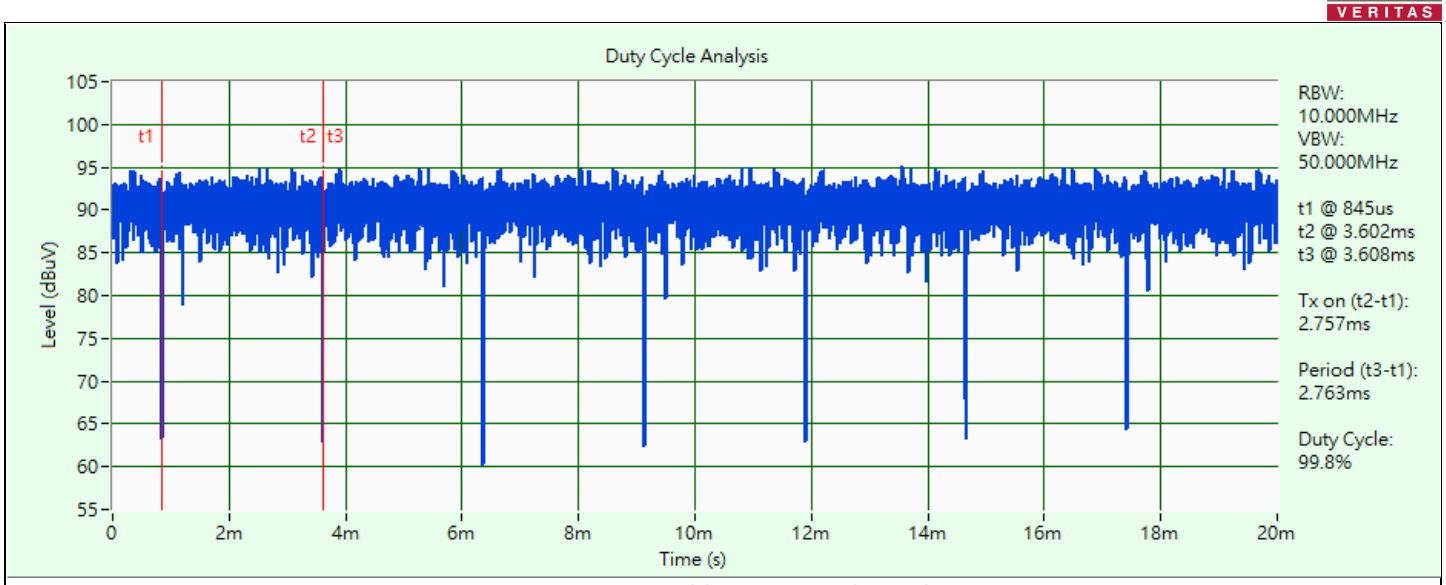
802.11ax (HE40)



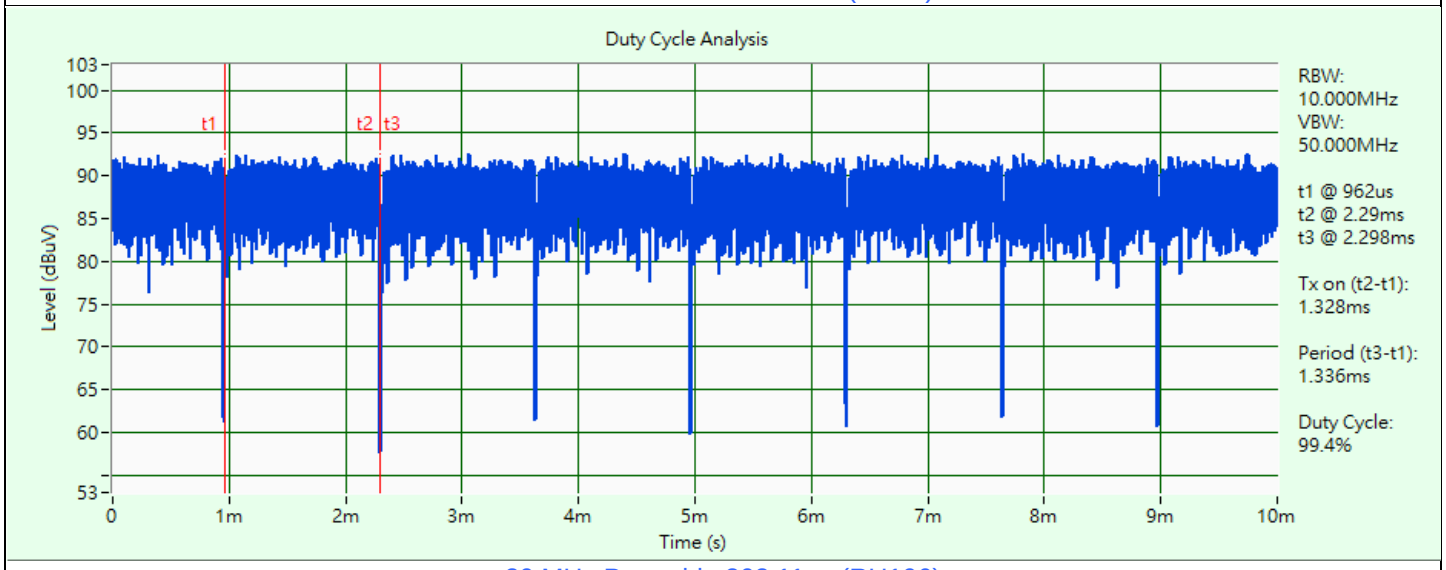
802.11ax (HE80)



20 MHz Preamble 802.11ax (RU26)



20 MHz Preamble 802.11ax (RU52)



20 MHz Preamble 802.11ax (RU106)

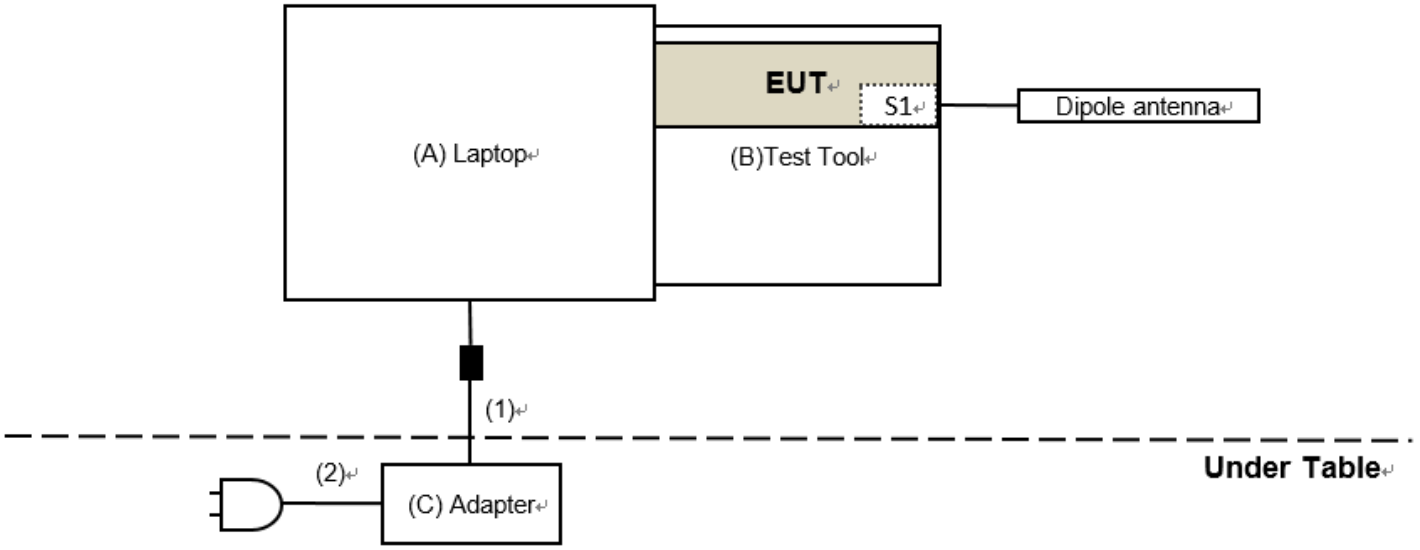
3.6 Test Program Used and Operation Descriptions

Controlling software (WiFi:RTL8851B_PCIE_MP_Package_ALPHA_v2.0.20_homologation(94894)) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

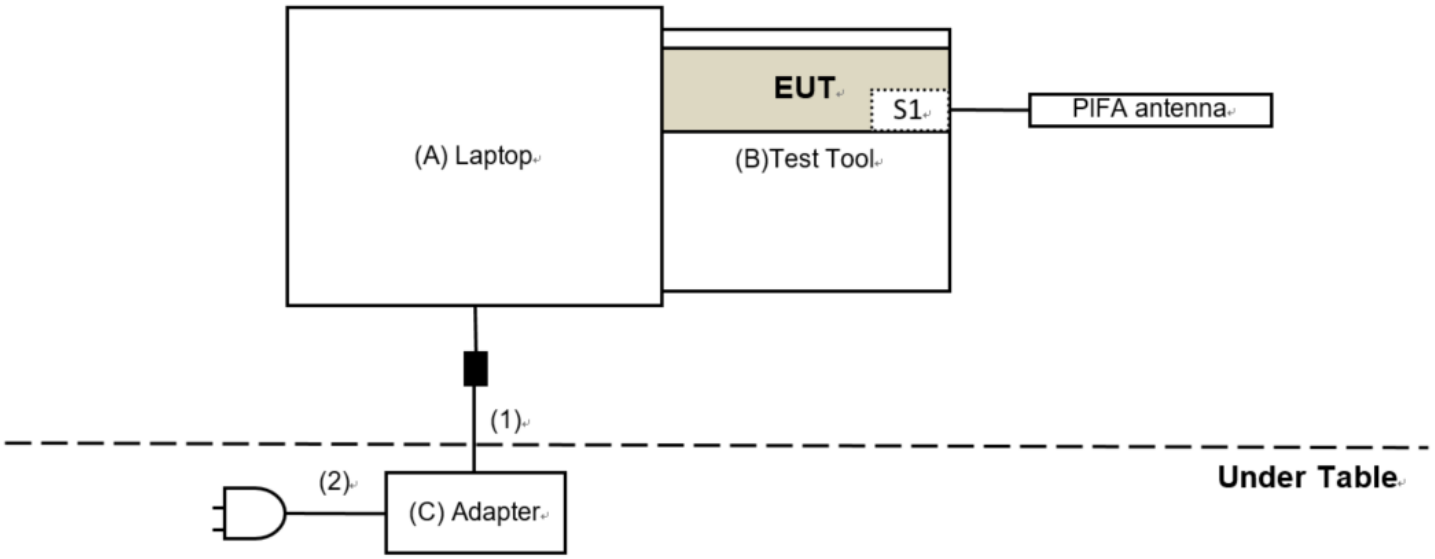
3.7 Connection Diagram of EUT and Peripheral Devices

For Unwanted Emission Test

Mode A



Mode B



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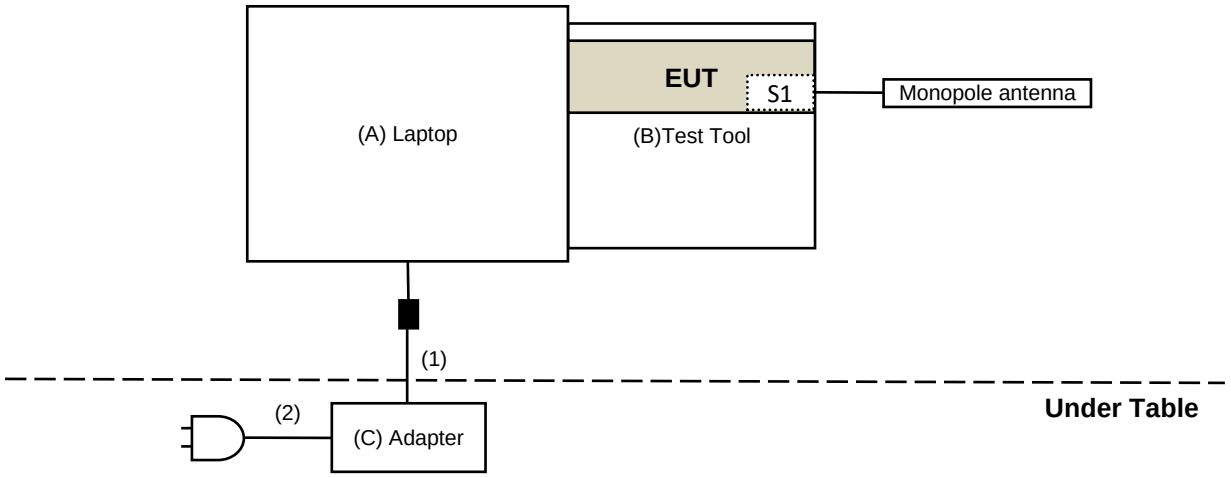
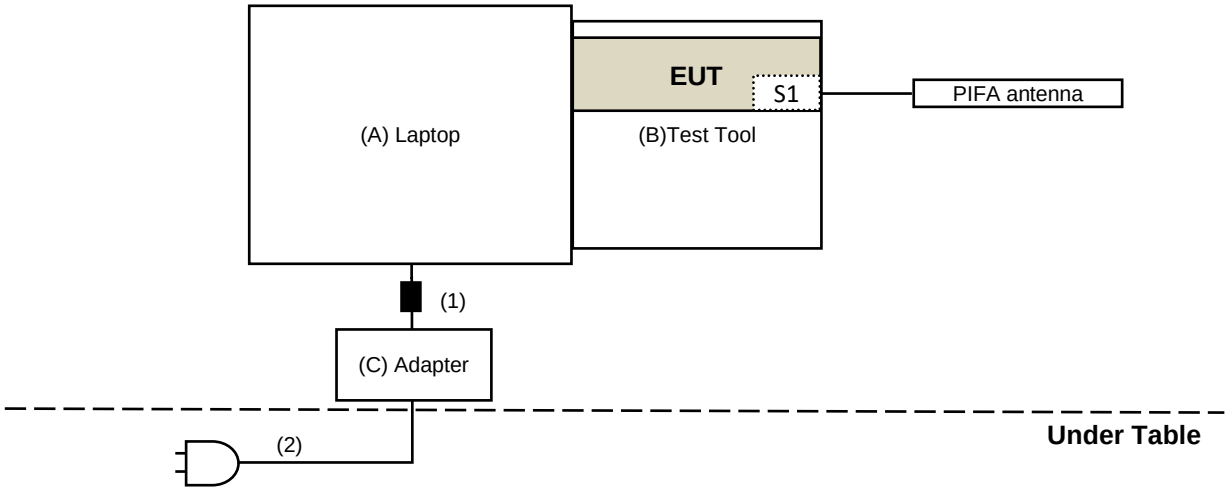


For AC Power Conducted Emission Test

Mode B



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Laptop	Dell	E5420	FHNS4S1	N/A	Provided by Lab
B	Test Tool	Realtek	N/A	N/A	N/A	Supplied by applicant
C	Adapter	Dell	FA65NE0-00	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC Cable	1	1.8	NO	1	Provided by Lab
2	AC Cable	1	1	NO	0	Provided by Lab

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 26 dB Bandwidth

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2022/4/5	2023/4/4
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer Keysight	N9020B	MY60112409	2023/2/18	2024/2/17

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2023/3/29

4.2 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2022/4/5	2023/4/4
Power Meter Anritsu	ML2495A	1529002	2022/6/22	2023/6/21
Pulse Power Sensor Anritsu	MA2411B	1726434	2022/6/22	2023/6/21
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer Keysight	N9020B	MY60112409	2023/2/18	2024/2/17

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2023/3/29

4.3 Power Spectral Density

Refer to section 4.1 to get information of the instruments.

4.4 6 dB Bandwidth

Refer to section 4.1 to get information of the instruments.

4.5 Occupied Bandwidth

Refer to section 4.1 to get information of the instruments.

4.6 Frequency Stability

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
DC Power Source GOOD WILL	6905S	1991551	N/A	N/A
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2023/3/27	2024/3/26
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A
Spectrum Analyzer Keysight	N9020B	MY60112409	2023/2/18	2024/2/17
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	2022/12/26	2023/12/25
True RMS Clamp Meter Fluke	325	31130711WS	2022/6/9	2023/6/8

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2023/3/29

4.7 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance	N/A	EMC-01	2022/9/27	2023/9/26
Fixed attenuator STI	STI02-2200-10	005	2022/8/24	2023/8/23
LISN R&S	ESH3-Z5	848773/004	2022/10/18	2023/10/17
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2022/8/24	2023/8/23
Software BVADT	BVADT_Cond_V7.3.7.4	N/A	N/A	N/A
TEST RECEIVER R&S	ESCS 30	847124/029	2022/10/14	2023/10/13

Notes:

1. The test was performed in Conduction 1
2. Tested Date: 2023/3/21

4.8 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bilog Antenna Schwarzbeck	VULB 9168	9168-0842	2022/10/24	2023/10/23
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	N/A	N/A
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-02	2022/12/28	2023/12/27
LOOP ANTENNA Electro-Metrics	EM-6879	264	2023/2/21	2024/2/20
Pre_Amplifier Agilent	8447D	2944A10636	2023/3/12	2024/3/11
Pre_Amplifier EMCI	EMC330N	980538	2022/4/25	2023/4/24
RF Coaxial Cable COMMATE/PEWC	8D	966-5-1	2023/2/18	2024/2/17
		966-5-2	2023/2/18	2024/2/17
		966-5-3	2023/2/18	2024/2/17
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/12/19	2023/12/18
		LOOPCAB-002	2022/12/19	2023/12/18
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer Keysight	N9020B	MY60112410	2023/3/6	2024/3/5
Test Receiver R&S	ESR3	102528	2023/2/10	2024/2/9

Notes:

1. The test was performed in 966 Chamber No. 5.
2. Tested Date: 2023/3/24

4.9 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	N/A	N/A
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-1819	2022/11/13	2023/11/12
	BBHA 9170	9170-739	2022/11/13	2023/11/12
Pre_Amplifier EMCI	EMC12630SE	980509	2022/4/25	2023/4/24
	EMC184045SE	980387	2022/1/10 2022/12/28	2023/1/9 2023/12/27
RF Cable-Frequency range: 1-40GHz EMCI	EMC102-KM-KM-1200	160924	2022/1/10 2022/12/28	2023/1/9 2023/12/27
RF Coaxial Cable EMCI	EMC-KM-KM-4000	200214	2022/3/8 2023/2/20	2023/3/7 2024/2/19
	EMC104-SM-SM-1500	180503	2022/4/25	2023/4/24
	EMC104-SM-SM-2000	180501	180501	2022/4/25
	EMC104-SM-SM-6000	180506	180506	2022/4/25
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer Keysight	N9020B	MY60112410	2022/3/13 2023/3/6	2023/3/12 2024/3/5
Test Receiver R&S	ESR3	102528	2022/2/25 2023/2/10	2023/2/24 2024/2/9

Notes:

1. The test was performed in 966 Chamber No. 5.
2. Tested Date: 2022/12/20 ~ 2023/4/13

5 Limits of Test Items

5.1 26 dB Bandwidth

The results are for reference only.

5.2 RF Output Power

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)
	Fixed point-to-point Access Point	1 Watt (30 dBm)
	Indoor Access Point	1 Watt (30 dBm)
	Mobile and Portable client device	250mW (24 dBm)

Operation Band	Limit
U-NII-2A	250 mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	250 mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	1 Watt (30 dBm)

*B is the 26 dB emission bandwidth in megahertz

5.3 Power Spectral Density

Operation Band	EUT Category	Limit
U-NII-1	Outdoor Access Point	17 dBm/MHz
	Fixed point-to-point Access Point	
	Indoor Access Point	
	Mobile and Portable client device	11 dBm/MHz

Operation Band	Limit
U-NII-2A	11 dBm/MHz
U-NII-2C	11 dBm/MHz
U-NII-3	30 dBm/500 kHz

5.4 6 dB Bandwidth

Within the 5.725-5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.5 Occupied Bandwidth

The results are for reference only.

5.6 Frequency Stability

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

5.7 AC Power Conducted Emissions

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Notes:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.8 Unwanted Emissions below 1 GHz

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

Frequencies (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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

5.9 Unwanted Emissions above 1 GHz

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

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

Notes:

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 1000 MHz, 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 20 dB 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 3 m	
	PK: 74 (dBµV/m)	AV: 54 (dBµV/m)

For transmitters operating in the 5.15-5.25 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
15.407(b)(1)	PK: -27 (dBm/MHz)	PK: 68.2 (dBµV/m)

For transmitters operating in the 5.25-5.35 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
15.407(b)(2)	PK: -27 (dBm/MHz)	PK: 68.2 (dBµV/m)

For transmitters operating in the 5.47-5.725 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
15.407(b)(3)	PK: -27 (dBm/MHz)	PK: 68.2 (dBµV/m)

For transmitters operating in the 5.725-5.850 GHz band:

Applicable To	EIRP Limit	Equivalent Field Strength at 3 m
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.		

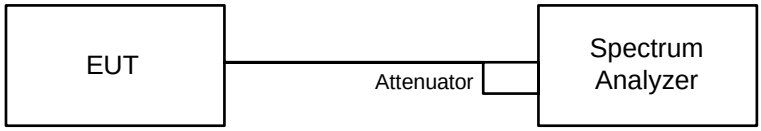
Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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

6 Test Arrangements

6.1 26 dB Bandwidth

6.1.1 Test Setup

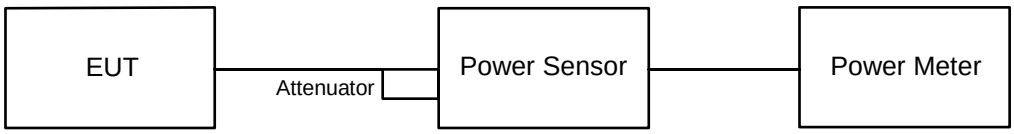


6.1.2 Test Procedure

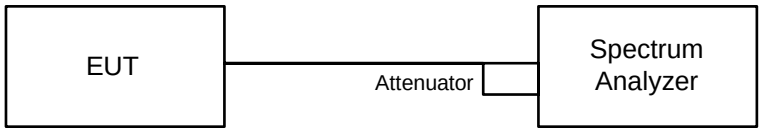
a. Set RBW = approximately 1% of the emission bandwidth.
b. Set the VBW > RBW.
c. Detector = Peak.
d. Trace mode = max hold.
e. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement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

6.2 RF Output Power

6.2.1 Test Setup



For channel straddling:



6.2.2 Test Procedure

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.

For channel straddling:

Method SA-1

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
c. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
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

Note: When measuring straddle channel power, use compute power by integrating the spectrum across the 26 dB EBW or 99% OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the EBW or OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW or 99% OBW of the spectrum.

For channel straddling:

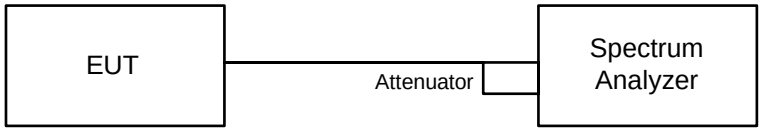
Method SA-2

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
c. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)Sweep time = auto, trigger set to “free run”.
d. Trace average at least 100 traces in power averaging mode.
e. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
f. Record the max value and add 10 log (1/duty cycle).

Note: When measuring straddle channel power, use compute power by integrating the spectrum across the 26 dB EBW or 99% OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the EBW or OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW or 99% OBW of the spectrum.

6.3 Power Spectral Density

6.3.1 Test Setup



6.3.2 Test Procedure

For specified measurement bandwidth 1 MHz:
Method SA-1

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
c. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
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

For specified measurement bandwidth 1 MHz:
Method SA-2

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
c. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
d. Sweep time = auto, trigger set to “free run”.
e. Trace average at least 100 traces in power averaging mode.
f. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
g. Record the max value and add 10 log (1/duty cycle).

For specified measurement bandwidth 500 kHz:
Method SA-1

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
c. Scale the observed power level to an equivalent value in 500 kHz by adjusting (increasing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300 kHz)
d. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
e. Sweep time = auto, trigger set to “free run”.
f. Trace average at least 100 traces in power averaging mode.
g. Record the max value

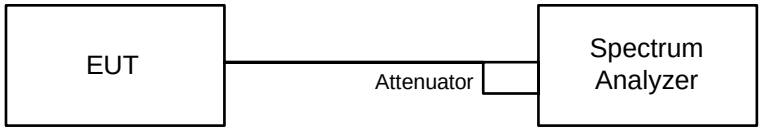
For specified measurement bandwidth 500 kHz:
Method SA-2

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
c. Scale the observed power level to an equivalent value in 500 kHz by adjusting (increasing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300 kHz)
d. Sweep points ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
e. Sweep time = auto, trigger set to “free run”.

f. Trace average at least 100 traces in power averaging mode.
g. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
h. Record the max value and add 10 log (1/duty cycle).

6.4 6 dB Bandwidth

6.4.1 Test Setup

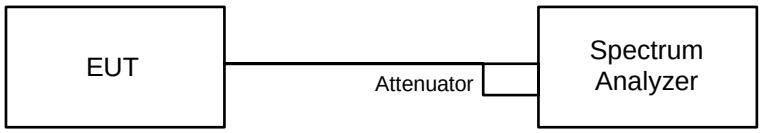


6.4.2 Test Procedure

a. Set resolution bandwidth (RBW) = 100 kHz.
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.

6.5 Occupied Bandwidth

6.5.1 Test Setup

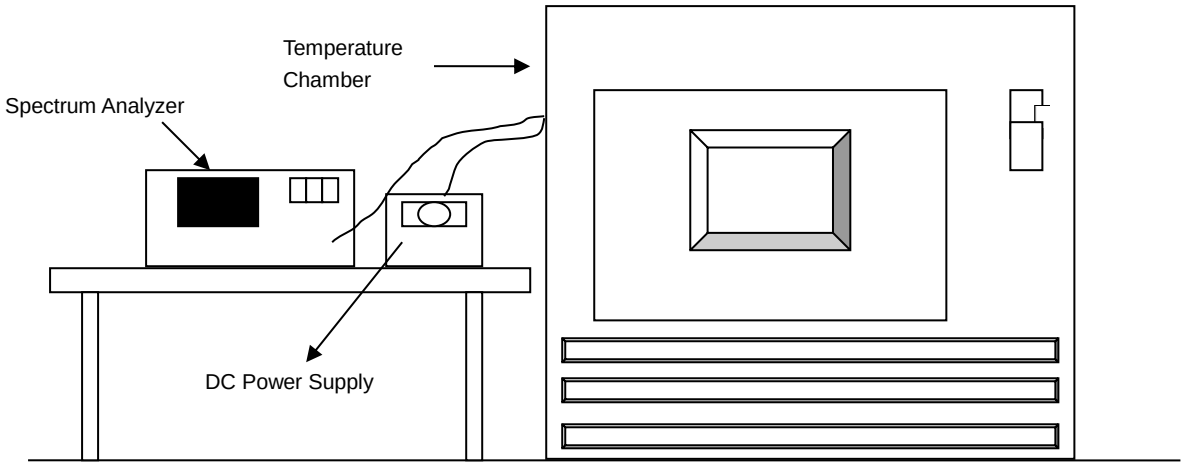


6.5.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to Sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean power of a given emission.

6.6 Frequency Stability

6.6.1 Test Setup

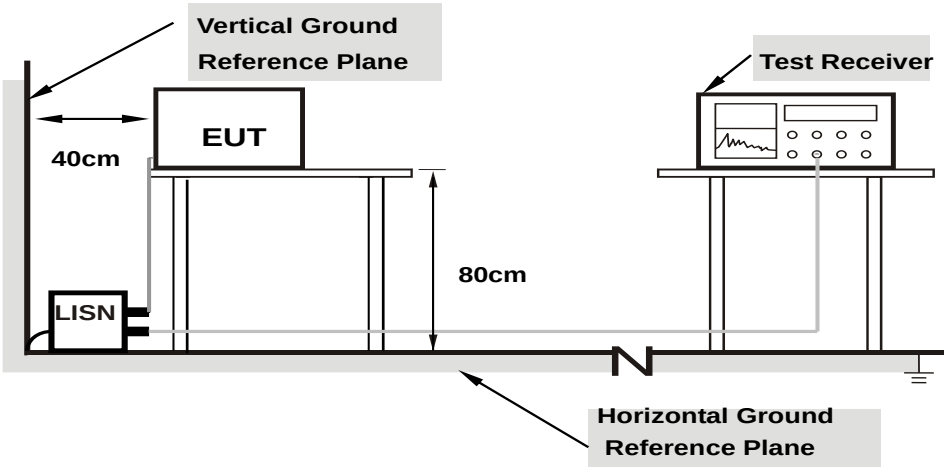


6.6.2 Test Procedure

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 (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
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.

6.7 AC Power Conducted Emissions

6.7.1 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.7.2 Test Procedure

a. The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

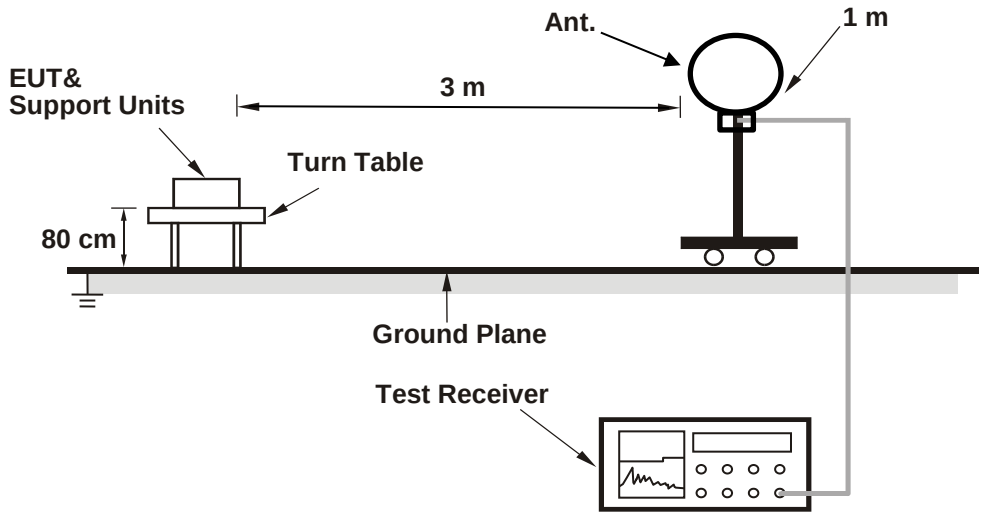
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz-30 MHz.

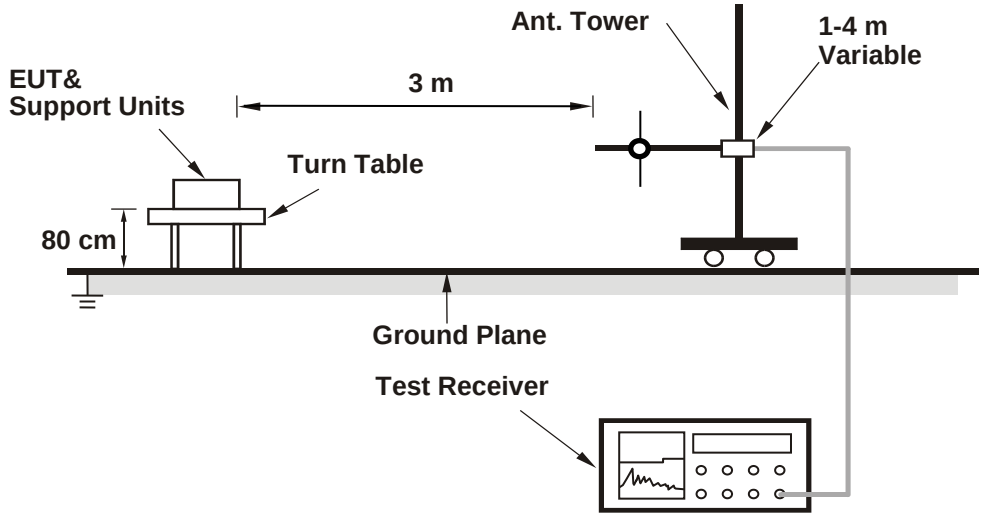
6.8 Unwanted Emissions below 1 GHz

6.8.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.8.2 Test Procedure

For Radiated emission below 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters 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. 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. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters 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.

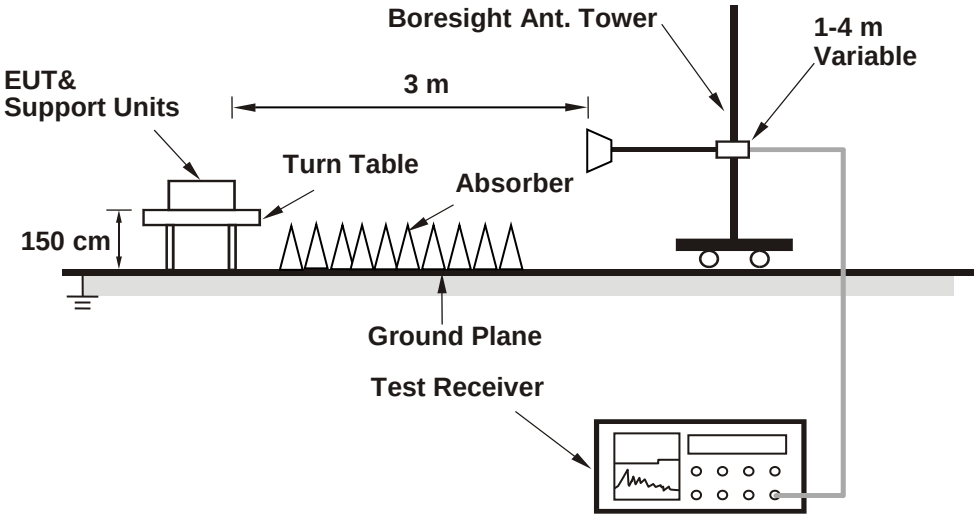
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

6.9 Unwanted Emissions above 1 GHz

6.9.1 Test Setup



For the actual test configuration, please refer to the attached file (Test Setup Photo).

6.9.2 Test Procedure

a. The EUT was placed on the top of a rotating table 1.5 meters 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. 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.

Notes:

1. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
2. For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10 Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1 GHz.
3. All modes of operation were investigated and the worst-case emissions are reported.

7 Test Results of Test Item

7.1 26 dB Bandwidth

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
52	5260	22.3
60	5300	22.31
64	5320	18.48
100	5500	18.58
116	5580	20.59
140	5700	18.52
144 (U-NII-2C)	5720	14.63
144 (U-NII-3)	5720	7.76

Determined Output Power Limit					
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)		
52	5260	22.30	24.48	>	24
60	5300	22.31	24.48	>	24
64	5320	18.48	23.66	<	24
100	5500	18.58	23.69	<	24
116	5580	20.59	24.13	>	24
140	5700	18.52	23.67	<	24
144 (U-NII-2C)	5720	14.63	22.65	<	24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

802.11ax (HE20)

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
52	5260	20.44
60	5300	20.46
64	5320	20.42
100	5500	20.4
116	5580	20.44
140	5700	20.46
144 (U-NII-2C)	5720	15.1
144 (U-NII-3)	5720	5.34

Determined Output Power Limit			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)
52	5260	20.44	24.1 > 24
60	5300	20.46	24.1 > 24
64	5320	20.42	24.1 > 24
100	5500	20.40	24.09 > 24
116	5580	20.44	24.1 > 24
140	5700	20.46	24.1 > 24
144 (U-NII-2C)	5720	15.10	22.78 < 24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

802.11ax (HE40)

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
54	5270	40.83
62	5310	40.83
102	5510	40.77
110	5550	40.85
134	5670	40.84
142 (U-NII-2C)	5710	35.37
142 (U-NII-3)	5710	5.6

Determined Output Power Limit			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)
54	5270	40.83	27.1 > 24
62	5310	40.83	27.1 > 24
102	5510	40.77	27.1 > 24
110	5550	40.85	27.11 > 24
134	5670	40.84	27.11 > 24
142 (U-NII-2C)	5710	35.37	26.48 > 24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

802.11ax (HE80)

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
58	5290	81.3
106	5530	81.37
122	5610	108.93
138 (U-NII-2C)	5690	75.63
138 (U-NII-3)	5690	5.78

Determined Output Power Limit			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)
58	5290	81.30	30.1 > 24
106	5530	81.37	30.1 > 24
122	5610	108.93	31.37 > 24
138 (U-NII-2C)	5690	75.63	29.78 > 24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

802.11ax (HE) 26-tone RU

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
52	5260	19.55
60	5300	18.12
64	5320	19.62
100	5500	19.56
116	5580	18.13
140	5700	19.71
144 (U-NII-2C)	5720	14.09
144 (U-NII-3)	5720	5.63

Determined Output Power Limit			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)
52	5260	19.55	23.91 < 24
60	5300	18.12	23.58 < 24
64	5320	19.62	23.92 < 24
100	5500	19.56	23.91 < 24
116	5580	18.13	23.58 < 24
140	5700	19.71	23.94 < 24
144 (U-NII-2C)	5720	14.09	22.48 < 24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

802.11ax (HE) 52-tone RU

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
52	5260	19.69
60	5300	18.41
64	5320	19.67
100	5500	19.64
116	5580	18.39
140	5700	19.73
144 (U-NII-2C)	5720	14.13
144 (U-NII-3)	5720	5.6

Determined Output Power Limit			
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)
52	5260	19.69	23.94 < 24
60	5300	18.41	23.65 < 24
64	5320	19.67	23.93 < 24
100	5500	19.64	23.93 < 24
116	5580	18.39	23.64 < 24
140	5700	19.73	23.95 < 24
144 (U-NII-2C)	5720	14.13	22.5 < 24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

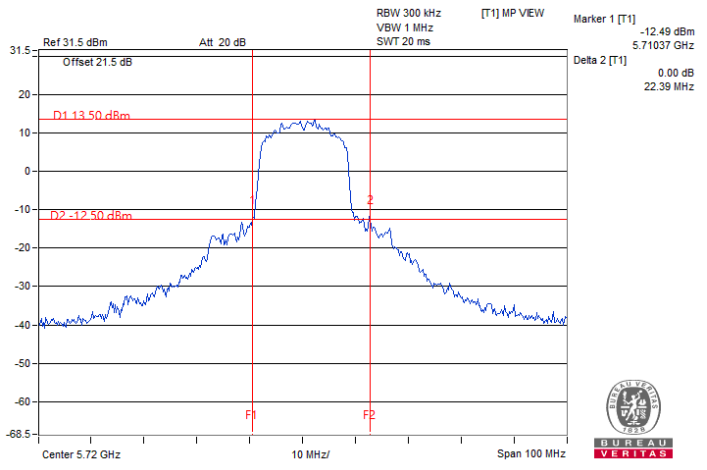
802.11ax (HE) 106-tone RU

Channel	Frequency (MHz)	26dB Bandwidth (MHz)
52	5260	19.68
60	5300	19.73
64	5320	19.82
100	5500	19.69
116	5580	19.77
140	5700	19.77
144 (U-NII-2C)	5720	14.24
144 (U-NII-3)	5720	5.71

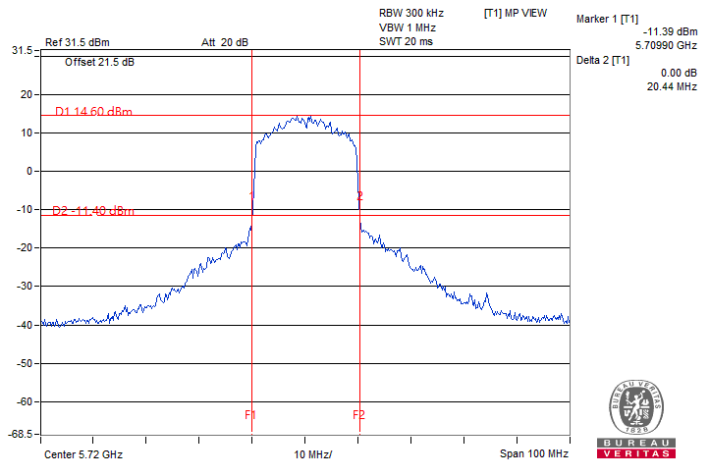
Determined Output Power Limit					
Channel Number	Freq.(MHz)	Min. B(MHz)	Determined Conducted Power Limit (dBm)		
52	5260	19.68	23.94	<	24
60	5300	19.73	23.95	<	24
64	5320	19.82	23.97	<	24
100	5500	19.69	23.94	<	24
116	5580	19.77	23.96	<	24
140	5700	19.77	23.96	<	24
144 (U-NII-2C)	5720	14.24	22.53	<	24

Note: For U-NII-2A, U-NII-2C Band output power limitation is determined based on 26dBc bandwidth.

Spectrum Plot of Minimum Value

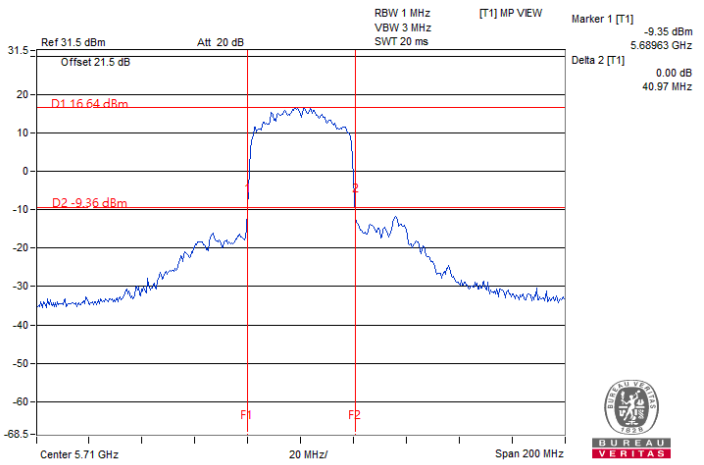


802.11a : CH 144 (U-NII-3)

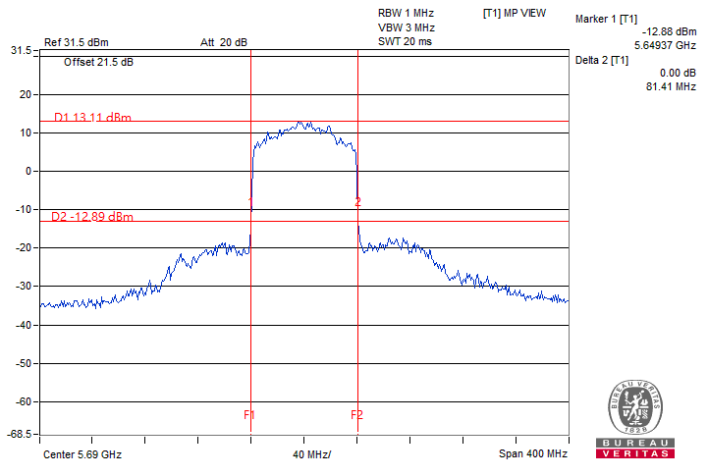


802.11ax (HE20) : CH 144 (U-NII-3)

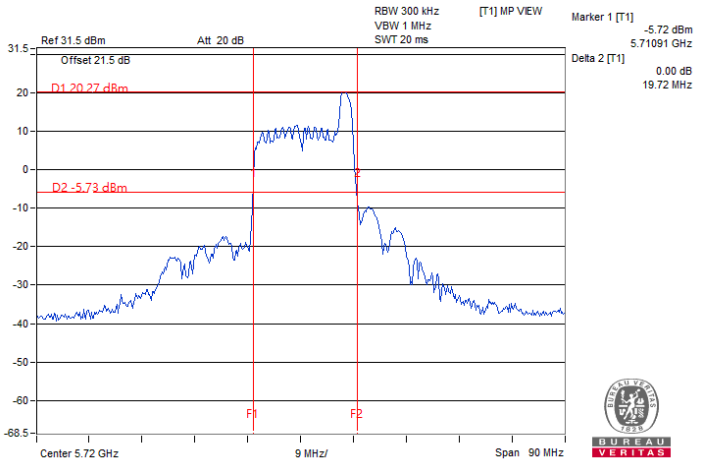
Spectrum Plot of Minimum Value



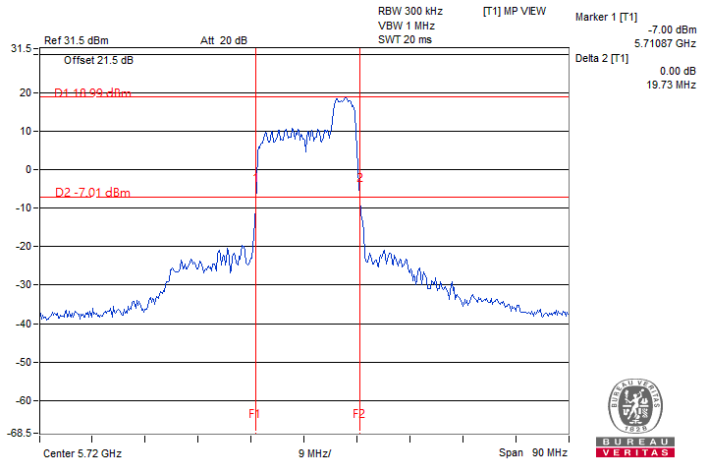
802.11ax (HE40) : CH 142 (U-NII-3)



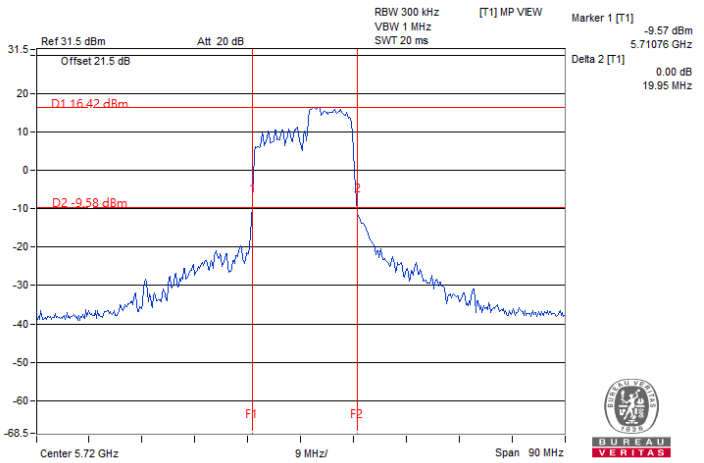
802.11ax (HE80) : CH 138 (U-NII-3)



802.11ax (HE) 26-tone RU : CH 144 (U-NII-3)



802.11ax (HE) 52-tone RU : CH 144 (U-NII-3)



802.11ax (HE) 106-tone RU : CH 144 (U-NII-3)

Notes:

1. For U-NII-2C straddle channel = 5725 MHz - Marker 1
2. For U-NII-3 straddle channel = Marker 1 + Delta 2 - 5725 MHz

7.2 RF Output Power

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	135.831	21.33	24	Pass
40	5200	191.426	22.82	24	Pass
48	5240	187.499	22.73	24	Pass
52	5260	184.502	22.66	24	Pass
60	5300	187.499	22.73	24	Pass
64	5320	121.06	20.83	23.66	Pass
100	5500	121.899	20.86	23.69	Pass
116	5580	158.125	21.99	24	Pass
140	5700	86.696	19.38	23.67	Pass
*144 (U-NII-2C)	5720	115.345	20.62	22.65	Pass
*144 (U-NII-3)	5720	17.498	12.43	30	Pass
149	5745	190.985	22.81	30	Pass
157	5785	200.447	23.02	30	Pass
165	5825	196.789	22.94	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	112.98	20.53	24	Pass
40	5200	171.002	22.33	24	Pass
48	5240	155.955	21.93	24	Pass
52	5260	175.792	22.45	24	Pass
60	5300	164.437	22.16	24	Pass
64	5320	99.312	19.97	24	Pass
100	5500	102.565	20.11	24	Pass
116	5580	140.929	21.49	24	Pass
140	5700	86.298	19.36	24	Pass
*144 (U-NII-2C)	5720	104.472	20.19	22.78	Pass
*144 (U-NII-3)	5720	18.707	12.72	30	Pass
149	5745	176.198	22.46	30	Pass
157	5785	179.473	22.54	30	Pass
165	5825	190.985	22.81	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
38	5190	61.944	17.92	24	Pass
46	5230	145.881	21.64	24	Pass
54	5270	146.218	21.65	24	Pass
62	5310	56.754	17.54	24	Pass
102	5510	59.156	17.72	24	Pass
110	5550	127.057	21.04	24	Pass
134	5670	98.401	19.93	24	Pass
*142 (U-NII-2C)	5710	108.643	20.36	24	Pass
*142 (U-NII-3)	5710	6.067	7.83	30	Pass
151	5755	163.682	22.14	30	Pass
159	5795	170.216	22.31	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
42	5210	110.408	20.43	24	Pass
58	5290	51.523	17.12	24	Pass
106	5530	62.806	17.98	24	Pass
122	5610	126.474	21.02	24	Pass
*138 (U-NII-2C)	5690	96.613	19.85	24	Pass
*138 (U-NII-3)	5690	2.158	3.34	30	Pass
155	5775	116.145	20.65	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test , the duty factor was included in the total power.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	123.595	20.92	24	Pass
40	5200	192.309	22.84	24	Pass
48	5240	175.792	22.45	24	Pass
52	5260	191.867	22.83	24	Pass
60	5300	178.238	22.51	24	Pass
64	5320	110.408	20.43	24	Pass
100	5500	113.763	20.56	24	Pass
116	5580	152.405	21.83	24	Pass
140	5700	93.972	19.73	24	Pass
*144 (U-NII-2C)	5720	104.472	20.19	22.78	Pass
*144 (U-NII-3)	5720	18.707	12.72	30	Pass
149	5745	191.867	22.83	30	Pass
157	5785	195.434	22.91	30	Pass
165	5825	209.411	23.21	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
38	5190	68.077	18.33	24	Pass
46	5230	163.305	22.13	24	Pass
54	5270	159.221	22.02	24	Pass
62	5310	61.944	17.92	24	Pass
102	5510	66.222	18.21	24	Pass
110	5550	139.637	21.45	24	Pass
134	5670	108.143	20.34	24	Pass
*142 (U-NII-2C)	5710	108.643	20.36	24	Pass
*142 (U-NII-3)	5710	6.067	7.83	30	Pass
151	5755	182.39	22.61	30	Pass
159	5795	187.068	22.72	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE80)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
42	5210	121.06	20.83	24	Pass
58	5290	54.325	17.35	24	Pass
106	5530	64.714	18.11	24	Pass
122	5610	135.519	21.32	24	Pass
*138 (U-NII-2C)	5690	96.613	19.85	24	Pass
*138 (U-NII-3)	5690	2.158	3.34	30	Pass
155	5775	129.42	21.12	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-2 and use spectrum analyzer test , the duty factor was included in the total power.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE) 26-tone RU

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	28.973	14.62	24	Pass
40	5200	34.995	15.44	24	Pass
48	5240	29.174	14.65	24	Pass
52	5260	30.061	14.78	23.91	Pass
60	5300	38.548	15.86	23.58	Pass
64	5320	37.497	15.74	23.92	Pass
100	5500	31.769	15.02	23.91	Pass
116	5580	31.989	15.05	23.58	Pass
140	5700	39.264	15.94	23.94	Pass
*144 (U-NII-2C)	5720	0.1786	-7.48	22.48	Pass
*144 (U-NII-3)	5720	69.183	18.40	30	Pass
149	5745	76.56	18.84	30	Pass
157	5785	83.56	19.22	30	Pass
165	5825	53.211	17.26	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

802.11ax (HE) 52-tone RU

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	60.814	17.84	24	Pass
40	5200	66.222	18.21	24	Pass
48	5240	51.523	17.12	24	Pass
52	5260	52.966	17.24	23.94	Pass
60	5300	55.335	17.43	23.65	Pass
64	5320	58.076	17.64	23.93	Pass
100	5500	52	17.16	23.93	Pass
116	5580	58.076	17.64	23.64	Pass
140	5700	61.802	17.91	23.95	Pass
*144 (U-NII-2C)	5720	0.7194	-1.43	22.5	Pass
*144 (U-NII-3)	5720	99.77	19.99	30	Pass
149	5745	167.494	22.24	30	Pass
157	5785	136.773	21.36	30	Pass
165	5825	172.187	22.36	30	Pass

Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

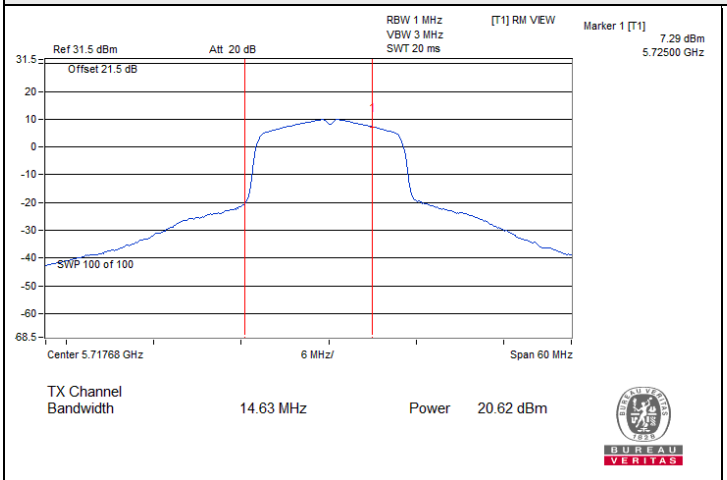
802.11ax (HE) 106-tone RU

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Test Result
36	5180	127.057	21.04	24	Pass
40	5200	101.158	20.05	24	Pass
48	5240	105.196	20.22	24	Pass
52	5260	103.753	20.16	23.94	Pass
60	5300	106.17	20.26	23.95	Pass
64	5320	150.661	21.78	23.97	Pass
100	5500	94.189	19.74	23.94	Pass
116	5580	82.035	19.14	23.96	Pass
140	5700	83.946	19.24	23.96	Pass
*144 (U-NII-2C)	5720	57.943	17.63	22.53	Pass
*144 (U-NII-3)	5720	63.387	18.02	30	Pass
149	5745	192.309	22.84	30	Pass
157	5785	146.218	21.65	30	Pass
165	5825	161.065	22.07	30	Pass

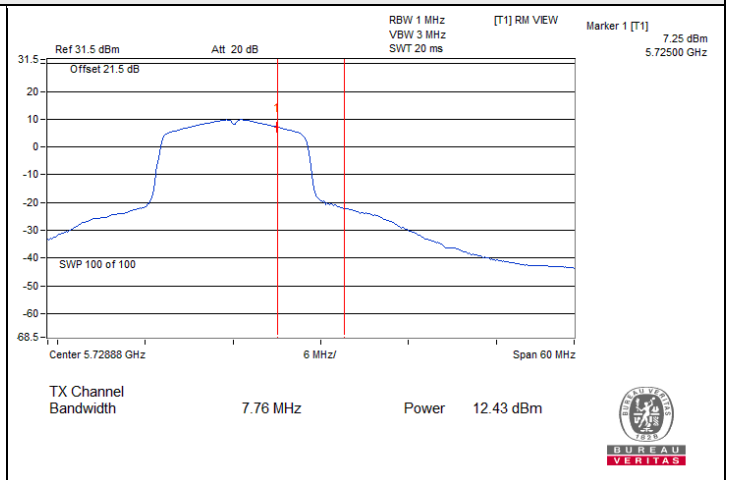
Notes:

1. * : Test was performed in accordance with measurement follow FCC KDB 789033 UNII test procedure Method SA-1 and use spectrum analyzer test.
2. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
3. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
4. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.
5. For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the output power limit shall not be reduced.

Spectrum Plot for channel straddling

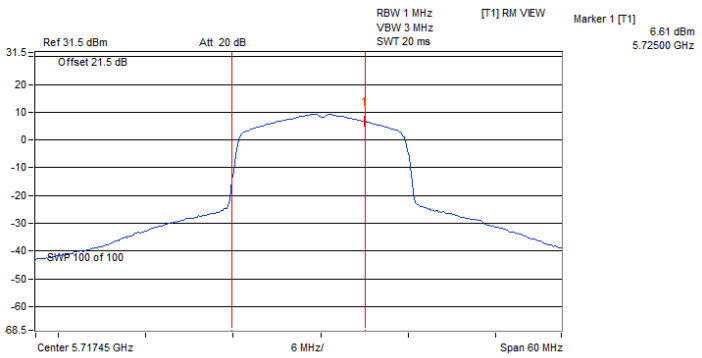


802.11a : CH 144 (U-NII-2C)



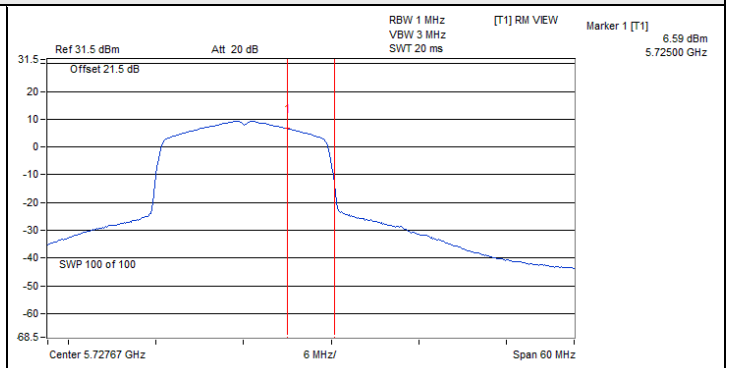
802.11a : CH 144 (U-NII-3)

Spectrum Plot for channel straddling



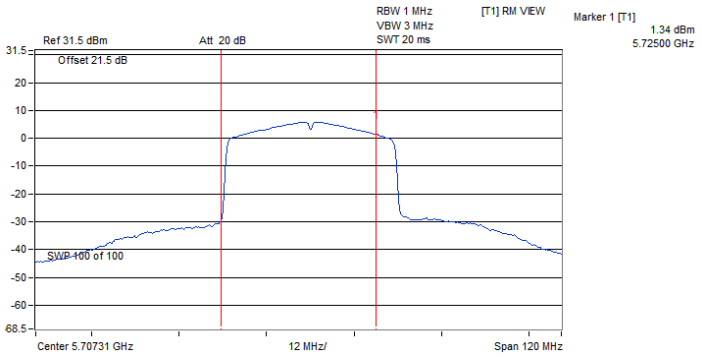
TX Channel Bandwidth 15.1 MHz Power 20.19 dBm

802.11ac (VHT20) : CH 144 (U-NII-2C)



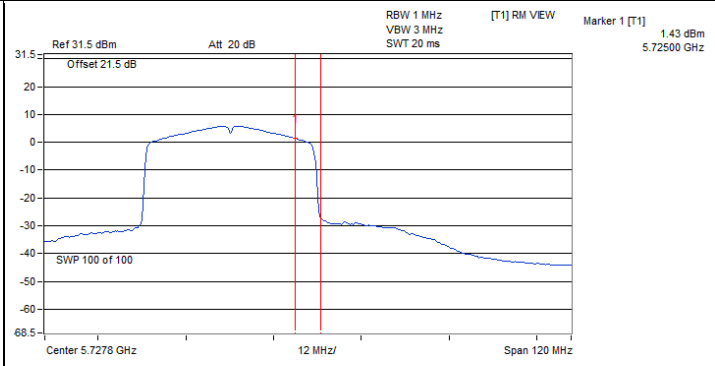
TX Channel Bandwidth 5.34 MHz Power 12.72 dBm

802.11ac (VHT20) : CH 144 (U-NII-3)



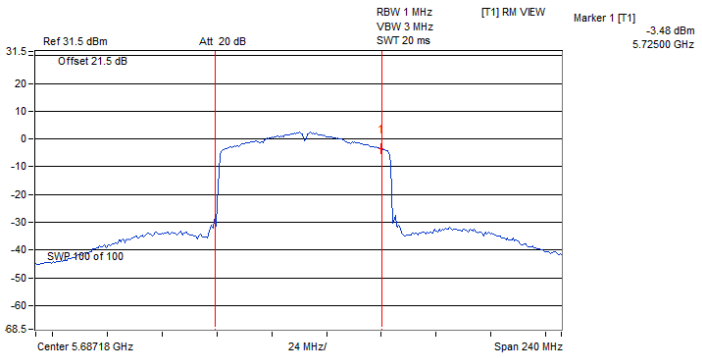
TX Channel Bandwidth 35.37 MHz Power 20.36 dBm

802.11ac (VHT40) : CH 142 (U-NII-2C)



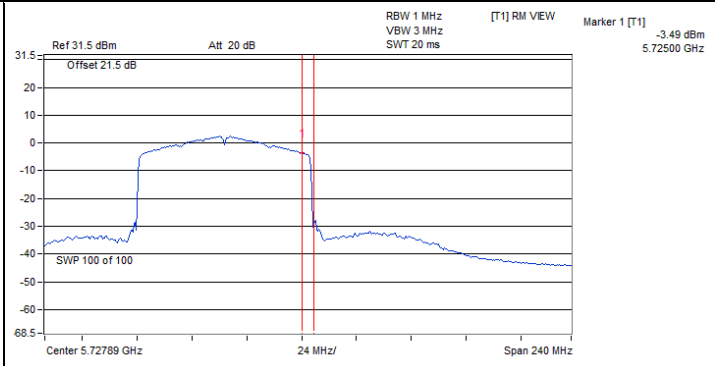
TX Channel Bandwidth 5.6 MHz Power 7.83 dBm

802.11ac (VHT40) : CH 142 (U-NII-3)



TX Channel Bandwidth 75.63 MHz Power 19.76 dBm

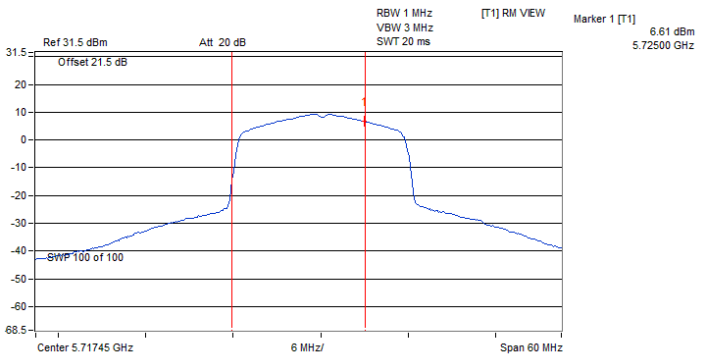
802.11ac (VHT80) : CH 138 (U-NII-2C)



TX Channel Bandwidth 5.78 MHz Power 3.25 dBm

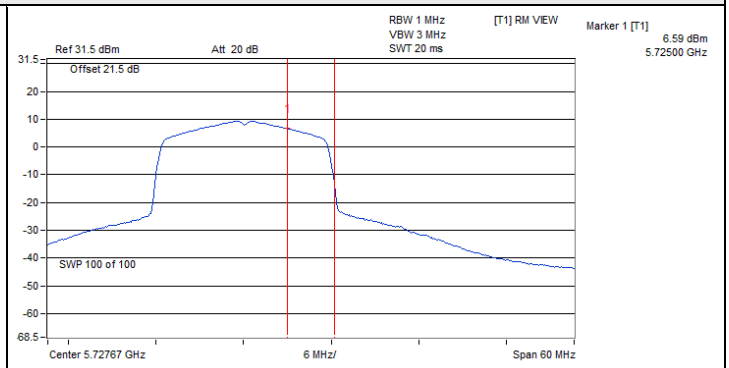
802.11ac (VHT80) : CH 138 (U-NII-3)

Spectrum Plot for channel straddling



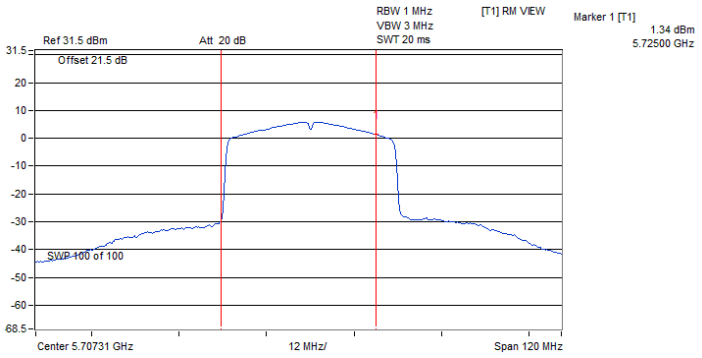
TX Channel Bandwidth 15.1 MHz Power 20.19 dBm

802.11ax (HE20) : CH 144 (U-NII-2C)



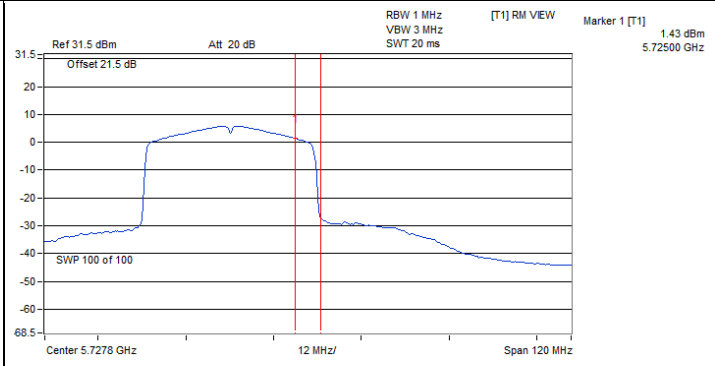
TX Channel Bandwidth 5.34 MHz Power 12.72 dBm

802.11ax (HE20) : CH 144 (U-NII-3)



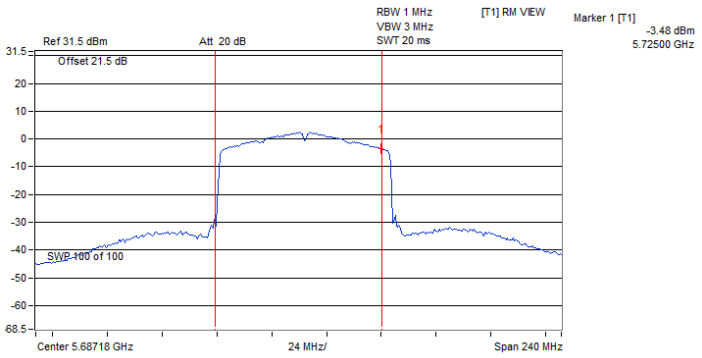
TX Channel Bandwidth 35.37 MHz Power 20.36 dBm

802.11ax (HE40) : CH 142 (U-NII-2C)



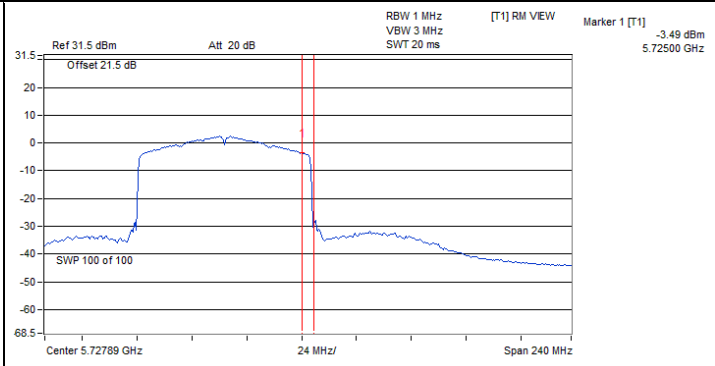
TX Channel Bandwidth 5.6 MHz Power 7.83 dBm

802.11ax (HE40) : CH 142 (U-NII-3)



TX Channel Bandwidth 75.63 MHz Power 19.76 dBm

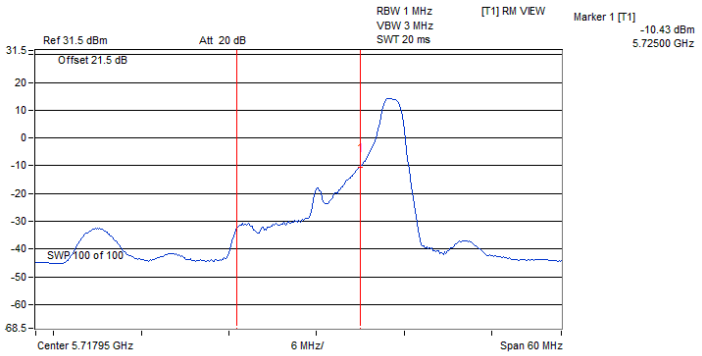
802.11ax (HE80) : CH 138 (U-NII-2C)



TX Channel Bandwidth 5.78 MHz Power 3.25 dBm

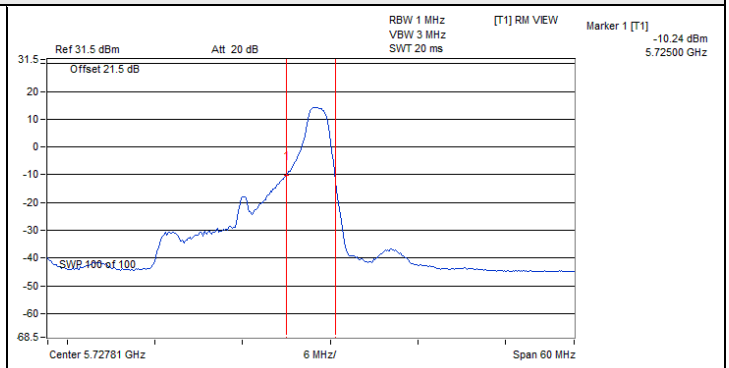
802.11ax (HE80) : CH 138 (U-NII-3)

Spectrum Plot for channel straddling



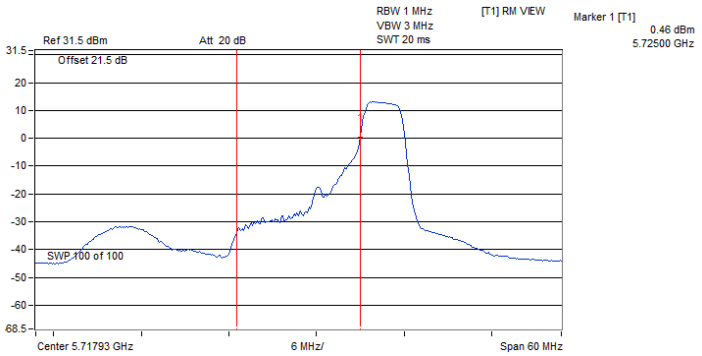
TX Channel Bandwidth 14.09 MHz Power -7.48 dBm

802.11ax (HE) 26-tone RU : CH 144 (U-NII-2C)



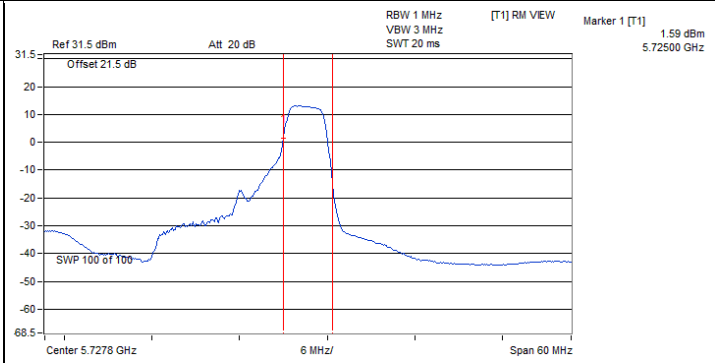
TX Channel Bandwidth 5.63 MHz Power 18.4 dBm

802.11ax (HE) 26-tone RU : CH 144 (U-NII-3)



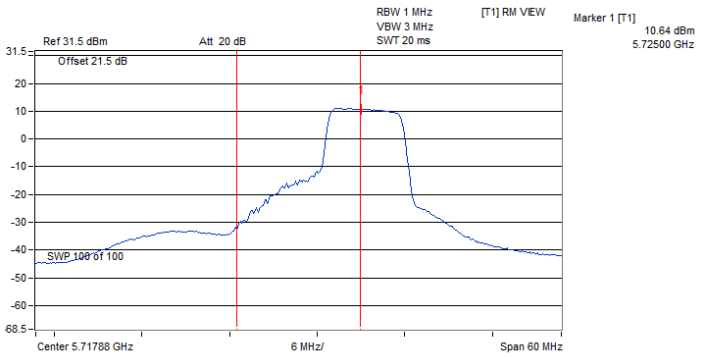
TX Channel Bandwidth 14.13 MHz Power -1.43 dBm

802.11ax (HE) 52-tone RU : CH 144 (U-NII-2C)



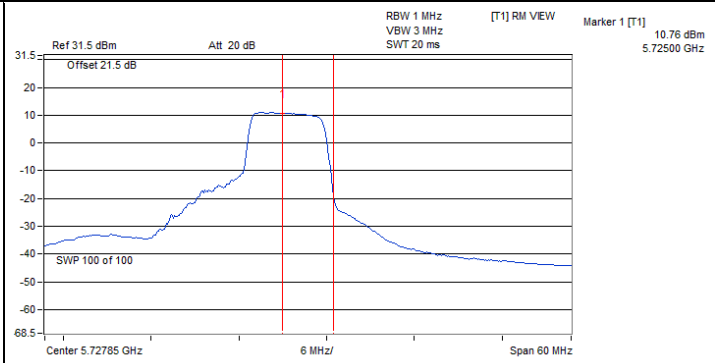
TX Channel Bandwidth 5.6 MHz Power 19.99 dBm

802.11ax (HE) 52-tone RU : CH 144 (U-NII-3)



TX Channel Bandwidth 14.24 MHz Power 17.63 dBm

802.11ax (HE) 106-tone RU : CH 144 (U-NII-2C)



TX Channel Bandwidth 5.71 MHz Power 18.02 dBm

802.11ax (HE) 106-tone RU : CH 144 (U-NII-3)

7.3 Power Spectral Density

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	9.27	11	Pass
40	5200	10.95	11	Pass
48	5240	10.75	11	Pass
52	5260	10.56	11	Pass
60	5300	10.52	11	Pass
64	5320	8.86	11	Pass
100	5500	8.91	11	Pass
116	5580	9.93	11	Pass
140	5700	7.66	11	Pass
144 (U-NII-2C)	5720	9.92	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	9.02	11	Pass
40	5200	10.70	11	Pass
48	5240	10.17	11	Pass
52	5260	10.44	11	Pass
60	5300	10.27	11	Pass
64	5320	8.21	11	Pass
100	5500	8.41	11	Pass
116	5580	9.45	11	Pass
140	5700	8.00	11	Pass
144 (U-NII-2C)	5720	9.38	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
38	5190	3.16	11	Pass
46	5230	6.70	11	Pass
54	5270	6.87	11	Pass
62	5310	2.46	11	Pass
102	5510	3.11	11	Pass
110	5550	5.99	11	Pass
134	5670	5.52	11	Pass
142 (U-NII-2C)	5710	5.97	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE80)

Chan.	Chan. Freq. (MHz)	PSD w/o Duty Factor (dBm/MHz)	Duty Factor (dB)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
42	5210	2.66	0.09	2.75	11	Pass
58	5290	-0.64	0.09	-0.55	11	Pass
106	5530	0.11	0.09	0.20	11	Pass
122	5610	3.80	0.09	3.89	11	Pass
138 (U-NII-2C)	5690	2.55	0.09	2.64	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 26-tone RU

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	10.92	11	Pass
40	5200	10.90	11	Pass
48	5240	10.70	11	Pass
52	5260	10.76	11	Pass
60	5300	10.98	11	Pass
64	5320	10.92	11	Pass
100	5500	10.76	11	Pass
116	5580	10.82	11	Pass
140	5700	10.94	11	Pass
144 (U-NII-2C)	5720	-7.95	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 52-tone RU

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	10.90	11	Pass
40	5200	10.78	11	Pass
48	5240	10.78	11	Pass
52	5260	10.54	11	Pass
60	5300	10.74	11	Pass
64	5320	10.62	11	Pass
100	5500	10.64	11	Pass
116	5580	10.96	11	Pass
140	5700	10.67	11	Pass
144 (U-NII-2C)	5720	0.54	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 106-tone RU

Chan.	Chan. Freq. (MHz)	PSD (dBm/MHz)	Max. PSD Limit (dBm/MHz)	Test Result
36	5180	10.67	11	Pass
40	5200	10.84	11	Pass
48	5240	10.76	11	Pass
52	5260	10.82	11	Pass
60	5300	10.64	11	Pass
64	5320	10.56	11	Pass
100	5500	10.48	11	Pass
116	5580	10.56	11	Pass
140	5700	10.76	11	Pass
144 (U-NII-2C)	5720	10.44	11	Pass

Notes:

1. For U-NII-1, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
2. For U-NII-2A, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.
3. For U-NII-2C, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11a

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
144 (U-NII-3)	5720	-1.12	1.10	30	Pass
149	5745	2.21	4.43	30	Pass
157	5785	2.7	4.92	30	Pass
165	5825	2.38	4.60	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
144 (U-NII-3)	5720	-2.42	-0.20	30	Pass
149	5745	1.42	3.64	30	Pass
157	5785	1.9	4.12	30	Pass
165	5825	2.25	4.47	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE40)

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
142 (U-NII-3)	5710	-7.4	-5.18	30	Pass
151	5755	-1.88	0.34	30	Pass
159	5795	-1.71	0.51	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE80)

Chan.	Chan. Freq. (MHz)	PSD w/o Duty Factor (dBm/300kHz)	Duty Factor (dB)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
138 (U-NII-3)	5690	-12.43	0.09	-10.12	30	Pass
155	5775	-6.02	0.09	-3.71	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 26-tone RU

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
144 (U-NII-3)	5720	10.24	12.46	30	Pass
149	5745	0.97	3.19	30	Pass
157	5785	5.27	7.49	30	Pass
165	5825	0.79	3.01	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 52-tone RU

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
144 (U-NII-3)	5720	1.14	3.36	30	Pass
149	5745	2.93	5.15	30	Pass
157	5785	4.38	6.60	30	Pass
165	5825	4.07	6.29	30	Pass

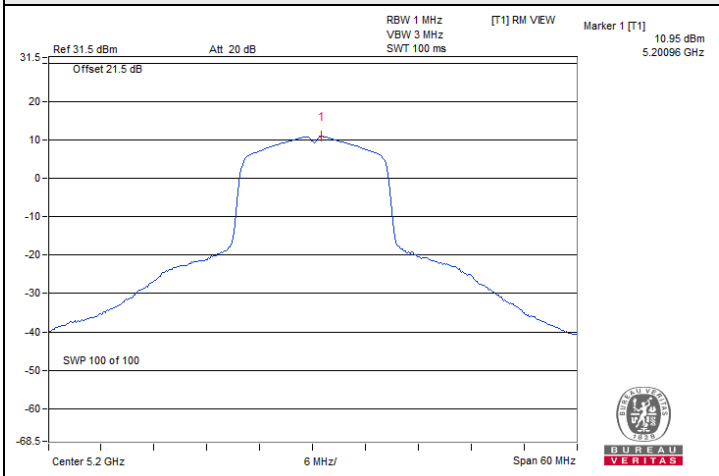
Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

802.11ax (HE) 106-tone RU

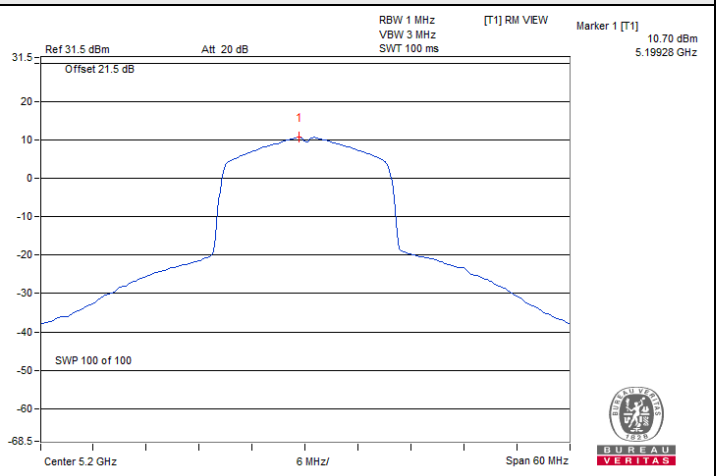
Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	PSD Limit (dBm/500kHz)	Test Result
144 (U-NII-3)	5720	0.96	3.18	30	Pass
149	5745	2.44	4.66	30	Pass
157	5785	1.21	3.43	30	Pass
165	5825	2.22	4.44	30	Pass

Note: For U-NII-3, the antenna gain is 5 dBi < 6 dBi, so the power density limit shall not be reduced.

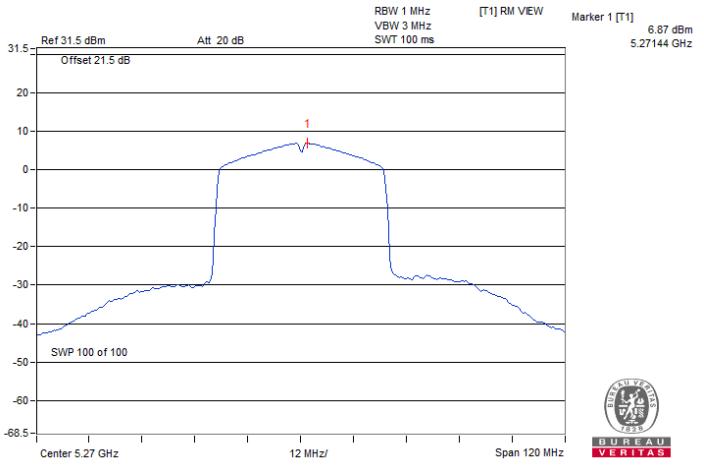
Spectrum Plot of Maximum Value



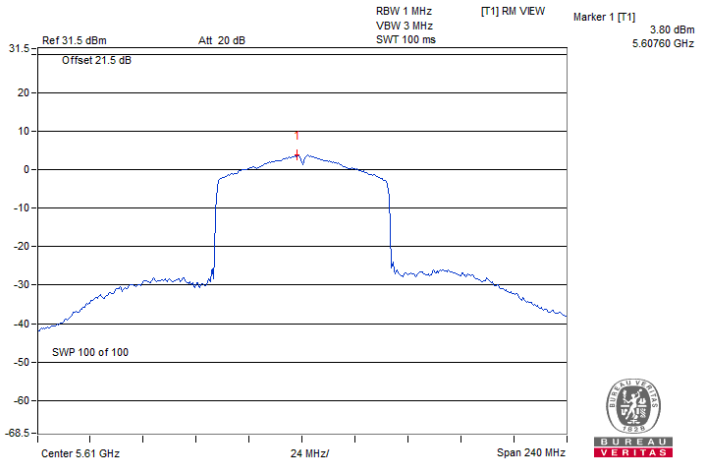
802.11a : CH 40



802.11ax (HE20) : CH 40

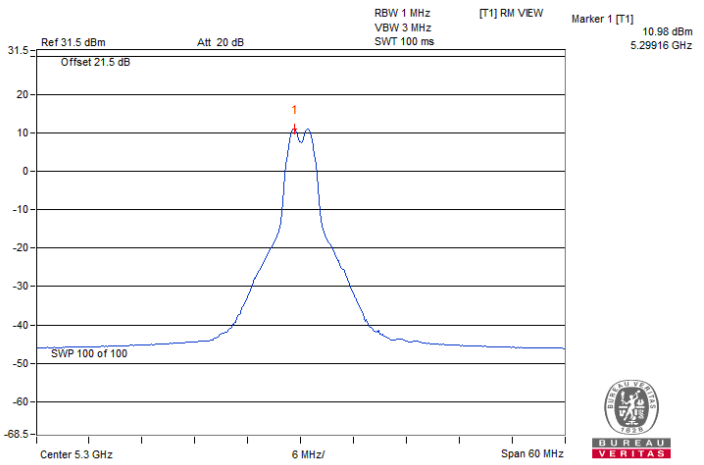


802.11ax (HE40) : CH 54

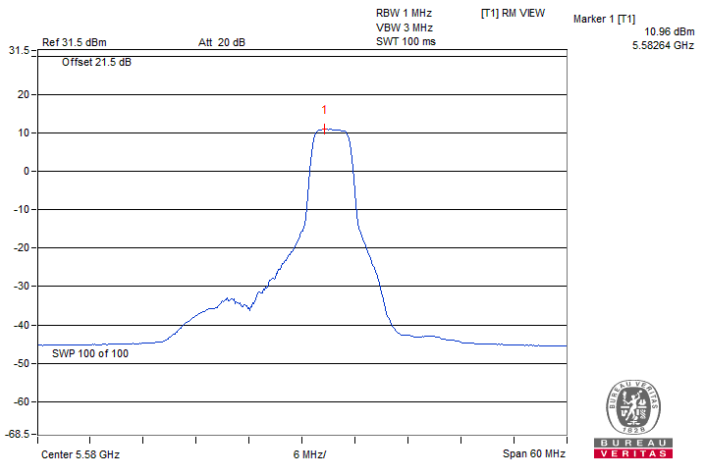


802.11ax (HE80) : CH 122

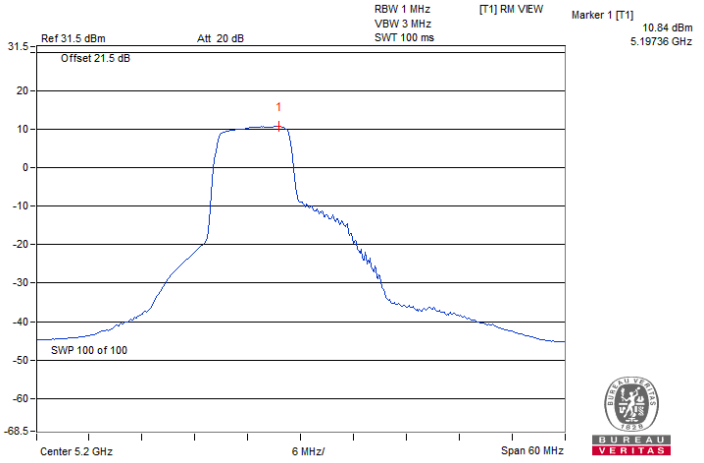
Spectrum Plot of Maximum Value



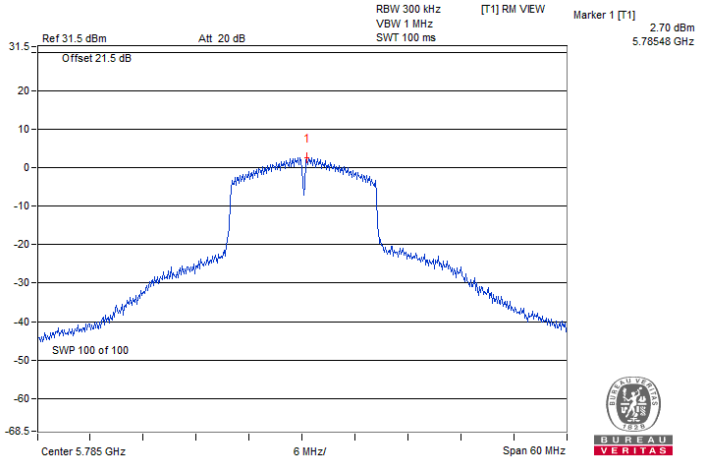
802.11ax (HE) 26-tone RU : CH 60



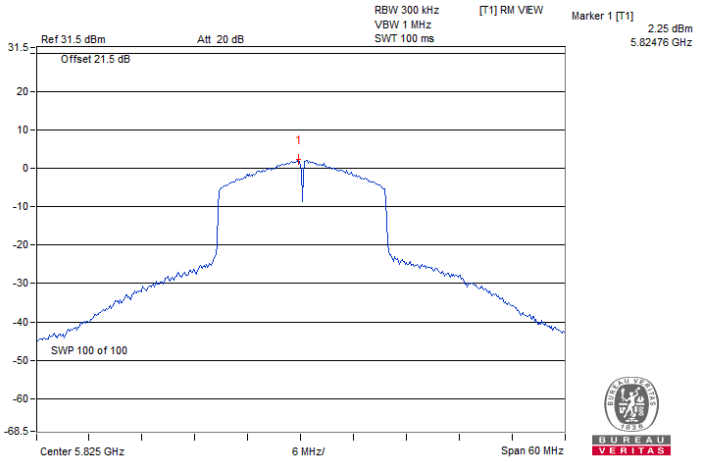
802.11ax (HE) 52-tone RU : CH 116



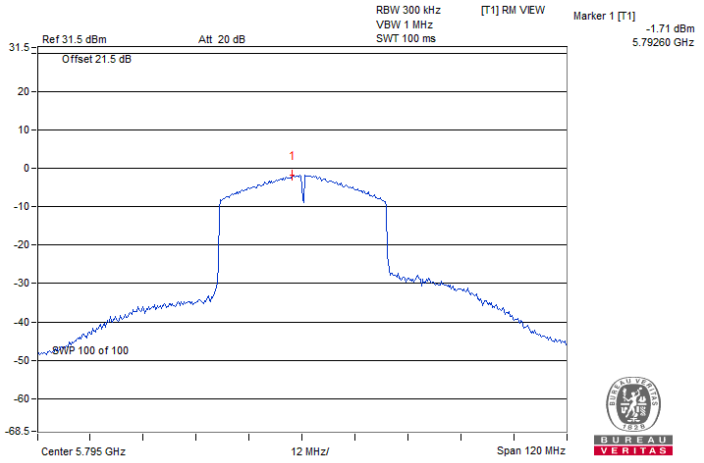
802.11ax (HE) 106-tone RU : CH 40



802.11a : CH 157

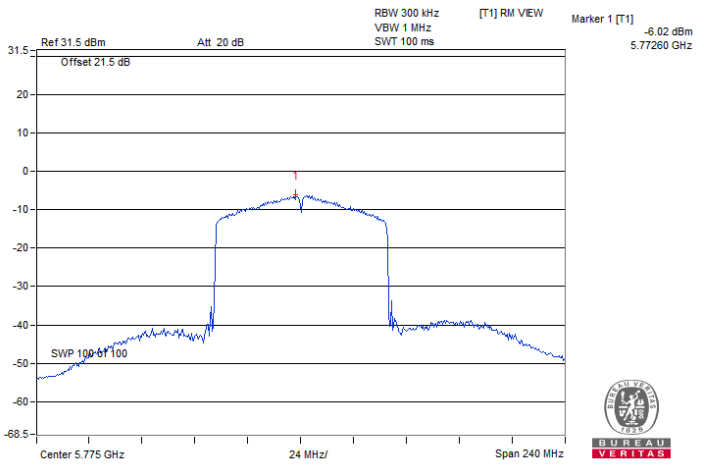


802.11ax (HE20) : CH 165

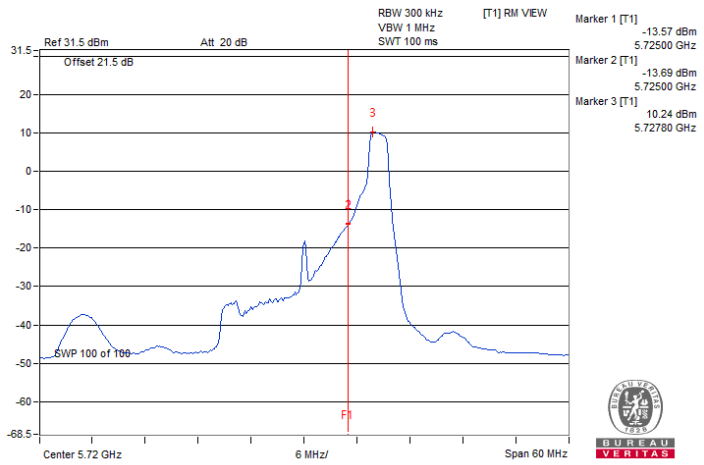


802.11ax (HE40) : CH 159

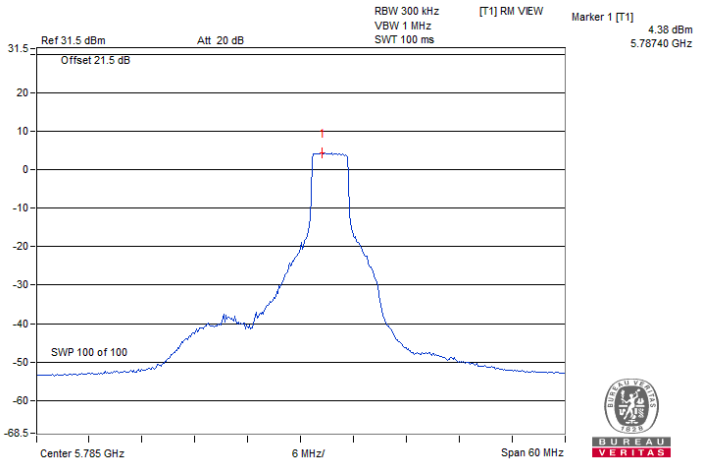
Spectrum Plot of Maximum Value



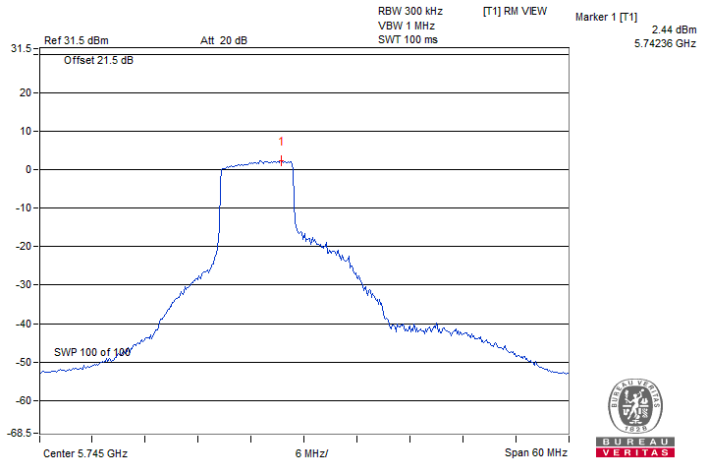
802.11ax (HE80) : CH 155



802.11ax (HE) 26-tone RU : CH 144 (U-NII-3)



802.11ax (HE) 52-tone RU : CH 157



802.11ax (HE) 106-tone RU : CH 149

7.4 6 dB Bandwidth

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
144 (U-NII-3)	5720	2.7	0.5	Pass
149	5745	15.15	0.5	Pass
157	5785	15.13	0.5	Pass
165	5825	15.14	0.5	Pass

802.11ax (HE20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
144 (U-NII-3)	5720	2.71	0.5	Pass
149	5745	15.13	0.5	Pass
157	5785	15.14	0.5	Pass
165	5825	15.14	0.5	Pass

802.11ax (HE40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
142 (U-NII-3)	5710	2.7	0.5	Pass
151	5755	35.11	0.5	Pass
159	5795	33.93	0.5	Pass

802.11ax (HE80)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
138 (U-NII-3)	5690	1.52	0.5	Pass
155	5775	71.43	0.5	Pass

802.11ax (HE) 26-tone RU

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
144 (U-NII-3)	5720	4.63	0.5	Pass
149	5745	14.54	0.5	Pass
157	5785	2.69	0.5	Pass
165	5825	15.81	0.5	Pass

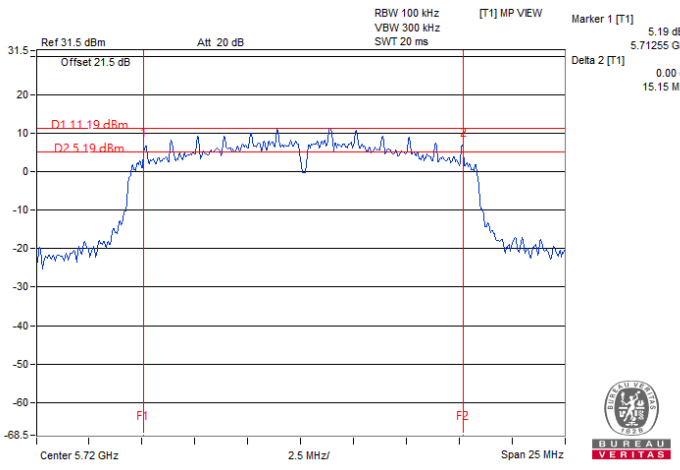
802.11ax (HE) 52-tone RU

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
144 (U-NII-3)	5720	4.61	0.5	Pass
149	5745	17.03	0.5	Pass
157	5785	13.83	0.5	Pass
165	5825	17.02	0.5	Pass

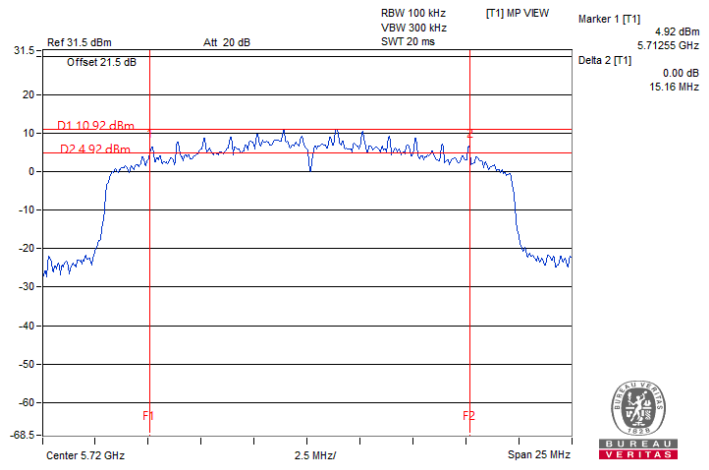
802.11ax (HE) 106-tone RU

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
144 (U-NII-3)	5720	4.72	0.5	Pass
149	5745	17.16	0.5	Pass
157	5785	17.19	0.5	Pass
165	5825	17.21	0.5	Pass

Spectrum Plot of Minimum Value

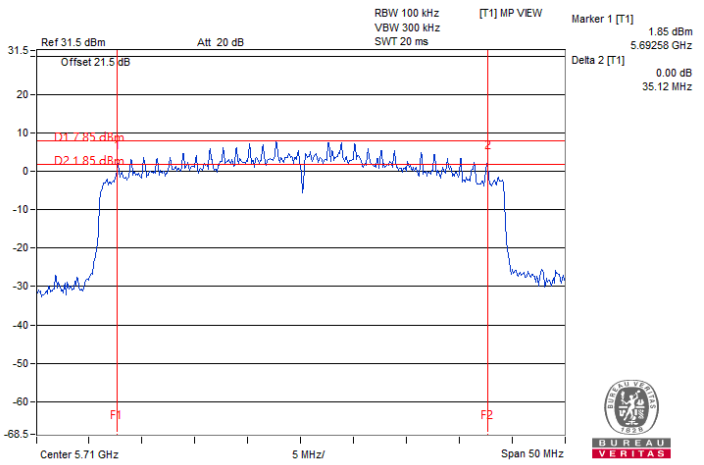


802.11a : CH 144 (U-NII-3)

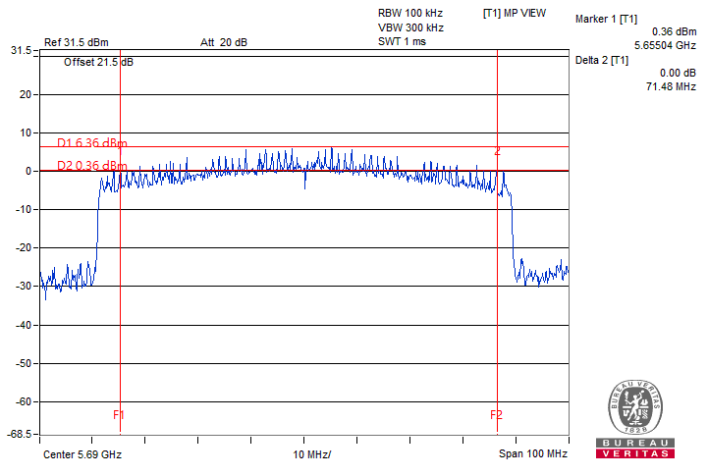


802.11ax (HE20) : CH 144 (U-NII-3)

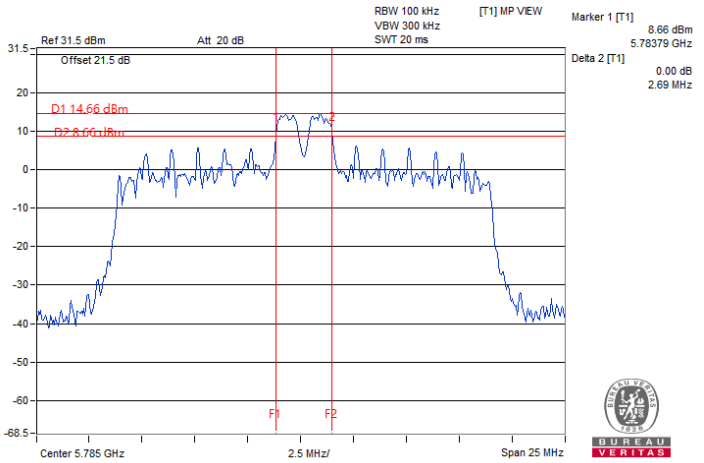
Spectrum Plot of Minimum Value



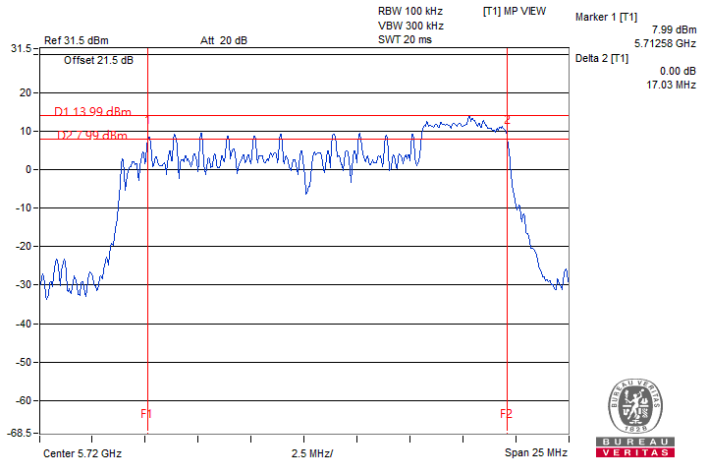
802.11ax (HE40) : CH 142 (U-NII-3)



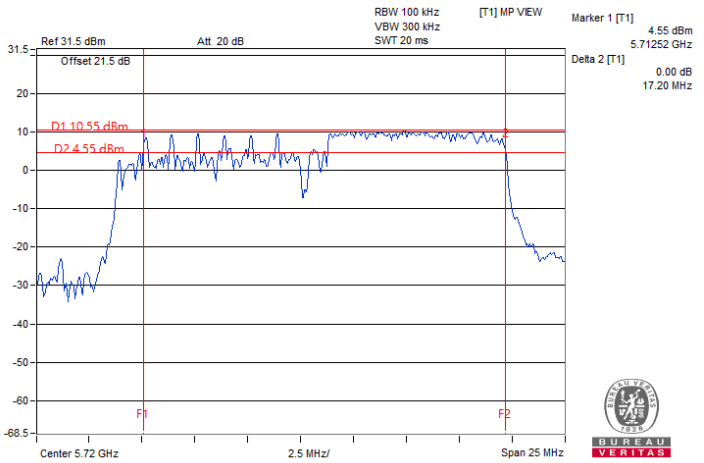
802.11ax (HE80) : CH 138 (U-NII-3)



802.11ax (HE) 26-tone RU : CH 157



802.11ax (HE) 52-tone RU : CH 144 (U-NII-3)



802.11ax (HE) 106-tone RU : CH 144 (U-NII-3)

Note: For U-NII-3 straddle channel = Marker 1 + Delta 2 - 5725 MHz

7.5 Occupied Bandwidth

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	16.32
40	5200	16.32
48	5240	16.32
52	5260	16.32
60	5300	16.32
64	5320	16.2
100	5500	16.2
116	5580	16.32
140	5700	16.2
144 (U-NII-2C)	5720	13.04
144 (U-NII-3)	5720	3.28
149	5745	17.64
157	5785	19.32
165	5825	16.8

802.11ax (HE20)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	18.6
40	5200	18.72
48	5240	18.72
52	5260	18.72
60	5300	18.72
64	5320	18.6
100	5500	18.6
116	5580	18.72
140	5700	18.6
144 (U-NII-2C)	5720	14.24
144 (U-NII-3)	5720	4.48
149	5745	18.72
157	5785	18.96
165	5825	18.96

802.11ax (HE40)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
38	5190	37.2
46	5230	37.2
54	5270	37.2
62	5310	37.2
102	5510	37.2
110	5550	37.2
134	5670	37.2
142 (U-NII-2C)	5710	33.48
142 (U-NII-3)	5710	3.72
151	5755	37.68
159	5795	38.16

802.11ax (HE80)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
42	5210	76.32
58	5290	76.32
106	5530	76.32
122	5610	76.8
138 (U-NII-2C)	5690	72.92
138 (U-NII-3)	5690	3.4
155	5775	76.32

802.11ax (HE) 26-tone RU

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	18.18
40	5200	16.35
48	5240	18.18
52	5260	18.18
60	5300	16.35
64	5320	18.18
100	5500	18.18
116	5580	16.32
140	5700	18.24
144 (U-NII-2C)	5720	13.4
144 (U-NII-3)	5720	4.84
149	5745	18.36
157	5785	16.32
165	5825	18.24

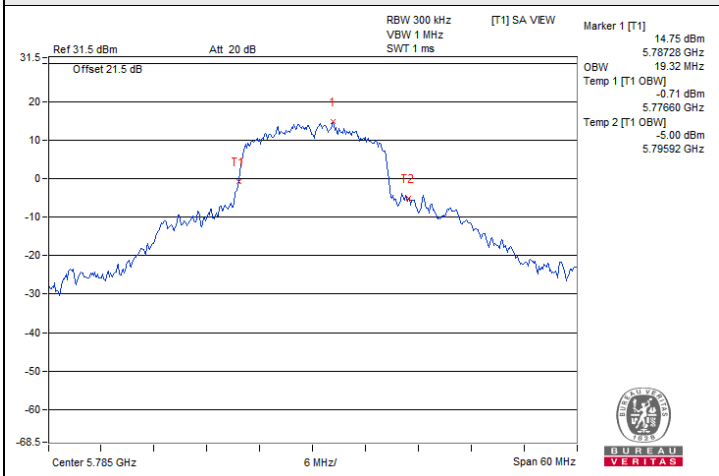
802.11ax (HE) 52-tone RU

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	18.09
40	5200	16.69
48	5240	18.09
52	5260	18.09
60	5300	16.69
64	5320	18.09
100	5500	18.09
116	5580	16.68
140	5700	18.12
144 (U-NII-2C)	5720	13.4
144 (U-NII-3)	5720	4.72
149	5745	18.12
157	5785	16.68
165	5825	18.12

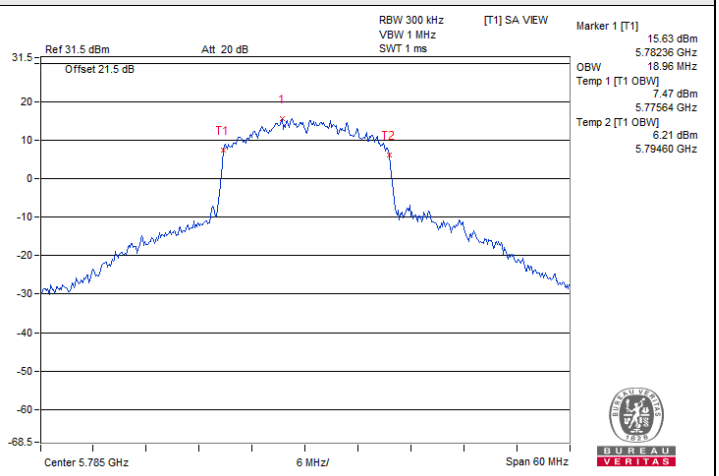
802.11ax (HE) 106-tone RU

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
36	5180	18
40	5200	18
48	5240	18
52	5260	18
60	5300	18
64	5320	18
100	5500	18
116	5580	18.12
140	5700	18.12
144 (U-NII-2C)	5720	13.4
144 (U-NII-3)	5720	4.72
149	5745	18.12
157	5785	18.12
165	5825	18.12

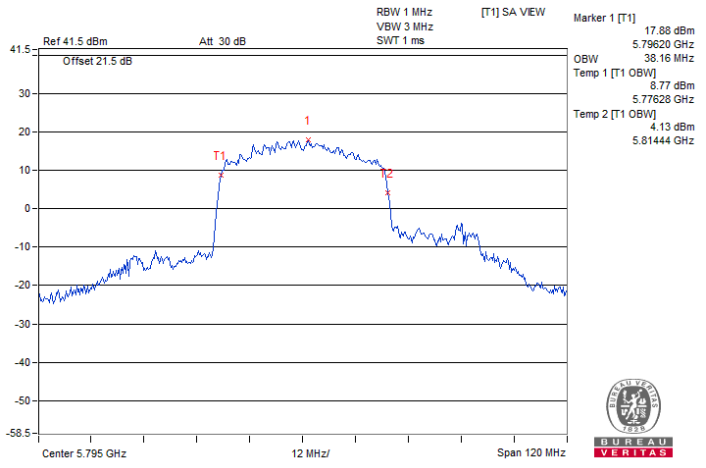
Spectrum Plot of Maximum Value



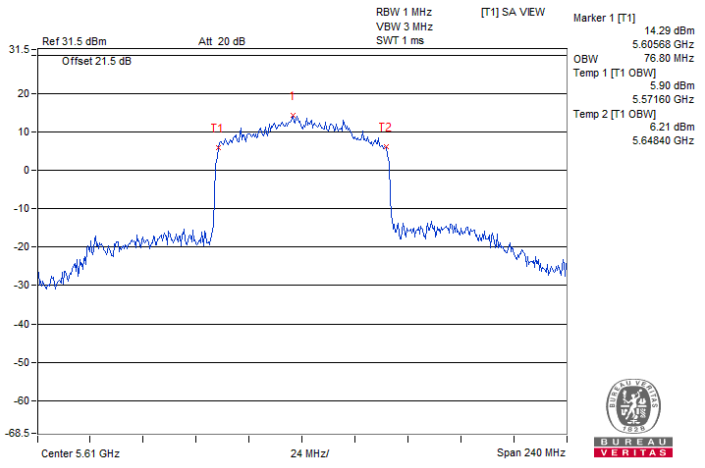
802.11a : CH 157



802.11ax (HE20) : CH 157

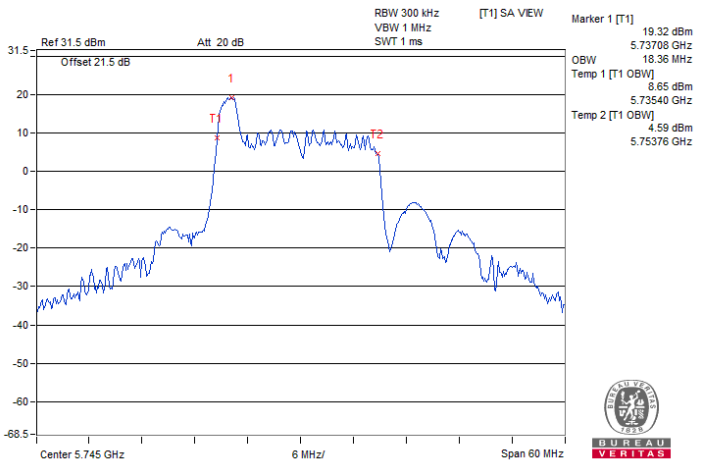


802.11ax (HE40) : CH 159

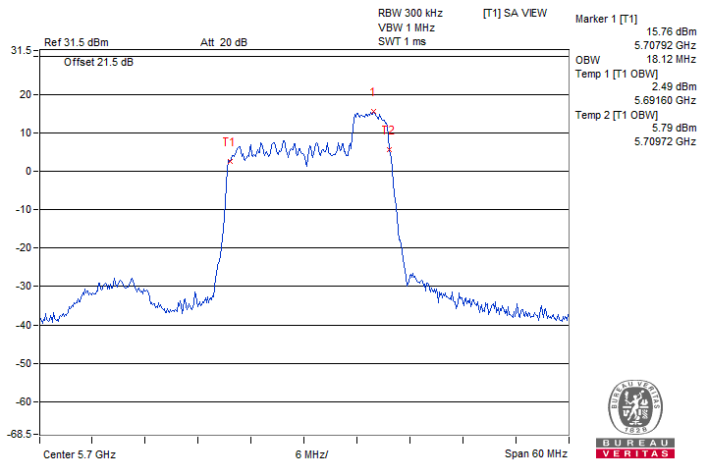


802.11ax (HE80) : CH 122

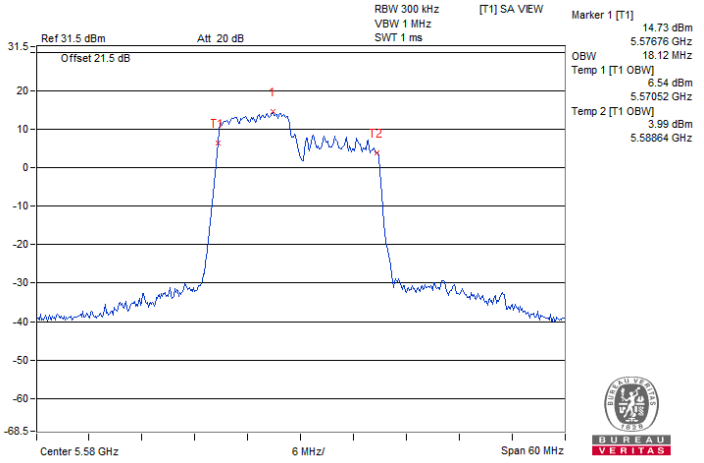
Spectrum Plot of Maximum Value



802.11ax (HE) 26-tone RU : CH 149

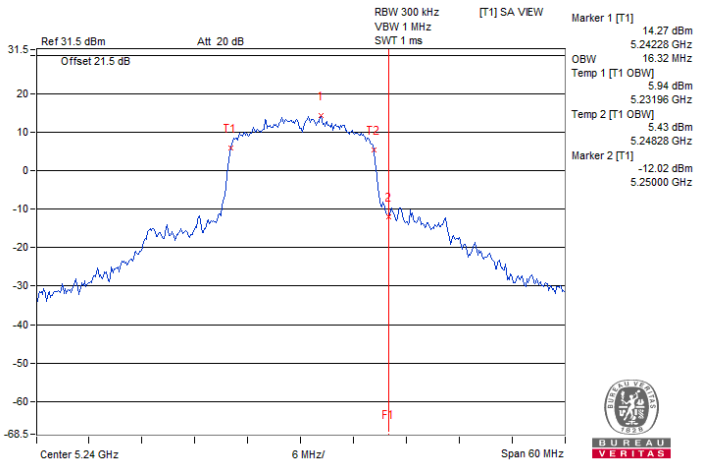


802.11ax (HE) 52-tone RU : CH 140

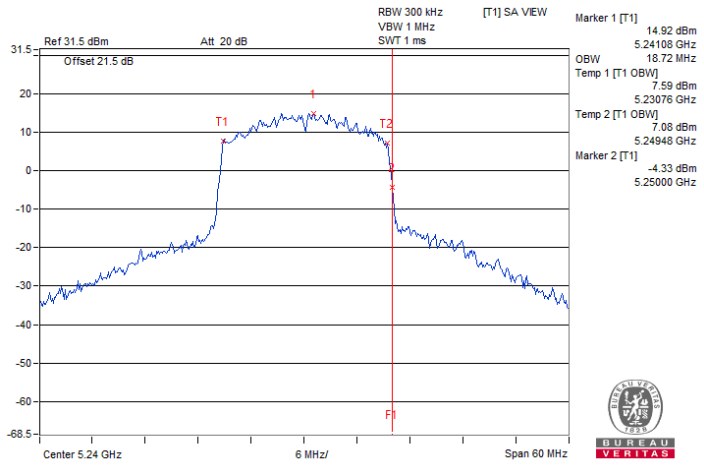


802.11ax (HE) 106-tone RU : CH 116

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



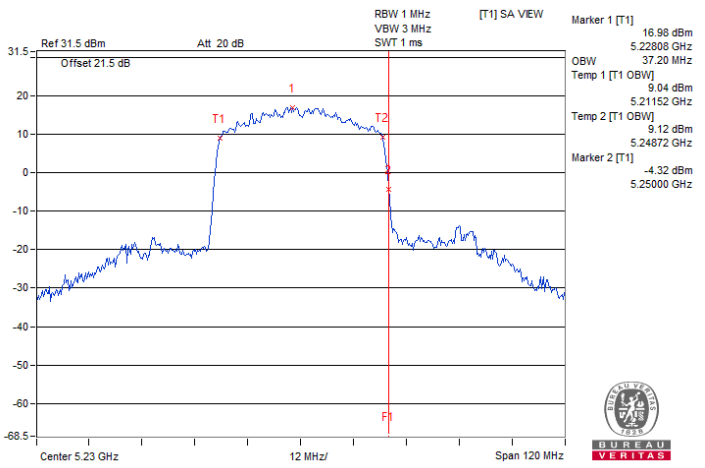
802.11a : CH 48



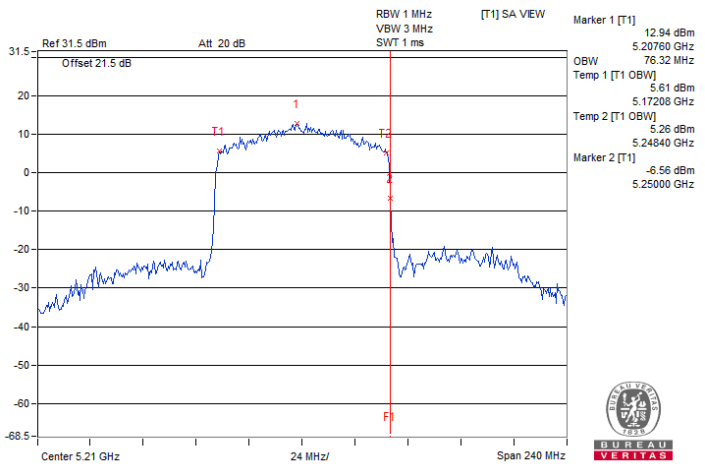
802.11ax (HE20) : CH 48

Spectrum Plot for nearby DFS band

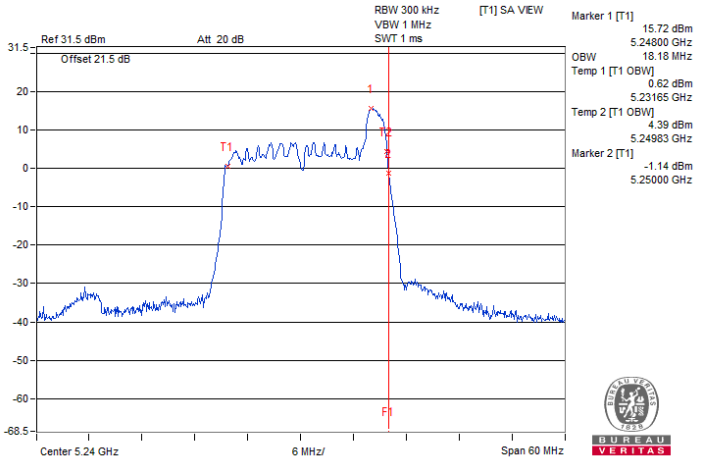
(DFS is required, if 99% OCP straddle into U-NII-2A)



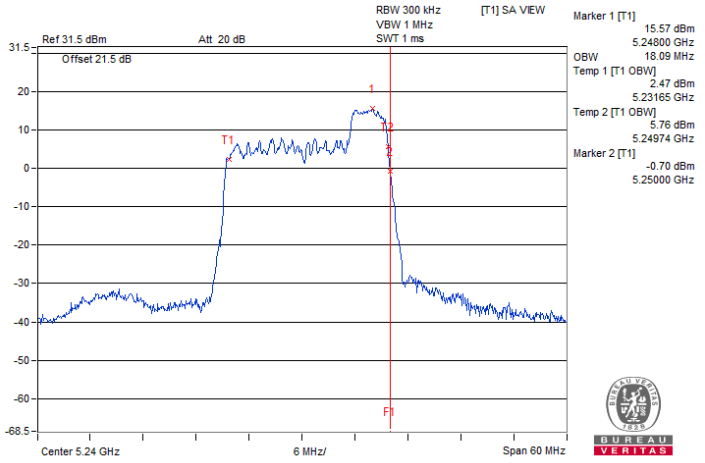
802.11ax (HE40) : CH 46



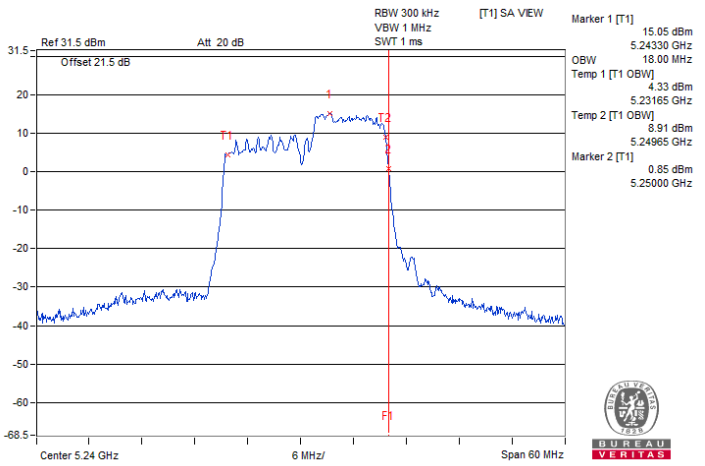
802.11ax (HE80) : CH 42



802.11ax (HE) 26-tone RU : CH 48



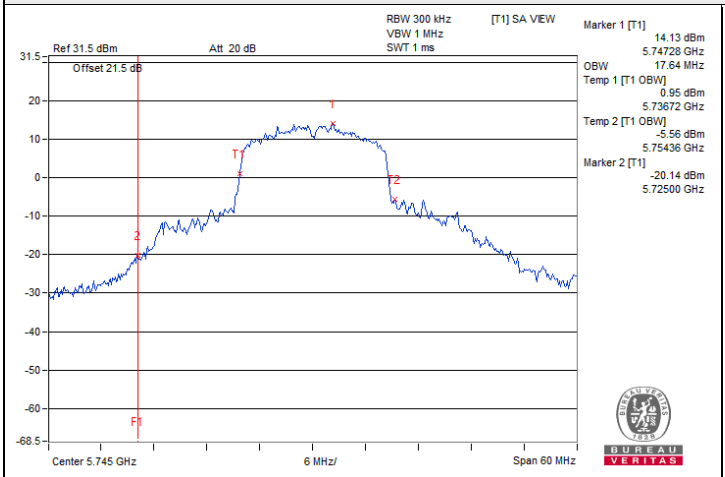
802.11ax (HE) 52-tone RU : CH 48



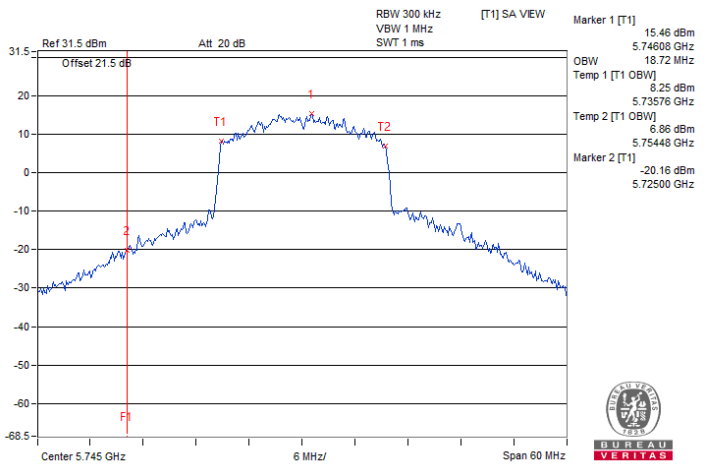
802.11ax (HE) 106-tone RU : CH 48

Spectrum Plot for nearby DFS band

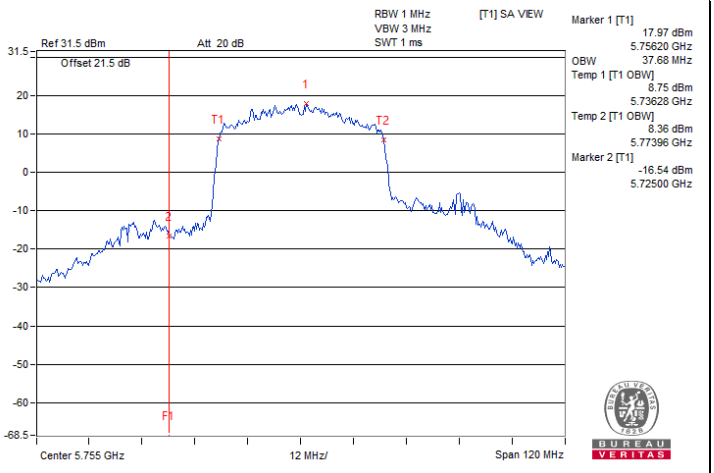
(DFS is required, if 99% OCP straddle into U-NII-2C)



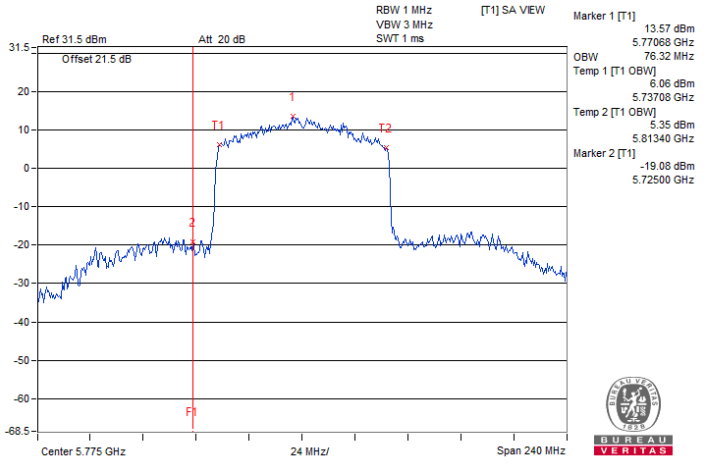
802.11a : CH 149



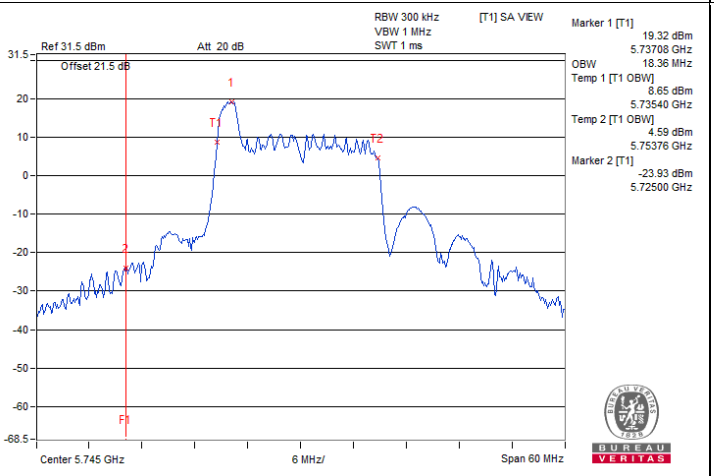
802.11ax (HE20) : CH 149



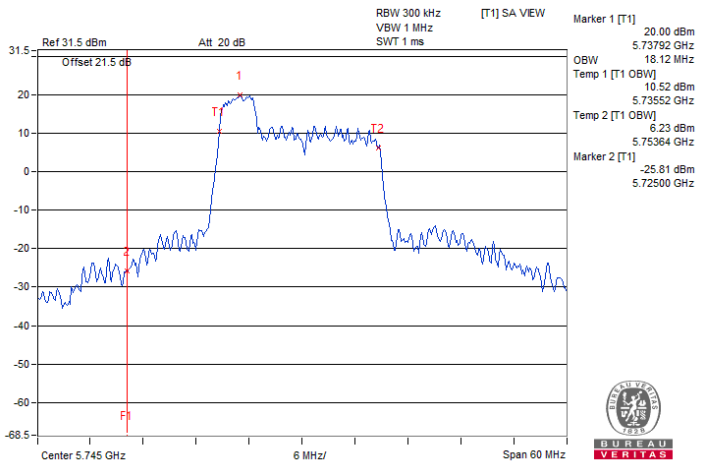
802.11ax (HE40) : CH 151



802.11ax (HE80) : CH 155



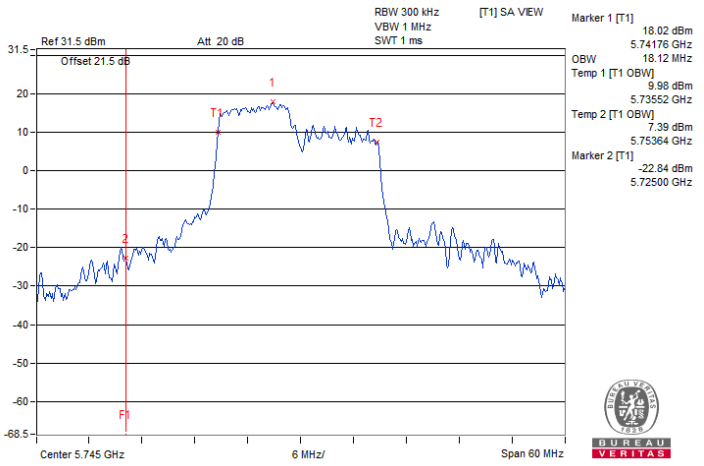
802.11ax (HE) 26-tone RU : CH 149



802.11ax (HE) 52-tone RU : CH 149

Spectrum Plot for nearby DFS band

(DFS is required, if 99% OCP straddle into U-NII-2C)



802.11ax (HE) 106-tone RU : CH 149

7.6 Frequency Stability

Input Power:	3.3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Katina Lu

802.11a

Frequency Stability Versus Temperature									
Operating Frequency: 5180 MHz									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
50	3.3	5179.9798	Pass	5179.9838	Pass	5179.9807	Pass	5179.9797	Pass
40	3.3	5180.018	Pass	5180.019	Pass	5180.0173	Pass	5180.0173	Pass
30	3.3	5180.0137	Pass	5180.0112	Pass	5180.0135	Pass	5180.0147	Pass
20	3.3	5180.025	Pass	5180.0267	Pass	5180.0253	Pass	5180.0257	Pass
10	3.3	5179.9848	Pass	5179.9898	Pass	5179.9892	Pass	5179.9858	Pass
0	3.3	5180.0193	Pass	5180.0215	Pass	5180.0188	Pass	5180.0193	Pass
-10	3.3	5179.9874	Pass	5179.9877	Pass	5179.9892	Pass	5179.9862	Pass
-20	3.3	5179.9878	Pass	5179.9888	Pass	5179.9883	Pass	5179.9861	Pass
-30	3.3	5179.9967	Pass	5179.9935	Pass	5179.9954	Pass	5179.9949	Pass

Frequency Stability Versus Voltage									
Operating Frequency: 5180 MHz									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minutes		5 Minutes		10 Minutes	
		Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result	Measured Frequency (MHz)	Test Result
20	3.795	5180.0208	Pass	5180.0217	Pass	5180.0165	Pass	5180.0216	Pass
	3.3	5180.025	Pass	5180.0267	Pass	5180.0253	Pass	5180.0257	Pass
	2.805	5180.0176	Pass	5180.0169	Pass	5180.0176	Pass	5180.0141	Pass

7.7 AC Power Conducted Emissions

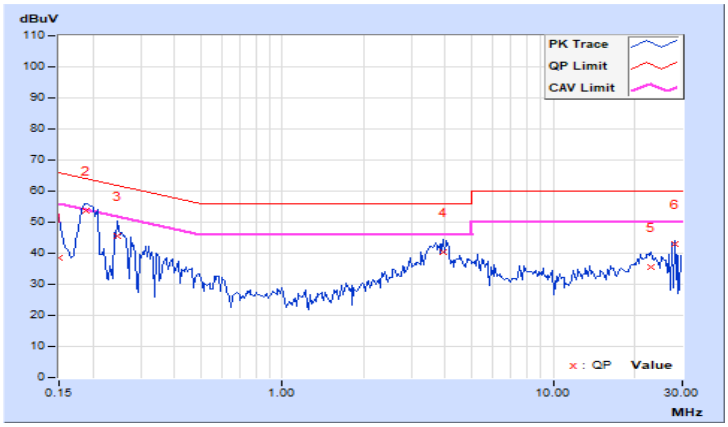
Mode B

RF Mode	802.11ax (HE20)	**Channel**	CH 165：5825 MHz
Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	**Environmental Conditions**	23°C, 71% RH
Tested By	Sampson Chen		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15000	9.96	28.54	12.55	38.50	22.51	66.00	56.00	-27.50	-33.49
2	**0.18906**	**9.96**	**43.83**	**28.46**	**53.79**	**38.42**	**64.08**	**54.08**	**-10.29**	**-15.66**
3	0.24766	9.96	35.54	21.01	45.50	30.97	61.84	51.84	-16.34	-20.87
4	3.92188	10.15	30.17	21.57	40.32	31.72	56.00	46.00	-15.68	-14.28
5	23.09375	11.15	24.54	19.18	35.69	30.33	60.00	50.00	-24.31	-19.67
6	28.28516	11.23	31.78	26.05	43.01	37.28	60.00	50.00	-16.99	-12.72

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

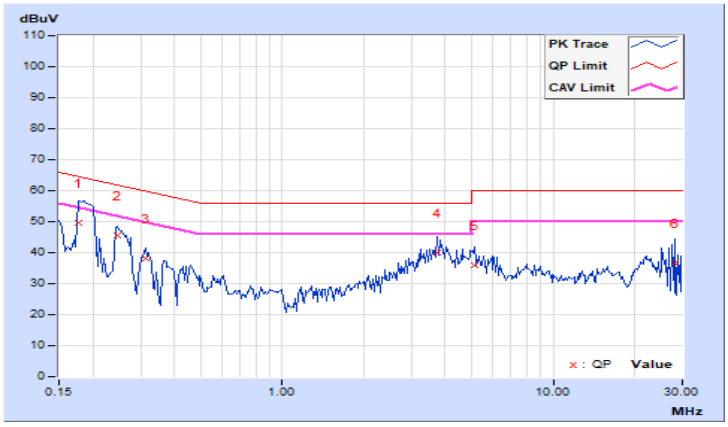


RF Mode	802.11ax (HE20)	**Channel**	CH 165：5825 MHz
Frequency Range	150kHz ~ 30MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	**Environmental Conditions**	23°C, 71% RH
Tested By	Sampson Chen		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.17734	9.94	39.82	20.88	49.76	30.82	64.61	54.61	-14.85	-23.79
2	0.24766	9.94	35.65	20.76	45.59	30.70	61.84	51.84	-16.25	-21.14
3	0.31406	9.94	28.09	12.76	38.03	22.70	59.86	49.86	-21.83	-27.16
4	3.72266	10.09	29.98	21.64	40.07	31.73	56.00	46.00	-15.93	-14.27
5	5.14844	10.15	25.69	17.95	35.84	28.10	60.00	50.00	-24.16	-21.90
6	28.29297	10.87	25.92	18.56	36.79	29.43	60.00	50.00	-23.21	-20.57

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



7.8 Unwanted Emissions below 1 GHz

Mode A

RF Mode	802.11ax (HE20)	**Channel**	CH 165：5825 MHz
Frequency Range	30 MHz ~ 1 GHz	**Detector Function & Bandwidth**	(QP) RB = 120kHz
Input Power (System)	120 Vac, 60 Hz	**Environmental Conditions**	28°C, 76% RH
Tested By	Louis Yang		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	39.20	28.6 QP	40.0	-11.4	1.12 H	360	41.9	-13.3
2	74.10	19.7 QP	40.0	-20.3	1.00 H	325	35.7	-16.0
3	233.80	29.2 QP	46.0	-16.8	1.52 H	360	44.2	-15.0
4	278.60	28.5 QP	46.0	-17.5	1.50 H	74	41.3	-12.8
5	281.09	19.6 QP	46.0	-26.4	1.05 H	360	32.3	-12.7
6	449.20	23.5 QP	46.0	-22.5	1.00 H	122	31.8	-8.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.