

Project No: TM-2407000112P
Report No.: TMWK2407002220KR

FCC ID: COF-BM25-EXT

Page: 1 / 213
Rev.: 00

RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART E

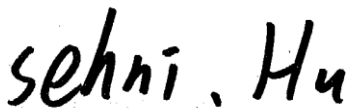
Test Standard	FCC Part 15.407
Product name	802.11a/b/g/n/ac 1x1 with BT 5.0 SiP Module
Brand Name	USI
Model No.	WM-BAC-BM-25-UFL
Test Result	Pass
Statements of Conformity	Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Approved by:



Sehni Hu
Supervisor

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
除非另有說明，此報告結果僅對測試之樣品負責，同時此樣品僅保留90天。本報告未經本公司書面許可，不可部份複製。

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com.tw/Terms-and-Conditions> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com.tw/Terms-and-Conditions>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of client's instruction, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced, except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.



Report No.: TMWK2407002220KR

Page: 2 / 213
Rev.: 00

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 28, 2024	Initial Issue	ALL	Peggy Tsai

Table of contents

1. GENERAL INFORMATION	4
1.1 EUT INFORMATION	4
1.2 EUT CHANNEL INFORMATION	5
1.3 ANTENNA INFORMATION	6
1.4 MEASUREMENT UNCERTAINTY	6
1.5 FACILITIES AND TEST LOCATION	7
1.6 INSTRUMENT CALIBRATION.....	8
1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT	10
1.8 TEST SET UP DIAGRAM	11
1.9 TEST PROGRAM.....	11
1.10 TEST METHODOLOGY AND APPLIED STANDARDS	11
2. TEST SUMMERY	12
3. DESCRIPTION OF TEST MODES	13
3.1 THE WORST MODE OF OPERATING CONDITION.....	13
3.2 THE WORST MODE OF MEASUREMENT	14
3.3 EUT DUTY CYCLE	15
4. TEST RESULT	17
4.1 AC POWER LINE CONDUCTED EMISSION	17
4.2 26DB BANDWIDTH, 6DB BANDWIDTH AND OCCUPIED BANDWIDTH(99%)	20
4.3 OUTPUT POWER MEASUREMENT.....	43
4.4 POWER SPECTRAL DENSITY	48
4.5 RADIATION BANDEDGE AND SPURIOUS EMISSION	59
4.6 DYNAMIC FREQUENCY SELECTION	197
APPENDIX 1 - PHOTOGRAPHS OF EUT	



Report No.: TMWK2407002220KR

Page: 4 / 213
Rev.: 00

1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Universal Global Scientific Industrial Co., Ltd. No. 141, Lane 351, Sec. 1, Taiping Road, Tsautuen, Nantou County 542007, Taiwan
Manufacturer	Universal Global Scientific Industrial Co., Ltd. No. 141, Lane 351, Sec. 1, Taiping Road, Tsautuen, Nantou County 542007, Taiwan
Equipment	802.11a/b/g/n/ac 1x1 with BT 5.0 SiP Module
Model No.	WM-BAC-BM-25-UFL
Model Discrepancy	N/A
Trade Name	USI
Received Date	July 12, 2024
Date of Test	July 12 ~ August 6, 2024
Power Operation	Power from Power supply: DC 3.6V
HW Version	V30
FW Version	dhd-1.363.125.25

Remark:

1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

1.2 EUT CHANNEL INFORMATION

Frequency Range	UNII-1	
	IEEE 802.11a	5180 ~ 5240 MHz
	IEEE 802.11n HT20	5180 ~ 5240 MHz
	IEEE 802.11ac VHT20	5180 ~ 5240 MHz
	IEEE 802.11n HT40	5190 ~ 5230 MHz
	IEEE 802.11ac VHT40	5190 ~ 5230 MHz
	IEEE 802.11ac VHT80	5210 MHz
	UNII-2a	
	IEEE 802.11a	5260 ~ 5320 MHz
	IEEE 802.11n HT20	5260 ~ 5320 MHz
	IEEE 802.11ac VHT20	5260 ~ 5320 MHz
	IEEE 802.11n HT40	5270 ~ 5310 MHz
	IEEE 802.11ac VHT40	5270 ~ 5310 MHz
	IEEE 802.11ac VHT80	5290 MHz
	UNII-2c	
	IEEE 802.11a	5500 ~ 5700 MHz
	IEEE 802.11n HT20	5500 ~ 5700 MHz
	IEEE 802.11ac VHT20	5500 ~ 5700 MHz
	IEEE 802.11n HT40	5510 ~ 5670 MHz
	IEEE 802.11ac VHT40	5510 ~ 5670 MHz
	IEEE 802.11ac VHT80	5530 ~ 5610 MHz
	UNII-3	
	IEEE 802.11a	5745 ~ 5825 MHz
	IEEE 802.11n HT20	5745 ~ 5825 MHz
	IEEE 802.11ac VHT20	5745 ~ 5825 MHz
	IEEE 802.11n HT40	5755 ~ 5795 MHz
	IEEE 802.11ac VHT40	5755 ~ 5795 MHz
	IEEE 802.11ac VHT80	5775 MHz
Modulation Type	1. IEEE 802.11a mode: OFDM	
	2. IEEE 802.11n HT 20 MHz mode: OFDM	
	3. IEEE 802.11n HT 40 MHz mode: OFDM	
	4. IEEE 802.11ac VHT 20 MHz mode: OFDM	
	5. IEEE 802.11ac VHT 40 MHz mode: OFDM	
	5. IEEE 802.11ac VHT 80 MHz mode: OFDM	

Remark:

Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 for test channels

Number of frequencies to be tested		
Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
☐ 1 MHz or less	1	Middle
☐ 1 MHz to 10 MHz	2	1 near top and 1 near bottom
☒ More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

1.3 ANTENNA INFORMATION

Antenna Type	☐ PIFA ☐ PCB ☐ Dipole ☒ FPC Antenna
Antenna Brand / Model	Amphenol / ST0224-10-401-A
Antenna Gain	Band I (5150-5250 MHz): Gain: 2.58 dBi Band II (5250~5350 MHz): Gain: 2.51 dBi Band III (5470-5725 MHz): Gain: 2.28 dBi Band IV (5725-5850MHz): Gain: 3.10 dBi
Antenna Connector	I-PEX MHF 1

Notes:

1. The antenna(s) of the EUT are permanently attached and there are no provisions for connection to an external antenna. So the EUT complies with the requirements of §15.203.

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	± 2.213 dB
Channel Bandwidth	± 2.7 %
RF output power (Spectrum)	± 2.440 dB
Power Spectral density	± 2.739 dB
Radiated Emission_9kHz-30MHz	± 3.761 dB
Radiated Emission_30MHz-200MHz	± 3.473 dB
Radiated Emission_200MHz-1GHz	± 3.946 dB
Radiated Emission_1GHz-6GHz	± 4.797 dB
Radiated Emission_6GHz-18GHz	± 4.803 dB
Radiated Emission_18GHz-26GHz	± 3.459 dB
Radiated Emission_26GHz-40GHz	± 3.297 dB

Remark:

- 1.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.



Report No.: TMWK2407002220KR

Page: 7 / 213
Rev.: 00

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

CAB identifier: TW1309

Test site	Test Engineer	Remark
AC Conduction Room	Ben Yang	-
Radiation	Tony Chao 、 Ray Li	-
RF Conducted	Marco Chan	-
DFS Test	KW Huang	-

Remark: The lab has been recognized as the FCC accredited lab. under the KDB 974614 D01 and is listed in the FCC public Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309

1.6 INSTRUMENT CALIBRATION

Conducted FCC/IC/NCC (All)					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Supply	GWINSTEK	SPS-3610	GPE880163	2023-11-16	2024-11-15
Power Sensor	Anritsu	MA2411B	1726104	2024-04-16	2025-04-15
Power Sensor	Anritsu	MA2412B	1726107	2024-04-16	2025-04-15
Power Meter	Anritsu	ML2496A	1804001	2024-04-16	2025-04-15
EXA Signal Analyzer	Keysight	N9010B	MY55460167	2024-01-03	2025-01-02
Attenuator	Marvelous Microwave Inc	MVE2213-10	08	2023-11-07	2024-11-06
Software	Radio Test Software Ver. 21				

966A Radiated					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Analyzer	KEYSIGHT	N9010A	MY52220817	2024-03-15	2025-03-14
Thermo-Hygro Meter	WISEWIND	1206	D07	2023-12-08	2024-12-07
Active Loop Antenna	SCHWARZBECK	FMZB 1513-60	1513-60-028	2023-12-13	2024-12-12
Bi-Log Antenna	Sunol Sciences	JB3	A030105	2024-07-12	2025-07-11
Preamplifier	EMEC	EM330	060609	2024-02-21	2025-02-20
Cable	Huber+Suhner	104PEA	20995+21000+182330	2024-02-21	2025-02-20
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2023-12-28	2024-12-27
Preamplifier	HP	8449B	3008A00965	2023-12-22	2024-12-21
Cable	EMCI	EMC101G	221213+221011+221012	2023-10-17	2024-10-16
Attenuator	Mini-Circuits	BW-S9W5	BWS9W5-09-966A-01	2024-02-07	2025-02-06
High Pass Filters	MICRO TRONICS	HPM13195	3	2024-01-23	2025-01-22
Horn Antenna	SCHWARZBECK	BBHA9170	1047	2023-12-13	2024-12-12
Pre-Amplifier	EMCI	EMC184045SE	980860	2023-12-12	2024-12-11
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Software	e3 V9-210616c				

Remark:

- Each piece of equipment is scheduled for calibration once a year.
- N.C.R. = No Calibration Required.



Report No.: TMWK2407002220KR

Page: 9 / 213
Rev.: 00

AC Mains Conduction					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI	100064	2024-06-14	2025-06-13
LISN	TESEQ	LN2-16N	22012	2024-02-29	2025-02-27
Cable	Woken	SFL402	185A	2024-07-08	2025-07-07
Power Supply	GWINISTEK	SPS-3610	GPE880163	2023-10-16	2024-10-15
Software	e3 V6-110812				

DFS Test					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EXA Signal Analyzer	Keysight	N9010A	MY54200716	2023-10-13	2024-10-12
Attenuator	E-INSTRUMENT	EPA-600H	EC1400050	2024-06-19	2025-06-18
Vector Signal Generator	KEYSIGHT	N5182B/N5182BX 07	MY61252828/ MY59362552	2024-01-19	2025-01-18
Power Divider	Marvelous	MVE8586	16011201	2024-06-19	2025-06-18
Power Divider	Marvelous	MVE8586	16011202	2024-06-19	2025-06-18
Power Divider	Solvang	STI08-0015	009	2024-07-03	2025-07-02
DC Power Supply	Motech	PPS1208	120033120005	2023-10-26	2024-10-25
Cable	Woken	SUMITOMO	1	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	2	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	3	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	4	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	5	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	8	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	9	2024-03-02	2025-03-01
Cable	Woken	SUMITOMO	13	2024-03-02	2025-03-01
Software	Dynamic Frequency Selection Test version 23.12.07				

Remark:

1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Required.



Report No.: TMWK2407002220KR

Page: 10 / 213
Rev.: 00

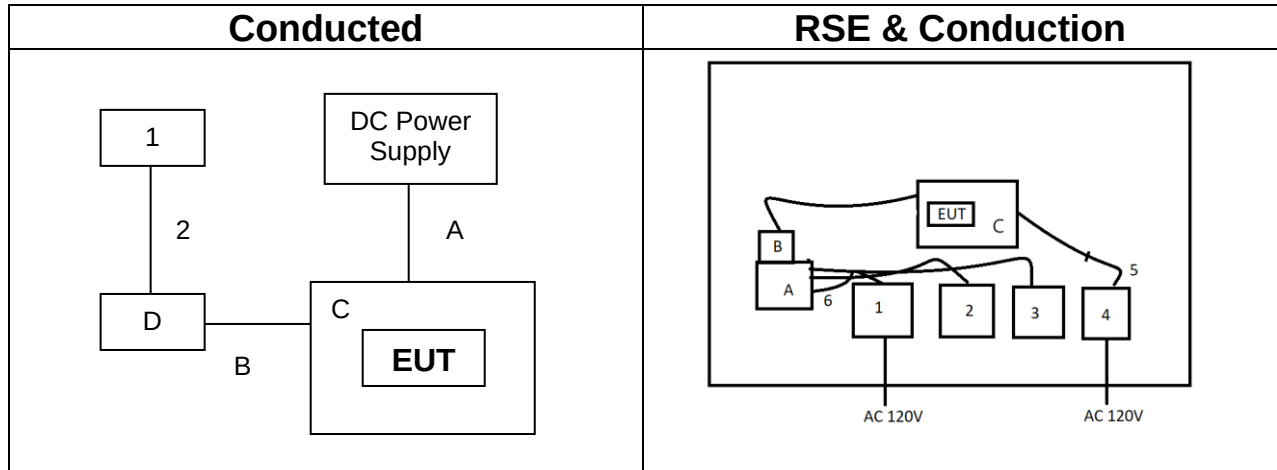
1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

EUT Accessories Equipment						
No.	Equipment	Brand	Model	Series No.	FCC ID	IC
C	Test Kit	N/A	N/A	N/A	N/A	N/A

Support Equipment (Conducted)					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	Monitor	Viewsonic	VS16263	N/A	N/A
2	HDMI Cable	UGREEN	HD104	N/A	N/A
A	DC Cable	N/A	N/A	N/A	N/A
B	Micro USB Cable	N/A	N/A	N/A	N/A
D	PC	ASUS	D320MT	N/A	N/A

Support Equipment (RSE & Conduction)					
No.	Equipment	Brand	Model	Series No.	FCC ID
1	Monitor	View sonic	VS16263	N/A	N/A
2	MOUSE	Lenovo	300 USB	N/A	N/A
3	KeyBoard	Logitech	K120	N/A	N/A
4	DC Power Source	GWINSTEK	SPS-3610	GPE880163	N/A
5	DC Cable	MISUMI	MCR3S-RE	N/A	N/A
6	HDMI Cable	UGREEN	HD104	N/A	N/A
A	PC	ASUS	D320MT	N/A	N/A
B	Test Kit	N/A	N/A	N/A	N/A

1.8 TEST SET UP DIAGRAM



1.9 TEST PROGRAM

The EUT connection corresponds to the surrounding fixture control board. This EUT uses the Linux system setup command to set the frequency, modulation, and power to allow the sample to continuously transmit (including frequency hopping mode).

1.10 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.407, KDB 789033 D02 v02r01, KDB 905462 D02 v02.

2. TEST SUMMERY

FCC Standard Sec.	Chapter	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.207	4.1	AC Conducted Emission	Pass
15.407(a)	4.2	26dB Bandwidth	Pass
15.407(e)	4.2	6dB Bandwidth	Pass
2.1049	4.2	Occupied Bandwidth (99%)	Pass
15.407(a)	4.3	Output Power Measurement	Pass
15.407(a)	4.4	Power Spectral Density	Pass
15.407(b)	4.5	Radiation Band Edge	Pass
15.407(b)	4.5	Radiation Spurious Emission	Pass
15.407(h)	5	Dynamic Frequency Selection	Pass

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	1. IEEE 802.11a mode: 6Mbps 2. IEEE 802.11n HT20 mode: MCS0 3. IEEE 802.11n HT40 mode: MCS0 4. IEEE 802.11ac VHT20 mode: MCS0 5. IEEE 802.11ac VHT40 mode: MCS0 6. IEEE 802.11ac VHT80 mode: MCS0																																																									
Operating Frequency	<table><tr><td></td><td>Mode</td><td>Frequency Range (MHz)</td></tr><tr><td rowspan="6">U-NII-1</td><td>IEEE 802.11a</td><td>5180, 5220, 5240</td></tr><tr><td>IEEE 802.11n HT20</td><td>5180, 5220, 5240</td></tr><tr><td>IEEE 802.11n HT40</td><td>5190, 5230</td></tr><tr><td>IEEE 802.11ac VHT20</td><td>5180, 5220, 5240</td></tr><tr><td>IEEE 802.11ac VHT40</td><td>5190, 5230</td></tr><tr><td>IEEE 802.11ac VHT80</td><td>5210</td></tr><tr><td rowspan="6">U-NII-2a</td><td>IEEE 802.11a</td><td>5260, 5300, 5320</td></tr><tr><td>IEEE 802.11n HT20</td><td>5260, 5300, 5320</td></tr><tr><td>IEEE 802.11n HT40</td><td>5270, 5310</td></tr><tr><td>IEEE 802.11ac VHT20</td><td>5260, 5300, 5320</td></tr><tr><td>IEEE 802.11ac VHT40</td><td>5270, 5310</td></tr><tr><td>IEEE 802.11ac VHT80</td><td>5290</td></tr><tr><td rowspan="6">U-NII-2c</td><td>IEEE 802.11a</td><td>5500, 5580, 5700</td></tr><tr><td>IEEE 802.11n HT20</td><td>5500, 5580, 5700</td></tr><tr><td>IEEE 802.11n HT40</td><td>5510, 5550, 5670</td></tr><tr><td>IEEE 802.11ac VHT20</td><td>5500, 5580, 5700</td></tr><tr><td>IEEE 802.11ac VHT40</td><td>5510, 5550, 5670</td></tr><tr><td>IEEE 802.11ac VHT80</td><td>5530, 5610</td></tr><tr><td rowspan="6">U-NII-3</td><td>IEEE 802.11a</td><td>5745, 5785, 5825</td></tr><tr><td>IEEE 802.11n HT20</td><td>5745, 5785, 5825</td></tr><tr><td>IEEE 802.11n HT40</td><td>5755, 5795</td></tr><tr><td>IEEE 802.11ac VHT20</td><td>5745, 5785, 5825</td></tr><tr><td>IEEE 802.11ac VHT40</td><td>5755, 5795</td></tr><tr><td>IEEE 802.11ac VHT80</td><td>5775</td></tr></table>				Mode	Frequency Range (MHz)	U-NII-1	IEEE 802.11a	5180, 5220, 5240	IEEE 802.11n HT20	5180, 5220, 5240	IEEE 802.11n HT40	5190, 5230	IEEE 802.11ac VHT20	5180, 5220, 5240	IEEE 802.11ac VHT40	5190, 5230	IEEE 802.11ac VHT80	5210	U-NII-2a	IEEE 802.11a	5260, 5300, 5320	IEEE 802.11n HT20	5260, 5300, 5320	IEEE 802.11n HT40	5270, 5310	IEEE 802.11ac VHT20	5260, 5300, 5320	IEEE 802.11ac VHT40	5270, 5310	IEEE 802.11ac VHT80	5290	U-NII-2c	IEEE 802.11a	5500, 5580, 5700	IEEE 802.11n HT20	5500, 5580, 5700	IEEE 802.11n HT40	5510, 5550, 5670	IEEE 802.11ac VHT20	5500, 5580, 5700	IEEE 802.11ac VHT40	5510, 5550, 5670	IEEE 802.11ac VHT80	5530, 5610	U-NII-3	IEEE 802.11a	5745, 5785, 5825	IEEE 802.11n HT20	5745, 5785, 5825	IEEE 802.11n HT40	5755, 5795	IEEE 802.11ac VHT20	5745, 5785, 5825	IEEE 802.11ac VHT40	5755, 5795	IEEE 802.11ac VHT80	5775
	Mode	Frequency Range (MHz)																																																								
U-NII-1	IEEE 802.11a	5180, 5220, 5240																																																								
	IEEE 802.11n HT20	5180, 5220, 5240																																																								
	IEEE 802.11n HT40	5190, 5230																																																								
	IEEE 802.11ac VHT20	5180, 5220, 5240																																																								
	IEEE 802.11ac VHT40	5190, 5230																																																								
	IEEE 802.11ac VHT80	5210																																																								
U-NII-2a	IEEE 802.11a	5260, 5300, 5320																																																								
	IEEE 802.11n HT20	5260, 5300, 5320																																																								
	IEEE 802.11n HT40	5270, 5310																																																								
	IEEE 802.11ac VHT20	5260, 5300, 5320																																																								
	IEEE 802.11ac VHT40	5270, 5310																																																								
	IEEE 802.11ac VHT80	5290																																																								
U-NII-2c	IEEE 802.11a	5500, 5580, 5700																																																								
	IEEE 802.11n HT20	5500, 5580, 5700																																																								
	IEEE 802.11n HT40	5510, 5550, 5670																																																								
	IEEE 802.11ac VHT20	5500, 5580, 5700																																																								
	IEEE 802.11ac VHT40	5510, 5550, 5670																																																								
	IEEE 802.11ac VHT80	5530, 5610																																																								
U-NII-3	IEEE 802.11a	5745, 5785, 5825																																																								
	IEEE 802.11n HT20	5745, 5785, 5825																																																								
	IEEE 802.11n HT40	5755, 5795																																																								
	IEEE 802.11ac VHT20	5745, 5785, 5825																																																								
	IEEE 802.11ac VHT40	5755, 5795																																																								
	IEEE 802.11ac VHT80	5775																																																								
Operation Transmitter	1. IEEE 802.11a mode: 1T1R(SISO) 2. IEEE 802.11n HT20 mode: 1T1R(SISO) 3. IEEE 802.11n HT40 mode: 1T1R(SISO) 4. IEEE 802.11ac VHT20 mode: 1T1R(SISO)) 5. IEEE 802.11ac VHT40 mode: 1T1R(SISO) 6. IEEE 802.11ac VHT80 mode: 1T1R(SISO)																																																									

Remark:

1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.

3.2 THE WORST MODE OF MEASUREMENT

AC Power Line Conducted Emission	
Test Condition	AC Power line conducted emission for line and neutral
Power supply Mode	Mode 1: EUT Power by DC power Supply
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement Above 1G	
Test Condition	Radiated Emission Above 1G
Power supply Mode	Mode 1: EUT power by Power Supply
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Worst Position	☐ Placed in fixed position. ☐ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☒ Placed in fixed position at Z-Plane (H-Plane)

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Power supply Mode	Mode 1: EUT power by Power Supply
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Radiated Emission Measurement [Co-Location]	
Test Condition	Radiated Emission [Co-Location]
Power supply Mode	Mode 1: EUT Power by Wi-Fi 2.4G+BLE_1M Mode 2: EUT Power by Wi-Fi 2.4G+BT BR Mode 3: EUT Power by Wi-Fi 5G+BLE_1M Mode 4: EUT Power by Wi-Fi 5G+BT BR
Worst Mode	☐ Mode 1 ☐ Mode 2 ☐ Mode 3 ☒ Mode 4

Remark:

1. The worst mode was record in this test report.
2. AC power line conducted emission were performed the EUT transmit at the highest output power channel as worse case.
3. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Y -Plane) were recorded in this report
4. The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40, therefore investigated worst case to representative mode in test report



Report No.: TMWK2407002220KR

Page: 15 / 213
Rev.: 00

3.3 EUT DUTY CYCLE

Temperature: 23.1 ~ 25.2°C

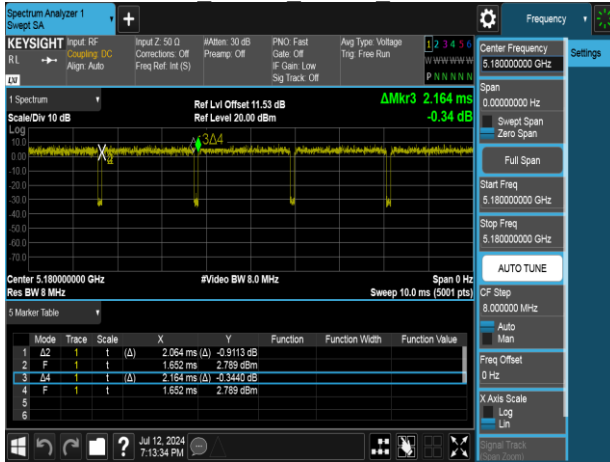
Test date: July 12 ~ August 6, 2024

Humidity: 50 ~ 61% RH

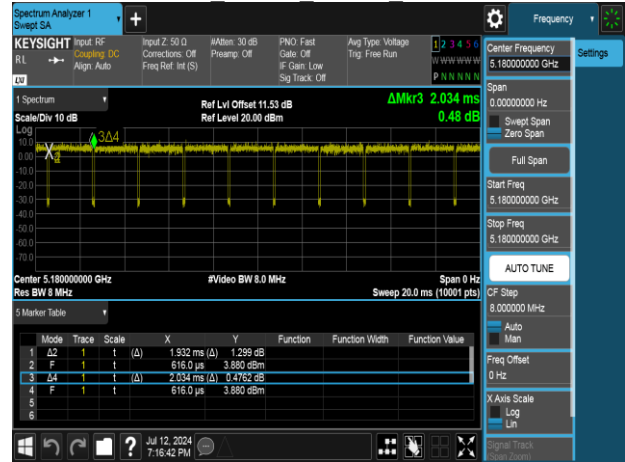
Tested by: Marco Chan

Mode	Duty Cycle (%) =Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	95.38	0.21	0.48	1.00
802.11n_20	94.96	0.22	0.52	1.00
802.11ac_20	94.99	0.22	0.52	1.00
802.11n_40	90.25	0.45	1.06	2.00
802.11ac_40	90.30	0.44	1.05	2.00
802.11ac_80	81.85	0.87	2.17	3.00

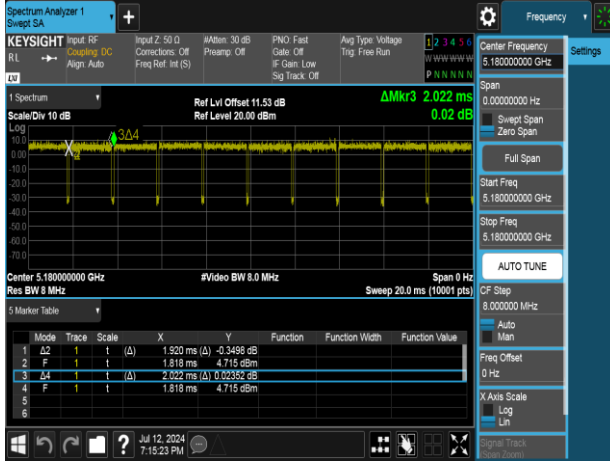
802.11a 20MHz Chain0 5180MHz



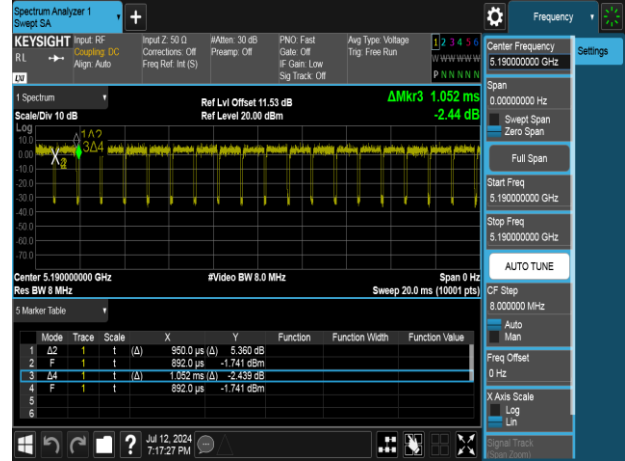
802.11ac 20MHz Chain0 5180MHz



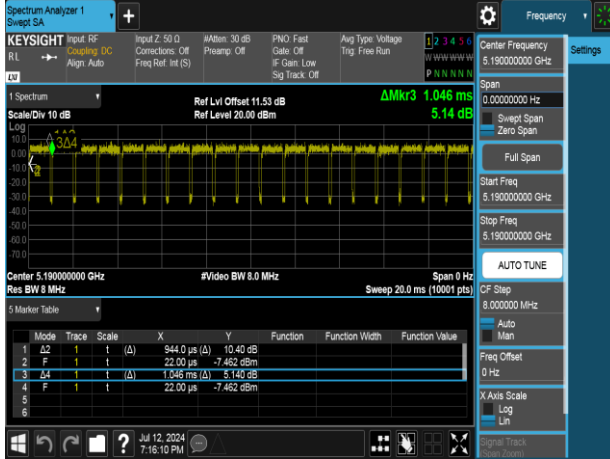
802.11n 20MHz Chain0 5180MHz



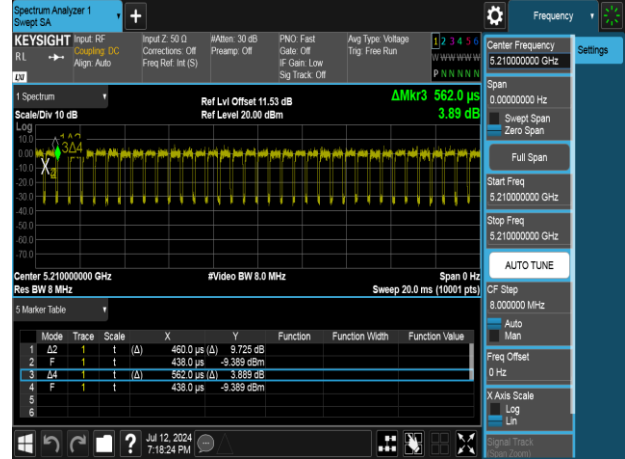
802.11ac 40MHz Chain0 5190MHz



802.11n 40MHz Chain0 5190MHz



802.11ac 80MHz Chain0 5210MHz



4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

Frequency Range (MHz)	Limits(dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

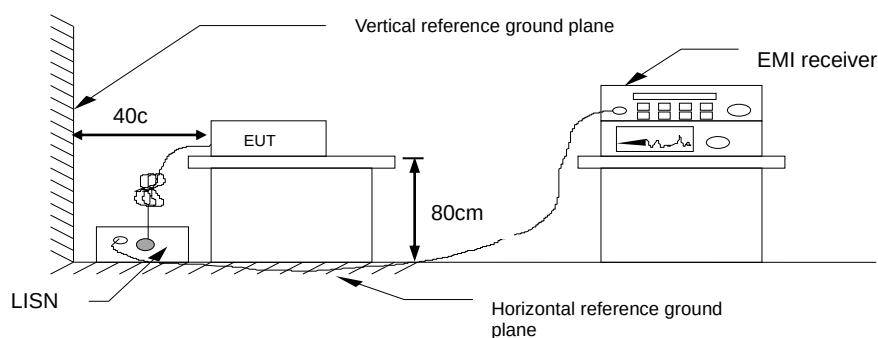
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

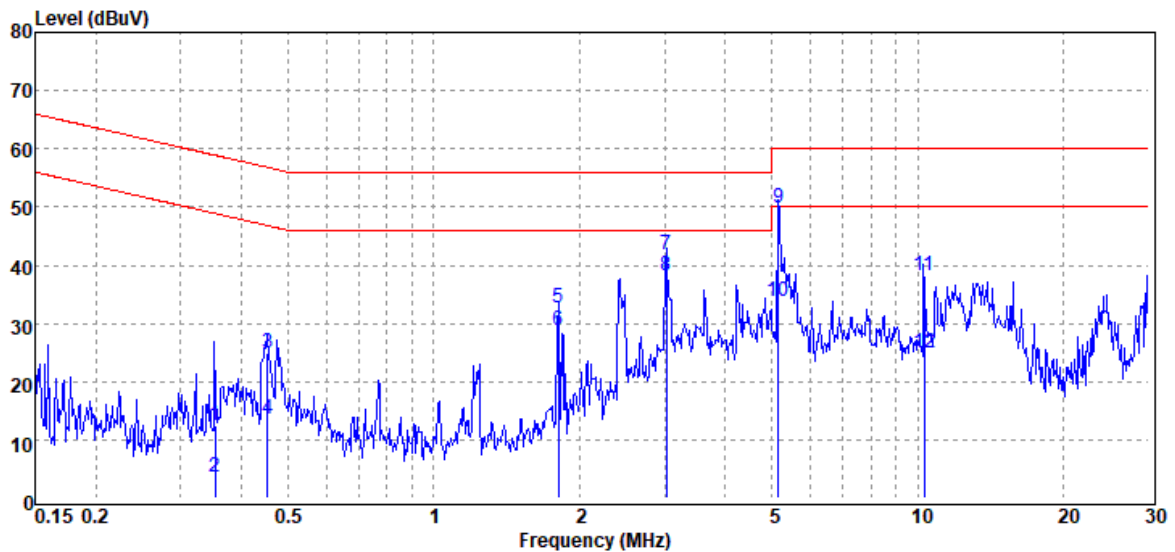
4.1.3 Test Setup



4.1.4 Test Result

Project No : TM-2407000112P
 Operation Mode : 5G
 Test Chamber : Conduction
 Probe : LINE
 Note :

Test Date : 2024-07-22
 Temp./Humi. : 23.4°C / 54%
 Engineer : Ben Yang
 Test Voltage : AC 120V/60Hz



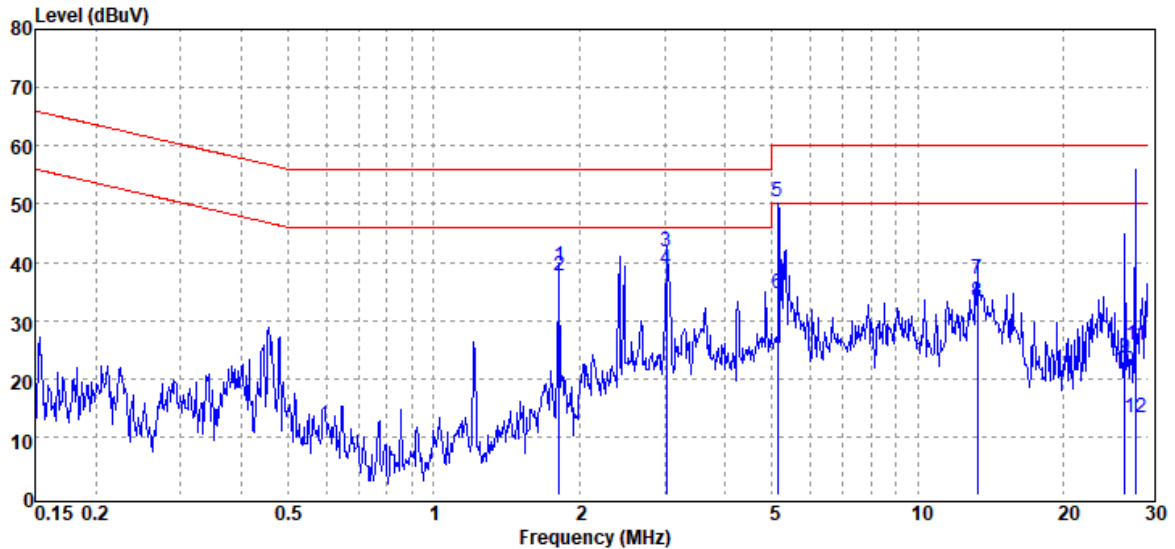
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Read Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.353	QP	12.04	0.38	12.42	58.89	-46.47
0.353	Average	3.22	0.38	3.60	48.89	-45.29
0.453	QP	24.54	0.38	24.92	56.83	-31.91
0.453	Average	13.07	0.38	13.45	46.83	-33.38
1.809	QP	32.56	0.18	32.74	56.00	-23.26
1.809	Average	28.49	0.18	28.67	46.00	-17.33
3.021	QP	41.64	0.22	41.86	56.00	-14.14
3.021	Average	38.11	0.22	38.33	46.00	-7.67
5.148	QP	49.59	0.27	49.86	60.00	-10.14
5.148	Average	33.44	0.27	33.71	50.00	-16.29
10.294	QP	37.96	0.36	38.32	60.00	-21.68
10.294	Average	24.61	0.36	24.97	50.00	-25.03

Note: 1. Actual FS= Spectrum Read Level + Factor

Note: 2. Margin= Actual FS - Limit

Project No : TM-2407000112P
 Operation Mode : 5G
 Test Chamber : Conduction
 Probe : NEUTRAL
 Note :

Test Date : 2024-07-22
 Temp./Humi. : 23.4°C / 54%
 Engineer : Ben Yang
 Test Voltage : AC 120V/60Hz



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Read Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
1.815	QP	39.02	0.16	39.18	56.00	-16.82
1.815	Average	37.44	0.16	37.60	46.00	-8.40
3.021	QP	41.69	0.19	41.88	56.00	-14.12
3.021	Average	38.68	0.19	38.87	46.00	-7.13
5.142	QP	50.17	0.25	50.42	60.00	-9.58
5.142	Average	34.31	0.25	34.56	50.00	-15.44
13.264	QP	36.84	0.38	37.22	60.00	-22.78
13.264	Average	32.73	0.38	33.11	50.00	-16.89
26.743	QP	22.92	0.52	23.44	60.00	-36.56
26.743	Average	20.81	0.52	21.33	50.00	-28.67
28.241	QP	25.14	0.54	25.68	60.00	-34.32
28.241	Average	12.84	0.54	13.38	50.00	-36.62

Note: 1. Actual FS= Spectrum Read Level + Factor

Note: 2. Margin= Actual FS - Limit

4.2 26dB BANDWIDTH, 6dB BANDWIDTH AND OCCUPIED BANDWIDTH(99%)

4.2.1 Test Limit

26 dB Bandwidth : For reporting purposes only.

6 dB Bandwidth : Least 500kHz.

Occupied Bandwidth(99%) : For reporting purposes only.

4.2.2 Test Procedure

26dB

1. This measurement setting are specified in section D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW: approximately 1% of the emission bandwidth.
3. Set the VBW>RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Measure the maximum width of the emission that is 26dB down from the peak of the emission. Compare this with the RBW setting of the analyser. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

6dB

1. This measurement setting are specified in section D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = 100 kHz.
3. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

99%

1. This measurement setting are specified in section D of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set center frequency to the nominal EUT channel center frequency.
3. Set span = 1.5 times to 5.0 times the OBW.
4. Set RBW = 1 % to 5% of the OBW.
5. Set VBW $\geq$ 3 xRBW

4.2.3 Test Setup

Refer to section 1.8.



Report No.: TMWK2407002220KR

Page: 22 / 213
Rev.: 00

4.2.4 Test Result

Temperature: 23.1 ~ 25.2°C

Test date: July 12 ~ August 6, 2024

Humidity: 50 ~ 61% RH

Tested by: Marco Chan

Occupied Bandwidth(99%)

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.568	12.190
5220	16.704	12.230
5240	16.646	12.210
5260	16.680	12.220
5300	16.664	12.220
5320	16.555	12.190
5500	16.568	12.190
5580	16.581	12.200
5700	16.598	12.200

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	16.848	16.31
5785	16.809	16.26
5825	16.941	16.27

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.677	12.470
5220	17.786	12.500
5240	17.841	12.510
5260	17.789	12.500
5300	17.773	12.500
5320	17.714	12.480
5500	17.725	12.490
5580	17.732	12.490
5700	17.755	12.490

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5745	17.884	17.37
5785	17.752	17.54
5825	17.757	17.47

802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.097	15.570
5230	36.176	15.580
5270	36.248	15.590
5310	36.164	15.580
5510	36.137	15.580
5550	36.225	15.590
5670	36.183	15.590

802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5755	36.395	36.13
5795	36.371	36.29

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.533	18.780
5290	75.575	18.780
5530	75.498	18.780
5610	75.598	18.790

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	6dB BW (MHz)
5775	75.511	75.39

6 dB Bandwidth & 26 dB Bandwidth

802.11a_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.92	13.210
5220	21.44	13.310
5240	21.34	13.290
5260	23.53	13.720
5300	21.52	13.330
5320	20.48	13.110
5500	21.33	13.290
5580	21.26	13.280
5700	20.81	13.180

802.11a_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.47	12.170
5785	16.13	12.080
5825	16.38	12.140

802.11a_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.363990	< 5250
5745	5736.715488	> 5725

Note: The measurement results of all 6dBc test channels are greater than 500kHz.

802.11n_HT20_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	21.30	13.280
5220	22.04	13.430
5240	24.58	13.910
5260	22.26	13.480
5300	24.67	13.920
5320	21.17	13.260
5500	21.48	13.320
5580	21.34	13.290
5700	21.09	13.240

802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.53	12.180
5785	16.97	12.300
5825	17.33	12.390

802.11n_HT20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.943162	< 5250
5745	5736.176421	> 5725

Note: The measurement results of all 6dBc test channels are greater than 500kHz.

802.11n_HT40_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	39.65	15.980
5230	47.05	16.730
5270	51.29	17.100
5310	39.33	15.950
5510	39.66	15.980
5550	44.55	16.490
5670	39.47	15.960

802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.85	15.540
5795	35.22	15.470

802.11n_HT40_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.126841	< 5250
5755	5736.935461	> 5725

Note: The measurement results of all 6dBc test channels are greater than 500kHz.

802.11ac_VHT80_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	80.89	19.080
5290	81.02	19.090
5530	81.84	19.130
5610	81.25	19.100

802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.24	18.760

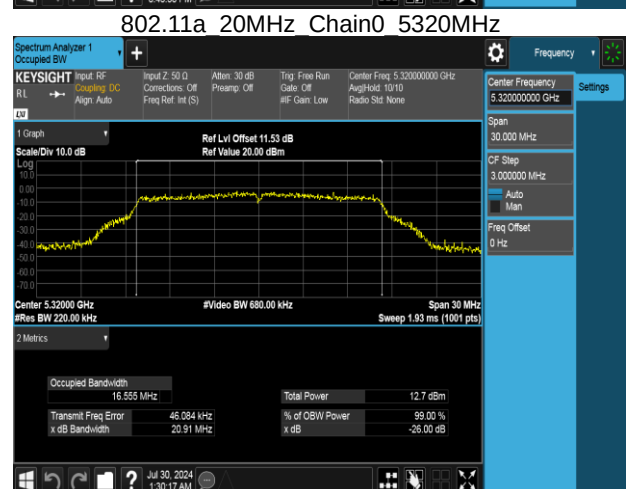
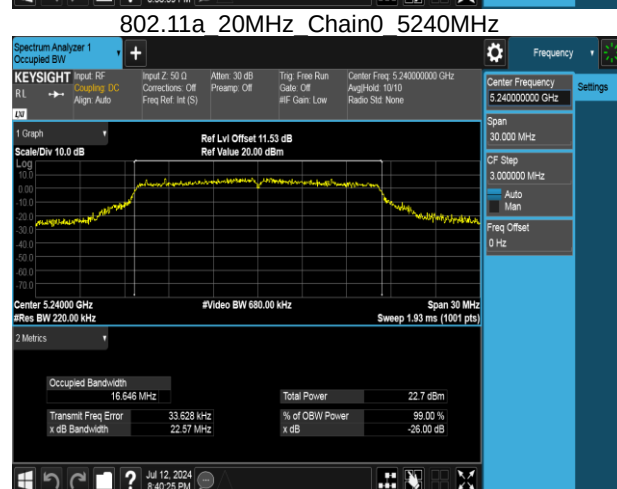
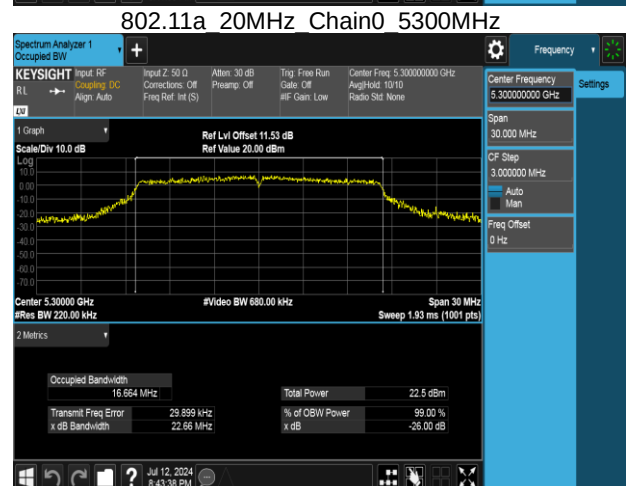
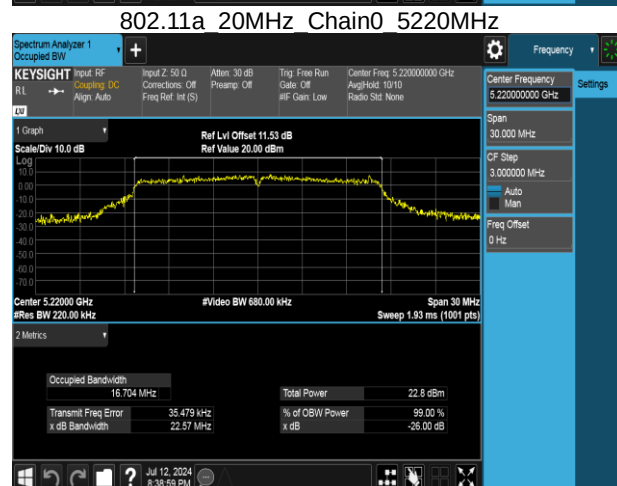
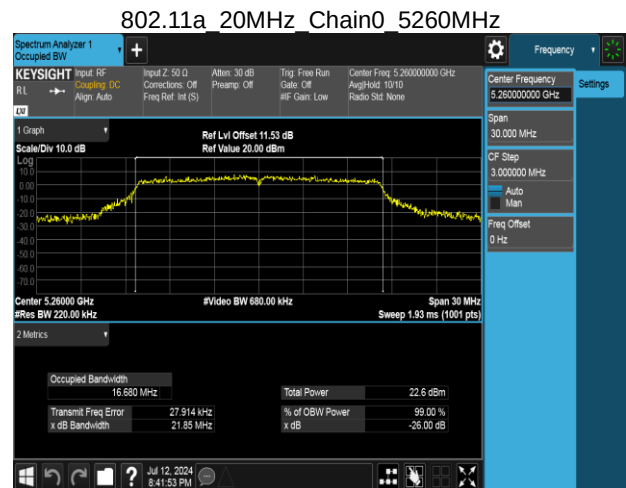
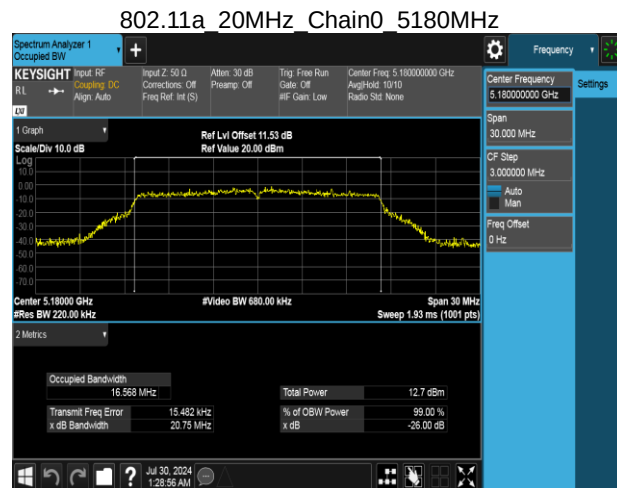
802.11ac_VHT80_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5247.765514	< 5250
5775	5737.387917	> 5725

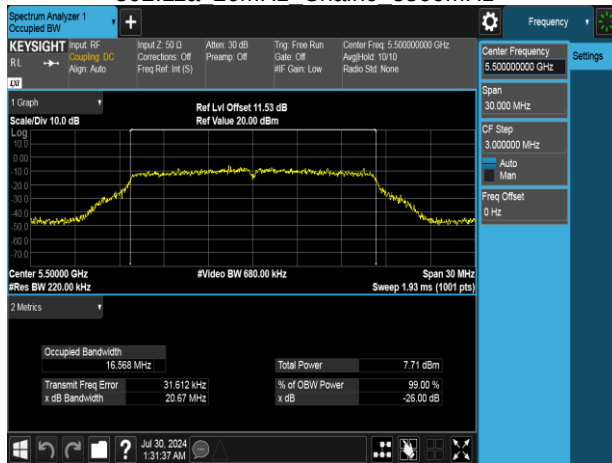
Note: The measurement results of all 6dBc test channels are greater than 500kHz.

Test Data

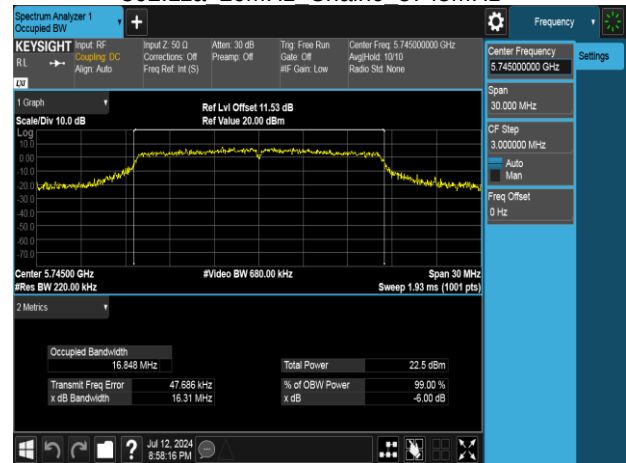
Occupied Bandwidth(99%)



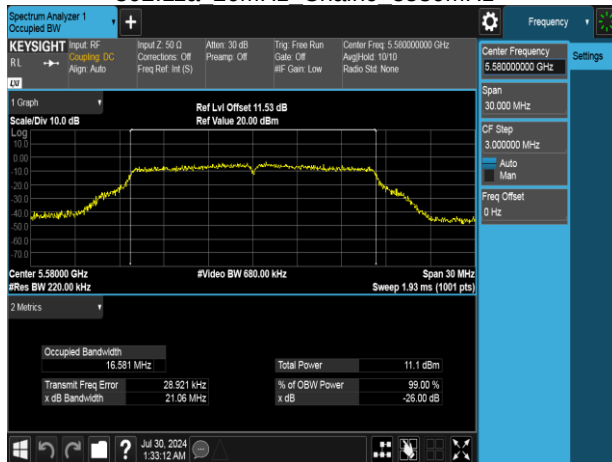
802.11a 20MHz Chain0 5500MHz



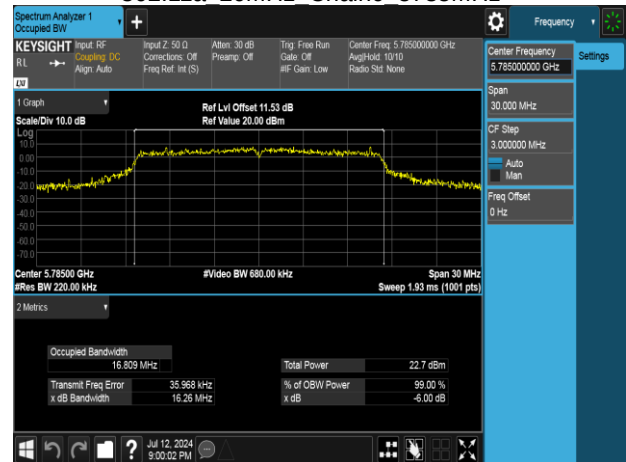
802.11a 20MHz Chain0 5745MHz



802.11a 20MHz Chain0 5580MHz



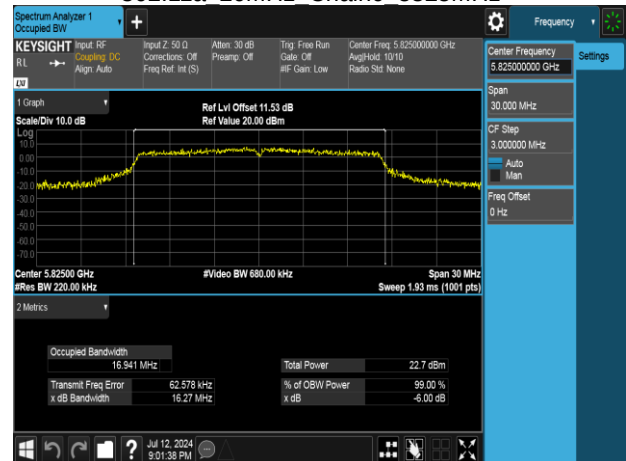
802.11a 20MHz Chain0 5785MHz

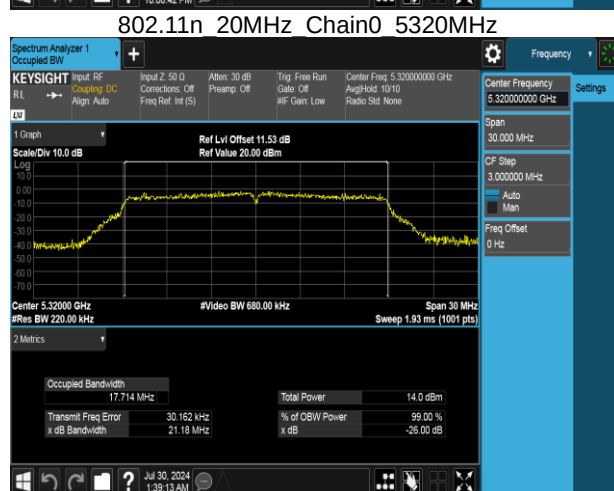
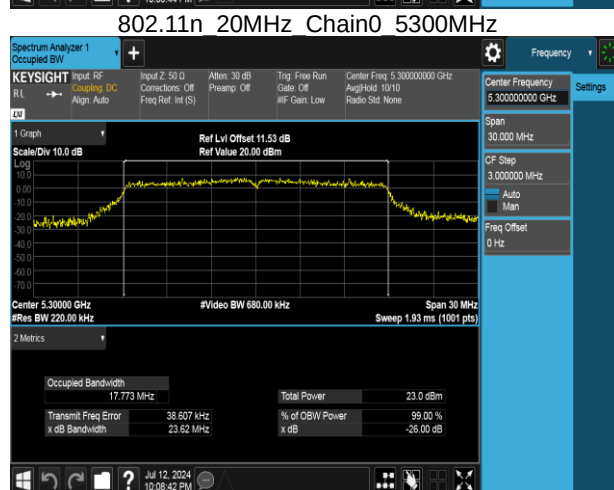
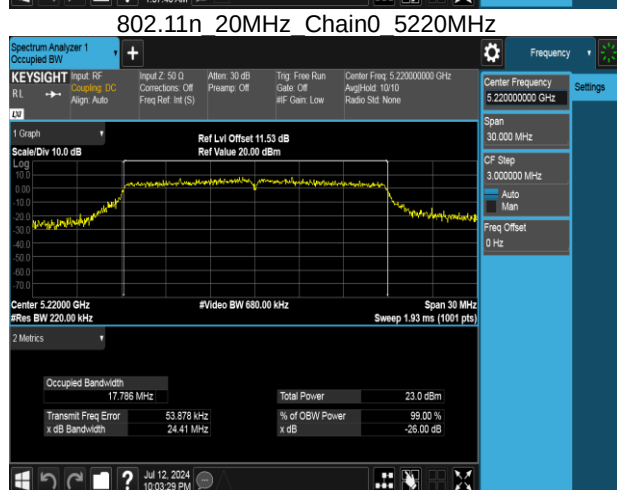
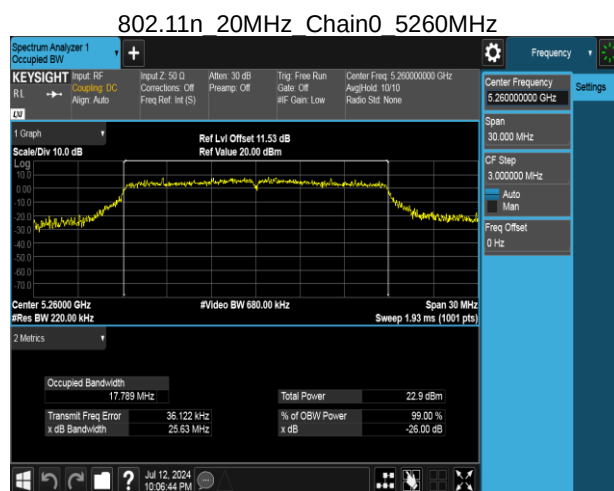
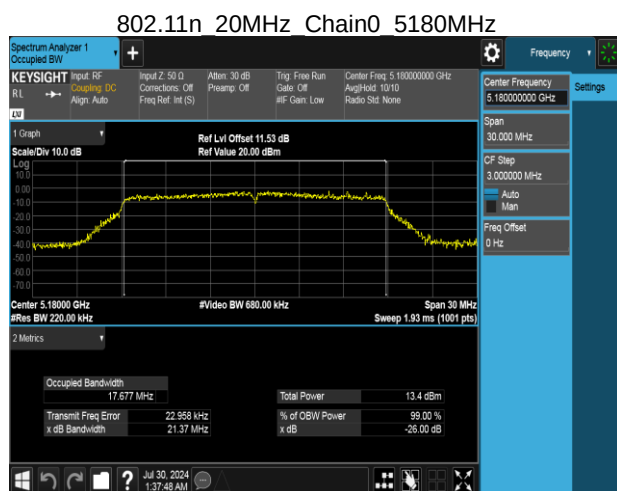


802.11a 20MHz Chain0 5700MHz

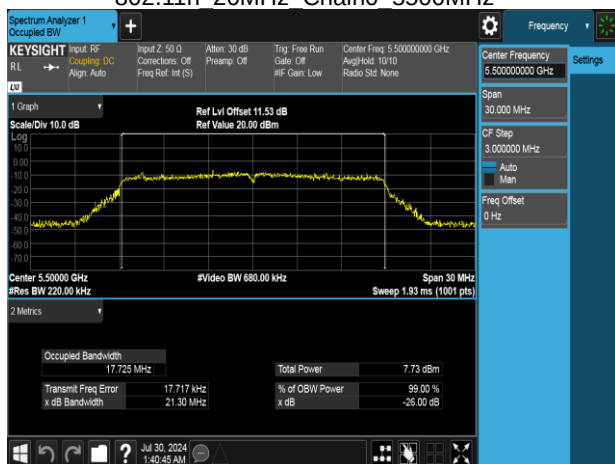


802.11a 20MHz Chain0 5825MHz

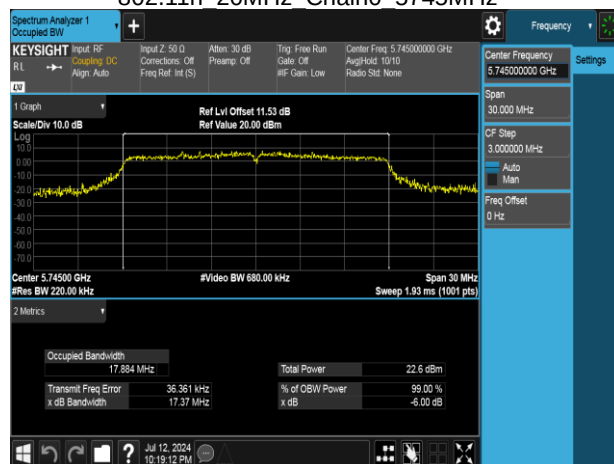




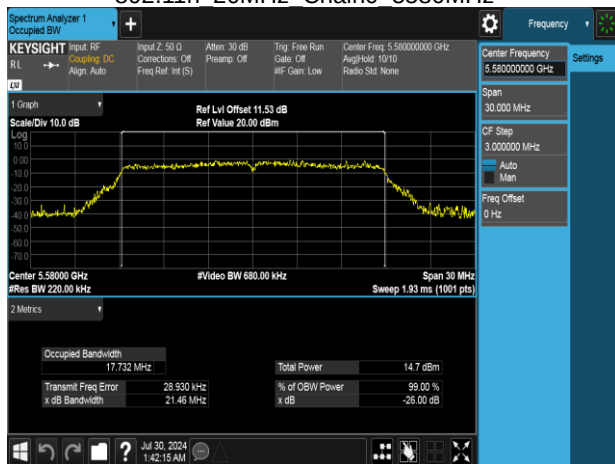
802.11n 20MHz Chain0 5500MHz



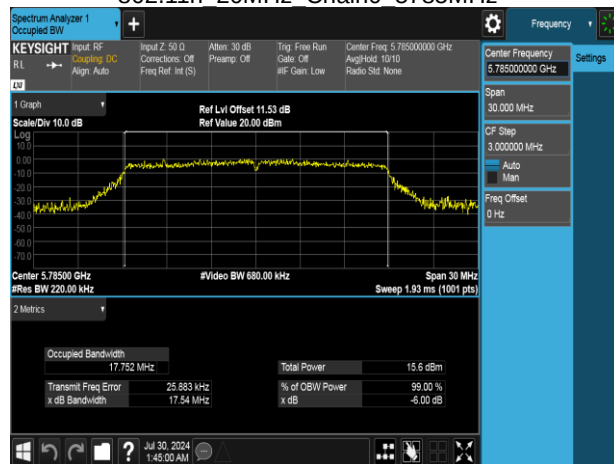
802.11n 20MHz Chain0 5745MHz



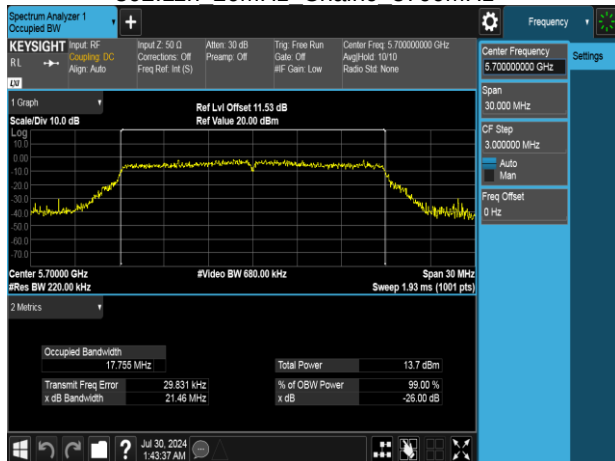
802.11n 20MHz Chain0 5580MHz



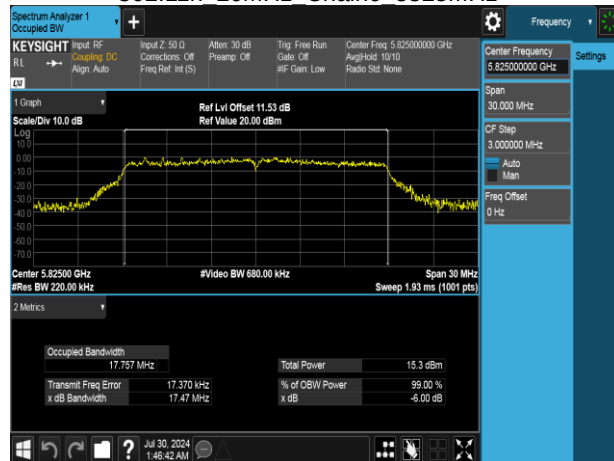
802.11n 20MHz Chain0 5785MHz



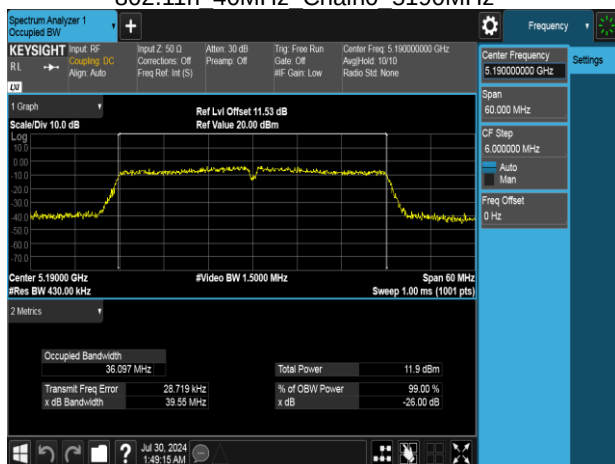
802.11n 20MHz Chain0 5700MHz



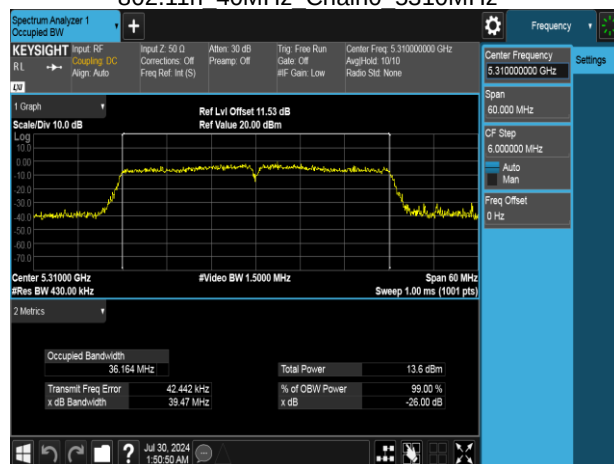
802.11n 20MHz Chain0 5825MHz



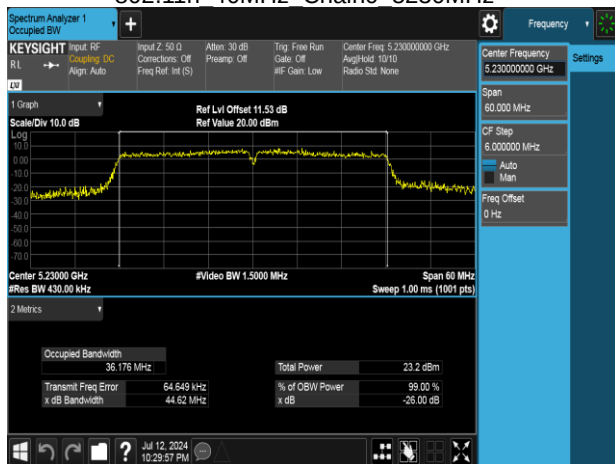
802.11n 40MHz Chain0 5190MHz



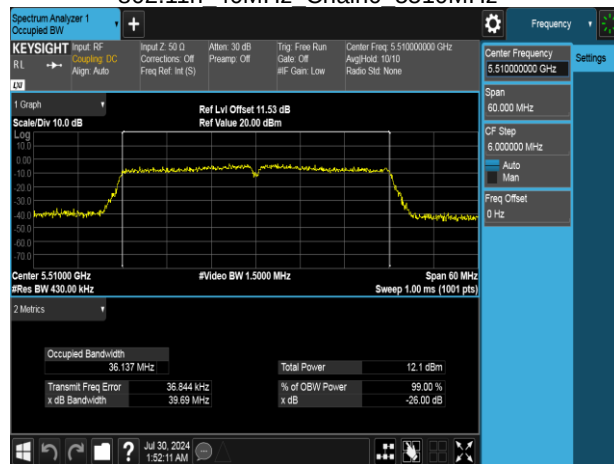
802.11n 40MHz Chain0 5310MHz



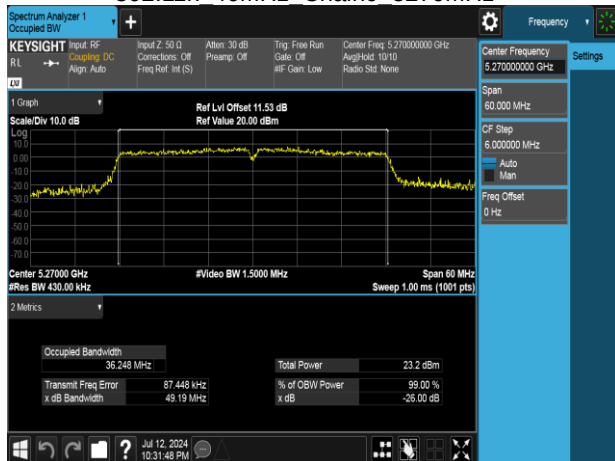
802.11n 40MHz Chain0 5230MHz



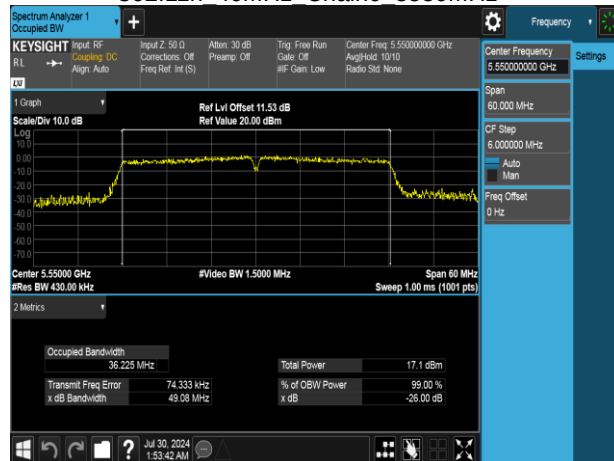
802.11n 40MHz Chain0 5510MHz



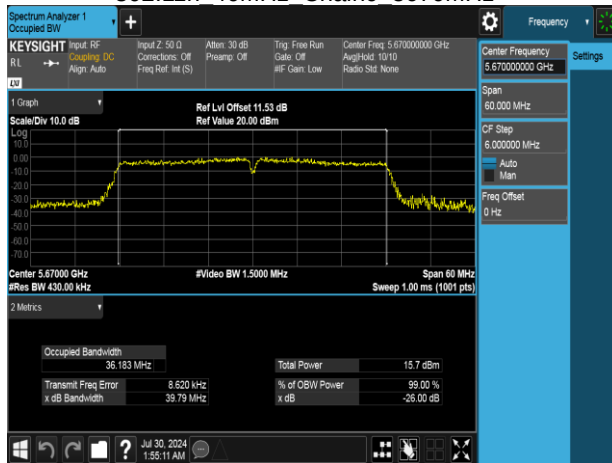
802.11n 40MHz Chain0 5270MHz



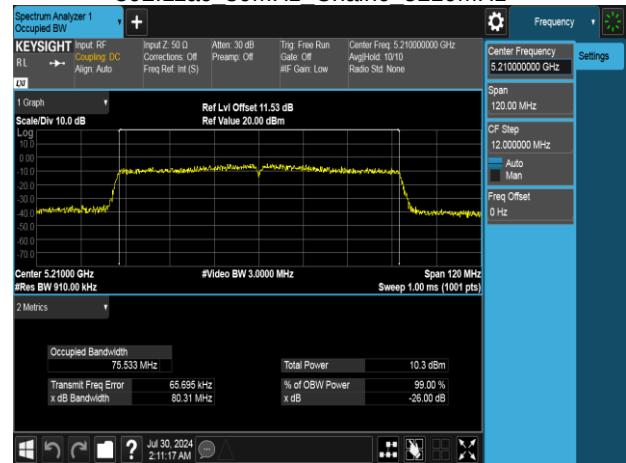
802.11n 40MHz Chain0 5550MHz



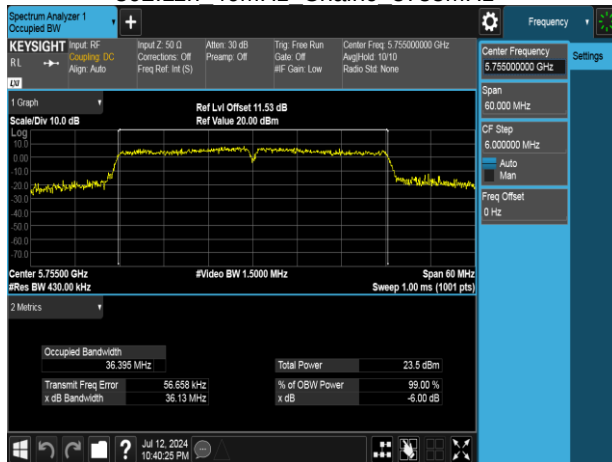
802.11n 40MHz Chain0 5670MHz



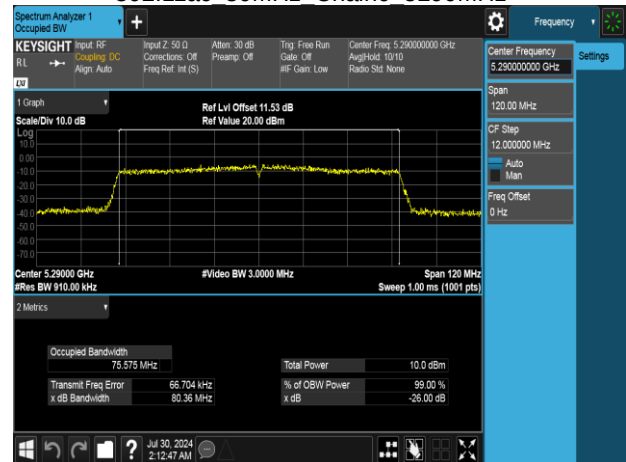
802.11ac 80MHz Chain0 5210MHz



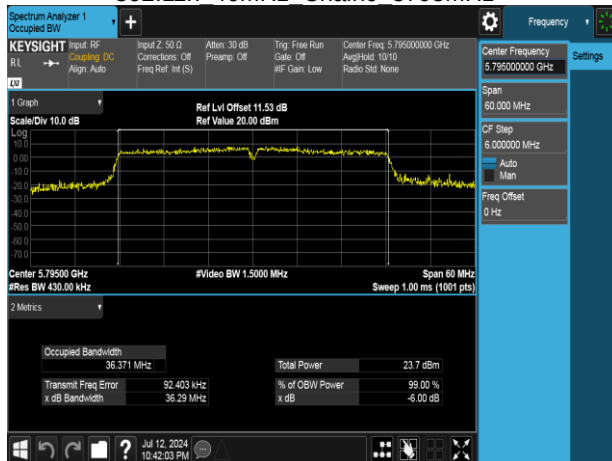
802.11n 40MHz Chain0 5755MHz



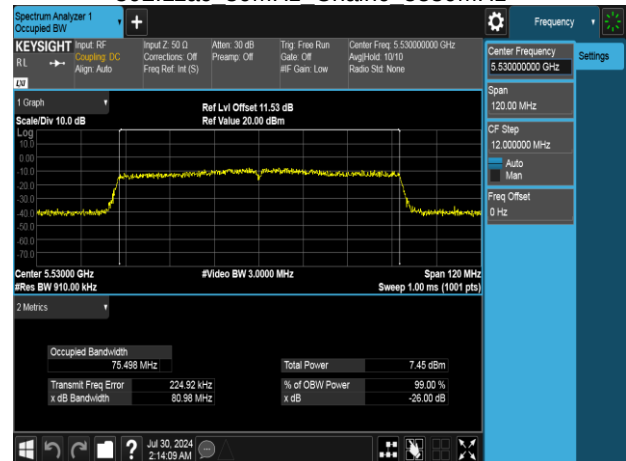
802.11ac 80MHz Chain0 5290MHz



802.11n 40MHz Chain0 5795MHz

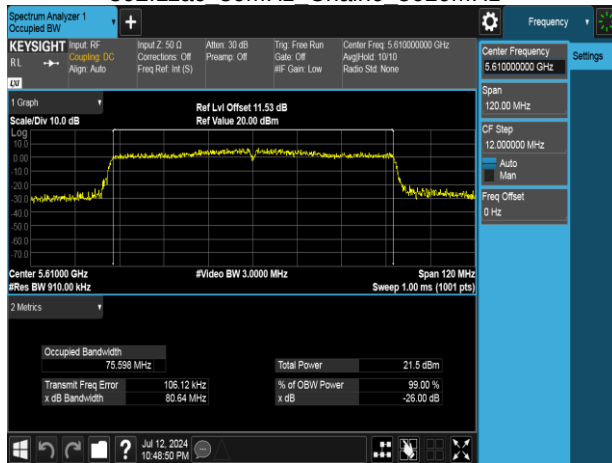


802.11ac 80MHz Chain0 5530MHz

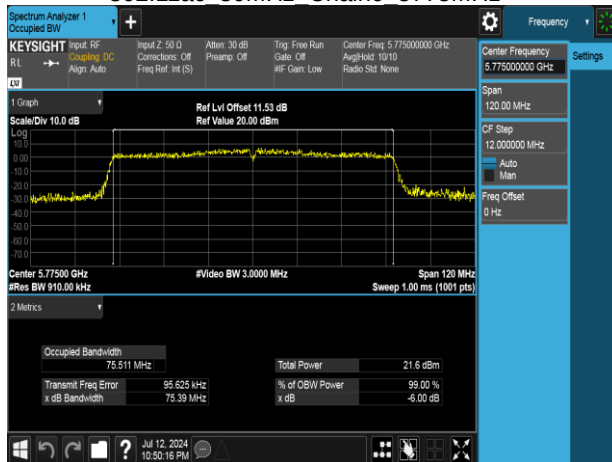


Report No.: TMWK2407002220KR

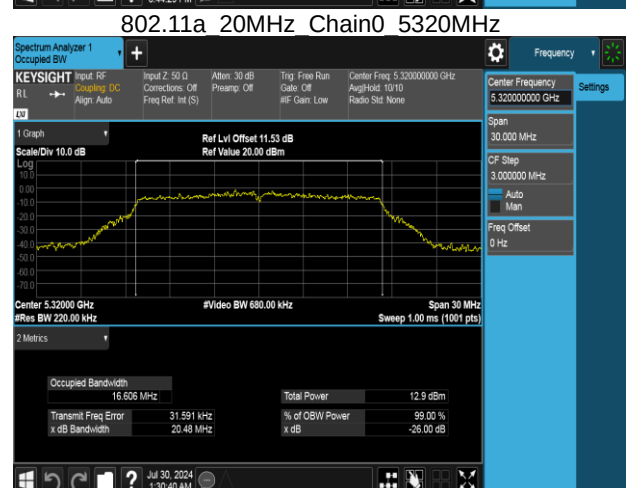
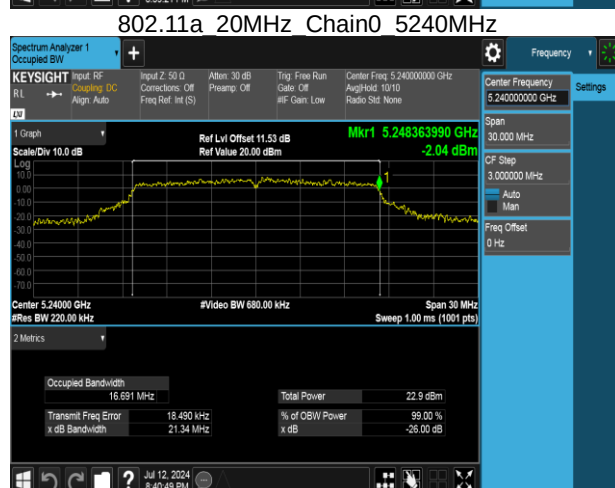
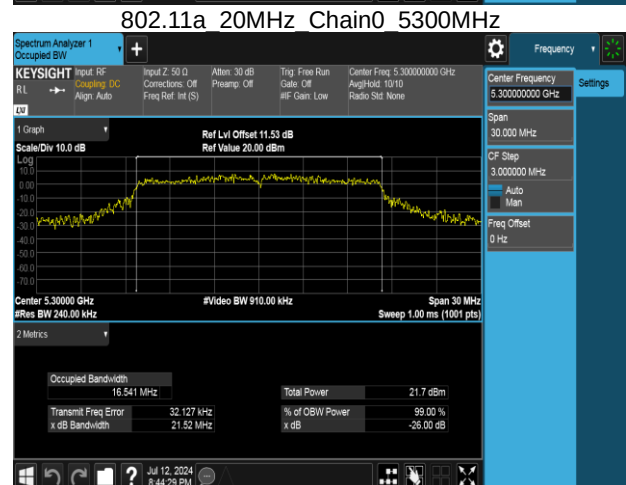
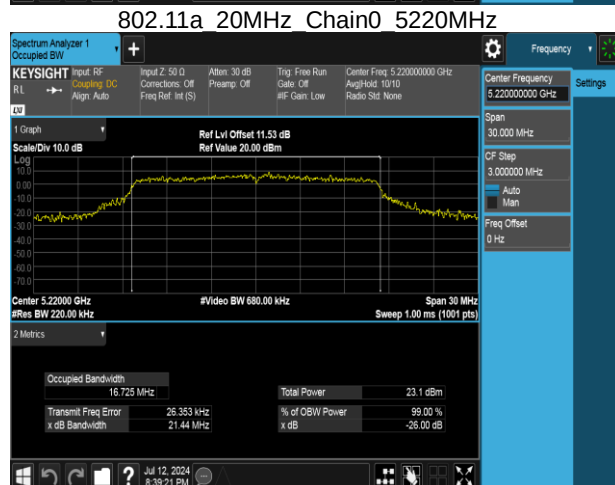
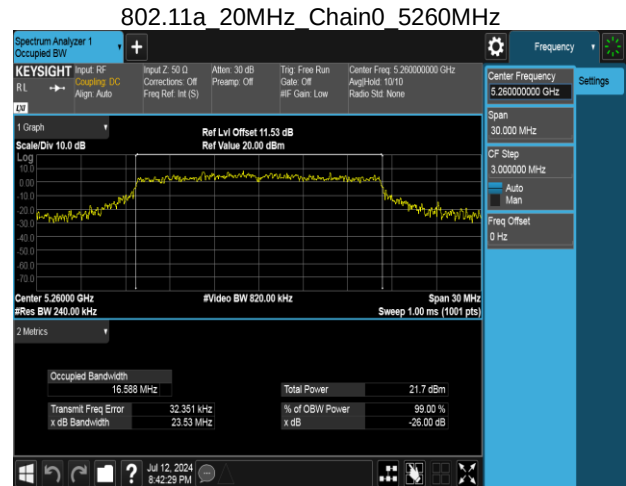
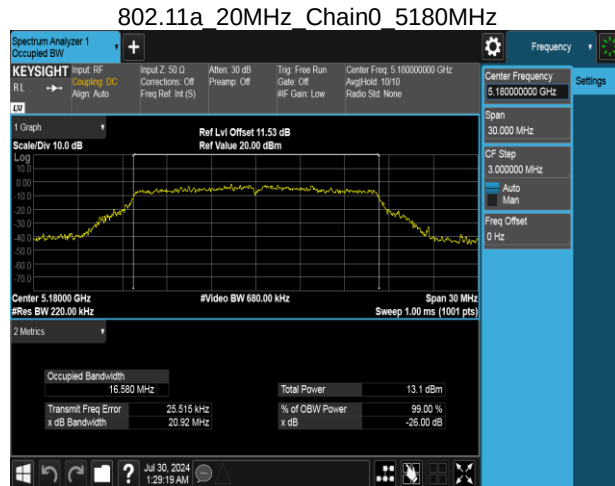
802.11ac 80MHz Chain0 5610MHz



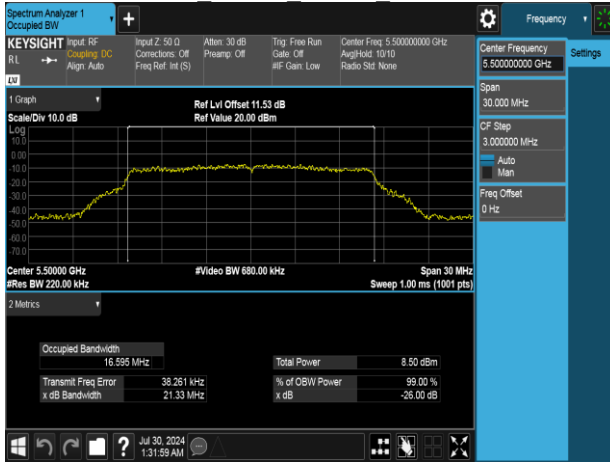
802.11ac 80MHz Chain0 5775MHz



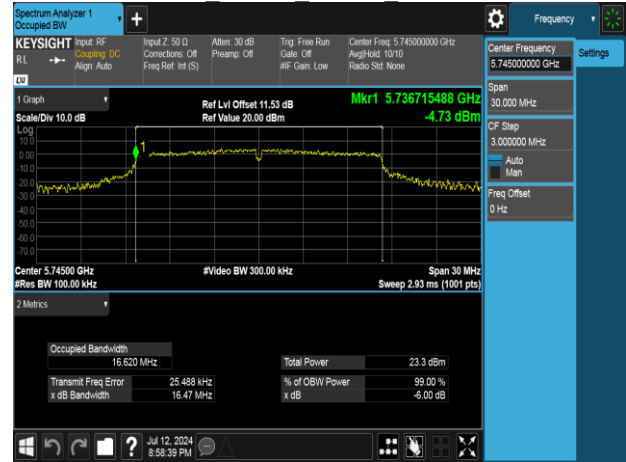
6 dB Bandwidth & 26 dB Bandwidth



802.11a 20MHz Chain0 5500MHz



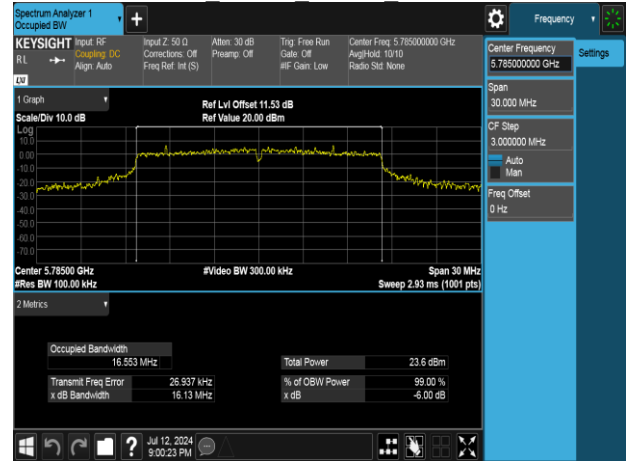
802.11a 20MHz Chain0 5745MHz



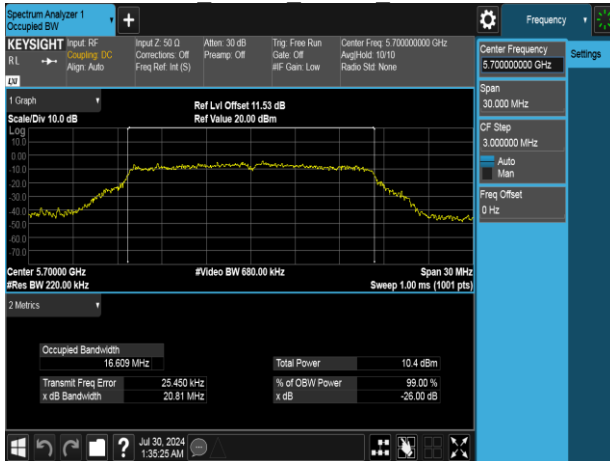
802.11a 20MHz Chain0 5580MHz



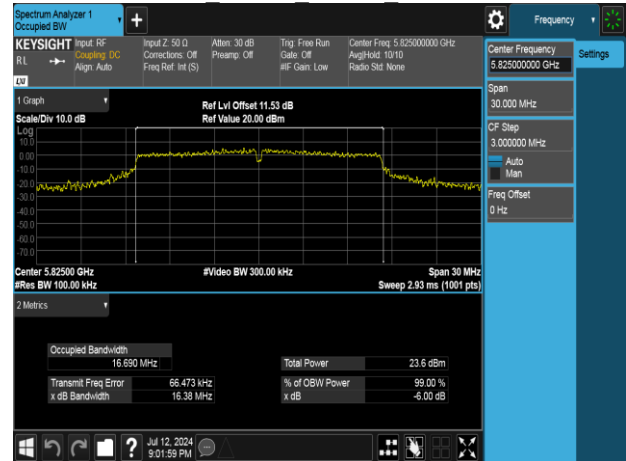
802.11a 20MHz Chain0 5785MHz



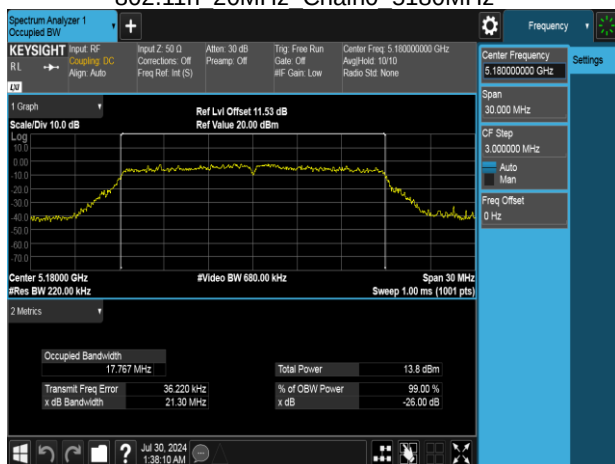
802.11a 20MHz Chain0 5700MHz



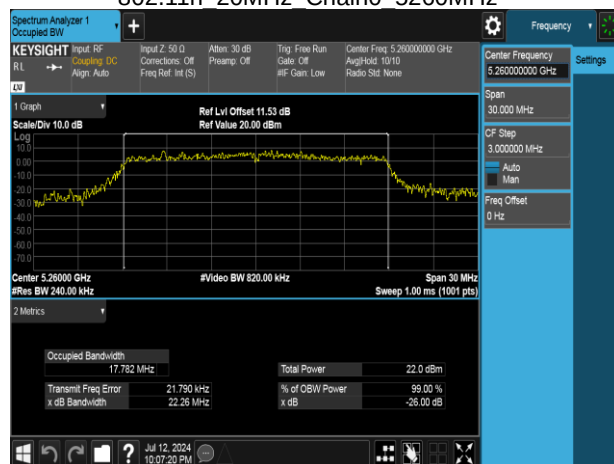
802.11a 20MHz Chain0 5825MHz



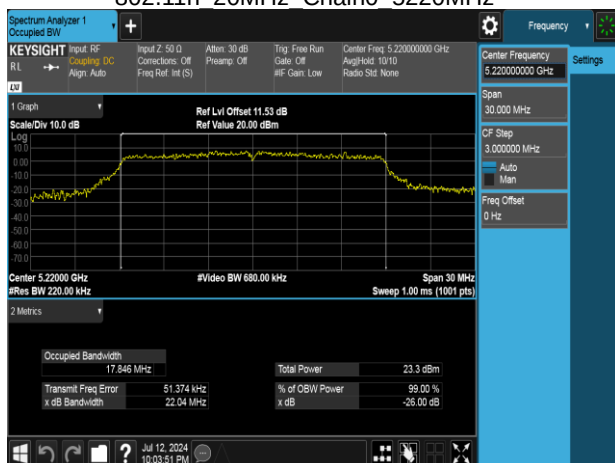
802.11n 20MHz Chain0 5180MHz



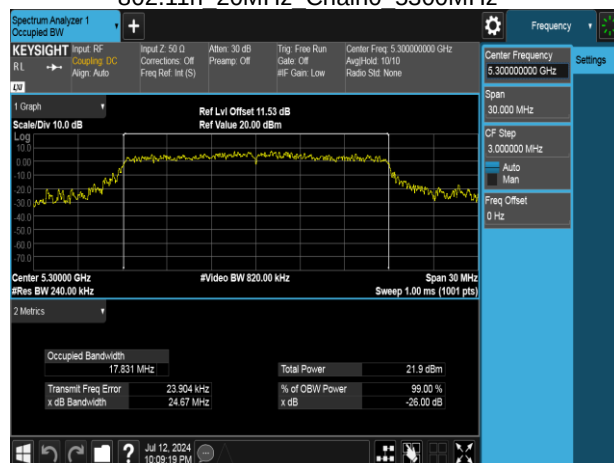
802.11n 20MHz Chain0 5260MHz



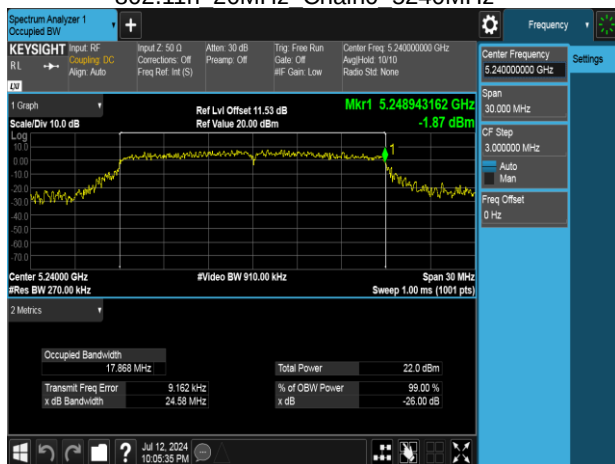
802.11n 20MHz Chain0 5220MHz



802.11n 20MHz Chain0 5300MHz



802.11n 20MHz Chain0 5240MHz



802.11n 20MHz Chain0 5320MHz

