TEST REPORT

Report Number: 14982479-E8V2

Applicant	:	APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A3084 (Parent Model) A3295, A3296, A3297 (Variant Models)
Brand	:	APPLE
FCC ID	:	BCG-E8684A (Parent Model) BCG-E8685A, BCG-E8686A, BCG-E8687A (Variant Models)
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART E

Date Of Issue:
2024/08/05

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
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ACCREDITED
CERT #0751.05

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2024/07/25	Initial Review	Tony Li
V2	2024/08/05	Addressed TCB Feedback on Sections 6 and 9	Tony Li

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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A3084 (Parent Model) A3295, A3296, A3297 (Variant Models)
Brand	APPLE
FCC ID	BCG-E8684A (Parent Model) BCG-E8685A, BCG-E8686A, BCG-E8687A (Variant Models)
EUT Description	SMARTPHONE
Serial Number	LX61C6R73G, DWYRQGJ4X5 CYHJ7CN4HD, H0KPWHK6FX, G2DYLHHKC7
Sample Receipt Date	2024/02/26
Date Tested	2024/04/01 to 2024/07/25
Applicable Standards	CFR 47 Part 15 Subpart E
Test Results	COMPLIES

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Prepared & Reviewed By:
	
Chin Pang Senior Lab Engineer UL Verification Services, Inc.	Tony Li Lead Test Engineer UL Verification Services, Inc.

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2. TEST RESULT SUMMARY

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

Below is a list of the data provided by the customer:

1. Antenna gain and type (see section 6.2)
2. Cable loss (see section 6.2)

FCC Clause	Requirement	Result	Comment
See Comment	Duty Cycle	Reporting purposes only	Per ANSI C63.10, Section 12.2.
See Comment	26dB BW/99% OBW	Reporting purposes only	Per ANSI C63.10 Sections 6.9.2 and 6.9.3
15.407 (e)	6 dB BW	Complies	None.
15.407 (a) (1-4), (h) (1)	Output Power	Complies	None.
15.407 (a) (1-3, 5)	PSD	Complies	None.
15.209, 15.205, 15.407 (b)	Radiated Emissions	Complies	None.
15.207	AC Mains Conducted Emissions	Complies	None.

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with:
- FCC CFR 47 Part 2
- FCC CFR 47 Part 15
- FCC KDB 662911 D01 v02r01
- FCC KDB 789033 D02 v02r01
- ANSI C63.10-2013
- KDB 414788 D01 Radiated Test Site v01r01

4. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA			
☒	Building 3: 843 Auburn Court, Fremont, CA 94538 USA			
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538 USA			
☒	Building 5: 47670 Kato Rd, Fremont, CA 94538 USA			

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U_{LAB}
Conducted Antenna Port Emission Measurement	1.94
Power Spectral Density	2.466
Time Domain Measurements Using SA	3.39
RF Power Measurement Direct Method Using Power Meter	0.450 (Peak), 1.3 (Ave)
Radio Frequency (Spectrum Analyzer)	141.16 Hz
Occupied Bandwidth	1.2%
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.87 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB

Uncertainty figures are valid to a confidence level of 95%.

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5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with cellular GSM, GPRS, EGPRS, WCDMA, LTE, 5GNR1, 5GNR2, IEEE 802.11a/b/g/n/ac/ax/be, Bluetooth (BT), Ultra-Wideband (UWB), Global Positioning System (GPS), Near-Field Communication (NFC), Narrow-Band (NB) UNII, 802.15.4, 802.15.4ab-Narrow Band (NB), Wireless Power Transfer (WPT) and Mobile Satellite Service (MSS) technologies. The rechargeable battery is not user accessible. This device is not user-serviceable and requires special tools to disassemble.

6.2. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna Type is IFA.

The antennas' gains, as provided by the manufacturer, are as follows:

Frequency Range (MHz)	Antenna 6 (dBi)	Antenna 5 (dBi)	Uncorrelated Chains (dBi)	Correlated Chains (dBi)
5150 - 5250 UNII - 1	-0.40	-4.40	-1.95	0.84
5250 - 5350 UNII - 2a	0.00	-3.40	-1.38	1.48
5500 - 5700 UNII - 2c	-0.40	-1.40	-0.87	2.12
5725 - 5825 UNII 3	0.30	-0.40	-0.04	2.97

Frequency Range (MHz)	Cable Loss (dB)	
	Antenna 6	Antenna 5
5150 - 5250 UNII - 1	2.80	3.10
5250 - 5350 UNII - 2a	2.80	3.20
5500 - 5700 UNII - 2c	2.80	3.40
5725 - 5825 UNII 3	3.00	3.40

The cables were used for RF antenna port tests that had been offset to the test equipment during testing.

6.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 27_20_193_15.

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6.4. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5.2 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 1TX			
5180-5240	802.11a	Covered by 802.11n HT20 1TX	
5180-5240	802.11n HT20	19.97	99.31
5190-5230	802.11n HT40	20.96	124.74
5180-5240	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5190-5230	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5210	802.11ac VHT80	16.42	43.85
5250	802.11ac VHT160	14.48	28.05
5180-5240	802.11ax HE20	Covered by 802.11be EHT20 1TX	
5180-5240	802.11be EHT20	19.98	99.54
5190-5230	802.11ax HE40	Covered by 802.11be EHT40 1TX	
5190-5230	802.11be EHT40	20.98	125.31
5210	802.11ax HE80	Covered by 802.11be EHT80 1TX	
5210	802.11be EHT80	17.96	62.52
5250	802.11ax HE160	Covered by 802.11be EHT160 1TX	
5250	802.11be EHT160	17.98	62.81
5.2 GHz band, 2TX			
5180-5240	802.11n HT20 CDD	21.73	148.94
5180-5240	802.11n HT20 SDM/STBC	Covered by 802.11n HT20 2TX CDD	
5190-5230	802.11n HT40 CDD	22.95	197.24
5190-5230	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5180-5240	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5190-5230	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5210	802.11ac VHT80 CDD	18.46	70.15
5210	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5250	802.11ac VHT160 CDD	16.97	49.77
5250	802.11ac VHT160 SDM/STBC	Covered by 802.11ac VHT160 2TX CDD	
5180-5240	802.11ax HE20 OFDMA	Covered by 802.11be EHT20 2TX CDD	
5180-5240	802.11be EHT20 CDD	19.97	99.31
5180-5240	802.11ax HE20 SDM	Covered by 802.11be EHT20 SDM	
5180-5240	802.11be EHT20 SDM	Covered by 802.11be EHT20 2TX CDD	
5190-5230	802.11ax HE40 OFDMA	Covered by 802.11be EHT40 2TX CDD	
5190-5230	802.11be EHT40 CDD	22.91	195.43
5190-5230	802.11ax HE40 SDM	Covered by 802.11be EHT40 SDM	
5190-5230	802.11be EHT40 SDM	Covered by 802.11be EHT40 2TX CDD	
5210	802.11ax HE80 OFDMA	Covered by 802.11be EHT80 2TX CDD	
5210	802.11be EHT80 CDD	19.97	99.31
5210	802.11ax HE80 SDM	Covered by 802.11be EHT80 SDM	
5210	802.11be EHT80 SDM	Covered by 802.11be EHT80 2TX CDD	
5250	802.11ax HE160 OFDMA	Covered by 802.11be EHT160 2TX CDD	
5250	802.11be EHT160 CDD	19.96	99.08
5250	802.11ax HE160 SDM	Covered by 802.11be EHT160 SDM	
5250	802.11be EHT160 SDM	Covered by 802.11be EHT160 2TX CDD	

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5.3 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz band, 1TX			
5260 - 5320	802.11a	Covered by 802.11n HT20 1TX	
5260 - 5320	802.11n HT20	19.97	99.31
5270 - 5310	802.11n HT40	20.93	123.88
5260 - 5320	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5270 - 5310	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5290	802.11ac VHT80	16.94	49.43
5250	802.11ac VHT160	14.48	28.05
5260 - 5320	802.11ax HE20	Covered by 802.11be EHT20 1TX	
5260 - 5320	802.11be EHT20	19.96	99.08
5270 - 5310	802.11ax HE40	Covered by 802.11be EHT40 1TX	
5270 - 5310	802.11be EHT40	20.94	124.17
5290	802.11ax HE80	Covered by 802.11be EHT80 1TX	
5290	802.11be EHT80	17.98	62.81
5250	802.11ax HE160	Covered by 802.11be EHT160 1TX	
5250	802.11be EHT160	17.98	62.81
5.3 GHz band, 2TX			
5260 - 5320	802.11n HT20 CDD	19.97	99.31
5260 - 5320	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5270 - 5310	802.11n HT40 CDD	22.94	196.79
5270 - 5310	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5260 - 5320	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5270 - 5310	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5290	802.11ac VHT80 CDD	19.45	88.10
5290	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5250	802.11ac VHT160 CDD	16.97	49.77
5250	802.11ac VHT160 SDM/STBC	Covered by 802.11ac VHT160 2TX CDD	
5260 - 5320	802.11ax HE20 OFDMA	Covered by 802.11be EHT20 2TX CDD	
5260 - 5320	802.11be EHT20 CDD	19.96	99.08
5260 - 5320	802.11ax HE20 SDM	Covered by 802.11be EHT20 SDM	
5260 - 5320	802.11be EHT20 SDM	Covered by 802.11be EHT20 2TX CDD	
5270 - 5310	802.11ax HE40 OFDMA	Covered by 802.11be EHT40 2TX CDD	
5270 - 5310	802.11be EHT40 CDD	22.95	197.24
5270 - 5310	802.11ax HE40 SDM	Covered by 802.11be EHT40 SDM	
5270 - 5310	802.11be EHT40 SDM	Covered by 802.11be EHT40 2TX CDD	
5290	802.11ax HE80 OFDMA	Covered by 802.11be EHT80 2TX CDD	
5290	802.11be EHT80 CDD	19.96	99.08
5290	802.11ax HE80 SDM	Covered by 802.11be EHT80 SDM	
5290	802.11be EHT80 SDM	Covered by 802.11be EHT80 2TX CDD	
5250	802.11ax HE160 OFDMA	Covered by 802.11be EHT160 2TX CDD	
5250	802.11be EHT160 CDD	19.96	99.08
5250	802.11ax HE160 SDM	Covered by 802.11be EHT160 SDM	
5250	802.11be EHT160 SDM	Covered by 802.11be EHT160 2TX CDD	

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5.6 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 1TX			
5500-5720	802.11a	Covered by 802.11n HT20 1TX	
5500-5720	802.11n HT20	19.96	99.08
5510-5710	802.11n HT40	20.94	124.17
5500-5720	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5510-5710	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5530-5690	802.11ac VHT80	20.98	125.31
5570	802.11ac VHT160	15.43	34.91
5500-5720	802.11ax HE20	Covered by 802.11be EHT20 1TX	
5500-5720	802.11be EHT20	19.98	99.54
5510-5710	802.11ax HE40	Covered by 802.11be EHT40 1TX	
5510-5710	802.11be EHT40	20.97	125.03
5530-5690	802.11ax HE80	Covered by 802.11be EHT80 1TX	
5530-5690	802.11be EHT80	20.96	124.74
5570	802.11ax HE160	Covered by 802.11be EHT160 1TX	
5570	802.11be EHT160	17.96	62.52
5.6 GHz band, 2TX			
5500-5720	802.11n HT20 CDD	19.95	98.86
5500-5720	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5510-5710	802.11n HT40 CDD	22.96	197.70
5510-5710	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5500-5720	802.11ac VHT20 SDM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5510-5710	802.11ac VHT40 SDM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5530-5690	802.11ac VHT80 CDD	22.94	196.79
5530-5690	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5570	802.11ac VHT160 CDD	17.96	62.52
5570	802.11ac VHT160 SDM/STBC	Covered by 802.11ac VHT160 2TX CDD	
5500-5720	802.11ax HE20 OFDMA	Covered by 802.11be EHT20 2TX CDD	
5500-5720	802.11be EHT20 CDD	19.93	98.40
5500-5720	802.11ax HE20 SDM	Covered by 802.11be EHT20 SDM	
5500-5720	802.11be EHT20 SDM	Covered by 802.11be EHT20 2TX CDD	
5510-5710	802.11ax HE40 OFDMA	Covered by 802.11be EHT40 2TX CDD	
5510-5710	802.11be EHT40 CDD	22.96	197.70
5510-5710	802.11ax HE40 SDM	Covered by 802.11be EHT40 SDM	
5510-5710	802.11be EHT40 SDM	Covered by 802.11be EHT40 2TX CDD	
5530-5690	802.11ax HE80 OFDMA	Covered by 802.11be EHT80 2TX CDD	
5530-5690	802.11be EHT80 CDD	22.95	197.24
5530-5690	802.11ax HE80 SDM	Covered by 802.11be EHT80 SDM	
5530-5690	802.11ax HE80 SDM	Covered by 802.11be EHT80 2TX CDD	
5570	802.11ax HE160 OFDMA	Covered by 802.11be EHT160 2TX CDD	
5570	802.11be EHT160 CDD	19.97	99.31
5570	802.11ax HE160 SDM	Covered by 802.11be EHT160 SDM	
5570	802.11be EHT160 SDM	Covered by 802.11be EHT160 2TX CDD	

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5.8 GHz BAND (FCC)

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.8 GHz band, 1TX			
5745-5825	802.11a	Covered by 802.11n HT20 1TX	
5745-5825	802.11n HT20	20.98	125.31
5755-5795	802.11n HT40	20.98	125.31
5745-5825	802.11ac VHT20	Covered by 802.11n HT20 1TX	
5755-5795	802.11ac VHT40	Covered by 802.11n HT40 1TX	
5775	802.11ac VHT80	20.98	125.31
5745-5825	802.11ax HE20	Covered by 802.11be EHT20 1TX	
5745-5825	802.11be EHT20	20.97	125.03
5755-5795	802.11ax HE40	Covered by 802.11be EHT40 1TX	
5755-5795	802.11be EHT40	20.92	123.59
5775	802.11ax HE80	Covered by 802.11be EHT80 1TX	
5775	802.11be EHT80	20.91	123.31
5.8 GHz band, 2TX			
5745-5825	802.11n HT20 CDD	23.94	247.74
5745-5825	802.11n HT20 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5755-5795	802.11n HT40 CDD	23.97	249.46
5755-5795	802.11n HT40 SDM/STBC	Covered by 802.11n HT40 2TX CDD	
5745-5825	802.11ac VHT20 STM/STBC/CDD	Covered by 802.11n HT20 2TX CDD	
5755-5795	802.11ac VHT40 STM/STBC/CDD	Covered by 802.11n HT40 2TX CDD	
5775	802.11ac VHT80 CDD	23.98	250.03
5775	802.11ac VHT80 SDM/STBC	Covered by 802.11ac VHT80 2TX CDD	
5745-5825	802.11ax HE20 OFDMA	Covered by 802.11be EHT20 2TX CDD	
5745-5825	802.11be EHT20 CDD	23.96	248.89
5745-5825	802.11ax HE20 SDM	Covered by 802.11be EHT20 SDM	
5745-5825	802.11be EHT20 SDM	Covered by 802.11be EHT20 2TX CDD	
5755-5795	802.11ax HE40 OFDMA	Covered by 802.11be EHT40 2TX CDD	
5755-5795	802.11be EHT40 CDD	23.98	250.03
5755-5795	802.11ax HE40 SDM	Covered by 802.11be EHT40 SDM	
5755-5795	802.11be EHT40 SDM	Covered by 802.11be EHT40 2TX CDD	
5775	802.11ax HE80 OFDMA	Covered by 802.11be EHT80 2TX CDD	
5775	802.11be EHT80 CDD	23.97	249.46
5775	802.11ax HE80 SDM	Covered by 802.11be EHT80 SDM	
5775	802.11be EHT80 SDM	Covered by 802.11be EHT80 2TX CDD	

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6.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z on ANT 6, ANT 5 and 2TX. It was determined that Y (Landscape) orientation was the worst-case orientation for ANT 6, 2TX, and X (Flatbed) for ANT 5.

802.11n 2TX and 802.11be 2TX modes were used to perform on radiated harmonic spurious final test to cover all SISO modes. Max power was tuned to maximum based on among all the modes. For testing purposes, radiated harmonics spurious below 1GHz, 1-18GHz L/M/H channels, 18-40GHz, and power line conducted emissions were performed with the EUT set at the 2TX CDD mode among the CDD/SDM modes with power setting equal or higher than FCC conducted SISO modes as worst-case scenario.

For Radiated band edge test all test modes have been investigated with power setting equal or higher than FCC conducted SISO modes as worst-case scenario.

Below 1GHz tests were performed with EUT connected to AC power adapter as the worst case; and for above 1GHz, the worst-case configuration reported was tested with EUT only. For AC line conducted emission, test was investigated with AC power adapter and with laptop. There were no emissions found below 30MHz within 20dB of the limit.

Simultaneous transmission with the bluetooth was investigated, and no noticeable emission was found.

With same power on Full RU and SU higher data rate, investigation was performed on both band edge to determine the worst case, and SU mode was determined to be the worst case.

Low data rate was used to test on antenna port conducted tests and radiated spurious emissions since it has the highest maximum power. For radiated band edge, the following are the worst-case data rates set for test:

802.11n HT20 mode : MCS7
802.11n HT40 mode : MCS7
802.11ac VHT80 mode: MCS9
802.11ac VHT160 mode MCS9
802.11be (5.2G & 5.8G bands): EHT20/EHT40/EHT80 Partial Tones and SU mode: MCS11
802.11be (5.3G & 5.6G bands): EHT20/EHT40/EHT80/Partial Tones and SU mode: MCS11.

Note: ANT1 and ANT2 indicated in the test result sections are representative of AN6 and ANT5, respectively.

The modulation and bandwidth of 802.11ax and 802.11be modes are similar at 20 MHz (40 MHz, 80 MHz, 160 MHz), and the target power of 802.11ax mode is equal to or lower than that of 802.11be mode, and the data rate of 802.11be mode is higher than 802.11ax mode, so 802.11be mode is performed in the test to represent worst-case reporting.

The modulation and bandwidth of 802.11a and 802.11n modes are similar at 20 MHz and the target power of 802.11a mode is equal to or lower than that of 802.11n mode. The data rate of 802.11n mode is higher than 802.11a mode, so 802.11n mode is performed in the test to represent worst-case reporting.

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The target power of SDM mode is equal to or lower than that of CDD mode. CDD correlated antenna gain is also worst-case, so CDD mode is performed in the test to represent worst-case reporting.

After the investigation, we found that the worst case of power and PSD modes for full testing as table shown below, in addition we were also spot-check for Full RU and the rest of Partial RU modes on radiated bandedge and radiated spurious emissions.

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WIFI UNII 5G - 802.11be										
BW (MHz)	Tone (T)	RU Index	Worst Case Tone (UNII-1)		Worst Case Tone (UNII-2a)		Worst Case Tone (UNII-2c)		Worst Case Tone (UNII-3)	
			Power	PSD	Power	PSD	Power	PSD	Power	PSD
20	26	0 ~ 8		X						X
	52	37 ~ 40				X		X		
	52 + 26	70 ~ 81								
	106	53 ~ 54								
	106 + 26	82 ~ 89								
	242	61								
	SU	--	X		X		X		X	
40	26	0 ~ 17		X						X
	52	37 ~ 44								
	52 + 26	70 ~ 81								
	106	53 ~ 56				X		X		
	106 + 26	82 ~ 89								
	242	61 ~ 62		X		X				
	484	65								
	SU	--	X		X		X		X	
80	26	0 ~ 36								
	52	37 ~ 52								
	52 + 26	70 ~ 81		X						X
	106	53 ~ 60								
	106 + 26	82 ~ 89								
	242	61 ~ 64		X		X				
	484	65 ~ 66				X		X		
	484 + 242	90 ~ 93								
	996	67								
	SU	--	X		X		X		X	
160	26	0 ~ S36								
	52	37 ~ S52								
	52 + 26	70 ~ S81								
	106	53 ~ S60								
	106 + 26	82 ~ S89								
	242	61 ~ S64		X		X		X		
	484	65 ~ S66								
	484 + 242	90 ~ S93								
	996	67 ~ S67								
	996 + 484	94+sb0=0 95+sb0=0 94+sb0=1 95+sb0=1								
	996 + 484 + 242	96+sb0-0 97+sb0-0 98+sb0-0 99+sb0-0 96+sb0-1 97+sb0-1 98+sb0-1 99+sb0-1								
	996x2	S68								
	SU	--	X		X		X			

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		**Manufacturer**	**Model**	**Serial Number**		**FCC ID/ DoC**
Laptop		Apple	Macbook Pro	C02VD7SAHV22		BCGA1708
Laptop AC/DC adapter		Liteon Technology	A1424	NSW25679		DoC
EUT AC/DC adapter		Apple	A1720	C3D8417A7R93KVPA8		DoC
Conducted Switch Box		UL	n/a	208281		N/A
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	SMA	1	SMA	Shielded	0.75	To spectrum Analyzer
2	Antenna	2	SMA	Un-shielded	0.2	To Conducted Switch Box
3	USB-C	1	USB-C	Shielded	1.0	N/A
4	AC	1	AC	Un-shielded	2	N/A
I/O CABLES (RF RADIATED AND AC LINE CONDUCTED TEST)						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-shielded	2	N/A
2	USB	1	USB	Shielded	1	N/A

TEST SETUP

The EUT setup is shown as below. Test software exercised the radio card.

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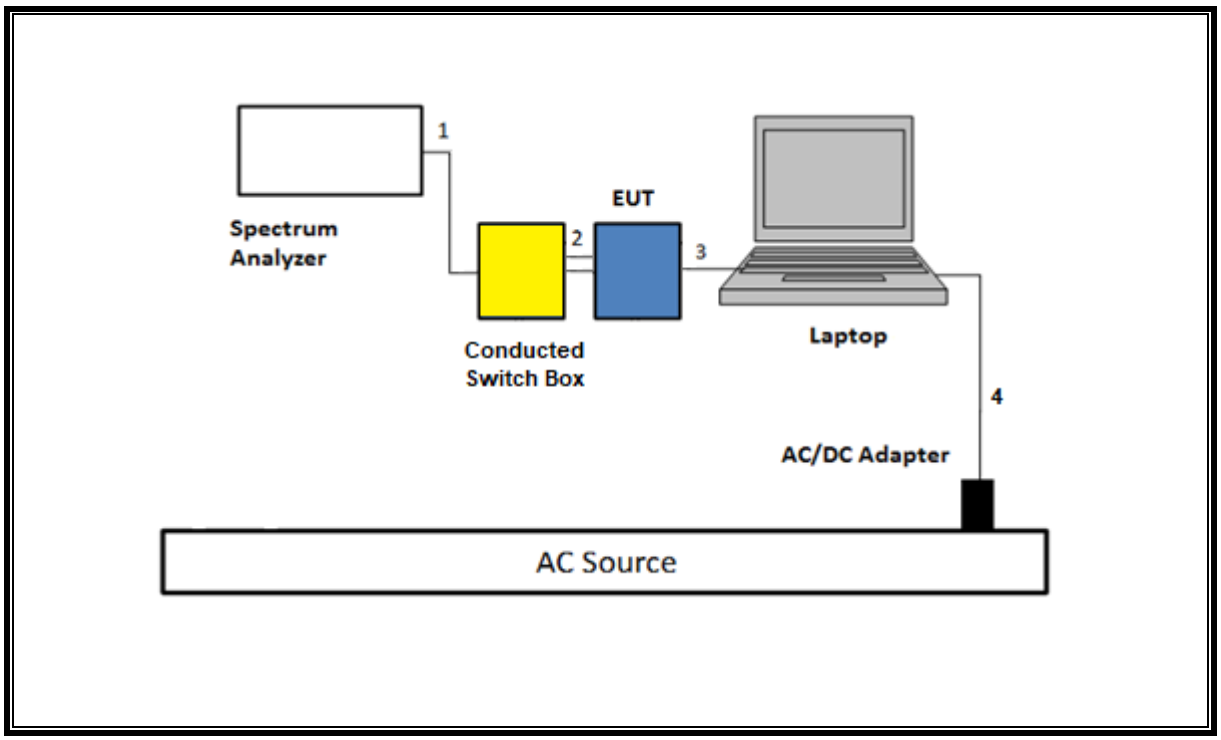
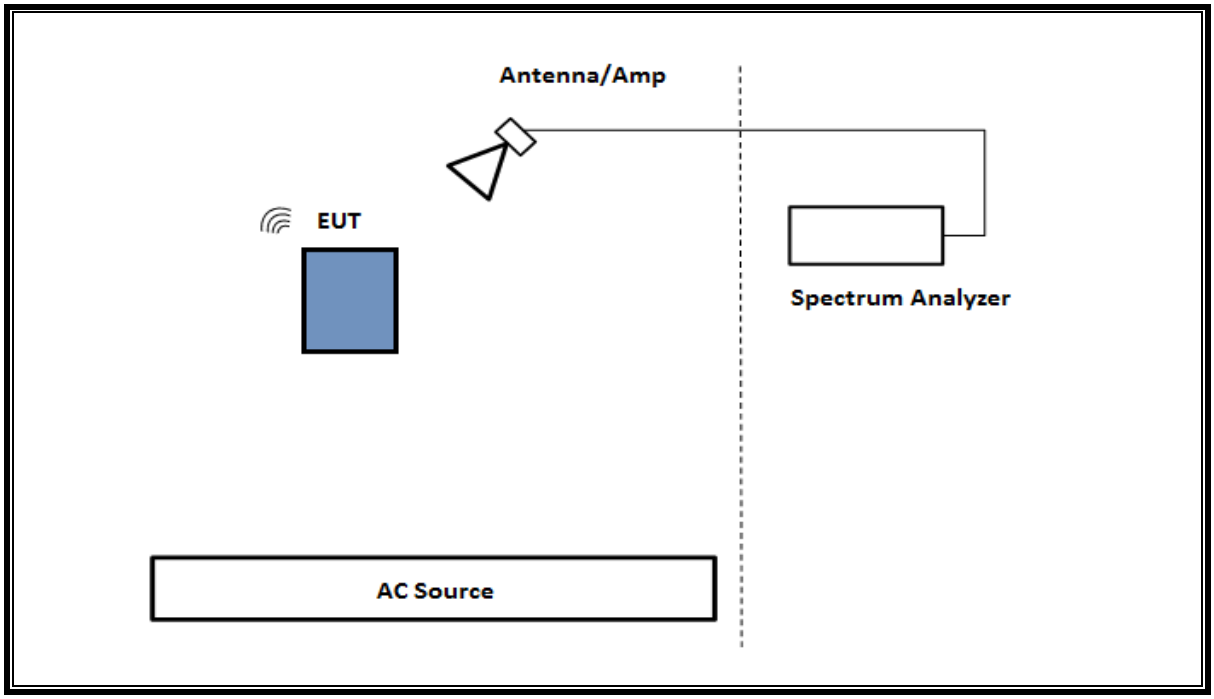
SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS Above 1 GHz (1 to 40GHz)



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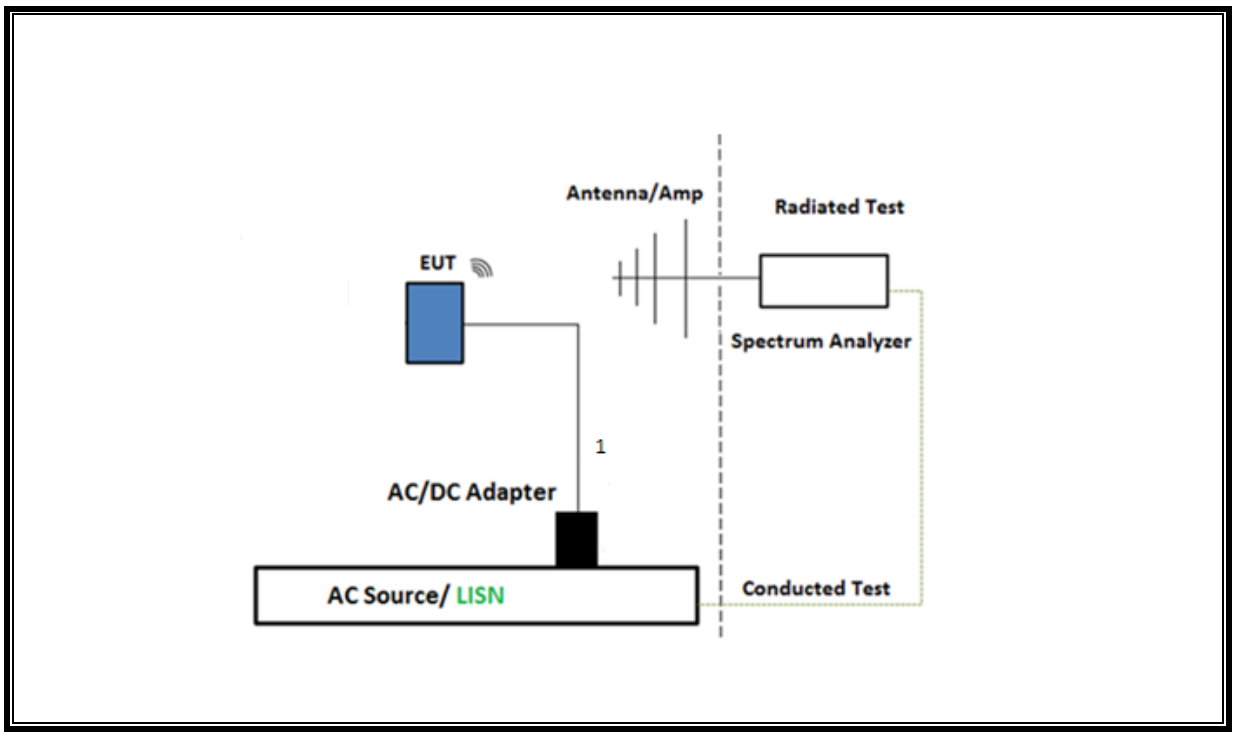
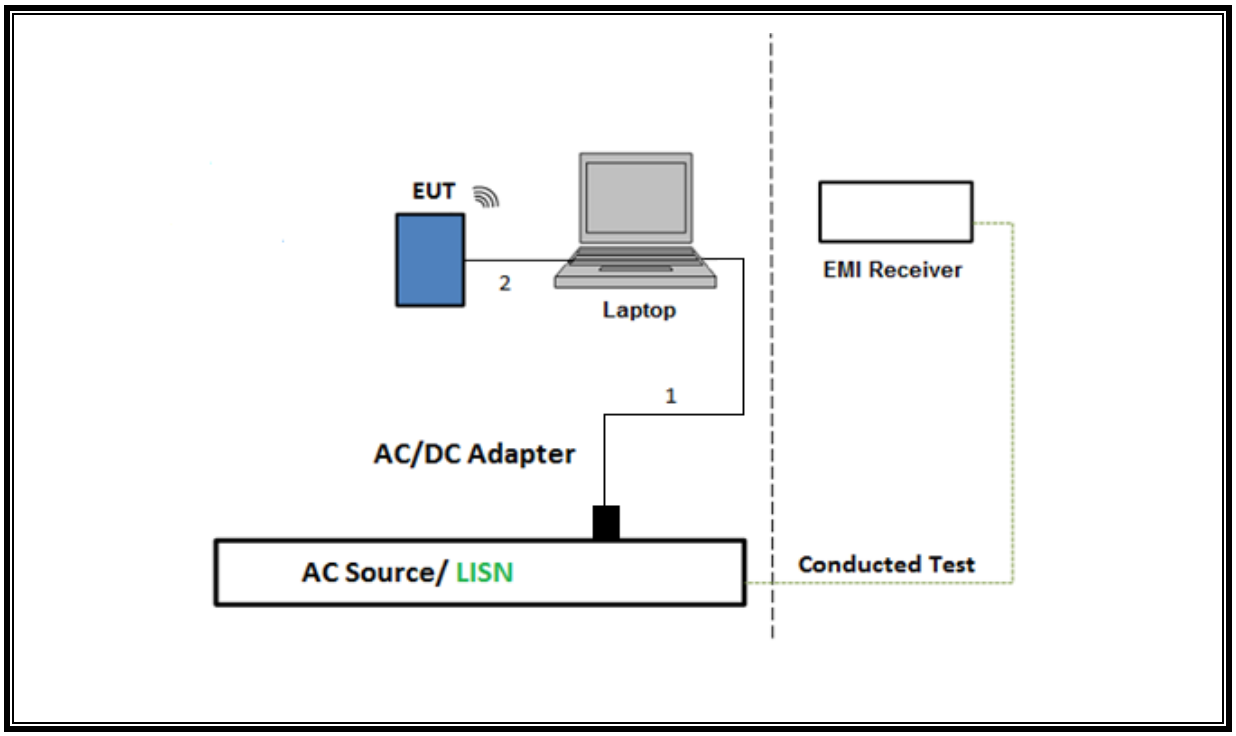
SETUP DIAGRAM FOR Below 1GHz and AC LINE CONDUCTED TEST



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION



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7. MEASUREMENT METHOD

On Time and Duty Cycle: KDB 789033 D02 v02r01, Section B.

6 dB Emission BW: KDB 789033 D02 v02r01, Section C.2

26 dB Emission BW: KDB 789033 D02 v02r01, Section C.1

99% Occupied BW: KDB 789033 D02 v02r01, Section D.

Conducted Output Power: KDB 789033 D02 v02r01

Power Spectral Density: KDB 789033 D02 v02r01, Section F

Unwanted emissions in restricted bands: KDB 789033 D02 v02r01, Sections G.3, G.4, G.5, and G.6.

Unwanted emissions in non-restricted bands: KDB 789033 D02 v02r01, Sections G.3, G.4, and G.5.

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

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8. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:1887

TEST EQUIPMENT LIST8				
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**
*Antenna, Horn 1-18GHz	ETS-Lindgren	3117	81887	2024/06/30
RF Filter Box, 1-18GHz	Miteq	UL-FR1	217521	2024/08/31
EMI Test Receiver	Rohde & Schwarz	ESW44	169936	2025/02/28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	230299	2025/01/31
EMI Test Receiver	Rohde & Schwarz	ESW44	223461	2025/02/28
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	226780	2025/04/30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	200896	2025/02/28
RF Filter Box, 1-18GHz, 12 Ports	UL-FR1	Frankenstein	231874	2024/08/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201501	2024/11/30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	223084	2024/10/31
RF Filter Box, 1-18GHz	UL-FR1	NA	171389	2025/03/31
EMI Test Receiver	Rohde & Schwarz	ESW44	225683	2025/02/28
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226674	2025/02/28
*EMI Test Receiver	Rohde & Schwarz	ESW44	226079	2024/05/01
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	225079	2025/04/30
Antenna, BroadBand Hybrid 30 MHz - 3 GHz	SUNOL SCIENCES CORP.	JB3	230634	2025/01/31
Link File, @3m, 9kHz-1000MHz Hybrid Path Loss	UL-FR1	Port 0 Factors	232001	2025/02/28
*Antenna, Horn 18 to 26.5GHz	A.R.A	MWH-1826/B	172353	2024/06/30
Link File, RF Amplifier Assembly, 18-26.5GHz, 60dB Gain	AMPLICAL	AMP18G26.5-60	171583	2025/03/31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90731	2025/01/31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	80120	2025/01/31
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	90719	2025/01/31
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	90389	2025/01/31
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	80397	2025/01/31
Spectrum Analyzer, PXA, 3Hz to 50GHz w/Ext. Mixer	Keysight Technologies Inc	N9030A	80400	2025/02/02
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight Technologies Inc	N9030A	125178	2025/01/31
*Conducted Switch Box	N/A	CSB	208281	2024/04/30
Conducted Switch Box	N/A	CSB	208281	2025/05/08
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	178557	Verified Before Use
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	178558	Verified Before Use

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TEST EQUIPMENT LIST (cont.)				
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	226673	2025/01/31
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	230547	2025/02/28
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	225474	2025/04/30
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	206807	2025/02/28
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201500	2025/02/28
RF Filter Box, 1-18GHz, 17 Ports	UL-FR1	RATS 2	225575	2025/04/27
Antenna, Horn 26.5 to 40GHz	A.R.A	MWH-2640/B	172346	2025/03/14
*Link File, RF Amplifier Assembly, 26-40GHz, 65dB Gain	AMPLICAL	AMP26G40-65	172367	2024/06/30
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	170063	2024/11/30
Antenna, Passive Loop 30Hz - 1MHz	ELECTRO-METRICS	EM-6871	170014	2024/08/31
Antenna, Passive Loop 100kHz to 30MHz	ELECTRO-METRICS	EM-6872	170016	2024/08/31

AC Line Conducted				
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	93091	2025/02/28
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01-480V	175765	2025/01/31
Transient Limiter	TE	TBFL1	207996	2024/08/31
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, 2023, May 1	
Conducted Software	UL	UL EMC	2020.8.16	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, 2023, Mar 3	

*Testing was completed before calibration due date and/or after calibration was completed.

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

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Mode	Tone (T)	Data Rate (Mbps)	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
HT20	--	MCS0	1.919	1.941	0.9888	98.88%	0.00	0.010
	--	MCS7	0.228	0.249	0.9153	91.53%	0.38	4.386
HT40	--	MCS0	0.944	0.965	0.9782	97.82%	0.10	1.060
	--	MCS7	0.128	0.149	0.8600	86.00%	0.65	7.825
VHT80	--	MCS0	0.390	0.415	0.9398	93.98%	0.27	2.564
	--	MCS9	0.072	0.094	0.7673	76.73%	1.15	13.908
VHT160	--	MCS0	0.252	0.272	0.9255	92.55%	0.34	3.967
	--	MCS11	0.056	0.076	0.7336	73.36%	1.35	17.889
EHT20	SU	MCS0	3.055	3.077	0.9929	99.29%	0.00	0.010
		MCS11	0.161	0.182	0.8835	88.35%	0.54	6.223
	26T	MCS0	3.990	4.031	0.9899	98.99%	0.00	0.010
		MCS11	0.293	0.331	0.8835	88.35%	0.54	3.415
	52T	MCS0	3.820	3.858	0.9902	99.02%	0.00	0.010
		MCS11	0.279	0.317	0.8801	88.01%	0.55	3.584
EHT40	SU	MCS0	1.561	1.583	0.9861	98.61%	0.00	0.010
		MCS11	0.156	0.178	0.8789	87.89%	0.56	6.410
	26T	MCS0	3.961	4.031	0.9827	98.27%	0.00	0.010
		MCS11	0.265	0.331	0.8006	80.06%	0.97	3.774
	106T	MCS0	3.490	3.550	0.9831	98.31%	0.00	0.010
		MCS11	0.262	0.301	0.8704	87.04%	0.60	3.817
	242T	MCS0	3.043	3.064	0.9930	99.30%	0.00	0.010
		MCS11	0.234	0.256	0.9141	91.41%	0.39	4.274
EHT80	SU	MCS0	1.485	1.510	0.9834	98.34%	0.00	0.010
		MCS11	0.154	0.177	0.8701	87.01%	0.60	6.494
	242T	MCS0	3.043	3.065	0.9926	99.26%	0.00	0.010
		MCS11	0.235	0.256	0.9180	91.80%	0.37	4.255
	484T	MCS0	4.008	4.209	0.9522	95.22%	0.21	0.250
		MCS11	0.292	0.314	0.9299	92.99%	0.32	3.425
	MRU52+26T	MCS0	3.779	3.815	0.9904	99.04%	0.00	0.010
		MCS11	0.278	0.316	0.8797	87.97%	0.56	3.597
EHT160	SU	MCS0	0.428	0.449	0.9532	95.32%	0.21	2.339
		MCS11	0.077	0.098	0.7866	78.66%	1.04	12.920
	242T	MCS0	3.044	3.065	0.9930	99.30%	0.00	0.010
		MCS11	0.235	0.257	0.9170	91.70%	0.38	4.250
HT20 SDM	--	MCS0	0.992	1.013	0.9790	97.90%	0.09	1.008
HT40 SDM	--	MCS0	0.500	0.521	0.9587	95.87%	0.18	2.002
VHT80 SDM	--	MCS0	0.256	0.278	0.9205	92.05%	0.36	3.909
VHT160 SDM	--	MCS0	0.152	0.172	0.8794	87.94%	0.56	6.596
EHT20 SDM	SU	MCS0	1.579	1.601	0.9864	98.64%	0.00	0.010
	26T		3.992	4.031	0.9904	99.04%	0.00	0.010
EHT40 SDM	SU	MCS0	0.822	0.844	0.9743	97.43%	0.11	1.216
	26T		3.961	4.031	0.9827	98.27%	0.00	0.010
	242T		3.043	3.081	0.9877	98.77%	0.00	0.010
EHT80 SDM	SU	MCS0	0.430	0.452	0.9507	95.07%	0.22	2.325
	242T		3.043	3.081	0.9877	98.77%	0.00	0.010
	MRU52+26T		3.777	3.815	0.9900	99.00%	0.00	0.010
EHT160 SDM	SU	MCS0	0.251	0.272	0.9231	92.31%	0.35	3.984
	242T		3.041	3.106	0.9792	97.92%	0.09	0.329

Note: There is same duty cycle factor on 1TX and 2TX

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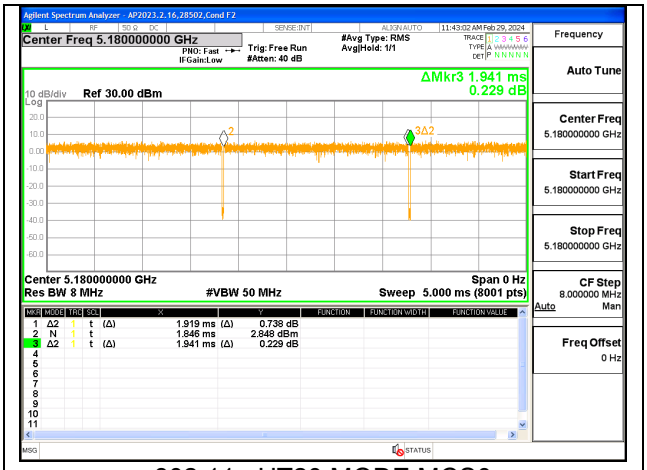
DUTY CYCLE PLOTS



802.11n HT20 MODE MCS0

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9.2. 26 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

ID:	12491	Date:	6/11/2024

9.2.1. 802.11n/ac SISO MODE IN THE UNII-1 BAND

UNII-1 (SISO)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 1	Ant 2	Ant 1	Ant 2
HT20 (FCC)	5180	36	21.31	23.01	17.9050	17.7790
	5200	40	20.75	20.73	17.7770	17.7990
	5240	48	21.06	20.65	17.7970	17.7900
HT40 (FCC)	5190	38	45.10	42.73	36.3400	36.4050
	5230	46	41.19	40.97	36.1790	36.2210
VHT80 (FCC)	5210	42	85.66	82.41	75.7900	75.7550
VHT160 (FCC)	5250 (Straddle)	50	163.10	163.10	154.8600	154.8800

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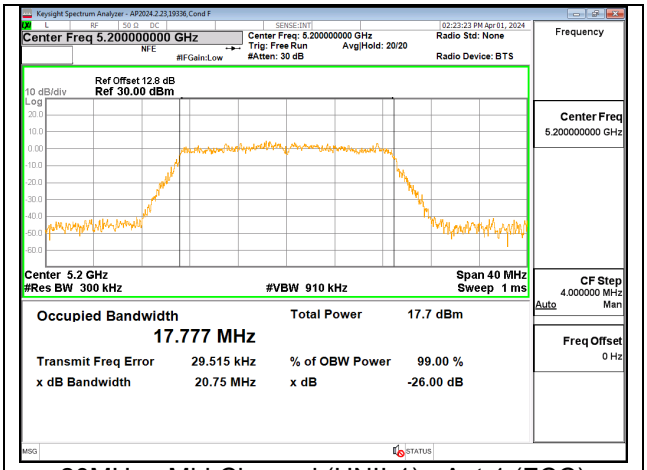

20MHz - Mid Channel (UNII-1) - Ant 1 (FCC)

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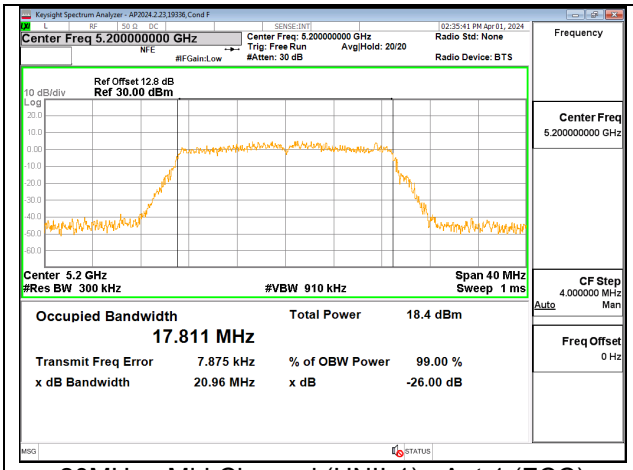
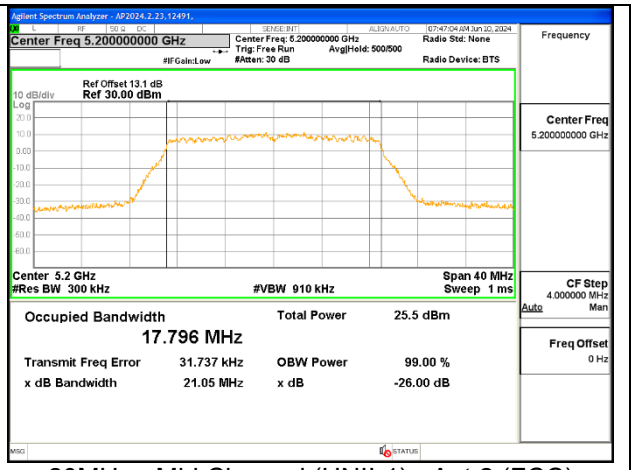
9.2.2. 802.11n/ac MIMO CDD MODE IN THE UNII-1 BAND

UNII-1 (MIMO CDD)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
			Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
HT20 (FCC)	5180	36	21.79	21.62	--	17.7960	17.9570	--
	5200	40	20.96	21.05	--	17.8110	17.7960	--
	5240	48	20.62	21.08	--	17.7480	17.7960	--
HT40 (FCC)	5190	38	42.51	43.75	--	36.4030	36.4230	--
	5230	46	40.83	41.13	--	36.2730	36.3640	--
VHT80 (FCC)	5210	42	89.34	88.04	--	75.8820	75.7350	--
VHT160 (FCC)	5250 (Straddle)	50	163.70	162.30	--	155.0600	154.6900	--



20MHz - Mid Channel (UNII-1) - Ant 1 (FCC)



20MHz - Mid Channel (UNII-1) - Ant 2 (FCC)

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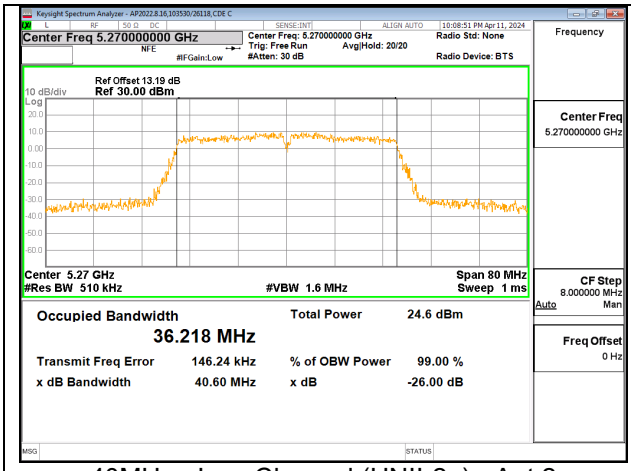
9.2.3. 802.11n/ac SISO MODE IN THE UNII-2A BAND

UNII-2a (SISO)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 1	Ant 2	Ant 1	Ant 2
HT20	5260	52	20.72	20.68	17.7790	17.8140
	5300	60	21.04	20.81	17.7910	17.7820
	5320	64	21.46	21.29	17.8650	17.8860
HT40	5270	54	40.67	40.60	36.2460	36.2180
	5310	62	44.74	42.16	36.3650	36.4140
VHT80	5290	58	82.44	82.79	75.9350	75.8170
VHT160	5250 (Straddle)	50	163.10	163.10	154.8600	154.8800



40MHz - Low Channel (UNII-2a) - Ant 2

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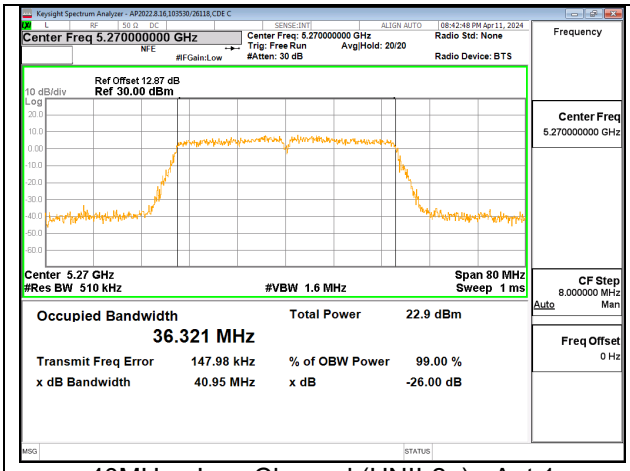
9.2.4. 802.11n/ac MIMO CDD MODE IN THE UNII-2A BAND

UNII-2a (MIMO CDD)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
			Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
HT20	5260	52	21.08	20.57	20.57	17.6870	17.7630	17.6870
	5300	60	20.96	20.70	20.70	17.7390	17.7760	17.7390
	5320	64	21.24	22.73	21.24	17.8330	17.7820	17.7820
HT40	5270	54	40.95	40.07	40.07	36.3210	36.2190	36.2190
	5310	62	43.24	43.71	43.24	36.4290	36.3750	36.3750
VHT80	5290	58	84.27	82.01	82.01	75.7560	75.7900	75.7560
VHT160	5250 (Straddle)	50	163.70	162.30	162.30	155.0600	154.6900	154.6900



40MHz - Low Channel (UNII-2a) - Ant 1

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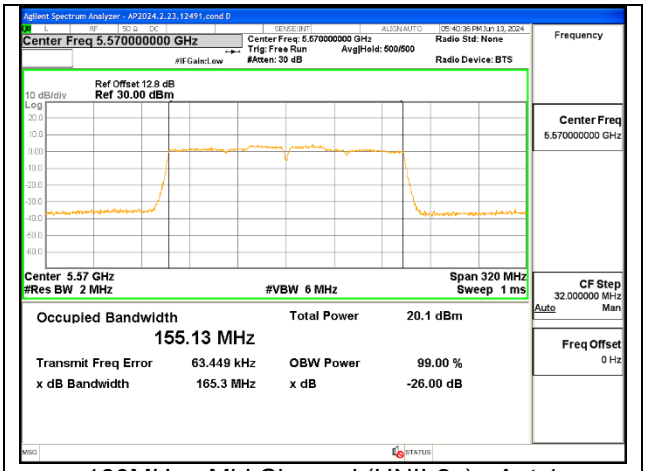
9.2.5. 802.11n/ac SISO MODE IN THE UNII-2C BAND

UNII-2c (SISO)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 1	Ant 2	Ant 1	Ant 2
HT20	5500	100	22.99	21.79	18.0390	18.0560
	5580	116	21.38	21.27	17.9340	17.9440
	5700	140	22.21	22.48	17.9970	18.0060
	5720 (Straddle)	144	21.20	21.29	17.9160	17.9320
HT40	5510	102	45.15	48.77	36.6140	36.6120
	5550	110	41.63	42.15	36.4510	36.4650
	5670	134	46.91	47.49	36.5950	36.7380
	5710 (Straddle)	142	41.34	41.39	36.4620	36.4660
VHT80	5530	106	84.15	84.65	75.8540	75.9530
	5610	122	86.89	87.21	75.9940	76.0010
	5690 (Straddle)	138	81.98	81.20	75.7820	75.6860
VHT160	5570	114	165.30	164.90	155.1300	155.1700



160MHz - Mid Channel (UNII-2c) - Ant 1

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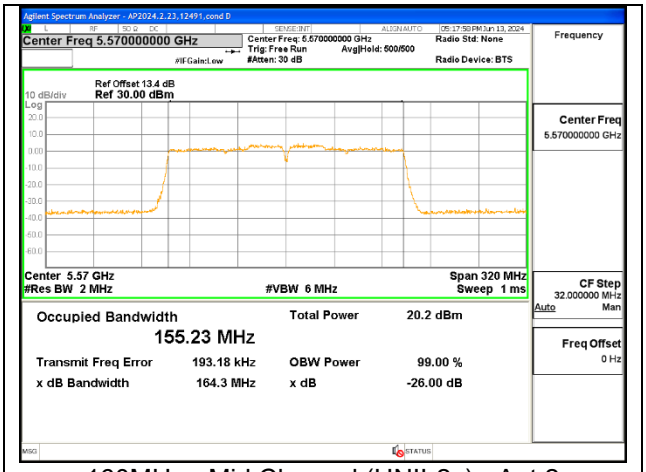
9.2.6. 802.11n/ac MIMO CDD MODE IN THE UNII-2C BAND

UNII-2c (MIMO CDD)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
			Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
HT20	5500	100	21.45	21.57	21.45	18.0220	17.9510	17.9510
	5580	116	21.13	21.03	21.03	17.9180	17.8060	17.8060
	5700	140	23.31	24.26	23.31	18.0270	17.9540	17.9540
	5720 (Straddle)	144	21.17	21.08	21.08	17.8980	17.8040	17.8040
HT40	5510	102	47.33	41.84	41.84	36.6330	36.4620	36.4620
	5550	110	41.58	40.76	40.76	36.4890	36.3540	36.3540
	5670	134	46.28	42.17	42.17	36.6710	36.4510	36.4510
	5710 (Straddle)	142	41.21	40.87	40.87	36.4750	36.3250	36.3250
VHT80	5530	106	84.97	84.68	84.68	75.8280	75.8310	75.8280
	5610	122	98.76	83.63	83.63	75.9530	75.9290	75.9290
	5690 (Straddle)	138	81.70	80.76	80.76	75.8640	75.7100	75.7100
VHT160	5570	114	165.80	164.30	164.30	155.2100	155.2300	155.2100



160MHz - Mid Channel (UNII-2c) - Ant 2

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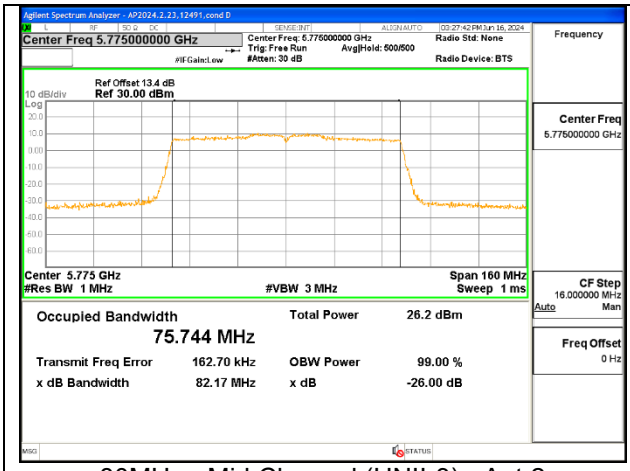
9.2.7. 802.11n/ac SISO MODE IN THE UNII-3 BAND

UNII-3 (SISO)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 1	Ant 2	Ant 1	Ant 2
HT20	5745	149	21.18	21.21	17.9060	17.9070
	5785	157	21.24	21.24	17.9330	17.8860
	5825	165	21.48	21.41	17.9210	17.9190
HT40	5755	151	41.34	41.37	36.4950	36.4560
	5795	159	41.48	41.20	36.4810	36.4660
VHT80	5775	155	81.60	82.17	75.7676	75.7440



80MHz - Mid Channel (UNII-3) - Ant 2

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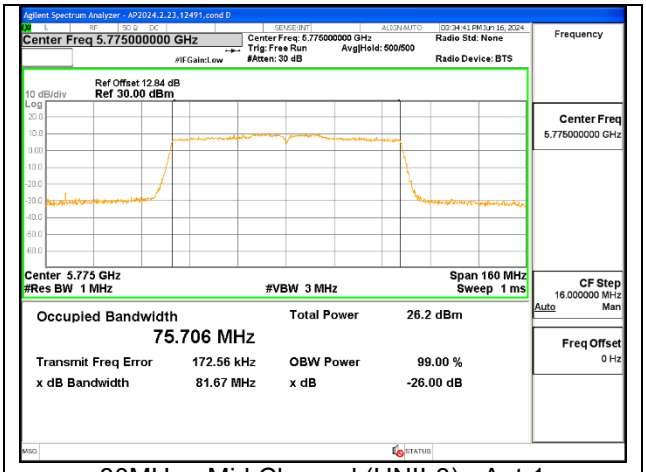
9.2.8. 802.11n/ac MIMO CDD MODE IN THE UNII-3 BAND

UNII-3 (MIMO CDD)	Frequency (MHz)	Channel Number	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
			Ant 1	Ant 2	Ant 1	Ant 2
HT20	5745	149	21.21	20.88	17.9190	17.7840
	5785	157	21.06	21.05	17.8990	17.7790
	5825	165	21.34	20.91	17.9340	17.8160
HT40	5755	151	41.36	40.96	36.4140	36.2680
	5795	159	41.41	40.81	36.4690	36.3500
VHT80	5775	155	81.67	81.36	75.7060	75.7150



80MHz - Mid Channel (UNII-3) - Ant 1

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9.2.9. 802.11be SISO MODE IN THE UNII-1 BAND

UNII-1 (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
EHT20 (FCC)	5180	36	SU	--	23.96	21.51	19.0030	19.0090
			26T	0	19.64	19.63	18.2060	18.3000
				4	18.58	18.42	16.8960	17.0180
				8	20.25	19.94	18.4320	18.0410
	5200	40	SU	--	21.05	20.86	18.7910	18.9430
			26T	0	16.66	19.68	18.1130	18.3610
				4	18.91	18.78	16.9510	17.0450
				8	20.08	19.92	18.3790	18.1320
	5240	48	SU	--	20.77	20.53	18.9710	18.9770
			26T	0	19.55	19.54	18.1250	18.2740
				4	18.04	18.85	16.8420	16.6780
				8	20.08	20.18	18.2290	18.0160
EHT40 (FCC)	5190	38	SU	--	42.93	41.90	37.8790	37.8810
			26T	0	19.33	19.62	18.2920	17.9620
				9	20.47	23.30	19.3220	20.4790
				17	20.04	20.02	17.7620	17.6940
			242T	61	32.14	36.29	19.7890	19.8120
				62	29.42	29.59	19.6970	19.8130
	5230	46	SU	--	41.19	40.78	37.9810	37.8510
			26T	0	19.55	19.42	18.0410	18.0420
				9	22.16	21.20	19.8680	19.3390
				17	20.15	20.32	18.1620	18.2630
			242T	61	29.74	29.52	19.9820	19.7490
				62	36.09	29.82	19.7200	19.5660
EHT80 (FCC)	5210	42	SU	--	82.26	81.82	77.1340	77.2310
			242T	61	27.92	31.01	20.2500	20.5200
				62	35.67	36.32	20.3330	20.1620
				64	30.63	30.55	20.2900	20.2210
			MRU52+26T	71	19.14	18.67	17.0480	17.1940
				74	20.50	20.88	17.5680	17.4980
				80	19.84	20.39	17.4490	16.3330
EHT160 (FCC)	5250 (Straddle)	50	SU	--	165.20	166.50	156.1800	155.9200
			242T	61	29.57	30.51	20.3030	20.7770
				62	47.95	46.46	37.5400	37.4550
				S64	30.71	31.95	20.1460	20.3010

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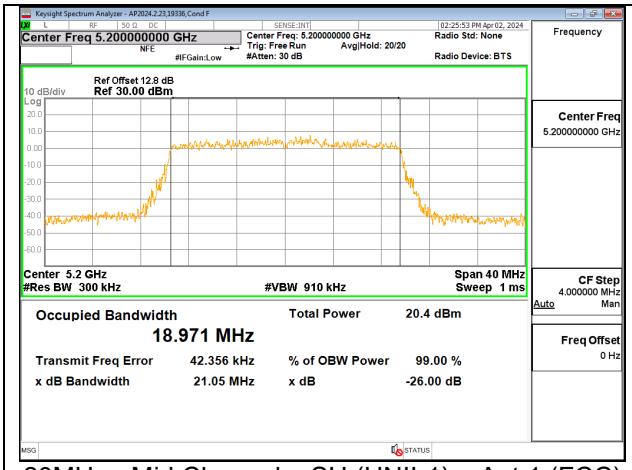
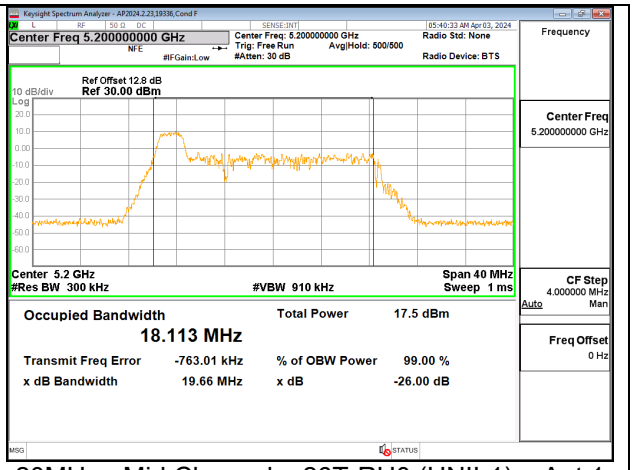


20MHz - Mid Channel – SU (UNII-1) – Ant 1 (FCC)



20MHz - Mid Channel – 26T-RU0 (UNII-1) – Ant 1

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9.2.10. 802.11be MIMO CDD MODE IN THE UNII-1 BAND

UNII-1 (MIMO CDD)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
					Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
EHT20 (FCC)	5180	36	SU	--	22.95	21.74	--	19.0030	19.0150	--
			26T	0	19.68	19.62	--	18.2450	18.0010	--
				4	18.85	18.11	--	16.7790	16.8310	--
				8	20.26	19.74	--	18.4100	18.2900	--
	5200	40	SU	--	20.38	20.84	--	18.9190	18.9870	--
			26T	0	19.48	19.60	--	18.2880	18.0370	--
				4	18.63	18.02	--	17.0090	16.7930	--
				8	19.69	19.44	--	18.4320	18.2430	--
	5240	48	SU	--	20.70	20.90	--	18.9510	18.9670	--
			26T	0	19.75	19.50	--	18.2810	18.2810	--
				4	18.56	18.15	--	16.7310	16.5730	--
				8	19.96	19.60	--	18.3340	18.2340	--
EHT40 (FCC)	5190	38	SU	--	40.78	41.20	--	37.8180	37.8990	--
			26T	0	19.37	19.43	--	18.1410	18.0150	--
				9	22.21	21.21	--	20.3690	20.0260	--
				17	20.19	19.45	--	18.1620	17.9510	--
			242T	61	34.86	26.80	--	19.6330	19.4310	--
				62	29.22	27.68	--	19.5860	19.3630	--
	5230	46	SU	--	40.60	40.40	--	37.7310	37.7690	--
			26T	0	19.49	19.41	--	18.0390	17.8480	--
				9	22.35	22.92	--	20.5080	19.9100	--
				17	20.13	19.48	--	18.2360	18.0410	--
			242T	61	30.22	28.84	--	19.7390	19.3850	--
				62	29.35	27.80	--	19.6950	19.4110	--
EHT80 (FCC)	5210	42	SU	--	83.10	90.97	--	77.2220	77.0100	--
			242T	61	28.27	27.81	--	19.9700	19.7600	--
				62	35.74	32.10	--	20.3430	19.7330	--
				64	29.52	27.16	--	20.0630	19.5710	--
			MRU52+26T	71	18.40	17.68	--	16.8930	16.1530	--
				74	22.55	18.74	--	17.5450	17.2500	--
				80	21.26	20.14	--	17.3860	17.1380	--
EHT160 (FCC)	5250 (Straddle)	50	SU	--	165.90	164.80	--	156.4500	156.0600	--
			242T	61	32.64	29.48	--	20.9130	20.1450	--
				62	47.26	43.80	--	37.6180	36.9810	--
				S64	32.86	27.42	--	20.0230	19.7920	--

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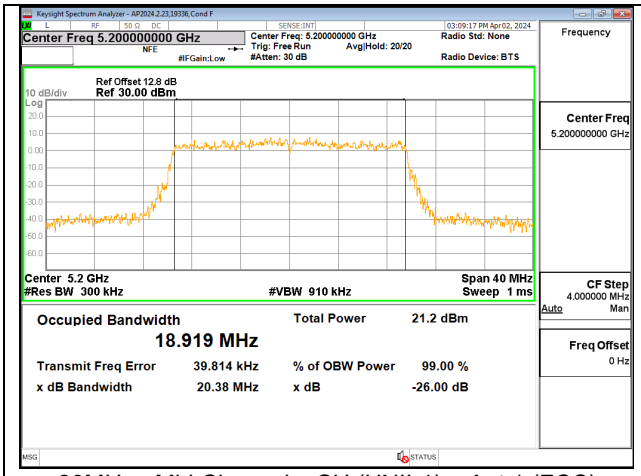
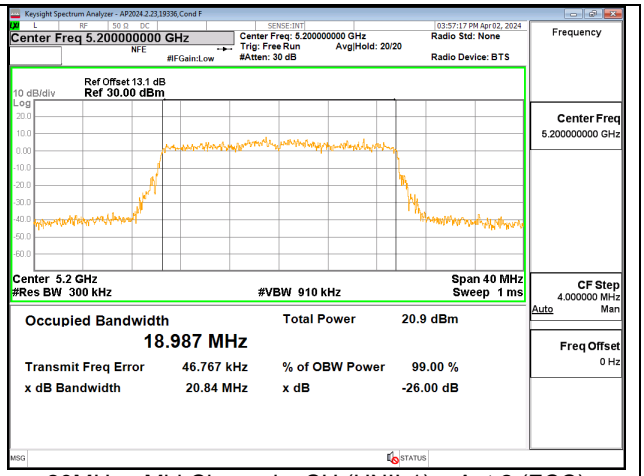
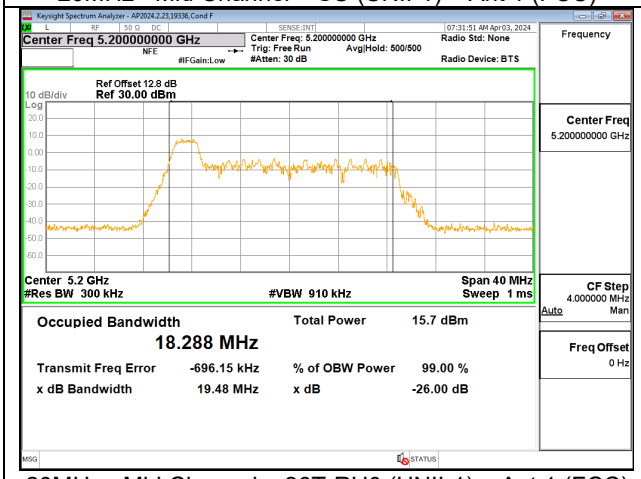


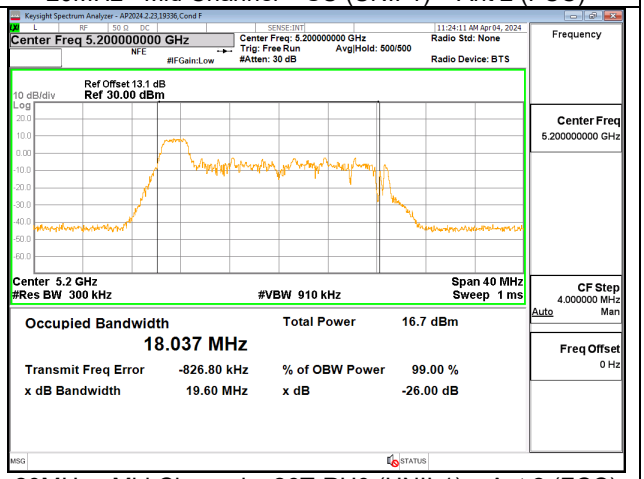
20MHz - Mid Channel – SU (UNII-1) – Ant 1 (FCC)



20MHz - Mid Channel – SU (UNII-1) – Ant 2 (FCC)



20MHz - Mid Channel – 26T-RU0 (UNII-1) – Ant 1 (FCC)



20MHz - Mid Channel – 26T-RU0 (UNII-1) – Ant 2 (FCC)

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9.2.11. 802.11be SISO MODE IN THE UNII-2A BAND

UNII-2a (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
EHT20	5260	52	SU	--	20.78	20.91	19.0110	18.9930
			52T	37	19.81	19.76	18.1880	18.2710
				38	19.28	19.23	17.2100	17.1530
				40	20.57	20.57	18.1450	18.0670
	5300	60	SU	--	20.86	21.06	18.9480	19.0200
			52T	37	19.86	19.82	18.3210	18.3220
				38	18.88	19.04	17.1640	17.0340
				40	20.65	20.39	18.2930	18.2570
	5320	64	SU	--	21.62	20.79	19.0670	18.9930
			52T	37	19.92	19.89	18.2660	18.2000
				38	18.79	19.43	16.9210	17.1570
				40	20.58	20.56	18.2870	18.2560
EHT40	5270	54	SU	--	40.77	40.50	37.8790	37.9380
			106T	53	22.51	19.66	18.1030	17.4960
				54	26.89	25.89	20.2750	19.1810
				56	23.92	23.74	18.3160	17.9150
			242T	61	28.96	31.57	19.4550	19.6430
				62	28.72	31.14	19.3360	19.7440
	5310	62	SU	--	42.29	42.27	37.9180	37.8610
			106T	53	22.45	20.64	18.0290	17.7950
				54	28.68	28.06	19.8830	19.1150
				56	24.87	24.14	18.1210	17.9510
			242T	61	30.49	33.95	19.2950	19.6670
				62	27.73	30.92	19.2760	19.6620
EHT80	5290	58	SU	--	82.55	84.62	77.1220	77.1650
			242T	61	28.15	28.93	20.0680	20.0100
				62	45.98	45.54	37.3180	37.2830
				64	33.54	29.69	20.2230	20.3140
			484T	65	57.82	56.25	38.9300	39.1620
				66	59.56	60.59	39.9770	40.1800
EHT160	5250 (Straddle)	50	SU	--	165.20	166.50	156.1800	155.9200
			242T	61	29.57	30.51	20.3030	20.7770
				62	47.95	46.46	37.5400	37.4550
				S64	30.71	31.95	20.1460	20.3010

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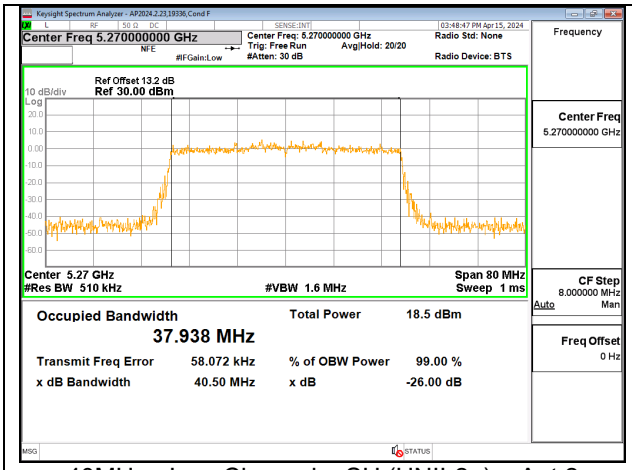
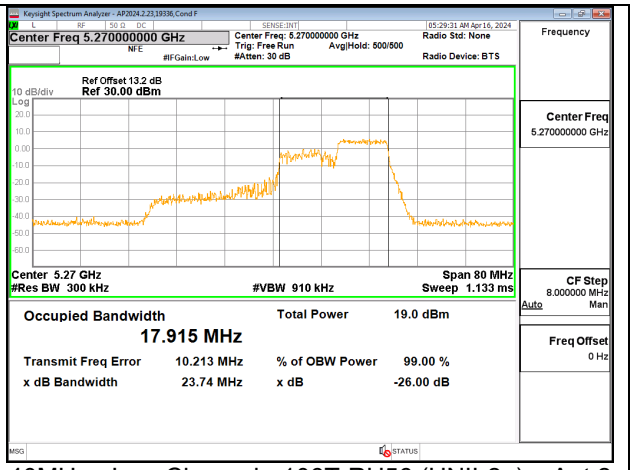
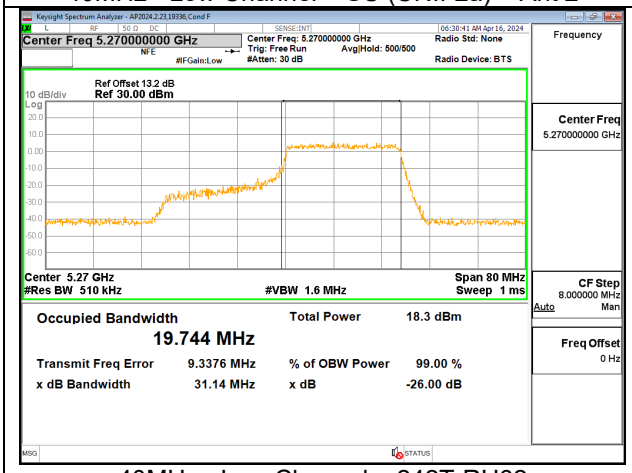


40MHz - Low Channel – SU (UNII-2a) – Ant 2



40MHz - Low Channel - 106T-RU56 (UNII-2a) – Ant 2



40MHz - Low Channel – 242T-RU62 (UNII-2a) – Ant 2

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9.2.12. 802.11be MIMO CDD MODE IN THE UNII-2A BAND

UNII-2a (MIMO CDD)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
					Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
EHT20	5260	52	SU	--	21.03	21.25	21.03	19.0280	18.9990	18.9990
			52T	37	19.94	19.53	19.53	18.2770	18.0840	18.0840
				38	19.46	18.39	18.39	17.1900	16.8870	16.8870
				40	20.52	19.72	19.72	18.3230	18.1330	18.1330
	5300	60	SU	--	21.02	20.95	20.95	18.9780	18.9830	18.9780
			52T	37	19.76	19.68	19.68	18.3330	17.8860	17.8860
				38	19.39	18.44	18.44	17.1530	16.7940	16.7940
				40	20.46	19.83	19.83	18.3010	18.1530	18.1530
	5320	64	SU	--	22.09	21.63	21.63	18.9870	19.0250	18.9870
			52T	37	19.85	19.89	19.85	18.2450	18.1270	18.1270
				38	19.45	18.29	18.29	17.2660	16.8670	16.8670
				40	20.40	19.79	19.79	18.2740	18.0820	18.0820
EHT40	5270	54	SU	--	40.59	41.14	40.59	37.8810	37.8430	37.8430
			106T	53	21.25	19.79	19.79	17.8270	17.9300	17.8270
				54	26.72	23.98	23.98	19.1130	19.7480	19.1130
				56	23.08	20.09	20.09	17.8500	17.5220	17.5220
			242T	61	30.48	30.03	30.03	19.9250	19.6550	19.6550
				62	32.23	30.19	30.19	19.6380	19.7270	19.6380
	5310	62	SU	--	40.64	44.46	40.64	37.8340	37.9200	37.8340
			106T	53	20.70	19.91	19.91	17.7690	17.4820	17.4820
				54	25.87	25.91	25.87	19.1830	19.6140	19.1830
				56	22.64	19.99	19.99	17.9520	17.9410	17.9410
			242T	61	28.69	31.09	28.69	19.6690	19.5320	19.5320
				62	30.71	30.83	30.71	19.8000	19.6760	19.6760
EHT80	5290	58	SU	--	84.38	82.99	82.99	77.2500	77.1370	77.1370
			242T	61	29.49	31.13	29.49	20.4080	19.6180	19.6180
				62	46.38	43.75	43.75	37.1520	37.1220	37.1220
				64	29.79	26.37	26.37	20.5800	19.5240	19.5240
			484T	64	55.21	52.90	52.90	39.2280	38.4880	38.4880
				66	60.35	51.50	51.50	39.7950	38.5190	38.5190
EHT160	5250 (Straddle)	50	SU	--	165.90	164.80	164.80	156.4500	156.0600	156.0600
			242T	61	32.64	29.48	29.48	20.9130	20.1450	20.1450
				62	47.26	43.80	43.80	37.6180	36.9810	36.9810
				S64	32.86	27.42	27.42	20.0230	19.7920	19.7920

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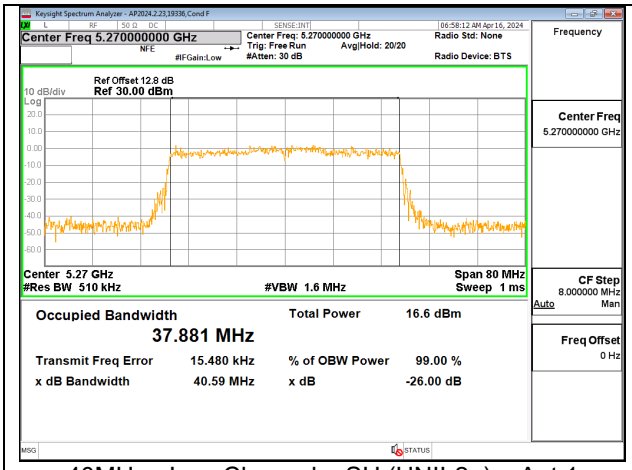
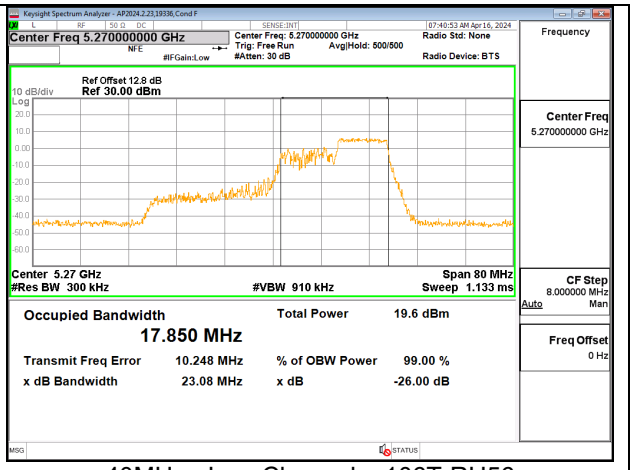
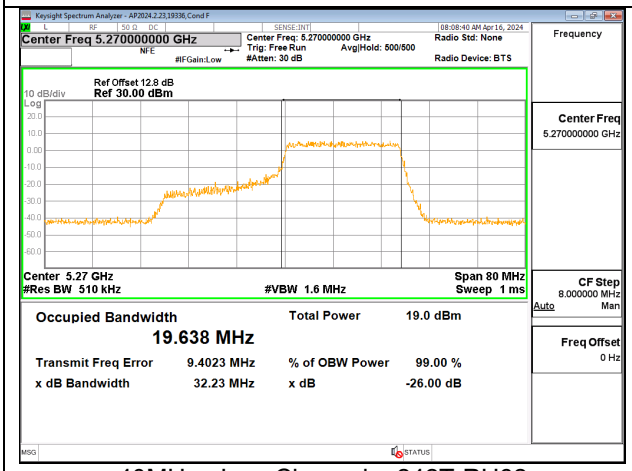


40MHz - Low Channel – SU (UNII-2a) – Ant 1



40MHz - Low Channel – 106T-RU56 (UNII-2a) – Ant 1



40MHz - Low Channel – 242T-RU62 (UNII-2a) – Ant 1

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9.2.13. 802.11be SISO MODE IN THE UNII-2C BAND

UNII-2c (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
EHT20	5500	100	SU	--	21.74	21.52	19.0840	19.0510
			52T	37	19.69	19.99	18.2740	18.1260
				38	18.81	18.97	16.2660	17.1160
				40	20.45	20.58	18.2910	18.3110
	5580	116	SU	--	21.20	20.97	18.9960	18.9970
			52T	37	19.71	19.90	18.2500	18.2820
				38	19.39	19.53	17.0150	17.2350
				40	20.30	20.43	18.2730	18.2360
	5700	140	SU	--	23.03	22.32	19.0280	19.0210
			52T	37	19.82	19.95	18.2050	18.3040
				38	18.98	19.37	17.0820	17.2130
				40	20.52	20.70	18.3790	18.1600
	5720 (Straddle)	144	SU	--	21.01	20.92	18.9450	19.0170
			52T	37	20.09	19.79	18.2130	18.2880
				38	18.92	19.29	17.0900	17.1170
				40	20.37	20.46	18.3450	18.1690
EHT40	5510	102	SU	--	42.08	45.01	37.9330	37.9360
			106T	53	22.13	22.08	18.0700	18.1280
				54	26.50	27.24	20.4090	20.6010
				56	24.79	24.35	18.4040	18.5050
	5550	110	SU	--	41.40	41.03	37.8880	37.8490
			106T	53	22.07	22.60	18.1000	18.0750
				54	26.67	28.05	19.9410	20.4420
				56	24.49	25.08	18.3410	18.4460
	5670	134	SU	--	42.76	45.64	37.9870	37.9250
			106T	53	21.87	22.82	18.0950	18.1310
				54	27.18	27.04	19.4440	20.4580
				56	24.90	24.69	18.3310	18.4000
	5710 (Straddle)	142	SU	--	41.21	41.39	37.8670	37.8790
			106T	53	21.65	22.74	18.0840	18.2140
				54	26.71	28.76	20.1710	20.2520
				56	24.41	24.20	18.2910	18.1380
EHT80	5530	106	SU	--	82.66	82.47	77.1620	77.1810
			484T	65	49.47	51.31	38.4860	38.5520
				66	56.30	54.19	38.7230	38.4120
	5610	122	SU	--	99.49	96.91	77.5080	77.4630
			484T	65	59.17	53.69	38.5330	36.2140
				66	61.85	61.58	39.3930	38.9270
	5690 (Straddle)	138	SU	--	82.54	82.31	77.6030	77.2980
			484T	65	51.62	54.25	38.5350	38.4780
				66	56.52	54.60	38.3480	38.4590
EHT160	5570	106	SU	--	164.50	164.60	156.6000	156.2700
			242T	61	28.13	29.07	19.7080	19.9340
				62	29.51	34.30	20.4830	20.6430
				S64	27.15	29.08	20.1140	19.4900

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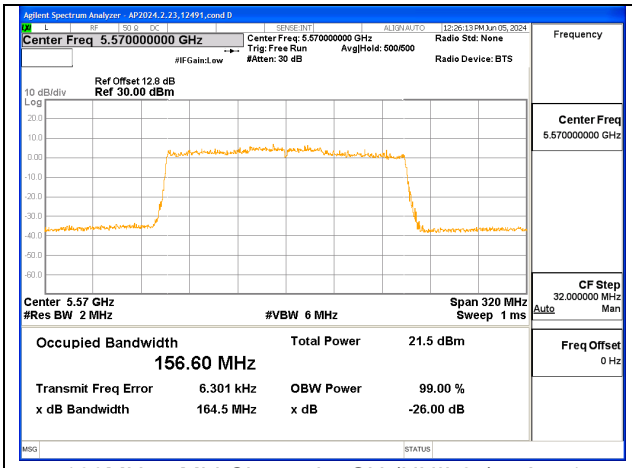
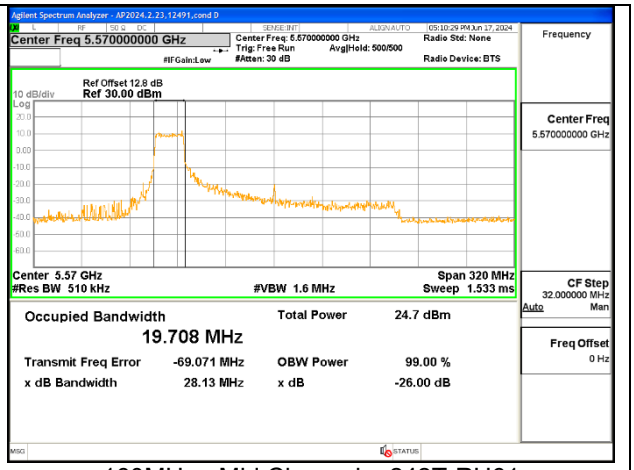


160MHz - Mid Channel – SU (UNII-2c) – Ant 1



160MHz - Mid Channel – 242T-RU61 (UNII-2c) – Ant 1

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9.2.14. 802.11be MIMO CDD MODE IN THE UNII-2C BAND

UNII-2c (MIMO CDD)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
					Ant 1	Ant 2	Min BW	Ant 1	Ant 2	Min BW
EHT20	5500	100	SU	--	21.93	21.84	21.84	19.0390	19.0720	19.0390
			52T	37	19.95	19.69	19.69	18.1620	18.1440	18.1440
				38	19.43	18.34	18.34	17.1560	16.7710	16.7710
				40	20.20	19.61	19.61	18.2630	17.9670	17.9670
	5580	116	SU	--	21.15	21.12	21.12	18.9770	18.9850	18.9770
			52T	37	19.76	19.65	19.65	18.0780	17.9900	17.9900
				38	19.18	18.38	18.38	17.1360	16.7780	16.7780
				40	20.35	19.71	19.71	18.3590	18.1370	18.1370
	5700	140	SU	--	23.54	23.69	23.54	19.0290	19.1100	19.0290
			52T	37	19.80	19.94	19.80	18.2190	18.1310	18.1310
				38	19.39	18.24	18.24	17.1910	16.7970	16.7970
				40	20.62	19.66	19.66	18.1910	17.9860	17.9860
	5720 (Straddle)	144	SU	--	21.36	21.28	21.28	18.9700	19.0190	18.9700
			52T	37	19.93	19.83	19.83	18.2790	18.1250	18.1250
				38	19.47	18.09	18.09	17.1900	16.9000	16.9000
				40	20.47	19.80	19.80	18.2460	18.0370	18.0370
EHT40	5510	102	SU	--	42.45	42.77	42.45	37.9060	37.8840	37.8840
			106T	53	22.49	19.95	19.95	18.2260	17.8860	17.8860
				54	27.06	24.84	24.84	20.0620	19.6540	19.6540
				56	24.19	20.38	20.38	18.3710	17.8570	17.8570
	5550	110	SU	--	41.33	41.03	41.03	37.8710	37.8490	37.8490
			106T	53	21.46	19.87	19.87	18.1090	17.9300	17.9300
				54	25.95	25.95	25.95	20.0770	19.6210	19.6210
				56	24.72	19.96	19.96	18.2430	17.8870	17.8870
	5670	134	SU	--	43.52	40.24	40.24	37.9280	37.9250	37.9250
			106T	53	21.79	19.73	19.73	18.0410	17.7910	17.7910
				54	27.97	25.80	25.80	20.5960	19.4240	19.4240
				56	23.92	20.27	20.27	18.5460	17.8860	17.8860
	5710 (Straddle)	142	SU	--	41.24	41.18	41.18	37.8690	37.8730	37.8690
			106T	53	22.31	20.00	20.00	18.2010	17.9310	17.9310
				54	27.92	23.98	23.98	20.1680	19.2540	19.2540
				56	24.48	20.13	20.13	18.3840	17.9120	17.9120
EHT80	5530	106	SU	--	83.32	83.19	83.19	77.1450	77.1430	77.1430
			484T	65	47.82	48.87	47.82	38.3560	38.2710	38.2710
				66	59.43	52.66	52.66	38.5870	38.2000	38.2000
	5610	122	SU	--	86.24	88.74	86.24	77.3950	77.4380	77.3950
			484T	65	48.94	45.27	45.27	38.4140	38.3320	38.3320
				66	56.67	58.02	56.67	39.0830	38.5240	38.5240
	5690 (Straddle)	138	SU	--	82.27	81.59	81.59	77.2590	77.3180	77.2590
			484T	65	50.28	48.45	48.45	38.4910	38.3350	38.3350
				66	54.59	52.22	52.22	38.3690	38.2460	38.2460
EHT160	5570	106	SU	--	164.2	165.3	164.2	156.3900	156.4100	156.3900
			242T	61	27.28	28.86	27.28	20.0650	19.6170	19.6170
				62	34.00	30.45	30.45	20.5380	20.0010	20.0010
				S64	28.07	26.56	26.56	20.1560	19.7260	19.7260

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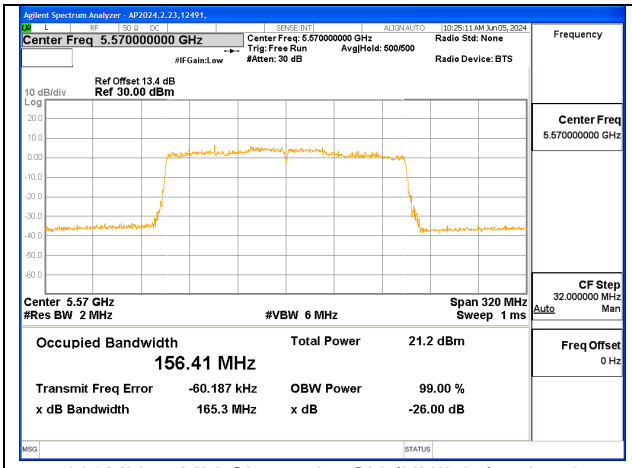
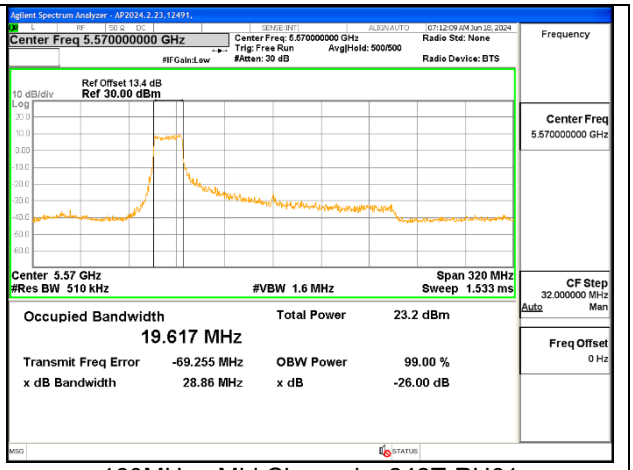


160MHz - Mid Channel – SU (UNII-2c) – Ant 2



160MHz - Mid Channel – 242T-RU61 (UNII-2c) – Ant 2

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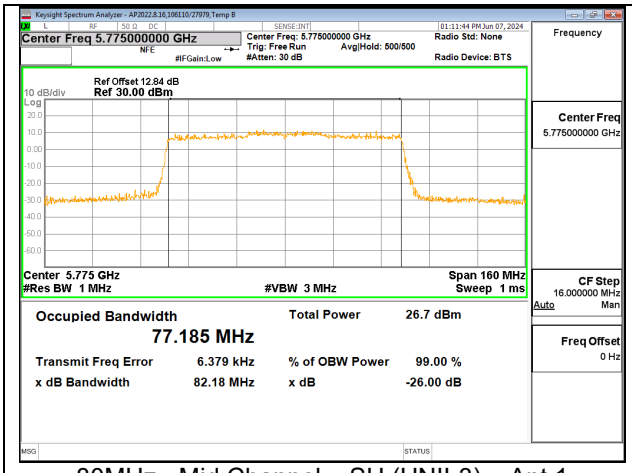
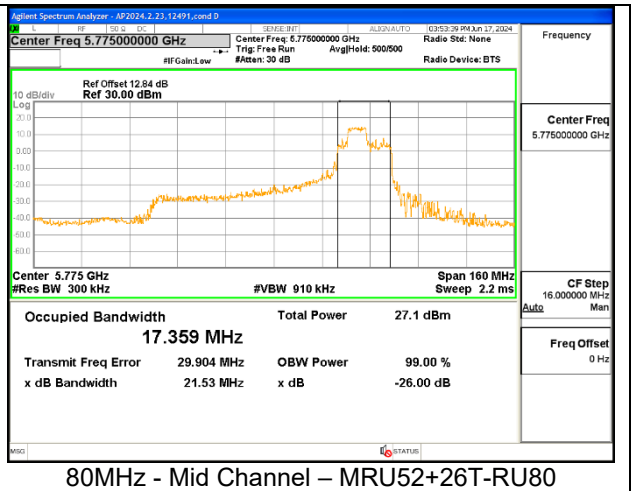
9.2.15. 802.11be SISO MODE IN THE UNII-3 BAND

UNII-3 (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
EHT20	5745	149	SU	--	21.20	21.32	18.9830	18.9860
			26T	0	19.71	19.63	18.3010	18.2810
				4	18.67	18.32	17.0850	16.7460
				8	20.16	19.80	18.4600	18.3080
	5785	157	SU	--	21.27	21.32	19.0000	18.9720
			26T	0	19.67	19.73	18.3980	18.3230
				4	18.63	18.03	17.0390	16.0570
				8	19.88	20.21	18.4130	18.3580
	5825	165	SU	--	21.30	21.11	19.0060	18.9660
			26T	0	19.45	19.65	18.3090	18.2750
				4	18.75	18.59	17.1450	16.9440
				8	20.15	18.73	18.3910	16.8930
EHT40	5755	151	SU	--	41.32	54.95	37.8740	38.1100
			26T	0	19.70	19.80	18.2450	18.2350
				9	22.42	23.42	21.1590	21.2460
				17	20.72	20.85	18.4930	17.7780
	5795	159	SU	--	41.27	42.52	37.8740	38.1690
			26T	0	19.67	18.63	18.2390	17.2700
				9	22.54	23.42	20.9920	20.7390
				17	19.89	20.79	18.3570	18.4840
EHT80	5775	155	SU	--	82.18	81.65	77.1850	77.1940
			MRU52+26T	71	19.09	19.01	17.2060	17.2650
				74	23.06	21.96	17.5510	17.5520
				80	21.53	20.36	17.3590	17.5010



80MHz - Mid Channel – SU (UNII-3) – Ant 1



80MHz - Mid Channel – MRU52+26T-RU80 (UNII-3) – Ant 1

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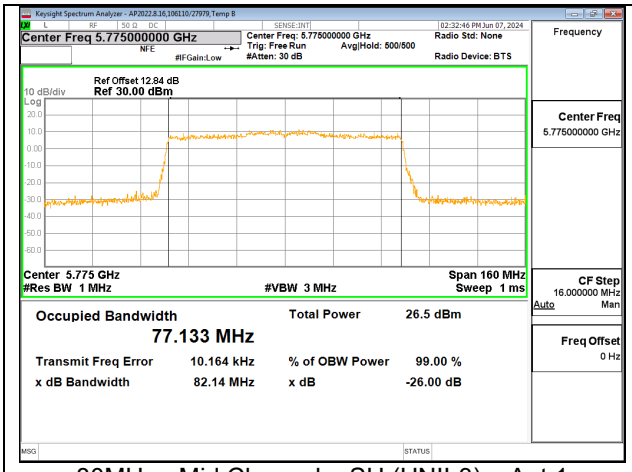
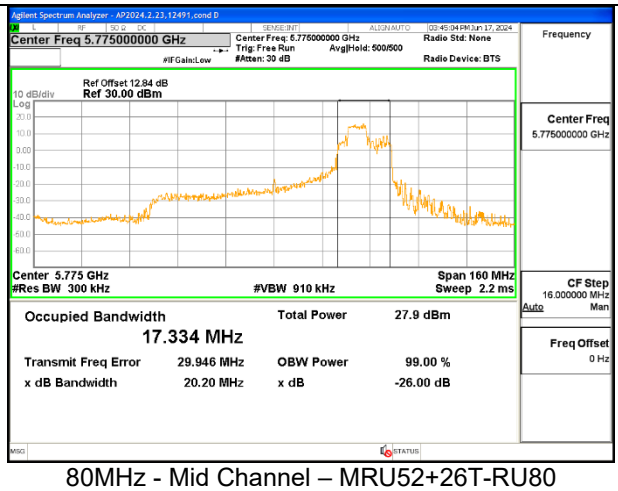
9.2.16. 802.11be MIMO CDD MODE IN THE UNII-3 BAND

UNII-3 (MIMO CDD)	Frequency (MHz)	Channel Number	Tone	RU Index	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
EHT20	5745	149	SU	--	21.38	21.18	19.1100	18.9950
			26T	0	19.65	19.59	18.3970	18.2910
				4	18.81	18.32	17.0280	16.8860
				8	20.18	19.68	18.4200	18.0370
	5785	157	SU	--	21.33	21.23	18.9850	18.9599
			26T	0	19.62	19.52	18.3860	18.2360
				4	18.81	18.05	17.1360	16.8700
				8	20.09	19.72	18.4490	17.7320
	5825	165	SU	--	21.32	20.84	19.0310	18.9990
			26T	0	19.64	19.65	18.3560	18.3610
				4	18.75	18.07	17.1570	16.8450
				8	20.24	19.52	18.4590	18.2440
EHT40	5755	151	SU	--	41.25	41.04	37.9550	37.8880
			26T	0	19.74	19.78	18.3490	18.1230
				9	22.63	21.65	21.0430	20.8860
				17	20.87	19.50	18.5230	17.5670
	5795	159	SU	--	41.15	44.76	37.8700	38.1630
			26T	0	19.95	19.64	18.3180	18.0160
				9	23.24	24.16	21.2570	20.8210
				17	20.64	19.61	18.3410	18.0650
EHT80	5775	155	SU	--	82.14	80.93	77.1330	77.0230
			MRU52+26T	71	18.36	18.47	17.2390	17.0000
				74	19.71	18.84	17.4440	17.1970
				80	20.20	18.74	17.3340	17.1110



80MHz - Mid Channel – SU (UNII-3) – Ant 1



80MHz - Mid Channel – MRU52+26T-RU80 (UNII-3) – Ant 1

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9.3. BANDWIDTH VERIFICATION OF CHANNEL PUNCTURING IN THE DFS BANDS

LIMITS

When a 20 MHz portion is punctured the remaining emissions do not bleed into the notched channel.

For Channel Puncturing, investigation was performed on the following :

Bandwidth	RU Size
80MHz	484+242
160MHz	996+484
	996+484+242

RESULTS

The 99% Occupied Bandwidth are contained outside of the notched band.

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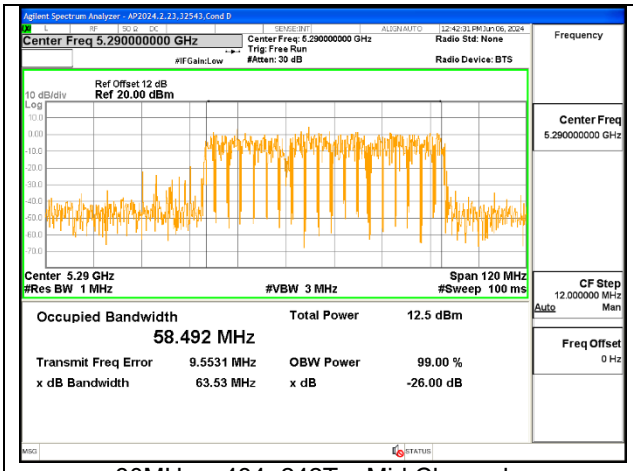
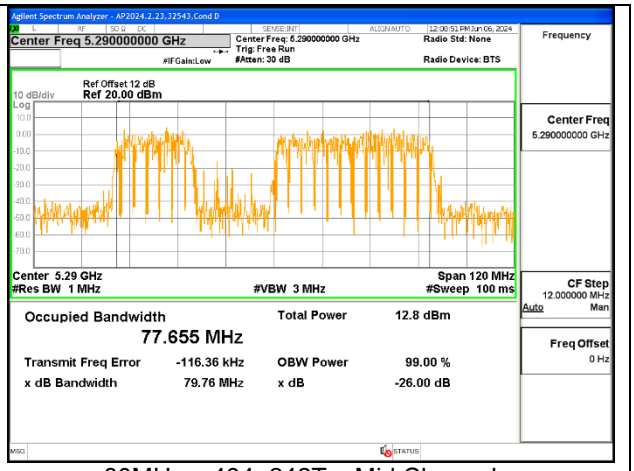
9.3.1. 802.11be EHT80 SISO MODE

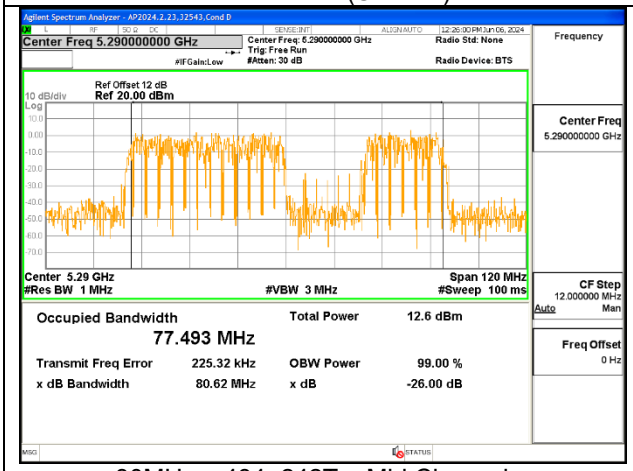
ID:	32543	Date:	2024/06/06



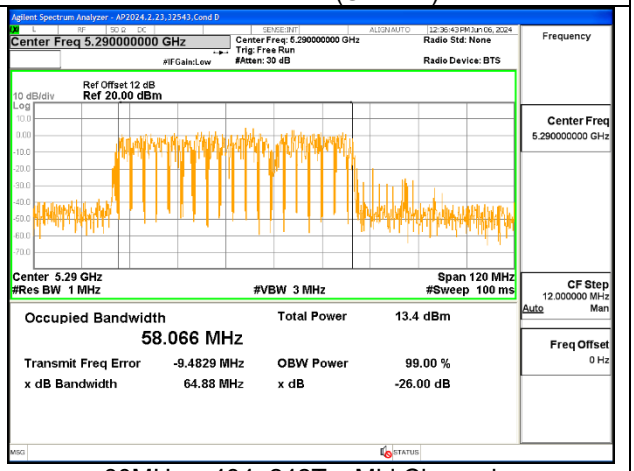
80MHz – 484+242T – Mid Channel – Puncture Pattern 1 – (UNII-2a) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 2 – (UNII-2a) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 4 – (UNII-2a) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 8 – (UNII-2a) – Ant 1

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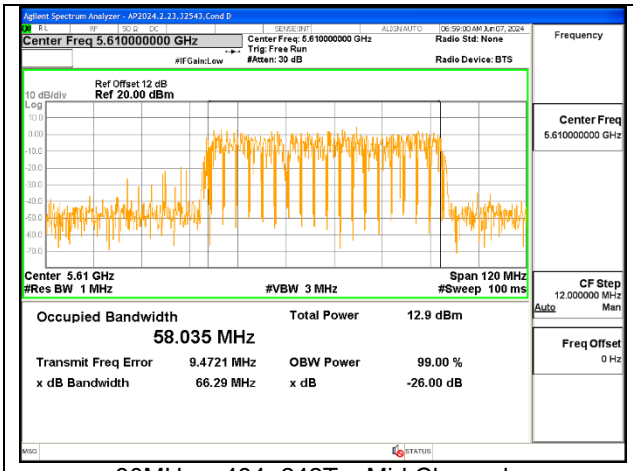
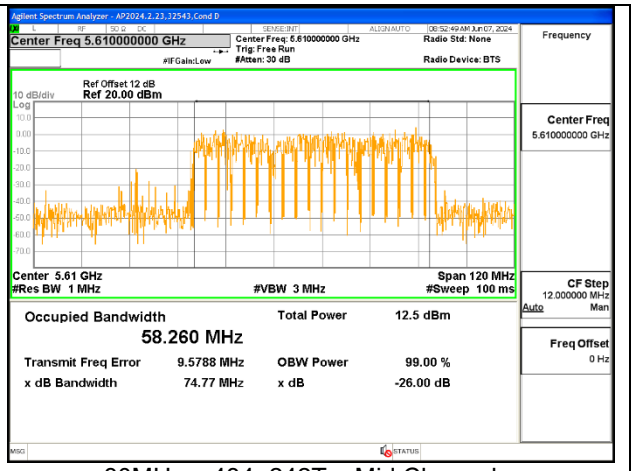
9.3.2. 802.11be EHT80 MIMO CDD MODE

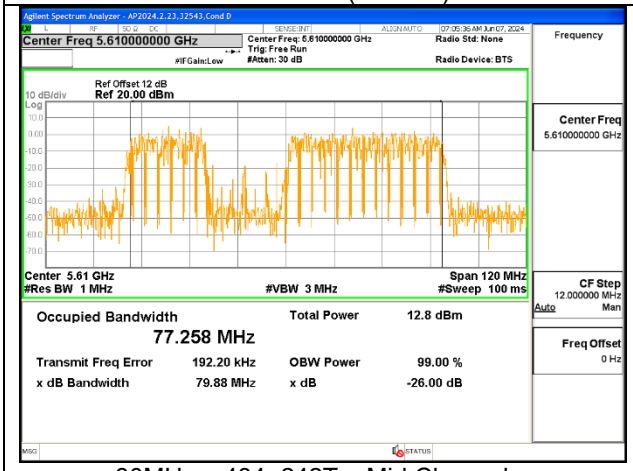
ID:	32543	Date:	2024/06/07



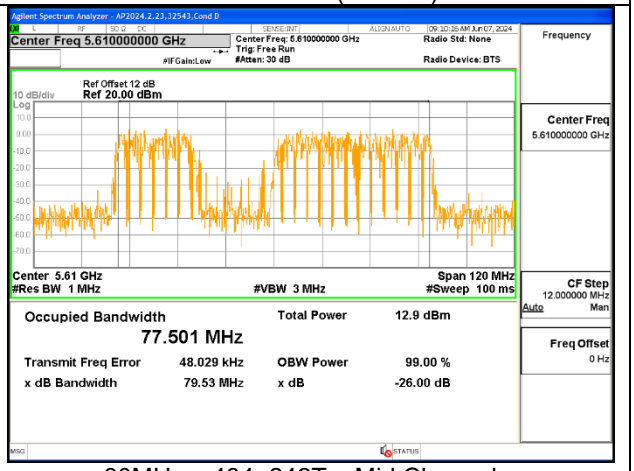
80MHz – 484+242T – Mid Channel – Puncture Pattern 1 – (UNII-2c) – Ant 1



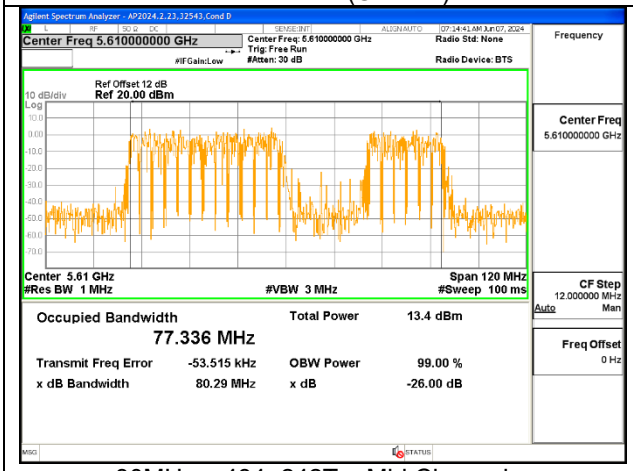
80MHz – 484+242T – Mid Channel – Puncture Pattern 1 – (UNII-2c) – Ant 2



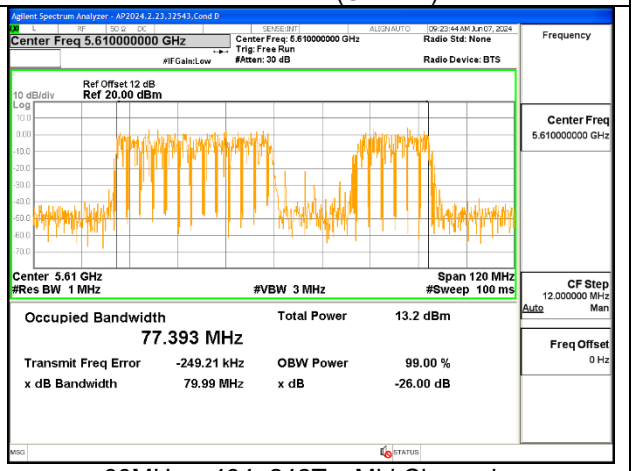
80MHz – 484+242T – Mid Channel – Puncture Pattern 2 – (UNII-2c) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 2 – (UNII-2c) – Ant 2



80MHz – 484+242T – Mid Channel – Puncture Pattern 4 – (UNII-2c) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 4 – (UNII-2c) – Ant 2

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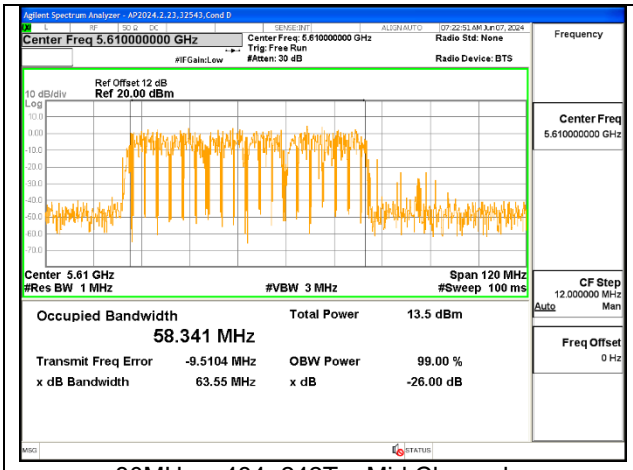
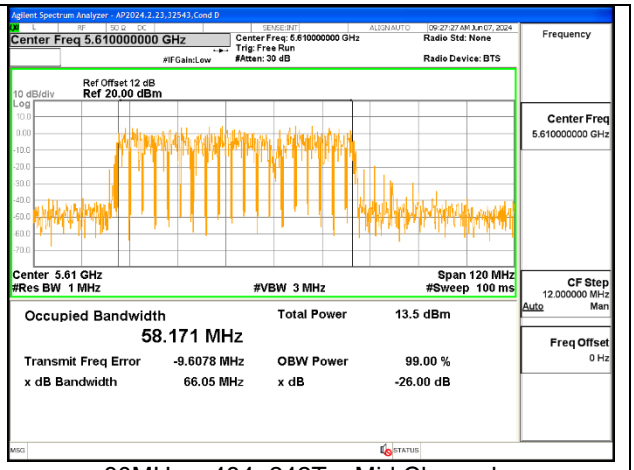


80MHz – 484+242T – Mid Channel – Puncture Pattern 8 – (UNII-2c) – Ant 1



80MHz – 484+242T – Mid Channel – Puncture Pattern 8 – (UNII-2c) – Ant 2

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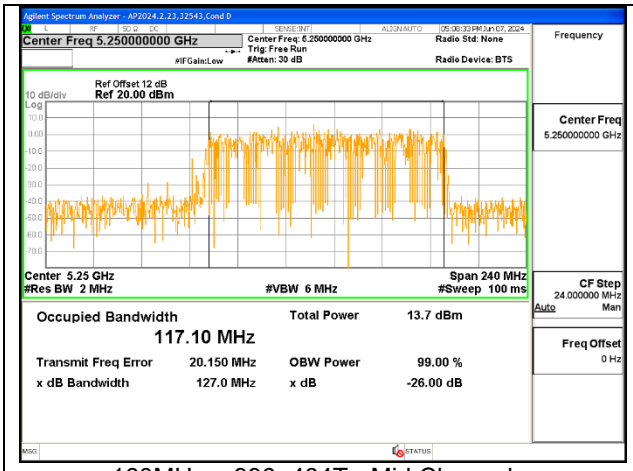
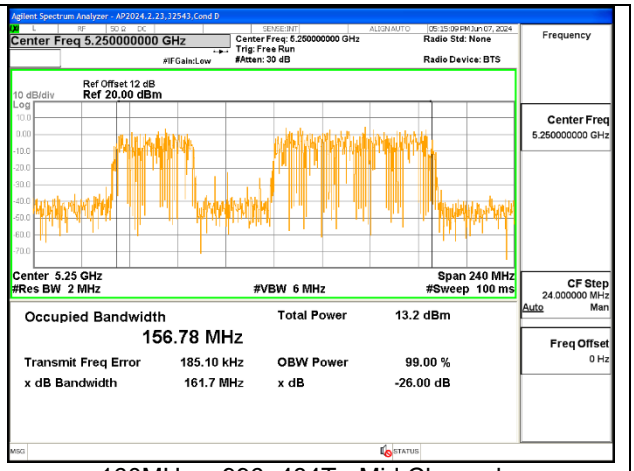
9.3.3. 802.11be EHT160 SISO MODE

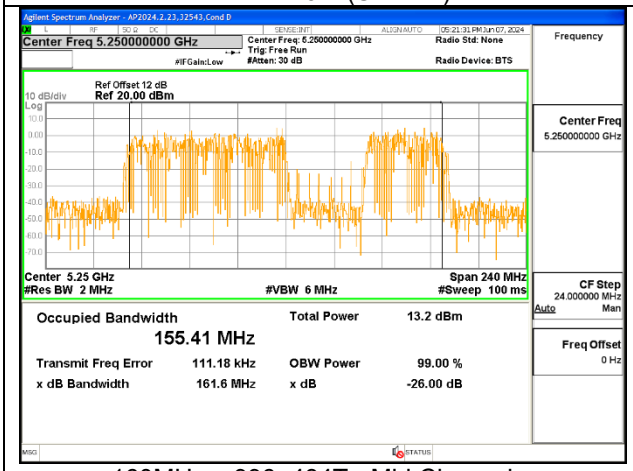
ID:	32543	Date:	2024/06/07



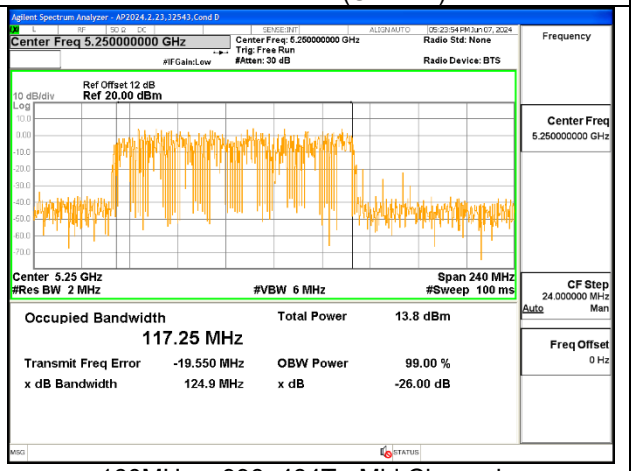
160MHz – 996+484T - Mid Channel – Puncture Pattern 3 – (UNII-2a) – Ant 1



160MHz – 996+484T - Mid Channel – Puncture Pattern 12 – (UNII-2a) – Ant 1



160MHz – 996+484T - Mid Channel – Puncture Pattern 48 – (UNII-2a) – Ant 1



160MHz – 996+484T - Mid Channel – Puncture Pattern 192 – (UNII-2a) – Ant 1

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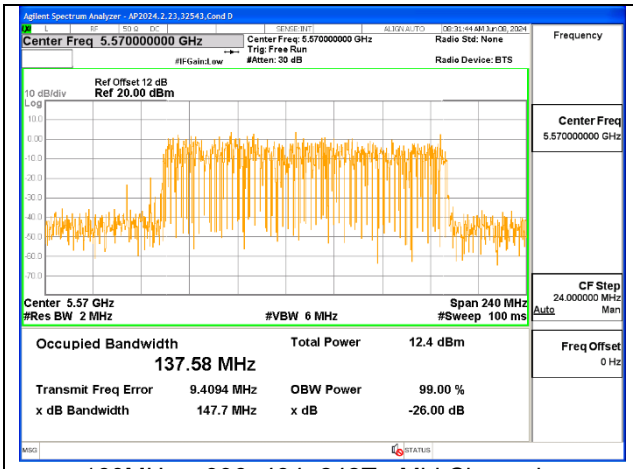
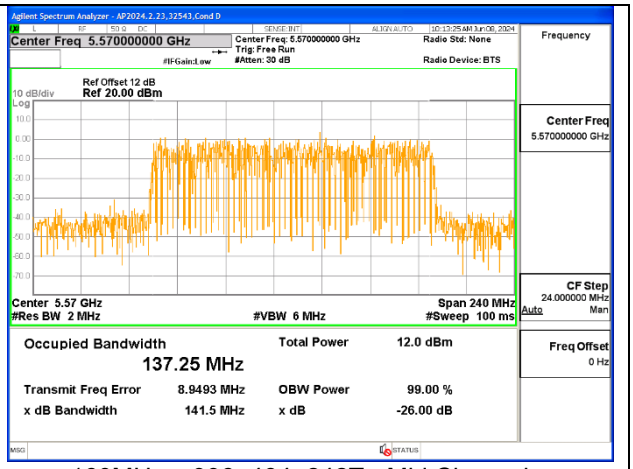
9.3.4. 802.11be EHT160 MIMO CDD MODE

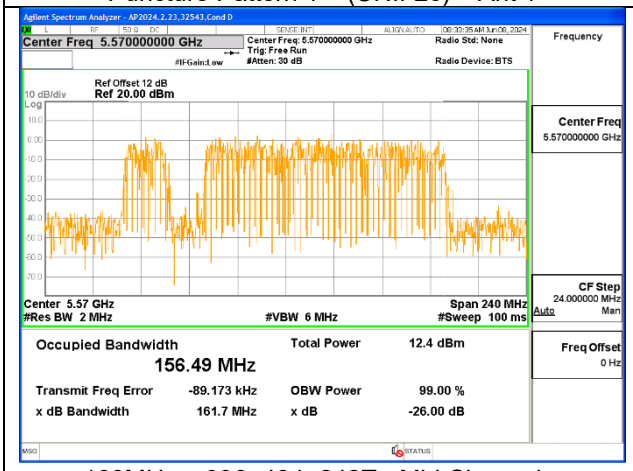
ID:	32543	Date:	2024/06/08



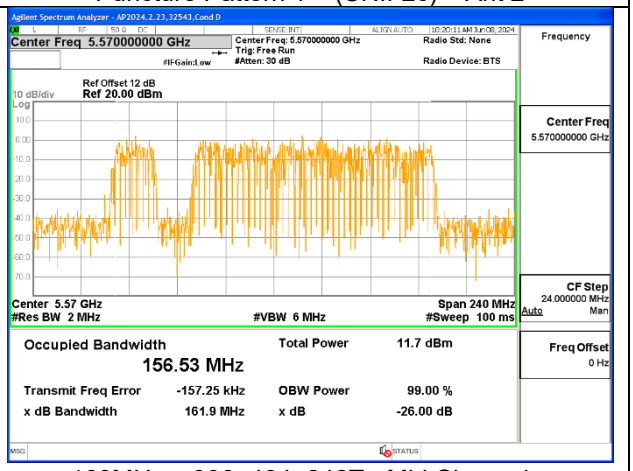
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 1 – (UNII-2c) – Ant 1



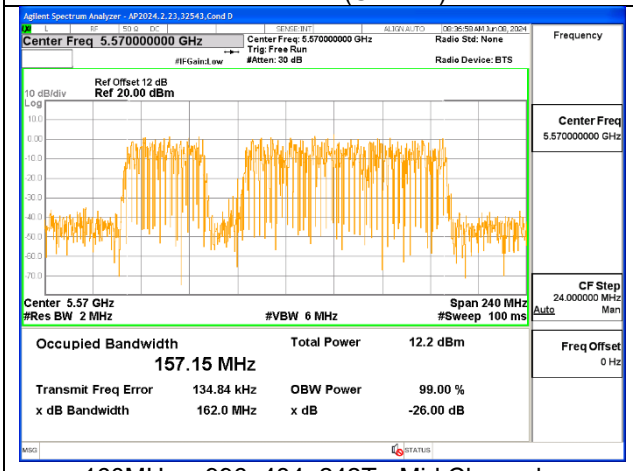
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 1 – (UNII-2c) – Ant 2



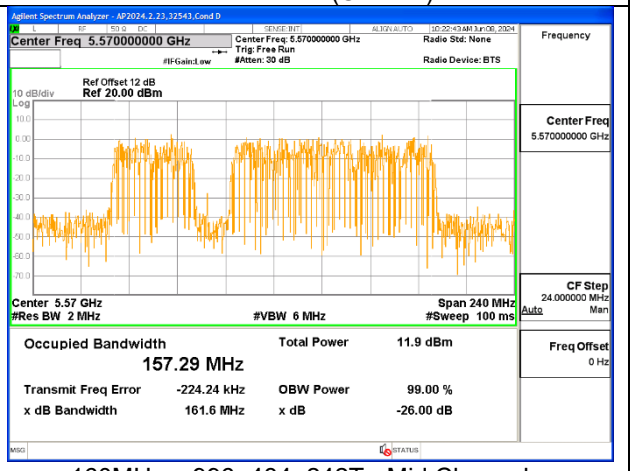
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 2– (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 2– (UNII-2c) – Ant 2



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 4 – (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 4 – (UNII-2c) – Ant 2

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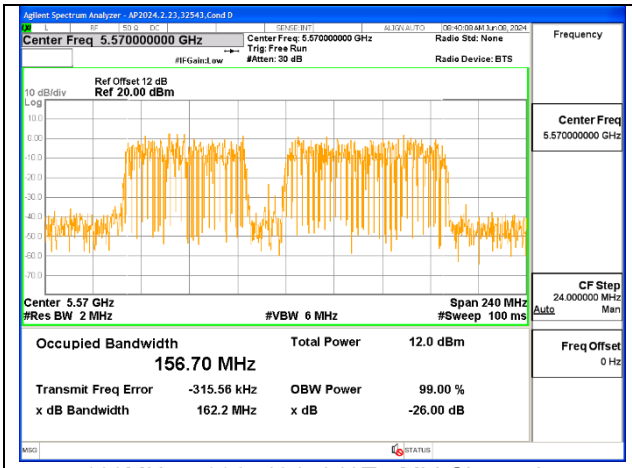
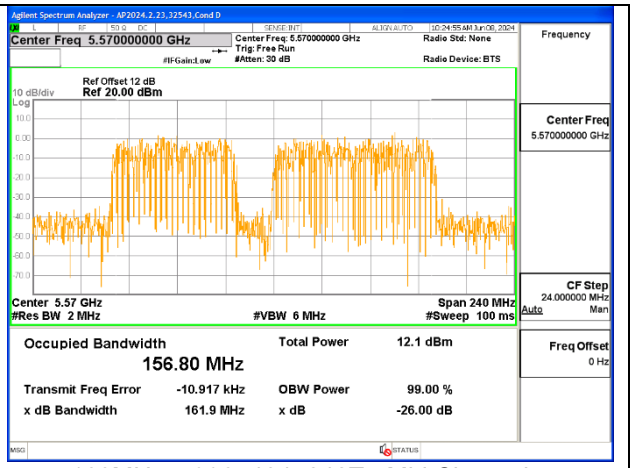
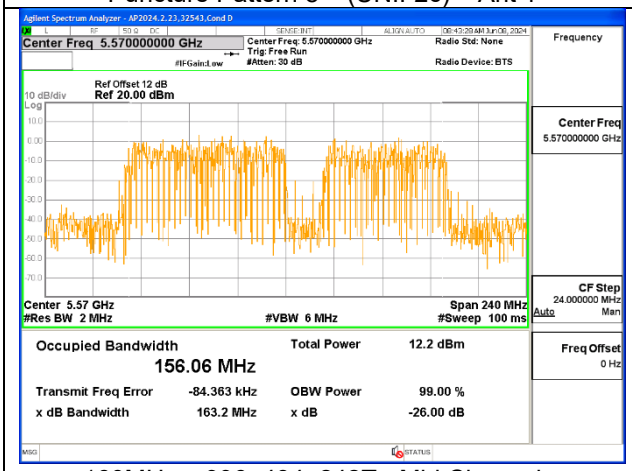


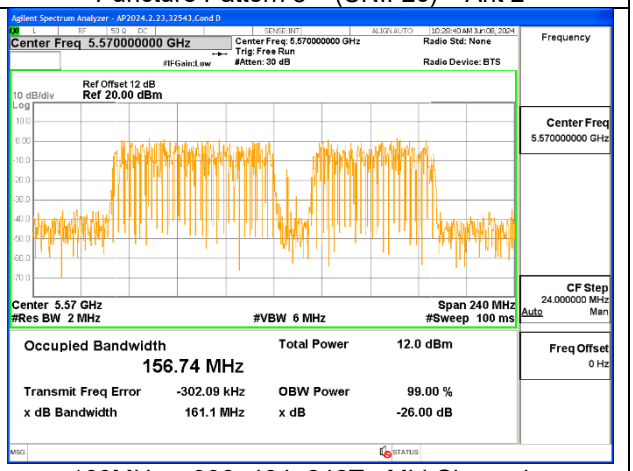
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 8 – (UNII-2c) – Ant 1



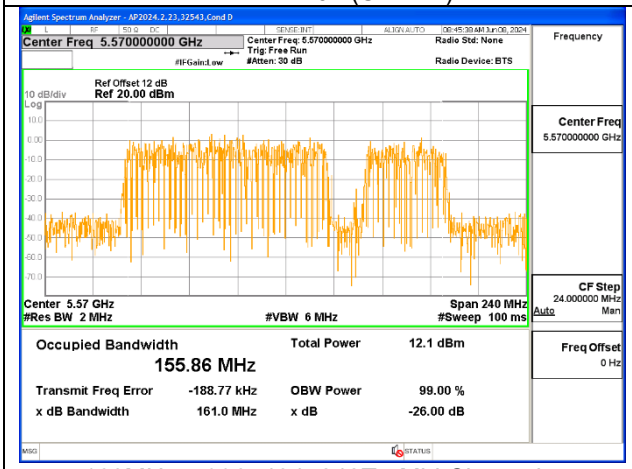
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 8 – (UNII-2c) – Ant 2



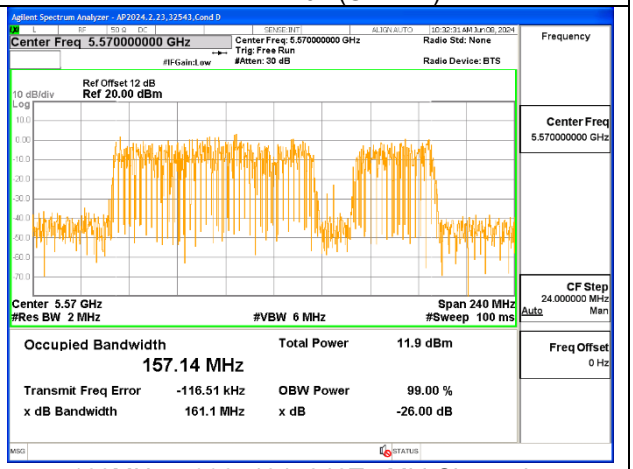
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 16– (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 16– (UNII-2c) – Ant 2



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 32 – (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 32 – (UNII-2c) – Ant 2

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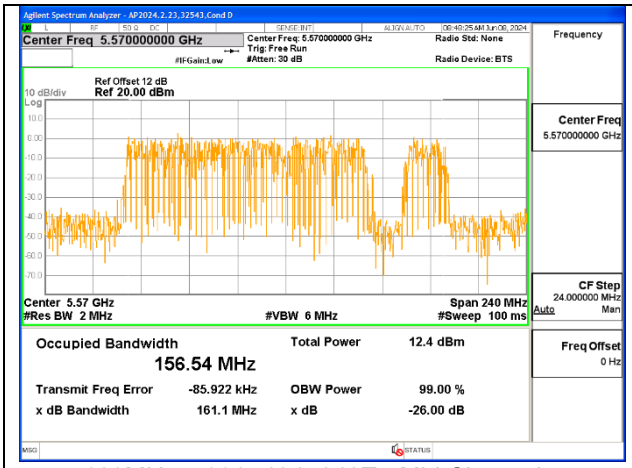
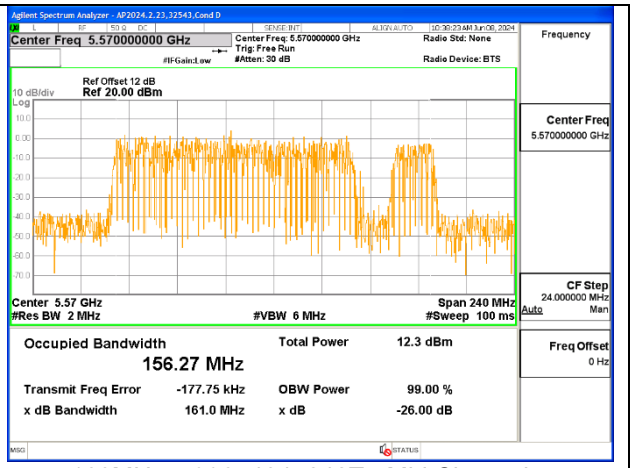
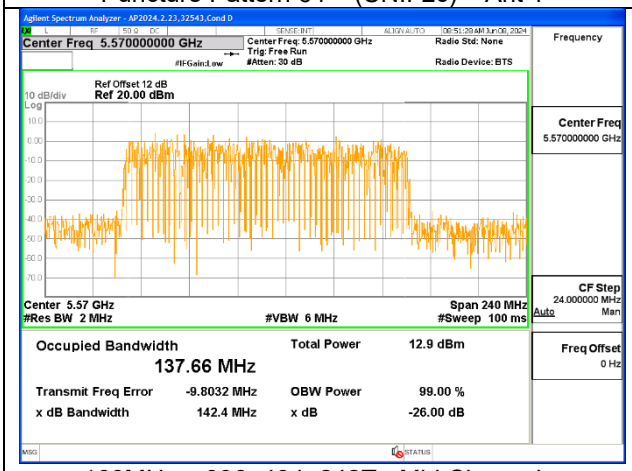


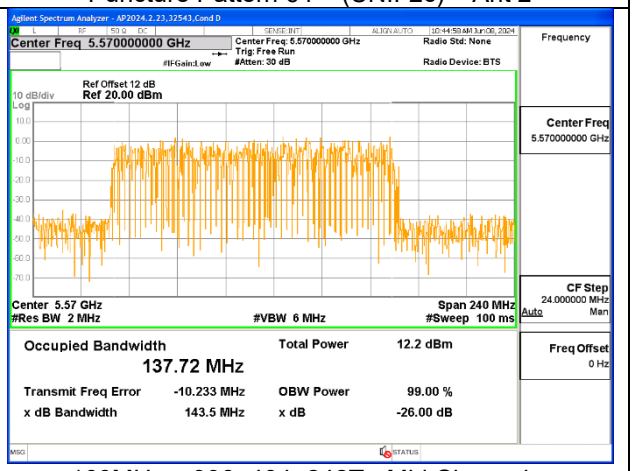
160MHz – 996+484+242T - Mid Channel – Puncture Pattern 64 – (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 64 – (UNII-2c) – Ant 2



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 128– (UNII-2c) – Ant 1



160MHz – 996+484+242T - Mid Channel – Puncture Pattern 128– (UNII-2c) – Ant 2

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9.4. 6 dB BANDWIDTH

LIMITS

FCC §15.407 (e)

RSS-247 6.2.4.1

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

RESULTS

For 6dB bandwidth measurements, the 802.11be HT20 was tested at 26T as a worst-case scenario. For straddle channels, 52T was tested as worst-case as 26T is not supported.

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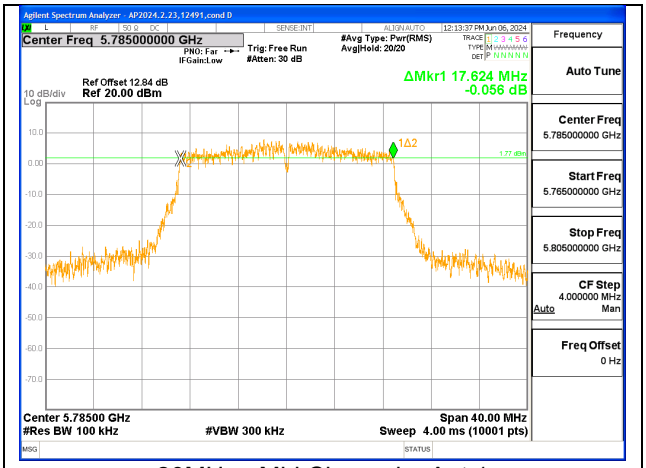
9.4.1. 802.11n/ac SISO MODE IN THE 5.8 GHz BAND

UNII-3 (SISO)	Frequency (MHz)	Channel Number	6 dB BW (MHz)	
			Ant 1	Ant 2
HT20	5720 (Straddle)	144	3.916	3.928
	5745	149	17.584	17.632
	5785	157	17.624	17.160
	5825	165	17.260	17.588
HT40	5710 (Straddle)	142	3.280	3.168
	5755	151	35.736	35.688
	5795	159	35.160	36.056
VHT80	5690 (Straddle)	138	3.224	3.320
	5775	155	75.120	75.104



20MHz - Mid Channel – Ant 1

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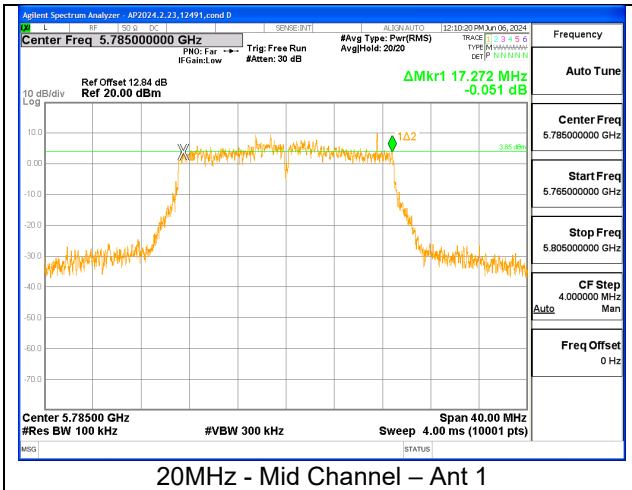
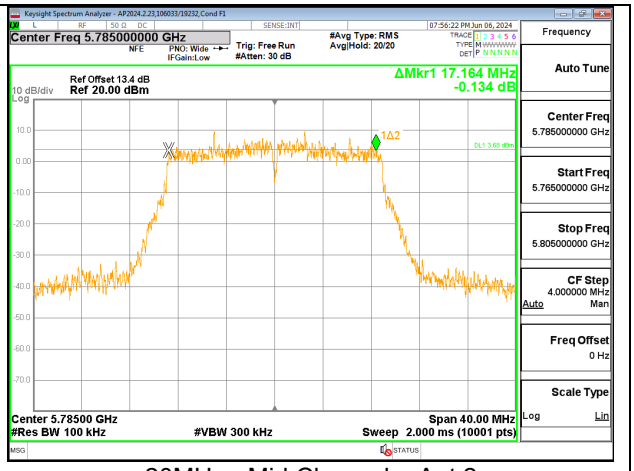
9.4.2. 802.11n/ac MIMO CDD MODE IN THE 5.8 GHz BAND

UNII-3 (MIMO CDD)	Frequency (MHz)	Channel Number	6 dB BW (MHz)	
			Ant 1	Ant 2
HT20	5720 (Straddle)	144	3.820	3.832
	5745	149	17.568	17.560
	5785	157	17.272	17.164
	5825	165	17.252	17.564
HT40	5710 (Straddle)	142	3.248	3.168
	5755	151	35.136	36.064
	5795	159	35.424	36.040
VHT80	5690 (Straddle)	138	3.288	3.176
	5775	155	75.232	76.096



20MHz - Mid Channel – Ant 1



20MHz - Mid Channel – Ant 2

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9.4.3. 802.11be SISO MODE IN THE 5.8 GHz BAND

UNII-3 (SISO)	Frequency (MHz)	Channel Number	Tone	RU Index	6 dB BW (MHz)	
					Ant 1	Ant 2
EHT20	5720 (Straddle)	144	SU	--	--	--
			52T	40	3.944	3.980
	5745	149	SU	--	--	--
			26T	0	2.096	1.972
				4	2.632	2.596
				8	2.032	2.040
	5785	157	SU	--	--	--
			26T	0	2.024	1.916
				4	2.656	2.564
				8	2.044	2.120
	5825	165	SU	--	--	--
			26T	0	2.088	2.072
				4	2.580	2.560
				8	2.020	2.580
EHT40	5710 (Straddle)	142	SU	--	--	--
			52T	44	3.976	4.016
	5755	151	SU	--	--	--
			26T	0	2.024	2.072
				9	2.048	2.096
				17	2.064	2.088
	5795	159	SU	--	--	--
			26T	0	2.016	1.992
				9	2.032	2.032
				17	2.032	2.128
EHT80	5690 (Straddle)	138	SU	--	--	--
			52T	52	4.008	3.960
	5775	155	SU	--	--	--
			26T	0	2.064	2.080
				18	2.592	2.576
				36	2.080	2.048

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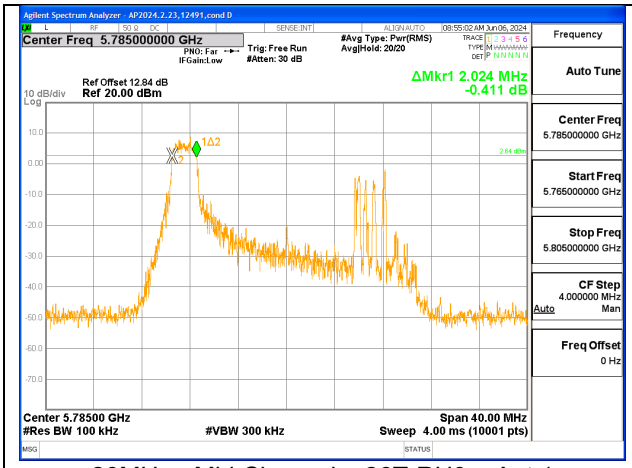
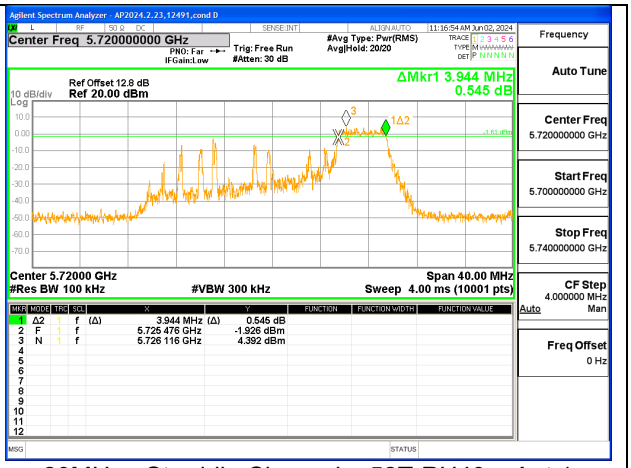


20MHz - Mid Channel – 26T-RU0 – Ant 1



20MHz - Straddle Channel – 52T-RU40 – Ant 1

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9.4.4. 802.11be MIMO CDD MODE IN THE 5.8 GHz BAND

UNII-3 (MIMO CDD)	Frequency (MHz)	Channel Number	Tone	RU Index	6 dB BW (MHz)	
					Ant 1	Ant 2
EHT20	5720 (Straddle)	144	SU	--	--	--
			52T	40	4.480	4.072
	5745	149	SU	--	--	--
			26T	0	2.052	2.036
				4	2.532	2.580
				8	2.004	2.020
	5785	157	SU	--	--	--
			26T	0	2.024	2.044
				4	2.572	2.660
				8	1.996	2.000
	5825	165	SU	--	--	--
			26T	0	1.996	2.016
				4	2.604	2.640
				8	2.036	2.096
EHT40	5710 (Straddle)	142	SU	--	--	--
			52T	44	4.480	4.072
	5755	151	SU	--	--	--
			26T	0	2.088	2.112
				9	2.008	2.032
				17	2.104	2.072
	5795	159	SU	--	--	--
			26T	0	2.008	2.032
				9	2.016	2.008
				17	2.024	2.032
EHT80	5690 (Straddle)	138	SU	--	--	--
			52T	52	3.992	4.008
	5775	155	SU	--	--	--
			26T	0	2.064	2.032
				18	2.640	2.592
				36	2.016	2.032

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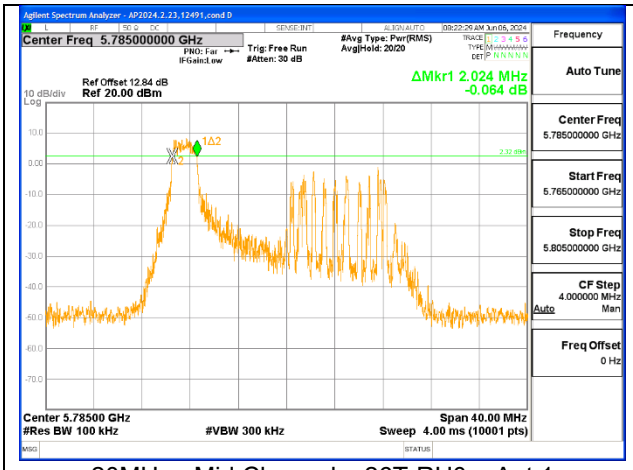
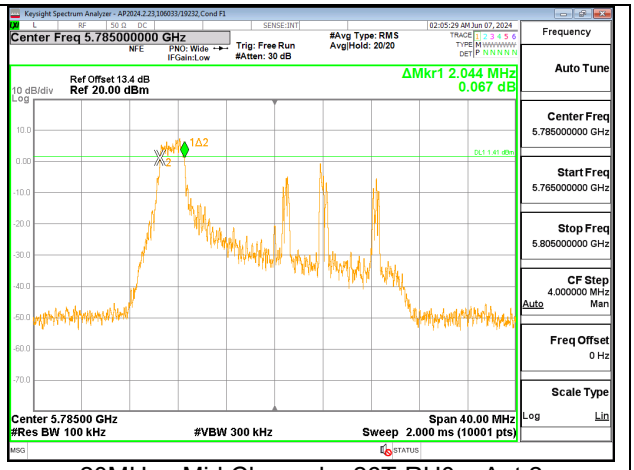
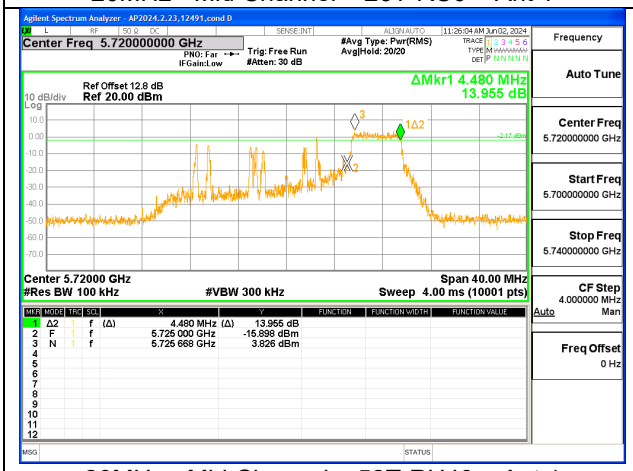


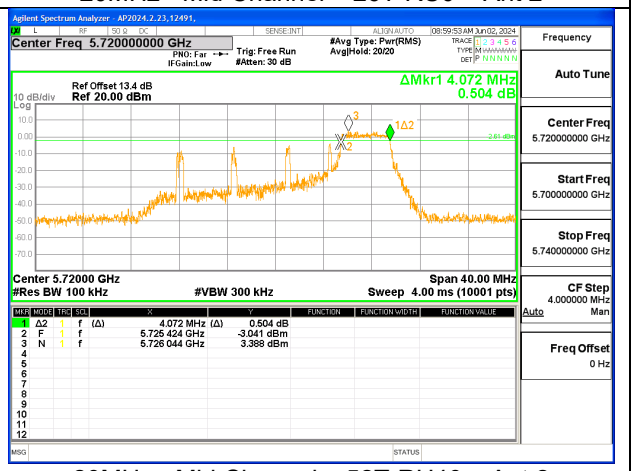
20MHz - Mid Channel – 26T-RU0 – Ant 1



20MHz - Mid Channel – 26T-RU0 – Ant 2



20MHz - Mid Channel – 52T-RU40 – Ant 1



20MHz - Mid Channel – 52T-RU40 – Ant 2

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9.5. OUTPUT POWER AND PSD

LIMITS

FCC §15.407

Band 5.15–5.25 GHz

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Bands 5.25-5.35 GHz and 5.47-5.725 GHz
The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Band 5.725-5.85 GHz

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

TEST PROCEDURE

The measurement method used for output power is KDB 789033 D02 v02r01, Section E.3.b (Method PM-G).

The measurement method used for power spectral density is KDB 789033 D02 v02r01, Section F.
For all straddle channels, full bandwidth power and PSD/MHz are reported in the 5.6GHz section because the combined 5.6GHz and 5.8GHz power and PSD/MHz already passed the worst-case 5.6GHz power and 5.8 GHz PSD/500kHz limits.

11n HT20 and 11ax HE20 straddle channel 26dB bandwidth= (26dB BW/2)+5
11n HT20 and 11ax HE20 straddle channel 99% bandwidth= (99% BW/2)+5

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DIRECTIONAL ANTENNA GAIN

For 1 TX:
There is only one transmitter output therefore the directional gain is equal to the antenna gain.

For 2 TX:

Tx chains are uncorrelated for power and correlated for PSD due to the device supporting CDD in all MIMO modes. The directional gains are as follows:

Band (GHz)	ANT1 Gain (dBi)	ANT2 Gain (dBi)	Uncorrelated Chains Directional Gain (dBi)	Correlated Chains Directional Gain (dBi)
5.2	-0.40	-4.40	-1.95	0.84
5.3	0.00	-3.40	-1.38	1.48
5.6	-0.40	-1.40	-0.87	2.12
5.8	0.30	-0.40	-0.04	2.97

DIRECTIONAL GAIN CALCULATION:

ANSI C63.10-2013 section 14.4.3

Uncorrelated directional gain=10*LOG((10^(Ant6/10)+10^(Ant5/10))/2)
Correlated directional Gain=10*LOG(((10^(Ant6/20)+10^(Ant5/20))^2)/2)

Sample Calculation at 5.2GHz Band:

Ant1=-0.40, Ant2=-4.40

Uncorrelated Antenna gain=10log[(10^(-0.40/10)+10^(-4.40/10))/2]=-1.95dBi

Correlated Antenna gain=10log[(10^(-0.40/20)+10^(-4.40/20))^2)/2]=0.84dBi

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9.5.1. 802.11n/ac SISO MODE IN THE UNII-1 BAND

UNII-1 (SISO)	20MHz	40MHz	80MHz	160MHz
DCCF (MCS0) (dB)	0.00	0.10	0.27	0.34
Ant 1 (dBi)	-0.40			
Ant 2 (dBi)	-4.40			

UNII-2a (SISO)	
Straddle Channel	
Ant 1 (dBi)	0.00
Ant 2 (dBi)	-3.40

UNII-1 (SISO)	Freq (MHz)	Ch. #	Minimum Bandwidth (MHz)		Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/MHz)		PSD (dBm/MHz)		Total Corrected PSD (dBm/MHz)	
			Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2
HT20 (FCC)	5180	36	--		24	24	18.95	18.97	18.95	18.97	11	11	8.531	8.975	8.531	8.975
	5200	40					19.91	19.97	19.91	**19.97**			9.843	9.958	9.843	9.958
	5240	48					19.94	19.91	19.94	19.91			9.966	10.107	9.966	10.107
HT40 (FCC)	5190	38	--		24	24	16.45	16.46	16.45	16.46	11	11	3.324	3.491	3.424	3.591
	5230	46					20.96	20.96	**20.96**	**20.96**			8.342	7.937	8.442	8.037
VHT80 (FCC)	5210	42	--		24	24	16.42	16.40	**16.42**	16.40	11	11	0.499	0.272	0.769	0.542
VHT160 (FCC)	5250 (Straddle)	50	--		24	24	14.48	14.42	**14.48**	14.42	11	11	-4.193	-4.303	-3.853	-3.963

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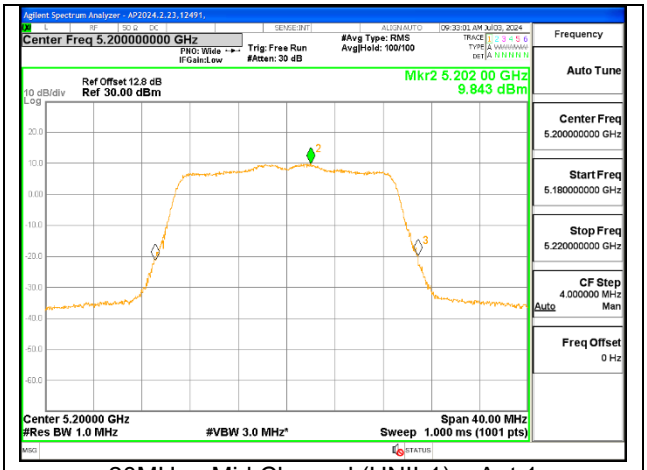
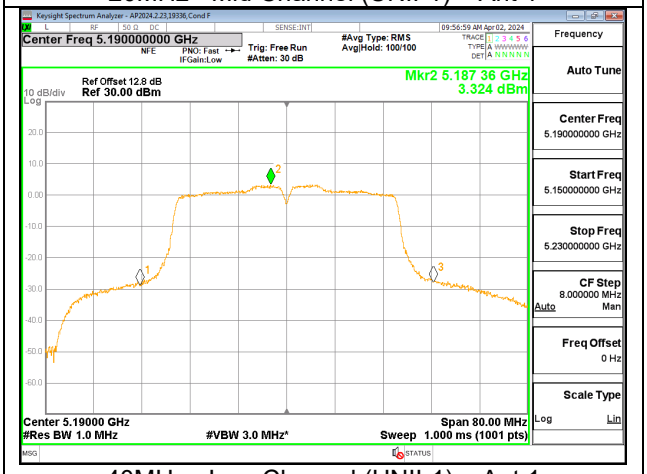
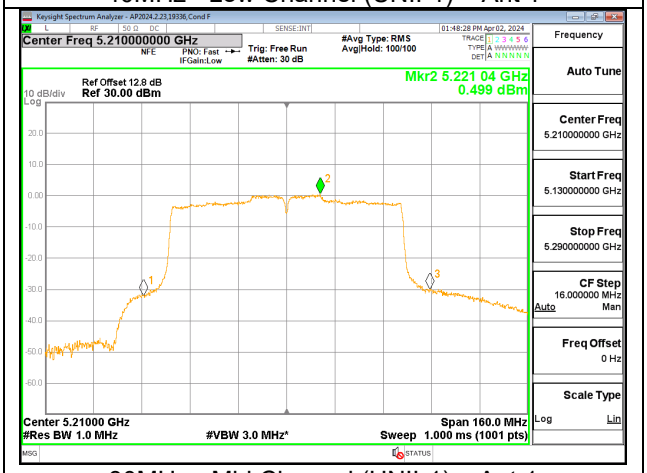


20MHz - Mid Channel (UNII-1) – Ant 1



40MHz - Low Channel (UNII-1) – Ant 1



80MHz - Mid Channel (UNII-1) – Ant 1

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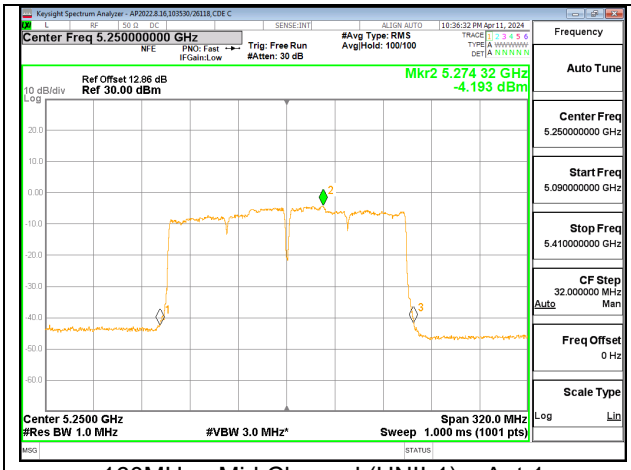

160MHz - Mid Channel (UNII-1) – Ant 1

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9.5.2. 802.11n/ac MIMO CDD MODE IN THE UNII-1 BAND

UNII-1 (MIMO CDD)	20MHz	40MHz	80MHz	160MHz
DCCF (MCS0) (dB)	0.00	0.10	0.27	0.34
Un-Correlated Gain (dBi)	-1.95			
Correlated Gain (dBi)	0.84			

UNII-2a (MIMO CDD)	
Straddle Channel	
Ant 1 (dBi)	-1.38
Ant 2 (dBi)	1.48

UNII-1 (MIMO CDD)	Freq (MHz)	Ch. #	Min BW (MHz)	Power Limit (dBm)	Output Power (Gated) (dBm)		Total MIMO Corrected Power (dBm)	PSD Limit (dBm/MHz)	PSD (dBm/MHz)		Total MIMO Corrected PSD (dBm/MHz)
					Ant 1	Ant 2			Ant 1	Ant 2	
HT20 (FCC)	5180	36	--	24	16.92	16.89	19.92	11	7.091	6.820	9.968
	5200	40			16.91	16.96	19.95		6.693	6.656	9.685
	5240	48			19.96	16.98	21.73		7.074	7.019	10.057
HT40 (FCC)	5190	38	--	24	15.92	15.94	18.94	11	2.666	2.861	5.875
	5230	46			19.97	19.91	22.95		6.799	6.767	9.893
VHT80 (FCC)	5210	42	--	24	15.43	15.47	18.46	11	-0.761	-0.723	2.538
VHT160 (FCC)	5250 (Straddle)	50	--	24	13.94	13.97	16.97	11	-4.846	-4.954	-1.549

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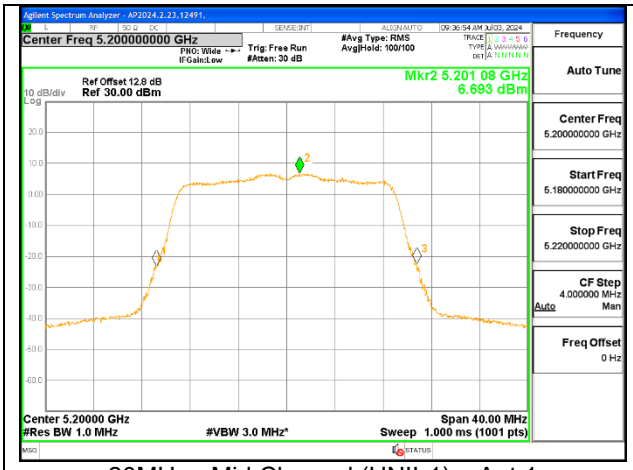
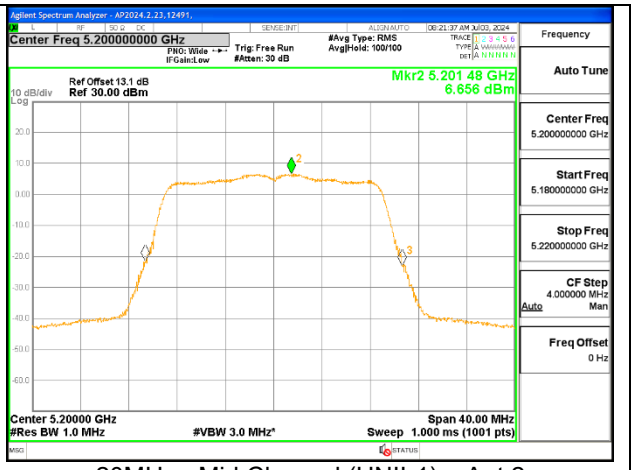
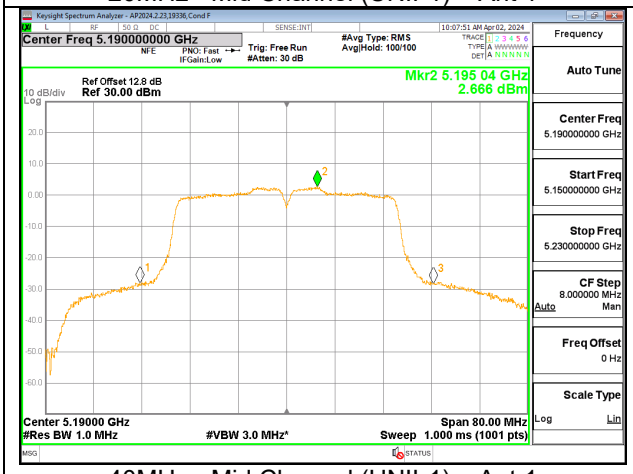


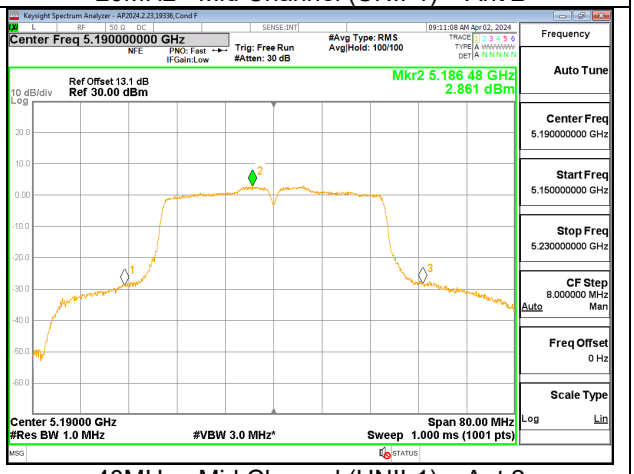
20MHz - Mid Channel (UNII-1) – Ant 1



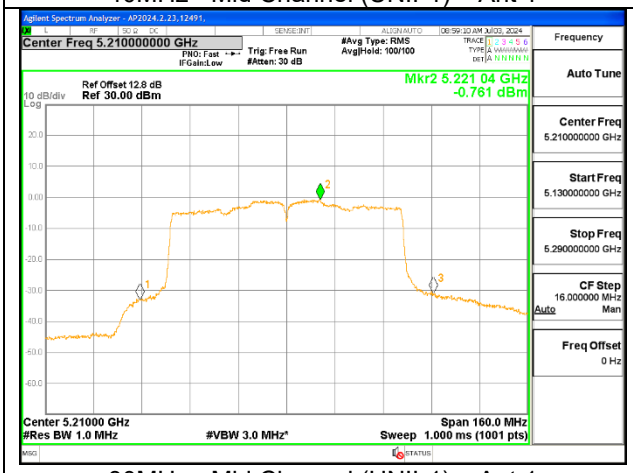
20MHz - Mid Channel (UNII-1) – Ant 2



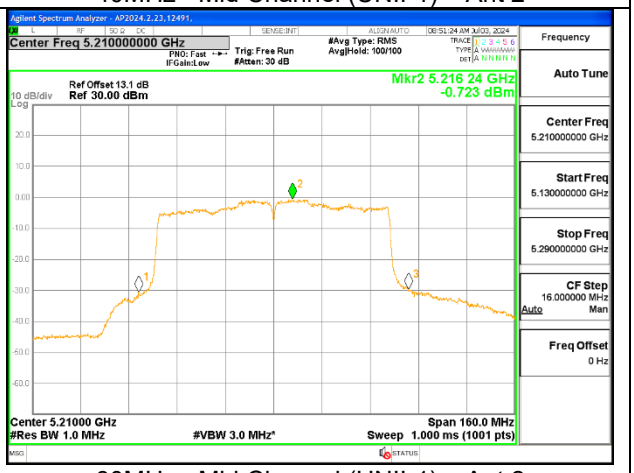
40MHz - Mid Channel (UNII-1) – Ant 1



40MHz - Mid Channel (UNII-1) – Ant 2



80MHz - Mid Channel (UNII-1) – Ant 1



80MHz - Mid Channel (UNII-1) – Ant 2

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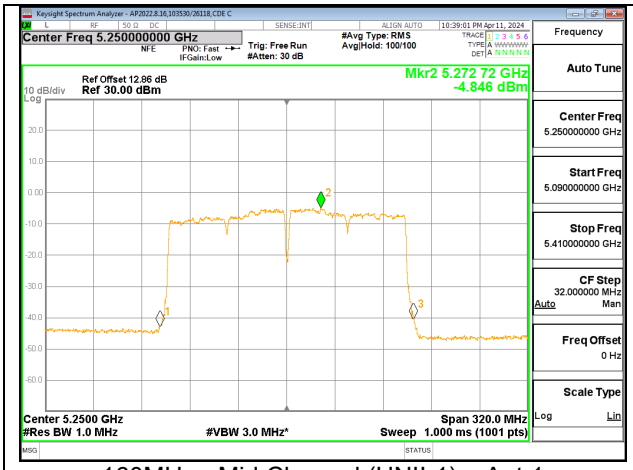
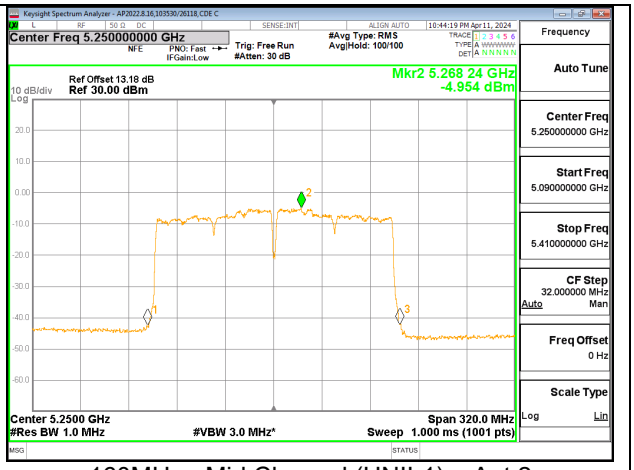


160MHz - Mid Channel (UNII-1) – Ant 1



160MHz - Mid Channel (UNII-1) – Ant 2

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9.5.3. 802.11n/ac SISO MODE IN THE UNII-2A BAND

UNII-2a (SISO)	20MHz	40MHz	80MHz	160MHz
DCCF (MCS0) (dB)	0.00	0.10	0.27	0.34
Ant 1 (dBi)	0.00			
Ant 2 (dBi)	-3.40			

UNII-1 (SISO)	
Straddle Channel	
Ant 1 (dBi)	-0.40
Ant 2 (dBi)	-4.40

UNII-2a (SISO)	Freq (MHz)	Ch. #	Minimum Bandwidth (MHz)		Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/MHz)		PSD (dBm/MHz)		Total Corrected PSD (dBm/MHz)	
			Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2
HT20 (FCC)	5260	52	20.72	20.68	24.00	24.00	19.89	19.92	19.89	19.92	11.00	11.00	10.916	10.971	10.916	10.971
	5300	60	21.04	20.81	24.00	24.00	19.97	19.94	**19.97**	19.94			10.764	10.963	10.764	10.963
	5320	64	21.46	21.29	24.00	24.00	18.96	18.90	18.96	18.90			8.554	8.545	8.554	8.545
HT40 (FCC)	5270	54	40.67	40.60	24.00	24.00	20.92	20.93	20.92	**20.93**	11.00	11.00	9.119	9.168	9.219	9.268
	5310	62	44.74	42.16	24.00	24.00	16.95	16.93	16.95	16.93			3.319	3.410	3.419	3.510
VHT80 (FCC)	5290	58	82.44	82.79	24.00	24.00	16.94	16.92	**16.94**	16.92	11.00	11.00	0.689	0.969	0.959	1.239
VHT160 (FCC)	5250 (Straddle)	50	163.10	163.10	24.00	24.00	14.48	14.42	**14.48**	14.42	11.00	11.00	-4.193	-4.303	-3.853	-3.963

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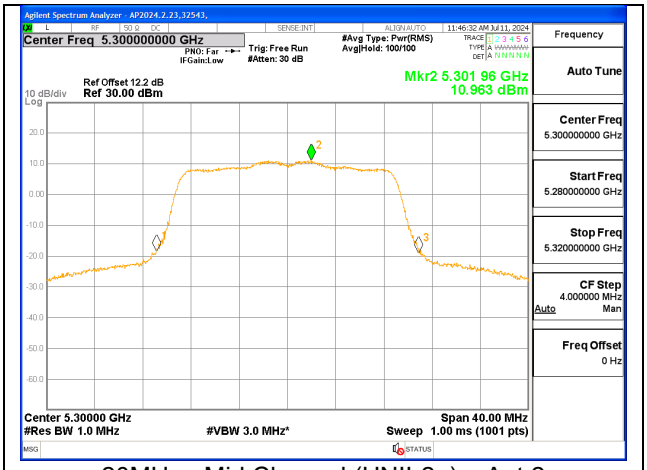
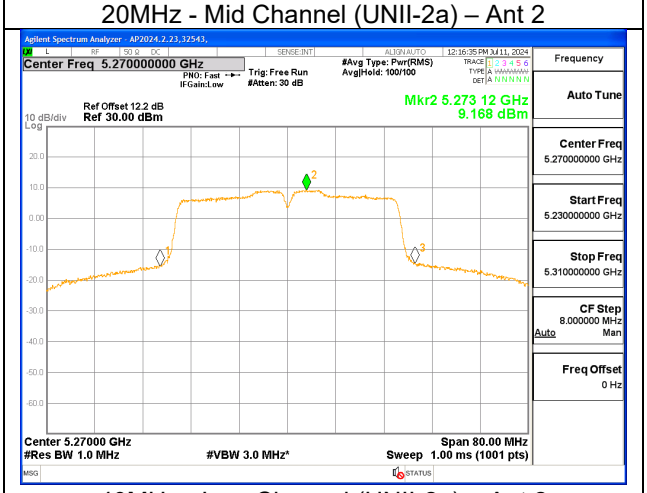
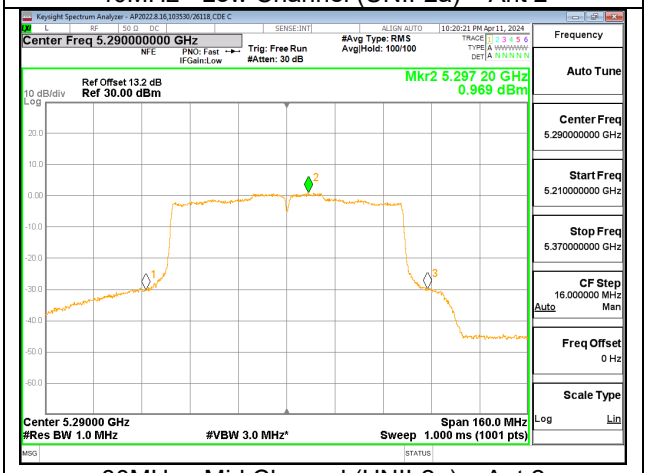


20MHz - Mid Channel (UNII-2a) – Ant 2



40MHz - Low Channel (UNII-2a) – Ant 2



80MHz - Mid Channel (UNII-2a) – Ant 2

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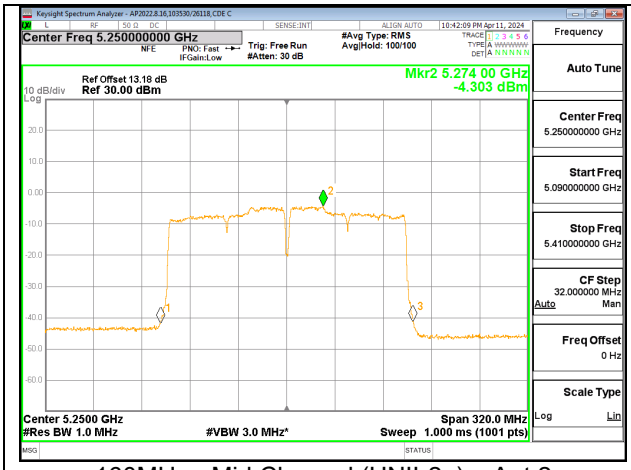

160MHz - Mid Channel (UNII-2a) – Ant 2

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9.5.4. 802.11n/ac MIMO CDD MODE IN THE UNII-2A BAND

UNII-2a (MIMO CDD)	20MHz	40MHz	80MHz	160MHz
DCCF (MCS0) (dB)	0.00	0.10	0.27	0.34
Un-Correlated Gain (dBi)	-1.38			
Correlated Gain (dBi)	1.48			

UNII-1 (MIMO CDD)	
Straddle Channel	
Ant 1 (dBi)	-1.95
Ant 2 (dBi)	0.84

UNII-2a (MIMO CDD)	Freq (MHz)	Ch. #	Min BW (MHz)	Power Limit (dBm)	Output Power (Gated) (dBm)		Total MIMO Corrected Power (dBm)	PSD Limit (dBm/MHz)	PSD (dBm/MHz)		Total MIMO Corrected PSD (dBm/MHz)
					Ant 1	Ant 2			Ant 1	Ant 2	
HT20 (FCC)	5260	52	20.57	24.00	16.94	16.93	19.95	11.00	7.966	7.950	10.968
	5300	60	20.70	24.00	16.91	16.90	19.92		7.883	7.646	10.776
	5320	64	21.24	24.00	16.94	16.97	19.97		7.768	7.766	10.777
HT40 (FCC)	5270	54	40.07	24.00	19.89	19.97	22.94	11.00	6.555	6.491	9.633
	5310	62	43.24	24.00	15.44	15.40	18.43		2.292	2.093	5.304
VHT80 (FCC)	5290	58	82.01	24.00	16.46	16.41	19.45	11.00	0.366	0.090	3.510
VHT160 (FCC)	5250 (Straddle)	50	162.30	24.00	13.94	13.97	16.97	11.00	-4.846	-4.954	-1.549

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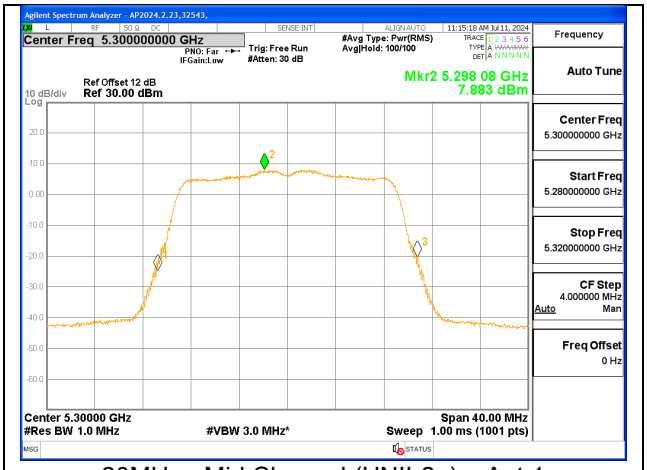
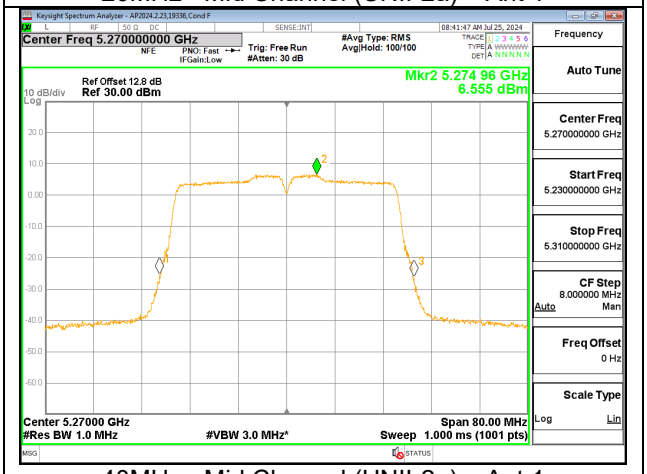
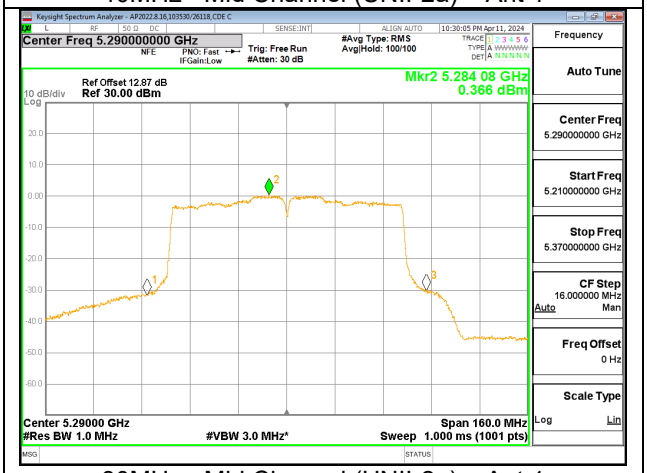


20MHz - Mid Channel (UNII-2a) – Ant 1



40MHz - Mid Channel (UNII-2a) – Ant 1



80MHz - Mid Channel (UNII-2a) – Ant 1

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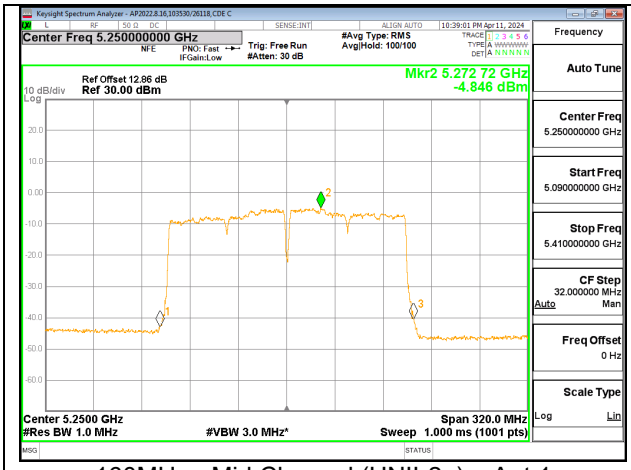

160MHz - Mid Channel (UNII-2a) – Ant 1

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9.5.5. 802.11n/ac SISO MODE IN THE UNII-2C BAND

UNII-2c (SISO)	20MHz	40MHz	80MHz	160MHz
DCCF (MCS0) (dB)	0.00	0.10	0.27	0.34
Ant 1 (dBi)	-0.40			
Ant 2 (dBi)	-1.40			

UNII-3 (SISO)	
Straddle Channel	
Ant 1 (dBi)	0.30
Ant 2 (dBi)	-0.40

UNII-2c (SISO)	Freq (MHz)	Ch. #	Minimum Bandwidth (MHz)		Power Limit (dBm)		Output Power (Gated) (dBm)		Total Corrected Power (dBm)		PSD Limit (dBm/MHz)		PSD (dBm/MHz)		Total Corrected PSD (dBm/MHz)	
			Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant2	Ant 1	Ant 2	Ant 1	Ant 2
HT20 (FCC)	5500	100	22.99	21.79	24.00	24.00	19.44	19.48	19.44	19.48	11.00	11.00	10.154	10.251	10.154	10.251
	5580	116	21.38	21.27	24.00	24.00	19.96	19.94	**19.96**	19.94			9.677	9.575	9.677	9.575
	5700	140	22.21	22.48	24.00	24.00	16.94	16.93	16.94	16.93			7.529	8.048	7.529	8.048
	5720 (Straddle)	144	15.60	15.65	22.93	22.94	19.95	19.92	19.95	19.92			9.905	9.995	9.905	9.995
HT40 (FCC)	5510	102	45.15	48.77	24.00	24.00	15.96	15.90	15.96	15.90	11.00	11.00	4.000	4.060	4.100	4.160
	5550	110	41.63	42.15	24.00	24.00	20.94	20.93	**20.94**	20.93			8.233	7.882	8.333	7.982
	5670	134	46.91	47.49	24.00	24.00	19.48	19.45	19.48	19.45			7.517	7.566	7.617	7.666
	5710 (Straddle)	142	41.34	41.39	24.00	24.00	20.92	20.92	20.92	20.92			8.148	8.229	8.248	8.329
VHT80 (FCC)	5530	106	84.15	84.65	24.00	24.00	16.91	16.98	16.91	16.98	11.00	11.00	1.583	1.557	1.853	1.827
	5610	122	86.89	87.21	24.00	24.00	20.91	20.97	20.91	20.97			5.016	4.964	5.286	5.234
	5690 (Straddle)	138	81.98	81.20	24.00	24.00	20.89	20.98	20.89	**20.98**			4.870	5.156	5.140	5.426
VHT160 (FCC)	5570	106	165.30	164.90	24.00	24.00	15.41	15.43	15.41	**15.43**	11.00	11.00	-3.605	-3.571	-3.265	-3.231

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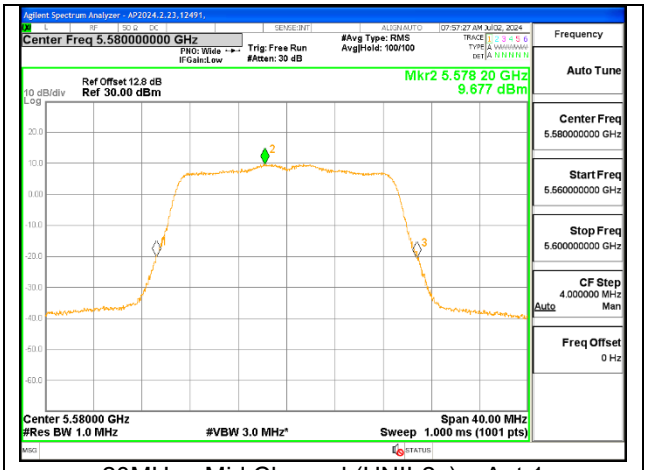
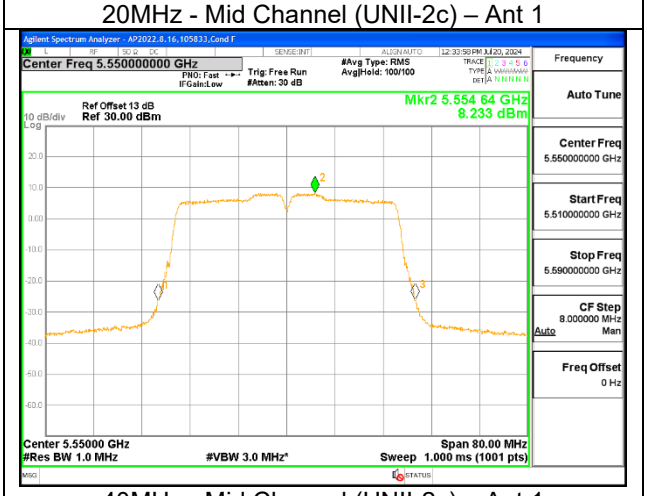
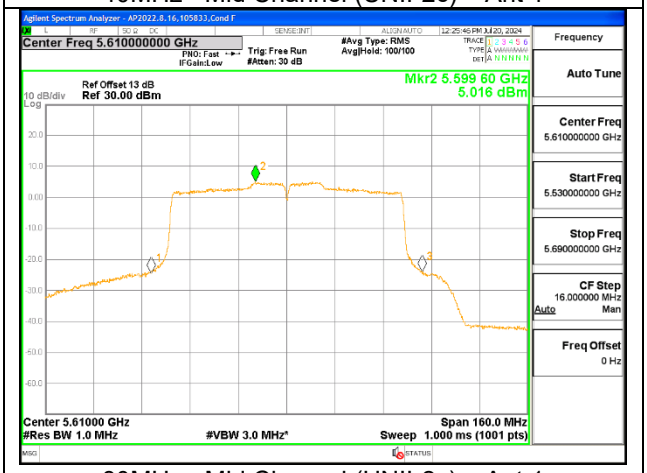


20MHz - Mid Channel (UNII-2c) – Ant 1



40MHz - Mid Channel (UNII-2c) – Ant 1



80MHz - Mid Channel (UNII-2c) – Ant 1

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