



Certificate #4312.01

TEST REPORT

Product Name: High-End Smart Video Phone for Android™
Trade Mark: GRANDSTREAM
Model No. / HVIN: GXV3470
Report Number: 220421012RFC-4
Test Standards: FCC 47 CFR Part 15 Subpart E
RSS-247 Issue 2
RSS-Gen Issue 5
FCC ID: YZZGXV3470
IC: 11964A-GXV3470
Test Result: PASS
Date of Issue: June 28, 2022

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

Prepared by:

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June 28, 2022

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Version

Version No.	Date	Description
V1.0	June 28, 2022	Original



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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	High-End Smart Video Phone for Android™		
Model No. / HVIN:	GXV3470		
Trade Mark:	GRANDSTREAM		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n/ax Bluetooth 5.0	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac/ax
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac/ax
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac/ax
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac/ax
Sample Received Date:	April 21, 2022		
Sample Tested Date:	April 21, 2022 to June 22, 2022		

1.2.2 Description of Accessories

Adapter(1)	
Model No.:	H18US1200150A
Input:	100-240 V~50/60 Hz 0.8 A max
Output:	12.0 V = 1.5 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter(2)	
Model No.:	F18W8-120150SPAUY
Input:	100-240 V~50/60 Hz 0.6 A
Output:	12.0 V = 1.5 A
DC Cable:	2.5 Meter, Unshielded without ferrite

Adapter(3)	
Model No.:	DSA-18PFR-09 FUS 120150
Input:	100-240 V~50/60 Hz 0.6 A
Output:	12.0 V = 1.5 A 18.0W
DC Cable:	2.5 Meter, Unshielded without ferrite

Cable(1)	
Connector:	Ethernet Cable
Cable Type:	Unshielded without ferrite
Length:	1.5 Meter

Cable(2)	
Connector:	Phone Cord
Cable Type:	Unshielded without ferrite
Length:	3.5 Meter

Others	
1x Handset	

Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Bands:	5150 MHz to 5250 MHz (U-NII-1)
	5250 MHz to 5350 MHz (U-NII-2A)
	5470 MHz to 5725 MHz (U-NII-2C)
	5 725 MHz to 5 850 MHz (U-NII-3)
Frequency Ranges:	5180 MHz to 5240 MHz
	5260 MHz to 5320 MHz
	5500 MHz to 5700 MHz
	5 745 MHz to 5 825 MHz
Support Standards:	IEEE 802.11a/n/ac/ax
TPC Function:	Not Support
DFS Operational mode:	Slave without radar Interference detection function
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11ax: OFDMA1024-QAM,256QAM, 64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20: 20 MHz
	IEEE 802.11n-HT40/ac-VHT40/ax-HE40: 40 MHz
	IEEE 802.11ac-VHT80/ax-HE80: 80 MHz
Data Rat Data Rate:	IEEE 802.11a: Up to 54 Mbps
	IEEE 802.11n-HT20: Up to MCS15
	IEEE 802.11n-HT40: Up to MCS15
	IEEE 802.11ac-VHT20: Up to MCS8
	IEEE 802.11ac-VHT40: Up to MCS9
	IEEE 802.11ac-VHT80: Up to MCS9
	IEEE 802.11ax-HE20: Up to MCS11
	IEEE 802.11ax-HE40: Up to MCS11
Number of Channels:	5150 MHz to 5250 MHz:
	4 for IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20

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	2 for IEEE 802.11n-HT40)/ac-VHT40/ax-HE40 1 for IEEE 802.11acVHT80/ax-HE80					
	5250 MHz to 5350 MHz: 4 for IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20 2 for IEEE 802.11n-HT40)/ac-VHT40/ax-HE40 1 for IEEE 802.11acVHT80/ax-HE80					
	5470 MHz to 5725 MHz: 11 for IEEE 802.11a/n-HT20/ac-VHT20//ax-HE20 5 for IEEE 802.11n-HT40/ac-VHT40//ax-HE40 2 for IEEE 802.11ac-VHT80/ax-HE80					
	5725 MHz to 5850 MHz: 5 for IEEE 802.11a/n-HT20/ac-VHT20/ax-HE20 2 for IEEE 802.11n-HT40/ac-VHT40//ax-HE40 1 for IEEE 802.11ac-VHT80//ax-HE80					
Antenna Type:	Chain 0	Dipole Antenna				
	Chain 1	Dipole Antenna				
Antenna Gain: (Provided by the customer)	Chain 0	5150 MHz to 5250 MHz: 4.0dBi				
		5250 MHz to 5350 MHz: 4.0dBi				
		5470 MHz to 5725 MHz: 4.0dBi				
		5725 MHz to 5850 MHz: 4.0dBi				
	Chain 1	5150 MHz to 5250 MHz: 5.0dBi				
		5250 MHz to 5350 MHz: 5.0dBi				
		5470 MHz to 5725 MHz: 5.0dBi				
		5725 MHz to 5850 MHz: 5.0dBi				
Maximum EIRP (dBm):	SISO_Chain 0		U-NII-1			
	IEEE 802.11a:		18.37			
	SISO_Chain 1		U-NII-1			
	IEEE 802.11a:		18.39			
	MIMO_Chain 0+1		U-NII-1			
	IEEE 802.11n-HT20:		16.98			
	IEEE 802.11n-HT40:		21.18			
	IEEE 802.11ac-VHT20:		16.77			
	IEEE 802.11ac-VHT40:		21.07			
	IEEE 802.11ac-VHT80:		20.28			
	IEEE 802.11ax-HE20:		17.20			
	IEEE 802.11ax-HE40:		21.47			
	IEEE 802.11ax-HE80:		20.39			
Maximum conducted output power (dBm):	SISO_Chain 0		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:		14.37	14.04	14.03	14.02
	SISO_Chain 1		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:		13.39	13.05	13.09	12.82
	MIMO_Chain 0+1		U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11n-HT20:		9.46	16.52	16.61	16.29
	IEEE 802.11n-HT40:		13.66	17.54	17.47	17.42
IEEE 802.11ac-VHT20:		9.25	16.53	16.63	16.27	

	IEEE 802.11ac-VHT40:	13.55	17.18	17.17	17.01
	IEEE 802.11ac-VHT80:	12.76	20.10	19.03	19.01
	IEEE 802.11ax-HE20:	9.68	16.66	16.70	16.34
	IEEE 802.11ax-HE40:	13.95	17.46	17.40	17.22
	IEEE 802.11ax-HE80:	12.87	20.25	19.19	19.15
Normal Test Voltage:		12 VDC			

1.4 OTHER INFORMATION

Operation Frequency Each of Channel				
	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
IEEE 802.11a, IEEE 802.11n-HT20, IEEE 802.11ac-VHT20 IEEE 802.11ax-HE20	$f = 5000 + 5k, k = 32 + 4n$			$f = 5000 + 5k,$ $k = 145 + 4n$
	$n = 1, \dots, 4$	$n = 5, \dots, 8$	$n = 17, \dots, 27$	$n = 1, \dots, 5$
IEEE 802.11n-HT40, IEEE 802.11ac-VHT40 IEEE 802.11ax-HE40	$f = 5000 + 5k, k = 30 + 8n$			$f = 5000 + 5k,$ $k = 143 + 8n$
	$n = 1, 2$	$n = 1, \dots, 5$	$n = 9, \dots, 13$	$n = 1, 2$
IEEE 802.11ac-VHT80 IEEE 802.11ax-HE80	$f = 5000 + 5k, k = 26 + 16n$			$f = 5000 + 5k,$ $k = 155$
	$n = 1$	$n = 1, 2$	$n = 5, 6$	
Note: f is the operating frequency (MHz); k is the operating channel.				

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	DELL	Latitude 3400	16238087894	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust
USB disk	Kingston	DTSE9	N/A	UnionTrust
Flat Panel Monitor	DELL	SE2018HL	CN-0DDDDMM-FC C00-141-C5EU-A0 0	UnionTrust
Monitor	DELL	E1916HVI	CN-01MRJV-72872 -61D-CRJU-A00	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Ethernet Cable	RJ45	1.5 Unshielded without ferrite	UnionTrust
2	Antenna Cable	SMA	0.1 Meter	UnionTrust

1.6 TEST LOCATION

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1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

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1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.2 dB
2	Conducted emission 150KHz-30MHz	±2.7 dB
3	Radiated emission 9KHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	5.6 GHz: ± 6.4 x 10 ⁻⁸
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart E Test Cases			
Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203 FCC 47 CFR Part 15 Subpart E Section 15.407(a)(1) (2) RSS-Gen Issue 5, Section 6.8	N/A	PASS
26 dB emission bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(2)(5) RSS-247 Issue 2 Section 6.2.1.2	KDB 789033 D02 v02r01 Section C.1	PASS
6 dB bandwidth	FCC 47 CFR Part 15 Subpart E Section 15.407 (e) RSS-247 Issue 2 Section 6.2.4.1	KDB 789033 D02 v02r01 Section C.2	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, section 6.7	PASS
Maximum conducted output power	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3) RSS-247 Issue 2 Section 6.2.1.1/6.2.2.1/6.2.3.1/6.2.4.1	KDB 789033 D02 v02r01 Section E.3.a (Method PM)	PASS
Peak Power Spectral Density	FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3) RSS-247 Issue 2 Section 6.2.1.1/6.2.2.1/6.2.3.1/6.2.4.1	KDB 789033 D02 v02r01 Section F	PASS
Radiated Emissions and Band Edge Measurement	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(1)(2)(3)(4)(6) FCC 47 CFR Part 15 Subpart C Section 15.209/205 RSS-247 Issue 2 Section 6.2.1.2/6.2.2.2/6.2.3.2/6.2.4.2	KDB 789033 D02 v02r01 Section G.3, G.4, G.5, and G.6	PASS
Dynamic Frequency Selection	FCC 47 CFR Part 15 Subpart E Section 15.407 (h) RSS-247 Issue 2 Section 6.3	KDB 905462 D03 Client Without DFS New Rules v01r02	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart E Section 15.407 (b)(6) FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013, Section 6.2.	PASS
Note: 1) N/A: In this whole report not applicable.			
Disclaimer and Explanations: The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.			

For Dynamic Frequency Selection

Test Case	Result
Channel Availability Check Time	N/A ¹
U-NII Detection Bandwidth	N/A ¹
Channel Closing Transmission Time	PASS
Channel Move Time	PASS
DFS Detection Threshold	N/A ¹
Non- Occupancy Period	N/A ¹
Note: 1) The EUT is slave, NA In this whole report not applicable.	

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3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 05, 2021	Nov. 04, 2022
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 15, 2022	Apr. 14, 2023
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 11, 2021	Nov. 10, 2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 11, 2021	Nov. 10, 2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 11, 2021	Nov. 10, 2023
☒	Preamplifier	HP	8447F	2805A02960	Nov. 05, 2021	Nov. 04, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Apr. 30, 2021	Apr. 29, 2023
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 06, 2021	Nov. 05, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 14, 2020	Nov. 13, 2023
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 17, 2020	Nov. 16, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☐	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	Nov. 06, 2021	Nov. 05, 2022
☒	Band Rejection Filter (5150MHz~5880MHz)	Micro-Tronics	BRM50716	G186	Nov. 06, 2021	Nov. 05, 2022
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	Nov. 05, 2021	Nov. 04, 2022
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 05, 2021	Nov. 04, 2022
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Apr. 15, 2022	Apr. 14, 2023
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 05, 2021	Nov. 04, 2022
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 05, 2021	Nov. 04, 2022
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 05, 2021	Nov. 04, 2022

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4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NT/NV	+15 to +35	12	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
26 dB emission bandwidth	24.5	51	100.2	220421011-A02/2	Rain Wang
6 dB bandwidth	24.5	51	100.2		Rain Wang
Occupied Bandwidth	24.5	51	100.2		Rain Wang
Maximum conducted output power	24.5	51	100.2		Rain Wang
Peak Power Spectral Density	24.5	51	100.2		Rain Wang
Radiated Emissions Measurement	25.3	52	100.2	220421011-A01/2	Asia Yan
Band Edge Measurement	25.3	52	100.2		Asia Yan
Dynamic Frequency Selection	24.5	51	100.2	220421011-A02/2	Rain Wang
AC Power Line Conducted Emission	24.8	48	101.1	220421011-B01/4	David Zhang

4.2 TEST CHANNELS

Mode	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
IEEE 802.11a IEEE 802.11n-HT20 IEEE 802.11ac-VHT20 IEEE 802.11ax-HE20	5150 MHz to 5250 MHz	Channel 36	Channel 44	Channel 48
		5180 MHz	5220 MHz	5240 MHz
	5250 MHz to 5350 MHz	Channel 52	Channel 60	Channel 64
		5260 MHz	5300 MHz	5320 MHz
	5470 MHz to 5725 MHz	Channel 100	Channel 116	Channel 140
		5500 MHz	5580 MHz	5700 MHz
	5725 MHz to 5850 MHz	Channel 149	Channel 157	Channel 165
		5745 MHz	5785 MHz	5825 MHz
IEEE 802.11n-HT40 IEEE 802.11ac-VHT40 IEEE 802.11ax-HE40	5150 MHz to 5250 MHz	Channel 38	--	Channel 46
		5190 MHz	--	5230 MHz
	5250 MHz to 5350 MHz	Channel 54	--	Channel 62
		5270 MHz	--	5310 MHz
	5470 MHz to 5725 MHz	Channel 102	Channel 110	Channel 134
		5510 MHz	5550 MHz	5670 MHz
	5725 MHz to 5850 MHz	Channel 151	--	Channel 159
		5755 MHz	--	5795 MHz
IEEE 802.11ac-VHT80 IEEE 802.11ax-HE80	5150 MHz to 5250 MHz	--	Channel 42	--
		--	5210 MHz	--
	5250 MHz to 5350 MHz	--	Channel 58	--
		--	5290 MHz	--
	5470 MHz to 5725 MHz	Channel 106	--	--
		5530 MHz	--	--
	5725 MHz to 5850 MHz	--	Channel 155	--
		--	5775 MHz	--

4.3 EUT TEST STATUS

Mode	Tx/Rx Function	Description
IEEE 802.11a/n/ac/ax	1Tx/1Rx or 2Tx/2Rx	1. Keep the EUT in transmitting mode with all kind of modulation and all kind of data rate.

Power Setting(Provided by the customer)				
	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
IEEE 802.11a	14	14	12	12
IEEE 802.11n-HT20	7	14	12	12
IEEE 802.11n-HT40	11	15	13	13
IEEE 802.11ac-VHT20	7	14	12	12
IEEE 802.11ac-VHT40	11	15	13	13
IEEE 802.11ac-VHT80	10	18	15	15
IEEE 802.11ax-HE20	7	14	12	12
IEEE 802.11ax-HE40	11	15	13	13
IEEE 802.11ax-HE80	11	18	15	15
OFDMA (RU)	0	8	5	1

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Test Software(Provided by the customer)

Test software name: Telnet commands;

4.4 PRE-SCAN

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Following data rate was (were) selected for the final test as listed below

Mode	Worst-case data rates
IEEE 802.11a	6 Mbps
IEEE 802.11n-HT20	MCS8
IEEE 802.11n-HT40	MCS8
IEEE 802.11ac-VHT20	MCS0
IEEE 802.11ac-VHT40	MCS0
IEEE 802.11ac-VHT80	MCS0
IEEE 802.11ax-HE20	MCS0
IEEE 802.11ax-HE40	MCS0
IEEE 802.11ax-HE80	MCS0

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

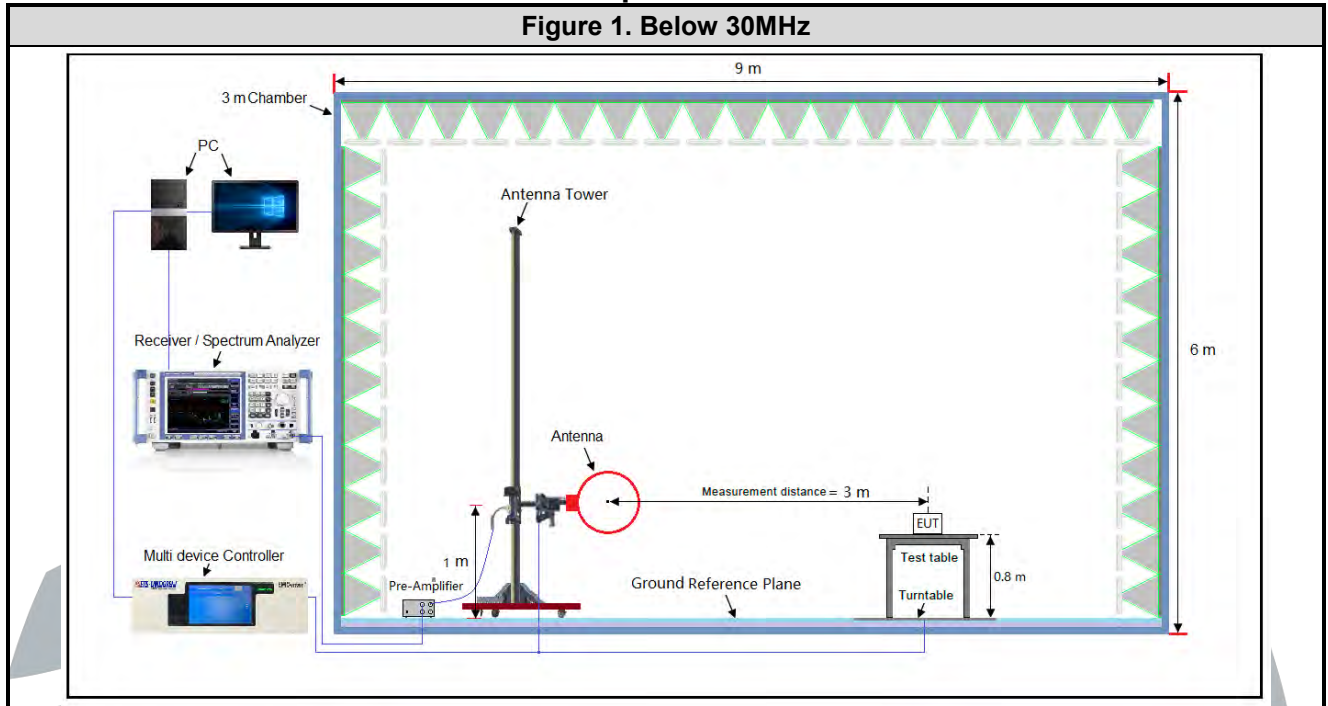
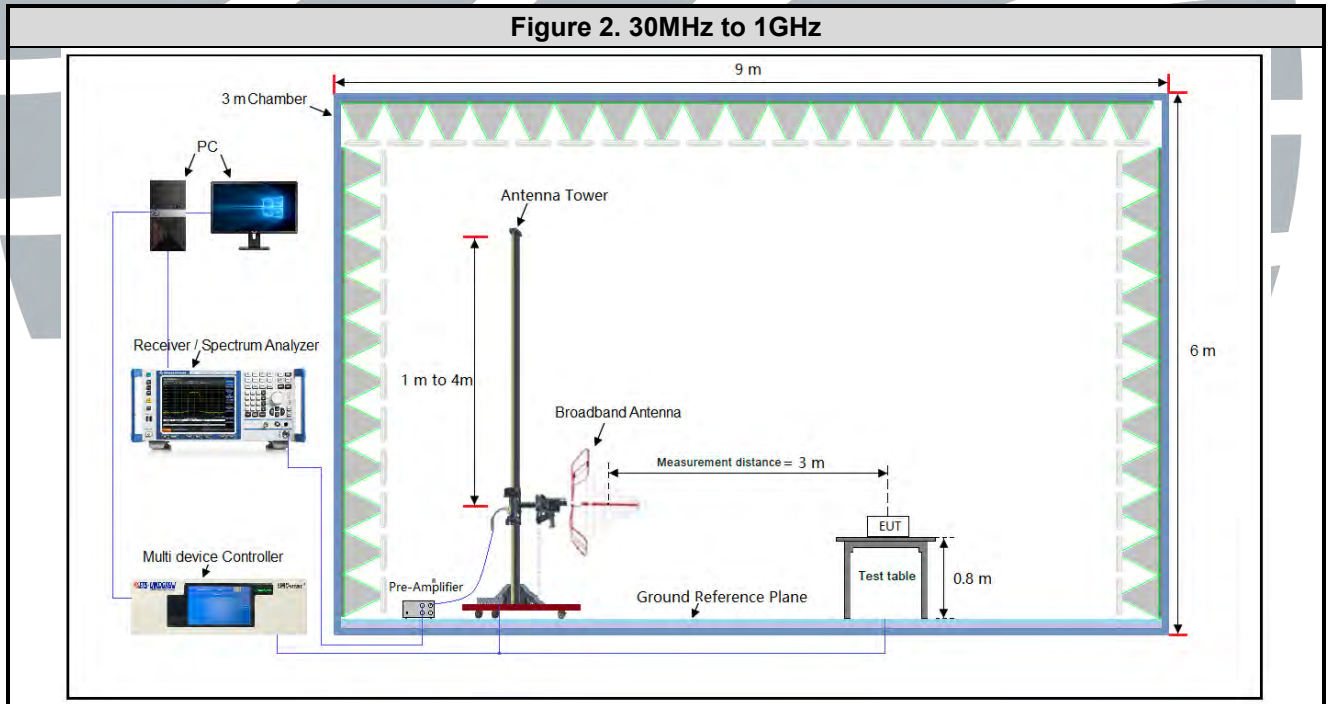
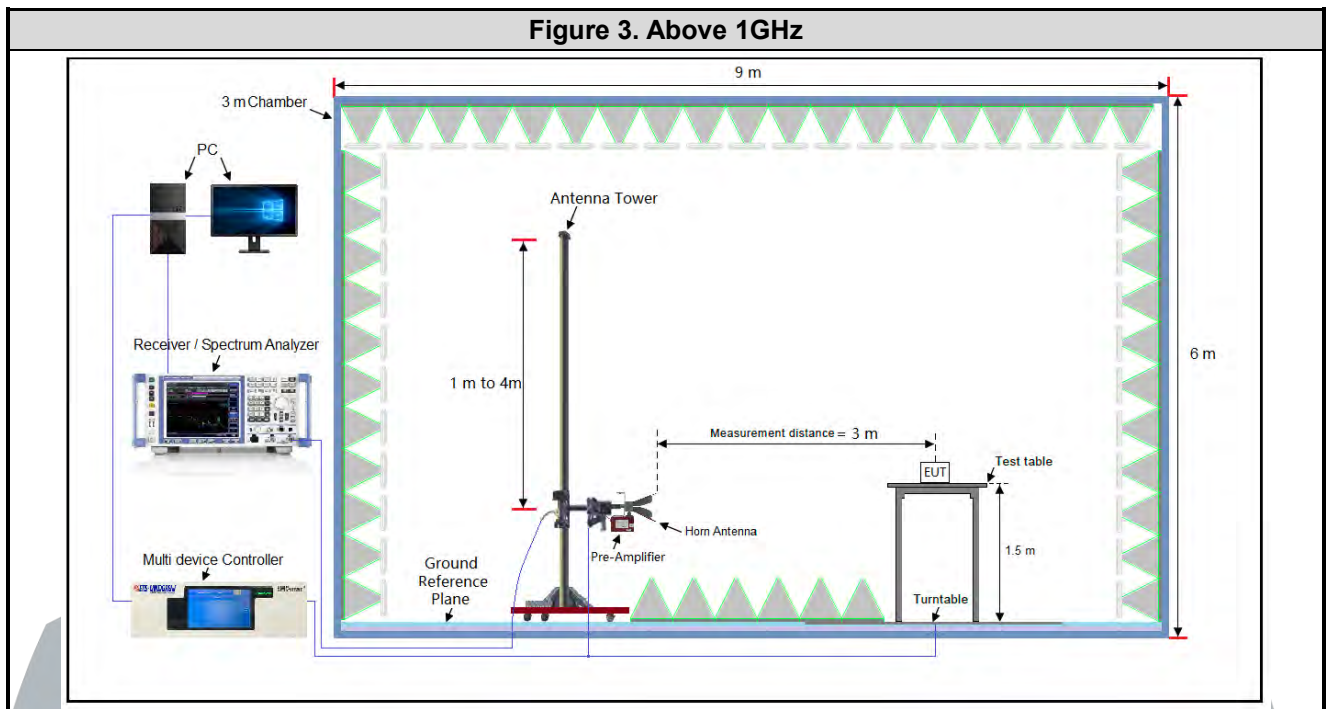
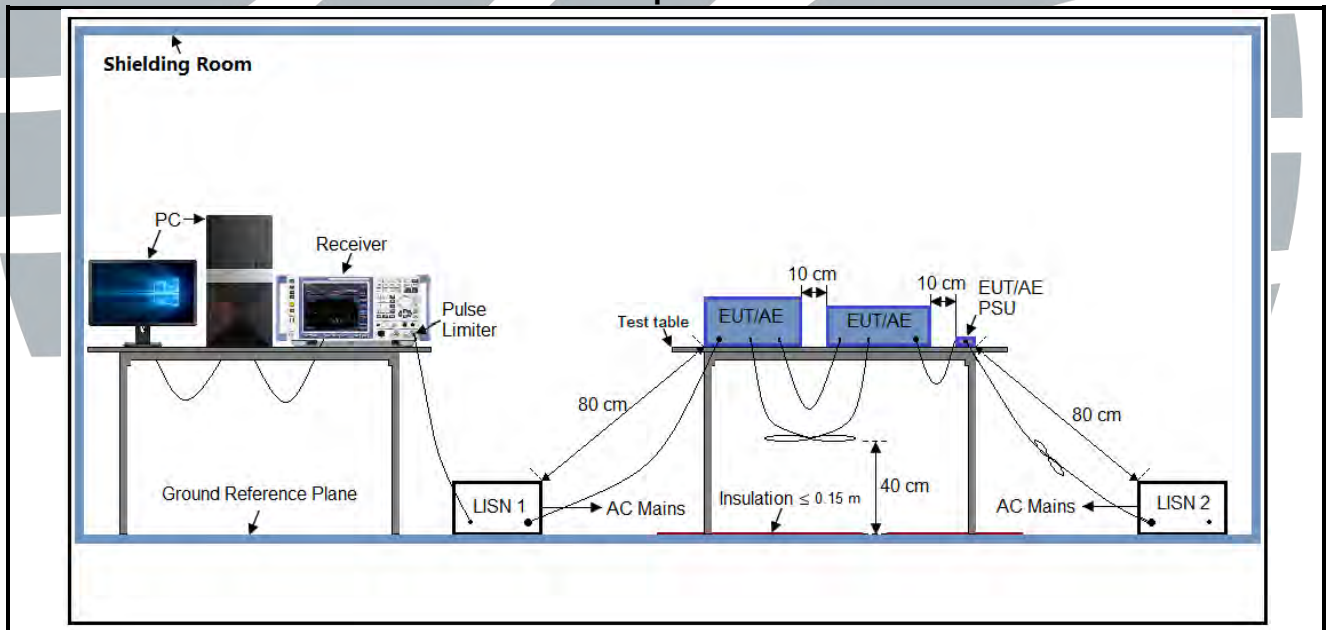


Figure 2. 30MHz to 1GHz

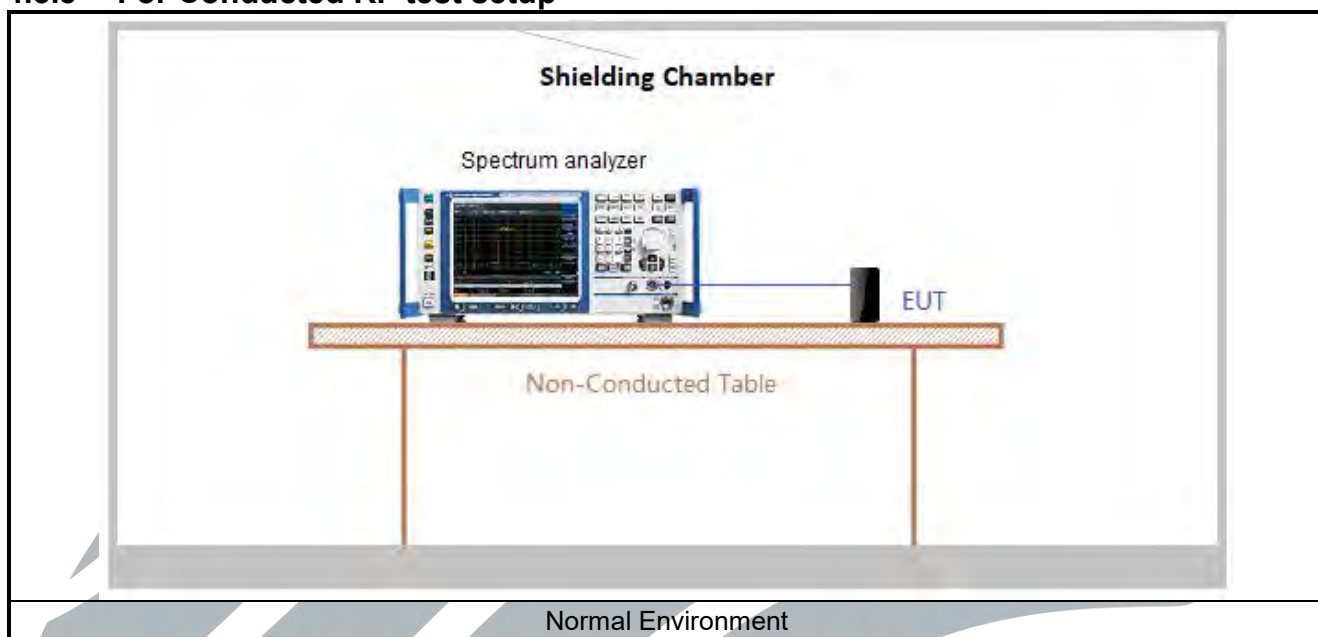




4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Y axis
	1TX	Chain 1	Y axis
	2TX	Chain 0+1	Y axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.7 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 12.2.

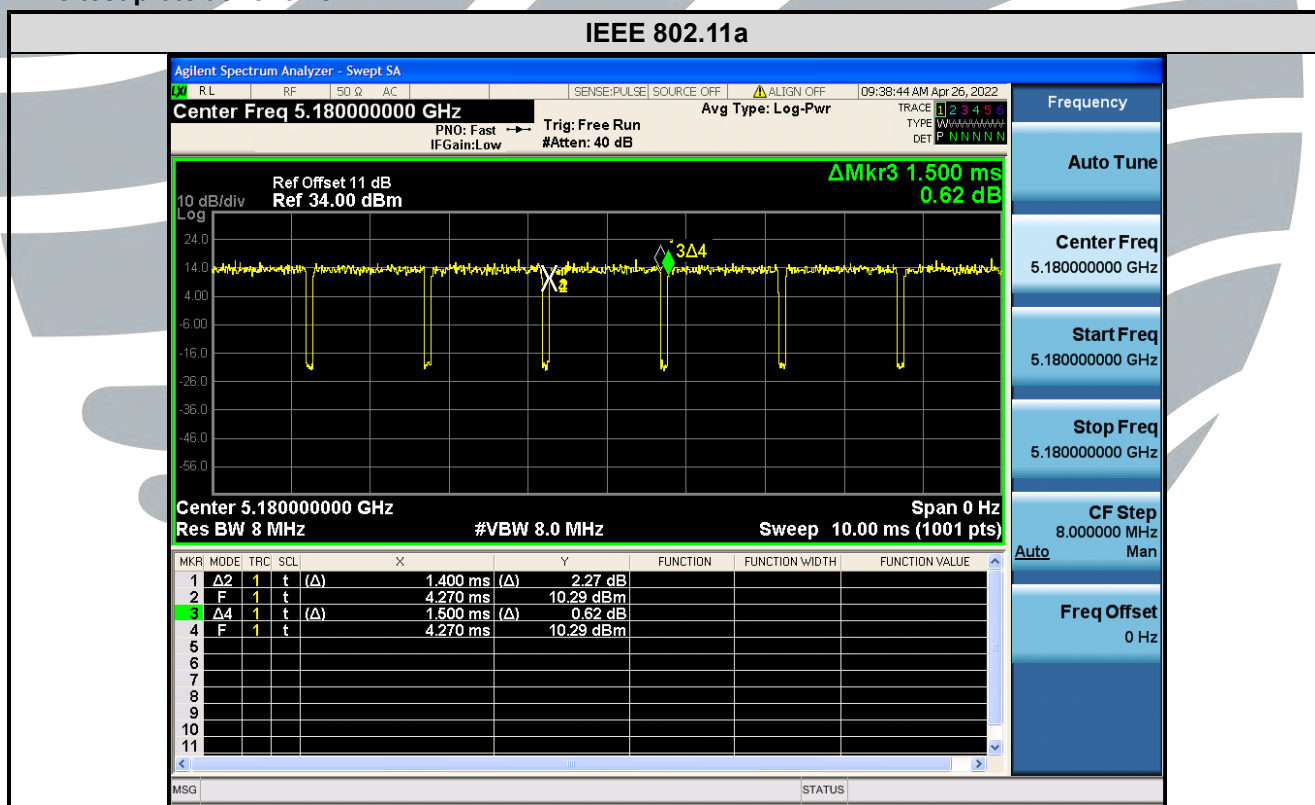
Test Results

Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11a	6	1.400	1.500	0.93	93.33	0.30	0.71	-0.60
IEEE 802.11n-HT20	MCS8	1.300	1.400	0.93	92.86	0.32	0.77	-0.64
IEEE 802.11n-HT40	MCS8	0.645	0.745	0.87	86.58	0.63	1.55	-1.25
IEEE 802.11ac-VHT20	MCS0	1.920	1.940	0.99	98.97	0.00	0.01	-0.09
IEEE 802.11ac-VHT40	MCS0	1.540	1.570	0.98	98.09	0.00	0.01	-0.17
IEEE 802.11ac-VHT80	MCS0	2.210	2.270	0.97	97.36	0.12	0.45	-0.23
IEEE 802.11ax-HE20	MCS0	1.485	1.515	0.98	98.02	0.00	0.01	-0.17
IEEE 802.11ax-HE40	MCS0	0.770	0.800	0.96	96.25	0.17	1.30	-0.33
IEEE 802.11ax-HE80	MCS0	0.402	0.432	0.93	93.06	0.31	2.49	-0.63

Remark:

- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$;
- 3) Average factor = $20 \log_{10} \text{Duty Cycle}$.

The test plots as follows



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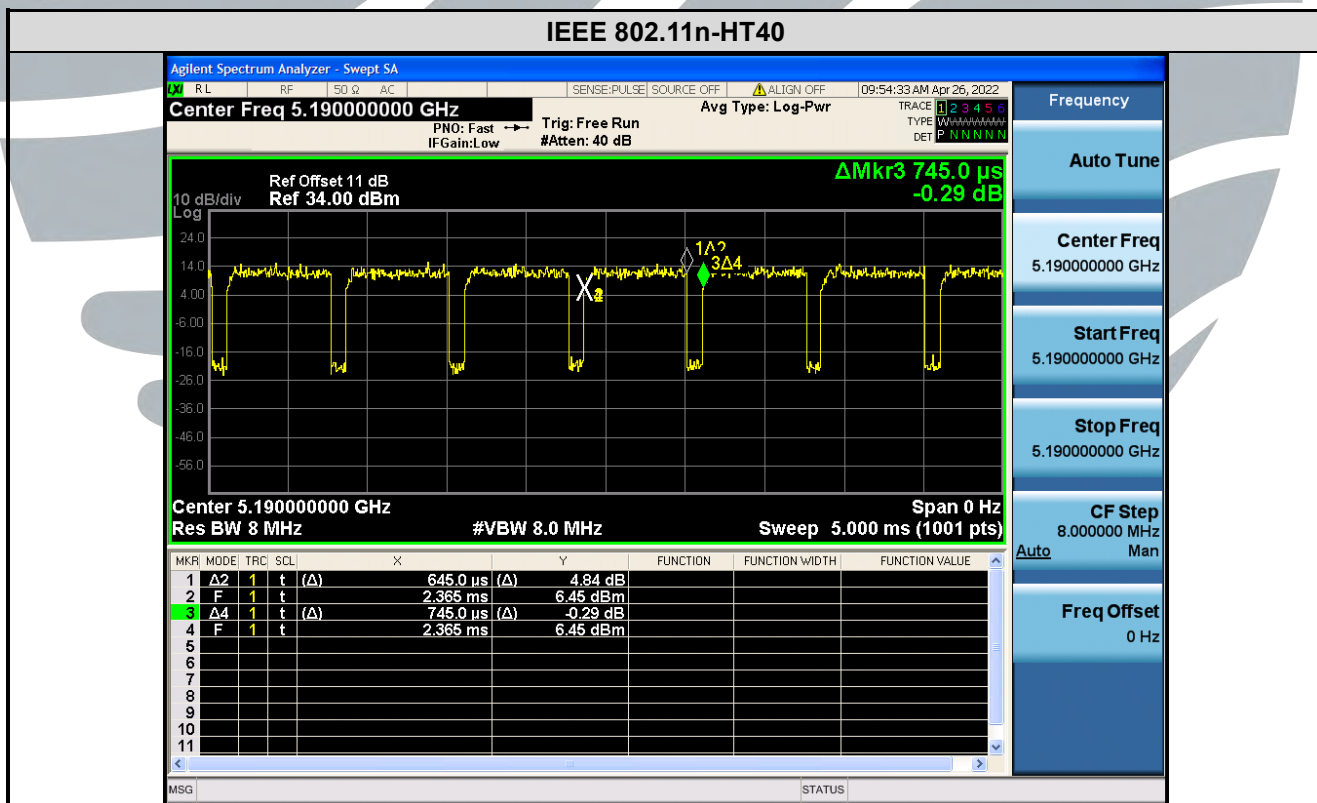
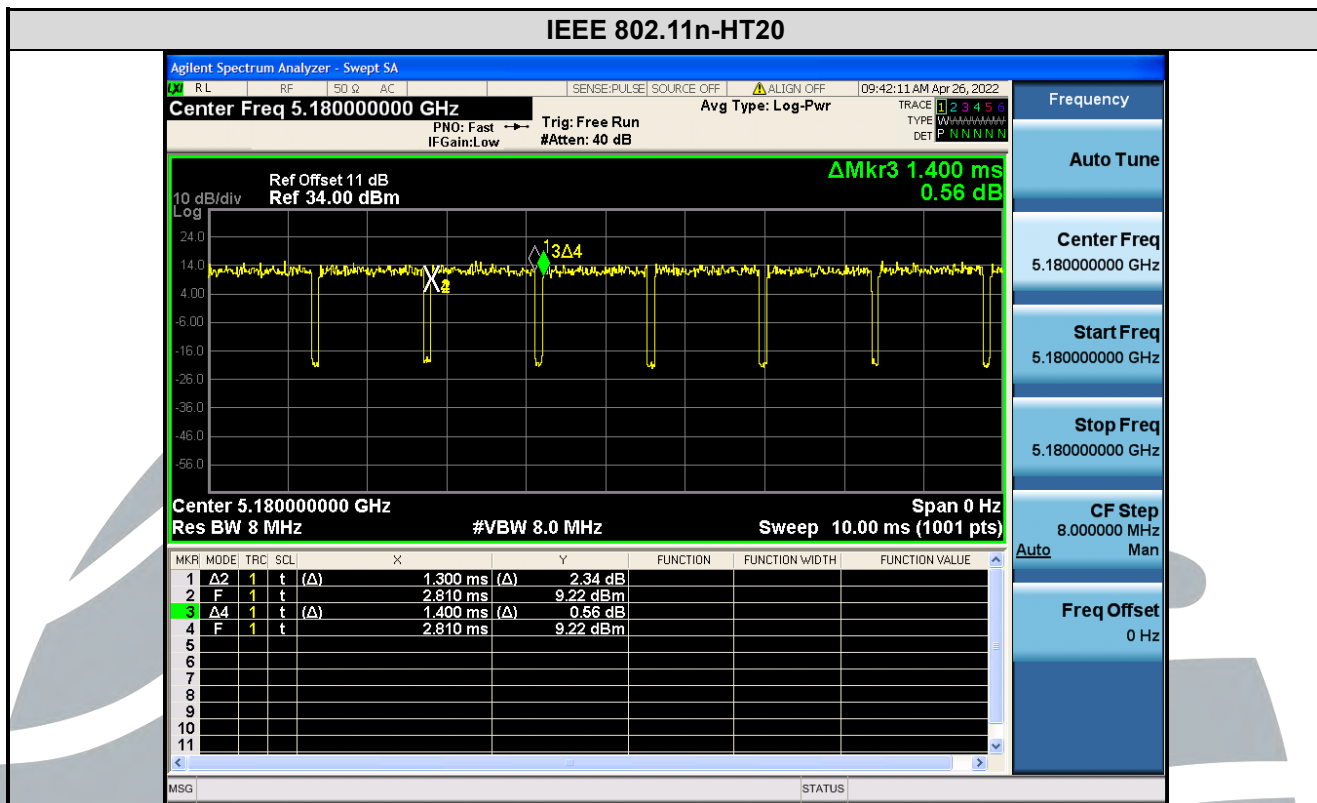
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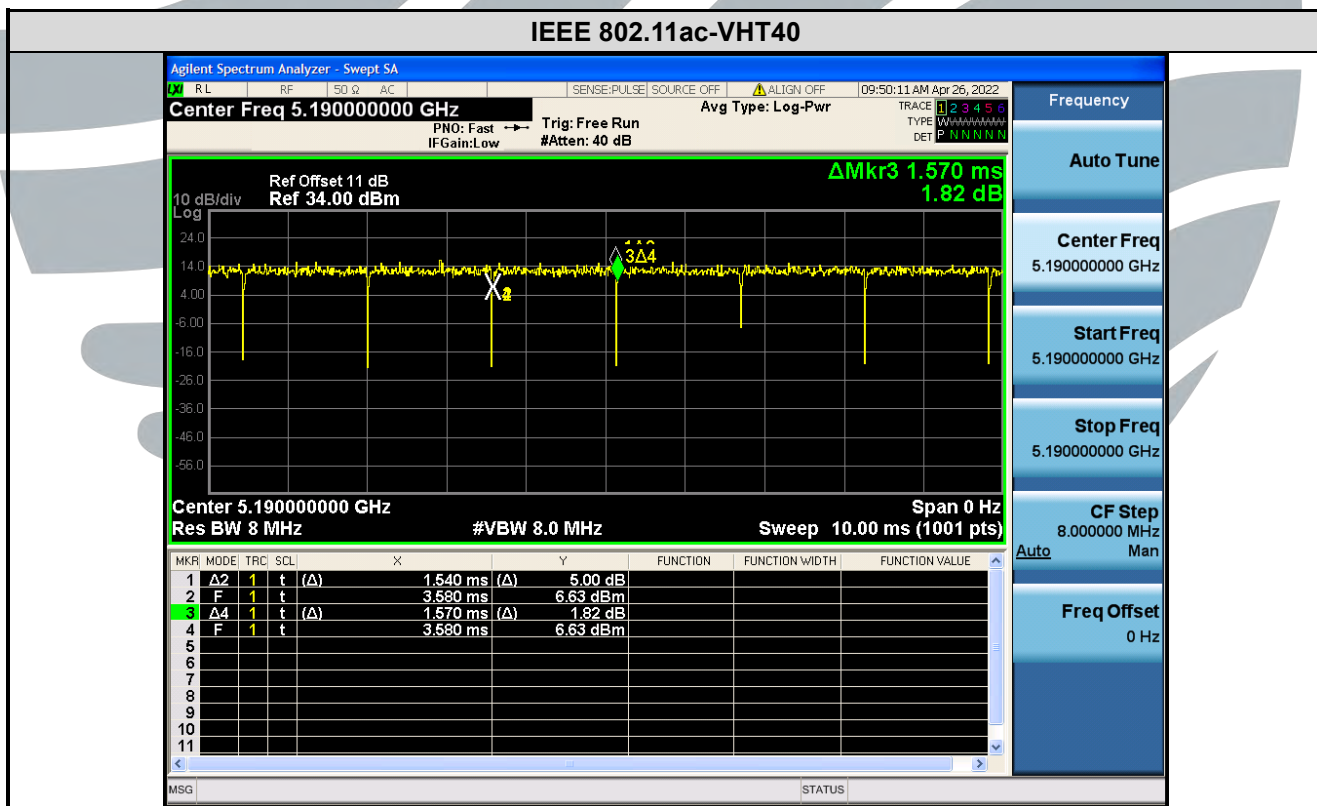
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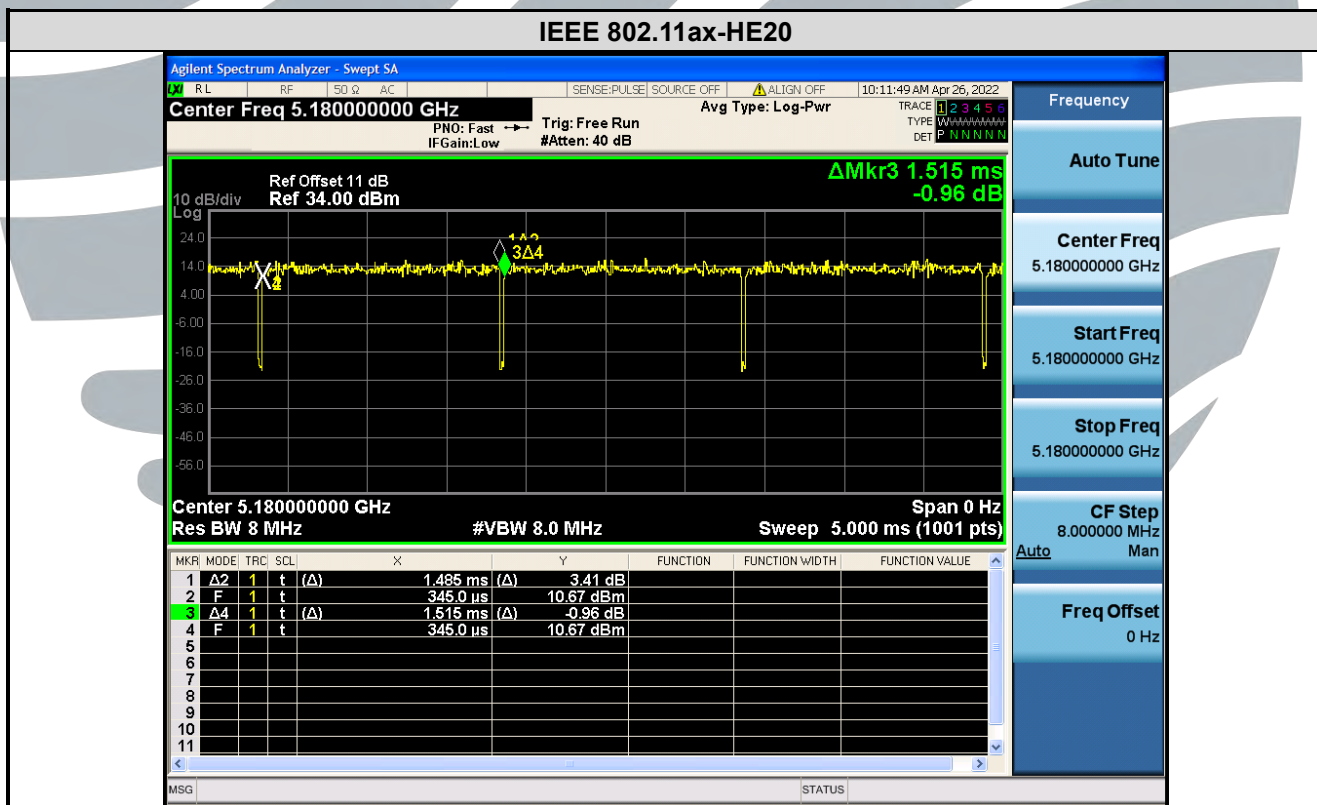
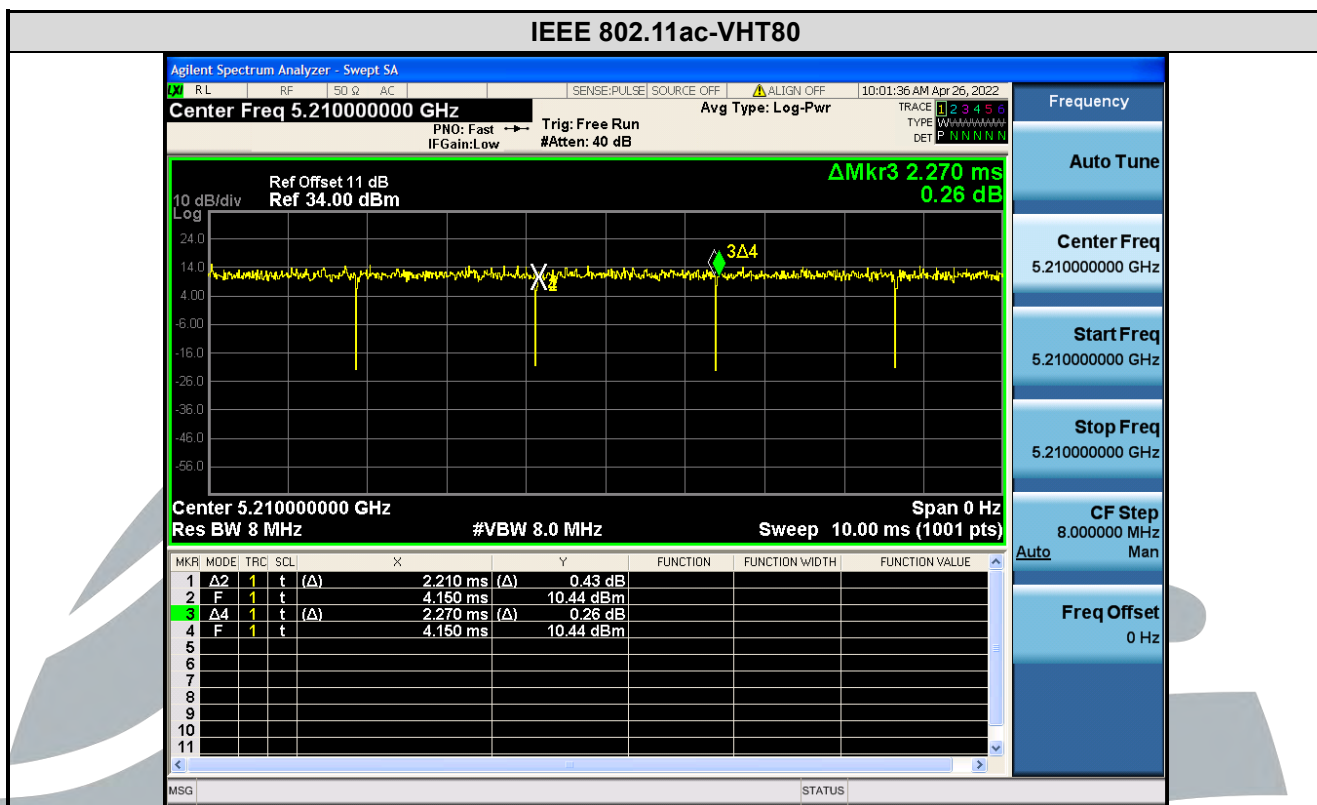
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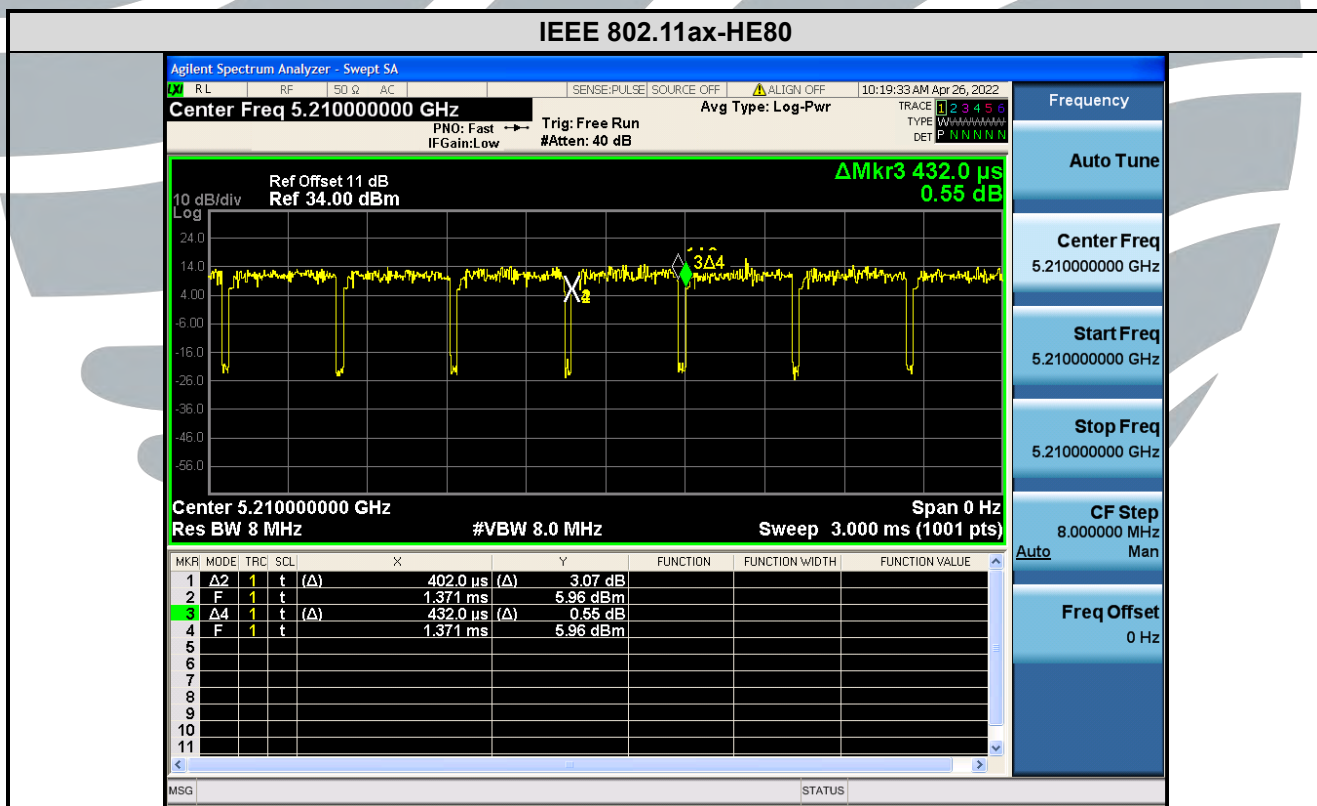
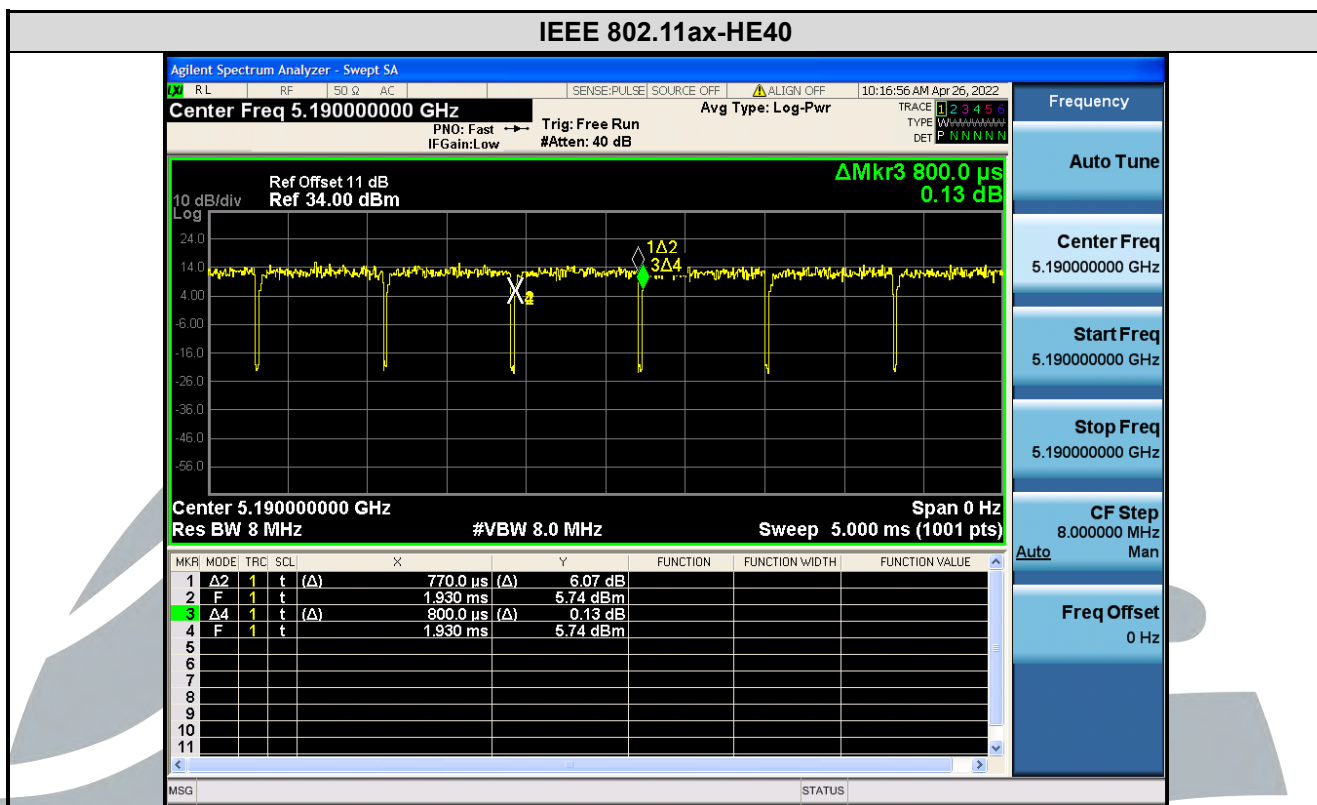
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5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 2	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
6	KDB 789033 D02 General UNII Test Procedures New Rules v02r01	Guidelines for compliance testing of unlicensed national information infrastructure (U-NII) device part 15, subpart E
7	KDB 905462 D06 802.11 Channel Plans New Rules v02	Operation in U-NII bands -802.11 channel PLAN(\$15.407)
8	KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02	Compliance measurement procedures for Unlicensed –National Information Infrastructure devices operates in the frequency bands 5250 MHz to 5350 MHz and 5470 MHz to 5725 MHz bands incorporating dynamic frequency selection
9	KDB 905462 D03 Client Without DFS New Rules v01r02	U-NII client devices without radar detection capability
10	KDB 662911 D01 Multiple Transmitter Output v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.407(a)(1) (2) requirement: The conducted output power limit specified in paragraph (a) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (a) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by the by the amount in dB that the directional gain of the antenna exceeds 6 dBi. RSS-Gen Issue 5, Section 6.8 requirement: According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. EUT Antenna: Both antenna in the interior of the equipment and no consideration of replacement. The transmit signals are correlated with each other, the best case directional gain of the antenna is 7.52 dBi (See section 5.5).

5.326 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(2)(5)
RSS-247 Issue 2 Section 6.2.1.2

Test Method: KDB 789033 D02 v02r01 Section C.1

Limit: None; for reporting purposes only.

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum analyzer.

Spectrum analyzer according to the following Settings:

a) Set RBW = approximately 1 % of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

Mode	Channel	26 dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Chain 0	Chain 1	Chain 0	Chain 1
IEEE 802.11a	36 (5180)	21.23	21.53	16.821	16.887
	44 (5220)	21.20	21.13	16.821	16.843
	48 (5240)	21.11	21.13	16.816	16.876
	52 (5260)	21.14	21.21	16.801	16.800
	60 (5300)	21.25	21.45	16.770	16.761
	64 (5320)	21.10	21.61	16.792	16.846
	100 (5500)	21.01	21.34	16.812	16.809
	116 (5580)	21.12	21.20	16.890	16.951
	140 (5700)	21.41	21.04	16.833	16.833
IEEE 802.11n-HT20	36 (5180)	21.42	22.90	18.004	17.905
	44 (5220)	21.67	23.62	17.957	17.883
	48 (5240)	21.49	22.56	17.964	17.848
	52 (5260)	21.62	21.58	17.859	17.868
	60 (5300)	21.47	21.36	17.873	17.820
	64 (5320)	21.73	21.30	17.969	17.851
	100 (5500)	21.41	21.71	17.916	17.855
	116 (5580)	21.68	21.48	17.961	17.882
	140 (5700)	21.86	21.65	18.008	17.824
IEEE 802.11n-HT40	38 (5190)	42.71	41.89	36.406	36.416
	46 (5230)	40.28	39.50	36.405	36.404
	54 (5270)	40.94	40.27	36.470	36.371
	62 (5310)	40.19	39.99	36.382	36.273
	102 (5510)	40.21	39.51	36.507	36.411
	110 (5550)	49.82	39.55	36.362	36.363
	134 (5670)	48.55	39.58	36.423	36.284

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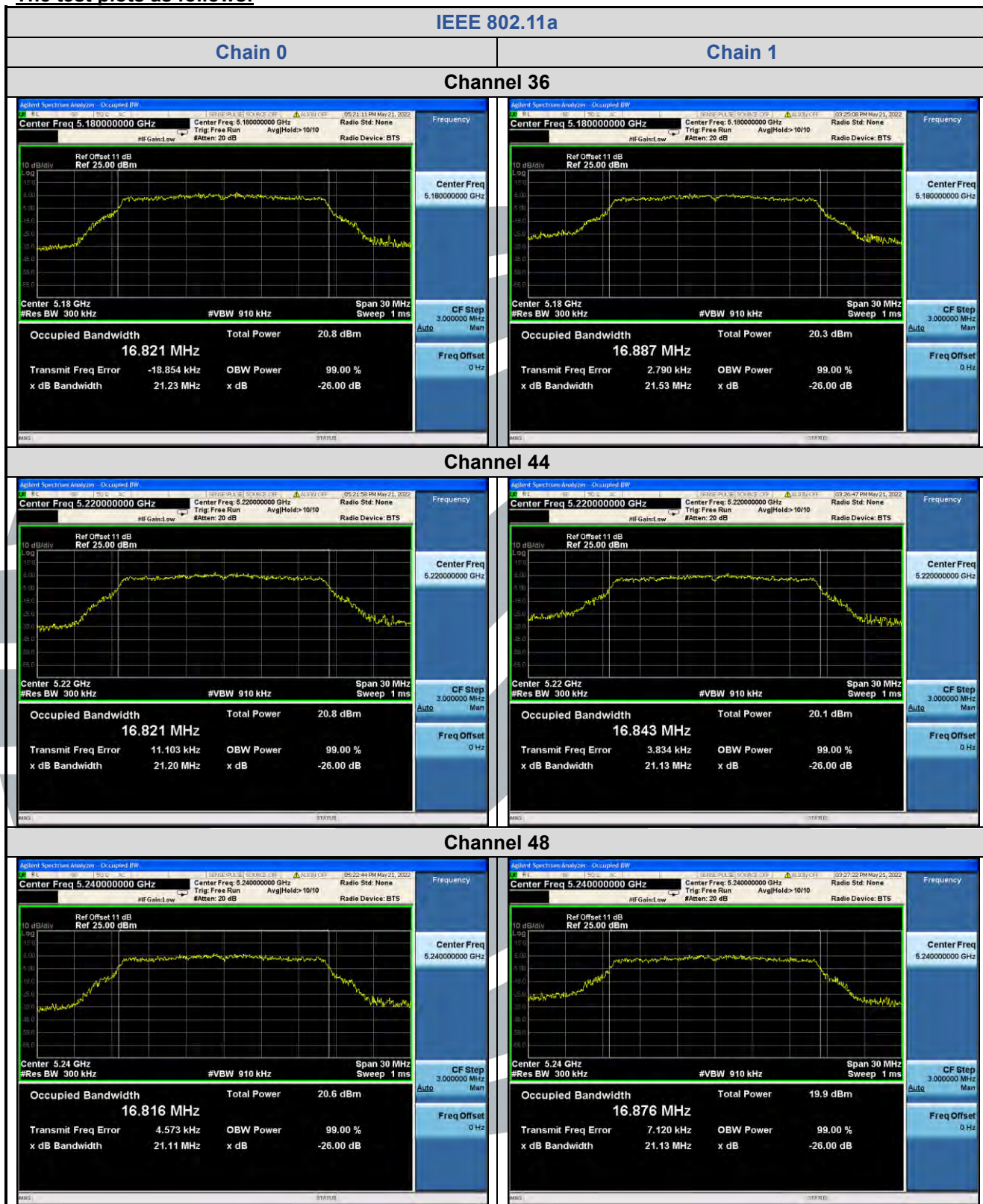
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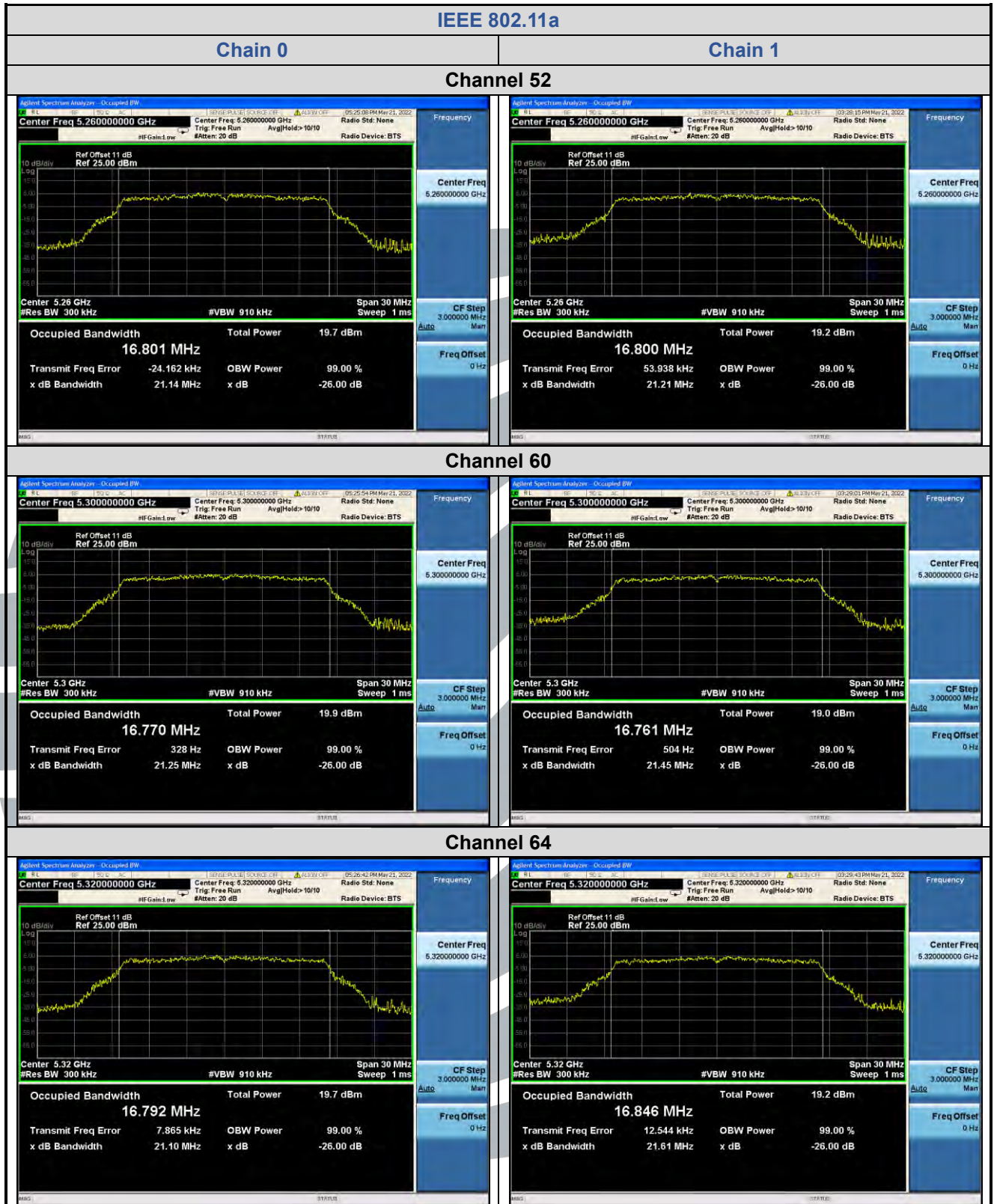
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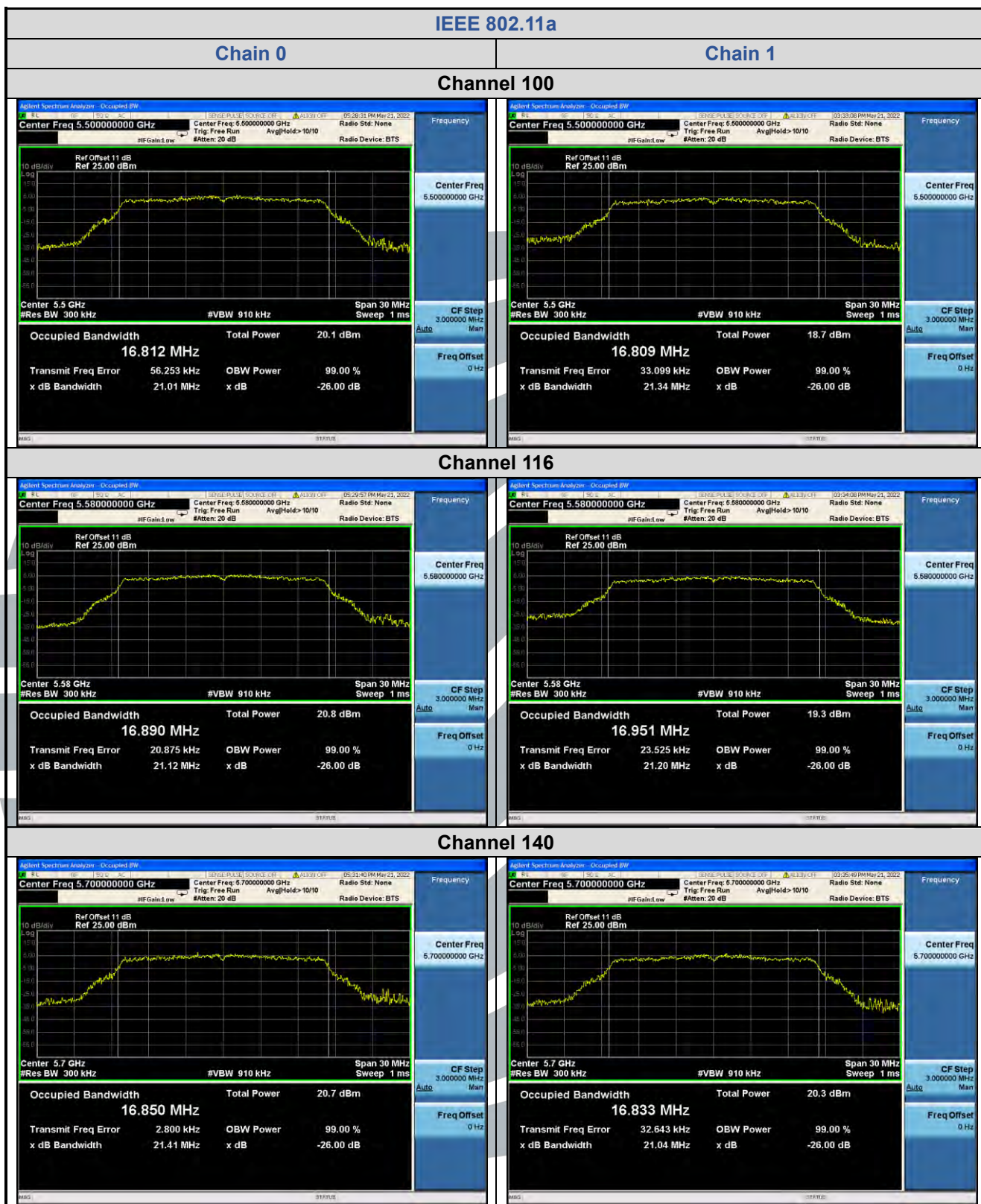
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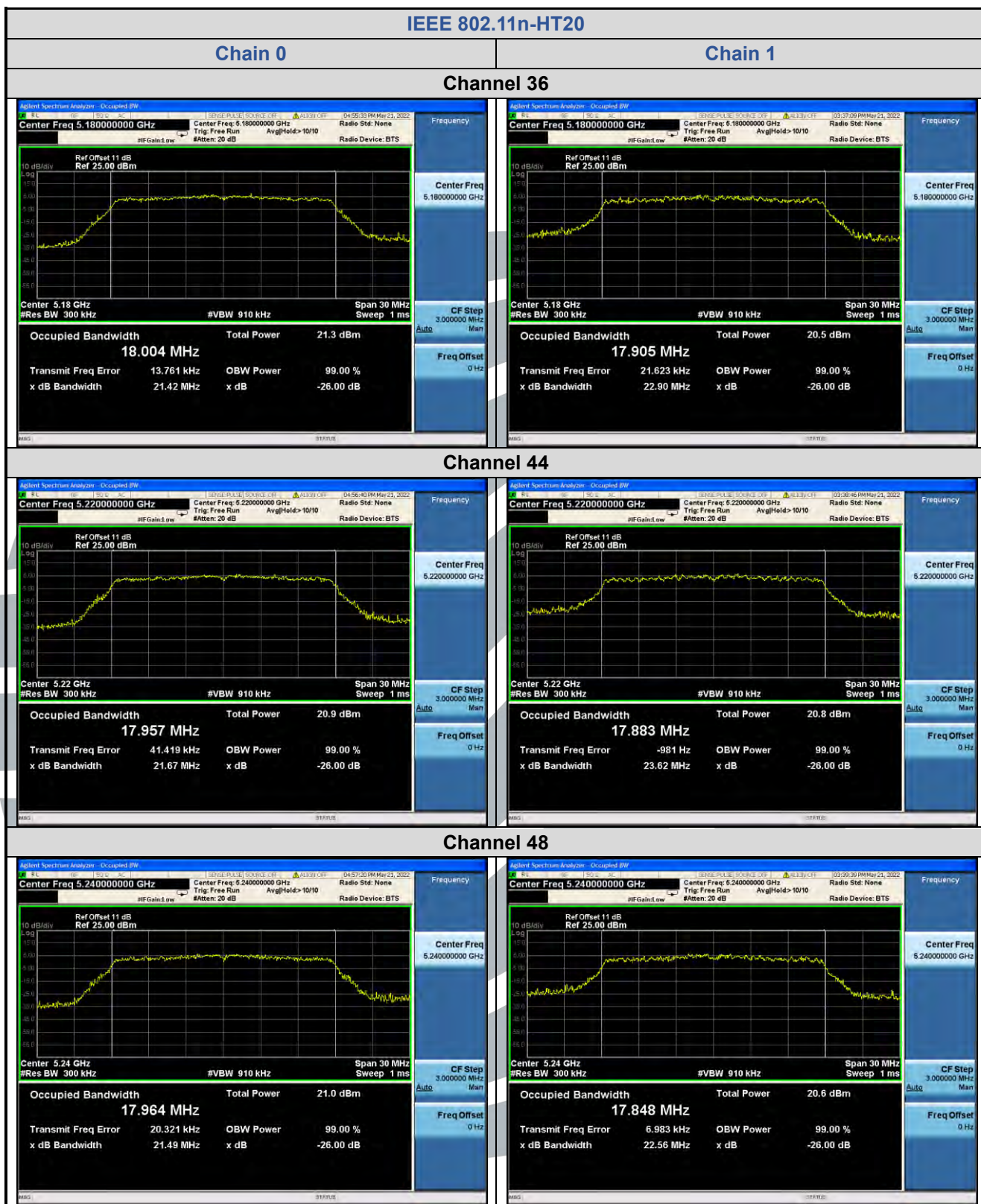
IEEE 802.11ac-VHT20	36 (5180)	21.47	21.30	17.925	17.859
	44 (5220)	21.51	21.65	17.898	17.884
	48 (5240)	21.68	21.74	17.954	17.869
	52 (5260)	21.46	21.54	17.911	17.852
	60 (5300)	21.74	21.56	17.924	17.831
	64 (5320)	21.67	22.09	17.894	17.847
	100 (5500)	21.70	21.77	17.919	17.851
	116 (5580)	21.47	21.33	17.972	17.844
	140 (5700)	22.00	21.43	17.949	17.877
IEEE 802.11ac-VHT40	38 (5190)	44.61	42.43	36.498	36.367
	46 (5230)	43.24	40.07	36.409	36.362
	54 (5270)	42.61	40.24	36.392	36.382
	62 (5310)	40.30	40.85	36.435	36.366
	102 (5510)	40.27	40.06	36.401	36.365
	110 (5550)	39.99	44.87	36.397	36.367
	134 (5670)	47.25	40.21	36.525	36.325
IEEE 802.11ac-VHT80	42 (5210)	119.6	120.0	76.510	76.496
	58 (5290)	113.6	119.8	76.155	76.232
	106 (5530)	118.9	119.9	76.060	76.080
IEEE 802.11ax-HE20	36 (5180)	21.31	21.26	18.931	19.001
	44 (5220)	21.09	21.40	18.972	18.934
	48 (5240)	21.37	21.39	18.905	18.981
	52 (5260)	20.77	21.02	18.912	18.922
	60 (5300)	21.25	20.99	18.905	18.930
	64 (5320)	21.30	21.24	18.912	18.904
	100 (5500)	21.08	21.40	18.941	18.898
	116 (5580)	21.48	21.08	18.943	18.959
	140 (5700)	21.46	21.25	18.990	18.967
IEEE 802.11ax-HE40	38 (5190)	39.97	40.07	37.634	37.621
	46 (5230)	39.96	39.94	37.584	37.665
	54 (5270)	40.04	39.90	37.734	37.560
	62 (5310)	39.91	39.79	37.558	37.602
	102 (5510)	39.85	46.41	37.585	37.678
	110 (5550)	40.20	47.22	37.595	37.612
	134 (5670)	41.39	39.87	37.690	37.578
IEEE 802.11ax-HE80	42 (5210)	120.0	119.9	78.034	77.658
	58 (5290)	117.9	119.8	77.392	77.620
	106 (5530)	114.8	101.6	77.412	77.438

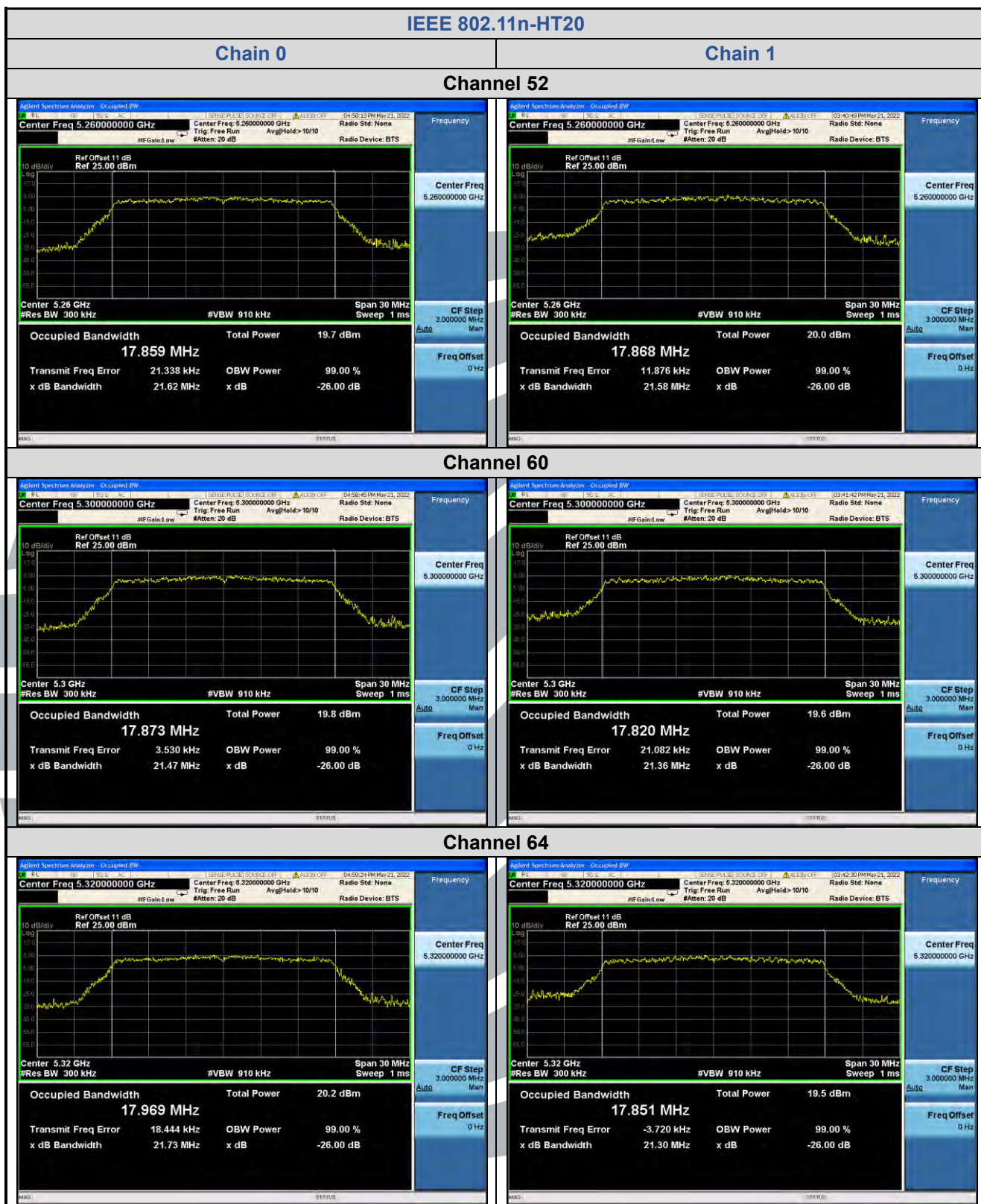
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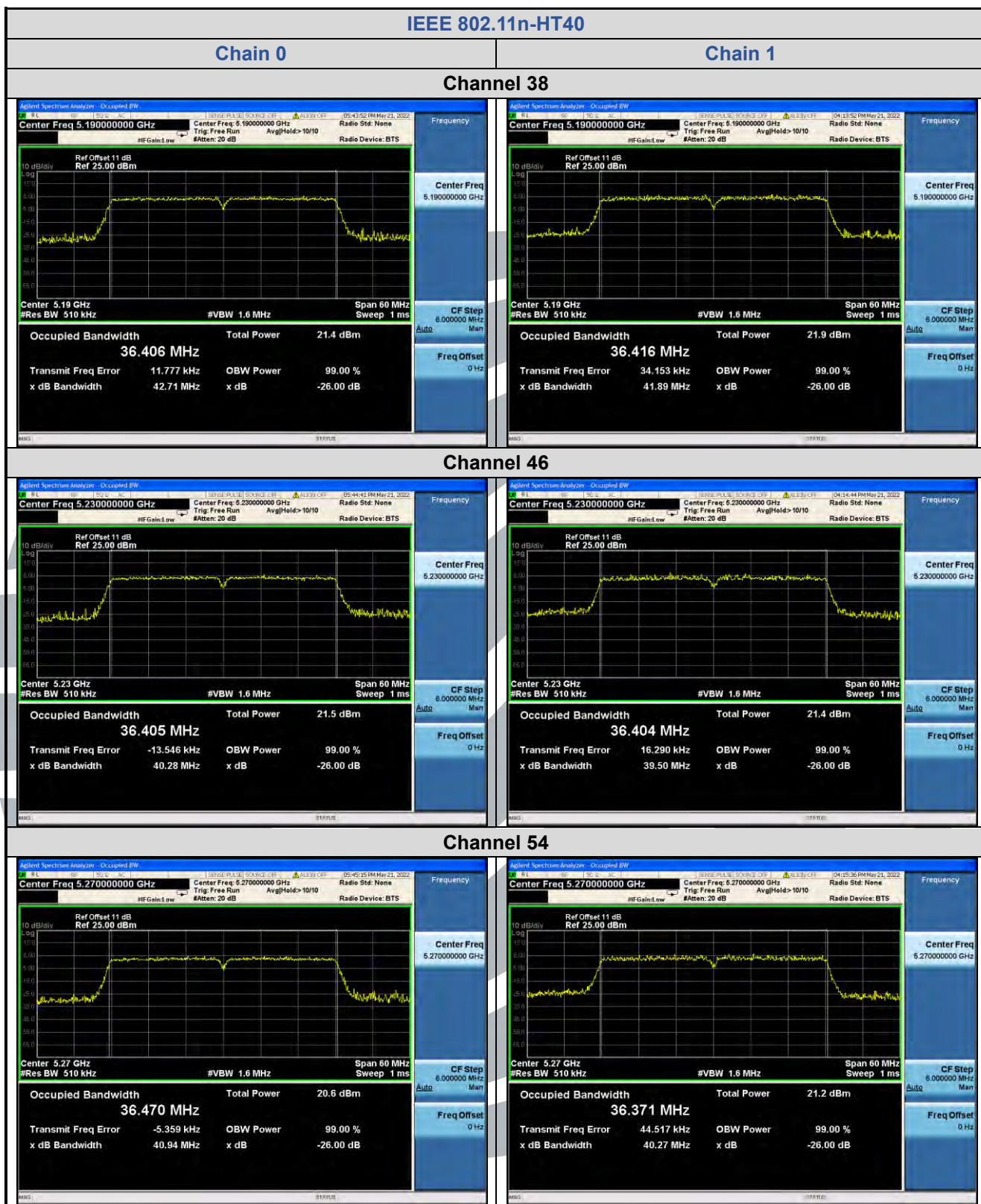


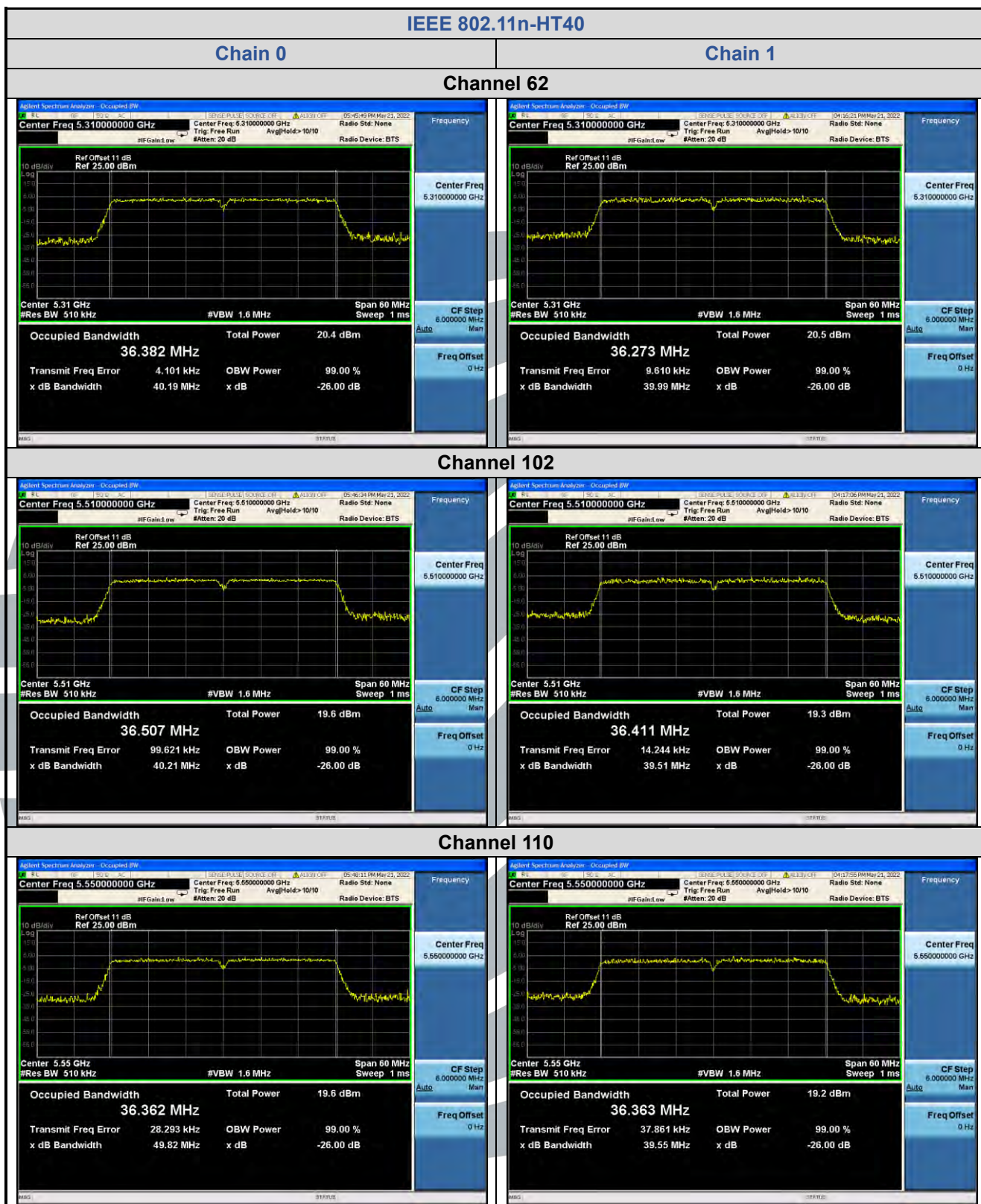


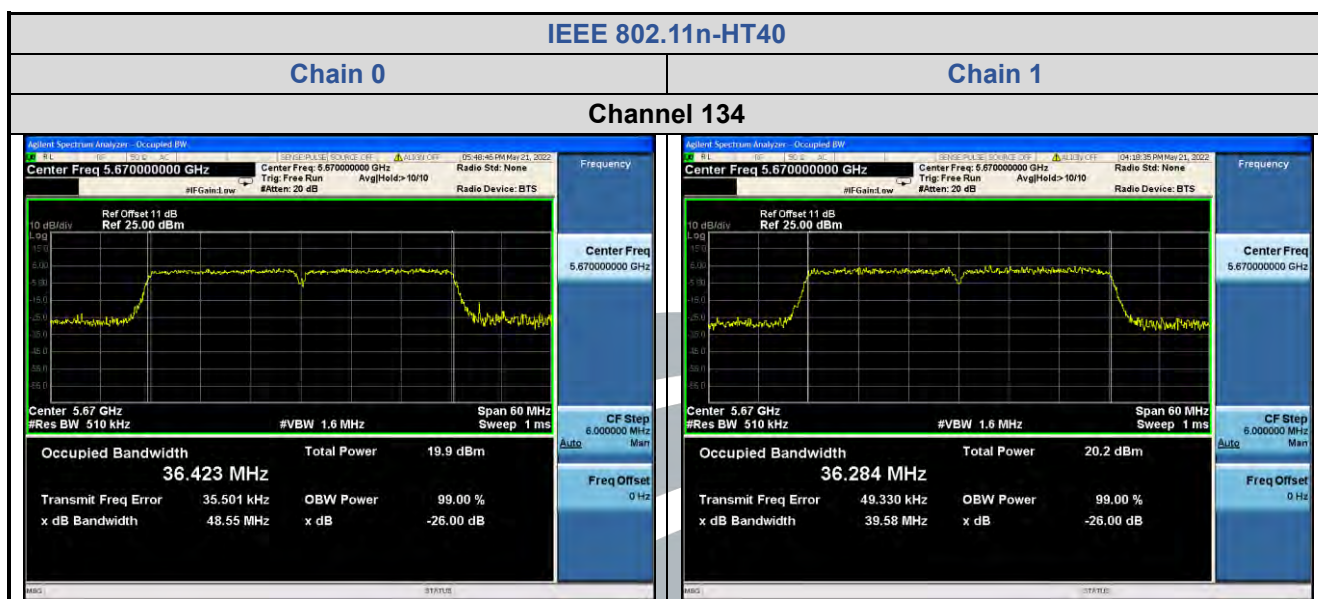












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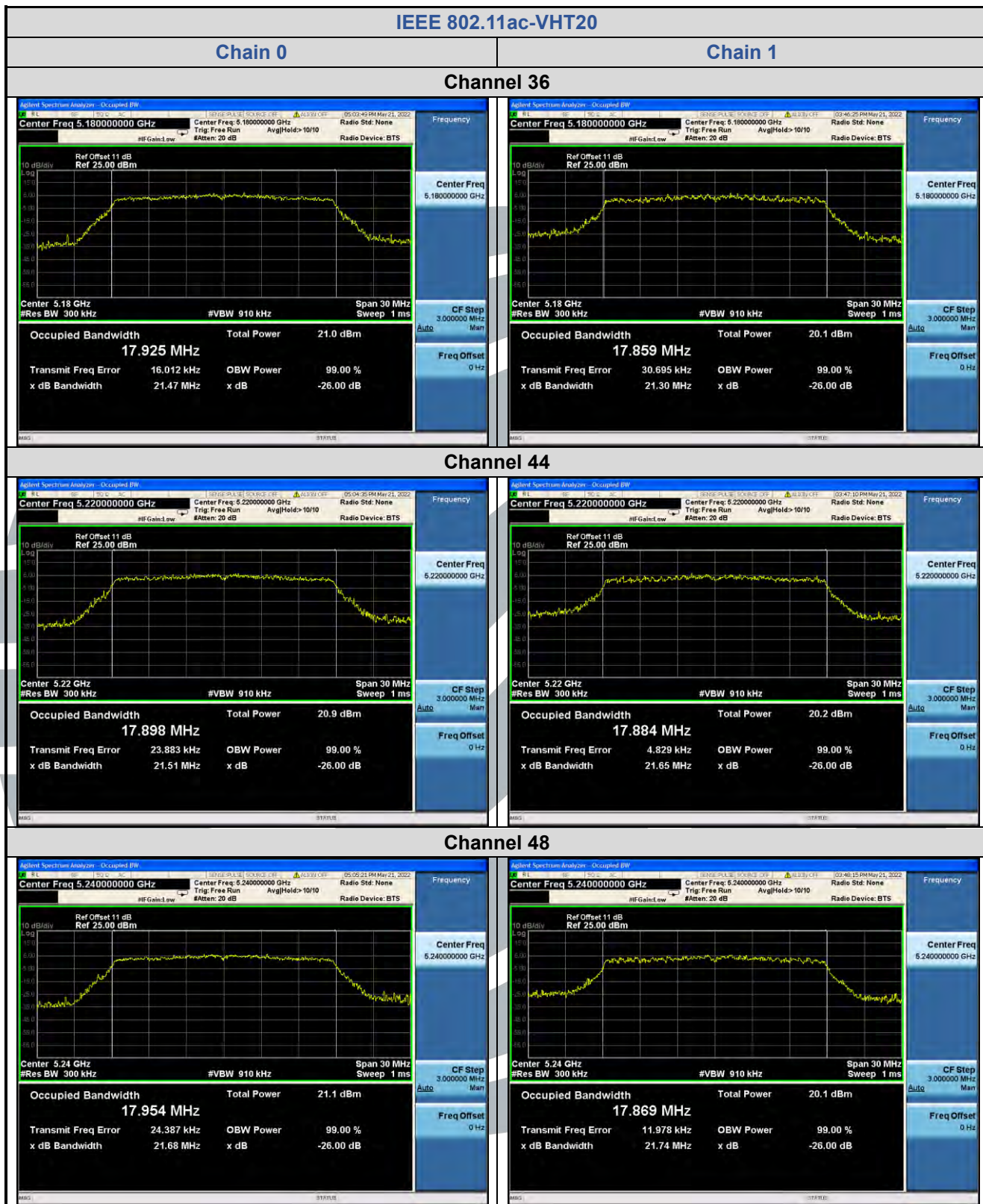
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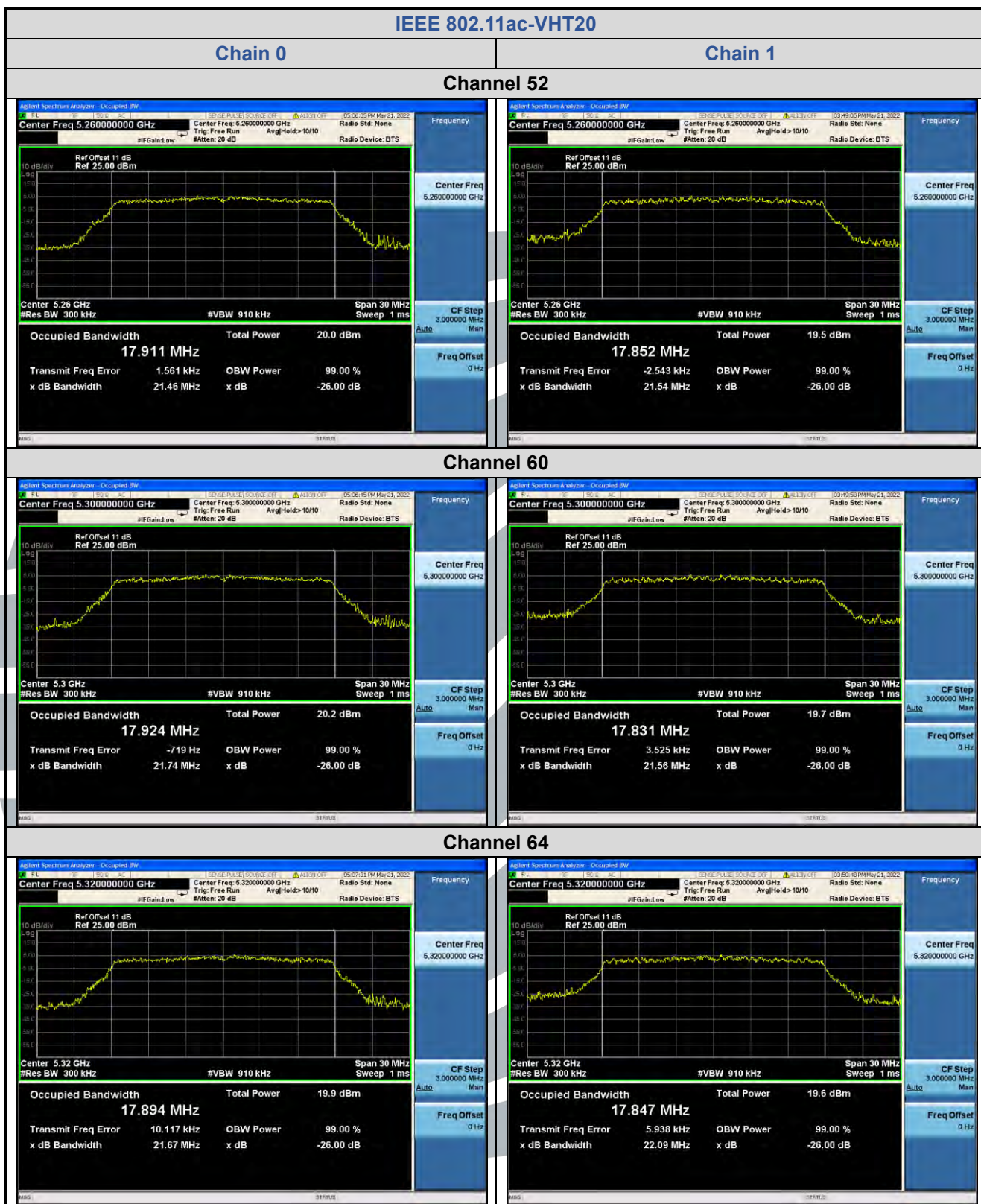
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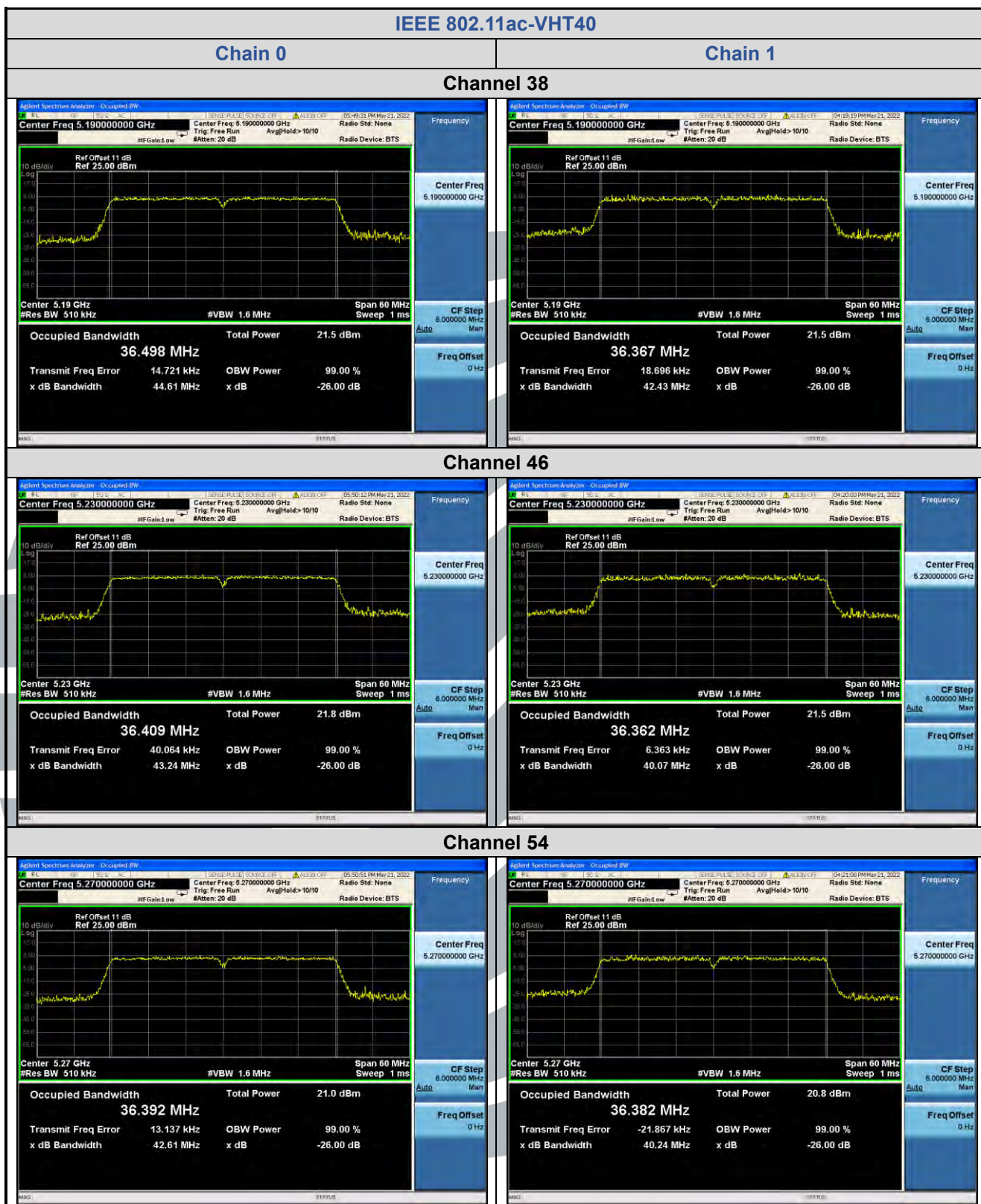
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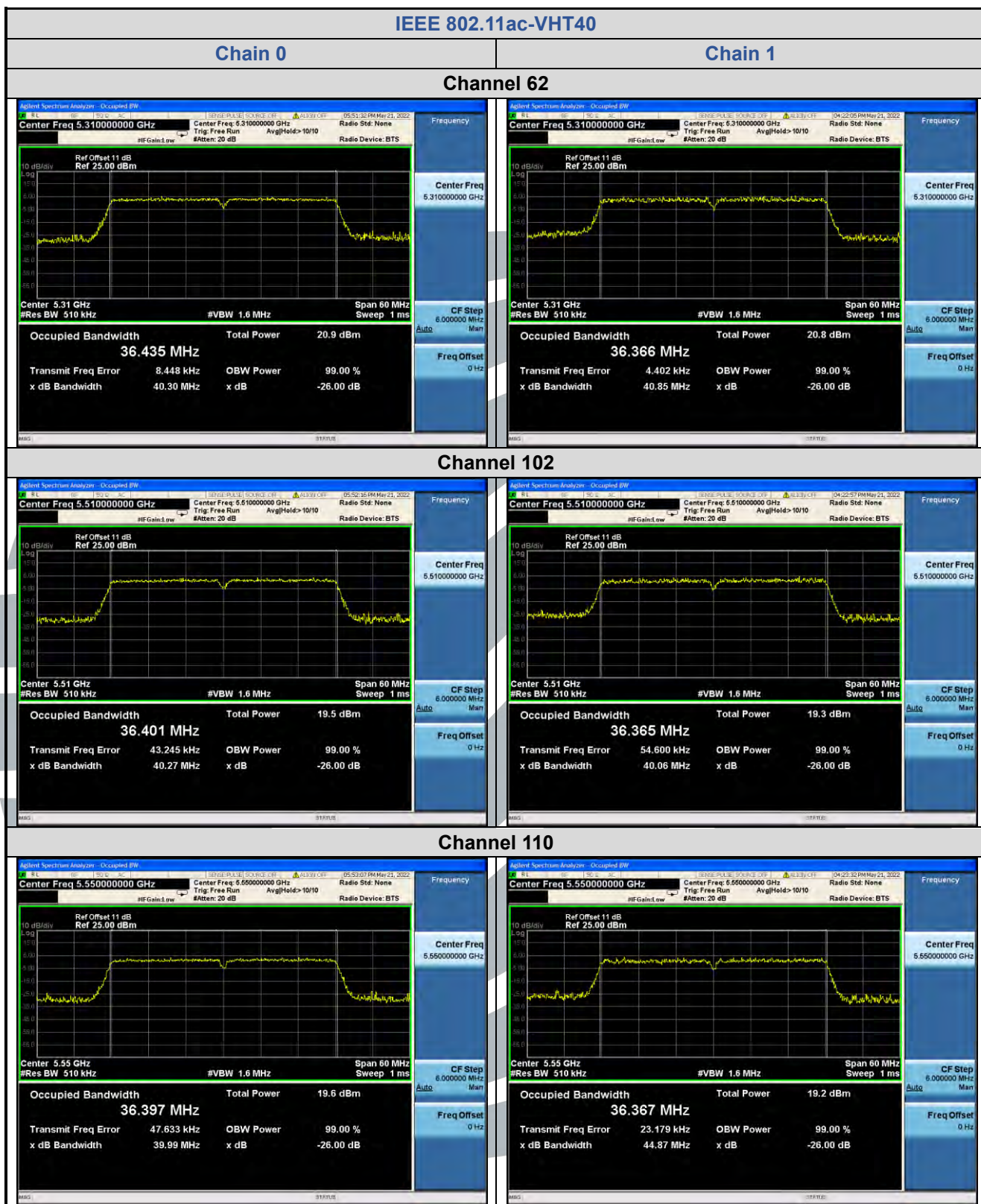
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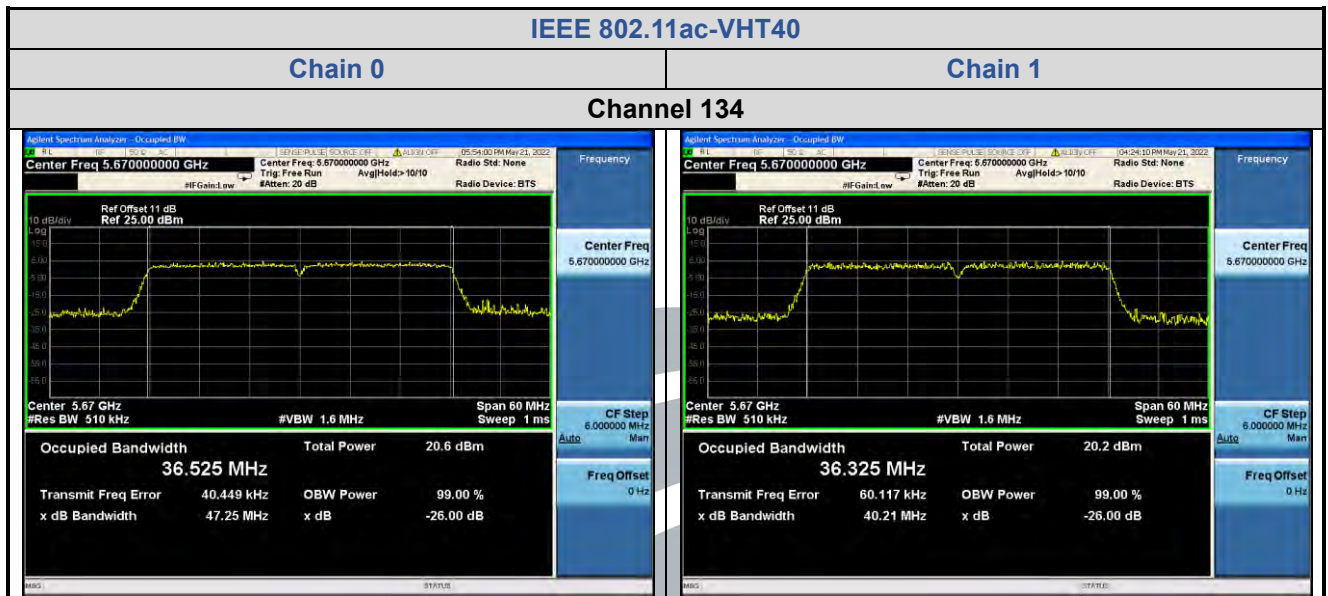












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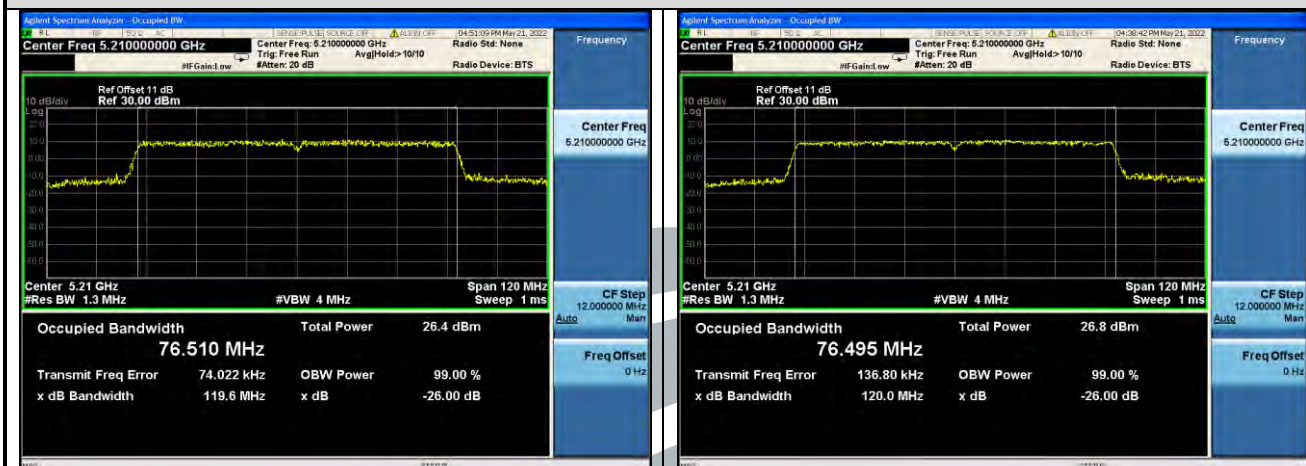
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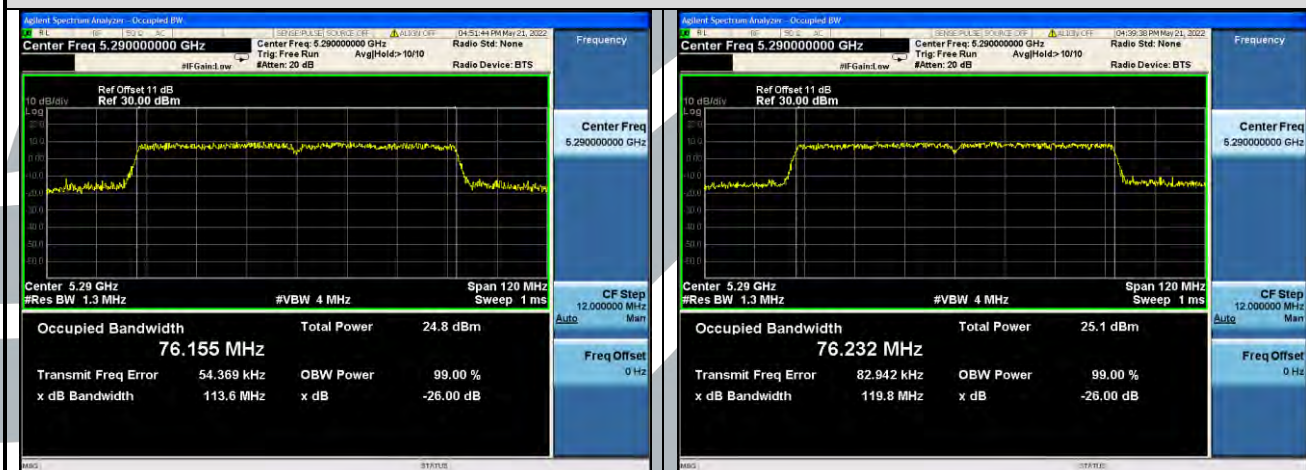
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IEEE 802.11ac-VHT80

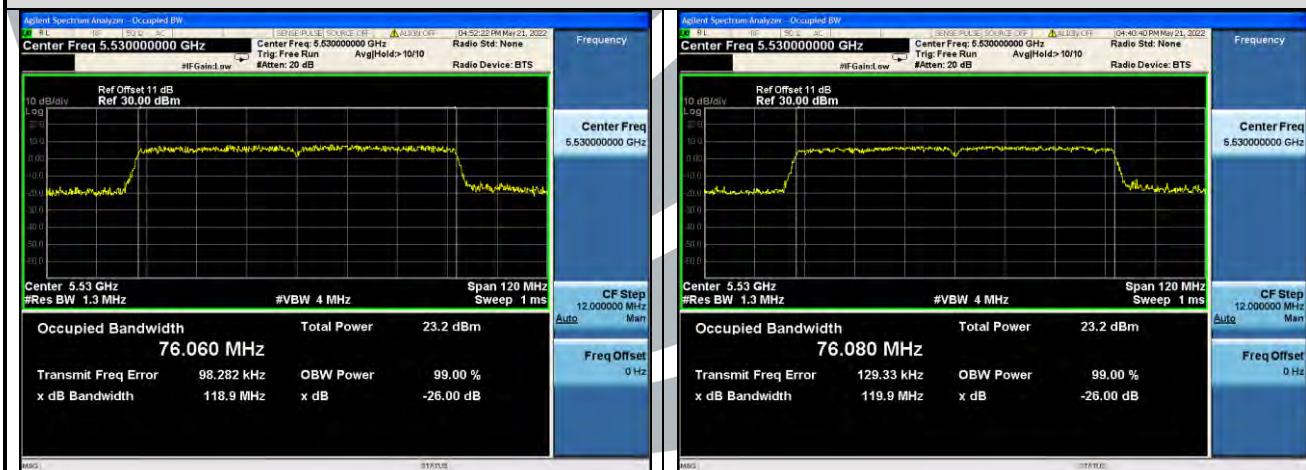
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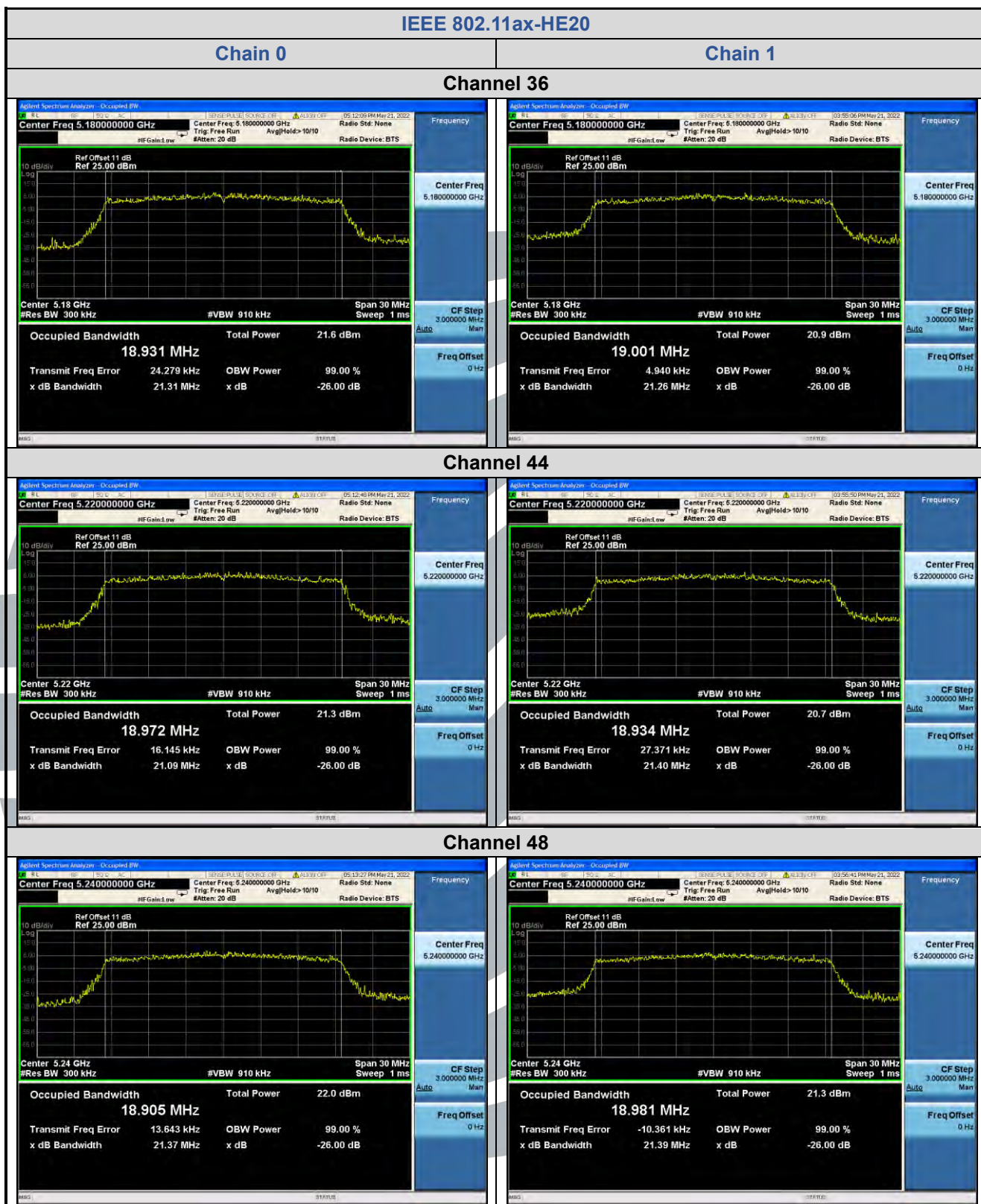


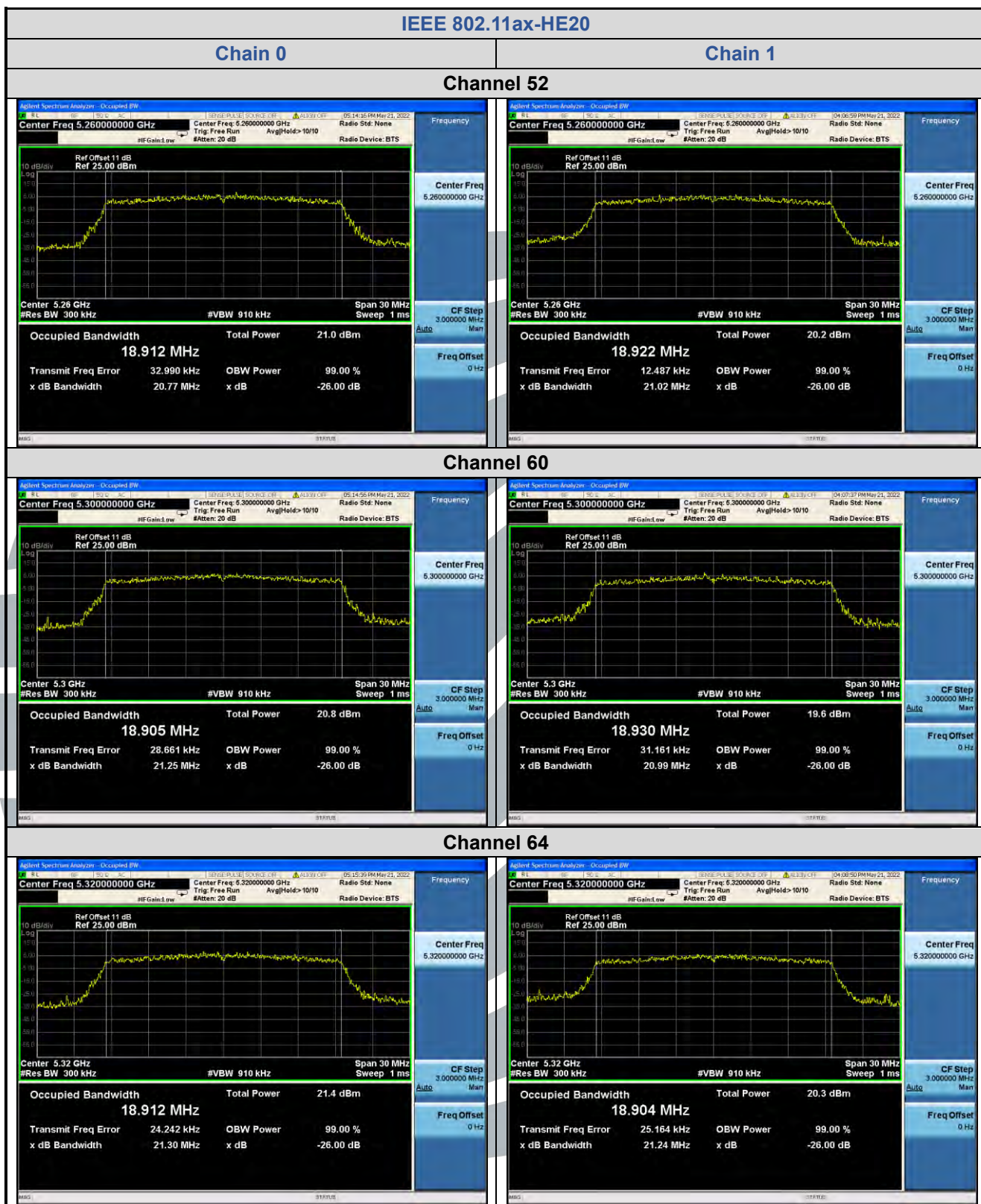
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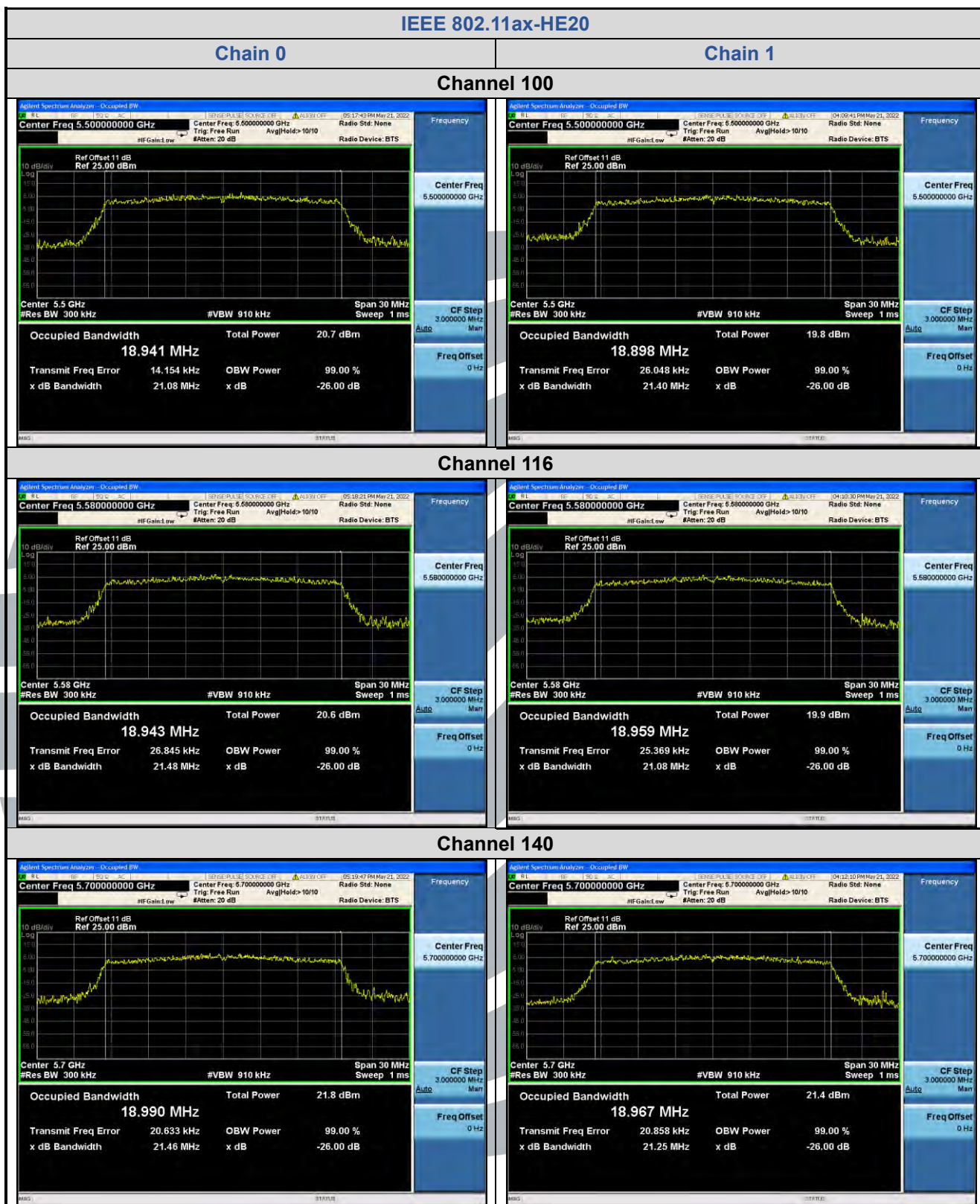


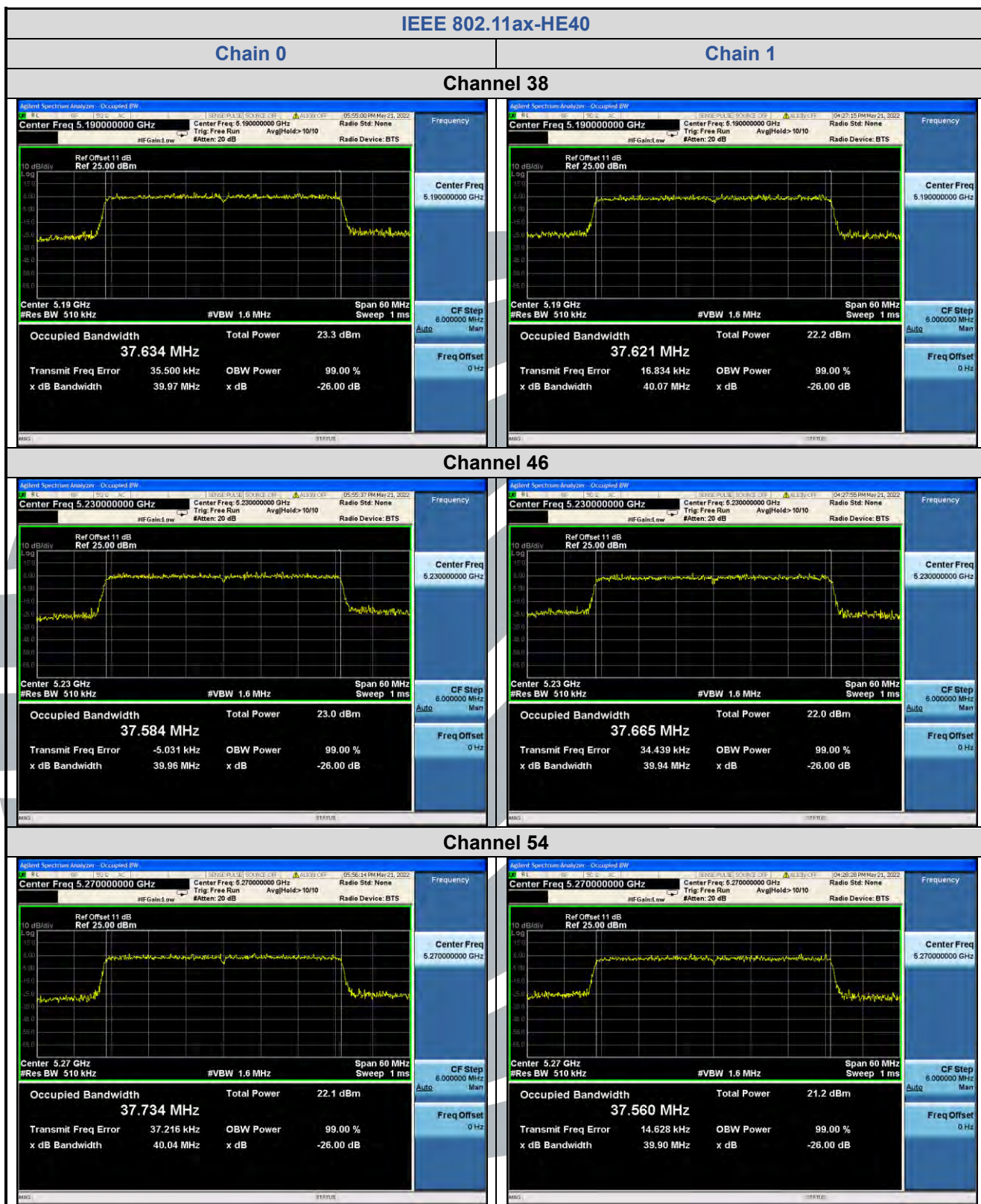
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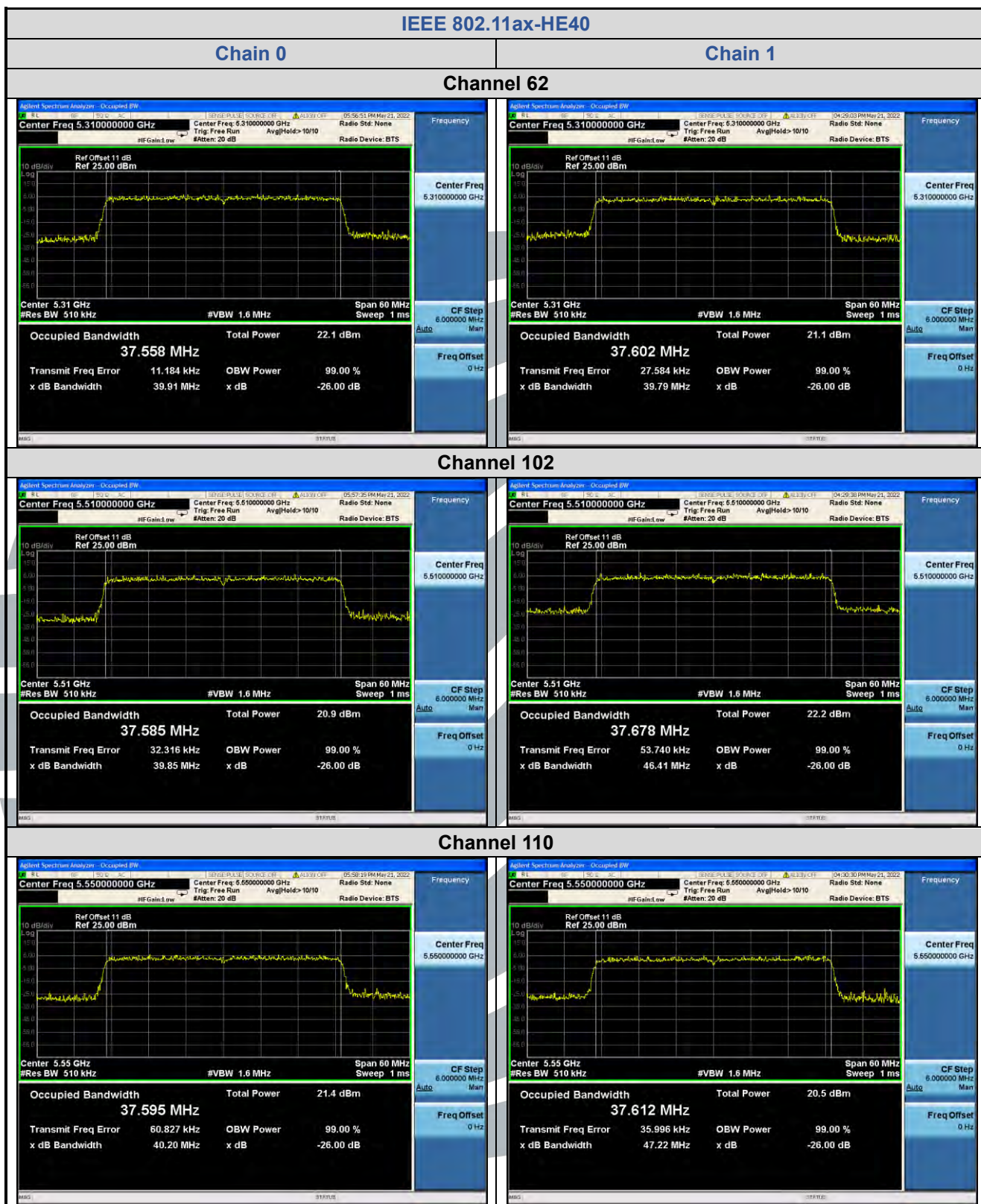


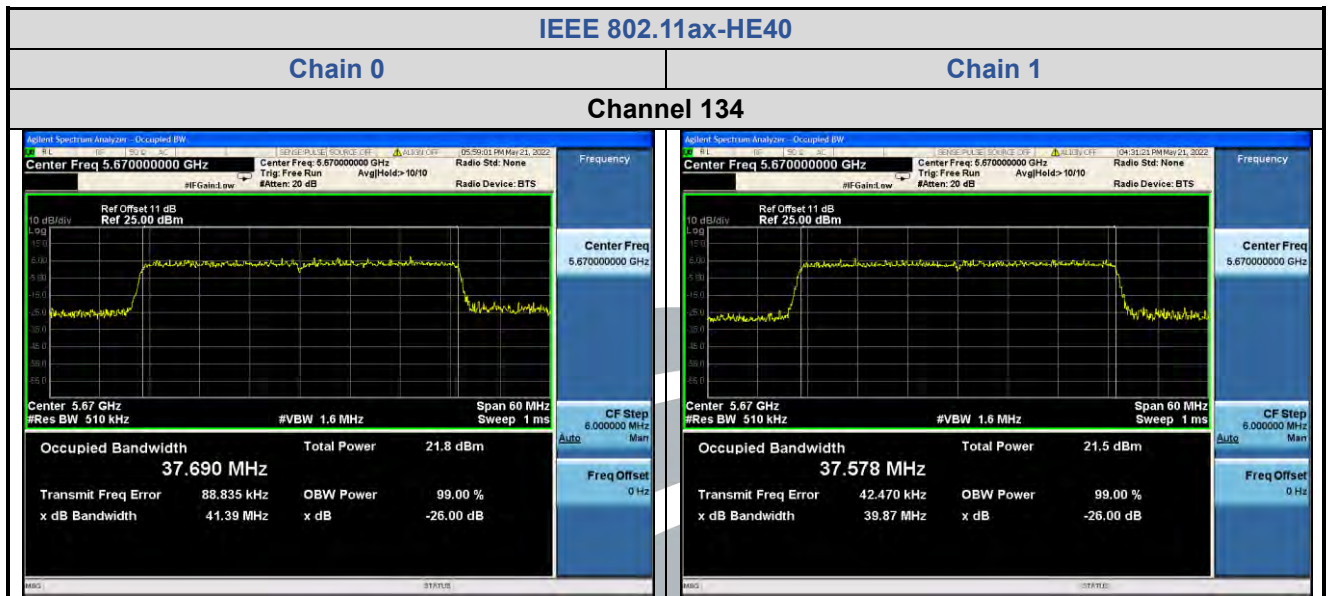












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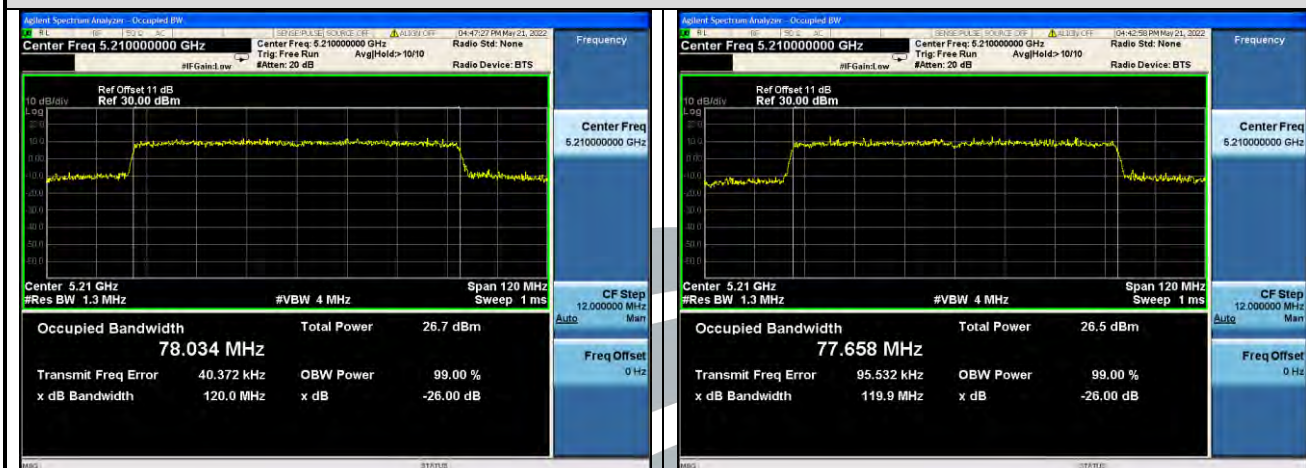
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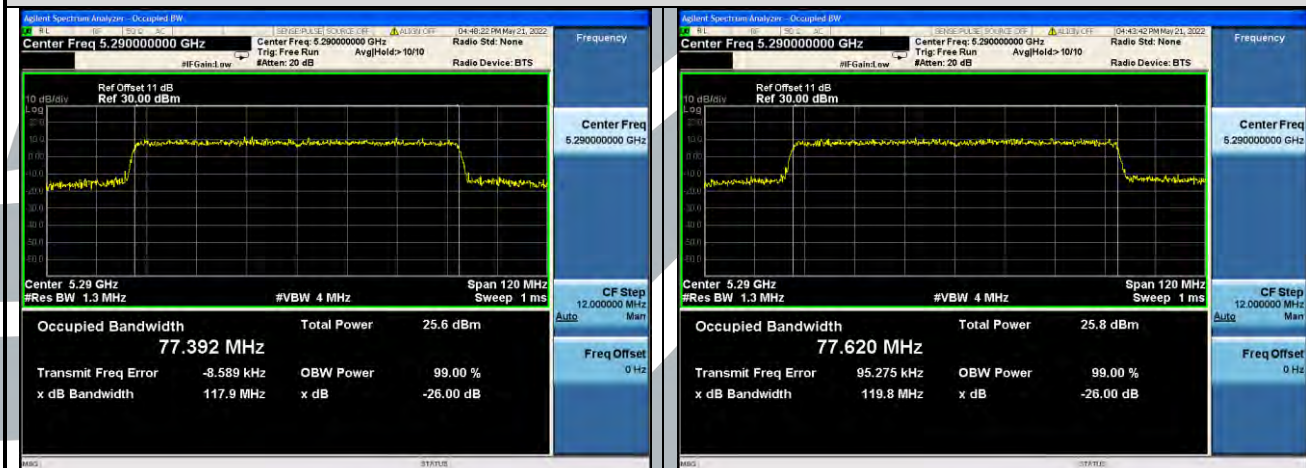
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IEEE 802.11ax-HE80

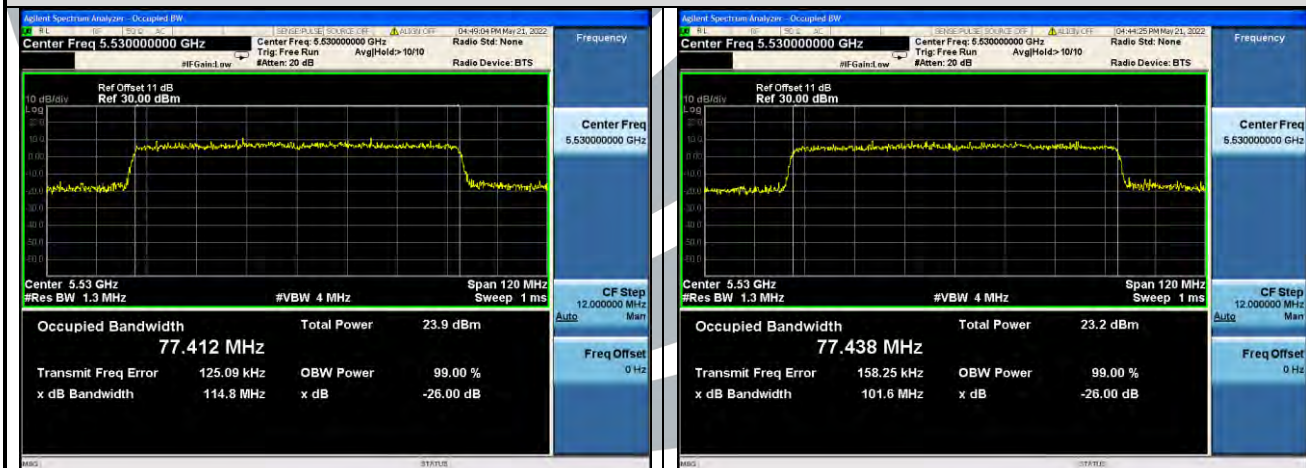
Channel 42



Channel 58



Channel 106



5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (e)
RSS-247 Issue 2 Section 6.2.4.1

Test Method: KDB 789033 D02 v02r01 Section C.2

Limit: Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure:

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer.

Spectrum analyzer according to the following Settings:

6dB Bandwidth

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 * \text{RBW}$.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

- a) Set RBW = 1% to 5% of the occupied bandwidth
- b) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Test Data:

Mode	Channel/ Frequency (MHz)	6 dB Bandwidth (MHz)		99% Bandwidth (MHz)		6 dB Bandwidth Limit	Pass / Fail
		Chain 0	Chain 1	Chain 0	Chain 1		
IEEE 802.11a	149 (5745)	16.29	16.34	17.048	17.003	> 500 kHz	Pass
	157 (5785)	16.30	16.29	16.949	16.908	> 500 kHz	Pass
	165 (5825)	16.04	16.32	16.938	16.918	> 500 kHz	Pass
IEEE 802.11n-HT20	149 (5745)	16.97	17.59	18.072	17.812	> 500 kHz	Pass
	157 (5785)	17.02	17.59	18.071	17.834	> 500 kHz	Pass
	165 (5825)	17.00	17.60	18.013	17.812	> 500 kHz	Pass
IEEE 802.11n-HT40	151 (5755)	36.62	36.43	36.668	36.374	> 500 kHz	Pass
	159 (5795)	36.35	36.39	36.496	36.313	> 500 kHz	Pass
IEEE 802.11ac-VHT20	149 (5745)	17.58	17.61	18.077	17.839	> 500 kHz	Pass
	157 (5785)	17.30	17.62	18.056	17.824	> 500 kHz	Pass
	165 (5825)	17.07	17.60	18.059	17.803	> 500 kHz	Pass
IEEE 802.11ac-VHT40	151 (5755)	36.42	36.44	36.619	36.374	> 500 kHz	Pass
	159 (5795)	36.36	36.39	36.769	36.318	> 500 kHz	Pass
IEEE 802.11ac-VHT80	155 (5775)	76.26	76.50	76.255	76.131	> 500 kHz	Pass
IEEE 802.11ax-HE20	149 (5745)	18.13	18.72	18.933	18.911	> 500 kHz	Pass
	157 (5785)	18.64	18.81	18.962	18.920	> 500 kHz	Pass
	165 (5825)	18.76	17.90	18.932	18.908	> 500 kHz	Pass
IEEE 802.11ax-HE40	151 (5755)	37.69	37.69	37.748	37.625	> 500 kHz	Pass
	159 (5795)	37.73	37.14	37.679	37.539	> 500 kHz	Pass
IEEE 802.11ax-HE80	155 (5775)	77.64	77.35	77.653	77.458	> 500 kHz	Pass

The test plots as follows:
6 dB Bandwidth

