



Certificate #4312.01

TEST REPORT

Product Name: Dual-band Wi-Fi 6 Router
Trade Mark: GRANDSTREAM
Model No. / HVIN: GWN7062
Report Number: 210928005RFC-2
Test Standards: FCC 47 CFR Part 15 Subpart E
RSS-247 Issue 2
RSS-Gen Issue 5
FCC ID: YZZGWN7062
IC: 11964A-GWN7062
Test Result: PASS
Date of Issue: February 15, 2022

Prepared for:

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

Prepared by:

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February 15, 2022

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Version

Version No.	Date	Description
V1.0	February 15, 2022	Original



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CONTENTS

1. GENERAL INFORMATION	4
1.1 CLIENT INFORMATION	4
1.2 EUT INFORMATION	4
1.2.1 GENERAL DESCRIPTION OF EUT	4
1.2.2 DESCRIPTION OF ACCESSORIES	4
1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD	4
1.4 OTHER INFORMATION	6
1.5 DESCRIPTION OF SUPPORT UNITS	7
1.6 TEST LOCATION	7
1.7 TEST FACILITY	7
1.8 DEVIATION FROM STANDARDS	7
1.9 ABNORMALITIES FROM STANDARD CONDITIONS	8
1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER	8
1.11 MEASUREMENT UNCERTAINTY	8
2. TEST SUMMARY	9
3. EQUIPMENT LIST	10
4. TEST CONFIGURATION	12
4.1 ENVIRONMENTAL CONDITIONS FOR TESTING	12
4.1.1 NORMAL OR EXTREME TEST CONDITIONS	12
4.1.2 RECORD OF NORMAL ENVIRONMENT	12
4.2 TEST CHANNELS	13
4.3 EUT TEST STATUS	13
4.4 PRE-SCAN	14
4.5 TEST SETUP	15
4.5.1 FOR RADIATED EMISSIONS TEST SETUP	15
4.5.2 FOR CONDUCTED EMISSIONS TEST SETUP	16
4.5.3 FOR CONDUCTED RF TEST SETUP	17
4.6 SYSTEM TEST CONFIGURATION	18
4.7 DUTY CYCLE	19
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION	24
5.1 REFERENCE DOCUMENTS FOR TESTING	24
5.2 ANTENNA REQUIREMENT	24
5.3 26 dB BANDWIDTH & OCCUPIED BANDWIDTH	25
5.4 6 dB BANDWIDTH & OCCUPIED BANDWIDTH	50
5.5 MAXIMUM CONDUCTED OUTPUT POWER OR E.I.R.P	66
5.6 PEAK POWER SPECTRAL DENSITY	74
5.7 RADIATED EMISSIONS AND BAND EDGE MEASUREMENT	121
5.8 AC POWER LINE CONDUCTED EMISSION	171
APPENDIX 1 PHOTOS OF TEST SETUP	174
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS	174

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:	Dual-band Wi-Fi 6 Router		
Model No. / HVIN:	GWN7062		
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	
	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:	September 29, 2021		
Sample Tested Date:	September 29, 2021 to January 10, 2022		

1.2.2 Description of Accessories

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

Cable	
Description:	Ethernet cable
Cable Type:	Unshielded without ferrite
Length:	1.5 Meter

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:	Master

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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 802.11ac/ax: OFDM(1024-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 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 MCS8	
	IEEE 802.11ax-HE40: Up to MCS11	
	IEEE 802.11ax HE80: Up to MCS11	
Number of Channels:	5150 MHz to 5250 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 802.11ac-VHT80/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 802.11ac-VHT80/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	
	Chain 0	Dipole Antenna
	Chain 1	Dipole Antenna
	Chain 0	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
	Chain 1	5150 MHz to 5250 MHz: 4.5dBi 5250 MHz to 5350 MHz: 4.5dBi 5470 MHz to 5725 MHz: 4.5dBi 5725 MHz to 5850 MHz: 4.5dBi
Antenna Gain: (Provided by the customer)		
Maximum EIRP (dBm):	SISO_Chain 0	U-NII-1
	IEEE 802.11a:	19.53
	SISO_Chain 1	U-NII-1
	IEEE 802.11a:	19.62
	MIMO_Chain 0+1	U-NII-1
	IEEE 802.11n-HT20:	20.48

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Maximum conducted output power (dBm):	IEEE 802.11n-HT40:	20.79			
	IEEE 802.11ac-VHT20:	20.58			
	IEEE 802.11ac-VHT40:	20.66			
	IEEE 802.11ac-VHT80:	20.93			
	IEEE 802.11ax-HE20:	20.34			
	IEEE 802.11ax-HE40:	20.88			
	IEEE 802.11ax-HE80:	19.67			
	SISO_Chain 0	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:	22.72	22.03	21.12	21.47
	SISO_Chain 1	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11a:	22.40	21.93	21.57	21.42
	MIMO_Chain 0+1	U-NII-1	U-NII-2A	U-NII-2C	U-NII-3
	IEEE 802.11n-HT20:	24.59	20.07	19.70	23.15
	IEEE 802.11n-HT40:	26.62	21.38	21.97	23.88
	IEEE 802.11ac-VHT20:	24.67	20.38	19.65	22.71
	IEEE 802.11ac-VHT40:	26.63	21.35	22.03	23.82
	IEEE 802.11ac-VHT80:	15.07	14.11	17.03	24.00
	IEEE 802.11ax-HE20:	24.54	19.75	19.45	22.58
	IEEE 802.11ax-HE40:	25.73	20.88	21.54	23.35
	IEEE 802.11ax-HE80:	14.89	13.98	16.87	23.84
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

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

1.8 DEVIATION FROM STANDARDS

None.

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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 Note2
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. 2) Please refer to Report No.: 210928005RFC-3 for DFS Test report.			

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	N/A	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 05, 2021	Nov. 04, 2022
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Apr. 22, 2021	Apr. 21, 2022
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 11, 2021	Nov. 10, 2023
☒	Preamplifier	HP	8447F	2805A02960	Nov. 14, 2020	Nov. 13, 2021
☒	Band Rejection Filter (5150MHz~5880MHz)	Micro-Tronics	BRM50716	G186	Nov. 11, 2021	Nov. 10, 2023
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	Nov. 10, 2020	Nov. 9, 2021
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	Nov. 05, 2021	Nov. 04, 2022
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	Nov. 16, 2020	Nov. 15, 2021
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	Nov. 06, 2021	Nov. 05, 2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	Nov. 14, 2020	Nov. 13, 2023
☒	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. 18, 2020	Nov. 17, 2021
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 05, 2021	Nov. 04, 2022
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 18, 2020	Nov. 17, 2021
☒	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 05, 2021	Nov. 04, 2022
☒	Test Software	Audix	e3	Software Version: 9.160323		

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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. 22, 2021	Apr. 21, 2022
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	Nov. 10, 2020	Nov. 9, 2021
					Nov. 05, 2021	Nov. 04, 2022
☐	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430023	Nov. 10, 2020	Nov. 9, 2021
					Nov. 05, 2021	Nov. 04, 2022
☒	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	Nov. 10, 2020	Nov. 9, 2021
					Nov. 05, 2021	Nov. 04, 2022
☒	Spectrum Analyzer	R&S	FSV40-N	101653	Apr. 22, 2021	Apr. 21, 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	23.4	51	99.8	210928005-A02/6	Bert Xiong
6 dB bandwidth	23.4	51	99.8		Bert Xiong
Occupied Bandwidth	23.4	51	99.8		Bert Xiong
Maximum conducted output power	23.4	51	99.8		Bert Xiong
Peak Power Spectral Density	23.4	51	99.8		Bert Xiong
Radiated Emissions Measurement	22.6	53	99.5	210928009-A06/6	Lucas Ouyang
Band Edge Measurement	22.6	53	99.5		Fire Huo
Dynamic Frequency Selection	23.4	51	99.8	210928005-A02/6	Bert Xiong
AC Power Line Conducted Emission	25.0	48	101.1	210928009-A06/6	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)										
Mode	U-NII-1				U-NII-2A		U-NII-2C		U-NII-3	
	FCC		ICES		(FCC&ICES)					
	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain n 1
IEEE 802.11a	L&H:22 M:23	L&H:22 M:23	16	16	22	22	L&H:22 M:23	L&H:22 M:23	23	23
IEEE 802.11n-HT20	L&H:17 M:22	L&H:17 M:22	13	13	L&H:17 M:18	L&H:17 M:18	L&H:17 M:19	L&H:17 M:19	22	22
IEEE 802.11n-HT40	L:14 H:22.5	L:14 H:22.5	12	12	L:18 H:14	L:18 H:14	L&H:14 M:20	L&H:14 M:20	22.5	22.5
IEEE 802.11ac-VHT20	L&H:17 M:22	L&H:17 M:22	13	13	L&H:17 M:18	L&H:17 M:18	L&H:17 M:19	L&H:17 M:19	22	22
IEEE 802.11ac-VHT40	L:14 H:22.5	L:14 H:22.5	12	12	L:18 H:14	L:18 H:14	L&H:14 M:20	L&H:14 M:20	22.5	22.5
IEEE	12	12	12	12	12	12	15	15	22	22

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802.11ac-VHT80										
IEEE 802.11ax-HE20	L&H:17 M:22	L&H:17 M:22	13	13	L&H:17 M:18	L&H:17 M:18	L&H:17 M:19	L&H:17 M:19	22	22
IEEE 802.11ax-HE40	L:14 H:22.5	L:14 H:22.5	13	13	L:18 H:14	L:18 H:14	L&H:14 M:20	L&H:14 M:20	22.5	22.5
IEEE 802.11ax-HE80	12	12	12	12	12	12	15	15	22	22

Note: Regarding the frequency band U-NII-1, except for Maximum conducted output power and Peak Power Spectral Density, other items only reflect the data of the highest power setting.

Test Software(Provided by the customer)
Test software name: QRCT 4.0;

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

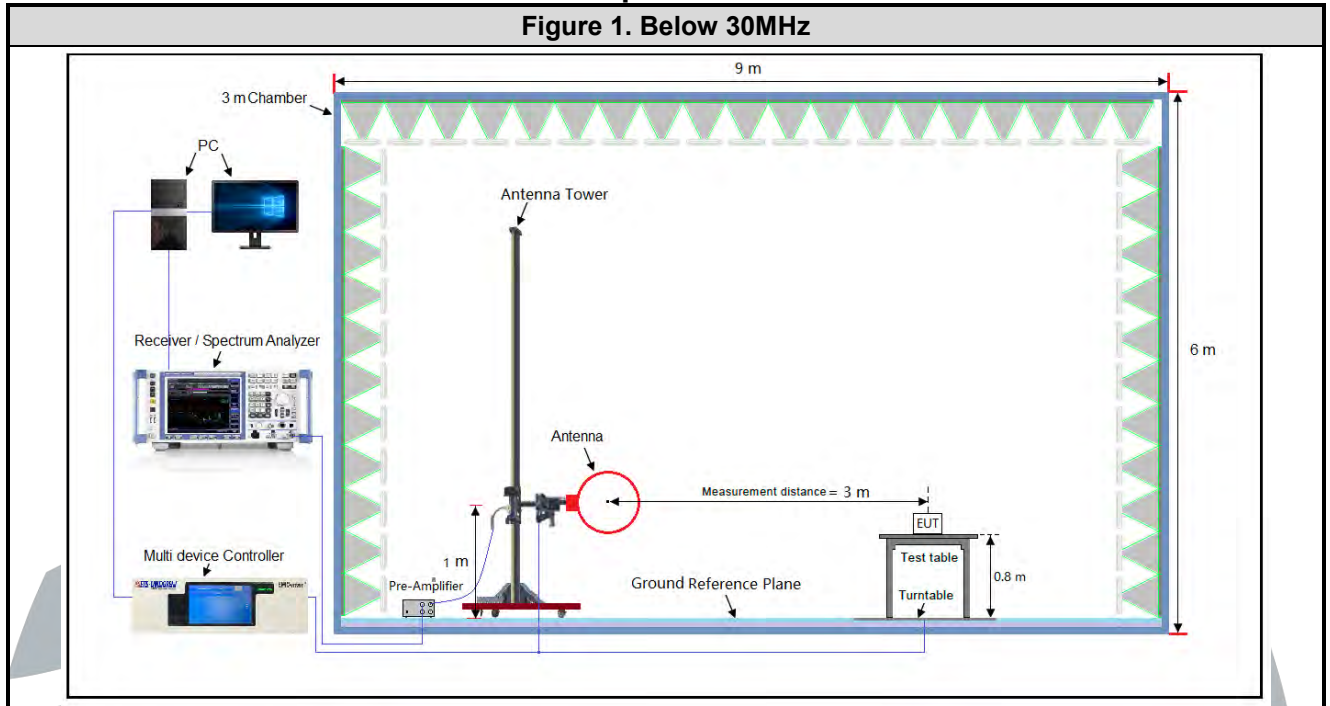
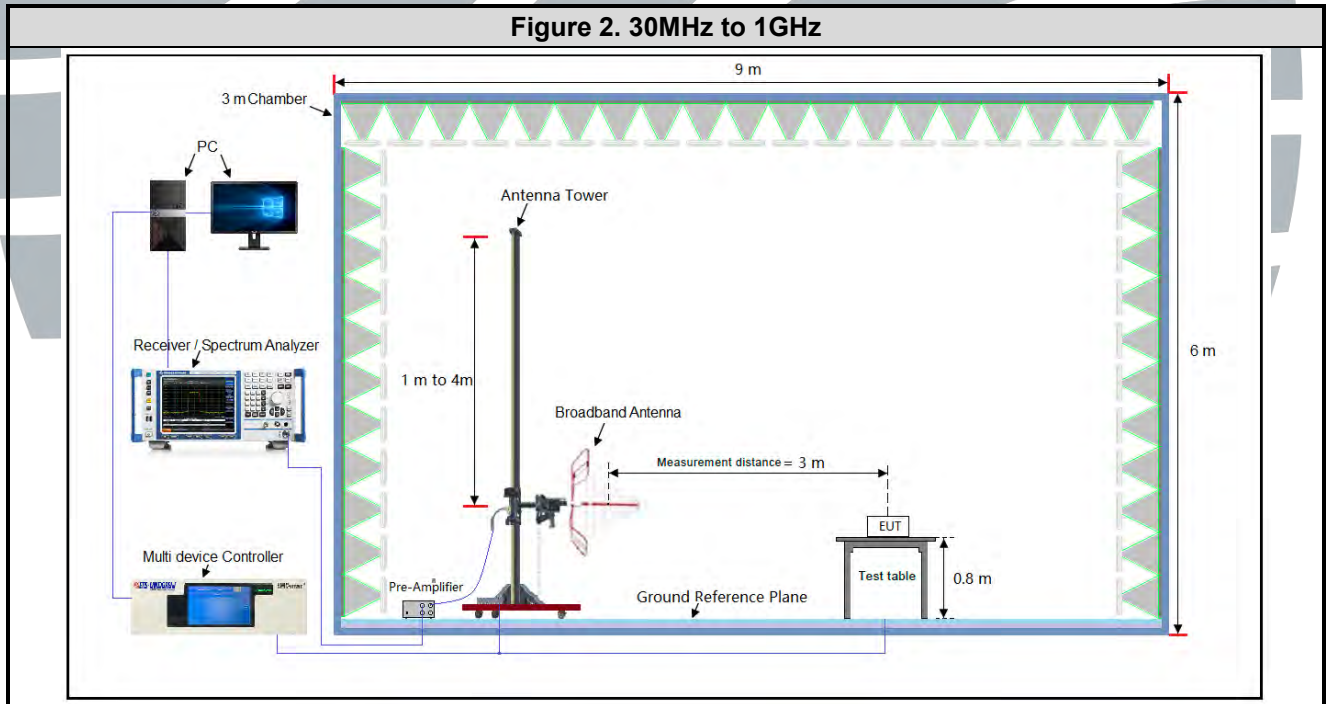
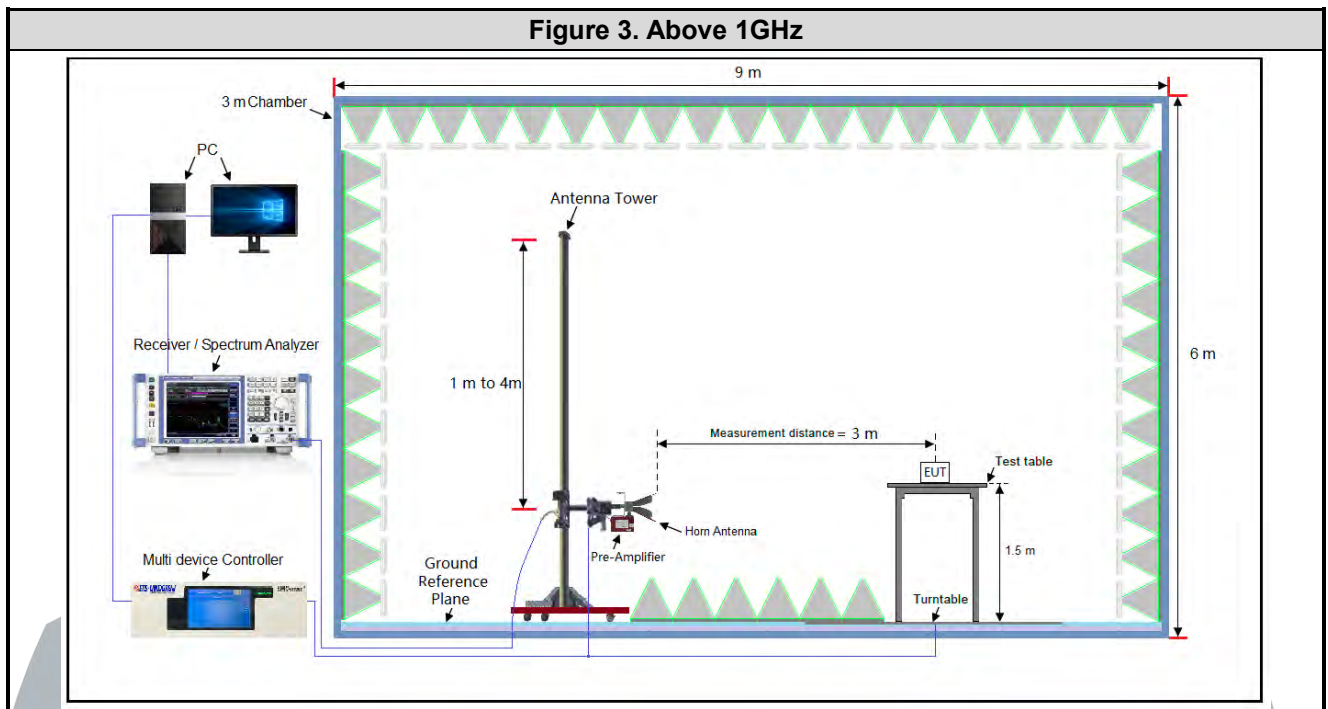
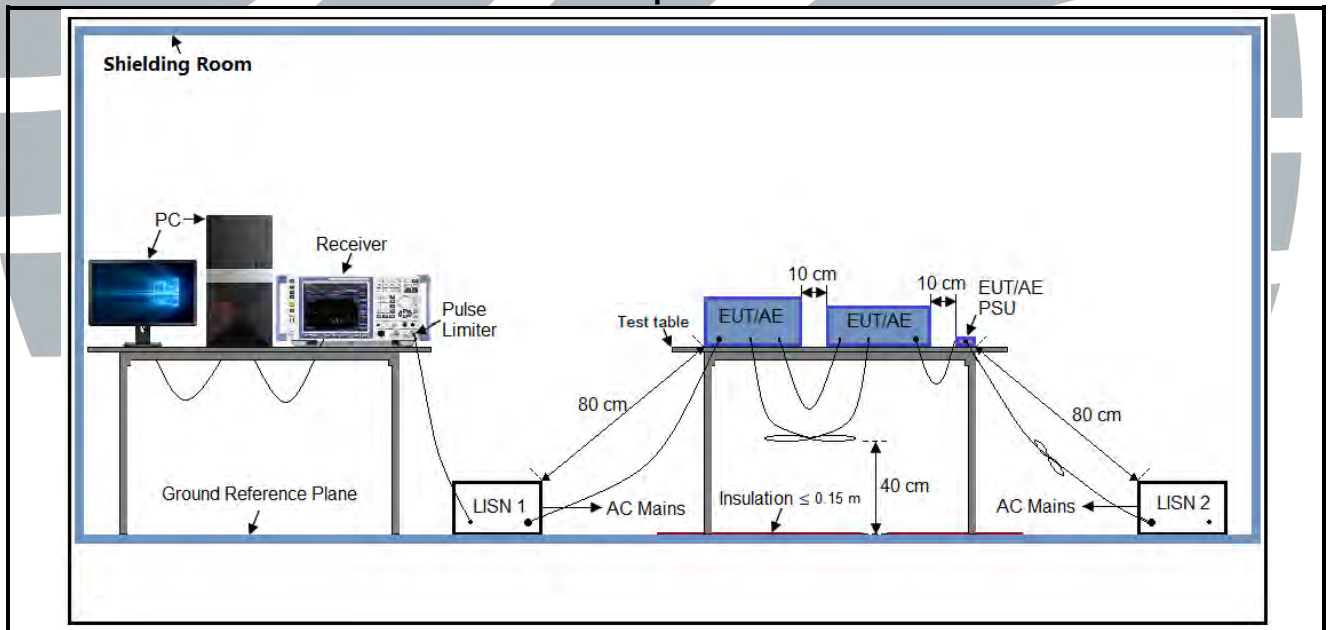


Figure 2. 30MHz to 1GHz

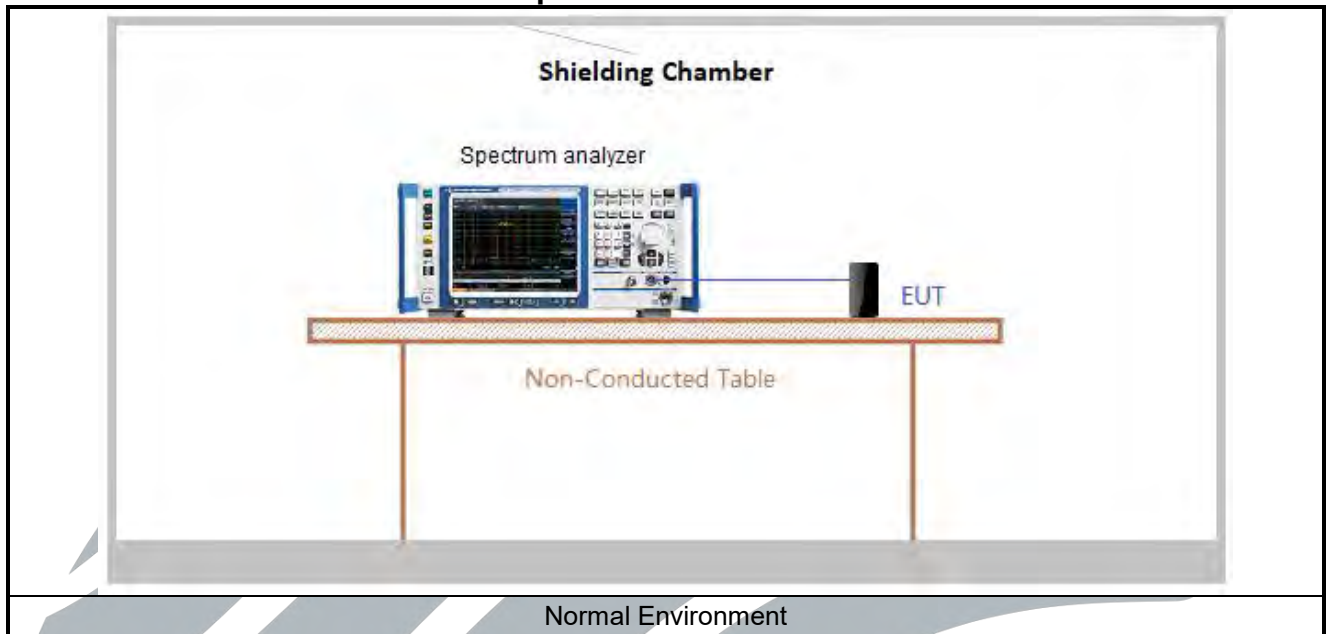




4.5.2 For Conducted Emissions test setup



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.

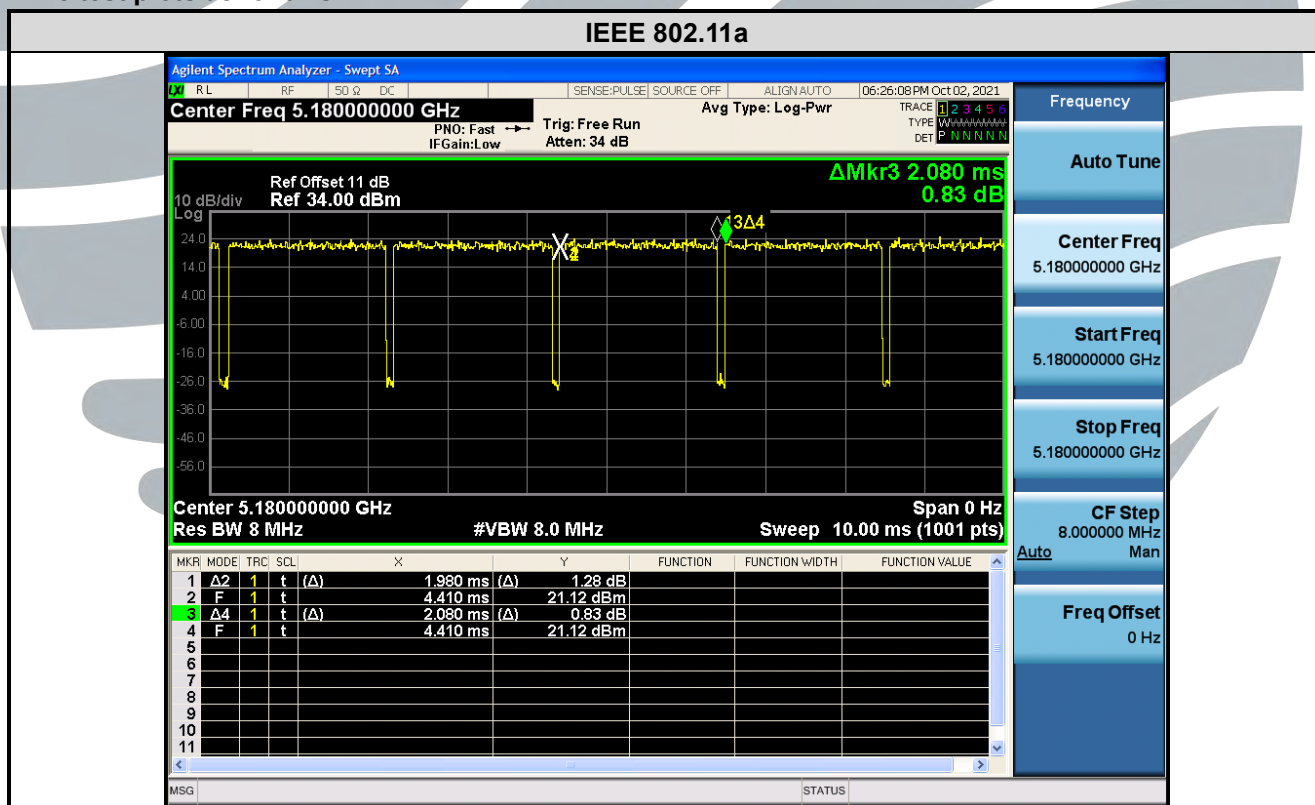
Test Results

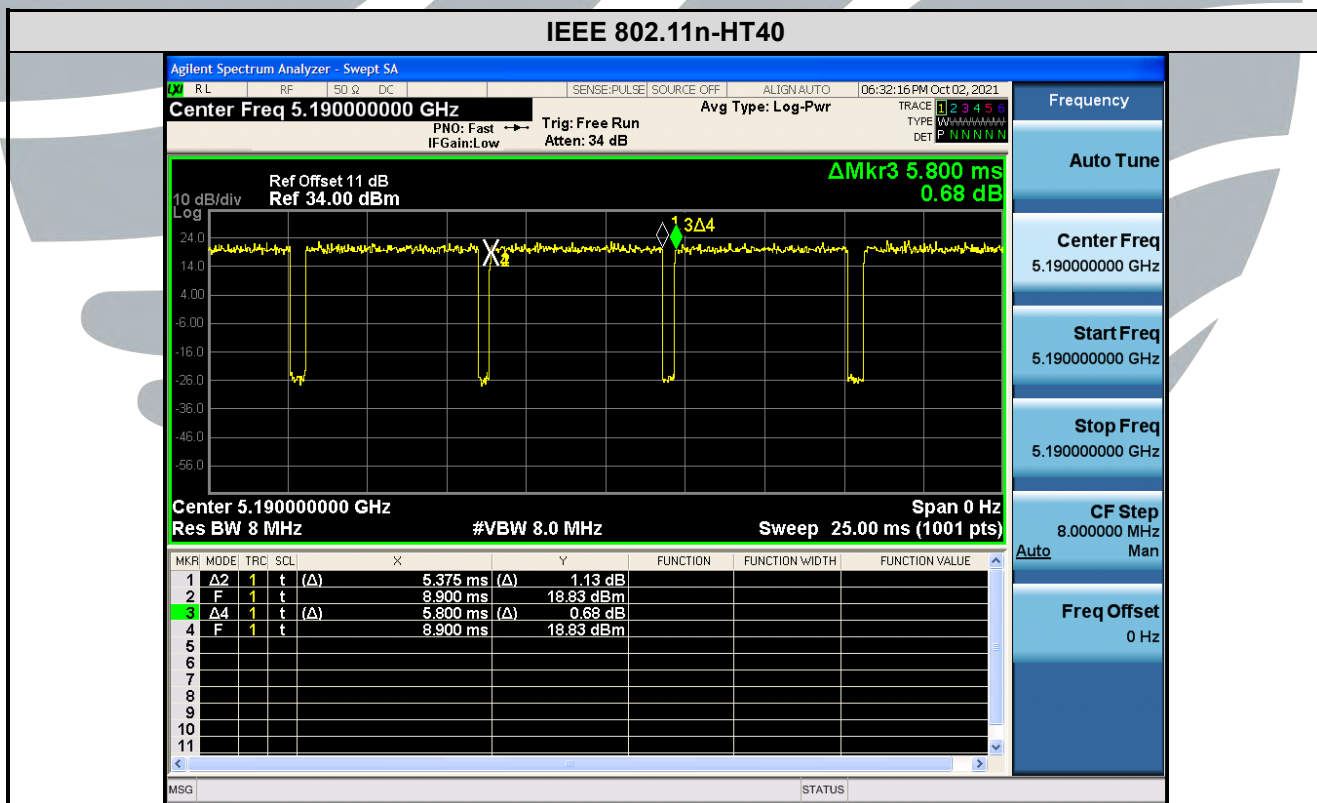
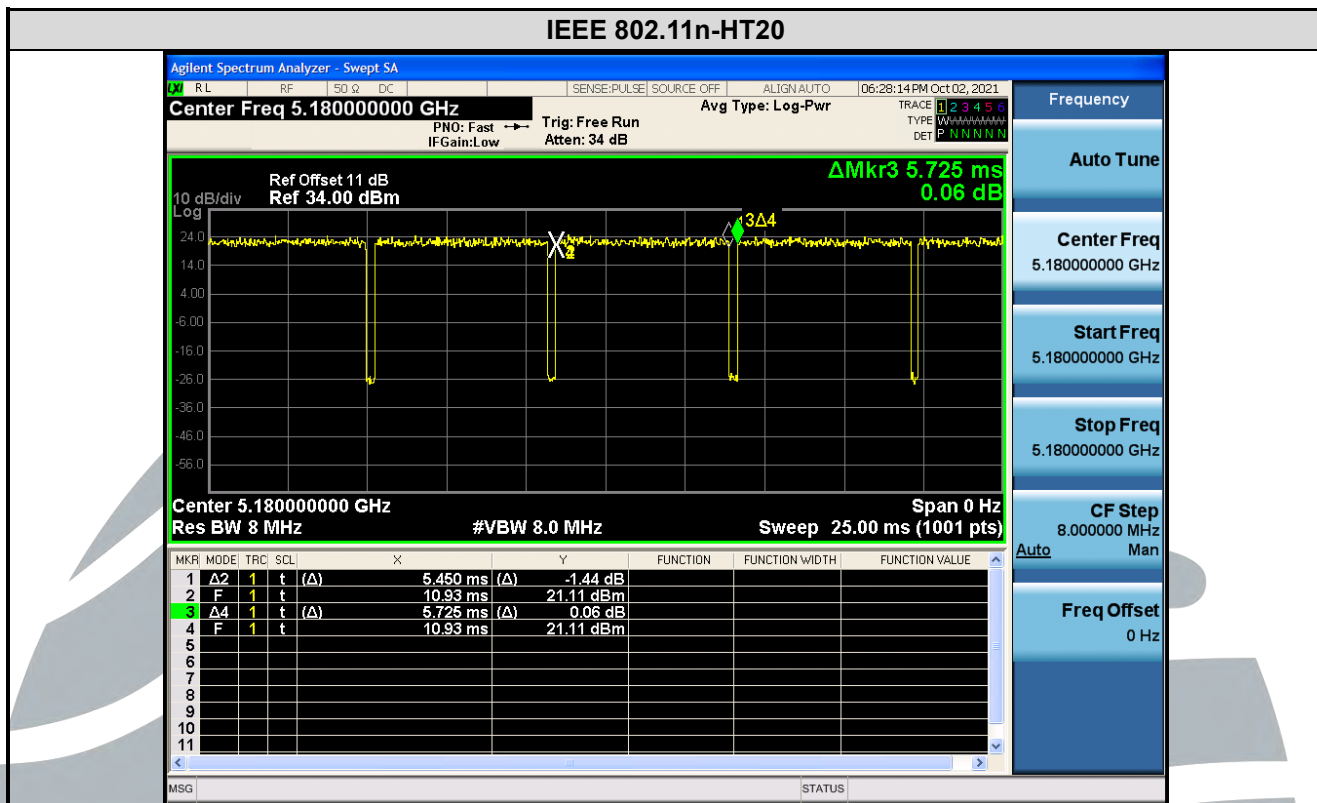
Mode	Data rates (Mbps)	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)	Average Factor (dB)
IEEE 802.11a	6	1.980	2.080	0.95	95.19	0.21	0.51	-0.43
IEEE 802.11n-HT20	MCS8	5.450	5.725	0.95	95.20	0.21	0.18	-0.43
IEEE 802.11n-HT40	MCS8	5.375	5.800	0.93	92.67	0.33	0.19	-0.66
IEEE 802.11ac-VHT20	MCS0	5.450	5.675	0.96	96.04	0.18	0.18	-0.35
IEEE 802.11ac-VHT40	MCS0	5.425	5.775	0.94	93.94	0.27	0.18	-0.54
IEEE 802.11ac-VHT80	MCS0	5.450	5.900	0.92	92.37	0.34	0.18	-0.69
IEEE 802.11ax-HE20	MCS0	5.425	5.675	0.96	95.59	0.20	0.18	-0.39
IEEE 802.11ax-HE40	MCS0	5.425	5.750	0.94	94.35	0.25	0.18	-0.51
IEEE 802.11ax-HE80	MCS0	5.400	5.850	0.92	92.31	0.35	0.19	-0.70

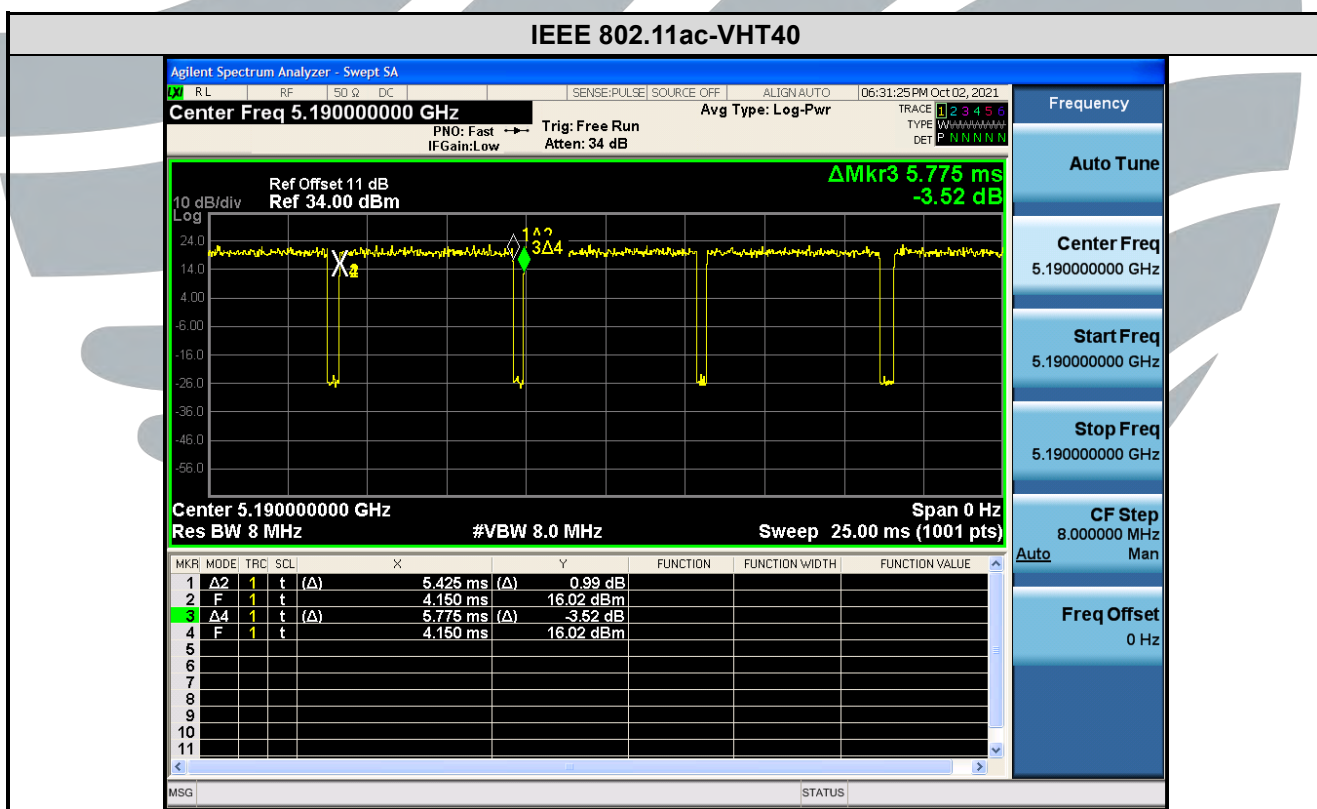
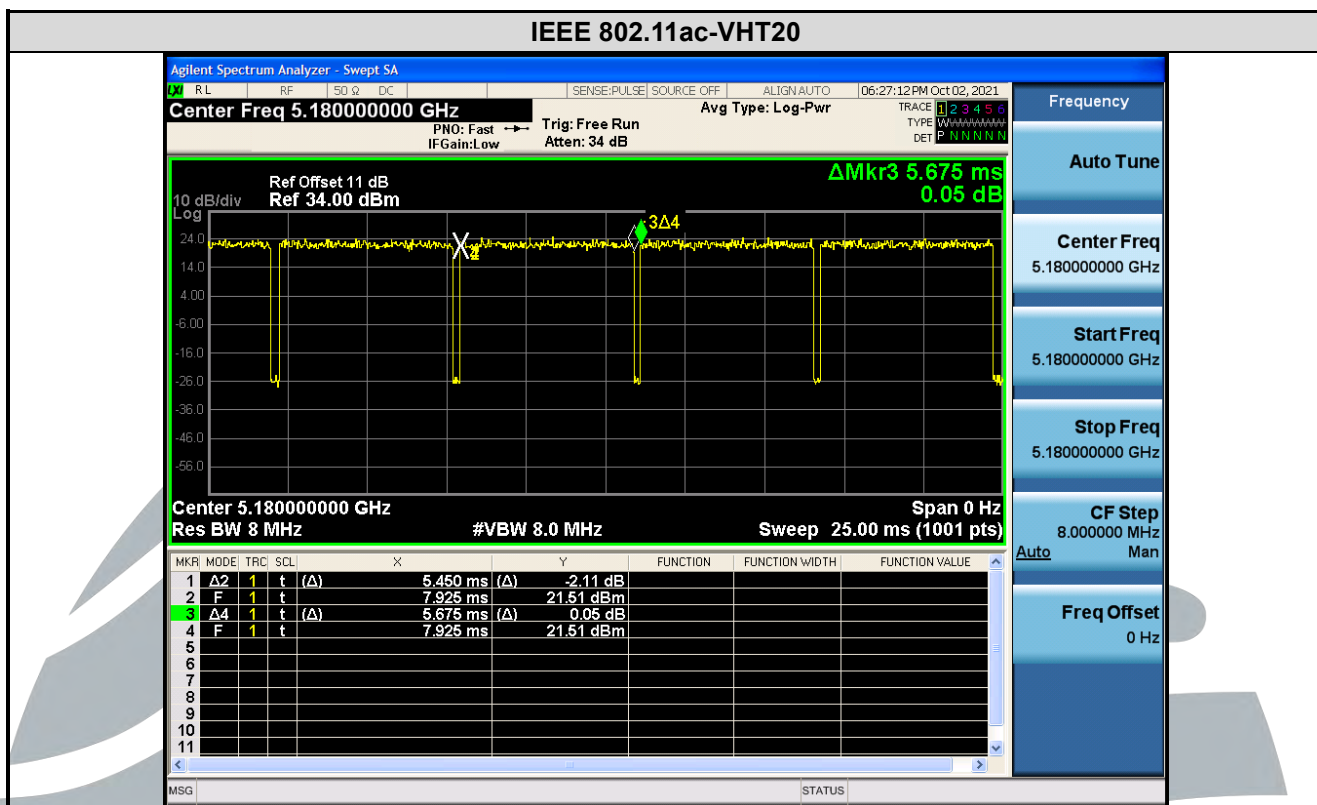
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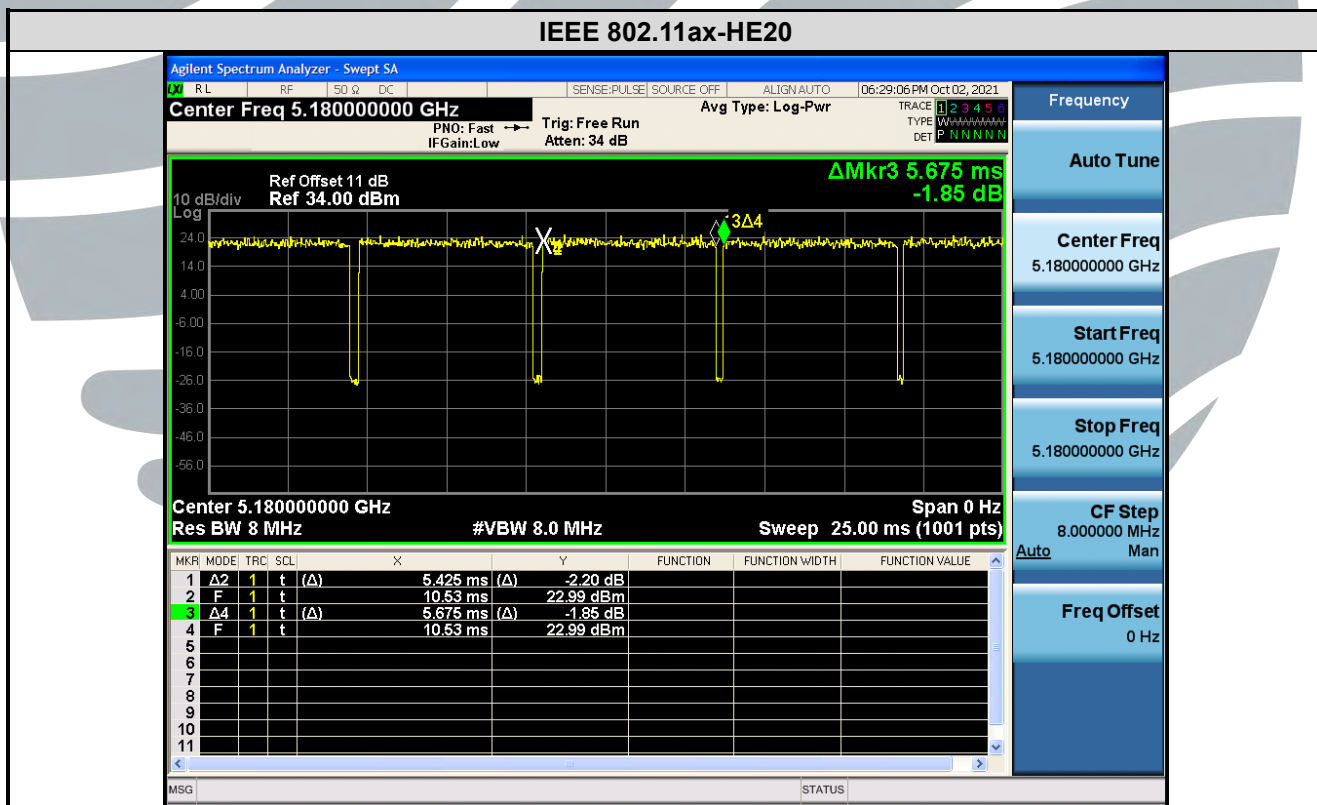
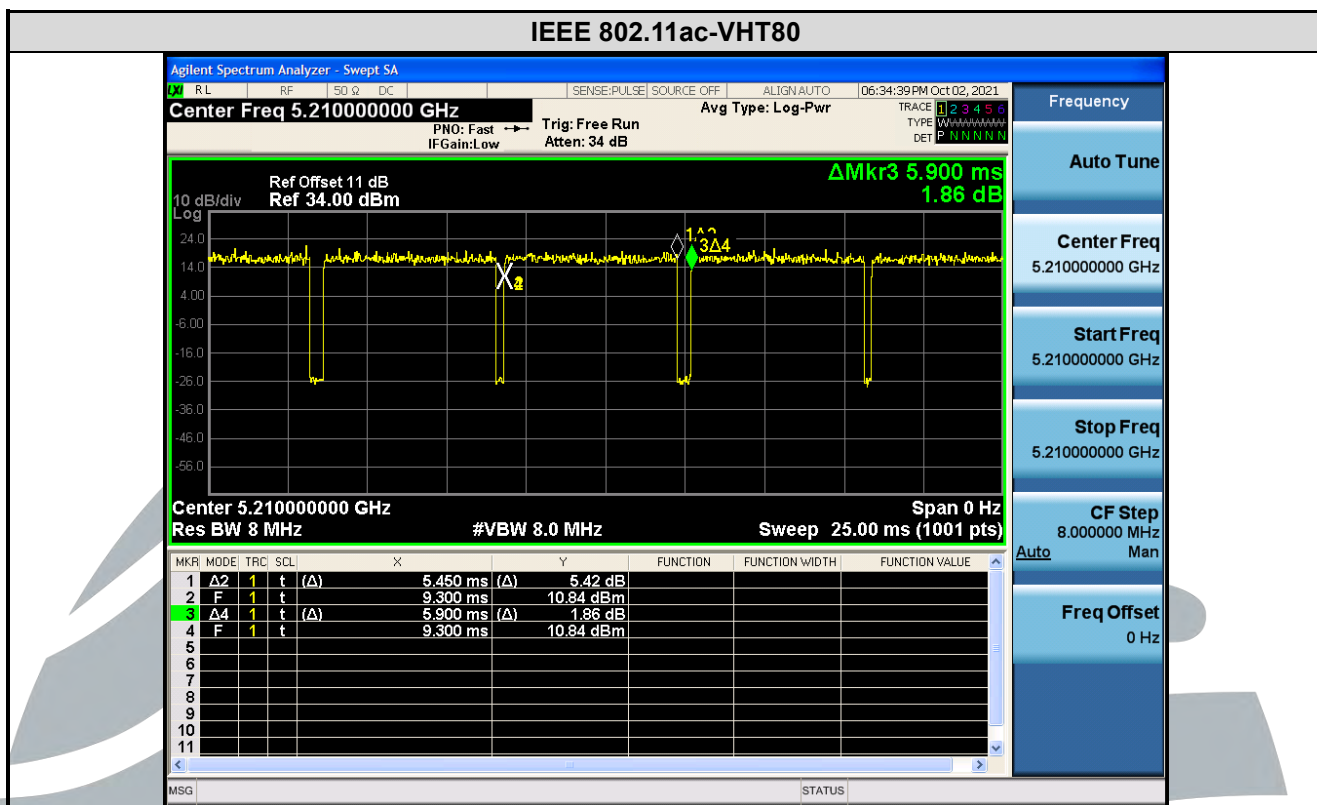
- 1) Duty cycle= On Time/ Period;
- 2) Duty Cycle factor = $10 * \log(1/ \text{Duty cycle})$;
- 3) Average factor = $20 \log_{10} \text{Duty Cycle}$.

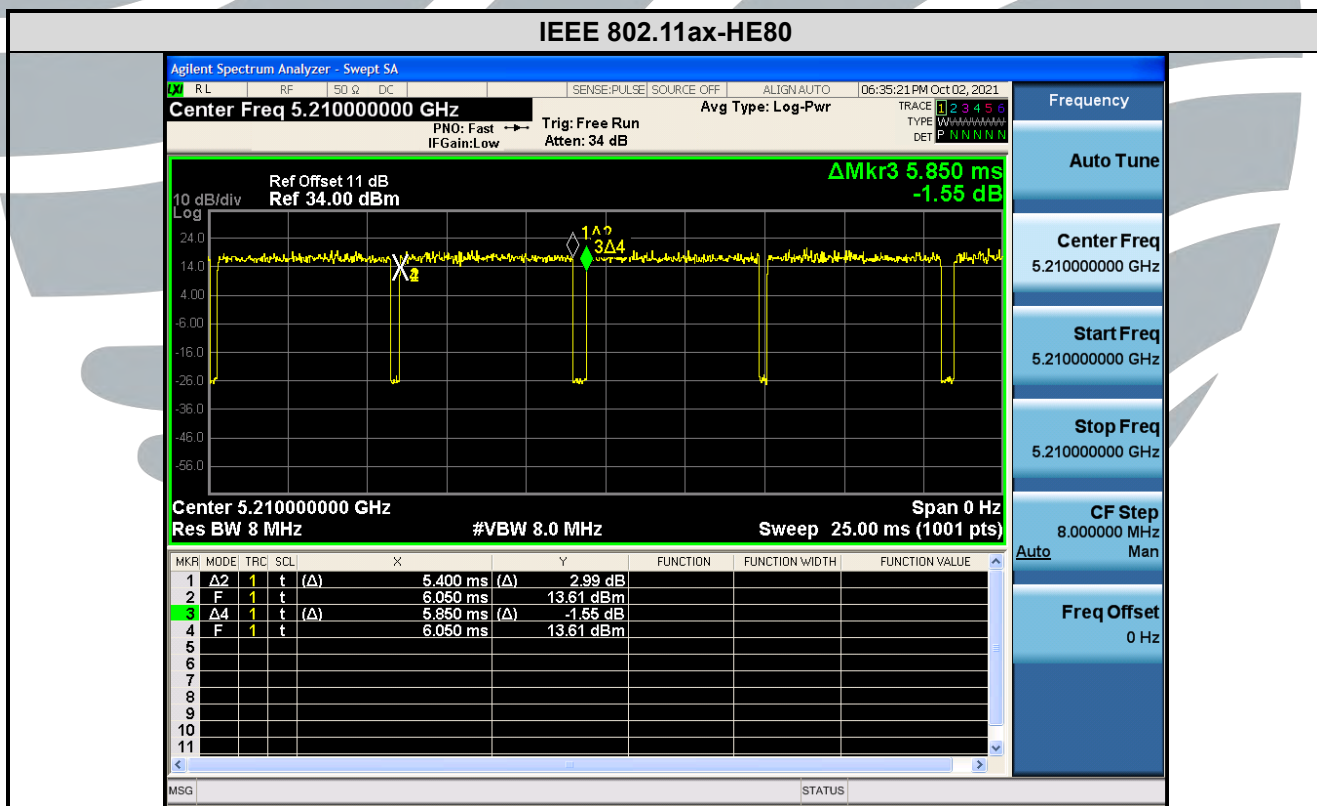
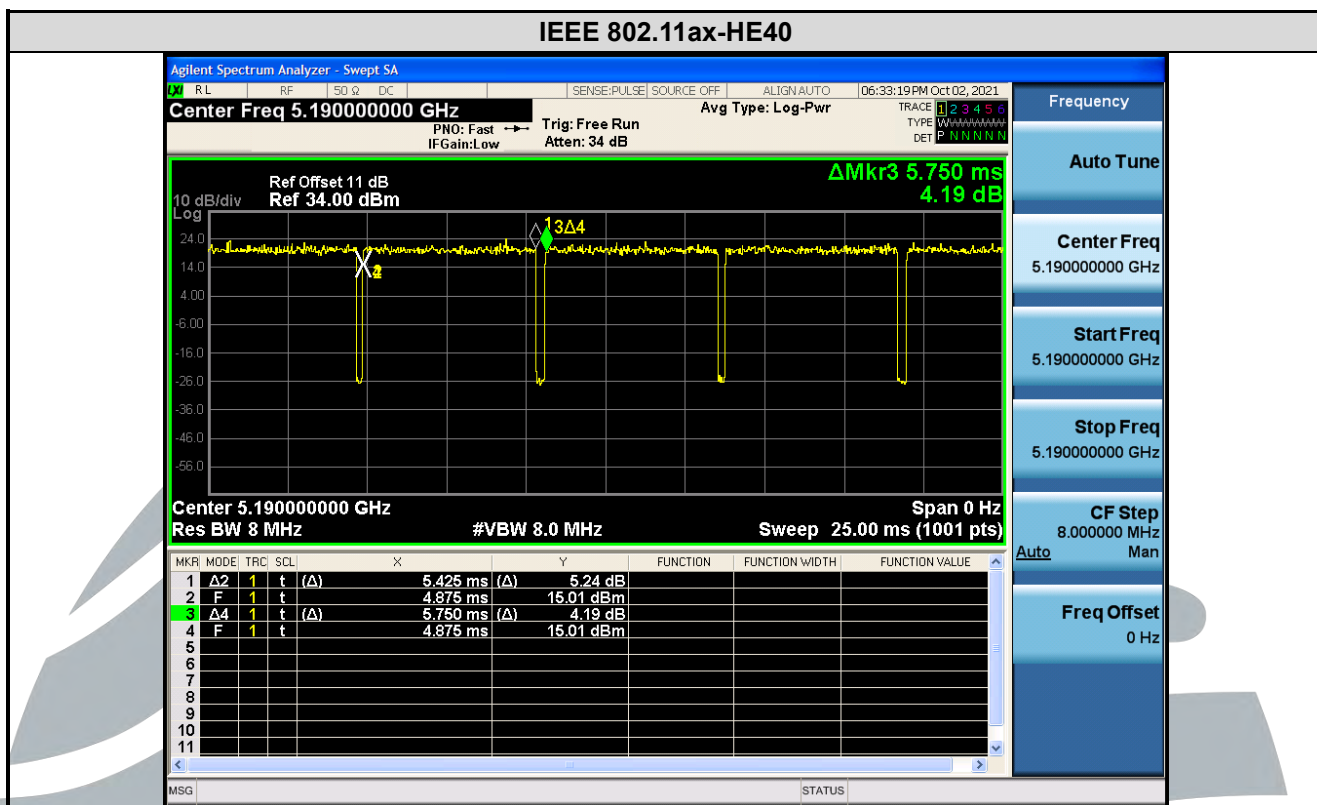
The test plots as follows











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 5.0 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)	19.96	20.27	16.455	16.457
	44 (5220)	20.14	20.30	16.415	16.433
	48 (5240)	19.39	19.89	16.473	16.450
	52 (5260)	19.64	20.58	16.409	16.439
	60 (5300)	19.74	20.64	16.470	16.441
	64 (5320)	20.14	20.48	16.447	16.457
	100 (5500)	20.38	19.76	16.493	16.412
	116 (5580)	19.95	20.50	16.488	16.421
	140 (5700)	20.29	20.42	16.451	16.432
IEEE 802.11n-HT20	36 (5180)	20.47	20.64	17.650	17.683
	44 (5220)	20.97	20.46	17.677	17.641
	48 (5240)	20.74	20.18	17.713	17.667
	52 (5260)	21.13	21.06	17.657	17.633
	60 (5300)	20.77	20.73	17.682	17.644
	64 (5320)	20.41	20.89	17.664	17.639
	100 (5500)	20.93	20.29	17.677	17.658
	116 (5580)	21.14	20.51	17.635	17.666
	140 (5700)	20.43	21.28	17.645	17.648
IEEE 802.11n-HT40	38 (5190)	39.67	40.17	36.144	36.069
	46 (5230)	40.15	40.51	36.059	36.071
	54 (5270)	40.19	40.11	36.042	36.035
	62 (5310)	40.37	40.52	36.103	36.124
	102 (5510)	39.84	40.46	36.058	36.098
	110 (5550)	40.55	39.91	36.070	36.087
	134 (5670)	39.14	39.72	36.066	36.163

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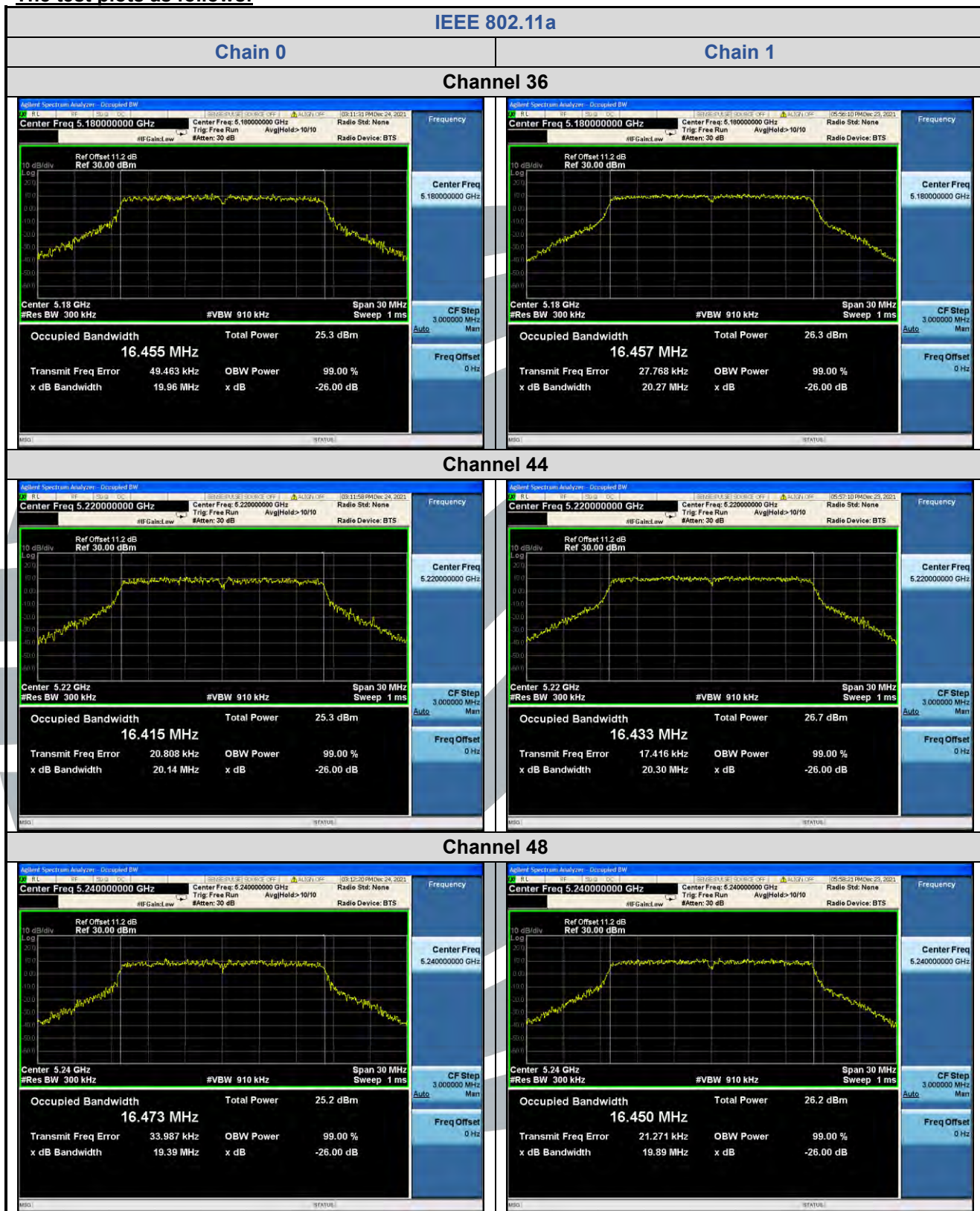
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IEEE 802.11ac-VHT20	36 (5180)	20.44	21.55	17.620	17.855
	44 (5220)	20.62	21.23	17.671	17.837
	48 (5240)	20.48	20.79	17.669	17.854
	52 (5260)	20.98	20.54	17.655	17.770
	60 (5300)	20.67	21.26	17.645	17.882
	64 (5320)	20.94	21.64	17.667	17.878
	100 (5500)	20.63	20.96	17.636	17.812
	116 (5580)	21.06	21.41	17.670	17.867
	140 (5700)	20.93	21.12	17.653	17.803
IEEE 802.11ac-VHT40	38 (5190)	40.00	42.73	36.207	36.545
	46 (5230)	40.15	42.27	36.068	36.404
	54 (5270)	40.31	42.27	36.101	36.388
	62 (5310)	39.88	42.78	36.058	36.455
	102 (5510)	39.42	42.96	36.145	36.466
	110 (5550)	40.13	41.56	36.048	36.460
	134 (5670)	40.35	44.01	36.087	36.496
IEEE 802.11ac-VHT80	42 (5210)	80.02	82.06	75.535	75.383
	58 (5290)	81.35	81.68	75.398	75.462
	106 (5530)	81.60	81.76	75.359	75.521
IEEE 802.11ax-HE20	36 (5180)	21.67	21.80	18.961	19.058
	44 (5220)	20.51	22.08	18.925	19.053
	48 (5240)	21.07	22.75	18.955	18.992
	52 (5260)	20.86	21.29	18.901	19.064
	60 (5300)	20.98	21.12	18.941	19.008
	64 (5320)	20.67	21.07	18.943	19.028
	100 (5500)	20.65	22.71	18.910	19.086
	116 (5580)	20.66	22.07	18.952	19.116
	140 (5700)	21.01	22.38	18.912	19.111
IEEE 802.11ax-HE40	38 (5190)	40.43	43.03	37.731	38.028
	46 (5230)	40.30	55.77	37.793	38.129
	54 (5270)	41.98	42.06	37.815	37.930
	62 (5310)	40.19	42.16	37.721	37.876
	102 (5510)	39.93	43.48	37.756	38.043
	110 (5550)	40.42	42.51	37.653	37.900
	134 (5670)	40.42	44.00	37.584	38.101
IEEE 802.11ax-HE80	42 (5210)	81.67	81.10	77.019	77.034
	58 (5290)	81.35	82.31	76.984	77.122
	106 (5530)	82.26	80.92	77.222	77.192

The test plots as follows:



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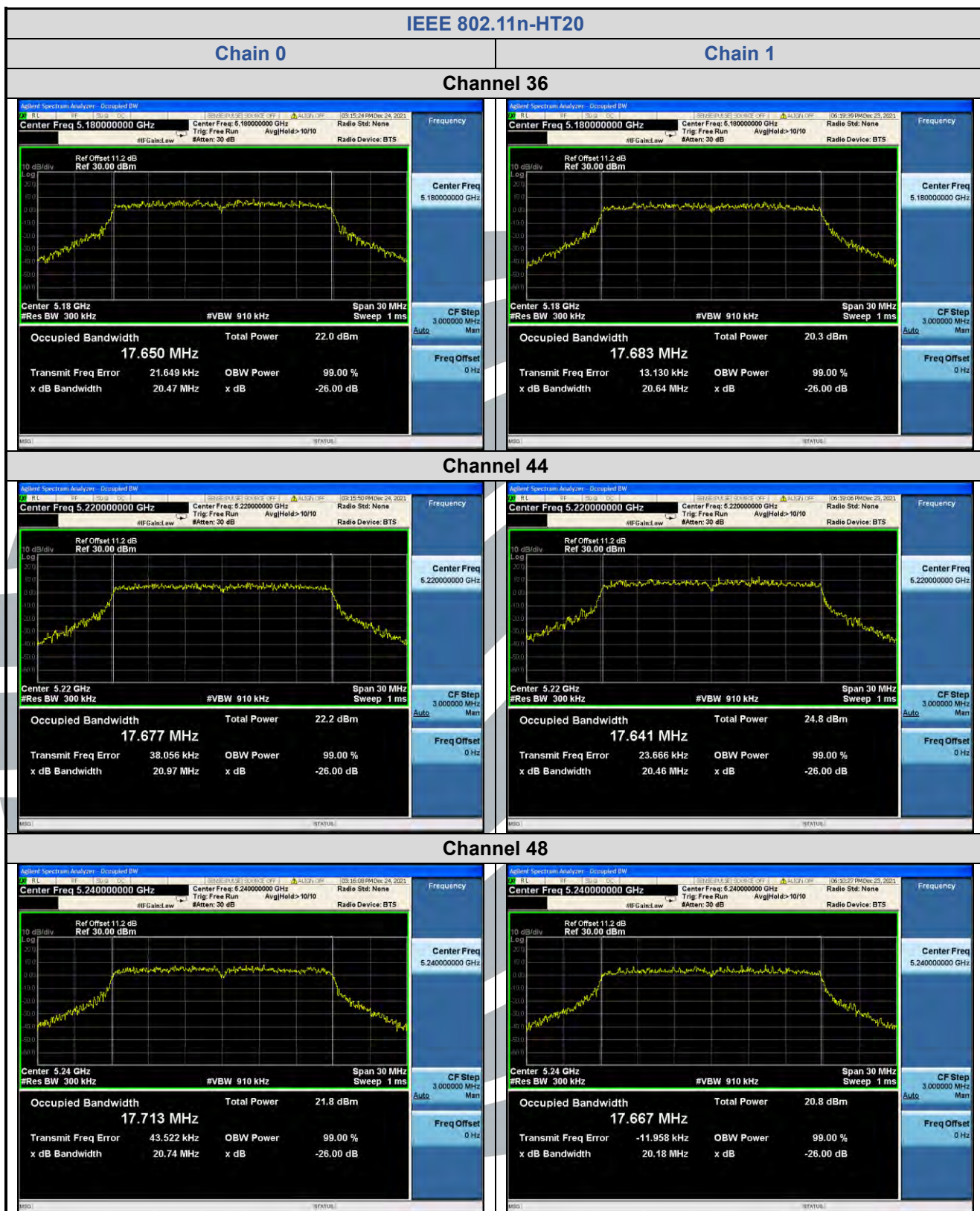
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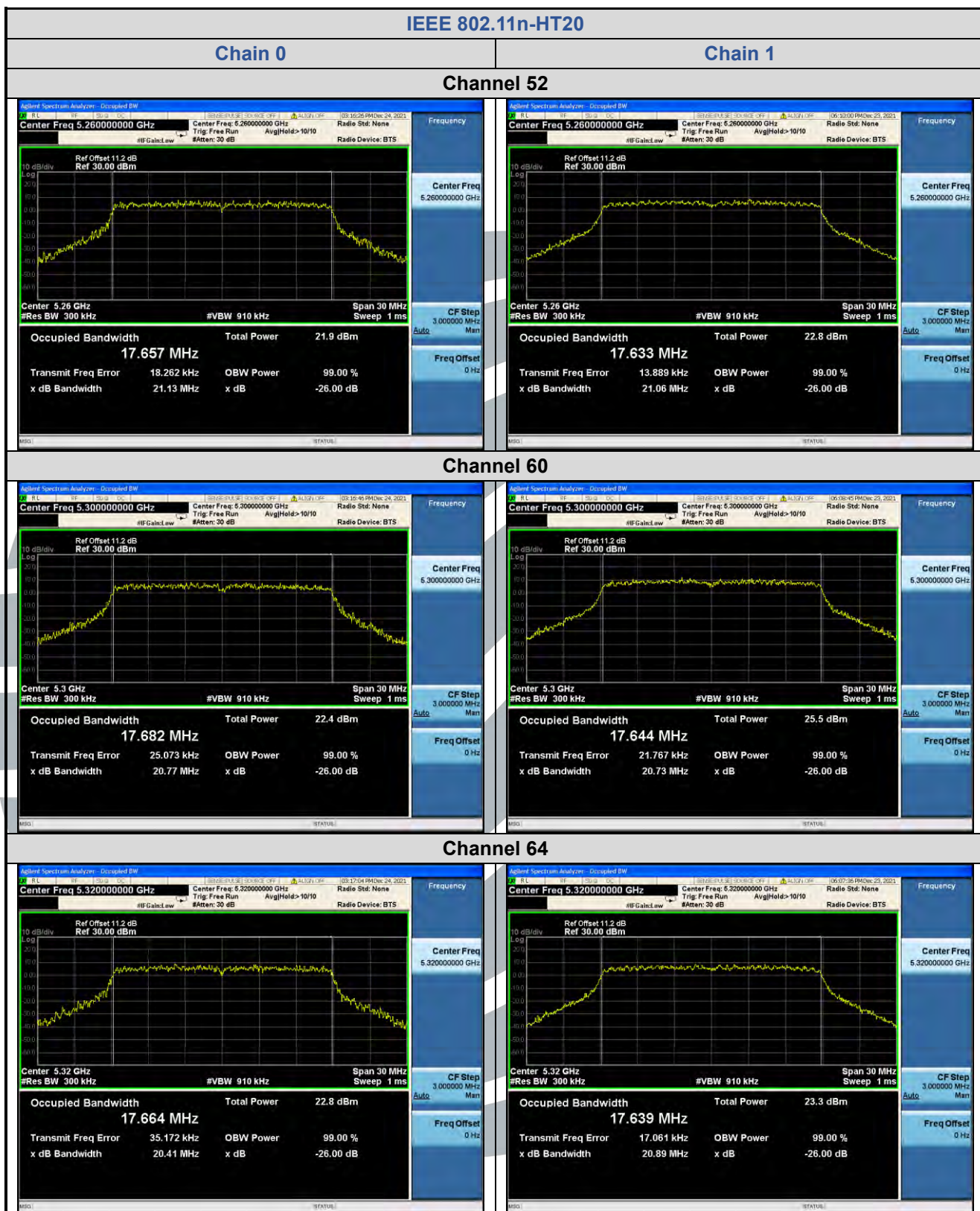
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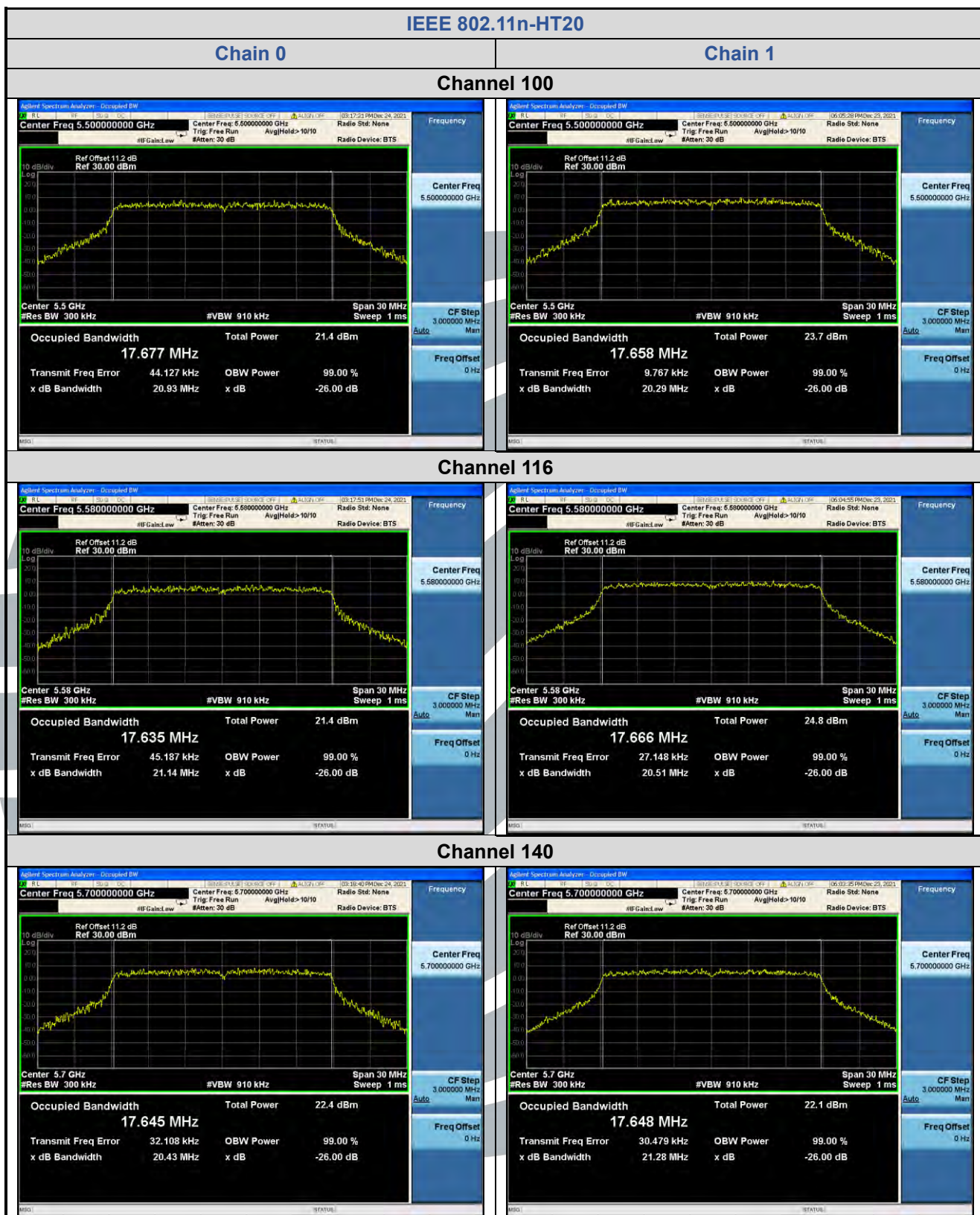
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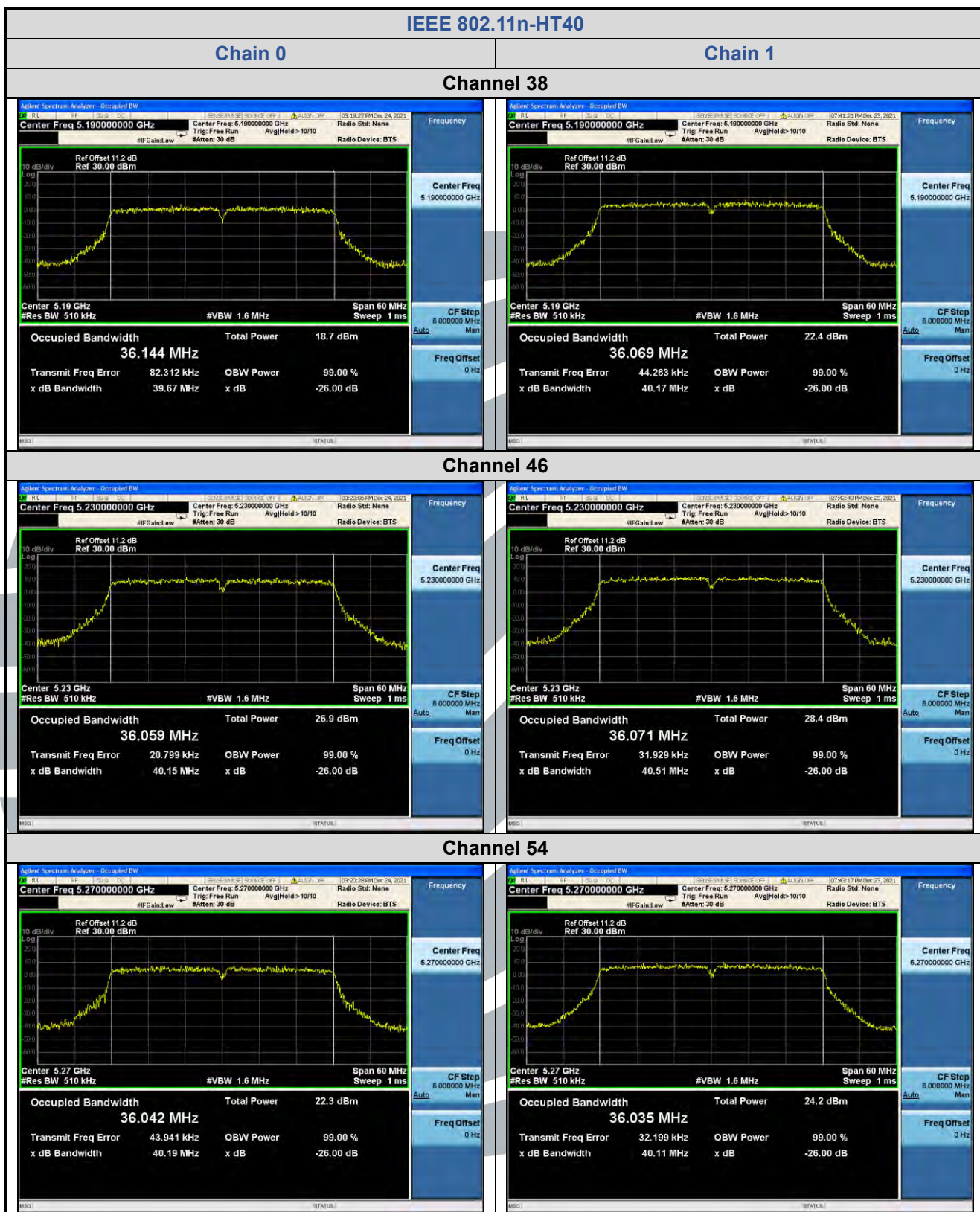


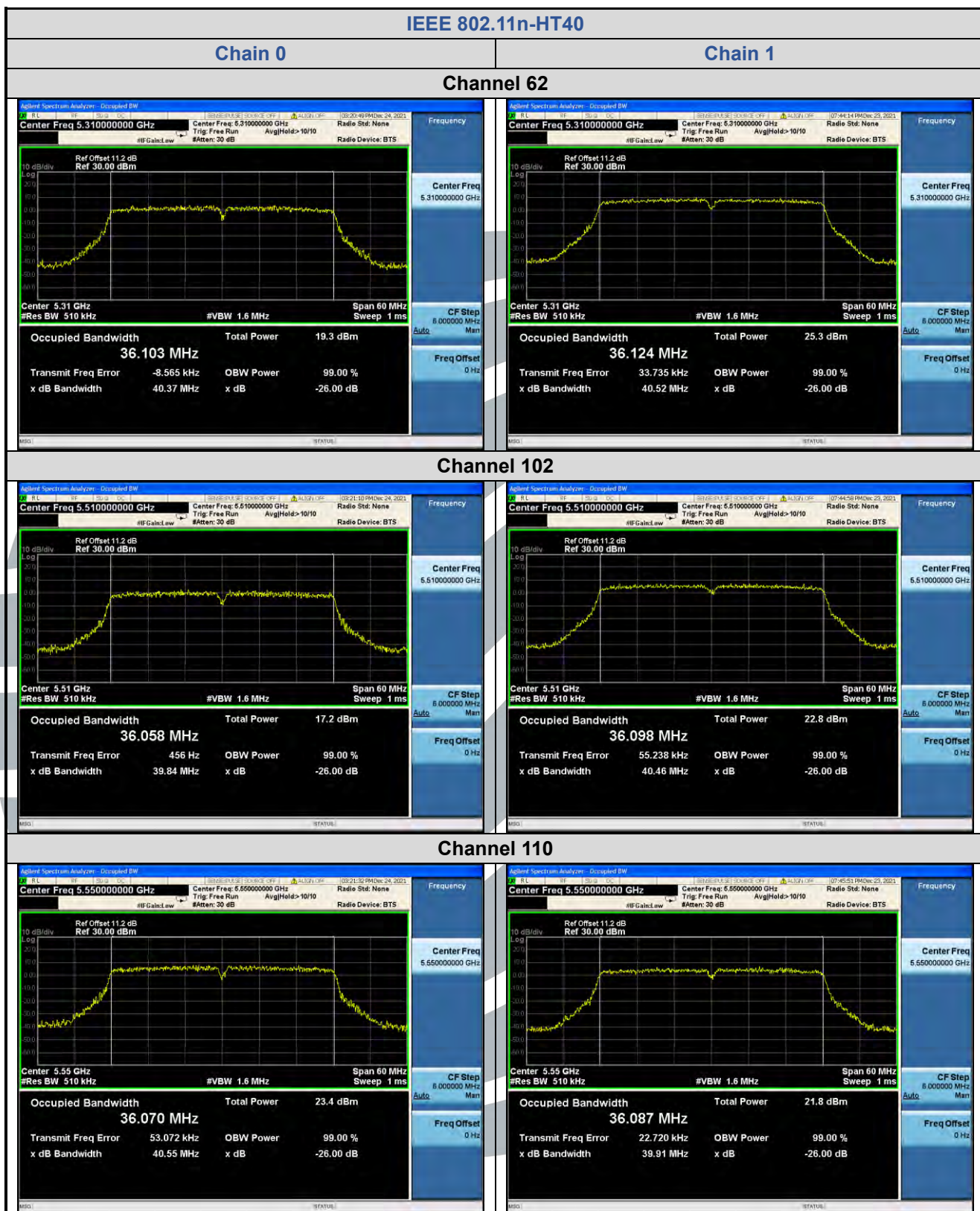


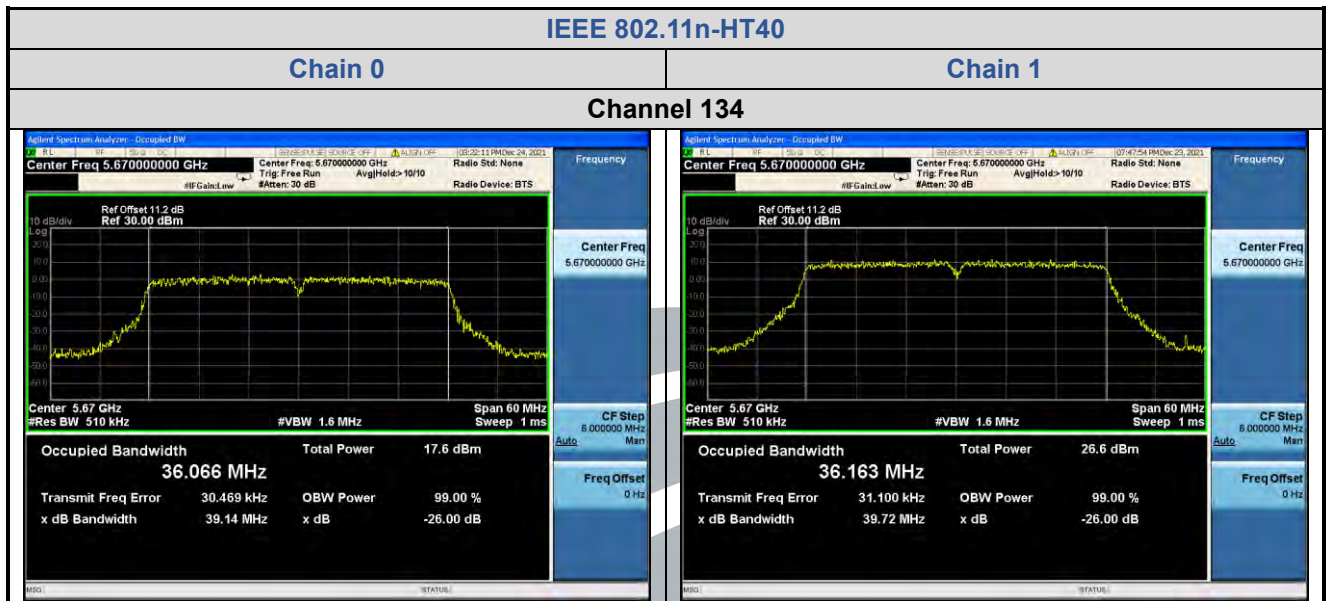












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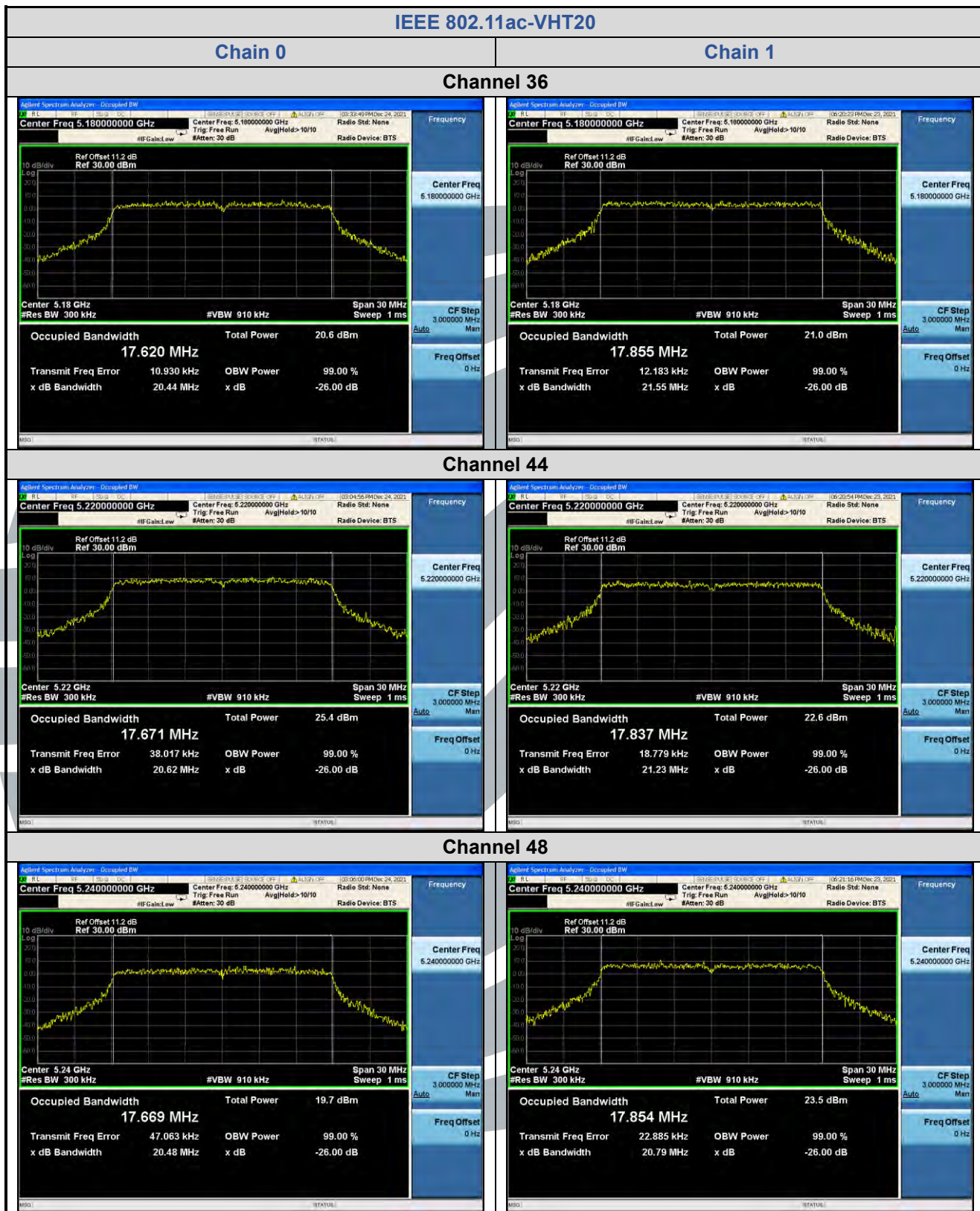
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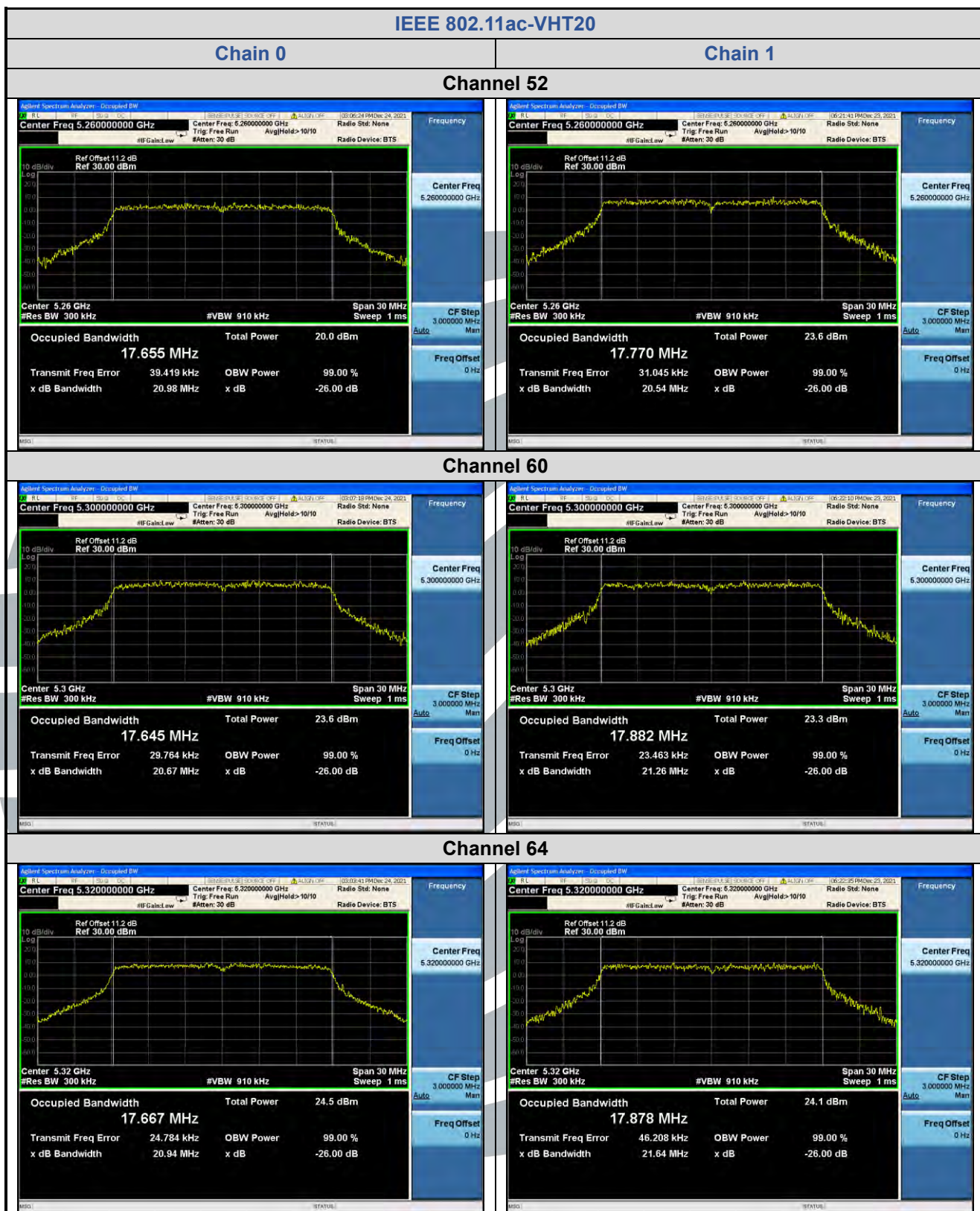
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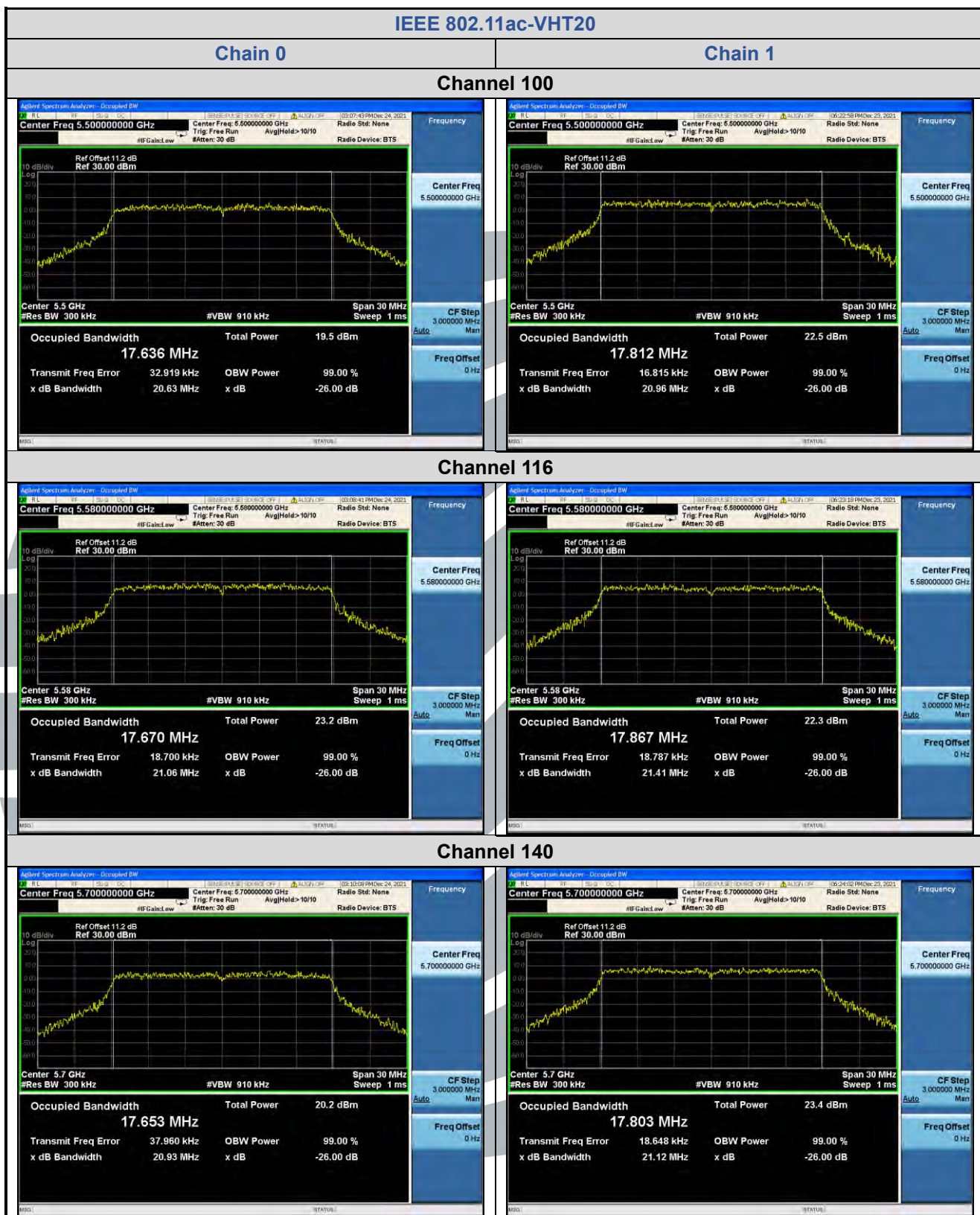
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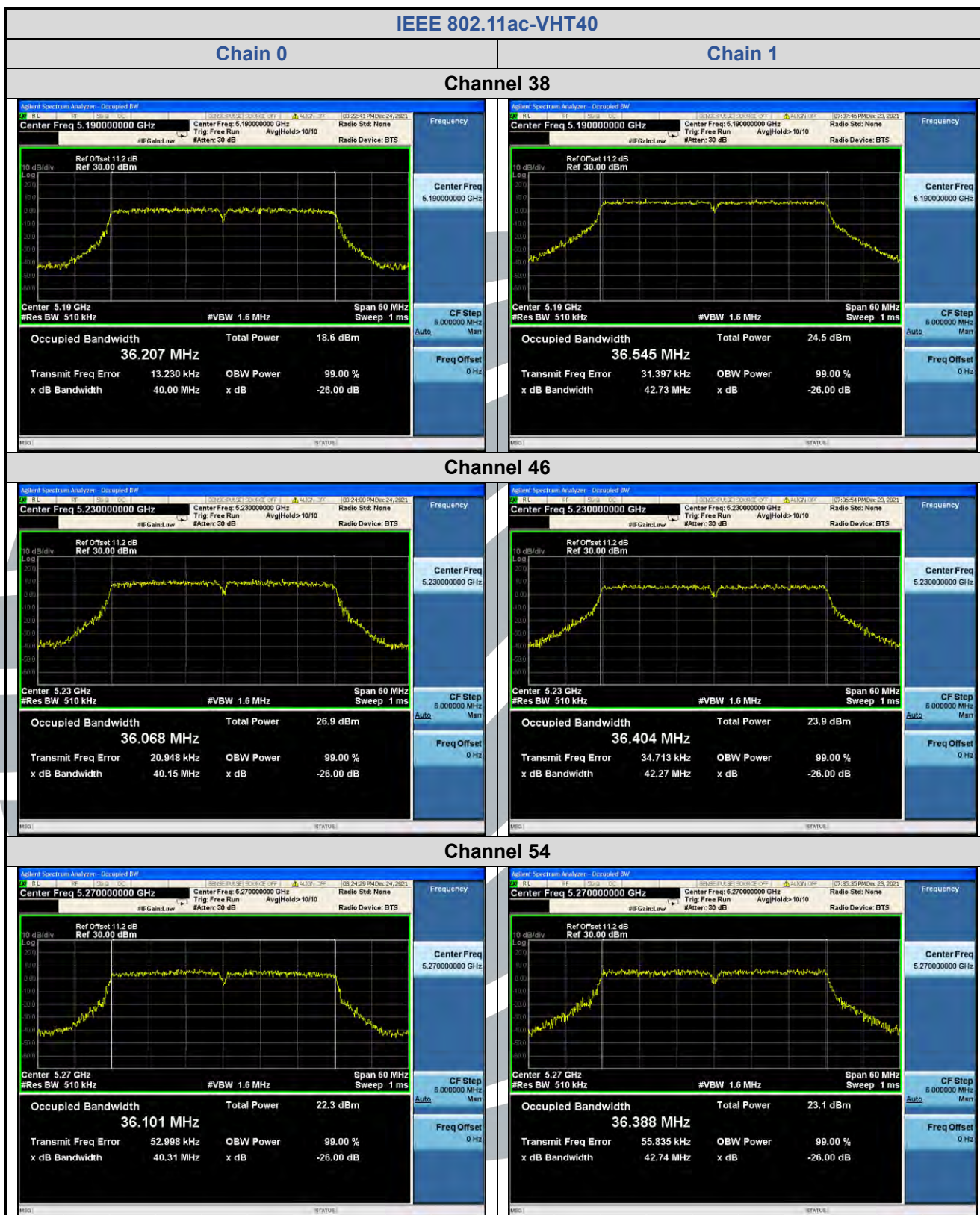
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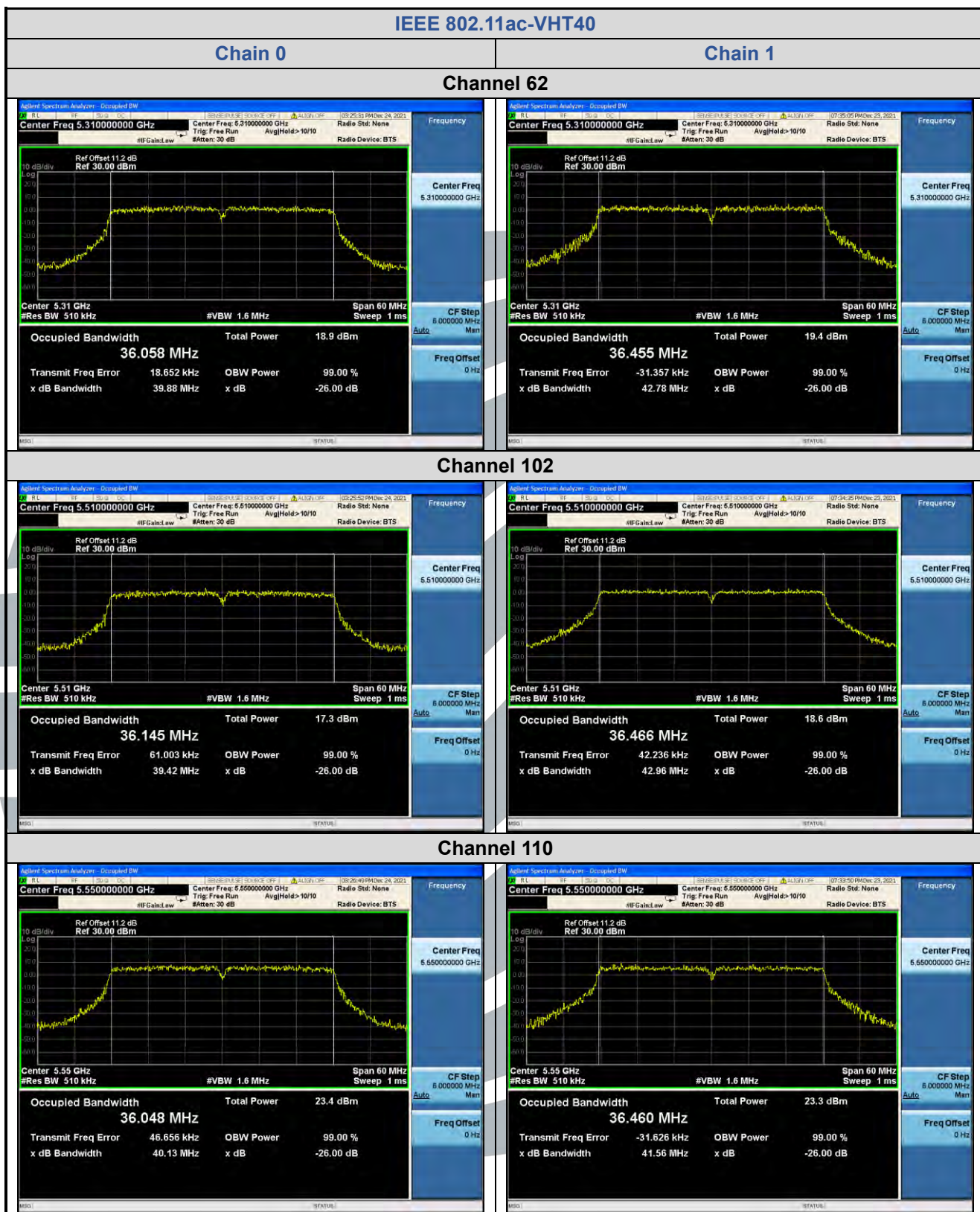
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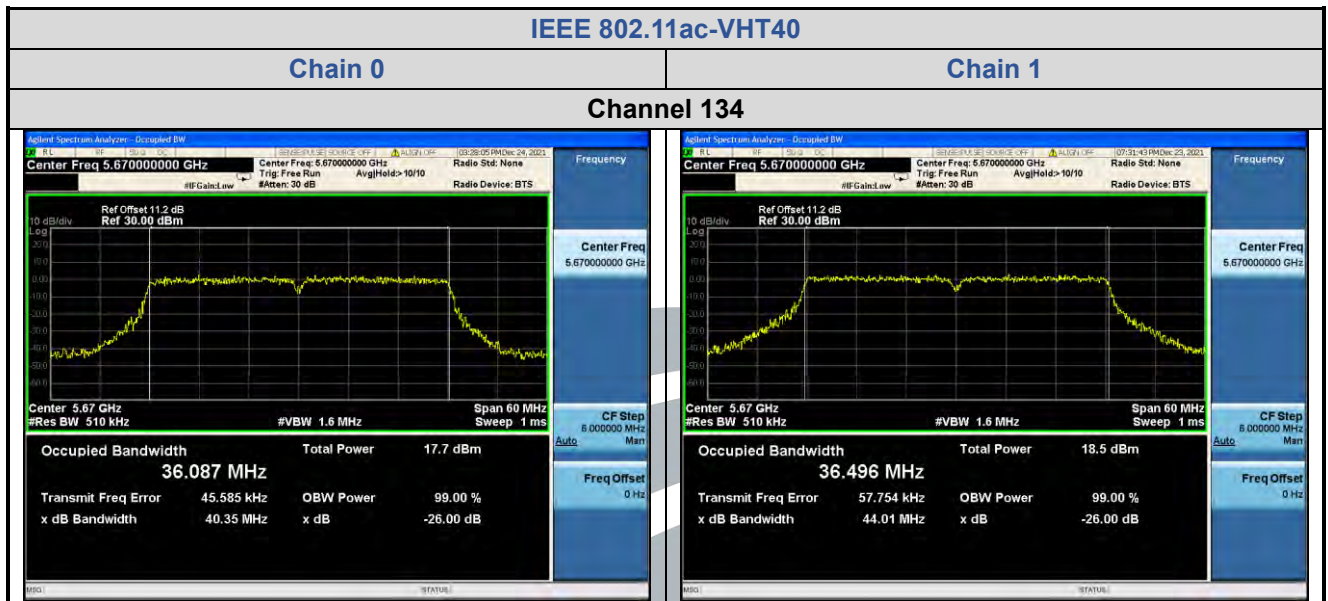












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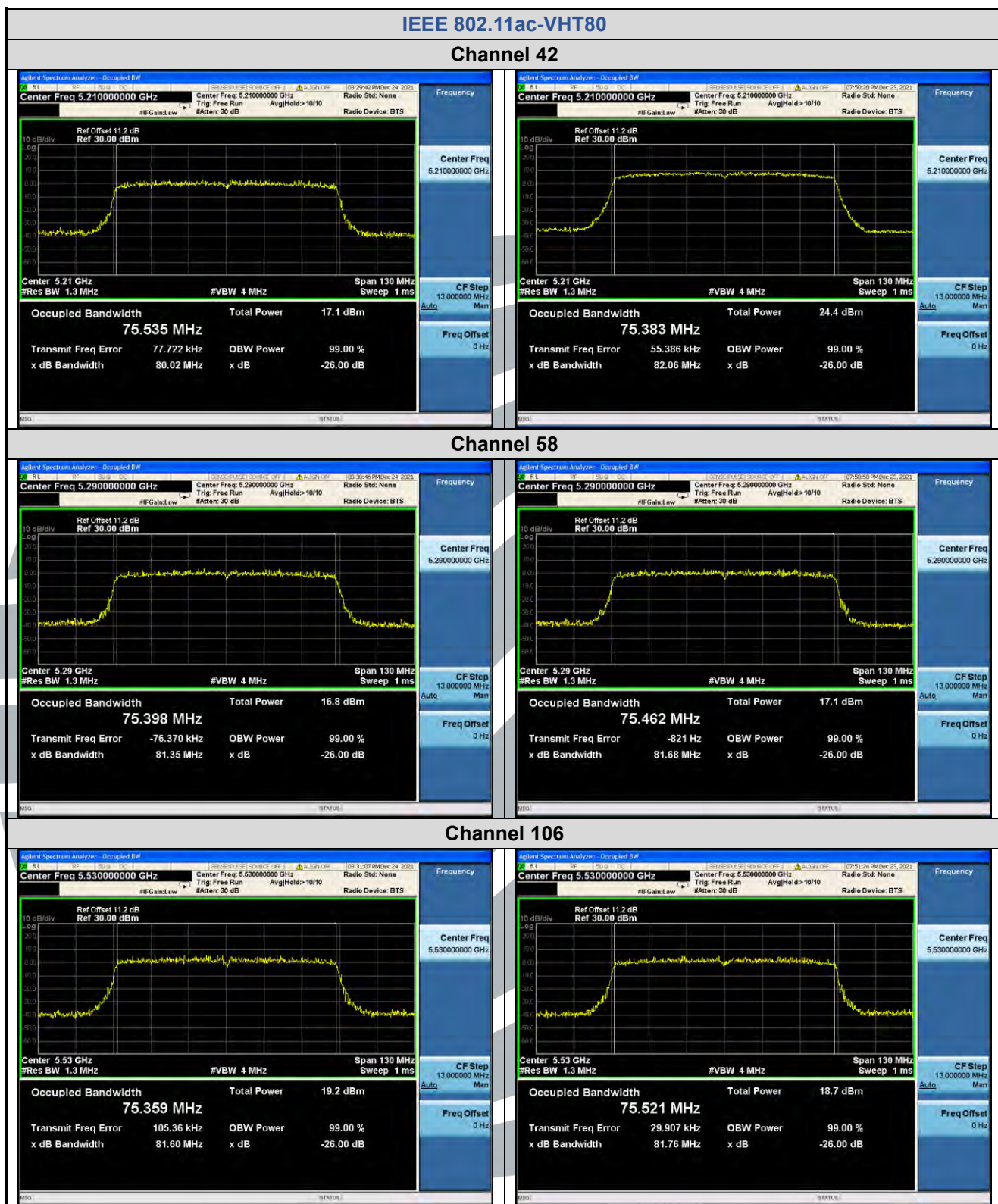
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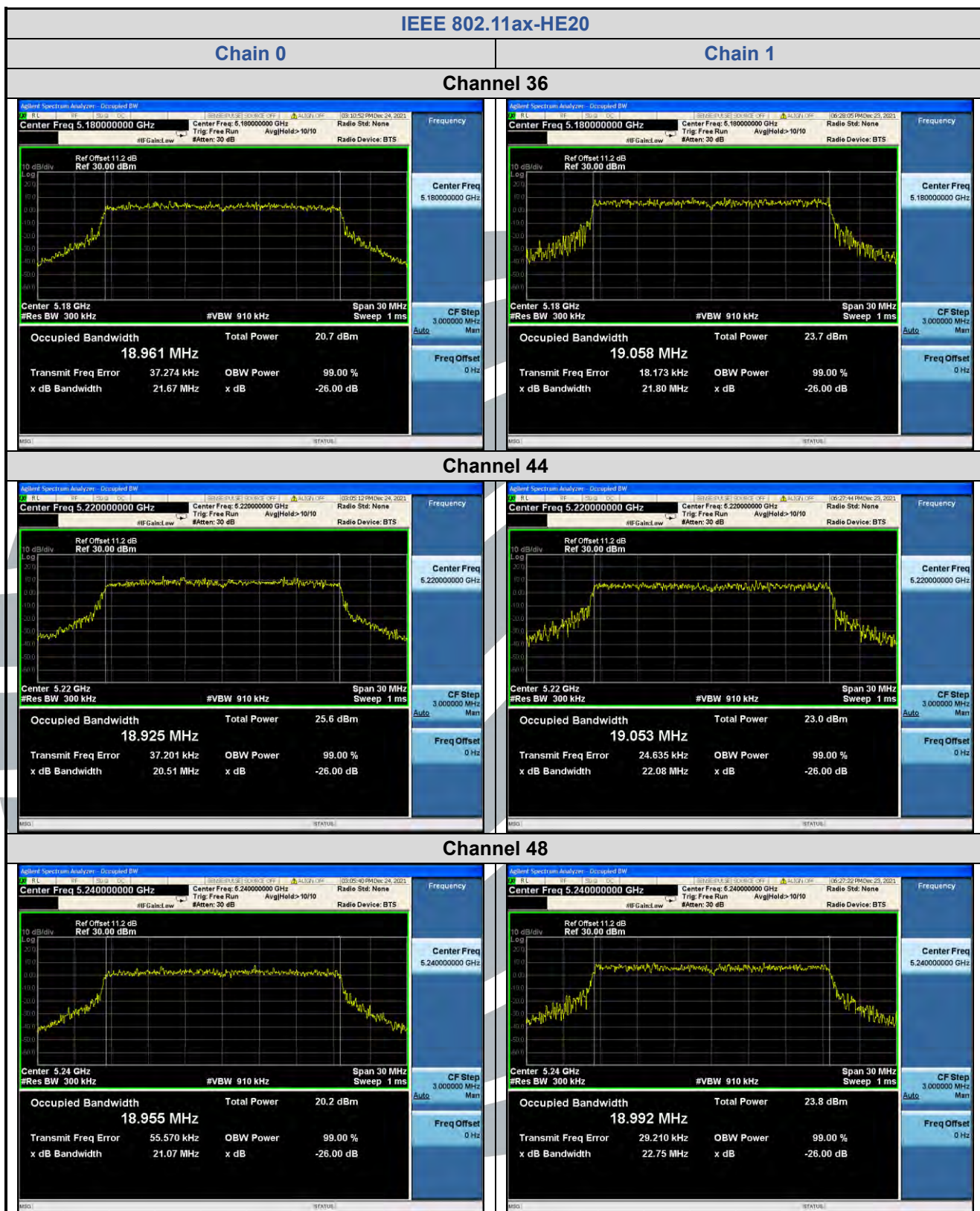
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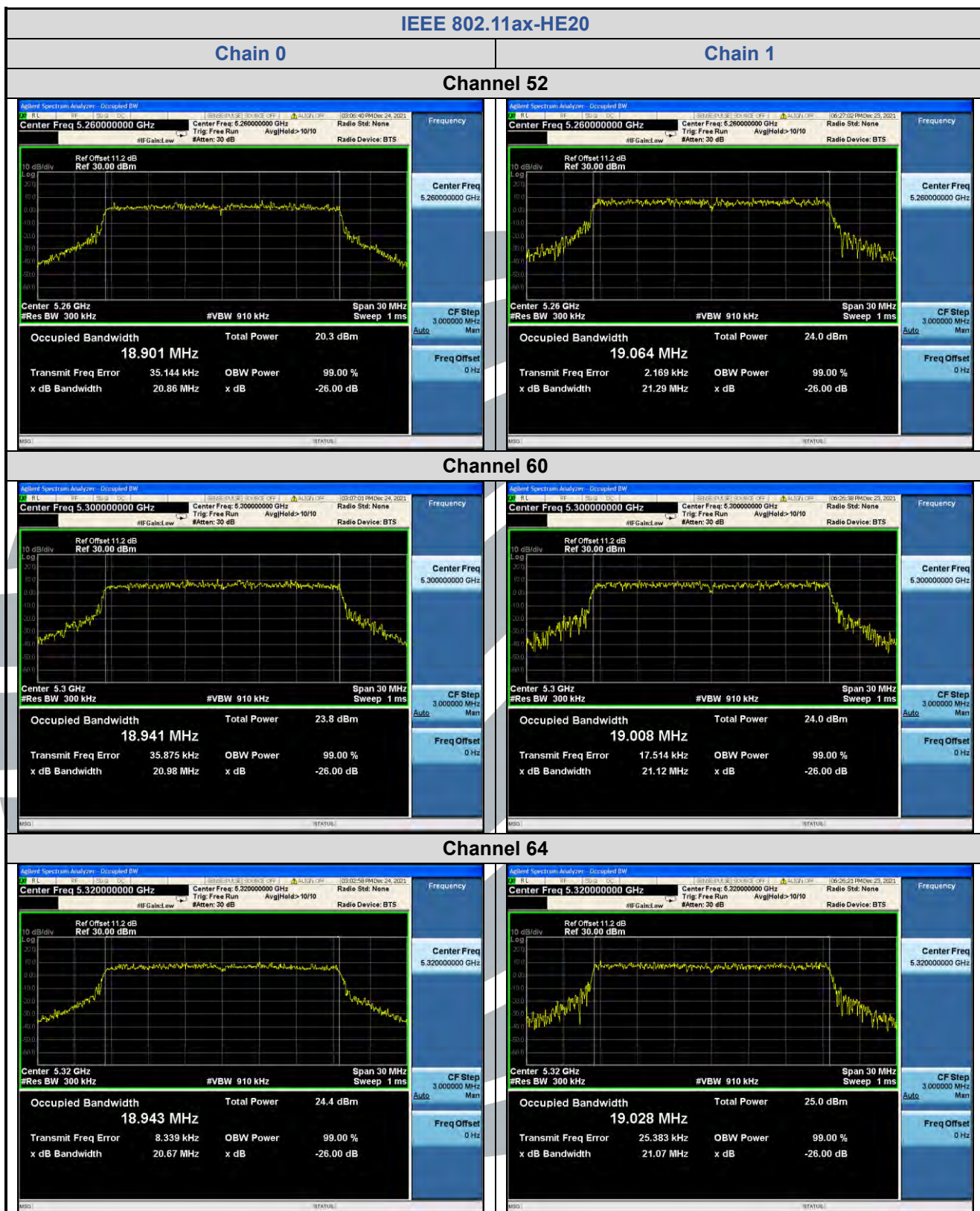
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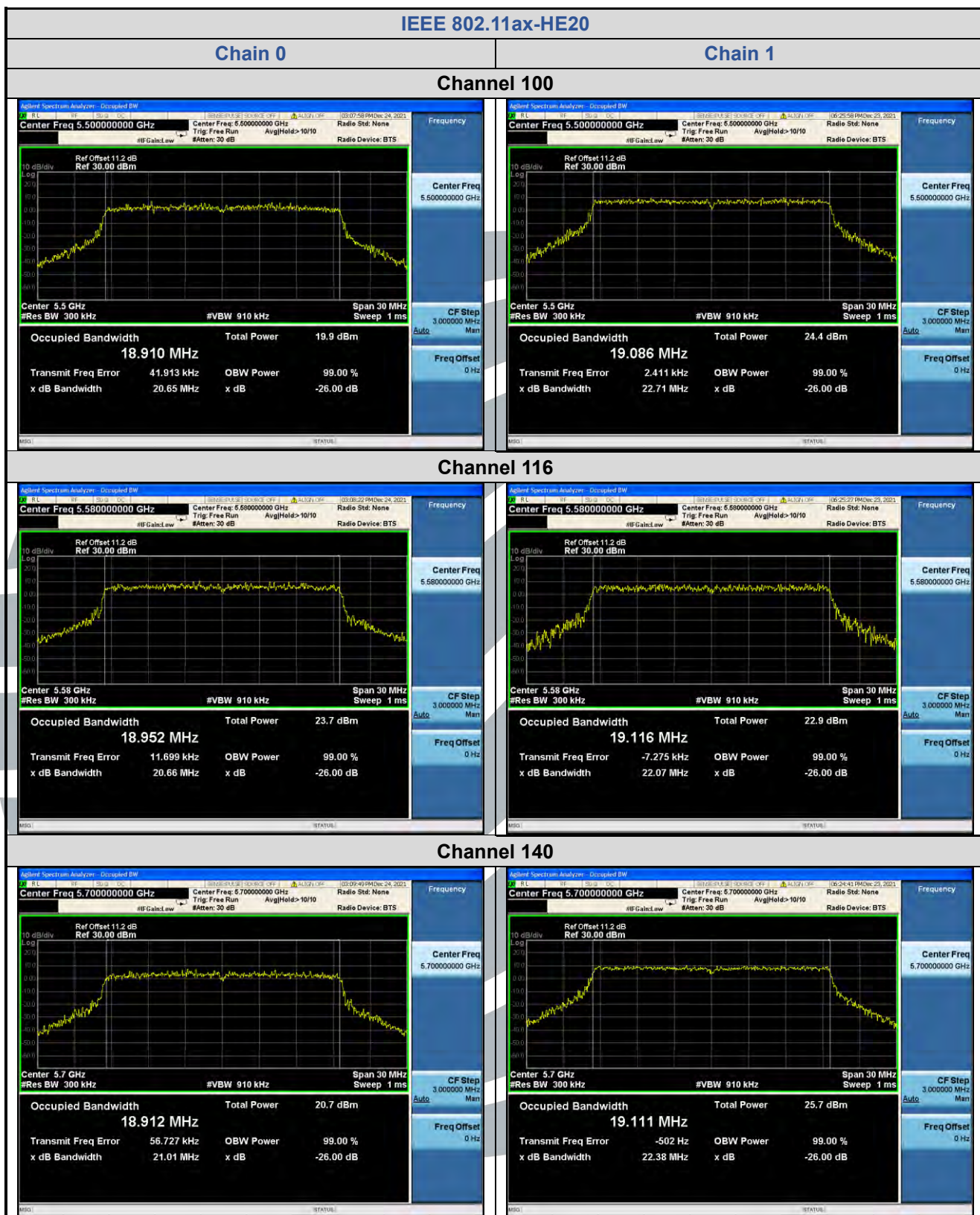
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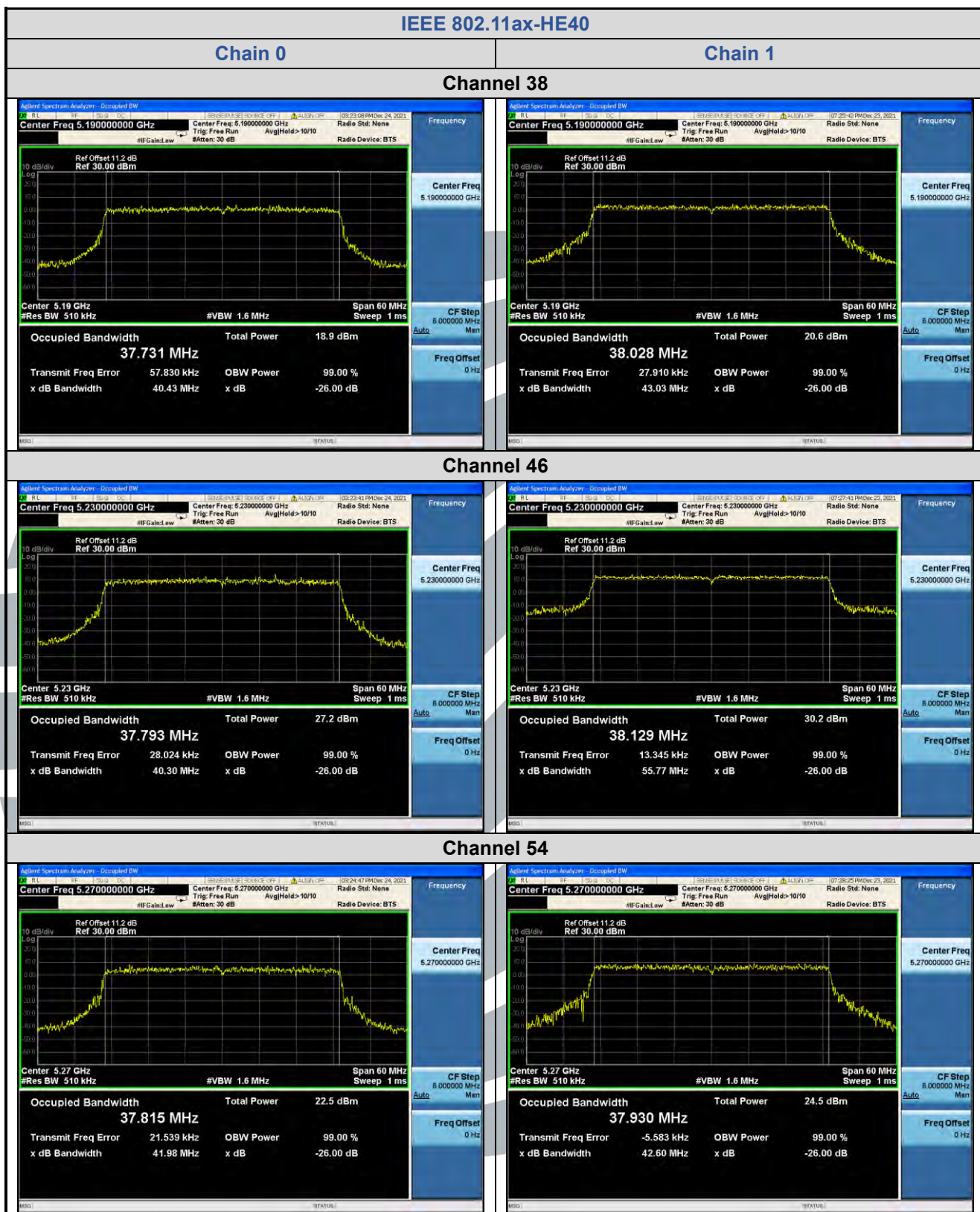
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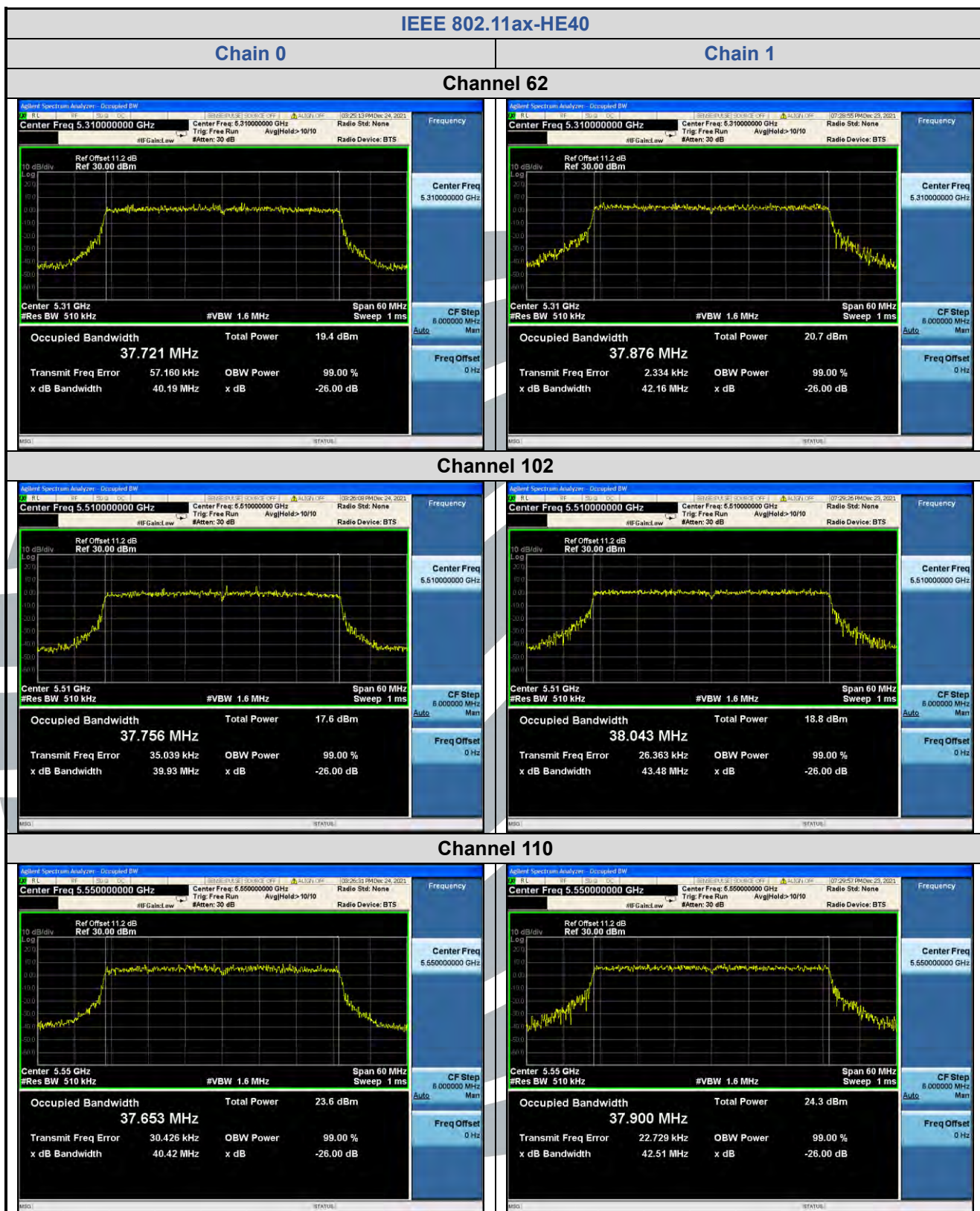


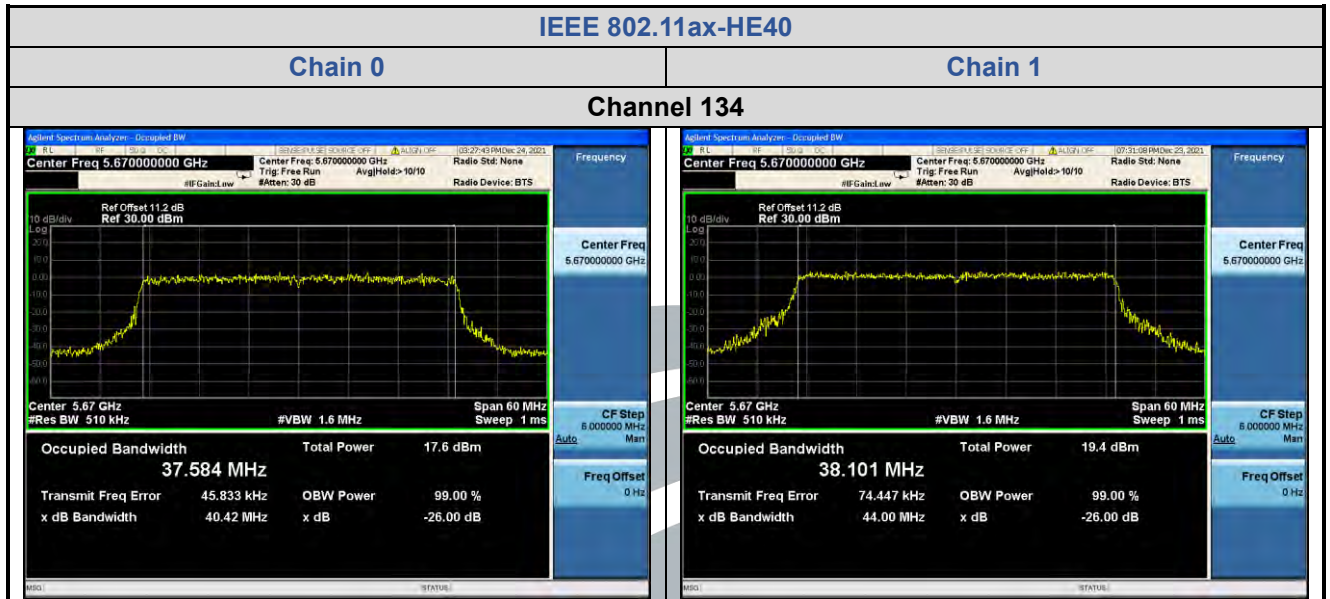












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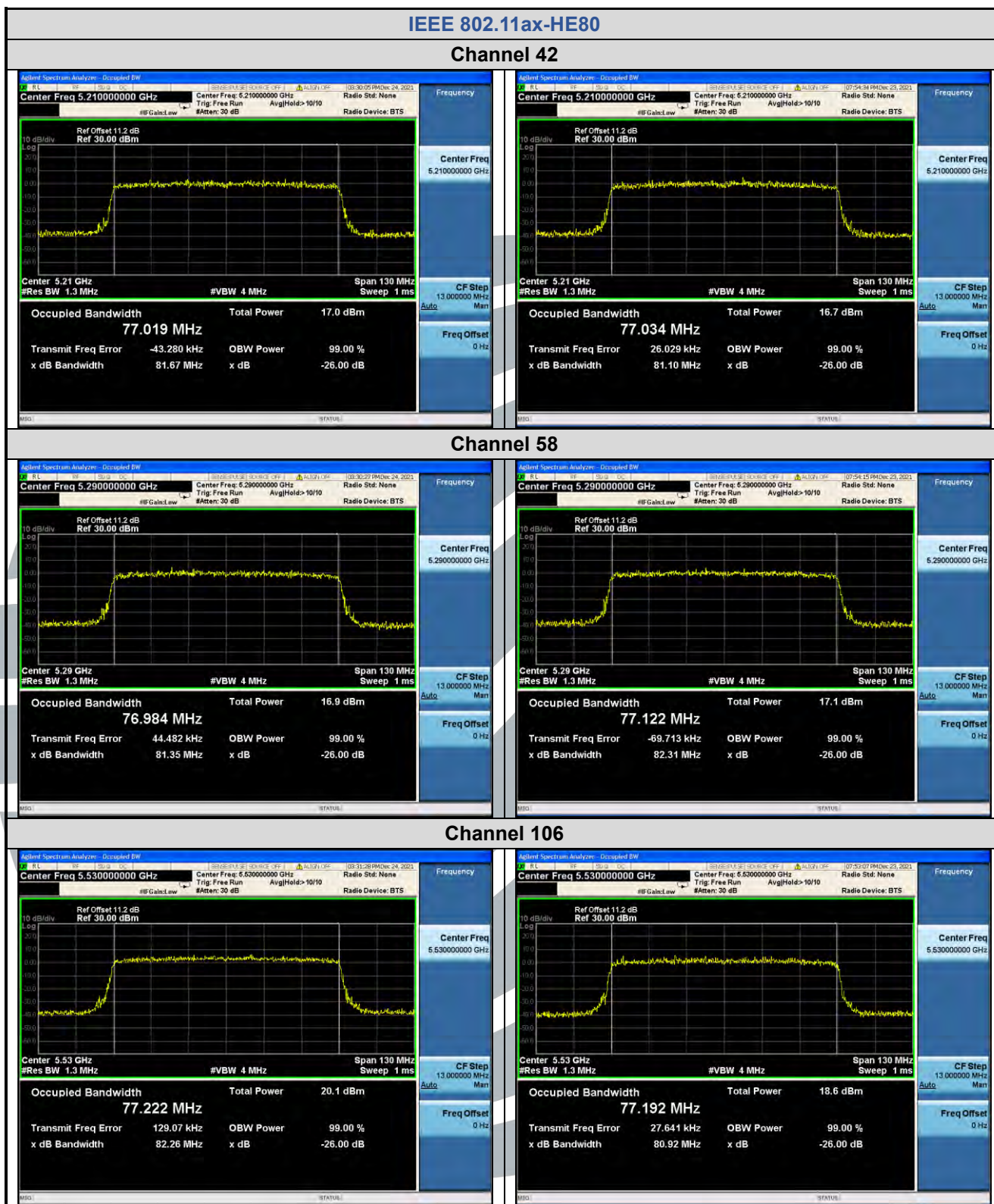
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5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

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

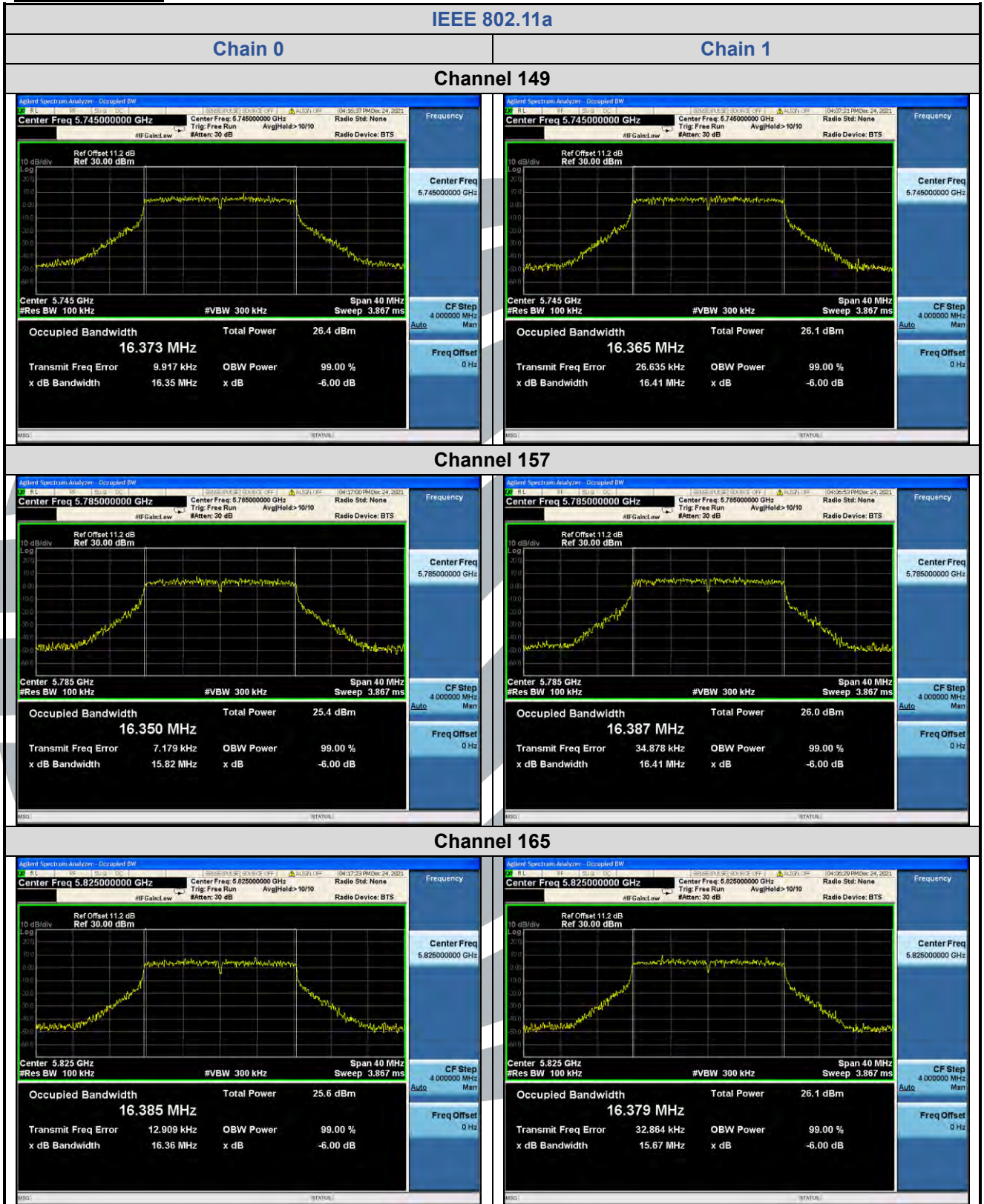
Test Results: Pass

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)	16.35	16.41	16.442	16.452	> 500 kHz	Pass
	157 (5785)	15.82	16.41	16.461	16.430	> 500 kHz	Pass
	165 (5825)	16.36	15.67	16.433	16.430	> 500 kHz	Pass
IEEE 802.11n-HT20	149 (5745)	17.35	17.65	17.660	17.672	> 500 kHz	Pass
	157 (5785)	17.64	17.62	17.614	17.643	> 500 kHz	Pass
	165 (5825)	15.43	17.52	17.669	17.651	> 500 kHz	Pass
IEEE 802.11n-HT40	151 (5755)	36.39	36.33	36.124	36.108	> 500 kHz	Pass
	159 (5795)	36.40	36.43	36.070	36.151	> 500 kHz	Pass
IEEE 802.11ac-VHT20	149 (5745)	17.64	16.53	17.672	17.635	> 500 kHz	Pass
	157 (5785)	17.67	17.67	17.635	17.639	> 500 kHz	Pass
	165 (5825)	17.65	16.14	17.585	17.620	> 500 kHz	Pass
IEEE 802.11ac-VHT40	151 (5755)	36.44	33.18	36.089	36.064	> 500 kHz	Pass
	159 (5795)	36.37	33.86	36.071	36.071	> 500 kHz	Pass
IEEE 802.11ac-VHT80	155 (5775)	71.99	76.45	75.465	75.372	> 500 kHz	Pass
IEEE 802.11ax-HE20	149 (5745)	18.99	19.01	18.923	18.884	> 500 kHz	Pass
	157 (5785)	18.39	18.97	18.949	18.935	> 500 kHz	Pass
	165 (5825)	19.00	18.07	18.952	18.904	> 500 kHz	Pass
IEEE 802.11ax-HE40	151 (5755)	38.01	36.98	37.799	37.602	> 500 kHz	Pass
	159 (5795)	37.84	38.01	37.733	37.812	> 500 kHz	Pass
IEEE 802.11ax-HE80	155 (5775)	76.74	77.89	77.104	77.124	> 500 kHz	Pass

The test plots as follows:

6 dB Bandwidth



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