



Test report No. : 4790460525-US-R0-V0
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Issued date : 2022/10/14
FCC ID : RYK-WPEQ276AX

RADIO TEST REPORT

Product : 802.11 ax Mini PCIe Module

Model Name : WPEQ-276AX

FCC ID : RYK-WPEQ276AX

Test Regulation : FCC 47 CFR Part 15 Subpart E (Section 15.407)

Received Date : 2022/7/18

Test Date : 2022/7/19 ~ 2022/8/31

Issued Date : 2022/10/14

Applicant : SparkLAN Communications, Inc.
5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067,
Taiwan

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan



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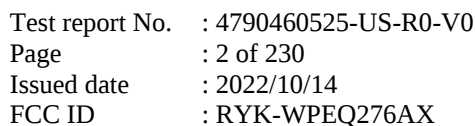
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Doc No: 17-EM-F0988 / 1.0



Original Test Report No.: 4790460525-US-R0-V0

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1. Attestation of Test Results

APPLICANT: SparkLAN Communications, Inc.
5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067, Taiwan

MANUFACTURER: SparkLAN Communications, Inc.
5F, No. 199, Ruihu St., Neihu Dist., Taipei City 114067, Taiwan

EUT DESCRIPTION: 802.11 ax Mini PCIe Module

BRAND: SparkLAN

MODEL: WPEQ-276AX

SAMPLE STAGE: Engineering Verification Test sample

DATE of TESTED: 2022/7/19 ~ 2022/8/31

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart E (Section 15.407)	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Cindy Hsin
Project Handler

Date :2022/10/14

Approved and Authorized By:

Eric Lee
Senior Laboratory Engineer

Date : 2022/10/14

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.407(b)(8)	AC Power Conducted Emissions	PASS
15.407(b)(5)(8)	Radiated Emissions	PASS
15.407(b)(6)	In-Band Emission (Mask)	PASS
15.407(a)(4/5/6/7/8)	Max Average Transmit Power	PASS
15.407(a)(10)	Emission Bandwidth Measurement	PASS
15.407(a)(4/5/6/7/8)	Peak Power Spectral Density	PASS
15.407 (d)(6)	Contention-based Protocol.	PASS
15.407(g)	Frequency Stability	PASS
15.407(a)(7)(8)	Dual Client- Proper Power Adjustment	PASS
15.407(d)(5)	Operational restrictions for 6 GHz U-NII devices	PASS
15.203	Antenna Requirement	PASS

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3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB 789033 D02 General UNII Test Procedure New Rules v02r01, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, KDB 987594 D02 U-NII 6 GHz EMC Measurement v01r01 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

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5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Measurement	Frequency	Uncertainty
Conducted disturbance at mains terminals ports	150kHz ~ 30MHz	± 2.9 dB
RF Conducted	9 kHz - 40GHz	± 2.4 dB
Radiated disturbance below 30MHz	9 kHz - 30 MHz	± 1.9 dB
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	± 5.8 dB
Radiated disturbance above 1 GHz	1GHz ~ 40GHz	± 4.8 dB

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6. Equipment under Test

6.1. Description of EUT

Product	802.11 ax Mini PCIe Module	
Brand Name	SparkLAN	
Model Name	WPEQ-276AX	
Operating Frequency	5.935 ~ 6.415GHz, 6.435 ~ 6.525GHz, 6.525 ~ 6.875GHz, 6.875 ~ 7.115GHz	
Modulation	1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK	
Transfer Rate	802.11ax: up to MCS11	
Number of Channel	5925 ~ 6425MHz	25 for 802.11ax (HE20)
		12 for 802.11ax (HE40)
		6 for 802.11ax (HE80)
		3 for 802.11ax (HE160)
	6425 ~ 6525MHz	5 for 802.11ax (HE20)
		3 for 802.11ax (HE40)
		2 for 802.11ax (HE80)
		1 for 802.11ax (HE160)
	6525 ~ 6855MHz	17 for 802.11ax (HE20)
		8 for 802.11ax (HE40)
		3 for 802.11ax (HE80)
		1 for 802.11ax (HE160)
	6875 ~ 7125MHz	13 for 802.11ax (HE20)
		6 for 802.11ax (HE40)
		3 for 802.11ax (HE80)
		2 for 802.11ax (HE160)

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Maximum Output Power	Non-Beamforming mode: 5925 ~ 6425MHz: 12.71 dBm 6425 ~ 6525MHz: 12.47 dBm 6525 ~ 6875MHz: 12.45 dBm 6875 ~ 7125MHz: 12.65 dBm Beamforming mode: 5925 ~ 6425MHz: 12.33 dBm 6425 ~ 6525MHz: 12.13 dBm 6525 ~ 6875MHz: 12.01 dBm 6875 ~ 7125MHz: 12.30 dBm
Normal Voltage	3.3Vdc
Sample ID	5245046

Note:

1. The EUT have two SKU as below :

Model	SKU	Difference
WPEQ-276AX	SKU #1	With Heatsink Operation Temperatures : -20℃~70℃;
	SKU #2	Without Heatsink Operation Temperatures : -20℃~50℃;

*Except above explanation, there is no different in technical construction that included circuit diagram, PCB Layout, components and component layout, all electrical construction, and mechanical construction.

2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11ax (HE20)	2TX,2RX
802.11ax (HE40)	2TX,2RX
802.11ax (HE80)	2TX,2RX
802.11ax (HE160)	2TX,2RX

3. The EUT contains following accessory devices.

Product	Brand	Model	Description
Antenna 1	SparkLAN	AD-506AX	-
Antenna 2	SparkLAN	AD-501AX	-
Antenna 3	SparkLAN	AD-509AX	-
Antenna 4	SparkLAN	AD-507AX	-
Antenna 5	SparkLAN	AD-508AX	-

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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6.2. Channel List

FOR 5925 ~ 6425MHz (U-NII-5 band)

25 channels are provided for 802.11ax (HE20):

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
2	5935 MHz	25	6075 MHz	49	6195 MHz	73	6315 MHz
1	5955 MHz	29	6095 MHz	53	6215 MHz	77	6335 MHz
5	5975 MHz	33	6115 MHz	57	6235 MHz	81	6355 MHz
9	5995 MHz	37	6135 MHz	61	6255 MHz	85	6375 MHz
13	6015 MHz	41	6155 MHz	65	6275 MHz	89	6395 MHz
17	6035 MHz	45	6175 MHz	69	6295 MHz	93	6415 MHz
21	6055 MHz	-	-	-	-	-	-

12 channels are provided for 802.11ax (HE40):

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
3	5965 MHz	27	6085 MHz	51	6205 MHz	75	6325 MHz
11	6005 MHz	35	6125 MHz	59	6245 MHz	83	6365 MHz
19	6045 MHz	43	6165 MHz	67	6285 MHz	91	6405 MHz

6 channels are provided for 802.11ax (HE80):

Channel	Frequency	Channel	Frequency	Channel	Frequency
7	5985 MHz	39	6145 MHz	71	6305 MHz
23	6065 MHz	55	6225 MHz	87	6385 MHz

3 channels are provided for 802.11ax (HE160):

Channel	Frequency	Channel	Frequency	Channel	Frequency
15	6025 MHz	47	6185 MHz	79	6345 MHz

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FOR 6425 ~ 6525MHz (U-NII-6 band)

5 channels are provided for 802.11ax (HE20):

Channel	Frequency	Channel	Frequency	Channel	Frequency
97	6435 MHz	105	6475 MHz	113	6515 MHz
101	6455 MHz	109	6495 MHz	-	-

3 channels are provided for 802.11ax (HE40):

Channel	Frequency	Channel	Frequency	Channel	Frequency
99	6445 MHz	107	6485 MHz	*115	6525 MHz

2 channels are provided for 802.11ax (HE80):

Channel	Frequency	Channel	Frequency
103	6465 MHz	*119	6545 MHz

1 channel is provided for 802.11ax (HE160):

Channel	Frequency
*111	6505 MHz

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FOR 6525 ~ 6875MHz (U-NII-7 band)

17 channels are provided for 802.11ax (HE20):

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
117	6535 MHz	137	6635 MHz	153	6715 MHz	169	6795 MHz
121	6555 MHz	141	6655 MHz	157	6735 MHz	173	6815 MHz
125	6575 MHz	145	6675 MHz	161	6755 MHz	177	6835 MHz
129	6595 MHz	149	6695 MHz	165	6775 MHz	181	6855 MHz
133	6615 MHz	-	-	-	-	-	-

8 channels are provided for 802.11ax (HE40):

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
123	6565 MHz	139	6645 MHz	155	6725 MHz	171	6805 MHz
131	6605 MHz	147	6685 MHz	163	6765 MHz	179	6845 MHz

3 channels are provided for 802.11ax (HE80):

Channel	Frequency	Channel	Frequency	Channel	Frequency
135	6625 MHz	151	6705 MHz	167	6785 MHz

1 channel is provided for 802.11ax (HE160):

Channel	Frequency
143	6665 MHz



FOR 6875 ~ 7125MHz (U-NII-8 band):

13 channels are provided for 802.11ax (HE20):

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
185	6875 MHz	201	6955 MHz	213	7015 MHz	225	7075 MHz
189	6895 MHz	205	6975 MHz	217	7035 MHz	229	7095 MHz
193	6915 MHz	209	6995 MHz	221	7055 MHz	233	7115 MHz
197	6935 MHz	-	-	-	-	-	-

6 channels are provided for 802.11ax (HE40):

Channel	Frequency	Channel	Frequency	Channel	Frequency
*187	6885 MHz	203	6965 MHz	219	7045 MHz
195	6925 MHz	211	7005 MHz	227	7085 MHz

3 channels are provided for 802.11ax (HE80):

Channel	Frequency	Channel	Frequency	Channel	Frequency
*183	6865 MHz	199	6945 MHz	215	7025 MHz

2 channels are provided for 802.11ax (HE160):

Channel	Frequency	Channel	Frequency
*175	6825 MHz	207	6985 MHz

Note: * means straddle channel.



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6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	20~26°C/ 62~68%RH	3.3Vdc	2022/07/19~ 2022/08/31	Mike Cai
Radiated Spurious Emission	966-2	20~26°C/ 62~68%RH	3.3Vdc	2022/07/19~ 2022/08/25	Mike Cai
AC power Line Conducted Emission	SR1	20~26°C/ 62~68%RH	3.3Vdc	2022/08/24~ 2022/08/25	Mike Cai

FCC Test Firm Registration Number: 498077

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6.4. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Ant. Type	Frequency Band (MHz)	Maximum Gain (dBi)	Remark
1	Chain (0)+(1)	SparkLAN	AD-506AX	Dipole	2400~2483	2.65	RP-SMA
					5150~5250	4.35	
					5250~5350	4.35	
					5470~5725	4.35	
					5725~5850	4.81	
					5925~6425	4.98	
					6425~6525	4.85	
					6525~6875	4.79	
					6875~7125	4.82	
2	Chain (0)+(1)	SparkLAN	AD-501AX	Dipole	2400~2483	3.7	RP-SMA
					5150~5850	5	
					5925~7125	5	
3	Chain (0)+(1)	SparkLAN	AD-509AX	Dipole	2400~2483	3.7	RP-SMA
					5150~5850	5	
					5925~7125	5	
4	Chain (0)+(1)	SparkLAN	AD-507AX	Dipole	2400~2483	2.67	I-PEX
					5150~5250	4.35	
					5250~5350	3.83	
					5470~5725	4.7	
					5725~5850	4.87	
					5925~6425	4.91	
					6425~6525	4.85	
					6525~6875	4.94	
					6875~7125	4.94	
5	Chain (0)+(1)	SparkLAN	AD-508AX	Dipole	2400~2483	2.67	I-PEX
					5150~5250	4.35	
					5250~5350	3.83	
					5470~5725	4.7	
					5725~5850	4.87	
					5925~6425	4.91	
					6425~6525	4.85	
					6525~6875	4.94	
					6875~7125	4.94	

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer specification or user manual.

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6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the dipole antenna was investigated in two orthogonal (lay and stand), it was determined that stand mode was worst-case. Therefore, all final radiated testing was performed with the dipole antenna in stand mode.
- For AC power line conducted emissions, the pre-scan has been determined by AC power 120Vac/60Hz (worst case)
- The antennas AD-501AX has the highest gain, the following conducted tests are all carried out using this antenna.
- The antennas AD-501AX/ AD-509AX has the same type, therefore, the highest gain was determined antenna AD-501AX worst-case, the Antenna AD-501AX was selected for the final radiated testing.
- The EUT with two SKUs, and there're no different in technical construction that included circuit diagram, PCB Layout, components and component layout, all electrical construction, and mechanical construction. The EUT with Heatsink's was the worst case, therefore the final test used it for all items.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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Non-Beamforming mode:

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11ax20	5955-6415	OFDMA	1 to 93	1, 2 ,45, 93	HE0
	802.11ax40			3 to 91	3, 43, 91	HE0
	802.11ax80			7 to 87	7, 39, 87	HE0
	802.11ax160			15 to 79	15,47,79	HE0
	802.11ax20	6435-6515	OFDMA	97 to 113	97, 105, 113	HE0
	802.11ax40			99 to 115	99, 107, 115	HE0
	802.11ax80			103 to 119	103, 119	HE0
	802.11ax160			111	111	HE0
	802.11ax20	6535-6875	OFDMA	117 to 181	117, 149, 181	HE0
	802.11ax40			123 to 179	123, 155, 179	HE0
	802.11ax80			135 to 167	135, 151, 167	HE0
	802.11ax160			143	143	HE0
	802.11ax20	6875-7115	OFDMA	185 to 233	185, 209, 229, 233	HE0
	802.11ax40			187 to 227	187, 211, 227	HE0
	802.11ax80			183 to 215	183, 199, 215	HE0
	802.11ax160			175 to 207	175, 207	HE0
Radiated Emissions (Below 1GHz)	802.11ax160	5955-6415	OFDMA	15 to 79	79	HE0
AC Power Line Conducted Emission	802.11ax160	5955-6415	OFDMA	15 to 79	79	HE0

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Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11ax20	5955-6415	OFDMA	1 to 93	1, 2 ,45, 93	HE0
	802.11ax40			3 to 91	3, 43, 91	HE0
	802.11ax80			7 to 87	7, 39, 87	HE0
	802.11ax160			15 to 79	15,47,79	HE0
	802.11ax20	6435-6515	OFDMA	97 to 113	97, 105, 113	HE0
	802.11ax40			99 to 115	99, 107, 115	HE0
	802.11ax80			103 to 119	103, 119	HE0
	802.11ax160			111	111	HE0
	802.11ax20	6535-6875	OFDMA	117 to 181	117, 149, 181	HE0
	802.11ax40			123 to 179	123, 155, 179	HE0
	802.11ax80			135 to 167	135, 151, 167	HE0
	802.11ax160			143	143	HE0
	802.11ax20	6875-7115	OFDMA	185 to 233	185, 209, 229, 233	HE0
	802.11ax40			187 to 227	187, 211, 227	HE0
	802.11ax80			183 to 215	183, 199, 215	HE0
	802.11ax160			175 to 207	175, 207	HE0
Contention Based Protocol Measurement	802.11ax20	5955-6415	OFDMA	1 to 93	1	HE0
	802.11ax160			15 to 79	15	HE0
	802.11ax20	6435-6515	OFDMA	97 to 113	97	HE0
	802.11ax160			111	111	HE0
	802.11ax20	6535-6875	OFDMA	117 to 181	145	HE0
	802.11ax160			143	143	HE0
	802.11ax20	6875-7115	OFDMA	185 to 233	193	HE0
	802.11ax160			175 to 207	207	HE0

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Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Conducted Emissions (Above 1GHz)	802.11ax20	5955-6415	OFDMA	1 to 93	1, 2 ,45, 93	HE0
	802.11ax40			3 to 91	3, 43, 91	HE0
	802.11ax80			7 to 87	7, 39, 87	HE0
	802.11ax160			15 to 79	15,47,79	HE0
	802.11ax20	6435-6515	OFDMA	97 to 113	97, 105, 113	HE0
	802.11ax40			99 to 115	99, 107, 115	HE0
	802.11ax80			103 to 119	103, 119	HE0
	802.11ax160			111	111	HE0
	802.11ax20	6535-6875	OFDMA	117 to 181	117, 149, 181	HE0
	802.11ax40			123 to 179	123, 155, 179	HE0
	802.11ax80			135 to 167	135, 151, 167	HE0
	802.11ax160			143	143	HE0
	802.11ax20	6875-7115	OFDMA	185 to 233	185, 209, 229, 233	HE0
	802.11ax40			187 to 227	187, 211, 227	HE0
	802.11ax80			183 to 215	183, 199, 215	HE0
	802.11ax160			175 to 207	175, 207	HE0

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Beamforming mode:

Test Item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Antenna Port Conducted Measurement	802.11ax20	5955-6415	OFDMA	1 to 93	1, 2 ,45, 93	HE0
	802.11ax40			3 to 91	3, 43, 91	HE0
	802.11ax80			7 to 87	7, 39, 87	HE0
	802.11ax160			15 to 79	15,47,79	HE0
	802.11ax20	6435-6515	OFDMA	97 to 113	97, 105, 113	HE0
	802.11ax40			99 to 115	99, 107, 115	HE0
	802.11ax80			103 to 119	103, 119	HE0
	802.11ax160			111	111	HE0
	802.11ax20	6535-6875	OFDMA	117 to 181	117, 149, 181	HE0
	802.11ax40			123 to 179	123, 155, 179	HE0
	802.11ax80			135 to 167	135, 151, 167	HE0
	802.11ax160			143	143	HE0
	802.11ax20	6875-7115	OFDMA	185 to 233	185, 209, 229, 233	HE0
	802.11ax40			187 to 227	187, 211, 227	HE0
	802.11ax80			183 to 215	183, 199, 215	HE0
	802.11ax160			175 to 207	175 to 207	HE0

*Note: The worse spurious emissions test and maximum output power was found in Non-Beamforming mode. Therefore Beamforming mode only the test data of the RF output power were recorded in this report.

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6.6. Duty cycle

Mode	On Time(ms)	On+Off Time(ms)	Duty Cycle	Duty Factor(dB)	VBW(for AV at Freq above 1GHz)
802.11ax(HE20)	5.340	5.378	0.993	N/A	10Hz
802.11ax(HE40)	4.770	4.845	0.985	N/A	10Hz
802.11ax(HE80)	2.510	2.565	0.979	0.09	510Hz
802.11ax(HE160)	2.200	2.225	0.989	N/A	10Hz

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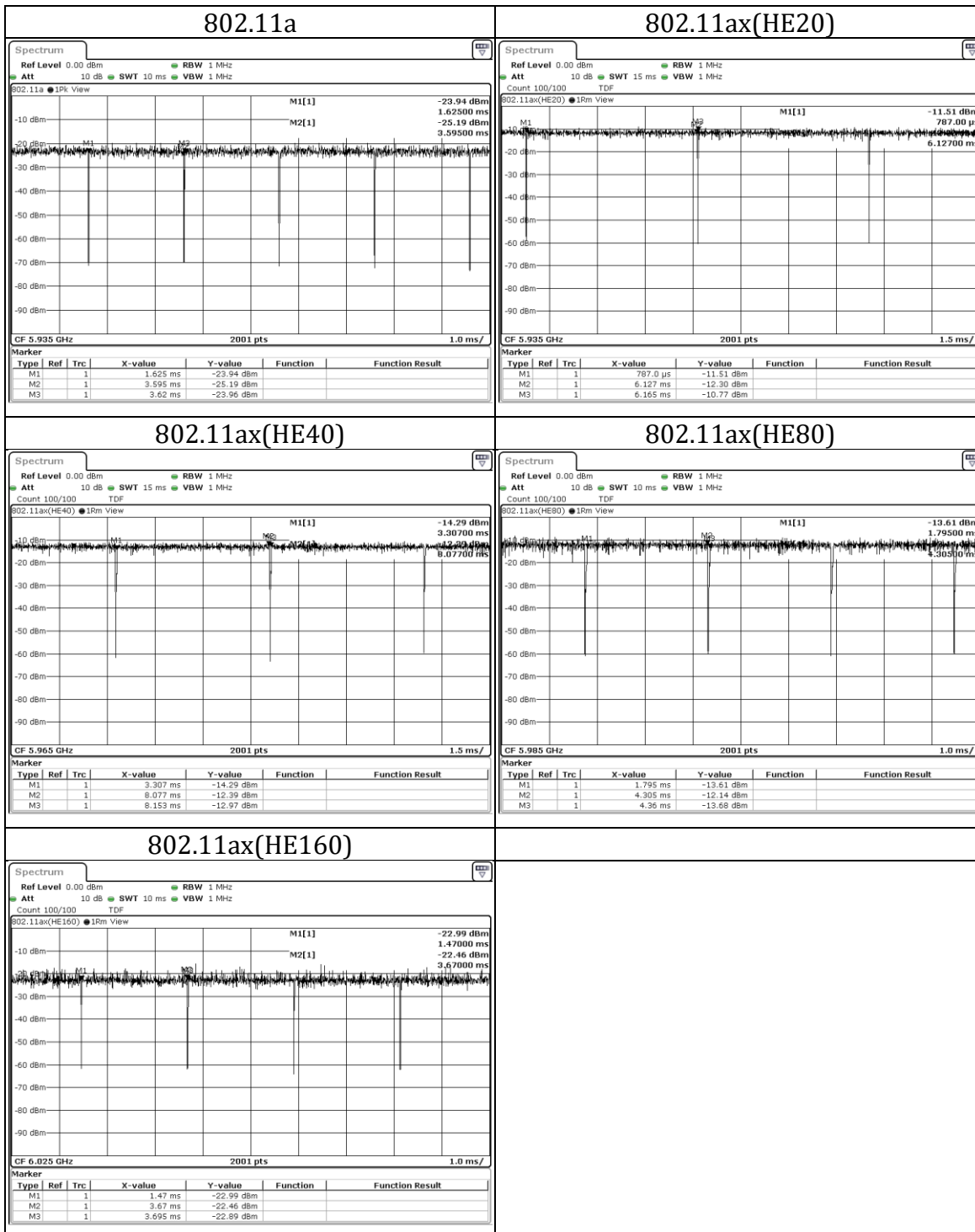
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7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	2021/11/9	2022/11/8
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	2021/12/10	2022/12/9
Loop Antenna	ETS lindgren	6502	00213440	2021/12/23	2022/12/22
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	2022/2/8	2023/2/7
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	2021/12/13	2022/12/12
Horn Antenna (18-40 GHz)	Schwarzbeck	BBHA 9170	781	2021/12/17	2022/12/16
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	2022/6/7	2023/6/6
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	2022/2/16	2023/2/15
Preamplifier (18-40GHz)	EMCI	EMC184040SEE	980426	2022/5/17	2023/5/16
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-4 & 170425-2	2021/12/3	2022/12/2
Cables	Hanyitek	K1K50-UP0264-K1K50-2500	170214-1 & 170214-2	2021/12/3	2022/12/2

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Expired date
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2021/10/29	2022/10/28
USB Power Sensor	Anritsu	MA24408A	12031	2022/3/23	2023/3/22
Temperature & Humidity Test Chamber	GIANT FORCE	GTH-150-40-CP-AR	MAA1701-010	2022/3/11	2023/3/10
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	2021/11/15	2022/11/14
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	2021/8/30	2022/8/29
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	2021/8/26	2022/8/25
Cables	TITAN	CFD200	T0732ACFD20 020A300-2	2022/4/9	2023/4/8
Contention Based Protocol Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	2021/10/29	2022/10/28
Signal Generator	Keysight	N5182B	MY57300028	2021/11/14	2022/11/13

UL Software		
Description	Name	Version
Radiated measurement	e3	6.191211 (V6)
Conducted measurement	RF-Conducted-WiFi6e	ver 1.1
AC power Line Conducted Emission	EZ EMC	UL-3A1.2

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8. Description of Test Setup

Support Equipment

ID	Equipment	Brand Name	Model Name	S/N	Remark
A	Adapter	Asian Power Devices	WA-24E12FU	N/A	Provide by client
B	Fixture	N/A	N/A	N/A	Provide by client
C	Laptop	DELL	Latitude E5470	CXSKWF2	Provide by lab

I/O Cables

ID	Equipment	Brand Name	Model Name	Length (m)	Remark
1	RJ-45 Cable	Fastlink	FL-61STU-04	10	Provide by lab

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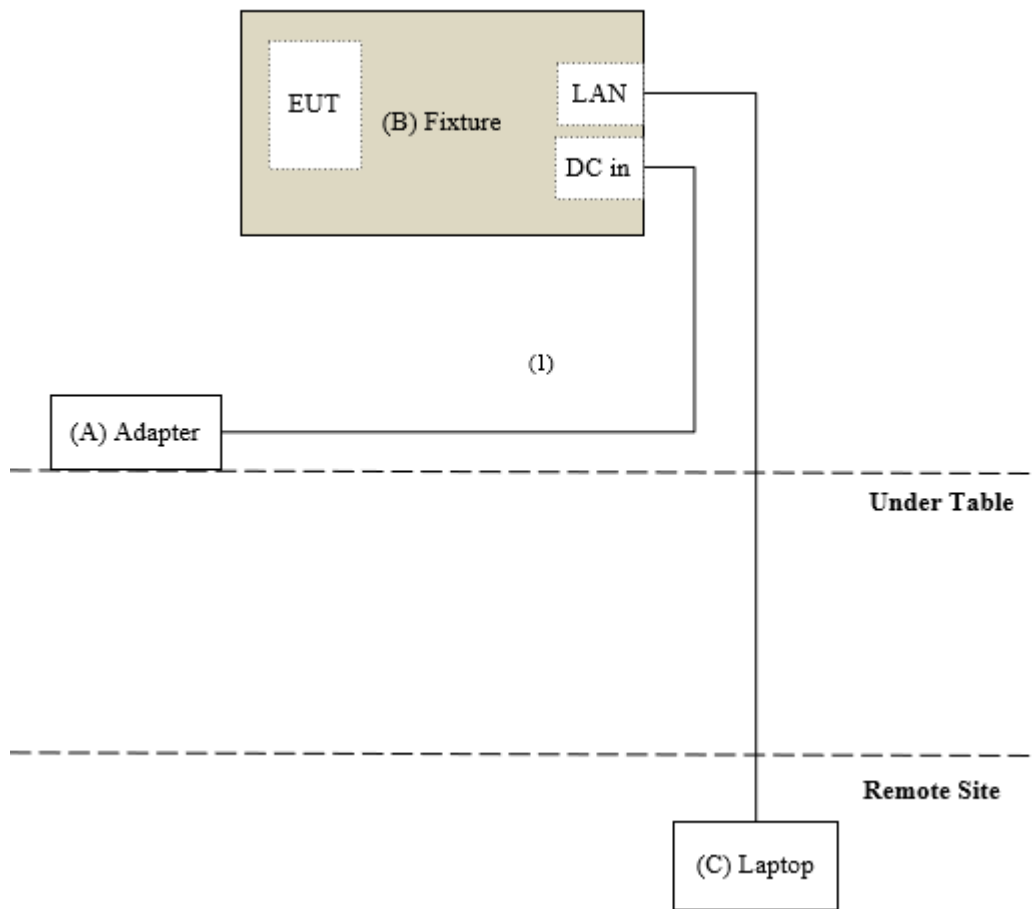
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Test Setup

Controlled using a bespoke application (Tera Term tool to paste RF command) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Setup Diagram for Test



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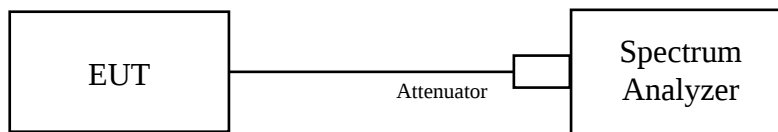
9. Test Results

9.1. 26dB Bandwidth

Test procedure

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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%.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.



Test Data

Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE20)	2	5935	21.522	21.65	320	PASS
	1	5955	21.922	21.363	320	PASS
	45	6175	21.34	21.292	320	PASS
	93	6415	21.903	21.743	320	PASS
	97	6435	21.32	21.643	320	PASS
	105	6475	21.489	21.617	320	PASS
	113	6515	21.232	21.174	320	PASS
	117	6535	21.51	21.446	320	PASS
	149	6695	21.588	21.609	320	PASS
	181	6855	21.568	21.27	320	PASS
	185	6875	21.327	21.511	320	PASS
	209	6995	21.622	21.434	320	PASS
	229	7095	21.687	21.726	320	PASS
	233	7115	21.428	21.895	320	PASS
	185	6875	21.327	21.511	320	PASS
	209	6995	21.622	21.434	320	PASS
	229	7095	21.687	21.726	320	PASS
	233	7115	21.428	21.895	320	PASS

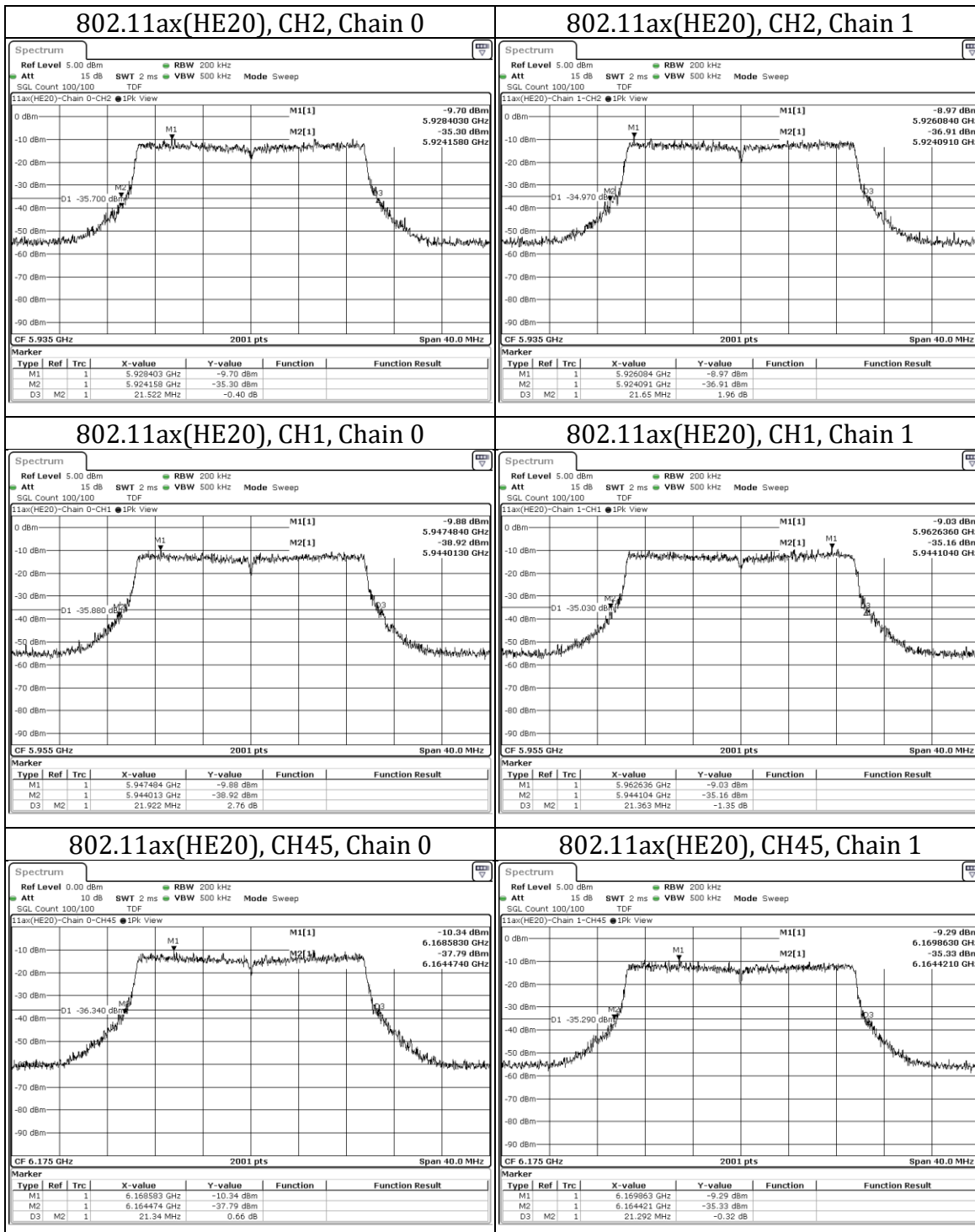
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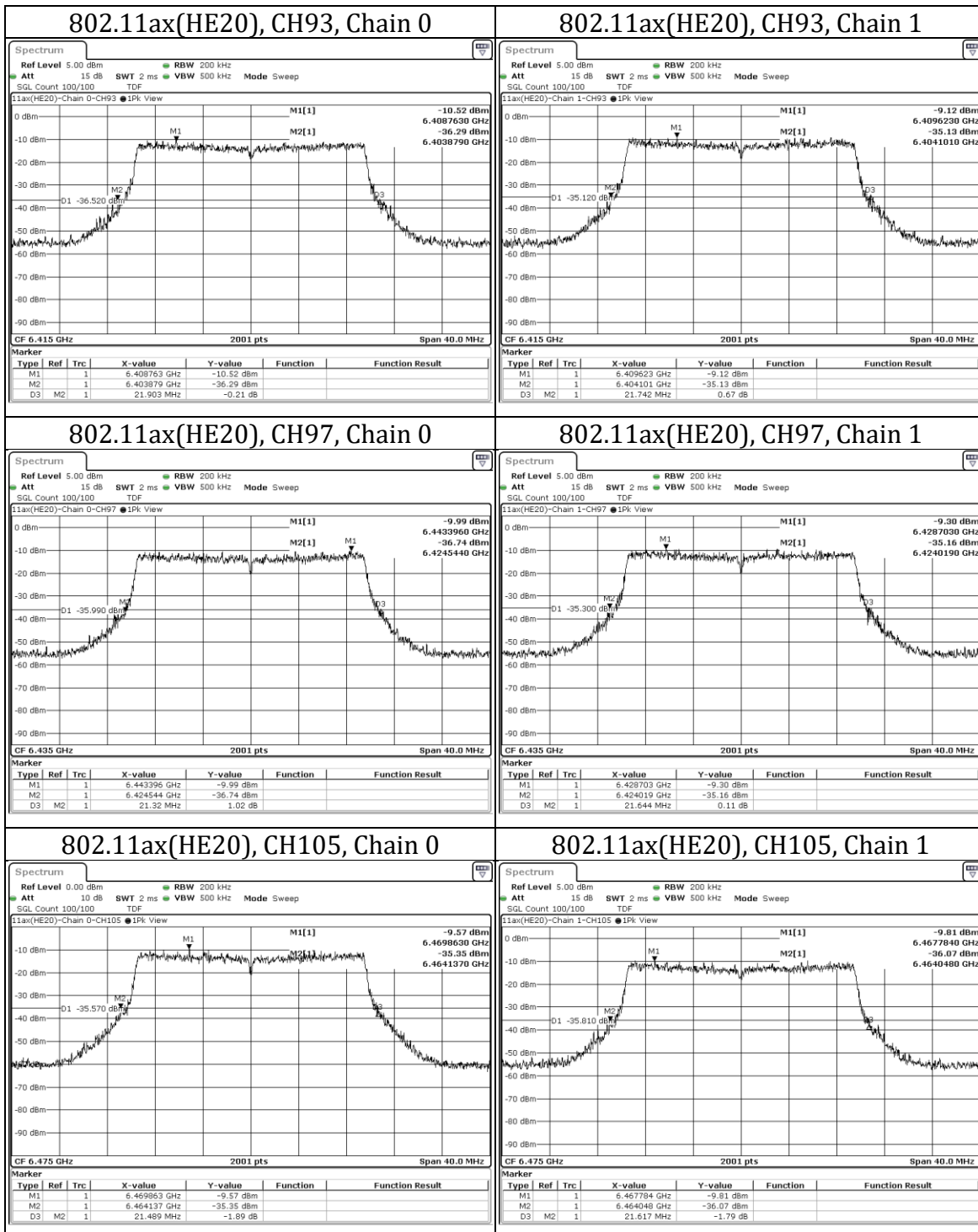
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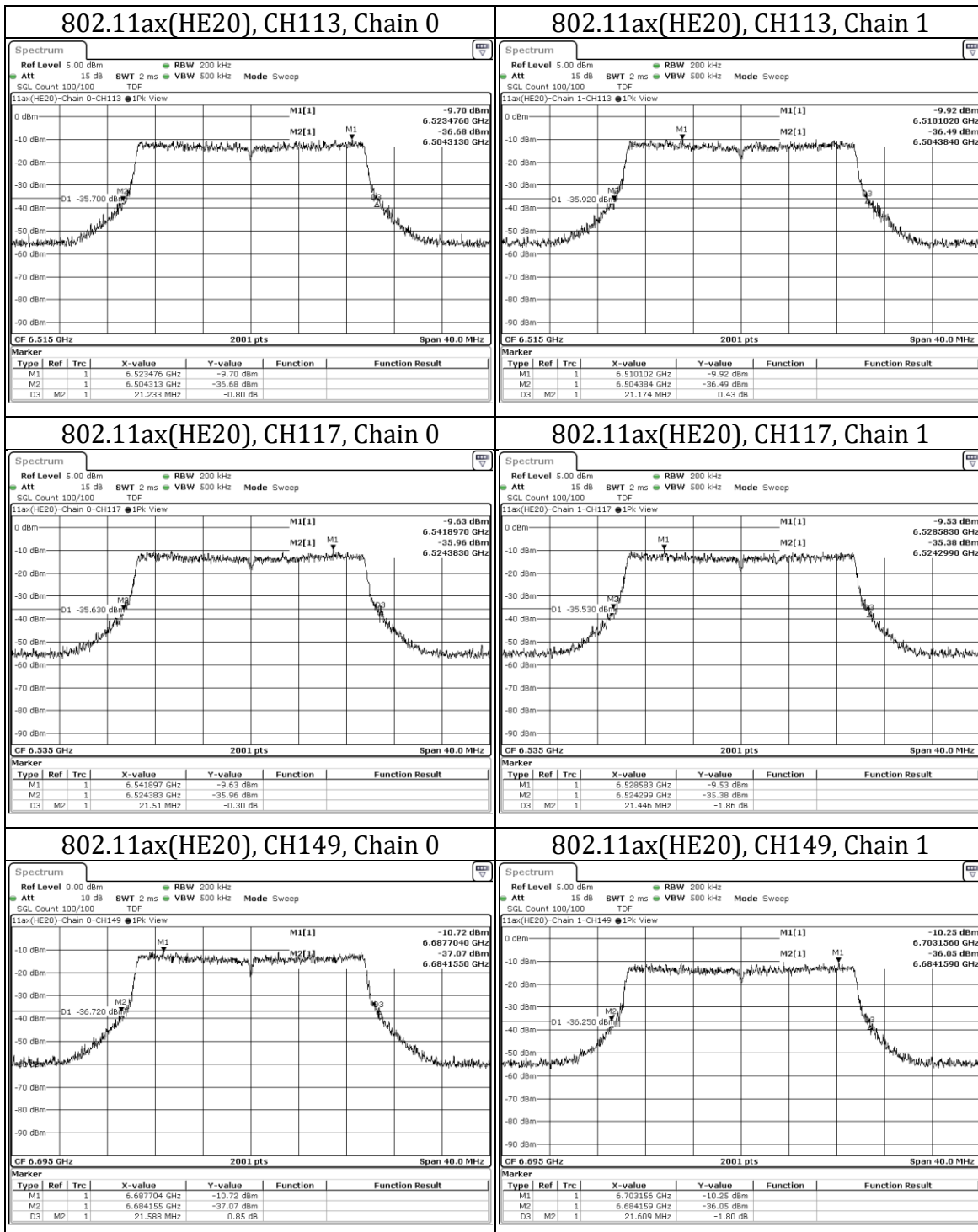
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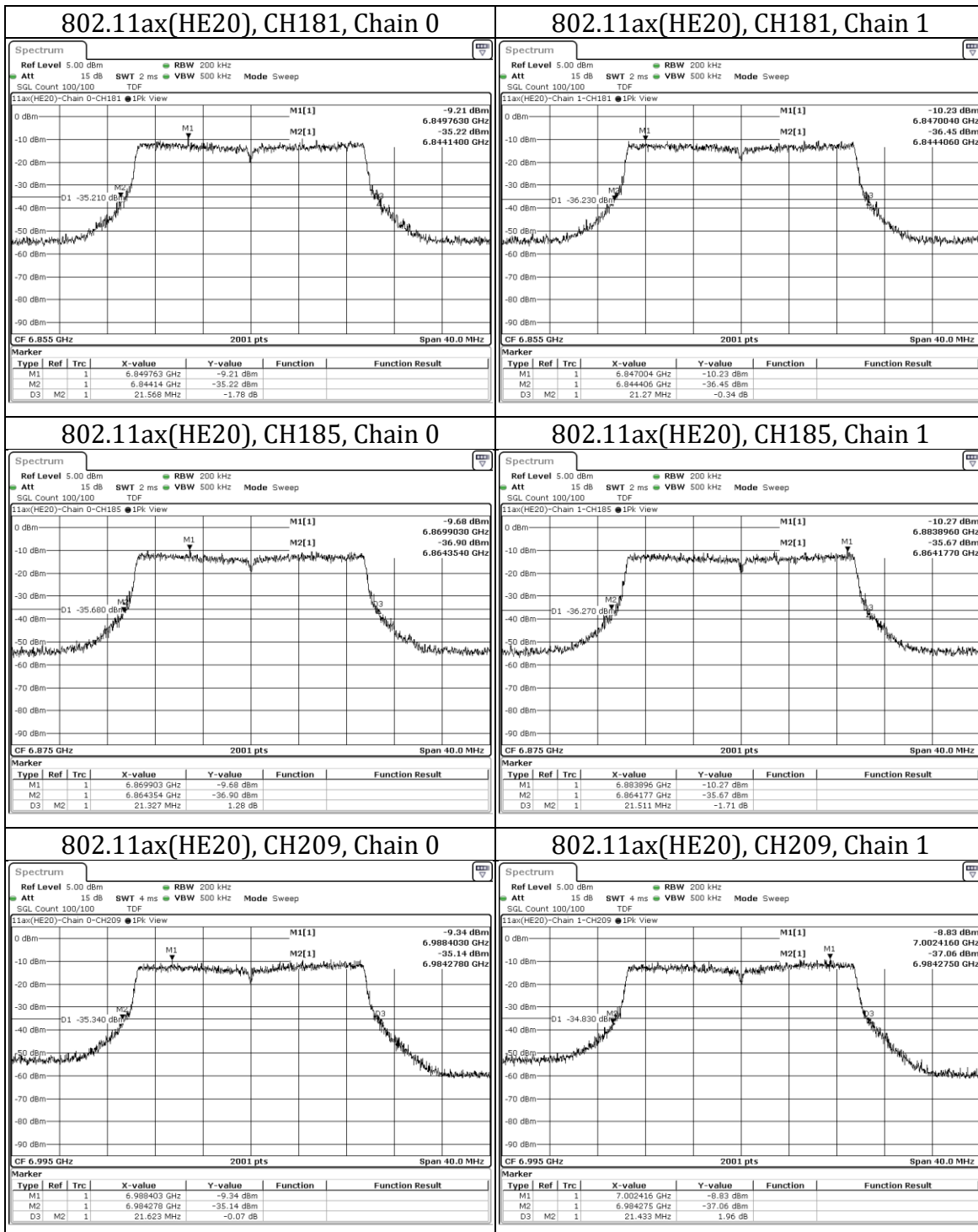
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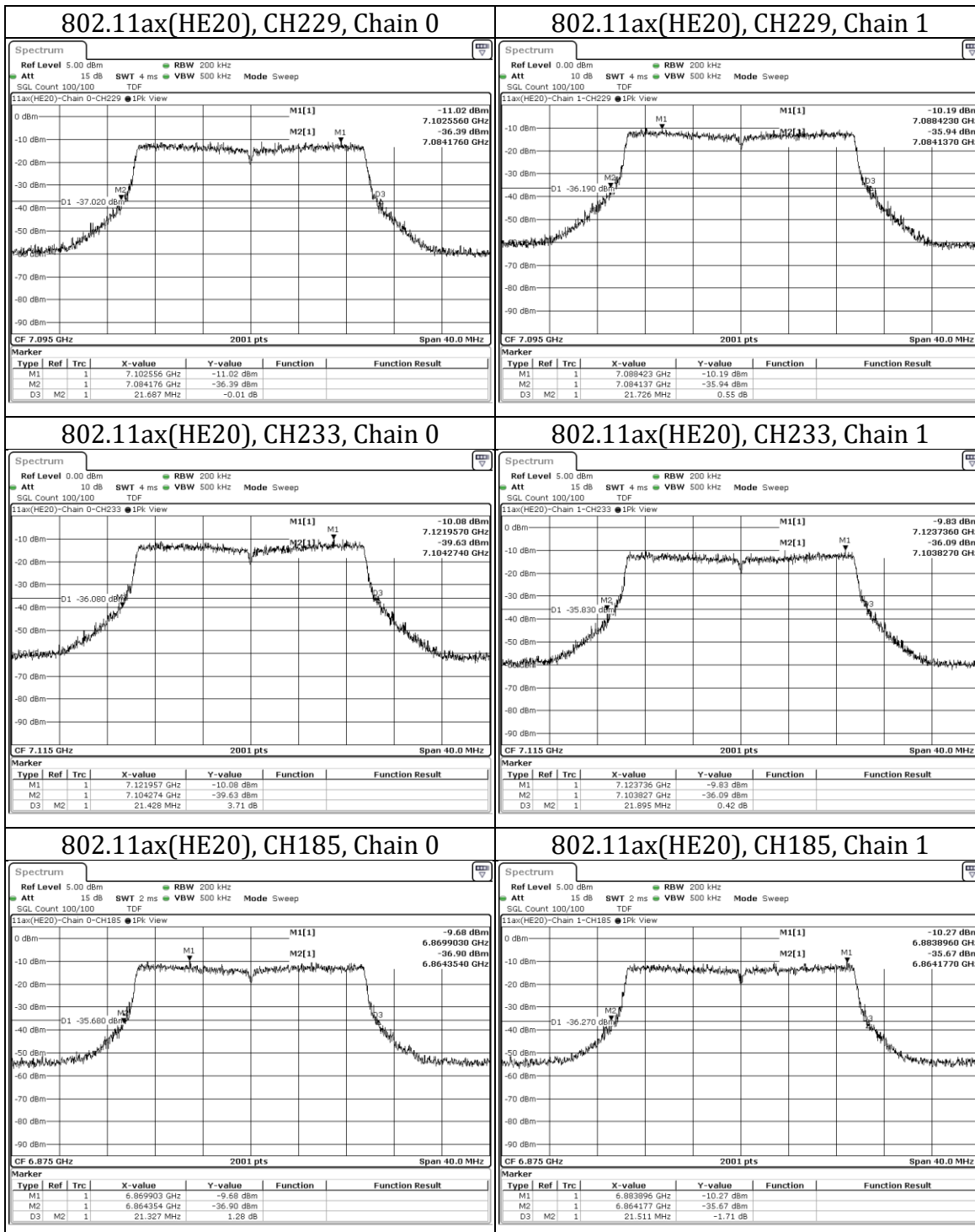
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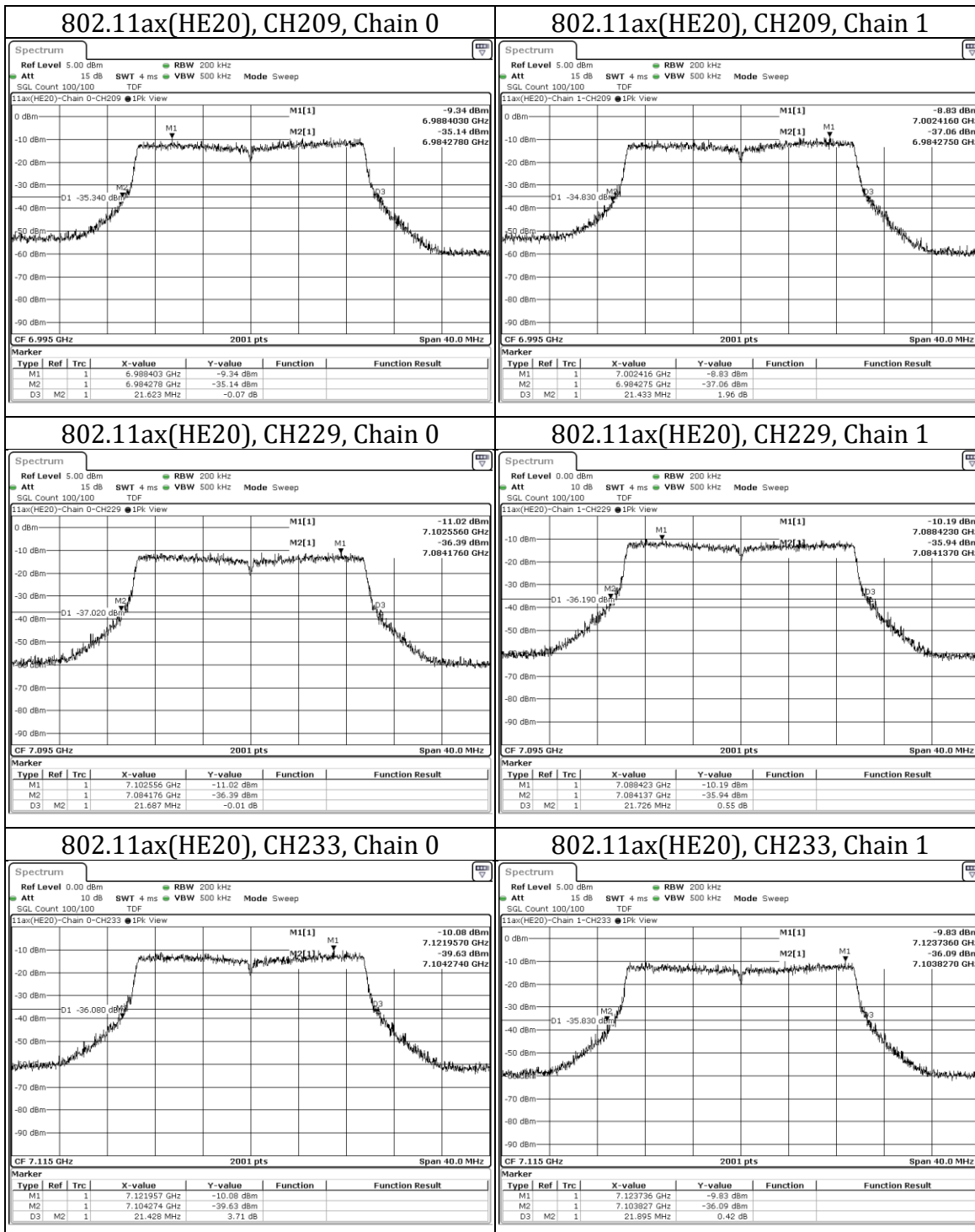
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Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE40)	3	5965	40.148	40.441	320	PASS
	43	6165	40.499	40.425	320	PASS
	91	6405	40.136	40.299	320	PASS
	99	6445	40.441	40.202	320	PASS
	107	6485	40.179	40.152	320	PASS
	115	6525	40.167	40.23	320	PASS
	123	6565	40.198	40.278	320	PASS
	155	6725	40.076	40.266	320	PASS
	179	6845	40.262	40.019	320	PASS
	187	6885	40.147	40.346	320	PASS
	211	7005	40.201	40.117	320	PASS
	227	7085	40.187	40.435	320	PASS

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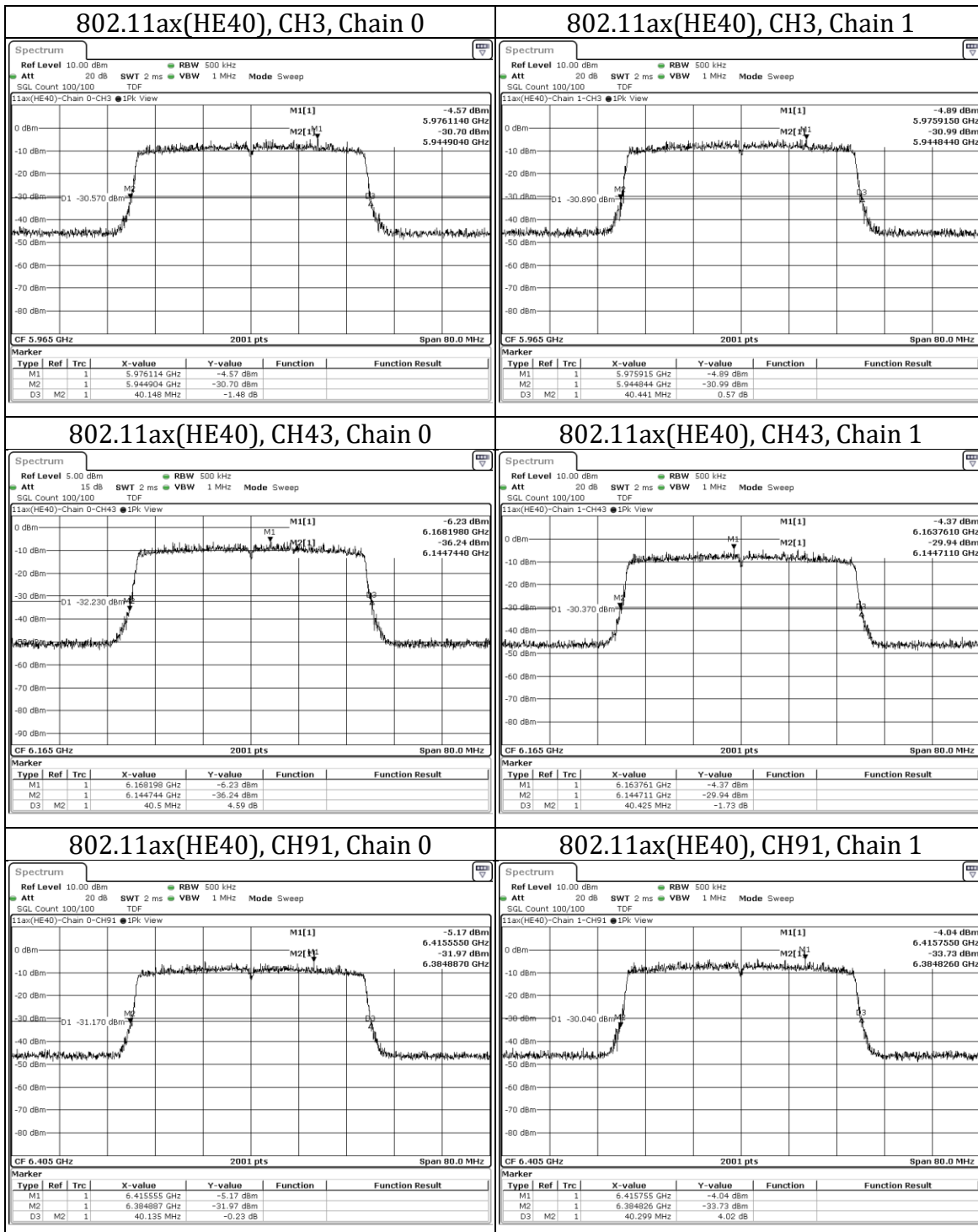
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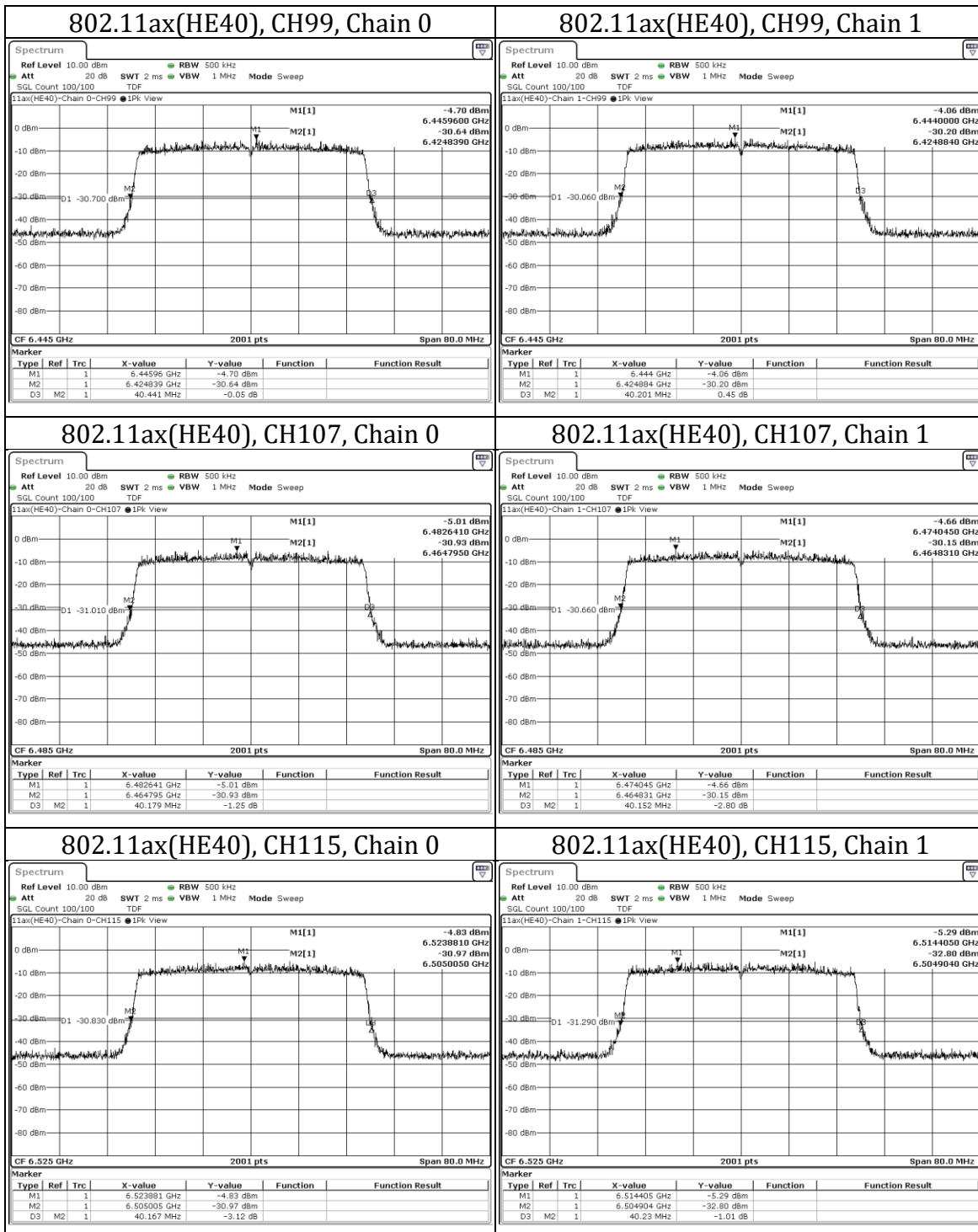
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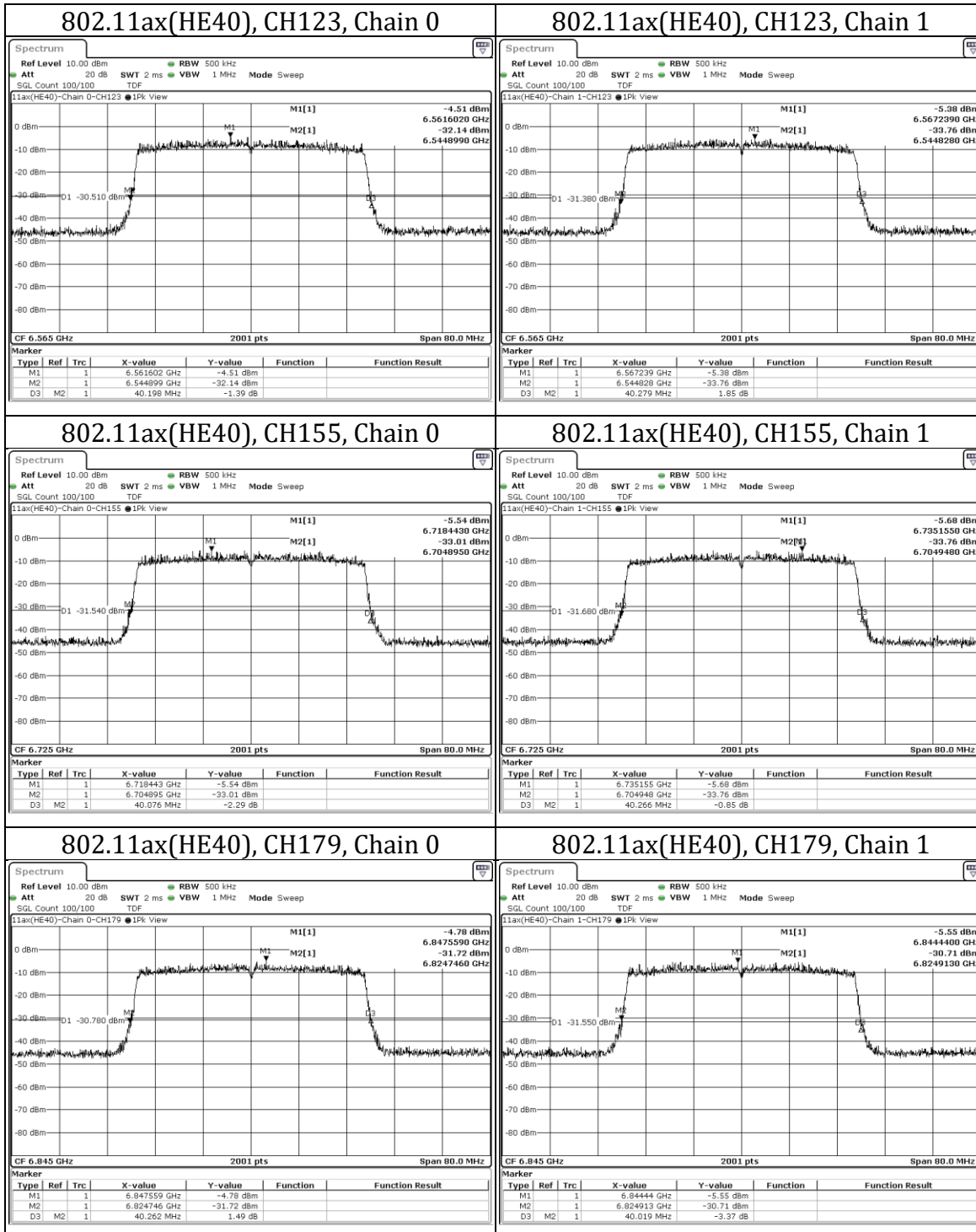
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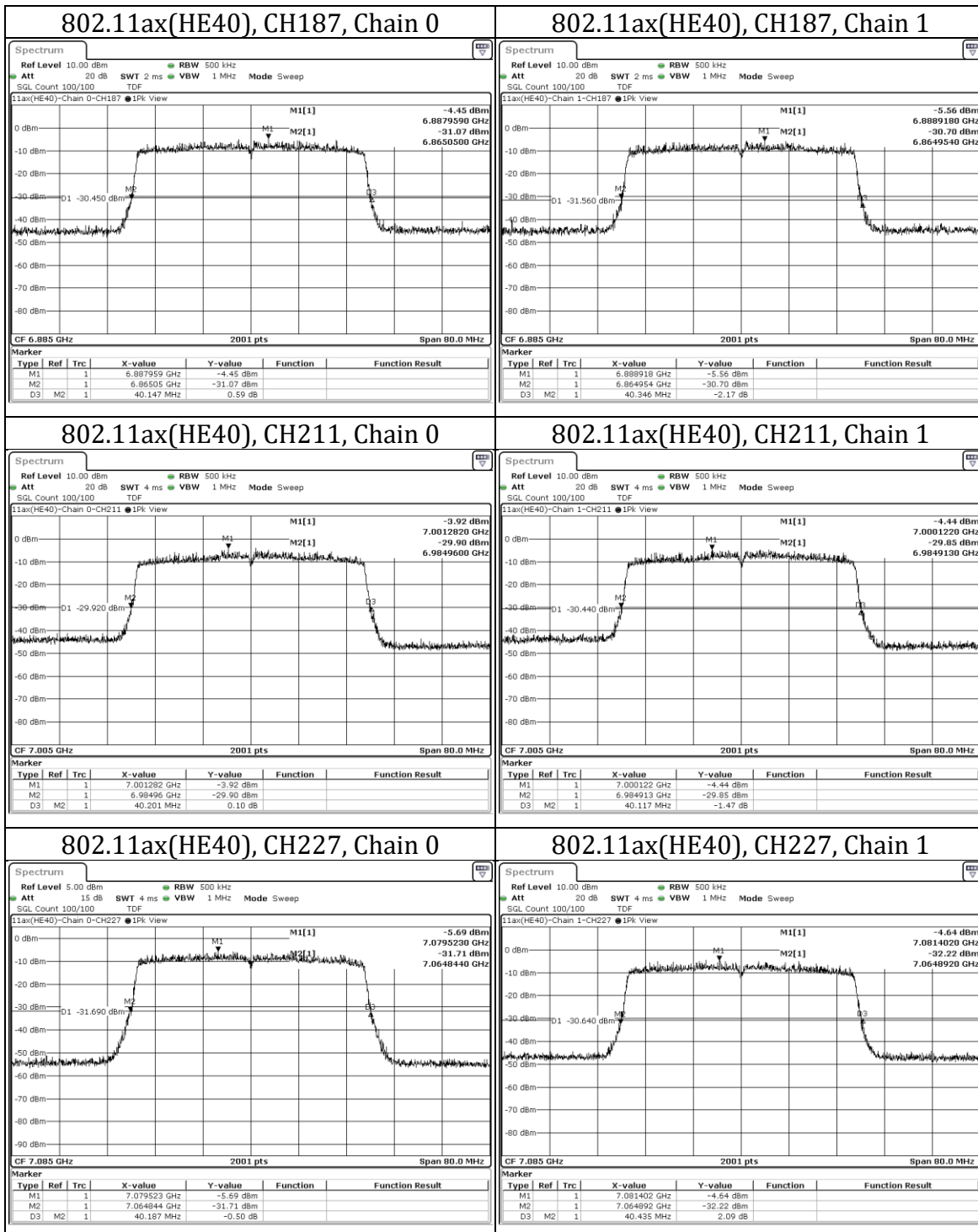
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Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE80)	7	5985	82.266	81.932	320	PASS
	39	6145	82	81.32	320	PASS
	87	6385	81.563	81.742	320	PASS
	103	6465	82.005	81.737	320	PASS
	119	6545	82.146	82.136	320	PASS
	135	6625	83.053	81.684	320	PASS
	151	6705	82.474	81.711	320	PASS
	167	6785	82.149	81.939	320	PASS
	183	6865	81.735	81.711	320	PASS
	199	6945	82.584	82.034	320	PASS
	215	7025	81.763	82.978	320	PASS

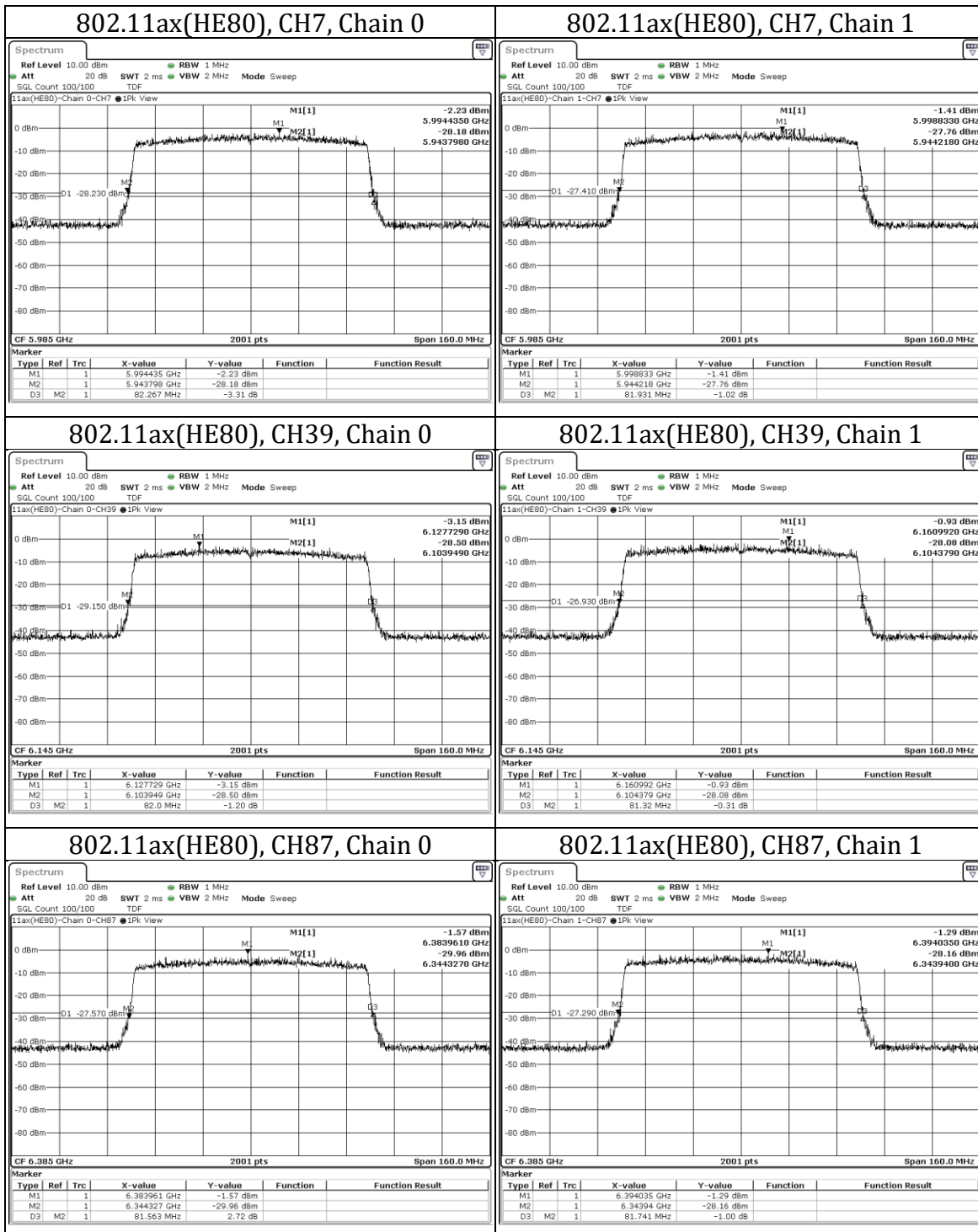
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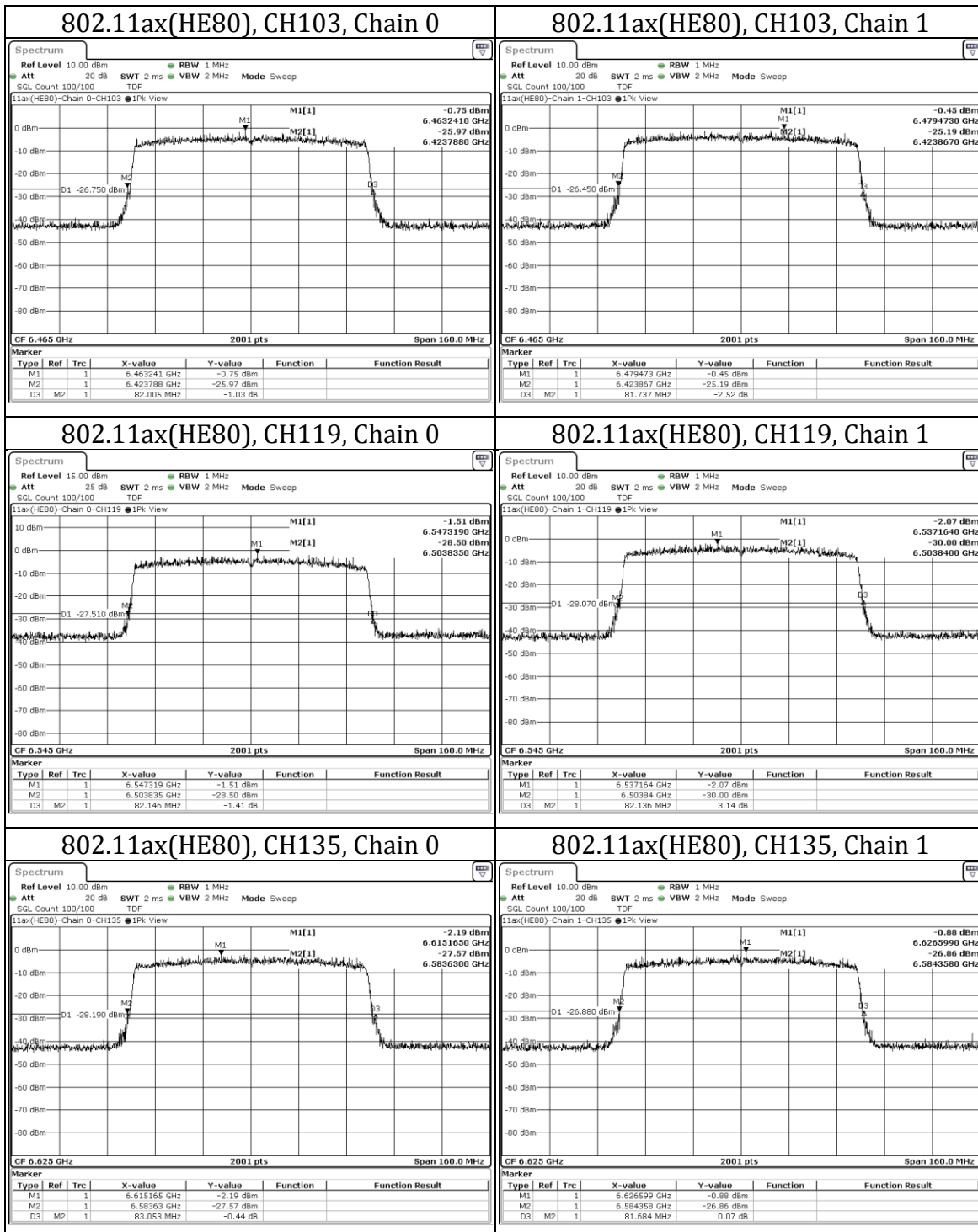
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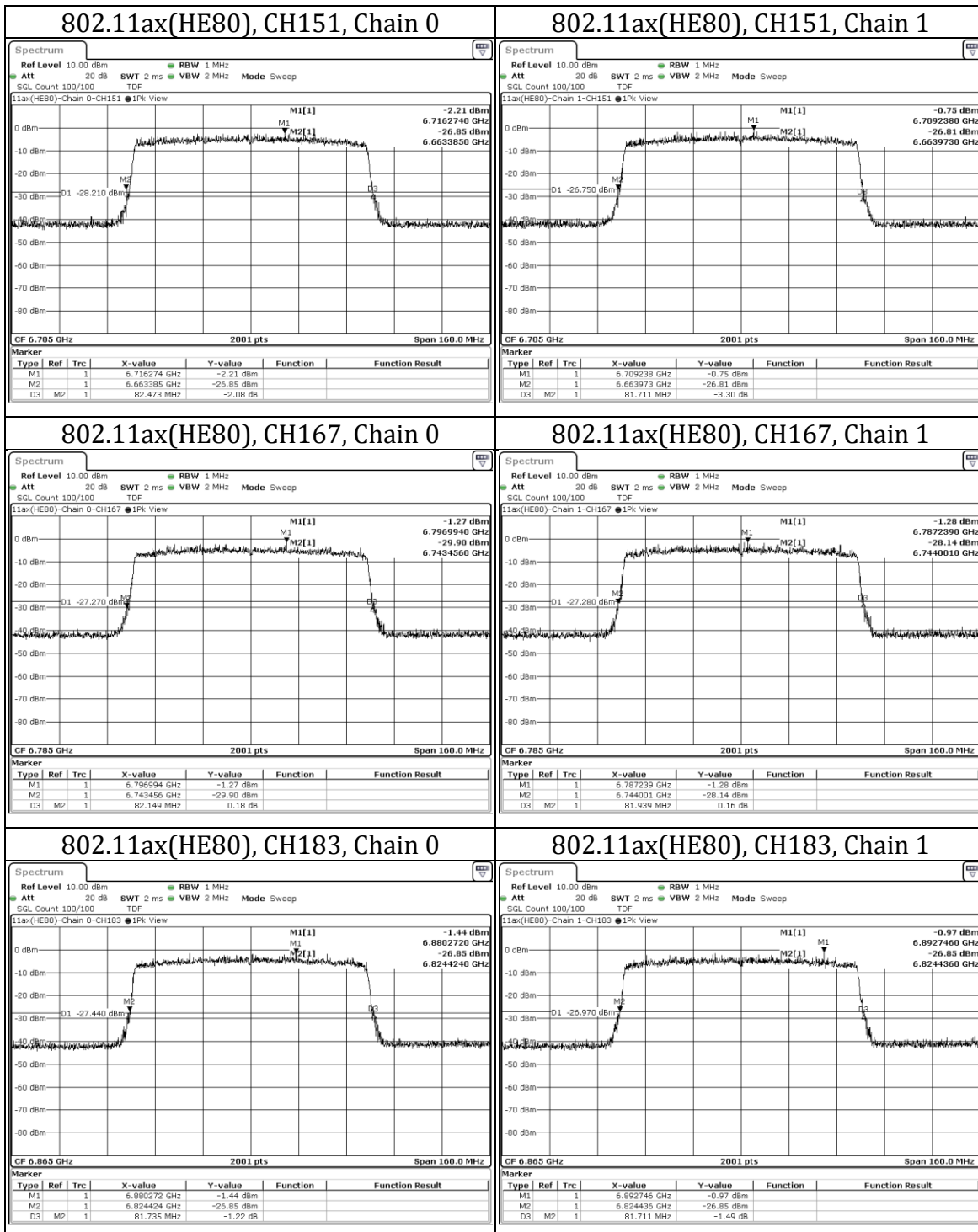
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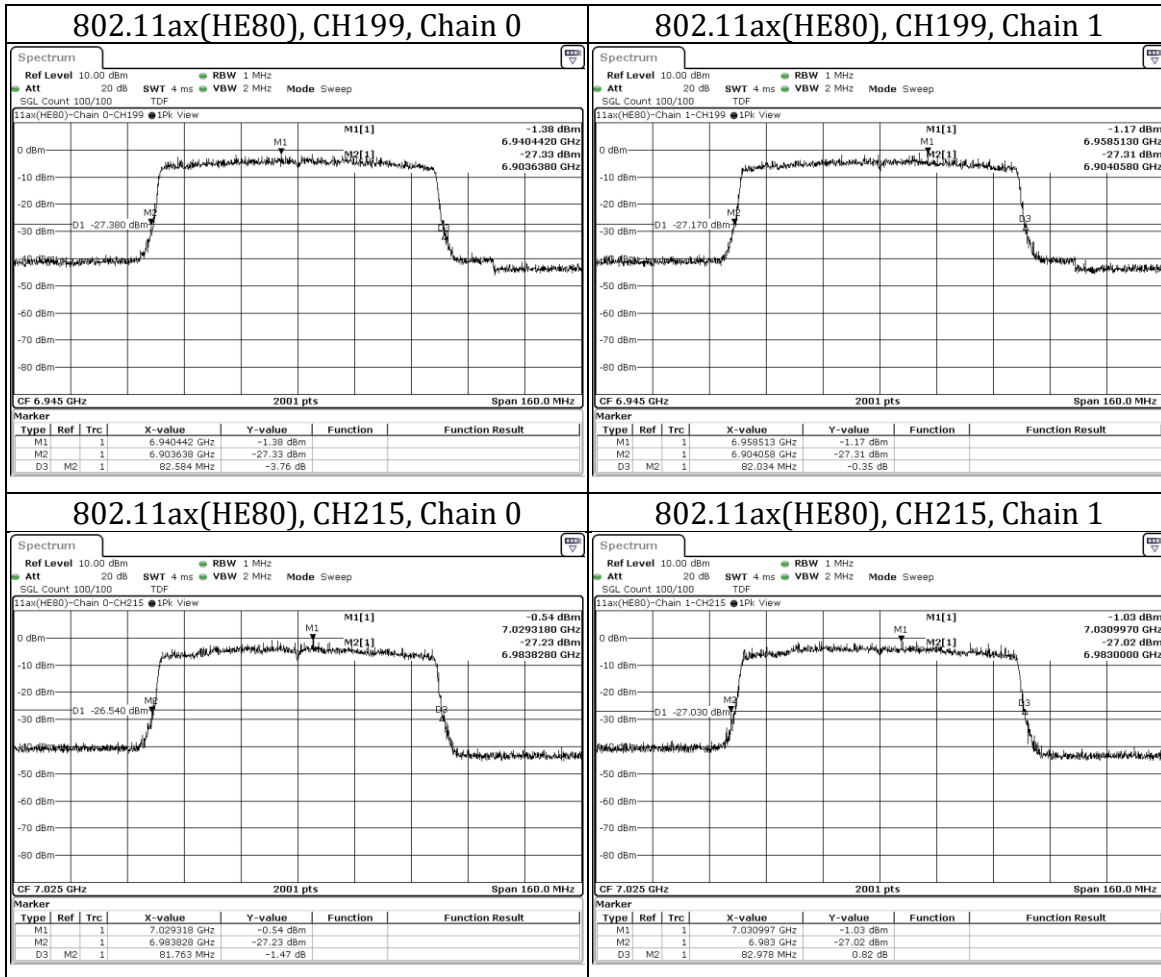
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Mode	CH	Freq (MHz)	26dB BW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11ax(HE160)	15	6025	162.977	164.203	320	PASS
	47	6185	162.637	162.668	320	PASS
	79	6345	164.69	163.636	320	PASS
	111	6505	164.51	163.794	320	PASS
	143	6665	162.825	163.726	320	PASS
	175	6825	163.866	164.385	320	PASS
	207	6985	163.288	163.373	320	PASS

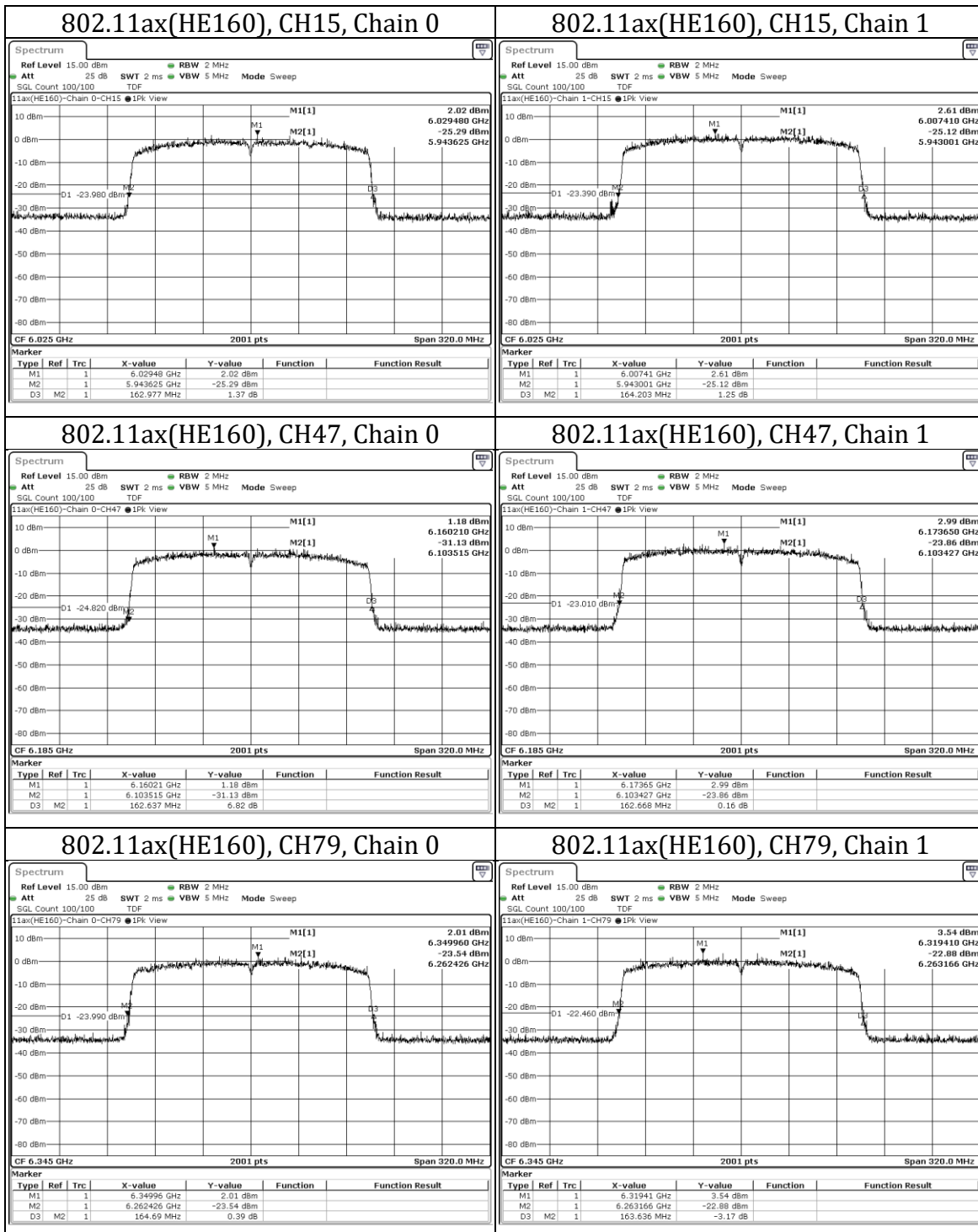
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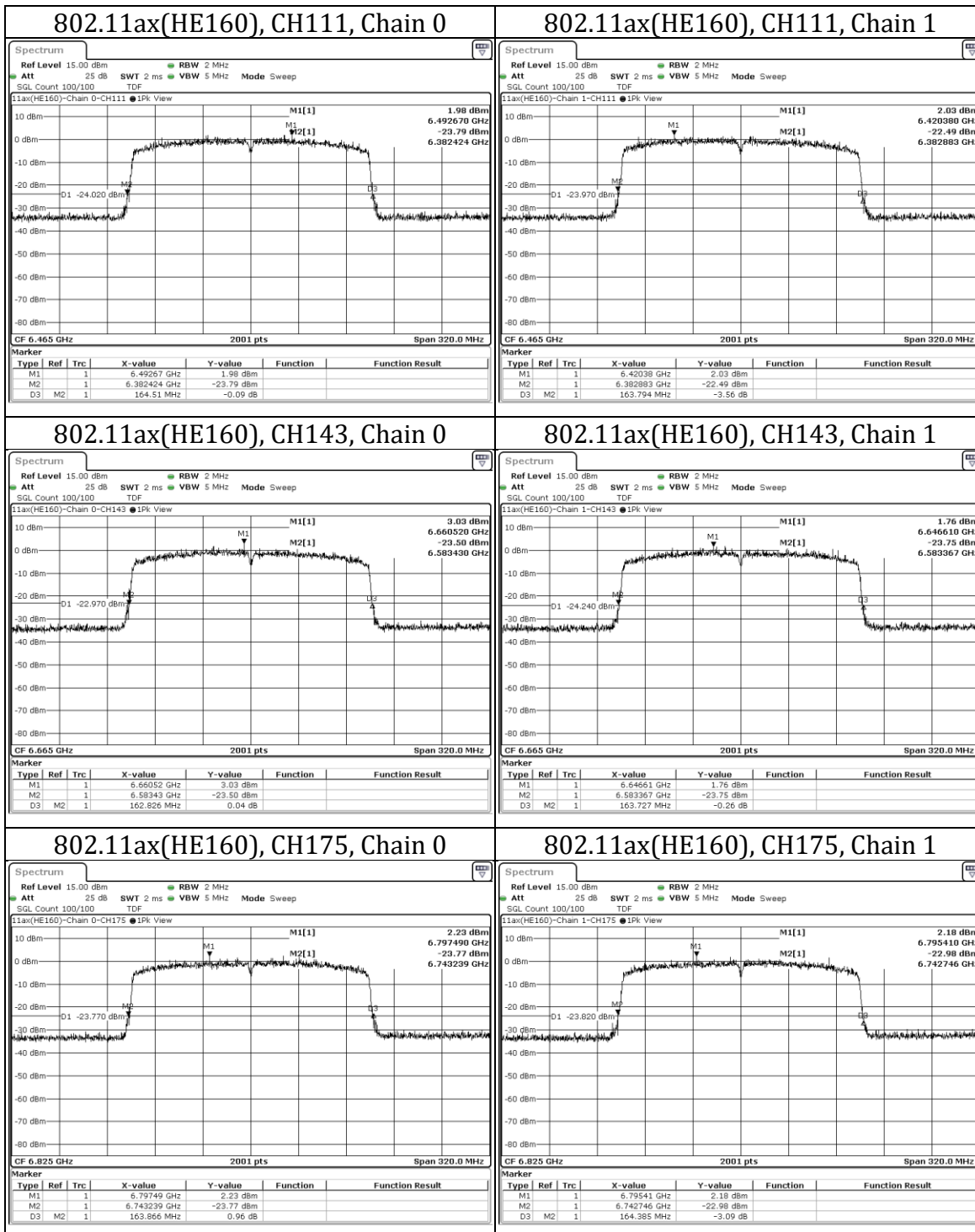
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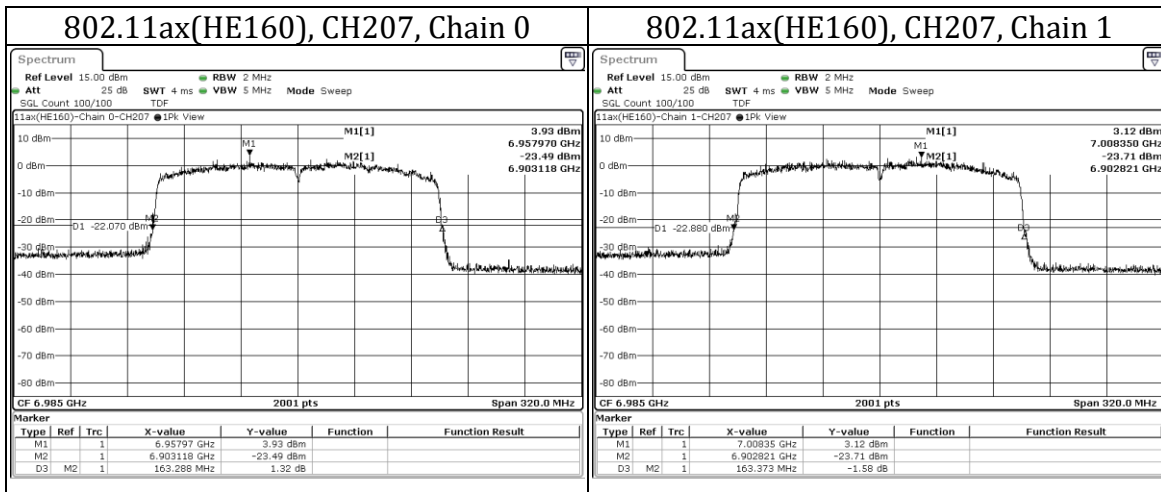
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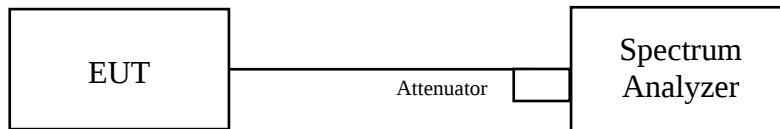


9.2. Occupied Bandwidth

Test procedure

- Set center frequency to the nominal EUT channel center frequency.
- Set span = 1.5 times to 5.0 times the OBW.
- Set RBW = 1% to 5% of the OBW
- Set VBW $\geq 3 \times$ RBW
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available).
- If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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Test Data

Mode	CH	Freq (MHz)	OBW (MHz)		Limit (MHz)	Result
			Chain 0	Chain 1		
802.11a	2	5935	16.672	16.635	320	PASS
	1	5955	16.683	16.65	320	PASS
	45	6175	16.7	16.666	320	PASS
	93	6415	16.686	16.618	320	PASS
	97	6435	16.669	16.633	320	PASS
	105	6475	16.652	16.655	320	PASS
	113	6515	16.65	16.618	320	PASS
	117	6535	16.658	16.621	320	PASS
	149	6695	16.672	16.643	320	PASS
	181	6855	16.709	16.635	320	PASS
	185	6875	16.709	16.641	320	PASS
	209	6995	16.734	16.633	320	PASS
	229	7095	16.717	16.647	320	PASS

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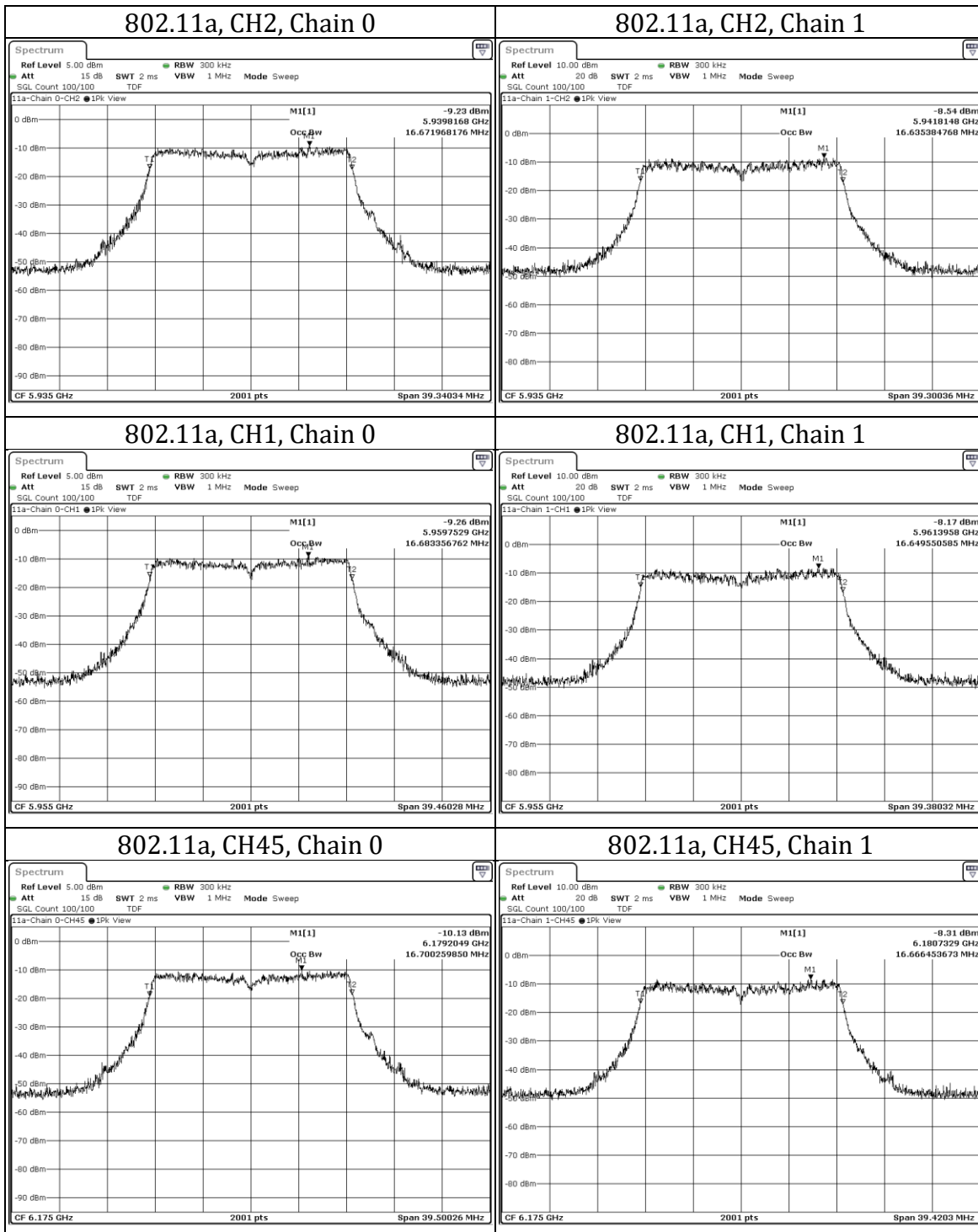
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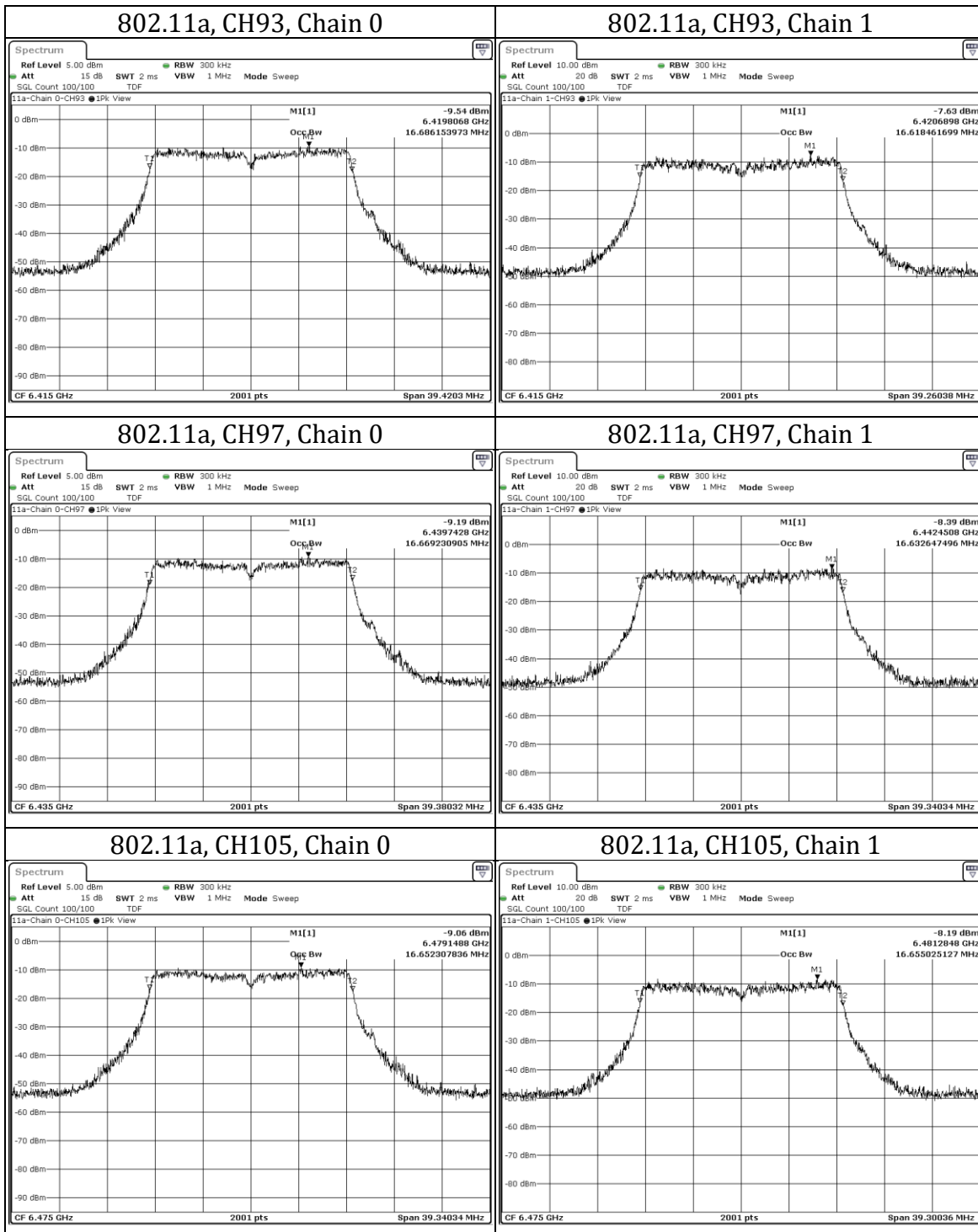
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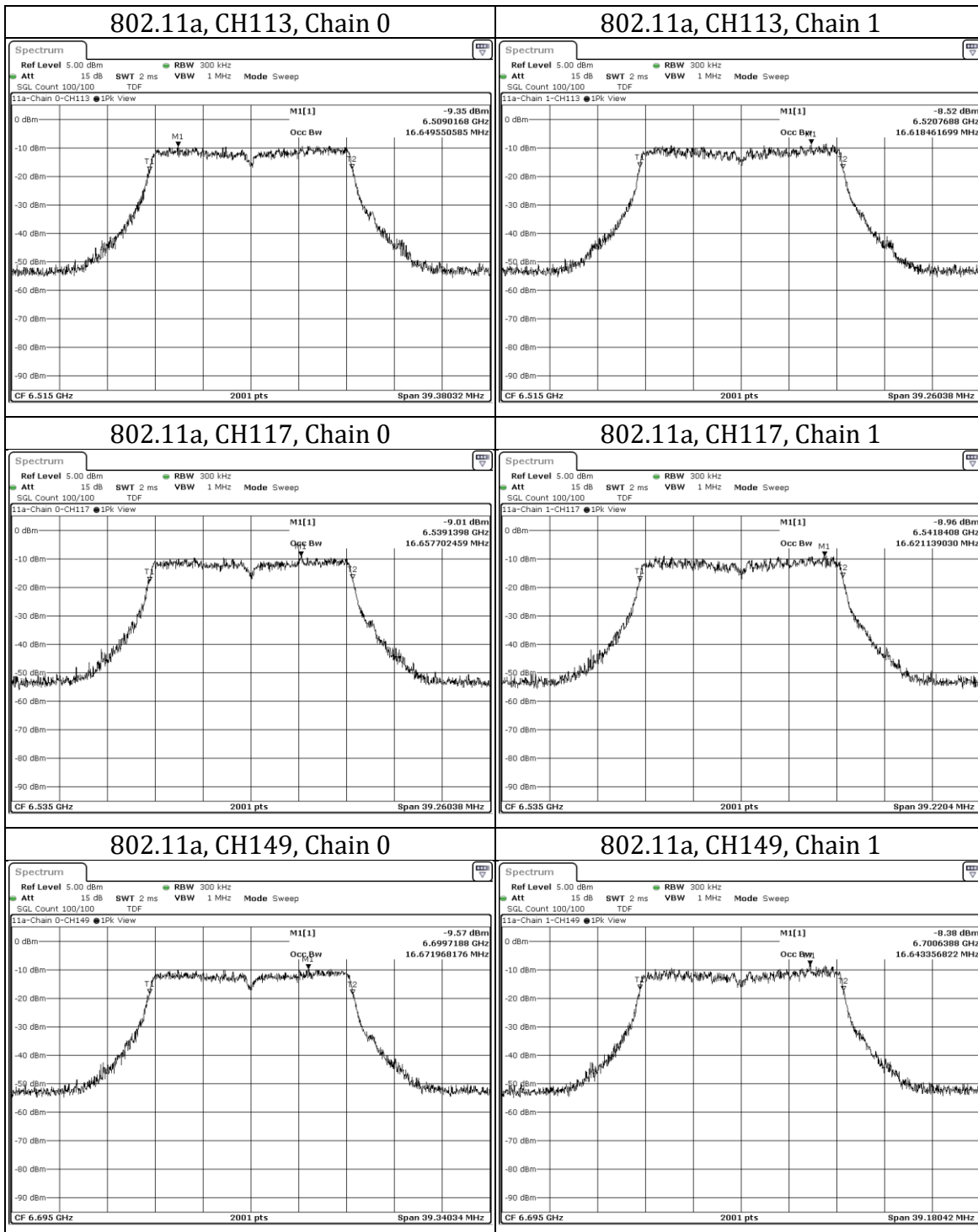
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