

TEST REPORT

Part 15 Subpart E 15.407

Equipment under test iiRcade GOLD PCBA

Model name IRORO2-PCBA

FCC ID 2AXRRIRORO2-PCBA

Applicant IIRCADE, INC.

Manufacturer IIRCADE, INC.

Date of test(s) 2022.08.16 ~ 2022.08.31

Date of issue 2022.10.19

Issued to
IIRCADE, INC.

No.A-627, 338 GwanggyoJungang-Ro, Suji-Gu, Yongin-Si, Gyeonggi-Do, 16942
Republic of Korea

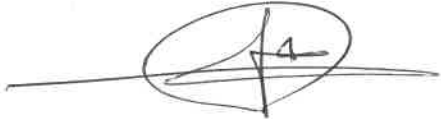
Tel: +82-31-893-1540 Fax : +82-31-893-1541

Issued by
KES Co., Ltd.

3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea

473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

Tel: +82-31-425-6200 / Fax: +82-31-424-0450

Test and report completed by :	Report approval by :
	
Gu-Bong, Kang Test engineer	Yeong-Jun Cho Technical manager

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Revision history

Revision	Date of issue	Test report No.	Description
-	2022.10.19	KES-RF1-22T0142	Initial

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1. General information

Applicant: IIRCADE, INC.
Applicant address: No.A-627, 338 GwanggyoJungang-Ro, Suji-Gu, Yongin-Si, Gyeonggi-Do, 16942
Republic of Korea
Test site: KES Co., Ltd.
Test site address: ☐ 3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si,
Gyeonggi-do, 14057, Korea
☒ 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148
FCC, IC rule part(s): FCC : 15.407
FCC ID: 2AXRRIRORO2-PCBA
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test: iiRcade GOLD PCBA
Frequency range: 2 402 MHz ~ 2 480 MHz (BDR/EDR)
2 402 MHz ~ 2 480 MHz (LE 1Mbps)
2 412 MHz ~ 2 462 MHz (11b/g/n_HT20)
2 422 MHz ~ 2 452 MHz (11n_HT40)
UNII-1 5 180 MHz ~ 5 240 MHz (11a/an_VHT20/ac_VHT20)
5 190 MHz ~ 5 230 MHz (11an_VHT40/ac_VHT40)
5 210 MHz (11ac_VHT80)
UNII-2A 5 260 MHz ~ 5 320 MHz (11a/an_VHT20/ac_VHT20)
5 270 MHz ~ 5 310 MHz (11an_VHT40/ac_VHT40)
5 290 MHz (11ac_VHT80)
UNII-2C 5 500 MHz ~ 5 700 MHz (11a/an_VHT20/ac_VHT20)
5 510 MHz ~ 5 670 MHz (11an_VHT40/ac_VHT40)
5 530 MHz ~ 5 610 MHz (11ac_VHT80)
UNII-3 5 745 MHz ~ 5 825 MHz (11a/an_VHT20/ac_VHT20)
5 755 MHz ~ 5 795 MHz (11an_VHT40/ac_VHT40)
5 775 MHz (11ac_VHT80)
Model: IRORO2-PCBA
Modulation technique: GFSK, $\pi/4$ DQPSK, 8DPSK, OFDM

Number of channels	2 402 MHz ~ 2 480 MHz (BDR/EDR) : 79ch 2 402 MHz ~ 2 480 MHz (LE 1Mbps) : 40ch 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20) : 11ch 2 422 MHz ~ 2 452 MHz (11n_HT40) : 7ch
UNII-1	5 180 MHz ~ 5 240 MHz (11a/an_VHT20/ac_VHT20) : 4ch 5 190 MHz ~ 5 230 MHz (11an_VHT40/ac_VHT40) : 2ch 5 210 MHz (11ac_VHT80) : 1ch
UNII-2A	5 260 MHz ~ 5 320 MHz (11a/an_VHT20/ac_VHT20) : 4ch 5 270 MHz ~ 5 310 MHz (11an_VHT40/ac_VHT40) : 2ch 5 290 MHz (11ac_VHT80) : 1ch
UNII-2C	5 500 MHz ~ 5 700 MHz (11a/an_VHT20/ac_VHT20) : 11ch 5 510 MHz ~ 5 670 MHz (11an_VHT40/ac_VHT40) : 5ch 5 530 MHz ~ 5 610 MHz (11ac_VHT80) : 2ch
UNII-3	5 745 MHz ~ 5 825 MHz (11a/an_VHT20/ac_VHT20) : 5ch 5 755 MHz ~ 5 795 MHz (11an_VHT40/ac_VHT40) : 2ch 5 775 MHz (11ac_VHT80) : 1ch
Antenna specification	PCB Antenna BT / LE : 4.38 dBi, 2.4G WiFi : 4.21 dBi UNII-1 : 2.86 dBi / UNII-2A : 2.33 dBi / UNII-2C : 1.33 dBi / UNII-3 : 1.03 dBi
Power source	AC 120 V(Adapter OutPut DC 24 V)
H/W version	6.2
S/W version	9.010.000

1.2. Test configuration

The **IIRCADE, INC.// iiRcade GOLD PCBA // IRORO2-PCBA //**

FCC ID: 2AXRRIRORO2-PCBA was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.407
KDB 789033 D02 v02r01
ANSI C63.10-2013

1.3. Derivative Model Information

N/A

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Sample calculation

Where relevant, the following sample calculation is provided

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.65 + 10 = 11.65 \text{ (dB)}\end{aligned}$$

For Radiation test :

Field strength level (dB μ V/m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) – Amplifier gain (dB)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.38 dB (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1 GHz	4.50 dB (SAC #6)
	Above 1 GHz	4.90 dB (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Maximum average output power

Refer to the average output power

Note.

- Radiated emission were performed with the EUT set to transmit at the channel with highest output Power as worst-case scenario.
- Worst-case data rates as provided by the client were:

BDR,EDR,LE ; **Default**

b : **1Mbps**, g : **6Mbps**, n_HT20 : **MCS0**, n_HT40 : **MCS0**

UNII-1 a : **6 Mbps**, an_VHT20/40 : **MCS0**, ac_VHT20/40/80 : **MCS0**

UNII-2A a : **6 Mbps**, an_VHT20/40 : **MCS0**, ac_VHT20/40/80 : **MCS0**

UNII-2C a : **6 Mbps**, an_VHT20/40 : **MCS0**, ac_VHT20/40/80 : **MCS0**

UNII-3 a : **6 Mbps**, an_VHT20/40 : **MCS0**, ac_VHT20/40/80 : **MCS0**

1.8. Frequency/channel operations

Ch.	Frequency (MHz)	Mode
00	2 402	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
40	2 442	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps
.	.	.
78	2 480	BDR 1 Mbps, EDR 2 Mbps, EDR 3 Mbps

Ch.	Frequency (MHz)	Mode
00	2 402	BLE 1 Mbps
.	.	.
20	2 442	BLE 1 Mbps
.	.	.
39	2 480	BLE 1 Mbps

Ch.	Frequency (MHz)	Mode
1	2 412	802.11b/g/n_HT20
.	.	.
6	2 437	802.11b/g/n_HT20
.	.	.
11	2 462	802.11b/g/n_HT20

Ch.	Frequency (MHz)	Mode
3	2 422	802.11n_HT40
.	.	.
6	2 437	802.11n_HT40
.	.	.
9	2 452	802.11n_HT40

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UNII-1

Ch.	Frequency (MHz)
36	5 180
44	5 220
48	5 240

UNII-2A

Ch.	Frequency (MHz)
52	5 260
56	5 280
64	5 320

UNII-2C

Ch.	Frequency (MHz)
100	5 500
120	5 600
140	5 700

UNII-3

Ch.	Frequency (MHz)
149	5 745
157	5 785
165	5 825

802.11a/an_VHT20/ac_VHT20 mode

UNII-1

Ch.	Frequency (MHz)
38	5 190
46	5 230

UNII-2A

Ch.	Frequency (MHz)
54	5 270
62	5 310

UNII-2C

Ch.	Frequency (MHz)
102	5 510
118	5 590
134	5 670

UNII-3

Ch.	Frequency (MHz)
151	5 755
159	5 795

802.11an_VHT40/ac_VHT40 mode

UNII-1

Ch.	Frequency (MHz)
42	5 210

UNII-2A

Ch.	Frequency (MHz)
58	5 290

UNII-2C

Ch.	Frequency (MHz)
106	5 530
122	5 610

UNII-3

Ch.	Frequency (MHz)
155	5 775

802.11ac_VHT80 mode

2. Summary of tests

Section in FCC Part 15	Parameter	Test results
15.407(a)	26 dB bandwidth & 99 % bandwidth	Pass
15.407(a)	6 dB bandwidth	Pass
15.407(a)	Maximum conducted output power	Pass
15.407(a)	Power spectral density	Pass
15.407(g)	Frequency stability	Pass
15.205 15.209 15.407(b)	Radiated restricted band and emission	Pass
15.207	AC power line conducted emissions	Pass
15.203	Antenna Requirement	Pass ^{note1}

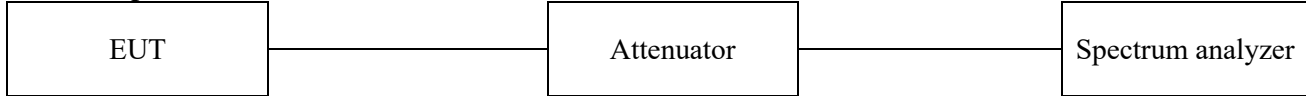
Note.

1. Please refer to the antenna spec for antenna requirement items.

3. Test results

3.1. 26 dB bandwidth & 99% Occupied Bandwidth

Test setup



Test procedure

26 dB bandwidth

KDB 789033 D02 v02r01– Section C.1

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. 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%.

99 % bandwidth

KDB 789033 D02 v02r01– Section D

1. Set span = 1.5 times to 5.0 times the OBW.
2. Set RBW = 1% to 5% of the OBW
3. Set the VBW > 3 x RBW.
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak bandwidth function of the instrument (if available).
5. Use the 99% power bandwidth function of the instrument (if available).
6. 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.

In the result,

-DFS requirements are not applicable in the 5 150 MHz ~ 5 250 MHz.

Limit

N/A

Test results

Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 180	a	21.36	16.72
	5 220		20.44	16.75
	5 240		20.54	16.78
UNII-2A	5 260		20.36	16.63
	5 280		20.29	16.50
	5 320		20.34	16.49
UNII-2C	5 500		20.39	16.60
	5 600		20.29	16.47
	5 700		20.27	16.62
UNII-3	5 745		20.32	16.67
	5 785		20.36	16.60
	5 825		20.23	16.59
UNII-1	5 180	an_HT20	21.72	17.93
	5 220		21.73	17.83
	5 240		21.70	17.85
UNII-2A	5 260		21.68	17.82
	5 280		21.62	17.91
	5 320		21.47	17.84
UNII-2C	5 500		21.17	17.83
	5 600		21.32	17.79
	5 700		21.24	17.79
UNII-3	5 745		21.13	17.76
	5 785		21.21	17.76
	5 825		21.11	17.76

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Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 180	ac_VHT20	21.70	17.88
	5 220		21.74	17.98
	5 240		21.68	17.80
UNII-2A	5 260		21.65	17.85
	5 280		21.61	17.79
	5 320		21.43	17.76
UNII-2C	5 500		21.05	17.79
	5 600		21.16	17.79
	5 700		21.22	17.78
UNII-3	5 745		21.28	17.80
	5 785		21.15	17.83
	5 825		21.03	17.84
UNII-1	5 190	an_HT40	41.44	36.22
	5 230		41.21	36.16
UNII-2A	5 270		41.06	36.16
	5 310		41.05	36.16
UNII-2C	5 510		40.41	36.10
	5 590		40.44	36.08
	5 670		40.66	36.07
UNII-3	5 755		40.81	36.09
	5 795		40.98	36.12
UNII-1	5 190	ac_VHT40	41.10	36.22
	5 230		40.66	36.20
UNII-2A	5 270		40.84	36.18
	5 310		40.83	36.12
UNII-2C	5 510		40.72	36.12
	5 590		40.80	36.08
	5 670		40.47	36.08
UNII-3	5 755		40.12	36.09
	5 795		40.85	36.13

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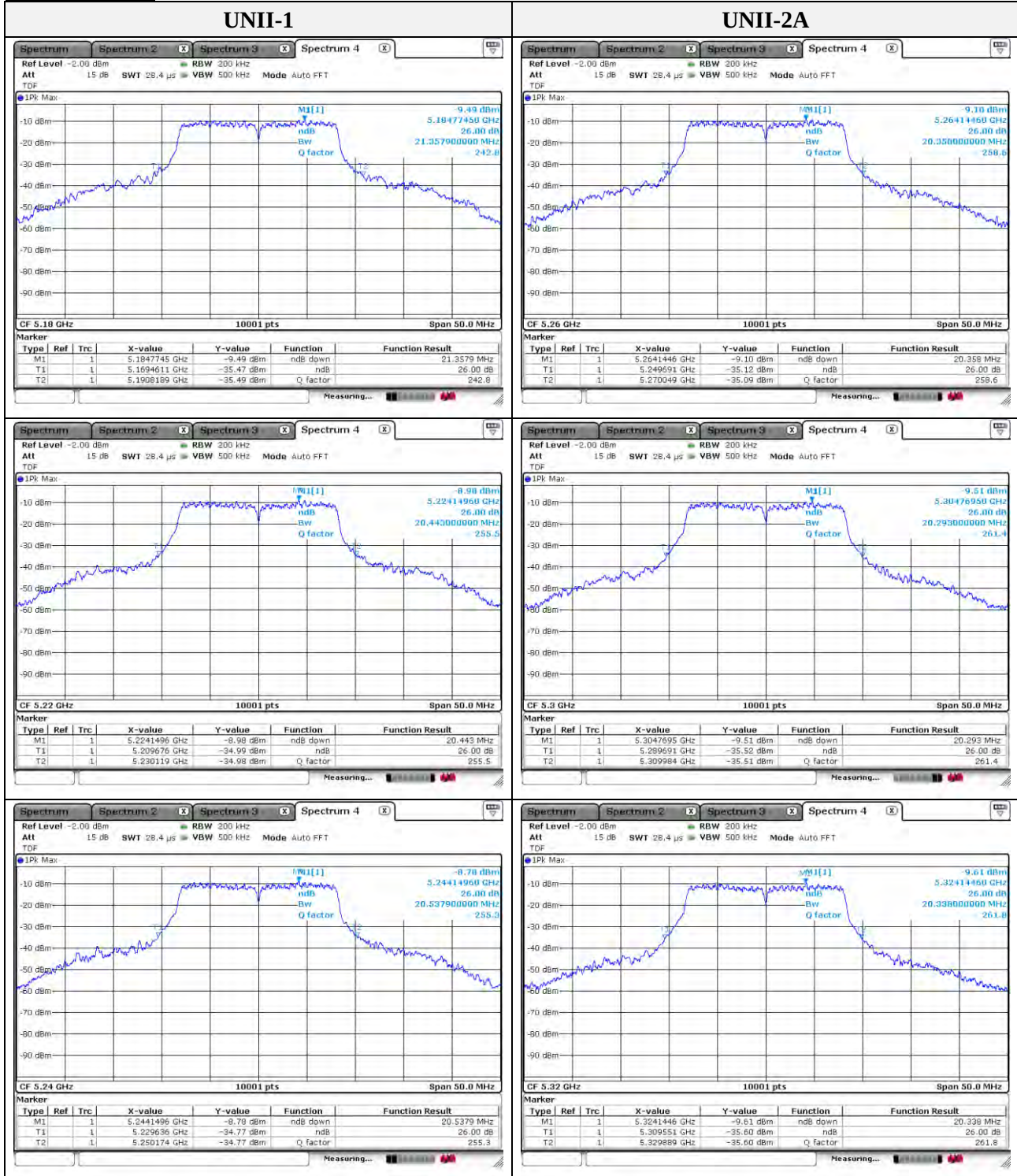


Band	Frequency(MHz)	Mode	26 dB bandwidth(MHz)	99 % bandwidth(MHz)
UNII-1	5 210	ac_VHT80	79.86	75.64
UNII-2A	5 290		79.86	75.58
UNII-2C	5 530		79.75	75.48
	5 610		79.67	75.46
UNII-3	5 775		79.83	75.48

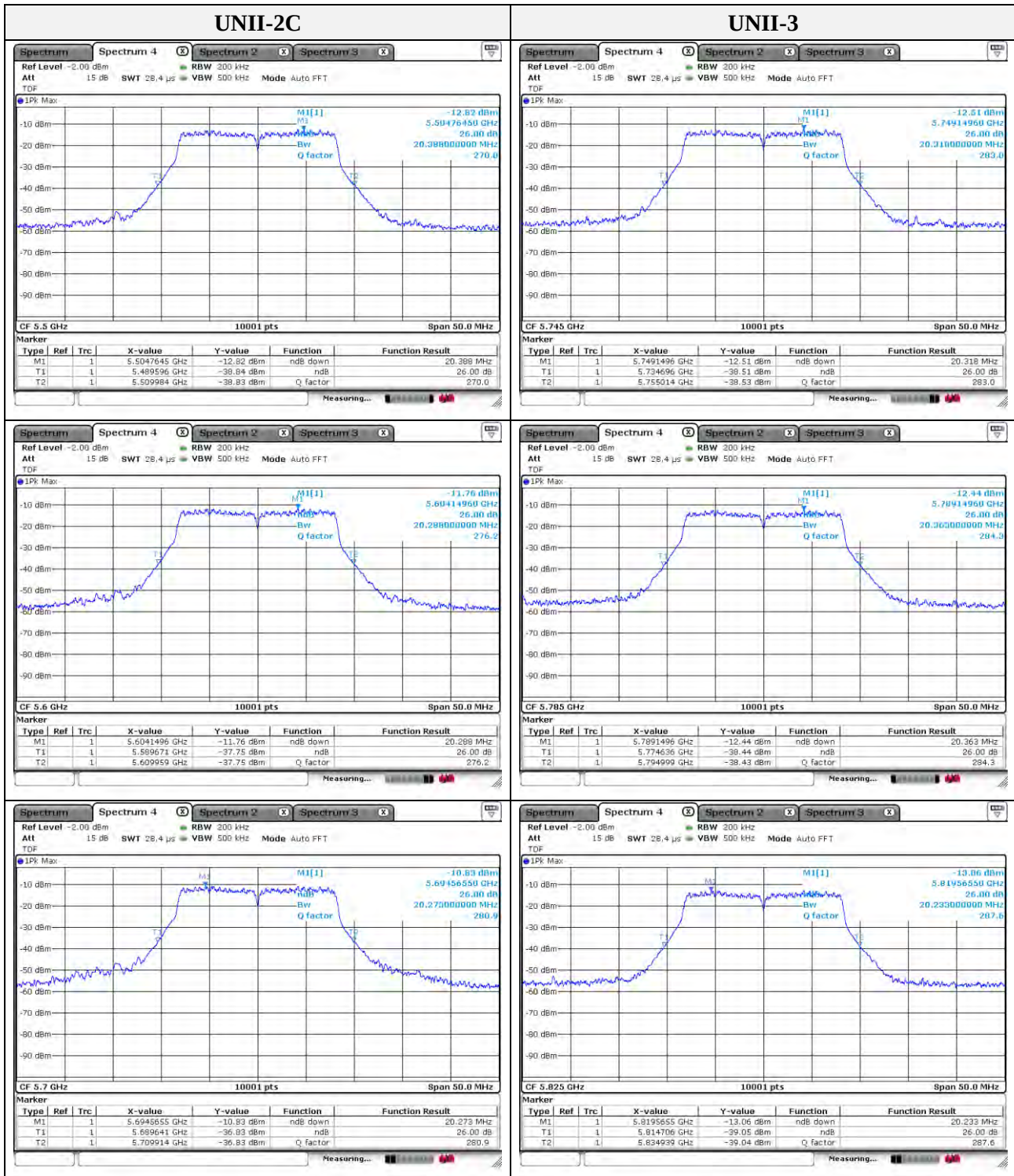
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26 dB bandwidth

Mode : 802.11a

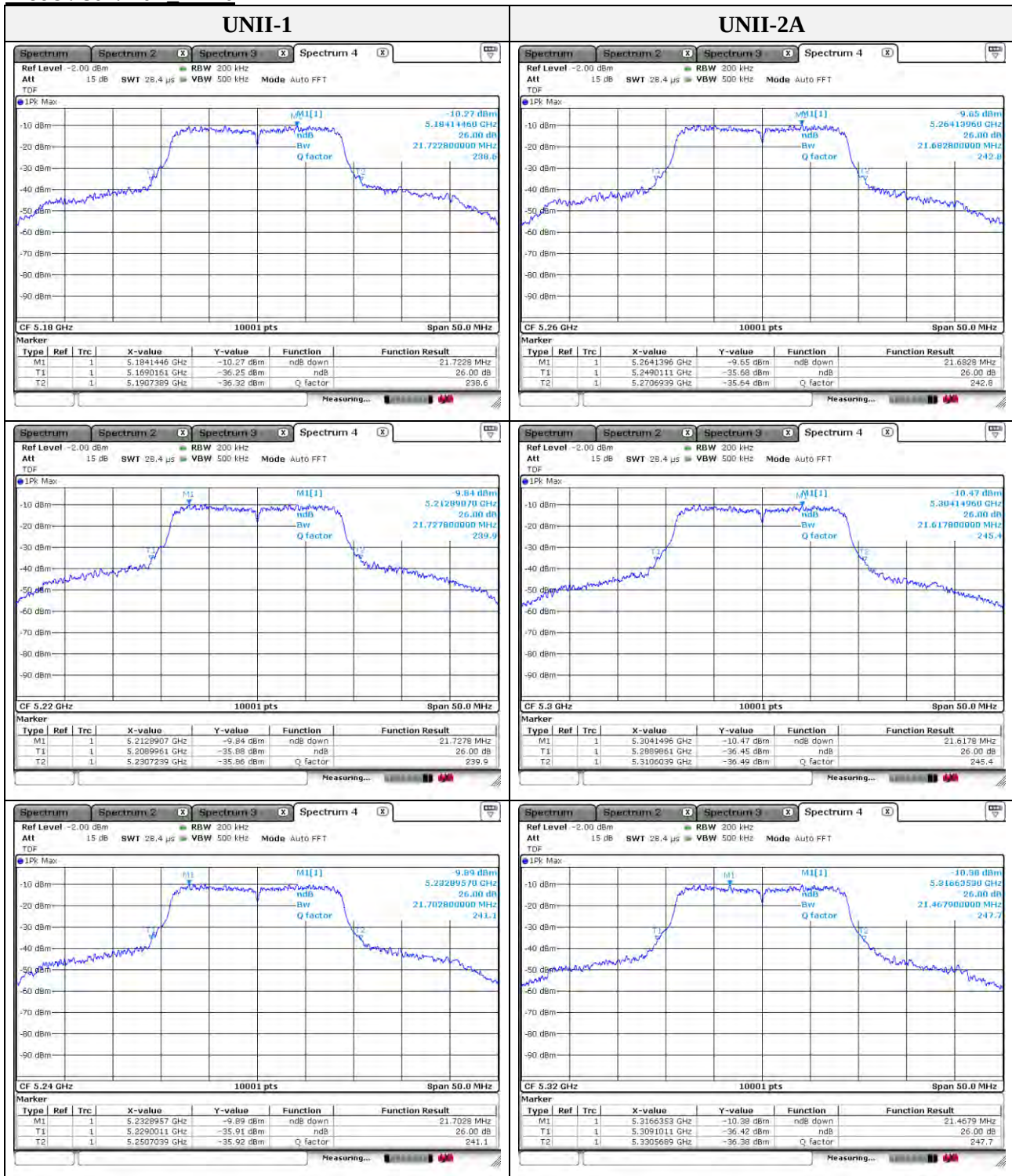


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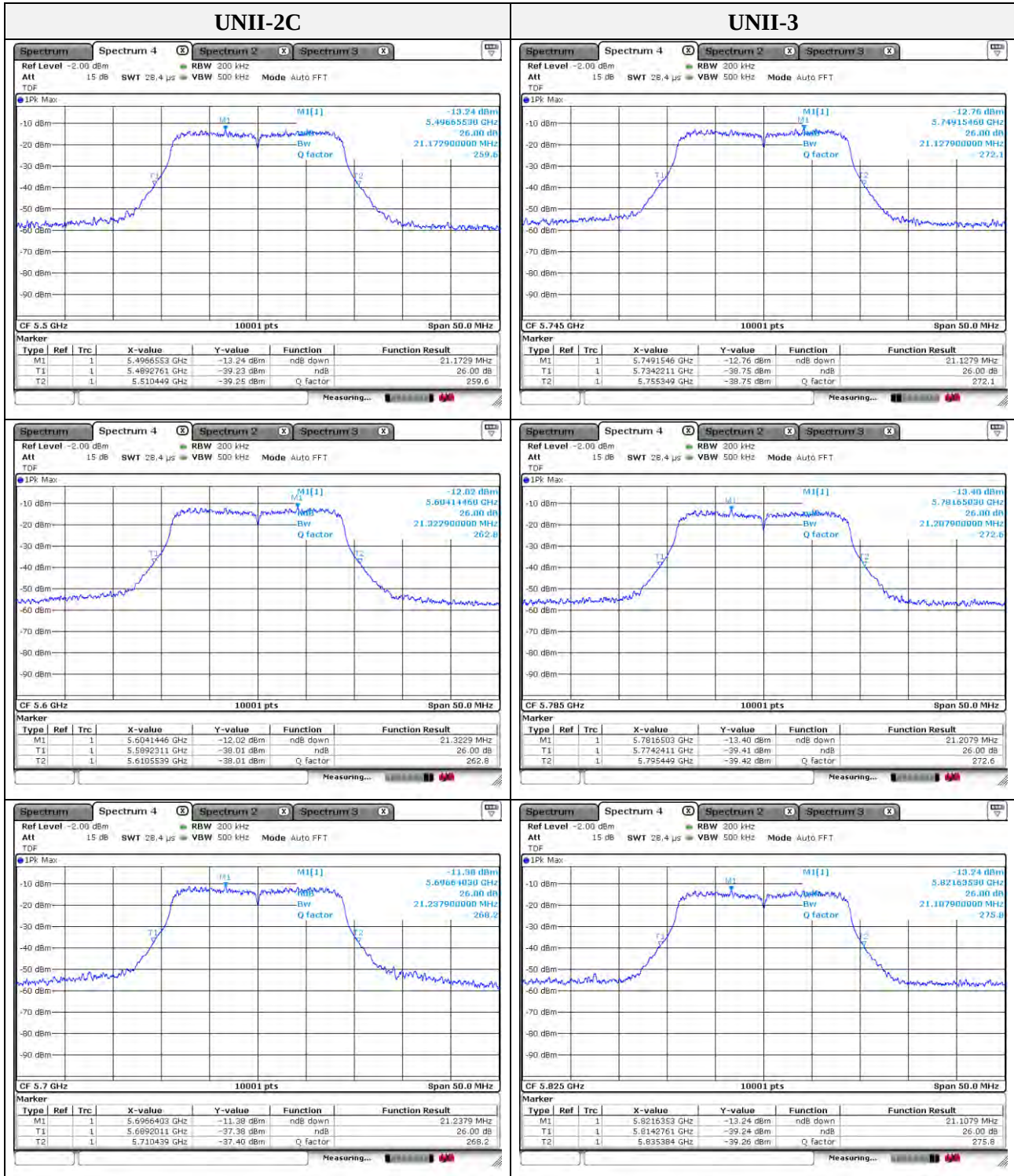


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Mode : 802.11an HT20

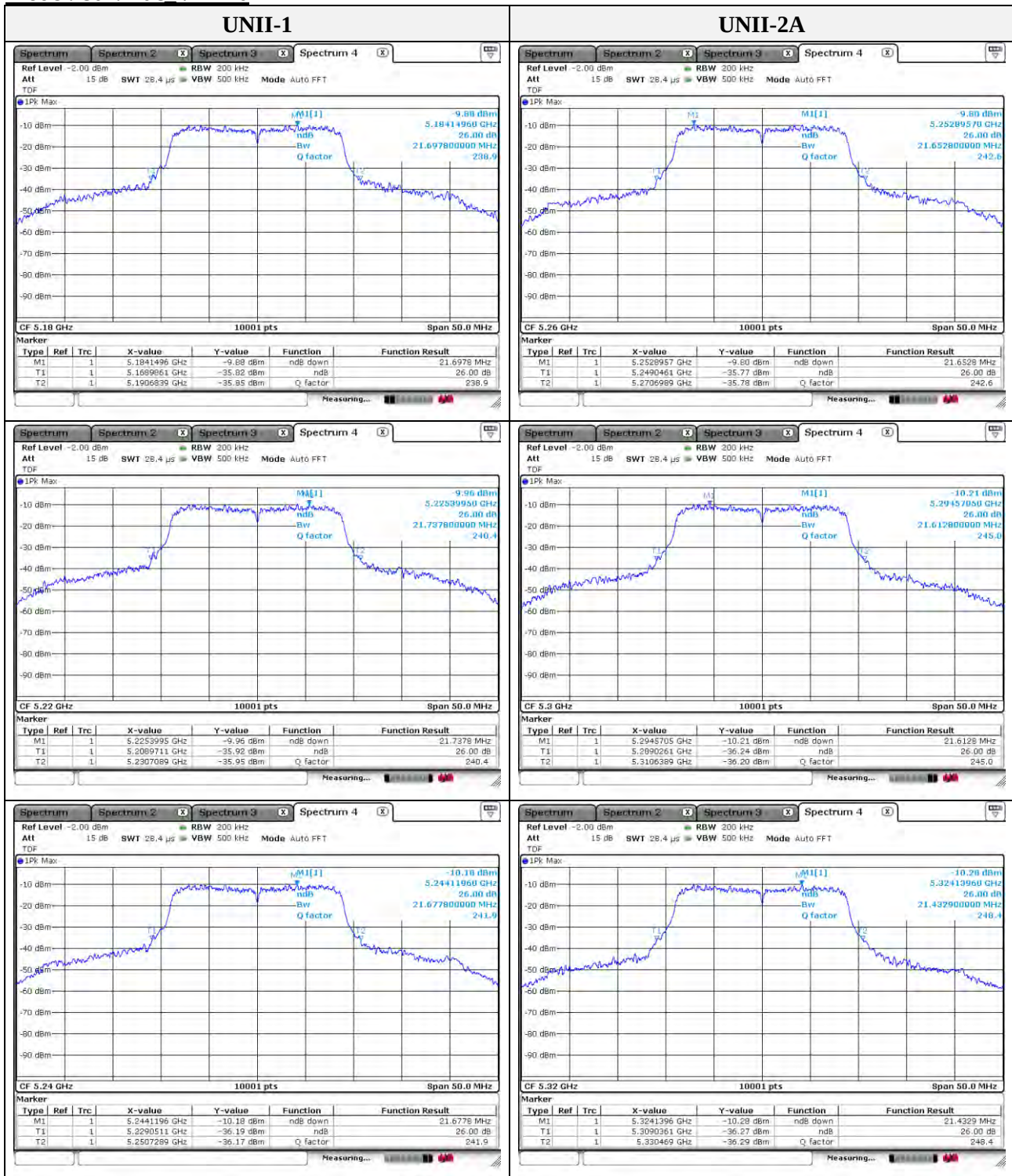


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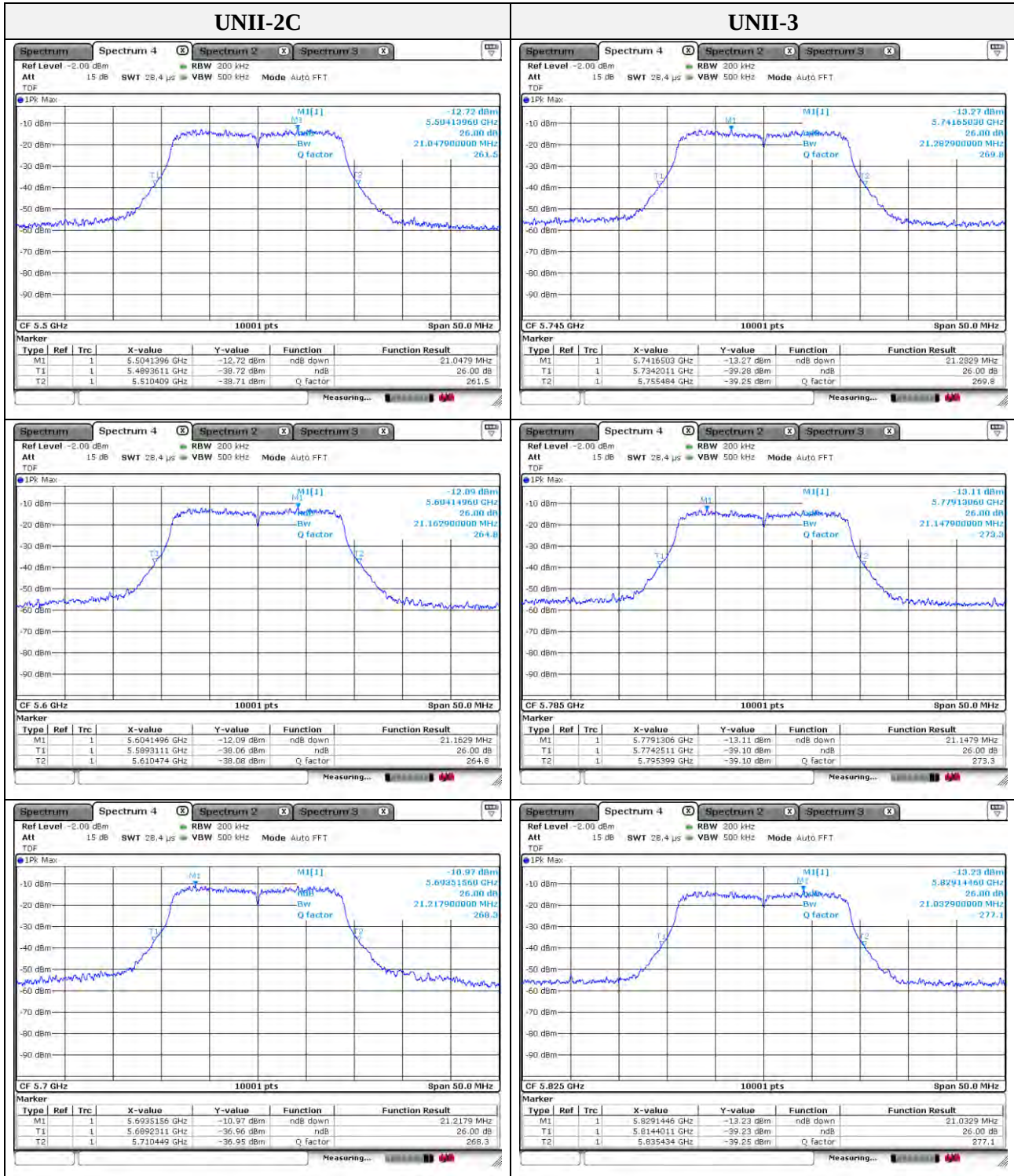


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Mode : 802.11ac VHT20

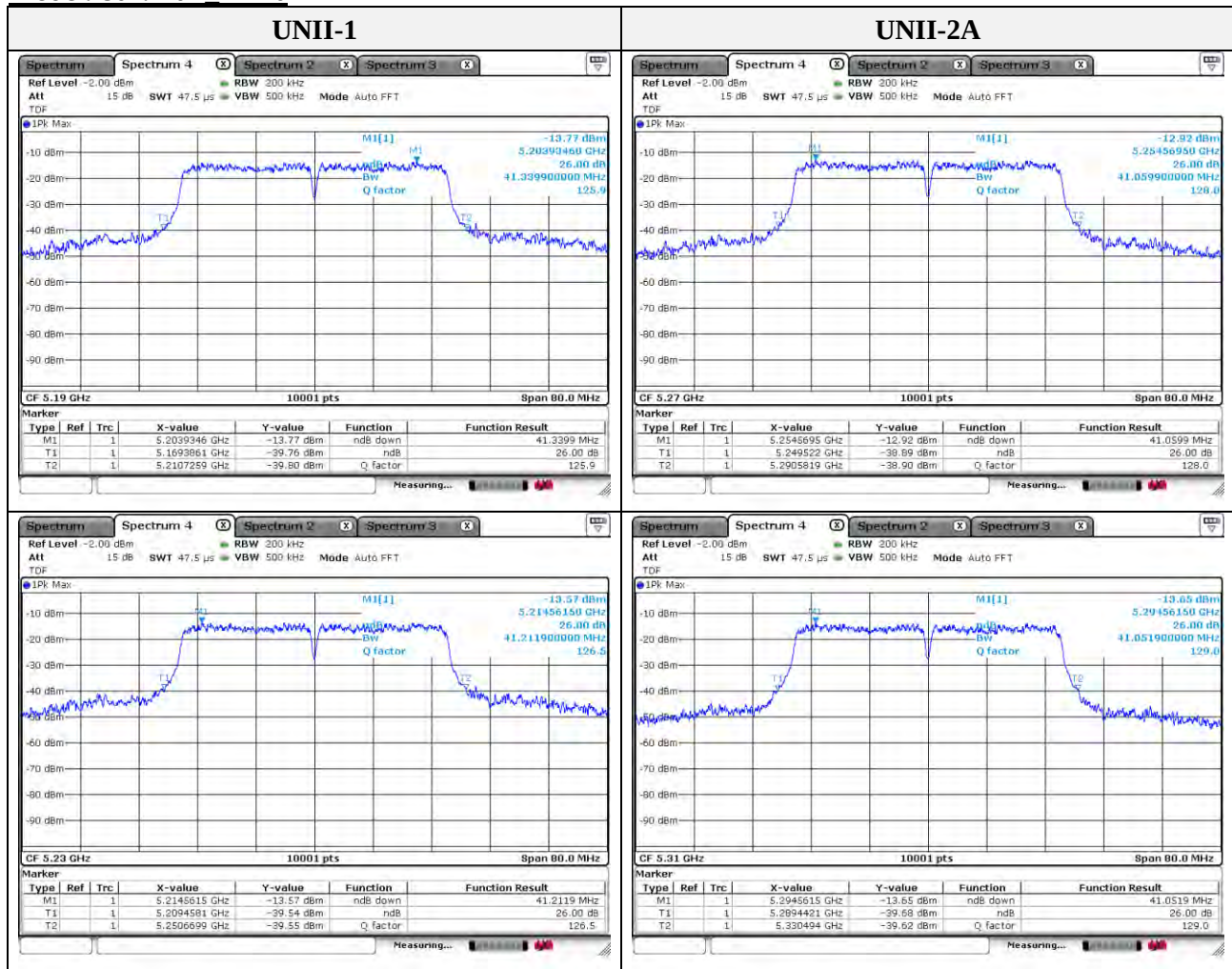


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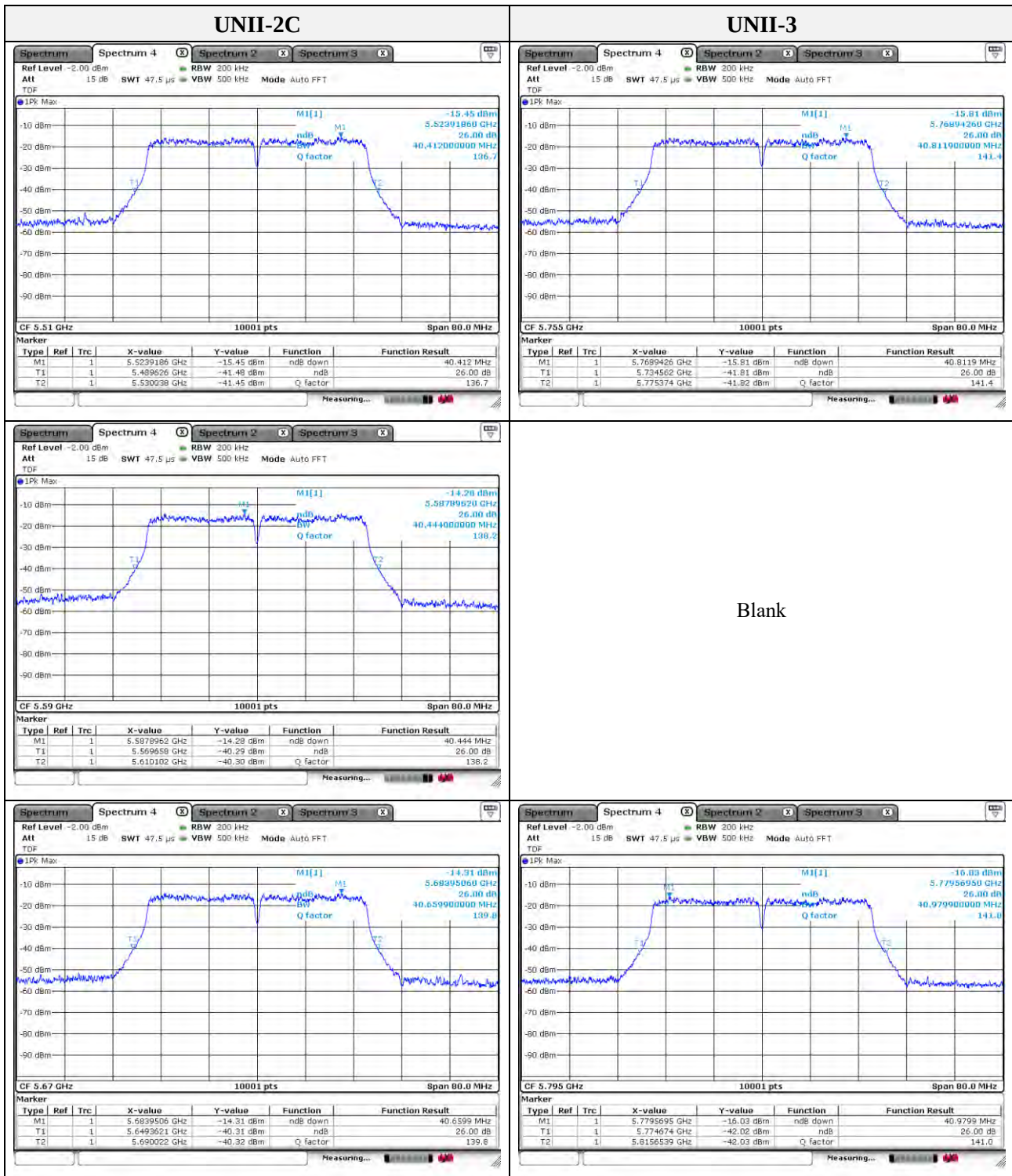


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Mode : 802.11an HT40

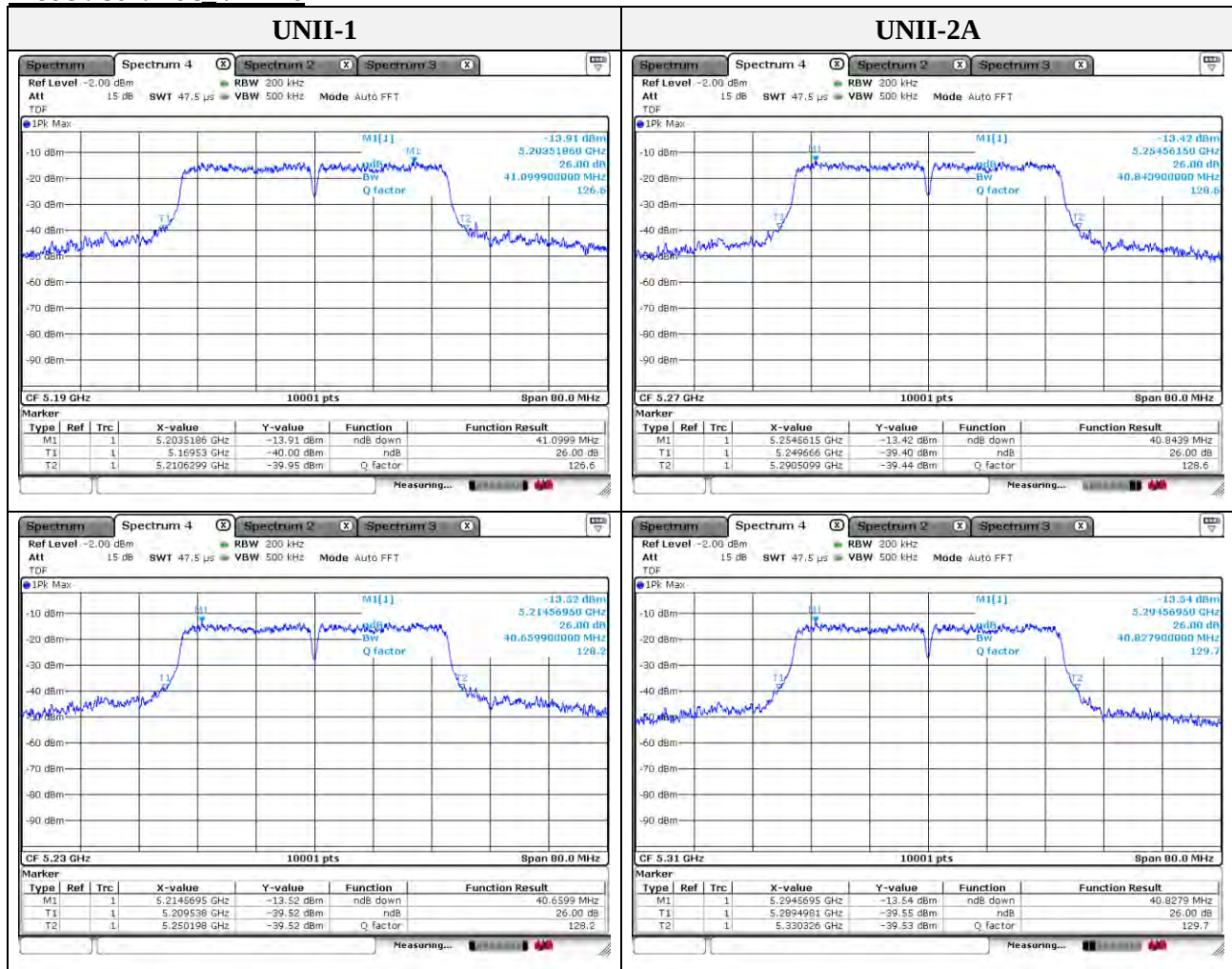


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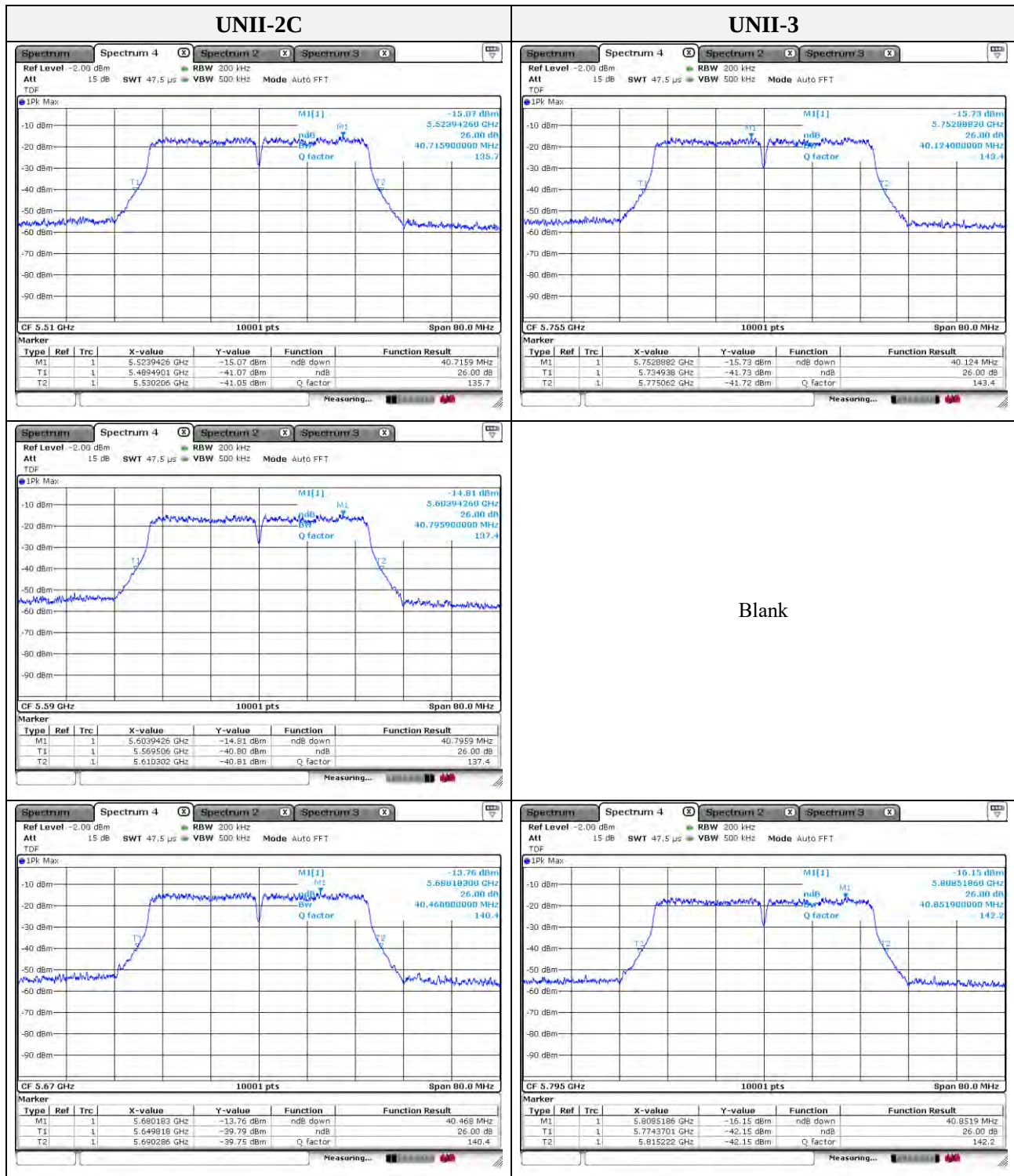


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Mode : 802.11ac VHT40

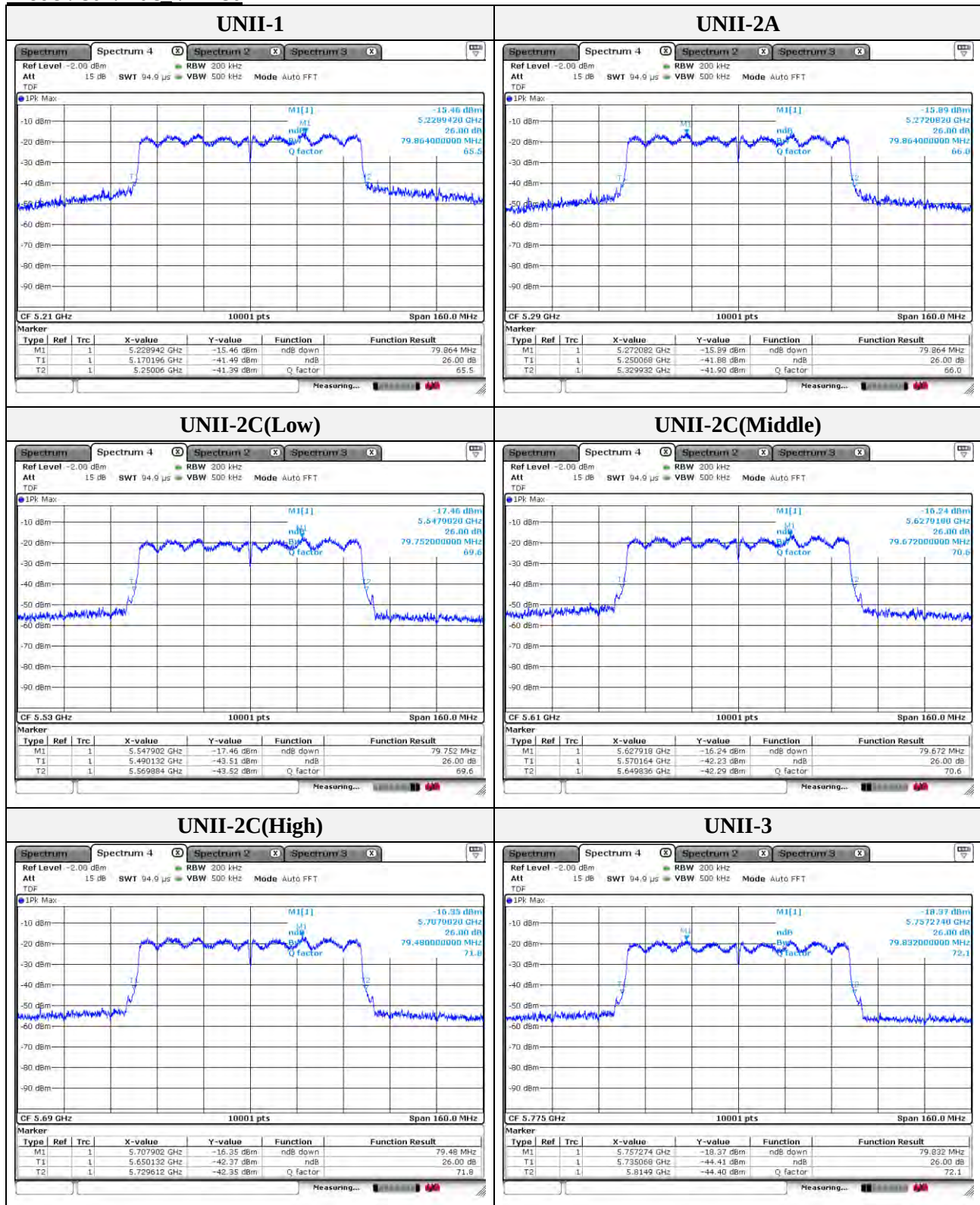


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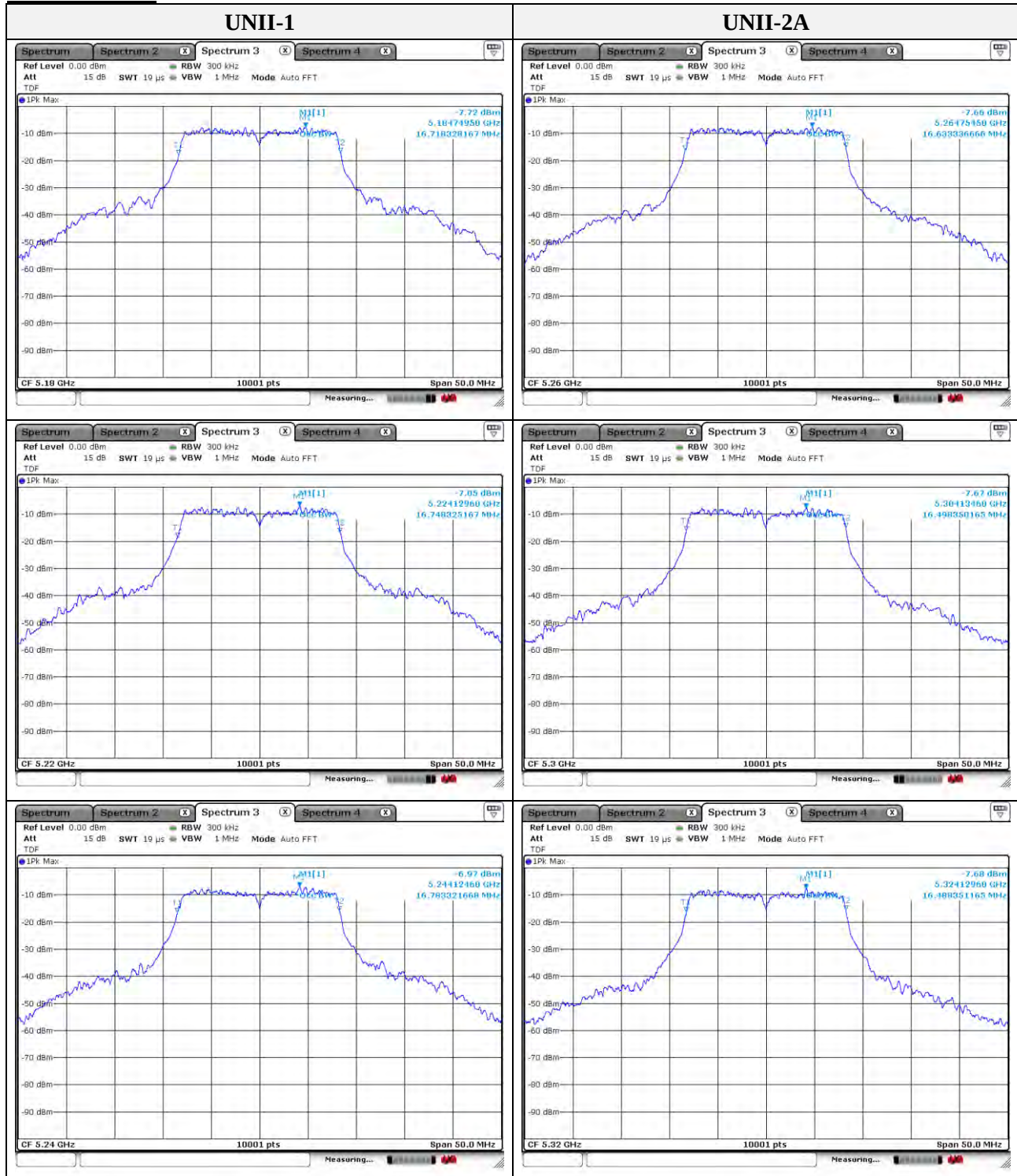
Mode : 802.11ac VHT80



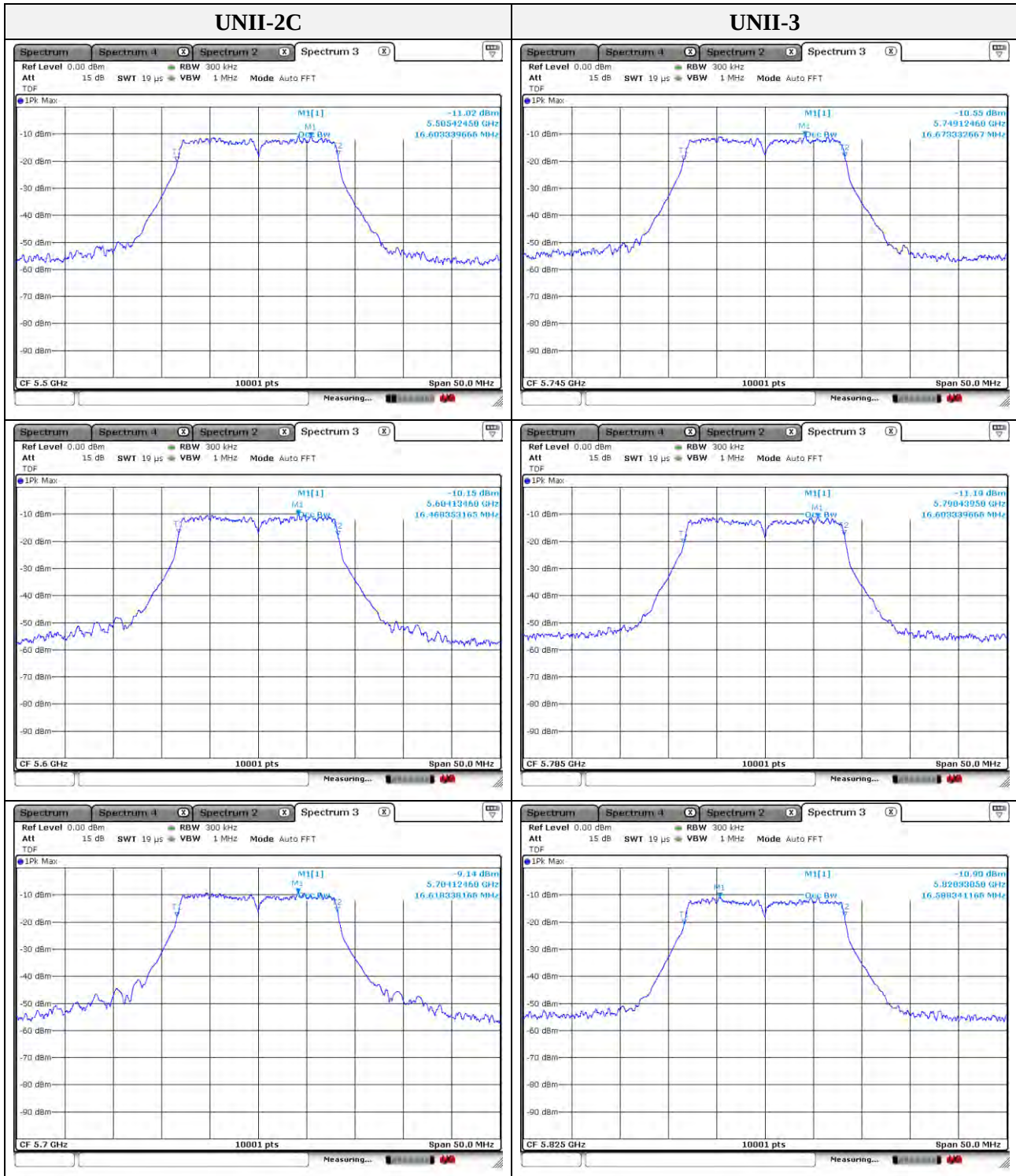
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99% bandwidth

Mode : 802.11a

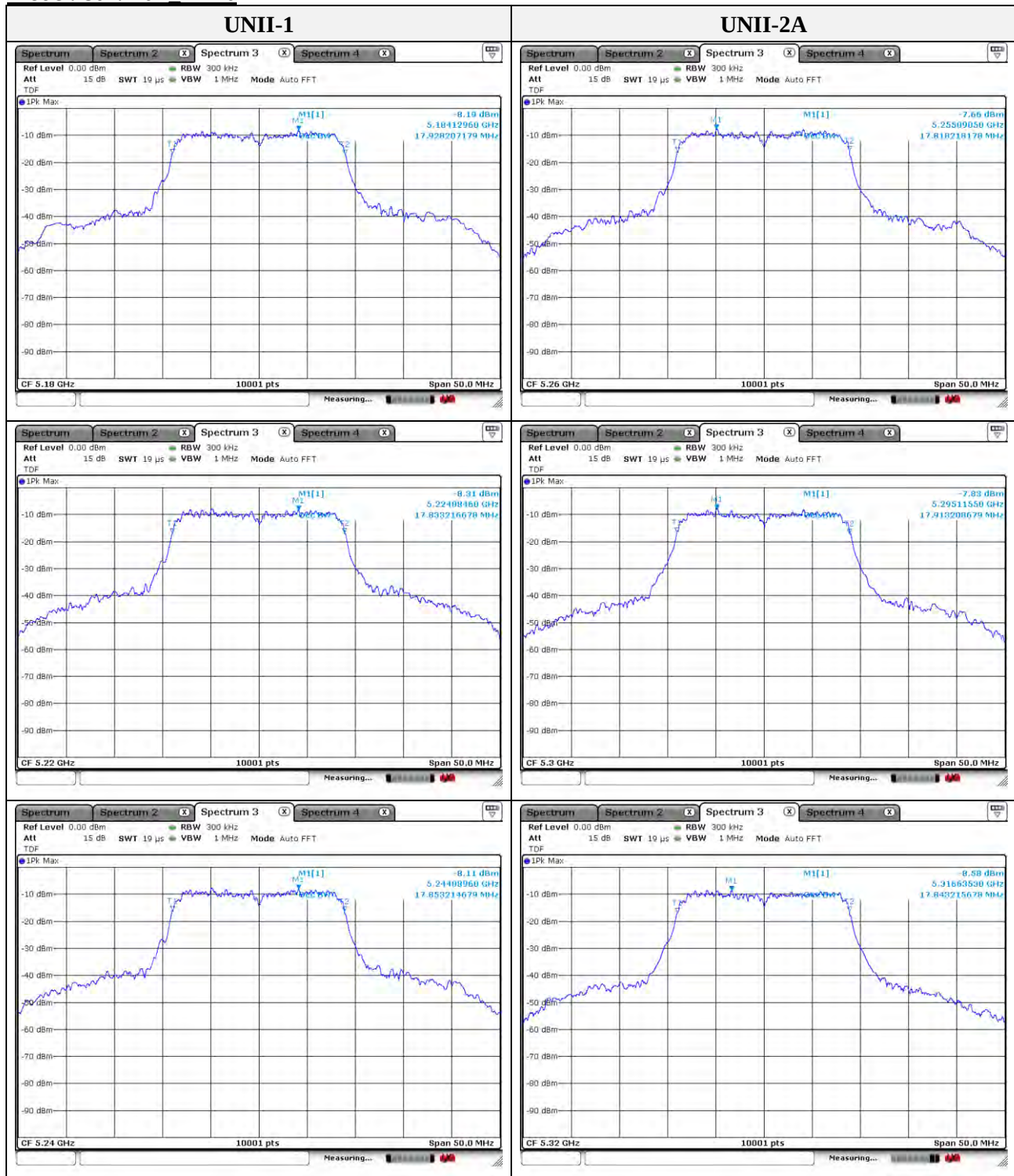


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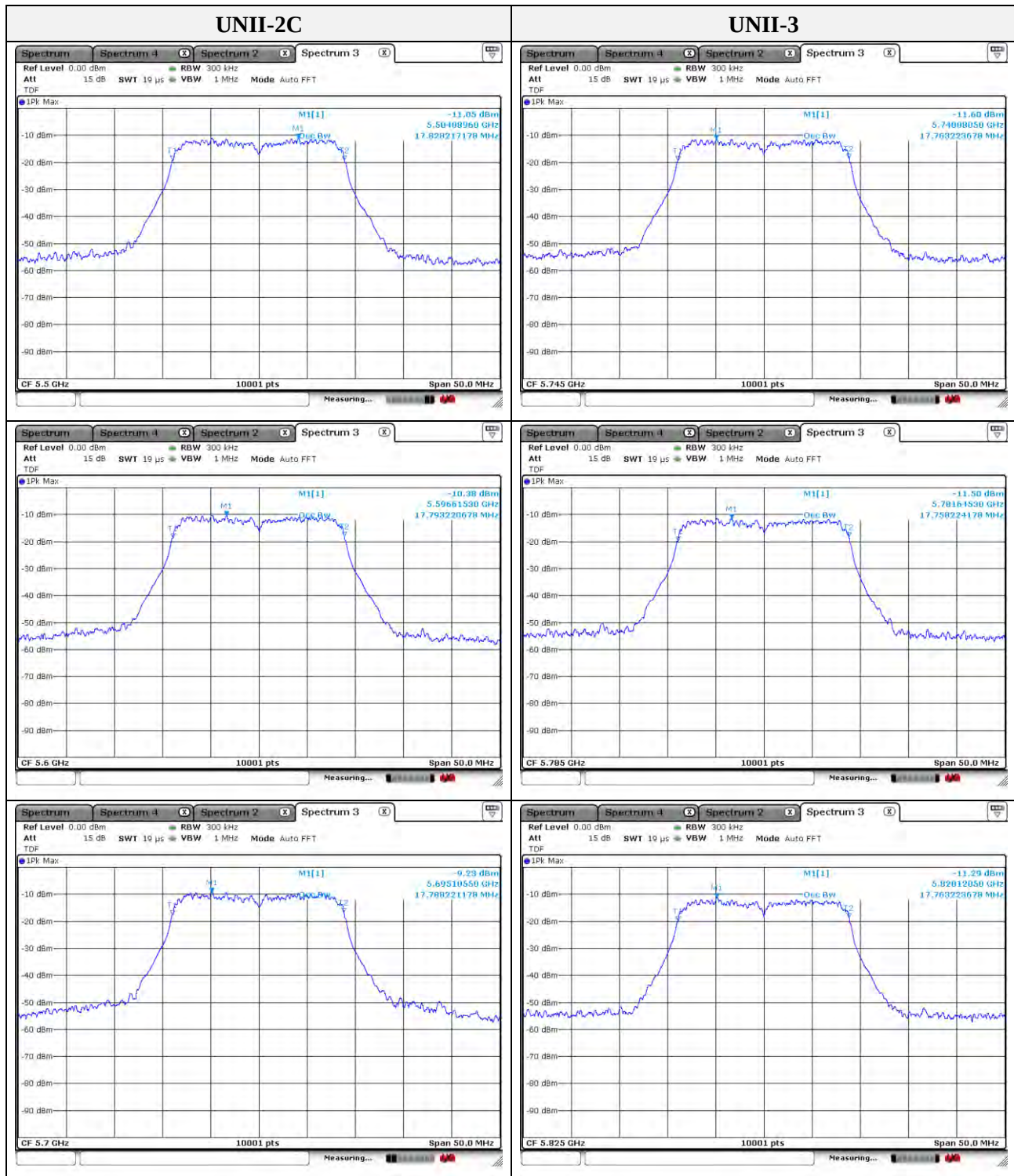


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Mode : 802.11an HT20

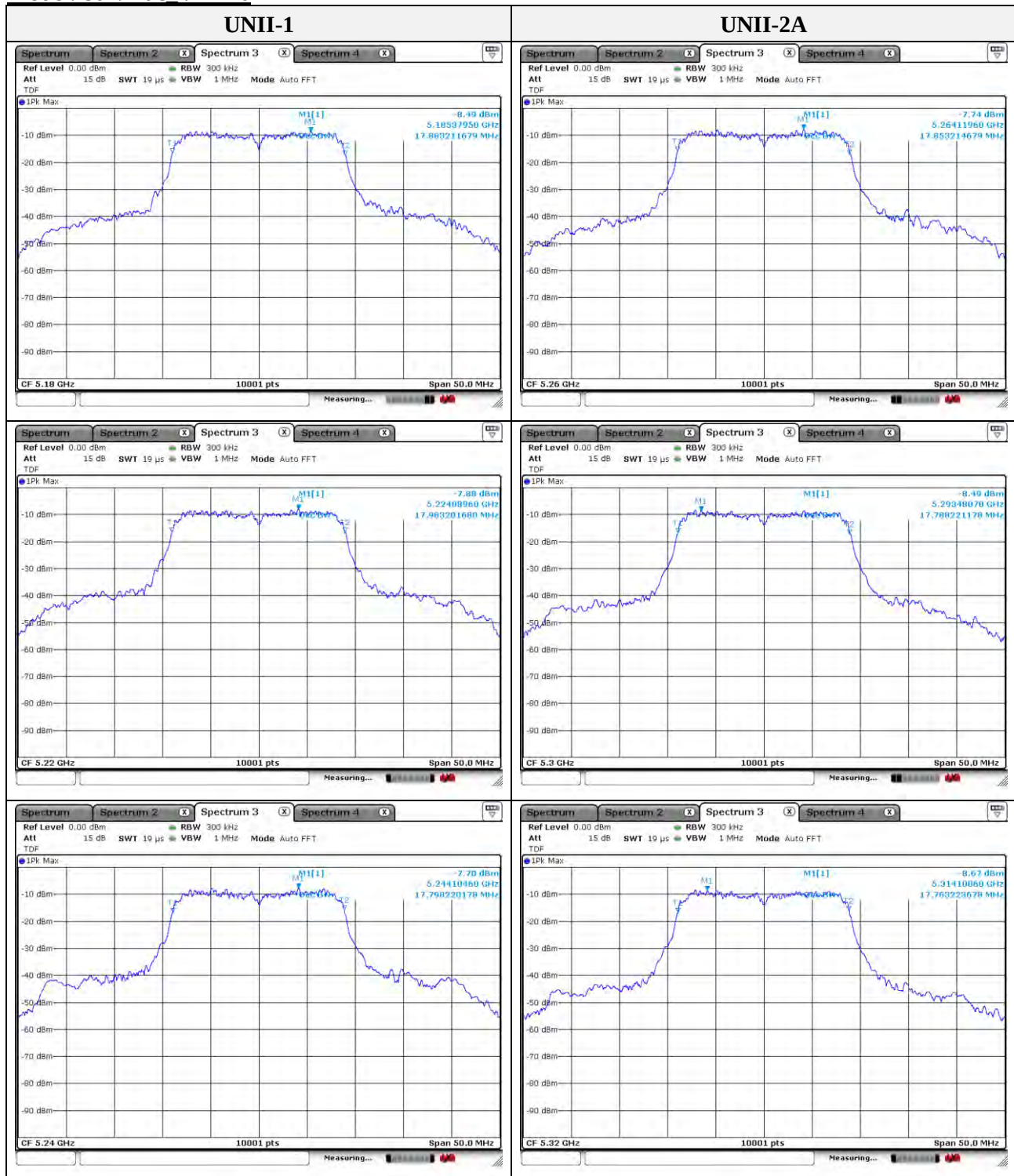


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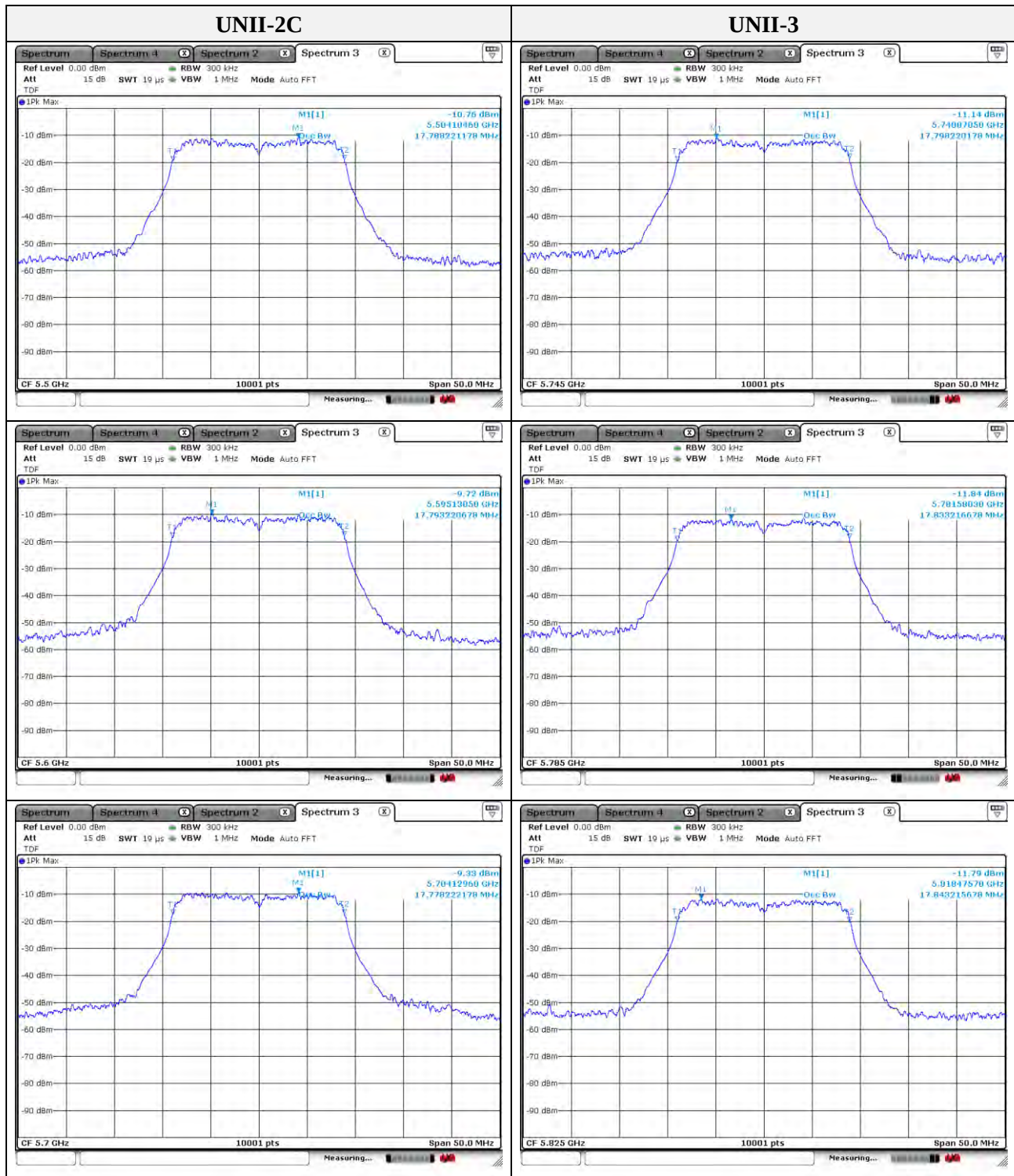


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Mode : 802.11ac VHT20

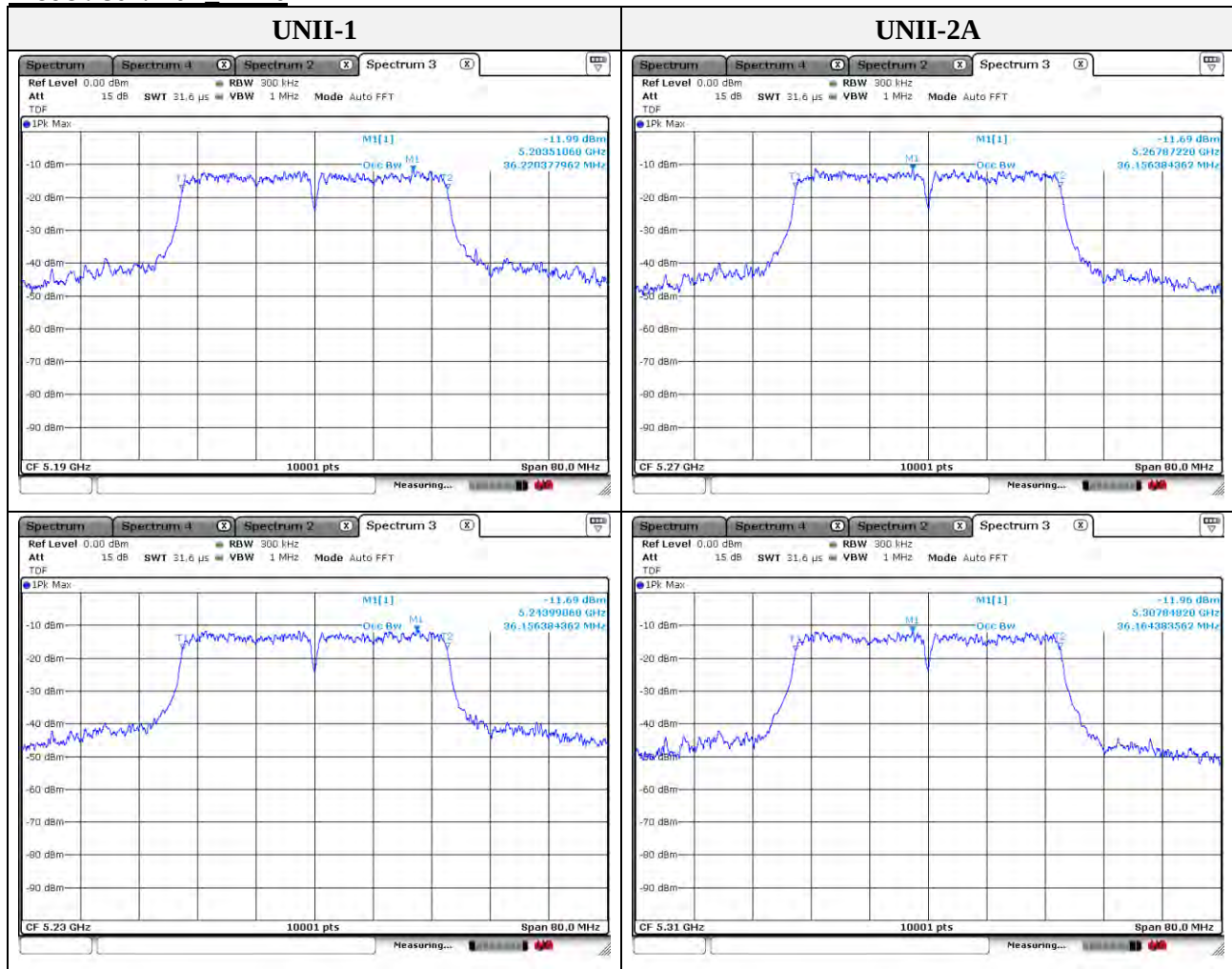


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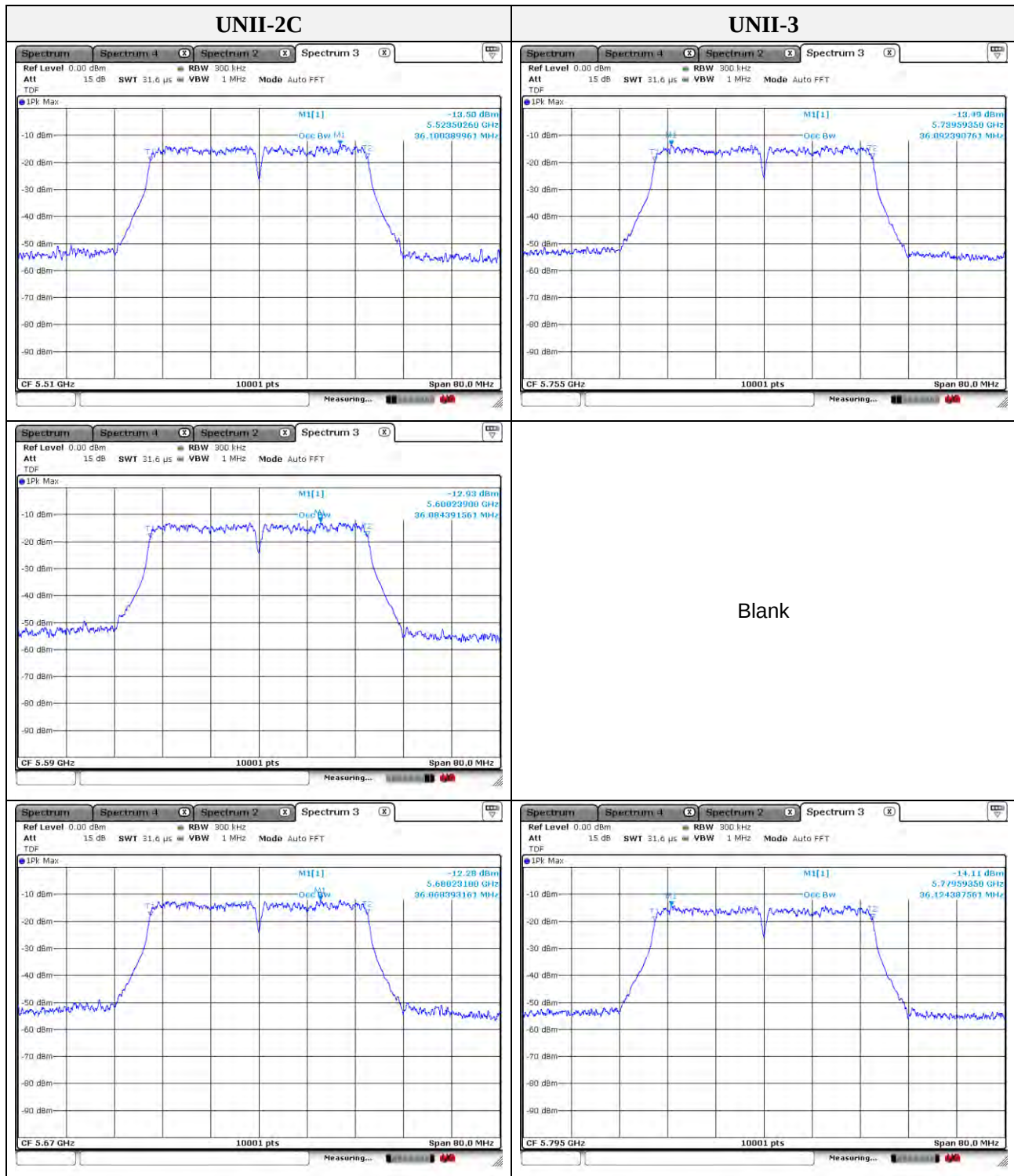


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Mode : 802.11an HT40

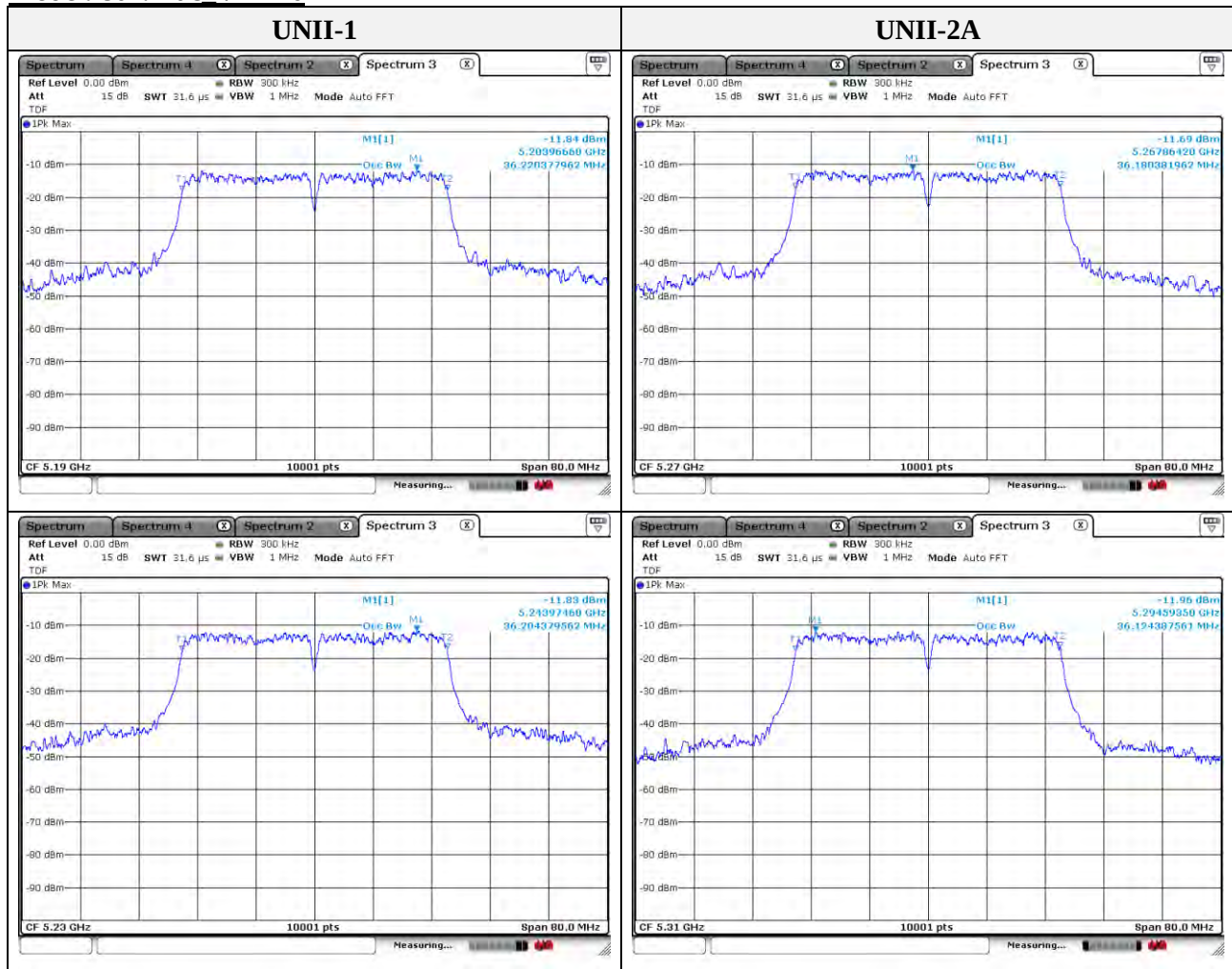


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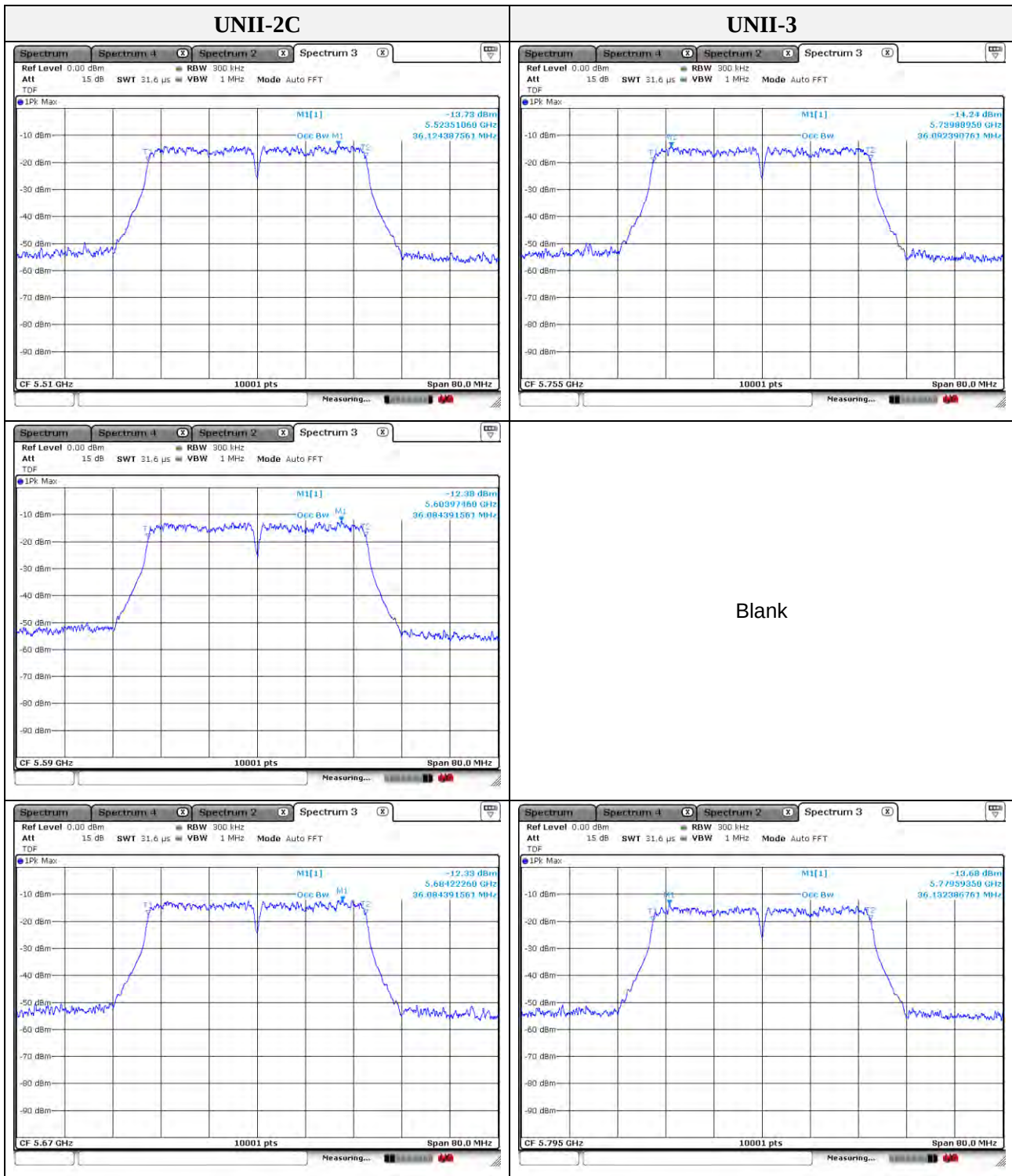


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Mode : 802.11ac VHT40

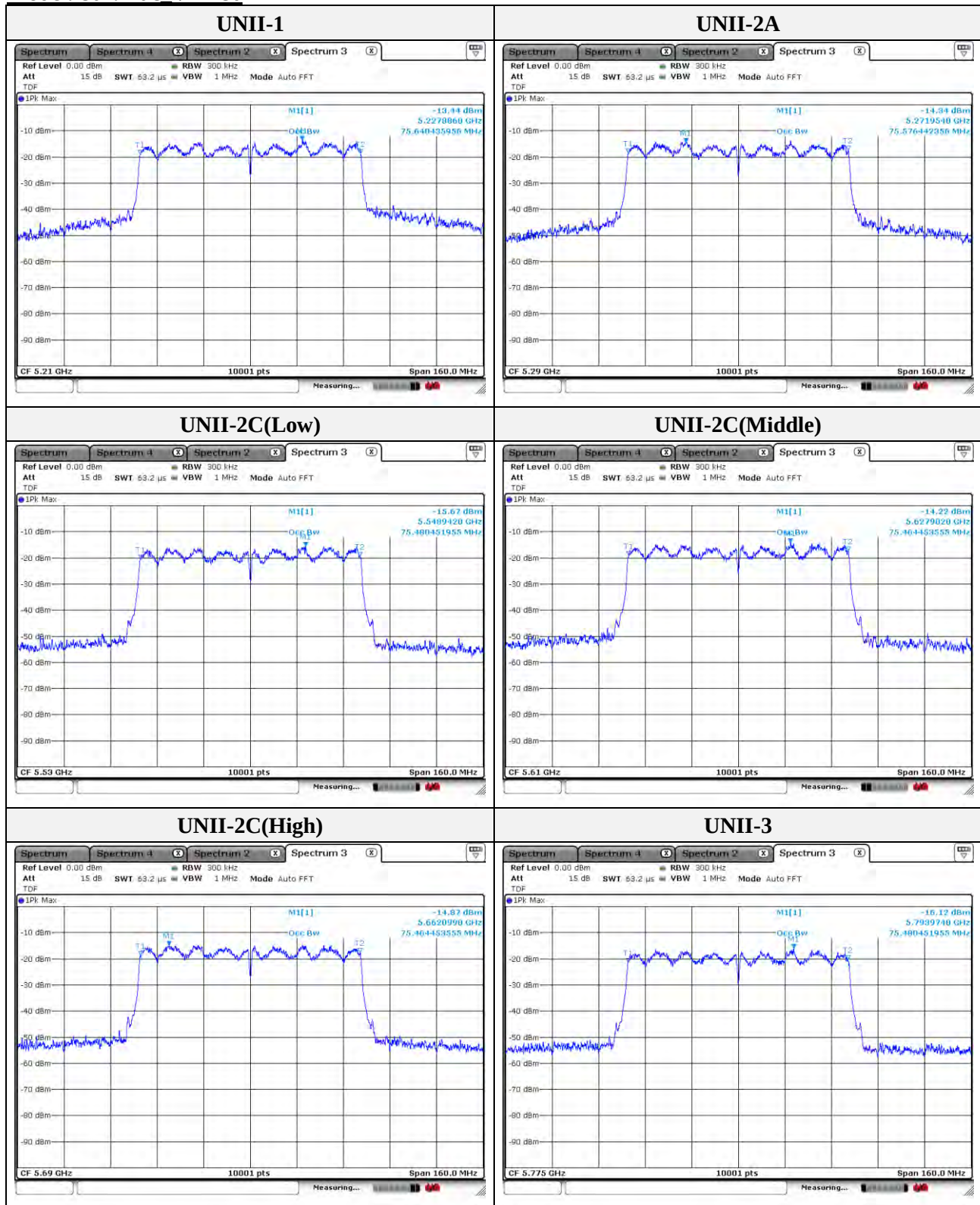


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