



FCC Part 15.407

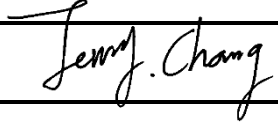
TEST REPORT

For

AirTies Wireless Networks

Mithat Uluönlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey

FCC ID: Z3WAIR7430

Report Type	Original Report
Product Type:	UHD Wireless Set-Top Box
Report Number :	RLK1810008-00D
Report Date :	2019/06/21
Reviewed By:	Jerry Chang 
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Taiwan)

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Revision History

Revision	Report Number	Issue Date	Description	Author/Revised by
1.0	RLK1810008-00D	2019/06/21	Original Report	Himiko Chen

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	AirTies Wireless Networks Mithat Uluönlü Sokak No 23, Esentepe, Şişli, ISTANBULI, 34394 Turkey
Manufacturer	XAVi Technologies Corp. 3F-1, No. 27, Puding Rd., Hsinchu City 300, Taiwan
Brand(Trade) Name	AirTies
Product (Equipment)	UHD Wireless Set-Top Box
Model Name	Air7430
EUT Function	IEEE 802.11 an(HT20/HT40) + ac(VHT20/VHT40/VHT80) Note: A mode non-Beamforming and n/ac only Beamforming mode. Without TDWR.
Frequency Range	UNII-2a: 5250 MHz ~ 5350 MHz, UNII-2c: 5470 MHz ~ 5725 MHz UNII-3: 5725 MHz ~ 5850 MHz
Number of Channels	For UNII-2a: IEEE 802.11a/n HT20/ac VHT20: 4 Channels IEEE 802.11n HT40/ac VHT40: 2 Channels IEEE 802.11ac VHT80: 1 Channels For UNII-2c: IEEE 802.11a/n HT20/ac VHT20: 10 Channels IEEE 802.11n HT40/ac VHT40: 5 Channels IEEE 802.11ac VHT80: 2 Channels For UNII-2c to 3 Straddle channel: IEEE 802.11a/n HT20/ac VHT20: 1 Channels IEEE 802.11n HT40/ac VHT40: 1 Channels IEEE 802.11ac VHT80: 1 Channels
Output Power	UNII-2a: IEEE 802.11a Mode: 21.21dBm (0.1321 W) IEEE 802.11n HT20 Mode: 17.10dBm (0.0512 W) IEEE 802.11n HT40 Mode: 18.23dBm (0.0665 W) IEEE 802.11ac VHT20 Mode: 17.19dBm (0.0523 W) IEEE 802.11ac VHT40 Mode: 18.45dBm (0.0699 W) IEEE 802.11ac VHT80 Mode: 20.02dBm (0.1004 W) UNII-2c: IEEE 802.11a Mode: 21.38dBm (0.1374 W) IEEE 802.11n HT20 Mode: 17.58dBm (0.0572 W) IEEE 802.11n HT40 Mode: 18.30dBm (0.0676 W) IEEE 802.11ac VHT20 Mode: 17.68dBm (0.0586 W) IEEE 802.11ac VHT40 Mode: 18.52dBm (0.0711 W) IEEE 802.11ac VHT80 Mode: 20.55dBm (0.1135 W)
Modulation Type	OFDM
Received Date	Oct. 26, 2018
Date of Test	Jan. 31, 2019 ~ Jun. 04, 2019

Related Submittal(s)/Grant(s)

FCC Part 15.247 DSS with FCC ID : Z3WAIR7430
FCC Part 15.247 DTS with FCC ID : Z3WAIR7430

*All measurement and test data in this report was gathered from production sample serial number: 1803009 (Assigned by BACL, Taiwan).

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☒ AC 120V/60Hz ☒ Adapter <i>Brand Name: MOSO</i> <i>Model: MSA-C2000IS12.0-24Y-US</i> <i>I/P: 100-240Vac,0.7A</i> <i>O/P: 12Vdc,2A</i> ☐ By Power Core
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1.3 Objective

The Objective of this Test Report was to document the compliance of the AirTies Wireless Networks Appliance (Model: Air7430) to the requirements of the following Standards:

-Part 2, Subpart J, Part 15 Subparts A and Part 15 Subparts E of the Federal Communication Commission's rules.

-KDB 662911 D01 Multiple Transmitter Output v02r01

-KDB 789033 D02 General U-NII Test Procedures New Rules v02r01

- ANSI C63.10-2013 of the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.4 Measurement Uncertainty

Parameter	Expanded Measurement uncertainty
RF output power with Power Meter	± 0.55 dB
Occupied Channel Bandwidth	± 4.45 %
RF Conducted test with Spectrum	± 1.45 dB
AC Power Line Conducted Emission	± 2.66 dB
Radiated Below 1G	± 3.57 dB
Radiated Above 1G-18G	± 4.29 dB
Radiated Above 18G-40G	± 4.67 dB

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on

☒ 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

☒ 68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 974454. Designation No.: TW3180

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in testing mode which was provided by manufacturer.

No special accessory, No modification was made to the EUT and No special equipment used during test.

IEEE 802.11 a/n HT20-BF/ac VHT20-BF			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	112	5560
56	5280	116	5580
60	5300	132	5660
64	5320	136	5680
100	5500	140	5700
104	5520	144	5720
108	5540	-	-

For UNII-2a: Channel 52, 60 and 64 were tested. For UNII-2c: Channel 100, 116 and 140 were tested.

For Straddle channel: 144 was tested.

IEEE 802.11 n HT40-BF/ac VHT40-BF			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
54	5270	118	5550
62	5310	134	5670
102	5510	142	5710
110	5500	-	-

For UNII-2a: Channel 54 and 62 were tested. For UNII-2c: Channel 102, 118 and 134 were tested.

For Straddle channel: 142 was tested.....

IEEE 802.11 ac VHT80-BF			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
58	5290	138	5690
106	5530	-	-

For UNII-2a: Channel 58 was tested. For UNII-2c: Channel 106 was tested. For Straddle channel: 138 was tested

Modulation Used for Conformance Test			
Configuration	N _{TX}	Data Rate	Worst Data Rate
802.11a mode	1	6-54 Mbps	6 Mbps
802.11n HT20-BF mode	4	MCS 0-32	MCS 0
802.11n HT40-BF mode	4	MCS 0-32	MCS 0
802.11ac VHT20-BF mode	4	MCS 0-10 NSS4	MCS 0
802.11ac VHT40-BF mode	4	MCS 0-10 NSS4	MCS 0
802.11ac VHT80-BF mode	4	MCS 0-10 NSS4	MCS 0

Worst Case of Power Setting					
EUT Exercise Software			Command and iperf via Putty		
Configuration	N _{TX}	UNII Band	Low CH	Mid CH	High CH
802.11a mode	1	UNII-2a	83	83	82
		UNII-2c	83	83	76
		Straddle	-	86	-
802.11n HT20-BF mode	4	UNII-2a	45	45	45
		UNII-2c	47	47	43
		Straddle	-	45	-
802.11n HT40-BF mode	4	UNII-2a	48	-	48
		UNII-2c	50	-	50
		Straddle	-	48	-
802.11ac VHT20-BF mode	4	UNII-2a	45	45	45
		UNII-2c	47	47	43
		Straddle	-	45	-
802.11ac VHT40-BF mode	4	UNII-2a	48	-	48
		UNII-2c	50	-	50
		Straddle	-	48	-
802.11ac VHT80-BF mode	4	UNII-2a	-	55	-
		UNII-2c	-	58	-
		Straddle	-	56	-

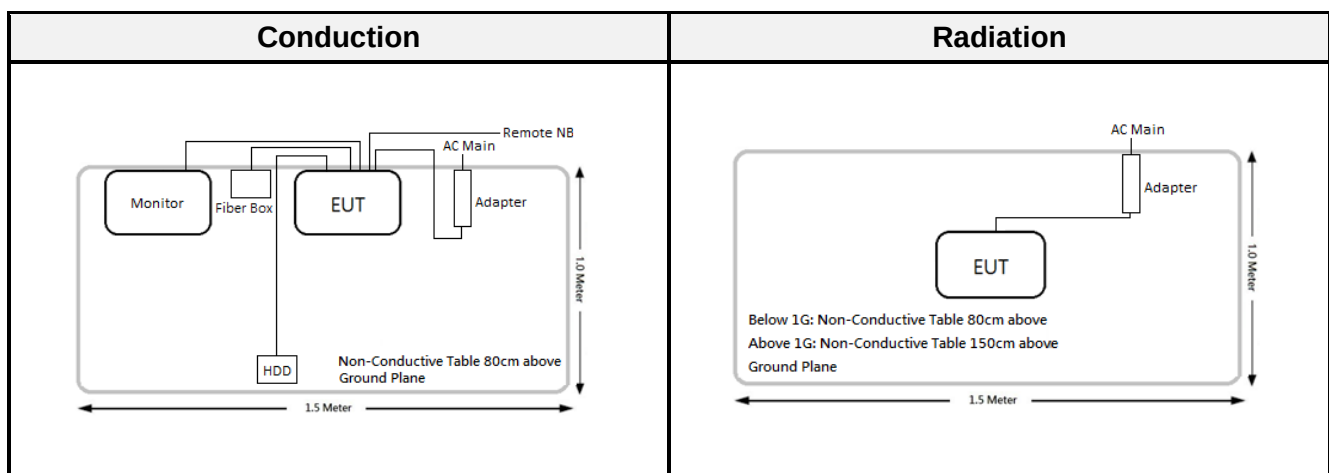
- The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all data rates bandwidths, and modulations. Radiation and conducted test had been pre-test, and the Antenna Chain 0 was worst chain for 802.11a mode, and recording the worst data and plot in the report. Radiated below 1G were tested worst output power mode.
- This Device a mode only Non-Beamforming mode and n/ac only Beamforming mode.
- Due to 802.11n HT20/T40 mode output power are less than 802.11ac VHT20/40. Therefore, 802.11ac VHT20/VHT40 cover 802.11n HT20/40 in the test, Include conducted and radiated, except power test.
- In the Bandwidth test, record all test data, and put the worst chain plot in the report.

2.2 Support Equipment and External Cable List

No.	Description	Manufacturer	Model Number	BSMI	FCC ID / DoC
A	Monitor	DELL	PP27LA	R33038	DoC
B	HDD	WD	WESNWDBUZG0014BBK	D33015	DoC
C	Fiber BOX	SPDIF	2RCA	NA	NA
D	Notebook PC	DELL	Latitude E5470	R33002	DoC

No.	Cable Description	Shielding Type	Length (m)	From	To
1	HDMI Cable	Shielded	1.8	EUT	Monitor
2	USB Cable	Shielded	1	EUT	HDD
3	Fiber Cable	Non- Shielded	0.6	EUT	Fiber BOX
4	LAN Cable	Non- Shielded	10	EUT	NB

2.3 Block Diagram of Test Setup

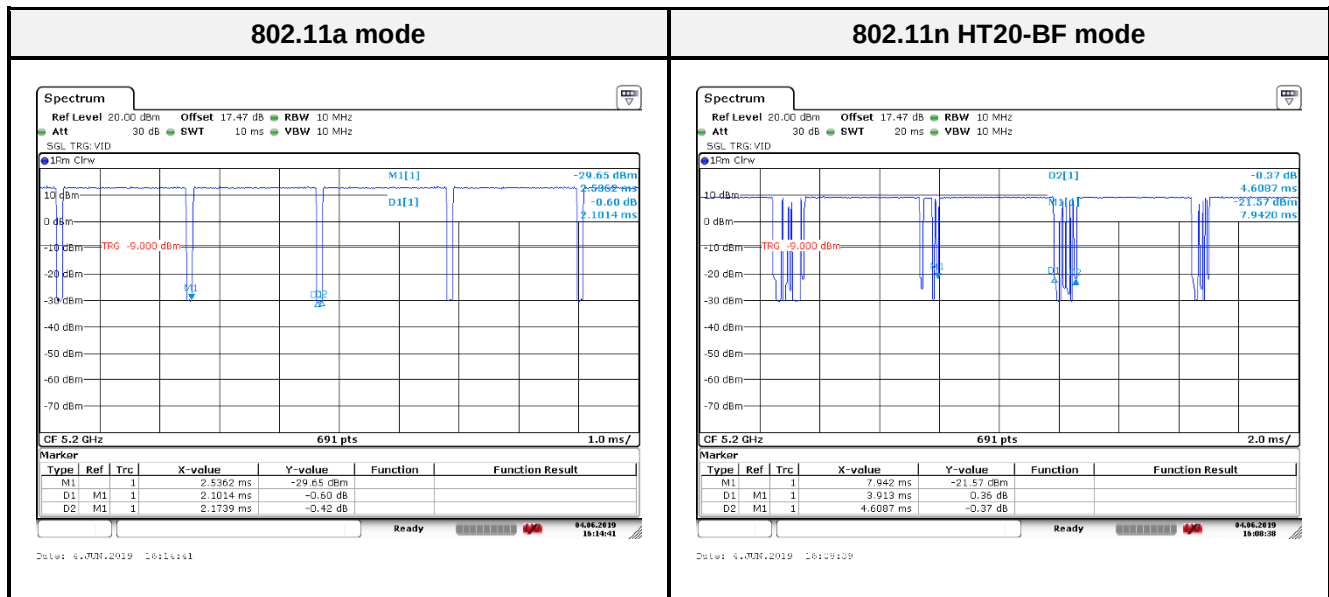


2.4 Duty Cycle

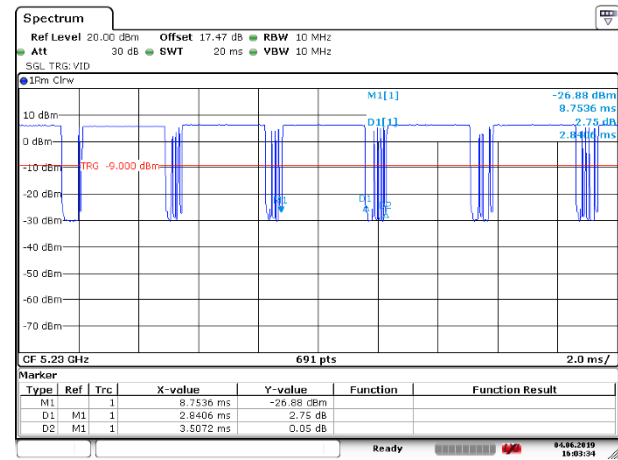
According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 section B:

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

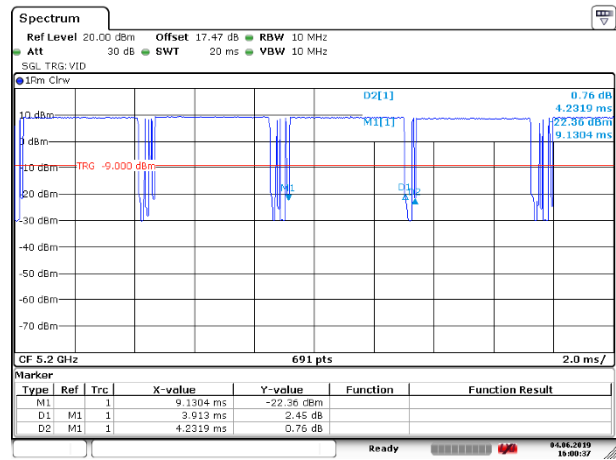
Configuration	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a mode	2.10	2.17	96.77	0.14
802.11n HT20-BF mode	3.91	4.60	85.00	0.71
802.11n HT40-BF mode	2.84	3.50	81.14	0.91
802.11ac VHT20-BF mode	3.91	4.23	92.43	0.34
802.11ac VHT40-BF mode	2.85	3.34	85.33	0.69
802.11ac VHT80-BF mode	1.81	2.28	79.39	1.00



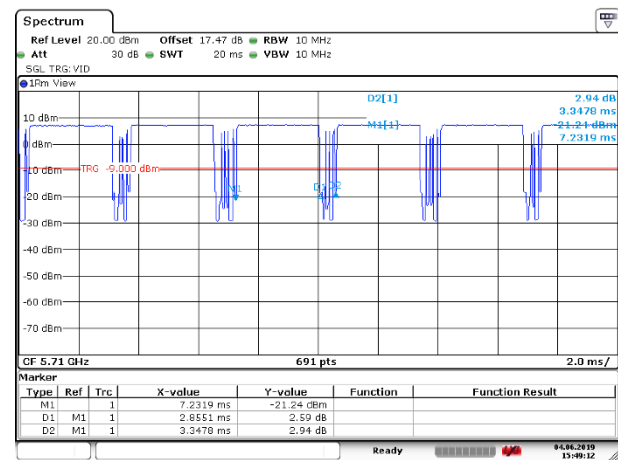
802.11n HT40-BF mode



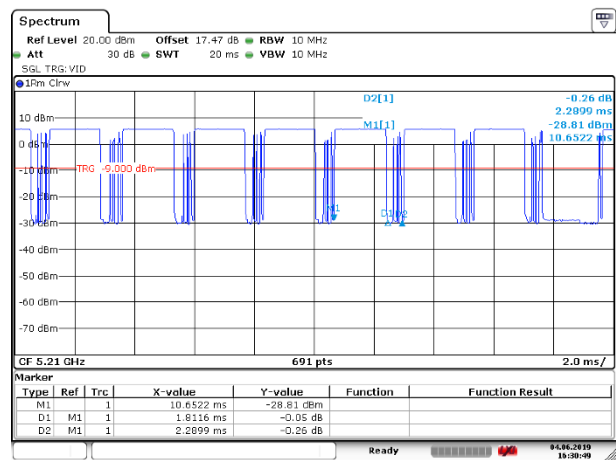
802.11ac VHT20-BF mode



802.11ac VHT40-BF mode



802.11ac VHT80-BF mode



3 Summary of Test Results

FCC Rules	Description of Test	Result
§1.1310, §2.1091, §15.407 (f)	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a), §15.407(b)(6)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.407(b)	Spurious Emissions	Compliance
§15.407(a)(e)	Emission Bandwidth	Compliance
§15.407(a)(1)	Maximum Peak Output Power	Compliance
§15.407(a)(1)(5)	Power Spectral Density	Compliance

4 FCC §1.1310, §2.1091, §15.407(f) - Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

According to §15.407(f), U-NII devices are subject to the radio frequency radiation exposure requirements specified in § 1.1307(b), and 2.1091 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary: Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

4.2 RF Exposure Evaluation Result

MPE Evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi 2.4G	2412-2462	3.60	2.291	27.00	501.187	25	0.1463	1
BLE	2402-2480	-4.30	0.372	8.00	6.310	25	0.0003	1
BR+EDR	2402-2480	-4.30	0.372	11.00	12.589	25	0.0006	1
Wi-Fi 5G UNII-1	5150-5250	9.44	8.790	23.00	199.526	25	0.2234	1
Wi-Fi 5G UNII-2a	5250-5350	9.44	8.790	21.00	158.489	25	0.1409	1
Wi-Fi 5G UNII-2c	5470-5725	9.78	9.506	19.00	79.433	25	0.0961	1
Wi-Fi 5G UNII-3	5745-5850	9.03	7.999	27.00	501.187	25	0.5107	1

The Wi-Fi 2.4G, BT and Wi-Fi 5G can transmit simultaneously:

$$= S_{2.4G}/S_{\text{limit-2.4G}} + S_{\text{BR+EDR}}/S_{\text{limit-BR+EDR}} + S_{5G \text{ UNII-3}}/S_{\text{limit-5G UNII-3}}$$

$$= 0.1463/1 + 0.0006/1 + 0.5107/1 = 0.6576 < 1.0$$

Result: MPE evaluation meet 25 cm the requirement of standard.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 15.203 and § 15.407(a)(3),

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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2 Antenna List and Details

Brand	Model	Antenna Type	Antenna Gain (Per Channel)					Result
			5180 MHz	5260 MHz	5500 MHz	5660 MHz	5750 MHz	
AirTies	Wi-Fi Ant-1	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-2	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-3	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance
AirTies	Wi-Fi Ant-4	PCB Antenna	3.30	3.42	2.86	3.76	3.01	Compliance

Note: The EUT has an internal antenna arrangement, which was permanently attached, fulfill the requirement of this section.

Per KDB 662911 D01 Multiple Transmitter Output v02r01, for 802.11n BF mode and 802.11ac BF mode:

1. Power Directional Gain: = Antenna + $10\log(N_{ANT})$
 $= 10\log(((10^{(Ant-1)/10}) + (10^{(Ant-2)/10}) + (10^{(Ant-3)/10}) + 10^{(Ant-4)/10}))/4) + 10\log(N_{ANT})$
2. Power Density Directional Gain = Antenna + Array Gain
 $= 10\log(((10^{(Ant-1)/10}) + (10^{(Ant-2)/10}) + (10^{(Ant-3)/10}) + 10^{(Ant-4)/10}))/4) + 10\log(N_{TX}/N_{SS})$

For 802.11 n mode / ac mode with BF (Per Channel) calculated Result please refer as below table:

Frequency (MHz)	Gain (dBi)	$10\log(N_{ANT})$ / Array Gain (dBi)	Power Directional Gain (dBi)	Power Density Directional Gain (dBi)
5180	3.30	6.02	9.32	9.32
5190	3.30	6.02	9.32	9.32
5200	3.30	6.02	9.32	9.32
5210	3.30	6.02	9.32	9.32
5230	3.42	6.02	9.44	9.44
5240	3.42	6.02	9.44	9.44
5260	3.42	6.02	9.44	9.44
5270	3.42	6.02	9.44	9.44
5290	3.42	6.02	9.44	9.44
5300	3.42	6.02	9.44	9.44
5310	3.42	6.02	9.44	9.44
5500	2.86	6.02	8.88	8.88
5510	2.86	6.02	8.88	8.88
5530	2.86	6.02	8.88	8.88
5550	2.86	6.02	8.88	8.88
5580	2.86	6.02	8.88	8.88
5610	3.76	6.02	9.78	9.78
5670	3.76	6.02	9.78	9.78
5700	3.76	6.02	9.78	9.78
5745	3.01	6.02	9.03	9.03
5755	3.01	6.02	9.03	9.03
5775	3.01	6.02	9.03	9.03
5785	3.01	6.02	9.03	9.03
5795	3.01	6.02	9.03	9.03
5825	3.01	6.02	9.03	9.03

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

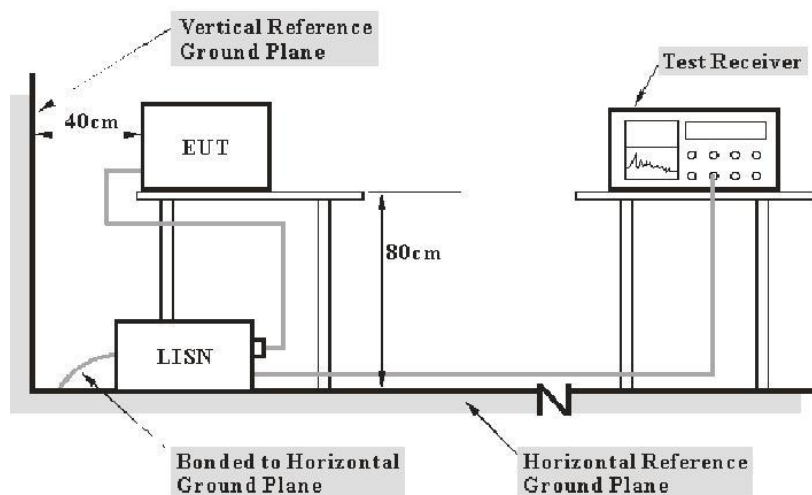
According to FCC §15.207 and §15.407(b)(6),

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 2}
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency. Note 2: A linear average detector is required

6.2 EUT Setup and Test Procedure



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	Receiver RBW
150 kHz - 30 MHz	9 kHz

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conduction Room					
LISN	Rohde & Schwarz	ENV216	101248	2018/06/27	2019/06/26
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2018/08/03	2019/08/02
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	e3	V9.150826k	N.C.R	N.C.R

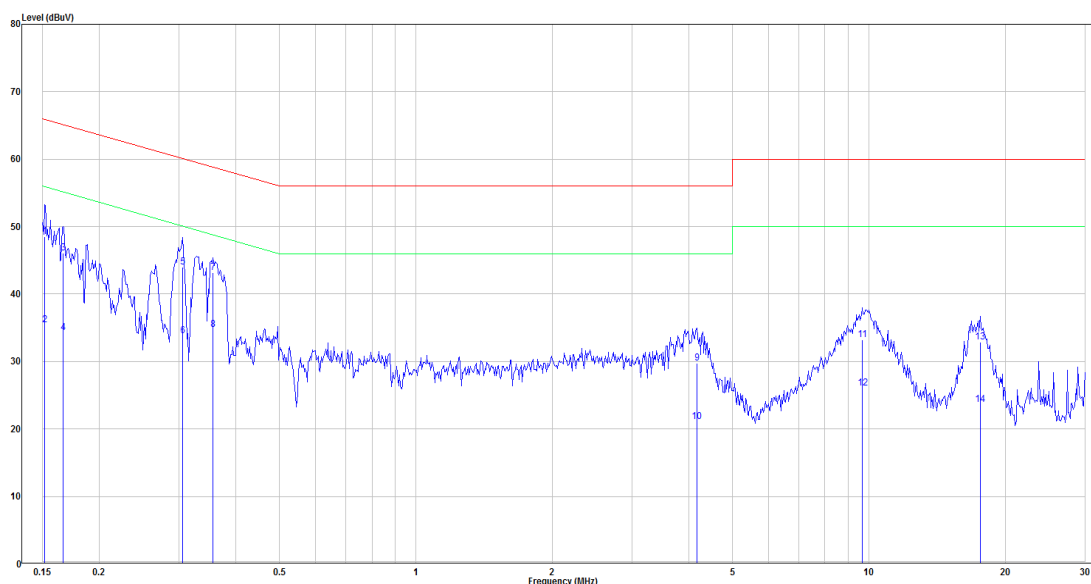
***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

6.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1010 hPa	Test Engineer:	Ray Huang
Test Date:	2018-12-07		

6.5 Test Data and Test Plot

Mode: AC 120 V/60 Hz, Wi-Fi 5G mode, Line



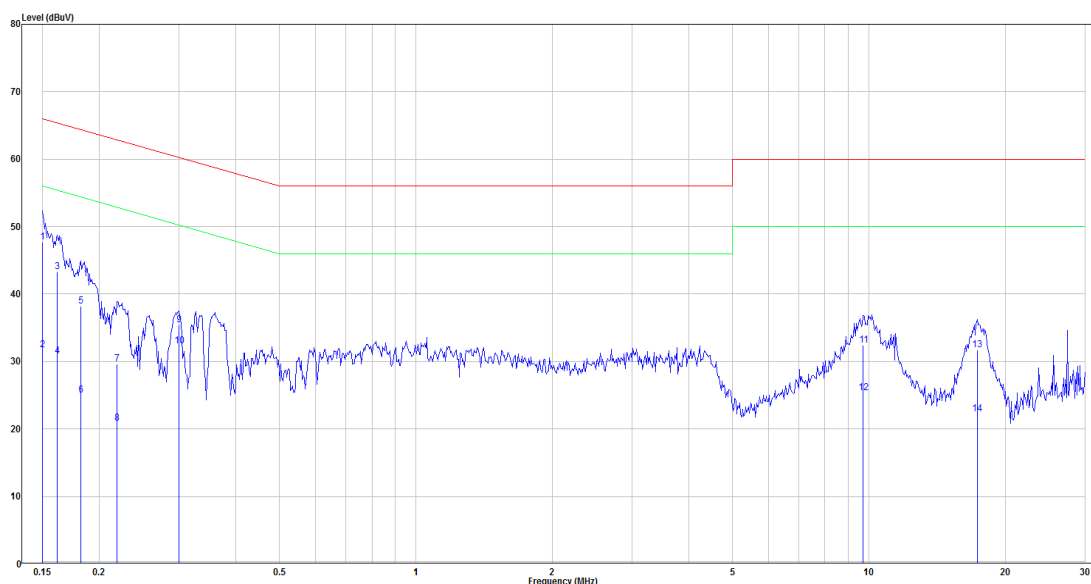
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Over limit (dB)	Remark
1	0.152	29.11	19.45	48.56	65.92	-17.36	QP
2	0.152	15.92	19.45	35.37	55.92	-20.55	Average
3	0.167	26.57	19.45	46.02	65.13	-19.11	QP
4	0.167	14.85	19.45	34.30	55.13	-20.83	Average
5	0.306	24.54	19.47	44.01	60.08	-16.07	QP
6	0.306	14.35	19.47	33.82	50.08	-16.26	Average
7	0.357	23.73	19.47	43.20	58.80	-15.60	QP
8	0.357	15.25	19.47	34.72	48.80	-14.08	Average
9	4.168	10.12	19.59	29.71	56.00	-26.29	QP
10	4.168	1.49	19.59	21.08	46.00	-24.92	Average
11	9.677	13.55	19.71	33.26	60.00	-26.74	QP
12	9.677	6.30	19.71	26.01	50.00	-23.99	Average
13	17.600	13.08	19.78	32.86	60.00	-27.14	QP
14	17.600	3.89	19.78	23.67	50.00	-26.33	Average

Note:

$Level = Read\ Level + Factor$

$Over\ Limit\ (Margin) = Level - Limit\ Line$

$Factor = (LISN, ISN, PLC\ or\ current\ probe)\ Factor + Cable\ Loss + Attenuator$

Mode: AC 120V/60 Hz, Wi-Fi 5G mode, Line

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Over limit (dB)	Remark
1	0.150	28.30	19.44	47.74	66.00	-18.26	QP
2	0.150	12.28	19.44	31.72	56.00	-24.28	Average
3	0.162	23.89	19.45	43.34	65.38	-22.04	QP
4	0.162	11.35	19.45	30.80	55.38	-24.58	Average
5	0.182	18.76	19.45	38.21	64.39	-26.18	QP
6	0.182	5.50	19.45	24.95	54.39	-29.44	Average
7	0.219	10.22	19.46	29.68	62.85	-33.17	QP
8	0.219	1.43	19.46	20.89	52.85	-31.96	Average
9	0.300	16.02	19.46	35.48	60.25	-24.77	QP
10	0.300	12.88	19.46	32.34	50.25	-17.91	Average
11	9.725	12.66	19.71	32.37	60.00	-27.63	QP
12	9.725	5.63	19.71	25.34	50.00	-24.66	Average
13	17.338	11.87	19.80	31.67	60.00	-28.33	QP
14	17.338	2.46	19.80	22.26	50.00	-27.74	Average

Note:

$Level = Read\ Level + Factor$

$Over\ Limit\ (Margin) = Level - Limit\ Line$

$Factor = (LISN, ISN, PLC\ or\ current\ probe)\ Factor + Cable\ Loss + Attenuator$

7 FCC §15.209, §15.205 & §15.407(b) – Unwanted Emission

7.1 Applicable Standard

According to FCC §15.407(b),

Undesirable emission limits. Except as shown in paragraph (b) (7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (4) For transmitters operating in the 5.725-5.85 GHz band:
 - (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
 - (ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

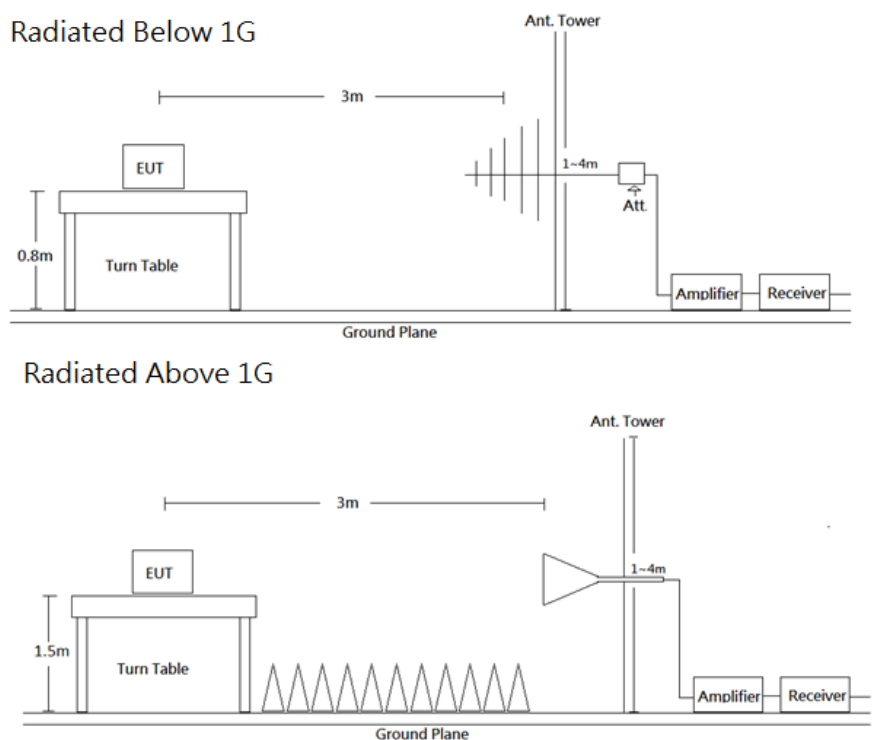
MHz	MHz	MHz	GHz
0.090-0.110	13.36-13.41	399.9-410	4.5-5.15
0.495-0.505	16.42-16.423	608-614	5.35-5.46
2.1735-2.1905	16.69475-16.69525	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

7.2 EUT Setup and Test Procedure



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.407 Limits.

The system was investigated from 30 MHz to 40 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Detector	Duty cycle	Measurement method
30-1000 MHz	120 kHz	/	QP	-	QP
Above 1 GHz	1 MHz	3 MHz	PK	-	PK
	1 MHz	3 MHz	RMS	>98%	Ave
	1 MHz	1/T	PK	<98%	Ave

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
966A Room					
Active Loop Antenna	ETS-Lindgren	6502	00035796	2019/03/12	2020/03/11
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2018/12/11	2019/12/10
Horn Antenna	EMCO	3115	9311-4158	2018/04/20	2019/04/19
Horn Antenna	EMCO	3115	9311-4158	2019/04/17	2020/04/16
Horn Antenna	ETS-Lindgren	3116	62638	2018/08/29	2019/08/28
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2018/12/07	2019/12/06
Microwave Preamplifier	EM Electronics Corporation	EM18G40G	060656	2019/01/11	2020/01/10
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2018/10/23	2019/10/22
Spectrum Analyzer	Spectrum Analyzer	FSV40	101435	2019/02/11	2020/02/10
Micro flex Cable	UTIFLEX	FSCM 64639 / (2M)	93D0127	2018/07/31	2019/07/30
Micro flex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-002	2018/11/06	2019/11/05
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2019/03/04	2020/03/03
Micro flex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2019/01/16	2020/01/15
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	60772	N.C.R	N.C.R
Software	AUDIX	e3	E3LK-01	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2017/11/15	2018/11/14
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

7.4 Test Environmental Conditions

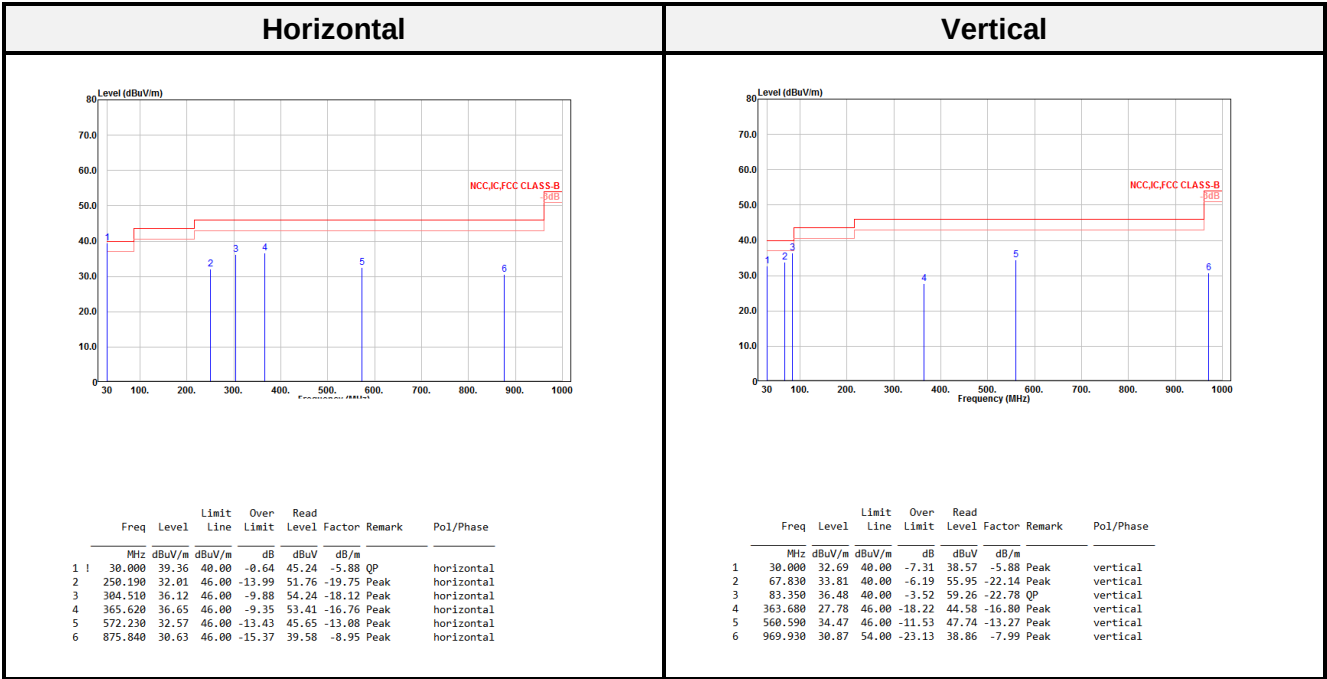
Temperature:	25°C	Relative Humidity:	45 %
ATM Pressure:	1014hPa	Test Engineer:	Leo Chang
Test Date:	2019-04-24~2019-05-24	-	-

7.5 Test Data and Test Plot

Wi-Fi 5G Mode:

Transmitting mode (Pre-scan with three orthogonal axis, and worse case as X axis)

Below 1G (30 MHz-1 GHz) test the output power worst mode



Level = Read Level + Factor

Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

Above 1G (1 GHz-40 GHz) in UNII-2a:**802.11a mode:**

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5142.900	46.68	54.00	-7.32	47.85	-1.17	Average	5107.800	45.46	54.00	-8.54	46.53	-1.07	Average
5142.900	60.02	74.00	-13.98	61.19	-1.17	Peak	5107.800	59.24	74.00	-14.76	60.31	-1.07	Peak
5258.400	104.10			105.34	-1.24	Average	5266.500	92.04			93.29	-1.25	Average
5258.400	114.70			115.94	-1.24	Peak	5266.500	102.49			103.74	-1.25	Peak
5354.700	47.22	54.00	-6.78	48.77	-1.55	Average	5376.900	45.30	54.00	-8.70	46.94	-1.64	Average
5354.700	60.70	74.00	-13.30	62.25	-1.55	Peak	5376.900	59.32	74.00	-14.68	60.96	-1.64	Peak
10520.000	49.47	68.20	-18.73	42.83	6.64	Peak	10520.000	50.33	68.20	-17.87	43.69	6.64	Peak
15780.000	43.01	54.00	-10.99	32.46	10.55	Average	15780.000	44.77	54.00	-9.23	34.22	10.55	Average
15780.000	56.99	74.00	-17.01	46.44	10.55	Peak	15780.000	56.50	74.00	-17.50	45.95	10.55	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5136.900	46.57	54.00	-7.43	47.74	-1.17	Average	5111.400	45.54	54.00	-8.46	46.62	-1.08	Average
5136.900	60.03	74.00	-13.97	61.20	-1.17	Peak	5111.400	57.23	74.00	-16.77	58.31	-1.08	Peak
5306.700	104.30			105.64	-1.34	Average	5302.500	92.43	54.00	38.43	93.75	-1.32	Average
5306.700	114.42			115.76	-1.34	Peak	5302.500	100.54			101.86	-1.32	Peak
5359.500	49.29	54.00	-4.71	50.86	-1.57	Average	5378.100	45.01			46.65	-1.64	Average
5359.500	63.63	74.00	-10.37	65.20	-1.57	Peak	5378.100	57.06	74.00	-16.94	58.70	-1.64	Peak
10600.000	36.05	54.00	-17.95	29.34	6.71	Average	10600.000	36.31	54.00	-17.69	29.60	6.71	Average
10600.000	49.76	74.00	-24.24	43.05	6.71	Peak	10600.000	49.68	74.00	-24.32	42.97	6.71	Peak
15900.000	44.31	54.00	-9.69	34.25	10.06	Average	15900.000	44.27	54.00	-9.73	34.21	10.06	Average
15900.000	57.54	74.00	-16.46	47.48	10.06	Peak	15900.000	58.84	74.00	-15.16	48.78	10.06	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5318.190	103.84			105.22	-1.38	Average	5326.520	91.63			93.05	-1.42	Average
5318.190	113.93			115.31	-1.38	Peak	5326.520	102.09			103.51	-1.42	Peak
5350.390	53.06	54.00	-0.94	54.59	-1.53	Average	5351.720	46.26	54.00	-7.74	47.80	-1.54	Average
5350.390	70.54	74.00	-3.46	72.07	-1.53	Peak	5351.720	61.55	74.00	-12.45	63.09	-1.54	Peak
10640.000	36.47	54.00	-17.53	29.73	6.74	Average	10640.000	36.41	54.00	-17.59	29.67	6.74	Average
10640.000	49.54	74.00	-24.46	42.80	6.74	Peak	10640.000	51.63	74.00	-22.37	44.89	6.74	Peak
15960.000	43.82	54.00	-10.18	33.82	10.00	Average	15960.000	43.84	54.00	-10.16	33.84	10.00	Average
15960.000	56.48	74.00	-17.52	46.48	10.00	Peak	15960.000	57.83	74.00	-16.17	47.83	10.00	Peak

802.11ac VHT20-BF mode:

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5107.600	51.52	54.00	-2.48	50.79	0.73	Average	5080.800	49.90	54.00	-4.10	49.10	0.80	Average
5107.600	65.58	74.00	-8.42	64.85	0.73	Peak	5080.800	63.20	74.00	-10.80	62.40	0.80	Peak
5266.400	110.87			110.40	0.47	Average	5266.400	98.69			98.22	0.47	Average
5266.400	121.37			120.90	0.47	Peak	5266.400	108.03			107.56	0.47	Peak
5362.000	51.66	54.00	-2.34	51.40	0.26	Average	5371.200	47.52	54.00	-6.48	47.30	0.22	Average
5362.000	64.60	74.00	-9.40	64.34	0.26	Peak	5371.200	63.33	74.00	-10.67	63.11	0.22	Peak
10520.000	53.52	68.20	-14.68	44.60	8.92	Peak	10520.000	53.18	68.20	-15.02	44.26	8.92	Peak
15780.000	47.98	54.00	-6.02	33.99	13.99	Average	15780.000	47.95	54.00	-6.05	33.96	13.99	Average
15780.000	61.97	74.00	-12.03	47.98	13.99	Peak	15780.000	61.94	74.00	-12.06	47.95	13.99	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5133.200	51.85	54.00	-2.15	51.17	0.68	Average	5135.600	50.17	54.00	-3.83	49.49	0.68	Average
5133.200	64.66	74.00	-9.34	63.98	0.68	Peak	5135.600	63.15	74.00	-10.85	62.47	0.68	Peak
5294.800	111.28			110.85	0.43	Average	5295.200	101.58			101.15	0.43	Average
5294.800	120.50			120.07	0.43	Peak	5295.200	112.53			112.10	0.43	Peak
5374.400	53.10	54.00	-0.90	52.90	0.20	Average	5406.000	49.94	54.00	-4.06	49.87	0.07	Average
5374.400	65.40	74.00	-8.60	65.20	0.20	Peak	5406.000	63.74	74.00	-10.26	63.67	0.07	Peak
10600.000	42.18	54.00	-11.82	32.91	9.27	Average	10600.000	40.12	54.00	-13.88	30.85	9.27	Average
10600.000	54.22	74.00	-19.78	44.95	9.27	Peak	10600.000	53.85	74.00	-20.15	44.58	9.27	Peak
15900.000	48.08	54.00	-5.92	34.36	13.72	Average	15900.000	47.69	54.00	-6.31	33.97	13.72	Average
15900.000	62.08	74.00	-11.92	48.36	13.72	Peak	15900.000	63.18	74.00	-10.82	49.46	13.72	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5325.540	109.25			108.85	0.40	Average	5324.840	102.37			101.98	0.39	Average
5325.540	120.78			120.38	0.40	Peak	5324.840	113.52			113.13	0.39	Peak
5350.180	53.72	54.00	-0.28	53.41	0.31	Average	5350.320	50.65	54.00	-3.35	50.34	0.31	Average
5350.180	73.25	74.00	-0.75	72.94	0.31	Peak	5350.320	64.56	74.00	-9.44	64.25	0.31	Peak
10640.000	41.21	54.00	-12.79	31.36	9.85	Average	10640.000	40.49	54.00	-13.51	30.64	9.85	Average
10640.000	55.42	74.00	-18.58	45.57	9.85	Peak	10640.000	53.37	74.00	-20.63	43.52	9.85	Peak
15960.000	47.58	54.00	-6.42	34.10	13.48	Average	15960.000	48.21	54.00	-5.79	34.73	13.48	Average
15960.000	61.68	74.00	-12.32	48.20	13.48	Peak	15960.000	62.01	74.00	-11.99	48.53	13.48	Peak

802.11ac VHT40-BF mode:

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5114.800	53.46	54.00	-0.54	52.74	0.72	Average	5118.400	51.12	54.00	-2.88	50.41	0.71	Average
5114.800	67.47	74.00	-6.53	66.75	0.72	Peak	5118.400	64.89	74.00	-9.11	64.18	0.71	Peak
5276.000	106.67	54.00			0.44	Average	5262.400	99.60	54.00			0.49	Average
5276.000	117.96	74.00			0.44	Peak	5262.400	110.82	74.00			0.49	Peak
5437.600	53.56	54.00	-0.44	53.47	0.09	Average	5424.000	50.46	54.00	-3.54	50.39	0.07	Average
5437.600	66.83	74.00	-7.17	66.74	0.09	Peak	5424.000	64.69	74.00	-9.31	64.62	0.07	Peak
10540.000	55.78	68.20	-12.42	46.94	8.84	Peak	10540.000	54.41	68.20	-13.79	45.57	8.84	Peak
15810.000	46.32	54.00	-7.68	32.45	13.87	Average	15810.000	46.37	54.00	-7.63	32.50	13.87	Average
15810.000	61.04	74.00	-12.96	47.17	13.87	Peak	15810.000	60.22	74.00	-13.78	46.35	13.87	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5295.440	101.63	54.00			0.43	Average	5300.560	95.05	54.00			0.43	Average
5295.440	112.67	74.00			0.43	Peak	5300.560	107.13	74.00			0.43	Peak
5353.040	53.51	54.00	-0.49	53.21	0.30	Average	5355.760	50.06	54.00	-3.94	49.79	0.27	Average
5353.040	73.42	74.00	-0.58	73.12	0.30	Peak	5355.760	64.47	74.00	-9.53	64.20	0.27	Peak
10620.000	39.79	54.00	-14.21	30.14	9.65	Average	10620.000	41.18	54.00	-12.82	31.53	9.65	Average
10620.000	54.98	74.00	-19.02	45.33	9.65	Peak	10620.000	55.22	74.00	-18.78	45.57	9.65	Peak
15930.000	47.72	54.00	-6.28	34.12	13.60	Average	15930.000	47.89	54.00	-6.11	34.29	13.60	Average
15930.000	62.73	74.00	-11.27	49.13	13.60	Peak	15930.000	63.22	74.00	-10.78	49.62	13.60	Peak

802.11ac VHT80-BF mode:

Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5138.800	50.84	54.00	-3.16	50.17	0.67	Average	5142.400	50.22	54.00	-3.78	49.55	0.67	Average
5138.800	64.59	74.00	-9.41	63.92	0.67	Peak	5142.400	64.15	74.00	-9.85	63.48	0.67	Peak
5261.200	92.12			91.63	0.49	Average	5299.600	93.11			92.68	0.43	Average
5261.200	113.74			113.25	0.49	Peak	5299.600	104.18			103.75	0.43	Peak
5358.000	53.53	54.00	-0.47	53.27	0.26	Average	5359.600	50.39	54.00	-3.61	50.12	0.27	Average
5358.000	72.10	74.00	-1.90	71.84	0.26	Peak	5359.600	63.40	74.00	-10.60	63.13	0.27	Peak
10594.000	52.69	68.20	-15.51	43.54	9.15	Peak	10580.000	52.68	68.20	-15.52	43.79	8.89	Peak
15870.000	48.58	54.00	-5.42	34.78	13.80	Average	15870.000	48.55	54.00	-5.45	34.75	13.80	Average
15870.000	61.89	74.00	-12.11	48.09	13.80	Peak	15870.000	63.38	74.00	-10.62	49.58	13.80	Peak

Above 1G (1 GHz-40 GHz) in UNII-2c:**802.11a mode:**

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5470.000	53.22	54.00	-0.78	54.81	-1.59	Average	5467.040	47.81	54.00	-6.19	49.40	-1.59	Average
5470.000	72.16	74.00	-1.84	73.75	-1.59	Peak	5467.040	65.11	74.00	-8.89	66.70	-1.59	Peak
5498.240	102.66			104.19	-1.53	Average	5498.320	93.25			94.78	-1.53	Average
5498.240	113.44			114.97	-1.53	Peak	5498.320	103.94			105.47	-1.53	Peak
11000.000	35.61	54.00	-18.39	28.37	7.24	Average	11000.000	35.91	54.00	-18.09	28.67	7.24	Average
11000.000	48.84	74.00	-25.16	41.60	7.24	Peak	11000.000	48.92	74.00	-25.08	41.68	7.24	Peak
16500.000	55.12	68.20	-13.08	45.07	10.05	Peak	16500.000	54.52	68.20	-13.68	44.47	10.05	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5464.880	46.03	54.00	-7.97	47.62	-1.59	Average	5450.480	45.24	54.00	-8.76	46.84	-1.60	Average
5464.880	59.65	74.00	-14.35	61.24	-1.59	Peak	5450.480	58.28	74.00	-15.72	59.88	-1.60	Peak
5575.920	102.76			103.99	-1.23	Average	5586.800	93.11			94.30	-1.19	Average
5575.920	113.29			114.52	-1.23	Peak	5586.800	103.43			104.62	-1.19	Peak
5744.240	53.19	54.00	-0.81	53.65	-0.46	Average	5735.280	47.83	54.00	-6.17	48.30	-0.47	Average
5744.240	66.18	74.00	-7.82	66.64	-0.46	Peak	5735.280	60.78	74.00	-13.22	61.25	-0.47	Peak
11160.000	36.06	54.00	-17.94	28.75	7.31	Average	11160.000	36.06	54.00	-17.94	28.75	7.31	Average
11160.000	49.77	74.00	-24.23	42.46	7.31	Peak	11160.000	50.64	74.00	-23.36	43.33	7.31	Peak
16740.000	56.90	68.20	-11.30	45.45	11.45	Peak	16740.000	56.55	68.20	-11.65	45.10	11.45	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5698.220	99.33			99.83	-0.50	Average	5695.640	91.73			92.25	-0.52	Average
5698.220	110.45			110.95	-0.50	Peak	5695.640	102.70			103.22	-0.52	Peak
5725.040	67.68	68.20	-0.52	68.16	-0.48	Peak	5726.720	65.23	68.20	-2.97	65.71	-0.48	Peak
11400.000	36.43	54.00	-17.57	28.59	7.84	Average	11400.000	37.36	54.00	-16.64	29.52	7.84	Average
11400.000	49.64	74.00	-24.36	41.80	7.84	Peak	11400.000	51.14	74.00	-22.86	43.30	7.84	Peak
17100.000	55.87	68.20	-12.33	43.77	12.10	Peak	17100.000	56.16	68.20	-12.04	44.06	12.10	Peak

802.11ac VHT20-BF mode:

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5469.630	53.14	54.00	-0.86	52.99	0.15	Average	5468.310	50.11	54.00	-3.89	49.96	0.15	Average
5469.630	73.12	74.00	-0.88	72.97	0.15	Peak	5468.310	66.06	74.00	-7.94	65.91	0.15	Peak
5494.050	102.86			102.65	0.21	Average	5504.830	99.64			99.41	0.23	Average
5494.050	115.24			115.03	0.21	Peak	5504.830	110.92			110.69	0.23	Peak
11000.000	41.19	54.00	-12.81	31.46	9.73	Average	11000.000	41.31	54.00	-12.69	31.58	9.73	Average
11000.000	55.47	74.00	-18.53	45.74	9.73	Peak	11000.000	54.24	74.00	-19.76	44.51	9.73	Peak
16500.000	61.78	68.20	-6.42	47.63	14.15	Peak	16500.000	59.75	68.20	-8.45	45.60	14.15	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5425.460	53.36	54.00	-0.64	53.28	0.08	Average	5468.020	49.96	54.00	-4.04	49.81	0.15	Average
5425.460	66.47	74.00	-7.53	66.39	0.08	Peak	5468.020	63.80	74.00	-10.20	63.65	0.15	Peak
5575.560	103.90			103.33	0.57	Average	5575.180	96.19			95.62	0.57	Average
5575.560	117.64			117.07	0.57	Peak	5575.180	106.06			105.49	0.57	Peak
5734.780	53.83	54.00	-0.17	52.37	1.46	Average	5776.580	51.31	54.00	-2.69	49.81	1.50	Average
5734.780	67.22	74.00	-6.78	65.76	1.46	Peak	5776.580	64.98	74.00	-9.02	63.48	1.50	Peak
11160.000	42.66	54.00	-11.34	32.46	10.20	Average	11160.000	40.75	54.00	-13.25	30.55	10.20	Average
11160.000	54.84	74.00	-19.16	44.64	10.20	Peak	11160.000	54.35	74.00	-19.65	44.15	10.20	Peak
16740.000	60.39	68.20	-7.81	45.25	15.14	Peak	16740.000	60.77	68.20	-7.43	45.63	15.14	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5694.510	107.99			106.60	1.39	Average	5705.620	97.76			96.32	1.44	Average
5694.510	118.42			117.03	1.39	Peak	5705.620	108.76			107.32	1.44	Peak
5776.680	53.10	54.00	-0.90	51.60	1.50	Average	5743.570	51.16	54.00	-2.84	49.69	1.47	Average
5776.680	67.41	74.00	-6.59	65.91	1.50	Peak	5743.570	65.16	74.00	-8.84	63.69	1.47	Peak
11400.000	42.23	54.00	-11.77	31.41	10.82	Average	11400.000	42.07	54.00	-11.93	31.25	10.82	Average
11400.000	56.13	74.00	-17.87	45.31	10.82	Peak	11400.000	55.73	74.00	-18.27	44.91	10.82	Peak
17100.000	61.16	68.20	-7.04	45.14	16.02	Peak	17100.000	60.64	68.20	-7.56	44.62	16.02	Peak

802.11ac VHT40-BF mode:

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5469.290	53.28	54.00	-0.72	53.13	0.15	Average	5467.860	49.81	54.00	-4.19	49.66	0.15	Average
5469.290	73.40	74.00	-0.60	73.25	0.15	Peak	5467.860	67.51	74.00	-6.49	67.36	0.15	Peak
5505.950	102.64			102.40	0.24	Average	5517.260	94.79			94.51	0.28	Average
5505.950	114.26			114.02	0.24	Peak	5517.260	105.49			105.21	0.28	Peak
11020.000	39.71	54.00	-14.29	29.85	9.86	Average	11020.000	40.34	54.00	-13.66	30.48	9.86	Average
11020.000	53.91	74.00	-20.09	44.05	9.86	Peak	11020.000	53.87	74.00	-20.13	44.01	9.86	Peak
16530.000	59.33	68.20	-8.87	45.07	14.26	Peak	16530.000	61.57	68.20	-6.63	47.31	14.26	Peak

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5403.420	53.29	54.00	-0.71	53.21	0.08	Average	5388.600	50.46	54.00	-3.54	50.32	0.14	Average
5403.420	66.79	74.00	-7.21	66.71	0.08	Peak	5388.600	63.89	74.00	-10.11	63.75	0.14	Peak
5561.880	102.84			102.34	0.50	Average	5542.500	96.77			96.36	0.41	Average
5561.880	113.38			112.88	0.50	Peak	5542.500	108.00			107.60	0.40	Peak
5724.140	52.97	54.00	-1.03	51.53	1.44	Average	5720.340	51.32	54.00	-2.68	49.88	1.44	Average
5724.140	66.54	74.00	-7.46	65.10	1.44	Peak	5720.340	65.11	74.00	-8.89	63.67	1.44	Peak
11100.000	39.78	54.00	-14.22	29.54	10.24	Average	11100.000	39.69	54.00	-14.31	29.45	10.24	Average
11100.000	54.44	74.00	-19.56	44.20	10.24	Peak	11100.000	54.67	74.00	-19.33	44.43	10.24	Peak
16650.000	60.32	68.20	-7.88	45.76	14.56	Peak	16650.000	61.40	68.20	-6.80	46.84	14.56	Peak

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5683.500	101.78			100.47	1.31	Average	5663.200	95.48			94.34	1.14	Average
5683.500	113.02			111.71	1.31	Peak	5663.200	106.73			105.59	1.14	Peak
5728.100	68.04	68.20	-0.16	66.59	1.45	Peak	5726.400	65.96	68.20	-2.24	64.51	1.45	Peak
11340.000	42.11	54.00	-11.89	31.58	10.53	Average	11340.000	41.82	54.00	-12.18	31.29	10.53	Average
11340.000	54.78	74.00	-19.22	44.25	10.53	Peak	11340.000	54.14	74.00	-19.86	43.61	10.53	Peak
17010.000	60.33	68.20	-7.87	45.17	15.16	Peak	17010.000	61.01	68.20	-7.19	45.85	15.16	Peak

802.11ac VHT80-BF mode:

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5465.140	53.13	54.00	-0.87	52.98	0.15	Average	5468.920	50.69	54.00	-3.31	50.54	0.15	Average
5465.140	72.04	74.00	-1.96	71.89	0.15	Peak	5468.920	70.24	74.00	-3.76	70.09	0.15	Peak
5514.700	99.45			99.18	0.27	Average	5492.860	92.76			92.55	0.21	Average
5514.700	111.23			110.96	0.27	Peak	5492.860	106.89			106.68	0.21	Peak
11060.000	39.69	54.00	-14.31	29.58	10.11	Average	11060.000	39.45	54.00	-14.55	29.34	10.11	Average
11060.000	53.95	74.00	-20.05	43.84	10.11	Peak	11060.000	53.61	74.00	-20.39	43.50	10.11	Peak
16590.000	59.67	68.20	-8.53	45.34	14.33	Peak	16590.000	60.68	68.20	-7.52	46.35	14.33	Peak

802.11ac VHT80-BF mode:

High CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5422.500	51.64	54.00	-2.36	51.57	0.07	Average	5403.600	49.58	54.00	-4.42	49.50	0.08	Average
5422.500	64.62	74.00	-9.38	64.55	0.07	Peak	5403.600	63.82	74.00	-10.18	63.74	0.08	Peak
5587.650	99.59			98.96	0.63	Average	5575.950	91.02			90.44	0.58	Average
5587.650	113.28			112.65	0.63	Peak	5575.950	105.83			105.25	0.58	Peak
5742.000	66.87	68.20	-1.33	65.41	1.46	Peak	5748.300	65.30	68.20	-2.90	63.83	1.47	Peak
11220.000	41.17	54.00	-12.83	30.98	10.19	Average	11220.000	39.84	54.00	-14.16	29.65	10.19	Average
11220.000	54.01	74.00	-19.99	43.82	10.19	Peak	11220.000	54.34	74.00	-19.66	44.15	10.19	Peak
16830.000	60.56	68.20	-7.64	45.71	14.85	Peak	16830.000	59.70	68.20	-8.50	44.85	14.85	Peak

Above 1G (1 GHz-40 GHz) in Straddle channel:**802.11a mode:**

Low CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5458.400	47.66	54.00	-6.34	47.52	0.14	Average	5454.200	47.77	54.00	-6.23	47.65	0.12	Average
5458.400	60.55	74.00	-13.45	60.41	0.14	Peak	5454.200	60.44	74.00	-13.56	60.32	0.12	Peak
5463.200	60.83	68.20	-7.37	60.69	0.14	Peak	5466.200	60.69	68.20	-7.51	60.54	0.15	Peak
5715.800	103.34			101.89	1.45	Average	5717.000	95.30			93.86	1.44	Average
5715.800	117.43			115.98	1.45	Peak	5717.000	105.96			104.52	1.44	Peak
5873.000	66.91	68.20	-1.29	64.71	2.20	Peak	5931.800	64.25	68.20	-3.95	61.71	2.54	Peak
11440.000	40.84	54.00	-13.16	29.83	11.01	Average	11440.000	40.32	54.00	-13.68	29.31	11.01	Average
11440.000	54.24	74.00	-19.76	43.23	11.01	Peak	11440.000	53.17	74.00	-20.83	42.16	11.01	Peak
17160.000	60.53	68.20	-7.67	44.41	16.12	Peak	17160.000	60.70	68.20	-7.50	44.58	16.12	Peak

802.11ac VHT20 mode:

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5445.800	50.02	54.00	-3.98	49.91	0.11	Average	5422.400	49.79	54.00	-4.21	49.72	0.07	Average
5445.800	63.04	74.00	-10.96	62.93	0.11	Peak	5422.400	62.82	74.00	-11.18	62.75	0.07	Peak
5460.200	62.77	68.20	-5.43	62.63	0.14	Peak	5463.800	63.08	68.20	-5.12	62.94	0.14	Peak
5724.800	108.01			106.57	1.44	Average	5715.800	97.30			95.85	1.45	Average
5724.800	117.71			116.27	1.44	Peak	5715.800	107.26			105.81	1.45	Peak
5874.800	67.93	68.20	-0.27	65.70	2.23	Peak	5866.400	66.25	68.20	-1.95	64.12	2.13	Peak
11440.000	42.55	54.00	-11.45	31.54	11.01	Average	11440.000	42.66	54.00	-11.34	31.65	11.01	Average
11440.000	56.62	74.00	-17.38	45.61	11.01	Peak	11440.000	56.22	74.00	-17.78	45.21	11.01	Peak
17160.000	62.33	68.20	-5.87	46.21	16.12	Peak	17160.000	61.11	68.20	-7.09	44.99	16.12	Peak

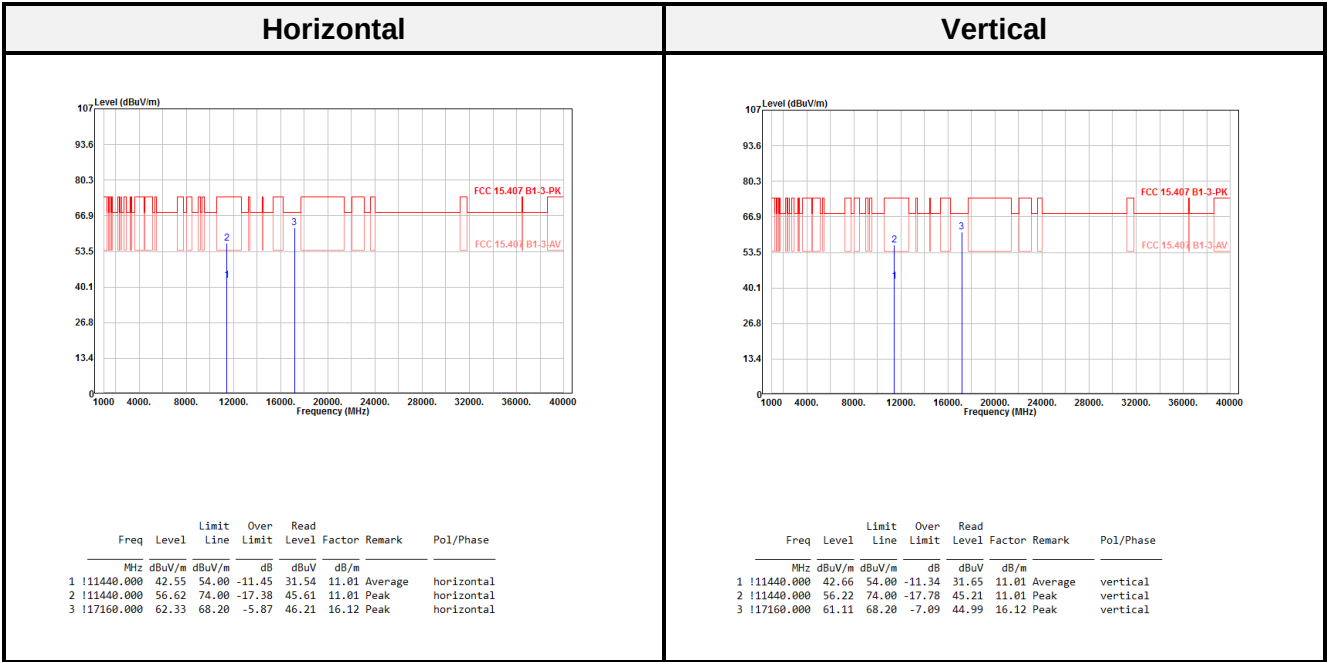
802.11ac VHT40 mode:

Middle CH													
Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5457.800	53.34	54.00	-0.66	53.21	0.13	Average	5430.800	50.17	54.00	-3.83	50.09	0.08	Average
5457.800	64.89	74.00	-9.11	64.76	0.13	Peak	5430.800	63.55	74.00	-10.45	63.47	0.08	Peak
5461.400	65.43	68.20	-2.77	65.29	0.14	Peak	5467.400	63.50	68.20	-4.70	63.35	0.15	Peak
5717.000	106.87			105.43	1.44	Average	5702.600	96.63			95.20	1.43	Average
5717.000	117.35			115.91	1.44	Peak	5702.600	107.06			105.63	1.43	Peak
5881.400	68.08	68.20	-0.12	65.79	2.29	Peak	6005.000	66.29	68.20	-1.91	63.82	2.47	Peak
11420.000	42.57	54.00	-11.43	31.59	10.98	Average	11420.000	42.30	54.00	-11.70	31.32	10.98	Average
11420.000	55.23	74.00	-18.77	44.25	10.98	Peak	11420.000	54.22	74.00	-19.78	43.24	10.98	Peak
17130.000	61.65	68.20	-6.55	45.45	16.20	Peak	17130.000	61.51	68.20	-6.69	45.31	16.20	Peak

802.11ac VHT80 mode:

Horizontal							Vertical						
Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Remark
MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	
5426.000	51.87	54.00	-2.13	51.79	0.08	Average	5446.400	50.04	54.00	-3.96	49.93	0.11	Average
5426.000	64.77	74.00	-9.23	64.69	0.08	Peak	5446.400	63.84	74.00	-10.16	63.73	0.11	Peak
5465.000	65.03	68.20	-3.17	64.88	0.15	Peak	5465.600	62.91	68.20	-5.29	62.76	0.15	Peak
5667.200	102.79			101.62	1.17	Average	5700.800	92.28			90.85	1.43	Average
5667.200	115.27			114.10	1.17	Peak	5700.800	104.65			103.22	1.43	Peak
5888.000	67.37	68.20	-0.83	65.00	2.37	Peak	5903.600	66.77	68.20	-1.43	64.26	2.51	Peak
11220.000	41.17	54.00	-12.83	30.98	10.19	Average	11220.000	39.84	54.00	-14.16	29.65	10.19	Average
11220.000	54.01	74.00	-19.99	43.82	10.19	Peak	11220.000	54.34	74.00	-19.66	44.15	10.19	Peak
16830.000	60.56	68.20	-7.64	45.71	14.85	Peak	16830.000	59.70	68.20	-8.50	44.85	14.85	Peak

Above 1G (1 GHz-40 GHz): test the worst mode: Straddle channel VHT20



Level = Read Level + Factor

Over Limit = Level – Limit

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

Spurious emissions more than 20 dB below the limit were not reported

8 FCC §15.407(a)(e) –Emission Bandwidth and Occupied Bandwidth

8.1 Applicable Standard

According to FCC §15.407(a),

The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less.

Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

As per FCC §15.407(e): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

8.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,

Emission Bandwidth (EBW)

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 maximum 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% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geq 3 \cdot$ RBW
5. 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.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. 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.

8.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

8.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Test Date:	2019-01-31 to 2019-06-04		

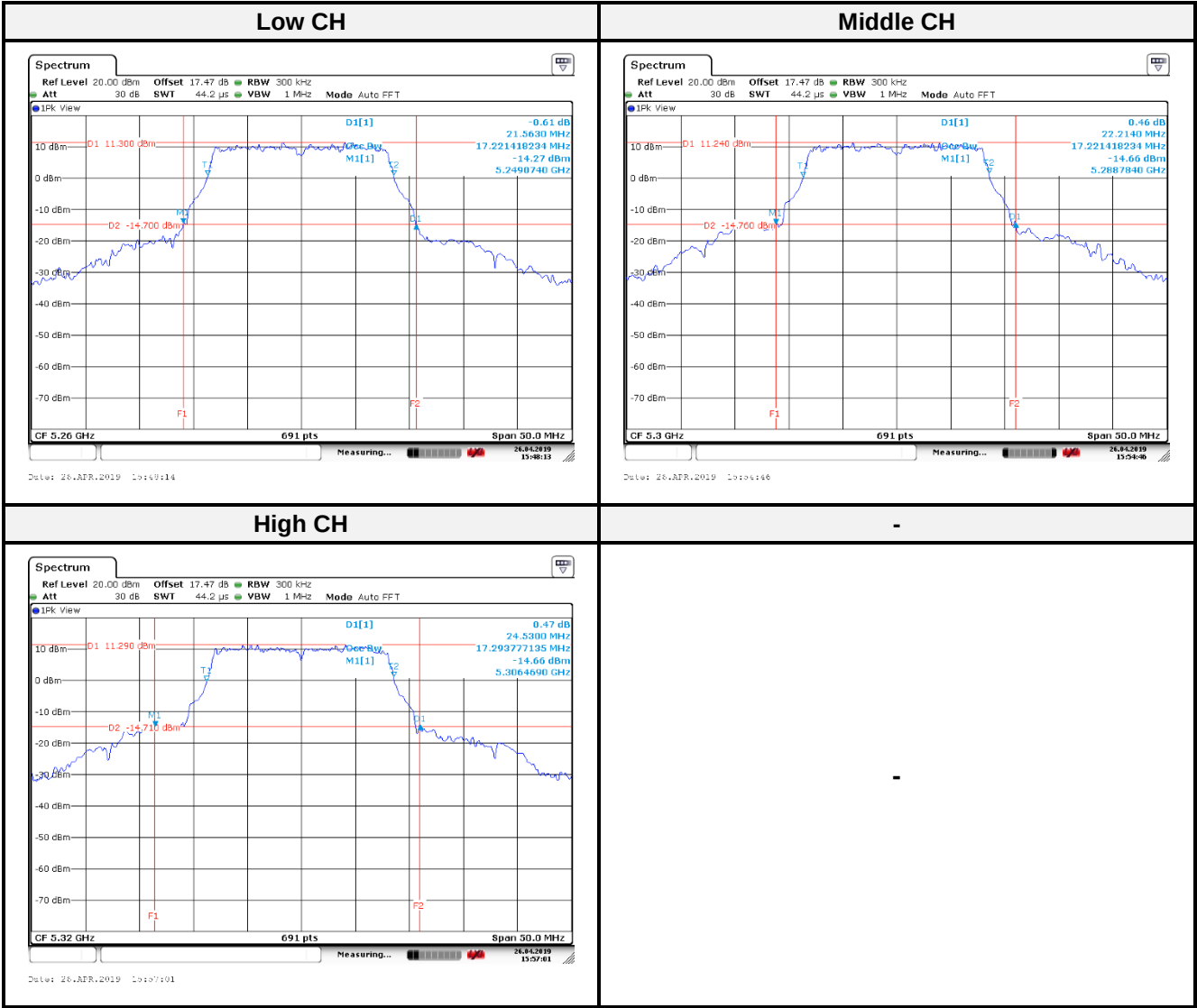
8.5 Test Data and Test Plot

UNII Band	Mode	Channel	Frequency (MHz)	26dB Emission Bandwidth (MHz)			
				Chain 0	Chain 1	Chain 2	Chain 3
UNII-2a	802.11a	52	5260	21.56	-	-	-
		60	5300	22.21	-	-	-
		64	5320	24.53	-	-	-
UNII-2c		100	5500	21.49	-	-	-
		116	5580	24.89	-	-	-
		140	5700	21.34	-	-	-
Straddle		144	5720	22.72	-	-	-
UNII-2a	802.11ac20	52	5260	21.41	21.70	21.70	21.63
		60	5300	21.70	21.78	21.78	21.41
		64	5320	21.49	21.63	21.78	21.70
UNII-2c		100	5500	21.20	21.41	21.34	21.27
		116	5580	21.27	21.70	21.20	21.49
		140	5700	21.41	21.41	21.49	21.34
Straddle		144	5720	16.12	16.00	16.00	16.00
UNII-2a	802.11ac 40	54	5270	40.52	41.22	41.33	41.33
		62	5310	40.98	41.10	41.33	41.22
		102	5510	40.64	41.45	41.22	40.87
UNII-2c		110	5550	41.33	41.22	41.10	40.98
		134	5670	40.98	41.22	41.33	40.98
		Straddle	142	5710	35.90	35.55	35.47
UNII-2a		802.11ac 80	58	5290	85.44	84.52	84.75
UNII-2c	106		5530	85.67	84.98	84.52	84.75
Straddle	138		5690	77.35	77.49	77.49	77.35

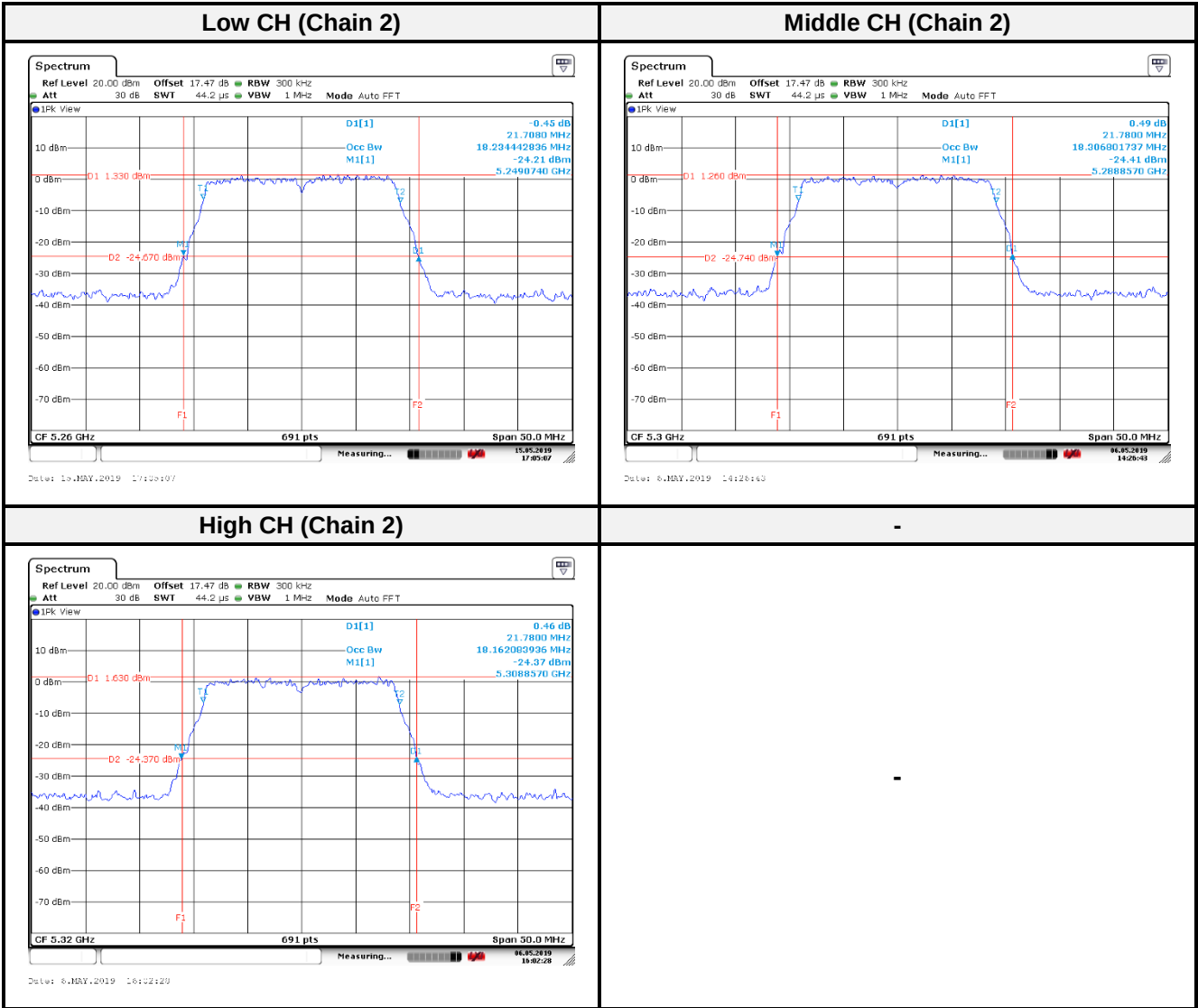
UNII Band	Mode	Channel	Frequency (MHz)	6dB Emission Bandwidth (MHz)			
				Chain 0	Chain 1	Chain 2	Chain 3
Straddle	802.11a	144	5720	3.13	-	-	-
	802.11ac20	144	5720	3.81	3.81	3.81	3.81
	802.11ac 40	142	5710	3.14	3.10	3.19	3.14
	802.11ac 80	138	5690	3.09	3.09	3.09	3.09

UNII Band	Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)			
				Chain 0	Chain 1	Chain 2	Chain 3
UNII-2a	802.11a	52	5260	17.22	-	-	-
		60	5300	17.22	-	-	-
64		5320	17.29	-	-	-	
UNII-2c		100	5500	17.29	-	-	-
		116	5580	17.14	-	-	-
Straddle		140	5700	17.07	-	-	-
		144	5720	14.99	-	-	-
		144	5720	12.01			
UNII-2a	802.11ac20	52	5260	18.23	18.08	18.23	18.16
		60	5300	18.30	18.16	18.30	18.23
64		5320	18.23	18.23	18.16	18.23	
UNII-2c		100	5500	18.08	18.23	18.16	18.08
		116	5580	18.16	18.37	18.08	18.16
Straddle		140	5700	14.35	14.18	14.18	14.18
		144	5720	14.35	14.18	14.18	14.18
			144	5720	4.52	4.55	4.52
UNII-2a	802.11ac 40	54	5270	36.70	36.93	37.04	36.93
		62	5310	36.98	36.81	36.81	36.93
102		5510	36.70	36.81	36.93	36.81	
UNII-2c		110	5550	36.70	36.81	36.70	36.81
		134	5670	36.93	36.93	36.93	36.93
Straddle		142	5710	33.42	33.34	33.16	33.42
		142	5710	5.16	6.16	3.73	4.08
UNII-2a	802.11ac 80	58	5290	76.87	76.87	76.64	76.87
UNII-2c		106	5530	76.87	76.64	76.87	76.87
Straddle		138	5690	73.37	73.66	73.66	73.22
		138	5690	5.20	6.59	6.48	7.00

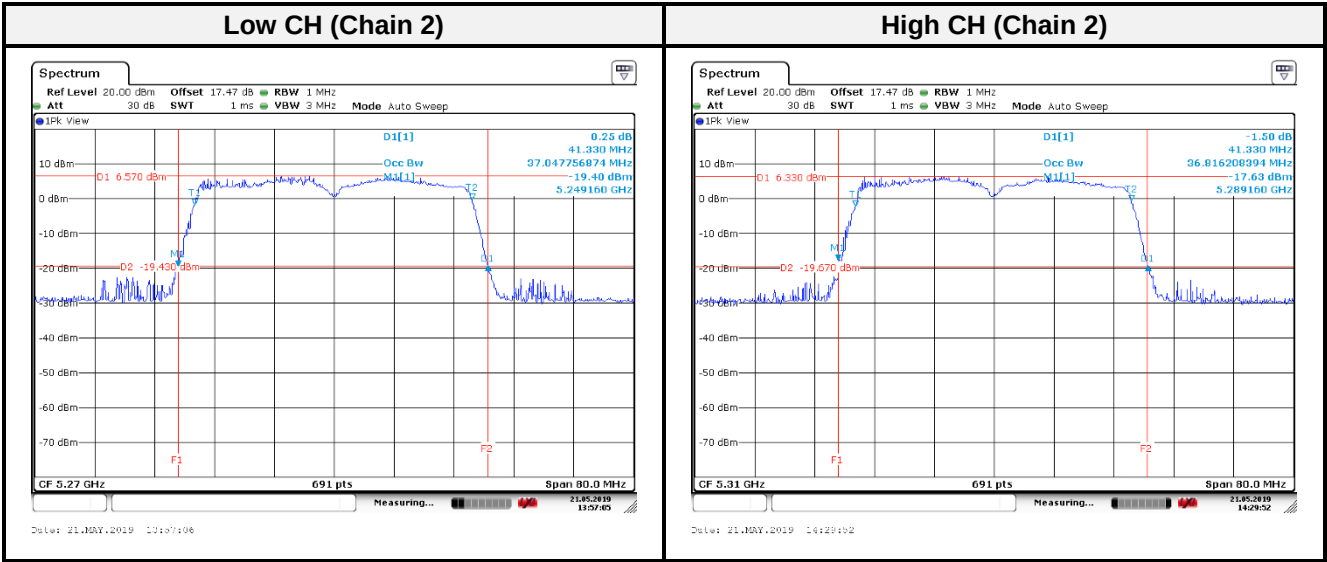
For UNII-2a
802.11a mode Chain 0:



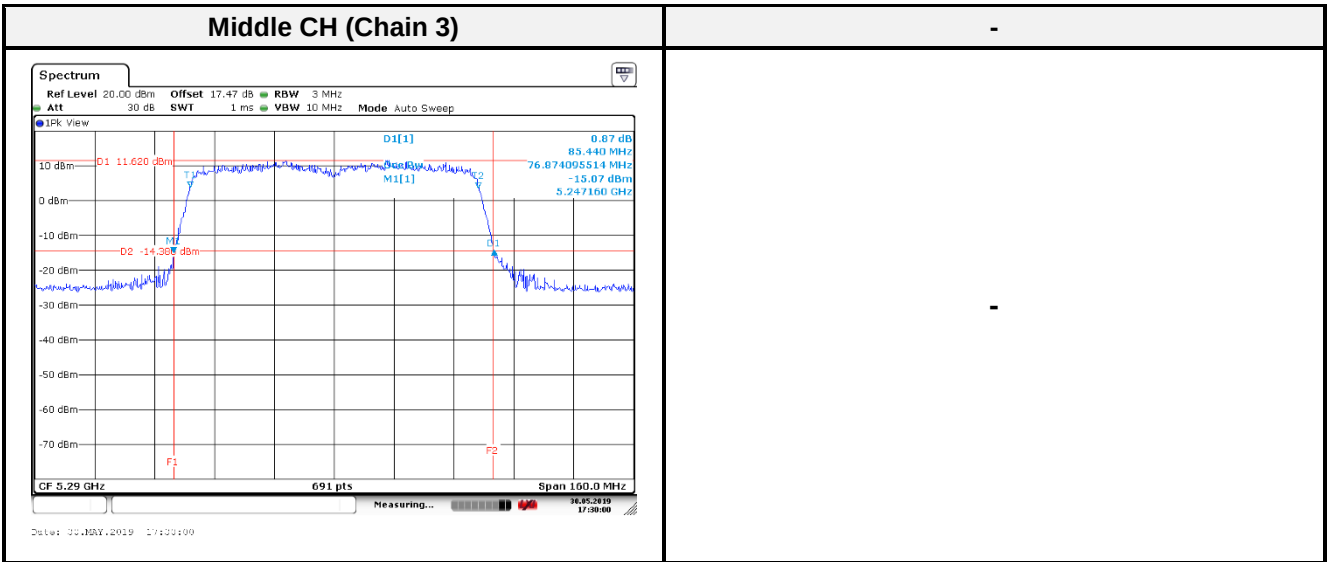
802.11ac VHT20-BF mode:



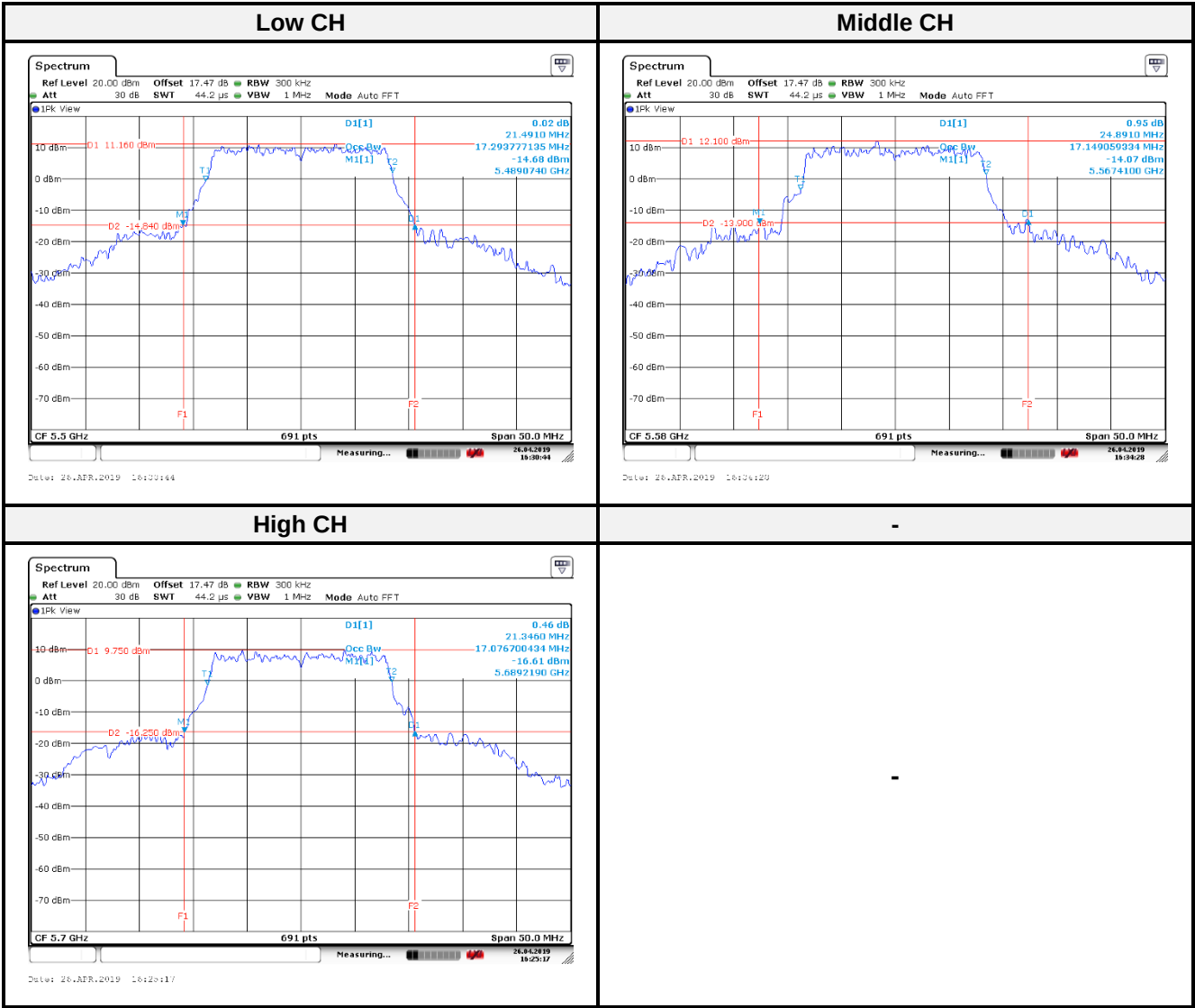
802.11ac VHT40-BF mode:



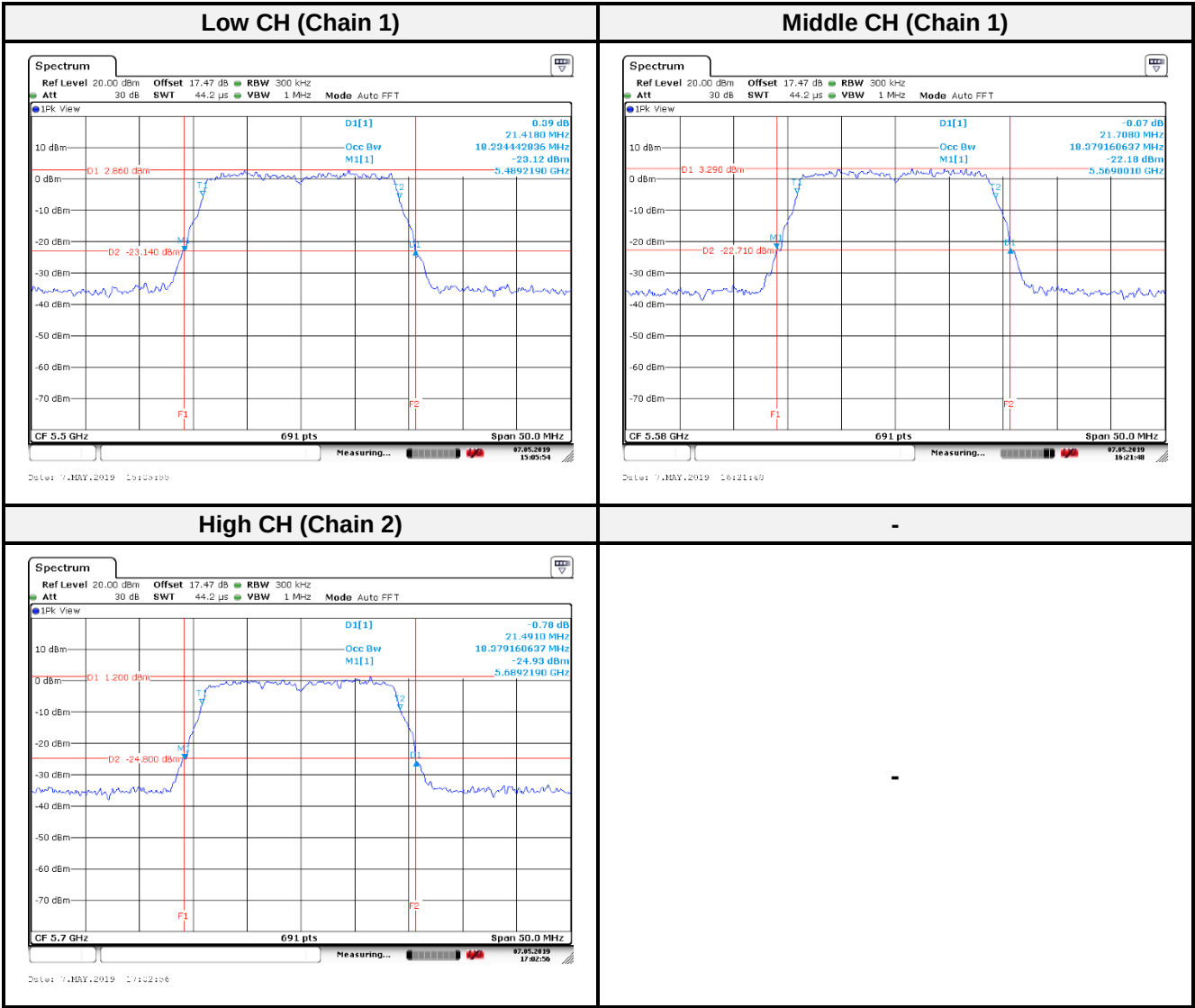
802.11ac VHT80-BF mode:



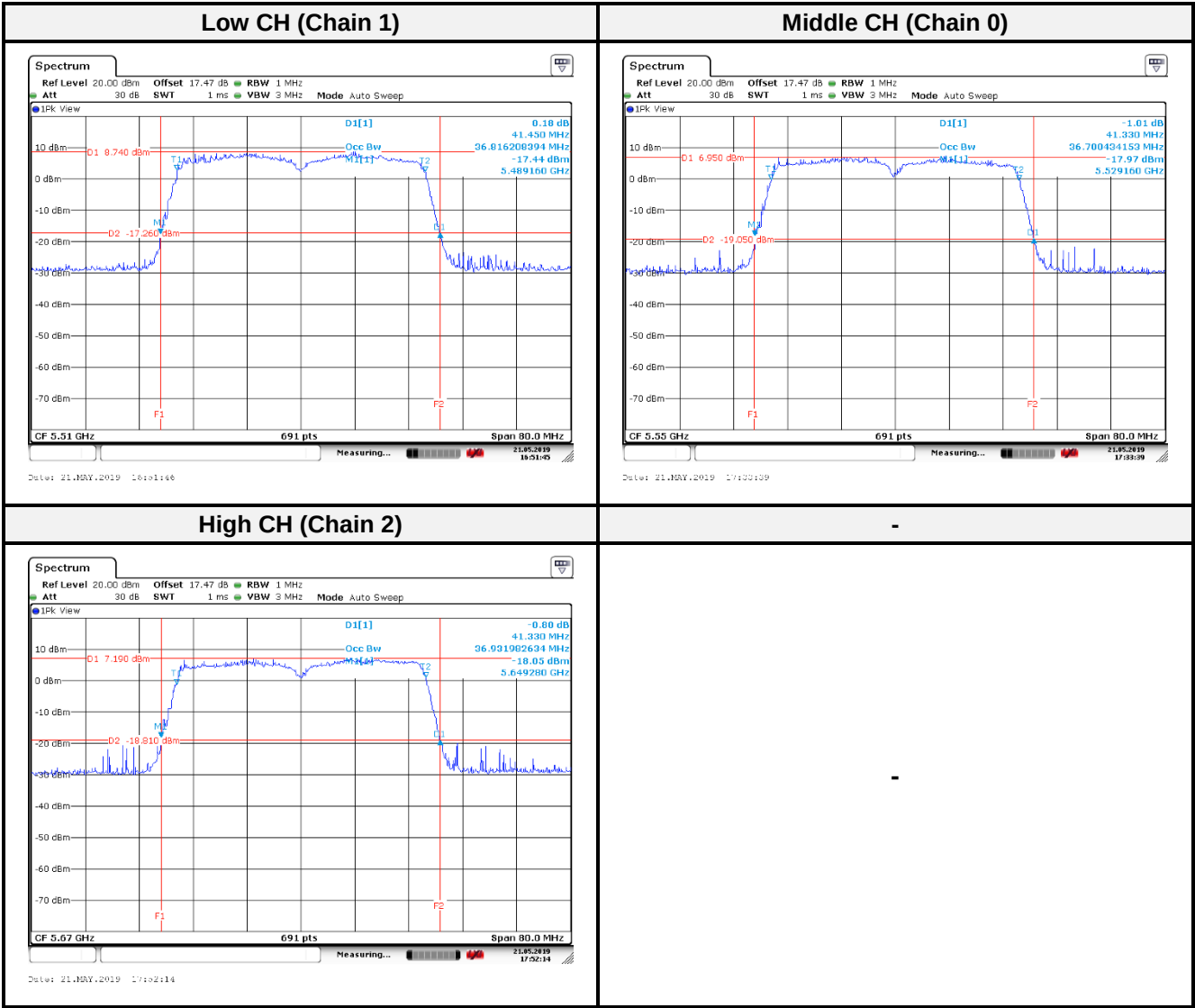
For UNII-2c
802.11a mode chain 0:



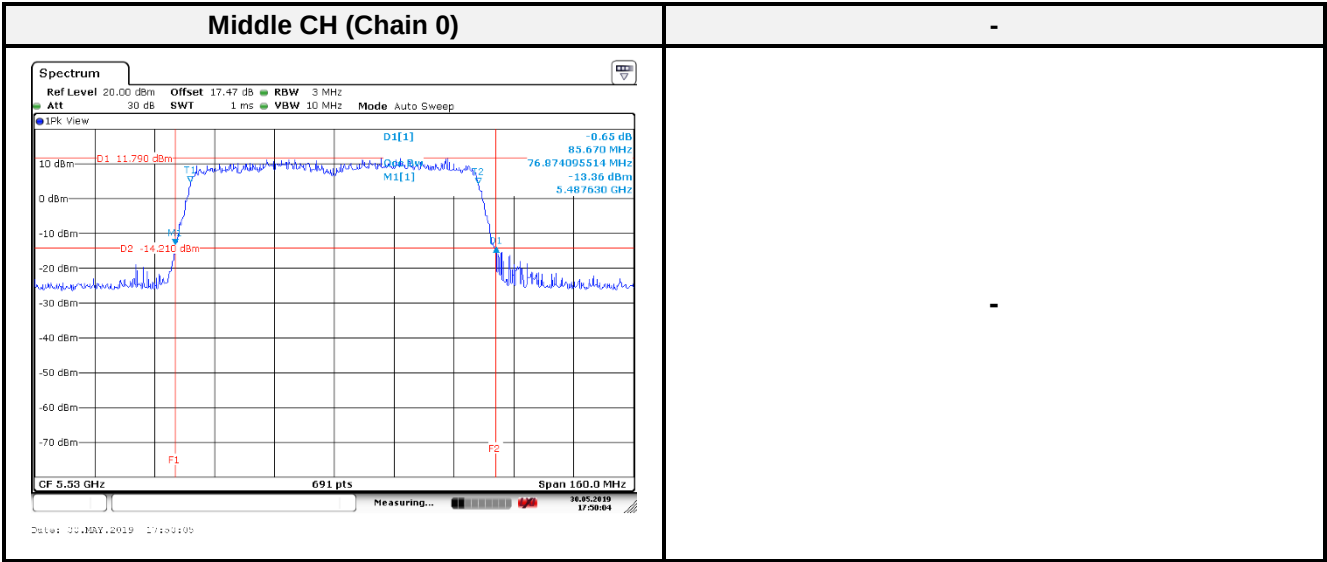
802.11ac VHT20-BF mode:



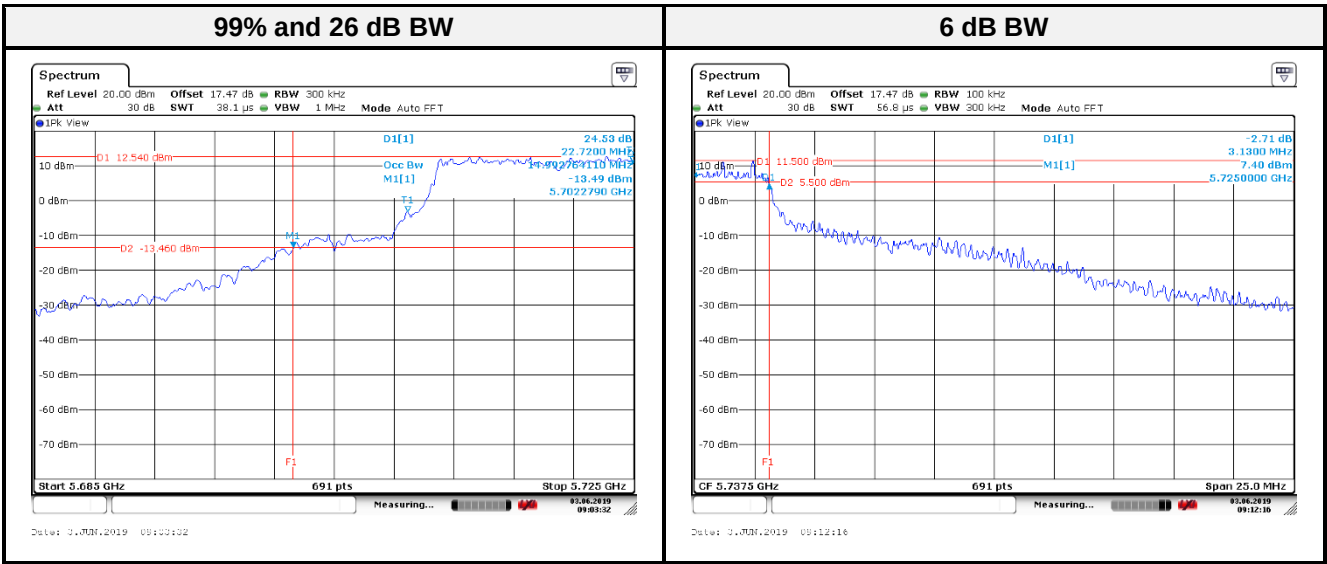
802.11ac VHT40-BF mode:



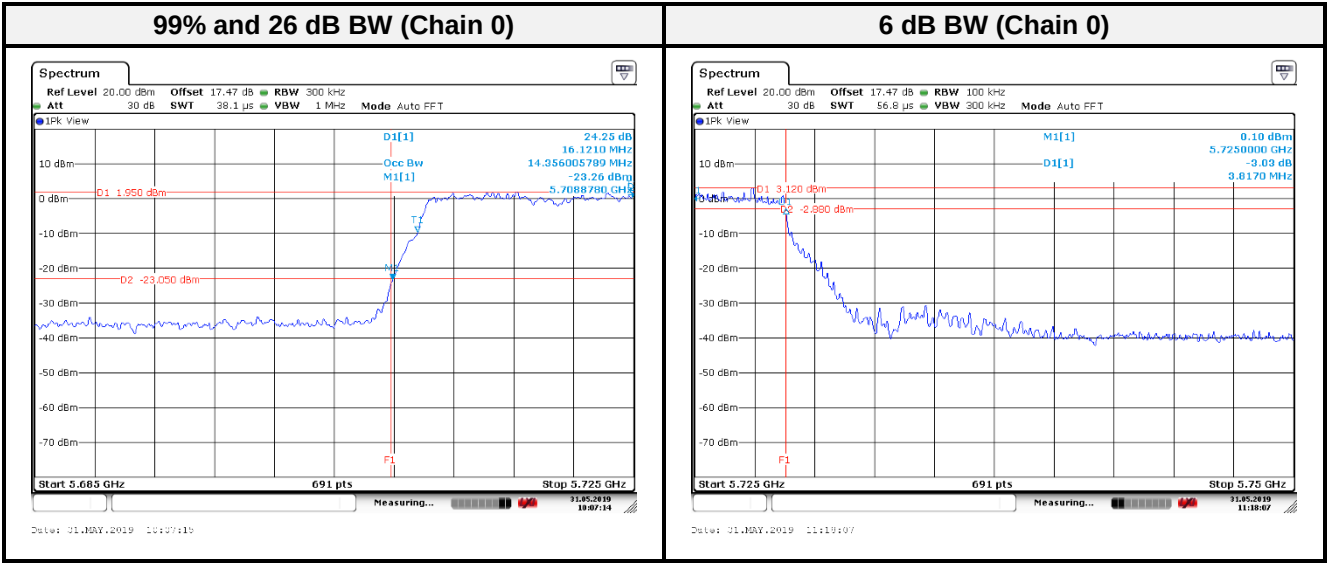
802.11ac VHT80-BF mode:



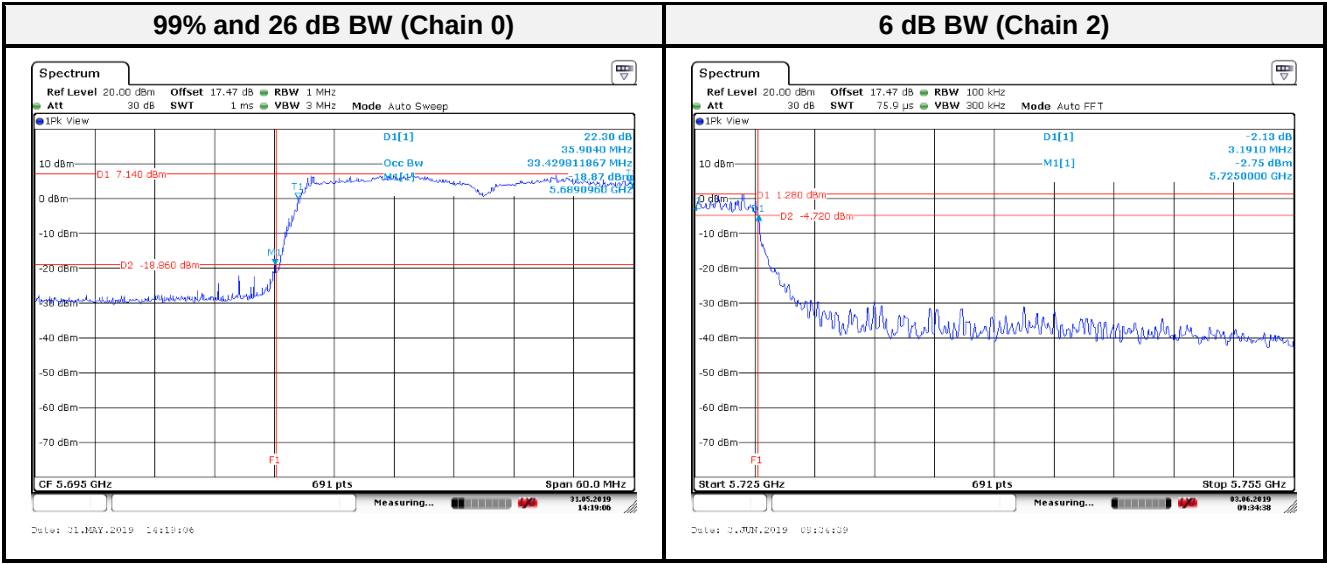
For Straddle channel
802.11a mode (Chain 2):



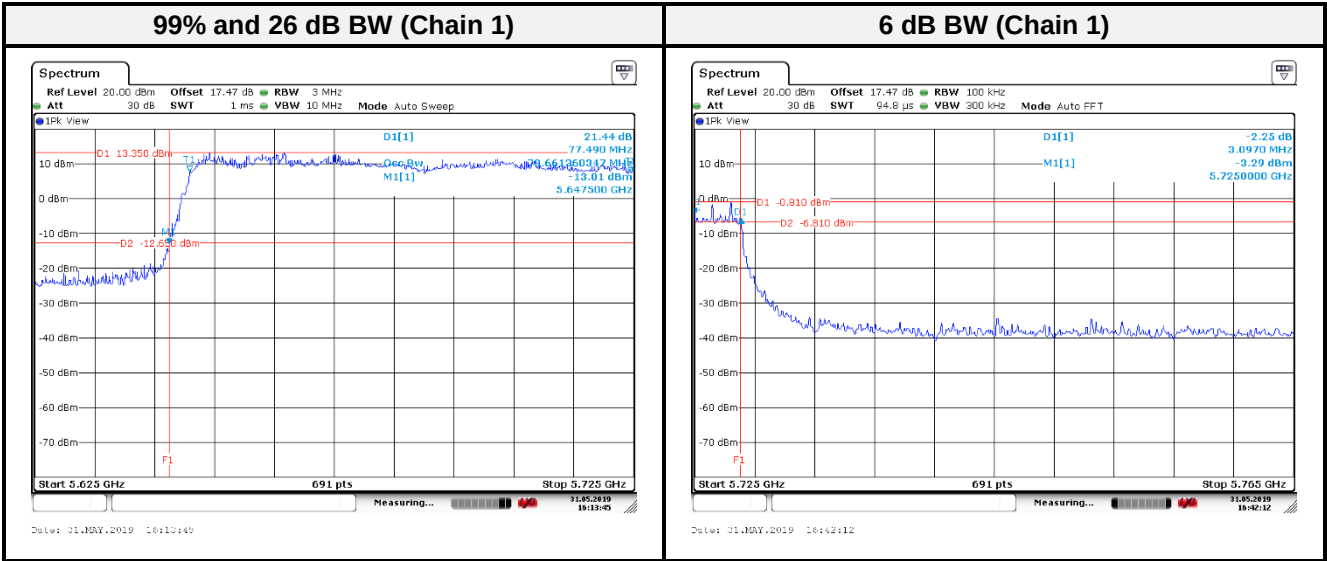
802.11 ac VHT20 mode:



802.11 ac VHT40 mode:



802.11 ac VHT80 mode:



9 FCC §15.407(a)(1) – Maximum Output Power

9.1 Applicable Standard

According to FCC §15.407(a),

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

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

9.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,

The use Power Meter

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a Power sensor.

9.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10
Power Sensor	Keysight	U2021XA	MY54080018	2018/03/07	2019/03/06

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

9.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Test Date:	2019-01-31~2019-06-04	-	-

9.5 Test Data

Mode	Channel	Frequency (MHz)	Duty Factor (dB)	Maximum Conducted Average Output Power(dBm)					Power DG (dBi)	Limit (dBm)
				Chain 0	Chain 1	Chain 2	Chain 3	Sum		
802.11a	52	5260	0.14	20.70	-	-	-	20.70	3.42	24.00
	60	5300	0.14	21.21	-	-	-	21.21	3.42	24.00
	64	5320	0.14	21.03	-	-	-	21.03	3.42	24.00
	100	5500	0.14	20.88	-	-	-	20.88	2.86	24.00
	116	5580	0.14	20.96	-	-	-	20.96	2.86	24.00
	140	5700	0.14	18.95	-	-	-	18.95	2.86	24.00
	144	5720	0.14	21.38	-	-	-	21.38	3.01	24.00
	144	5720	0.14	14.57	-	-	-	14.57	3.01	30
802.11n HT20	52	5260	0.71	10.96	11.15	10.92	11.30	17.10	9.44	20.56
	60	5300	0.71	10.52	11.01	10.27	11.77	16.95	9.44	20.56
	64	5320	0.71	10.49	10.79	10.26	11.84	16.91	9.44	20.56
	100	5500	0.71	11.46	11.60	11.37	11.68	17.55	8.88	21.12
	116	5580	0.71	11.42	11.67	11.36	11.80	17.58	8.88	21.12
	140	5020	0.71	10.00	10.22	9.90	10.70	16.23	9.78	20.22
	144	5720	0.71	9.67	9.96	9.29	10.61	15.93	9.03	20.97
	144	5720	0.71	4.61	4.80	4.00	5.07	10.65	9.03	26.97
802.11n HT40	54	5270	0.91	12.18	12.30	12.04	12.32	18.23	9.44	20.56
	62	5310	0.91	12.16	12.25	12.03	12.39	18.23	9.44	20.56
	102	5510	0.91	12.21	12.35	12.14	12.41	18.30	8.88	21.12
	110	5550	0.91	12.15	12.27	11.99	12.40	18.22	8.88	21.12
	134	5670	0.91	11.29	11.78	10.85	12.12	17.55	9.78	20.22
	142	5710	0.91	10.69	11.17	10.09	11.50	16.91	9.03	20.97
	142	5710	0.91	1.40	1.56	1.33	1.70	7.52	9.03	26.97
	144	5720	0.91	1.40	1.56	1.33	1.70	7.52	9.03	26.97
802.11ac VHT20	52	5260	0.34	11.09	11.19	10.97	11.42	17.19	9.44	20.56
	60	5300	0.34	10.56	11.01	10.34	11.82	16.99	9.44	20.56
	64	5320	0.34	10.72	10.80	10.44	12.05	17.07	9.44	20.56
	100	5500	0.34	11.60	11.72	11.52	11.79	17.68	8.88	21.12
	116	5580	0.34	11.62	11.71	11.39	11.80	17.65	8.88	21.12
	140	5700	0.34	11.24	11.55	10.75	12.18	17.48	9.78	20.22
	144	5720	0.34	10.14	10.19	9.63	10.64	16.19	9.03	20.01
	144	5720	0.34	4.75	4.90	4.06	5.16	10.76	9.03	26.97

Mode	Channel	Frequency (MHz)	Duty Factor (dB)	Maximum Conducted Average Output Power(dBm)					Power DG (dBi)	Limit (dBm)
				Chain 0	Chain 1	Chain 2	Chain 3	Sum		
802.11ac VHT40	54	5270	0.69	12.36	12.52	12.28	12.57	18.45	9.44	20.56
	62	5310	0.69	12.35	12.43	12.21	12.57	18.41	9.44	20.56
	102	5510	0.69	12.47	12.53	12.36	12.62	18.52	8.88	21.12
	110	5550	0.69	12.38	12.52	12.31	12.66	18.49	8.88	21.12
	134	5670	0.69	11.94	12.40	11.25	12.74	18.14*	9.78*	20.22
	142	5710	0.69	10.96	11.52	10.52	11.66	17.21	9.03	20.97
	142	5710	0.69	1.64	1.84	1.53	1.90	7.75	9.03	26.97
802.11ac VHT80	58	5290	1.00	13.96	14.03	13.85	14.15	20.02*	9.44*	20.56
	106	5530	1.00	14.43	14.61	14.28	14.78	20.55	8.88	21.12
	132	5690	1.00	13.48	13.75	13.38	14.15	19.72	9.78	20.22
	132	5690	1.00	-0.19	0.12	-0.51	0.68	6.07	9.78	26.22

Note:

In 802.11n/ac mode

For CH 52, 54, 58, 60, 62, and 64. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 24 - (DG-6) = 24 - (9.44 - 6) = 20.56 dBm

For CH 100, 102, 106, 110 and 116 Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 24 - (DG-6) = 24 - (8.88 - 6) = 21.12 dBm

For CH 134 and 140. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 24 - (DG-6) = 24 - (9.78 - 6) = 20.22 dBm

In Straddle 802.11n/ac mode

For CH 142 and 144. Due to Antenna with DG greater than 6 dBi.

Therefore, UNII-2c Limit = 24 - (DG-6) = 24 - (9.03 - 6) = 20.97. UNII-3 Limit = 30 - (DG-6) = 30 - (9.03 - 6) = 26.97 dBm

For CH 132. Due to Antenna with DG greater than 6 dBi.

Therefore, UNII-2c Limit = 24 - (DG-6) = 24 - (9.78 - 6) = 20.22. UNII-3 Limit = 30 - (DG-6) = 30 - (9.78 - 6) = 26.22 dBm

10 FCC §15.407(a) – Power Spectral Density

10.1 Applicable Standard

According to FCC §15.407(a),

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

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

10.2 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and ANSI 63.10: 2013 Sec 10.3.7.

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth ($< 1 \text{ MHz}$, or $< 500 \text{ kHz}$) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

- a) Set the RBW to 1 MHz.
- b) Set the VBW to be at least 1 MHz (a VBW of 3 MHz is desirable).
- c) Set the frequency span to examine the spectrum across a convenient frequency segment (e.g., 600 MHz).
- d) Select the power averaging (rms) detector.
- e) Set the sweep time so that there is no more than a 1 ms integration period over each measurement bin.
- f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

10.3 Test Equipment List and Details

Description	Manufacture	Model	Serial No.	Cal. Date.	Cal. Due.
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2018/11/14	2019/11/13
Cable	WOKEN	SFL402	S02-160323-07	2019/02/11	2020/02/10

***Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

10.4 Test Environmental Conditions

Temperature:	25 °C	Relative Humidity:	45 %
ATM Pressure:	1015hPa	Test Engineer:	Leo Chang
Test Date:	2019-01-31~2019-06-04	-	-

10.5 Test Data and Test Plot

UNII Band	Mode	Channel	Frequency (MHz)	Duty Factor (dB)	Maximum Power Spectral Density (dBm/MHz)					PSD-DG (dBi)	Limit (dBm/MHz)
					Chain 0	Chain 1	Chain 2	Chain 3	Total		
UNII-2a	802.11a	52	5260	0.14	10.57	-	-	-	10.57	3.42	11.00
		60	5300	0.14	10.66	-	-	-	10.66	3.42	11.00
		64	5320	0.14	10.66	-	-	-	10.66	3.42	11.00
UNII-2c		100	5500	0.14	10.69	-	-	-	10.69	2.86	11.00
		116	5580	0.14	10.71	-	-	-	10.71	2.86	11.00
Straddle		140	5700	0.14	8.88	-	-	-	8.88	2.86	11.00
		144	5720	0.14	10.78	-	-	-	10.78	3.01	11.00
		144	5720	0.14	14.52	-	-	-	14.52	3.01	30.00
UNII-2a	802.11ac VHT20	52	5260	0.34	1.24	1.41	0.94	1.68	7.35	9.44	7.56
		60	5300	0.34	1.00	1.33	0.96	1.73	7.29	9.44	7.56
		64	5320	0.34	1.20	1.42	1.03	1.39	7.29	9.44	7.56
UNII-2c		100	5500	0.34	1.61	1.68	1.46	1.77	7.65	8.88	8.12
		116	5580	0.34	1.61	1.65	1.42	1.75	7.63	8.88	8.12
Straddle		140	5700	0.34	0.90	0.93	0.84	1.47	7.06	9.78	7.22
		144	5720	0.34	1.52	1.61	0.98	1.81	7.51	9.03	7.97
		144	5720	0.34	3.36	3.58	3.33	4.37	9.70	9.03	26.97
UNII-2a	802.11ac VHT40	54	5270	0.69	1.38	1.43	1.33	1.54	7.44	9.44	7.56
		62	5310	0.69	1.38	1.45	1.36	1.47	7.43	9.44	7.56
UNII-2c		102	5510	0.69	1.82	1.85	1.81	1.92	7.87	8.88	8.12
		110	5550	0.69	1.77	1.79	1.70	1.82	7.79	8.88	8.12
Straddle		134	5670	0.69	0.88	1.36	0.72	1.40	7.12	9.78	7.22
		142	5710	0.69	1.09	1.36	1.06	2.00	7.41	9.03	7.97
		142	5710	0.69	1.57	1.77	1.44	1.88	7.69	9.03	26.97
UNII-2a	802.11ac VHT80	58	5290	1.00	-1.52	-1.37	-1.64	-1.26	4.58	9.44	7.56
UNII-2c		106	5530	1.00	0.28	0.81	-0.76	0.85	6.36	8.88	8.12
		138	5690	1.00	0.15	0.18	-0.09	1.62	6.54	9.78	7.22
Straddle		138	5690	1.00	0.41	0.60	0.21	0.69	6.50	9.78	26.22

Note:

In 802.11ac mode

For CH 52, 54, 58, 60, 62, and 64. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 11 - (DG-6) = 11 - (9.44 - 6) = 7.56 dBm/MHz

For CH 100, 102, 106, 110 and 116 Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 11 - (DG-6) = 11 - (8.88 - 6) = 8.12 dBm/MHz

For CH 134 and 140. Due to Antenna with DG greater than 6 dBi. Therefore, Limit = 11 - (DG-6) = 11 - (9.78 - 6) = 7.22 dBm/MHz

In Straddle 802.11ac mode

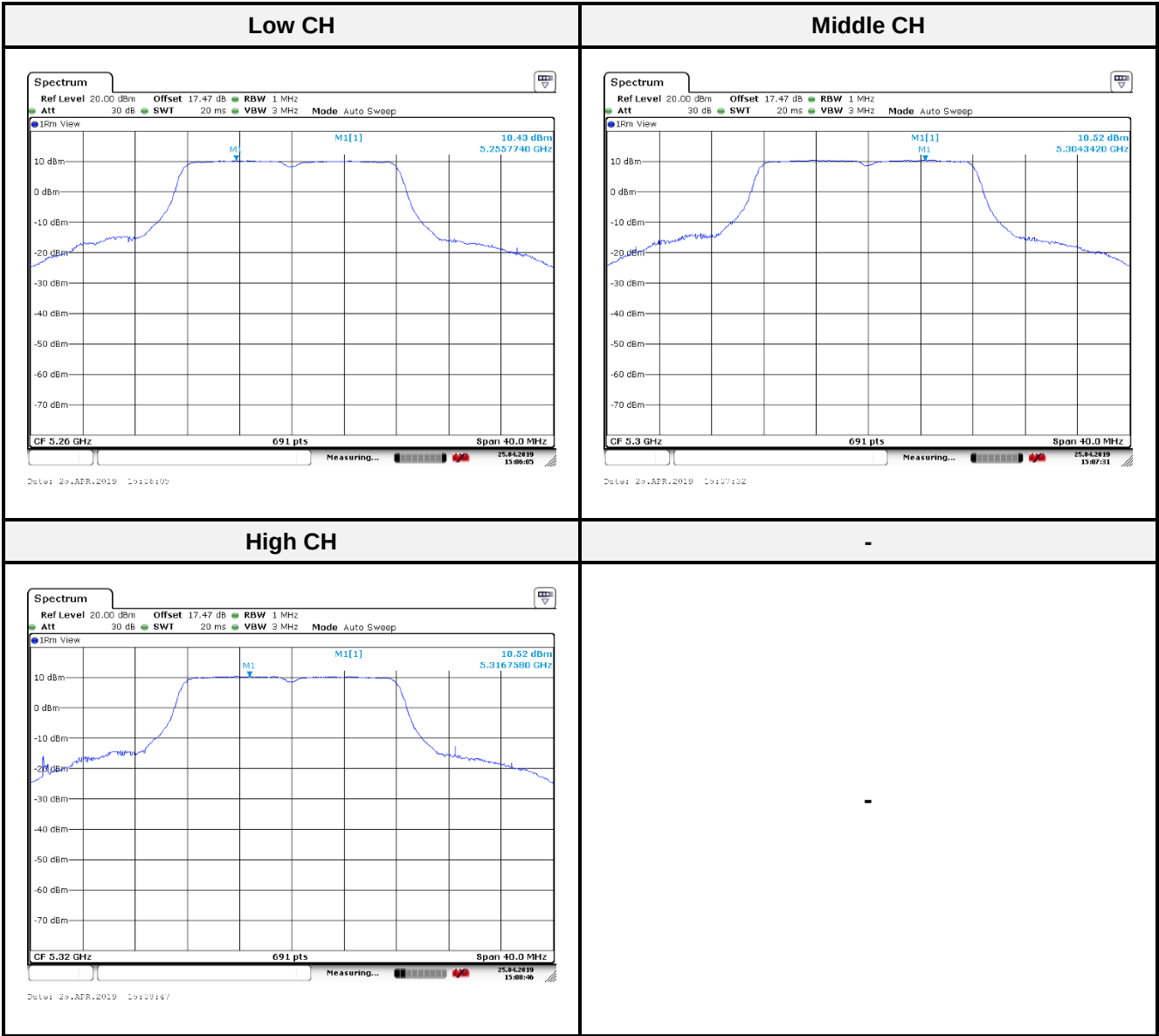
For CH 142 and 144. Due to Antenna with DG greater than 6 dBi.

Therefore, UNII-2c Limit = 11 - (DG-6) = 11 - (9.03 - 6) = 7.97. UNII-3 Limit = 30 - (DG-6) = 30 - (9.03 - 6) = 26.97 dBm/MHz

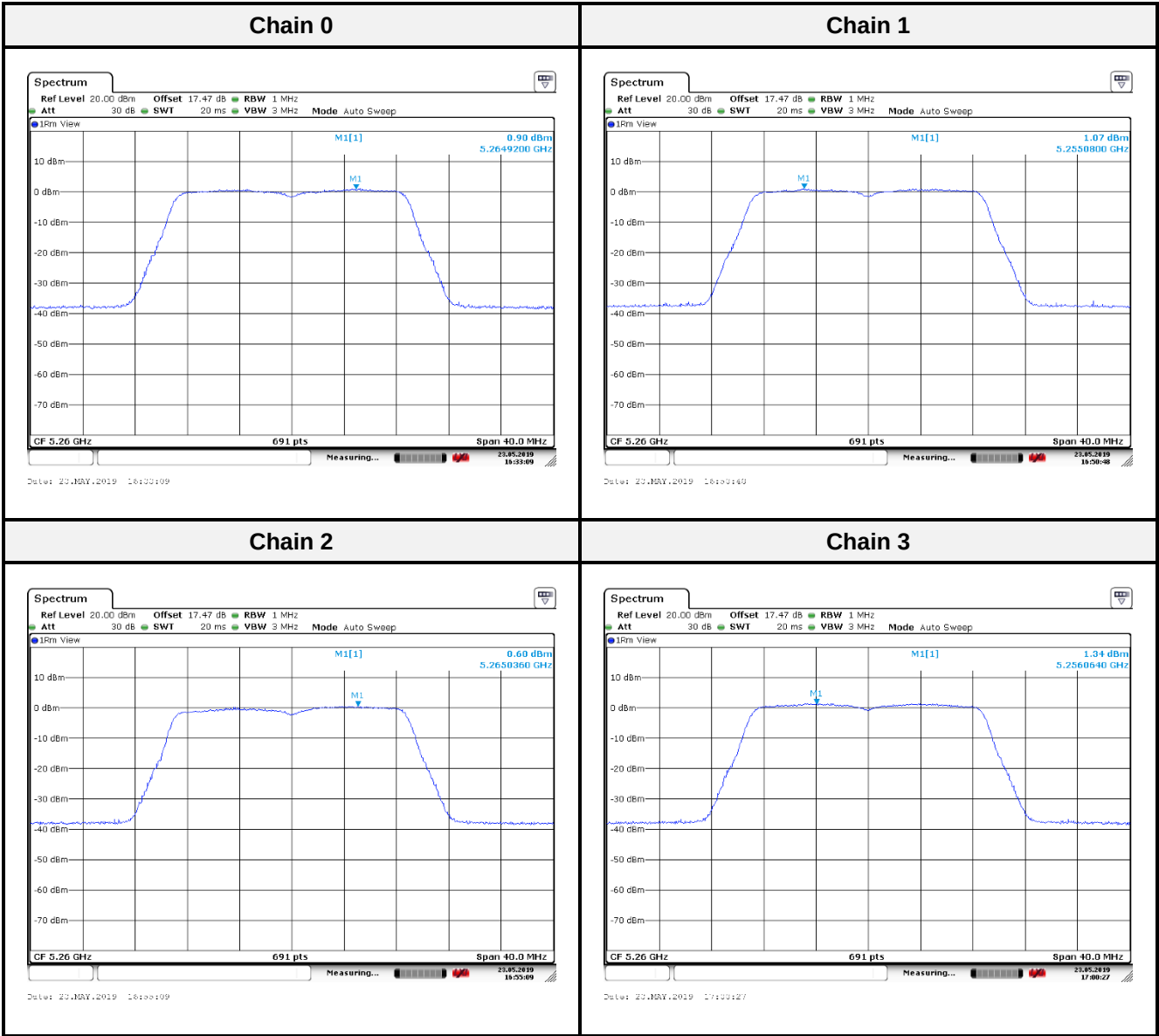
For CH 132. Due to Antenna with DG greater than 6 dBi.

Therefore, UNII-2c Limit = 11 - (DG-6) = 11 - (9.78 - 6) = 7.22. UNII-3 Limit = 30 - (DG-6) = 30 - (9.78 - 6) = 26.22 dBm/MHz

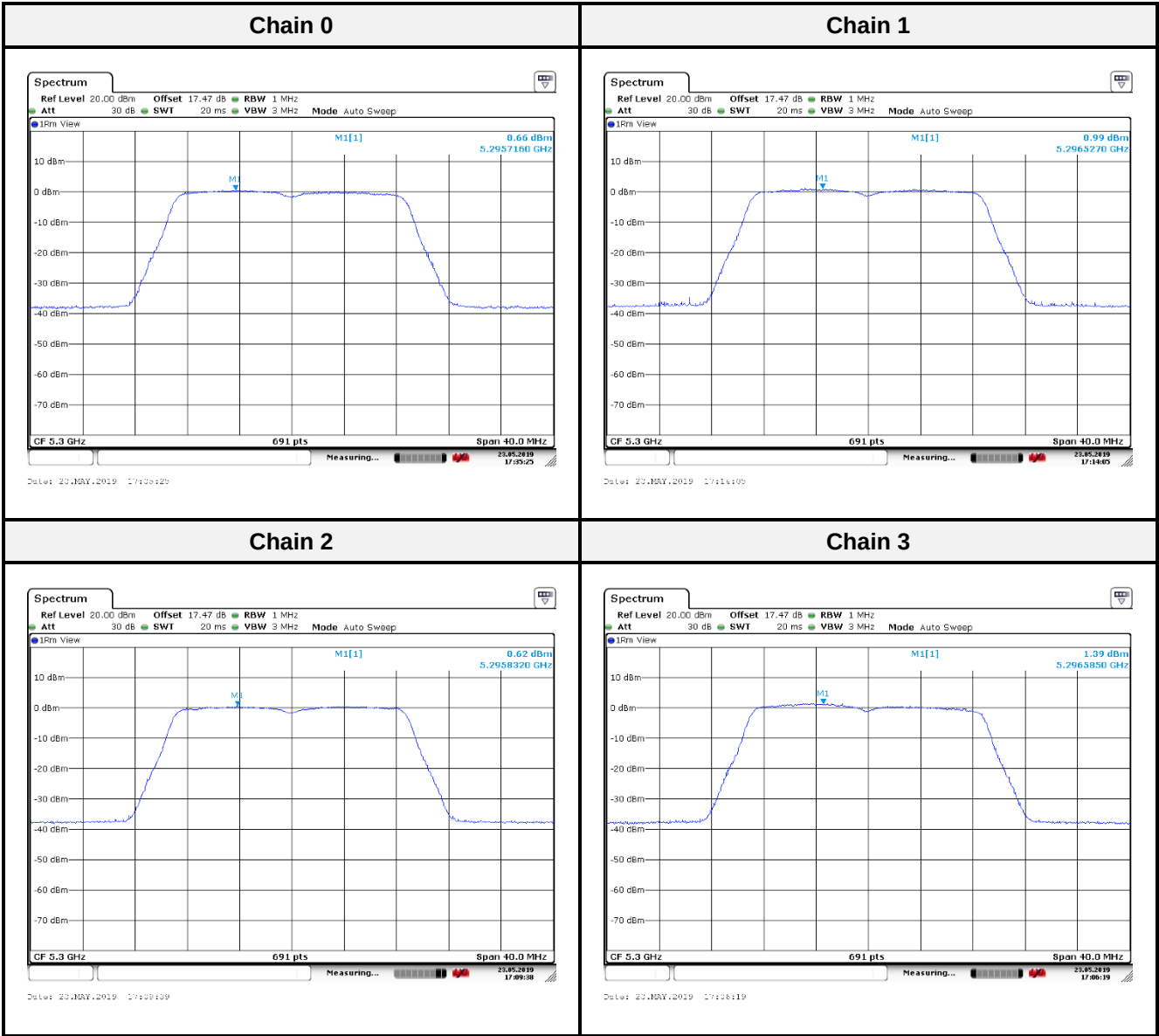
For UNII-1:
802.11a mode:



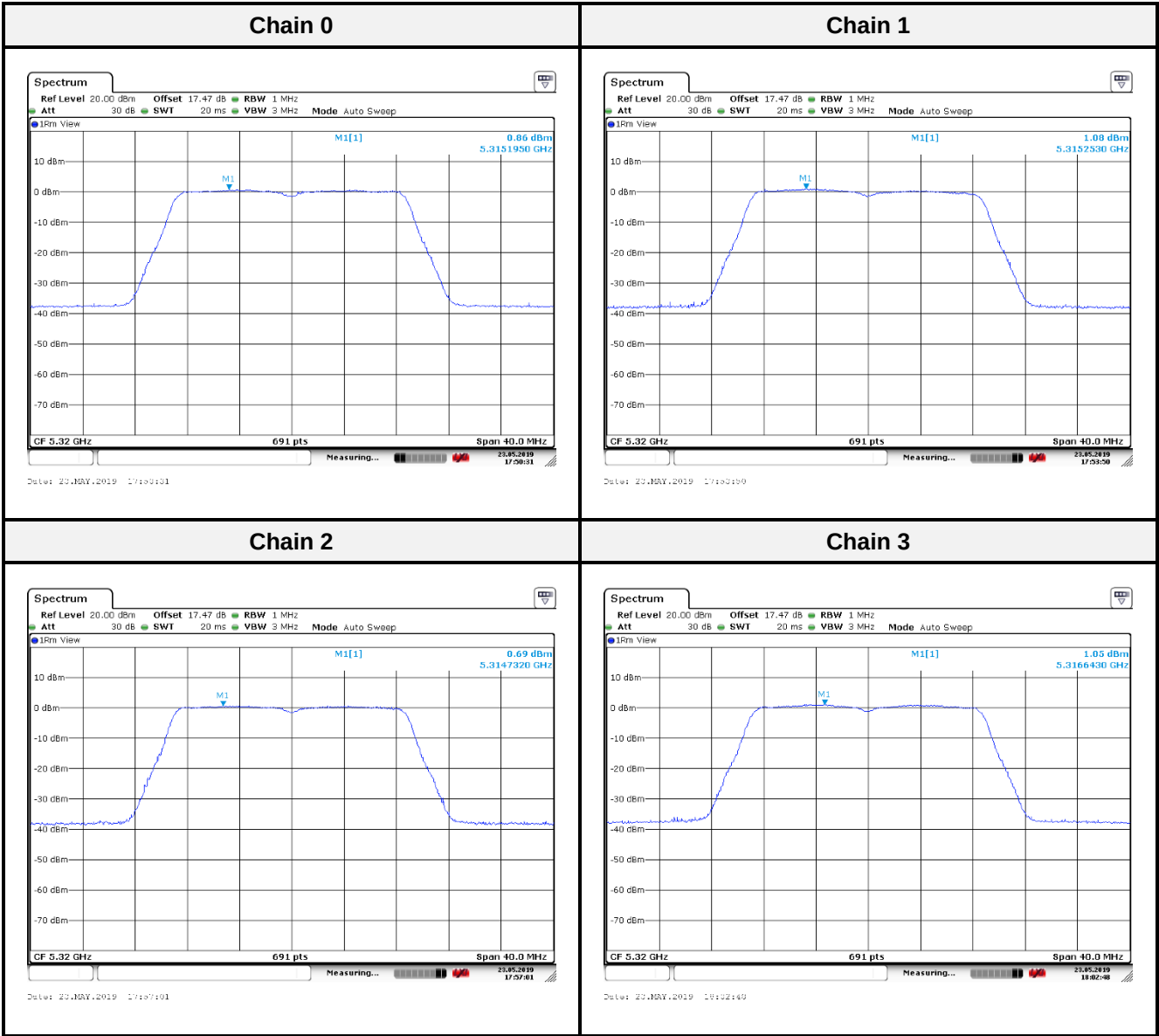
802.11ac VHT20-BF mode: Low Channel



802.11ac VHT20-BF mode: Middle Channel



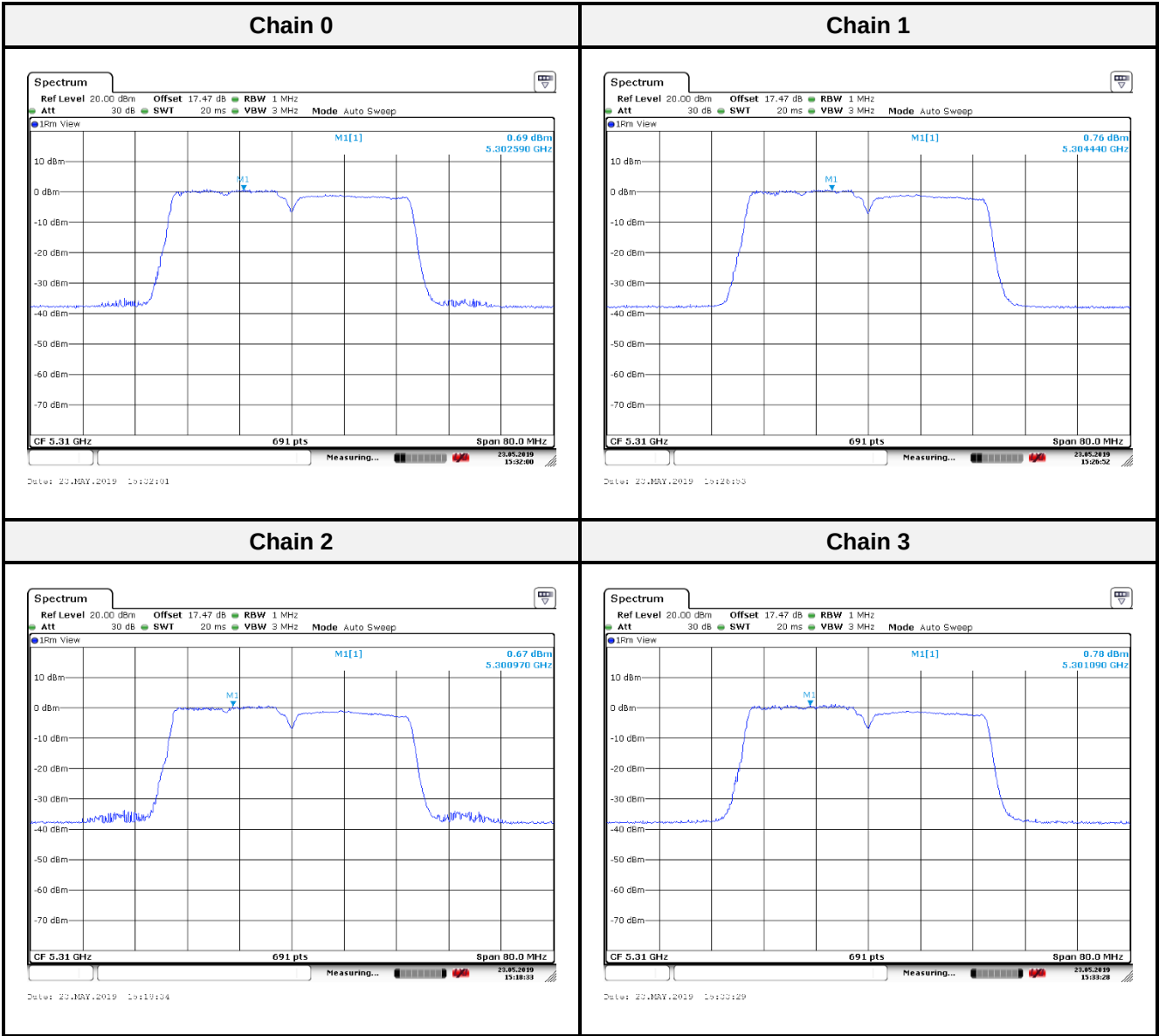
802.11ac VHT20-BF mode: High Channel



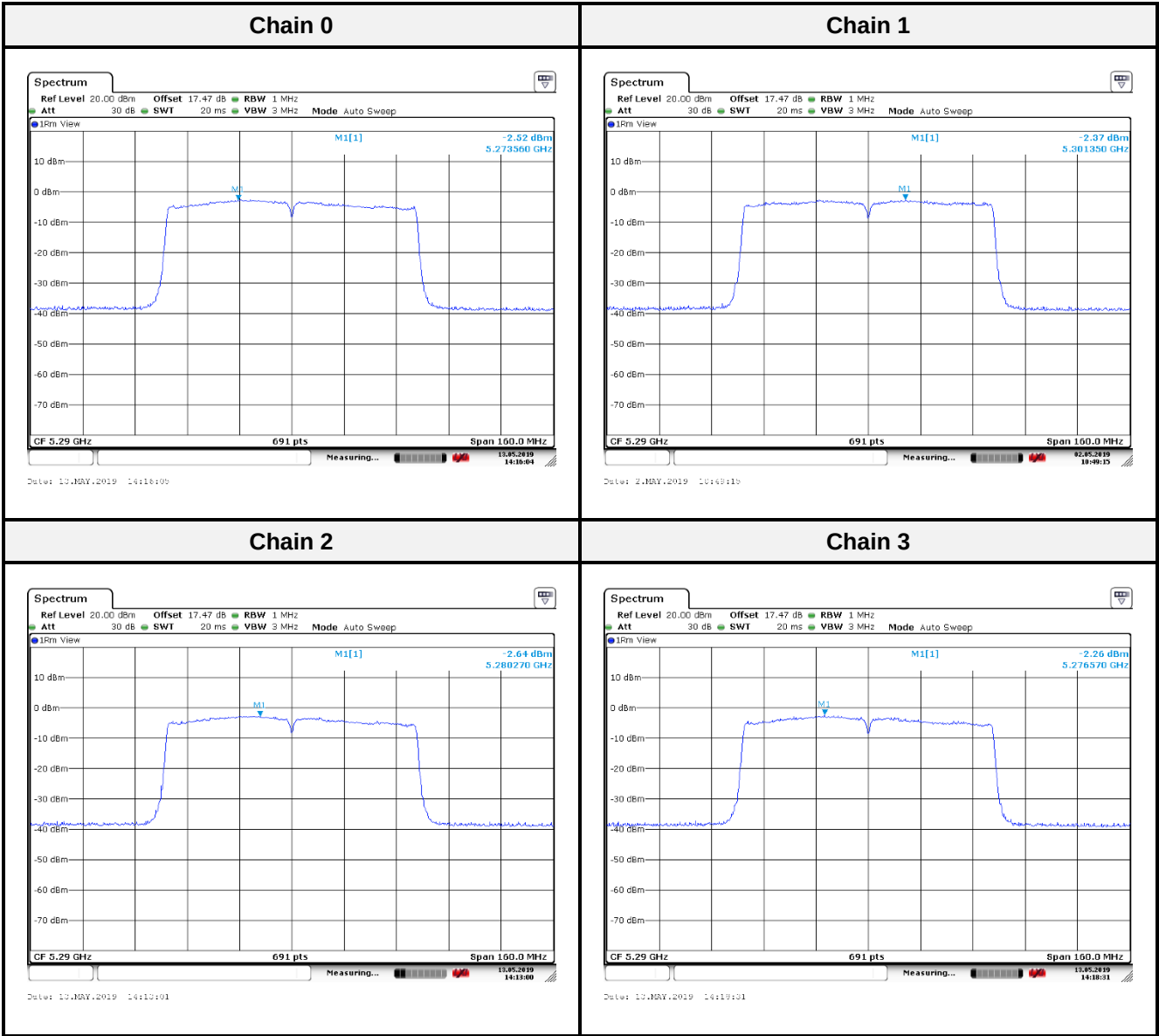
The figure displays four screenshots of a spectrum analyzer, labeled Chain 0, Chain 1, Chain 2, and Chain 3. Each screenshot shows a power spectrum plot with a peak at 5.26 GHz. The y-axis represents power in dBm, ranging from -70 dBm to 10 dBm. The x-axis represents frequency in GHz, ranging from 5.27 GHz to 5.26 GHz. The plots show a signal with a peak at 5.26 GHz and a span of 80.0 MHz. The peak power is measured at 0.69 dBm for Chain 0, 0.74 dBm for Chain 1, 0.64 dBm for Chain 2, and 0.85 dBm for Chain 3. The plots also show the signal's bandwidth (BW) and the span of the measurement (Span 80.0 MHz). The date and time of the measurement are 2019.05.29 13:12:04 for Chain 0, 2019.05.29 13:07:43 for Chain 1, 2019.05.29 14:57:43 for Chain 2, and 2019.05.29 14:53:33 for Chain 3.

Chain	Peak Power (dBm)	Frequency (GHz)	Span (MHz)	Date/Time
Chain 0	0.69	5.264790	80.0	2019.05.29 13:12:04
Chain 1	0.74	5.265140	80.0	2019.05.29 13:07:43
Chain 2	0.64	5.257800	80.0	2019.05.29 14:57:43
Chain 3	0.85	5.264210	80.0	2019.05.29 14:53:33

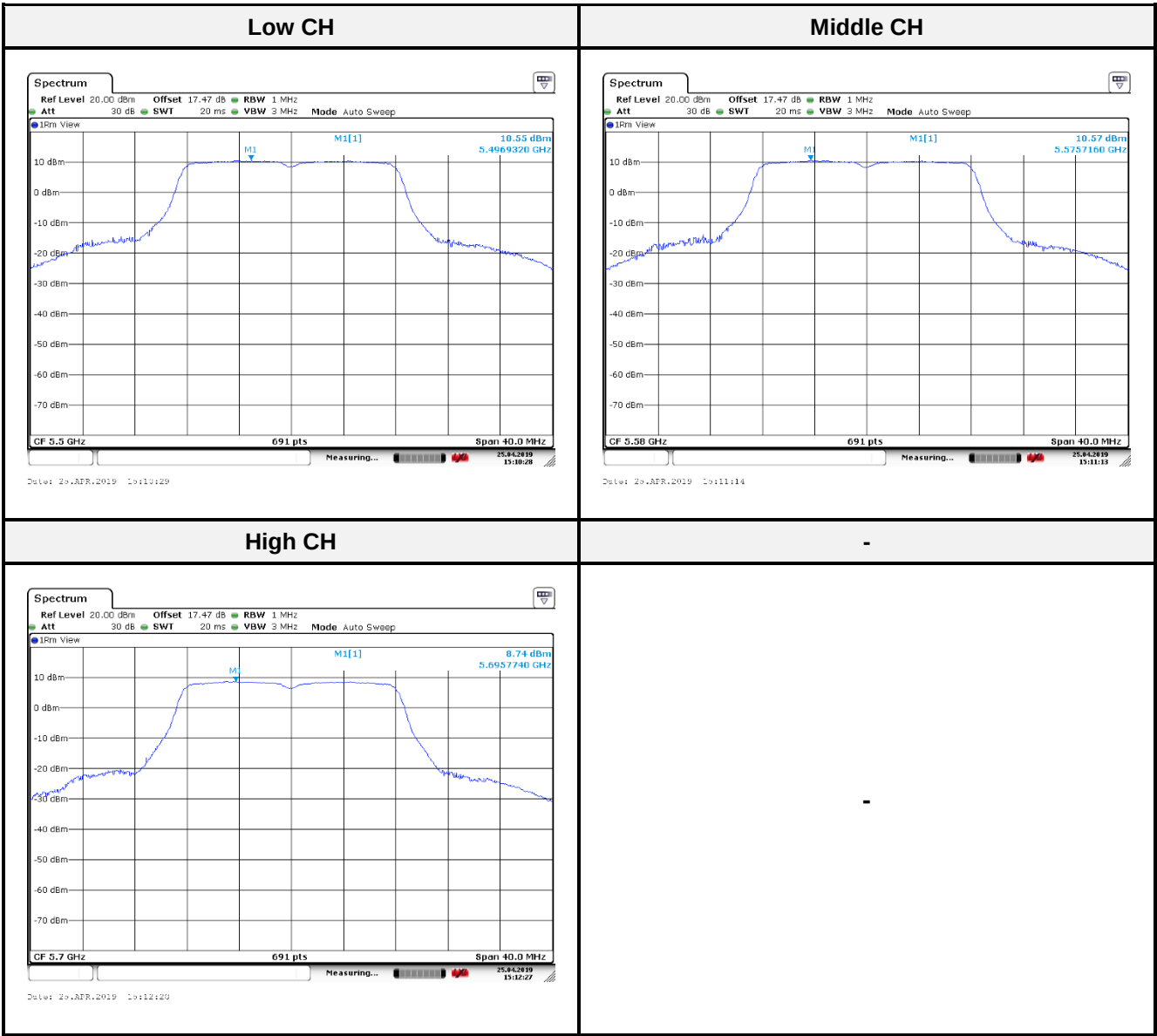
802.11ac VHT40-BF mode: High Channel



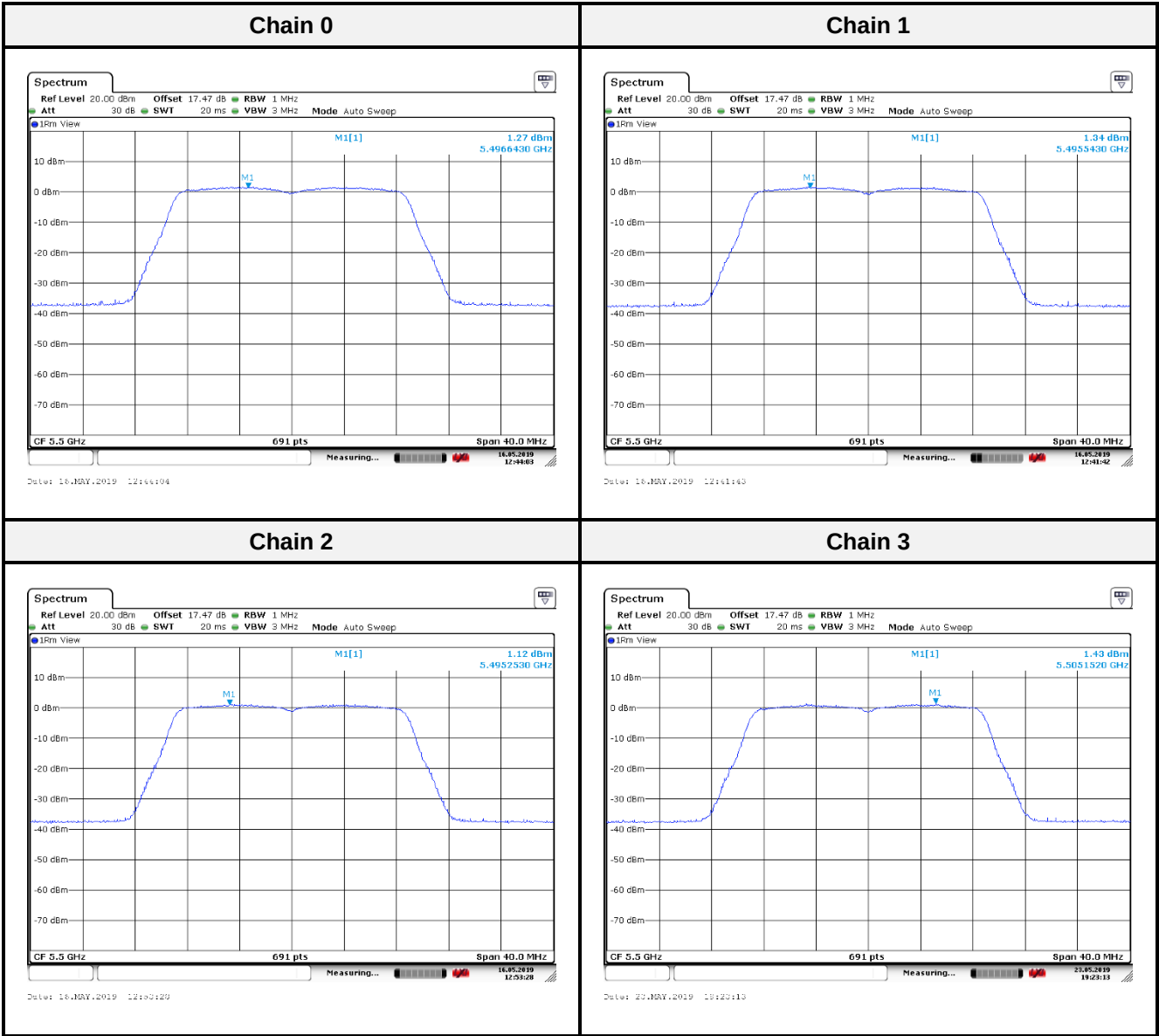
802.11ac VHT80-BF mode



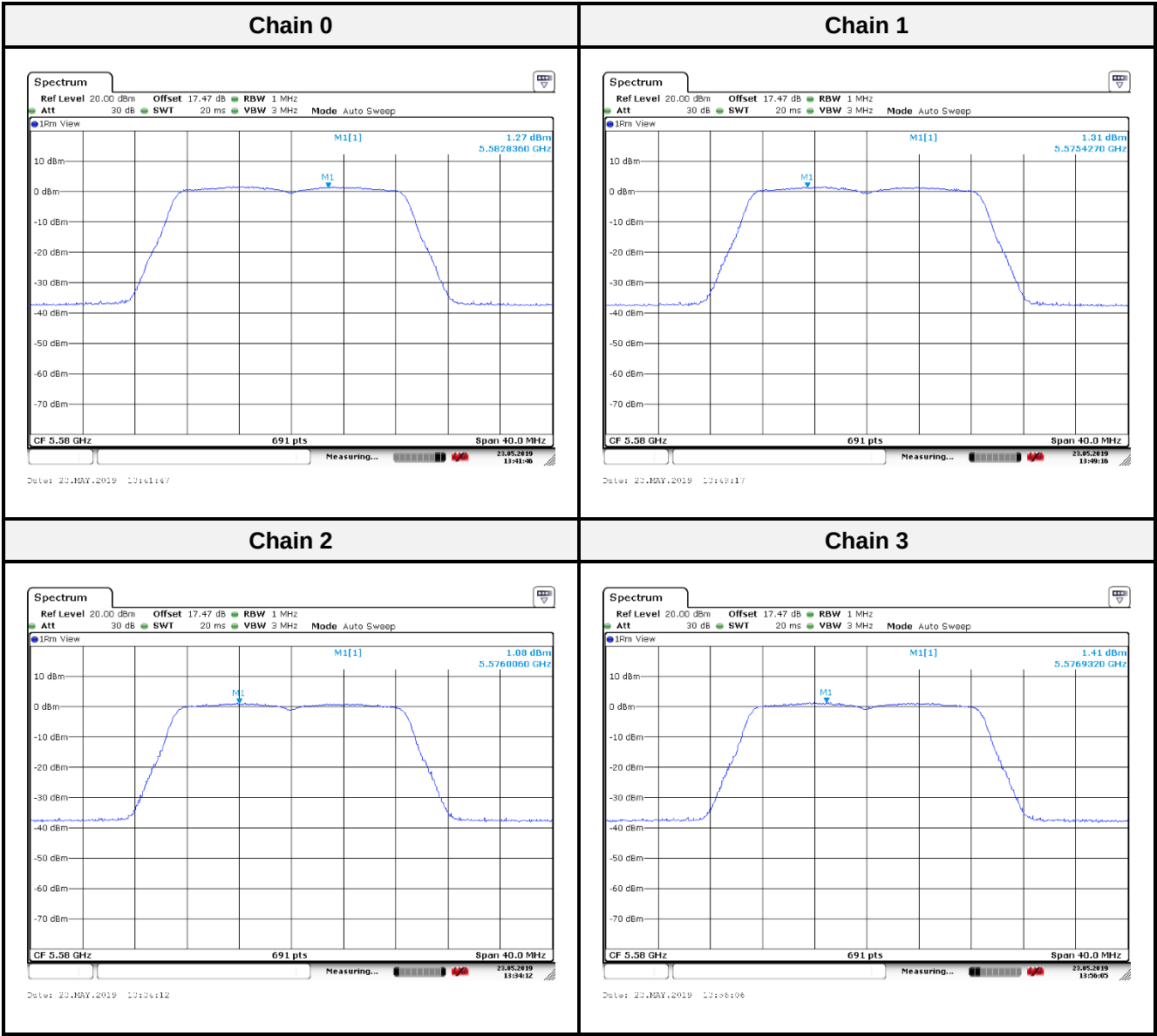
For UNII-2c
802.11a mode:



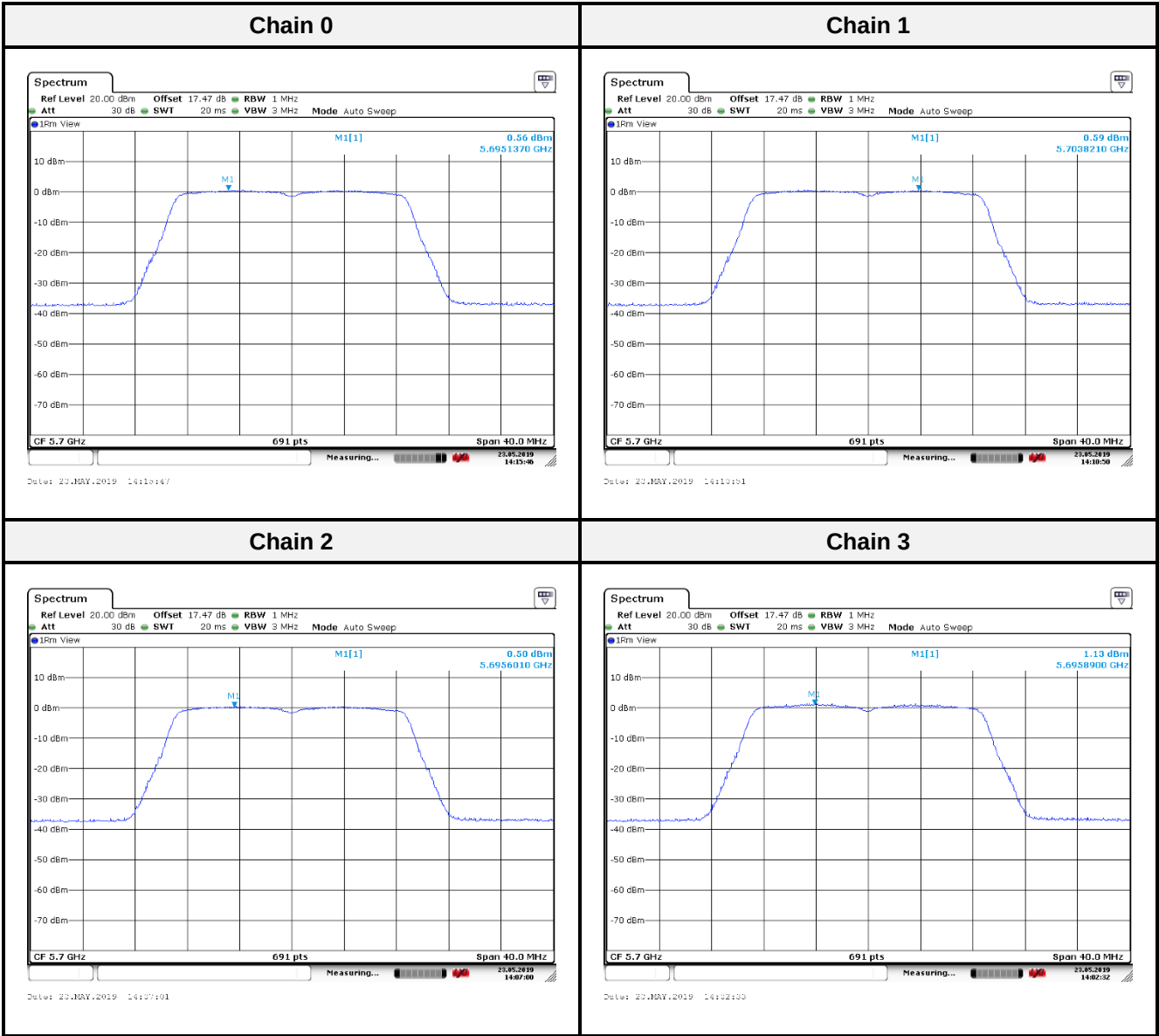
802.11ac VHT20-BF mode: Low Channel



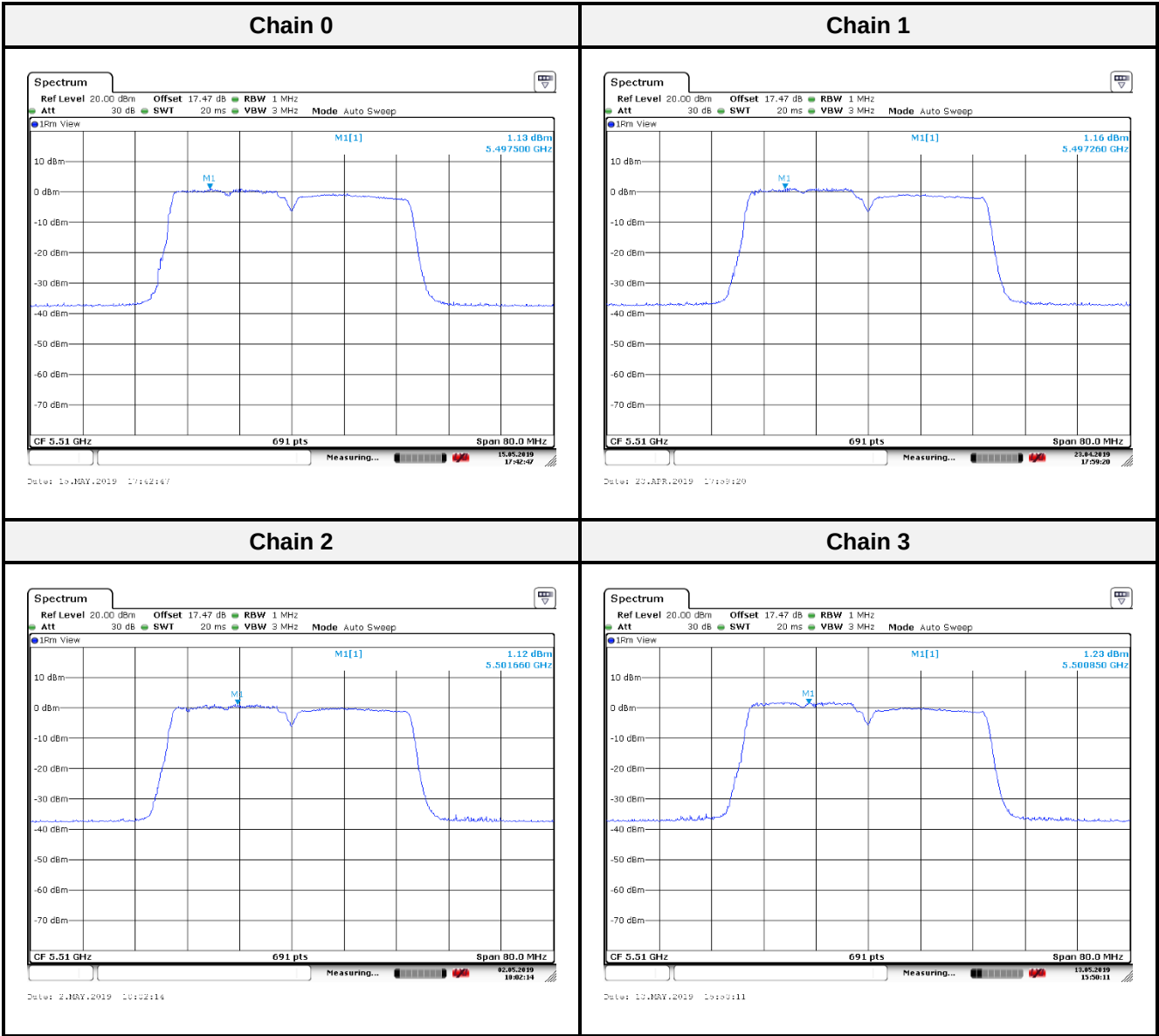
802.11ac VHT20-BF mode: Middle Channel



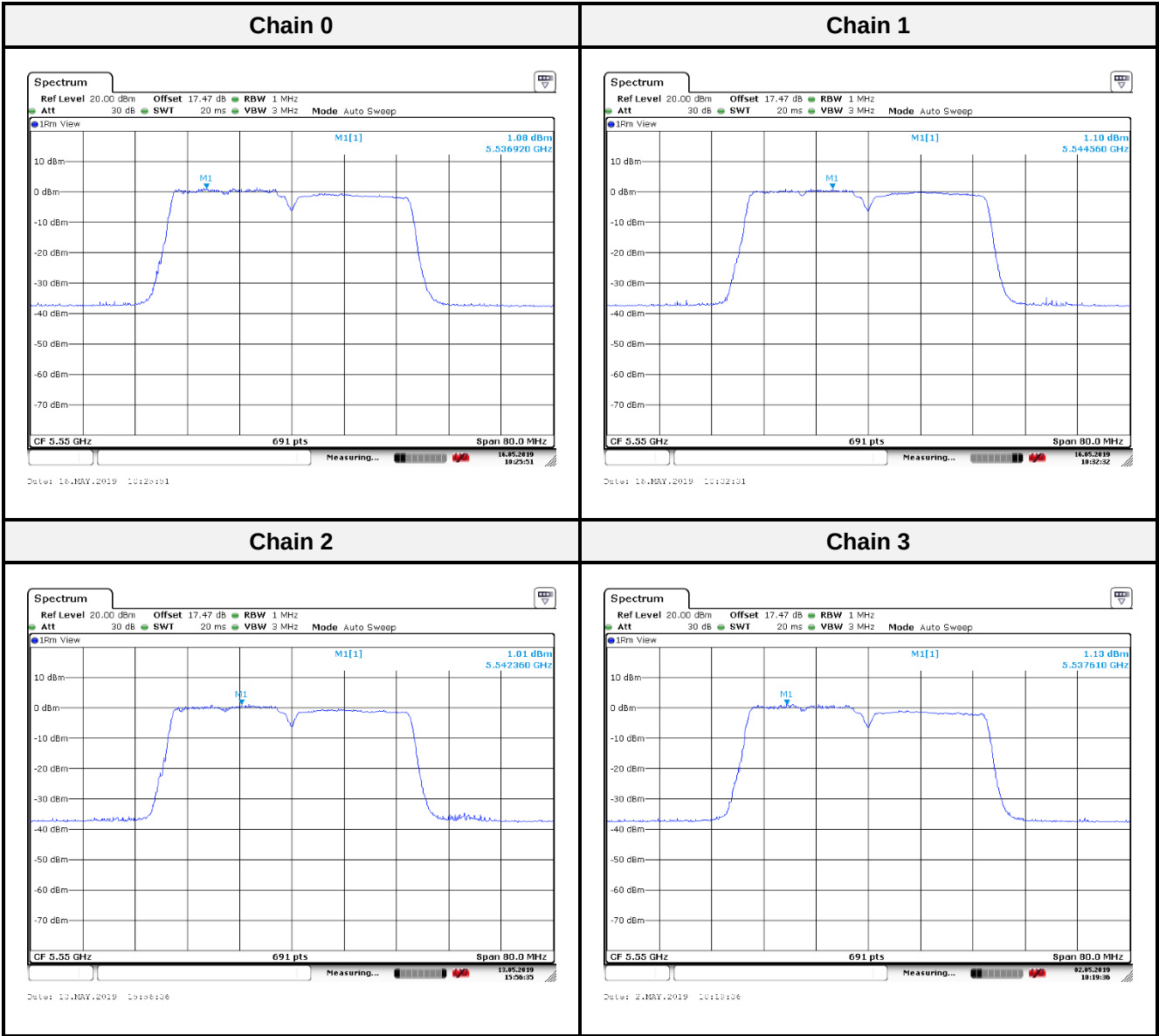
802.11ac VHT20-BF mode: High Channel



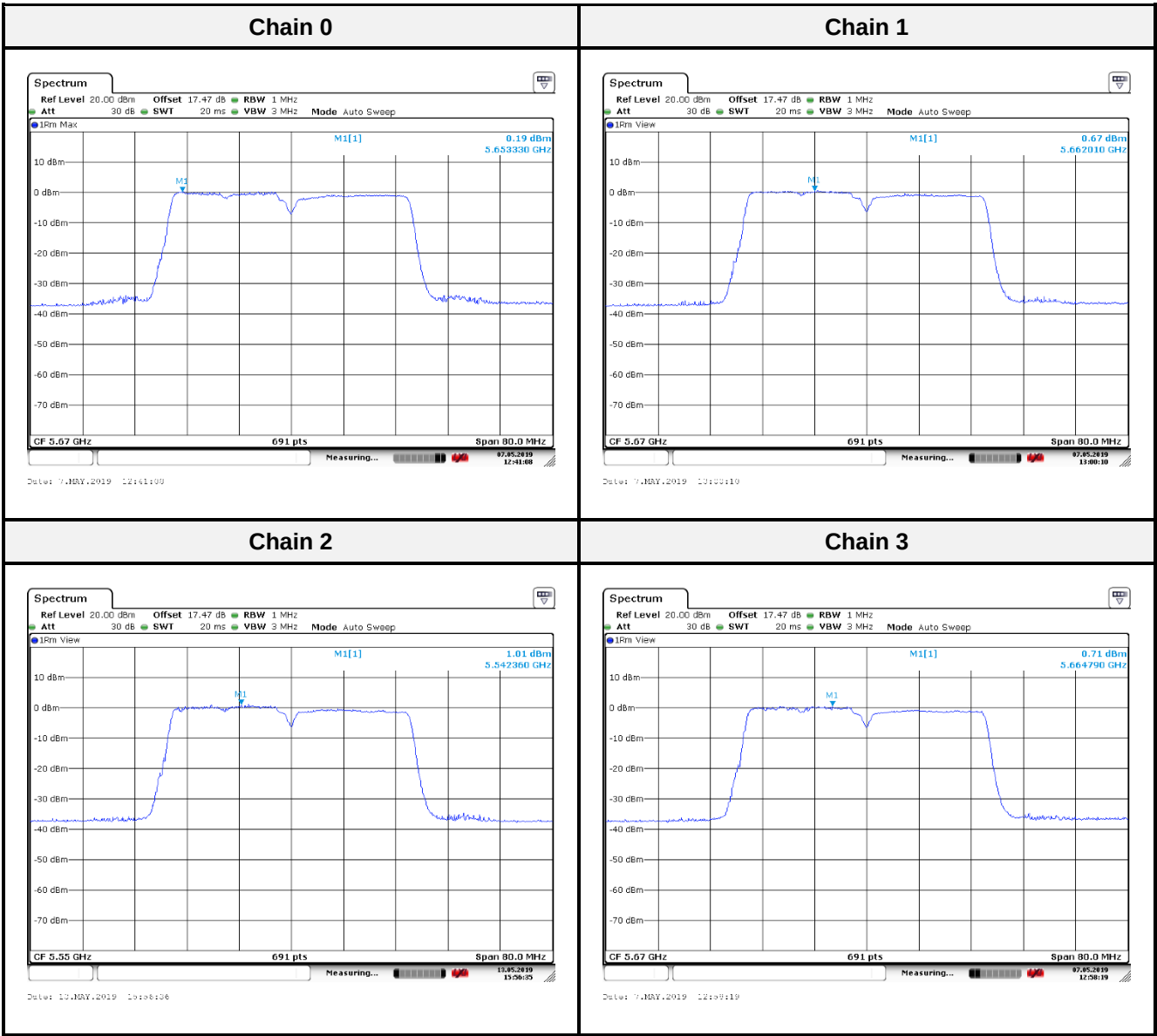
802.11ac VHT40-BF mode: Low Channel



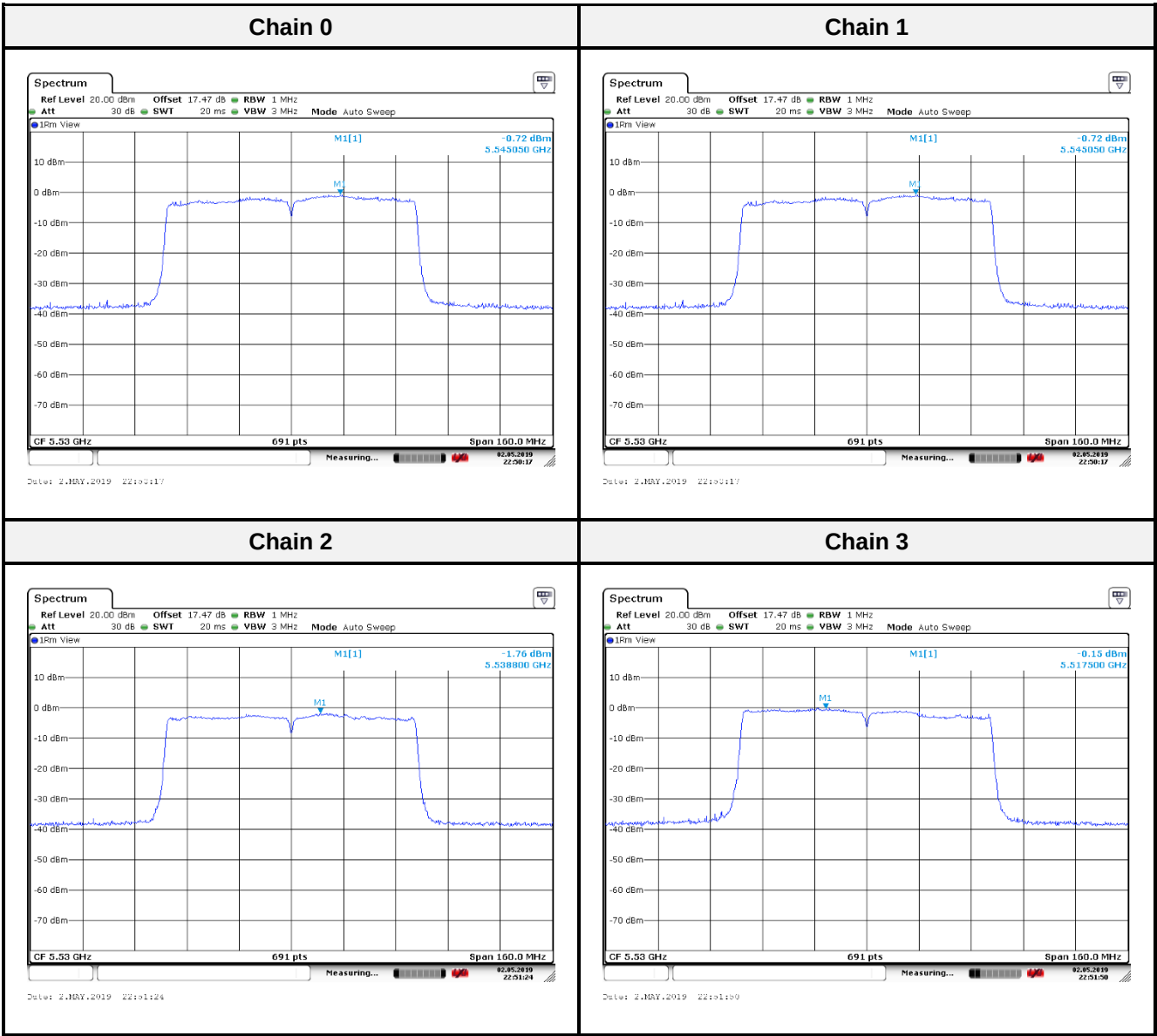
802.11ac VHT40-BF mode: Middle Channel



802.11ac VHT40-BF mode: High Channel

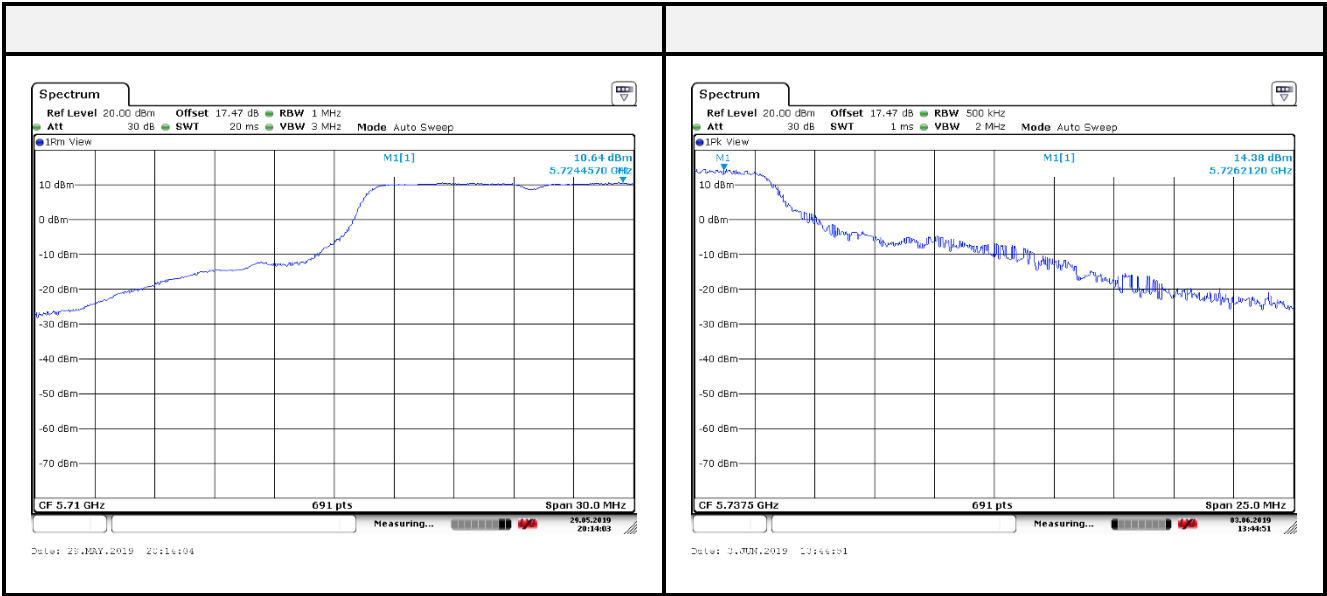


802.11ac VHT80-BF mode

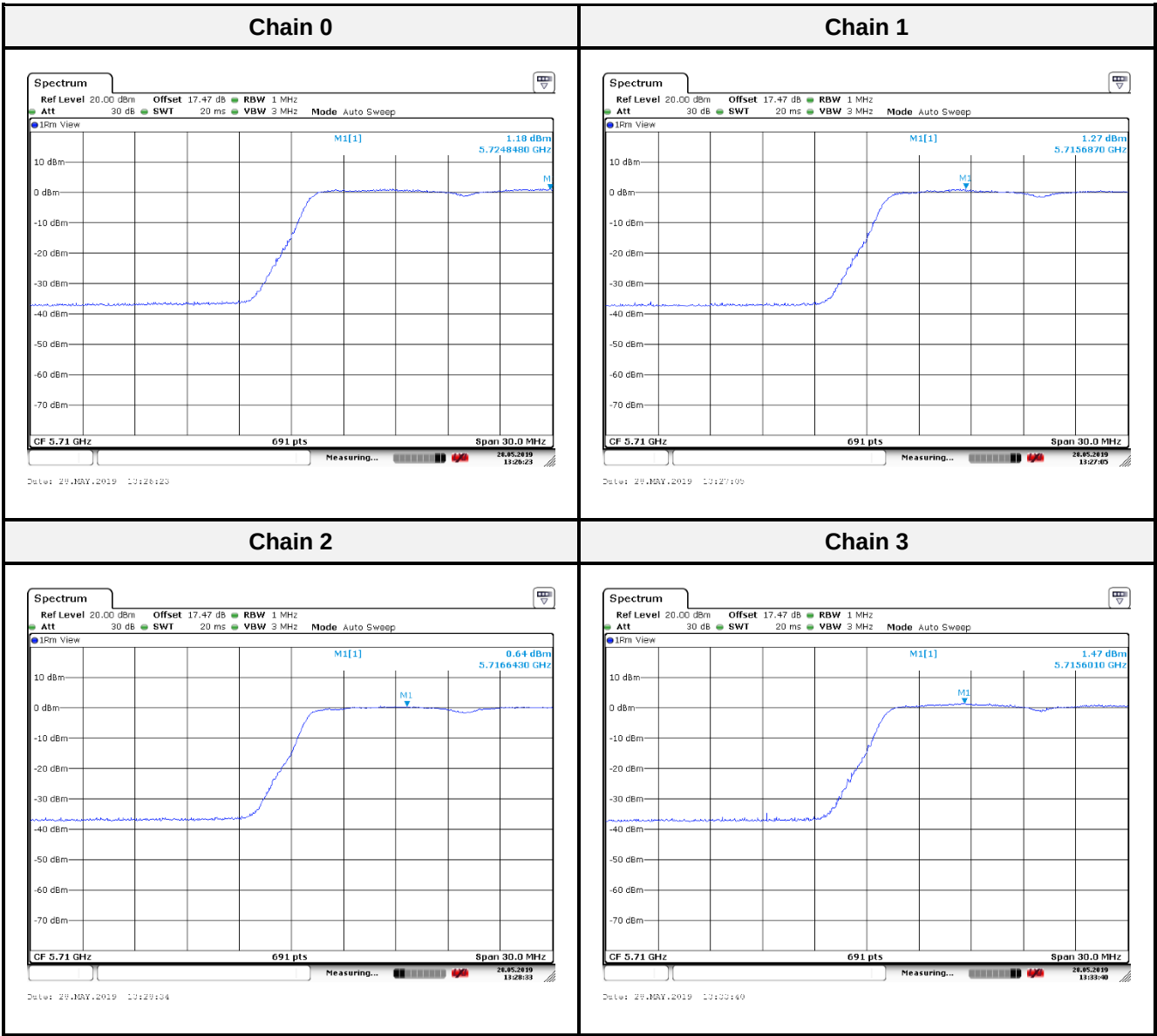


For Straddle Channel

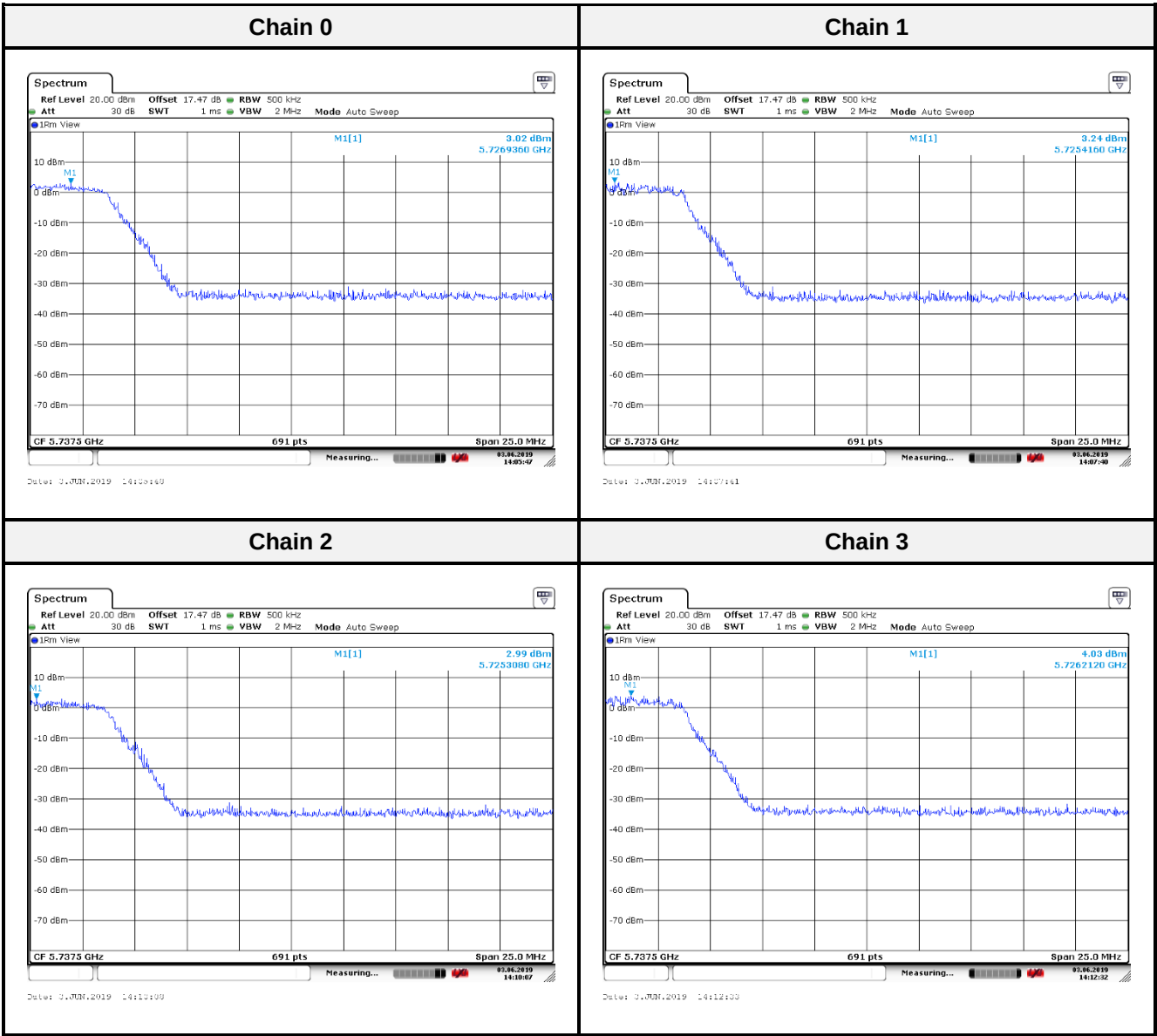
802.11a mode:



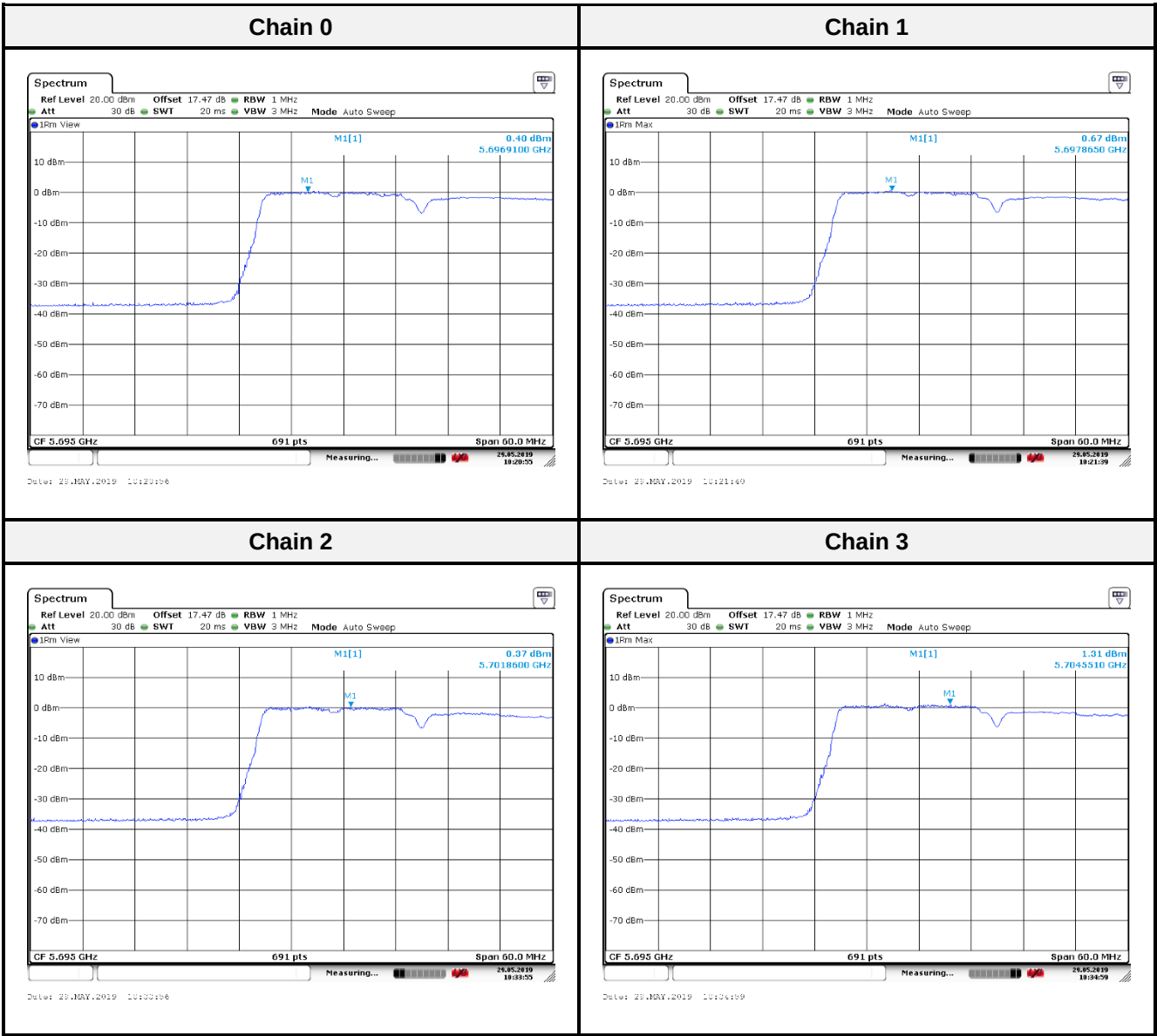
802.11ac VHT20 mode: (UNII-2c)



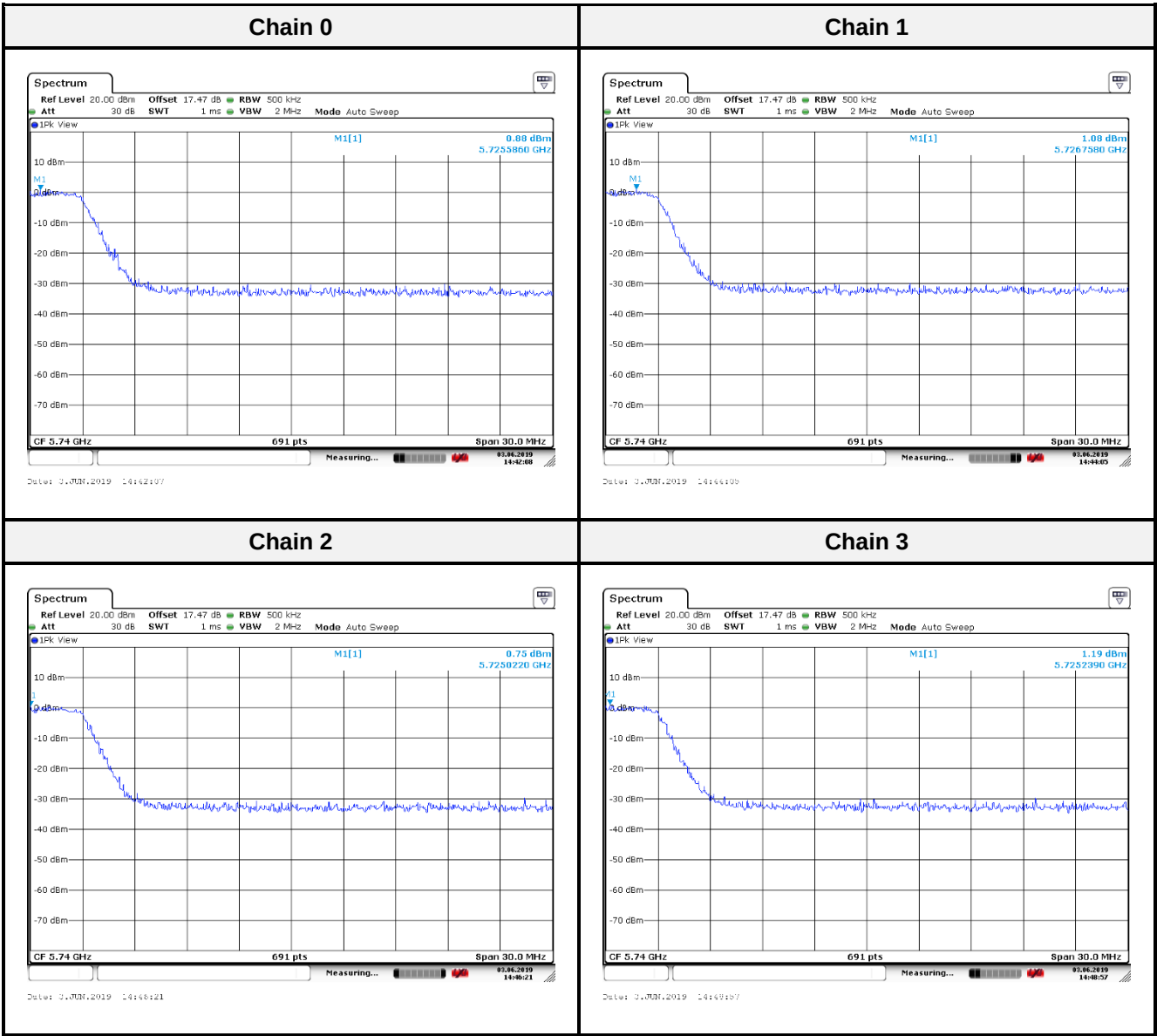
802.11ac VHT20 mode: (UNII-3)



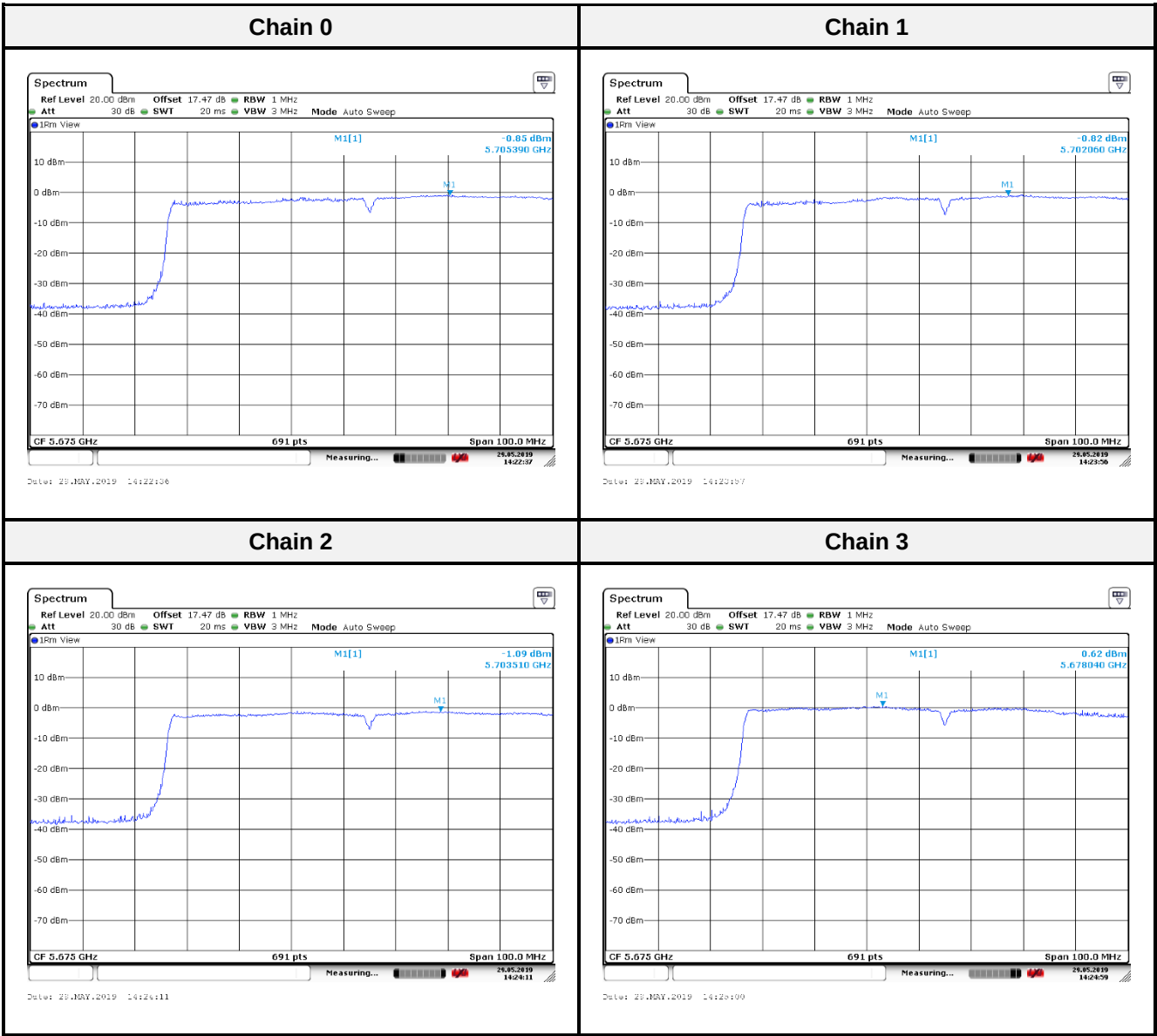
802.11ac VHT40 mode: (UNII-2c)



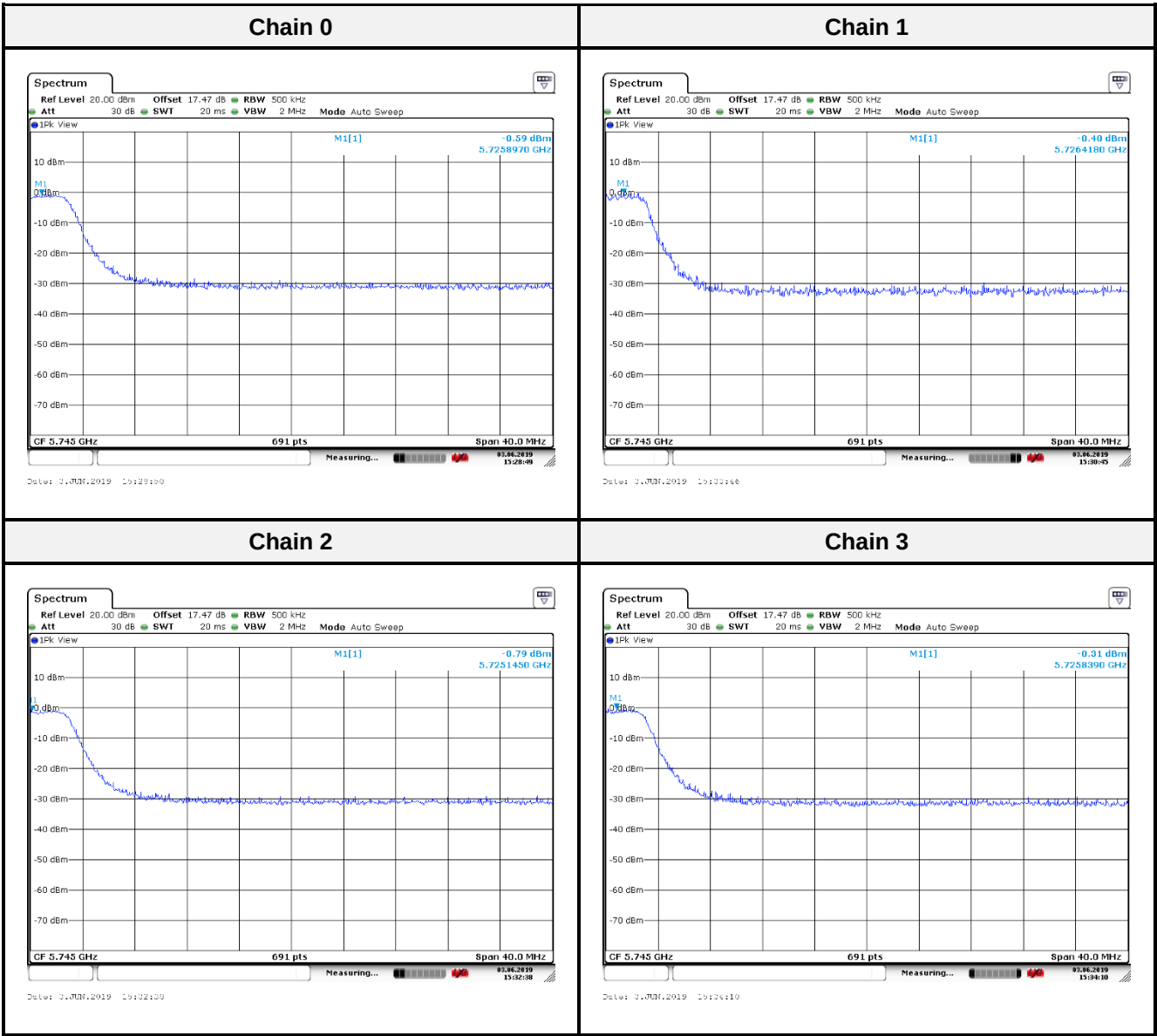
802.11ac VHT40 mode: (UNII-3)



802.11ac VHT80 mode: (UNII-2c)



802.11ac VHT80 mode: (UNII-3)



***** END OF REPORT *****