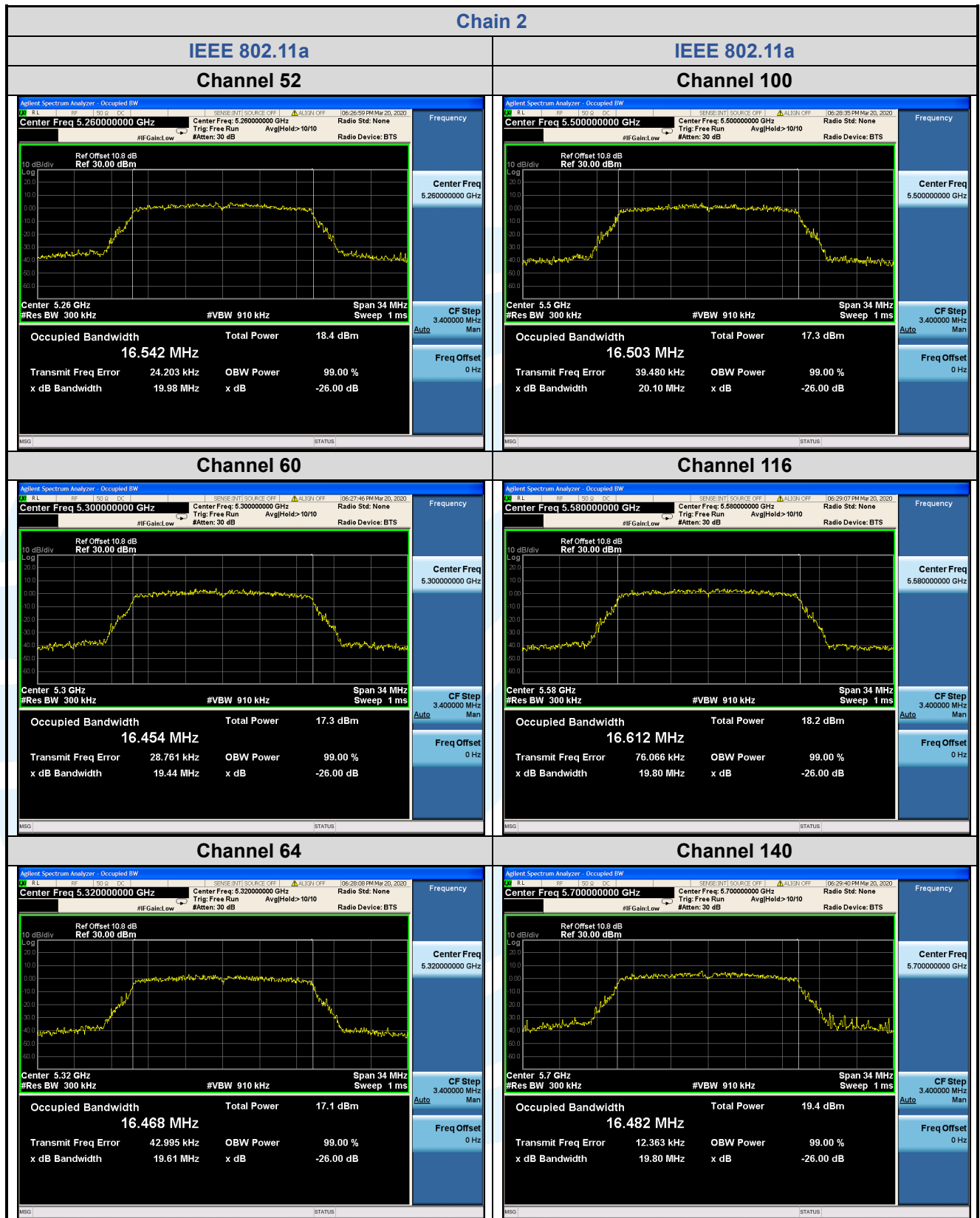
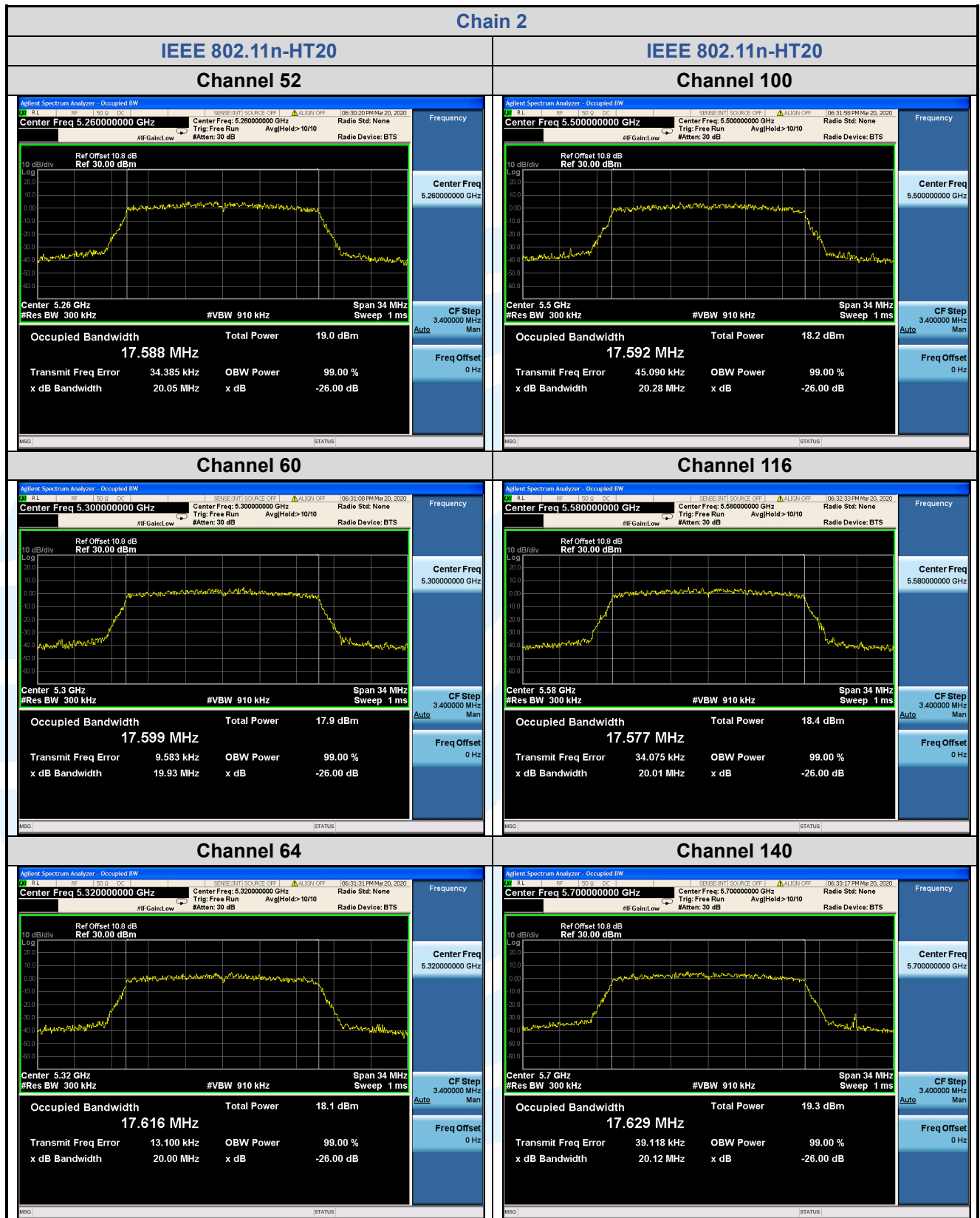
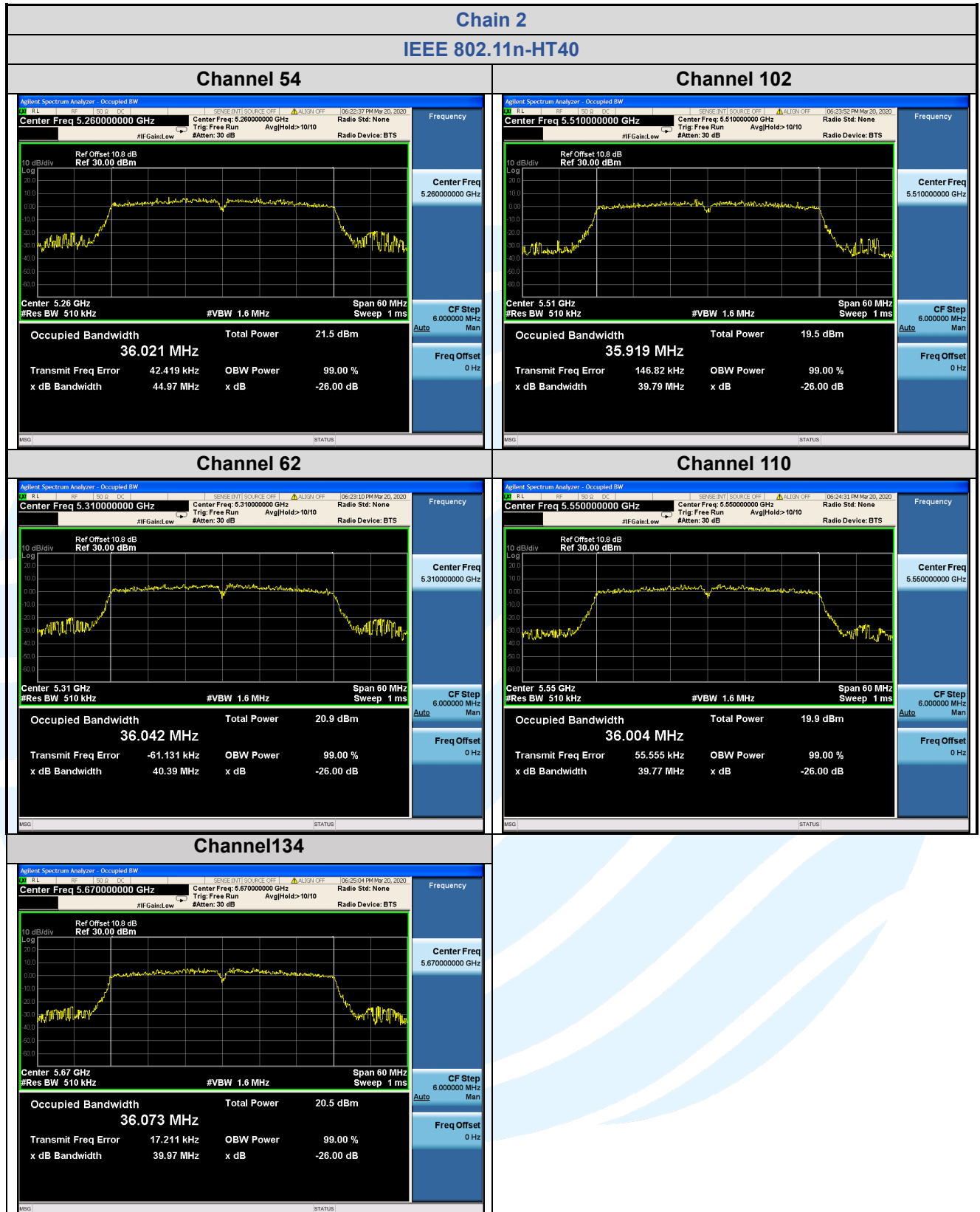
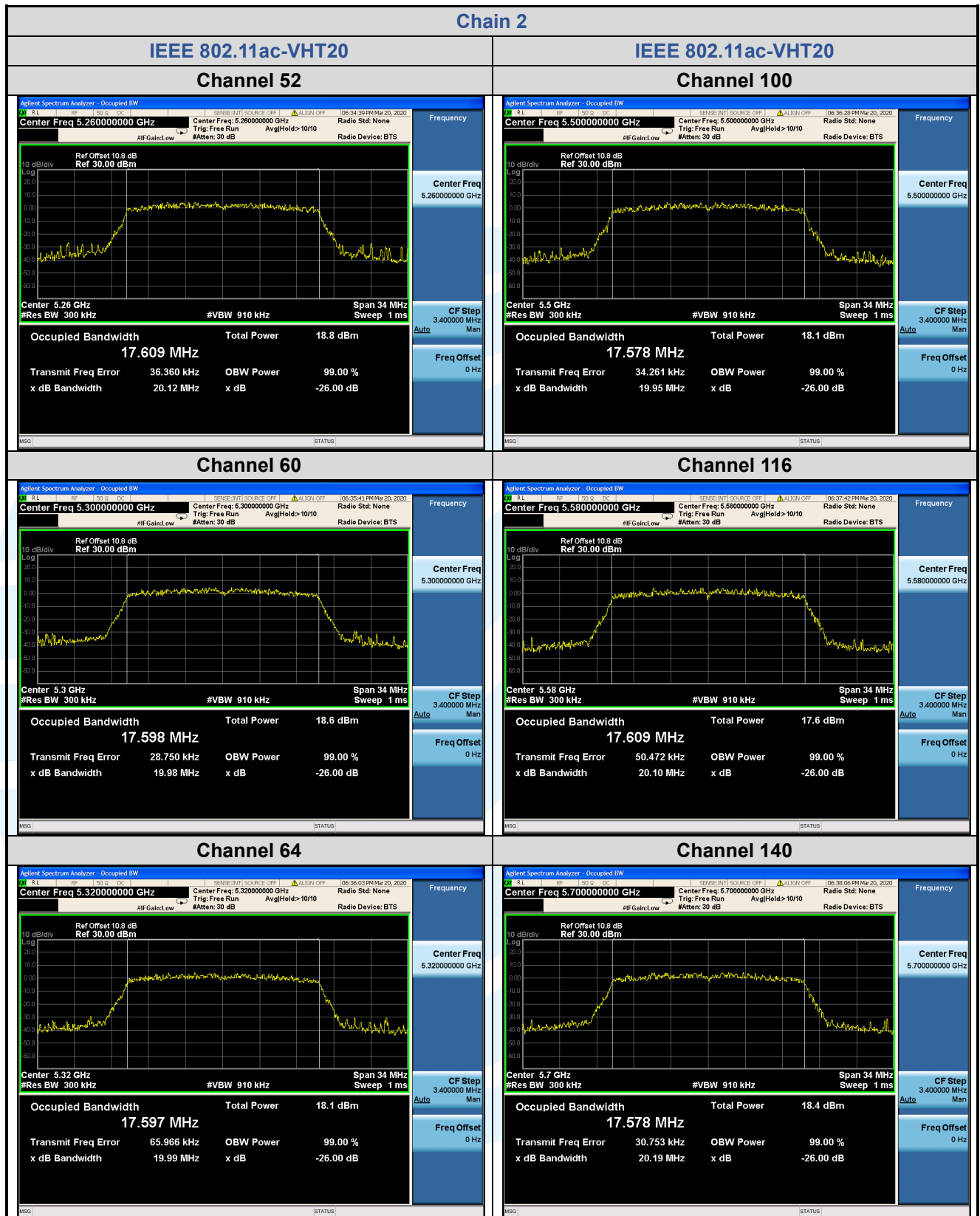
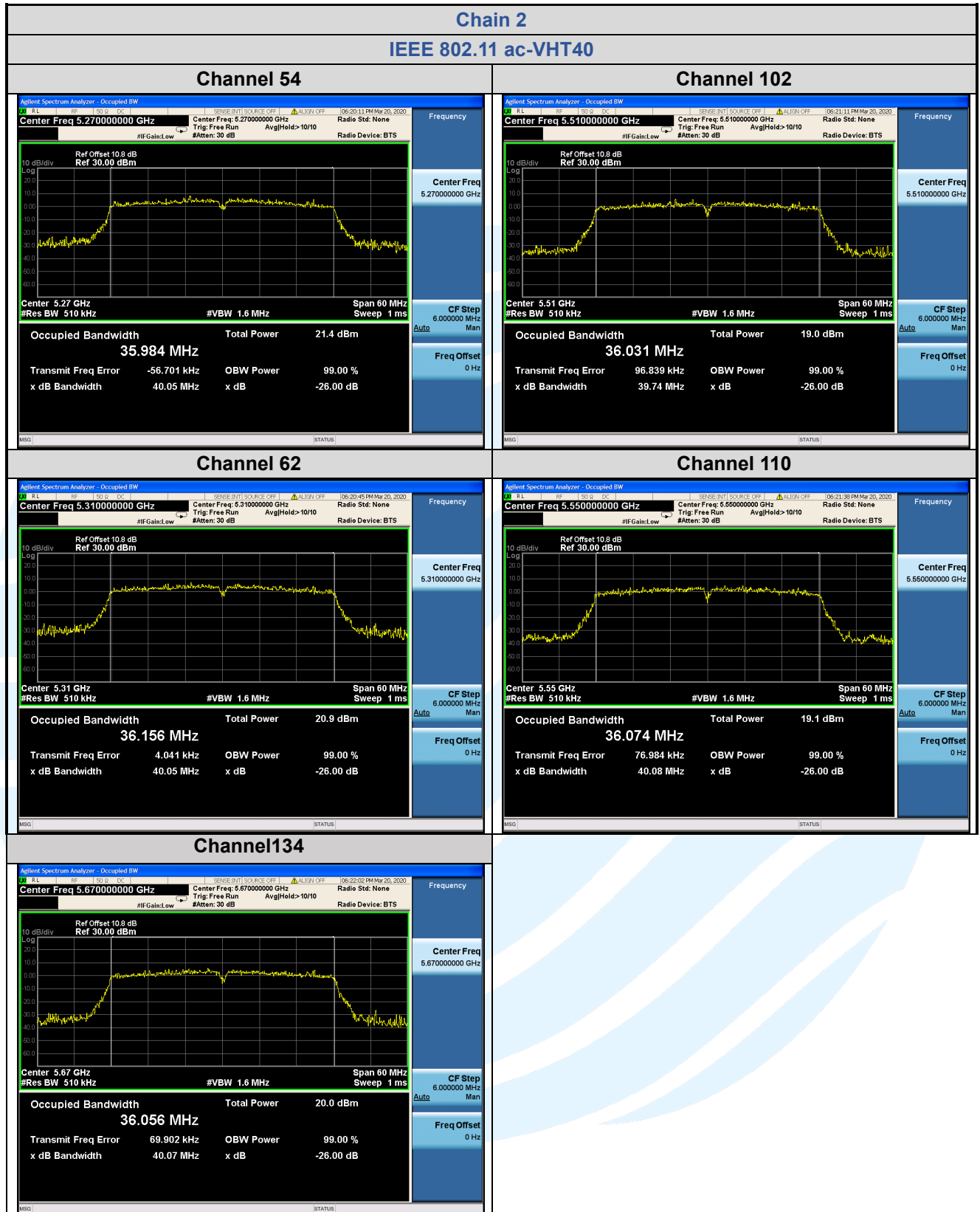


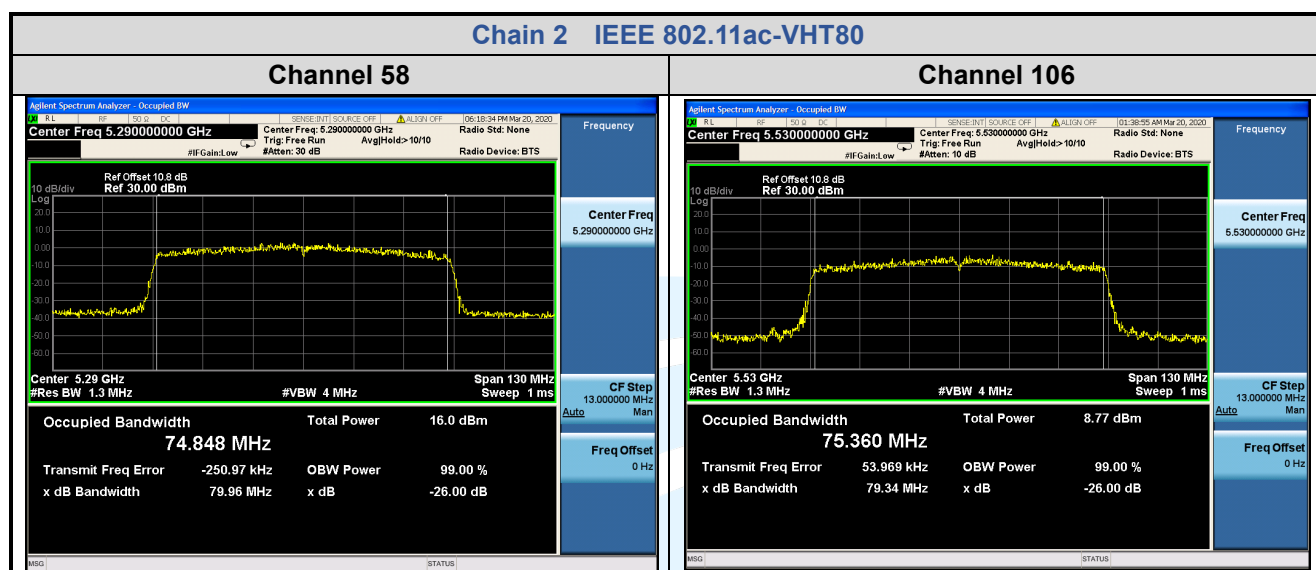












5.4 MAXIMUM CONDUCTED OUTPUT POWER OR E.I.R.P

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)
Section 6.2.1.1/6.2.2.1/6.2.3.1/6.2.4.1

Test Method: KDB 789033 D02 v02r01 Section E.3.a (Method PM)

Limits: FCC 47 CFR Part 15 Subpart E

- 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.

Limits: RSS-247 Issue 2

1. Frequency band 5250-5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10 \log_{10} B$, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Additional requirements

In addition to the above requirements, devices shall comply with the following, where applicable:

- Outdoor fixed devices with a maximum e.i.r.p. greater than 200 mW shall comply with the following e.i.r.p. at different elevations, where θ is the angle above the local horizontal plane (of the Earth) as shown below:

i. -13 dBW/MHz	for $0^\circ \leq \theta < 8^\circ$
ii. $-13 - 0.716 (\theta - 8)$ dBW/MHz	for $8^\circ \leq \theta < 40^\circ$
iii. $-35.9 - 1.22 (\theta - 40)$ dBW/MHz	for $40^\circ \leq \theta \leq 45^\circ$
iv. -42 dBW/MHz	for $\theta > 45^\circ$

The measurement procedure defined in Annex A of this document shall be used to verify the compliance to the e.i.r.p. at different elevations.

- Devices, other than outdoor fixed devices, having an e.i.r.p. greater than 200 mW shall comply with either i. or ii. below:
 - devices shall comply with the e.i.r.p. elevation mask in 6.2.2.3(a); or
 - devices shall implement a method to permanently reduce their e.i.r.p. via a firmware feature in the event that the Department requires it. The test report must demonstrate how the device's power table can be updated to meet this firmware requirement. The manufacturer shall provide this firmware to update all systems automatically in compliance with the directions received from the Department.

2. Frequency bands 5470-5600 MHz and 5650-5725 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Test Procedure:

- Connected the EUT's antenna port to measure device by 10dB attenuator.

2. Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of Tx on burst.

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Test Data:

Directional gain and the maximum output power limit.

RSS-247 Issue 2

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Correlated chains directional gain	Peak Power Limits (dBm)
U-NII-2A	3.00	3.00	3.00	7.77	22.23
U-NII-2C	3.00	3.00	3.00	7.77	22.23
Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:					
If <i>any</i> transmit signals are <i>correlated</i> with each other,					
Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi					

FCC 47 CFR Part 15 Subpart E

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	Peak Power Limits (dBm)
U-NII-2A	3.00	3.00	3.00	7.77	22.23
U-NII-2C	3.00	3.00	3.00	7.77	22.23
Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:					
If <i>any</i> transmit signals are <i>correlated</i> with each other,					
Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi					

Frequency band 5250-5350 MHz

RSS-247 Issue 2:

For IEEE 802.11 a/n-HT20, the minimum 99% emission bandwidth is 16.454MHz

$11 \text{ dBm} + 10\log_{10}(16.454) = 22.16 \text{ dBm} < 22.23\text{dBm}$

So the 22.16 dB limit applicable

For IEEE 802.11 n-HT40/ac-VHT80, the minimum 99% emission bandwidth is 35.865 MHz

$11 \text{ dBm} + 10\log_{10}(35.865) = 25.55 \text{ dBm} > 22.23 \text{ dBm}$

So the 22.23 dB limit applicable

FCC 47 CFR Part 15 Subpart E:

For IEEE 802.11 a/n/ac, the minimum 26 dB emission bandwidth is 19.44 MHz

$11 \text{ dBm} + 10\log_{10}(19.44) = 22.89\text{dBm} > 22.23 \text{ dBm}$

So the 22.23dB limit applicable

For the 22.20dB limit applicable								
Mode	Channel/ Frequency (MHz)	Maximum conducted output power (dBm)			Total Power MIMO_ Chain 0+1+2 (dBm)	Limit (dBm)		Pass / Fail
		SISO				FCC Part 15E	RSS- 247	
		Chain 0	Chain 1	Chain 2				
IEEE 802.11a	52 (5260)	13.11	13.80	13.79	18.35	22.23	22.16	Pass
	60 (5300)	13.18	13.88	13.38	18.27	22.23	22.16	Pass
	64 (5320)	13.24	14.01	13.38	18.33	22.23	22.16	Pass
IEEE 802.11n- HT20	52 (5260)	14.08	14.55	14.70	19.23	22.23	22.16	Pass
	60 (5300)	14.11	14.86	14.23	19.19	22.23	22.16	Pass
	64 (5320)	14.08	14.88	14.17	19.17	22.23	22.16	Pass
IEEE 802.11n- HT40	54 (5270)	16.43	16.85	16.69	21.44	22.23	22.23	Pass
	62 (5310)	16.40	17.07	16.15	21.33	22.23	22.23	Pass
IEEE 802.11ac- VHT20	52 (5260)	14.09	14.61	14.72	19.26	22.23	22.16	Pass
	60 (5300)	14.12	14.80	14.24	19.17	22.23	22.16	Pass
	64 (5320)	14.06	14.89	14.12	19.15	22.23	22.16	Pass
IEEE 802.11ac- VHT40	54 (5270)	16.57	16.97	16.85	21.57	22.23	22.23	Pass
	62 (5310)	16.54	17.18	16.43	21.50	22.23	22.23	Pass
IEEE 802.11ac- VHT80	58 (5290)	10.37	11.11	10.84	15.55	22.23	22.23	Pass

Remark:

- Maximum conducted output power = Conducted output power + Duty Cycle Factor
- Total Power (Chain 0+1+2) = $10 \cdot \log_{10}[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10}) + (10^{\text{Chain 2}/10})]$

Frequency bands 5470-5725 MHz (RSS-247 Issue 2 Not including 5600-5650 MHz)

RSS-247 Issue 2:

For IEEE 802.11 a/n-HT20, the minimum 99% emission bandwidth is 16.494 MHz

$11 \text{ dBm} + 10\log_{10}(16.494) = 22.17 \text{ dBm} < 22.23 \text{ dBm}$

So the 22.17 dB limit applicable

For IEEE 802.11 n-HT40/ac-VHT80, the minimum 99% emission bandwidth is 35.879 MHz

$11 \text{ dBm} + 10\log_{10}(35.879) = 25.55 \text{ dBm} > 22.23 \text{ dBm}$

So the 22.23 dB limit applicable

FCC 47 CFR Part 15 Subpart E:

For IEEE 802.11 a/n/ac, the minimum 26 dB emission bandwidth is 19.79 MHz

$11 \text{ dBm} + 10\log_{10}(19.79) = 22.96 \text{ dBm} > 22.23 \text{ dBm}$

So the 22.23dB limit applicable

to the 22.20dB limit applicable								
Mode	Channel/ Frequency (MHz)	Maximum conducted output power (dBm)			Total Power MIMO_ Chain 0+1 +2(dBm)	Limit (dBm)		Pass / Fail
		SISO				FCC Part 15E	RSS- 247	
		Chain 0	Chain 1	Chain 2				
IEEE 802.11a	100 (5500)	12.65	13.30	13.86	18.07	22.23	22.17	Pass
	116 (5580)	12.93	12.83	13.53	17.88	22.23	22.17	Pass
	140 (5700)	13.13	13.67	13.37	18.17	22.23	22.17	Pass
IEEE 802.11n- HT20	100 (5500)	12.96	13.71	14.25	18.45	22.23	22.17	Pass
	116 (5580)	13.19	13.20	13.83	18.19	22.23	22.17	Pass
	140 (5700)	13.53	13.98	13.74	18.53	22.23	22.17	Pass
IEEE 802.11n- HT40	102 (5510)	14.35	14.86	15.30	19.63	22.23	22.23	Pass
	110 (5550)	14.47	14.35	15.02	19.40	22.23	22.23	Pass
	134 (5670)	14.84	15.38	15.32	19.96	22.23	22.23	Pass
IEEE 802.11ac- VHT20	100 (5500)	13.02	13.79	14.42	18.56	22.23	22.17	Pass
	116 (5580)	13.31	13.25	14.01	18.31	22.23	22.17	Pass
	140 (5700)	13.62	14.02	13.99	18.66	22.23	22.17	Pass
IEEE 802.11ac- VHT40	102 (5510)	14.46	15.01	15.60	19.82	22.23	22.23	Pass
	110 (5550)	14.64	14.45	15.15	19.53	22.23	22.23	Pass
	134 (5670)	14.93	15.47	15.47	20.07	22.23	22.23	Pass
IEEE 802.11ac- VHT80	106 (5530)	9.78	10.05	10.92	15.04	22.23	22.23	Pass

Remark:

1. Maximum conducted output power = Conducted output power + Duty Cycle Factor
2. Total Power (Chain 0+1+2) = $10 \cdot \log_{10}[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10}) + (10^{\text{Chain 2}/10})]$

5.5 PEAK POWER SPECTRAL DENSITY

Test Requirement: FCC 47 CFR Part 15 Subpart E Section 15.407 (a)(1)(2)(3)
RSS-247 Issue 2 Section 6.2.1.1/6.2.2.1/6.2.3.1/6.2.4.1

Test Method: KDB 789033 D02 v02r01 Section F

Limits: FCC 47 CFR Part 15 Subpart E

1. 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.

Limits: RSS-247 Issue 2

1. Frequency band 5250-5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or $1.76 + 10 \log_{10} B$, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

Devices, other than devices installed in vehicles, shall comply with the following:

- a) The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
- b) The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Additional requirements

In addition to the above requirements, devices shall comply with the following, where applicable:

- a) Outdoor fixed devices with a maximum e.i.r.p. greater than 200 mW shall comply with the following e.i.r.p. at different elevations, where θ is the angle above the local horizontal plane (of the Earth) as shown below:

i. -13 dBW/MHz	for $0^\circ \leq \theta < 8^\circ$
ii. $-13 - 0.716 (\theta - 8)$ dBW/MHz	for $8^\circ \leq \theta < 40^\circ$
iii. $-35.9 - 1.22 (\theta - 40)$ dBW/MHz	for $40^\circ \leq \theta \leq 45^\circ$
iv. -42 dBW/MHz	for $\theta > 45^\circ$

The measurement procedure defined in Annex A of this document shall be used to verify the compliance to the e.i.r.p. at different elevations.

- b) Devices, other than outdoor fixed devices, having an e.i.r.p. greater than 200 mW shall comply with either i. or ii. below:
 - iii. devices shall comply with the e.i.r.p. elevation mask in 6.2.2.3(a); or
 - iv. devices shall implement a method to permanently reduce their e.i.r.p. via a firmware feature in the event that the Department requires it. The test report must demonstrate how the device's power table can be updated to meet this firmware requirement. The manufacturer shall provide this firmware to update all systems automatically in compliance with the directions received from the Department.

2. Frequency bands 5470-5600 MHz and 5650-5725 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Test Procedure:

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

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-RSS247-V1.0

Spectrum analyzer according to the following Settings:

1. For U-NII-2A, U-NII-2C band:

Using method SA-2

a) Set span to encompass the entire emission bandwidth (EBW) of the signal.

b) Set RBW = 1 MHz, Set VBW $\geq$ 3 RBW, Detector = RMS

c) Sweep time = auto, trigger set to "free run".

d) Trace average at least 100 traces in power averaging mode.

e) Record the max value and add 10 log (1/duty cycle)

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Transmitter mode

Test Results: Pass

Test Data:

Directional gain and the maximum output power limit.
RSS-247 Issue 2:

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	PSD Limits (dBm/MHz)
U-NII-2A	3.00	3.00	3.00	7.77	9.23
U-NII-2C	3.00	3.00	3.00	7.77	9.23
Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:					
If <i>any</i> transmit signals are <i>correlated</i> with each other,					
Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi					

FCC 47 CFR Part 15 Subpart E:

Frequency Band	Chain 0 Antenna Gain (dBi)	Chain 1 Antenna Gain (dBi)	Chain 2 Antenna Gain (dBi)	Correlated chains directional gain (dBi)	PSD Limits (dBm/MHz)
U-NII-2A	3.00	3.00	3.00	7.77	9.23
U-NII-2C	3.00	3.00	3.00	7.77	9.23
Basic methodology with N_{ANT} transmit antennas, each with the same directional gain G_{ANT} dBi, being driven by N_{ANT} transmitter outputs of equal power. Directional gain is to be computed as follows:					
If <i>any</i> transmit signals are <i>correlated</i> with each other,					
Directional gain = $G_{ANT} + 10 \log(N_{ANT})$ dBi					

Frequency band 5250-5350 MHz

Mode	Channel/ Frequency (MHz)	Power spectral density (dBm/MHz)			Total power spectral density MIMO_Chain 0+1+2 (dBm/MHz)	Limit (dBm/MHz)	Pass / Fail
		SISO					
		Chain 0	Chain 1	Chain 2			
IEEE 802.11a	52 (5260)	3.35	3.50	3.70	8.29	9.23	Pass
	60 (5300)	3.46	4.01	3.32	8.38	9.23	Pass
	64 (5320)	3.47	3.77	3.17	8.25	9.23	Pass
IEEE 802.11n- HT20	52 (5260)	3.27	4.24	4.29	8.73	9.23	Pass
	60 (5300)	3.64	4.41	4.17	8.85	9.23	Pass
	64 (5320)	3.71	4.54	4.09	8.90	9.23	Pass
IEEE 802.11n- HT40	54 (5270)	3.80	3.52	4.06	8.57	9.23	Pass
	62 (5310)	3.51	3.93	3.41	8.39	9.23	Pass
IEEE 802.11ac- VHT20	52 (5260)	3.97	4.24	4.27	8.94	9.23	Pass
	60 (5300)	3.45	4.25	3.90	8.65	9.23	Pass
	64 (5320)	3.60	4.36	3.71	8.68	9.23	Pass
IEEE 802.11ac- VHT40	54 (5270)	3.88	4.27	3.93	8.80	9.23	Pass
	62 (5310)	3.73	3.42	2.14	7.92	9.23	Pass
IEEE 802.11ac- VHT80	58 (5290)	-5.08	-3.52	-3.66	0.74	9.23	Pass

Remark:

1. Power spectral density = Conducted power spectral density + Duty Cycle Factor
2. Total Power (Chain 0+1+2) = $10 \cdot \log[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10}) + (10^{\text{Chain 2}/10})]$

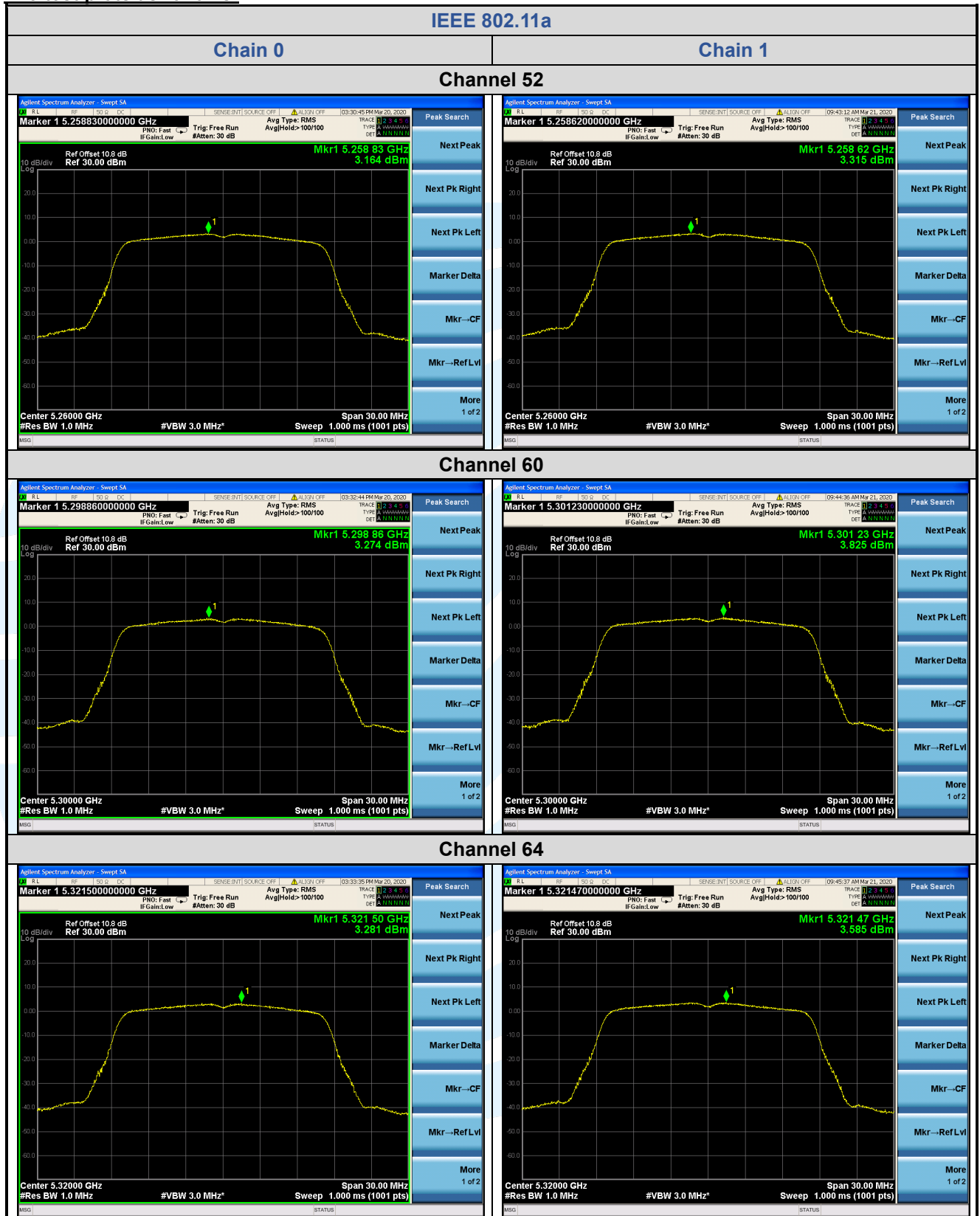
Frequency bands 5470-5725 MHz (RSS-247 Issue 2 Not including 5600-5650 MHz)

Mode	Channel/ Frequency (MHz)	Power spectral density (dBm/MHz)			Total power spectral density MIMO_Chain 0+1 +2 (dBm/MHz)	Limit (dBm/MHz)	Pass / Fail
		SISO					
		Chain 0	Chain 1	Chain 2			
IEEE 802.11a	100 (5500)	2.10	2.99	3.49	7.66	9.23	Pass
	116 (5580)	2.76	2.83	3.55	7.83	9.23	Pass
	140 (5700)	3.62	3.91	3.96	8.60	9.23	Pass
IEEE 802.11n- HT20	100 (5500)	2.37	3.12	3.75	7.89	9.23	Pass
	116 (5580)	3.23	2.90	3.83	8.11	9.23	Pass
	140 (5700)	3.75	4.05	4.11	8.75	9.23	Pass
IEEE 802.11n- HT40	102 (5510)	0.52	0.71	1.17	5.58	9.23	Pass
	110 (5550)	0.74	0.66	1.14	5.62	9.23	Pass
	134 (5670)	1.66	2.12	2.02	6.71	9.23	Pass
IEEE 802.11ac- VHT20	100 (5500)	2.40	3.25	3.80	7.96	9.23	Pass
	116 (5580)	3.19	3.04	3.71	8.09	9.23	Pass
	140 (5700)	3.78	4.24	3.83	8.73	9.23	Pass
IEEE 802.11ac- VHT40	102 (5510)	0.66	1.06	1.26	5.77	9.23	Pass
	110 (5550)	0.81	1.15	1.58	5.97	9.23	Pass
	134 (5670)	1.44	2.18	2.16	6.71	9.23	Pass
IEEE 802.11ac- VHT80	106 (5530)	-5.46	-4.47	-4.47	0.00	9.23	Pass

Remark:

1. Power spectral density = Conducted power spectral density + Duty Cycle Factor
2. Total Power (Chain 0+1+2) = $10 \cdot \log[(10^{\text{Chain 0}/10}) + (10^{\text{Chain 1}/10}) + (10^{\text{Chain 2}/10})]$

The test plots as follows:



Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: 16/F, Block A, Building 6, Baoneng Science and Technology Park, Qingxiang Road No.1, Longhua New District, Shenzhen, China

Tel: +86-755-28230888

Fax: +86-755-28230886

E-mail: info@uttlab.com

<http://www.uttlab.com>

UTTR-RF-RSS247-V1.0

