IEEE 802.11n HT40

Channel 38 / 5190 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.38	54.53	33.21	35.82	9.52	61.44	74.00	-12.56	Peak	Horizontal
10.38	38.03	33.21	35.82	9.52	44.94	54.00	-9.06	Average	Horizontal
10.38	59.49	32.82	35.82	9.52	66.01	74.00	-7.99	Peak	Vertical
10.38	42.31	32.82	35.82	9.52	48.83	54.00	-5.17	Average	Vertical

Channel 46 / 5230 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.46	54.45	33.21	35.82	9.52	61.36	74.00	-12.64	Peak	Horizontal
10.46	38.57	33.21	35.82	9.52	45.48	54.00	-8.52	Average	Horizontal
10.46	59.66	32.82	35.82	9.52	66.18	74.00	-7.82	Peak	Vertical
10.46	41.15	32.82	35.82	9.52	47.67	54.00	-6.33	Average	Vertical

IEEE 802.11ac VHT20

Channel 36 / 5180 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.36	55.79	33.21	35.82	9.52	62.70	74.00	-11.30	Peak	Horizontal
10.36	39.44	33.21	35.82	9.52	46.35	54.00	-7.65	Average	Horizontal
10.36	59.18	32.82	35.82	9.52	65.70	74.00	-8.30	Peak	Vertical
10.36	41.36	32.82	35.82	9.52	47.88	54.00	-6.12	Average	Vertical

Channel 40 / 5200 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.44	55.21	33.21	35.82	9.52	62.12	74.00	-11.88	Peak	Horizontal
10.44	38.04	33.21	35.82	9.52	44.95	54.00	-9.05	Average	Horizontal
10.44	58.24	32.82	35.82	9.52	64.76	74.00	-9.24	Peak	Vertical
10.44	42.05	32.82	35.82	9.52	48.57	54.00	-5.43	Average	Vertical

Channel 48 / 5240 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.48	55.53	33.21	35.82	9.52	62.44	74.00	-11.56	Peak	Horizontal
10.48	38.65	33.21	35.82	9.52	45.56	54.00	-8.44	Average	Horizontal
10.48	58.40	32.82	35.82	9.52	64.92	74.00	-9.08	Peak	Vertical
10.48	41.79	32.82	35.82	9.52	48.31	54.00	-5.69	Average	Vertical

IEEE 802.11ac VHT40

Channel 38 / 5190 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.38	55.23	33.21	35.82	9.52	62.14	74.00	-11.86	Peak	Horizontal
10.38	38.36	33.21	35.82	9.52	45.27	54.00	-8.73	Average	Horizontal
10.38	59.19	32.82	35.82	9.52	65.71	74.00	-8.29	Peak	Vertical
10.38	41.98	32.82	35.82	9.52	48.50	54.00	-5.50	Average	Vertical

Channel 46 / 5230 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.46	54.43	33.21	35.82	9.52	61.34	74.00	-12.66	Peak	Horizontal
10.46	38.17	33.21	35.82	9.52	45.08	54.00	-8.92	Average	Horizontal
10.46	59.29	32.82	35.82	9.52	65.81	74.00	-8.19	Peak	Vertical
10.46	41.13	32.82	35.82	9.52	47.65	54.00	-6.35	Average	Vertical

IEEE 802.11ac VHT80

Channel 42 / 5210 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
10.42	54.20	33.21	35.82	9.52	61.11	74.00	-12.89	Peak	Horizontal
10.42	38.43	33.21	35.82	9.52	45.34	54.00	-8.66	Average	Horizontal
10.42	58.73	32.82	35.82	9.52	65.25	74.00	-8.75	Peak	Vertical
10.42	42.63	32.82	35.82	9.52	49.15	54.00	-4.85	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz ~ 40 GHz, No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions measured in frequency range from 9 KHz ~ 40 GHz were made with an instrument using Peak detector mode.
3). 18~40GHz at least have 20dB margin. No recording in the test report.
4). Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20, IEEE 802.11ac VHT40, IEEE 802.11ac VHT80;
5). Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5.6.8.2 UNII Band 3

IEEE 802.11a

Channel 149 / 5745 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.49	55.46	33.92	36.09	10.26	63.55	74.00	-10.45	Peak	Horizontal
11.49	39.29	33.92	36.09	10.26	47.38	54.00	-6.62	Average	Horizontal
11.49	59.94	33.99	35.99	10.26	68.20	74.00	-5.80	Peak	Vertical
11.49	41.80	33.99	35.99	10.26	50.06	54.00	-3.94	Average	Vertical

Channel 157 / 5785 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.57	55.27	33.92	36.09	10.26	63.36	74.00	-10.64	Peak	Horizontal
11.57	38.88	33.92	36.09	10.26	46.97	54.00	-7.03	Average	Horizontal
11.57	58.10	33.99	35.99	10.26	66.36	74.00	-7.64	Peak	Vertical
11.57	41.31	33.99	35.99	10.26	49.57	54.00	-4.43	Average	Vertical

Channel 163 / 5825 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.65	55.44	33.92	36.09	10.26	63.53	74.00	-10.47	Peak	Horizontal
11.65	39.71	33.92	36.09	10.26	47.80	54.00	-6.20	Average	Horizontal
11.65	59.65	33.99	35.99	10.26	67.91	74.00	-6.09	Peak	Vertical
11.65	41.24	33.99	35.99	10.26	49.50	54.00	-4.50	Average	Vertical

IEEE 802.11n HT20

Channel 149 / 5745 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.49	55.33	33.92	36.09	10.26	63.42	74.00	-10.58	Peak	Horizontal
11.49	39.56	33.92	36.09	10.26	47.65	54.00	-6.35	Average	Horizontal
11.49	58.72	33.99	35.99	10.26	66.98	74.00	-7.02	Peak	Vertical
11.49	41.91	33.99	35.99	10.26	50.17	54.00	-3.83	Average	Vertical

Channel 157 / 5785 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.57	55.38	33.92	36.09	10.26	63.47	74.00	-10.53	Peak	Horizontal
11.57	38.02	33.92	36.09	10.26	46.11	54.00	-7.89	Average	Horizontal
11.57	58.33	33.99	35.99	10.26	66.59	74.00	-7.41	Peak	Vertical
11.57	41.20	33.99	35.99	10.26	49.46	54.00	-4.54	Average	Vertical

Channel 163 / 5825 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.65	55.64	33.92	36.09	10.26	63.73	74.00	-10.27	Peak	Horizontal
11.65	38.93	33.92	36.09	10.26	47.02	54.00	-6.98	Average	Horizontal
11.65	58.55	33.99	35.99	10.26	66.81	74.00	-7.19	Peak	Vertical
11.65	42.24	33.99	35.99	10.26	50.50	54.00	-3.50	Average	Vertical

IEEE 802.11n HT40

Channel 151 / 5755 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.51	55.97	33.92	36.09	10.26	64.06	74.00	-9.94	Peak	Horizontal
11.51	38.92	33.92	36.09	10.26	47.01	54.00	-6.99	Average	Horizontal
11.51	58.40	33.99	35.99	10.26	66.66	74.00	-7.34	Peak	Vertical
11.51	42.71	33.99	35.99	10.26	50.97	54.00	-3.03	Average	Vertical

Channel 159 / 5795 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.59	54.75	33.92	36.09	10.26	62.84	74.00	-11.16	Peak	Horizontal
11.59	38.20	33.92	36.09	10.26	46.29	54.00	-7.71	Average	Horizontal
11.59	59.24	33.99	35.99	10.26	67.50	74.00	-6.50	Peak	Vertical
11.59	42.34	33.99	35.99	10.26	50.60	54.00	-3.40	Average	Vertical

IEEE 802.11ac VHT20

Channel 149 / 5745 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.49	55.04	33.92	36.09	10.26	63.13	74.00	-10.87	Peak	Horizontal
11.49	38.42	33.92	36.09	10.26	46.51	54.00	-7.49	Average	Horizontal
11.49	59.00	33.99	35.99	10.26	67.26	74.00	-6.74	Peak	Vertical
11.49	41.43	33.99	35.99	10.26	49.69	54.00	-4.31	Average	Vertical

Channel 157 / 5785 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.57	55.19	33.92	36.09	10.26	63.28	74.00	-10.72	Peak	Horizontal
11.57	39.49	33.92	36.09	10.26	47.58	54.00	-6.42	Average	Horizontal
11.57	58.88	33.99	35.99	10.26	67.14	74.00	-6.86	Peak	Vertical
11.57	41.06	33.99	35.99	10.26	49.32	54.00	-4.68	Average	Vertical

Channel 163 / 5825 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.65	55.50	33.92	36.09	10.26	63.59	74.00	-10.41	Peak	Horizontal
11.65	39.88	33.92	36.09	10.26	47.97	54.00	-6.03	Average	Horizontal
11.65	58.71	33.99	35.99	10.26	66.97	74.00	-7.03	Peak	Vertical
11.65	42.78	33.99	35.99	10.26	51.04	54.00	-2.96	Average	Vertical

IEEE 802.11ac VHT40

Channel 151 / 5755 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.51	55.31	33.92	36.09	10.26	63.40	74.00	-10.60	Peak	Horizontal
11.51	38.78	33.92	36.09	10.26	46.87	54.00	-7.13	Average	Horizontal
11.51	59.37	33.99	35.99	10.26	67.63	74.00	-6.37	Peak	Vertical
11.51	41.93	33.99	35.99	10.26	50.19	54.00	-3.81	Average	Vertical

Channel 159 / 5795 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.59	54.55	33.92	36.09	10.26	62.64	74.00	-11.36	Peak	Horizontal
11.59	39.42	33.92	36.09	10.26	47.51	54.00	-6.49	Average	Horizontal
11.59	58.96	33.99	35.99	10.26	67.22	74.00	-6.78	Peak	Vertical
11.59	42.06	33.99	35.99	10.26	50.32	54.00	-3.68	Average	Vertical

IEEE 802.11ac VHT80

Channel 155 / 5775 MHz

Freq. GHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11.51	54.17	33.92	36.09	10.26	62.26	74.00	-11.74	Peak	Horizontal
11.51	38.05	33.92	36.09	10.26	46.14	54.00	-7.86	Average	Horizontal
11.51	58.87	33.99	35.99	10.26	67.13	74.00	-6.87	Peak	Vertical
11.51	42.65	33.99	35.99	10.26	50.91	54.00	-3.09	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz ~ 40 GHz, No emission found between lowest internal used/generated frequency to 30MHz.

2). Radiated emissions measured in frequency range from 9 KHz ~ 40 GHz were made with an instrument using Peak detector mode.

3). 18~40GHz at least have 20dB margin. No recording in the test report.

4). Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20, IEEE 802.11ac VHT40, IEEE 802.11ac VHT80;

5). Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

5.7. Power line conducted emissions

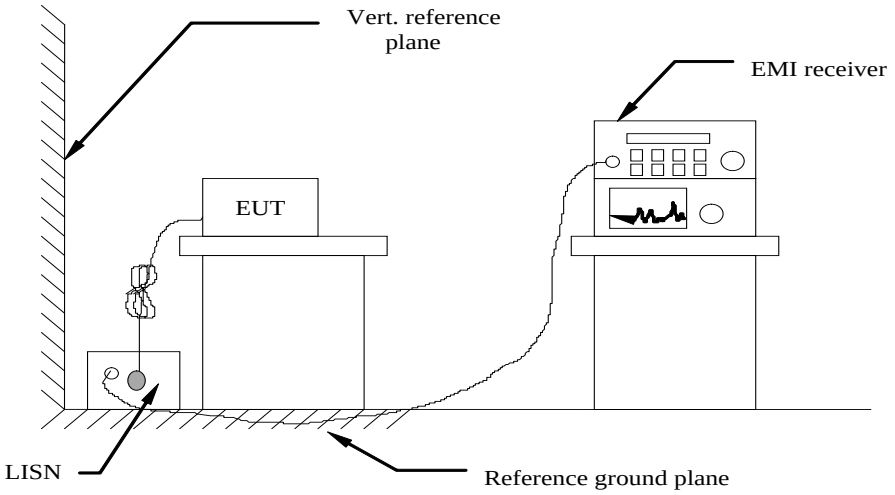
5.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

5.7.2 Block Diagram of Test Setup



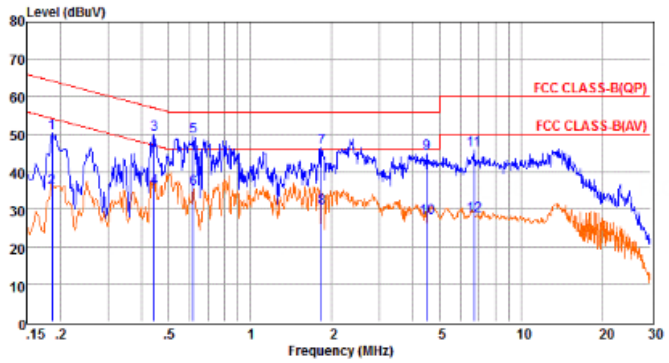
5.7.3 Test Results

PASS.

The test data please refer to following page.

AC Conducted Emission of power by adapter @ AC 120V/60Hz @ IEEE 802.11a (worst case)

Line

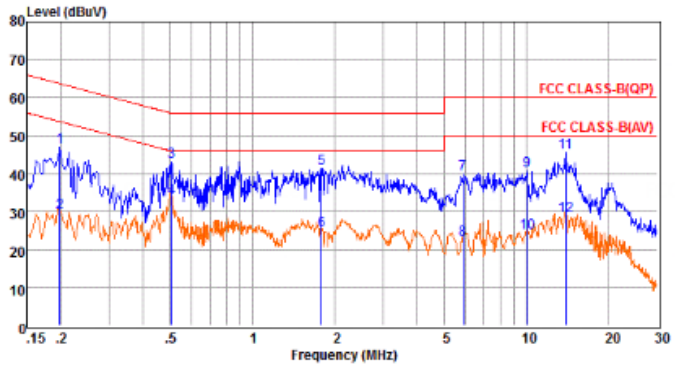


Pol: LINE

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.19	30.74	9.62	0.02	10.00	50.38	64.20	-13.82	QP
2	0.19	16.17	9.62	0.02	10.00	35.81	54.19	-18.38	Average
3	0.44	30.24	9.62	0.04	10.00	49.90	57.02	-7.12	QP
4	0.44	16.05	9.62	0.04	10.00	35.71	47.02	-11.31	Average
5	0.62	29.73	9.63	0.04	10.00	49.40	56.00	-6.60	QP
6	0.62	15.63	9.63	0.04	10.00	35.30	46.00	-10.70	Average
7	1.84	26.59	9.64	0.05	10.00	46.28	56.00	-9.72	QP
8	1.84	10.65	9.64	0.05	10.00	30.34	46.00	-15.66	Average
9	4.50	25.09	9.65	0.06	10.00	44.80	56.00	-11.20	QP
10	4.50	7.94	9.65	0.06	10.00	27.65	46.00	-18.35	Average
11	6.70	26.00	9.68	0.07	10.00	45.75	60.00	-14.25	QP
12	6.70	8.57	9.68	0.07	10.00	28.32	50.00	-21.68	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

Neutral



Pol: NEUTRAL

	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.20	27.24	9.59	0.02	10.00	46.85	63.71	-16.86	QP
2	0.20	10.13	9.59	0.02	10.00	29.74	53.71	-23.97	Average
3	0.50	23.42	9.62	0.04	10.00	43.08	56.00	-12.92	QP
4	0.50	13.89	9.62	0.04	10.00	33.55	46.00	-12.45	Average
5	1.78	21.75	9.63	0.05	10.00	41.43	56.00	-14.57	QP
6	1.78	5.28	9.63	0.05	10.00	24.96	46.00	-21.04	Average
7	5.87	20.20	9.67	0.06	10.00	39.93	60.00	-20.07	QP
8	5.87	2.87	9.67	0.06	10.00	22.60	50.00	-27.40	Average
9	10.07	20.87	9.72	0.08	10.00	40.67	60.00	-19.33	QP
10	10.07	4.72	9.72	0.08	10.00	24.52	50.00	-25.48	Average
11	13.91	25.74	9.74	0.10	10.00	45.58	60.00	-14.42	QP
12	13.92	9.11	9.74	0.10	10.00	28.95	50.00	-21.05	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

****Note: Pre-scan all modes and recorded the worst case results in this report (IEEE 802.11a).*

5.8 Undesirable Emissions Measurement

5.8.1 Limit

According to ξ15.407 (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:

(a) 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.

(b) 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.

(c) 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.

(d) 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.

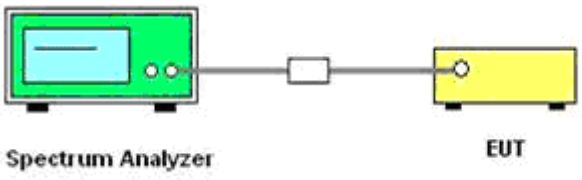
(e) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(f) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(g) The provisions of §15.205 apply to intentional radiators operating under this section.

(h) 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.

5.8.2 Test Configuration



5.8.3 Test Procedure

According to KDB789033 D02 General UNII Test Procedures New Rules Section G: Unwanted Emission Measurement

1. Unwanted Emissions in the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, measurements performed using the peak and average measurement procedures described in sections II.G.5. and II.G.6, respectively, must satisfy the respective peak and average limits. If all peak measurements satisfy the average limit, then average measurements are not required.

d) For conducted measurements above 1000 MHz, EIRP shall be computed as specified in section II.G.3.b) and then field strength shall be computed as follows (see KDB Publication 412172):

i) E[dBμV/m] = EIRP[dBm] - 20 log (d[meters]) + 104.77, where E = field strength and d = distance at which field strength limit is specified in the rules;

ii) E[dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters

e) For conducted measurements below 1000 MHz, the field strength shall be computed as specified in d), above, and then an additional 4.7 dB shall be added as an upper bound on the field strength that would be observed on a test range with a ground plane for frequencies between 30 MHz and 1000 MHz, or an additional 6 dB shall be added for frequencies below 30 MHz.

2. Unwanted Emissions that fall Outside of the Restricted Bands

a) For all measurements, follow the requirements in section II.G.3. “General Requirements for Unwanted Emissions Measurements.”

b) At frequencies below 1000 MHz, use the procedure described in section II.G.4. “Procedure for Unwanted Emissions Measurements below 1000 MHz.”

c) At frequencies above 1000 MHz, use the procedure for maximum emissions described in section II.G.5., “Procedure for Unwanted Maximum Unwanted Emissions Measurements Above 1000 MHz.”

d) Section 15.407(b) (1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.

i) Section 15.407(b) (4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b) (4) (i). An alternative to the band emissions mask is specified in Section 15.407(b) (4) (ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

e) If radiated measurements are performed, field strength is then converted to EIRP as follows:

i) EIRP = ((E×d) ^2) / 30

Where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotopically radiated power in watts;

ii) Working in dB units, the above equation is equivalent to:

EIRP [dBm] = E [dBμV/m] + 20 log (d [meters]) - 104.77

iii) Or, if d is 3 meters:

EIRP [dBm] = E [dBμV/m] - 95.23

3) Radiated versus Conducted Measurements.

The unwanted emission limits in both the restricted and non-restricted bands are based on radiated measurements; however, as an alternative, antenna-port conducted measurements in conjunction with cabinet emissions tests will be permitted to demonstrate compliance provided that the following steps are performed:

(i) Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.

(ii) Impedance matching. Conducted tests shall be performed using equipment that matches the nominal impedance of the antenna assembly used with the EUT.

(iii) EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.3 However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

(iv) EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), compute the total EIRP as follows:

- Compute EIRP for each output, as described in (iii), above.
- Follow the procedures specified in KDB Publication 662911 for summing emissions across the outputs or adjusting emission levels measured on individual outputs by 10 log (N_{ANT}), where N_{ANT} is the number of outputs.
- Add the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

(v) Direction of maximum emission.

For all radiated emissions tests, measurements shall correspond to the direction of maximum emission level for each measured emission (see ANSI C63.10 for guidance).

5.8.4 Test Results

5.8.4.1 UNII Band 1

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-42.278	5.00	0.00	57.922	Peak	74.00	PASS
4500.000	-51.684	5.00	0.00	48.516	Average	54.00	PASS
5150.000	-40.295	5.00	0.00	59.905	Peak	74.00	PASS
5150.000	-49.714	5.00	0.00	50.486	Average	54.00	PASS
5350.000	-40.503	5.00	0.00	59.697	Peak	74.00	PASS
5350.000	-51.640	5.00	0.00	48.560	Average	54.00	PASS
5460.000	-40.841	5.00	0.00	59.359	Peak	74.00	PASS
5460.000	-52.028	5.00	0.00	48.172	Average	54.00	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-41.374	5.00	0.00	58.826	Peak	74.00	PASS
4500.000	-51.729	5.00	0.00	48.471	Average	54.00	PASS
5150.000	-40.015	5.00	0.00	60.185	Peak	74.00	PASS
5150.000	-49.969	5.00	0.00	50.231	Average	54.00	PASS
5350.000	-41.609	5.00	0.00	58.591	Peak	74.00	PASS
5350.000	-51.642	5.00	0.00	48.558	Average	54.00	PASS
5460.000	-41.112	5.00	0.00	59.088	Peak	74.00	PASS
5460.000	-52.001	5.00	0.00	48.199	Average	54.00	PASS

IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-40.985	5.00	0.00	59.215	Peak	74.00	PASS
4500.000	-51.751	5.00	0.00	48.449	Average	54.00	PASS
5150.000	-38.177	5.00	0.00	62.023	Peak	74.00	PASS
5150.000	-48.900	5.00	0.00	51.300	Average	54.00	PASS
5350.000	-41.700	5.00	0.00	58.500	Peak	74.00	PASS
5350.000	-51.358	5.00	0.00	48.842	Average	54.00	PASS
5460.000	-41.465	5.00	0.00	58.735	Peak	74.00	PASS
5460.000	-51.731	5.00	0.00	48.469	Average	54.00	PASS

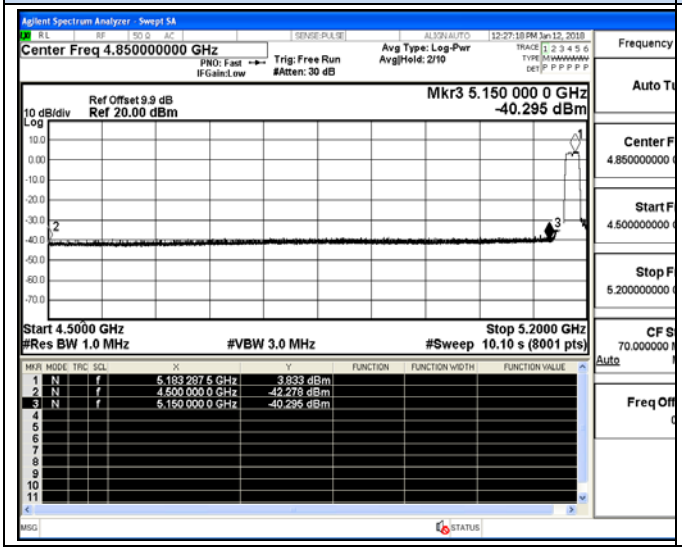
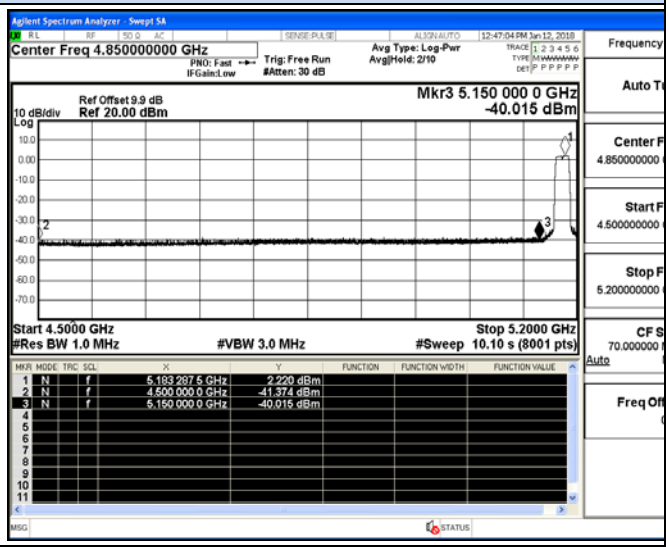
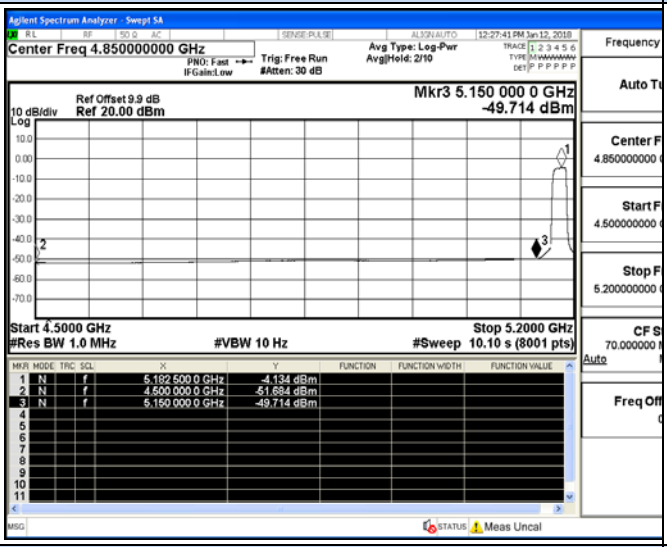
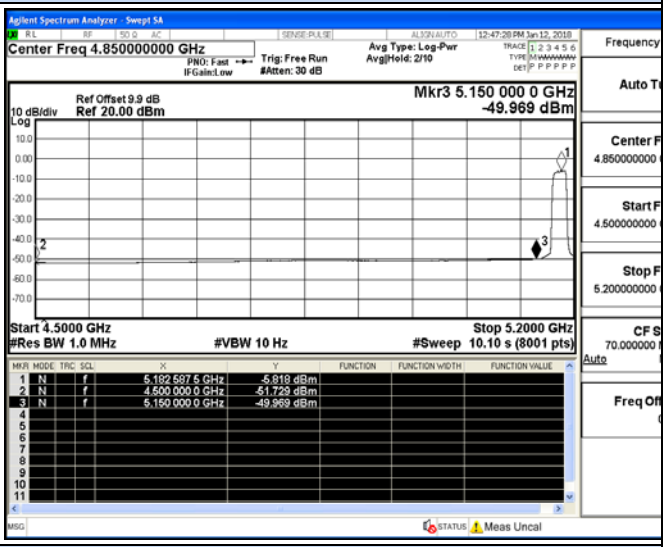
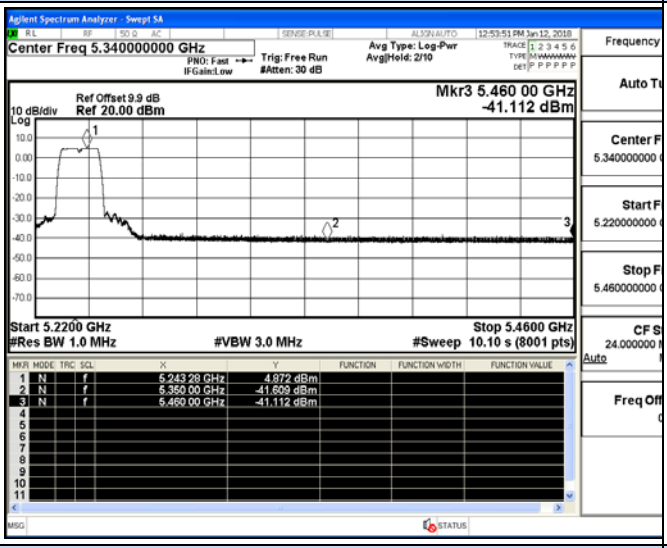
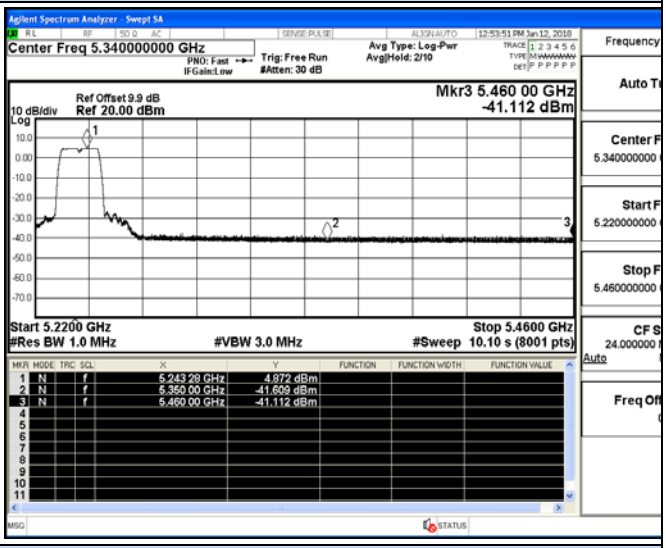
IEEE 802.11ac VHT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-42.304	5.00	0.00	57.896	Peak	74.00	PASS
4500.000	-51.730	5.00	0.00	48.470	Average	54.00	PASS
5150.000	-39.585	5.00	0.00	60.615	Peak	74.00	PASS
5150.000	-49.788	5.00	0.00	50.412	Average	54.00	PASS
5350.000	-42.039	5.00	0.00	58.161	Peak	74.00	PASS
5350.000	-51.662	5.00	0.00	48.538	Average	54.00	PASS
5460.000	-41.425	5.00	0.00	58.775	Peak	74.00	PASS
5460.000	-52.023	5.00	0.00	48.177	Average	54.00	PASS

IEEE 802.11ac VHT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-42.125	5.00	0.00	58.075	Peak	74.00	PASS
4500.000	-51.730	5.00	0.00	48.470	Average	54.00	PASS
5150.000	-37.875	5.00	0.00	62.325	Peak	74.00	PASS
5150.000	-48.906	5.00	0.00	51.294	Average	54.00	PASS
5350.000	-41.093	5.00	0.00	59.107	Peak	74.00	PASS
5350.000	-51.370	5.00	0.00	48.830	Average	54.00	PASS
5460.000	-41.829	5.00	0.00	58.371	Peak	74.00	PASS
5460.000	-51.713	5.00	0.00	48.487	Average	54.00	PASS

IEEE 802.11ac VHT80							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Convert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
4500.000	-41.145	5.00	0.00	59.055	Peak	74.00	PASS
4500.000	-50.985	5.00	0.00	49.215	Average	54.00	PASS
5150.000	-42.300	5.00	0.00	57.900	Peak	74.00	PASS
5150.000	-51.249	5.00	0.00	48.951	Average	54.00	PASS
5350.000	-41.612	5.00	0.00	58.588	Peak	74.00	PASS
5350.000	-51.738	5.00	0.00	48.462	Average	54.00	PASS
5460.000	-40.576	5.00	0.00	59.624	Peak	74.00	PASS
5460.000	-50.337	5.00	0.00	49.863	Average	54.00	PASS

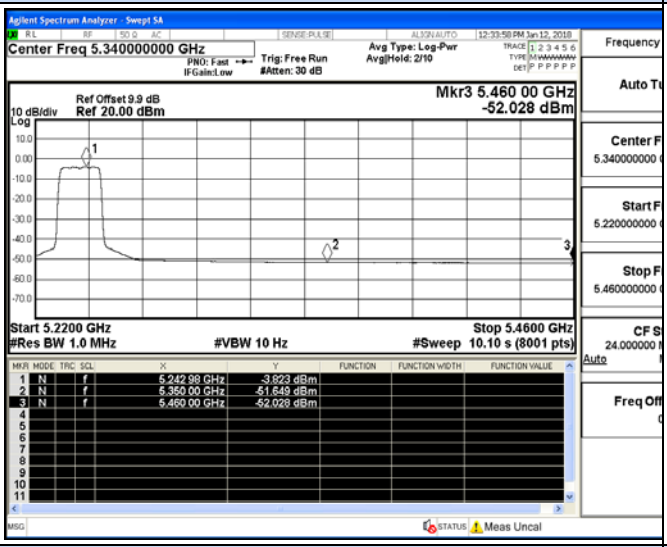
Remark:

1. *Measured Undesirable emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20, IEEE 802.11ac VHT40, IEEE 802.11ac VHT80;*
4. *Covert Radiated E Level At 3m = Conducted average power + Directional Gain + 104.77-20*log(3);*
5. *Please refer to following test plots;*

Undesirable emission	
IEEE 802.11a	IEEE 802.11n HT20
	
Channel 36 / 5180 MHz – Peak	Channel 36 / 5180 MHz – Peak
	
Channel 36 / 5180 MHz – Average	Channel 36 / 5180 MHz – Average
	
Channel 48 / 5240 MHz – Peak	Channel 48 / 5240 MHz – Peak

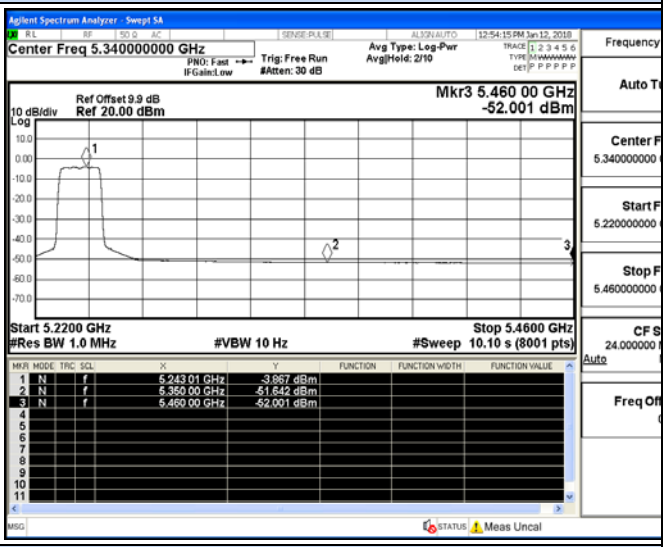
Undesirable emission

IEEE 802.11a



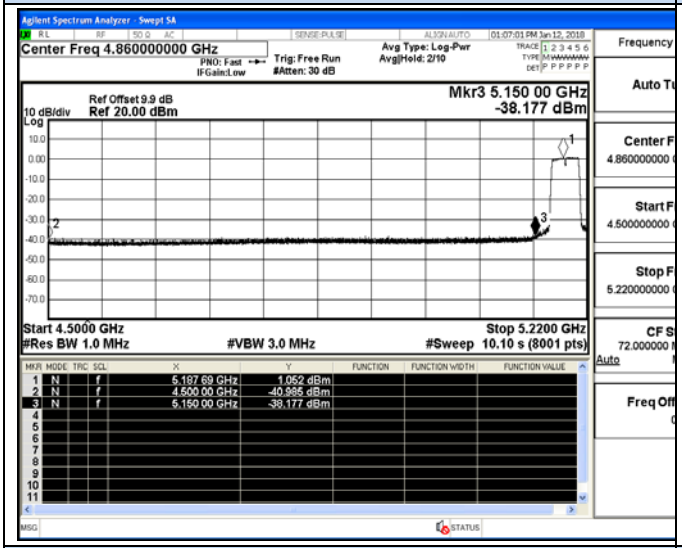
Channel 48 / 5240 MHz – Average

IEEE 802.11n HT20



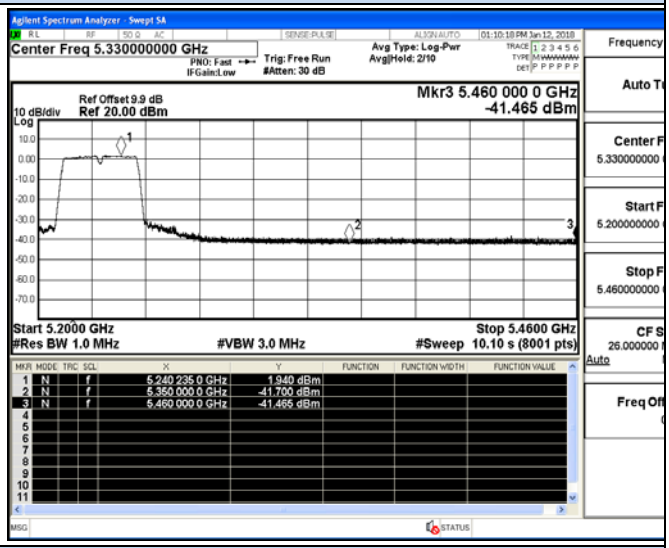
Channel 48 / 5240 MHz – Average

IEEE 802.11n HT40

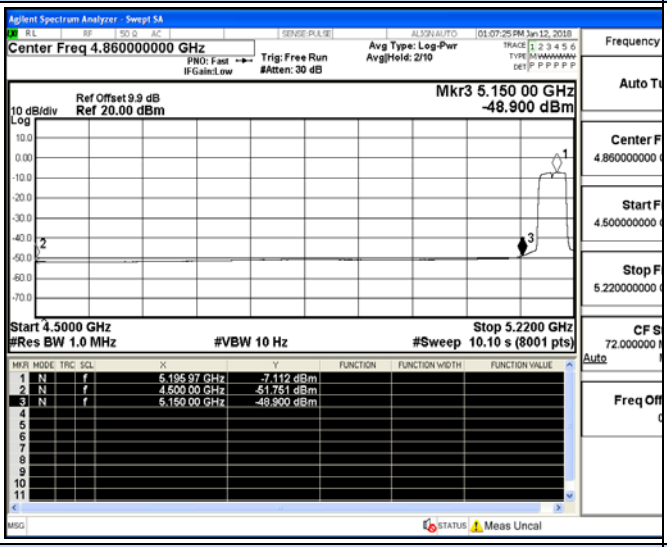


Channel 38 / 5190 MHz – Peak

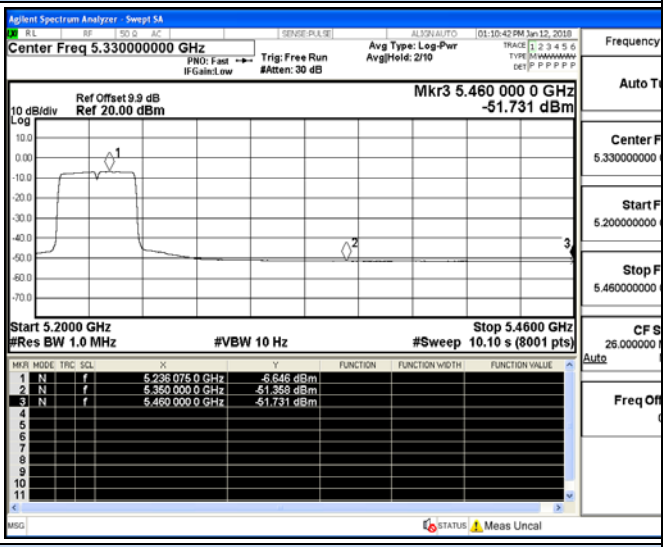
IEEE 802.11n HT40



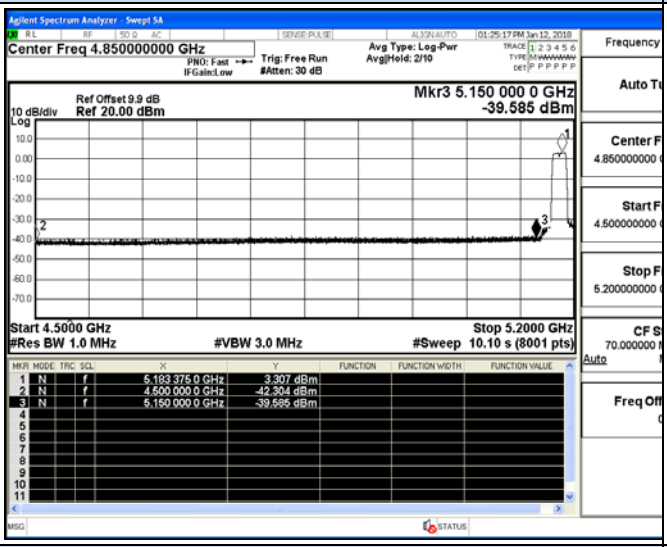
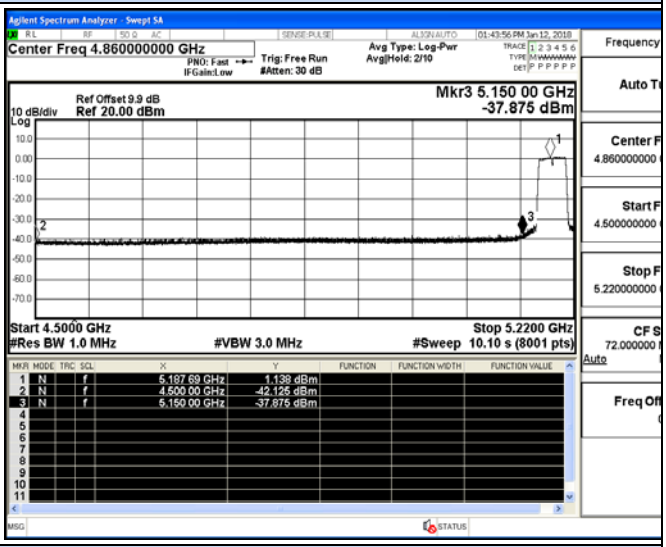
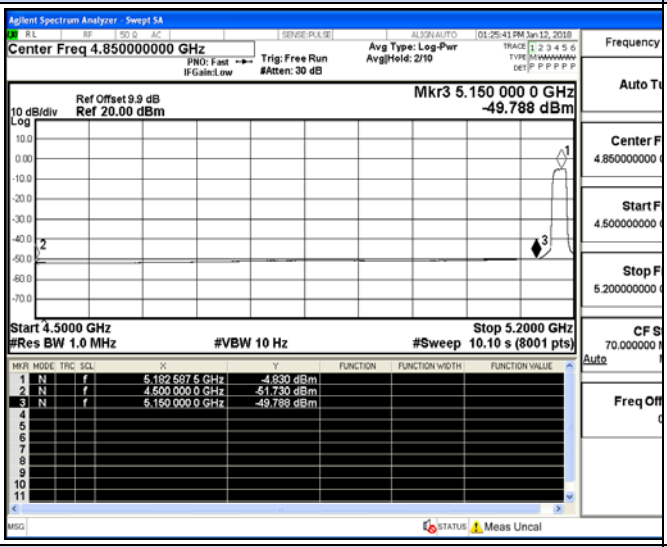
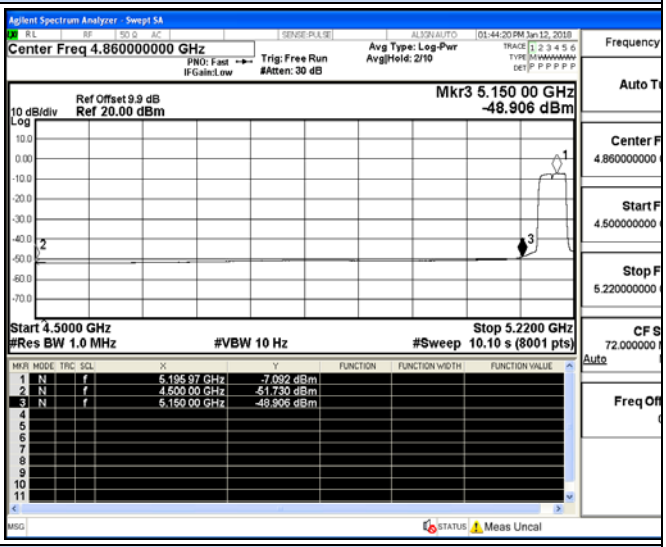
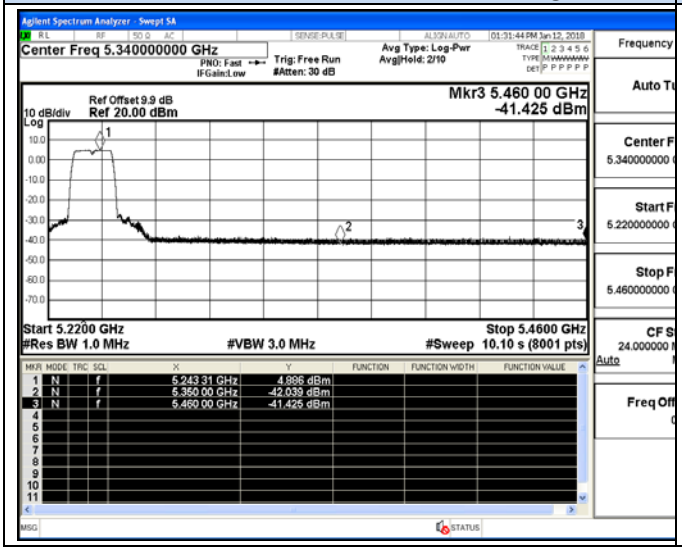
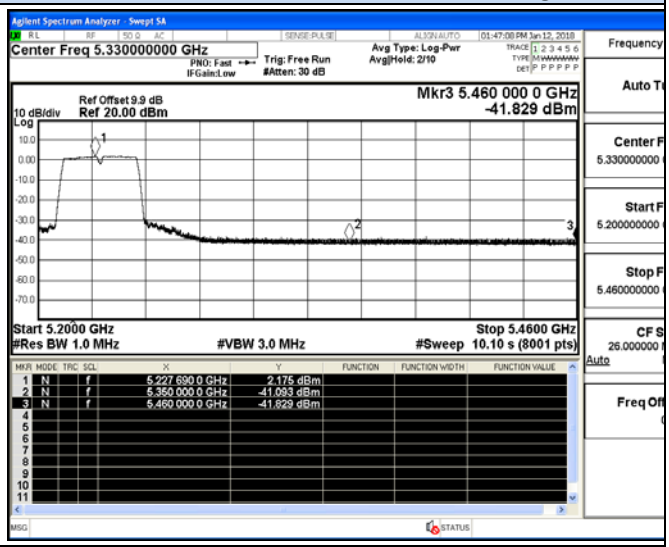
Channel 46 / 5230 MHz – Peak



Channel 38 / 5190 MHz – Average

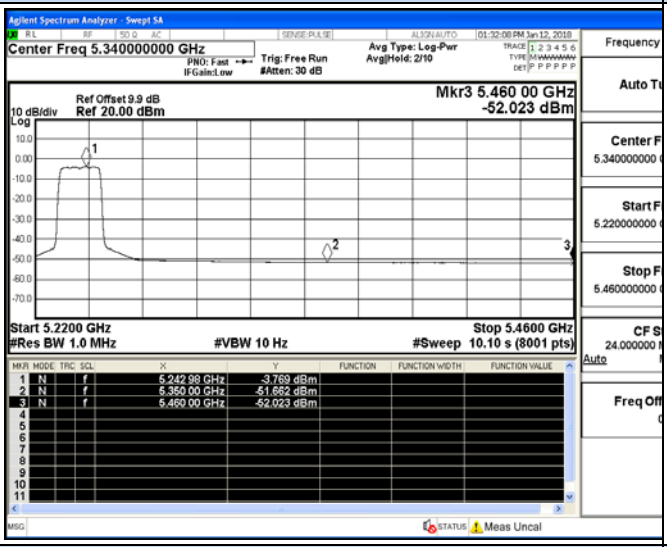


Channel 46 / 5230 MHz – Average

Undesirable emission	
IEEE 802.11ac VHT20	IEEE 802.11ac VHT40
	
Channel 36 / 5180 MHz – Peak	Channel 38 / 5190 MHz – Peak
	
Channel 36 / 5180 MHz – Average	Channel 38 / 5190 MHz – Average
	
Channel 48 / 5240 MHz – Peak	Channel 46 / 5230 MHz – Peak

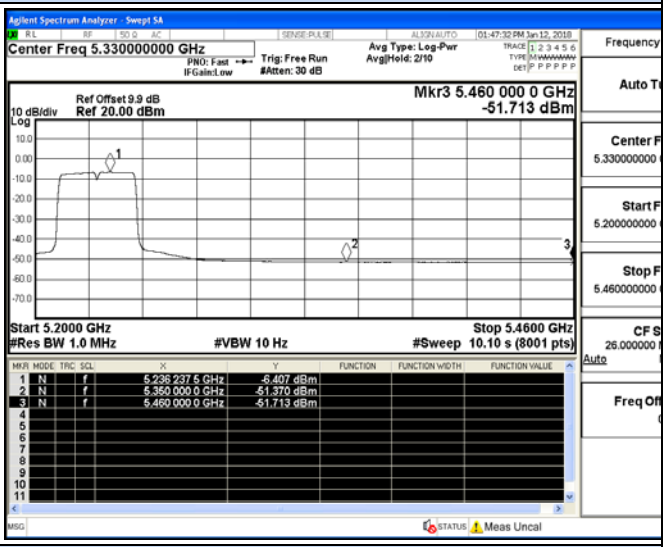
Undesirable emission

IEEE 802.11ac VHT20



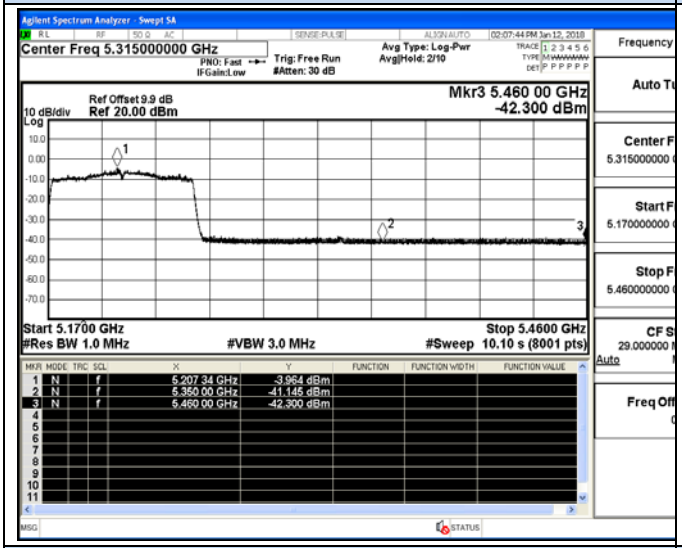
Channel 48 / 5240 MHz – Average

IEEE 802.11ac VHT40



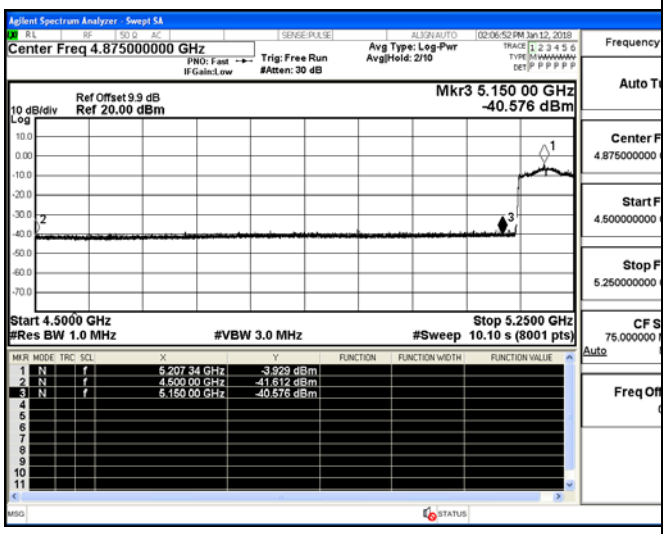
Channel 46 / 5230 MHz – Average

IEEE 802.11ac VHT80

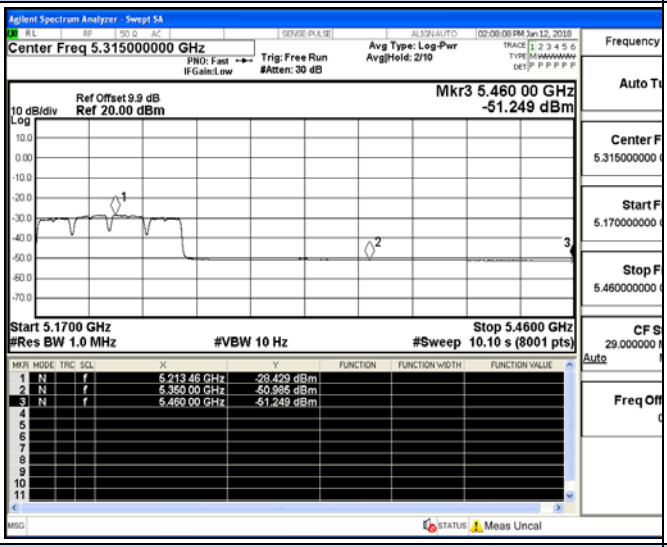


Channel 42 / 5210 MHz – Peak(left)

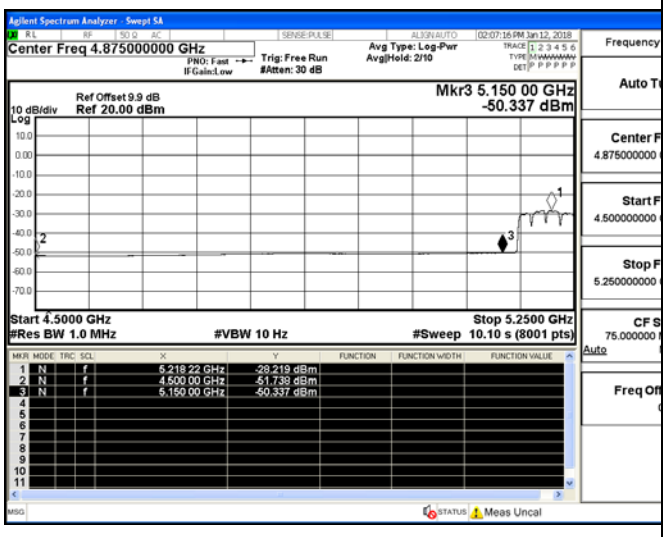
IEEE 802.11ac VHT80



Channel 46 / 5230 MHz – Peak(right)



Channel 42 / 5210 MHz – Average(left)



Channel 46 / 5230 MHz – Average(right)

5.8.4.2 UNII Band 3

IEEE 802.11a							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-40.521	5.00	-35.521	Peak	-27.00	-8.521	PASS
5700.000	-41.348	5.00	-36.348	Peak	10.00	-46.348	PASS
5720.000	-39.771	5.00	-34.771	Peak	15.60	-50.371	PASS
5725.000	-36.166	5.00	-31.166	Peak	27.00	-58.166	PASS
5850.000	-36.633	5.00	-31.633	Peak	27.00	-58.633	PASS
5855.000	-38.346	5.00	-33.346	Peak	15.60	-48.946	PASS
5875.000	-39.823	5.00	-34.823	Peak	10.00	-44.823	PASS
5925.000	-41.169	5.00	-36.169	Peak	-27.00	-9.169	PASS

IEEE 802.11n HT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-41.264	5.00	-36.264	Peak	-27.00	-9.264	PASS
5700.000	-40.879	5.00	-35.879	Peak	10.00	-45.879	PASS
5720.000	-41.171	5.00	-36.171	Peak	15.60	-51.771	PASS
5725.000	-36.616	5.00	-31.616	Peak	27.00	-58.616	PASS
5850.000	-33.643	5.00	-28.643	Peak	27.00	-55.643	PASS
5855.000	-36.822	5.00	-31.822	Peak	15.60	-47.422	PASS
5875.000	-40.044	5.00	-35.044	Peak	10.00	-45.044	PASS
5925.000	-41.445	5.00	-36.445	Peak	-27.00	-9.445	PASS

IEEE 802.11n HT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-41.719	5.00	-36.719	Peak	-27.00	-9.719	PASS
5700.000	-41.336	5.00	-36.336	Peak	10.00	-46.336	PASS
5720.000	-37.188	5.00	-32.188	Peak	15.60	-47.788	PASS
5725.000	-36.727	5.00	-31.727	Peak	27.00	-58.727	PASS
5850.000	-39.776	5.00	-34.776	Peak	27.00	-61.776	PASS
5855.000	-40.278	5.00	-35.278	Peak	15.60	-50.878	PASS
5875.000	-40.658	5.00	-35.658	Peak	10.00	-45.658	PASS
5925.000	-42.097	5.00	-37.097	Peak	-27.00	-10.097	PASS

IEEE 802.11ac VHT20							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-40.431	5.00	-35.431	Peak	-27.00	-8.431	PASS
5700.000	-40.758	5.00	-35.758	Peak	10.00	-45.758	PASS
5720.000	-40.835	5.00	-35.835	Peak	15.60	-51.435	PASS
5725.000	-35.932	5.00	-30.932	Peak	27.00	-57.932	PASS
5850.000	-33.831	5.00	-28.831	Peak	27.00	-55.831	PASS
5855.000	-37.590	5.00	-32.590	Peak	15.60	-48.190	PASS
5875.000	-40.762	5.00	-35.762	Peak	10.00	-45.762	PASS
5925.000	-41.431	5.00	-36.431	Peak	-27.00	-9.431	PASS

IEEE 802.11ac VHT40							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-42.077	5.00	-37.077	Peak	-27.00	-10.077	PASS
5700.000	-41.528	5.00	-36.528	Peak	10.00	-46.528	PASS
5720.000	-38.839	5.00	-33.839	Peak	15.60	-49.439	PASS
5725.000	-36.520	5.00	-31.520	Peak	27.00	-58.520	PASS
5850.000	-39.674	5.00	-34.674	Peak	27.00	-61.674	PASS
5855.000	-38.531	5.00	-33.531	Peak	15.60	-49.131	PASS
5875.000	-40.135	5.00	-35.135	Peak	10.00	-45.135	PASS
5925.000	-41.284	5.00	-36.284	Peak	-27.00	-9.284	PASS

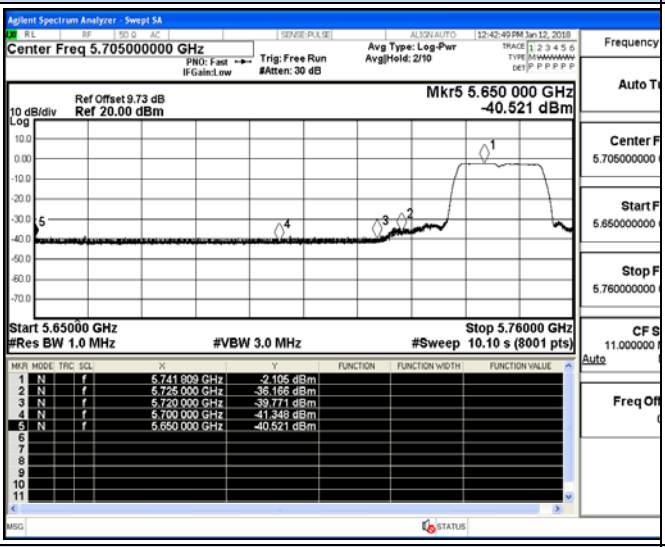
IEEE 802.11ac VHT80							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm/1MHz)	Detector	Limit (dBm/1MHz)	Over limit (dB)	Verdict
5650.000	-43.054	5.00	-38.054	Peak	-27.00	-11.054	PASS
5700.000	-33.510	5.00	-28.510	Peak	10.00	-38.510	PASS
5720.000	-31.478	5.00	-26.478	Peak	15.60	-42.078	PASS
5725.000	-30.072	5.00	-25.072	Peak	27.00	-52.072	PASS
5850.000	-33.826	5.00	-28.826	Peak	27.00	-55.826	PASS
5855.000	-34.928	5.00	-29.928	Peak	15.60	-45.528	PASS
5875.000	-39.062	5.00	-34.062	Peak	10.00	-44.062	PASS
5925.000	-41.985	5.00	-36.985	Peak	-27.00	-9.985	PASS

Remark:

1. *Measured unwanted emission at difference data rate for each mode and recorded worst case for each mode.*
2. *Test results including cable loss;*
3. *Worst case data at 6Mbps at IEEE 802.11a; MCS0 at IEEE 802.11n HT20, IEEE 802.11n HT40, IEEE 802.11ac VHT20, IEEE 802.11ac VHT40, IEEE 802.11ac VHT80;*
4. *EIRP = Conducted power + Directional Gain*
5. *EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.) The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.3 However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20% of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.*
6. *Over limit = EIRP - Limit*
7. *Please refer to following test plots;*

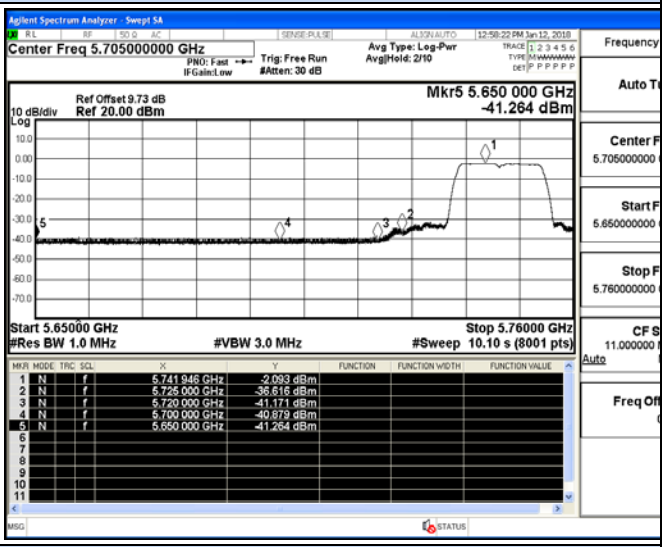
Unwanted emission

IEEE 802.11a

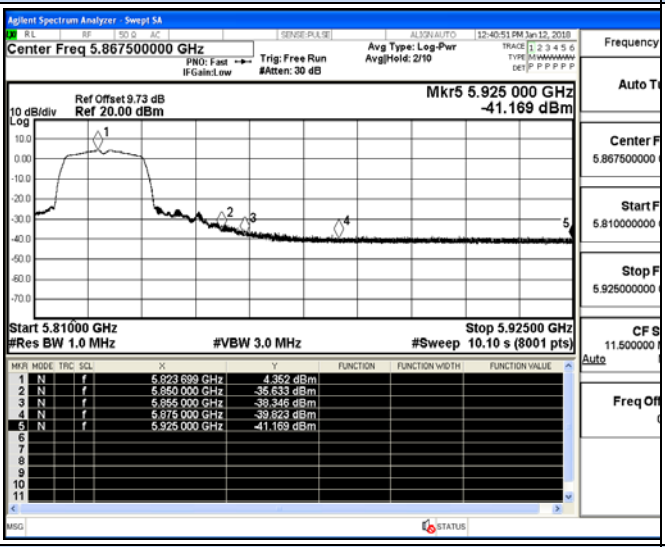


Channel 149 / 5745 MHz – Peak

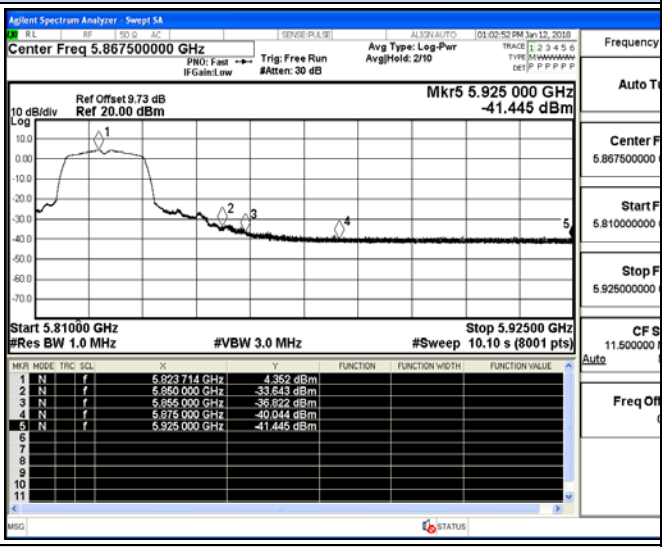
IEEE 802.11n HT20



Channel 149 / 5745 MHz – Peak

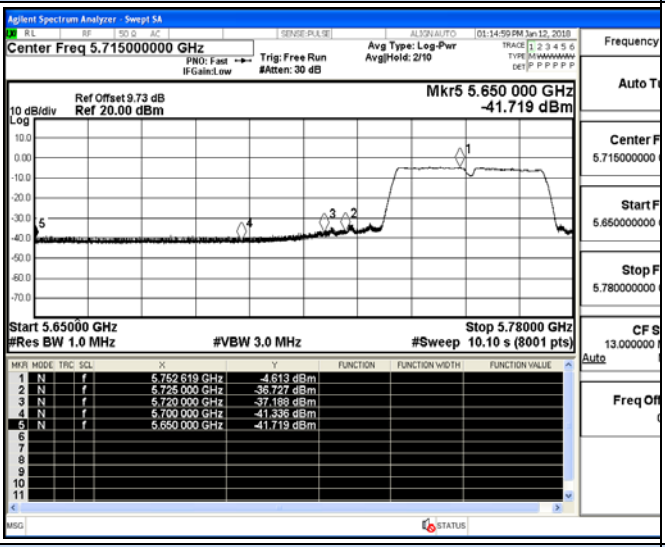


Channel 165 / 5825 MHz – Peak



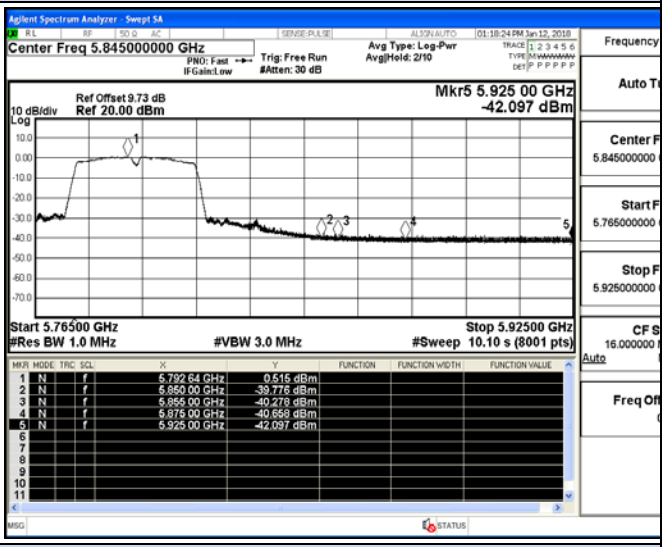
Channel 165 / 5825 MHz – Peak

IEEE 802.11n HT40



Channel 151 / 5755 MHz – Peak

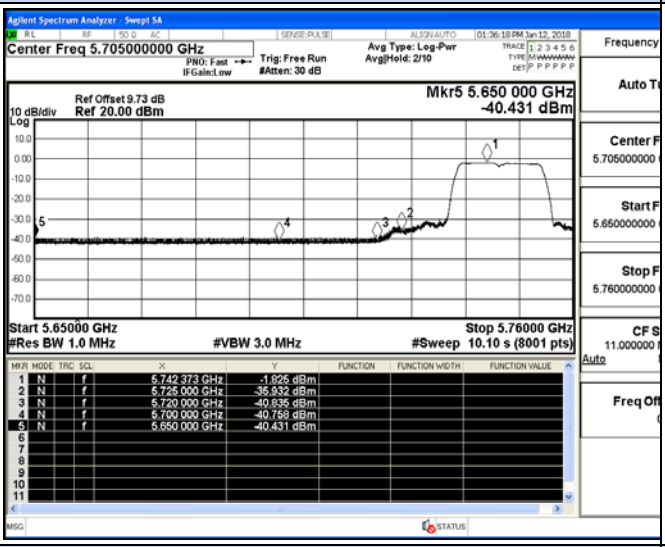
IEEE 802.11n HT40



Channel 159 / 5795 MHz – Peak

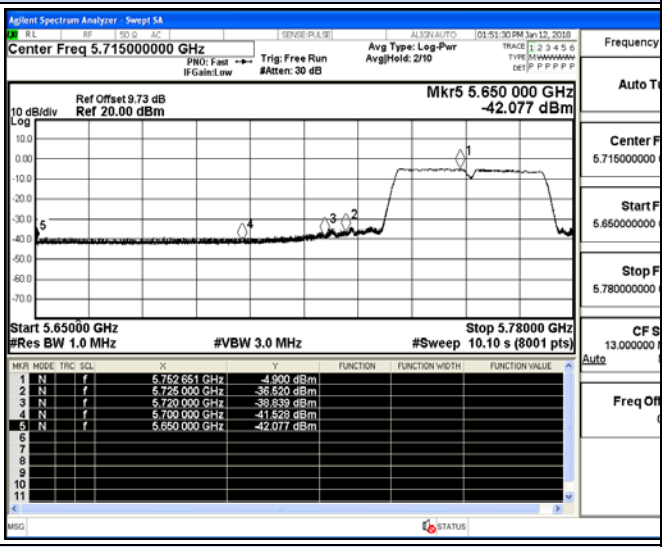
Unwanted emission

IEEE 802.11ac VHT20

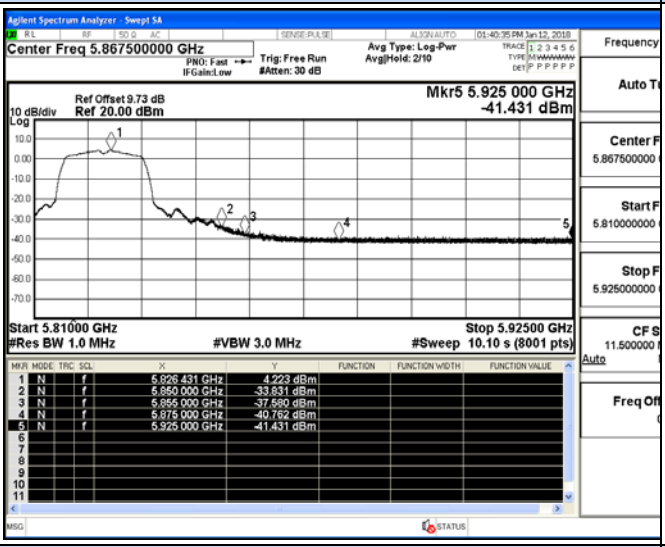


Channel 149 / 5745 MHz – Peak

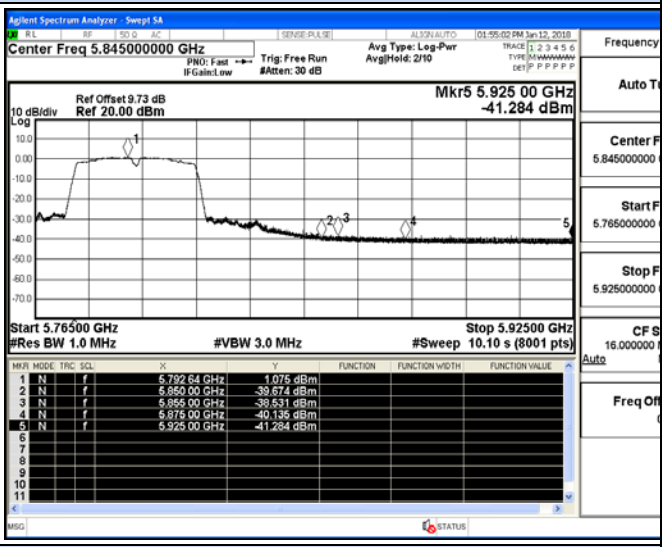
IEEE 802.11ac VHT40



Channel 149 / 5745 MHz – Peak

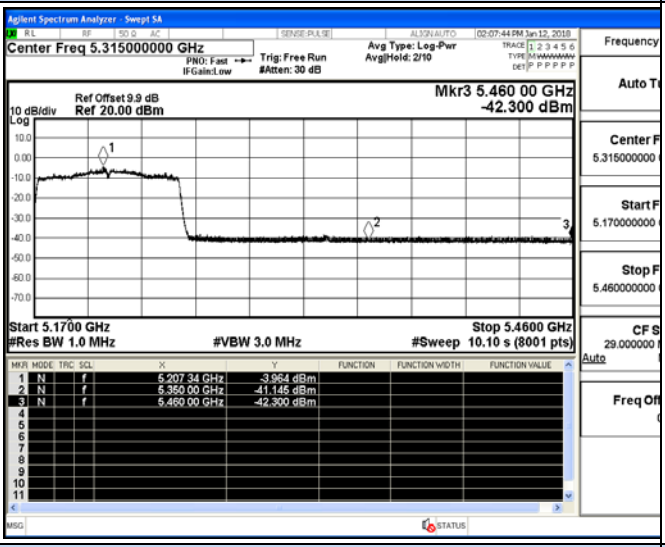


Channel 165 / 5825 MHz – Peak

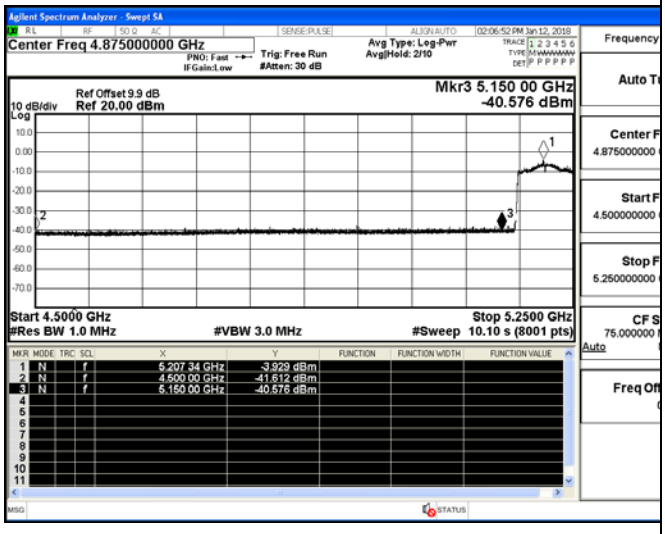


Channel 165 / 5825 MHz – Peak

IEEE 802.11ac VHT80



Channel 155 / 5775 MHz – Peak(left)



Channel 155 / 5775 MHz – Peak(right)

5.9. Antenna Requirements

5.9.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited

And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.9.2 Antenna Connected Construction

5.9.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

5.9.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 5dBi, and the antenna is an external antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.9.2.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.
Conducted power refers ANSI C63.10:2013 Output power test procedure for NII devices.
Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

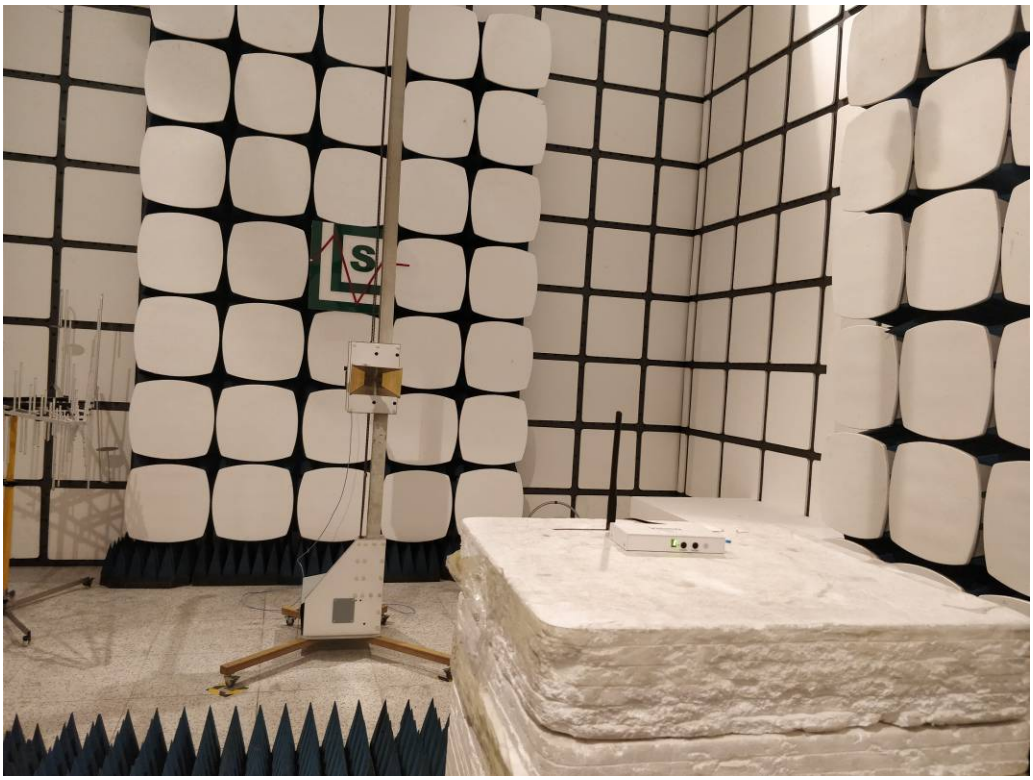
Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

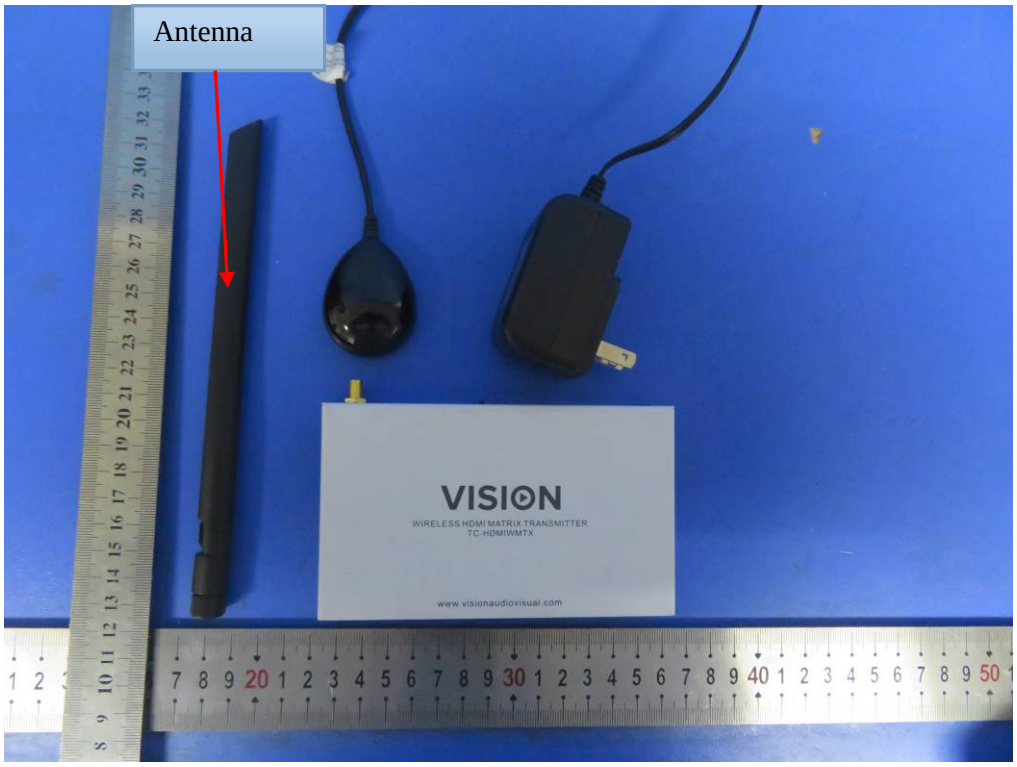
Limits

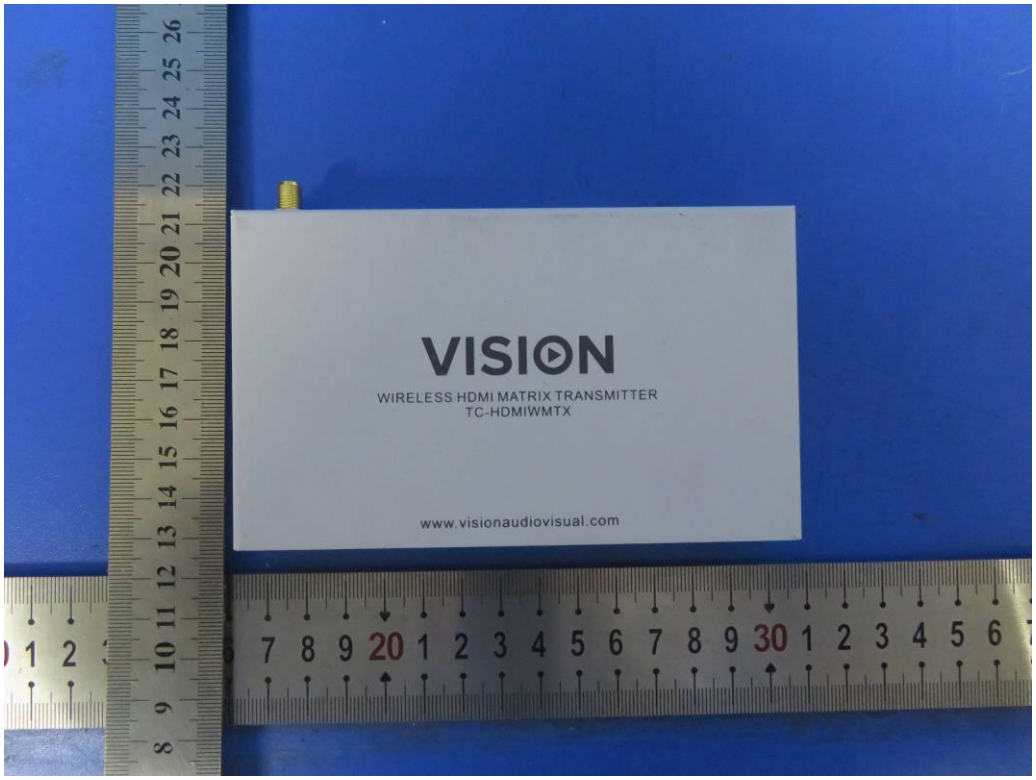
FCC	ISED
Antenna Gain	
6 dBi	

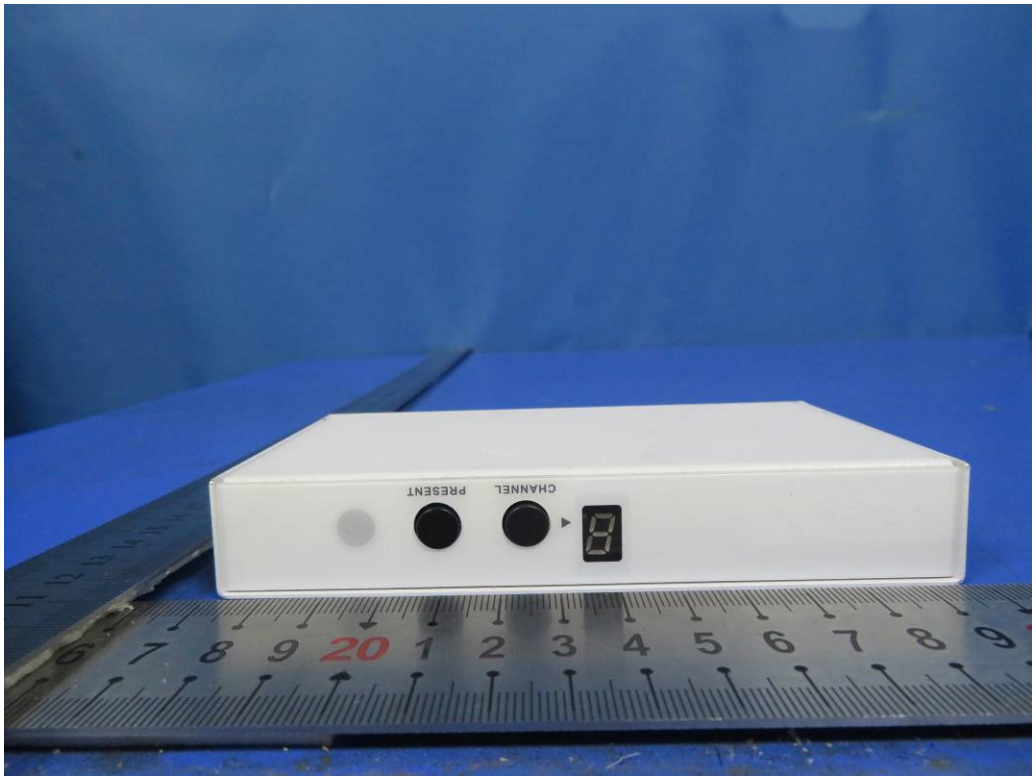
6. TEST SETUP PHOTOGRAPHS OF EUT

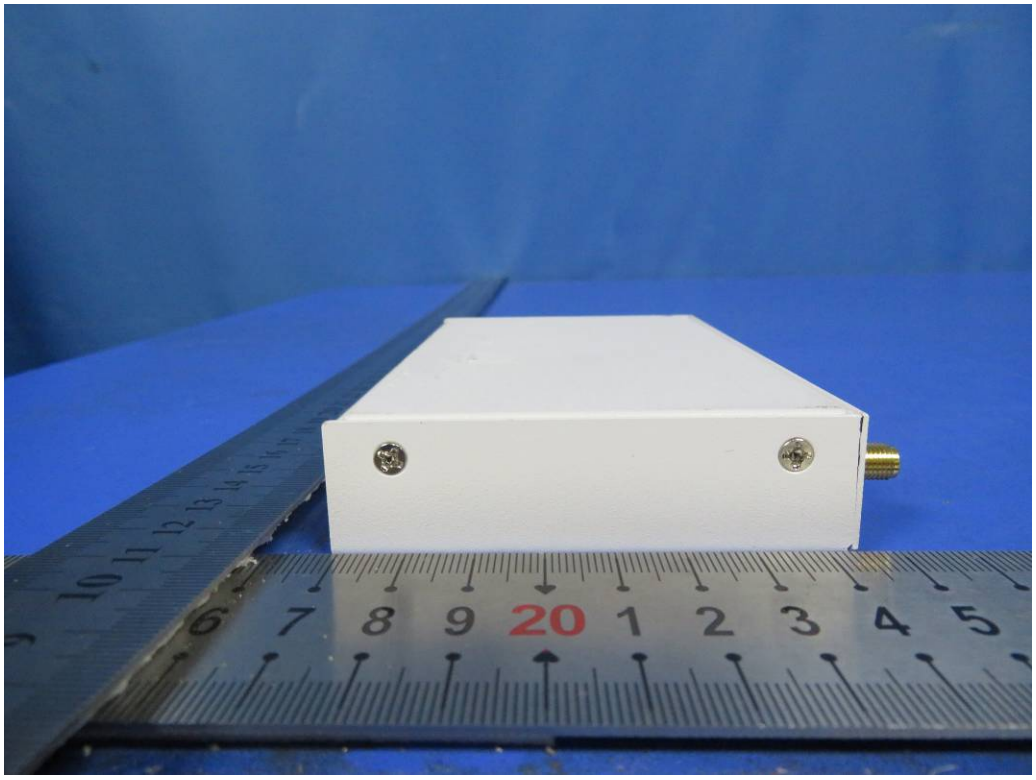


7. EXTERIOR PHOTOGRAPHS OF THE EUT

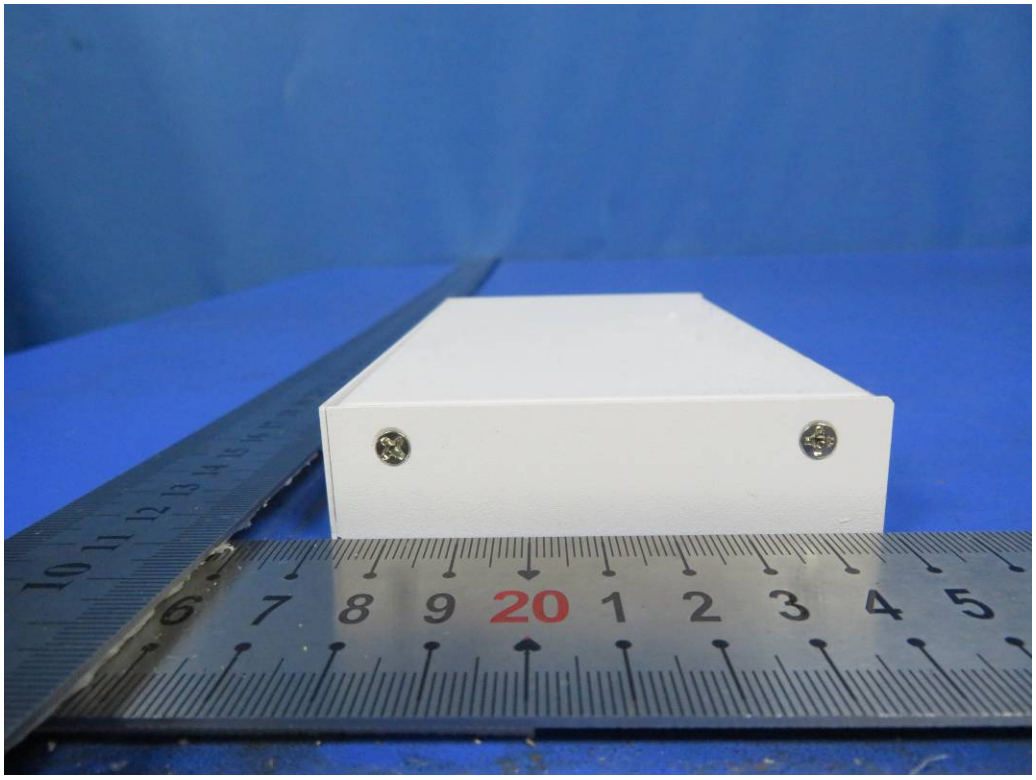


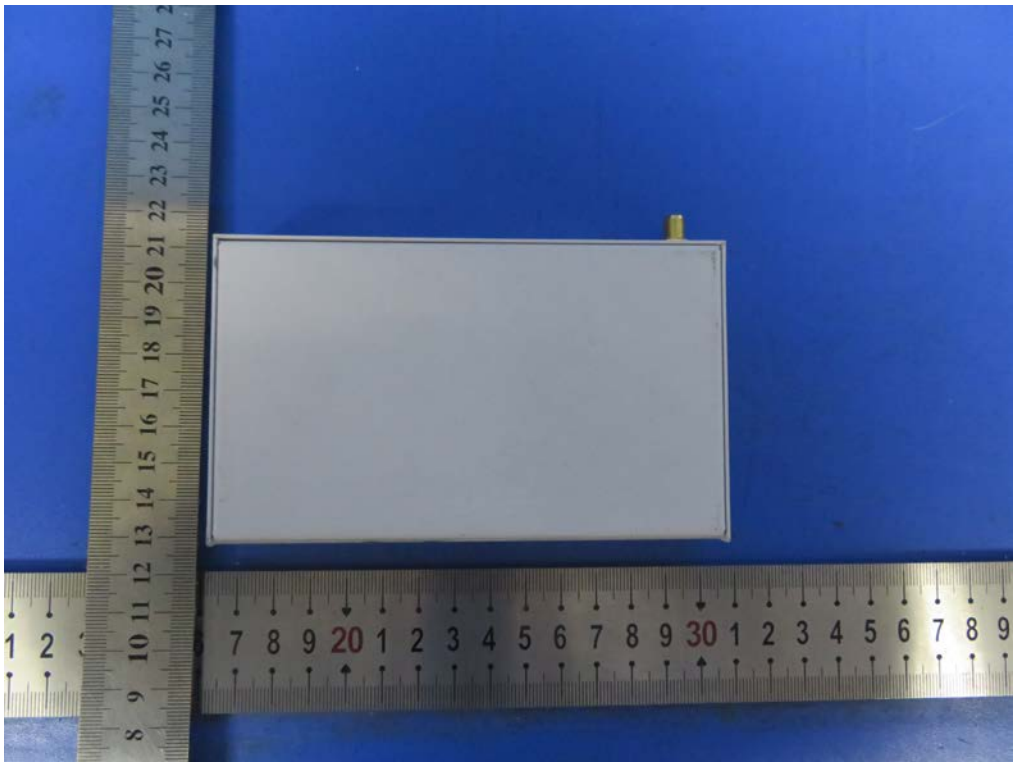



PRESENT
CHANNEL
8

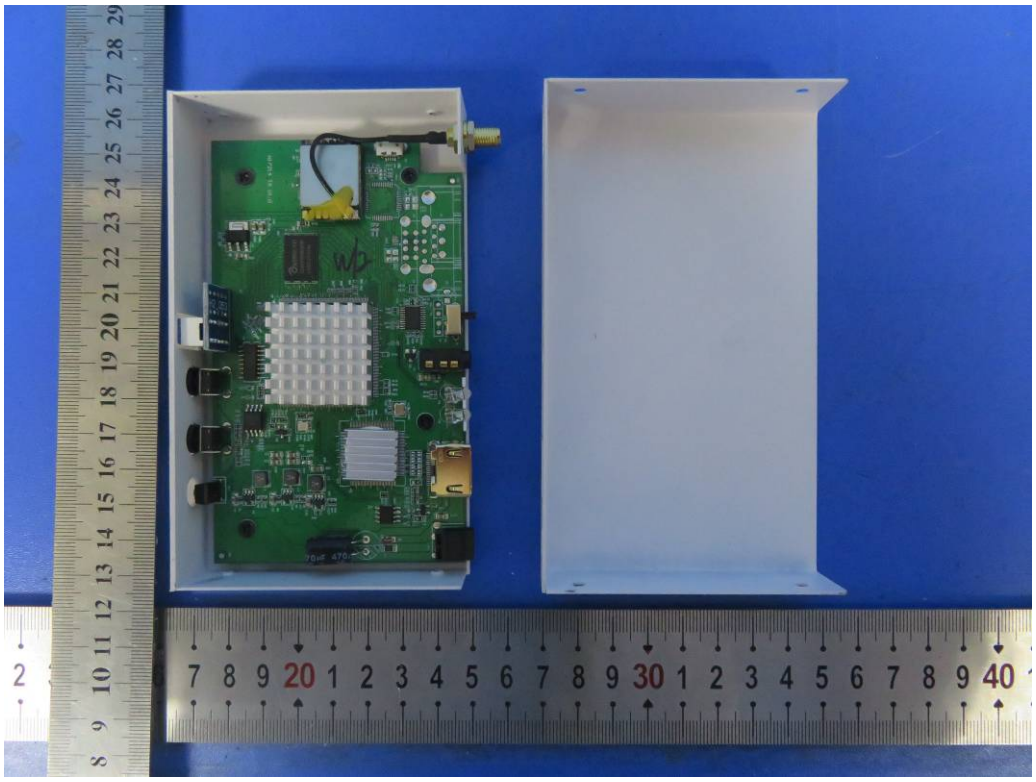


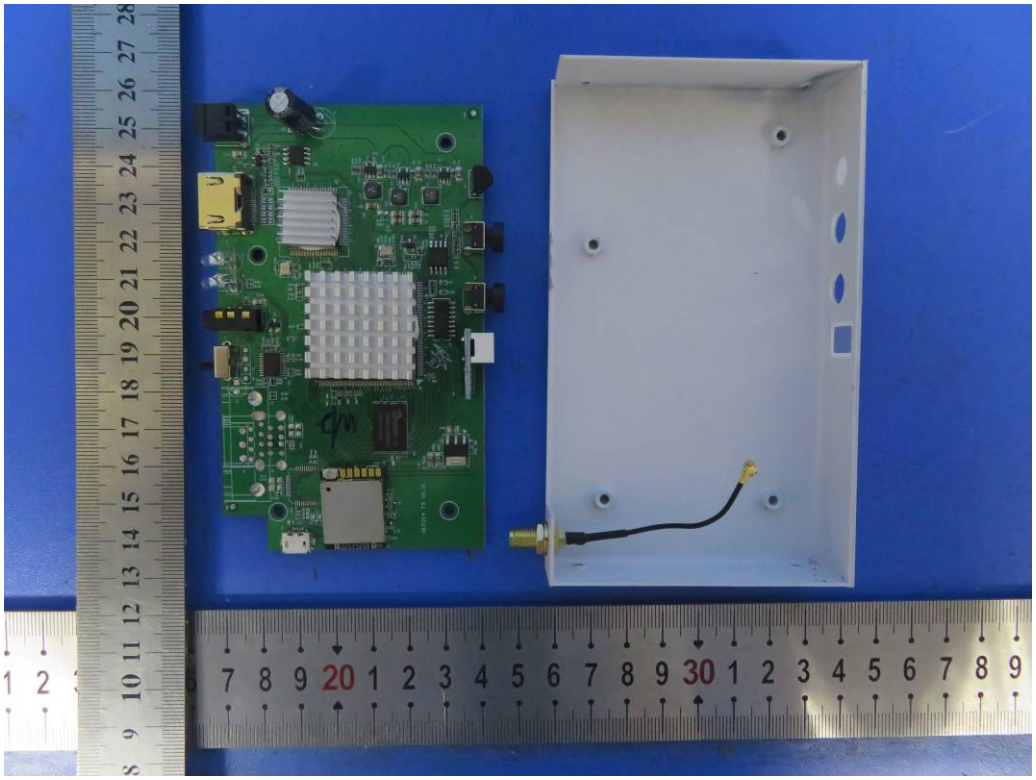

IR OUT
HDMI
INPUT
DC 5V

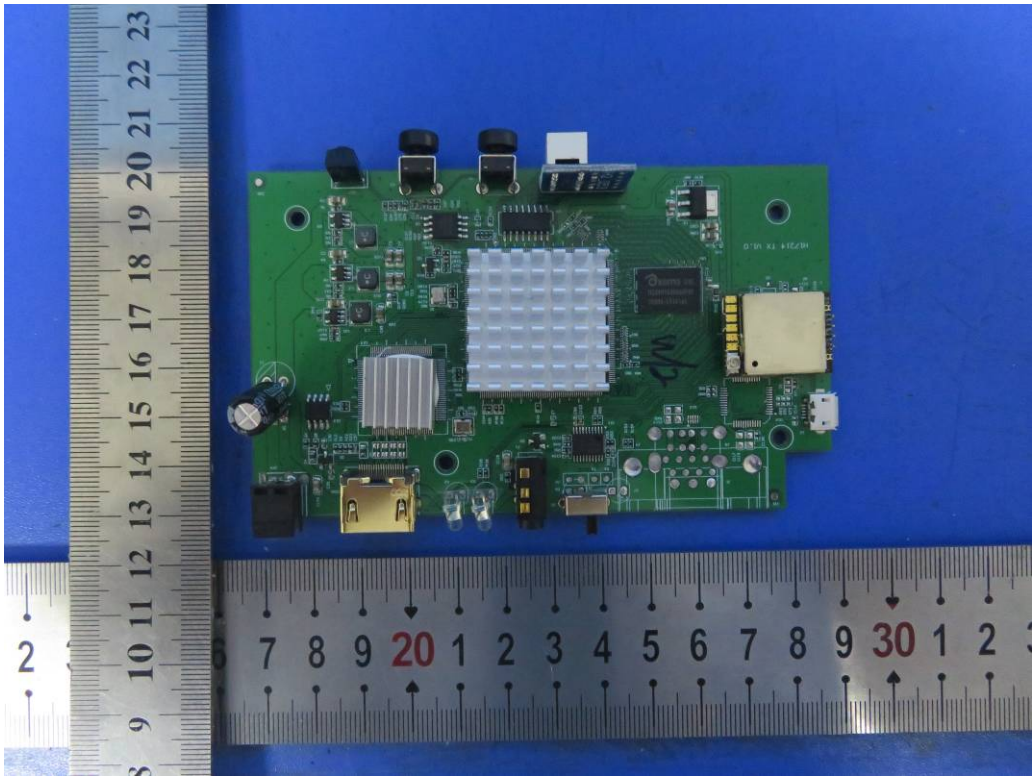


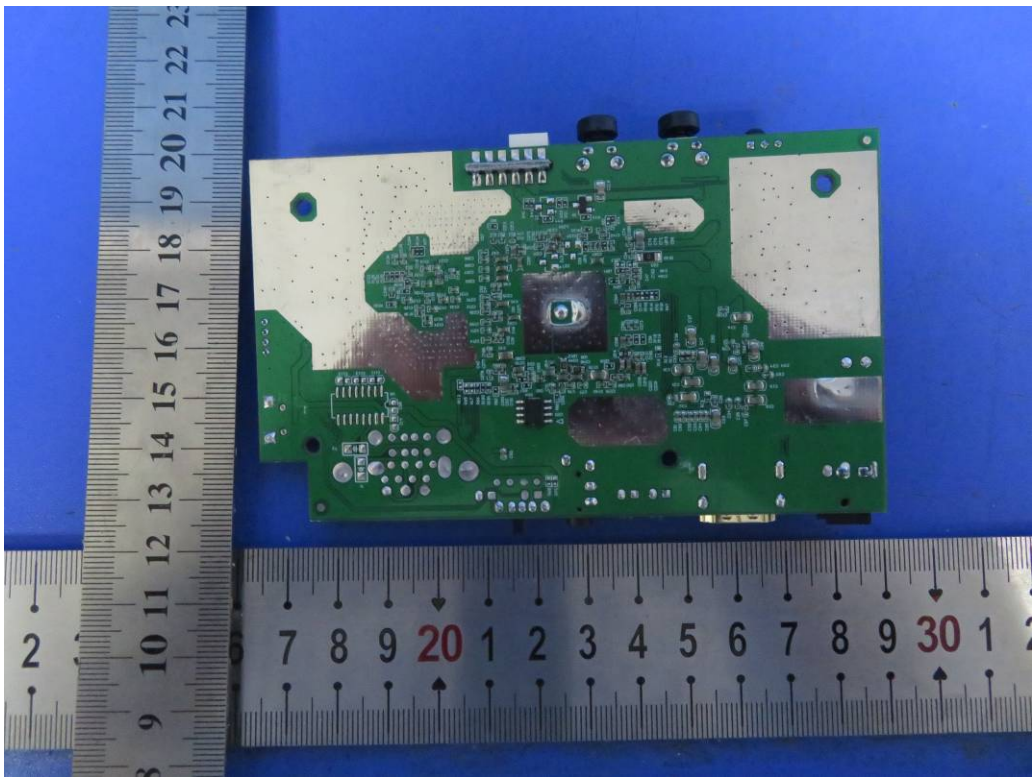


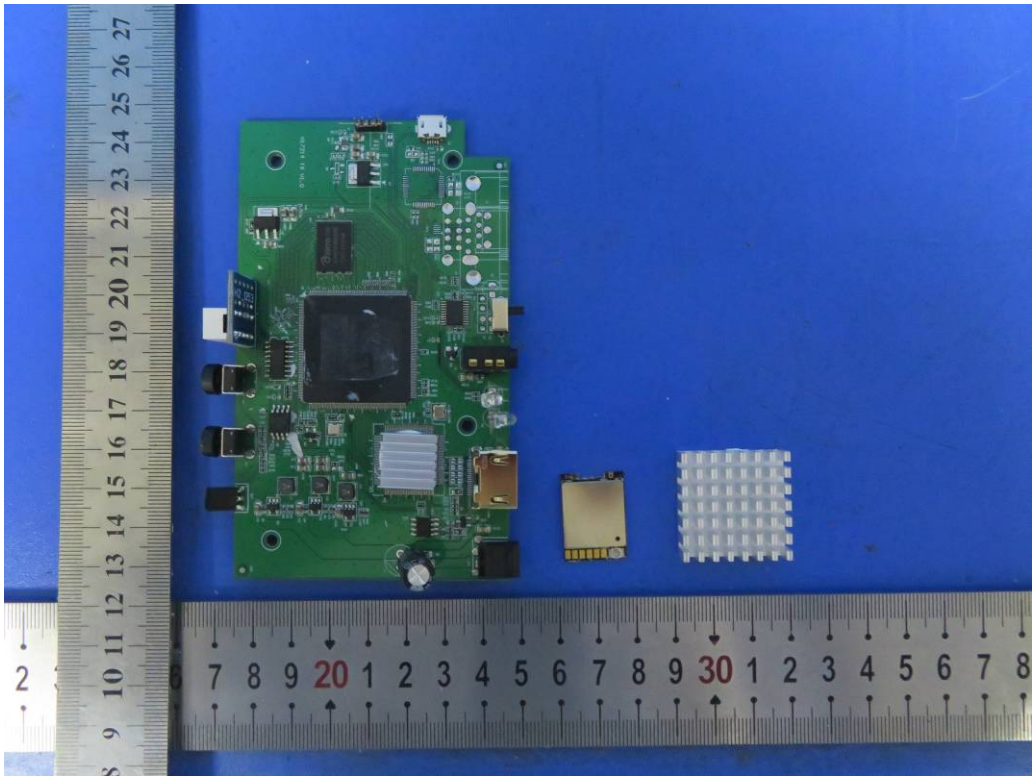
8. INTERIOR PHOTOGRAPHS OF THE EUT

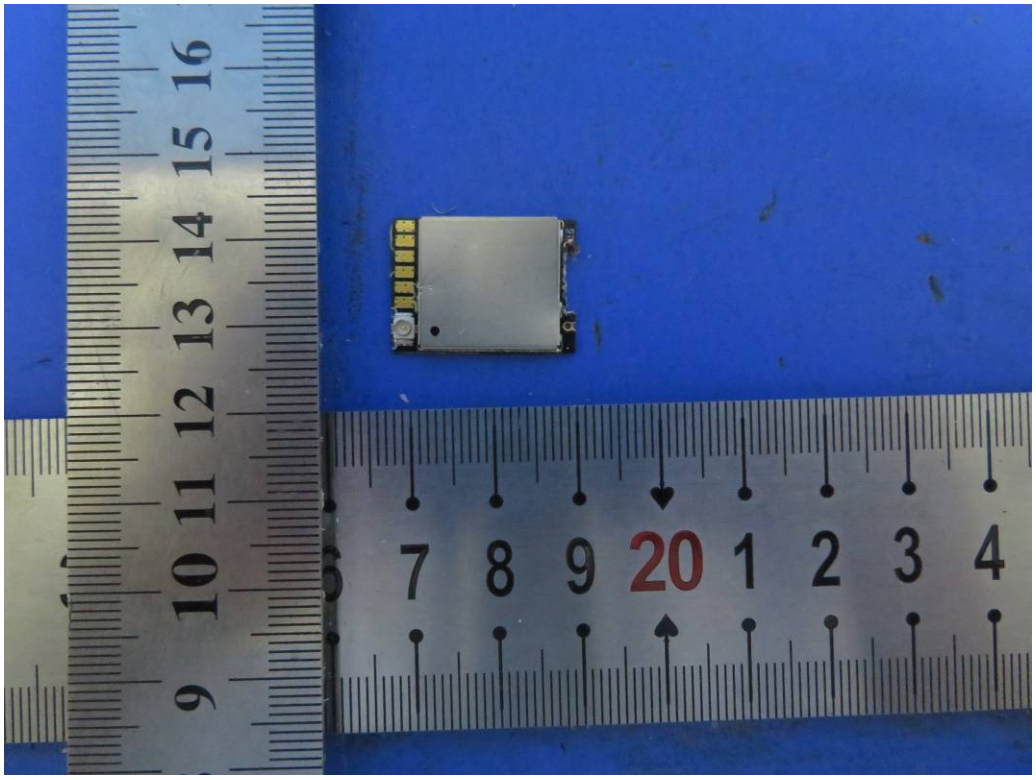


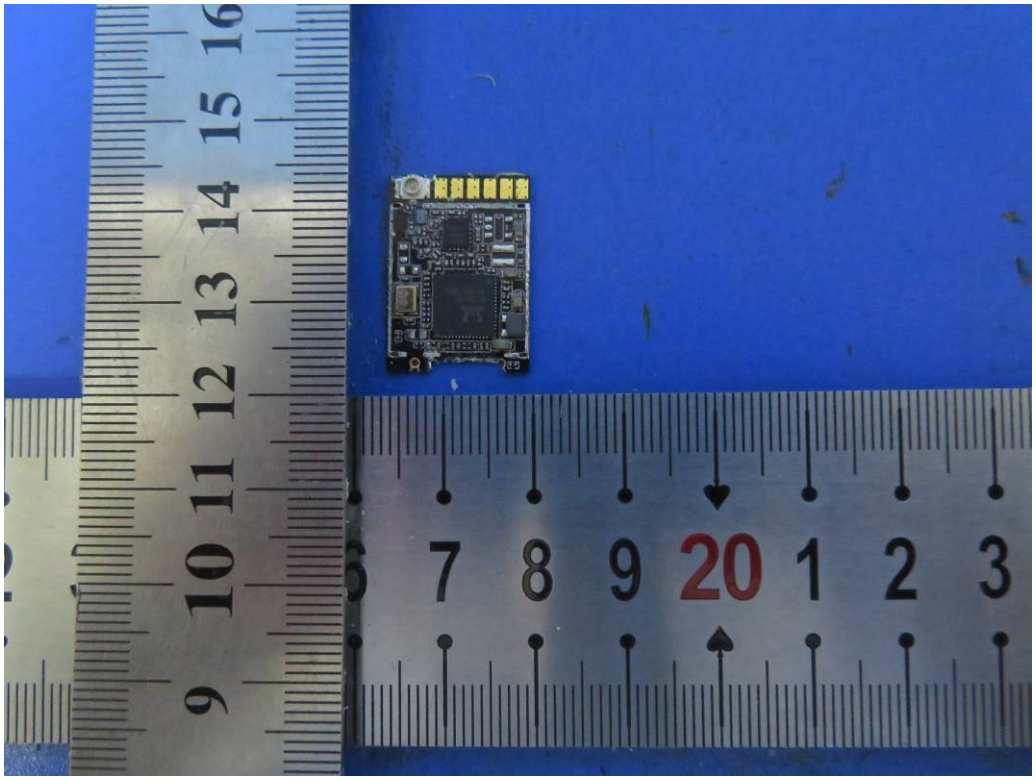


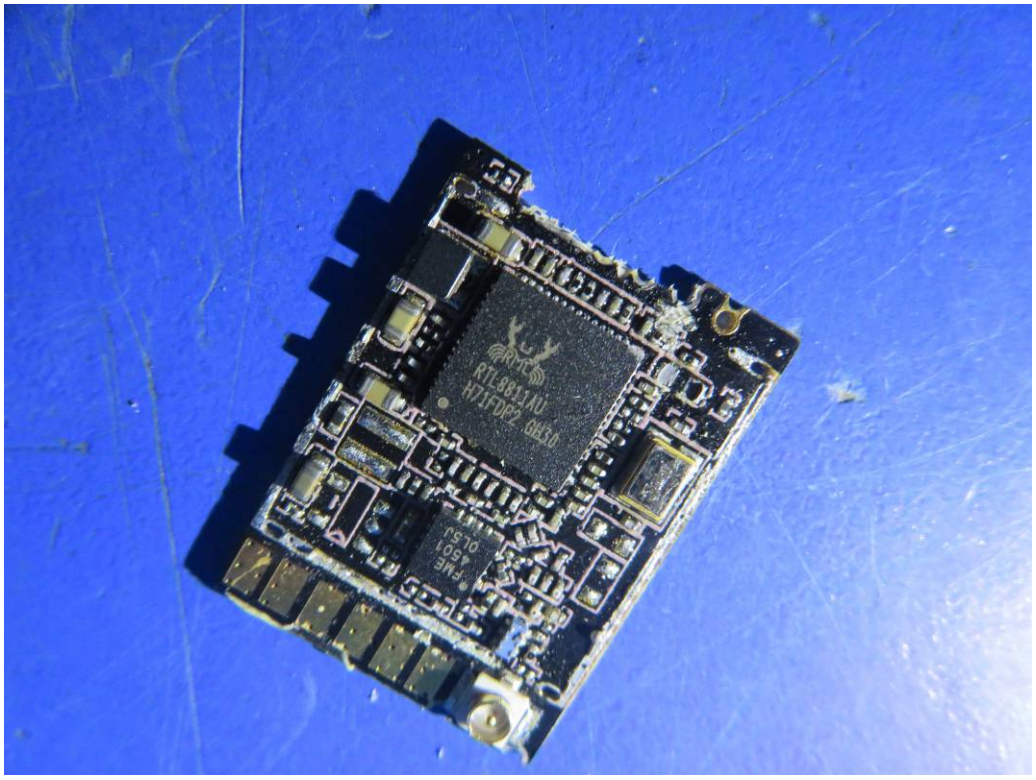












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