



7. OUTPUT POWER TEST

7.1. Limits

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 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.

7.2. Test setup

1. The maximum average conducted output power can be measured using Method PM-G (Measurement using a gated RF average power meter):
2. Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.
 - a. The Transmitter output (antenna port) was connected to the power meter.
 - b. Turn on the EUT and power meter and then record the power value.
 - c. Repeat above procedures on all channels needed to be tested.



7.3. Test result

Band1

	Frequency (MHz)	Average Output Power(dBm)		Total Output Power(dBm)		FCC Limit (dBm)	Result
		ANT1	ANT2	ANT1	ANT2		
802.11a	5180	17.32	17.25	17.32	17.25	23.98	Pass
	5220	17.28	17.27	17.28	17.27	23.98	Pass
	5240	17.25	17.26	17.25	17.26	23.98	Pass
802.11n (HT20)	5180	12.24	12.18	15.22		23.98	Pass
	5220	12.26	12.16	15.22		23.98	Pass
	5240	12.15	12.14	15.16		23.98	Pass
802.11n (HT40)	5190	12.26	12.18	15.23		23.98	Pass
	5230	12.19	12.16	15.19		23.98	Pass
802.11ac (HT20)	5180	12.22	12.17	15.21		23.98	Pass
	5220	12.23	12.19	15.22		23.98	Pass
	5240	12.24	12.20	15.23		23.98	Pass
802.11ac (HT40)	5190	12.24	12.22	15.24		23.98	Pass
	5230	12.25	12.19	15.23		23.98	Pass
802.11ac (HT80)	5210	12.26	12.19	15.24		23.98	Pass



Band4

802.11a	Frequency (MHz)	Average Output Power(dBm)		Duty factor (dB)	Total Output Power(dBm)		FCC Limit (dBm)	Result
		ANT1	ANT2		ANT1	ANT2		
802.11a	5745	15.35	15.27	0	15.35	15.27	30.00	Pass
	5785	15.36	15.25	0	15.36	15.25	30.00	Pass
	5825	15.29	15.23	0	15.29	15.23	30.00	Pass
802.11n (HT20)	5745	10.21	10.13	0	13.18		30.00	Pass
	5785	10.18	10.17	0	13.19		30.00	Pass
	5825	10.22	10.12	0	13.18		30.00	Pass
802.11n (HT40)	5755	10.22	10.21	0	13.23		30.00	Pass
	5795	10.16	10.15	0	13.17		30.00	Pass
802.11ac (HT20)	5745	10.25	10.17	0	13.22		30.00	Pass
	5785	10.21	10.19	0	13.21		30.00	Pass
	5825	10.24	10.18	0	13.22		30.00	Pass
802.11ac (HT40)	5755	10.26	10.22	0	13.25		30.00	Pass
	5795	10.24	10.19	0	13.23		30.00	Pass
802.11ac (HT80)	5775	10.27	10.17	0	13.23		30.00	Pass



8. PEAK POWER SPECTRAL DENSITY TEST

8.1. Limits

In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

In addition, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.

8.2. Test setup

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
4. For U-NII1, U-NII-2A, U-NII-2C Band:

Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

For U-NII-3 Band:

Set RBW=510 kHz, VBW=3*RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)

5. Use the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add $10 \log(1/\text{duty cycle})$.

we test all antennas, the antenna 1 was worst mode and the data recording in the report.



8.3. Test data

Test data as below

Band 1

	Frequency (MHz)	Reading Level (dBm)		Duty factor (dB)	PPSD (dBm)		FCC Limit (dBm)	Result
		ANT1	ANT2		ANT1	ANT2		
802.11a	5180	-2.17	-2.23	0	-2.17	-2.23	11.00	Pass
	5220	-2.04	-2.23	0	-2.04	-2.23	11.00	Pass
	5240	-1.90	-2.18	0	-1.90	-2.18	11.00	Pass
802.11n (HT20)	5180	-2.30	-2.37	0	0.68		11.00	Pass
	5220	-2.16	-2.41	0	0.73		11.00	Pass
	5240	-2.37	-2.41	0	0.62		11.00	Pass
802.11n (HT40)	5190	-5.47	-5.94	0	-2.69		11.00	Pass
	5230	-5.90	-5.86	0	-2.87		11.00	Pass
802.11ac (HT20)	5180	-8.21	-8.28	0	-5.23		11.00	Pass
	5220	-7.84	-8.19	0	-5.00		11.00	Pass
	5240	-7.16	-8.09	0	-4.59		11.00	Pass
802.11ac (HT40)	5190	-10.77	-10.82	0	-7.78		11.00	Pass
	5230	-10.40	-10.82	0	-7.59		11.00	Pass
802.11ac (HT80)	5210	-5.98	-6.48	0	-3.21		11.00	Pass



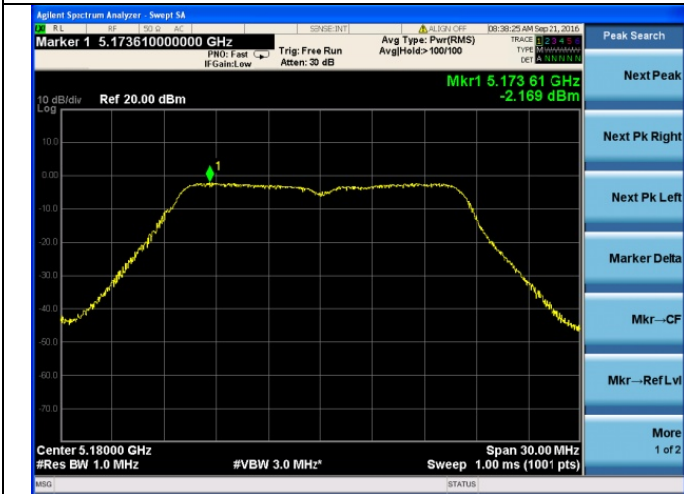
Band 4

	Frequency (MHz)	Reading Level (dBm)		Duty factor (dB)	PPSD (dBm)		FCC Limit (dBm)	Result
		ANT1	ANT2		ANT1	ANT2		
802.11a	5745	-4.66	-4.57	0	-1.74	-1.65	30.00	Pass
	5785	-3.95	-4.48	0	-1.03	-1.56	30.00	Pass
	5825	-3.93	-4.52	0	-1.01	-1.60	30.00	Pass
802.11n (HT20)	5745	-4.45	-4.92	0	1.25		30.00	Pass
	5785	-4.88	-4.86	0	1.06		30.00	Pass
	5825	-4.02	-4.84	0	1.52		30.00	Pass
802.11n (HT40)	5755	-5.62	-5.85	0	0.20		30.00	Pass
	5795	-5.41	-6.35	0	0.08		30.00	Pass
802.11ac (HT20)	5745	-3.19	-4.36	0	-0.73		30.00	Pass
	5785	-3.74	-4.08	0	-0.90		30.00	Pass
	5825	-4.13	-4.26	0	-1.18		30.00	Pass
802.11ac (HT40)	5755	-6.31	-6.51	0	-3.40		30.00	Pass
	5795	-6.09	-6.48	0	-3.27		30.00	Pass
802.11ac (HT80)	5775	-6.16	-6.62	0	-0.45		30.00	Pass

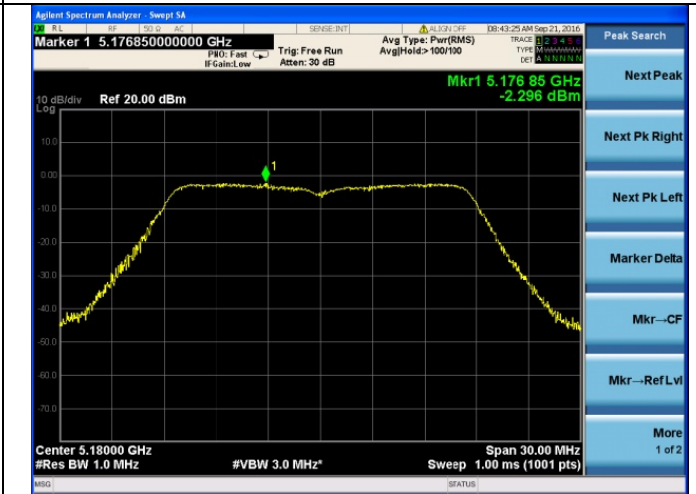


Band 1

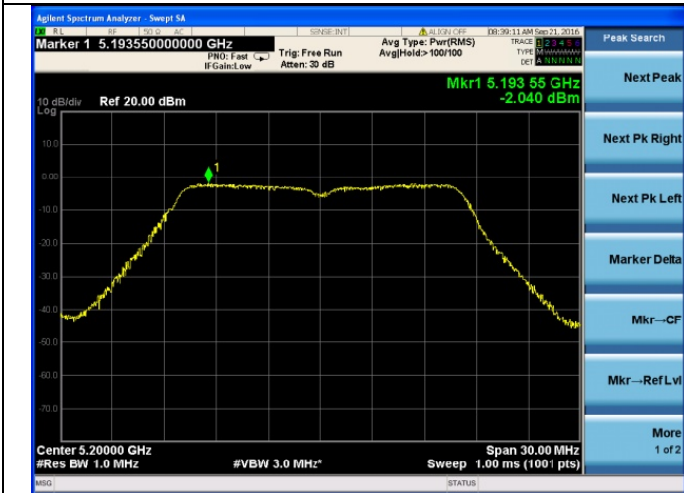
802.11a 5180MHz



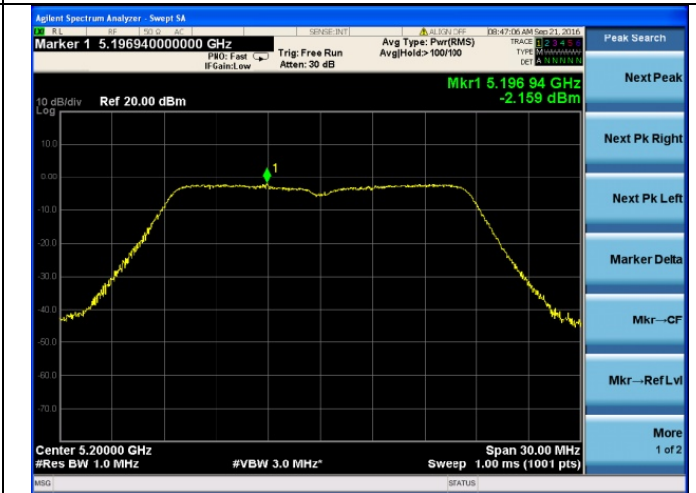
802.11n20MHz 5180MHz



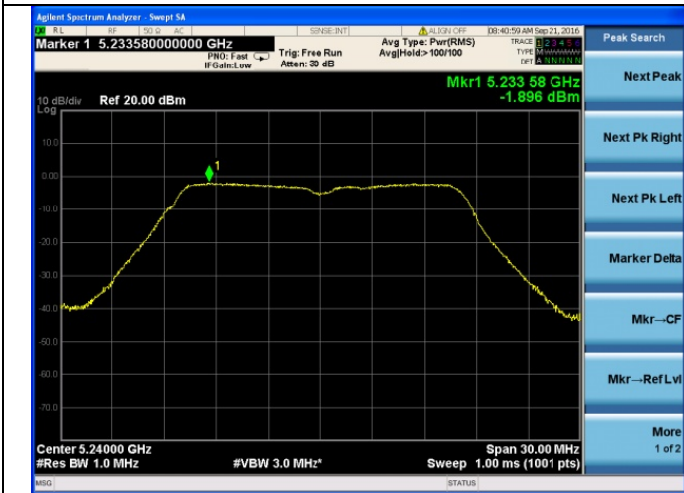
802.11a 5220MHz



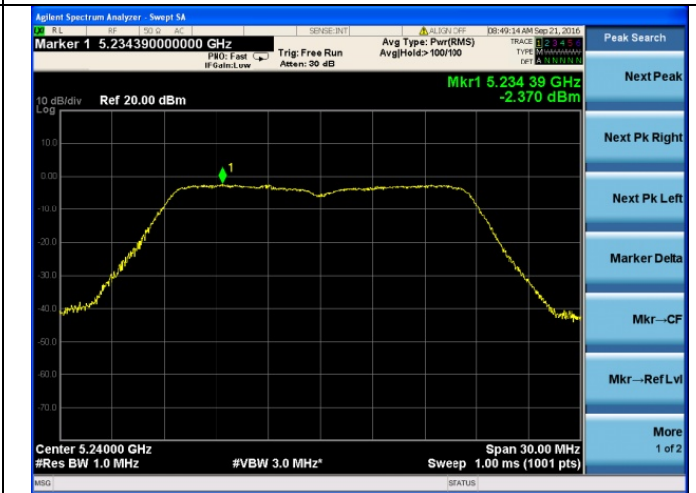
802.11n20MHz 5200MHz



802.11a 5240MHz



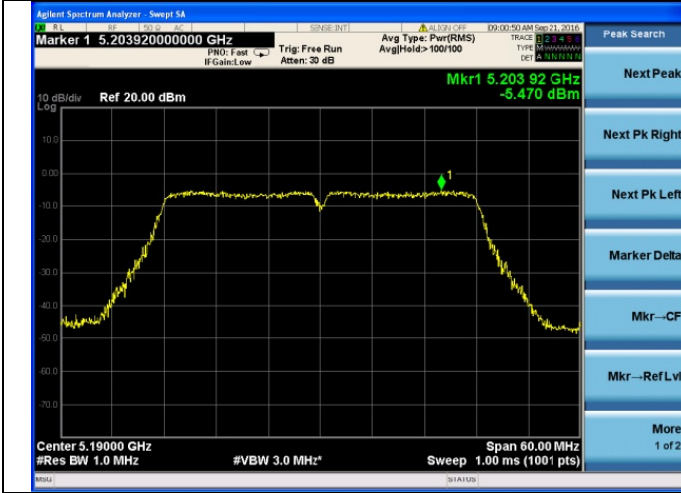
802.11n20MHz 5240MHz





Band 1

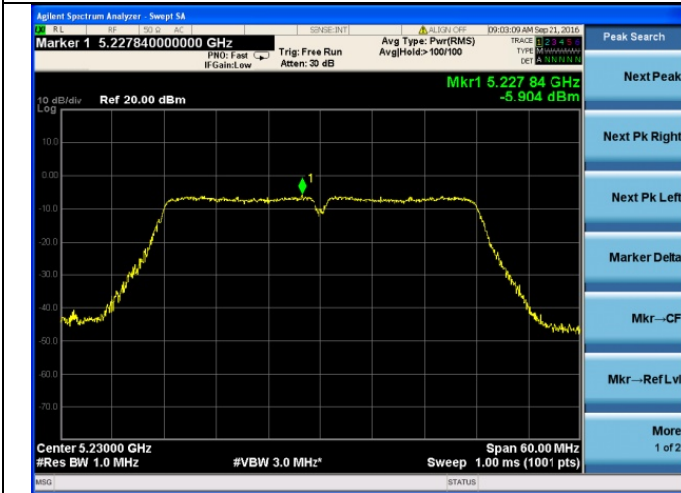
802.11n40MHz 5190MHz



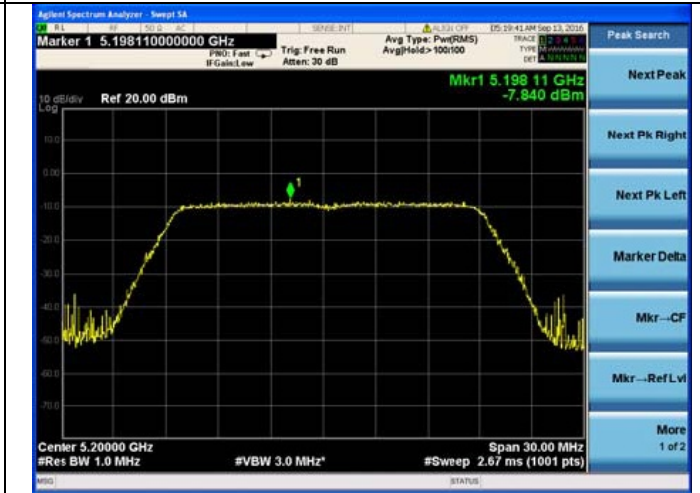
802.11ac20MHz 5180MHz



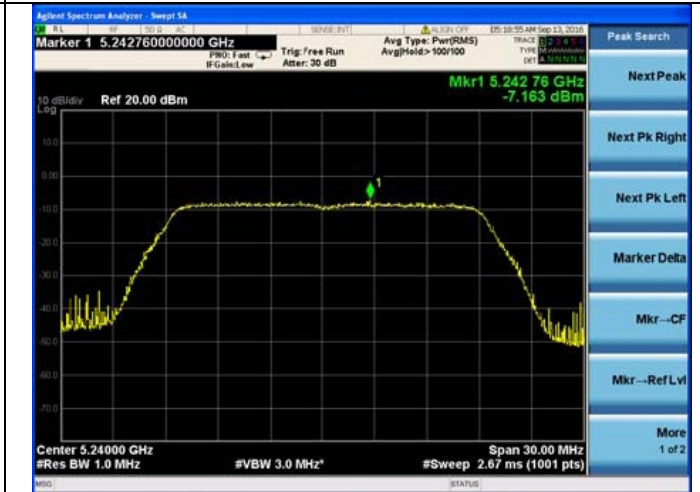
802.11n40MHz 5230MHz



802.11ac20MHz 5200MHz



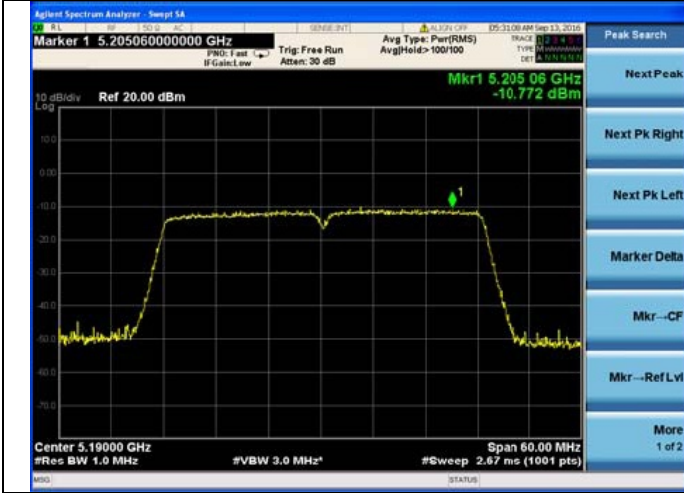
802.11ac20MHz 5240MHz



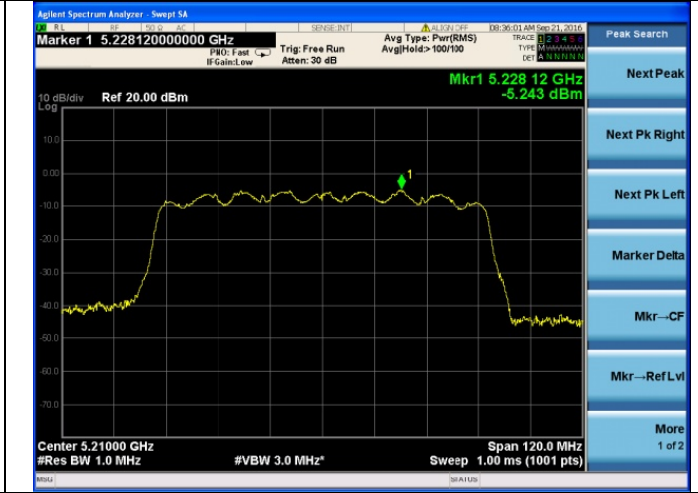


Band 1

802.11ac40MHz 5190MHz



802.11ac 80MHz 5210MHz



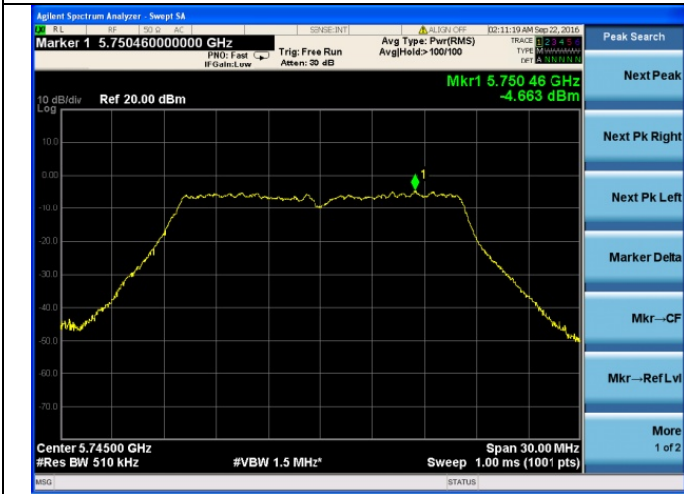
802.11ac40MHz 5230MHz



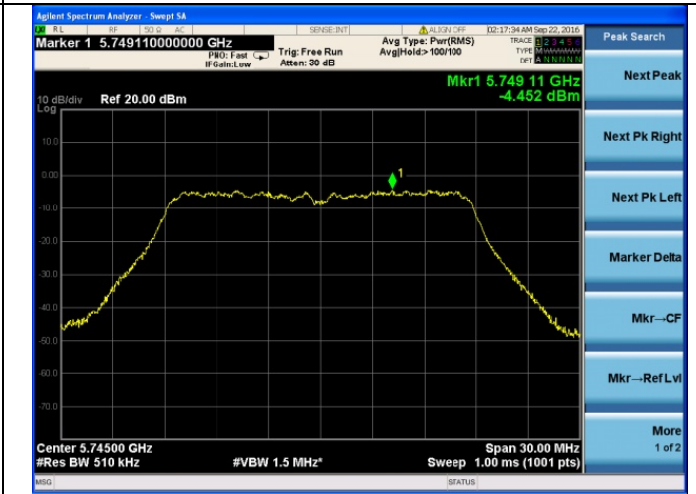


Band 4

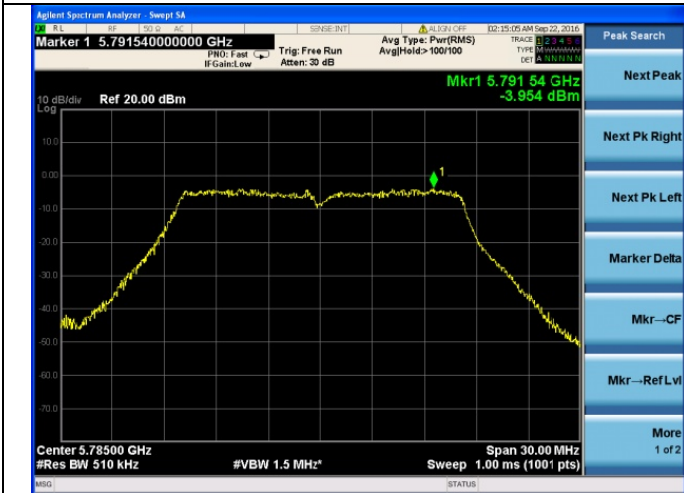
802.11a 5745MHz



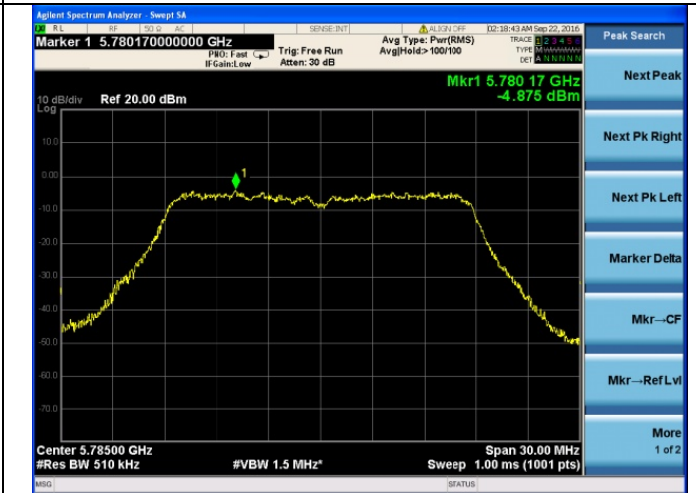
802.11n20MHz 5745MHz



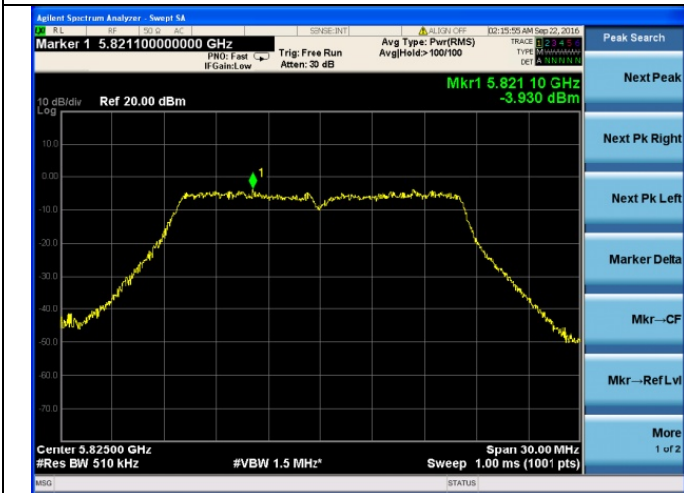
802.11a 5785MHz



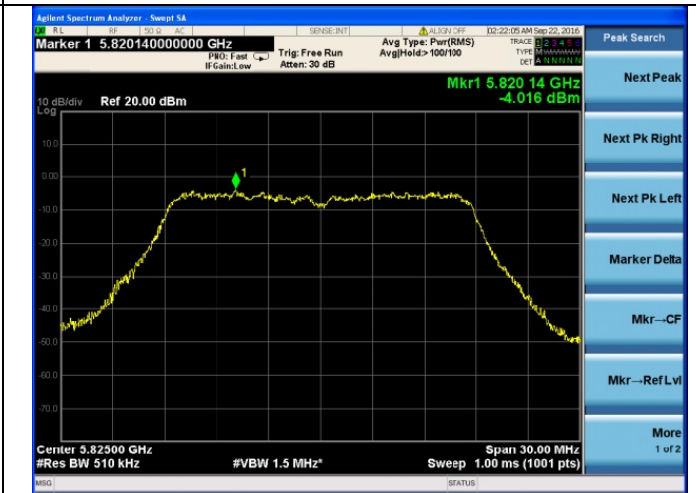
802.11n20MHz 5785MHz



802.11a 5825MHz



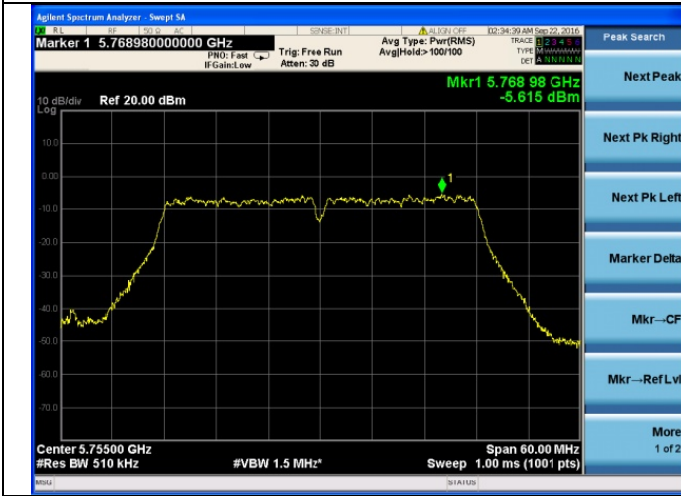
802.11n20MHz 5825MHz





Band 4

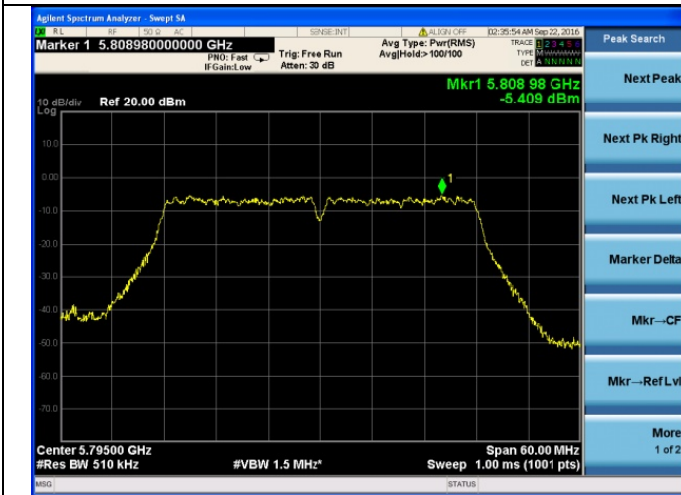
802.11n40MHz 5755MHz



802.11ac20MHz 5745MHz



802.11n40MHz 5795MHz



802.11ac20MHz 5785MHz



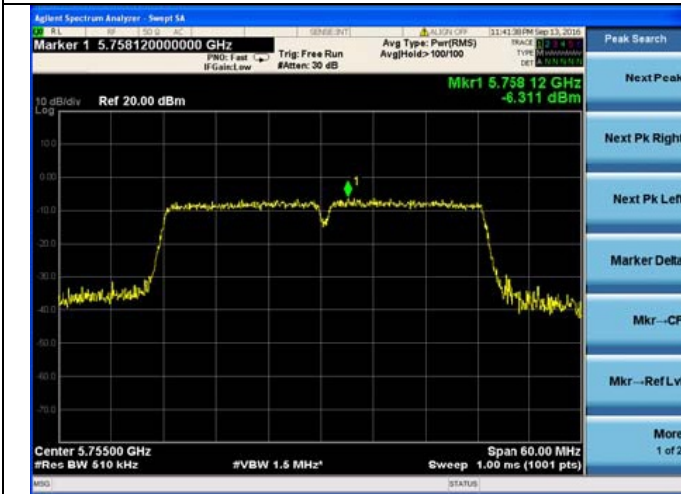
802.11ac20MHz 5825MHz





Band 4

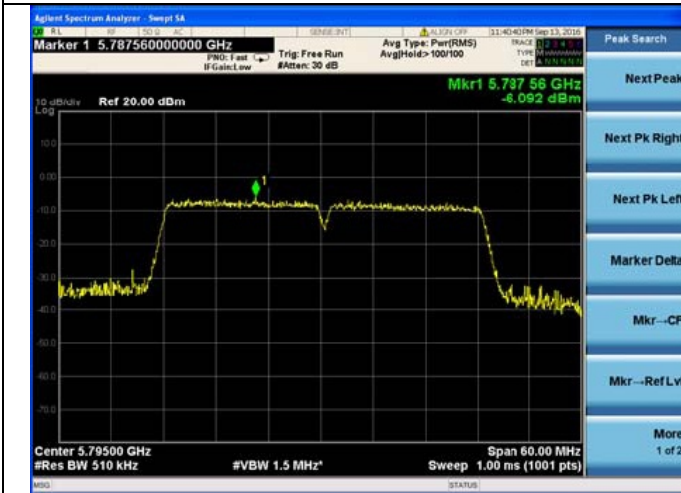
802.11ac40MHz 5755MHz



802.11ac 80MHz 5775MHz



802.11ac40MHz 5795MHz





9. DUTY CYCLE TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

Operation Mode	Duty Cycle	Duty Fator (dB) $10 * \log (1/ \text{Duty cycle})$
802.11a	100%	0
802.11n(HT20)	100%	0
802.11n(HT40)	100%	0
802.11ac(HT20)	100%	0
802.11ac(HT40)	100%	0
802.11ac(HT80)	100%	0



10. FREQUENCY STABILITY

10.1. Limits

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

10.2. Test setup

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.
2. Set EUT as normal operation.
3. Turn the EUT on and couple its output to spectrum.
4. Turn the EUT off and set the chamber to the highest temperature specified.
5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.
6. Repeat step with the temperature chamber set to the lowest temperature.

we test all antennas, the antenna 1 was worst mode and the data recording in the report.



10.3. Test data

Test data as below

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5180	48.00	25	5180	5180.0086	0.0086	1.6691	
	55.20		5180	5180.0072	0.0072	1.3988	
	40.80		5180	5180.0080	0.0080	1.5533	
	48.00		-20	5180	5180.0079	0.0079	1.5340
			-10	5180	5180.0091	0.0091	1.7656
			0	5180	5180.0112	0.0112	2.1710
			10	5180	5180.0121	0.0121	2.3448
			20	5180	5180.0093	0.0093	1.8042
			30	5180	5180.0129	0.0129	2.4992
			40	5180	5180.0091	0.0091	1.7656
			50	5180	5180.0101	0.0101	1.9587
			60	5180	5180.0091	0.0091	1.7656
			70	5180	5180.0098	0.0098	1.9008

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5190	48.00	25	5190	5190.0071	0.0071	1.3653	
	55.20		5190	5190.0057	0.0057	1.0956	
	40.80		5190	5190.0065	0.0065	1.2497	
	48.00		-20	5190	5190.0064	0.0064	-1.2304
			-10	5190	5190.0076	0.0076	1.4617
			0	5190	5190.0097	0.0097	1.8663
			10	5190	5190.0106	0.0106	2.0397
			20	5190	5190.0078	0.0078	1.5002
			30	5190	5190.0114	0.0114	2.1938
			40	5190	5190.0076	0.0076	1.4617
			50	5190	5190.0086	0.0086	1.6543
			60	5190	5190.0076	0.0076	1.4617
			70	5190	5190.0083	0.0083	1.5965



Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5200	48.00	25	5200	5200.0159	0.0159	3.0615	
	55.20		5200	5200.0145	0.0145	2.7923	
	40.80		5200	5200.0153	0.0153	2.9462	
	48.00		-20	5200	5200.0152	0.0152	2.9269
			-10	5200	5200.0164	0.0164	3.1577
			0	5200	5200.0185	0.0185	3.5615
			10	5200	5200.0194	0.0194	3.7346
			20	5200	5200.0166	0.0166	3.1962
			30	5200	5200.0202	0.0202	3.8885
			40	5200	5200.0164	0.0164	3.1577
			50	5200	5200.0174	0.0174	3.3500
			60	5200	5200.0164	0.0164	3.1577
			70	5200	5200.0171	0.0171	3.2923

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5210	48.00	25	5210	5210.0133	0.0133	2.5578	
	55.20		5210	5210.0119	0.0119	2.2891	
	40.80		5210	5210.0127	0.0127	2.4426	
	48.00		-20	5210	5210.0126	0.0126	2.4234
			-10	5210	5210.0138	0.0138	2.6537
			0	5210	5210.0159	0.0159	3.0568
			10	5210	5210.0168	0.0168	3.2296
			20	5210	5210.0140	0.0140	2.6921
			30	5210	5210.0176	0.0176	3.3831
			40	5210	5210.0138	0.0138	2.6537
			50	5210	5210.0148	0.0148	2.8457
			60	5210	5210.0138	0.0138	2.6537
			70	5210	5210.0145	0.0145	2.7881



Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5230	48.00	25	5230	5230.0123	0.0123	2.3503	
	55.20		5230	5230.0109	0.0109	2.0826	
	40.80		5230	5230.0117	0.0117	2.2356	
	48.00		-20	5230	5230.0116	0.0116	2.2164
			-10	5230	5230.0128	0.0128	2.4459
			0	5230	5230.0149	0.0149	2.8474
			10	5230	5230.0158	0.0158	3.0195
			20	5230	5230.0130	0.0130	2.4841
			30	5230	5230.0166	0.0166	3.1725
			40	5230	5230.0128	0.0128	2.4459
			50	5230	5230.0138	0.0138	2.6371
			60	5230	5230.0128	0.0128	2.4459
			70	5230	5230.0135	0.0135	2.5797

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5240	48.00	25	5240	5240.0123	0.0123	2.3466	
	55.20		5240	5240.0109	0.0109	2.0794	
	40.80		5240	5240.0117	0.0117	2.2321	
	48.00		-20	5240	5240.0116	0.0116	2.2130
			-10	5240	5240.0128	0.0128	2.4420
			0	5240	5240.0149	0.0149	2.8427
			10	5240	5240.0158	0.0158	3.0145
			20	5240	5240.0130	0.0130	2.4802
			30	5240	5240.0166	0.0166	3.1672
			40	5240	5240.0128	0.0128	2.4420
			50	5240	5240.0138	0.0138	2.6328
			60	5240	5240.0128	0.0128	2.4420
			70	5240	5240.0135	0.0135	2.5756



Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5745	48.00	25	5745	5745.0125	0.0125	2.1755	
	55.20		5745	5745.0111	0.0111	1.9318	
	40.80		5745	5745.0119	0.0119	2.0710	
	48.00		-20	5745	5745.0118	0.0118	2.0536
			-10	5745	5745.0130	0.0130	2.2625
			0	5745	5745.0151	0.0151	2.6280
			10	5745	5745.0160	0.0160	2.7847
			20	5745	5745.0132	0.0132	2.2973
			30	5745	5745.0168	0.0168	2.9239
			40	5745	5745.0130	0.0130	2.2625
			50	5745	5745.0140	0.0140	-2.4366
			60	5745	5745.0130	0.0130	2.2625
			70	5745	5745.0137	0.0137	2.3843

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5755	48.00	25	5755	5755.0143	0.0143	2.4763	
	55.20		5755	5755.0150	0.0150	2.5979	
	40.80		5755	5755.0146	0.0146	2.5284	
	48.00		-20	5755	5755.0170	0.0170	2.9454
			-10	5755	5755.0161	0.0161	2.7891
			0	5755	5755.0156	0.0156	2.7022
			10	5755	5755.0145	0.0145	2.5110
			20	5755	5755.0154	0.0154	2.6674
			30	5755	5755.0165	0.0165	2.8586
			40	5755	5755.0151	0.0151	2.6153
			50	5755	5755.0146	0.0146	2.5284
			60	5755	5755.0183	0.0183	3.1713
			70	5755	5755.0153	0.0153	2.6500



Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5775	48.00	25	5775	5775.0119	0.0119	2.0528	
	55.20		5775	5775.0126	0.0126	2.1740	
	40.80		5775	5775.0122	0.0122	2.1048	
	48.00		-20	5775	5775.0146	0.0146	2.5203
			-10	5775	5775.0137	0.0137	2.3645
			0	5775	5775.0132	0.0132	2.2779
			10	5775	5775.0121	0.0121	2.0874
			20	5775	5775.0130	0.0130	2.2433
			30	5775	5775.0141	0.0141	2.4338
			40	5775	5775.0127	0.0127	2.1913
			50	5775	5775.0122	0.0122	2.1048
			60	5775	5775.0159	0.0159	2.7455
			70	5775	5775.0129	0.0129	2.2260

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5785	48.00	25	5785	5785.0116	0.0116	1.9978	
	55.20		5785	5785.0131	0.0131	2.2570	
	40.80		5785	5785.0119	0.0119	2.0496	
	48.00		-20	5785	5785.0129	0.0129	2.2225
			-10	5785	5785.0121	0.0121	2.0842
			0	5785	5785.0137	0.0137	2.3608
			10	5785	5785.0127	0.0127	2.1879
			20	5785	5785.0122	0.0122	2.1015
			30	5785	5785.0126	0.0126	2.1706
			40	5785	5785.0121	0.0121	2.0842
			50	5785	5785.0146	0.0146	2.5163
			60	5785	5785.0149	0.0149	2.5682
			70	5785	5785.0132	0.0132	2.2743



Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5795	48.00	25	5795	5795.0116	0.0116	1.9947	
	55.20		5795	5795.0131	0.0131	2.2535	
	40.80		5795	5795.0119	0.0119	2.0464	
	48.00		-20	5795	5795.0129	0.0129	2.2190
			-10	5795	5795.0121	0.0121	2.0809
			0	5795	5795.0137	0.0137	2.3570
			10	5795	5795.0127	0.0127	2.1845
			20	5795	5795.0122	0.0122	2.0982
			30	5795	5795.0126	0.0126	2.1672
			40	5795	5795.0121	0.0121	2.0809
			50	5795	5795.0146	0.0146	2.5123
			60	5795	5795.0149	0.0149	2.5641
			70	5795	5795.0132	0.0132	2.2708

Ref. Freq. (MHz)	Test Voltage (V)	Test Temp. (°C)	Spectrum Frequency (MHz)	Measured Frequency (MHz)	Δ Frequency (MHz)	Deviation (ppm)	
5825	48.00	25	5825	5825.0121	0.0121	2.0854	
	55.20		5825	5825.0136	0.0136	2.3429	
	40.80		5825	5825.0124	0.0124	2.1369	
	48.00		-20	5825	5825.0134	0.0134	2.3086
			-10	5825	5825.0126	0.0126	2.1712
			0	5825	5825.0142	0.0142	2.4459
			10	5825	5825.0132	0.0132	2.2742
			20	5825	5825.0127	0.0127	2.1884
			30	5825	5825.0131	0.0131	2.2571
			40	5825	5825.0126	0.0126	2.1712
			50	5825	5825.0151	0.0151	2.6004
			60	5825	5825.0154	0.0154	2.6519
			70	5825	5825.0137	0.0137	2.3601



11. TRANSMISSION IN THE ABSENCE OF DATA

11.1. Limits

According to §15.407(c)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

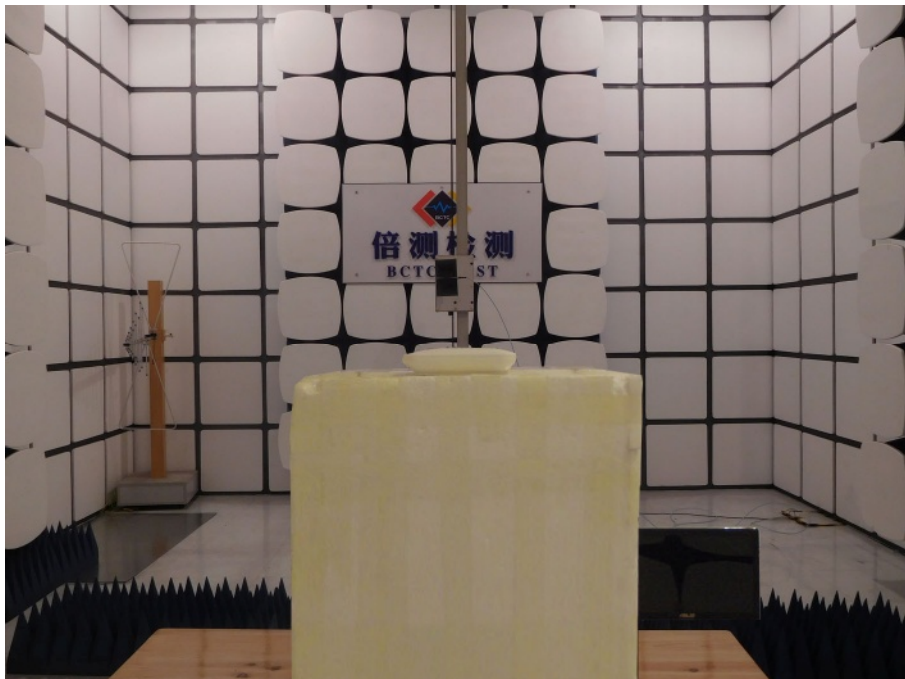
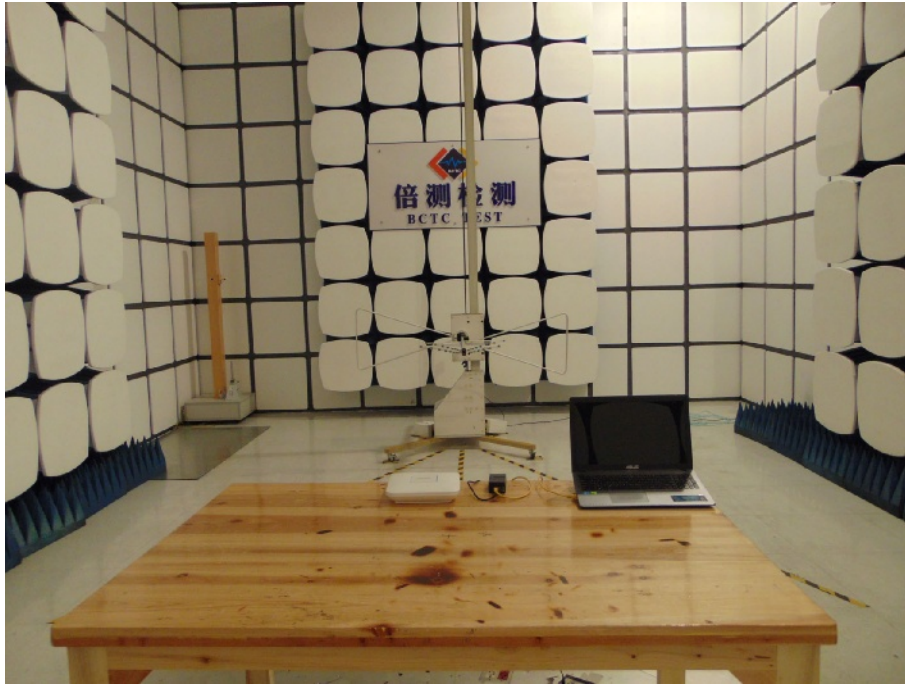
11.2. Test result

No non-compliance noted:

Refer to the theory of operation.

12. PHOTOGRAPHS OF TEST SET-UP

Radiated Emission Test



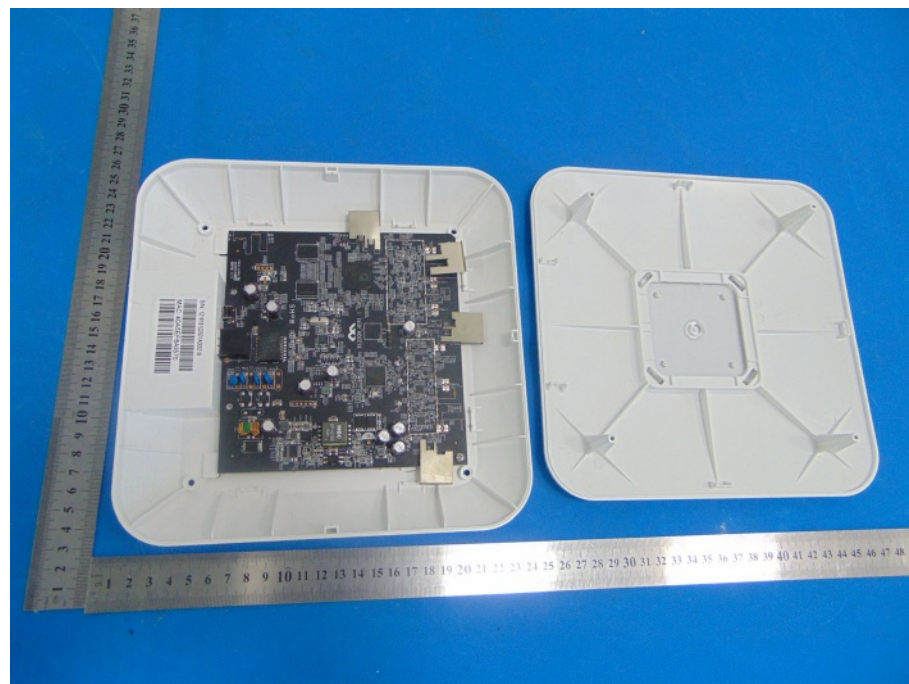
Conducted Measurement Photos



13. PHOTOGRAPHS OF THE EUT







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