



6. 26DB AND 99% BANDWIDTH TEST

6.1. Measurement Procedure

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033, at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3



26dB bandwidth

	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	21.10	16.787
	5200	21.10	16.785
	5240	21.12	16.794
802.11n (HT20)	5180	21.64	17.850
	5200	21.70	17.860
	5240	21.86	17.879
802.11n (HT40)	5190	42.64	36.292
	5230	42.72	36.239
802.11ac (HT80)	5210	79.86	74.907

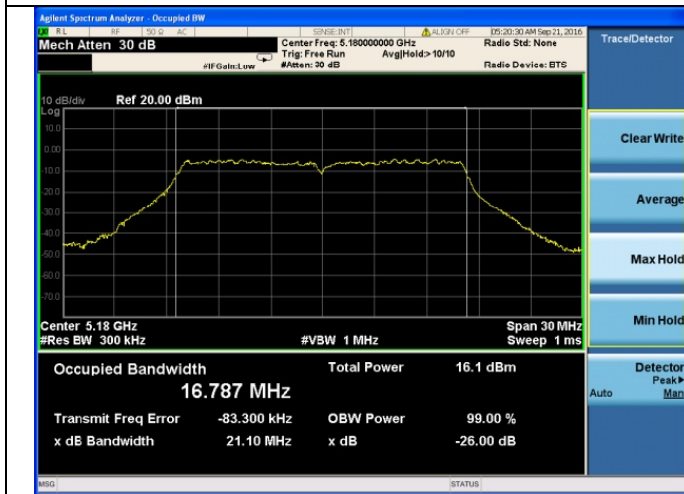
6dB bandwidth

	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.58	16.495	>0.5
	5785	16.55	16.481	>0.5
	5825	16.57	16.488	>0.5
802.11n (HT20)	5745	17.78	16.665	>0.5
	5785	17.75	17.652	>0.5
	5825	17.76	17.657	>0.5
802.11n (HT40)	5755	36.56	36.211	>0.5
	5795	36.53	36.210	>0.5
802.11ac (HT80)	5775	75.08	74.943	>0.5



Band 1

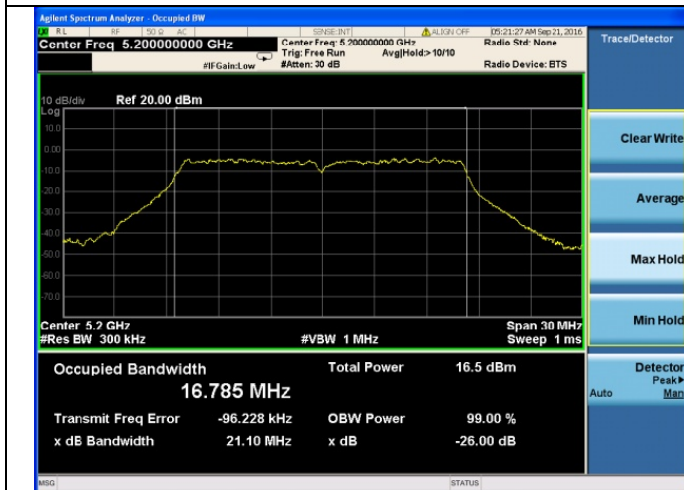
802.11a 5180MHz



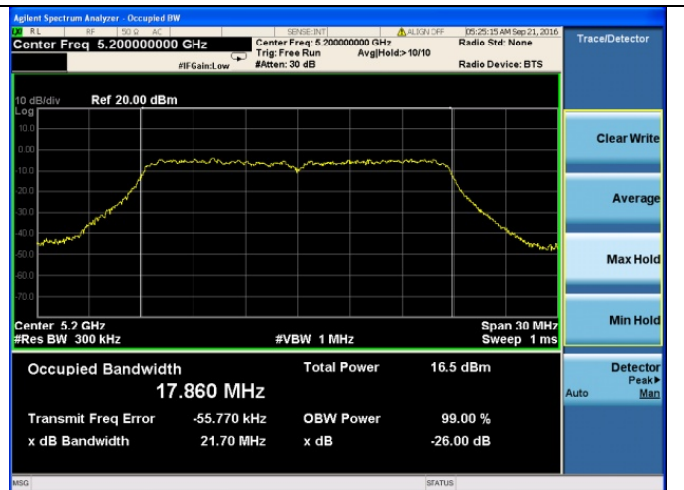
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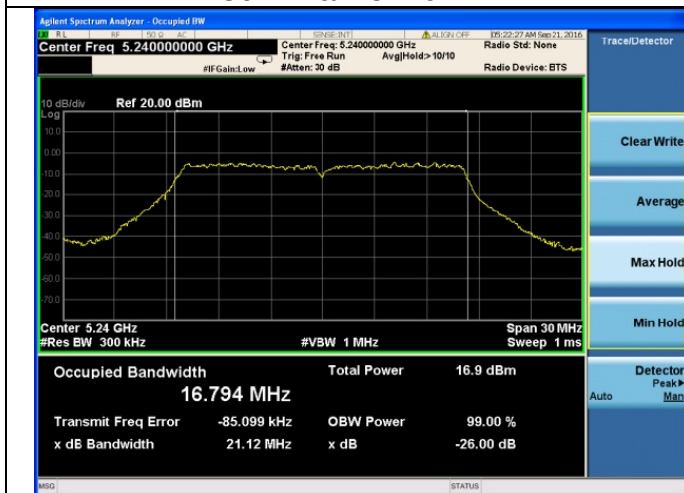
802.11a 5220MHz



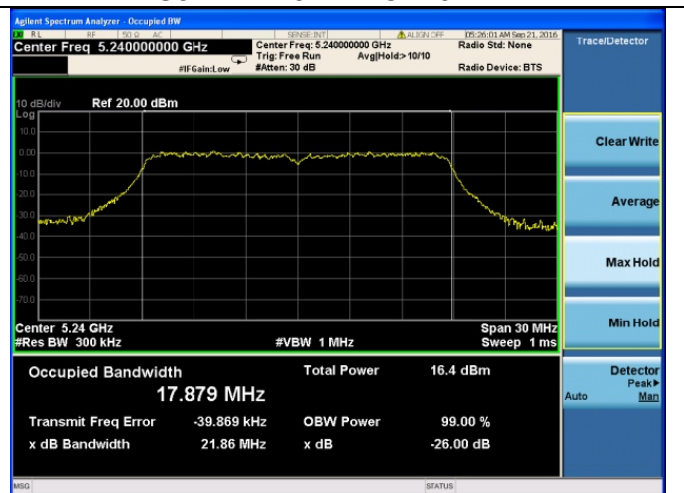
802.11n20MHz 5200MHz



802.11a 5240MHz



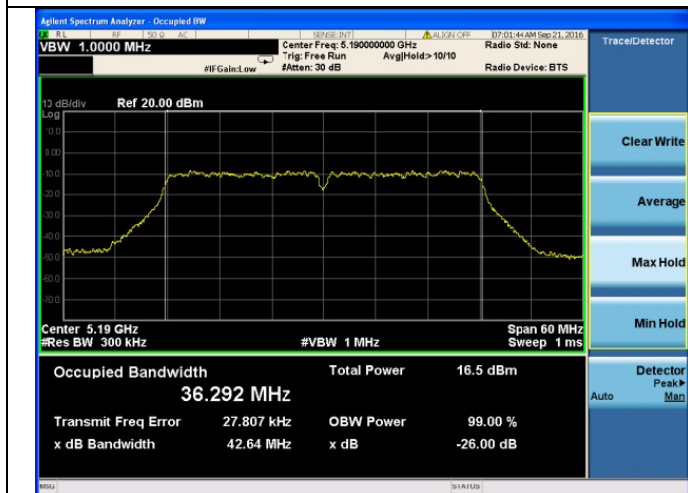
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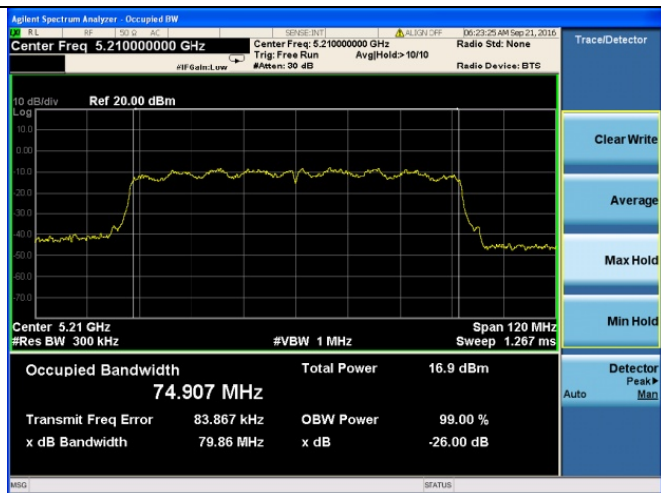


Band 1

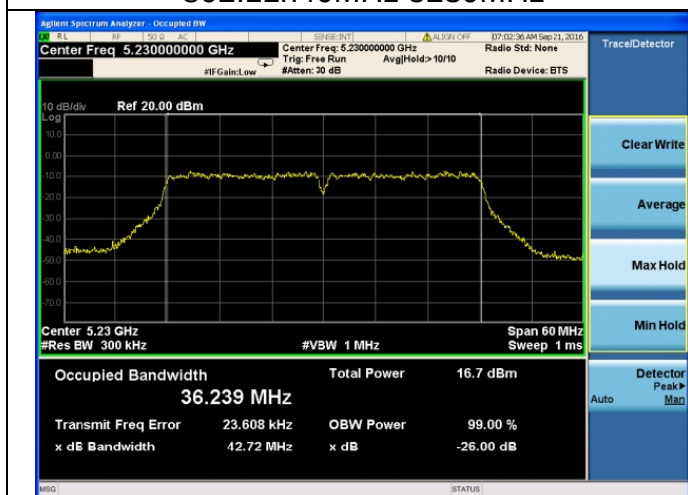
802.11n40MHz 5190MHz



802.11ac 80MHz 5210MHz



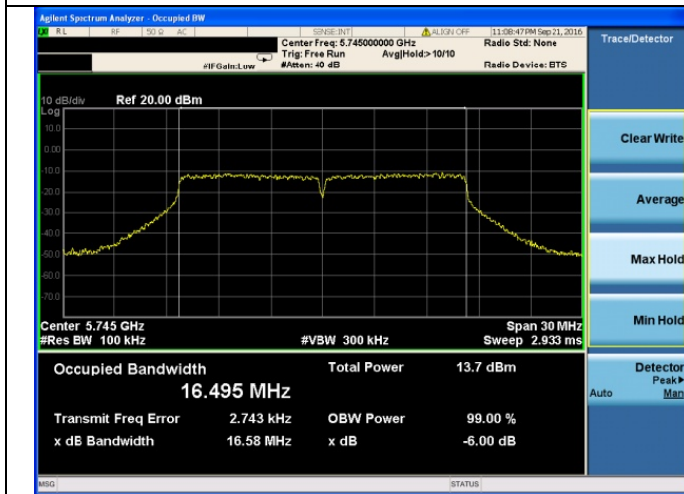
802.11n40MHz 5230MHz



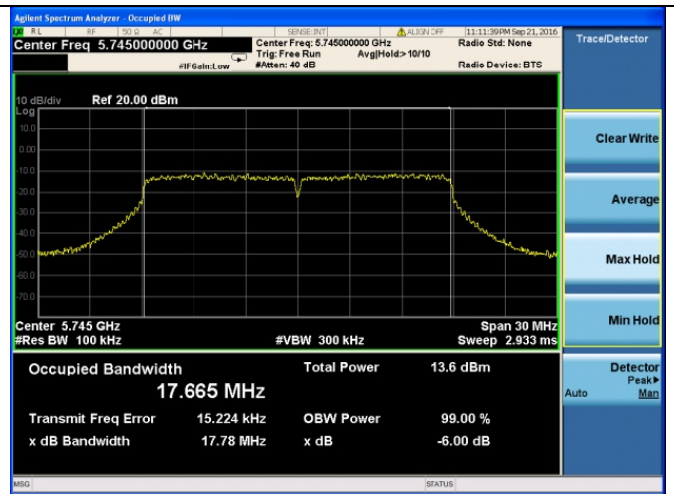


Band 4

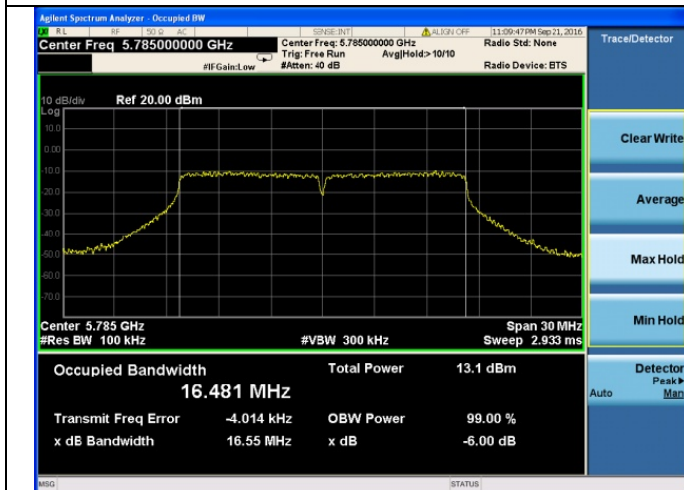
802.11a 5745MHz



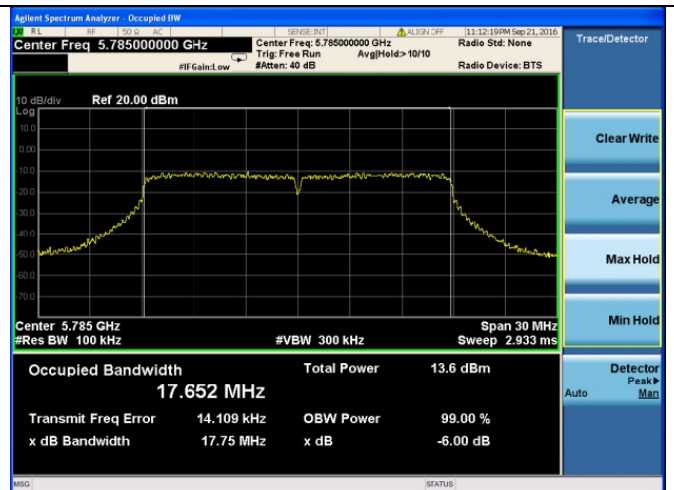
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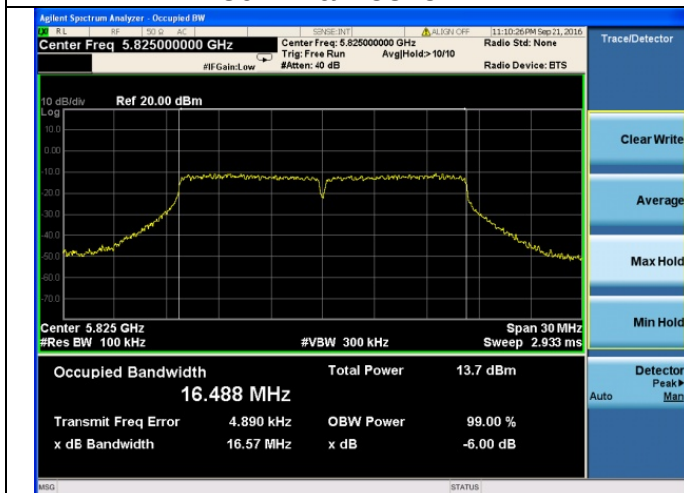
802.11a 5785MHz



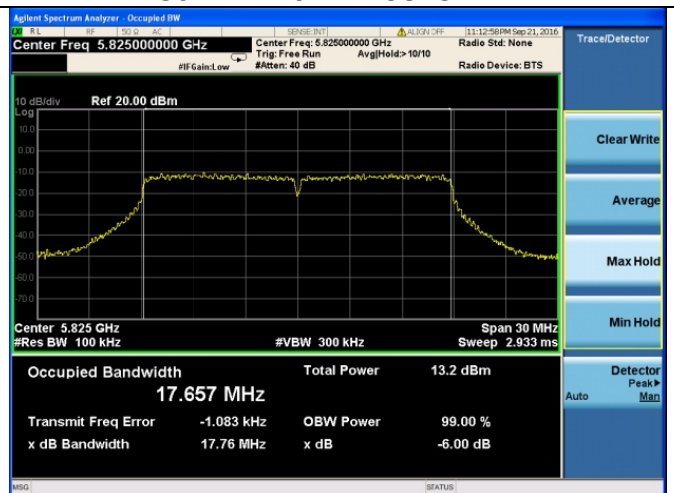
802.11n20MHz 5785MHz



802.11a 5825MHz



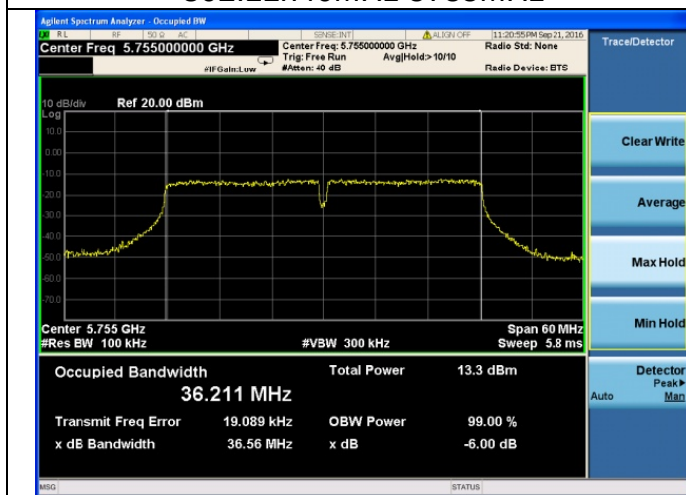
802.11n20MHz 5825MHz



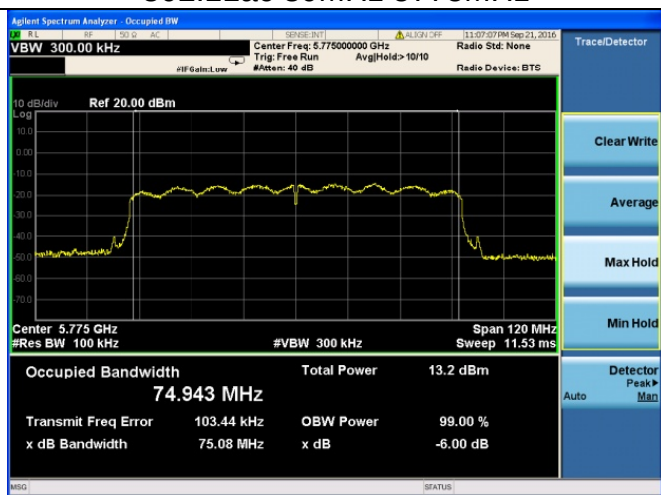


Band 1

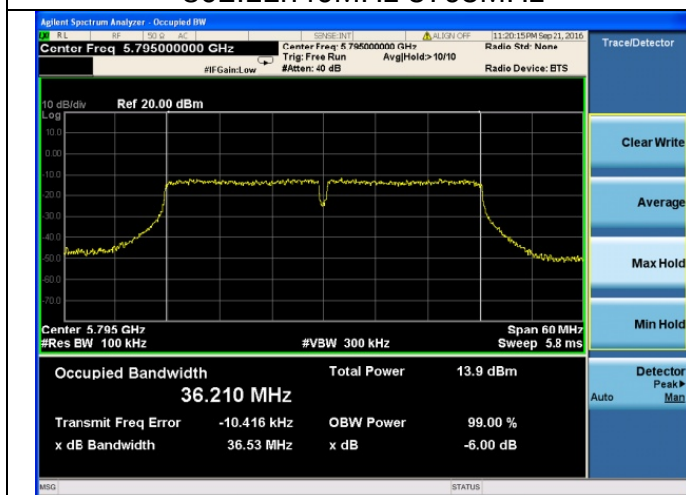
802.11n40MHz 5755MHz



802.11ac 80MHz 5775MHz



802.11n40MHz 5795MHz





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

	Frequency (MHz)	Average Output Power(dBm)	Duty factor (dB)	Total Output Power(dBm)	FCC Limit (dBm)	FCC Limit (mW)	Result
802.11a	5180	14.32	0.06	14.38	23.98	250	Pass
	5220	14.28	0.06	14.34	23.98	250	Pass
	5240	14.25	0.06	14.31	23.98	250	Pass
	5745	13.35	0.06	13.41	30.00	1000	Pass
	5785	13.36	0.06	13.42	30.00	1000	Pass
	5825	13.29	0.06	13.35	30.00	1000	Pass
802.11n (HT20)	5180	14.24	0.07	14.31	23.98	250	Pass
	5220	14.26	0.07	14.33	23.98	250	Pass
	5240	14.15	0.07	14.22	23.98	250	Pass
	5745	13.21	0.07	13.28	30.00	1000	Pass
	5785	13.18	0.07	13.25	30.00	1000	Pass
	5825	13.22	0.07	13.29	30.00	1000	Pass
802.11n (HT40)	5190	14.26	0.14	14.40	23.98	250	Pass
	5230	14.19	0.14	14.33	23.98	250	Pass
	5755	13.22	0.14	13.36	30.00	1000	Pass
	5795	13.16	0.14	13.30	30.00	1000	Pass
802.11ac (HT80)	5210	14.26	0.28	14.54	23.98	250	Pass
	5775	13.27	0.28	13.55	30.00	1000	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 $10 \log(1/\text{duty cycle})$.

8.3. Test data

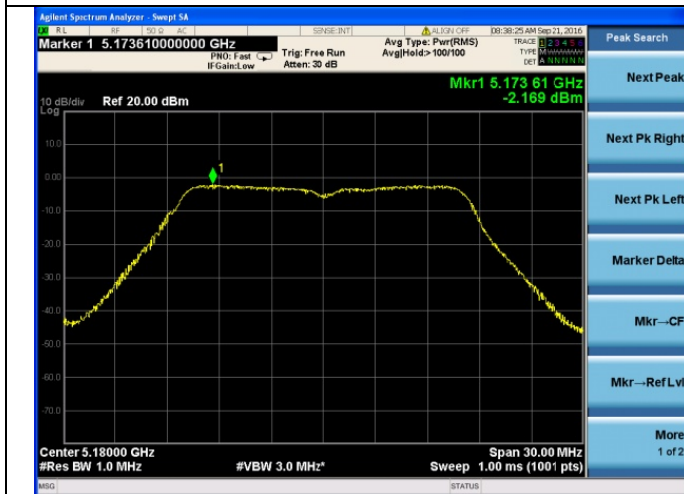
Test data as below

	Frequency (MHz)	Reading Level (dBm)	Duty factor (dB)	Duty factor 10 log (1MHz/ RBW)	PPSD (dBm)	FCC Limit (dBm)	Result
802.11a	5180	-2.169	0.06	0.0	-2.11	11.00	Pass
	5220	-2.040	0.06	0.0	-1.98	11.00	Pass
	5240	-1.896	0.06	0.0	-1.84	11.00	Pass
	5745	-4.663	0.06	2.92	-1.68	30.00	Pass
	5785	-3.954	0.06	2.92	-0.97	30.00	Pass
	5825	-3.930	0.06	2.92	-0.95	30.00	Pass
802.11n (HT20)	5180	-2.296	0.07	0.0	-2.23	11.00	Pass
	5220	-2.159	0.07	0.0	-2.09	11.00	Pass
	5240	-2.370	0.07	0.0	-2.30	11.00	Pass
	5745	-4.452	0.07	2.92	-1.46	30.00	Pass
	5785	-4.875	0.07	2.92	-1.89	30.00	Pass
	5825	-4.016	0.07	2.92	-1.03	30.00	Pass
802.11n (HT40)	5190	-5.470	0.14	0.0	-5.33	11.00	Pass
	5230	-5.904	0.14	0.0	-5.76	11.00	Pass
	5755	-5.615	0.14	2.92	-2.56	30.00	Pass
	5795	-5.409	0.14	2.92	-2.35	30.00	Pass
802.11ac (HT80)	5210	-5.981	0.28	0.0	-5.70	11.00	Pass
	5775	-6.156	0.28	2.92	-2.96	30.00	Pass

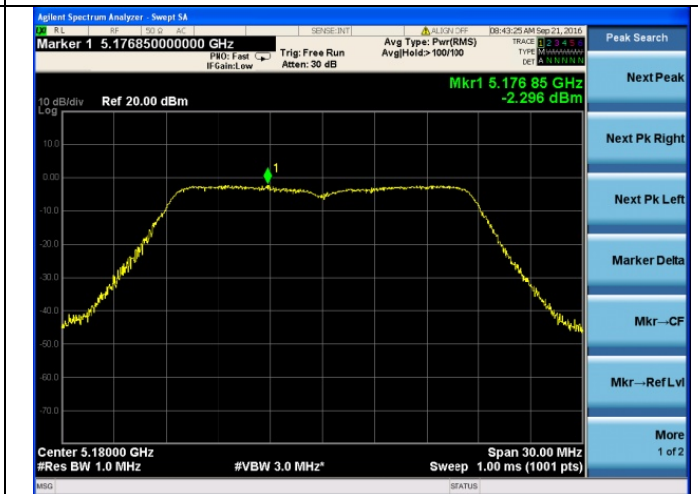


Band 1

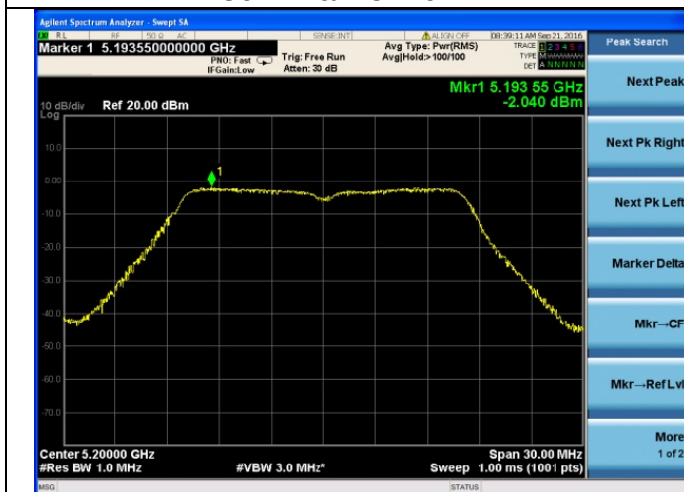
802.11a 5180MHz



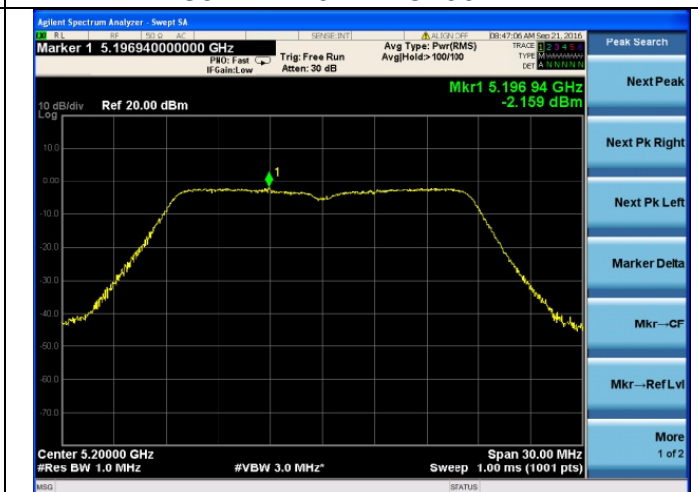
802.11n20MHz 5180MHz



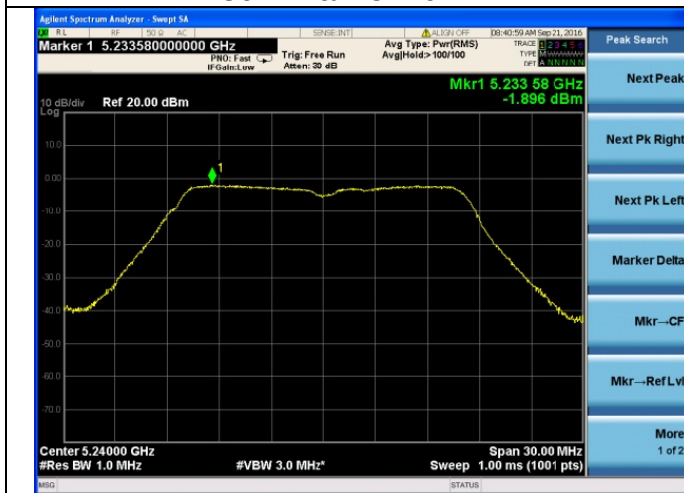
802.11a 5220MHz



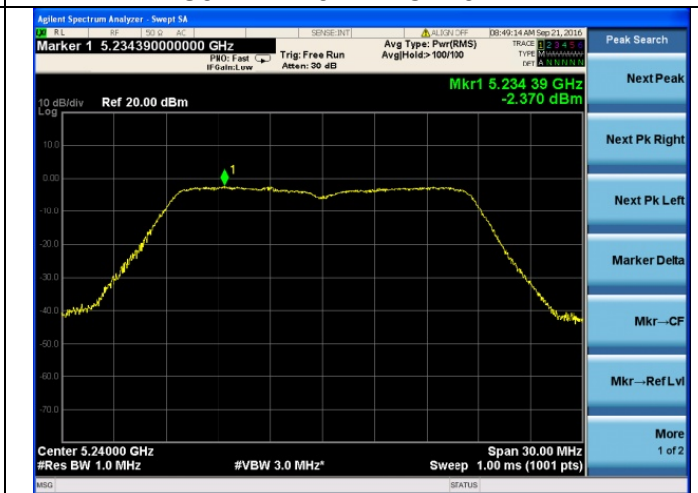
802.11n20MHz 5200MHz



802.11a 5240MHz



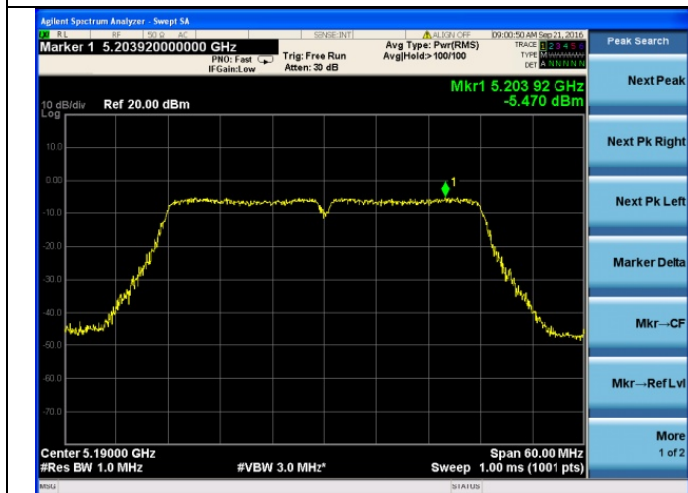
802.11n20MHz 5240MHz





Band 1

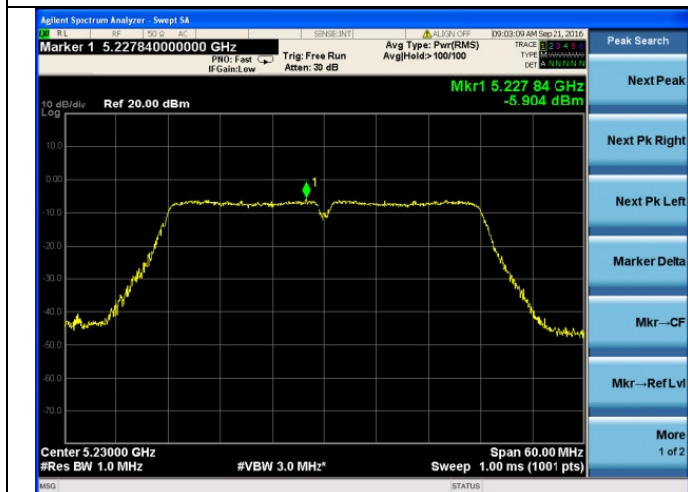
802.11n40MHz 5190MHz



802.11ac 80MHz 5210MHz



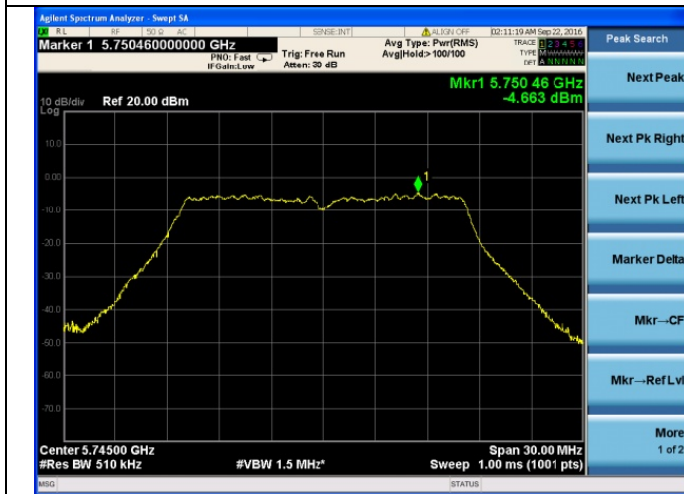
802.11n40MHz 5230MHz



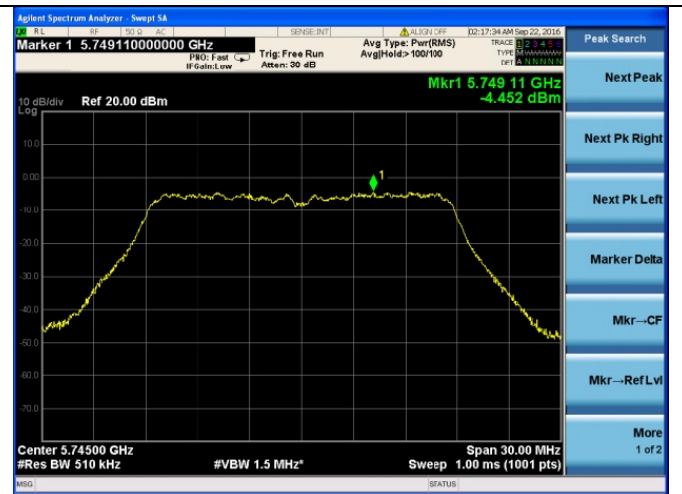


Band 4

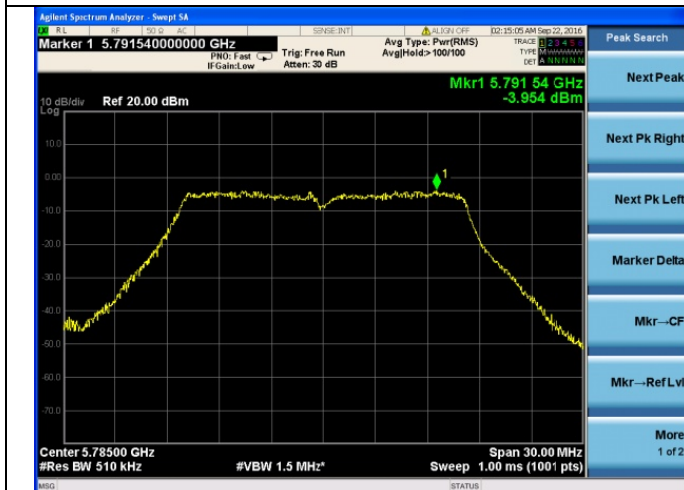
802.11a 5745MHz



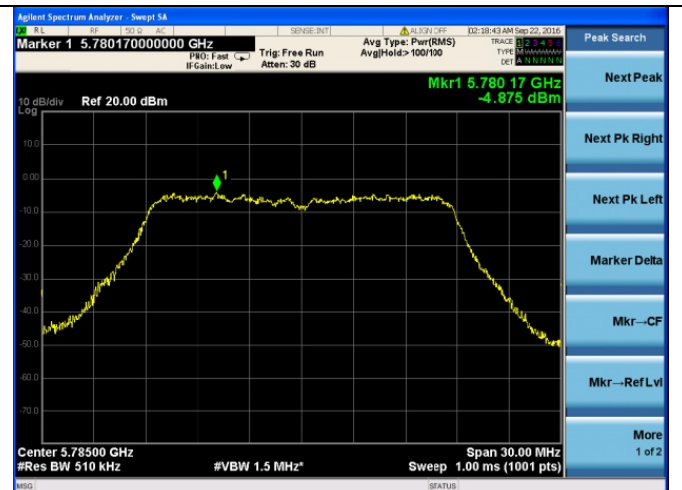
802.11n20MHz 5745MHz



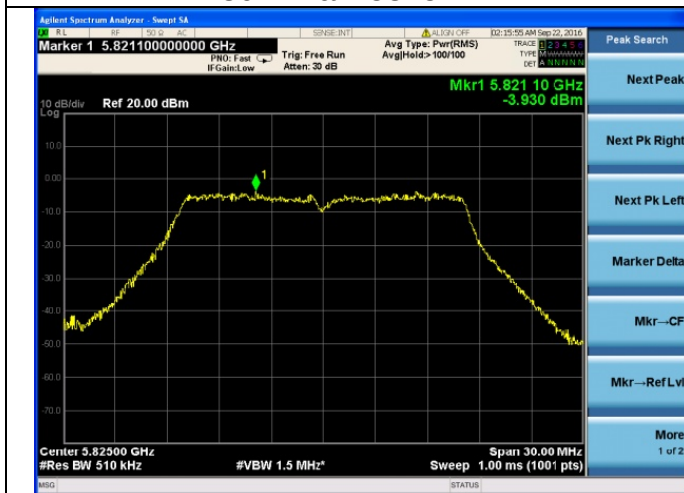
802.11a 5785MHz



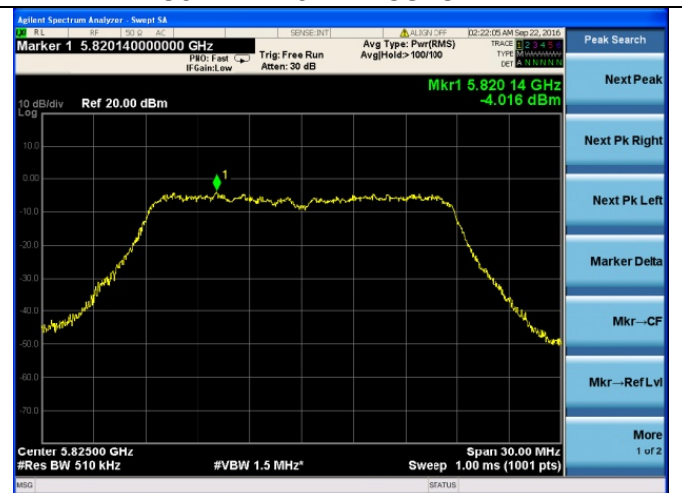
802.11n20MHz 5785MHz



802.11a 5825MHz



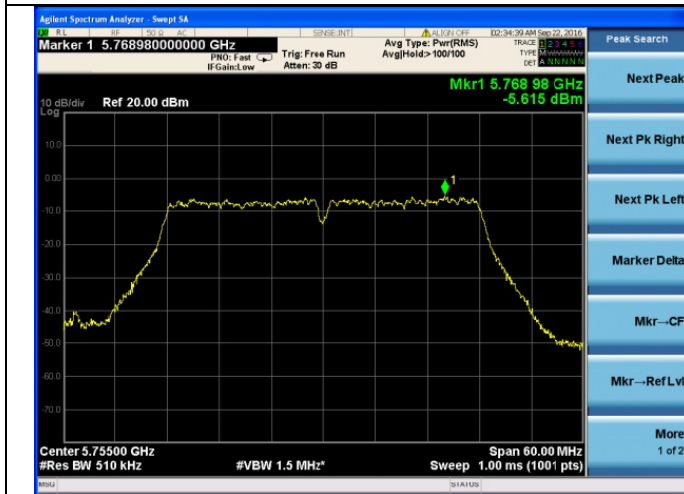
802.11n20MHz 5825MHz





Band 4

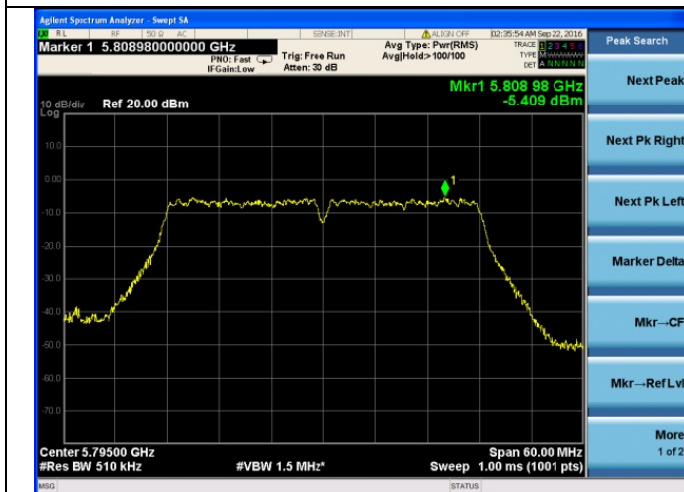
802.11n40MHz 5755MHz



802.11ac 80MHz 5775MHz



802.11n40MHz 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/ Duty cycle)
802.11a	98.60%	0.06
802.11n(HT20)	98.50%	0.07
802.11n(HT40)	96.90%	0.14
802.11ac(HT80)	93.80%	0.28



802.11n(HT40)



802.11ac(HT80)





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

	Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)	Δ Frequency (MHz)
802.11a	5.75V	-20℃	5180.000	5180.0339	-0.0339
			5220.000	5220.0258	-0.0258
			5240.000	5240.0159	-0.0159
			5745.000	5745.0244	-0.0244
			5785.000	5785.0263	-0.0263
			5825.000	5825.0242	-0.0242
	4.25V		5180.000	5180.0160	-0.0160
			5220.000	5220.0230	-0.0230
			5240.000	5240.0187	-0.0187
			5745.000	5745.0196	-0.0196
			5785.000	5785.0248	-0.0248
			5825.000	5825.0318	-0.0318
	5.00V	25℃	5180.000	5180.0429	-0.0429
			5220.000	5220.0161	-0.0161
			5240.000	5240.0272	-0.0272
			5745.000	5745.0249	-0.0249
			5785.000	5785.0329	-0.0329
			5825.000	5825.0194	-0.0194
	5.75V	50℃	5180.000	5180.0259	-0.0259
			5220.000	5220.0176	-0.0176
			5240.000	5240.0229	-0.0229
			5745.000	5745.0516	-0.0516
			5785.000	5785.0319	-0.0319
			5825.000	5825.0511	-0.0511
	4.25V		5180.000	5180.0248	-0.0248
			5220.000	5220.0187	-0.0187
			5240.000	5240.0272	-0.0272
			5745.000	5745.0386	-0.0386
			5785.000	5785.0195	-0.0195
			5825.000	5825.0641	-0.0641



	Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
802.11n(H T20)	5.75V	-20℃	5180.000	5180.0382	-0.0382
			5220.000	5220.0300	-0.0300
			5240.000	5240.0201	-0.0201
			5745.000	5745.0290	-0.0290
			5785.000	5785.0310	-0.0310
			5825.000	5825.0289	-0.0289
	4.25V		5180.000	5180.0202	-0.0202
			5220.000	5220.0271	-0.0271
			5240.000	5240.0229	-0.0229
			5745.000	5745.0242	-0.0242
			5785.000	5785.0295	-0.0295
			5825.000	5825.0365	-0.0365
	5.00V	25℃	5180.000	5180.0471	-0.0471
			5220.000	5220.0202	-0.0202
			5240.000	5240.0314	-0.0314
			5745.000	5745.0295	-0.0295
			5785.000	5785.0376	-0.0376
			5825.000	5825.0241	-0.0241
	5.75V	50℃	5180.000	5180.0301	-0.0301
			5220.000	5220.0217	-0.0217
			5240.000	5240.0271	-0.0271
			5745.000	5745.0562	-0.0562
			5785.000	5785.0366	-0.0366
			5825.000	5825.0558	-0.0558
	4.25V		5180.000	5180.0290	-0.0290
			5220.000	5220.0228	-0.0228
			5240.000	5240.0314	-0.0314
			5745.000	5745.0432	-0.0432
			5785.000	5785.0242	-0.0242
			5825.000	5825.0688	-0.0688



	Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
802.11n(H T40)	5.75V	-20℃	5190.000	5190.0351	-0.0351
			5230.000	5230.0170	-0.0170
			5755.000	5755.0255	-0.0255
			5795.000	5795.0255	-0.0255
	4.25V		5190.000	5190.0171	-0.0171
			5230.000	5230.0198	-0.0198
			5755.000	5755.0207	-0.0207
			5795.000	5785.0331	9.9669
	5.00V	25℃	5190.000	5190.0440	-0.0440
			5230.000	5230.0283	-0.0283
			5755.000	5755.0260	-0.0260
			5795.000	5795.0207	-0.0207
	5.75V	50℃	5190.000	5190.0270	-0.0270
			5230.000	5230.0240	-0.0240
			5755.000	5755.0527	-0.0527
			5795.000	5795.0524	-0.0524
	4.25V		5190.000	5190.0259	-0.0259
			5230.000	5230.0283	-0.0283
			5755.000	5755.0397	-0.0397
			5795.000	5795.0654	-0.0654

	Test Voltage	Test Temp.	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
802.11ac(HT80)	5.75V	-20℃	5210.000	5210.0350	-0.0350
			5775.000	5775.0255	-0.0255
	4.25V		5210.000	5210.0170	-0.0170
			5775.000	5775.0207	-0.0207
	5.00V	25℃	5210.000	5210.0439	-0.0439
			5775.000	5775.0260	-0.0260
	5.75V	50℃	5210.000	5210.0269	-0.0269
			5775.000	5775.0527	-0.0527
	4.25V		5210.000	5210.0258	-0.0258
			5775.000	5775.0397	-0.0397



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.

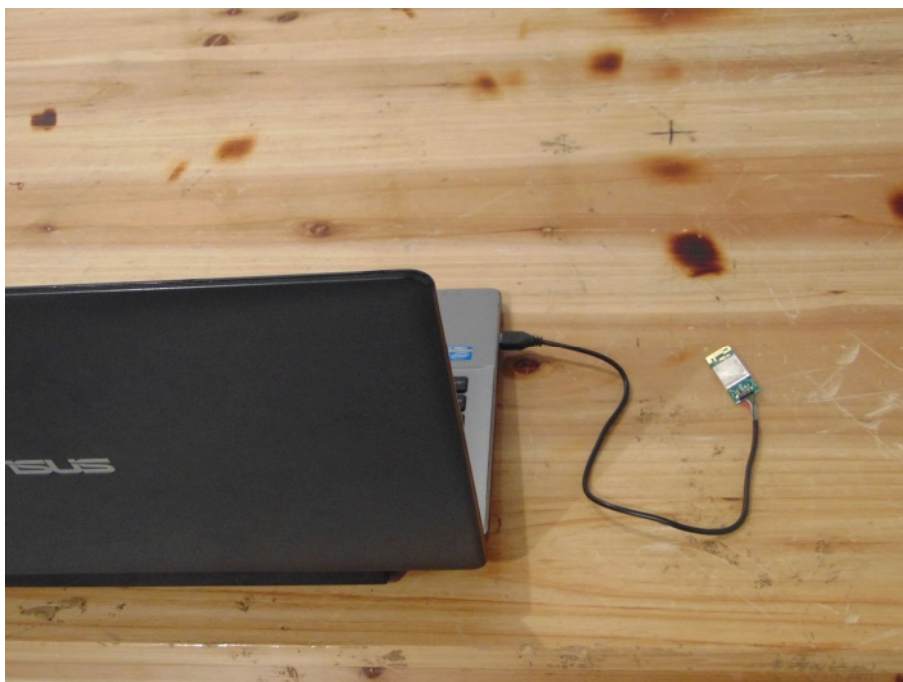
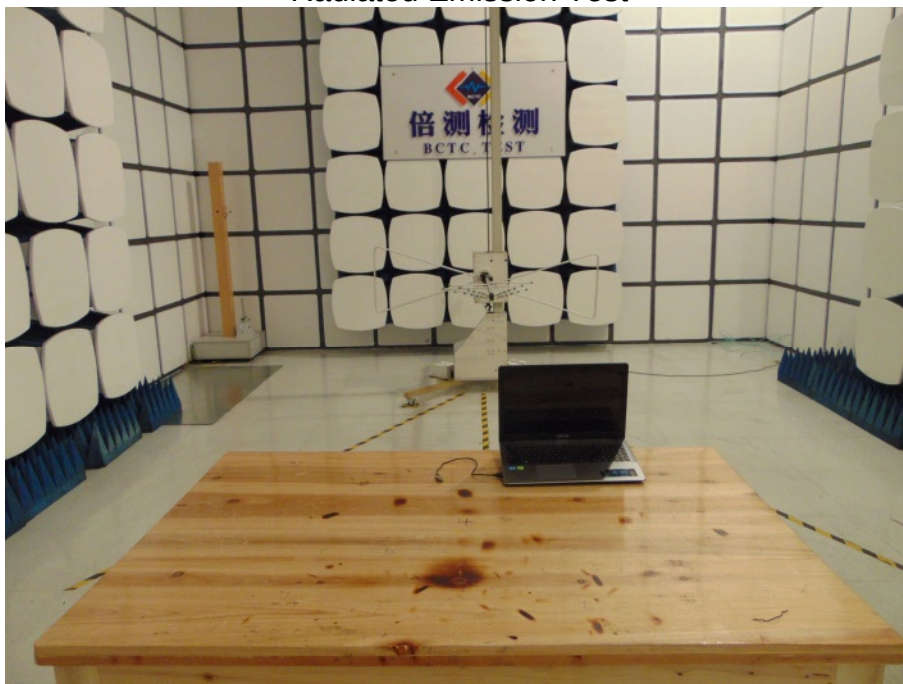
11.2. Test result

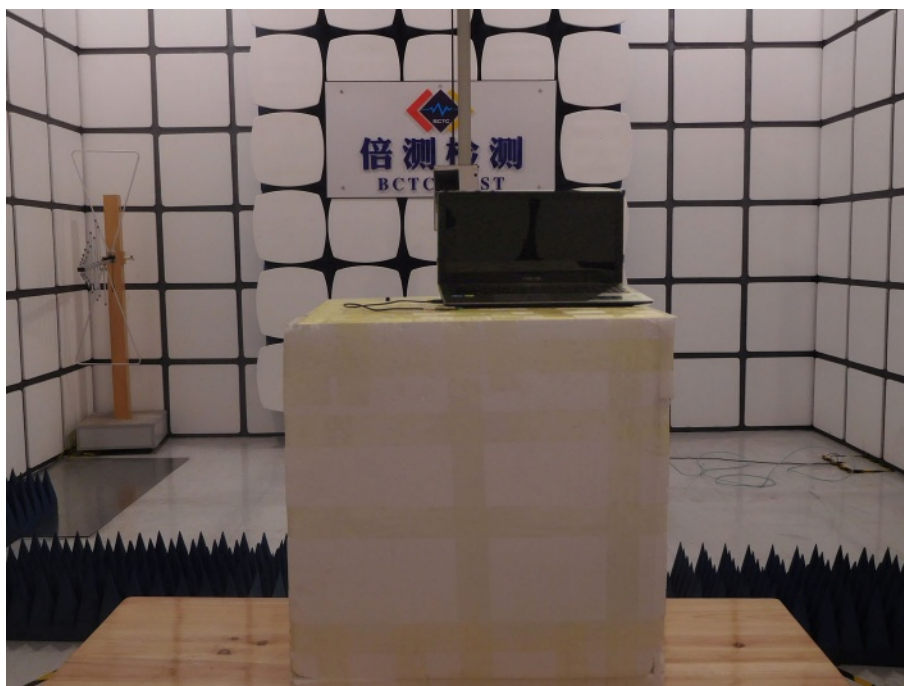
No non-compliance noted:

Refer to the theory of operation.

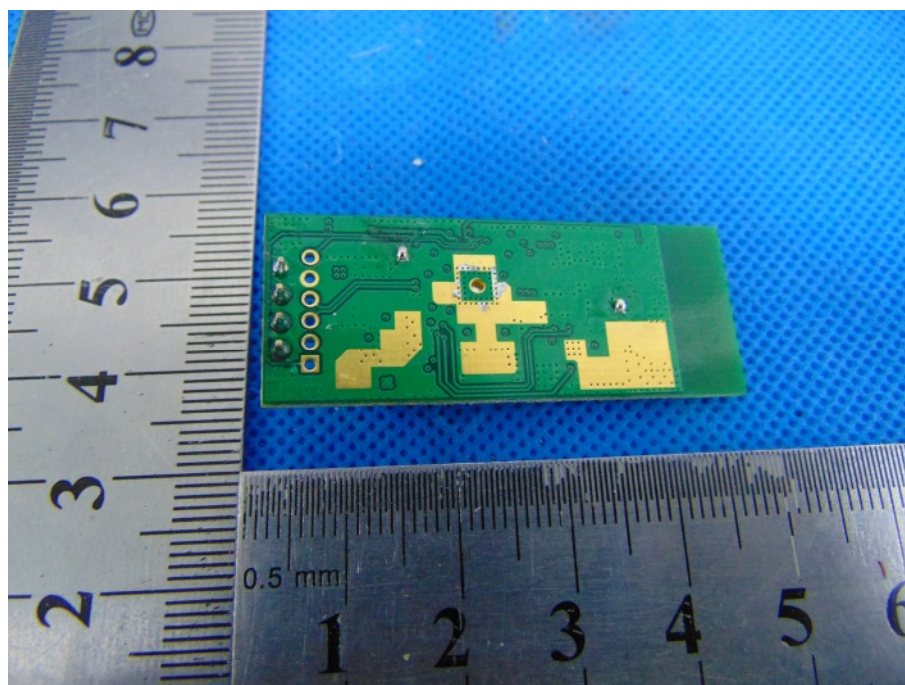
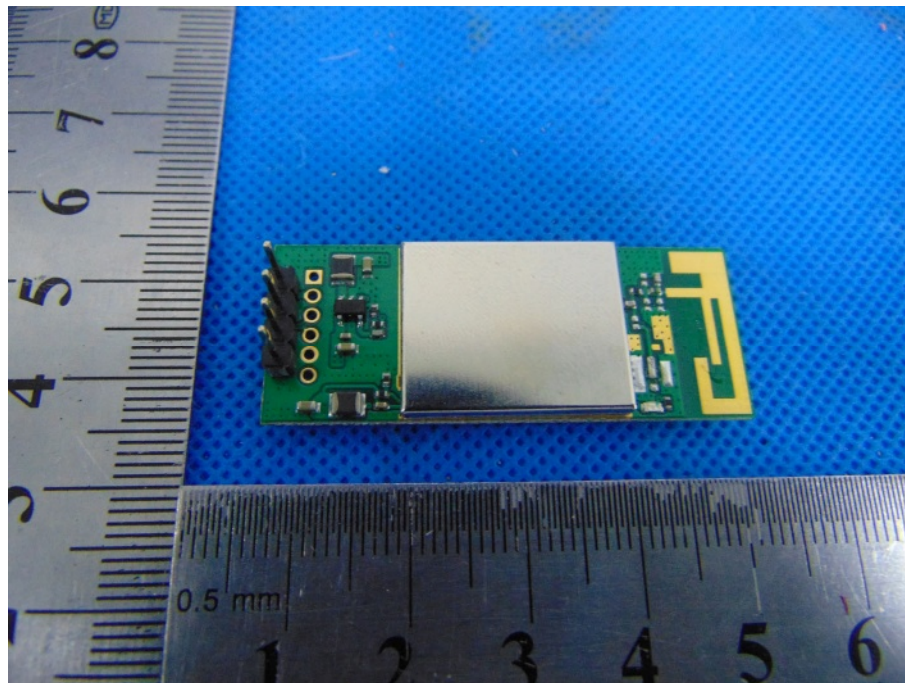
12. PHOTOGRAPHS OF TEST SET-UP

Radiated Emission Test





13. PHOTOGRAPHS OF THE EUT



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