5. 6DB & 99% EMISSION BANDWIDTH

5.1 APPLIED PROCEDURES / LIMIT

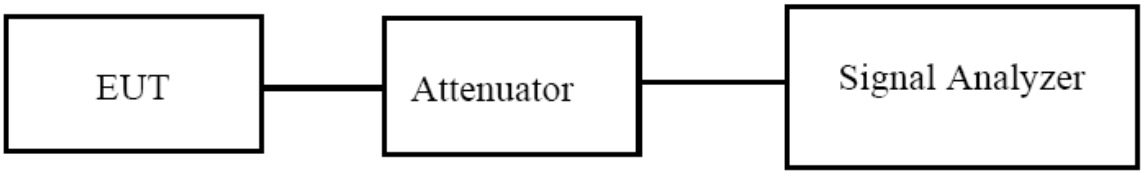
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

5.2 TEST PROCEDURE

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

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

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.



5.3 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.4 TEST RESULTS

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 12V
Test Mode ：	TX Frequency Band Ⅳ(5745-5825MHz)		

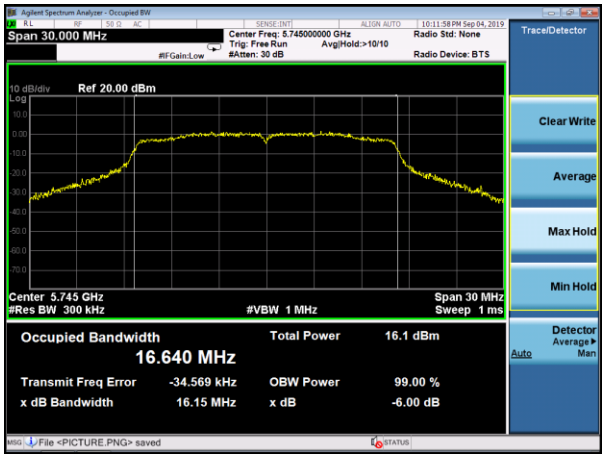
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A ,only shown Antenna A Plot.

Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	6dB bandwidth (MHz)	Limit MHz	Result
			ANT A	ANT A		
802.11a	CH149	5745	16.640	16.15	≥500	Pass
	CH157	5785	16.590	16.11	≥500	Pass
	CH165	5825	16.582	16.07	≥500	Pass
802.11 n20	CH149	5745	17.749	17.35	≥500	Pass
	CH157	5785	17.748	17.41	≥500	Pass
	CH165	5825	17.750	17.42	≥500	Pass
802.11 n40	CH151	5755	36.353	36.01	≥500	Pass
	CH159	5795	36.325	35.98	≥500	≥500
802.11 AC20	CH149	5745	17.784	17.47	≥500	≥500
	CH157	5785	17.745	17.37	≥500	≥500
	CH165	5825	17.735	17.37	≥500	≥500
802.11 AC40	CH151	5755	36.316	35.86	≥500	≥500
	CH159	5795	36.323	35.93	≥500	≥500
802.11 AC80	CH155	5775	75.628	75.89	≥500	≥500

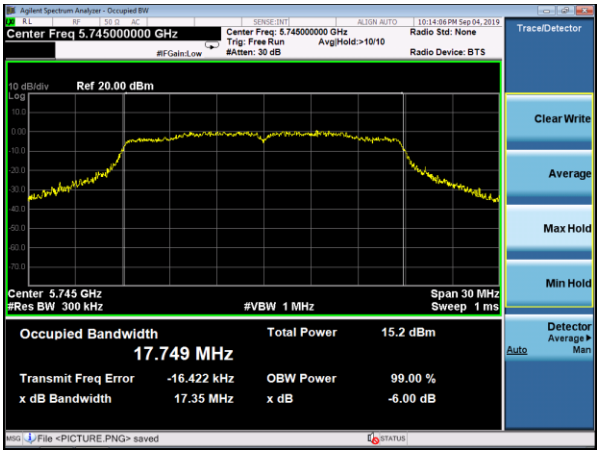
Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	6dB bandwidth (MHz)	Limit MHz	Result
			ANT B	ANT B		
802.11a	CH149	5745	16.594	16.01	≥500	Pass
	CH157	5785	16.512	15.88	≥500	Pass
	CH165	5825	16.503	16.13	≥500	Pass
802.11 n20	CH149	5745	17.738	17.44	≥500	Pass
	CH157	5785	17.689	17.32	≥500	Pass
	CH165	5825	17.749	17.30	≥500	Pass
802.11 n40	CH151	5755	36.310	35.99	≥500	Pass
	CH159	5795	36.310	35.92	≥500	≥500
802.11 AC20	CH149	5745	17.714	17.18	≥500	≥500
	CH157	5785	17.718	17.44	≥500	≥500
	CH165	5825	17.707	17.12	≥500	≥500
802.11 AC40	CH151	5755	36.280	36.02	≥500	≥500
	CH159	5795	36.302	36.00	≥500	≥500
802.11 AC80	CH155	5775	75.553	75.97	≥500	≥500

Test plot

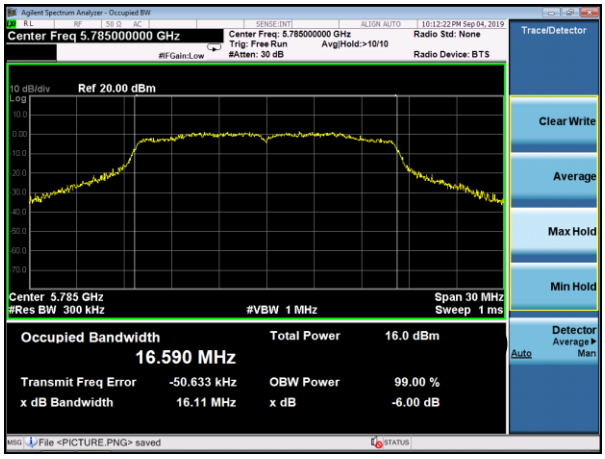
(802.11a) 6dB&99%Bandwidth plot on channel 149



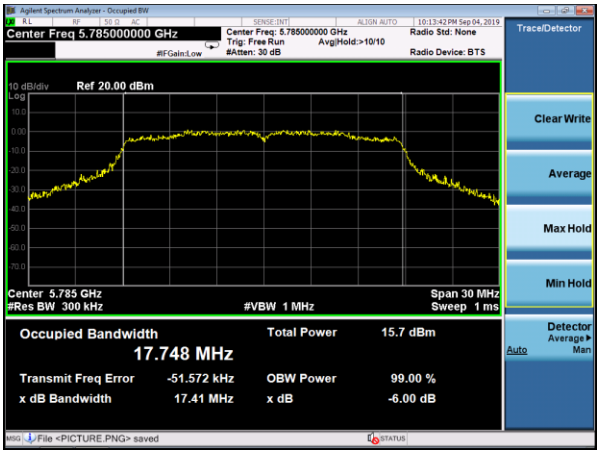
(802.11 n20) 6dB&99%Bandwidth plot on channel 149



(802.11a) 6dB&99%Bandwidth plot on channel 157

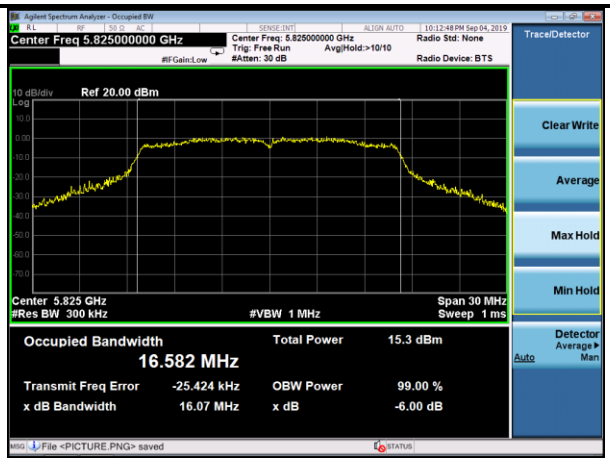


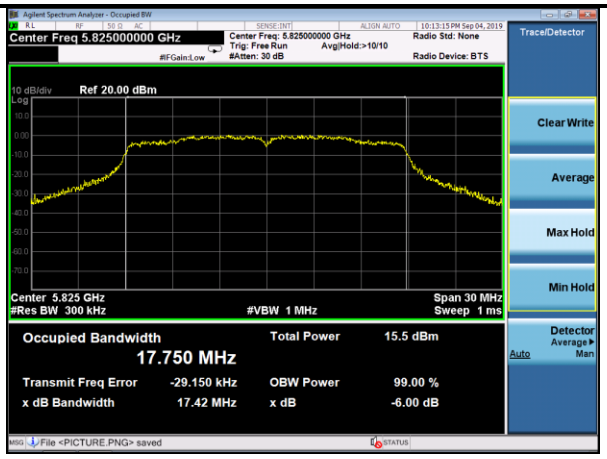
(802.11 n20) 6dB&99%Bandwidth plot on channel 157



(802.11a) 6dB&99%Bandwidth plot on channel 165

(802.11 n20) 6dB&99%Bandwidth plot on channel 165

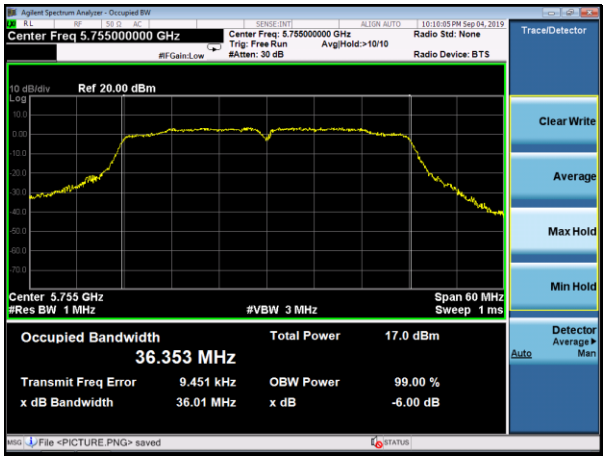


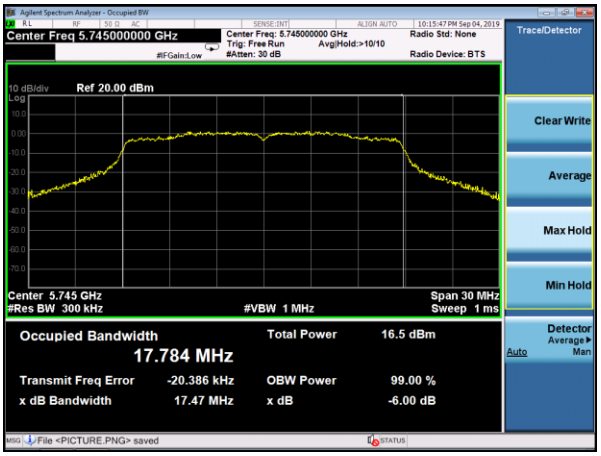


Test plot

(802.11 n40) 6dB&99%Bandwidth plot on channel 151

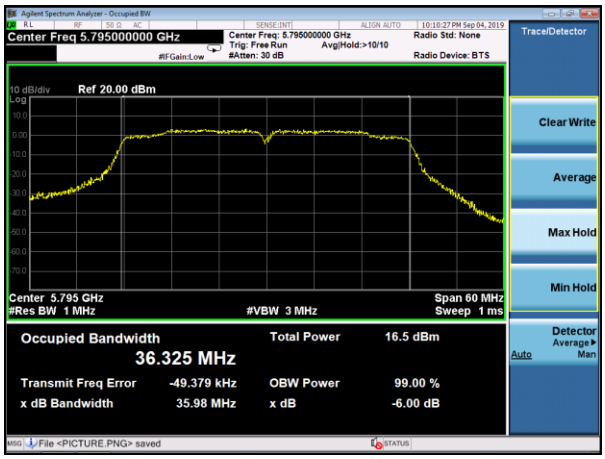
(802.11 AC20) 6dB&99%Bandwidth plot on channel 149

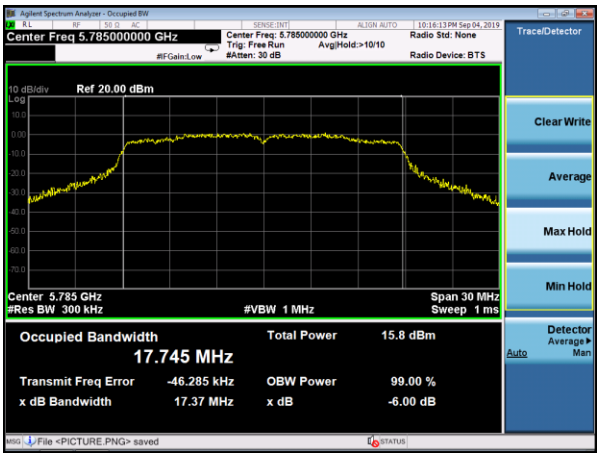




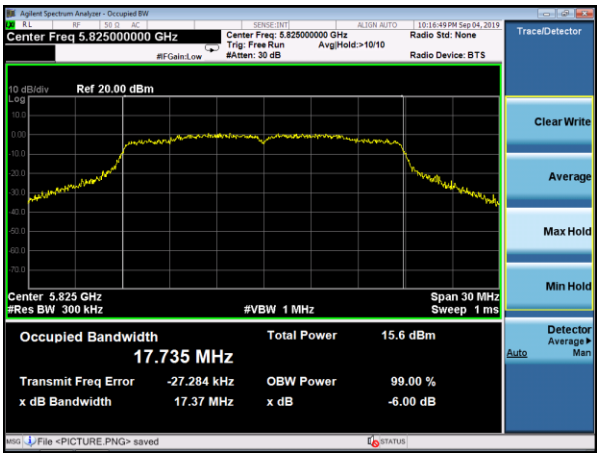
(802.11 n40) 6dB&99%Bandwidth plot on channel 159

(802.11 AC20) 6dB&99%Bandwidth plot on channel 157



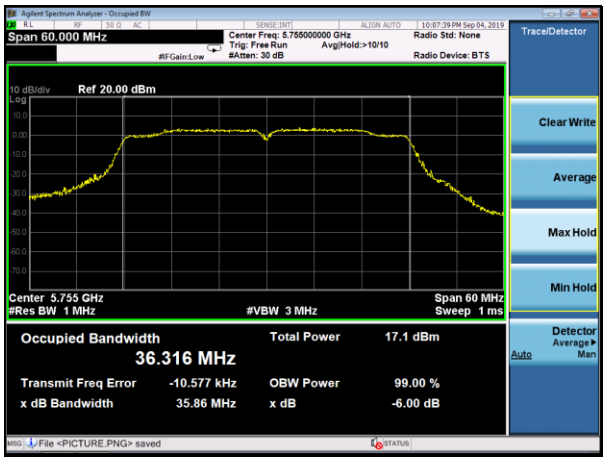


(802.11 AC20) 6dB&99%Bandwidth plot on channel 165

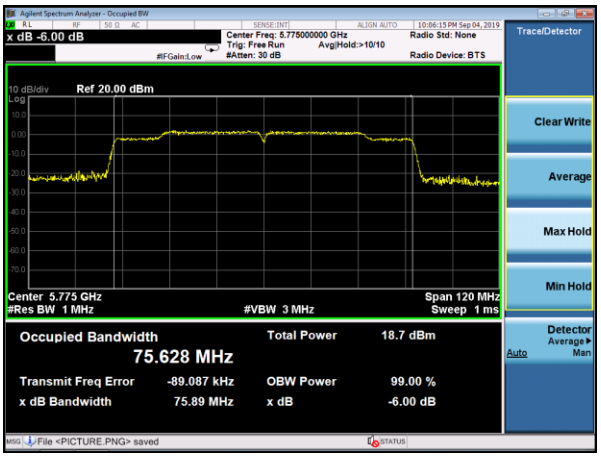


Test plot

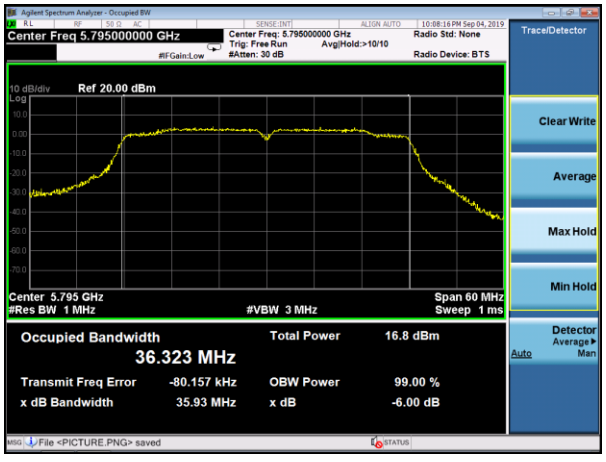
(802.11 AC40) 6dB&99%Bandwidth plot on channel 151



(802.11 AC80) 6dB&99%Bandwidth plot on channel 155



(802.11 AC40) 6dB&99%Bandwidth plot on channel 159



5.5 PPLIED PROCEDURES / LIMIT

According to FCC §15.407

The maximum conduced output power should not exceed:

Frequency Band(MHz)	Limit
5150~5250	250mW
5725~5850	1W

The maximum e.i.r.p should not exceed:

Frequency Band(MHz)	Limit
5150~5250	200mW or 10dBm +10logB whichever is less
5725~5850	N/A

Note: Where “B” is the 99% emission bandwidth in MHz

5.6 TEST PROCEDURE

· Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF power meter.

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

a) The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)

Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.1 However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).

a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:

• The EUT transmits continuously (or with a duty cycle ≥ 98 percent).

• Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.

(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.

(iii) Method SA-3 (RMS detection with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.

b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

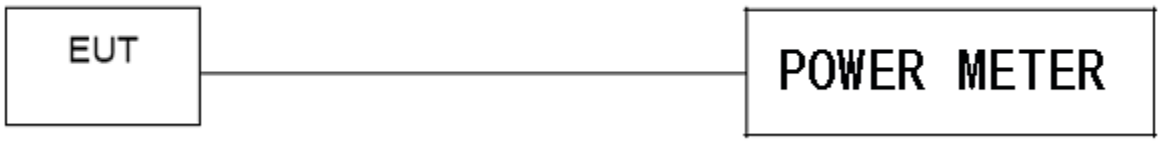
(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum

5.7 DEVIATION FROM STANDARD

No deviation.

5.8 TEST SETUP



5.9 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.10 TEST RESULTS

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 12V
Test Mode ：	TX (5G) Mode Frequency Band IV (5745-5825MHz)		

Antenna A gain: 1dBi, Antenna B gain: 1dBi, Directional gain=[10log(GA+ G B)] dbi =4.01dbi

Test Channel	Frequency	Maximum output power. Antenna port (AV)			LIMIT	Result
	(MHz)	ANT A(dBm)	ANT B(dBm)	Total output power	dBm	
TX 802.11a Mode						
CH 149	5745	13.638	12.622	/	30	Pass
CH 157	5785	13.272	12.886	/	30	Pass
CH 165	5825	13.476	13.027	/	30	Pass
TX 802.11 n20M Mode						
CH 149	5745	12.627	12.577	15.61	30	Pass
CH 157	5785	12.651	13.031	15.86	30	Pass
CH 165	5825	13.412	12.683	16.07	30	Pass
TX 802.11 n40M Mode						
CH 151	5755	12.532	11.589	15.10	30	Pass
CH 159	5795	12.037	11.435	14.76	30	Pass
TX 802.11 AC20M Mode						
CH 149	5745	13.810	13.790	16.81	30	Pass
CH 157	5785	13.139	13.686	16.43	30	Pass
CH 165	5825	13.377	12.932	16.17	30	Pass
TX 802.11 AC40M Mode						
CH 151	5755	12.362	11.727	15.07	30	Pass
CH 159	5795	12.455	11.864	15.18	30	Pass
TX 802.11 AC80M Mode						
CH 155	5775	11.515	10.940	14.25	30	Pass

6. OUT OF BAND EMISSIONS

6.1 APPLICABLE STANDARD

According to FCC §15.407(b)

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

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

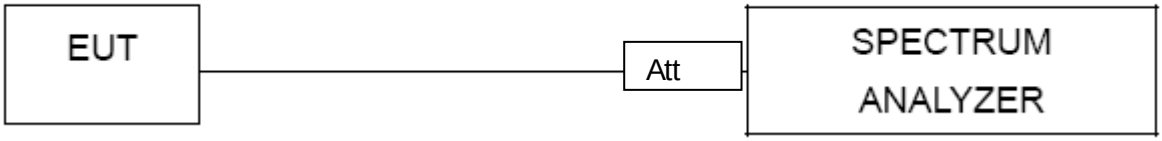
6.2 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

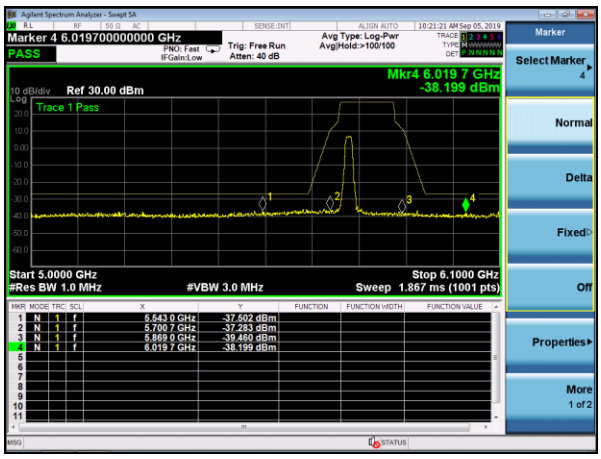
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 12V

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A ,only shown Antenna A Plot.

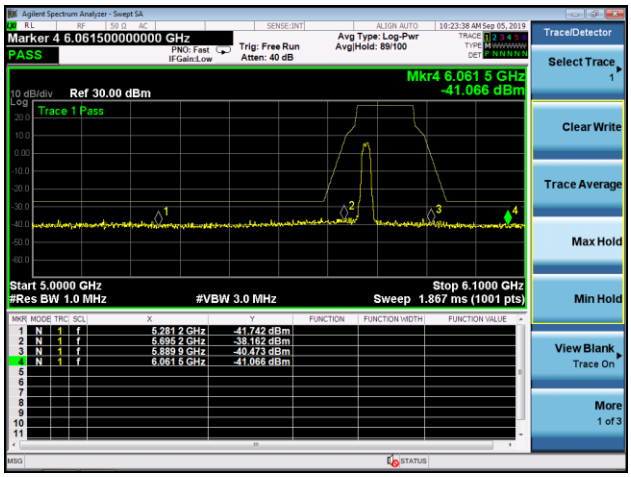
5.8G

5.75~5.85 GHz

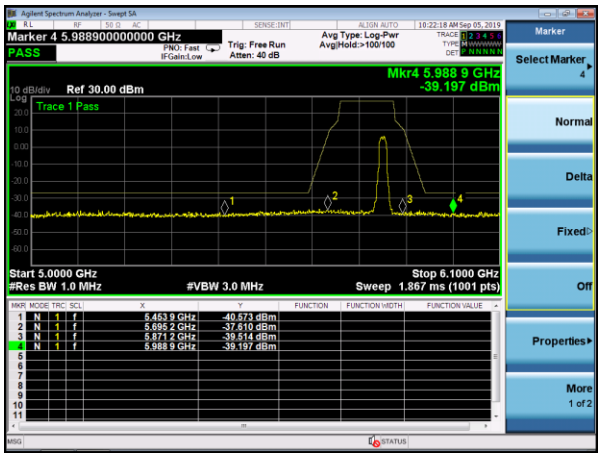
(802.11a) Band Edge, Left Side



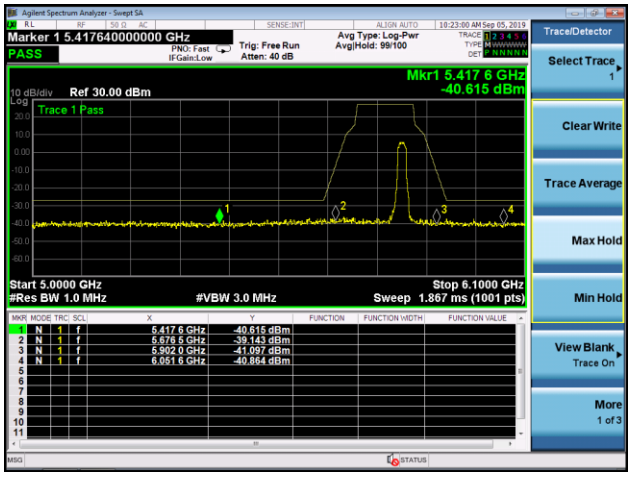
(802.11n20) Band Edge, Left Side



(802.11a) Band Edge, Right Side

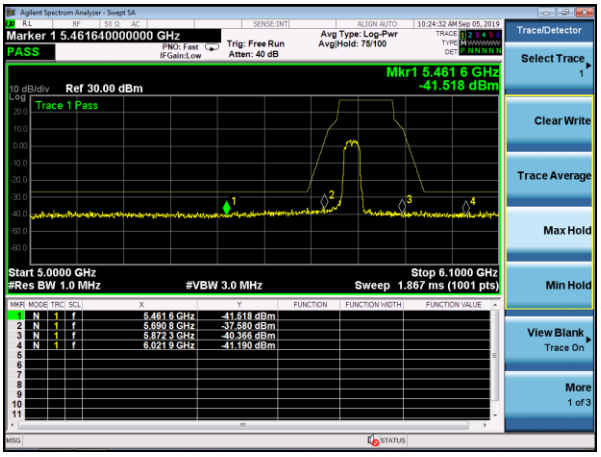


(802.11n20) Band Edge, Right Side

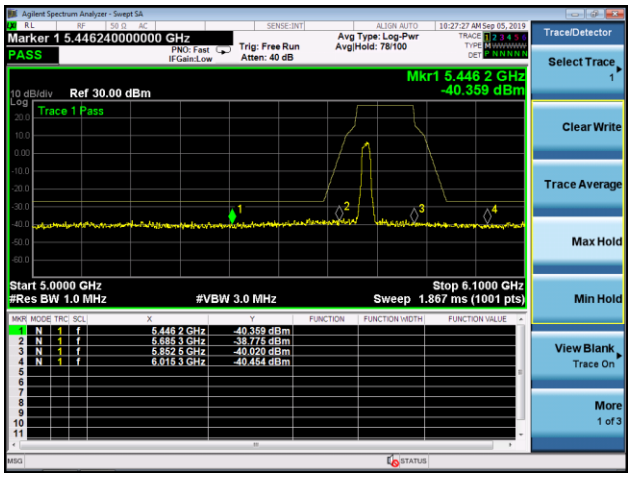


5.75~5.85 GHz

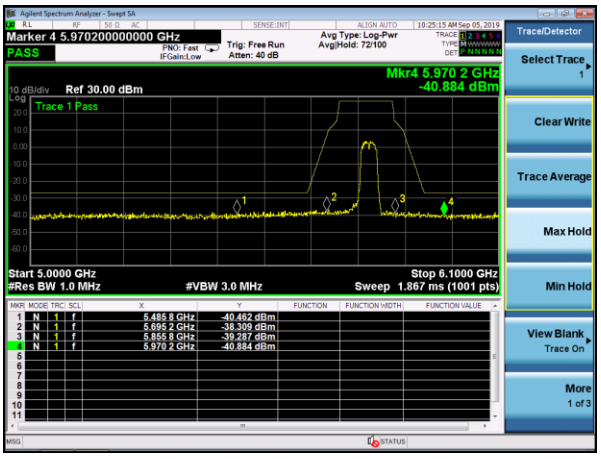
(802.11n40) Band Edge, Left Side



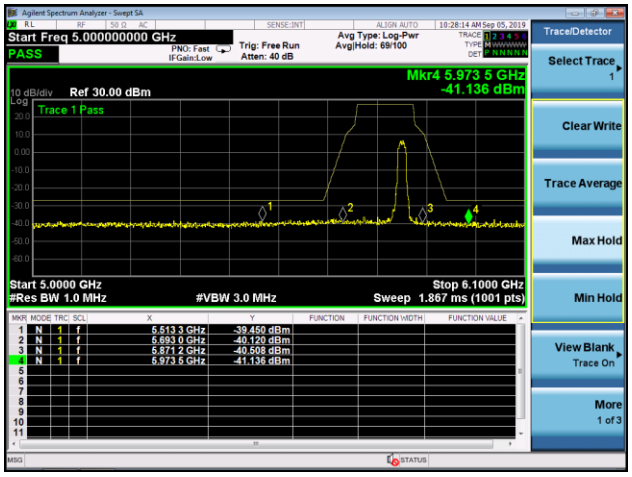
(802.11ac20) Band Edge, Left Side



(802.11n40) Band Edge, Right Side

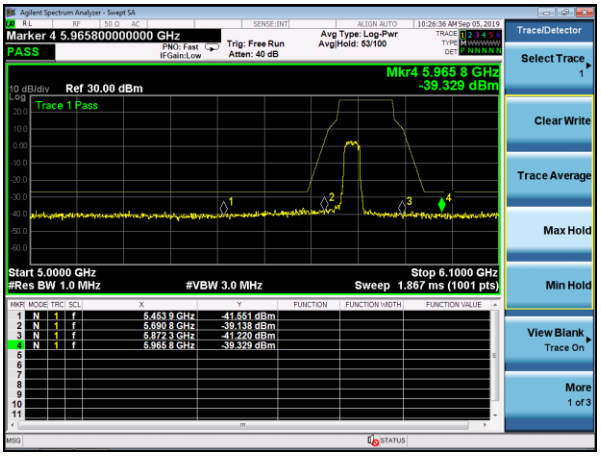


(802.11ac20) Band Edge, Right Side

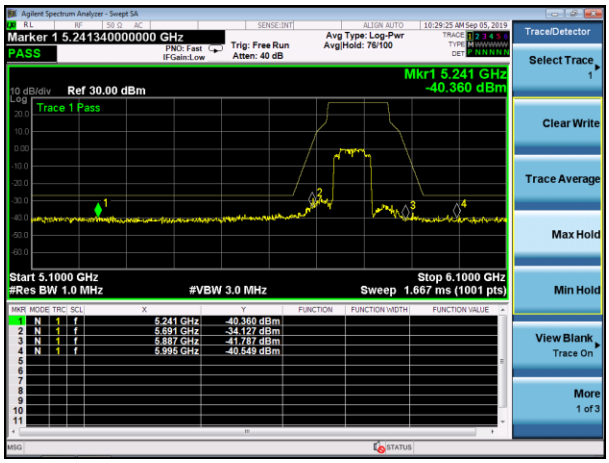


5.75~5.83 GHz

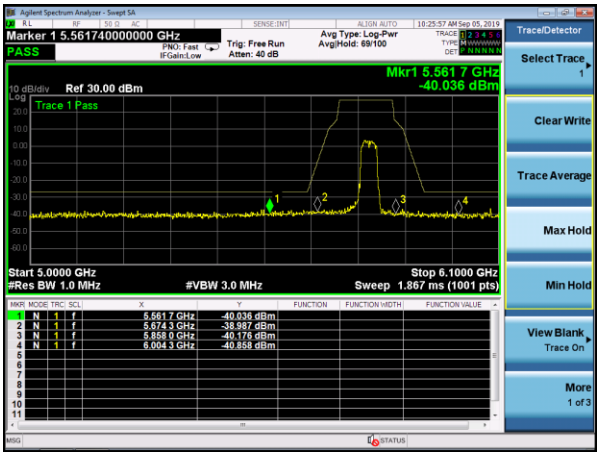
(802.11ac40) Band Edge, Left Side



(802.11ac80) Band Edge



(802.11ac40) Band Edge, Right Side



8.SPURIOUS RF CONDUCTED EMISSIONS

8.1CONFORMANCE LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

8.2MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

8.3TEST SETUP

Please refer to Section 6.1 of this test report.

8.4TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBW= 300KHz to measure the peak field strength , and mwasure frequeny range from 9KHz to 26.5GHz.

8.5TEST RESULTS

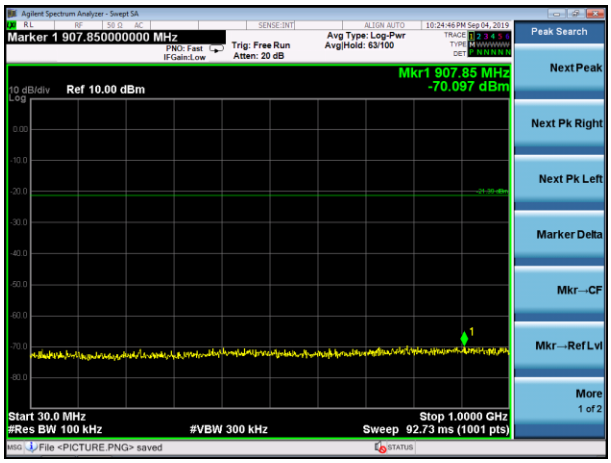
Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A ,only shown Antenna A Plot.

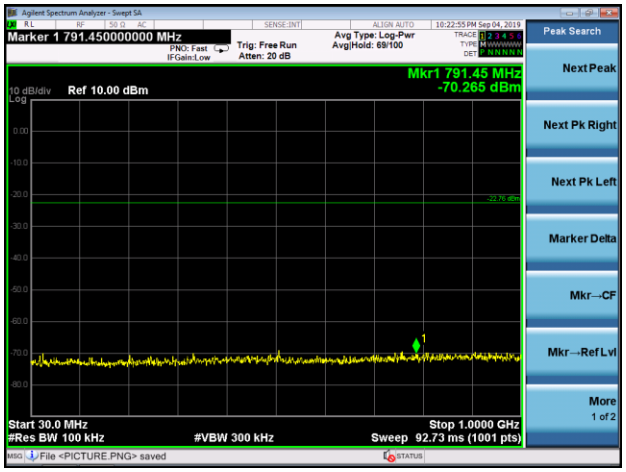
5.8G

Test Plot

802.11a on channel 149



802.11a on channel 157



802.11a on channel 149

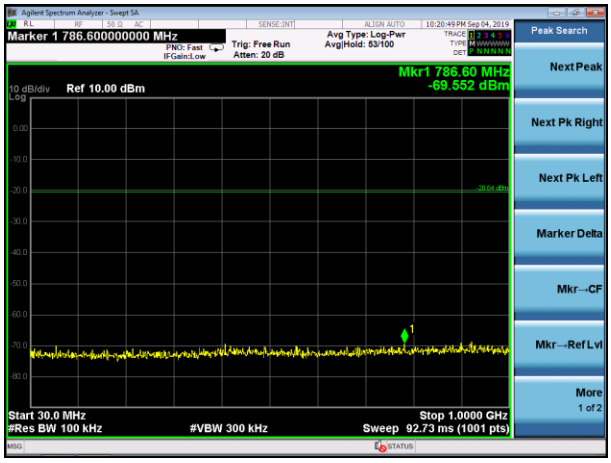
802.11a on channel 157

802.11a on channel 149

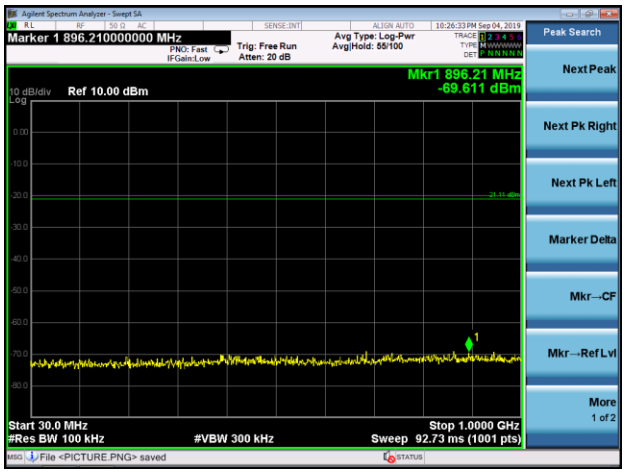
802.11a on channel 157

Test Plot

802.11a on channel 165



802.11n20 on channel 149



802.11a on channel 165

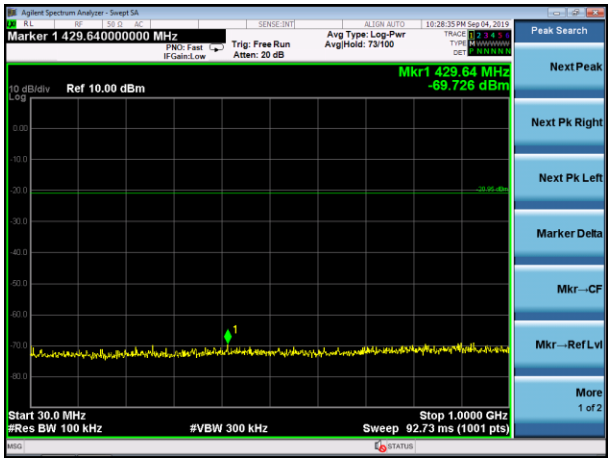
802.11n20 on channel 149

802.11a on channel 165

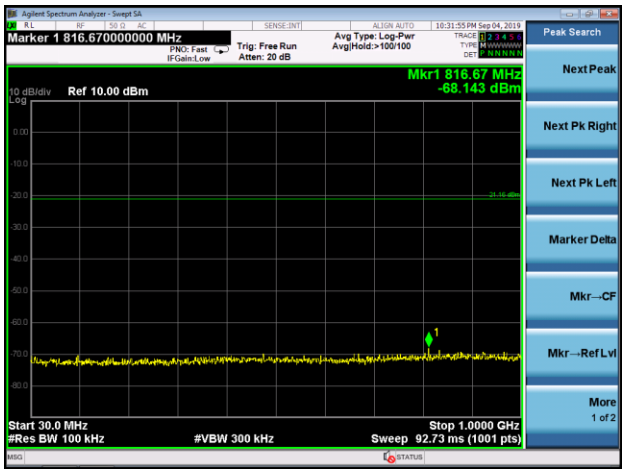
802.11n20 on channel 149

Test Plot

802.11n20 on channel 157



802.11n20 on channel 165



802.11n20 on channel 157

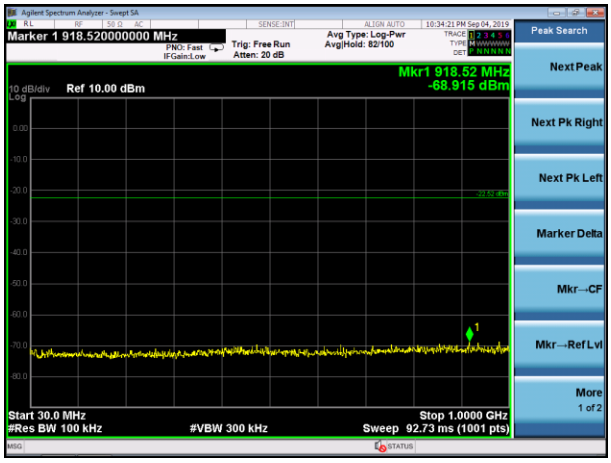
802.11n20 on channel 165

802.11n20 on channel 157

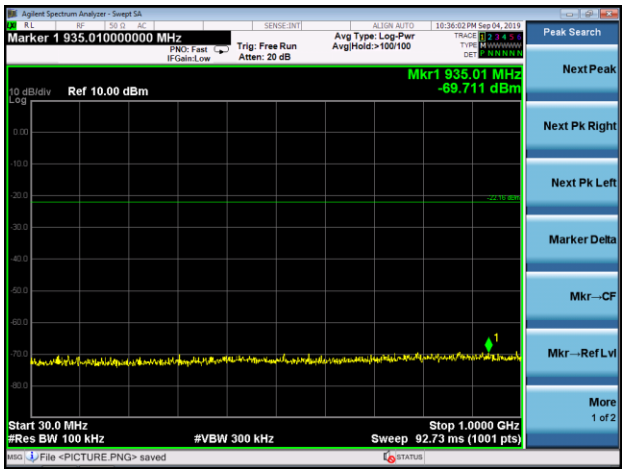
802.11n20 on channel 165

Test Plot

802.11n40 on channel 151



802.11n40 on channel 159



802.11n40 on channel 151

802.11n40 on channel 159

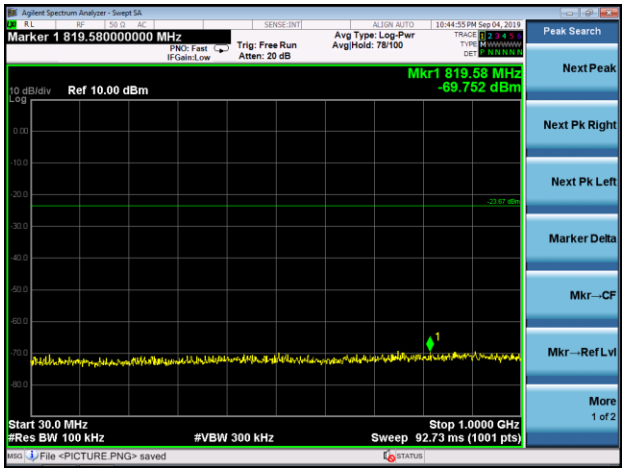
802.11n40 on channel 151

802.11n40 on channel 159

Test Plot

802.11ac20 on channel 165

802.11ac40 on channel 151



802.11ac20 on channel 165

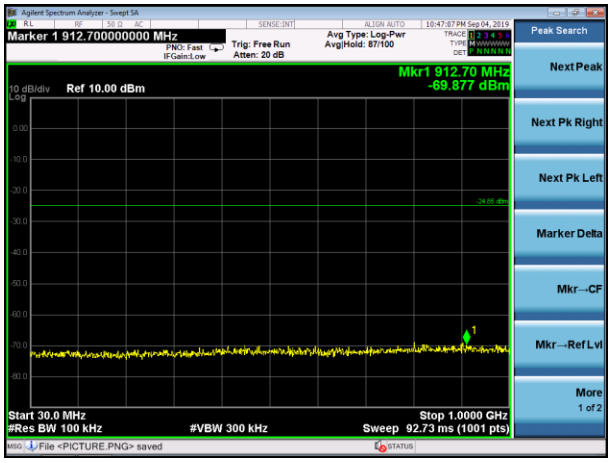
802.11ac40 on channel 151

802.11ac20 on channel 165

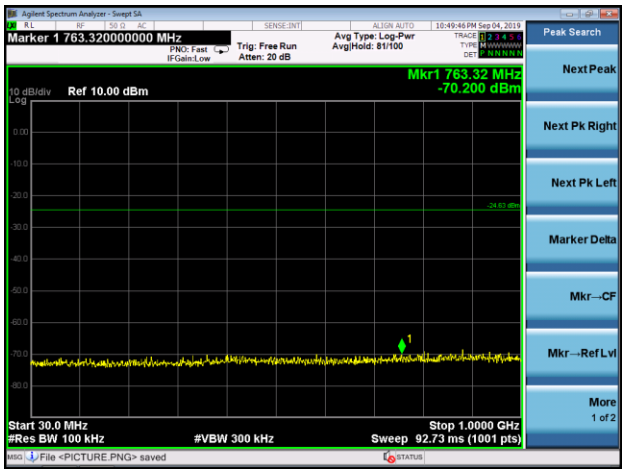
802.11ac40 on channel 151

Test Plot

802.11ac40 on channel 159

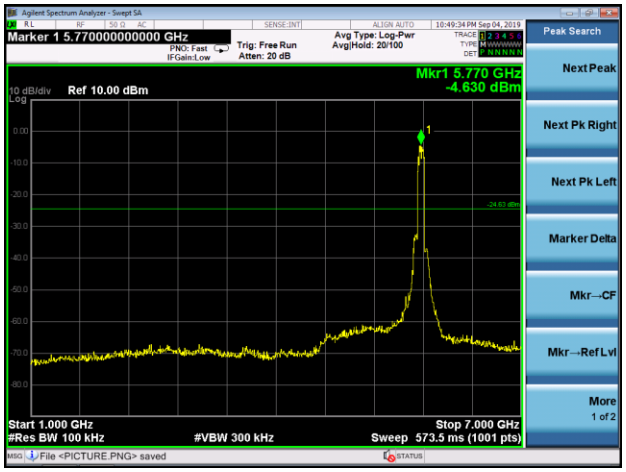


802.11ac80 on channel 155



802.11 ac40 on channel 159

802.11 ac80 on channel 155



802.11 ac40 on channel 159

802.11 ac80 on channel 155

9. Frequency Stability Measurement

9.1 LIMIT

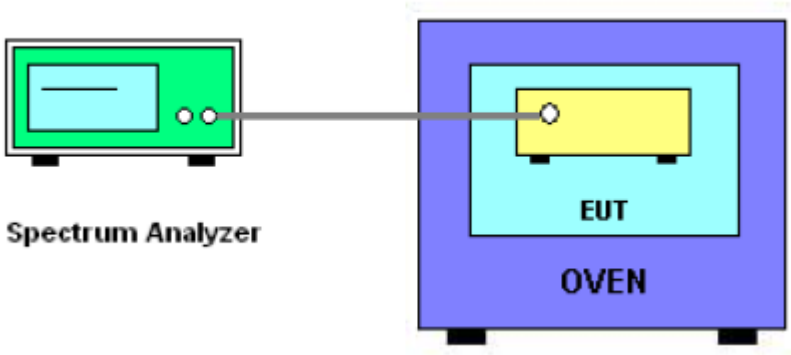
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

9.2 TEST PROCEDURES

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is $(fc-f)/fc \times 10^6$ ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -20°C~70°C.

9.3 TEST SETUP LAYOUT



9.4 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously un-modulation transmitting mode.

9.5 TEST RESULTS

Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Test Voltage ：	DC 12V
Test Mode ：	TX Frequency(5745-5850MHz)		

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5745.00396	5745	0.00396	-0.6898
		V max (V)	13.80	5745.00731	5745	0.00731	-1.2732
		V min (V)	10.20	5745.00521	5745	0.00521	-0.9075
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5745.01185	5745	0.01185	-2.0634
		T (°C)	-10	5745.00217	5745	0.00217	-0.3776
		T (°C)	0	5745.00459	5745	0.00459	-0.7984
		T (°C)	10	5745.01180	5745	0.01180	-2.0536
		T (°C)	20	5745.00908	5745	0.00908	-1.5812
		T (°C)	30	5745.01196	5745	0.01196	-2.0822
		T (°C)	40	5745.00869	5745	0.00869	-1.5118
		T (°C)	50	5745.00617	5745	0.00617	-1.0741
		T (°C)	60	5745.00265	5745	0.00265	-0.4610
		T (°C)	70	5745.00130	5745	0.00130	-0.2269
Limits				± 20 ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5785.00296	5785	0.00296	-0.5111
		V max (V)	13.80	5785.00656	5785	0.00656	-1.1335
		V min (V)	10.20	5785.00772	5785	0.00772	-1.3345
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5785.01002	5785	0.01002	-1.7316
		T (°C)	-10	5785.00717	5785	0.00717	-1.2395
		T (°C)	0	5785.00111	5785	0.00111	-0.1917
		T (°C)	10	5785.00759	5785	0.00759	-1.3121
		T (°C)	20	5785.00053	5785	0.00053	-0.0919
		T (°C)	30	5785.00208	5785	0.00208	-0.3591
		T (°C)	40	5785.01151	5785	0.01151	-1.9896
		T (°C)	50	5785.00978	5785	0.00978	-1.6903
		T (°C)	60	5785.00926	5785	0.00926	-1.6006
		T (°C)	70	5785.00051	5785	0.00051	-0.0883
Limits				± 20 ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5825.00482	5825	0.00482	-0.8275
		V max (V)	13.80	5825.01245	5825	0.01245	-2.1372
		V min (V)	10.20	5825.00536	5825	0.00536	-0.9204
Limits				± 20 ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5825.01202	5825	0.01202	-2.0633
		T (°C)	-10	5825.00740	5825	0.00740	-1.2711
		T (°C)	0	5825.00987	5825	0.00987	-1.6941
		T (°C)	10	5825.01219	5825	0.01219	-2.0925
		T (°C)	20	5825.00547	5825	0.00547	-0.9392
		T (°C)	30	5825.01170	5825	0.01170	-2.0078
		T (°C)	40	5825.00130	5825	0.00130	-0.2239
		T (°C)	50	5825.01045	5825	0.01045	-1.7933
		T (°C)	60	5825.00205	5825	0.00205	-0.3513
		T (°C)	70	5825.00499	5825	0.00499	-0.8564
Limits				± 20 ppm			
Result				Complies			

10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

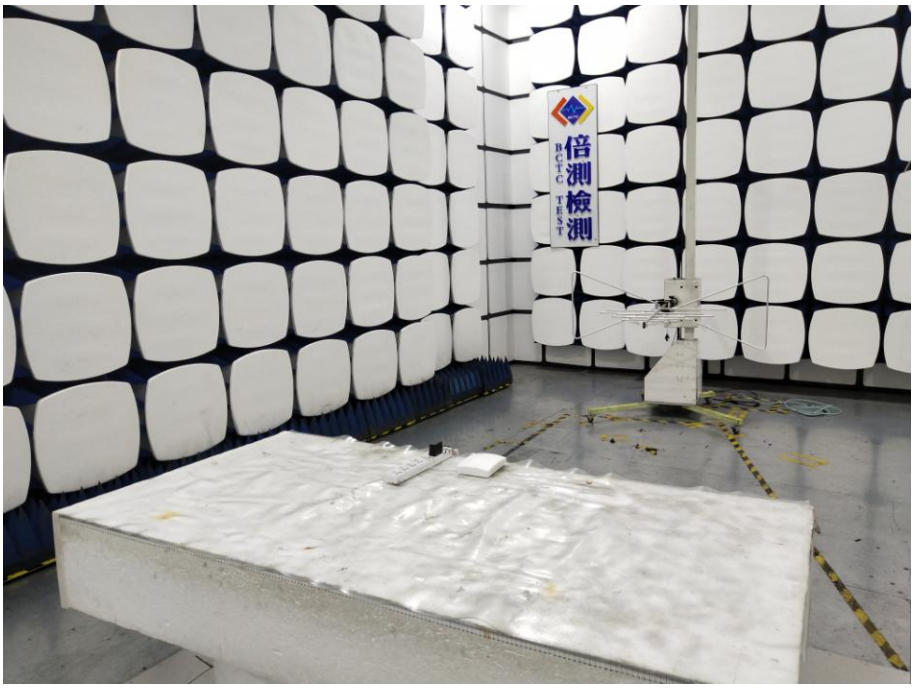
10.2 EUT ANTENNA

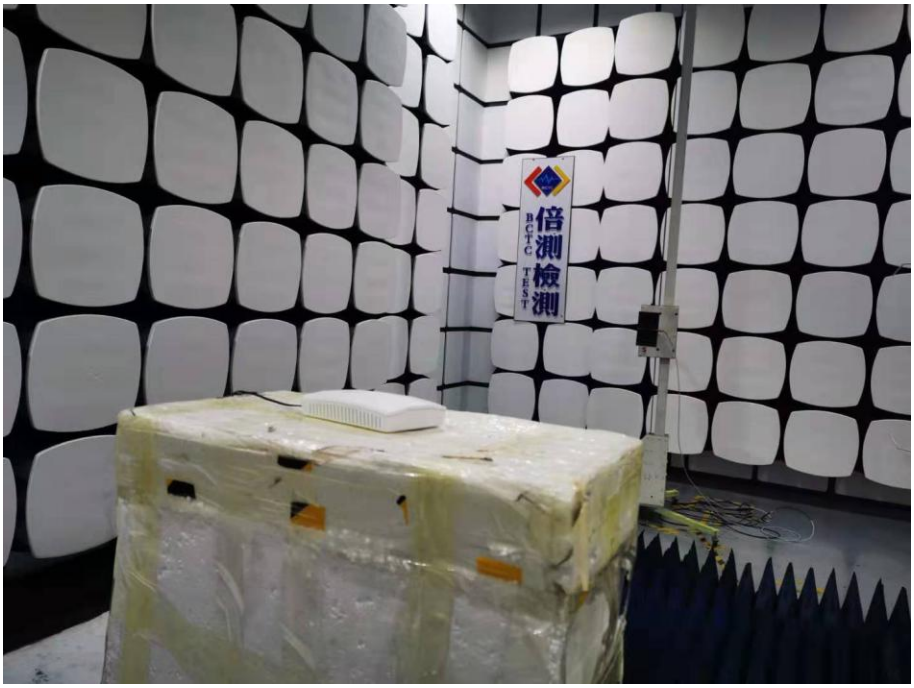
The EUT antenna is internal antenna(antenna gain: 4.01dBi). It comply with the standard requirement.

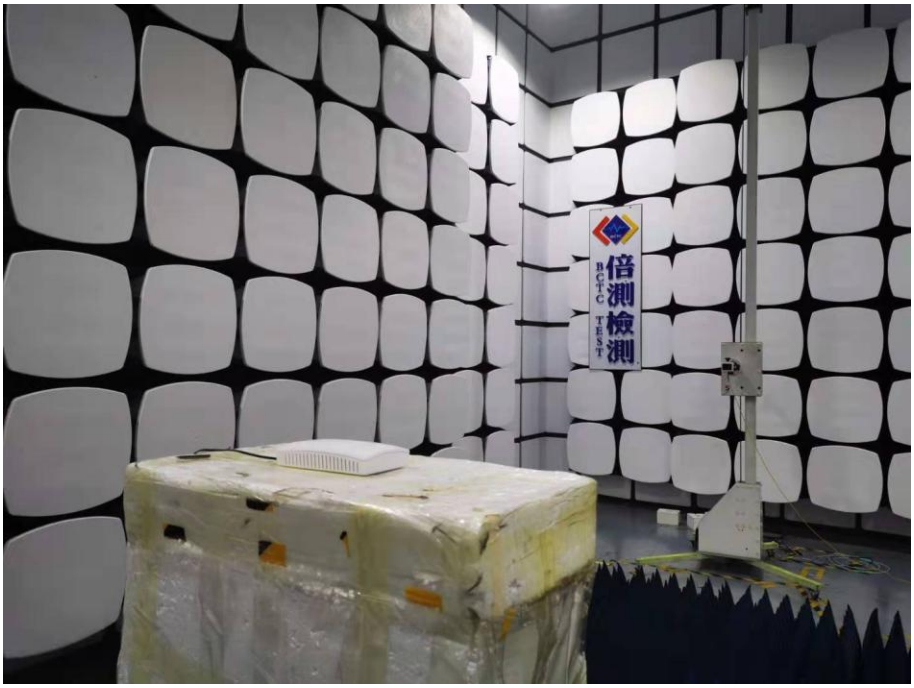
11. EUT TEST PHOTO

Conducted Measurement Photos

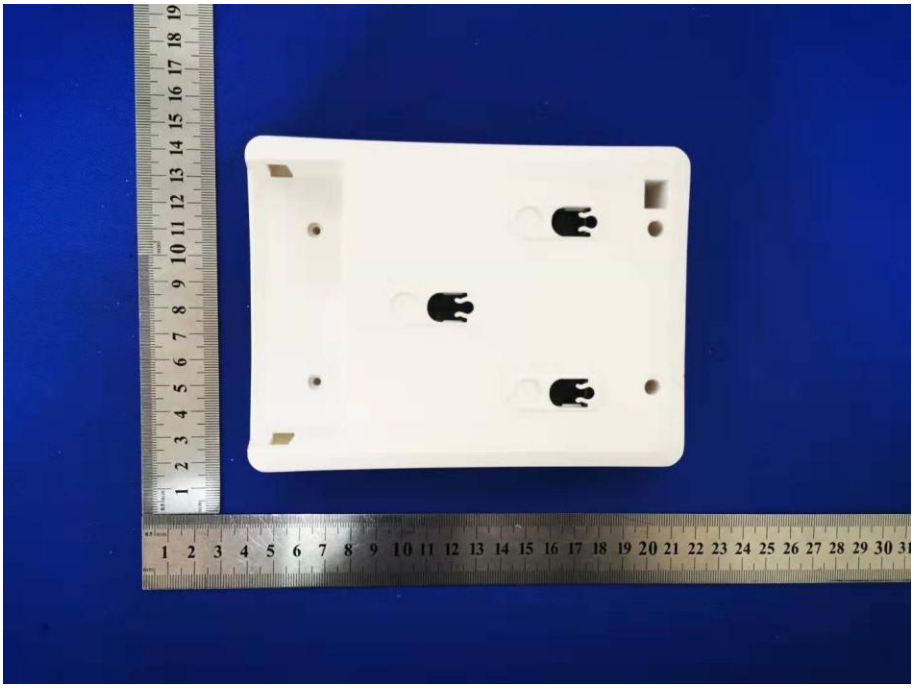
Radiated Measurement Photos




倍测检测
BCTC TEST


倍测检测
BCTC TEST

12. EUT PHOTO



※※※※※ **END OF REPORT** ※※※※※