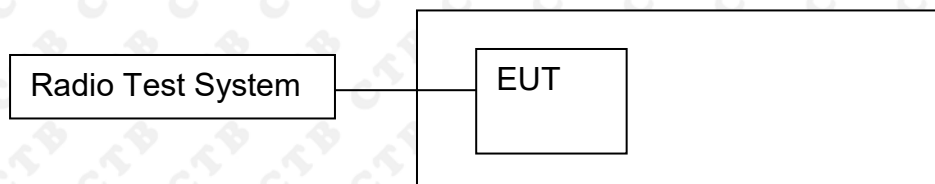


10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limits

(1) For the band 5.15-5.25 GHz.

(iv) 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. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

10.3 Test Procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

1. Emission Bandwidth (EBW)

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- 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%.

2. Minimum Emission Bandwidth for the band 5.725–5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725–5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- Set RBW = 100 kHz.

- b) Set the video bandwidth (VBW) $\geq 3 * \text{RBW}$.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described in this section. For devices that use channel aggregation refer to III.A and III.C for determining emission bandwidth.

D. 99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the 789033 D02 General UNII Test Procedures New Rules v02r01 Page 4 spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with Section 15.407(a).

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 $\geq 3 * \text{RBW}$
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.

10.4 Test Results

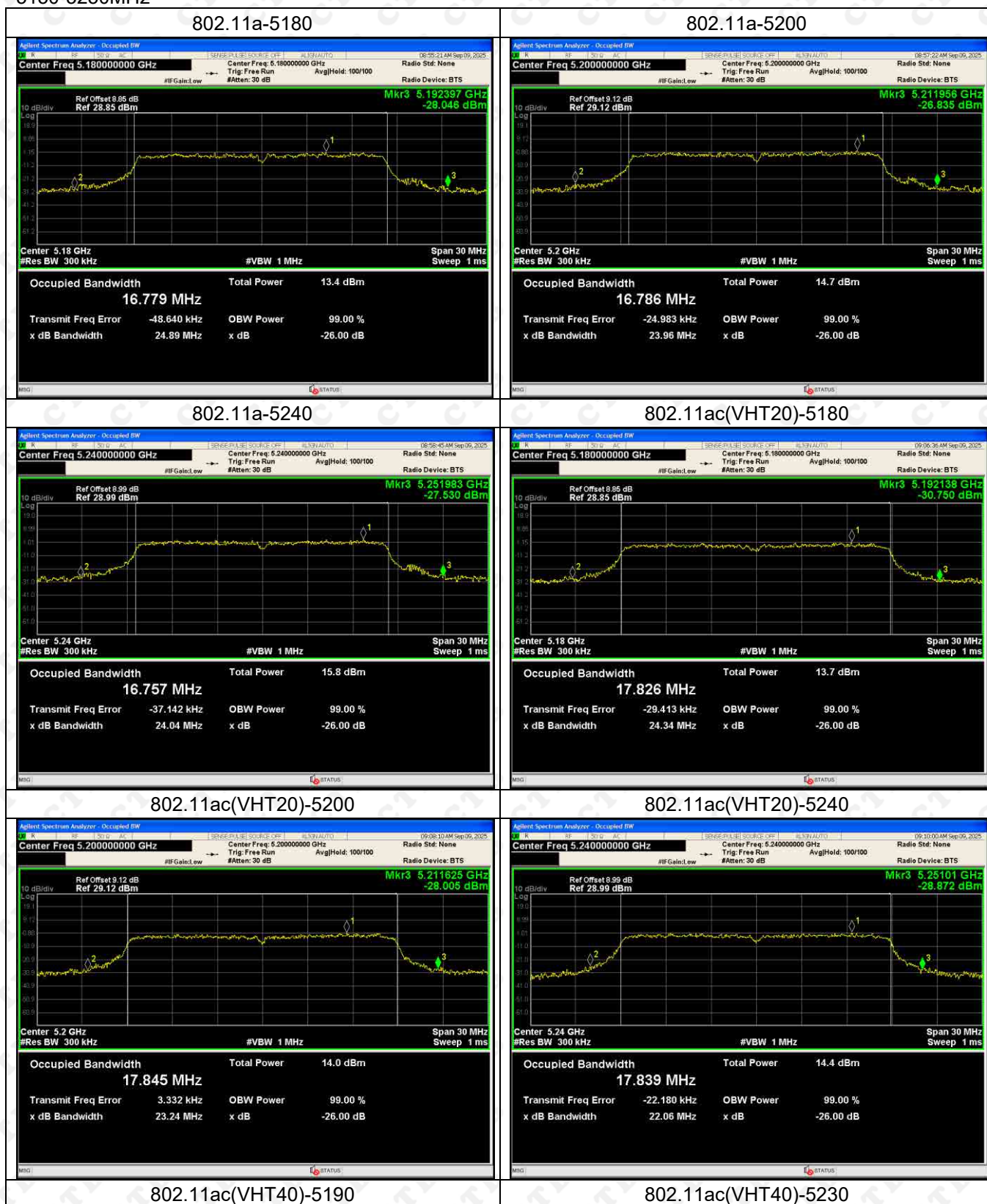
5150-5250MHz

Test mode Ant 1	Test Channel (MHz)	26dB Bandwidth (MHz)	Result
802.11a	5180	24.89	Pass
	5200	23.962	Pass
	5240	24.04	Pass
802.11ac(VHT20)	5180	24.336	Pass
	5200	23.243	Pass
	5240	22.065	Pass
802.11ac(VHT40)	5190	57.567	Pass
	5230	56.865	Pass
802.11ac(VHT80)	5210	81.85	Pass
802.11n(HT20)	5180	26.993	Pass
	5200	27.904	Pass
	5240	21.371	Pass
802.11n(HT40)	5190	52.89	Pass
	5230	40.527	Pass
802.11ax(HE20)	5180	24.61	Pass
	5200	21.896	Pass
	5240	21.379	Pass
802.11ax(HE40)	5190	40.322	Pass
	5230	40.24	Pass
802.11ax(HE80)	5210	79.948	Pass

5725-5850 MHz

Test mode Ant 1	Test Channel (MHz)	6dB Bandwidth (MHz)	Result
802.11a	5745	16.5	Pass
	5785	16.524	Pass
	5825	16.515	Pass
802.11ac(VHT20)	5745	17.759	Pass
	5785	17.748	Pass
	5825	17.753	Pass
802.11ac(VHT40)	5755	36.468	Pass
	5795	36.467	Pass
802.11ac(VHT80)	5775	76.472	Pass
802.11n(HT20)	5745	17.784	Pass
	5785	17.752	Pass
	5825	17.79	Pass
802.11n(HT40)	5755	36.432	Pass
	5795	36.474	Pass
802.11ax(HE20)	5745	17.754	Pass
	5785	17.787	Pass
	5825	17.786	Pass
802.11ax(HE40)	5755	36.448	Pass
	5795	36.495	Pass
802.11ax(HE80)	5775	76.423	Pass

Test Graph 5150-5250MHz





802.11ac(VHT80)-5210



802.11n(HT20)-5180



802.11n(HT20)-5200



802.11n(HT20)-5240



802.11n(HT40)-5190



802.11n(HT40)-5230



802.11ax(HE20)-5180



802.11ax(HE20)-5200



802.11ax(HE20)-5240



802.11ax(HE40)-5190



802.11ax(HE40)-5230



802.11ax(HE80)-5210



5725-5850MHz

802.11a-5745



802.11a-5785



802.11a-5825



802.11ac(VHT20)-5745



802.11ac(VHT20)-5785



802.11ac(VHT20)-5825



802.11ac(VHT40)-5755

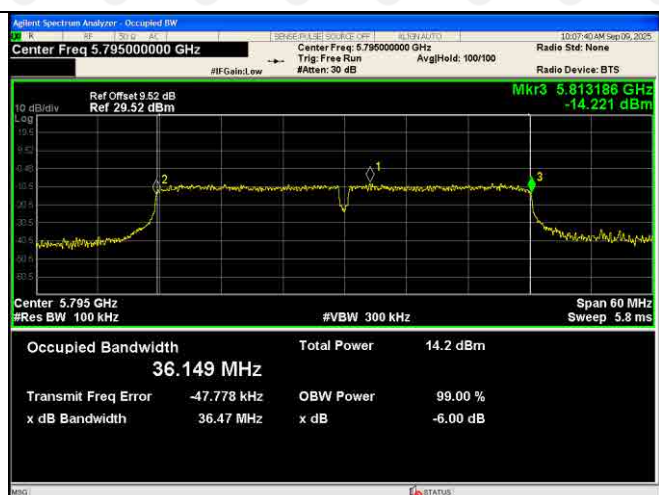


802.11ac(VHT40)-5795

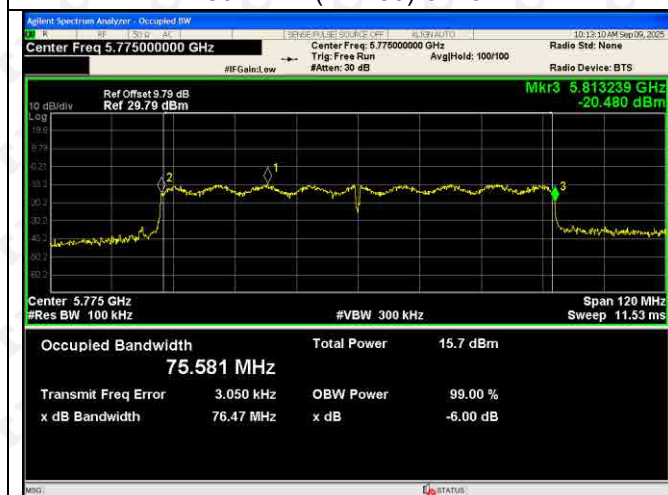




802.11ac(VHT80)-5775



802.11n(HT20)-5745



802.11n(HT20)-5785



802.11n(HT20)-5825



5802.11n(HT40)-5755



802.11n(HT40)-5795



802.11ax(HE20)-5745



802.11ax(HE20)-5785



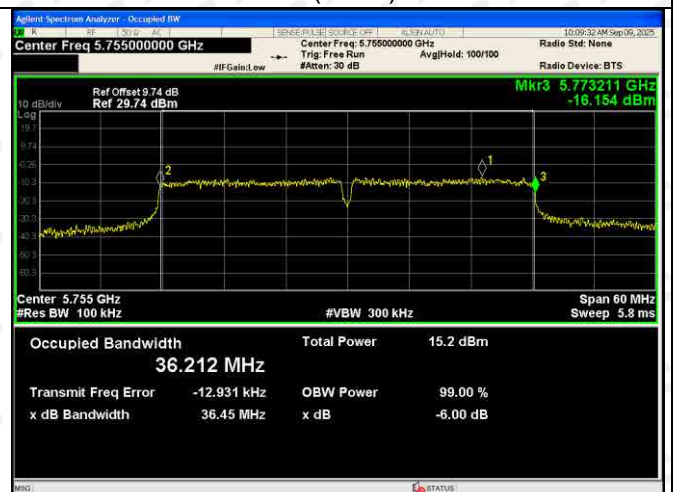
802.11ax(HE20)-5825



802.11ax(HE40)-5755



802.11ax(HE40)-5795

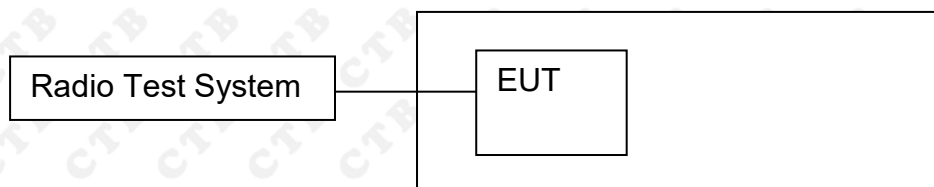


802.11ax(HE80)-5775



11. POWER SPECTRAL DENSITY

11.1 Block Diagram Of Test Setup



11.2 Limit

(1) For the band 5.15-5.25 GHz.

(iv) 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. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

11.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

For devices operating in the bands 5.15–5.25 GHz, 5.25–5.35 GHz, and 5.47–5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725–5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

a) Set $\text{RBW} \geq 1/T$, where T is defined in II.B.I.a).

b) Set $\text{VBW} \geq 3 \text{ RBW}$.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz/RBW})$ to the measured result, whereas RBW ($< 500 \text{ kHz}$) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log (1 \text{ MHz/RBW})$ to the measured result, whereas RBW ($< 1 \text{ MHz}$) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

11.4 Test Result

5150-5250MHz:

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit [dBm/MHz]	Result
802.11a	5180	-3.688	11	Pass
	5200	-2.321	11	Pass
	5240	-1.241	11	Pass
802.11ac(VHT20)	5180	-3.695	11	Pass
	5200	-3.392	11	Pass
	5240	-3.144	11	Pass
802.11ac(VHT40)	5190	-6.626	11	Pass
	5230	-5.501	11	Pass
802.11ac(VHT80)	5210	-8.109	11	Pass
802.11n(HT20)	5180	-3.755	11	Pass
	5200	-2.621	11	Pass
	5240	-3.3	11	Pass
802.11n(HT40)	5190	-6.489	11	Pass
	5230	-5.706	11	Pass
802.11ax(HE20)	5180	-3.747	11	Pass
	5200	-3.243	11	Pass
	5240	-3.205	11	Pass
802.11ax(HE40)	5190	-6.403	11	Pass
	5230	-5.404	11	Pass
802.11ax(HE80)	5210	-7.416	11	Pass

5725-5850MHz:

Test mode	Test Channel (MHz)	PSD [dBm/500kHz]	Limit [dBm/MHz]	Result
802.11a	5745	-5.776	30	Pass
	5785	-5.02	30	Pass
	5825	-4.251	30	Pass
802.11ac(VHT20)	5745	-5.872	30	Pass
	5785	-5.317	30	Pass
	5825	-6.245	30	Pass
802.11ac(VHT40)	5755	-8.967	30	Pass
	5795	-9.838	30	Pass
802.11ac(VHT80)	5775	-10.848	30	Pass
802.11n(HT20)	5745	-5.838	30	Pass
	5785	-4.887	30	Pass
	5825	-5.58	30	Pass
802.11n(HT40)	5755	-7.918	30	Pass
	5795	-8.842	30	Pass
802.11ax(HE20)	5745	-5.718	30	Pass
	5785	-5.077	30	Pass
	5825	-6.061	30	Pass
802.11ax(HE40)	5755	-8.706	30	Pass
	5795	-9.632	30	Pass
802.11ax(HE80)	5775	-10.966	30	Pass

5150-5250MHz





802.11ac(VHT80)-5210



802.11n(HT20)-5180



802.11n(HT20)-5200



802.11n(HT20)-5240



802.11n(HT40)-5190



802.11n(HT40)-5230



802.11ax(HE20)-5180



802.11ax(HE20)-5200



802.11ax(HE20)-5240



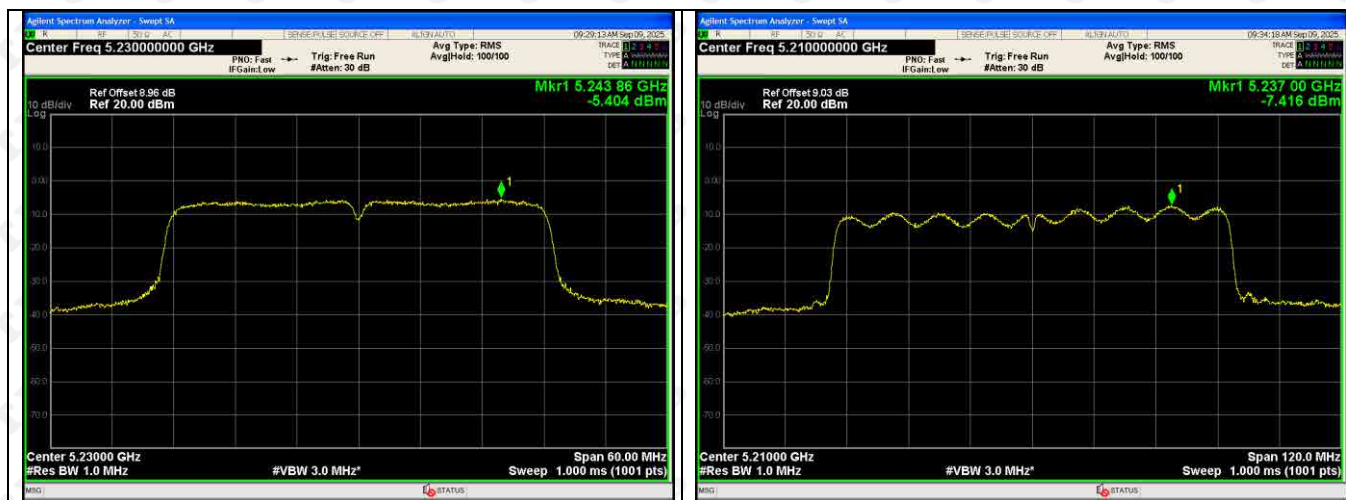
802.11ax(HE40)-5190



802.11ax(HE40)-5230



802.11ax(HE80)-5210



5725-5850MHz





802.11ac(VHT80)-5775



802.11n(HT20)-5745



802.11n(HT20)-5785



802.11n(HT20)-5825



5802.11n(HT40)-5755



802.11n(HT40)-5795



802.11ax(HE20)-5745



802.11ax(HE20)-5785



802.11ax(HE20)-5825



802.11ax(HE40)-5755



802.11ax(HE40)-5795

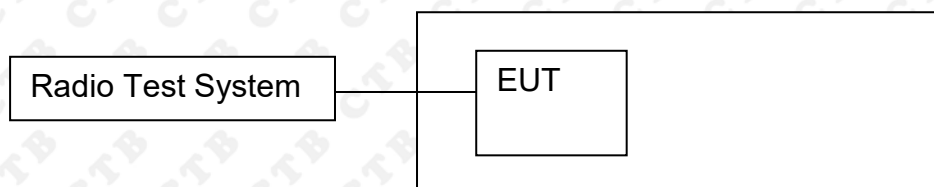


802.11ax(HE80)-5775



12. FREQUENCY STABILITY

12.1 Block Diagram Of Test Setup



12.2 Limit

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.

12.3 Test procedure

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.

12.4 Test Result

5150-5250MHz

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5180.0221	5180	0.0221	4.2624
		V max (V)	132	5180.0167	5180	0.0167	3.2170
		V min (V)	108	5180.0128	5180	0.0128	2.4779
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5180.0508	5180	0.0508	9.8002
		T (°C)	10	5180.0132	5180	0.0132	2.5486
		T (°C)	20	5180.0109	5180	0.0109	2.1072
		T (°C)	30	5180.0193	5180	0.0193	3.7328
		T (°C)	40	5180.0522	5180	0.0522	10.0835
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5200.0096	5200	0.0096	1.8541
		V max (V)	132	5200.0494	5200	0.0494	9.5049
		V min (V)	108	5200.0050	5200	0.0050	0.9700
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5200.0023	5200	0.0023	0.4515
		T (°C)	10	5200.0199	5200	0.0199	3.8253
		T (°C)	20	5200.0275	5200	0.0275	5.2934
		T (°C)	30	5200.0386	5200	0.0386	7.4240
		T (°C)	40	5200.0013	5200	0.0013	0.2531
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5240.0436	5240	0.0436	8.3211
		V max (V)	132	5240.0282	5240	0.0282	5.3754
		V min (V)	108	5240.0219	5240	0.0219	4.1736
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5240.0385	5240	0.0385	7.3382
		T (°C)	10	5240.0487	5240	0.0487	9.2897
		T (°C)	20	5240.0477	5240	0.0477	9.0987
		T (°C)	30	5240.0252	5240	0.0252	4.8036
		T (°C)	40	5240.0005	5240	0.0005	0.0862
Limits				±20ppm			
Result				Complies			

TX Frequency (5725-5850MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5745.0474	5745	0.0474	8.2551
		V max (V)	132	5745.0079	5745	0.0079	1.3797
		V min (V)	108	5745.0474	5745	0.0474	8.2551
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5745.0682	5745	0.0682	11.8657
		T (°C)	10	5745.0877	5745	0.0877	15.2592
		T (°C)	20	5745.0030	5745	0.0030	0.5249
		T (°C)	30	5745.0725	5745	0.0725	12.6224
		T (°C)	40	5745.0275	5745	0.0275	4.7944
Limits				±20ppm			
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)	120	5785.0934	5785	0.0934	16.1439
		V max (V)	132	5785.0124	5785	0.0124	2.1498
		V min (V)	108	5785.0307	5785	0.0307	5.3033
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5785.0343	5785	0.0343	5.9315
		T (°C)	10	5785.0599	5785	0.0599	10.3612
		T (°C)	20	5785.0928	5785	0.0928	16.0427
		T (°C)	30	5785.0154	5785	0.0154	2.6621
		T (°C)	40	5785.0092	5785	0.0092	1.5898
Limits				±20ppm			
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)	120	5825.0305	5825	0.0305	5.2440
		V max (V)	132	5825.0298	5825	0.0298	5.1079
		V min (V)	108	5825.0198	5825	0.0198	3.3916
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	0	5825.0263	5825	0.0263	4.5100
		T (°C)	10	5825.0563	5825	0.0563	9.6637
		T (°C)	20	5825.0387	5825	0.0387	6.6357
		T (°C)	30	5825.0263	5825	0.0263	4.5141
		T (°C)	40	5825.0630	5825	0.0630	10.8170
Limits				±20ppm			
Result				Complies			

13. OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT

13.1 Requirement

15.407(c) requirement:

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 signal ling 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.

13.2 Test Results

Operation in the absence of information to the transmit:

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of WLAN message transmitting from remote device and verify whether it shall reconnect. (manufacturer declare)

14. ANTENNA REQUIREMENT

15.203 requirement:

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.

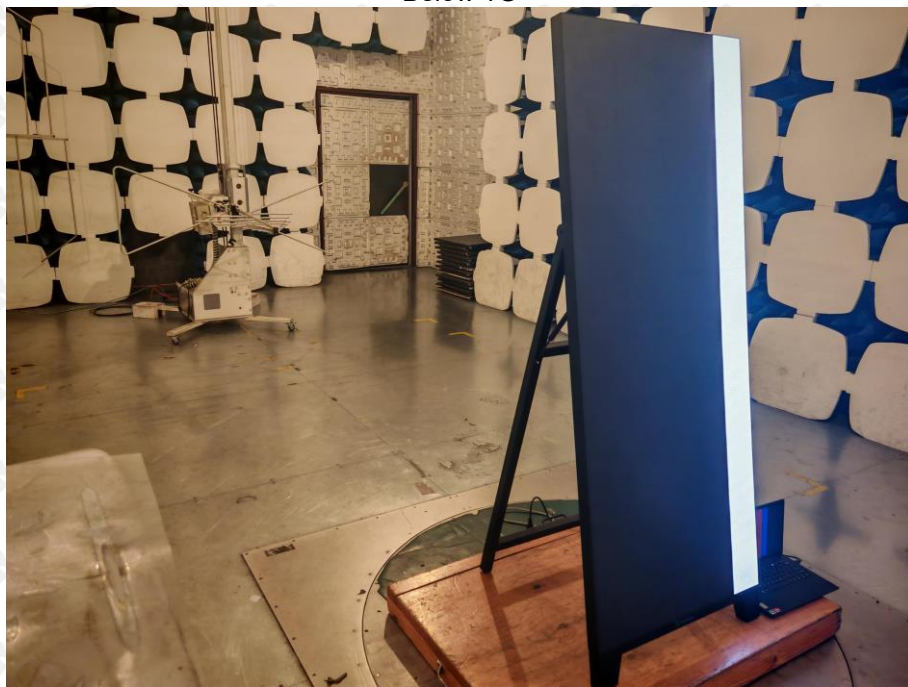
EUT Antenna:

The antenna is Internal Antenna and no consideration of replacement. The best case gain of the antenna WiFi (5.2G): -2.07dBi, WiFi (5.8G): 1.12dBi

15. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1G



Above 1G



Conducted emissions



***** END OF REPORT *****