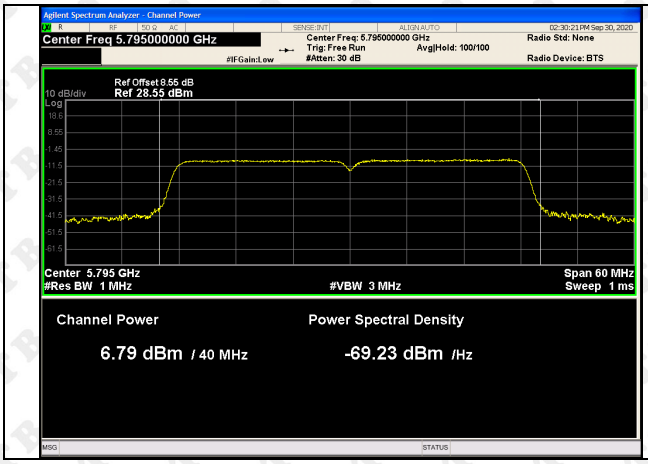
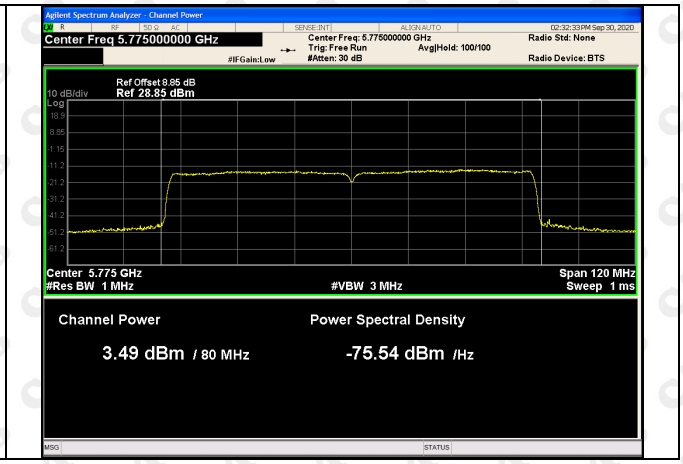
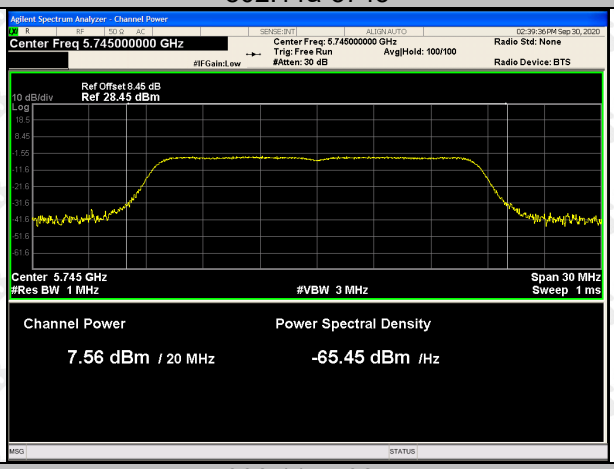

Agilent Spectrum Analyzer - Channel Power
Center Freq 5.795000000 GHz
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.55 dB
10 dB/div
Ref 28.55 dBm
Center 5.795 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
6.79 dBm / 40 MHz
Power Spectral Density
-69.23 dBm /Hz

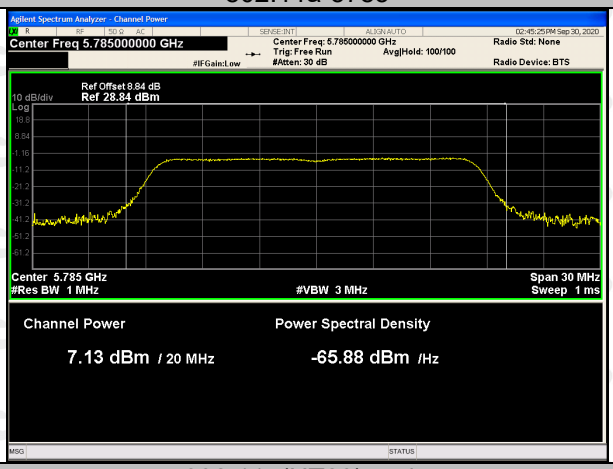

Agilent Spectrum Analyzer - Channel Power
Center Freq 5.775000000 GHz
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.85 dB
10 dB/div
Ref 28.85 dBm
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
3.49 dBm / 80 MHz
Power Spectral Density
-75.54 dBm /Hz

ANT 3

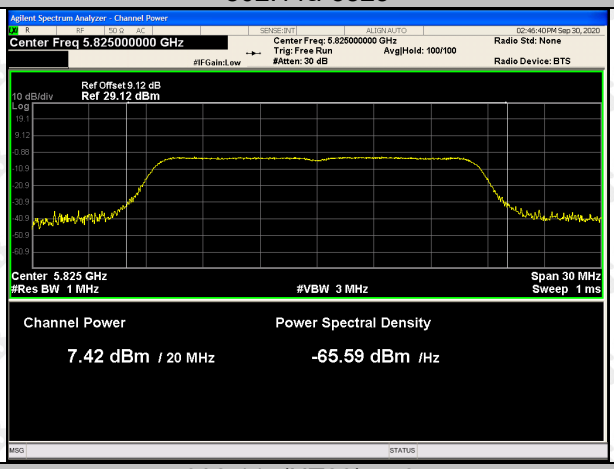
802.11a-5745



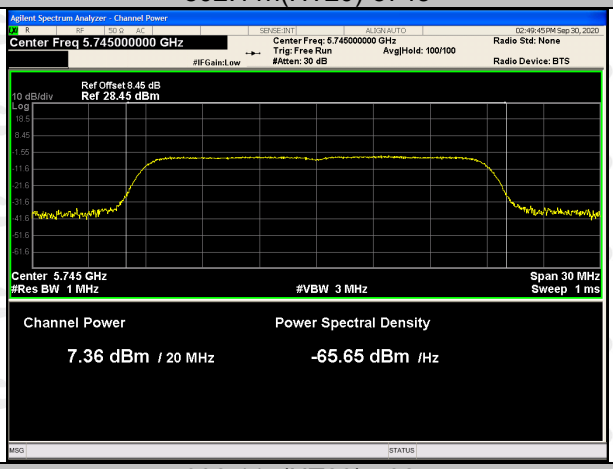
802.11a-5785



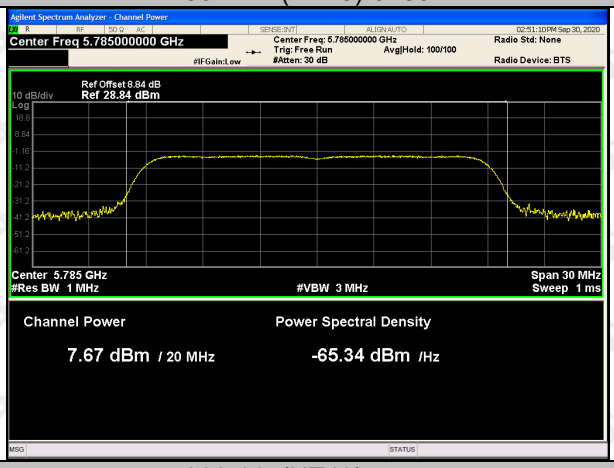
802.11a-5825



802.11n(HT20)-5745



802.11n(HT20)-5785



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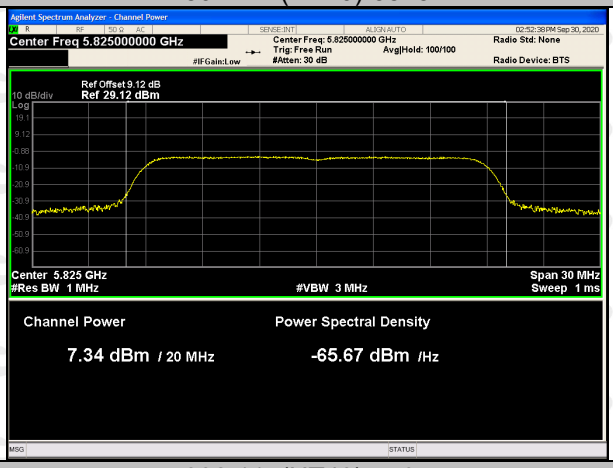
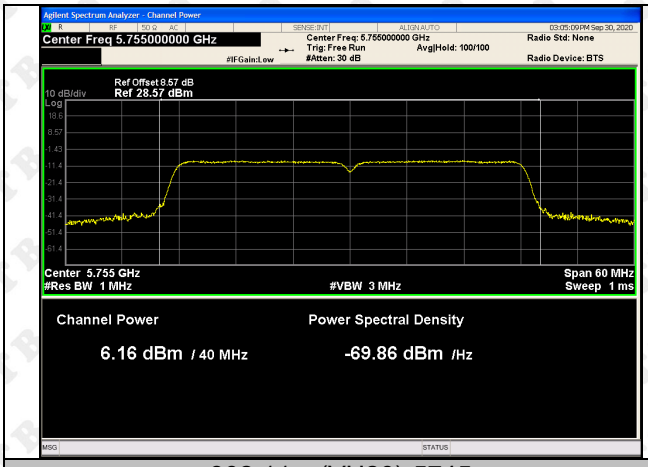
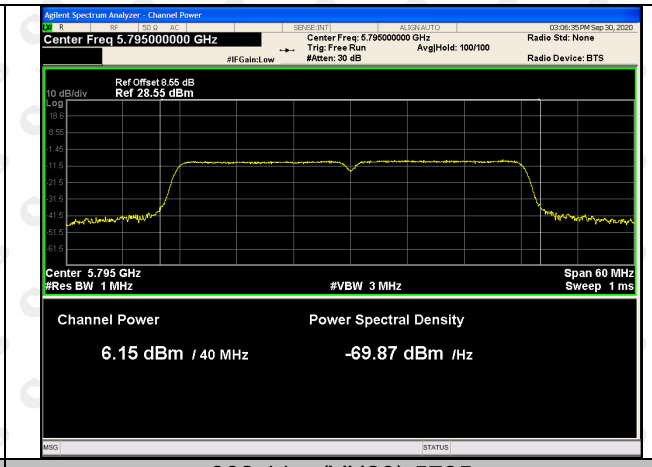


802.11n(HT40)-5755

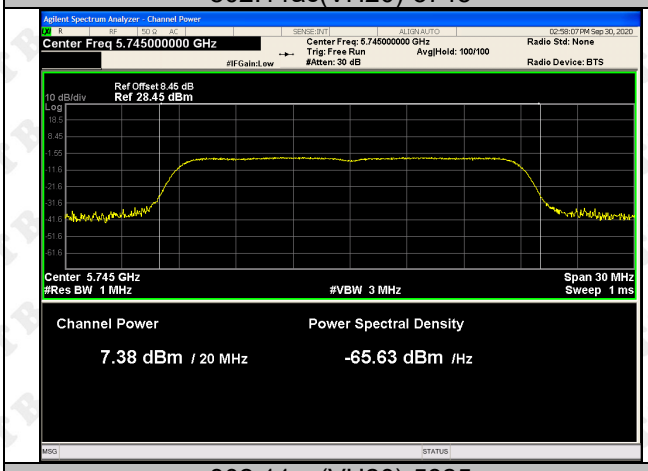
802.11n(HT40)-5795



802.11ac(VH20)-5745



802.11ac(VH20)-5785



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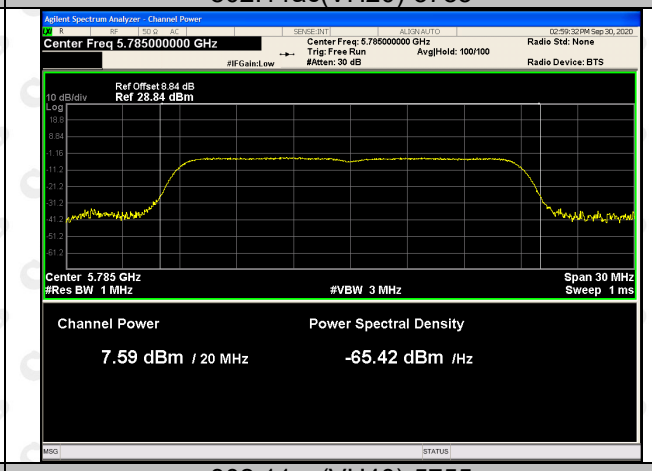
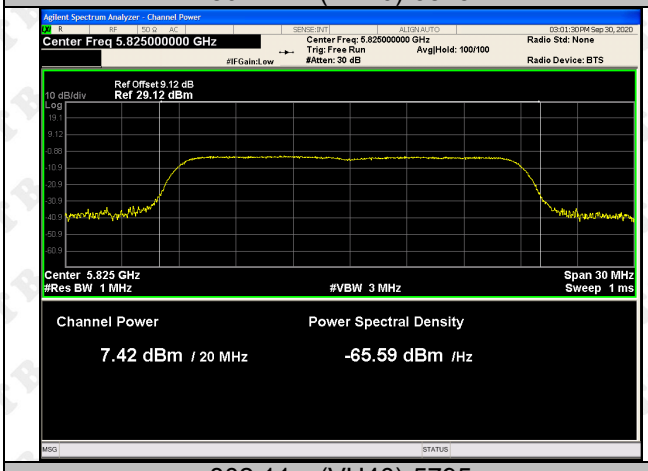
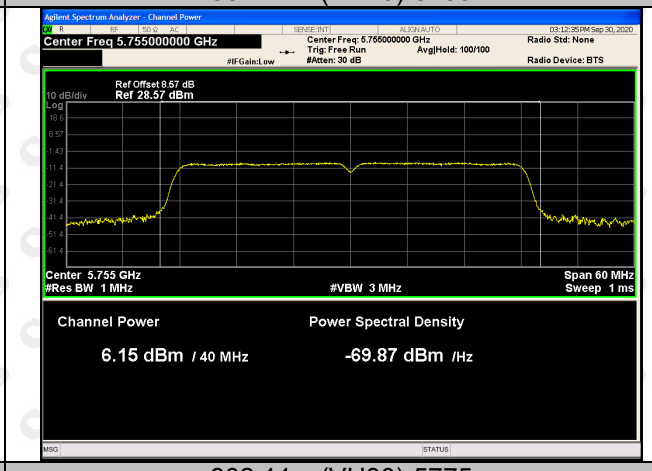


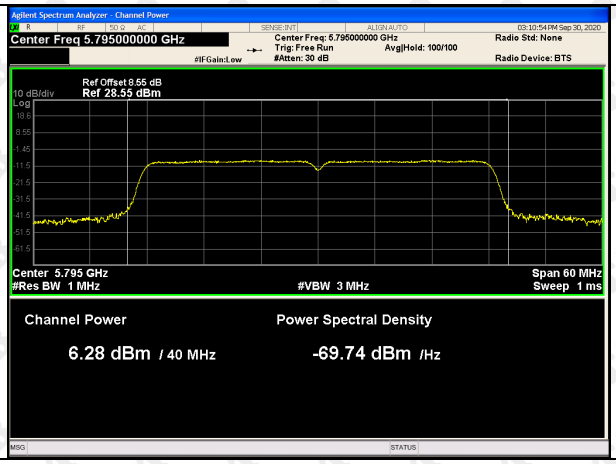
802.11ac(VH40)-5755

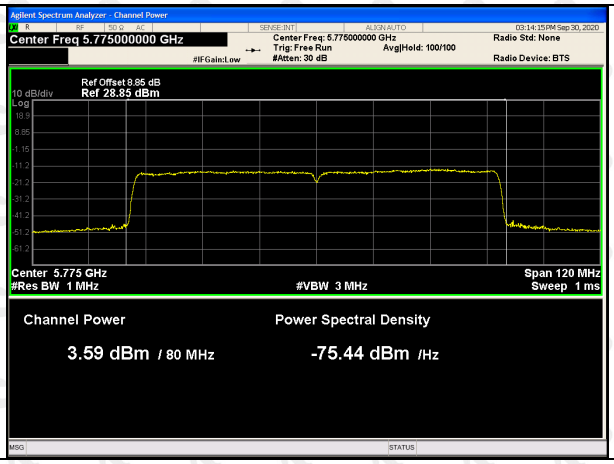


802.11ac(VH40)-5795



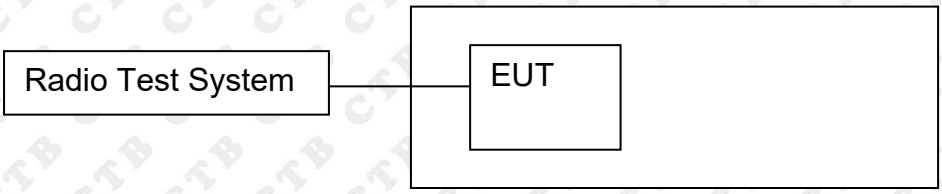
802.11ac(VH80)-5775


Agilent Spectrum Analyzer - Channel Power
Center Freq 5.795000000 GHz
Center Freq: 5.795000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.55 dB
10 dB/div
Ref 28.55 dBm
Log
Center 5.795 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
6.28 dBm / 40 MHz
Power Spectral Density
-69.74 dBm /Hz


Agilent Spectrum Analyzer - Channel Power
Center Freq 5.775000000 GHz
Center Freq: 5.775000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 8.85 dB
10 dB/div
Ref 28.85 dBm
Log
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
3.59 dBm / 80 MHz
Power Spectral Density
-75.44 dBm /Hz

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)
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%.
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:
a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 * 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 ≥ 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.

10.4 Test Results

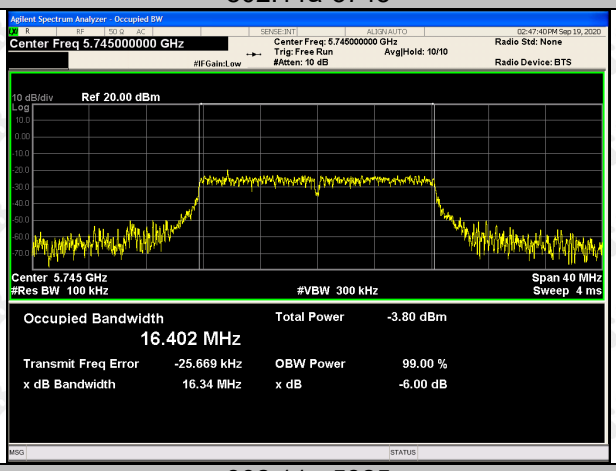
ANT 1

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.3435	16.4015	≥0.5
	5785	16.3846	16.4046	≥0.5
	5825	16.0491	16.3656	≥0.5
802.11a20	5745	17.5729	17.5513	≥0.5
	5785	17.5784	17.5519	≥0.5
	5825	17.3779	17.5704	≥0.5
802.11a40	5755	35.5675	36.0334	≥0.5
	5795	35.0939	35.8735	≥0.5
802.11a80	5775	75.1161	75.276	≥0.5
802.11n(HT20)	5745	17.5713	17.5812	≥0.5
	5785	17.4744	17.5479	≥0.5
	5825	17.6068	17.5838	≥0.5
802.11n(HT40)	5755	35.1514	36.0475	≥0.5
	5795	34.9012	35.9443	≥0.5

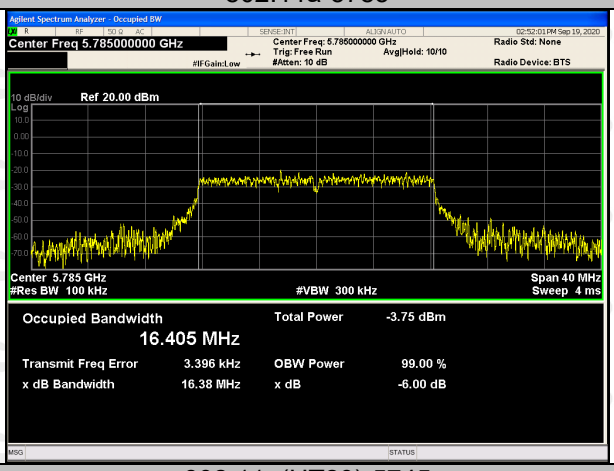
Test Graph1

5725-5850MHz

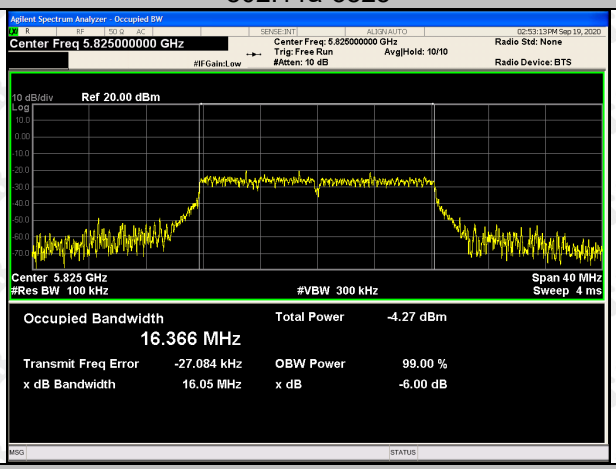
802.11a-5745



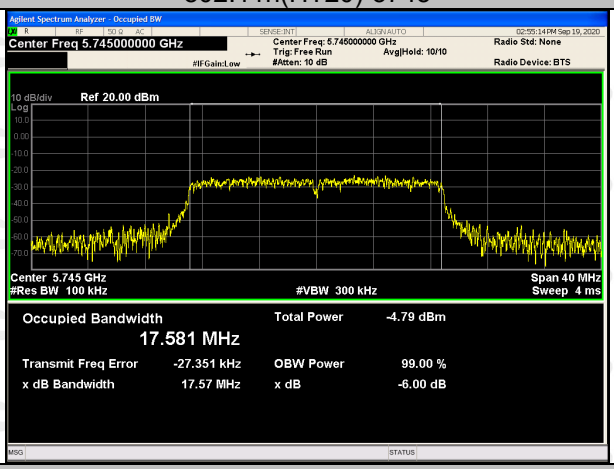
802.11a-5785



802.11a-5825

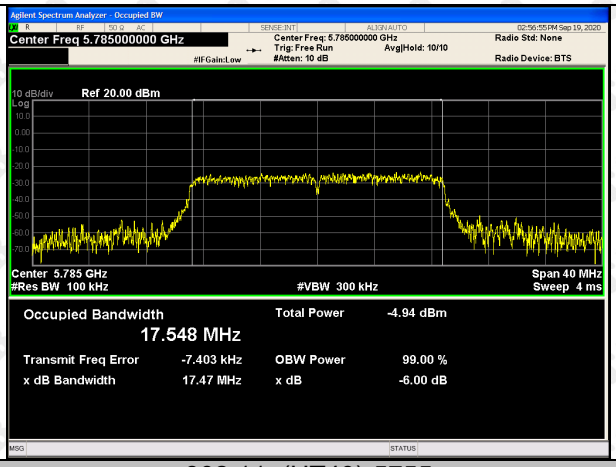


802.11n(HT20)-5745



802.11n(HT20)-5785

802.11n(HT20)-5825



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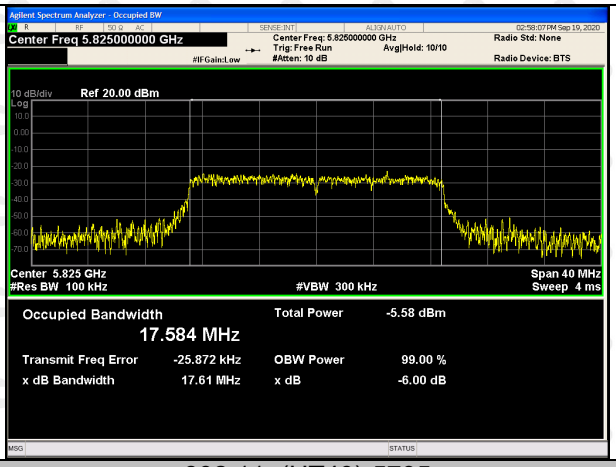

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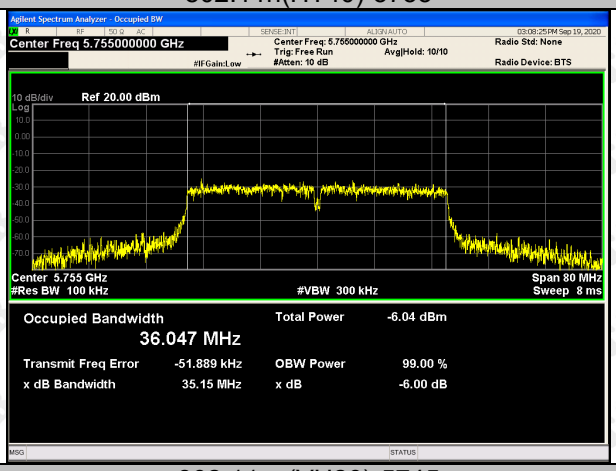
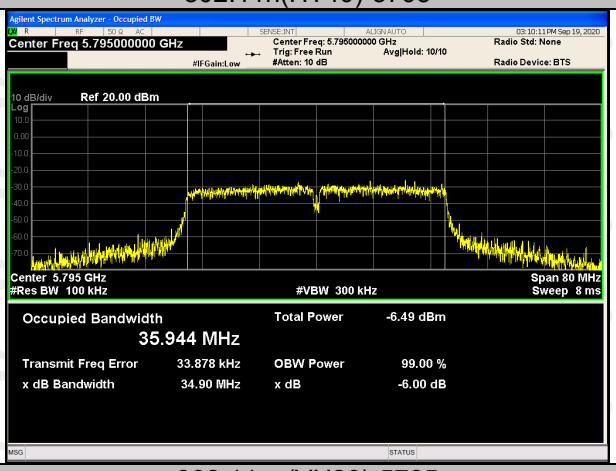


802.11ac(VH20)-5745



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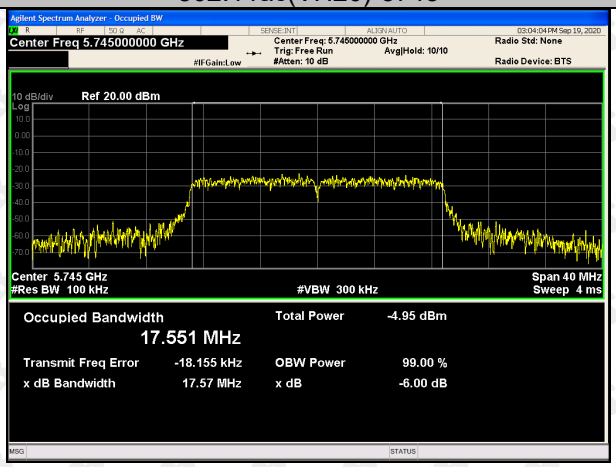

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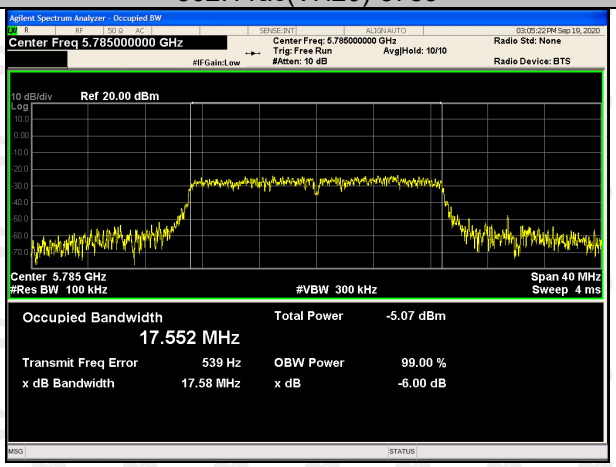

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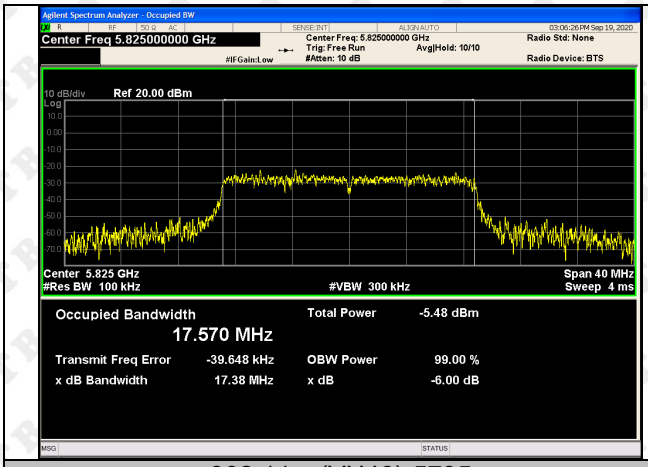
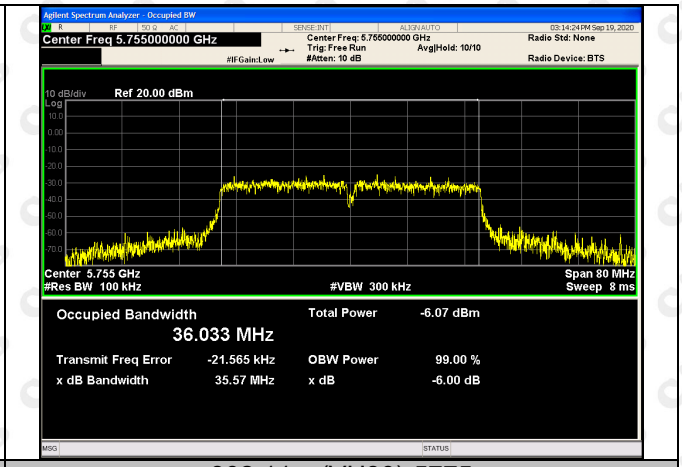
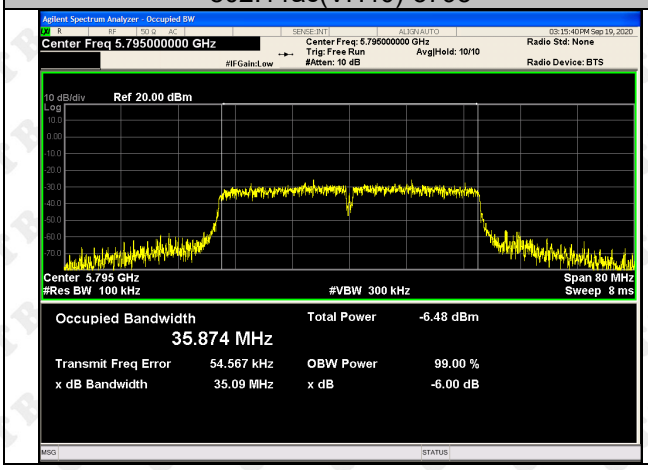
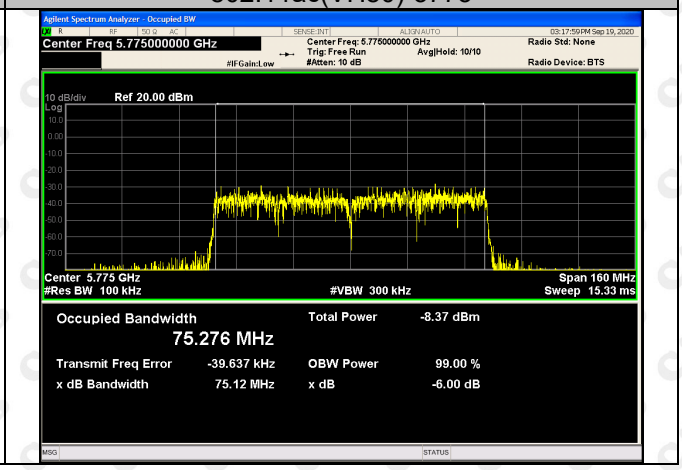




802.11ac(VH40)-5795

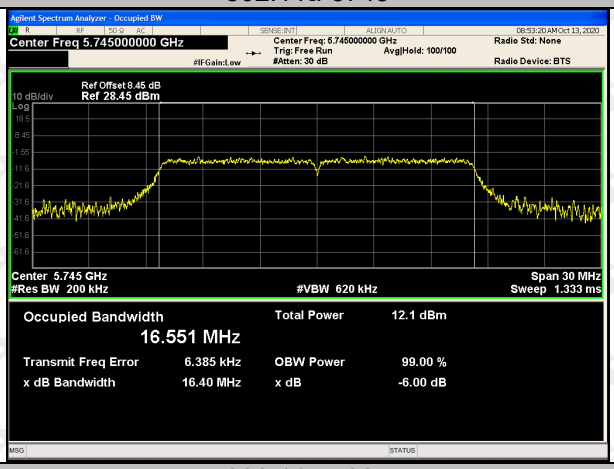
802.11ac(VH80)-5775



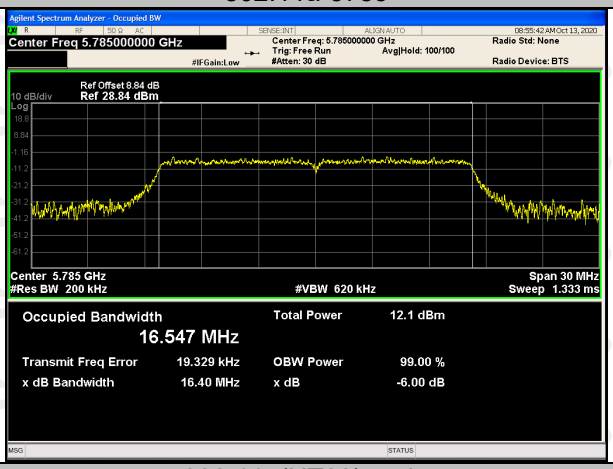


ANT 2	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.40	16.5506	≥0.5
	5785	16.40	16.5474	≥0.5
	5825	16.42	16.54074	≥0.5
802.11a20	5745	17.54	17.6517	≥0.5
	5785	17.58	17.6266	≥0.5
	5825	17.43	17.6390	≥0.5
802.11a40	5755	36.39	36.2613	≥0.5
	5795	36.33	36.2736	≥0.5
802.11a80	5775	75.95	75.6104	≥0.5
802.11n(HT20)	5745	17.50	17.6441	≥0.5
	5785	17.51	17.6124	≥0.5
	5825	17.54	17.6240	≥0.5
802.11n(HT40)	5755	36.23	36.2775	≥0.5
	5795	36.23	36.2860	≥0.5

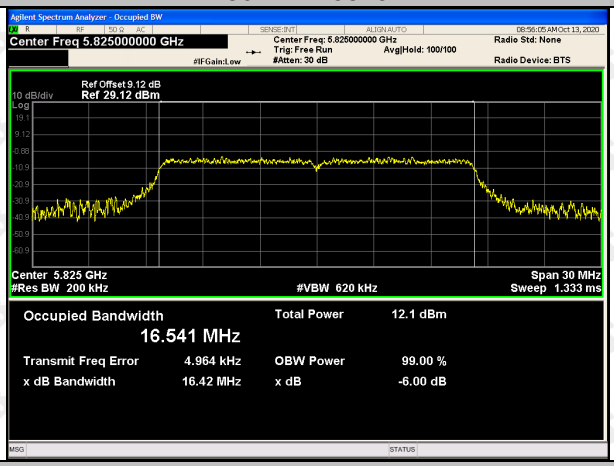
802.11a-5745



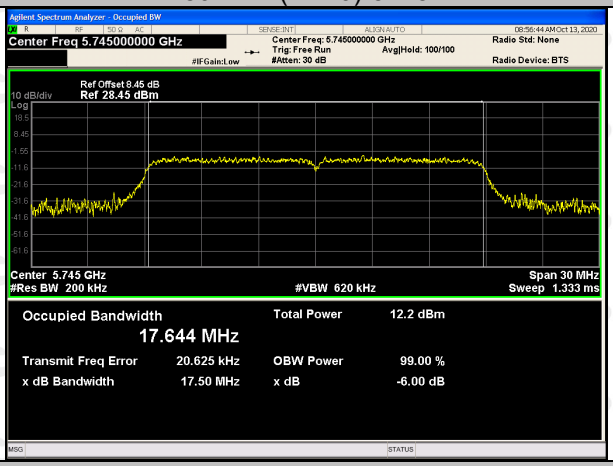
802.11a-5785



802.11a-5825



802.11n(HT20)-5745



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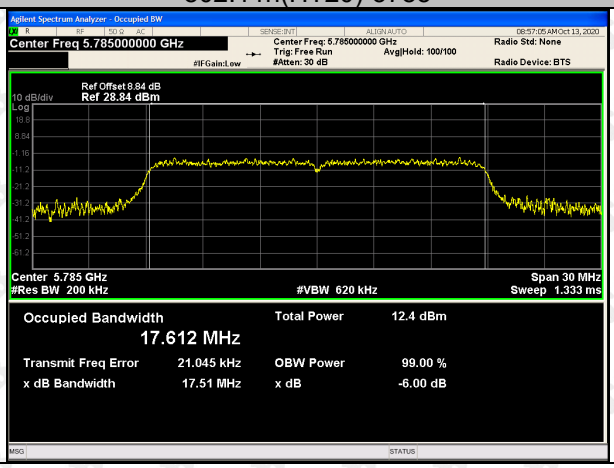
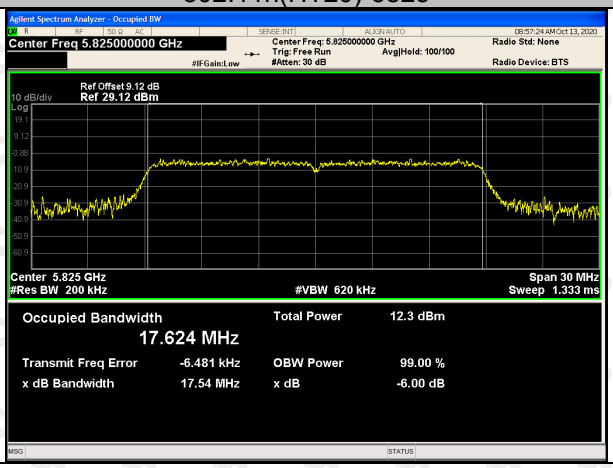
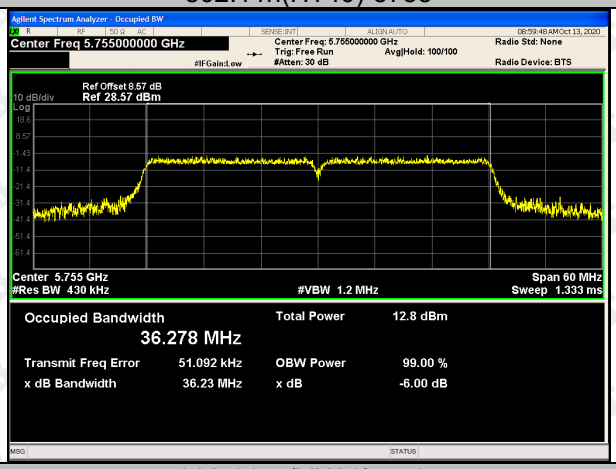


802.11n(HT20)-5825



802.11n(HT40)-5755



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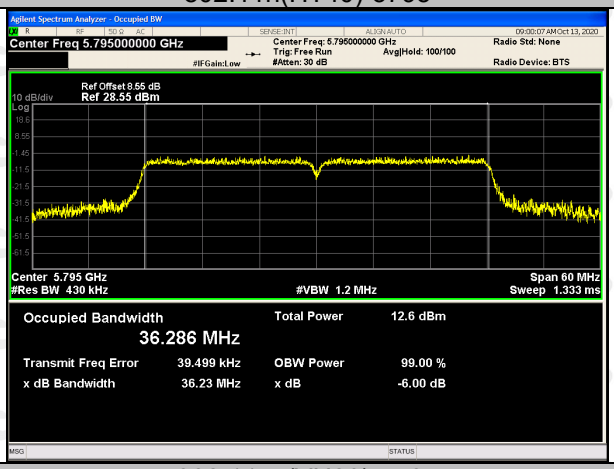
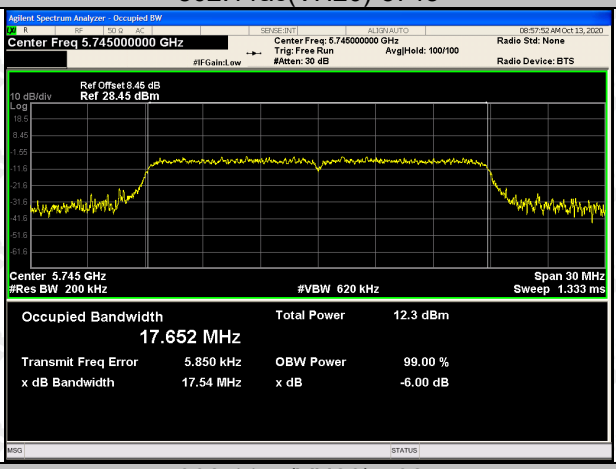


802.11ac(VH20)-5745



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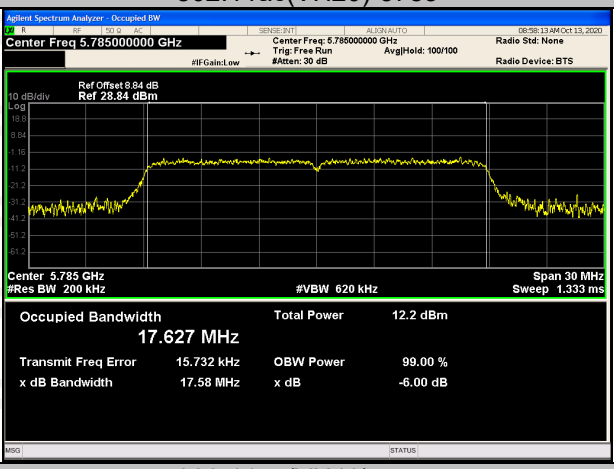

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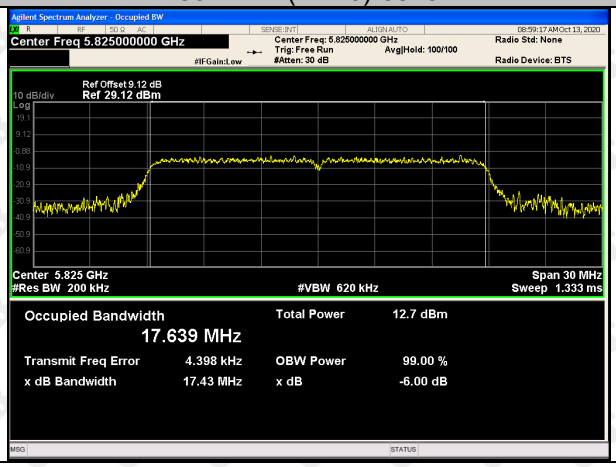

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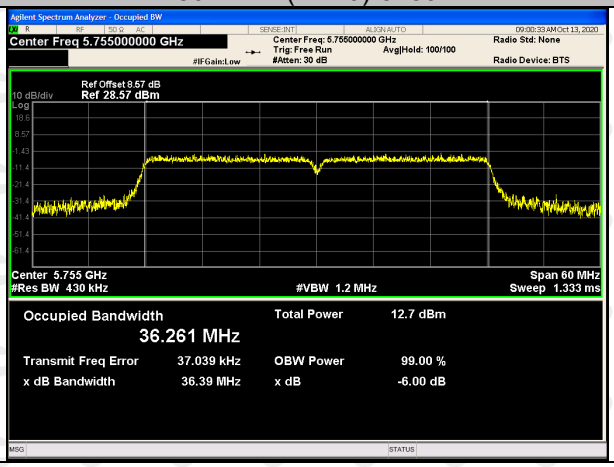

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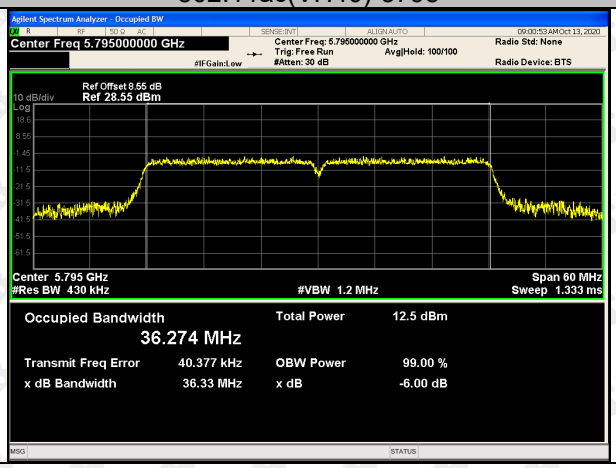
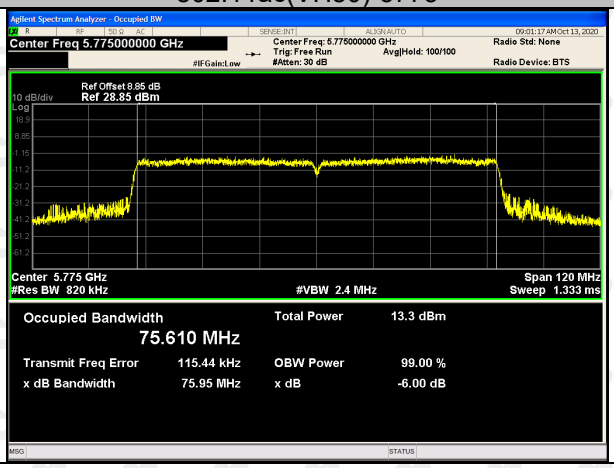
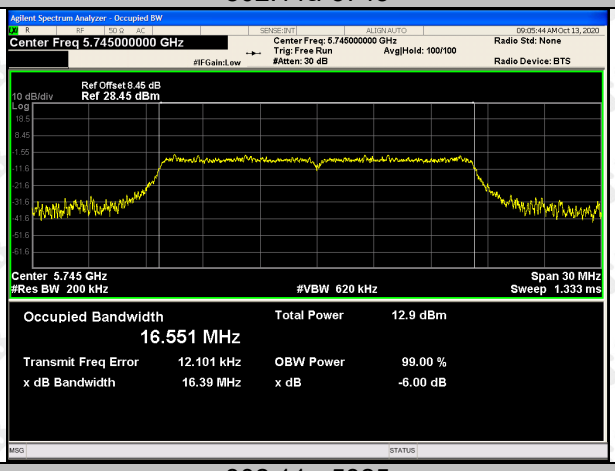
	

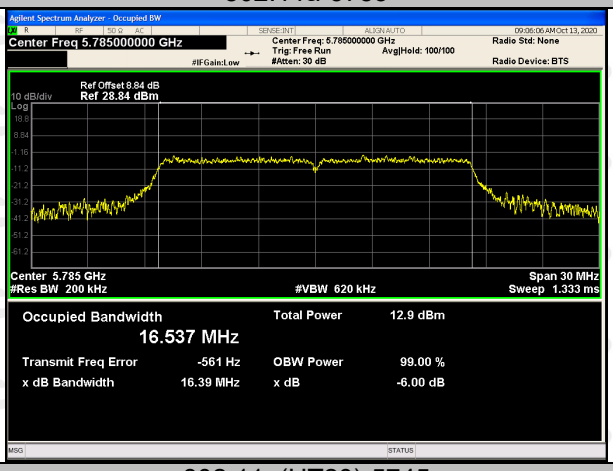
ANT 3

Test mode 3	Test Channel (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)
802.11a	5745	16.39	16.5514	≥0.5
	5785	16.39	16.5368	≥0.5
	5825	16.38	16.5690	≥0.5
802.11a20	5745	17.59	17.6558	≥0.5
	5785	17.55	17.6280	≥0.5
	5825	17.60	17.6232	≥0.5
802.11a40	5755	36.22	36.2863	≥0.5
	5795	36.04	36.2146	≥0.5
802.11a80	5775	75.93	75.5634	≥0.5
802.11n(HT20)	5745	17.60	17.6339	≥0.5
	5785	17.49	17.6107	≥0.5
	5825	17.50	17.6124	≥0.5
802.11n(HT40)	5755	36.24	36.2538	≥0.5
	5795	36.34	36.19512	≥0.5

802.11a-5745



802.11a-5785



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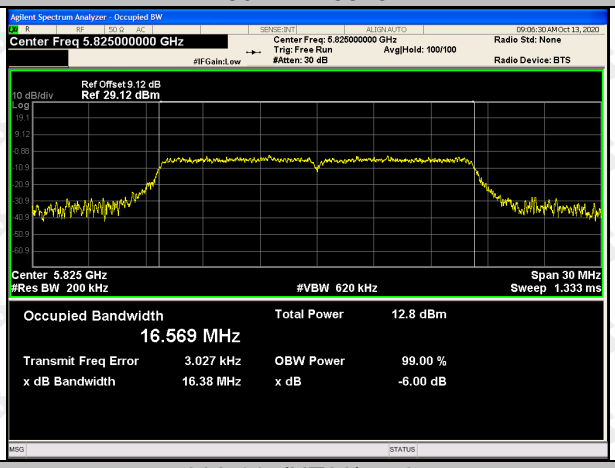

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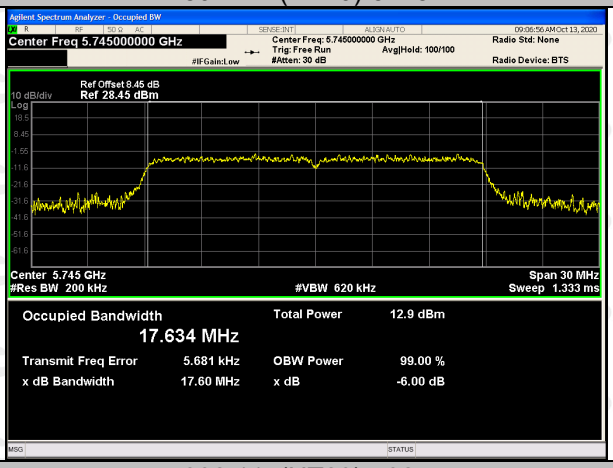

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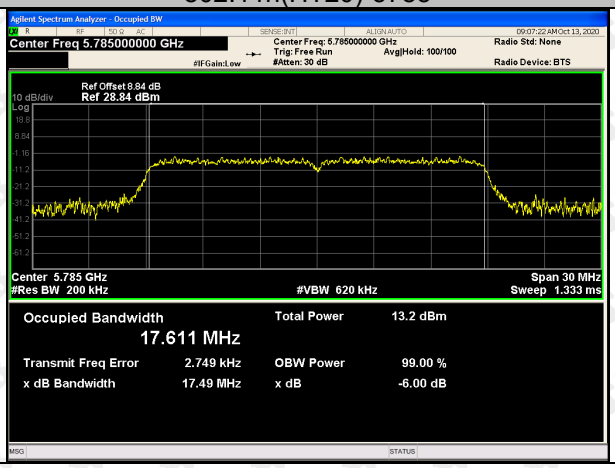

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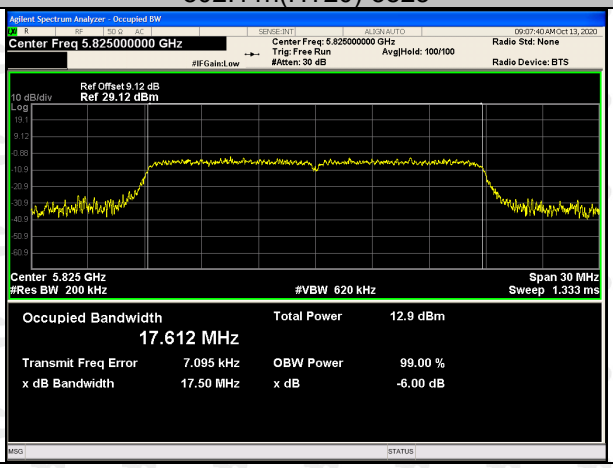

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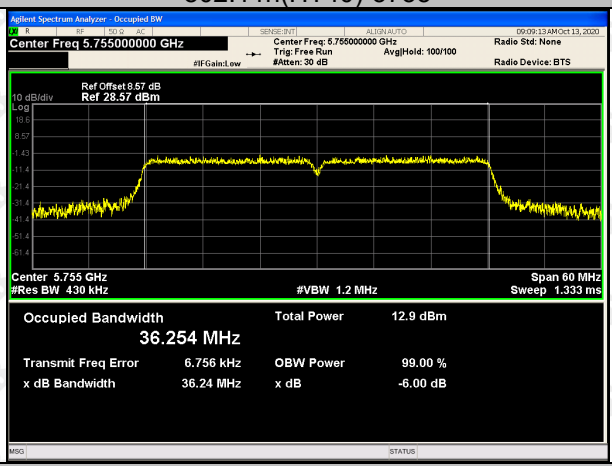

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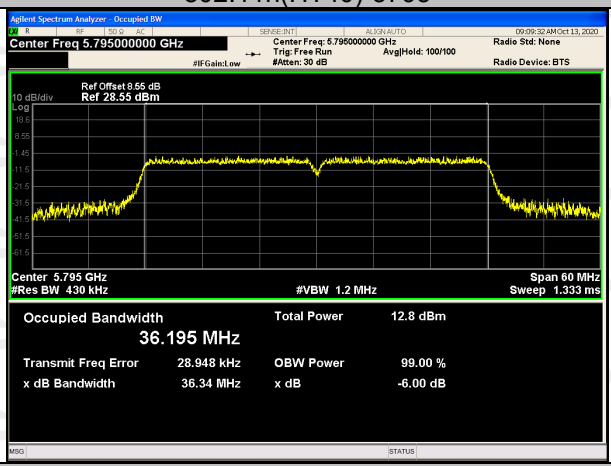

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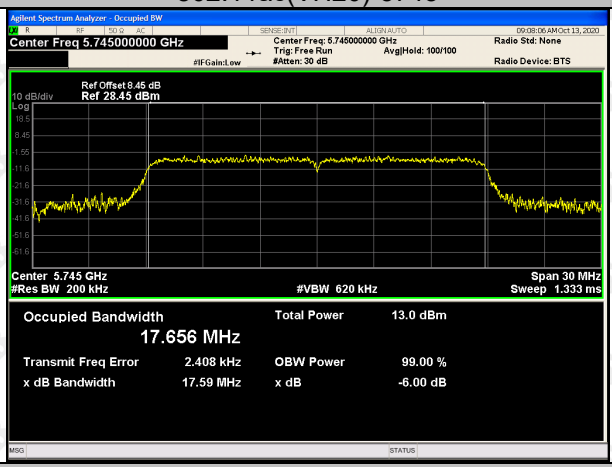

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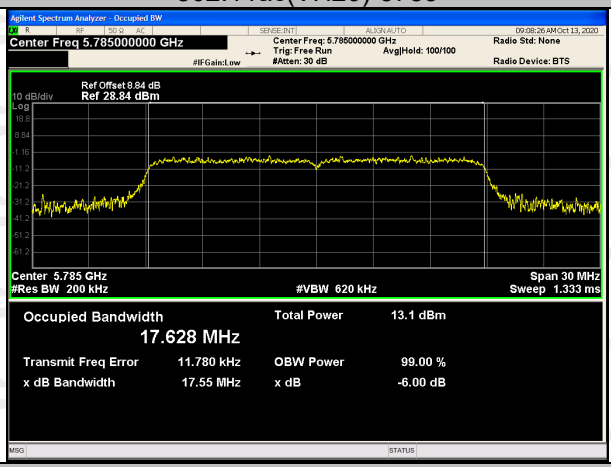

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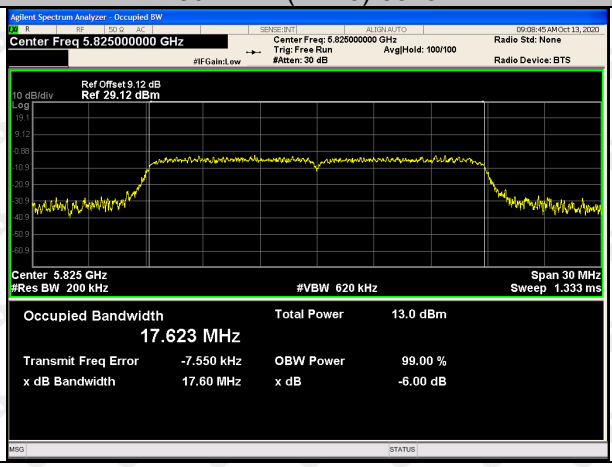

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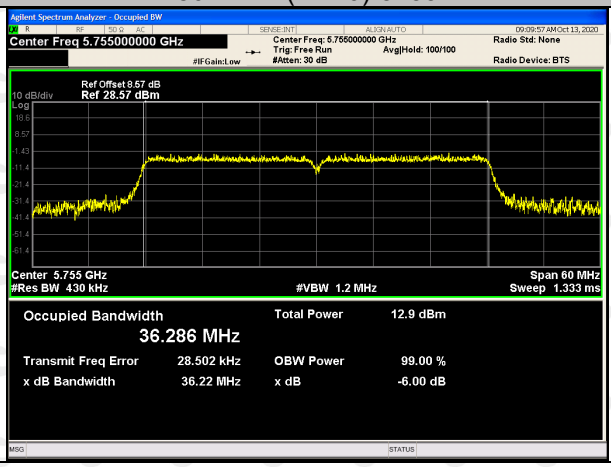
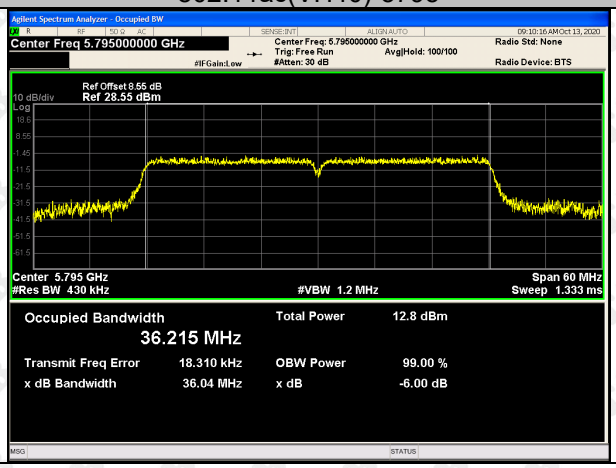
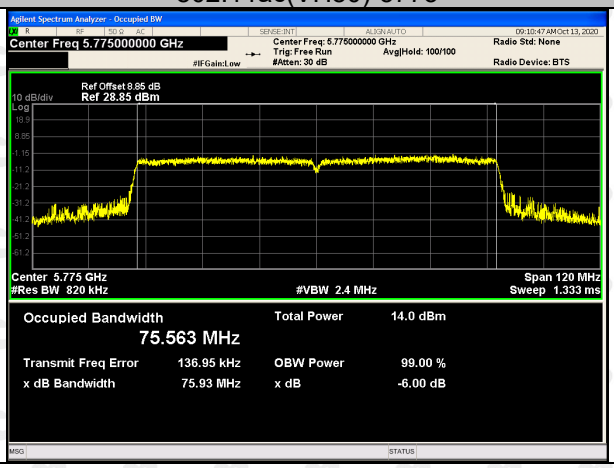
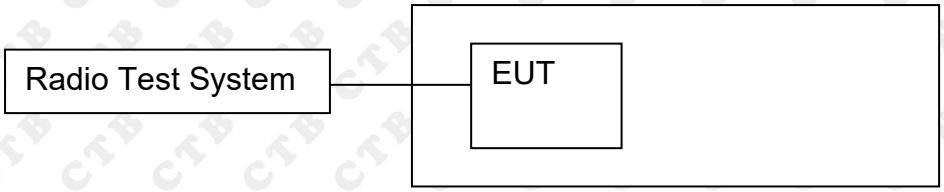


802.11ac(VH40)-5795	802.11ac(VH80)-5775
	

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 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 RBW ≥ 1/*T*, where *T* is defined in II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 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 (1MHz/RBW) to the measured result, whereas RBW (< 1 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

ANT 1

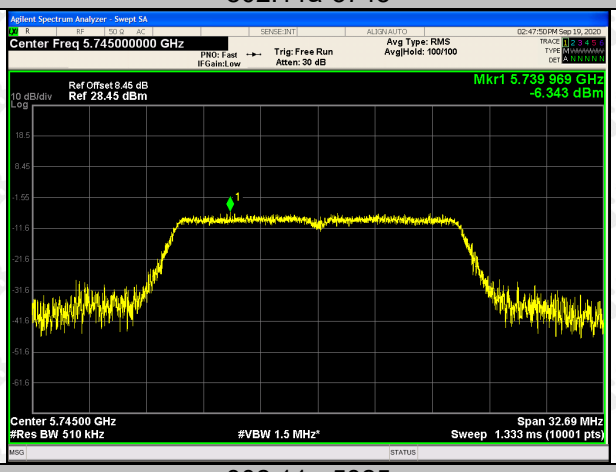
Test mode1	Test Channel (MHz)	PSD [dBm/500kHz]	Result
802.11a	5745	-6.343	Pass
	5785	-6.028	Pass
	5825	-6.332	Pass
802.11n(HT20)	5745	-6.283	Pass
	5785	-6.16	Pass
	5825	-6.024	Pass
802.11n(HT40)	5755	-9.846	Pass
	5795	-10.955	Pass
802.11ac(VH20)	5745	-6.772	Pass
	5785	-6.466	Pass
	5825	-6.615	Pass
802.11ac(VH40)	5755	-10.876	Pass
	5795	-11.132	Pass
802.11ac(VH80)	5775	-15.03	Pass

ANT 2+3

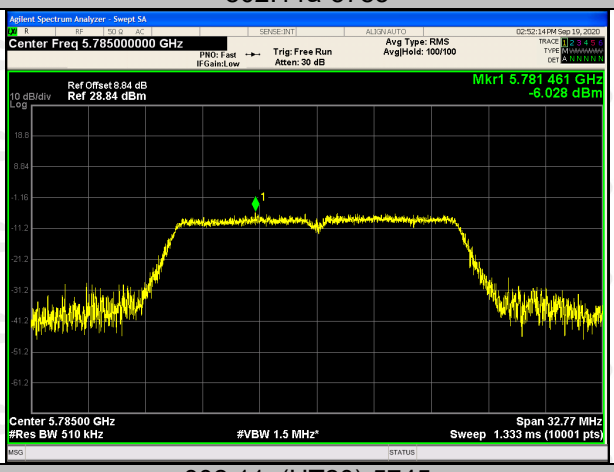
Test mode	Test Channel (MHz)	PSD [dBm/500kHz] ANT 2	PSD [dBm/500kHz] ANT 3	PSD [dBm/500kHz] Total	Result
802.11a	5745	-5.681	-5.934	-2.795	Pass
	5785	-6.045	-6.358	-3.188	Pass
	5825	-6.2	-6.113	-3.146	Pass
802.11n(HT20)	5745	-6.804	-6.354	-3.563	Pass
	5785	-6.345	-6.159	-3.241	Pass
	5825	-6.12	-6.424	-3.259	Pass
802.11n(HT40)	5755	-10.353	-10.584	-7.457	Pass
	5795	-9.852	-10.604	-7.201	Pass
802.11ac(VH20)	5745	-6.777	-6.492	-3.622	Pass
	5785	-6.369	-6.249	-3.298	Pass
	5825	-5.903	-6.37	-3.120	Pass
802.11ac(VH40)	5755	-10.374	-10.752	-7.549	Pass
	5795	-10.006	-10.298	-2.795	Pass
802.11ac(VH80)	5775	-15.314	-15.09	-3.188	Pass

ANT 1

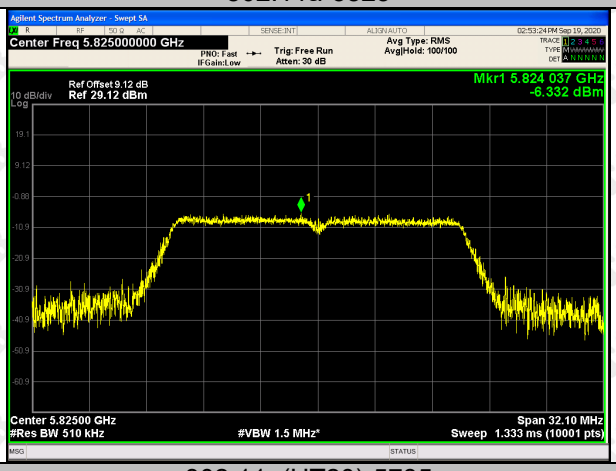
802.11a-5745



802.11a-5785



802.11a-5825



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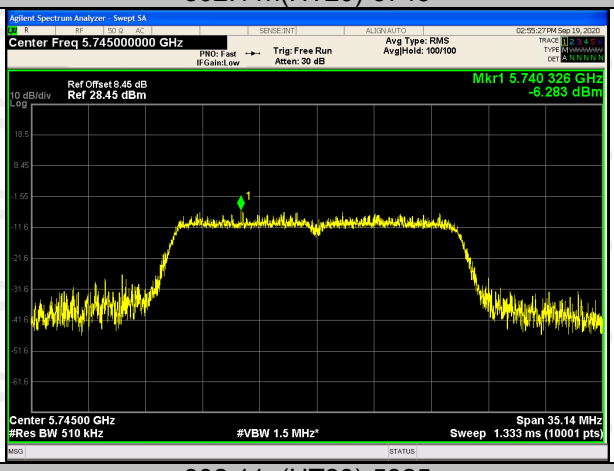

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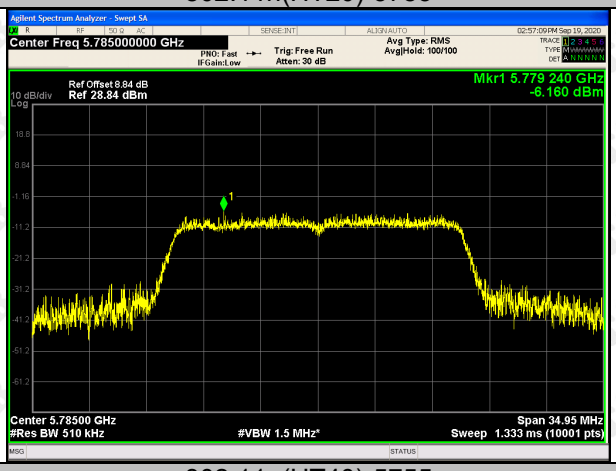

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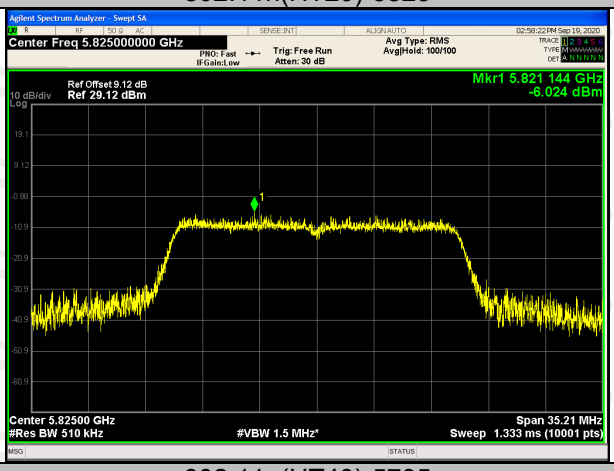
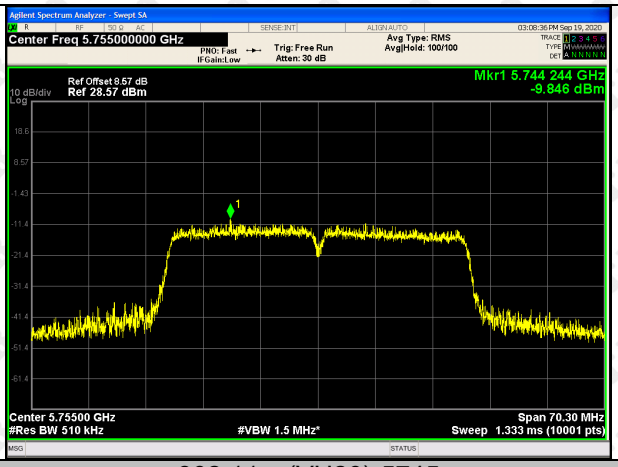


802.11n(HT40)-5755

802.11n(HT40)-5795



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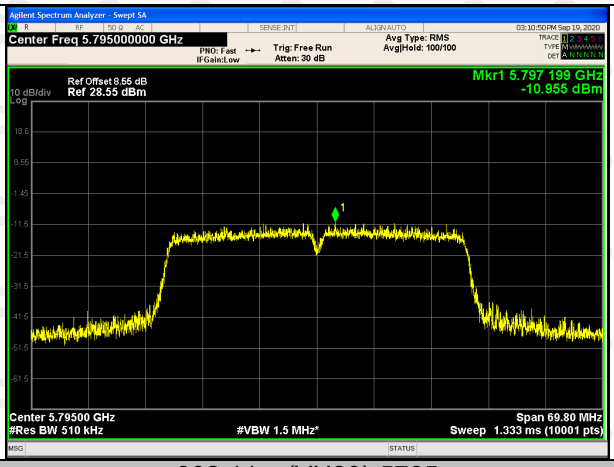

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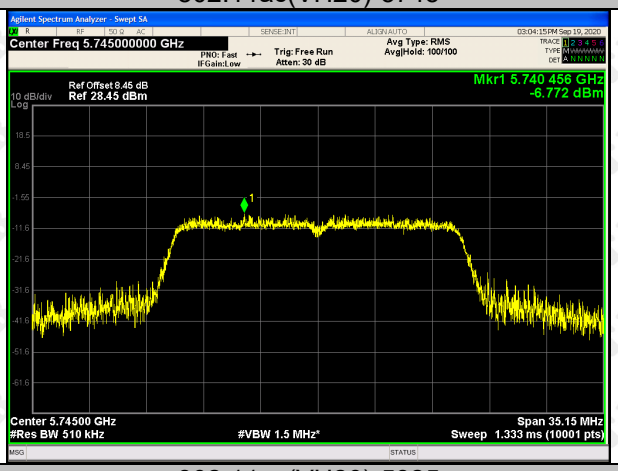

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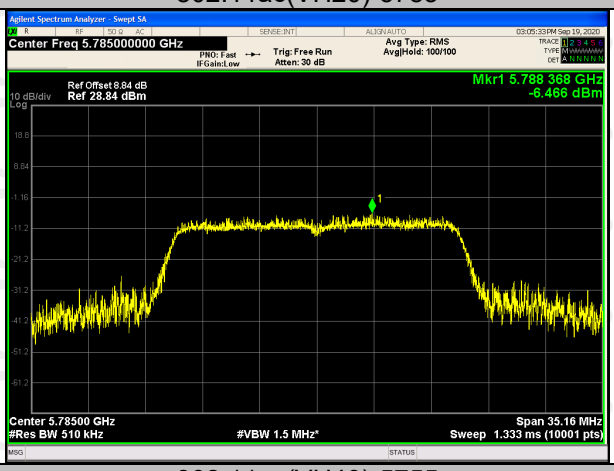

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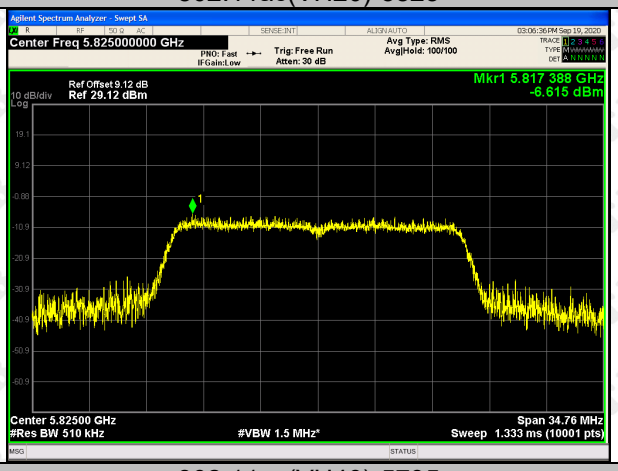

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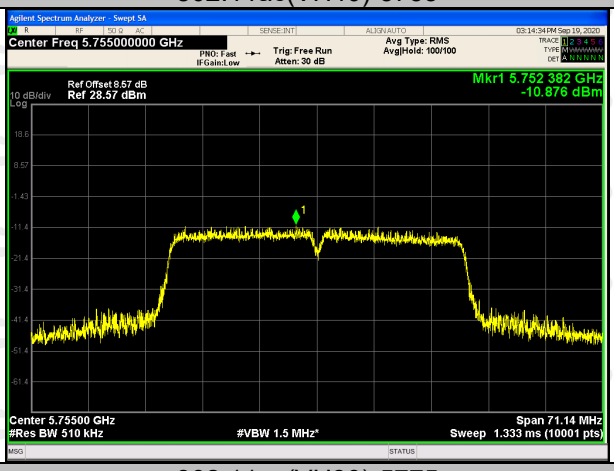
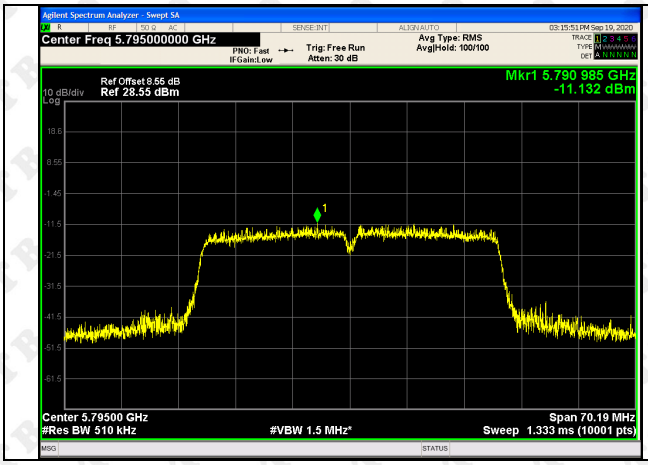
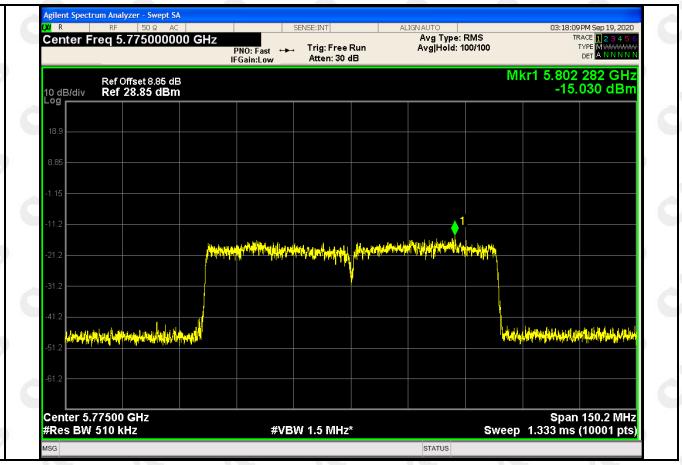


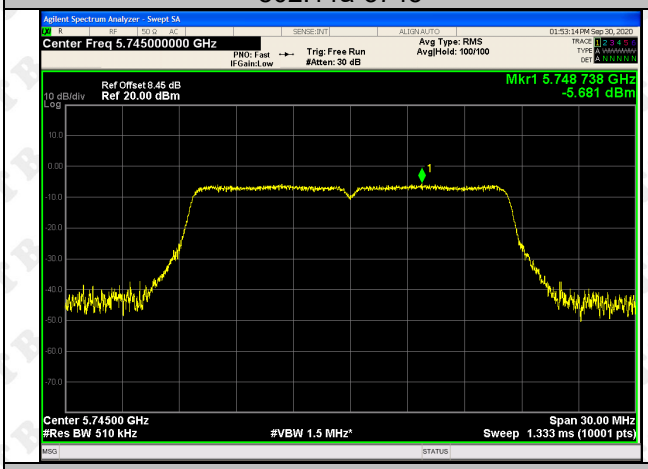
802.11ac(VH80)-5775



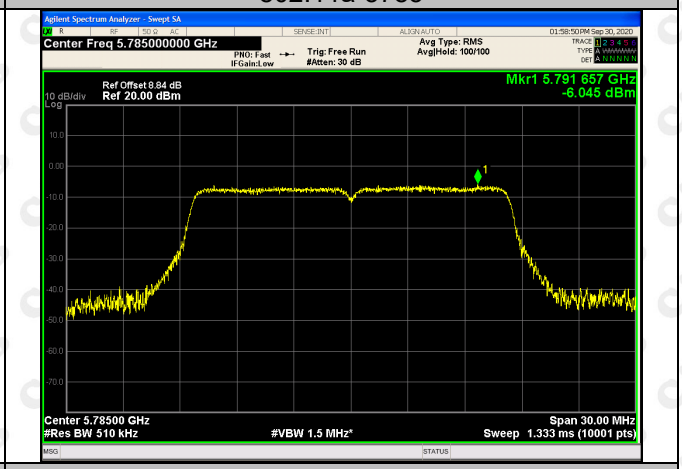


ANT 2

802.11a-5745



802.11a-5785



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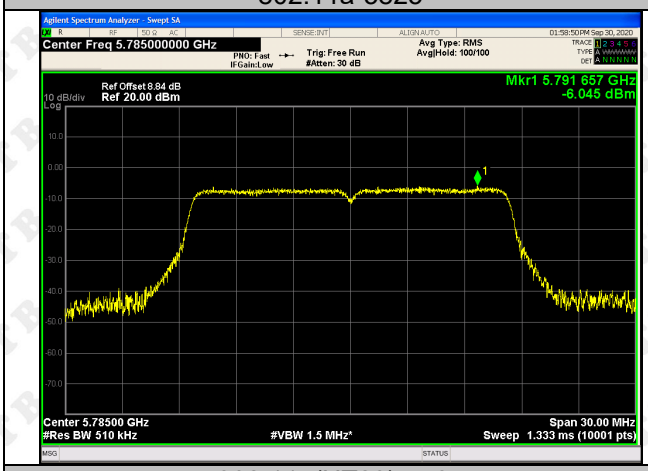

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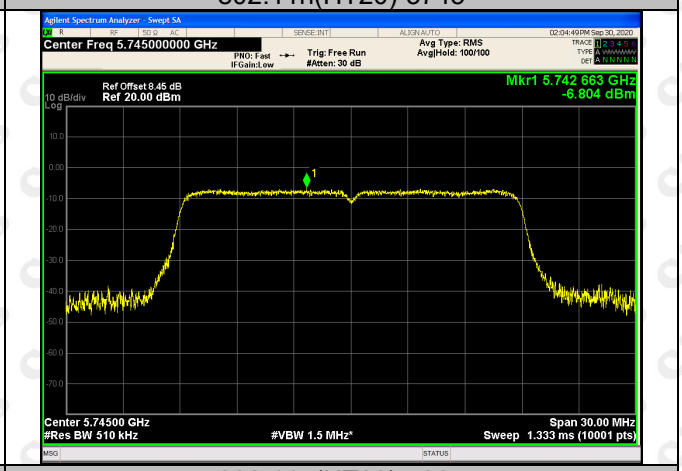

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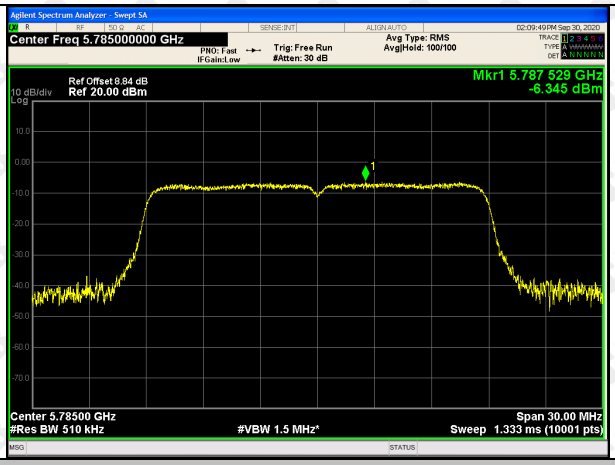

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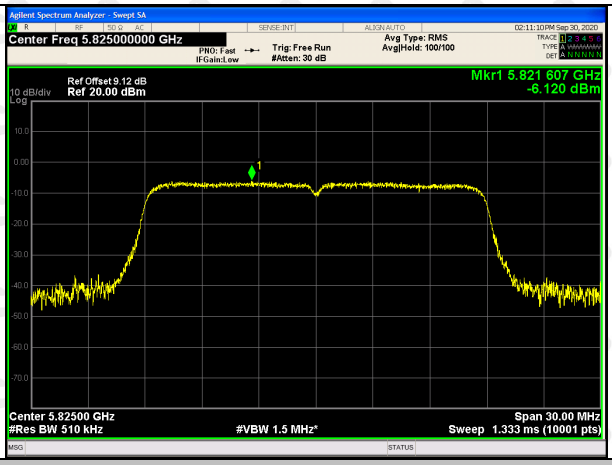

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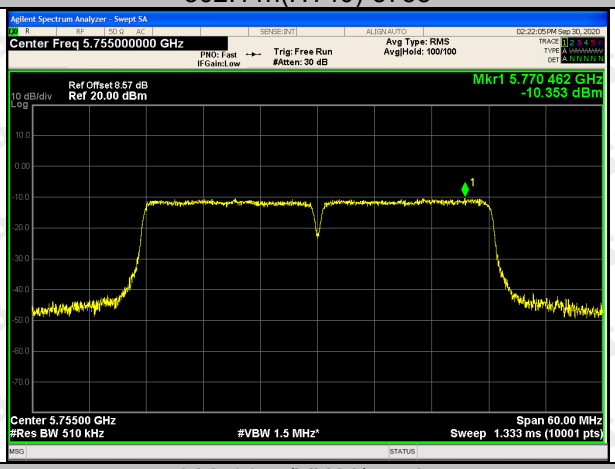

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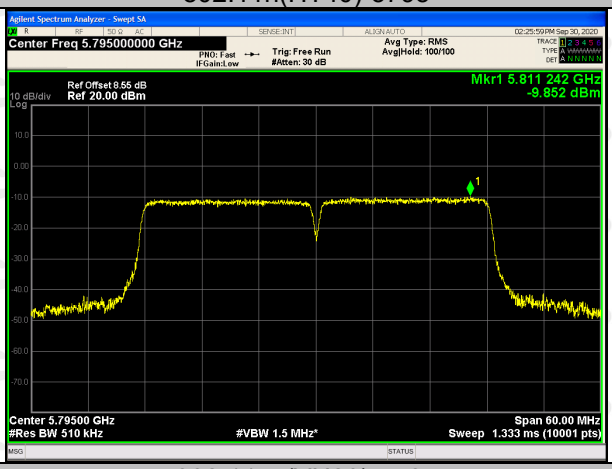

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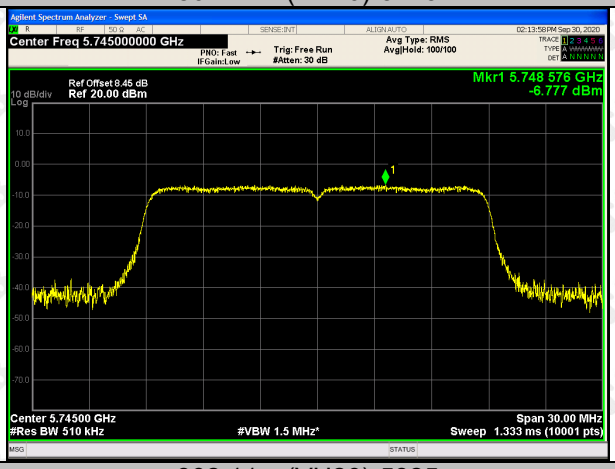

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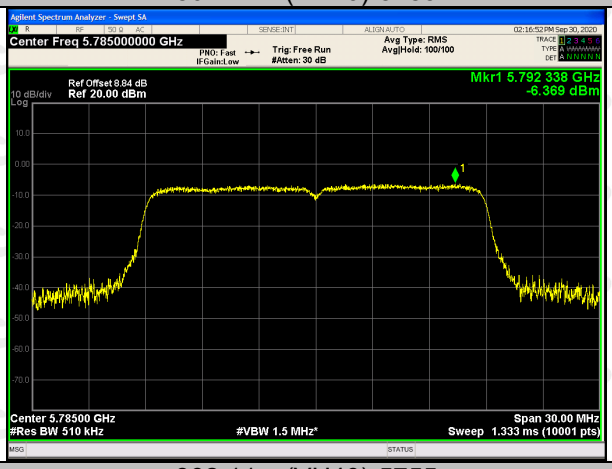

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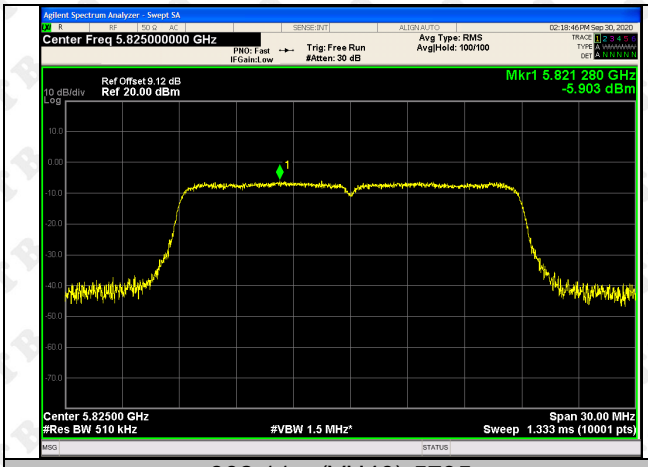

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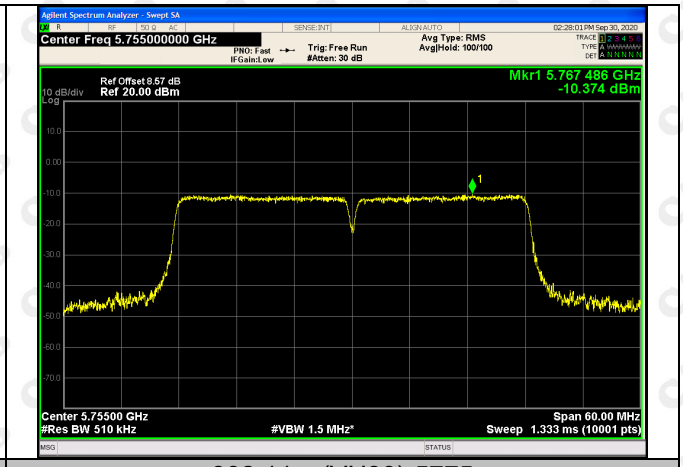

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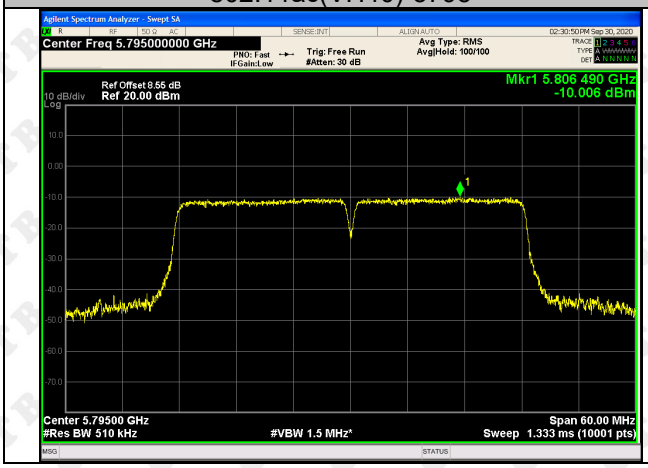

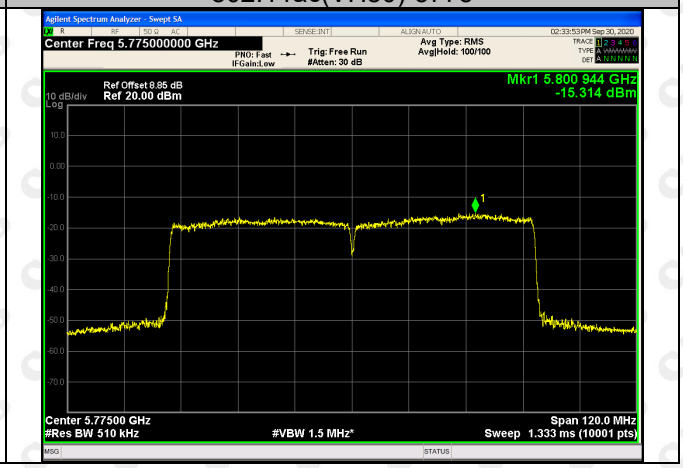

ANT 3

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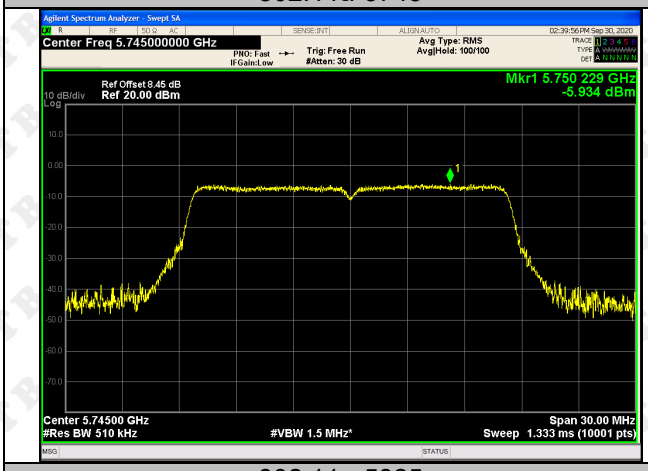

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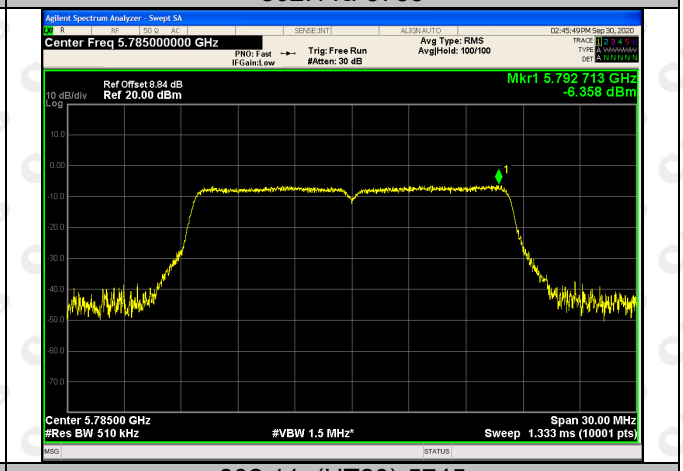

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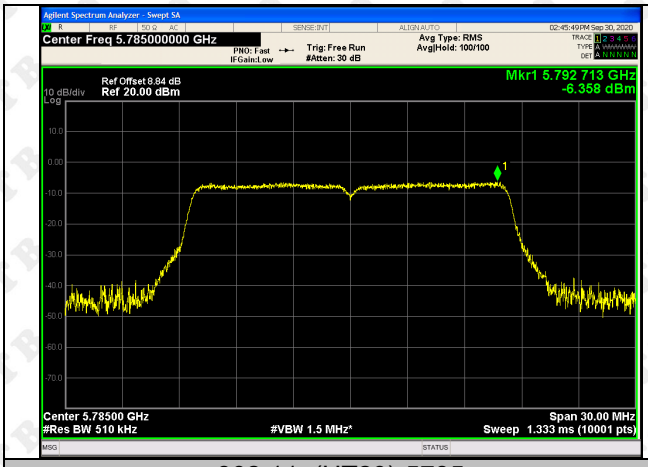

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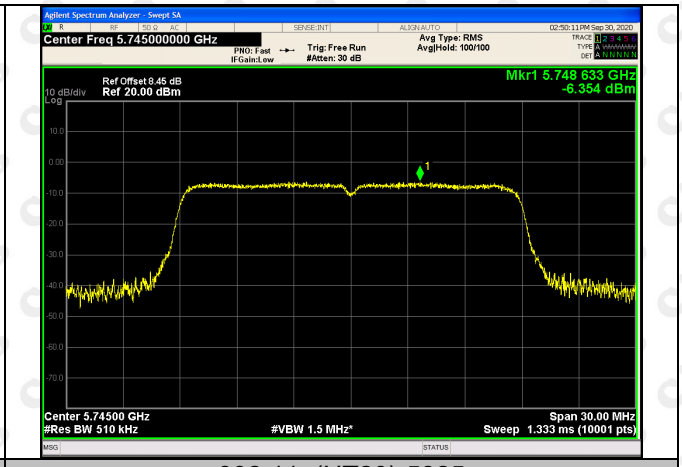

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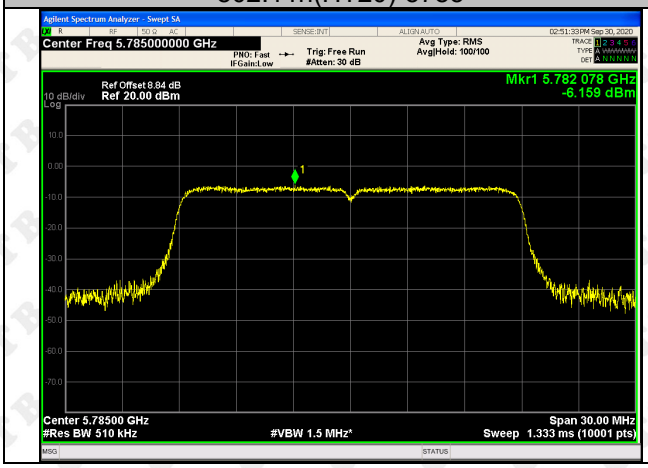

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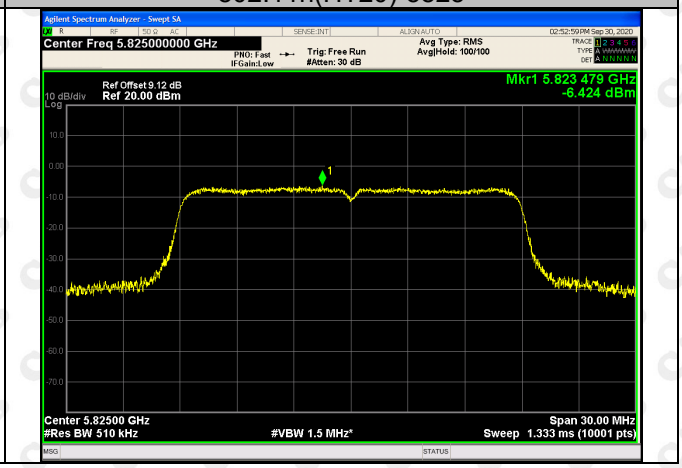

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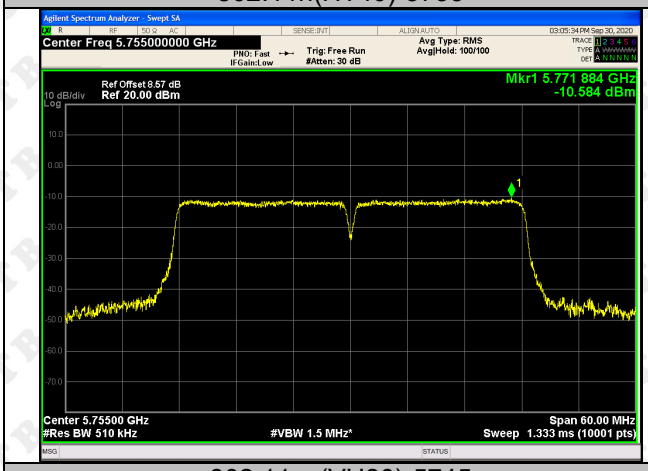

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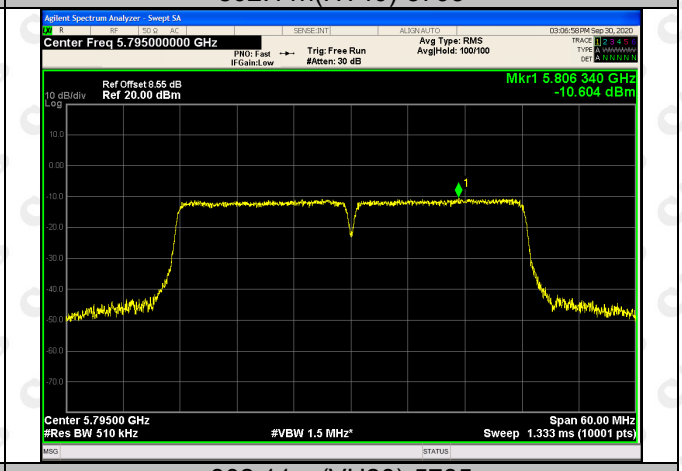

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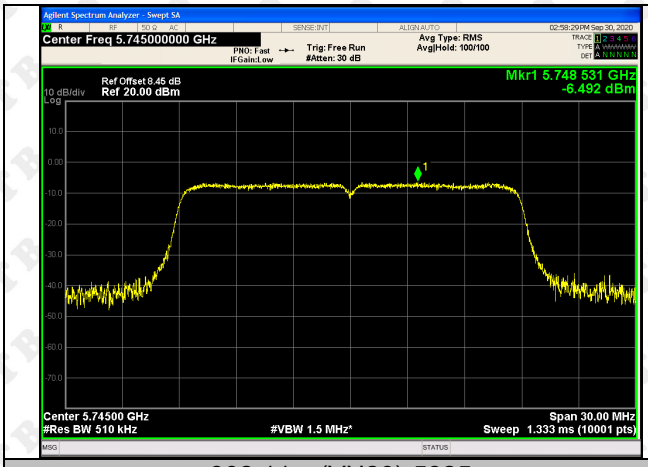

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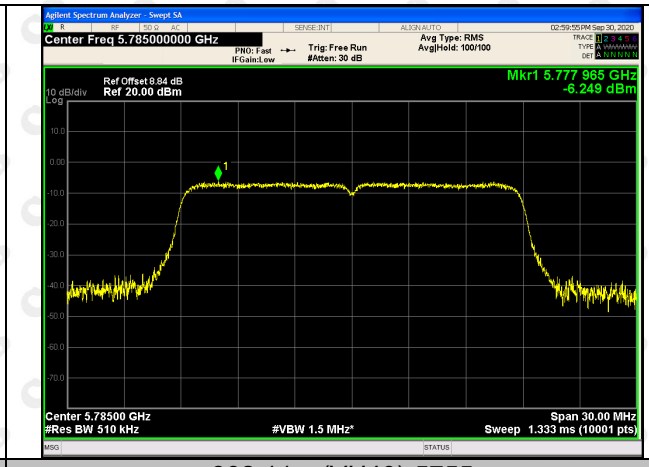

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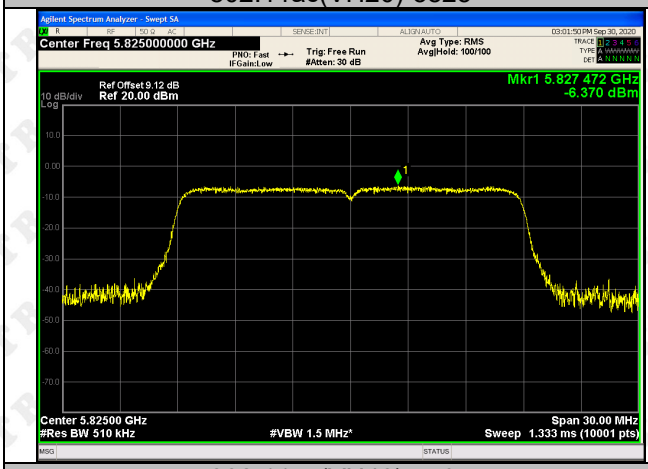

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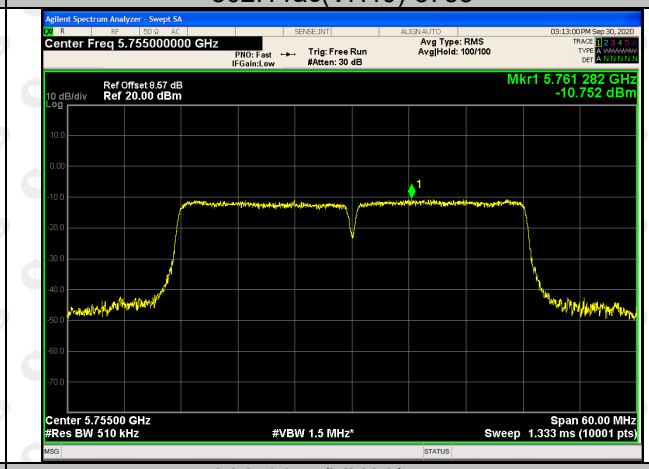

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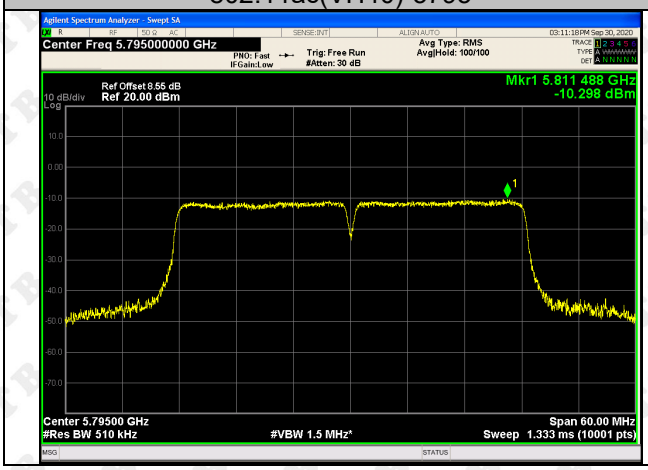
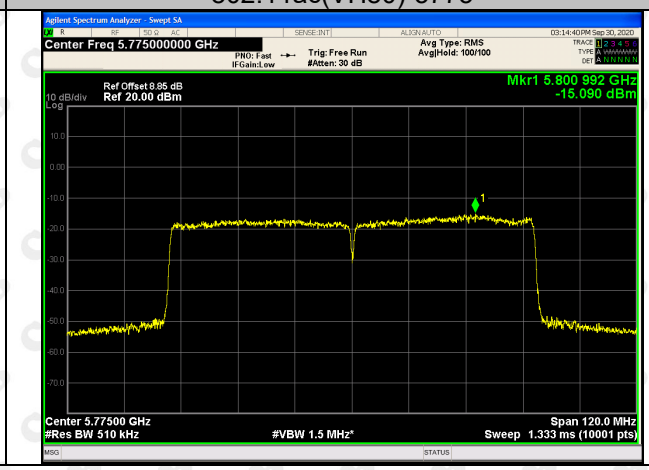
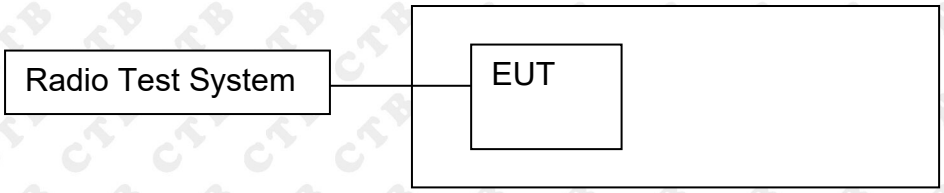




12. FREQUENCY STABILITY

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

Pass

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 ASK message transmitting from remote device and verify whether it shall resend or
discontinue transmission. (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.
15.247(b) (4) requirement:
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

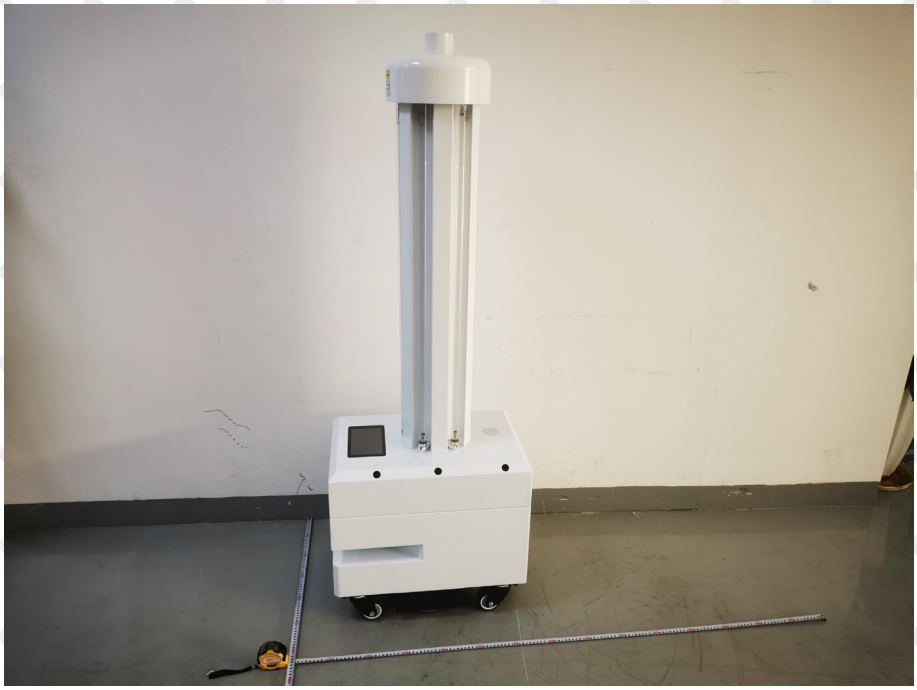
EUT Antenna:

The antenna is Internal Antenna and no consideration of replacement. The best case gain of the antenna is 3.0dBi.

15. EUT PHOTOGRAPHS

EUT Photo 1

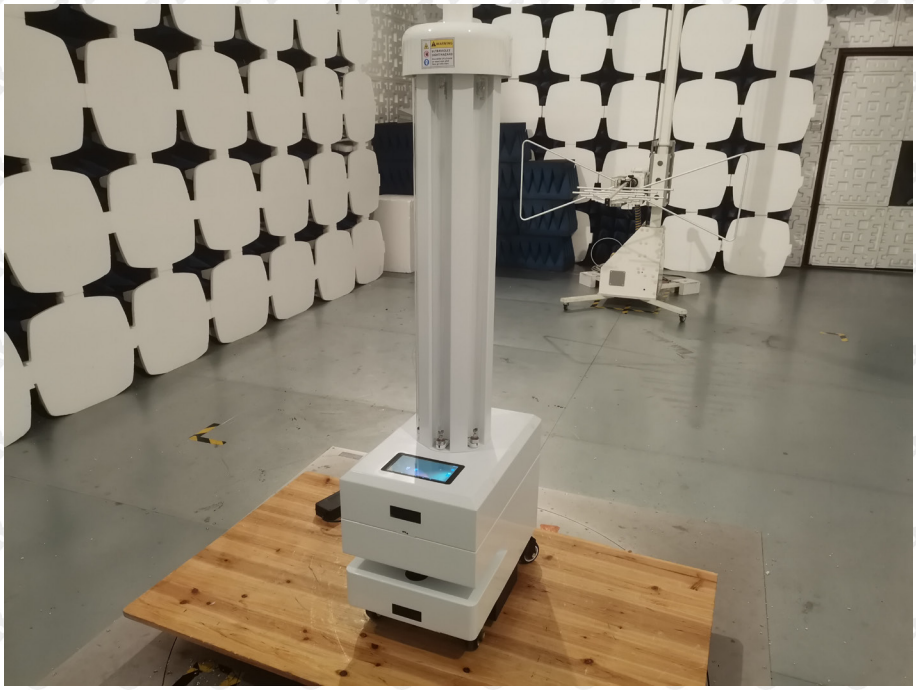
EUT Photo 2



16. EUT TEST SETUP PHOTOGRAPHS

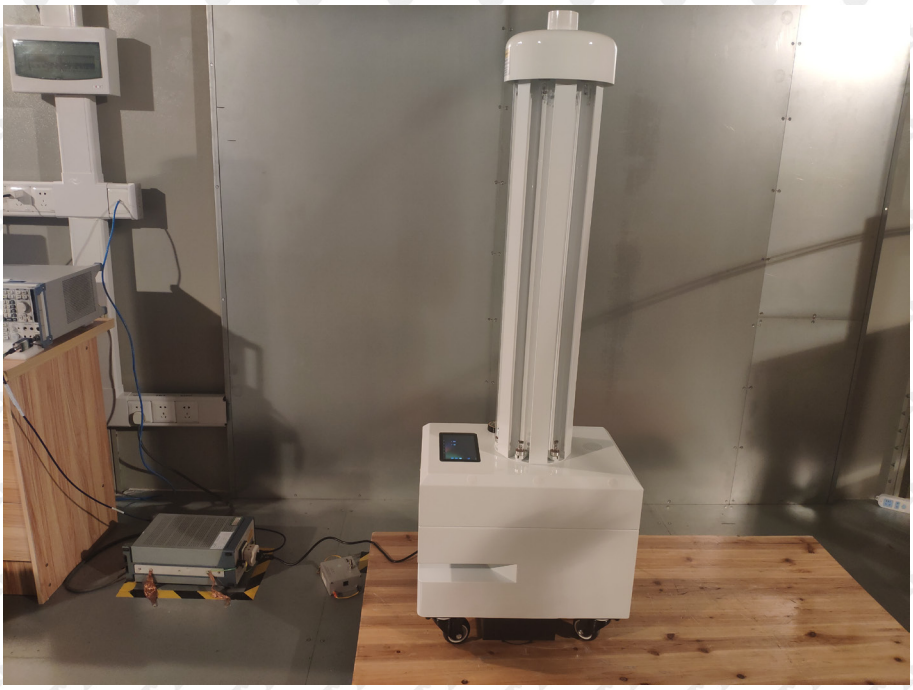
Spurious emissions

Below 1GHz



Above 1GHz

Conducted Emission



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