



7 Emission Bandwidth and Occupied Bandwidth

Test Requirement	: FCC CFR47 Part 15 Section 15.407(a)(e)
Test Method	: ANSI C63.10:2013 According to FCC §15.407(a), 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.
Test Limit	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. As per FCC §15.407(e): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

7.1 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,
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%; 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 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 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 $VBW \geq 3 \cdot RBW$
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.

7.2 Test Result

PASS

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations / data rates and antenna ports.
Following channel was selected for the final test as listed below.

26 dB emission bandwidth:

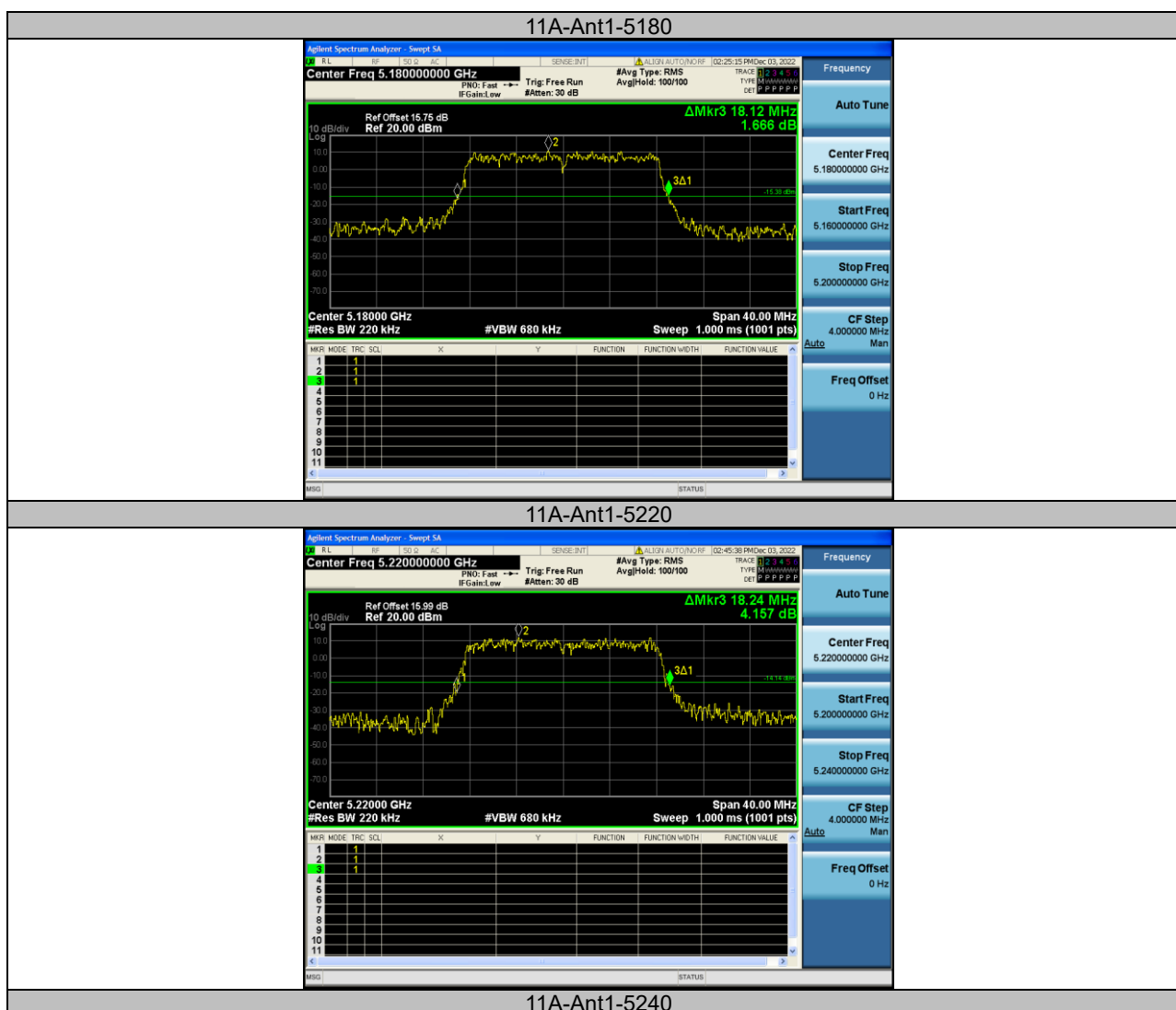
TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	18.120	5170.920	5189.040	---	---
11A	Ant1	5220	18.240	5210.880	5229.120	---	---
11A	Ant1	5240	18.160	5230.880	5249.040	---	---
11A	Ant1	5745	18.000	5735.840	5753.840	---	---
11A	Ant1	5785	17.760	5776.080	5793.840	---	---
11A	Ant1	5825	18.280	5815.800	5834.080	---	---
11A	Ant2	5180	18.160	5170.960	5189.120	---	---
11A	Ant2	5220	18.200	5210.960	5229.160	---	---
11A	Ant2	5240	18.200	5231.000	5249.200	---	---
11A	Ant2	5785	18.160	5775.880	5794.040	---	---
11A	Ant2	5745	18.080	5736.000	5754.080	---	---
11A	Ant2	5825	18.480	5815.720	5834.200	---	---

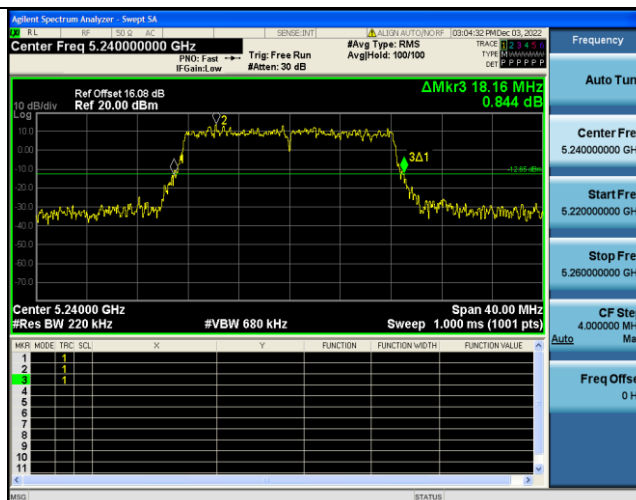


minimum 6 dB bandwidth:

TestMode	Antenna	Frequency[MHz]	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5745	16.120	5736.800	5752.920	0.5	PASS
11A	Ant1	5785	16.320	5776.800	5793.120	0.5	PASS
11A	Ant1	5825	16.400	5816.720	5833.120	0.5	PASS
11A	Ant2	5785	16.400	5776.720	5793.120	0.5	PASS
11A	Ant2	5745	16.360	5736.760	5753.120	0.5	PASS
11A	Ant2	5825	16.320	5816.800	5833.120	0.5	PASS

Test Graphs:





11A-Ant1-5745



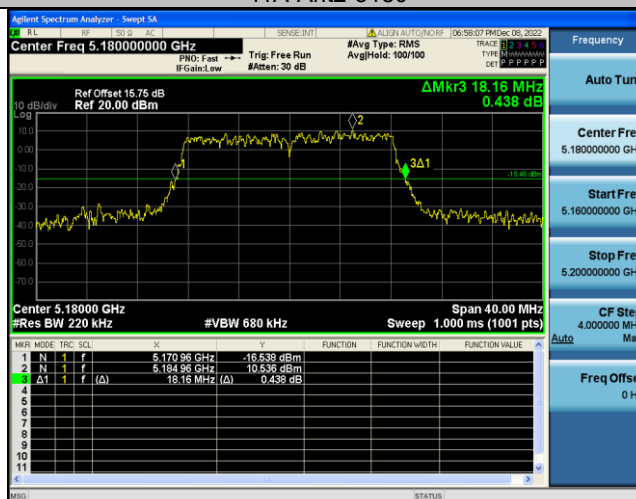
11A-Ant1-5785



11A-Ant1-5825



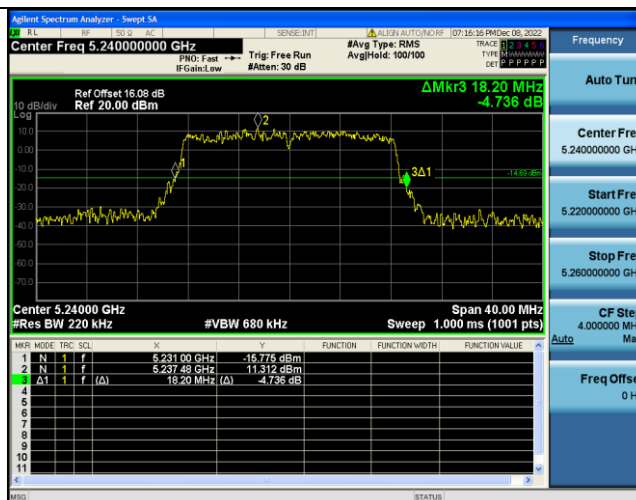
11A-Ant2-5180



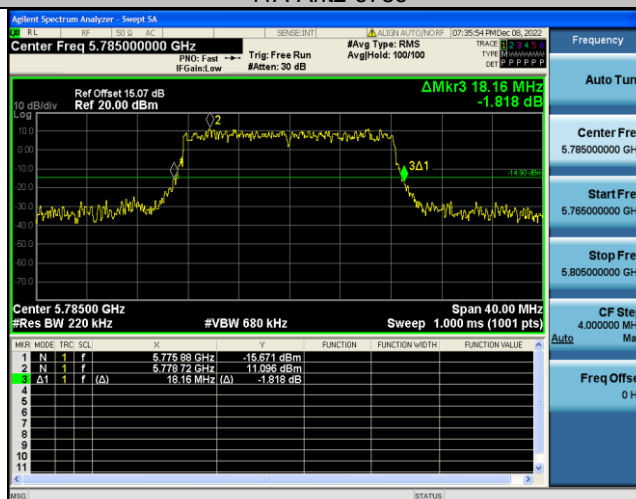
11A-Ant2-5220



11A-Ant2-5240



11A-Ant2-5785



11A-Ant2-5745

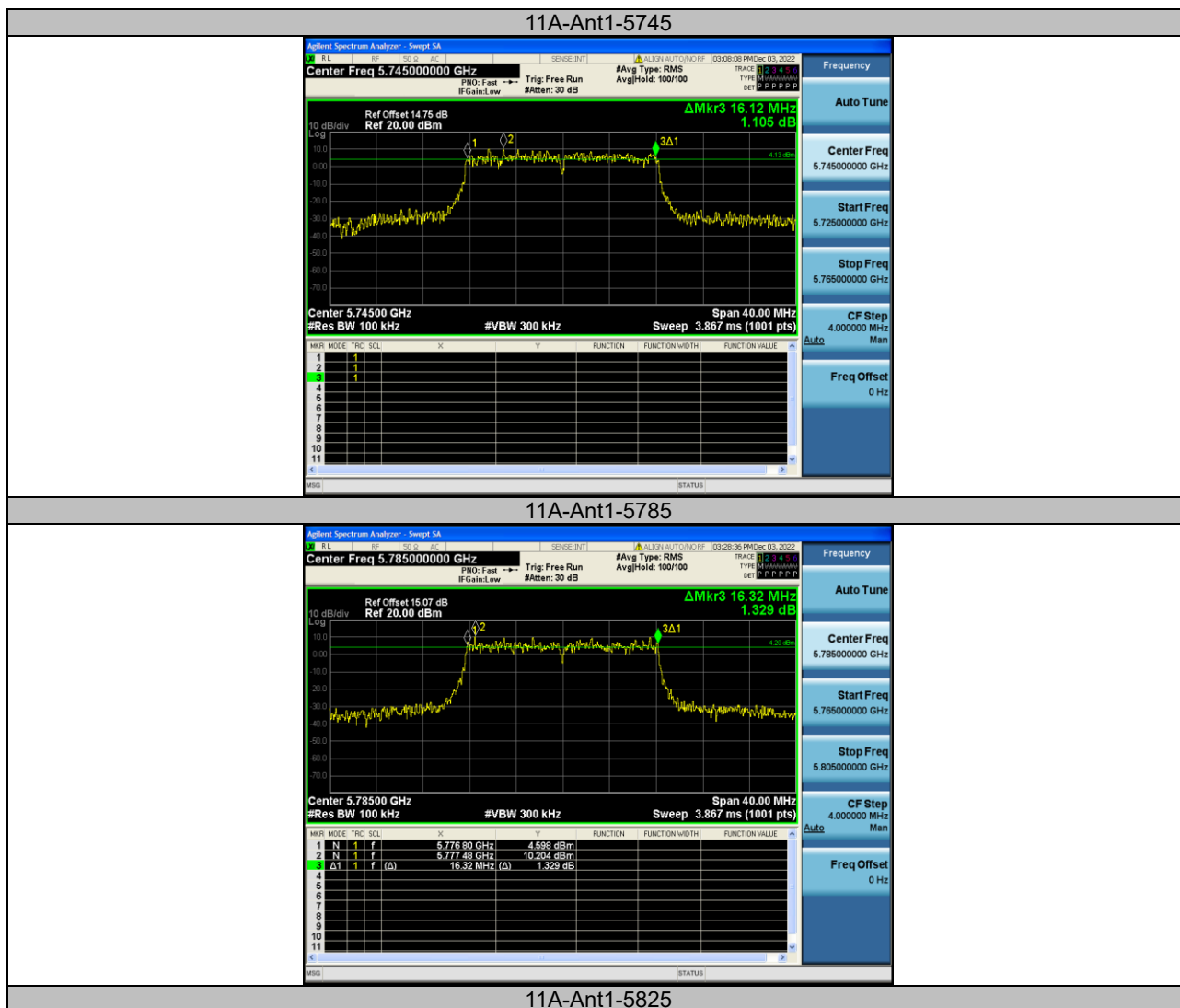


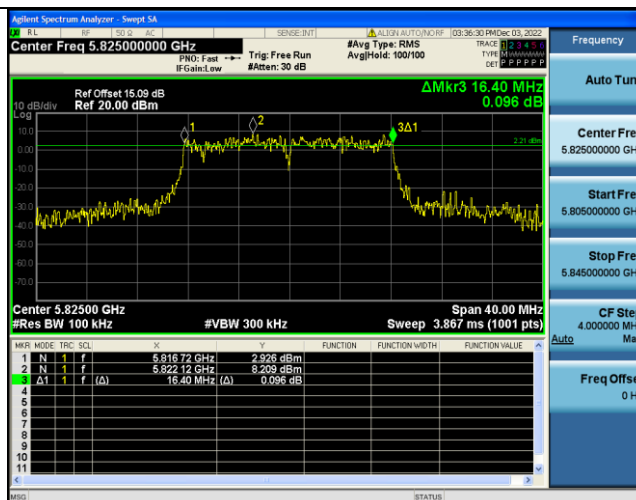
11A-Ant2-5825



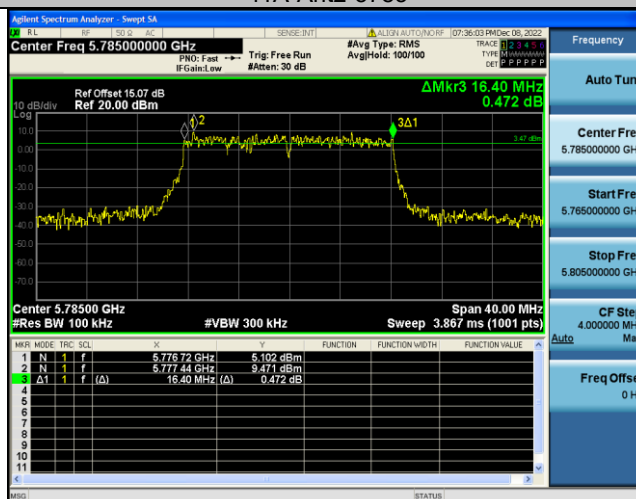


Min emission bandwidth Test Graphs:

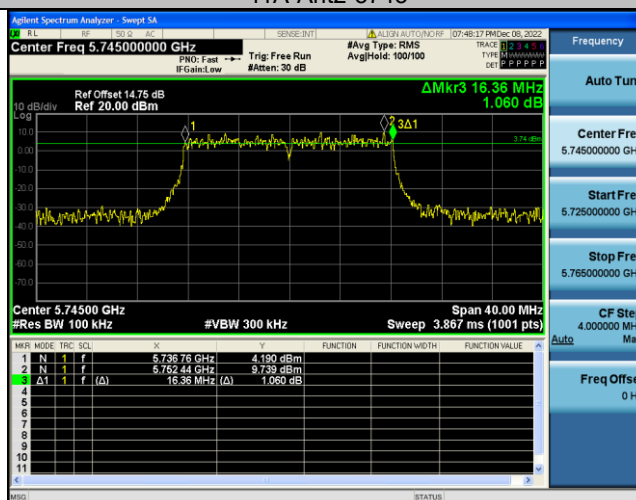




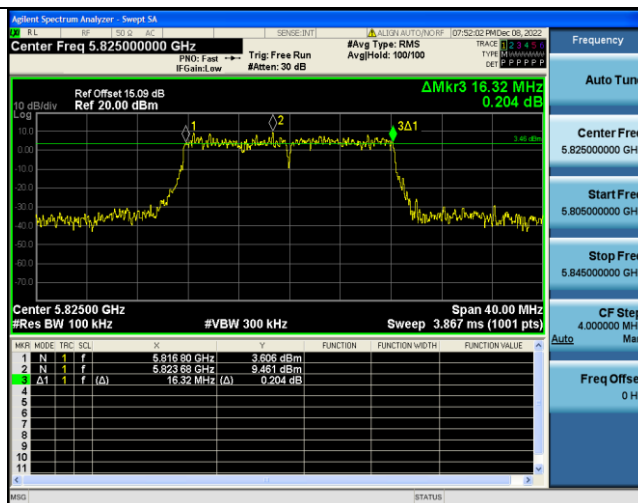
11A-Ant2-5785



11A-Ant2-5745



11A-Ant2-5825





8 Maximum Peak Output Power

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013
Test Limit	: For 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.

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.

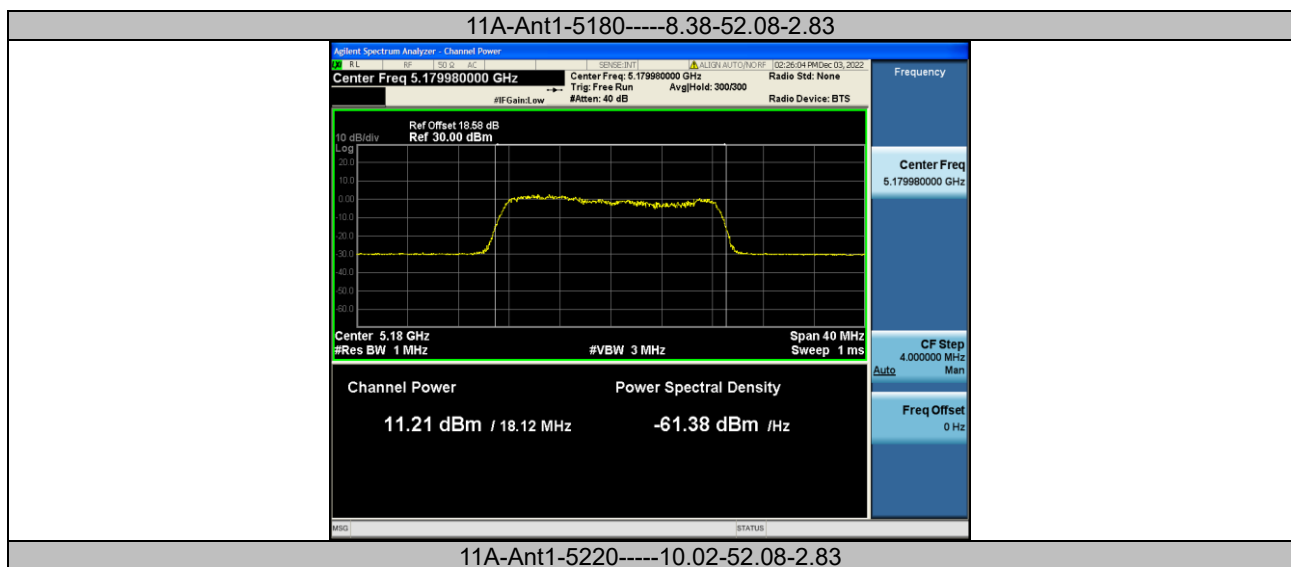
8.1 Test Procedure

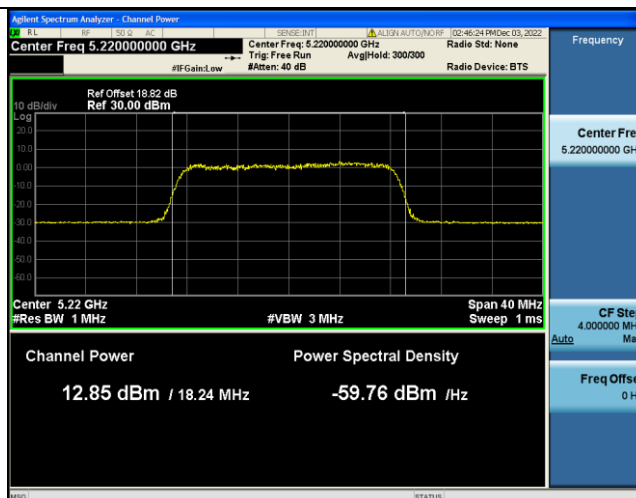
According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, The use Power Meter 1. Place the EUT on a bench and set it in transmitting mode. 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a Power meter.



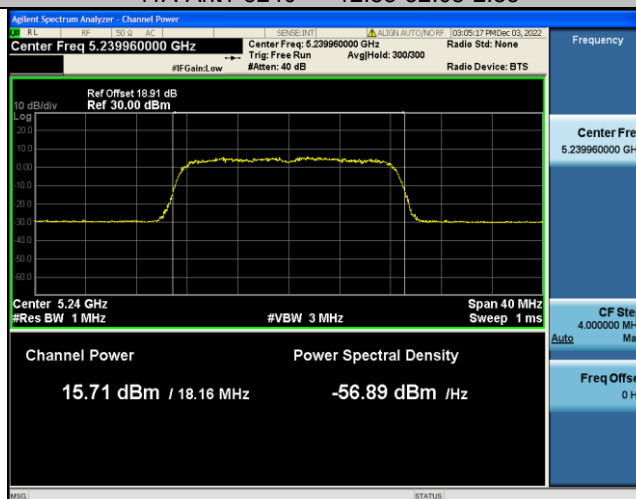
8.2 Test Result

Test Mode	Antenna	Frequency[MHz]	Channel Power [dBm]	Duty Cycle [%]	DC Factor [dBm]	Result [dBm]	Limit [dBm]	Verdict
11A	Ant1	5180	8.38	52.08	2.83	11.21	≤23.98	PASS
11A	Ant1	5220	10.02	52.08	2.83	12.85	≤23.98	PASS
11A	Ant1	5240	12.88	52.08	2.83	15.71	≤23.98	PASS
11A	Ant1	5745	12.28	52.08	2.83	15.11	≤30.00	PASS
11A	Ant1	5785	11.17	52.08	2.83	14.00	≤30.00	PASS
11A	Ant1	5825	10.94	52.08	2.83	13.77	≤30.00	PASS
11A	Ant2	5180	10.50	100.00	0.00	10.50	≤23.98	PASS
11A	Ant2	5220	10.84	52.08	2.83	13.67	≤23.98	PASS
11A	Ant2	5240	11.63	52.08	2.83	14.46	≤23.98	PASS
11A	Ant2	5785	12.03	52.08	2.83	14.86	≤30.00	PASS
11A	Ant2	5745	10.95	52.08	2.83	13.78	≤30.00	PASS
11A	Ant2	5825	11.27	52.08	2.83	14.10	≤30.00	PASS

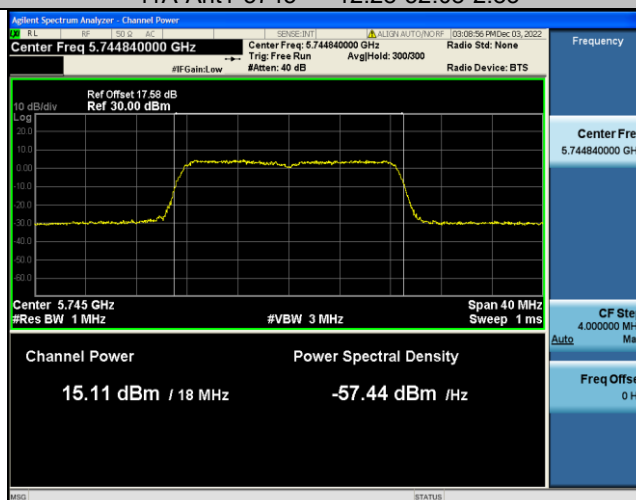




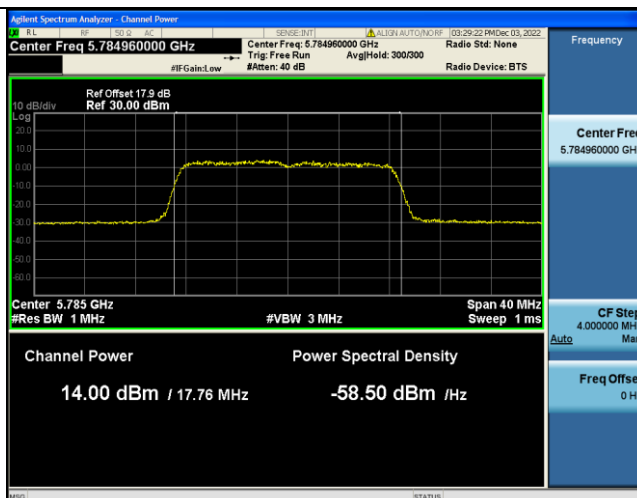
11A-Ant1-5240-----12.88-52.08-2.83



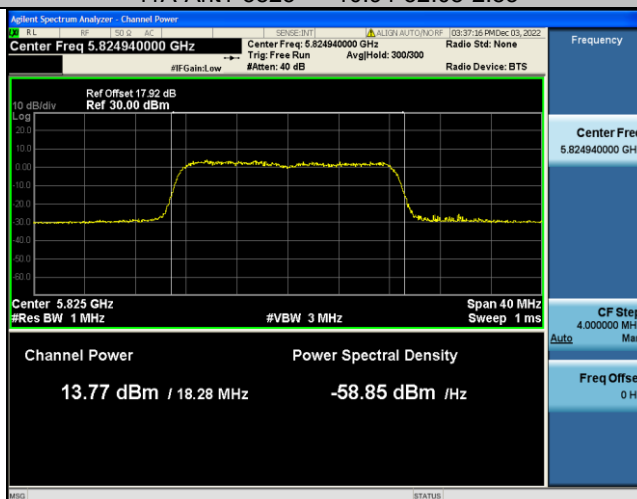
11A-Ant1-5745-----12.28-52.08-2.83



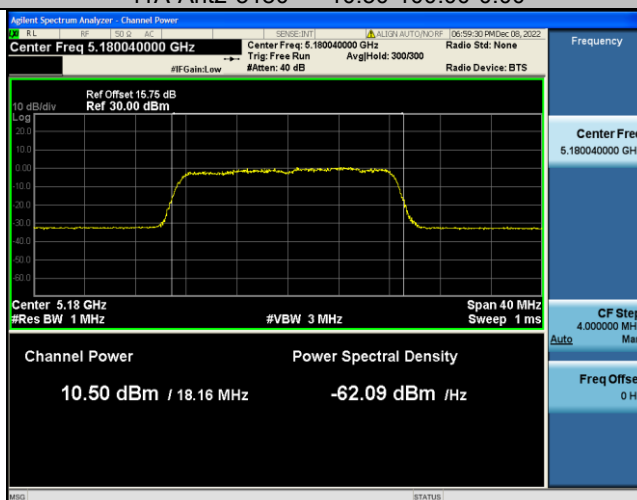
11A-Ant1-5785-----11.17-52.08-2.83



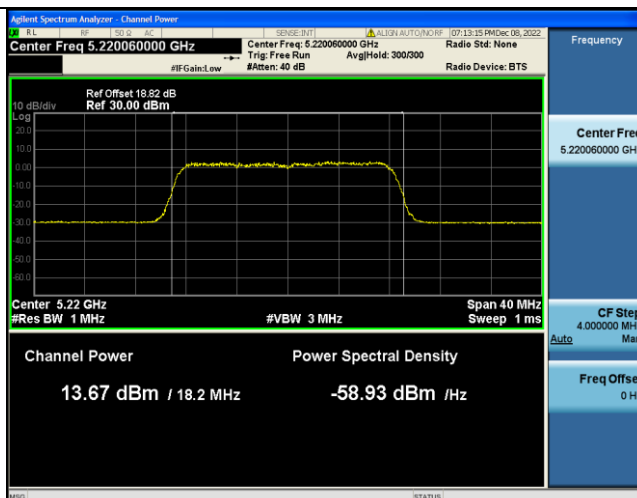
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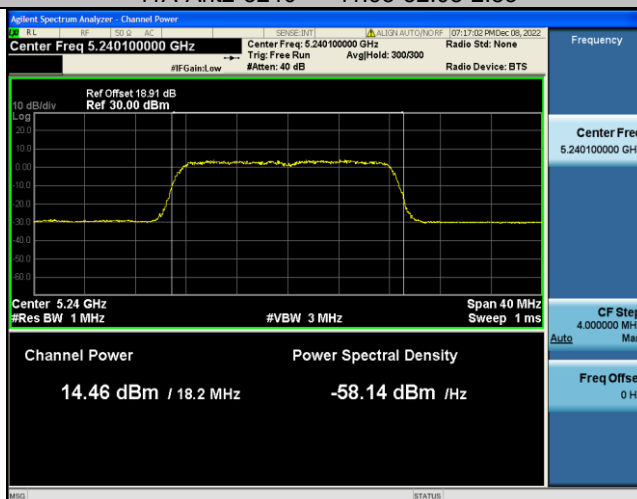
11A-Ant2-5180-----10.50-100.00-0.00



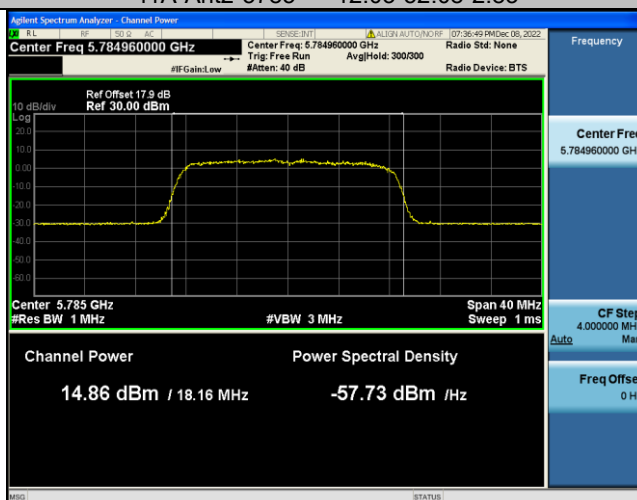
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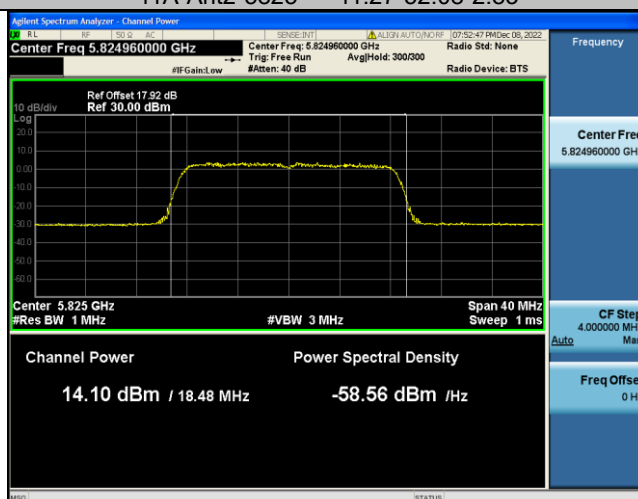
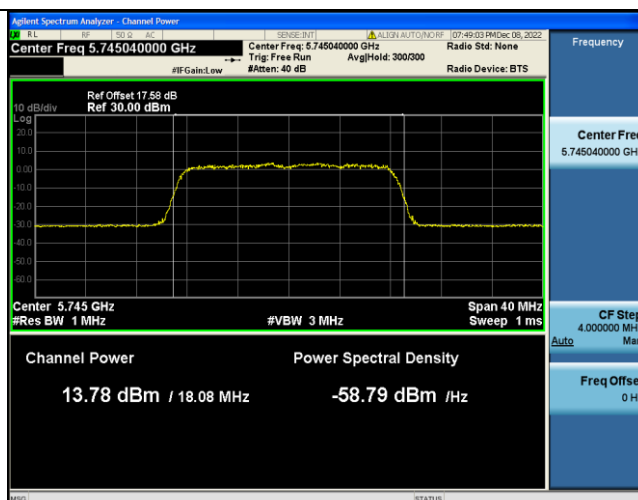
11A-Ant2-5240-----11.63-52.08-2.83



11A-Ant2-5785-----12.03-52.08-2.83



11A-Ant2-5745-----10.95-52.08-2.83





9 Power Spectral density

Test Requirement	: FCC CFR47 Part 15 Section 15.2407(a)
Test Method	: ANSI C63.10:2013
Test Limit	: For 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.. 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-kHzband. 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



9.1 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 and ANSI 63.10: 2013 Sec 10.3.7. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above 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 a 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 the RBW to 1 MHz.
- b) Set the VBW to be at least 1 MHz (a VBW of 3 MHz is desirable).
- c) Set the frequency span to examine the spectrum across a convenient frequency segment (e.g., 600 MHz).
- d) Select the power averaging (rms) detector.
- e) Set the sweep time so that there is no more than a 1 ms integration period over each measurement bin.
- f) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.



9.2 Test Result

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations / data rates and antenna ports.

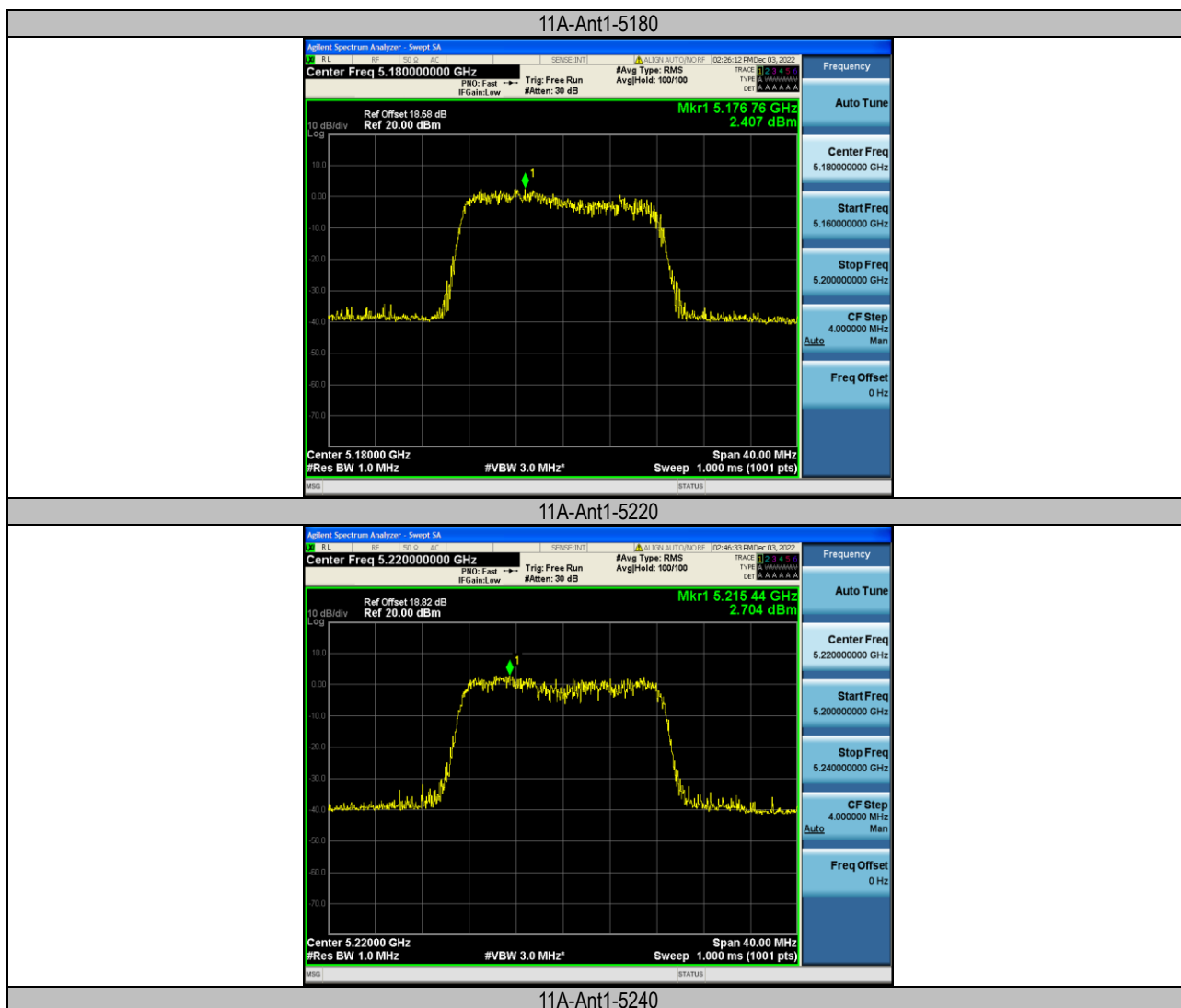
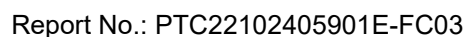
Following channel was selected for the final test as listed below

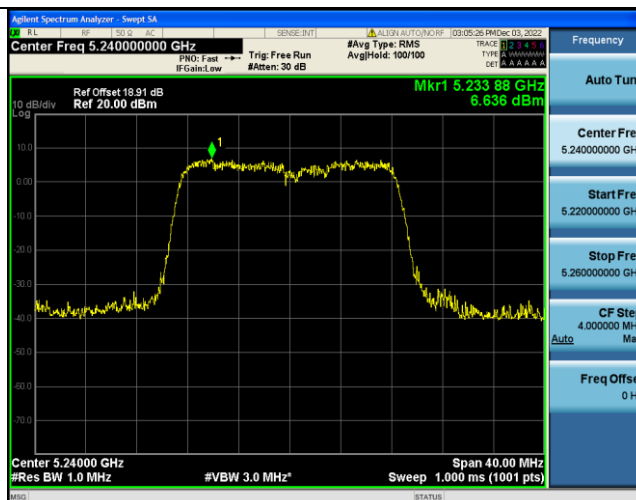
TestMode	Antenna	Frequency[MHz]	Result [dBm/MHz]	Duty Cycle [%]	DC Factor [dBm]	Final Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	2.41	52.08	2.83	5.24	≤11.00	PASS
11A	Ant1	5220	2.7	52.08	2.83	5.53	≤11.00	PASS
11A	Ant1	5240	6.64	52.08	2.83	9.47	≤11.00	PASS
11A	Ant1	5745	5.18	52.08	2.83	8.01	≤30.00	PASS
11A	Ant1	5785	5.48	52.08	2.83	8.31	≤30.00	PASS
11A	Ant1	5825	5.12	52.08	2.83	7.95	≤30.00	PASS
11A	Ant2	5180	1.31	100.00	0.00	1.31	≤11.00	PASS
11A	Ant2	5220	4.84	52.08	2.83	7.67	≤11.00	PASS
11A	Ant2	5240	5.26	52.08	2.83	8.09	≤11.00	PASS
11A	Ant2	5785	5.74	52.08	2.83	8.57	≤30.00	PASS
11A	Ant2	5745	4.63	52.08	2.83	7.46	≤30.00	PASS
11A	Ant2	5825	5.00	52.08	2.83	7.83	≤30.00	PASS

Note: 1.The Result and Limit Unit is dBm/500 kHz in the band 5.725–5.85 GHz.

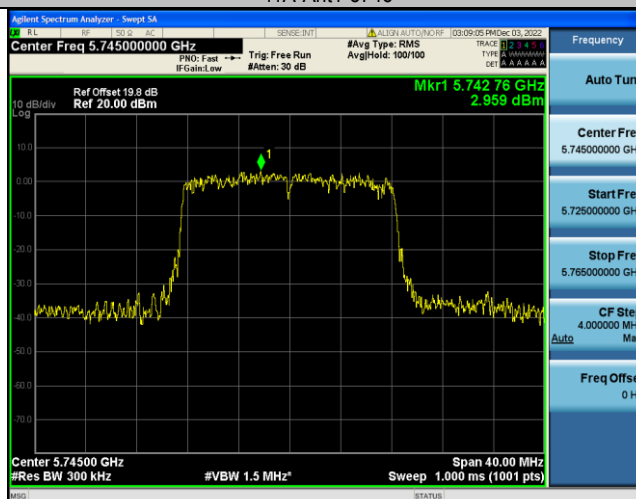
2. in the band 5.725–5.85 GHz the test RBW select 300KHz,so the measured result corrected by $\text{Result} + 10 \log(500 \text{ kHz}/300\text{kHz})$.

3. DC Factor= $[10 \log(1 / D)]$, where D is the duty cycle.

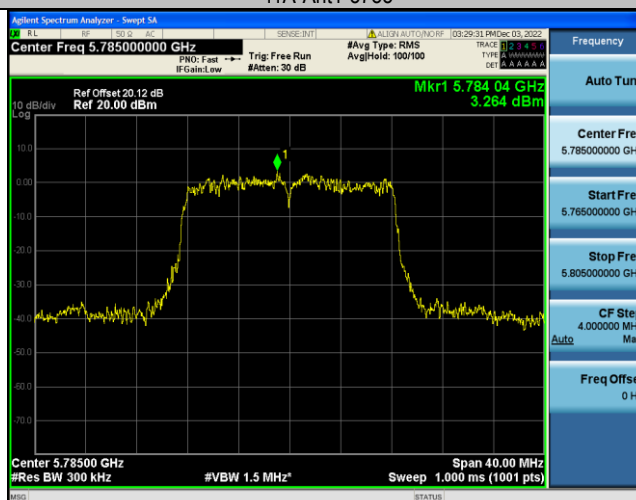




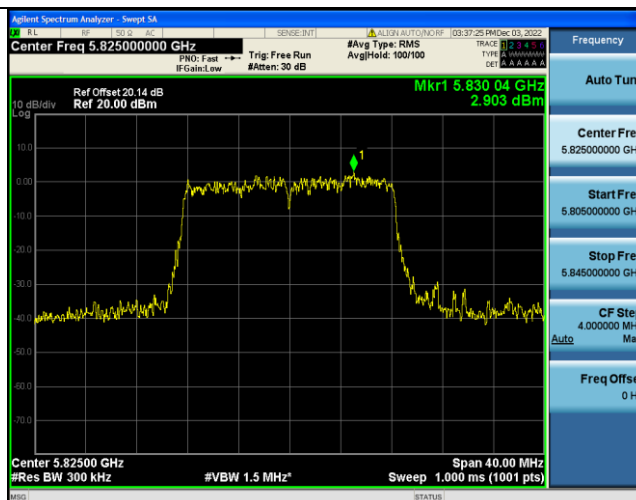
11A-Ant1-5745



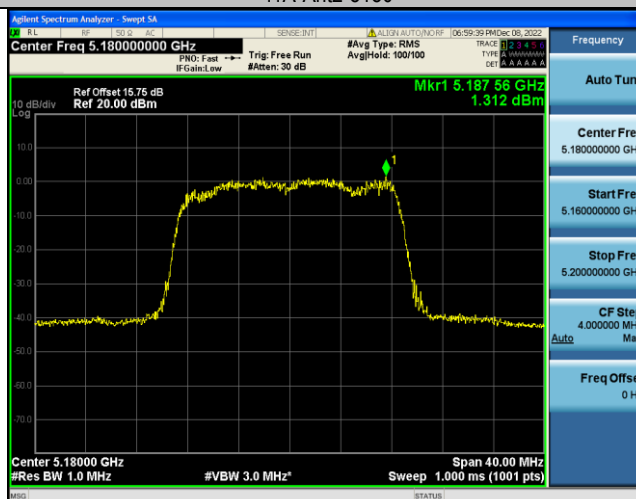
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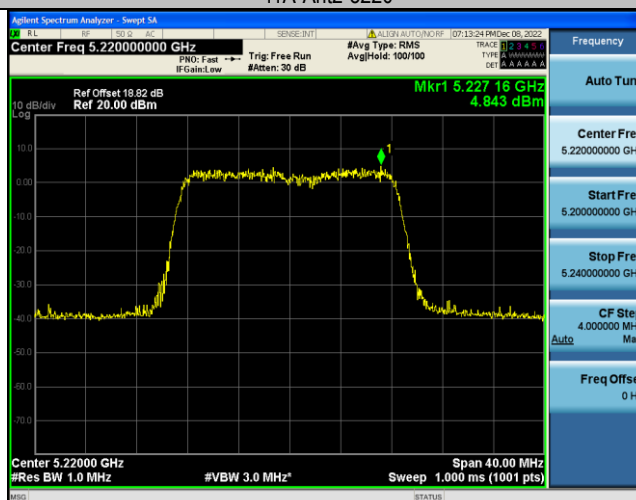
11A-Ant1-5825



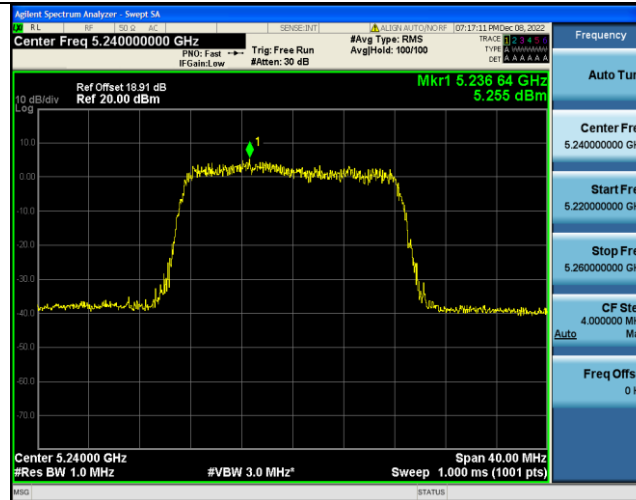
11A-Ant2-5180



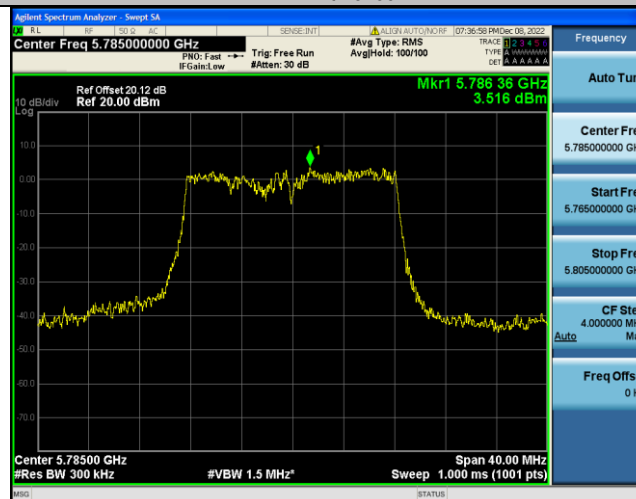
11A-Ant2-5220



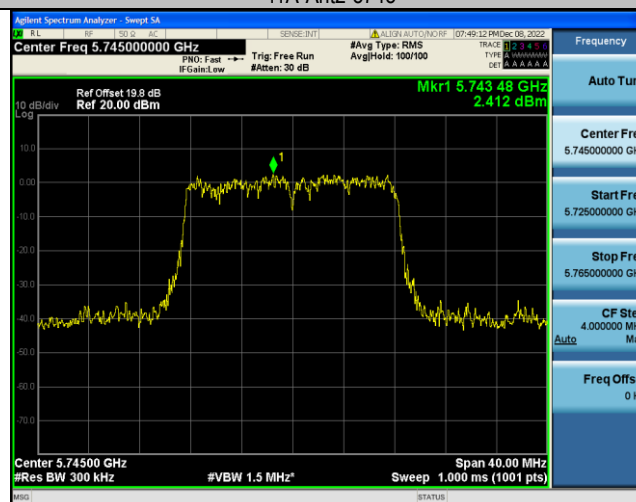
11A-Ant2-5240



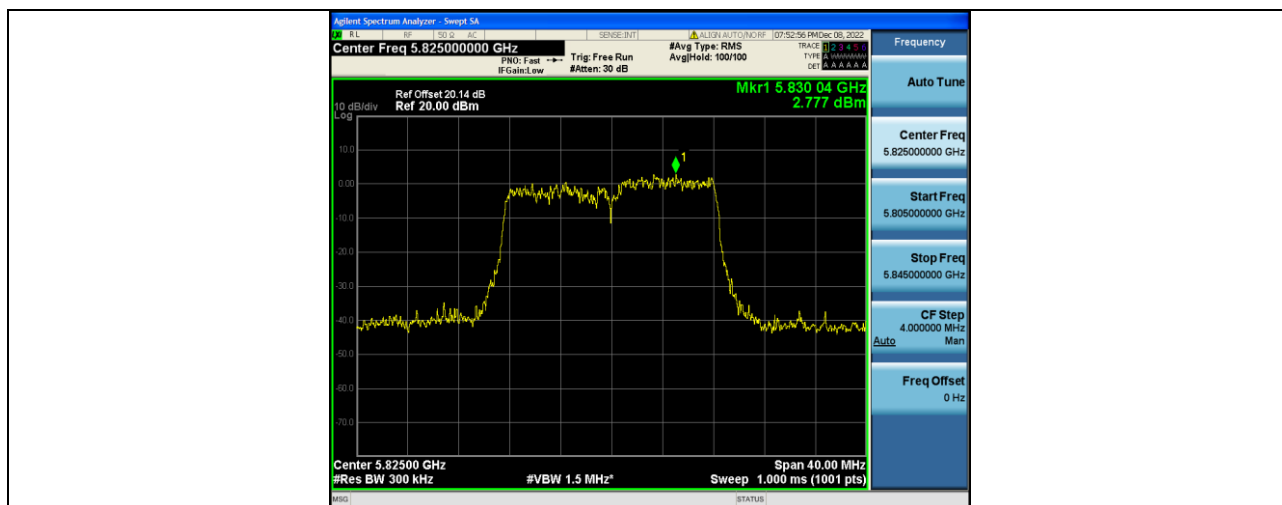
11A-Ant2-5785



11A-Ant2-5745



11A-Ant2-5825





9.3 Antenna Requirement

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.407 (a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.4 Result

The EUT'S antenna, permanent attached antenna, is Directly connected external Antenna. The antenna's gain is 5.18 dBi and meets the requirement.



10 Frequency Stability

Test Requirement : FCC Part15 E Section 15.407 (g)

Test 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.

10.1 Test Procedure

1. The EUT is installed in an environment test chamber with external power source.
2. Set the chamber to operate at 50 centigrade and external power source to output at nominal voltage of EUT.
3. A sufficient stabilization period at each temperature is used prior to each frequency measurement.
4. When temperature is stabled, measure the frequency stability.
5. The test shall be performed under -30 to 50 centigrade and 85 to 115 percent of the nominal voltage. Change setting of chamber and external power source to complete all conditions.

10.2 Test Result



Voltage								
TestMode	Antenna	Frequency [MHz]	Voltage [Vdc]	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
11A	Ant1	5180	NV	NT	37000	7.142857	20	PASS
			LV	NT	33000	6.370656	20	PASS
			HV	NT	43000	8.301158	20	PASS
		5220	NV	NT	44000	8.494208	20	PASS
			LV	NT	42000	8.108108	20	PASS
			HV	NT	32000	6.177606	20	PASS
		5240	NV	NT	40000	7.722008	20	PASS
			LV	NT	41000	7.915058	20	PASS
			HV	NT	38000	7.335907	20	PASS
		5745	NV	NT	34000	6.513410	20	PASS
			LV	NT	46000	8.812261	20	PASS
			HV	NT	39000	7.471264	20	PASS
		5785	NV	NT	41000	7.854406	20	PASS
			LV	NT	32000	6.130268	20	PASS
			HV	NT	43000	8.237548	20	PASS
		5825	NV	NT	37000	7.088123	20	PASS
			LV	NT	41000	7.854406	20	PASS
			HV	NT	34000	6.513410	20	PASS

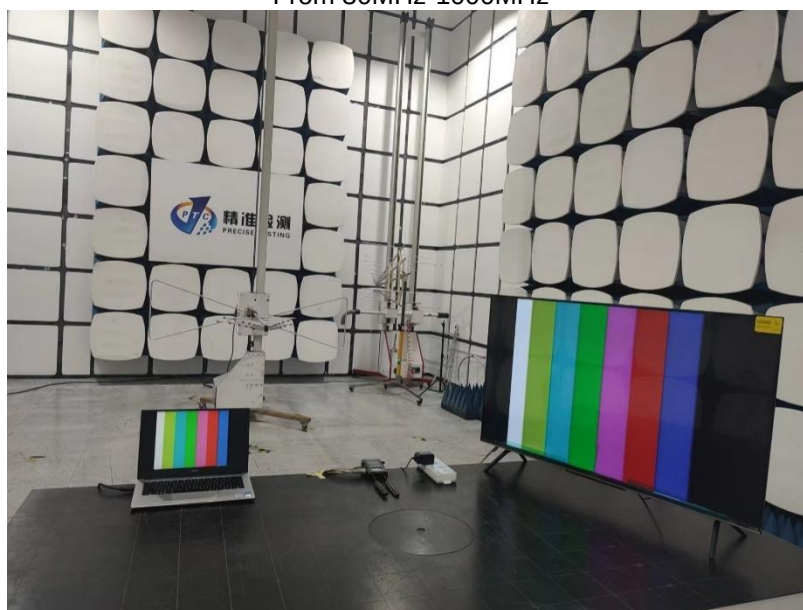
Voltage								
TestMode	Antenna	Frequency [MHz]	Voltage [Vdc]	Temperature (°C)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
11A	Ant2	5180	NV	NT	37000	7.142857	20	PASS
			LV	NT	48000	9.266409	20	PASS
			HV	NT	40000	7.722008	20	PASS
		5220	NV	NT	44000	8.429119	20	PASS
			LV	NT	39000	7.471264	20	PASS
			HV	NT	32000	6.130268	20	PASS
		5240	NV	NT	49000	9.351145	20	PASS
			LV	NT	31000	5.916031	20	PASS
			HV	NT	40000	7.633588	20	PASS
		5745	NV	NT	46000	8.006963	20	PASS
			LV	NT	40000	6.962576	20	PASS
			HV	NT	45000	7.832898	20	PASS
		5785	NV	NT	46000	8.006963	20	PASS
			LV	NT	40000	6.962576	20	PASS
			HV	NT	45000	7.832898	20	PASS
		5825	NV	NT	49000	8.412017	20	PASS
			LV	NT	46000	7.896996	20	PASS
			HV	NT	43000	7.381974	20	PASS

11 Test Setup

Conducted Emissions

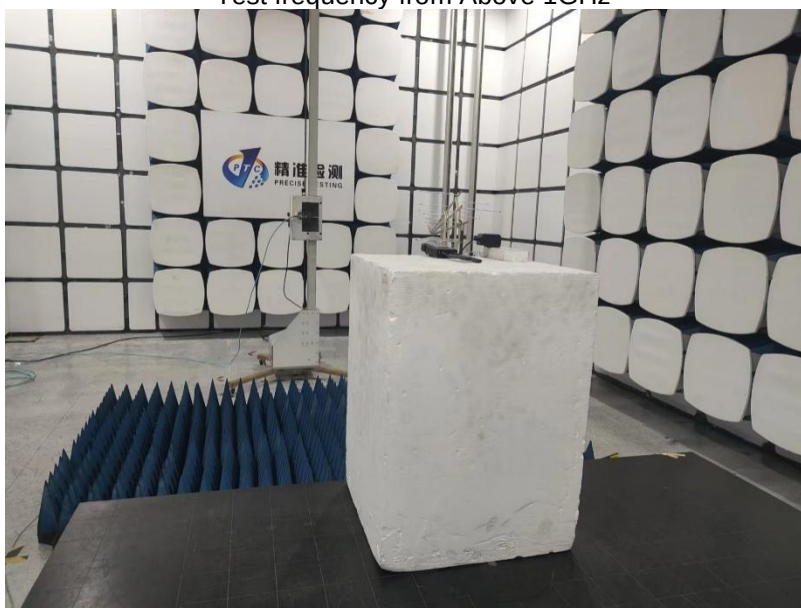


Radiated Spurious Emissions
From 30MHz-1000MHz





Test frequency from Above 1GHz

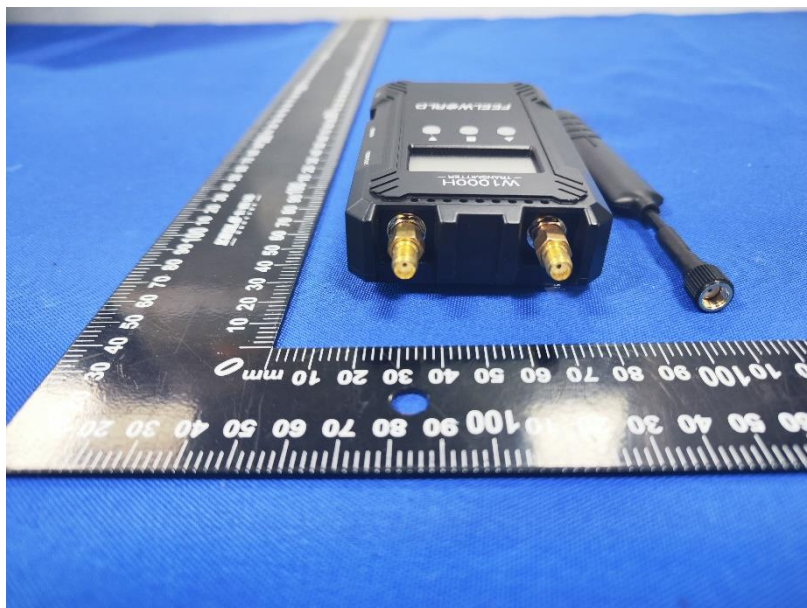


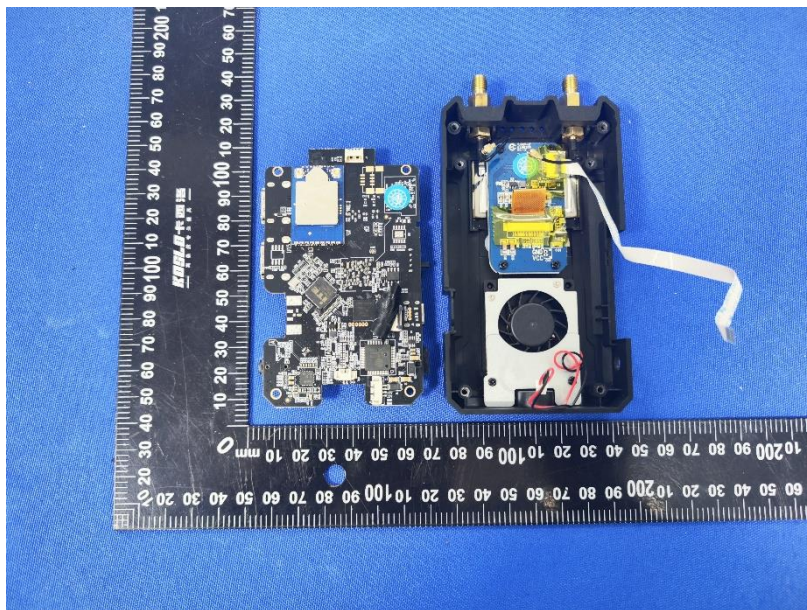
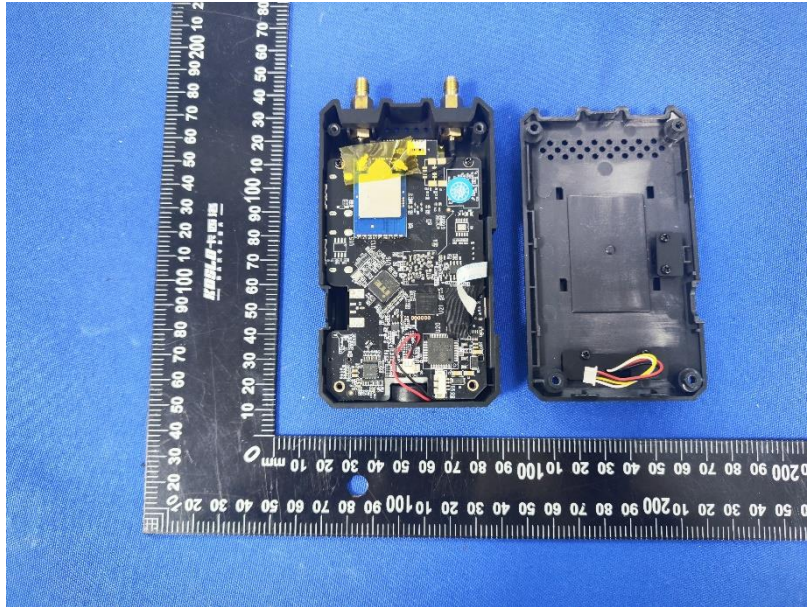
12 EUT PHOTOS

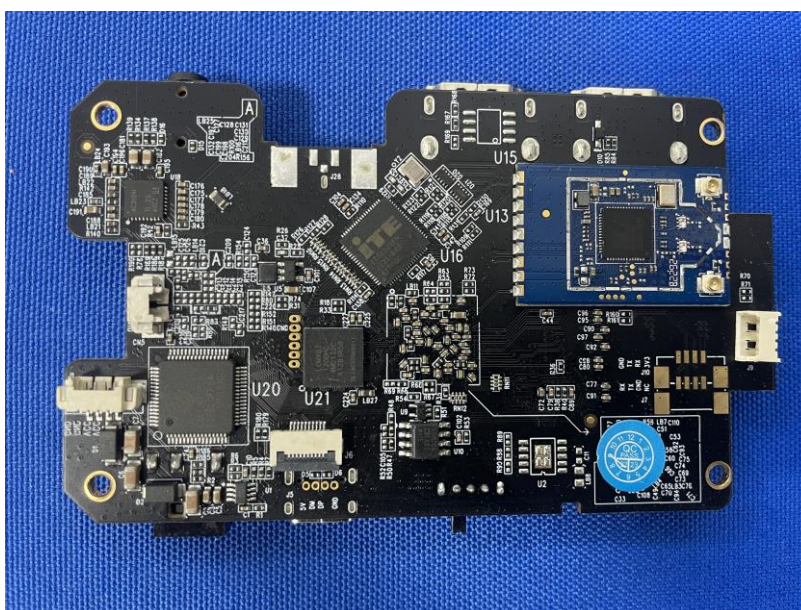
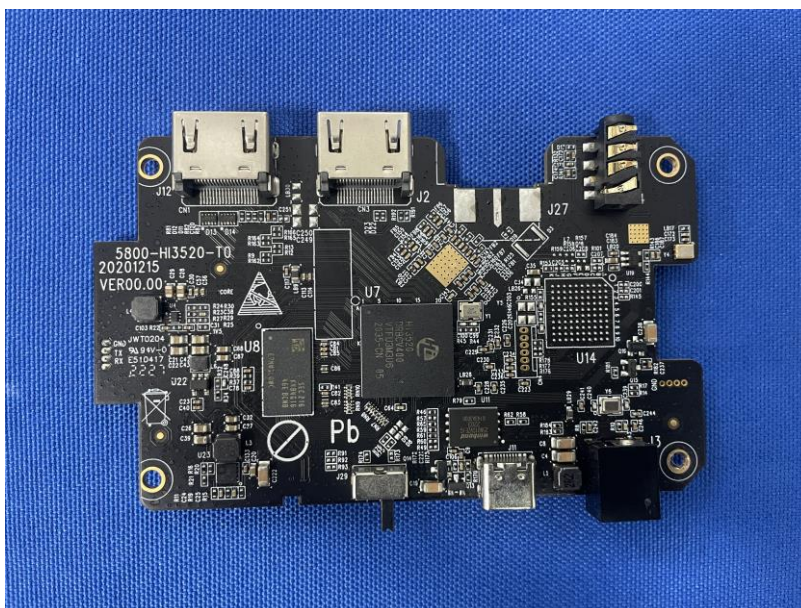


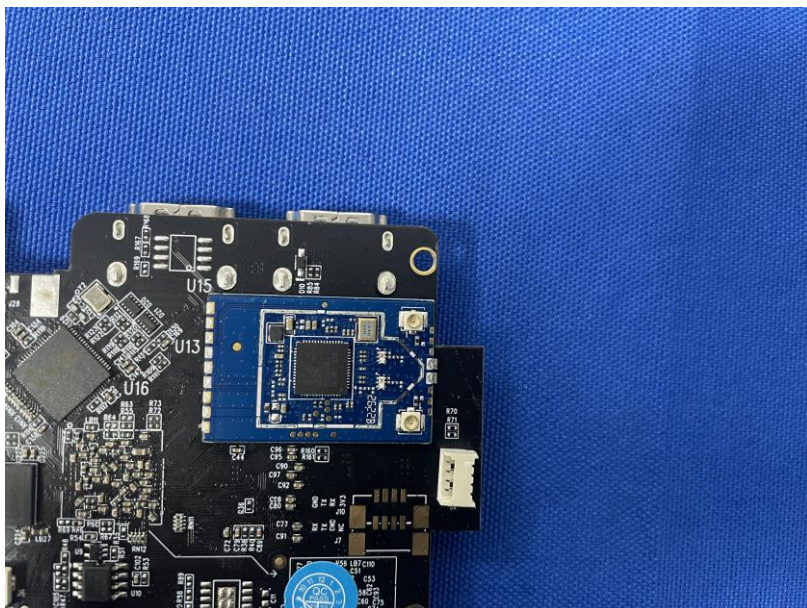


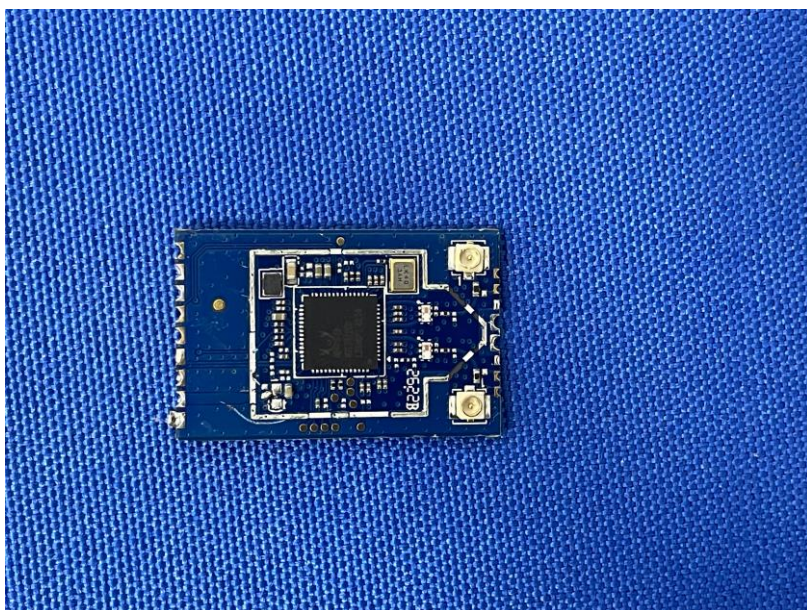
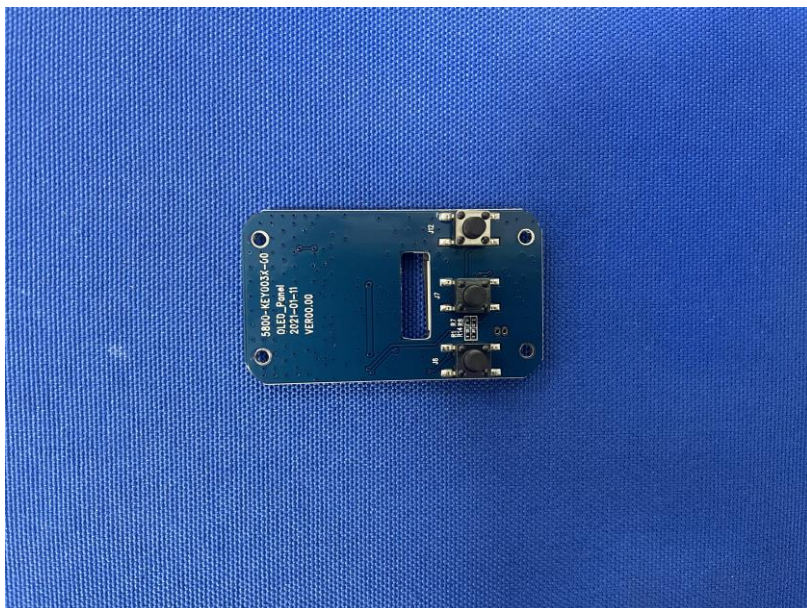


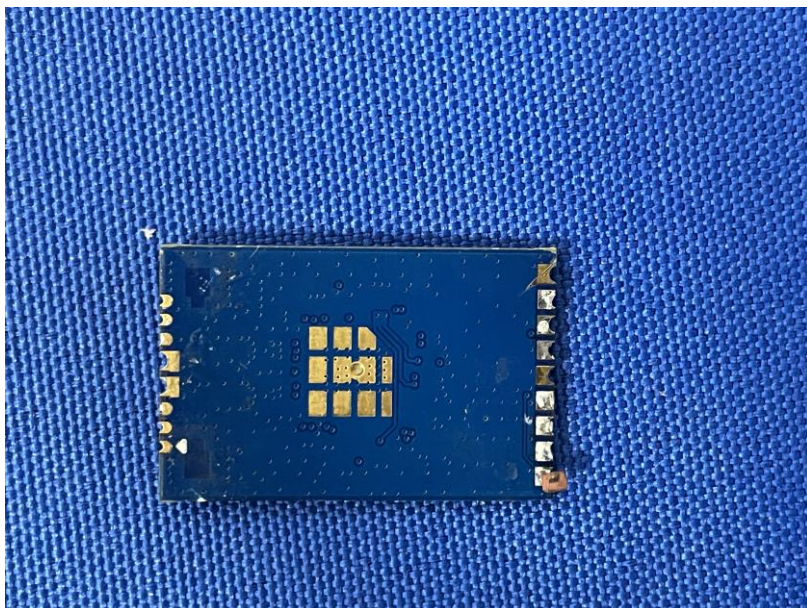












*******THE END REPORT*******