



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:

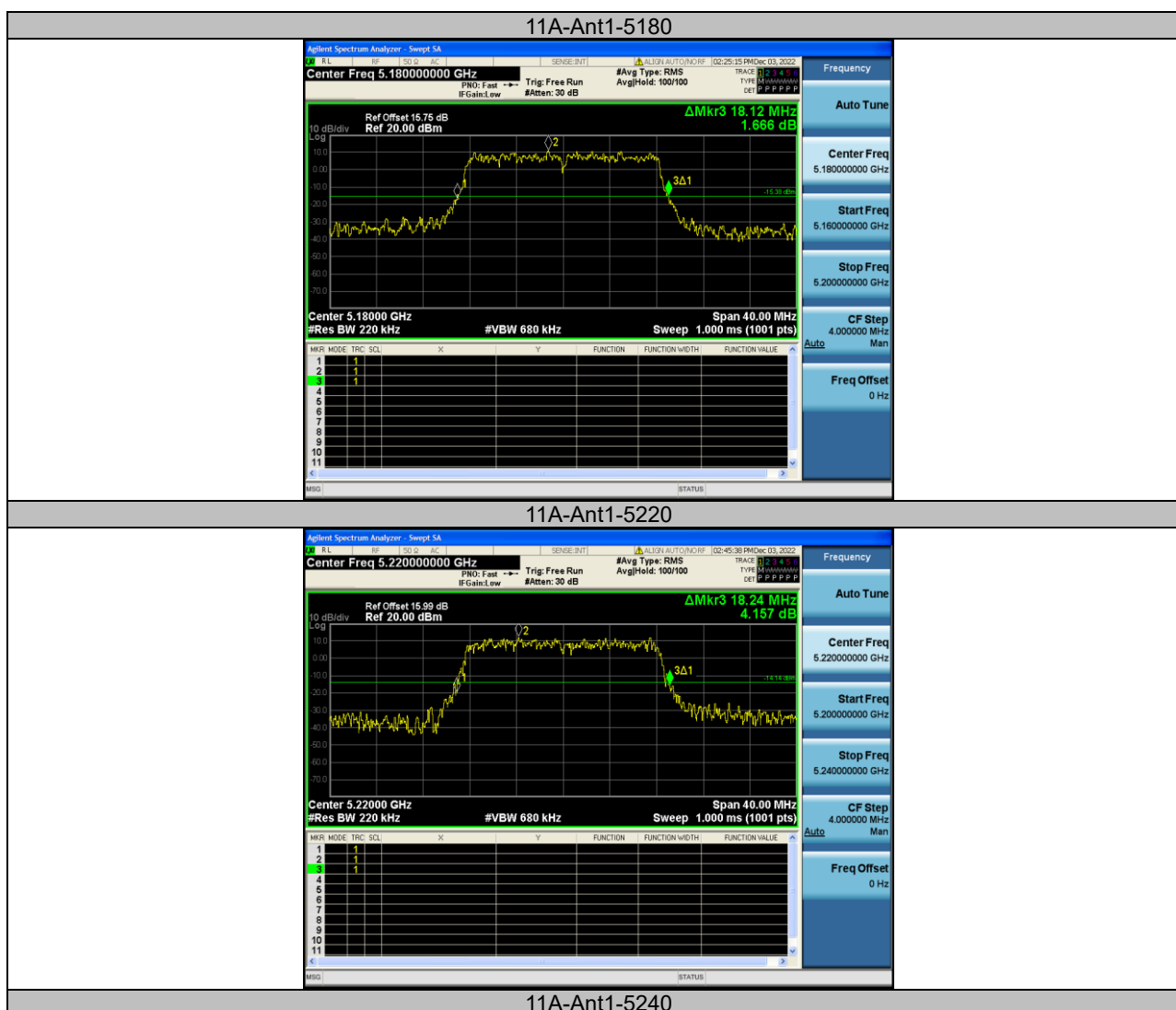
| TestMode | Antenna | Frequency[MHz] | 26db EBW [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|----------------|----------------|----------|----------|------------|---------|
| 11A | Ant1 | 5180 | 18.120 | 5170.920 | 5189.040 | --- | --- |
| 11A | Ant1 | 5220 | 18.240 | 5210.880 | 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 | --- | --- |

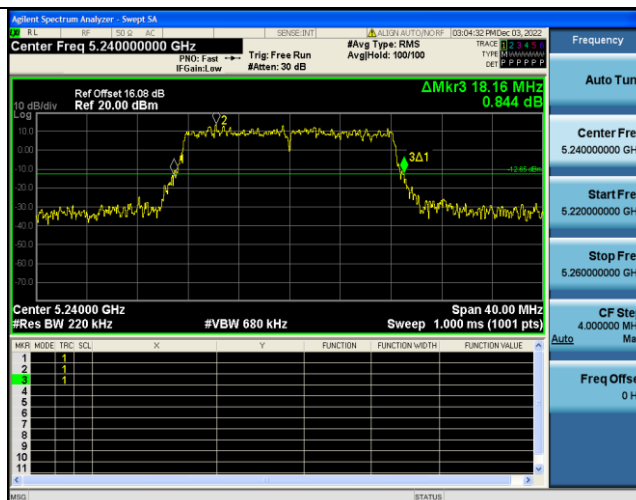


minimum 6 dB bandwidth:

| 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



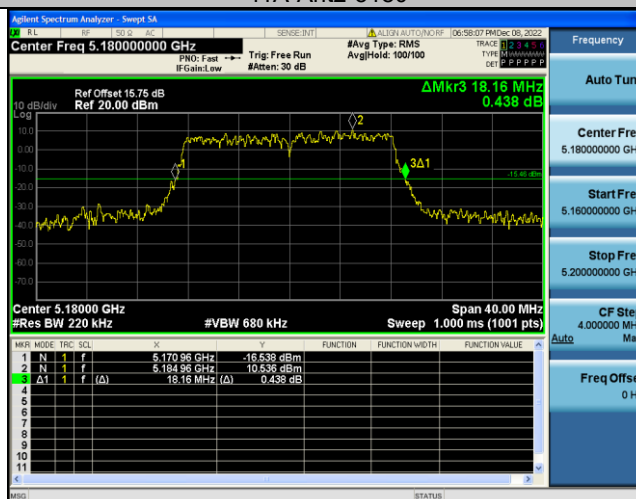
11A-Ant1-5785



11A-Ant1-5825



11A-Ant2-5180



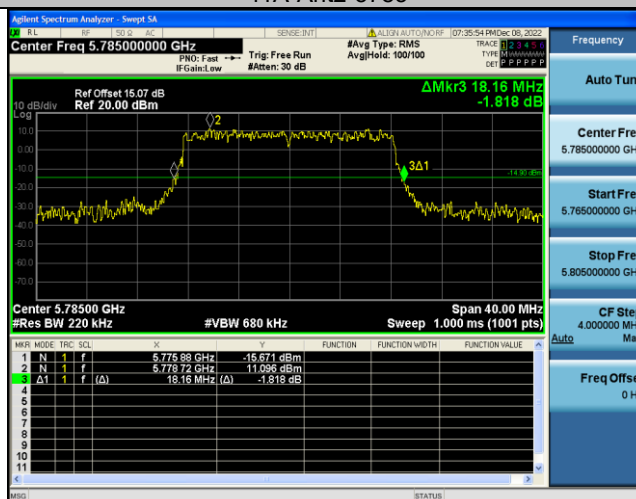
11A-Ant2-5220



11A-Ant2-5240



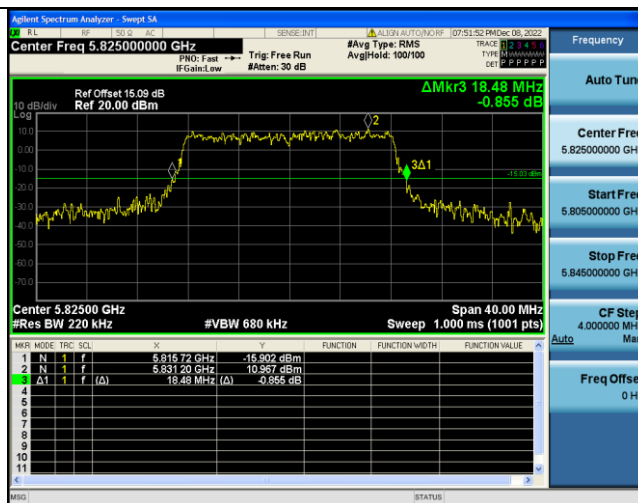
11A-Ant2-5785

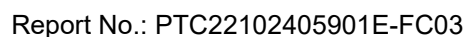


11A-Ant2-5745



11A-Ant2-5825





11A-Ant1-5745

Agilent Spectrum Analyzer - Sweep 14

Center Freq 5.745000000 GHz

Ref Offset 14.75 dB

Ref 20.00 dBm

Span 40.00 MHz

#VBW 300 kHz

Sweep 3.867 ms (1001 pts)

ΔMkr3 16.12 MHz

1.105 dB

Frequency

Auto Tune

Center Freq 5.745000000 GHz

Start Freq 6.725000000 GHz

Stop Freq 5.765000000 GHz

CF Step 4.000000 MHz

Freq Offset 0 Hz

11A-Ant1-5785

Agilent Spectrum Analyzer - Sweep 14

Center Freq 5.785000000 GHz

Ref Offset 15.07 dB

Ref 20.00 dBm

Span 40.00 MHz

#VBW 300 kHz

Sweep 3.867 ms (1001 pts)

ΔMkr3 16.32 MHz

1.329 dB

Frequency

Auto Tune

Center Freq 5.785000000 GHz

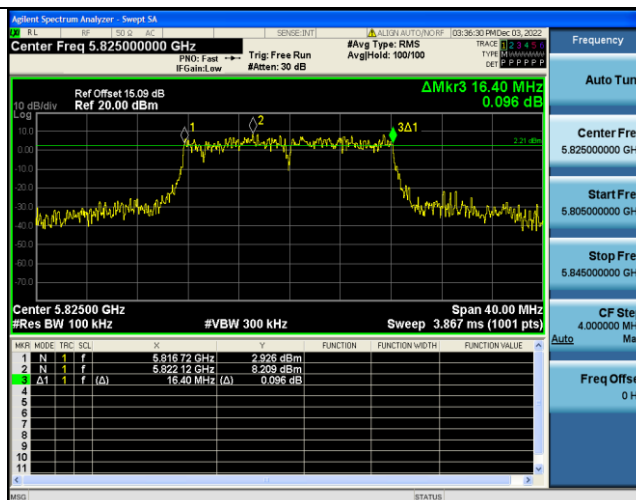
Start Freq 5.765000000 GHz

Stop Freq 5.805000000 GHz

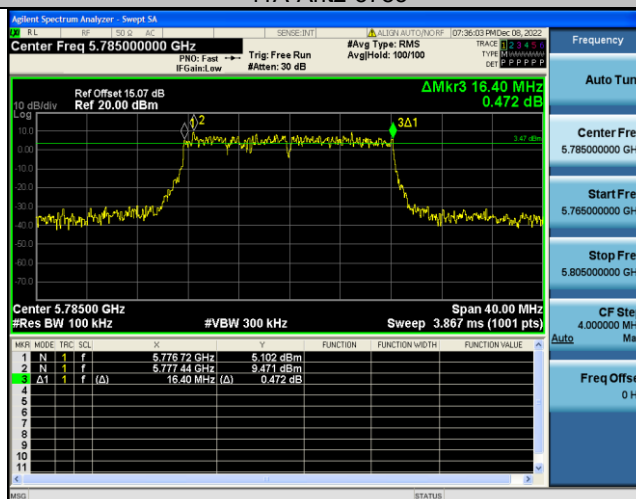
CF Step 4.000000 MHz

Freq Offset 0 Hz

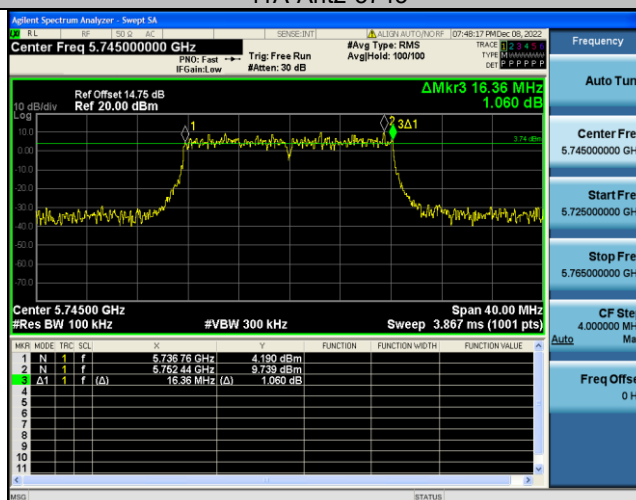
| MNR | MODE | TRC | SCL | X | Y | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|-----|-------|---------------|------------|----------|----------------|----------------|
| 1 | N | 1 | f | 5.77690 GHz | 4.598 dBm | | | |
| 2 | N | 1 | f | 5.77749 GHz | 10.204 dBm | | | |
| 3 | Δ1 | 1 | f (Δ) | 16.32 MHz (Δ) | 1.329 dB | | | |



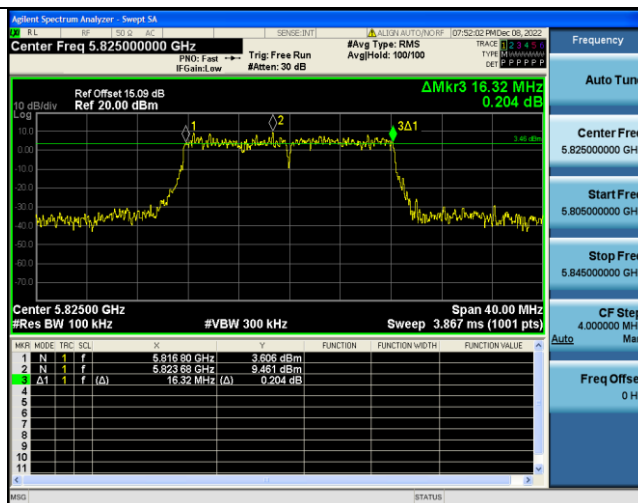
11A-Ant2-5785



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.

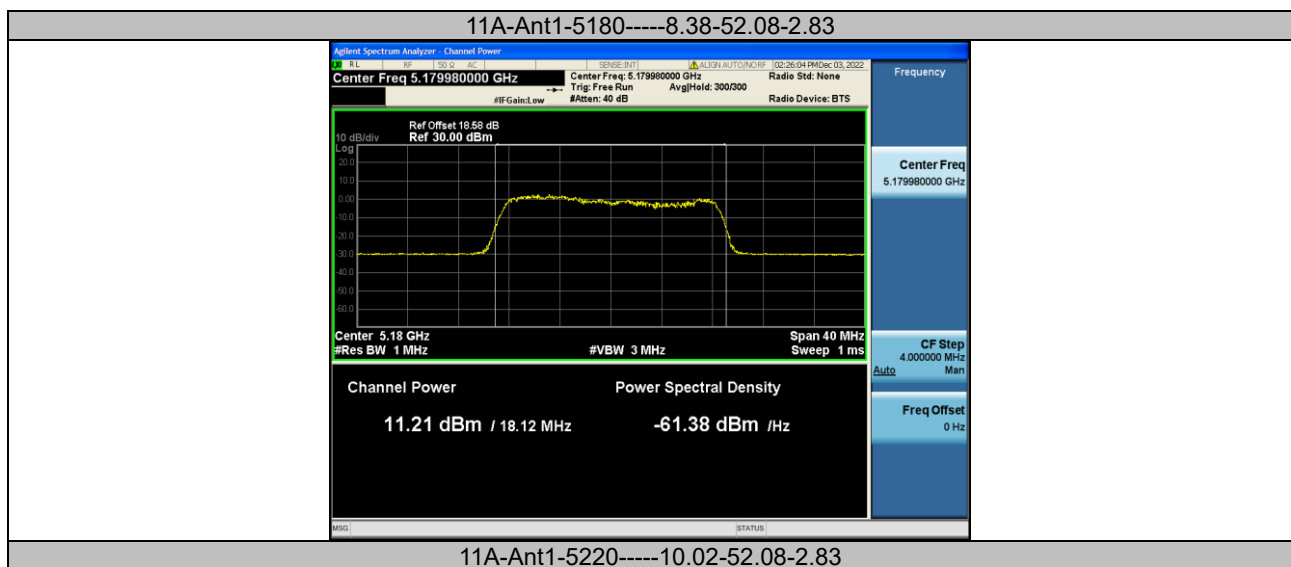
8.1 Test Procedure

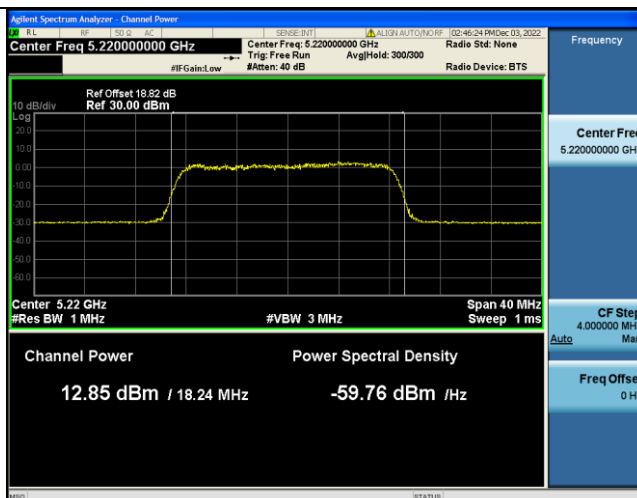
According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, The use Power Meter 1. Place the EUT on a bench and set it in transmitting mode. 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a Power meter.



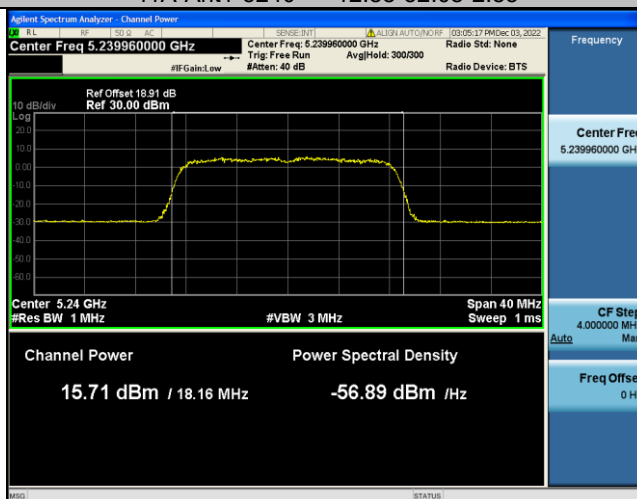
8.2 Test Result

| 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 |

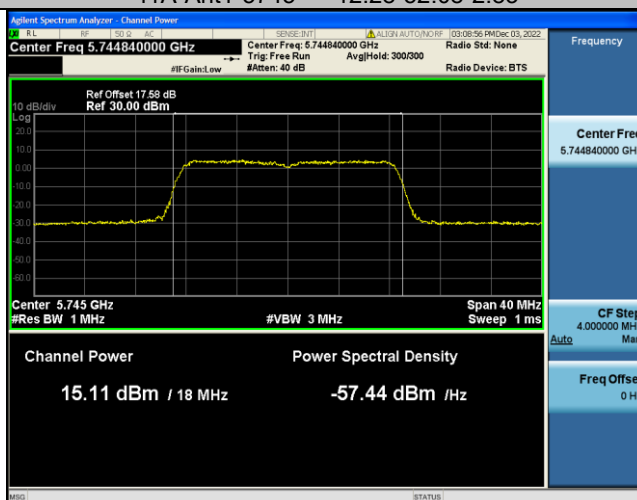




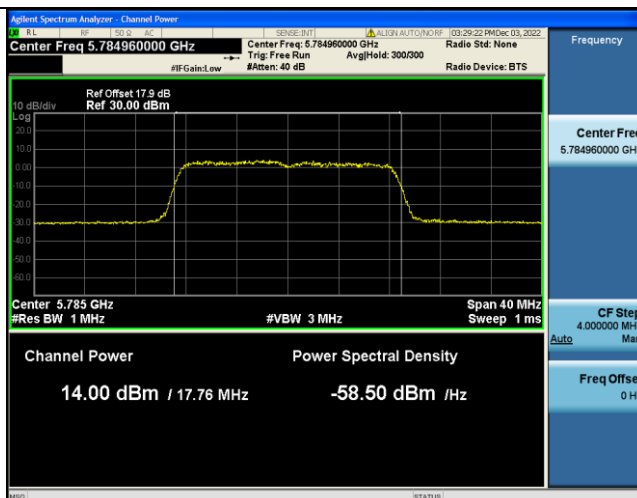
11A-Ant1-5240-----12.88-52.08-2.83



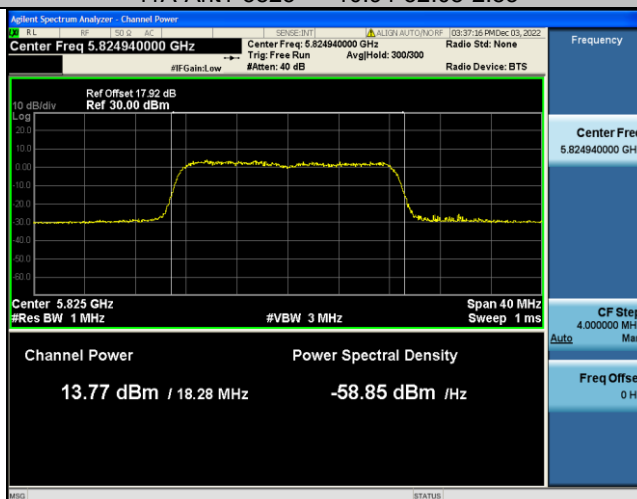
11A-Ant1-5745-----12.28-52.08-2.83



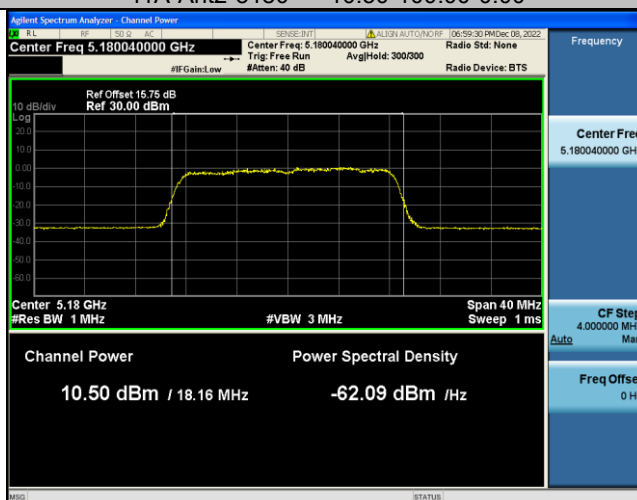
11A-Ant1-5785-----11.17-52.08-2.83



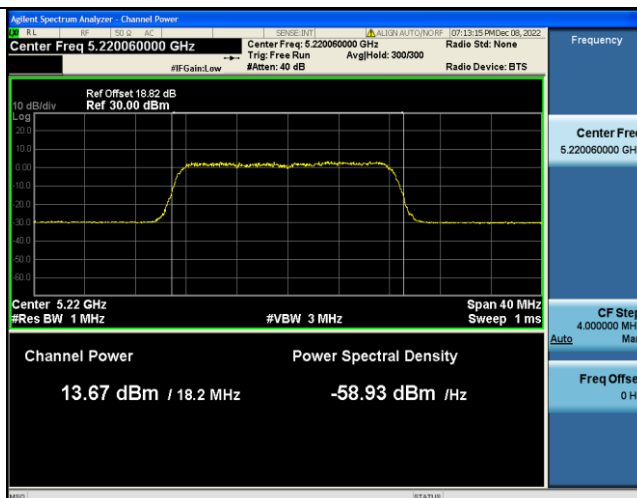
11A-Ant1-5825-----10.94-52.08-2.83



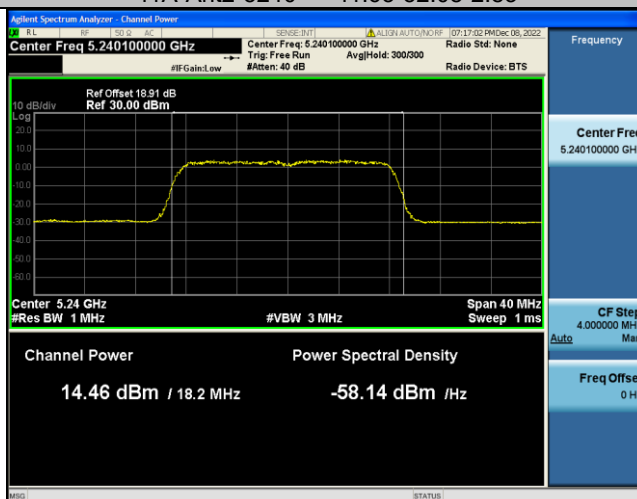
11A-Ant2-5180-----10.50-100.00-0.00



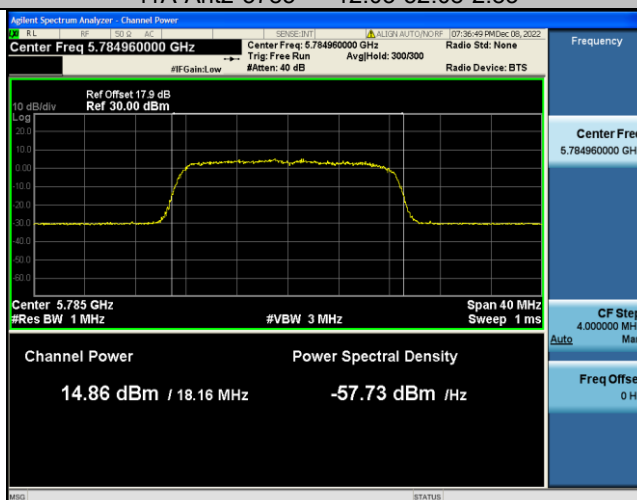
11A-Ant2-5220-----10.84-52.08-2.83



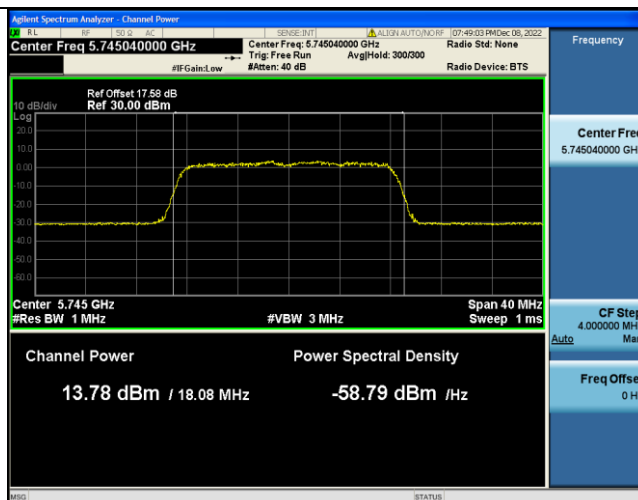
11A-Ant2-5240-----11.63-52.08-2.83



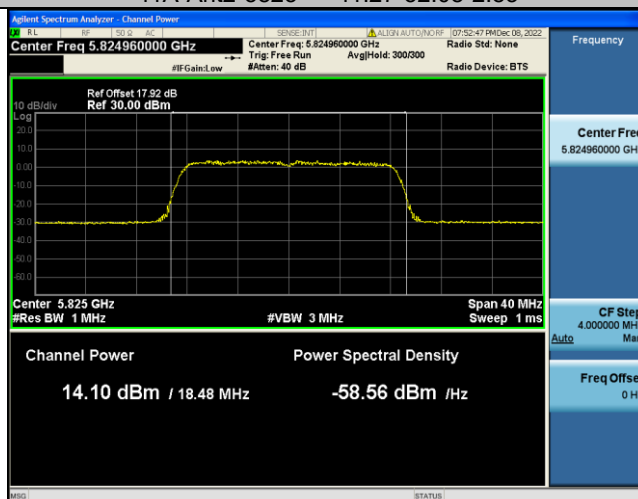
11A-Ant2-5785-----12.03-52.08-2.83



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



11A-Ant2-5825-----11.27-52.08-2.83





9 Power Spectral density

| | |
|------------------|---|
| Test Requirement | : FCC CFR47 Part 15 Section 15.2407(a) |
| Test Method | : ANSI C63.10:2013 |
| Test Limit | <p>: 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..</p> <p>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</p> |



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 |

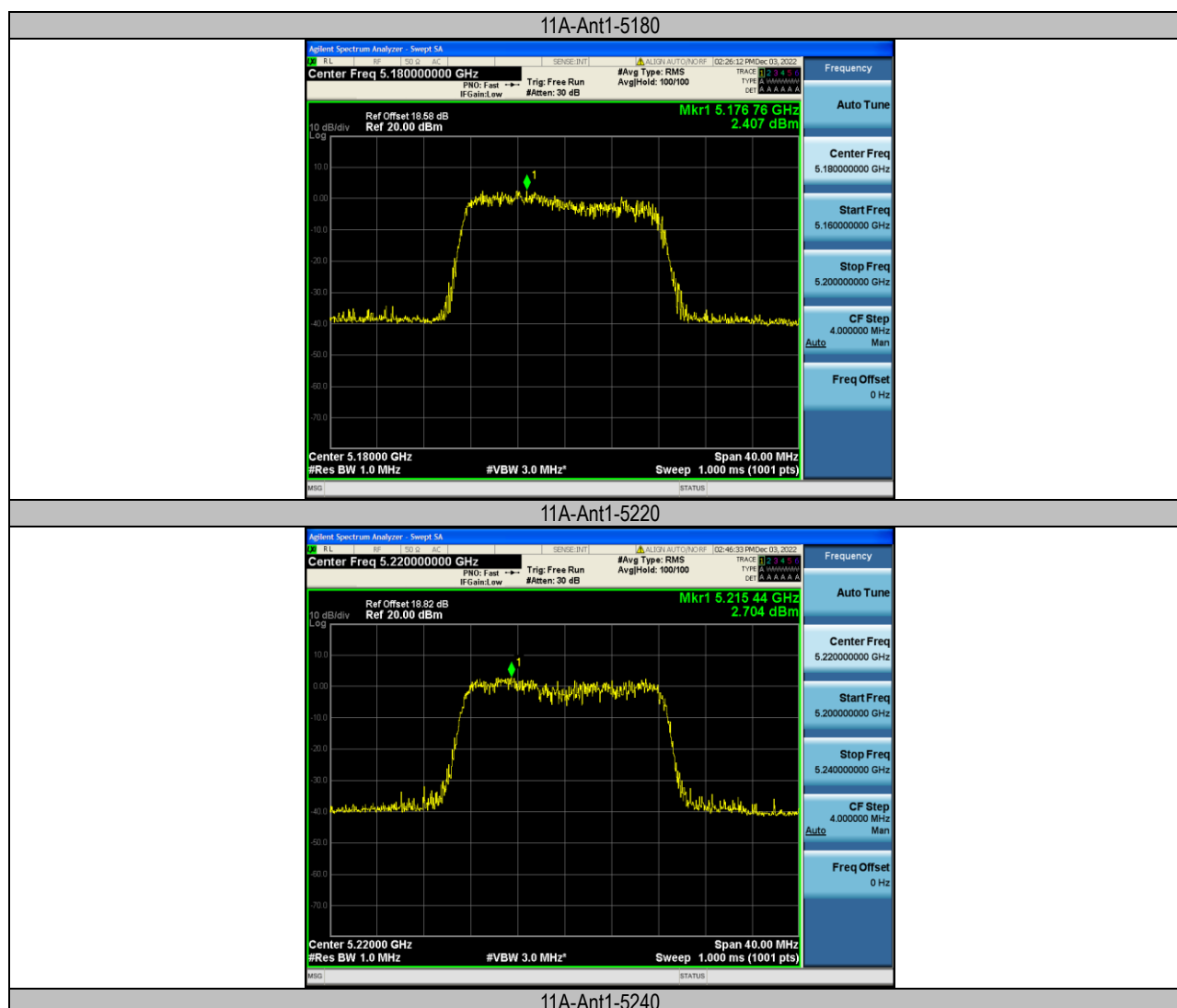
Note: 1.The Result and Limit Unit is dBm/500 kHz in the band 5.725–5.85 GHz.

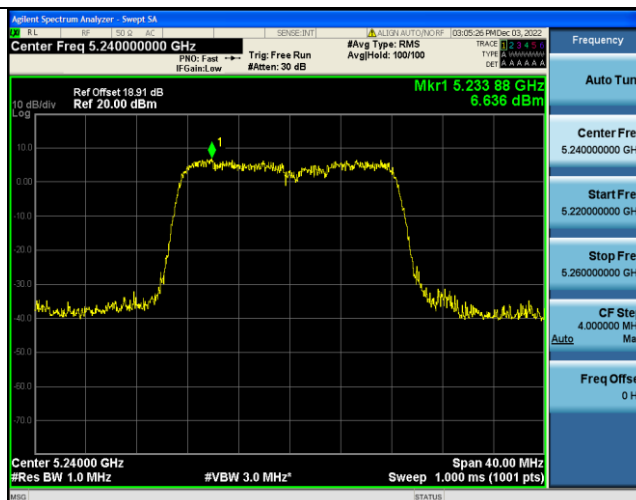
2. in the band 5.725–5.85 GHz the test RBW select 300KHz,so the measured result corrected by $\text{Result} + 10 \log(500 \text{ kHz}/300\text{kHz})$.

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

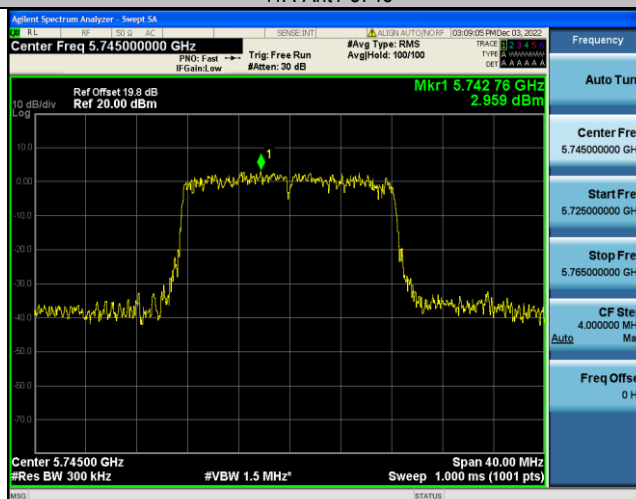


Test Graphs:

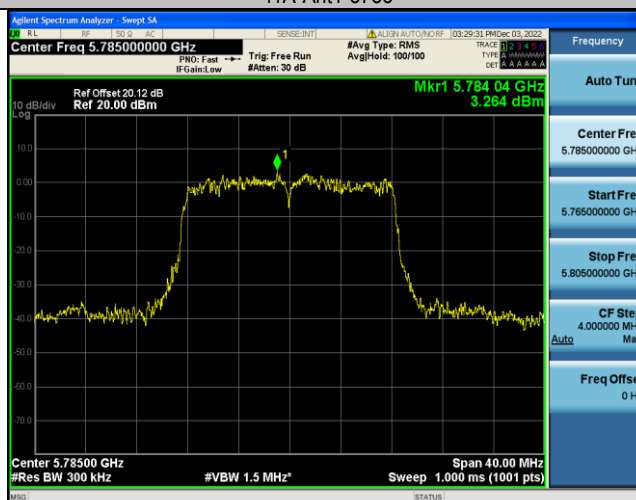




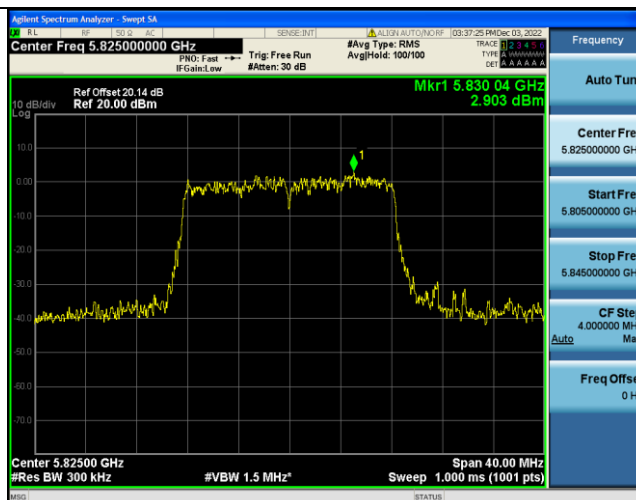
11A-Ant1-5745



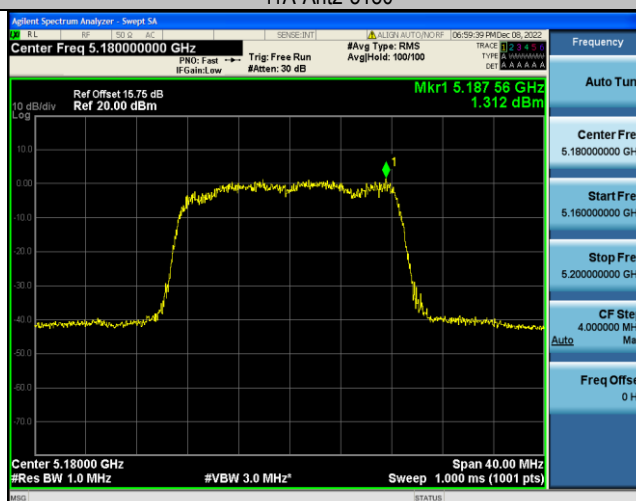
11A-Ant1-5785



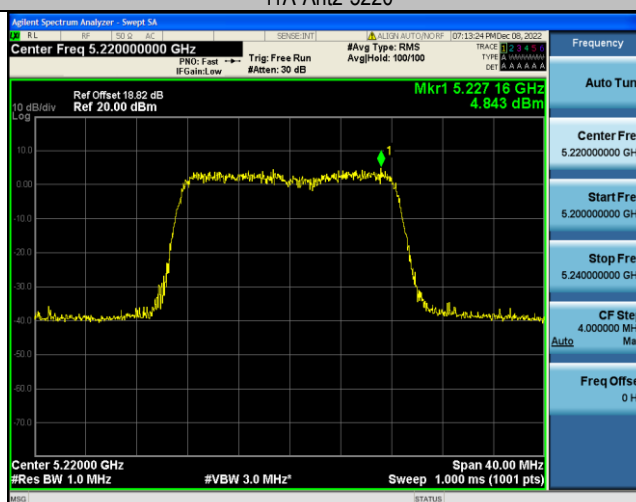
11A-Ant1-5825



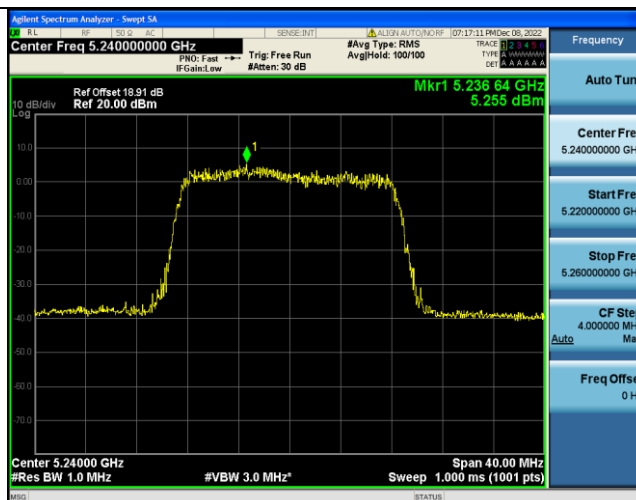
11A-Ant2-5180



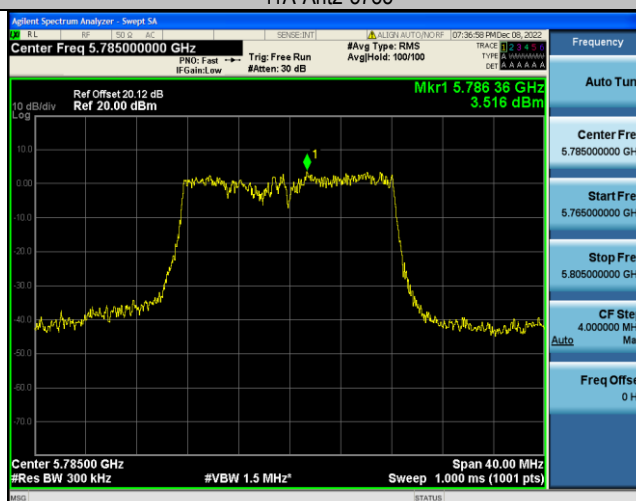
11A-Ant2-5220



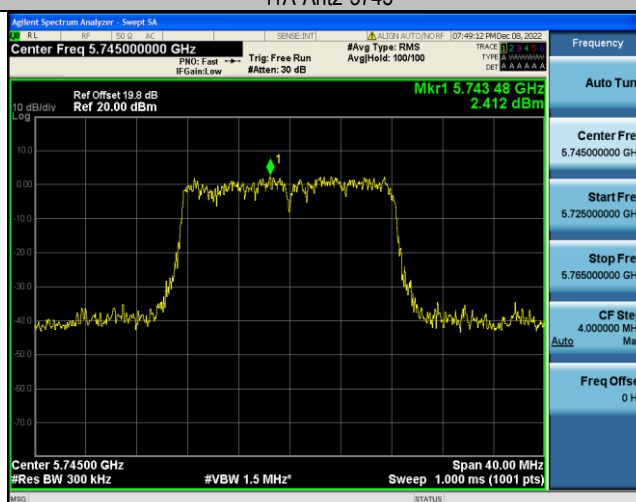
11A-Ant2-5240



11A-Ant2-5785



11A-Ant2-5745



11A-Ant2-5825





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 |

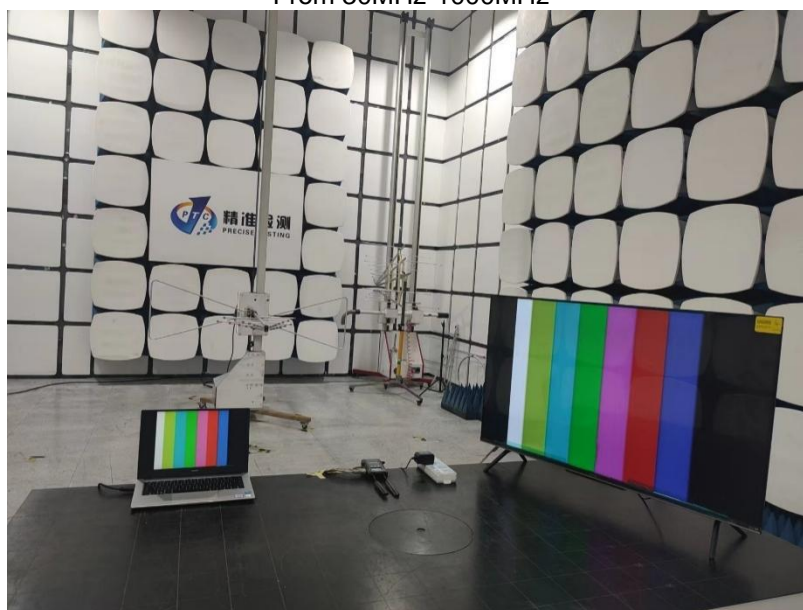
| Voltage | | | | | | | | |
|----------|---------|-----------------|---------------|------------------|----------------|-----------------|-------------|---------|
| TestMode | Antenna | Frequency [MHz] | Voltage [Vdc] | Temperature (°C) | Deviation (Hz) | Deviation (ppm) | Limit (ppm) | Verdict |
| 11A | 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

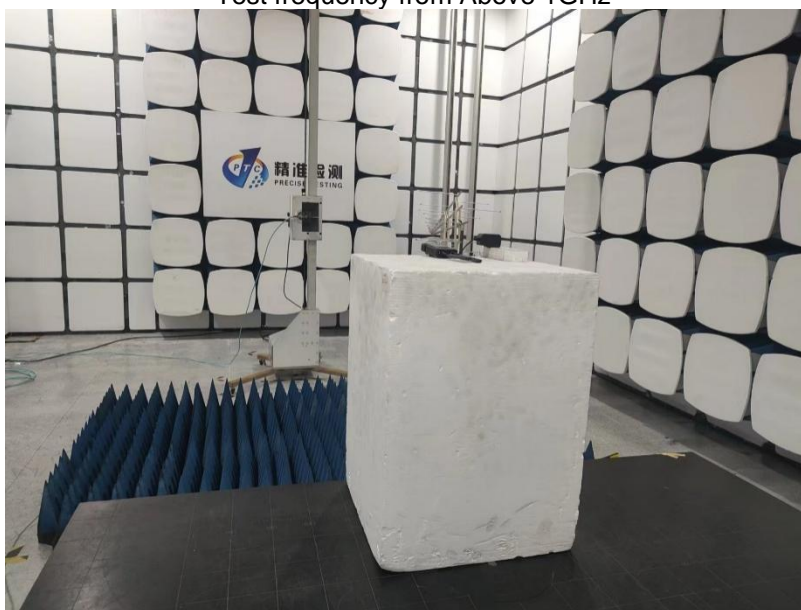


Radiated Spurious Emissions
From 30MHz-1000MHz





Test frequency from Above 1GHz

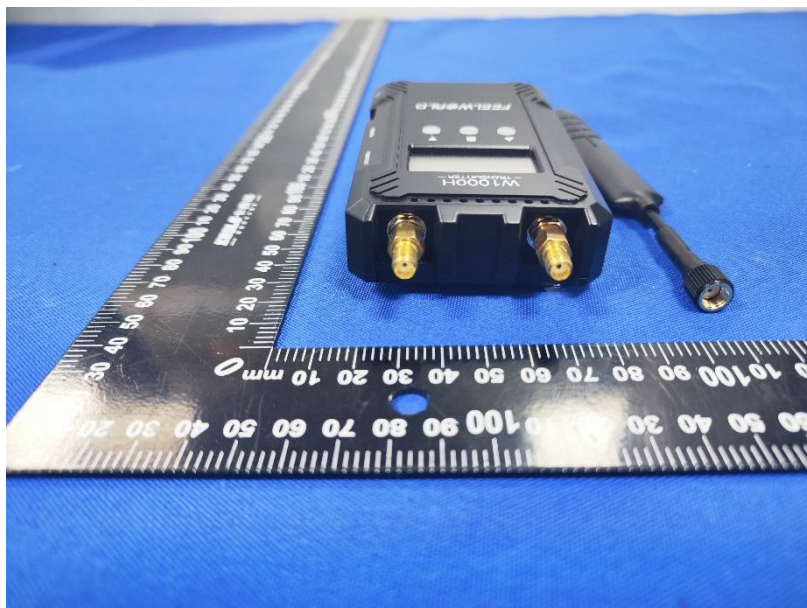


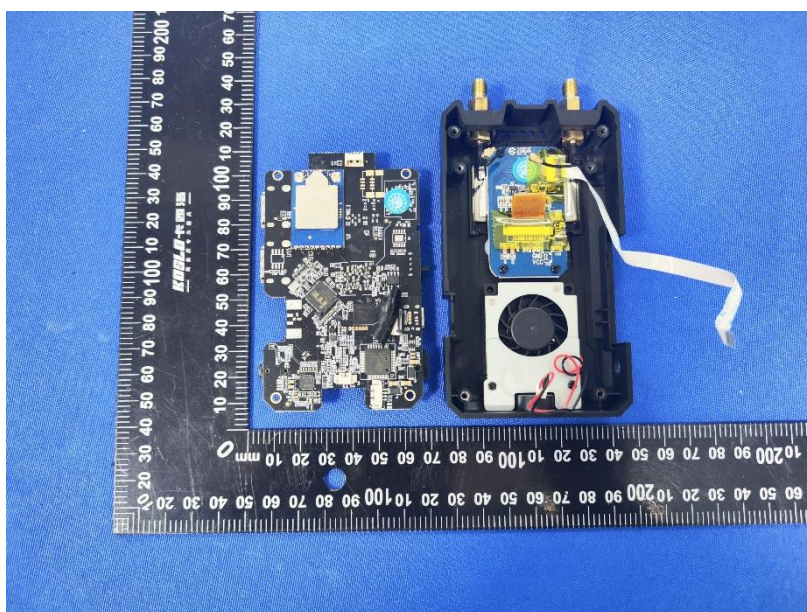
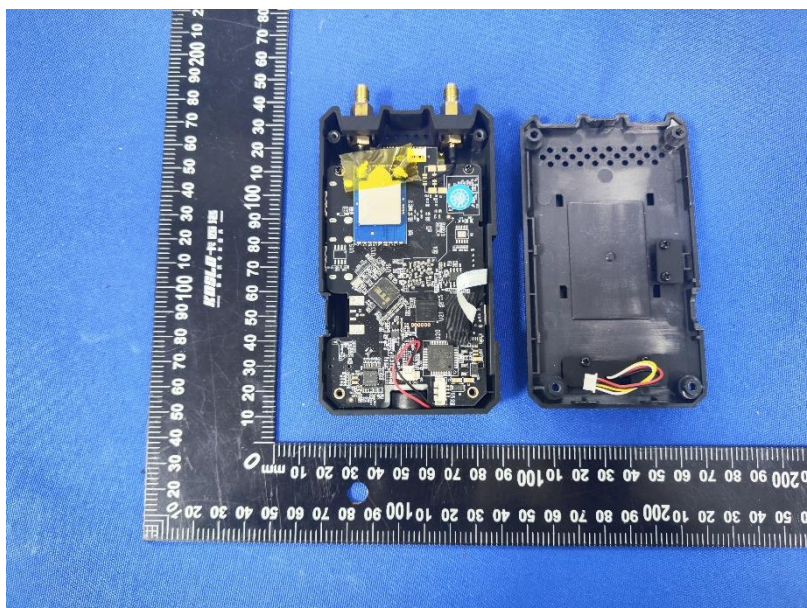
12 EUT PHOTOS

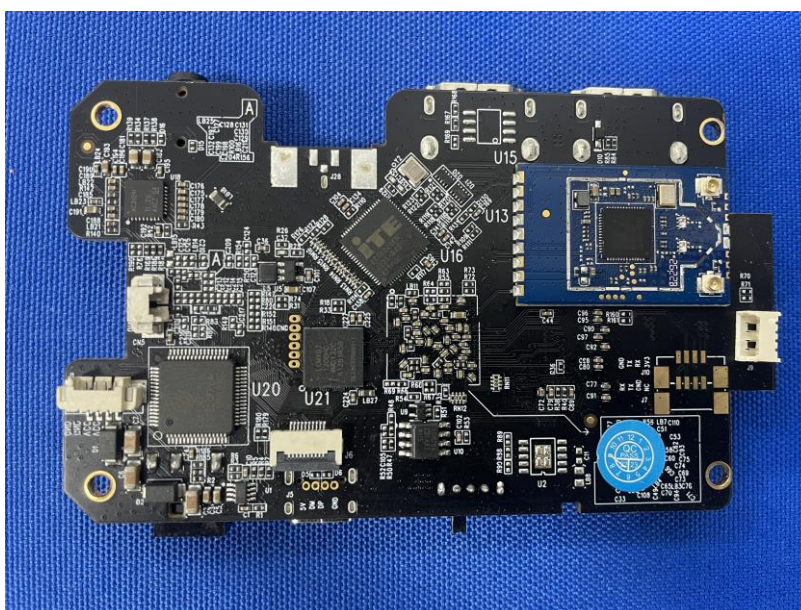
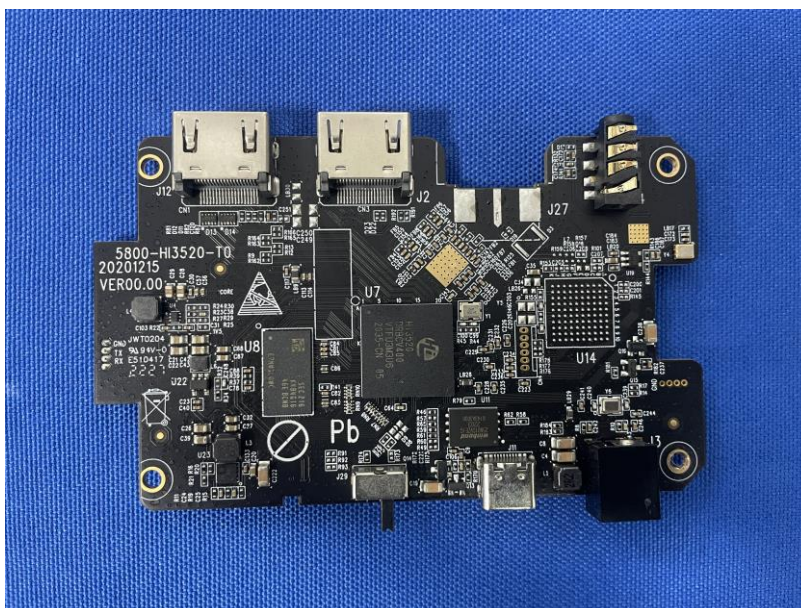


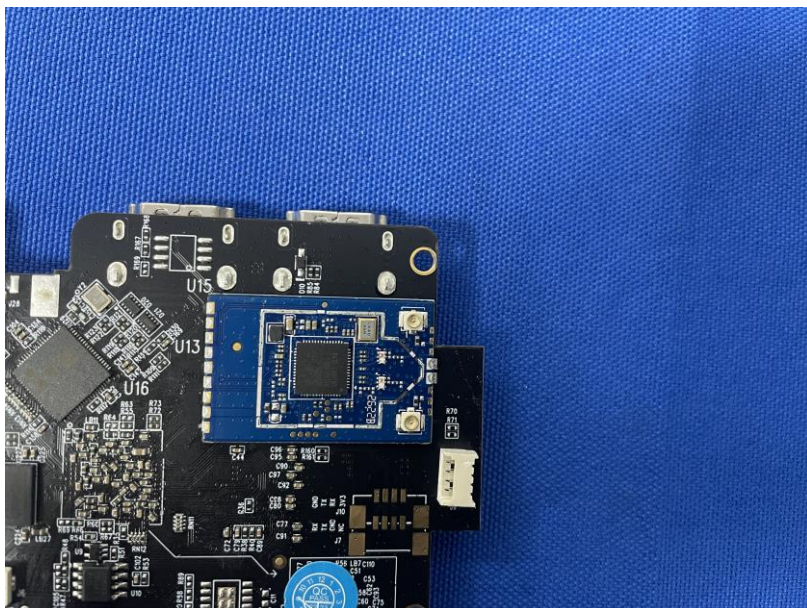


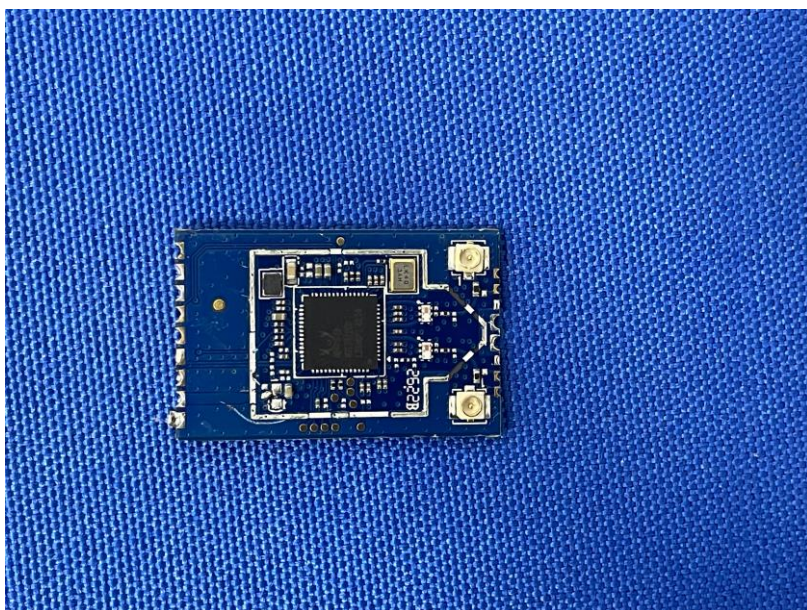
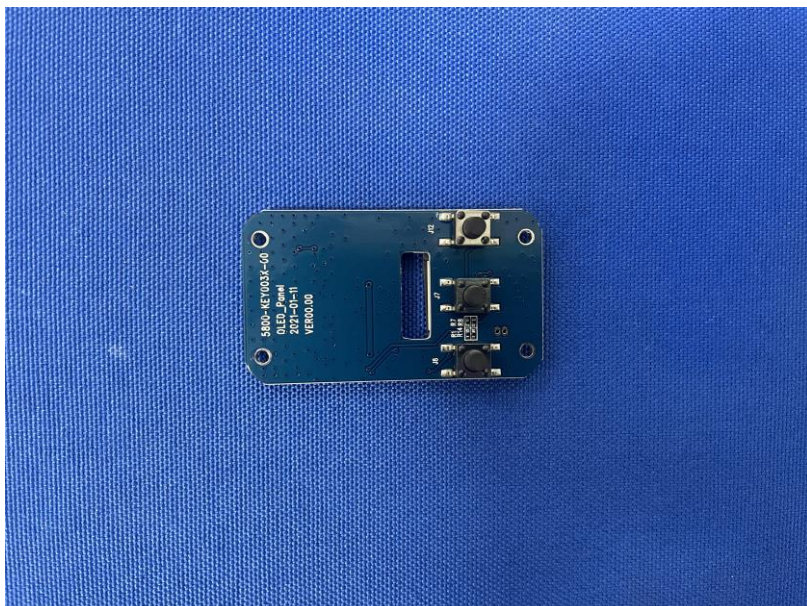


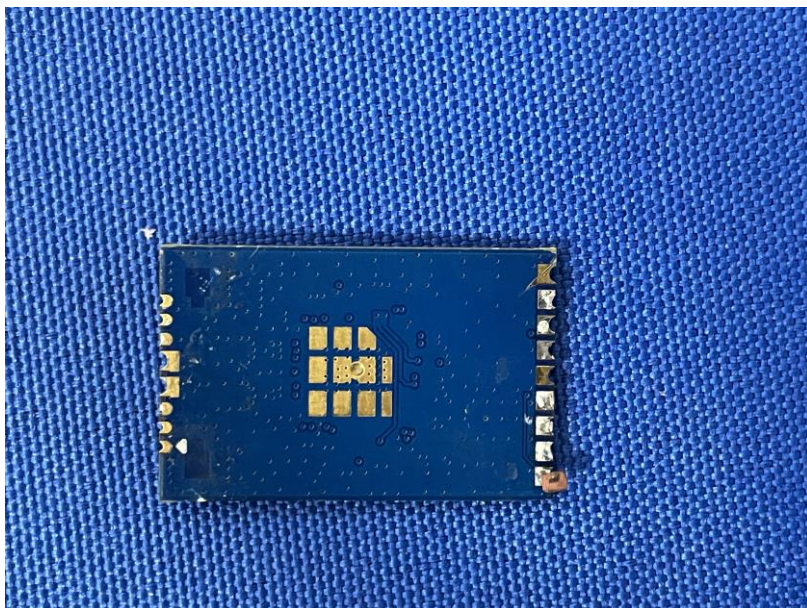












*******THE END REPORT*******