# FCC TEST REPORT

**Test report**
**On Behalf of**

**Okaylight Technology Co.,LTD**
**For**
**Digital wireless thermostat**

**Model No.: OTS600+OPS600, OTS600+OPS200N**

## FCC ID: 2ARTQ-OPTS600

| | |
|---|---|
| **Prepared for :** | **Okaylight Technology Co.,LTD**<br>**1st Floor, Building 3, LiKe Science and Technology Park, Changsheng North Road, Dalang Town, Dongguan 523000, Guangdong Province, China** |
| **Prepared By :** | **Shenzhen HUAK Testing Technology Co., Ltd.**<br>**1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China** |
| **Date of Test:** | **Oct. 23, 2019 ~ Nov. 04, 2019** |
| **Date of Report:** | **Nov. 04, 2019** |
| **Report Number:** | **HK1910252675-E** |

# TEST RESULT CERTIFICATION

| | | |
|---|---|---|
| **Applicant's name** | : | Okaylight Technology Co.,LTD |
| Address | : | 1st Floor, Building 3, LiKe Science and Technology Park, Changsheng North Road, Dalang Town, Dongguan 523000, Guangdong Province, China |
| **Manufacture's Name** | : | Okaylight Technology Co.,LTD |
| Address | : | 1st Floor, Building 3, LiKe Science and Technology Park, Changsheng North Road, Dalang Town, Dongguan 523000, Guangdong Province, China |

**Product description**

| | | |
|---|---|---|
| Trade Mark | : | OKAYLIGHT / WEBER / NASHONE |
| Product name | : | Digital wireless thermostat |
| Model and/or type reference | : | OTS600+OPS600, OTS600+OPS200N |
| **Standards** | : | FCC Rules and Regulations Part 15 Subpart C Section 15.247<br>ANSI C63.10: 2013 |



| | | |
|---|---|---|
| **Date of Test** | : | |
| Date (s) of performance of tests | : | Oct. 23, 2019 ~ Nov. 04, 2019 |
| Date of Issue | : | Nov. 04, 2019 |
| Test Result | : | **Pass** |

Testing Engineer : 

(Gary Qian)

Technical Manager : 

(Eden Hu)

Authorized Signatory : 

(Jason Zhou)

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# 1 TEST SUMMARY

## 1.1 TEST PROCEDURES AND RESULTS

| Requirement | CFR 47 Section | Result |
|---|---|---|
| Antenna requirement | §15.203/§15.247 (c) | PASS |
| AC Power Line Conducted Emission | §15.207 | N/A |
| Conducted Peak Output Power | §15.247 (b) | PASS |
| 6dB Emission Bandwidth | §15.247 (a)(2) | PASS |
| Power Spectral Density | §15.247 (e) | PASS |
| Band Edge | §15.247(d) | PASS |
| Spurious Emission | §15.205/§15.209 | PASS |

*Note:*

*1. PASS: Test item meets the requirement.*

*2. Fail: Test item does not meet the requirement.*

*3. N/A: Test case does not apply to the test object.*

*4. The test result judgment is decided by the limit of test standard.*

## 1.2 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

## 1.3 Measurement Uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

| No. | Item | MU |
|---|---|---|
| 1 | Conducted Emission | ±2.56dB |
| 2 | RF power, conducted | ±0.12dB |
| 3 | Spurious emissions, conducted | ±0.11dB |
| 4 | All emissions, radiated(<1G) | ±3.92dB |
| 5 | All emissions, radiated(>1G) | ±4.28dB |
| 6 | Temperature | ±0.1°C |
| 7 | Humidity | ±1.0% |

# 2 GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| Equipment | Digital wireless thermostat |
| Model Name | OTS600+OPS600 |
| Serial No. | OTS600+OPS200N |
| Model Difference | All model's the function, software and electric circuit are the same, only model named different. Test sample model: OTS600+OPS600 |
| Trade Mark | OKAYLIGHT / WEBER / NASHONE |
| FCC ID | 2ARTQ-OPTS600 |
| Hardware Version: | V2.0 |
| Software Version: | V1.0 |
| Operation frequency | 2416MHz -- 2480MHz |
| Number of Channels | 5 |
| Antenna Type | PCB antenna |
| Antenna Gain | 0dBi |
| Modulation Type | GFSK |
| Power Source | DC 3.0V from battery |

## 2.2 Carrier Frequency of Channels

| Channel | Frequency |
|---|---|
| 1 | 2416 MHz |
| 2 | 2432 MHz |
| 3 | 2448 MHz |
| 4 | 2464 MHz |
| 5 | 2480 MHz |

## 2.3 Operation of EUT during testing

Operating Mode
The mode is used: **Transmitting mode**
Low Channel: 2416MHz
Middle Channel: 2448MHz
High Channel: 2480MHz

## 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing and Radiation testing:


Operation of EUT Above1GHz Radiation testing:


## 2.5 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Description | Model No. | Manufacturer | Remark | Certificate |
|---|---|---|---|---|
| Receiver | / | Okaylight Technology Co.,LTD | / | SDOC |
| | | | | |
| | | | | |

***Note:***

*1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*

*2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

*3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.*

## 2.6 MEASUREMENT INSTRUMENTS LIST

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | L.I.S.N. Artificial Mains Network | R&S | ENV216 | HKE-002 | Dec. 27, 2018 | 1 Year |
| 2. | Receiver | R&S | ESCI 7 | HKE-010 | Dec. 27, 2018 | 1 Year |
| 3. | RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2018 | 1 Year |
| 4. | Spectrum analyzer | R&S | FSP40 | HKE-025 | Dec. 27, 2018 | 1 Year |
| 5. | Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2018 | 1 Year |
| 6. | Preamplifier | Schwarzbeck | BBV 9743 | HKE-006 | Dec. 27, 2018 | 1 Year |
| 7. | EMI Test Receiver | Rohde & Schwarz | ESCI 7 | HKE-010 | Dec. 27, 2018 | 1 Year |
| 8. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | HKE-012 | Dec. 27, 2018 | 1 Year |
| 9. | Loop Antenna | Schwarzbeck | FMZB 1519B | HKE-014 | Dec. 27, 2018 | 1 Year |
| 10. | Horn Antenna | Schewarzbeck | 9120D | HKE-013 | Dec. 27, 2018 | 1 Year |
| 11. | Pre-amplifier | EMCI | EMC051845SE | HKE-015 | Dec. 27, 2018 | 1 Year |
| 12. | Pre-amplifier | Agilent | 83051A | HKE-016 | Dec. 27, 2018 | 1 Year |
| 13. | EMI Test Software EZ-EMC | Tonscend | JS1120-B Version | HKE-083 | Dec. 27, 2018 | N/A |
| 14. | Power Sensor | Agilent | E9300A | HKE-086 | Dec. 27, 2018 | 1 Year |
| 15. | Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2018 | 1 Year |
| 16. | Signal generator | Agilent | N5182A | HKE-029 | Dec. 27, 2018 | 1 Year |
| 17. | Signal Generator | Agilent | 83630A | HKE-028 | Dec. 27, 2018 | 1 Year |
| 18. | Shielded room | Shiel Hong | 4*3*3 | HKE-039 | Dec. 27, 2017 | 3 Year |
| 19. | Power Meter | R&S | NRVD | SEL0069 | Dec. 27, 2018 | 1 Year |
| 20 | High Gain Antenna | Schewarzbeck | LB-180400KF | HKE-054 | Dec. 27, 2018 | 1 Year |

# 3 TEST RESULTS AND MEASUREMENT DATA

## 3.1 CONDUCTED EMISSIONS TEST

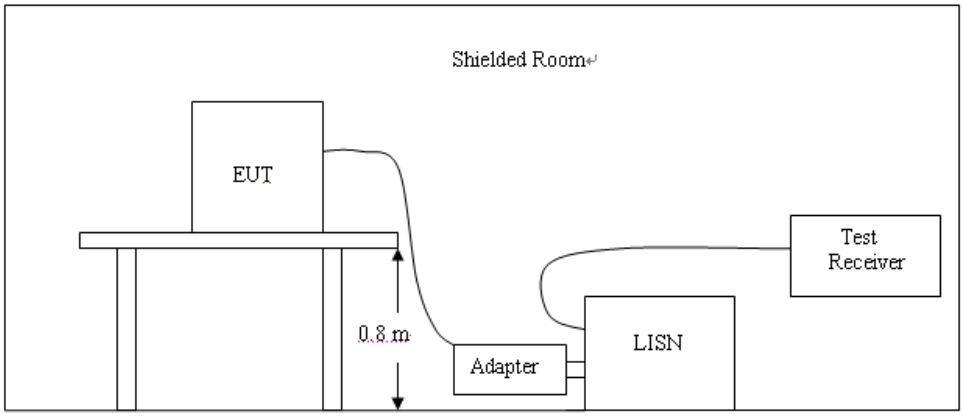
**LIMIT**

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207 and RSS Gen 8.8, AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus as below:

| Frequency range (MHz) | Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.

7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

## TEST RESULTS

Not application to this device

## 3.2 RADIATED EMISSION TEST

**Limit**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission

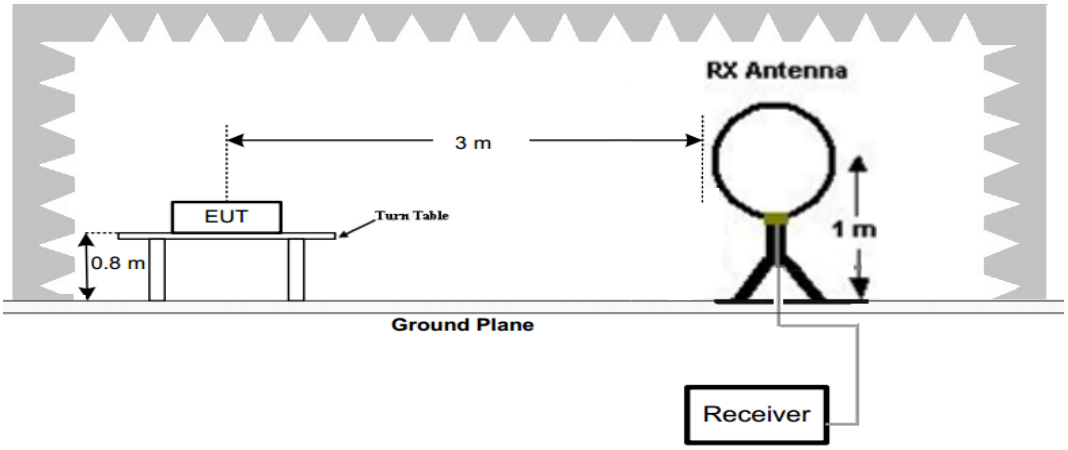
Unwanted emissions that fall into restricted bands shall comply with the limits specified in RSS-Gen; and Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Radiated emission limits

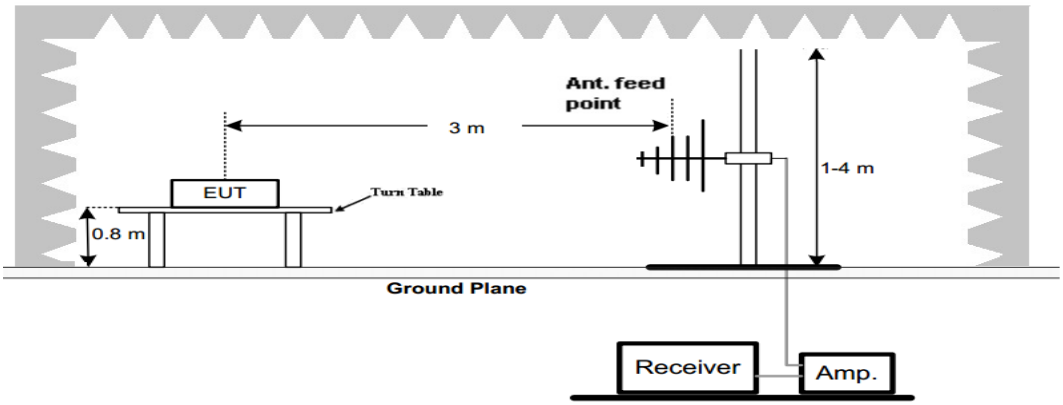
| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 0.009-0.49 | 3 | 20log(2400/F(KHz))+40log(300/3) | 2400/F(KHz) |
| 0.49-1.705 | 3 | 20log(24000/F(KHz))+ 40log(30/3) | 24000/F(KHz) |
| 1.705-30 | 3 | 20log(30)+ 40log(30/3) | 30 |
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

**TEST CONFIGURATION**

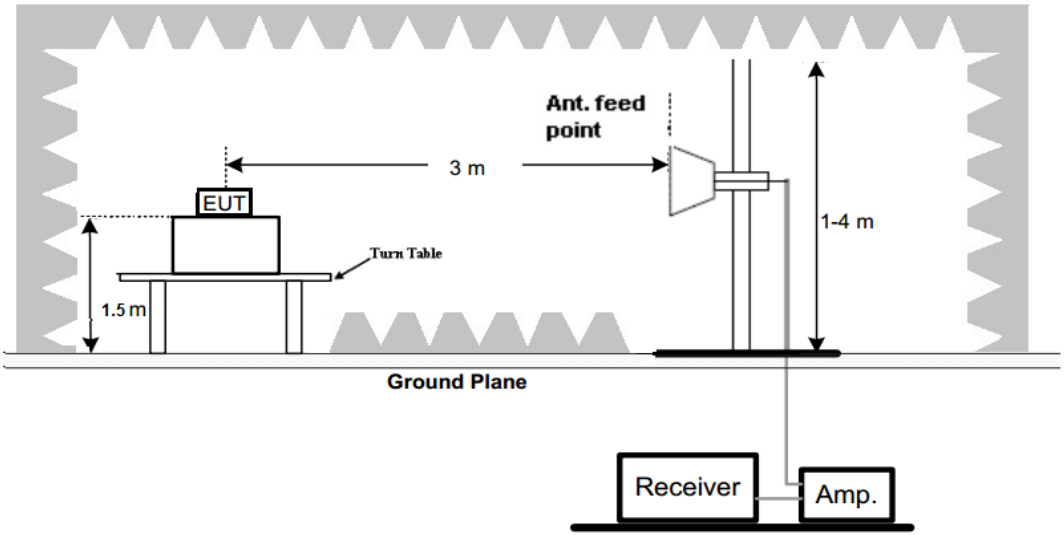
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz




(C) Radiated Emission Test Set-Up, Frequency above 1000MHz




## Test Procedure

1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

Note: For the radiated emission test above 1GHz:Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Test the EUT in the lowest channel,the middle channel,the Highest channel
The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.Repeat above procedures until all frequencies measured was complete.

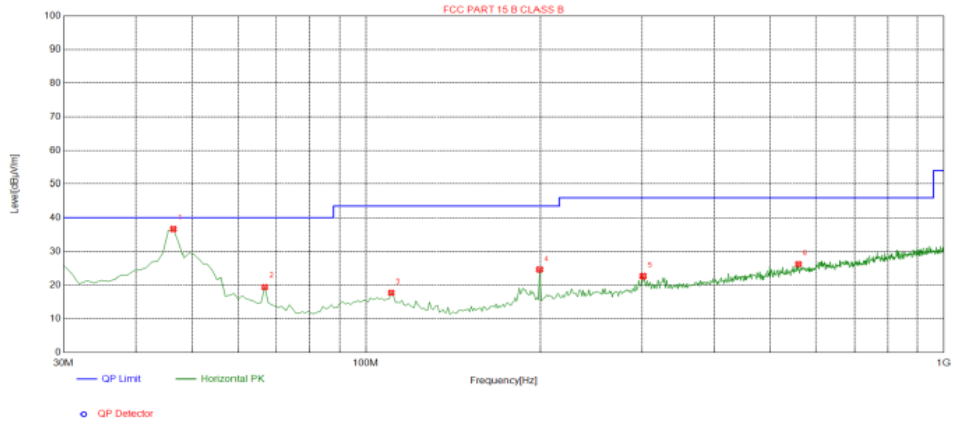
## TEST RESULTS

Remark:
1. Radiated Emission measured at low middle and high mode from 9 KHz to 10th harmonic of fundamental and recorded worst case .
2. There is no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

Below 1GHz Test Results:

Antenna polarity: H

**Test Graph**




**Suspected List**

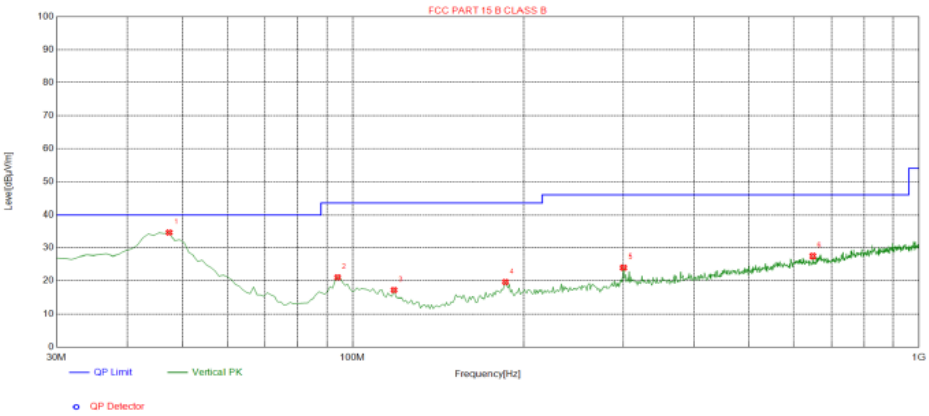
| Suspected List | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Level [dBµV/m] | Factor [dB] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 46.4900 | 36.62 | -13.65 | 40.00 | 3.38 | 100 | 24 | Horizontal |
| 2 | 66.8600 | 19.48 | -16.88 | 40.00 | 20.52 | 100 | 12 | Horizontal |
| 3 | 110.510 | 17.77 | -15.52 | 43.50 | 25.73 | 100 | 294 | Horizontal |
| 4 | 199.750 | 24.58 | -15.08 | 43.50 | 18.92 | 100 | 40 | Horizontal |
| 5 | 301.600 | 22.67 | -12.72 | 46.00 | 23.33 | 100 | 113 | Horizontal |
| 6 | 559.620 | 26.20 | -6.69 | 46.00 | 19.80 | 100 | 300 | Horizontal |

**Final Data List**

Remark:
Margin = Limit – Level
Level=Test receiver reading + factor
Factor= Antenna factor + cable loss- Amp factor

Antenna polarity: V

**Test Graph**




**Suspected List**

| Suspected List | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO. | Freq. [MHz] | Level [dBµV/m] | Factor [dB] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity |
| 1 | 47.4600 | 34.63 | -13.65 | 40.00 | 5.37 | 100 | 218 | Vertical |
| 2 | 94.0200 | 21.05 | -16.40 | 43.50 | 22.45 | 100 | 71 | Vertical |
| 3 | 118.270 | 17.13 | -16.81 | 43.50 | 26.37 | 100 | 348 | Vertical |
| 4 | 186.170 | 19.61 | -16.33 | 43.50 | 23.89 | 100 | 168 | Vertical |
| 5 | 300.630 | 24.01 | -12.73 | 46.00 | 21.99 | 100 | 348 | Vertical |
| 6 | 649.830 | 27.48 | -5.82 | 46.00 | 18.52 | 100 | 36 | Vertical |

**Final Data List**

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results:

CH Low (2416MHz)

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4832 | 56.30 | -3.61 | 52.69 | 74 | -21.31 | Peak |
| 4832 | 47.44 | -3.61 | 43.83 | 54 | -10.17 | AVG |
| 7248 | 56.26 | -0.94 | 55.32 | 74 | -18.68 | Peak |
| 7248 | 47.26 | -0.94 | 46.32 | 54 | -7.68 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4832 | 56.56 | -3.61 | 52.95 | 74 | -21.05 | Peak |
| 4832 | 47.79 | -3.61 | 44.18 | 54 | -9.82 | AVG |
| 7248 | 55.97 | -0.94 | 55.03 | 74 | -18.97 | Peak |
| 7248 | 46.84 | -0.94 | 45.90 | 54 | -8.10 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

CH Middle (2448MHz)

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4896 | 55.77 | -3.47 | 52.30 | 74 | -21.70 | Peak |
| 4896 | 46.08 | -3.47 | 42.61 | 54 | -11.39 | AVG |
| 7344 | 55.95 | -0.78 | 55.17 | 74 | -18.83 | Peak |
| 7344 | 47.23 | -0.78 | 46.45 | 54 | -7.55 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4896 | 56.08 | -3.47 | 52.61 | 74 | -21.39 | Peak |
| 4896 | 47.24 | -3.47 | 43.77 | 54 | -10.23 | AVG |
| 7344 | 55.98 | -0.78 | 55.20 | 74 | -18.80 | Peak |
| 7344 | 46.89 | -0.78 | 46.11 | 54 | -7.89 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

CH High (2480MHz)

Horizontal:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4960 | 56.64 | -3.43 | 53.21 | 74 | -20.79 | Peak |
| 4960 | 47.37 | -3.43 | 43.94 | 54 | -10.06 | AVG |
| 7440 | 56.97 | -0.77 | 56.20 | 74 | -17.80 | Peak |
| 7440 | 46.96 | -0.77 | 46.19 | 54 | -7.81 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Vertical:

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 4960 | 57.63 | -3.43 | 54.20 | 74 | -19.80 | Peak |
| 4960 | 46.91 | -3.43 | 43.48 | 54 | -10.52 | AVG |
| 7440 | 57.05 | -0.77 | 56.28 | 74 | -17.72 | Peak |
| 7440 | 46.55 | -0.77 | 45.78 | 54 | -8.22 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions are reported.

## 3.3 BAND EDGE

### Limits

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 100KHz and VBM to 300KHz to measure the peak field strength and set RBW to 1MHz and VBW to 10Hz to measure the average radiated field strength.The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

### Test Result

Radiated Band Edge Test:

Operation Mode: TX CH Low (2416MHz)

Horizontal

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 55.87 | -5.81 | 50.06 | 74 | -23.94 | Peak |
| 2310 | 49.71 | -5.81 | 43.90 | 54 | -10.10 | AVG |
| 2390 | 56.54 | -5.84 | 50.70 | 74 | -23.30 | Peak |
| 2390 | 48.95 | -5.84 | 43.11 | 54 | -10.89 | AVG |
| 2400 | 57.87 | -5.84 | 52.03 | 74 | -21.97 | Peak |
| 2400 | 48.02 | -5.84 | 42.18 | 54 | -11.82 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Vertical:

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | |
| 2310 | 55.91 | -5.81 | 50.10 | 74 | -23.90 | Peak |
| 2310 | 49.58 | -5.81 | 43.77 | 54 | -10.23 | AVG |
| 2390 | 56.59 | -5.84 | 50.75 | 74 | -23.25 | Peak |
| 2390 | 47.47 | -5.84 | 41.63 | 54 | -12.37 | AVG |
| 2400 | 56.65 | -5.84 | 50.81 | 74 | -23.19 | Peak |
| 2400 | 49.58 | -5.84 | 43.74 | 54 | -10.26 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Operation Mode: TX CH High (2480MHz)

Horizontal

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.5 | 56.77 | -6.04 | 50.73 | 74 | -23.27 | Peak |
| 2483.5 | 49.81 | -6.04 | 43.77 | 54 | -10.23 | AVG |
| 2500 | 57.78 | -6.06 | 51.72 | 74 | -22.28 | Peak |
| 2500 | 48.30 | -6.06 | 42.24 | 54 | -11.76 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

Vertical:

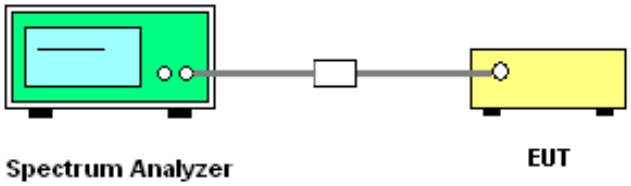
| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|
| 2483.5 | 56.17 | -6.04 | 50.13 | 74 | -23.87 | Peak |
| 2483.5 | 49.75 | -6.04 | 43.71 | 54 | -10.29 | AVG |
| 2500 | 57.08 | -6.06 | 51.02 | 74 | -22.98 | Peak |
| 2500 | 47.06 | -6.06 | 41.00 | 54 | -13.00 | AVG |
| Remark :Factor= Antenna Factor + Cable Loss - Pre-amplifier | | | | | | |

## 3.4 Conducted Output Power

**Limit**

30dBm

**TEST CONFIGURATION**



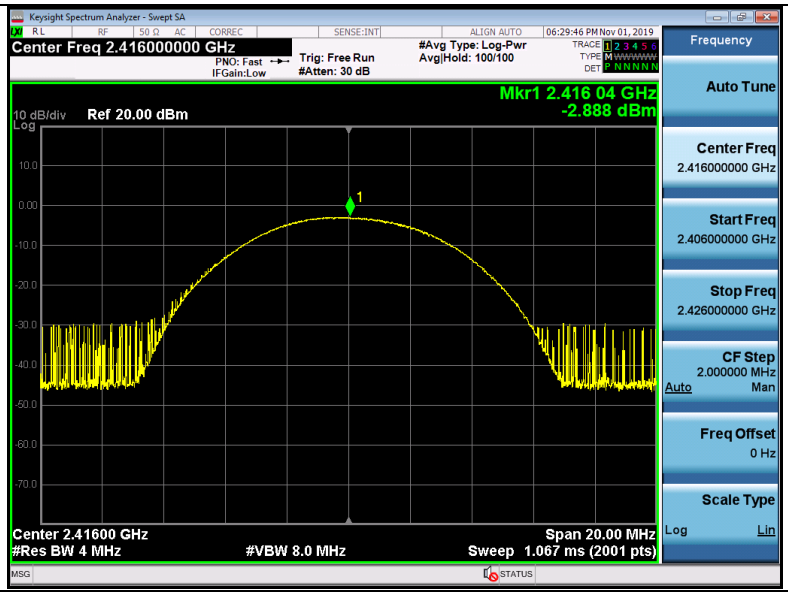

**Test Procedure:**

ANSI C63.10: 2013 Section 11.9.1.1

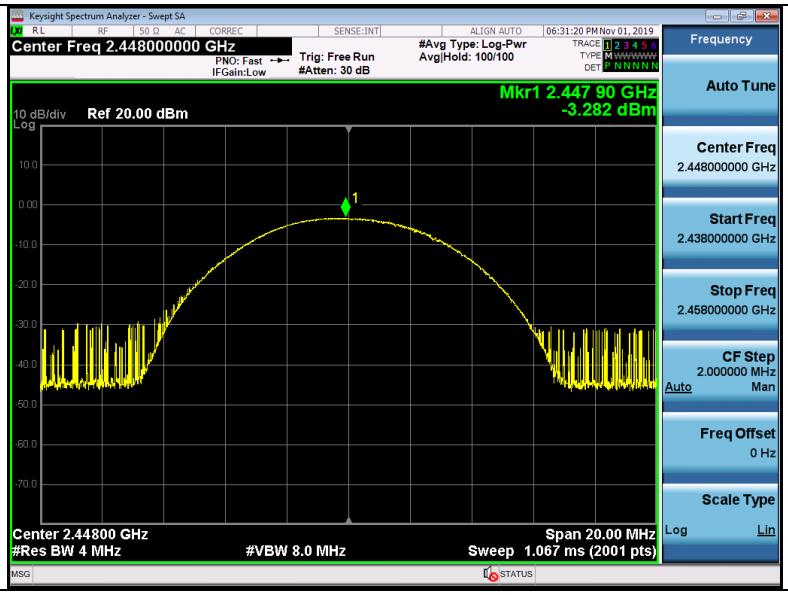
**Test Results:**

| Test Channel (MHz) | Conducted Output Power (dBm) | Limit (dBm) | Result |
|---|---|---|---|
| 2416 | -2.888 | 30 | PASS |
| 2448 | -3.282 | 30 | PASS |
| 2480 | -4.166 | 30 | PASS |

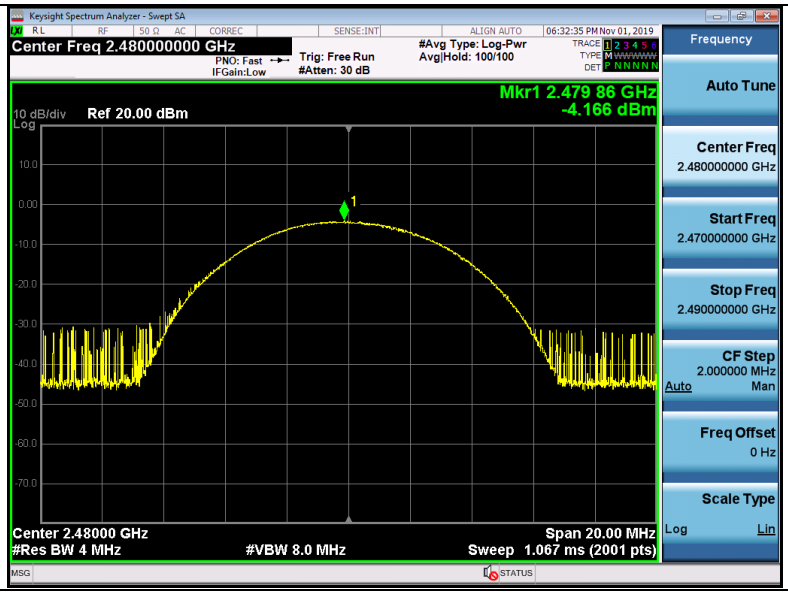
2416MHz




2448MHz




2480MHz

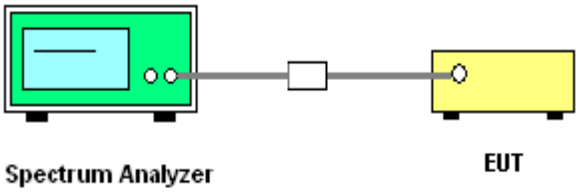


## 3.5 OCCUPIED BANDWIDTH MEASUREMENT

**Limit**

500KHz

**TEST CONFIGURATION**




**Test Procedure:**

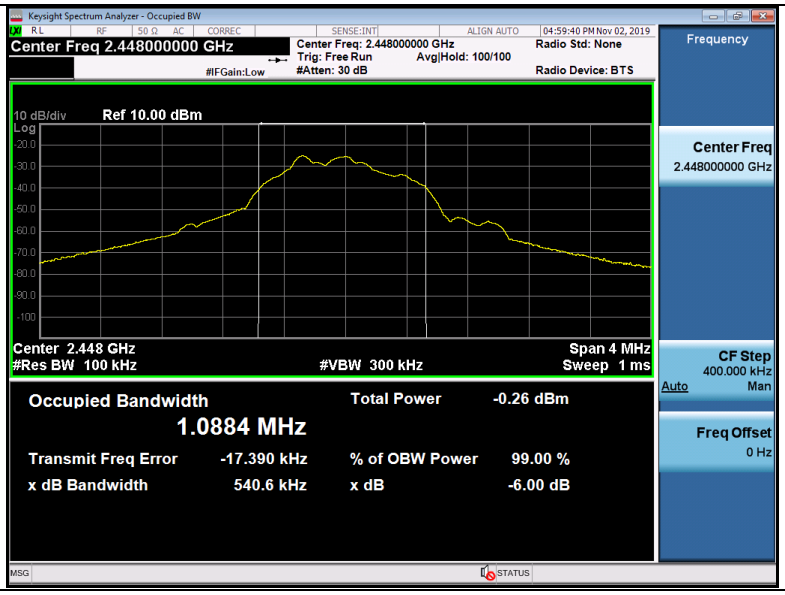
1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.
4. Measure and record the results in the test report.

**Test Results:**

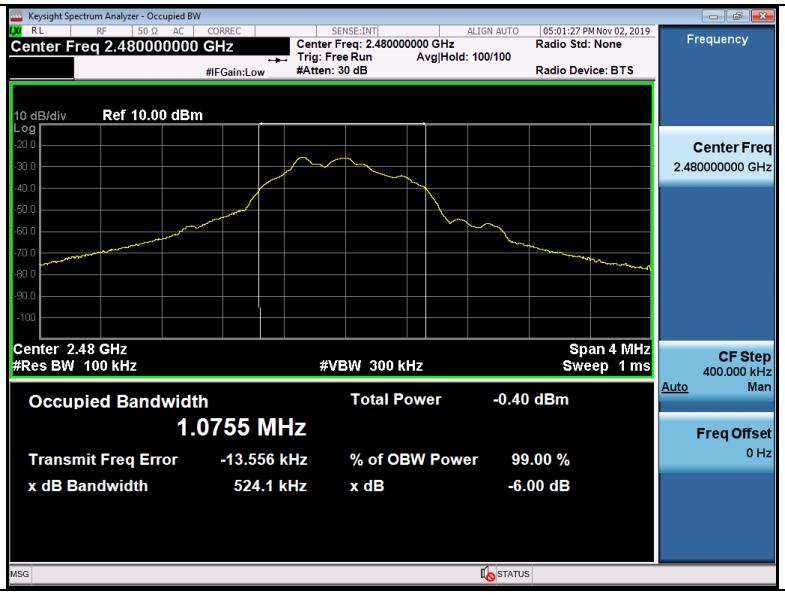
| Test Channel (MHz) | 6dB Emission Bandwidth (MHz) | Limit (kHz) | Result |
|---|---|---|---|
| 2416 | 533.9 | 500 | PASS |
| 2448 | 540.6 | | PASS |
| 2480 | 524.1 | | PASS |

2416MHz


2448MHz


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.448000000 GHz
Center Freq: 2.448000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
04:59:40 PM Nov 02, 2019
Frequency
10 dB/div
Log
Ref 10.00 dBm
Center 2.448 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 1 ms
Occupied Bandwidth
1.0884 MHz
Total Power -0.26 dBm
Transmit Freq Error -17.390 kHz
% of OBW Power 99.00 %
x dB Bandwidth 540.6 kHz
x dB -6.00 dB
Center Freq
2.448000000 GHz
CF Step
400.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

2480MHz

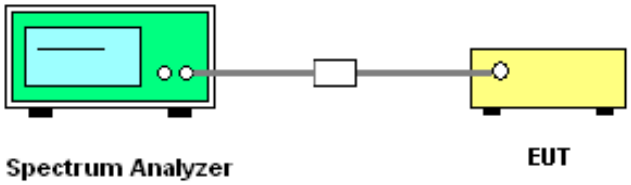

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold: 100/100
#Atten: 30 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
05:01:27 PM Nov 02, 2019
Frequency
10 dB/div
Log
Ref 10.00 dBm
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4 MHz
Sweep 1 ms
Occupied Bandwidth
1.0755 MHz
Total Power -0.40 dBm
Transmit Freq Error -13.556 kHz
% of OBW Power 99.00 %
x dB Bandwidth 524.1 kHz
x dB -6.00 dB
Center Freq
2.480000000 GHz
CF Step
400.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

## 3.5 Power Spectral Density

**Limit**

Max 8dBm/3kHz

**TEST CONFIGURATION**



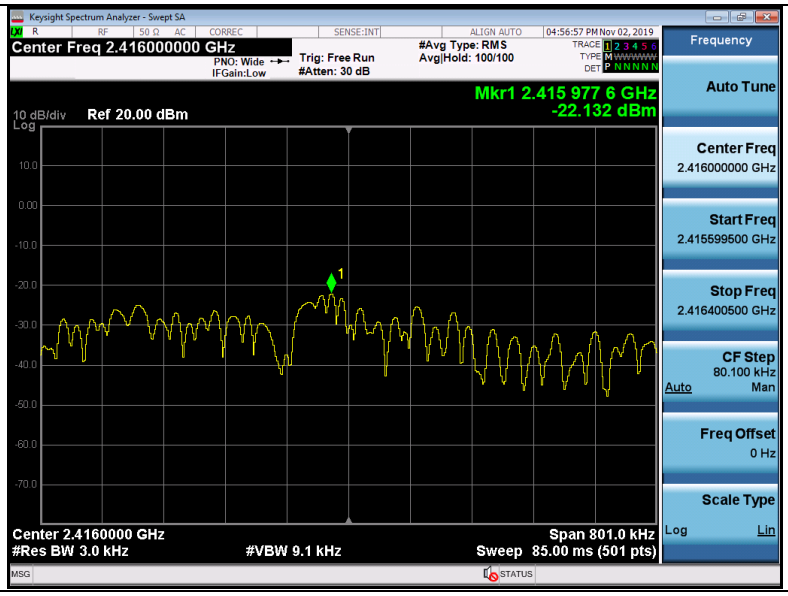

**Test Procedure:**

1. The testing follows Measurement procedure 10.2 method PKPSD of FCC KDB Publication No.558074 D01 DTS Meas. Guidance v05
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW.
5. Detector = Peak, Sweep time = auto couple.
6. Employ trace averaging (Peak) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

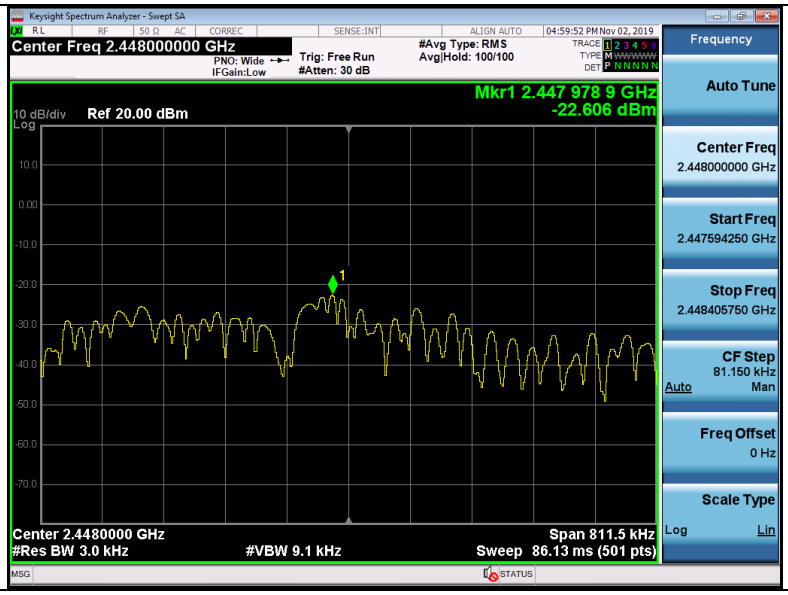
**Test Result**

| Test Channel (MHz) | Power Spectral Density (dBm/3kHz) | Limit (dBm/3kHz) | Result |
|---|---|---|---|
| 2416 | -22.132 | ≤ 8.00 | PASS |
| 2448 | -22.606 | ≤ 8.00 | PASS |
| 2480 | -23.029 | ≤ 8.00 | PASS |

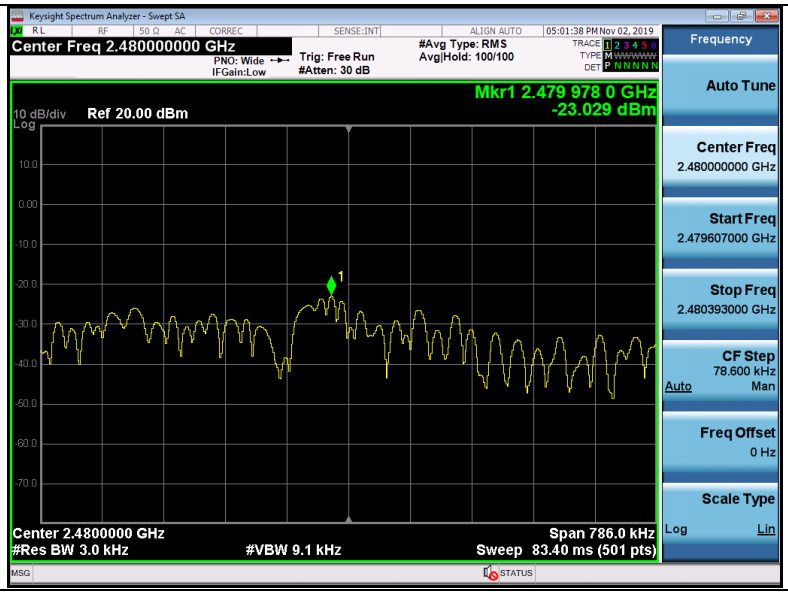
2416MHz




2448MHz




2480MHz

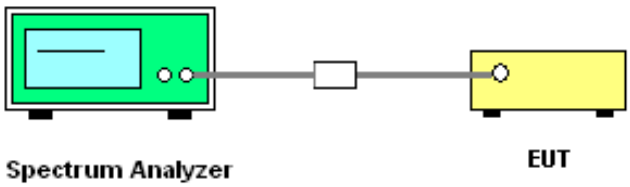


## 3.6 Conducted Band Edge and Spurious Emission Measurement

### Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

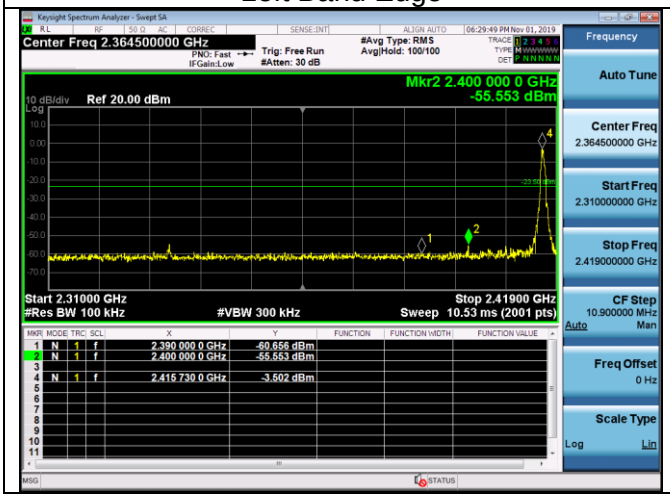
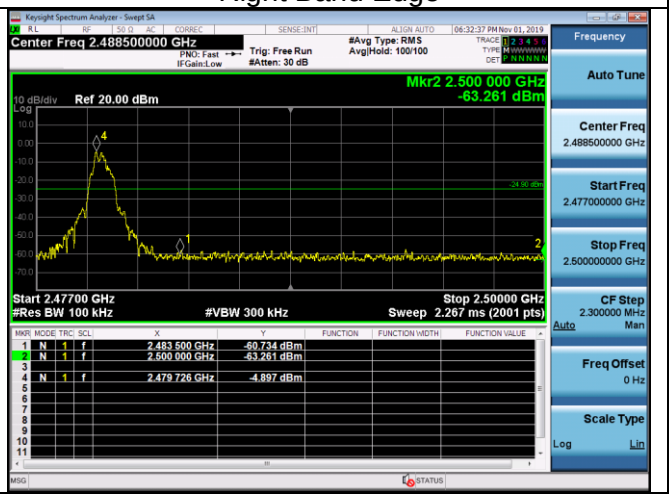
### TEST CONFIGURATION



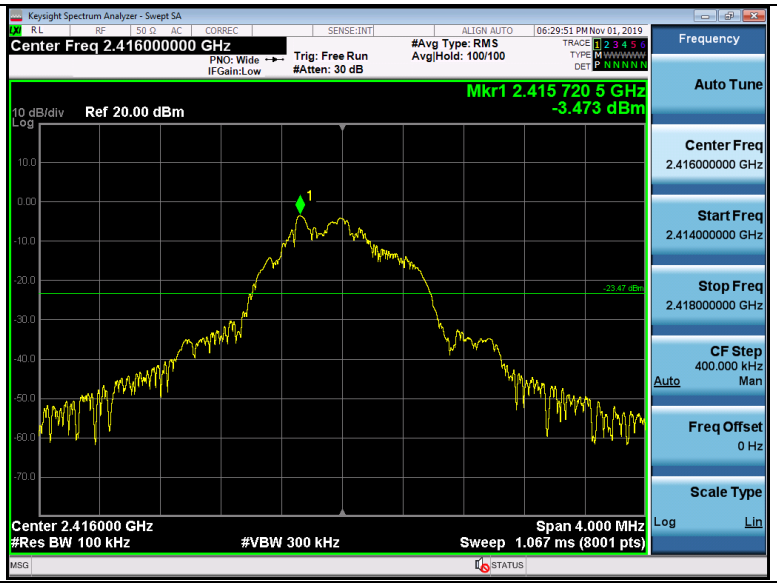
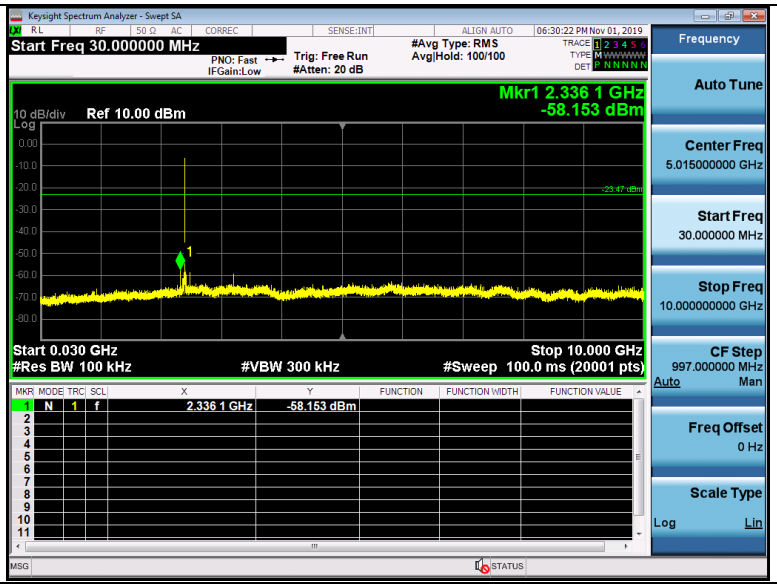
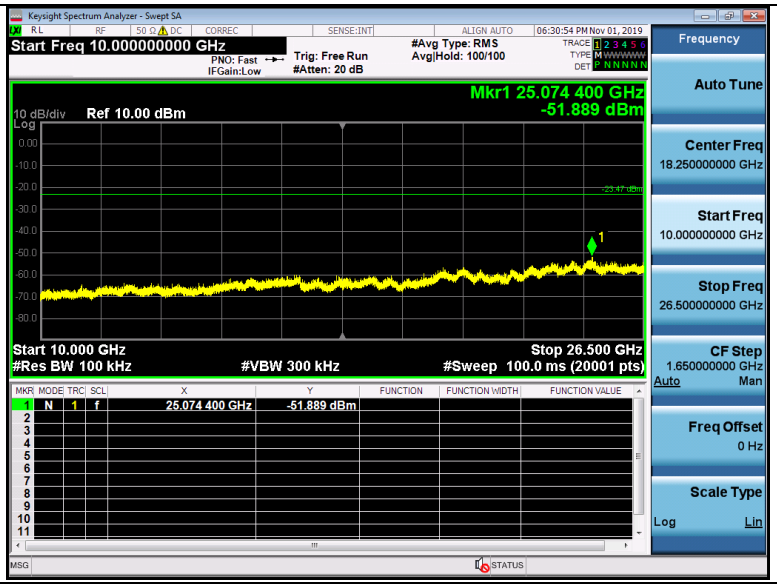

### Test Procedure:

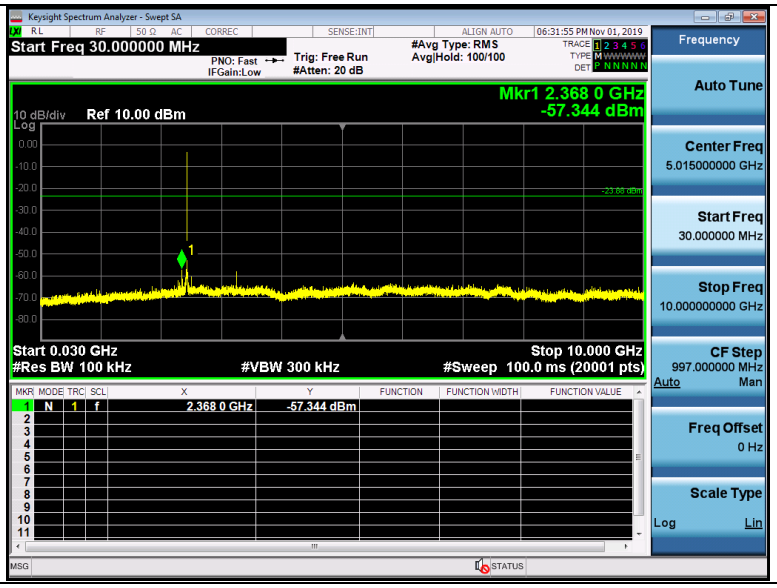
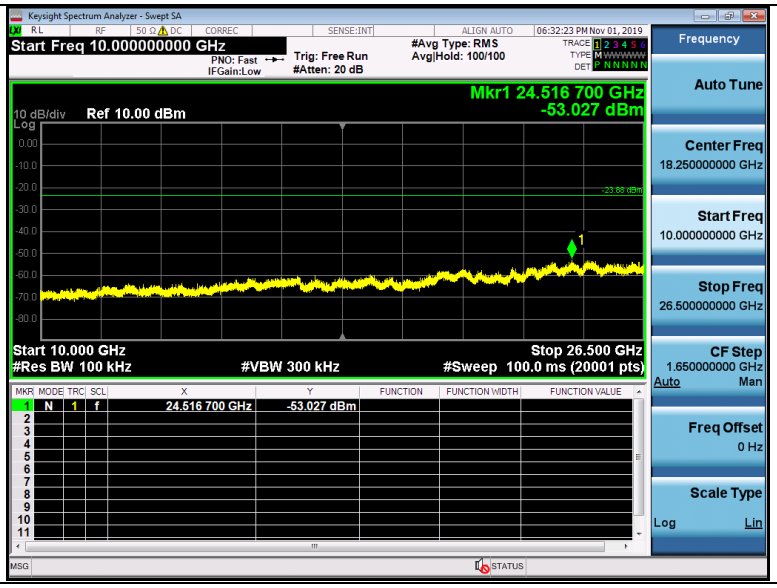
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

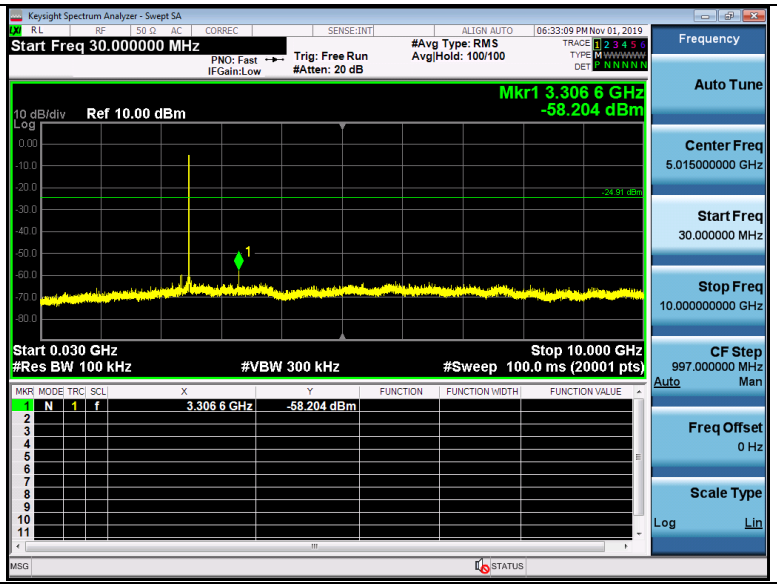
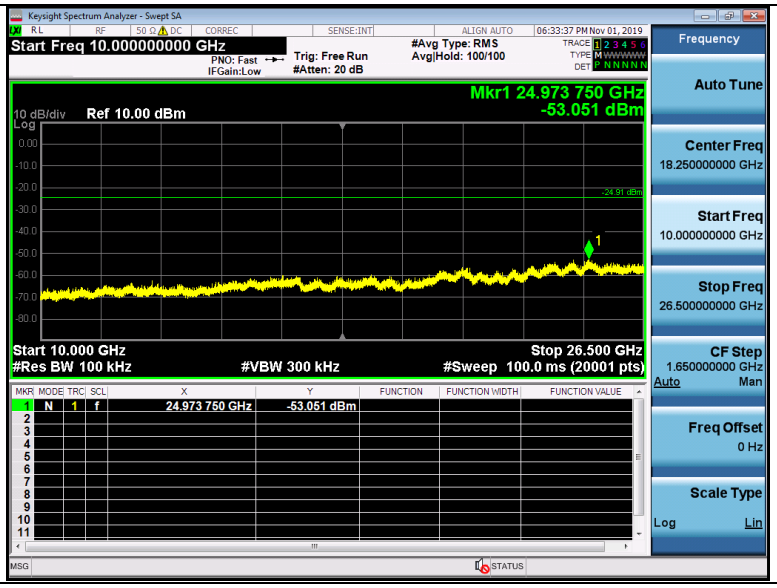
### Test Result

| Left Band Edge | Right Band Edge |
|---|---|
|  |  |

**Spurious emission**

| | |
|---|---|
| Low Channel | Reference |
| |  |
| | 30MHz – 10GHz |
| |  |
| | 10GHz – 26.5GHz |
| |  |

| | |
|---|---|
| Middle Channel | Reference |
| |  |
| | 30MHz – 10GHz |
| |  |
| | 10GHz – 26.5GHz |
| |  |

| | |
|---|---|
| High Channel | Reference |
| |  |
| | 30MHz – 10GHz |
| |  |
| | 10GHz – 26.5GHz |
| |  |

## 3.7 ANTENNA REQUIREMENT

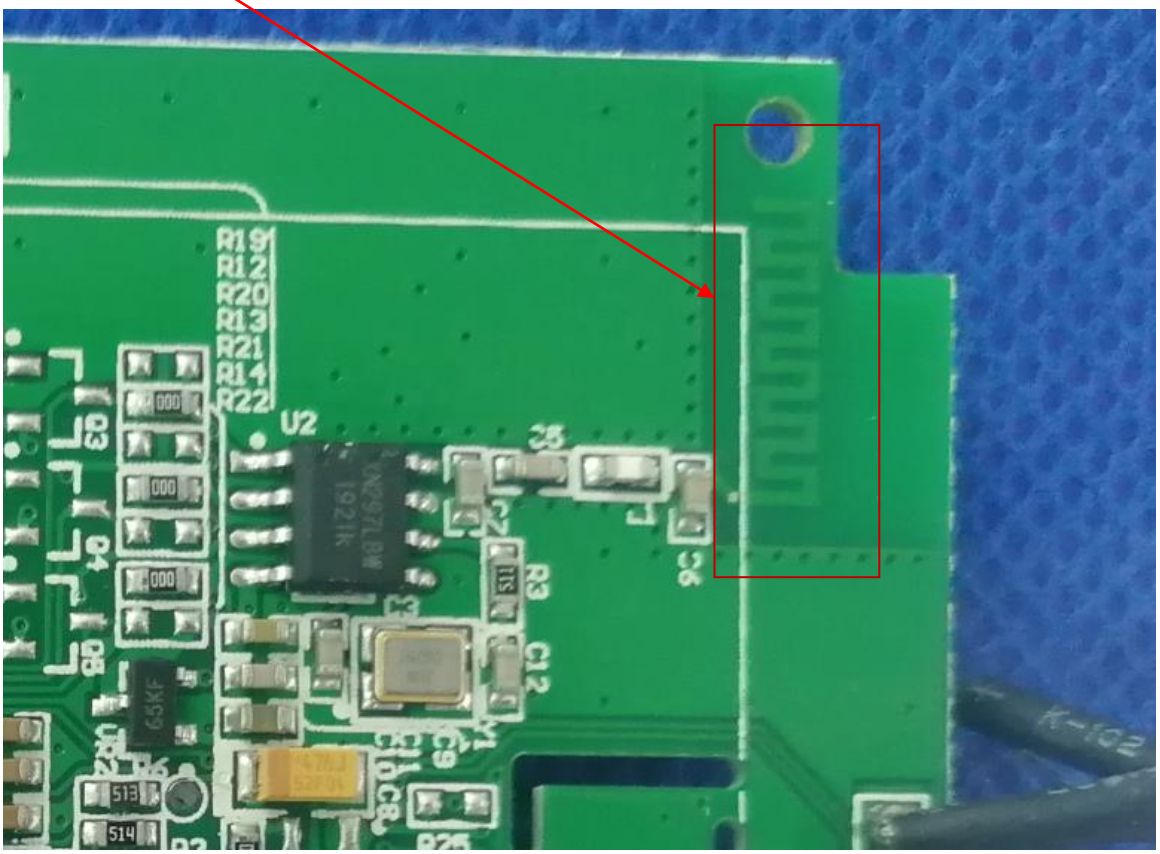
**Standard Applicable**

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 15.249, 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.

**Antenna Connected Construction**

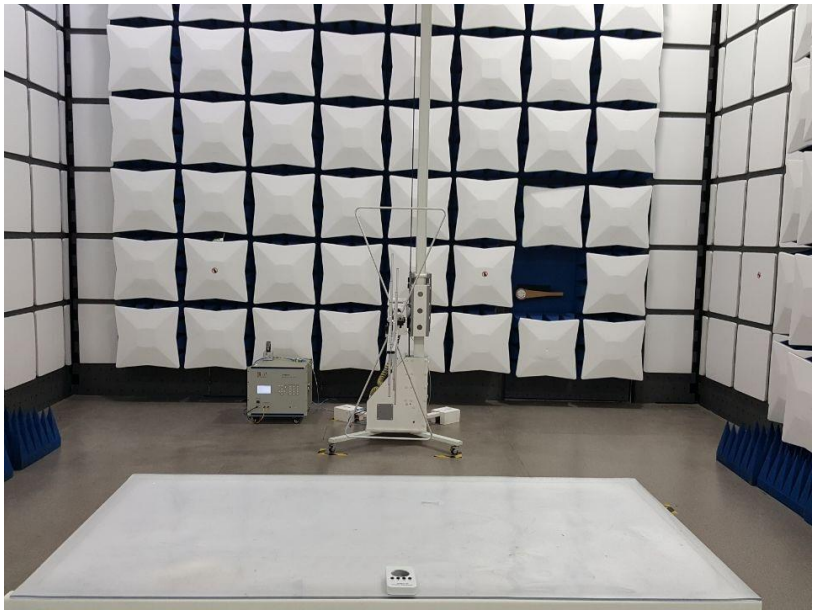
The antenna used in this product is a PCB antenna , The directional gains of antenna used for transmitting is 0dBi.

PCB ANTENNA

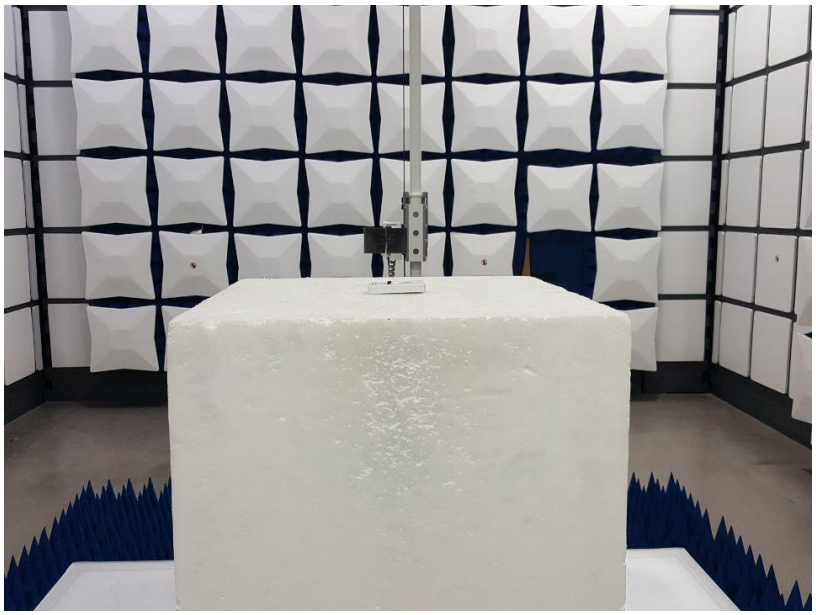


# 4 PHOTOGRAPH OF TEST

30MHz-1000MHz

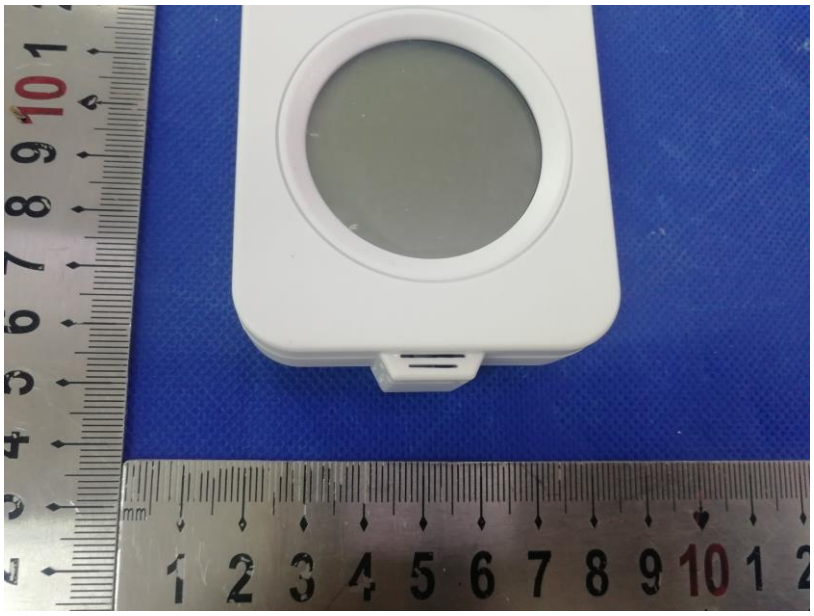


Above 1000MHz



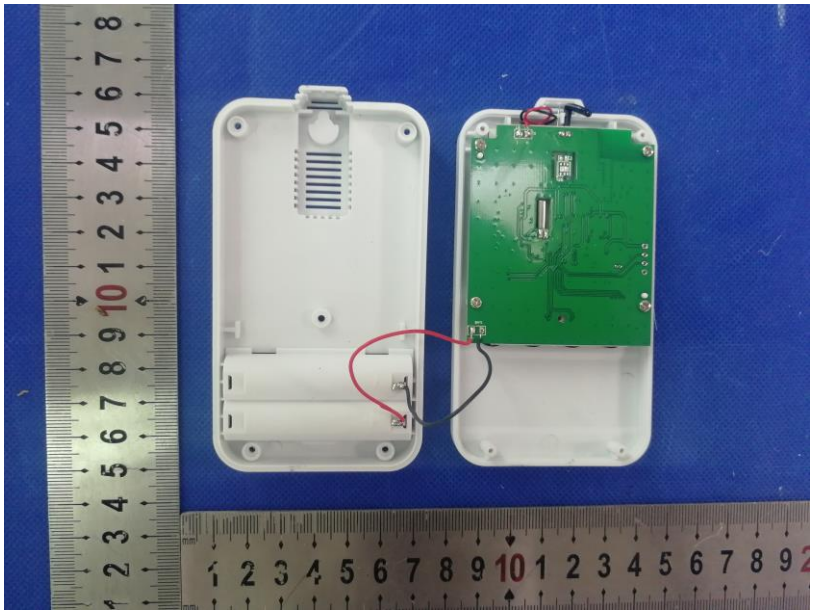
# 5 PHOTOGRAPH OF EUT

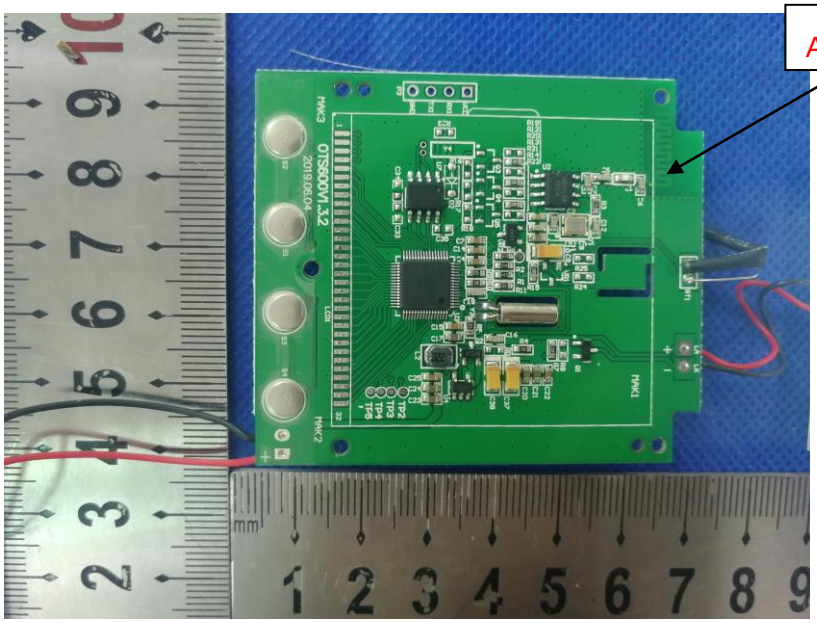
**External photos**

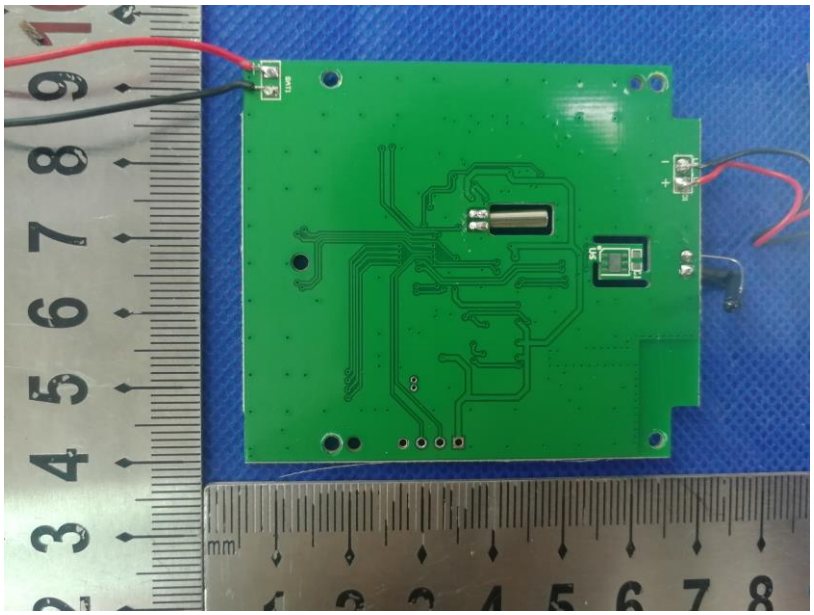




M
OK
Built-in RC
Wireless Thermostat

**Internal photos**





**END**