# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** ..... | : | WTF15S0425705E |
| **FCC ID** ..... | : | XNZKTH91802G |
| **Applicant**..... | : | KATUMFEL INDUSTRY LIMITED(HK) |
| **Address**..... | : | FuCheng Industrial Town, HongTian, ShaJing, Shenzhen, Hong Kong |
| **Manufacturer** ..... | : | The same as above |
| **Address**..... | : | The same as above |
| **Product Name**..... | : | 2.4G transmitter |
| **Model No**. ..... | : | KTH-91802G |
| **Brand**…… | : | N/A |
| **Standards**..... | : | FCC CFR47 Part 15 Section 15.247:2014 |
| **Date of Receipt sample** .... | : | April. 28, 2015 |
| **Date of Test**..... | : | April. 28~May 06, 2015 |
| **Date of Issue**..... | : | Jun. 03, 2015 |
| **Test Result**..... | : | **Pass** |

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.


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Philo Zhong / Manager

# 2 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.247(d) | PASS |
| Band edge | 15.247(d)<br>15.205(a) | PASS |
| Conducted Emission | 15.207 | N/A |
| 20dB Bandwidth | 15.247(a)(1) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Frequency Separation | 15.247(a)(1) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS |
| Dwell time | 15.247(a)(1)(iii) | PASS |
| Maximum Permissible Exposure<br>(Exposure of Humans to RF Fields) | 1.1307(b)(1) | PASS |

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# 4 General Information

## 4.1 General Description of E.U.T.

Product Name :2.4G transmitter
Model No. :KTH-91802G
Frequency Range : 2405-2478MHz, 74 Channels in total
Antenna installation : Integrated Antenna
Antenna Gain : 3.0 dBi
Type of Modulation : GFSK
The Lowest Oscillator : 16MHz

## 4.2 Details of E.U.T.

**Technical Data:** : Transmitter: 1.5VDC *4

## 4.3 Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 0 | 2405 | 1 | 2406 | 2 | 2407 | 3 | 2408 |
| 4 | 2409 | 5 | 2410 | 6 | 2411 | 7 | 2412 |
| 8 | 2413 | 9 | 2414 | 10 | 2415 | 11 | 2416 |
| 12 | 2417 | 13 | 2418 | 14 | 2419 | 15 | 2420 |
| 16 | 2421 | 17 | 2422 | 18 | 2423 | 19 | 2424 |
| 20 | 2425 | 21 | 2426 | 22 | 2427 | 23 | 2428 |
| 24 | 2429 | 25 | 2430 | 26 | 2431 | 27 | 2432 |
| 28 | 2433 | 29 | 2434 | 30 | 2435 | 31 | 2436 |
| 32 | 2437 | 33 | 2438 | 34 | 2439 | 35 | 2440 |
| 36 | 2441 | 37 | 2442 | 38 | 2443 | 39 | 2444 |
| 40 | 2445 | 41 | 2446 | 42 | 2447 | 43 | 2448 |
| 44 | 2449 | 45 | 2450 | 46 | 2451 | 47 | 2452 |
| 48 | 2453 | 49 | 2454 | 50 | 2455 | 51 | 2456 |
| 52 | 2457 | 53 | 2458 | 54 | 2459 | 55 | 2460 |
| 56 | 2461 | 57 | 2462 | 58 | 2463 | 59 | 2464 |
| 60 | 2465 | 61 | 2466 | 62 | 2467 | 63 | 2468 |
| 64 | 2469 | 65 | 2470 | 66 | 2471 | 67 | 2472 |
| 68 | 2473 | 69 | 2474 | 70 | 2475 | 71 | 2476 |
| 72 | 2477 | 73 | 2478 | 74 | / | 75 | / |

## 4.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

  Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, July 12, 2012.

- **FCC Test Site 1#– Registration No.: 880581**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

# 5 Equipment Used during Test

## 5.1 Equipments List

| Conducted Emissions Test Site 1# | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | EMI Test Receiver | R&S | ESCI | 100947 | Sep.15,2014 | Sep.14,2015 |
| 2. | LISN | R&S | ENV216 | 101215 | Sep.15,2014 | Sep.14,2015 |
| 3. | Cable | Top | TYPE16(3.5M) | - | Sep.15,2014 | Sep.14,2015 |
| **Conducted Emissions Test Site 2#** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | EMI Test Receiver | R&S | ESCI | 101155 | Sep.15,2014 | Sep.14,2015 |
| 2. | LISN | SCHWARZBECK | NSLK 8128 | 8128-289 | Sep.15,2014 | Sep.14,2015 |
| 3. | Limiter | York | MTS-IMP-136 | 261115-001-0024 | Sep.15,2014 | Sep.14,2015 |
| 4. | Cable | LARGE | RF300 | - | Sep.15,2014 | Sep.14,2015 |
| **3m Semi-anechoic Chamber for Radiation Emissions Test site 1#** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | EMC Analyzer | Agilent | E7405A | MY45114943 | Sep.15,2014 | Sep.14,2015 |
| 2 | Active Loop Antenna | Beijing Dazhi | ZN30900A | - | Sep.15,2014 | Sep.14,2015 |
| 3 | Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 336 | Apr.19,2015 | Apr.18,2016 |
| 4 | Coaxial Cable (below 1GHz) | Top | TYPE16(13M) | - | Sep.15,2014 | Sep.14,2015 |
| 5 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120 D | 667 | Apr.19,2015 | Apr.18,2016 |
| 6 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9170 | 335 | Apr.19,2015 | Apr.18,2016 |
| 7 | Broadband Preamplifier | COMPLIANCE DIRECTION | PAP-1G18 | 2004 | Mar.17,2015 | Mar.16,2016 |
| 8 | Coaxial Cable (above 1GHz) | Top | 1GHz-25GHz | EW02014-7 | Apr.10,2015 | Apr.09,2016 |
| **3m Semi-anechoic Chamber for Radiation Emissions Test site 2#** | | | | | | |
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No** | **Last Calibration Date** | **Calibration Due Date** |
| 1 | Test Receiver | R&S | ESCI | 101296 | Sep.15,2014 | Sep.14,2015 |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9160 | 9160-3325 | Sep.15,2014 | Sep.14,2015 |
| 3 | Amplifier | Compliance pirection systems inc | PAP-0203 | 22024 | Sep.15,2014 | Sep.14,2015 |
| 4 | Cable | HUBER+SUHNER | CBL2 | 525178 | Sep.15,2014 | Sep.14,2015 |

| RF Conducted Testing | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Last Calibration Date** | **Calibration Due Date** |
| 1. | EMC Analyzer (9k~26.5GHz) | Agilent | E7405A | MY45114943 | Sep.15,2014 | Sep.14,2015 |
| 2. | Spectrum Analyzer (9k-6GHz) | R&S | FSL6 | 100959 | Sep.15,2014 | Sep.14,2015 |
| 3. | Signal Analyzer (9k~26.5GHz) | Agilent | N9010A | MY50520207 | Sep.15,2014 | Sep.14,2015 |

## 5.2 Measurement Uncertainty

| **Parameter** | **Uncertainty** |
|---|---|
| Radio Frequency | ± 1 x $10^{-6}$ |
| RF Power | ± 1.0 dB |
| RF Power Density | ± 2.2 dB |
| Radiated Spurious Emissions test | ± 5.03 dB (Bilog antenna 30M~1000MHz) |
| | ± 5.47 dB (Horn antenna 1000M~25000MHz) |
| Conducted Spurious Emissions test | ± 3.64 dB (AC mains 150KHz~30MHz) |

## 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

# 6 Conducted Emission

| | |
|---|---|
| Test Requirement: | FCC CFR 47 Part 15 Section 15.207 |
| Test Method: | ANSI C63.4:2003 |
| Test Result: | N/A |
| Frequency Range: | 150kHz to 30MHz |
| Class/Severity: | Class B |
| Limit: | 66-56 dBμV between 0.15MHz & 0.5MHz |
| | 56 dBμV between 0.5MHz & 5MHz |
| | 60 dBμV between 5MHz & 30MHz |
| Detector: | Peak for pre-scan (9kHz Resolution Bandwidth) |

Re: Due to the EUT power from battery, this Item is not applicable.

# 7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

Test Result: PASS

Measurement Distance: 3m

Limit:

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | 100 * 30 | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

## 7.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

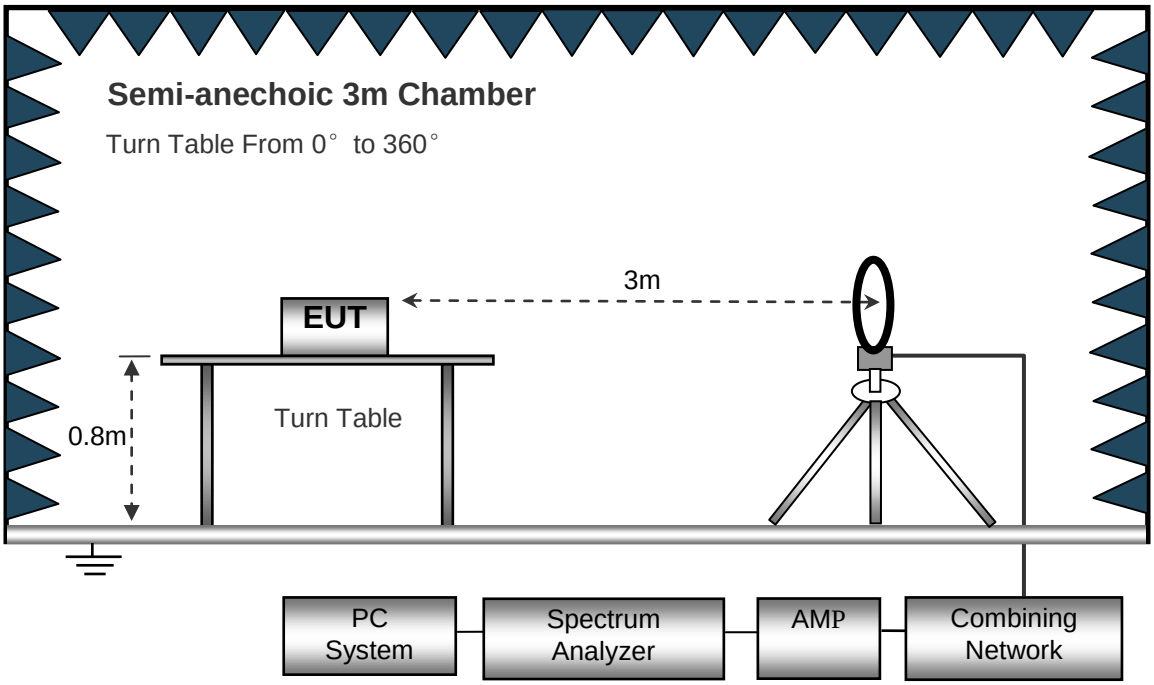
EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

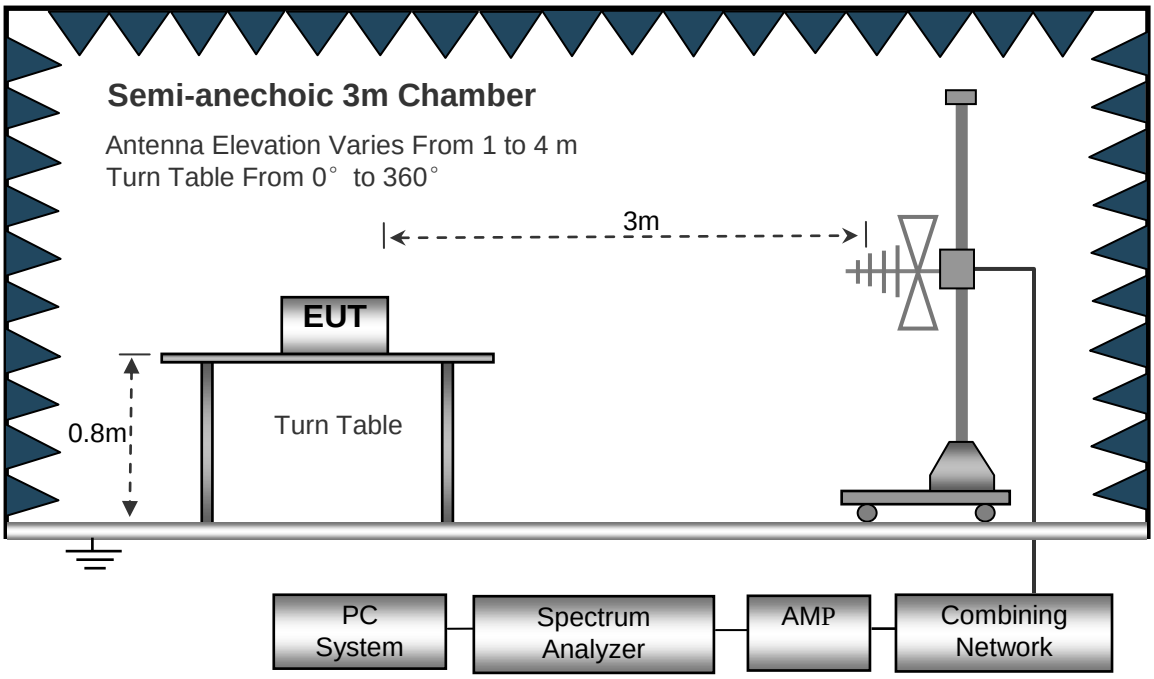
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

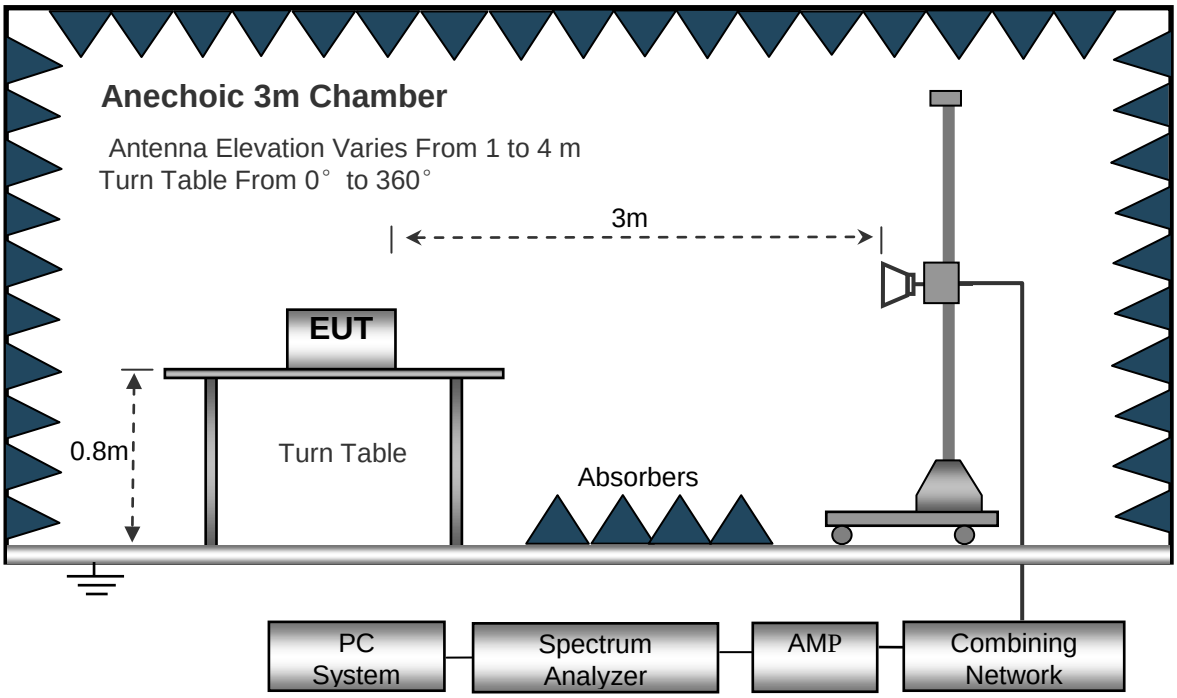
The test setup for emission measurement below 30MHz.




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.




## 7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz

Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

## 7.4 Test Procedure

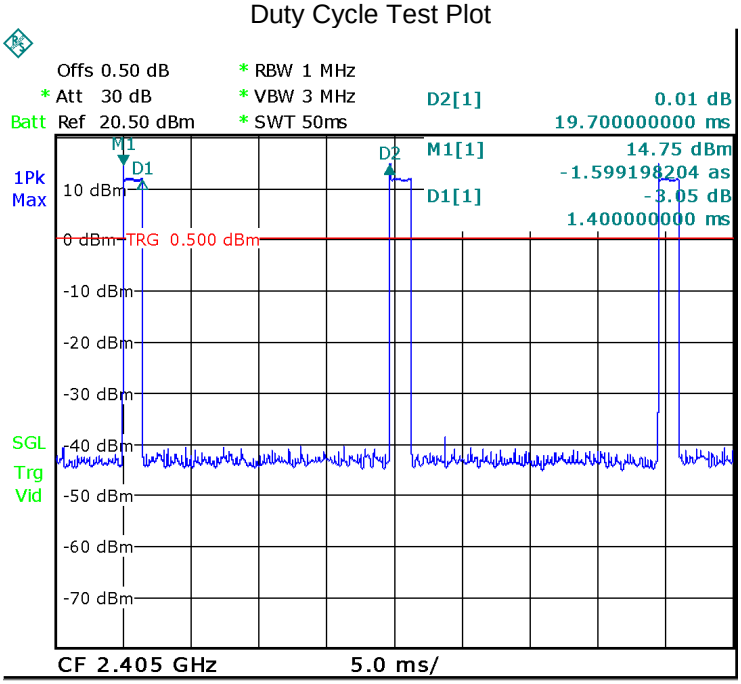
1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

## 7.5 Summary of Test Results

AV = Peak +20Log$_{10}$(duty cycle) =PK-23

Duty Cycle=(1.4/19.7)*100%=7.1%

Duty Cycle Test Plot



**Test Frequency: 16MHz to 30MHz**

The measurements were more than 20 dB below the limit and not reported.

**Test Frequency: 30MHz ~ 18GHz**

Test mode: transmitting mode

Low Channel

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV) | (PK/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 322.60 | 15.61 | QP | 79 | 1.4 | H | 17.01 | 32.62 | 46.00 | -13.38 |
| 322.60 | 17.22 | QP | 29 | 1.0 | V | 17.01 | 34.23 | 46.00 | -11.77 |
| 4810.00 | 72.16 | PK | 221 | 1.7 | H | -0.62 | 71.54 | 74.00 | -2.46 |
| 4810.00 | 70.33 | PK | 136 | 1.8 | V | -0.62 | 69.71 | 74.00 | -4.29 |
| 7215.00 | 51.39 | PK | 251 | 1.6 | H | 2.21 | 53.60 | 74.00 | -20.40 |
| 7215.00 | 51.27 | PK | 243 | 1.3 | V | 2.21 | 53.48 | 74.00 | -20.52 |

| Frequency | PK | Turn table Angle | RX Antenna | | Duty cycle Factor | AV | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV/m) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 4810.00 | 72.16 | 2 | 1.8 | H | -23.00 | 49.16 | 54.00 | -4.84 |
| 4810.00 | 70.33 | 18 | 1.5 | V | -23.00 | 47.33 | 54.00 | -6.67 |
| 7215.00 | 51.39 | 41 | 1.3 | H | -23.00 | 28.39 | 54.00 | -25.61 |
| 7215.00 | 51.27 | 107 | 1.2 | V | -23.00 | 28.27 | 54.00 | -25.73 |

Middle Channel

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV) | (PK/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 322.60 | 16.22 | PK | 263 | 1.3 | H | 17.01 | 33.23 | 46.00 | -12.77 |
| 322.60 | 18.03 | PK | 72 | 1.5 | V | 17.01 | 35.04 | 46.00 | -10.96 |
| 4882.00 | 71.12 | PK | 89 | 1.2 | H | -0.62 | 70.50 | 74.00 | -3.50 |
| 4882.00 | 69.66 | PK | 352 | 1.1 | V | -0.62 | 69.04 | 74.00 | -4.96 |
| 7323.00 | 50.47 | PK | 60 | 1.9 | H | 2.21 | 52.68 | 74.00 | -21.32 |
| 7323.00 | 50.62 | PK | 173 | 1.0 | V | 2.21 | 52.83 | 74.00 | -21.17 |

| Frequency | PK | Turn table Angle | RX Antenna | | Duty cycle Factor | AV | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV/m) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 4882.00 | 71.12 | 326 | 1.3 | H | -23.00 | 48.12 | 54.00 | -5.88 |
| 4882.00 | 69.66 | 194 | 2.0 | V | -23.00 | 46.66 | 54.00 | -7.34 |
| 7323.00 | 50.47 | 100 | 1.5 | H | -23.00 | 27.47 | 54.00 | -26.53 |
| 7323.00 | 50.62 | 323 | 1.0 | V | -23.00 | 27.62 | 54.00 | -26.38 |

High Channel

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV) | (PK/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 322.60 | 20.91 | PK | 102 | 1.0 | H | 17.01 | 37.92 | 46.00 | -8.08 |
| 322.60 | 24.82 | PK | 126 | 1.7 | V | 17.01 | 41.83 | 46.00 | -4.17 |
| 4956.00 | 70.38 | PK | 236 | 1.8 | H | -0.62 | 69.76 | 74.00 | -4.24 |
| 4956.00 | 69.71 | PK | 90 | 1.7 | V | -0.62 | 69.09 | 74.00 | -4.91 |
| 7434.00 | 50.29 | PK | 167 | 1.4 | H | 2.21 | 52.50 | 74.00 | -21.50 |
| 7434.00 | 50.44 | PK | 55 | 1.8 | V | 2.21 | 52.65 | 74.00 | -21.35 |

| Frequency | PK | Turn table Angle | RX Antenna | | Duty cycle Factor | AV | FCC Part 15.247 | |
|---|---|---|---|---|---|---|---|---|
| | | | Height | Polar | | | Limit | Margin |
| (MHz) | (dBμV/m) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 4956.00 | 70.38 | 319 | 1.6 | H | -23.00 | 47.38 | 54.00 | -6.62 |
| 4956.00 | 69.71 | 359 | 1.7 | V | -23.00 | 46.71 | 54.00 | -7.29 |
| 7434.00 | 50.29 | 143 | 1.0 | H | -23.00 | 27.29 | 54.00 | -26.71 |
| 7434.00 | 50.44 | 135 | 1.9 | V | -23.00 | 27.44 | 54.00 | -26.56 |

**Test Frequency :Above 18GHz**

The measurements were more than 20 dB below the limit and not reported

# 8 Band Edge Measurement

| | |
|---|---|
| Test Requirement: | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |
| Test Method: | DA 00-705 |
| Test Limit: | Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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) (see §15.205(c)). |
| Test Mode: | Transmitting and Hopping |

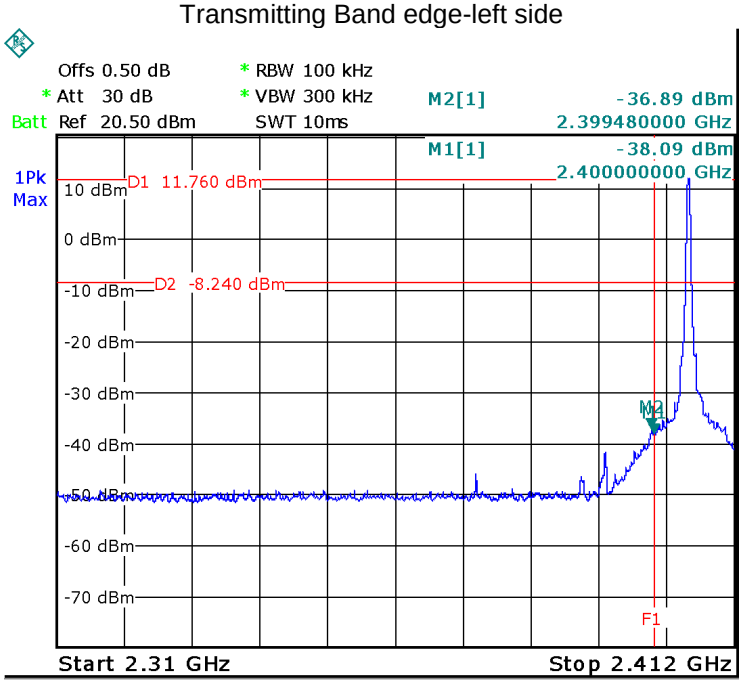
## 8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
   Detector function = peak, Trace = max hold

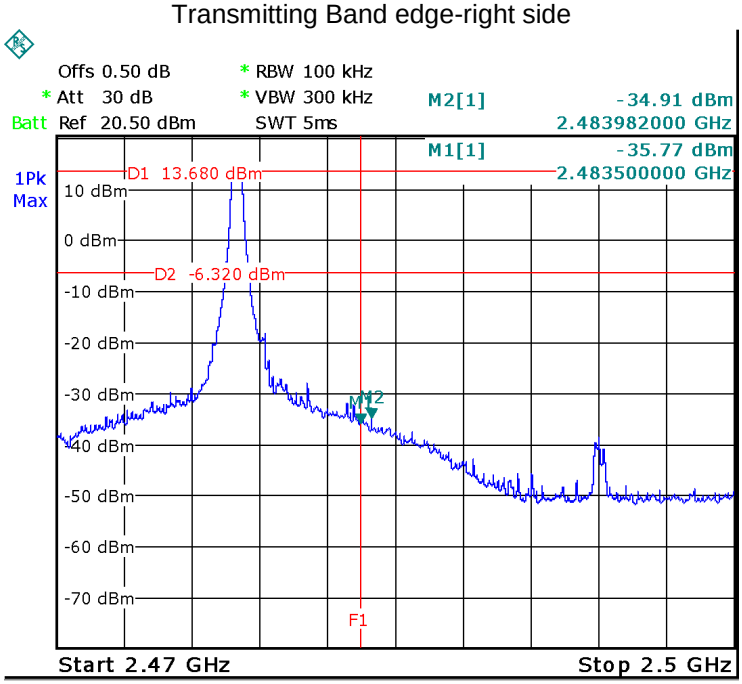
## 8.2 Test Result

Test plots

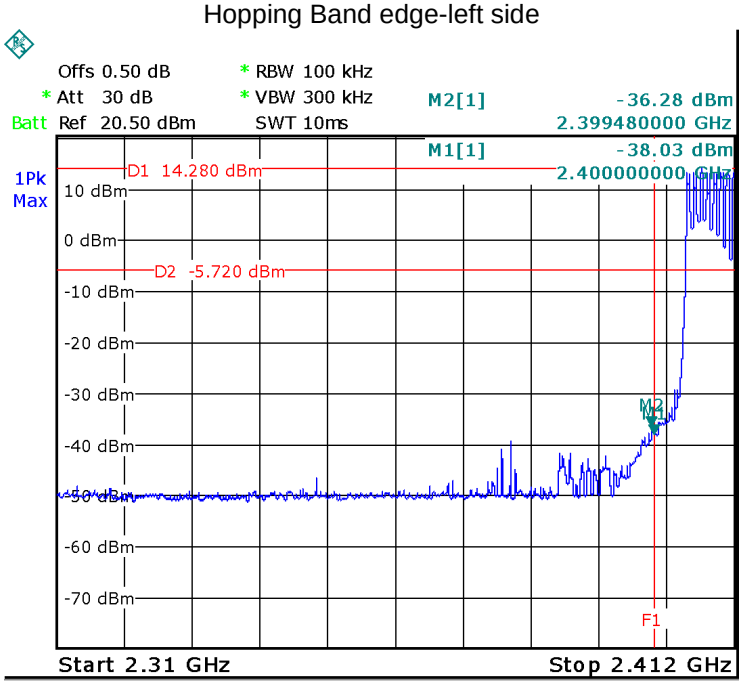
Transmitting Band edge-left side



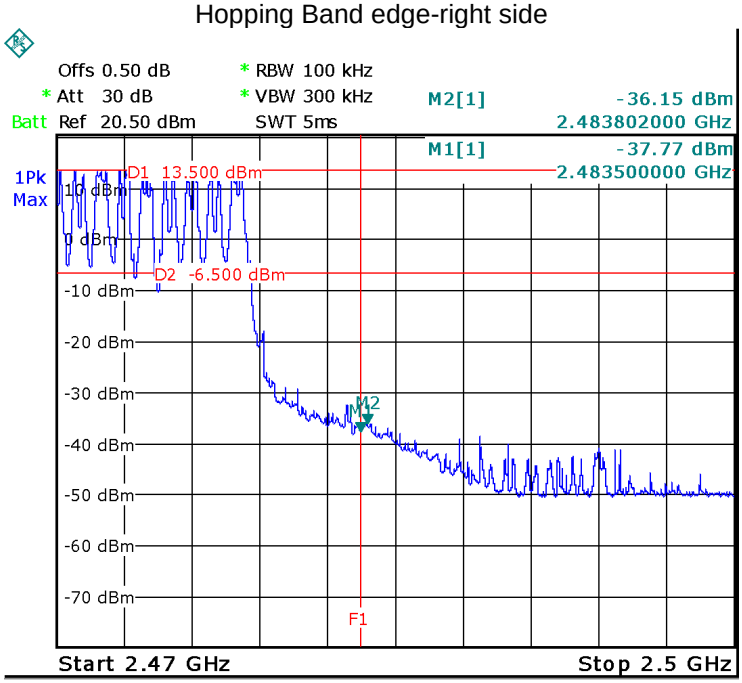

Transmitting Band edge-right side



Hopping Band edge-left side




Hopping Band edge-right side



# 9 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

## 9.1 Test Procedure

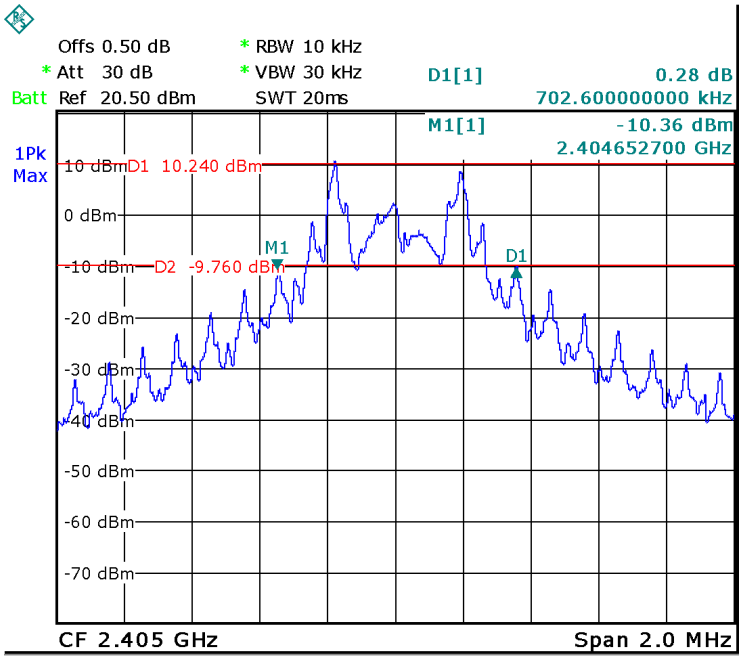
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 10kHz, VBW = 30kHz

## 9.2 Test Result

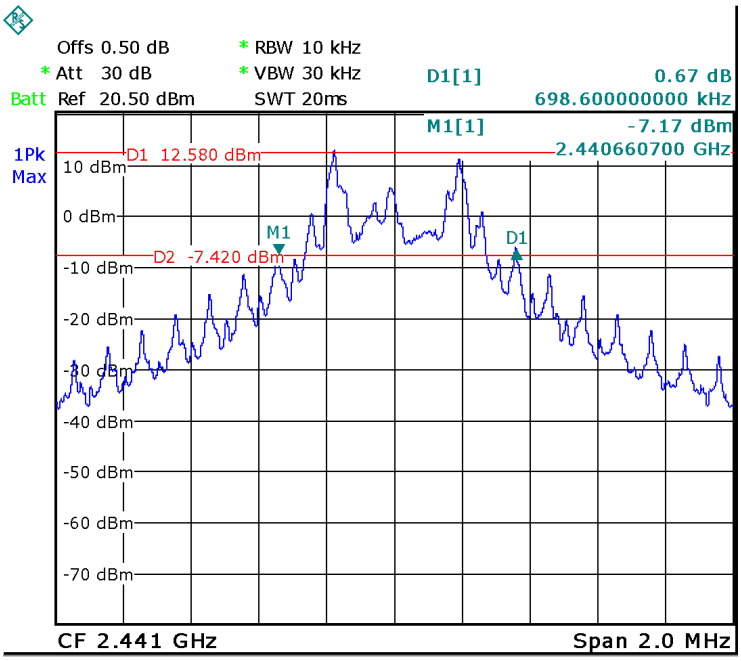
| Test Channel | Bandwidth |
|---|---|
| Low | 0.703MHz |
| Middle | 0.699MHz |
| High | 0.703MHz |

Test plots

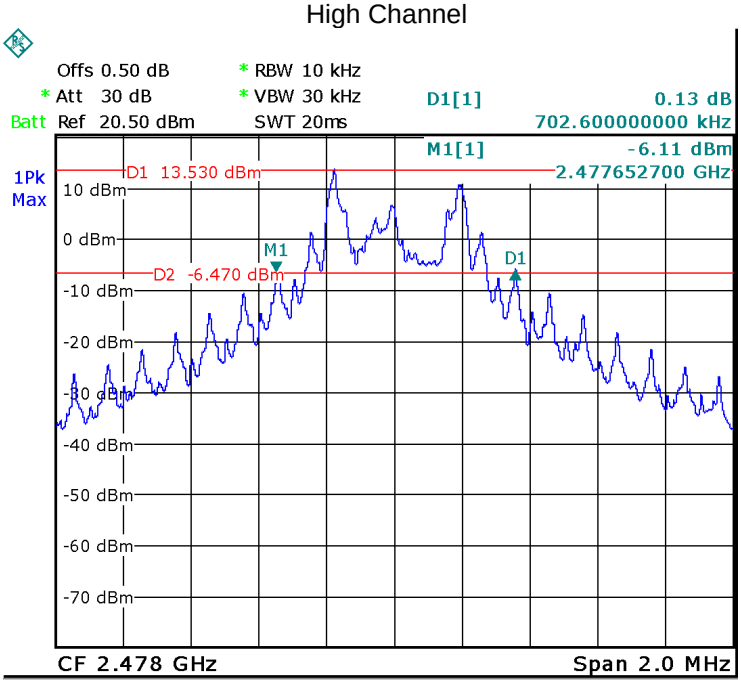
Low Channel



Middle Channel




High Channel



# 10 Maximum Peak Output Power

| | |
|---|---|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247 |
| Test Method: | DA 00-705 |
| Test Limit: | Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.<br>Refer to the result “Number of Hopping Frequency” of this document. The 0.125watts (20.97 dBm) limit applies. |
| Test mode: | Test in fixing frequency transmitting mode. |

## 10.1 Test Procedure

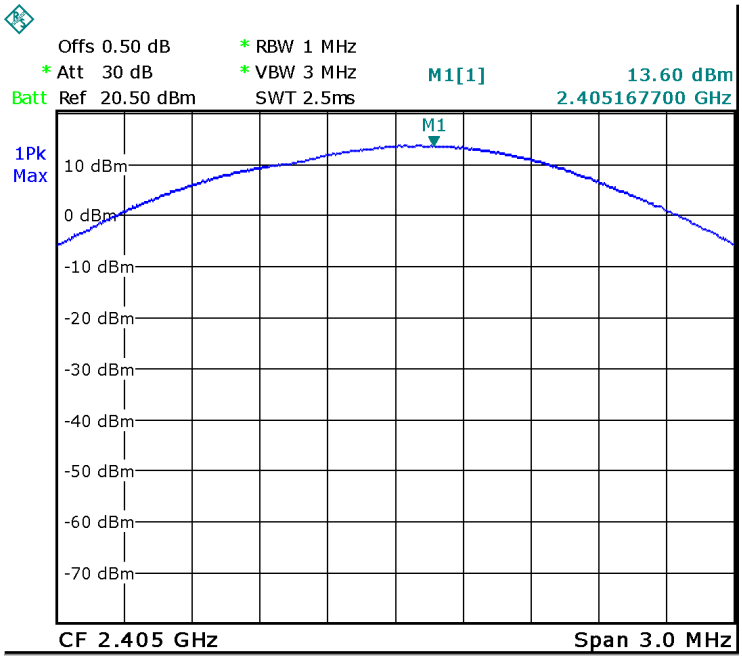
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

## 10.2 Test Result

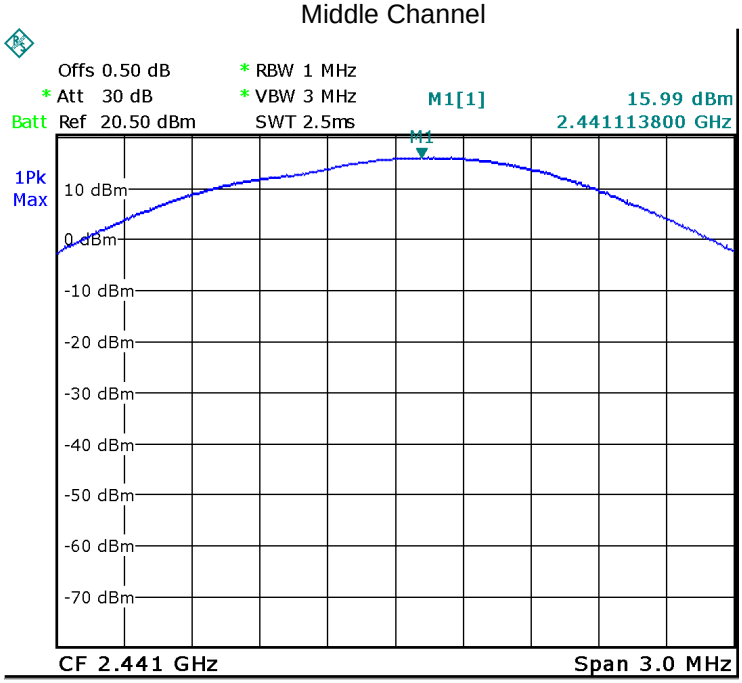
| Test Channel | Output Power (dBm) | Limit (dBm) |
|---|---|---|
| Low | 13.60 | 20.97 |
| Middle | 15.99 | 20.97 |
| High | 16.70 | 20.97 |

Test plots

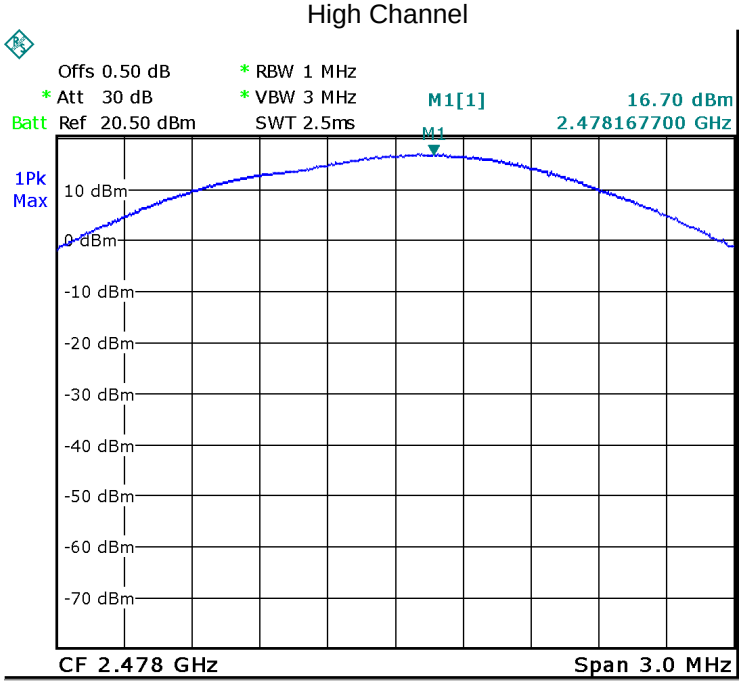
Low Channel




Middle Channel



High Channel



# 11 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Limit: Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.

Test Mode: Test in hopping transmitting operating mode.

## 11.1 Test Procedure

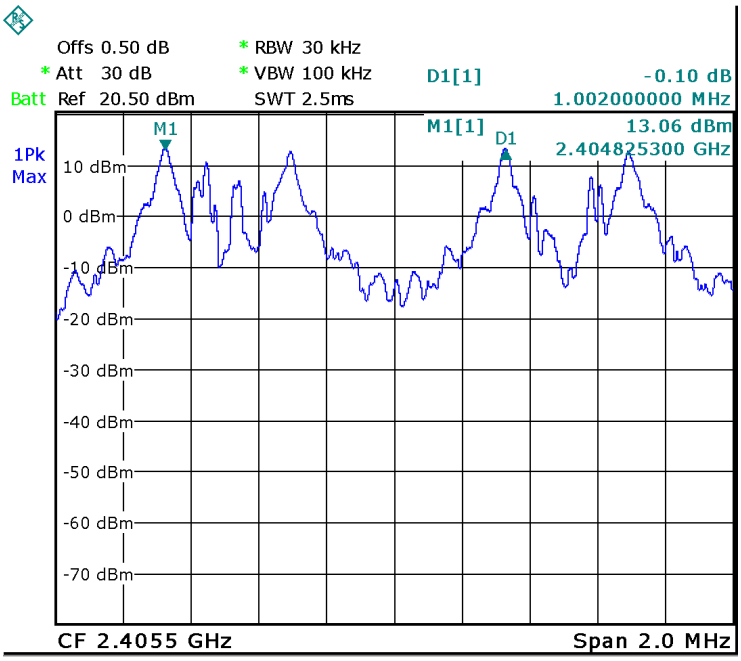
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

## 11.2 Test Result

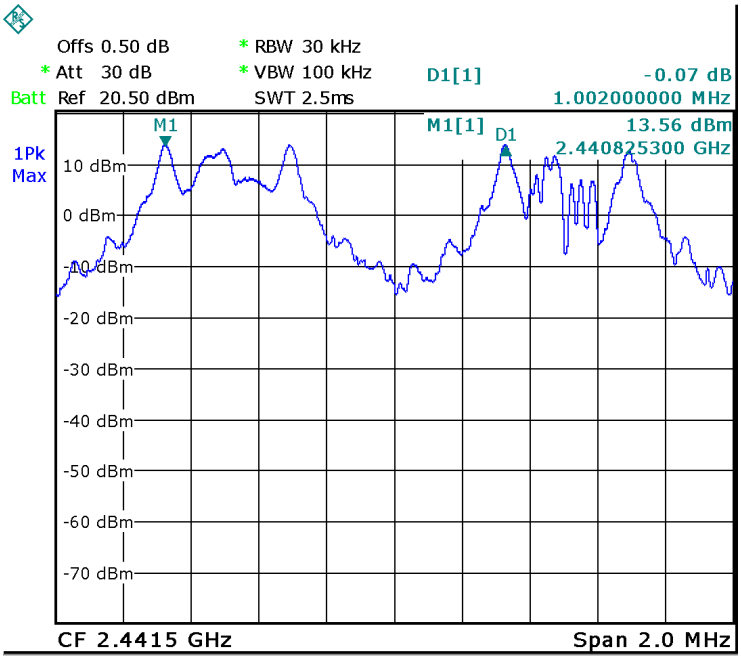
| Test Channel | Separation (MHz) | Result |
|---|---|---|
| Low | 1.002 | PASS |
| Middle | 1.002 | PASS |
| High | 1.002 | PASS |

Test plots

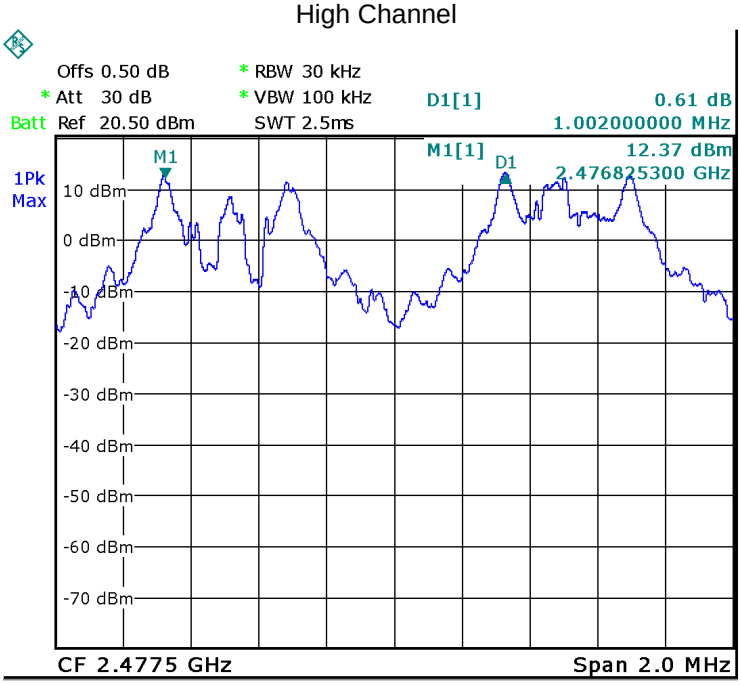
Low Channel




Middle Channel



High Channel



# 12 Number of Hopping Frequency

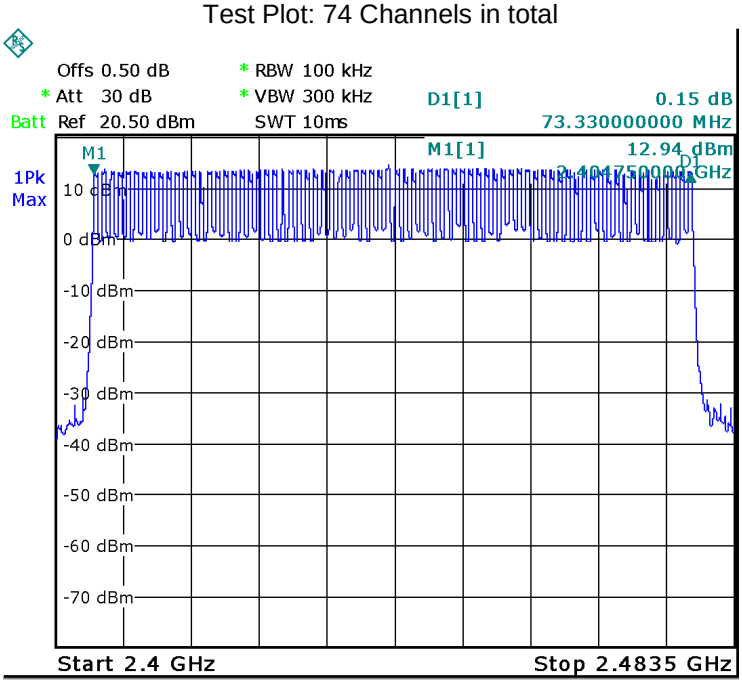
| | |
|---|---|
| Test Requirement: | FCC CFR47 Part 15 Section 15.247 |
| Test Method: | DA 00-705 |
| Test Limit: | Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. |
| Test Mode: | Test in hopping transmitting operating mode. |

## 12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100KHz. VBW = 300KHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

## 12.2 Test Result

Test Plot: 74 Channels in total



# 13 Dwell Time

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Limit: Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Mode: Test in hopping transmitting operating mode.

## 13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

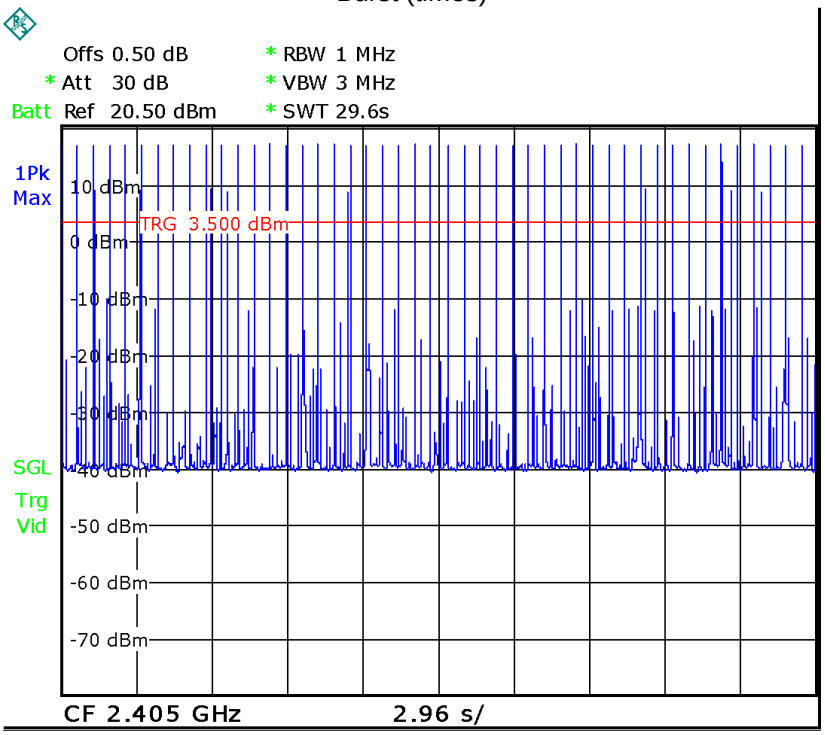
## 13.2 Test Result

| Channel | marker-delta (ms) | Observation Period(s) | Burst (times) | Dwell Time(s) | Limits (s) |
|---|---|---|---|---|---|
| Low | 1.44 | 29.6 | 46 | 0.066 | 0.4 |
| High | 1.28 | 29.6 | 46 | 0.059 | 0.4 |
| Calculation formula:<br>Dwell time= 0.4s*Number of Hopping Frequency*Burst(Times)*<br>(marker delta/1000)/Observation Period<br>Remark: Number of Hopping Frequency=74; Observation Period=29.6s; Low Channel=2405MHz; High Channel=2478MHz | | | | | |

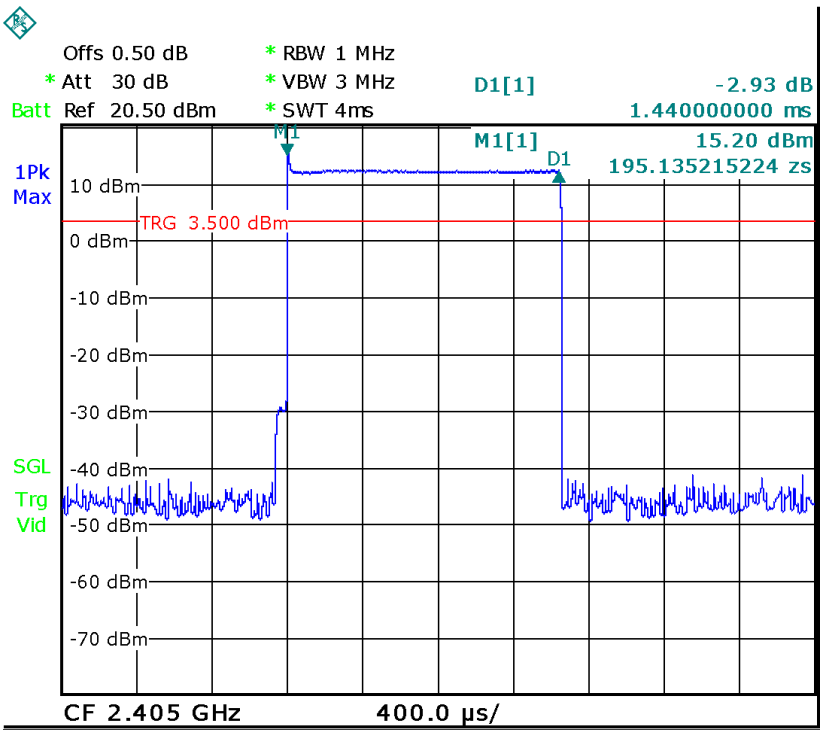
Test Plots

Low Channel

Burst (times)

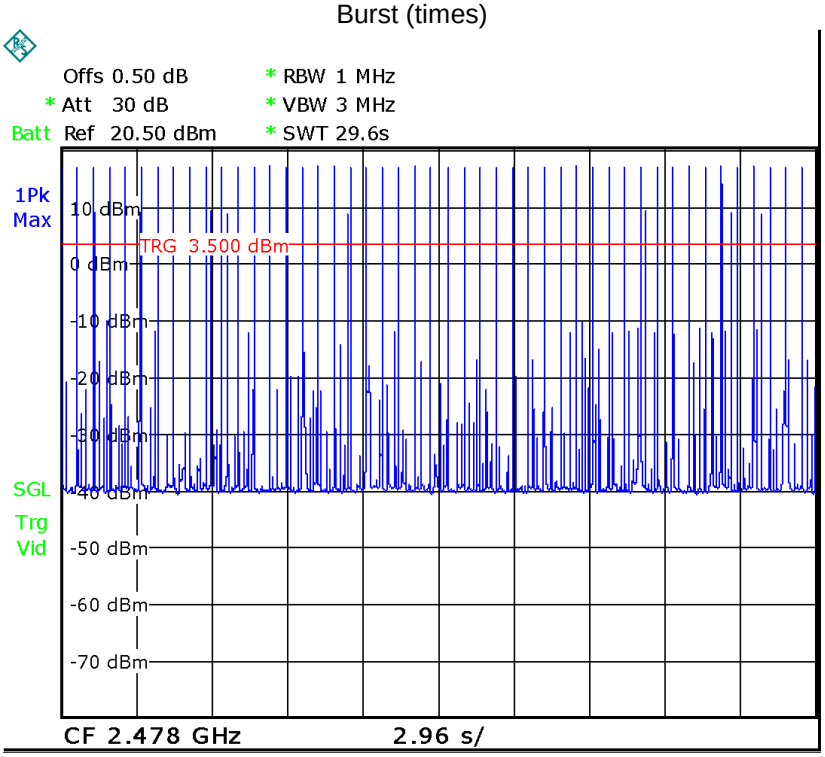



marker-delta

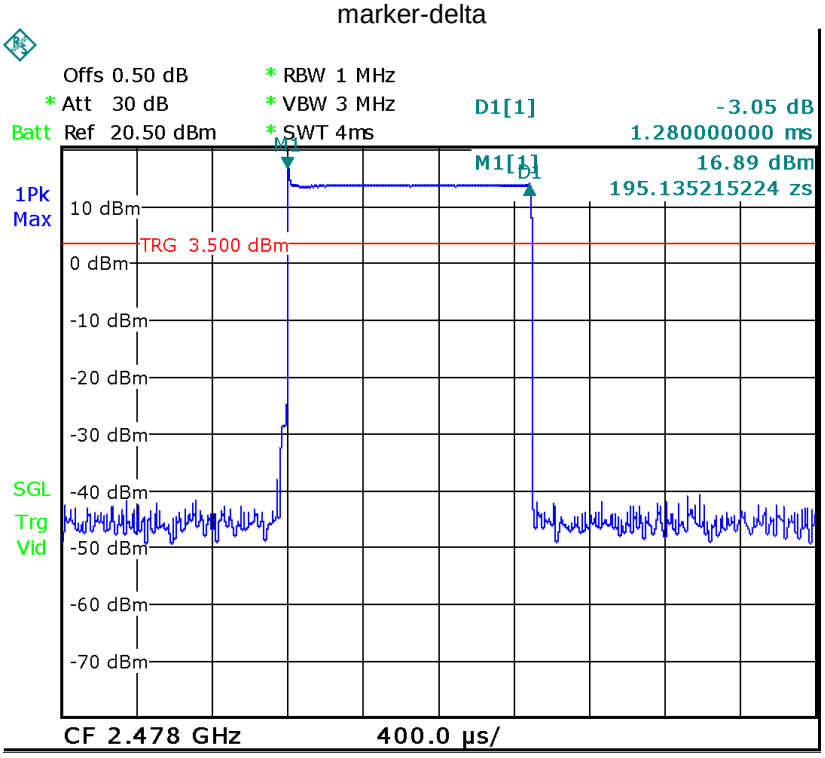


High Channel

Burst (times)




marker-delta



# 14 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a internal permanent antenna, fulfil the requirement of this section.

# 15 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method 447498 D01 General RF Exposure Guidance v05r02

## 15.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤3.0 for 1-g SAR and ≤7.5 for 10-g extremity SAR where

1. f(GHz) is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

## 15.2 The procedures / limit

| Conducted Peak power(dBm) | Conducted Peak power(mW) | Source-based time-averaged maximum conducted output power(mW) | Minimum test separation distance required for the exposure conditions (mm) | SAR Test Exclusion Thresholds(mW) |
|---|---|---|---|---|
| 16.70 | 46.77 | 3.274 | 20 | 95 |

Remark: Max. duty factor is 0.07.

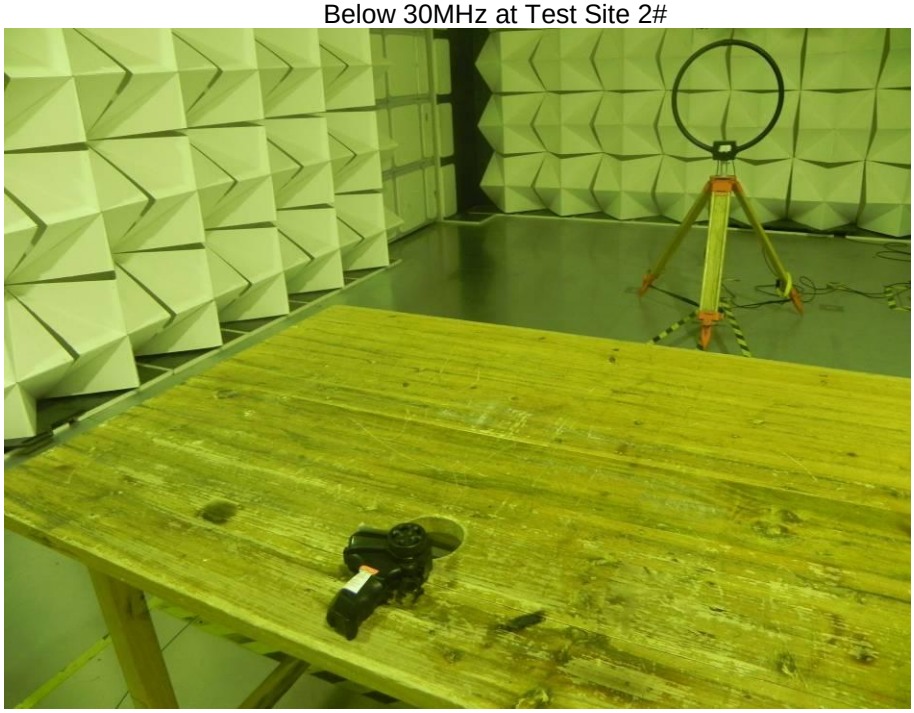
Calculation formula: Source-based time-averaged maximum conducted output power(mW) =Conducted peak power(mW)*0.07

The minimum test separation distance from extremity is 20mm.

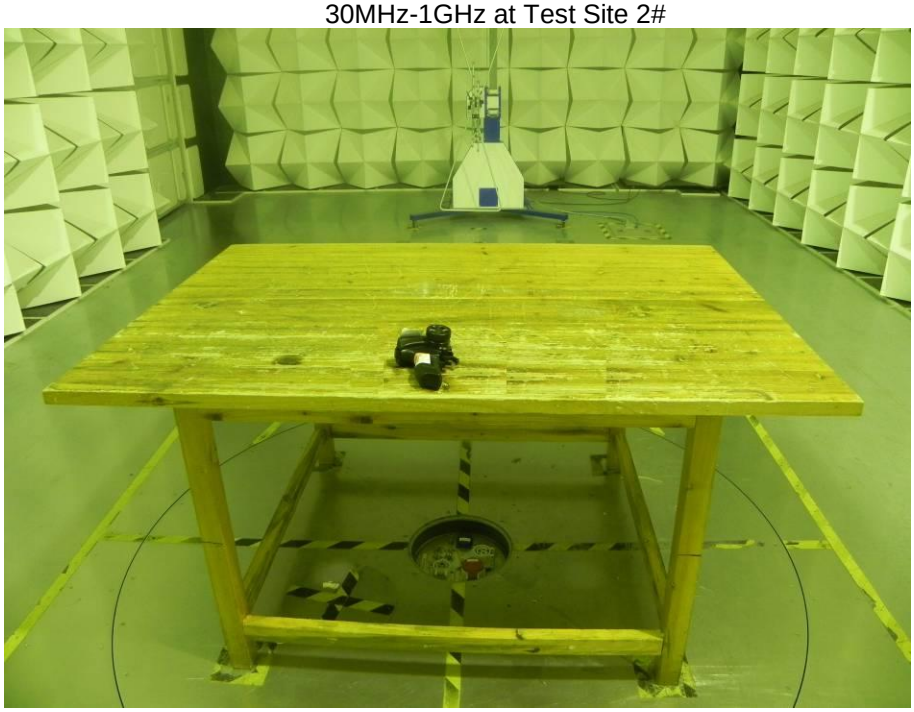
# 16 Photographs – Model KTH-91802G Test Setup

## 16.1 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz at Test Site 2#



30MHz-1GHz at Test Site 2#



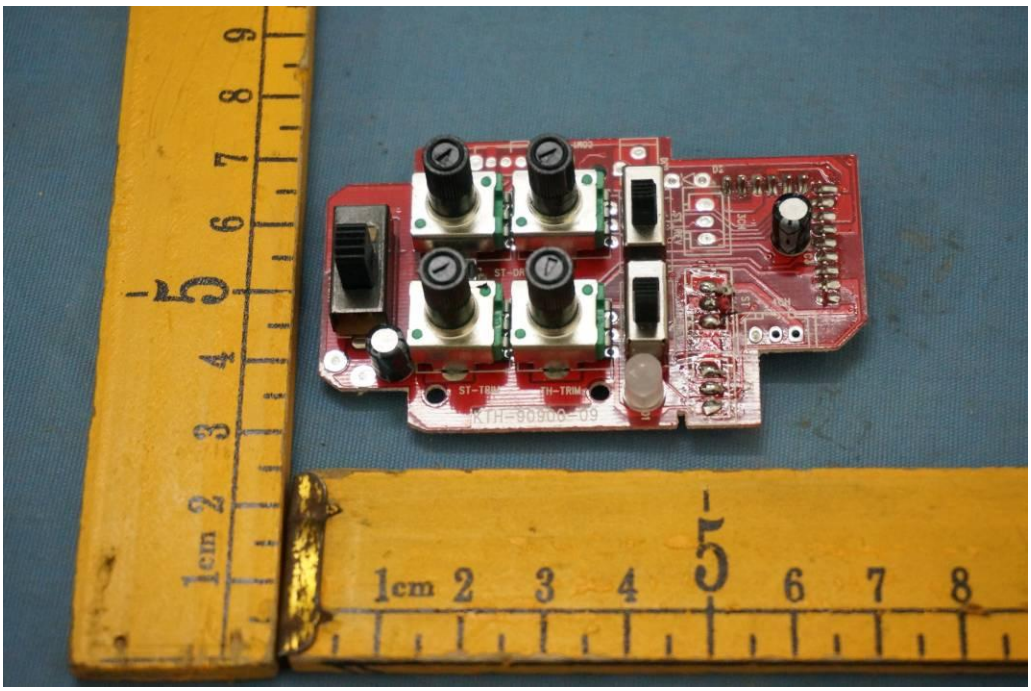
Above 1GHz at Test Site 1#

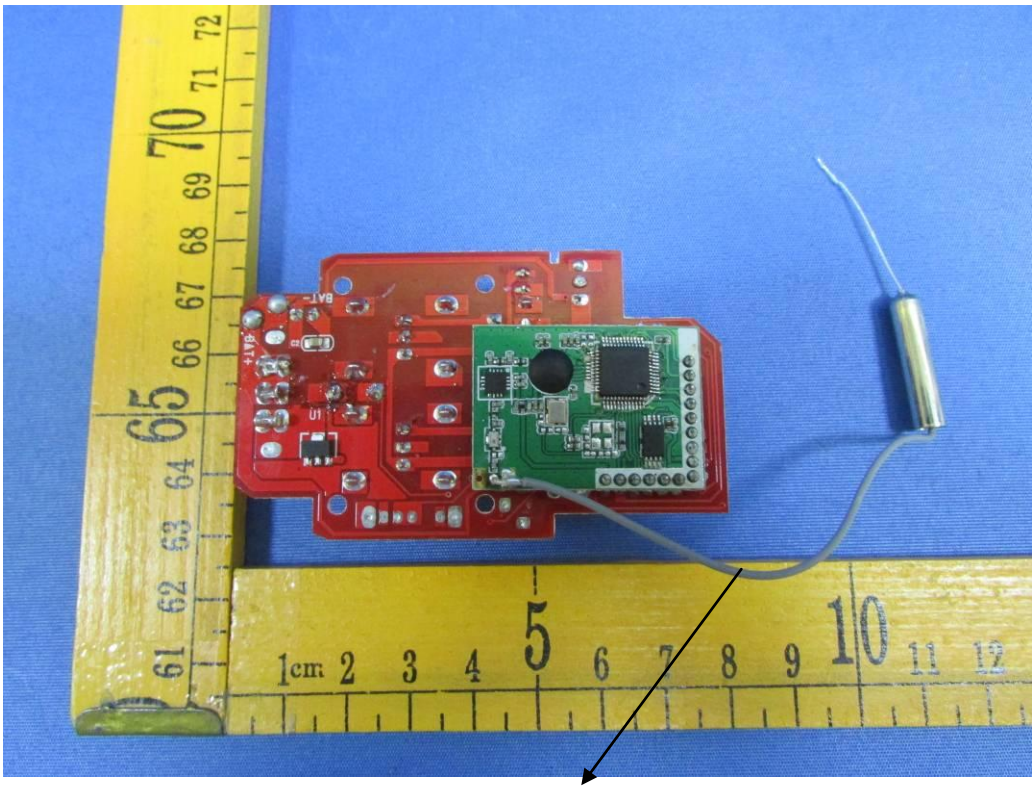
# 17 Photographs - Constructional Details

## 17.1 Model KTH-91802G External View

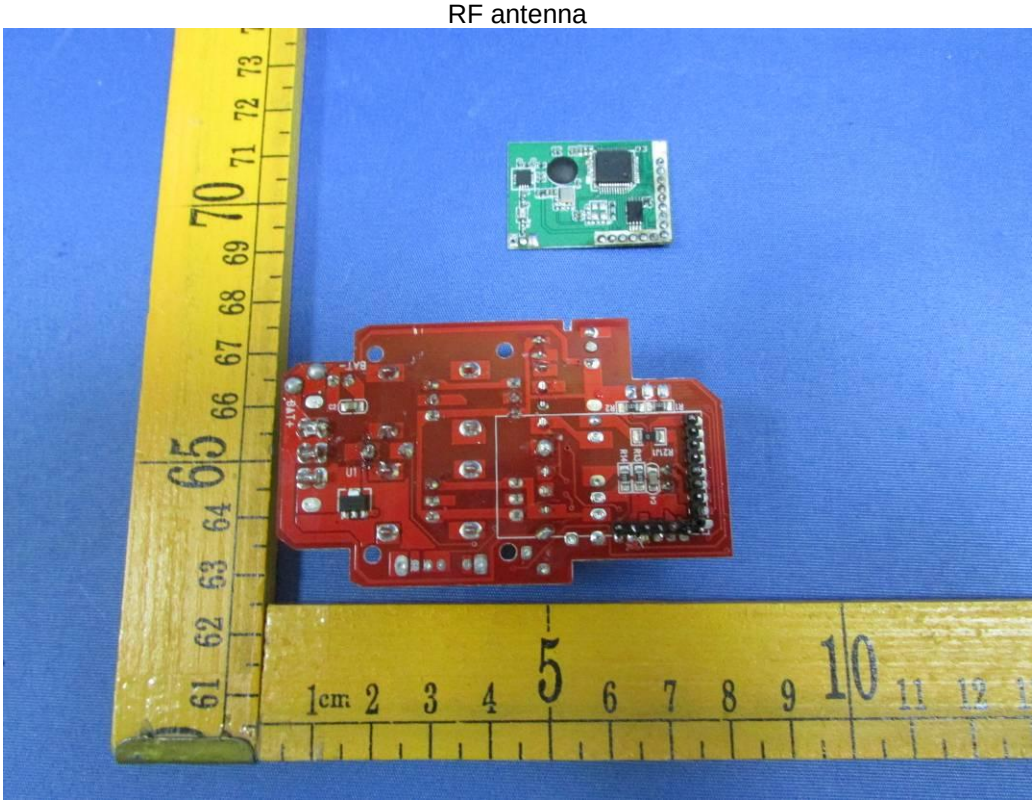
## 17.2 Model KTH-91802G Internal View

2.4G transmitter

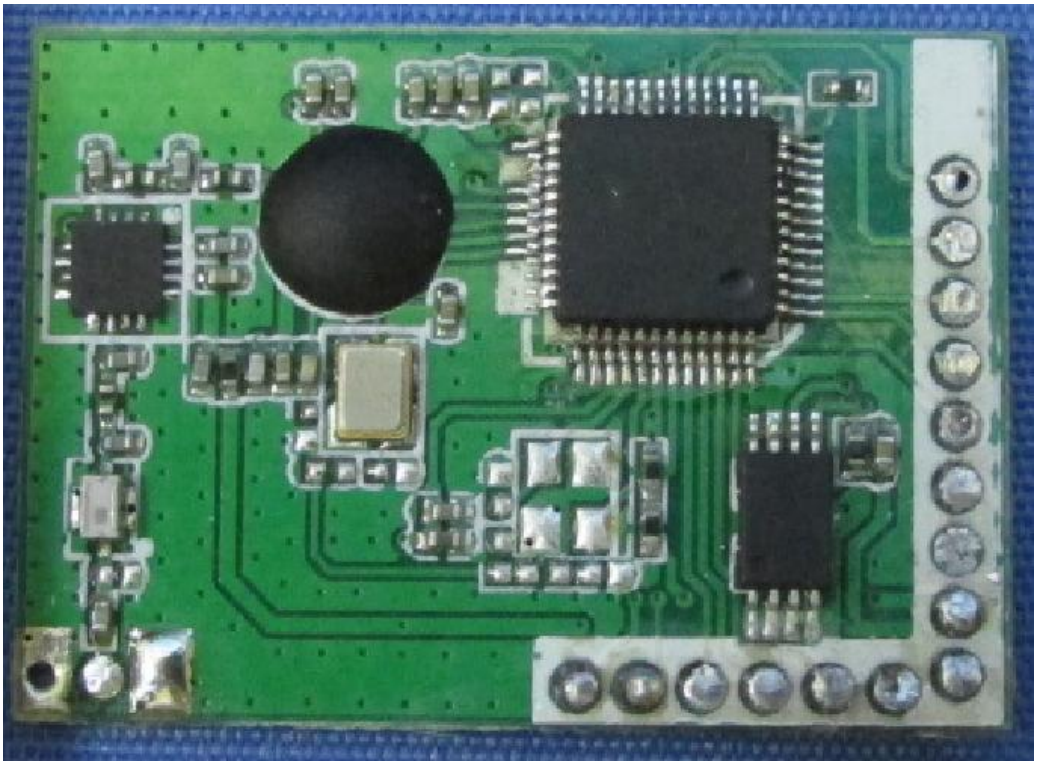


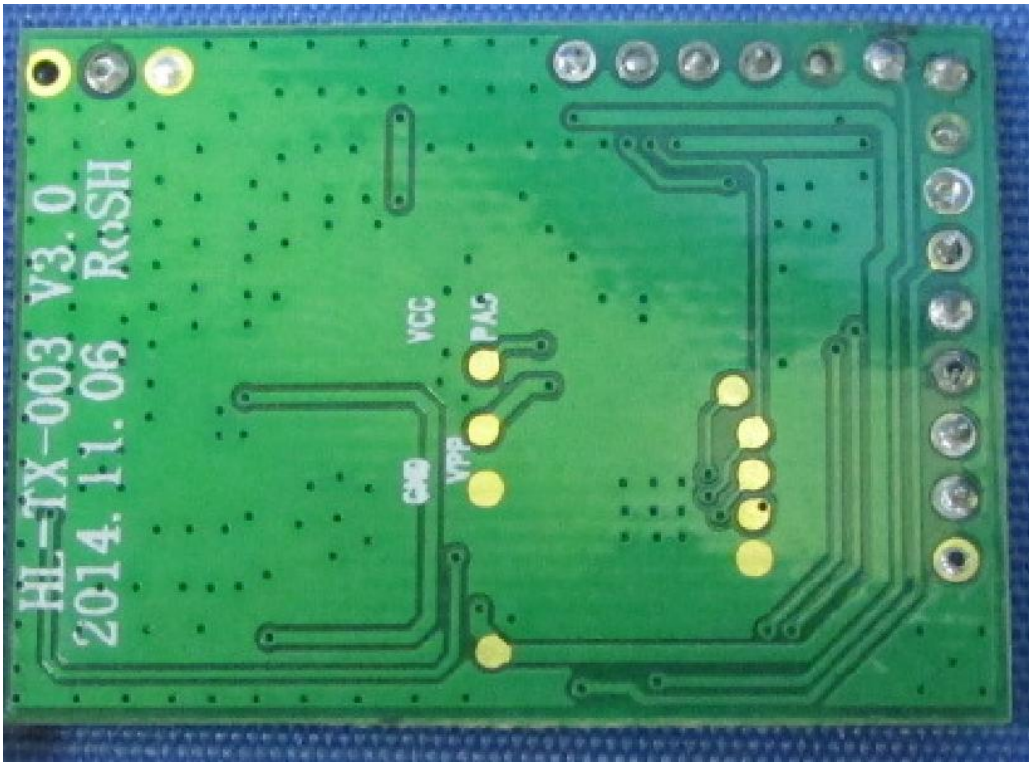


RF antenna



RF module






====== End of Report ======