# FCC/IC - TEST REPORT

| | | | | |
|---|---|---|---|---|
| Report Number | : | **68.960.18.0015.01** | Date of Issue: | August 02, 2018 |
| Model | : | MTT1801 | | |
| Product Type | : | Command Tower | | |
| Applicant | : | MATATALAB CO., LTD. | | |
| Address | : | Buliding 5, Pingshan Minqi Technology Park, Xili Town, Nanshan District, 518000 Shenzhen, China | | |
| Factory | : | Shenzhen Zowee Inteligent Manufacturing Co., Ltd. | | |
| Address | : | No. 149, Tongfuyu Industrial Zone, Songgang, Baoan District, Shenzhen, Guangdong 518105 China | | |
| Test Result | : | **n Positive o Negative** | | |
| Total pages including Appendices | : | **31** | | |

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# 1 Table of Contents





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## 2 Details about the Test Laboratory

**Details about the Test Laboratory**
Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District
Shenzhen 518052
P.R. China

Telephone: 86 755 8828 6998
Fax: 86 755 8288 5299

FCC Registration No.: 514049
IC Registration No.: 10320A -1

# 3 Description of the Equipment Under Test

| | |
|---|---|
| Product: | Command Tower |
| Model no.: | MTT1801 |
| FCC ID: | 2APCM-MTT1801 |
| Options and accessories: | USB Cable |
| Rating: | 3.7VDC, 2000mAh (Supplied by Built Li-ion Polymer battery)<br>5VDC, 2A (Charged by USB port) |
| RF Transmission Frequency: | 2402MHz-2480MHz |
| No. of Operated Channel: | 40 |
| Modulation: | GFSK |
| Antenna Type: | Ceramic Antenna |
| Antenna Gain: | -6.8dBi |
| Description of the EUT: | The Equipment Under Test (EUT) is Command Tower operated at 2.4GHz |


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# 4 Summary of Test Standards

| Test Standards | |
|---|---|
| FCC Part 15 Subpart C 10-1-2017 Edition | PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators |

All the test methods were according to KDB558074 D01 v04 DTS Measurement Guidance and ANSI C63.10 (2013).


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# 5 Summary of Test Results

| Technical Requirements | | | | | | |
|---|---|---|---|---|---|---|
| **FCC Part 15 Subpart C** | | | | | | |
| Test Condition | | Pages | Test Site | Test Result | | |
| | | | | Pass | Fail | N/A |
| §15.207 | Conducted emission AC power port | -- | -- | ☐ | ☐ | ☒ |
| §15.247 (b) (1) | Conducted peak output power | 10 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(a)(1) | 20dB bandwidth | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1) | Carrier frequency separation | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Number of hopping frequencies | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(1)(iii) | Dwell Time | --- | --- | ☐ | ☐ | ☒ |
| §15.247(a)(2) | 6dB bandwidth and 99% Occupied Bandwidth | 13 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(e) | Power spectral density | 16 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) | Spurious RF conducted emissions | 20 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) | Band edge | 24 | Site 1 | ☒ | ☐ | ☐ |
| §15.247(d) & §15.209 & §15.205 | Spurious radiated emissions for transmitter | 26 | Site 1 | ☒ | ☐ | ☐ |
| §15.203 | Antenna requirement | See note 1 | | ☒ | ☐ | ☐ |

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a Ceramic antenna, which gain is -6.8dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.


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# 6 General Remarks

**Remarks**

This submittal(s) (test report) is intended for FCC ID: 2APCM-MTT1801, complies with Section 15.205, 15.209, 15.247 of the FCC Part 15, Subpart C.

MTT1801 is a Command Tower with BLE Function, The TX and RX range is 2402MHz-2480MHz.

**SUMMARY:**

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment under Test

n - **Fulfills** the general approval requirements.

o - **Does not** fulfill the general approval requirements.

Sample Received Date: June 12, 2018

Testing Start Date: June 12, 2018

Testing End Date: July 4, 2018

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

| Reviewed by: | Prepared by: | Tested by: |
|---|---|---|
| Phoebe Hu | Mark Chen | Tree Zhan |
| EMC Section Manager | EMC Project Engineer | EMC Test Engineer |



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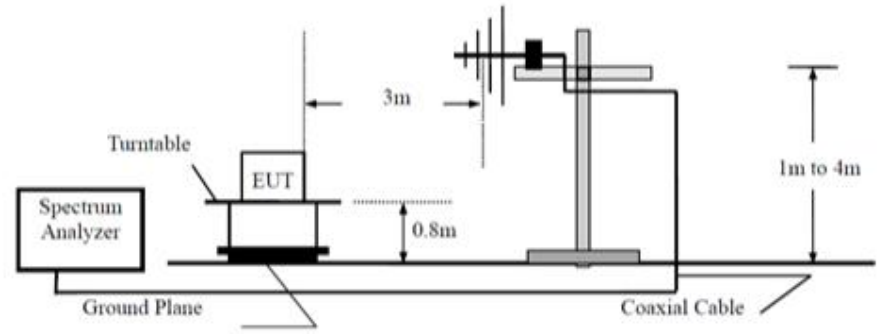
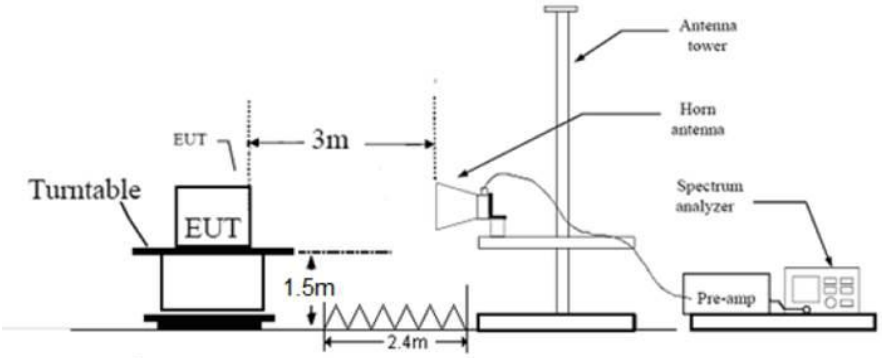
# 7 Test Setups

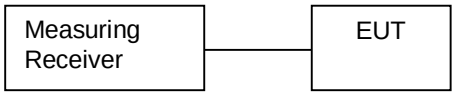
Below 1GHz




Above 1GHz




Conducted RF test setups





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# 8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH) |
|---|---|---|---|
| Notebook | Lenovo | X220 | --- |
| Adapter | --- | --- | |

Test software: nrfGo Test Tool, which used to control the EUT in continues transmitting mode.

The system was configured to channel 0, 19, and 39 for the test.


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# 9 Technical Requirement

## 9.1 Conducted peak output power

**Test Method**

1. Use the following spectrum analyzer settings:
   RBW > the 6dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

**Limits**

According to §15.247 (b) (1), conducted peak output power limit as below:

| Frequency Range<br>MHz | Limit<br>W | Limit<br>dBm |
|---|---|---|
| 2400-2483.5 | ≤1 | ≤30 |

Test result as below table

| Frequency<br>MHz | Conducted Peak Output Power<br>dBm | Result |
|---|---|---|
| Bottom channel 2402MHz | -13.66 | Pass |
| Middle channel 2440MHz | -13.45 | Pass |
| Top channel 2480MHz | -13.48 | Pass |


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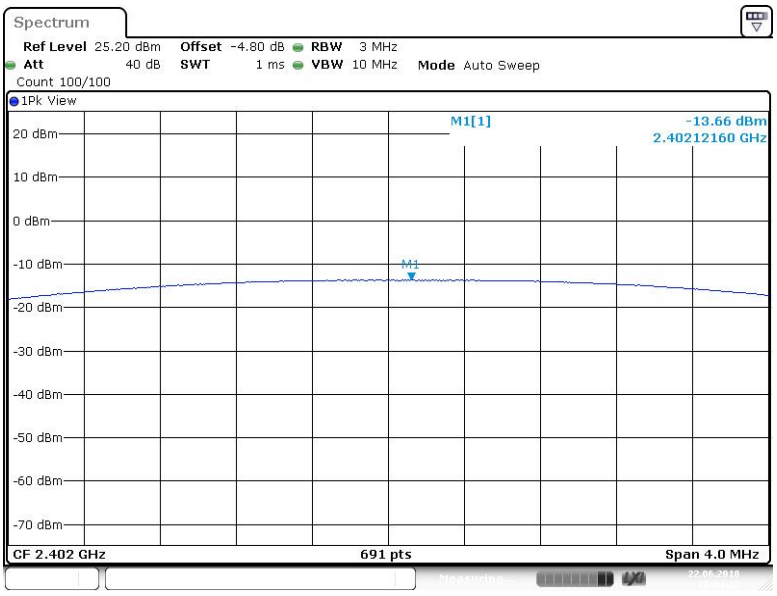
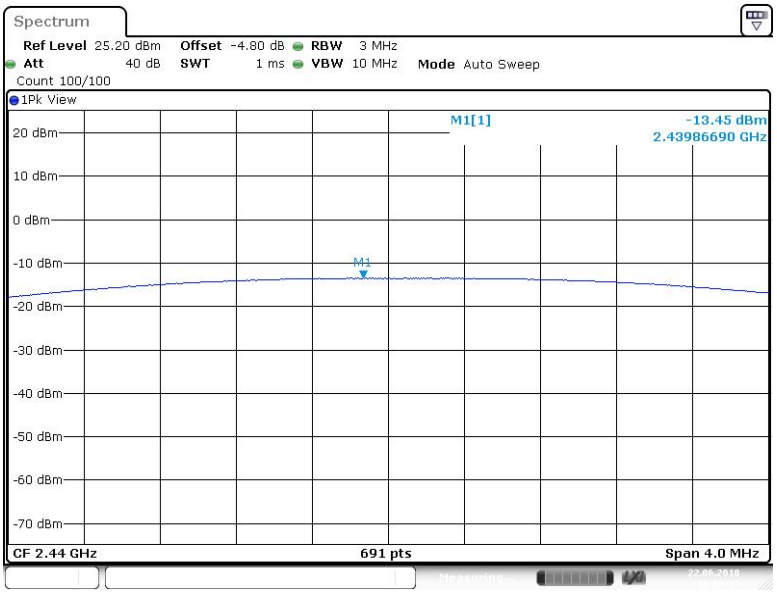
Low channel 2402MHz




Middle channel 2440MHz



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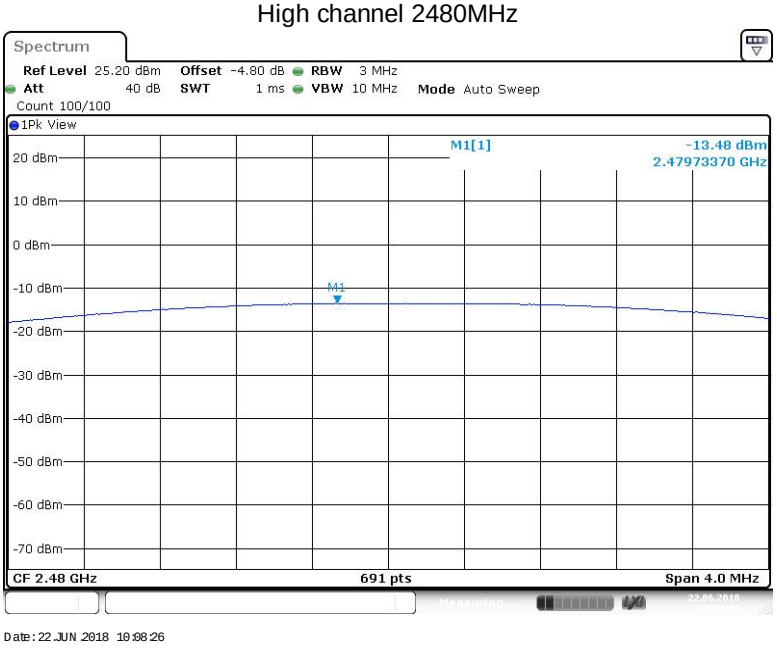
High channel 2480MHz



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## 9.2 Power spectral density

**Test Method**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

**Limit**

| Limit [dBm] |
|---|
| ≤8 |

Test result

| Frequency<br>**MHz** | Power spectral density<br>**dBm** | Result |
|---|---|---|
| Top channel 2402MHz | -27.13 | Pass |
| Middle channel 2440MHz | -26.81 | Pass |
| Bottom channel 2480MHz | -26.34 | Pass |


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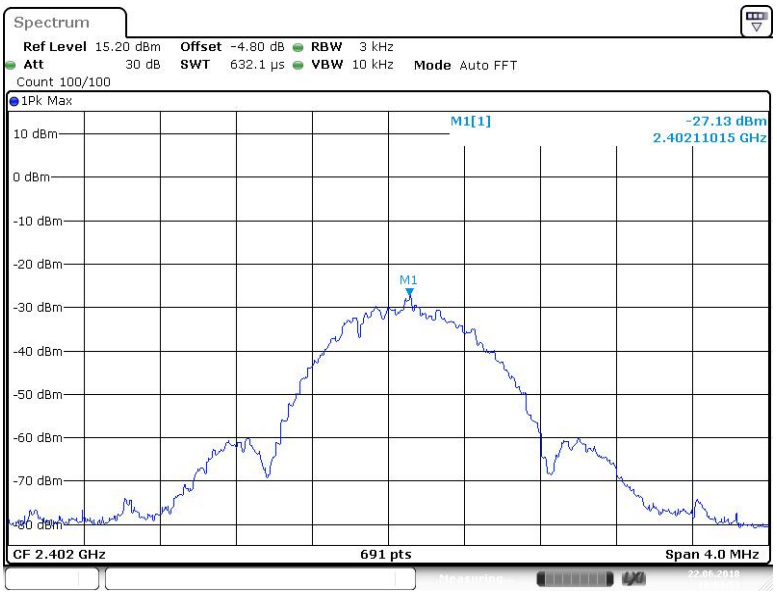
Low channel 2402MHz

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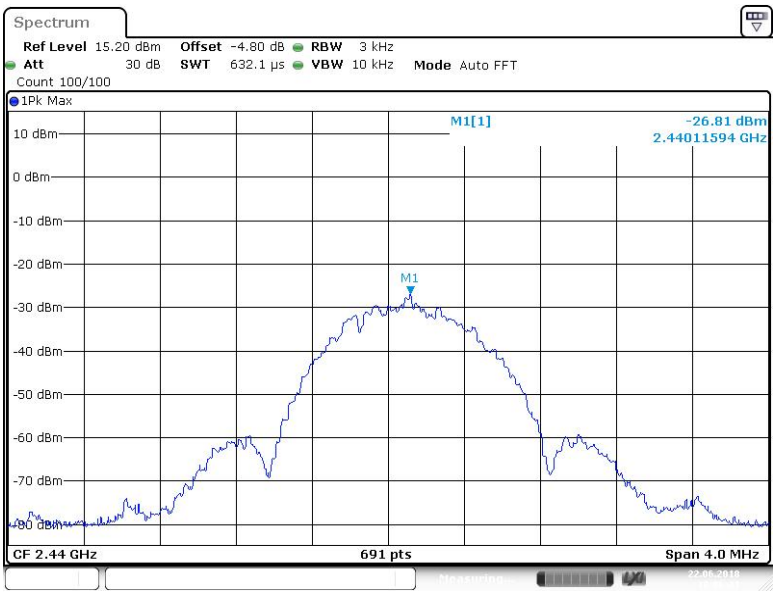
Middle channel 2440MHz

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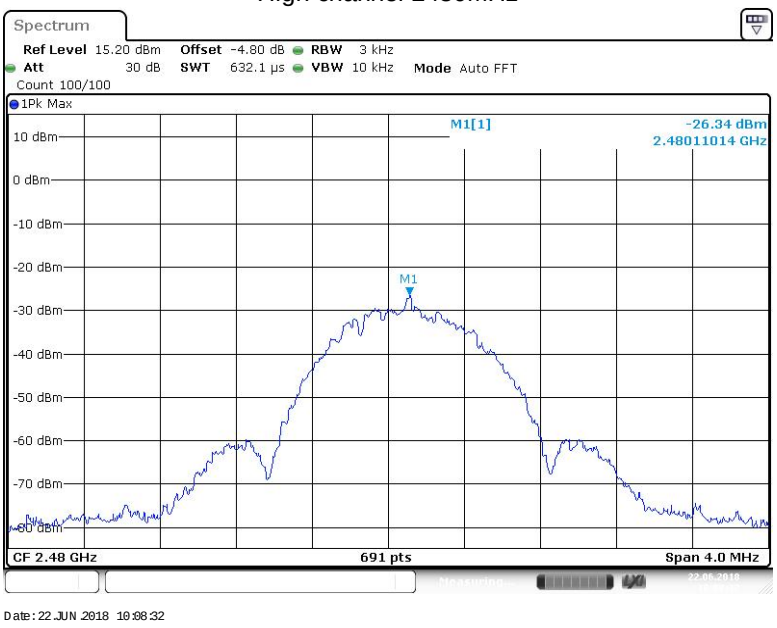
High channel 2480MHz



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## 9.3 6 dB Bandwidth and 99% Occupied Bandwidth

**Test Method**

1. Use the following spectrum analyzer settings:
RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

**Limit**

| Limit [kHz] |
|---|
| ≥500 |

Test result

| Frequency MHz | 6dB bandwidth kHz | 99 bandwidth kHz | Result |
|---|---|---|---|
| Bottom channel 2402MHz | 676 | 1027 | Pass |
| Middle channel 2440MHz | 688 | 1031 | Pass |
| Top channel 2480MHz | 688 | 1035 | Pass |


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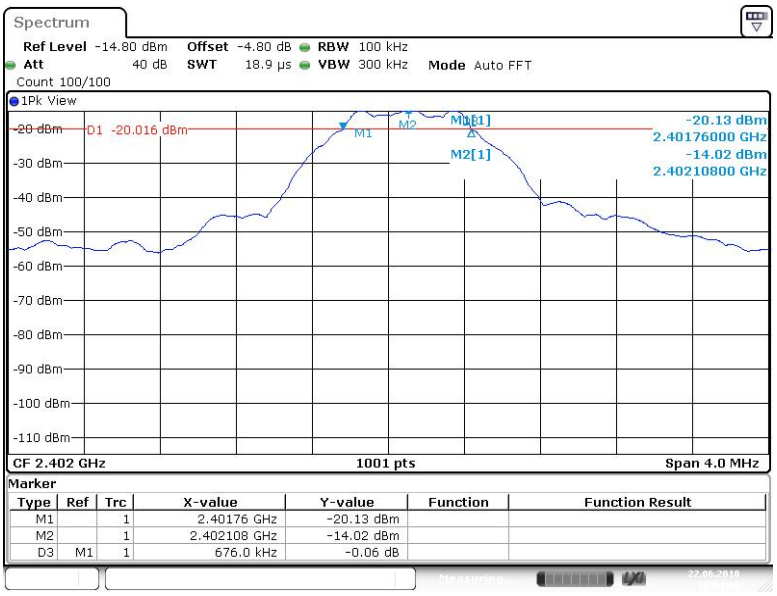
## 6 dB Bandwidth/99% Occupied bandwidth

Low channel 2402MHz

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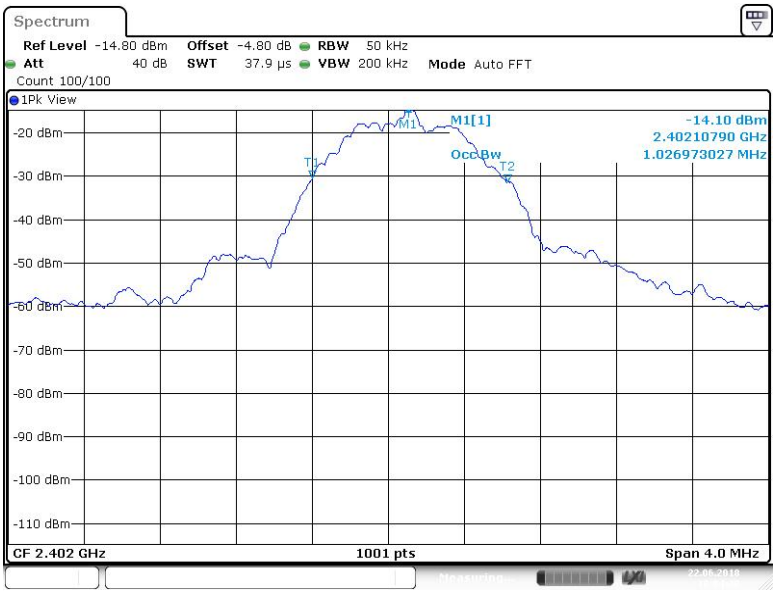


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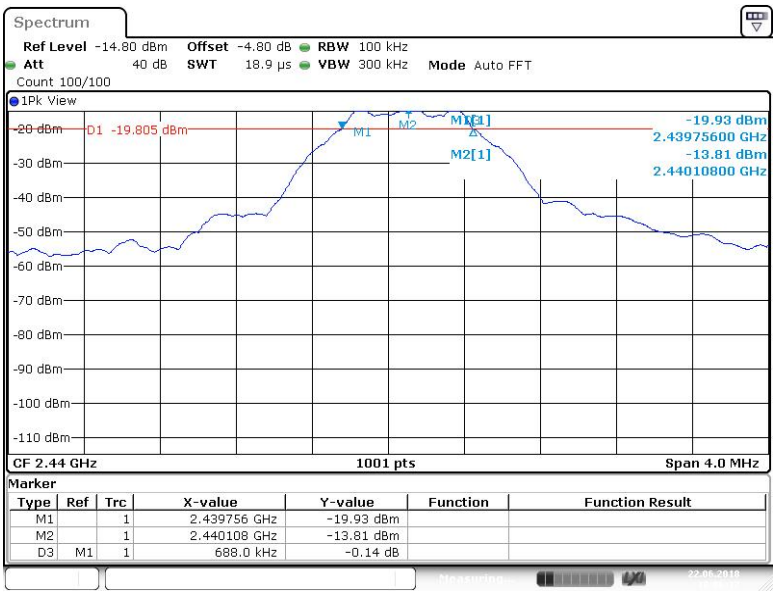
Middle channel 2440MHz

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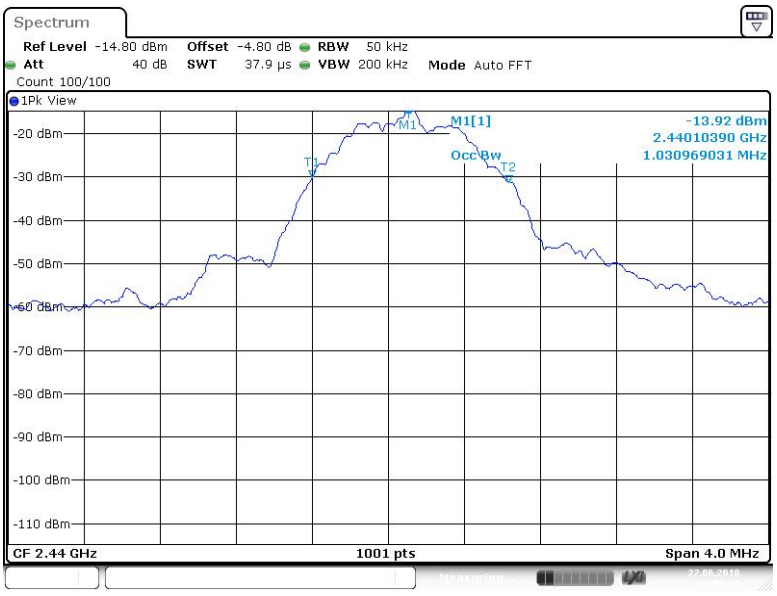


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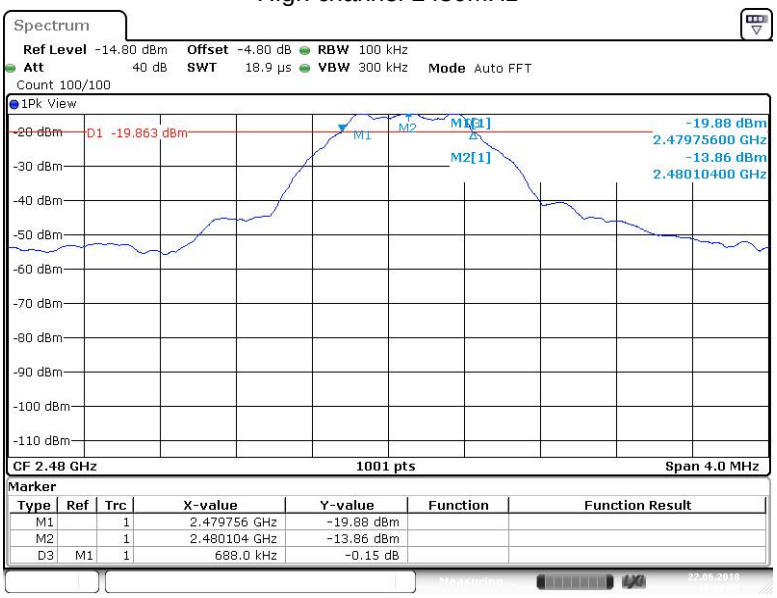
High channel 2480MHz

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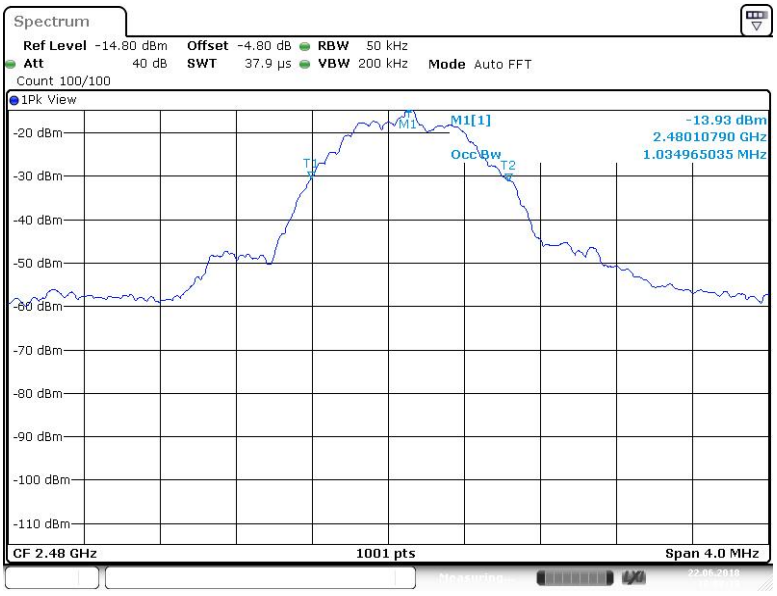


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## 9.4 Spurious RF conducted emissions

**Test Method**

1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish the reference level.
   a. Set the center frequency and span to encompass frequency range to be measured.
   b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
3. Repeat above procedures until other frequencies measured were completed.

**Limit**

| Frequency Range MHz | Limit (dBc) |
|---|---|
| 30-25000 | -20 |


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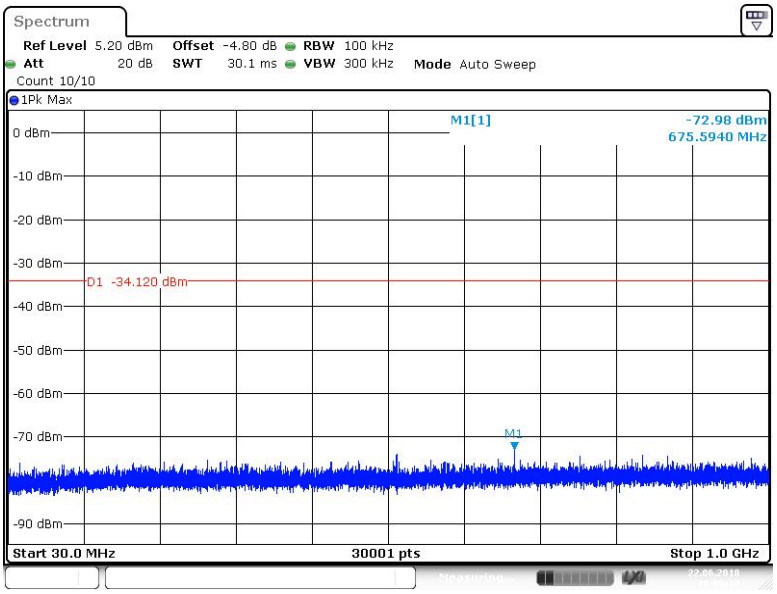
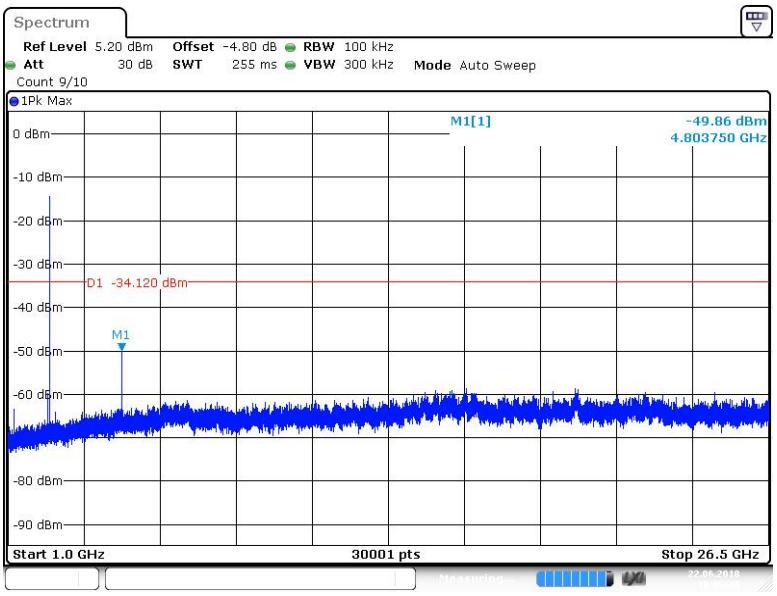
## Spurious RF conducted emissions

2402MHz



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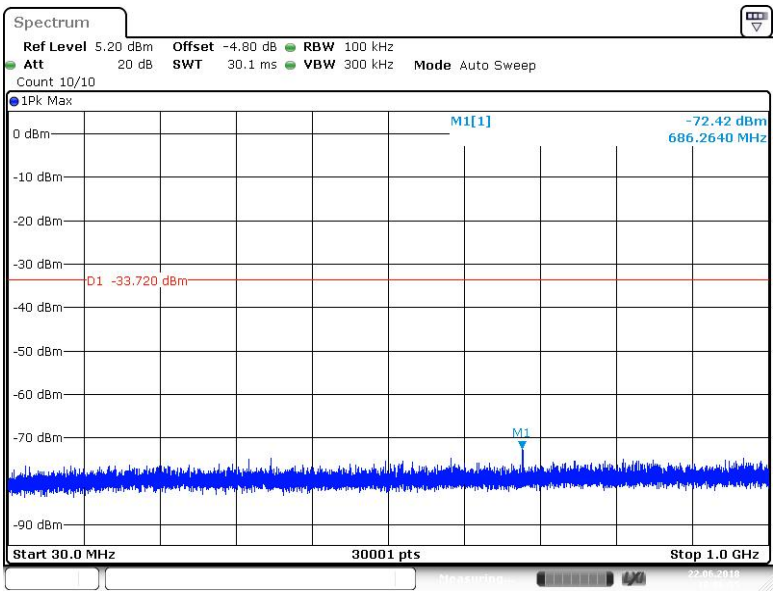
2440MHz

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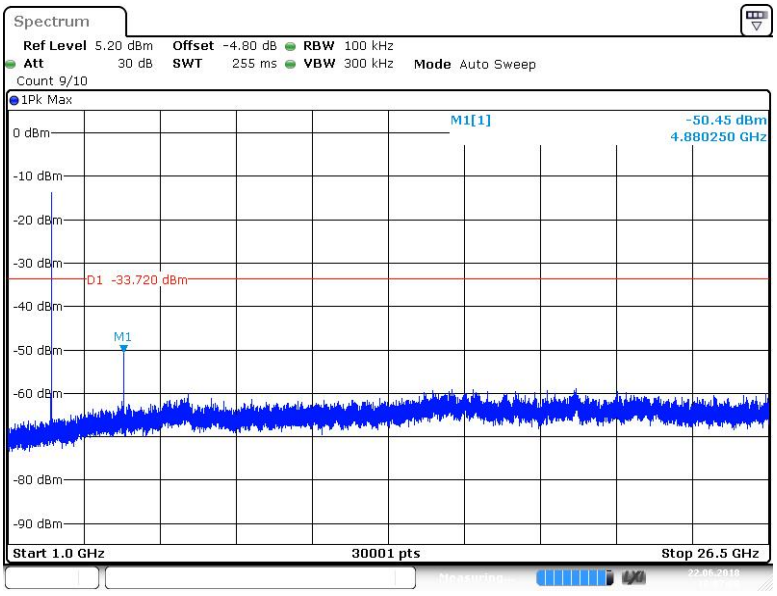


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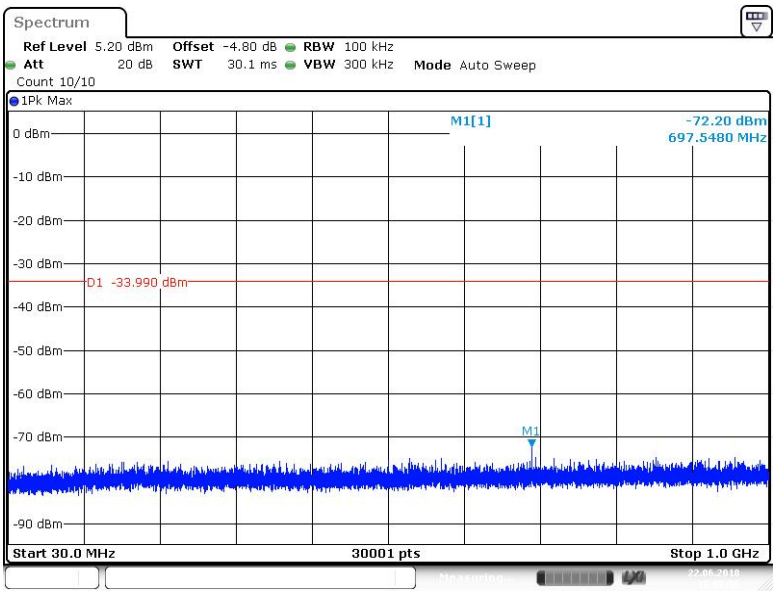
2480MHz

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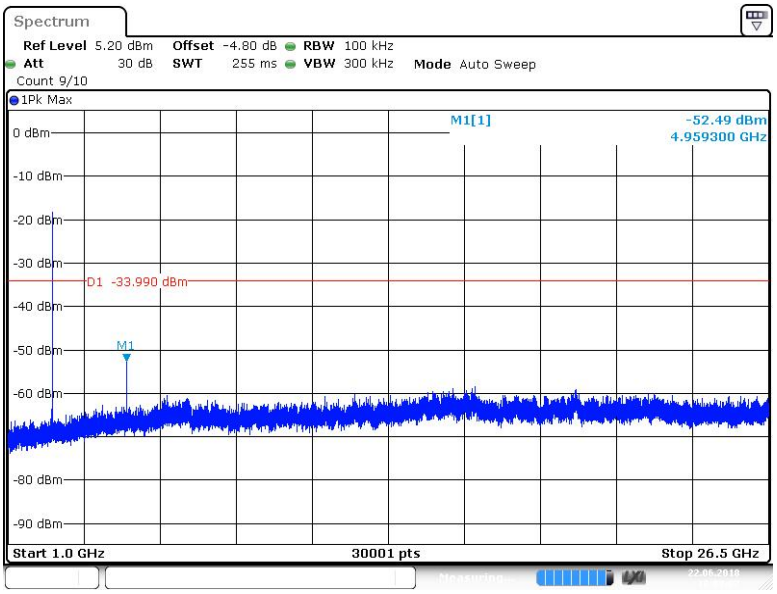


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## 9.5 Band edge

**Test Method**

1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.

**Limit**

| Frequency Range MHz | Limit (dBc) |
|---|---|
| 30-25000 | -20 |


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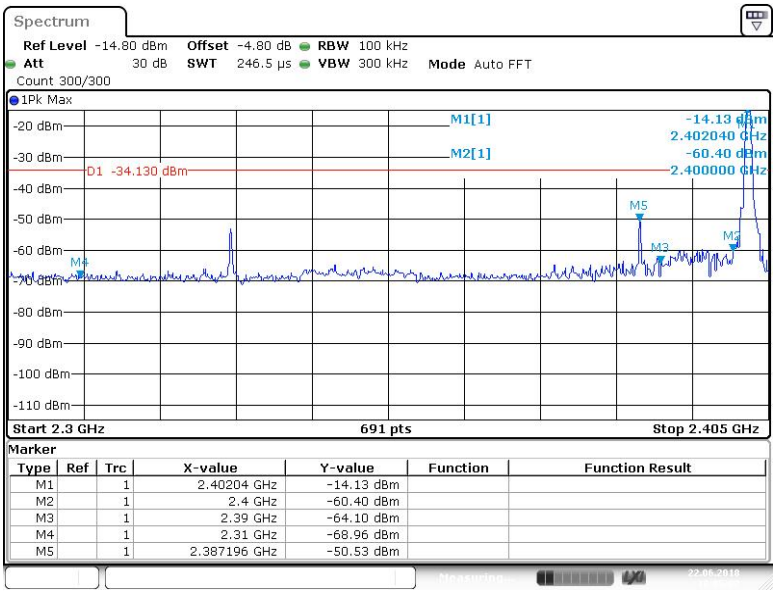
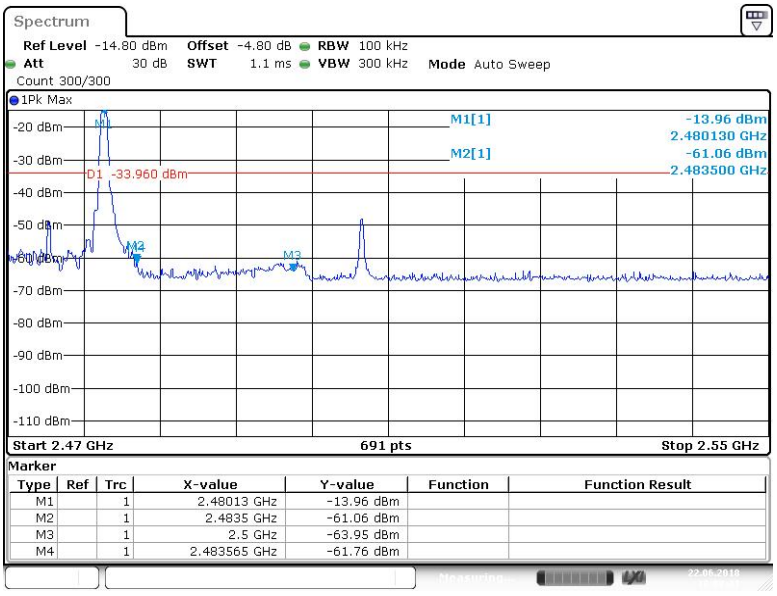
## Band edge testing

2402MHz




Date: 22.JUN.2018 10:05:03

2480MHz




Date: 22.JUN.2018 10:08:41



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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

## 9.6 Spurious radiated emissions for transmitter

**Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna 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.

4: 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

**Note:**

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at requencyabove1GHz


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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

## Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

| Frequency MHz | Field Strength uV/m | Field Strength dBµV/m | Detector |
|---|---|---|---|
| 30-88 | 100 | 40 | QP |
| 88-216 | 150 | 43.5 | QP |
| 216-960 | 200 | 46 | QP |
| 960-1000 | 500 | 54 | QP |
| Above 1000 | 500 | 54 | AV |
| Above 1000 | 5000 | 74 | PK |


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## Spurious radiated emissions for transmitter

**Transmitting spurious emission test result as below:**

Low channel 2402MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Correct factor | Result |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | | dBµV/m | | dBuV/m | (dB) | |
| 30-1000MHz | 912.05 | 33.65 | H | 46 | QP | 12.35 | -15.5 | Pass |
| | 525.02 | 35.71 | V | 40 | QP | 10.29 | -20.3 | Pass |
| 1000-25000MHz | -- | -- | H | 74 | PK | -- | -- | Pass |
| | -- | -- | H | 54 | AV | -- | -- | Pass |
| | -- | -- | V | 74 | PK | -- | -- | Pass |
| | -- | -- | V | 54 | AV | -- | -- | Pass |

Middle channel 2440MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Correct factor | Result |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | | dBµV/m | | dBuV/m | (dB) | |
| 30-1000MHz | -- | -- | H | 43.5 | QP | -- | -- | Pass |
| | -- | -- | H | 46 | QP | -- | -- | Pass |
| 1000-25000MHz | -- | -- | H | 74 | PK | -- | -- | Pass |
| | -- | -- | H | 54 | AV | -- | -- | Pass |
| | -- | -- | V | 74 | PK | -- | -- | Pass |
| | -- | -- | V | 54 | AV | -- | -- | Pass |


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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
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High channel 2480MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Correct factor | Result |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | | dBµV/m | | dBuV/m | (dB) | |
| 30-1000MHz | -- | -- | H | 43.5 | QP | -- | -- | Pass |
| | -- | -- | H | 46 | QP | -- | -- | Pass |
| 1000-25000MHz | -- | -- | H | 74 | PK | -- | -- | Pass |
| | -- | -- | H | 54 | AV | -- | -- | Pass |
| | -- | -- | V | 74 | PK | -- | -- | Pass |
| | -- | -- | V | 54 | AV | -- | -- | Pass |

Remark:

(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.

(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss


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Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District,
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# 10 Test Equipment List

## List of Test Instruments

Radiated Emission Test

| Description | Manufacturer | Model no. | Serial no. | cal. due date |
|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESR 26 | 101269 | 2018-7-14 |
| Trilog Super Broadband Test Antenna | Schwarzbeck | VULB 9163 | 707 | 2018-7-14 |
| Horn Antenna | Rohde & Schwarz | HF907 | 102294 | 2018-7-14 |
| Pre-amplifier | Rohde & Schwarz | SCU 18 | 102230 | 2018-7-14 |
| Signal Generator | Rohde & Schwarz | SMY01 | 839369/005 | 2018-7-7 |
| Attenuator | Agilent | 8491A | MY39264334 | 2018-7-7 |
| 3m Semi-anechoic chamber | TDK | 9X6X6 | ---- | 2020-7-7 |
| Test software | Rohde & Schwarz | EMC32 | Version 9.15.00 | N/A |

TS8997 Test System

| Description | Manufacturer | Model no. | Serial no. | cal. due date |
|---|---|---|---|---|
| Signal Generator | Rohde & Schwarz | SMB100A | 108272 | 2018-7-7 |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101030 | 2018-7-7 |
| Vector Signal Generator | Rohde & Schwarz | SMU 200A | 105324 | 2018-7-7 |
| RF Switch Module | Rohde & Schwarz | OSP120/OSP-B157 | 101226/100851 | 2018-7-7 |
| Power Splitter | Weinschel | 1580 | SC319 | 2018-7-7 |
| 10dB Attenuator | Weinschel | 56-10 | 58764 | 2018-7-14 |
| 10dB Attenuator | R&S | DNF | DNF-001 | 2018-7-14 |
| 10dB Attenuator | R&S | DNF | DNF-002 | 2018-7-14 |
| 10dB Attenuator | R&S | DNF | DNF-003 | 2018-7-14 |
| 10dB Attenuator | R&S | DNF | DNF-004 | 2018-7-14 |
| Test software | Rohde & Schwarz | EMC32 | Version 9.26.01 | N/A |


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## 11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

| System Measurement Uncertainty | |
|---|---|
| Test Items | Extended Uncertainty |
| Uncertainty for Radiated Spurious Emission 25MHz-3000MHz | Horizontal: 4.98dB;<br>Vertical: 5.06dB; |
| Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz | Horizontal: 4.95dB;<br>Vertical: 4.94dB; |
| Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz | Horizontal: 5.14dB;<br>Vertical: 5.12dB; |
| Uncertainty for Conducted RF test with TS 8997 | Power level test involved: 1.05dB |


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