China

# FCC/IC - TEST REPORT

| | | | | |
|---|---|---|---|---|
| Report Number | : | **64.790.14.02064.01** | Date of Issue: | September 1, 2014 |

| | | |
|---|---|---|
| Model | : | mu-so |
| Product Type | : | WIRELESS MUSIC SYSTEM |
| Applicant | : | Naim Audio Ltd |
| Address | : | Southampton Road Salisbury Wiltshire SP1 2LN UK |
| Production Facility | : | CHIYU ELECTRONICS (SHEN ZHEN) CO.,LTD |
| Address | : | No. 101, Chi-Yu Road, Chi-Yu Industrial Zone, Fu-Yong Town, Bao-An Distict, ShenZhen, China |

| | | |
|---|---|---|
| Test Result | : | ■ **Positive** ☐ **Negative** |
| Total pages including Appendices | : | 69 |

*TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025.*

*TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations. TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch issued reports.*





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 1 Table of Contents





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 2 Details about the Test Laboratory

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

| | |
|---|---|
| Company name: | TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch<br>5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China |
| Telephone: | +86 20 3832 0668 |
| Fax: | +86 20 3832 0478 |

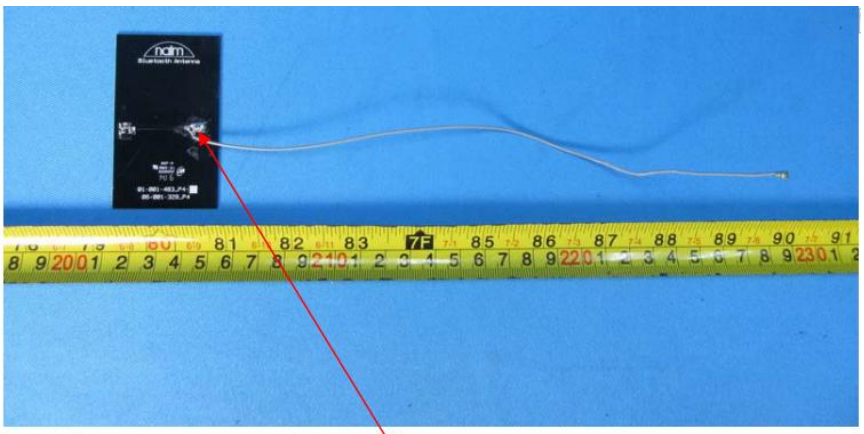
Test site 2:

| | |
|---|---|
| Company name: | Neutron Engineering Inc ction,<br>Address: No.3, Jinshagang 1st Road, ShiXia,<br>Dalang Town, DongGuan, China. |
| Telephone: | +86-769-83183000 |
| Fax: | +86-769-83196000 |
| FCC Registration Number: | 319330 |
| IC egistration Number: | 4428B |

China

# 3 Description of the Equipment Under Test

| | |
|---|---|
| Product: | WIRELESS MUSIC SYSTEM |
| Model no.: | mu-so |
| FCC ID: | 2ACURMUSO |
| IC ID: | 12217A-MUSO |
| Brand Name: | NAIM |
| Options and accessories: | NIL |
| Rating: | 100-240V~ 50/60Hz |
| RF Transmission Frequency: | Bluetooth BR/EDR/LE: 2402~2480MHz<br>WIFI 802.11b/g: 2412~2462MHz |
| Modulation: | Bluetooth: GFSK<br>WIFI: DSSS(CCK/QPSK/BPSK) |
| Antenna Type: | PCB |
| Antenna Gain: | Antenna for Bluetooth |



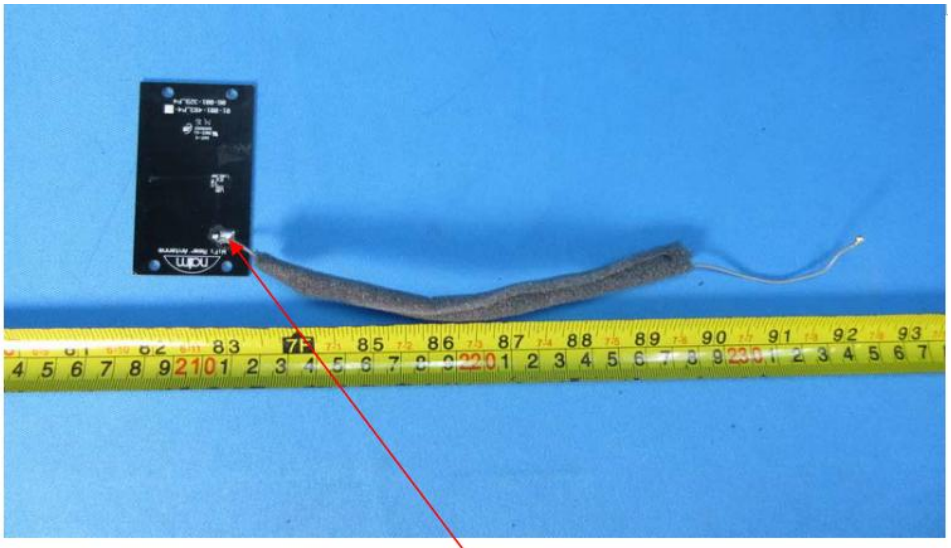

Antenna gain: 1.64dBi



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

Antenna for WIFI



Antenna Location – Antenna 1

Antenna gain: 2.51dBi

Antenna Location – Antenna 2

Antenna gain: 1.05dBi

Description of the EUT: The Equipment Under Test (EUT) is a wireless speaker with Bluetooth and WIFI function.



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 4 Summary of Test Standards

| Test Standards | |
|---|---|
| FCC Part 15 Subpart C 10-1-2013 Edition | PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators |
| RSS-Gen Issue 3 December 2010 | General Requirements and Information for the Certification of Radio Apparatus |
| RSS-210 Issue 8 December 2010 | RSS-210 — Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment |

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000, DTS procedures KDB 558074 v03r02 (June 5, 2014) and C63.10 (2009).



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 5 Summary of Test Results

| Technical Requirements | | | | | |
|---|---|---|---|---|---|
| **FCC Part 15 Subpart C, RSS-Gen, RSS-210** | | | | | |
| Test Condition | | | Pages | Test Site | Test Result |
| §15.207 | RSS-GEN A7.2.4 | Conducted emission AC power port | 11 | Site 2 | Pass |
| §15.247(b)(1) | RSS-210 A8.4 | Conducted peak output power | 16 | Site 2 | Pass |
| §15.247(a)(1) | RSS-210 A8.1(a) & RSSGEN 4.6.2 | 20dB bandwidth and 99% Occupied Bandwidth | 18 | Site 2 | Pass |
| §15.247(a)(1) | RSS-210 A8.1(b) | Carrier frequency separation | 22 | Site 2 | Pass |
| §15.247(a)(1)(iii) | RSS-210 A8.1(d) | Number of hopping frequencies | 26 | Site 2 | Pass |
| §15.247(a)(1)(iii) | RSS-210 A8.1(c) | Dwell Time | 29 | Site 2 | Pass |
| §15.247(a)(2) | RSS-210 A8.2(a) | 6dB bandwidth | 34 | Site 2 | Pass |
| §15.247(d) | RSS-210 A8.5 | Spurious RF conducted emissions | 41 | Site 2 | Pass |
| §15.247(d) | RSS-210 A8.5 | Band edge | 50 | Site 2 | Pass |
| §15.247(d) & §15.209 & | RSS-210 2.5 & RSSGEN 7.2.5 & RSSGEN 6.1 | Spurious radiated emissions for transmitter and receiver | 56 | Site 2 | Pass (Note 1) |
| §15.247(e) | RSS-210 A8.2(b) | Power spectral density* | 61 | Site 2 | Pass |
| §15.203 | RSSGEN 7.1.2 | Antenna requirement | See note 2 | | Pass |

Note 1: There are two antennas for WIFI module, one is for TX when another is for RX. TX and RX ports can be used interchangeably. This test was performed with the antenna whose gain is 2.51dBi.
Note 2: The EUT uses PCB layout antenna, the maximum antenna gain is 2.51dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 6 General Remarks

**Remarks**

This submittal(s) (test report) is intended for FCC ID: 2ACURMUSO, IC ID:12217A-MUSO complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-210.

**SUMMARY:**

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

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

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

Sample Received Date: June 25, 2014

Testing Start Date: August 7, 2014

Testing End Date: September 1, 2014

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

Reviewed by: Tony Liu

Prepared by: Celia Xiang

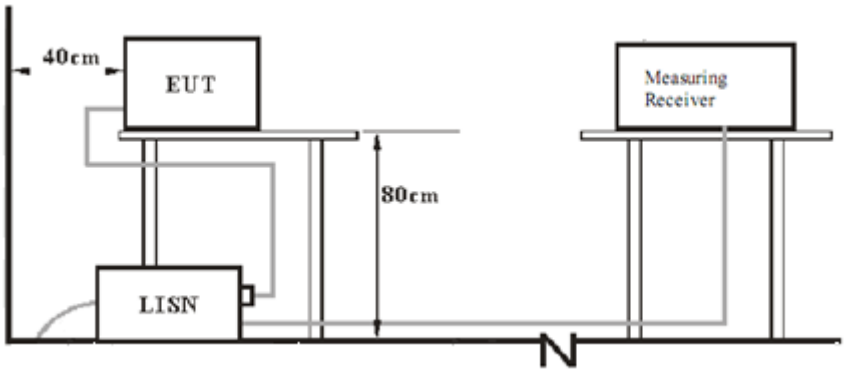


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

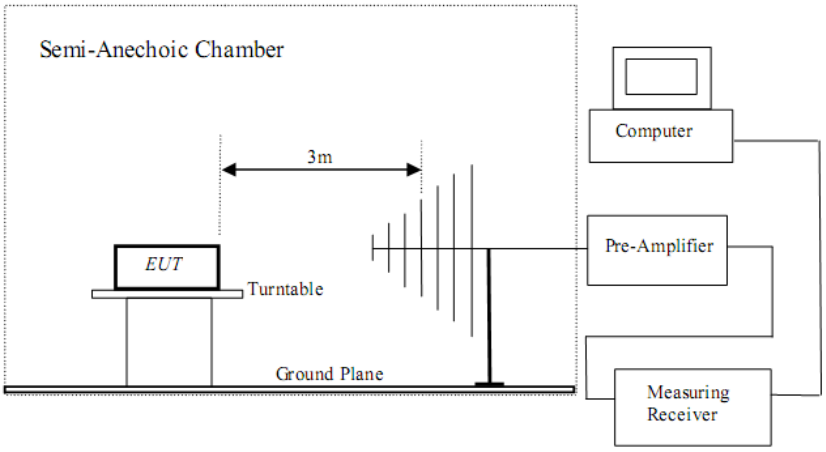
China

# 7 Test Setups

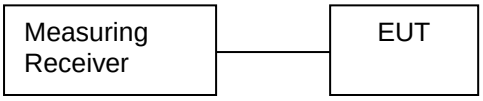
## 7.1 AC Power Line Conducted Emission test setups




## 7.2 Radiated test setups




## 7.3 Conducted RF test setups






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH) |
|---|---|---|---|
| PC | ASUS | X80L | -- |

Test software: “BlueSuite 2.5” for Bluetooth and “Teraterm480” for WIFI are used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status).

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 9 Technical Requirement

## 9.1 Conducted Emission

**Test Method**

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

**Limit**

According to §15.207 & RSS-GEN A7.2.4, conducted emissions limit as below:

| Frequency MHz | QP Limit dBµV | AV Limit dBµV |
|---|---|---|
| 0.150-0.500 | 66-56* | 56-46* |
| 0.500-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Decreasing linearly with logarithm of the frequency

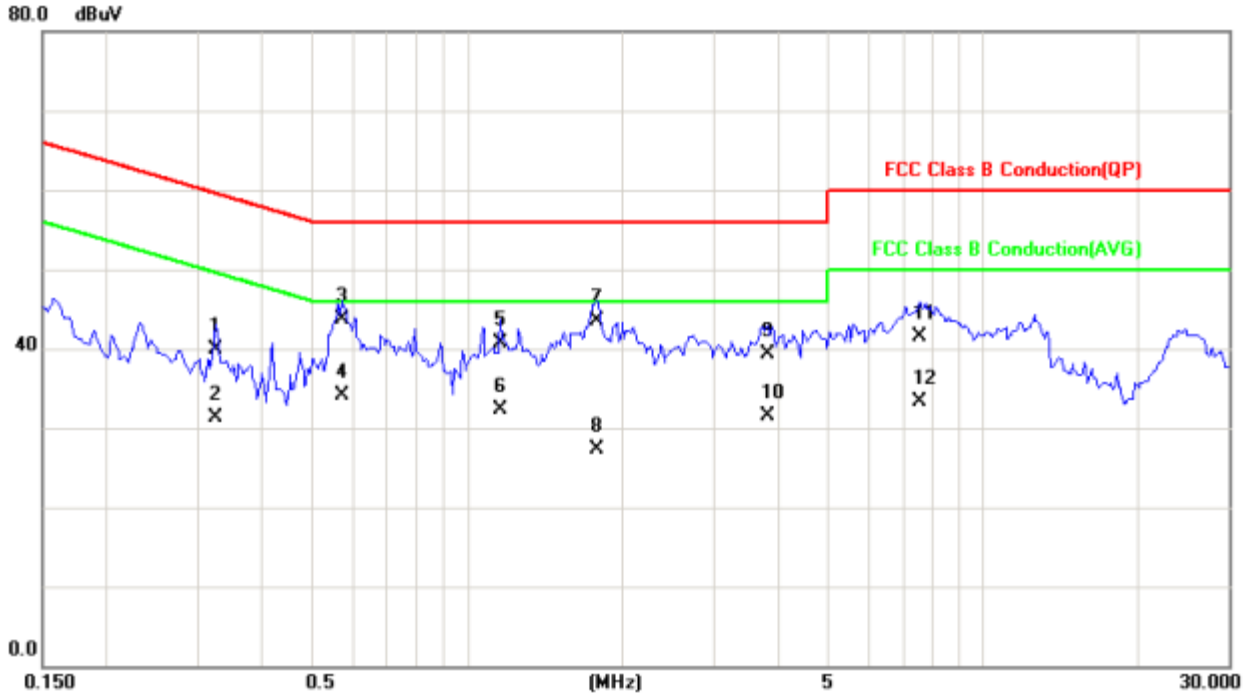


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## Conducted Emission

| | | |
|---|---|---|
| Product Type | : | WIRELESS MUSIC SYSTEM |
| M/N | : | mu-so |
| Operating Condition | : | Play music with WIFI function on. |
| Test Specification | : | Live |
| Comment | : | AC 120V/60Hz |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.3257 | 30.23 | 9.60 | 39.83 | 59.56 | -19.73 | QP |
| 2 | | 0.3257 | 21.65 | 9.60 | 31.25 | 49.56 | -18.31 | AVG |
| 3 | | 0.5720 | 34.01 | 9.67 | 43.68 | 56.00 | -12.32 | QP |
| 4 | * | 0.5720 | 24.50 | 9.67 | 34.17 | 46.00 | -11.83 | AVG |
| 5 | | 1.1656 | 31.02 | 9.70 | 40.72 | 56.00 | -15.28 | QP |
| 6 | | 1.1656 | 22.65 | 9.70 | 32.35 | 46.00 | -13.65 | AVG |
| 7 | | 1.7828 | 33.82 | 9.70 | 43.52 | 56.00 | -12.48 | QP |
| 8 | | 1.7828 | 17.70 | 9.70 | 27.40 | 46.00 | -18.60 | AVG |
| 9 | | 3.8242 | 29.54 | 9.81 | 39.35 | 56.00 | -16.65 | QP |
| 10 | | 3.8242 | 21.63 | 9.81 | 31.44 | 46.00 | -14.56 | AVG |
| 11 | | 7.5546 | 31.59 | 10.01 | 41.60 | 60.00 | -18.40 | QP |
| 12 | | 7.5546 | 23.37 | 10.01 | 33.38 | 50.00 | -16.62 | AVG |

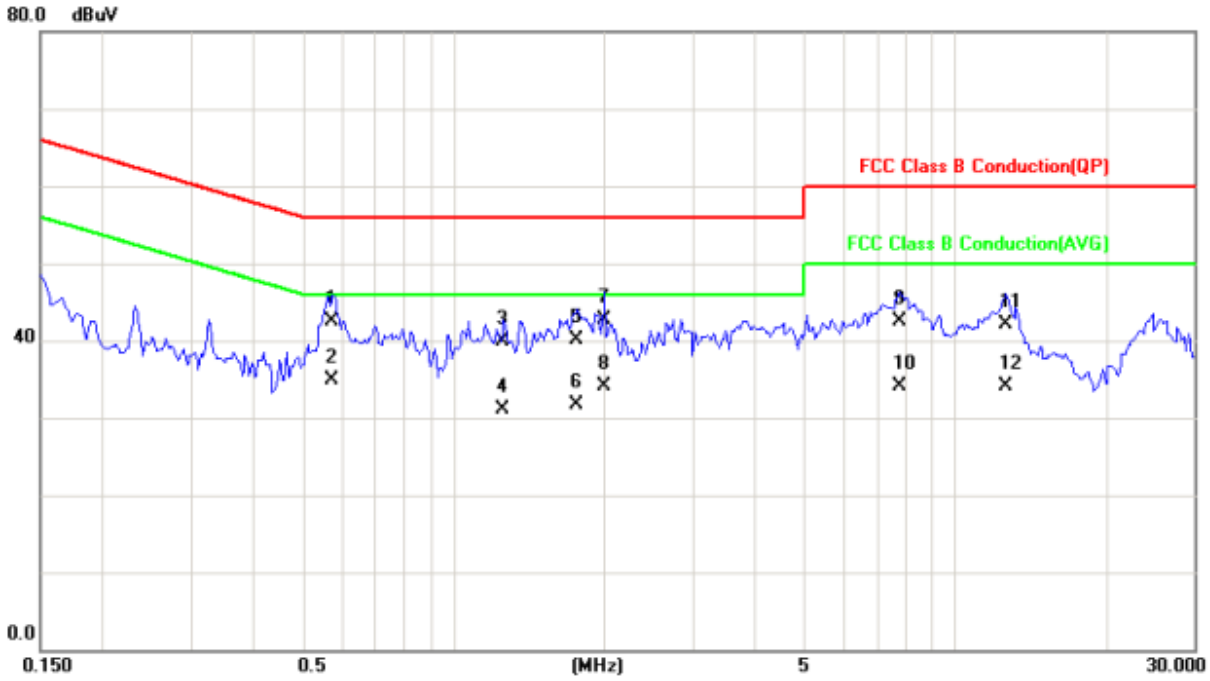


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## Conducted Emission

| | | |
|---|---|---|
| Product Type | : | WIRELESS MUSIC SYSTEM |
| M/N | : | mu-so |
| Operating Condition | : | Play music with WIFI function on. |
| Test Specification | : | Neutral |
| Comment | : | AC 120V/60Hz |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.5757 | 32.84 | 9.65 | 42.49 | 56.00 | -13.51 | QP |
| 2 | * | 0.5757 | 25.20 | 9.65 | 34.85 | 46.00 | -11.15 | AVG |
| 3 | | 1.2593 | 30.27 | 9.69 | 39.96 | 56.00 | -16.04 | QP |
| 4 | | 1.2593 | 21.49 | 9.69 | 31.18 | 46.00 | -14.82 | AVG |
| 5 | | 1.7671 | 30.29 | 9.72 | 40.01 | 56.00 | -15.99 | QP |
| 6 | | 1.7671 | 21.96 | 9.72 | 31.68 | 46.00 | -14.32 | AVG |
| 7 | | 2.0016 | 33.01 | 9.74 | 42.75 | 56.00 | -13.25 | QP |
| 8 | | 2.0016 | 24.40 | 9.74 | 34.14 | 46.00 | -11.86 | AVG |
| 9 | | 7.7382 | 32.52 | 9.99 | 42.51 | 60.00 | -17.49 | QP |
| 10 | | 7.7382 | 24.03 | 9.99 | 34.02 | 50.00 | -15.98 | AVG |
| 11 | | 12.6835 | 31.95 | 10.20 | 42.15 | 60.00 | -17.85 | QP |
| 12 | | 12.6835 | 23.83 | 10.20 | 34.03 | 50.00 | -15.97 | AVG |

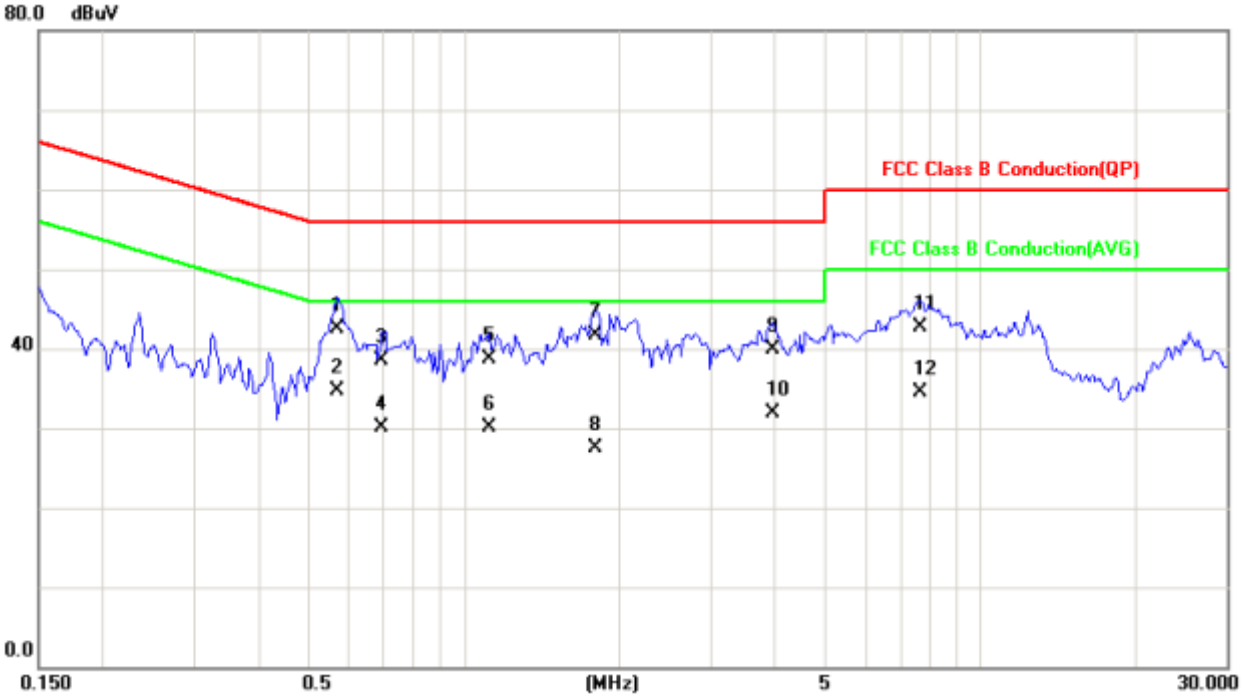


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## Conducted Emission

Product Type : WIRELESS MUSIC SYSTEM
M/N : mu-so
Operating Condition : Play music with Bluetooth function on.
Test Specification : Live
Comment : AC 120V/60Hz




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.5680 | 32.86 | 9.68 | 42.54 | 56.00 | -13.46 | QP |
| 2 | * | 0.5680 | 25.10 | 9.68 | 34.78 | 46.00 | -11.22 | AVG |
| 3 | | 0.6968 | 28.95 | 9.62 | 38.57 | 56.00 | -17.43 | QP |
| 4 | | 0.6968 | 20.56 | 9.62 | 30.18 | 46.00 | -15.82 | AVG |
| 5 | | 1.1226 | 29.02 | 9.70 | 38.72 | 56.00 | -17.28 | QP |
| 6 | | 1.1226 | 20.36 | 9.70 | 30.06 | 46.00 | -15.94 | AVG |
| 7 | | 1.7945 | 31.96 | 9.71 | 41.67 | 56.00 | -14.33 | QP |
| 8 | | 1.7945 | 17.70 | 9.71 | 27.41 | 46.00 | -18.59 | AVG |
| 9 | | 3.9687 | 30.05 | 9.81 | 39.86 | 56.00 | -16.14 | QP |
| 10 | | 3.9687 | 22.03 | 9.81 | 31.84 | 46.00 | -14.16 | AVG |
| 11 | | 7.6562 | 32.61 | 10.01 | 42.62 | 60.00 | -17.38 | QP |
| 12 | | 7.6562 | 24.58 | 10.01 | 34.59 | 50.00 | -15.41 | AVG |

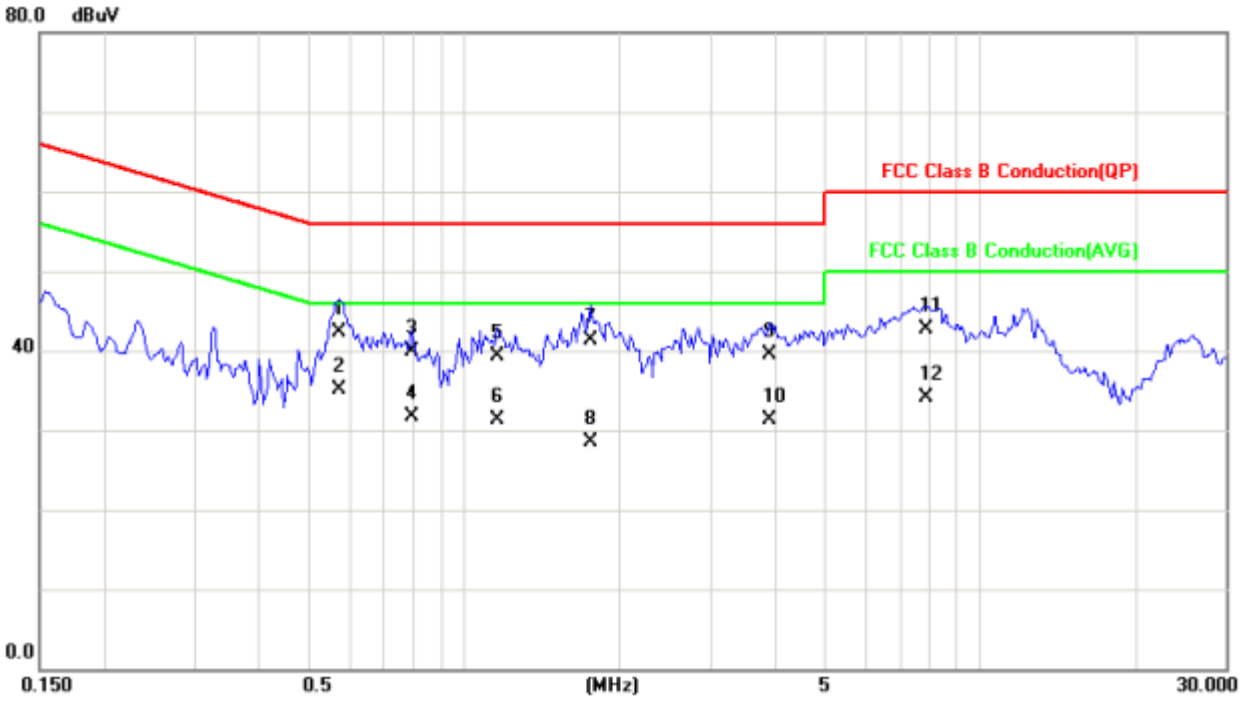


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## Conducted Emission

| | | |
|---|---|---|
| Product Type | : | WIRELESS MUSIC SYSTEM |
| M/N | : | mu-so |
| Operating Condition | : | Play music with Bluetooth function on. |
| Test Specification | : | Neutral |
| Comment | : | AC 120V/60Hz |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | Detector |
| 1 | | 0.5720 | 32.59 | 9.65 | 42.24 | 56.00 | -13.76 | QP |
| 2 | * | 0.5720 | 25.50 | 9.65 | 35.15 | 46.00 | -10.85 | AVG |
| 3 | | 0.7945 | 30.25 | 9.67 | 39.92 | 56.00 | -16.08 | QP |
| 4 | | 0.7945 | 22.01 | 9.67 | 31.68 | 46.00 | -14.32 | AVG |
| 5 | | 1.1656 | 29.58 | 9.68 | 39.26 | 56.00 | -16.74 | QP |
| 6 | | 1.1656 | 21.69 | 9.68 | 31.37 | 46.00 | -14.63 | AVG |
| 7 | | 1.7594 | 31.67 | 9.72 | 41.39 | 56.00 | -14.61 | QP |
| 8 | | 1.7594 | 18.70 | 9.72 | 28.42 | 46.00 | -17.58 | AVG |
| 9 | | 3.9180 | 29.58 | 9.83 | 39.41 | 56.00 | -16.59 | QP |
| 10 | | 3.9180 | 21.49 | 9.83 | 31.32 | 46.00 | -14.68 | AVG |
| 11 | | 7.8516 | 32.61 | 10.00 | 42.61 | 60.00 | -17.39 | QP |
| 12 | | 7.8516 | 24.16 | 10.00 | 34.16 | 50.00 | -15.84 | AVG |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## 9.2 Conducted peak output power

**Test Method**

1. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB bandwidth of the emission being measured, VBW≥RBW,
   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) and RSS-210 A8.4, conducted peak output power limit as below:

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



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## Conducted peak output power

| Bluetooth | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Mode | Measurement (dBm) | Limit | Result |
| 2402 | GFSK | 3.80 | ≤ 30dBm | Pass |
| 2441 | | 3.79 | | Pass |
| 2480 | | 3.24 | | Pass |
| 2402 | 8DPSK | 2.67 | | Pass |
| 2441 | | 3.56 | | Pass |
| 2480 | | 3.10 | | Pass |
| 2402 | BLE | 2.79 | | Pass |
| 2440 | | 2.56 | | Pass |
| 2480 | | 2.64 | | Pass |

| WIFI | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Mode | Measurement (dBm) | Limit | Result |
| 2412 | 802.11b | 7.10 | ≤ 30dBm | Pass |
| 2437 | | 7.22 | | Pass |
| 2462 | | 7.06 | | Pass |
| 2412 | 802.11g | -1.02 | | Pass |
| 2437 | | -1.33 | | Pass |
| 2462 | | -1.04 | | Pass |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.3 20 dB Bandwidth and 99% Occupied Bandwidth

**Test Method**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Limit [kHz] |
|---|
| N/A |

**Result:**

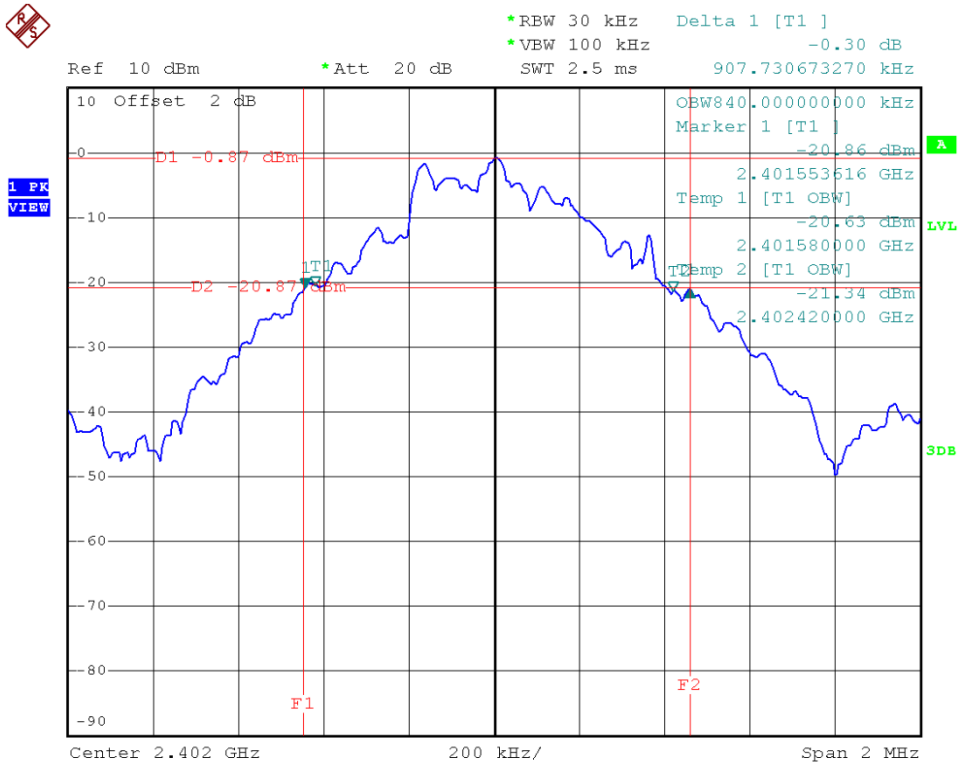
| Bluetooth | | | |
|---|---|---|---|
| Frequency (MHz) | Mode | 20 dB Bandwidth | 99% Bandwidth |
| 2402 | GFSK | 907.73 | 840 |
| 2441 | | 847.88 | 850 |
| 2480 | | 912.72 | 930 |
| 2402 | 8DPSK | 1.207 | 1.15 |
| 2441 | | 1.207 | 1.14 |
| 2480 | | 1.207 | 1.14 |

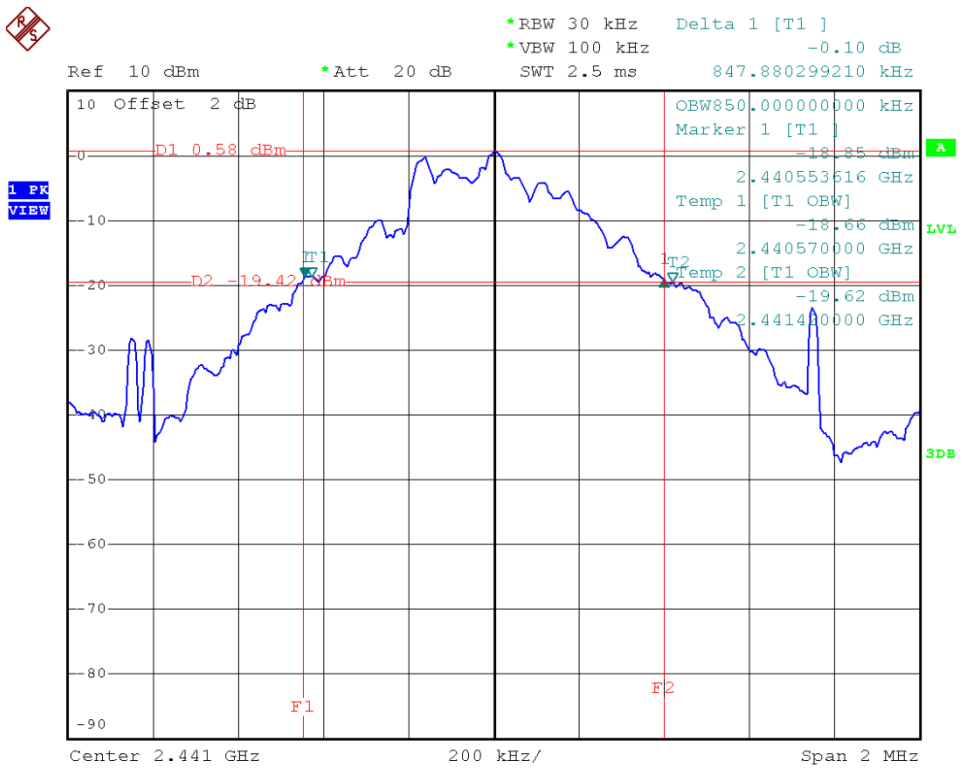


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

Plots:
BT GFSK

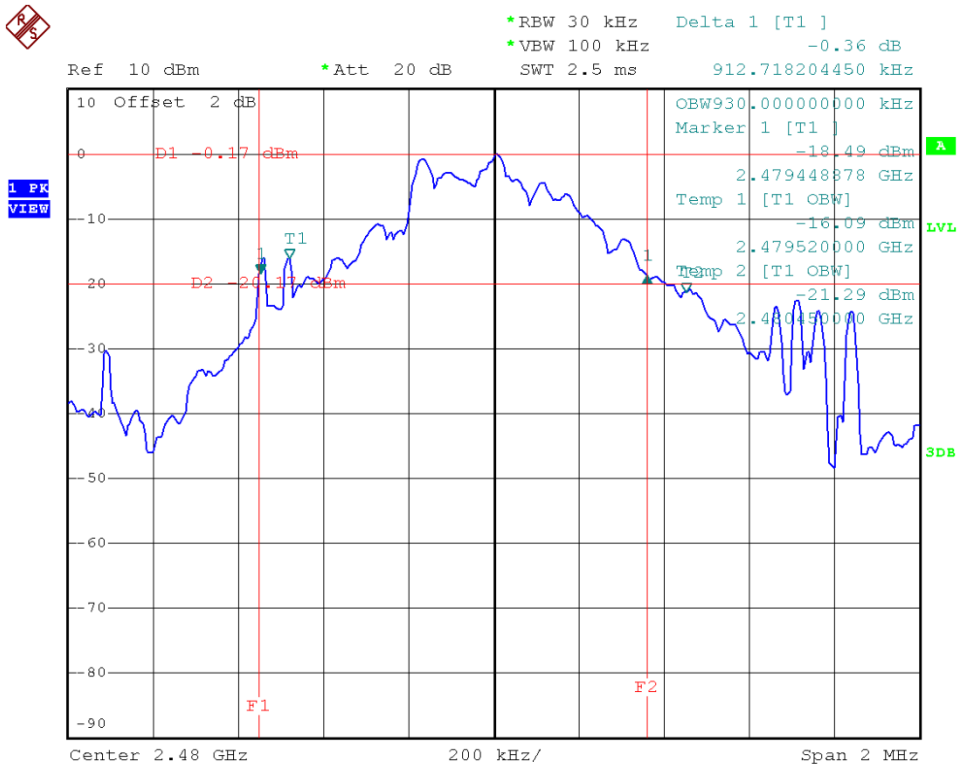


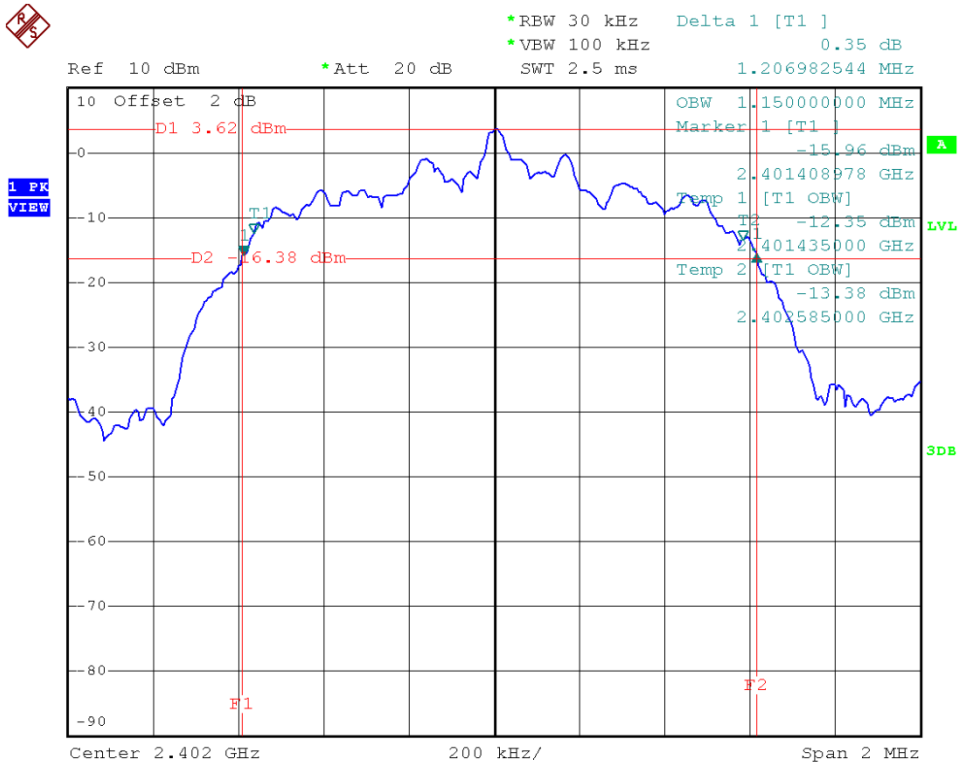



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



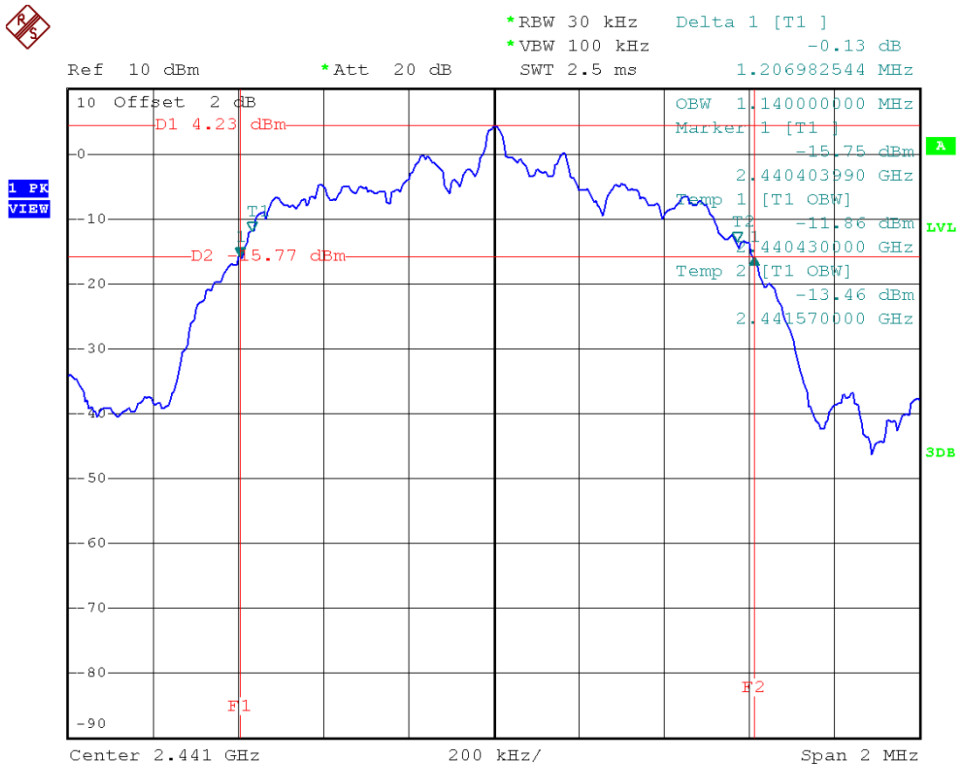

BT 8DPSK

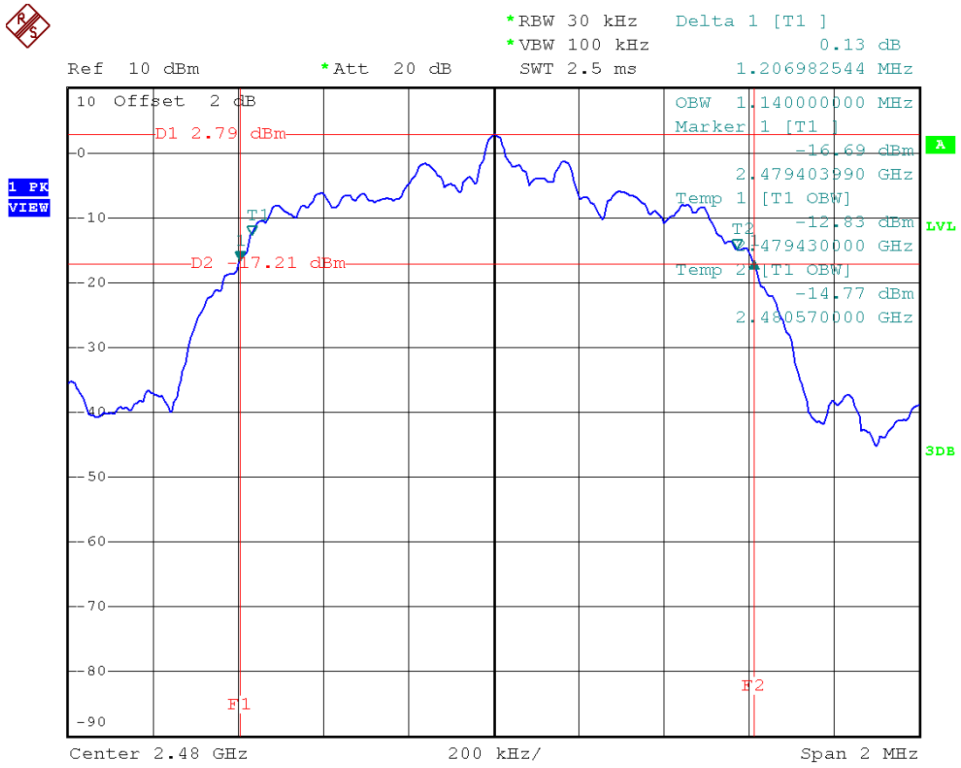





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## 9.4 Carrier Frequency Separation

**Test Method**

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Limit<br>kHz |
|---|
| ≥25KHz or 2/3 of the 20 dB bandwidth which is greater |

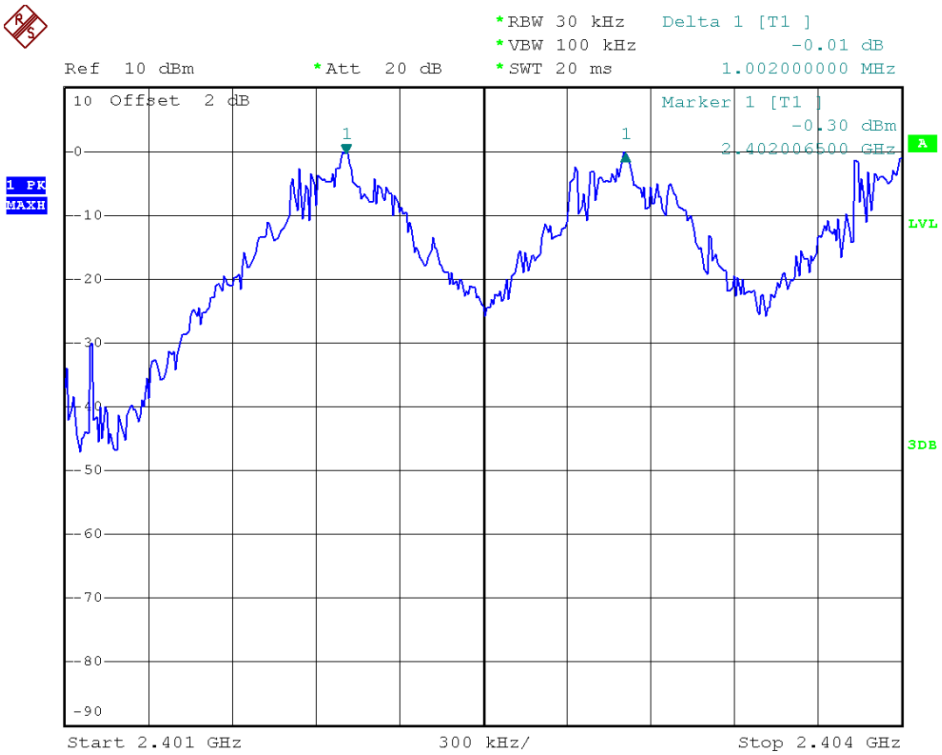
**Result:**

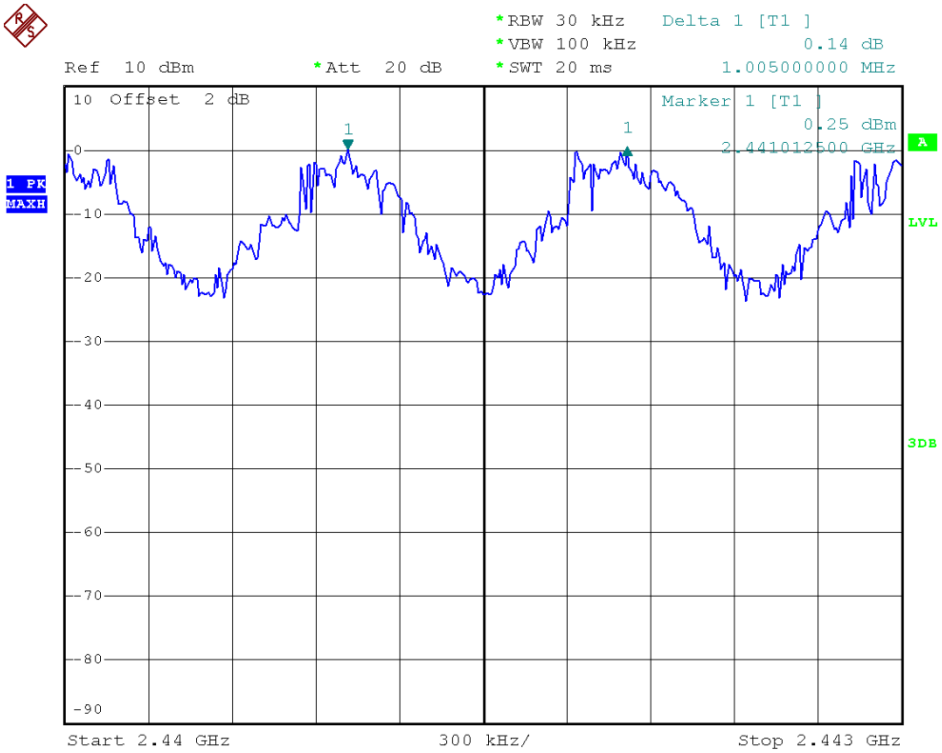
| Frequency (MHz) | Mode | Carrier Frequency Separation (KHz) | 2/3 of 20 dB Bandwidth(KHz) | Result |
|---|---|---|---|---|
| 2402 | GFSK | 1.002 | 605.15 | Pass |
| 2441 | | 1.005 | 565.25 | Pass |
| 2480 | | 1.008 | 608.48 | Pass |
| 2402 | 8DPSK | 1.004 | 0.80 | Pass |
| 2441 | | 1.014 | 0.80 | Pass |
| 2480 | | 1.005 | 0.80 | Pass |


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

Plots:

BT GFSK

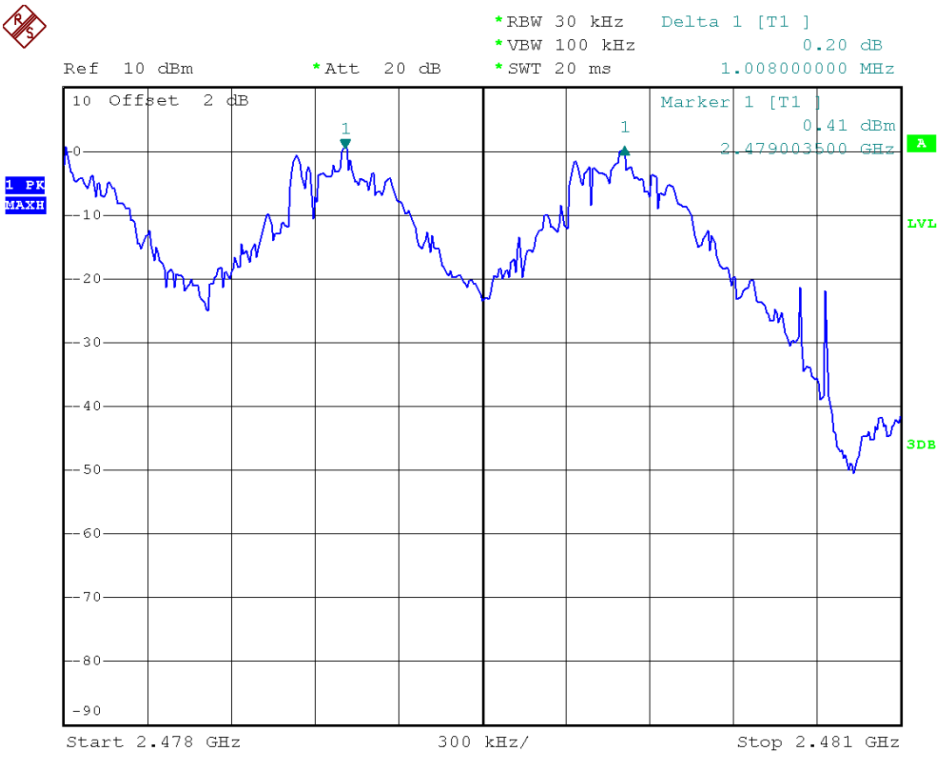


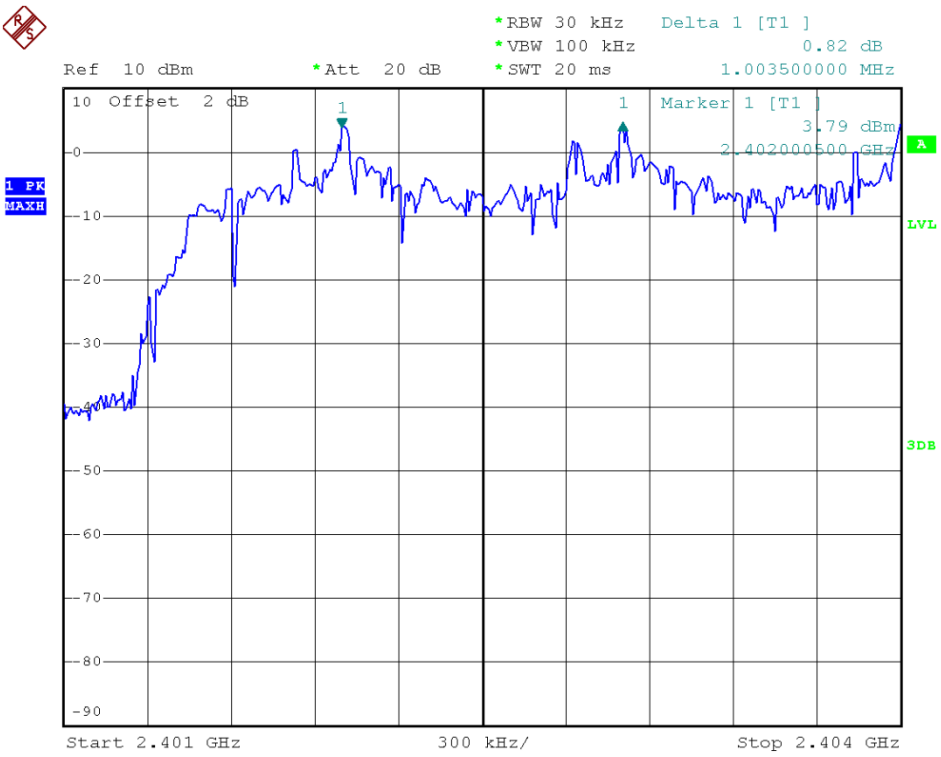



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



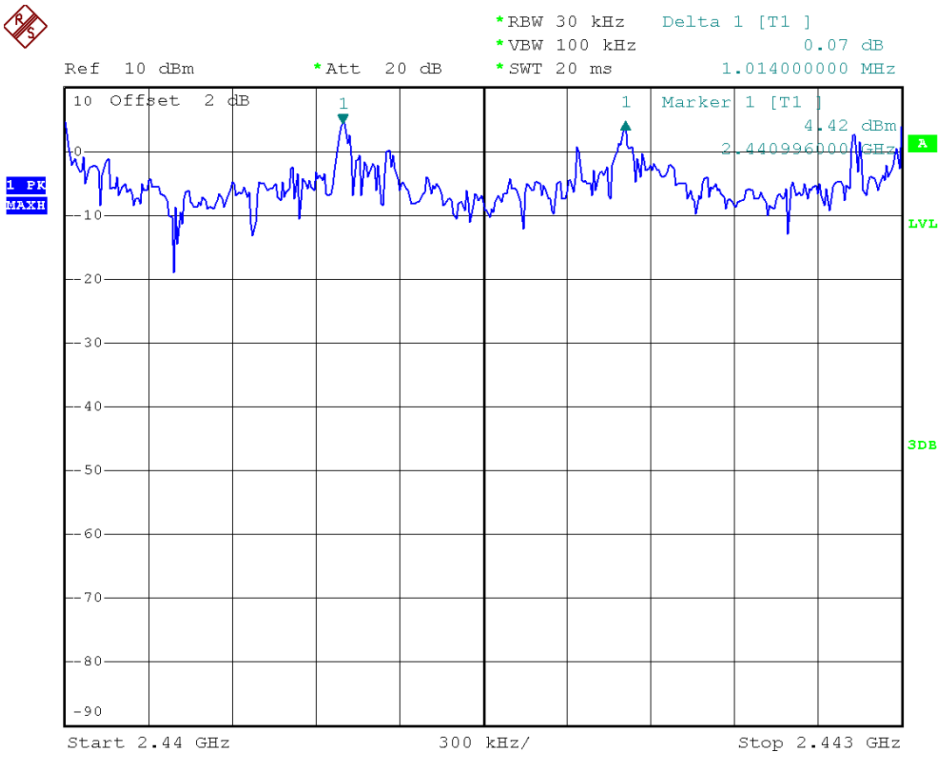

BT 8DPSK

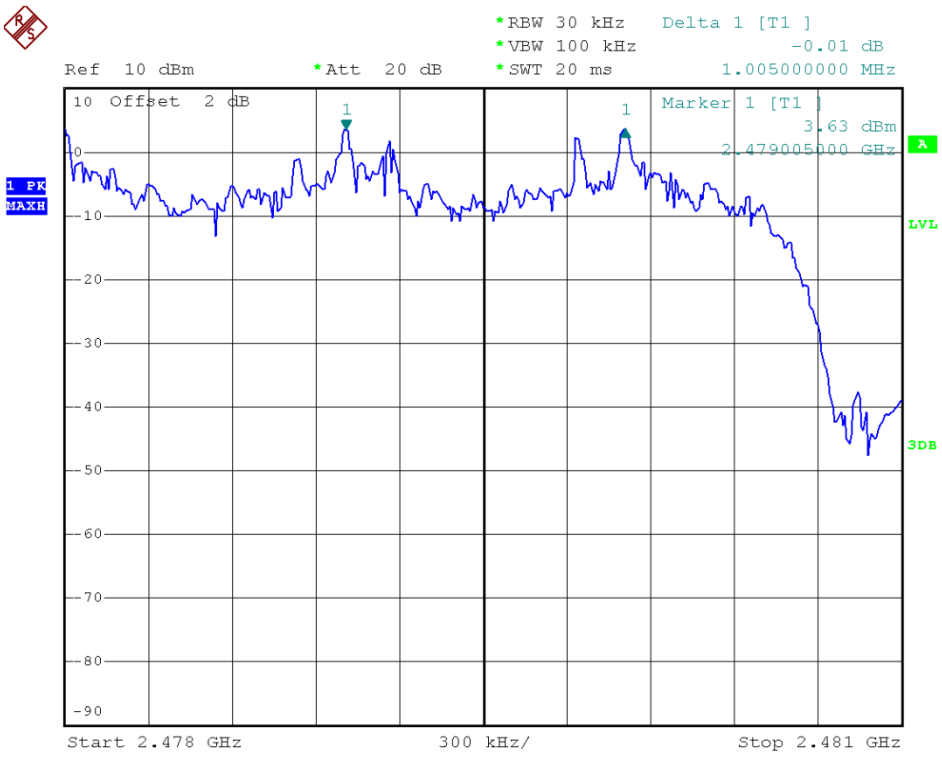





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.5 Number of hopping frequencies

**Test Method**

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW ≥RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Limit number |
|---|
| ≥ 15 |



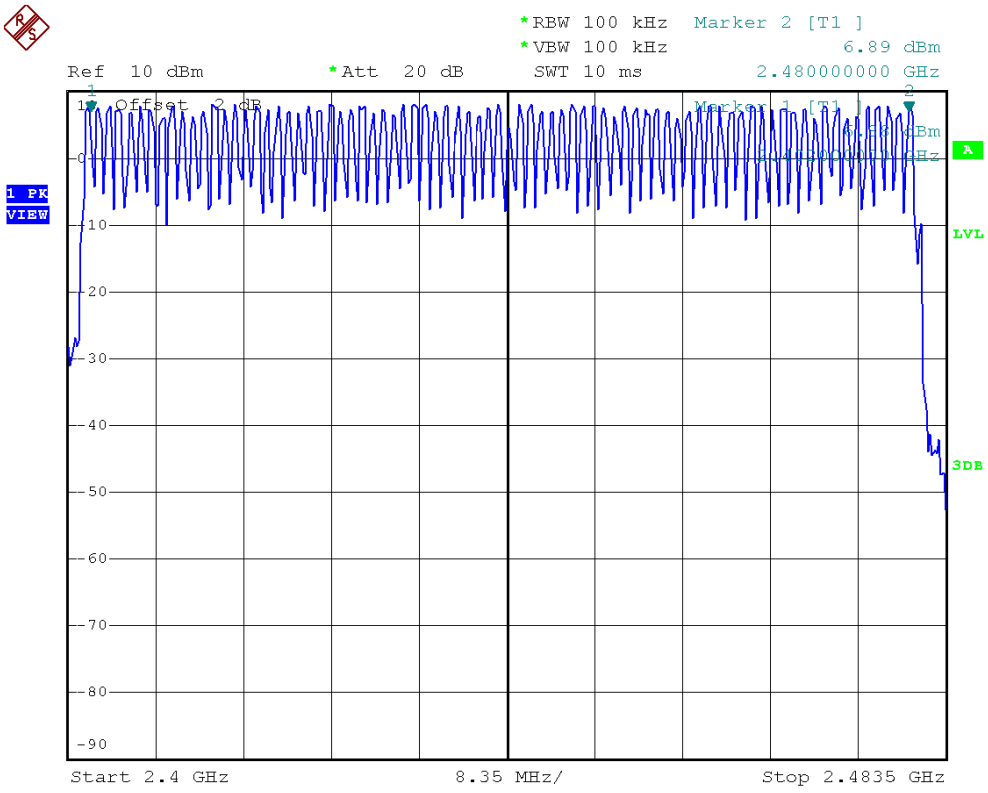
TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

| Number of hopping frequencies | Result |
|---|---|
| 79 | Pass |

BT GFSK

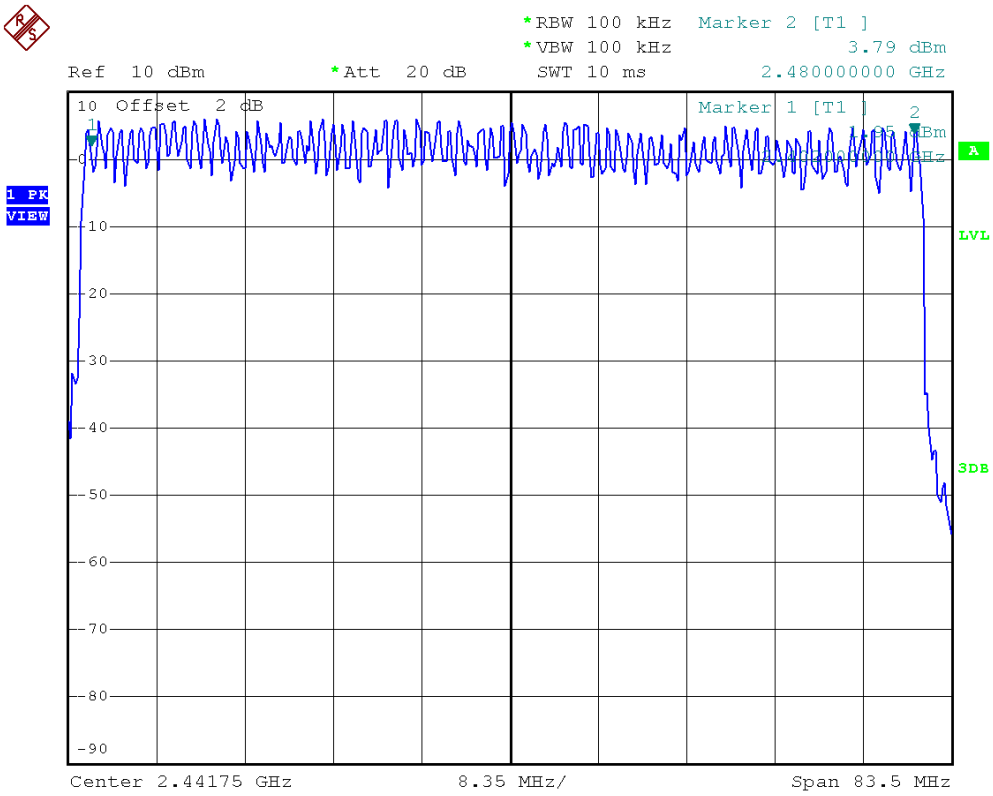





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## BT 8DPSK






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.6 Dwell Time

**Test Method**

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

**Limit**

According to §15.247(a)(1)(iii) & RSS-210 A8.1(c) The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## Dwell Time

**Dwell time**

The maximum dwell time shall be 0,4 s.
According to the Bluetooth Core Specification, the worse result (DH5, 3DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s*ch];

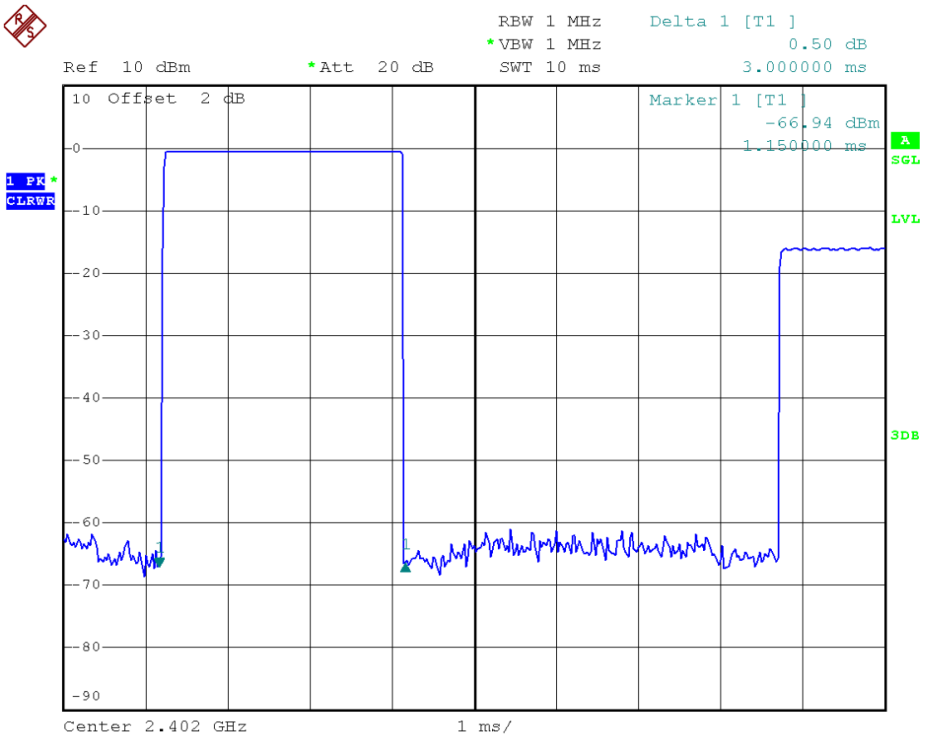
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5=1600 / 6 / 79 *31.6=106.67

Test Result

| Modulation | Frequency (MHz) | Mode | Reading (ms) | Total Hops | Test Result (ms) | Limit (ms) | Result |
|---|---|---|---|---|---|---|---|
| GFSK | 2402 | DH5 | 3.0 | 106.67 | 320 | < 400 | Pass |
| | 2441 | DH5 | 3.1 | 106.67 | 331 | < 400 | Pass |
| | 2480 | DH5 | 3.0 | 106.67 | 320 | < 400 | Pass |
| 8DPSK | 2402 | 3DH5 | 3.0 | 106.67 | 320 | < 400 | Pass |
| | 2441 | 3DH5 | 3.0 | 106.67 | 320 | < 400 | Pass |
| | 2480 | 3DH5 | 3.0 | 106.67 | 320 | < 400 | Pass |

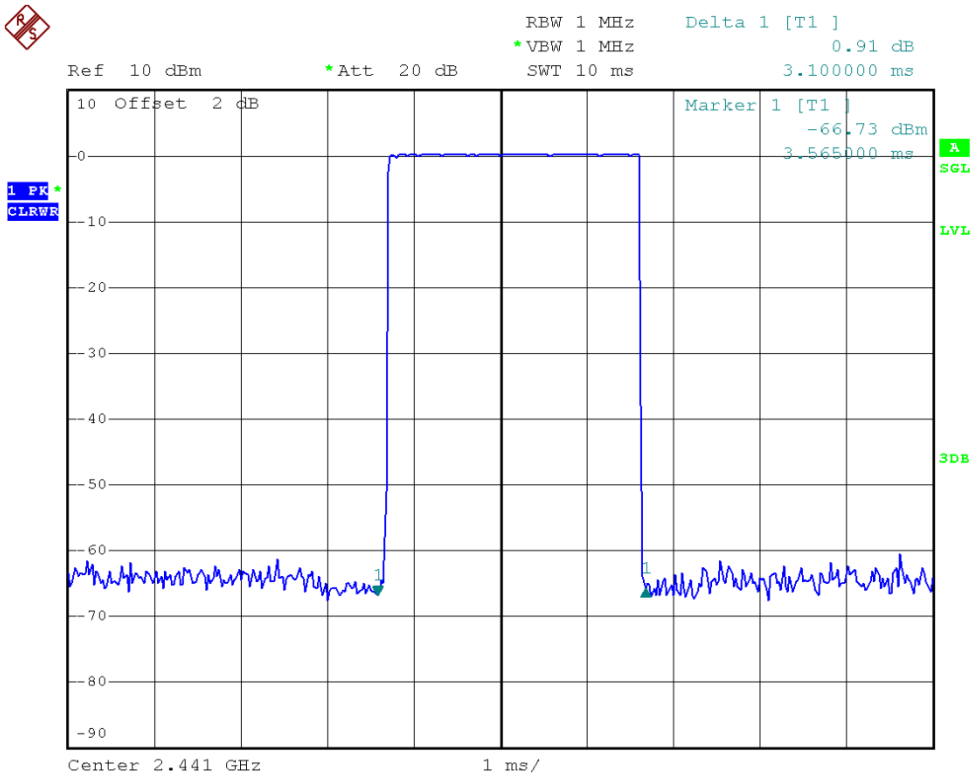
BT GFSK DH5

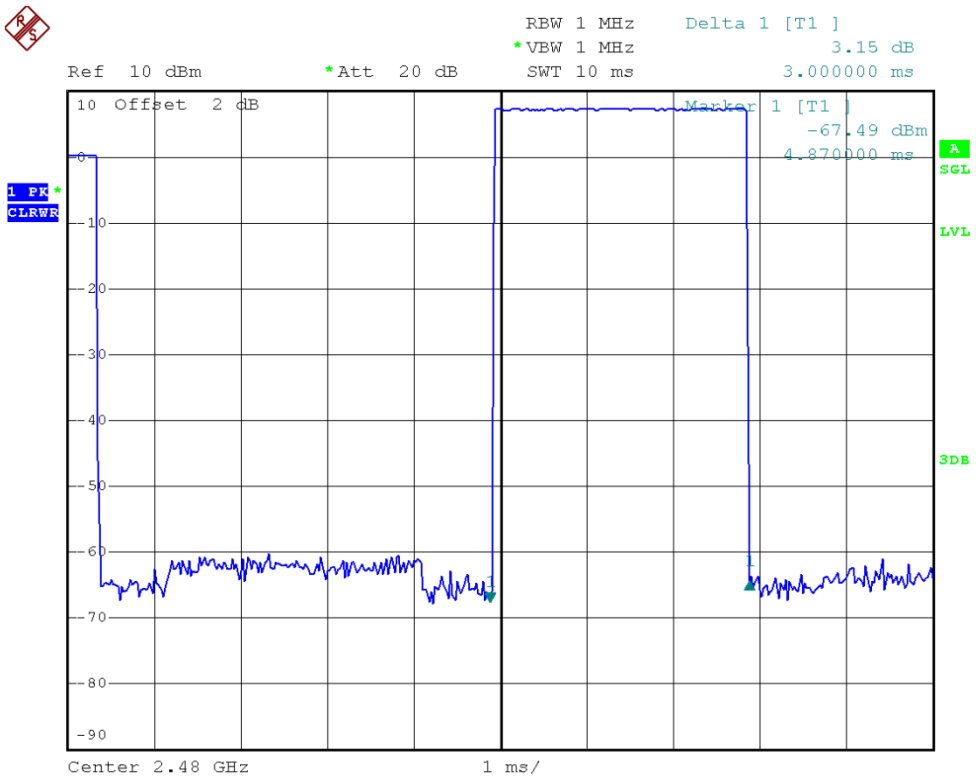





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



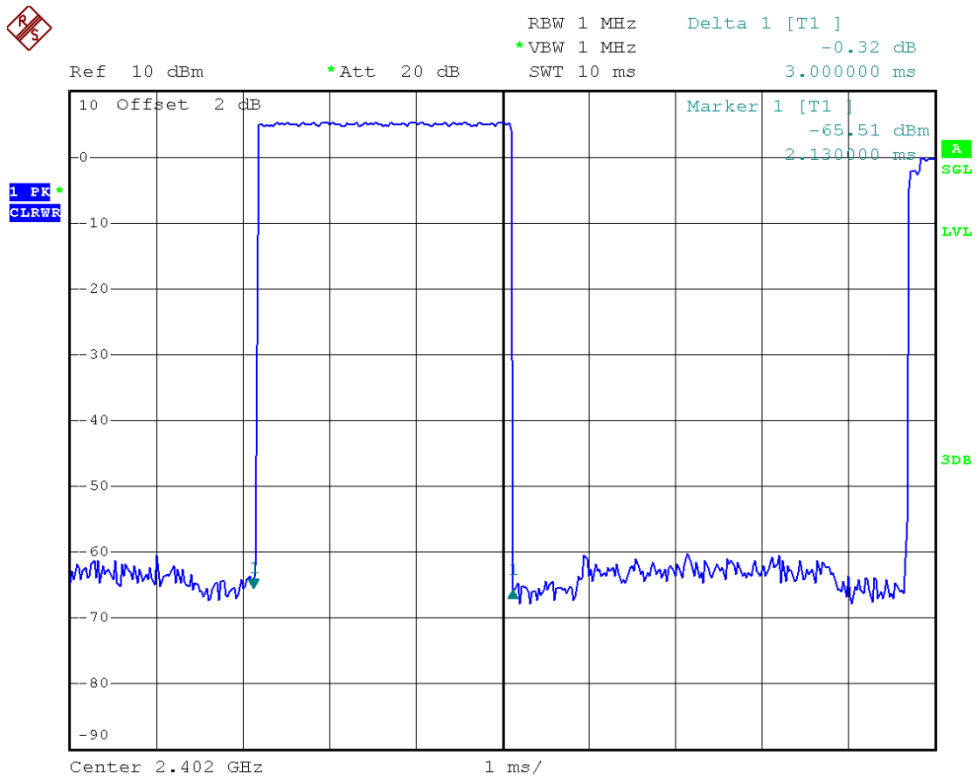



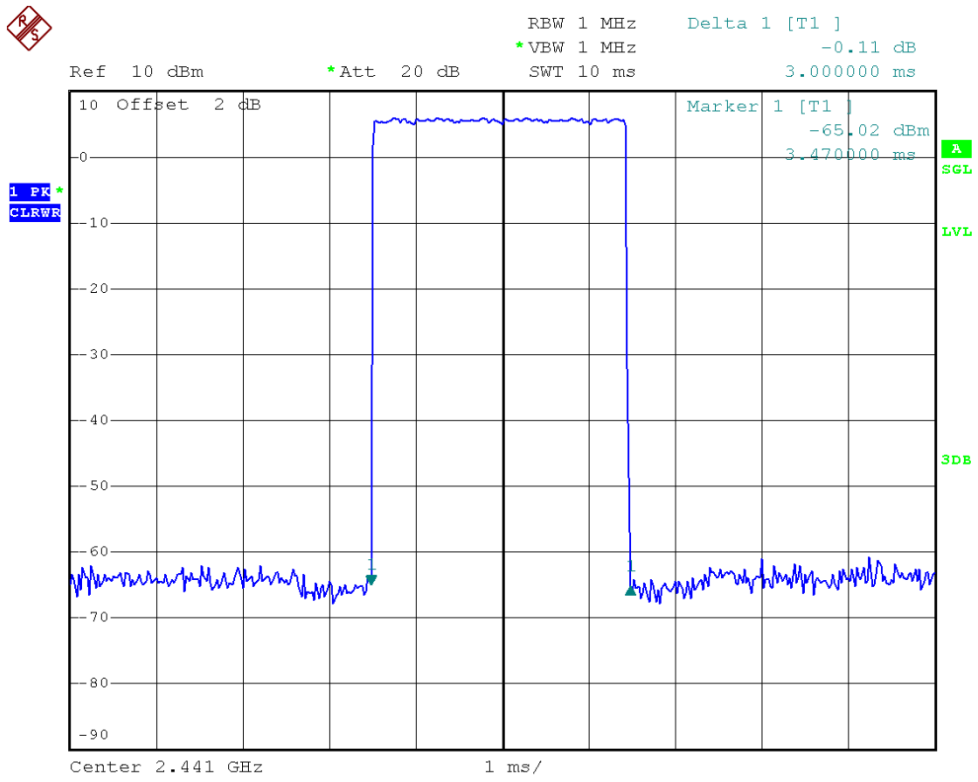



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## BT 8DPSK 3DH5

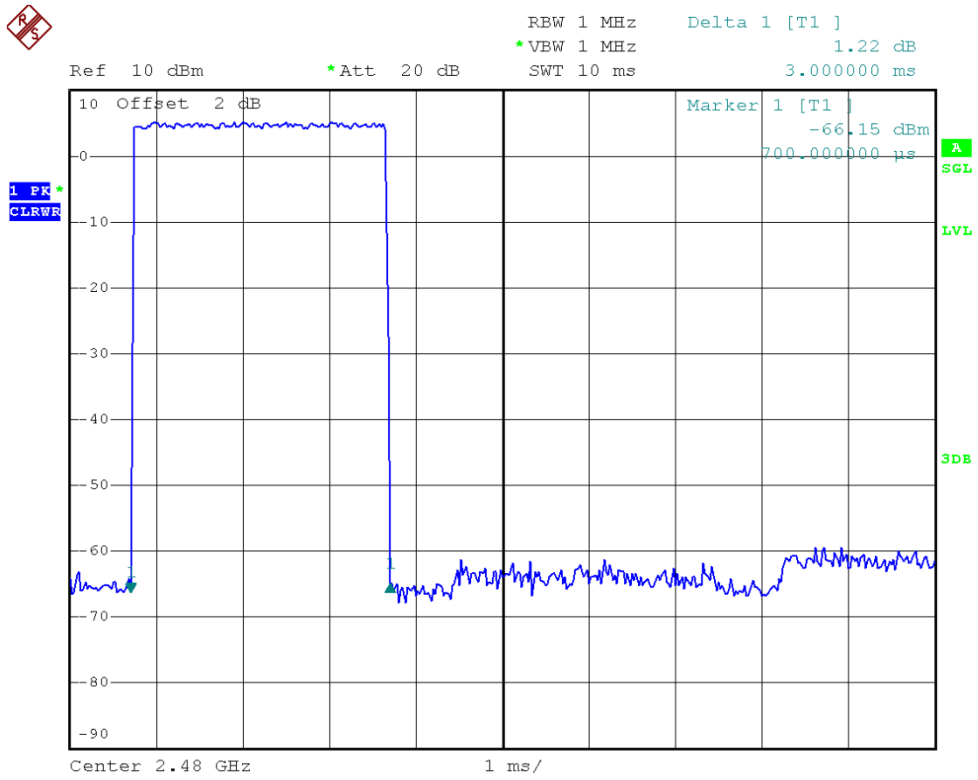





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## 9.7 6 dB Bandwidth

**Test Method**

5. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
6. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
7. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
8. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Limit [kHz] |
|---|
| ⩾ 500 |

**Result:**

| Bluetooth | | | |
|---|---|---|---|
| Frequency (MHz) | Mode | 6 dB Bandwidth | Result |
| 2402 | BLE | 710.72 | Pass |
| 2440 | | 695.76 | Pass |
| 2480 | | 703.24 | Pass |

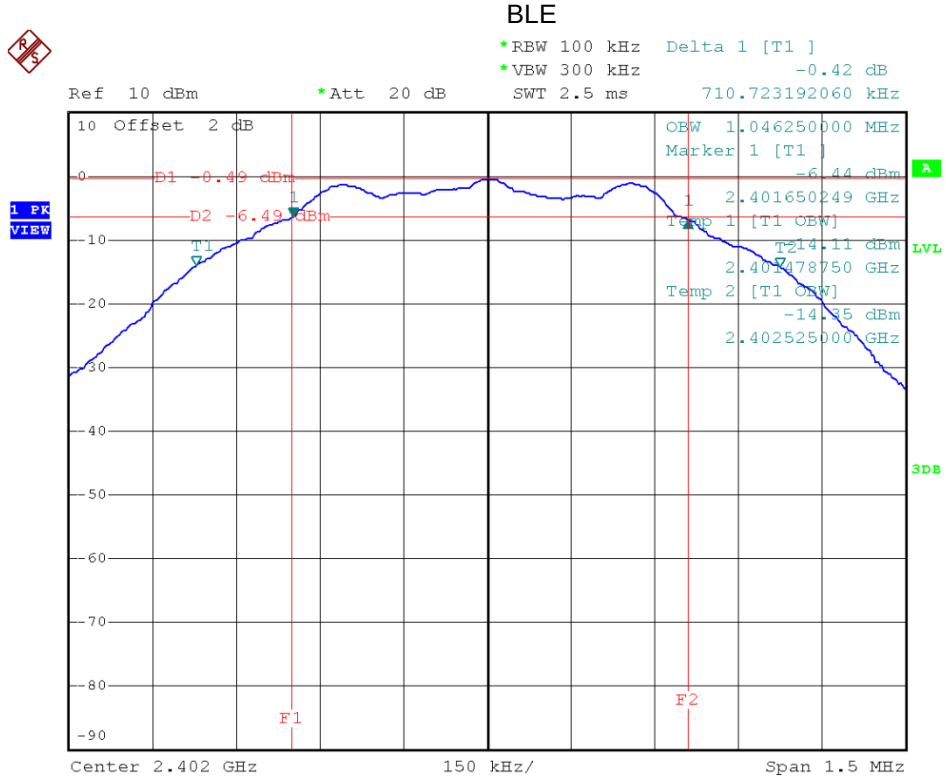
| WIFI | | | |
|---|---|---|---|
| Frequency (MHz) | Mode | 6 dB Bandwidth | Result |
| 2412 | 802.11b | 11.12 | Pass |
| 2437 | | 12.07 | Pass |
| 2462 | | 12.07 | Pass |
| 2412 | 802.11g | 16.06 | Pass |
| 2437 | | 16.11 | Pass |
| 2462 | | 16.31 | Pass |

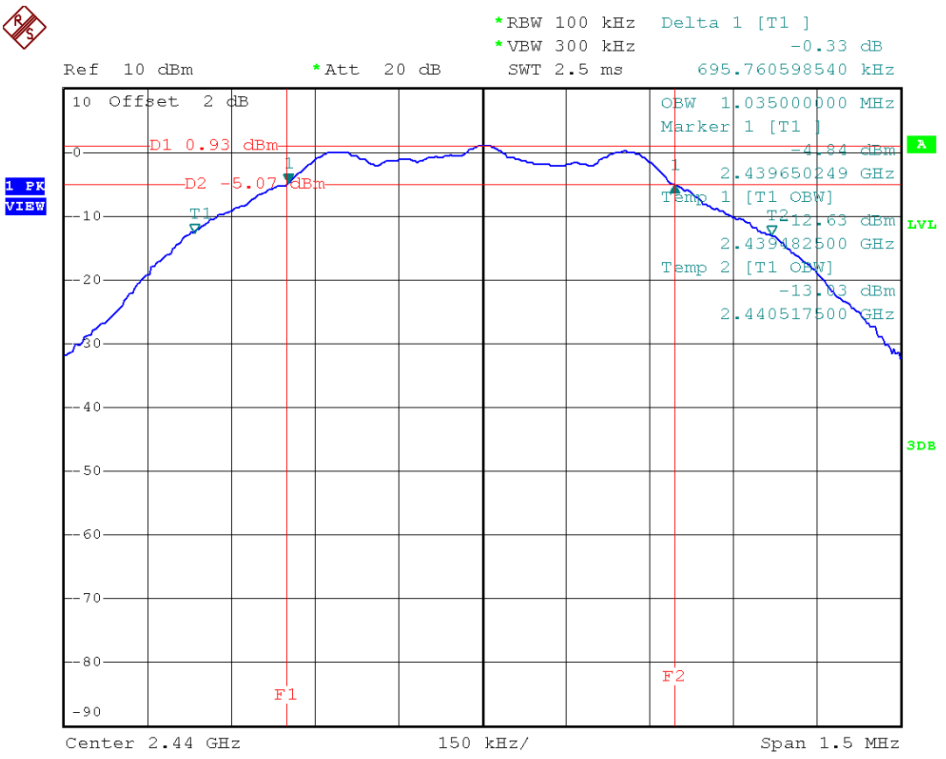


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

BLE

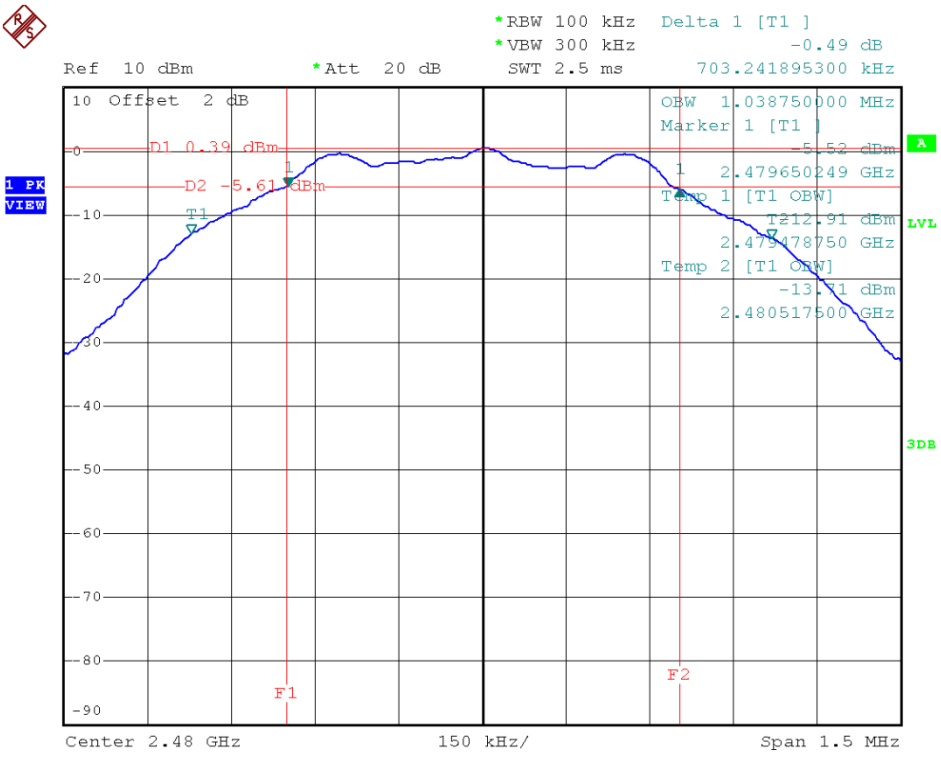


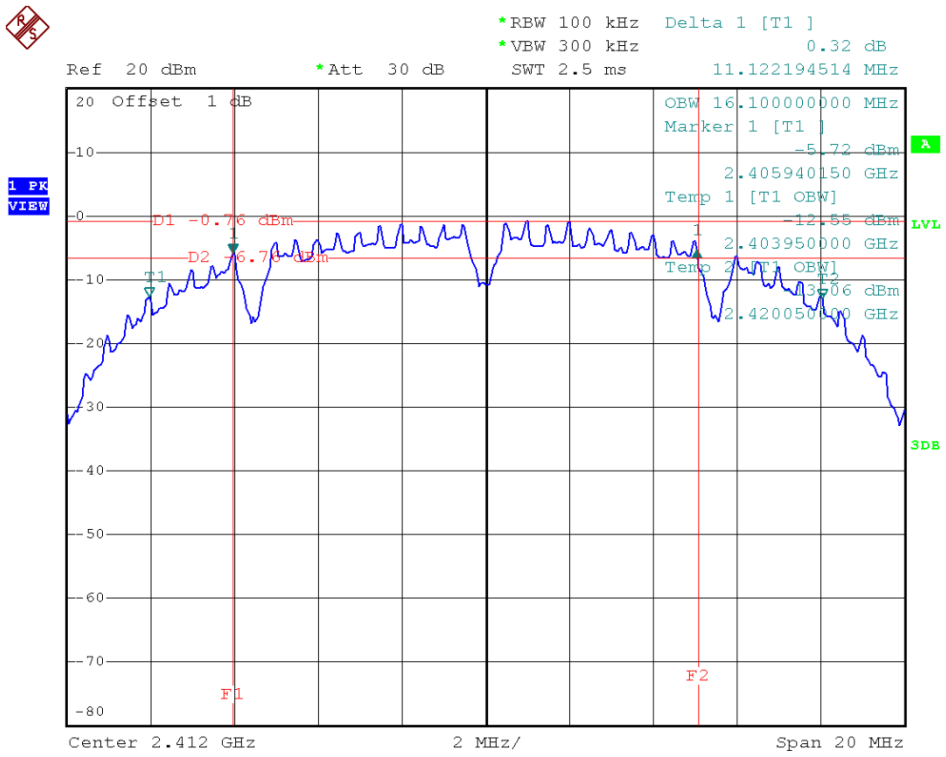



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



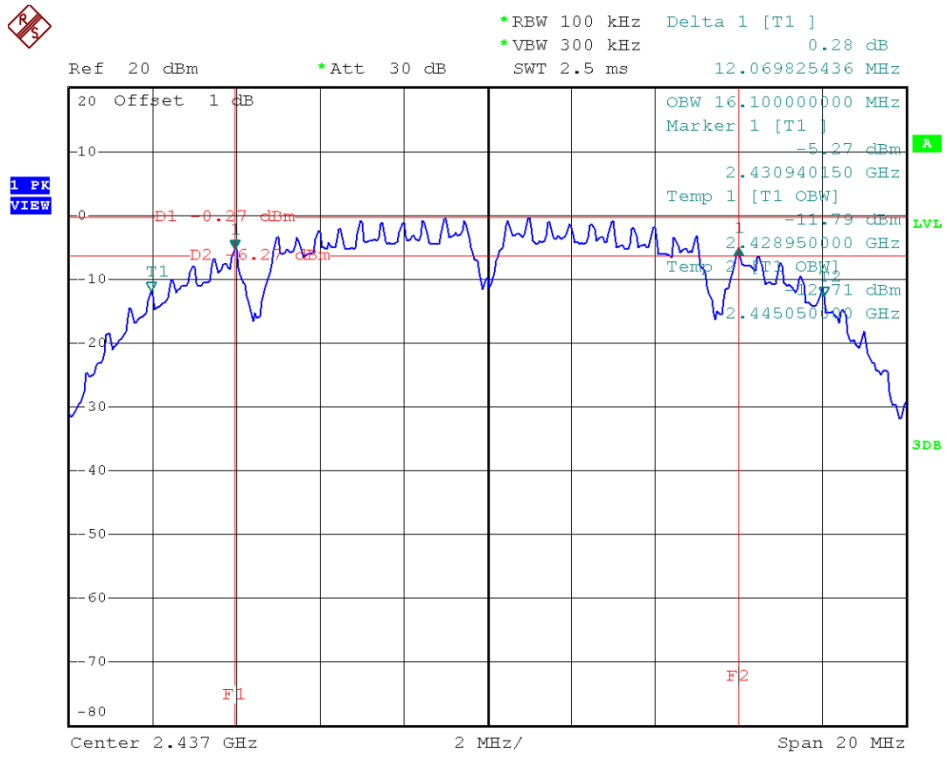

802.11b

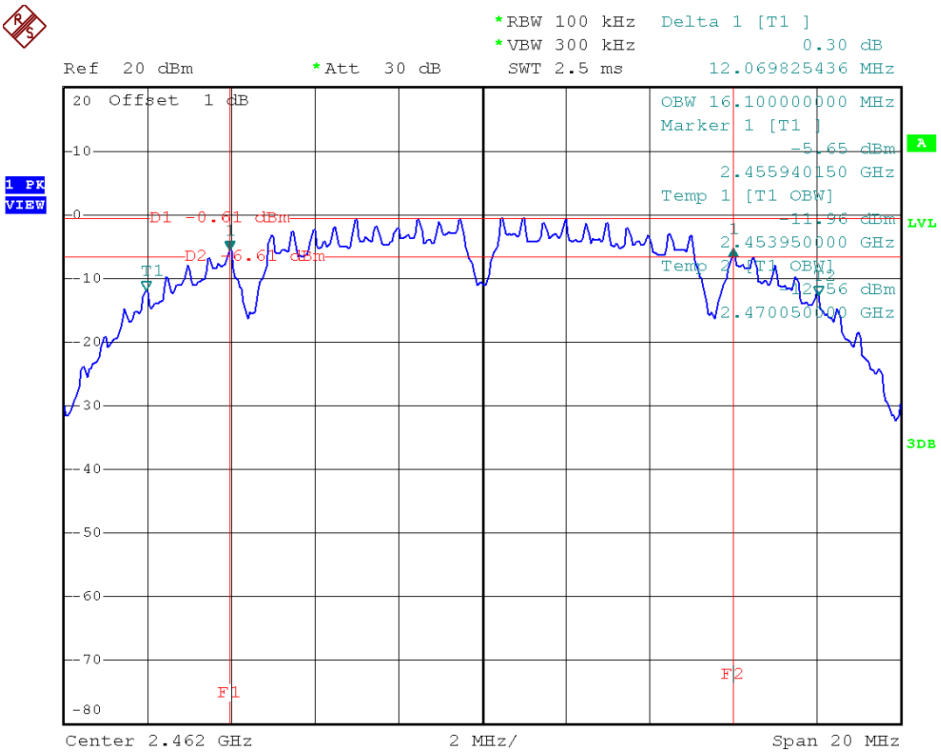





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

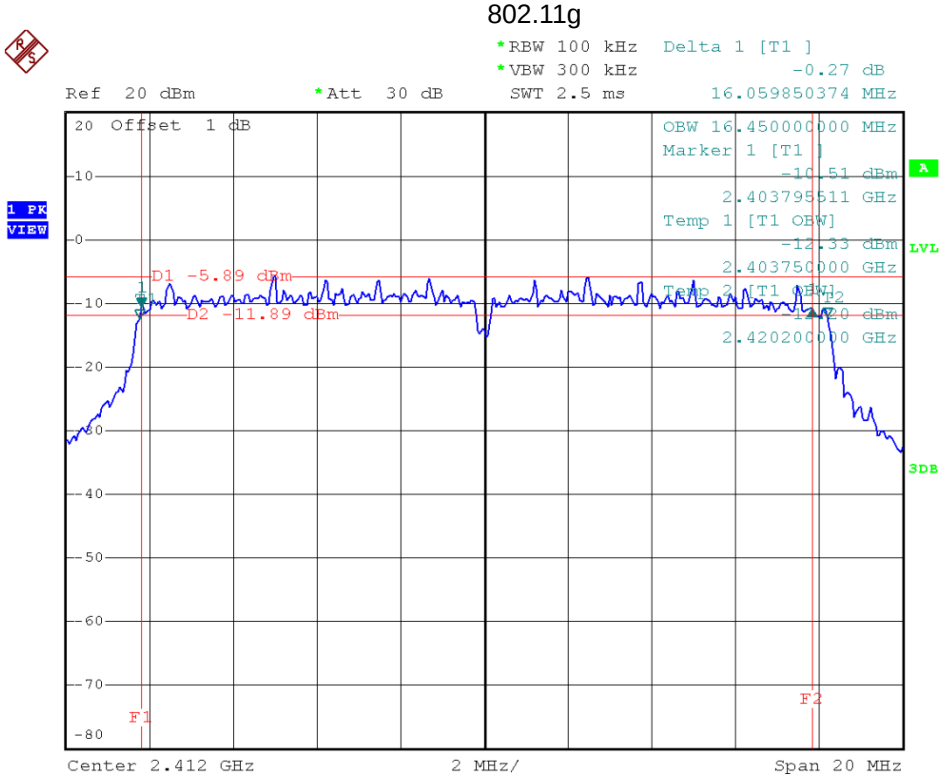


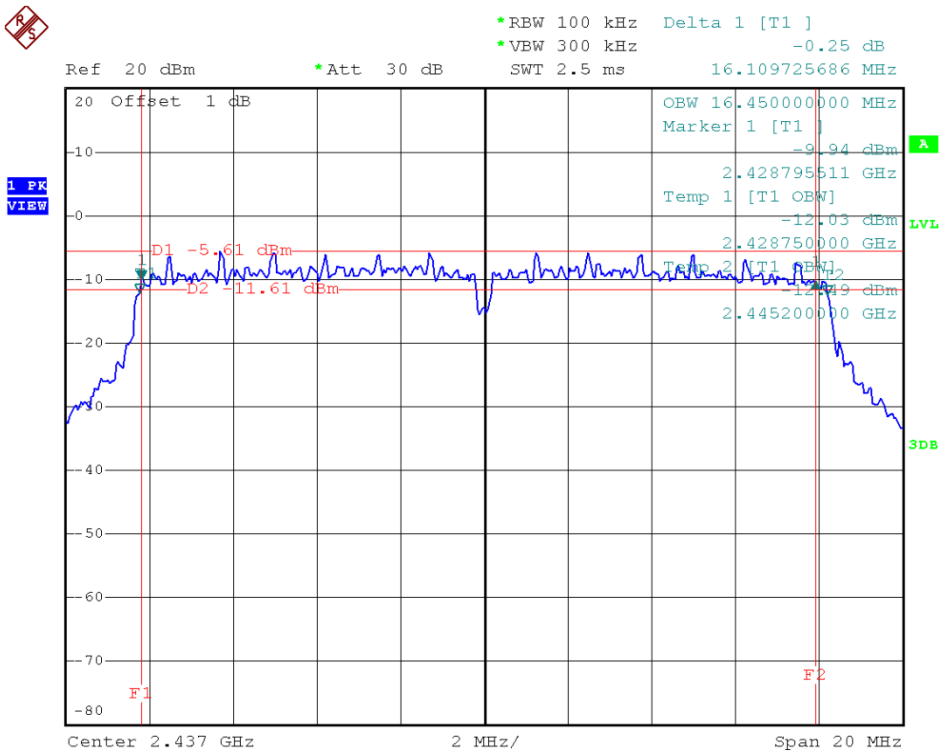



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

802.11g




Date: 7.AUG.2014 11:51:28

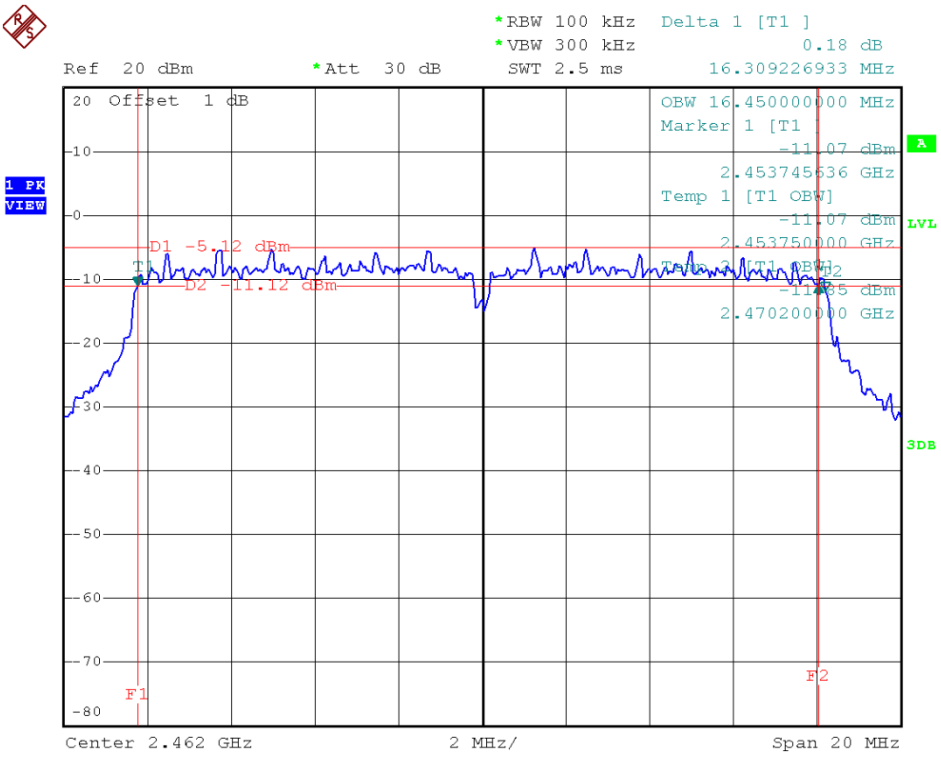



Date: 7.AUG.2014 11:59:17



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.8 Spurious RF conducted emissions

**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 emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10$^{th}$ harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

**Limit**

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

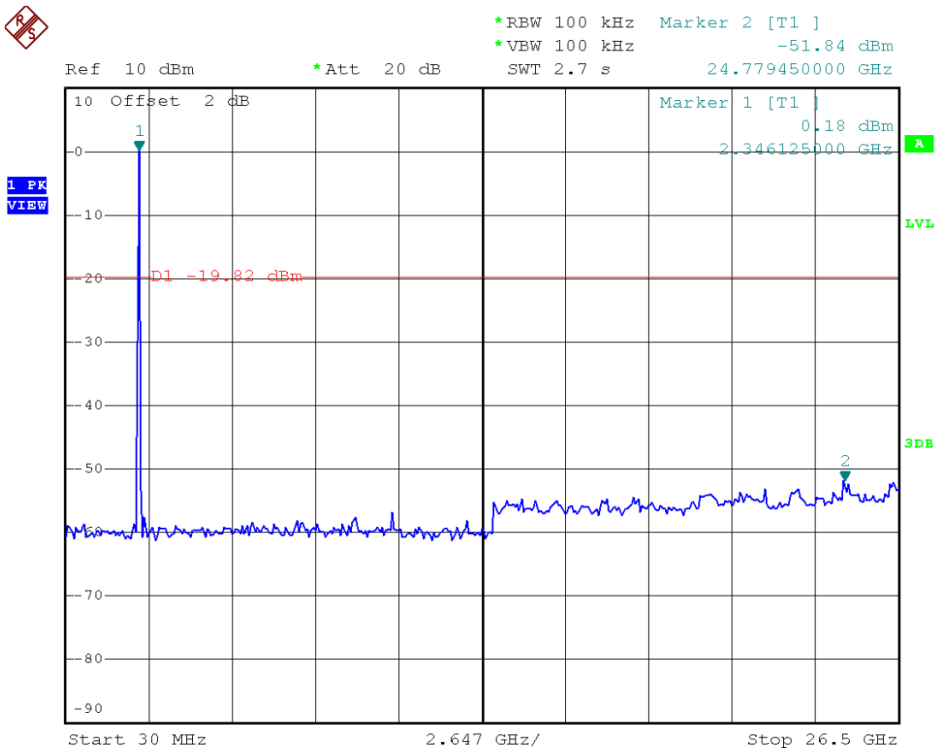


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

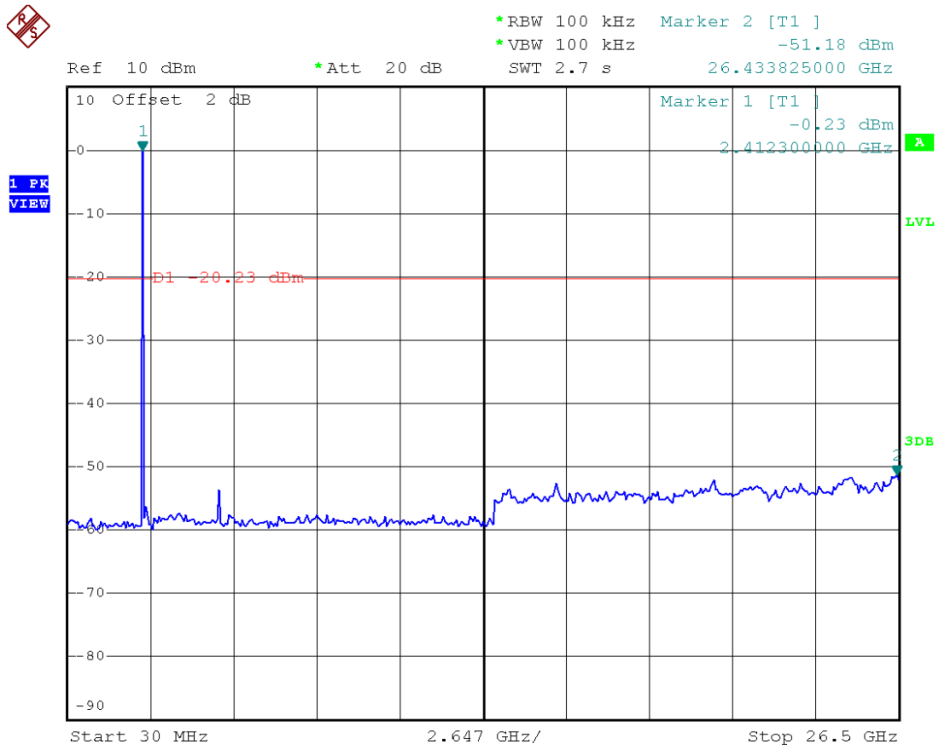
China

## Spurious RF conducted emissions

BT GFSK mode
2402MHz



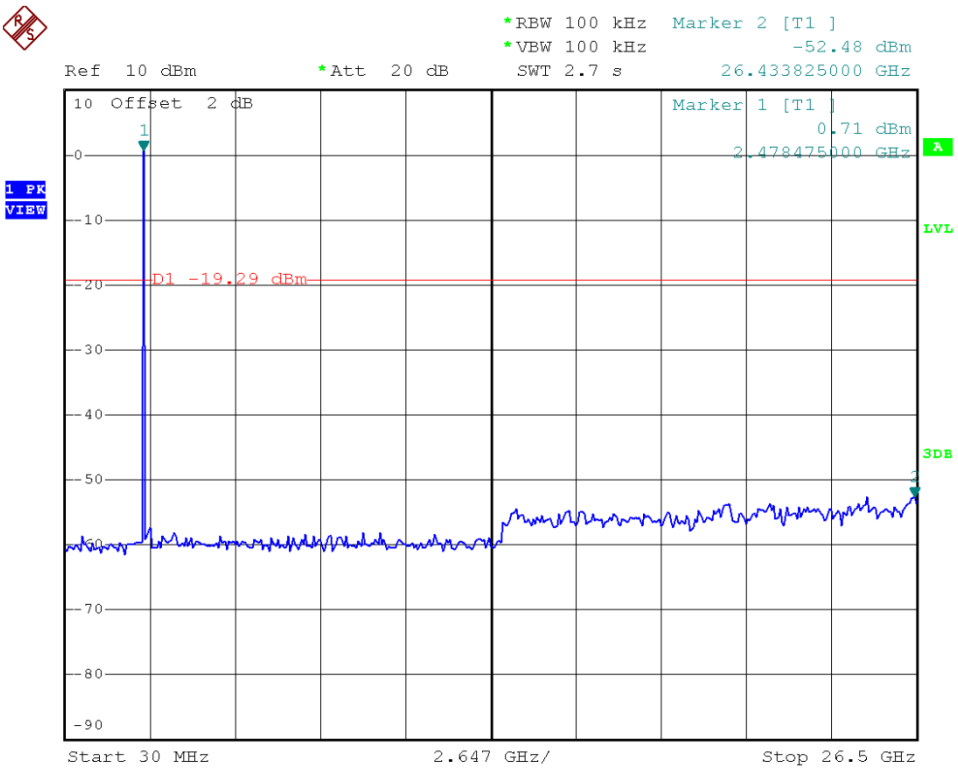

2442MHz



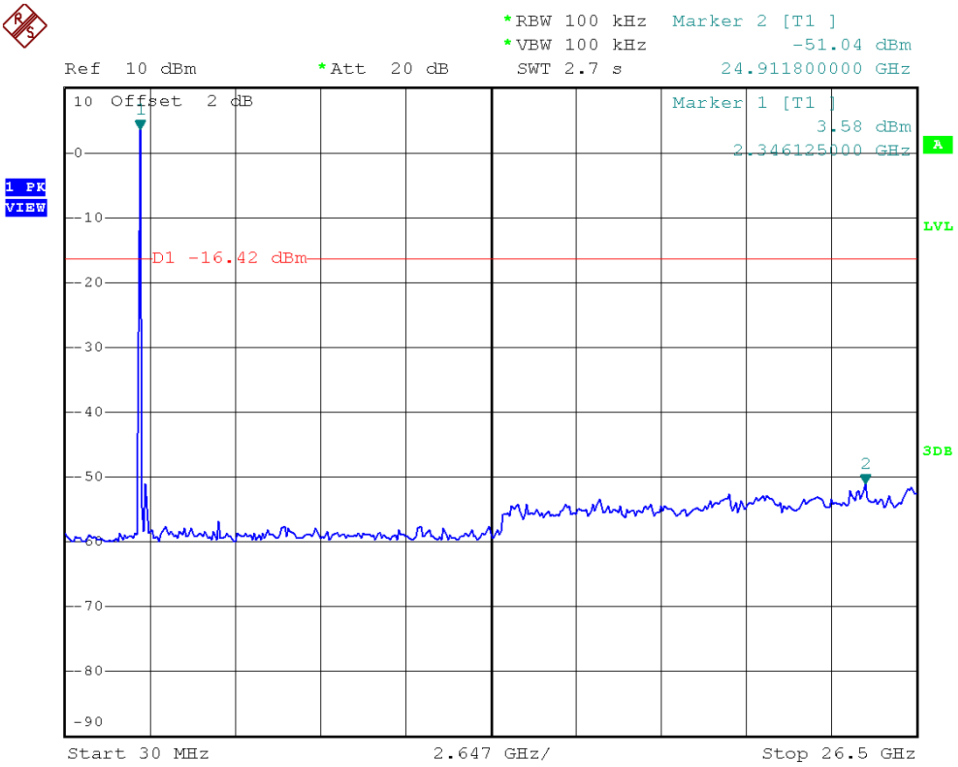



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

2480MHz




8DPSK
2402MHz

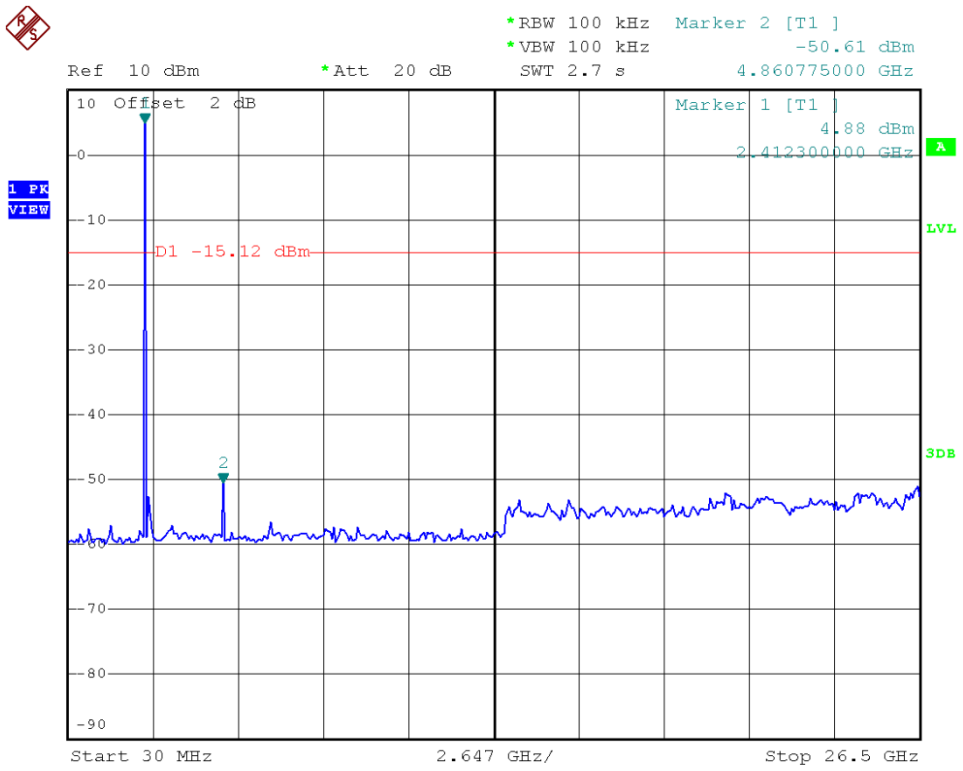




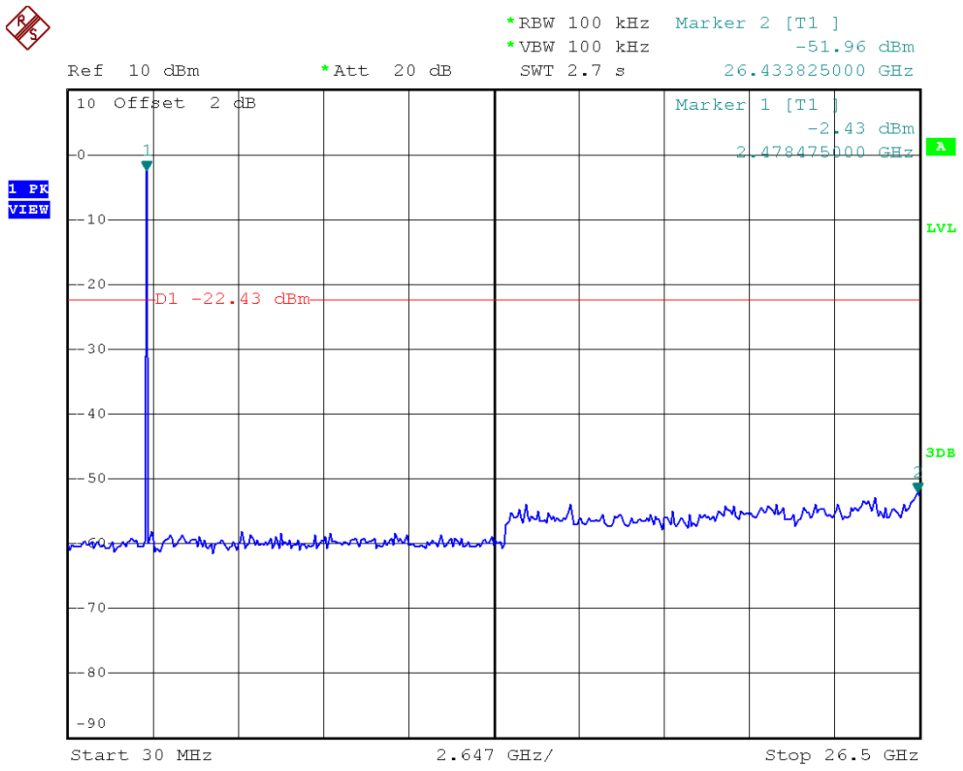

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 2441MHz




## 2480MHz



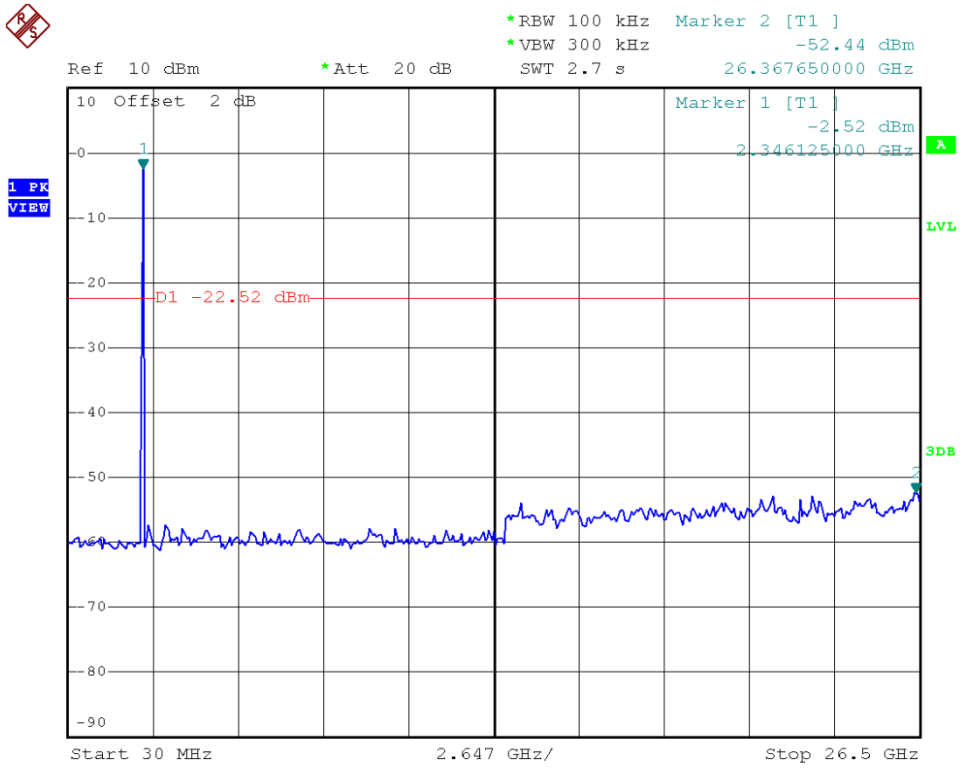



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

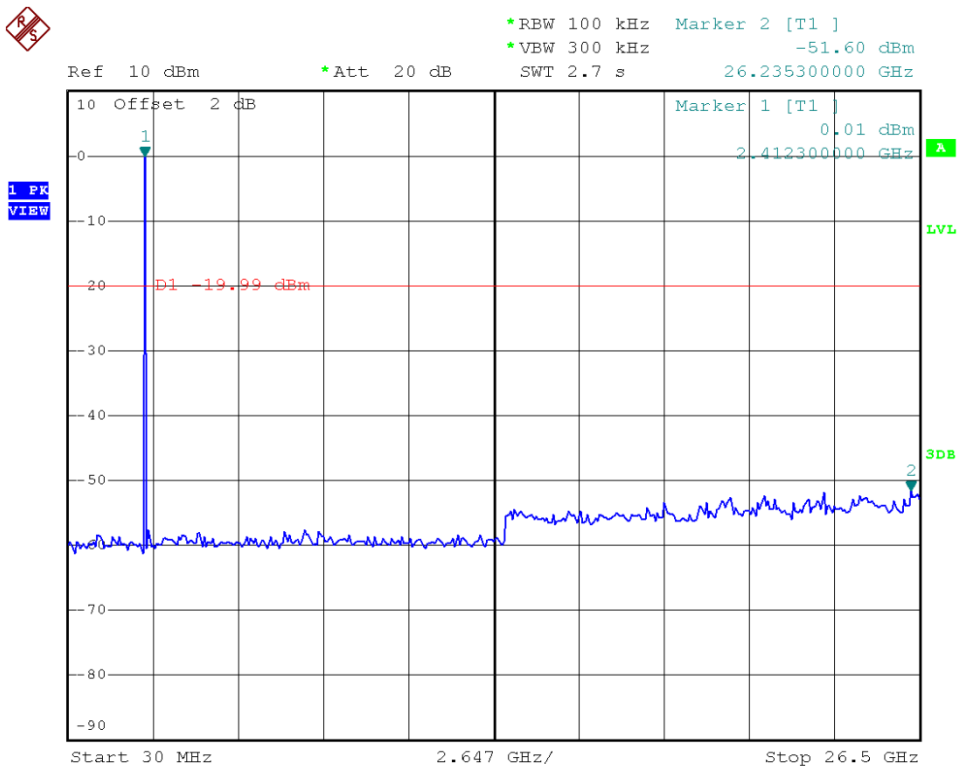
China

BLE

2402MHz



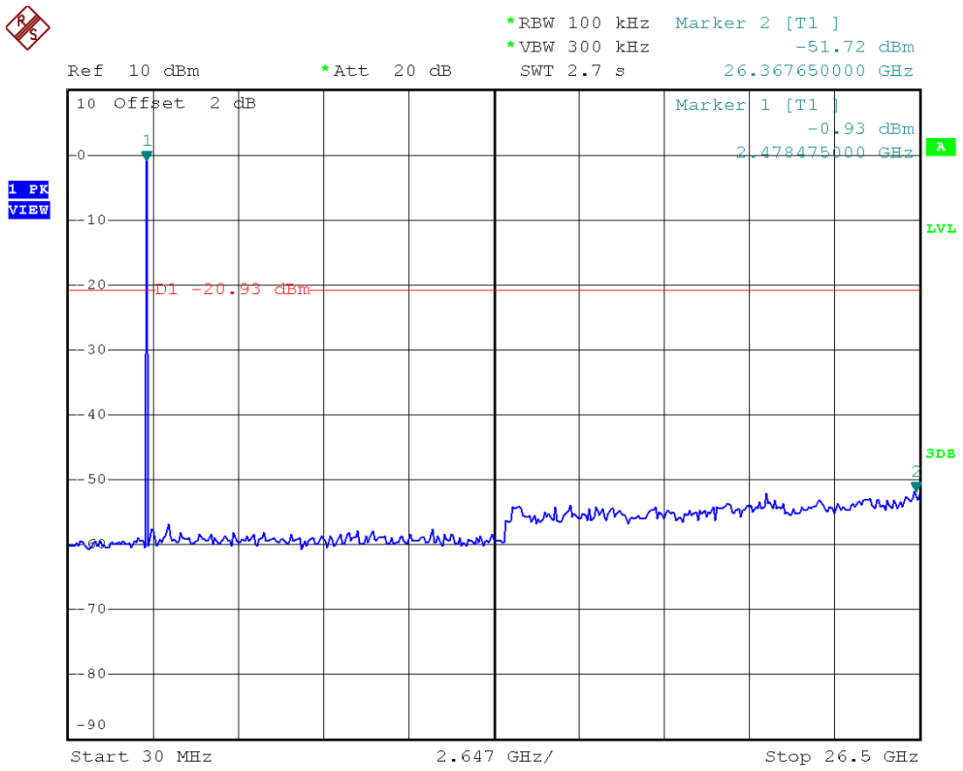

2440MHz





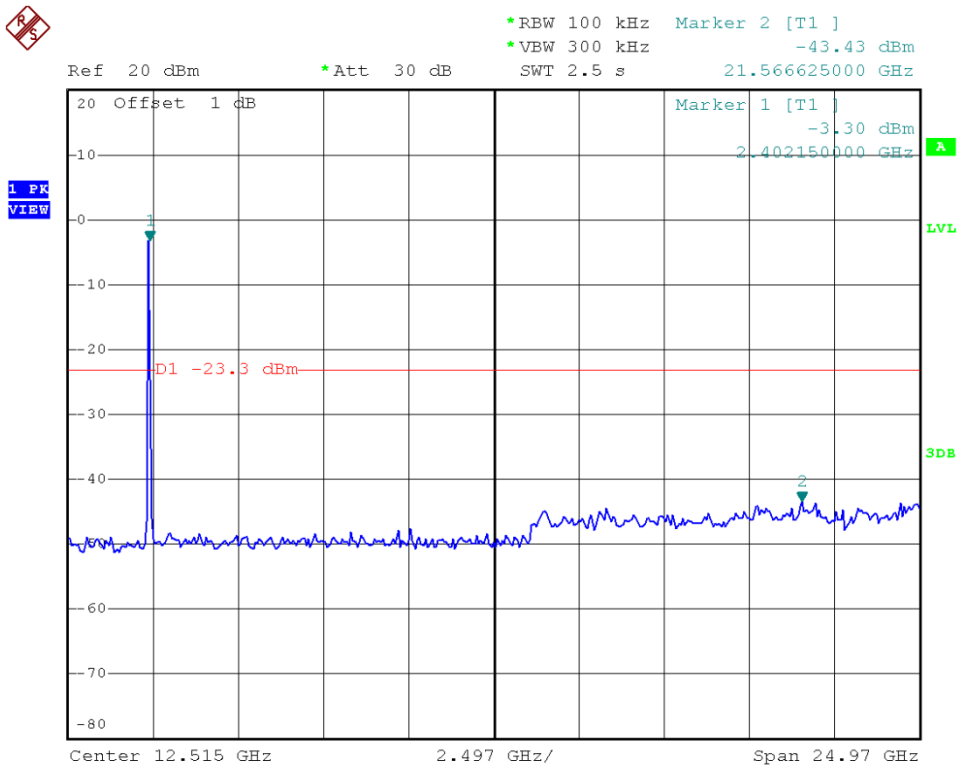

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

2480MHz




802.11b

2412MHz

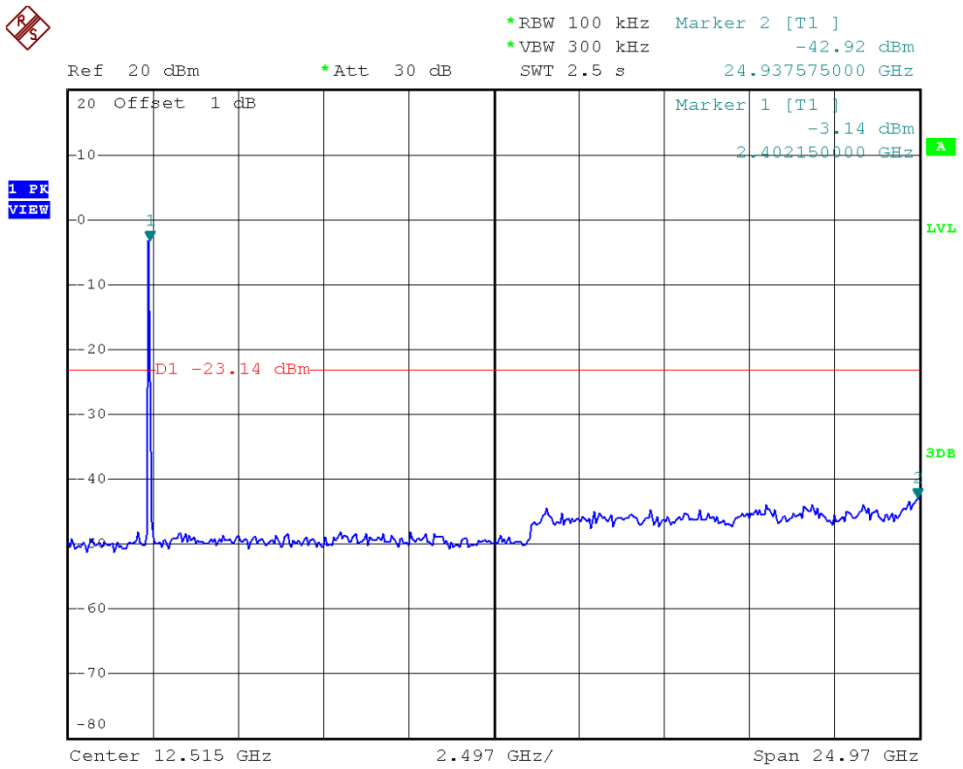




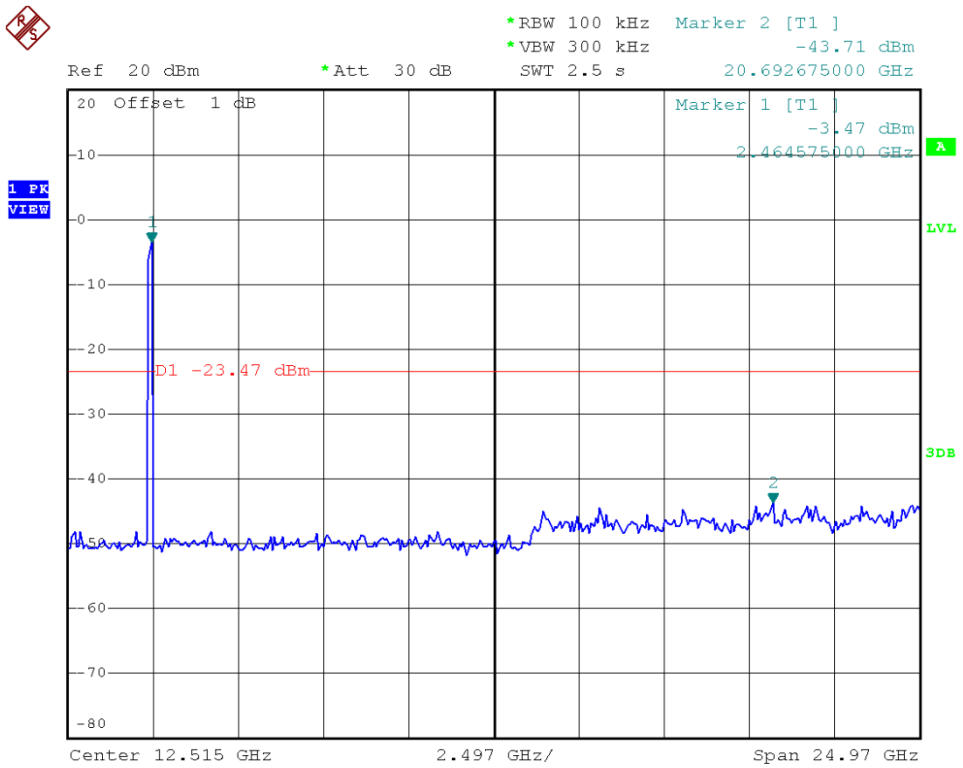

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 2437MHz




## 2462MHz

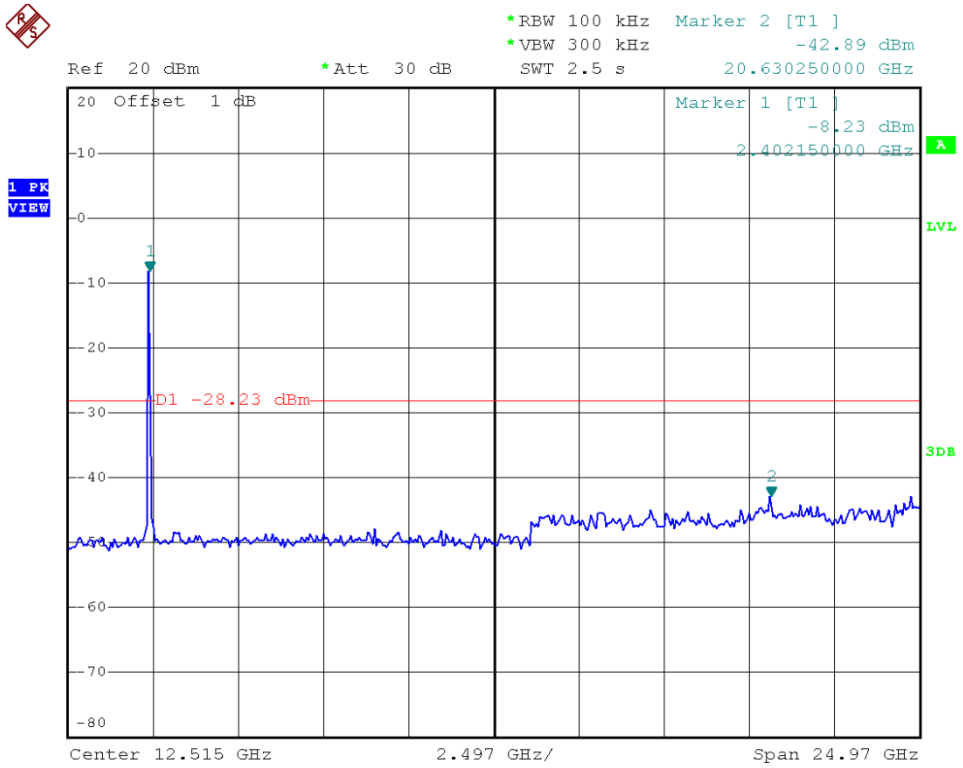




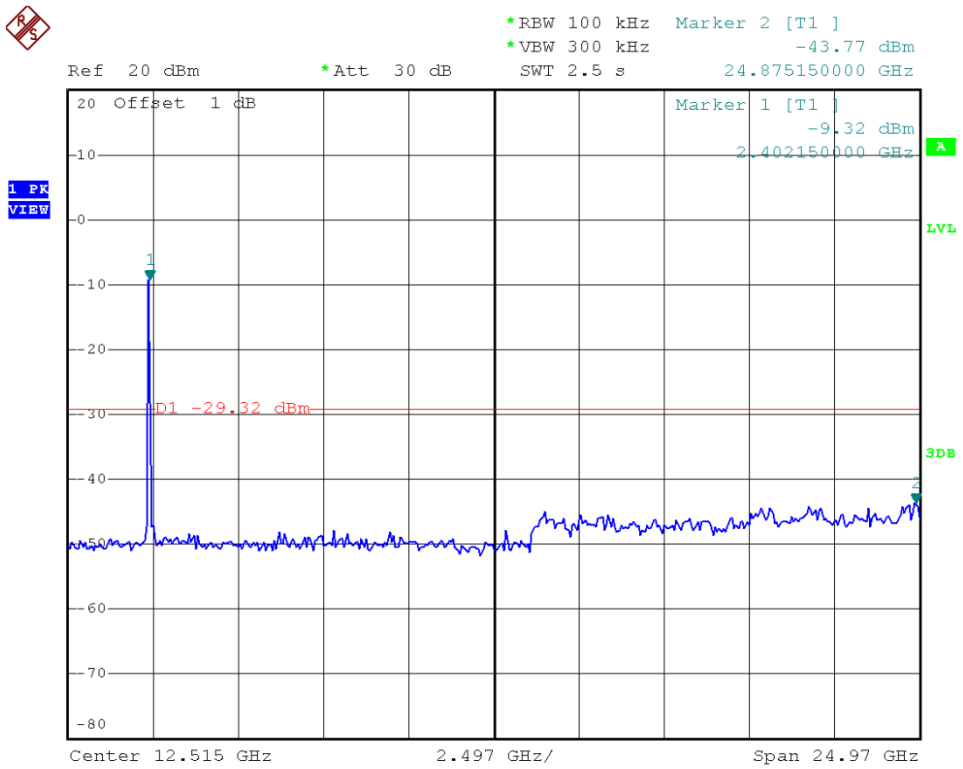

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

802.11g

2412MHz




2437MHz

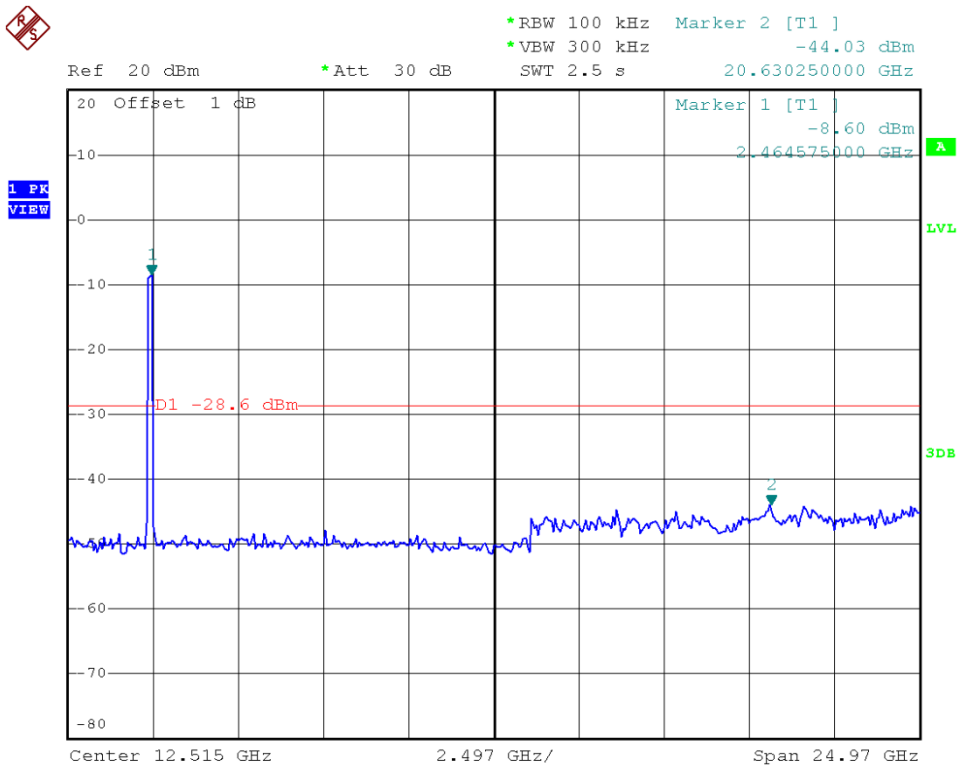





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

2462MHz






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.9 Band edge testing

**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. .
4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

**Limit:**

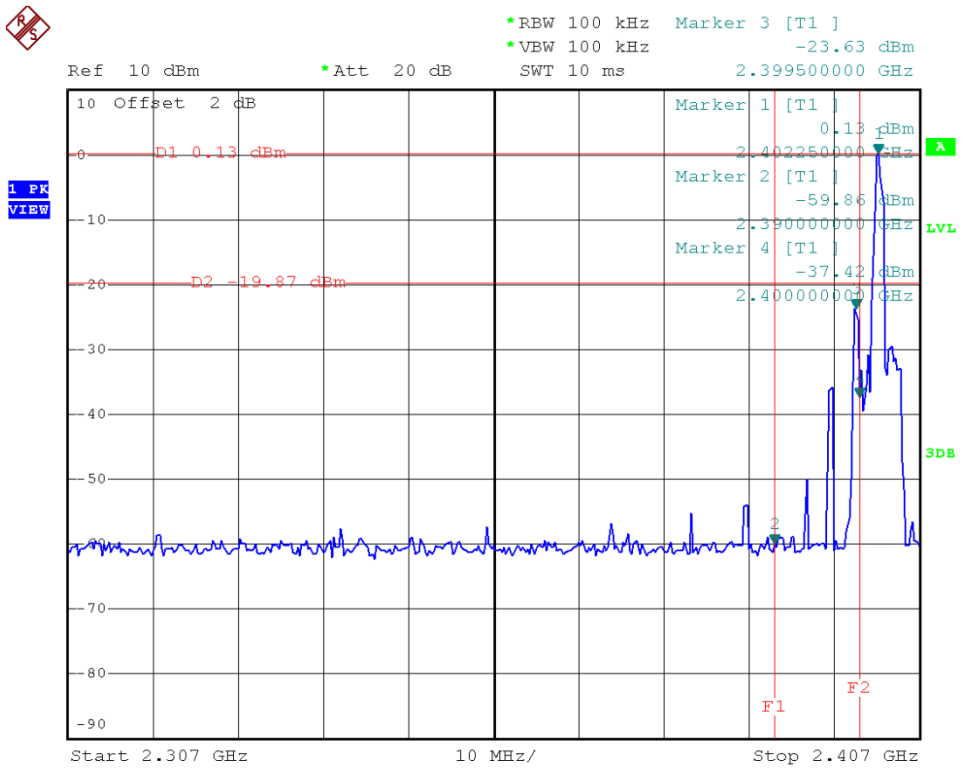
According to §15.247(d) and RSS-210 A8.5, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) and RSS-Gen7.2.2, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

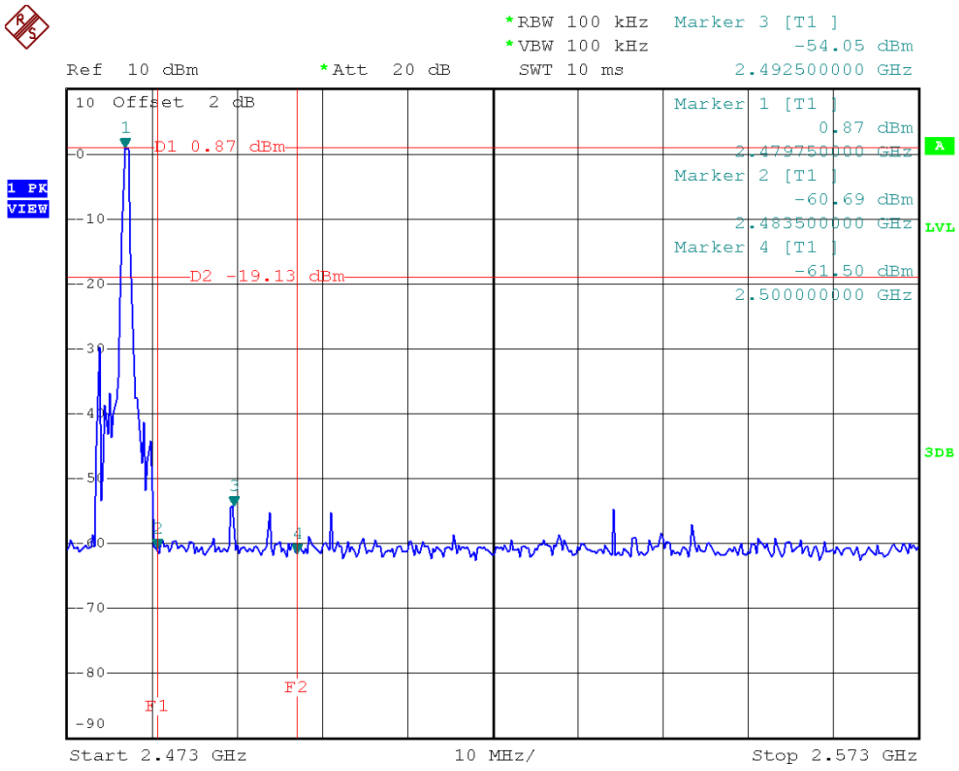


TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## Band edge testing

### BT GFSK



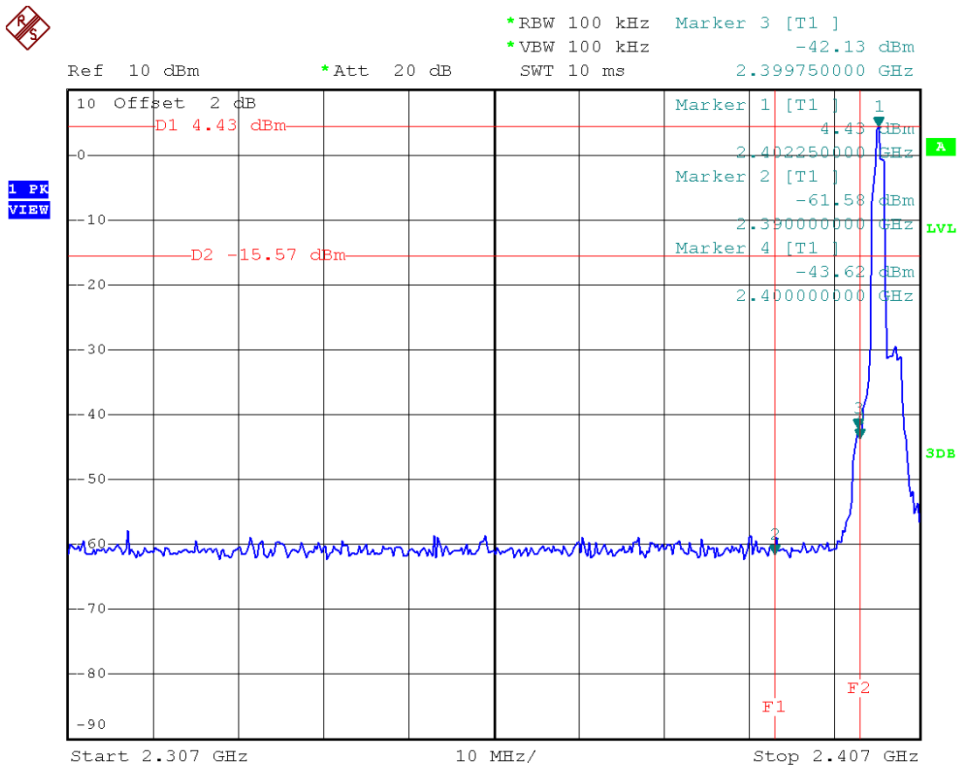



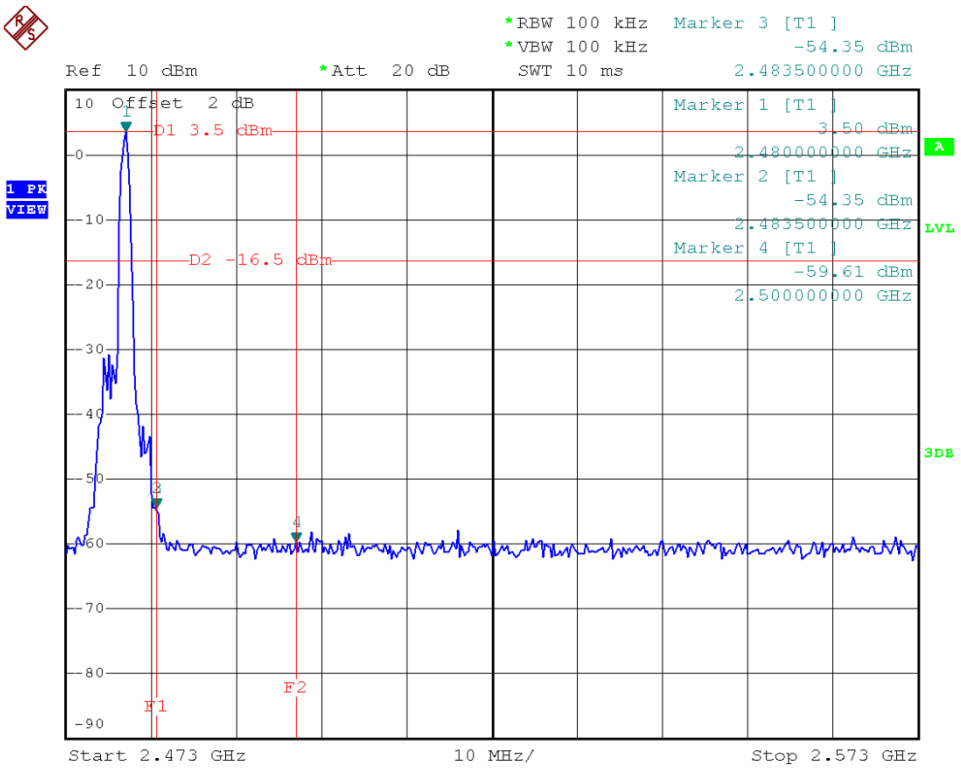



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 8DPSK



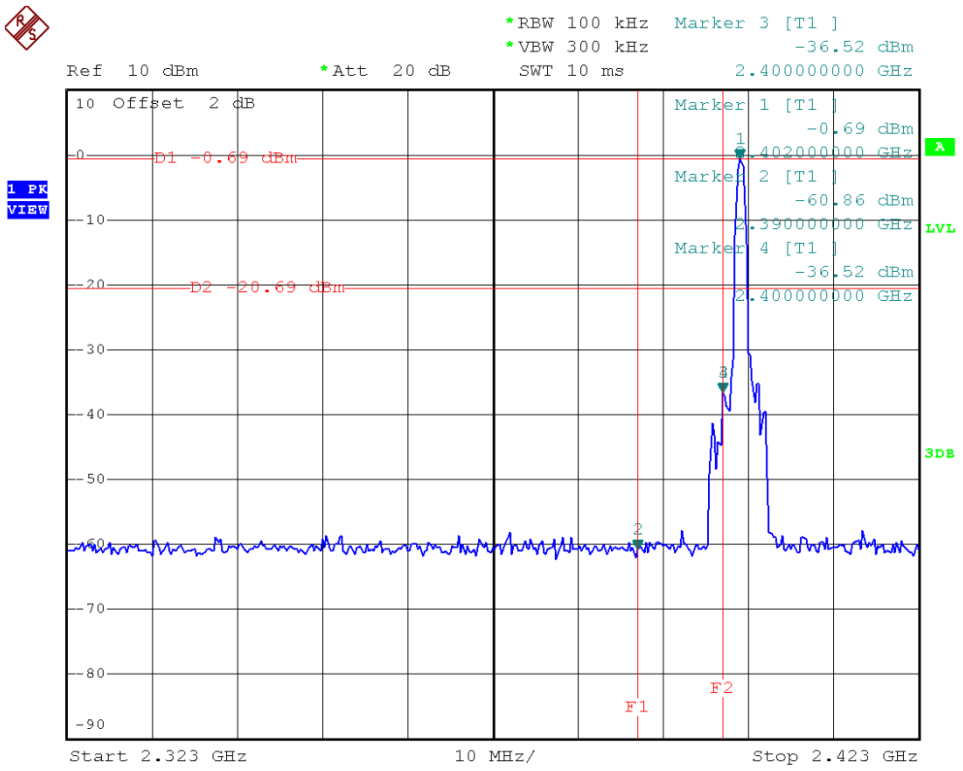



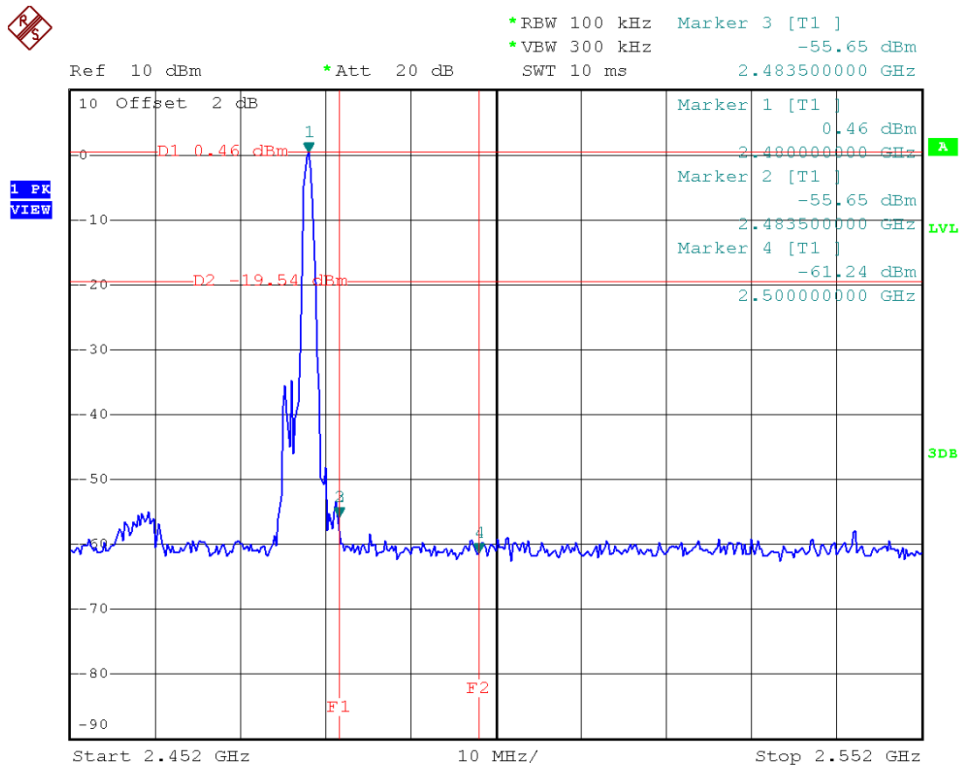



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## BLE



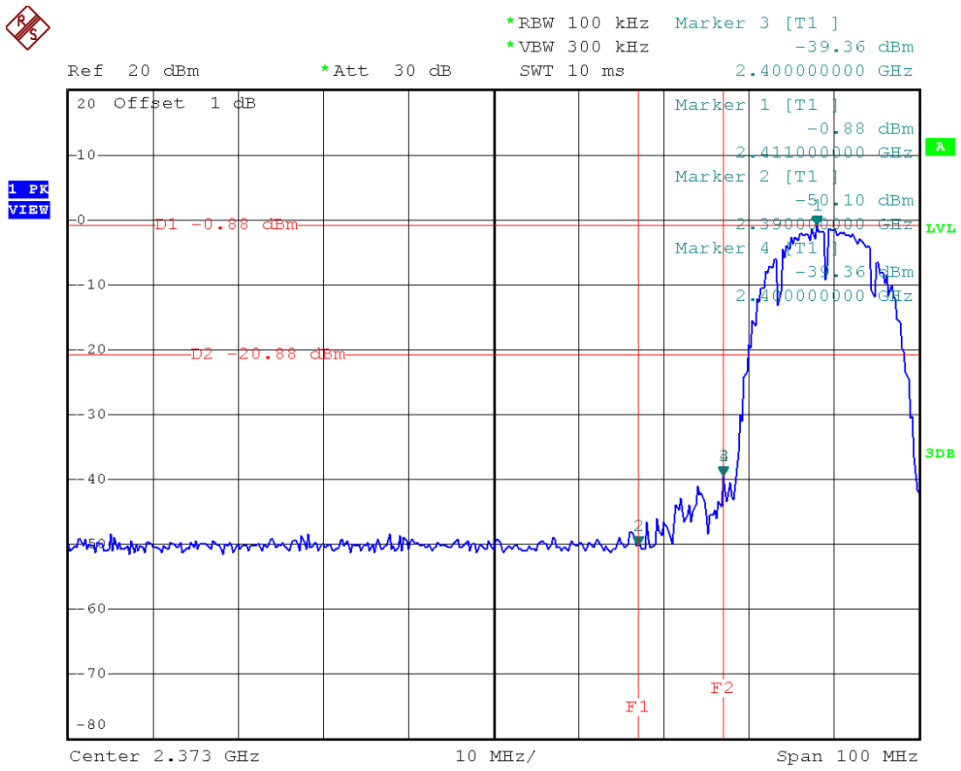



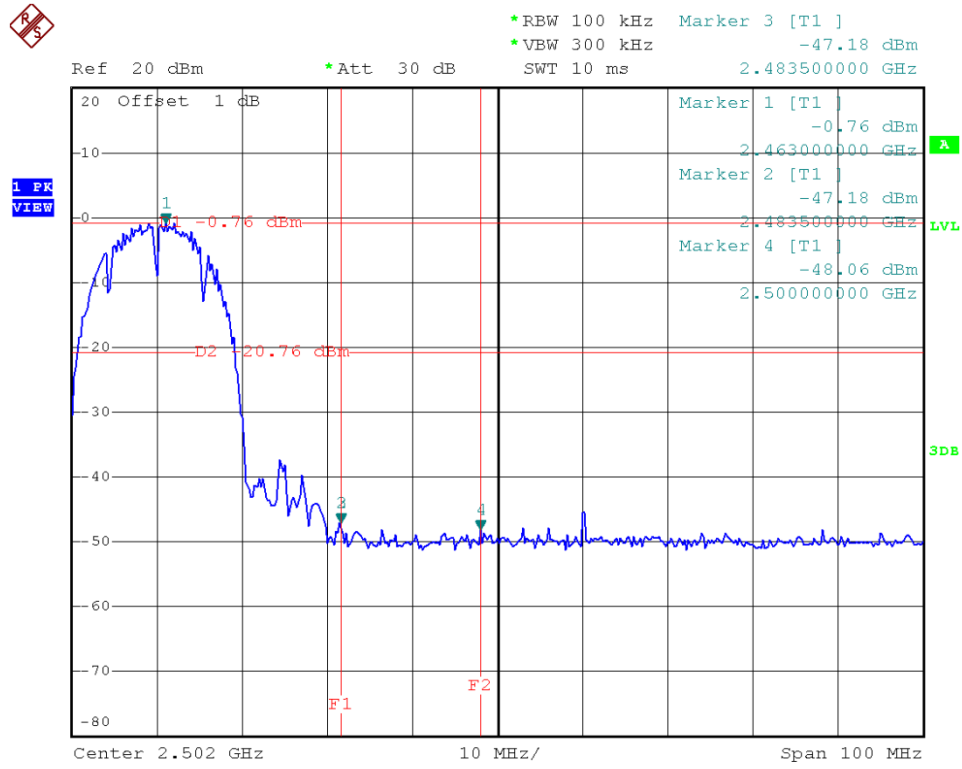



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 802.11b



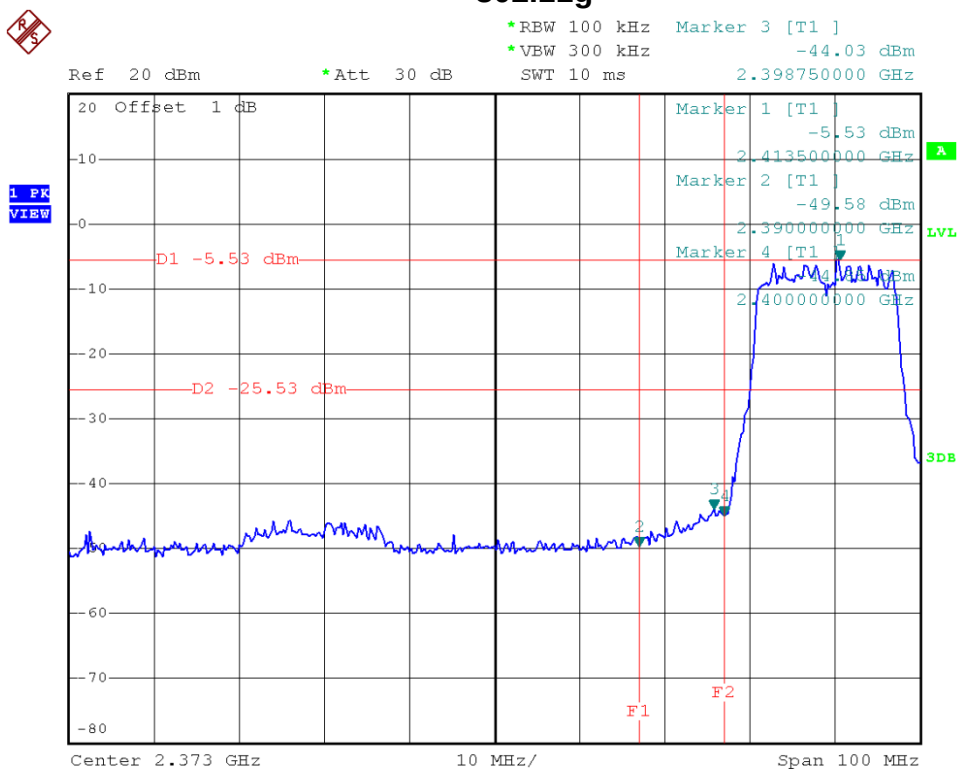



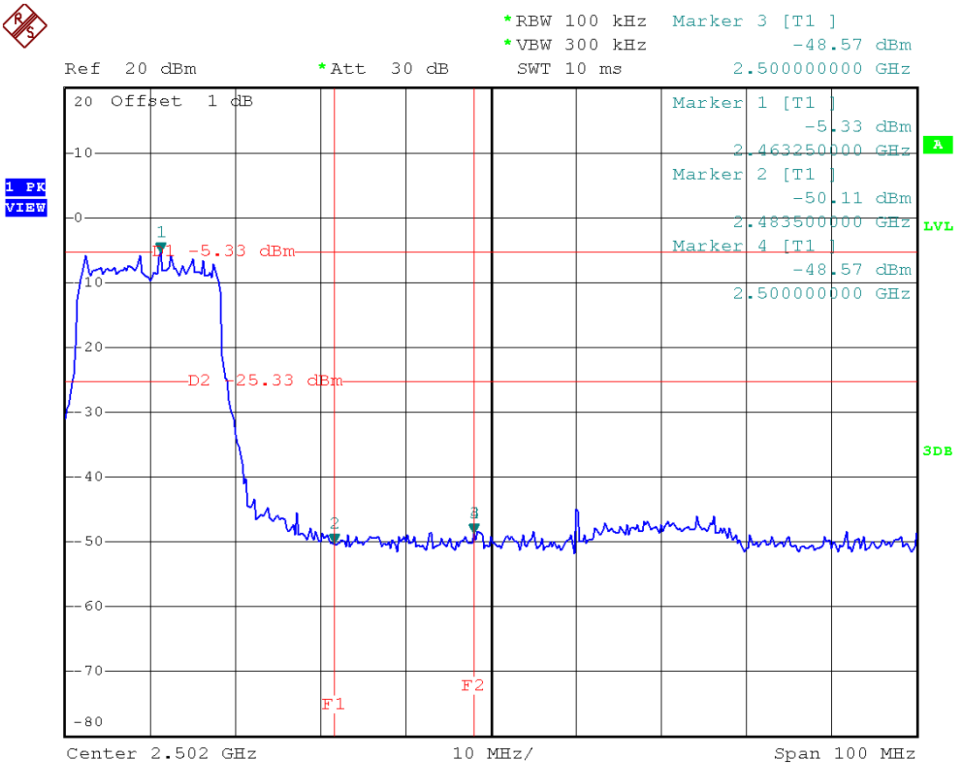



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 802.11g






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 9.10 Spurious radiated emissions for transmitter and receiver

**Test Method**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
   Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-2009 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
   The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength,submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

**Limit**

According to part 15.247(d), 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 |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## Spurious radiated emissions for transmitter and receiver

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

**Only data of the worst case was reported.**

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

BT GFSK - 2402MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBμV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 103.72 | 49.21 | -15.64 | 33.57 | 43.5 | QP | V | Pass |
| 384.05 | 52.68 | -10.88 | 41.8 | 46 | QP | H | Pass |
| 2390 | 26.24 | 33.35 | 59.59 | 74 | PK | H | Pass |
| 2390 | 15.81 | 33.35 | 49.16 | 54 | AV | H | Pass |
| 4804 | 78.58 | -32.98 | 45.6 | 74 | PK | H | Pass |
| 4804 | 70.35 | -32.98 | 37.37 | 54 | AV | H | Pass |
| 2390 | 26.55 | 33.35 | 59.9 | 74 | PK | V | Pass |
| 2390 | 15.84 | 33.35 | 49.19 | 54 | AV | V | Pass |
| 4804 | 82.54 | -32.98 | 49.56 | 74 | PK | V | Pass |
| 4804 | 71.2 | -32.98 | 38.22 | 54 | AV | V | Pass |

BT GFSK - 2441MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBμV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 288.02 | 54.95 | -12.26 | 42.69 | 46 | QP | H | Pass |
| 103.72 | 51.06 | -15.64 | 35.42 | 43.5 | QP | V | Pass |
| 4882 | 82.17 | -32.95 | 49.22 | 74 | PK | V | Pass |
| 4882 | 70.84 | -32.95 | 37.89 | 54 | AV | V | Pass |
| 4882 | 78.94 | -32.95 | 45.99 | 74 | PK | H | Pass |
| 4882 | 69.96 | -32.95 | 37.01 | 54 | AV | H | Pass |

BT GFSK - 2480MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBμV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 103.72 | 50.78 | -15.64 | 35.14 | 43.5 | QP | V | Pass |
| 288.02 | 54.13 | -12.26 | 41.87 | 46 | QP | H | Pass |
| 2483.5 | 28.71 | 33.37 | 62.08 | 74 | PK | H | Pass |
| 2483.5 | 16.75 | 33.37 | 50.12 | 54 | AV | H | Pass |
| 4960 | 79.18 | -32.92 | 46.24 | 74 | PK | H | Pass |
| 4960 | 70.17 | -32.92 | 37.25 | 54 | AV | H | Pass |
| 2483.5 | 28.39 | 33.37 | 61.76 | 74 | PK | V | Pass |
| 2483.5 | 16.42 | 33.37 | 49.79 | 54 | AV | V | Pass |
| 4960 | 82.94 | -32.92 | 50.02 | 74 | PK | V | Pass |
| 4960 | 72.08 | -32.92 | 39.16 | 54 | AV | V | Pass |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

BLE - 2402MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 47.46 | 40.97 | -13.09 | 27.88 | 40 | QP | V | Pass |
| 288.02 | 51.68 | -12.26 | 39.42 | 46 | QP | H | Pass |
| 2390 | 26.09 | 33.35 | 59.44 | 74 | PK | H | Pass |
| 2390 | 15.74 | 33.35 | 49.09 | 54 | AV | H | Pass |
| 4804 | 79.10 | -32.98 | 46.12 | 74 | PK | H | Pass |
| 4804 | 68.54 | -32.98 | 35.56 | 54 | AV | H | Pass |
| 2390 | 27.04 | 33.35 | 60.39 | 74 | PK | V | Pass |
| 2390 | 15.73 | 33.35 | 49.08 | 54 | AV | V | Pass |
| 4804 | 83.16 | -32.98 | 50.18 | 74 | PK | V | Pass |
| 4804 | 72.62 | -32.98 | 39.64 | 54 | AV | V | Pass |

BLE - 2440MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 288.02 | 51.68 | -12.26 | 39.42 | 46 | QP | H | Pass |
| 47.46 | 41.51 | -13.09 | 28.42 | 40 | QP | V | Pass |
| 4880 | 82.05 | -32.95 | 49.10 | 74 | PK | V | Pass |
| 4880 | 69.25 | -32.95 | 36.30 | 54 | AV | V | Pass |
| 4880 | 79.07 | -32.95 | 46.12 | 74 | PK | H | Pass |
| 4880 | 69.88 | -32.95 | 36.93 | 54 | AV | H | Pass |

BLE - 2480MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 45.52 | 36.86 | -12.82 | 24.04 | 40 | QP | V | Pass |
| 288.02 | 49.95 | -12.26 | 37.69 | 46 | QP | H | Pass |
| 2483.5 | 28.41 | 33.37 | 61.78 | 74 | PK | H | Pass |
| 2483.5 | 17.01 | 33.37 | 50.38 | 54 | AV | H | Pass |
| 4960 | 76.08 | -32.92 | 43.16 | 74 | PK | H | Pass |
| 4960 | 67.83 | -32.92 | 34.91 | 54 | AV | H | Pass |
| 2483.5 | 28.10 | 33.37 | 61.47 | 74 | PK | V | Pass |
| 2483.5 | 17.00 | 33.37 | 50.37 | 54 | AV | V | Pass |
| 4960 | 82.05 | -32.92 | 49.13 | 74 | PK | V | Pass |
| 4960 | 70.16 | -32.92 | 37.24 | 54 | AV | V | Pass |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## 802.11b - 2412MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 45.52 | 37.45 | -12.82 | 24.63 | 40 | QP | V | Pass |
| 288.02 | 49.79 | -12.26 | 37.53 | 46 | QP | H | Pass |
| 2390 | 27.12 | 33.35 | 60.47 | 74 | PK | H | Pass |
| 2390 | 15.84 | 33.35 | 49.19 | 54 | AV | H | Pass |
| 4824 | 83.14 | -32.97 | 50.17 | 74 | PK | H | Pass |
| 4824 | 70.65 | -32.97 | 37.68 | 54 | AV | H | Pass |
| 2390 | 26.09 | 33.35 | 59.44 | 74 | PK | V | Pass |
| 2390 | 15.79 | 33.35 | 49.14 | 54 | AV | V | Pass |
| 4824 | 85.87 | -32.97 | 52.90 | 74 | PK | V | Pass |
| 4824 | 72.43 | -32.97 | 39.46 | 54 | AV | V | Pass |

## 802.11b - 2437MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 384.05 | 47.21 | -10.88 | 36.33 | 46 | QP | H | Pass |
| 45.52 | 35.41 | -12.82 | 22.59 | 40 | QP | V | Pass |
| 4874 | 84.25 | -32.95 | 51.30 | 74 | PK | V | Pass |
| 4874 | 71.07 | -32.95 | 38.12 | 54 | AV | V | Pass |
| 4874 | 85.64 | -32.95 | 52.69 | 74 | PK | H | Pass |
| 4874 | 73.72 | -32.95 | 40.77 | 54 | AV | H | Pass |

## 802.11b - 2462MHz Test Result

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBµV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 45.52 | 34.98 | -12.82 | 22.16 | 40 | QP | V | Pass |
| 288.02 | 49.94 | -12.26 | 37.68 | 46 | QP | H | Pass |
| 2483.5 | 23.56 | 33.37 | 55.57 | 74 | PK | H | Pass |
| 2483.5 | 13.73 | 33.37 | 45.74 | 54 | AV | H | Pass |
| 4924 | 83.22 | -32.93 | 50.29 | 74 | PK | H | Pass |
| 4924 | 71.42 | -32.93 | 38.49 | 54 | AV | H | Pass |
| 2483.5 | 29.41 | 33.37 | 61.42 | 74 | PK | V | Pass |
| 2483.5 | 13.72 | 33.37 | 45.73 | 54 | AV | V | Pass |
| 4924 | 84.12 | -32.93 | 51.19 | 74 | PK | V | Pass |
| 4924 | 71.13 | -32.93 | 38.20 | 54 | AV | V | Pass |

Remark:

(1) QP Emission Level= Antenna Factor +Cable Loss + Reading
PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading
AV Emission Level= PK Emission Level+20log(dutycycle)

(2) 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.

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



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## Receiving emission test result as below:

| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB) | Emission Level (dBuV/m) | Limit (dBμV/m) | Detector | Antenna Polarity | Result |
|---|---|---|---|---|---|---|---|
| 47.46 | 40.97 | -13.09 | 27.88 | 40 | QP | V | Pass |
| 103.72 | 46.41 | -15.64 | 30.77 | 43.5 | QP | V | Pass |
| 45.52 | 34.92 | -12.82 | 22.10 | 40 | QP | H | Pass |
| 384.05 | 46.94 | -10.88 | 36.06 | 46 | QP | H | Pass |
| 1000-25000 | -- | -- | -- | 74 | AV | H | Pass |
| 1000-25000 | -- | -- | -- | 74 | PK | V | Pass |

Remark:

(1) QP Emission Level= Antenna Factor +Cable Loss + Reading
PK Emission Level= Antenna Factor +Cable Loss - Amp. factor + Reading
AV Emission Level= PK Emission Level+20log (duty cycle)

(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 20db below the permissible limits or the field strength is too small to be measured.

(3) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section RSS-Gen.



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

## 9.11 Power Spectral Density

**Test Method**

5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10$^{th}$ harmonic. Typically, several plots are required to cover this entire span.
   RBW = 3 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
6. Allow the trace to stabilize. Set the marker on the peak of the maximum emission recorded.
7. The level displayed must comply with the limit specified in this Section. Submit these plots.
8. Repeat above procedures until all frequencies measured were complete.

**Limit**

| Limit |
| --- |
| PSD |
| ≤ 8dBm/3KHz |



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

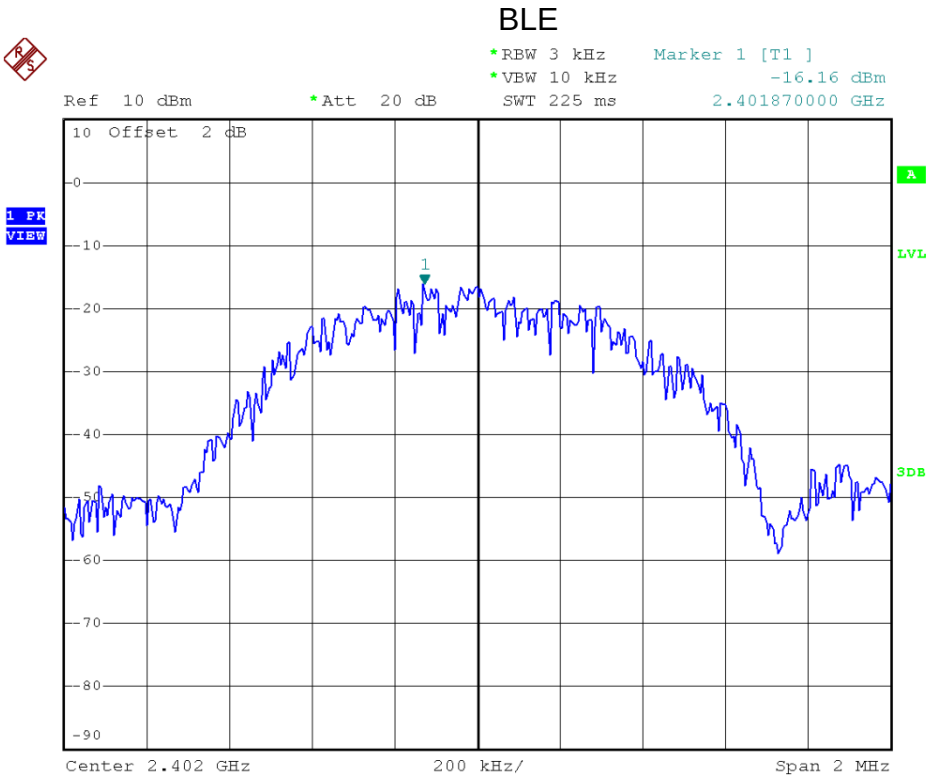
## Power spectral density

Test result:

| Frequency (MHz) | Mode | Measurement (dBm/3KHz) | Limit | Result |
|---|---|---|---|---|
| 2402 | BLE | -16.16 | ≤ 8dBm/3KHz | Pass |
| 2440 | | -14.80 | | Pass |
| 2480 | | -15.25 | | Pass |
| 2412 | 802.11b | -15.10 | | Pass |
| 2437 | | -14.31 | | Pass |
| 2462 | | -14.14 | | Pass |
| 2412 | 802.11g | -20.34 | | Pass |
| 2437 | | -20.01 | | Pass |
| 2462 | | -20.09 | | Pass |

Plots:

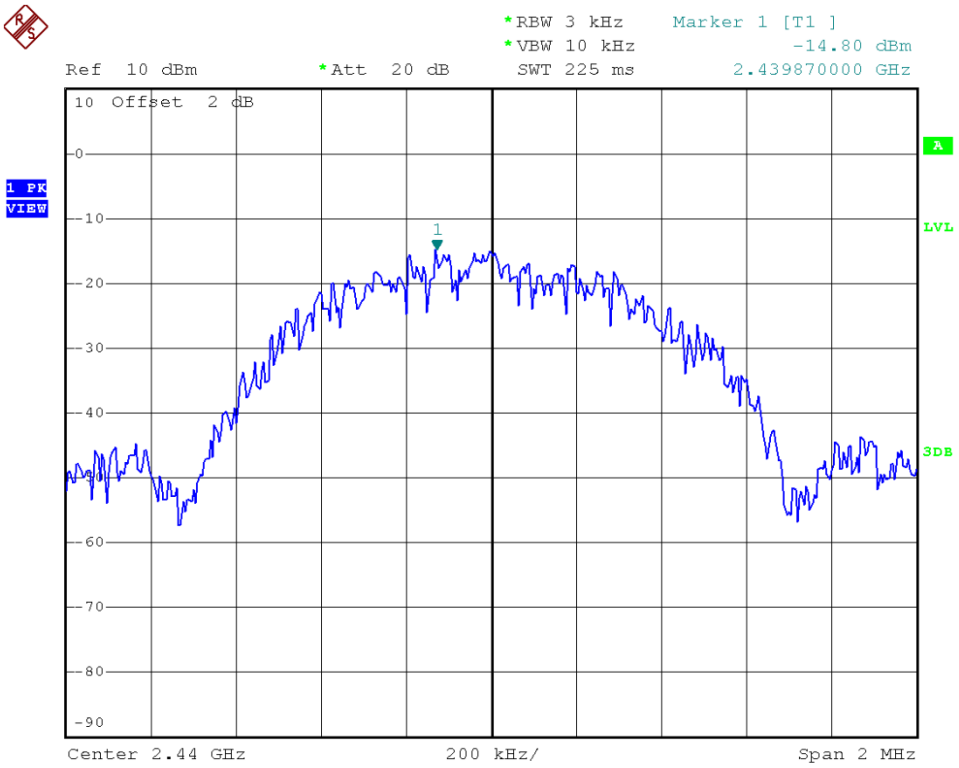
BLE

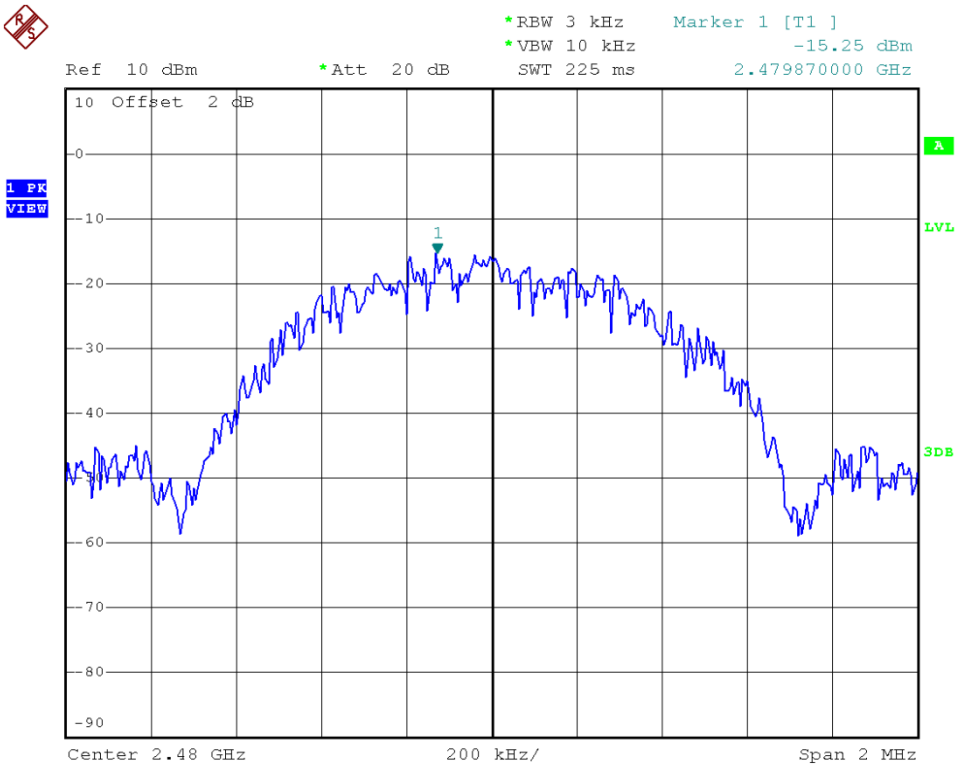





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



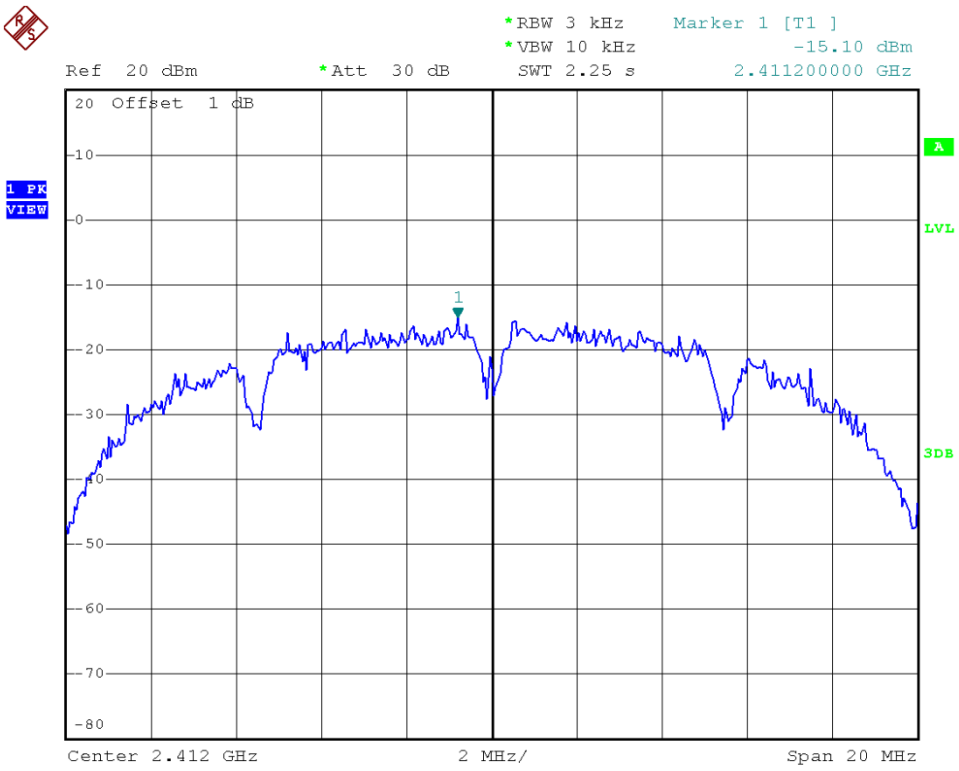



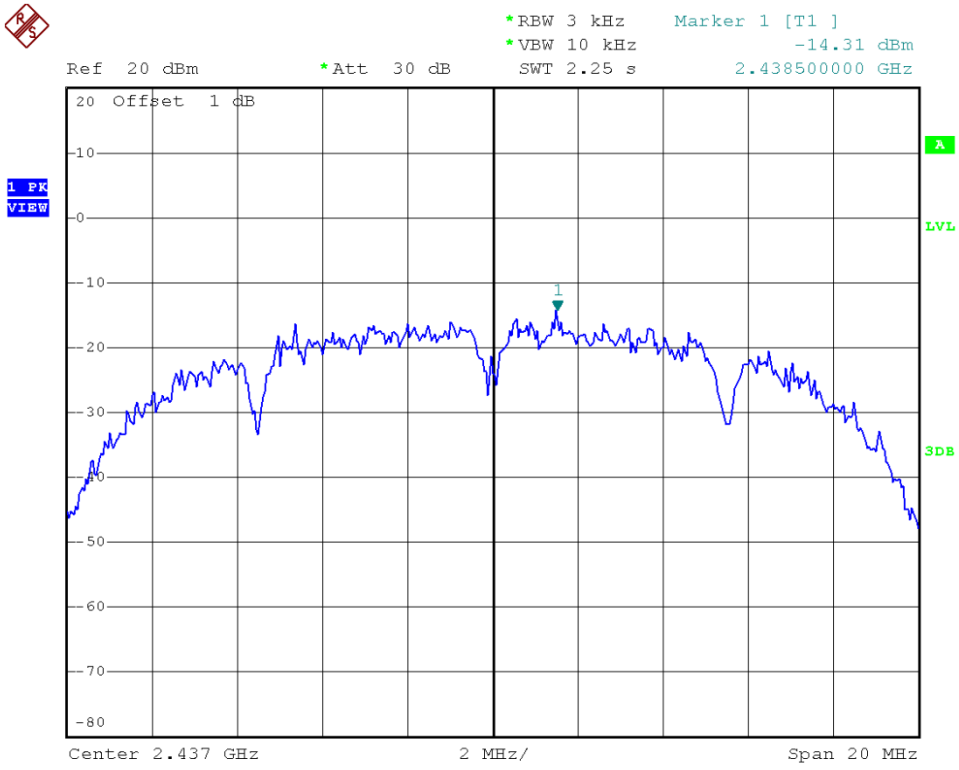



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

802.11b

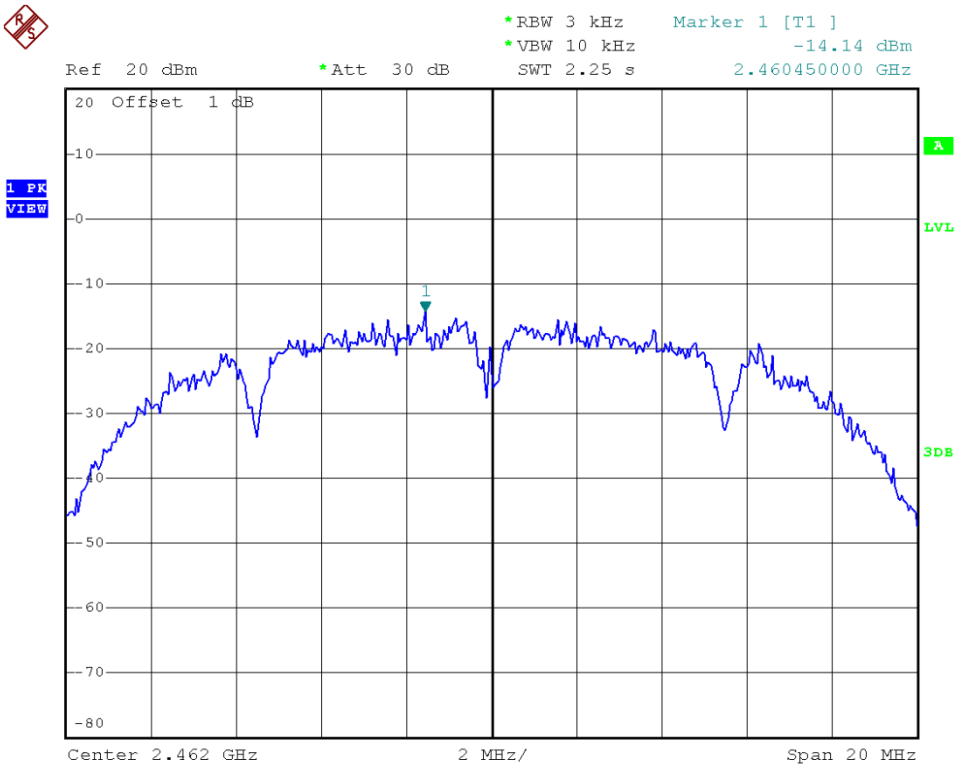


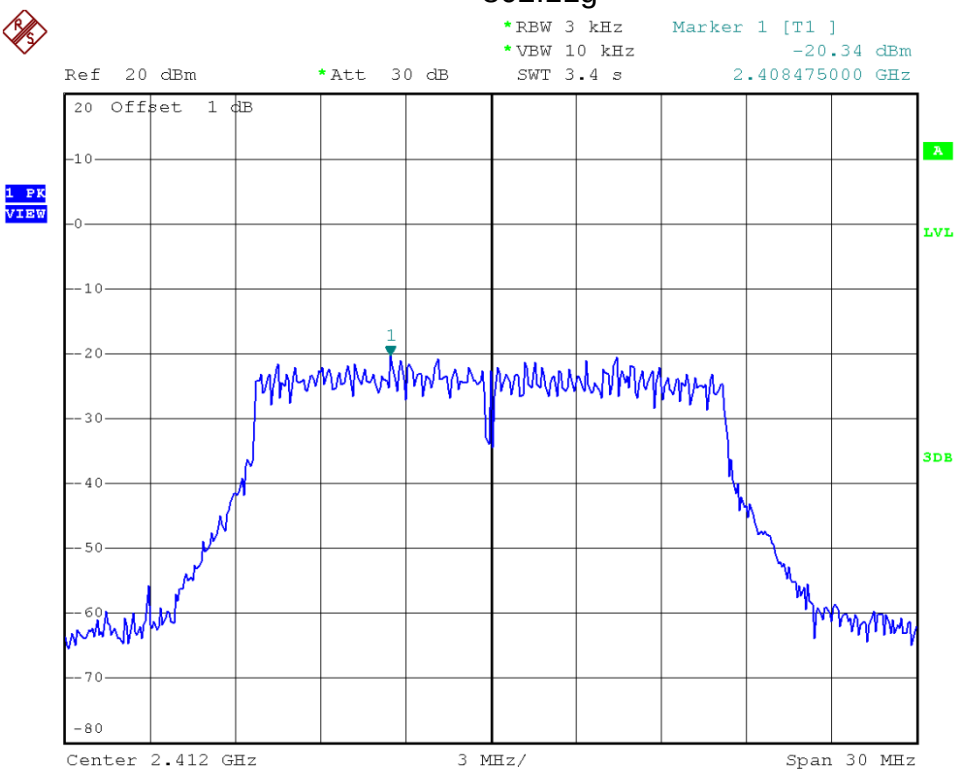



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China



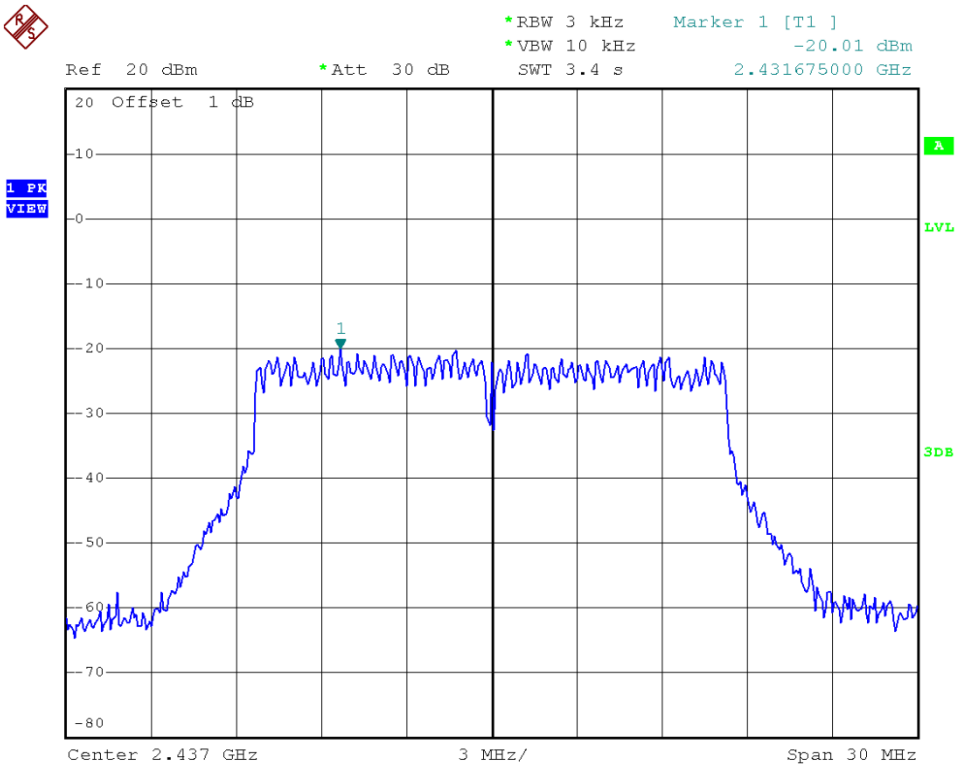

802.11g

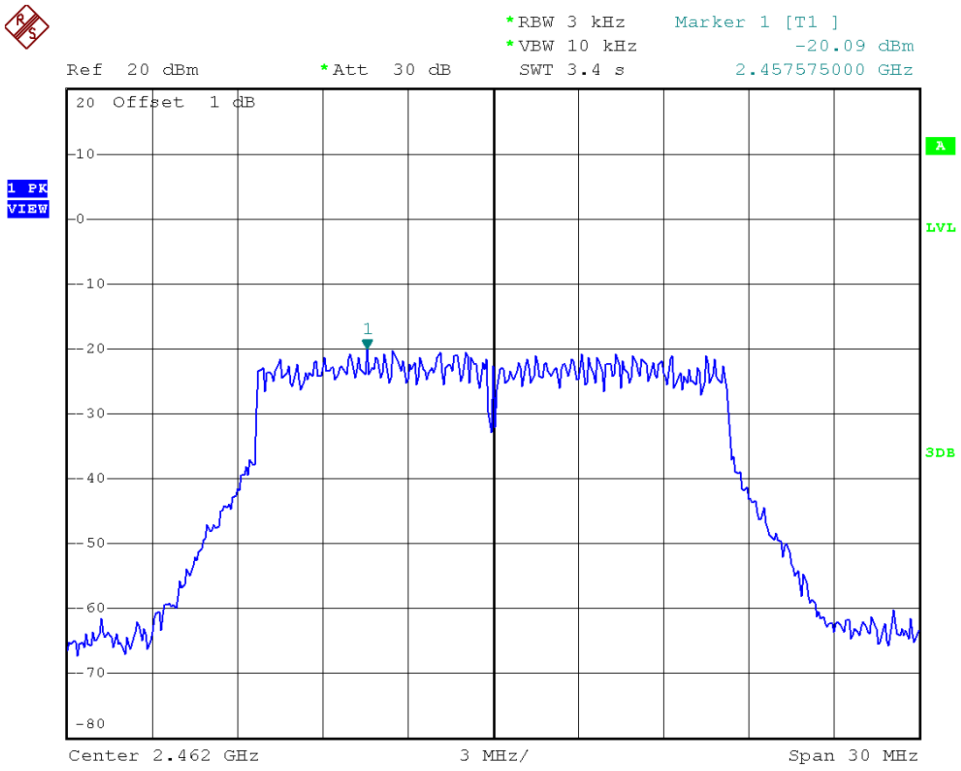





TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China






TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

# 10 Test Equipment List

## List of Test Instruments

| | DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DUE DATE | |
|---|---|---|---|---|---|---|
| CE | LISN | EMCO | 3816/2 | 00052765 | Mar. 29, 2015 | ☐ |
| | LISN | R&S | ENV216 | 101447 | Mar. 29, 2015 | ☒ |
| | Test Cable | N/A | C_17 | N/A | Mar. 14, 2015 | ☒ |
| | EMI TEST RECEIVER | R&S | ESCS30 | 833364/017 | Mar. 29, 2015 | ☒ |
| | 50Ω Terminator | SHX | TF2-3G-A | 08122902 | Mar. 29, 2015 | ☒ |
| C | Spectrum Analyzer | R&S | FSP 40 | 100185 | Nov. 11, 2014 | ☒ |
| RE < 1 GHz | Antenna | Schwarbeck | VULB9160 | 9160-3232 | Mar. 29, 2015 | ☒ |
| | Amplifier | HP | 8447D | 2944A09673 | Mar. 29, 2015 | ☒ |
| | Receiver | AGILENT | N9038A | MY52130039 | Aug. 23, 2015 | ☒ |
| | Test Cable | N/A | C-01_CB03 | N/A | Jul. 01, 2015 | ☒ |
| | Controller | CT | SC100 | N/A | N/A | ☒ |
| RE > 1 GHz | Antenna | ETS | 3115 | 00075789 | Mar. 29, 2015 | ☒ |
| | Amplifier | Agilent | 8449B | 3008A02274 | Mar. 29, 2015 | ☒ |
| | Receiver | AGILENT | N9038A | MY52130039 | Aug. 23, 2015 | ☒ |
| | Test Cable | HUBER+SUHNER | C-48 | N/A | Apr. 30, 2015 | ☒ |
| | Controller | CT | SC100 | N/A | N/A | ☒ |
| | Broad-Band Horn Antenna | Schwarzbeck | BBHA 9170 | 9170319 | Feb. 22, 2015 | ☐ |
| | Microwave Preamplifier With Adaptor | EMC INSTRUMENT | EMC2654045 | 980039 & HA01 | Feb. 22, 2015 | ☐ |
| | Active Loop Antenna | R&S | HFH2-Z2 | 830749/020 | Mar. 29, 2015 | ☐ |

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density*
- Spurious RF conducted emissions
- Band edge



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478

China

## 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**

| Items | Extended Uncertainty |
|---|---|
| Radiated spurious emission | 4.32dB (30MHz-1GHz)<br>2.27dB (1GHz -25GHz) |
| Conducted spurious emission | 2.10dB(30MHz-25GHz) |
| Bandwidth test | $1*10^{-9}$ |
| Conducted emission | 2.4dB |

-- End of Report --



TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
5F, Communication Building,163 Pingyun Rd, Huangpu Ave. West Guangzhou, P.R.China TEL: +86 20 3832 0668 FAX: +86 20 3832 0478