China

FCC - TEST REPORT

Report Number	:	**708881974822-00**	Date of Issue:	August 7, 2019

Model	: TYZS3; TYZS3_IPEX
Product Type	: TYZS3 Zigbee Module
FCC ID	: 2ANDL-TYZS3
Applicant	: Hangzhou Tuya Information Technology Co.,Ltd
Address of Applicant	: Room701,Building3,More Center,No.87 GuDun
	: Road,Hangzhou,Zhejiang China
Manufacturer	: Hangzhou Tuya Information Technology Co.,Ltd
Address of Manufacturer	: Room701,Building3,More Center,No.87 GuDun
	: Road,Hangzhou,Zhejiang China
Factory	: Same as applicant
Address of Factory	: Same as applicant

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	37

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai 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. Shanghai 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. Shanghai 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. Shanghai Branch issued reports.

China

1 Table of Contents

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

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. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
FCC Registration No.:	820234
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600

China

3 Description of the Equipment under Test

Description of the Equipment Under Test

Product: TYZS3 Zigbee Module

Model no.: TYZS3; TYZS3_IPEX

FCC ID: 2ANDL-TYZS3

Trade Mark: NA

Options and accessories: NA

Input Rated Voltage: DC 1.8V-3.8V

RF Transmission Frequency: 2405~2480MHz

No. of Operated Channel: Zigbee: 16

Channel list:

Operation Frequency each of channel			
Channel	**Frequency**	**Channel**	**Frequency**
11	2405 MHz	19	2445 MHz
12	2410 MHz	20	2450 MHz
13	2415 MHz	21	2455 MHz
14	2420 MHz	22	2460 MHz
15	2425 MHz	23	2465 MHz
16	2430 MHz	24	2470 MHz
17	2435 MHz	25	2475 MHz
18	2440 MHz	26	2480 MHz

Radio technology: IEEE802.15.4

Modulation: 16-ary orthogonal modulation, O-QPSK PHY

Data speed (IEEE 802.15.4): 250kbps MAX

Antenna Type: PCB antenna;
Ipex connector for high gain external antenna

Antenna Gain: 2.2dBi for PCB antenna;
2.5dBi for external antenna

Description of the EUT: The Equipment Under Test (EUT) is a TYZS3 Zigbee Module. There are 2 models in all, both of them have the same electric construction except for the antenna. We chose model TYZS3_IPEX as representative to perform all RF conducted tests and conducted emission.However,for the spurious radiated emissions both of the models were tested.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

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

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

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	13-15	---	☒	☐	☐
§15.247 (b) (1)	Conducted peak output power	16	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(e)	Power spectral density	22-26	Site 1	☒	☐	☐
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	17-21	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	27-39	Site 1	☒	☐	☐
§15.247(d)	Spurious radiated emissions and Band edge for transmitter	40-46	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses a permanently integral antenna, which gain is 2.5dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

15.203 requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-TYZS3, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

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:	July 23, 2019
Testing Start Date:	July 26, 2019
Testing End Date:	July 31, 2019

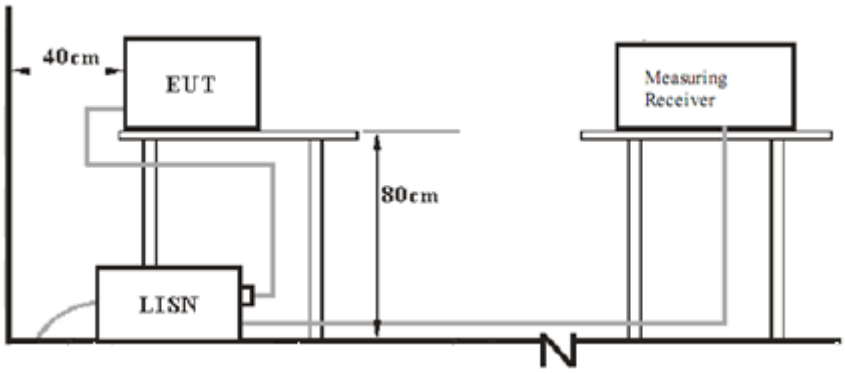
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Wenqiang LU
EMC Section Manager	EMC Project Engineer	EMC Test Engineer

China

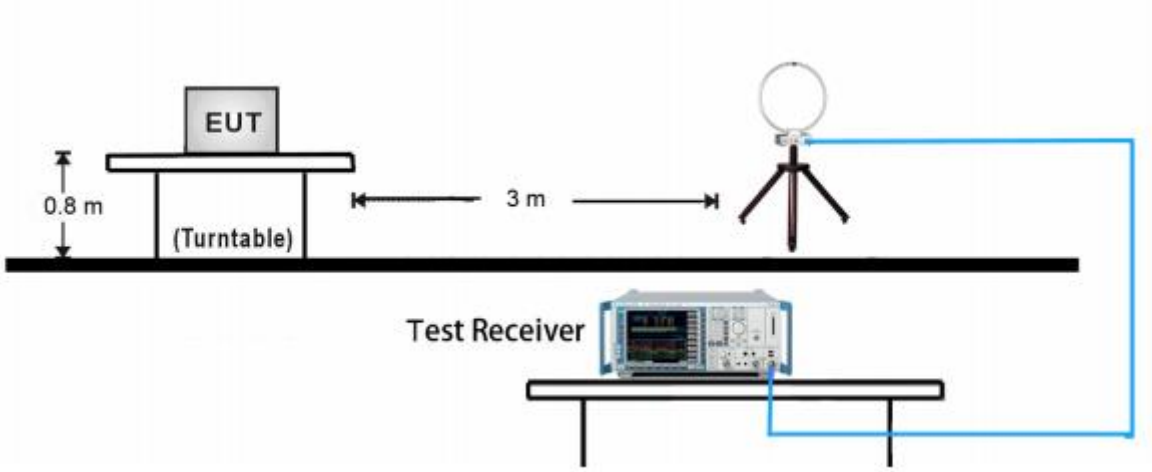
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

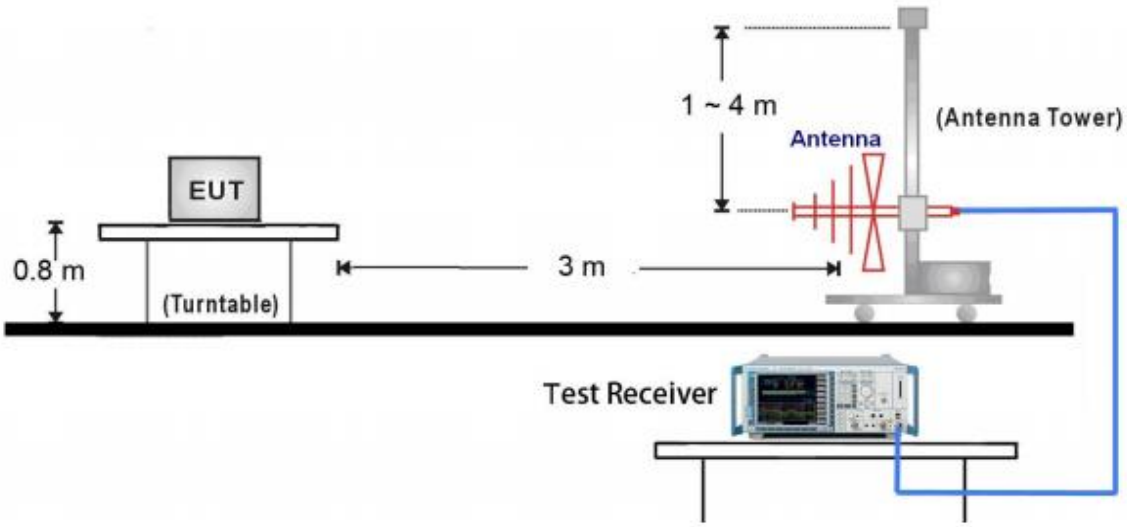
9kHz ~ 30MHz Test Setup:



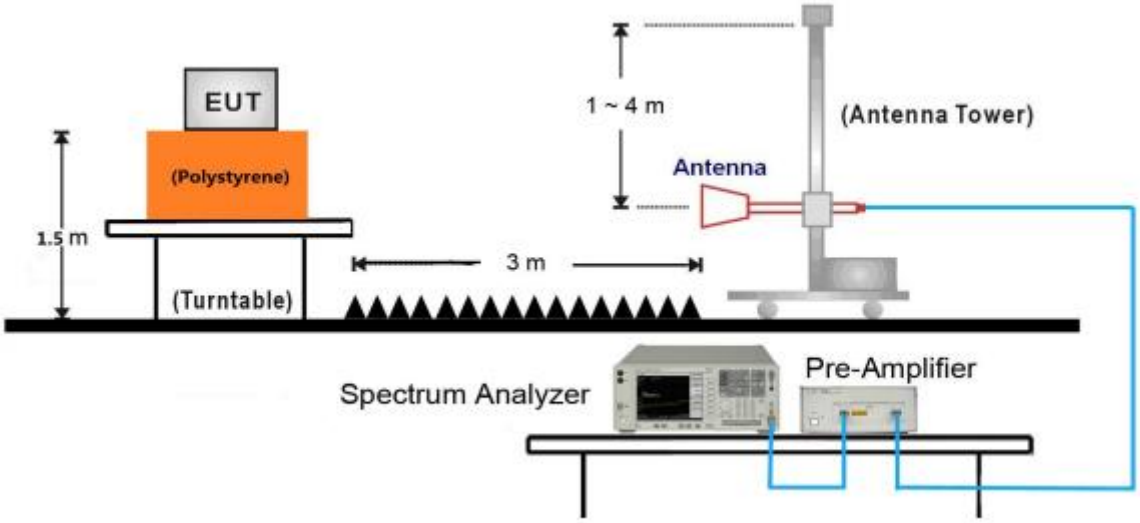
TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

30MHz ~ 1GHz Test Setup:



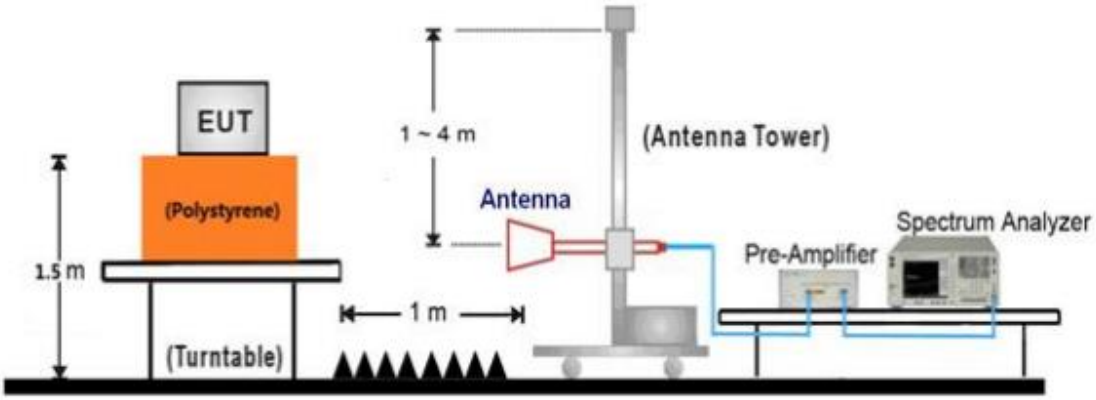
1GHz ~ 18GHz Test Setup:



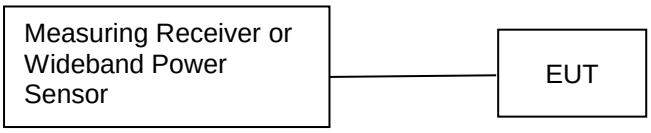
TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)
Notebook	Lenove	X240

Test channel & mode:
The EUT configured using a proprietary communication interface provided by the client. The interface allows channel control required to support the evaluation.

Test software	SecureCRT

Test mode	Channel	Frequency (MHz)
Tx	11	2405
Tx	20	2450
Tx	26	2480

Device Capabilities
This device contains the following capabilities:
ZigBee Module Device.
Duty Cycle: 100%

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

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

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

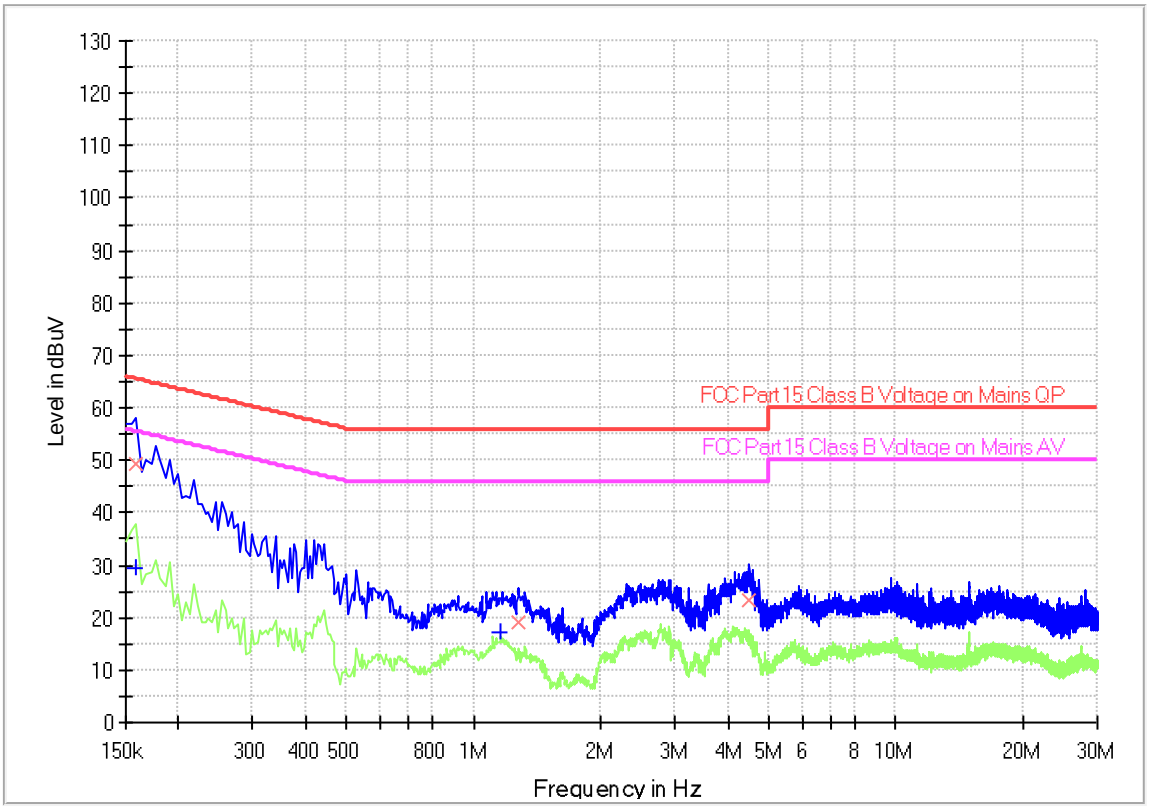
Decreasing linearly with logarithm of the frequency

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Conducted Emission

Product Type	:	TYZS3 Zigbee Module
M/N	:	TYZS3_IPEX
Operating Condition	:	Mode 1: Tx_2405MHz
Test Specification	:	FCC_Part15.207
Comment	:	L-line, AC 120V/60Hz (powered by notebook)



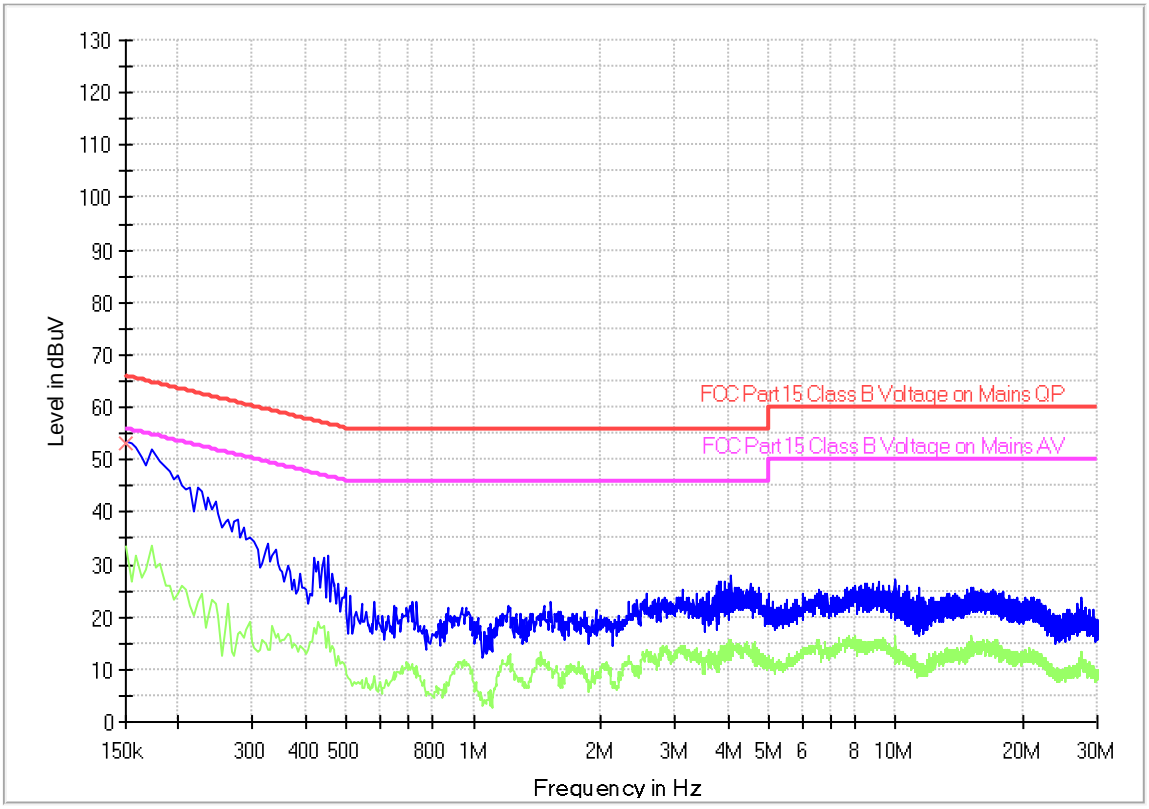
Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.159000	---	29.61	55.52	25.91	1000.0	9.000	L1	19.5
0.159000	49.42	---	65.52	16.10	1000.0	9.000	L1	19.5
1.162500	---	17.19	46.00	28.81	1000.0	9.000	L1	19.5
1.275000	19.05	---	56.00	36.95	1000.0	9.000	L1	19.5
4.506000	23.41	---	56.00	32.59	1000.0	9.000	L1	19.6

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Product Type	:	TYZS3 Zigbee Module
M/N	:	TYZS3_IPEX
Operating Condition	:	Mode 1: Tx_2405MHz
Test Specification	:	FCC_Part15.207
Comment	:	N-line, AC 120V/60Hz (powered by notebook)



Final_Result

Frequency (MHz)	Quasi Peak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	53.13	---	66.00	12.87	1000.0	9.000	N	19.5

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

9.2 Conducted peak output power

Test Method

1. Connect the spectrum analyzer to the EUT
   a) Set the RBW ≥ DTS bandwidth.
   b) Set VBW ≥ 3xRBW.
   c) Set span ≥ 3xRBW
   d) Sweep time = auto couple.
   e) Detector = peak.
   f) Trace mode = max hold.
   g) Allow trace to fully stabilize.
   h) Use peak marker function to determine the peak amplitude level.

Limits

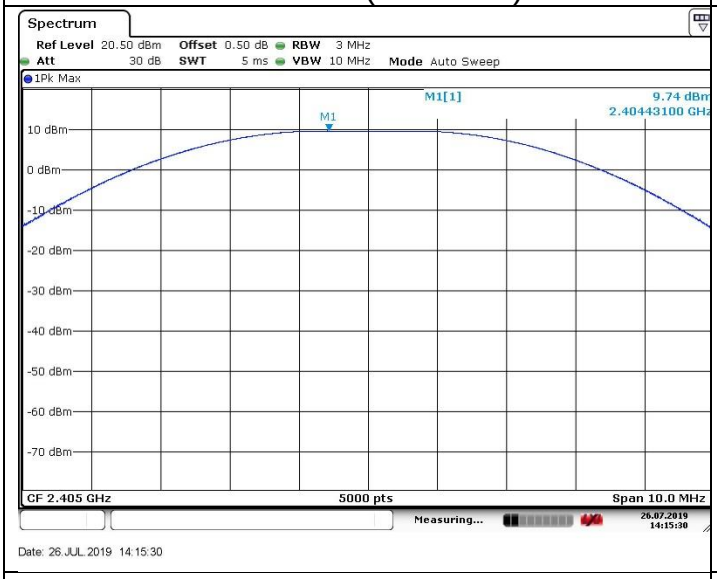
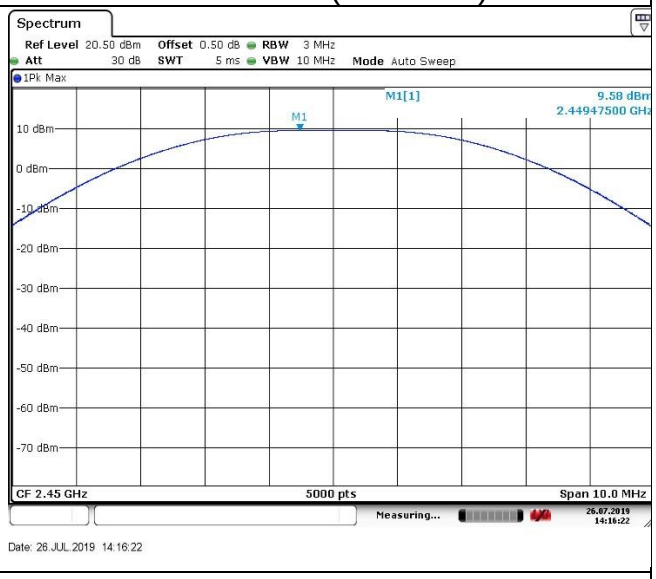
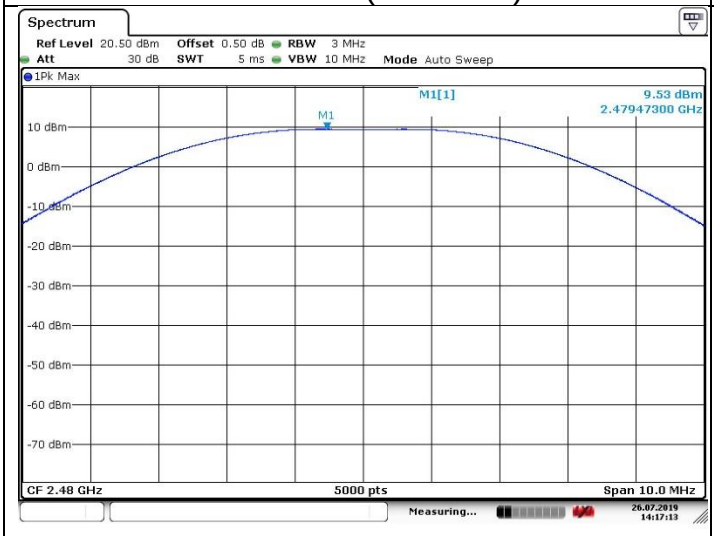
Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Test result as below table

Model	Ch.	Freq. (MHz)	Peak Power (dBm)	Limit (dBm)
O-QPSK	11	2405	9.74	30
	20	2450	9.58	30
	26	2480	9.53	30

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Zigbee O-QPSK peak output power	
Channel 11 (2405MHz)	Channel 20 (2450MHz)
 Date: 26.JUL.2019 14:15:30	 Date: 26.JUL.2019 14:16:22
Channel 26 (2480MHz)	
 Date: 26.JUL.2019 14:17:13	

China

9.3 6dB bandwidth 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 6 dB Bandwidth value.

Limit

Limit [kHz]
≥500

Test result

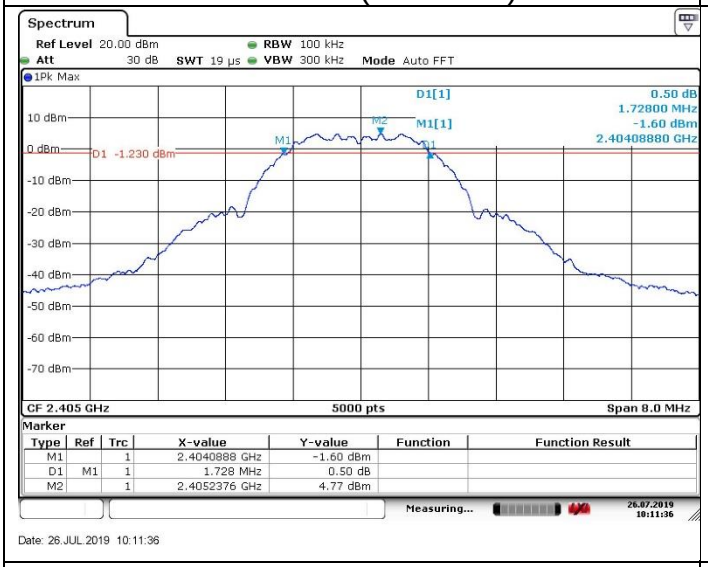
Test Mode	Channel No.	Freq. (MHz)	6db Bandwidth (MHz)	Limit (MHz)	Result
O-QPSK	11	2405	1.728	≥ 0.5	Pass
	20	2450	1.728	≥ 0.5	Pass
	26	2480	1.720	≥ 0.5	Pass

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

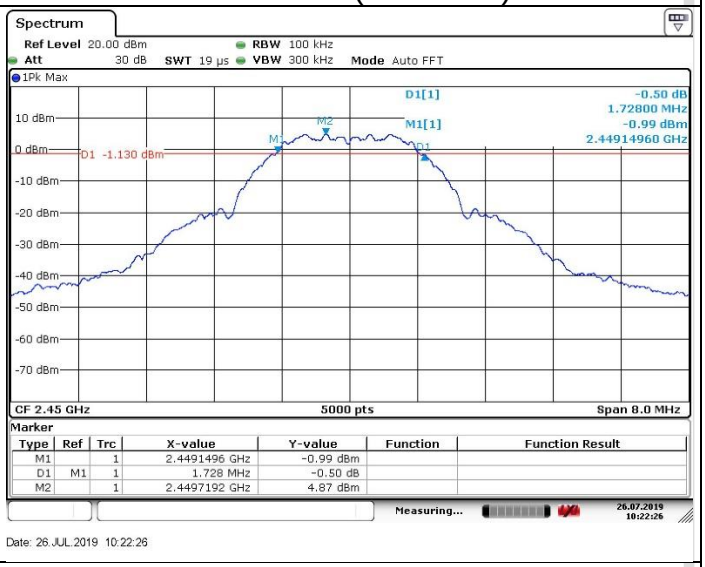
China

Zigbee O-QPSK 6dB Bandwidth

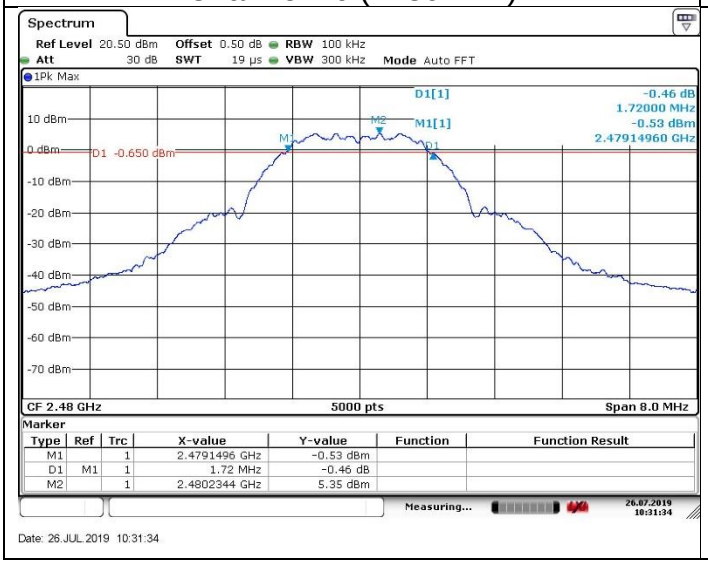
Channel 11 (2405MHz)



Channel 20 (2450MHz)



Channel 26 (2480MHz)



9.4 Power spectral density

Test Method

This procedure shall be used if average 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

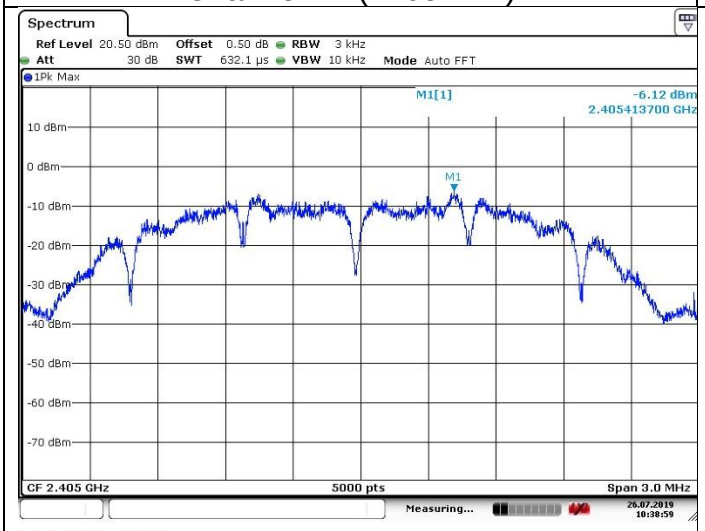
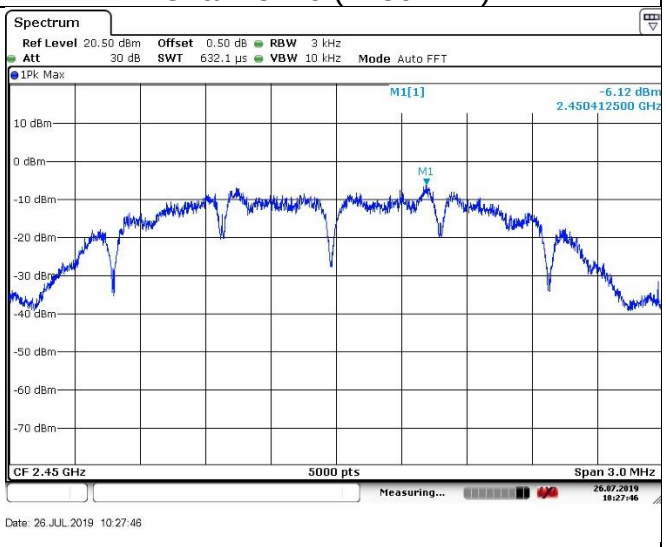
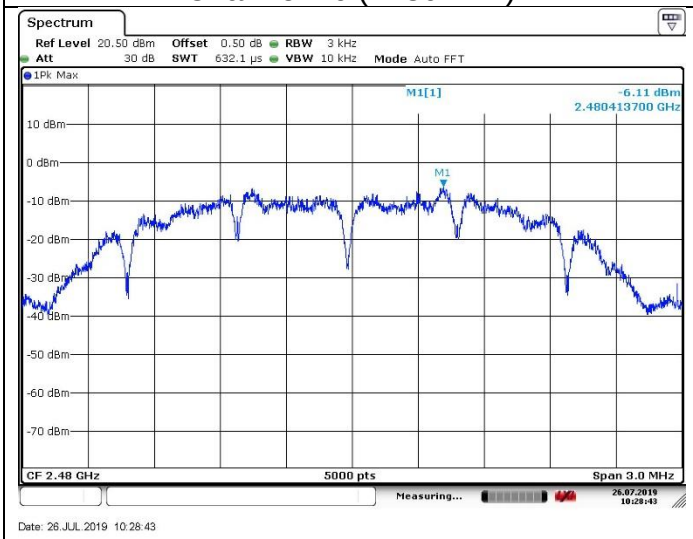
Limit [dBm]
≤8

Test result

Test Mode	Channel No.	Freq. (MHz)	PKPSD (dBm / 10kHz)	Limit (dBm/3kHz)	Result
O-QPSK	11	2405	-6.12	≤8	Pass
	20	2450	-6.12	≤8	Pass
	26	2480	-6.11	≤8	Pass

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Zigbee O-QPSK PK PSD	
Channel 11 (2405MHz)	Channel 20 (2450MHz)
	
Channel 26 (2480MHz)	
	

9.5 Conducted Band Edge and Out-of-Band 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

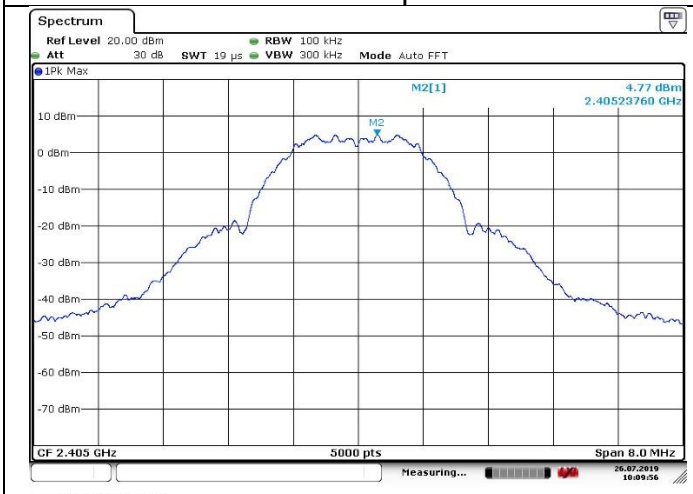
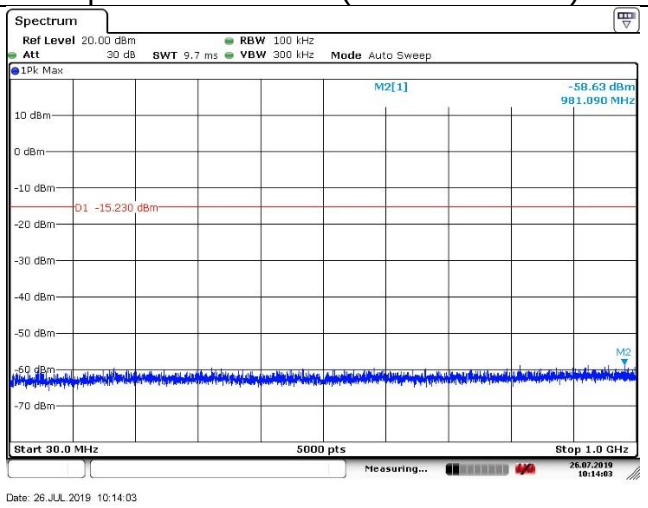
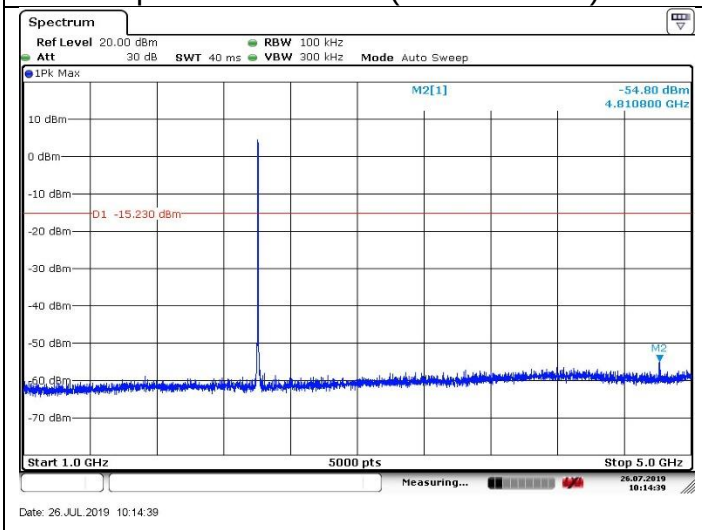
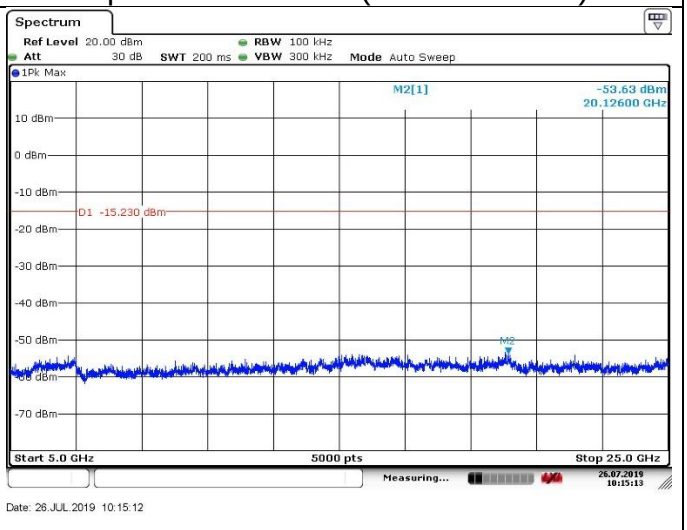
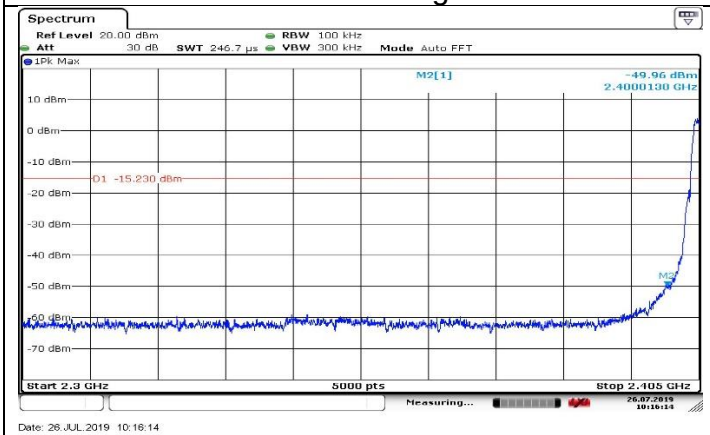
Test result

Test Mode	Channel No.	Freq. (MHz)	Limit	Result
O-QPSK	11	2405	20dBc	Pass
	20	2450	20dBc	Pass
	26	2480	20dBc	Pass

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Spurious RF conducted emissions

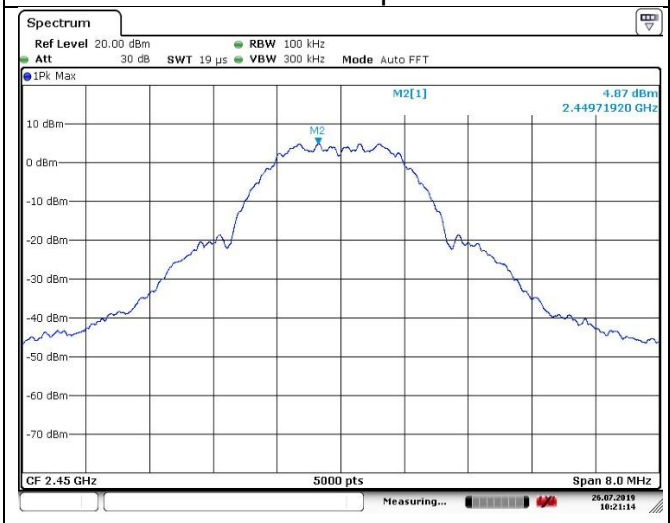
Zigbee O-QPSK Out-of-Band Emissions	
Channel 11 (2405MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
Low band edge	
	

China

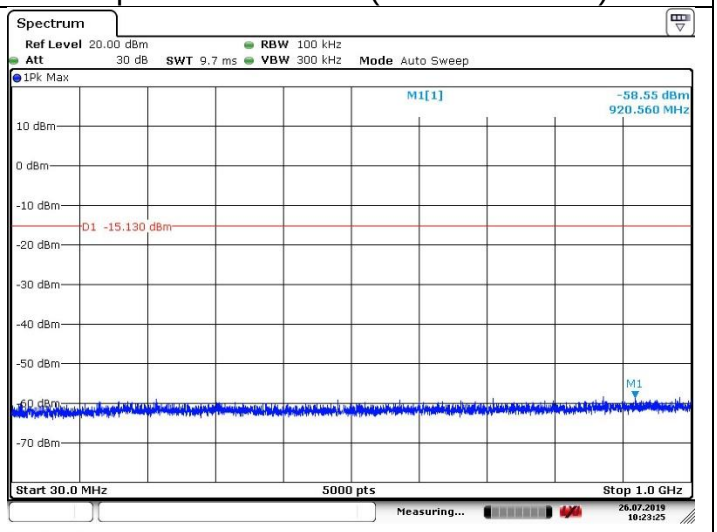
Zigbee O-QPSK Out-of-Band Emissions

Channel 20 (2450MHz)

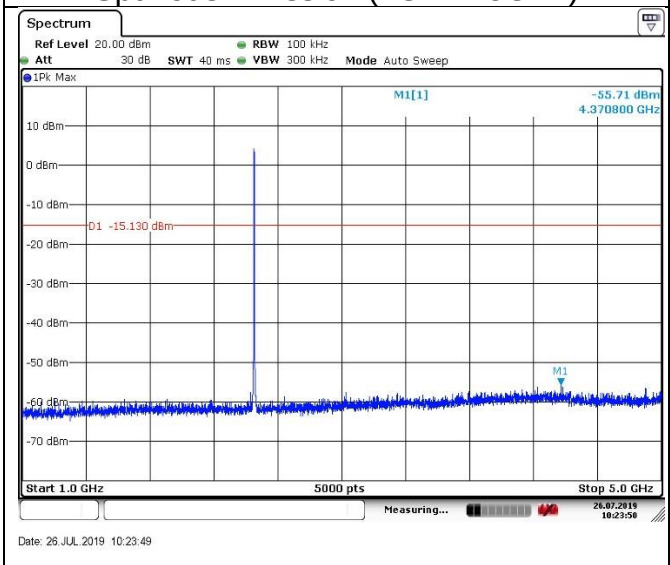
Reference point



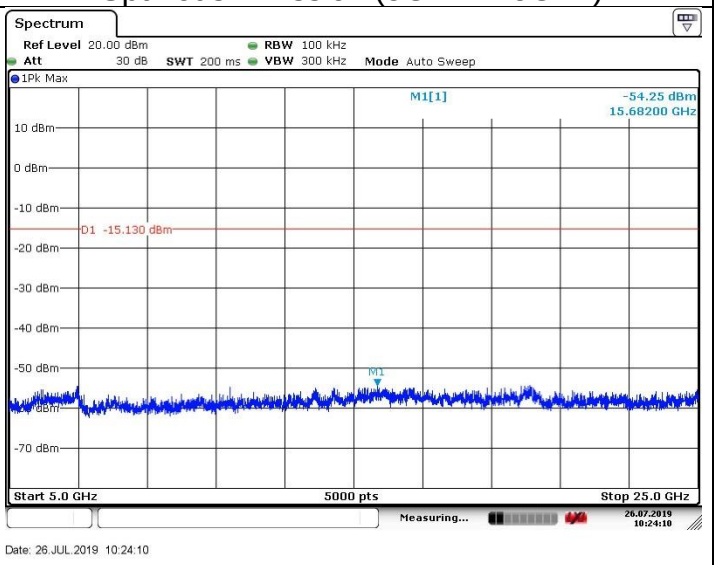
Spurious Emission (30MHz – 1GHz)



Spurious Emission (1GHz –5GHz)

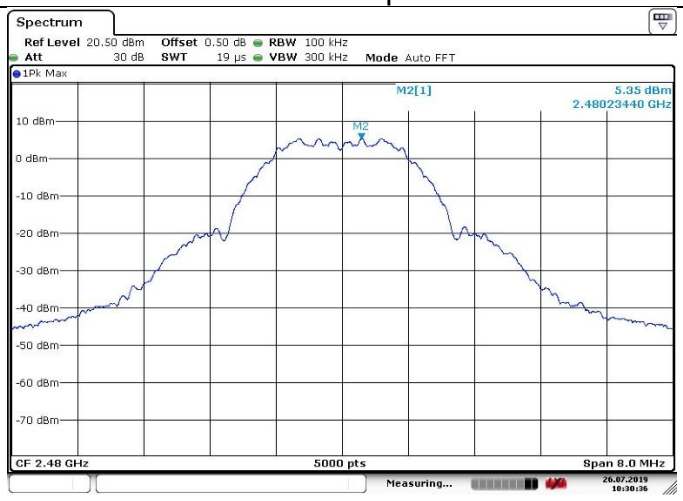
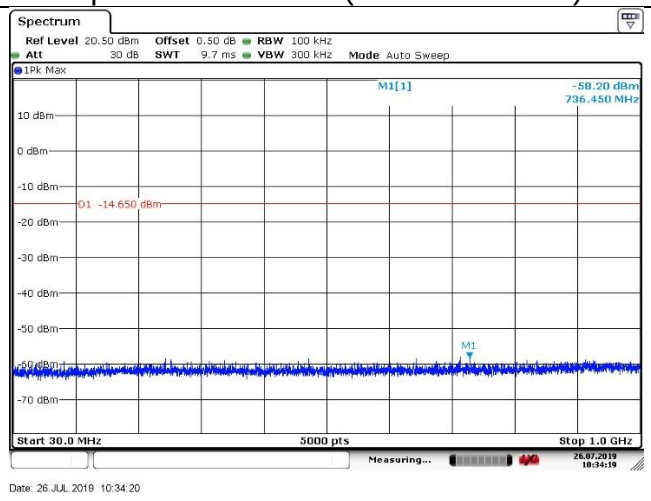
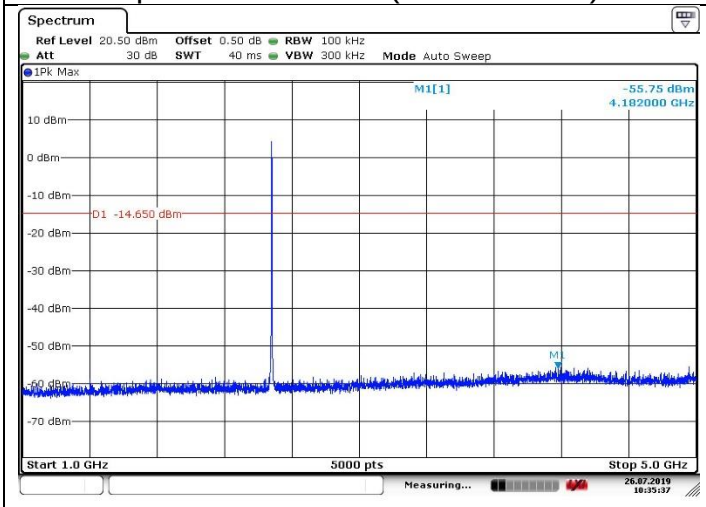
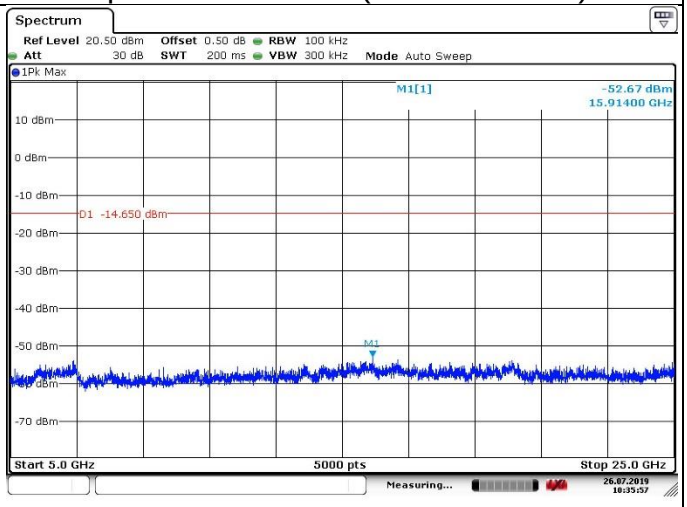
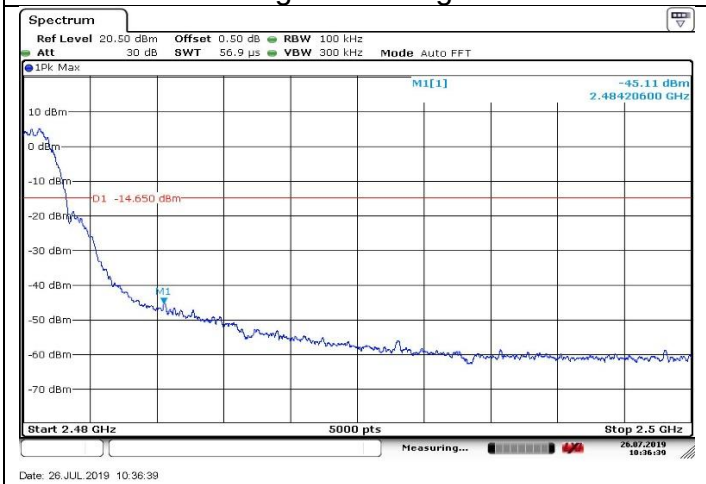


Spurious Emission (5GHz –25GHz)



TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

Zigbee O-QPSK Out-of-Band Emissions	
Channel 26 (2480MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –25GHz)
	
High band edge	
	

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 frequency above 1GHz.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

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.

LIMITS OF RADIATED EMISSION MEASUREMENT (Frequency Range 9kHz-1000MHz)

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

Frequency MHz	Field Strength (dBuv/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.
(2) The tighter limit applies at the band edges.
(3) Emission level (dBuV/m)=20logEmission level (uV/m).

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Spurious radiated emissions for transmitter

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.

Transmitting spurious emission test result as below:
Remark 1: There are the ambient noise within frequency range 9kHz ~ 30MHz and 18GHz ~ 25GHz, the permissible value is not show in the report.
Remark 2: Average measurement was not performed if peak level lower than average limit.
Remark 3: Other frequency was 20dB below limit line with 1-18GHz, there is not show in the report.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Test Result

Model: TYZS3

Test mode: Zigbee O-QPSK					
Channel 11 (2405MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2389.5	40.2	74.0	-33.8	Peak	Horizontal
4890.0	44.1	74.0	-29.9	Peak	Horizontal
2389.5	50.1	74.0	-23.9	Peak	Vertical
2612.3	45.2	74.0	-28.8	Peak	Vertical
4891.3	43.1	74.0	-30.9	Peak	Vertical

Test mode: Zigbee O-QPSK					
Channel 20 (2450MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4890.0	44.1	74.0	-29.9	Peak	Horizontal
2655.3	46.2	74.0	-27.8	Peak	Vertical
4891.3	41.2	74.0	-32.8	Peak	Vertical

Test mode: Zigbee O-QPSK					
Channel 26 (2480MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2483.5	58.5	74.0	-15.5	Peak	Horizontal
2483.5	46.7	54.0	-7.3	Average	Horizontal
4958.5	40.2	74.0	-33.8	Peak	Horizontal
2483.5	56.2	74.0	-17.8	Peak	Vertical
2483.5	42.6	54.0	-11.4	Average	Vertical
2656.9	45.8	74.0	-28.2	Peak	Vertical
4958.5	41.2	74.0	-32.8	Peak	Vertical

Remark:

(1) Emission level= Original Receiver Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(3) Margin = limit – Corrected Reading

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Model: TYZS3_IPEX

Test mode: Zigbee O-QPSK					
Channel 11 (2405MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2389.5	41.3	74.0	-32.7	Peak	Horizontal
4890.0	43.1	74.0	-30.9	Peak	Horizontal
2389.5	45.3	74.0	-28.7	Peak	Vertical
2655.9	47.1	74.0	-26.9	Peak	Vertical
4891.3	42.5	74.0	-31.5	Peak	Vertical

Test mode: Zigbee O-QPSK					
Channel 20 (2450MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
4890.0	44.1	74.0	-29.9	Peak	Horizontal
2675.5	45.1	74.0	-28.9	Peak	Vertical
4891.3	41.5	74.0	-32.5	Peak	Vertical

Test mode: Zigbee O-QPSK					
Channel 26 (2480MHz)					
Frequency (MHz)	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2483.2	56.5	74.0	-17.5	Peak	Horizontal
2483.2	49.4	54.0	-4.6	Average	Horizontal
4958.5	41.4	74.0	-32.6	Peak	Horizontal
2483.5	59.2	74.0	-14.8	Peak	Vertical
2483.5	47.4	54.0	-6.6	Average	Vertical
2666.2	48.1	74.0	-25.9	Peak	Vertical
4958.5	41.3	74.0	-32.7	Peak	Vertical

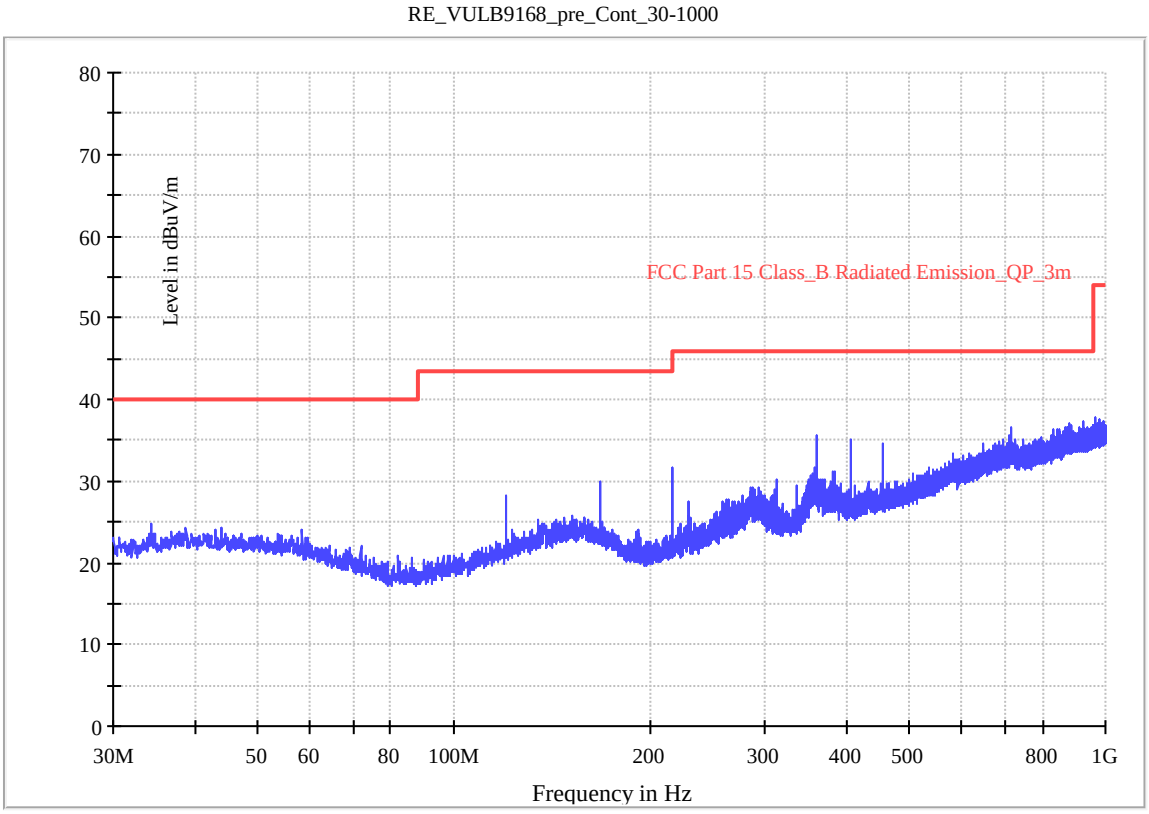
Remark:

(4) Emission level= Original Receiver Reading + Correct Factor
(5) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
(6) Margin = limit – Corrected Reading

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/07/27 - 10:11
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Horizontal
EUT: TYZS3 Zigbee Module, Model no: TYZS3	Power: 120VAC, 60Hz
Note: Transmit by Zigbee at channel 2405MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	

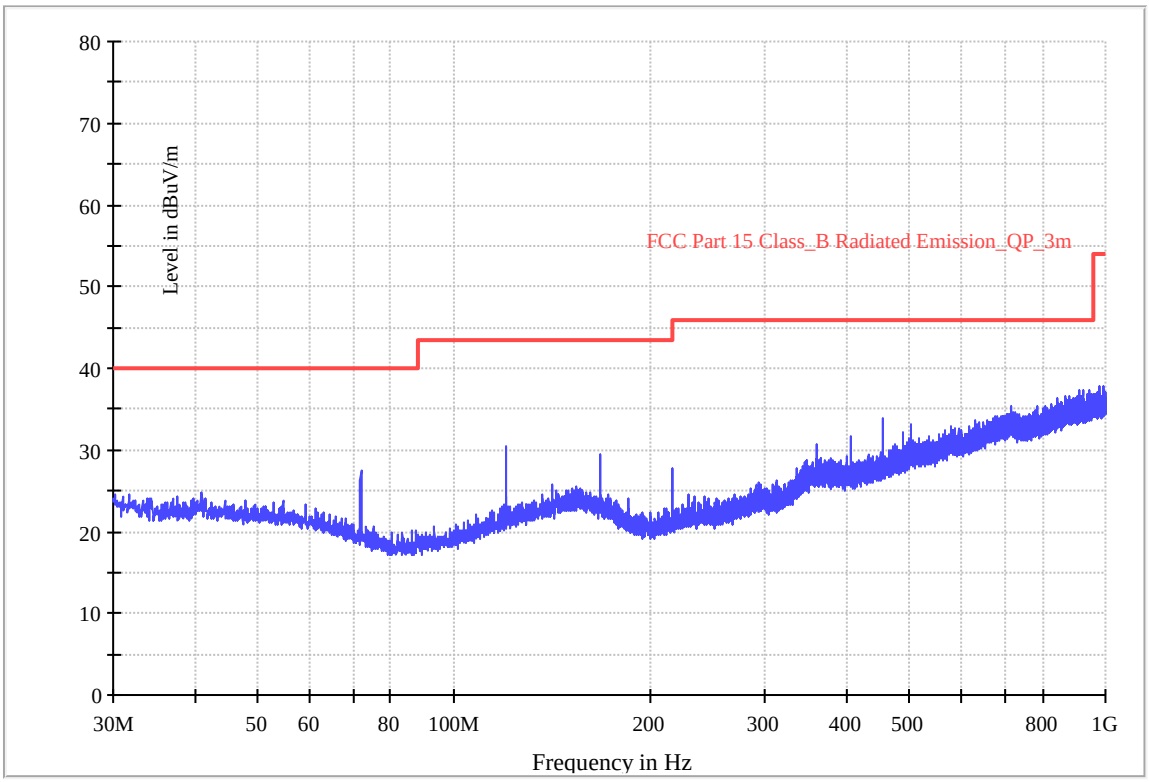


Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Site: 3 meter chamber	Time: 2019/07/27 - 10:19
Limit: FCC_Part15.209_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Vertical
EUT: TYZS3 Zigbee Module, Model no: TYZS3	Power: 120VAC, 60Hz
Note: Transmit by Zigbee at channel 2405MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000

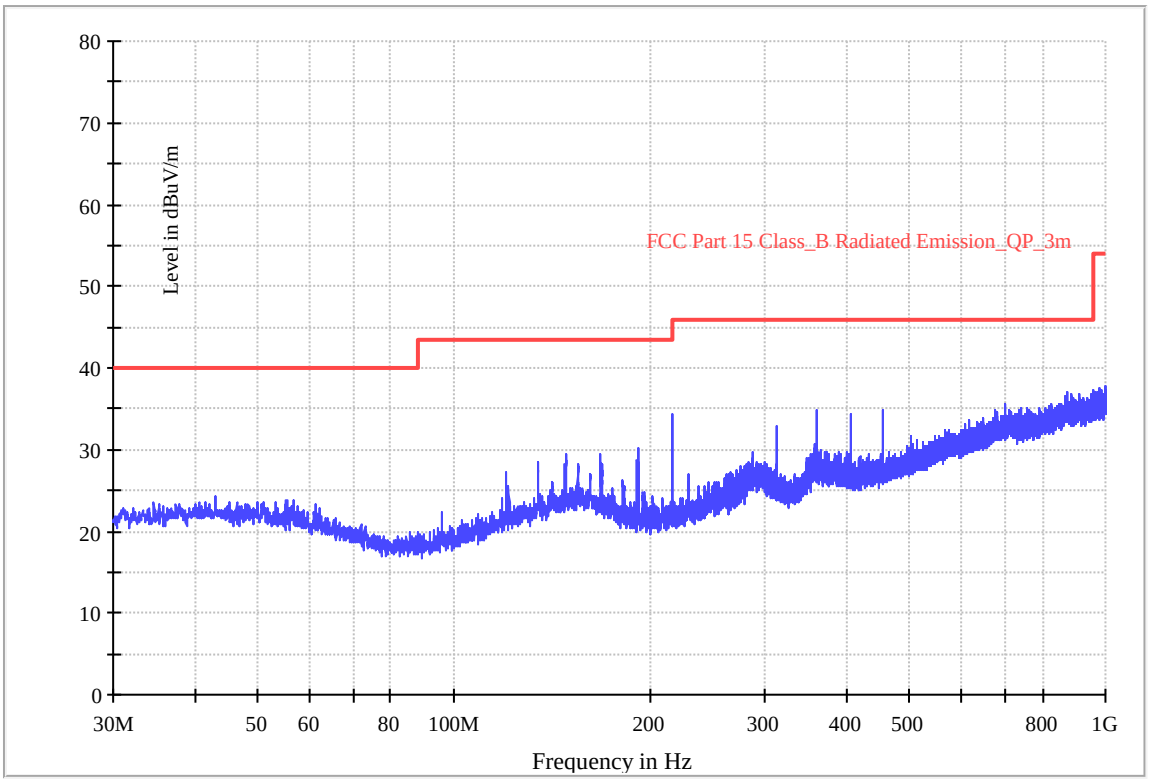


Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Site: 3 meter chamber	Time: 2019/07/27 - 10:42
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Horizontal
EUT: TYZS3 Zigbee Module, Model no: TYZS3_IPEX	Power: 120VAC, 60Hz
Note: Transmit by Zigbee at channel 2405MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000

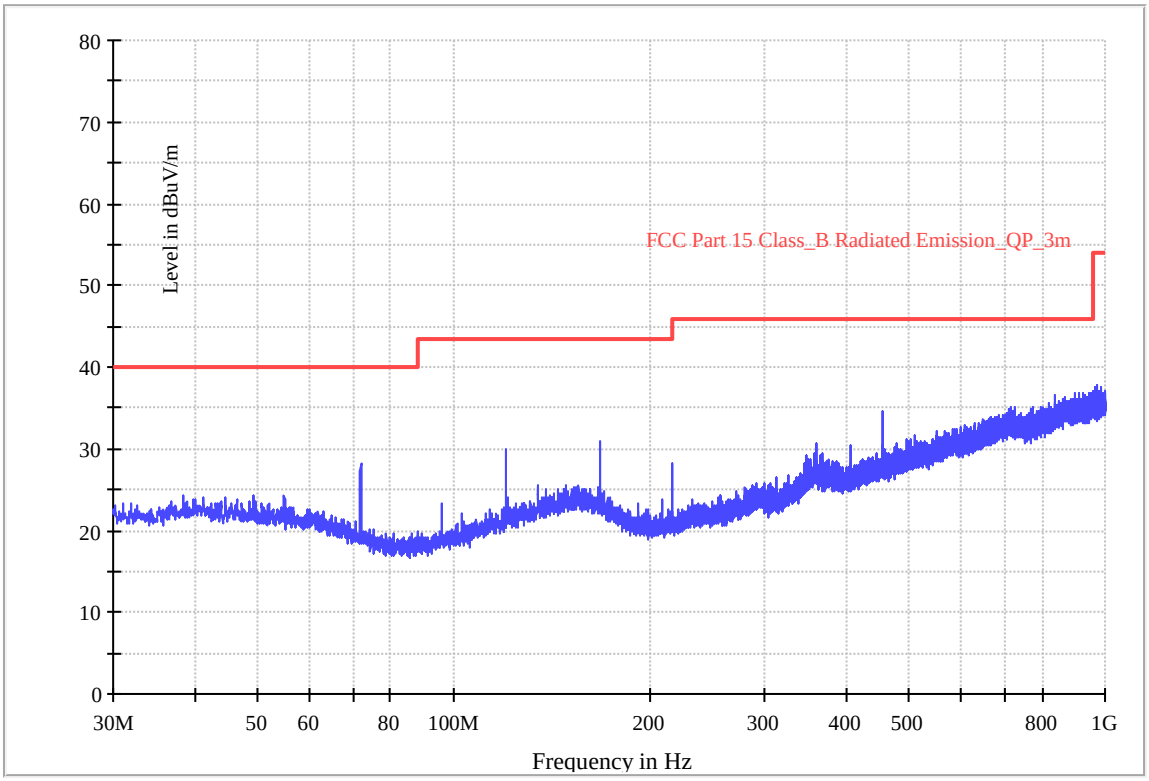


Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

Site: 3 meter chamber	Time: 2019/07/27 - 10:39
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Jiaxi XU
Probe: VULB9168	Polarity: Vertical
EUT: TYZS3 Zigbee Module, Model no: TYZS3_IPEX	Power: 120VAC, 60Hz
Note: Transmit by Zigbee at channel 2405MHz. Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_30-1000



Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Wideband power sensor	Rohde & Schwarz	NRP-Z81	103140	2020-8-4
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	848	2021-6-10
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-6-27
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	E326	2021-1-28
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-10
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2020-8-4
	LISN	Rohde & Schwarz	ENV216	101924	2020-8-4

C - Conducted RF tests

- Conducted peak output power
- 6dB Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Conducted Band edge

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

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:

Test Site1

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.16dB
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.15dB (Horizontal) ±5.12dB (Vertical) 18GHz to 25GHz, ±4.76dB

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600

China

13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
3-13, No.151, Heng Tong Road, Shanghai, 200070, P.R. China
Phone: +86 21 61410123, Fax:+86 21 61408600