Certificate No.: 3745.01

China

FCC - TEST REPORT

Report Number	:	**709502204659-00A** Date of Issue: November 28, 2022
Model	:	TS24-U
Product Type	:	Wireless Module
Applicant	:	Hangzhou Tuya Information Technology Co.,Ltd
Address	:	Room701,Building3,More Center,No.87 GuDun Road,Hangzhou,Zhejiang China
Manufacturer	:	Hangzhou Tuya Information Technology Co.,Ltd
Address	:	Room701,Building3,More Center,No.87 GuDun Road,Hangzhou,Zhejiang China
Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	39

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Test Firm FCC Registration Number:	820234
Designation number:	CN1183
IC Company Number:	25988
CAB identifier:	CN0101
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600

3 Description of the Equipment under Test

Description of the Equipment Under Test

Product:	Wireless Module
Model no.:	TS24-U
FCC ID:	2ANDL-TS24-U
Options and accessories:	NA
Rating:	2.0V-3.8V DC
RF Transmission Frequency:	2405~2480MHz
No. of Operated Channel:	16
Modulation:	16-ary orthogonal modulation, O-QPSK PHY

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

Antenna Type:	PCB antenna
Antenna Gain:	-1.0 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a wireless Module. We tested it and listed the worst data in this report.
Test sample no.:	SHA-691431-1

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

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	12-16	Site 1	☒	☐	☐
§15.247 (b) (1)	Conducted peak output power	17-18	Site 1	☒	☐	☐
§15.247(a)(1)	20dB bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	Dwell Time	---	---	☐	☐	☒
§15.247(a)(2)	6dB bandwidth	19-20	Site 1	☒	☐	☐
§15.247(e)	Power spectral density	21-22	Site 1	☒	☐	☐
§15.247(d)	Spurious RF conducted emissions	23-26	Site 1	☒	☐	☐
§15.247(d)	Band edge	27-28	Site 1	☒	☐	☐
§15.247(d) & §15.209	Spurious radiated emissions for transmitter	29-35	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses PCB antenna, which gain is -1.0dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-TS24-U, 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.

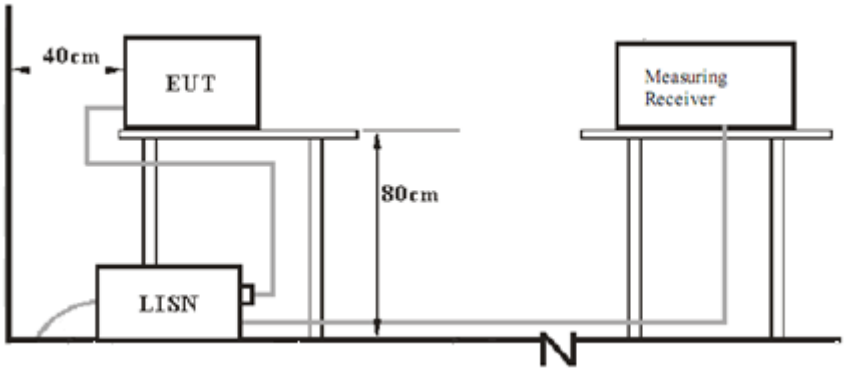
Sample Received Date:	November 10, 2022
Testing Start Date:	November 11, 2022
Testing End Date:	November 25, 2022

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

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Zeng Jianqing
Review Engineer	Project Engineer	Test Engineer

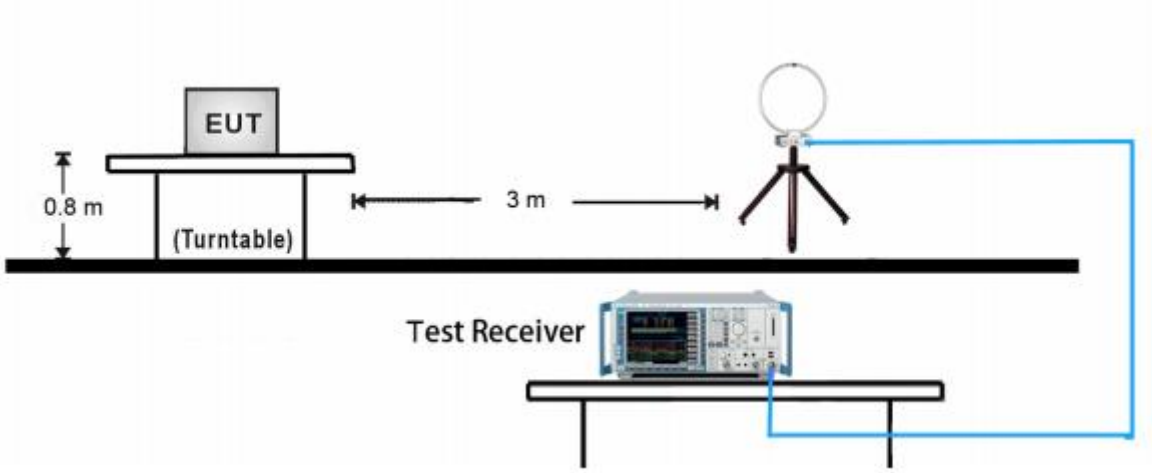
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

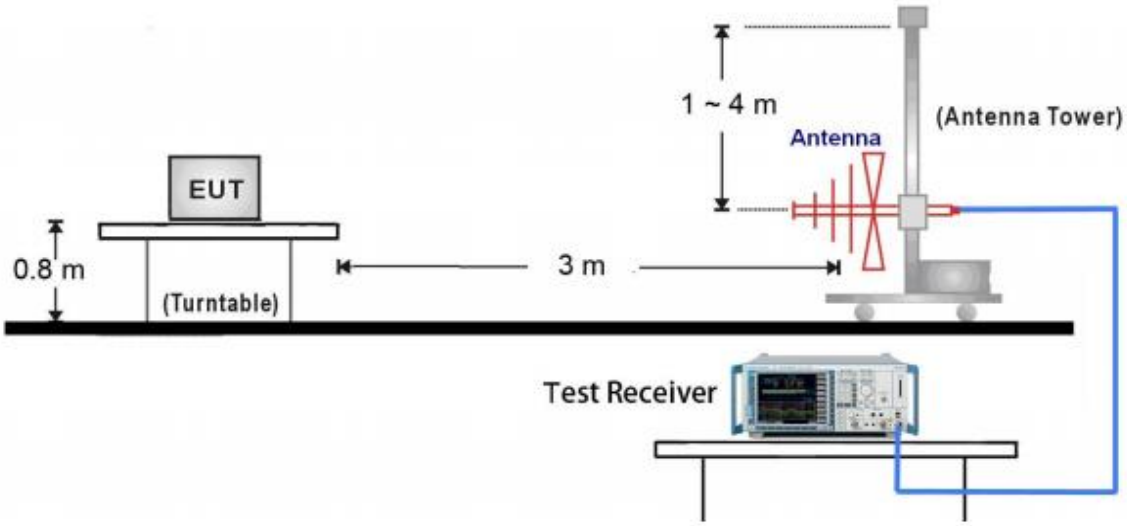


7.2 Radiated test setups

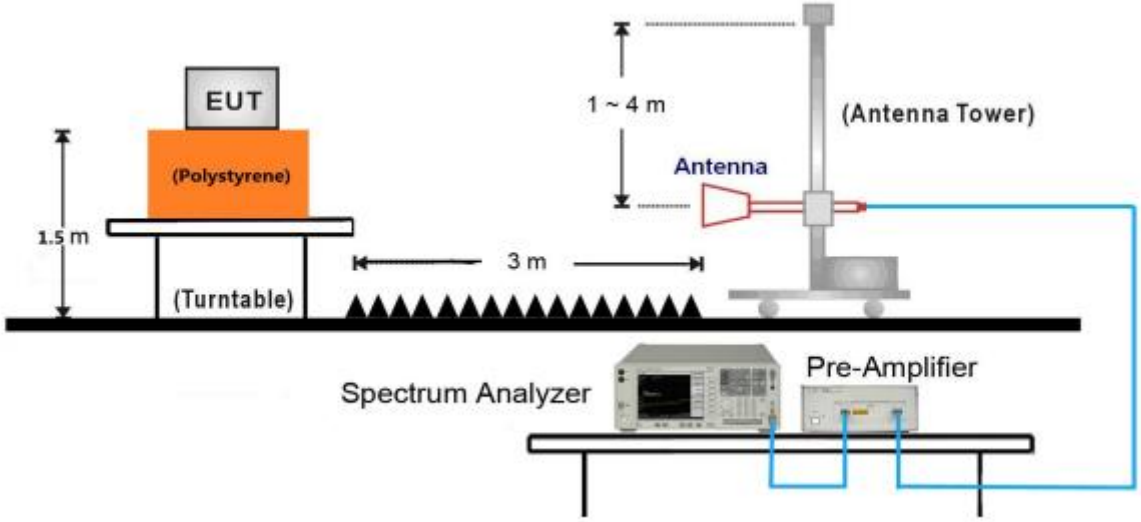
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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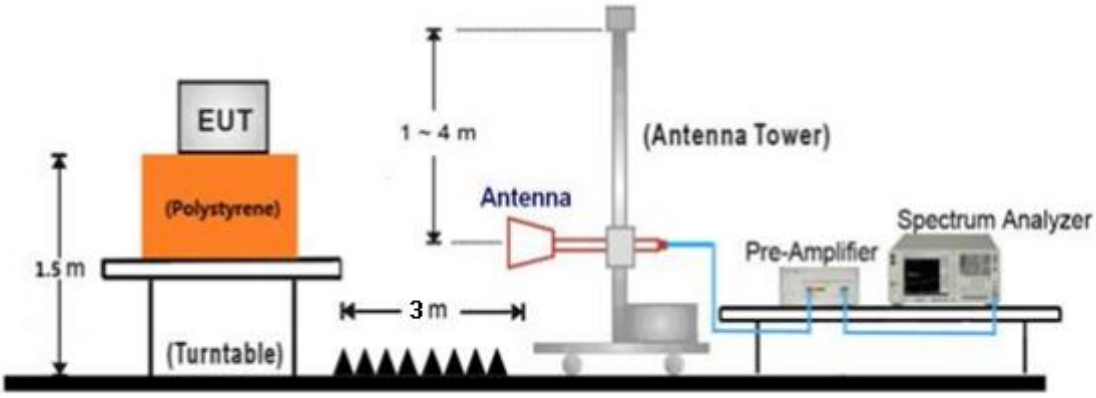
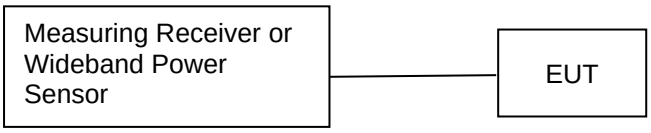
18GHz ~ 40GHz Test Setup:



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenove	E470	PF-OU5TS7 17/09

Test software: SecureCRT

The system was configured to channel 11, 19, and 26 for the test.

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.

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

Conducted Emission

150k-30MHz Conducted Emission Test

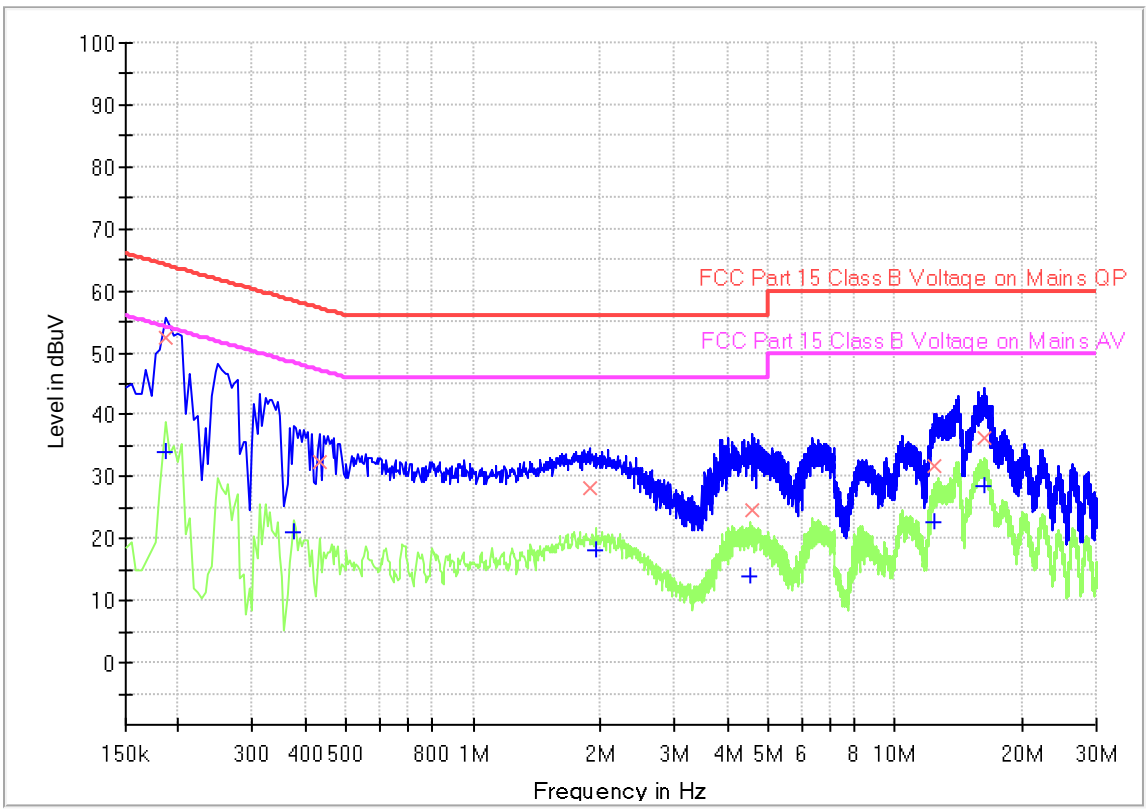
EUT Information

EUT Name:	Wireless Module
Model	TS24-U
Client:	Hangzhou Tuya Information Technology Co., Ltd
Op Cond	Power on, TX 2405MHz, AC 120V/60Hz, T23.3, H40.2%, P102.5kPa
Operator:	Zeng jianqing
Standard	FCC Part 15B Class B
Comment:	Phase L
Sample No.:	SHA-691431-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.186000	---	34.03	54.21	20.18	1000.0	9.000	L1	19.6
0.186000	52.37	---	64.21	11.84	1000.0	9.000	L1	19.6
0.375000	---	21.02	48.39	27.37	1000.0	9.000	L1	19.6
0.433500	32.50	---	57.19	24.69	1000.0	9.000	L1	19.6
1.882500	28.32	---	56.00	27.68	1000.0	9.000	L1	19.6
1.950000	---	18.19	46.00	27.81	1000.0	9.000	L1	19.6
4.528500	---	13.90	46.00	32.10	1000.0	9.000	L1	19.6
4.591500	24.60	---	56.00	31.40	1000.0	9.000	L1	19.6
12.381000	31.89	---	60.00	28.11	1000.0	9.000	L1	19.8
12.381000	---	22.75	50.00	27.25	1000.0	9.000	L1	19.8
16.296000	36.28	---	60.00	23.72	1000.0	9.000	L1	19.9
16.354500	---	28.49	50.00	21.51	1000.0	9.000	L1	19.9

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150k-30MHz Conducted Emission Test

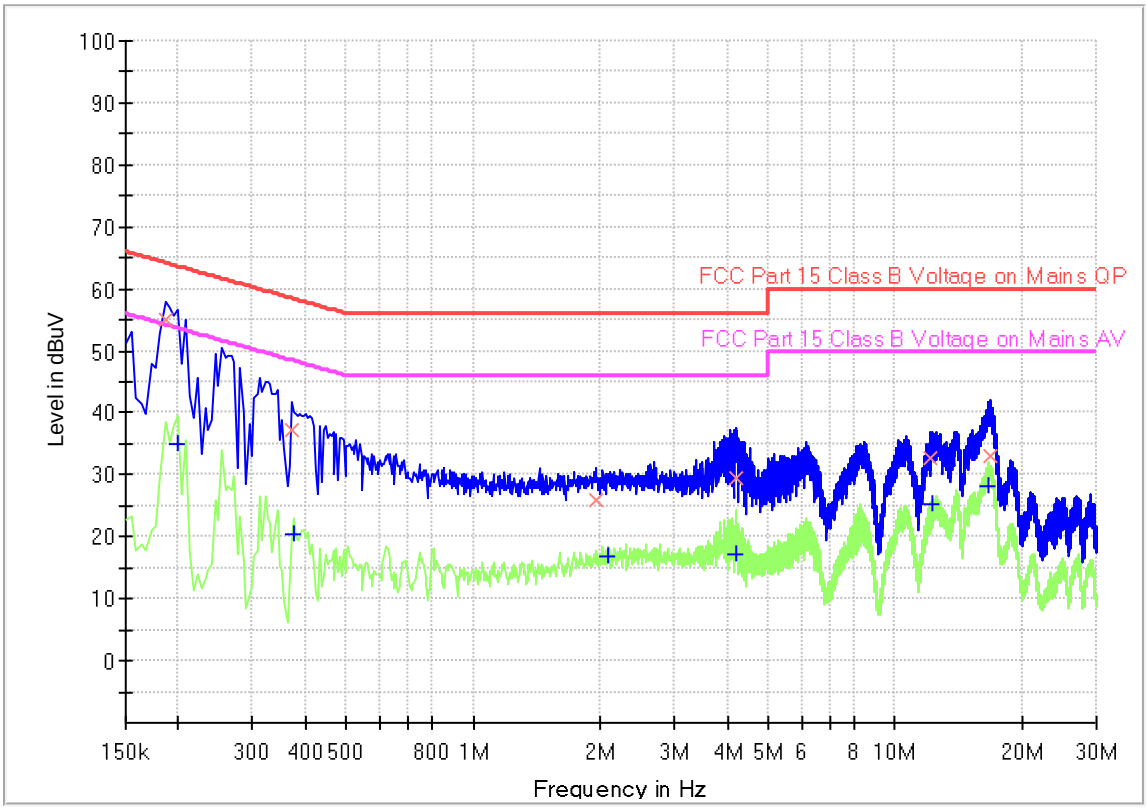
EUT Information

EUT Name:	Wireless Module
Model	TS24-U
Client:	Hangzhou Tuya Information Technology Co., Ltd
Op Cond	Power on, TX 2405MHz, AC 120V/60Hz, T23.3, H40.2%, P102.5kPa
Operator:	Zeng jianqing
Standard	FCC Part 15B Class B
Comment:	Phase N
Sample No.:	SHA-691431-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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China

Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.186000	54.96	---	64.21	9.25	1000.0	9.000	N	19.6
0.199500	---	35.00	53.63	18.63	1000.0	9.000	N	19.6
0.370500	37.21	---	58.49	21.28	1000.0	9.000	N	19.6
0.375000	---	20.46	48.39	27.93	1000.0	9.000	N	19.6
1.959000	25.94	---	56.00	30.06	1000.0	9.000	N	19.6
2.094000	---	17.00	46.00	29.00	1000.0	9.000	N	19.6
4.186500	---	17.33	46.00	28.67	1000.0	9.000	N	19.7
4.209000	29.47	---	56.00	26.53	1000.0	9.000	N	19.7
12.174000	32.79	---	60.00	27.21	1000.0	9.000	N	19.9
12.304500	---	25.25	50.00	24.75	1000.0	9.000	N	19.9
16.624500	---	28.18	50.00	21.82	1000.0	9.000	N	19.9
16.782000	33.10	---	60.00	26.90	1000.0	9.000	N	19.9

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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9.2 Conducted peak output power

Test Method

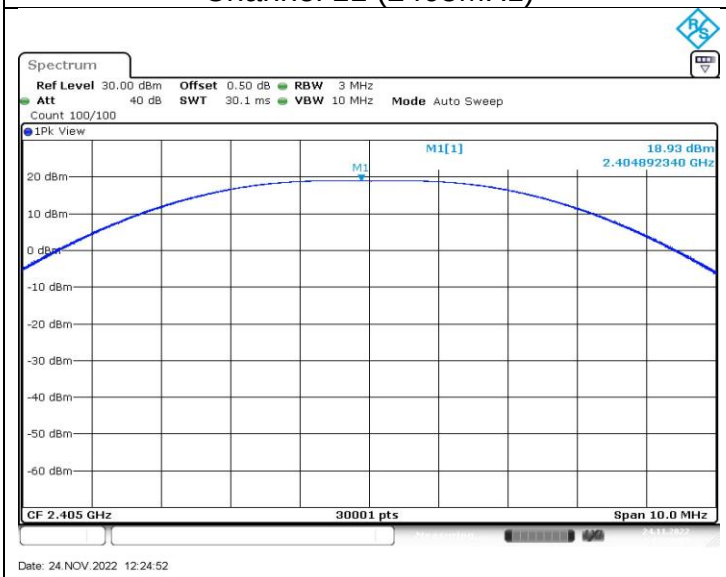
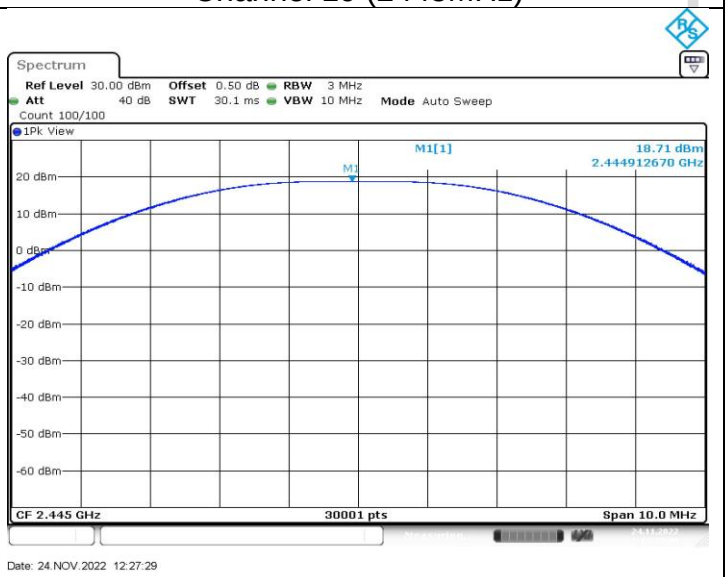
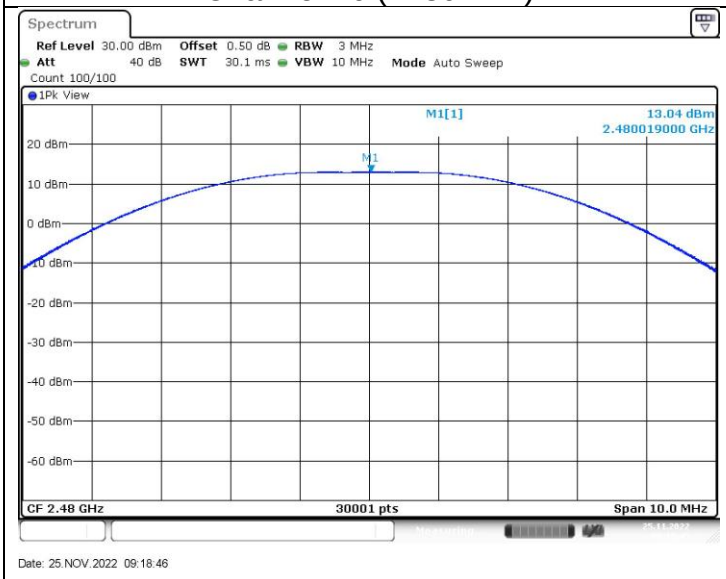
1. Use the following spectrum analyzer settings:
   RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW
   Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

Limits

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

Test result as below table

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2405MHz	18.93	Pass
Middle channel 2445MHz	18.71	Pass
High channel 2480MHz	13.04	Pass

Peak output power	
Channel 11 (2405MHz)	Channel 19 (2445MHz)
	
Channel 26 (2480MHz)	
	

9.3 6dB bandwidth

Test Method

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

Limit

Limit [kHz]
≥500

Test result

Frequency MHz	6dB bandwidth MHz	Result
Top channel 2405MHz	1.265	Pass
Middle channel 2445MHz	1.267	Pass
Bottom channel 2480MHz	1.611	Pass

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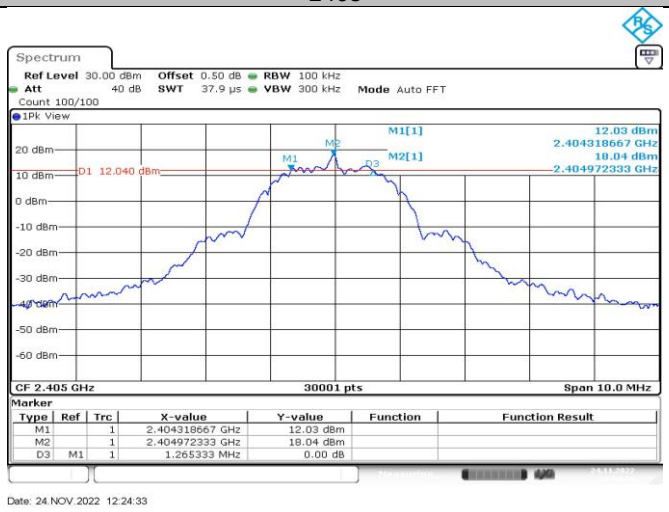
6dB Bandwidth

2405



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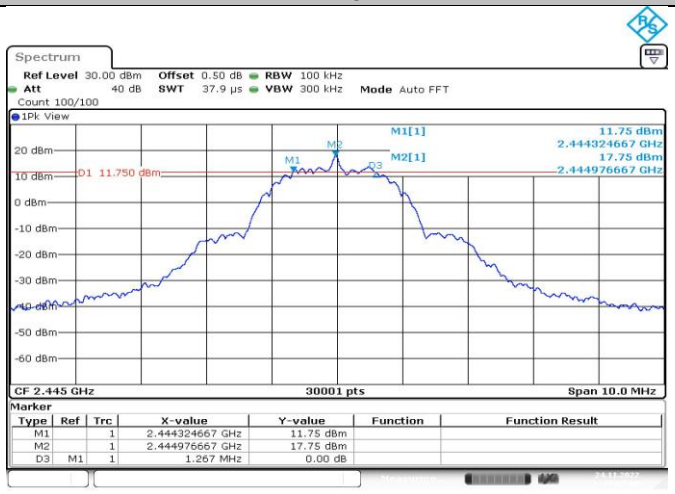
2445



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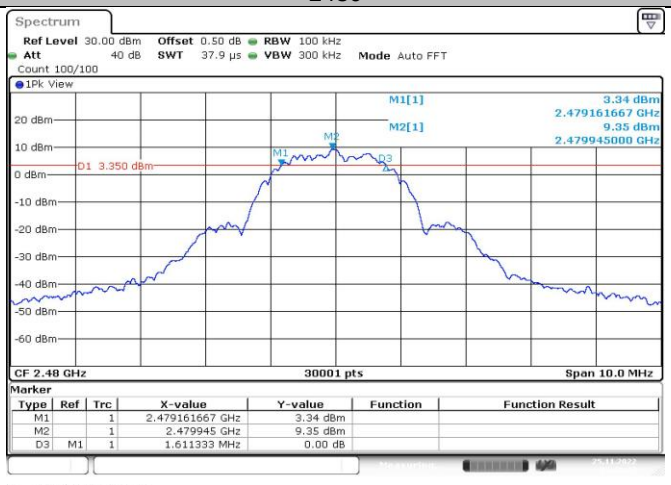
2480



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9.4 Power spectral density

Test Method

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

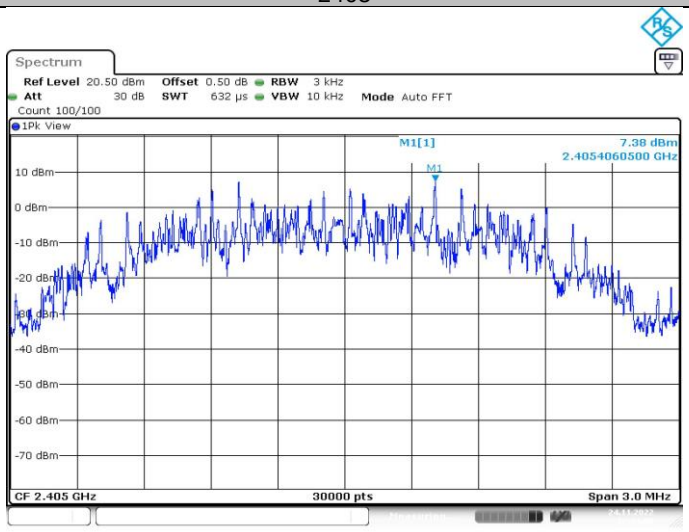
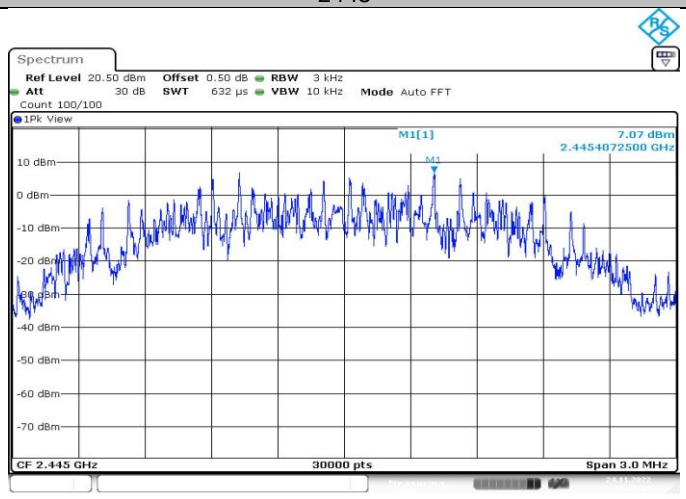
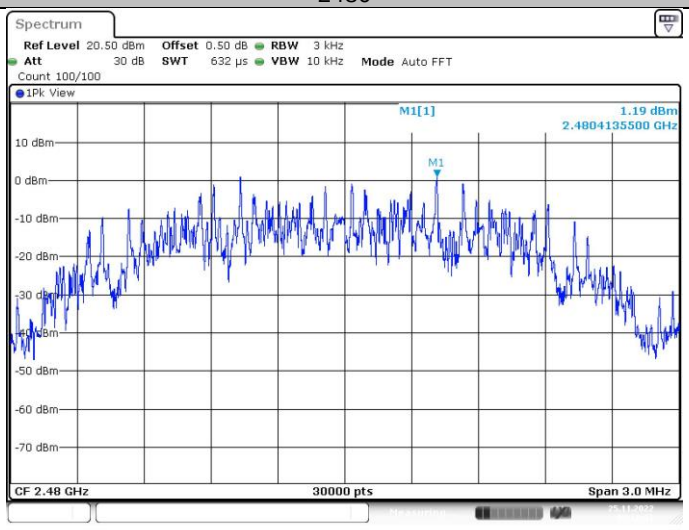
1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz,VBW≥3RBW,Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures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

Limit

Limit [dBm/3kHz]
≤8

Test result

Frequency **MHz**	Power spectral density **dBm/3kHz**	Result
Top channel 2405MHz	7.38	Pass
Middle channel 2445MHz	7.07	Pass
Bottom channel 2480MHz	1.19	Pass

2405
 Date: 24.NOV.2022 12:24:58
2445
 Date: 24.NOV.2022 12:27:34
2480
 Date: 25.NOV.2022 09:18:51

9.5 Spurious RF conducted emissions

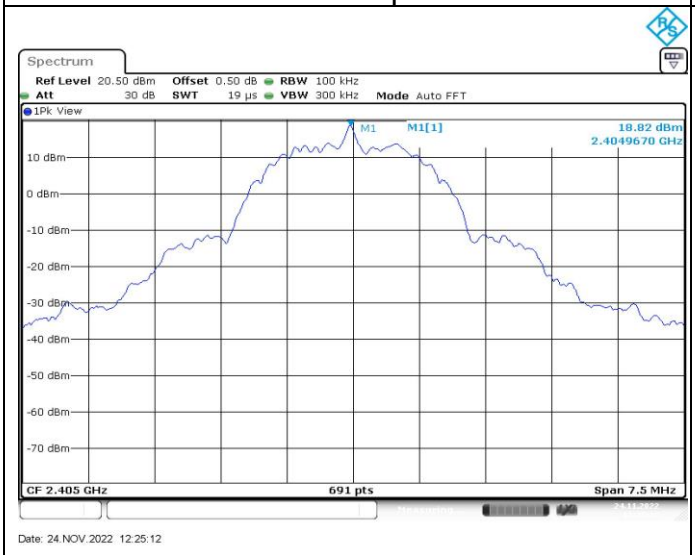
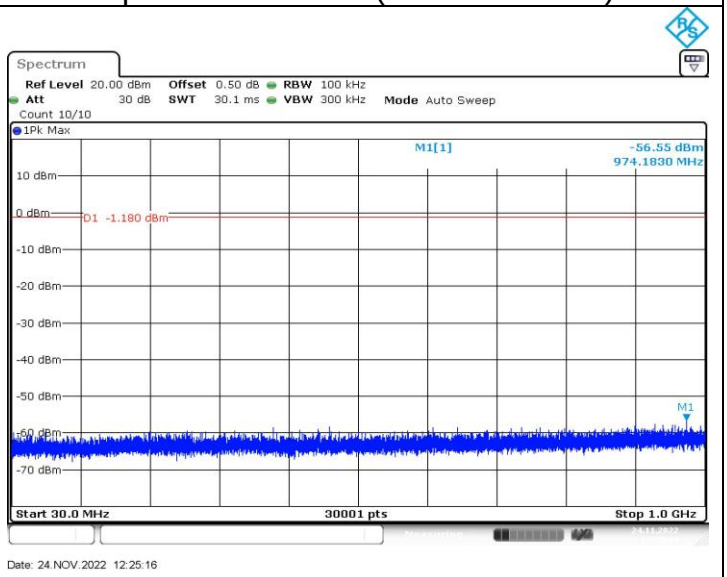
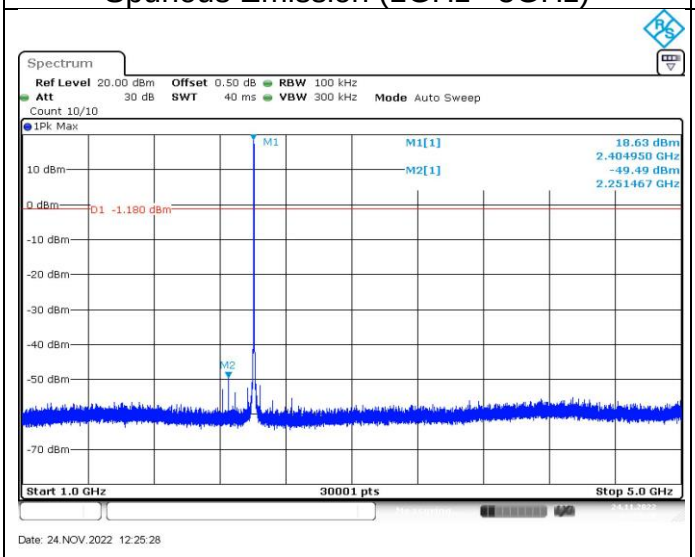
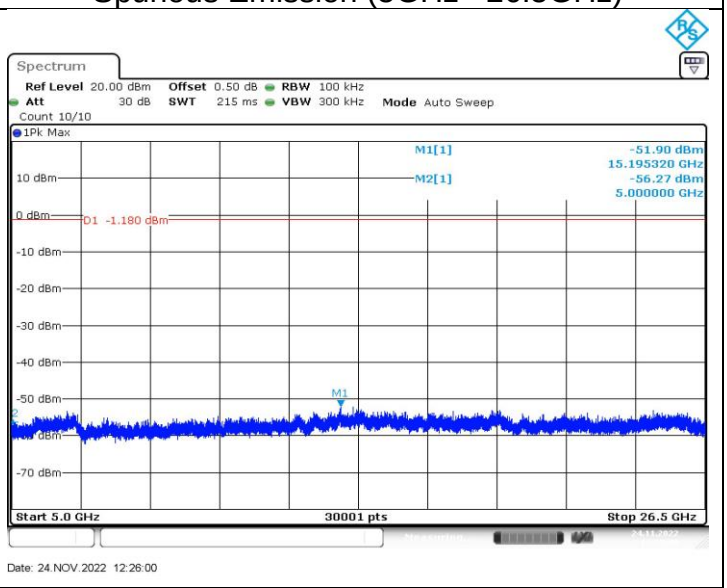
Test Method

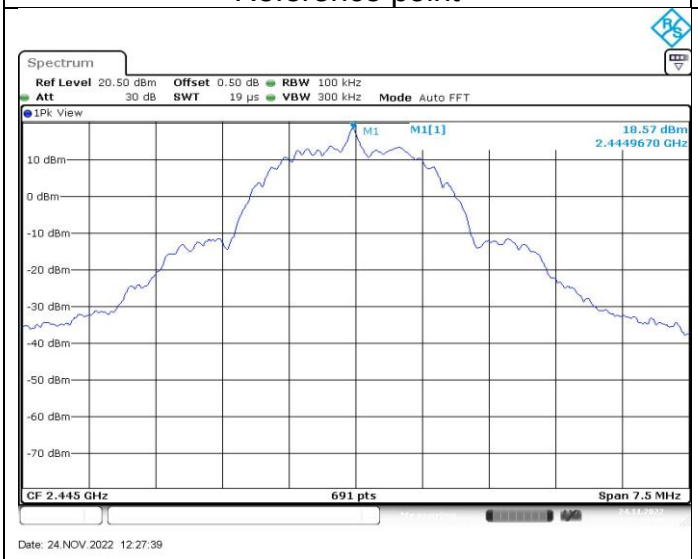
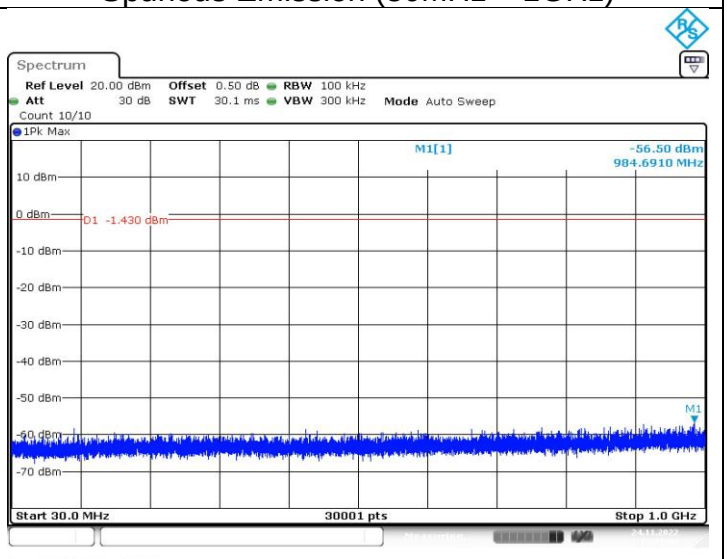
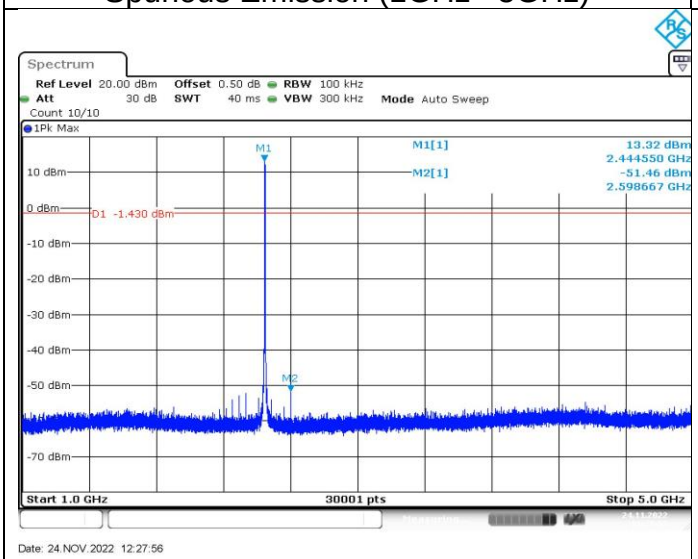
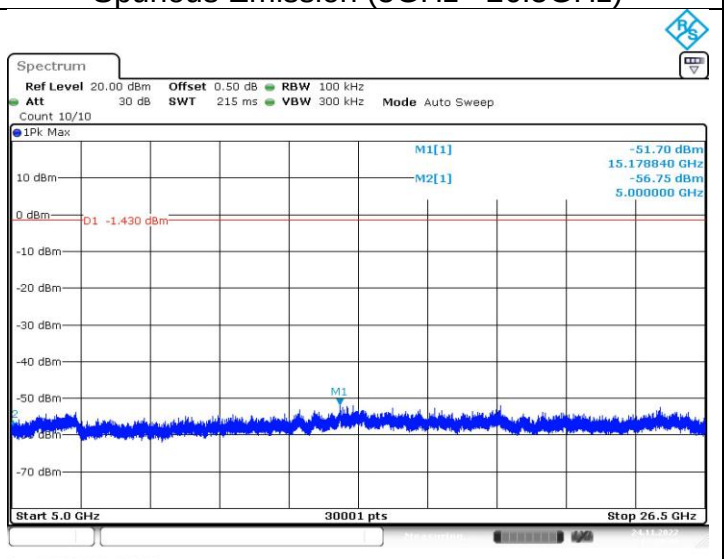
1. Establish a reference level by using the following procedure:
   a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
   b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
2. Use the maximum PSD level to establish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

Limit

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

Spurious RF conducted emissions

Out-of-Band Emissions	
Channel 11 (2405MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

Out-of-Band Emissions	
Channel 19 (2445MHz)	
Reference point	Spurious Emission (30MHz – 1GHz)
	
Spurious Emission (1GHz –5GHz)	Spurious Emission (5GHz –26.5GHz)
	

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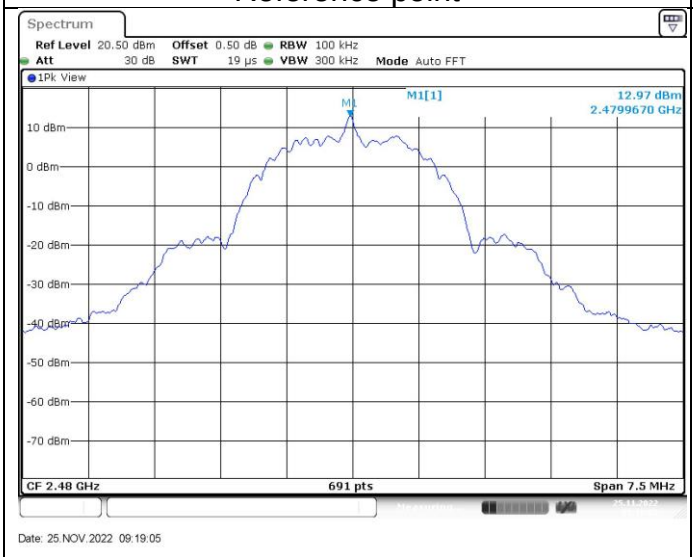
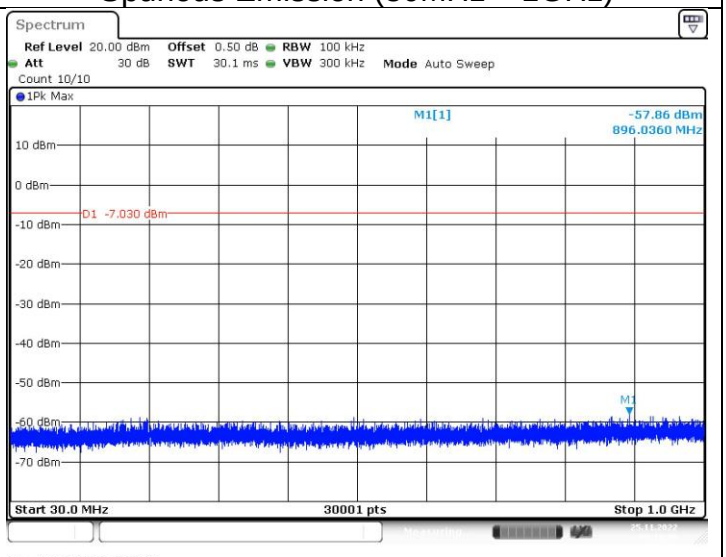
Out-of-Band Emissions

Channel 26 (2480MHz)

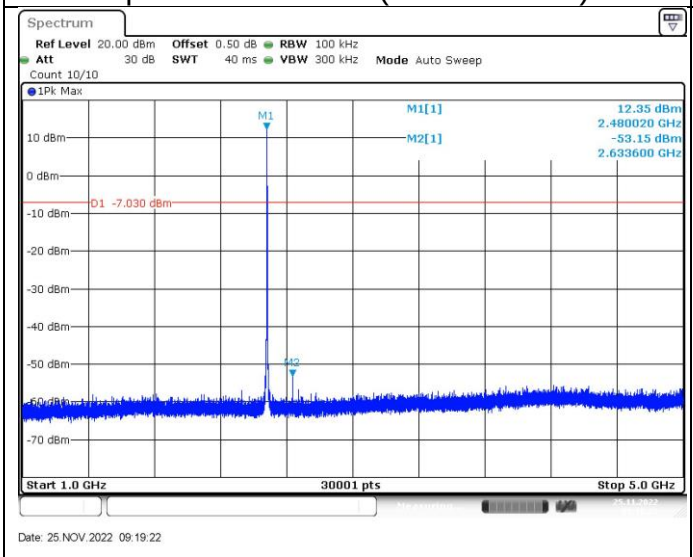
Reference point



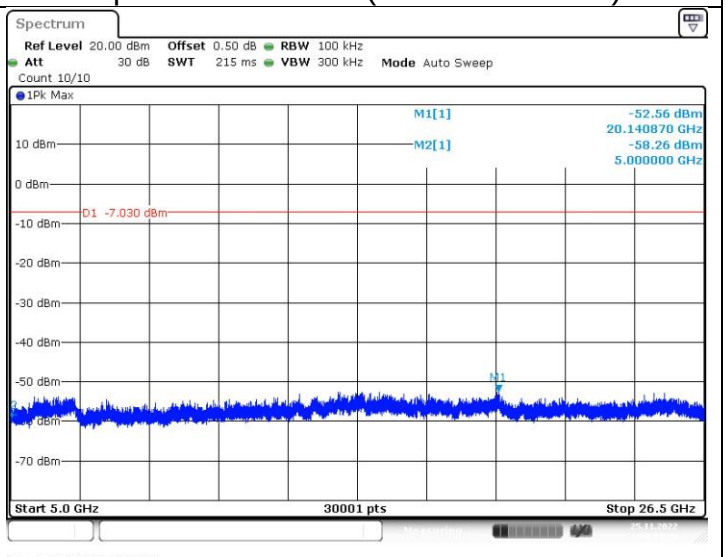
Spurious Emission (30MHz – 1GHz)



Spurious Emission (1GHz –5GHz)



Spurious Emission (5GHz –26.5GHz)



9.6 Band edge

Test Method

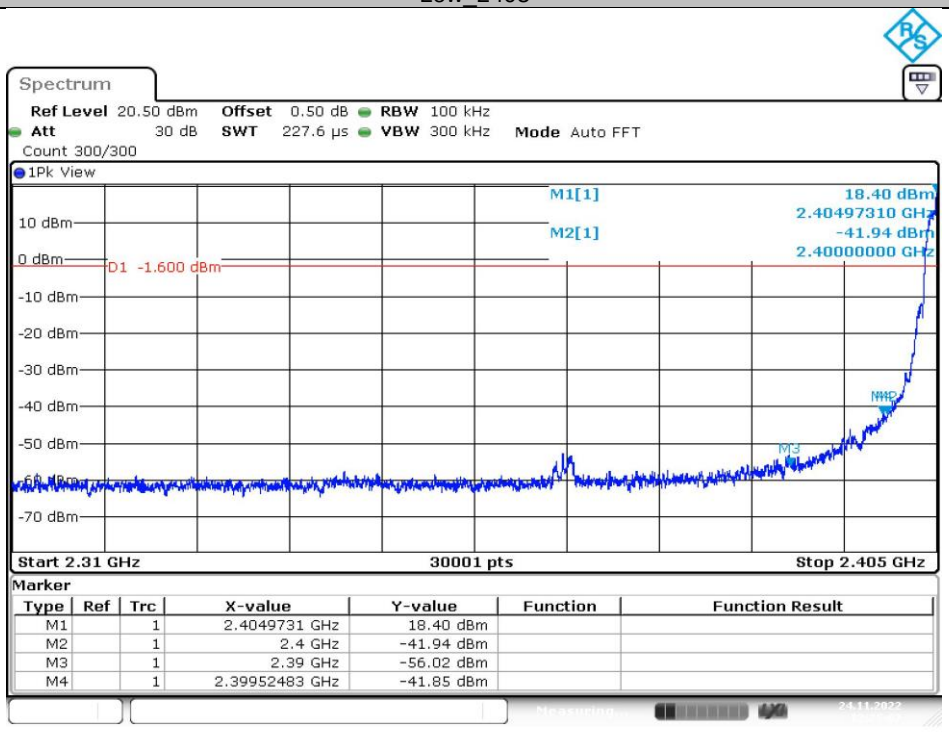
1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold.
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.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

Limit

According to §15.247(d) and RSS-247 5.5, 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-Gen 8.10, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

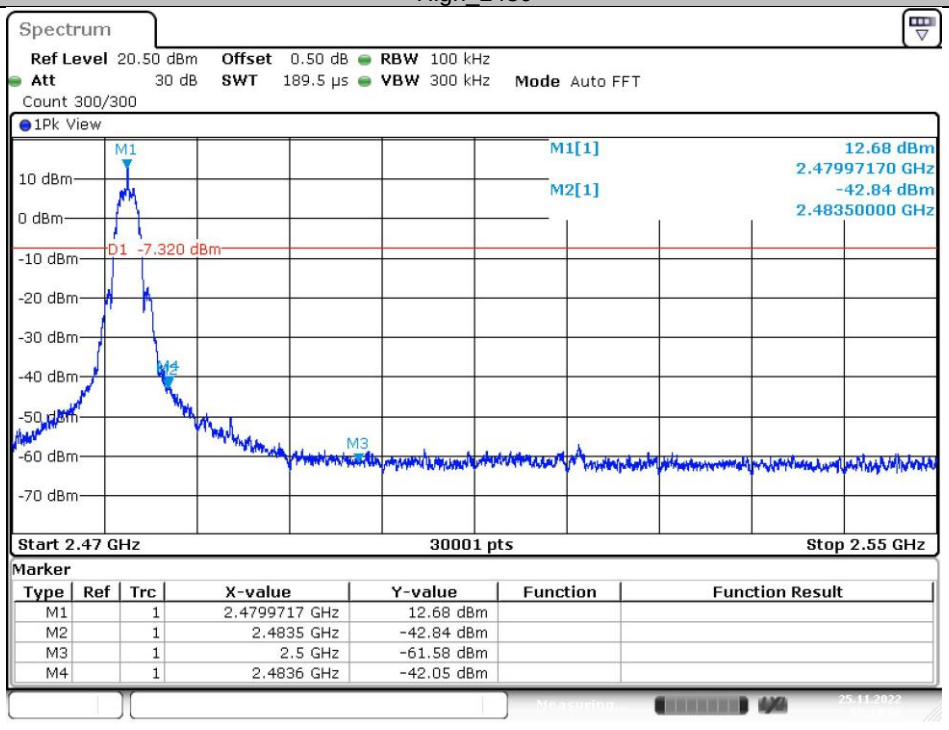
Test result

Low_2405



Date: 24.NOV.2022 12:25:07

High_2480



Date: 25.NOV.2022 09:19:00

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9.7 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 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 to 120 kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions 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, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

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 and RSS-GEN 8.10 must comply with the radiated emission limits specified in section 15.209.

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

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

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Spurious radiated emissions for transmitter

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.
Pre-scan with three orthogonal axis and worst case as X axis. The only worse case test result is listed in the report.

Test result

Test channel: 2405MHz					
Frequency MHz	**Measure Level (dBuV/m)**	**Limit (dBuV/M)**	**Margin (dB)**	**Detector**	**Polarization**
2367.11	48.73	74.00	25.27	PK	Horiznotal
2389.68	50.85	74.00	23.15	PK	Horiznotal
4810.83	55.24	74.00	18.76	PK	Horiznotal
4810.83	48.00	54.00	6.00	AV	Horiznotal
2389.68	43.52	74.00	30.48	PK	Vertical
4810.83	53.22	74.00	20.78	PK	Vertical
4810.83	47.20	54.00	6.80	AV	Vertical

Test channel:2445MHz					
Frequency MHz	**Measure Level (dBuV/m)**	**Limit (dBuV/M**	**Margin (dB)**	**Detector**	**Polarization**
4891.30	54.31	74.00	19.69	PK	Horiznotal
4891.30	46.20	54.00	7.80	AV	Horiznotal
7336.46	51.48	74.00	22.52	PK	Horiznotal
4891.30	49.62	74.00	24.38	PK	Vertical

Test channel:2480MHz					
Frequency MHz	**Measure Level (dBuV/m)**	**Limit (dBuV/M**	**Margin (dB)**	**Detector**	**Polarization**
2483.60	60.01	74.00	13.99	PK	Horiznotal
2483.60	51.20	54.00	2.80	AV	Horiznotal
4960.01	43.28	74.00	30.72	PK	Horiznotal
2483.56	62.29	74.00	11.71	PK	Vertical
2483.56	51.10	54.00	2.90	AV	Vertical
4960.11	52.60	74.00	21.40	PK	Vertical

Remark:

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

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30-1000MHz Radiated Emission

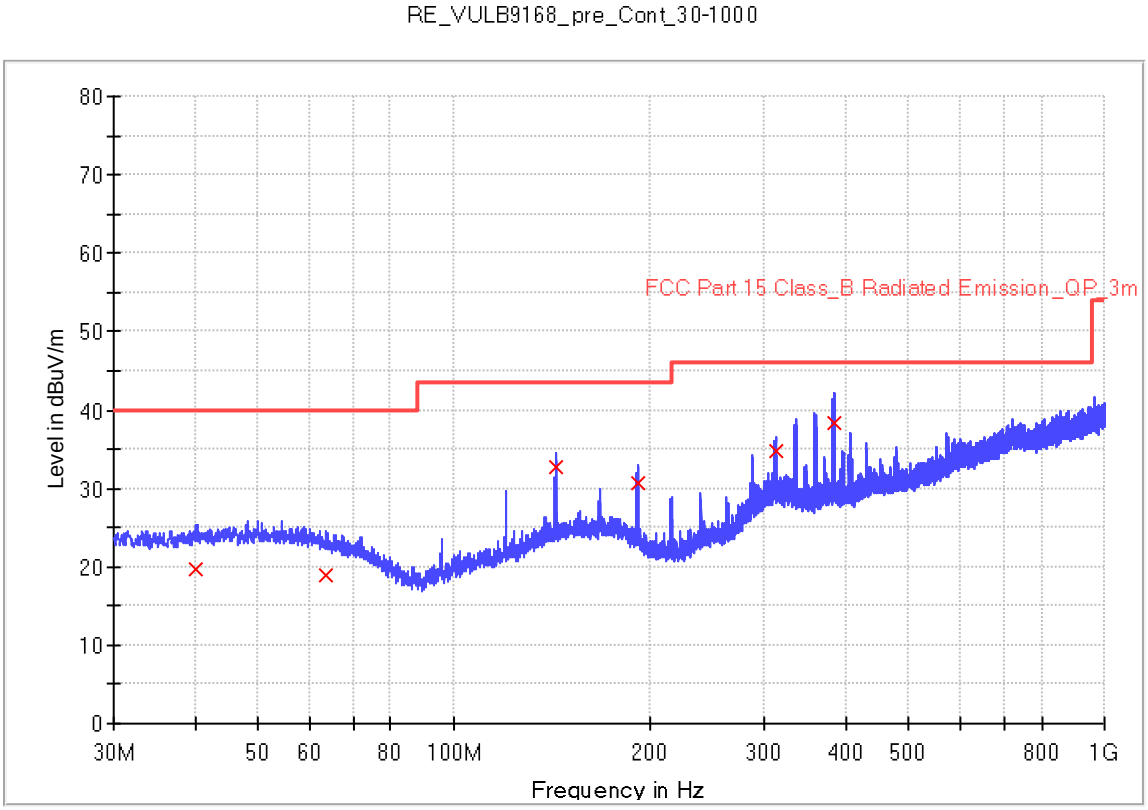
EUT Information

EUT Name:	Wireless Module
Model:	TS24-U
Client:	Hangzhou Tuya Information Technology Co., Ltd
Op Cond:	Power on,TX_2405MHz, DC 3.3V, T21.8, H50.7%, P102.5kPa
Operator:	Zeng jianqing
Test Spec:	FCC Part 15B Class B
Comment:	Horizontal
Sample No:	SHA-691431-1

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.005 s	20 dB



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Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
40.120000	19.8	1000.0	120.000	100.0	H	203.0	20.0	20.2	40.0
63.480000	18.8	1000.0	120.000	150.0	H	74.0	19.6	21.2	40.0
143.640000	32.7	1000.0	120.000	100.0	H	118.0	20.6	10.8	43.5
191.520000	30.6	1000.0	120.000	150.0	H	352.0	18.4	12.9	43.5
311.880000	34.7	1000.0	120.000	200.0	H	277.0	21.8	11.3	46.0
383.760000	38.4	1000.0	120.000	150.0	H	140.0	23.8	7.6	46.0

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30-1000MHz Radiated Emission

EUT Information

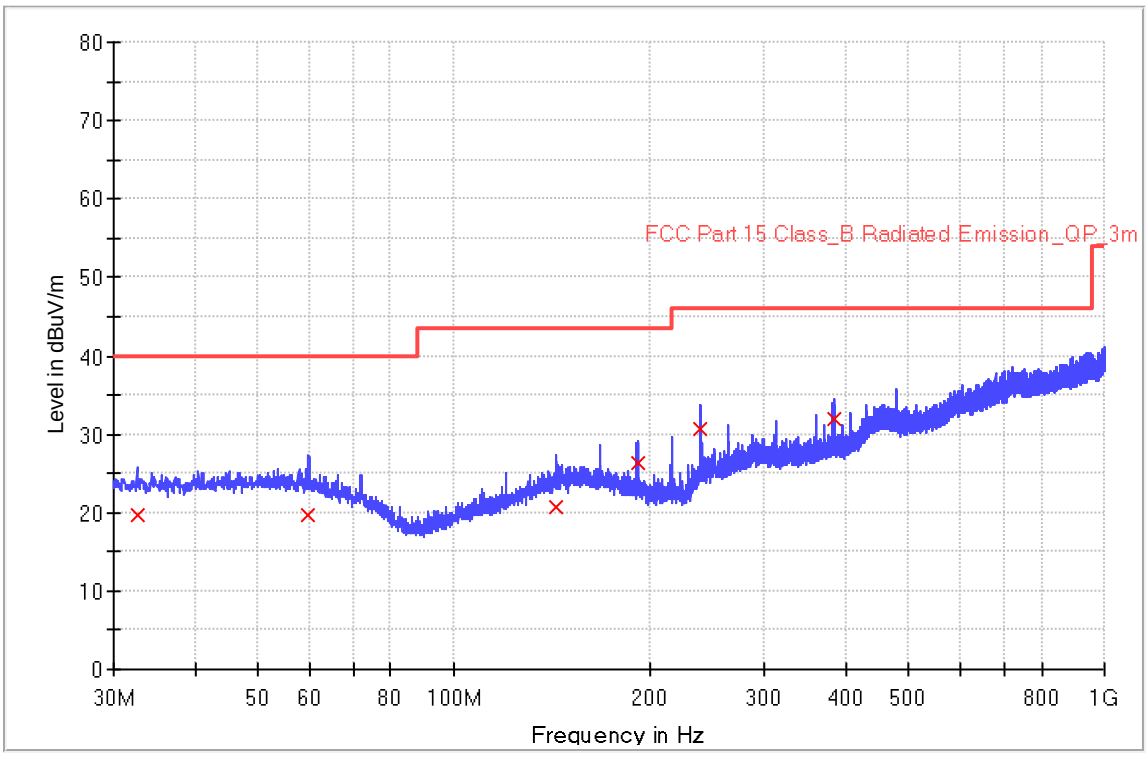
EUT Name:	Wireless Module
Model:	TS24-U
Client:	Hangzhou Tuya Information Technology Co., Ltd
Op Cond:	Power on,TX_2405MHz, DC 3.3V, T21.8, H50.7%, P102.5kPa
Operator:	Zeng jianqing
Test Spec:	FCC Part 15B Class B
Comment:	Vertical
Sample No:	SHA-691431-1

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.005 s	20 dB

RE_VULB9168_pre_Cont_30-1000



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Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
32.600000	19.8	1000.0	120.000	100.0	V	246.0	19.4	20.2	40.0
59.840000	19.7	1000.0	120.000	100.0	V	141.0	20.1	20.3	40.0
143.880000	20.6	1000.0	120.000	200.0	V	57.0	20.5	22.9	43.5
191.840000	26.2	1000.0	120.000	200.0	V	173.0	18.3	17.3	43.5
238.800000	30.6	1000.0	120.000	150.0	V	328.0	19.4	15.4	46.0
383.000000	31.8	1000.0	120.000	150.0	V	209.0	23.8	14.2	46.0

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.

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10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2022-8-1	2023-7-31
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2022-8-1	2023-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2022-8-1	2023-7-31
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2021-9-23	2024-9-22
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-3-15	2024-3-14
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2022-8-1	2023-7-31
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2022-5-20	2023-5-19
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2020-9-23	2023-9-22
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-8	2024-5-7
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2022-8-1	2023-7-31
	LISN	Rohde & Schwarz	ENV216	101924	2022-8-1	2023-7-31

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	Bluetooth and WiFi Test System	Shenzhen JS tonscend co.,ltd	2.6.77.0518
RE	EMC 32	Rohde & Schwarz	V10.50.40
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

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11 System Measurement Uncertainty

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

Items	Extended Uncertainty
Conducted Disturbance	9kHz to 30MHz, 3.16dB (AMN)
Radiated Disturbance	9kHz to 30MHz, 3.52dB 30MHz to 1GHz, 5.03dB (Horizontal) 5.12dB (Vertical) 1GHz to 18GHz, 5.49dB 18GHz to 40GHz, 5.63dB
RF Conducted Measurement	Power related： 1.16dB Frequency related： 6.00×10^{-8}

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

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

----------End of Test Report----------

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