FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....: CTA24072501101

FCC ID..... : 2BKPR-TZB-100

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Date of issue.....:	Aug. 01, 2024

Testing Laboratory Name .....:	**Shenzhen CTA Testing Technology Co., Ltd.**
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Applicant’s name.....:	**Thingscare Inc.**
Address .....:	Room 512, 43 Yangsan-ro, Yeongdeungpo-gu, Seoul, Republic of Korea
Test specification .....:	
Standard .....:	**FCC Part 15.247**

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Equipment description.....:	**TOO Zigbee Hub**
Trade Mark .....:	TOO
Manufacturer .....:	Shenzhen easyiot Technology Co., Ltd
Model/Type reference.....:	TZB-100
Listed Models .....:	N/A
Modulation .....:	OQPSK
Frequency.....	2405-2480MHz
Ratings .....:	DC 5.0V From external circuit
Result.....:	**PASS**

TEST REPORT

Equipment under Test	:	TOO Zigbee Hub
Model /Type	:	TZB-100
Listed Models	:	N/A
Applicant	:	**Thingscare Inc.**
Address	:	Room 512, 43 Yangsan-ro, Yeongdeungpo-gu, Seoul, Republic of Korea
Manufacturer	:	**Shenzhen easyiot Technology Co., Ltd**
Address	:	409, Block A, Building 1, Ruishangju, Guxing Community, Xixiang Subdistrict, Shenzhen Bao'an District, Guangdong Province, China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 TEST STANDARDS 4

2 SUMMARY 5

2.1 General Remarks 5
2.2 Product Description* 5
2.3 Equipment Under Test 5
2.4 Short description of the Equipment under Test (EUT) 5
2.5 EUT operation mode 6
2.6 Block Diagram of Test Setup 6
2.7 Related Submittal(s) / Grant (s) 6
2.8 Modifications 6

3 TEST ENVIRONMENT 7

3.1 Address of the test laboratory 7
3.2 Test Facility 7
3.3 Environmental conditions 7
3.4 Summary of measurement results 8
3.5 Statement of the measurement uncertainty 8
3.6 Equipments Used during the Test 9

4 TEST CONDITIONS AND RESULTS 11

4.1 AC Power Conducted Emission 11
4.2 Radiated Emissions and Band Edge 14
4.3 Maximum Peak Output Power 21
4.4 Power Spectral Density 22
4.5 6dB Bandwidth 24
4.6 Out-of-band Emissions 26
4.7 Antenna Requirement 30

TEST SETUP PHOTOS OF THE EUT 31

5 PHOTOS OF THE EUT 32

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
KDB558074 D01 V05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Jul. 25, 2024
Testing commenced on	:	Jul. 25, 2024
Testing concluded on	:	Aug. 01, 2024

2.2 Product Description*

Name of EUT	TOO Zigbee Hub
Model Number	TZB-100
Power Rating	DC 5.0V From external circuit
Adapter information (Auxiliary test suppied by test Lab）	Model: EP-TA20CBC Input: AC 100-240V 50/60Hz Output: DC 5V 2A
Sample ID:	CTA240725011-1# (Engineer sample) CTA240725011-2# (Normal sample)
Operation frequency	2405-2480MHz
Modulation	OQPSK
Antenna Type	PCB antenna
Antenna Gain	0.52 dBi

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 5.0V From external circuit

2.4 Short description of the Equipment under Test (EUT)

This is a TOO Zigbee Hub.
For more details, refer to the user's manual of the EUT.

2.5 EUT operation mode

The Applicant use Key to control the EUT for staying in continuous transmitting and receiving mode for testing .There is 16 channels provided to the EUT. Channel Low,Mid and High was selected to test.

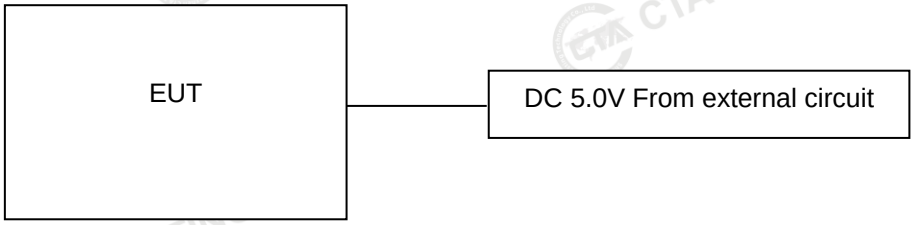
Operation Frequency:

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

Test frequency:

Channel	Frequency (MHz)
Low	2405
Mid	2440
High	2480

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
FCC-Registration No.: 517856 Designation Number: CN1318
Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01
Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	23 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing：

Temperature:	24 ° C
Humidity:	47 %
Atmospheric pressure:	950-1050mbar

Conducted testing：

Temperature:	24 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Test result
§15.247(e)	Power spectral density	Zigbee	☒ Lowest ☒ Middle ☒ Highest	Zigbee	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	Zigbee	☒ Lowest ☒ Middle ☒ Highest	Zigbee	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(b)(3)	Maximum output Peak power	Zigbee	☒ Lowest ☒ Middle ☒ Highest	Zigbee	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	Band edge compliance conducted	Zigbee	☒ Lowest ☒ Highest	Zigbee	☒ Lowest ☒ Highest	complies
§15.205	Band edge compliance radiated	Zigbee	☒ Lowest ☒ Highest	Zigbee	☒ Lowest ☒ Highest	complies
§15.247(d)	TX spurious emissions conducted	Zigbee	☒ Lowest ☒ Middle ☒ Highest	Zigbee	☒ Lowest ☒ Middle ☒ Highest	complies
§15.247(d)	TX spurious emissions radiated	Zigbee	☒ Lowest ☒ Middle ☒ Highest	Zigbee	☒ Lowest ☒ Middle ☒ Highest	complies
§15.209(a)	TX spurious Emissions radiated Below 1GHz	Zigbee	-/-	Zigbee	-/-	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	Zigbee	-/-	Zigbee	-/-	complies

Remark:
1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen CTA Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Shenzhen CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.02 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Output Peak power	30MHz~18GHz	0.55 dB	(1)
Power spectral density	/	0.57 dB	(1)
Spectrum bandwidth	/	1.1%	(1)
Radiated spurious emission (30MHz-1GHz)	30~1000MHz	4.10 dB	(1)
Radiated spurious emission (1GHz-18GHz)	1~18GHz	4.32 dB	(1)
Radiated spurious emission (18GHz-40GHz)	18-40GHz	5.54 dB	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6 Equipments Used during the Test

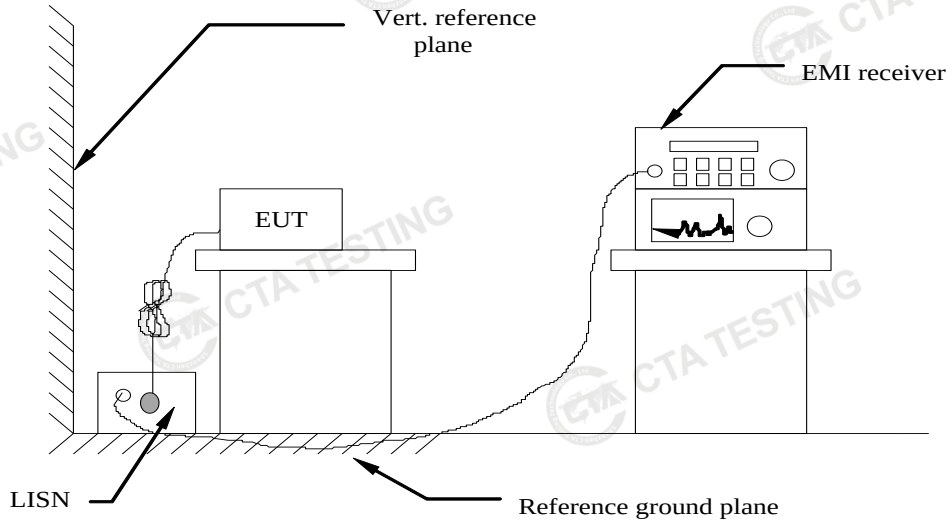
Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2023/08/02	2024/08/01
LISN	R&S	ENV216	CTA-314	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESPI	CTA-307	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESCI	CTA-306	2023/08/02	2024/08/01
Spectrum Analyzer	Agilent	N9020A	CTA-301	2023/08/02	2024/08/01
Spectrum Analyzer	R&S	FSP	CTA-337	2023/08/02	2024/08/01
Vector Signal generator	Agilent	N5182A	CTA-305	2023/08/02	2024/08/01
Analog Signal Generator	R&S	SML03	CTA-304	2023/08/02	2024/08/01
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	R&S	CTA-302	2023/08/02	2024/08/01
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2023/08/02	2024/08/01
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2023/10/17	2024/10/16
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2023/10/13	2024/10/12
Loop Antenna	Zhinan	ZN30900C	CTA-311	2023/10/17	2024/10/16
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/07	2024/08/06
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2023/08/02	2024/08/01
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2023/08/02	2024/08/01
Directional coupler	NARDA	4226-10	CTA-303	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2023/08/02	2024/08/01
Automated filter bank	Tonscend	JS0806-F	CTA-404	2023/08/02	2024/08/01
Power Sensor	Agilent	U2021XA	CTA-405	2023/08/02	2024/08/01
Amplifier	Schwarzbeck	BBV9719	CTA-406	2023/08/02	2024/08/01

Test Equipment	Manufacturer	Model No.	Version number	Calibration Date	Calibration Due Date
EMI Test Software	Tonscend	TS®JS32-RE	5.0.0.2	N/A	N/A
EMI Test Software	Tonscend	TS®JS32-CE	5.0.0.1	N/A	N/A
RF Test Software	Tonscend	TS®JS1120-3	3.1.65	N/A	N/A
RF Test Software	Tonscend	TS®JS1120	3.1.46	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

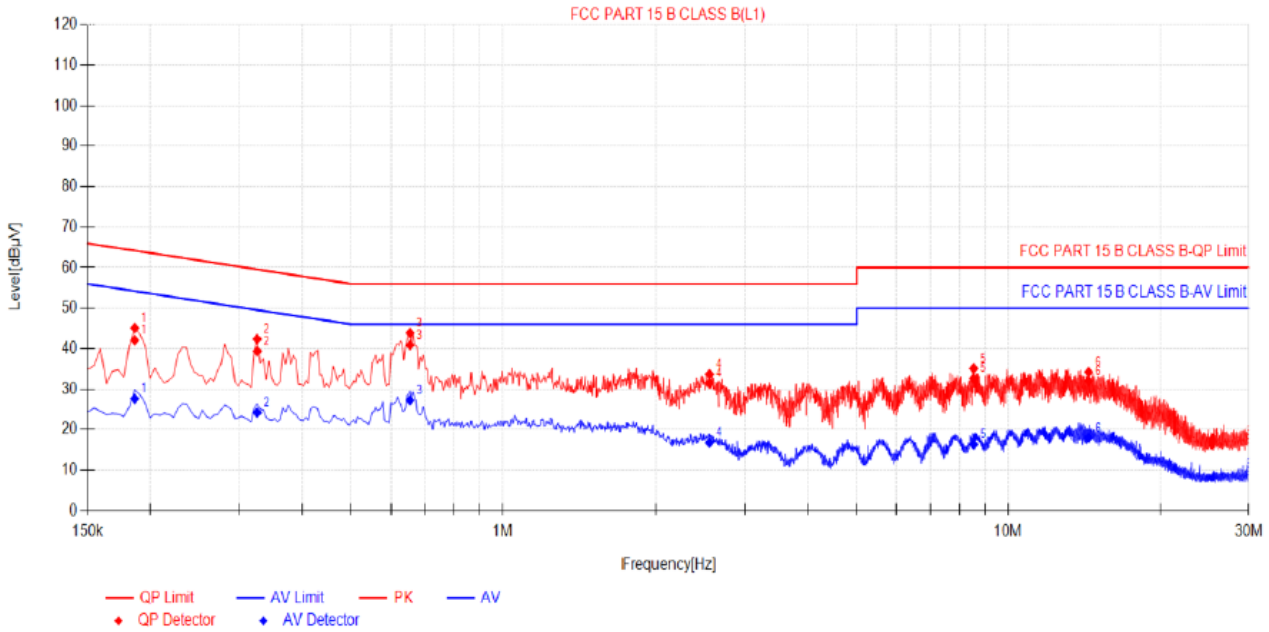
TEST RESULTS

Remark:

1. Zigbee was tested at Low, Middle, and High channel; only the worst result of Zigbee High channel was reported as below:

2. Both 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz power supply have been tested, only the worst result of 120 VAC, 60 Hz was reported as below:

Power supply:	DC 5.0V from adapter AC 120V/60Hz	Polarization	L



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.186	10.03	32.05	42.08	64.21	22.13	17.59	27.62	54.21	26.59	PASS
2	0.3255	9.91	29.47	39.38	59.57	20.19	14.31	24.22	49.57	25.35	PASS
3	0.654	9.97	30.92	40.89	56.00	15.11	17.30	27.27	46.00	18.73	PASS
4	2.553	10.09	21.32	31.41	56.00	24.59	6.71	16.80	46.00	29.20	PASS
5	8.538	10.27	22.38	32.65	60.00	27.35	6.07	16.34	50.00	33.66	PASS
6	14.442	10.30	21.73	32.03	60.00	27.97	7.72	18.02	50.00	31.98	PASS

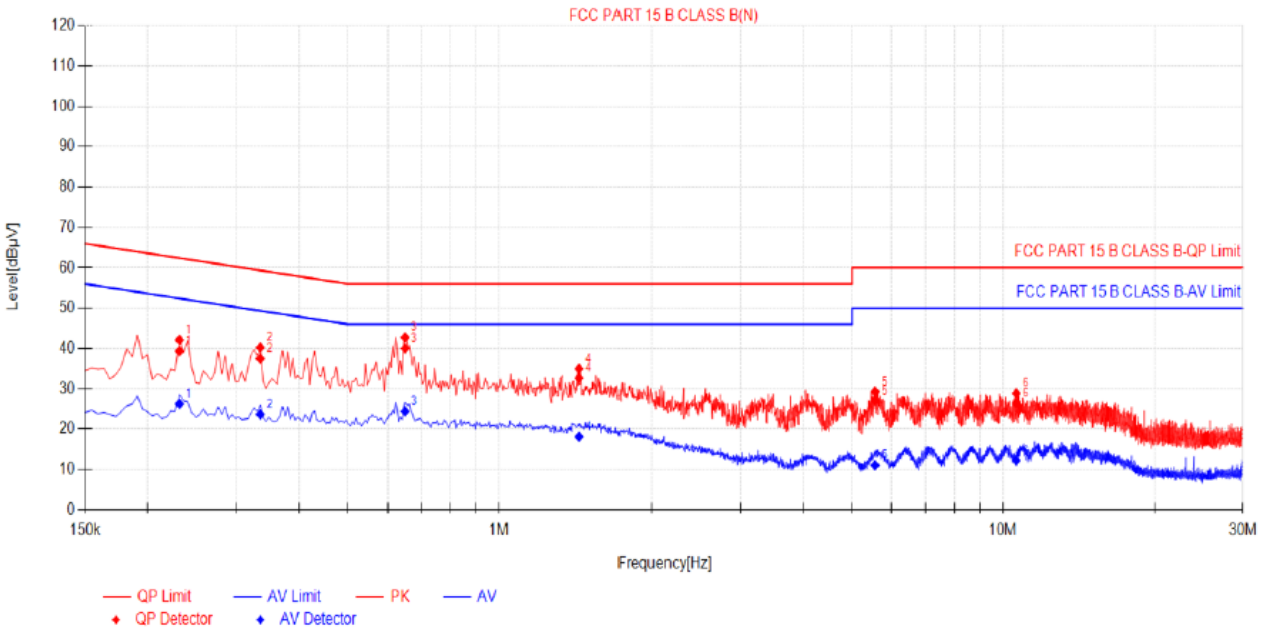
Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)

4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

Power supply:	DC 5.0V from adapter AC 120V/60Hz	Polarization	N



Final Data List

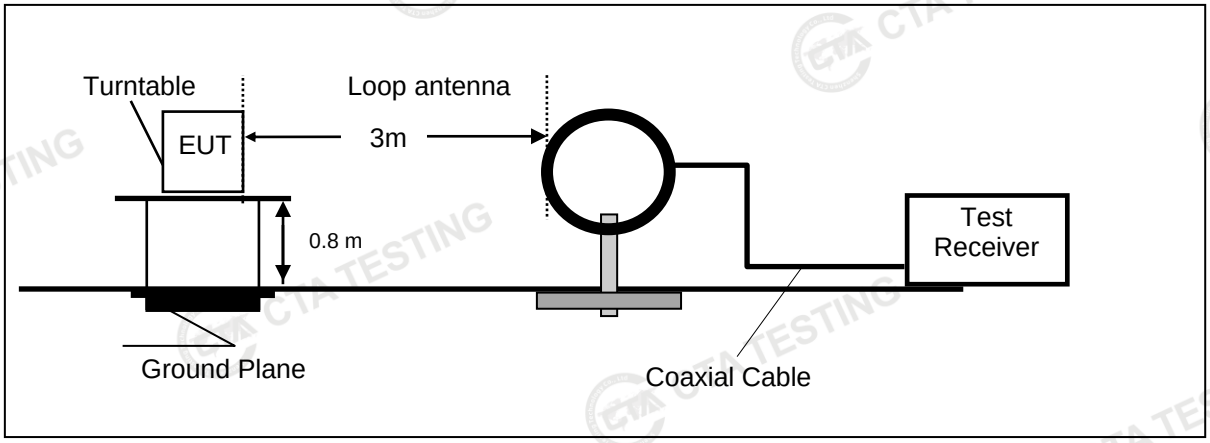
NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.231	9.99	29.39	39.38	62.41	23.03	16.31	26.30	52.41	26.11	PASS
2	0.3345	9.86	27.67	37.53	59.34	21.81	13.85	23.71	49.34	25.63	PASS
3	0.6495	10.11	29.90	40.01	56.00	15.99	14.33	24.44	46.00	21.56	PASS
4	1.4415	10.14	22.54	32.68	56.00	23.32	7.97	18.11	46.00	27.89	PASS
5	5.5635	10.18	16.89	27.07	60.00	32.93	0.87	11.05	50.00	38.95	PASS
6	10.626	10.40	16.04	26.44	60.00	33.56	1.85	12.25	50.00	37.75	PASS

Note:1).QP Value (dBµV)= QP Reading (dBµV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). QPMargin(dB) = QP Limit (dBµV) - QP Value (dBµV)
4). AVMargin(dB) = AV Limit (dBµV) - AV Value (dBµV)

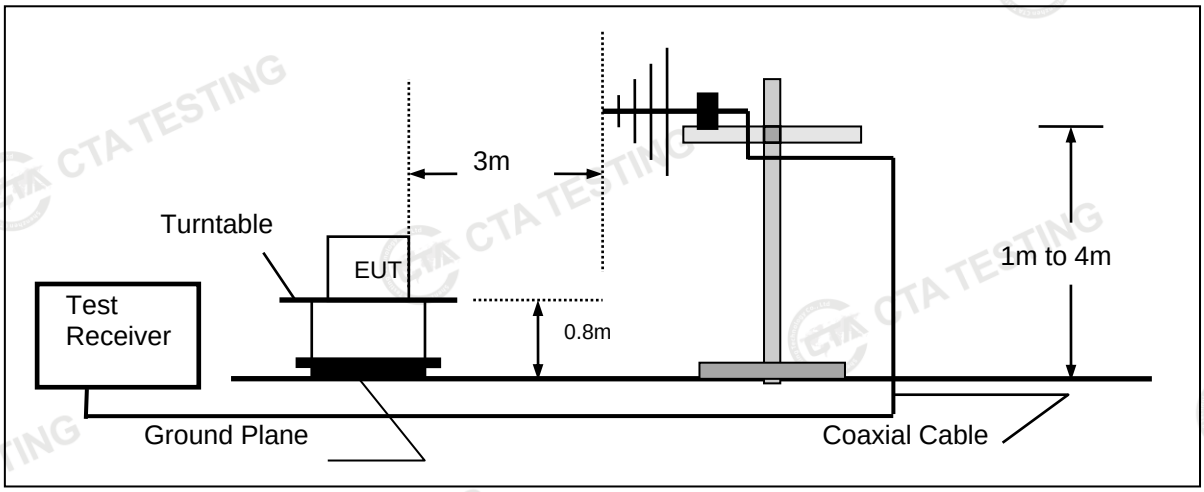
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

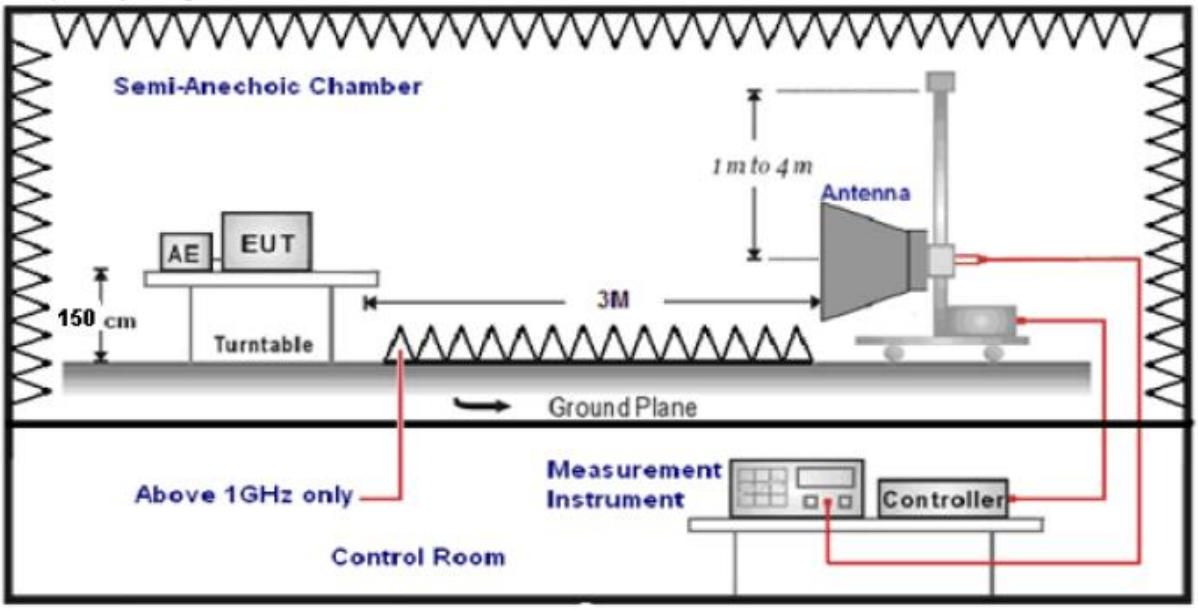
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

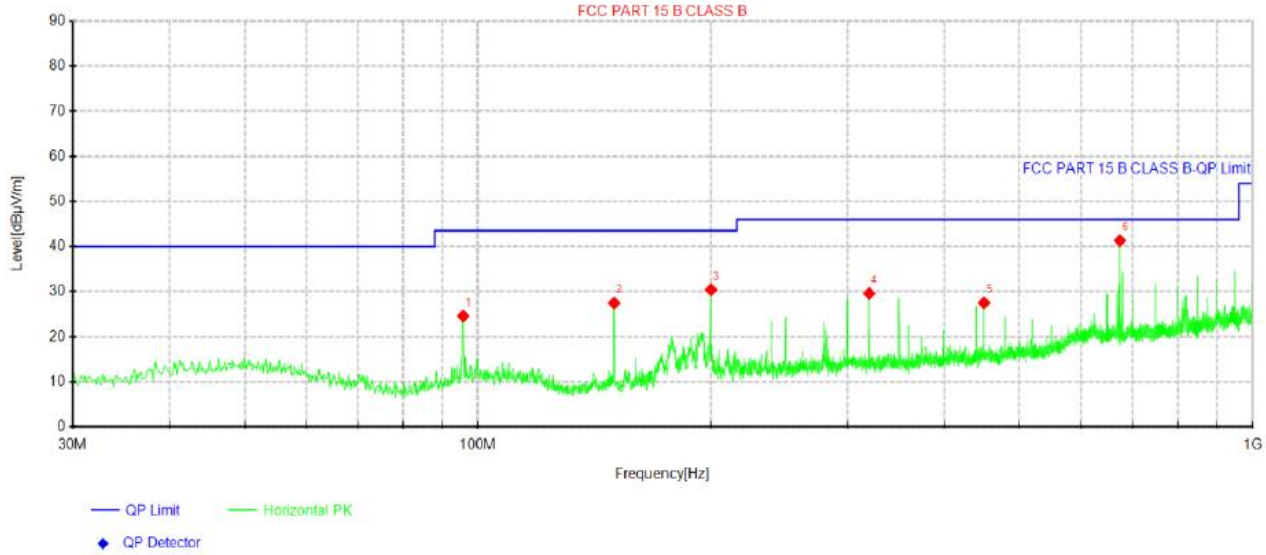
TEST RESULTS

Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. Zigbee were tested at Low, Middle, and High channel and recorded worst mode at Zigbee.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal



Suspected Data List

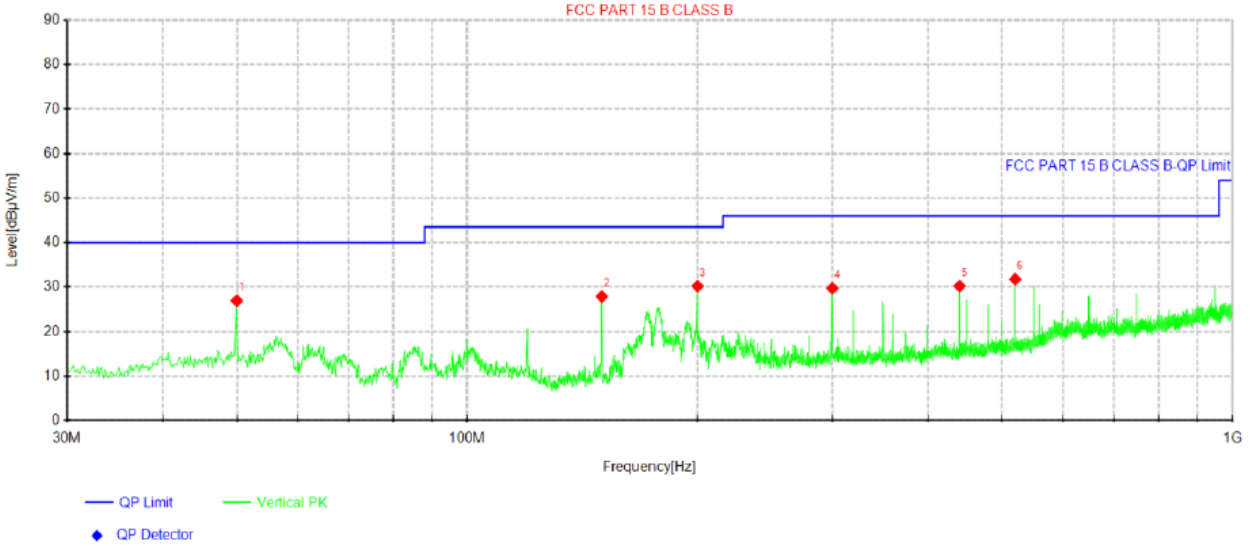
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	95.7175	38.82	24.60	-14.22	43.50	18.90	100	82	Horizontal
2	149.916	43.41	27.47	-15.94	43.50	16.03	100	257	Horizontal
3	199.992	43.68	30.43	-13.25	43.50	13.07	100	257	Horizontal
4	320.03	40.98	29.61	-11.37	46.00	16.39	100	210	Horizontal
5	450.01	37.48	27.52	-9.96	46.00	18.48	100	165	Horizontal
6	673.837	46.59	41.31	-5.28	46.00	4.69	100	210	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	50.0062	38.39	26.95	-11.44	40.00	13.05	100	360	Vertical
2	149.916	43.83	27.89	-15.94	43.50	15.61	100	321	Vertical
3	199.992	43.47	30.22	-13.25	43.50	13.28	100	360	Vertical
4	300.023	41.12	29.75	-11.37	46.00	16.25	100	358	Vertical
5	439.946	40.36	30.24	-10.12	46.00	15.76	100	181	Vertical
6	519.971	40.83	31.77	-9.06	46.00	14.23	100	343	Vertical

Note:1).Level (dBμV/m)= Reading (dBμV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBμV/m) - Level (dBμV/m)

For 1GHz to 25GHz

GFSK (above 1GHz)

Frequency(MHz):			2405		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	62.06	PK	74	11.94	66.33	32.33	5.12	41.72	-4.27
4804.00	45.20	AV	54	8.80	49.47	32.33	5.12	41.72	-4.27
7206.00	53.59	PK	74	20.41	54.11	36.6	6.49	43.61	-0.52
7206.00	43.35	AV	54	10.65	43.87	36.6	6.49	43.61	-0.52

Frequency(MHz):			2405		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.88	PK	74	14.12	64.15	32.33	5.12	41.72	-4.27
4804.00	43.24	AV	54	10.76	47.51	32.33	5.12	41.72	-4.27
7206.00	51.80	PK	74	22.20	52.32	36.6	6.49	43.61	-0.52
7206.00	41.48	AV	54	12.52	42.00	36.6	6.49	43.61	-0.52

Frequency(MHz):			2440		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	61.50	PK	74	12.50	65.38	32.6	5.34	41.82	-3.88
4880.00	44.43	AV	54	9.57	48.31	32.6	5.34	41.82	-3.88
7320.00	53.00	PK	74	21.00	53.11	36.8	6.81	43.72	-0.11
7320.00	42.74	AV	54	11.26	42.85	36.8	6.81	43.72	-0.11

Frequency(MHz):			2440		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4880.00	59.80	PK	74	14.20	63.68	32.6	5.34	41.82	-3.88
4880.00	41.83	AV	54	12.17	45.71	32.6	5.34	41.82	-3.88
7320.00	51.21	PK	74	22.79	51.32	36.8	6.81	43.72	-0.11
7320.00	41.16	AV	54	12.84	41.27	36.8	6.81	43.72	-0.11

Frequency(MHz):			2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	60.77	PK	74	13.23	63.85	32.73	5.66	41.47	-3.08
4960.00	43.68	AV	54	10.32	46.76	32.73	5.66	41.47	-3.08
7440.00	52.33	PK	74	21.67	51.88	37.04	7.25	43.84	0.45
7440.00	41.85	PK	54	12.15	41.40	37.04	7.25	43.84	0.45

Frequency(MHz):			2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	58.79	PK	74	15.21	61.87	32.73	5.66	41.47	-3.08
4960.00	42.17	AV	54	11.83	45.25	32.73	5.66	41.47	-3.08
7440.00	50.77	PK	74	23.23	50.32	37.04	7.25	43.84	0.45
7440.00	40.34	PK	54	13.66	39.89	37.04	7.25	43.84	0.45

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

GFSK

Frequency(MHz):			**2405**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	61.84	PK	74	12.16	72.26	27.42	4.31	42.15	-10.42
2390.00	43.68	AV	54	10.32	54.10	27.42	4.31	42.15	-10.42
Frequency(MHz):			**2405**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	60.17	PK	74	13.83	70.59	27.42	4.31	42.15	-10.42
2390.00	41.95	AV	54	12.05	52.37	27.42	4.31	42.15	-10.42
Frequency(MHz):			**2480**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	61.18	PK	74	12.82	71.29	27.7	4.47	42.28	-10.11
2483.50	42.98	AV	54	11.02	53.09	27.7	4.47	42.28	-10.11
Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	59.28	PK	74	14.72	69.39	27.7	4.47	42.28	-10.11
2483.50	41.02	AV	54	12.98	51.13	27.7	4.47	42.28	-10.11

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 30dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration

Test Results

Type	Channel	Output power (dBm)	Limit (dBm)	Result
OQPSK	11	-2.28	30.00	Pass
	18	-2.44		
	26	-2.44		

Note: 1.The test results including the cable lose.

4.4 Power Spectral Density

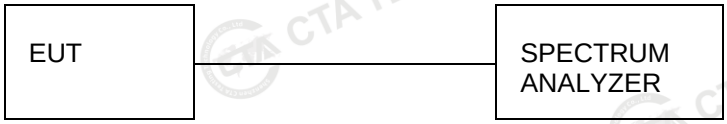
Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW ≥ 3 kHz.
3. Set the VBW ≥ 3× RBW.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8dBm.

Test Configuration

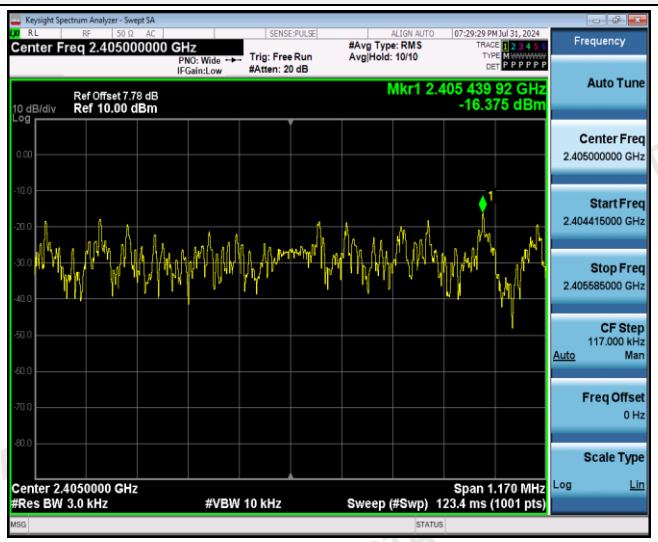


Test Results

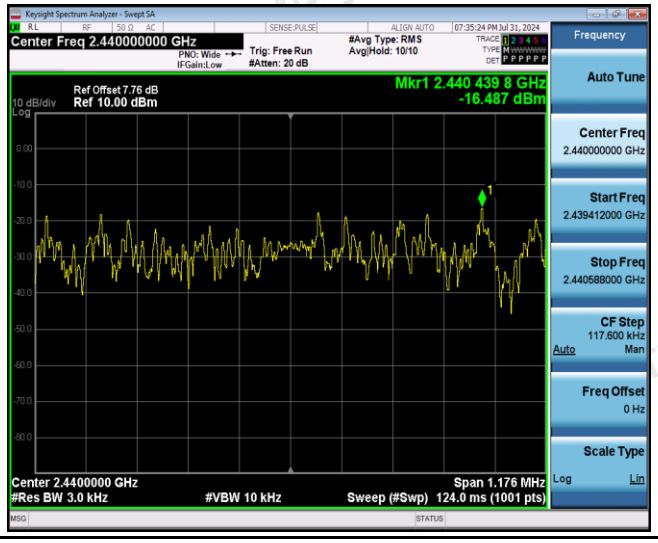
Type	Channel	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
OQPSK	11	-16.38	8.00	Pass
	18	-16.49		
	26	-16.98		

Test plot as follows:

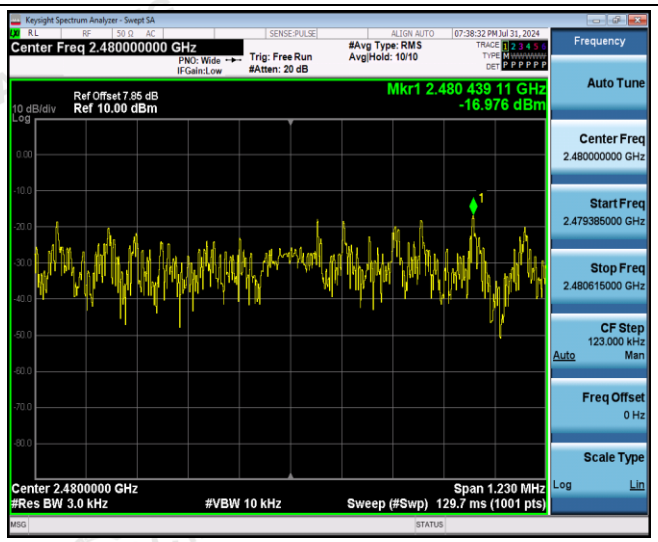
OQPSK



CH11



CH18



CH26

4.5 6dB Bandwidth

Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100 KHz RBW and 300 KHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

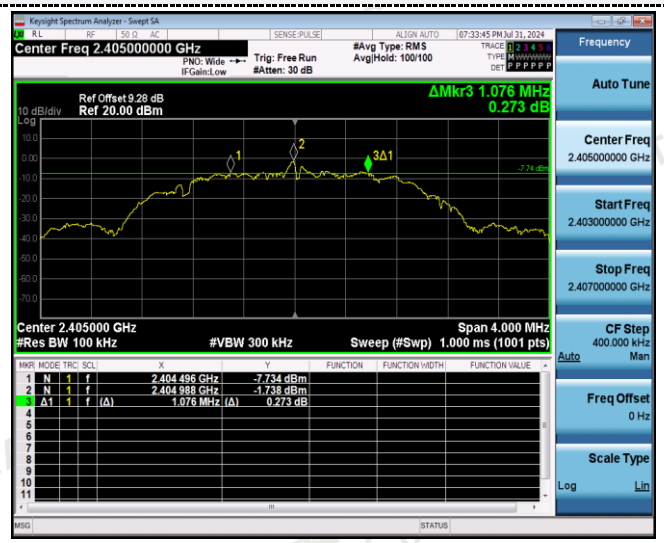
Test Configuration

Test Results

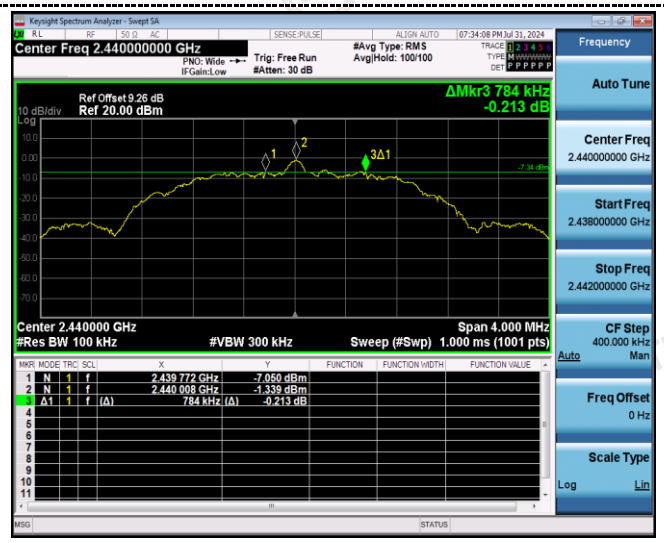
Type	Channel	6dB Bandwidth (MHz)	Limit (KHz)	Result
OQPSK	11	1.076	≥500	Pass
	18	0.784		
	26	0.820		

Test plot as follows:

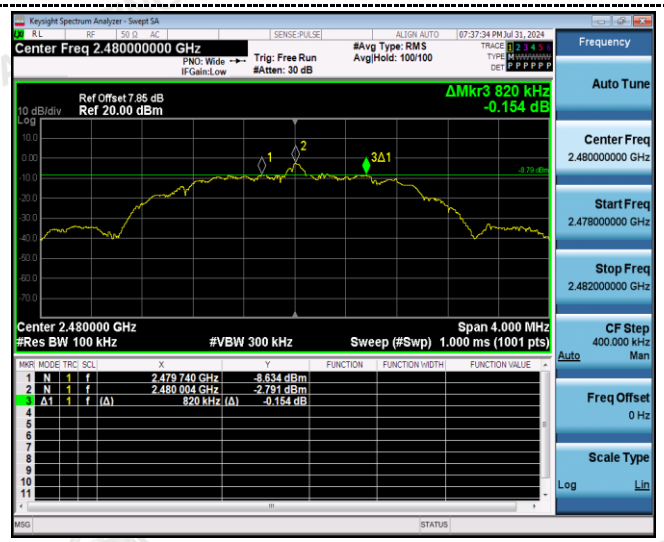
OQPSK



CH11



CH18



CH26

4.6 Out-of-band Emissions

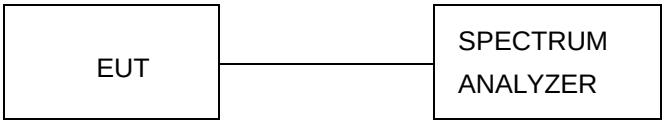
Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

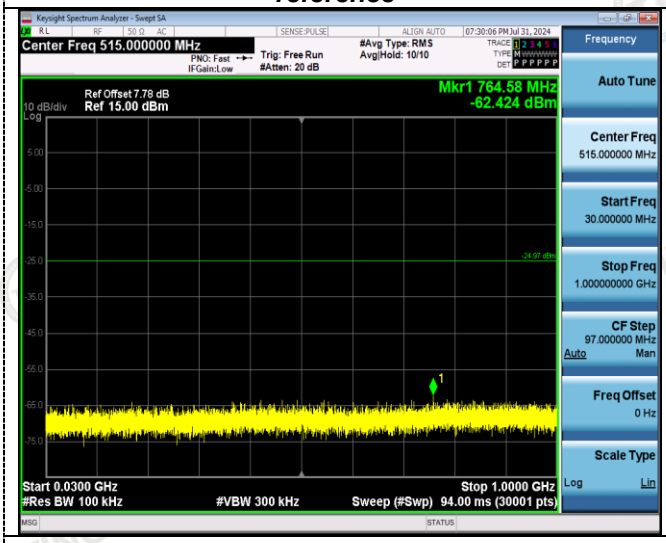
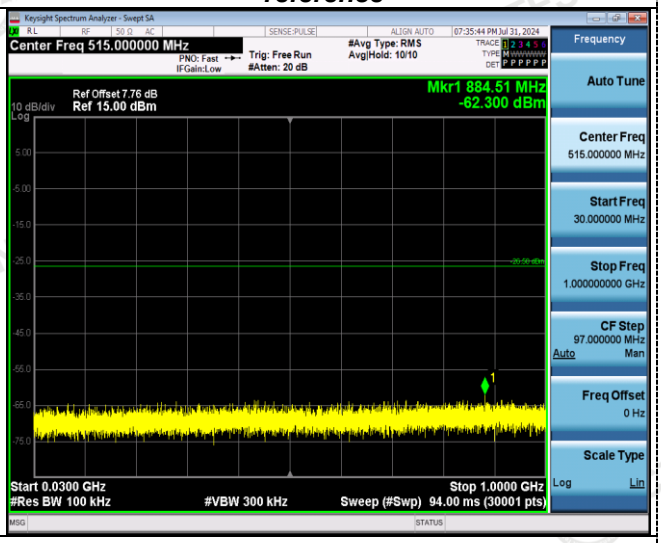
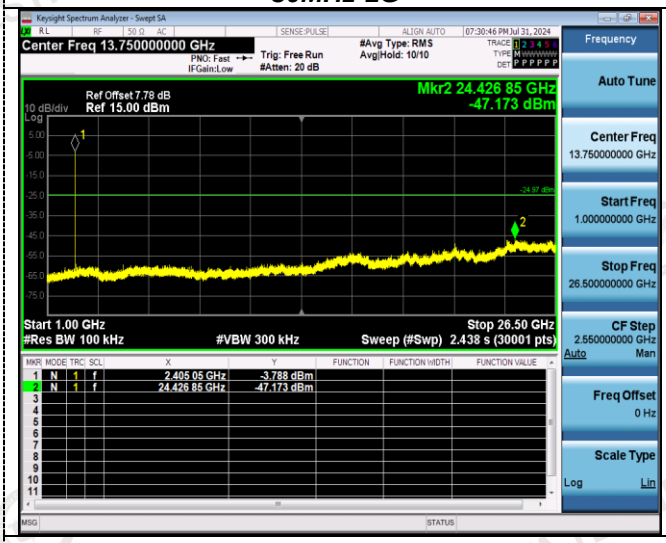
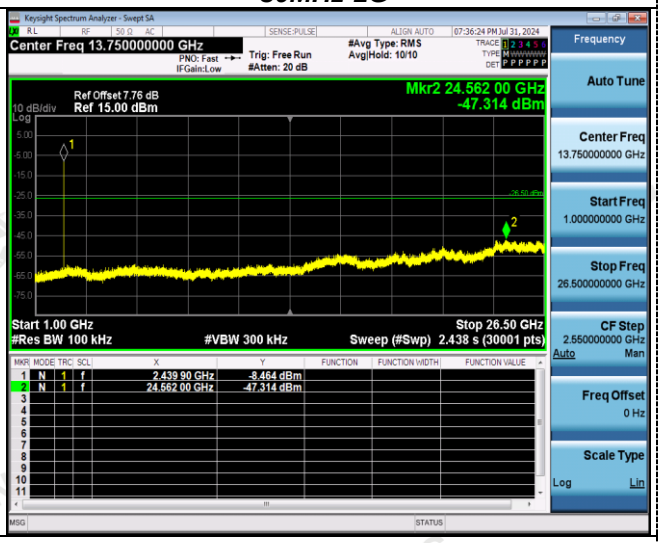
Test Configuration

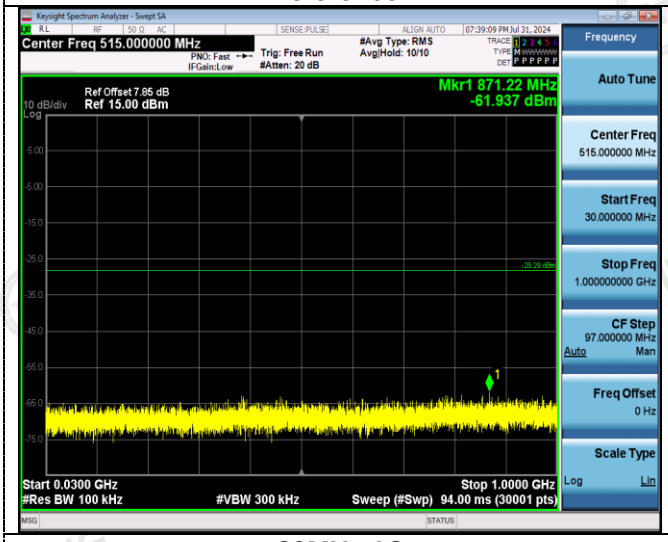
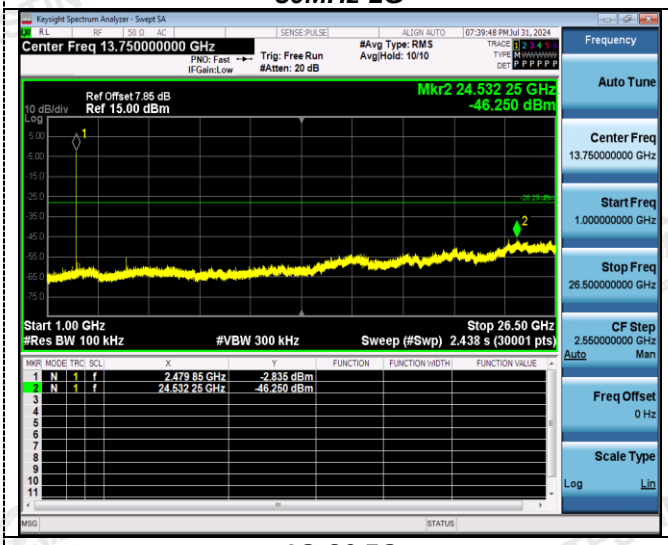


Test Results

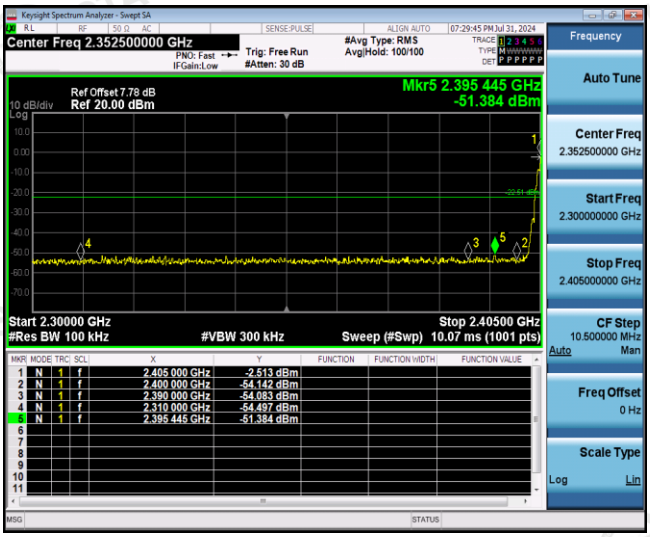
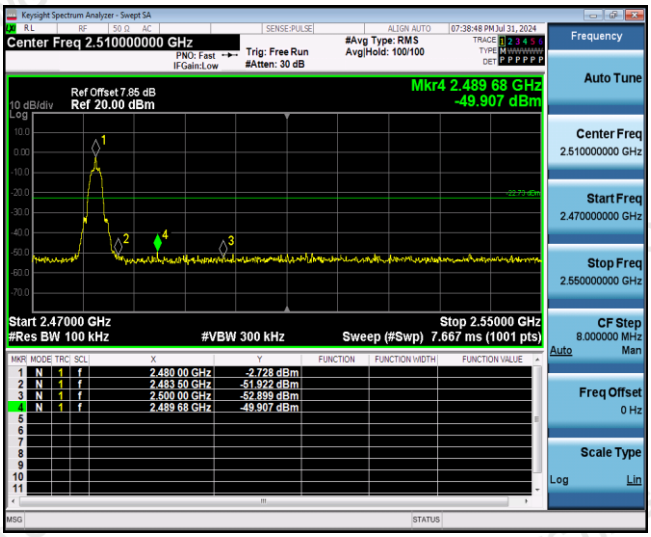
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

Test plot as follows:

OQPSK (CH11)	OQPSK (CH18)
reference	reference
	
30MHz-1G	30MHz-1G
	
1G-26.5G	1G-26.5G

OQPSK (CH26)	
reference	
	
30MHz-1G	
	
1G-26.5G	

Band-edge Measurements for RF Conducted Emissions:

OQPSK	
	
Left bandedge	Right bandedge

4.7 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

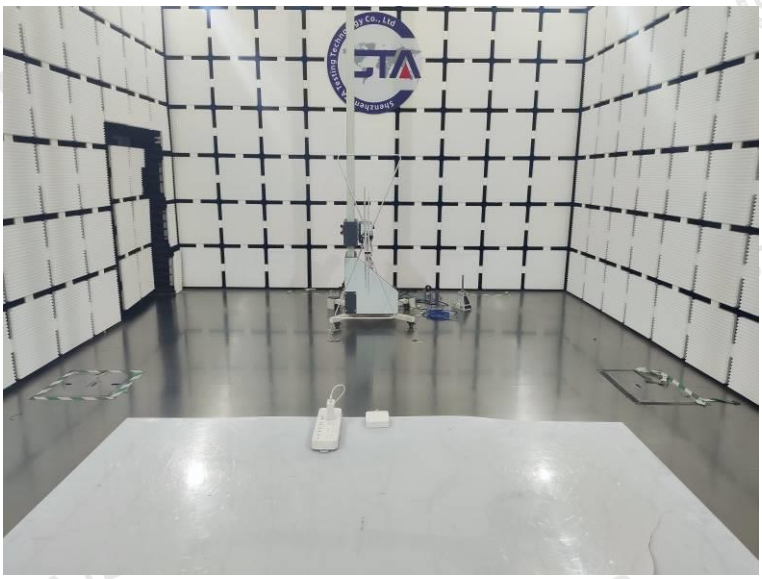
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

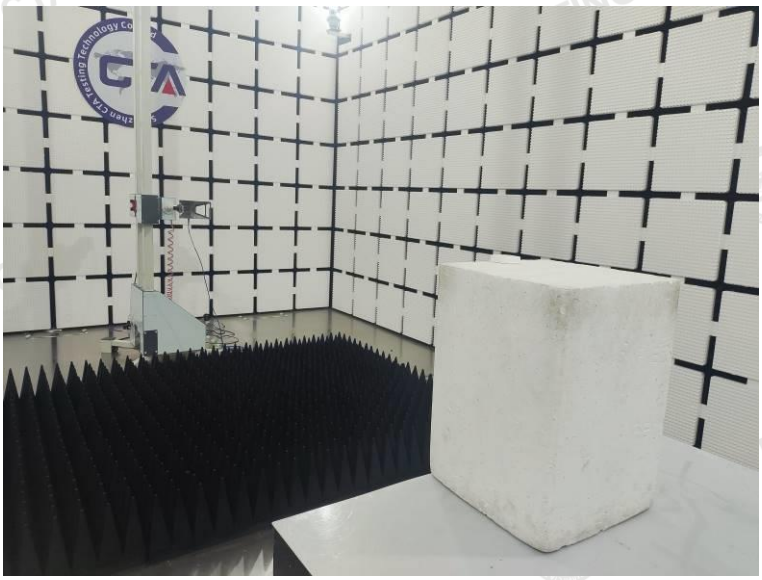
Antenna Connected Construction

The gain of antenna was 0.52 dBi.

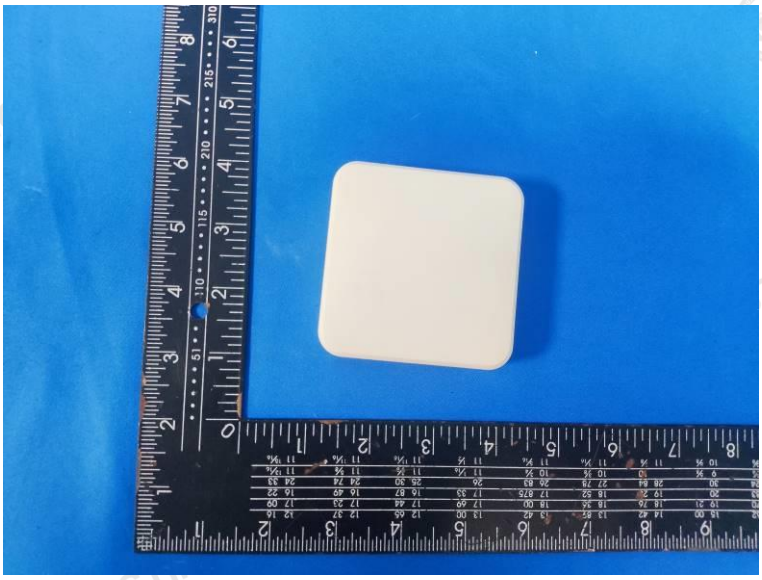
Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen CTA Testing Technology Co., Ltd. does not assume any responsibility.

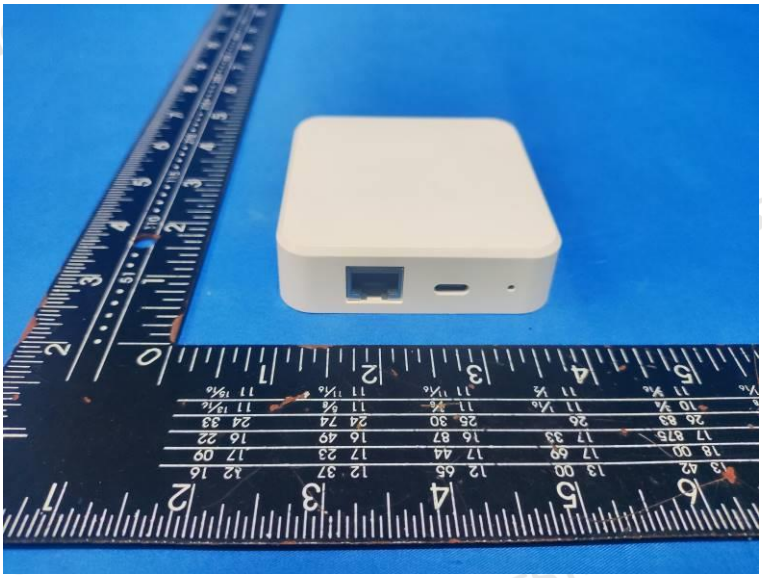
Test Setup Photos of the EUT

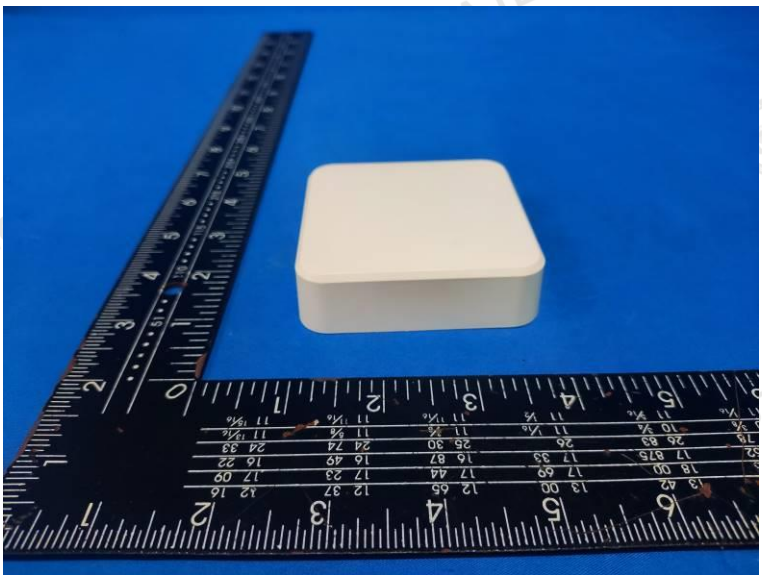


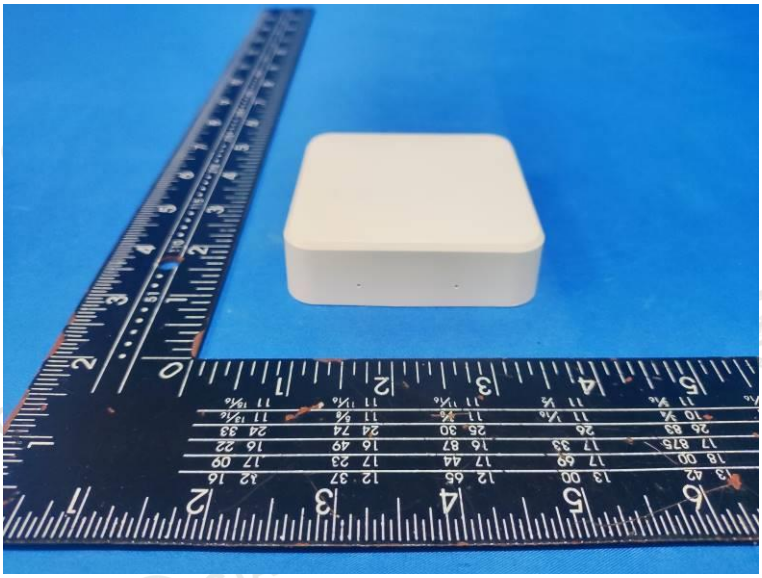


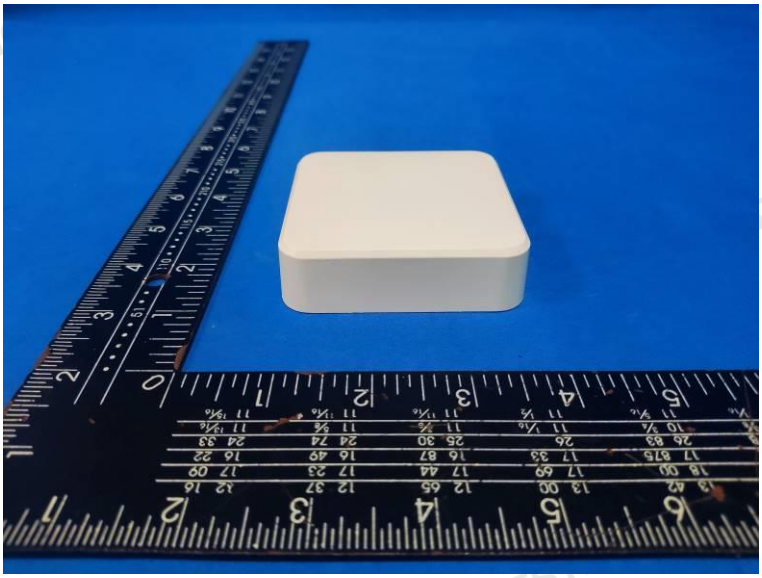
5 Photos of the EUT

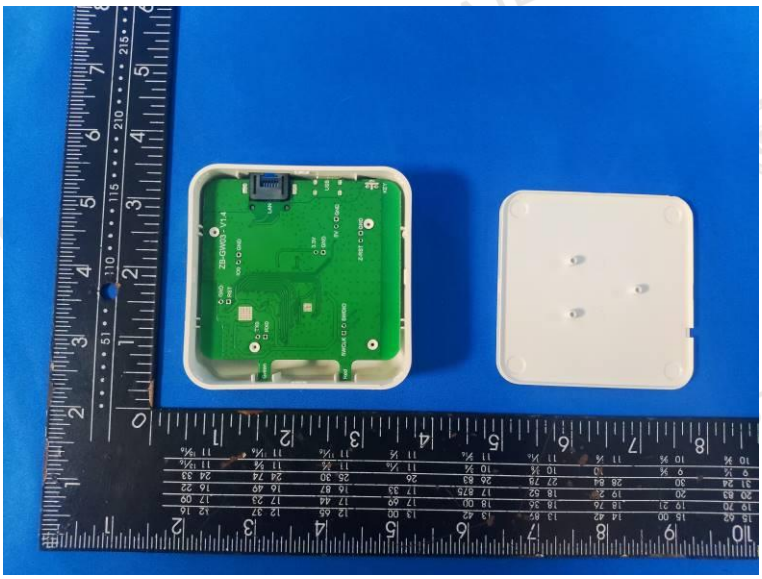


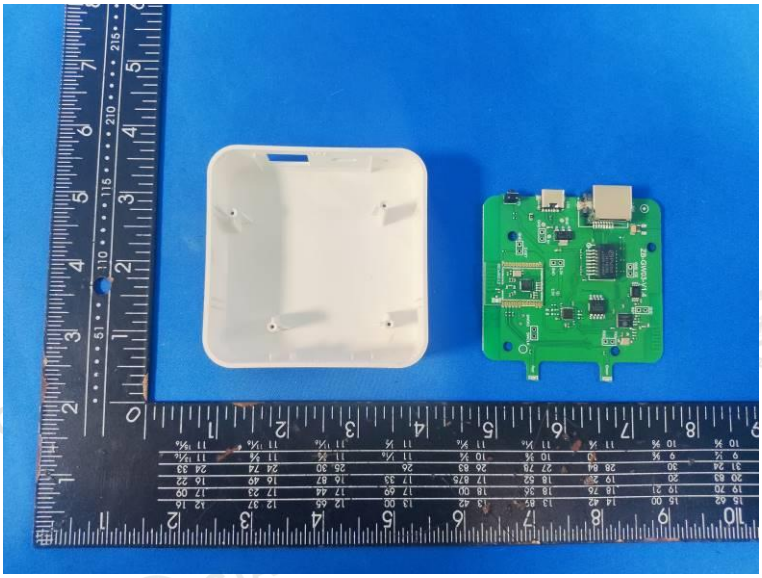


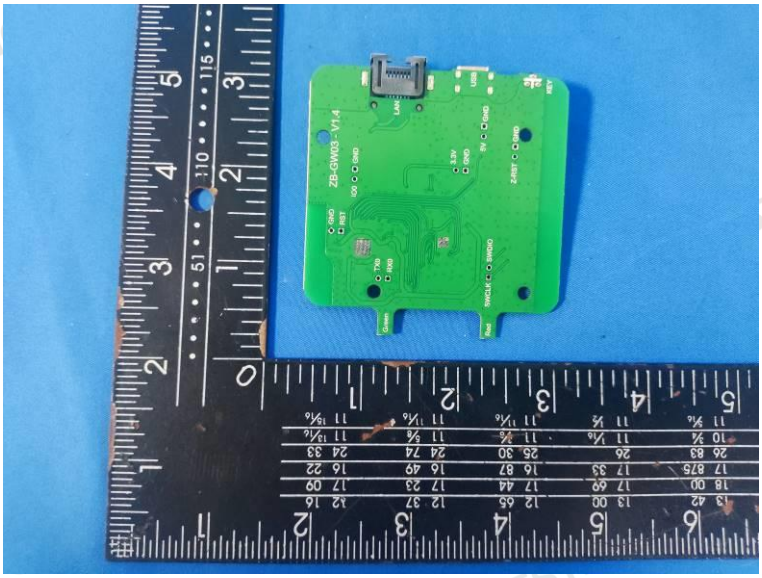


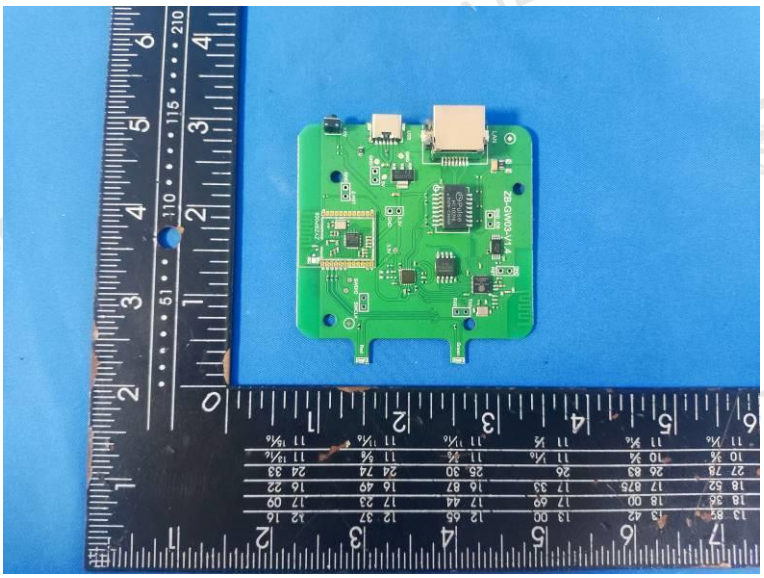


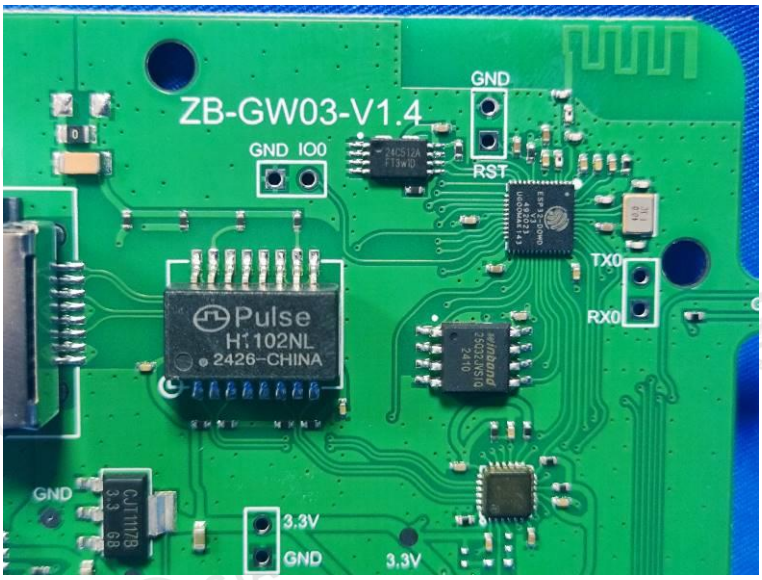











ZB-GW03-V1.4
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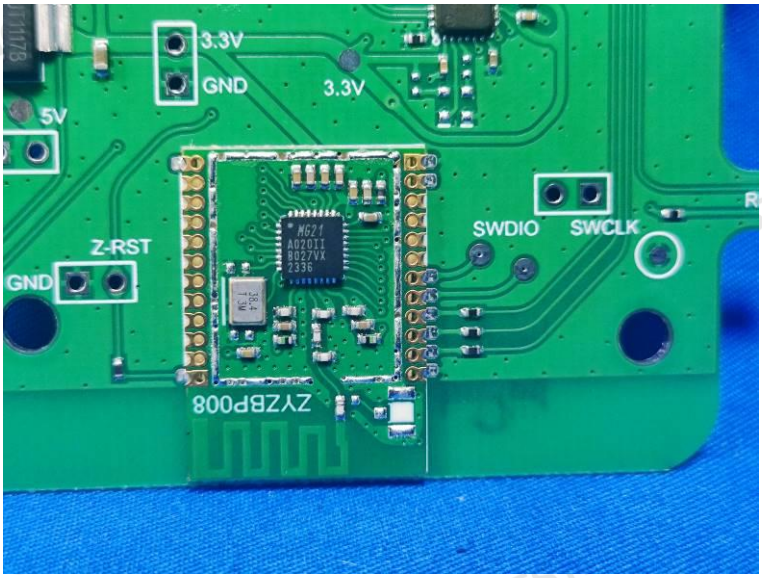
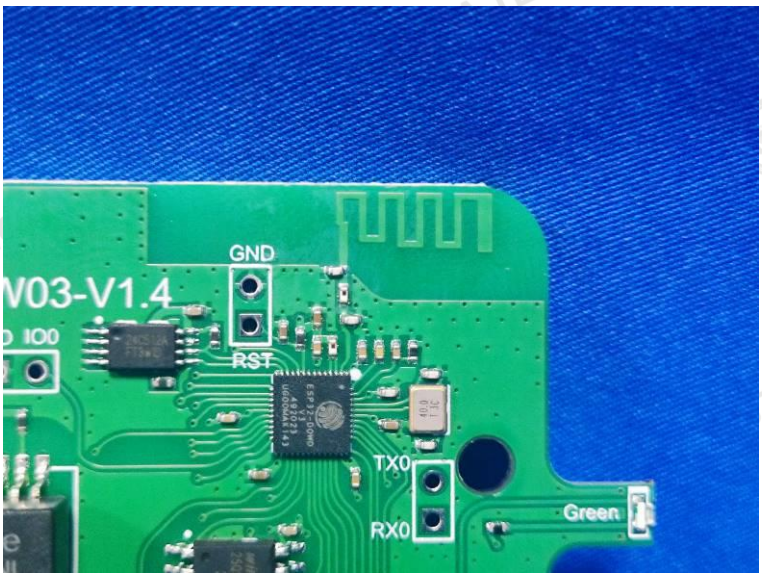
IO0
GND
RST
TX0
RX0
Pulse
H1102NL
2426-CHINA
GND
3.3V
GND
3.3V


3.3V
GND
3.3V
5V
Z-RST
GND
SWDIO
SWCLK
ZYZBP008


GND
W03-V1.4
IO0
RST
TX0
RX0
Green

********** End of Reprt **********