



Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street,
Bao'an District, Shenzhen, China

FCC PART 15 SUBPART CTEST REPORT

FCC PART 15.247

Report Reference No.: CTA26042002901

FCC ID.: 2BR3K-DBCAM-M52-1

Compiled by

(position+printedname+signature) ...: File administrators Zoey Cao

Supervised by

(position+printedname+signature): Project Engineer Ace Chai

Approved by

(position+printedname+signature): RF Manager Eric Wang

Date of issue: May 09, 2026

Testing Laboratory Name: Shenzhen CTA Testing Technology Co., Ltd.

Address: Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community,
Fuhai Street, Bao'an District, Shenzhen, China

Applicant's name: HK EKO ELECTRONICS LIMITED

Address: FLAT/RM 1 14/F HENLEY INDUSTRIAL CENTRE, 9-15 BUTE
STREET, MONG KOK KL, HONGKONG, China

Test specification:

Standard: FCC Part 15.247

Shenzhen CTA Testing Technology Co., Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen CTA Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen CTA Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Equipment description: Doorbell Camera

Trade Mark: N/A

Manufacturer: HK EKO ELECTRONICS LIMITED

Model/Type reference: M52

Listed Models: P52, T52, U52, V52, N52

Modulation: GFSK

Frequency: From 2402MHz to 2480MHz

Ratings: Rechargeable Li-ion Battery DC 3.7V

Result: PASS

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: http://www.cta-test.cn

TEST REPORT

Equipment under Test : Doorbell Camera

Model /Type : M52

Listed Models : P52, T52, U52, V52, N52

Model difference : M52 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names, color and appearance. So the test data of M52 can represent the remaining models.

Applicant : HK EKO ELECTRONICS LIMITED

Address : FLAT/RM 1 14/F HENLEY INDUSTRIAL CENTRE, 9-15 BUTTE STREET, MONG KOK KL, HONGKONG, China

Manufacturer : HK EKO ELECTRONICS LIMITED

Address : FLAT/RM 1 14/F HENLEY INDUSTRIAL CENTRE, 9-15 BUTTE STREET, MONG KOK KL, HONGKONG, 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 configuration	5
2.6	EUT operation mode.....	6
2.7	Block Diagram of Test Setup	6
2.8	Related Submittal(s) / Grant (s).....	6
2.9	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	10
4.1	AC Power Conducted Emission	10
4.2	Radiated Emissions	13
4.3	Maximum Peak Output Power.....	26
4.4	Power Spectral Density	27
4.5	6dB Bandwidth.....	28
4.6	Out-of-band Emissions	29
4.7	Antenna Requirement.....	30
4.8	On Time and Duty Cycle	31
4.9	Emissions at Restricted Band.....	32
5	Test Setup Photos of the EUT	34
6	Photos of the EUT	36

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 C63.10-2020 +COR. 1-2023+ C63.10A-2024+ ERRATA TO C63.10A-2024](#): 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	:	Apr. 20, 2026
Testing commenced on	:	Apr. 20, 2026
Testing concluded on	:	May 09, 2026

2.2 Product Description*

Product Description:	Doorbell Camera
Model/Type reference:	M52
Power supply:	DC 5V(Adapter Input AC 120V/60Hz) or Rechargeable Li-ion Battery DC 3.7V
Hardware version:	M52_MAIN V1.0
Software version:	M500_103_119
Testing sample ID:	CTA260420029-1# (Engineer sample) CTA260420029-2# (Normal sample)
Bluetooth BLE	
Supported type:	Bluetooth low Energy
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2 MHz
Antenna type:	Internal Antenna
Antenna gain:	2.99dBi

2.3 Equipment Under Test

Power supply system utilised

Refer to section 2.2

2.4 Short description of the Equipment under Test (EUT)

This is a Doorbell Camera.

For more details, refer to the user's manual of the EUT.

Test Software Version	ETF GUI Tool(Version:1.3.3d)		
Frequency	2402 MHz	2440MHz	2480 MHz
GFSK	5	5	5

2.5 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

● Adapter (Auxiliary test supplied by testing Lab)	Model: HW-100225C00 Input: AC100-240V 50/60Hz 0.75A Output: DC5V 2A, DC9V 2A, DC 10V 2.25A
● PC (Auxiliary test supplied by testing Lab)	Model: TB000602317 Trade Mark: ThinkPad
● USB serial port board (Auxiliary test supplied by testing Lab)	Model: USB To TTL

2.6 EUT operation mode

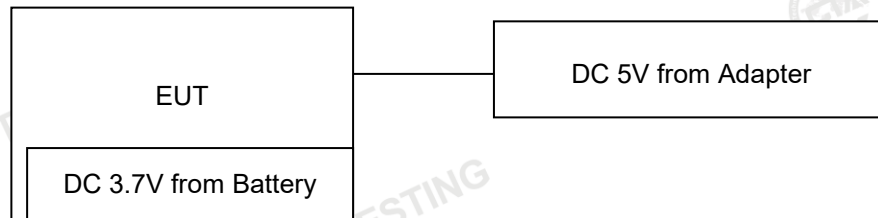
The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 40 channels provided to the EUT and Channel 00/19/39 were selected to test.

Operation Frequency:

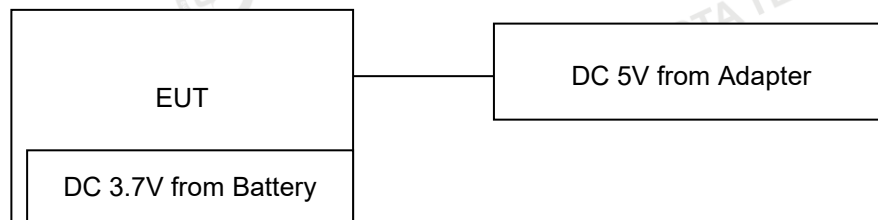
Channel	Frequency (MHz)
00	2402
01	2404
02	2406
⋮	⋮
19	2440
⋮	⋮
37	2476
38	2478
39	2480

2.7 Block Diagram of Test Setup

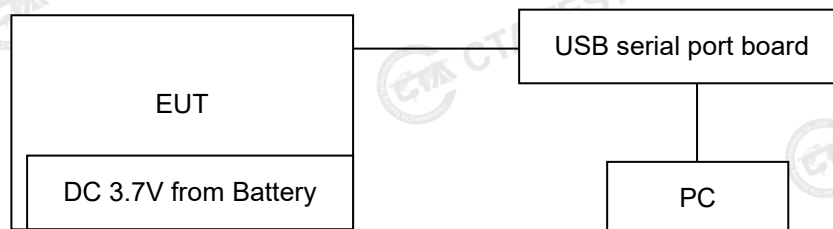
AC Power Conducted Emission



Radiated Emission



RF Conducted



2.8 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.

2.9 Modifications

No modifications were implemented to meet testing criteria.

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: <http://www.cta-test.cn>

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:	25 ° C
Humidity:	60 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing:

Temperature:	25 ° C
Humidity:	60 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	25 ° C
Humidity:	55 %
Atmospheric pressure:	950-1050mbar

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

Tel:+86-755 2322 5875 E-mail:cta@cta-test.cn Web:http://www.cta-test.cn

3.4 Summary of measurement results

Test Specification clause	Test case	Test result
§15.247(e)	Power spectral density	complies
§15.247(a)(2)	Spectrum bandwidth – 6 dB bandwidth	complies
§15.247(b)(3)	Maximum output Peak power	complies
§15.247(d)	Band edge compliance conducted	complies
§15.205	Band edge compliance radiated	complies
§15.247(d)	TX spurious emissions conducted	complies
§15.247(d)	TX spurious emissions radiated	complies
§15.209(a)	TX spurious Emission radiated Below 1GHz	complies
§15.207	AC Power Conducted Emission	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. RF Conducted test Offset= cable loss, For conducted spurious emission test, cable loss is the maximum value in the range of test.

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)
Time	/	±2%	(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

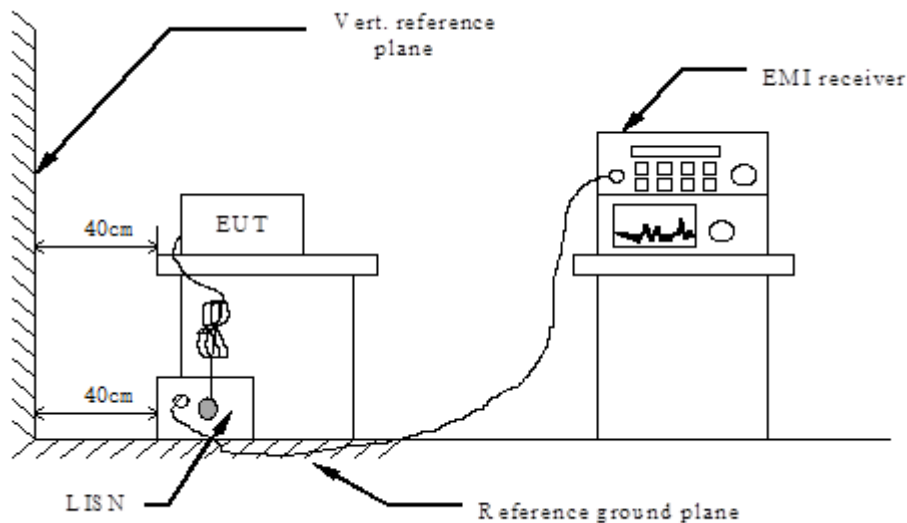
Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2025/08/04	2026/08/03
LISN	R&S	ENV216	CTA-314	2025/07/30	2026/07/29
EMI Test Receiver	R&S	ESPI	CTA-307	2025/07/30	2026/07/29
EMI Test Receiver	R&S	ESCI	CTA-306	2025/07/30	2026/07/29
Spectrum Analyzer	Agilent	N9020A	CTA-342	2025/07/30	2026/07/29
Vector Signal generator	Agilent	N5182A	CTA-305	2025/07/30	2026/07/29
Analog Signal Generator	R&S	E4421B	CTA-304	2025/07/30	2026/07/29
WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW500	CTA-302	2025/07/30	2026/07/29
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2025/07/31	2026/07/30
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2023/10/17	2026/10/16
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2023/10/13	2026/10/12
Loop Antenna	Zhinan	ZN30900C	CTA-311	2023/10/17	2026/10/16
Horn Antenna	Schwarzbeck	BBHA 9170	CTA-346	2025/05/18	2028/05/17
Amplifier	Schwarzbeck	BBV9745	CTA-312	2025/07/30	2026/07/29
Amplifier	Tonscend	TAP-011840	CTA-313	2025/07/30	2026/07/29
Automatic control unit	Tonscend	JS0806-2	CTA-351	2025/07/30	2026/07/29
Amplifier	SKET	LNPA 1840G-50	CTA-345	2025/05/17	2026/05/16
Spectrum analyzer	R&S	FSV40-N	CTA-344	2025/05/17	2026/05/16
2.4GFilter	HX Microwave	HXLBQ-DZA61	CTA-365	2025/07/31	2026/07/30
6dB attenuator	Shanghaihuaxiang	GZL-TS5-6-6	CTA-347	2025/05/17	2026/05/16
Programmable Constant Temperature And Humidity Test Chamber	DONGGUAN JINGYU	HT-H-408	CTA-053	2025/07/30	2026/07/29
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

Note: The automatic control unit integrated Power sensor

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 table top system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2020.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2020
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2020
- 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

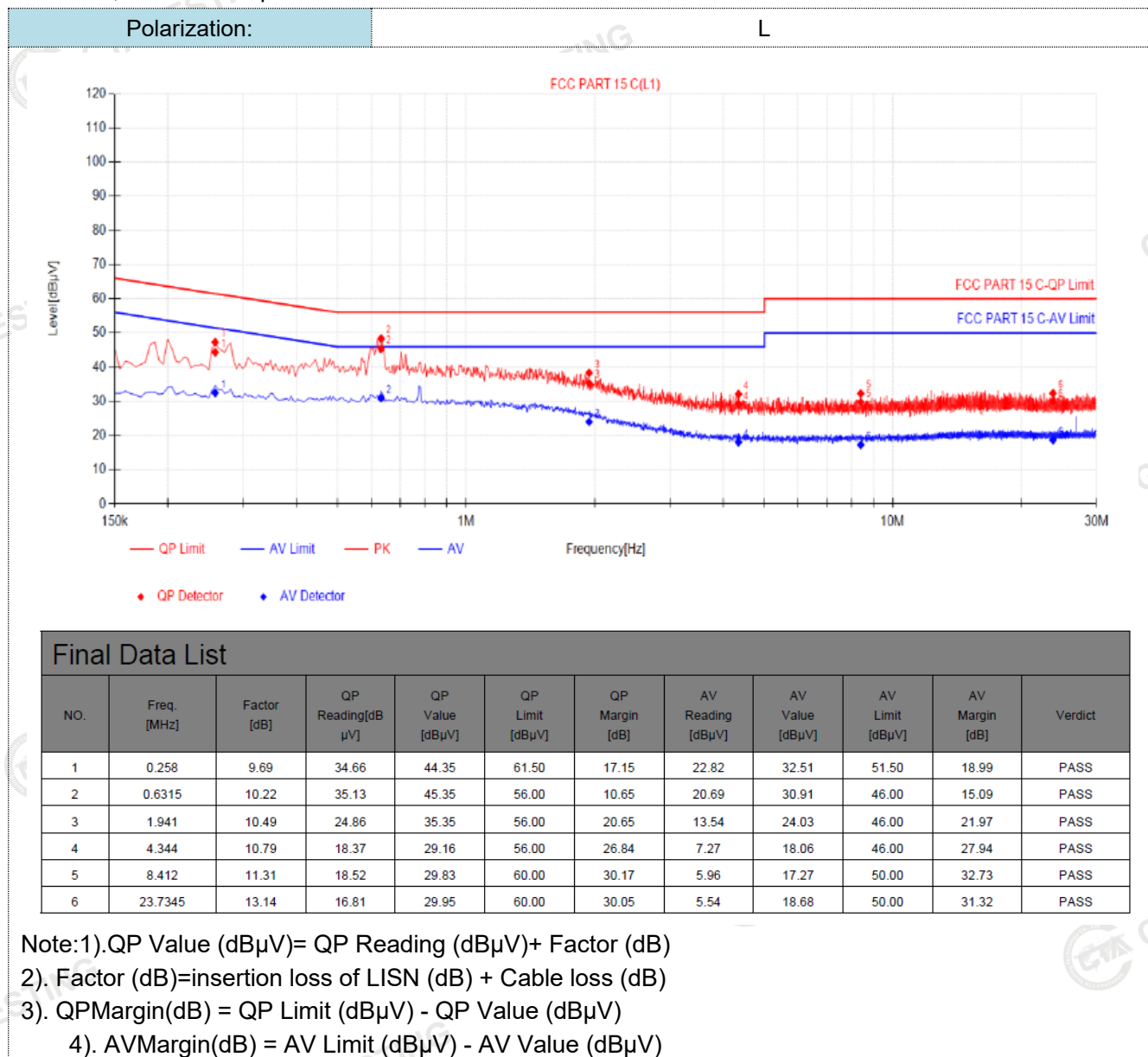
Remark:

1. BLE 1M, BLE 2M was tested at Low, Middle, and High channel; only the worst result of BLE 2M Middle channel was reported as below:

Shenzhen CTA Testing Technology Co., Ltd.

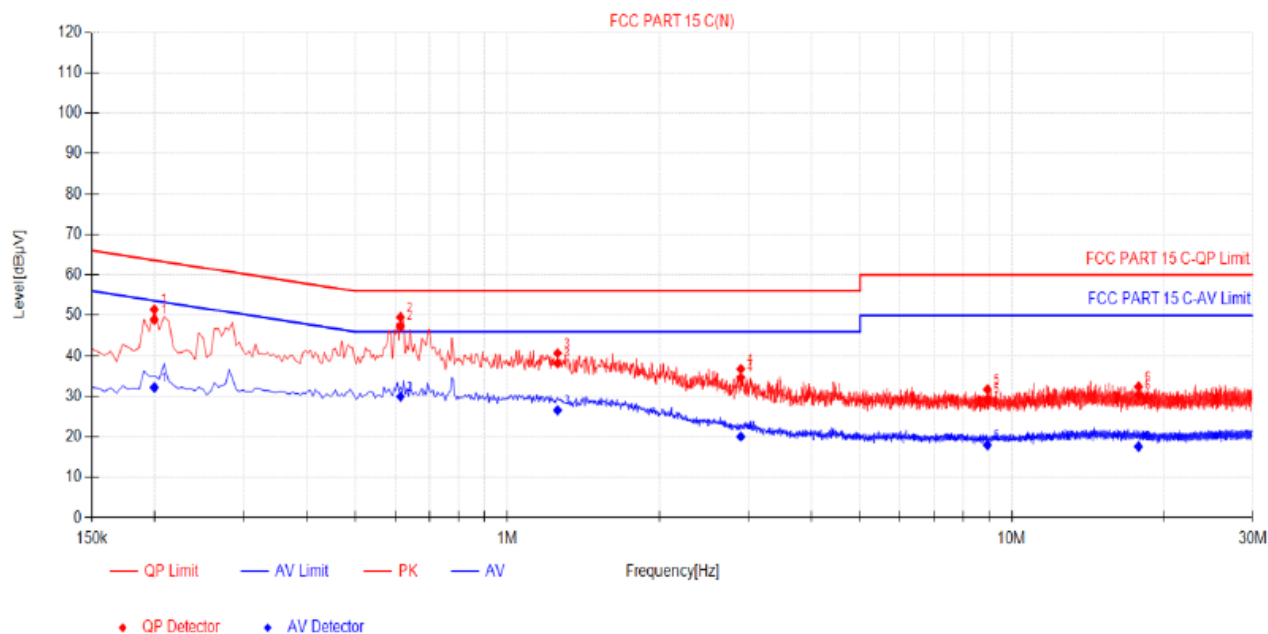
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: http://www.cta-test.cn

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:



Polarization:

N



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dB μV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1995	9.97	38.97	48.94	63.63	14.69	22.23	32.20	53.63	21.43	PASS
2	0.6135	10.23	37.17	47.40	56.00	8.60	19.72	29.95	46.00	16.05	PASS
3	1.257	10.40	27.75	38.15	56.00	17.85	16.18	26.58	46.00	19.42	PASS
4	2.8995	10.60	24.06	34.66	56.00	21.34	9.46	20.06	46.00	25.94	PASS
5	8.9475	11.46	17.93	29.39	60.00	30.61	6.49	17.95	50.00	32.05	PASS
6	17.8215	12.74	17.60	30.34	60.00	29.66	4.82	17.56	50.00	32.44	PASS

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

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

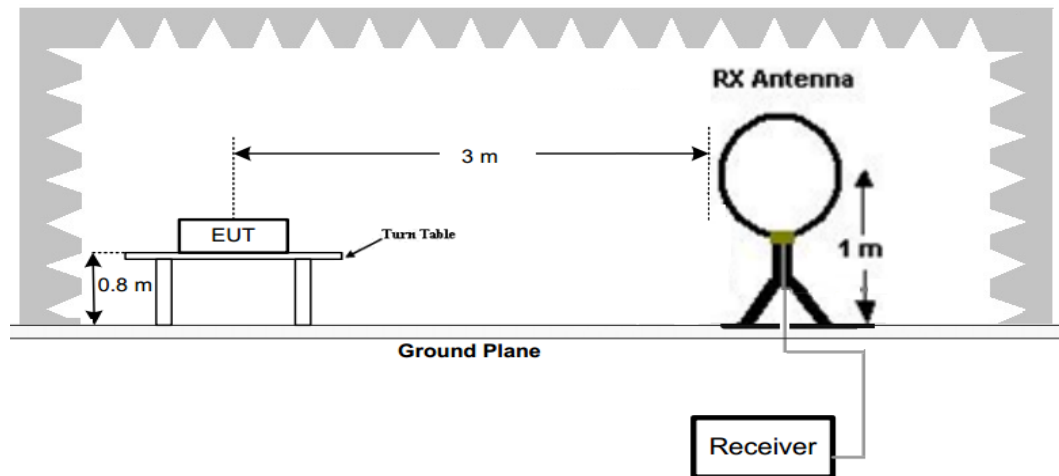
3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

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

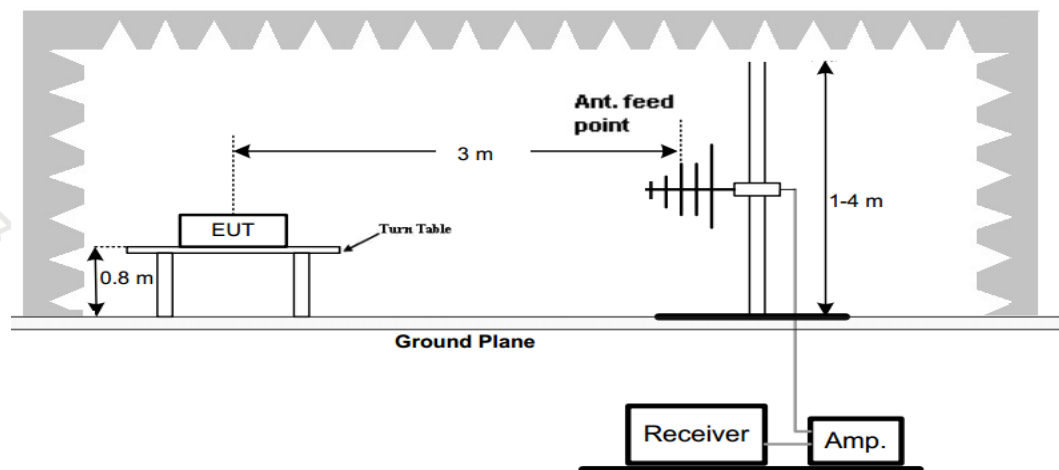
4.2 Radiated Emissions

TEST CONFIGURATION

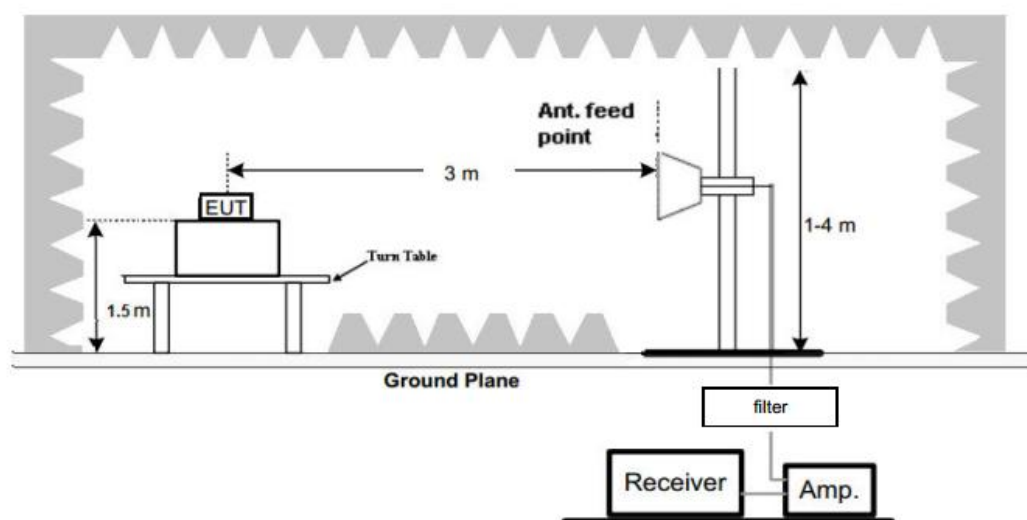
Frequency range 9 KHz–30MHz

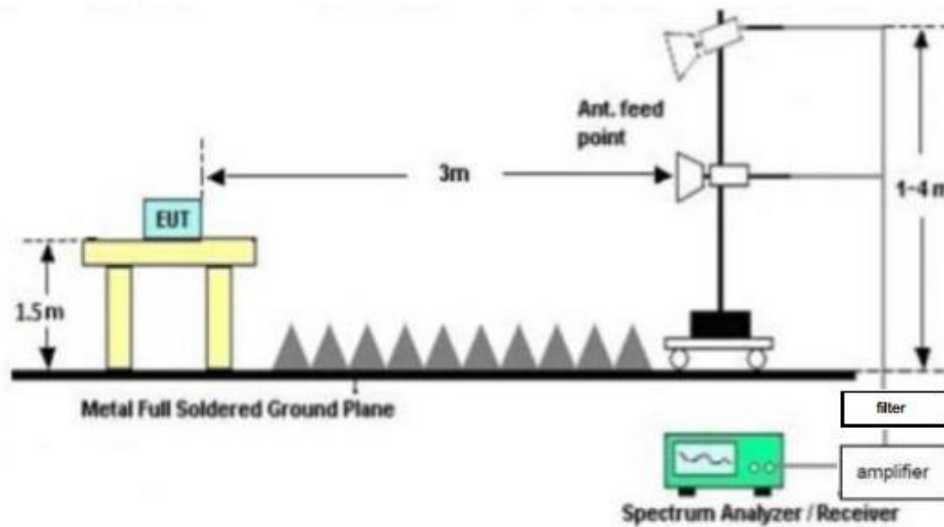


Frequency range 30MHz – 1000MHz



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°C to 360°C 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 Antenna	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	

$$\text{Transd} = AF + CL - AG$$

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: http://www.cta-test.cn

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 the 100kHz 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.

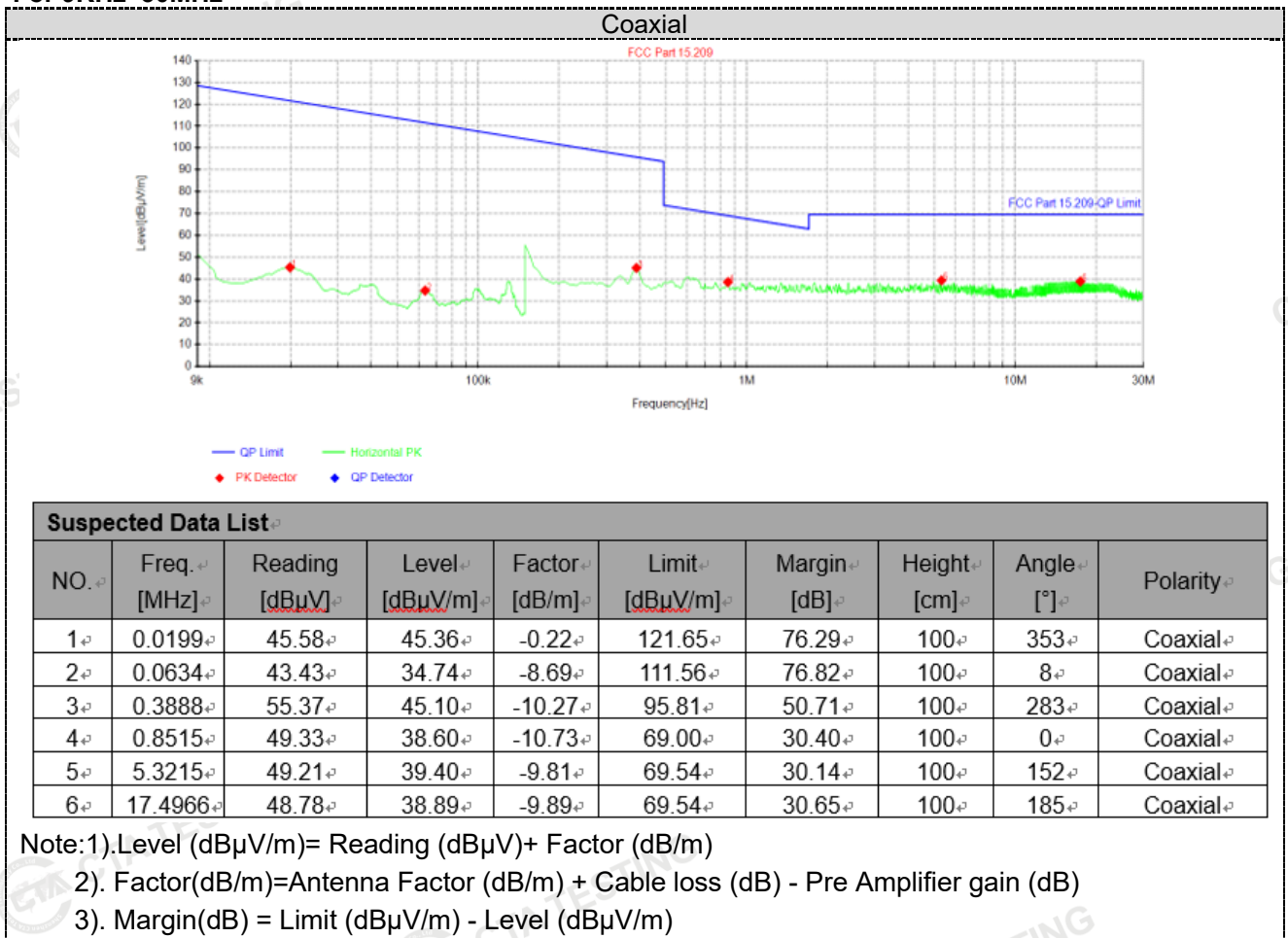
Frequency(MHz)	Distance(Meters)	Radiated(dBμV/m)	Radiated(μV/m)
0.009-0.49	3	$20\log(2400/F(KHz))+40\log(300/3)$	$2400/F(KHz)$
0.49-1.705	3	$20\log(24000/F(KHz))+40\log(30/3)$	$24000/F(KHz)$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0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

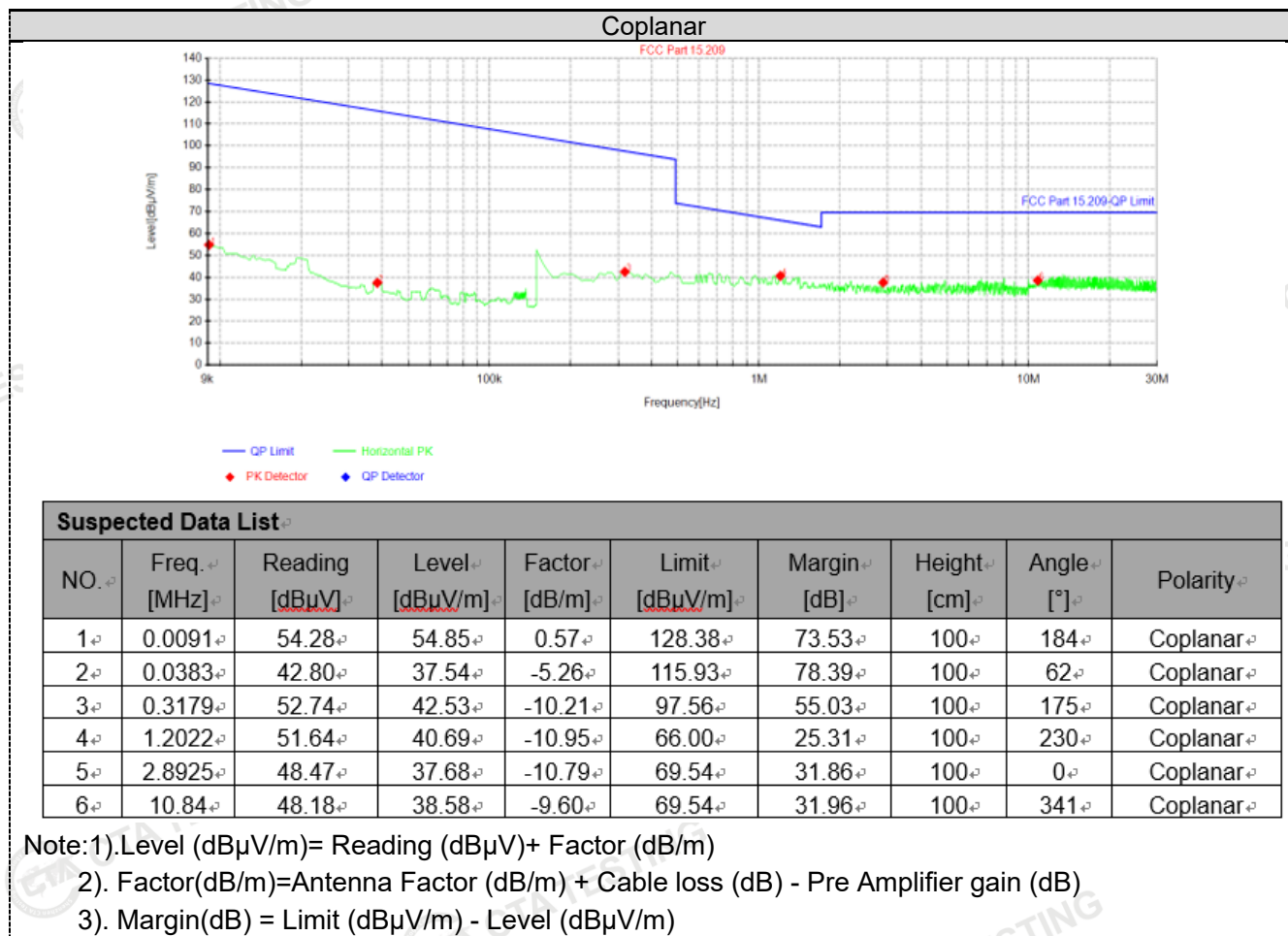
TEST RESULTS

Remark:

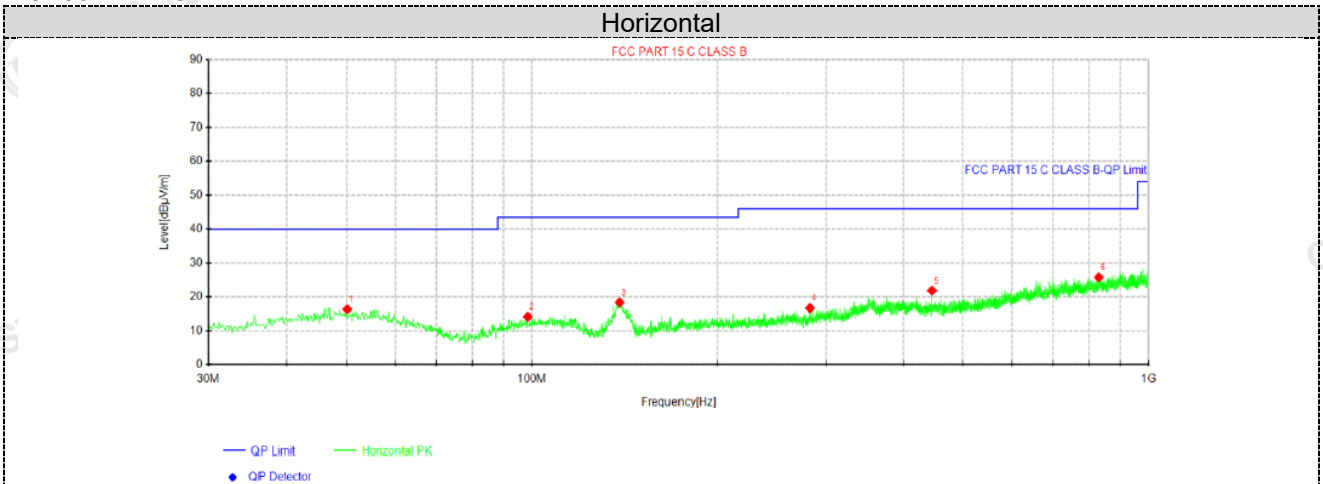
1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. BLE 1M, BLE 2M were tested at Low, Middle, and High channel for all models and recorded worst mode at the BLE 2MMiddle channel.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental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

For 9KHz-30MHz





For 30MHz-1GHz



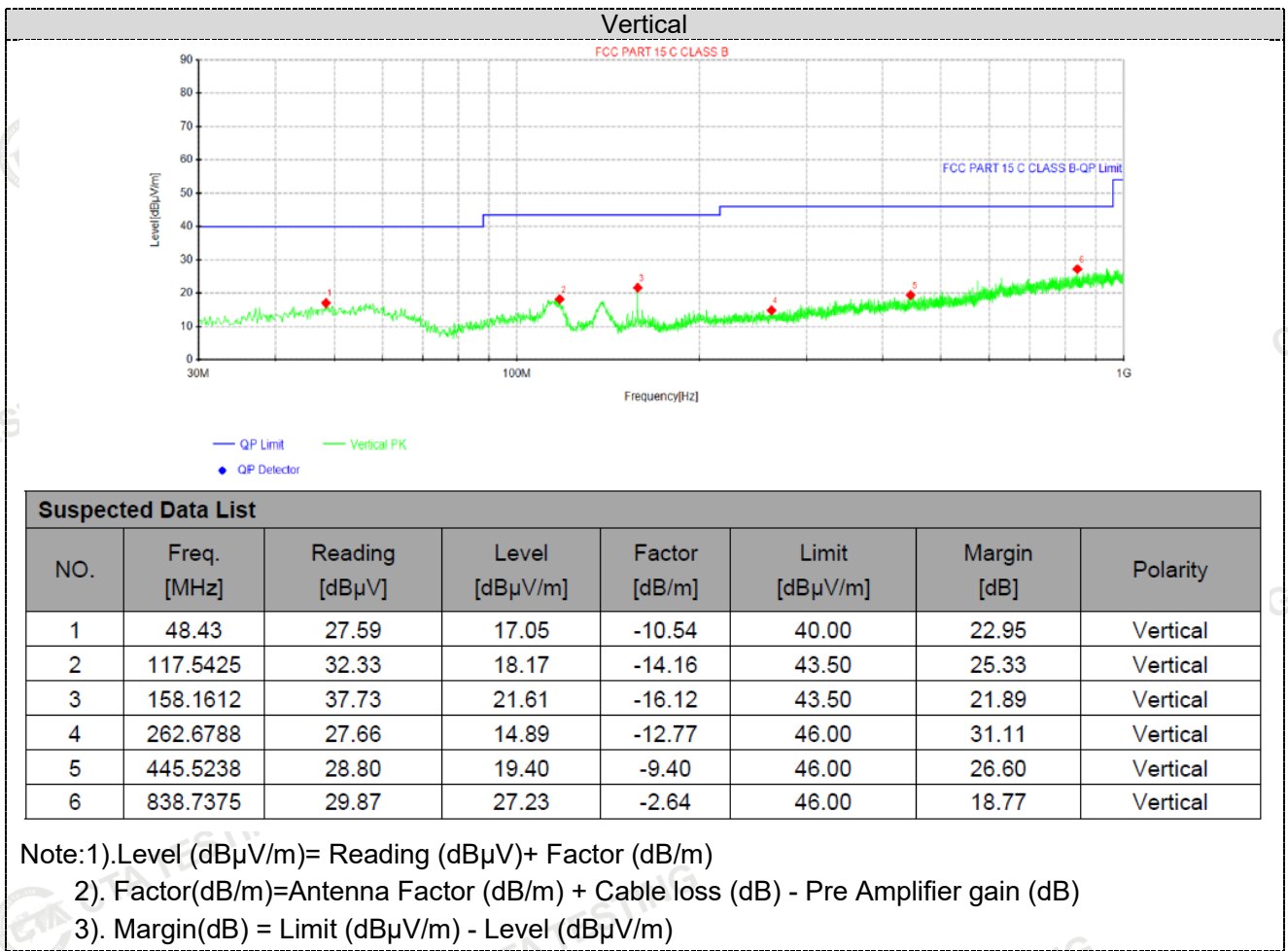
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	50.1275	27.02	16.37	-10.65	40.00	23.63	Horizontal
2	98.385	27.06	14.18	-12.88	43.50	29.32	Horizontal
3	138.64	35.26	18.36	-16.90	43.50	25.14	Horizontal
4	282.3212	29.08	16.73	-12.35	46.00	29.27	Horizontal
5	445.5238	31.25	21.85	-9.40	46.00	24.15	Horizontal
6	830.3712	28.67	25.78	-2.89	46.00	20.22	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)



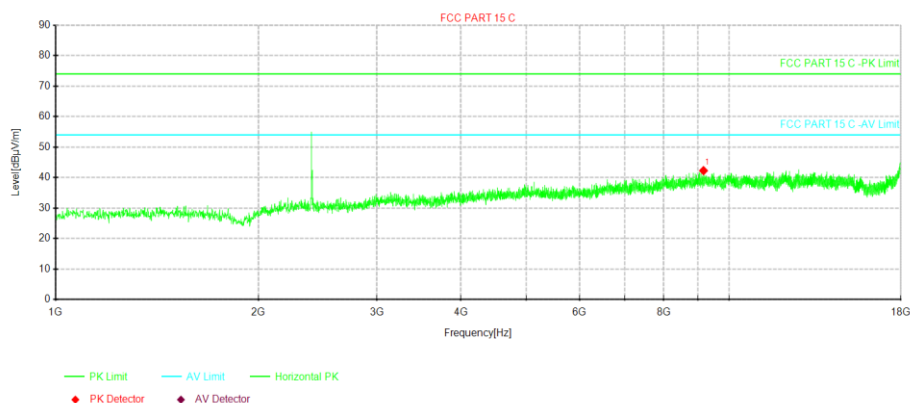
For 1GHz to 26GHz

GFSK (above 1GHz)

2402MHz

Horizontal

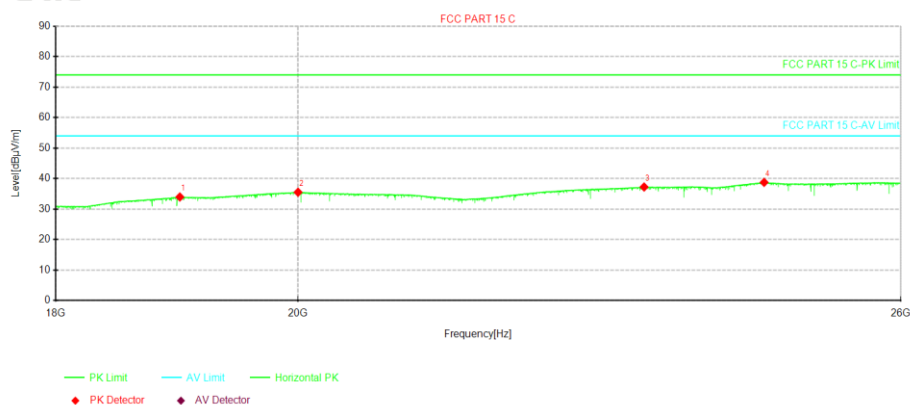
1-18GHz



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	9165.9166	48.21	42.29	-5.92	74.00	31.71	Horizontal

18-26GHz



Suspected Data List

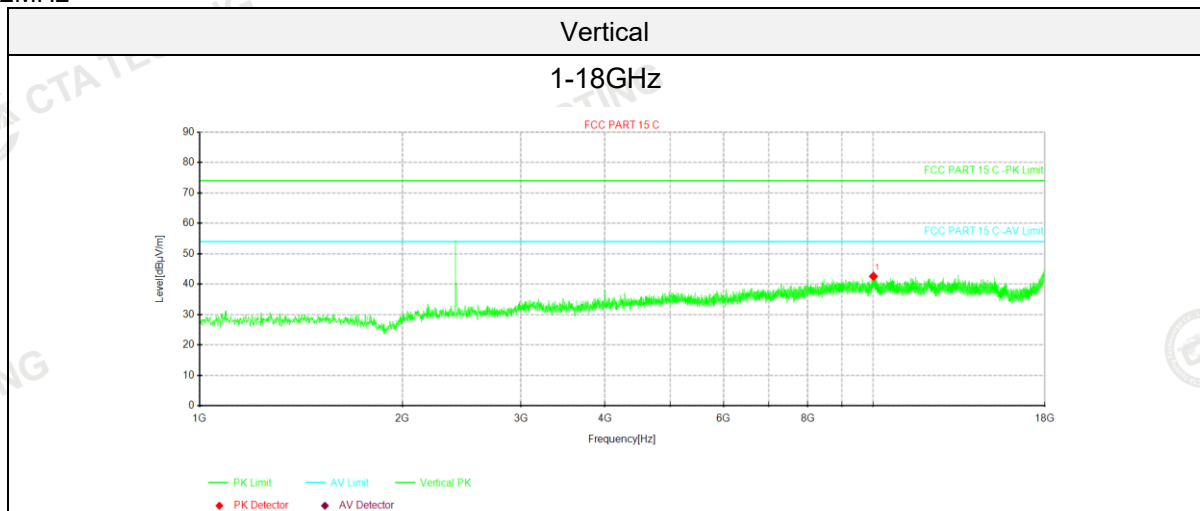
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	19000	24.99	33.98	8.99	74.00	40.02	Horizontal
2	20002.4	24.98	35.54	10.56	74.00	38.46	Horizontal
3	23252	24.99	37.25	12.26	74.00	36.75	Horizontal
4	24498.4	24.98	38.77	13.79	74.00	35.23	Horizontal

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)

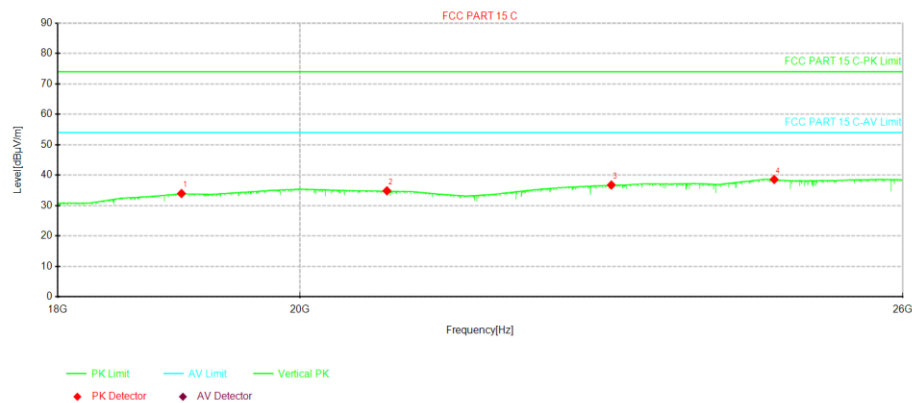
3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

2402MHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	10016.0016	47.81	42.59	-5.22	74.00	31.41	Vertical

18-26GHz

**Suspected Data List**

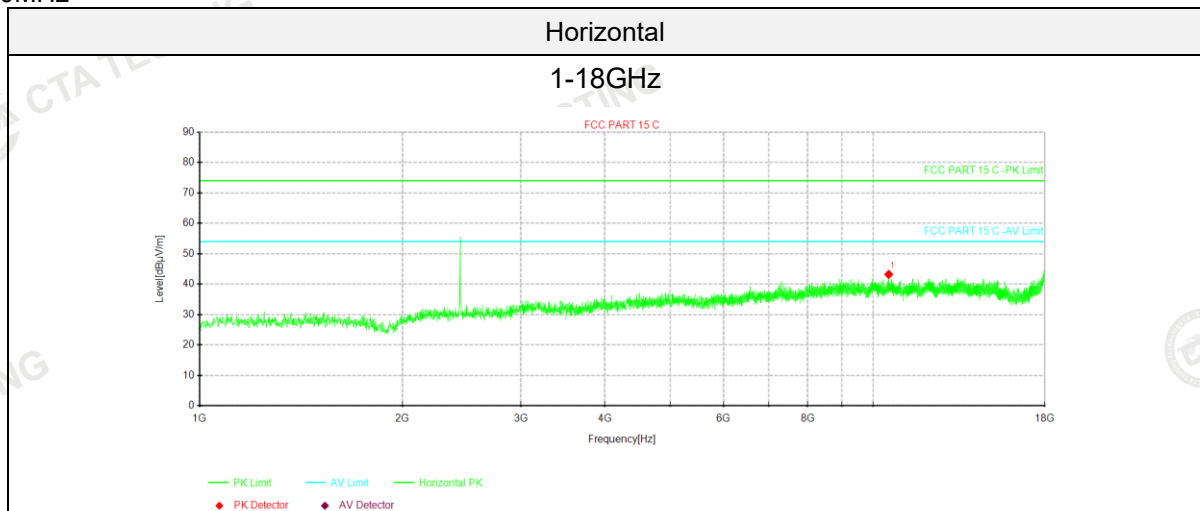
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	18996.8	25.00	33.97	8.97	74.00	40.03	Vertical
2	20772.8	24.99	34.86	9.87	74.00	39.14	Vertical
3	22903.2	24.99	36.77	11.78	74.00	37.23	Vertical
4	24584	24.96	38.59	13.63	74.00	35.41	Vertical

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)

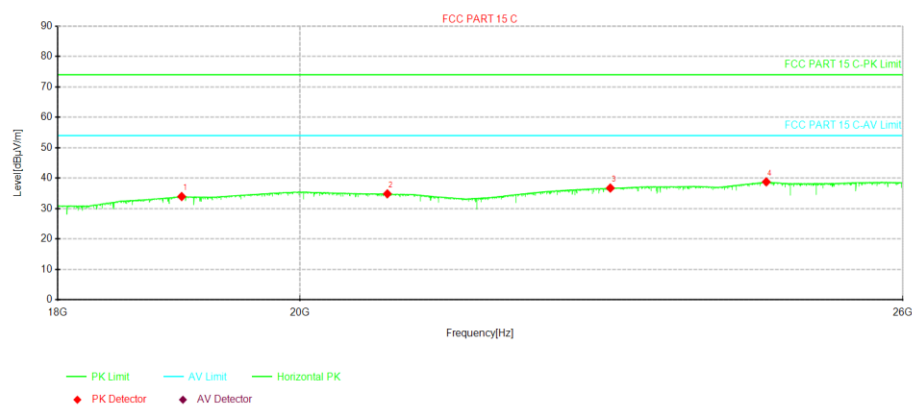
3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

2440MHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	10553.2553	48.85	43.23	-5.62	74.00	30.77	Horizontal

18-26GHz

**Suspected Data List**

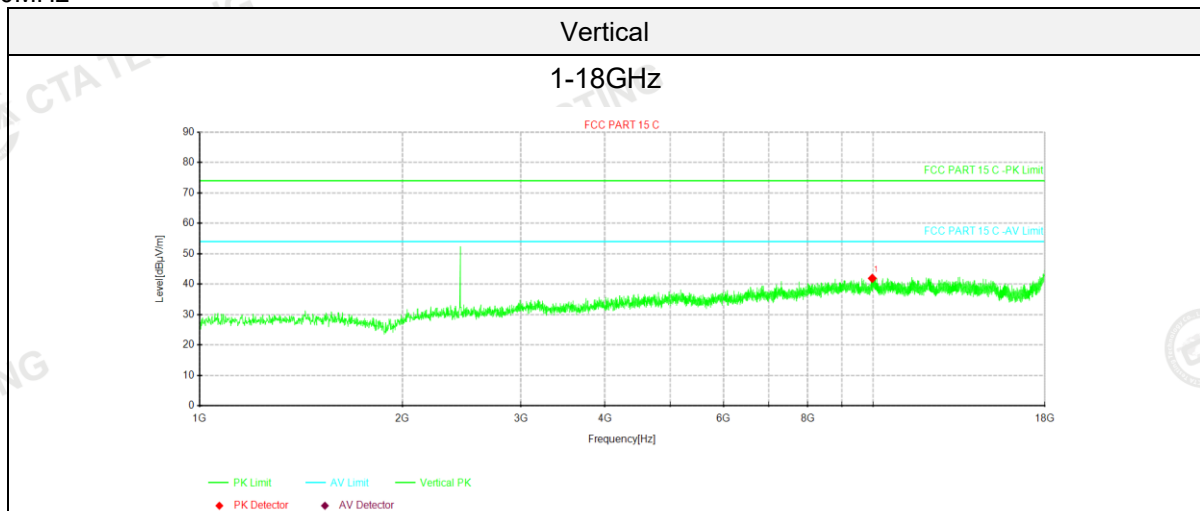
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	18998.4	24.98	33.97	8.99	74.00	40.03	Horizontal
2	20776.8	24.99	34.86	9.87	74.00	39.14	Horizontal
3	22892.8	24.99	36.76	11.77	74.00	37.24	Horizontal
4	24500	24.99	38.78	13.79	74.00	35.22	Horizontal

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)

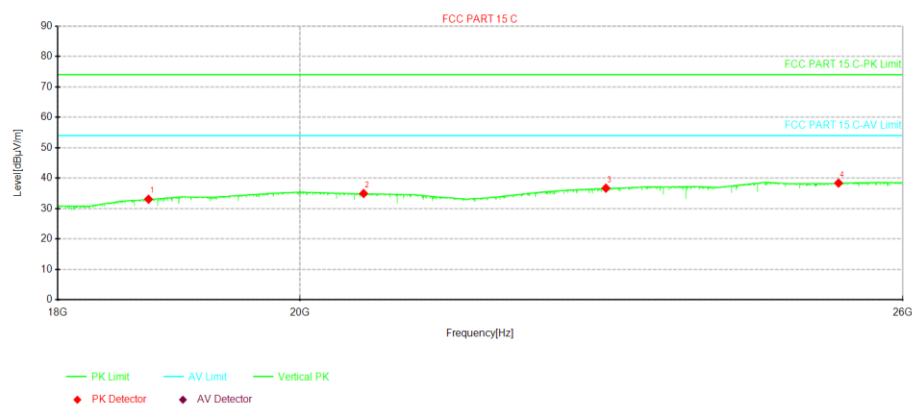
3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

2440MHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	9976.8977	47.34	41.92	-5.42	74.00	32.08	Vertical

18-26GHz

**Suspected Data List**

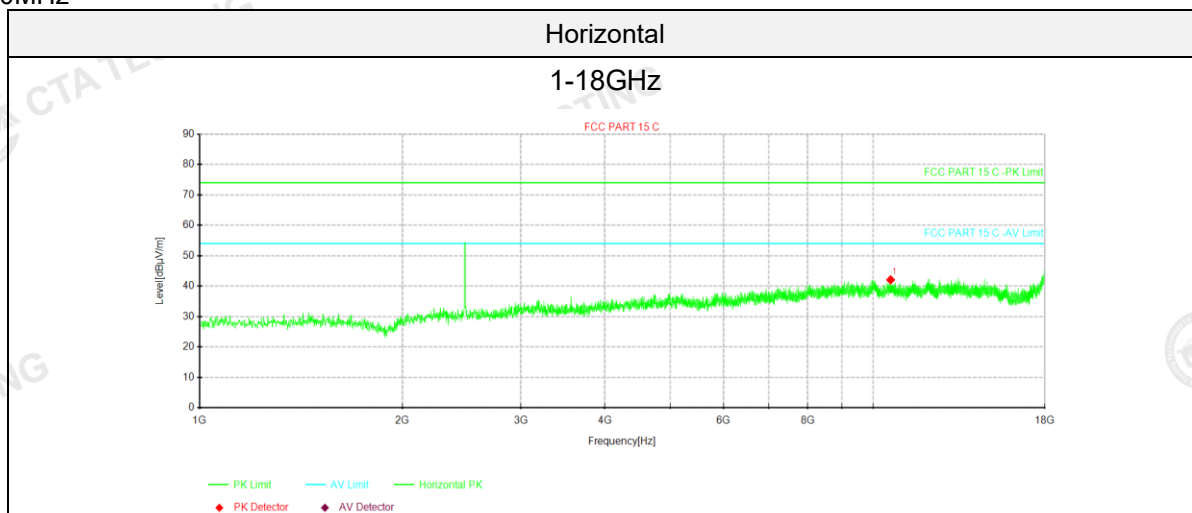
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	18726.4	24.98	33.08	8.10	74.00	40.92	Vertical
2	20563.2	24.98	34.96	9.98	74.00	39.04	Vertical
3	22848.8	24.99	36.71	11.72	74.00	37.29	Vertical
4	25282.4	24.99	38.39	13.40	74.00	35.61	Vertical

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)

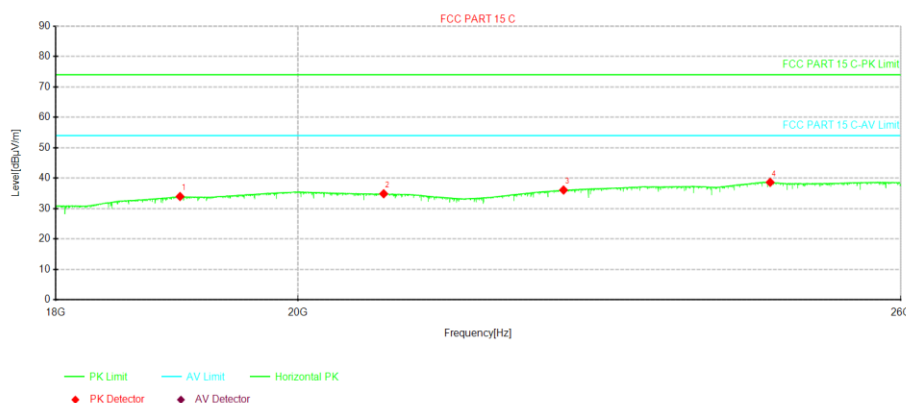
3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

2480MHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	10621.2621	47.65	42.09	-5.56	74.00	31.91	Horizontal

18-26GHz

**Suspected Data List**

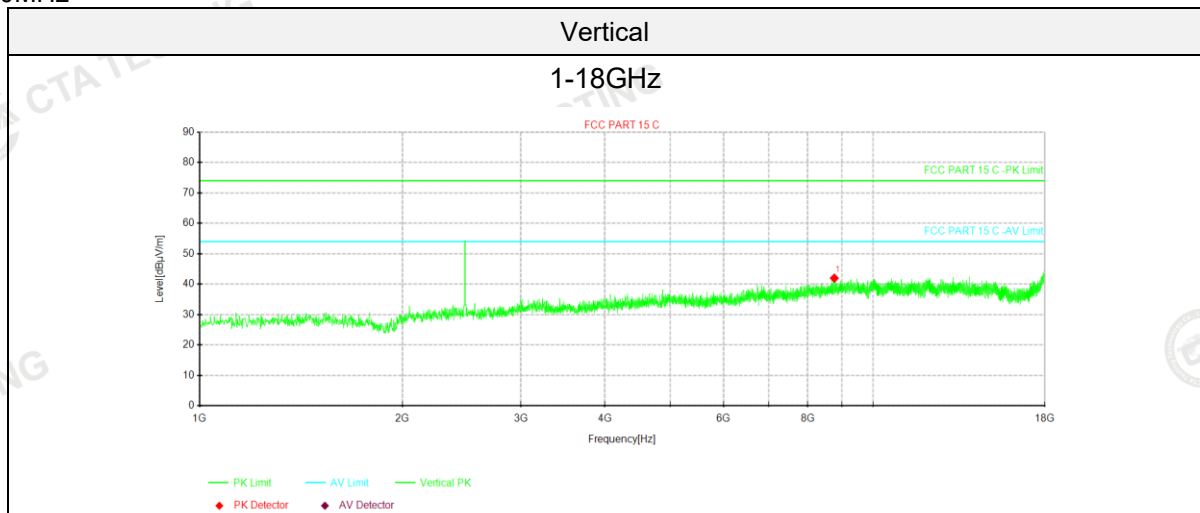
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	19001.6	24.98	33.97	8.99	74.00	40.03	Horizontal
2	20761.6	25.00	34.87	9.87	74.00	39.13	Horizontal
3	22451.2	24.99	36.11	11.12	74.00	37.89	Horizontal
4	24562.4	24.96	38.64	13.68	74.00	35.36	Horizontal

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)

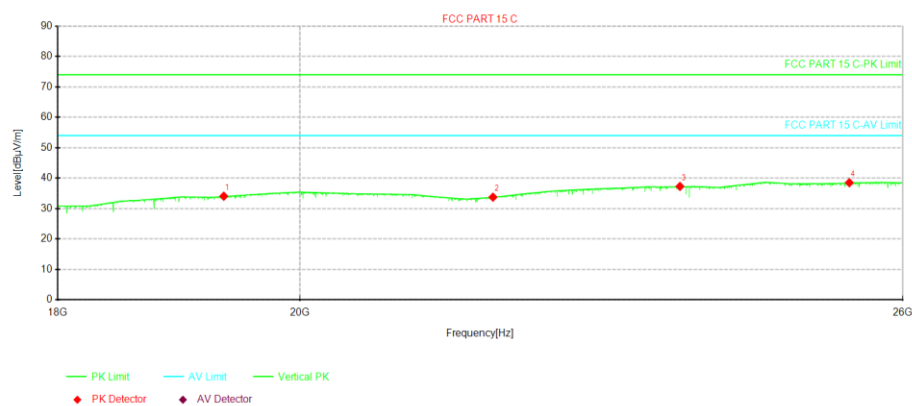
3). Margin (dB) = Limit (dBμV/m) - Level (dBμV/m)

2480MHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	8761.2761	48.71	41.98	-6.73	74.00	32.02	Vertical

18-26GHz

**Suspected Data List**

NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	19349.6	24.98	34.07	9.09	74.00	39.93	Vertical
2	21753.6	24.98	33.77	8.79	74.00	40.23	Vertical
3	23596.8	24.99	37.29	12.30	74.00	36.71	Vertical
4	25400.8	24.99	38.52	13.53	74.00	35.48	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)

4.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 30dBm.

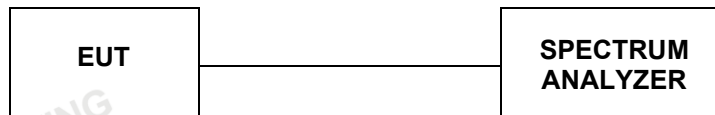
Test Procedure

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

According to the testing method in Chapter 11.9.1.1 of C63.10-2020, Set spectrum analyzer as following:

- a) Set the RBW $\geq$ DTS bandwidth.
- b) Set VBW $\geq 3 \times$ RBW.
- c) Set span $\geq 3 \times$ RBW
- 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.

Test Configuration



Test Results

Please refer to FCC Appendix RF Test Data for BLE

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

4.4 Power Spectral Density

Limit

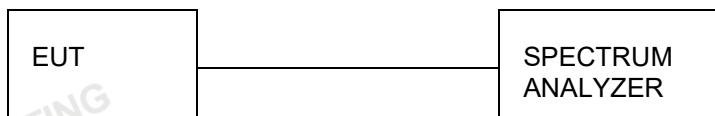
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure

The testing follows the ANSI C63.10 2020 section 11.10.2:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span >1.5 times the DTS bandwidth.
- Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq [3 \times \text{RBW}]$.
- Detector = peak.
- Sweep time = No faster than coupled (auto) time.
- Trace mode = max-hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

Test Configuration



Test Results

Please refer to FCC Appendix RF Test Data for BLE

4.5 6dB Bandwidth

Limit

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

Test Procedure

- a) Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz.
- b) Set the VBW $\geq [3 \times \text{RBW}]$.
- c) Detector = peak.
- d) Trace mode = max-hold.
- e) Sweep = No faster than coupled (auto) time.
- f) Allow the trace to stabilize.

Test Configuration



Test Results

Please refer to FCC Appendix RF Test Data for BLE

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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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

The testing follows the ANSI C63.10 Section 11.11.2 and 11.11.3 and 6.10.4:

●Reference level measurement

Establish a reference level by using the following procedure:

- Set instrument center frequency to DTS channel center frequency.
 - Set the span to ≥ 1.5 times the DTS bandwidth.
 - Set the RBW = 100 kHz.
 - Set the VBW $\geq [3 \times \text{RBW}]$.
 - Detector = peak.
 - Sweep time = auto couple.
 - Trace mode = max hold.
 - Allow trace to fully stabilize.
 - Use the peak marker function to determine the maximum PSD level.
- Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

●Emission level measurement

Establish an emission level by using the following procedure:

- Set the center frequency and span to encompass frequency range to be measured.
- Set the RBW = 100 kHz.
- Set the VBW $\geq [3 \times \text{RBW}]$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- 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) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

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.

Please refer to FCC Appendix RF Test Data for BLE

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: http://www.cta-test.cn

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(b) (4):

if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Connected Construction

The EUT antenna is an Internal antenna and antenna gain is 2.99dBi. It complies with the standard requirement.

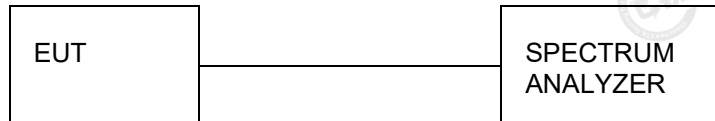
Remark: The antenna gain is provided by the customer, if the data provided by the customer is not accurate, Shenzhen CTA Testing Technology Co., Ltd. does not assume any responsibility.

4.8 On Time and Duty Cycle

Standard Applicable

None; for reporting purpose only.

TEST CONFIGURATION



Test Procedures

- 1). Set the Centre frequency of the spectrum analyzer to the transmitting frequency;
- 2). Set the span=0MHz, RBW=8MHz, VBW=8MHz, Sweep time=Auto;
- 3). Detector = peak;
- 4). Trace mode = Single hold.

Please refer to FCC Appendix RF Test Data for BLE

4.9 Emissions at Restricted Band

Standard Applicable

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 conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



Test Procedures

According to ANSI C63.10 Field Strength Approach (linear terms):

$$E = \text{EIRP} - 20 \log d + 104.8$$

Where:

E is the electric field strength in dBuV/m

EIRP is the equivalent isotropically radiated power in dBm

d is the specified measurement distance in m

f) Compare the resultant electric field strength level with the applicable regulatory limit.

g) Perform the radiated spurious emission test.

Where all terms are as previously defined.

- 1). Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2). Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- 3). Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=3MHz for RMS detector, Max Hold=Average, Trace=100times for AV test.
- 4). Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5). Repeat above procedures until all measured frequencies were complete.
- 6). Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
- 7). Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
- 8). Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for

frequencies >1000 MHz).

9). For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

10). Compare the resultant electric field strength level to the applicable regulatory limit.

11). Perform radiated spurious emission test duress until all measured frequencies were complete.

Test Results

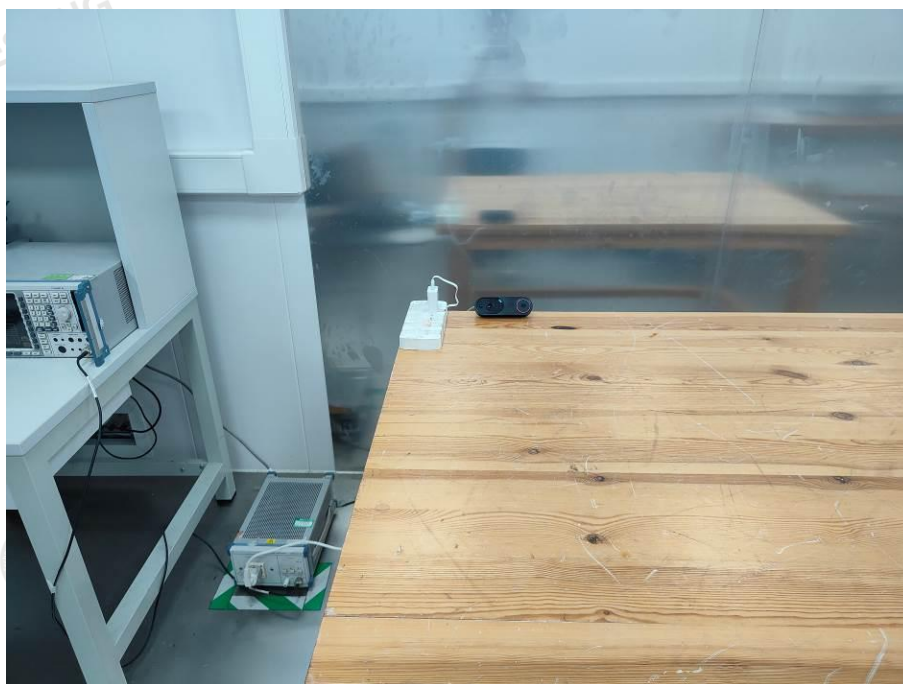
Please refer to FCC Appendix RF Test Data for BLE.

Remark:

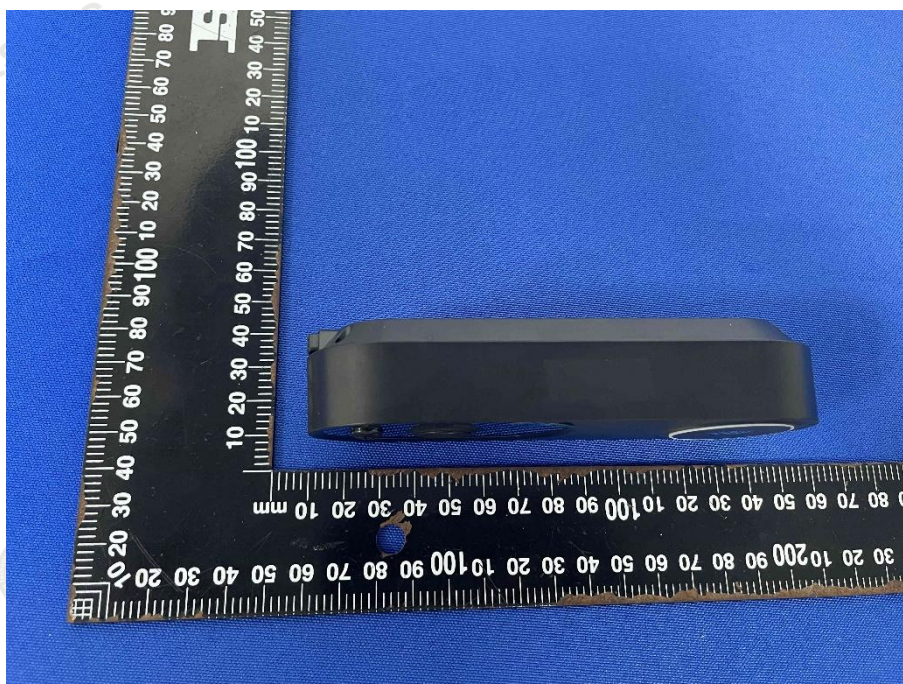
- 1). Test results including cable loss;
- 2). Measured at difference Packet Type for each mode and recorded worst case for each mode.
- 3). “---” means that the fundamental frequency not for 15.209 limits requirement.
- 4). Measured at Hopping and Non-Hopping mode, recorded worst at Non-Hopping mode.
- 5). The other emission levels were very low against the limit.
- 6). The average measurement was not performed when the peak measured data under the limit of average detection.
- 7). Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=3MHz/Sweep time=Auto/Detector=RMS, Max Hold=Average, Trace=100times.
- 8). *Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.*

5 Test Setup Photos of the EUT







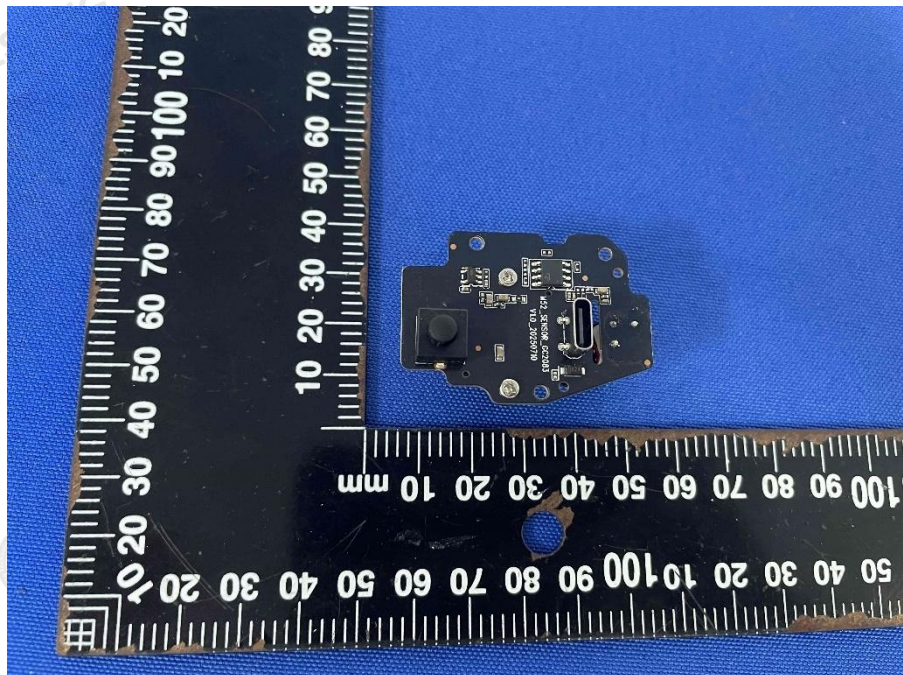


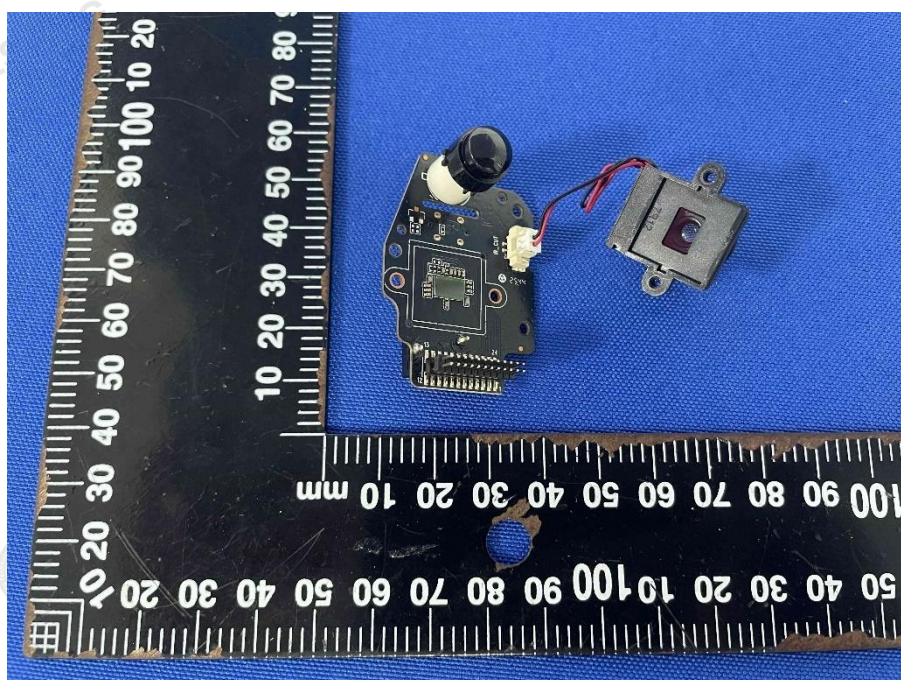
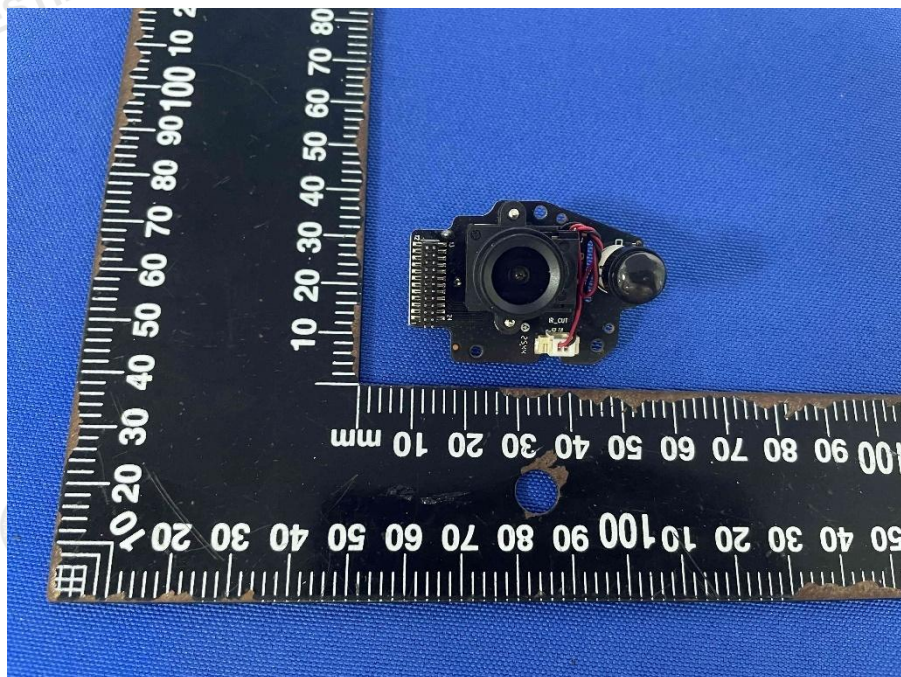
Shenzhen CTA Testing Technology Co., Ltd.

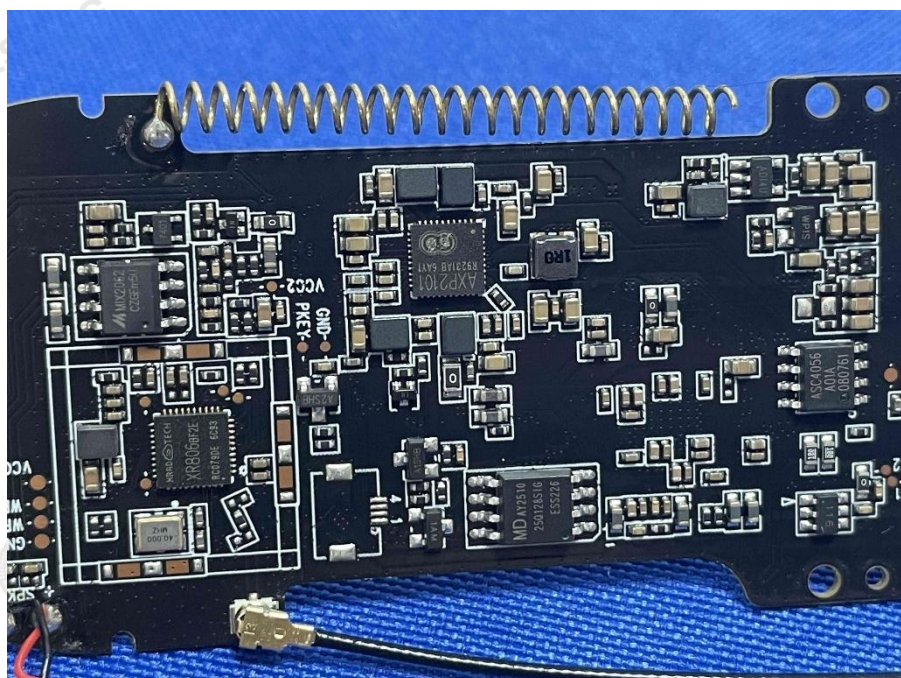
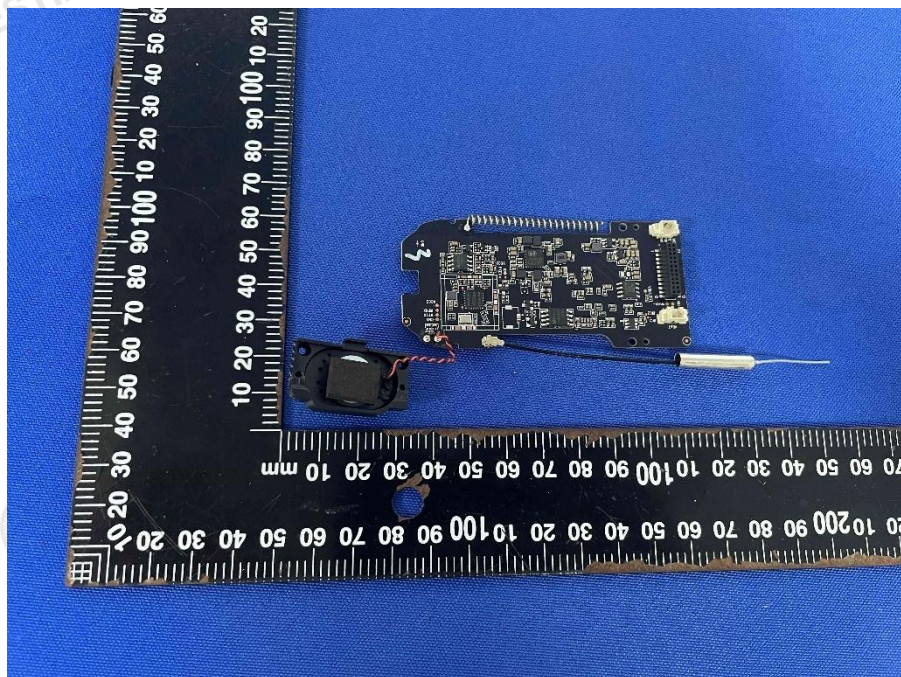
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

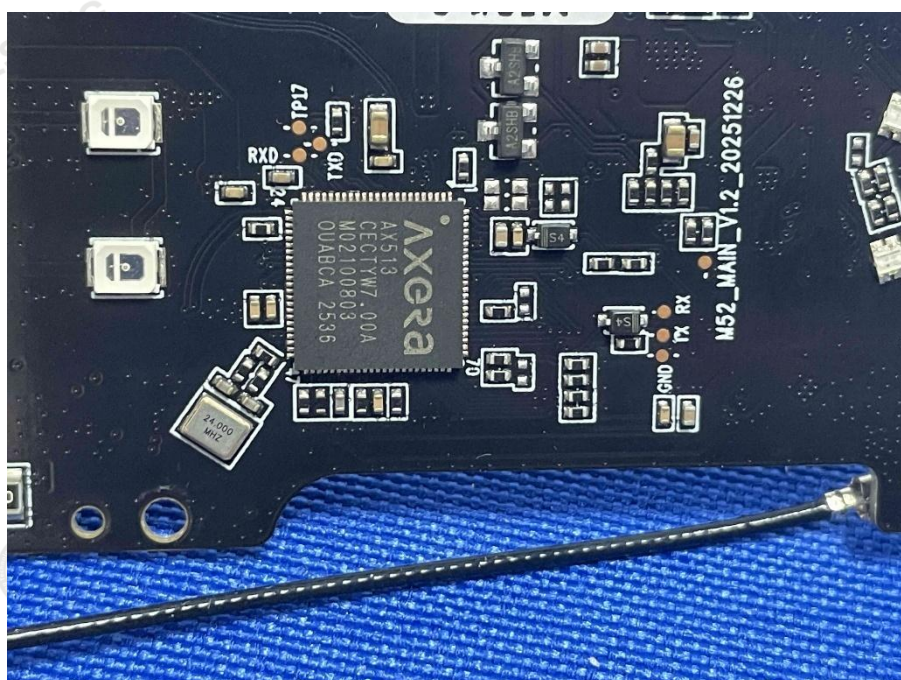
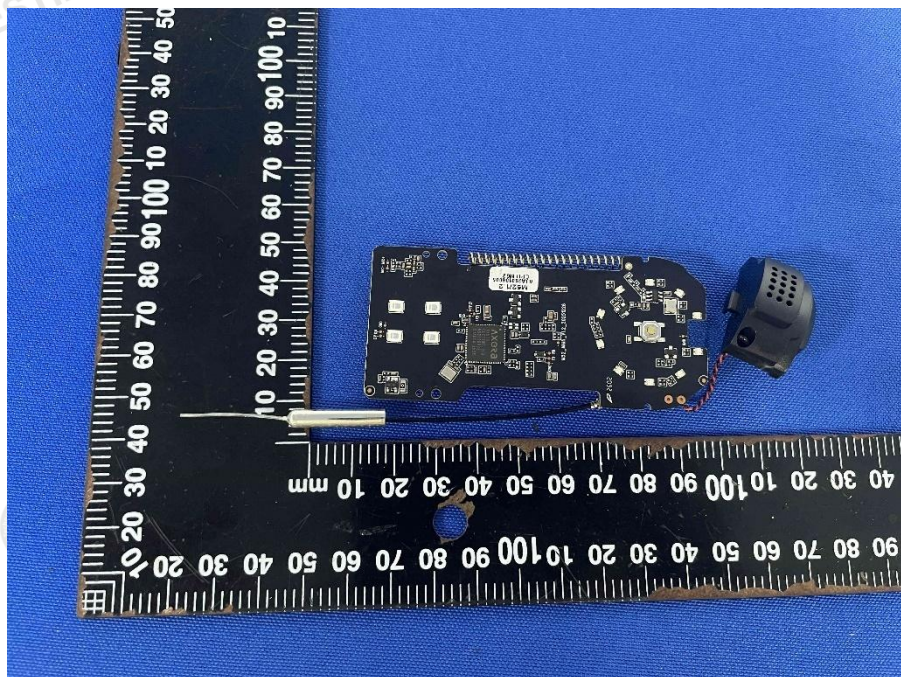
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: <http://www.cta-test.cn>

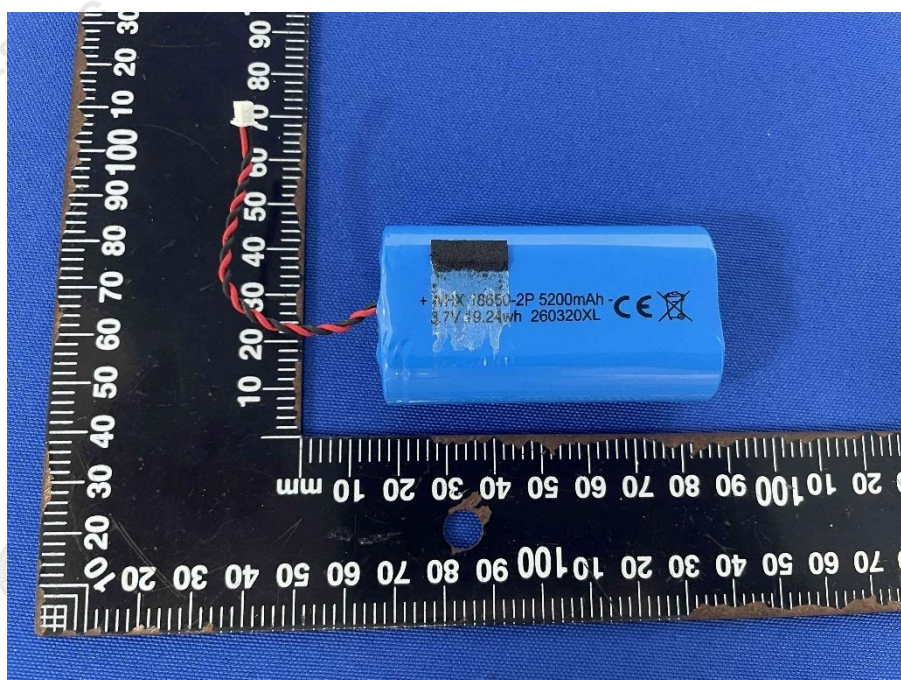
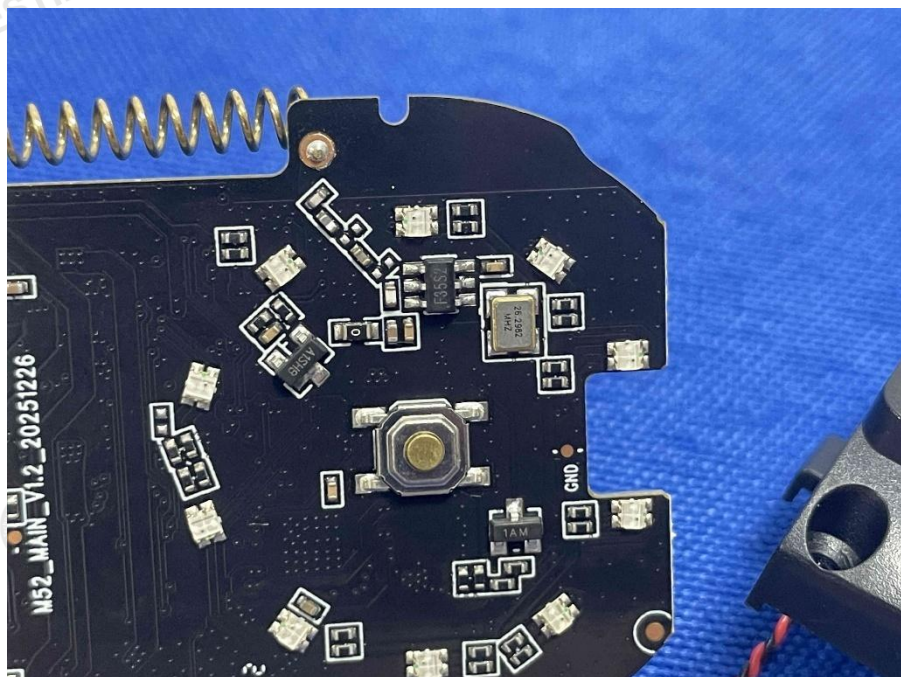












***** End of Reprt *****

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Tel: +86-755 2322 5875 E-mail: cta@cta-test.cn Web: <http://www.cta-test.cn>