



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 C TEST REPORT

FCC PART 15.247

Report Reference No.....: CTA25011600701

FCC ID.....: 2A9JD-GS300

Compiled by

(position+printed name+signature) ..: File administrators Joan Wu

Supervised by

(position+printed name+signature) ..: Project Engineer Zoey Cao

Approved by

(position+printed name+signature) ..: RF Manager Eric Wang

Date of issue: Feb. 07, 2025

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.....: Shenzhen Jingyun Wulian Technology CO.,Ltd

Address: 11/F, Building A, Dahong Zhigu, No.59, Gangzi Street, Shajing Xinqiao Street Bao'an District, Shenzhen, 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.

Test item description: Smart wearable watch

Trade Mark: N/A

Manufacturer: Shenzhen Jingyun Wulian Technology CO.,Ltd

Model/Type reference: GS300

Listed Models: N/A

Modulation: GFSK, $\pi/4$ DQPSK, 8DPSK

Frequency: From 2402MHz to 2480MHz

Rating: DC 3.7V From battery and DC 5.0V From external circuit

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 : Smart wearable watch

Model /Type : GS300

Listed Models : N/A

Applicant : **Shenzhen Jingyun Wulian Technology CO.,Ltd**

Address : 11/F, Building A, Dahong Zhigu, No.59, Gangzi Street, Shajing
Xinqiao Street Bao'an District, Shenzhen, China

Manufacturer : **Shenzhen Jingyun Wulian Technology CO.,Ltd**

Address : 11/F, Building A, Dahong Zhigu, No.59, Gangzi Street, Shajing
Xinqiao Street Bao'an District, Shenzhen, 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

<u>1</u>	<u>TEST STANDARDS</u>	<u>4</u>
<u>2</u>	<u>SUMMARY</u>	<u>5</u>
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	6
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
<u>3</u>	<u>TEST ENVIRONMENT</u>	<u>7</u>
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
<u>4</u>	<u>TEST CONDITIONS AND RESULTS.....</u>	<u>11</u>
4.1	AC Power Conducted Emission	11
4.2	Radiated Emission	14
4.3	Maximum Peak Output Power	21
4.4	20dB Bandwidth	22
4.5	Frequency Separation	29
4.6	Number of hopping frequency	32
4.7	Time of Occupancy (Dwell Time)	35
4.8	Out-of-band Emissions	42
4.9	Pseudorandom Frequency Hopping Sequence	59
4.10	Antenna Requirement	60
<u>5</u>	<u>TEST SETUP PHOTOS OF THE EUT</u>	<u>61</u>
<u>6</u>	<u>EXTERNAL AND INTERNAL PHOTOS OF THE EUT</u>	<u>62</u>

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

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Jan. 16, 2025
Testing commenced on	:	Jan. 16, 2025
Testing concluded on	:	Feb. 07, 2025

2.2 Product Description

Product Name:	Smart wearable watch
Model/Type reference:	GS300
Power supply:	DC 3.7V From battery and DC 5.0V From external circuit
Hardware version:	V1.0
Software version:	V1.0
Testing sample ID:	CTA250116007-1# (Engineer sample) CTA250116007-2# (Normal sample)
Bluetooth :	
Supported Type:	Bluetooth BR/EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Internal antenna
Antenna gain:	0.82 dBi for Ant1 and Ant2

2.3 Equipment Under Test

Power supply system utilised

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

DC 3.7V From battery and DC 5.0V From external circuit

2.4 Short description of the Equipment under Test (EUT)

This is a Smart wearable watch.

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

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		Model: EP-TA20CBC Input: AC 100-240V 50/60Hz Output: DC 5V 2A
-----------	--	---

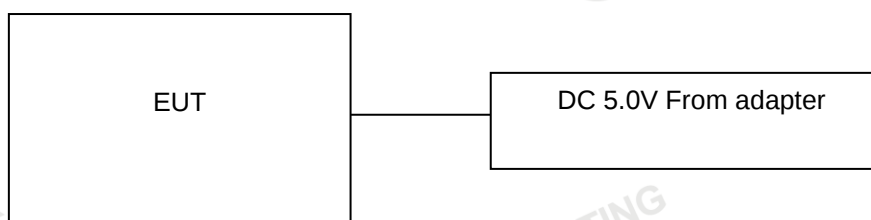
2.6 EUT operation mode

The Applicant provides communication tools software(AT command) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

Operation Frequency:

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
38	2440
39	2441
40	2442
⋮	⋮
77	2479
78	2480

2.7 Block Diagram of Test Setup



2.8 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device 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.

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.

ISED#: 27890 CAB identifier: CN0127

Shenzhen CTA Testing Technology Co., Ltd. has been listed by Innovation, Science and Economic Development Canada 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:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

AC Power Conducted Emission:

Temperature:	25 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	25 ° C
Humidity:	44 %
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 Mode	Test Channel	Recorded In Report		Test result
§15.247(a)(1)	Carrier Frequency separation	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Number of Hopping channels	GFSK Π/4DQPSK 8DPSK	☒ Full	GFSK	☒ Full	Compliant
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Spectrum bandwidth of aFHSS system 20dB bandwidth	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(b)(1)	Maximum output peak power	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	Band edge compliance conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.205	Band edge compliance radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.247(d)	TX spurious emissions conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	TX spurious emissions radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.209(a)	TX spurious Emissions radiated Below 1GHz	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Middle	Compliant
§15.107(a) §15.207	Conducted Emissions 9KHz-30 MHz	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Middle	Compliant

Remark: The measurement uncertainty is not included in the test result.

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)

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

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	2024/08/03	2025/08/02
LISN	R&S	ENV216	CTA-314	2024/08/03	2025/08/02
EMI Test Receiver	R&S	ESPI	CTA-307	2024/08/03	2025/08/02
EMI Test Receiver	R&S	ESCI	CTA-306	2024/08/03	2025/08/02
Spectrum Analyzer	Agilent	N9020A	CTA-301	2024/08/03	2025/08/02
Spectrum Analyzer	R&S	FSU	CTA-337	2024/08/03	2025/08/02
Vector Signal generator	Agilent	N5182A	CTA-305	2024/08/03	2025/08/02
Analog Signal Generator	R&S	SML03	CTA-304	2024/08/03	2025/08/02
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	R&S	CTA-302	2024/08/03	2025/08/02
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2024/08/03	2025/08/02
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	Beijing Hangwei Dayang	OBH100400	CTA-336	2023/10/17	2026/10/16
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2024/08/03	2025/08/02
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2024/08/03	2025/08/02
Directional coupler	NARDA	4226-10	CTA-303	2024/08/03	2025/08/02
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2024/08/03	2025/08/02
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2024/08/03	2025/08/02
Automated filter bank	Tonscend	JRUQI-MH8R06-F	CTA-404	2024/08/03	2025/08/02
Power Sensor	Agilent	U2021XA	CTA-405	2024/08/03	2025/08/02
Amplifier	Schwarzbeck	BBV9719	CTA-406	2024/08/03	2025/08/02

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 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

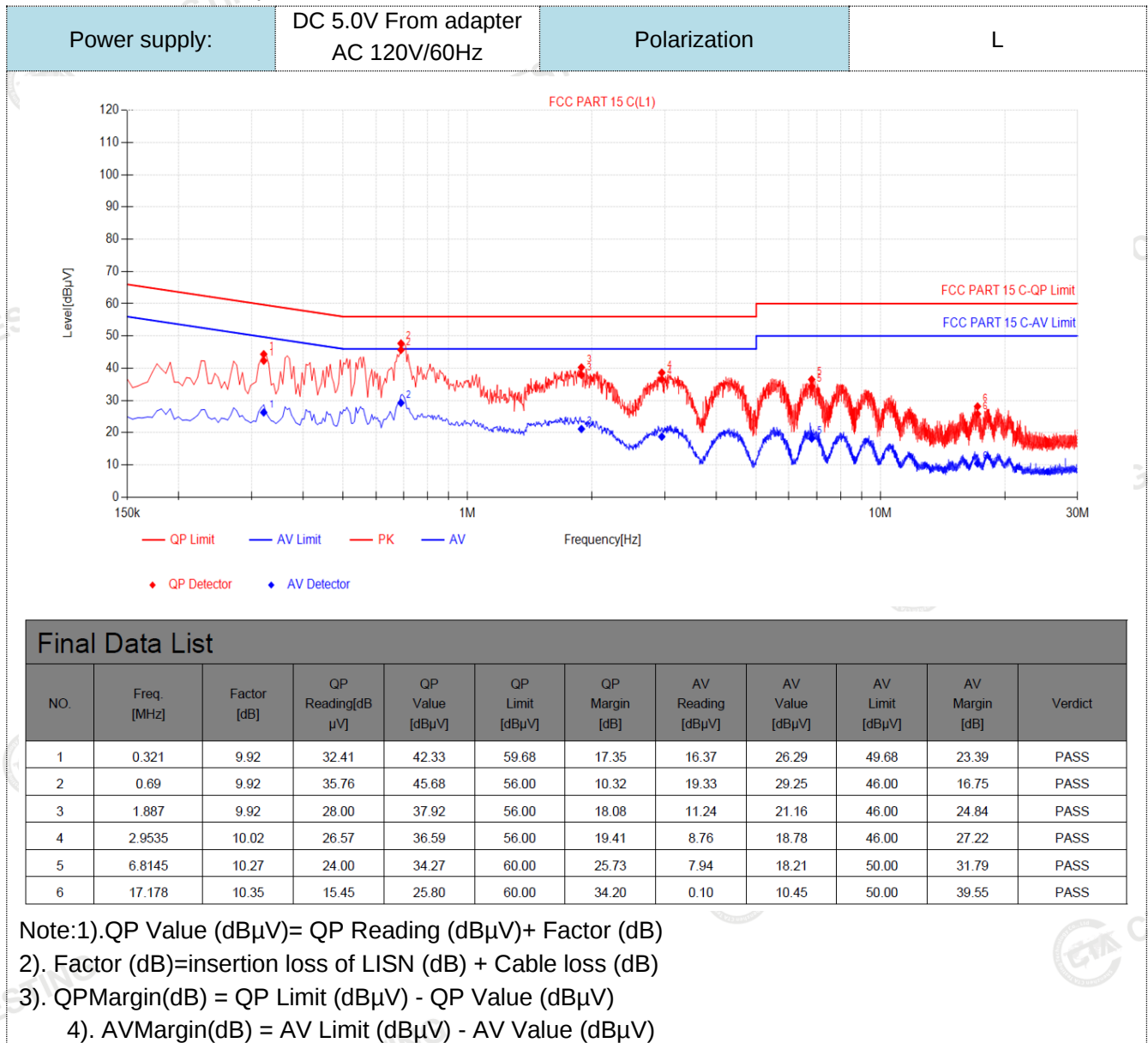
Remark:

1. All modes of GFSK, $\pi/4$ DQPSK and 8DPSK were test at Low, Middle, and High channel; only the worst result of GFSK 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:

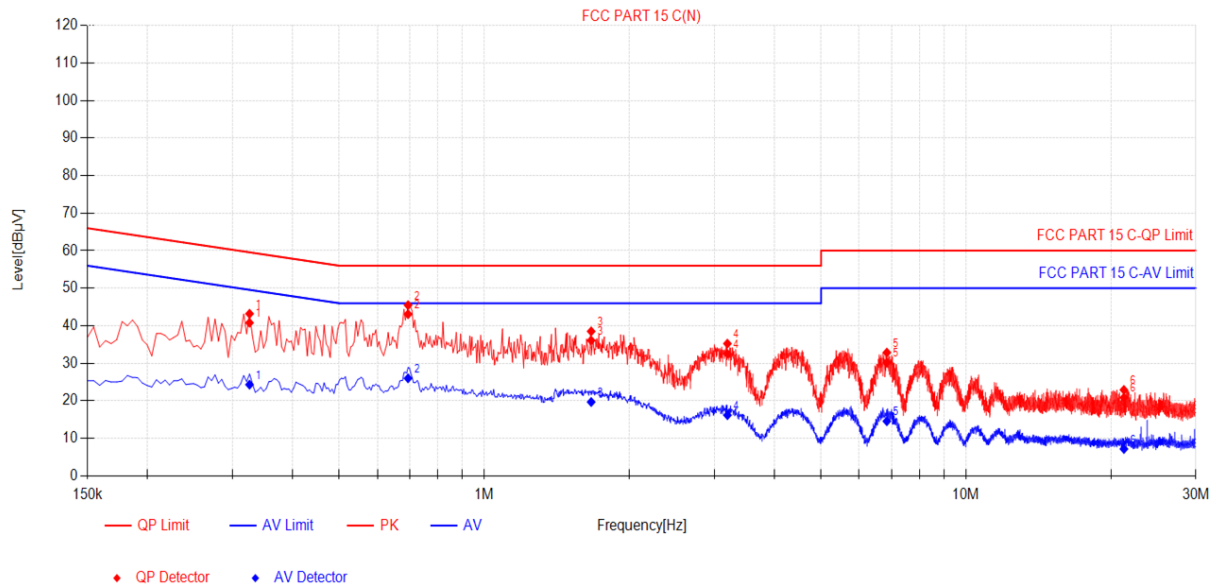


Power supply:

DC 5.0V From adapter
AC 120V/60Hz

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	0.3255	9.86	30.93	40.79	59.57	18.78	14.44	24.30	49.57	25.27	PASS
2	0.6945	10.06	33.02	43.08	56.00	12.92	15.95	26.01	46.00	19.99	PASS
3	1.6665	10.15	25.95	36.10	56.00	19.90	9.54	19.69	46.00	26.31	PASS
4	3.1965	10.22	22.32	32.54	56.00	23.46	5.96	16.18	46.00	29.82	PASS
5	6.8505	10.40	19.84	30.24	60.00	29.76	4.17	14.57	50.00	35.43	PASS
6	21.273	10.61	10.26	20.87	60.00	39.13	-3.43	7.18	50.00	42.82	PASS

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

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

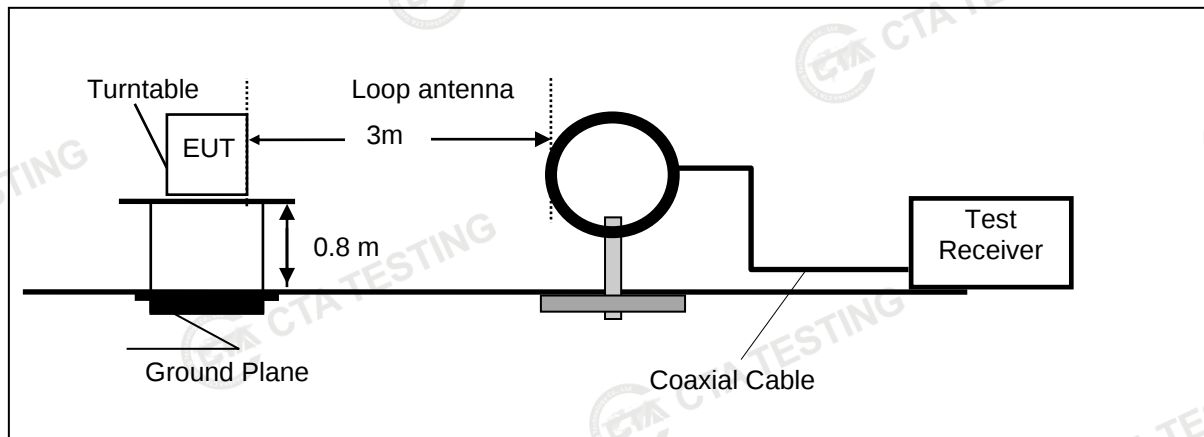
3). QPMargin(dB) = QP Limit (dBμV) - QP Value (dBμV)

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

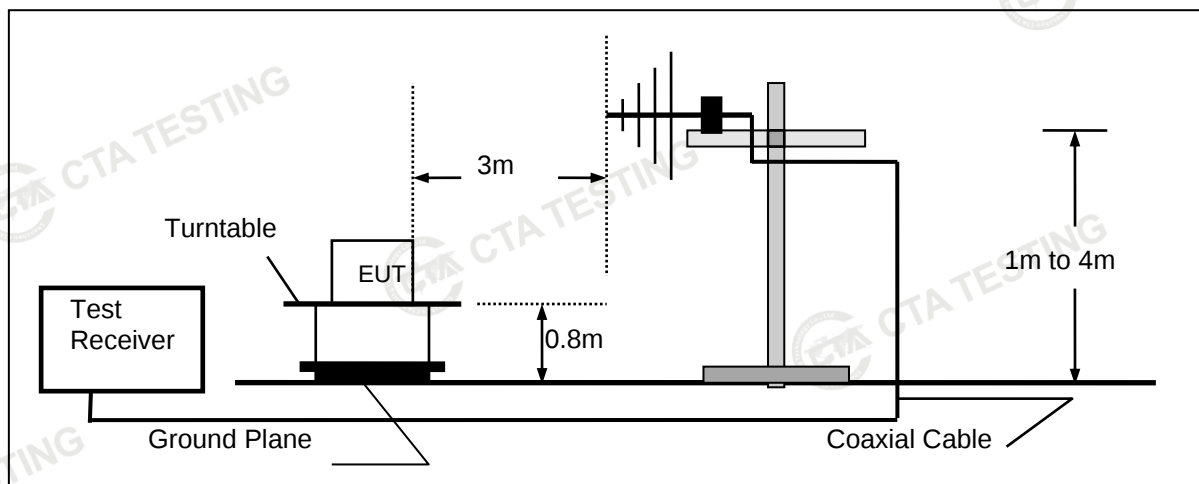
4.2 Radiated Emission

TEST CONFIGURATION

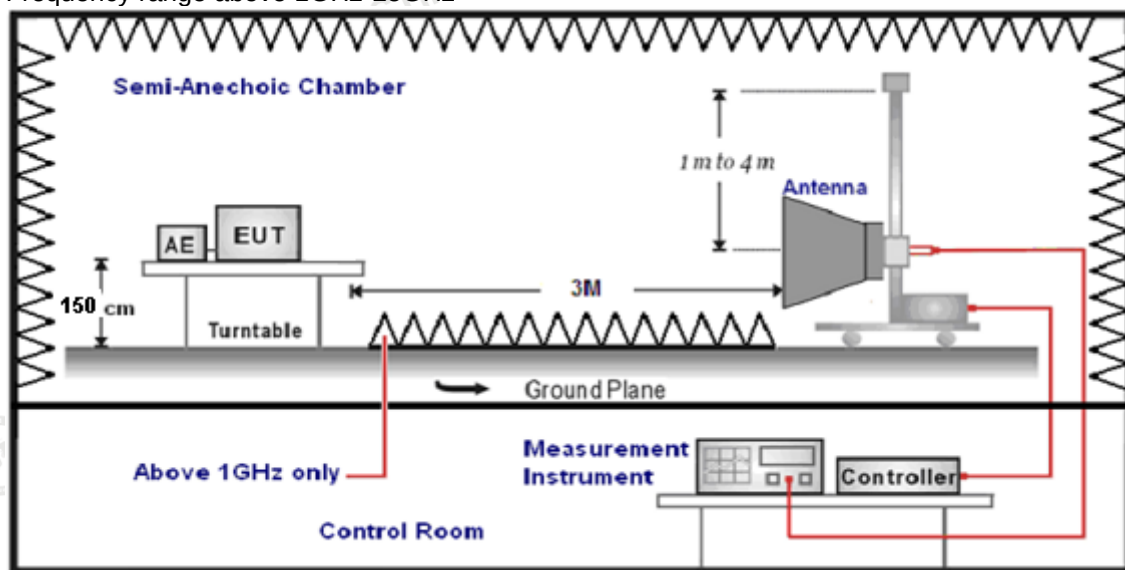
Frequency range 9 KHz – 30MHz

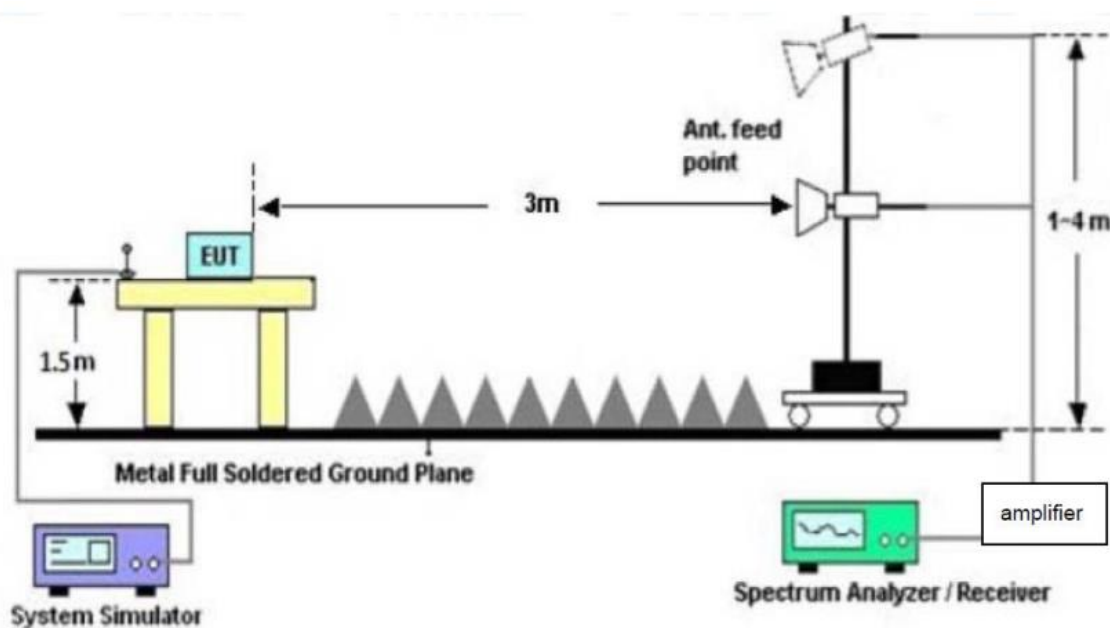


Frequency range 30MHz – 1000MHz



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. 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	

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

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 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	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
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

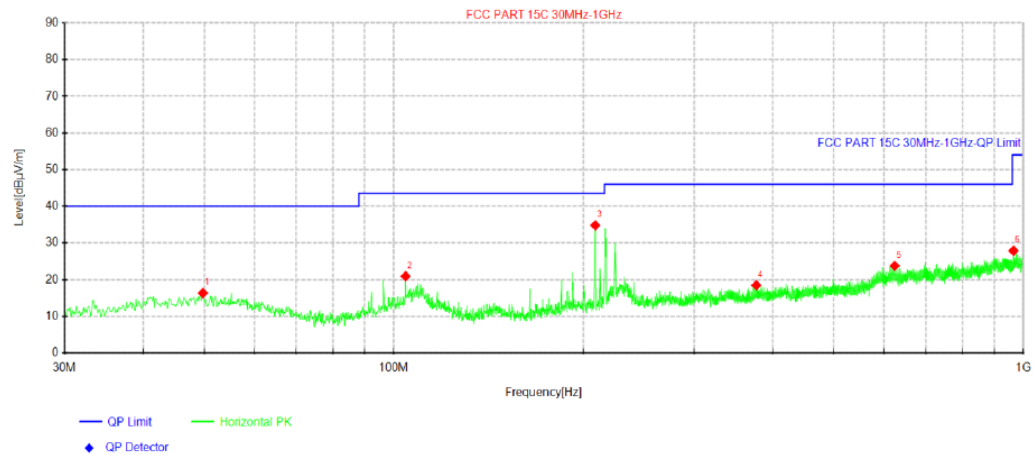
TEST RESULTS

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. We measured Radiated Emission at GFSK, $\pi/4$ DQPSK and 8DPSK mode from 9 KHz to 25GHz and recorded worst case at GFSK DH5 mode.
3. For below 1GHz testing recorded worst at GFSK DH5 middle channel.
4. 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

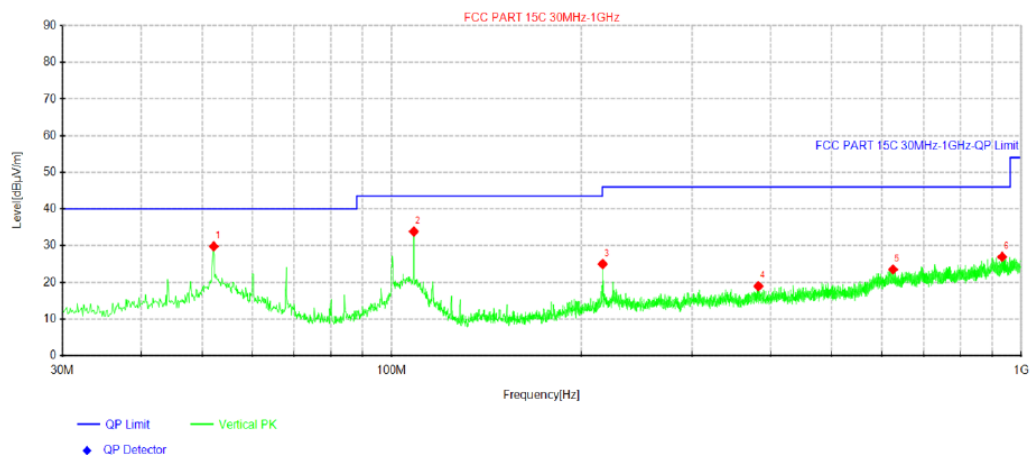
NO.	Freq. [MHz]	Reading [dBμV]	Level [dBμV/m]	Factor [dB/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.7638	33.59	16.36	-17.23	40.00	23.64	100	338	Horizontal
2	104.447	40.02	20.94	-19.08	43.50	22.56	100	349	Horizontal
3	208.965	53.55	34.80	-18.75	43.50	8.70	200	213	Horizontal
4	376.532	34.89	18.48	-16.41	46.00	27.52	100	34	Horizontal
5	624.61	35.56	23.78	-11.78	46.00	22.22	200	189	Horizontal
6	964.352	35.89	27.88	-8.01	54.00	26.12	100	213	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	52.1888	47.19	29.80	-17.39	40.00	10.20	100	335	Vertical
2	108.448	53.16	33.86	-19.30	43.50	9.64	100	314	Vertical
3	216.361	43.57	24.99	-18.58	46.00	21.01	200	360	Vertical
4	382.352	35.23	18.95	-16.28	46.00	27.05	100	359	Vertical
5	625.701	35.29	23.51	-11.78	46.00	22.49	100	360	Vertical
6	932.463	35.23	26.94	-8.29	46.00	19.06	200	22	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 25GHzNote: GFSK , $\pi/4$ DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.**GFSK (above 1GHz)**

Frequency(MHz):			2402		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	61.66	PK	74	12.34	65.93	32.33	5.12	41.72	-4.27
4804.00	45.06	AV	54	8.94	49.33	32.33	5.12	41.72	-4.27
7206.00	53.82	PK	74	20.18	54.34	36.6	6.49	43.61	-0.52
7206.00	43.00	AV	54	11.00	43.52	36.6	6.49	43.61	-0.52

Frequency(MHz):			2402		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	59.71	PK	74	14.29	63.98	32.33	5.12	41.72	-4.27
4804.00	42.58	AV	54	11.42	46.85	32.33	5.12	41.72	-4.27
7206.00	51.84	PK	74	22.16	52.36	36.6	6.49	43.61	-0.52
7206.00	41.28	AV	54	12.72	41.80	36.6	6.49	43.61	-0.52

Frequency(MHz):			2441		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)
4882.00	61.06	PK	74	12.94	64.94	32.6	5.34	41.82	-3.88
4882.00	44.22	AV	54	9.78	48.10	32.6	5.34	41.82	-3.88
7323.00	53.22	PK	74	20.78	53.33	36.8	6.81	43.72	-0.11
7323.00	42.38	AV	54	11.62	42.49	36.8	6.81	43.72	-0.11

Frequency(MHz):			2441		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)
4882.00	59.22	PK	74	14.78	63.10	32.6	5.34	41.82	-3.88
4882.00	42.35	AV	54	11.65	46.23	32.6	5.34	41.82	-3.88
7323.00	51.68	PK	74	22.32	51.79	36.8	6.81	43.72	-0.11
7323.00	40.45	AV	54	13.55	40.56	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	60.28	PK	74	13.72	63.36	32.73	5.66	41.47	-3.08
4960.00	43.44	AV	54	10.56	46.52	32.73	5.66	41.47	-3.08
7440.00	52.59	PK	74	21.41	52.14	37.04	7.25	43.84	0.45
7440.00	41.61	AV	54	12.39	41.16	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	58.56	PK	74	15.44	61.64	32.73	5.66	41.47	-3.08
4960.00	41.36	AV	54	12.64	44.44	32.73	5.66	41.47	-3.08
7440.00	50.22	PK	74	23.78	49.77	37.04	7.25	43.84	0.45
7440.00	39.86	AV	54	14.14	39.41	37.04	7.25	43.84	0.45

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

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)

Note: GFSK, $\pi/4$ DQPSK and 8DPSK all have been tested, only worse case GFSK is reported.

GFSK

Frequency(MHz):			2402		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	61.73	PK	74	12.27	72.15	27.42	4.31	42.15	-10.42
2390.00	43.52	AV	54	10.48	53.94	27.42	4.31	42.15	-10.42
Frequency(MHz):			2402		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	59.53	PK	74	14.47	69.95	27.42	4.31	42.15	-10.42
2390.00	41.98	AV	54	12.02	52.40	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	61.08	PK	74	12.92	71.19	27.7	4.47	42.28	-10.11
2483.50	42.70	AV	54	11.30	52.81	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	59.35	PK	74	14.65	69.46	27.7	4.47	42.28	-10.11
2483.50	40.80	AV	54	13.20	50.91	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

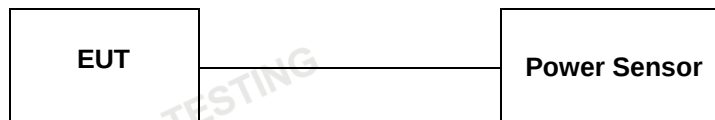
Limit

The Maximum Peak Output Power Measurement is 125mW (20.97).

Test Procedure

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

Test Configuration



Test Results

ANT1:

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	-1.43	20.97	Pass
	39	-1.62		
	78	-1.58		
$\pi/4$ DQPSK	00	-2.24	20.97	Pass
	39	-2.42		
	78	-2.46		
8DPSK	00	-2.20	20.97	Pass
	39	-2.42		
	78	-2.28		

ANT2:

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	0.65	20.97	Pass
	39	0.48		
	78	0.41		
$\pi/4$ DQPSK	00	-0.15	20.97	Pass
	39	-0.33		
	78	-0.37		
8DPSK	00	-0.15	20.97	Pass
	39	-0.31		
	78	-0.34		

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

4.4 20dB Bandwidth

Limit

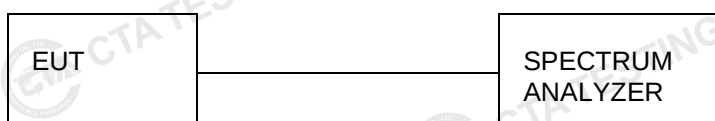
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

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 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration



Test Results

ANT1:

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	CH00	0.963	Pass
	CH39	0.960	
	CH78	0.954	
$\pi/4$ DQPSK	CH00	1.281	
	CH39	1.317	
	CH78	1.341	
8DPSK	CH00	1.308	
	CH39	1.284	
	CH78	1.284	

ANT2:

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	CH00	0.939	Pass
	CH39	0.954	
	CH78	1.011	
$\pi/4$ DQPSK	CH00	1.305	
	CH39	1.269	
	CH78	1.278	
8DPSK	CH00	1.278	
	CH39	1.281	
	CH78	1.335	

Test plot as follows:

ANT1:

GFSK Modulation



CH00



CH39



CH78

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

$\pi/4$ DQPSK Modulation

CH00



CH39



CH78

8DPSK Modulation



CH00



CH39



CH78

ANT2:



$\pi/4$ DQPSK Modulation

CH00



CH39



CH78

8DPSK Modulation



CH00



CH39



CH78

4.5 Frequency Separation

LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

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.

TEST CONFIGURATION



TEST RESULTS

ANT1:

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.000	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
$\pi/4\text{DQPSK}$	CH38	1.280	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
8DPSK	CH38	1.192	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			

ANT2:

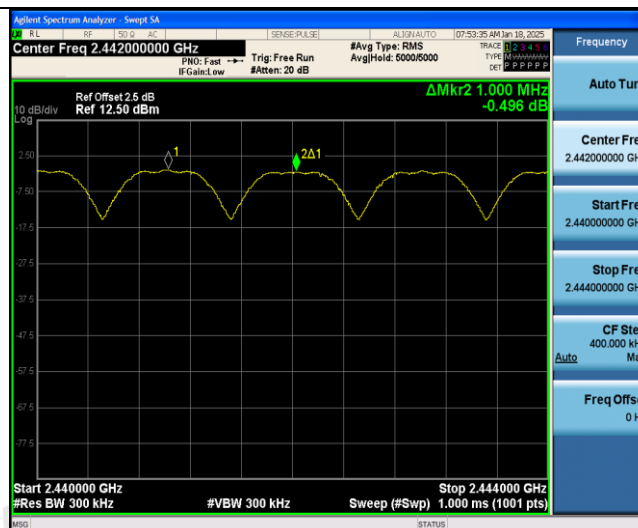
Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.016	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
$\pi/4\text{DQPSK}$	CH38	1.024	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			
8DPSK	CH38	1.020	25KHz or $2/3 \times 20\text{dB}$ bandwidth	Pass
	CH39			

Note:

We have tested all mode at high, middle and low channel, and recorded worst case at middle

Test plot as follows:

ANT1:

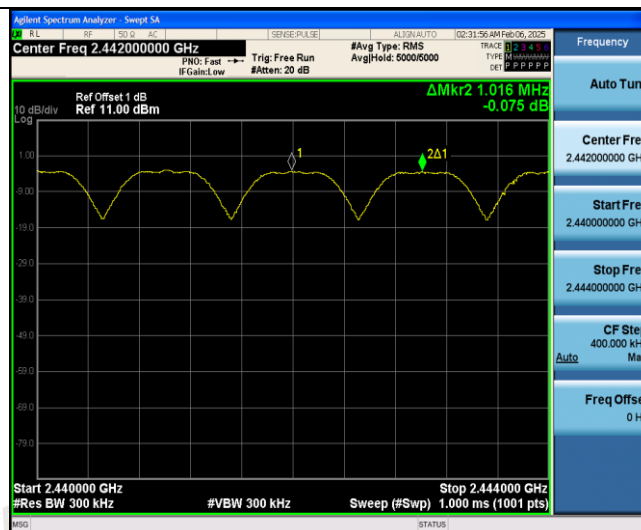


GFSK

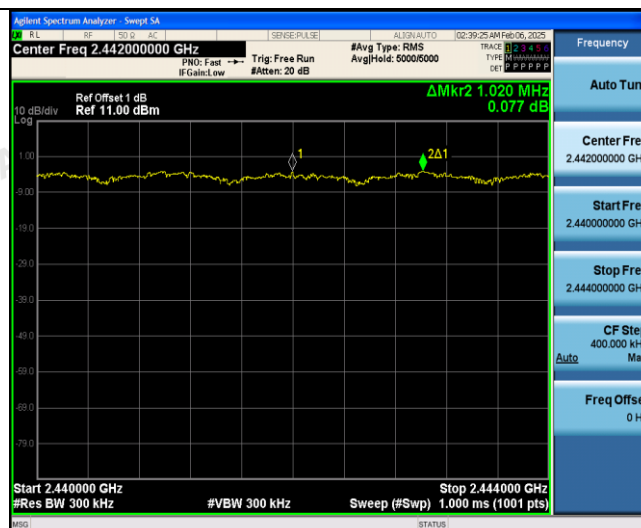
 $\pi/4$ DQPSK

8DPSK

ANT2:



GFSK

 $\pi/4$ DQPSK

8DPSK

4.6 Number of hopping frequency

Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

Test Configuration



Test Results

ANT1:

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
$\pi/4$ DQPSK	79		
8DPSK	79		

ANT2:

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
$\pi/4$ DQPSK	79		
8DPSK	79		

Test plot as follows:

Agilent Spectrum Analyzer - Swept SA

SENSE: A.L. SEI AL33141/TO 07:54:20 AM Jan 10, 2025

Center Freq 2.441750000 GHz

PRO: Fast IF Gain: Low Trig: Free Run #Avg Type: RMS

Ref Offset 2.5 dB Ref 12.50 dBm

10 dB/div Log

Start 2.40000 GHz Stop 2.48350 GHz

#Res BW 300 kHz #VBW 300 kHz Sweep (#Swp) 1.133 ms (1001 pts)

Frequency

Auto Tune

Center Freq 2.441750000 GHz

Start Freq 2.400000000 GHz

Stop Freq 2.483500000 GHz

CF Step 8.350000 MHz

Auto Man

Freq Offset 0 Hz

Agilent Spectrum Analyzer - Swept SA

RF: 2.441750000 GHz SENSE: PAUSE ALPH: AUTO 07:56:30 AM Jan 19, 2025

Center Freq 2.441750000 GHz #Avg Type: RMS

PN0: Fast IF Gain: Low Trig: Free Run #Atten: 20 dB

TYPE: 2.5 kHz BW DET: P P P P P

Ref Offset 2.5 dB Ref 12.50 dBm

20 dB/div Log

Start 2.40000 GHz #Res BW 300 kHz #VBW 300 kHz Sweep (#Swp) 1.133 ms (1001 pts)

Stop 2.48350 GHz

Frequency

Auto Tune

Center Freq 2.441750000 GHz

Start Freq 2.400000000 GHz

Stop Freq 2.483600000 GHz

CF Step 8.350000 MHz

Auto Man

Freq Offset 0 Hz

Agilent Spectrum Analyzer - Sweep SA

File Edit View Settings Help

SENSE: PA, RB

ALPHA: AUTO

07:56:53 AM Jan 19, 2025

Center Freq 2.441750000 GHz

PN0: Fast Trig: Free Run #Avg Type: RMS

IF Gain: Low #Atten: 20 dB

TRACE 12.441750000

TYPE 10.000000000

DET 1.000000000

Frequency

Auto Tune

Center Freq 2.441750000 GHz

Start Freq 2.400000000 GHz

Stop Freq 2.483500000 GHz

CF Step 8.350000 MHz

Auto Man

Freq Offset 0 Hz

10 dB/div

Log

Ref Offset 2.5 dB

Ref 12.50 dBm

Start 2.40000 GHz

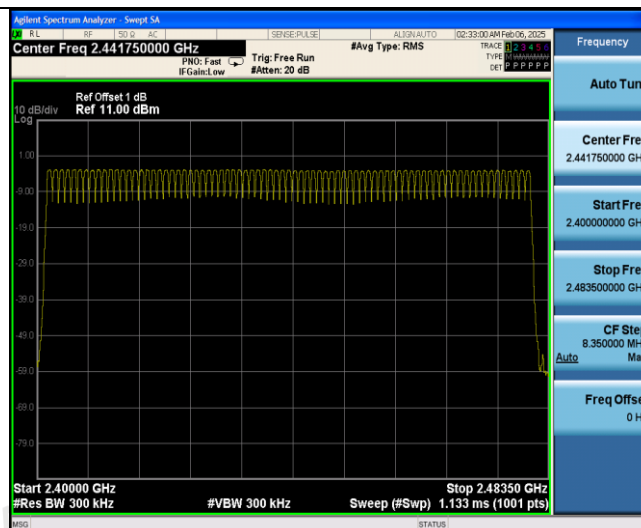
#VBW 300 kHz

Sweep (#Swp) 1.133 ms (1001 pts)

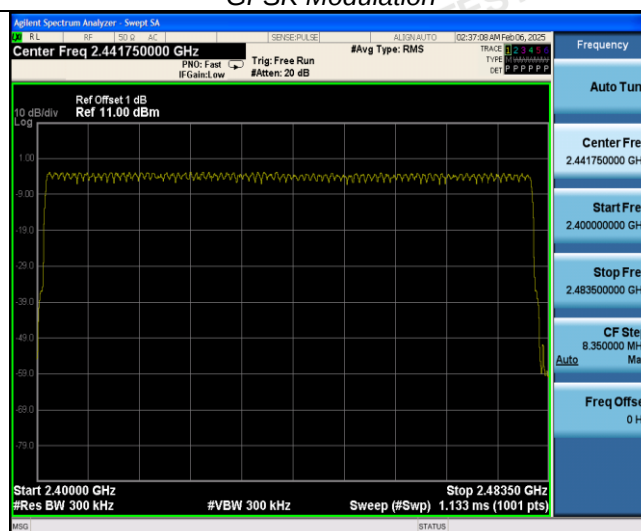
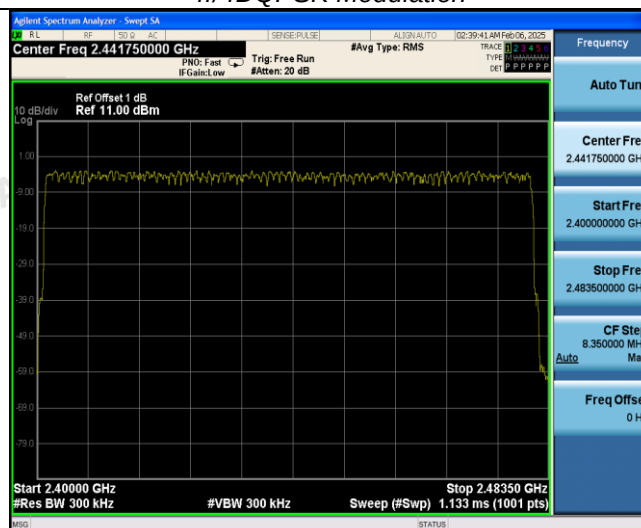
Stop 2.48350 GHz

MSG STATUS

ANT2:



GFSK Modulation

 $\pi/4$ DQPSK Modulation

8DPSK Modulation

4.7 Time of Occupancy (Dwell Time)

Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

Test Configuration



Test Results

ANT1:

Modulation	Packet	Burst time (ms)	Dwell time (s)	Limit (s)	Result
GFSK	DH1	0.390	0.125	0.40	Pass
	DH3	1.640	0.262		
	DH5	2.890	0.308		
π/4DQPSK	2-DH1	0.390	0.125	0.40	Pass
	2-DH3	1.640	0.262		
	2-DH5	2.900	0.309		
8DPSK	3-DH1	0.380	0.122	0.40	Pass
	3-DH3	1.640	0.262		
	3-DH5	2.900	0.309		

ANT2:

Modulation	Packet	Burst time (ms)	Dwell time (s)	Limit (s)	Result
GFSK	DH1	0.390	0.125	0.40	Pass
	DH3	1.650	0.264		
	DH5	2.890	0.308		
π/4DQPSK	2-DH1	0.390	0.125	0.40	Pass
	2-DH3	1.640	0.262		
	2-DH5	2.890	0.308		
8DPSK	3-DH1	0.390	0.125	0.40	Pass
	3-DH3	1.650	0.264		
	3-DH5	2.890	0.308		

Note: We have tested all mode at high, middle and low channel, and recorded worst case at middle channel.

Dwell time = Pulse time (ms) × (1600 ÷ 2 ÷ 79) × 31.6 Second for DH1, 2-DH1, 3-DH1

Dwell time = Pulse time (ms) × (1600 ÷ 4 ÷ 79) × 31.6 Second for DH3, 2-DH3, 3-DH3

Dwell time = Pulse time (ms) × (1600 ÷ 6 ÷ 79) × 31.6 Second for DH5, 2-DH5, 3-DH5

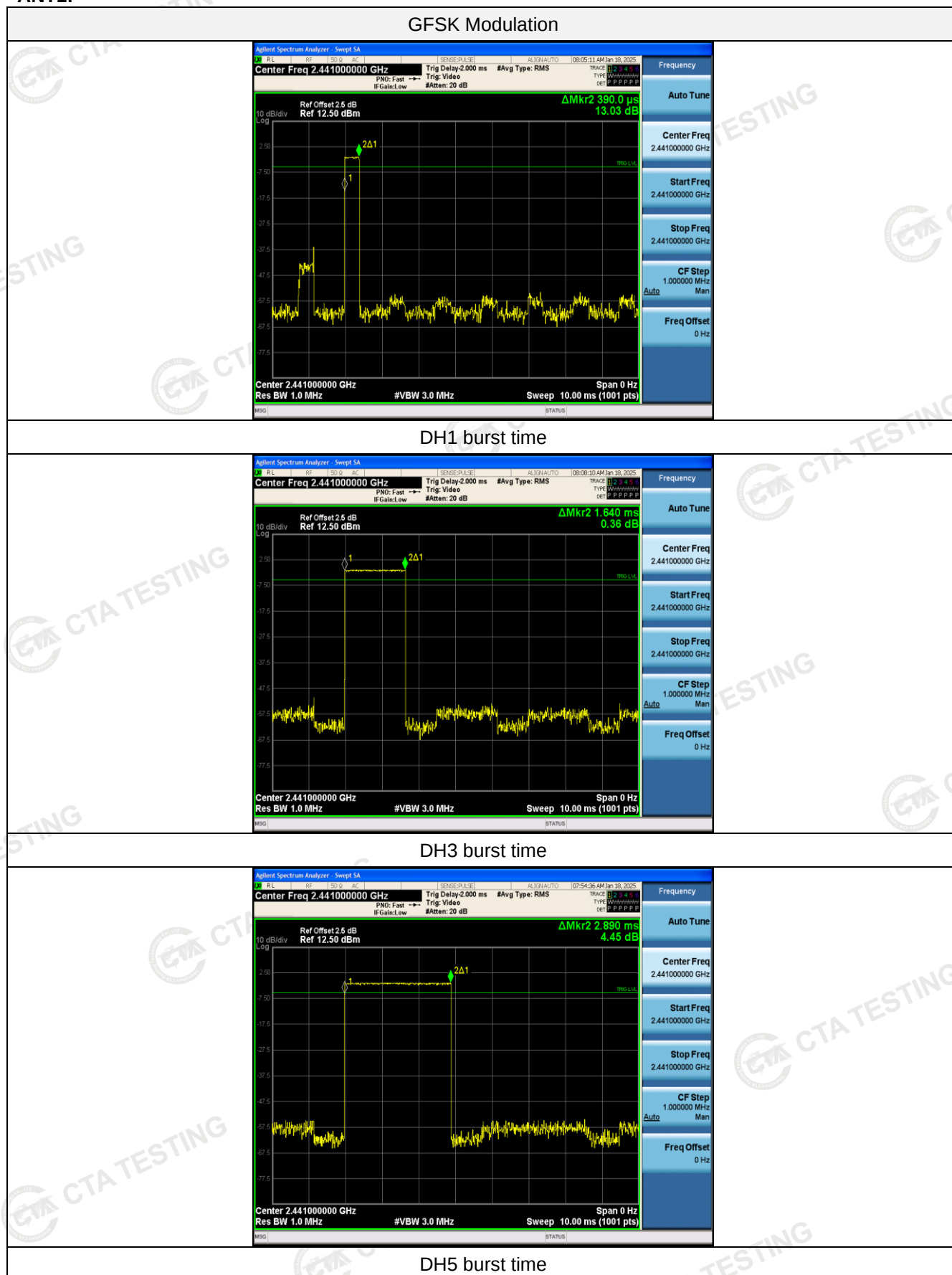
Shenzhen CTA Testing Technology Co., Ltd.

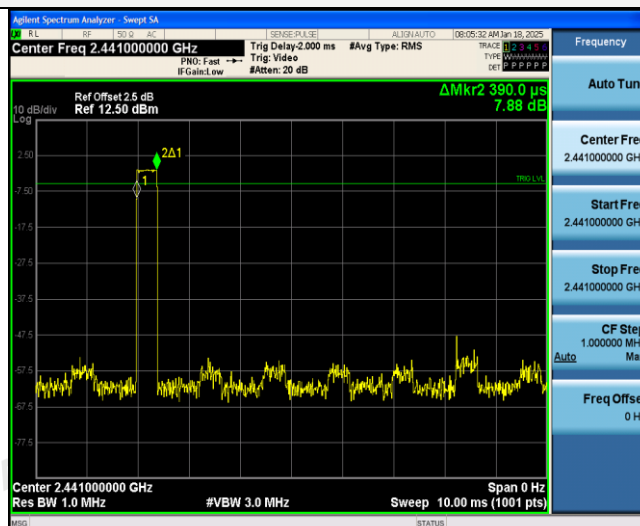
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

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

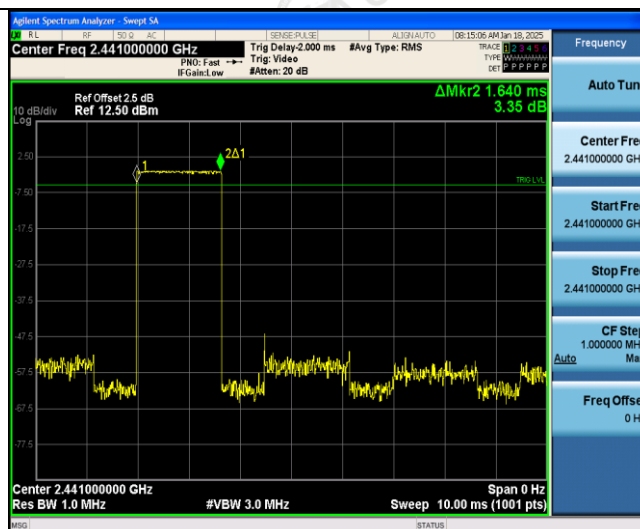
Test plot as follows:

ANT1:



$\pi/4$ DQPSK Modulation

2-DH1 burst time

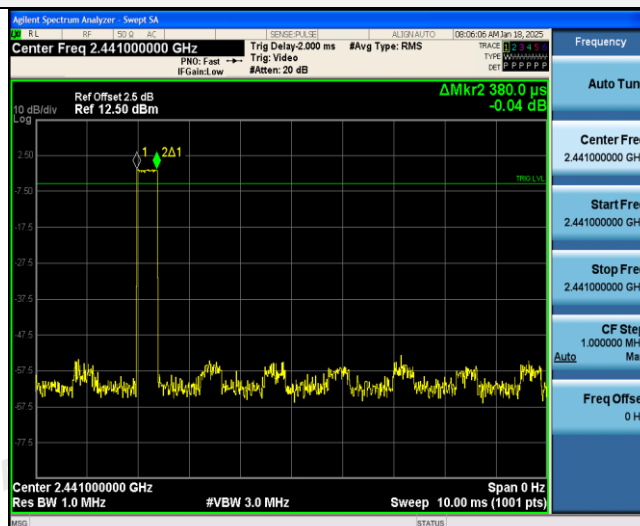


2-DH3 burst time

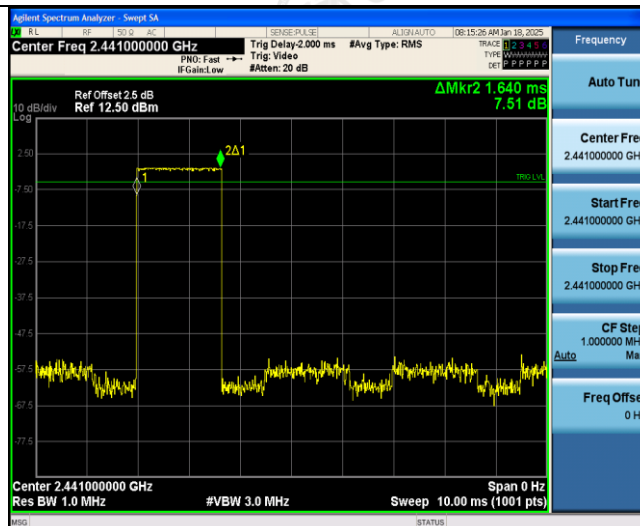


2-DH5 burst time

8DPSK Modulation



3-DH1 burst time



3-DH3 burst time



3-DH5 burst time