

Test Report

Verified code: 276194

Report No.: E20221227602901-2

Customer: Lumi United Technology Co., Ltd

Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District,
Nanshan District, Shenzhen, China

Sample Name: Camera Hub G3

Sample Model: CH-H03

Receive Sample Date: Jan.05,2023

Test Date: Jan.12,2023 ~ Jan.12,2023

Reference Document: CFR 47, FCC Part 15 Subpart C
RADIO FREQUENCY DEVICES:Subpart C—Intentional Radiators
§15.247 Radiated Spurious Emission

Test Result: Pass

Prepared by: *Wen Wen*

Reviewed by: *Wu Haoming*

Approved by: *Zhao Zetian*

GRG METROLOGY & TEST GROUP CO., LTD.

Issued Date: 2023-04-14

GRG METROLOGY & TEST GROUP CO., LTD.

Address: No.163, Pingyun Road, West of Huangpu Avenue, Guangzhou, Guangdong, China
Tel: (+86) 400-602-0999 FAX: (+86) 020-38698685 Web: <http://www.grgtest.com>



Statement

1. The report is invalid without "special seal for inspection and testing"; some copies are invalid; The report is invalid if it is altered or missing; The report is invalid without the signature of the person who prepared, reviewed and approved it.
2. The sample information is provided by the client and responsible for its authenticity; The content of the report is only valid for the samples sent this time.
3. When there are reports in both Chinese and English, the Chinese version will prevail when the language problems are inconsistent.
4. If there is any objection concerning the report, please inform us within 15 days from the date of receiving the report.
5. Without the agreement of the laboratory, the client is not authorized to use the test results for unapproved propaganda.

----- The following blanks -----

TABLE OF CONTENTS

1.	TEST RESULT SUMMARY	6
2.	GENERAL DESCRIPTION OF EUT	7
2.1	APPLICANT	7
2.2	MANUFACTURER	7
2.3	BASIC DESCRIPTION OF EQUIPMENT UNDER TEST.....	7
2.4	CHANNEL LIST	8
2.5	TEST OPERATION MODE.....	8
2.6	LOCAL SUPPORTIVE INSTRUMENTS	8
2.7	CONFIGURATION OF SYSTEM UNDER TEST.....	8
3.	LABORATORY AND ACCREDITATIONS	10
3.1	LABORATORY	10
3.2	ACCREDITATIONS	10
3.3	MEASUREMENT UNCERTAINTY	11
4.	LIST OF USED TEST EQUIPMENT AT GRGT	12
5.	RADIATED SPURIOUS EMISSIONS.....	13
5.1	LIMITS	13
5.2	TEST PROCEDURES	13
5.3	TEST SETUP.....	17
5.4	DATA SAMPLE.....	18
5.5	TEST RESULTS.....	19
	APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM.....	25
	APPENDIX B. PHOTOGRAPH OF THE EUT.....	25

----- The following blanks -----

REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20221227602901-2	Original Issue	2023-03-13

The applicant declared that the model CH-H03 comparison before and after the change as below: The 802.11n HT40 mode of the 2.4G Wi-Fi module has been deleted for this model, as well as other modification information in the following table. There are corresponding changes to the circuit schematic and PCB layout, but this will not affect the RF performance test results. For details, see the following table:

The Original model		The New model	
Change 1. Parameter before change	Bit number C160 is vacant	Parameter after Change	Add C160 capacitor, capacity : 12pF
Change 2. Add components	1.R97 location as shown below 2.R17, C158, and C159 are empty as shown below 3.R34 is another name on the motherboard, under the camera	Parameter after Change	1.Move bit number R97 position 2.Move bit number R34 position 3.Add resistor R17=120R, capacitor C158=27pF, C159=27pF
Change 3. Change component parameters (Change pcba: usb small version)	bit number: L1 (resistor) Parameter: 0R (usb small version)	Parameter after Change	bit number: L1 (magnetic bead) Parameter: magnetic bead value: 100MHz@120ohm magnetic beads (usb small version)
Change 4. Parameter before change (U1 added one replacement suppliers)	bit number: U1 parameter: 2.8V~30V\1MHz\2A\0.6mA\SOT23-6 SILERGY SY7200AABC	Parameter after Change	bit number: U1 A:parameter: 2.8V~30V\1MHz\2A\0.6mA\SOT23-6 SILERGY SY7200AABC B: parameter: 2.7~6V\60mA\0.8MHz\1A\SOT23-6 ETA ETA1617S2G

Change 5. Parameter before change	Bit number U6 is FORESEE/FS35ND02G-S3Y2QWFI000	Parameter after Change	Bit number U6 is 1. ESMT/F50L2G41XA -104YG2B or 2. Winbond/W25N02KVZEIR
Change 6. Add components	Bit number U19 is HDSC/HC32F005C6UA	Parameter after Change	Bit number U19 is Cmsemicon/CMS32L031QN20
Change 7. Change component parameters (Change pcba: usb small version)	1.Bit number U18 is SmartSens/SC3335 2.Bit number U12 is 1.2V LDO	Parameter after Change	1.Bit number U18 is SmartSens/SC3338 2.Bit number U12 is vacant
Change 8. Software Version	3.2.8_0003.0004	Parameter after Change	V3.5.2_0010.0004

Note: According to the difference declared letter by applicant, after evaluated only the Radiated Spurious Emission 30MHz to 1GHz test data need tested and revised, all other test data please refer to the report E20210426746801-9 which issue on 2021-09-04.

----- The following blanks -----

1. TEST RESULT SUMMARY

Standard	Item	Limit / Severity	Result
CFR 47, FCC Part 15 Subpart C (§15.247)	Radiated Spurious Emission	§15.209	PASS

----- The following blanks -----

2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

2.2 MANUFACTURER

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

2.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Product Name: Camera Hub G3
Product Model: CH-H03
Adding Model: /
Trade Name: Aqara
FCC ID: 2AKIT-CHH03
Power Supply: DC5V power supplied by adapter
Adapter Specification: Model:A8A-050200U-US1
Input:100-240V~ 50/60Hz 0.35A
Output:5.0V  2.0A
Frequency Band: 2412MHz-2462MHz for 802.11b/g/n HT20
Modulation Type: DSSS for 802.11b mode;
OFDM for 802.11g mode;
OFDM for 802.11n mode.
Antenna Specification: Internal antenna with 3dBi gain (Max.)
Temperature Range: -10℃~40℃
Hardware Version: A20-GHC01-MIAN-X4
Software Version: V3.5.2_0010.0004
Sample submitting way: ☒ Provided by customer ☐ Sampling
Sample No: E20221227602901-0002
Note: /

2.4 CHANNEL LIST

CH01 - CH11 for IEEE 802.11b, IEEE 802.11g, IEEE 802.11n HT20							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

2.5 TEST OPERATION MODE

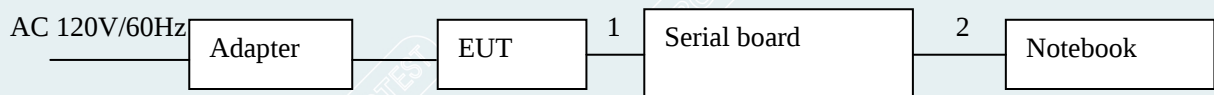
Mode No.	Description of the modes
1	2.4G Wi-Fi TX mode

2.6 LOCAL SUPPORTIVE INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Note
Notebook	LENOVO	TianYi 310-14ISK	MP18DLC6	/
Serial board	/	/	/	/

No.	Cable Type	Qty.	Shielded Type	Ferrite Core(Qty.)	Length
1	DC Cable	1	No	0	1.0m
2	USB Cable	1	No	0	1.5m

2.7 CONFIGURATION OF SYSTEM UNDER TEST



Test software:

Software version
QCOM_V1.0

----- The following blanks -----

Power Setting:

Mode	Date Rate	Frequency (MHz)	Power Setting
802.11b	1M	2412	44
		2437	44
		2462	44
802.11g	6M	2412	48
		2437	48
		2462	48
802.11n HT20	MCS0	2412	48
		2437	48
		2462	48

----- The following blanks -----

3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of GRG METROLOGY & TEST GROUP CO., LTD.

Add : No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District
Shenzhen, 518110, People's Republic of China

P.C. : 518110

Tel : 0755-61180008

Fax : 0755-61180008

3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA A2LA(Certificate#:2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada ISED (Company Number: 24897, CAB identifier:CN0069)

USA FCC (Registration Number: 759402, Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site,
<http://www.grgtest.com>

----- The following blanks -----

3.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement		Frequency	Uncertainty
Radiated Emission	Horizontal	30MHz~200MHz	4.5dB
		200MHz~1000MHz	4.4dB
	Vertical	30MHz~200MHz	4.4dB
		200MHz~1000MHz	4.5dB

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
Humidity	6 %
Temperature	2 °C

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95%.
This uncertainty represents an expanded uncertainty factor of $k=2$.

----- The following blanks -----

4. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission(30MHz-1GHz)				
Test S/W	EZ	CCS-03A1	/	/
Test Receiver	R&S	ESR7	102444	2023-09-02
Preamplifier	EMEC	EM330	I00426	2023-03-05
Bi-log Antenna	TESEQ	CBL6143A	26039	2024-10-23

Note: The calibration interval of the above test instruments is 12 months except Bi-log Antenna, The calibration interval of the Bi-log Antenna is 24 months.

----- The following blanks -----

5. RADIATED SPURIOUS EMISSIONS

5.1 LIMITS

In any 100kHz 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 100kHz 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 30dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required.

Frequency (MHz)	Quasi-peak($\mu\text{V/m}$)	Measurement distance(m)	Quasi-peak(dB $\mu\text{V/m}$)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30~88	100	3	40
88~216	150	3	43.5
216~960	200	3	46
Above 960	500	3	54

NOTE:

- (1) The emission limits for the ranges 9-90kHz and 110-490kHz are based on measurements employing a linear average detector.
- (2) The lower limit shall apply at the transition frequencies.
- (3) Above 18GHz test distance is 1m, so the PeakLimit=74+20*log(3/1)=83.54 (dB $\mu\text{V/m}$).
The Avg Limit=54+20*log(3/1)=63.54 (dB $\mu\text{V/m}$).

5.2 TEST PROCEDURES

1) Sequence of testing 9kHz to 30MHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.
- The EUT is placed on a desktop position in the center of the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Pre measurement:

- The turntable rotates from 0 °to 360 °.
- The antenna height is 1.0 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

- Identified emissions during the pre measurement the software maximizes by rotating the turntable

position (0 ° to 360 °) and by rotating the elevation axes (0 ° to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

2) Sequence of testing 30MHz to 1GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 ° to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable rotates from 0 ° to 360 ° and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1GHz to 18GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.
- The EUT is placed on a desktop position in the center of the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Pre measurement:

- The turntable rotates from 0 ° to 360 °.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 4 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable rotates from 0 ° to 360 ° and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.
- The EUT is placed on a desktop position in the center of the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

Pre measurement:

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

NOTE:

(a).The frequency from 9kHz to 150kHz, Set RBW=300Hz(for Peak&AVG), RBW=300Hz(for Peak&AVG).

the frequency from 150kHz to 30MHz, Set RBW=9kHz, RBW=9kHz,(for QP Detector).

(b).The frequency from 30MHz to 1GHz, Set RBW=120kHz, RBW=300kHz,(for QP Detector).

----- The following blanks -----

5.3 TEST SETUP

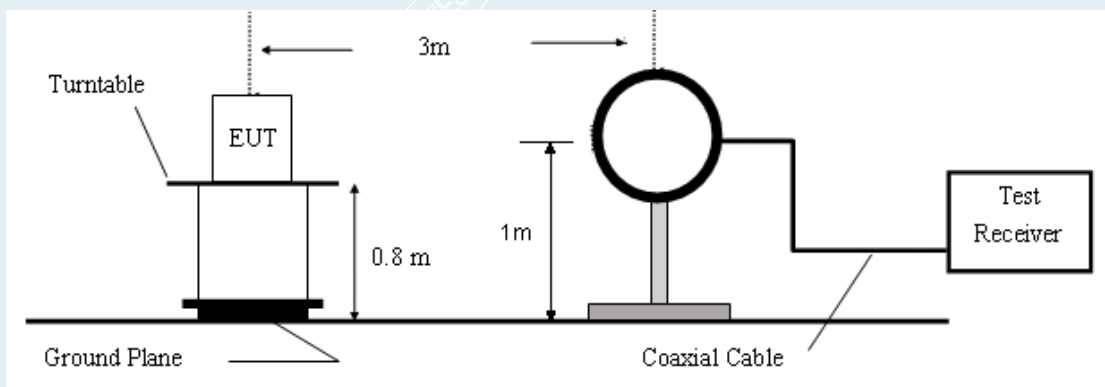


Figure 1. 9kHz to 30MHz radiated emissions test configuration

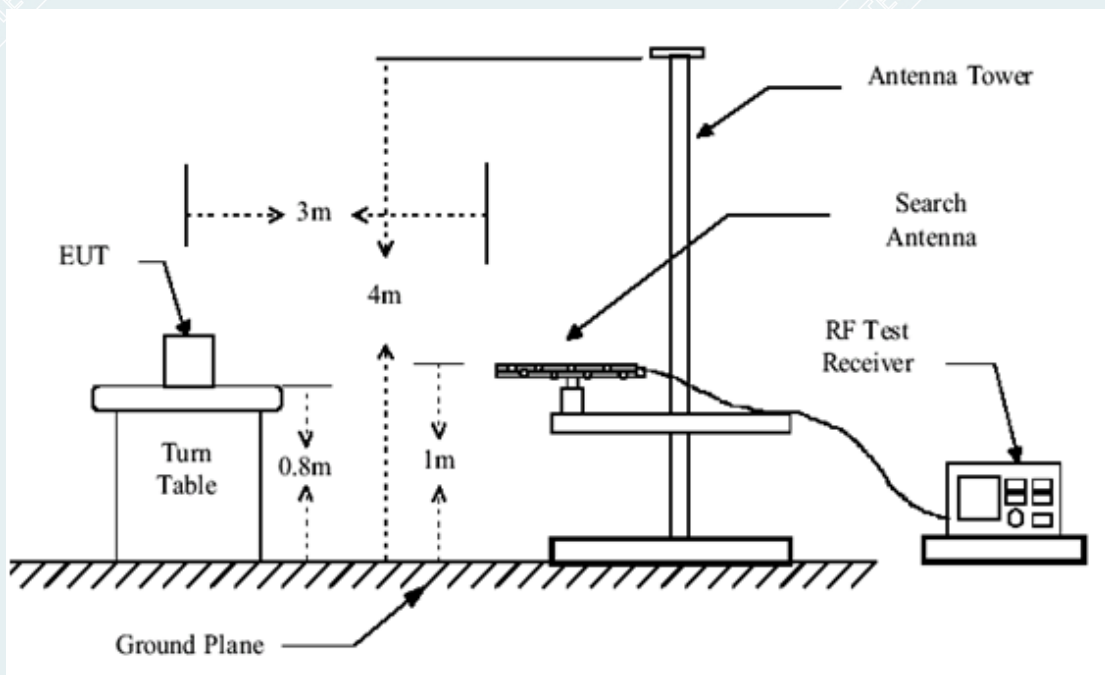


Figure 2. 30MHz to 1GHz radiated emissions test configuration

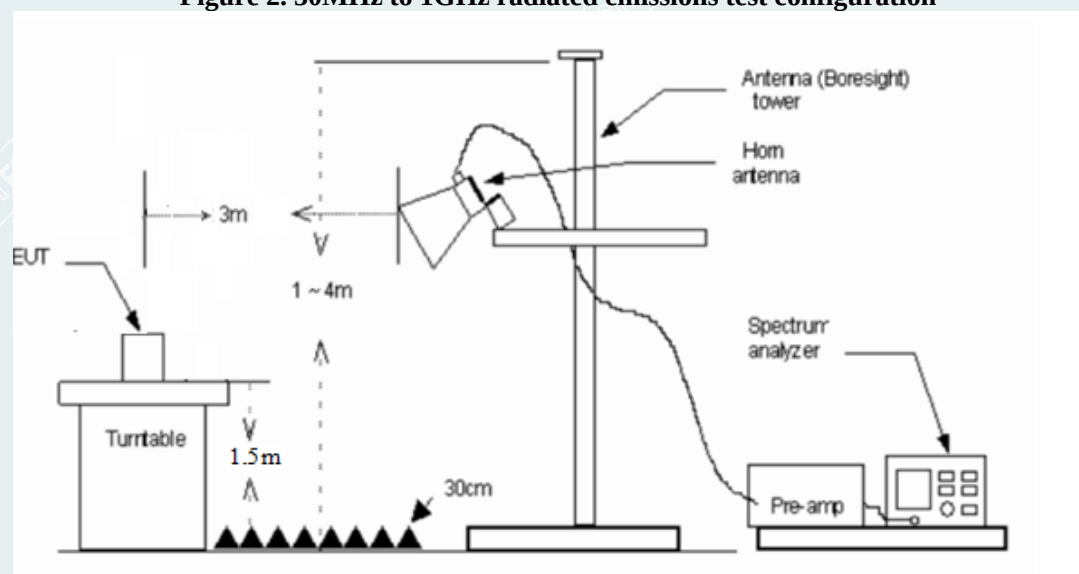


Figure 3. 1GHz to 18GHz radiated emissions test configuration

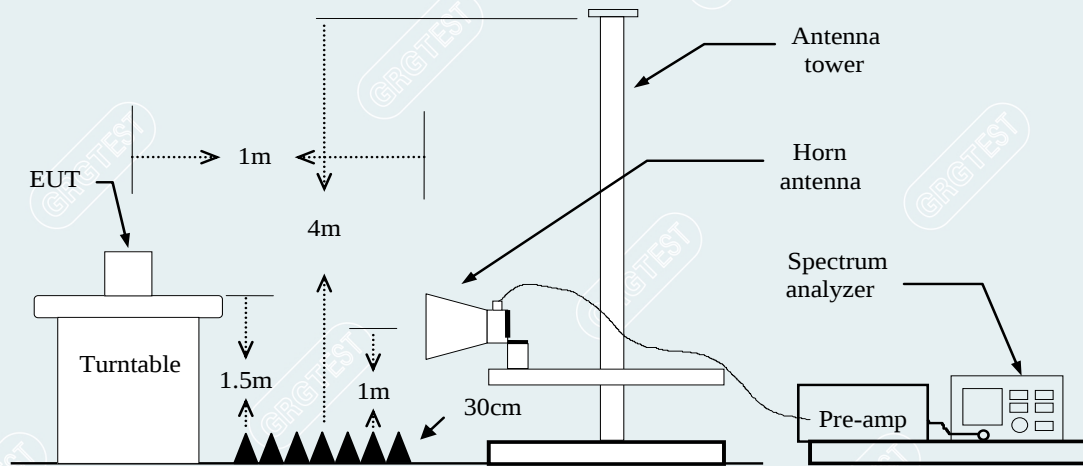


Figure 4. 18GHz to 26.5GHz radiated emissions test configuration

5.4 DATA SAMPLE

30MHz to 1GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	37.06	-15.48	21.58	40.00	-18.42	QP	Vertical

1GHz-18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	65.45	-11.12	54.33	74.00	-19.67	peak	Vertical
xxx	xxx	63.00	-11.12	51.88	54.00	-2.12	AVG	Vertical

Above 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	68.86	57.66	-11.20	83.54	25.88	peak	Vertical
xxx	xxx	68.89	-11.20	57.69	63.54	5.85	AVG	Vertical

Frequency (MHz)

= Emission frequency in MHz

Ant. Pol. (H/V)

= Antenna polarization

Reading (dBuV)

= Uncorrected Analyzer / Receiver reading

Factor (dB)

= Antenna factor + Cable loss – Amplifier gain

Result (dBuV/m)

= Reading (dBuV) + Correction Factor (dB/m)

Limit (dBuV/m)

= Limit stated in standard

Margin (dB)

= Remark Result (dBuV/m) – Limit (dBuV/m)

Peak

= Peak Reading

QP

= Quasi-peak Reading

AVG

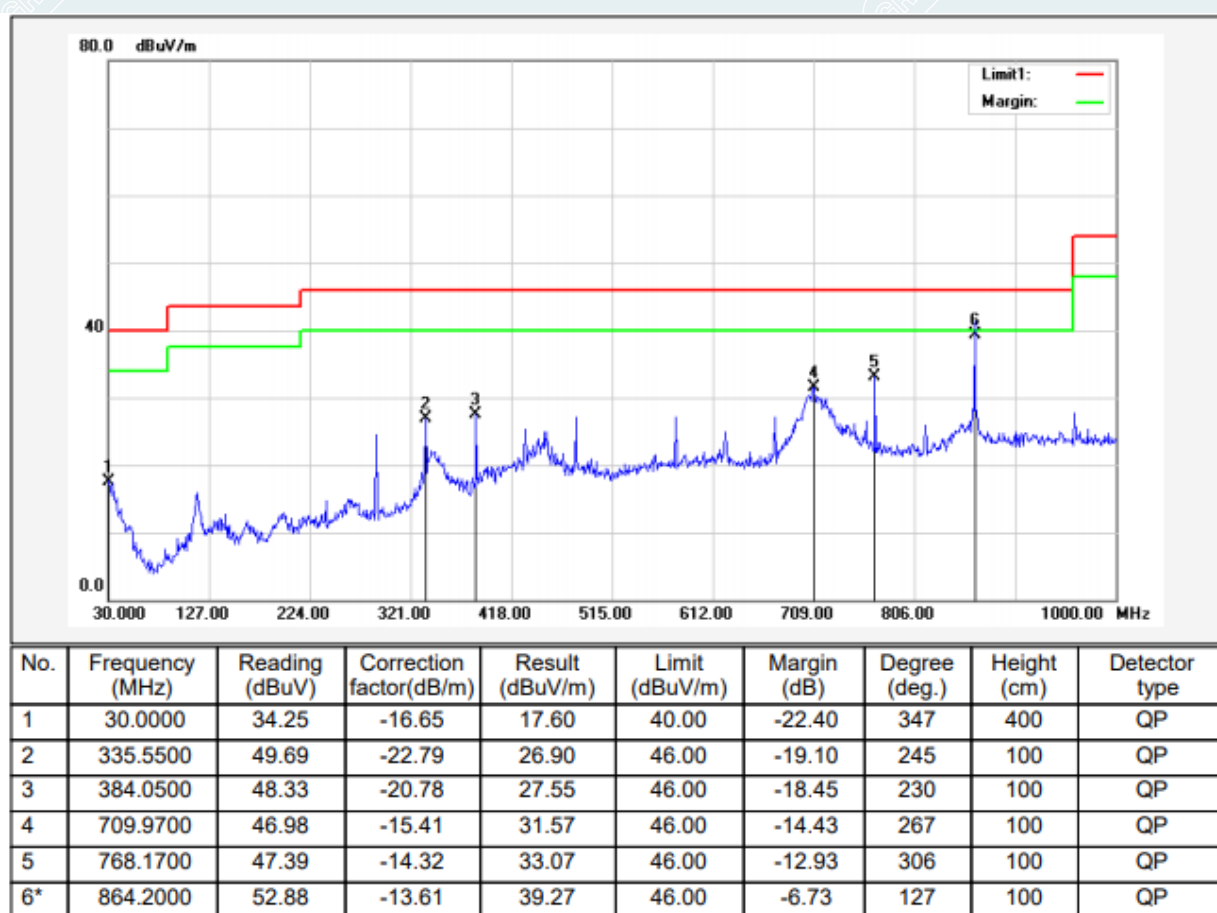
= Average Reading

5.5 TEST RESULTS

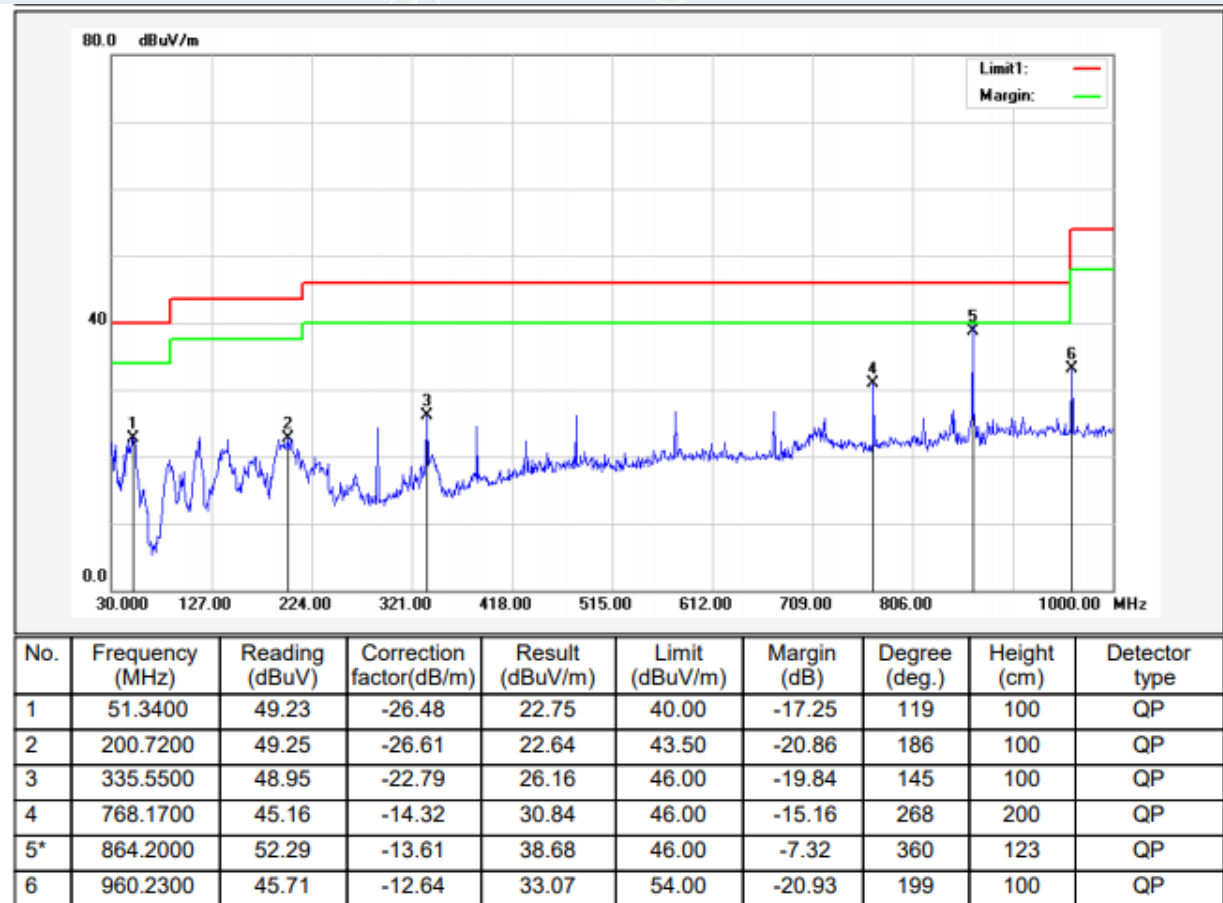
Below 1GHz

All models were pretested and only the worst modes and channels were recorded in this report. (IEEE 802.11b)

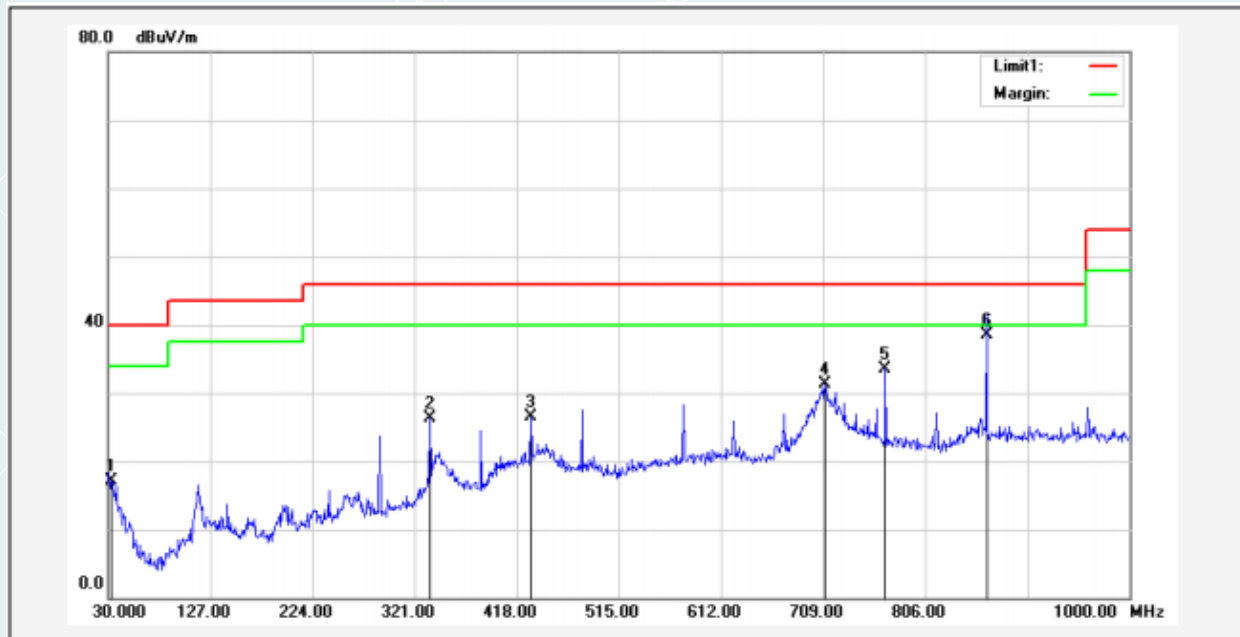
EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2412MHz)	Polarity	Horizontal
Tested By	Huang Xinlong	Tested Date	2023-01-12



EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2412MHz)	Polarity	Vertical
Tested By	Huang Xinlong	Tested Date	2023-01-12

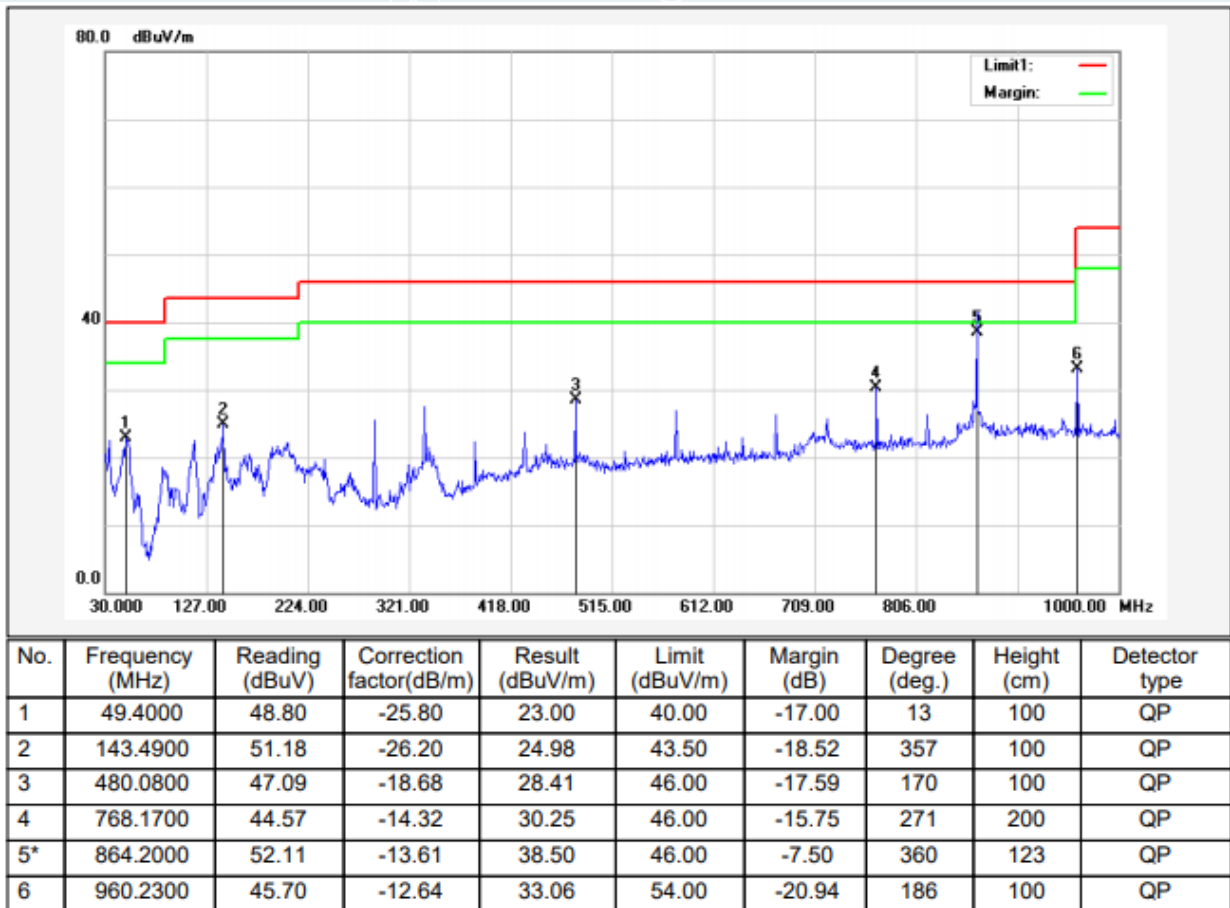


EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2437MHz)	Polarity	Horizontal
Tested By	Huang Xinlong	Tested Date	2023-01-12

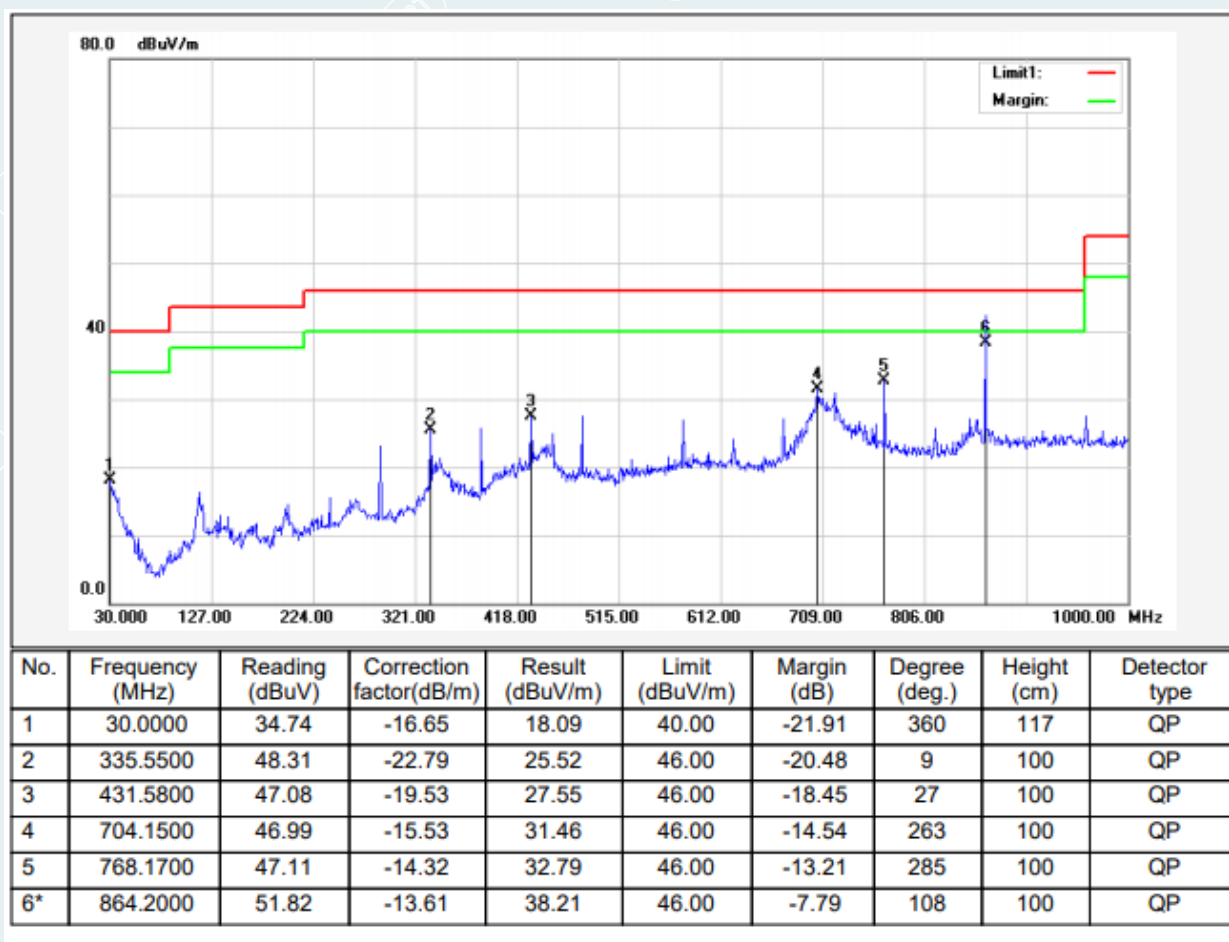


No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1	32.9100	35.16	-18.06	17.10	40.00	-22.90	233	400	QP
2	335.5500	49.07	-22.79	26.28	46.00	-19.72	241	100	QP
3	431.5800	46.07	-19.53	26.54	46.00	-19.46	11	100	QP
4	710.9400	46.59	-15.38	31.21	46.00	-14.79	253	100	QP
5	768.1700	47.92	-14.32	33.60	46.00	-12.40	108	100	QP
6*	864.2000	52.20	-13.61	38.59	46.00	-7.41	128	100	QP

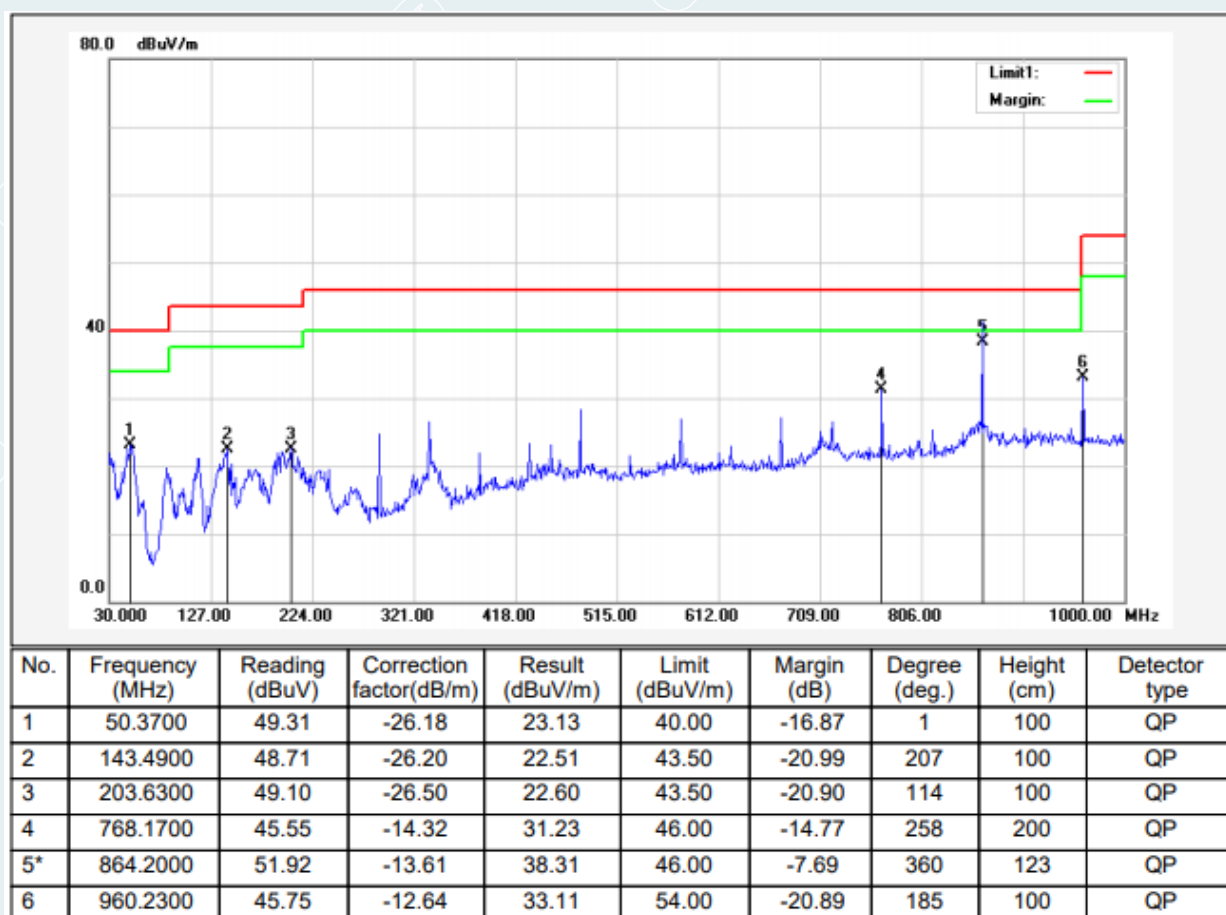
EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2437MHz)	Polarity	Vertical
Tested By	Huang Xinlong	Tested Date	2023-01-12



EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2462MHz)	Polarity	Horizontal
Tested By	Huang Xinlong	Tested Date	2023-01-12



EUT Name	Camera Hub G3	Model	CH-H03
Environmental Conditions	22.3°C/49%RH/101.0kPa	Test Voltage	AC 120V/60Hz
Test Mode	IEEE 802.11b Frequency (2462MHz)	Polarity	Vertical
Tested By	Huang Xinlong	Tested Date	2023-01-12

**Remark:**

- 1 Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Quasi-peak detector mode.
- 2 Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 3 The IF bandwidth of Receiver between 30MHz to 1GHz was 120 kHz.

----- The following blanks -----

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E20221227602901-18-Test photo-FCC+IC.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20221227602901-17 EUT photo-FCC+IC.

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