

FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

Hisense Home Appliances Group Co., Ltd. Qingdao Branch

Wi-Fi/BLE Intelligent controls module

Model Number: HLW3215-TG

Additional Model: HLW3215-TG01

FCC ID: 2A9F9HLW32155V

Applicant :	Hisense Home Appliances Group Co., Ltd. Qingdao Branch
Address:	Hisense R/D center, #399 SongLing Road, Qingdao,
	Shandong 266104, China
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
	Tel: 86-769-83081888-808

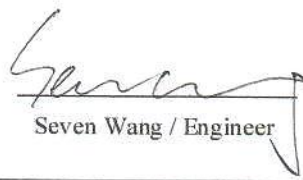
Report Number:	ESTE-R2212049
Date of Test:	Nov. 11~Dec. 01, 2022
Date of Report:	Dec. 05, 2022

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EST Technology Co., Ltd.

Applicant:	Hisense Home Appliances Group Co., Ltd. Qingdao Branch		
Address:	Hisense R/D center, #399 SongLing Road, Qingdao, Shandong 266104, China		
Manufacturer:	Hisense Home Appliances Group Co., Ltd. Qingdao Branch		
Address:	Hisense R/D center, #399 SongLing Road, Qingdao, Shandong 266104, China		
Factory:	Shenzhen Shi Xinzhongxin Technology Co., Ltd		
Address:	1st, 2nd, 3rd, A2, A3, Building A1, East Ring Industrial Zone, No. 293, Nanpu Road, Shangliao Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong 518125, China		
E.U. T:	Wi-Fi/BLE Intelligent controls module		
Model Number:	HLW3215-TG		
Additional Model:	HLW3215-TG01 Note: HLW3215-TG with pin header, HLW3215-TG01 without pin header.		
Power Supply:	DC 5V		
Trade Name:	Hisense	Serial No.:	-----
Date of Receipt:	Nov. 11, 2022	Date of Test:	Nov. 11~Dec. 01, 2022
Test Specification:	FCC Part 15 Subpart C (15.247) ANSI C63.10:2013 FCC KDB 558074 D01 15.247 Meas Guidance v05r02		
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.		
Prepared by:	Reviewed by:	Date: Dec. 05, 2022	
 Ring Yang / Assistant	 Seven Wang / Engineer	 Iceman Hu / Manager	
Other Aspects:	None.		
<i>Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested</i>			
<i>This test report is based on a single evaluation of one sample of above mentioned products, it is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.</i>			

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	Wi-Fi/BLE Intelligent controls module
Model Number	:	HLW3215-TG
Software Version	:	N/A
Hardware Version	:	N/A
Operation frequency	:	2402MHz~2480MHz
Number of channel	:	40
Max Output Power (PEAK)	:	7.27dBm
Modulation Type	:	GFSK
Sample Type	:	Prototype production

Note: For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	PCB	-	0

Note: This information is provided by the applicant.

1.3. Information of RF Cable

Cable Loss(dB)	Provided by
1.0	Hisense Home Appliances Group Co., Ltd. Qingdao Branch
Note: 1.The customer declared the loss value of the RF Cable, and the test results of this report only apply to the sample as received. 2. This information is provided by the applicant.	

2. SUMMARY OF TEST

2.1. Summary of test result

No.	Description of Test Item	FCC Standard Section	Results
1	6dB Bandwidth	15.247(a)(2)	PASS
2	Maximum Peak Output Power	15.247(b)(3)	PASS
3	Power Spectral Density	15.247(e)	PASS
4	Conducted Band Edge	15.247(d)	PASS
5	Conducted Spurious Emissions	15.247(d)	PASS
6	Radiated Spurious Emissions and Band Edge	15.205 15.209 15.247(d)	PASS
7	AC Power Line Conducted Emissions	15.207	N/A
8	Antenna Requirement	15.203	PASS

Note:“N/A” denotes test is not applicable in this test report.

2.2. Test Facilities

EMC Lab : Certificated by CNAS, CHINA
Registration No.: L5288
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA
Designation Number: CN1215
This Certificate is valid until: January 31, 2024

Certificated by A2LA, USA
Registration No.: 4366.01
This Certificate is valid until: January 31, 2024

Certificated by Industry Canada
CAB identifier No.: CN0035
This Certificate is valid until: January 31, 2024

Certificated by VCCI, Japan
Registration No.: C-14103; T-20073; R-13663;
R-20103; G-20097
Date of registration: Apr. 20, 2020
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany
Registration No.: UA 50413872 0001
Date of registration: July 31, 2018

Certificated by Intertek
Registration No.: 2011-RTL-L2-64
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan,
Guangdong, China

2.3. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	$\pm 3.48\text{dB}$
Uncertainty for spurious emissions test (Below 30MHz)	$\pm 1.62\text{ dB}$
Uncertainty for spurious emissions test (30MHz-1GHz)	$\pm 4.60\text{ dB(Polarize: H)}$
	$\pm 4.68\text{ dB(Polarize: V)}$
Uncertainty for spurious emissions test (1GHz to 25GHz)	$\pm 4.96\text{dB}$
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

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

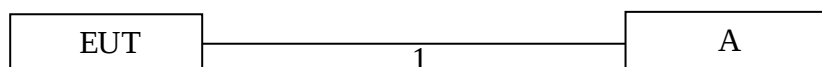
2.4. Assistant equipment used for test

Code	Equipment	Manufacturer	Model No.	Equipment No.	Serial No.
A	Laptop computer	DELL	Inspiron 5493	EST-E316	5376699759

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	0.1m	USB Cable

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into BLE test mode by software before test.



(EUT: Wi-Fi/BLE Intelligent controls module)

2.6. Test Mode

The test mode was selected for the final test as listed below.

Test Item	Modulation Type	Test Channel
6dB Bandwidth	GFSK	Low/Middle/High
Maximum Peak Output Power	GFSK	Low/Middle/High
Power Spectral Density	GFSK	Low/Middle/High
Conducted Band Edge	GFSK	Low/ High
Conducted Spurious Emissions	GFSK	Low/Middle/High
Radiated Spurious Emissions(Below 1GHz)	GFSK	Low/Middle/High
Radiated Spurious Emissions(Above 1GHz)	GFSK	Low/Middle/High
Radiated Band Edge	GFSK	Low/High

Note:In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane**.

2.7. Power Setting of Test Software

Software Name	Wifi_Test_Tool_V1.7.7.exe		
Frequency(MHz)	2402	2440	2480
Setting	Auto	Auto	Auto

Note: This information is provided by the applicant.

2.8. Duty Cycle

Refer to section 10: Appendix A

Note:

1. If duty cycle $< 98\%$, the conducted average output power and average power spectral density should be add duty factor.
2. If duty cycle $\geq 98\%$, the EUT is consider to be transmitting continuously, the conducted average output power and average power spectral density no need to add duty factor (consider to be zero).
3. The conducted peak output power and peak power spectral density no need to consider duty factor.
4. The on-time time is transmission duration (T).

2.9. Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	1	2404
2	2406	3	2408
4	2410	5	2412
6	2414	7	2416
8	2418	9	2420
10	2422	11	2424
12	2426	13	2428
14	2430	15	2432
16	2434	17	2436
18	2438	19	2440
20	2442	21	2444
22	2446	23	2448
24	2450	25	2452
26	2454	27	2456
28	2458	29	2460
30	2462	31	2464
32	2466	33	2468
34	2470	35	2472
36	2474	37	2476
38	2478	39	2480

2.10. Test Equipment List

For conducted emission test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	EST-E001	LIS AI	June 13,22	1 Year
Artificial Mains Network	Rohde & Schwarz	ENV216	EST-E002	LIS AI	June 13,22	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	EST-E078	LIS AI	June 13,22	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A

For radiated emission test(9kHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LIS AI	June 13,22	1 Year
Active Loop Antenna	SCHWARZB ECK	FMZB 1519B	EST-E054	LIS AI	June 13,22	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	N/A	EST-001	N/A	N/A	N/A	N/A

For radiated emissions test (30MHz-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LIS AI	June 13,22	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LIS AI	June 13,22	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For radiated emission test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZB ECK	BBHA9120D	EST-E031	LIS AI	June 13,22	1 Year
Horn Antenna	Com-Power	AHA-840	EST-E133	LIS AI	June 13,22	1 Year
Low Noise Amplifier	RF	TRLA-01018 0G45N	EST-E142	LIS AI	June 13,22	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	EST-E069	LIS AI	June 13,22	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

For connect EUT antenna terminal test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
TS 1120	Tonscend	/	/	/	/	/
Test Software	Tonscend	TS1120-3	3.2.11	/	/	/
RF Control Unit	Tonscend	JS0806-2	EST-E134	LIS AI	June 13,22	1 Year
Signal and Spectrum Analyzer	Rohde &Schwarz	FSV 40	EST-E136	LIS AI	June 13,22	1 Year

3. 6dB BANDWIDTH

3.1. Limit

Systems using digital modulation techniques operate in the 2400-2483.5 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2. Test Setup



3.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	3MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

3.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the ndB down function to measure 6dB Bandwidth.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

3.5. Test Result

Refer to section 10: Appendix B

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limit

For systems using digital modulation in 2400-2483.5 MHz, the maximum peak output power is 1 Watt(30dBm).

4.2. Test Setup



4.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	$\geq$ DTS Bandwidth
VBW	3*RBW
Span	$\geq$ 3*DTS Bandwidth
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

4.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 4.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

4.5. Test Result

Refer to section 10: Appendix C

5. POWER SPECTRAL DENSITY

5.1. 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.

5.2. Test Setup



5.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	3KHz
VBW	10KHz
Span	2MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

5.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 5.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

5.5. Test Result

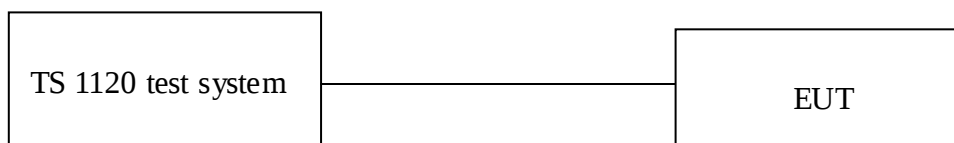
Refer to section 10: Appendix D

6. CONDUCTED BAND EDGE

6.1. 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. 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)).

6.2. Test Setup



6.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	100MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

6.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 6.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

6.5. Test Result

Refer to section 10: Appendix E & F

7. CONDUCTED SPURIOUS EMISSIONS

7.1. 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. 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)).

7.2. Test Setup



7.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	26.5GHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

7.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 7.3.
- Set the EUT transmit continuously with maximum output power.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels were measured.
- Record the results in the test report.

7.5. Test Result

Refer to section 10: Appendix E & G

8. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

15.209 Limit

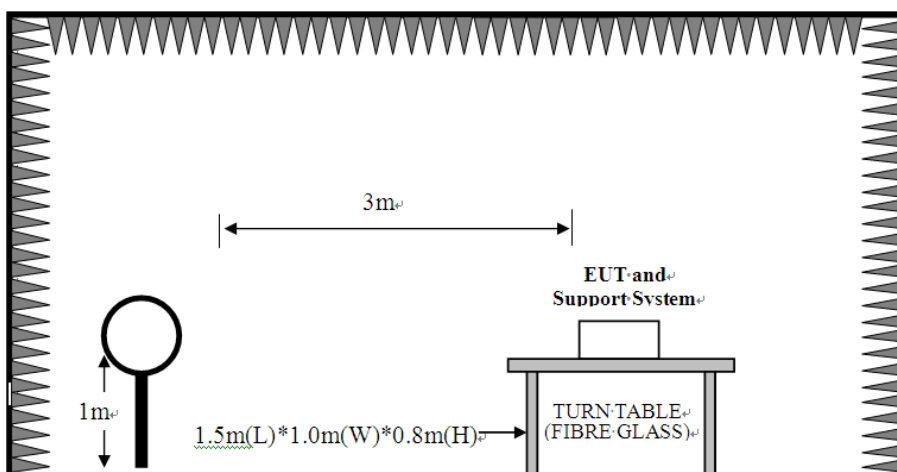
Frequency (MHz)	Field Strength(μ V/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

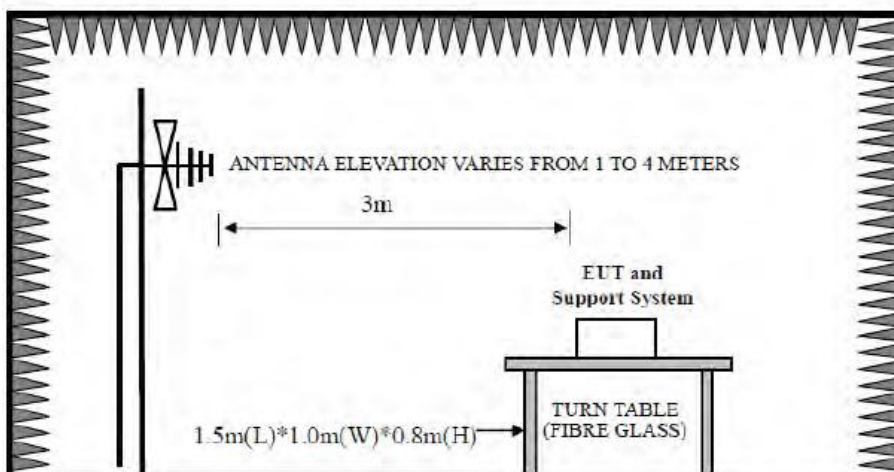
- (1) Emission level dB μ V = 20 log Emission level μ V/m.
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

8.2. Test Setup

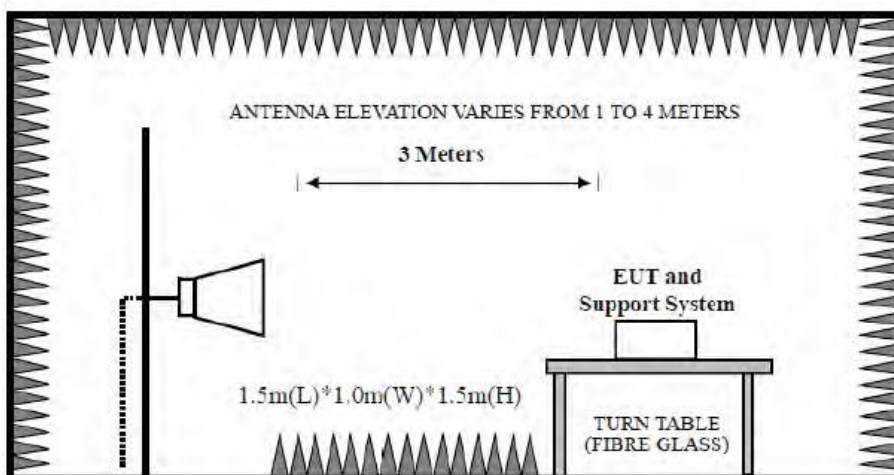
9kHz~30MHz



30~1000MHz



Above 1GHz



8.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
VBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For Above 1GHz

Spectrum Parameters	Setting	
RBW	1MHz	
VBW	PEAK Measurement	AVG Measurement
	3MHz	Duty cycle $\geq 98\%$, VBW=10Hz
		Duty cycle $< 98\%$, VBW $\geq 1/T$
Start frequency	1GHz	
Stop frequency	25GHz	
Sweep Time	Auto	
Detector	PEAK	
Trace Mode	Max Hold	

Note :T is the on-time time of the duty cycle,when EUT transmit continuously with maximum output power,unit is seconds. reference section 2.8 for the on-time time.

8.4. Test Procedure

- a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
- b. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
- c. Set the EUT transmit continuously with maximum output power.
- d. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
- e. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
- f. Spectrum analyzer setting parameters in accordance with section 8.3.
- g. Repeat above procedures until all channels were measured.
- h. Record the results in the test report.

Note:

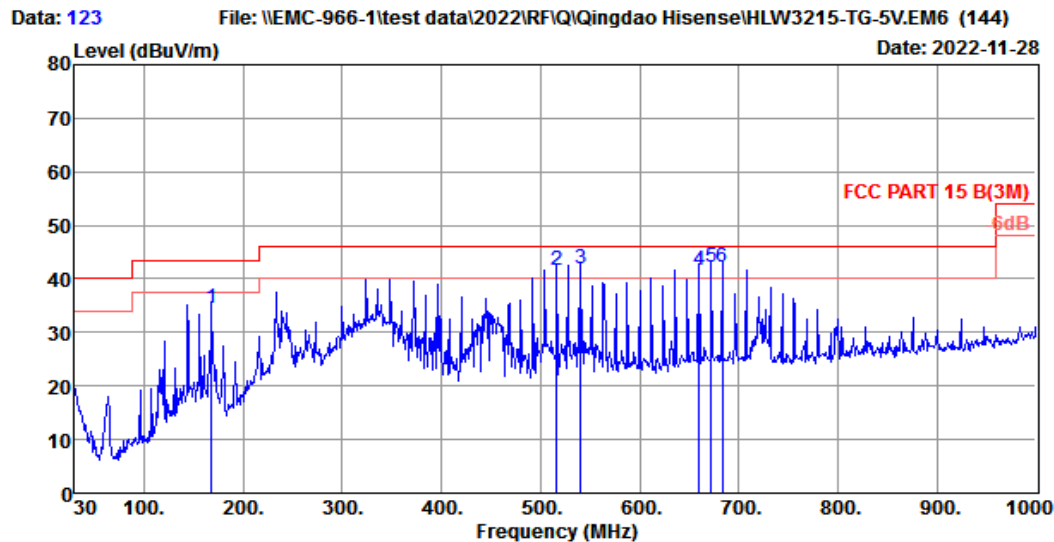
1. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
2. The frequency 2402MHz ,2440MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

8.5. Test Result

Radiated Emissions Below 1GHz

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan, Guangdong, China
Tel: +86-769-83081888
Fax: +86-769-83081878



Site no. : 1# 966 Chamber Data no. : 123
 Dis. / Ant. : 3m 37062 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15 B(3M)
 Env. / Ins. : Temp:24.3;Humi:50.2%;Press:101.35kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	167.74	10.30	1.17	23.17	34.64	43.50	8.86	QP
2	515.97	19.06	2.13	20.44	41.63	46.00	4.37	QP
3	540.22	19.60	2.14	20.20	41.94	46.00	4.06	QP
4	660.50	22.11	2.49	17.12	41.72	46.00	4.28	QP
5	672.14	22.20	2.46	17.47	42.13	46.00	3.87	QP
6	683.78	22.16	2.42	17.50	42.08	46.00	3.92	QP

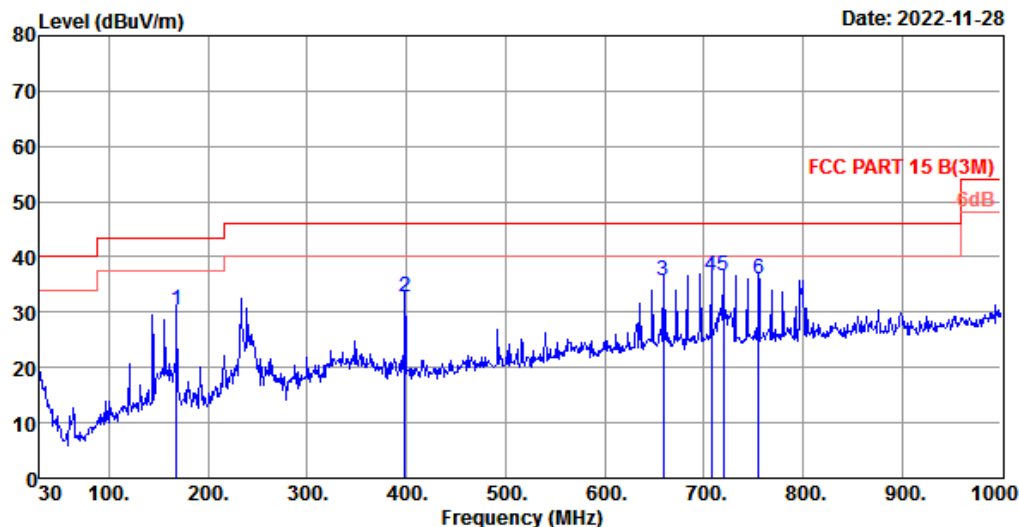
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

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Data: 124 File: \\EMC-966-1\\test data\\2022\\RF\\Q\\Qingdao Hisense\\HLW3215-TG-5V.EM6 (144)

Date: 2022-11-28



Site no. : 1# 966 Chamber Data no. : 124
Dis. / Ant. : 3m 37062 Ant. pol. : VERTICAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:24.3;Humi:50.2%;Press:101.35kPa
Engineer : JBR
EUT : Wi-Fi/BLE Intelligent controls module
Power : DC 5V
M/N : HLW3215-TG-5V
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	167.74	10.30	1.17	18.95	30.42	43.50	13.08	QP
2	398.60	16.99	1.79	14.11	32.89	46.00	13.11	QP
3	659.53	22.10	2.50	11.26	35.86	46.00	10.14	QP
4	708.03	22.12	2.53	11.82	36.47	46.00	9.53	QP
5	719.67	22.20	2.62	11.81	36.63	46.00	9.37	QP
6	755.56	22.53	2.67	10.78	35.98	46.00	10.02	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

- The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
- All channels had been pre-test, only the worst case was reported.



Radiated Emissions Above 1G

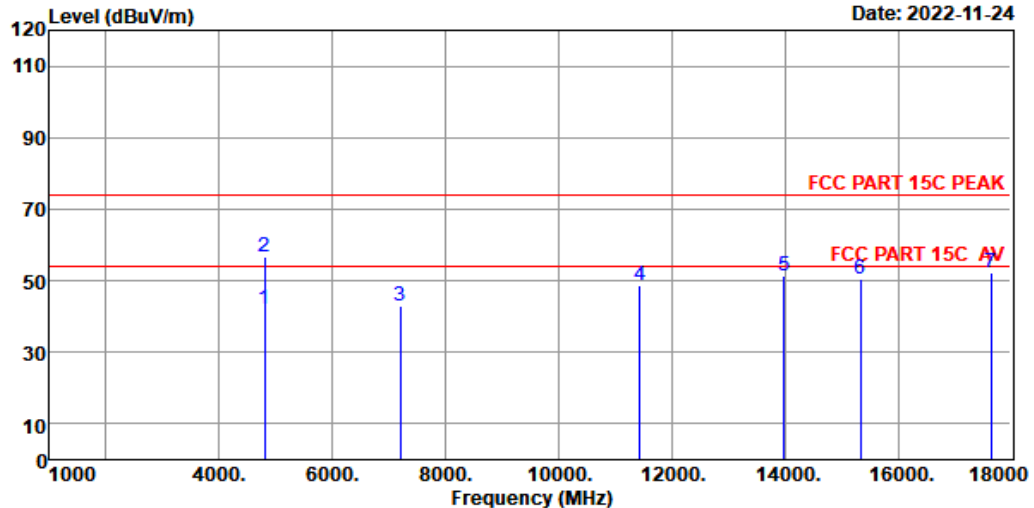
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Data: 77

File: \\EMC-966-1\test data\2022\RF\Q\Qingdao Hisense\HLW3215-TG-5V,EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 77
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4804.00	32.39	4.90	45.44	40.27	42.12	54.00	11.88	Average
2	4804.00	32.39	4.90	45.44	54.66	56.51	74.00	17.49	Peak
3	7206.00	36.16	6.25	44.99	35.52	42.94	74.00	31.06	Peak
4	11438.00	38.86	8.03	43.55	35.51	48.85	74.00	25.15	Peak
5	13988.00	40.00	9.11	41.93	34.25	51.43	74.00	22.57	Peak
6	15331.00	38.94	9.50	44.69	36.63	50.38	74.00	23.62	Peak
7	17643.00	40.42	10.53	43.91	35.04	52.08	74.00	21.92	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

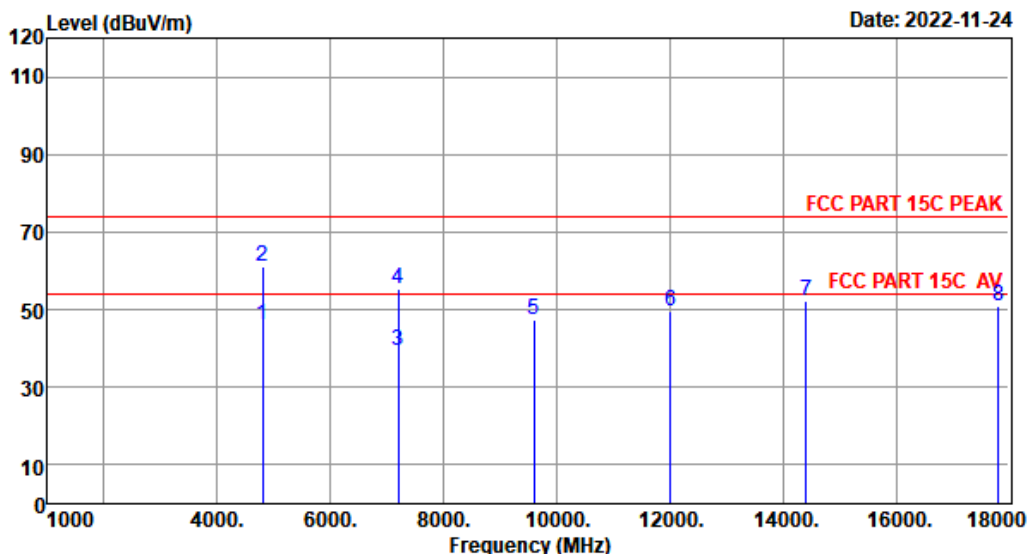
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Data: 78

File: \\EMC-966-1\\test data\\2022\\RF\\Q\\Qingdao Hisense\\HLW3215-TG-5V-EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 78
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4804.00	32.39	4.90	45.44	44.23	46.08	54.00	7.92	Average
2	4804.00	32.39	4.90	45.44	59.29	61.14	74.00	12.86	Peak
3	7206.00	36.16	6.25	44.99	32.00	39.42	54.00	14.58	Average
4	7206.00	36.16	6.25	44.99	47.93	55.35	74.00	18.65	Peak
5	9602.00	38.12	7.43	44.58	36.33	47.30	74.00	26.70	Peak
6	12016.00	38.81	8.26	43.17	35.79	49.69	74.00	24.31	Peak
7	14413.00	39.79	9.25	42.91	36.24	52.37	74.00	21.63	Peak
8	17813.00	40.98	10.61	43.84	32.99	50.74	74.00	23.26	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.

2. Margin= Limit - Emission Level.

3. The emission levels that are 20dB below the official limit are not reported.

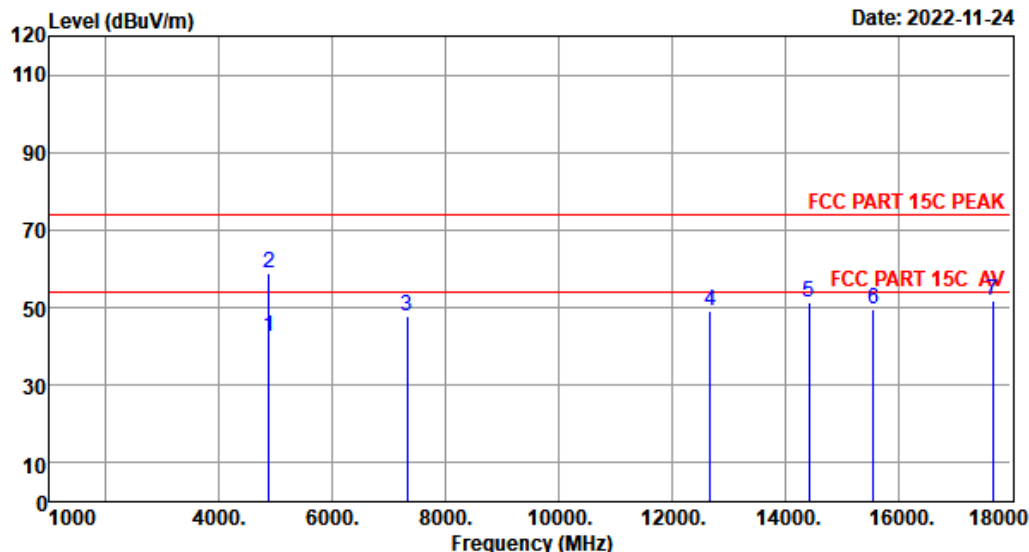
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Data: 79

File: \\EMC-966-1\test data\2022\RF\Q\Qingdao Hisense\HLW3215-TG-5V.EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 79
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4876.00	32.54	4.94	45.41	40.57	42.64	54.00	11.36	Average
2	4876.00	32.54	4.94	45.41	56.85	58.92	74.00	15.08	Peak
3	7324.00	36.26	6.34	44.97	40.01	47.64	74.00	26.36	Peak
4	12679.00	39.41	8.58	42.72	33.79	49.06	74.00	24.94	Peak
5	14430.00	39.78	9.25	42.95	35.22	51.30	74.00	22.70	Peak
6	15569.00	38.53	9.55	44.84	36.43	49.67	74.00	24.33	Peak
7	17677.00	40.53	10.55	43.90	34.61	51.79	74.00	22.21	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

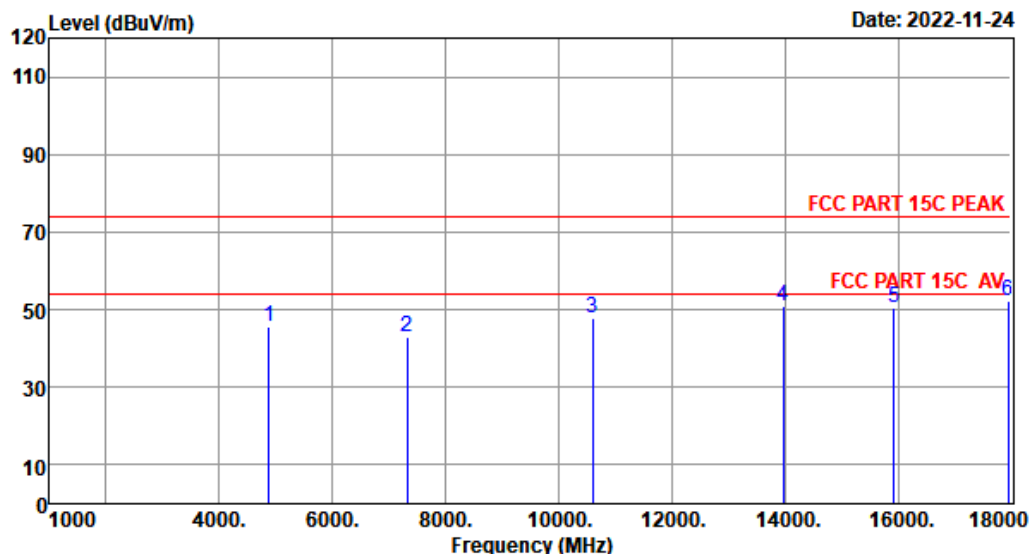
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Data: 80

File: \\EMC-966-1\\test data\\2022\\RF\\Q\\Qingdao Hisense\\HLW3215-TG-5V-EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 80
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4880.00	32.55	4.94	45.41	43.67	45.75	74.00	28.25	Peak
2	7320.00	36.26	6.34	44.97	35.26	42.89	74.00	31.11	Peak
3	10605.00	38.62	7.68	44.11	35.55	47.74	74.00	26.26	Peak
4	13971.00	39.99	9.09	41.89	33.65	50.84	74.00	23.16	Peak
5	15926.00	37.93	9.62	44.68	37.73	50.60	74.00	23.40	Peak
6	17949.00	41.43	10.68	43.78	34.01	52.34	74.00	21.66	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

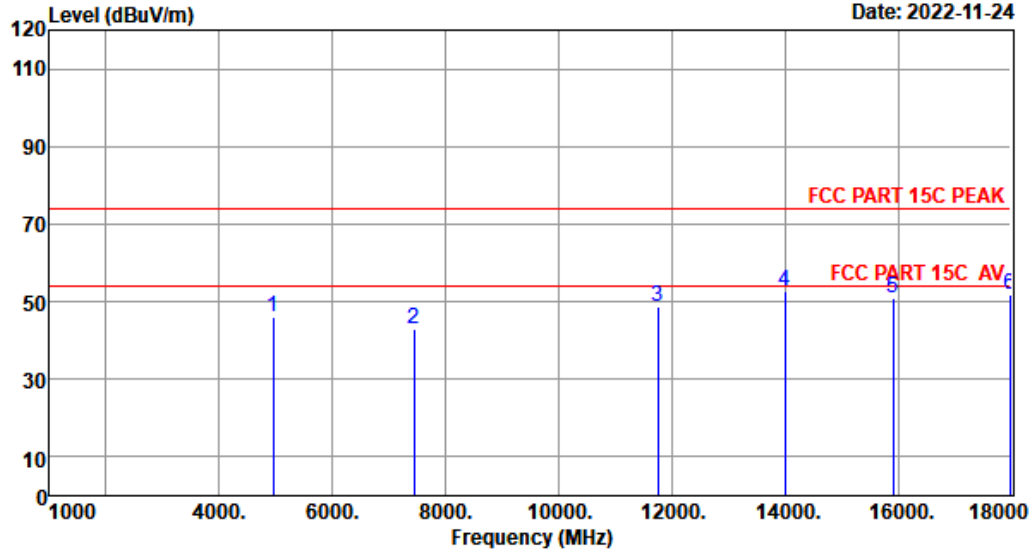
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Data: 81

File: \\EMC-966-1\\test data\\2022\\RF\\Q\\Qingdao Hisense\\HLW3215-TG-5V-EM6 (120)

Date: 2022-11-24



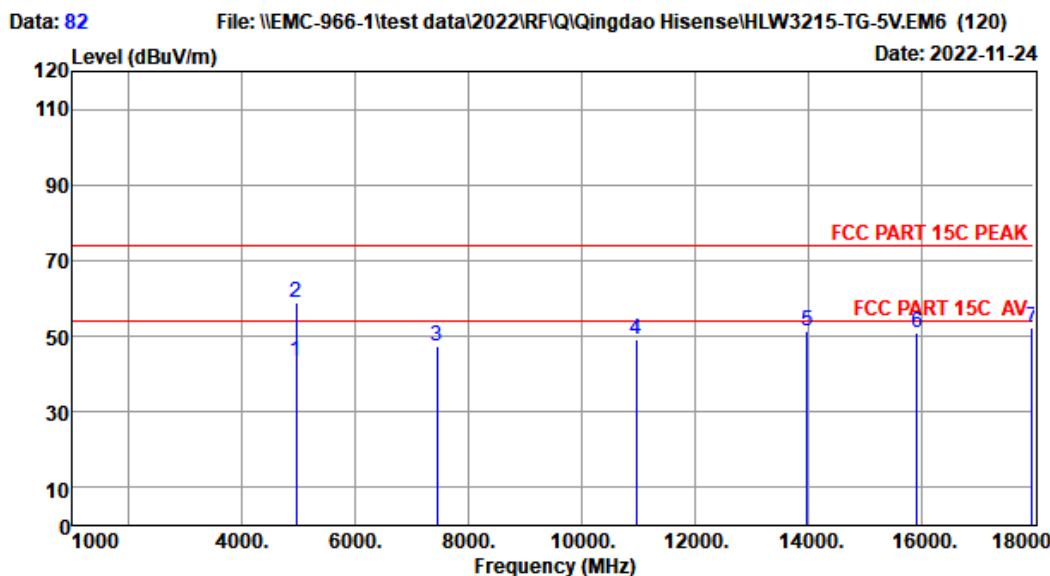
Site no. : 1# 966 Chamber Data no. : 81
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4960.00	32.72	4.98	45.38	43.62	45.94	74.00	28.06	Peak
2	7440.00	36.35	6.43	44.95	35.15	42.98	74.00	31.02	Peak
3	11761.00	38.82	8.15	43.34	35.24	48.87	74.00	25.13	Peak
4	14005.00	40.00	9.12	41.97	35.55	52.70	74.00	21.30	Peak
5	15909.00	37.95	9.62	44.69	38.17	51.05	74.00	22.95	Peak
6	17983.00	41.54	10.70	43.76	33.32	51.80	74.00	22.20	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

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Site no. : 1# 966 Chamber Data no. : 82
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4960.00	32.72	4.98	45.38	41.28	43.60	54.00	10.40	Average
2	4960.00	32.72	4.98	45.38	56.69	59.01	74.00	14.99	Peak
3	7440.00	36.35	6.43	44.95	39.58	47.41	74.00	26.59	Peak
4	10962.00	38.87	7.84	43.87	36.43	49.27	74.00	24.73	Peak
5	13988.00	40.00	9.11	41.93	34.39	51.57	74.00	22.43	Peak
6	15926.00	37.93	9.62	44.68	38.18	51.05	74.00	22.95	Peak
7	17966.00	41.49	10.69	43.77	33.91	52.32	74.00	21.68	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

Note: The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Radiated Band Edge

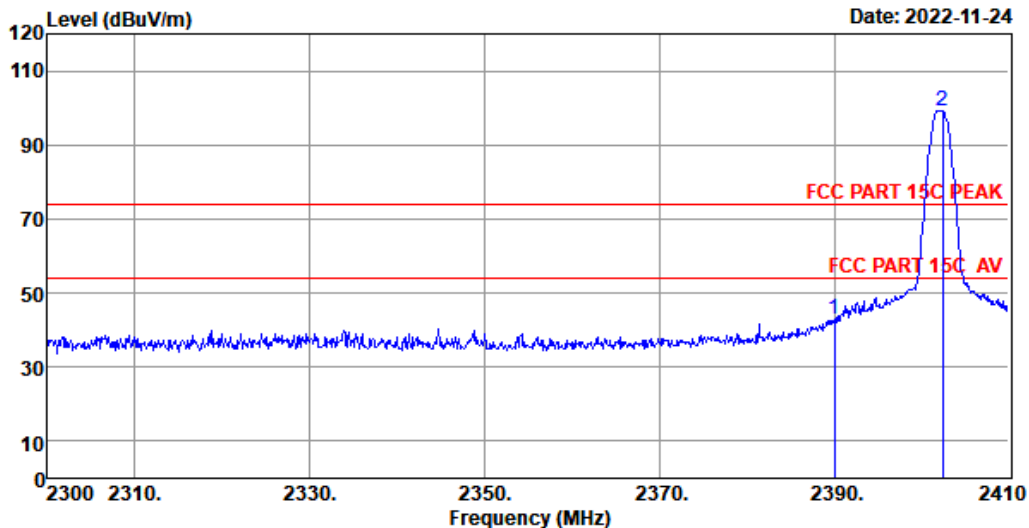
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Data: 73

File: \\EMC-966-1\test data\2022\RF\Q\Qingdao Hisense\HLW3215-TG-5V.EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 73
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	3.47	46.48	48.45	42.87	74.00	31.13	Peak
2	2402.41	27.47	3.48	46.48	104.64	99.11	74.00	-25.11	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

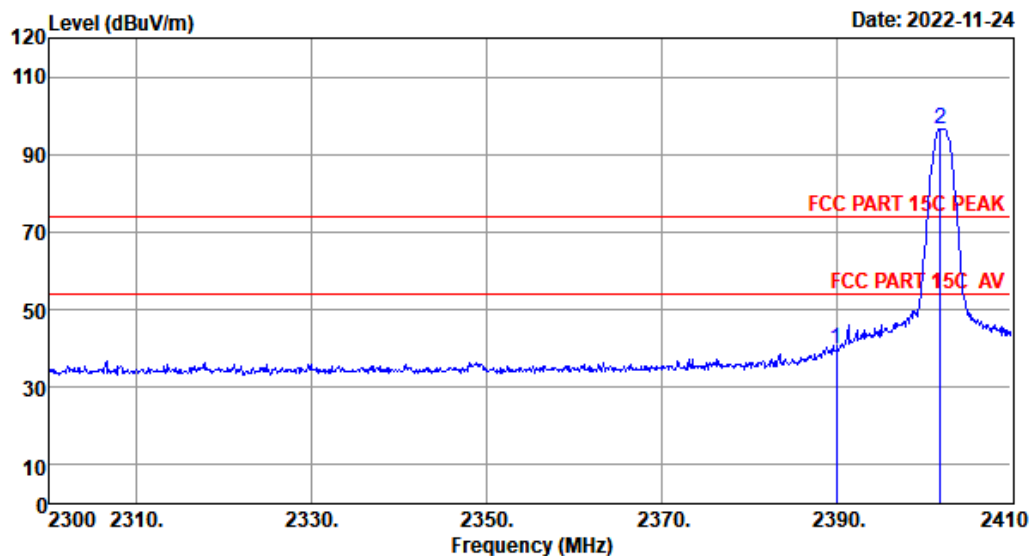
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Data: 74

File: \\EMC-966-1\test data\2022\RF\Q\Qingdao Hisense\HLW3215-TG-5V.EM6 (120)

Date: 2022-11-24



Site no. : 1# 966 Chamber Data no. : 74
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	3.47	46.48	45.32	39.74	74.00	34.26	Peak
2	2401.86	27.47	3.48	46.48	102.02	96.49	74.00	-22.49	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

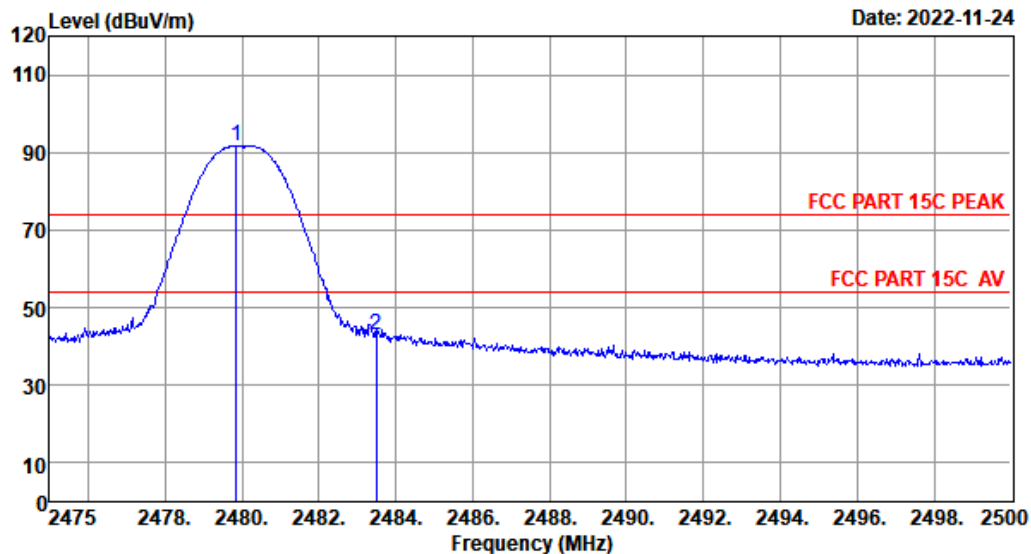
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Data: 75

File: \\EMC-966-1\test data\2022\RF\Q\Qingdao Hisense\HLW3215-TG-5V.EM6 (120)

Date: 2022-11-24



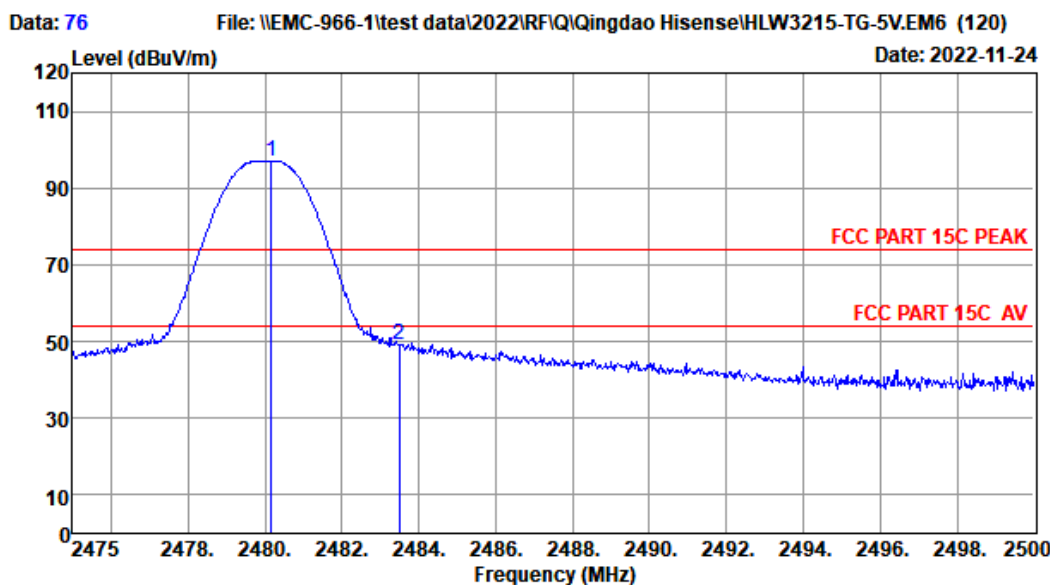
Site no. : 1# 966 Chamber Data no. : 75
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.85	27.69	3.51	46.45	96.81	91.56	74.00	-17.56	Peak
2	2483.50	27.70	3.51	46.44	48.21	42.98	74.00	31.02	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

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Site no. : 1# 966 Chamber Data no. : 76
 Dis. / Ant. : 3m BBHA9120D 1-18G 2208 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:20.9°C;Humi:50%;Press:101.52kPa
 Engineer : JBR
 EUT : Wi-Fi/BLE Intelligent controls module
 Power : DC 5V
 M/N : HLW3215-TG-5V
 Test Mode : GFSK 1Mbps TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.18	27.69	3.51	46.45	102.29	97.04	74.00	-23.04	Peak
2	2483.50	27.70	3.51	46.44	54.46	49.23	74.00	24.77	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. Margin= Limit - Emission Level.
 3. The emission levels that are 20dB below the official limit are not reported.

Note: All channels had been pre-test, only of the worst case channels were reported.



9. ANTENNA REQUIREMENTS

9.1. Limit

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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

9.2. Test Result

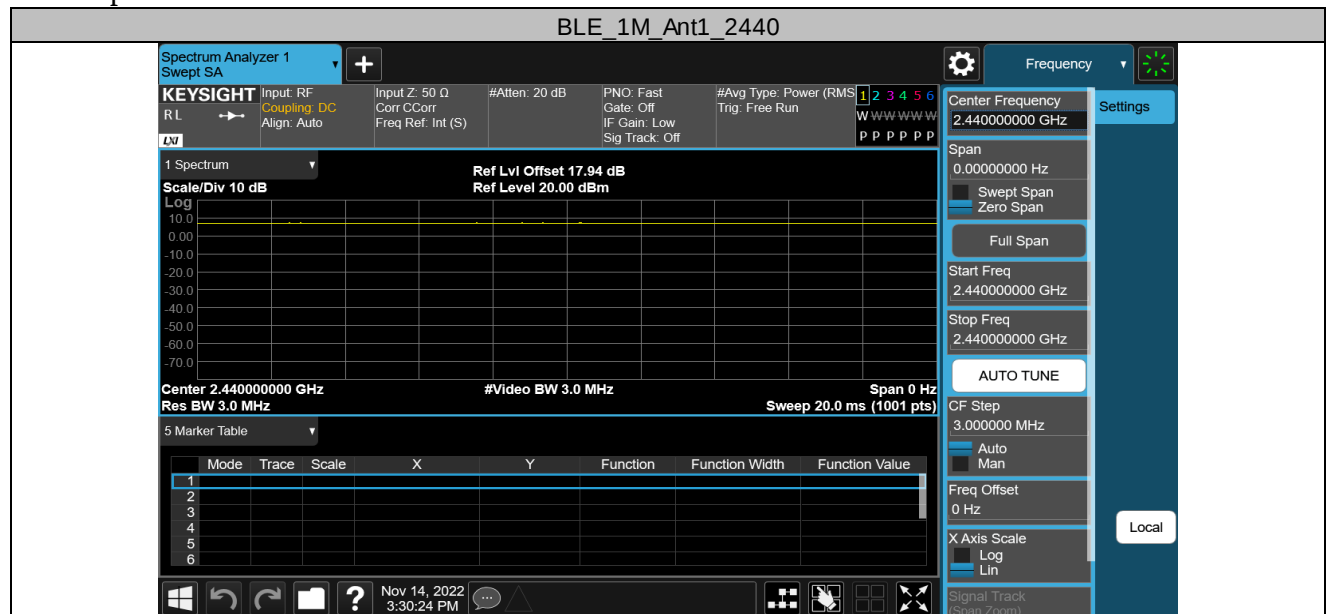
The antennas used for this product is PCB antenna ,so compliance with antenna requirements.
(Please refer to the EUT photo for details)

10.APPENDIX

Appendix A: Duty Cycle Test Result

Test Mode	Antenna	Frequency[MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor [dB]
BLE 1M	Ant1	2440	20.00	20.00	100.00	0.00

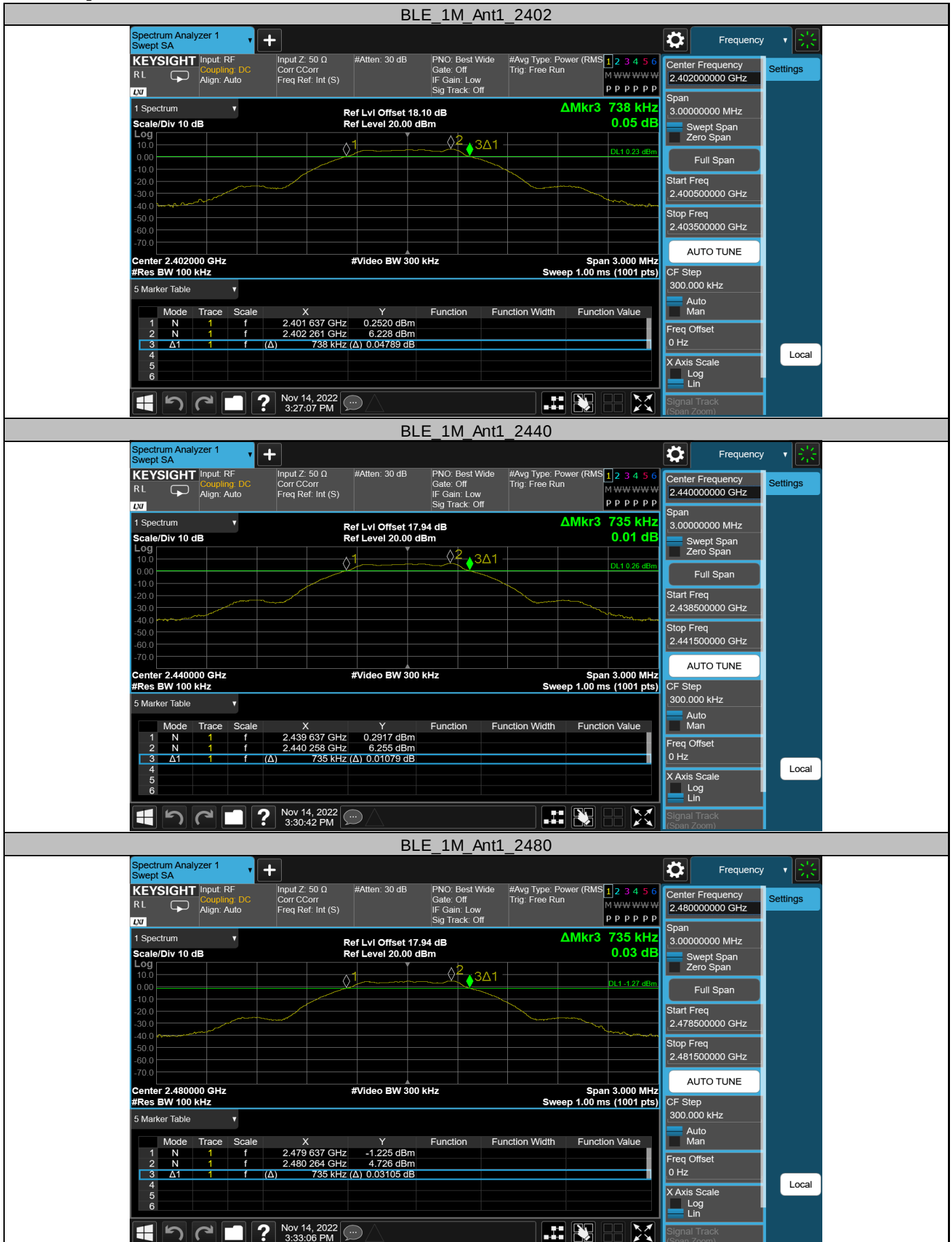
Test Graphs



Appendix B: DTS Bandwidth Test Result

Test Mode	Antenna	Frequency[MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	0.738	2401.637	2402.375	0.5	PASS
		2440	0.735	2439.637	2440.372	0.5	PASS
		2480	0.735	2479.637	2480.372	0.5	PASS

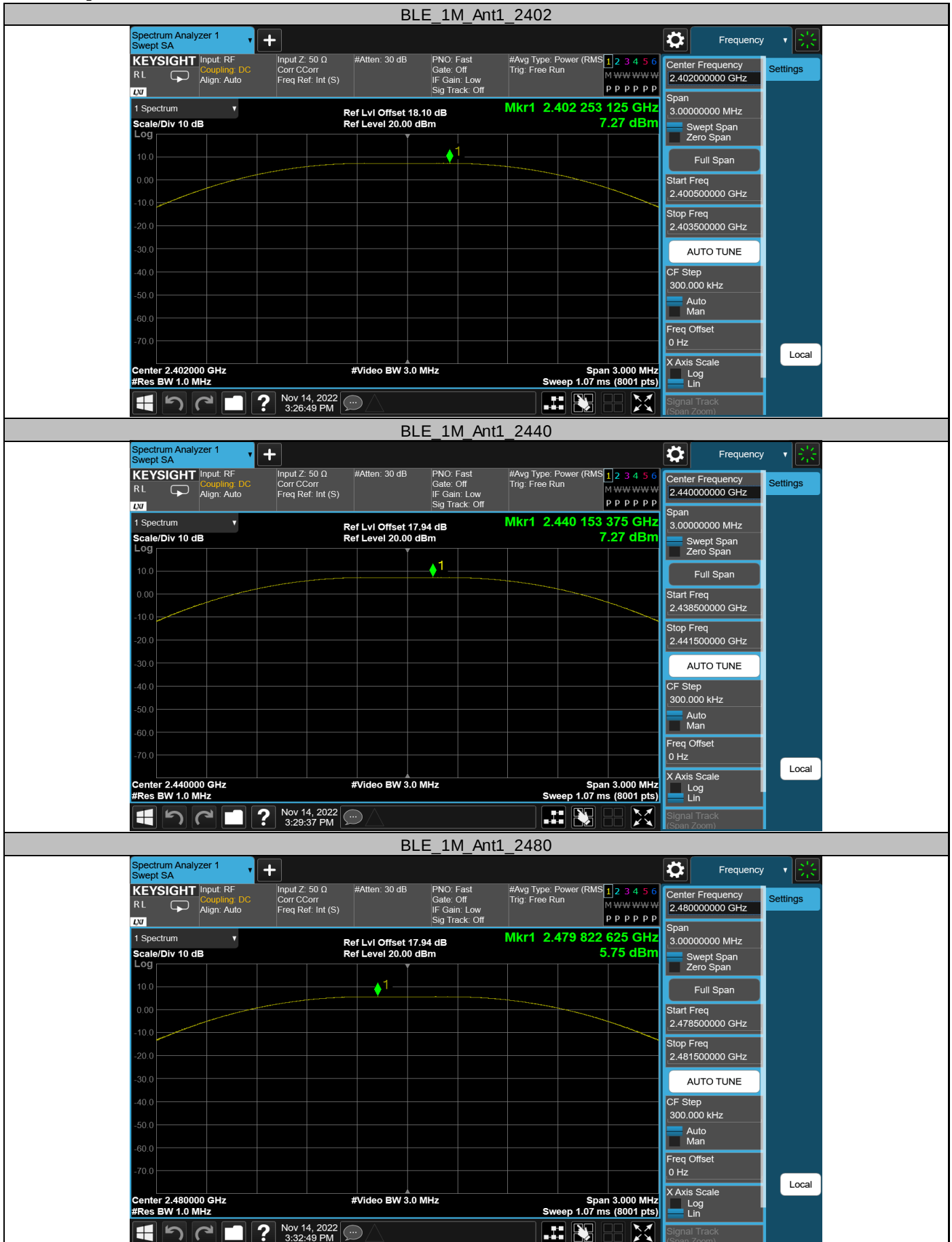
Test Graphs



Appendix C: Maximum conducted output power
Test Result Peak

Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power [dBm]	Conducted Limit [dBm]	Verdict
BLE_1M	Ant1	2402	7.27	≤30	PASS
		2440	7.27	≤30	PASS
		2480	5.75	≤30	PASS

Test Graphs Peak



Appendix D: Maximum power spectral density
Test Result

Test Mode	Antenna	Frequency[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
BLE_1M	Ant1	2402	-9.35	≤8.00	PASS
		2440	-9.29	≤8.00	PASS
		2480	-10.81	≤8.00	PASS

Test Graphs



Appendix E: Reference level measurement
Test Result

Test Mode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm]
BLE_1M	Ant1	2402	2402.25	6.07
		2440	2440.26	6.21
		2480	2480.25	4.70

Test Graphs

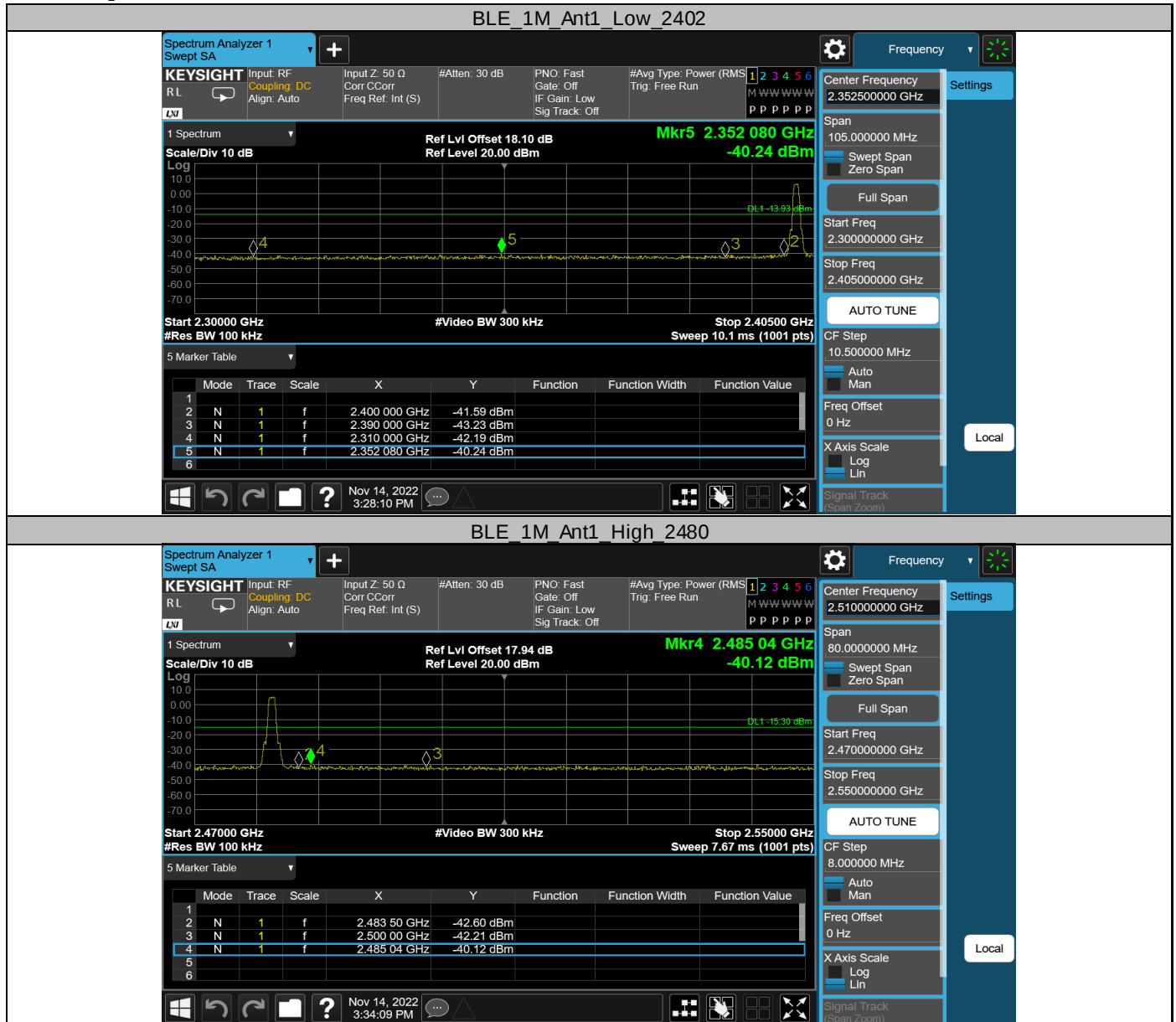


Appendix F: Band edge measurements

Test Result

Test Mode	Antenna	Ch Name	Frequency [MHz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
BLE_1M	Ant1	Low	2402	6.07	-40.24	≤ -13.93	PASS
		High	2480	4.70	-40.12	≤ -15.3	PASS

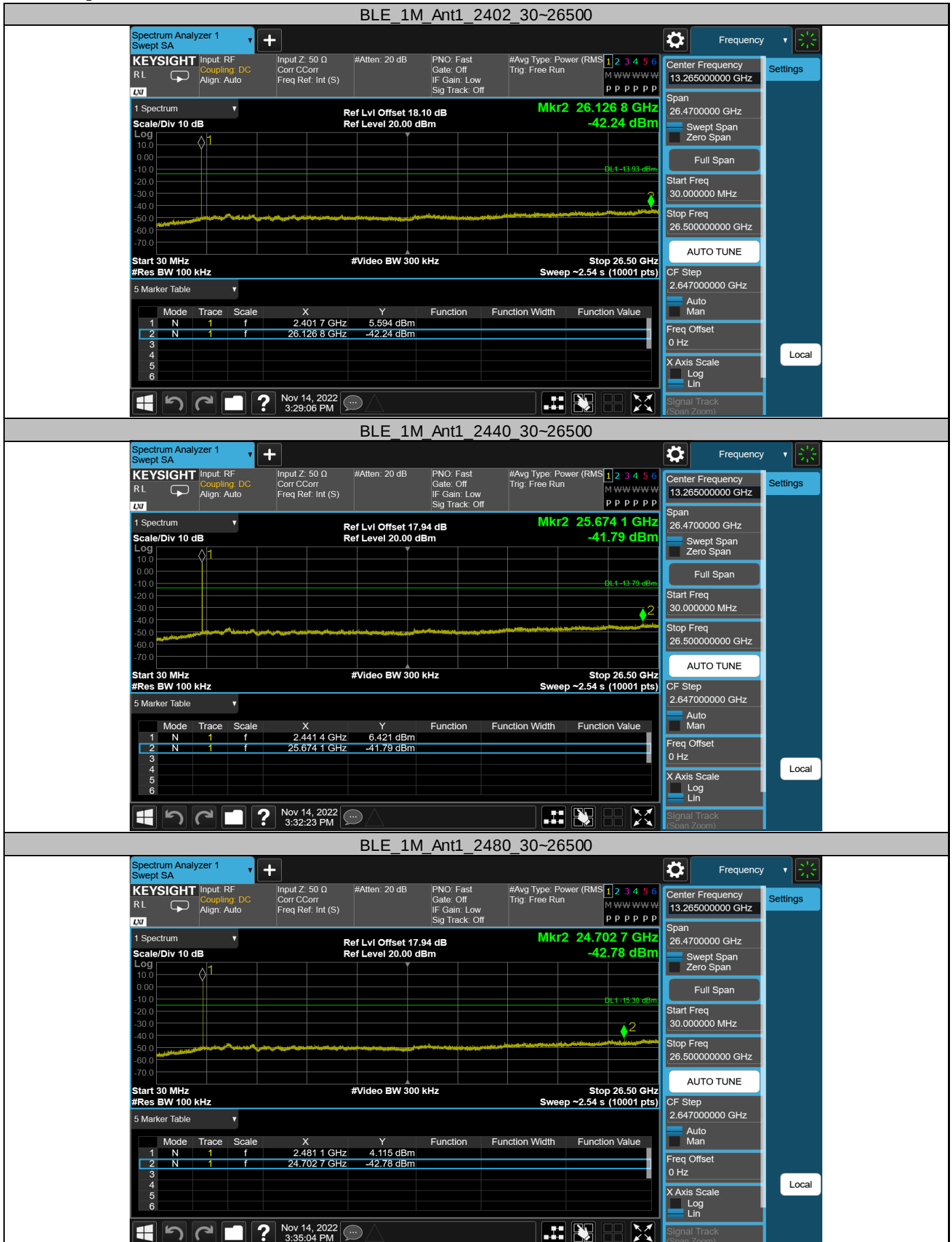
Test Graphs



Appendix G: Conducted Spurious Emission Test Result

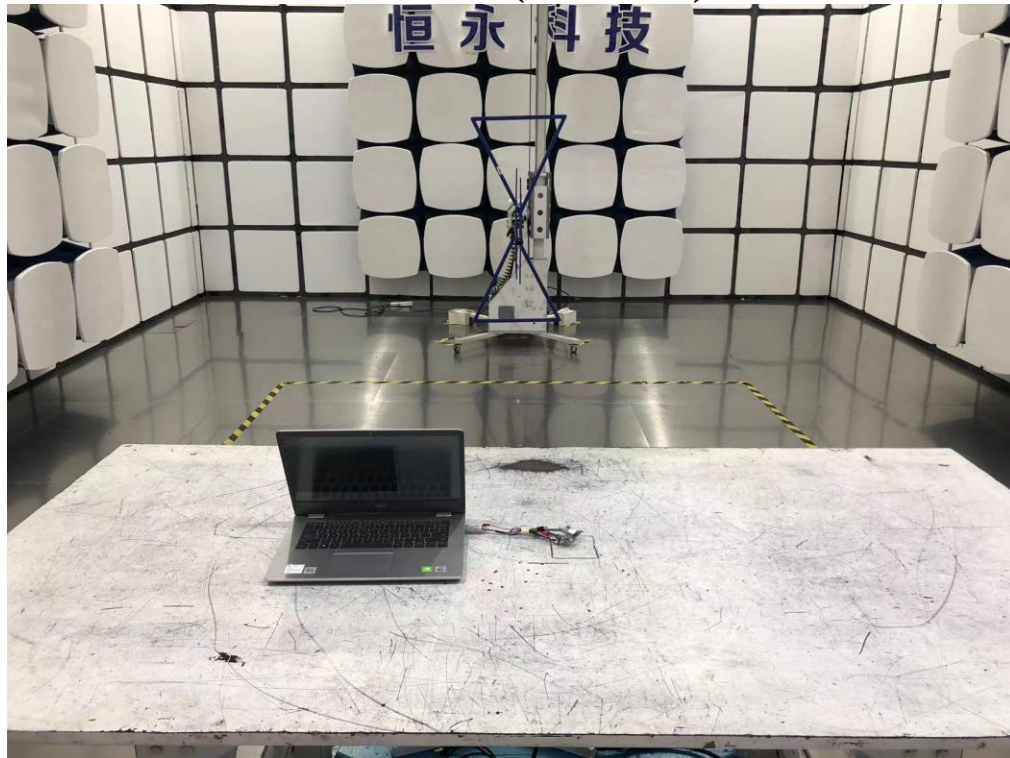
Test Mode	Antenna	Frequency[MHz]	Freq Range [MHz]	Ref Level [dBm]	Result [dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	30~26500	6.07	-42.24	≤-13.93	PASS
		2440	30~26500	6.21	-41.79	≤-13.79	PASS
		2480	30~26500	4.70	-42.78	≤-15.3	PASS

Test Graphs

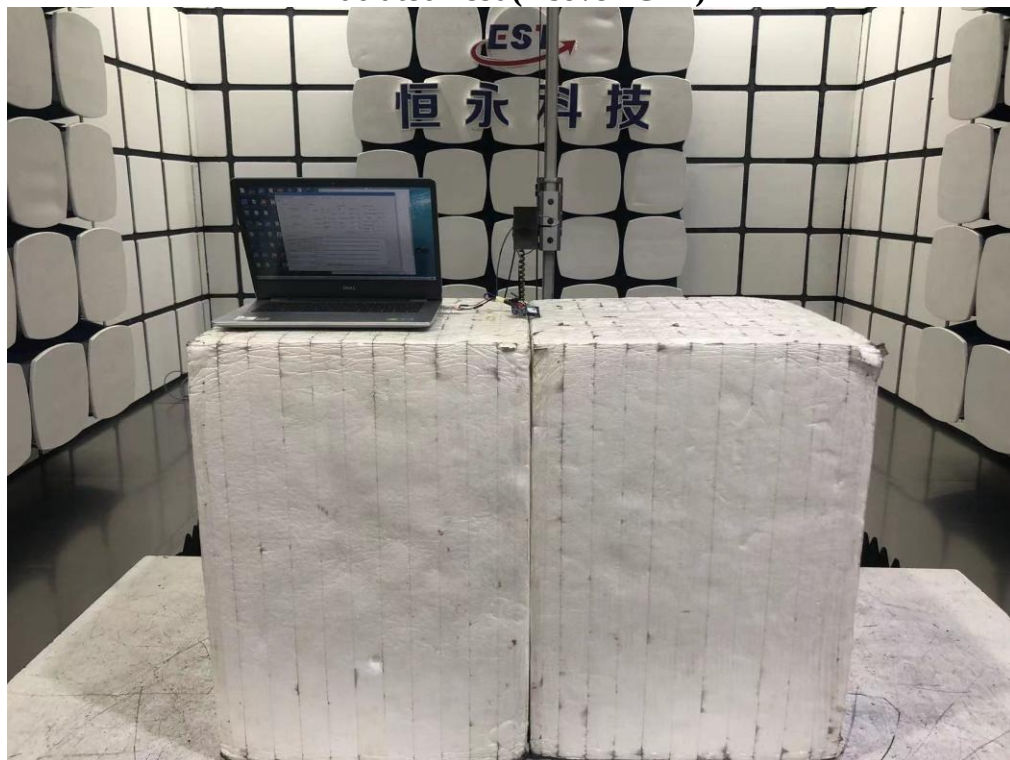


11. TEST SETUP PHOTO

Radiated Test (Below 1GHz)

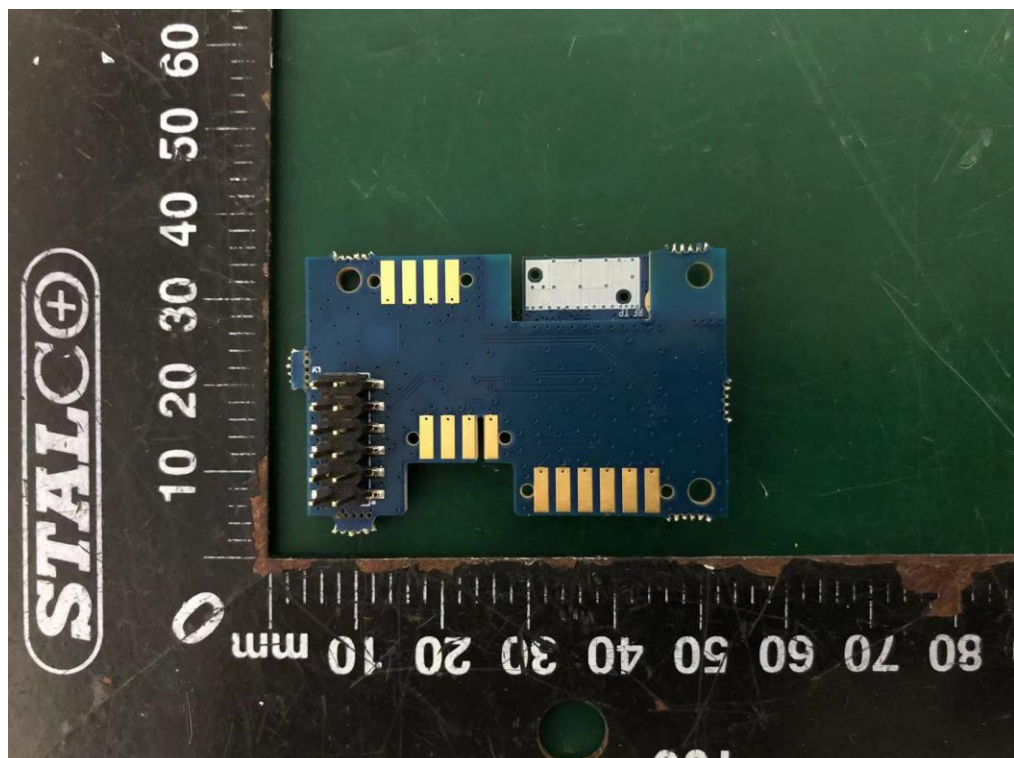
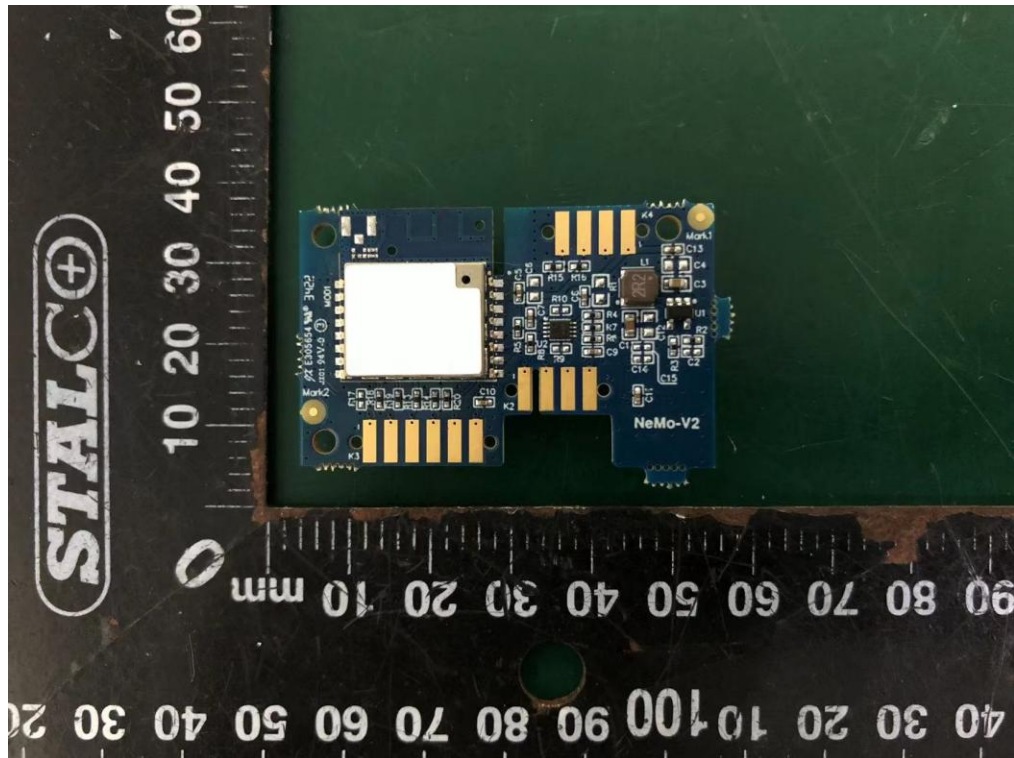


Radiated Test (Above 1GHz)

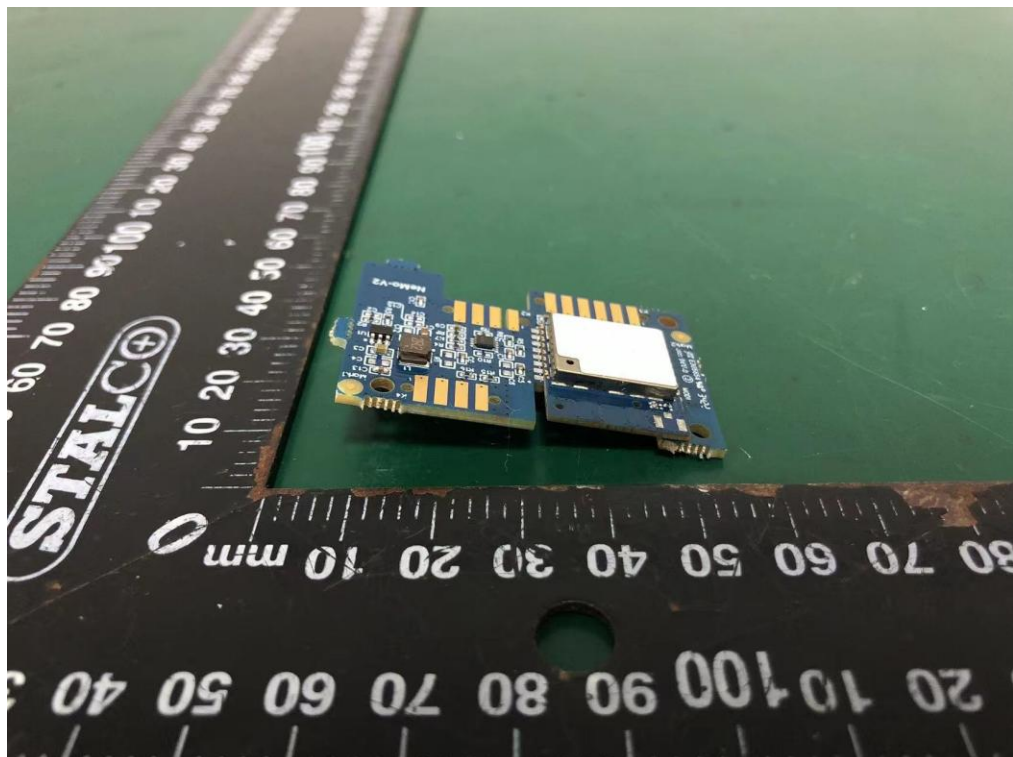
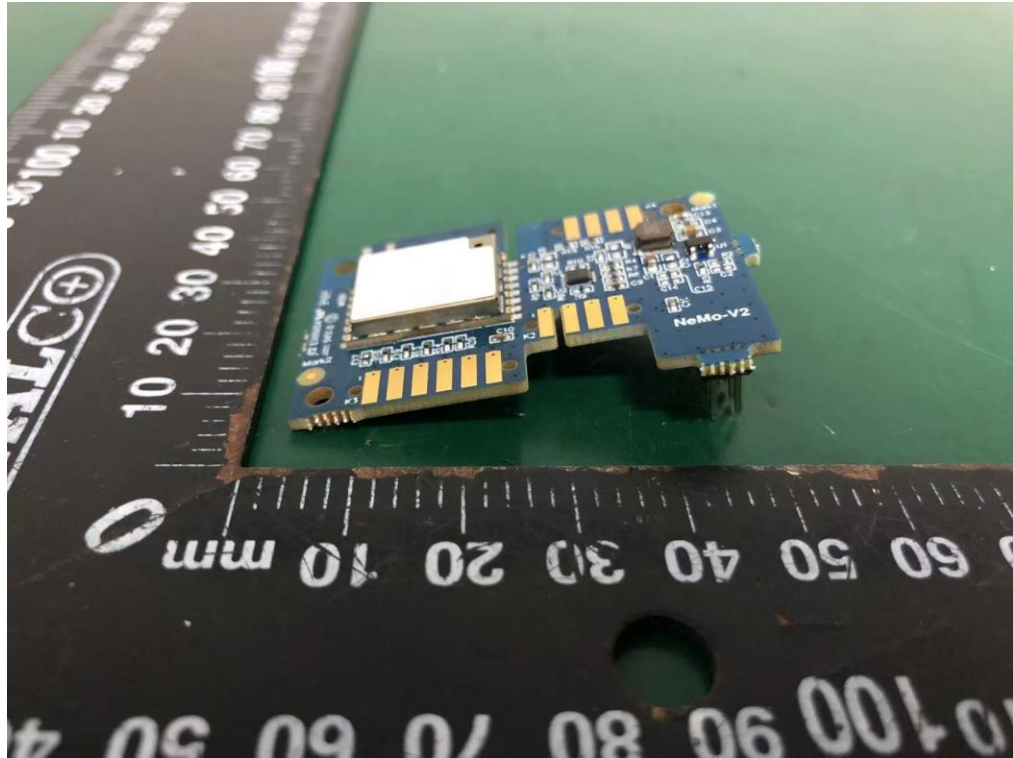


12. EUT PHOTO

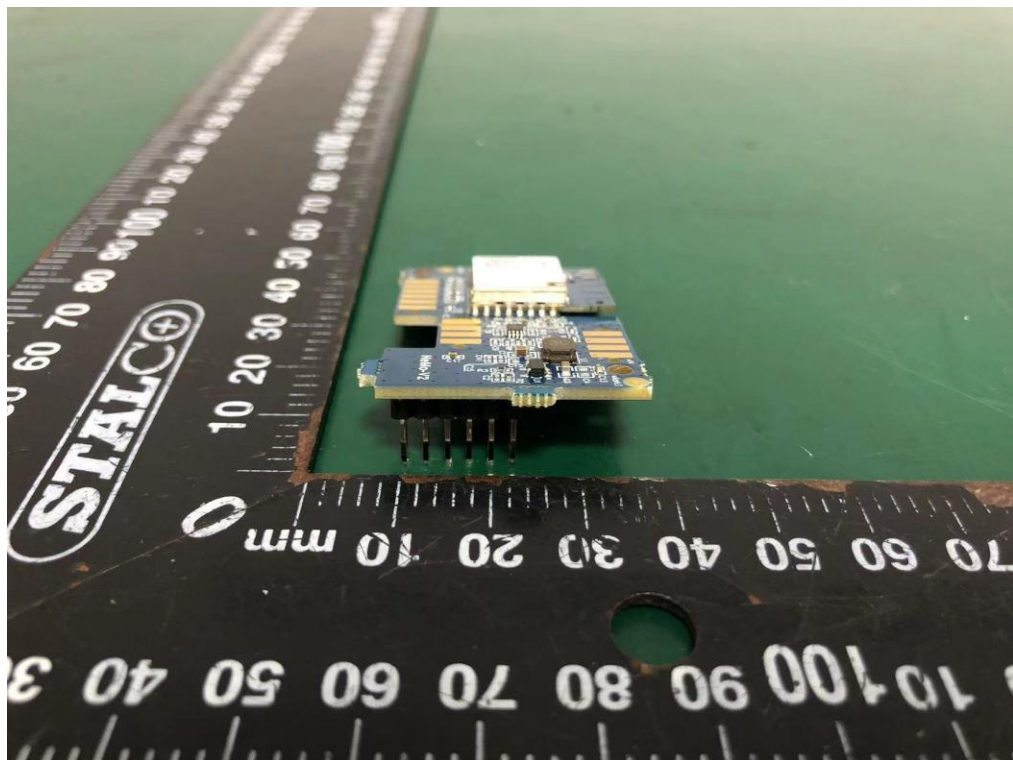
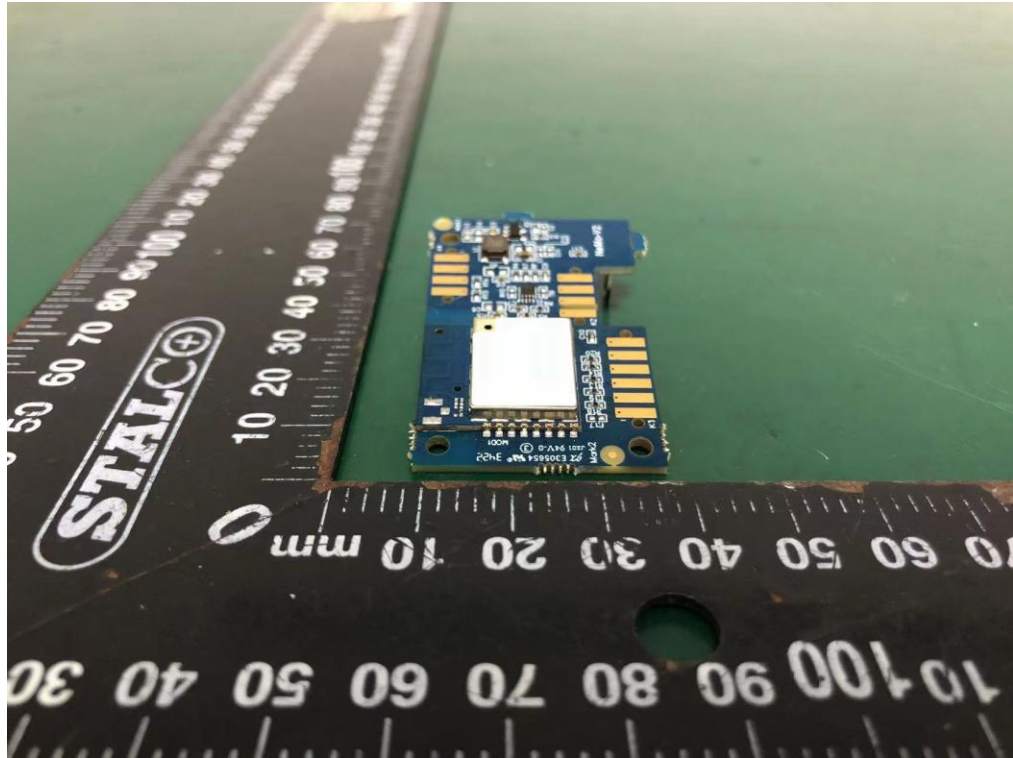
With pin header
External Photos
M/N: HLW3215-TG



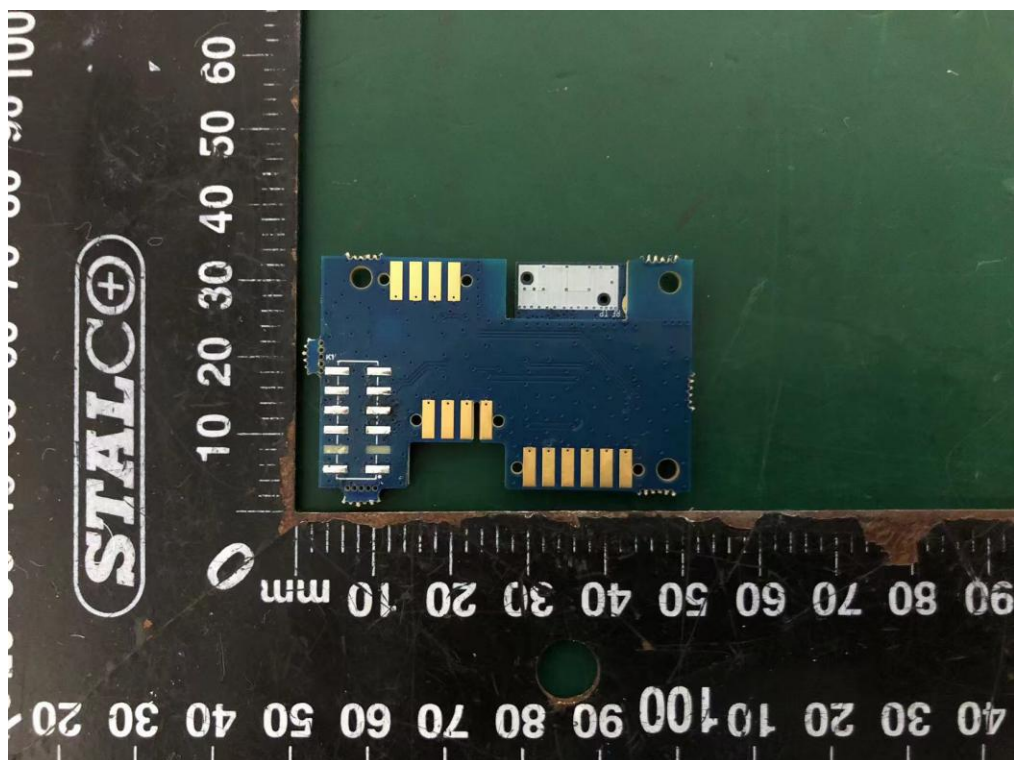
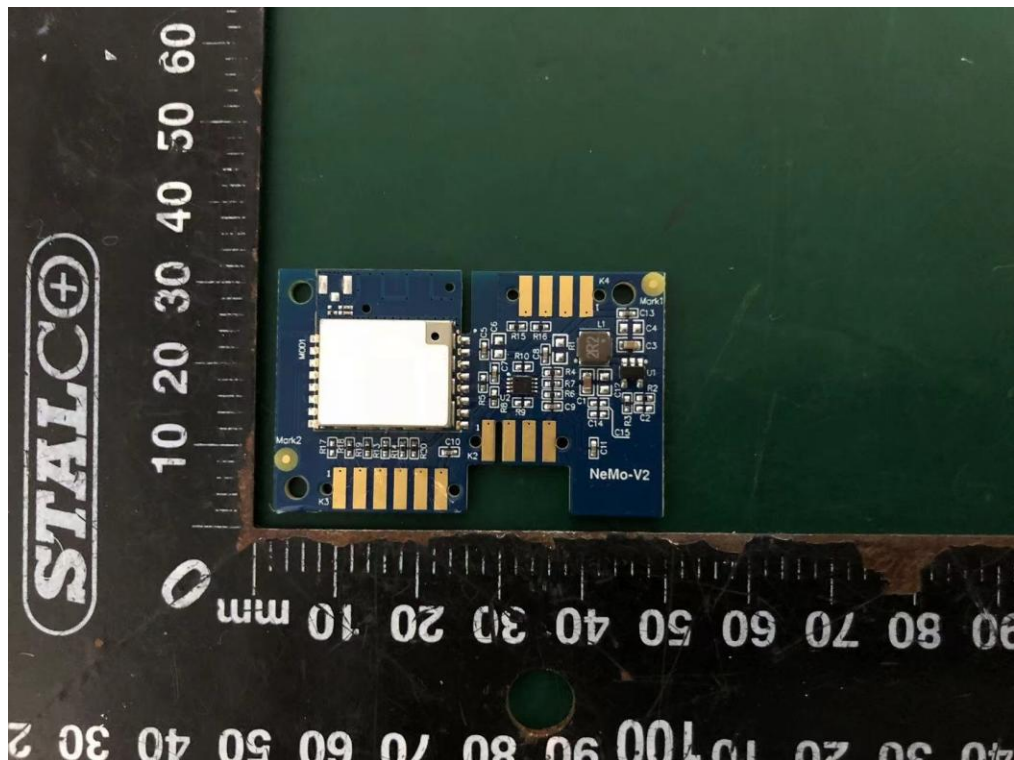
External Photos
M/N: HLW3215-TG



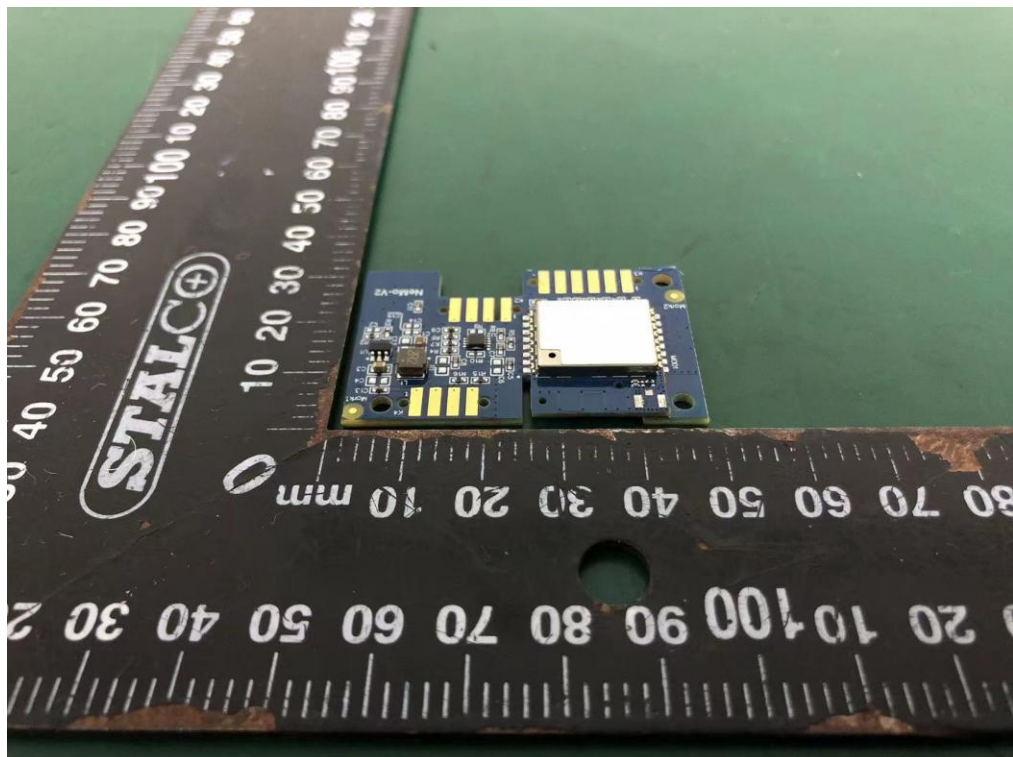
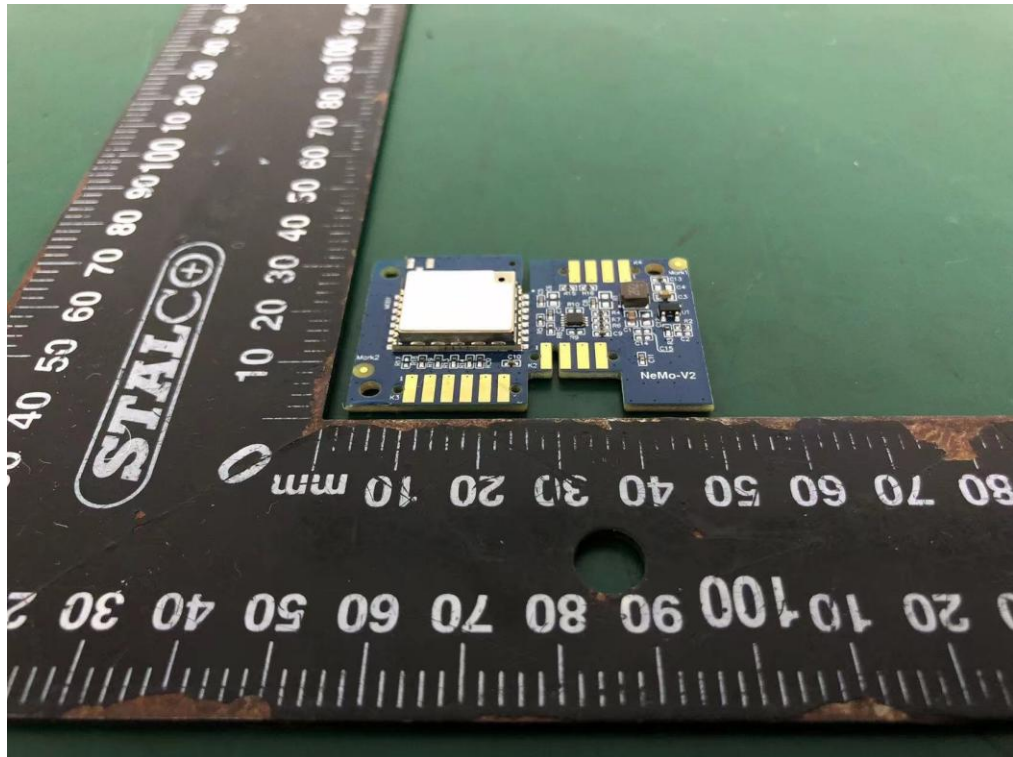
External Photos
M/N: HLW3215-TG



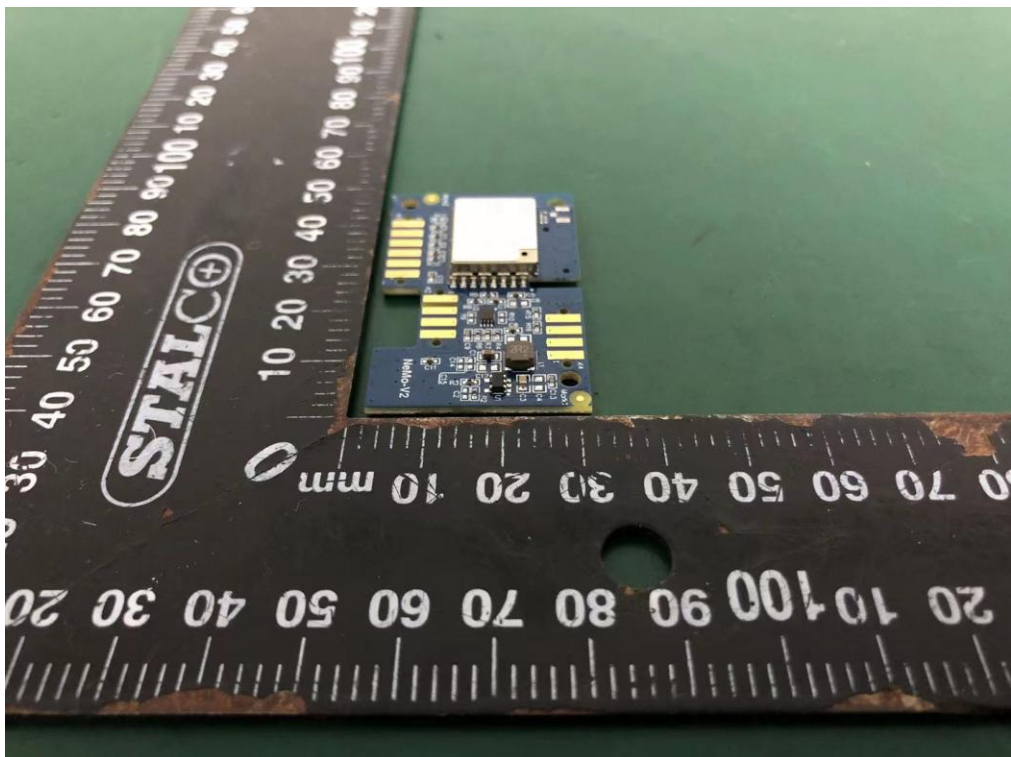
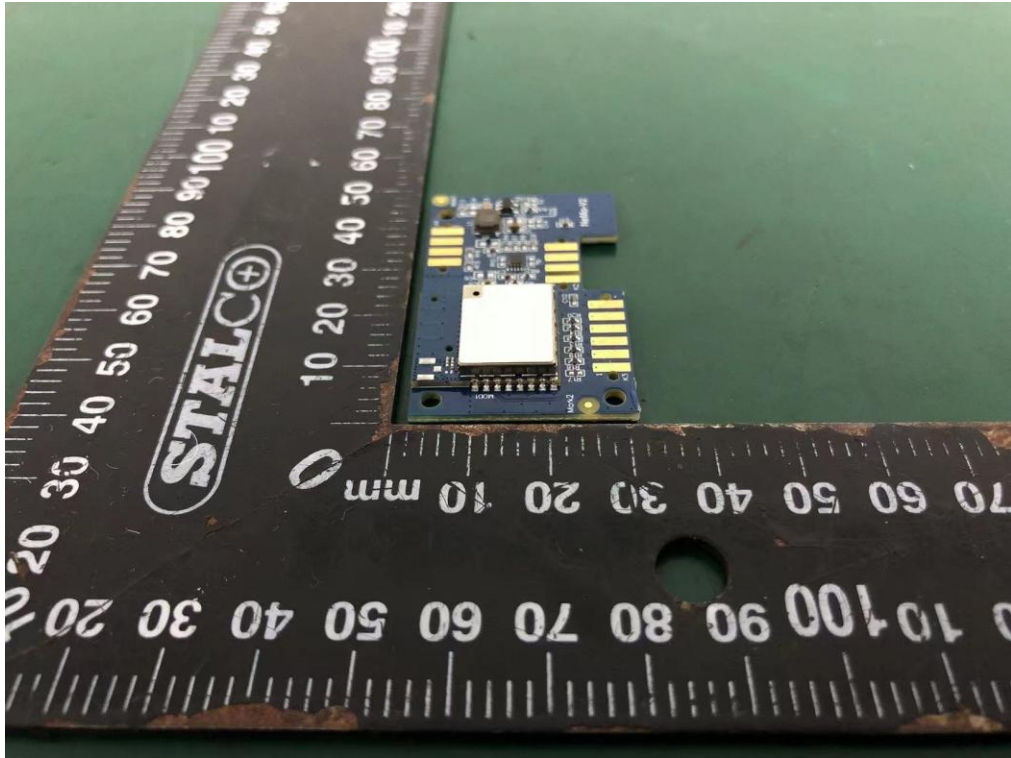
Without pin header
External Photos
M/N: HLW3215-TG01



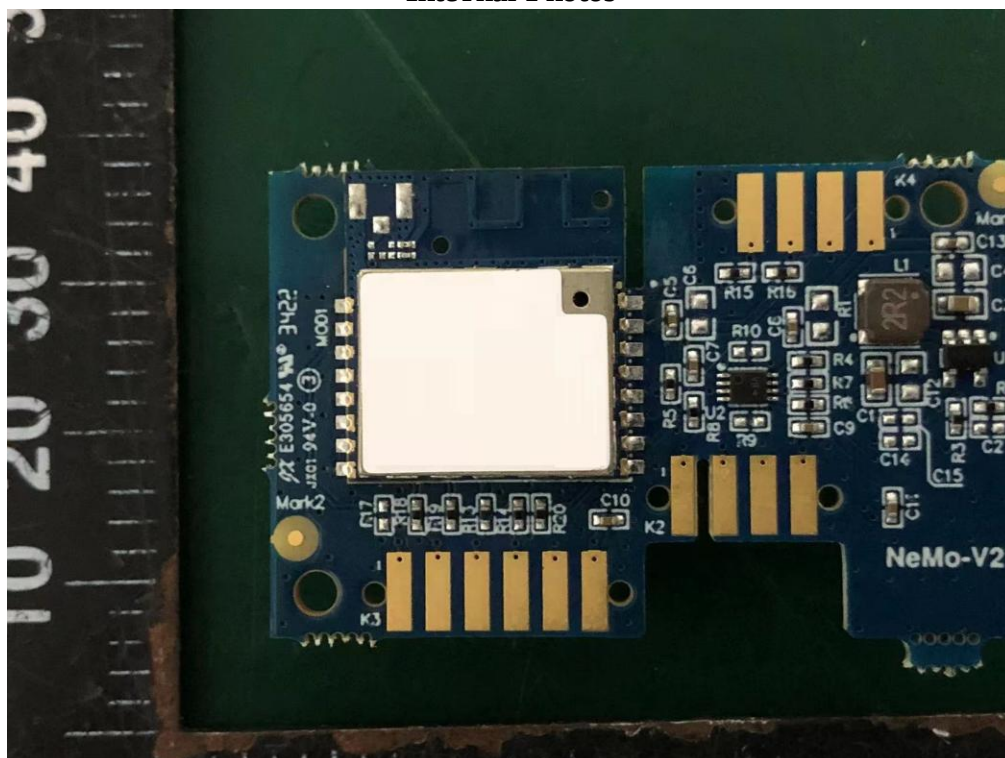
External Photos
M/N: HLW3215-TG01



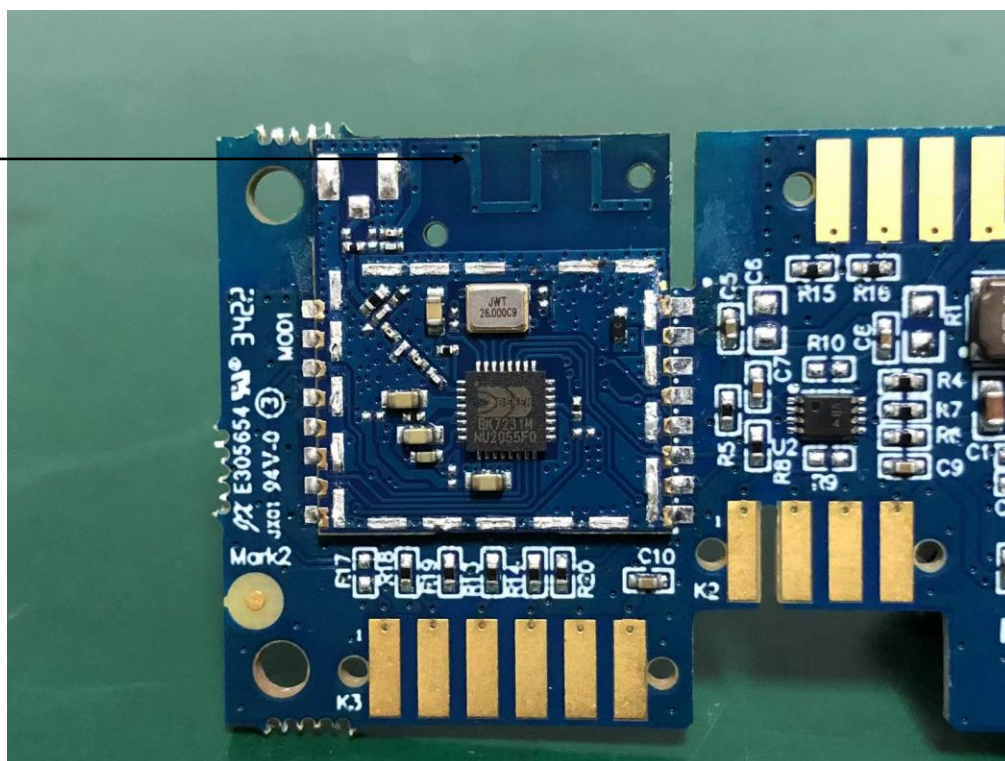
External Photos
M/N: HLW3215-TG01



Internal Photos



Bluetooth
Antenna



End of Test Report