FCC TEST REPORT

FOR

SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED

Interactive touch projector screen

TEST Model No.:CY-120C

Additional Model NO.: CY-100X,CY-100K,CY-120X,CY-120K,CY-150K

Prepared for	:	SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED
Address	:	3rd Floor,Tower A,Building 10,Huafeng Technology Park, No.535 Fengtang Avenue,Fuyong Street,Bao'an District, Shenzhen, Guangdong, China
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Date of receipt of test sample	:	January 01, 2018
Number of tested samples	:	1
Sample number	:	Prototype
Date of Test	:	January 01, 2018 ~ January 22, 2018
Date of Report	:	January 22, 2018

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FCC TEST REPORT

FCC CFR 47 PART 15 C(15.249): 2015

Report Reference No.	**:**	**LCS171226034AEA**
Date of Issue	:	January 22, 2018
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED**
Address	:	3rd Floor,Tower A,Building 10,Huafeng Technology Park, No.535 Fengtang Avenue,Fuyong Street,Bao'an District, Shenzhen, Guangdong, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.249): 2015 / ANSI C63.10: 2013
Test Report Form No.	:	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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Test Item Description.	**:**	Interactive touch projector screen
Trade Mark	:	Tontex
Test Model.....	:	CY-120C
Ratings	:	AC 100-240V ,50/60Hz
Result	**:**	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Peter Xiao	Dick Su	Gavin Liang
Peter Xiao / File administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS171226034AEA	January 22, 2018 Date of issue

Test Model.....	: CY-120C
EUT.....	: Interactive touch projector screen
Applicant.....	: **SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED**
Address.....	: 3rd Floor,Tower A,Building 10,Huafeng Technology Park, No.535 Fengtang Avenue,Fuyong Street,Bao'an District, Shenzhen, Guangdong, China
Telephone.....	: /
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Manufacturer.....	: **SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED**
Address.....	: 3rd Floor,Tower A,Building 10,Huafeng Technology Park, No.535 Fengtang Avenue,Fuyong Street,Bao'an District, Shenzhen, Guangdong, China
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Fax.....	: /
Factory.....	: **SHENZHEN HECHUANG SCIENCE & EDUCATION CO.,LIMITED**
Address.....	: 3rd Floor,Tower A,Building 10,Huafeng Technology Park, No.535 Fengtang Avenue,Fuyong Street,Bao'an District, Shenzhen, Guangdong, China
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

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.

Revision History

Revision	Issue Date	Revisions	Revised By
000	January 22, 2018	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT	:	Interactive touch projector screen
Test Model	:	CY-120C
List Model No.	:	CY-100X,CY-100K,CY-120X,CY-120K,CY-150K
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	:	AC 100-240V ,50/60Hz
Hardware Version	:	ver2.0
Software Version	:	1.0
2.4G	:	
Frequency Range	:	2402MHz
Channel Number	:	1 channels
Modulation Type	:	GFSK/FSK
Antenna Description	:	PCB Antenna, 0dBi(max.)

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	--	--	--	--

1.3. External I/O

I/O Port Description	Quantity	Cable
--	--	--

1.4. Description of Test Facility

FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001
NVLAP Registration Code is 600167-0

1.5. 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 CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS 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.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	4.00dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

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

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1.7. Description Of Test Modes

The EUT operates in the unlicensed ISM band at 2.4GHz. The following operating modes were applied for the related test items.

All test modes were tested, only the result of the worst case was recorded in the report.
The EUT is considered a portable unit and was set to transmit at 100% duty cycle. It was pre-tested on the positioned of each 3 axis. The worst case was found positioned on X-plane.

Mode of Operations	Transmitting Frequency (MHz)
GFSK	2410
	2438
	2468
For Conducted Emission	
Test Mode	TX Mode
For Radiated Emission	
Test Mode	TX Mode

Worst-case mode and channel used for 150kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be TX-2402MHz.

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX-2402MHz.

***Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

Channel List & Frequency:

Test Mode	Channel	Frequency Range (MHz)
Tx/Rx	1	2402
Standby	--	--

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

According to the requirements in Section 6.2 of ANSI C63.10: 2013, AC power-line conducted emissions shall be measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table and the turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10: 2013

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3. CONNECTION DIAGRAM OF TEST SYSTEM

3.1. Justification

The system was configured for testing in a continuous transmit condition. Continuous transmitting.

EUT power supply after continuous emission signal.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

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4. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207(a)	Power Line Conducted Emissions	Compliant
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.205	Band Edges Measurement	Compliant
§15.249, §15.215	20 dB Bandwidth	Compliant

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5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Meter	R&S	NRVS	100444	2017-06-17	2018-06-16
2	Power Sensor	R&S	NRV-Z81	100458	2017-06-17	2018-06-16
3	Power Sensor	R&S	NRV-Z32	10057	2017-06-17	2018-06-16
4	EPM Series Power Meter	Agilent	E4419B	MY45104493	2017-06-17	2018-06-16
5	E-SERIES AVG POWER SENSOR	Agilent	E9301H	MY41495234	2017-06-17	2018-06-16
6	ESA-E SERIES SPECTRUM ANALYZER	Agilent	E4407B	MY41440754	2017-11-18	2018-11-17
7	MXA Signal Analyzer	Agilent	N9020A	MY49100040	2017-06-17	2018-06-16
8	SPECTRUM ANALYZER	R&S	FSP	100503	2017-06-17	2018-06-16
9	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-17	2018-06-16
10	Positioning Controller	MF	MF-7082	/	2017-06-17	2018-06-16
11	EMI Test Software	AUDIX	E3	N/A	2017-06-17	2018-06-16
12	EMI Test Receiver	ROHDE & SCHWARZ	ESR 7	101181	2017-06-17	2018-06-16
13	AMPLIFIER	QuieTek	QTK-A2525G	CHM10809065	2017-11-18	2018-11-17
14	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2017-06-23	2018-06-22
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2017-05-02	2018-05-01
16	Horn Antenna	EMCO	3115	6741	2017-06-23	2018-06-22
17	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-17	2018-06-16
18	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-17	2018-06-16
19	TEST RECEIVER	R&S	ESCI	101142	2017-06-17	2018-06-16
20	RF Cable-CON	UTIFLEX	3102-26886-4	CB049	2017-06-17	2018-06-16
21	10dB Attenuator	SCHWARZBECK	MTS-IMP136	261115-001-0032	2017-06-17	2018-06-16
22	Artificial Mains	R&S	ENV216	101288	2017-06-17	2018-06-16

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6. ANTENNA REQUIREMENT

6.1. Standard Applicable

According to § 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator 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.

6.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2.0dBi, and the antenna is connect to PCB board and no consideration of replacement. Please see EUT photo for details.

Result: Compliance.

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

7.2. Instruments Setting

The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

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Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1000KHz / 1000KHz for peak

7.3. Test Procedure

1) **Sequence of testing 9 kHz to 30 MHz**

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.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement 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 QPK 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 premeasurement and the limit will be stored.

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2) **Sequence of testing 30 MHz to 1 GHz**

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.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 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 position (± 45°) 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.

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3) **Sequence of testing 1 GHz to 12.75 GHz**

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.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height is 1.5 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 found antenna polarisation and turntable position of the premeasurement the software maximizes the peaks by rotating the turntable position (0° to 360°). This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps). This procedure is repeated for both antenna polarisations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS 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 premeasurement with marked maximum final measurements and the limit will be stored.

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4) **Sequence of testing above 12.75 GHz**

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.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- 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 RMS 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.

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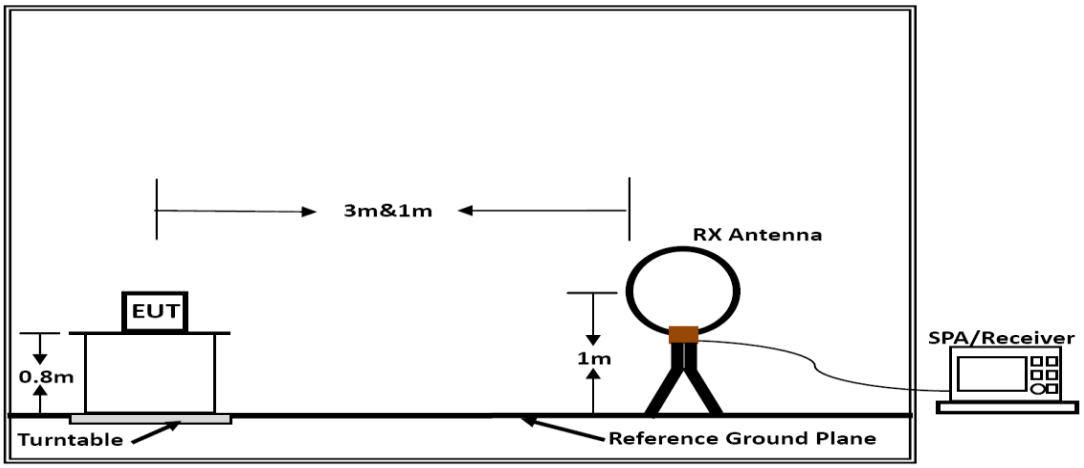
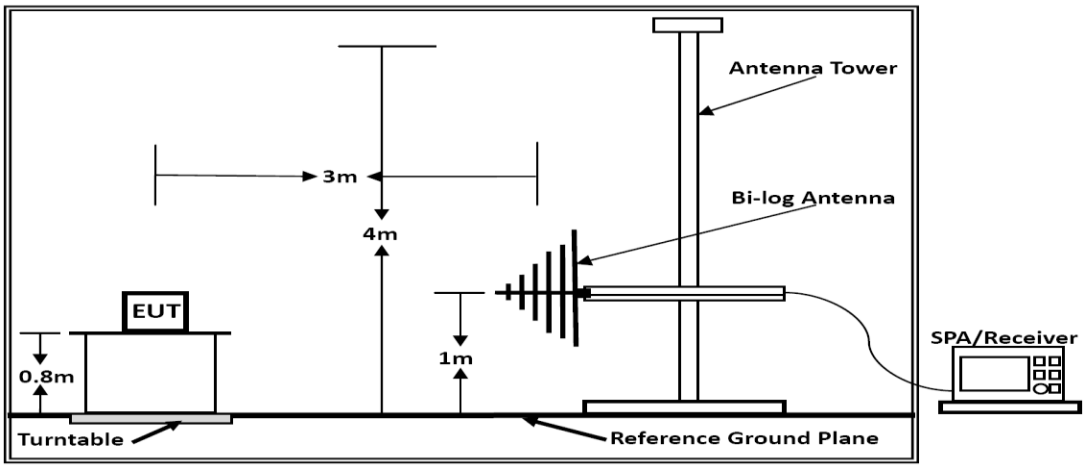
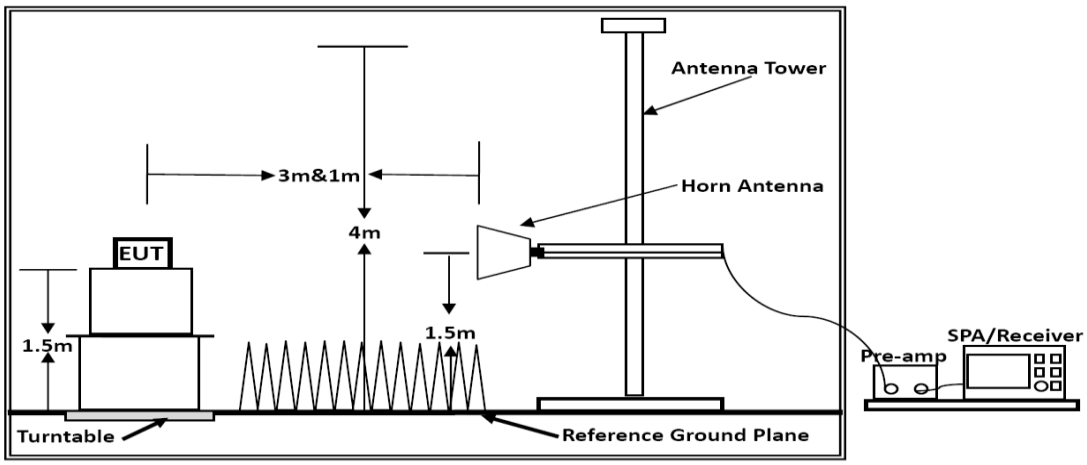
7.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

7.5. Test Results

Results of Radiated Emissions (9kHz~30MHz)

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

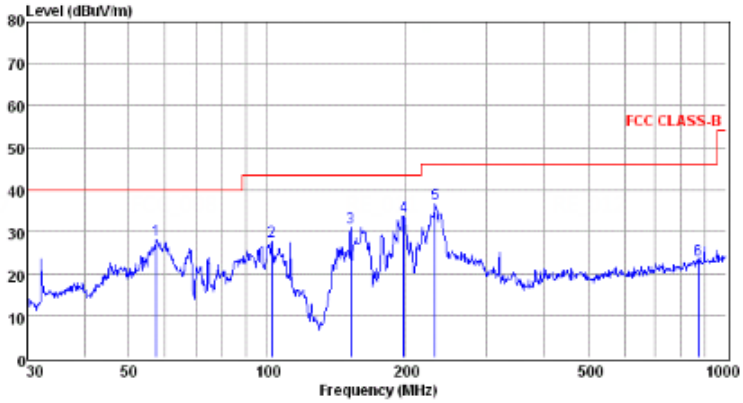
Note:

The radiated emissions from 9kHz to 30MHz are at least 20dB below the official limit and no need to report.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

Results of Radiated Emissions (30MHz~1000MHz)

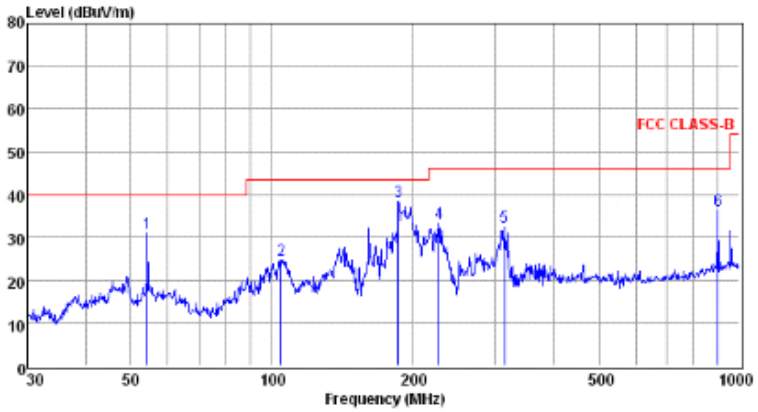
Temperature	25.6℃	Humidity	50.4%
Test Engineer	Peter Xiao	Test Date	January 15, 2018
Test Mode	TX-2402MHz		



pol: VERTICAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	57.39	14.70	0.47	12.86	28.03	40.00	-11.97	QP
2	102.36	14.02	0.60	12.95	27.57	43.50	-15.93	QP
3	152.13	21.81	0.73	8.35	30.89	43.50	-12.61	QP
4	198.59	22.20	0.84	10.57	33.61	43.50	-9.89	QP
5	232.53	23.76	0.98	11.76	36.50	46.00	-9.50	QP
6	869.13	0.52	1.87	20.77	23.16	46.00	-22.84	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported



pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	54.26	17.35	0.46	13.05	30.86	40.00	-9.14	QP
2	104.54	11.43	0.61	12.75	24.79	43.50	-18.71	QP
3	186.44	27.01	0.98	10.25	38.24	43.50	-5.26	QP
4	227.69	20.70	0.93	11.54	33.17	46.00	-12.83	QP
5	314.38	17.99	1.09	13.25	32.33	46.00	-13.67	QP
6	900.15	13.25	1.88	21.09	36.22	46.00	-9.78	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Notes: Only record the worst case.

7.6. Results for Radiated Emissions (Above 1GHz)

Field Strength Of Fundamental (TX-2402MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
2402.00	H	82.45	75.18	114	94	Pass
2402.00	V	88.65	78.29	114	94	Pass

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	47.58	33.06	35.04	3.94	49.54	74.00	-24.46	Peak	Horizontal
4804.00	32.48	33.06	35.04	3.94	34.44	54.00	-19.56	Average	Horizontal
4804.00	49.52	33.06	35.04	3.94	51.48	74.00	-22.52	Peak	Vertical
4804.00	34.42	33.06	35.04	3.94	36.38	54.00	-17.62	Average	Vertical

Notes: Only record the worst case.

1. Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30MHz.

2. Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3. No emission was be recorded above 18GHz means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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7.7. Results for Band edge Testing (Radiated)

Temperature	25.6℃	Humidity	50.4%
Test Engineer	Peter Xiao	Test Date	January 15, 2018

GFSK-Low channel							
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-49.843	2.0	0.0	47.357	Peak	74.00	PASS
2310.000	-62.538	2.0	0.0	34.662	AV	54.00	PASS
2390.000	-49.854	2.0	0.0	47.346	Peak	74.00	PASS
2390.000	-62.302	2.0	0.0	34.898	AV	54.00	PASS
GFSK-High channel							
2483.500	-53.091	2.0	0.0	44.109	Peak	74.00	PASS
2483.500	-62.283	2.0	0.0	34.917	AV	54.00	PASS
2500.000	-53.110	2.0	0.0	44.090	Peak	74.00	PASS
2500.000	-62.474	2.0	0.0	34.726	AV	54.00	PASS

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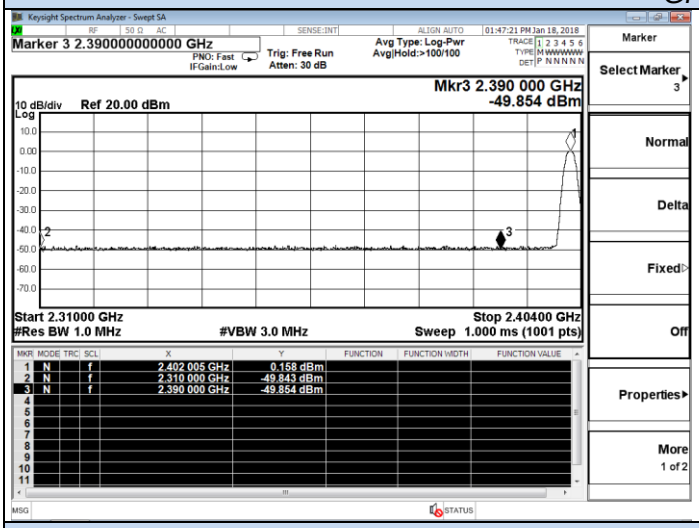
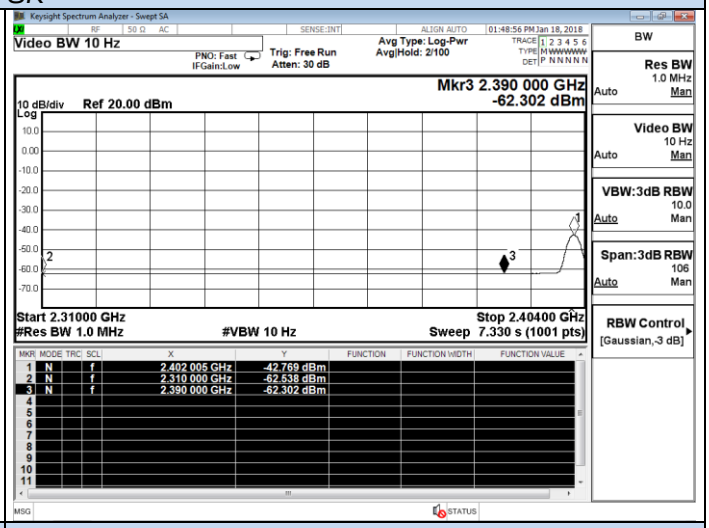
Band-edge measurements for radiated emissions

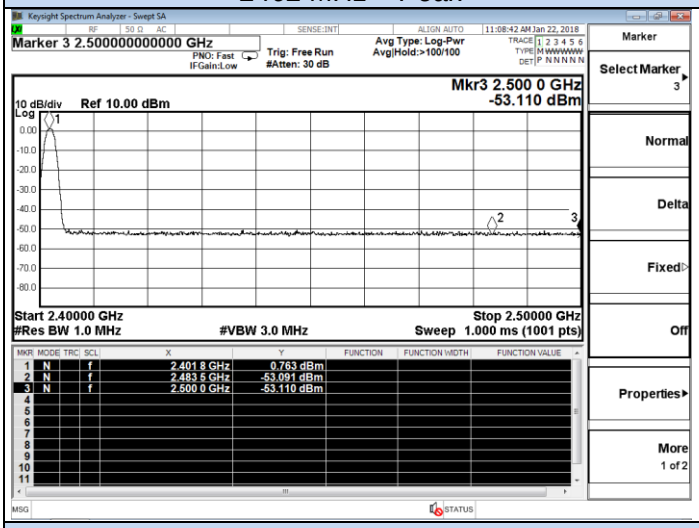
GFSK



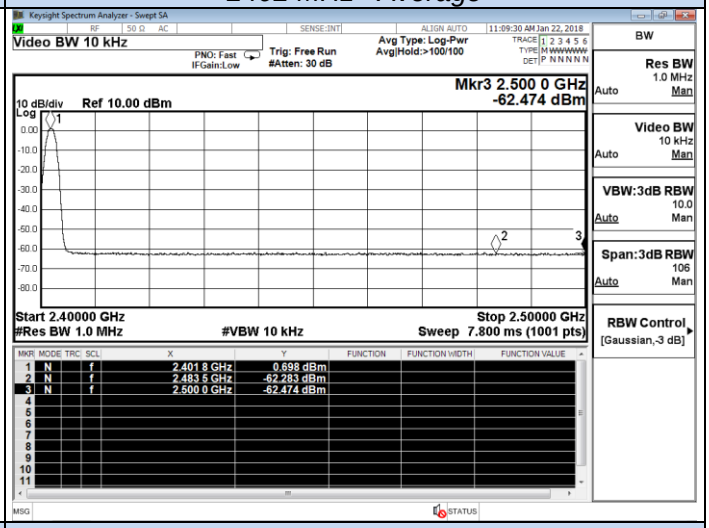
2402 MHz – Peak



2402 MHz –Average



2402 MHz – Peak



2402 MHz –Average

7.8. AC Power line conducted emissions

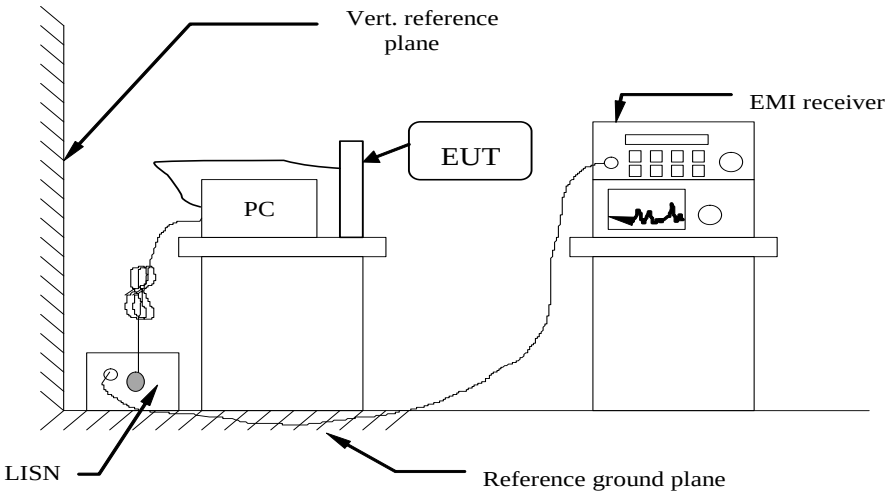
7.8.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

7.8.2 Block Diagram of Test Setup

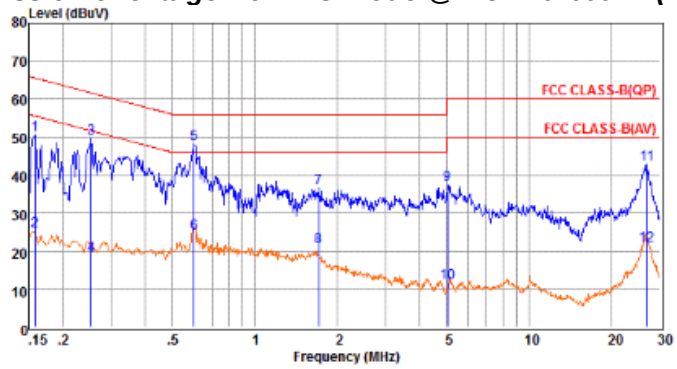


7.8.3 Test Results

PASS

The test data please refer to following page.

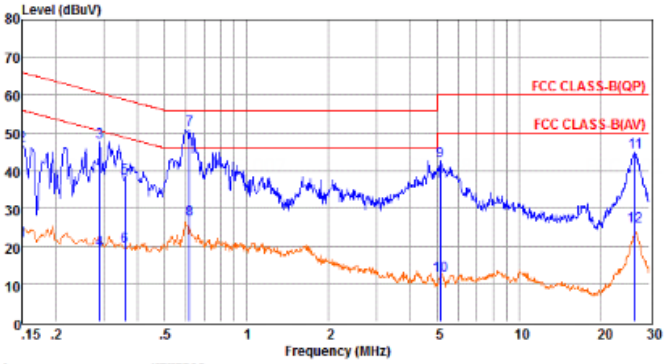
AC Conducted Emission of charge from PC mode @ AC 120V/60Hz (worst case)



Pol: LINE

	Freq MHz	Reading dBuV	LISNFac dB	CabLos dB	Aux2Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.16	31.10	9.58	0.02	10.00	50.70	65.56	-14.86	QP
2	0.16	5.57	9.58	0.02	10.00	25.17	55.55	-30.38	Average
3	0.25	30.14	9.63	0.03	10.00	49.80	61.64	-11.84	QP
4	0.25	-0.93	9.63	0.03	10.00	18.73	51.64	-32.91	Average
5	0.60	28.42	9.63	0.04	10.00	48.09	56.00	-7.91	QP
6	0.60	5.03	9.63	0.04	10.00	24.70	46.00	-21.30	Average
7	1.71	16.92	9.64	0.05	10.00	36.61	56.00	-19.39	QP
8	1.71	1.47	9.64	0.05	10.00	21.16	46.00	-24.84	Average
9	5.03	17.75	9.65	0.06	10.00	37.46	60.00	-22.54	QP
10	5.03	-8.00	9.65	0.06	10.00	11.71	50.00	-38.29	Average
11	26.84	23.06	9.71	0.13	10.00	42.90	60.00	-17.10	QP
12	26.84	1.63	9.71	0.13	10.00	21.47	50.00	-28.53	Average

Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.



Pol: NEUTRAL

	Freq MHz	Reading dBuV	LISNFac dB	CabLos dB	Aux2Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15	1.76	9.70	0.02	10.00	21.48	56.00	-34.52	Average
2	0.15	26.97	9.70	0.02	10.00	46.69	66.00	-19.31	QP
3	0.29	28.00	9.60	0.03	10.00	47.63	60.54	-12.91	QP
4	0.29	-0.59	9.60	0.03	10.00	19.04	50.54	-31.50	Average
5	0.36	18.33	9.61	0.03	10.00	37.97	58.78	-20.81	QP
6	0.36	0.26	9.61	0.03	10.00	19.90	48.78	-28.88	Average
7	0.62	31.16	9.63	0.04	10.00	50.83	56.00	-5.17	QP
8	0.62	7.25	9.63	0.04	10.00	26.92	46.00	-19.08	Average
9	5.14	22.93	9.66	0.06	10.00	42.65	60.00	-17.35	QP
10	5.14	-7.43	9.66	0.06	10.00	12.29	50.00	-37.71	Average
11	26.56	25.05	9.83	0.13	10.00	45.01	60.00	-14.99	QP
12	26.56	5.37	9.83	0.13	10.00	25.33	50.00	-24.67	Average

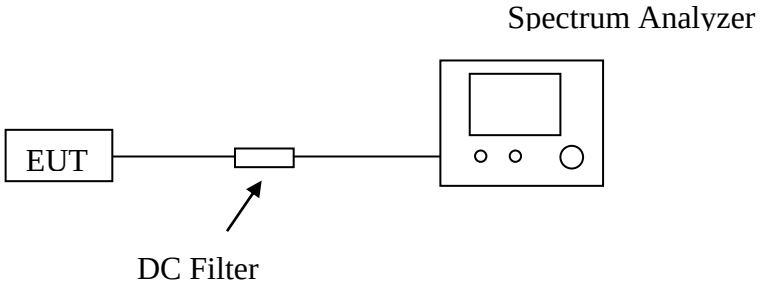
Remarks: 1. Measured = Reading + LISNFac + Cable Loss + Aux2 Fac.
2. The emission levels that are 20dB below the official limit are not reported.

8. 20 DB BANDWIDTH MEASUREMENT

8.1. Standard Applicable

According to §15.215

8.2. Block Diagram of Test Setup



8.3. Test Procedure

Use the following spectrum analyzer settings:

Span = 3MHz

RBW = 100KHz

VBW = 300KHz

Sweep = auto

Detector function = peak

Trace = max hold

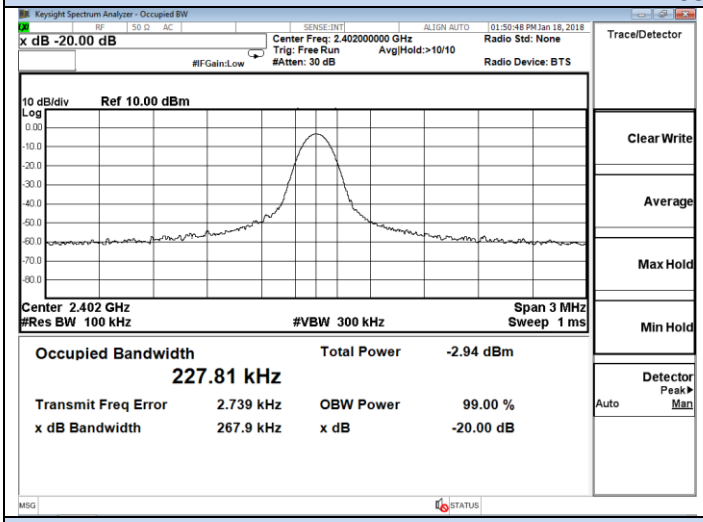
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

8.4. Test Results

Temperature	25.6℃	Humidity	50.4%
Test Engineer	Peter Xiao	Test Date	January 15, 2018

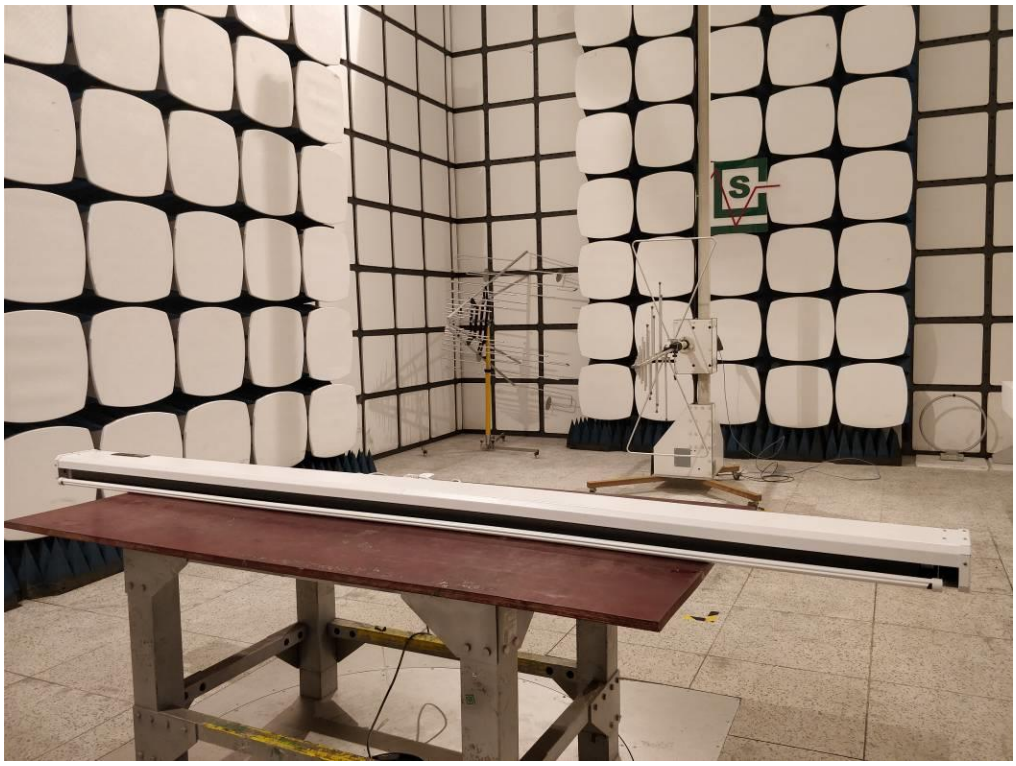
Test Result Of 20dB Bandwidth Measurement		
Test Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
2402	0.2679	Non-Specified

Test plot

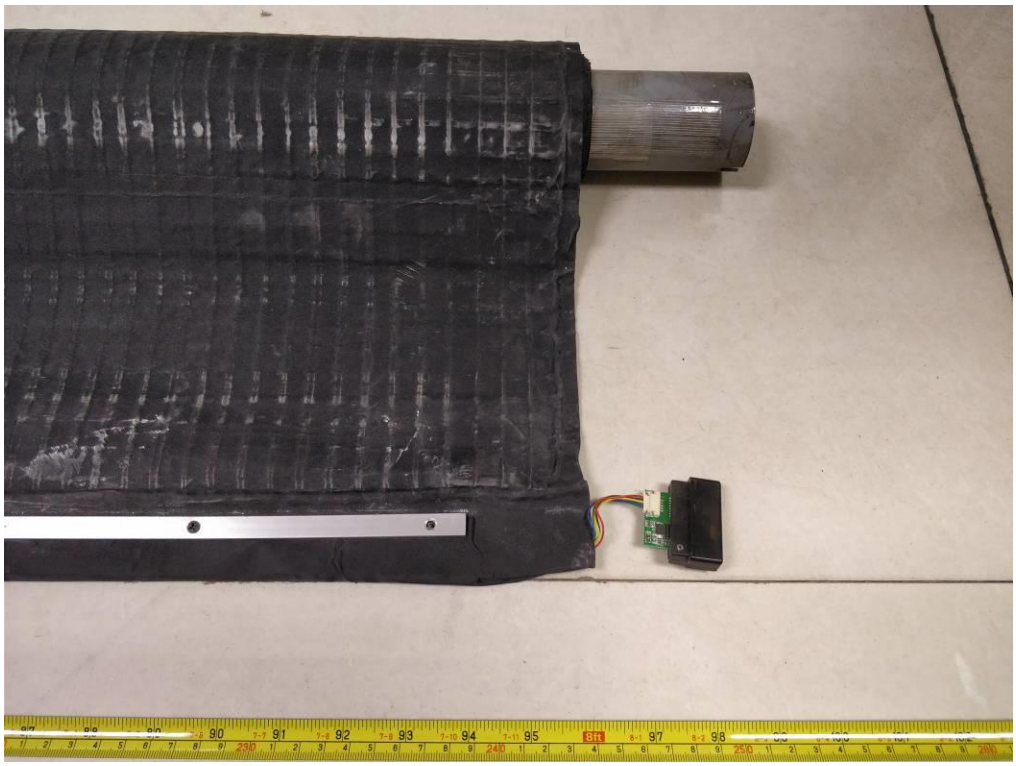


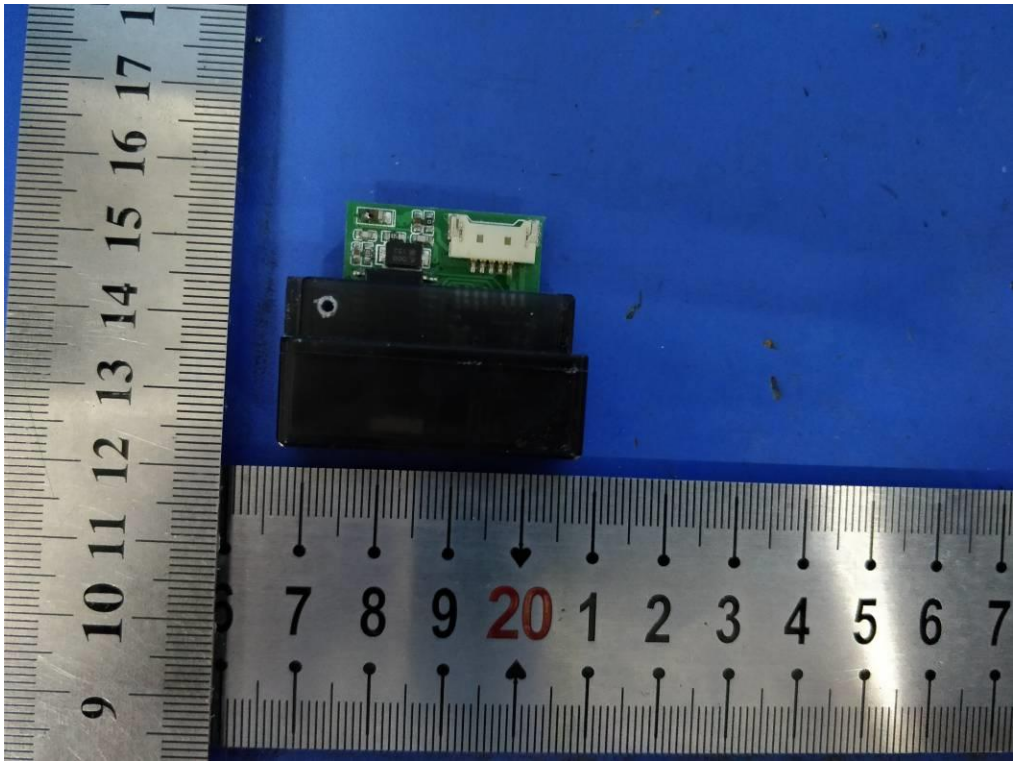
2402 MHz

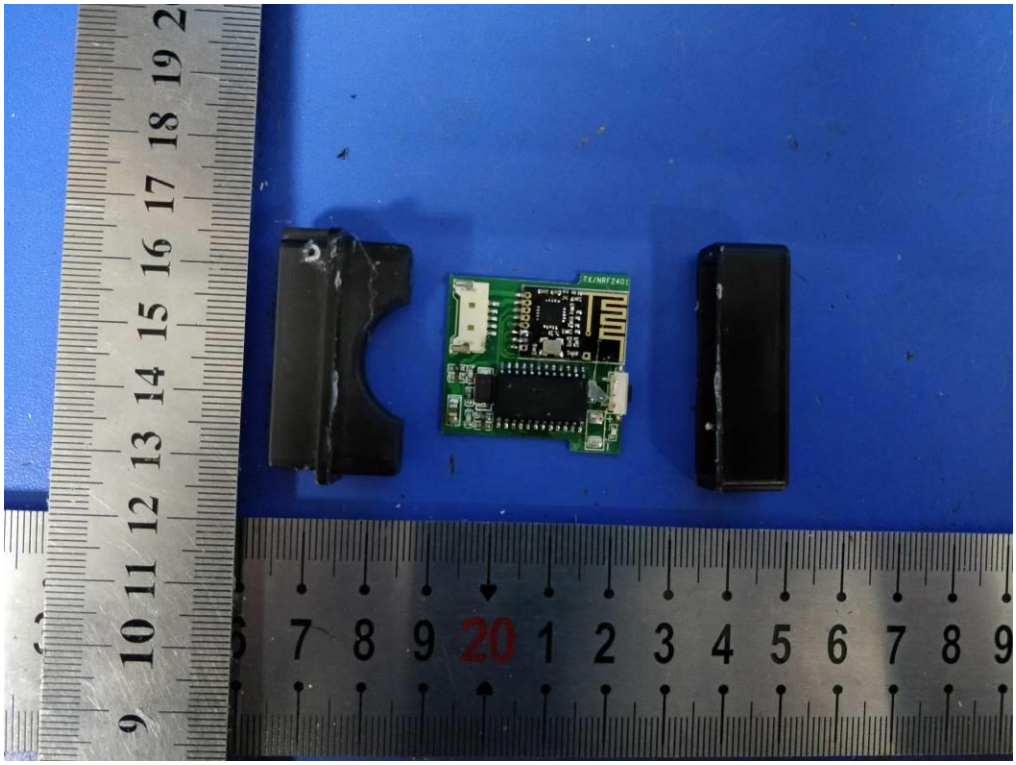
9. TEST SETUP PHOTOGRAPHS

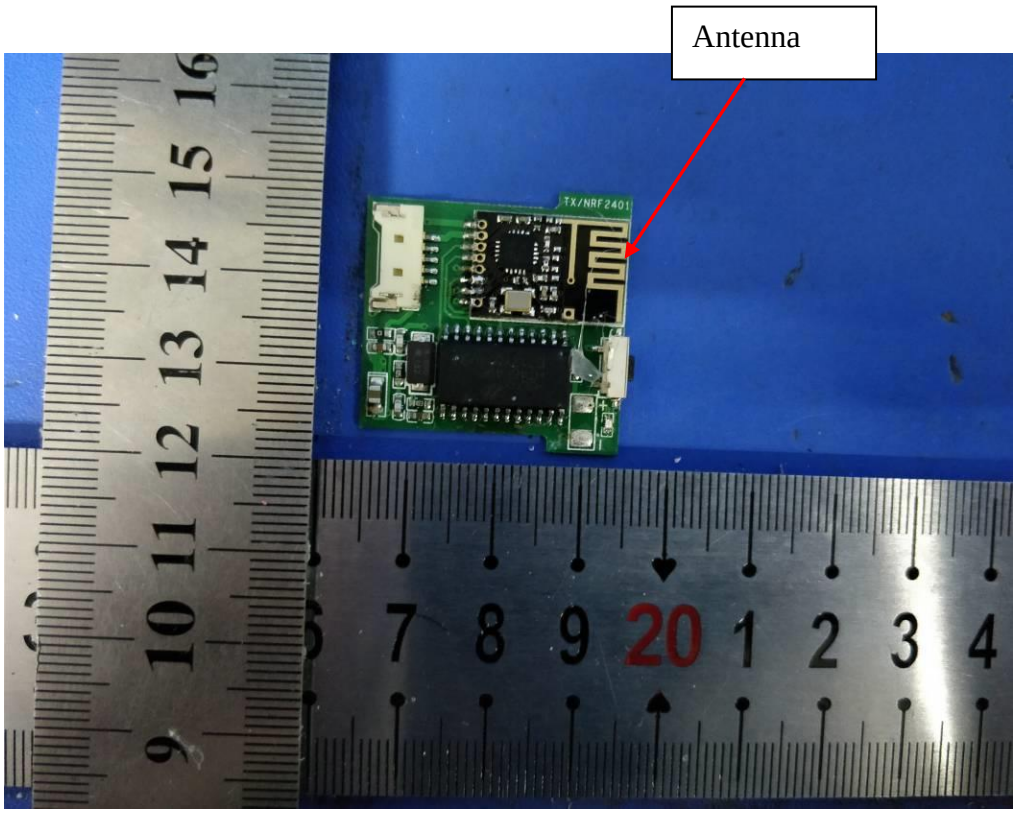


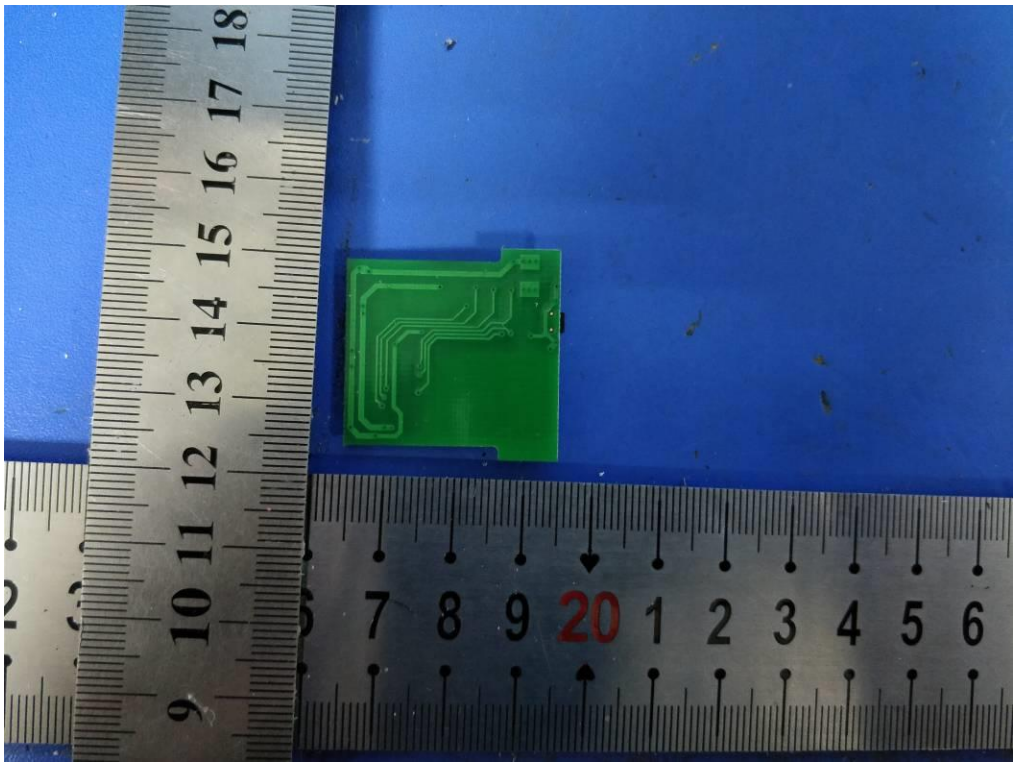
10. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

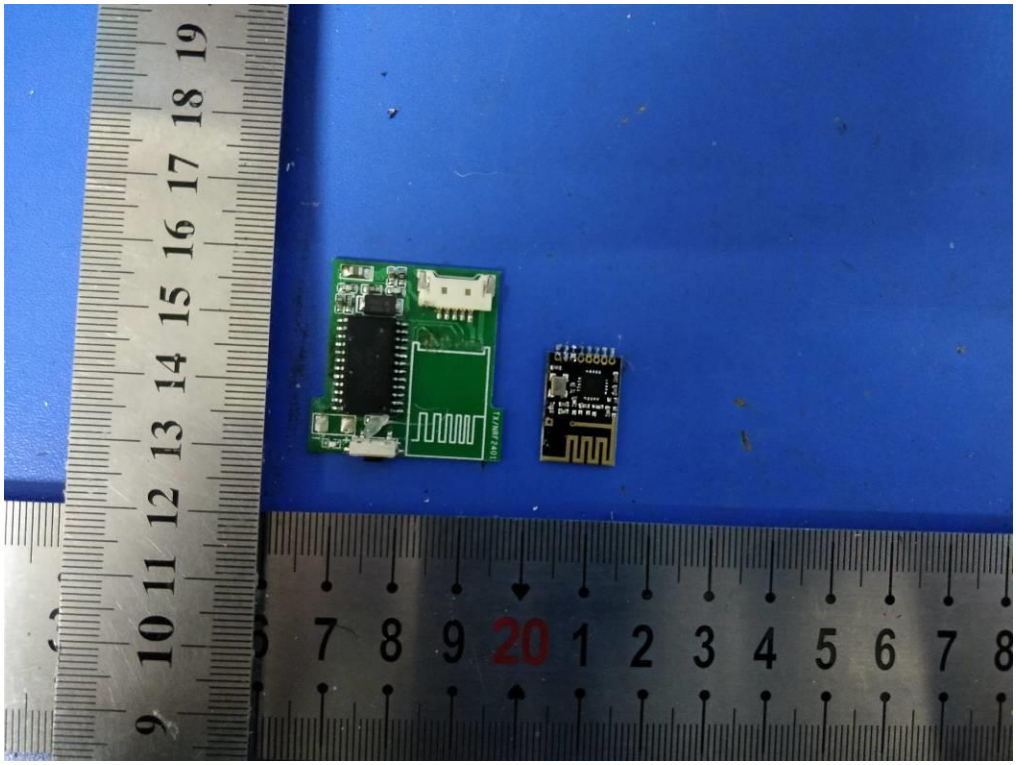


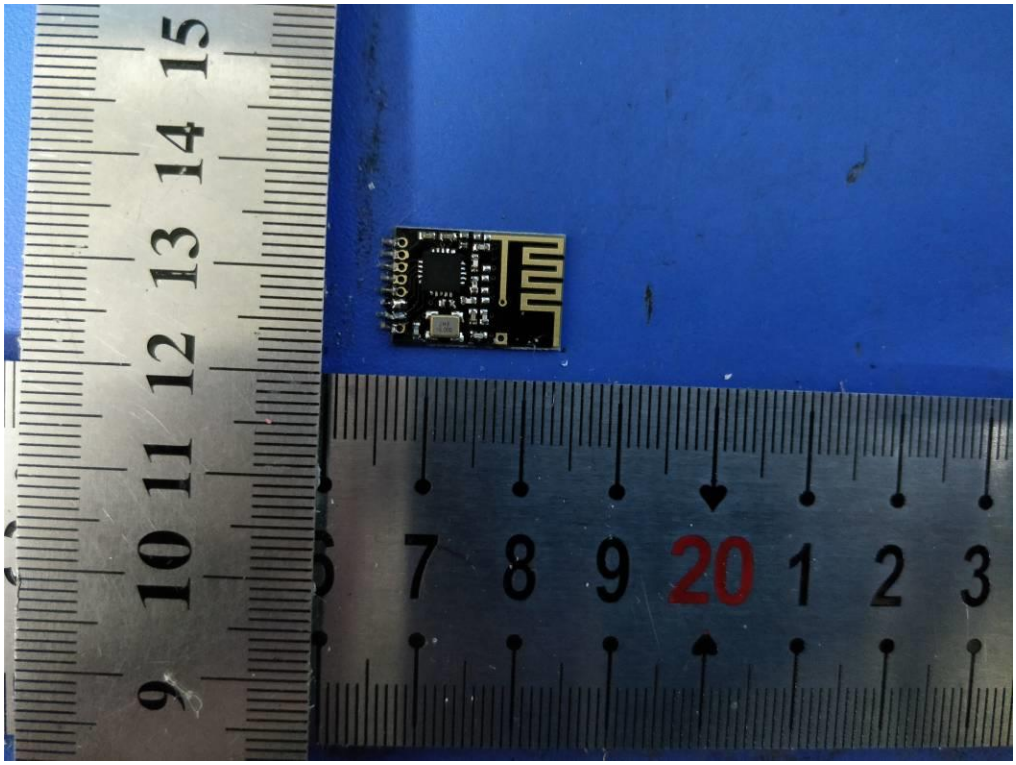


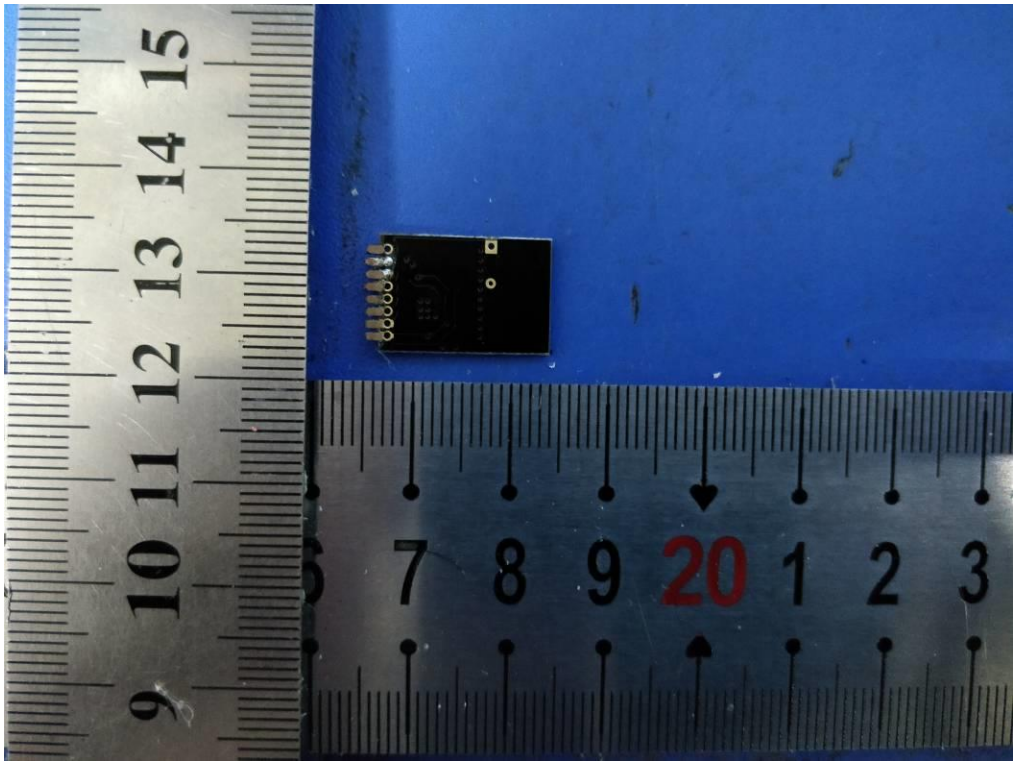


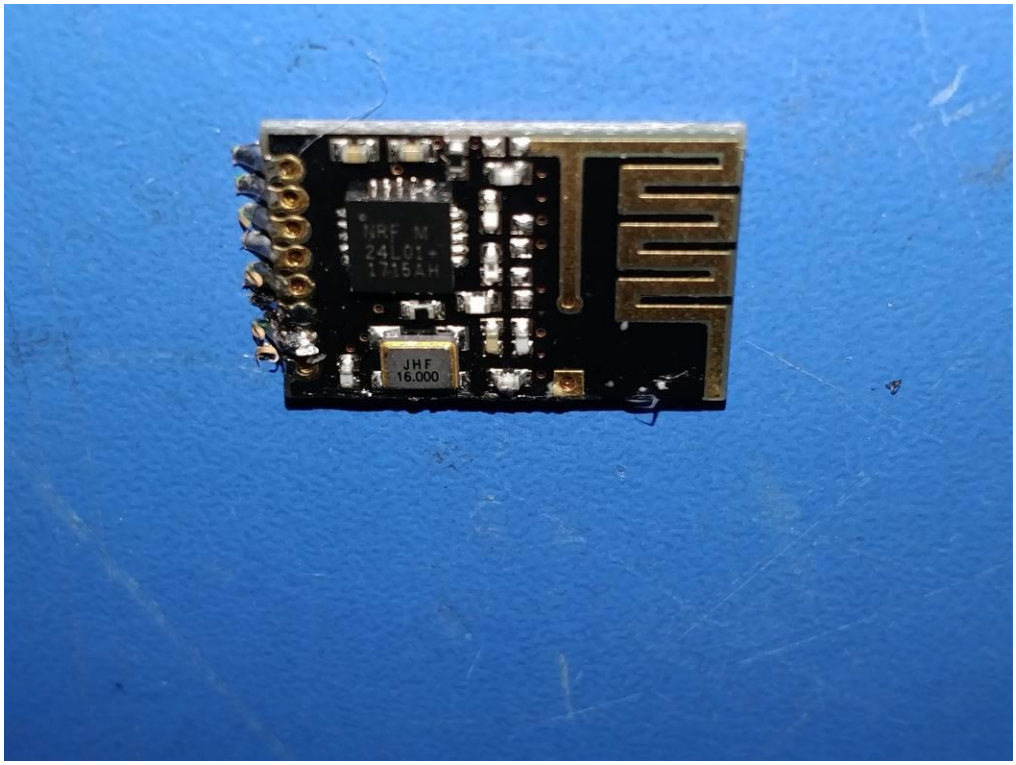

Antenna
TX/NRF2401











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