FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

TLV CO.,LTD.

RF Module

Model No.: iT-ZB-R

FCC ID: H3RTZRR1001

Prepared for : TLV CO.,LTD.
881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511 Japan

Prepared By : Audix Technology (Shenzhen) Co., Ltd.
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Report Number	:	ACS-F17124-1
Date of Test	:	Dec.22,2020~Feb.25,2021
Date of Report	:	Feb.26,2021

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TEST REPORT CERTIFICATION

Applicant	:	TLV CO.,LTD.
Manufacture	:	TLV CO.,LTD.
Product	:	RF Module
FCC ID	:	H3RTZRR1001

(A)Model No. : iT-ZB-R
(B) Power Supply : DC 3.6V
(C) Test Voltage : DC 3.6V

Tested for comply with:
FCC CFR 47 Part 15 Subpart C

Test procedure used:
ANSI C63.10: 2013
KDB 558074 D01v05r02

The device described above is tested by AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and AUDIX TECHNOLOGY (SHENZHEN) CO., LTD. is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC and IC requirements. This report contains data that are not covered by the NVLAP accreditation.

This Report is made under FCC Part 2.1074. No modifications were required during testing to bring this product into compliance.

This report applies to single evaluation of one sample of above mentioned product. This report shall not be reproduced in part without written approval of AUDIX TECHNOLOGY (SHENZHEN) CO., LTD.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Date of Test : Dec.22,2020~Feb.25,2021 Report of date: Feb.26,2021

Prepared by : Brave Zhang / Assistant

Reviewed by : Sunny Lu/ Deputy Manager

AUDIX® 信華科技（深圳）有限公司
Audix Technology (Shenzhen) Co., Ltd.
EMC 部門報告專用章
Stamp only for EMC Dept. Report

Approved & Authorized Signer : Signature: David Jin
David Jin / Deputy General Manager

Modified History

Rev.	Summary	Date of Rev.	Report No.
A1.0	Original Report.	Jul.19,2017	ACS-F17124
A1.1	Add antenna with same gain.	Feb.26,2021	ACS-F17124-1

Note: After evaluating the above differences, only Radiated Emission, Output Power, Band Edge need to be re-rest. Other test items refer to the original report.

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	**Standard**	**Results**
Power Line Conducted Emission Test	FCC Part 15: 15.207 ANSI C63.10 :2013	N/A
Radiated Emission Test	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10 : 2013	PASS
Conducted Spurious Emissions	FCC Part 15: 15.247(a)(1) ANSI C63.10 : 2013	N/A
6dB Bandwidth Test	FCC Part 15: 15.215 ANSI C63.10 : 2013	N/A
Maximum Peak Output Power Test	FCC Part 15: 15.247(b)(1) ANSI C63.10 : 2013	PASS
Band Edge Compliance Test	FCC Part 15: 15.247(d) ANSI C63.10 : 2013	PASS
Power Spectral Density Test	FCC Part 15: 15.247(d) ANSI C63.10 : 2013	N/A
MPE Estimation	FCC Part 15: 15.247	PASS
Antenna requirement	FCC Part 15: 15.203	PASS
Note: N/A means that the change of the antenna has no effect on the test item and does not need to be retested.		

2. GENERAL INFORMATION

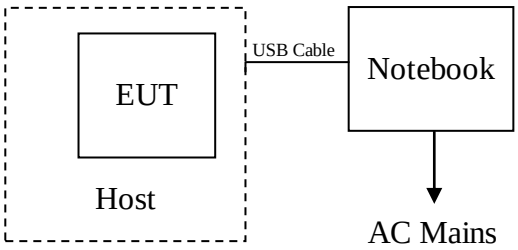
2.1. Description of Device (EUT)

Applicant	TLV CO.,LTD.
Applicant Address	881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511 Japan
Manufacturer	TLV CO.,LTD.
Manufacturer Address	881 Nagasuna, Noguchi, Kakogawa, Hyogo 675-8511 Japan
System Name	RF Module
Model No.	iT-ZB-R
FCC ID	H3RTZRR1001
Radio	General 2.4GHz wireless
Frequency Range	2405MHz-2480MHz
Type of Modulation	O-QPSK
Antenna Information	Dipole Antenna, 2.14dBi PK gain
Audio Cable	Unshielded, Detachable; 1.4m
Sample Type	Prototype production
Date of Receipt	Nov.24,2020
Date of Test	Dec.22,2020~Feb.25,2021

2.2.Tested Supporting System Details

No.	Description	ACS No.	Manufacturer	Model	Serial Number
1	Notebook	N/A	HP	TPN-C116	N/A
		Power Cord: Unshielded, Detachable, 1.5m			
2	iTrapSensor Monitoring System, Repeater Unit	N/A	TLV	iT5-ZB-RUN	N/A
3	USB Cable: Shielded, Detachable, 1.5m				

2.3.Block diagram of connection between the EUT and simulators



(EUT: RF Module)

2.4. Test Facility
Site Description

Name of Firm	:	Audix Technology (Shenzhen) Co., Ltd. No. 6, Kefeng Road, Science & Technology Park, Nanshan District , Shenzhen, Guangdong, China
EMC Lab.	:	Accredited by Industry Canada Registration Number: IC 5183A-1 Valid Date: Mar.31, 2021
	:	Accredited by NVLAP, USA NVLAP Code: 200372-0 Valid Date: Mar.31, 2021
	:	Certificated by FCC USA. Designation No.: CN5022 Valid Date: Mar.31, 2021

2.5. Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Radiation Emission test in 3m chamber	3.6dB(30~200MHz, Polarization: H)
	4.0dB(30~200MHz, Polarization: V)
	3.6dB(200M~1GHz, Polarization: H)
	3.8dB(200M~1GHz, Polarization: V)
Uncertainty for Radiation Emission test in 3m chamber(1GHz-25GHz)	4.6dB(1~6GHz, Distance: 3m)
	4.6dB(6~25GHz, Distance: 3m)
Uncertainty for Radiated Spurious Emission test	3.7dB(30MHz~1000MHz)
	3.3dB(1~26.5GHz)
Uncertainty for Conduction Spurious emission test	2.0dB
Uncertainty for Output power test	0.8dB
Uncertainty for Bandwidth test	83kHz
Uncertainty for DC power test	1.9%
Uncertainty for test site temperature and humidity	0.6℃
	3%

Note: EMI uncertainty is evaluated by CISPR16-4-2.
The value of measurement uncertainty of EMI is less than U_{CISPR}.
The value is not calculated in the test results.

3. POWER LINE CONDUCTED EMISSION TEST

According to Paragraph (c) of FCC Part 15 section 15.207, Tests to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

4. RADIATED EMISSION MEASUREMENT

4.1. Test Equipment

Frequency range: 30~1000MHz

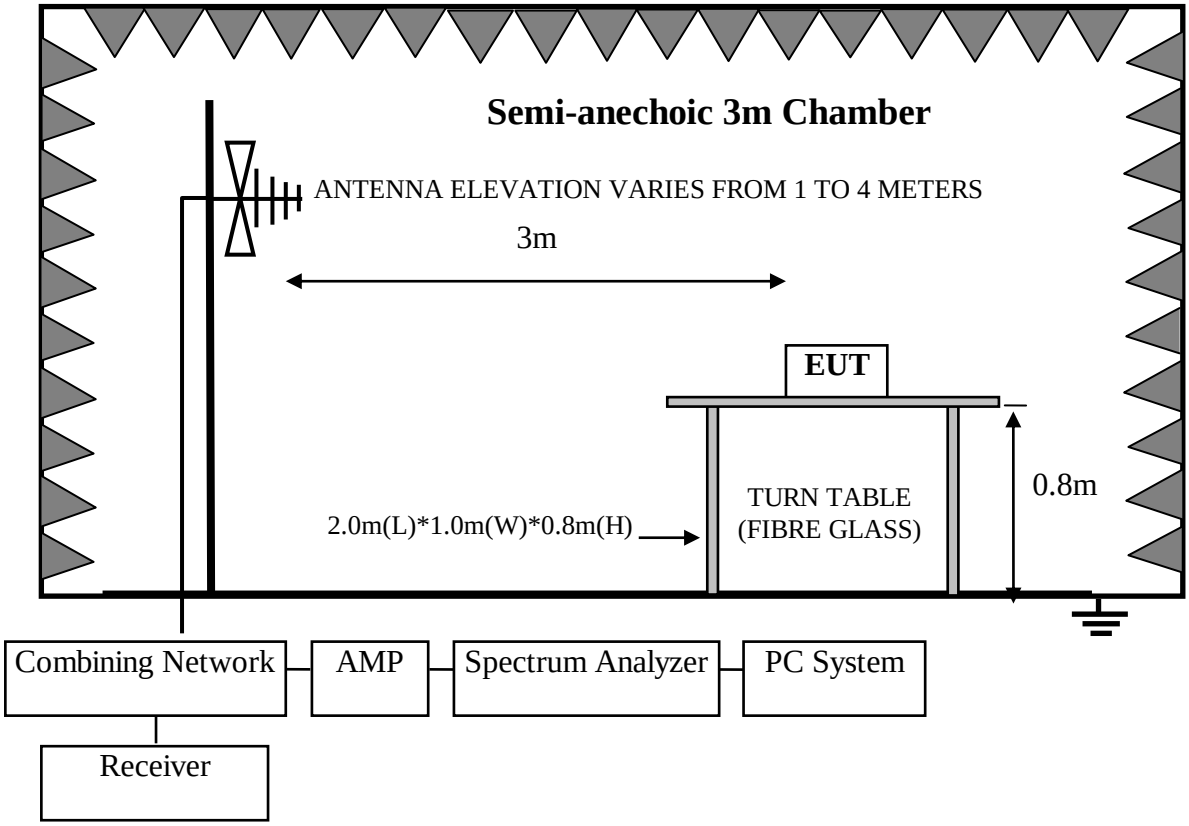
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber(NSA)	AUDIX	N/A	N/A	May.03,20	1 Year
2.	3#Chamber(SE)	AUDIX	N/A	N/A	May.17,18	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.11,20	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR7	101547	Apr.12,20	1 Year
5.	Amplifier	HP	8447D	2648A04738	Apr.11,20	1 Year
6.	Bi log Antenna	TESEQ	CBL6112D	25237	Dec.22,20	1 Year
7.	NSA Cable	HUBER+SUHNER	CFD400NL-LW	No.3	Oct.11,20	1 Year
8.	Coaxial Switch	Anritsu	MP59B	6201397222	Apr.11,20	1 Year
9.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A
Note: N/A means Not applicable.						

Frequency range: above 1000MHz

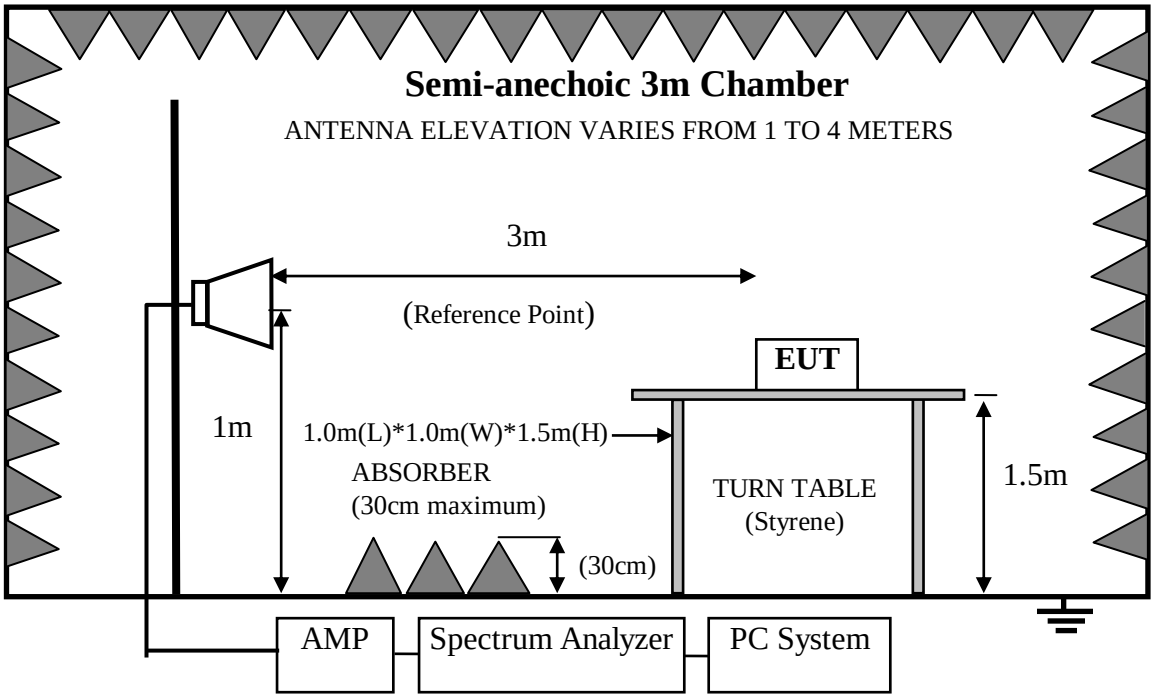
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3#Chamber(Svswr)	AUDIX	N/A	N/A	Apr.15,20	1 Year
2.	3#Chamber(SE)	AUDIX	N/A	N/A	May.17,18	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.11,20	1 Year
4.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Jul.30,20	1 Year
5.	Horn Antenna	ETS	3116	00060089	Dec.09,20	1 Year
6.	Amplifier	Agilent	83017A	MY53270084	Oct.11,20	1 Year
7.	RF Cable	Hubersuhner	SUCOFLEX-106	505238/6	Apr.11,20	1 Year
8.	Test Software	AUDIX	e3	6.2009-5-21a(n)	N/A	N/A
Note: N/A means Not applicable.						

4.2. Block Diagram of Test Setup

For frequency range 30MHz-1000MHz



For frequency range 1GHz-25GHz



4.3. Radiated Emission Limit Standard:

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000MHz	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark： (1) Emission level dBμV = 20 log Emission level μV/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.

(4) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

4.4. EUT Configuration on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.4.1. RF Module (EUT)

Model No. : iT-ZB-R
Serial No. : N/A

4.5. Operating Condition of EUT

4.5.1. Setup the EUT and simulator as shown as Section 4.2.

4.5.2. Turn on the power of all equipments.

4.5.3. Let EUT work in Tx mode.

4.6. Test Procedure

Frequency below 30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)*2.4m(W)*0.3m(H) on the ground . The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it.EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horm antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10-2013 on radiated emission Test.

This test was performed with EUT in X, Y, Z position, and the worse case was found when EUT in X position as the test photo indicated.

The bandwidth of the EMI test receiver (R&S ESR7) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

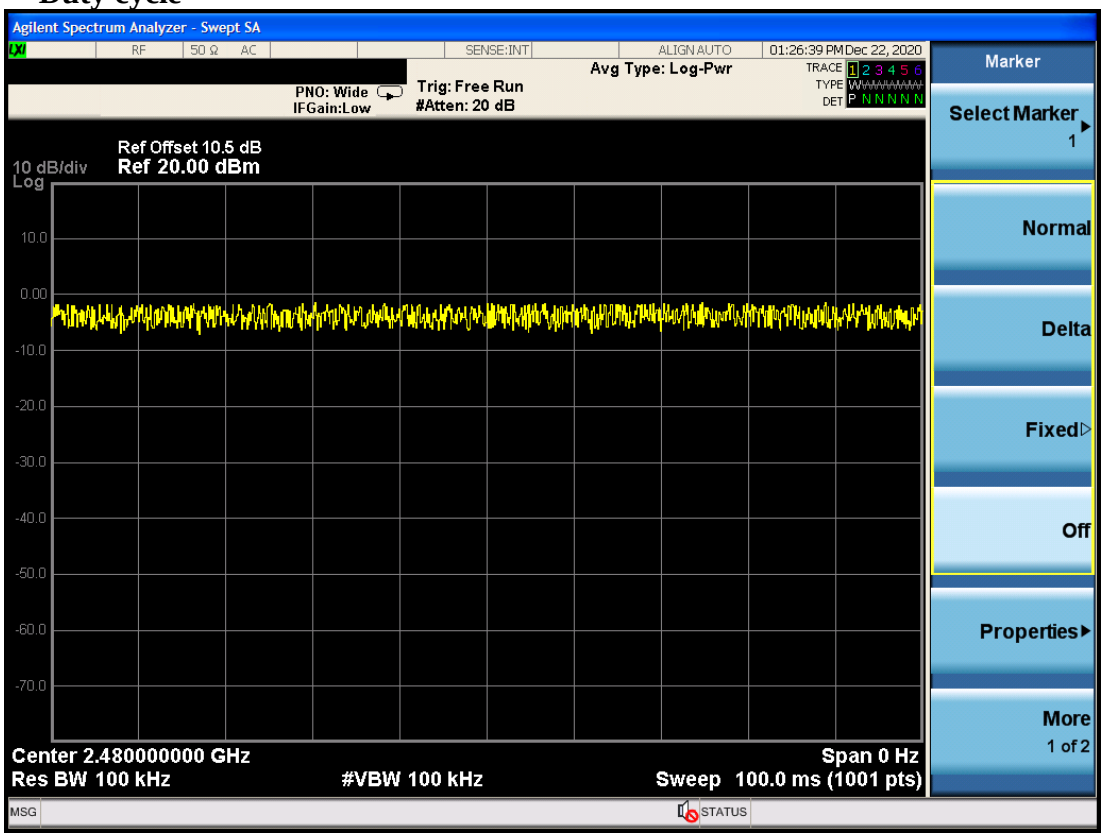
The bandwidth of the Spectrum's RBW is set at 1MHz and VBW is set at 3MHz for peak emissions measurement and RBW is set at 1MHz, VBW is set at 10Hz for average measurement

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

4.7. Radiated Emission Test Results
PASS.

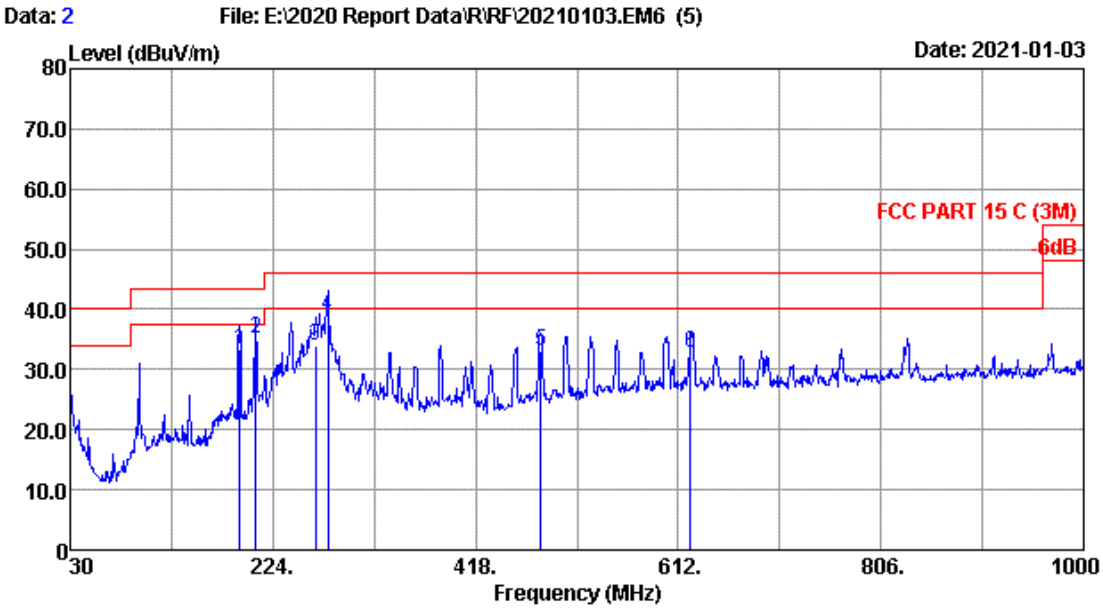
All the emissions from 30MHz to 25GHz were comply with the 15.209 Limit.
Note 1: For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
Note 2:The emissions (9kHz~30MHz) not reported for there is no emission be found.

Duty cycle



Note: The Duty Cycle is close to 100%.

Frequency: 30MHz~1GHz

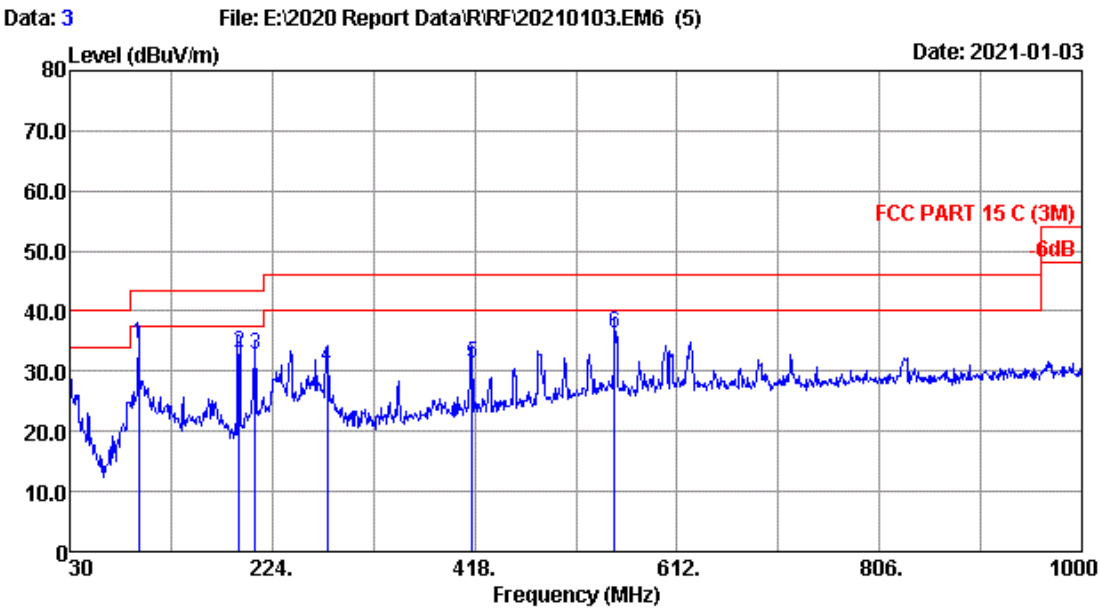


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 CBL6112D-25237
Limit : FCC PART 15 C (3M)
Env. / Ins. : 23.4*C/54%
Power rating : DC3.6V
Test Mode : TX Mode

Data no. : 2
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	191.990	15.00	1.45	16.82	33.27	43.50	10.23	QP
2	207.510	15.51	1.50	18.16	35.17	43.50	8.33	QP
3	264.740	18.48	1.62	13.90	34.00	46.00	12.00	QP
4	276.380	18.62	1.66	18.63	38.91	46.00	7.09	QP
5	480.080	22.90	2.28	7.81	32.99	46.00	13.01	QP
6	623.640	24.44	2.63	5.80	32.87	46.00	13.13	QP

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



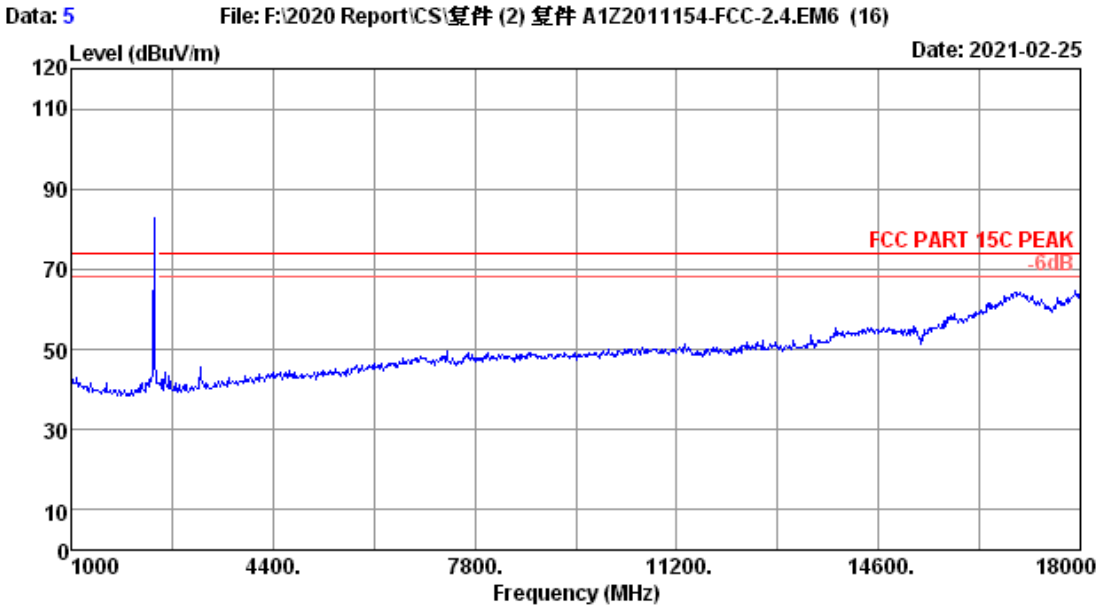
Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 CBL6112D-25237
Limit : FCC PART 15 C (3M)
Env. / Ins. : 23.4*C/54%
Power rating : DC3.6V
Test Mode : TX Mode

Data no. : 3
Ant. pol. : VERTICAL
Engineer : Allen

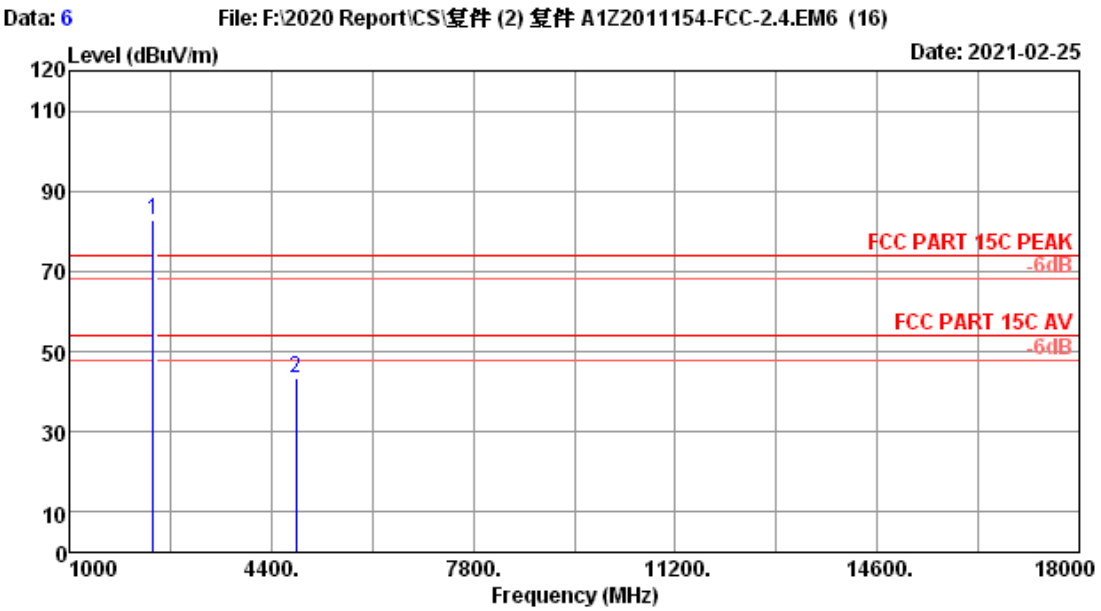
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	95.960	16.16	0.98	17.36	34.50	43.50	9.00	QP
2	191.990	15.00	1.45	16.68	33.13	43.50	10.37	QP
3	207.510	15.51	1.50	15.68	32.69	43.50	10.81	QP
4	276.380	18.62	1.66	10.40	30.68	46.00	15.32	QP
5	416.060	21.79	2.08	7.49	31.36	46.00	14.64	QP
6	551.860	24.68	2.46	9.15	36.29	46.00	9.71	QP

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

Frequency: 1GHz~18GHz



Site no.	: 3m Chamber	Data no.	: 5
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.9*C/56%	Engineer	: Allen
Power rating	: DC 3.6V		
Test Mode	: 2405MHz Tx Mode		

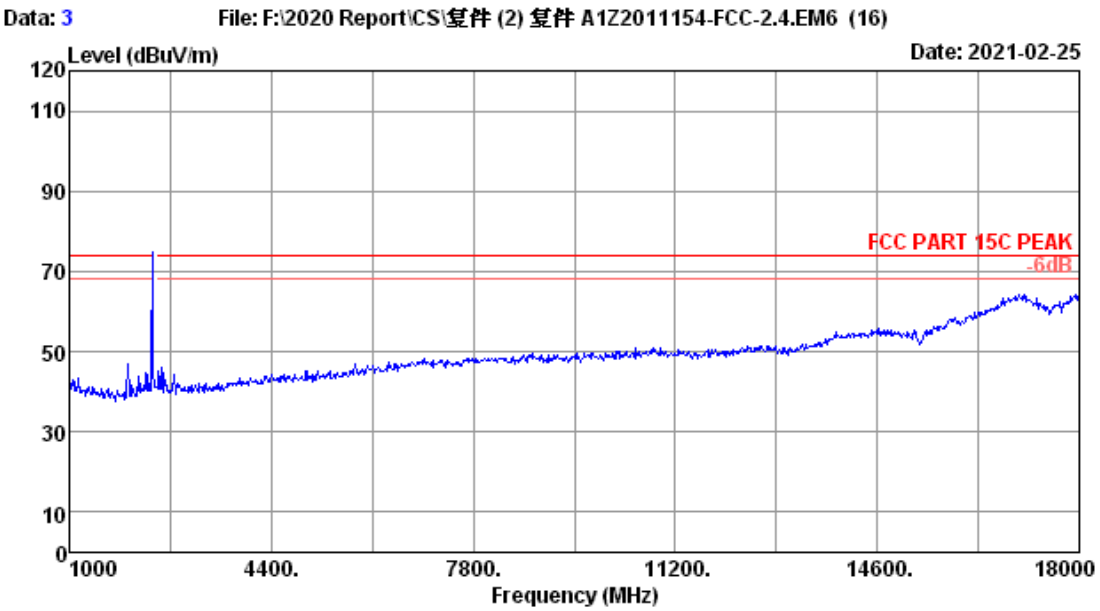


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2405MHz Tx Mode

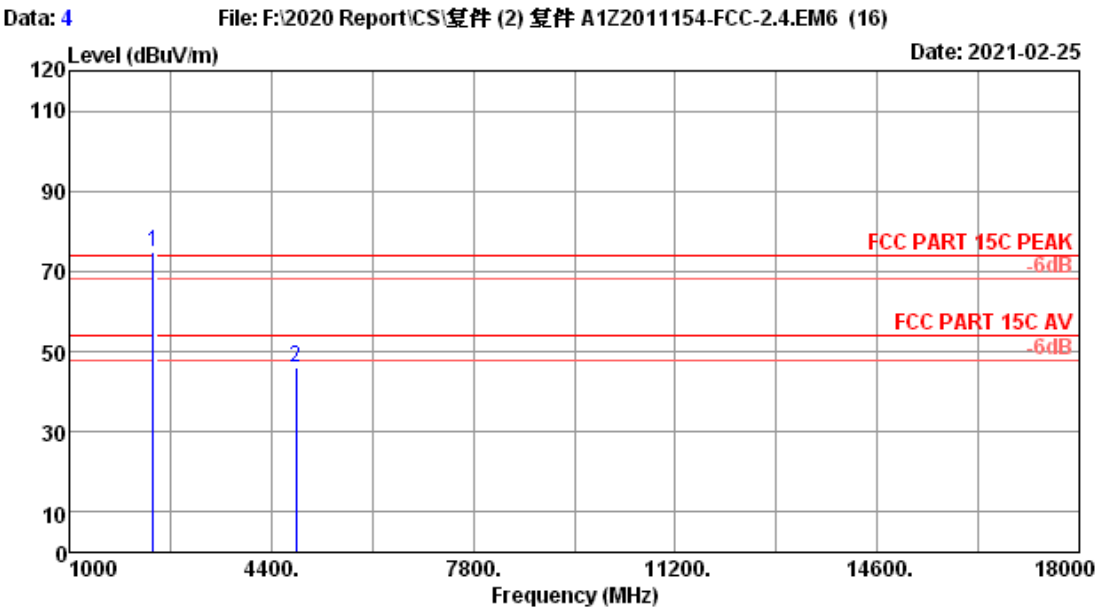
Data no. : 6
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2405.00	28.04	0.92	87.46	33.48	82.94	------	------	Peak
2	4810.00	32.61	1.38	42.50	33.18	43.31	74.00	30.69	Peak

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




```
Site no.      : 3m Chamber                    Data no.   : 3
Dis. / Ant.   : 3m   2020 MCTD1209-3006       Ant. pol.  : VERTICAL
Limit         : FCC PART 15C PEAK
Env. / Ins.   : 23.9*C/56%                    Engineer   : Allen
Power rating  : DC 3.6V
Test Mode     : 2405MHz  Tx  Mode
```

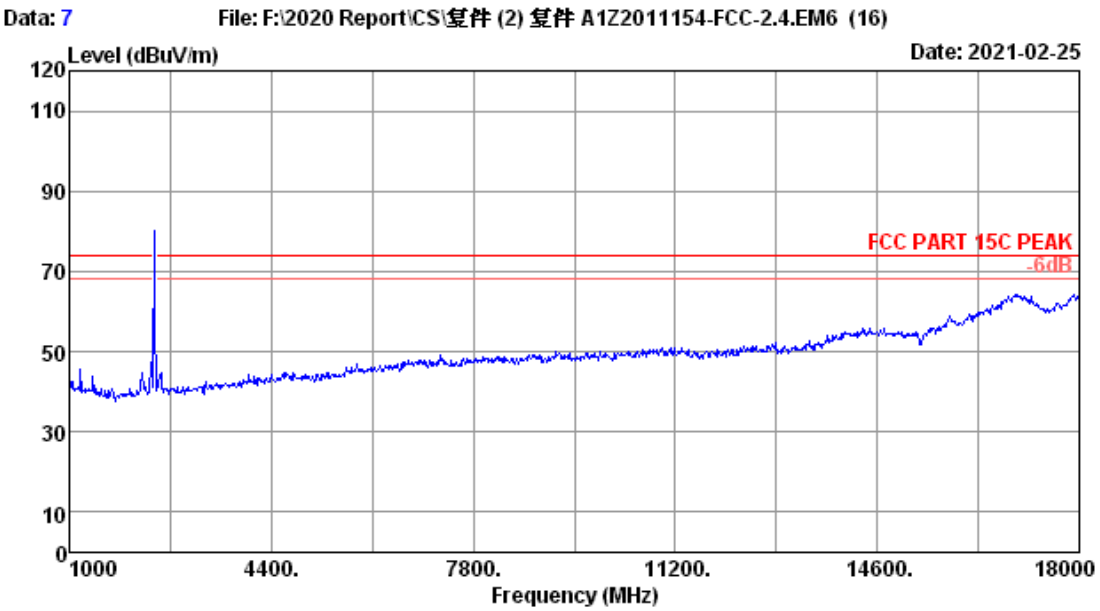


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2405MHz Tx Mode

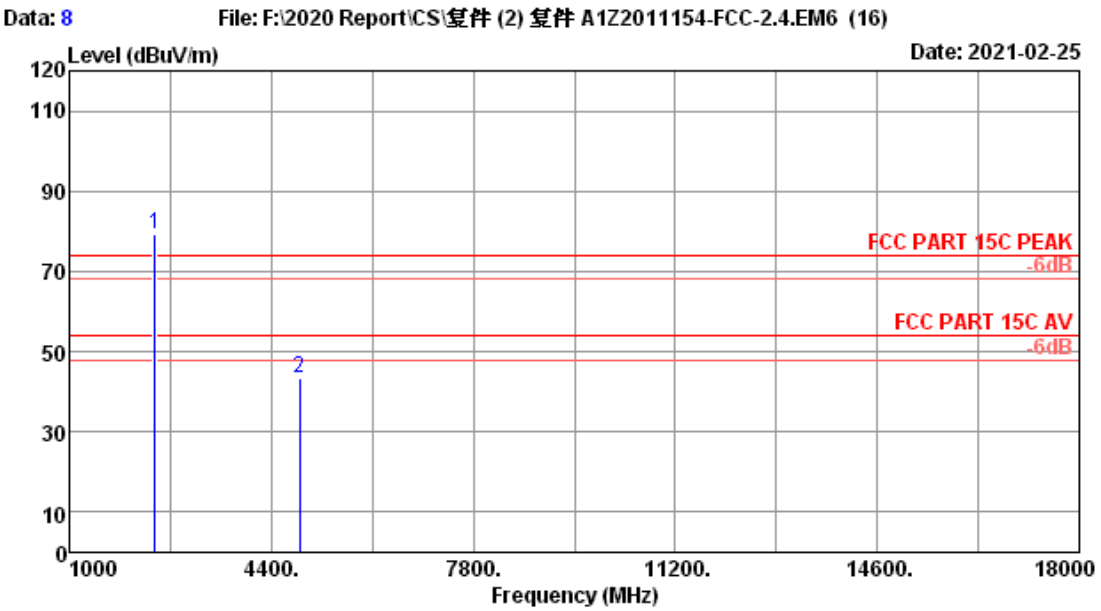
Data no. : 4
Ant. pol. : VERTICAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2405.00	28.04	0.92	79.22	33.48	74.70	------	------	Peak
2	4810.00	32.61	1.38	45.20	33.18	46.01	74.00	27.99	Peak

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



Site no.	: 3m Chamber	Data no.	: 7
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.9*C/56%	Engineer	: Allen
Power rating	: DC 3.6V		
Test Mode	: 2440MHz Tx Mode		

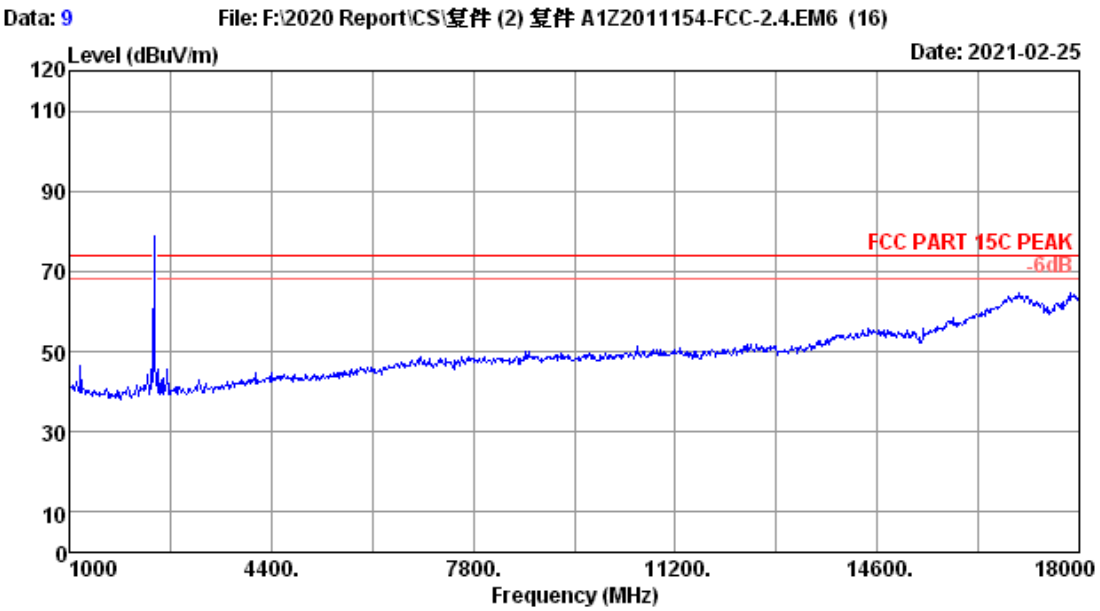


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2440MHz Tx Mode

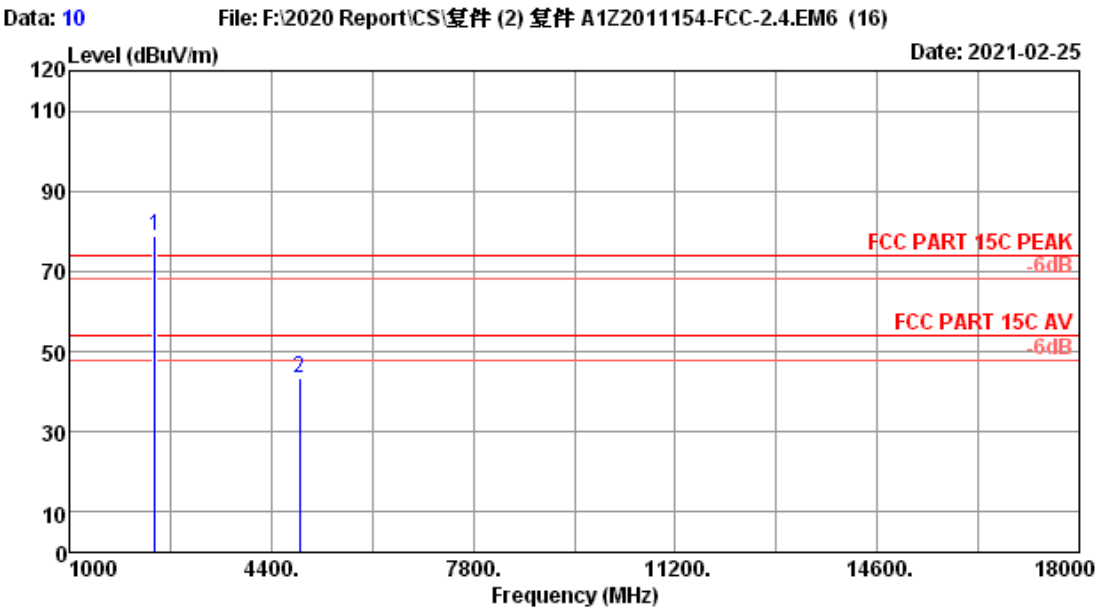
Data no. : 8
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.11	0.93	83.59	33.47	79.16	------	------	Peak
2	4880.00	32.68	1.39	42.34	33.19	43.22	74.00	30.78	Peak

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



Site no.	: 3m Chamber	Data no.	: 9
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.9*C/56%	Engineer	: Allen
Power rating	: DC 3.6V		
Test Mode	: 2440MHz Tx Mode		

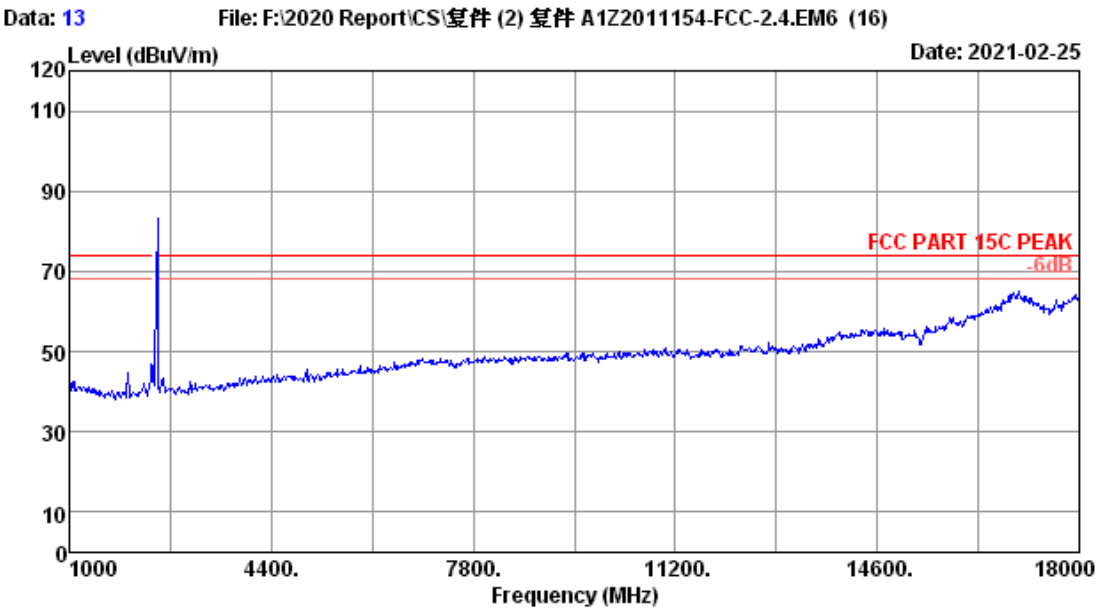


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2440MHz Tx Mode

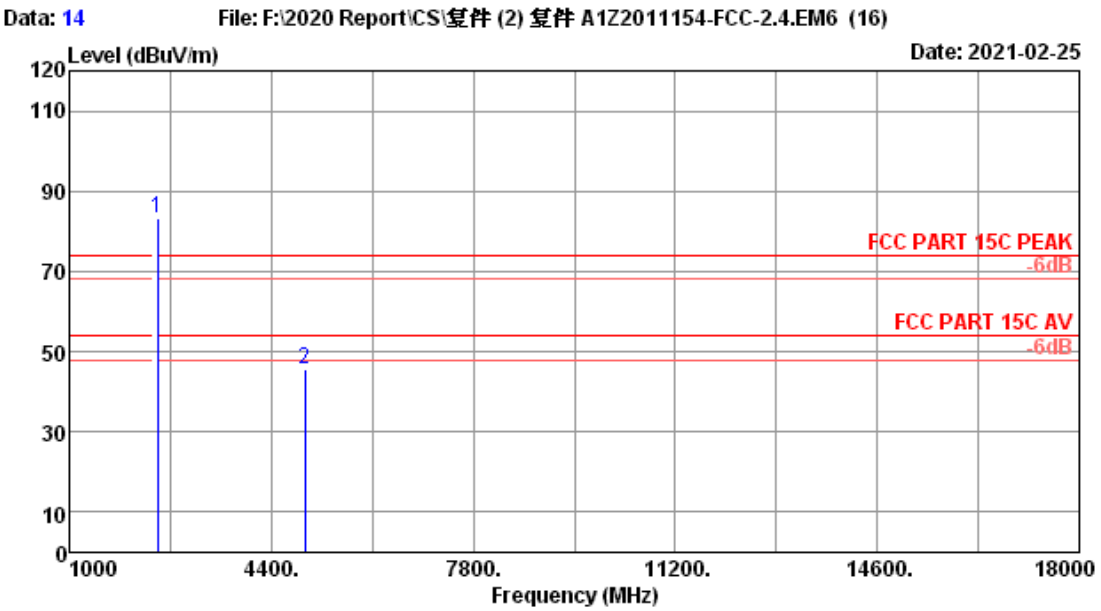
Data no. : 10
Ant. pol. : VERTICAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	28.11	0.93	83.18	33.47	78.75	------	------	Peak
2	4880.00	32.68	1.39	42.42	33.19	43.30	74.00	30.70	Peak

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



Site no.	: 3m Chamber	Data no.	: 13
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.9*C/56%	Engineer	: Allen
Power rating	: DC 3.6V		
Test Mode	: 2480MHz Tx Mode		

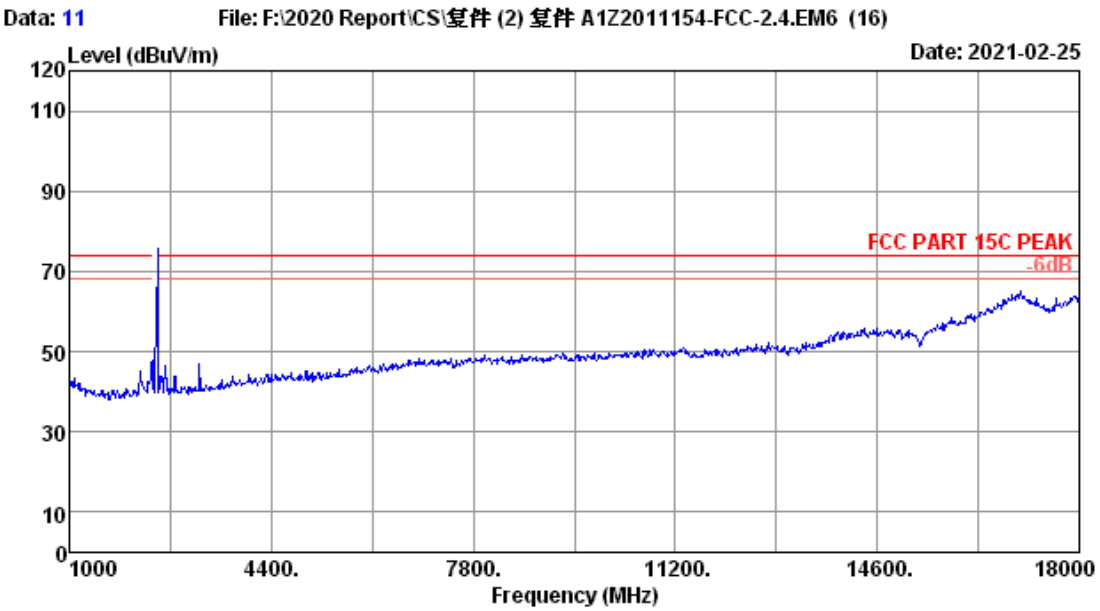


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2480MHz Tx Mode

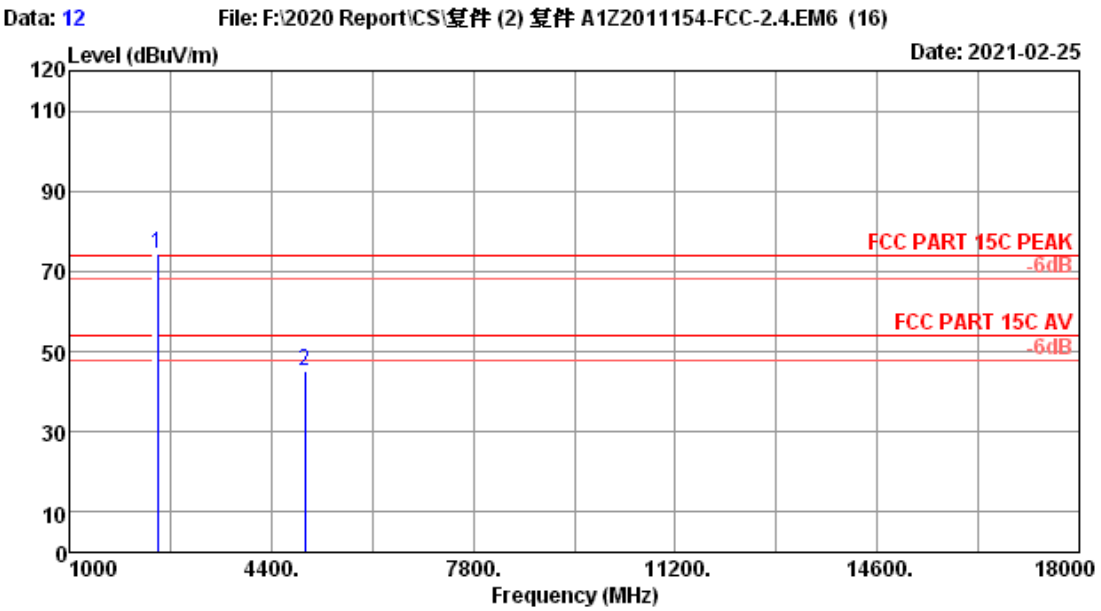
Data no. : 14
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	28.17	0.94	87.66	33.46	83.31	------	------	Peak
2	4960.00	32.77	1.39	44.69	33.20	45.65	74.00	28.35	Peak

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



Site no.	: 3m Chamber	Data no.	: 11
Dis. / Ant.	: 3m 2020 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 23.9*C/56%	Engineer	: Allen
Power rating	: DC 3.6V		
Test Mode	: 2480MHz Tx Mode		



Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2480MHz Tx Mode

Data no. : 12
Ant. pol. : VERTICAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	28.17	0.94	78.90	33.46	74.55	------	------	Peak
2	4960.00	32.77	1.39	44.02	33.20	44.98	74.00	29.02	Peak

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

5. MAXIMUM PEAK OUTPUT POWER TEST

5.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Power meter	HP	436A	2016A07891	Apr 11,20	1 Year
3.	Power Sensor	Agilent	8482B	MY41090514	Apr.11,20	1 Year
4.	Amplifier	HP	8449B	3008A00836	Apr.11,20	1 Year
5.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	Apr.12,20	1 Year

5.2. Limit

For systems using digital modulation in the 2400—2483.5MHz, The Peak output Power shall not exceed 1W(30dBm).

5.3. Test Procedure

Connected the EUT's antenna port to Power Sensor, and use power meter to test peak output power.

5.4. Test Results

EUT: RF Module			
M/N: iT-ZB-R			
Test date:2020-12-29	Pressure: 102.1±1.0 kpa	Humidity: 51.1±3.0%	
Tested by: Allen	Test site: RF site	Temperature:22.8±0.6℃	
Test Mode	Frequency (MHz)	Peak output Power (dBm)	Limit (dBm)
O-QPSK	2405	6.745	30
	2440	6.289	30
	2480	5.791	30
Conclusion: PASS			

6. BAND EDGE COMPLIANCE TEST

6.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.12,20	1 Year
2.	Amplifier	Agilent	8449B	3008A02495	Apr.11,20	1 Year
3.	Horn Antenna	ETC	MCTD 1209	DRH15F03007	Jul.30,20	1 Year
4.	RF Cable	EMCI	EMC102-KM -KM 3500	170702	Apr.12,20	1 Year

6.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

6.3. Test Produce

For upper band emissions that are up to two bandwidths(2MHz) away (2483.5MHz to 2485.5MHz）from the band-edge use below produce:

1. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 100KHz and with a video bandwidth 300KHz. Record the peak levels of the fundamental emission and the relevant band-edge emission, Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
2. Subtract the delta measured in step (1) from the maximum field strengths measured in clause 4 .The resultant field strengths are then used to determine band-edge compliance as required by Section 15.205

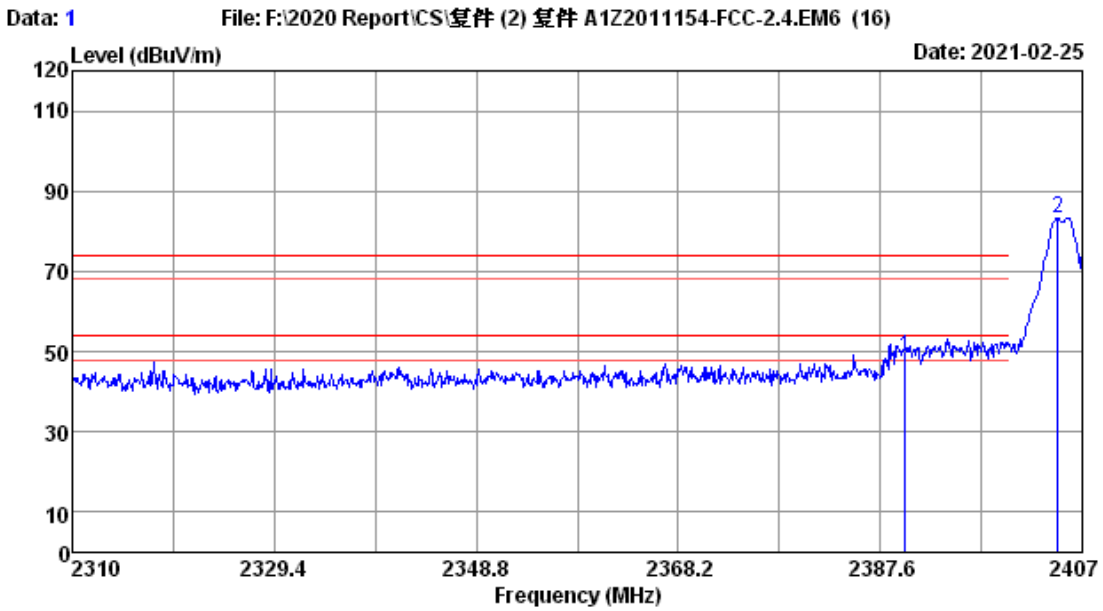
   For emissions above two bandwidths away from the band-edge use below produce:

   1. The EUT is placed on a turntable, which is 0.8m above the ground plane and worked at highest radiated power.
   2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
   3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
   4. Set the spectrum analyzer in the following setting in order to capture the lower and upperband-edges of the emission:
      (a) PEAK: RBW=1MHz; VBW=3MHz, PK detector, Sweep=AUTO
      (b) Average: RBW=1MHz; VBW=10Hz, Sweep=AUTO

6.4. Test Results

Pass (The testing data was attached in the next pages.)

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

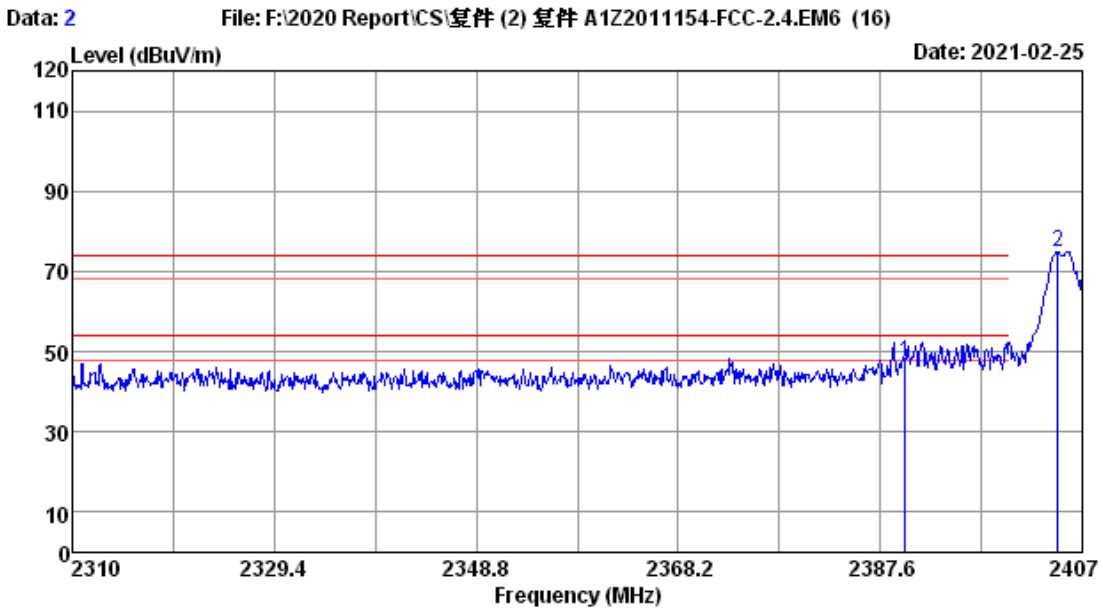


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2405MHz Tx Mode

Data no. : 1
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.03	28.01	0.92	53.28	33.48	48.73	74.00	25.27	Peak
2	2404.67	28.04	0.92	87.75	33.48	83.23	------	------	Peak

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

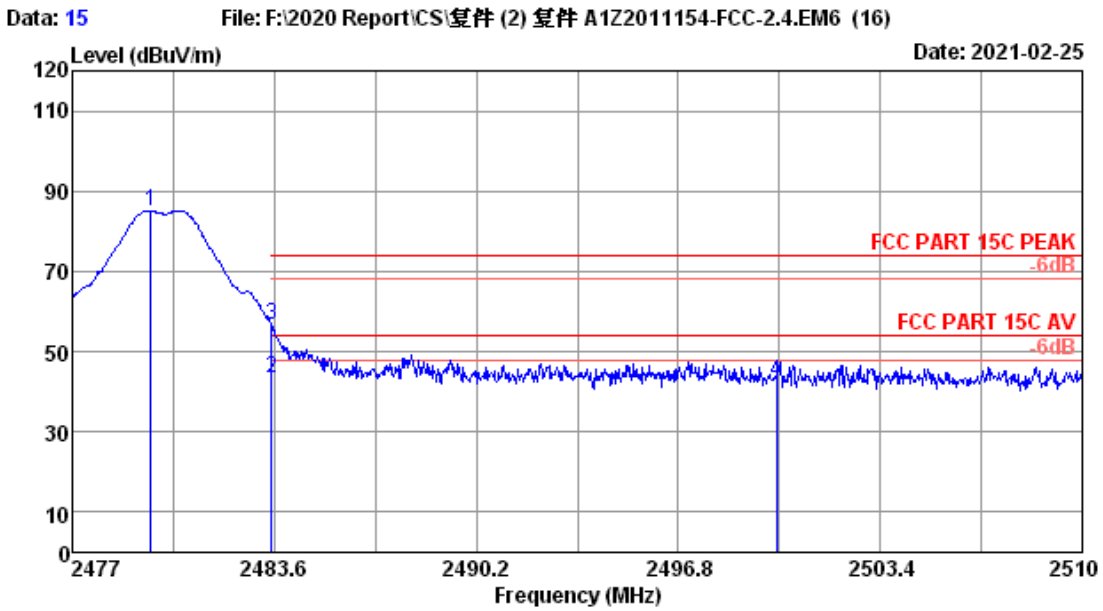


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2405MHz Tx Mode

Data no. : 2
Ant. pol. : VERTICAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.03	28.01	0.92	51.78	33.48	47.23	74.00	26.77	Peak
2	2404.67	28.04	0.92	79.37	33.48	74.85	------	------	Peak

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

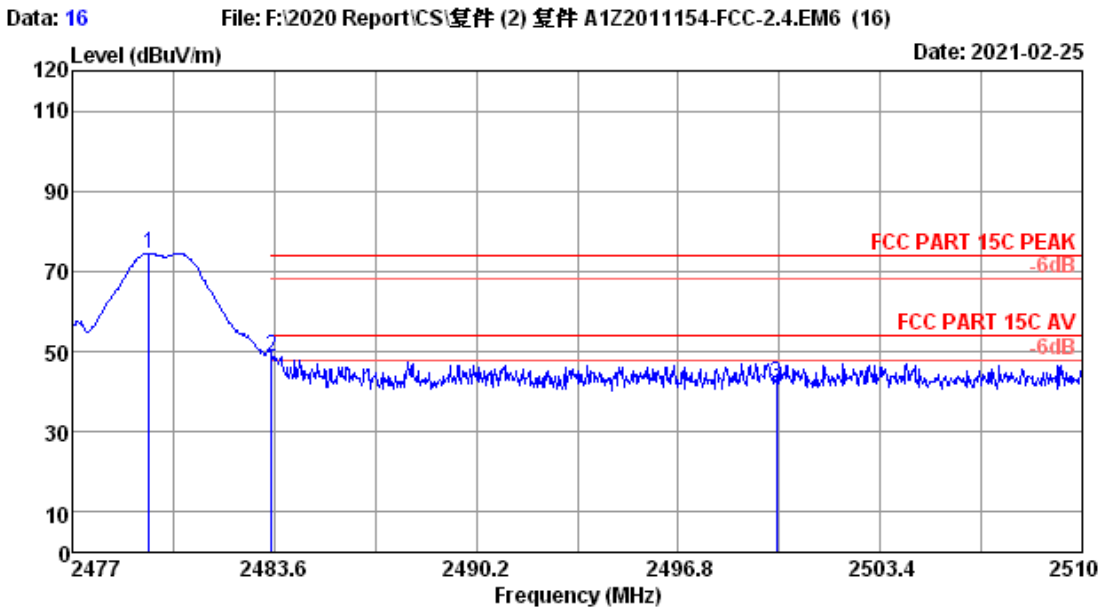


Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2480MHz Tx Mode

Data no. : 15
Ant. pol. : HORIZONTAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.57	28.17	0.94	89.53	33.46	85.18	------	------	Peak
2	2483.50	28.17	0.94	47.91	33.46	43.56	54.00	10.44	Average
3	2483.50	28.17	0.94	61.14	33.46	56.79	74.00	17.21	Peak
4	2500.00	28.20	0.95	46.82	33.45	42.52	74.00	31.48	Peak

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



Site no. : 3m Chamber
Dis. / Ant. : 3m 2020 MCTD1209-3006
Limit : FCC PART 15C PEAK
Env. / Ins. : 23.9*C/56%
Power rating : DC 3.6V
Test Mode : 2480MHz Tx Mode

Data no. : 16
Ant. pol. : VERTICAL
Engineer : Allen

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.51	28.17	0.94	78.90	33.46	74.55	------	------	Peak
2	2483.50	28.17	0.94	53.24	33.46	48.89	74.00	25.11	Peak
3	2500.00	28.20	0.95	46.58	33.45	42.28	74.00	31.72	Peak

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

7. MPE ESTIMATION

7.1.Limit for General Population/ Uncontrolled Exposures

Frequency	**Power density (mW/cm2)**	**Averaging time(minutes)**
300MHz----1.5GHz	F/1500	30
1.5GHz---100GHz	1.0	30

Frequency	**Power density (mW/cm2)**	**Averaging time(minutes)**
2405	1	30
2440	1	30
2480	1	30

Note: F= Frequency in MHz

7.2.Estimation Result

EUT: RF Module		
M/N: iT-ZB-R		
Test date:2020-12-29	Pressure: 102.1±1.0kpa	Humidity: 51.1±3.0%
Tested by: Allen	Test site: RF site	Temperature:23.9±0.6 ℃

Test Mode	Frequency (MHz)	Peak output power (dBm)	Output power (mW)	Antenna Gain(dBi)	Antenna Gain(Linear)	MPE PSD(mW/cm^2)
TX	2405	6.745	4.73	2.14	1.64	0.0015
	2440	6.289	4.26	2.14	1.64	0.0014
	2480	5.791	3.79	2.14	1.64	0.0012

$$MPE=\frac{PG}{4\pi R^2} \quad (R=20\ cm)$$

8. ANTENNA REQUIREMENT

8.1. STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

8.2. ANTENNA CONNECTED CONSTRUCTION

The antennas used for this product are Dipole Antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.14dBi.

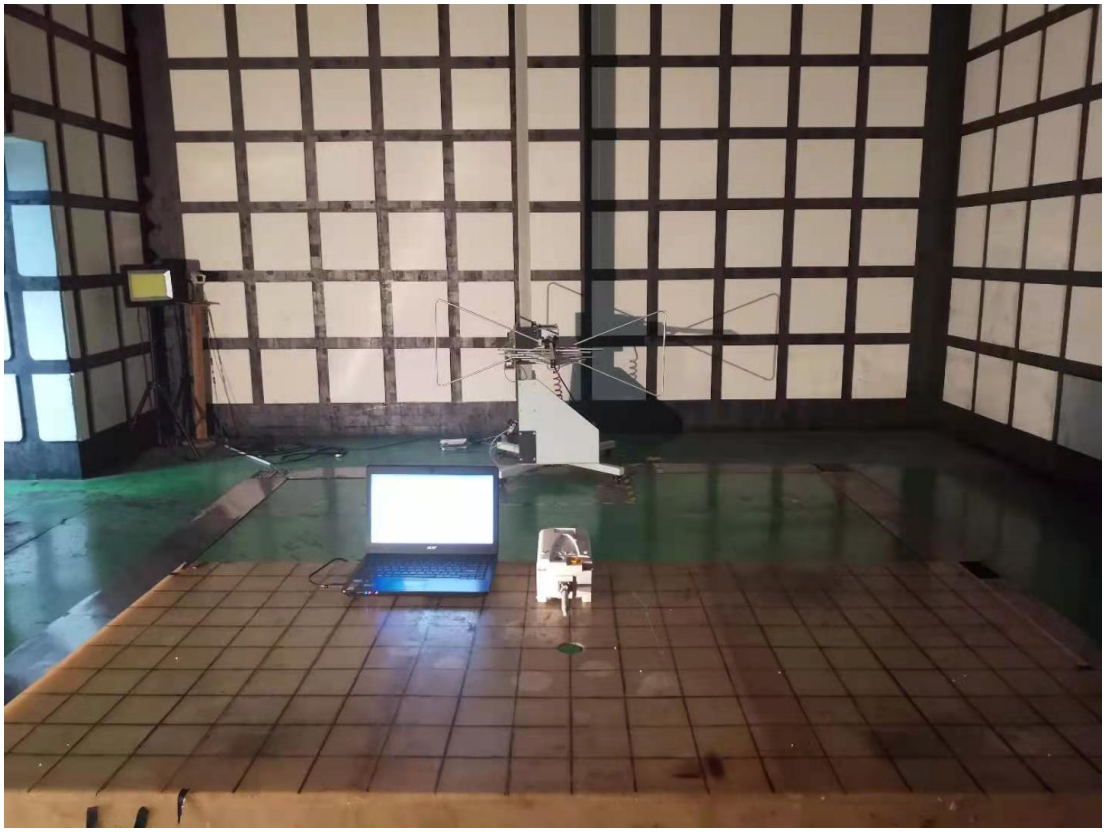
9. DEVIATION TO TEST SPECIFICATIONS

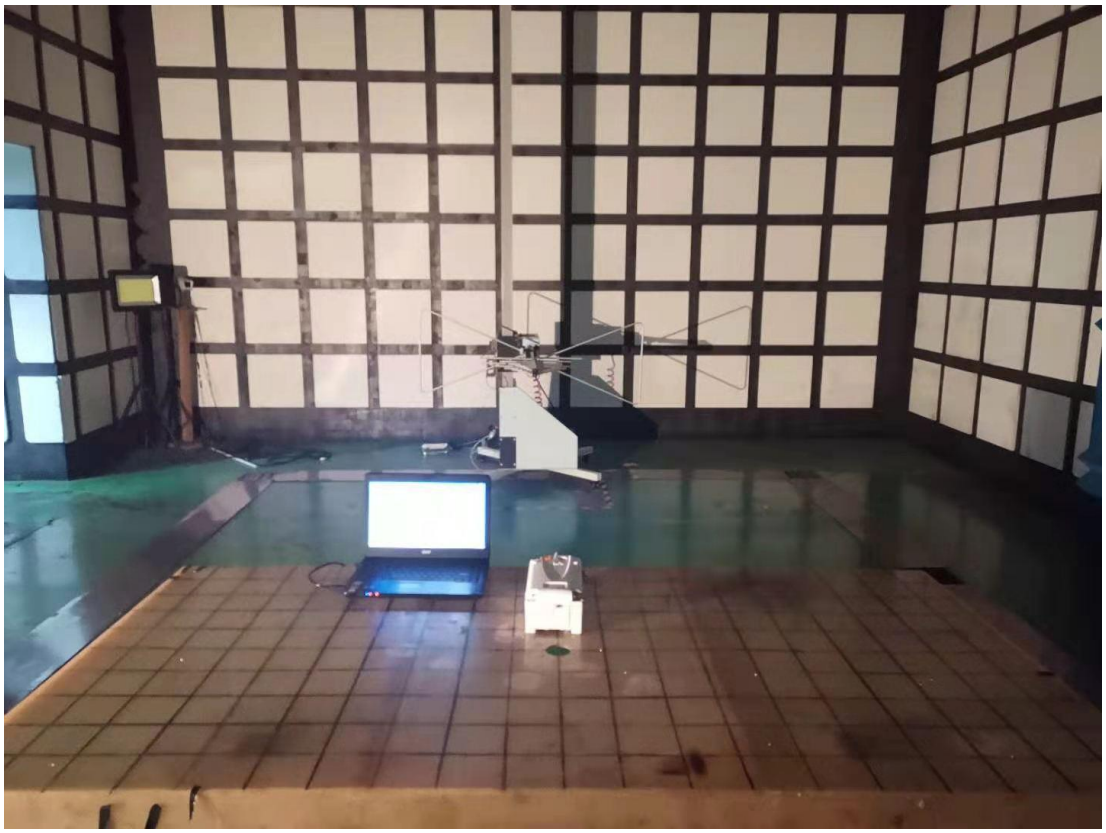
[NONE]

THE END

Appendix A. Photograph of Test

A.1 Photos of Radiated Emission Test





(Above 1000MHz)

Appendix B. Photo of the EUT

Figure 1
General Appearance of the EUT

Figure 2
General Appearance of the EUT

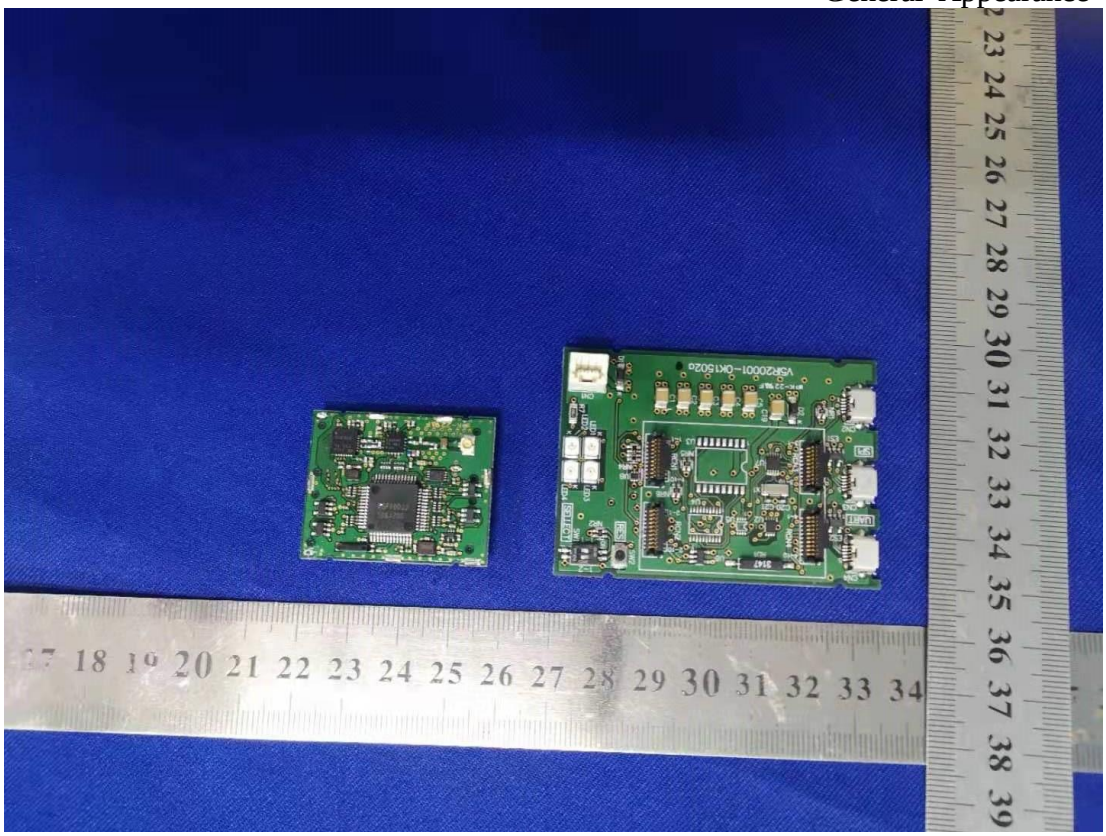


Figure 3
General Appearance of the EUT

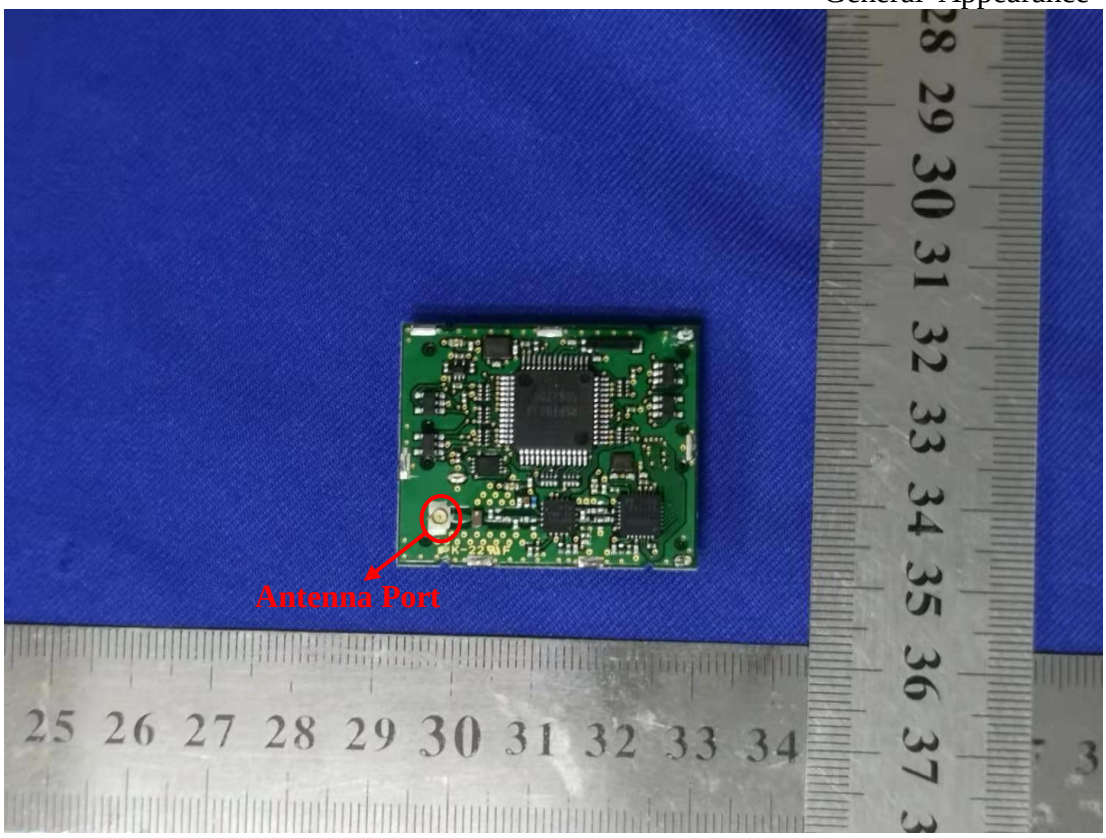


Figure 4
General Appearance of the EUT

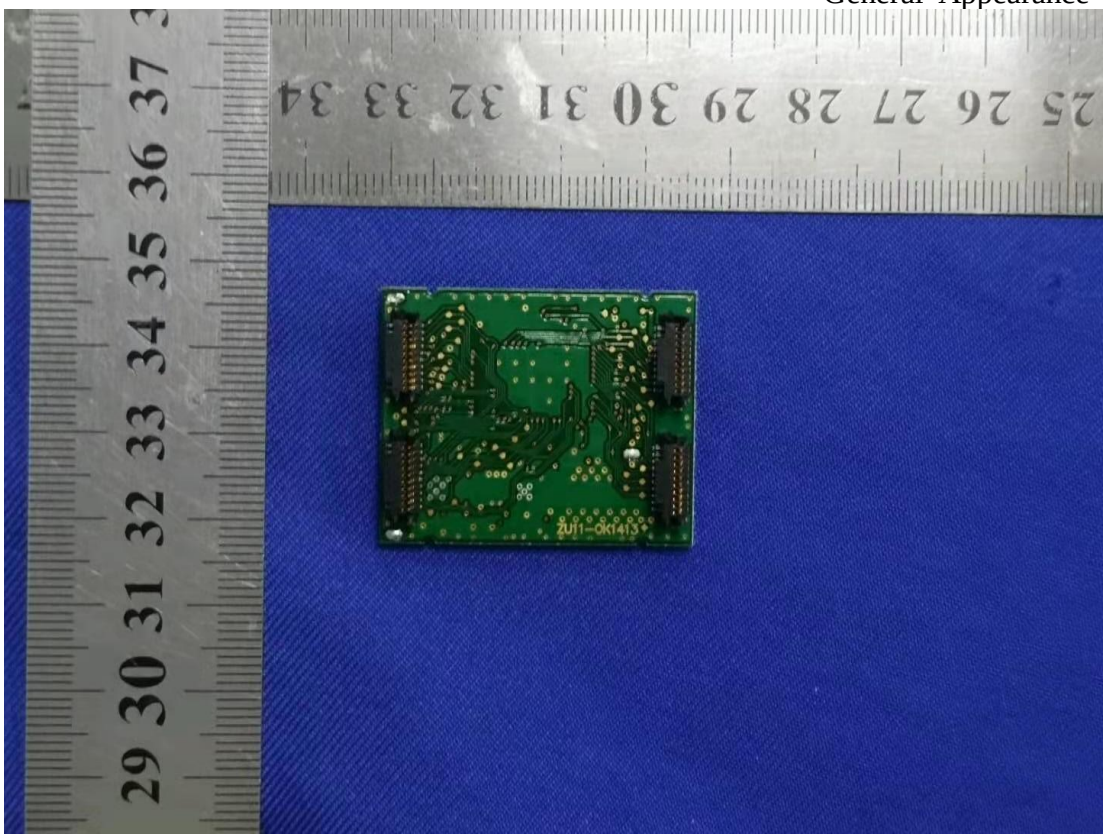


Figure 5
General Appearance of the EUT

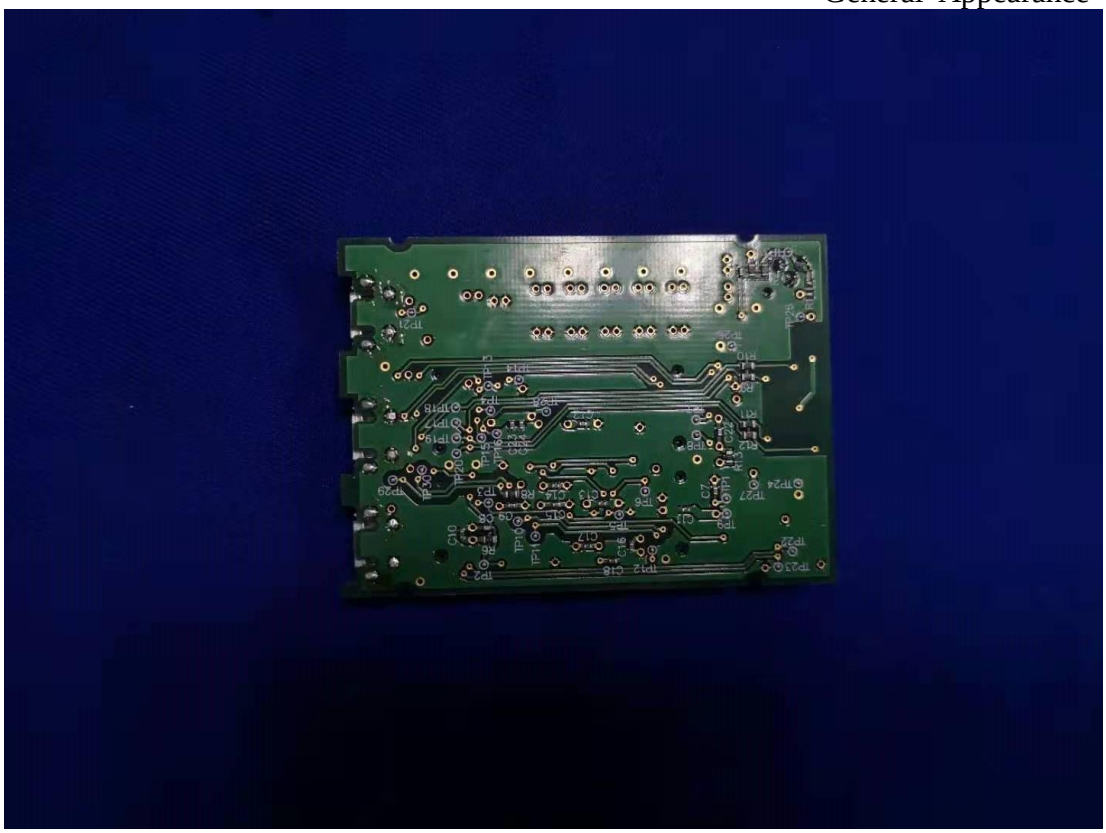
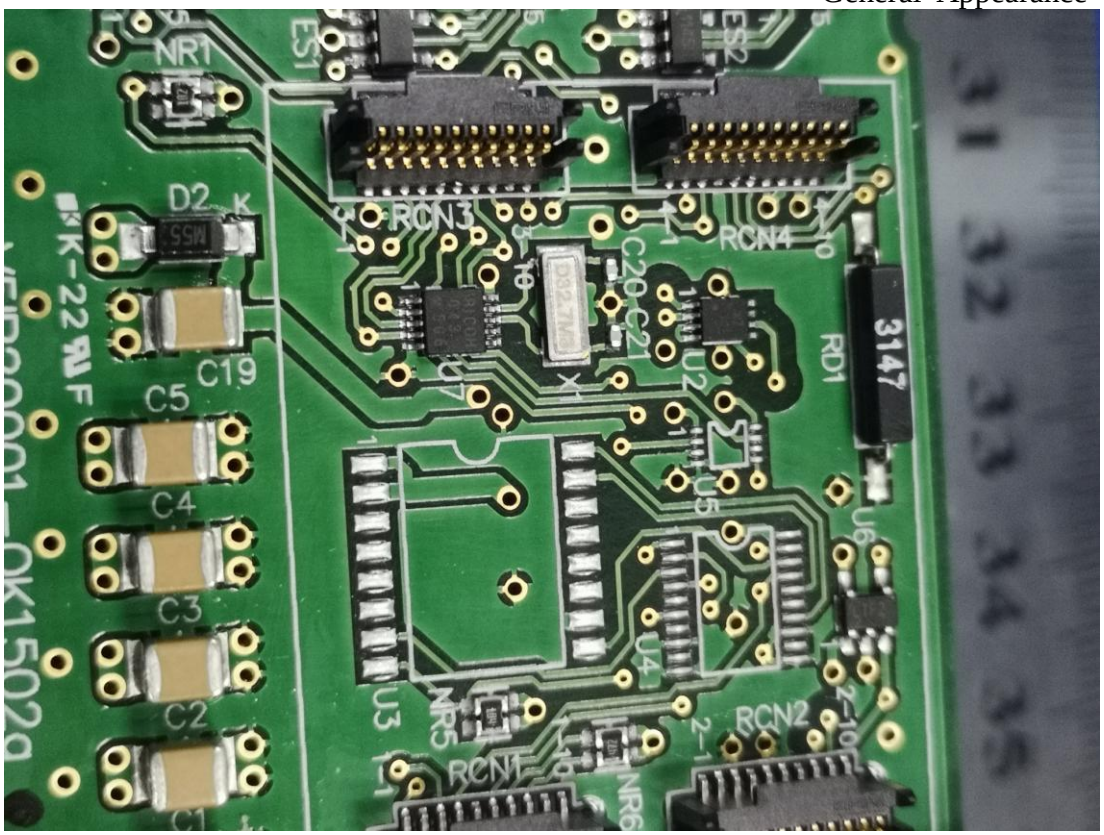



Figure 6
General Appearance of the EUT