

EMC Test Report

For

Beijing InHand Networks Technology Co., Ltd.

Test Standards:	<u>FCC 47 CFR Part 15 Subpart B</u>
Product Description:	<u>Industrial Ethernet Switch</u>
Tested Model:	<u>ISM7028U</u>
Adding Models:	<u>ISM2008U,ISM2308U,ISM2016U,ISM2316U,ISM3012U, ISM3312U,ISM3016U,ISM3316U,ISE3018D,ISM3018D, ISM5028U,ISM5026U,ISM6008U,ISM6308U,ISM6012U, ISM6312U,ISM6016U,ISM6316U,ISM6324U,ISM7012U, ISM7312U,ISM7016U,ISM7316U,ISM7024D,ISM8028U</u>
Classification:	<u>Supplier's Declaration of Conformity</u>
Report No.:	<u>EC2203011E02</u>
Tested Date:	<u>2022-03-07 to 2022-03-09</u>
Issued Date:	<u>2022-03-18</u>
Prepared By:	<u><i>Jerry Liu</i></u> Jerry Liu / Engineer
Approved By:	<u><i>Tiny Yang</i></u> Tiny Yang /RF Manager

Hunan Ecloud Testing Technology Co., Ltd.

Building A1, Changsha E Center, No. 18 Xiangtai Avenue, Liuyang Economic and
Technological Development Zone, Hunan, P.R.C

Tel.: +86-731-89634887 Fax.: +86-731-89634887

www.hn-ecloud.com

Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2022.03.18	Valid	Original Report

Table of Contents

1 TEST LABORATORY.....	5
1.1 Test facility.....	5
2 GENERAL DESCRIPTION.....	6
2.1 Applicant.....	6
2.2 Manufacturer.....	6
2.3 General Description Of EUT.....	6
2.4 Modification of EUT.....	6
2.5 Support equipment List.....	7
2.6 Applicable Standards.....	7
3 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	8
3.1 Descriptions of Test Mode.....	8
3.2 Connection of System Under Test.....	9
3.3 Test Setup.....	9
4 TEST RESULT.....	11
4.1 AC Conducted Emission Measurement.....	11
4.2 Radiated Emission Measurement.....	14
5 LIST OF MEASURING EQUIPMENT.....	19
6 UNCERTAINTY OF EVALUATION.....	20
APPENDIX A. SETUP PHOTOGRAPHS.....	21
APPENDIX B. PHOTOGRAPHS OF EUT.....	23

Summary of Test Result

FCC Rule	Description	Limit	Result
15.107	AC Conducted Emission	< 15.107 limits	Pass
15.109	Radiated Emission	< 15.109 limits	Pass

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number: L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1244 , Test Firm Registration Number: 793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED#:24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Code : 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

2 General Description

2.1 Applicant

Beijing InHand Networks Technology Co., Ltd.

Room 501, floor 5, building 3, yard 18, ziyue road, chaoyang district, Beijing

2.2 Manufacturer

Beijing InHand Networks Technology Co., Ltd.

Room 501, floor 5, building 3, yard 18, ziyue road, chaoyang district, Beijing

2.3 General Description Of EUT

Product	Industrial Ethernet Switch
Model NO.	ISM7028U
Additional NO.	ISM2008U,ISM2308U,ISM2016U,ISM2316U,ISM3012U,ISM3312U,ISM3016U,ISM3316U,ISE3018D,ISM3018D,ISM5028U,ISM5026U,ISM6008U,ISM6308U,ISM6012U,ISM6312U,ISM6016U,ISM6316U,ISM6324U,ISM7012U,ISM7312U,ISM7016U,ISM7316U,ISM7024D,ISM8028U
Difference Description	The twenty-six models are the same in these: Hardware design. The final number of each product model represents the number of network ports in the product. ISM7028U has 28 ports, the largest number of ports among all series products. The product models with same final number are original product applied in different markets and industries.
TEST VOLTAGE	AC120V/60Hz
Highest Frequency:	156.25MHz
Equipment Category	Class A

NOTE:

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

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Support equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Serial Number
1.	Notebook Computer	Lenovo	ThinkPad E580	SDOC	PF-12XLH6

2.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC 47 CFR Part 15 Subpart B

3 Test Configuration of Equipment Under Test

3.1 Descriptions of Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz).

Radiated:

(a) For unintentional radiators:

Including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

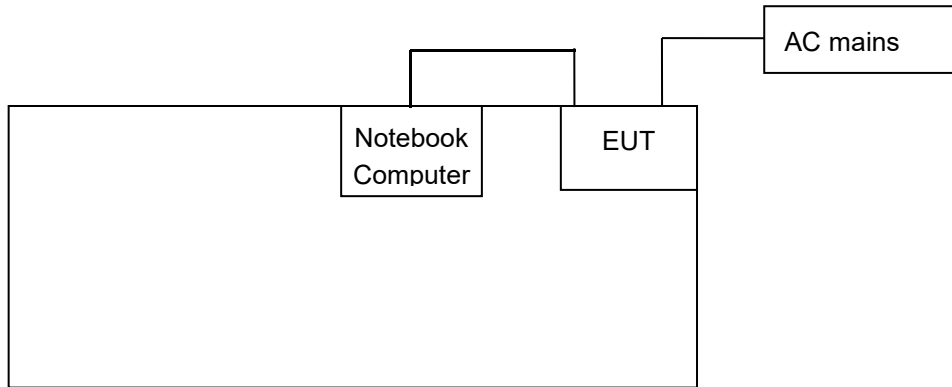
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Details of Test line Items
Radiated Emissions
Mode 1 : Working<Fig.1>

mode of all test items listed in section 2.1

Test items	mode
Radiated Emission	Mode 1
AC Conducted Emission	Mode 1

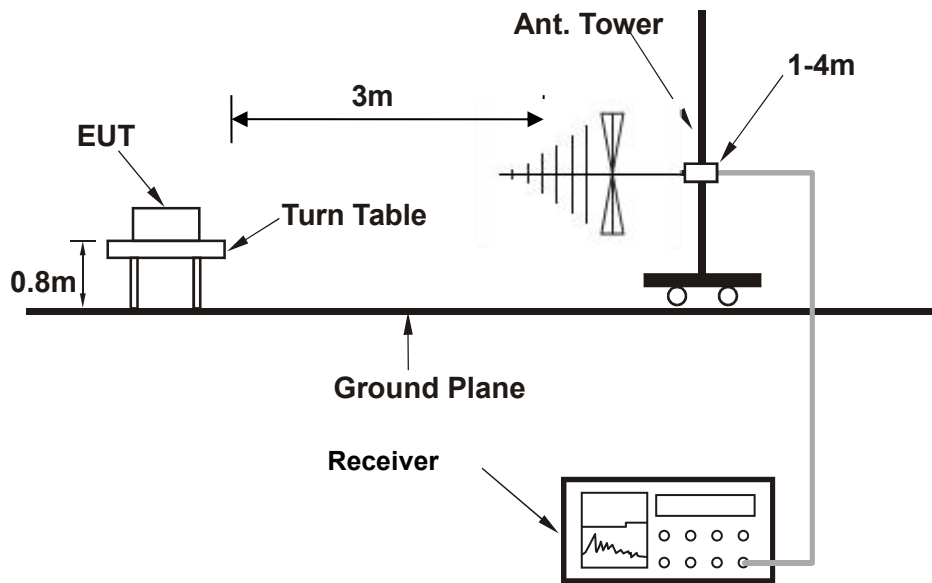
3.2 Connection of System Under Test



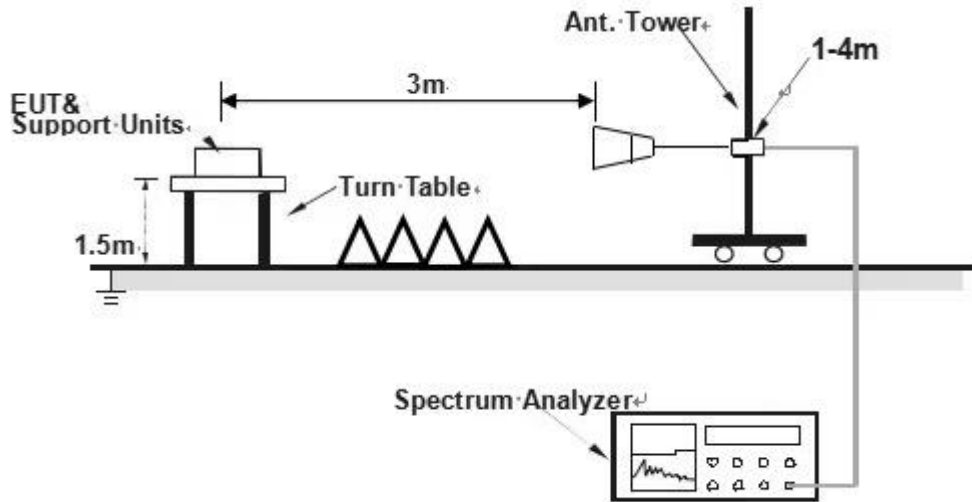
<Fig.1>

3.3 Test Setup

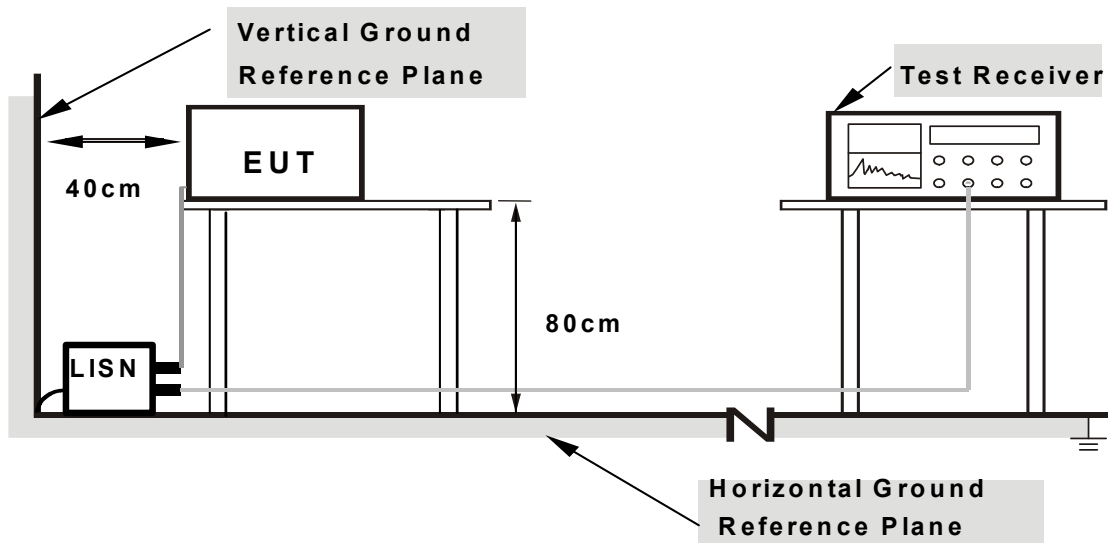
Setup diagram for Radiation(Below 1G) Test



Setup diagram for Radiation(Above 1G) Test



Setup diagram for AC Conducted Emission Test



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

4 Test Result

4.1 AC Conducted Emission Measurement

4.1.1 Limit of AC Conducted Emission

For a Class A digital device that 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 the limits in the following table, as measured using a 50 μ H/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

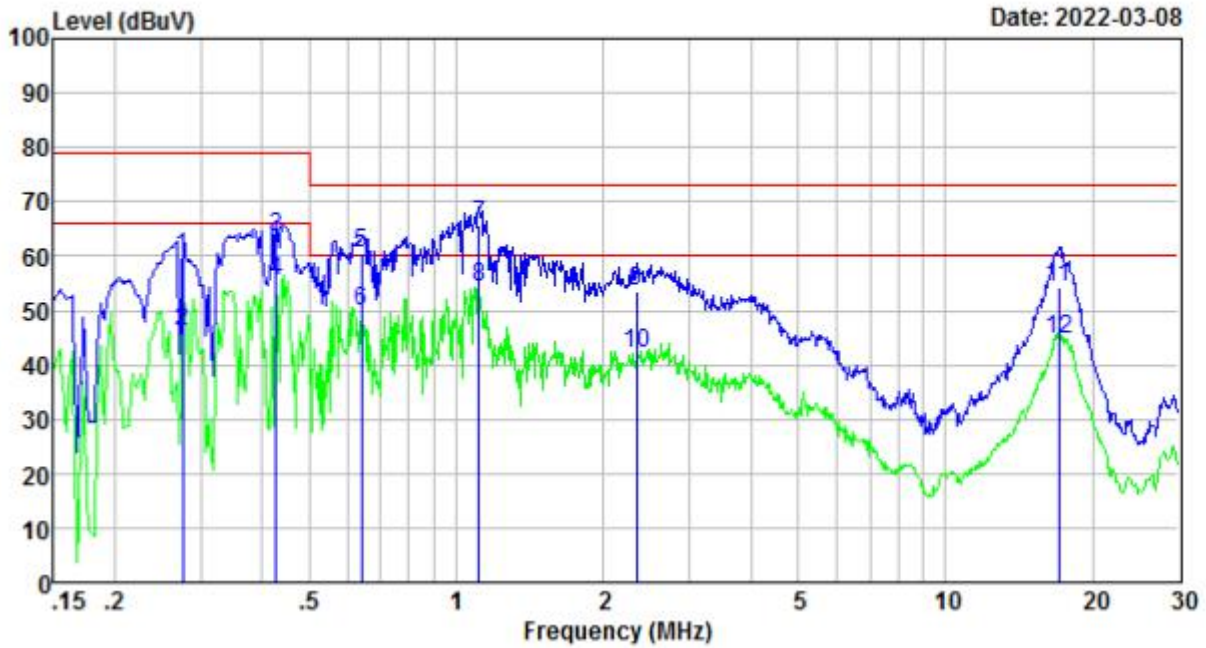
Frequency Range	Quasi Peak(dB μ V)	Average(dB μ V)
0.15-0.5	79	66
0.5-30	73	60

4.1.2 Test Procedures

1. During the conducted emissions test, the EUT was connected to the main outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.
2. Set the test-receiver system to Quasi-Peak and Average Detect Function and specified bandwidth (IF Bandwidth =9kHz) with Maximum Hold Mode. The frequency range from 150 kHz to 30 MHz was searched.

4.1.3 Test Result of AC Conducted Emission

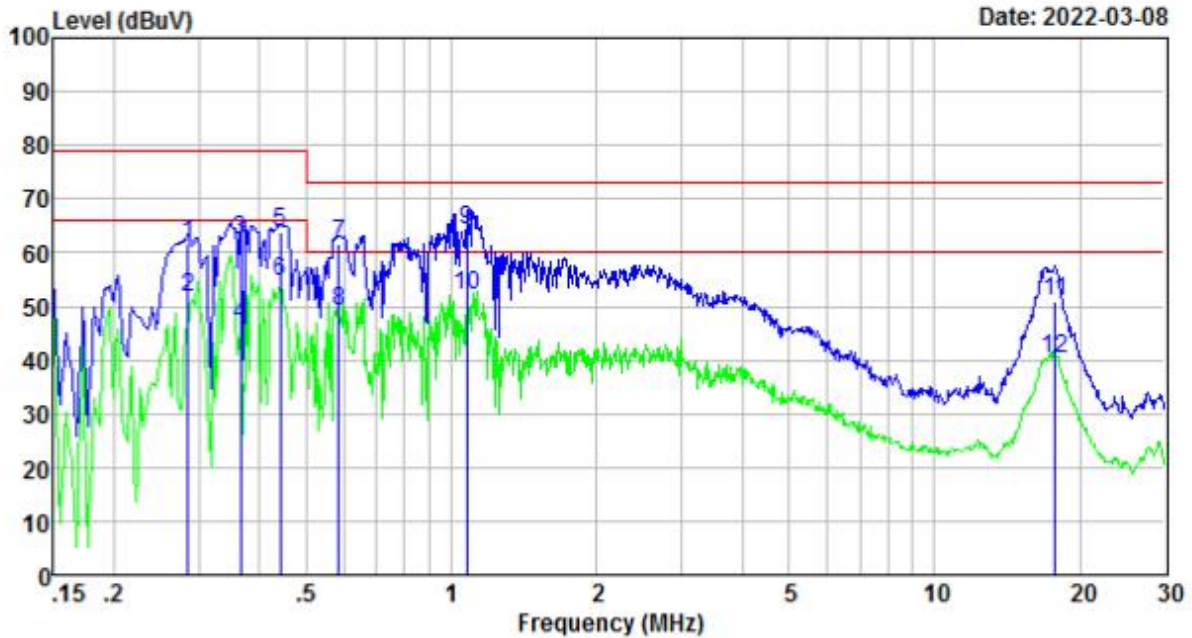
Test Mode :	Mode 1	Temperature :	19℃
Test Engineer :	Jerry Liu	Relative Humidity :	53%
Test Voltage :	AC120V/060Hz	Phase :	LINE
Function Type :	RJ45 Ping	Model :	ISM7028U



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.276	50.20	9.57	0.01	59.78	79.00	-19.22	QP
0.276	36.70	9.57	0.01	46.28	66.00	-19.72	Average
0.428	53.80	9.57	0.01	63.38	79.00	-15.62	QP
0.428	45.60	9.57	0.01	55.18	66.00	-10.82	Average
0.641	50.80	9.58	0.02	60.40	73.00	-12.60	QP
0.641	40.10	9.58	0.02	49.70	60.00	-10.30	Average
1.111	56.11	9.58	0.02	65.71	73.00	-7.29	QP
1.111	44.71	9.58	0.02	54.31	60.00	-5.69	Average
2.334	43.90	9.60	0.03	53.53	73.00	-19.47	QP
2.334	32.40	9.60	0.03	42.03	60.00	-17.97	Average
17.018	44.10	10.09	0.11	54.30	73.00	-18.70	QP
17.018	34.30	10.09	0.11	44.50	60.00	-15.50	Average

Result Level= Reading Level + LISN Factor + Cable Loss

Test Mode :	Mode 1	Temperature :	19°C
Test Engineer :	Jerry Liu	Relative Humidity :	53%
Test Voltage :	AC120V/60Hz	Phase :	Neutral
Function Type :	RJ45 Ping	Model :	ISM7028U



Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	Result level dBuV	Limit level dBuV	Over limit dB	Remark
0.285	51.90	9.56	0.01	61.47	79.00	-17.53	QP
0.285	42.10	9.56	0.01	51.67	66.00	-14.33	Average
0.365	52.90	9.57	0.01	62.48	79.00	-16.52	QP
0.365	36.90	9.57	0.01	46.48	66.00	-19.52	Average
0.442	54.40	9.57	0.01	63.98	79.00	-15.02	QP
0.442	45.10	9.57	0.01	54.68	66.00	-11.32	Average
0.585	52.10	9.58	0.01	61.69	73.00	-11.31	QP
0.585	39.60	9.58	0.01	49.19	60.00	-10.81	Average
1.077	54.50	9.59	0.02	64.11	73.00	-8.89	QP
1.077	42.40	9.59	0.02	52.01	60.00	-7.99	Average
17.755	40.50	10.21	0.11	50.82	73.00	-22.18	QP
17.755	30.00	10.21	0.11	40.32	60.00	-19.68	Average

Result Level= Reading Level + LISN Factor + Cable Loss

4.2 Radiated Emission Measurement

4.2.1 Limit of Radiated Emission

The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency range (MHz)	Distance (Meters)	Field Strength (microvolts/meter)
30 ~ 88	10	90
88~216	10	150
216-960	10	210
Above 960	10	300

Note: (1) The smaller limit shall apply at the combination point between two frequency bands.

(2) Distance refers to the distance in meters between the measuring instrument antenna and periphery of the EUT.

(3) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function, unless otherwise specified.

(4) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

4.2.2 Test Procedures

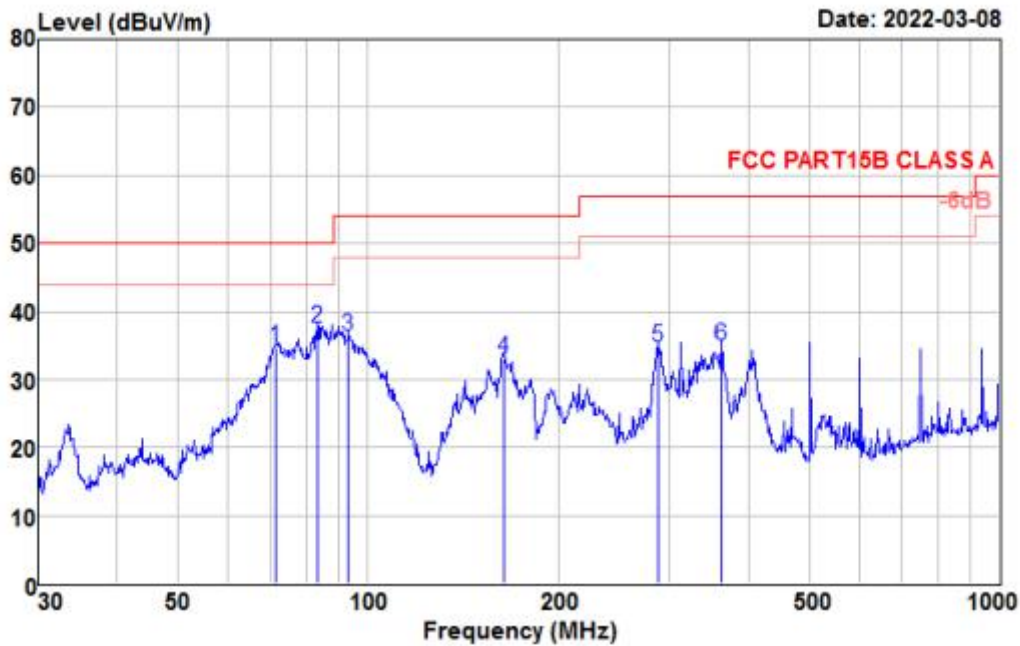
1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual.
2. Support equipment, if needed, was placed as per FCC 15B. All I/O cables were positioned to simulate typical actual usage as per FCC 15B.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.

4.2.3 Test Result of Radiated Emission

Test Mode :	Mode1	Temperature :	22°C
Test Engineer :	Jerry Liu	Relative Humidity :	51%
Test Distance :	3m	Polarization :	Horizontal
Test Voltage :	AC120V/60Hz	Model :	ISM7028U

■ Emission level (dB μ V/m) = 20 log Emission level (μ V/m)

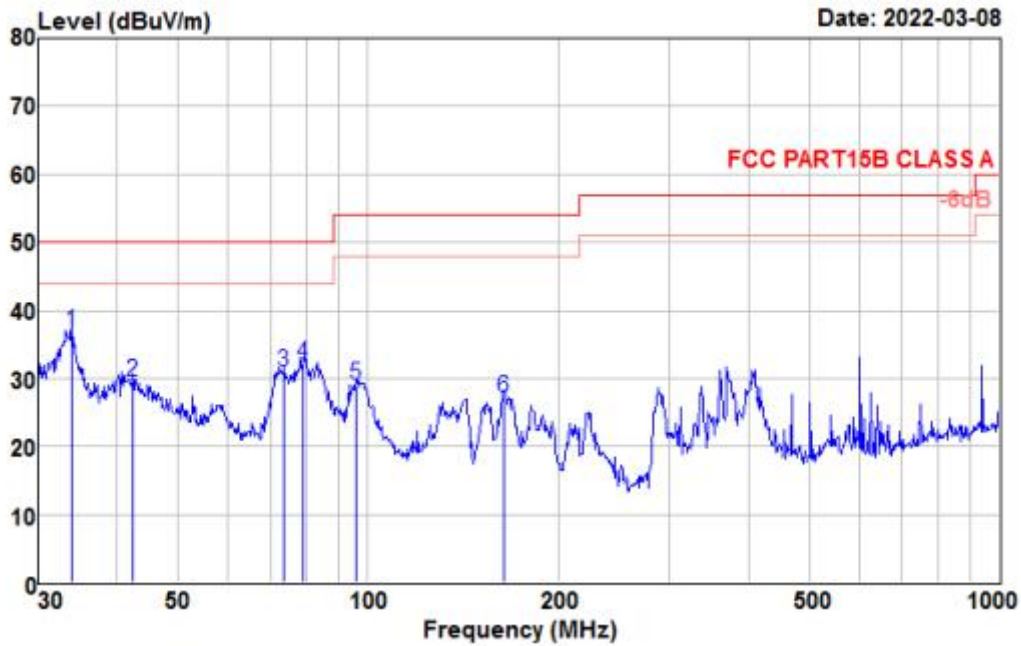
■ Corrected Reading: Antenna Factor + Cable Loss + Reading Level - Preamp Factor = Level



Freq MHz	Reading level dB μ V	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dB μ V/m	Limit level dB μ V/m	Over limit dB	Remark
71.581	53.72	12.06	1.58	32.65	34.71	50.00	-15.29	QP
83.230	59.59	8.87	1.74	32.66	37.54	50.00	-12.46	QP
93.113	58.41	8.69	1.82	32.66	36.26	54.00	-17.74	QP
164.330	49.40	13.85	2.48	32.67	33.06	54.00	-20.94	QP
289.002	50.95	13.10	3.33	32.64	34.74	57.00	-22.26	QP
362.985	49.40	14.43	3.73	32.70	34.86	57.00	-22.14	QP

Test Mode :	Mode1	Temperature :	22°C
Test Engineer :	Jerry Liu	Relative Humidity :	51%
Test Distance :	3m	Polarization :	Vertical
Test Voltage :	AC120V/60Hz	Model :	ISM7028U

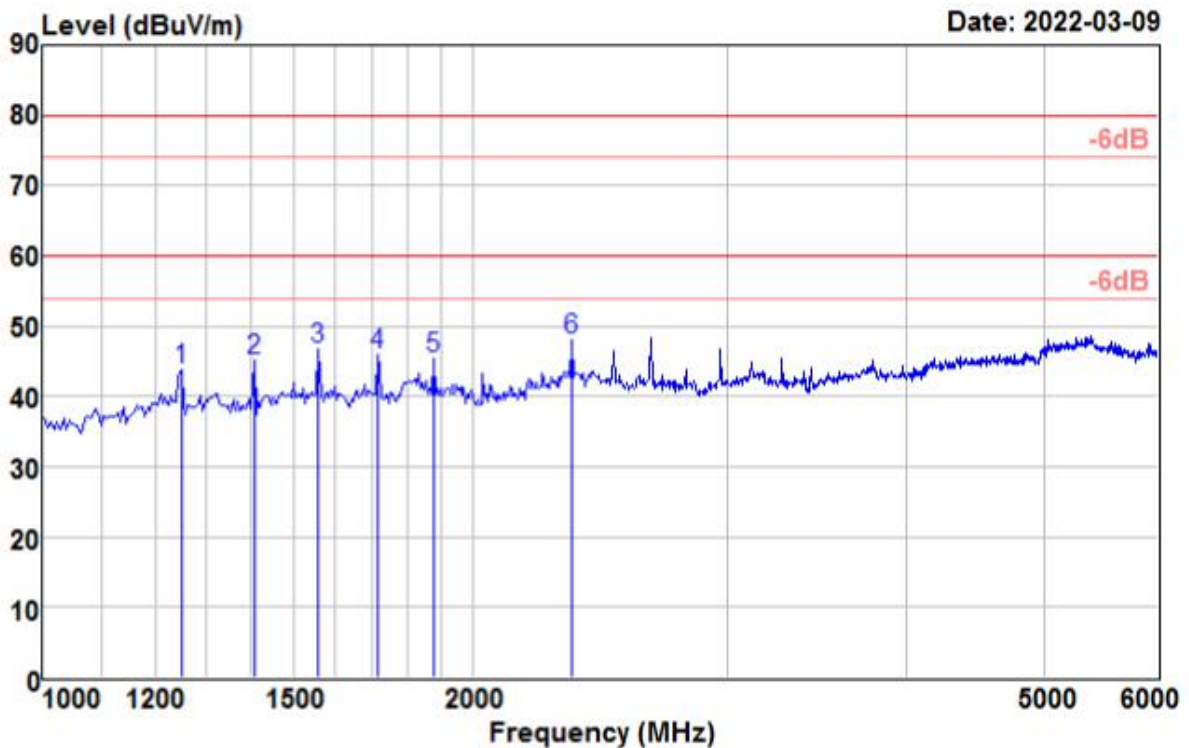
- Emission level (dB μ V/m) = 20 log Emission level (μ V/m)
- Corrected Reading: Antenna Factor + Cable Loss + Reading Level - Preamp Factor = Level



Freq MHz	Reading level dBUV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBUV/m	Limit level dBUV/m	Over limit dB	Remark
33.917	54.75	13.72	1.02	32.65	36.84	50.00	-13.16	QP
42.451	46.10	14.91	1.24	32.65	29.60	50.00	-20.40	QP
73.617	50.19	11.70	1.61	32.65	30.85	50.00	-19.15	QP
78.965	53.41	9.63	1.69	32.66	32.07	50.00	-17.93	QP
95.762	50.99	8.81	1.85	32.66	28.99	54.00	-25.01	QP
164.330	43.56	13.85	2.48	32.67	27.22	54.00	-26.78	QP

Test Mode :	Mode1	Temperature :	22°C
Test Engineer :	Jerry Liu	Relative Humidity :	55%
Test Distance :	3m	Polarization :	Horizontal
Test Voltage :	AC120V/60Hz	Model :	ISM7028U

- Emission level (dB μ V/m) = 20 log Emission level (μ V/m)
- Corrected Reading: Antenna Factor + Cable Loss + Reading Level - Preamp Factor = Level

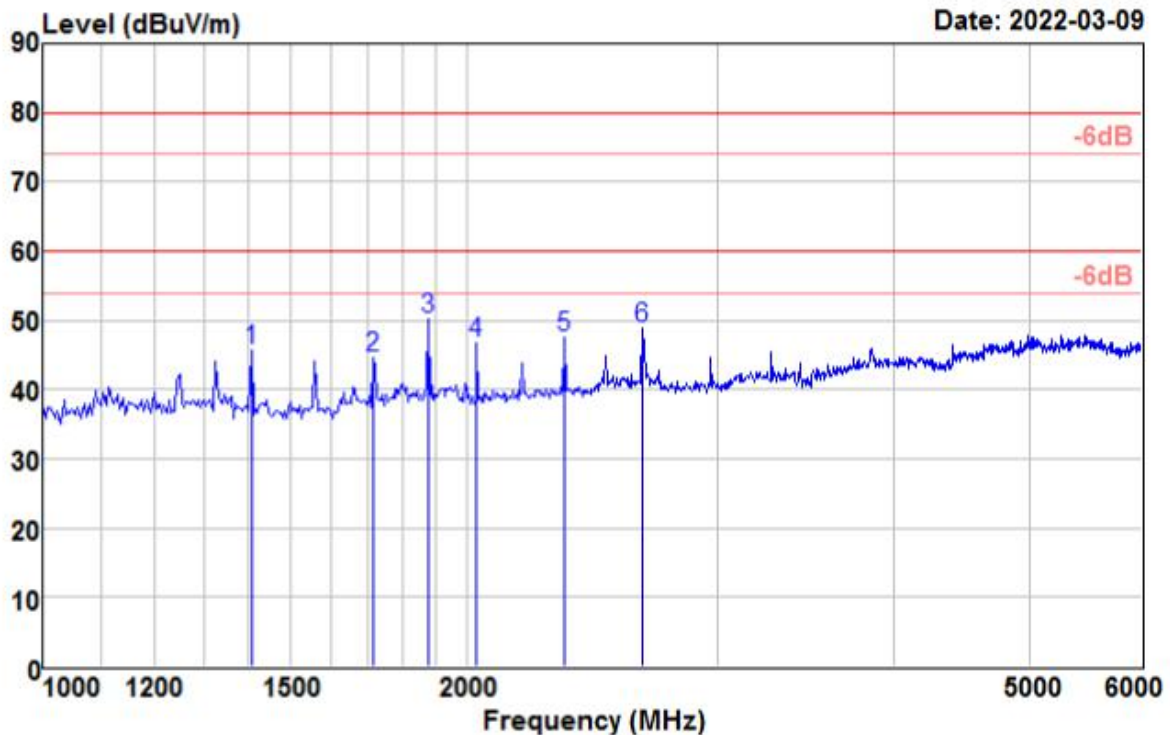


Freq MHz	Reading level dBUV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBUV/m	Limit level dBUV/m	Over limit dB	Remark
1250.000	76.90	24.40	2.93	60.53	43.70	80.00	-36.30	Peak
1405.000	77.80	24.71	3.03	60.42	45.12	80.00	-34.88	Peak
1560.000	78.55	25.12	3.25	60.31	46.61	80.00	-33.39	Peak
1715.000	77.21	25.67	3.30	60.20	45.98	80.00	-34.02	Peak
1875.000	75.57	26.25	3.59	60.09	45.32	80.00	-34.68	Peak
2345.000	76.29	27.46	4.12	59.69	48.18	80.00	-31.82	Peak

Test Mode :	Mode1	Temperature :	22°C
Test Engineer :	Jerry Liu	Relative Humidity :	5%
Test Distance :	3m	Polarization :	Vertical
Test Voltage :	AC120V/60Hz	Model :	ISM7028U

■ Emission level (dB μ V/m) = 20 log Emission level (μ V/m)

■ Corrected Reading: Antenna Factor + Cable Loss + Reading Level - Preamp Factor = Level



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV/m	Limit level dBuV/m	Over limit dB	Remark
1405.000	78.30	24.71	3.03	60.42	45.62	80.00	-34.38	Peak
1715.000	75.81	25.67	3.30	60.20	44.58	80.00	-35.42	Peak
1875.000	80.37	26.25	3.59	60.09	50.12	80.00	-29.88	Peak
2030.000	76.32	26.77	3.62	59.97	46.74	80.00	-33.26	Peak
2345.000	75.68	27.46	4.12	59.69	47.57	80.00	-32.43	Peak
2655.000	76.19	27.92	4.27	59.41	48.97	80.00	-31.03	Peak

5 List of Measuring Equipment

Test Equipment for Conducted Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
LISN	R&S	ENV216	102125	2021-12-29	2022-12-28
LISN	R&S	ENV432	101327	2021-12-29	2022-12-28
EMI Test Receiver	R&S	ESR3	102143	2021-12-30	2022-12-29
EMI Test Software	Audix	E3	N/A	N/A	N/A
Test Equipment for Radiated Emission					
Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
EMI Test Receiver	R&S	ESR-3	102144	2021-12-30	2022-12-29
Amplifier	Sonoma	310	363917	2021-12-29	2022-12-28
Broadband Antenna	Schwarzbeck	VULB 9168	9168-757	2020-09-27	2023-09-26
Spectrum Analyzer	R&S	FSV 30	103728	2021-12-30	2022-12-29
Amplifier	HuaYi	ITI-010180G50B	20042201	2021-12-30	2022-12-29
Horn Antenna	Schwarz beck	BBHA 9120 D	1677	2020-02-14	2023-02-13
EMI Test Software	Audix	E3	N/A	N/A	N/A

N/A: No Calibration Required

6 Uncertainty of Evaluation

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.42dB
Radiated emission	30MHz ~ 1GHz	5.28dB
Radiated emission	1GHz ~ 6GHz	4.89dB

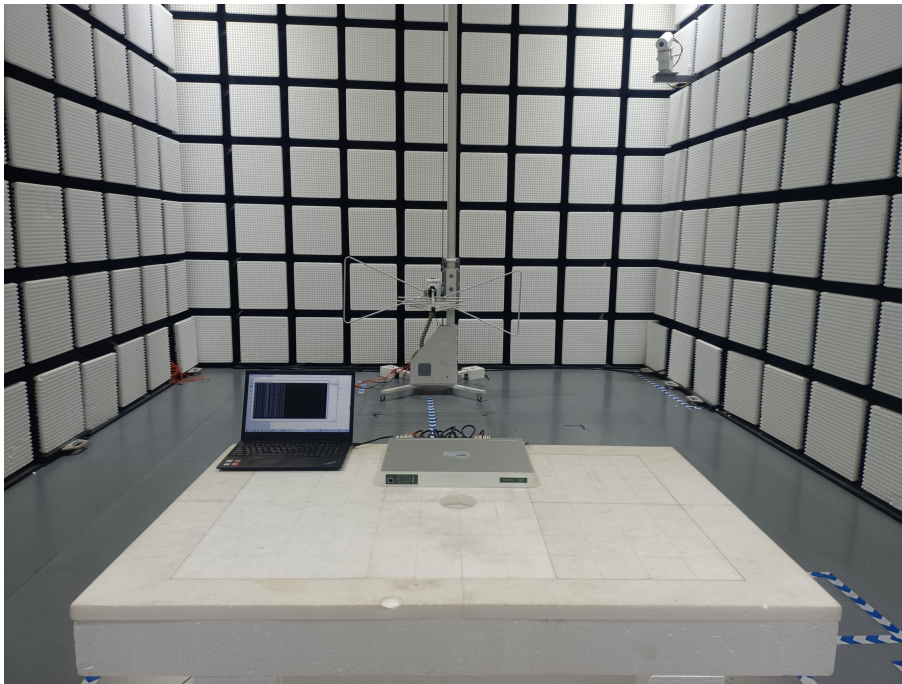
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Appendix A. Setup Photographs

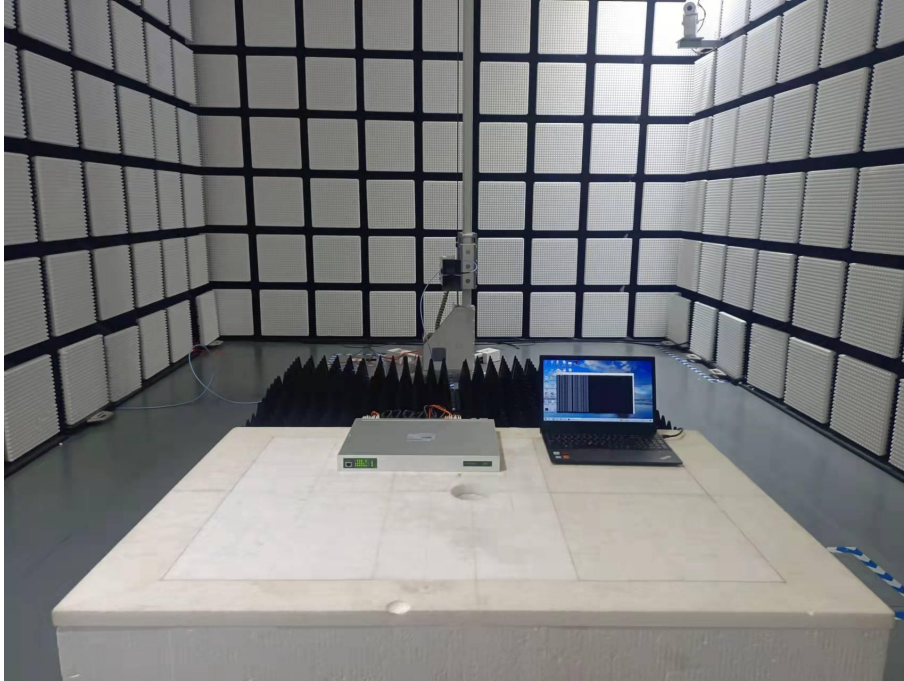
Radiated Emission Test Setup



Radiated Emission Test Setup(Below 1GHz)

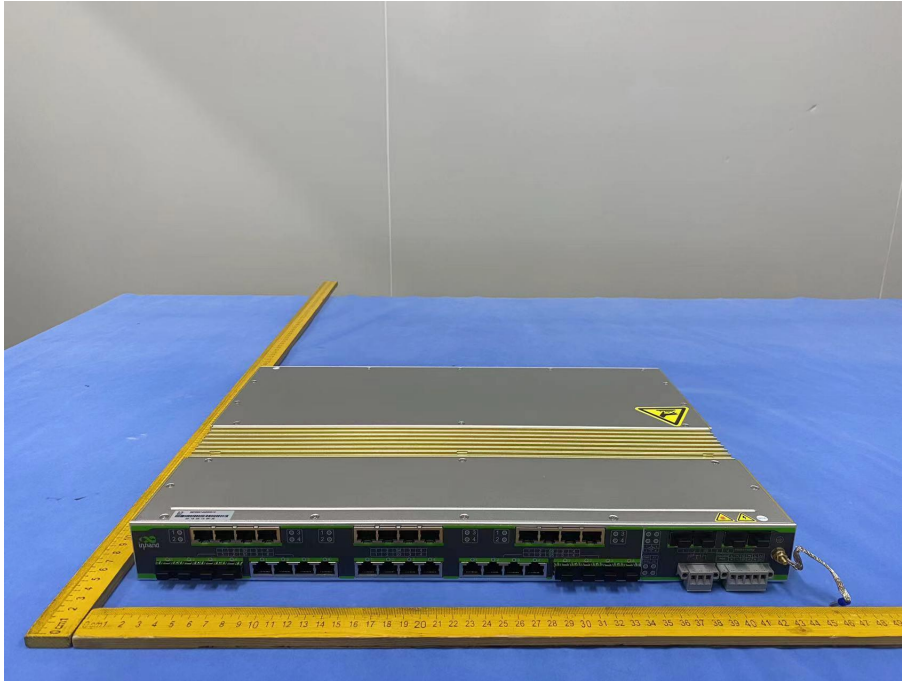


Radiated Emission Test Setup(Above 1GHz)

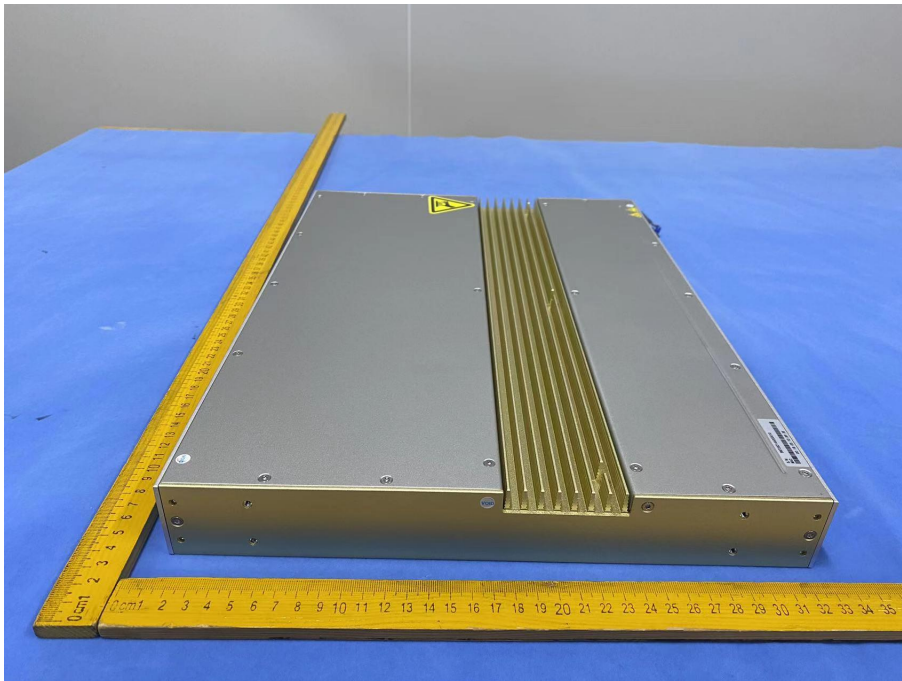


Appendix B. Photographs of EUT

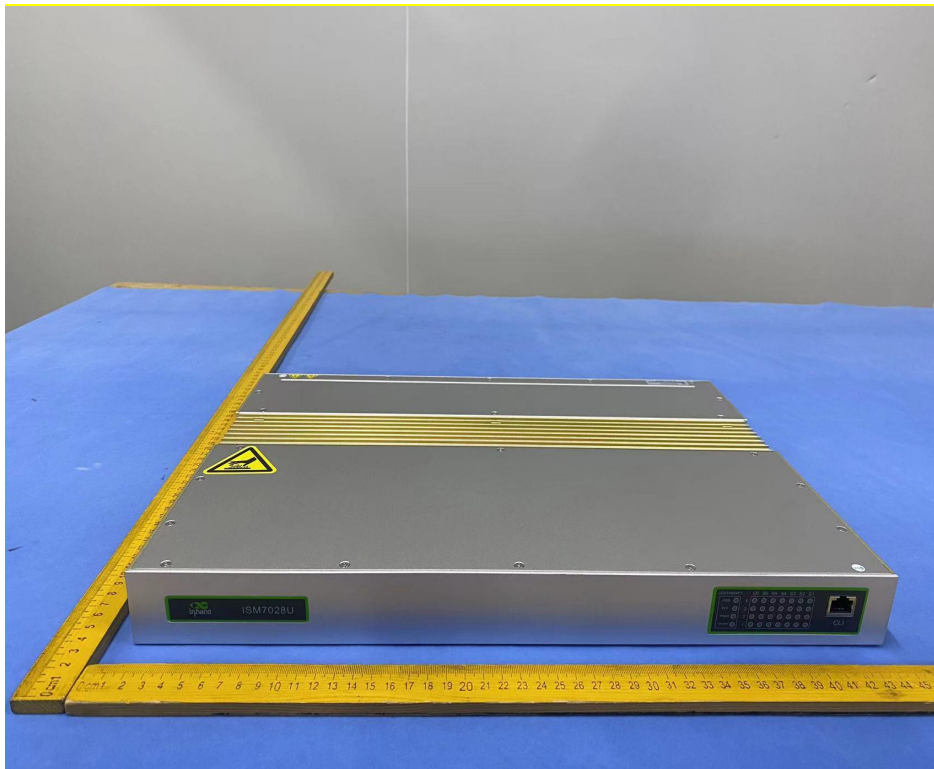
ISM7028U Side View



ISM7028U Side View



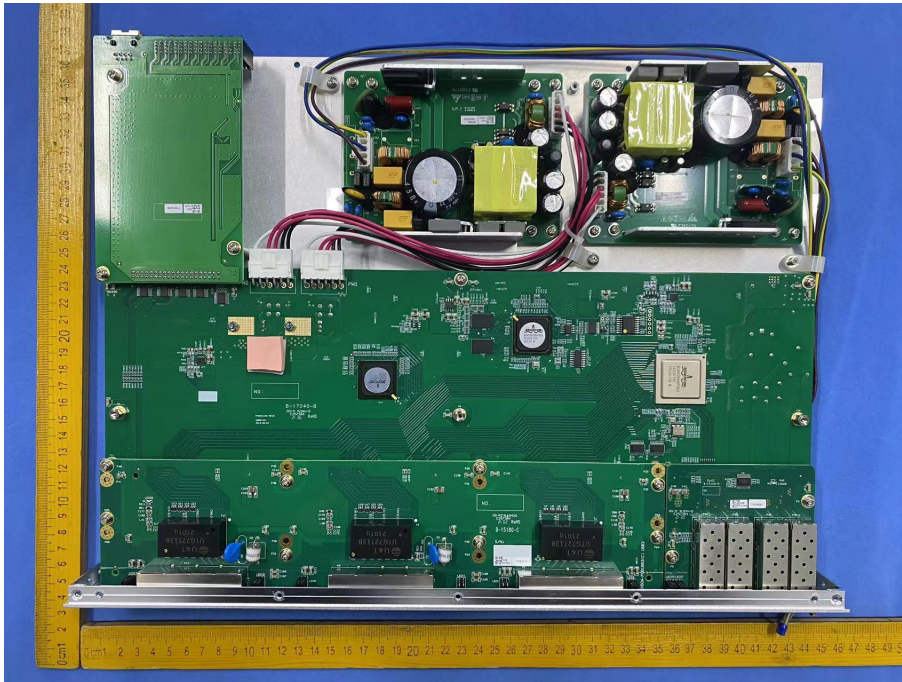
ISM7028U Side View



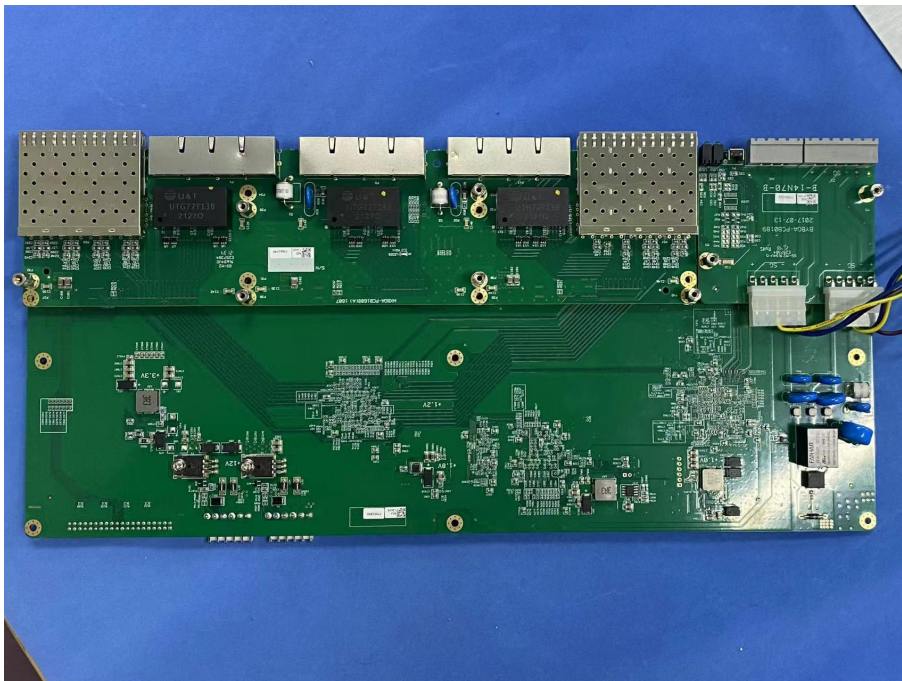
ISM7028U Side View



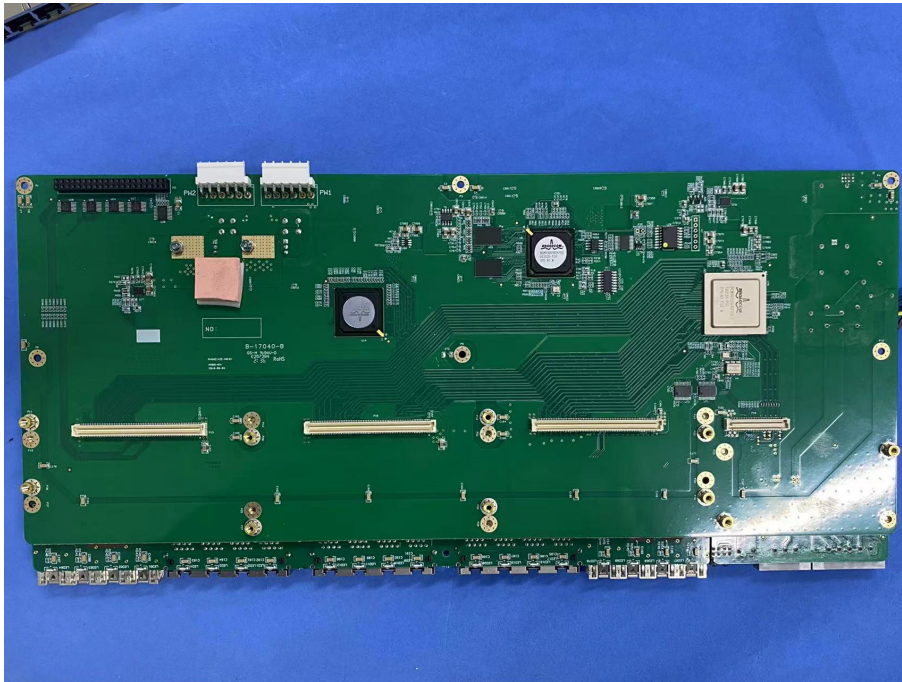
ISM7028U Inside View



ISM7028U Inside View



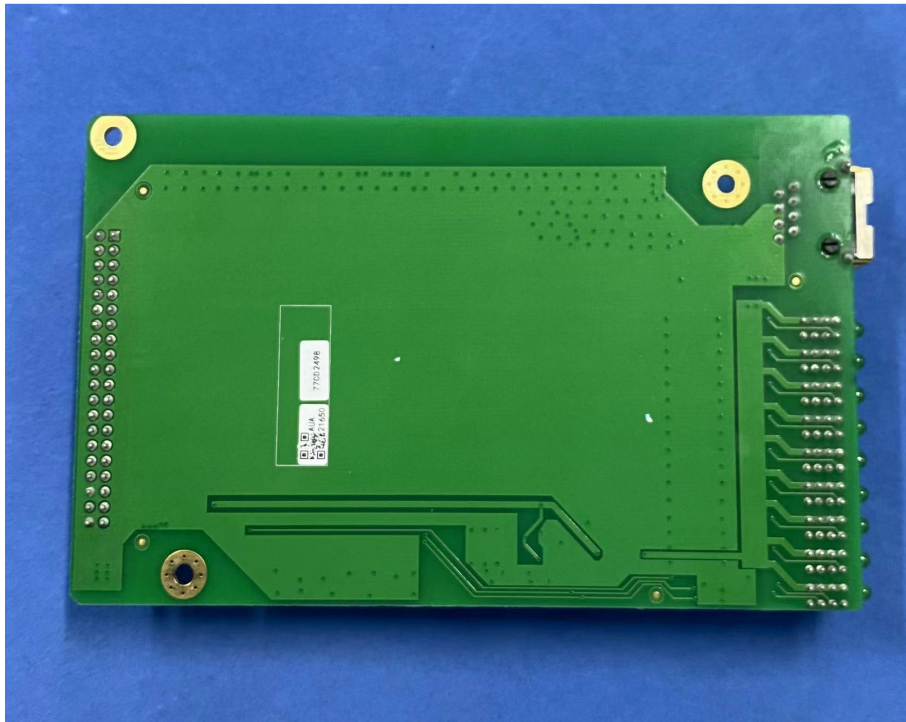
ISM7028U Inside View



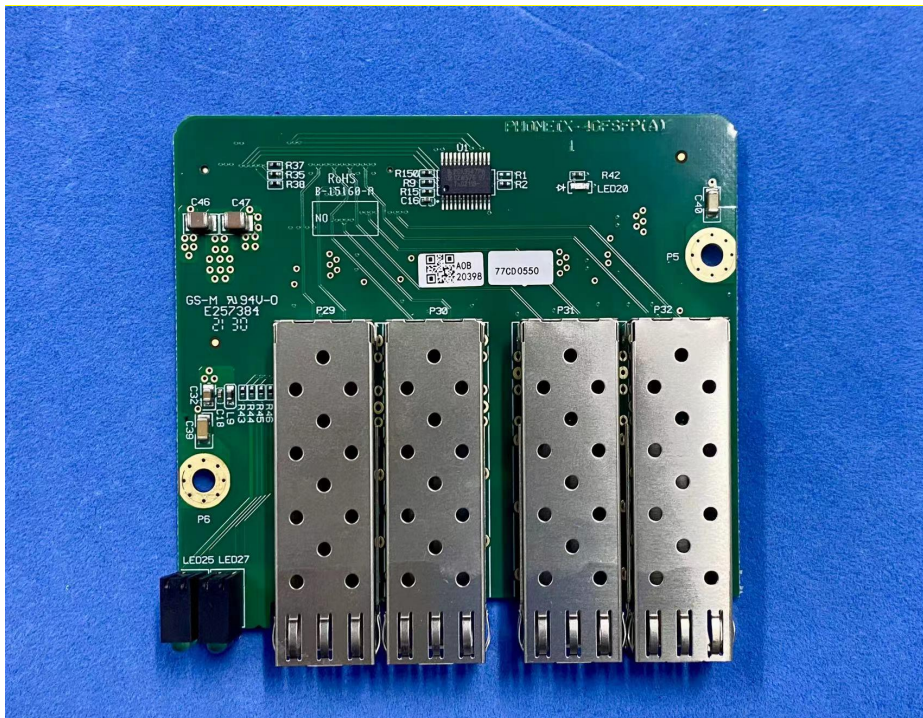
ISM7028U Inside View



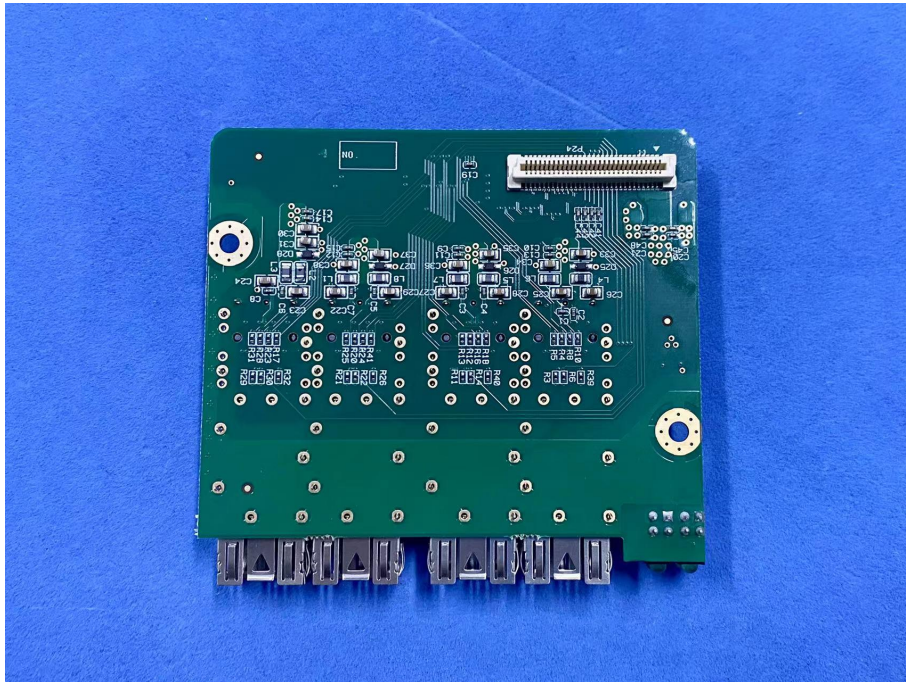
ISM7028U Inside View



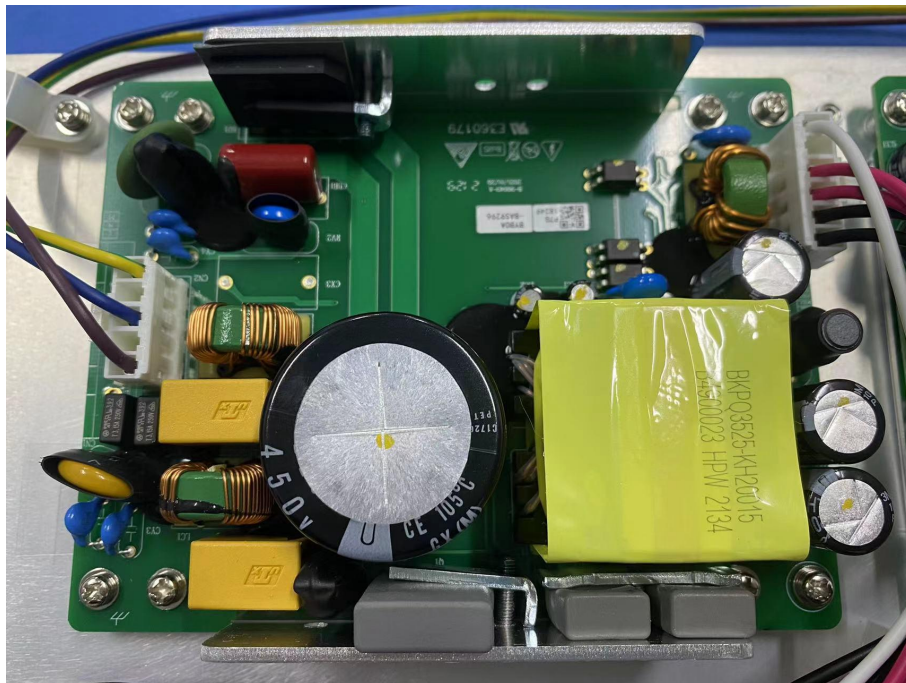
ISM7028U Inside View



ISM7028U Inside View



ISM7028U Inside View



-----End of the report-----