

EMC REPORT

Applicant: Jinan USR IOT Technology Limited

Address of Applicant: Floor 2, Wuzhou Scientific Research Building, No.1100
Shunfeng Street, Gaoxin District, Jinan, Shandong, China

Equipment Under Test (EUT)

Product Name: LoRa Gateway

Model No.: USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290

Applicable standards: Draft ETSI EN 301 489-1 V2.2.0 (2017-03)
Final draft ETSI EN 301 489-3 V2.1.1 (2017-03)
Draft ETSI EN 301 489-17 V3.2.0 (2017-03)

Date of sample receipt: 13 Aug., 2018

Date of Test: 13 Aug., to 12 Dec., 2018

Date of report issue: 17 Dec., 2018

Test Result: PASS*

*In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.



Bruce Zhang
Laboratory Manager



This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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2 Version

Version No.	Date	Description
00	17 Dec., 2018	Original

Tested by:

Zora Lee

Test Engineer

Date:

17 Dec., 2018

Reviewed by:

Wimer Zhang

Project Engineer

Date:

17 Dec., 2018

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4 Test Summary

Test Item	Test Requirement	Test Method	Application	Result
EMI Test Items				
Radiated Emission	ETSI EN301 489-1	EN 55032	Enclosure	PASS
Conducted Emission	ETSI EN301 489-1	EN 55032	AC port	PASS
Harmonic Current Emissions	ETSI EN301 489-1	EN 61000-3-2	AC port	Not Required
Voltage Fluctuations and Flicker	ETSI EN301 489-1	EN 61000-3-3	AC port	Not Required
EMS Test Items				
ESD (Electrostatic Discharge)	ETSI EN301 489-1	EN 61000-4-2	Enclosure	PASS
Radiated Immunity	ETSI EN301 489-1	EN 61000-4-3	Enclosure	PASS
EFT (Electrical Fast Transients)	ETSI EN301 489-1	EN 61000-4-4	AC port	N/A
Surge Immunity	ETSI EN301 489-1	EN 61000-4-5	AC port	N/A
Injected Currents	ETSI EN301 489-1	EN 61000-4-6	AC port	N/A
Voltage Dips and Interruptions	ETSI EN301 489-1	EN 61000-4-11	AC port	N/A
Remark: Pass: Meet the requirement N/A: Not Applicable.				

5 General Information

5.1 Client Information

Applicant:	Jinan USR IOT Technology Limited
Address:	Floor 2, Wuzhou Scientific Research Building, No.1100 Shunfeng Street, Gaoxin District, Jinan, Shandong, China
Manufacturer/Factory:	Jinan USR IOT Technology Limited
Address:	Floor 2, Wuzhou Scientific Research Building, No.1100 Shunfeng Street, Gaoxin District, Jinan, Shandong, China

5.2 General Description of E.U.T.

Product Name:	LoRa Gateway
Model No.:	USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290
Tx Frequency:	Wi-Fi: 2412MHz~2472MHz RFID: 865MHz-868MHz & 915.1MHz
Rx Frequency	Wi-Fi: 2412MHz~2472MHz RFID: 865MHz-868MHz & 915.1MHz
Hardware version:	V1.4
Software version:	V1.0.5
Modulation technology:	802.11b: DSSS, 802.11g/n: OFDM RFID: Lora
Antenna Type:	External Antenna
Antenna Gain:	Wi-Fi: 1.0 dBi RFID: 1.4 dBi
Power supply:	DC 5-36V(Nominal Match: 12V, 1A)
Remarks:	Model No.: USR-LG220, USR-LG210, USR-LG230, USR-LG240, USR-LG250, USR-LG260, USR-LG270, USR-LG280, USR-LG290 were identical inside, the electrical circuit design, layout, components used and internal wiring, with difference being model name.

Test mode

TM1 mode:	2.4G WiFi link + Lora link + LAN link (worse case)
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5.3 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
DELL	PC	OPTIPLEX745	N/A	DoC
DELL	MONITOR	E178FPC	N/A	DoC
DELL	KEYBOARD	SK-8115	N/A	DoC
DELL	MOUSE	MOC5UO	N/A	DoC
HP	Printer	CB495A	05257893	DoC
Jinan USR IOT	Adapter	DQS151-120100-VV	N/A	N/A

5.4 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 30MHz)	±2.22 dB
Radiated Emission (9kHz ~ 30MHz)	±2.76 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.28 dB
Radiated Emission (1GHz ~ 18GHz)	±5.72 dB
Radiated Emission (18GHz ~ 26.5GHz)	±2.88 dB

5.5 Description of Cable Used

N/A

5.6 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Registration No.: 727551**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC (Federal Communications Commission). The Registration No. is 727551.

- **IC - Registration No.: 10106A-1**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

5.7 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: <http://www.ccis-cb.com>

5.8 Monitoring of EUT for the Immunity Test

Visual:	Monitored the LED display of EUT
Sound:	N/A
Other:	Monitored the data link of EUT

5.9 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-16-2018	03-15-2019
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-16-2018	03-15-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2018	03-06-2019
Pre-amplifier	CD	PAP-1G18	11804	03-07-2018	03-06-2019
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2018	03-06-2019
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2018	03-06-2019
Simulated Station	Anritsu	MT8820C	6201026545	03-07-2018	03-06-2019
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2018	03-06-2019
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2018	03-06-2019
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2018	03-06-2019

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-07-2018	03-06-2019
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-07-2018	03-06-2019
LISN	CHASE	MN2050D	1447	03-19-2018	03-18-2019
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2018	07-20-2019
ISN	Schwarzbeck	CAT3 8158	CCIS0185	03-14-2018	03-13-2019
ISN	Schwarzbeck	CAT5 8158	CCIS0186	03-14-2018	03-13-2019
ISN	Schwarzbeck	NTFM 8158	CCIS0187	03-14-2018	03-13-2019
Cable	HP	10503A	N/A	03-07-2018	03-06-2019
EMI Test Software	AUDIX	E3	Version: 6.110919b		

ESD:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
ESD Simulator	Haefely	ONYX30	183900	04-06-2018	04-05-2019

Surge:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Surge test system	Prima	SUG61005BG	PR160951341	12-28-2017	12-27-2018
Surge test system	Prima	SUG10/700G	PR161151381	12-28-2017	12-27-2018

EFT:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EFT test system	Prima	EFT61004AG	PR16084621	12-16-2017	12-15-2018
Coupling clamp	Prima	/	CCIS0189	03-19-2018	03-18-2019

Voltage dips and Interruption:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Voltage dips and Interruption test system	Prima	DRP61011AG	PR16076343	12-16-2017	12-15-2018

Conducted Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Conducted Disturbance Test system	SCHLODER	CDG6000	126B1445/2016	03-19-2018	03-18-2019
Coupling/Decoupling Network	SCHLODER	CDN-M2+3	A2210417/2016	03-19-2018	03-18-2019
EM Clamp	SCHLODER	EMCL-20	132A1281/2016	03-19-2018	03-18-2019
Nexus Conduitiuning Amplifier	B&K	2690	SEL0077	N/A	N/A
MUTH Simulator	B&K	4227	SEL0078	N/A	N/A
Sound Level Calibrator	B&K	4231	SEL0079	N/A	N/A
Audio Analyzer	Rohde & Schwarz	UPL 16	SEL0076	03-07-2018	03-06-2019

Radiated Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Signal Generator	Rohde & Schwarz	SMR27	SEL0068	03-07-2018	03-06-2019
RF Amplifier 80M-1GHz	Amplifier Research	AR 150W1000	SEL0066	03-07-2018	03-06-2019
RF Amplifier 1GHz-4.2GHz	Amplifier Research	AR 25S1G4AM1	SEL0065	03-07-2018	03-06-2019
RF Amplifier 4GHz-6GHz	Amplifier Research	35S4G8A	SEL0068	03-07-2018	03-06-2019
Power Meter	Rohde & Schwarz	NRVS	SEL0069	03-07-2018	03-06-2019
Power Sensor	Rohde & Schwarz	URV5-Z2	SEL0071	03-07-2018	03-06-2019
Power Sensor	Rohde & Schwarz	URV5-Z2	SEL0072	03-07-2018	03-06-2019
Software EMC32	Rohde & Schwarz	EMC32-S	SEL0082	N/A	N/A
Log-periodic Antenna	Amplifier Research	AT1080	SEL0073	03-07-2018	03-06-2019
Antenna Tripod	Amplifier Research	TP1000A	SEL0074	N/A	N/A
High Gain Horn Antenna	Amplifier Research	AT4002A	SEL0075	03-07-2018	03-06-2019
Nexus Conduitiuning Amplifier	B&K	2690	SEL0077	N/A	N/A
MUTH Simulator	B&K	4227	SEL0078	N/A	N/A
Sound Level Calibrator	B&K	4231	SEL0079	N/A	N/A
Audio Analyzer	Rohde & Schwarz	UPL 16	SEL0076	03-07-2018	03-06-2019

6 EMC Requirements Specification in ETSI EN 301489

6.1 EMI (Emission)

6.1.1 Radiated Emission

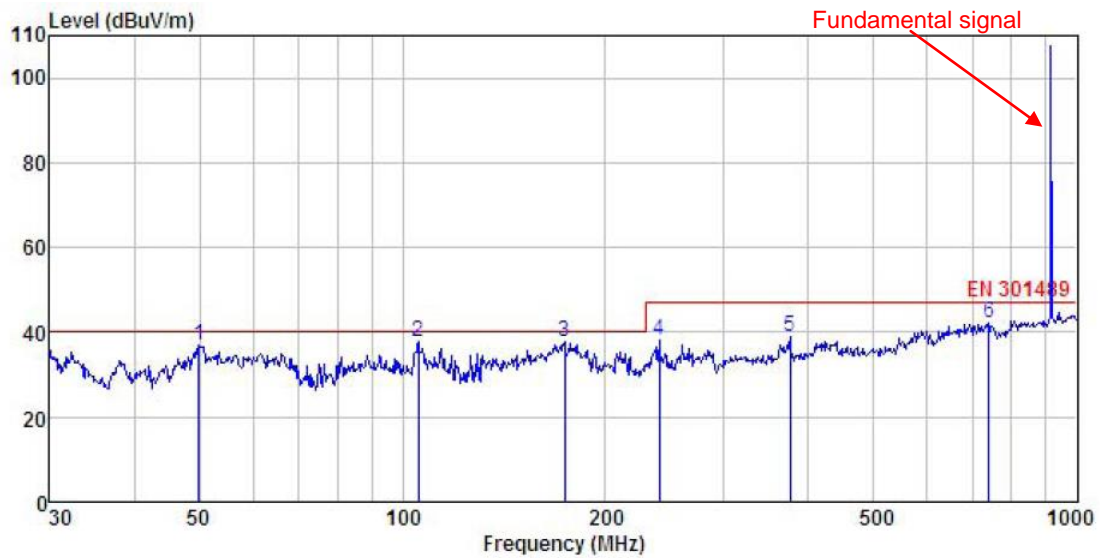
Test Requirement:	ETSI EN 301 489 -1				
Test Method:	EN 55032				
Test Frequency Range:	30MHz to 6GHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	QP Value
	Above 1GHz	Peak	1MHz	3MHz	PK Value
		Average	1MHz	3MHz	AV Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-230MHz		40.0		QP Value
	230MHz-1GHz		47.0		QP Value
	1GHz-3GHz		50.0		AV Value
			70.0		PK Value
	3GHz-6GHz		54.0		AV Value
			74.0		PK Value
Test setup:	Below 1GHz:		Above 1GHz:		
Test Procedure:	<p>30MHz to 1GHz:</p> <ol style="list-style-type: none">1. The radiated emissions test was conducted in a semi-anechoic chamber.2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT.4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.				

	<p>Above 1GHz:</p> <ol style="list-style-type: none">1. The radiated emissions test was conducted in a fully-anechoic chamber.2. The tabletop EUT was placed upon anon-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT.4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:

Below 1GHz:

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%



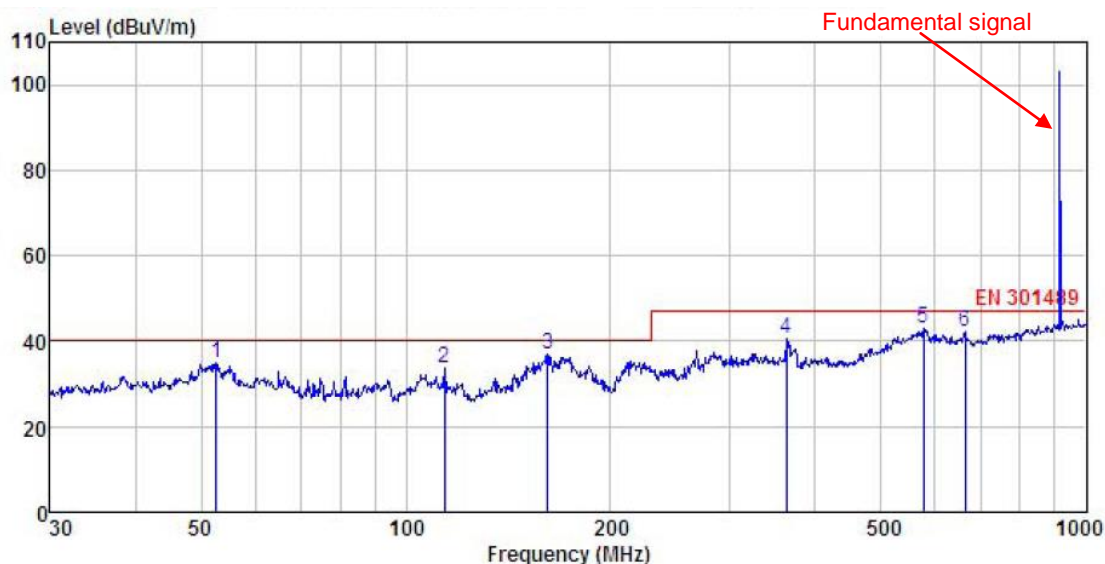
REMARK :

	Freq	Read	Antenna	Cable	Preamp	Level	Limit	Over	Remark
	MHz	Level	Factor	Loss	Factor	dBuV/m	dBuV/m	Limit	
		dBuV	dB/m	dB	dB			dB	
1	49.881	21.52	14.09	1.26	0.00	36.87	40.00	-3.13	QP
2	105.642	23.75	12.05	2.00	0.00	37.80	40.00	-2.20	QP
3	173.814	25.34	9.56	2.68	0.00	37.58	40.00	-2.42	QP
4	239.987	22.43	12.97	2.82	0.00	38.22	47.00	-8.78	QP
5	375.939	20.70	15.08	3.09	0.00	38.87	47.00	-8.13	QP
6	739.661	17.11	20.76	4.32	0.00	42.19	47.00	-4.81	QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24°C Humi: 57%



REMARK :

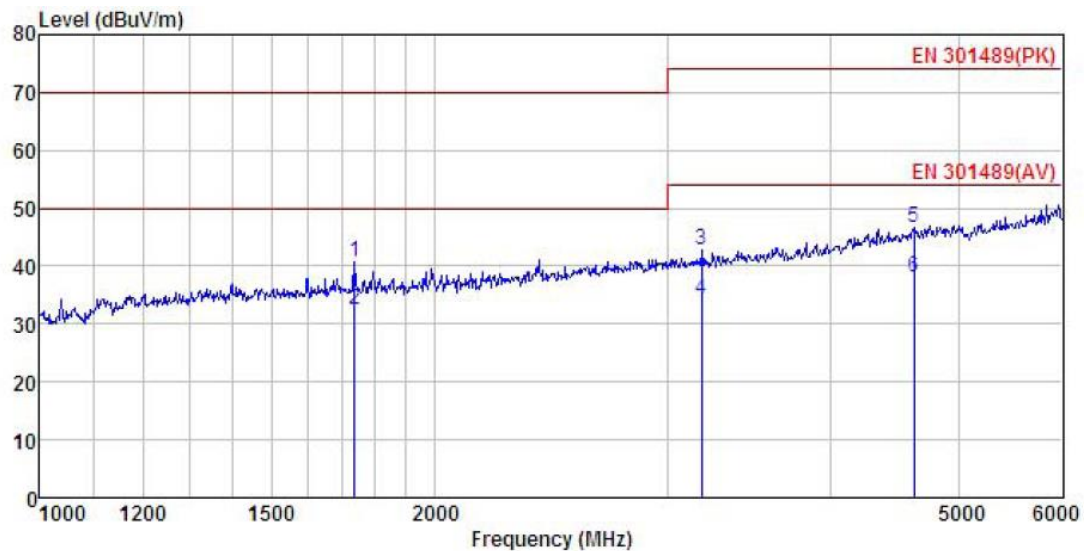
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	52.575	20.19	13.63	1.29	0.00	35.11	40.00	-4.89	QP
2	114.114	19.98	11.41	2.10	0.00	33.49	40.00	-6.51	QP
3	161.474	25.17	9.15	2.60	0.00	36.92	40.00	-3.08	QP
4	362.985	22.82	14.85	3.09	0.00	40.76	47.00	-6.24	QP
5	576.644	20.46	18.65	3.92	0.00	43.03	47.00	-3.97	QP
6	663.473	18.38	19.80	3.95	0.00	42.13	47.00	-4.87	QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Above 1GHz:

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	TM 1
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Vertical
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%

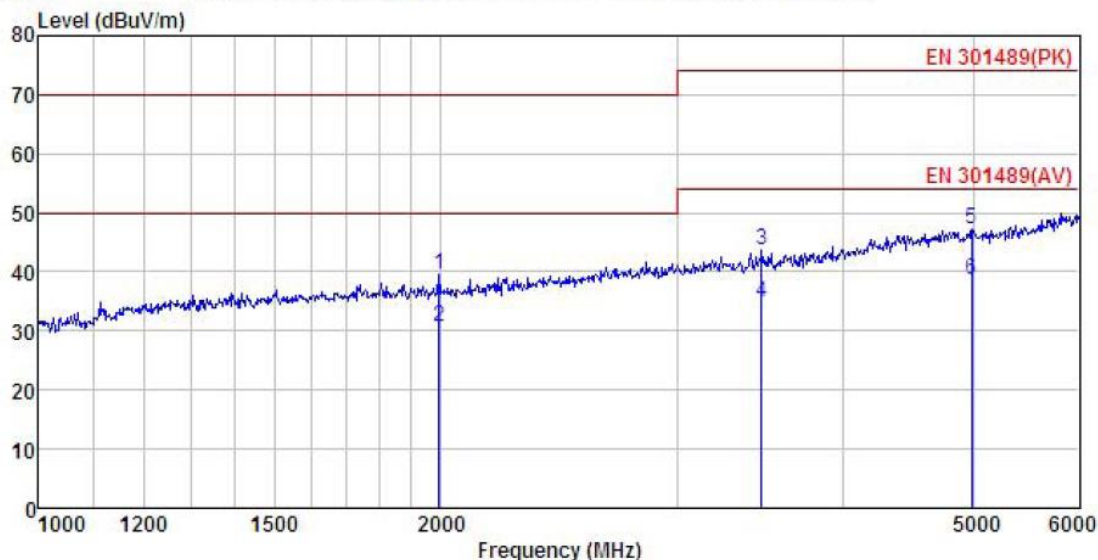


REMARK :										
	Freq	ReadAntenna	Cable	Aux	Preamp		Limit	Over		
	MHz	Level	Factor	Loss	Factor	Factor	Level	Line	Limit	Remark
		dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB	
1	1734.454	49.60	25.81	4.03	2.32	41.15	40.61	70.00	-29.39	Peak
2	1734.454	41.32	25.81	4.03	2.32	41.15	32.33	50.00	-17.67	Average
3	3189.176	47.09	28.72	5.42	2.93	41.41	42.75	74.00	-31.25	Peak
4	3189.176	38.55	28.72	5.42	2.93	41.41	34.21	54.00	-19.79	Average
5	4624.792	46.84	31.31	6.89	3.59	42.10	46.53	74.00	-27.47	Peak
6	4624.792	38.44	31.31	6.89	3.59	42.10	38.13	54.00	-15.87	Average

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product Name:	LoRa Gateway	Product Model:	USR-LG220
Test By:	Zora	Test mode:	TM 1
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24℃ Humi: 57%



REMARK	:	Read	Antenna	Cable	Aux	Preamp	Limit	Over	
	Freq	Level	Factor	Loss	Factor	Factor	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dB	dBuV/m	dBuV/m	dB
1	1991.428	47.97	26.38	4.33	2.54	41.64	39.58	70.00	-30.42 Peak
2	1991.428	39.24	26.38	4.33	2.54	41.64	30.85	50.00	-19.15 Average
3	3474.263	47.67	28.89	5.73	2.96	41.43	43.82	74.00	-30.18 Peak
4	3474.263	38.77	28.89	5.73	2.96	41.43	34.92	54.00	-19.08 Average
5	4989.431	46.51	31.88	6.93	3.73	41.88	47.17	74.00	-26.83 Peak
6	4989.431	37.89	31.88	6.93	3.73	41.88	38.55	54.00	-15.45 Average

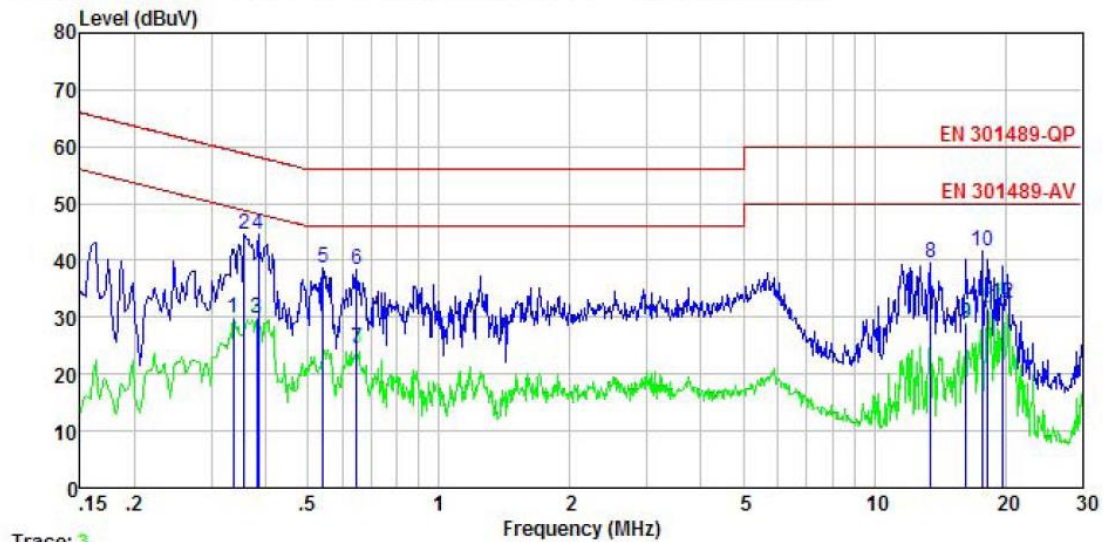
Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test Requirement:	ETSI EN 301 489 -1		
Test Method:	EN 55032		
Test Frequency Range:	150kHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test setup:	<p>The diagram illustrates the test setup. A horizontal line at the top represents the 'Reference Plane'. Below it, on the left, is a box labeled 'AUX Equipment' connected to a 'LISN' box. To the right of 'AUX Equipment' is the 'E.U.T' (Equipment Under Test) box. A vertical double-headed arrow indicates a distance of '40cm' between the 'Reference Plane' and the top of the 'E.U.T' box. To the right of the 'E.U.T' box, another vertical double-headed arrow indicates a distance of '80cm' between the 'Reference Plane' and the top of the 'EMI Receiver' box. The 'EMI Receiver' box is connected to the 'E.U.T' box. To the right of the 'EMI Receiver' box is a 'Filter' box, which is connected to 'AC power'. The 'AUX Equipment' and 'E.U.T' boxes are both connected to a common 'Test table/Insulation plane' at the bottom.</p> <p><i>Remark</i> <i>E.U.T: Equipment Under Test</i> <i>LISN: Line Impedance Stabilization Network</i> <i>Test table height=0.8m</i></p>		
Test procedure	<p>The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). Which provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.</p>		
Test Instruments:	Refer to section 5.10 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

Measurement Data:

Product name:	LoRa Gateway	Product Model:	USR-LG220
Test by:	Zora	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5°C Humi: 55%

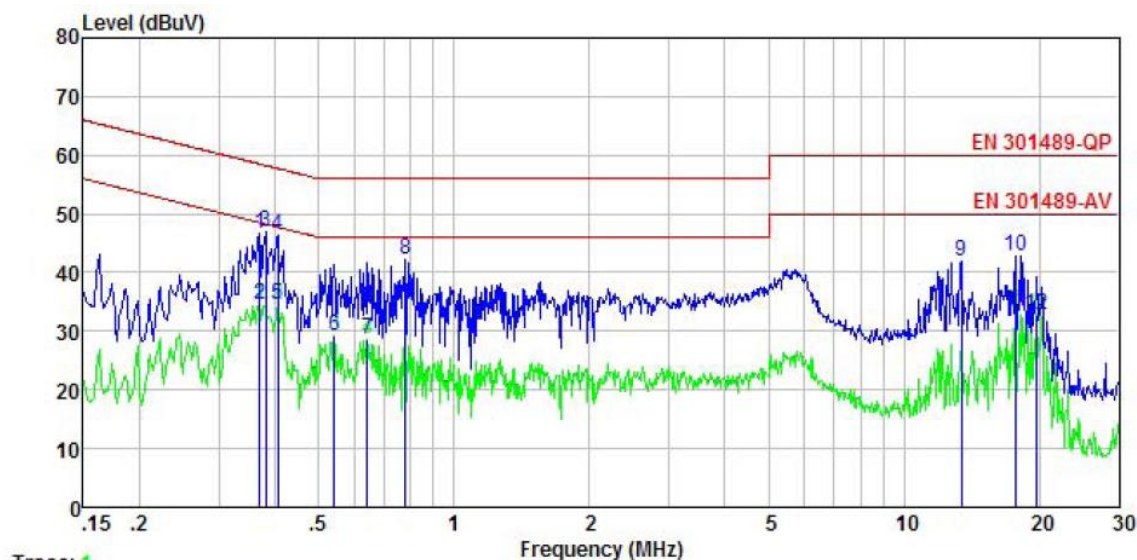


Remark	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.337	18.99	0.13	10.73	29.85	49.27	-19.42	Average
2	0.358	33.79	0.12	10.73	44.64	58.78	-14.14	QP
3	0.381	19.04	0.12	10.72	29.88	48.25	-18.37	Average
4	0.385	33.66	0.12	10.72	44.50	58.17	-13.67	QP
5	0.541	27.69	0.12	10.76	38.57	56.00	-17.43	QP
6	0.647	27.57	0.13	10.77	38.47	56.00	-17.53	QP
7	0.647	13.60	0.13	10.77	24.50	46.00	-21.50	Average
8	13.479	28.35	0.32	10.91	39.58	60.00	-20.42	QP
9	16.226	17.80	0.31	10.91	29.02	50.00	-20.98	Average
10	17.661	30.30	0.29	10.92	41.51	60.00	-18.49	QP
11	18.232	20.43	0.29	10.92	31.64	50.00	-18.36	Average
12	19.740	21.38	0.27	10.93	32.58	50.00	-17.42	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

Product name:	LoRa Gateway	Product Model:	USR-LG220
Test by:	Zora	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5°C Humi: 55%



Trace: 1

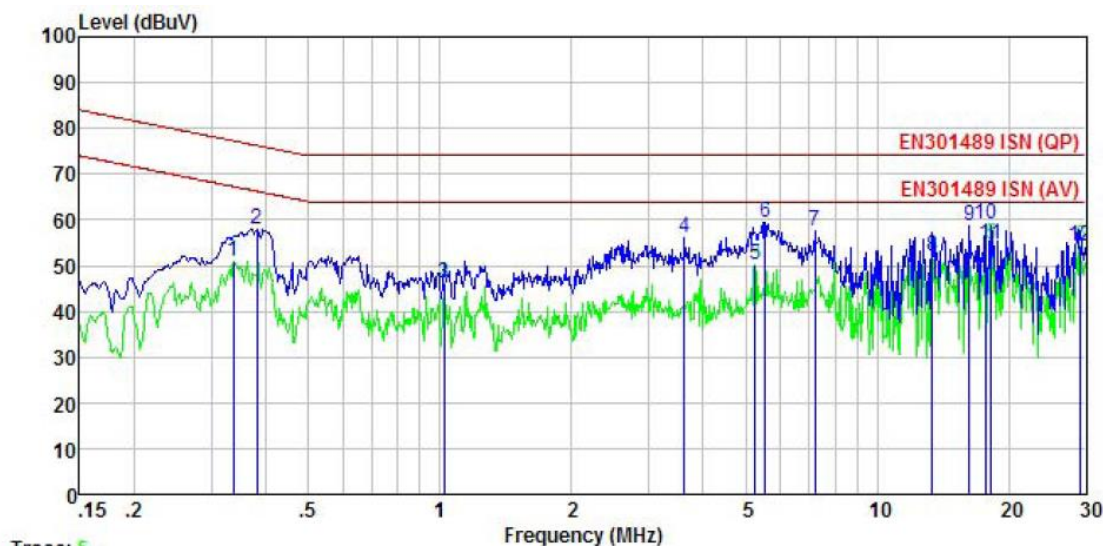
Remark :

	Freq	Read	LISN	Cable	Level	Limit	Over	
	MHz	dBuV	Factor	Loss	dBuV	dBuV	Limit	Remark
1	0.369	35.05	0.97	10.73	46.75	58.52	-11.77	QP
2	0.369	22.90	0.97	10.73	34.60	48.52	-13.92	Average
3	0.381	35.15	0.97	10.72	46.84	58.25	-11.41	QP
4	0.406	34.58	0.97	10.72	46.27	57.73	-11.46	QP
5	0.406	22.76	0.97	10.72	34.45	47.73	-13.28	Average
6	0.541	17.40	0.97	10.76	29.13	46.00	-16.87	Average
7	0.641	16.84	0.97	10.77	28.58	46.00	-17.42	Average
8	0.779	30.35	0.97	10.80	42.12	56.00	-13.88	QP
9	13.408	30.00	0.93	10.91	41.84	60.00	-18.16	QP
10	17.661	31.16	0.78	10.92	42.86	60.00	-17.14	QP
11	17.661	21.72	0.78	10.92	33.42	50.00	-16.58	Average
12	19.740	21.07	0.70	10.93	32.70	50.00	-17.30	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss.

Product name:	LoRa Gateway	Product Model:	USR-LG220
Test by:	Zora	Test mode:	RJ45
Test frequency:	150 kHz ~ 30 MHz	Phase:	/
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5°C Humi: 55%



Trace: 5

Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.337	30.38	9.87	10.73	50.98	67.27	-16.29	Average
2	0.381	37.40	9.83	10.72	57.95	76.25	-18.30	QP
3	1.021	25.51	9.61	10.87	45.99	64.00	-18.01	Average
4	3.623	35.58	9.46	10.90	55.94	74.00	-18.06	QP
5	5.249	29.91	9.43	10.84	50.18	64.00	-13.82	Average
6	5.535	39.15	9.43	10.83	59.41	74.00	-14.59	QP
7	7.213	37.48	9.42	10.81	57.71	74.00	-16.29	QP
8	13.337	31.75	9.41	10.91	52.07	64.00	-11.93	Average
9	16.226	38.37	9.41	10.91	58.69	74.00	-15.31	QP
10	17.661	38.60	9.41	10.92	58.93	74.00	-15.07	QP
11	18.232	34.19	9.41	10.92	54.52	64.00	-9.48	Average
12	29.216	33.80	9.43	10.87	54.10	64.00	-9.90	Average

Notes:

4. An initial pre-scan was performed on the line and neutral lines with peak detector.
5. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
6. Final Level = Receiver Read level + LISN Factor + Cable Loss.

6.1.3 Harmonics Test Results

Test Requirement:	ETSI EN 301 489-1/3/17: EN 61000-3-2
Test Method:	N/A: See Remark Below
Remark:	<p>There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2.</p> <p>For further details, please refer to Clause 7, Note 1 of EN 61000-3-2 which states:</p> <p>“For the following categories of equipment limits are not specified in this edition of the standard.</p> <p>Note 1: Equipment with a rated power of 75W or less, other than lighting equipment.”</p>

6.1.4 Flicker Test Results

Test Requirement:	ETSI EN 301 489-1/3/17: EN 61000-3-3
Test Method:	N/A: See Remark Below
Remark:	<ol style="list-style-type: none"> 1. The appropriate requirements of EN 61000-3-3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase EN 61000-3-11 [12] applies. 2. As the section 6.1 of EN 6100-3-3, “Devices and Equipment that do(with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested”.

6.2 EMS (Immunity)

Performance Criteria of ETSI EN 301 489-1/3/17, sub clause 6

Criteria	Performance Criteria of EN 301 489-1 clause 6
CT/CR	<p>During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.</p> <p>During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.</p> <p>If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.</p>
TT/TR	<p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none"> • For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost. • For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. A SW reboot is not allowed. <p>Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</p> <p>For all other ports the following applies:</p> <ul style="list-style-type: none"> • After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance. • During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed. • If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

Performance Criteria of EN 301 489-3 clause 6

In the table below:

- performance criterion A applies for immunity tests with phenomena of a continuous nature;
- performance criterion B applies for immunity tests with phenomena of a transient nature.

NOTE: Whether a phenomenon is considered transient, continuous or otherwise is indicated in the test procedures for the phenomenon in ETSI EN 301 489-1 [1], clause 9.

Table 2: Performance Requirements

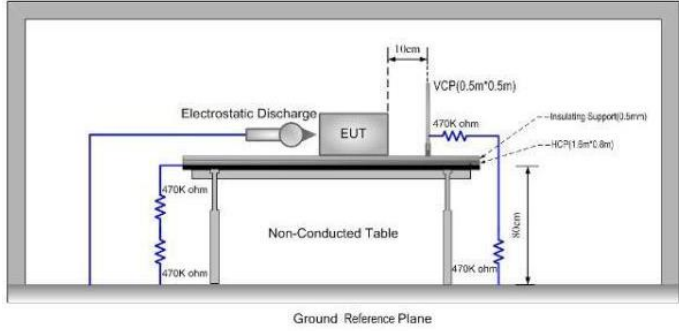
Criterion	During test	After test
A	<p>Operate as intended</p> <p>No loss of function</p> <p>No unintentional responses</p>	<p>Operate as intended</p> <p>No loss of function</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p>
B	<p>May show loss of function</p> <p>No unintentional responses</p>	<p>Operate as intended</p> <p>Lost function(s) shall be self-recoverable</p> <p>No degradation of performance</p> <p>No loss of stored data or user programmable functions</p>

Criteria	Performance Criteria of EN 301 489-17 clause 6
CT	The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TT	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
CR	The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TR	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Table 1: Performance criteria

Criteria	During test	After test
A	Shall operate as intended. (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 3). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 2). Shall be no unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 3).
<p>NOTE 1: Operate as intended during the test allows a level of degradation not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 3: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

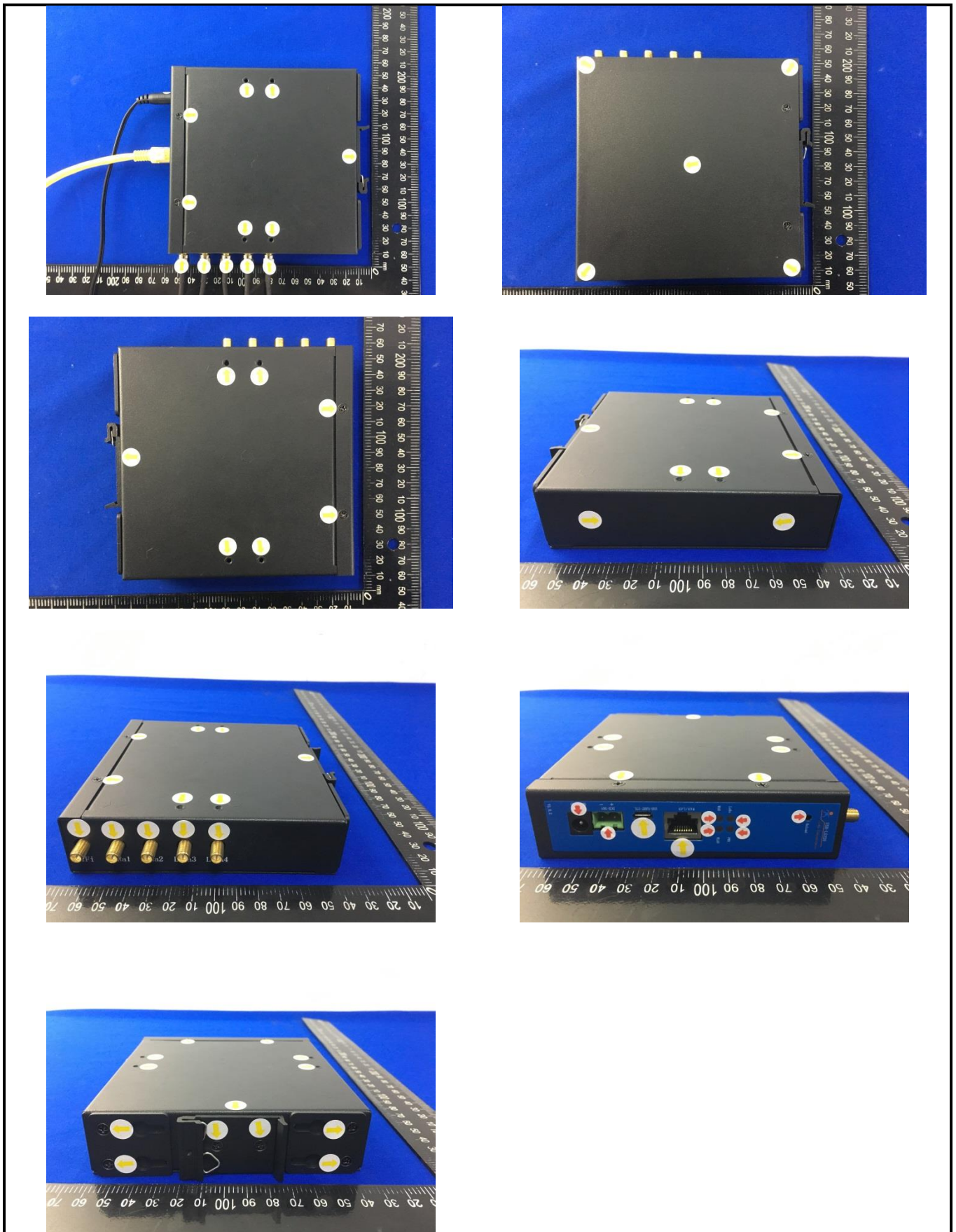
6.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN 301 489-1
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge, HCP and VCP: $\pm 2\text{kV}$, $\pm 4\text{kV}$, Air Discharge: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$
Polarity:	Positive & Negative
Number of Discharge:	Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point.
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Testsetup:	
Test Procedure:	<p>1) Air discharge: The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed</p> <p>2) Contact discharge: The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.</p> <p>3) Indirect discharge for horizontal coupling plane At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge. Consideration should be given to exposing all sides of the EUT.</p> <p>4) Indirect discharge for vertical coupling plane At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.</p>
Test environment:	Temp.: 26°C Humid.: 54% Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

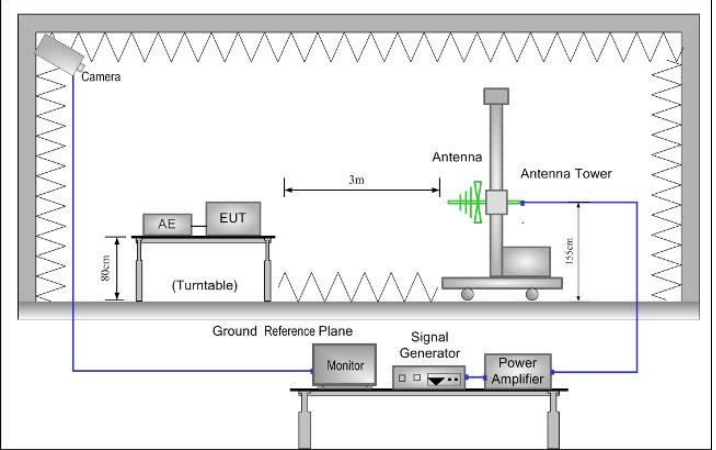
Measurement Record:

Test points:	I: Please refer to red arrows as below plots			
	II: Please refer to yellow arrows as below plots			
Direct discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observations (Performance Criterion)	Result
$\pm 2, \pm 4$	Contact	II	TT/TR	Pass
$\pm 2, \pm 4, \pm 8$	Air	I	TT/TR	Pass
Indirect discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observation Performance	Result
$\pm 2, \pm 4$	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	TT/TR	Pass
$\pm 2, \pm 4$	VCP-Front/Back /Left/Right	Center of the VCP	TT/TR	Pass
<p><i>Remark:</i></p> <p><i>Red arrow: air discharge test points.</i></p> <p><i>Yellow arrow: contact discharge test points.</i></p>				

ESD Test points as below:



6.2.2 Radiated Immunity

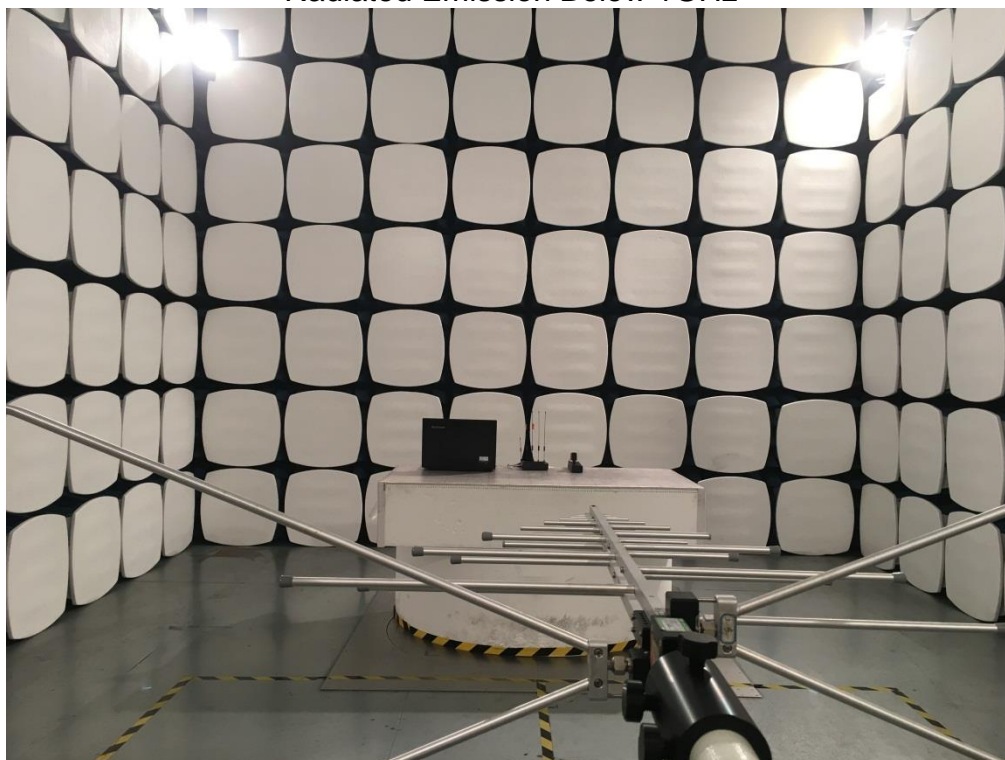
Test Requirement:	ETSI EN 301 489 -1				
Test Method:	EN 61000-4-3				
Frequency range:	80MHz to 6GHz				
Test Level:	3V/m				
Modulation:	80%, 1kHz Amplitude Modulation				
Testsetup:					
Test Procedure:	<ol style="list-style-type: none"> 1. For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table top items. 2. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length. 3. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area). 4. The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value. 5. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s. 6. The test normally was performed with the generating antenna facing each side of the EUT. 7. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. 8. The EUT was performed in a configuration to actual installation conditions, a video camera and/or a audio monitor were used to monitor the performance of the EUT. 				
Test environment:	Temp.:	26°C	Humid.:	54%	Press.: 101kPa
Test Instruments:	Refer to section 5.10 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				

Measurement Record:

Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result
80MHz-6GHz	3V/m	1kHz, 80% Amp. Mod, 1% increment, dwell time=3seconds	V	Front	CT/CR	Pass
			H			
			V	Rear		
			H			
			V	Left		
			H			
			V	Right		
			H			
			V	Top		
			H			
			V	Bottom		
			H			

7 Test Setup Photo

Radiated Emission Below 1GHz



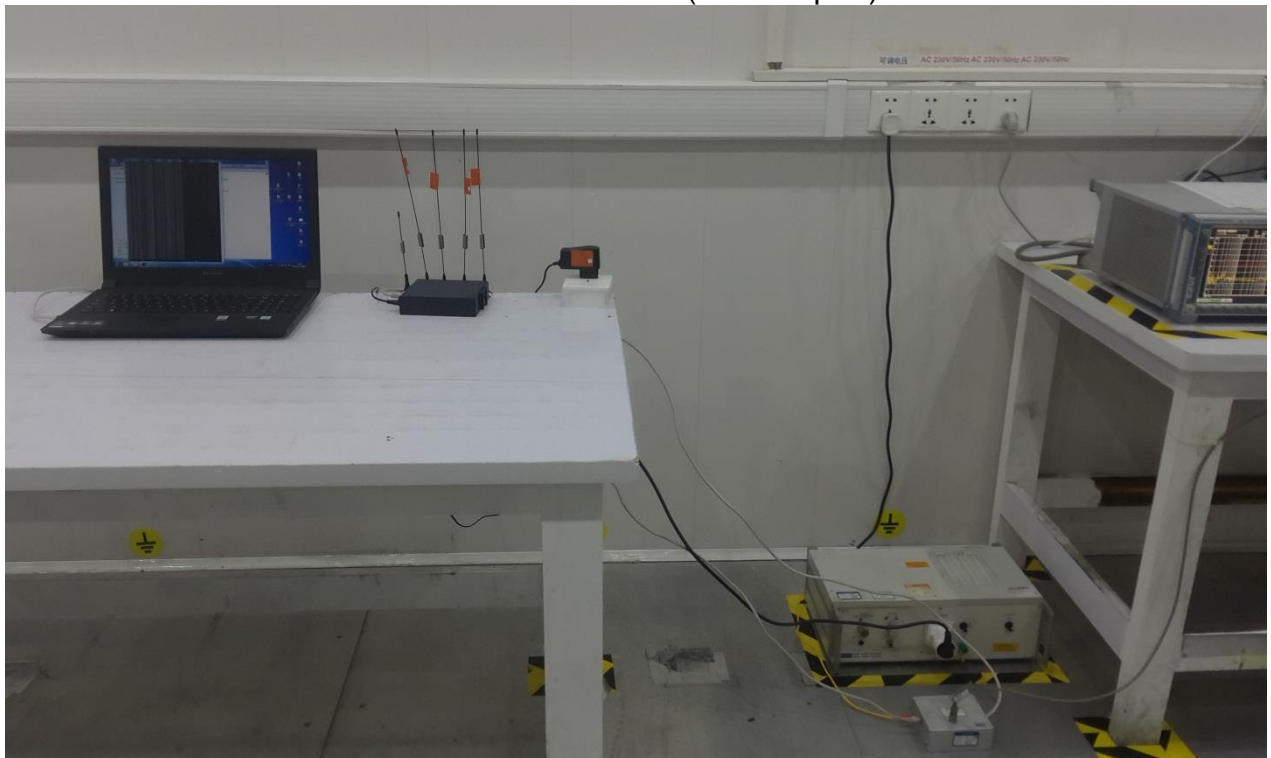
Radiated Emission Above 1GHz



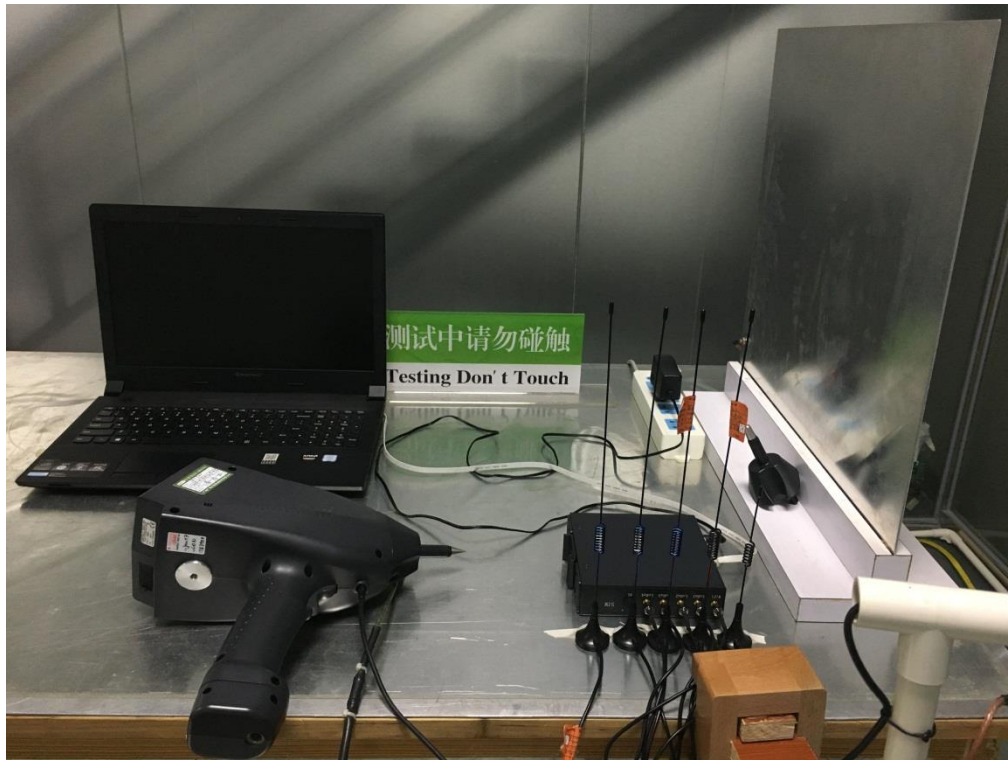
Conducted Emission(for AC main port)



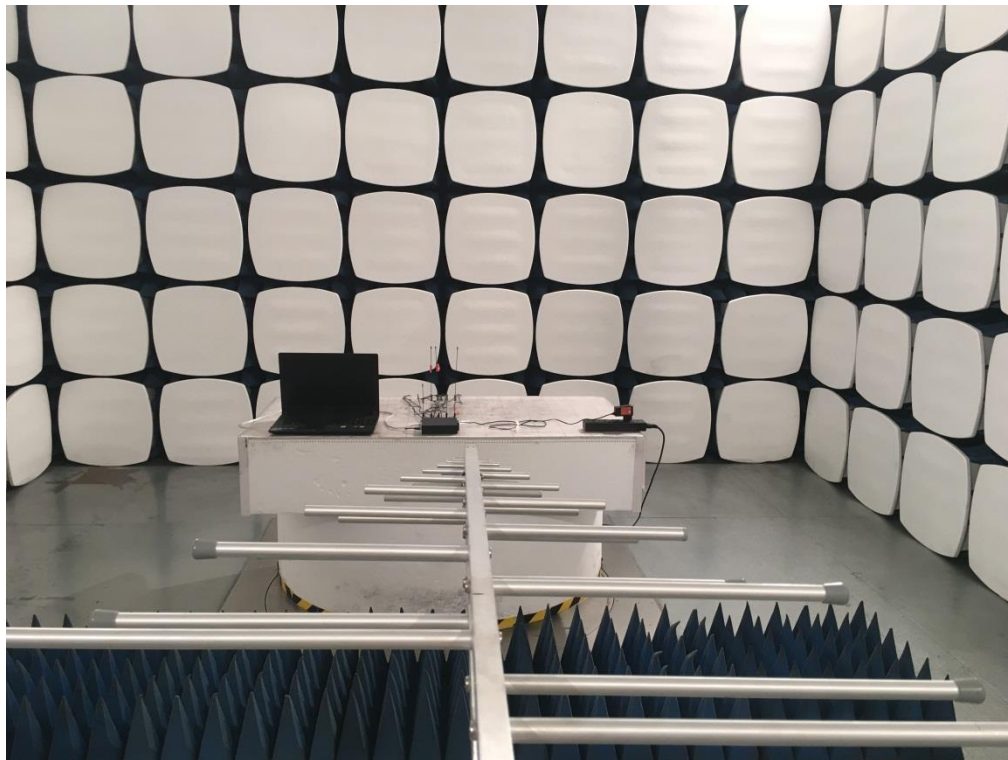
Conducted Emission(for LAN port)



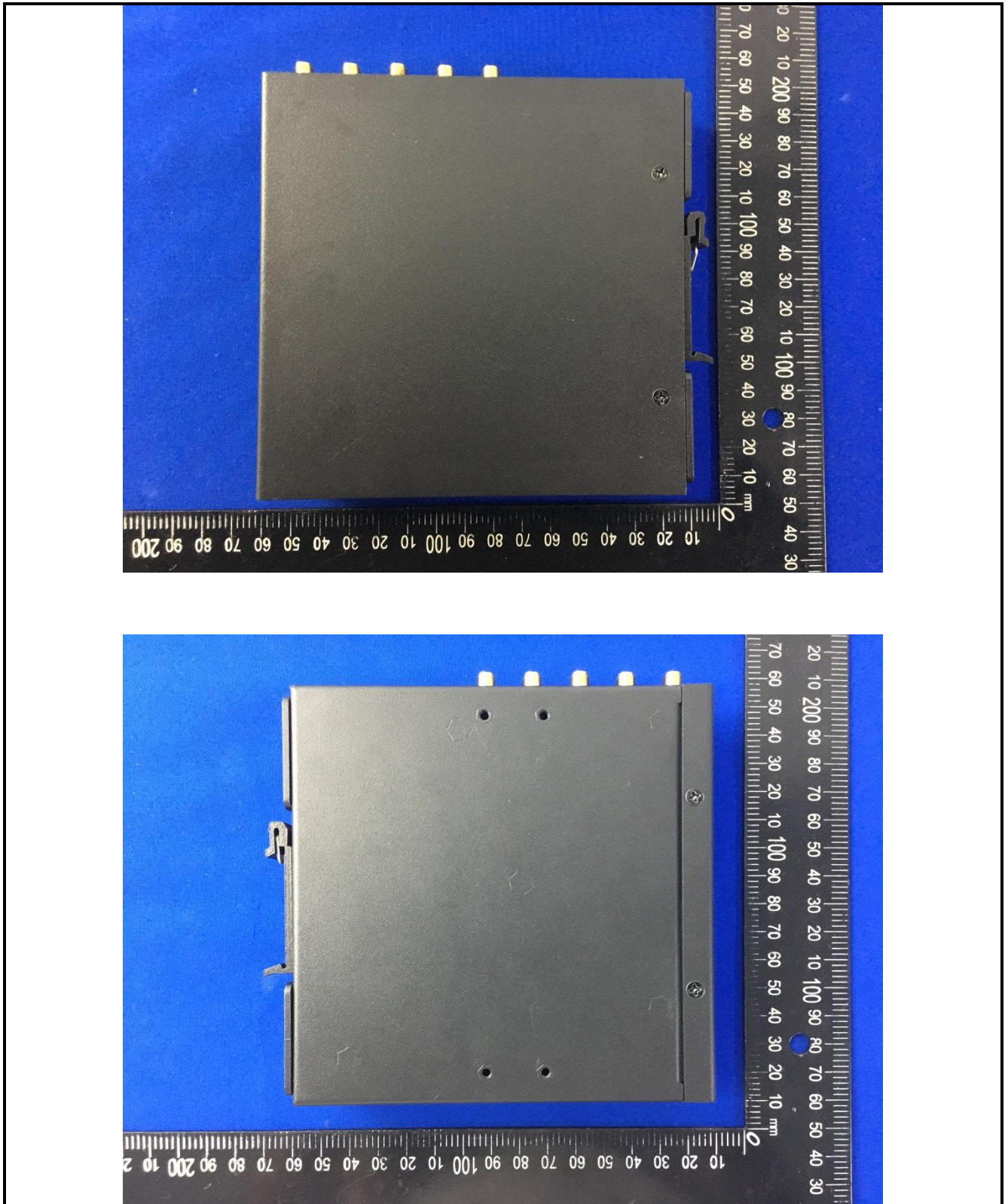
ESD

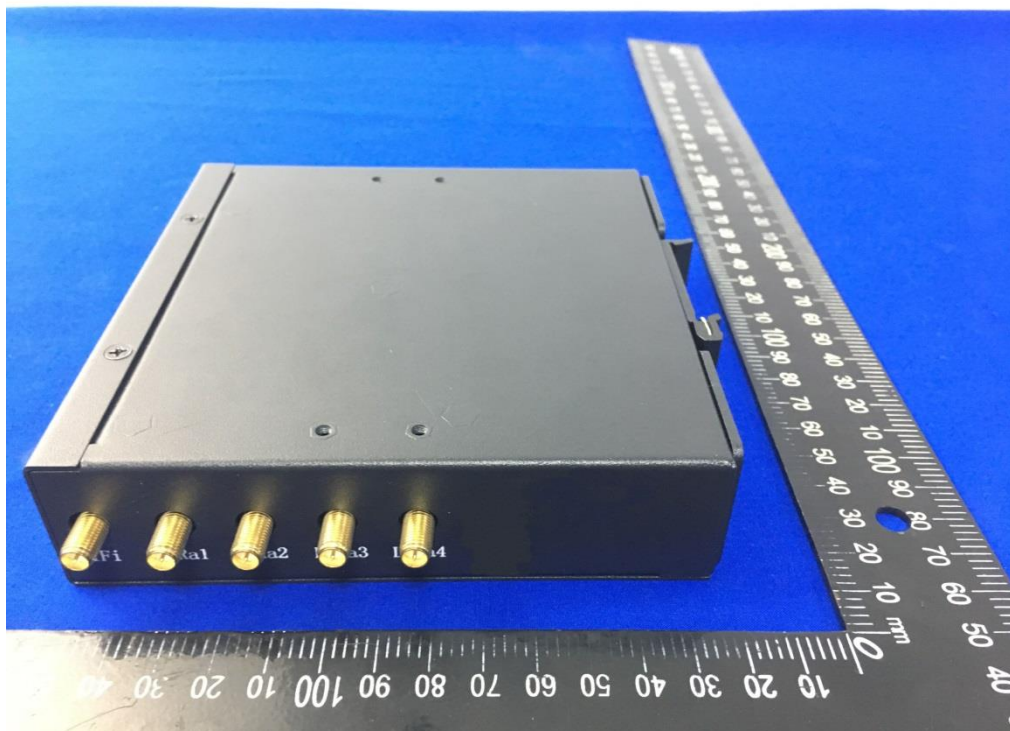
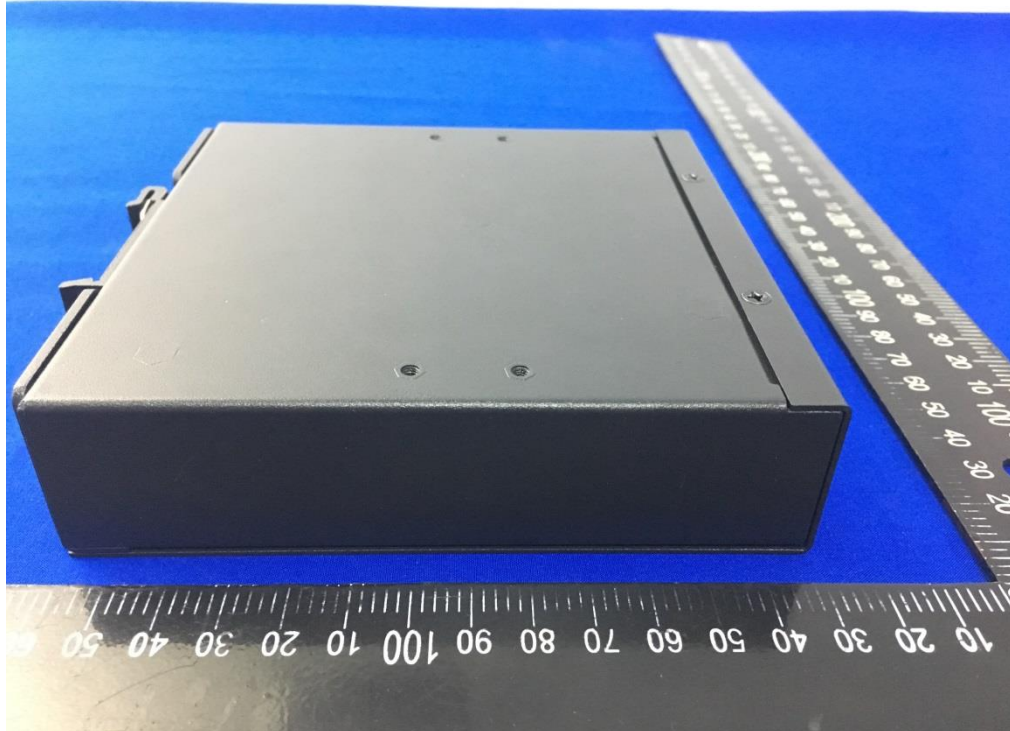


R/S

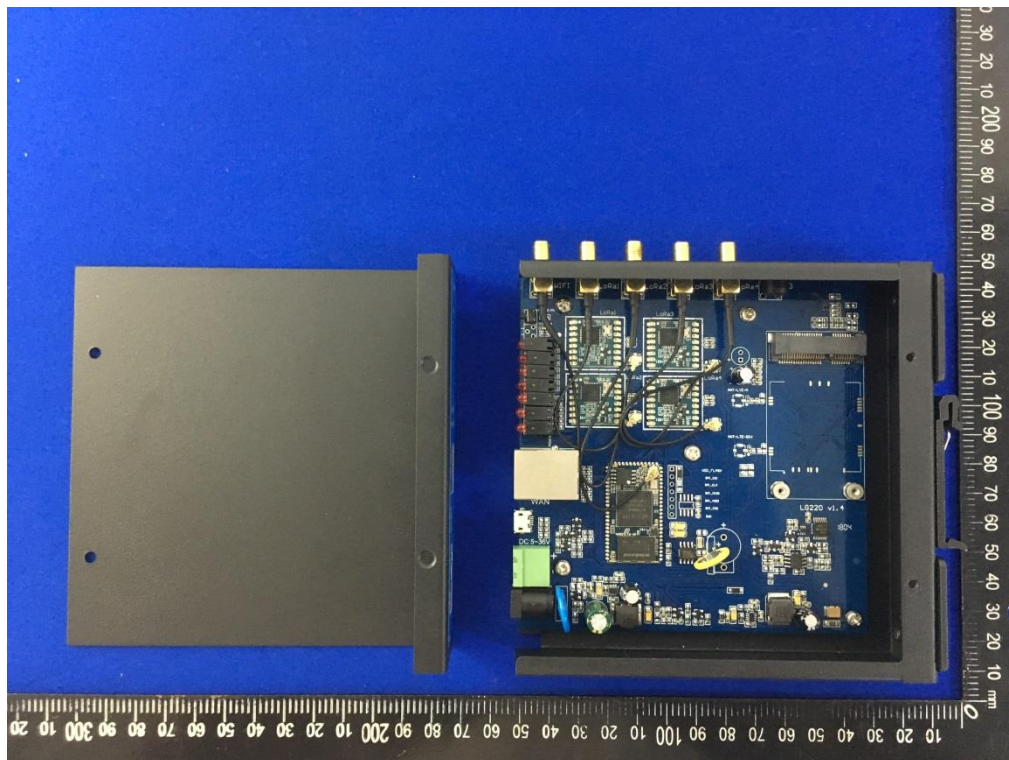
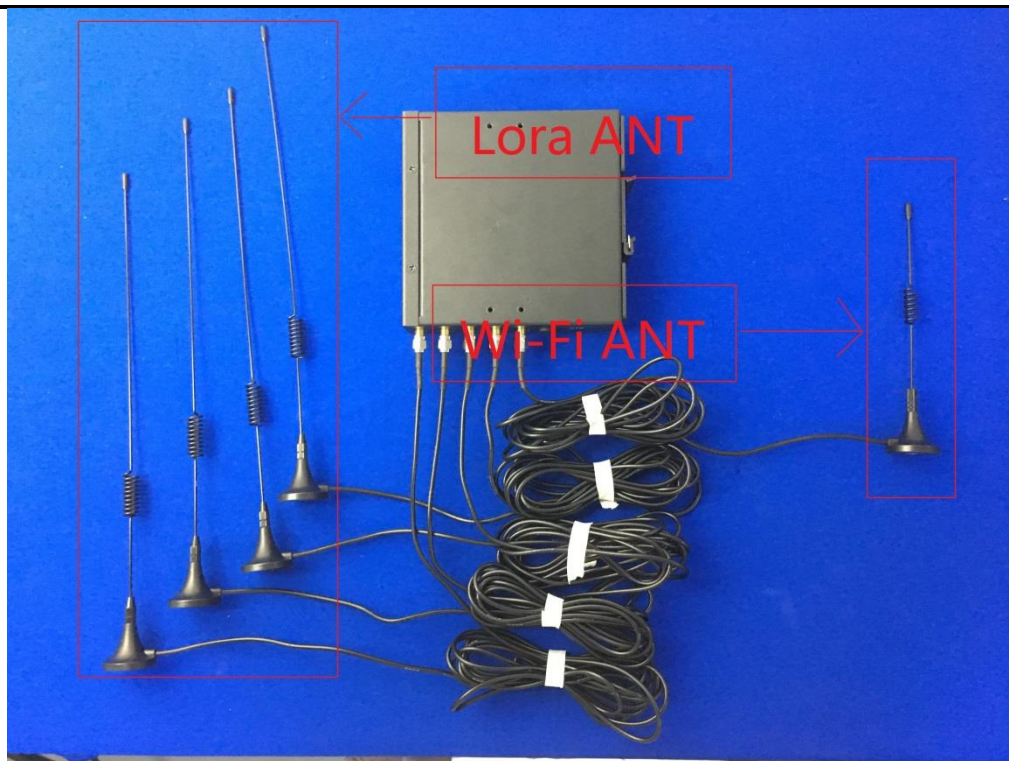


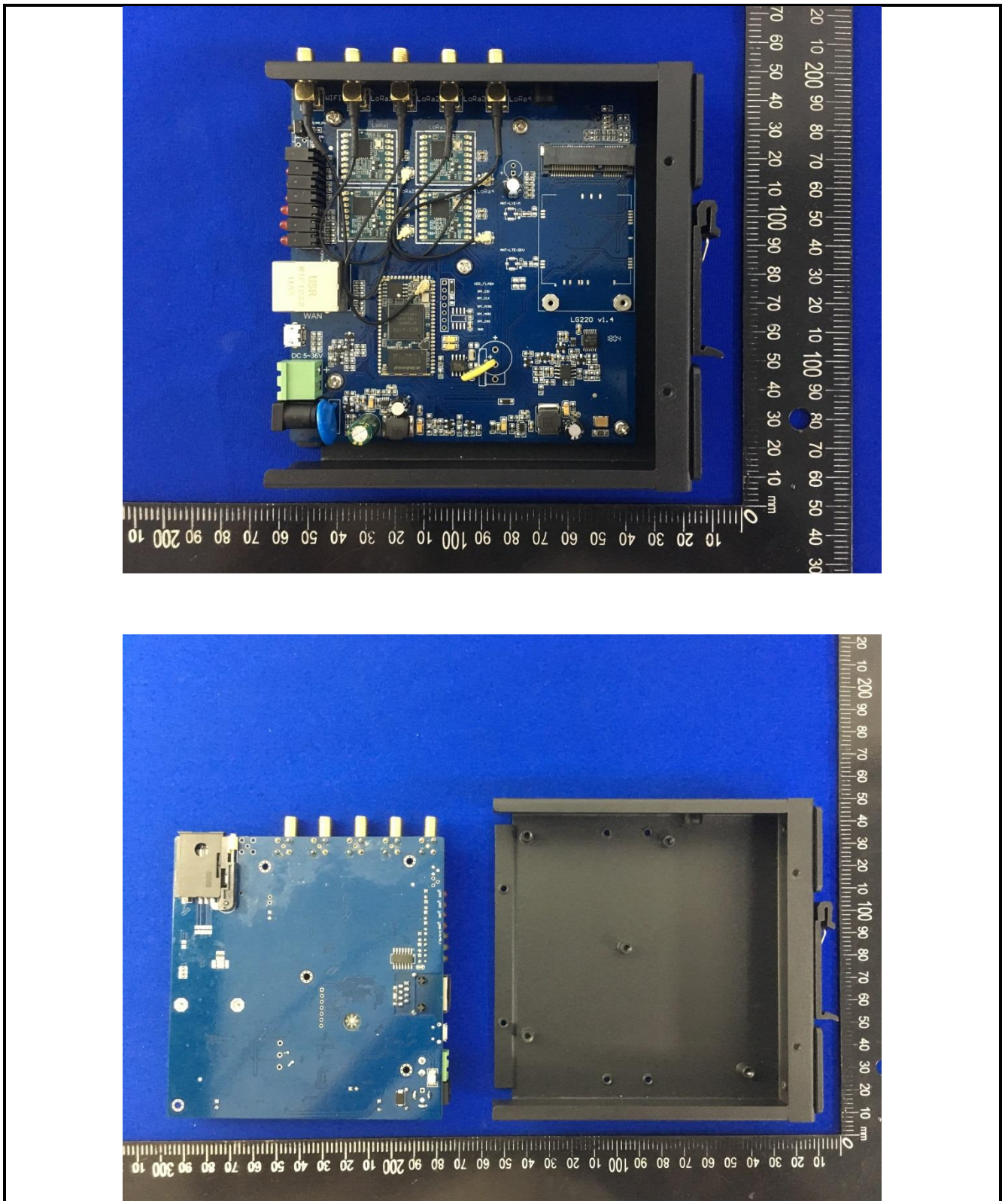
8 EUT Constructional Details

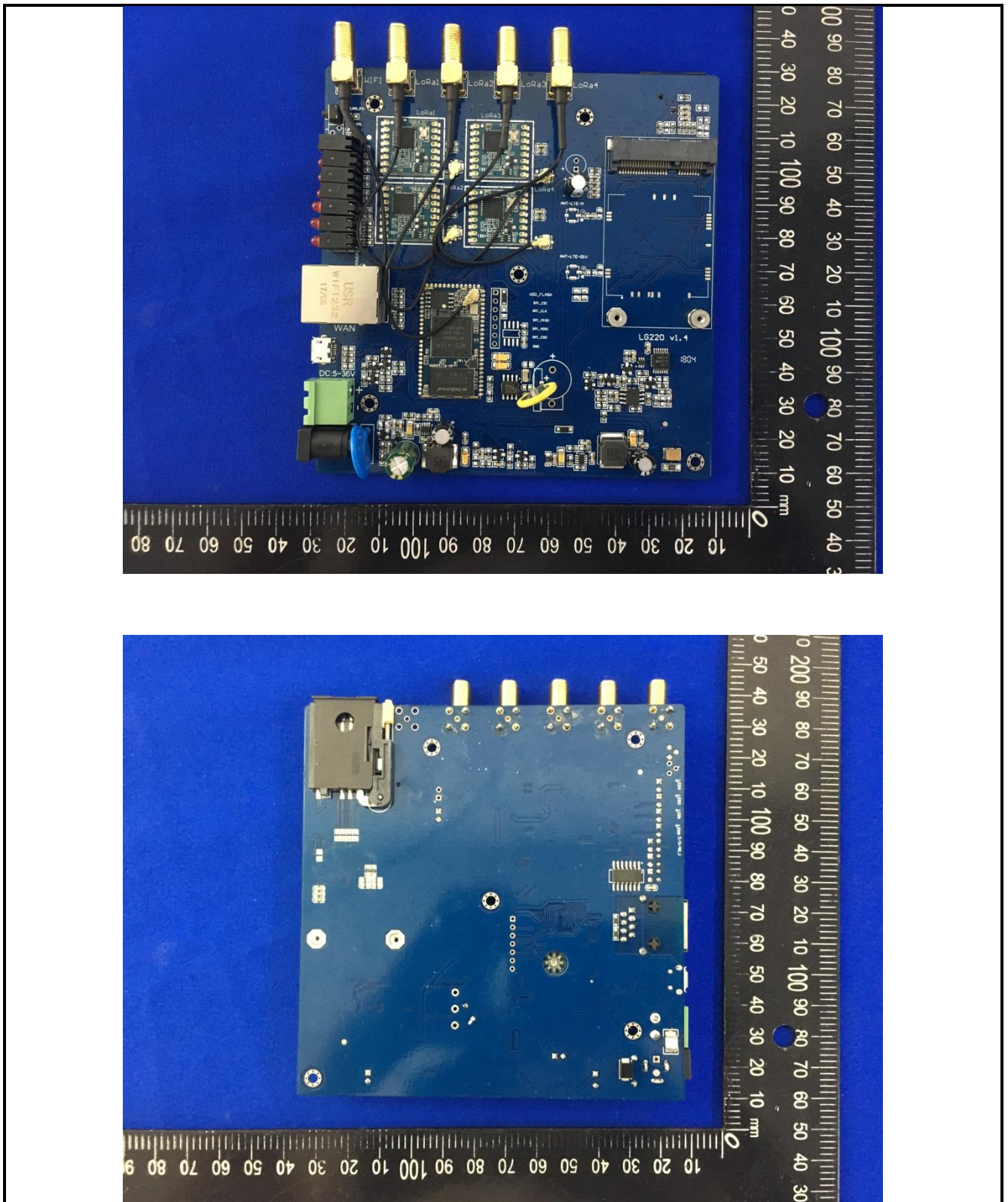


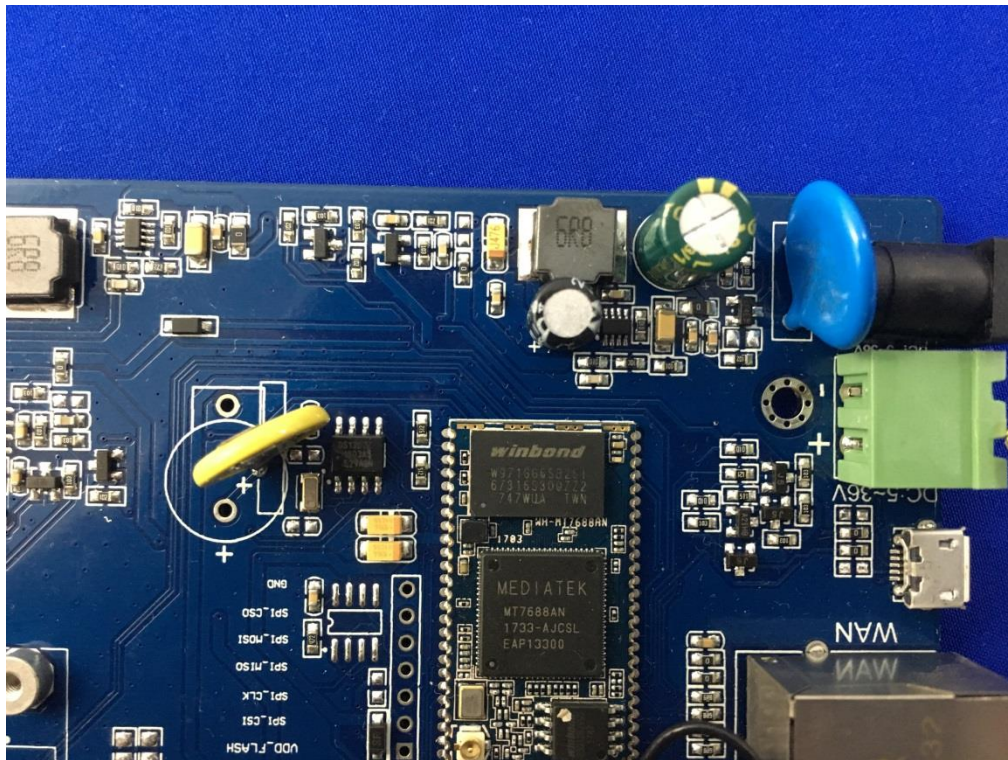
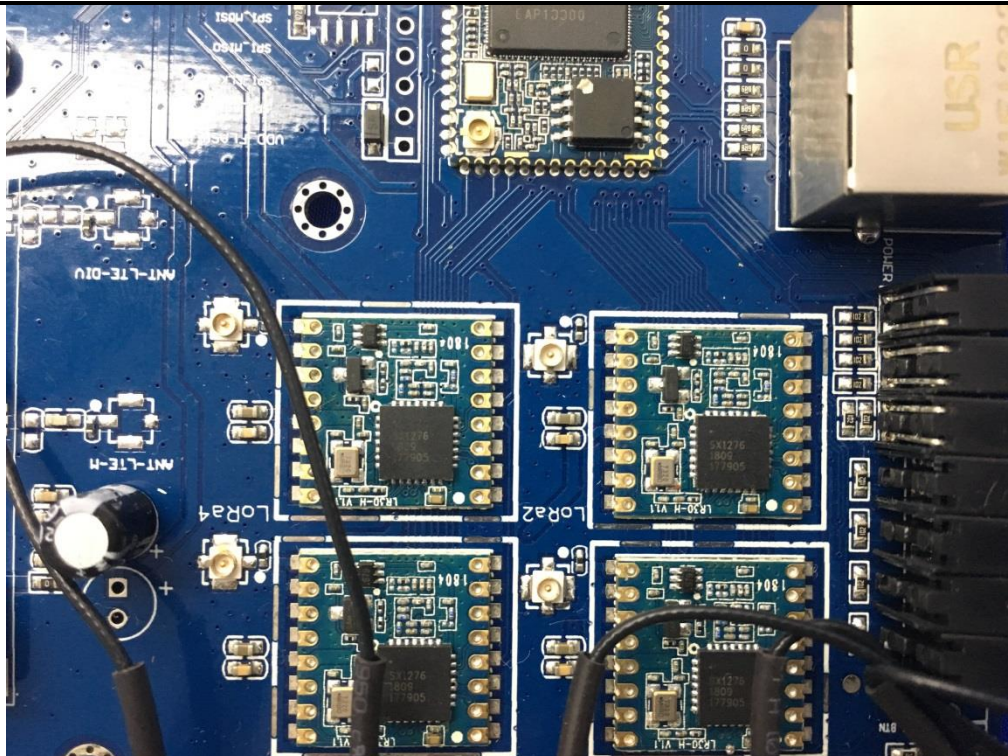












-----End of report-----