

TEST REPORT

Applicant: Dragino Technology Co., Limited

Address of Applicant: Room 1101, City Invest Commercial Center, No.546
QingLinRoad LongCheng Street, LongGang District, Shenzhen
518116,China

Manufacturer/Factory: Dragino Technology Co., Limited

**Address of
Manufacturer/Factory:** Room 1101, City Invest Commercial Center, No.546
QingLinRoad LongCheng Street, LongGang District, Shenzhen
518116,China

Equipment Under Test (EUT)

Product Name: LoRa I/O Controller

Model No.: LT-33222-L

Trade Mark: Dragino

Applicable standards: ETSI EN 301 489-1 V2.1.1 (2017-02)
Final draft ETSI EN 301 489-3 V2.1.1 (2017-03)

Date of sample receipt: November 01, 2018

Date of Test: November 02-14, 2018

Date of report issue: November 15, 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.

Robinson Lo
Laboratory Manager



This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	November 15, 2018	Original

Prepared By:

Bill. Yuan

Date:

November 15, 2018

Project Engineer

Check By:

Robinson

Date:

November 15, 2018

Reviewer

3 Contents

	Page
1 COVER PAGE.....	1
2 VERSION.....	2
3 CONTENTS	3
4 TEST SUMMARY	4
5 GENERAL INFORMATION.....	5
5.1 GENERAL DESCRIPTION OF EUT	5
5.2 OPERATING MODES	6
5.3 DESCRIPTION OF SUPPORT UNITS	6
5.4 DEVIATION FROM STANDARDS.....	6
5.5 ABNORMALITIES FROM STANDARD CONDITIONS	6
5.6 TEST FACILITY.....	6
5.7 TEST LOCATION	6
6 TEST INSTRUMENTS LIST	7
7 EMC REQUIREMENTS SPECIFICATION IN ETSI EN 301489-3.....	9
7.1 EMISSION.....	9
7.1.1 Radiated Emission.....	9
7.2 IMMUNITY	12
7.2.1 Electrostatic Discharge.....	13
7.2.2 Radiated Immunity.....	15
8 TEST SETUP PHOTO.....	17
9 EUT CONSTRUCTIONAL DETAILS	19

4 Test Summary

EMI Test				
Test Item	Test Requirement	Test Method	Application	Result
Radiated Emission	ETSI EN 301 489-3	ETSI EN301 489-1	Enclosure	Pass
Conducted Emission	ETSI EN 301 489-3	ETSI EN301 489-1	AC port	N/A
Harmonic Current Emissions	ETSI EN 301 489-3	ETSI EN301 489-1	AC port	N/A
Voltage Fluctuations and Flicker	ETSI EN 301 489-3	ETSI EN301 489-1	AC port	N/A
EMS Test				
ESD (Electrostatic Discharge)	ETSI EN 301 489-3	EN 61000-4-2	Enclosure	Pass
Radiated Immunity, 80MHz to 6 GHz	ETSI EN 301 489-3	EN 61000-4-3	Enclosure	Pass
EFT (Electrical Fast Transients)	ETSI EN 301 489-3	EN 61000-4-4	AC port	N/A
Surge Immunity	ETSI EN 301 489-3	EN 61000-4-5	AC port	N/A
Injected Currents 150kHz to 80MHz	ETSI EN 301 489-3	EN 61000-4-6	AC port	N/A
Voltage Dips and Interruptions	ETSI EN 301 489-3	EN 61000-4-11	AC port	N/A

Pass: The EUT complies with the essential requirements in the standard.

N/A: not applicable.

5 General Information

5.1 General Description of EUT

Product Name:	LoRa I/O Controller
Model No.:	LT-33222-L
Operation Frequency:	868.4MHz(Declared by manufacturer)
Occupied bandwidth	200kHz(Declared by manufacturer)
Number of Channels:	1
Antenna type:	External Antenna
Modulation type:	FSK
Antenna Gain:	0dBi(Max)
Power supply:	DC 12V

5.2 Operating Modes

Operation mode	Keep the EUT in normal Operation mode.
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5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
GS	Supreme maintenance Free	S5D26R-MFZ	9442804454

5.4 Deviation from Standards

None.

5.5 Abnormalities from Standard Conditions

None.

5.6 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● FCC —Registration No.: 381383 Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018. ● Industry Canada (IC) —Registration No.: 9079A-2 The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.
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5.7 Test Location

RI test was performed at:
SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab, No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.s
All other tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 27 2018	June. 26 2019
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 27 2018	June. 26 2019
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 27 2018	June. 26 2019
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 27 2018	June. 26 2019
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 27 2018	June. 26 2019
9	Coaxial Cable	GTS	N/A	GTS211	June. 27 2018	June. 26 2019
10	Coaxial cable	GTS	N/A	GTS210	June. 27 2018	June. 26 2019
11	Coaxial Cable	GTS	N/A	GTS212	June. 27 2018	June. 26 2019
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 27 2018	June. 26 2019
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 27 2018	June. 26 2019
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 27 2018	June. 26 2019
15	Band filter	Amindeon	82346	GTS219	June. 27 2018	June. 26 2019
16	Power Meter	Anritsu	ML2495A	GTS540	June. 27 2018	June. 26 2019
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 27 2018	June. 26 2019
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 27 2018	June. 26 2019
19	Splitter	Agilent	11636B	GTS237	June. 27 2018	June. 26 2019
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 27 2018	June. 26 2019

ESD						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	ESD Simulator	KIKUSUI	KES4021A	GTS242	June. 27 2018	June. 26 2019
2	Thermo meter	KTJ	TA328	GTS243	June. 27 2018	June. 26 2019

Radiated Immunity (80MHz-6GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Fully-Anechoic Chamber 2	Chang Zhou Zhong Shuo	854	SEM001-05	2017-05-10	2020-05-09
Measurement Software	Rohde & Schwarz	EMC32 V9.25.00	N/A	N/A	N/A
Signal Generator	Rohde & Schwarz	SMB100A	SEM006-11	2018-04-02	2019-04-01
Broadband Amplifier(80MHz-1GHz)	Rohde & Schwarz	BBA150-BC250	SEM005-12	2018-09-26	2019-09-25
Broadband Amplifier(800MHz-3GHz)	Rohde & Schwarz	BBA150-D110	SEM005-13	2018-04-02	2019-04-01
Broadband Amplifier(2.5GHz-6GHz)	Rohde & Schwarz	BBA150-E60	SEM005-16	2018-04-13	2019-04-12
Power Sensor	Rohde & Schwarz	NRP-Z91	SEM009-09	2018-04-02	2019-04-01
Stacked Log.-Per.-Broadband Antenna(70MHz-10GHz)	Schwarzbeck	STLP 9129	SEM003-25	N/A	N/A
Amplifier(10kHz-250MHz)	Amplifier Research	75A250A	SEM005-11	2018-04-02	2019-04-01
Universal Radio Communication Tester	Rohde & Schwarz	CMU 200	SEM010-01	2018-09-26	2019-09-25
Universal Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-03	2018-04-02	2019-04-01
Conditioning Amplifier	Brüel & Kjaer	2690-OS2	SEM005-10	2018-04-20	2019-04-19
Mouth Simulator	Brüel & Kjaer	4227	SEM017-01	2018-04-10	2019-04-09
Signal Source	Brüel & Kjaer	4231	SEM017-02	2018-04-14	2019-04-13
Audio Analyzer	Rohde & Schwarz	UPV	SEM008-03	2018-09-26	2019-09-25

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 27 2018	June. 26 2019
2	Barometer	ChangChun	DYM3	GTS255	June. 27 2018	June. 26 2019

7 EMC Requirements Specification in ETSI EN 301489-3

7.1 Emission

7.1.1 Radiated Emission

Test Requirement:	ETSI EN 301 489-3				
Test Method:	ETSI EN 301 489-1 and EN55016-2-3				
Test Frequency Range:	30MHz to 6GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
AV		1MHz	3MHz	Average Value	
Limit:	Frequency	Limit (dBuV/m @3m)		Remark	
	30MHz-230MHz	40.00		Quasi-peak Value	
	230MHz-1GHz	47.00		Quasi-peak Value	
	1GHz-3GHz	50.00		Average Value	
		70.00		Peak Value	
3GHz-6GHz	54.00		Average Value		
	74.00		Peak Value		
Test setup:	Below 1GHz				
Test setup:	Above 1GHz				

<p>Test Procedure:</p>	<p>■ From 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 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 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.
<p>Test environment:</p>	<p>Temp.: 25 °C Humid.: 50% Press.: 1 010mbar</p>
<p>Measurement Record:</p>	<p>Uncertainty: ± 4.5dB</p>
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.2 for details ,</p>
<p>Test results:</p>	<p>Pass</p>

**Measurement Data
Below 1GHz**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarity
31.73	53.63	11.24	0.57	35.13	30.31	40.00	-9.69	Vertical
37.16	44.48	11.70	0.63	35.49	21.32	40.00	-18.68	Vertical
60.28	38.55	11.18	0.86	36.33	14.26	40.00	-25.74	Vertical
70.83	40.40	7.49	0.95	36.45	12.39	40.00	-27.61	Vertical
96.78	34.02	11.72	1.17	36.69	10.22	40.00	-29.78	Vertical
460.73	35.01	16.57	3.14	37.51	17.21	47.00	-29.79	Vertical
31.62	41.50	11.23	0.57	35.12	18.18	40.00	-21.82	Horizontal
40.42	41.54	12.21	0.66	35.69	18.72	40.00	-21.28	Horizontal
48.33	38.64	12.29	0.75	36.10	15.58	40.00	-24.42	Horizontal
177.51	38.52	8.80	1.73	37.23	11.82	40.00	-28.18	Horizontal
242.53	35.02	11.93	2.08	37.37	11.66	47.00	-35.34	Horizontal
369.41	34.19	14.83	2.72	37.49	14.25	47.00	-32.75	Horizontal

Above 1GHz

Peak measurement

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarity
1110.00	41.87	24.56	4.44	35.68	35.19	70.00	-34.81	Vertical
2035.00	39.05	26.49	5.76	36.73	34.57	70.00	-35.43	Vertical
3035.00	36.33	28.58	7.28	37.40	34.79	74.00	-39.21	Vertical
3960.00	37.69	29.50	8.68	37.50	38.37	74.00	-35.63	Vertical
4960.00	38.54	31.63	9.48	37.60	42.05	74.00	-31.95	Vertical
5950.00	37.11	32.68	10.25	36.55	43.49	74.00	-30.51	Vertical
1245.00	41.40	24.89	4.58	35.88	34.99	70.00	-35.01	Horizontal
2795.00	35.55	28.23	6.91	37.28	33.41	70.00	-36.59	Horizontal
3270.00	37.81	28.44	7.63	37.43	36.45	74.00	-37.55	Horizontal
4170.00	37.54	30.01	8.87	37.52	38.90	74.00	-35.10	Horizontal
5110.00	37.13	31.68	9.59	37.47	40.93	74.00	-33.07	Horizontal
5795.00	38.37	32.31	10.14	36.71	44.11	74.00	-29.89	Horizontal

Remarks:

1. The EUT was test at 3m in field chamber.
2. If the average limit is met when using a Peak detector, the EUT shall be deemed to meet both peak and average limits. And measurement with the average detector is unnecessary.
3. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

7.2 Immunity

Performance Criteria of ETSI EN 301 489-3, clause 6	
Continuous phenomena applied to transmitters (CT)	<ol style="list-style-type: none"> 1. During the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check). 2. At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. 3. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
Transient phenomena applied to Transmitters (TT)	<ol style="list-style-type: none"> 1. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. 2. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained. 3. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
Continuous phenomena applied to Receivers (CR)	<ol style="list-style-type: none"> 1. During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence. 2. During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check). 3. At the conclusion of the test, the EUT shall operate as intended with no loss of user control the The communication link shall have been maintained.
Transient phenomena applied to Receivers (TR)	<ol style="list-style-type: none"> 1. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. 2. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained
Ancillary equipment tested on a stand alone basis	<p>If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in the clauses above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.</p>

7.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN 301 489-3
Test Method:	EN 61000-4-2
Discharge Voltage:	Contact Discharge: $\pm 4\text{kV}$ Air Discharge: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$ HCP/VCP: $\pm 4\text{kV}$
Polarity:	Positive & Negative
Number of Discharge:	Contact Discharge: Minimum 10 times at each test point, Air Discharge: Minimum 10 times at each test point.
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Limit:	Criteria B
Test setup:	
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 25 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</p>

	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.
Test environment:	Temp.: 24 °C Humid.: 51% Press.: 1 010mbar
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

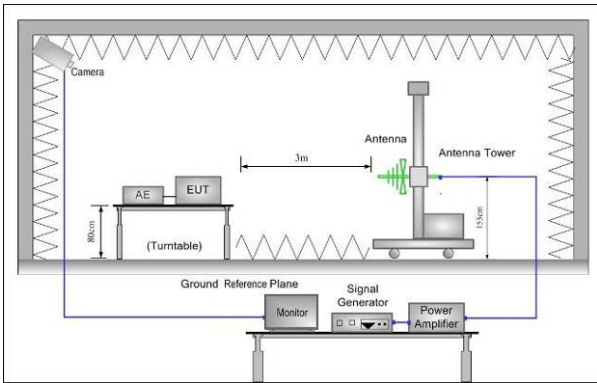
Measurement Record:

Test points:	I: Metal, Screws			
	II: Gap, Holes			
Direct discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observations Performance	Result
± 2, ± 4	Contact	I	A	Pass
± 2, ± 4, ± 8	Air	II	A	Pass
Indirect discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observation Performance	Result
± 2, ± 4	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	A	Pass
± 2, ± 4	VCP-Front/Back /Left/Right	Center of the VCP	A	Pass

Remark:

A: No degradation in performance of the EUT was observed.

7.2.2 Radiated Immunity

Test Requirement:	ETSI EN 301 489-3
Test Method:	EN 61000-4-3
Frequency range:	80MHz to 6GHz
Test Level:	3V/m
Modulation:	80%, 1kHz Amplitude Modulation
Performance Criterion:	Criteria A
Test setup:	
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.: 25 °C	Humid.: 52%	Press.: 1 010mbar
Test Instruments:	Refer to section 6.0 for details		
Test mode:	Refer to section 5.2 for details		
Test results:	Pass		

Measurement Record:

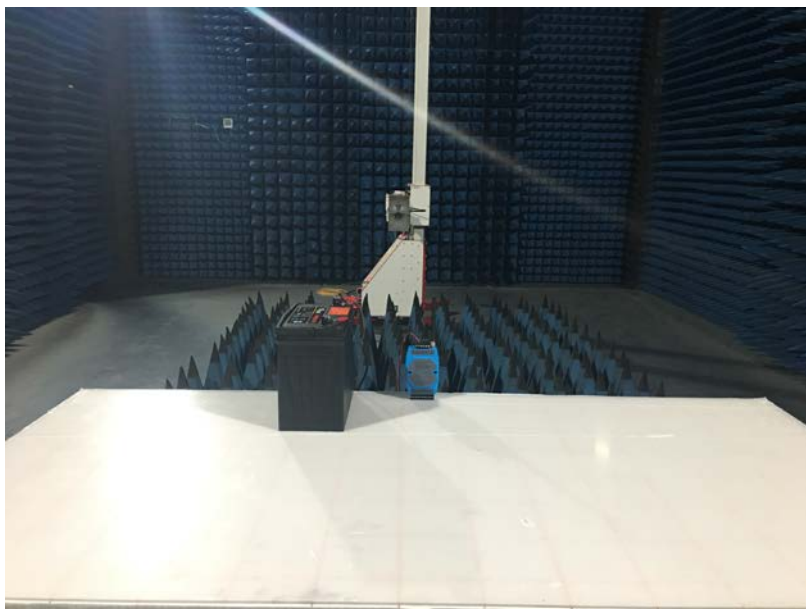
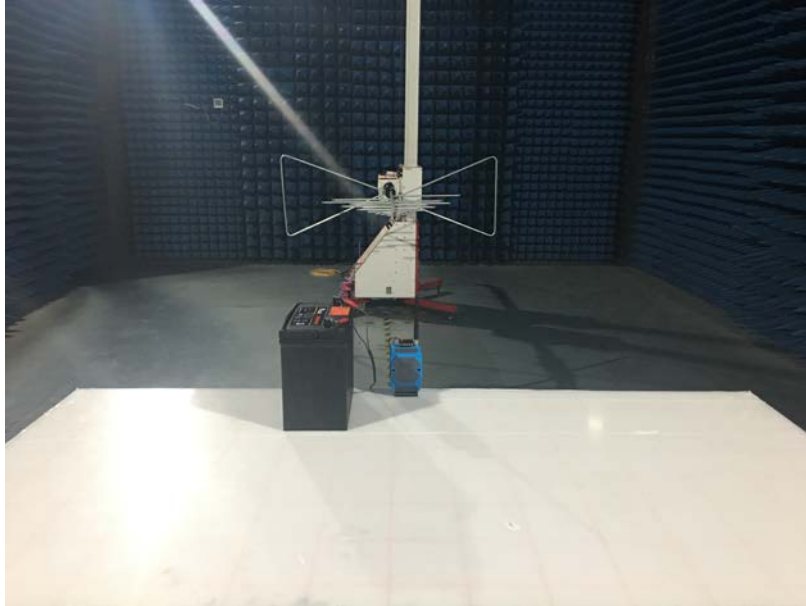
Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)
80 MHz-6 GHz	3 V/m	1 kHz, 80 % Amp. Mod, 10 % increment, dwell time=3seconds	V	Front	A
			H		A
			V	Rear	A
			H		A
			V	Left	A
			H		A
			V	Right	A
			H		A
			V	Top	A
			H		A
			V	Bottom	A
			H		A

Remarks:

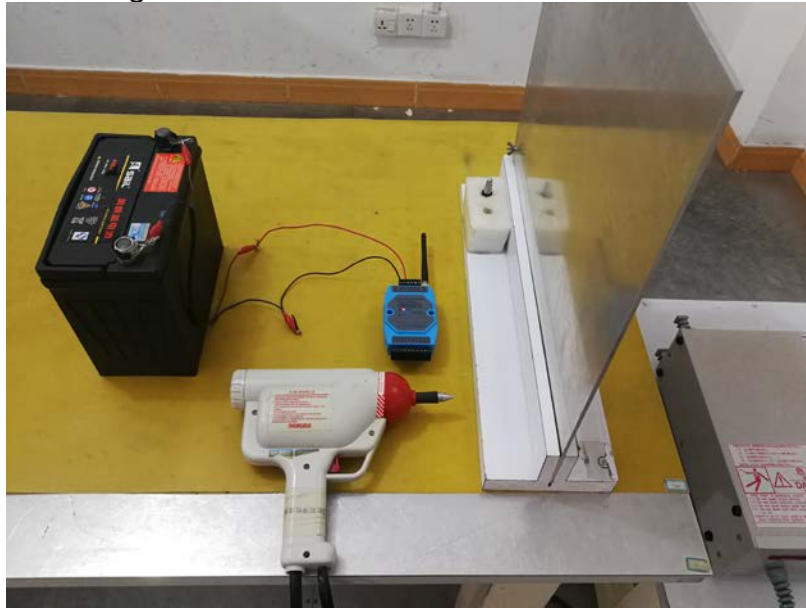
A: No degradation in performance of the EUT was observed.

8 Test Setup Photo

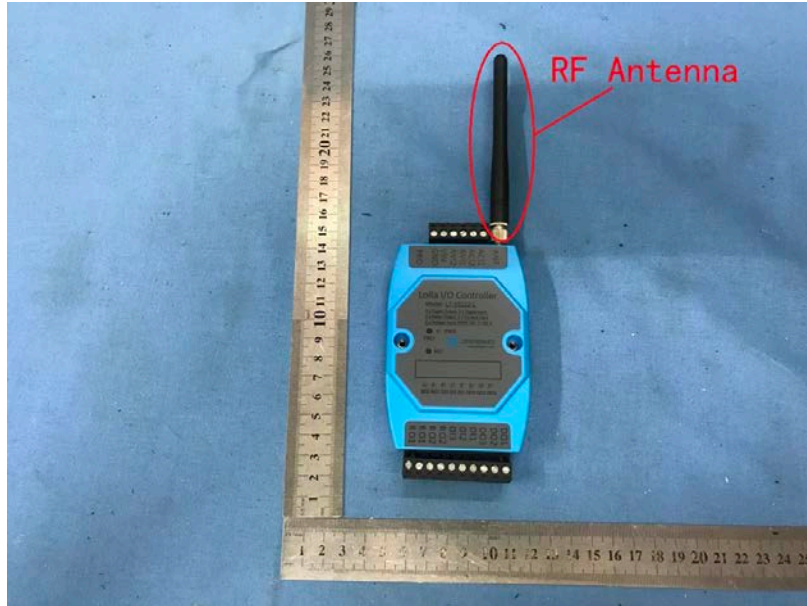
Radiated Emission

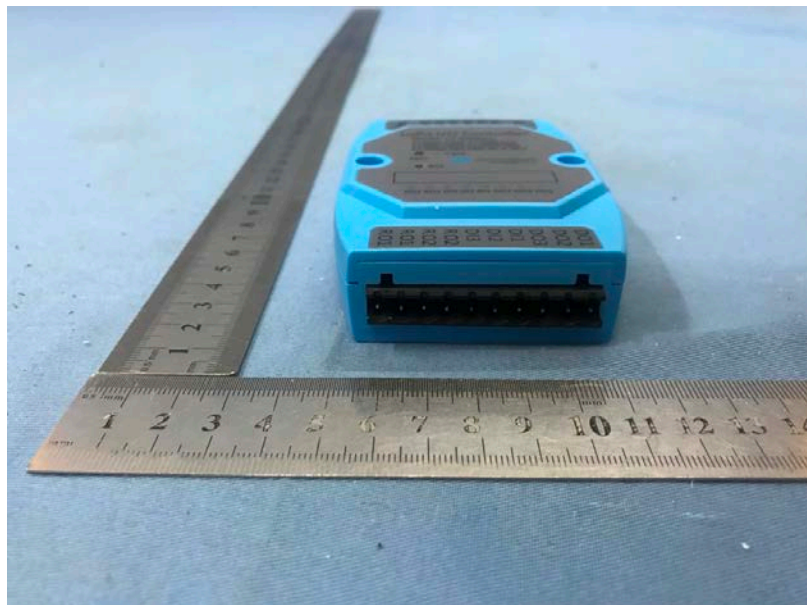
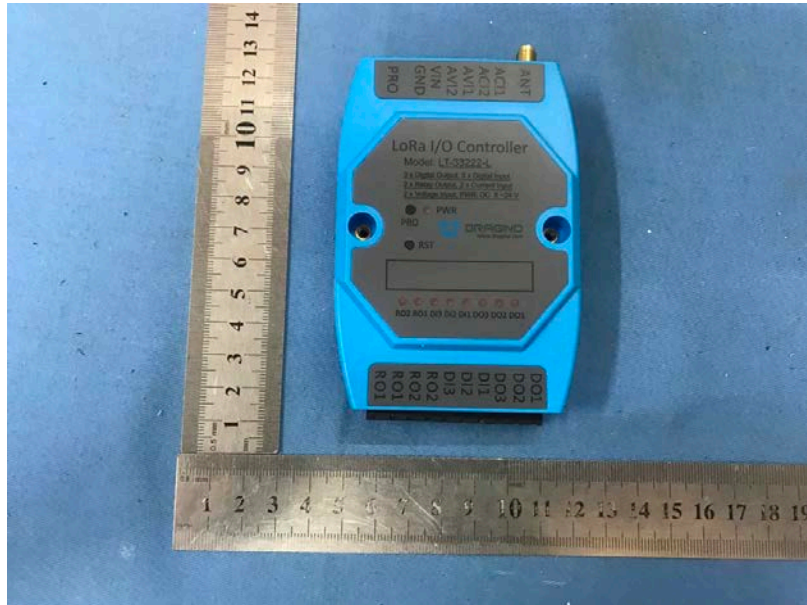


Electrostatic discharge

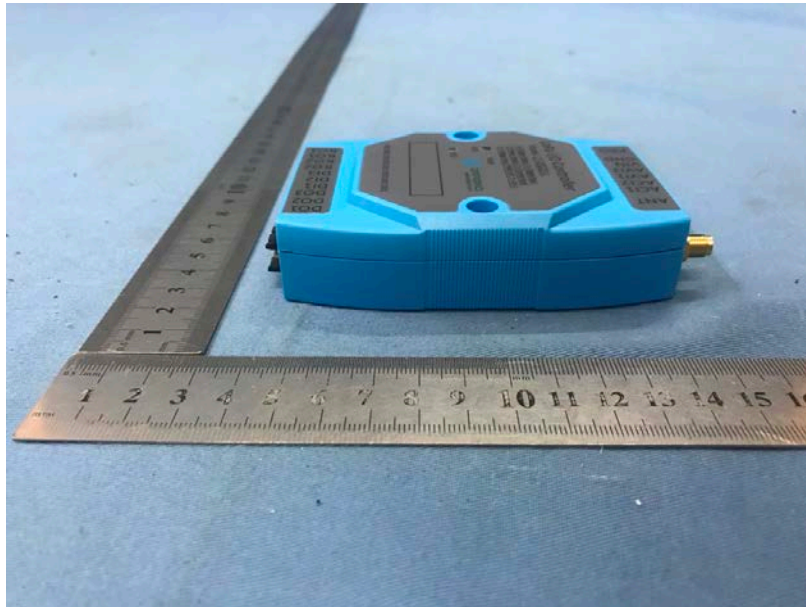


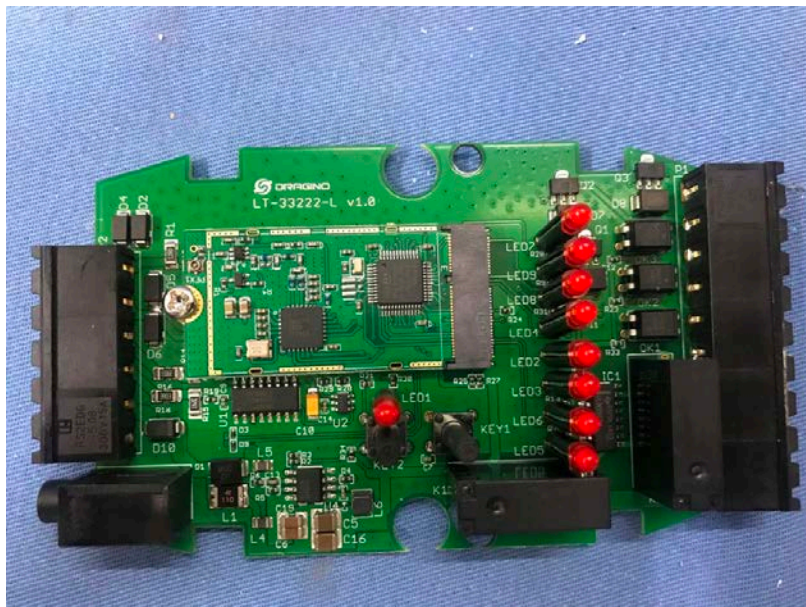
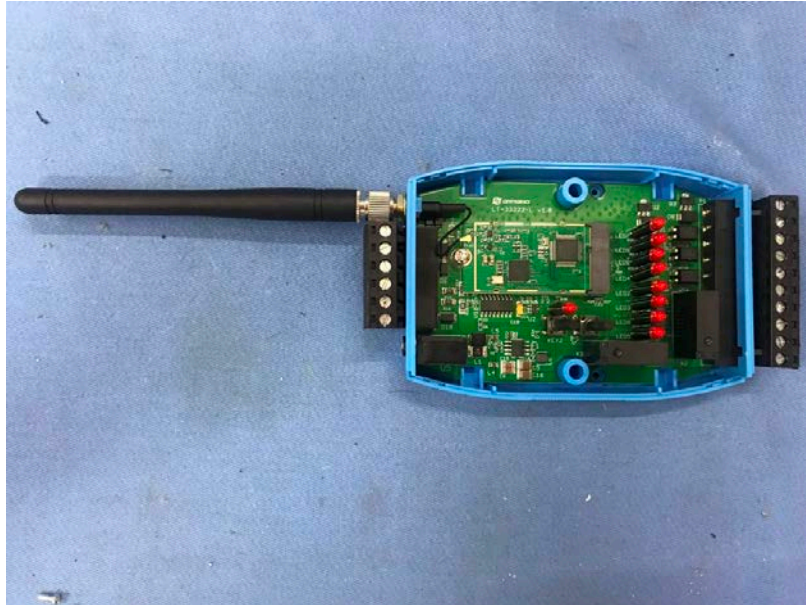
9 EUT Constructional Details

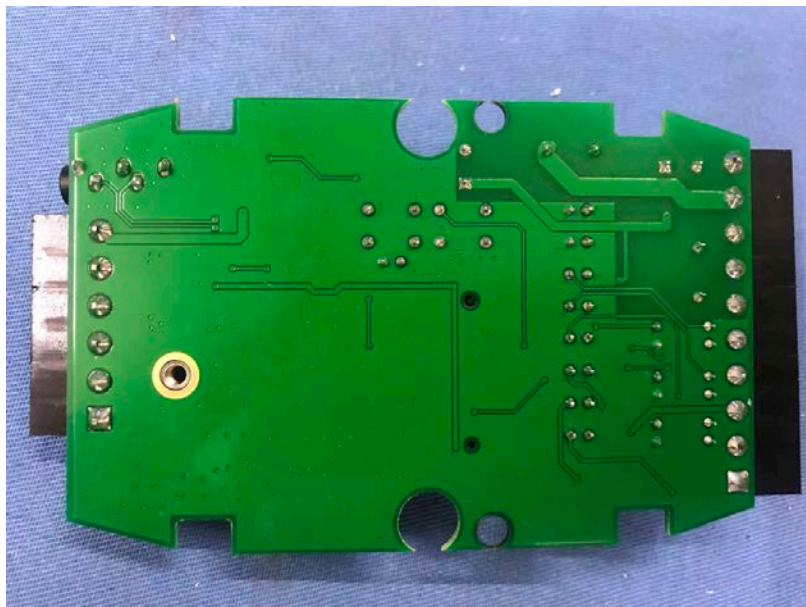
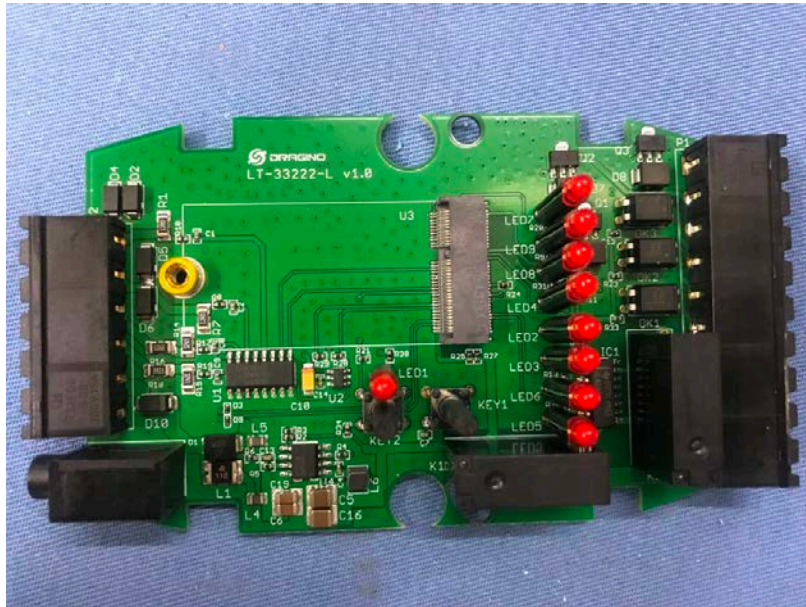


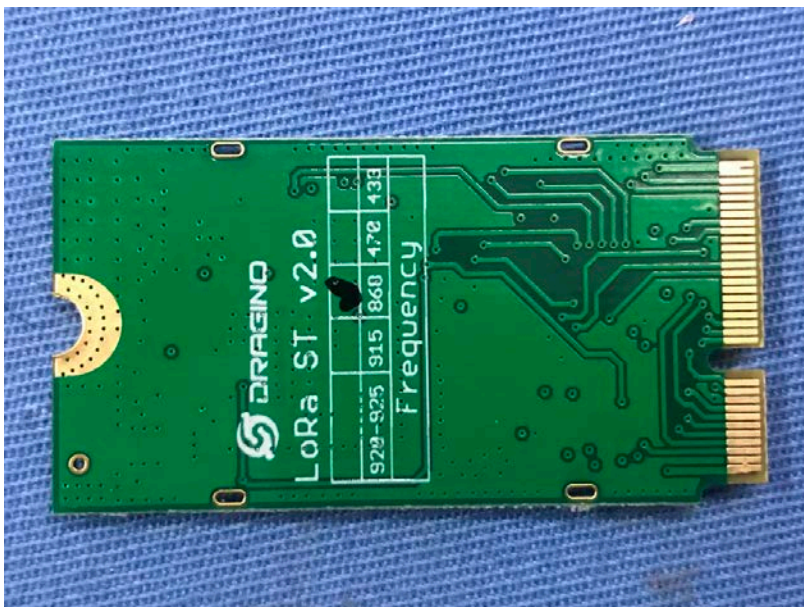












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