

ETSI EN 301 489-1 V2.2.3 (2019-11)
DRAFT ETSI EN 301 489-3 V2.1.2 (2021-03)

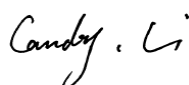
TEST REPORT

For

Dragino Technology Co., Limited

Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng
Street, LongGang District, Shenzhen 518116, China

Tested Model: RS485-BL
Multiple Model: LSE01, LDDS20, LDDS75

Report Type: Original Report	Product Type: LoRaWAN IoT Sensor
Report Number: <u>SZ1210331-09263E-02</u>	
Report Date: <u>2021-04-15</u>	
Reviewed By: <u>Candy Li</u> RF Engineer	
Prepared By: Shenzhen Accurate Technology Co., Ltd. 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China Tel: (0755) 26503290 Fax: (0755) 26503396 Http://www.atc-lab.com	

Note: Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
OBJECTIVE	3
PERFORMANCE CRITERION	4
TEST METHODOLOGY	4
TEST FACILITY	4
MEASUREMENT UNCERTAINTY	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL I/O CABLE.....	6
BLOCK DIAGRAM OF TEST SETUP	6
SUMMARY OF TEST RESULTS.....	7
TEST EQUIPMENT LIST	8
TEST SYSTEM SETUP.....	9
EMI TEST RECEIVER SETUP.....	9
CORRECTED AMPLITUDE & MARGIN CALCULATION	10
TEST RESULTS SUMMARY.....	10
§7.2 - RF ELECTROMAGNETIC FIELD (80 MHz to 6000 MHz).....	13
TEST SYSTEM SETUP.....	13
TEST STANDARD	13
TEST PROCEDURE	14
TEST DATA AND SETUP PHOTO	14
§7.2 - ELECTROSTATIC DISCHARGE	16
TEST SYSTEM SETUP.....	16
TEST STANDARD	16
EXHIBIT A - EUT PHOTOGRAPHS.....	21
EXHIBIT B – Declaration of Similarity	22
EXHIBIT C - TEST SETUP PHOTOGRAPHS	23

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	LoRaWAN IoT Sensor
Tested Model	RS485-BL
Multiple Model	LSE01, LDDS20, LDDS75
Model Differences	Refer to the DoS letter
Voltage Range	DC3.6V by battery
Date of Test	2021-03-25 to 2021-04-11
Sample serial number	SZ1210331-09263E-RF-S1 (Assigned by ATC)
Received date	2021-03-17
Sample/EUT Status	Good condition

Objective

This test report is in accordance with ETSI EN 301 489-1 V2.2.3 (2019-11), ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility; DRAFT ETSI EN 301 489-3 V2.1.2 (2021-03), ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard for ElectroMagnetic Compatibility

The objective is to determine compliance with ETSI EN 301 489-1 V2.2.3 (2019-11), DRAFT ETSI EN 301 489-3 V2.1.2 (2021-03).

Performance criterion

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test. After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

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 reboot or re-start operation is allowed.

Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.3 (2019-11).

Test Facility

Name of Firm: Shenzhen Accurate Technology Co., Ltd

Site Location: 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

Subcontracted Items: Radiated RF Electromagnetic Fields

Subcontractor: Bay Area Compliance Labs Corp.(Shenzhen)

Site Location: 5F(B-West), 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of test at Shenzhen Accurate Technology Co., Ltd is shown as below. And the uncertainty will be taken into consideration for the test data recorded in the report.

Item		Expanded Measurement uncertainty
Conducted Emissions	AC Mains	2.72 dB ($k=2$, 95% level of confidence)
Radiated emission	30MHz-1GHz	4.28 dB ($k=2$, 95% level of confidence)
	1GHz-18GHz	4.98 dB ($k=2$, 95% level of confidence)

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user)

Test Mode 1: SRD operation (Monitor by Spectrum Analyzer)

Equipment Modifications

No modifications were made to the EUT.

Support Equipment List and Details

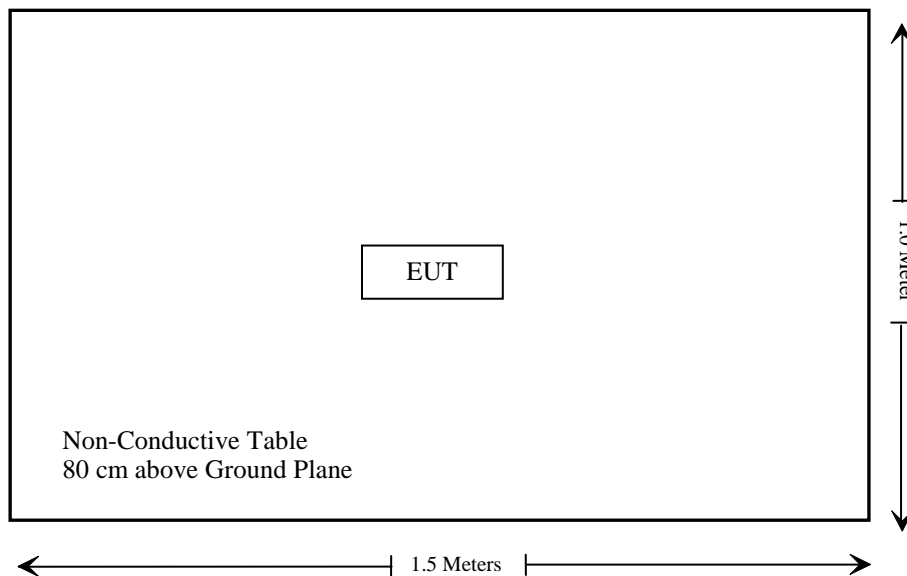
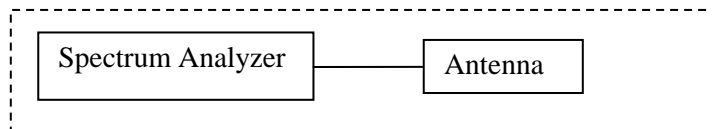
Manufacturer	Description	Model	Serial Number
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495

External I/O Cable

Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup

Test Mode 1:



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§7.1	Reference to clauses EN 301 489-1 §8.4 AC mains power input/output ports	Not Applicable
	Reference to clauses EN 301 489-1 §8.3 DC power input/output ports	Not Applicable
	Reference to clauses EN 301 489-1 §8.2 Enclosure port of ancillary equipment measured on a stand alone basis	Compliance
	Reference to clauses EN 301 489-1 §8.5 Harmonic current emissions (AC mains input port)	Not Applicable
	Reference to clauses EN 301 489-1 §8.6 Voltage fluctuations and flicker (AC mains input port)	Not Applicable
	Reference to clauses EN 301 489-1 §8.7 Wired network ports	Not Applicable
§7.2	Reference to clauses EN 301 489-1 §9.2 Radio frequency electromagnetic field (80 MHz to 6000 MHz) (EN 61000-4-3)	Compliance
	Reference to clauses EN 301 489-1 §9.3 Electrostatic discharge (EN 61000-4-2)	Compliance
	Reference to clauses EN 301 489-1 §9.4 Fast transients, common mode (EN 61000-4-4)	Not Applicable
	Reference to clauses EN 301 489-1 §9.5 Radio frequency, common mode (EN 61000-4-6)	Not Applicable
	Reference to clauses EN 301 489-1 §9.6 Transients and surges in the vehicular environment (ISO 7637-2)	Not Applicable
	Reference to clauses EN 301 489-1 §9.8 Surges (EN 61000-4-5)	Not Applicable
	Reference to clauses EN 301 489-1 §9.7 Voltage dips and interruptions (EN 61000-4-11)	Not Applicable

Not Applicable:

Please refer to Applicability overview tables in sections 7.1 and 7.2 of EN 301 489-1 requirements for Radio and ancillary equipment.

Note: The equipment is powered by battery.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
Rohde& Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Schwarzbeck	Log-periodic antenna	VULB9163	9163-323	2020/01/05	2023/01/04
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Amplifier	SONOMA INSTRUMENT	310 N	186131	2020/12/25	2021/12/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2020/12/25	2021/12/24
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2020/07/08	2021/07/07
Radiated Emission Test Software: EZ EMC V 1.1.4.2					
TESEQ	ESD Generator	NSG 437	823	2020/12/26	2021/12/25

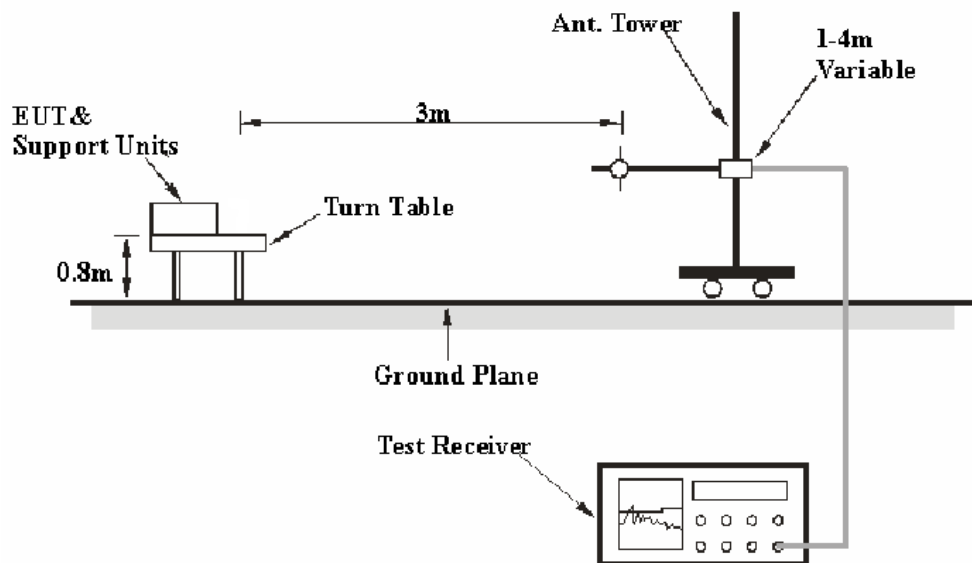
* **Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RS					
HP	Signal Generator	8665B	3744A01692	2020/7/31	2021/7/30
AR	Amplifier	500W1000B	0348446	2021/2/28	2022/2/27
AR	Amplifier	60S1G6	0348712	2021/2/28	2022/2/27
AR	Antenna	ATL80M1G	0348837	NCR	/
AR	Antenna	ATT700M12G	0349411	NCR	/
BACL	Test Software	VEE PRO	V2.3 VXE	NCR	/
HP	Signal Generator	8665B	3744A01692	2020/7/31	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§7.1 - RADIATED EMISSIONS

Test System Setup



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the CISPR 16-1-4:2012, CISPR 16-2-3:2010. The limit was specified in EN 301 489-1.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
1 GHz – 6 GHz	1 MHz	3 MHz	-	Peak
1 GHz – 6 GHz	1 MHz	Reduce Video Bandwidth	-	Peak

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude.}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the EN 301 489-1,

Test Data

Environmental Conditions

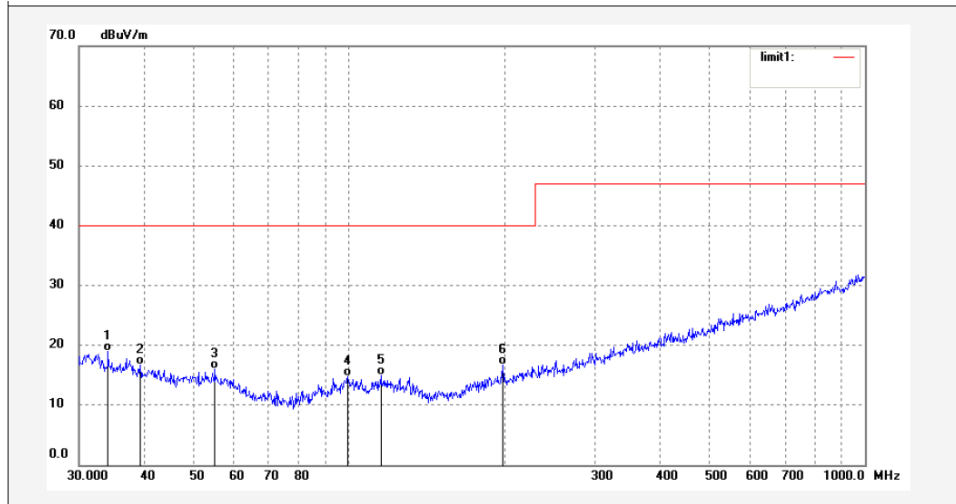
Temperature:	22~25 °C
Relative Humidity:	52~56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding on 2021-04-11.

Test Mode 1:

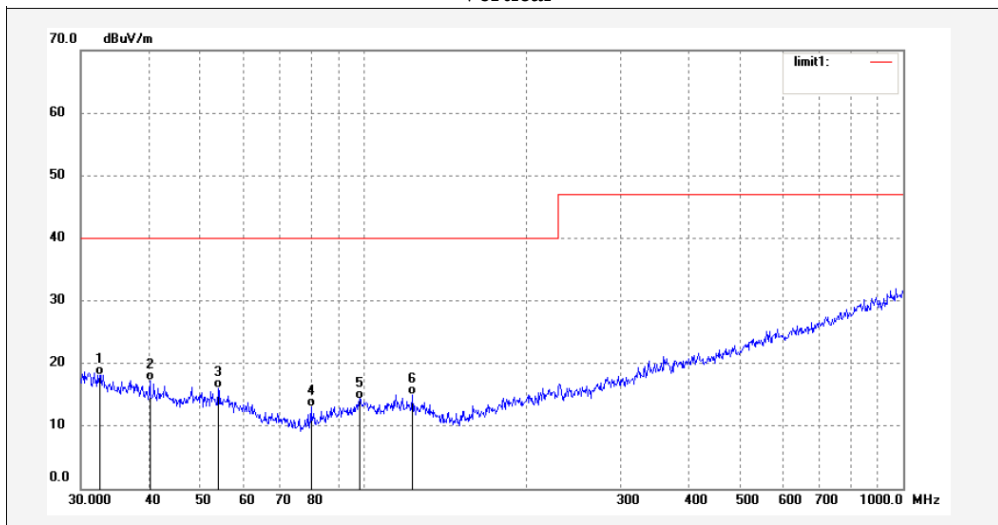
30 MHz-1 GHz:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	34.1561	27.58	-8.67	18.91	40.00	-21.09	QP			
2	39.4371	26.62	-9.98	16.64	40.00	-23.36	QP			
3	55.0274	27.65	-11.64	16.01	40.00	-23.99	QP			
4	99.5281	26.81	-11.94	14.87	40.00	-25.13	QP			
5	115.3205	26.88	-11.92	14.96	40.00	-25.04	QP			
6	198.5880	28.07	-11.43	16.64	40.00	-23.36	QP			

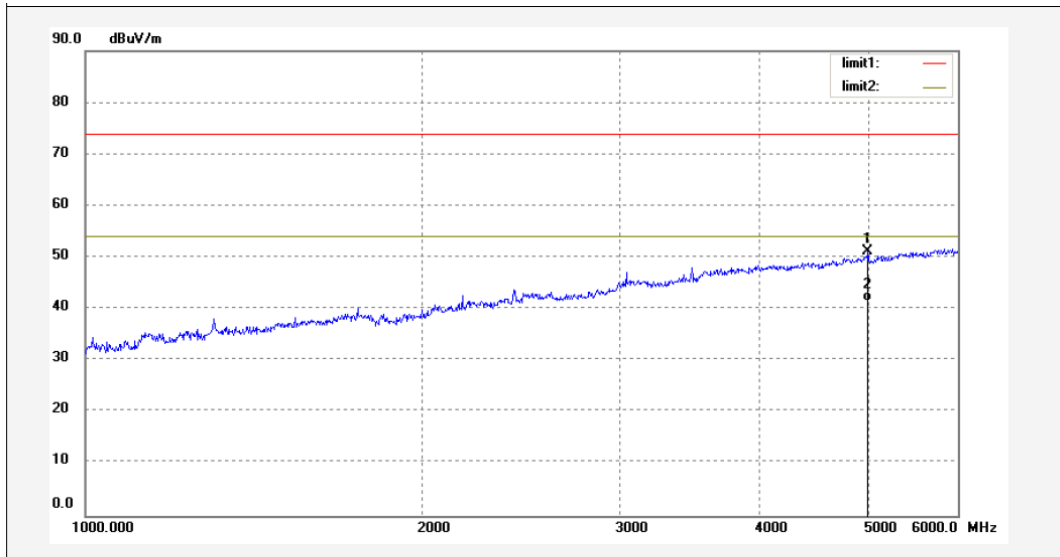
Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	32.5198	26.28	-8.18	18.10	40.00	-21.90	QP			
2	40.2757	27.36	-10.18	17.18	40.00	-22.82	QP			
3	53.8818	27.60	-11.55	16.05	40.00	-23.95	QP			
4	80.0806	28.23	-15.15	13.08	40.00	-26.92	QP			
5	98.4866	26.64	-12.29	14.35	40.00	-25.65	QP			
6	123.2655	27.35	-12.36	14.99	40.00	-25.01	QP			

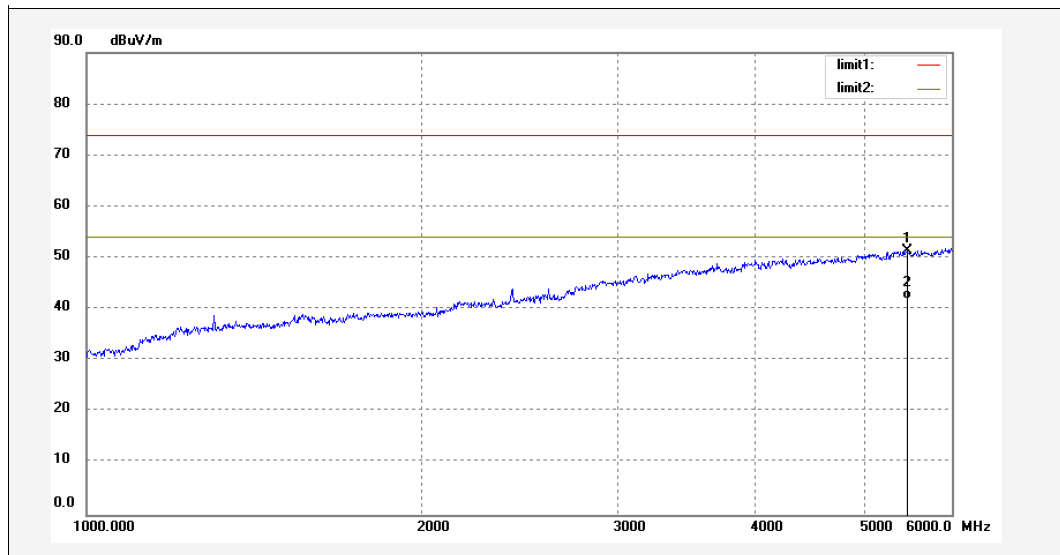
1-6GHz:

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	4988.864	47.90	3.37	51.27	74.00	-22.73	peak			
2	4988.864	38.06	3.37	41.43	54.00	-12.57	AVG			

Vertical



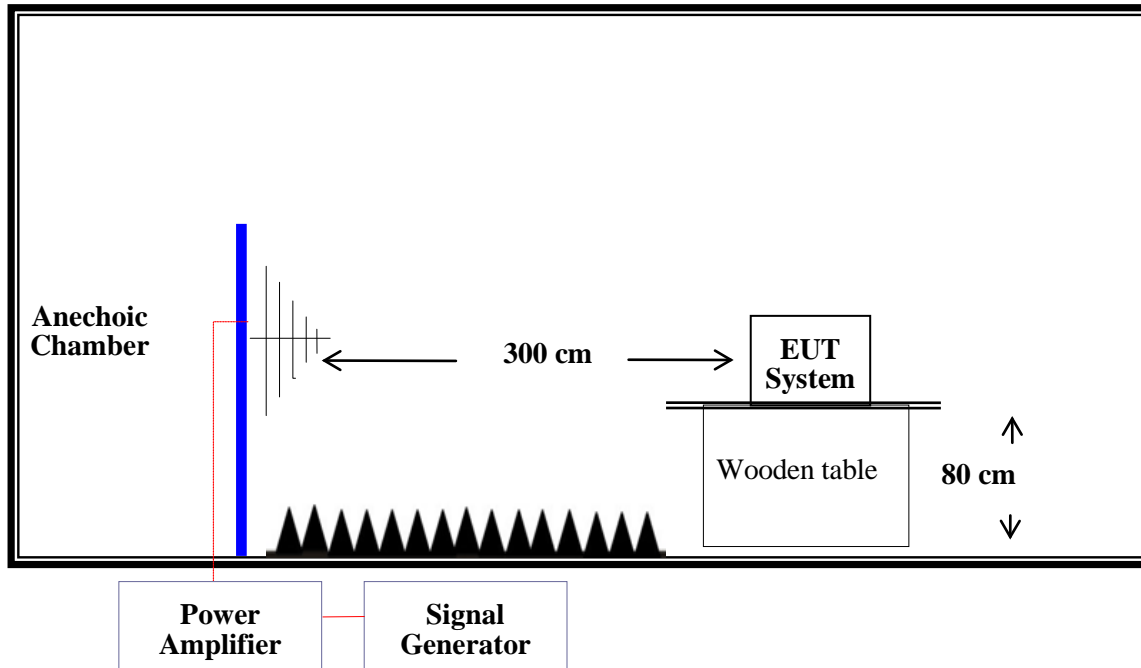
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	5466.224	48.02	3.31	51.33	74.00	-22.67	peak			
2	5466.224	38.56	3.31	41.87	54.00	-12.13	AVG			

Note:

- 1) Corrected Amplitude = Meter Reading + Correction Factor
- 2) Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain
- 3) Margin = Limit – Corrected Amplitude

§7.2 - RF ELECTROMAGNETIC FIELD (80 MHz to 6000 MHz)

Test System Setup



Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-3:2006+A1:2008 +A2: 2010

Test Level

Level	Field Strength (V/m)
1.	1
2.	3
3.	10
X.	Special

Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above the ground. The EUT is set 3 meters away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarizations of the antenna are set on test. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.

In order to judge the EUT performance, a CCD camera and Spectrum Analyzer are used to monitor the EUT.

All the scanning conditions are as follows:

Condition of Test

Remarks

1. Field Strength	3 V/m (Test Level 2)
2. Radiated Signal	Modulated
3. Scanning Frequency	80 - 6000 MHz
4. Frequency step	1%
5. Dwell Time	1 Sec.

Test Data and Setup Photo

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Logic Lin on 2021-04-11.

Test Mode 1:

Modulation: Amplitude 80%, 1 kHz sine wave

Frequency Range (MHz)	Front Side (3 V/m)		Rear Side (3 V/m)		Left Side (3 V/m)		Right Side (3 V/m)	
	VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-6000	A	A	A	A	A	A	A	A

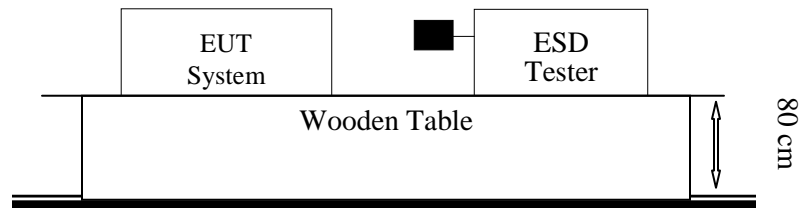
Note: "A" stand for, during test, operate as intended No loss function, no degradation of performance, no unintentional transmissions. and after test, no degradation of performance, no loss of function, no loss of stored data or user programmable functions.



Test Setup Photo

§7.2 - ELECTROSTATIC DISCHARGE

Test System Setup



Remark: ■ is the tip of the electrode

EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 10 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.6 by 0.8-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

Test Standard

ETSI EN 301 489-1 V2.2.3 (2019-11) / EN 61000-4-2:2009

Test Level

Level	Test Voltage Contact Discharge (\pm kV)	Test Voltage Air Discharge (\pm kV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X.	Special	Special

Performance criterion: B

Test Procedure

Air Discharge:

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Contact Discharge:

All the procedure shall be same as Section 8.3.1 of EN 61000-4-2, except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

Indirect discharge for horizontal coupling plane

At least 50 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

Indirect discharge for vertical coupling plane

At least 50 single discharges shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m × 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

Test Data and Setup Photo

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding on 2021-04-11.

Table 1: Electrostatic Discharge Immunity (Air Discharge)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-8 kV	+8 kV	-15 kV	+15 kV
Gap	A	A	A	A	A	A	/	/

Table 2: Electrostatic Discharge Immunity (Direct Contact)

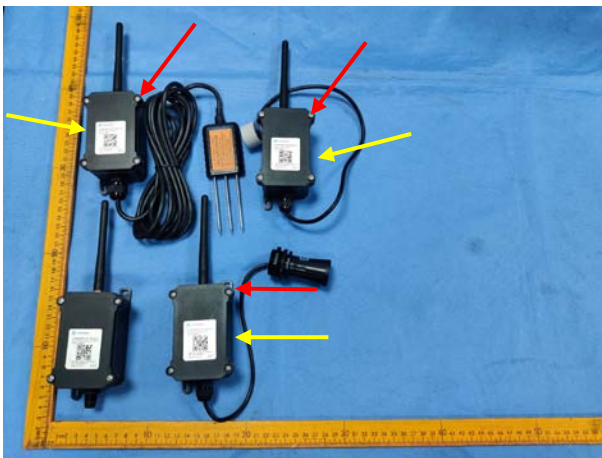
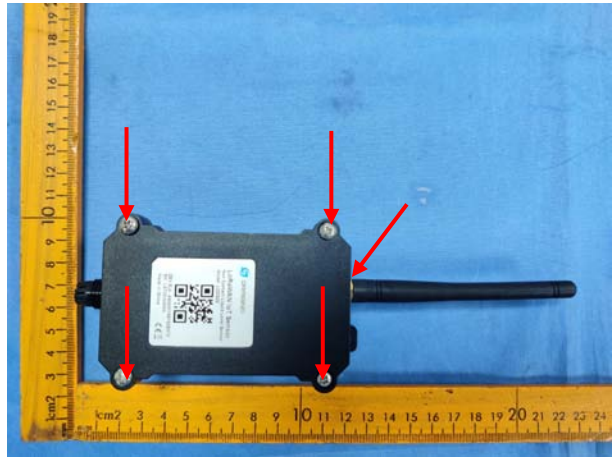
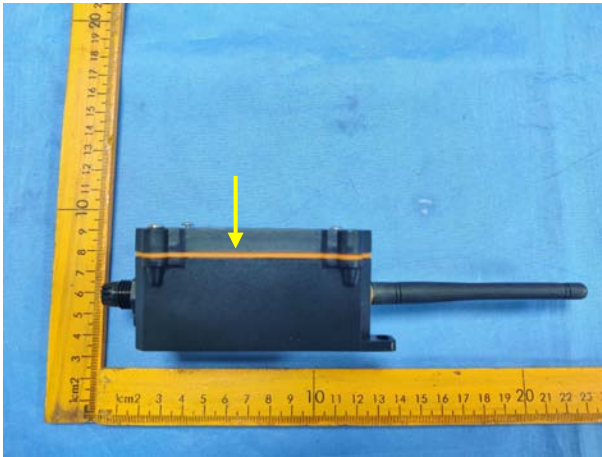
EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Antenna	A	A	A	A	/	/	/	/
Screw	A	A	A	A	/	/	/	/

Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/

Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

EN 61000-4-2 Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/



Note:  represents direct contact  represents air discharge



Test Setup Photo

EXHIBIT A - EUT PHOTOGRAPHS

Please refer to the Attachment.

EXHIBIT B – Declaration of Similarity

Dragino Technology Co., Limited
ADD: Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad
LongCheng Street, LongGang District ; Shenzhen 518116,China
Tel: +86 755 86610829
Fax: +86 755 86647123
Email: edwin@dragino.com

Product Similarity Declaration

Date: 2021-04-19

Dear Sir/Madam,

We, Dragino Technology Co., Limited hereby declare that we have a product named as LoRaWAN IoT Sensor, (model: RS485-BL) were tested by Shenzhen Accurate Technology Co., Ltd., Meanwhile, for our marketing purpose, we would like to list a series model LSE01 , LDDS20 , LDDS75 on reports and certificate. The differences between the main test and the series are as follows:

- SE01: equal to RS485-BL + soil sensor probe (series)
- LDDS75: equal to RS485-BL + Distance Sensor Probe (Series)
- LDDS20: equal to RS485-BL + distance sensor probe (series)

We confirm that all information above is true, and we'll be responsible for all the consequences.
Please contact me if you have any question.

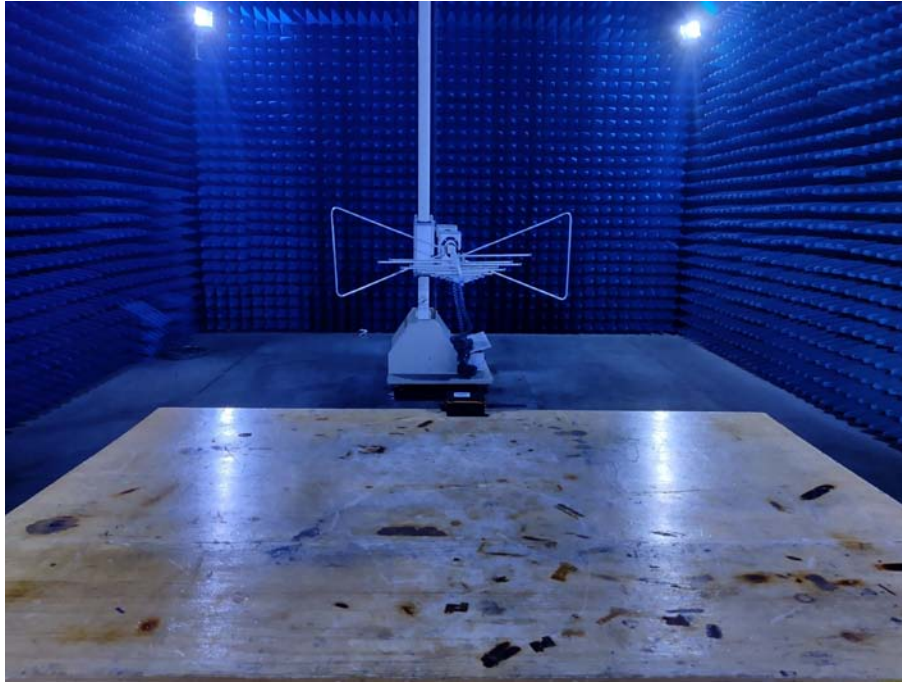
Sincerely Yours,



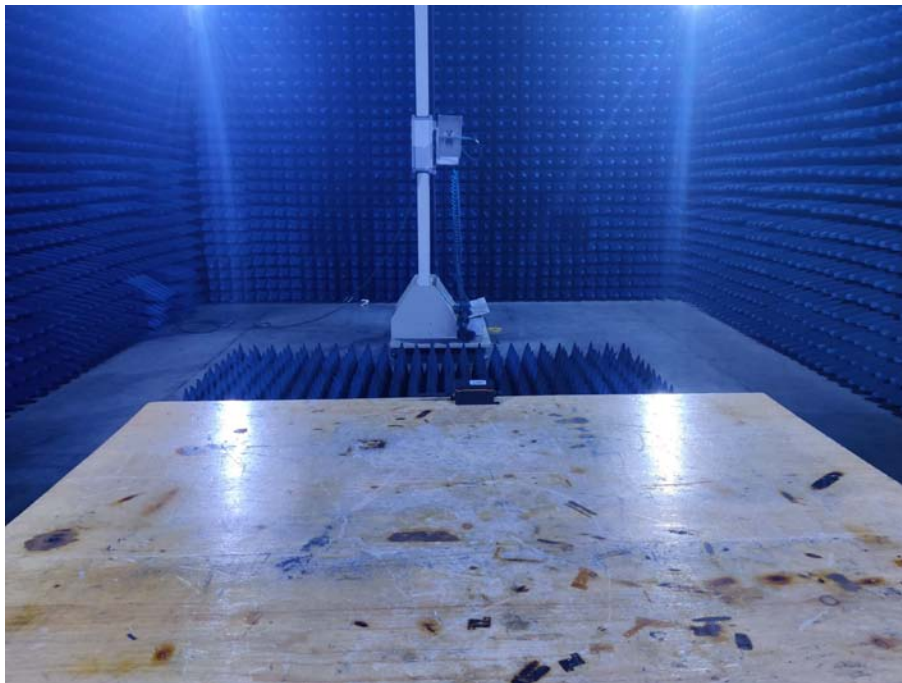
Signature:
Edwin Chen
Title: General Manager

EXHIBIT C - TEST SETUP PHOTOGRAPHS

Radiated Emissions (Below 1 GHz)



Radiated Emissions (Above 1 GHz)



******* END OF REPORT *******