■**Report No.:** DDT-R19050915-1E1

■**Issued Date:** Aug. 01, 2019

EN 301 489 EMC TEST REPORT

FOR

Applicant	:	LJ ELECTRONICS TECHNOLOGY LIMITED
Address	:	Suite 1003,10/F.,Chung Sheung Building,9 Queen Victoria Street,Centra,HONG KONG
Equipment under Test	:	LoRa Tranceiver Module
Model No.	:	LJ1276-868
Trade Mark	:	LJelect
Manufacturer	:	GONGGUAN HOLCHAN ELECTRONICS TECHNOLOGY LIMITED
Address	:	The 2nd Floor (west side),JieAn Industrial Park, The 1st Industrial Road,TuTang Village,ChangPing Town,DongGuan City, GuangDong, ChinaChangPing Town,DongGuan City, GuangDong, China

Issued By: Dongguan Dongdian Testing Service Co., Ltd.

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808

Tel: +86-0769-38826678, **E-mail:** ddt@dgddt.com, **http:**//www.dgddt.com

REPORT

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TEST REPORT DECLARE

Applicant	:	LJ ELECTRONICS TECHNOLOGY LIMITED
Address	:	2904 Research Rd., Champaign, IL 61822, USA
Equipment under Test	:	LoRa Tranceiver Module
Model No.	:	LJ1276-868
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Address	:	The 2nd Floor (west side),JieAn Industrial Park, The 1st Industrial Road,TuTang Village,ChangPing Town,DongGuan City, GuangDong, ChinaChangPing Town,DongGuan City, GuangDong, China

Test Standard Used:
Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);
EN 61000-3-2:2014; EN 61000-3-3:2013

We Declare:
The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment in accordance with above standards about the electromagnetic compatibility requirements of Article 3.1(b) of Directive 2014/53/EU.

Report No:	DDT-R19050915-1E1		
Date of Receipt:	Jul. 04, 2019	**Date of Test:**	Jul. 04, 2019 ~ Jul. 30, 2019

Prepared By: ***Approved By:***

Eddie Liu/Engineer ***Damon Hu/EMC Manager***

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

Revision history

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Aug. 01, 2019	

1. Summary of test results

Description of Test Item	According Standard	Results
EMC emission		
Radiated emission	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**PASS**
Conducted emission(DC power port)	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Conducted emission(AC mains port)	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Harmonic current emissions	EN 61000-3-2:2014	**N/A**
Voltage fluctuation and flicker	EN 61000-3-3:2013	**N/A**
Conducted emission (Telecommunication port)	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Immunity		
Electrostatic discharge	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**PASS**
RF electromagnetic field (80MHz to 6GHz)	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**PASS**
Electrical fast transients	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Conducted disturbance	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Voltage dips and interruptions	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Surge	Draft EN 301 489-1 V2.2.1: 2019-03 Final draft EN 301 489-3 V2.1.1	**N/A**
Note: N/A is an abbreviation for Not Applicable.		

Remark: Performance criteria:

Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (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 2). 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 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). 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 2).
NOTE 1:	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.	
NOTE 2:	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.	

Performance criteria for continuours phenomena applied to Transmitter (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.

Performance criteria for Transient phenomena applied to Transmitters (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.

Performance criteria for Continuous phenomena applied to Receivers (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.

Performance criteria for Transient phenomena applied to Receivers (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.

2. General test information

2.1. Description of EUT

EUT* Name	:	LoRa Tranceiver Module
Model Number	:	LJ1276-868
EUT function description	:	Please reference user manual of this device
Power supply	:	DC 3.3 V
Operation frequency	:	868.1 MHz- 868.5 MHz
Number of Channel	:	3 Channels
Modulation	:	FSK, GFSK, LoRa(Tests done with LoRa Modulation)
Antenna Type	:	Dedicated Antenna, maximum PK gain: 1.2 dBi
Sample Type	:	Series production

Note: EUT is the ab. of equipment under test.

2.2. Accessories of EUT

Description of Accessories	Trade mark	Model number	Serial No.	Other
N/A	N/A	N/A	N/A	N/A

2.3. Assistant equipment used for test

Description of Accessories	Manufacturer	Model number	Serial No.	Other
N/A	N/A	N/A	N/A	N/A

2.4. Block diagram EUT configuration for test

For mode 1: Tx mode

2.5. Decision of final test mode

According pre-test, the worst test modes decided as below and reported.

Emission	Radiated emission	Mode 1: Tx mode
Immunity	Electrostatic discharge	Mode 1: Tx mode
	Continuous radio frequency disturbances	Mode 1: Tx mode

2.6. Deviations of test standard

No Deviation.

2.7. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-25℃
Humidity range:	40-75%
Pressure range:	86-106kPa

2.8. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd.

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808

Tel: +86-0769-38826678, http: //www.dgddt.com, Email: ddt@dgddt.com

CNAS Accreditation No. L6451; A2LA Accreditation No. 3870.01

FCC Designation Number: CN1182; Test Firm Registration Number: 540522

Industry Canada site registration number: 10288A-1

2.9. Measurement uncertainty

Test Item	Uncertainty
Conducted disturbance at mains terminals	3.32dB (150kHz-30MHz)
Uncertainty for telecommunication port conduction emission test	AAN with aLCL = 55 ... 40 dB c: 3.64dB AAN with aLCL = 65 ... 50 dB c: 4.08dB AAN with aLCL = 75 ... 60 dB c: 4.56dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation disturbance test (1GHz to 6GHz)	4.10dB
Uncertainty for Flicker test	0.2%
Uncertainty for Harmonic test	5%
Temperature	0.4℃
Humidity	2%
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3. Conducted Emission Test Report (mains power port)

3.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

3.2. Test Equipment

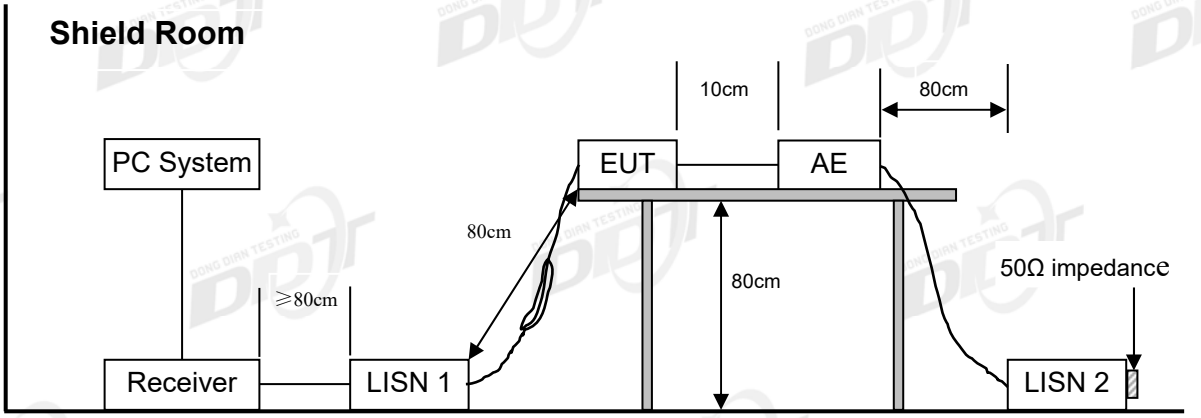
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Test Receiver	R&S	ESCI	100551	Oct. 12, 2018	1 Year
LISN 1	R&S	ENV216	101109	Oct. 12, 2018	1 Year
LISN 2	R&S	ESH2-Z5	100309	Oct. 12, 2018	1 Year
Pulse Limiter	R&S	ESH3-Z2	101242	Oct. 12, 2018	1 Year
CE Cable 1	HUBSER	ESU8/RF2	W10.01	Oct. 12, 2018	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A

3.3. Reference Standard

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

3.4. Block Diagram of Test Setup

For table-top equipment



3.5. Limits

Class A

Frequency			Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz	~	500kHz	79	66
500kHz	~	30MHz	73	60

Class B

Frequency			Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz	~	500kHz	66 ~ 56*	56 ~ 46*
500kHz	~	5MHz	56	46
5MHz	~	30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

3.6. Test Procedure

(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.

(2) Setup the EUT and assistant equipment as shown in section 2.4 and 3.4

(3) The EUT's power adapter was connected to the power mains through a line impedance stabilization network (L.I.S.N). which this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted disturbance. In order to find the maximum emission, the relative positions of equipment and all of the interface cables were changed according to EN 301489 on conducted disturbance emission test.

(4) The bandwidth of test receiver is set at 9 KHz.

(5) The frequency range from 150 KHz to 30MHz is checked.

3.7. Test Result

N/A, because it is powered by battery

4. Radiated emissions test

4.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	Eddie
Test and report Date	:	May 30, 2019

4.2. Test Equipment

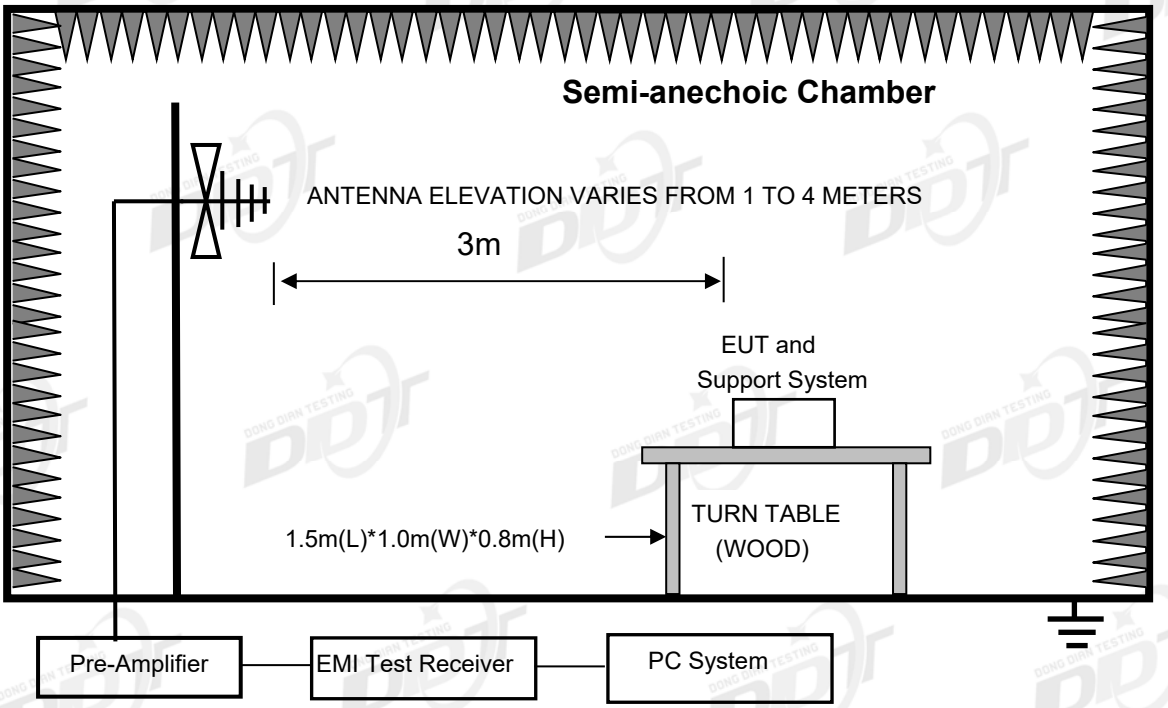
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Radiation 1#chamber (below 1G)					
EMI Test Receiver	R&S	ESU8	100316	Oct. 12, 2018	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	Nov. 09, 2018	1 Year
RF Cable	HUBSER	CP-X2+ CP-X1	W11.03+ W12.02	Oct. 12, 2018	1Year
Test software	Audix	E3	V 6.11111b	N/A	N/A
Radiation 1#chamber (above 1G)					
EMI Test Receiver	R&S	ESU8	100316	Oct. 12, 2018	1 Year
Spectrum analyzer	Agilent	E4447A	MY50180031	Jun. 25, 2019	1 Year
Double Ridged Horn Antenna	R&S	HF907	100276	Nov. 16, 2018	1 Year
Pre-amplifier	TERA-MW	TRLA-0040G35	101303	Oct. 12, 2018	1 Year
Pre-amplifier	A.H.	PAM-0118	360	Oct. 12, 2018	1 Year
RF Cable	N/A	SMAJ-SMAJ-1M + SMAJ-SMAJ-11M	17070133+17070131	Oct. 12, 2018	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A

4.3. Reference Standard

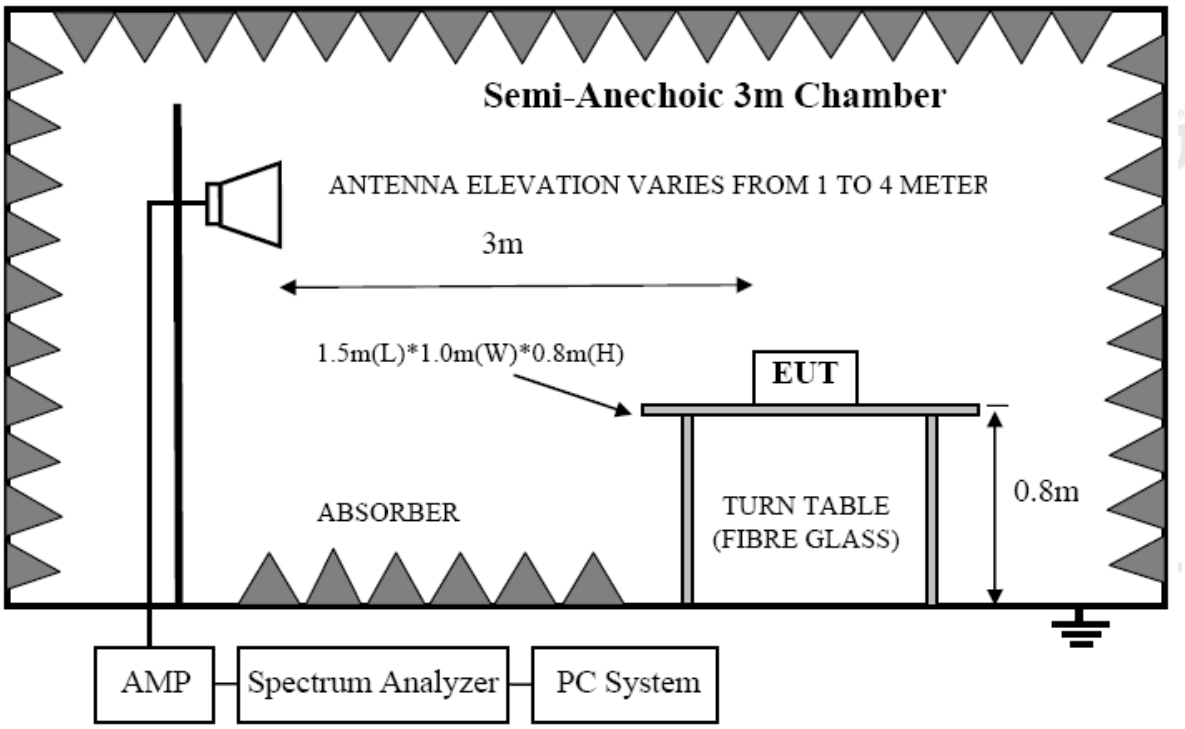
Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

4.4. Block diagram of test setup

Below 1GHz



Above 1GHz



4.5. Radiated disturbance limit of class B

Frequency	Field Strengths Limits at 10m measuring distance dB(μV)/m	Field Strengths Limits at 3m measuring distance dB(μV)/m
30MHz to 230MHz	30	40
230MHz to 1000MHz	37	47
1GHz to 3GHz	/	Average:50; Peak:70
3GHz to 6GHz	/	Average:54; Peak:74

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

(2) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

(3) According EN 301489, if the field-strength measurement at 10 m cannot be made because of high ambient noise levels, or for other reasons, measurement of class B EUT's may be made at a closer distance, for example 3 m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to specified distance for determining compliance.

4.6. Test Procedure

(1) The EUT was placed on a non-metallic table, 80 cm above the ground plane inside an semi-anechoic chamber.

(2) Test antenna was located 3m (see note) from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to EN 301489 on radiated emission test.

(3) Spectrum frequency from 30MHz to ☐1GHz /☒6GHz was investigated.

(4) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to EN301489 on Radiated Emission test.

(5) For emissions from 30MHz to 1GHz, Quasi-Peak values were measured with EMI Receiver and the bandwidth of Receiver is 120 kHz.

(6) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz VBW is set at 3MHz.

4.7. Test result

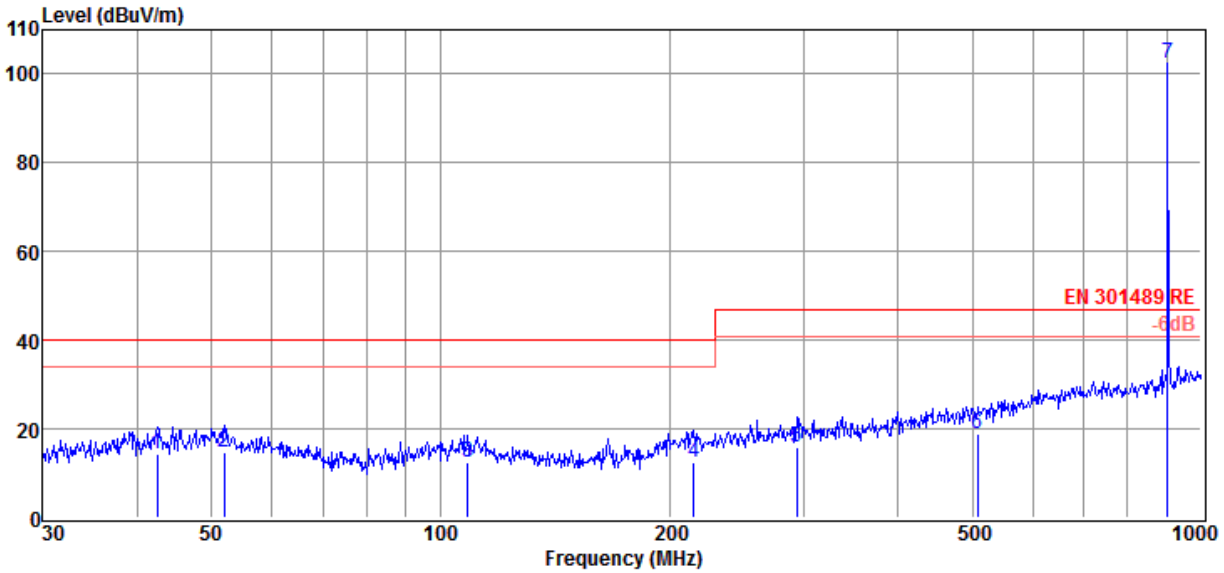
PASS. (See below detailed test result)

Radiated Emission test (below 1GHz)

TR-4-E-009 Radiated Emission Test Result

Test Site	: DDT 3m Chamber 1#	D:\2019 RE1# Report Data\Q19050915-1E\RE.EM6	
Test Date	: 2019-07-24	**Tested By**	: Jerry
EUT	: LoRa Tranceiver Module	**Model Number**	: LJ1276-868
Power Supply	: Battery	**Test Mode**	: Tx mode
Condition	: Temp:24.5'C,Humi:55%,Press:101.4kPa	**Antenna/Distance**	: 2018 VULB 9163 1#/3m/VERTICAL
Memo	: 903.31 MHz is the RF operating frequency of the sample		

Data: 2



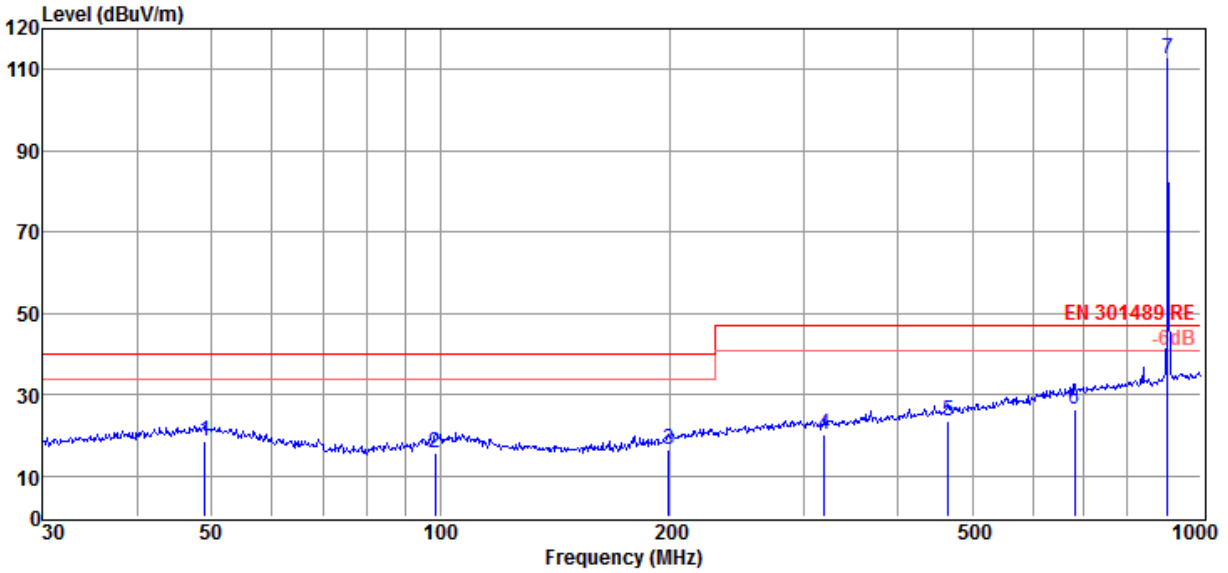
Item (Mark)	Freq. (MHz)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBμV/m)	Limit Line (dBμV/m)	Over Limit (dB)	Detector	Polarization
1	42.45	-3.00	13.72	3.80	14.52	40.00	-25.48	QP	VERTICAL
2	52.03	-3.12	13.90	3.89	14.67	40.00	-25.33	QP	VERTICAL
3	108.65	-3.49	11.79	4.25	12.55	40.00	-27.45	QP	VERTICAL
4	215.27	-4.12	11.87	4.87	12.62	40.00	-27.38	QP	VERTICAL
5	294.11	-3.31	13.87	5.16	15.72	47.00	-31.28	QP	VERTICAL
6	508.26	-4.19	17.23	5.85	18.89	47.00	-28.11	QP	VERTICAL
7	903.31	73.71	21.74	6.93	102.38	47.00	55.38	Working frequency	

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

TR-4-E-009 Radiated Emission Test Result

Test Site	: DDT 3m Chamber 1#	D:\2019 RE1# Report Data\Q19050915-1E\RE.EM6	
Test Date	: 2019-07-24	**Tested By**	: Jerry
EUT	: LoRa Tranceiver Module	**Model Number**	: LJ1276-868
Power Supply	: Battery	**Test Mode**	: Tx mode
Condition	: Temp:24.5'C,Humi:55%,Press:101.4kPa	**Antenna/Distance**	: 2018 VULB 9163 1#/3m/HORIZONTAL
Memo	: 903.31 MHz is the RF operating frequency of the sample		

Data: 3



Item (Mark)	Freq. (MHz)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dBµV/m)	Limit Line (dBµV/m)	Over Limit (dB)	Detector	Polarization
1	49.01	0.06	14.49	3.86	18.41	40.00	-21.59	QP	HORIZONTAL
2	98.49	-0.06	11.45	4.20	15.59	40.00	-24.41	QP	HORIZONTAL
3	199.29	0.19	11.30	4.81	16.30	40.00	-23.70	QP	HORIZONTAL
4	319.94	0.39	14.36	5.26	20.01	47.00	-26.99	QP	HORIZONTAL
5	465.60	1.19	16.62	5.72	23.53	47.00	-23.47	QP	HORIZONTAL
6	682.35	0.26	19.83	6.33	26.42	47.00	-20.58	QP	HORIZONTAL
7	903.31	83.81	21.74	6.93	112.48	47.00	65.48	Working frequency	

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

Radiated Emission test (1GHz-6GHz)

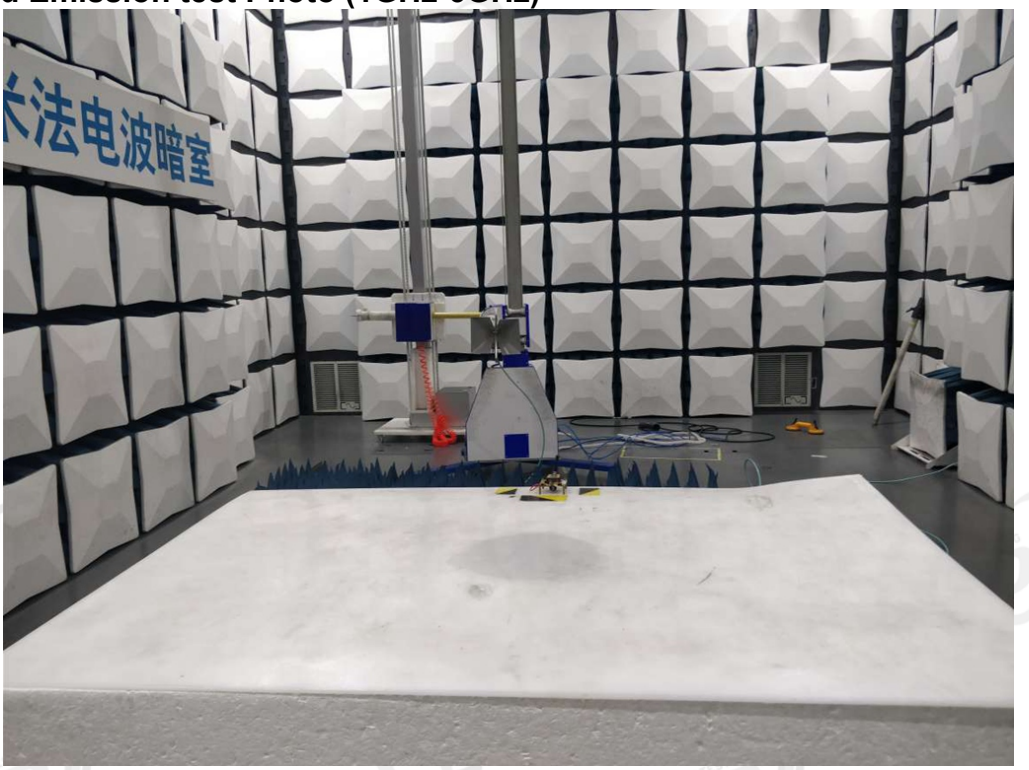
Freq. (MHz)	Read level (dBμV)	Antenna Factor (dB/m)	PRM Factor (dB)	Cable Loss (dB)	Result Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector type	Polarization
Test mode: Mode 1									
2275.00	52.73	28.88	44.13	3.81	41.29	70.00	-28.71	Peak	VERTICAL
2785.00	55.26	30.43	44.33	4.36	45.72	70.00	-24.28	Peak	VERTICAL
3650.00	55.14	32.35	44.40	5.24	48.33	74.00	-25.67	Peak	VERTICAL
4660.00	54.00	33.70	44.26	5.81	49.25	74.00	-24.75	Peak	VERTICAL
5025.00	54.18	33.92	44.19	5.88	49.79	74.00	-24.21	Peak	VERTICAL
5565.00	54.85	34.35	44.08	5.95	51.07	74.00	-22.93	Peak	VERTICAL
2625.00	54.25	29.81	44.27	4.28	44.07	70.00	-25.93	Peak	HORIZONTAL
3450.00	53.91	32.02	44.40	5.01	46.54	74.00	-27.46	Peak	HORIZONTAL
4050.00	54.36	32.97	44.39	5.67	48.61	74.00	-25.39	Peak	HORIZONTAL
4650.00	54.80	33.69	44.27	5.80	50.02	74.00	-23.98	Peak	HORIZONTAL
5235.00	53.34	34.09	44.15	5.91	49.19	74.00	-24.81	Peak	HORIZONTAL
5450.00	55.24	34.26	44.11	5.93	51.32	74.00	-22.68	Peak	HORIZONTAL
Result: Pass									

Note: Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

4.8. Test photo

Radiated Emission test Photo (80MHz-1GHz)

Radiated Emission test Photo (1GHz-6GHz)



5. Harmonic current and Voltage fluctuations & flicker test report

5.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

5.2. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
HARMONICS and Voltage fluctuation and flicker tester	EMC-PARTNER	HAR1000-1P	HAP1000-1P230V-0205	Jul. 02, 2018	1 Year
Test Software	EMC-PARTNER	Harmonics-1000	4.19	N/A	N/A

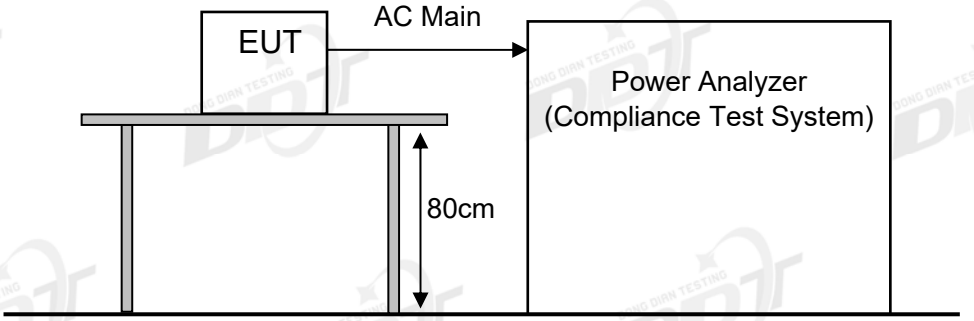
5.3. Test Standard

EN 61000-3-2:2014, Classification of equipment: ☒ Class A, ☐ Class B, ☐ Class C, ☐ Class D.

EN 61000-3-3:2013

5.4. Block diagram of test setup

(1) Table-top device



5.5. Harmonic current limits

For Class A equipment

Harmonic order(n)	Maximum permissible harmonic current (A)
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15≤n≤39	0.15*15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8≤n≤40	0.23*8/n

For Class B equipment

The harmonics of the input current shall not exceed the values given in class A equipment limits multiplied by a factor of 1.5.

For Class C equipment

Harmonic order(n)	Maximum permissible harmonic currrent expressed as a percentage of the input current at the fundamental frequency %
2	2
3	30xλ
5	10
7	7
9	3
11≤n≤39 (odd harmonic only)	0.23*8/n
Note: λ is the circuit power factor.	

For Class D equipment

Harmonic order(n)	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current (A)
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13≤n≤39 (odd harmonic only)	3.85/n	Refer to Class A limit

5.6. Voltage fluctuations & flicker Limit

Test Item	Limit	Note
Pst	1.0	Pst means Short-term flicker indicator
Plt	0.65	Plt means long-term flicker indicator
Tdt	0.2	Tdt means maximum time that dt exceeds 3%
dmax(%)	4%	dmax means maximum relative voltage change.
dc(%)	3%	dc means relative steady-state voltage change.

5.7. Test Procedure

For Harmonic current test:
The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the necessary for the EUT to be exercised.

For Voltage fluctuations & flicker
The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal conditions during the flick measurement; the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

5.8. Test result

Harmonic current test result:
Not Applicable
This product is not defined as lighting equipment, and has rated power less than 75W, therefore, no limit apply according to EN 61000-3-2 harmonics currents emissions test.

Voltage fluctuations & flicker test result:
N/A, because it is powered by battery

6. Electrostatic discharge test report

6.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	Eddie
Test and report Date	:	Jul. 30, 2019

6.2. Test Equipment

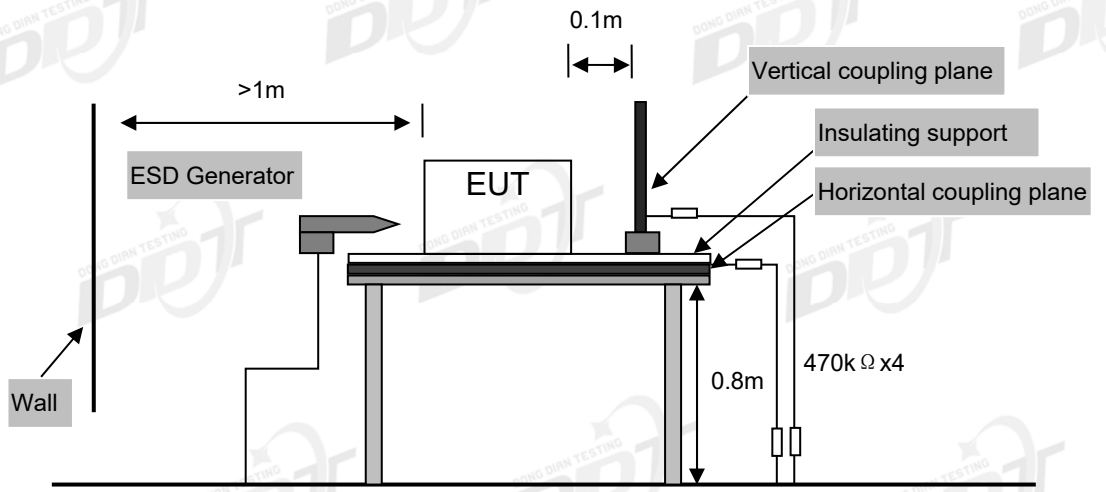
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
ESD Generator	TESEQ	NSG 437	981	Nov. 05, 2018	1 Year

6.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

6.4. Block diagram of test setup

(1) Table-top equipment



6.5. Test levels and performance criterion

Test Level		Performance Criteria
Air Discharge	±2kV, ±4kV and ±8kV	B
Contact Discharge	±4kV	

Performance criteria B description: During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended.

6.6. Test Procedure

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 20 times for each pre-selected test point. This procedure was repeated until all the air discharge completed.

Contact Discharge:
All the procedure was same as air discharge. Except that the generator was re-triggered for a new single discharge and repeated 20 times for each pre-selected test point. The tip of the discharge electrode was touching the EUT before the discharge switch was operated.

Indirect discharge for horizontal coupling plane:
At least 20 single discharges were 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 20 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.

6.7. Test result

Ambient Condition: 24.1 ℃ 49.3 %RH 101.4 kPa

Test Power supply: DC 3.3V Test Site: DDT 3# Shield Room

Test Times: 20 times at each point for contact discharge;
20 times at each point for air discharge.

Memo:

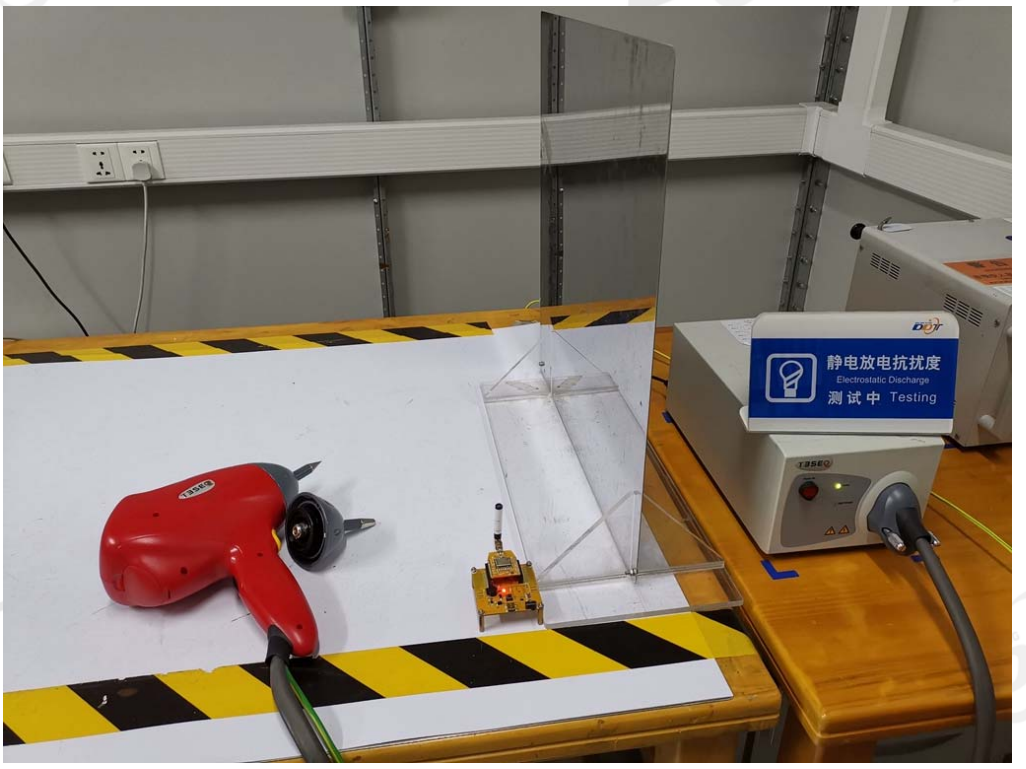
Operation Mode	Type of discharge	Test Level	Test Point	Performance		Result
				Required	Observation	(Pass/Fail)
Mode 1	Contact to EUT	±4kV	/	B	/	/
	Contact to Coupling Planes	±4kV	Coupling Planes	B	A	Pass
	Air	±2kV, ±4kV, and ±8kV	/	B	/	/

Test Point:

No.	Description	No.	Description	No.	Description
/	/	/	/	/	/
/	/	/	/	/	/
/	/	/		/	/

Observation Description: A: Operation as intend, no loss of function during test and after test.

6.8. Test photo



7. Continuous radio frequency disturbances

7.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	Eddie
Test and report Date	:	Jul. 30, 2019

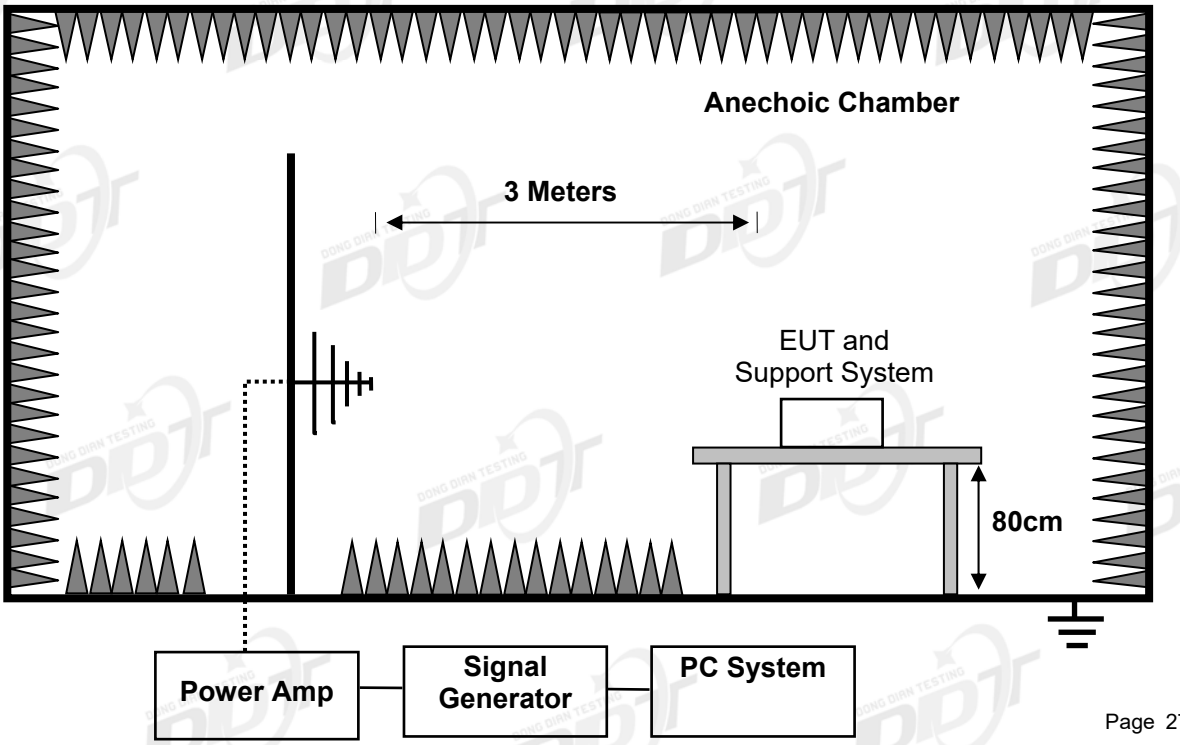
7.2. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Interval
RF Strength Susceptibility Test				
Signal generator	Agilent	N5172B	MY53050018	201.10.12
Amplifier	Wonder	HPA80M1000M500	101	2019.10.12
Amplifier	Wonder	HPA1000M2500M300	102	2019.10.12
Amplifier	Wonder	HPA2500M6000M200	103	2019.10.12
Power meter	Agilent	N1912A	MY50000460	2019.10.12
Power sensor	Agilent	E9323	MY44420907	2019.10.12
Power sensor	Agilent	E9323	US40410405	2019.10.12
Log-periodic antenna	Schwarzbeck	STLP 9149	587	2019.10.17
Horn antenna	Schwarzbeck	BBHA 9120J	00109	2019.10.17
Field strength probe	PMM	EP-601	611WX80209	2019.11.17

7.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

7.4. Block diagram of test setup



7.5. Test levels and performance criterion

Test Level		Performance Criteria
Frequency	80MHz-6GHz	**A**
Field Strength	3V/m measured unmodulated	
Modulation	AM modulated to a depth of 80% by a sinusoidal audio signal of 1KHz	
Step Size	10% increments	
Dwell time	1 Sec.	

7.6. Test Procedure

The test procedure was in accordance with EN 61000-4-3

The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.

The frequency range is swept from 80 MHz to 6GHz, with the signal 80% amplitude modulated with a 400 Hz sine-wave. The rate of sweep did not exceed 1.5 x 10^{-3} decade/s, where the frequency range is swept incrementally; the step size was 1% of preceding frequency value.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.

The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

The frequency on which the transmitter part of the EUT is intended to operate shall be excluded from conducted and radiated emission measurements when performed in transmit mode of operation.

Note: This test was subcontracted to Bureau of Quality and Technology Supervision of Dongguan City.

7.7. Test result

Ambient Condition: 24.1 ℃ 49.3 %RH 101.4 kPa						
Test Power spply: DC 3.3V						
Field Strength: ☒3V/m ☐10V/m ☐Other: Steps: ☒1% Dwell time: ☒1s ☐other:						
Swept Frequency Range: ☒80MHz---6GHz; ☐other:						
Modulation: ☐None ☒AM ☒1KHz ☐400Hz Modulation depth: ☒80% ☐other:						
Memo:						
Operation Mode	EUT Position towards antenna	Antenna: Horizontal		Antenna: Vertical		Result
		Required	Observation	Required	Observation	(Pass/Fail)
Mode 1	Front	A	A	A	A	Pass
	Right	A	A	A	A	Pass
	Rear	A	A	A	A	Pass
	Left	A	A	A	A	Pass
Observation Description: A: Operation as intend, no loss of function during test and after test.						

7.8. Test photo

8. Electrical fast transients (EFT) test report

8.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

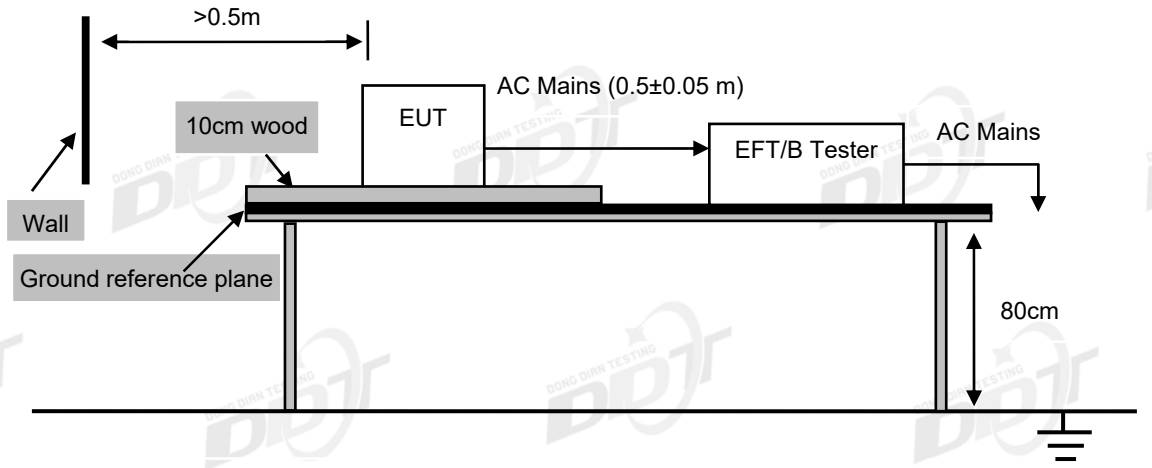
8.2. Test Equipment

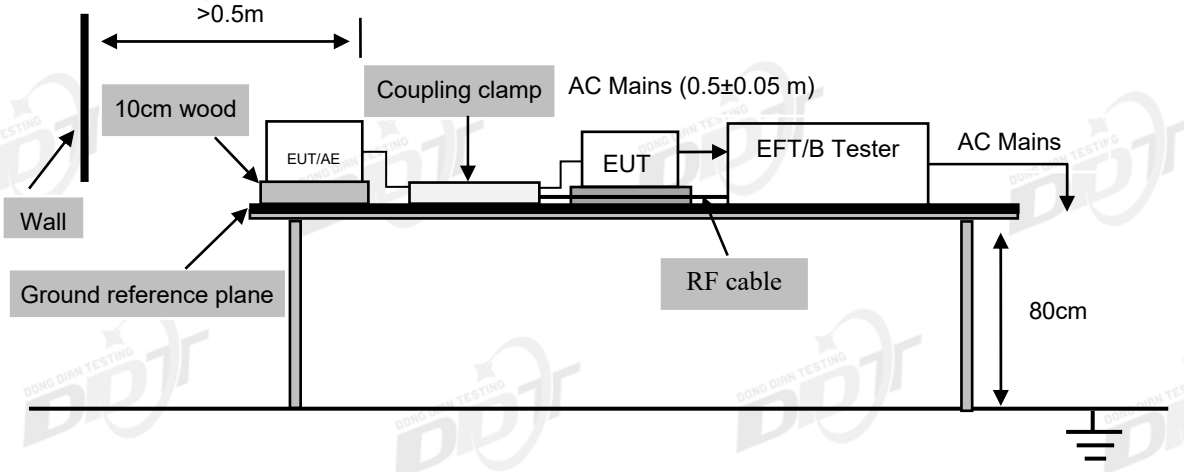
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EFT Generator	EMC PARTNER	TRA3000F	TRA3000F-1502	Jun. 25, 2019	1 Year
Capacitive coupling clamp	EMC PARTNER	103648	CN-EFT1000-1514	Jun. 25, 2019	1 Year

8.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

8.4. Block diagram of test setup





8.5. Test levels and performance criterion

Test Level		Performance Criteria
Test voltage	±1KV For AC mains Port	B
Repetition Frequency	5KHz	
Burst Duration	15ms	
Burst Period	300ms	
Inject Time(s)	120s	
Inject Method	Direct For AC mains port	
Inject Line	AC Mains of adapter	

Performance criteria B description: During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended.

8.6. Test Procedure

The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was 1m*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.

For input and AC power ports:
The EUT was connected to the power mains by using a coupling device that couples the EFT interference signal to AC power lines. Both positive transients and negative transients of test voltage were applied during compliance test and the duration of the test can’t less than 1min.

8.7. Test result

N/A, because it is powered by battery

9. Surges test report

9.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

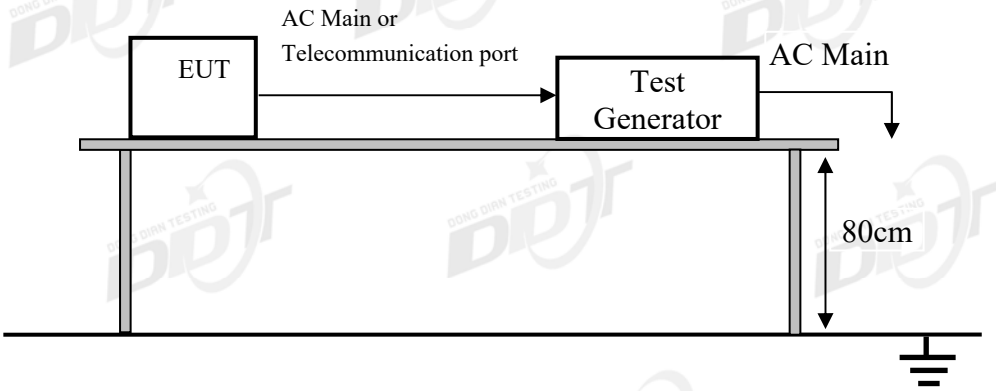
9.2. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Surge Generator	EMC PARTNER	TRANSIENT2000	MIG0603IN2 S-T-1504	Jun. 25, 2019	1 Year

9.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

9.4. Block diagram of test setup



9.5. Test levels and performance criterion

Test level for AC mains ports		Performance Criterion
Line to Line	1KV	B
Line to ground	2KV	B

Performance criteria B description: During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended.

9.6. Test Procedure

For line-to-line coupling mode, provide a 1kV 1.2/50us voltage surge (at pen-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV.

At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.

Different phase angles are done individually.

Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

9.7. Test result

N/A, because it is powered by battery

10. Continuous conducted disturbances

10.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

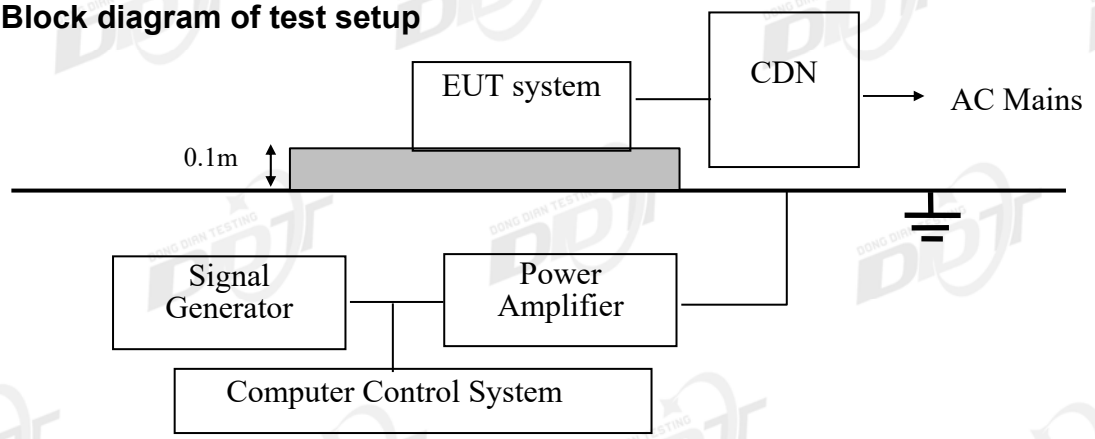
10.2. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Continuous conducted disturbances					
Conducted immunity test system	FRANKONIA	CIT-10	126B1207	Jun. 29, 2019	1 Year
CDN	FRANKONIA	CDN M2+M3	A2210191	Oct. 12, 2018	1 Year
Attenuation	BIRD	DAM75W (6dB)	1143	Oct. 12, 2018	1 Year
EM Clamp	FRANKONIA	EMCL	132A1143/2012	Oct. 12, 2018	1 Year
CDN	FRANKONIA	CDNT8	A6100017/2012	Oct. 12, 2018	1 Year
Test Software	CD-LAB	F5.318	1435V9992015	N/A	N/A

10.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

10.4. Block diagram of test setup



10.5. Test levels and performance criterion

Test Level		Performance Criteria
Frequency	0.15MHz to 80MHz	**A**
Field Strength	3V measured unmodulated	
Modulation	AM modulated to a depth of 80% by a sinusoidal audio signal of 400Hz	
Step Size	1% or 10% increments	
Dwell time	1 Sec.	

10.6. Test Procedure

The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).

The disturbance signal described below is injected to EUT through CDN.
The EUT operates within its operational mode(s) under intended climatic conditions after power on.
The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 400Hz sine wave.

The rate of sweep shall not exceed $1.5*10^{-3}$decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

10.7. Test result

N/A, because it is powered by battery

11. Voltage dips and interruptions

11.1. General information

Project No.	:	DDT-R19050915-1E1
Test and report Engineer	:	/
Test and report Date	:	/

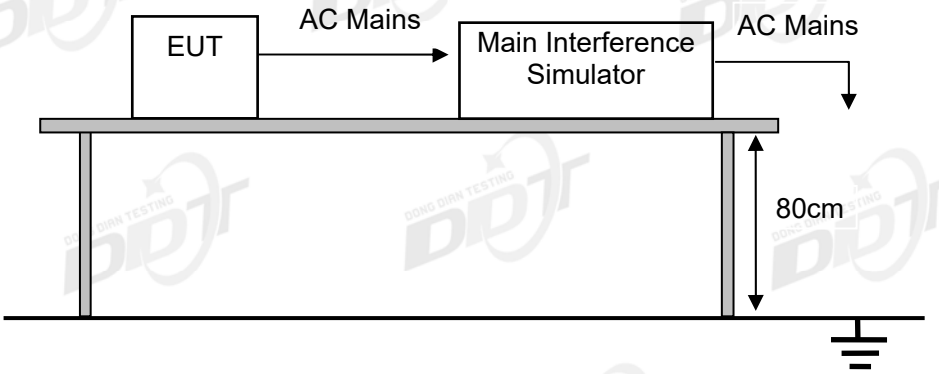
11.2. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
DIPS TESTER	EMC PARTNER	TRA3000D	EXT-TRA3000D-1510	Jun. 25, 2019	1 Year

11.3. Test and Reference Standards

Draft EN 301 489-1 V2.2.1: 2019-03; Final draft EN 301 489-3 V2.1.1 (2017-03);

11.4. Block diagram of test setup



11.5. Test levels and performance criterion

Test Level %UT	Voltage dip and short interruptions %UT	Duration (in period)	Performance Criterion
0	100	0.5	B
0	100	1	B
70	30	25	B
0	100	250	C

Performance criteria B description: During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended.
Performance criteria C description: During and after testing, a temporary loss of function is allowed, provided the function is self recoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

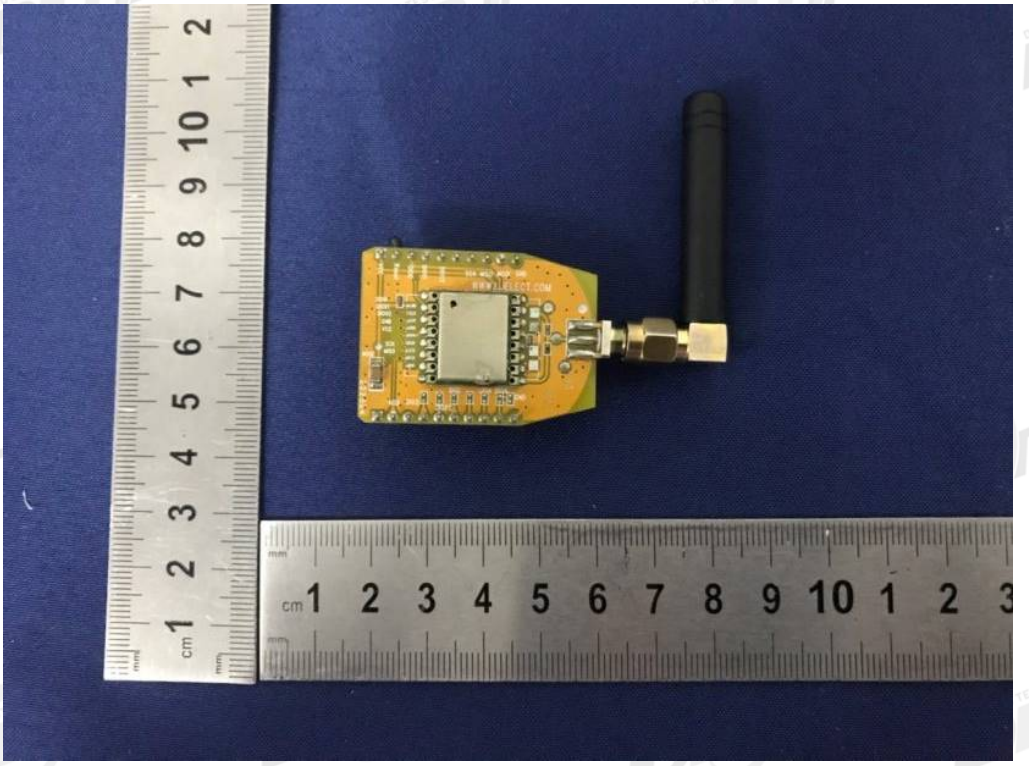
11.6. Test Procedure

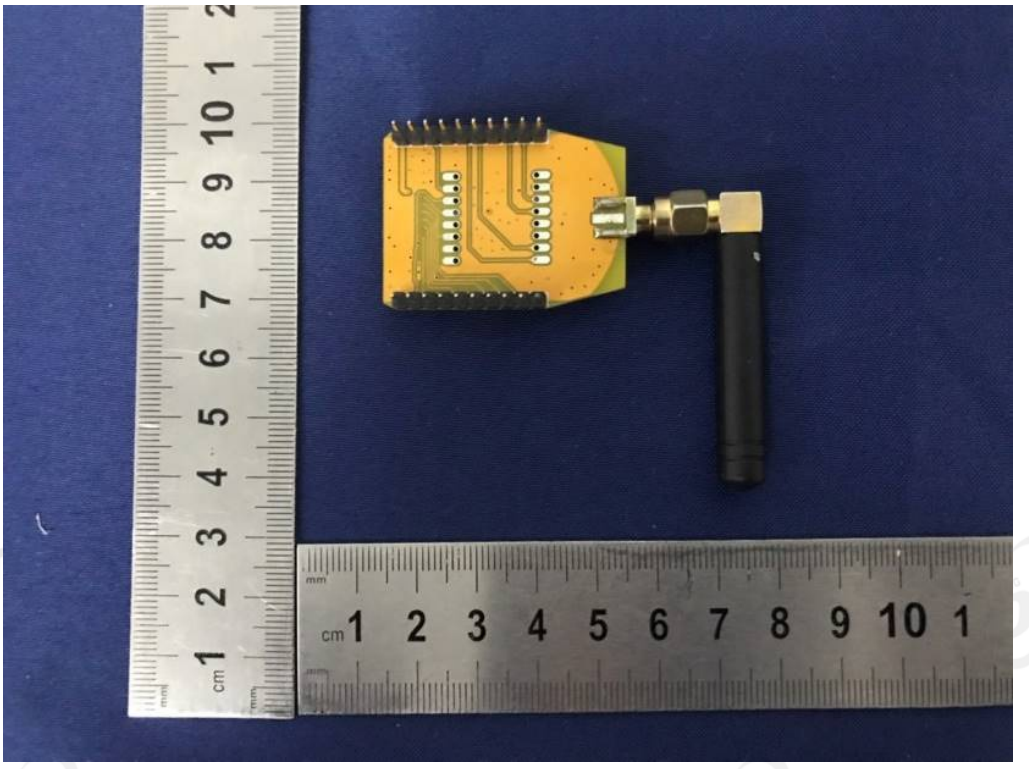
The EUT and test generator were setup as shown. The interruptions are introduced at selected phase angles with specified duration. Record any degradation of performance.

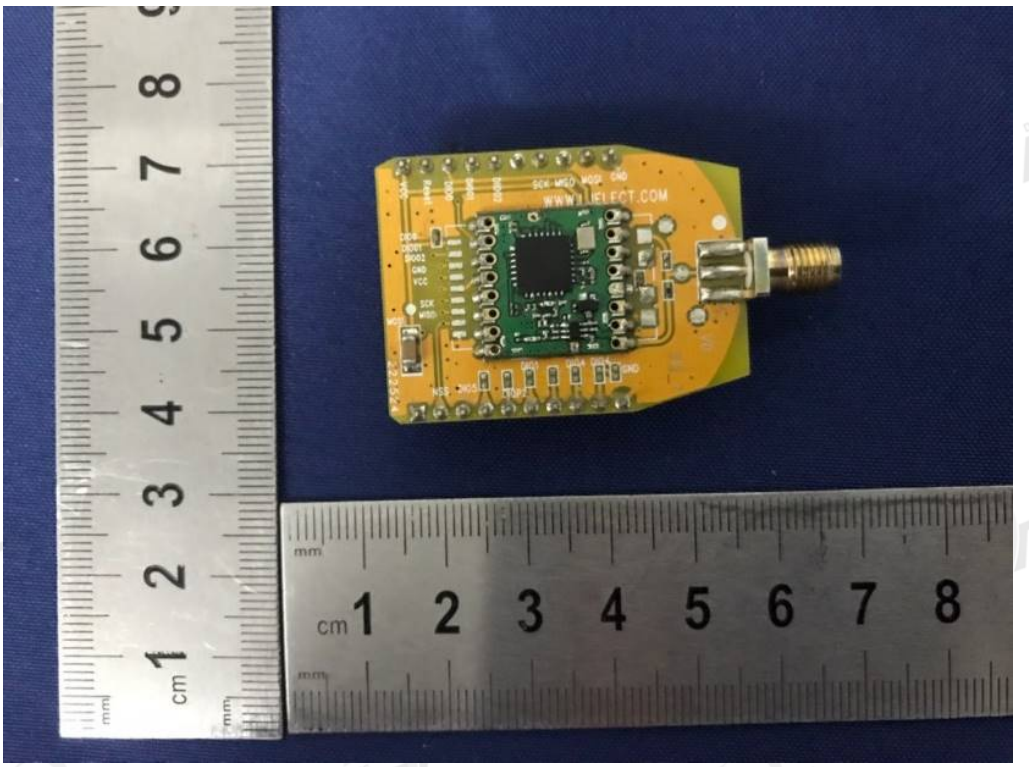
11.7. Test result

N/A, because it is powered by battery

12. Photos of the EUT







END OF REPORT