



## TEST REPORT

Product Name: LoRa Module

Trademark:  

Model Number: LoRa Module

Prepared For: Shenzhen Ai-Thinker Technology Co., Ltd

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Prepared By: Shenzhen CTB Testing Technology Co., Ltd.

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Sample Received Date: Nov. 22, 2022

Sample tested Date: Nov. 22, 2022 to Dec. 07, 2022

Issue Date: Dec. 07, 2022

Report No.: CTB221205048REX

Test Standards: ETSI EN 301 489-1 V2.2.3 (2019-11)  
Final draft ETSI EN 301 489-3 V2.2.0 (2021-11)

Test Results: PASS

Remark: This is EMC test report.

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Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "\*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

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(NOTE: N/A MEANS NOT APPLICABLE)

## 1. VERSION

ReportNo.	Issue Date	Description	Approved
CTB221205048REX	Dec. 7, 2022	Original	Valid

## 2. TEST SUMMARY

The Product has been tested according to the following specifications:

EMISSION		
Standard	Test Item	Test result
EN 55032	Conducted emissions from the AC mains power ports	Pass
EN 55032	Asymmetric mode conducted emissions	N/A <sup>1</sup>
EN 55032	Conducted differential voltage emissions	N/A <sup>2</sup>
EN 55032	Radiated emissions	Pass
EN 61000-3-2	Harmonic current emission(H)	N/A <sup>3</sup>
EN 61000-3-3	Voltage fluctuations & flicker(F)	N/A <sup>4</sup>

IMMUNITY		
Standard	Test Item	Test result
IEC 61000-4-2	Electrostatic discharge (ESD)	Pass
IEC 61000-4-3	Continuous RF electromagnetic field disturbances(RS)	Pass
IEC 61000-4-4	Electrical fast transients/burst (EFT)	N/A <sup>4</sup>
IEC 61000-4-5	Surges	N/A <sup>4</sup>
IEC 61000-4-6	Radio frequency, common mode	N/A <sup>4</sup>
IEC 61000-4-11	Voltage dips and interruptions (DIPS)	N/A <sup>4</sup>

Remark:

1. Applicable to ports listed above and intended to connect to cables longer than 3 m.
2. The Product has no antenna port.
3. The Product belongs to Class A, and its power is less than 75W, so it deems to fulfil this standard without testing.
- 4.The EUT is powered by the DC battery only and has no antenna port, the test item is not applicable.

### 3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Test item	Value (dB)
Conducted Emission (150KHz-30MHz)	3.2
Radiated Emission(30MHz ~1000MHz)	4.8
Radiated Emission(1GHz ~6GHz)	4.9

#### 4. PRODUCT INFORMATION AND TEST SETUP

##### 4.1 Product Information

Model(s):	Ra-01SCH
Model Description:	N/A
SRD:	863.5-869.5MHz
Receiver Category:	2
Hardware Version:	V1.0
Software Version:	V1.1
Type of Modulation:	LoRa
Antenna installation:	Sucker antenna
Antenna Gain:	2.63dBi
Ratings:	DC 3.3V by notebook

##### 4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

##### 4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/TypeNo.	SeriesNo.	Note
1.	Laptop	DELL	Vostro 5490	N/A	N/A

##### Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

#### 4.4 Test Mode

Test item	Test Mode	Test Voltage
Conducted emissions from the AC mains power ports (150KHz-30MHz) Class B	Charging+LoRa	AC 230V/50Hz
Radiated emissions(30MHz-6GHz)Class B	Charging+LoRa	AC 230V/50Hz
Electrostatic discharge (ESD) <input checked="" type="checkbox"/> Air Discharge: $\pm 2,4,8\text{kV}$ <input checked="" type="checkbox"/> Contact Discharge: $\pm 2,4\text{kV}$ <input checked="" type="checkbox"/> HCP & VCP: $\pm 2,4\text{kV}$	Charging+LoRa	AC 230V/50Hz
Continuous RF electromagnetic field disturbances(RS) <input checked="" type="checkbox"/> 80MHz-6000MHz , 3V/m,80%	Charging+LoRa	AC 230V/50Hz
All test mode were tested and passed, only Conducted Emissions, Radiated Emissions Harmonic Current Emissions and Voltage Fluctuations and Flicker shows <sup>(1)</sup> sthe worst case mode which were recorded in this report.		

## 5. TEST FACILITY AND TEST INSTRUMENT USED

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at 1&2F., Building A, No. 26, Xinh Road, Xinqiao, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

### 5.2 Test Instrument Used

Continuous disturbance					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	ROHDE&SCHWARZ	ESH3-Z5	100318	2023.07.19
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2023.07.19
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	2023.07.19
4	Coaxial cable	ZDECL	Z302S	18091904	2023.07.19
5	ISN	Schwarzbeck	NTFM8158	183	2023.07.19
6	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
7	Communication test set	R&S	CMW500	108058	2023.07.19
8	EZ-EMC	Frad	EMC-con3A1.1	/	/

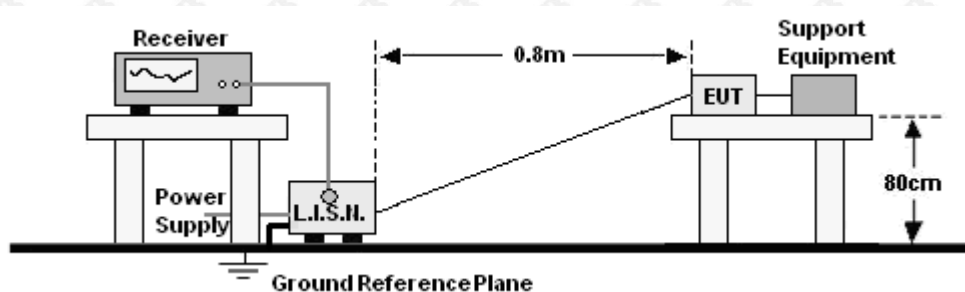
Radiated emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120D	1911	2023.07.22
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2023.07.22
3	Amplifier	Agilent	8449B	3008A01838	2023.07.19
4	Amplifier	HP	8447E	2945A02747	2023.07.19
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	2023.07.19
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2023.07.19
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2023.07.19
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2023.07.19
9	Coaxial cable	ETS	RFC-NNS-100-NMS-300 NI	/	2023.07.19
10	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
11	Communication test set	R&S	CMW500	108058	2023.07.19
12	EZ-EMC	Frad	EMC-con3A1.1	/	/

Electrostatic discharges					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	ESD Simulator	TESTQ	NSG437	329	2023.07.25
2	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
3	Communication test set	R&S	CMW500	108058	2023.07.19

Radio frequency electromagnetic field					
No.	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	Agilent	N5181A	2106070101	2023.07.19
2	Stacked Double Log.-Per. Antenna	SKET	STLP 9129 Plus	2106070106	2023.07.19
3	Switch Controller	SKET	RFSU-DC18G-4C	2106070105	2023.07.19
4	RF Power Meter	Agilent	U2001	2106070102	2023.07.19
5	E-Field Probe	Narda	EP-601	2106070107	2023.07.19
6	Power Amplifier	SKET	HAP-80M01G-250W	2106070103	2023.07.19
7	Power Amplifier	SKET	HAP-01G 06G-75W	2106070104	2023.07.19
8	Audio Analysis	R&S	UPV	2106070116	2023.07.24
9	Audio Output Matching Network	SKET	RCO Network	2106070117	2023.07.19
10	Communication test set	Agilent	E5515C	MY50102567	2023.07.19
11	Communication test set	R&S	CMW500	108058	2023.07.19
12	Test Software	SKET	/	/	/

## 6. CONDUCTED EMISSIONS

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

Limits for Conducted emissions at the mains ports of Class B MME

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56*	56 to 46*
0,50 to 5	56	46
5 to 30	60	50

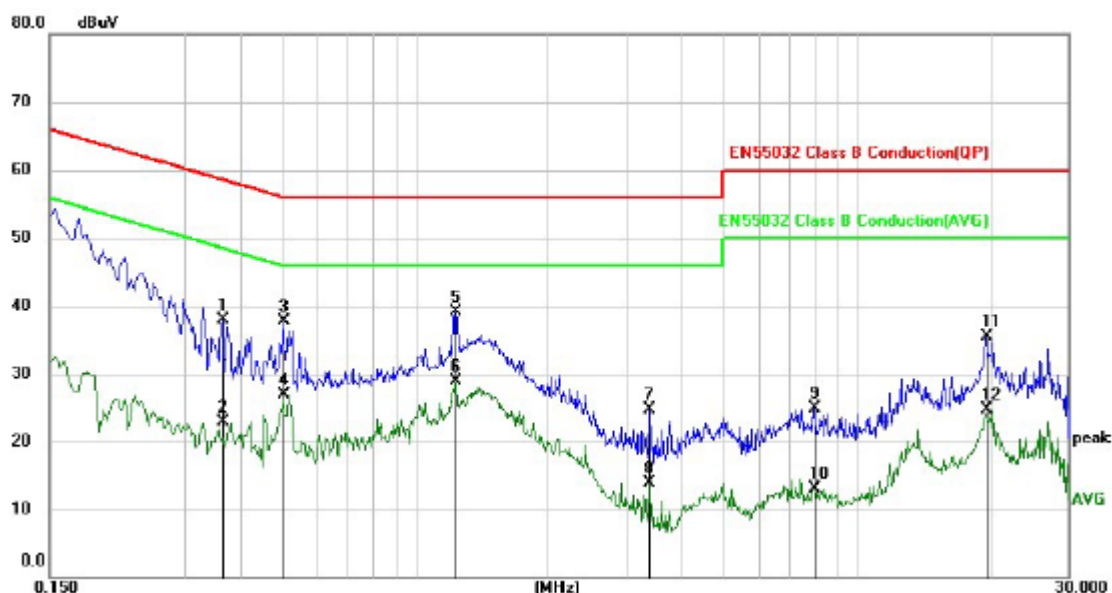
Notes: 1. \*Decreasing linearly with logarithm of frequency.  
2. The lower limit shall apply at the transition frequencies.

### 6.3 Test procedure

- The Product was placed on a nonconductive table 0.8m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
- The RBW of the receiver was set at 9 kHz in 150 kHz ~30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
- For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

## 6.4 Test Result

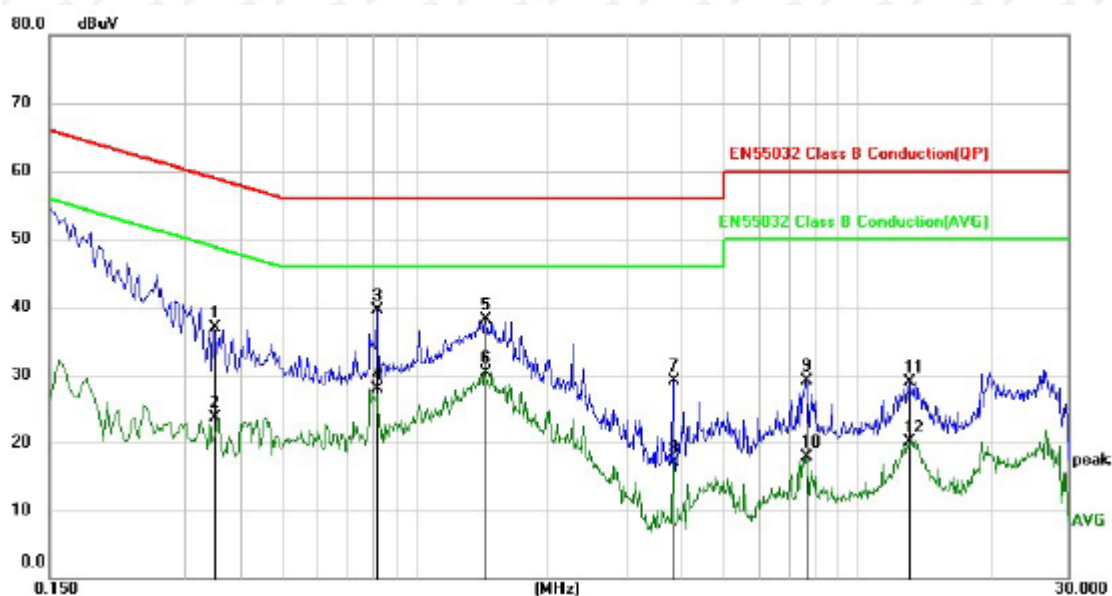
Temperature:	23℃	Relative Humidity:	54%
Pressure:	101kPa	Phase :	L
Test Mode	1(the worst data)	Remark:	N/A



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV	dBuV	dB	
1		0.3660	28.00	9.99	37.99	58.59	-20.60	QP
2		0.3660	12.90	9.99	22.89	48.59	-25.70	AVG
3		0.5020	27.78	9.97	37.75	56.00	-18.25	QP
4		0.5020	16.88	9.97	26.85	46.00	-19.15	AVG
5	*	1.2340	29.18	9.99	39.17	56.00	-16.83	QP
6		1.2340	18.92	9.99	28.91	46.00	-17.09	AVG
7		3.3980	14.61	10.09	24.70	56.00	-31.30	QP
8		3.3980	3.84	10.09	13.93	46.00	-32.07	AVG
9		8.0060	14.61	10.28	24.89	60.00	-35.11	QP
10		8.0060	2.87	10.28	13.15	50.00	-36.85	AVG
11		19.6060	25.02	10.56	35.58	60.00	-24.42	QP
12		19.6060	14.13	10.56	24.69	50.00	-25.31	AVG

Remark: Result=Reading +Factor  
Over Limit=Result -Limit

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Phase :	N
Test Mode	1(the worst data)	Remark:	N/A



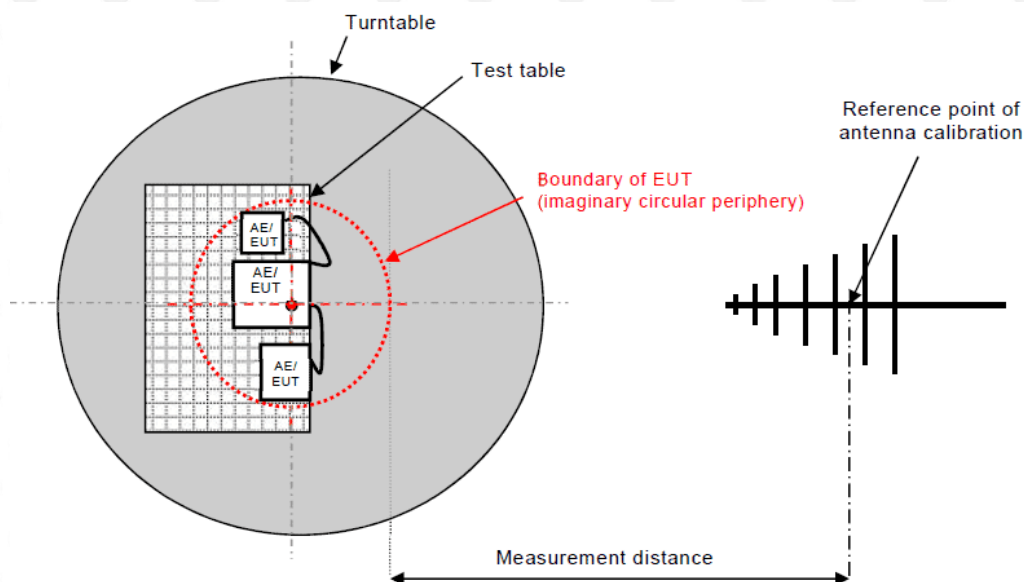
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.3500	26.85	9.99	36.84	58.96	-22.12	QP
2		0.3500	13.77	9.99	23.76	48.96	-25.20	AVG
3		0.8180	29.46	9.98	39.44	56.00	-16.56	QP
4		0.8180	17.93	9.98	27.91	46.00	-18.09	AVG
5		1.4380	28.03	10.00	38.03	56.00	-17.97	QP
6	*	1.4380	20.21	10.00	30.21	46.00	-15.79	AVG
7		3.8380	18.99	10.11	29.10	56.00	-26.90	QP
8		3.8380	7.09	10.11	17.20	46.00	-28.80	AVG
9		7.6820	18.87	10.27	29.14	60.00	-30.86	QP
10		7.6820	7.69	10.27	17.96	50.00	-32.04	AVG
11		13.1500	18.56	10.42	28.98	60.00	-31.02	QP
12		13.1500	9.78	10.42	20.20	50.00	-29.80	AVG

Remark: Result=Reading +Factor  
Over Limit=Result –Limit

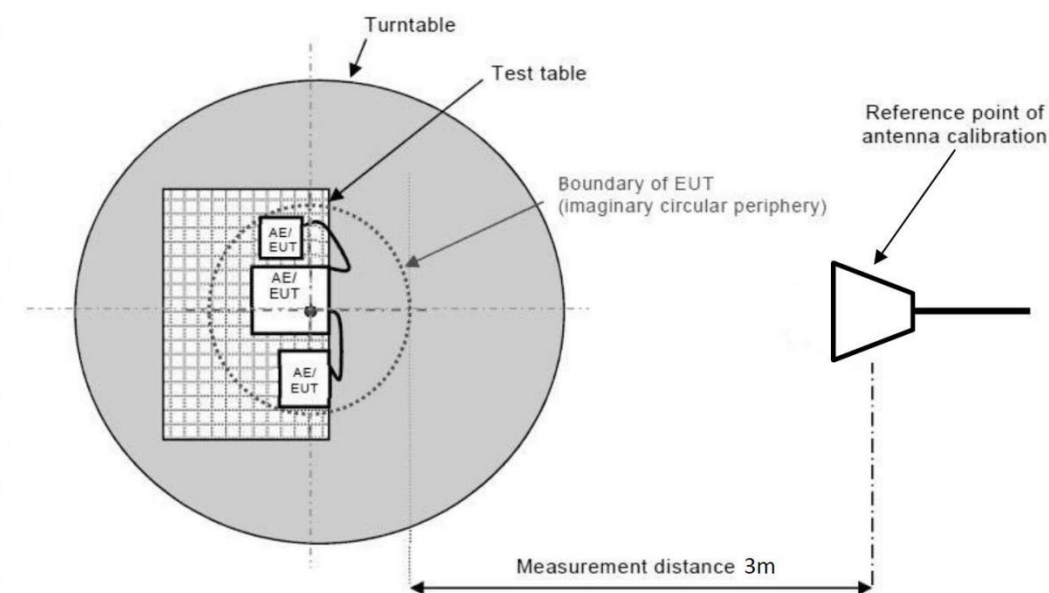
## 7. RADIATEDEMISSIONS TEST

### 7.1 Block Diagram Of Test Setup

30MHz ~ 1GHz:



Above 1GHz:



## 7.2 Limits

**Limits for radiated disturbance of Class B MME**

Frequency (MHz)	Quasi-peak limits at 3m dB( $\mu$ V/m)
30-230	40
230-1000	47

Frequency (GHz)	limit above 1G at 3m dB( $\mu$ V/m)	
	Average	peak
1-3	50	70
3-6	54	74

**Note:** The lower limit shall apply at the transition frequencies.

## 7.3 Test Procedure

### 30MHz ~ 1GHz:

- The Product was placed on the nonconductive turntable 0.8m above the ground in a semi anechoic chamber.
- Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

### Above 1GHz:

- The Product was placed on the non-conductive turntable 0.8m above the ground in a full anechoic chamber..
- Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
- For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

## 7.4 Test Results

Below 1GHz

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Polarization :	Horizontal
Test Mode	1(the worst data)	Remark:	N/A



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		42.6000	26.30	-6.51	19.79	40.00	-20.21	QP
2		71.4552	25.33	-9.29	16.04	40.00	-23.96	QP
3		160.0648	25.74	-5.48	20.26	40.00	-19.74	QP
4		282.9852	25.79	-6.27	19.52	47.00	-27.48	QP
5		606.7221	25.03	2.54	27.57	47.00	-19.43	QP
6	*	948.7610	27.61	7.63	35.24	47.00	-11.76	QP

Remark: Result=Reading +Factor  
Over Limit=Result -Limit

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Polarization :	Vertical
Test Mode	1(the worst data)	Remark:	N/A



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		50.3206	29.49	-6.65	22.84	40.00	-17.16	QP
2		65.4579	29.85	-8.39	21.46	40.00	-18.54	QP
3		164.3301	28.39	-5.99	22.40	40.00	-17.60	QP
4		343.1800	26.48	-4.25	22.23	47.00	-24.77	QP
5		565.6297	26.74	1.62	28.36	47.00	-18.64	QP
6	*	948.7610	23.32	7.63	30.95	47.00	-16.05	QP

Remark: Result=Reading +Factor  
Over Limit=Result -Limit

Above 1GHz

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Polarization :	Horizontal
Test Mode	1(the worst data)	Remark:	N/A

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1967.01	45.31	1.49	46.80	70.00	-23.20	peak
2	1968.49	28.24	1.49	29.73	50.00	-20.27	AVG
3	3774.14	42.67	5.77	48.44	74.00	-25.56	peak
4	3772.41	26.17	5.77	31.94	54.00	-22.06	AVG
5	4841.03	42.93	9.54	52.47	74.00	-21.53	peak
6	4840.88	24.16	9.54	33.71	54.00	-20.29	AVG

Remark: Result=Reading +Factor  
Over Limit=Result -Limit

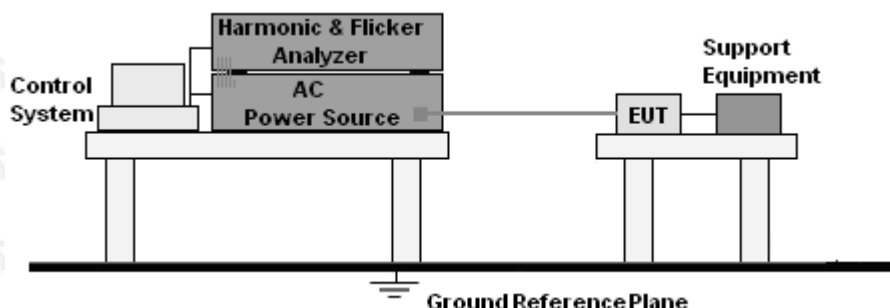
Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Polarization :	Vertical
Test Mode	1(the worst data)	Remark:	N/A

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	1997.18	47.19	1.58	48.77	70.00	-21.23	peak
2	1998.18	28.75	1.58	30.33	50.00	-19.67	AVG
3	3809.09	46.84	5.91	52.75	74.00	-21.25	peak
4	3810.93	28.65	5.91	34.56	54.00	-19.44	AVG
5	4773.36	44.31	9.38	53.69	74.00	-20.31	peak
6	4774.31	26.80	9.38	36.18	54.00	-17.82	AVG

Remark: Result=Reading +Factor  
Over Limit=Result -Limit

## 8. HARMONIC CURRENT EMISSION(H)

### 8.1 Block Diagram of Test Setup



### 8.2 Limit

EN IEC 61000-3-2:2019 Clause 7.

### 8.3 Test Procedure

- The Product was placed on the top of a non-conductive table 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 Product was chosen. The measure time shall be not less than the time necessary for the Product to be exercised.

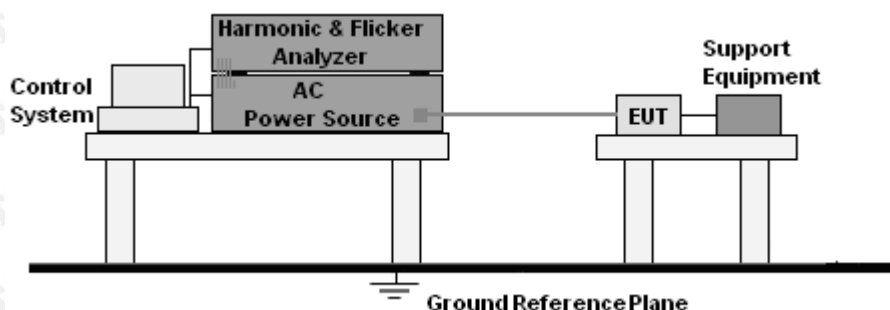
### Test Results

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Test Mode	1(the worst data)
Remark:	N/A	Test results	N/A

**Remark:**No limits apply for equipment with an active input power up to and including 75W.

## 9. VOLTAGE FLUCTUATIONS & FLICKER(F)

### 9.1 Block Diagram of Test Setup



### 9.2 Limit

EN 61000-3-3:2013/A1:2019 Clause 5.

### 9.3 Test Procedure

- The Product was placed on the top of a non-conductive table above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.
- During the flick test, the measure time shall include that part of whole operation cycle in which the Product produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.

### 9.4 Test Results

Temperature:	23 °C	Relative Humidity:	54%
Pressure:	101kPa	Test Mode	1(the worst data)
Remark:	N/A	Test results	N/A

**Remark:** Due to the maximum r.m.s input current (including inrush current) does not exceed 20A, and the supply current after inrush in within a variation band of 1.5A, it's not applicable to test the manual switching. Since the EUT is working in steady state with very low supply current, it will not cause any fluctuations and flicker on the supply system. Considering this, no flicker and voltage fluctuation test had been performed on the EUT, and the EUT can be deemed to comply with the standard accordingly without testing.

## 10. IMMUNITY TEST OF GENERAL THE PERFORMANCE CRITERIA

Product Standard	ETSI EN 301 489-1
<p>The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests.</p> <p>For the purpose of the present document two categories of performance criteria apply:</p> <ul style="list-style-type: none"> <li>•Performance criteria for continuous phenomena.</li> <li>•Performance criteria for transient phenomena.</li> </ul> <p>NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment.</p>	
Performance criteria for continuous phenomena	<p>During the test, the equipment shall:</p> <ul style="list-style-type: none"> <li>•continue to operate as intended;</li> <li>•not unintentionally transmit;</li> <li>•not unintentionally change its operating state;</li> <li>•not unintentionally change critical stored data.</li> </ul>
Performance criteria for transient phenomena	<p>For all ports and transient phenomena with the exception described below, the following applies:</p> <ul style="list-style-type: none"> <li>•The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.</li> <li>•After application of the transient phenomena, the equipment shall operate as intended.</li> </ul> <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"> <li>•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 otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li> <li>•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. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</li> </ul>

According To EN 301489 -3 standard, The General Performance Criteria As Following:

Table 1: Performance criteria

Criteria	During the test	After test (i.e. as a result of the application of the test)
<b>A</b>	Operate as intended No loss of function No unintentional responses	Operate as intended No loss of function No degradation of performance No loss of stored data or user programmable functions
<b>B</b>	May show loss of function No unintentional responses	Operate as intended Lost function(s) shall be self-recoverable No degradation of performance No loss of stored data or user programmable functions
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.		

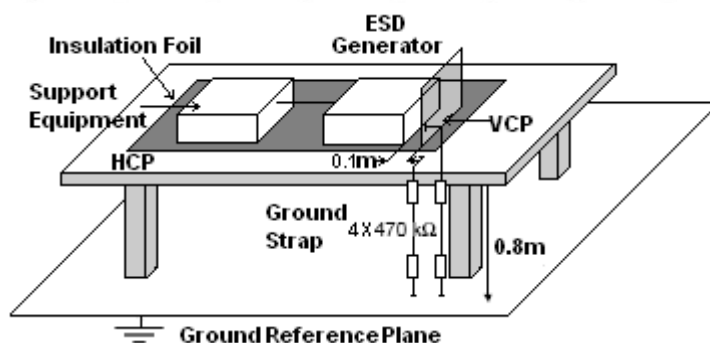
- performance criterion A applies for immunity tests with phenomena of a continuous nature;
- performance criterion B applies for immunity tests with phenomena of a transient nature.

## 11. ELECTROSTATIC DISCHARGE (ESD)

### 11.1 Test Specification

<b>Test Port</b>	: Enclosure port
<b>Discharge Impedance</b>	: 330 ohm / 150 pF
<b>Discharge Mode</b>	: Single Discharge
<b>Discharge Period</b>	: one second between each discharge

### 11.2 Block Diagram of Test Setup



### 11.3 Test Procedure

- Electrostatic discharges were applied only to those points and surfaces of the Product that are accessible to users during normal operation.
- The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges was at least 1 second.
- The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the Product.
- Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- Air discharges were applied with the round discharge tip of the discharge electrode approaching the Product as fast as possible (without causing mechanical damage) to touch the Product. After each discharge, the ESD generator was removed from the Product and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
- At least ten single discharges (in the most sensitive polarity) were applied to the Horizontal Coupling Plane at points on each side of the Product. The ESD generator was positioned vertically at a distance of 0.1 meters from the Product with the discharge electrode touching the HCP.

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the Vertical Coupling Plane in sufficiently different positions that the four faces of the Product were completely illuminated. The VCP(dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the Product.

#### 11.4 Test Results

Temperature :	23℃	Relative Humidity :	54%
Pressure :	101kPa	Test Mode :	Mode1

Discharge Method	Discharge Position	Voltage (±kV)	Min. No. of Discharge per polarity (Each Point)	Performance Criterion
Contact Discharge	Conductive Surfaces	4	10	A
	Indirect Discharge HCP	4	10	A
	Indirect Discharge VCP	4	10	A
Air Discharge	Slots, Apertures, and Insulating Surfaces	8	10	A

Note: A: No performance degradation during test.

B: During the test, the EUT shut down, after the test, it reset by itself.

C: During the test, the EUT shut down, after the test, it reset by user.

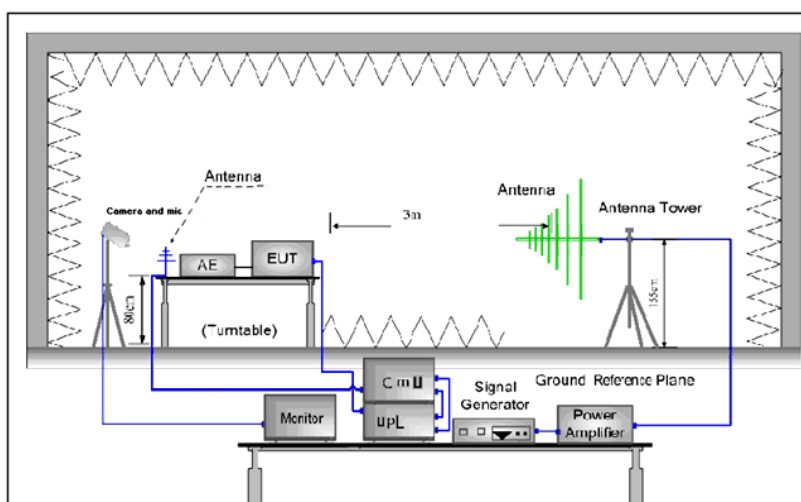
## 12. CONTINUOUS RF ELECTROMAGNETIC FIELD DISTURBANCES(RS)

### 12.1 Test Specification

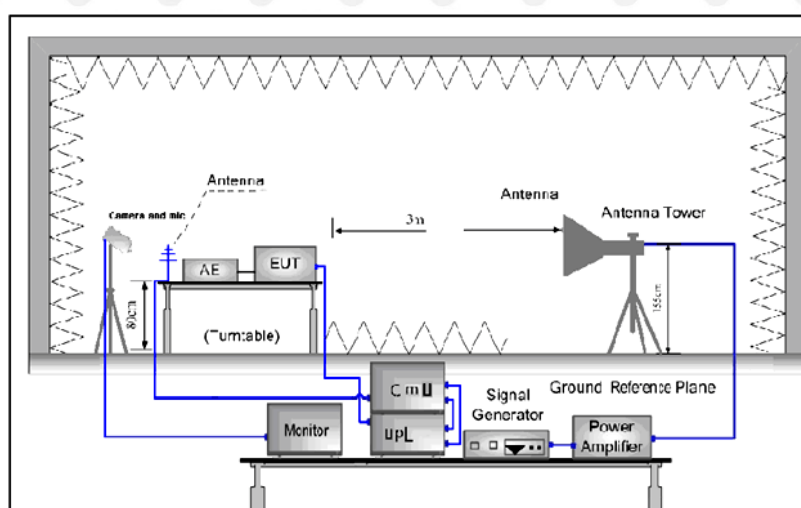
<b>Test Port</b>	: Enclosure port
<b>Step Size</b>	: 1%
<b>Modulation</b>	: 1kHz, 80% AM
<b>Dwell Time</b>	: 1 second
<b>Polarization</b>	: Horizontal & Vertical

### 12.2 Block Diagram of Test Setup

Below 1GHz:



Above 1GHz:



### 12.3 Test Procedure

- The testing was performed in a fully-anechoic chamber. The transmit antenna was located at a distance of 3 meters from the Product.
- The frequency range is swept from 80MHz to 6000MHz, with the signal 80% amplitude modulated with a 1 kHz sine wave, and the step size was 1%.
- The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond, but should not exceed 5 s at each of the frequencies during the scan.
- The test was performed with the Product exposed to both vertically and horizontally polarized fields on each of the four sides.
- For Broadcast reception function: Group 2 not apply in this test.

### 12.4 Test Results

Temperature :	23℃	Relative Humidity :	54%
Pressure :	101kPa	Test Mode :	Mode1

Frequency	Position	Field Strength (V/m)	PerformanceCriterion
80 - 6000MHz	Front, Right, Back, Left, Up, Down	3	A
Note: A: No performance degradation during test.			

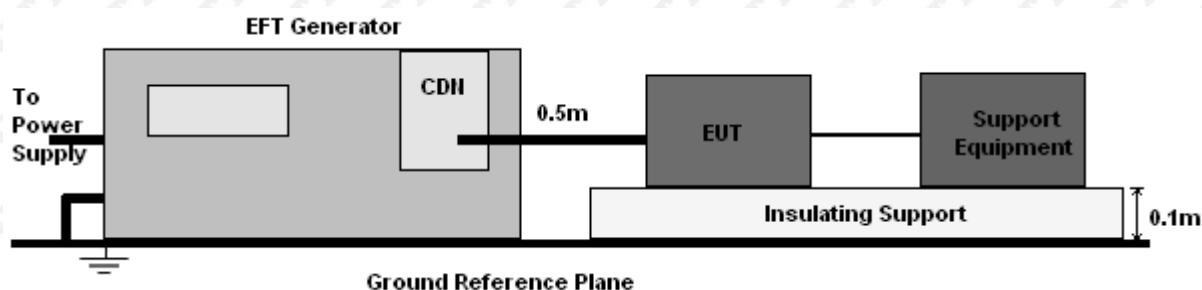
### 13. ELECTRICAL FAST TRANSIENTS/BURST (EFT)

#### 13.1 Test Specification

<b>Test Port</b>	: input a.c. power port
<b>Impulse Frequency</b>	: 5 kHz
<b>Impulse Wave-shape</b>	: 5/50 ns
<b>Burst Duration</b>	: 15 ms
<b>Burst Period</b>	: 300 ms
<b>Test Duration</b>	: 2 minutes per polarity

#### 13.2 Block Diagram of EUT Test Setup

For input a.c.power port:



#### 13.3 Test Procedure

- The Product and support units were located on a non-conductive table above ground reference plane.
- A 0.5m-long power cord was attached to Product during the test.

#### 13.4 Test Results

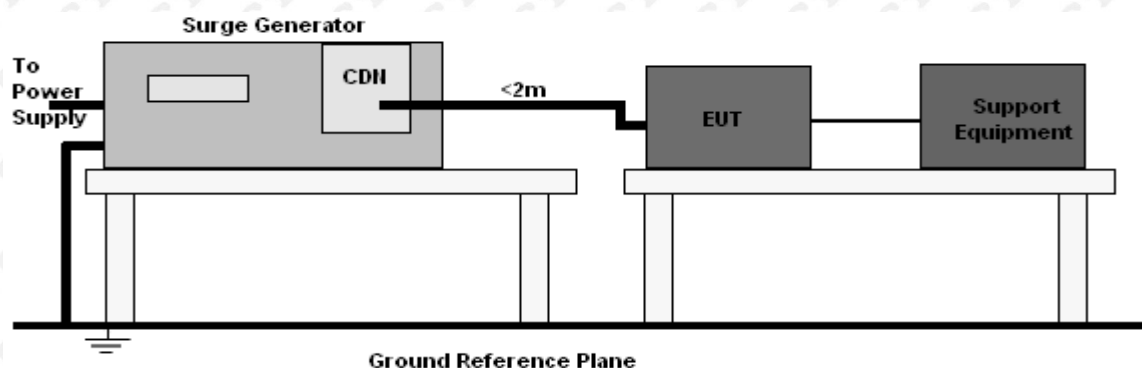
N/A

## 14. SURGES IMMUNITY TEST

### 14.1 Test Specification

<b>Test Port</b>	: input a.c. power port
<b>Wave-Shape</b>	: Open Circuit Voltage - 1.2 / 50 us Short Circuit Current - 8 / 20 us
<b>Pulse Repetition Rate</b>	: 1 pulse / min.
<b>Phase Angle</b>	: 0° / 90° / 180° / 270°
<b>Test Events</b>	: 5 pulses (positive & negative) for each polarity

### 14.2 Block Diagram of EUT Test Setup



### 14.3 Test Procedure

- The surge is to be applied to the Product power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave.
- The power cord between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter). Interconnection line between the Product and the coupling/decoupling networks shall be 2 meters in length (or shorter).

### 14.4 Test Result

N/A

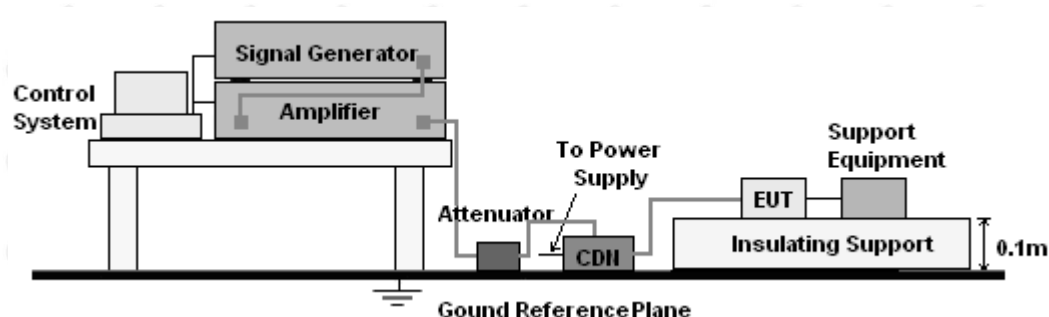
## 15. CONTINUOUS INDUCED RF DISTURBANCES (CS)

### 15.1 Test Specification

<b>Test Port</b>	: input a.c.power port
<b>Step Size</b>	: 1%
<b>Modulation</b>	: 1kHz, 80% AM
<b>Dwell Time</b>	: 1 second

### 15.2 Block Diagram of EUT Test Setup

For input a.c. power port:



### 15.3 Test Procedure

For input a.c.power port:

- The Product and support units were located at a ground reference plane with the interposition of a 0.1 m thickness insulating support and the CDN was located on GRP directly.
- The frequency range is swept from 150 kHz to 10MHz, 10MHz to 30MHz, 30MHz to 80MHz with the signal 80% amplitude modulated with a 1 kHz sine wave, and the step size was 1% of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the Product to be able to respond.

### 15.4 Test Result

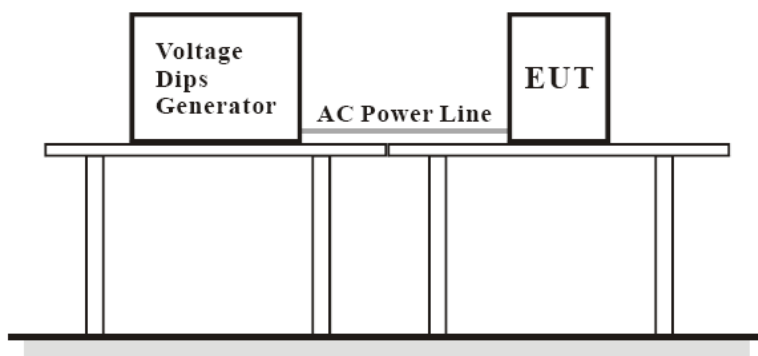
N/A

## 16. VOLTAGE DIPS AND INTERRUPTIONS (DIPS)

### 16.1 Test Specification

<b>Test Port</b>	: input a.c. power port
<b>Phase Angle</b>	: 0°, 180°
<b>Test cycle</b>	: 3 times

### 16.2 Block Diagram of EUT Test Setup

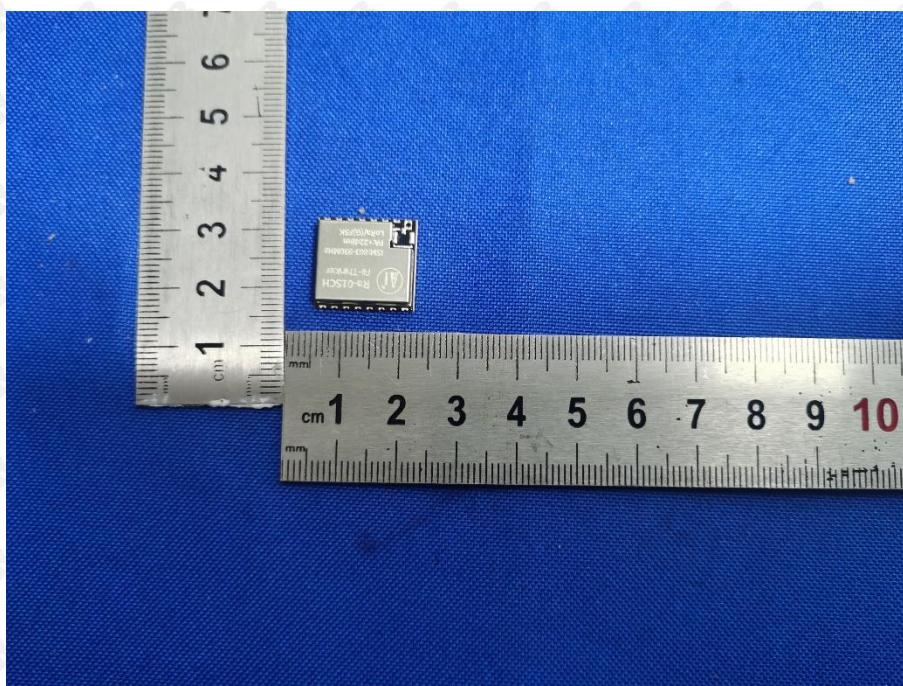


### 16.3 Test Procedure

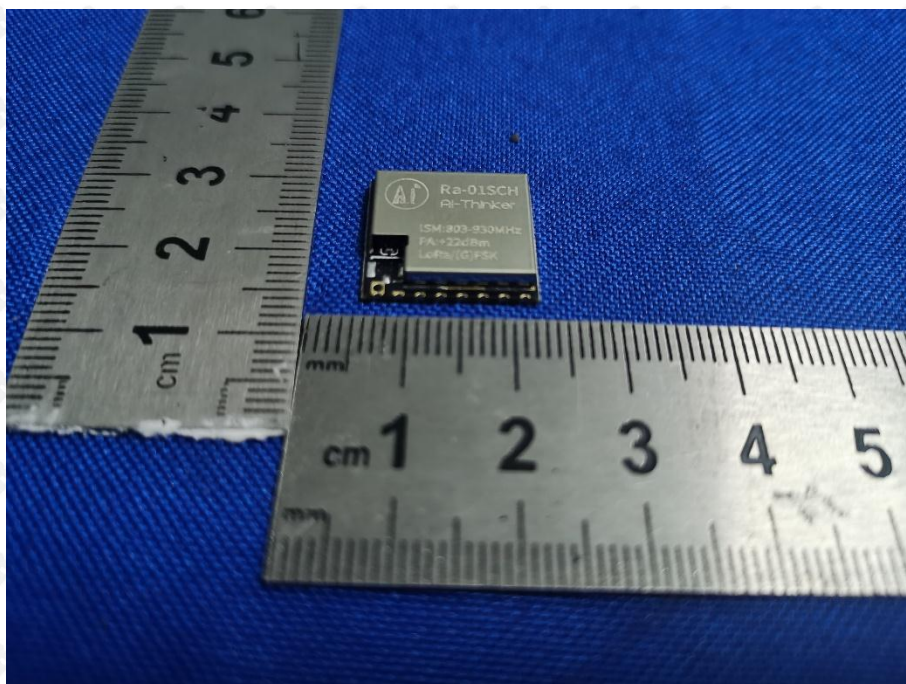
- The Product and support units were located on a non-conductive table above ground floor.
- Set the parameter of tests and then perform the test software of test simulator.
- Conditions changes to occur at 0 degree crossover point of the voltage waveform.

### 16.4 Test Result

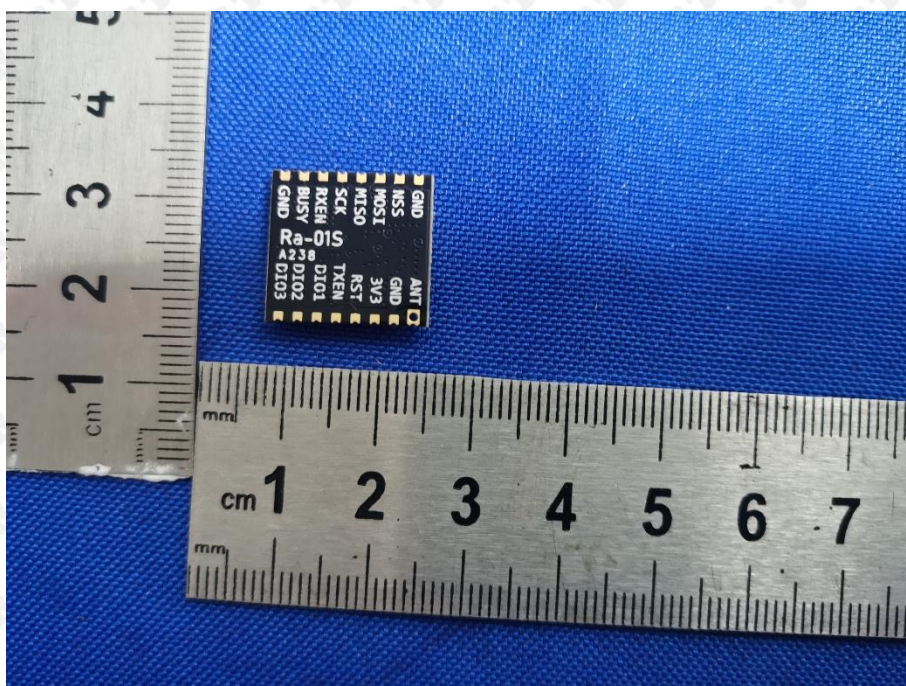
N/A

**17. EUT PHOTOGRAPHS****EUT Photo 1****EUT Photo 2**

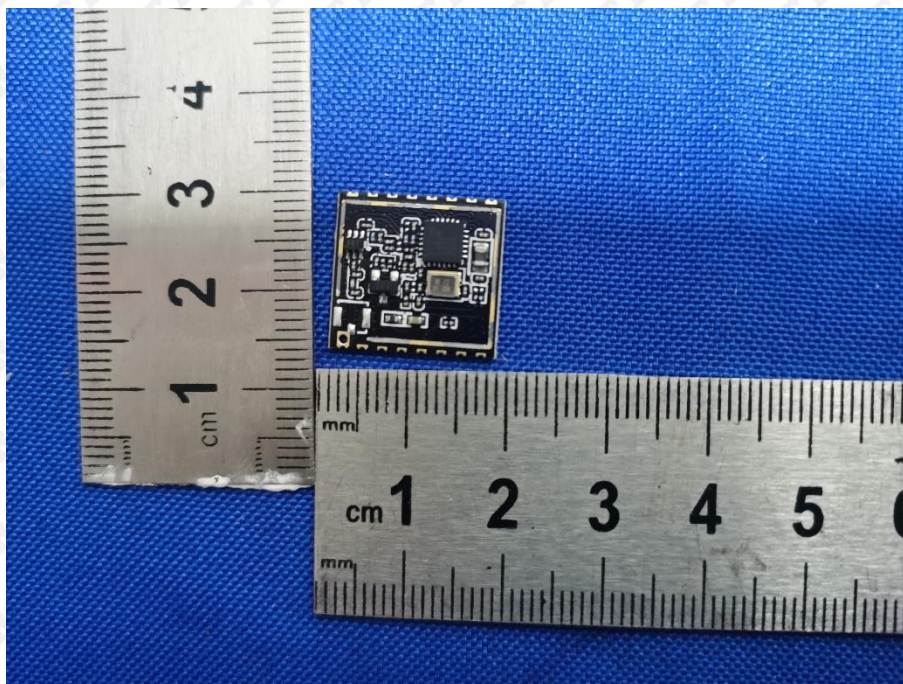
EUT Photo 3



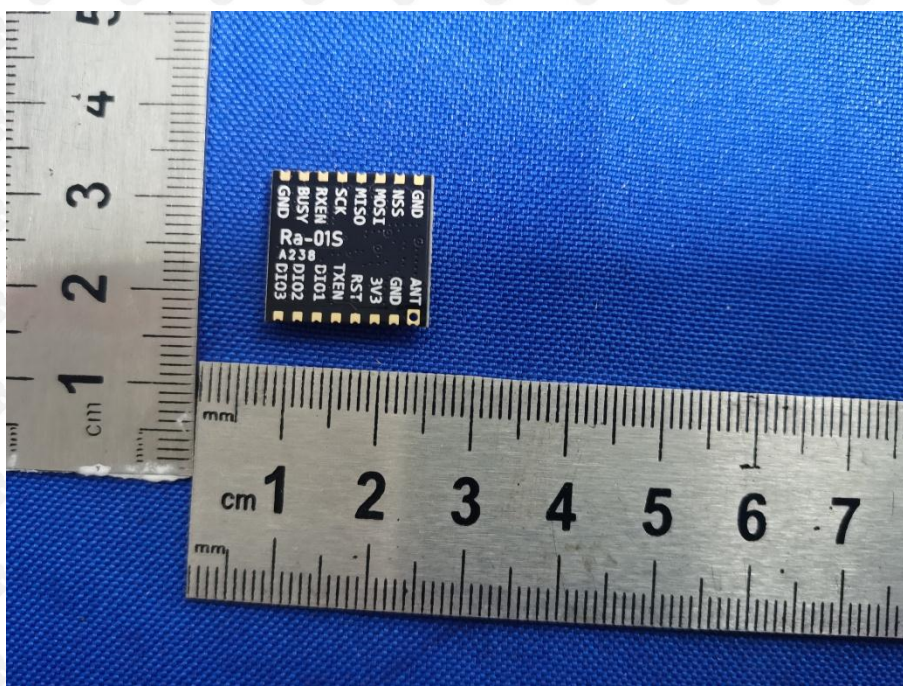
EUT Photo 4



Inside photos  
EUT Photo 1



EUT Photo 2

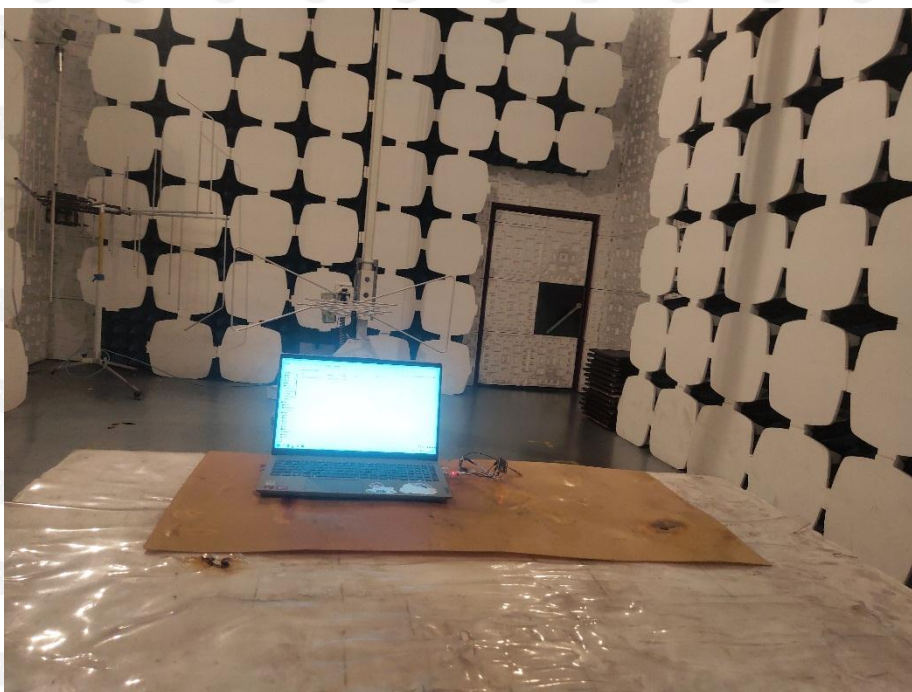


## 18. EUT TEST SETUP PHOTOGRAPHS

### Conducted emissions



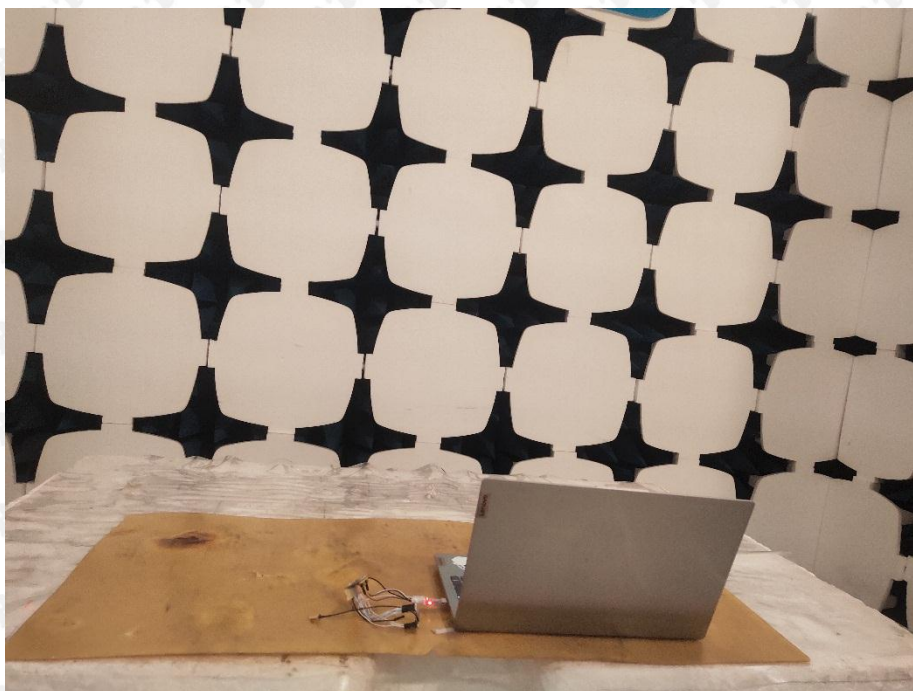
### Radiated emissions below 1G



ESD



RS



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