

# EMC MEASUREMENT REPORT

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**Applicant:** SIMCom Wireless Solutions Limited

**Address:** SIMCom Headquarters Building, Building 3, No. 289  
Linhong Road, Changning District, Shanghai P.R. China  
200335

**Product:** Wireless MODULE

**Model No.:** SIM7028

**Brand Name:** SIMCOM

**Standards:** EN 301 489 - 1 V2.2.3 (2019-11)  
EN 301 489 - 52 V1.2.1 (2021-11)  
AS/NZS CISPR 32: 2015 – Amd 1: 2020

**Result:** Complies

**Received Date:** 2021-09-07

**Test Date:** 2021-09-07 ~ 2021-09-30

**Reviewed By:**

\_\_\_\_\_  
Kevin Guo

**Approved By:**

\_\_\_\_\_  
Robin Wu



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

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### Revision History

Report No.	Version	Description	Issue Date	Note
2307RSU062-E6	V01	Initial Report	2023-08-03	Invalid
2307RSU062-E6	V02	Corrected the typo in the Cover	2023-08-06	Valid

Note: this report is based on the "2109RSU011" project, updated the version of the standard, and the test data are quoted from the MRT's report "2109RSU011-E5".

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## 1. General Information

### 1.1. Applicant

SIMCom Wireless Solutions Limited

SIMCom Headquarters Building, Building 3, No. 289 Linhong Road, Changning District, Shanghai P.R. China  
200335

### 1.2. Manufacturer

SIMCom Wireless Solutions Limited

SIMCom Headquarters Building, Building 3, No. 289 Linhong Road, Changning District, Shanghai P.R. China  
200335

### 1.3. Testing Facility

<input checked="" type="checkbox"/>	<b>Test Site – MRT Suzhou Laboratory</b>
	<b>Laboratory Location (Suzhou - Wuzhong)</b> D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
	<b>Laboratory Location (Suzhou - SIP)</b> 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China
	<b>Laboratory Accreditations</b>
	A2LA: 3628.01 FCC: CN1166 VCCI:
	CNAS: L10551 ISED: CN0001 <input type="checkbox"/> R-20025 <input type="checkbox"/> G-20034 <input type="checkbox"/> C-20020 <input type="checkbox"/> T-20020 <input type="checkbox"/> R-20141 <input type="checkbox"/> G-20134 <input type="checkbox"/> C-20103 <input type="checkbox"/> T-20104
<input type="checkbox"/>	<b>Test Site – MRT Shenzhen Laboratory</b>
	<b>Laboratory Location (Shenzhen)</b> 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	<b>Laboratory Accreditations</b>
	A2LA: 3628.02 FCC: CN1284
	CNAS: L10551 ISED: CN0105
<input type="checkbox"/>	<b>Test Site – MRT Taiwan Laboratory</b>
	<b>Laboratory Location (Taiwan)</b> No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	<b>Laboratory Accreditations</b>
	TAF: L3261-190725 FCC: 291082, TW3261
	ISED: TW3261

**1.4. Product Information**

Product Name	Wireless MODULE
Model No.	SIM7028
Brand Name	SIMCOM
3GPP Specification	LTE Category NB1: Band1/3/5/8/2/28
Operating Temp.	-40 ~ 85°C
Power Type	3.0 ~ 4.3Vdc, typical 3.3Vdc
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

## 1.5. Performance Criteria

### **General Requirements (ETSI EN 301 489-1):**

The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests.

For the purpose of the present document two categories of performance criteria apply:

- Performance criteria for continuous phenomena.
- Performance criteria for transient phenomena.

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.

### **Performance criteria for continuous phenomena**

During the test, the equipment shall:

- continue to operate as intended;
- not unintentionally transmit;
- not unintentionally change its operating state;
- not unintentionally change critical stored data.

### **Performance criteria for transient phenomena**

For all ports and transient phenomena with the exception described below, the following applies:

- 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.
- After application of the transient phenomena, the equipment shall operate as intended.

For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:

- 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.

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.



**Special Performance Requirements (ETSI EN 301 489-52):**

Performance criteria for Continuous phenomena

**● GSM and voice call**

Performance criteria for Continuous phenomena applied to Transmitters (CT)

With a link established, during the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

Note: When there is a high-level background noise present, the filter bandwidth may be reduced down to a minimum of 40 Hz.

In idle mode, the transmitter shall not operate unintentionally.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

Performance criteria for Continuous phenomena applied to Receivers (CR)

During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence.

In the case of narrow band responses, the procedure in clause 4.4.1 of EN 301 489-52 V1.2.1 shall be followed.

During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (audio breakthrough check).

Note: When there is a high-level background noise present, the filter bandwidth may be reduced down to a minimum of 40 Hz.

At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or critical stored data, and the communication link shall have been maintained.

**● UTRA**

In the data transfer mode, the performance criteria can be one of the following:

- if the BER (as referred in clause 5.3.1 of ETSI TS 134 109) is used, it shall not exceed 0,001 during the test sequence;
- if the BLER (as referred in ETSI TS 134 109) is used, it shall not exceed 0,01 during the test sequence.

The BLER calculation shall be based on evaluating the CRC on each transport block. Details are specified in annex C of EN 301 489-52 V1.2.1.

In the case of narrow band responses, the procedure in clause 4.4.3 of EN 301 489-52 V1.2.1 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 of EN 301 489-52 V1.2.1 shall apply.

- **E-UTRA, E-UTRA with LAA, inband or guard band NB-IoT, Standalone NB-IoT**

In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput.

In the case of narrow band responses, the procedure in clause 4.4.3 of EN 301 489-52 V1.2.1 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 of EN 301 489-52 V1.2.1 shall apply.

- **NR**

In data transfer mode, the data throughput of the EUT shall not fall below 95 % of the maximum data throughput.

In the case of narrow band responses, the procedure in clause 4.4.3 of EN 301 489-52 V1.2.1 shall be followed.

When testing a voice call, the performance criteria in clause 6.1.1 of EN 301 489-52 V1.2.1 shall apply.

#### **Performance criteria for Transient phenomena**

At the conclusion of each exposure of the transient phenomena, the EUT shall operate without loss of the communication link.

At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended without loss of user control functions or critical stored data.

In addition where the EUT supports idle mode it should be verified that the transmitter shall not unintentionally operate when transient phenomena are applied.

## 2. Test Configuration

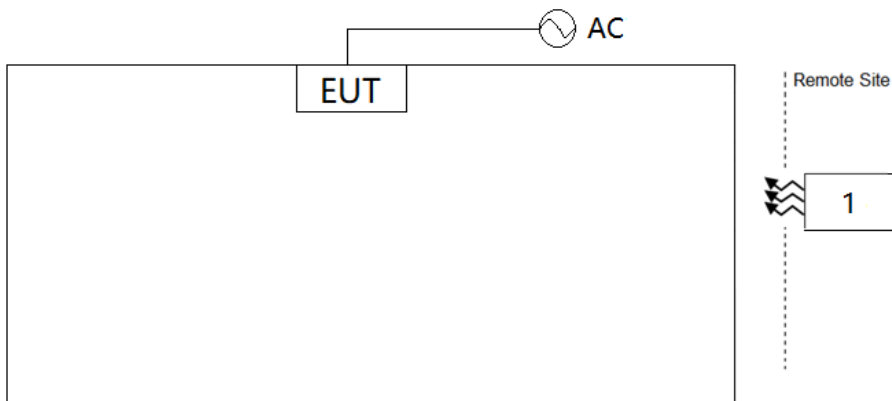
### 2.1. Test Mode

Mode 1: Power by USB and NB-IoT Band 1 Traffic

Mode 2: Power by USB and NB-IoT Band 1 Idle

### 2.2. Configuration of Tested System

Connection Diagram (Mode 1 ~ 2)



No.	Product	Manufacturer	Model No.
1	Wideband Radio Communication Tester	R&S	CMW 500

### 3. Measuring Instrument

Instrument Name	Manufacturer	Model No.	Asset No.	Cali. Interval	Cal. Due Date	Test Site
Electrostatic	HAEFELY	ONYX 30	MRTSUE06388	1 year	2022-01-04	WZ-TR2
Thermohygrometer and barometer	testo	622	MRTSUE06399	1 year	2022-01-26	WZ-TR2
MXG Analog Signal Generator	Agilent	N5181A	MRTSUE06370	1 year	2022-06-10	SIP-AC4
Audio Analyzer	Keysight	U8903B	MRTSUE06143	1 year	2022-06-10	SIP-AC4
EPM Series Power Meter	Agilent	E4418B	MRTSUE06204	1 year	2022-06-10	SIP-AC4
Power Sensor	Agilent	E9301H	MRTSUE06205	1 year	2022-06-10	SIP-AC4
Amplifier	ar	150W1000M1	MRTSUE06146	N/A	N/A	SIP-AC4
Amplifier	rflight	NTWPAS-1025100	MRTSUE06363	N/A	N/A	SIP-AC4
Amplifier	rflight	NTWPAS-2560100	MRTSUE06364	N/A	N/A	SIP-AC4
High-Gain Horn Antenna	ar	ATH800M5GA	MRTSUE06144	N/A	N/A	SIP-AC4
Log-Periodic Antenna	ar	ATR80M6G	MRTSUE06145	N/A	N/A	SIP-AC4
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06648	1 year	2021-11-26	SIP-AC4
Laser Powered Field Probe	ar	FL7006	MRTSUE06149	1 year	2022-01-09	SIP-AC4
Laser Probe Interface	ar	FL7000	MRTSUE06150	N/A	N/A	SIP-AC4
Two channel Microphone Conditioning Amplifier	Bruel & Kjaer	2690-OS2	MRTSUE06161	1 year	2021-10-21	SIP-AC4
Measurement Power Amplifier	Bruel & Kjaer	2735	MRTSUE06162	1 year	2021-10-21	SIP-AC4
Mouth Simulator	Bruel & Kjaer	4227	MRTSUE06164	1 year	2021-10-21	SIP-AC4
Sound Calibrator	Bruel & Kjaer	4231	MRTSUE06165	1 year	2021-10-20	SIP-AC4
Microphone Unit	Bruel & Kjaer	4192-L-001	MRTSUE06166	1 year	2021-10-20	SIP-AC4
Probe Microphone	Bruel & Kjaer	4182	MRTSUE06167	1 year	2021-09-19	SIP-AC4
Thermohygrometer and barometer	testo	608-H1	MRTSUE06625	1 year	2021-12-03	SIP-AC4

Software	Version	Function
JS32-RS	V1.0.0.1	RS Test Software

## 4. Decision Rules and Measurement Uncertainty

### 4.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 4.2. Measurement Uncertainty

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

<b>Conducted Emission</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
<b>Radiated Disturbance</b>
Measurement Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~6GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~6GHz: 6.40dB
<b>Harmonic Current Emissions</b>
The maximum measurement uncertainty is evaluated as 0.2%.
<b>Voltage Fluctuation and Flicker</b>
The maximum measurement uncertainty is evaluated as $d_c$ and $d_{max}$ : 0.095%, $P_{st}$ and $P_{lt}$ : 4%, $d_{(t)}$ : 1.5%.

## 5. Test Result

### 5.1. Summary

Test Items	Basic Standard	Verdict
<b>Emission Measurements</b>		
Radiated Emission	EN 55032:2015/AC: 2020	N/A
Conducted Emissions	EN 55032:2015/AC: 2020	N/A
Harmonic current emission	EN 61000-3-2: 2019	N/A
Voltage fluctuations and flicker	EN 61000-3-3: 2013+A1: 2019	N/A
<b>Immunity Measurements</b>		
Electrostatic Discharge (ESD)	EN 61000-4-2: 2009	Complied
Radio Frequency Electromagnetic Field (RS)	EN 61000-4-3: 2006/A1: 2001/A2: 2010	Complied
Electrical Fast Transient/Burst (EFT)	EN 61000-4-4:2012	N/A
Surge	EN 61000-4-5: 2014+A1: 2017	N/A
Conducted Disturbances (CS)	EN 61000-4-6: 2014	N/A
Power Frequency Magnetic Field (PFM)	EN 61000-4-8: 2010	N/A
Voltage Dips and interruptions	EN 61000-4-11: 2004+A1: 2017	N/A
Note: "N/A" means that the test item is not applicable, and the detailed information refers to relevant section.		

## 5.2. Conducted Emission Measurement

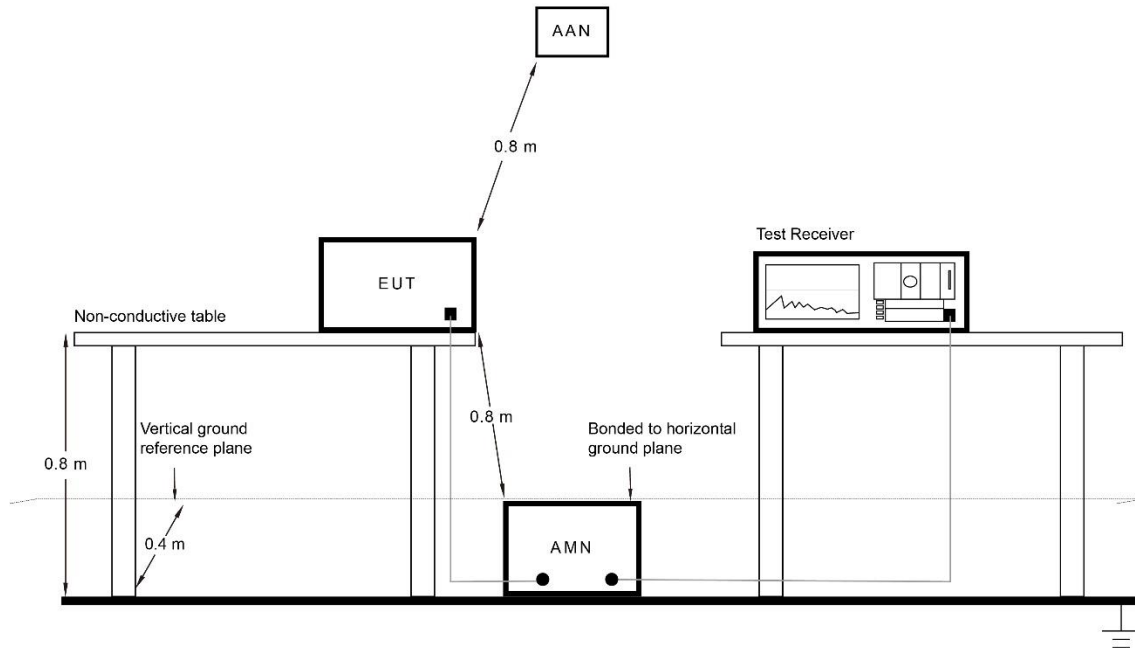
### 5.2.1. Test Limit

Limits for AC Mains Power input/output Ports				
Frequency Range (MHz)	Class A Limits		Class B Limits	
	QP dB( $\mu$ V)	AV dB( $\mu$ V)	QP dB( $\mu$ V)	AV dB( $\mu$ V)
0.15 ~ 0.5	79	66	66 to 56	56 to 46
0.5 ~ 5	73	60	56	46
5 ~ 30	73	60	60	50

Limits for Asymmetric Mode								
Frequency Range (MHz)	Class A Limits				Class B Limits			
	Voltage Limits dB( $\mu$ V)		Current limits dB( $\mu$ A)		Voltage Limits dB( $\mu$ V)		Current limits dB( $\mu$ A)	
	QP	AV	QP	AV	QP	AV	QP	AV
0.15 ~ 0.5	97 ~ 87	84 ~ 74	53 ~ 43	40 ~ 30	84 ~ 74	74 ~ 64	40 ~ 30	30 ~ 20
0.5 ~ 30	87	74	43	30	74	64	30	20

Limits for DC Power input/output Ports for EN 301 489 -1		
Frequency Range (MHz)	Quasi-peak dB( $\mu$ V)	Average dB( $\mu$ V)
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

### 5.2.2. Test Setup



### 5.2.3. Test Procedure

The receiver or associated equipment under measurement and the artificial mains network are disposed as shown in 5.2. Measurements shall be carried out using a selective voltmeter having a quasi-peak detector for broadband measurements and an average detector for narrow-band measurements in accordance with CISPR 16-1.

The mains lead shall be arranged to follow the shortest possible path between the receiver and artificial mains network on the ground. The mains lead in excess of 0,8 m separating the equipment under test from the artificial mains network shall be folded back and forth parallel to the lead so as to form a bundle with a length of 0,3 m to 0,4 m.

Earthing of the equipment under test if provided with a safety earth connection, shall be made to the earth terminal provided on the artificial mains network with the shortest possible lead.

If the equipment under test has a coaxial RF input connector, tests shall be performed with and without an earth connection made to the outer conductor screen of the coaxial RF input connector. When these tests are being carried out, no other earth connections shall be made to any additional earth terminal whatever.

If the equipment under test has no coaxial RF input connector and if it has an earth terminal, tests shall be performed with this terminal earthed.

### 5.2.4. Test Result

There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.



### 5.3. Radiated Emission Measurement

#### 5.3.1. Test Limit

Frequency Range (MHz)	Class A	Class B
	Quasi-peak Limits dB( $\mu$ V/m)	Quasi-peak Limits dB( $\mu$ V/m)
30 ~ 230	50	40
230 ~ 1000	57	47

Note 1: The lower limit shall apply at the transition frequency.

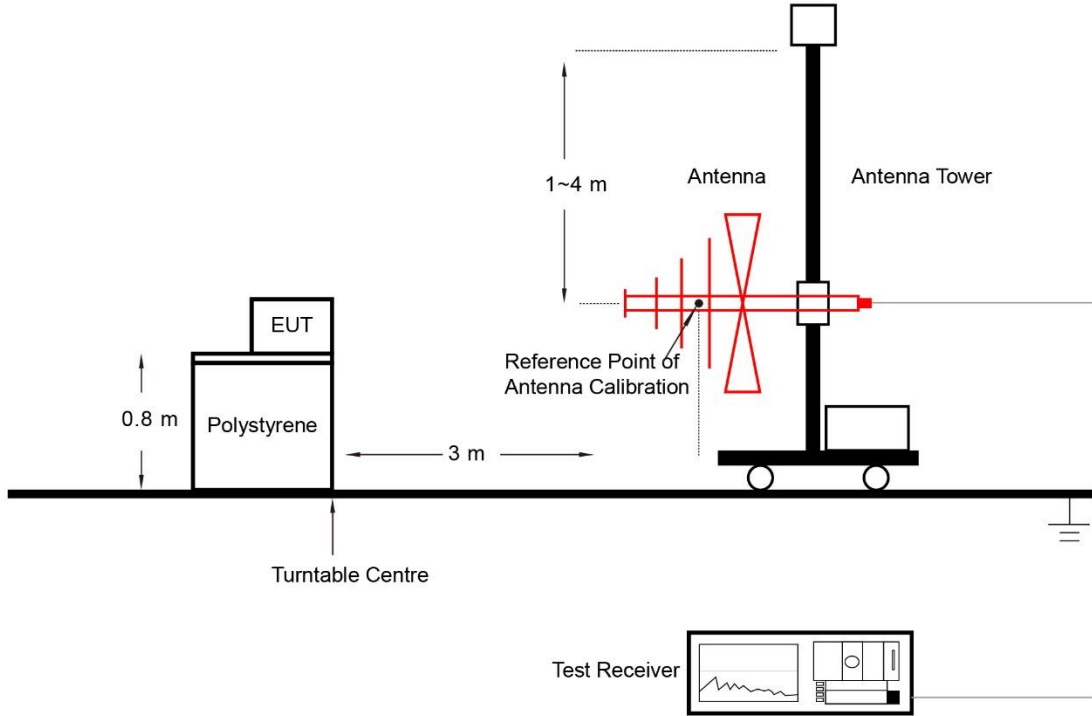
Note 2: Additional provisions may be required for cases where interference occurs.

Frequency Range (GHz)	Class A		Class B	
	Average limit dB( $\mu$ V/m)	Peak limit dB( $\mu$ V/m)	Average limit dB( $\mu$ V/m)	Peak limit dB( $\mu$ V/m)
1 ~ 3	56	76	50	70
3 ~ 6	60	80	54	74

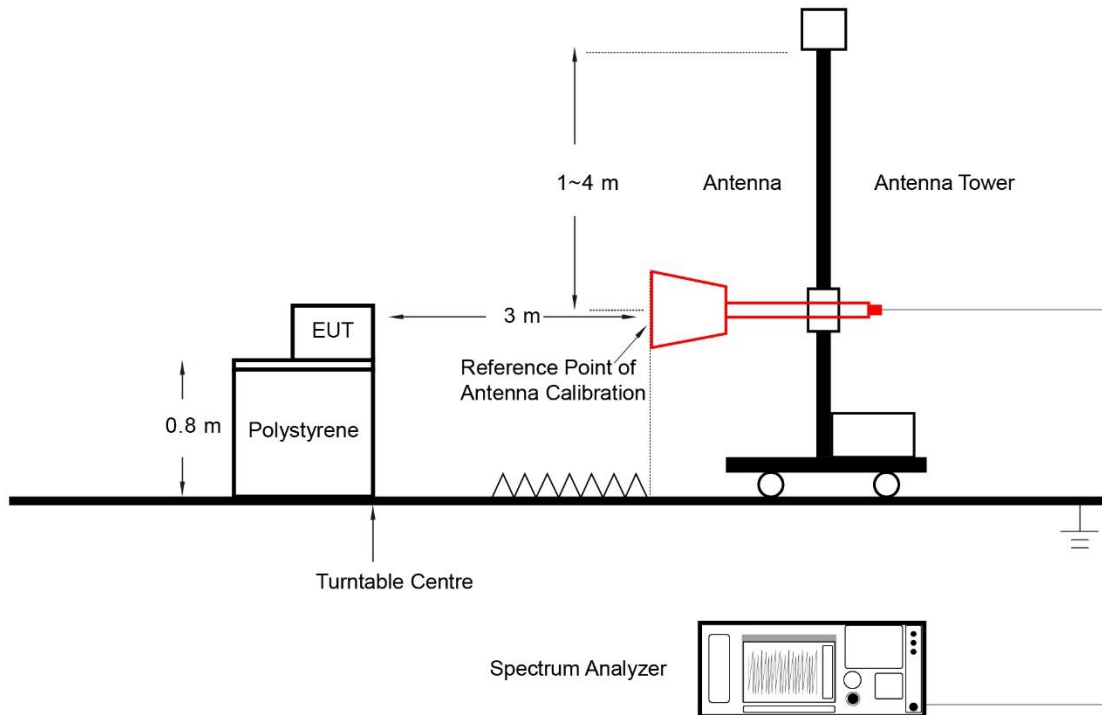
Note: The lower limit applies at the transition frequency.

### 5.3.2. Test Setup

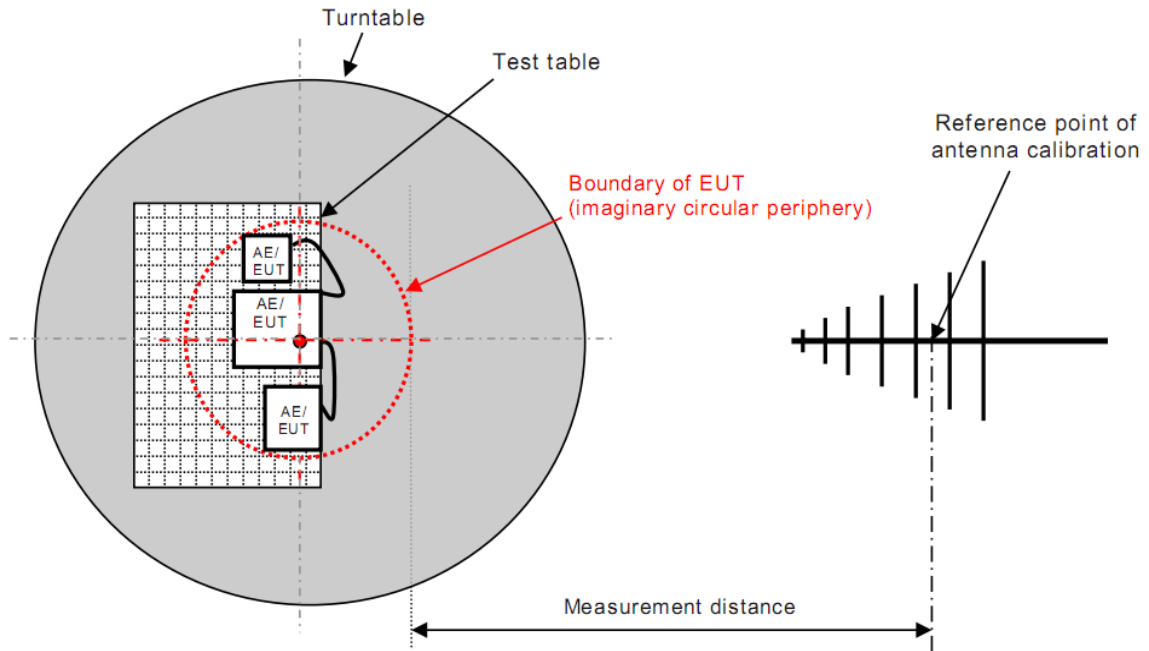
30 ~ 1000 MHz



1000 ~ 6000 MHz

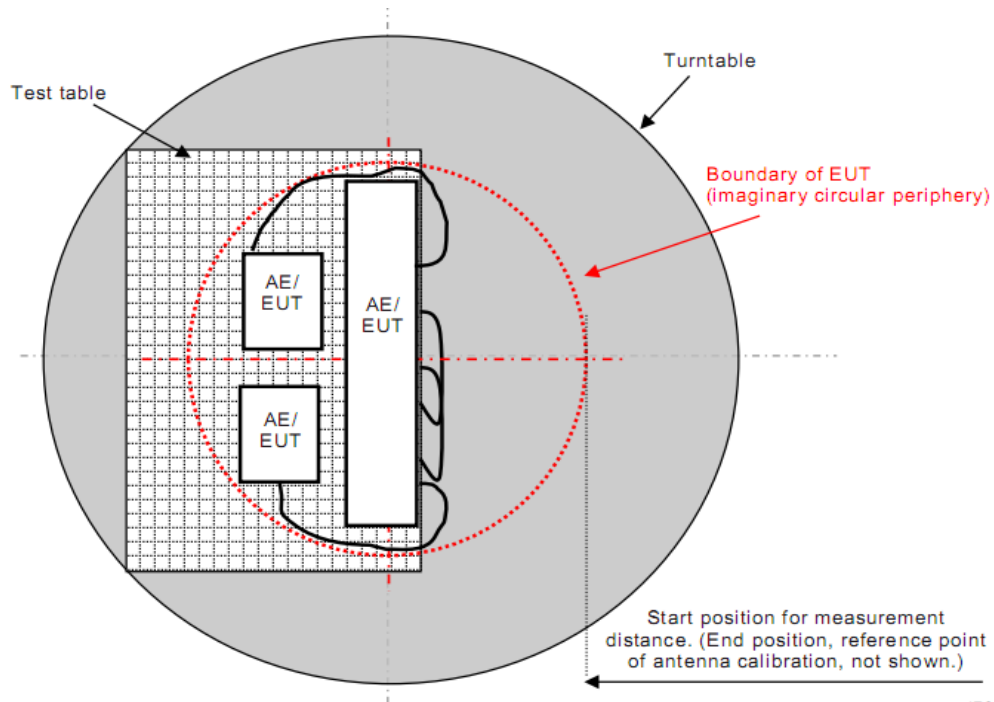


NOTE: About the radiated test setup, the EUT and local AE shall be arranged in the most compact practical arrangement within the test volume, while respecting typical spacing and the requirements defined in EN55032 Annex D. The central point of the arrangement shall be positioned at the centre of the turntable. The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna. See below Figure 1 and Figure 2.



IEC

Figure 1



IEC

Figure 2

### **5.3.3. Test Procedure**

Starting with the front of the receiver under test facing the measuring antenna, the measuring antenna is adjusted for horizontal polarization measurement and its height varied between 1 m and 4 m until the maximum reading is obtained.

The receiver under test is then rotated about its centre until the maximum meter reading is obtained, after which the measuring antenna height is again varied between 1 m and 4 m and the maximum reading noted.

The procedure is repeated for vertical polarization of the measuring antenna.

The highest value found, following this procedure, is defined as the radiation figure of the receiver.

If at certain frequencies the ambient signal field strength is high at the position of the receiving antenna, one of the following methods may be used to show compliance of the equipment under test.

For small frequency bands with high ambient signals, the disturbance value may be interpolated from the adjacent values. The interpolated value shall lie on the curve describing a continuous function of the disturbance values adjacent to the ambient noise.

### **5.2.5. Test Result**

Here is not any ancillary equipment with this module, so this test item is not applicable.

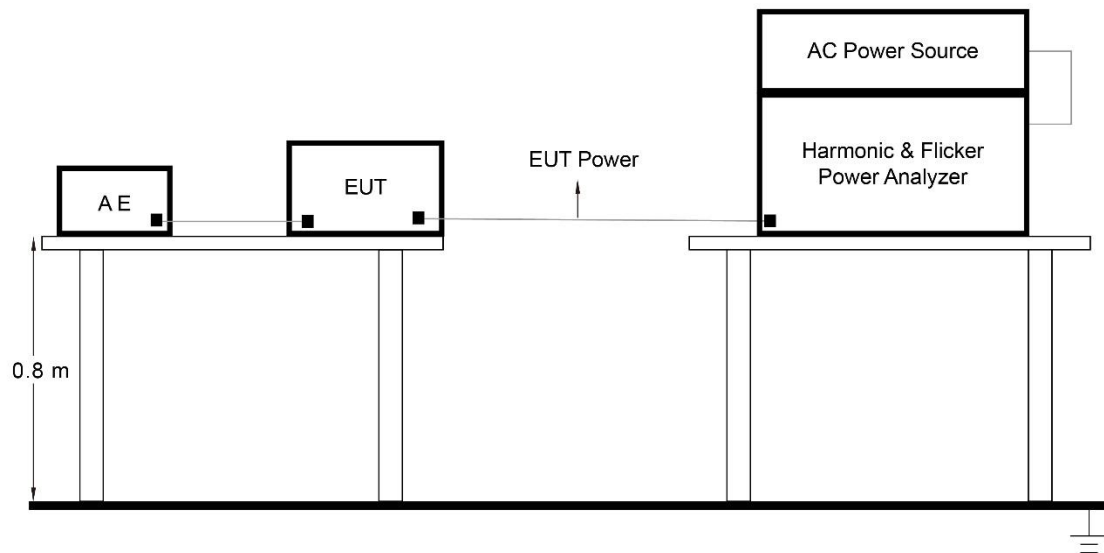
## 5.4. Harmonic Current Emissions Measurement

### 5.4.1. Test Limit

Limits of Class A Harmonics Currents

Harmonics Order n	Maximum Permissible harmonic current A	Harmonics Order n	Maximum Permissible harmonic current A
Odd harmonics		Even harmonics	
3	2.30	2	1.08
5	1.14	4	0.43
7	0.77	6	0.30
9	0.40	$8 \leq n \leq 40$	$0.23 * 8/n$
11	0.33	--	--
13	0.21	--	--
$15 \leq n \leq 39$	$0.15 * 15/n$	--	--

### 5.4.2. Test Setup



### 5.4.3.

#### **5.4.3. Test Procedure**

The EUT is supplied in series with power analyzer from a power source having the same normal voltage and frequency as the rated supply voltage and the equipment under test. And the rated voltage at the supply voltage of EUT of 0.98 times and 1.02 times shall be performed.

#### **5.4.4. Test Result**

There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.

## 5.5. Voltage Fluctuations and Flicker Measurement

### 5.5.1. Test Limit

The following limits apply:

- the value of  $P_{st}$  shall not be greater than 1.0;
- the value of  $P_{It}$  shall not be greater than 0.65;
- the value of  $d(t)$  during a voltage change shall not exceed 3.3% for more than 500ms;
- the relative steady-state voltage change,  $d_c$ , shall not exceed 3.3%;
- the maximum relative voltage change,  $d_{max}$ , shall not exceed;
  - a) 4% without additional conditions;
  - b) 6% for equipment which is:
    - switched manually, or
    - switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.

Note: The cycling frequency will be further limited by the  $P_{st}$  and  $P_{It}$  limit.

For example: a  $d_{max}$  of 6% producing a rectangular voltage change characteristic twice per hour will give a  $P_{It}$  of about 0.65.

- c) 7% for equipment which is:
  - attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
  - switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

$P_{st}$  and  $P_{It}$  requirements shall not be applied to voltage changes caused by manual switching.



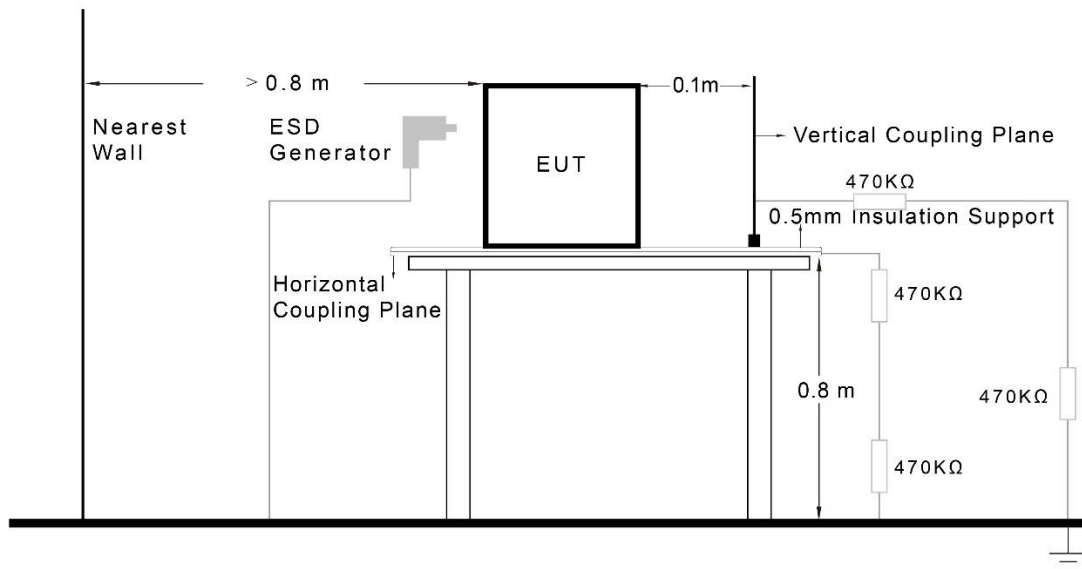


## 5.6. Electrostatic Discharge Measurement

### 5.6.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52			
Electrostatic discharge	±4 (Contact discharge)	kV (Test voltage)	Transient Phenomena
	±2, ±4, ±8 (Air discharge)	kV (Test voltage)	

### 5.6.2. Test Setup



### 5.6.3. Test Procedure

#### **Direct Application of Discharges to the EUT:**

Contact discharge was applied only to conductive surfaces of the EUT.

Air discharges were applied only to non-conductive surfaces of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges will be keep longer 1 second. It was at least twenty-five single discharges with positive and negative at the same selected point.

The selected point, which was performed with electrostatic discharge, was marked on the red label of the EUT.

#### **Indirect Application of Discharges to the EUT:**

##### Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge. It was at least ten single discharges with positive and negative at the same selected point.

##### Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge. It was at least ten single discharges with positive and negative at the same selected point.

#### 5.6.4. Test Result

Test Site	WZ-TR2	Temperature/Humidity	25.1°C /51.2%
Test Engineer	Cloud Guo	Barometric	102 KPa
Test Mode	Mode 1 ~ 2	Test Date	2021-09-23

Indirect Application		Performance Criterion Result
Test Location	Test Level	Vertical Coupling
Front, Rear, Left, Right	±4kV	Complied <sup>Note</sup>

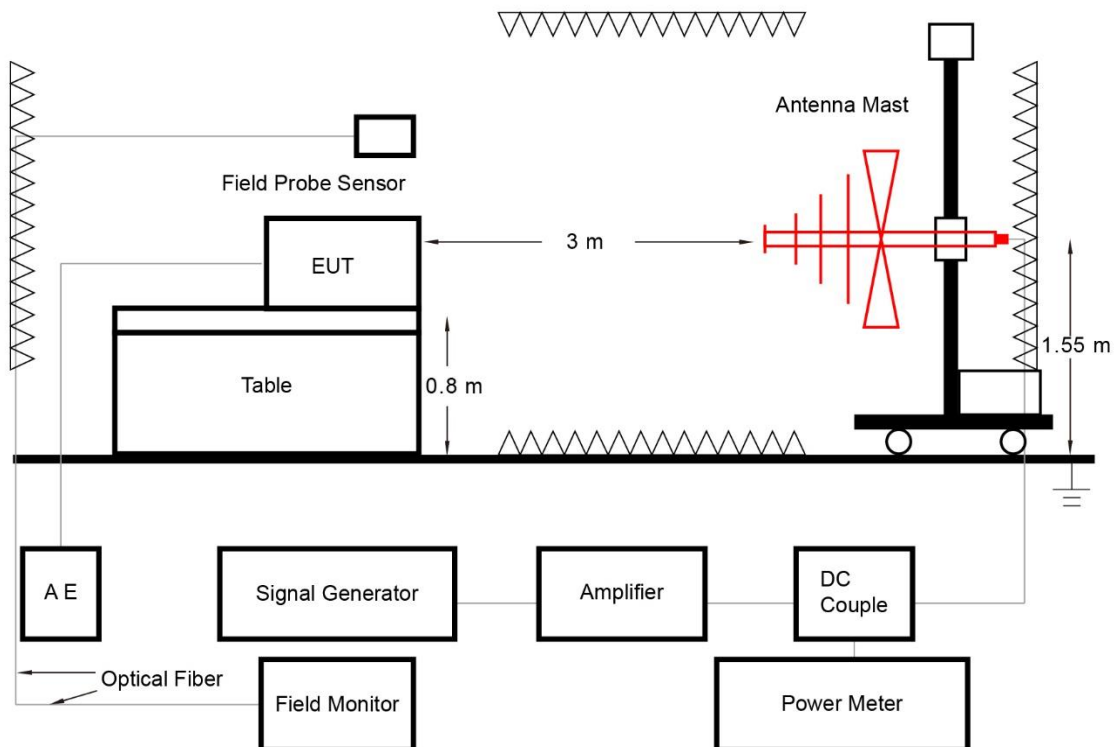
Note: During and after test, the EUT's throughput > 95 % no loss of service, there is not any degradation of performance.

## 5.7. Radio-Frequency Electromagnetic Field Measurement

### 5.7.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52 (Note 1, 2)			
Radio frequency electromagnetic field	80 - 6000	MHz	Continuous Phenomena
	3	V/m (unmodulated, r.m.s)	
	80	% AM (1kHz)	
Note 1: If the wanted signal is modulated at 1000Hz, then an audio signal of 400Hz shall be used. Note 2: The test shall be performed over the frequency range 80MHz to 6000MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers of EN 301 489-1, as appropriate.			

### 5.7.2. Test Setup



### 5.7.3. Test Procedure

The EUT and load, which are placed on a table that is 0.8 meter above ground, are placed with one coincident with the calibration plane such that the distance from antenna to the EUT was 3 meters.

The test shall normally be performed with the generating antenna facing each side of the EUT. When equipment can be used in different orientations (i.e. vertical or horizontal) all sides shall be exposed to the field during the test. When technically justified, some EUTs can be tested by exposing fewer faces to the generating antenna. In other cases, as determined for example by the type and size of EUT or the frequencies of test, more than four azimuths may need to be exposed.

All the scanning conditions are as follows:

	Condition of Test	Remarks
1.	Field Strength	3V/m
2.	Radiated Signal	AM 80% Modulated with 1kHz
3.	Scanning Frequency	80MHz ~ 6GHz
4.	Dwell Time	1 Seconds
5.	Frequency Step Size $\Delta f$	1%

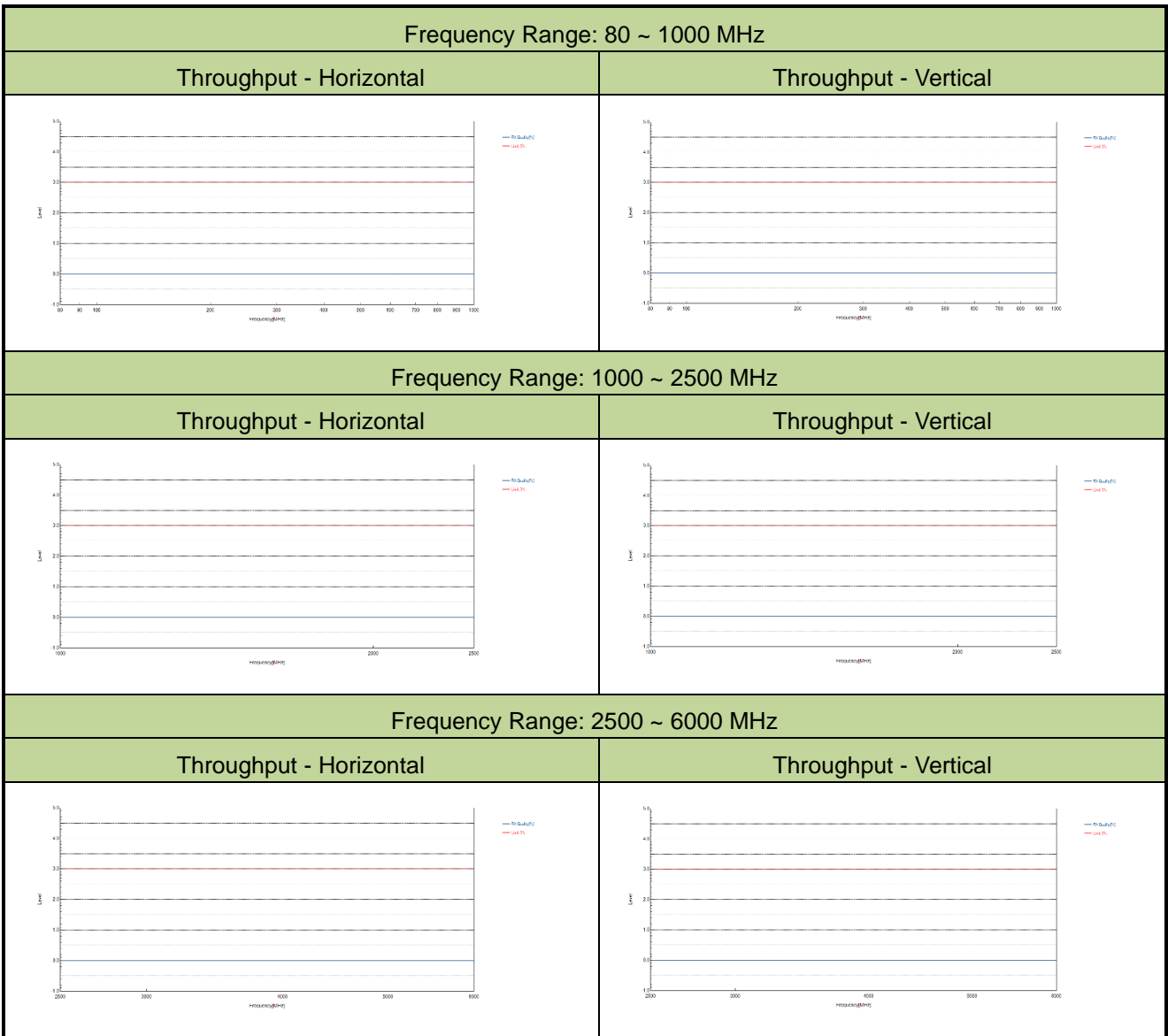
**5.7.4. Test Result**

Test Site	SIP-AC4	Temperature	26°C
Test Engineer	Barry Wu	Relative Humidity	52.8%
Test Mode	Mode 1 ~ 2	Test Date	2021-09-27

Frequency (MHz)	Polarity	Test Position	Field Strength (V/m)	Performance Criterion Result
80 ~ 1000	Horizontal/Vertical	Front	3	Complied <sup>Note</sup>
1000 ~ 6000	Horizontal/Vertical	Front	3	Complied <sup>Note</sup>

Note: During and after test, the EUT's throughput > 95 % no loss of service, there is not any degradation of performance.

**Worst Case Test Mode**



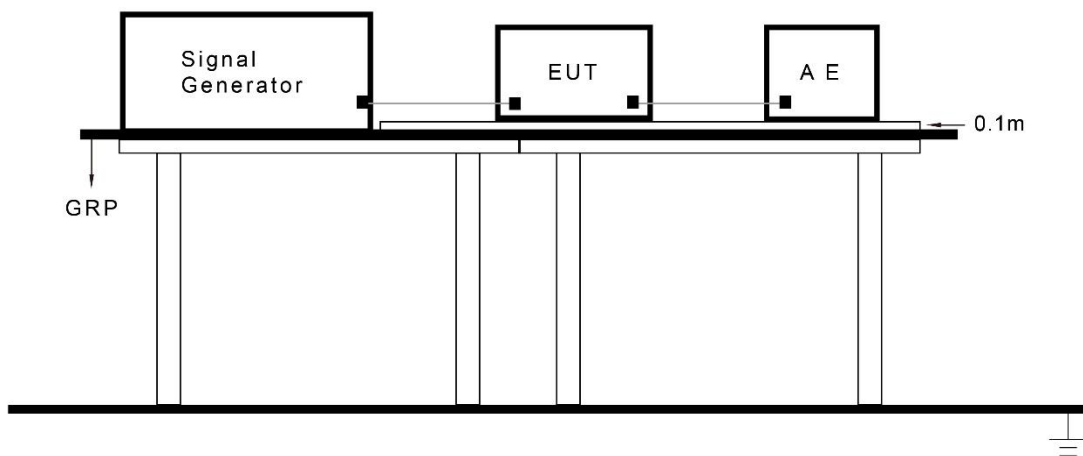
Note: the throughput shall be  $\geq 95\%$  % of the maximum throughput of the reference measurement channel.

## 5.8. Electrical Fast Transients Measurement

### 5.8.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52			
Input AC power ports			
Electrical fast transients	±1 5/50 5	kV (open circuit test voltage) Tr/Th (ns) Repetition frequency (kHz)	Transient Phenomena
Signal ports, telecommunication ports, and control ports			
Fast transients common mode	±0.5 5/50 5	kV (peak) Tr/Th ns Repetition frequency (kHz)	Transient Phenomena

### 5.8.2. Test Setup





### **5.8.3. Test Procedure**

The EUT is placed on a table that is 0.8 meter height. A ground reference plane is placed on the table, and uses a 0.1m insulation between the EUT and ground reference plane.

The minimum area of the ground reference plane is 1m\*1m, and 0.65mm thick min, and projected beyond the EUT by at least 0.1m on all sides.

#### **For Input AC Power Ports:**

The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal.

Each of the line conductors is impressed with burst noise for 1 minute.

The length of the power lines between the coupling device and the EUT is 0.5m.

#### **For Signal Ports, Telecommunication Ports, and Control Ports:**

The EFT interference signal is through a coupling clamp device couples to the signal of the EUT with burst noise for 1 minute.

The length of the signal lines between the coupling device and the EUT is 0.5m.

### **5.8.4. Test Result**

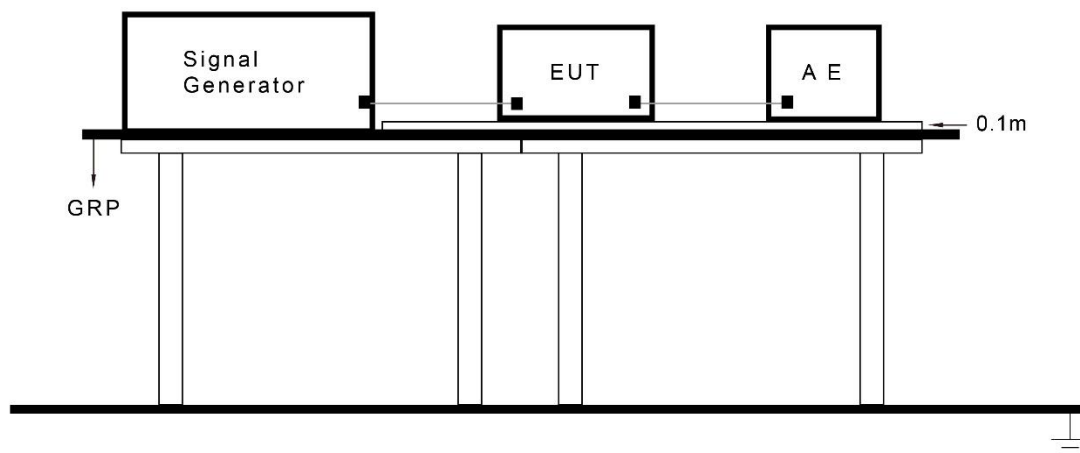
There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.

## 5.9. Surges Measurement

### 5.9.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52			
Input AC power ports			
Surges	1.2/50 (8/20) ±1 line to line ±2 line to earth	Tr/Th (us) kV kV	Transient Phenomena
Wired network ports directly connected to outdoor cables			
Surges (Symmetrically operated)	10/700 ±1 line to earth	Tr/Th (us) kV	Transient Phenomena
Surges (Non-symmetrically operated)	1.2/50 (8/20) ±0.5 line to line ±1 line to earth, shield to earth	Tr/Th (us) kV kV	Transient Phenomena
Wired network ports directly connected to indoor cables (Note)			
Surges	1.2/50 (8/20) ±0.5 line to ground, shield to earth	Tr/Th us kV	Transient Phenomena
Note: Applicable only to wired network ports, intended to be connected to indoor cables, support cable lengths greater than 30 m.			

### 5.9.2. Test Setup



### **5.9.3. Test Procedure**

The EUT is placed on a table that is 0.8 meter above a metal ground plane measured 1m\*1m minimum and 0.65mm thick minimum and projected beyond the EUT by at least 0.1m on all sides. The length of power cord between the coupling device and the EUT shall be 2m or less.

#### **For Input AC Power Ports:**

The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal.

The surge noise shall be applied synchronized to the voltage phase at 0°, 90°, 180°, 270° and the peak value of the AC voltage wave. (Positive and negative)

Each of Line to Earth and Line to Line is impressed with a sequence of five surge voltages with interval of 1 minute.

#### **For Telecommunication Ports:**

The signal line of EUT is connected to coupling and decoupling network that directly couples the surge interference signal.

Only Line to ground is impressed with a sequence of five surge voltages with interval of 1 minute.

### **5.9.4. Test Result**

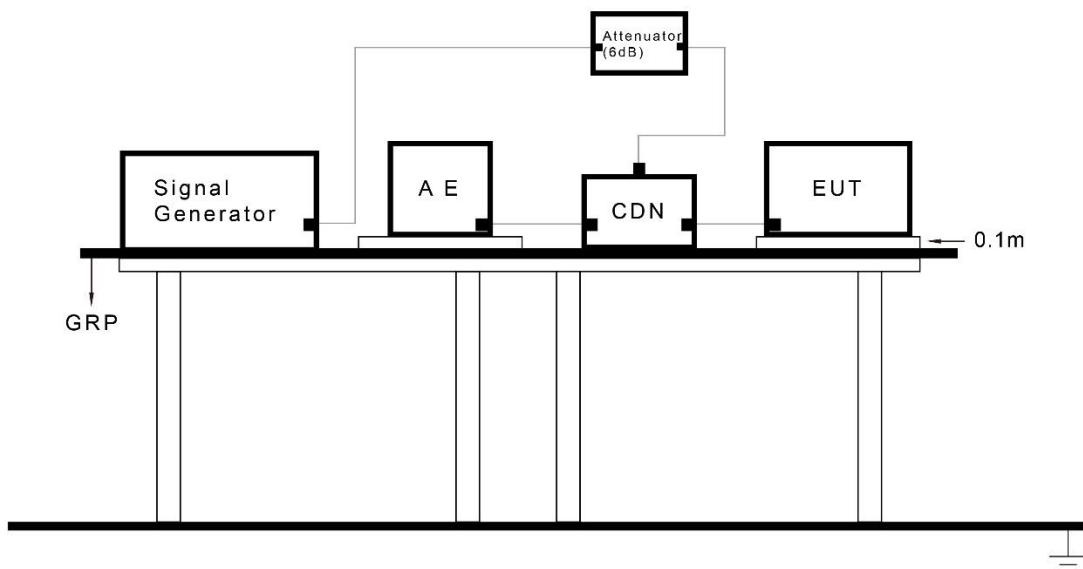
There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.

## 5.10. Radio-Frequency Common Mode Measurement

### 5.10.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52			
Input AC power ports (See Note 1 and 2)			
Radio-frequency common mode	0.15 - 80 3 80	MHz V (unmodulated, r.m.s) % AM (1kHz)	Continuous Phenomena
Signal ports, telecommunication ports, and control ports (See Note 1, 2 and 3)			
Radio frequency common mode	0.15 - 80 3 80	MHz V (unmodulated, r.m.s) % AM (1kHz)	Continuous Phenomena
Note 1: If the wanted signal is modulated at 1000Hz, then an audio signal of 400Hz shall be used. Note 2: The test shall be performed over the frequency range 150kHz to 80MHz with the exception of the exclusion band for transmitters, and for receivers and duplex transceivers [see clause 4 of EN 301 489-1. Note 3: This test shall be additionally performed on signal ports, telecommunication ports, control ports, and DC power ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3m.			

### 5.10.2. Test Setup



### 5.10.3. Test Procedure

The EUT is placed on a table that is 0.8 meter height, and a ground reference plane on the table, EUT is placed upon table and use 0.1m insulation between the EUT and ground reference plane.

#### For Input AC Power Ports:

The EUT is connected to the power mains through a coupling and decoupling networks for power supply lines. And directly couples the disturbances signal into EUT.

#### For Signal Ports, Telecommunication Ports, and Control Ports:

The disturbance signal is through a coupling and decoupling networks (CDN) or EM-clamp device couples to the signal and telecommunication lines of the EUT.

	Condition of Test	Remarks
1.	Field Strength	3V
2.	Radiated Signal	AM 80% Modulated with 1kHz
3.	Scanning Frequency	0.15MHz - 80MHz
4.	Dwell Time	1 Seconds
5.	Frequency Step Size $\Delta f$	1%

### 5.10.4. Test Result

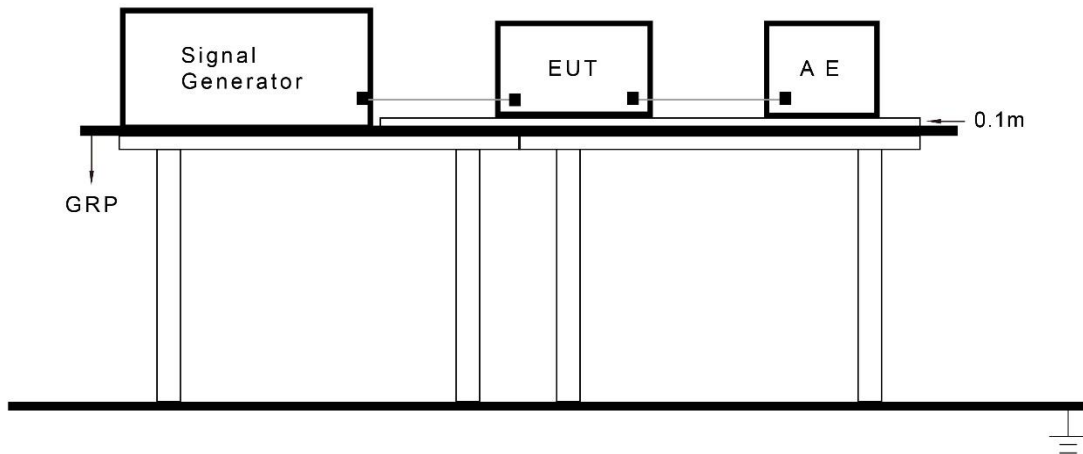
There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.

## 5.11. Voltage Dips and Interruptions Measurement

### 5.11.1. Test Limit

Environmental Phenomenon	Test Specification	Units	Performance Criterion
EN 301 489-1/52			
Input AC power ports			
Voltage dips	0 0.5	% residual cycle	TT & TR
	0 1	% residual cycle	TT & TR
	70 25	% residual cycle	TT & TR
Voltage interruptions	0 250	% residual cycle	TT & TR

### 5.11.2. Test Setup



### **5.11.3. Test Procedure**

The EUT is placed on a table which is 0.8 meter above a metal ground plane measured 1m\*1m minimum, and 0.65mm thick minimum, and projected beyond the EUT by at least 0.1m on all sides. The power cord shall be used the shortest power cord as specified by the manufacturer.

For Voltage dips and interruptions test:

The selection of test voltage is based on the rated power range. If the operation range is large than 20% of lower power range, both end of specified voltage shall be tested. Otherwise, the typical voltage specification is selected as test voltage.

The EUT is connected to the power mains through a coupling device that directly couples to the voltage dips and interruption generator.

### **5.11.4. Test Result**

There is not any power port and signal port. Therefore, this test item is not applicable for the EUT.

## **Appendix A - Test Setup Photograph**

Refer to "2307RSU062-ET" file.



## Appendix B - EUT Photograph

Refer to "2307RSU062-EE" file.

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