MEASUREMENT REPORT

EMC Test Report

Applicant: BEIJING STRONGLINK TECHNOLOGY CO,. LTD.

Address: Building C No.39 Xi'erqi street Haidian district, Beijing, 100085 China

Product: MIFARE MODULE

Model No.: SL030_V3.1

Serial Model No.: SL031_V3.0

Standards: ETSI EN 301 489-1 V2.2.0 (2017-03)
ETSI EN 301 489-3 V2.1.1 (2019-03)

Result: Complies

Test Date: April 02 ~ 26, 2019

Reviewed By: Sunny Sun
(Sunny Sun)

Approved By: Robin Wu
(Robin Wu)

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

Revision History

Report No.	Version	Description	Issue Date	Note
1903RSU035-E1	Rev. 01	Initial Report	05-05-2019	Valid

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Description Page

1. General Information

1.1. Applicant

BEIJING STRONGLINK TECHNOLOGY CO,. LTD.

Building C No.39 Xi'erqi street Haidian district, Beijing, 100085 China

1.2. Manufacturer

BEIJING STRONGLINK TECHNOLOGY CO,. LTD.

Building C No.39 Xi'erqi street Haidian district, Beijing, 100085 China

1.3. TestingFacility

Test Site

MRT Technology (Suzhou) Co., Ltd

Test Site Location

D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- **MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.**
- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LACert. No.3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.**

1.4. Feature of Equipment under Test

Product Name	MIFARE MODULE
Model No.	SL030_V3.1
Serial Model No.	SL031_V3.0
RFID	13.56MHz
Antenna Type	PCB Antenna
Type of modulation	ASK

Note: The two models only have different names, and the others are all same.

1.5. Standards Applicable for Testing

The EUT complies with the requirements of EN 301 489-1 V2.2.0 & EN 301 489-3 V2.1.1.

EMI Test:

EN 55032 Class B: 2015 (Conducted Emission)

EN 55032 Class B: 2015 (Radiated Emission)

EN 61000-3-2: 2014 (Harmonic)

EN 61000-3-3: 2013 (Flicker)

EMS Test:

EN 61000-4-2: 2009 (ESD)

EN 61000-4-3: 2006+A1:2008+A2:2010 (RS)

EN 61000-4-4: 2012 (EFT)

EN 61000-4-5: 2014 (Surge)

EN 61000-4-6: 2014 (CS)

EN 61000-4-11: 2004 (Dips)

1.6. Performance Criteria

General Requirements (ETSI EN 301489-1):

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

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

- performance criteria for continuous phenomena applied to transmitters;
- performance criteria for transient phenomena applied to transmitters;
- performance criteria for continuous phenomena applied to receivers;
- performance criteria for transient phenomena applied to receivers.

Normally, the performance criteria depend on the type of radio equipment. Thus, the present document only contains general performance criteria commonly used for the assessment of radio equipment. More specific and product-related performance criteria for a dedicated type of radio equipment may be found in the part of EN 301 489 series dealing with the particular type of radio equipment.

Performance criteria for continuous phenomena applied to transmitters and receivers

If no further details are given in the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment, the following general performance criteria for continuous phenomena shall apply.

During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

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

Performance criteria for transient phenomena applied to transmitters and receivers

If no further details are given in the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment, the following general performance criteria for transient phenomena shall apply.

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 restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A SW reboot is not allowed. 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. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

For all other ports the following applies:

- After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

- During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

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

Performance criteria for equipment which does not provide a continuous communication link

For radio equipment which does not provide a continuous communication link, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

Performance criteria for ancillary equipment tested on a stand-alone basis

If ancillary equipment is intended to be tested on a standalone basis, the performance criteria described in clauses 6.1 and 6.2 are not appropriate, in these cases the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation. The related specifications set out in clause 5.3 have also to be taken into account.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in clauses 6.1 and 6.2.

General Requirements (ETSI EN 301489-3):

For the purposes of the present document the provisions of ETSI EN 301 489-1 [1], clause 6, shall not apply.

The performance criteria are used to make an assessment whether a radio equipment passes or fails immunity tests.

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;

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.

Table 2: Performance Requirements

Criterion	During test	After test
A	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	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

Where "operate as intended" or "no loss of function" is specified, the EUT shall demonstrate correct functioning as described in clause 5.

Where the EUT has more than one mode of operation (see clause 4.5.2), an unplanned transition from one mode to another is considered as an unintentional response. The EUT shall be tested in sufficient modes to confirm there are no such unintentional responses.

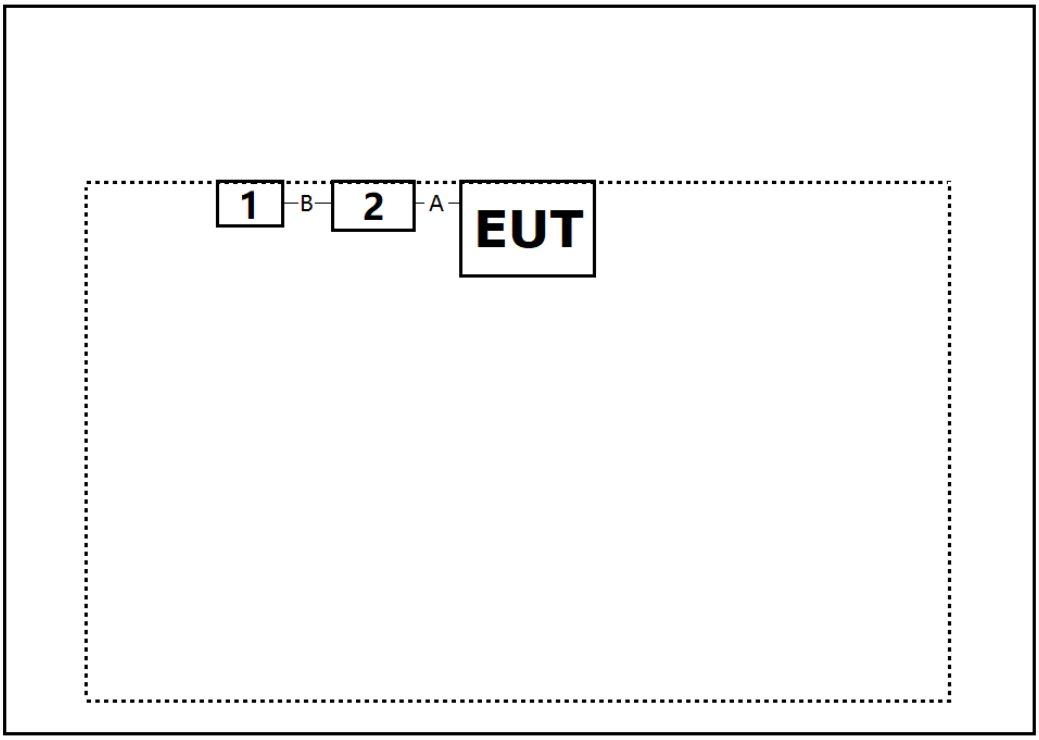
2. Test Configuration of Equipment under Test

2.1. Test Mode

Test Mode	
EMI Mode	Mode 1: Make the EUT power by adapter, and make the EUT connect with Host Device, and make the EUT identify the RFID Card.
EMS Mode	Mode 1: Make the EUT power by adapter, and make the EUT connect with Host Device, and make the EUT identify the RFID Card.

2.2. Configuration of Tested System

Connection Diagram



Signal Cable Type		Signal Cable Description
A	Power Cable	Shielded, 1.2m
B	Data line	Non-Shielding, 0.2m

2.3. Test System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Adapter	DVE	DSA-12PFA-09	N/A	Shielded, 1.2m
2	Host Device	StrongLink	TN030	N/A	N/A

2.4. Test Procedure

1	Setup the EUT and simulators as shown on above.
2	Make the EUT power by adapter, and make the EUT connect with Host Device, and make the EUT identify the RFID Card.
3	Start testing.

2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

3. Test Summary

Test Reference Standard	Test Item	Result (Pass/Fail)	Remark
Emission Measurements			
EN 55032	Conducted Emission	Pass	--
EN 55032	Radiated Emission	Pass	--
EN 61000-3-2	Harmonic Current Emissions	N/A	--
EN 61000-3-3	Voltage Fluctuations and Flicker	Pass	--
Immunity Measurements			
EN 61000-4-2	Electrostatic Discharge	Pass	--
EN 61000-4-3	Radio-Frequency Electromagnetic Field	Pass	--
EN 61000-4-4	Fast Transients, Common Mode	Pass	--
EN 61000-4-5	Surges	Pass	--
EN 61000-4-6	Radio-Frequency Common Mode	Pass	--
EN 61000-4-11	Voltage Dips and Interruptions	Pass	--
Note: “N/A” means that the test item is not applicable, and the detailed information refers to relevant sections.			

4. Conducted Emission

4.1. Limit of Conducted Emission

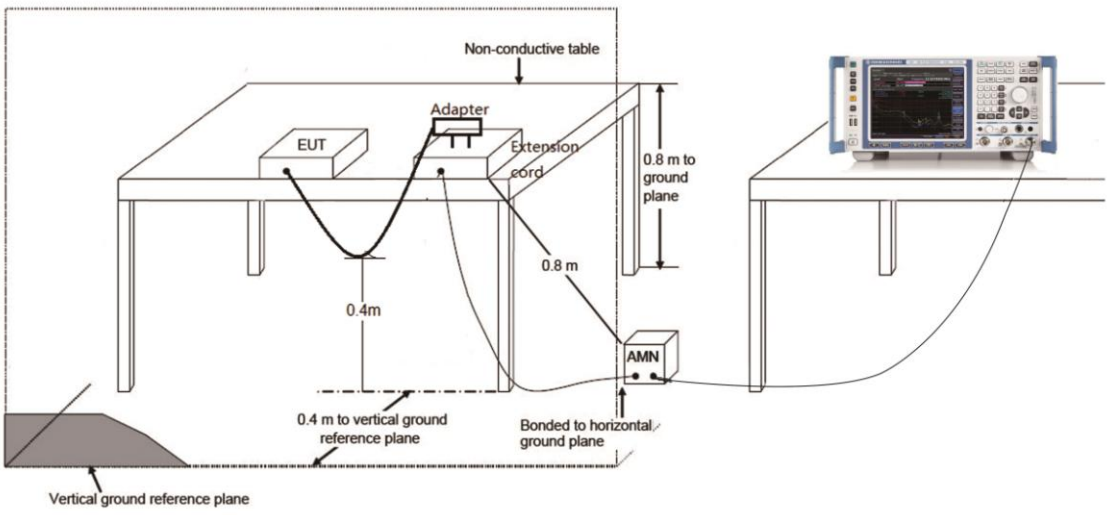
Limits of conducted emission for AC mains power input/output ports		
Frequency range MHz	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Limits of conducted emission for telecommunication ports				
Frequency range MHz	Voltage Limits dB(μV)		Current limits dB(μA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.50	84 to 74	74 to 64	40 to 30	30 to 20
0.50 to 30	74	64	30	20

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

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.

4.2. Test Setup



4.3. Test Procedure

The receiver or associated equipment under measurement and the artificial mains network are disposed as shown in 3.2. Measurements shall be carried out using a selective voltmeter having a quasi-peak detector for broadband measurements and an average detector for arrow-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.

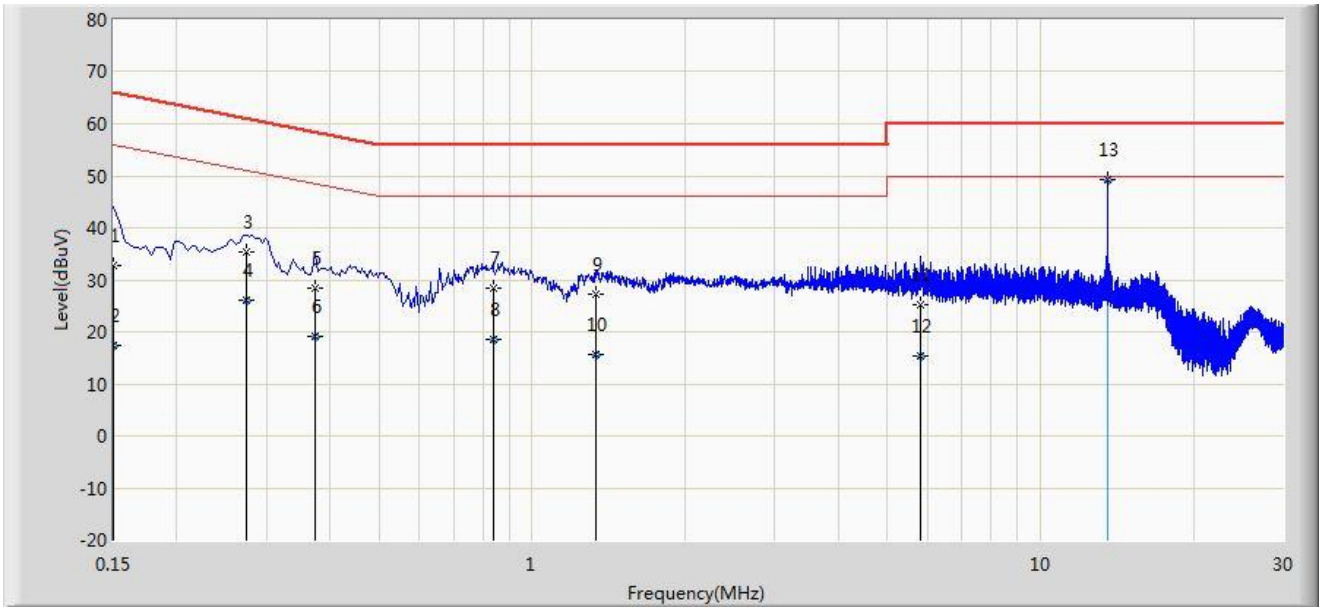
Earthing of the equipment under test if provided with a safety earth connection, shall be made to the earth terminal provided on the artificial mains network with the shortest possible lead.

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.

4.4. Test Result

Site: SR2	Time: 2019/04/11 - 10:04
Limit: EN55032_CE_Mains_ClassB	Engineer: David Lv
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: MIFARE MODULE	Power: AC 230V/50Hz
Test Mode 1	



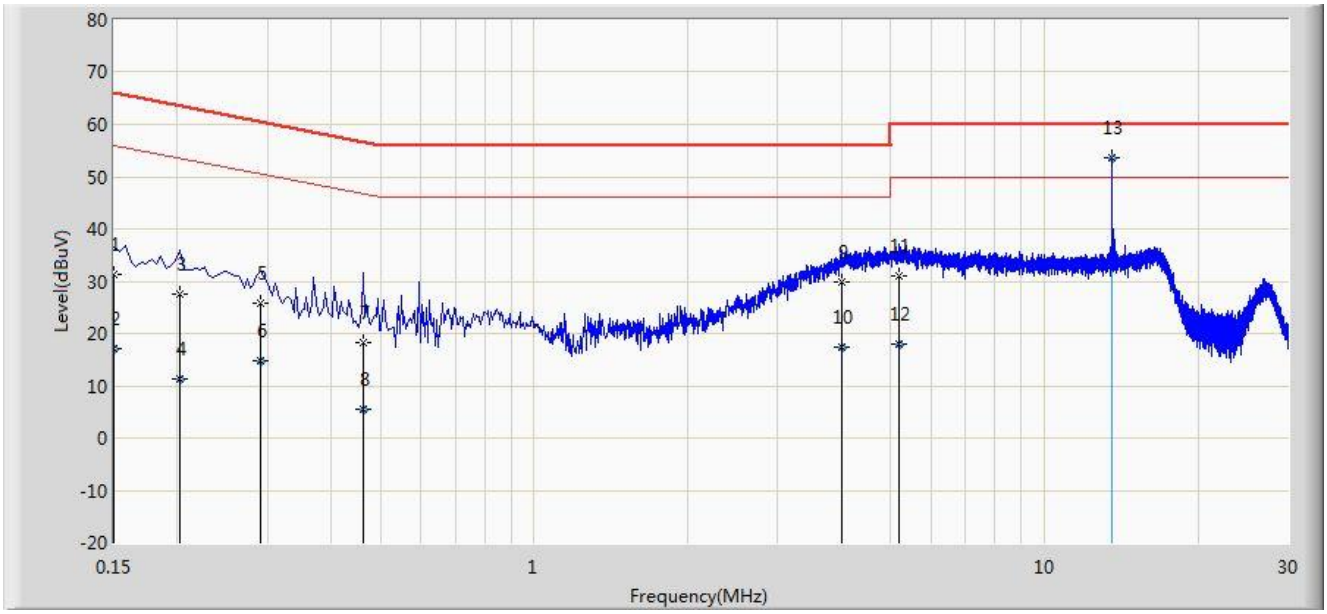
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.150	32.770	21.601	-33.230	66.000	11.168	QP
2			0.150	17.474	6.305	-38.526	56.000	11.168	AV
3			0.274	35.358	25.375	-25.638	60.996	9.983	QP
4		*	0.274	26.110	16.127	-24.886	50.996	9.983	AV
5			0.374	28.352	18.287	-30.060	58.412	10.064	QP
6			0.374	19.095	9.030	-29.317	48.412	10.064	AV
7			0.838	28.298	18.306	-27.702	56.000	9.992	QP
8			0.838	18.504	8.512	-27.496	46.000	9.992	AV
9			1.330	27.148	17.252	-28.852	56.000	9.896	QP
10			1.330	15.768	5.872	-30.232	46.000	9.896	AV
11			5.822	25.340	15.242	-34.660	60.000	10.097	QP
12			5.822	15.336	5.239	-34.664	50.000	10.097	AV
13			13.562	49.278	39.220	N/A	N/A	10.058	PK

Note 1: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB).

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Note 2: 13.56MHz (Point 13) is the RFID fundamental signal.

Site: SR2	Time: 2019/04/11 - 10:28
Limit: EN55032_CE_Mains_ClassB	Engineer: David Lv
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: MIFARE MODULE	Power: AC 230V/50Hz
Test Mode 1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.150	31.280	20.138	-34.720	66.000	11.142	QP
2			0.150	17.042	5.900	-38.958	56.000	11.142	AV
3			0.202	27.575	17.567	-35.953	63.528	10.008	QP
4			0.202	11.400	1.392	-42.128	53.528	10.008	AV
5			0.290	25.923	15.892	-34.602	60.524	10.030	QP
6			0.290	14.787	4.757	-35.737	50.524	10.030	AV
7			0.462	18.198	8.039	-38.459	56.657	10.159	QP
8			0.462	5.466	-4.693	-41.191	46.657	10.159	AV
9		*	4.018	29.942	19.969	-26.058	56.000	9.973	QP
10			4.018	17.315	7.341	-28.685	46.000	9.973	AV
11			5.202	30.987	20.931	-29.013	60.000	10.056	QP
12			5.202	17.848	7.793	-32.152	50.000	10.056	AV
13			13.562	53.626	43.526	N/A	N/A	10.100	PK

Note 1: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Note 2: 13.56MHz (Point 13) is the RFID fundamental signal.

5. Radiated Emission

5.1. Limit of Radiated Emission

Frequency range MHz	Quasi-peak limits dB(μV/m)
30 to 230	40
230 to 1000	47
Note 1: The lower limit shall apply at the transition frequency. Note 2: Additional provisions may be required for cases where interference occurs.	

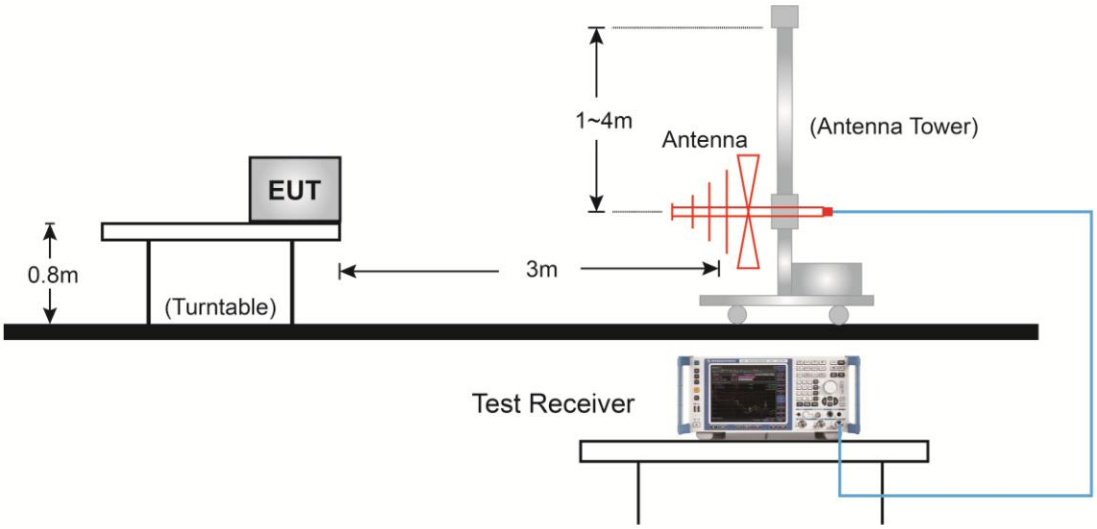
Frequency range GHz	Average limit dB(μV/m)	Peak limit dB(μV/m)
1 to 3	50	70
3 to 6	54	74
Note: The lower limit applies at the transition frequency.		

Required highest frequency for radiated measurement

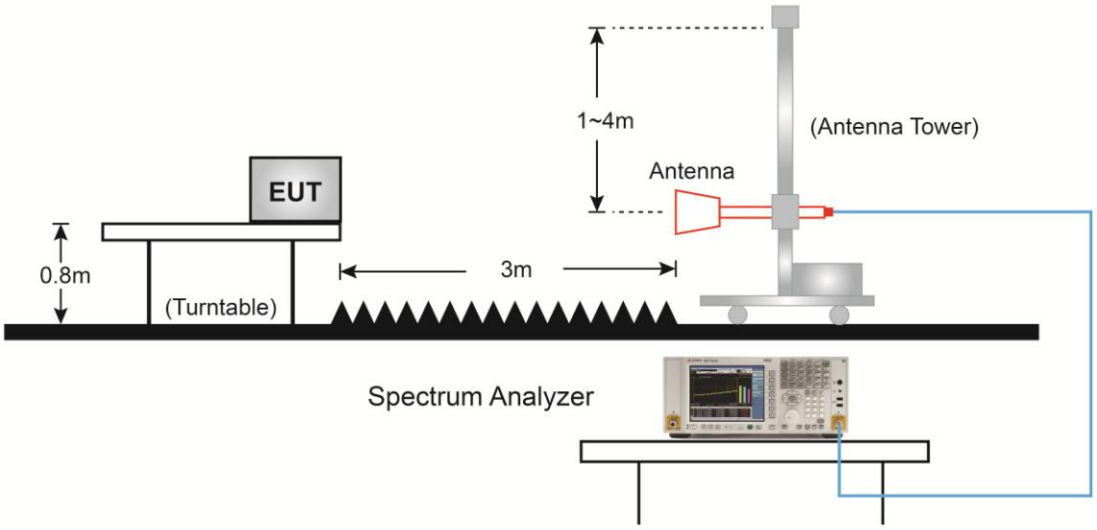
Highest internal frequency (F_x)	Highest measured frequency
$F_x \leq 108$ MHz	1 GHz
108 MHz ≤ $F_x \leq 500$ MHz	2 GHz
500 MHz ≤ $F_x \leq 1$ GHz	5 GHz
Above 1 GHz	5 x F_x up to a maximum of 6 GHz
Note 1: For FM and TV broadcast receivers, F_x is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies. Note 2: F_x is defined in 3.1.18 of EN 55032:2015 Note 3: For outdoor units of home satellite receiving systems highest measured frequency shall be 18 GHz.	

5.2. Test Setup

30 MHz ~1000 MHz



1000 MHz ~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.

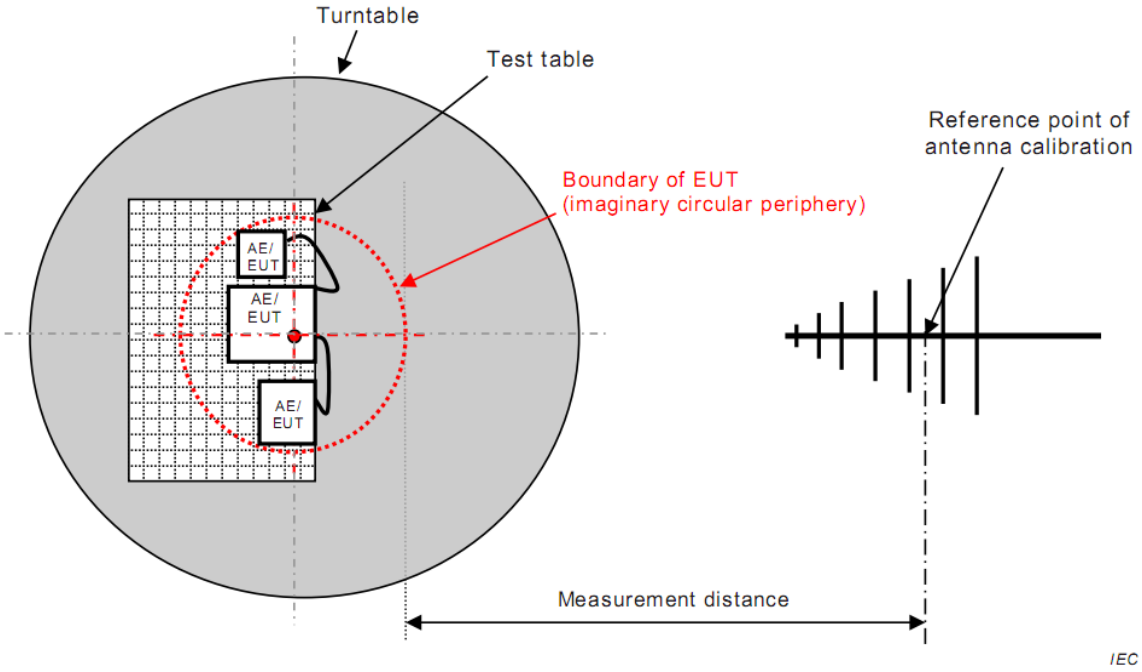


Figure 1

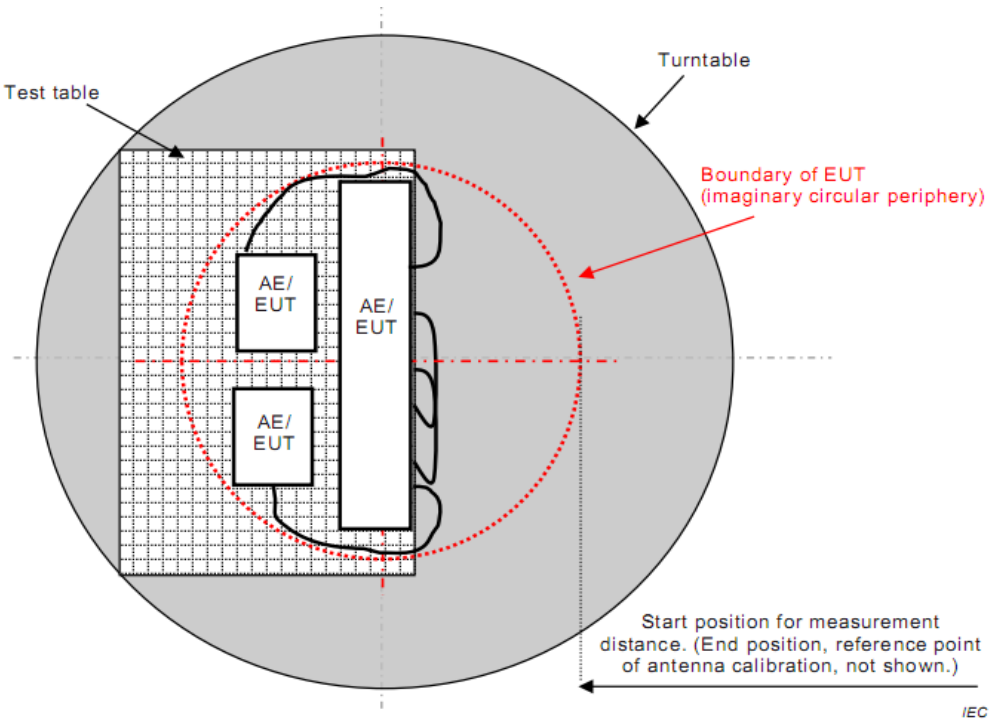


Figure 2

5.3. 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.

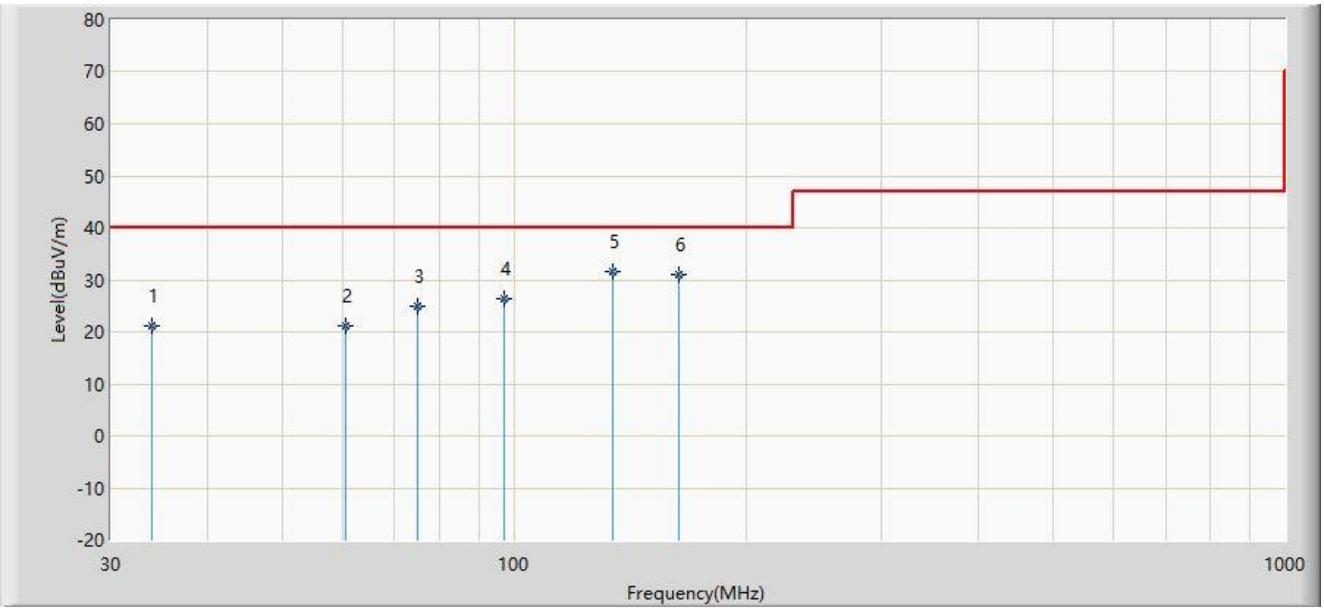
The highest value found, following this procedure, is defined as the radiation figure of the receiver.

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.

5.4. Test Result

Site: AC1	Time: 2019/04/02 - 22:11
Limit: EN55032_RE(3m)_Class B	Engineer: Bacon Dong
Probe: VULB 9168_20-2000MHz	Polarity: Horizontal
EUT: MIFARE MODULE	Power: AC 230V/50Hz
Test Mode 1	

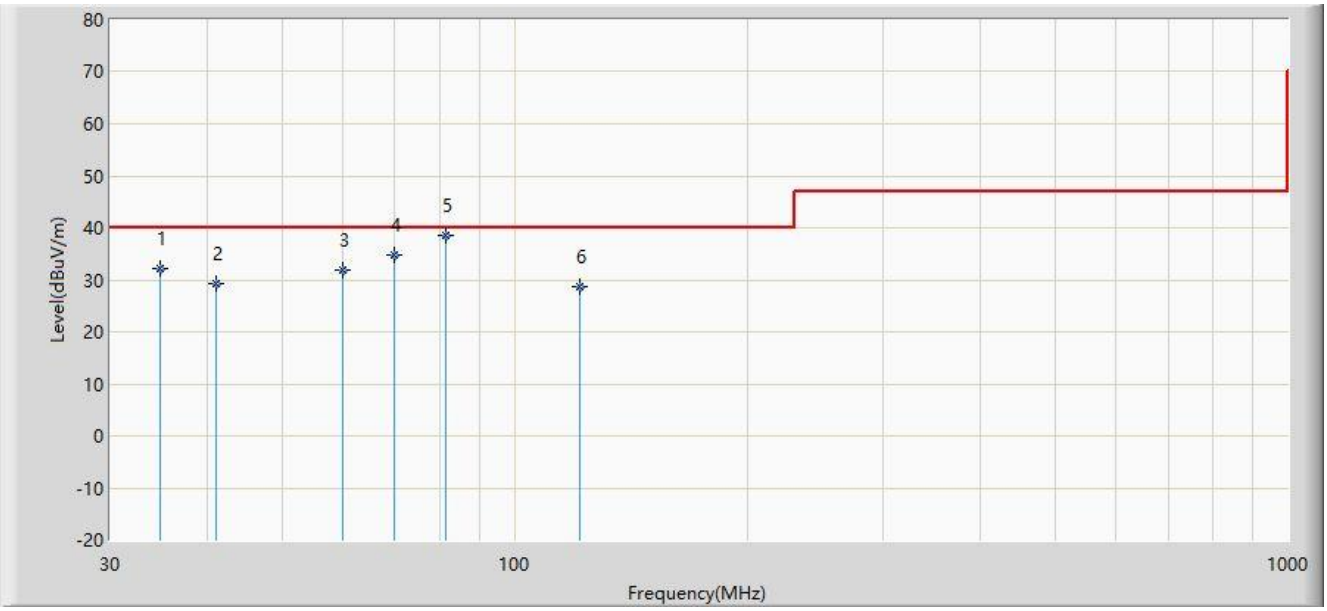


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			33.880	21.157	7.220	-18.843	40.000	13.937	QP
2			60.555	21.195	7.788	-18.805	40.000	13.407	QP
3			75.105	25.009	14.094	-14.991	40.000	10.915	QP
4			96.930	26.292	15.370	-13.708	40.000	10.921	QP
5		*	134.275	31.677	17.415	-8.323	40.000	14.262	QP
6			163.375	30.986	15.884	-9.014	40.000	15.103	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2019/04/02 - 22:16
Limit: EN55032_RE(3m)_Class B	Engineer: Bacon Dong
Probe: VULB 9168_20-2000MHz	Polarity: Vertical
EUT: MIFARE MODULE	Power: AC 230V/50Hz
Test Mode 1	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			34.850	32.144	18.128	-7.856	40.000	14.016	QP
2			41.155	29.389	14.788	-10.611	40.000	14.601	QP
3			60.070	31.939	18.451	-8.061	40.000	13.488	QP
4			69.770	34.705	22.992	-5.295	40.000	11.713	QP
5		*	81.373	38.421	28.200	-1.579	40.000	10.221	QP
6			121.180	28.633	15.221	-11.367	40.000	13.412	QP

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

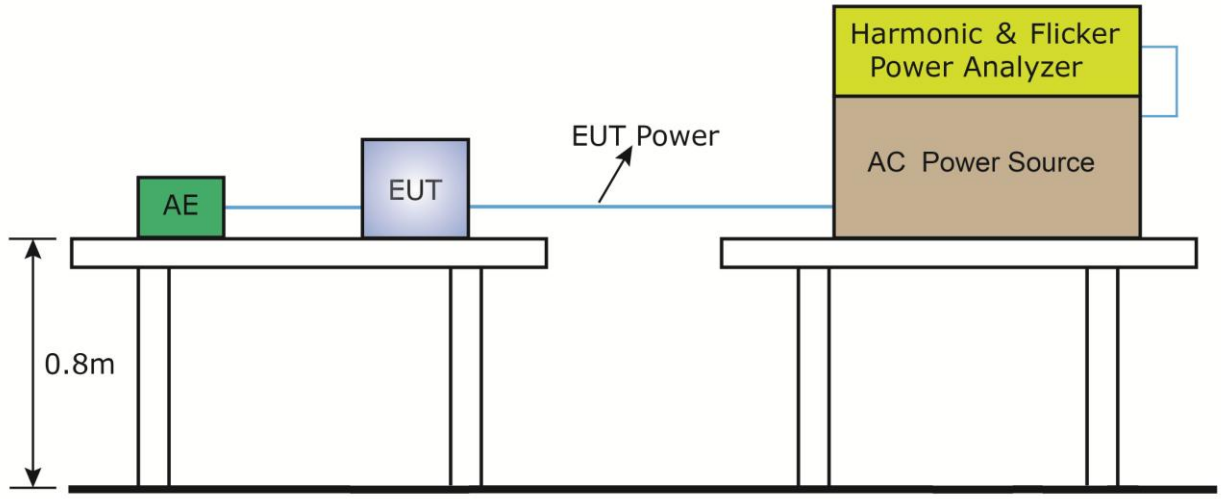
6. Harmonic Current Emissions

6.1. Limit of Harmonic Current Emissions

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 ≤ n ≤ 40	0.23 * 8/n
11	0.33	--	--
13	0.21	--	--
15 ≤ n ≤ 39	0.15 * 15/n	--	--

6.2. Test Setup



6.3. 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.

6.4. Test Result

The rated power of the EUT is less than 75 W, so this requirement doesn’t apply.

7. Voltage Fluctuations and Flicker

7.1. Limit of Voltage Fluctuations and Flicker

The following limits apply:

- the value of P_{st} shall not be greater than 1.0;
- the $_{value}$ of P_{lt} 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, dc, 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_{lt} limit.

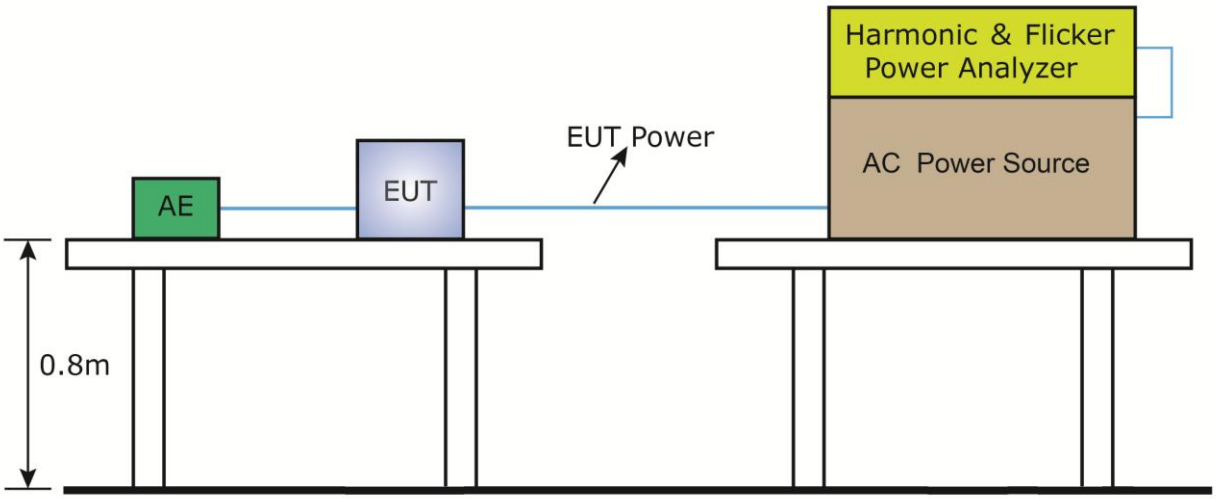
For example: a d_{max} of 6% producing a rectangular voltage change characteristic twice per hour will give a P_{lt} of about 0.65.

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_{1t} requirements shall not be applied to voltage changes caused by manual switching.

7.2. Test Setup



7.3. Test Procedure

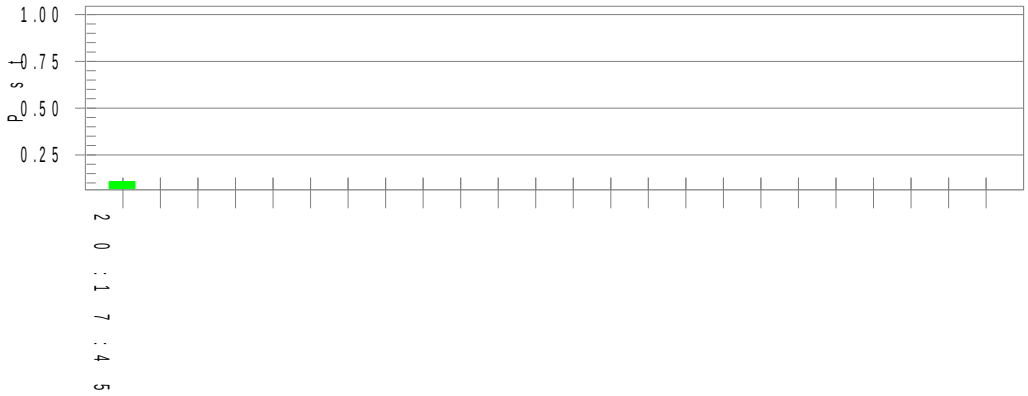
The EUT is supplied in series with power analyzer from a power source having the same normal voltage and frequency as the rated supply voltage and the equipment under test. And the rated voltage at the supply voltage of EUT of 0.98 times and 1.02 times shall be performed.

7.4. Test Result

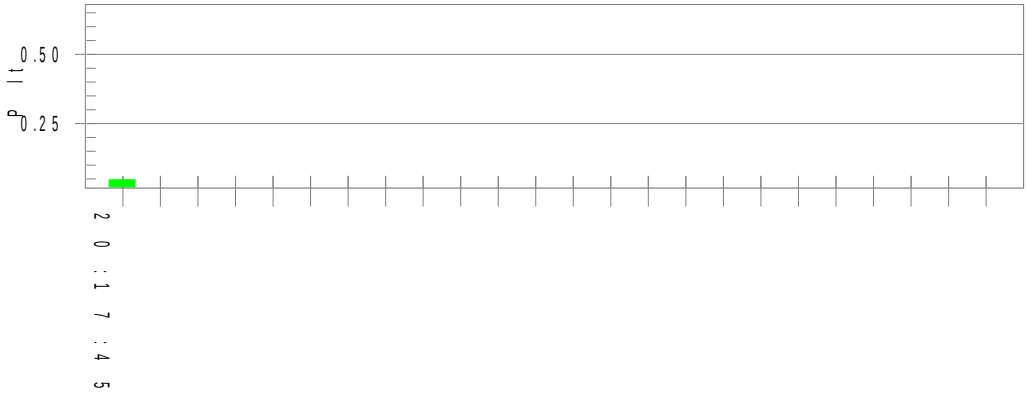
EUT	MIFARE MODULE	Temperature	24°C
Test Engineer	Liz Yuan	Relative Humidity	56%
Test Mode	Mode 1	Date of Test	2019/04/26

Test Result: Pass **Status: Test Completed**

Pst$_i$ and limit line **European Limits**



Plt and limit line



Parameter values recorded during the test:

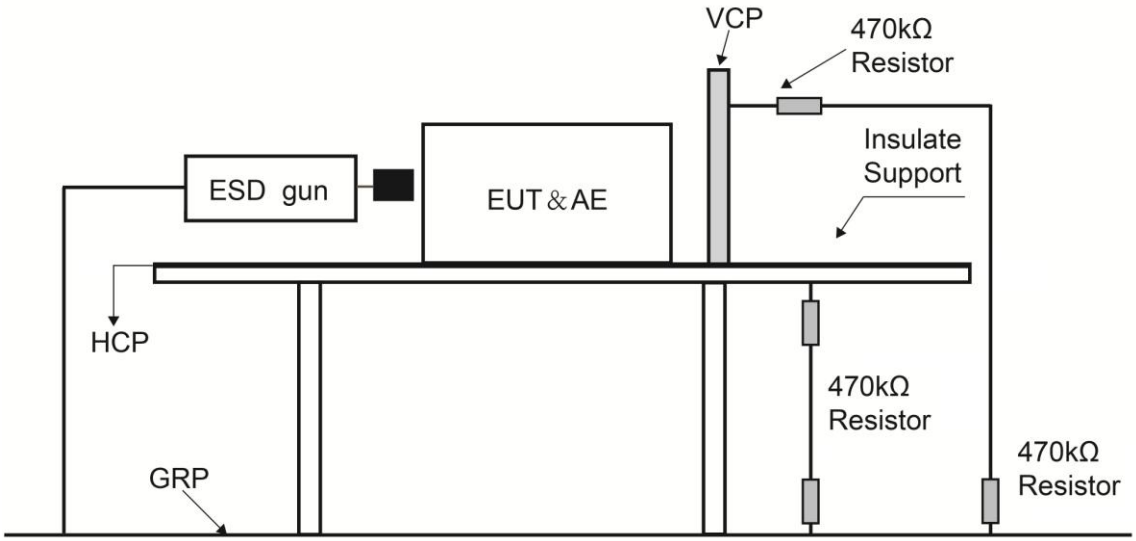
Vrms at the end of test (Volt):	**229.79**			
Highest dt (%):	**0.00**	**Test limit (%):**	**N/A**	**N/A**
T-max (mS):	**0**	**Test limit (mS):**	**500.0**	**Pass**
Highest dc (%):	**0.00**	**Test limit (%):**	**3.30**	**Pass**
Highest dmax (%):	**-0.04**	**Test limit (%):**	**4.00**	**Pass**
Highest Pst (10 min. period):	**0.108**	**Test limit:**	**1.000**	**Pass**
Highest Plt (2 hr. period):	**0.047**	**Test limit:**	**0.650**	**Pass**

8. Electrostatic Discharge

8.1. Limit of Electrostatic Discharge

Environmental phenomenon	Test specification	Units	Performance criterion
Enclosure port			
Electrostatic discharge	±2, ±4 (Contact discharge) ±2, ±4, ±8 (Air discharge)	kV (Charge voltage) kV (Charge voltage)	B

8.2. Test Setup



8.3. 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 twenty-five 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 twenty-five single discharges with positive and negative at the same selected point.

8.4. Test Result

EUT	MIFARE MODULE	Temperature	24°C
Test Engineer	Liz Yuan	Relative Humidity	58%
Test Mode	Mode 1	Date of Test	2019/04/08

Indirect Application		Test Result	
Test Location	Test Level	Horizontal Coupling	Vertical Coupling
Front, Rear Left, Right	±2kV, ±4kV	Pass	Pass

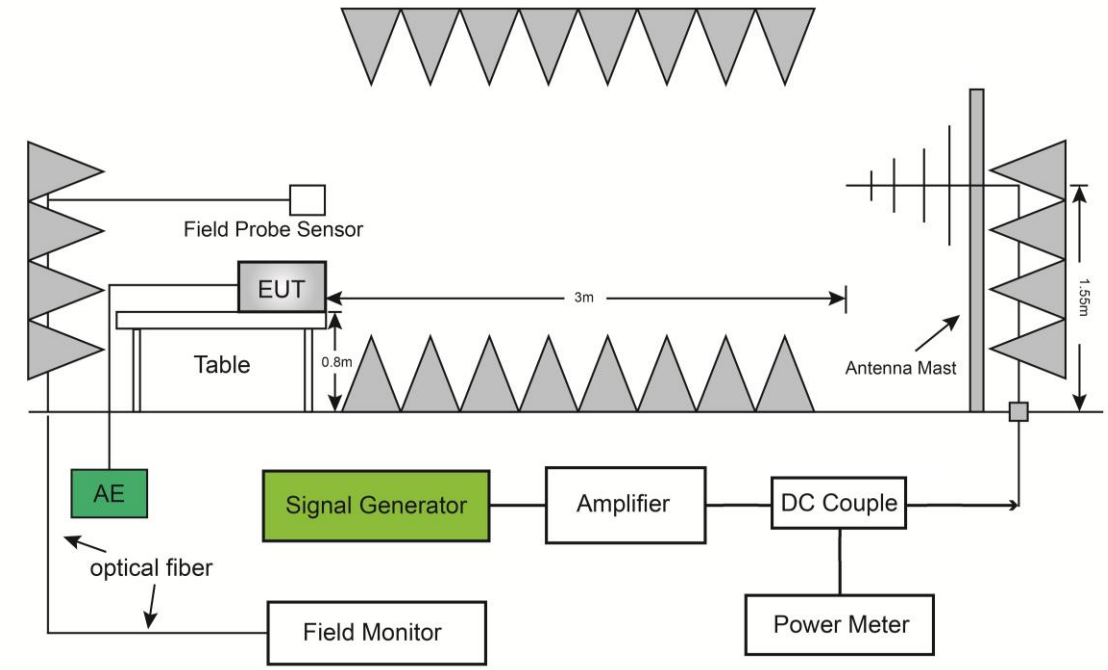
Note: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

9. Radio-Frequency Electromagnetic Field

9.1. Limit of Radio-Frequency Electromagnetic Field

Environmental phenomenon	Test specification	Units	Performance criterion
Enclosure port			
Radio-Frequency Electromagnetic field	80 - 2700 3 80	MHz V/m (unmodulated, r.m.s) % AM (1kHz)	A
Note: The test shall be performed over the frequency range 80MHz to 2700MHz with the exception of the exclusion band.			

9.2. Test Setup



9.3. 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. Both horizontal and vertical polarization of the antenna and four sides of the EUT are set on measurement.

In order to judge the EUT performance, a CCD camera is used to monitor the screen of the EUT.

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-2700MHz
4	Dwell Time	3Seconds
5.	Frequency Step Size $\triangle f$	1%

9.4. Test Result

EUT	MIFARE MODULE	Temperature	23°C
Test Engineer	Messiah Li	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/18

Frequency (MHz)	Polarity	Test Position	Field Strength (V/m)	Test Result
80 - 2700	Horizontal/Vertical	Front	3	Pass
		Rear		Pass
		Top		Pass
		Bottom		Pass

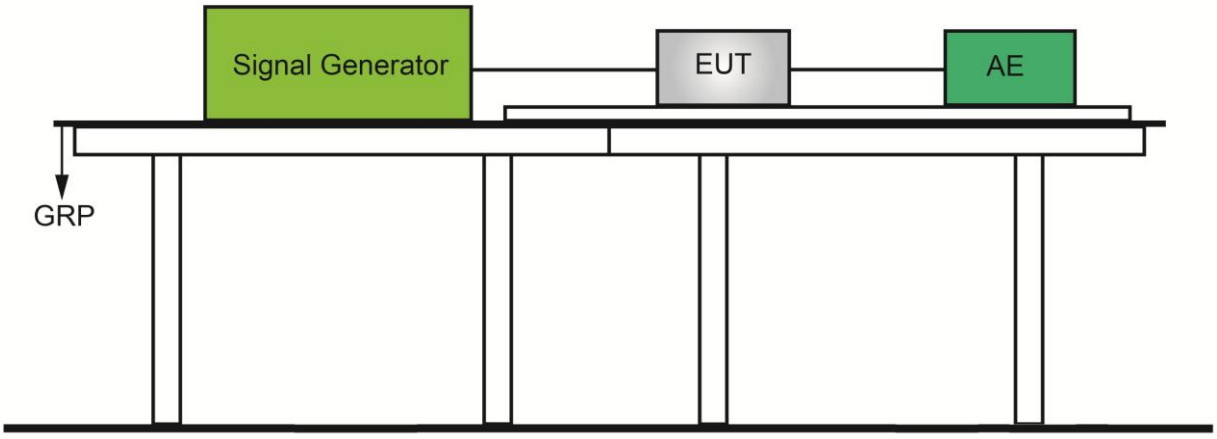
Note: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

10. Electrical Fast Transients

10.1. Limit of Electrical Fast Transients

Environmental Phenomenon	Test Specification	Units	Performance Criterion
Input AC power ports			
Electrical fast transients	±1 5/50 5	kV (open circuit test voltage) Tr/Th (ns) Repetition frequency (kHz)	A
Signal ports, wired network ports (excluding xDSL), control ports, and DC power ports			
Fast transients common mode	±0.5 5/50 5	kV (peak) Tr/Th ns Repetition frequency (kHz)	A
xDSL wired network ports			
Fast transients common mode	±0.5 5/50 100	kV (peak) Tr/Th ns Repetition frequency (kHz)	A
Note: This test shall be additionally performed on signal ports, wired network ports, control ports, and DC power ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m.			

10.2. Test Setup



10.3. 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, wired network ports, control port, and DC power 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.

10.4. Test Result

EUT	MIFARE MODULE	Temperature	23°C
Test Engineer	Liz Yuan	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/19

Inject Line	Polarity	Test Level (kV)	Test Duration (second)	Inject Method	Observation	Result
L	+	1	60	Direct	Note	Pass
L	-	1	60	Direct	Note	Pass
N	+	1	60	Direct	Note	Pass
N	-	1	60	Direct	Note	Pass
L + N	+	1	60	Direct	Note	Pass
L + N	-	1	60	Direct	Note	Pass

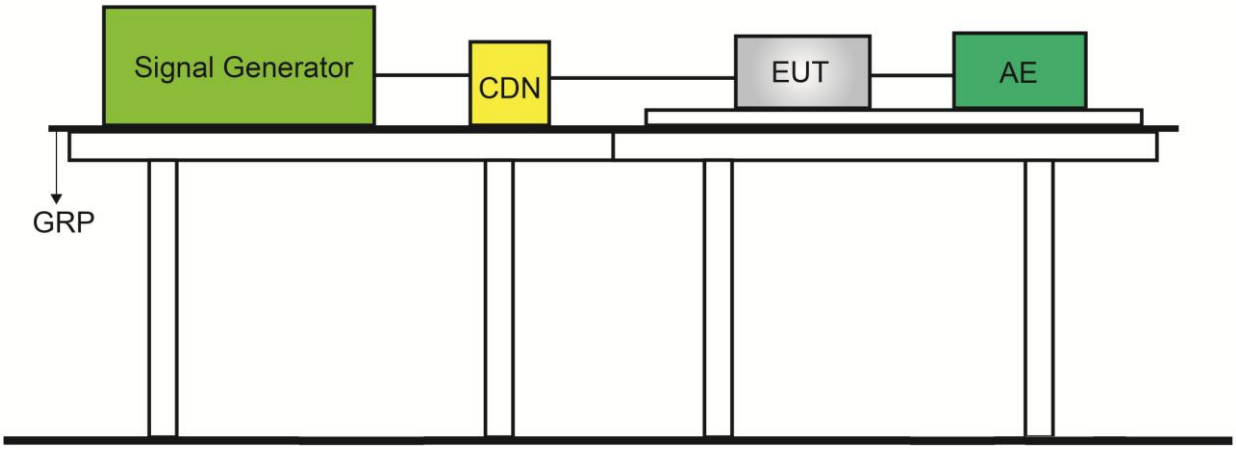
Note: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

11. Surges

11.1. Limit of Surges

Environmental phenomenon	Test specification	Units	Performance criterion
Input AC power ports (Note 1)			
Surges	1.2/50 (8/20) ±1 line to line ±2 line to earth	Tr/Th (us) kV (open circuit test voltage) kV (open circuit test voltage)	B
For symmetrically operated, wired network ports directly connected to outdoor cables (Note 1)			
Surges	10/700 (8/20) ±1 line to ground	Tr/Th us kV (peak)	B
For non-symmetrically operated, wired network ports directly connected to outdoor cables (Note 1)			
Surges	1.2/50 (8/20) ±1 line to ground, or shield to ground ±0.5 line to line	Tr/Th us kV (peak) kV (peak)	B
Wired network ports directly connected to indoor cables (See Note 1 and 2)			
Surges	1.2/50 (8/20) ±0.5 line to ground, or shield to ground	Tr/Th us kV (peak)	B
Note 1: Where normal functioning cannot be achieved because of the impact of the CDN on the EUT, no test shall be required. Note 2: The test level for wired network ports, intended to be connected to indoor cables (longer than 30 m) shall be 0,5 kV (applied line to ground, or shield to ground)			

11.2. Test Setup



11.3. 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 0^0, 90^0, 180^0, 270^0 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 Wired network 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.

11.4. Test Result

EUT	MIFARE MODULE	Temperature	23°C
Test Engineer	Liz Yuan	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/17

Inject Line	Polarity	Angle (degree)	Test Level (kV)	Waveform Tr/Th (us)	Test Interval (second)	Observation	Result
L+N	+	0	0.5 & 1	1.2/50	60	Note	Pass
L+N	-	0	0.5 & 1	1.2/50	60	Note	Pass
L+N	+	90	0.5 & 1	1.2/50	60	Note	Pass
L+N	-	90	0.5 & 1	1.2/50	60	Note	Pass
L+N	+	180	0.5 & 1	1.2/50	60	Note	Pass
L+N	-	180	0.5 & 1	1.2/50	60	Note	Pass
L+N	+	270	0.5 & 1	1.2/50	60	Note	Pass
L+N	-	270	0.5 & 1	1.2/50	60	Note	Pass

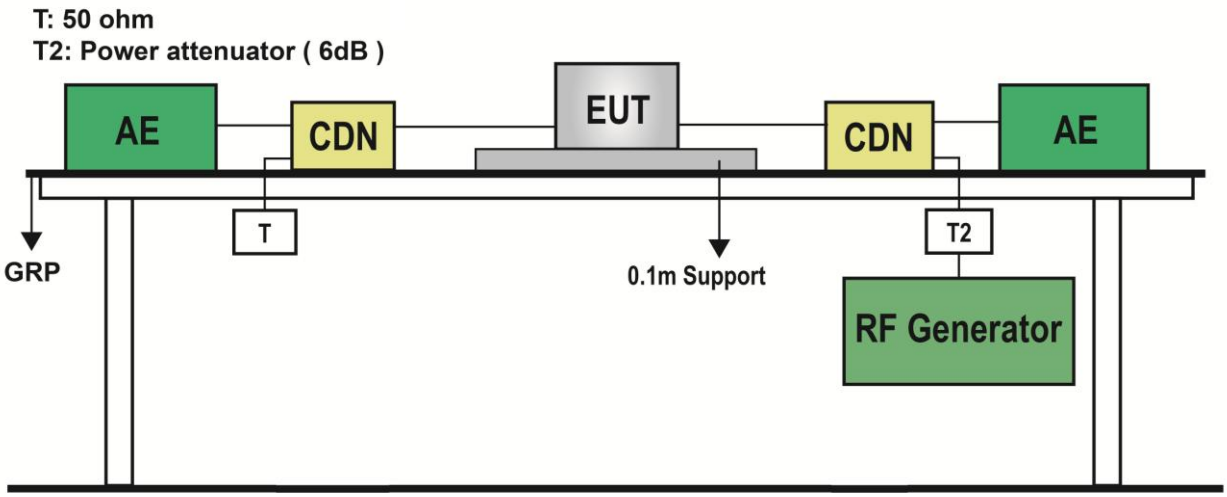
Note: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

12. Radio-Frequency Common Mode

12.1. Limit of Radio-Frequency Common Mode

Environmental phenomenon	Test specification	Units	Performance criterion
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)	A
Signal ports, wired network ports, control ports, and DC power ports (See Note 1, 2 and 3)			
Radio frequency common mode	0.15 - 80 3 80	MHz V (unmodulated, r.m.s) % AM (1kHz)	A
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, wired network ports, control ports, and DC power ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3m.			

12.2. Test Setup



12.3. 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, wired network ports, control ports, and DC power 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	3 Seconds
5.	Frequency Step Size $\triangle f$	1%

12.4. Test Result

Product	MIFARE MODULE	Temperature	25°C
Test Engineer	Lewis Huang	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/18

Frequency (MHz)	Inject Voltage (V)	Inject Ports	Inject Method	Observation	Result
0.15 - 80	3	AC Mains	CDN	Note	Pass

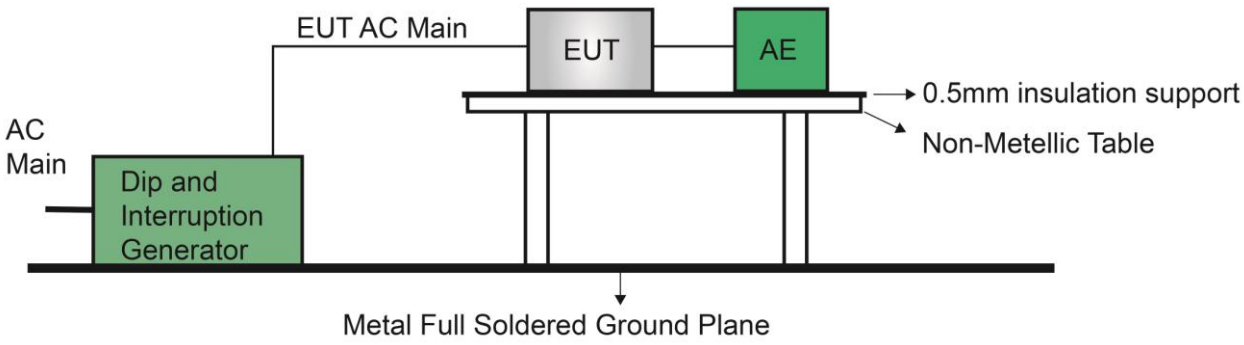
Note: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

13. Voltage Dips and Interruptions

13.1. Limit of Voltage Dips and Interruptions

Environmental phenomenon	Test specification	Units	Performance criterion
Input AC powerports			
Voltage dips	0 0.5	% residual cycle	B
	0 1	% residual cycle	B
	70 25	% residual cycle	B
Voltage interruptions	0 250	% residual cycle	B

13.2. Test Setup



13.3. 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.

13.4. Test Result

Product	MIFARE MODULE	Temperature	25°C
Test Engineer	Liz Yuan	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/16
Test Voltage	AC 230V/50Hz		

Item	Voltage % Reduction	Test Duration (periods)	Observation	Result
Voltage Dips	0	0.5	Note 1	Pass
	0	1	Note 1	Pass
	70	25	Note 1	Pass
Voltage Interruptions	0	250	Note 2	Pass

Note 1: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

Note 2: The system shut down during the test, but the EUT can restart, and continue to identify the RFID card, and the performance criterion was B.

Product	MIFARE MODULE	Temperature	25°C
Test Engineer	Liz Yuan	Relative Humidity	54%
Test Mode	Mode 1	Date of Test	2019/04/16
Test Voltage	AC 100V/50Hz		

Item	Voltage % Reduction	Test Duration (periods)	Observation	Result
Voltage Dips	0	0.5	Note 1	Pass
	0	1	Note 1	Pass
	70	25	Note 1	Pass
Voltage Interruptions	0	250	Note 2	Pass

Note 1: During and after the test, the EUT can operate as intended, and there is no loss of function and no degradation of performance, and the performance criterion is A.

Note 2: The system shut down during the test, but the EUT can restart, and continue to identify the RFID card, and the performance criterion was B.

14. Uncertainty Measurement

AC Conducted Emission Measurement - SR2
The maximum measurement uncertainty is evaluated as: 9kHz~150kHz: 3.84dB 150kHz~30MHz: 3.46dB
Radiated Emission Measurement - AC1
The maximum measurement uncertainty is evaluated as: Horizontal: 30MHz~300MHz: 4.07dB 300MHz~1GHz: 3.63dB 1GHz~18GHz: 4.16dB Vertical: 30MHz~300MHz: 4.18dB 300MHz~1GHz: 3.60dB 1GHz~18GHz: 4.76dB
Radiated Emission Measurement - AC2
The maximum measurement uncertainty is evaluated as: Horizontal: 30MHz~300MHz: 3.75dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.28dB Vertical: 30MHz~300MHz: 3.86dB 300MHz~1GHz: 3.53dB 1GHz~18GHz: 4.33dB
Harmonic Current Emissions - SR2
The maximum measurement uncertainty is evaluated as 0.2%.
Voltage Fluctuation and Flicker - SR2
The maximum measurement uncertainty is evaluated as d_c and d_{max}: 0.095%, P_{st} and P_{lt}: ±4%, $d_{(t)}$: 1.5%.

15. List of Measuring Instrument

Conducted Emission - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2020/04/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2019/06/14
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2019/06/14
Impedance Stabilization Network	TESEQ	ISN T200A	MRTSUE06004	1 year	2020/01/24
Impedance Stabilization Network	TESEQ	ISNT800	MRTSUE06005	1 year	2020/01/24
Impedance Stabilization Network	TESEQ	ISN T8-CAT6	MRTSUE06006	1 year	2020/01/24
Impedance Stabilization Network	R&S	ESH3-Z6	MRTSUE06187	1 year	2020/04/15
Impedance Stabilization Network	R&S	ESH3-Z6	MRTSUE06188	1 year	2020/04/15
RF current probe	R&S	EZ-17	MRTSUE06190	1 year	2020/04/15
Temperature/Humidity Meter	testo	608-H1	MRTSUE06404	1 year	2019/08/14
Shielding Anechoic Chamber	MIX-BEP	Chamber-SR2	MRTSUE06214	N/A	N/A

Harmonic Current Emissions / Voltage Fluctuation and Flicker - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Power Analyzer	California	PACS-1	MRTSUE06010	1 year	2020/01/06
AC Power Source	California	3001IX-208-CTS	MRTSUE06011	1 year	2020/01/06
Temperature/Humidity Meter	testo	608-H1	MRTSUE06404	1 year	2019/08/14
Shielding Anechoic Chamber	MIX-BEP	Chamber-SR2	MRTSUE06214	N/A	N/A

Radiated Disturbance - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cal. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/13
PXA Signal Analyzer	Keysight	N9030B	MRTSUE06395	1 year	2019/09/25
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2019/10/19
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/12
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/14
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2019/05/01

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2019/08/13
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2019/11/09
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2019/10/19
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2019/11/09
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2019/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2019/11/16
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/12
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2019/05/01

Electrostatic Discharge - TR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
ESD Generator	EM TEST	Dito	MRTSUE06225	1 year	2020/01/07
Electrostatic	HAEFELY	ONYX 30	MRTSUE06388	1 year	2020/01/23
Barometer	BaoPing	DYM3	MRTSUE06044	N/A	N/A
Scientific Ambient Monitor	Testo	622	MRTSUE06399	1 year	2020/01/07

Radio-Frequency Electromagnetic Field - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
MXG Analog Signal Generator	Keysight	N5181A	MRTSUE06370	1 year	2019/06/14
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2019/08/14
EPM Series Power Meter	Agilent	E4418B	MRTSUE06204	1 year	2019/06/14
Power Sensor	Agilent	E9301H	MRTSUE06205	1 year	2019/06/14
Amplifier	AR	150W1000M1	MRTSUE06146	N/A	N/A
Amplifier	rflight	NTWPAS-1025100	MRTSUE06364	N/A	N/A
Amplifier	rflight	NTWPAS-2560100	MRTSUE06363	N/A	N/A
High-Gain Horn Antenna	AR	ATH800M5GA	MRTSUE06144	N/A	N/A
Log-Periodic Antenna	AR	ATR80M6G	MRTSUE06145	N/A	N/A
Laser Powered Field Probe	AR	FL7006	MRTSUE06149	1 year	2019/12/21
Laser Probe Interface	AR	FI7000	MRTSUE06150	1 year	2019/12/21
Two channel Microphone Conditioning Amplifier	Bruel & Kjaer	2690-OS2	MRTSUE06161	1 year	2019/10/21
Measurement Power Amplifier	Bruel & Kjaer	2735	MRTSUE06162	1 year	2019/10/21
Mouth Simulator	Bruel & Kjaer	4227	MRTSUE06164	1 year	2019/10/21
Sound Calibrator	Bruel & Kjaer	4231	MRTSUE06165	1 year	2019/10/21
Microphone Unit	Bruel & Kjaer	4192-L-001	MRTSUE06166	1 year	2019/10/21
Probe Microphone	Bruel & Kjaer	4182	MRTSUE06167	1 year	2019/09/02
Digitial Thermometer & Hygrometer	Minggao	ETH529	MRTSUE06170	1 year	2019/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2019/05/01

Radio-Frequency Common Mode - TR1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Compact Immunity Test System	TESEQ	NSG4070-35	MRTSUE06237	1 year	2019/11/16
CDN	TESEQ	TESEQ ST08-10S	MRTSUE06240	1 year	2020/01/06
CDN	TESEQ	TESEQ M016S	MRTSUE06238	1 year	2020/01/06
CDN	TESEQ	TESEQ T8S	MRTSUE06239	1 year	2020/01/06
EM clamp	Teseq GmbH	KEMZ801A	MRTSUE06371	1 year	2019/05/22
Temperature Humidity Meter	Yuhuaze	HTC-2	MRTSUE06398	1 year	2019/10/21

Electrical Fast Transients / Surges / Voltage Dips and Interruptions / Power Frequency Magnetic Field - TR1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMS Compact Simulator	EM TEST	UCS500N7	MRTSUE06228	1 year	2019/11/16
Capacitive coupling clamp	EM TEST	CN-HFK	MRTSUE06223	1 year	2019/11/16
Magnetic Field Coil	EM TEST	MS100N+mc2 630	MRTSUE06226	1 year	2019/11/16
MOTORISED VARIAC FOR VOLTAGE VARIATION	EM TEST	MV2616	MRTSUE06229	1 year	2019/11/16
External 10/700us pulse module	EM TEST	TSurge7	MRTSUE06227	1 year	2019/11/16
CDN	TESEQ	TESEQ ST08-10S	MRTSUE06240	1 year	2020/01/06
CDN	3cTest	405T8	MRTSUE06250	1 year	2019/11/16
CDN	3ctest	405AF8	MRTSUE06265	1 year	2019/11/16
6dB Attenuator	3ctest	DTC75-6	MRTSUE06043	1 year	2019/06/14
Temperature Humidity Meter	Yuhuaze	HTC-2	MRTSUE06398	1 year	2019/10/21

Software	**Version**	**Function**
e3	V 8.3.5	EMI Test Software
Compliance Test System	v 4.6.2	Harmonic & Flicker
JS32-RS	V1.0.0.1	RS Test Software
NSG 4070 CTRL	v 1.3.0.1	CS Test Software
IEC CTRL	v 6.0.1	EMS Test Software

The End

Appendix A - Test Setup Photograph

Refer to “1903RSU035-ET” file.

Appendix B - EUT Photograph

Refer to “1903RSU035-EE” file.