TEST REPORT

Applicant:	BeiJing Stronglink Technology Co.,Ltd.
Address:	A402, Building 8, No. 97, Changping Road, Shahe Town, Changping District, Beijing (Changping Demonstration Park)
Equipment Type:	IIC MIFARE Module
Model Name:	SL030_V3.1
Brand Name:	Stronglink
Test Standard:	ETSI EN 301 489-1 V2.2.3(2019-11) Final draft ETSI EN 301 489-3 V2.2.0(2021-11)
Test Date:	Apr. 26, 2022 - Apr. 28, 2022
Date of Issue:	May 12, 2022

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Chong **Checked by:** Xia Long **Approved by:** Liao Jianming (Technical Director)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	May 12, 2022	Initial Issue

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1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China
Description	All measurement facilities used to collect the measurement data are located at Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	BeiJing Stronglink Technology Co.,Ltd.
Address	A402, Building 8, No. 97, Changping Road, Shahe Town, Changping District, Beijing (Changping Demonstration Park)

2.2 Manufacturer Information

Manufacturer	BeiJing Stronglink Technology Co.,Ltd.
Address	A402, Building 8, No. 97, Changping Road, Shahe Town, Changping District, Beijing (Changping Demonstration Park)

2.3 Factory Information

Factory	BeiJing Stronglink Technology Co.,Ltd.
Address	A402, Building 8, No. 97, Changping Road, Shahe Town, Changping District, Beijing (Changping Demonstration Park)

2.4 General Description for Equipment under Test (EUT)

EUT Name	IIC MIFARE Module
Model Name Under Test	SL030_V3.1
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity		NFC
Interfaces present on the EUT	AC Ports	No AC ports.
	DC Ports	From power supply to EUT, the DC port cable length is less than 3m.
	Signal/Control Ports	No Signal/Control ports.
	Wired Network Ports	No Wired Network ports.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

The objective of the report is to perform testing according to following standards:

No.	Identity	Document Title
1	ETSI EN 301 489-1 V2.2.3 (2019-11)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
2	Final draft ETSI EN 301 489-3 V2.2.0 (2021-11)	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard for ElectroMagnetic Compatibility

3.2 Referenced Standards

The following referenced standards are necessary for the report. For undated references in this report, the cited version applies.

No.	Identity	Document Title
1	CENELEC EN 55032 (2015)	Electromagnetic compatibility of multimedia equipment - Emission Requirements.
2	CENELEC EN 61000-3-2 (2014)	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤16 A per phase)
3	CENELEC EN 61000-3-3 (2013)	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection.
4	CENELEC EN 61000-4-2 (2009)	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.
5	CENELEC EN 61000-4-3 (2006), A1 (2008) and A2 (2010)	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.
6	CENELEC EN 61000-4-4 (2012)	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test.
7	CENELEC EN 61000-4-5 (2014): + A1 (2017)	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test.
8	CENELEC EN 61000-4-6 (2014)	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.
9	CENELEC EN 61000-4-11 (2004)	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests.
10	ISO 7637-2 (2004)	Road vehicles - Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only.

3.3 Verdict

No.	Base Standard	Description		Verdict	Test Result	Remark
Emission						
1	EN 55032	Radiated Emission	Below 1 GHz	Pass	ANNEX A.1	--
			Above 1 GHz	Pass		Note 1
2	EN 55032	Conducted Emission	AC Mains Port	N/A	ANNEX A.2	--
			DC Power Port	N/A		Note 2
			Wired Network Port	N/A		--
3	EN 61000-3-2	Harmonic Current Emissions		N/A	ANNEX A.3	Note 3
4	EN 61000-3-3	Voltage Fluctuations & Flicker		N/A	ANNEX A.4	--
Immunity						
5	EN 61000-4-2	Electrostatic Discharge Immunity		Pass	ANNEX A.5	--
6	EN 61000-4-3	Radiated RF Electromagnetic Field Immunity		Pass	ANNEX A.6	--
7	EN 61000-4-4	Electrical Fast Transient/Burst Immunity	AC Ports	N/A	ANNEX A.7	--
			DC Ports	N/A		Note 4
			Signal Ports,Control Ports, Wired Network Port	N/A		Note 4
8	ISO 7637-2	Transients and Surges		N/A	ANNEX A.8	Note 5
9	EN 61000-4-5	Surge Immunity	AC Ports	N/A	ANNEX A.9	--
			Wired Network Port	N/A		Note 6
10	EN 61000-4-6	Immunity to Conducted Disturbances Induced by RF Fields	AC Ports	N/A	ANNEX A.10	--
			DC Ports	N/A		Note 4
			Signal Ports,Control Ports, Wired Network Port	N/A		Note 4
11	EN 61000-4-11	Voltage Dips and Short Interruptions Immunity		N/A	ANNEX A.11	--

Note 1: The highest frequency of the internal sources of the EUT is above 108 MHz, the measurement shall be made above 1 GHz.

Note 2: This test is applicable for radio equipment and ancillary equipment for fixed use that are intended to be connected to a local DC power network or to local battery with connecting cables longer than 3 m.

Note 3: There is no need for Harmonics test to be performed on this product (rated power is less than 75 W) in accordance with EN 61000-3-2: 2014.

For further details, please refer to Clause 7 of EN 61000-3-2: 2014 which states:

“For the following categories of equipment, limits are not specified in this edition of the standard:

- equipment with a rated power of 75 W or less, other than lighting equipment.”

Note 4: This test is applicable for the cables may be longer than 3 m.

Note 5: These tests are applicable to radio and ancillary equipment intended for vehicular use.
Note 6: These tests are applicable to wired network ports intended to be connected to outdoor cables and indoor cables (longer than 30 m).

3.4 Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT 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.

Measurement	Value
Conducted emissions (9 kHz-30 MHz)-AMN	3.22 dB
Conducted emissions (150 kHz-30 MHz)-AAN_CAT3	3.66 dB
Conducted emissions (150 kHz-30 MHz)-AAN_CAT5	4.10 dB
Conducted emissions (150 kHz-30 MHz)-AAN_CAT6	4.58 dB
Radiated emissions (30 MHz-1 GHz)-10m	4.80 dB
Radiated emissions (30 MHz-1 GHz)-966#2	4.76 dB
Radiated emissions (30 MHz-1 GHz)-966#4	4.38 dB
Radiated emissions (1 GHz-18 GHz)-10m	4.72 dB
Radiated emissions (1 GHz-18 GHz)-966#2	4.88dB
Radiated emissions (1 GHz-18 GHz)-966#4	5.04 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments, Test Date and Test Engineer

Test items	Voltage	Temperature	Relative Humidity	Ambient Pressure	Test Date	Test Engineer
Radiated Emission	DC3.3V from Carrier board	22.6℃	56%	101kPa	Apr. 28, 2022	Liang Yongming
Electrostatic Discharge Immunity	DC3.3V from Carrier board	24.3℃	43%		Apr. 27, 2022	Liu Chenfang
Radiated RF Electromagnetic Field Immunity	DC3.3V from Carrier board	24.7℃	54%		Apr. 26, 2022	Chen Jiali

4.2 Test Equipment

Radiated Emission Test For Frequency Below 1 GHz (3m-966#2)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Agilent	N9038A	MY55330120	2021.10.20	2022.10.19	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2017119081	2021.10.20	2022.10.19	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-00867	2020.06.13	2023.06.12	☒
Anechoic Chamber	YiHeng	9m*6m*6m	966#2	2021.08.19	2024.08.18	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V19.918		☒

Radiated Emission Test For Frequency Above 1 GHz (3m-966#2)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Agilent	N9038A	MY55330120	2021.10.20	2022.10.19	☒
Amplifier (1-12GHz)	Advanced Microwave	WLA652A	1740103	2021.10.20	2022.10.19	☒
Amplifier （0.8-21GHz）	Mini-Circuits	ZVA-213-S+	225321316	2021.10.20	2022.10.19	☐
Amplifier （18-40GHz）	COM-MV	KA_LNA18-40G-01	18050001	2021.10.20	2022.10.19	☐
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	1917	2019.07.02	2022.07.01	☒
Anechoic Chamber	YiHeng	9m*6m*6m	966#2	2021.08.19	2024.08.18	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V19.918		☒

Electrostatic Discharge Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
ESD Test System	EMTEST	ESD NX30.1	11804	2021.08.06	2022.08.05	☒

Radiated RF Electromagnetic Field Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Anechoic Chamber	RAINFORD	7m*4m*3m	N/A	2019.11.24	2022.11.23	☒
Signal Generator	Agilent	N5181A	MY50141752	2022.01.08	2023.01.07	☒
Power Amplifier	OPHIR RF	5225F	1037	2022.02.16	2023.02.15	☒

Radiated RF Electromagnetic Field Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A	☒
Power Amplifier	OPHIR RF	5273F	1016	2022.02.16	2023.02.15	☒
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A	☒
Power Amplifier	RFLIGHT	NTWPAS	2560025	2022.02.16	2023.02.15	☒
Power Meter	R&S	NRVD-B2	7250BJ-0112/2011	2021.09.08	2022.09.07	☒
Feld Strength Meter	Narda	EP602	611WX80276	2021.09.26	2022.09.25	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-977	2022.02.16	2025.02.15	☒
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	1917	2019.07.02	2022.07.01	☒
Mouth Simulator	B&K	4227	2423931	2021.10.14	2022.10.13	☐
Sound Calibrator	B&K	4231	2430337	2021.10.13	2022.10.12	☐
Sound Level Meter	B&K	NL-20	00844023	2021.10.13	2022.10.12	☐
Ear Simulator	B&K	4192 -L-001	3038758	2021.10.12	2022.10.11	☐
Audio analyzer	R&S	UPL 16	100129	2022.01.08	2023.01.07	☐
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V19.918		☒

4.3 Test Enclosure list

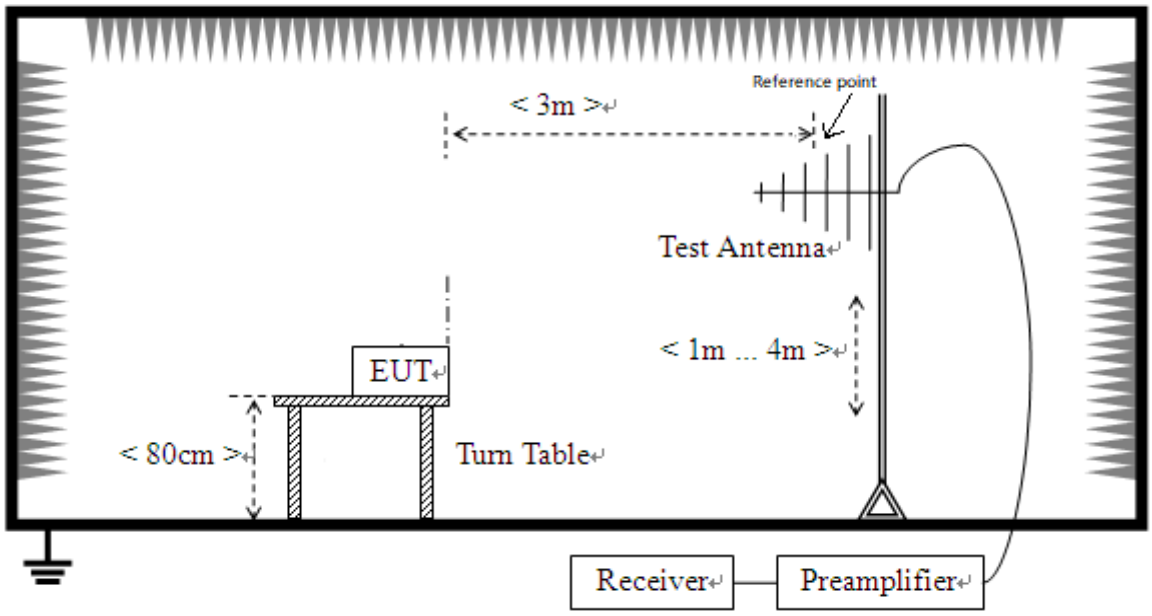
Description	Manufacturer	Model	Serial No.	Length	Description	Use
Adapter	N/A	N/A	N/A	N/A	N/A	☒
Carrier Board	N/A	N/A	N/A	N/A	N/A	☒
NFC Card	N/A	N/A	N/A	N/A	N/A	☒

4.4 Test Configurations

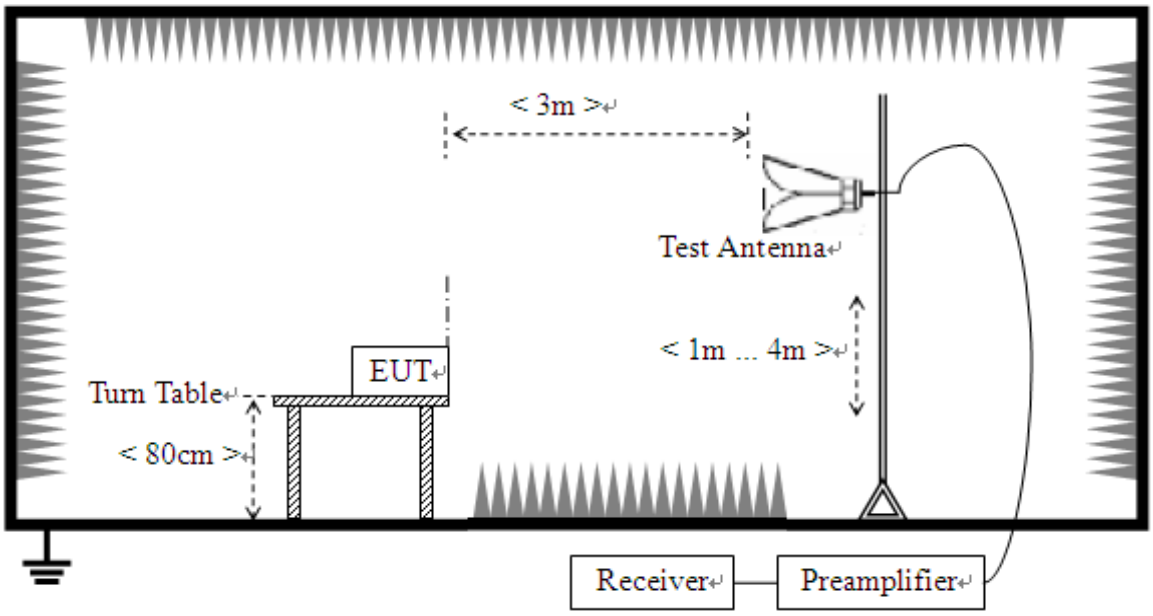
Test Configurations (TC) No.	Description
TC01	The NFC TX Test Mode EUT + Adapter + Carrier Board + NFC Card + NFC TX
TC02	The NFC RX Test Mode EUT + Adapter + Carrier Board + NFC RX
TC03	The NFC STANDBY Test Mode EUT + Adapter + Carrier Board + NFC STANDBY

4.5 Test Setups

Test Setup 1

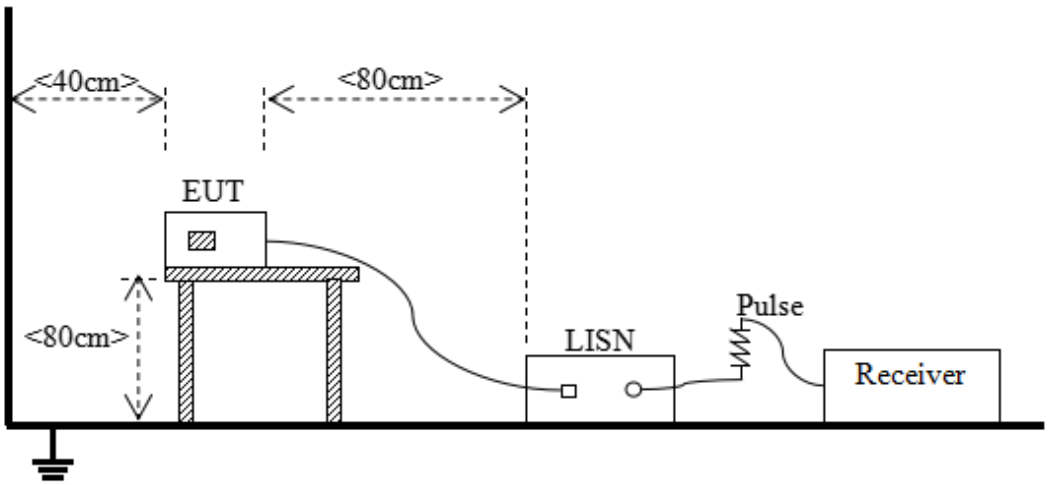


(For Radiated Emission Test (30 MHz-1 GHz))



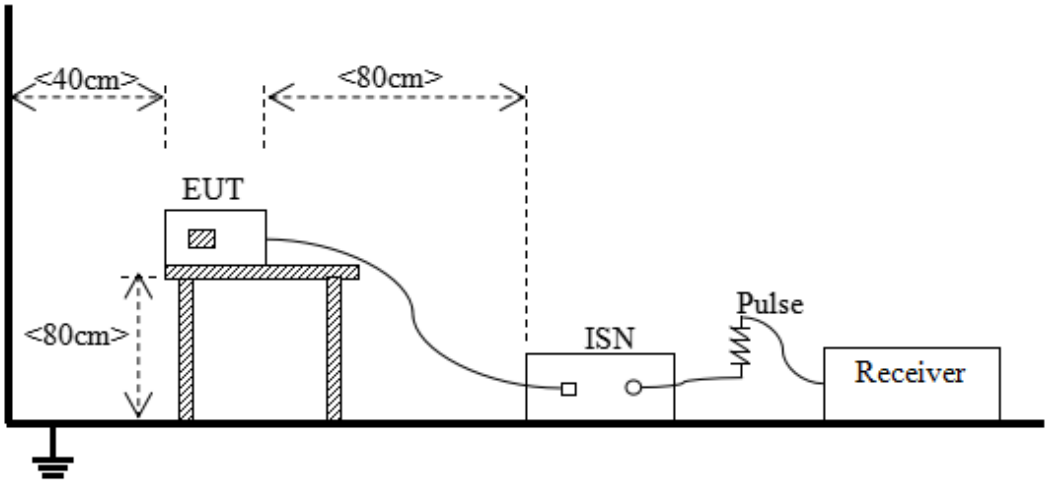
(For Radiated Emission Test (above 1 GHz))

Test Setup 2



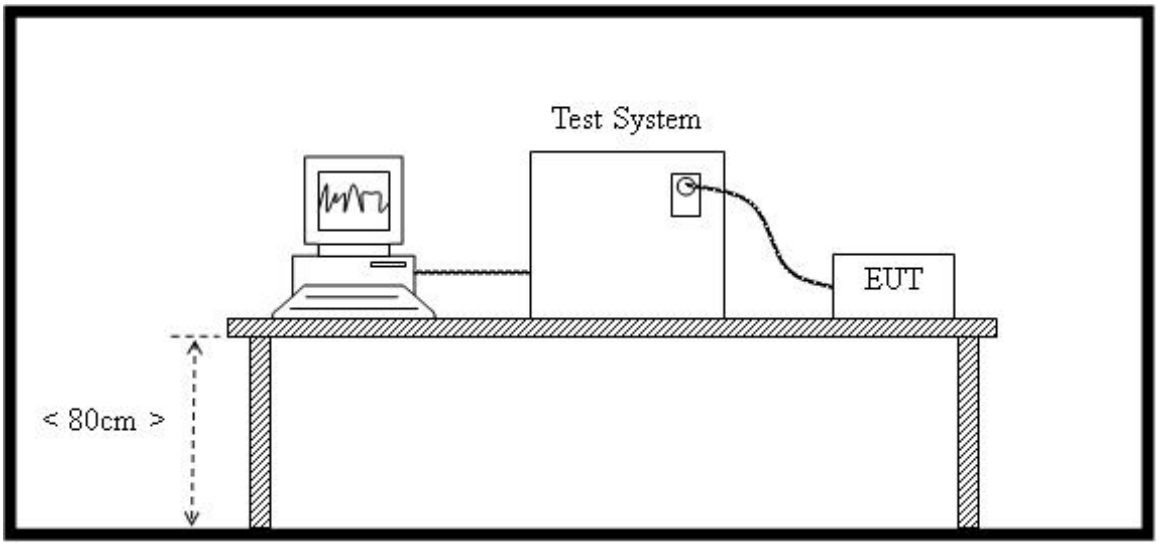
(For Conducted Emission at AC/DC Ports Test)

Test Setup 3



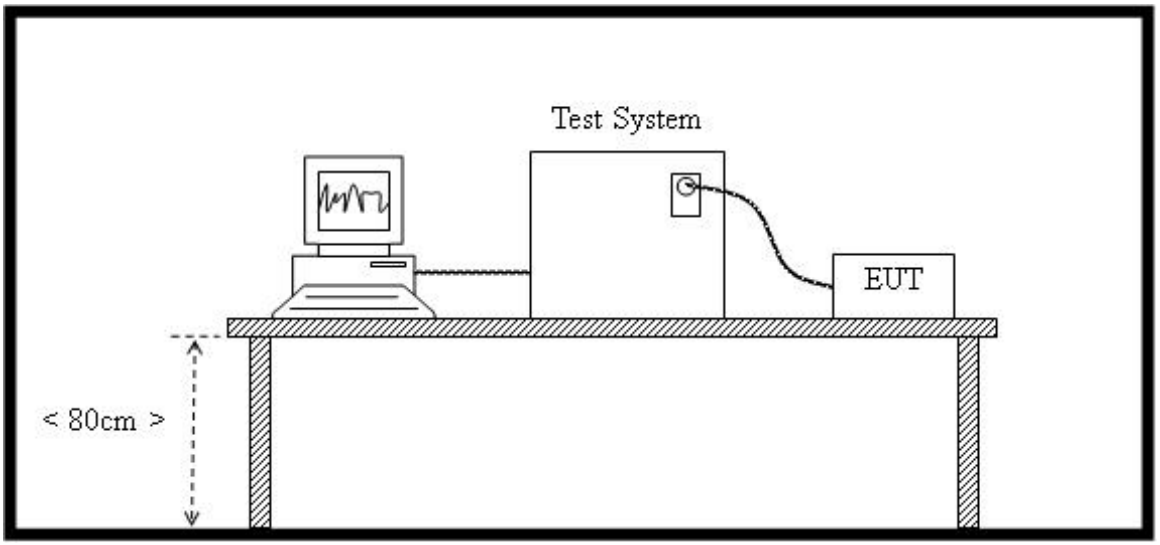
(For Conducted Emission for Wired Network Ports Test)

Test Setup 4



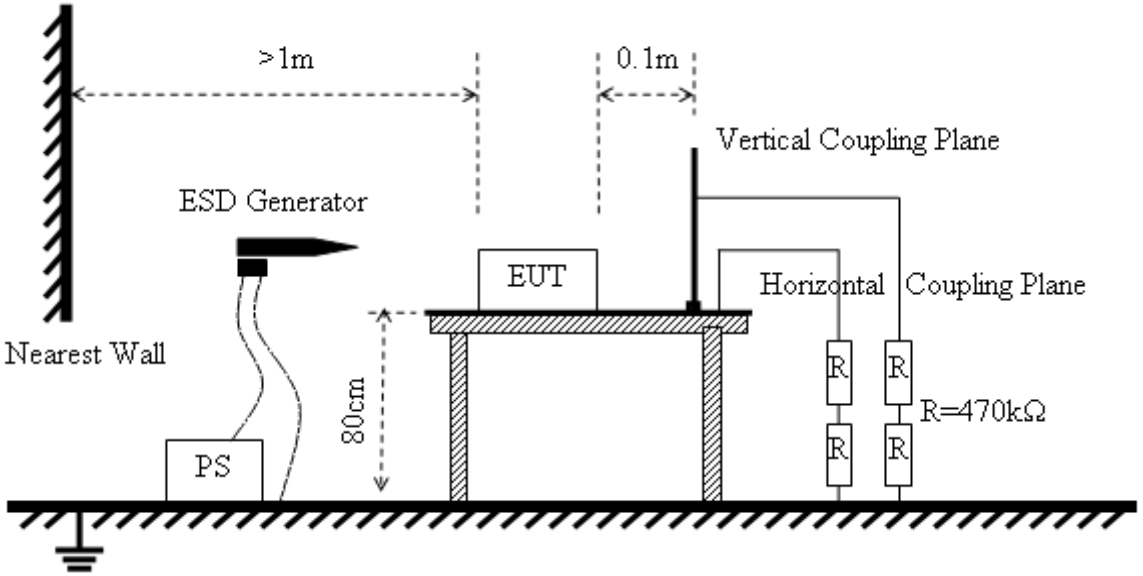
(For Harmonic Current Emissions Measurement Test)

Test Setup 5



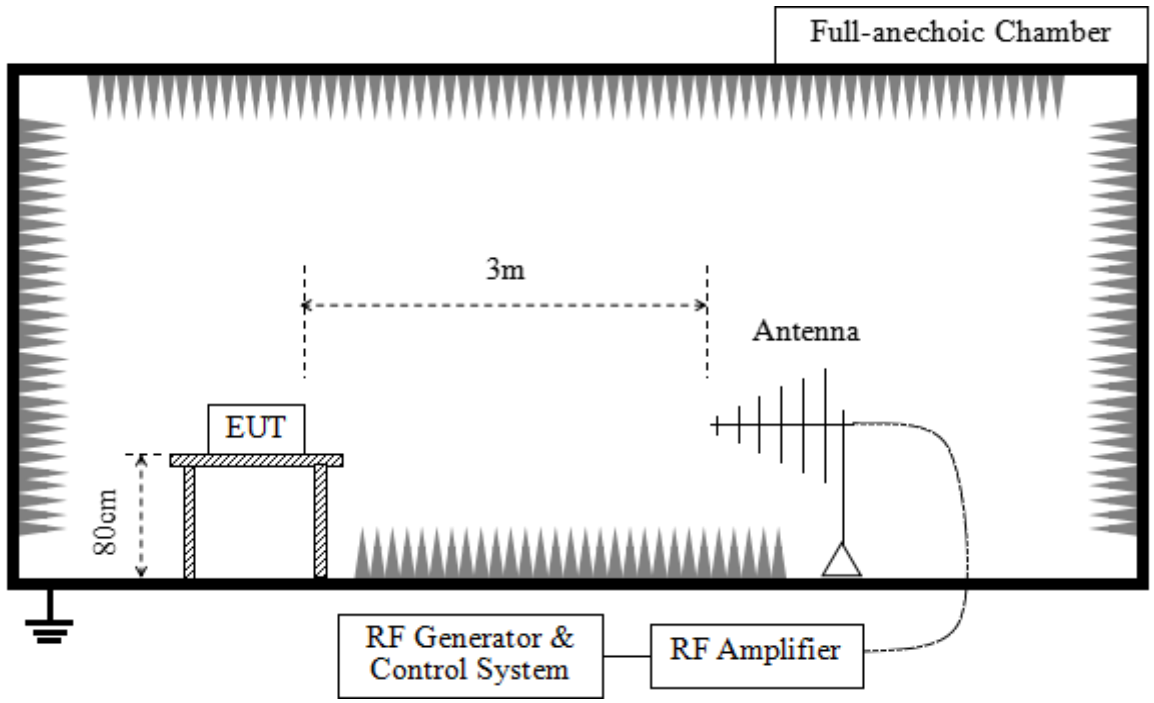
(For Voltage Fluctuations and Flicker Measurement Test)

Test Setup 6



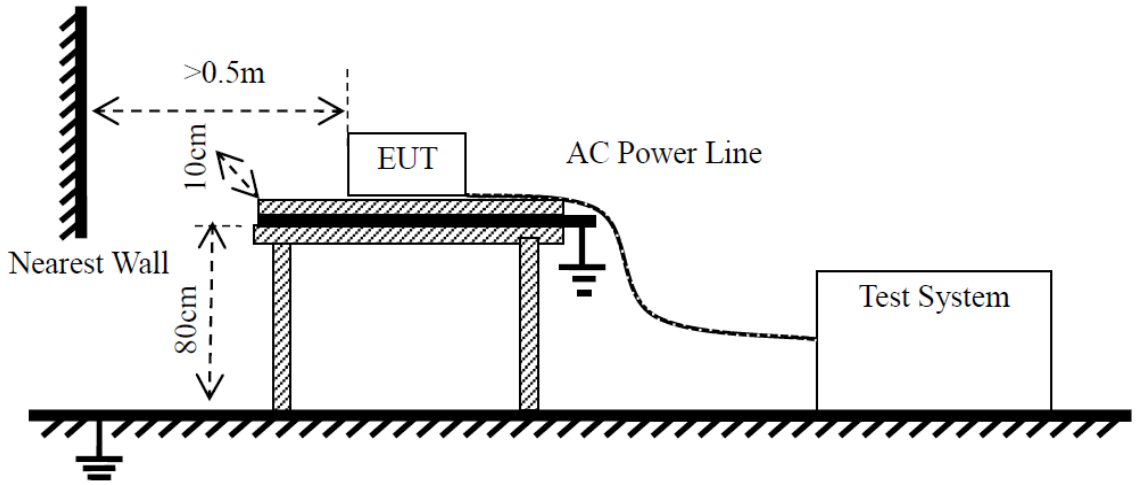
(For Electrostatic Discharge Immunity Test)

Test Setup 7



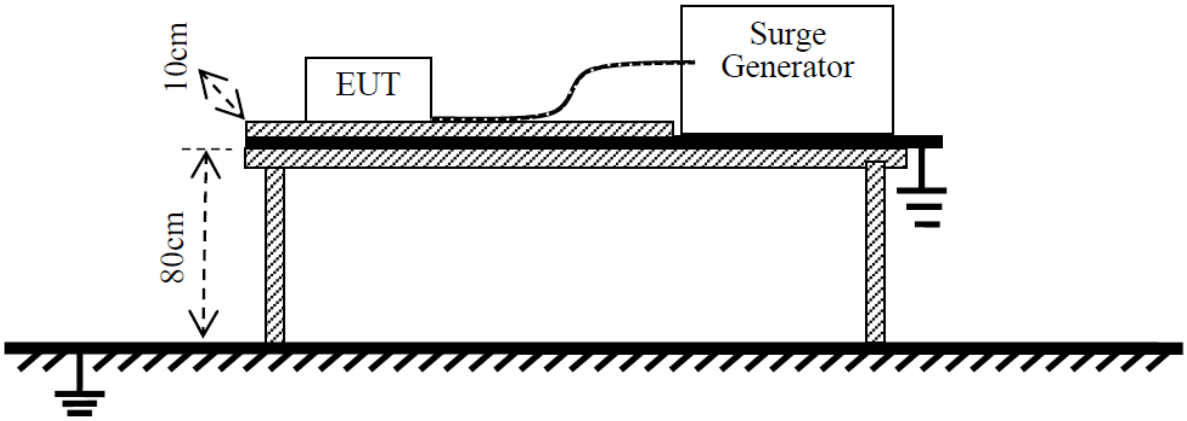
(For Radiated Immunity Test)

Test Setup 8



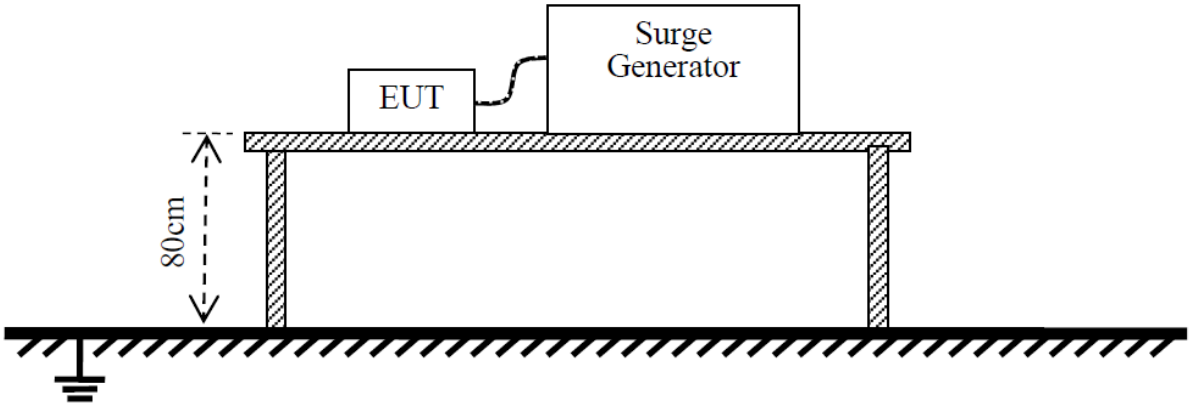
(For Electrical Fast Transient / Burst Immunity Test)

Test Setup 9



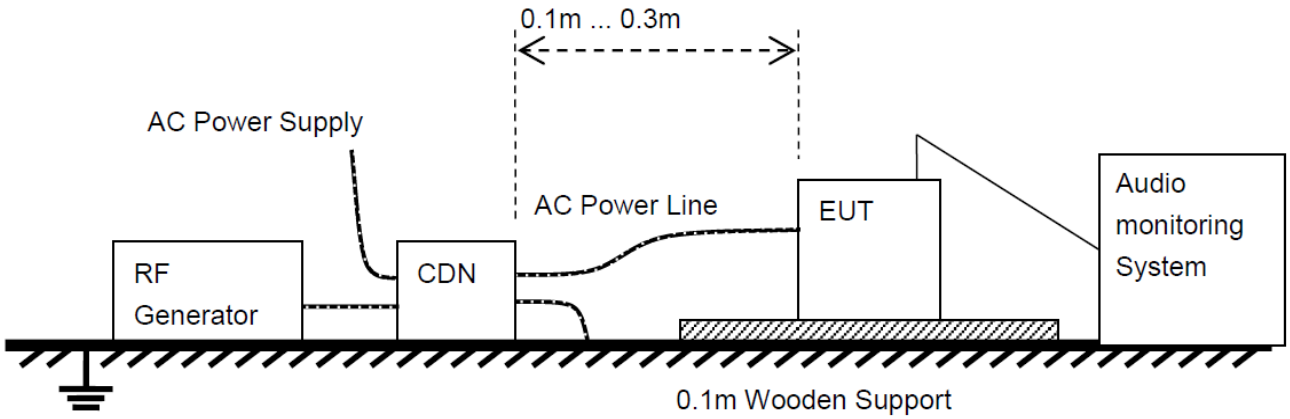
(Transients and Surges)

Test Setup 10



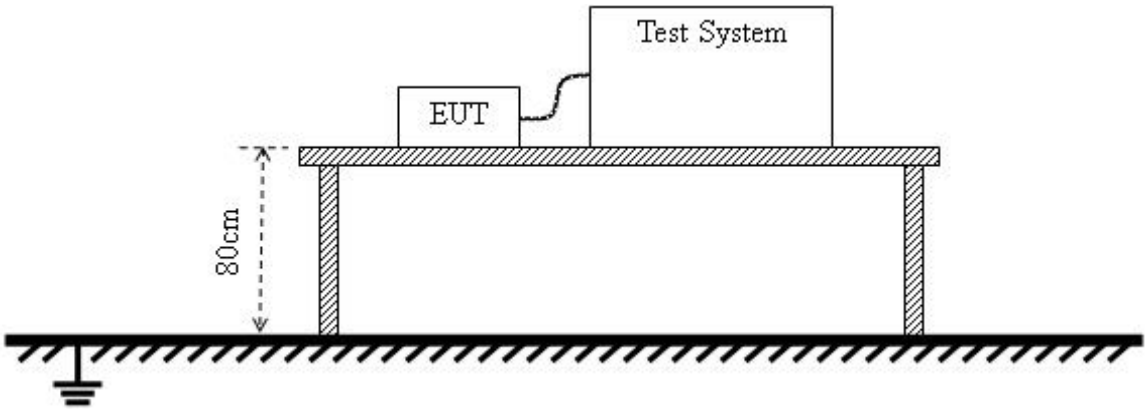
(For Surge Immunity Test)

Test Setup 11



(For Immunity to Conducted Disturbances Induced By RF Fields Test)

Test Setup 12



(For Voltage Dips and Short Interruptions Immunity Test)

4.6 Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Setup	Test Setup 1
	Test Configuration	TC01~TC03 Note
Electrostatic Discharge Immunity	Test Setup	Test Setup 6
	Test Configuration	TC01~TC03 Note
Radiated RF Electromagnetic Field Immunity	Test Setup	Test Setup 7
	Test Configuration	TC01~TC03 Note
Note: Based on client request, all normal using modes of the normal function were tested, but only the worst test data of test mode is reported in this report. The NFC TX Test Mode is the worst mode in this report.		

5 TEST ITEMS

5.1 Emission Tests

5.1.1 Radiated Emission

5.1.1.1 Limit

Frequency range (MHz)	Class A (at 3 m)	Class B (at 3 m)
	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Limit (dBμV/m)
30 - 230	50	40
230 - 1000	57	47

Frequency range (MHz)	Class A (at 3 m)		Class B (at 3 m)	
	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
1000-3000	76	56	70	50
3000-6000	80	60	74	54

NOTE:

1) The lower limit shall apply at the transition frequency.
2) Additional provisions may be required for cases where interference occurs.

5.1.1.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 1. The photo of test setup please refer to ANNEX B.

5.1.1.3 Test Procedure

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by antenna with 2 orthogonal polarities.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak for f <1 GHz, peak & RMS Average for f ≥ 1 GHz

Trace = max hold

5.1.1.4 Test Result

Please refer to ANNEX A.1.

5.1.2 Conducted Emission

5.1.2.1 Test Limit

AC Port

Frequency range (MHz)	Class A		Class B	
	Quasi-peak (dBμV)	Average (dBμV)	Quasi-peak (dBμV)	Average (dBμV)
0.15 - 0.50	79	66	66-56	56-46
0.50 - 5	73	60	56	46
5 - 30	73	60	60	50

DC Port

Frequency range (MHz)	Quasi-peak (dBμV)	Average (dBμV)
0.15 - 0.50	79	66
0.50 - 30	73	60

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

Wired Network Port

Frequency range (MHz)	Class A		Class B	
	Quasi-peak (dBμV)	Average (dBμV)	Quasi-peak (dBμV)	Average (dBμV)
0.15 - 0.50	97-87	84-74	84-74	74-64
0.50 - 30	87	74	74	64

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

5.1.2.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 2 or/and setup 3. The photo of test setup please refer to ANNEX B.

5.1.2.3 Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω/50 μH of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed.

Measurement of common mode (asymmetric mode)voltage emissions at wired network ports for attachment of unscreened balanced pairs shall be performed with the wired network port connected by a cable to an AAN. The AAN shall define the common mode termination impedance seen by the wired network port during the emission measurements.
The voltage division factor shall be added to the measured voltage measured by the receiver directly at the voltage measurement port of the AAN and the result compared with the voltage limits as applicable.

Use the following spectrum analyzer settings:

RBW = 9 KHz

VBW ≥ RBW

Sweep = 10ms

Detector function =peak & Average

Trace = max hold

5.1.2.4 Test Result

Please refer to ANNEX A.2.

5.1.3 Harmonic Current Emissions

5.1.3.1 Limit

Limits for Class A equipment				Limits for Class D equipment		
odd harmonic		Even harmonics		Harmonic order (n)	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
Harmonic order (n)	Maximum permissible harmonic current A	Harmonic order (n)	Maximum permissible harmonic current A			
3	2.30	2	1.08	3	3.4	2.30
5	1.14	4	0.43	5	1.9	1.14
7	0.77	6	0.30	7	1.0	0.77
9	0.40	8≤n≤40	0.23X8/n	9	0.5	0.40
11	0.33			11	0.35	0.33
13	0.21			15≤n≤39	3.85/n	0.15X15/n
15≤n≤39	0.15X15/n					

Note: For Class B equipment, the harmonics of the input current shall not exceed the values given in Table “limits for Class A equipment” multiplied by a factor of 1,5.

For the purpose of harmonic current limitation, equipment is classified as follows :(Note: Class C equipment requirement not include in this standard.)

Class A:

– balanced three-phase equipment;

– household appliances, excluding equipment identified as class D;

– tools, excluding portable tools;

– dimmers for incandescent lamps;

– audio equipment.

Equipment not specified in one of the three other classes shall be considered as class A equipment.

Class B:

– portable tools;

– arc welding equipment which is not professional equipment.

Class C:

– lighting equipment.

Class D:

Equipment having a specified power according to 6.2.2 less than or equal to 600 W, of the following types:

– personal computers and personal computer monitors;

– television receivers.

5.1.3.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 4. The photo of test setup please refer to ANNEX B.

5.1.3.3 Test Procedure

The EUT is placed on the top of a wooden table 0.8 m above the ground and operated to produce the

maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the necessary for the EUT to be exercised.

5.1.3.4 Test Result

Please refer to ANNEX A.3.

5.1.4 Voltage Fluctuations and Flicker Measurement

5.1.4.1 Limit

Test Item	Limit	Note
Pst	1.0	Short-term flicker indicator
Plt	0.65	Long-term flicker indicator
Tdt	0.5	Maximum time that dt exceeds 3%
dmax (%)	4%	Maximum relative voltage change
dc (%)	3.3%	Relative steady-state voltage change

5.1.4.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 5. The photo of test setup please refer to ANNEX B.

5.1.4.3 Test Procedure

During the Flicker measurement, the measure time shall include that part of whole operation changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours. The test specifications refer the next table.

No.	Specification	Value
1	Test Frequency	50 Hz
2	Test Voltage	230 VAC
3	Waveform	Sine
4	Test Time	10 minutes for Pst; 2 hours for Plt

5.1.4.4 Test Result

Please refer to ANNEX A.4.

5.2 Immunity Tests

5.2.1 Test Performance Criteria for Immunity Test

5.2.1.1 Performance Criteria (EN 301489-1)

5.2.1.1.1 General Performance Criteria

Type	Description
Criterion A	The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion B	The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended.
Criterion C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

5.2.1.2 Performance criteria (EN 301489-3)

5.2.1.2.1 General Performance Criteria

The performance criteria are used to make an assessment whether a radio equipment passes or fails immunity tests.
Only the performance criteria specified in the present document or in ETSI EN 301 489-1 [1] where referenced shall apply.
The provisions of ETSI EN 301 489-1 [1], clause 6, shall apply together with the following.

Continuous and non-continuous operation	Operating modes
Latency is the time delay between the initiation and the completion of operation of the EUT. Correct functioning requires completing the relevant operation within the maximum latency time. Where the maximum latency is specified in the applicable harmonised radio standard (in the wanted performance criterion, or an acknowledge requirement), that value shall be used. Where this is not the case, then the maximum latency is that required by the intended use of the EUT.	Where the EUT has more than one mode of operation (see clause 4.4.1), an unplanned transition from one mode to another is considered as an unintentional response. The EUT shall be tested in all modes to confirm there are no such unintentional responses.

5.2.2 Electrostatic Discharge Immunity

5.2.2.1 Test Specification

Specification	Value
Basic Standard	EN 61000-4-2
Discharge Impedance	330 Ohm / 150 pF
Discharge Voltage	Air Discharge: 2 kV; 4 kV; 8 kV; Contact Discharge: 2 kV; 4 kV
Polarity	Positive / Negative
Number of Discharge	Minimum 20 times at each test point
Discharge Mode	Single discharge
Discharge Period	1 second minimum

5.2.2.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 6. The photo of test setup please refer to ANNEX B.

5.2.2.3 Test Procedure

1. Electrostatic discharges are applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

2. The test is performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

3. The time interval between two successive single discharges is at least 1 second.

4. The ESD generator is held perpendicularly to the surface to which the discharge is applied and the return cable is at least 0.2 meters from the EUT.

5. Contact discharges are applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

6. Air discharges are applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator is removed from the EUT and re-triggered for a new single discharge. The test is repeated until all discharges were completed.

7. At least ten single discharges (in the most sensitive polarity) are applied to the Horizontal Coupling Plane at points on each side of the EUT. The ESD generator is positioned vertically at a distance of 0.1 meters from the EUT with the discharge electrode touching the HCP.

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

5.2.2.4 Test Result

Please refer to ANNEX A.5.

5.2.3 Radio Frequency Electromagnetic Field Immunity

5.2.3.1 Test Specification

Specification	Value
Basic Standard	EN 61000-4-3
Frequency Range	80 MHz to 6000 MHz
Field Strength	3 V/m (unmodulated, r.m.s)
Modulation	1 kHz sine wave, 80%, AM modulation
Frequency Step	1% of fundamental
Polarity of Antenna	Horizontal and Vertical
Test Distance	3 m
Antenna Height	1.5 m
Dwell Time	3 seconds

5.2.3.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 7. The photo of test setup please refer to ANNEX B.

5.2.3.3 Test Procedure

PER Test:

Before testing, we should set the base station(CMW500) to the mode that needs to be tested, such as Bluetooth or WIFI, then set EUT to the corresponding mode and connect to Base station. Adjust the base station interface to the PER interface, and observe the PER value on the base station interface by adding interference signal during the test.

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

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

2. The test signal is 80% amplitude modulated with a 1 kHz sine wave.

3. The frequency range is swept from 80 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers. The rate of sweep does not exceed 1.5*10-3 decade/s. Where the frequency range is swept incrementally, the step size is 1% of fundamental.

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

5. The field strength level is 3 V/m.

6. The test is performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides, but only the worst side data is reported in this report.

5.2.3.4 Test Result

Please refer to ANNEX A.6.

5.2.4 Electrical Fast Transient / Burst Immunity

5.2.4.1 Test Specification

Specification	Value
Basic Standard	EN 61000-4-4
Test Voltage	AC Power Port: 1 kV.
	DC Power Ports,Signal Ports,Control Ports, Wired Network Ports: 0.5 kV.
Polarity	Positive / Negative
Impulse Frequency	5 kHz
Impulse Wave Shape	5/50 ns
Burst Duration	15 ms
Burst Period	300 ms
Test Duration	> 1 min

5.2.4.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 8. The photo of test setup please refer to ANNEX B.

5.2.4.3 Test Procedure

1. The EUT is tested with 1000 V discharges to the AC power input leads, and 500 V for wired network port.

2. Both positive and negative polarity discharges are applied.

3. The length of the "hot wire" from the coaxial output of the EFT generator to the terminals on the EUT should not exceed 1m.

4. The duration time of each test sequential is 1min.

5. The transient / burst waveform is in accordance with IEC 61000-4-4, 5/50 ns.

5.2.4.4 Test Result

Please refer to ANNEX A.7.

5.2.5 Transients and Surges

Specification	Value
Basic Standard	ISO 7637-2
Immunity test level	III
Voltage	12 V
Test pulse number	1, 2a, 2b, 3a / 3b,4
Repetition Rate	For the purpose of EMC testing it is sufficient to apply pulses 1, 2a, 2b and 4, 10 times each, and apply the test pulses 3a and 3b for 20 minutes each.

5.2.5.1 Test Setup

Please refer to 4.5 section description of test setup of test setup 9. The photo of test setup please refer to ANNEX B.

5.2.5.2 Test Procedure

1. The immunity of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2: 2011.

2. For test pulses 3a and 3b, the leads between the terminals of the test pulse generator and the DUT shall be laid out in a straight parallel line at a height of (500+10 mm) above the ground plane and shall have a length of (0,5 ± 0,1) m.

3. Please refer to Annex B for the photographs of the Test Configuration.

5.2.5.3 Test Result

Please refer to ANNEX A.8.

5.2.6 Surge Immunity

5.2.6.1 Test Specification

AC Power Port and Wired Network Port

Specification	Value	
Ports class	AC Power Port	Wired Network Port
Basic Standard	EN 61000-4-5	
Waveform	Voltage: 1.2/50 μs	Voltage:1.2/50us,or 10/700 μs See Note 2,3,4
Test Voltage	line to ground 2 kV,line to line 1 kV; line to ground 1 kV, line to line 0.5 kV(Note 1)	0.5 kV,or 1 kV See Note 2,3,4
Polarity	Positive / Negative	
Phase Angle	0°, 90°, 180°, 270°	N/A
Repetition Rate	60 seconds	
Times	5 times per condition	

Note 1: The test level for AC mains ports, in telecommunications centres.

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).The test generator shall provide the 1,2/50 μs pulse.

Note 3: The test level for symmetrically operated, wired network ports, intended to be directly connected to wired network ports via outdoor cables, shall be 1 kV (applied lines to ground).The test generator shall provide the 10/700 μs pulse.

Note 4: The test level for non-symmetrically operated wired network ports, intended to be directly connected to wired network ports via outdoor cables, shall be 1 kV (applied line to ground, or shield to ground) and 0,5 kV (applied line to line).The test generator shall provide the 1,2/50 μs pulse.

5.2.6.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 10. The photo of test setup please refer to ANNEX B.

5.2.6.3 Test Procedure

The EUT and the auxiliary equipment are placed on a table of 0.8 m heights above a metal ground reference plane. The size of ground plane is greater than 1 m*1 m and project beyond the EUT by at least 0.1 m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT is less than 2 meters (provided by the manufacturer).

The EUT is connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise is applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).

The surges are applied line to line and line(s) to earth. When testing line to earth the test voltage is applied successively between each of the lines and earth. Set up to the test level specified increased the test voltage. All lower levels including the selected test level are tested. The polarity of each surge level included positive and negative test pulses.

5.2.6.4 Test Result

Please refer to ANNEX A.9.

5.2.7 Immunity to Conducted Disturbances Induced by RF Fields

5.2.7.1 Test Specification

Specification	Value
Basic Standard	EN 61000-4-6
Frequency Range	0.15 MHz – 80 MHz
Field Strength	3 V rms (unmodulated, r.m.s)
Modulation	1 kHz sine wave, 80% AM
Frequency Step	1% of fundamental
Coupled Cable	AC Power Line; DC Power Line; Wired Network Line
Coupling Device	CDN-M2+3

5.2.7.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 11. The photo of test setup please refer to ANNEX B.

5.2.7.3 Test Procedure

PER Test:

Before testing, we should set the base station(CMW500) to the mode that needs to be tested, such as Bluetooth or WIFI, then set EUT to the corresponding mode and connect to Base station. Adjust the base station interface to the PER interface, and observe the PER value on the base station interface by adding interference signal during the test.

The test procedure was in accordance with EN 61000-4-6.

1. The EUT shall be tested within its intended operating and climatic conditions.
2. The test shall be performed with the test generator connected to each of the coupling and decoupling devices in turn, while the other non-excited RF input ports of the coupling devices are terminated by a 50 Ohm load resistor.
3. The test signal is 80% amplitude modulated with a 1 kHz sine wave.
4. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80% amplitude. The sweep rate shall not exceed 1.5*10-3 decades/s. The step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value where the frequency is swept incrementally.
5. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised, and able to respond. Sensitive frequencies such as clock frequencies and harmonics or frequencies of dominant interest, shall be analyzed separately.
6. Attempts should be made to fully exercise the EUT during test, and to fully interrogate all exercise modes selected for susceptibility.

5.2.7.4 Test Result

Please refer to ANNEX A.10.

5.2.8 Voltage Dips and Short Interruptions Immunity

5.2.8.1 Test Specification

Specification	Value
Basic Standard	EN 61000-4-11
Voltage Dips	100% reduction: 10 ms; 100% reduction: 20 ms; 30% reduction: 500 ms
Voltage Interruptions	100% reduction: 5000 ms
Voltage Phase Angle	0°

5.2.8.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 12. The photo of test setup please refer to ANNEX B.

5.2.8.3 Test Procedure

The power cord is used as supplied by the manufacturer. The EUT was connected to the line output of the Voltage Dips and Interruption Generator.

The EUT is tested for a) 100% voltage dip of supplied voltage with duration of 10 ms; b) 100% voltage dip of supplied voltage with duration of 20 ms;c) 30% voltage dip of supplied voltage and duration 500 ms.Both of the dip tests are carried out for a sequence of three voltage dips with intervals of 10 seconds.

100% voltage interruption of supplied voltage with duration of 5000 ms is followed, which is a sequence of three voltage interruptions with intervals of 10 seconds.

Voltage reductions occur at 0 degrees crossover point of the voltage waveform. The performance of the EUT is checked after the voltage dip or interruption.

5.2.8.4 Test Result

Please refer to ANNEX A.11.

ANNEX A TEST RESULTS

A.1 Radiated Emission

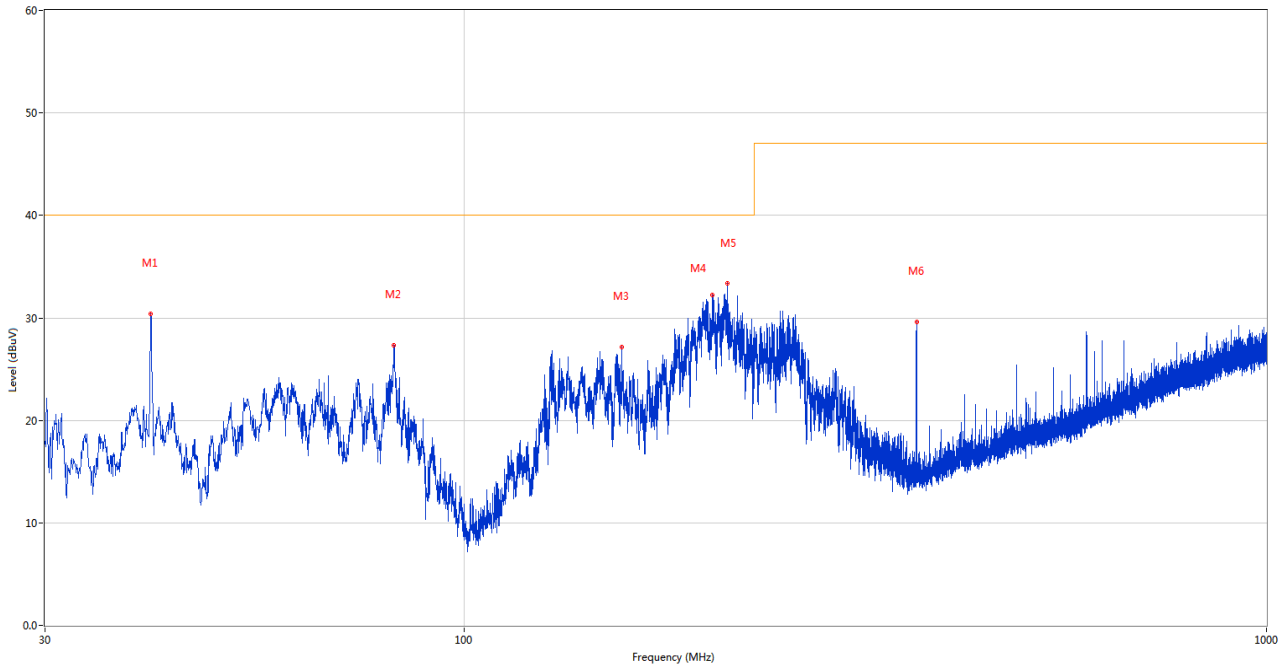
Note 1: The symbol of "--" in the table which means not application.

Note 2: Measurements shall be made with a quasi-peak measuring receiver in the frequency range 30 MHz to 1000 MHz. To reduce the testing time, a peak measuring receiver may be used instead of a quasi-peak measuring receiver. In case of dispute, measurement with a quasi-peak measuring receiver will take precedence.

Test Data and Plots (Below 1 GHz)

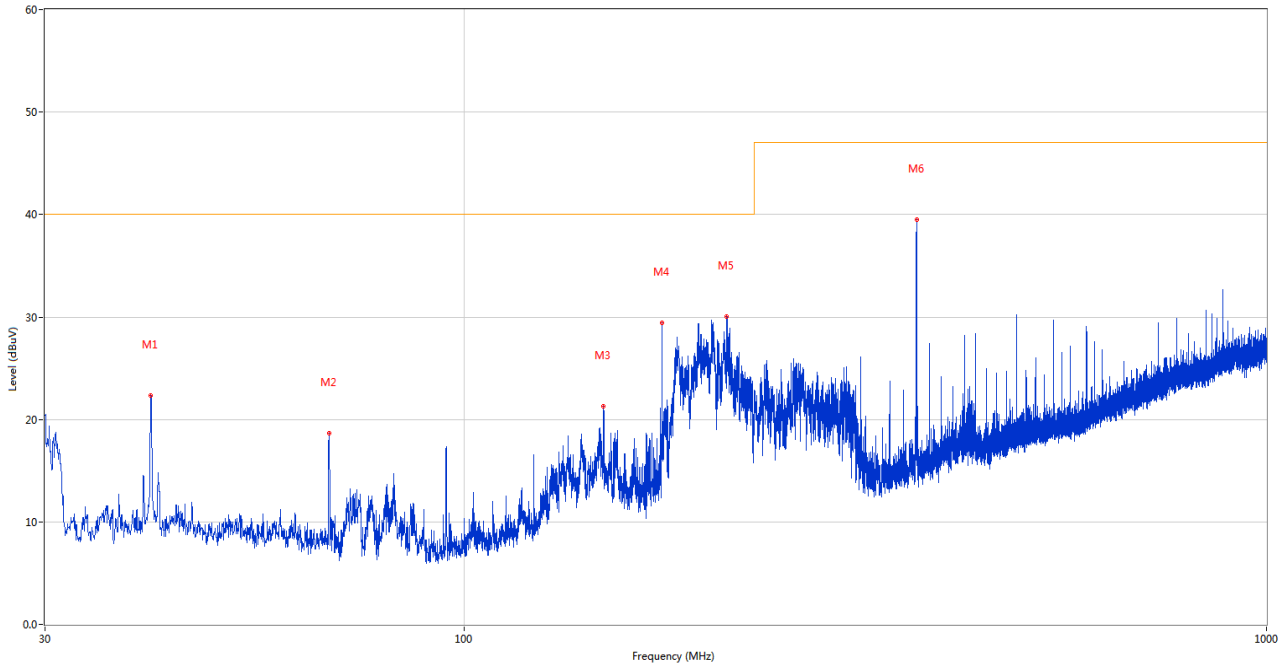
The NFC TX Test Mode

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	40.670	30.38	-26.18	40.0	-9.62	Peak	212.00	100	Vertical	Pass
2	81.701	27.35	-30.64	40.0	-12.65	Peak	78.00	100	Vertical	Pass
3	157.167	27.18	-24.73	40.0	-12.82	Peak	119.00	100	Vertical	Pass
4	203.970	32.22	-28.57	40.0	-7.78	Peak	212.00	100	Vertical	Pass
5	212.602	33.33	-28.03	40.0	-6.67	Peak	280.00	100	Vertical	Pass
6	366.154	29.61	-22.40	47.0	-17.39	Peak	301.00	200	Vertical	Pass

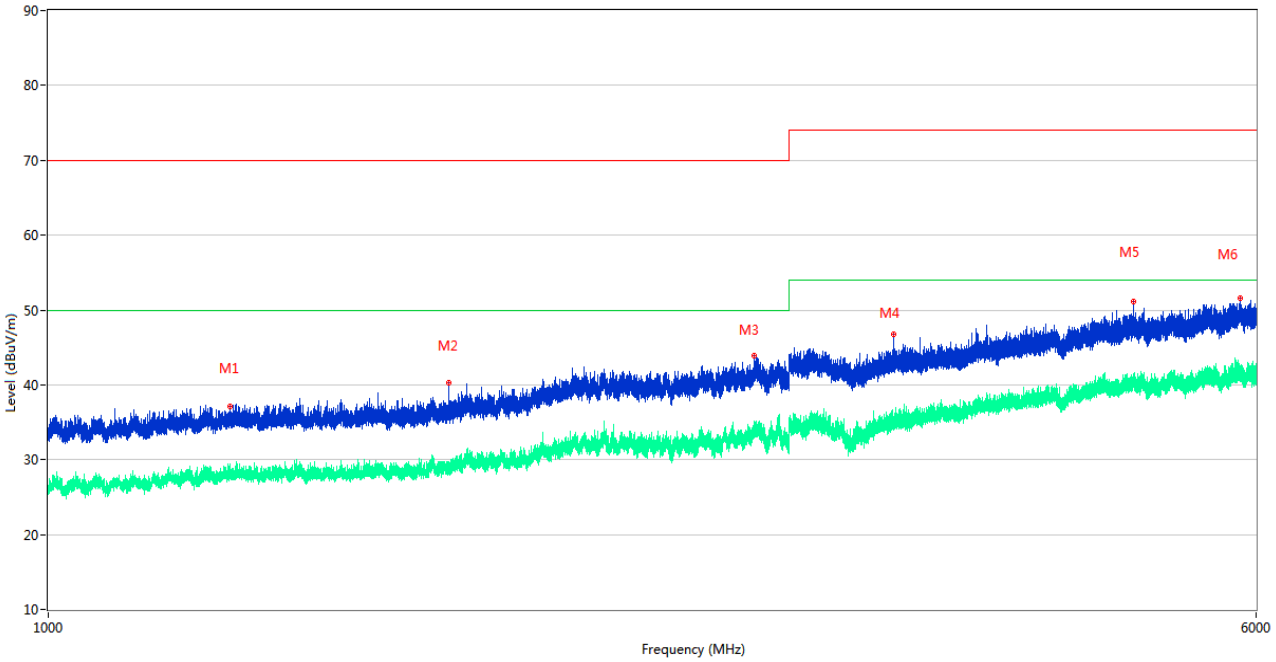
A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	40.670	22.33	-26.18	40.0	-17.67	Peak	100.00	200	Horizontal	Pass
2	67.782	18.69	-28.63	40.0	-21.31	Peak	167.00	200	Horizontal	Pass
3	149.165	21.28	-25.13	40.0	-18.72	Peak	230.00	200	Horizontal	Pass
4	176.324	29.45	-26.50	40.0	-10.55	Peak	217.00	200	Horizontal	Pass
5	212.505	30.08	-28.04	40.0	-9.92	Peak	72.00	100	Horizontal	Pass
6	366.202	39.53	-22.40	47.0	-7.47	Peak	207.00	100	Horizontal	Pass

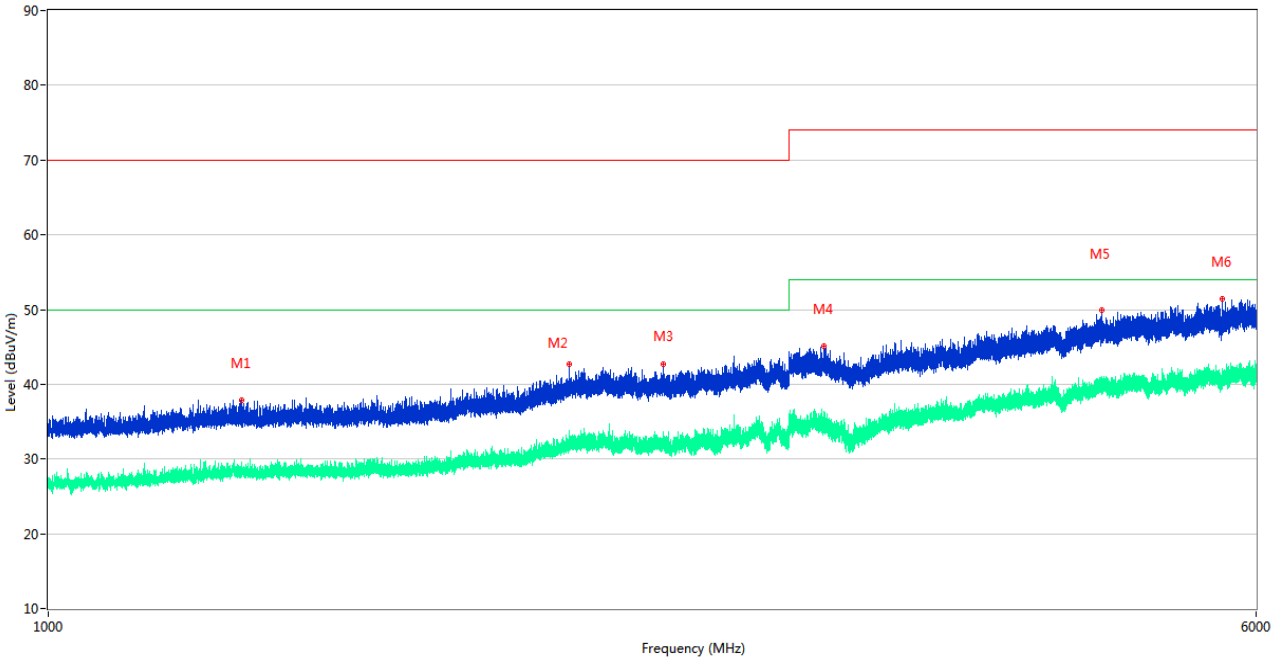
Test Data and Plots (Above 1 GHz)

A.1.3 Test Antenna Vertical, 1 GHz – 6 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1308.500	37.18	-14.76	70.0	-32.82	Peak	221.00	100	Vertical	Pass
1**	1308.500	29.40	-14.76	50.0	-20.60	AV	221.00	100	Vertical	Pass
2	1810.600	40.22	-14.56	70.0	-29.78	Peak	21.00	100	Vertical	Pass
2**	1810.600	29.68	-14.56	50.0	-20.32	AV	21.00	100	Vertical	Pass
3	2847.700	43.88	-7.85	70.0	-26.12	Peak	44.00	100	Vertical	Pass
3**	2847.700	33.21	-7.85	50.0	-16.79	AV	44.00	100	Vertical	Pass
4	3502.200	46.74	-6.40	74.0	-27.26	Peak	0.00	100	Vertical	Pass
4**	3502.200	34.91	-6.40	54.0	-19.09	AV	0.00	100	Vertical	Pass
5	5000.100	51.19	-0.94	74.0	-22.81	Peak	208.00	100	Vertical	Pass
5**	5000.100	40.62	-0.94	54.0	-13.38	AV	208.00	100	Vertical	Pass
6	5862.150	51.60	2.22	74.0	-22.40	Peak	287.00	100	Vertical	Pass
6**	5862.150	41.54	2.22	54.0	-12.46	AV	287.00	100	Vertical	Pass

A.1.4 Test Antenna Horizontal, 1 GHz – 6 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1332.100	37.88	-14.67	70.0	-32.12	Peak	81.00	100	Horizontal	Pass
1**	1332.100	28.24	-14.67	50.0	-21.76	AV	81.00	100	Horizontal	Pass
2	2166.600	42.76	-10.65	70.0	-27.24	Peak	290.00	100	Horizontal	Pass
2**	2166.600	31.36	-10.65	50.0	-18.64	AV	290.00	100	Horizontal	Pass
3	2490.400	42.76	-9.63	70.0	-27.24	Peak	50.00	100	Horizontal	Pass
3**	2490.400	32.26	-9.63	50.0	-17.74	AV	50.00	100	Horizontal	Pass
4	3157.950	45.11	-6.16	74.0	-28.89	Peak	75.00	100	Horizontal	Pass
4**	3157.950	35.05	-6.16	54.0	-18.95	AV	75.00	100	Horizontal	Pass
5	4773.750	49.87	-2.23	74.0	-24.13	Peak	357.00	100	Horizontal	Pass
5**	4773.750	39.83	-2.23	54.0	-14.17	AV	357.00	100	Horizontal	Pass
6	5709.000	51.46	-0.42	74.0	-22.54	Peak	0.00	100	Horizontal	Pass
6**	5709.000	41.03	-0.42	54.0	-12.97	AV	0.00	100	Horizontal	Pass

A.2 Conducted Emissions

Note: Not applicable.

A.3 Harmonic Current Emissions

Note: Not applicable.

A.4 Voltage Fluctuations and Flicker Measurement

Note: Not applicable.

A.5 Electrostatic Discharge Immunity

Test Points	Discharge Level (kV)	Discharge Mode	Number of Discharge	Verdict
HCP	±2, ±4	Contact	100	Pass
VCP	±2, ±4	Contact	100	Pass

Note: The performance comply with the performance criteria in Criterion B.

A.6 Radio Frequency Electromagnetic Field Immunity

Antenna Polarity	Frequency (MHz)	Side	Field Strength (V/m)	Verdict
Vertical	80 – 1000, 1000 – 3000, 3000 – 6000	Front	3	Pass
		Back	3	Pass
		Left	3	Pass
		Right	3	Pass
Horizontal	80 – 1000, 1000 – 3000, 3000 – 6000	Front	3	Pass
		Back	3	Pass
		Left	3	Pass
		Right	3	Pass

Note 1: The performance comply with the performance criteria in Criterion A.

A.7 Electrical Fast Transient / Burst Immunity

Note: Not applicable.

A.8 Transients and Surges

Note: Not applicable.

A.9 Surge Immunity

Note: Not applicable.

A.10 Immunity to Conducted Disturbances Induced by RF Fields

Note: Not applicable.

A.11 Voltage Dips and Short Interruptions Immunity

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2240685-AE-5.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2240685-AW-3.PDF”.

Statement

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--END OF REPORT--