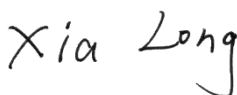


TEST REPORT

Applicant: Woan Technology (Shenzhen) Co., Ltd.
Address: Room 1101, Qiancheng Commercial Center, No. 5
Haicheng Road, Mabu Community, Xixiang
Sub-district, Bao'an District, Shenzhen, Guangdong,
P.R.China, 518100
Equipment Type: SwitchBot Card
Model Name: W2500030 (refer section 2.4)
Brand Name: SwitchBot
Test Standard: ETSI EN 300 330 V2.1.1 (2017-02)
Test Date: May 12, 2022 - May 13, 2022
Date of Issue: Jul. 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
<u>Rev. 01</u>	<u>Jul. 12, 2022</u>	<u>Initial Issue</u>

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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	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.2 Manufacturer Information

Manufacturer	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.3 Factory Information

Factory	Woan Technology (Shenzhen) Co., Ltd.
Address	Building A2, Zhengfeng Industrial Area, No.610 Fengtang Boulevard, Fuhai Sub-district, Bao'an District, Shenzhen

2.4 General Description for Equipment under Test (EUT)

EUT Name	SwitchBot Card
Model Name Under Test	W2500030
Series Model Name	W2500031, W2500032, W2500033, W2500034, W2500035
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name.
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	NFC
-----------------------------------	-----

The requirement for the following technical information of the EUT was tested in this report:

Modulation Type	ASK
Frequency Range	13.56 MHz
Product Class	1
Receiver Categorization	1
Number of channel	1
Tested Channel	1
Antenna Type	Coil Antenna
About the Product	The equipment is SwitchBot Card, intended for used with information technology equipment. Only NFC was tested in this report.

Note: The above EUT information in section 2.4 and 2.5 was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

The EUT has been tested according to ETSI EN 300 330 V2.1.1 (2017-02).

No.	Identity	Document Title
1	ETSI EN 300 330 V2.1.1 (2017-02)	Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

3.2 Verdict

Report Section	Standard Rule	Description	Result
Transmitter requirements			
5.1.1	4.3.1	Permitted range of operating frequencies	Pass
5.1.2	4.3.2	Operating frequency ranges	Pass
5.1.3	4.3.3	Modulation bandwidth	Pass
5.1.4	4.3.4	Transmitter H-field requirements (only applies to product class 1 and class 2)	Pass
--	4.3.5	Transmitter RF carrier current (only applies to product class 3)	N/A
--	4.3.6	Transmitter radiated E-field (only applies to product class 4)	N/A
--	4.3.7	Transmitter conducted spurious emissions (only applies to product class 3 and their power or current level in an artificial antenna (conducted spurious emission))	N/A
5.1.5	4.3.8	Transmitter radiated spurious domain emission limits < 30 MHz	Pass
5.1.6	4.3.9	Transmitter radiated spurious domain emission limits > 30 MHz	Pass
--	4.3.10	Transmitter Frequency stability (only applies to channelized systems where channel limits are defined)	N/A
Receiver requirements			
5.2.1	4.4.2	Receiver spurious emissions	N/A
--	4.4.3	Adjacent channel selectivity (only for channelized systems in the 27 MHz range)	N/A
--	4.4.4	Receiver blocking or desensitization (only applicable for channelized systems where channel definitions are used.)	N/A

Note: The EUT is SwitchBot Card, has no Receiver mode, so the test item of Receiver spurious emissions is not applicable.

3.3 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
Radiated emissions (9 kHz–30 MHz)	4.28 dB
Radiated emissions (30 MHz-1 GHz)	4.80 dB
Radiated emissions (1 GHz-18 GHz)	4.88 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

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

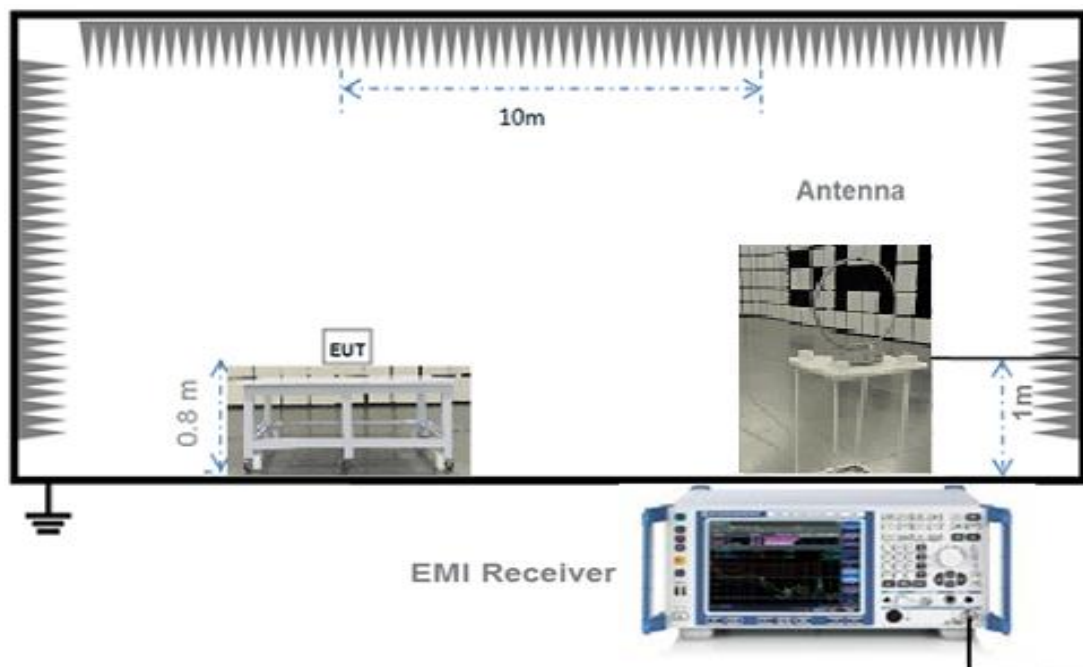
Relative Humidity	30% to 60%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+22°C to +25°C
	LT (Low Temperature)	\
	HT (High Temperature)	\
Working Voltage of the EUT	NV (Normal Voltage)	\
	LV (Low Voltage)	\
	HV (High Voltage)	\

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2021.10.10	2022.10.09
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2021.09.13	2022.09.12
EMI Receiver	KEYSIGHT	N9038A	MY55330120	2021.10.20	2022.10.19
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2021.06.04	2022.06.03
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2021.06.01	2022.05.31
Power Splitter	KMW	DCPD-LDC	1305003215	--	--
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	--	--
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2021.04.16	2024.04.15
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2021.08.20	2024.08.19
Temperature Chamber	AHK	SP20	1412	2021.11.30	2022.11.29
Anechoic Chamber	EMC TECHNOLOGY LTD	21.1m*11.6 m*7.35m	N/A	2021.08.15	2024.08.14
Anechoic Chamber	CHANGNING	9m*6m*6m	N/A	2020.03.16	2023.03.15
Shielded Enclosure	YiHeng Electronic Co., Ltd	3.5m*3.1m*2.8m	N/A	2022.02.19	2025.02.18

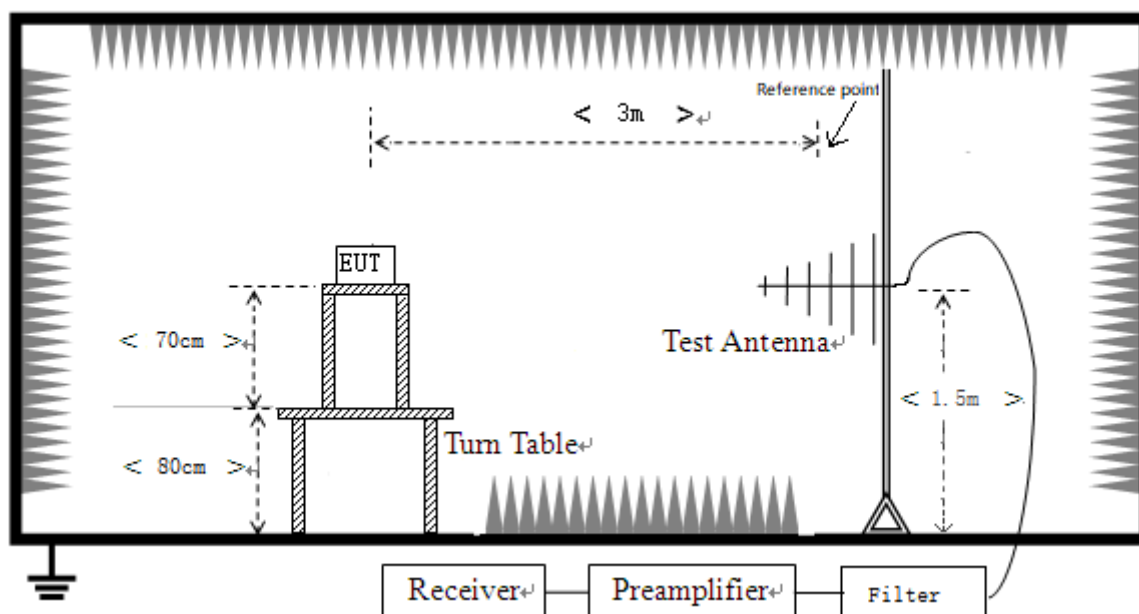
4.3 Description of Test Setup

4.3.2 For Radiated Test (Below 30 MHz)



(Diagram 1)

4.3.3 For Radiated Test (30 MHz-1 GHz)



(Diagram 2)

4.4 Receiver categorization

Technologies	Receiver spurious emission	Adjacent channel selectivity	Blocking or desensitization
tagging systems	yes	no (note 2)	no (note 1)
systems in the 27 MHz range	yes	yes	yes
all others	yes	no (note 2)	yes

NOTE 1: Blocking or desensitization not needed because of the physical co-location of RX to TX in tagging systems where the RX and TX operate simultaneously. The TX signal is used for the RX baseband mixing. The TX signal at the RX input is about 90 dB above the receiver sensitivity or tagging signal level the receiver (see ETSI TR 103 059 [i.9], figure 8). Furthermore given the very short communication ranges for most applications (e.g. NFC, RFID), a given interference blocking signal will have to be about 90 dB higher as the transmitter signal at the transceiver antenna, which is unlikely to happen.

NOTE 2: This requirement can only be required where a frequency plan with standard channel spacing is consistently used, for example in the 27 MHz band.

4.5 Product classes

Product Class	Description of transmitter	Antenna to be tested	Frequency range	Loop antenna area	Length of antenna (= maximum dimension of the antenna)	Customization of antenna design allowed	Transmitter carrier output limits	Spurious emissions limits
1	Inductive loop coil transmitter	Integral antenna (antenna type 1) or dedicated antenna supplied with the equipment (antenna type 2); (see note 1)	9 kHz to 30 MHz	< 30 m ²	< $\lambda/4$ (75 metres/f where f is in MHz) or < 30 m, whichever is shorter	No	H-field at 10 m (see clause 4.3.4.3)	H-field at 10 m (see clauses 4.3.8.3 and 4.3.9.3)
2	Inductive loop coil transmitter	Two representative antennas supplied with the equipment (see note 2)	9 kHz to 30 MHz	< 30 m ² (see note 3)	< $\lambda/4$ (75 metres/f where f is in MHz) or < 30 m, whichever is shorter	Yes (see note 3)	H-field at 10 m (see clause 4.3.4.3)	H-field at 10 m (see clauses 4.3.8.3 and 4.3.9.3)
3	Customized, large size loop antennas only	Test without an antenna by using an artificial antenna	9 kHz to 135 kHz	> 30 m ²	n.a.	Yes	Current in artificial antenna (see note 4 and clauses 4.3.4.3 and 4.3.6.3)	Current in artificial antenna (see note 4 and clauses 4.3.7.3 and 4.3.19.3)
4	E-field transmitter	Each type of antenna to be used	9 kHz to 30 MHz	n.a.	n.a.	n.a.	H-field at 10 m (see clause 4.3.6.3)	H-field at 10 m (see clauses 4.3.8.3 and 4.3.9.3)

NOTE 1: Where a manufacturer provides a range of standard antennas, the equipment will be tested as Product Class 1 equipment, with the antenna(s) attached.

The measurements shall be repeated for each antenna.

NOTE 2: The two antennas shall meet the manufacturer's design rules published in the equipment manual and shall have maximum and minimum loop areas respectively. Both antennas shall have the maximum magnetic dipole moment as declared by the manufacturer.

NOTE 3: Customization is only allowed according to the manufacturer's antenna design rules published in the equipment manual.

NOTE 4: ON-site measurements may be required.

4.6 Measuring receiver

Frequency	Detector type	Measurement receiver bandwidth	Spectrum analyzer bandwidth
9 kHz ≤ f < 150 kHz	Quasi Peak	200 Hz	300 Hz
150 kHz ≤ f < 30 MHz	Quasi Peak	9 kHz	10 kHz
30 MHz ≤ f < 1 GHz	Quasi Peak	120 kHz	100 kHz
NOTE: For the measurement of the ranges 6,765 MHz ≤ f ≤ 6,795 MHz and 11,810 MHz ≤ f ≤ 15,310 MHz, the measurement bandwidth has to be 200 Hz respectively 300 Hz.			

4.7 Short Range Devices within the 9 kHz to 30 MHz permitted frequency bands

	Frequency Bands/frequencies	Applications
Transmit and Receive	9 kHz to 90 kHz	Inductive devices, Generic use
Transmit and Receive	90 kHz to 119 kHz	Inductive devices, Generic use
Transmit and Receive	119 kHz to 140 kHz	Inductive devices, Generic use
Transmit and Receive	140 kHz to 148,5 kHz	Inductive devices, Generic use
Transmit and Receive	148,5 kHz to 5 MHz	Inductive devices, Generic use
Transmit and Receive	400 kHz to 600 kHz	RFID only
Transmit and Receive	5 MHz to 30 MHz	Inductive devices, Generic use
Transmit and Receive	3 155 kHz to 3 400 kHz	Inductive devices, Generic use
Transmit and Receive	984 kHz to 7 484 kHz (Note 3, Centre frequency is 4 234 kHz)	Inductive devices, Railway applications
Transmit and Receive	4 516 kHz	Inductive devices, Railway applications
Transmit and Receive	6 765 kHz to 6 795 kHz	Inductive devices, Generic use
Transmit and Receive	7 400 kHz to 8 800 kHz	Inductive devices, Generic use
Transmit and Receive	10 200 kHz to 11,000 MHz	Inductive devices, Generic use
Transmit and Receive	11,810 MHz to 15,310 MHz (Centre frequency is 13,56 MHz)	RFID only
Transmit and Receive	12,5 MHz to 20 MHz	Inductive devices, Wireless healthcare
Transmit and Receive	13,553 MHz to 13,567 MHz	Inductive devices, Generic use
Transmit and Receive	26,957 MHz to 27,283 MHz	Inductive devices, Generic use
Transmit and Receive	27,090 MHz to 27,100 MHz	Inductive devices, Railway applications
NOTE 1: In addition, it should be noted that other frequency bands may be available in a country within the frequency range 9 kHz to 30 MHz.		
NOTE 2: On non-harmonised parameters, national administrations may impose certain conditions such as the type of modulation, frequency, channel/frequency separations, maximum transmitter radiated power, duty cycle, and the inclusion of an automatic transmitter shut-off facility, as a condition for the issue of an Individual Rights for use of spectrum or General Authorization, or as a condition for use under "licence exemption" as it is in most cases for Short Range Devices.		
NOTE 3: Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.		

5. Test Type and Test Results

5.1. Transmitter Parameters

5.1.1. Permitted range of operating frequencies

5.1.1.1. Limit

The permitted range of operating frequency for intentional emissions shall be from 9 kHz to 30 MHz.

5.1.1.2. Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.1.3. Test Procedure

The permitted range of operating frequencies is the frequency range over which the equipment is authorized to operate.

If more than one modulation scheme can be generated by the EUT, then for each modulation scheme and one typical set of modulation parameters the maximum and minimum frequencies shall be measured and recorded separately.

5.1.1.4. Test Result

Please refer to ANNEX A.1.

5.1.2. Operating frequency ranges

5.1.2.1. Limit

The operating frequency ranges for intentional emissions shall be entirely within the frequency bands in table in section 4.7.

5.1.2.2. Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.2.3. Test Procedure

The operating frequency range (OFR) is the frequency range over which the EUT is transmitting. The operating frequency range of the EUT is determined by the lowest (fL) and highest frequency (fH) as occupied by the power envelope. With the centre frequency of the OFR as: $f_C = (f_H + f_L)/2$. An EUT could have more than one operating frequency range.

5.1.2.4. Test Result

Please refer to ANNEX A.2.

5.1.3. Modulation bandwidth

5.1.3.1. Limit

The modulation bandwidth shall be within the assigned frequency band or $\pm 7.5\%$ of the carrier frequency whichever is the smallest. For RFID and EAS Systems, the modulation bandwidth shall be within the transmitter emission boundary of figures I.1, I.2, I.3 and I.4. For further information, see CEPT/ERC/REC 70-03 [i.1] or ERC/ECC/CEPT Decisions as implemented through National Radio Interfaces (NRI) and additional NRI as relevant.

5.1.3.2. Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.3.3. Test Procedure

The transmitter shall be connected to an artificial antenna or if the transmitter has an integral antenna a test fixture shall be used. The RF output of the equipment shall be connected to a spectrum analyser via a $50\ \Omega$ variable attenuator.

The transmitter shall be operated at the nominal carrier power or field strength measured under normal test conditions.

The measurements shall be made during normal and extreme test conditions. During extreme test conditions, both extreme temperature and voltage apply simultaneously

5.1.3.4. Test Result

Please refer to ANNEX A.3.

5.1.4. Transmitter radiated H-field

5.1.4.1. Limit

The frequency ranges and limits shown in flow table.

H-field limits at 10 m

Frequency range (MHz)	H-field strength limit (H_f) dB μ A/m at 10 m or specified in mW e.r.p.
$0,009 \leq f < 0,090$	72 descending 3 dB/oct above 0,03 MHz or according to note 1 (see note 5)
$0,09 \leq f < 0,119$	42
$0,119 \leq f < 0,135$	66 descending 3 dB/oct above 0,119 MHz or according to note 1 (see notes 3 and 5)
$0,135 \leq f < 0,140$	42
$0,140 \leq f < 0,1485$	37,7
$0,1485 \leq f < 30$	-5 (see note 4)
$0,315 \leq f < 0,600$	-5
$3,155 \leq f < 3,400$	13,5
4,234	9 (see note 9)
4,516	7
$7,400 \leq f < 8,800$	9
$10,2 \leq f < 11,00$	9
$12,5 \leq f \leq 20$	-7
$6,765 \leq f \leq 6,795$	42 (see notes 3 and 7)
$26,957 \leq f \leq 27,283$	42 (see note 3)
$13,410 \leq f \leq 13,553, 13,567 \leq f \leq 13,710$	9 (see note 6)
$13,110 \leq f \leq 13,410, 13,710 \leq f \leq 14,010$	-3,5 (see note 6)
$12,660 \leq f \leq 13,110, 14,010 \leq f \leq 14,460$	-10 (see note 6)
$11,810 \leq f \leq 12,660, 14,460 \leq f \leq 15,310$	-16 (see note 6)
$13,460 \leq f \leq 13,553, 13,567 \leq f \leq 13,660$	27 (see note 6)
$13,360 \leq f \leq 13,460, 13,660 \leq f \leq 13,760$	Linear transition from 27 to -3,5 (see note 6)
$13,110 \leq f \leq 13,360, 13,760 \leq f \leq 14,010$	-3,5 (see note 6)
$12,660 \leq f \leq 13,110, 14,010 \leq f \leq 14,460$	-5 (see note 6)
$13,553 \leq f \leq 13,567$	42 (see note 3) or 60 (see notes 2 and 3)
27,095	42

26,995, 27,045, 27,095, 27,145, 27,195 (see note 8)	100 mW
NOTE 1: For the frequency ranges 9 kHz to 135 kHz, the following additional restrictions apply to limits above 42 dBμA/m: - for loop coil antennas with an area $\geq 0,16 \text{ m}^2$ this table and table B.1 with the antenna limitations apply; - for loop coil antennas with an area between $0,05 \text{ m}^2$ and $0,16 \text{ m}^2$ table B.1 applies with a correction factor. The limit is: table value + $10 \times \log(\text{area}/0,16 \text{ m}^2)$; - for loop coil antennas with an area $< 0,05 \text{ m}^2$ the limit is 10 dB below table B.1. NOTE 2: For RFID (incl. NFC) and EAS applications only. NOTE 3: Spectrum mask limit, see annex I. NOTE 4: For further information see annex G. NOTE 5: Limit is 42 dBμA/m for the following spot frequencies: 60 kHz $\pm$ 250 Hz, 66,6 kHz $\pm$ 750 Hz, 75 kHz $\pm$ 250 Hz, 77,5 kHz $\pm$ 250 Hz, and 129,1 kHz $\pm$ 500 Hz. NOTE 6: Only in conjunction with spectrum mask, see annex I. NOTE 7: The frequency range 6,765 MHz - 6,795 MHz is not a harmonised ISM frequency band according article 5.138 of the ITU Radio Regulations [i.13]. NOTE 8: Center frequencies for channelized systems by using ≤ 10 kHz bandwidth. NOTE 9: The limit is valid in the range 984 kHz - 7 484 kHz for Transmitting only on receipt of a Balise/Eurobalise tele-powering signal from a train.	

5.1.4.2. Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.4.3. Test Procedure

The conformance tests for Transmitter radiated H-field shall be as defined in clause 6.2.4 of the present document. Conformance shall be established under test conditions to be declared by the manufacturer according to clause 4.1. The interpretation of the results for the measurements uncertainty shall be as given in clause 5.13.

5.1.4.4. Test Result

Please refer to ANNEX A.4.

5.1.5. Transmitter radiated spurious domain emission limits < 30 MHz

5.1.5.1. Limit

Limits for transmitters spurious emissions in the range from 9 kHz to 30 MHz

Limits for measurements at 10 m distance:

State	Frequency $9\text{ KHz} \leq f < 10\text{MHz}$	Frequency $10\text{ MHz} \leq f < 30\text{MHz}$
Transmit	27 dB μ A/m at 9 kHz descending 3 dB/oct	-3.5 dB μ A/m
Standby	5.5 dB μ A/m at 9 kHz descending 3 dB/oct	-25 dB μ A/m

5.1.5.2. Test Setup

The section 4.3.2 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.5.3. Test Procedure

The conformance tests for transmitter radiated spurious domain emission limits < 30 MHz shall be as defined in clause 6.2.8 of the present document. Conformance shall be established under test conditions to be declared by the manufacturer according to clause 4.1. The interpretation of the results for the measurements uncertainty shall be as given in clause 5.13.

5.1.5.4. Test Result

Please refer to ANNEX A.5.

5.1.6. Transmitter radiated spurious domain emission limits > 30 MHz

5.1.6.1. Limit

Limits for transmitters spurious emissions in the range from 30 MHz to 1000 MHz

The power of any radiated emission shall not exceed the values as below.

State	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequency between 30 MHz to 1000 MHz
Operating	4 nW e.r.p	250 nW e.r.p
Standby	2 nW e.r.p	2 nW e.r.p

Note 1: The test limit has been transformed to the limit at 3m.

5.1.6.2. Test Setup

The section 4.3.2 (Diagram 2) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.6.3. Test Procedure

The conformance tests for transmitter radiated spurious domain emission limits > 30 MHz shall be as defined in clause 6.2.9 of the present document. Conformance shall be established under test conditions to be declared by the manufacturer according to clause 4.1. The interpretation of the results for the measurements uncertainty shall be as given in clause 5.13.

5.1.6.4. Test Result

Please refer to ANNEX A.6.

5.2. Receiver Parameters

5.2.1. Receiver Spurious Emissions

5.2.1.1. Limit

5.2.1.2. Limits for transmitters spurious emissions in the range from 9 kHz to 30 MHz

Limits for measurements at 10 m distance:

Frequency $9\text{ KHz} \leq f < 10\text{MHz}$	Frequency $10\text{ MHz} \leq f < 30\text{MHz}$
5.5dB μ A/m at 9kHz descending 3 dB/oct	-25 dB μ A/m

5.2.1.3. Limits for transmitters spurious emissions in the range from 30 MHz to 1000 MHz

The measured values shall not exceed 2 nW e.r.p.

5.2.1.4. Test Setup

See 4.3.1 and 4.3.2 (Diagram 1 and 2) for test setup description for the radiated test. The photo of test setup please refer to ANNEX B.

5.2.1.5. Test Procedure

The measurements of the radiated spurious emissions were made on an anechoic chamber. The spurious emissions produced by the equipment were measured at the distance of 3m. The spurious emissions are measured with a shielded loop antenna connected to a measurement receiver.

5.2.1.6. Test Result

Please refer to ANNEX A.7.

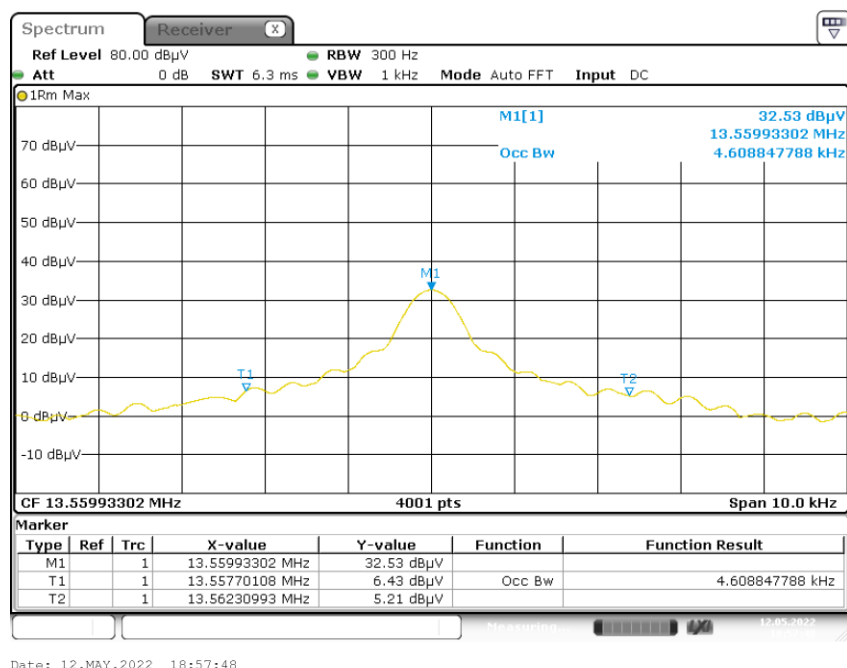
ANNEX A TEST RESULT

A.1 Permitted range of operating frequencies

Test Data

Test Method	Modulation	Test Conditions		operating frequencies (kHz)	limit
☒ Radiated ☐ Conducted	☒ ON ☐ OFF	NT	NV	13559.9330	13553 kHz to 13567 kHz
Test Result				Pass	

Test Plot

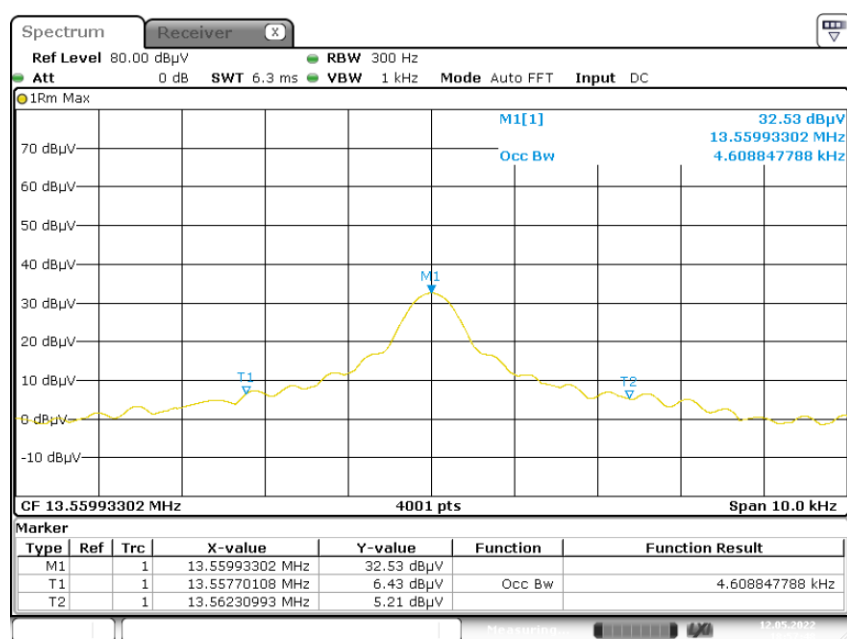


A.2 Operating frequency ranges

Test Data and Plot

Test Conditions		Frequency band			
		Measured (kHz)			Limit
		Low frequency	High frequency	F _c	
NT	NV	13557.70108	13562.30993	13560.00551	13553 kHz to 13567 kHz
Test Result		Pass			

Test Plot



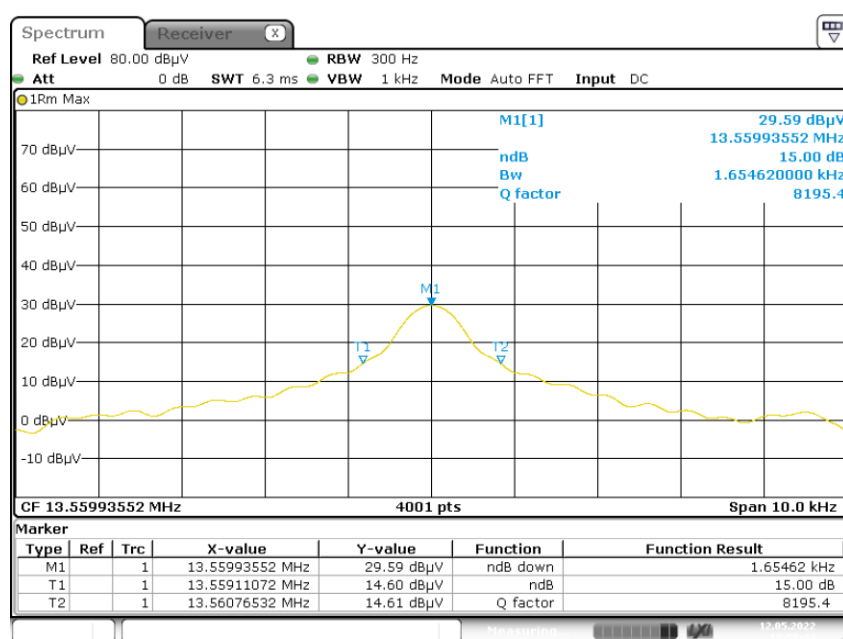
Date: 12.MAY.2022 18:57:48

A.3 Modulation bandwidth

Test Data

Test Conditions		Frequency band		
		Measured (kHz)		limit
		Low frequency	High frequency	
NT	NV	13559.11072	13560.76532	$\pm 7,5$ % of the carrier frequency
Test Result		Pass		

Test Plot



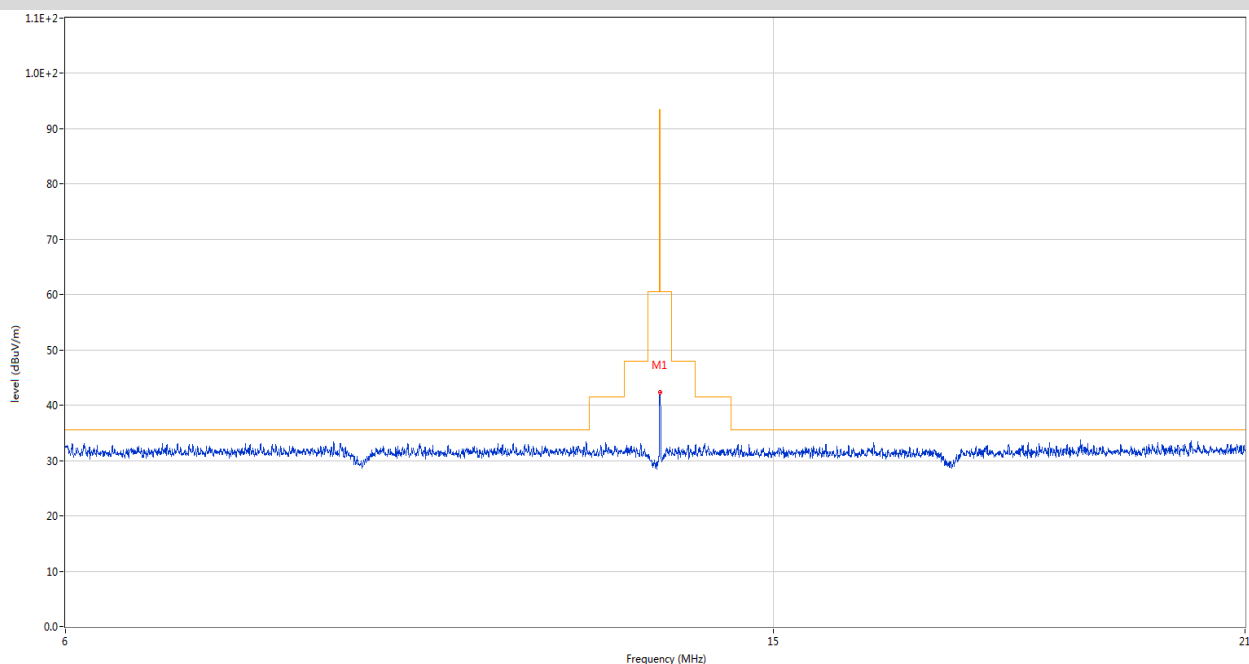
Date: 12.MAY.2022 10:58:34

A.4 Transmitter radiated H-field

Test Data and Plot

Field Strength of Fundamental Emissions Value						
Frequency (MHz)	Field Strength @10m (dBuV/m)	Field Strength @10m (dBuA/m)	Limit @10m (dBuA/m)	Margin @10m (dB)	Antenna	Verdict
13.560	42.37	-9.13	42	51.13	Vertical	Pass

OPERATING ANT-V



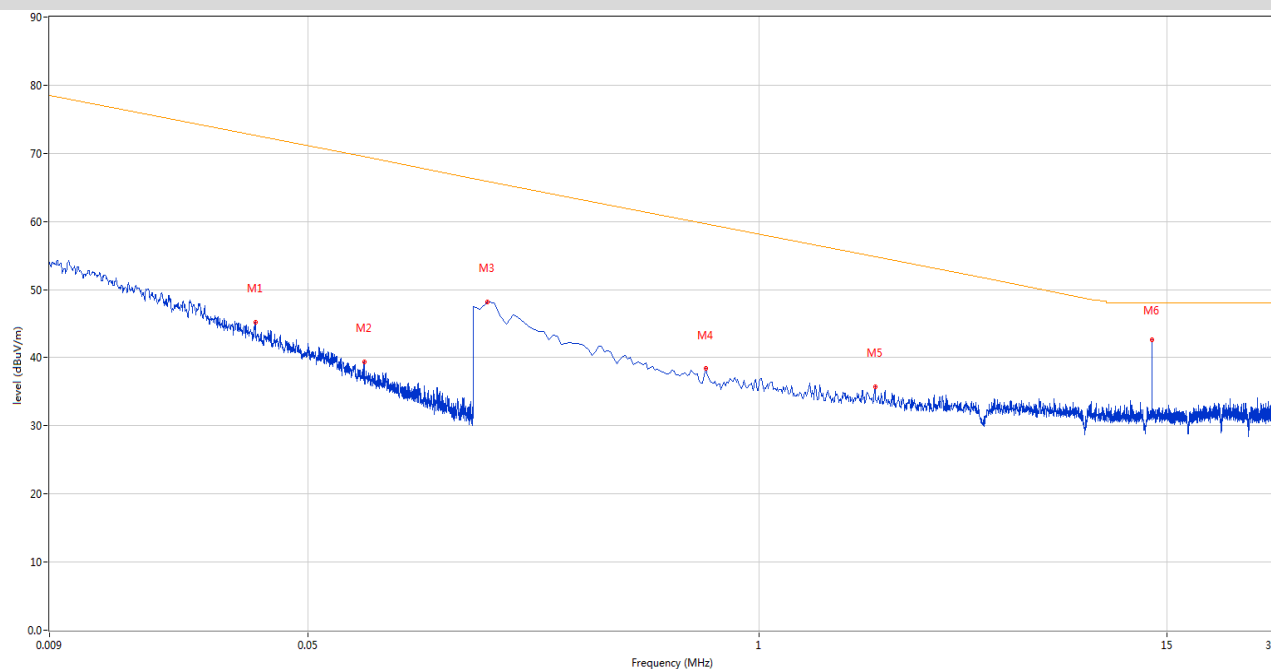
Note: For measuring equipment calibrated in dB μ V, the reading should be reduced by 51.5 dB to be converted to dB μ A/m.

A.5 Transmitter radiated spurious domain emission limits < 30 MHz

Note: This frequency which near 13.560 MHz with circle should be ignored because they are NFC carrier frequency.

Transmitters spurious emissions in the range from 9 kHz to 30 MHz

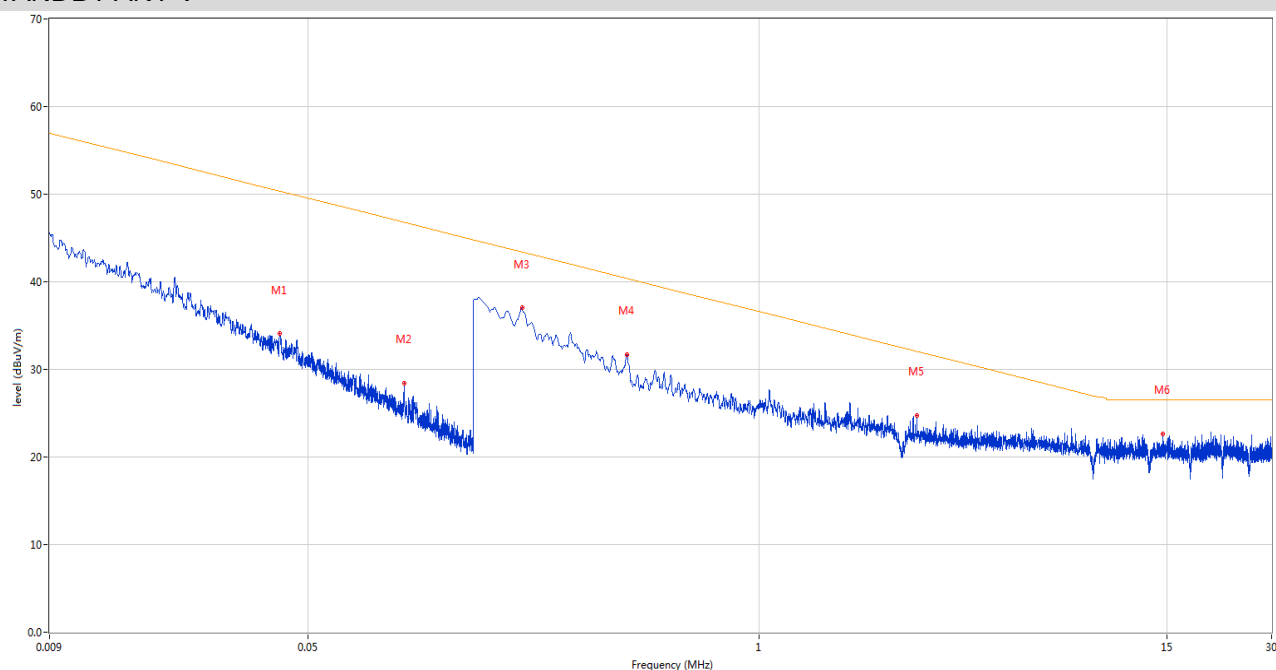
OPERATING ANT-V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.035	45.19	20.25	72.6	-27.41	Peak	0.00	100	Vertical	Pass
2	0.073	39.40	20.19	69.5	-30.10	Peak	335.00	100	Vertical	Pass
3	0.165	48.18	20.10	65.9	-17.72	Peak	0.00	100	Vertical	Pass
4	0.702	38.38	20.40	59.6	-21.22	Peak	237.00	100	Vertical	Pass
5	2.157	35.76	20.42	54.8	-19.04	Peak	228.00	100	Vertical	Pass
6	13.560	42.66	20.86	48.0	-5.34	Peak	228.00	100	Vertical	N/A

Note: For measuring equipment calibrated in dB μ V, the reading should be reduced by 51.5 dB to be converted to dB μ A/m.

STANDBY ANT-V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.042	34.09	10.65	50.4	-16.31	Peak	113.00	100	Vertical	Pass
2	0.095	28.43	10.47	46.8	-18.37	Peak	210.00	100	Vertical	Pass
3	0.207	37.03	10.26	43.4	-6.37	Peak	300.00	100	Vertical	Pass
4	0.416	31.69	10.14	40.4	-8.71	Peak	10.00	100	Vertical	Pass
5	2.851	24.68	9.96	32.1	-7.42	Peak	167.00	100	Vertical	Pass
6	14.550	22.61	10.18	26.5	-3.89	Peak	9.00	100	Vertical	Pass

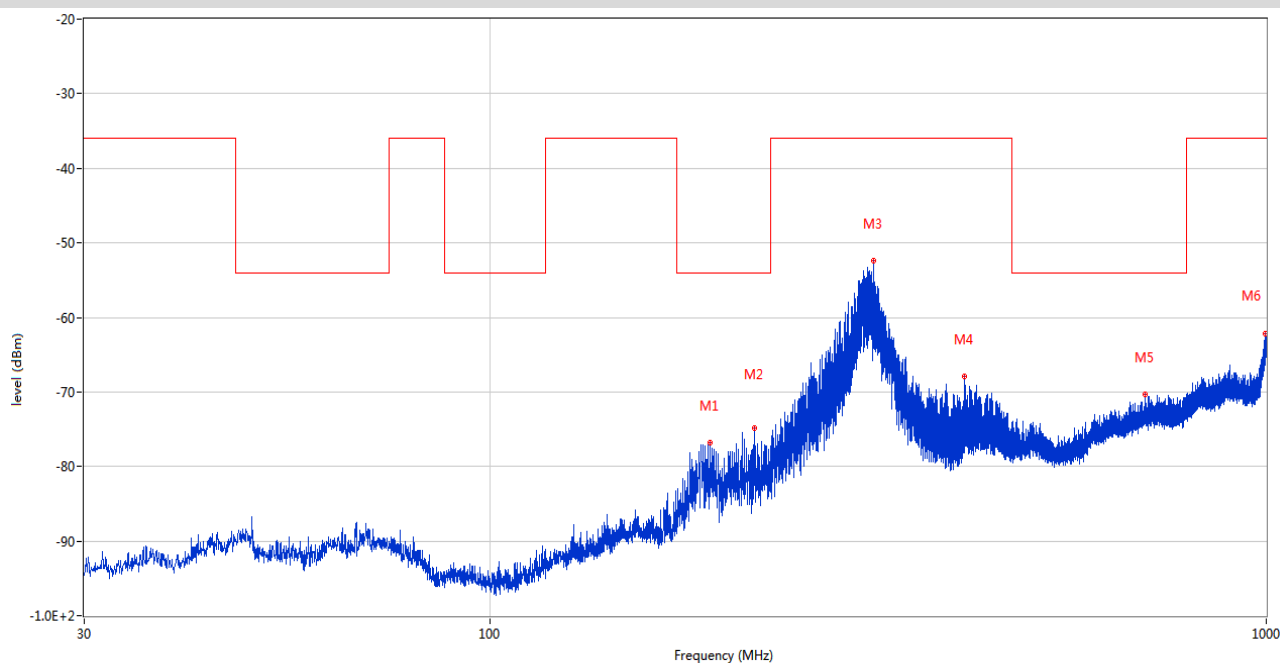
Note: For measuring equipment calibrated in dB μ V, the reading should be reduced by 51.5 dB to be converted to dB μ V/m.

A.6 Transmitter radiated spurious domain emission limits > 30 MHz

Transmitter spurious emissions in the range from 30 MHz to 1 GHz

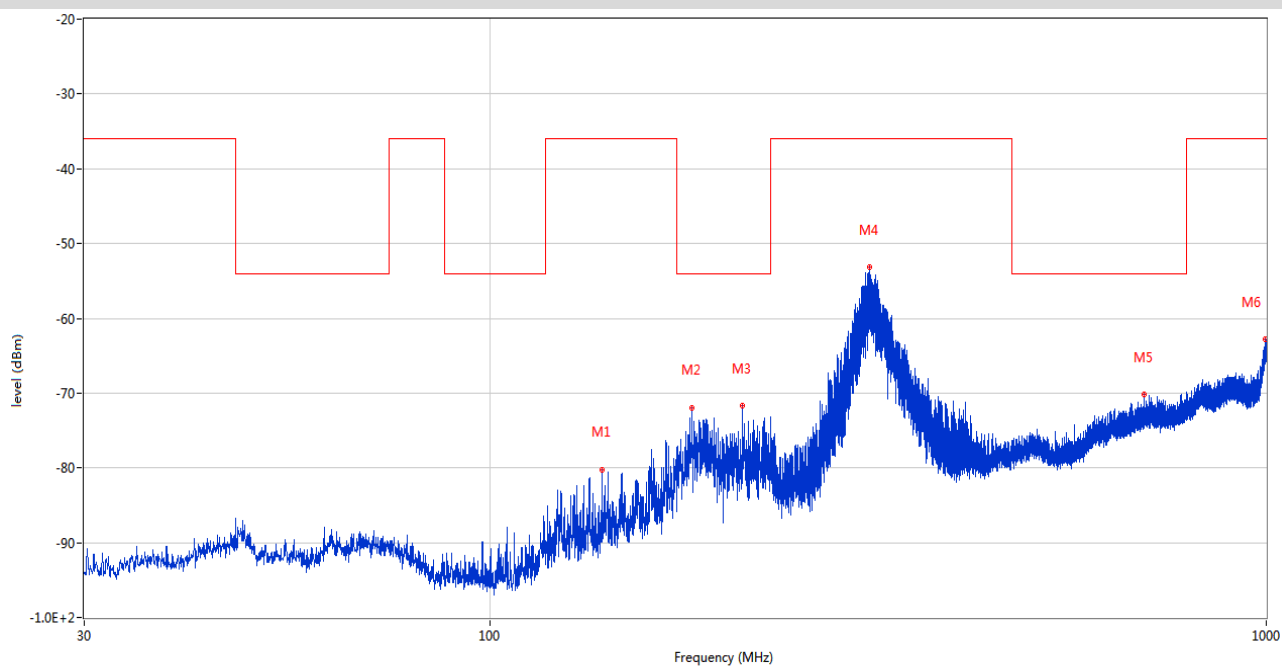
Test Data and Plot

OPERATING ANT-V



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
191.990	-76.85	-15.70	-54.0	-22.85	273.00	Vertical	Horizontal	Pass
218.908	-74.83	-15.55	-54.0	-20.83	266.00	Vertical	Horizontal	Pass
311.639	-52.38	-12.45	-36.0	-16.38	296.00	Vertical	Horizontal	Pass
408.300	-67.87	-8.91	-36.0	-31.87	324.00	Vertical	Horizontal	Pass
698.912	-70.32	-2.89	-54.0	-16.32	184.00	Vertical	Horizontal	Pass
998.206	-62.23	5.60	-36.0	-26.23	207.00	Vertical	Horizontal	Pass

OPERATING ANT-H



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
139.367	-80.28	-17.93	-36.0	-44.28	244.00	Horizontal	Horizontal	Pass
181.902	-71.90	-15.28	-54.0	-17.90	217.00	Horizontal	Horizontal	Pass
211.487	-71.73	-16.01	-54.0	-17.73	197.00	Horizontal	Horizontal	Pass
307.905	-53.10	-12.38	-36.0	-17.10	47.00	Horizontal	Horizontal	Pass
696.778	-70.16	-2.91	-54.0	-16.16	1.00	Horizontal	Horizontal	Pass
997.623	-62.85	5.40	-36.0	-26.85	237.00	Horizontal	Horizontal	Pass

STANDBY ANT-V



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
74.863	-90.19	-17.61	-57.0	-33.19	0.00	Vertical	Horizontal	Pass
181.805	-88.65	-15.30	-57.0	-31.65	263.00	Vertical	Horizontal	Pass
325.705	-83.27	-13.07	-57.0	-26.27	148.00	Vertical	Horizontal	Pass
500.547	-77.32	-6.58	-57.0	-20.32	55.00	Vertical	Horizontal	Pass
823.508	-71.31	-0.61	-57.0	-14.31	114.00	Vertical	Horizontal	Pass
999.806	-67.00	6.08	-57.0	-10.00	352.00	Vertical	Horizontal	Pass

STANDBY ANT-H



Frequency (MHz)	Result (dBm)	Factor (dB)	PK Limit (dBm)	Over Limit (dB)	Table (o)	ANT	EUT	Verdict
187.189	-87.37	-15.32	-57.0	-30.37	252.00	Horizontal	Horizontal	Pass
311.930	-82.46	-12.47	-57.0	-25.46	137.00	Horizontal	Horizontal	Pass
499.917	-78.20	-6.55	-57.0	-21.20	63.00	Horizontal	Horizontal	Pass
639.839	-75.14	-4.04	-57.0	-18.14	133.00	Horizontal	Horizontal	Pass
822.490	-70.23	-0.62	-57.0	-13.23	181.00	Horizontal	Horizontal	Pass
999.709	-66.93	6.06	-57.0	-9.93	329.00	Horizontal	Horizontal	Pass

A.7 Receiver spurious emissions

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2230879-AE-5.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2230879-AW-2.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2230879-AI-2.PDF”.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
3. For the report with CNAS mark or A2LA mark, the items marked with "☆" are not within the accredited scope.
4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the "inspection and testing dedicated stamp" or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--

TEST REPORT

Applicant: Woan Technology (Shenzhen) Co., Ltd.
Room 1101, Qiancheng Commercial Center, No. 5
Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

Address:

Equipment Type: SwitchBot Card

Model Name: W2500030 (refer section 2.4)

Brand Name: SwitchBot

Test Standard: EN 62479: 2010

Test Date: May 12, 2022 - May 13, 2022

Date of Issue: Jul. 12, 2022

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Xiong Chong**Checked by:** Liyao Zong**Approved by:** Wei Yanquan
(Chief Engineer)

Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Jul. 12, 2022</u>	<u>Initial Issue</u>

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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	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.2 Manufacturer Information

Manufacturer	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.3 Factory Information

Factory	Woan Technology (Shenzhen) Co., Ltd.
Address	Building A2, Zhengfeng Industrial Area, No.610 Fengtang Boulevard, Fuhai Sub-district, Bao'an District, Shenzhen

2.4 General Description for Equipment under Test (EUT)

EUT Name	SwitchBot Card
Model Name Under Test	W2500030
Series Model Name	W2500031, W2500032, W2500033, W2500034, W2500035
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name.
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

N/A.

2.6 Technical Information

Network and Wireless connectivity	NFC
-----------------------------------	-----

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	NFC
Frequency Range	13.56 MHz
Antenna Type	Coil Antenna
Exposure Category	General Population/Uncontrolled Exposure
EUT Stage	Portable Device

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	EN 62479:2010	Assesment of the compliance of low-power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)

4 DEVICE CATEGORY AND LEVELS LIMITS

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the following limits.

For frequency range 10 MHz to 10 GHz

The basic restriction at frequencies between 10 MHz and 100 GHz is on localized SAR in the head. Any device with output power below 20 mW cannot produce an exposure exceeding this restriction under the most pessimistic exposure conditions. The basic restriction is 2 W/kg so any unit which supplies less than 20 mW ($=2/100W$) from its antenna port, averaged over 6 minutes, will meet the basic restriction.

For frequency range 10 GHz to 300 GHz

The most conservative assumption is that all the transmitted power is absorbed within the specified area, therefore any device which supplies less than 20 mW will meet the basic restriction. The average time is equal to $68/f-1.05$ minutes (where f is in GHz) In the frequency range 10 GHz to 300 GHz, the basic restriction is $10 Wm^{-2}$ averaged over any $20 cm^2$ of exposed area with a spatial maximum of $200 Wm^{-2}$ averaged over $1 cm^2$

Criteria A: All electromagnetic fields

If the average power emitted by apparatus operating in the frequency range 10 MHz – 300GHz is less than or equal to 20 mW and the transmitting peak power is less than 20W then the apparatus is deemed to comply with the basic restrictions without testing. Averaging time is 6 minutes in the frequency range 10 MHz to 10 GHz. The average time is equal to $68/f-1.05$ minutes (where f is in GHz) in the frequency range 10 GHz to 300 GHz.

If the total supply power or the input power to the circuitry producing the greatest emissions in the device is less than or equal to 20 mW then it is assumed that the emitted power is less than 20 mW.

Criteria B: Pulse modulated electromagnetic fields with pulse duration less than 30 microseconds

For pulses of duration less than 30 microseconds at frequencies between 300 MHz and 10 GHz, there is also a basic restriction on Specific energy absorption (SA). This is $2mJ kg^{-1}$ in any 10g of tissue in the head. For most pulses, the SAR restriction will be more stringent, but for pulses with a repetition frequency of less than 100 Hz, the SA restriction will predominate. For devices producing pulses with repetition rates below 100 Hz, the average power should be less than $20 \times prf$ mW (pulse repetition frequency, prf in Hz).

5 ASSESSMENT RESULT

5.1 Output Power

Mode	Field Strength (dBuV/m)	E-Filed (V/m)	Limit of E-Filed (V/m)	Verdict
13.560 MHz	42.37	0.0001	28	Pass
Note 1: The Field Strength please refer to the Report No. BL-SZ2230879-405, which issued by Shenzhen BALUN Technology Co., Ltd. on Jul. 12, 2022, Section A.4 Transmitter radiated H-field. Note 2: The main frequency signal is lower than the base noise and not shown in this report. The max value of base noise is 42.37 dBuV/m.				

5.2 Conclusion

Note: The Field Strength at worst case is: 42.37 dBuV/m (0.0001 V/m) which is below the exempt condition 28 V/m. RF exposure assessment has been performed below to prove that this unit will not generate the harmful EM emission above the reference level as specified in EC Council Recommendation (1999/519/EC).

This EUT is deemed to comply with the reference level limits by Council Recommendation 1999/519/EC, therefore the basic restrictions are compliant with human exposure limits.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
3. For the report with CNAS mark or A2LA mark, the items marked with "☆" are not within the accredited scope.
4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the "inspection and testing dedicated stamp" or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--



Shenzhen BALUN Technology Co., Ltd.

Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055.

VERIFICATION OF CONFORMITY

Certificate No.: BL-SZ2230879D01

Applicant: Woan Technology (Shenzhen) Co., Ltd.
Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

Address:

Manufacture: Woan Technology (Shenzhen) Co., Ltd.
Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

Address:

Product: SwitchBot Card

Brand name: SwitchBot

Model name: W2500030, W2500031, W2500032, W2500033, W2500034, W2500035

The submitted sample of the above product has been tested according with following standards. Standard(s) used for showing compliance with the essential requirements in the **RED directive 2014/53/EU**:

Essential requirements	Standards:	Report No.:
EMC (Article 3.1 b)	ETSI EN 301 489-1 V2.2.3 (2019-11); Final draft ETSI EN 301 489-3 V2.2.0 (2021-11)	BL-SZ2230879-404
Radio (Article 3.2)	ETSI EN 300 330 V2.1.1 (2017-02);	BL-SZ2230879-405
Health (Article 3.1 a)	EN 62479: 2010	BL-SZ2230879-702



Date of Issue: July 12, 2022



Shenzhen BALUN Technology Co., Ltd.

Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055.

ATTESTATION OF CONFORMITY

Certificate No.: BL-SZ2230879D02

Applicant: Woan Technology (Shenzhen) Co., Ltd.
Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

Address:

Manufacture: Woan Technology (Shenzhen) Co., Ltd.
Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

Address:

Product: SwitchBot Card

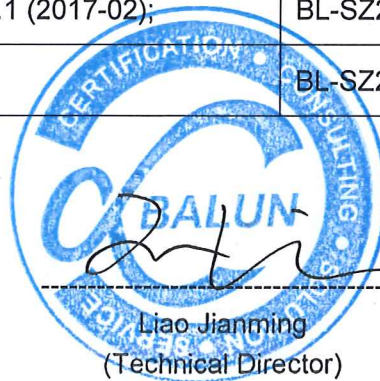
Brand name: SwitchBot

Model name: W2500030, W2500031, W2500032, W2500033, W2500034, W2500035

The submitted sample of the above product has been tested according with following standards. Standard(s) used for showing compliance with the **UK Radio Equipment Regulations (SI 2017/1206)**:

Regulation Section:	Test Standards:	Report No.:
6(1) - b) Electromagnetic Compatibility	ETSI EN 301 489-1 V2.2.3 (2019-11); Final draft ETSI EN 301 489-3 V2.2.0 (2021-11)	BL-SZ2230879-404
6(2) - Radio spectrum	ETSI EN 300 330 V2.1.1 (2017-02);	BL-SZ2230879-405
6(1) - a) Health	EN 62479: 2010	BL-SZ2230879-702

**UK
CA**



Jul. 12, 2022

Date of Issue: July 12, 2022

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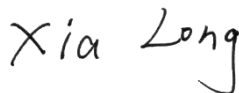
web: www.baluntek.com

TEST REPORT

Applicant: Woan Technology (Shenzhen) Co., Ltd.
Address: Room 1101, Qiancheng Commercial Center, No. 5
Haicheng Road, Mabu Community, Xixiang
Sub-district, Bao'an District, Shenzhen, Guangdong,
P.R.China, 518100
Equipment Type: SwitchBot Card
Model Name: W2500030 (refer section 2.4)
Brand Name: SwitchBot
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: May 12, 2022 - May 26, 2022
Date of Issue: Jul 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
<u>Rev. 01</u>	<u>Jul. 12, 2022</u>	<u>Initial Issue</u>

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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 & 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 & 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 & Technology Park, Shahe West Road, Nanshan District, Shenzhen, Guangdong Province, China.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.2 Manufacturer Information

Manufacturer	Woan Technology (Shenzhen) Co., Ltd.
Address	Room 1101, Qiancheng Commercial Center, No. 5 Haicheng Road, Mabu Community, Xixiang Sub-district, Bao'an District, Shenzhen, Guangdong, P.R.China, 518100

2.3 Factory Information

Factory	Woan Technology (Shenzhen) Co., Ltd.
Address	Building A2, Zhengfeng Industrial Area, No.610 Fengtang Boulevard, Fuhai Sub-district, Bao'an District, Shenzhen

2.4 General Description for Equipment under Test (EUT)

EUT Name	SwitchBot Card
Model Name Under Test	W2500030
Series Model Name	W2500031, W2500032, W2500033, W2500034, W2500035
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name.
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	No DC Ports.
	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	N/A		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	N/A	23.5℃	54%	101kPa	May 26, 2022	Huang Zehuai
Electrostatic Discharge Immunity	N/A	24.6℃	42%		May 23, 2022	Liu Chenfang
Radiated RF Electromagnetic Field Immunity	N/A	24.0℃	55%		May 24, 2022	Chen Jiali

4.2 Test Equipment

Radiated Emission Test For Frequency Below 1 GHz (10 m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2021.10.10	2022.10.09	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2018054558	2021.10.10	2022.10.09	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-01162	2020.08.12	2023.08.11	☒
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	N/A	2021.08.15	2024.08.14	☒
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	AMETEK CTS	DITO	P18332 22423	2021.06.04	2022.06.03	☒

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	☒
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	☒

Radiated RF Electromagnetic Field Immunity Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
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

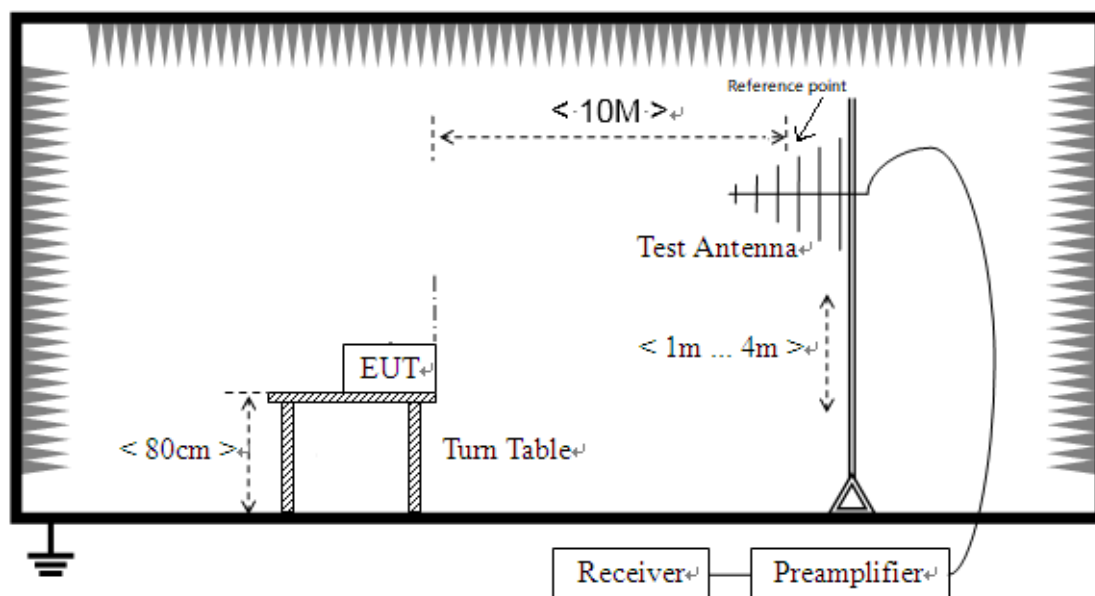
Description	Manufacturer	Model	Serial No.	Length	Description	Use
SwitchBot Keypad	SwitchBot	W2500020	N/A	N/A	N/A	☒

4.4 Test Configurations

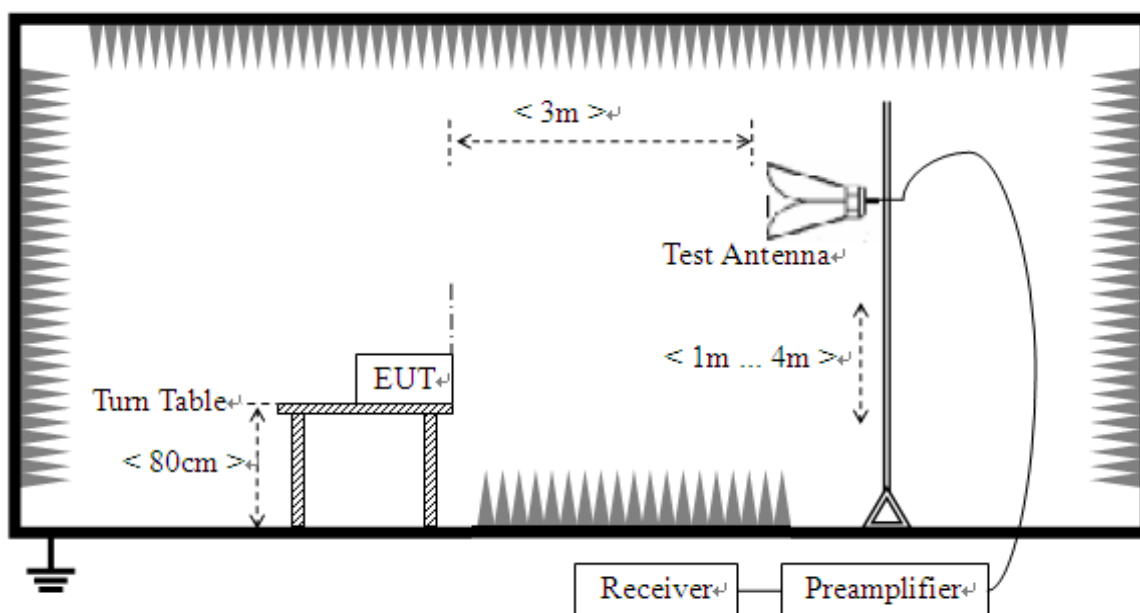
Test Configurations (TC) No.	Description
TC01	<u>The NFC Induction Test Mode</u> EUT + SwitchBot Keypad + NFC Induction

4.5 Test Setups

Test Setup 1

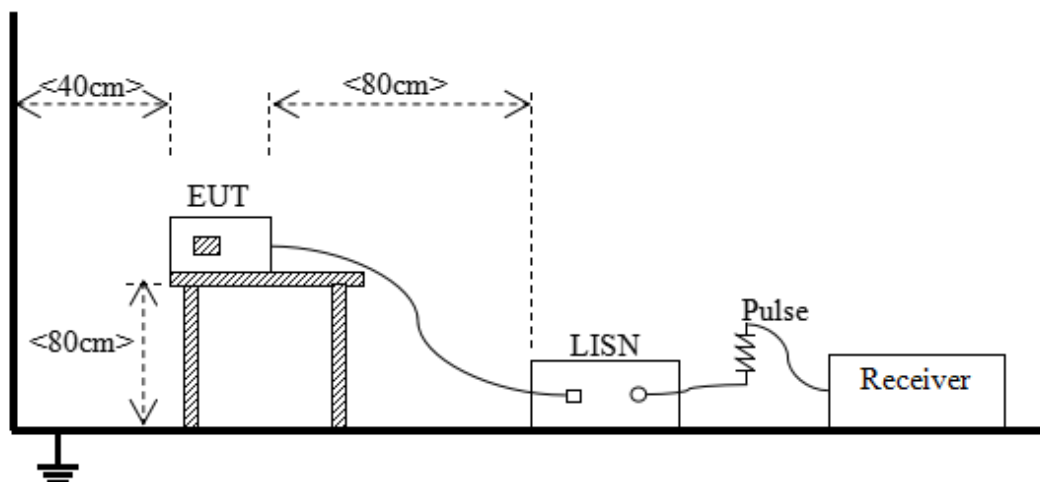


(For Radiated Emission Test (30 MHz-1 GHz))



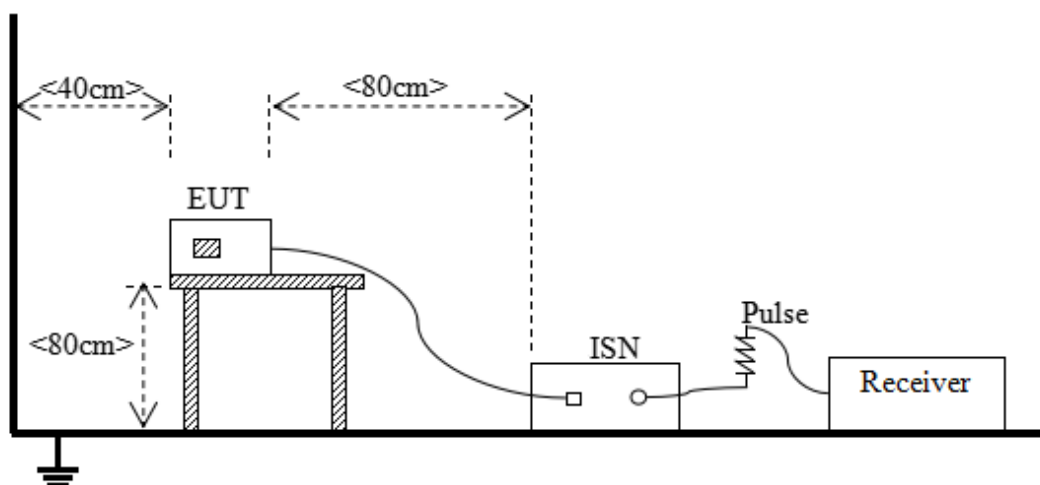
(For Radiated Emission Test (above 1 GHz))

Test Setup 2

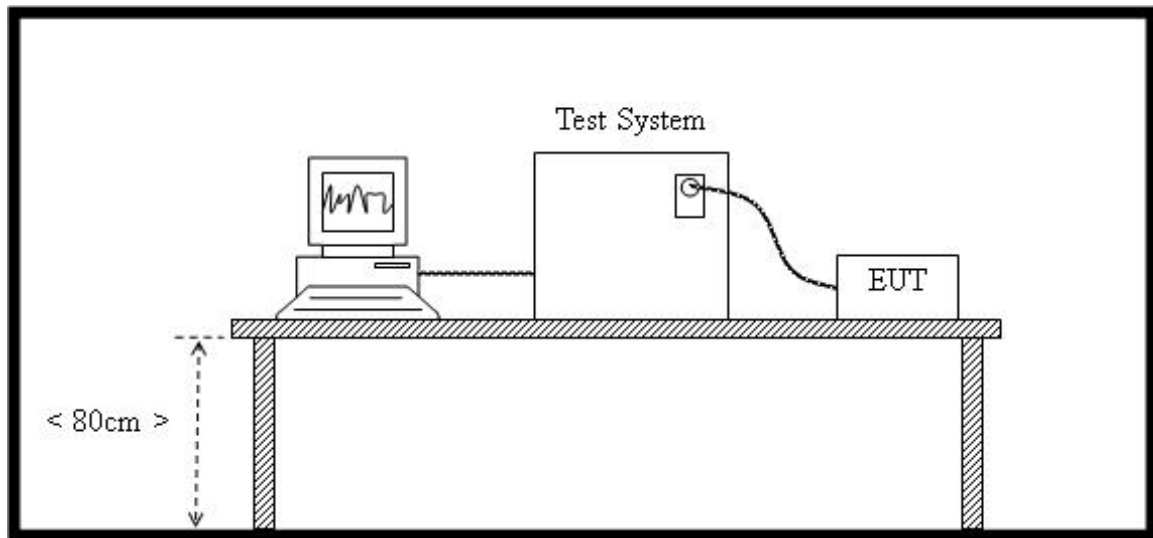


(For Conducted Emission at AC/DC Ports Test)

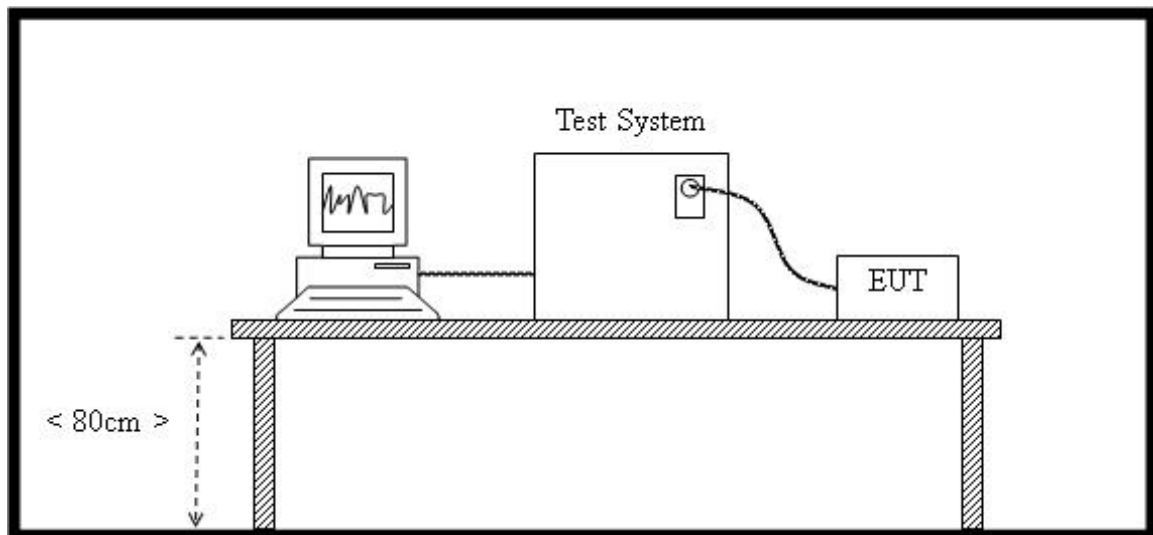
Test Setup 3



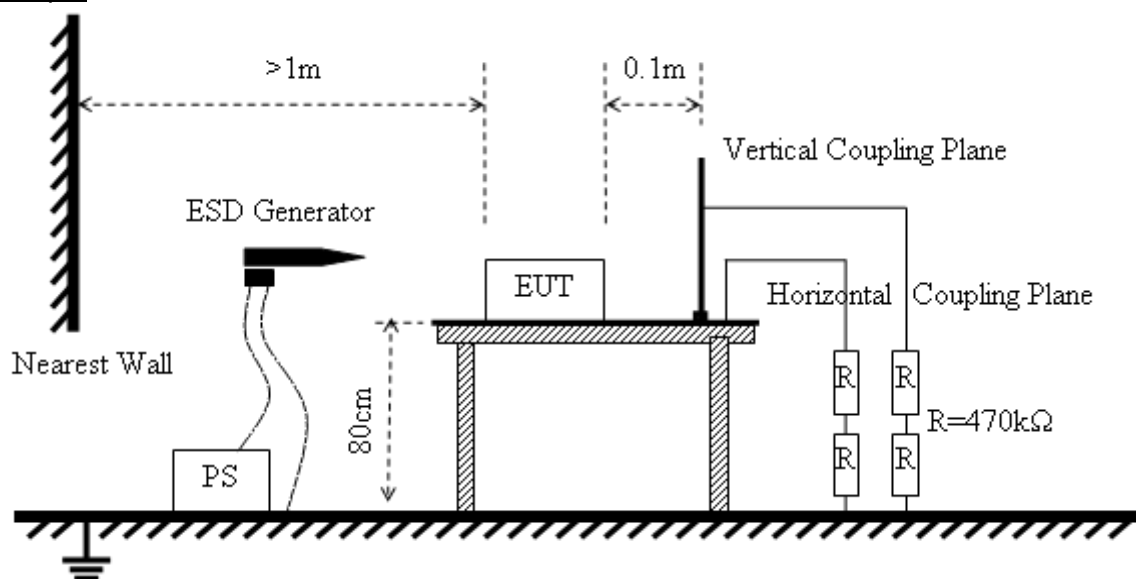
(For Conducted Emission for Wired Network Ports Test)

Test Setup 4

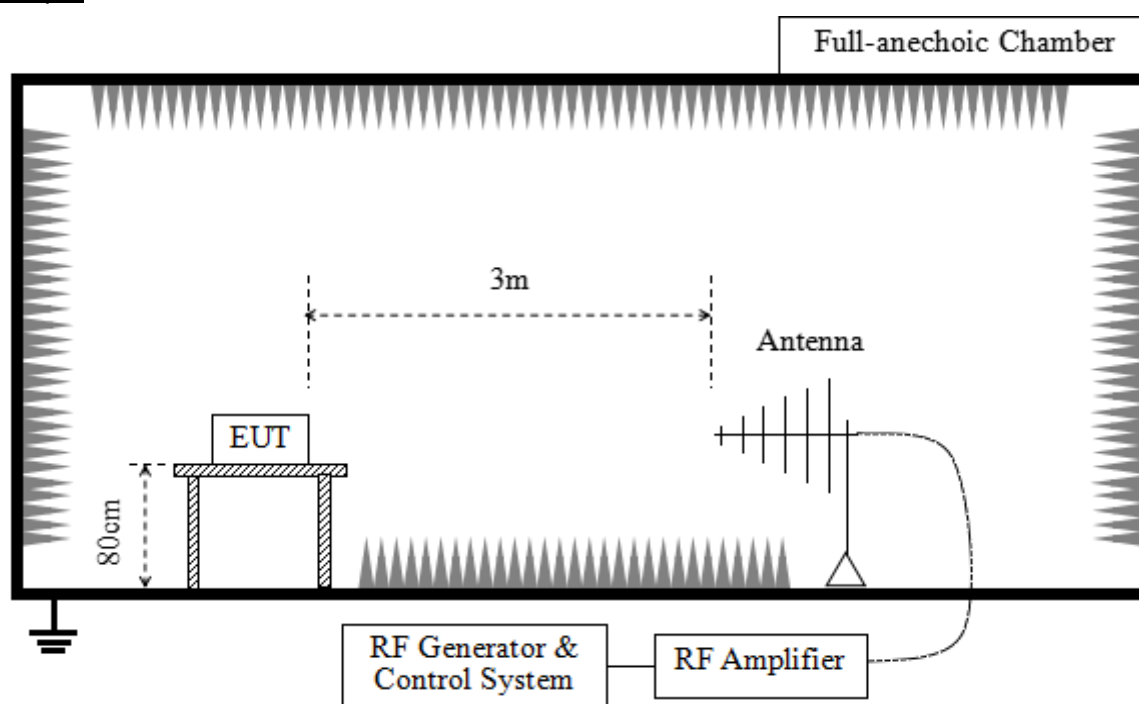
(For Harmonic Current Emissions Measurement Test)

Test Setup 5

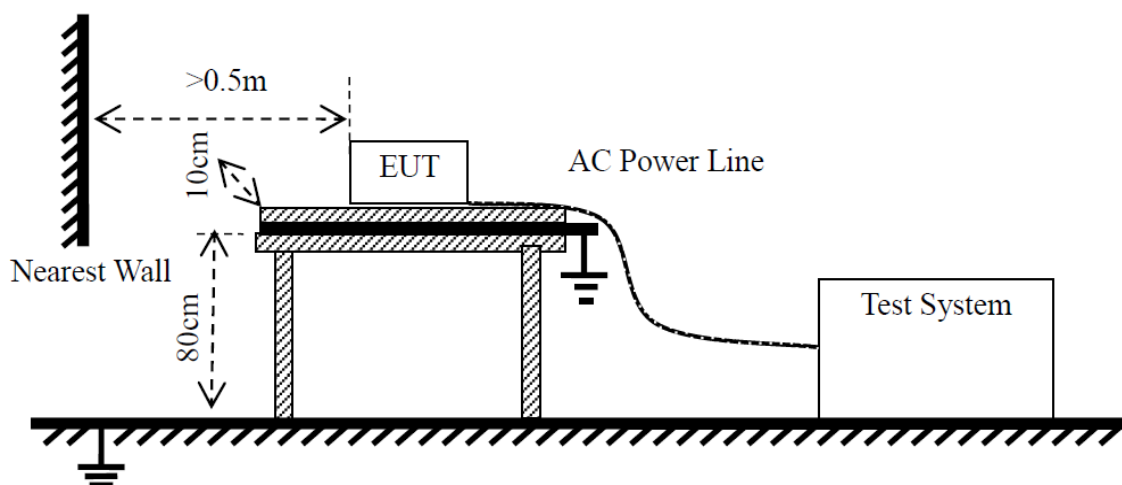
(For Voltage Fluctuations and Flicker Measurement Test)

Test Setup 6

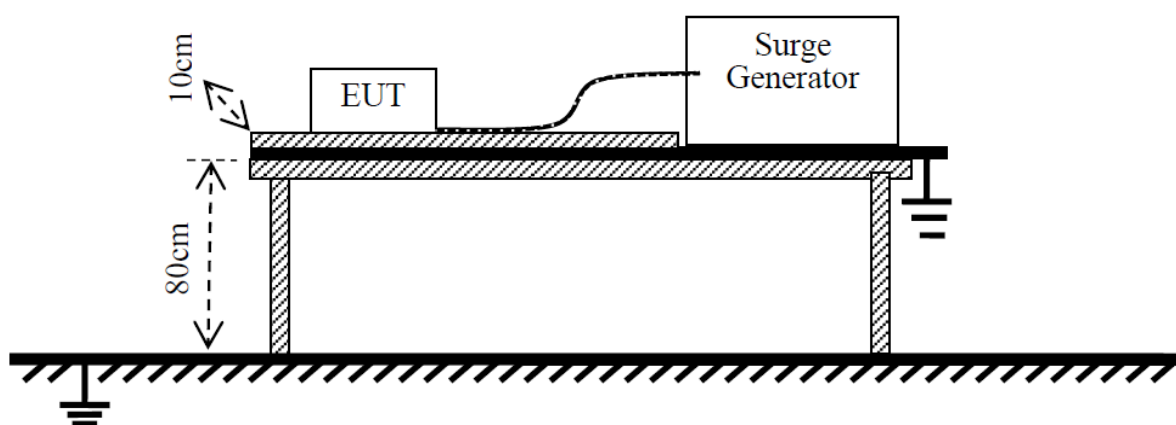
(For Electrostatic Discharge Immunity Test)

Test Setup 7

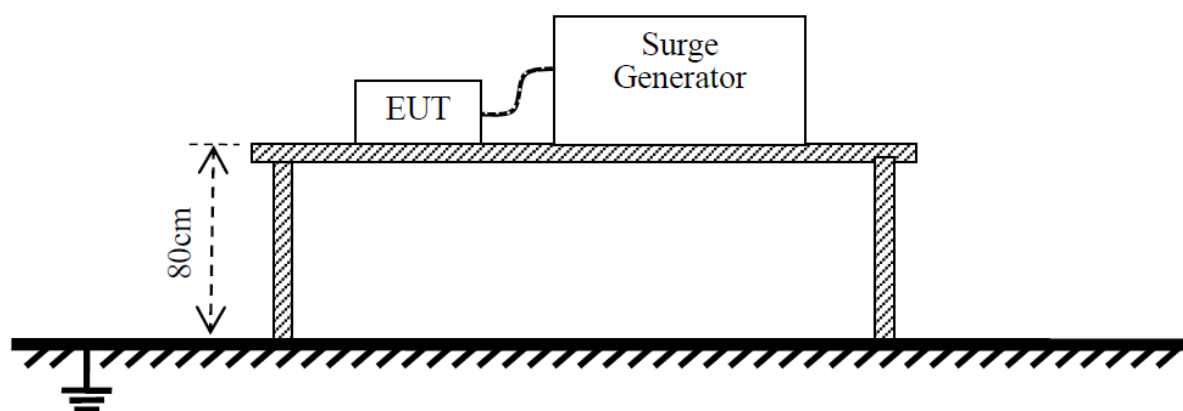
(For Radiated Immunity Test)

Test Setup 8

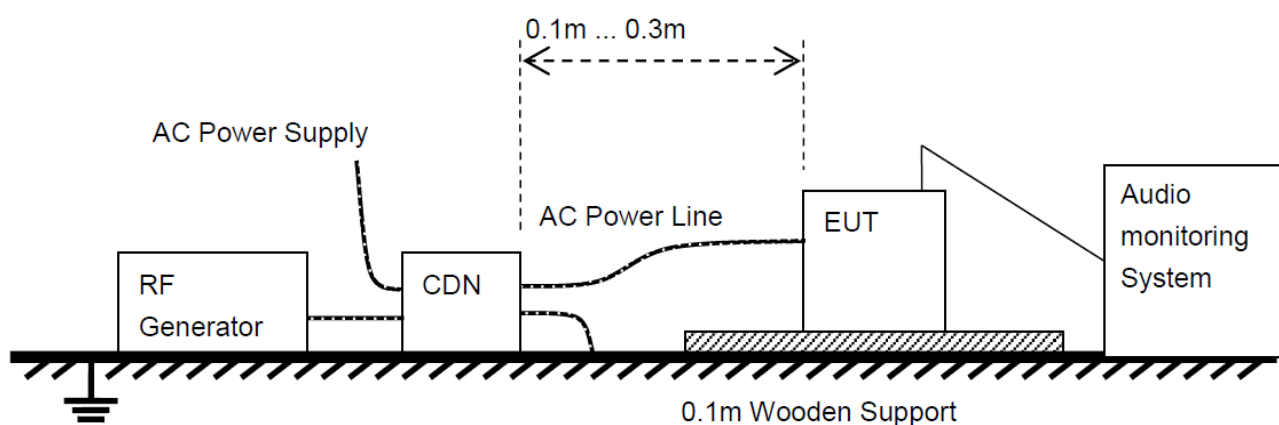
(For Electrical Fast Transient / Burst Immunity Test)

Test Setup 9

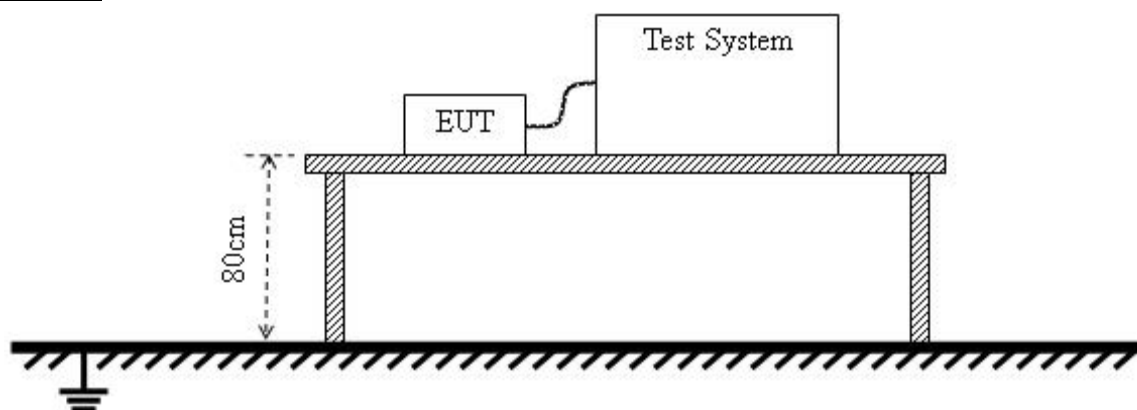
(Transients and Surges)

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 ^{Note}
Electrostatic Discharge Immunity	Test Setup	Test Setup 6
	Test Configuration	TC01 ^{Note}
Radiated RF Electromagnetic Field Immunity	Test Setup	Test Setup 7
	Test Configuration	TC01 ^{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 Induction 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 (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)
30 - 230	50	40
230 - 1000	57	47

Frequency range (MHz)	Class A (at 3 m)		Class B (at 3 m)	
	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak for $f < 1$ GHz, peak & RMS Average for $f \geq 1$ 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 (dB μ V)	Average (dB μ V)	Quasi-peak (dB μ V)	Average (dB μ V)
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 (dB μ V)	Average (dB μ V)
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 (dB μ V)	Average (dB μ V)	Quasi-peak (dB μ V)	Average (dB μ V)
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 μ H 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 $\geq$ 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

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 μ s	Voltage: 1.2/50 μ s, or 10/700 μ s 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 μ s 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 μ s 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 μ s 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

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

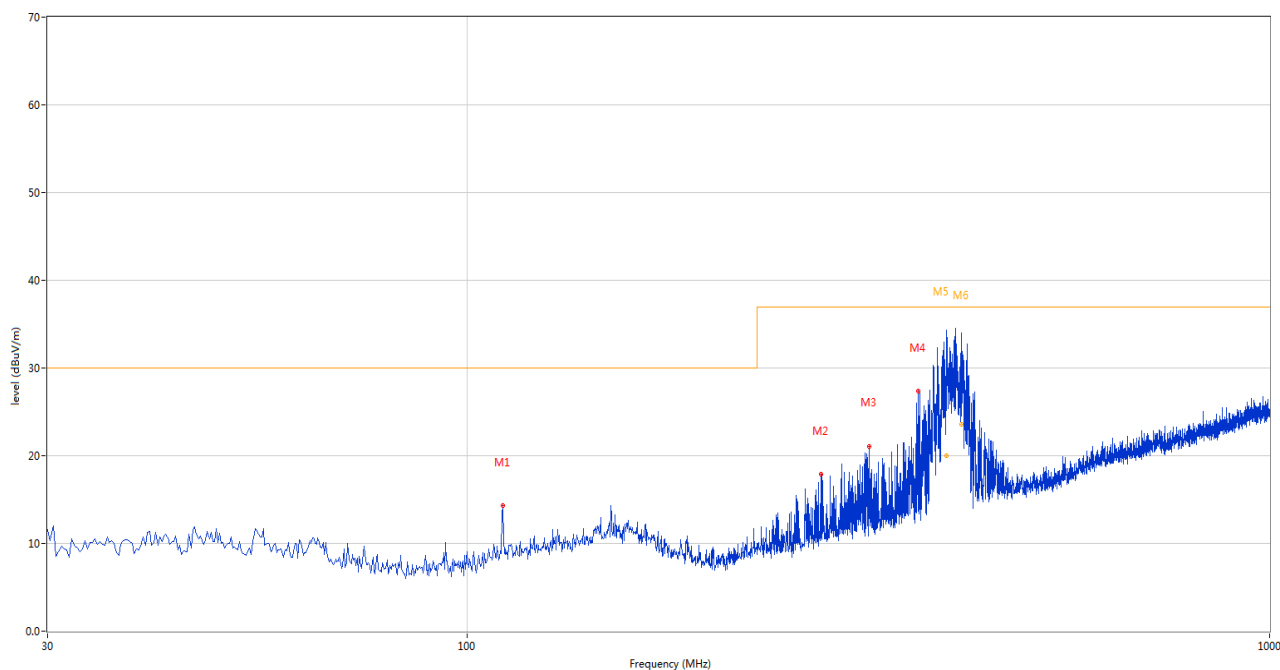
Note 1: The symbol of "--" in the table which means not application.

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)

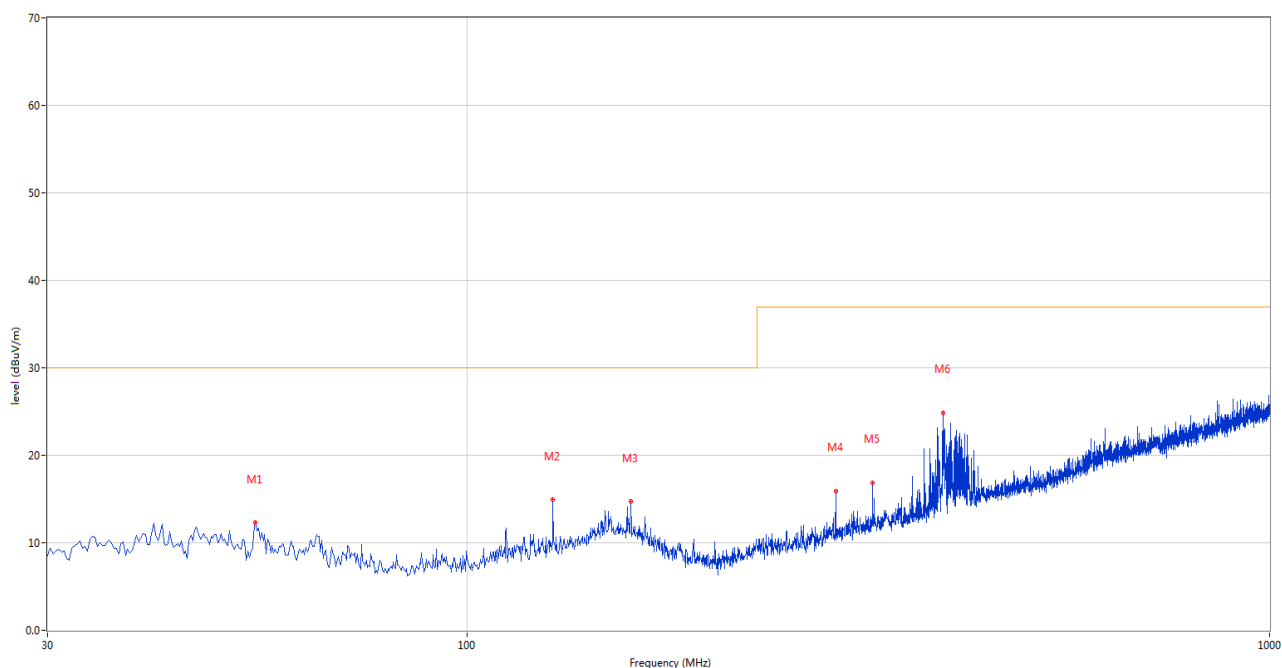
The NFC Induction Test Mode

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



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	110.732	14.31	-28.80	30.0	-15.69	Peak	231.00	200	Vertical	Pass
2	276.318	17.87	-26.30	37.0	-19.13	Peak	270.00	100	Vertical	Pass
3	317.048	21.05	-25.03	37.0	-15.95	Peak	159.00	100	Vertical	Pass
4	364.566	27.36	-23.84	37.0	-9.64	Peak	159.00	100	Vertical	Pass
5	395.587	33.69	-23.04	37.0	-3.31	Peak	265.00	108	Vertical	N/A
5*	395.587	20.04	-23.04	37.0	-16.96	QP	265.00	108	Vertical	Pass
6	413.048	32.86	-22.48	37.0	-4.14	Peak	220.00	122	Vertical	N/A
6*	413.048	23.61	-22.48	37.0	-13.39	QP	220.00	122	Vertical	Pass

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



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.486	12.27	-27.31	30.0	-17.73	Peak	60.00	200	Horizontal	Pass
2	127.946	14.94	-27.33	30.0	-15.06	Peak	13.00	100	Horizontal	Pass
3	159.948	14.72	-25.58	30.0	-15.28	Peak	346.00	100	Horizontal	Pass
4	287.956	15.91	-25.97	37.0	-21.09	Peak	156.00	200	Horizontal	Pass
5	319.958	16.88	-24.94	37.0	-20.12	Peak	0.00	200	Horizontal	Pass
6	392.204	24.86	-23.17	37.0	-12.14	Peak	120.00	200	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	$\pm 2, \pm 4$	Contact	100	Pass
VCP	$\pm 2, \pm 4$	Contact	100	Pass
Shell and Crack	$\pm 2, \pm 4, \pm 8$	Air	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-SZ2230879-AE-4.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2230879-AW-2.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2230879-AI-2.PDF”.

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