



TEST REPORT

Application No.: SHEM2109010331TX
Applicant: Shanghai Lanbao Sensing Technology Co., Ltd.
Address of Applicant: No. 228 Jinbi Road, Fengxian District, Shanghai, China
Manufacturer: Shanghai Lanbao Sensing Technology Co., Ltd.
Address of Manufacturer: No. 228 Jinbi Road, Fengxian District, Shanghai, China
Factory: Shanghai Lanbao Sensing Technology Co., Ltd.
Address of Factory: No. 228 Jinbi Road, Fengxian District, Shanghai, China
Equipment Under Test (EUT):
EUT Name: Capacitive Sensor
Model No.: CR12DF02DPO 3001
Refer to page 2
Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) : EN IEC 60947-5-2:2020 Clause 8.2.6.1, 8.2.6.2, 8.2.6.3, 9.6.1, 9.6.2, 9.6.3
Date of Receipt: 2021-09-03
Date of Test: 2021-09-22 to 2021-09-24
Date of Issue: 2021-09-27

Test Result:	Refer to Test Summary
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Parlam Zhan

Parlam Zhan
Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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Model No.:

SERIES C:

C R 18 X S C F 05 D P Q ☐ ☐ ☐ ☐ ☐

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

<p>1. Classification Symbols C: Capacitive type</p> <p>2. Shape Symbols R: thread cylindrical Q: smooth cylindrical E: Rectangular</p> <p>3. Enclosure Size Number: Enclosure Size: 01 to 99mm</p> <p>4. Customer code A to Z eg T:Turkey No Letter:China</p> <p>5. Enclosure Forms No letter: Cylindrical V: Angle Column Z: Combination H: Ring-shaped U: U-shaped X: Appearance improved/ Function enhanced products</p> <p>6. Enclosure Material No letter: metal-Cu enclosure G: Stainless Steel V: Aluminum alloy S: Plastic T: PTEE</p> <p>7. Housing length No letter: Square enclosure A: Short B: Standard C: Long D: Super long</p>	<p>8. Installation type N: Non-flush (nf) F: flush (f)</p> <p>9. Test distance 01 to 99 eg:01: 1mm</p> <p>10. Rated Voltage A: 20-250VAC D: 10-30VDC S: 20-250VAC/DC M: 18-36VDC</p> <p>11. Output Form B: AC/DC two wires P: PNP N: NPN F: NPN+PNP T: AC two wires K: Relay</p> <p>12. Output state O: NO C: NC R: NO+NC B: NO/NC optional L: IO Link</p>	<p>13. Switch function Classification No Letter: Standard function Z: self-diagnosis W: high-temperature S: Adjustable type with potentiometer Y: Extended sensing distance</p> <p>14. Lead wire length No Letter: 2m 1 m to 50 m eg:3M: 3m</p> <p>15. Connection Form No Letter: lead wire form E1: M8 3P connectors E2: M12 4P connectors E3: M8 4P connectors E4: M12 4P trapezoid connector E5: M12 5P connectors F1~9: Cable with connector eg:F3: Cable with connector M8, 3P, 0.2 m D: Terminal</p> <p>16. Customer code Blank: General Customer In 4 Digits: Special Customer</p>
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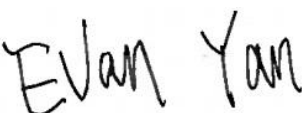

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Revision Record			
Version	Description	Date	Remark
00	Original	2021-09-27	/

Authorized for issue by:			
			
		Evan Yan / Project Engineer	
			
		Bruce Tang / Reviewer	



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2 Test Summary

Emission Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at DC Terminals (150kHz-30MHz)	EN IEC 60947-5-2:2020	CISPR 11:2015	Group 1 Class A	Pass
Radiated Emissions (30MHz-1GHz)	EN IEC 60947-5-2:2020	CISPR 11:2015	Group 1 Class A	Pass
Immunity Part				
Item	Standard	Method	Requirement	Result
Electrostatic Discharge	EN IEC 60947-5-2:2020	IEC 61000-4-2:2008	4kV Contact Discharge 8kV Air Discharge	Pass
Radiated Immunity (80MHz-1GHz, 1.4GHz-2GHz, 2GHz-6GHz)	EN IEC 60947-5-2:2020	IEC 61000-4-3:2006	80MHz-1GHz, 1.4GHz-2GHz: 3V/m, 80%, 1kHz Amp. Mod. 2GHz-6GHz: 1V/m, 80%, 1kHz Amp. Mod.	Pass
Electrical Fast Transients/Burst at Power Port	EN IEC 60947-5-2:2020	IEC 61000-4-4:2012	2kV 5/50ns Tr/Td 5kHz Repetition Frequency	Pass
Power Frequency Magnetic Field	EN IEC 60947-5-2:2020	IEC 61000-4-8:2009	50/60Hz 30A/m	Pass
Conducted Immunity at Power Port (150kHz-80MHz)	EN IEC 60947-5-2:2020	IEC 61000-4-6:2013	3Vrms (emf), 80%, 1kHz Amp. Mod.	Pass

Note1: The tests are based on the requirement of client.

Note2: Declaration of EUT Family Grouping:

There are series models mentioned in this report and they are the similar in electrical and electronic characters. Only the model CR12DF02DPO 3001 was tested since their differences are model number, trade name and appearance.

Note3: AC power supply refer to report SHEM210901033201.



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4 General Information

4.1 Details of E.U.T.

Power supply: DC10-30V

Test voltage: DC30V

4.2 Description of Support Units

Description	Manufacturer	Model No.	S/N
DC power supply	KIKUSUI	PMC35-3A	/
Load Resistor	/	/	/
Digital Multimeter	FLUKE	15B+	/

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Conducted Emission at mains port using AMN	2.6dB (9kHz to 150kHz)
		2.4dB (150kHz to 30MHz)
2	Conducted Emission at mains port using VP	1.8 dB (9kHz to 30MHz)
3	Conducted Emission at telecommunication port using AAN	4.2 dB (150kHz to 30MHz)
4	Radiated Power	3.2dB
5	Radiated Emission	4.5dB (30MHz-1GHz)
		5.1dB (1GHz-6GHz)
		5.4dB (6GHz-18GHz)
6	Radiated Disturbance (disturbance current in a LLAS)	2.4dB (9kHz to 30MHz)

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



4.4 Test Location

All tests were performed at:

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Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 6332.01)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA).

- **FCC (Designation Number: CN1301)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

- **ISED (CAB Identifier: CN0020)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 8617A

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

4.8 Monitoring of EUT for All Immunity Test

Visual: working status



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5 Equipment List

Conducted Emissions at Mains Terminals (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI test receiver	Rohde & Schwarz	ESR7	SHEM162-1	2020-12-20	2021-12-19
Line impedance stabilization network	SCHWARZBECK	NSLK8127	SHEM061-1	2020-12-20	2021-12-19
Line impedance stabilization network	EMCO	3816/2	SHEM019-1	2020-12-20	2021-12-19
Pulse limiter	Rohde & Schwarz	ESH3-Z2	SHEM029-1	2020-12-20	2021-12-19
Shielding Room	ZHONGYU	8*4*3M	SHEM079-2	2020-12-20	2023-12-19
CE test Cable	/	/	CE01	2020-12-20	2021-12-19

Radiated Emissions (30MHz-1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI test receiver	Rohde & Schwarz	ESU40	SHEM051-1	2020-12-20	2021-12-19
CONTROLLER	INNCO	CO200	SHEM047-1	N/A	N/A
ANTENNA MAST	INNCO	MA400-EP	SHEM047-2	N/A	N/A
TURN DEVICE	INNCO	DE 3600-RH	SHEM047-3	N/A	N/A
Broadband UHF-VHF ANTENNA	SCHWARZBECK	VULB9168	SHEM048-1	2019-10-14	2021-10-13
Semi/Fully Anechoic	ST	11*6*6M	SHEM078-2	2020-05-25	2023-05-24
Pre-Amplifier	HP	8447D	SHEM236-1	2021-05-27	2022-05-26

Electrostatic Discharge					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Electrostatic Discharge Simulator	TESEQ	NSG 437	SHEM041-2	2021-08-13	2022-08-12

Electrical Fast Transients/Burst at Power Port					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Immunity Test System	EMC PARTNER	TRA3000 F-S-D-V	SHEM163-1	2020-12-20	2021-12-19
Test software	EMC PARTNER	GENECS	Version: 3.29	N/A	N/A
Immunity Test System	TESEQ	NSG 3060	SHEM224-1	2021-04-15	2022-04-14
Coupling / Decoupling Network (CDN)	TESEQ	CDN 3061	SHEM224-3	2021-04-15	2022-04-14

Power Frequency Magnetic Field					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Immunity Test System	EMC PARTNER	TRA3000 F-S-D-V	SHEM163-1	2020-12-19	2021-12-18
Motorised Variac	MV2616	MV2616	SHEM026-6	N/A	N/A



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Current transformer for magnetic field coil	EM test	MC2630	SHEM026-7	2020-12-19	2021-12-18
Current transformer for magnetic field coil	EM test	MC26100	SHEM026-8	2020-12-19	2021-12-18
Magnetic field coil	EM test	MS100	SHEM026-9	2020-12-19	2021-12-18

Radiated Immunity (80MHz-6GHz)

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Signal generator	Rohde & Schwarz	SMJ100A	SHEM141-1	2021-08-13	2022-08-12
Power Meter	Rohde & Schwarz	NRP	SHEM057-1	2021-04-15	2022-04-14
Power meter sensor	Rohde & Schwarz	NRP-Z91	SHEM057-2	2021-04-15	2022-04-14
Antenna	SCHWARZBECK	STLP9128D	SHEM130-1	N/A	N/A
Amplifier	MILMEGA	AS0840-55-55	SHEM133-1	2019-12-20	2020-12-19
Power meter sensor	Rohde & Schwarz	NRP-Z22	SHEM136-1	2021-04-15	2022-04-14
ElectroMagnetic Field Probe	ETS-Lindgren	HI-6105	SHEM134-1	2021-08-06	2022-08-05

Conducted Immunity at Power Port (150kHz-80MHz)

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Signal generator	Rohde & Schwarz	SMJ100A	SHEM141-1	2021-08-13	2022-08-12
Power Amplifier	HAEFFLY	PAMP250	SHEM023-1	2020-12-20	2021-12-19
6dB Attenuator	HUAXIANG	DTS50-6dB-1G-A	SHEM123-2	2020-12-20	2021-12-19
Coupling clamp	LUTHI	EM 101	SHEM027-1	2020-12-20	2021-12-19
Coupling and Decoupling Network (CDN)	LUTHI	L-801 M1	SHEM023-5	2020-12-20	2021-12-19
Coupling and Decoupling Network (CDN)	LUTHI	L-801 M2/M3	SHEM023-6	2020-12-20	2021-12-19
RF Generator	SCHAFFNER	NSG 2070	SHEM221-1	2021-05-27	2022-05-26
Shielding Room	ZHONGYU	5*5*3M	SHEM079-6	2019-12-20	2022-12-19
Coupling and Decoupling Network	Teseq	CDN M016	SHEM168-1	2021-08-13	2022-08-12

General used equipment

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Digital pressure meter	YONGZHI	DYM3-01	SHEM082-1	2021-01-22	2024-01-21
Temperature&humidity recorder	ShangHai weather meter work	ZJ 1-2B	SHEM042-1~6	2021-09-07	2022-09-06
Digital Multimeter	FLUKE	17B	SHEM043-3	2021-09-04	2022-09-03
Autoformer regulator	Guangzhou bao de	TDGC2-5KVA	SHEM150-1	N/A	N/A
Multi-purpose tong tester	FLUKE	316	SHEM001-1	2020-12-20	2021-12-19



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6 Emission Test Results

6.1 Conducted Emissions at DC Terminals (150kHz-30MHz)

Test Requirement: EN IEC 60947-5-2:2020
 Test Method: CISPR 11:2015
 Frequency Range: 150kHz to 30MHz
 Limit:
 0.15MHz - 5MHz 97dB(μV)-89dB(μV) quasi-peak, 84dB(μV)-76dB(μV) average
 5MHz - 30MHz 89dB(μV) quasi-peak, 70dB(μV) average
 Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

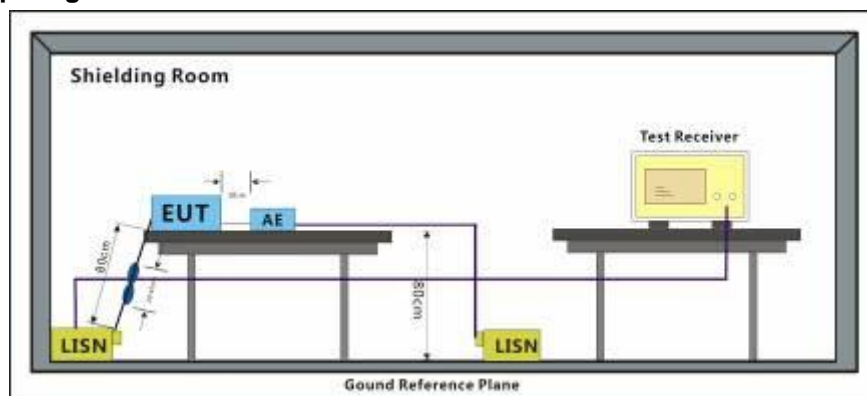
6.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

6.1.2 Test Setup Diagram



6.1.3 Measurement Data

An initial pre-scan was performed with peak detector. Quasi-Peak or Average measurement were performed at the frequencies with maximized peak emission were detected.

Notes: Emission Level=Read Level + LISN Factor + Cable Loss



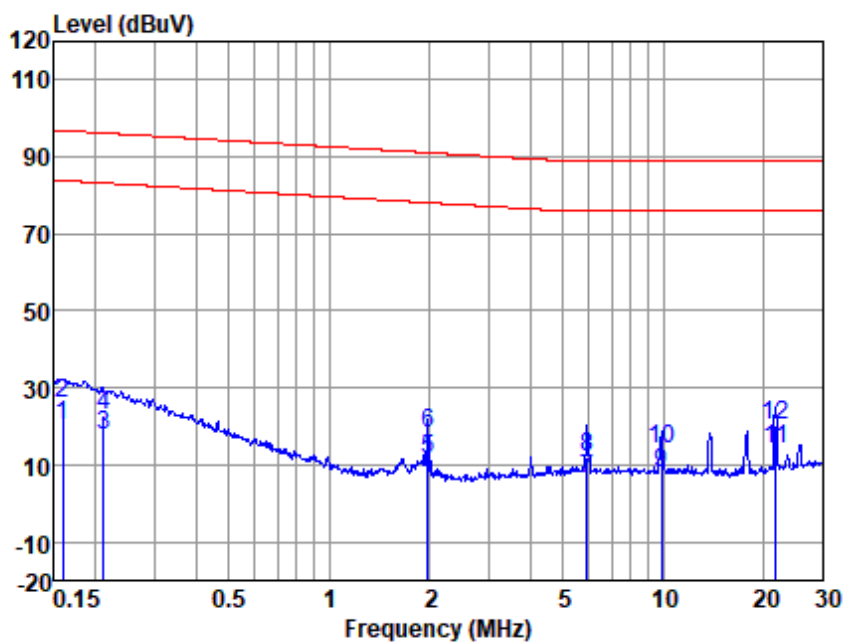
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Mode:a; Line:Live Line



LISN : LINE
EUT/Project No : 10331TX
Test Mode : a

	Freq (MHz)	Read level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.16	10.23	0.20	9.89	20.32	83.87	-63.55	Average
2	0.16	15.76	0.20	9.89	25.85	96.87	-71.02	QP
3	0.21	7.35	0.20	9.93	17.48	83.21	-65.73	Average
4	0.21	12.73	0.20	9.93	22.86	96.21	-73.35	QP
5	1.97	1.30	0.20	9.94	11.44	78.13	-66.69	Average
6	1.97	8.00	0.20	9.94	18.14	91.13	-72.99	QP
7	5.93	-4.07	0.20	10.05	6.18	76.00	-69.82	Average
8	5.93	1.96	0.20	10.05	12.21	89.00	-76.79	QP
9	9.91	-2.68	0.30	10.05	7.67	76.00	-68.33	Average
10	9.91	3.53	0.30	10.05	13.88	89.00	-75.12	QP
11	21.83	3.22	0.78	10.20	14.20	76.00	-61.80	Average
12	21.83	9.30	0.78	10.20	20.28	89.00	-68.72	QP

Notes: Emission Level = Read Level + LISN Factor + Cable loss



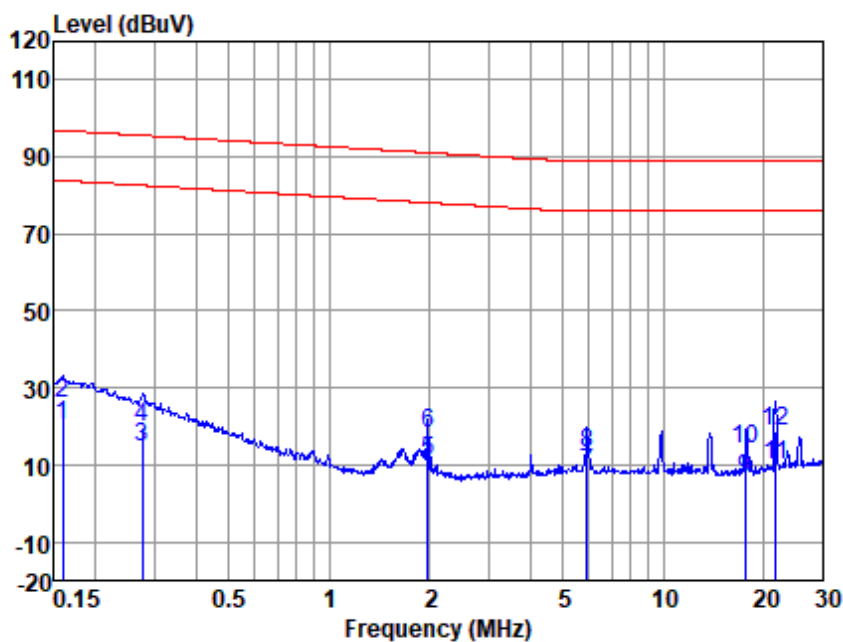
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Mode:a; Line:Neutral Line



LISN : NEUTRAL

EUT/Project No : 10331TX

Test Mode : a

	Freq (MHz)	Read level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Over Limit (dB)	Remark
1	0.16	9.97	0.20	9.89	20.06	83.87	-63.81	Average
2	0.16	15.71	0.20	9.89	25.80	96.87	-71.07	QP
3	0.28	4.45	0.20	9.94	14.59	82.61	-68.02	Average
4	0.28	9.56	0.20	9.94	19.70	95.61	-75.91	QP
5	1.97	0.95	0.20	9.94	11.09	78.13	-67.04	Average
6	1.97	8.33	0.20	9.94	18.47	91.13	-72.66	QP
7	5.93	-2.35	0.20	10.05	7.90	76.00	-68.10	Average
8	5.93	2.87	0.20	10.05	13.12	89.00	-75.88	QP
9	17.66	-4.24	0.61	10.17	6.54	76.00	-69.46	Average
10	17.66	3.14	0.61	10.17	13.92	89.00	-75.08	QP
11	21.83	-0.79	0.78	10.20	10.19	76.00	-65.81	Average
12	21.83	7.66	0.78	10.20	18.64	89.00	-70.36	QP

Notes: Emission Level = Read Level + LISN Factor + Cable loss



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6.2 Radiated Emissions (30MHz-1GHz)

Test Requirement: EN IEC 60947-5-2:2020

Test Method: CISPR 11:2015

Frequency Range: 30MHz to 1GHz

Measurement Distance: 3m

Limit:

30MHz-230MHz 50 dB(μV/m) quasi-peak

230MHz-1GHz 57 dB(μV/m) quasi-peak

Detector: Peak for pre-scan (120kHz resolution bandwidth) 30M to 1000MHz

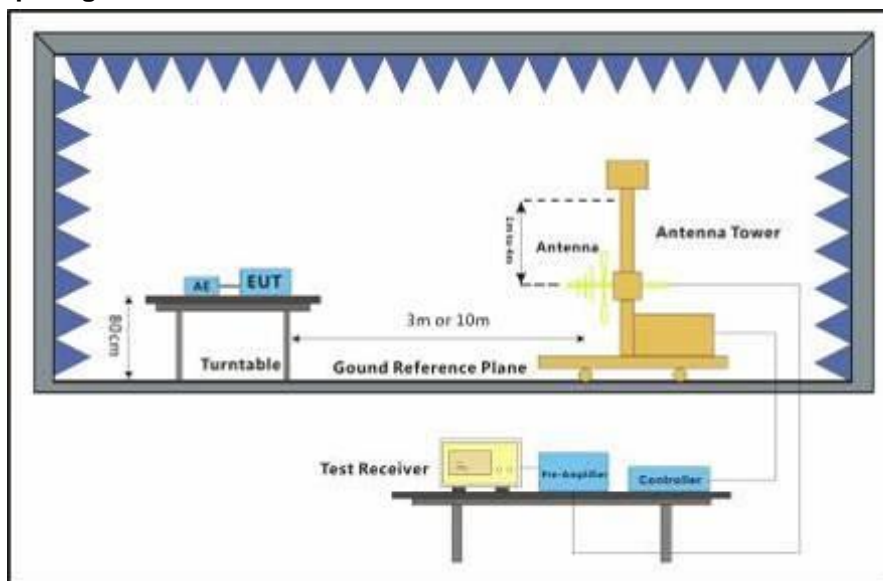
6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

6.2.2 Test Setup Diagram



6.2.3 Measurement Data

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

Notes: Emission Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor



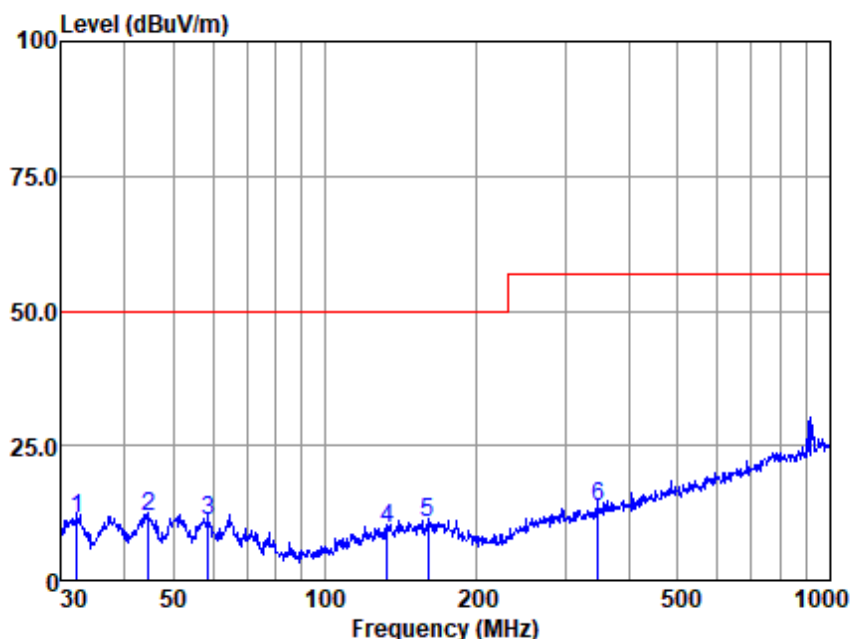
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Mode:a; Polarization:Horizontal



Antenna Polarity :HORIZONTAL

EUT/Project :10331TX

Test mode :a

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	32.293	40.73	12.30	0.81	42.37	11.47	50.00	-38.53	QP
2	44.743	39.54	13.48	0.95	42.30	11.67	50.00	-38.33	QP
3	58.613	39.17	13.18	1.10	42.30	11.15	50.00	-38.85	QP
4	132.685	37.93	12.00	1.75	42.23	9.45	50.00	-40.55	QP
5	159.784	37.70	13.20	1.92	42.20	10.62	50.00	-39.38	QP
6	348.027	38.35	14.27	2.98	41.91	13.69	57.00	-43.31	QP

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



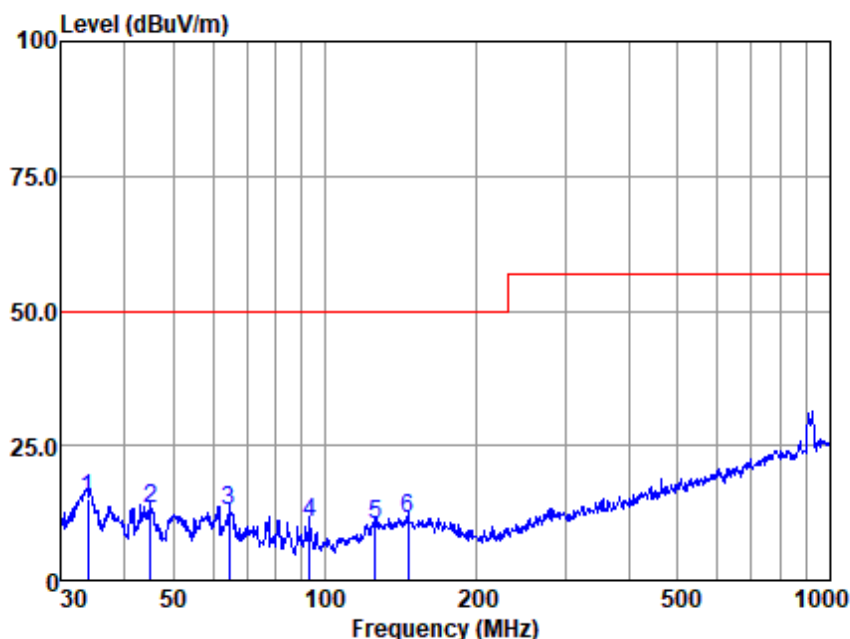
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Mode:a; Polarization:Vertical



Antenna Polarity :VERTICAL

EUT/Project :10331TX

Test mode :a

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	33.799	44.17	12.35	0.82	42.36	14.98	50.00	-35.02	QP
2	45.058	41.10	13.50	0.95	42.30	13.25	50.00	-36.75	QP
3	64.433	41.72	12.46	1.16	42.30	13.04	50.00	-36.96	QP
4	93.113	43.50	8.03	1.43	42.30	10.66	50.00	-39.34	QP
5	125.886	39.57	11.49	1.69	42.24	10.51	50.00	-39.49	QP
6	145.861	39.08	12.74	1.83	42.21	11.44	50.00	-38.56	QP

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



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7 Immunity Test Results

7.1 Performance Criteria Description in EN IEC 60947-5-2:2020

Item	Acceptance criteria (performance criteria during tests)		
	A	B	C
Overall performance	No noticeable changes of the operating characteristic Operating as intended ^a	Temporary degradation or loss of performance which is self-recoverable ^b	Temporary degradation or loss of performance which requires operator intervention or system reset
Operation of displays and signalling components	No changes to visible display information Only slight light intensity fluctuation of LEDs, or slight movement of characters	Temporary visible changes or loss of information Undesired LED illumination	Shut down, permanent loss of display or wrong information Unpermitted operating mode. Not self-recoverable
Information processing and sensing functions	Undisturbed communication and data interchange to external devices remains within the specification	Temporarily disturbed communication, which is detected and is self-recoverable	Erroneous processing of information Undetected loss of data and/or information Errors in communication Not self-recoverable
^a Due to the physical principle of the proximity switch, a degradation of performance at the sensor oscillating frequency ($\pm 20\%$) is permissible. At that frequency range, the performance criterion B shall be achieved. ^b The recovery time shall not exceed the maximum time which can be measured when the device is started by power-on at the power supply terminals (time delay before availability according to 8.2.1.7).			



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Type of test	Basic standard	Test level required		Acceptance criteria
Electrostatic discharge immunity test	IEC 61000-4-2	8 kV / air discharge or 4 kV / contact discharge		B ^h
Radiated radio-frequency electromagnetic field immunity test 80 MHz to 1 GHz and 1,4 GHz to 2 GHz	IEC 61000-4-3	3 V/m ^f		A
Radiated radio-frequency electromagnetic field immunity test 2 GHz to 6 GHz	IEC 61000-4-3	1 V/m		A
Electrical fast transient/burst immunity test	IEC 61000-4-4	AC power ports with rated voltage > 50 V	2 kV / 5 kHz coupling/decoupling network	B ^h
		DC power ports with rated voltage > 75 V	1 kV / 5 kHz coupling/decoupling network	
		All other ports ^k	2 kV / 5 kHz capacitive coupling clamp	
Conducted disturbances induced by radio-frequency fields immunity test 150 kHz to 80 MHz	IEC 61000-4-6	3 V ^f		A
Power frequency magnetic field immunity test ^a	IEC 61000-4-8	30 A/m		A
Voltage dips immunity test ^g	IEC 61000-4-11	Class 2 ^{b, c} 0 % during 0,5 cycle	Class 3 ^{b, c} 0 % during 0,5 cycle	B ^{h, i}
		Class 2 ^{b, c} 0 % during 1 cycle	Class 3 ^{b, c} 0 % during 1 cycle	B
		Class 2 ^{b, c, d} 70 % during 25/30 cycles	Class 3 ^{b, c, d} 40 % during 10/12 cycles 70 % during 25/30 cycles 80 % during 250/300 cycles	C
Voltage interruptions immunity test ^g	IEC 61000-4-11	Class 2 ^{b, c, d} 0 % during 250/300 cycles	Class 3 ^{b, c, d} 0 % during 250/300 cycles	C



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- ^a Applicable only to proximity switches containing devices susceptible to power frequency magnetic fields. In that case the proximity switch shall fulfil the acceptance criteria B (performance criteria during tests), according to Table 9.
- ^b Class 2 applies to points of common coupling and in-plant points of common coupling in the industrial environment in general.
- Class 3 applies to in-plant couplings in industrial environment only. This class should be considered when a major part of the load is fed through converters; welding machines are present; large motors are frequently started or loads vary rapidly.
- The manufacturer shall state the applicable class.
- ^c The given percentage means percentage of the rated operational voltage, e.g. 0 % means 0 V.
- ^d The value before the solidus (/) is for 50 Hz and the value after is for 60 Hz tests.
- ^e Test levels are under study for the future.
- ^f The level differs from IEC 60947-1 because the installation environment for proximity switches is primarily in automation machinery and experience of many years shows that the disturbance levels are so low that the immunity requirements in this standard are sufficient.
- ^g Applicable for AC switches only.
- ^h For keeping the functionality at the system level (e.g. automation or process) the state of the switching element shall not change for more than 1 ms for DC devices or one half-cycle of supply frequency for AC devices.
- ⁱ For devices with power consumption of more than 750 mW, the recovery time of the switching element may be longer than one half-cycle but shall be less than the maximum recovery time (time delay before availability according to 8.2.1.7).
- ^k Typically the power and signal ports are integrated in one cable with digital output signals (semiconductor switching elements) referred to GND. Insertion of a CDN would corrupt these signals due to the high capacitive load of the CDN. Power inputs with superimposed output signals (two-wire technology) fall into this category.



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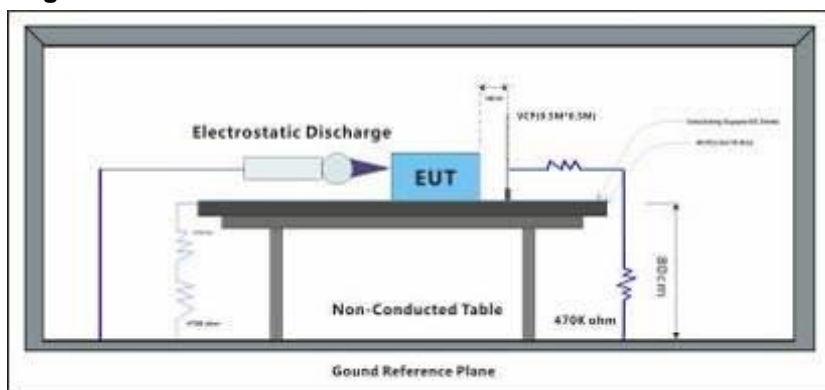
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7.2 Electrostatic Discharge

Test Requirement: EN IEC 60947-5-2:2020
Test Method: IEC 61000-4-2:2008
Performance Criterion: B
Discharge Impedance: 330Ω/150pF
Number of Discharge: Minimum 10 times at each test point
Discharge Mode: Single Discharge
Discharge Period: 1 second minimum

7.2.1 Test Setup Diagram



7.2.2 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

7.2.3 Test Results:

Observations: Test Point:

1. All insulated enclosure and seams.
2. All accessible metal parts of the enclosure.
3. All side

Discharge type	Level (kV)	Polarity	Test Point	Result / Observations
Air Discharge	2,4,8	+	1	A
Air Discharge	2,4,8	-	1	A
Contact Discharge	4	+	2	A
Contact Discharge	4	-	2	A
Horizontal Coupling	4	+	3	A
Horizontal Coupling	4	-	3	A
Vertical Coupling	4	+	3	A
Vertical Coupling	4	-	3	A

Results:

A: No degradation in the performance of the EUT was observed.



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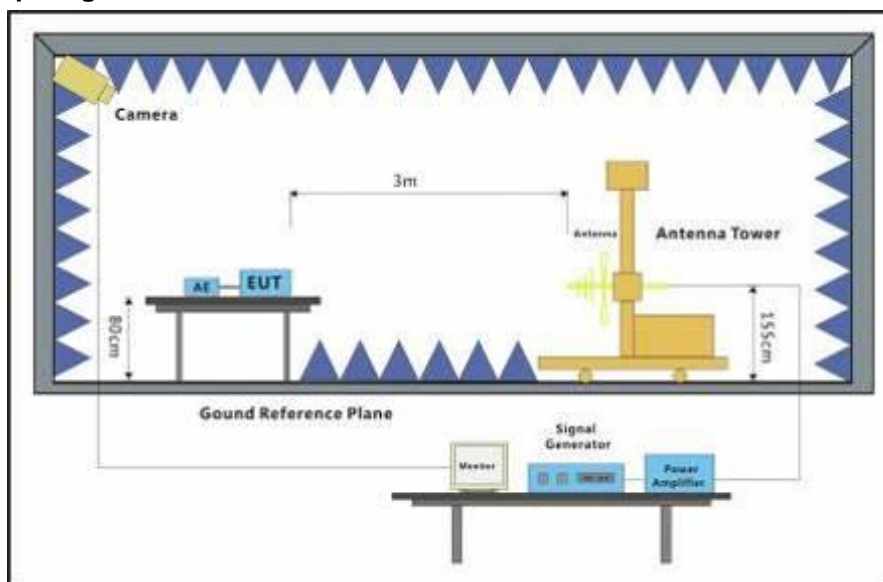
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7.3 Radiated Immunity (80MHz-1GHz, 1.4GHz-2GHz, 2GHz-6GHz)

Test Requirement: EN IEC 60947-5-2:2020
Test Method: IEC 61000-4-3:2006
Performance Criterion: A
Frequency Range: 80MHz to 1GHz, 1.4GHz to 2GHz, 2GHz to 6GHz
Antenna Polarisation: Vertical and Horizontal
Modulation: 1kHz, 80% Amp. Mod, 1% increment

7.3.1 Test Setup Diagram



7.3.2 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

7.3.3 Test Results:

Frequency	Level (V/m)	EUT Face	Dwell time	Result / Observations
80MHz-1GHz	3	Front	3s	A
80MHz-1GHz	3	Back	3s	A
80MHz-1GHz	3	Left	3s	A
80MHz-1GHz	3	Right	3s	A
80MHz-1GHz	3	Top	3s	A
80MHz-1GHz	3	Bottom	3s	A
1.4GHz-2GHz	3	Front	3s	A
1.4GHz-2GHz	3	Back	3s	A
1.4GHz-2GHz	3	Left	3s	A
1.4GHz-2GHz	3	Right	3s	A
1.4GHz-2GHz	3	Top	3s	A



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1.4GHz-2GHz	3	Bottom	3s	A
2GHz-6GHz	1	Front	3s	A
2GHz-6GHz	1	Back	3s	A
2GHz-6GHz	1	Left	3s	A
2GHz-6GHz	1	Right	3s	A
2GHz-6GHz	1	Top	3s	A
2GHz-6GHz	1	Bottom	3s	A

Results:

A: No degradation in the performance of the EUT was observed.



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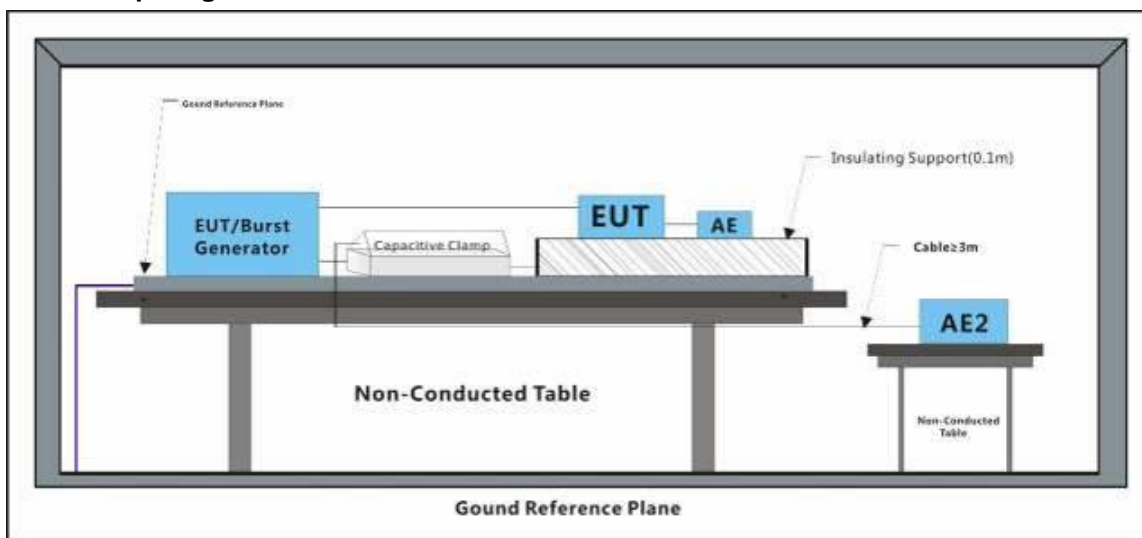
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7.4 Electrical Fast Transients/Burst at Power Port

Test Requirement: EN IEC 60947-5-2:2020
 Test Method: IEC 61000-4-4:2012
 Performance Criterion: B
 Repetition Frequency: 5kHz
 Burst Period: 300ms
 Test Duration: 2 minute per level & polarity

7.4.1 Test Setup Diagram



7.4.2 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

7.4.3 Test Results:

Test Line	Level (kV)	Polarity	CDN/Clamp	Result / Observations
DC power port	2	+	Clamp	A
DC power port	2	-	Clamp	A

Results:

A: No degradation in the performance of the EUT was observed.



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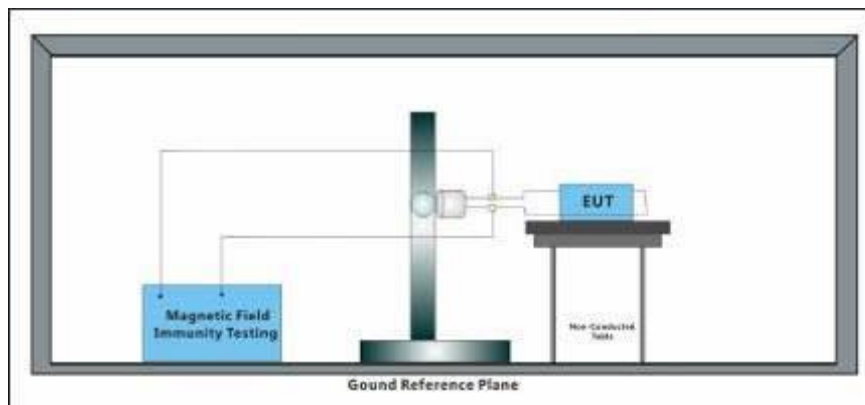
7.5 Power Frequency Magnetic Field

Test Requirement: EN IEC 60947-5-2:2020

Test Method: IEC 61000-4-8:2009

Performance Criterion: A

7.5.1 Test Setup Diagram



7.5.2 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 49 % RH Atmospheric Pressure:

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

7.5.3 Test Results:

Frequency	Level (A/m)	Axial	Magnetic Field Type	Result / Observations
50/60Hz	30	X	Continuous filed	A
50/60Hz	30	Y	Continuous filed	A
50/60Hz	30	Z	Continuous filed	A

Results:

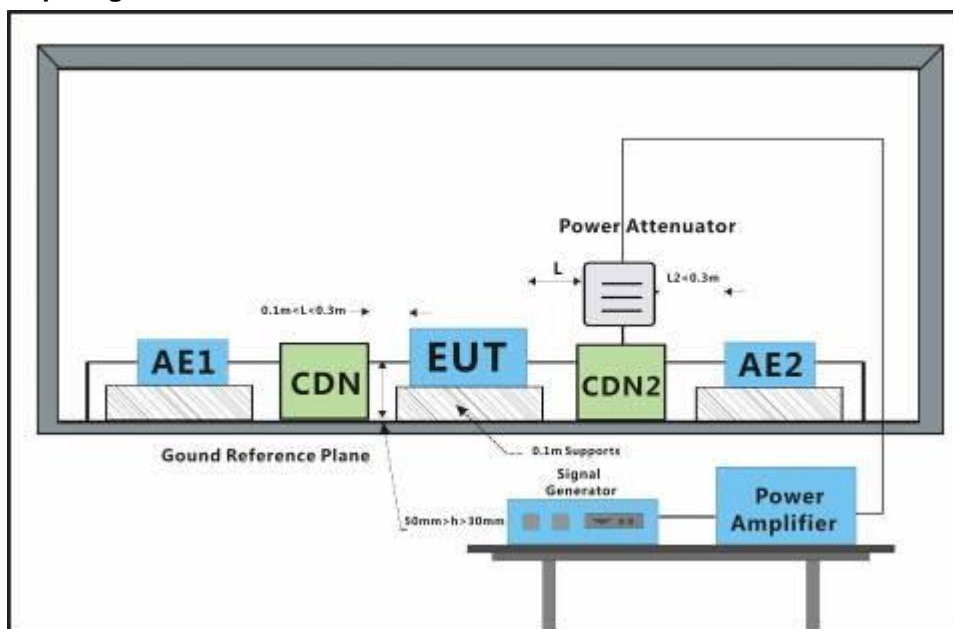
A: No degradation in the performance of the EUT was observed.



7.6 Conducted Immunity at Power Port (150kHz-80MHz)

Test Requirement: EN IEC 60947-5-2:2020
 Test Method: IEC 61000-4-6:2013
 Performance Criterion: A
 Frequency Range: 0.15MHz to 80MHz
 Modulation: 80%, 1kHz Amplitude Modulation
 Step Size: 1%

7.6.1 Test Setup Diagram



7.6.2 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Test mode: a: EUT was tested On-state and Off state. The target was positioned at 1/3Sn and 3Sn and the worst data was listed in the report.

7.6.3 Test Results:

Cable port	Level (Vrms)	CDN/Clamp	Dwell time	Result / Observations
DC power port	3	Clamp	3s	A

Results:

A: No degradation in the performance of the EUT was observed.



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8 Photographs

8.1 Conducted Emissions at DC Terminals (150kHz-30MHz) Test Setup



8.2 Radiated Emissions (30MHz-1GHz) Test Setup



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8.3 Electrostatic Discharge Test Setup



8.4 Radiated Immunity (80MHz-1GHz, 1.4GHz-2GHz, 2GHz-6GHz) Test Setup



8.5 Electrical Fast Transients/Burst at Power Port Test Setup



8.6 Conducted Immunity at Power Port (150kHz-80MHz) Test Setup



8.7 Power Frequency Magnetic Field Test Setup



8.8 EUT Constructional Details (EUT Photos)



- End of the Report -