

TEST REPORT

Base On Test Report No. :MH/2018/40142

Applicant : TRACO ELECTRONIC AG

Address : Sihlbruggstrasse 111 CH-6340 Baar Switzerland

Manufacturer : TRACO ELECTRONIC AG

Address : Sihlbruggstrasse 111 CH-6340 Baar Switzerland

Equipment Under Test (EUT) :

Name : DC/DC Converter

Brand Name :



Model No.: TMR 3-4811WIR; TMR 6-4811WIR; TMR 6-7211WIR

Added Model(s) : Please refer to Section 1.1

Standards:

EN 50155 : 2017(clause 13.4.8)	EN 55022 : 2010 (Class A, Class B)
EN 50121-3-2 : 2016	EN 61000-4-2 : 2009
EN 61000-4-3 : 2006+A1:2008+A2:2010	EN 61000-4-4 : 2012
EN 61000-4-5 : 2014	EN 61000-4-6 : 2014
IEC 61000-4-8 : 2009	

In the configuration tested, the EUT complied with the standards specified above.

Date of Receipt : Oct. 24, 2018

Date of Issue : Nov. 07, 2018

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Approved By

Date

Nov. 07, 2018

Bill Cheng
(Section Manager)

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Revision History

Report Number	Revision	Description	Issue Date
MH/2018/A0182	Rev.00	Initial creation of document	Nov. 07, 2018

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1. General Description

1.1 General Description of EUT

Name of EUT	: DC/DC Converter
Brand Name	: 
Model No.(s)	: TMR 3-4811WIR; TMR 6-4811WIR; TMR 6-7211WIR
Added Model(s)	: See the following note.
Variant Description	: See the following note.

Note: z can be any alphanumeric or dash or blank or slash for marketing purpose only.

Model	Input Range (VDC)	Output Voltage (VDC)	Output Current @Full Load (mA)
TMR 3-2410WIRzzzzzzzz	9 ~ 36	3.3	700
TMR 3-2411WIRzzzzzzzz	9 ~ 36	5	600
TMR 3-2419WIRzzzzzzzz	9 ~ 36	9	333
TMR 3-2412WIRzzzzzzzz	9 ~ 36	12	250
TMR 3-2413WIRzzzzzzzz	9 ~ 36	15	200
TMR 3-2415WIRzzzzzzzz	9 ~ 36	24	125
TMR 3-2421WIRzzzzzzzz	9 ~ 36	±5	±300
TMR 3-2422WIRzzzzzzzz	9 ~ 36	±12	±125
TMR 3-2423WIRzzzzzzzz	9 ~ 36	±15	±100
TMR 3-4810WIRzzzzzzzz	18 ~ 75	3.3	700
TMR 3-4811WIRzzzzzzzz	18 ~ 75	5	600
TMR 3-4819WIRzzzzzzzz	18 ~ 75	9	333
TMR 3-4812WIRzzzzzzzz	18 ~ 75	12	250
TMR 3-4813WIRzzzzzzzz	18 ~ 75	15	200
TMR 3-4815WIRzzzzzzzz	18 ~ 75	24	125
TMR 3-4821WIRzzzzzzzz	18 ~ 75	±5	±300
TMR 3-4822WIRzzzzzzzz	18 ~ 75	±12	±125
TMR 3-4823WIRzzzzzzzz	18 ~ 75	±15	±100
TMR 3-7210WIRzzzzzzzz	43 ~ 160	3.3	700
TMR 3-7211WIRzzzzzzzz	43 ~ 160	5	600
TMR 3-7219WIRzzzzzzzz	43 ~ 160	9	333
TMR 3-7212WIRzzzzzzzz	43 ~ 160	12	250
TMR 3-7213WIRzzzzzzzz	43 ~ 160	15	200
TMR 3-7215WIRzzzzzzzz	43 ~ 160	24	125
TMR 3-7221WIRzzzzzzzz	43 ~ 160	±5	±300
TMR 3-7222WIRzzzzzzzz	43 ~ 160	±12	±125
TMR 3-7223WIRzzzzzzzz	43 ~ 160	±15	±100

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Model	Input Range (VDC)	Output Voltage (VDC)	Output Current @Full Load (mA)
TMR 6-2410WIRzzzzzzzz	9 ~ 36	3.3	1500
TMR 6-2411WIRzzzzzzzz	9 ~ 36	5	1200
TMR 6-2419WIRzzzzzzzz	9 ~ 36	9	666
TMR 6-2412WIRzzzzzzzz	9 ~ 36	12	500
TMR 6-2413WIRzzzzzzzz	9 ~ 36	15	400
TMR 6-2415WIRzzzzzzzz	9 ~ 36	24	250
TMR 6-2421WIRzzzzzzzz	9 ~ 36	±5	±600
TMR 6-2422WIRzzzzzzzz	9 ~ 36	±12	±250
TMR 6-2423WIRzzzzzzzz	9 ~ 36	±15	±200
TMR 6-4810WIRzzzzzzzz	18 ~ 75	3.3	1500
TMR 6-4811WIRzzzzzzzz	18 ~ 75	5	1200
TMR 6-4819WIRzzzzzzzz	18 ~ 75	9	666
TMR 6-4812WIRzzzzzzzz	18 ~ 75	12	500
TMR 6-4813WIRzzzzzzzz	18 ~ 75	15	400
TMR 6-4815WIRzzzzzzzz	18 ~ 75	24	250
TMR 6-4821WIRzzzzzzzz	18 ~ 75	±5	±600
TMR 6-4822WIRzzzzzzzz	18 ~ 75	±12	±250
TMR 6-4823WIRzzzzzzzz	18 ~ 75	±15	±200
TMR 6-7210WIRzzzzzzzz	43 ~ 160	3.3	1500
TMR 6-7211WIRzzzzzzzz	43 ~ 160	5	1200
TMR 6-7219WIRzzzzzzzz	43 ~ 160	9	666
TMR 6-7212WIRzzzzzzzz	43 ~ 160	12	500
TMR 6-7213WIRzzzzzzzz	43 ~ 160	15	400
TMR 6-7215WIRzzzzzzzz	43 ~ 160	24	250
TMR 6-7221WIRzzzzzzzz	43 ~ 160	±5	±600
TMR 6-7222WIRzzzzzzzz	43 ~ 160	±12	±250
TMR 6-7223WIRzzzzzzzz	43 ~ 160	±15	±200

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1.2 Details of EUT

Power Supply	: DC 110V ~ 48V
Modes/Function	: Mode 1: TMR 3-4811WIR + Test Board (Class A) Mode 2: TMR 3-4811WIR + Test Board (Class B) Mode 3: TMR 6-4811WIR + Test Board (Class A) Mode 4: TMR 6-4811WIR + Test Board (Class B) Mode 5: TMR 6-7211WIR + Test Board (Class A) Mode 6: TMR 6-7211WIR + Test Board (Class B)
Highest operate description	: <108MHz

1.3 Description of Support Units

PRODUCT	MANUFACTURER	MODEL NO.	SERIAL NO.
Battery	YUASA	SMF55B24L(S)	ST-CLN159
Meter electric	N/A	N/A	N/A
LOAD	N/A	N/A	N/A

Support Equipment Used in Tested Cable

Cable Type	Core	Length	Shielding/Non-shielding
Power Cable	N/A	1.8M	Non-shielding

1.4 Operation Procedure

Mode 1, 2

1. Connect the EUT to LOAD (DC5V, 0.6A, 8.33ohm) and connect to the DC 48V.
2. Start the test.

Mode 3, 4

1. Connect the EUT to LOAD (DC5V, 1.2A, 4.16ohm) and connect to the DC 48V.
2. Start the test.

Mode 5, 6

1. Connect the EUT to LOAD (DC5V, 1.2A, 4.16ohm) and connect to DC 110V power on.
2. Start the test.

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1.5 The worst case of the EUT

EUT will be carried out in the worst case as followings:

Worst Case	
CE	Mode 1 ~ 6
ISN	N/A
RE	Mode 1 ~ 6

1.6 Modification List

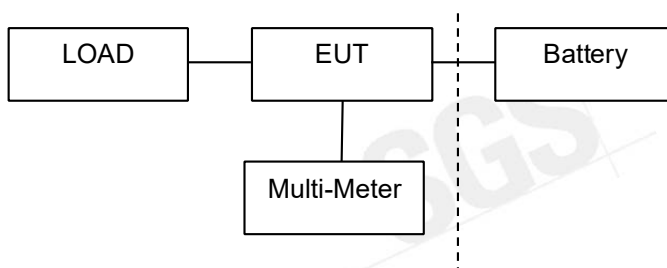
No modification by SGS Taiwan Electronics & Communication Laboratory.

1.7 Configuration of Tested System

Mode 1 ~ 6 (EMI)



Mode 6



1.8 Accessories Cable List

Cable Type	Core	Length	Shielding/Non-shielding
N/A	N/A	N/A	N/A

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1.9 Summary of Results

Highest Emission					
Standard	Test Type	Result	Phase/Pol.	Frequency(MHz)	Margin(dB)
EN 55022 : 2010 (Class A, Class B)	Conducted Emission	Pass	Line	0.2940	-46.70 (QP)
			Neutral	0.2940	-46.12 (QP)
	Radiated Emission	Pass	Ver.	57.6930	-10.03 (QP)

Immunity				
Standard	Test Type	Result	Performance Criteria	Test Judgment
EN 61000-4-2:2009	ESD test	PASS	Criterion B	Meets the requirements of Performance Criterion A
EN 61000-4-3:2006 +A1:2008 +A2:2010	RS test	PASS	Criterion A	Meets the requirements of Performance Criterion A
EN 61000-4-4:2012	EFT test	PASS	Criterion B	Meets the requirements of Performance Criterion A
EN 61000-4-5:2014	Surge test	PASS	Criterion B	Meets the requirements of Performance Criterion A
EN 61000-4-6:2014	CS Test	PASS	Criterion A	Meets the requirements of Performance Criterion A
IEC 61000-4-8:2009	PMF test	PASS	Criterion A	Meets the requirements of Performance Criterion A
IEC 61000-4-11:2004	DIP Test	N/A	Criterion C/C/B	Meets the requirements of Performance Criterion N/A

Remark:

EFT / Surge: Add external components when test.

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2. Radio Disturbance

EN 55022 : 2010

2.1 Test Results

EN 55022 (Class A, Class B)	Result
Conducted Emission	PASS
Radiated Emission	PASS

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2.2 Limit

Maximum permissible level of Line Conducted Emission

	Port	Test specification	Basic standard	Test set-up	Applicability note	Remarks
2.1	Battery power supply (port 10 on Figures A.1-A.5)	150 kHz to 500 kHz 500 kHz to 30 MHz	99 dB μ V peak 93 dB μ V peak	quasi-peak quasi-peak	EN 55016-2-1 EN 55016-2-1	See d
d This requirement refers to the industrial limit values but considering they have been defined to protect radio and TV sets and as the objective is not the same here, the applicable limit for railway applications have been relaxed by 20 dB to be more representative of potential problems.						

Maximum permissible level of Radiated Emission measured at 10 meter

	Port	Frequency range	Limits	Basic standard	Applicability note	Remarks
3.1	Enclosure	30 MHz to 230 MHz 230 MHz to 1 GHz	40 dB μ V/m quasi-peak at 10m 47 dB μ V/m quasi-peak at 10m	The measurement instrumentation shall be as defined in Clause 4 of EN 55016-1-1:2010. The measuring antennas shall be as defined in 4.4 of EN 55016-1-4:2010. The measuring site shall be as described in Clause 5 of EN 55016-1-4:2010. The measurement method shall be as specified in 7.2 of EN 55016-2-3:2010.	See e, f, g, h and k	May be measured at 30 m distance using the limits decreased by 10 dB. As stated in EN 55016-2-3 the antenna height shall be varied between 1 m to 4 m. Additional guidance on the test method can be found in EN 55016-2-3:2010, 7.3 and Clause 8.
3.2	Enclosure	1 GHz to 3 GHz 3 GHz to 6 GHz	76 dB μ V/m peak at 3m 56 dB μ V/m avg. at 3m 80 dB μ V/m peak at 3m 60 dB μ V/m avg. at 3m	The measurement instrumentation shall be as defined in Clauses 5 and 6 of EN 55016-1-1:2010. The measuring antennas shall be as defined in 4.5 of EN 55016-1-4:2010. The measuring site shall be as described in Clause 8 of EN 55016-1-4:2010. The measurement method shall be as specified in 7.3 of EN 55016-2-3:2010.	See f, g, i, j and k	May be measured at greater distances with the limits decreased by 20 dB/decade (relative to distance) For SAC and OATS facilities absorber may be required to achieve free space conditions as defined in EN 55016-1-4.
e Measurement distance is 10 m. A measurement distance of 3 m may be used with the limit increased by 10 dB.						
f Traction converters and auxiliary converters over 50 kVA cannot be tested individually but when the vehicle is tested as a whole in accordance with EN 50121-3-1:2015.						
g For apparatus containing devices operating at frequencies less than 9 kHz, measurements only need to be performed up to 230 MHz.						
h The apparatus is deemed to comply with the enclosure port requirement below 1 GHz if it meets the requirements defined in one or more of the tables of Clauses 1.1, 1.2 or 1.3 in EN 61000-6-4:2007.						
i If the highest internal frequency of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest internal frequency of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest internal frequency of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest internal frequency of the EUT is above 1 GHz, the measurement shall be made up to 6 GHz. Where the highest internal frequency is not known, tests shall be performed up to 6 GHz.						
j The peak detector limits shall not be applied to disturbances produced by arcs or sparks that are high voltage breakdown events. Such disturbances arise when devices contain or control mechanical switches that control current in inductors, or when devices contain or control subsystems that create static electricity (such as paper handling devices). The average limits apply to disturbances from arcs or sparks, and both peak and average limits will apply to other disturbances from such devices.						
k At transitional frequencies, the lower limit applies.						

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2.3 Methods and Procedures

Standard	Edition	Description
EN 55022	2010	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

2.4. Test of Conducted Emission

2.4.1 Test Instruments

SGS Conducted Emission HWAYA Conducted Room No.B EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI 3	101300	2017/11/1	2018/10/31
Coaxial Cable	EMC Instruments Corp.	EMC5D-BM-BM-3000	1401004	2018/5/25	2019/5/24
LISN	TESEQ	NNB 51	36061	2018/2/26	2019/2/25
Pulse Limiter	R&S	ESH3Z2	102099	2018/6/8	2019/6/7
LISN	TESEQ	NNB 51	36062	2018/3/30	2019/3/29
Test S/W	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) Measurement Uncertainty of Conducted Emission Expanded uncertainty Ulab (K=2) of conducted emission is 2.25 dB Theory values uncertainty Ucispr 16-4-2:2011+A1:2014 (K=2) of AC mains Conducted Emission is 3.44dB					

2.4.2 Measurement Level Calculation:

Factor = LISN insertion loss + Cable loss + Pulse Limiter Insertion Loss

Measurement Level = Reading Level + Factor

Over (Margin) = Measurement Level – Limit

2.4.3 EUT Operating Condition

Environment :

Temperature	Humidity
20 °C	48 %RH

Test setup : Please refer to photo of CE testing set-up

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2.4.4 Measurement Data(CE)

Model No.: TMR 3-4811WIR

Mode_1_L

Site: Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_1
Note: (+)

Phase: L1
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

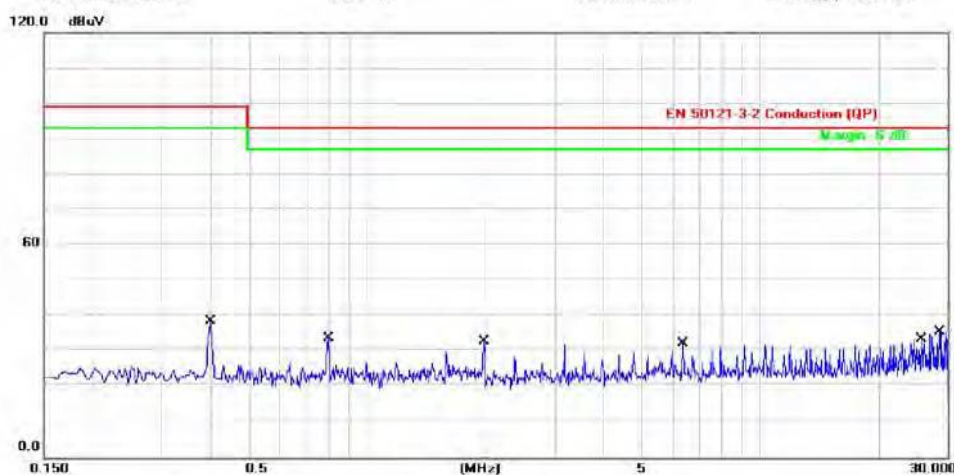
Conducted Emission

File: MH-2018-40142

Data: #6

Date: 2018/5/11

Time: 上午 09:56:45



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3980	18.70	19.96	38.66	99.00	-60.34	QP	
2		0.7980	11.80	19.96	31.76	93.00	-61.24	QP	
3	*	1.9900	12.90	20.55	33.45	93.00	-59.55	QP	
4		6.3660	9.90	20.08	29.98	93.00	-63.02	QP	
5		25.8540	10.50	20.27	30.77	93.00	-62.23	QP	
6		28.6420	6.60	20.35	26.95	93.00	-66.05	QP	

*:Maximum data x:Over limit l:over margin

File: MH-2018-40142\Data: #6

Page: 1

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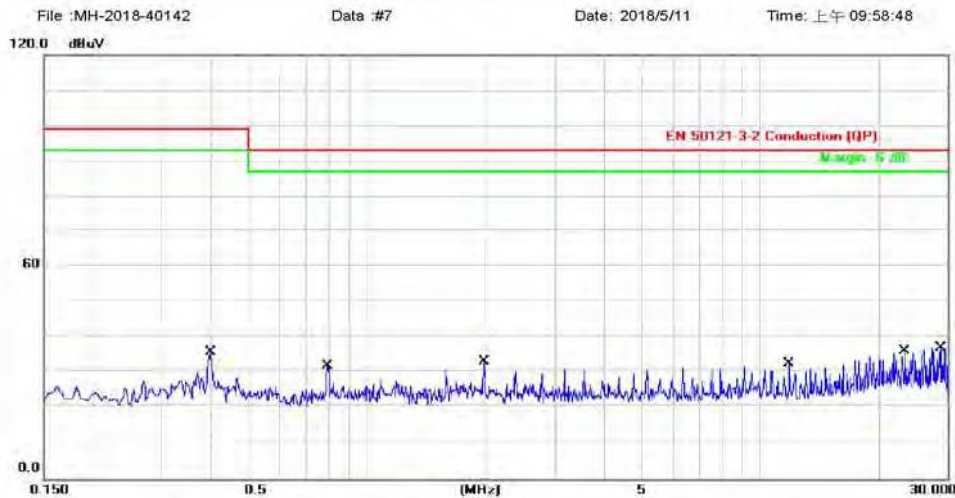
Mode_1_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_1
Note: (-)

Phase: **N**
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.3980	13.30	19.95	33.25	99.00	-65.75	QP	
2		0.7940	12.90	19.95	32.85	93.00	-60.15	QP	
3	*	1.9860	12.80	20.53	33.33	93.00	-59.67	QP	
4		11.9260	5.70	20.06	25.76	93.00	-67.24	QP	
5		23.4500	7.60	20.23	27.83	93.00	-65.17	QP	
6		29.0140	8.30	20.36	28.66	93.00	-64.34	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#7

Page: 1

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Model No.: TMR 3-4811WIR

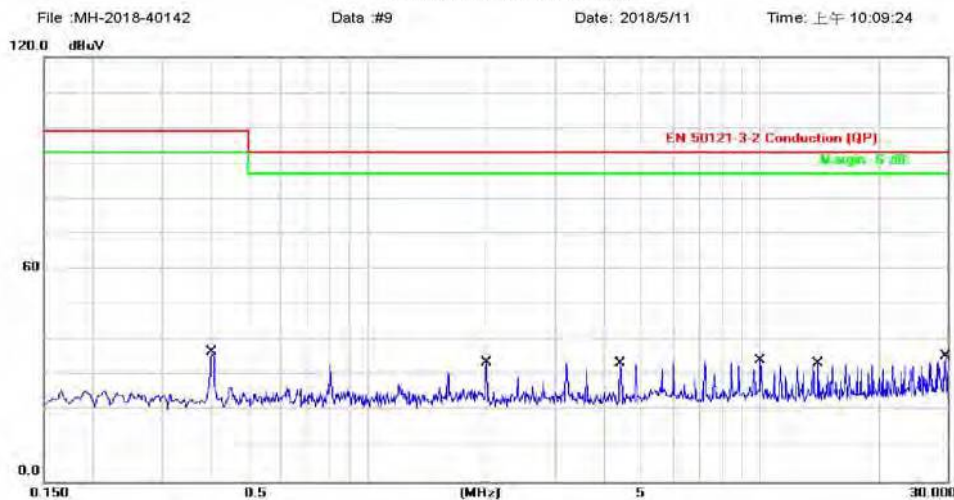
Mode_2_L

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_2
Note: (+)

Phase: L1
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4020	15.76	19.97	35.73	99.00	-63.27	QP	
2		2.0140	12.31	20.56	32.87	93.00	-60.13	QP	
3		4.4300	11.56	20.18	31.74	93.00	-61.26	QP	
4		10.0700	11.76	20.05	31.81	93.00	-61.19	QP	
5		14.0980	10.77	20.08	30.85	93.00	-62.15	QP	
6 *		29.8100	13.14	20.38	33.52	93.00	-59.48	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#9

Page: 1

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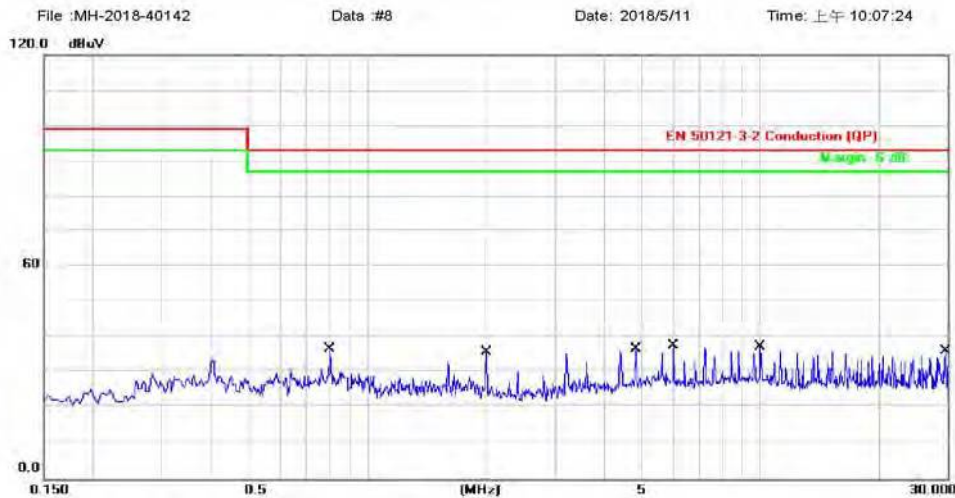
Mode_2_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_2
Note: (-)

Phase: **N**
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.8060	10.54	19.95	30.49	93.00	-62.51	QP	
2		2.0140	12.24	20.54	32.78	93.00	-60.22	QP	
3		4.8340	11.84	20.09	31.93	93.00	-61.07	QP	
4		6.0420	12.68	20.07	32.75	93.00	-60.25	QP	
5		10.0700	11.67	20.04	31.71	93.00	-61.29	QP	
6 *		29.8060	12.87	20.38	33.25	93.00	-59.75	QP	

*:Maximum data x:Over limit !:over margin

File :MH-2018-40142\Data :#8

Page: 1

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Model No.: TMR 6-4811WIR

Mode_3_L

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_3
Note: (+)Phase: L1
Power: DC 48VTemperature: 20 °C
Humidity: 48 %

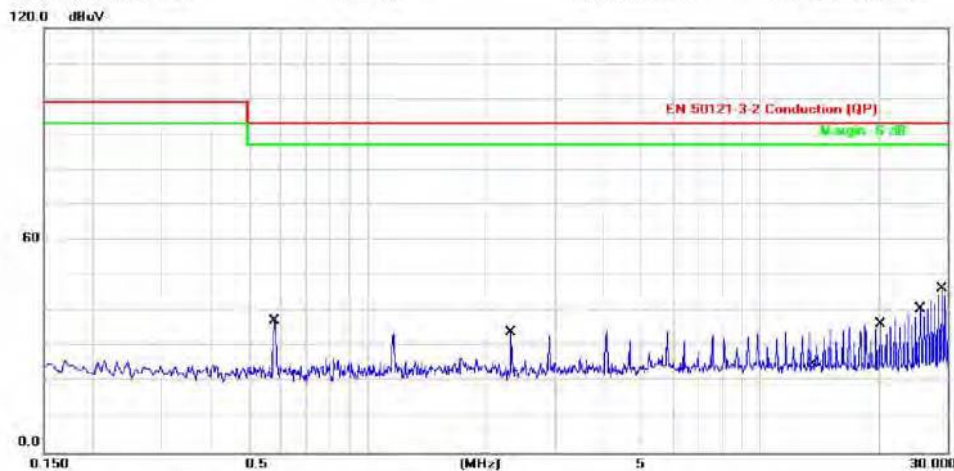
Conducted Emission

File :MH-2018-40142

Data :#10

Date: 2018/5/11

Time: 上午 10:37:25



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.5820	17.80	20.08	37.88	93.00	-55.12	QP	
2		2.3260	14.80	20.50	35.30	93.00	-57.70	QP	
3		13.6000	13.05	20.08	33.13	93.00	-59.87	QP	
4		20.3700	15.60	20.13	35.73	93.00	-57.27	QP	
5		25.6060	19.80	20.27	40.07	93.00	-52.93	QP	
6 *		29.0980	25.30	20.36	45.66	93.00	-47.34	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#10

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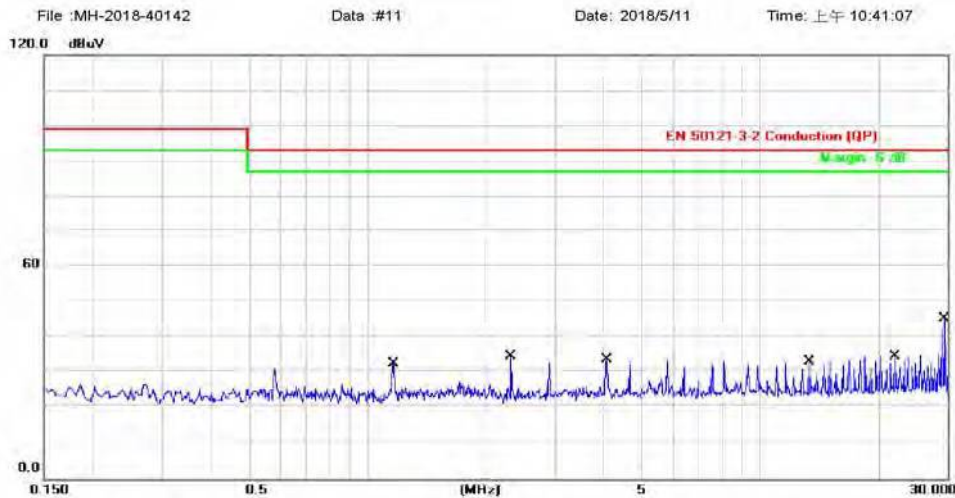
Mode_3_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_3
Note: (-)

Phase: **N**
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		1.1660	14.50	19.95	34.45	93.00	-58.55	QP	
2		2.3260	12.69	20.48	33.17	93.00	-59.83	QP	
3		4.0740	11.81	20.22	32.03	93.00	-60.97	QP	
4		13.3820	13.56	20.08	33.64	93.00	-59.36	QP	
5		22.1100	12.00	20.21	32.21	93.00	-60.79	QP	
6 *		29.6700	26.50	20.38	46.88	93.00	-46.12	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#11

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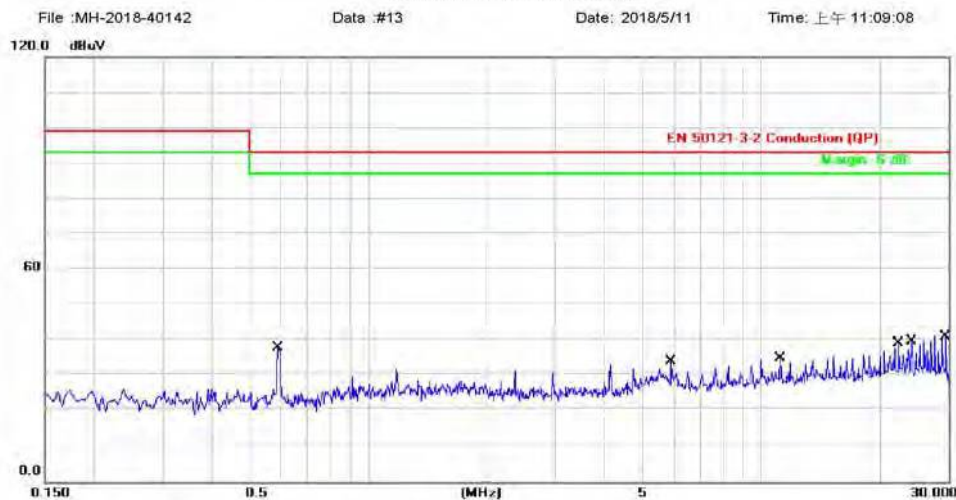
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Model No.: TMR 6-4811WIR

Mode_4_L

Site: Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_4
Note: (+)Phase: L1
Power: DC 48VTemperature: 20 °C
Humidity: 48 %

Conducted Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV	dB	Detector	Comment
1	*	0.5900	16.89	20.08	36.97	93.00	-56.03	QP	
2		5.9100	8.51	20.08	28.59	93.00	-64.41	QP	
3		11.2300	7.17	20.06	27.23	93.00	-65.77	QP	
4		22.4660	10.20	20.18	30.38	93.00	-62.62	QP	
5		24.2380	14.19	20.23	34.42	93.00	-58.58	QP	
6		29.5580	16.33	20.37	36.70	93.00	-56.30	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#13

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Mode_4_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_4
Note: (-)

Phase: **N**
Power: DC 48V

Temperature: 20 °C
Humidity: 48 %

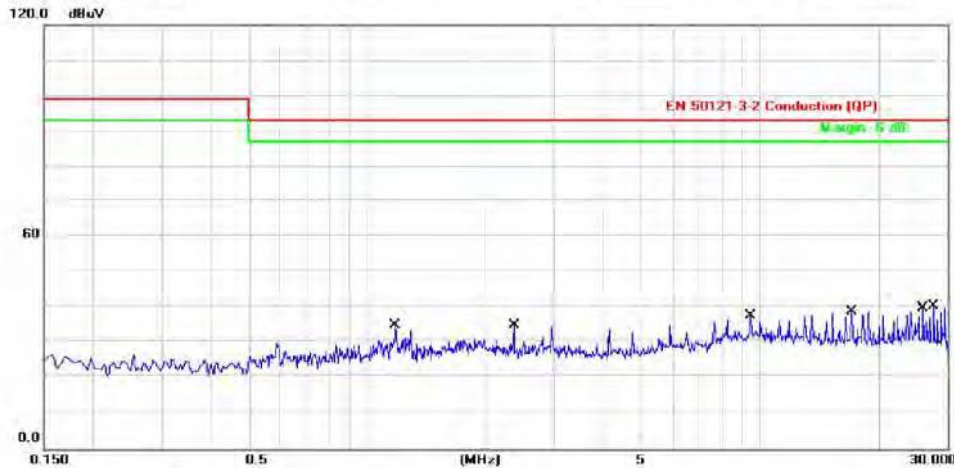
Conducted Emission

File :MH-2018-40142

Data :#12

Date: 2018/5/11

Time: 上午 11:06:14



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		1.1820	8.76	19.96	28.72	93.00	-64.28	QP	
2		2.3660	10.51	20.48	30.99	93.00	-62.01	QP	
3		9.4620	8.22	20.04	28.26	93.00	-64.74	QP	
4		17.1460	9.65	20.13	29.78	93.00	-63.22	QP	
5		26.0140	13.51	20.29	33.80	93.00	-59.20	QP	
6 *		27.7900	14.46	20.33	34.79	93.00	-58.21	QP	

*:Maximum data x:Over limit !:over margin

File :MH-2018-40142\Data :#12

Page: 1

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Model No.: TMR 6-7211WIR

Mode_5_L

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_5
Note: (+)

Phase: L1
Power: DC 110V

Temperature: 20 °C
Humidity: 48 %

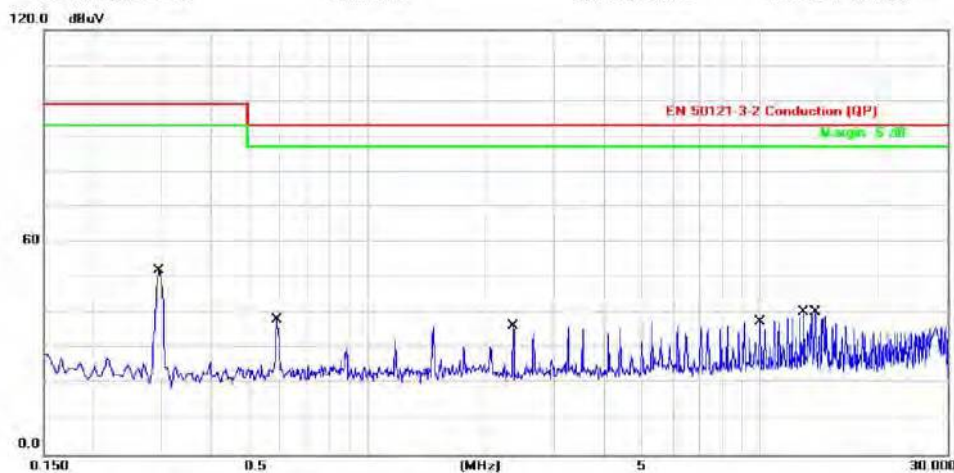
Conducted Emission

File :MH-2018-40142

Data :#14

Date: 2018/5/11

Time: 上午 11:42:38



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.2940	32.50	19.80	52.30	99.00	-46.70	QP	
2		0.5900	16.80	20.08	36.88	93.00	-56.12	QP	
3		2.3580	16.60	20.50	37.10	93.00	-55.90	QP	
4		10.0220	17.30	20.05	37.35	93.00	-55.65	QP	
5		12.9740	16.60	20.07	36.67	93.00	-56.33	QP	
6		13.8500	15.00	20.08	35.08	93.00	-57.92	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#14

Page: 1

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Mode_5_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_5
Note: (-)

Phase: **N**
Power: DC 110V

Temperature: 20 °C
Humidity: 48 %

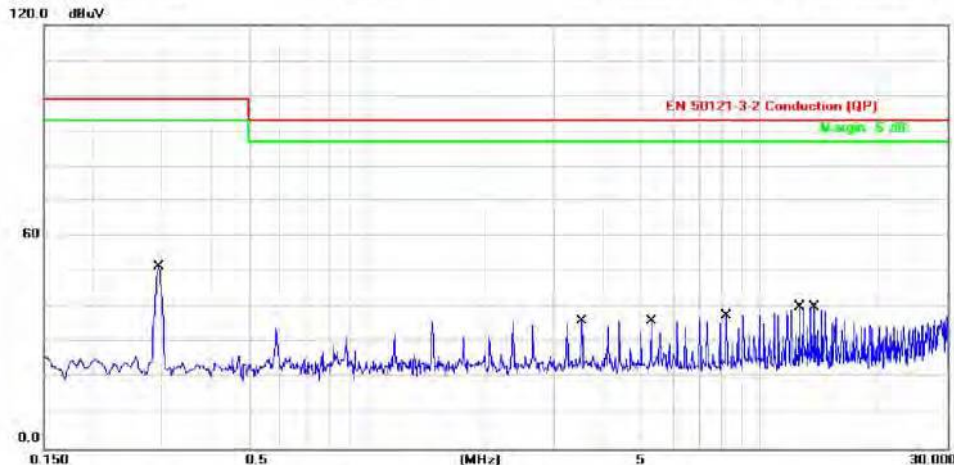
Conducted Emission

File :MH-2018-40142

Data :#15

Date: 2018/5/11

Time: 上午 11:45:47



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.2940	31.07	19.78	50.85	99.00	-48.15	QP	
2		3.5220	16.52	20.31	36.83	93.00	-56.17	QP	
3		5.2820	14.63	20.07	34.70	93.00	-58.30	QP	
4		8.2180	14.69	20.06	34.75	93.00	-58.25	QP	
5		12.6220	17.90	20.07	37.97	93.00	-55.03	QP	
6		13.7940	16.33	20.09	36.42	93.00	-56.58	QP	

*:Maximum data x:Over limit !:over margin

File :MH-2018-40142\Data :#15

Page: 1

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Model No.: TMR 6-7211WIR

Mode_6_L

Site: Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_6
Note: (+)Phase: L1
Power: DC 110VTemperature: 20 °C
Humidity: 48 %

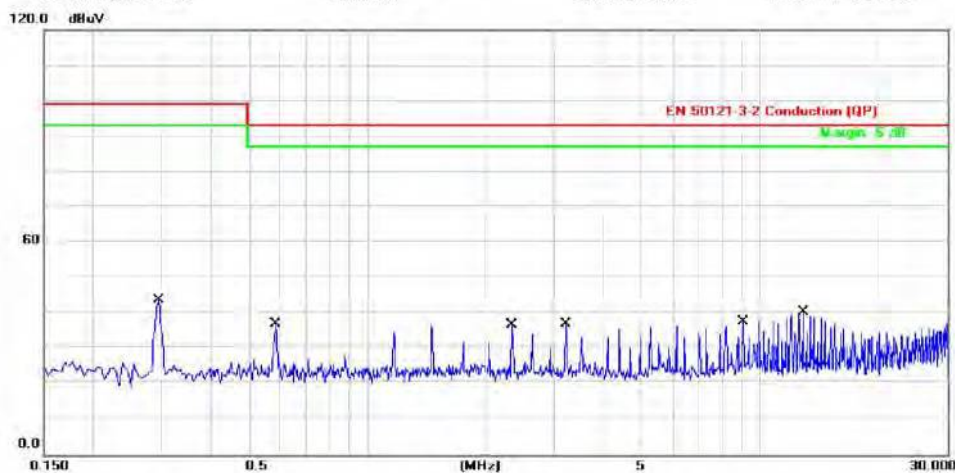
Conducted Emission

File :MH-2018-40142

Data :#17

Date: 2018/5/11

Time: 下午 12:14:33



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.2940	28.48	19.80	48.28	99.00	-50.72	QP	
2		0.5860	15.58	20.08	35.66	93.00	-57.34	QP	
3		2.3420	15.53	20.50	36.03	93.00	-56.97	QP	
4		3.2180	16.04	20.37	36.41	93.00	-56.59	QP	
5		9.0700	16.38	20.06	36.44	93.00	-56.56	QP	
6		12.8740	19.56	20.07	39.63	93.00	-53.37	QP	

*:Maximum data x:Over limit !:over margin

File :MH-2018-40142\Data :#17

Page: 1

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Mode_6_N

Site : Conduction Room
Limit: EN 50121-3-2 Conduction (QP)
Mode: Mode_6
Note: (-)

Phase: **N**
Power: DC 110V

Temperature: 20 °C
Humidity: 48 %

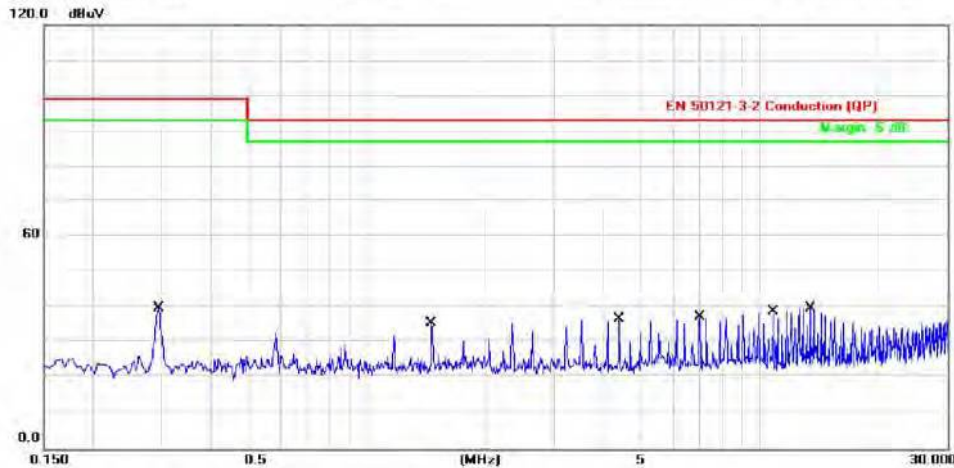
Conducted Emission

File :MH-2018-40142

Data :#16

Date: 2018/5/11

Time: 下午 12:12:50



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.2940	24.41	19.78	44.19	99.00	-54.81	QP	
2		1.4620	16.03	20.15	36.18	93.00	-56.82	QP	
3		4.3900	15.55	20.17	35.72	93.00	-57.28	QP	
4		7.0260	17.92	20.06	37.98	93.00	-55.02	QP	
5		10.8300	16.96	20.05	37.01	93.00	-55.99	QP	
6 *		13.4660	19.14	20.08	39.22	93.00	-53.78	QP	

*:Maximum data x:Over limit !:over margin

File :MH-2018-40142\Data :#16

Page: 1

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2.5 Test of Radiated Emission

2.5.1 Test Instruments

SGS Radiated Below 1GHz HWAYA 10m EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI 7	100950	2017/12/12	2018/12/11
EMI Test Receiver	R&S	ESCI 3	101343	2018/1/31	2019/1/30
Broadband Antenna	SCHWAZBECK	VULB9168	9168-628	2017/9/8	2018/9/7
Broadband Antenna	SCHWAZBECK	VULB9168	9168-629	2017/9/12	2018/9/11
Pre Amplifier	EMC Instruments Corp.	EMC330	980178	2018/3/31	2019/3/30
Pre Amplifier	EMC Instruments Corp.	EMC330	980179	2018/3/31	2019/3/30
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150917	2017/9/18	2018/9/17
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150919	2017/9/18	2018/9/17
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150820	2017/9/18	2018/9/17
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150918	2017/9/18	2018/9/17
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150821	2017/9/18	2018/9/17
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM	150822	2017/9/18	2018/9/17
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Controller	MF	MF-7802	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Antenna Master	MF	N/A	N/A	N.C.R.	N.C.R.
Turn Table	MF	N/A	N/A	N.C.R.	N.C.R.
Site NSA	Chance Most	10M Chamber	10M SAC	2017/12/31	2018/12/30
Test S/W	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R.	N.C.R.

SGS Taiwan LTD. Electronics & Communication Laboratory
 No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
 Measurement Uncertainty of Radiated Emission
 Expanded uncertainty U_{lab} (K=2) of radiated emission is 4.09 dB. (30MHz ~ 1000MHz)
 Theory values uncertainty U_{cispr} 16-4-2:2011+A1:2014 (K=2) of radiated emission is 5.22 dB. (30MHz ~ 1000MHz)

2.5.2 Measurement Level Calculation:

Factor = Antenna Factor + Cable Loss – Amplifier Gain

Measurement Level = Reading Level + Factor

Over (Margin) = Measurement Level – Limit

2.5.3 EUT Operating Condition

Environment :

Temperature	Humidity
20 °C	52 %RH

Test setup : Please refer to photo of RE testing set-up

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2.5.4 Measurement Data

Model No.: TMR 3-4811WIR

Mode_1_H

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_1
Note: [REDACTED] Test Board(Class A)

Polarization: **Horizontal**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB/m	dBuV/m	dBuV/m	dB		
1		39.7000	24.02	-11.62	12.40	40.00	-27.60	QP	
2		65.8900	27.09	-13.06	14.03	40.00	-25.97	QP	
3		159.9800	24.00	-11.40	12.60	40.00	-27.40	QP	
4		867.1100	23.45	0.60	24.05	47.00	-22.95	QP	
5		940.8300	23.36	1.78	25.14	47.00	-21.86	QP	
6	*	976.7200	23.51	1.73	25.24	47.00	-21.76	QP	

*:Maximum data x:Over limit |:over margin

File: MH-2018-40142\Data: #20

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Mode_1_V

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_1
Note: [REDACTED] Test Board(Class A)

Polarization: **Vertical**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		32.0800	30.82	-12.23	18.59	40.00	-21.41	QP	
2	*	64.3500	38.57	-12.46	26.11	40.00	-13.89	QP	
3		159.0100	23.02	-10.79	12.23	40.00	-27.77	QP	
4		879.7200	22.41	0.66	23.07	47.00	-23.93	QP	
5		973.8100	22.62	1.60	24.22	47.00	-22.78	QP	
6		983.5100	22.61	1.64	24.25	47.00	-22.75	QP	

*: Maximum data x: Over limit !: over margin

File: MH-2018-40142\Data: #19

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Model No.: TMR 3-4811WIR
Mode_2_H

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_2
Note: [REDACTED] Test Board(Class B)
Battery on the test-table

Polarization: **Horizontal**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measurement dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		41.6400	23.97	-11.45	12.52	40.00	-27.48	QP	
2		159.0100	23.82	-11.38	12.44	40.00	-27.56	QP	
3		739.0700	23.16	-0.92	22.24	47.00	-24.76	QP	
4		827.3400	24.53	0.22	24.75	47.00	-22.25	QP	
5		893.3000	23.45	0.76	24.21	47.00	-22.79	QP	
6 *		963.1400	23.54	1.87	25.41	47.00	-21.59	QP	

*: Maximum data x: Over limit l: over margin

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Mode_2_V

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_2
Note: [REDACTED] Test Board(Class B)
Battery on the test-table

Polarization: **Vertical**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB/m	dBuV/m	dBuV/m	dB		
1		48.4300	24.08	-10.77	13.31	40.00	-26.69	QP	
2		159.9800	24.27	-10.80	13.47	40.00	-26.53	QP	
3		745.8600	22.90	-0.86	22.04	47.00	-24.96	QP	
4		808.9100	23.01	0.25	23.26	47.00	-23.74	QP	
5		928.2200	23.02	1.32	24.34	47.00	-22.66	QP	
6	*	999.0300	23.81	1.70	25.51	47.00	-21.49	QP	

*: Maximum data x: Over limit !: over margin

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Model No.: TMR 6-4811WIR

Mode_3_H

Site: SGS 10m Chamber

Limit: EN50121-3-2

Mode: Mode_3

Note: [REDACTED] Test Board(Class A)

Polarization: **Horizontal**

Power: DC 48V

Distance: 10m

Temperature: 20 °C

Humidity: 52 %

Radiated Emission

File :MH-2018-40142

Data :#24

Date: 2018/5/3

Time: 下午 11:16:31



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB/m	dBuV/m	dBuV/m	dB		
1		33.6400	23.42	-12.19	11.23	40.00	-28.77	QP	
2		61.0400	23.99	-12.19	11.80	40.00	-28.20	QP	
3		163.8600	24.05	-11.32	12.73	40.00	-27.27	QP	
4		845.7700	23.58	0.45	24.03	47.00	-22.97	QP	
5		890.3900	24.33	0.74	25.07	47.00	-21.93	QP	
6 *		969.9300	23.64	1.80	25.44	47.00	-21.56	QP	

*:Maximum data x:Over limit l:over margin

File :MH-2018-40142\Data :#24

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Mode_3_V

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_3
Note: [REDACTED] Test Board(Class A)

Polarization: **Vertical**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB/m	dBuV/m	dBuV/m	dB		
1		34.3640	36.43	-12.05	24.38	40.00	-15.62	QP	
2	*	57.6930	41.28	-11.31	29.97	40.00	-10.03	QP	
3		114.1500	29.61	-13.87	15.74	40.00	-24.26	QP	
4		807.9400	22.63	0.26	22.89	47.00	-24.11	QP	
5		968.9600	22.53	1.58	24.11	47.00	-22.89	QP	
6		987.3900	22.64	1.64	24.28	47.00	-22.72	QP	

*: Maximum data x: Over limit !: over margin

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Model No.: TMR 6-4811WIR
Mode_4_H

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_4
Note: [REDACTED] Test Board(Class B)
Battery on the test-table

Polarization: **Horizontal**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV		dBuV/m	dBuV/m	dB		
1		59.1000	23.60	-11.92	11.68	40.00	-28.32	QP	
2		161.9200	24.15	-11.36	12.79	40.00	-27.21	QP	
3		843.8300	23.51	0.43	23.94	47.00	-23.06	QP	
4		870.9900	23.50	0.63	24.13	47.00	-22.87	QP	
5		935.0100	23.48	1.64	25.12	47.00	-21.88	QP	
6 *		967.9900	23.67	1.82	25.49	47.00	-21.51	QP	

*: Maximum data x: Over limit |: over margin

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Mode_4_V

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_4
Note: [REDACTED] Test Board(Class B)
Battery on the test-table

Polarization: **Vertical**
Power: DC 48V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		53.2800	24.32	-10.97	13.35	40.00	-26.65	QP	
2	*	79.8900	35.65	-15.77	19.88	40.00	-20.12	QP	
3		155.1300	24.13	-10.75	13.38	40.00	-26.62	QP	
4		871.9600	22.90	0.48	23.38	47.00	-23.62	QP	
5		933.0700	23.07	1.37	24.44	47.00	-22.56	QP	
6		957.3200	22.96	1.52	24.48	47.00	-22.52	QP	

*: Maximum data x: Over limit | : over margin

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Model No.: TMR 6-7211WIR
Mode_5_H

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_5
Note: [REDACTED] Test Board(Class A)

Polarization: **Horizontal**
Power: DC 110V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
1		53.2800	23.82	-11.40	12.42	40.00	-27.58	QP	
2		163.8600	23.77	-11.32	12.45	40.00	-27.55	QP	
3		263.7700	26.99	-11.68	15.31	47.00	-31.69	QP	
4		404.4200	22.90	-7.49	15.41	47.00	-31.59	QP	
5		498.5100	22.70	-5.13	17.57	47.00	-29.43	QP	
6 *		635.2800	22.75	-2.94	19.81	47.00	-27.19	QP	

*: Maximum data x: Over limit |: over margin

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Mode_5_V

Site: SGS 10m Chamber
Limit: EN50121-3-2
Mode: Mode_5
Note: [REDACTED] Test Board(Class A)

Polarization: **Vertical**
Power: DC 110V
Distance: 10m

Temperature: 20 °C
Humidity: 52 %

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB/m	dBuV/m	dBuV/m	dB		
1		31.9400	26.23	-12.24	13.99	40.00	-26.01	QP	
2		47.4600	26.07	-10.81	15.26	40.00	-24.74	QP	
3	*	69.7700	36.82	-13.65	23.17	40.00	-16.83	QP	
4		91.1100	30.78	-17.07	13.71	40.00	-26.29	QP	
5		151.2500	26.30	-10.71	15.59	40.00	-24.41	QP	
6		266.6800	31.72	-11.67	20.05	47.00	-26.95	QP	

*: Maximum data x: Over limit !: over margin

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Model No.: TMR 6-7211WIR
Mode_6_H

Site: SGS 10m Chamber Polarization: **Horizontal** Temperature: 20 °C
Limit: EN50121-3-2 Power: DC 110V Humidity: 52 %
Mode: Mode_6 Distance: 10m
Note: [REDACTED] Test Board(Class B)
Battery on the test-table

Radiated Emission



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	dBuV	Factor	ment	dBuV/m	dB	Detector	Comment
1		50.3700	23.61	-11.14	12.47	40.00	-27.53	QP	
2		145.4300	24.10	-11.48	12.62	40.00	-27.38	QP	
3 *		247.2800	37.81	-12.26	25.55	47.00	-21.45	QP	
4		855.4700	23.57	0.53	24.10	47.00	-22.90	QP	
5		918.5200	23.46	1.25	24.71	47.00	-22.29	QP	
6		976.7200	23.58	1.73	25.31	47.00	-21.69	QP	

*: Maximum data x: Over limit |: over margin

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Mode_6_V

Site: SGS 10m Chamber

Limit: EN50121-3-2

Mode: Mode_6

Note: [REDACTED] Test Board(Class B)
Battery on the test-tablePolarization: **Vertical**

Power: DC 110V

Distance: 10m

Temperature: 20 °C

Humidity: 52 %

Radiated Emission

File: MH-2018-40142

Data: #29

Date: 2018/5/24

Time: 上午 12:27:39



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		69.7700	28.06	-13.65	14.41	40.00	-25.59	QP	
2		152.2200	24.29	-10.72	13.57	40.00	-26.43	QP	
3		246.3100	32.21	-12.35	19.86	47.00	-27.14	QP	
4		791.4500	22.91	0.12	23.03	47.00	-23.97	QP	
5		927.2500	23.08	1.32	24.40	47.00	-22.60	QP	
6 *		995.1500	22.90	1.68	24.58	47.00	-22.42	QP	

*: Maximum data x: Over limit |: over margin

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3.IMMUNITY

EN 50121-3-2 : 2016

3.1 Test Results

Test Standard	Performance Criteria	Result
EN 61000-4-2:2009	B	PASS
EN 61000-4-3:2006+A1:2008+A2:2010	A	PASS
EN 61000-4-4:2012	B	PASS
EN 61000-4-5:2014	B	PASS
EN 61000-4-6:2014	A	PASS
IEC 61000-4-8:2009	A	PASS
IEC 61000-4-11:2004	C/C/B	N/A

3.2 Performance Criteria Description

Performance 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. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance 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. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C: Temporary loss of function is allowed, provided the function is selfrecoverable or can be restored by the operation of the controls.

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3.3 Test of EN 61000-4-2

3.3.1 Methods and Procedures

Standard	Edition	Description
EN 61000-4-2	2009	Electrostatic Discharge (ESD)

3.3.2 Test Instruments

SGS ESD EN61000-4-2 HwaYa No.2 EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
ESD Simulator	Thermo	MiniZap	612312	2018/6/22	2019/6/21
HCP	N/A	1.6 x 0.8 m	N/A	N.C.R.	N.C.R.
VCP	N/A	0.5 x 0.5 m	N/A	N.C.R.	N.C.R.
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)					

3.3.4 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of ESD testing set-up

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3.3.5 Results of Electrostatic Discharge Test (ESD)

Model No.:TMR 6-7211WIR

Test Mode	: Mode 6
Basic Standard	: EN 61000-4-2
Discharge Impedance	: 330 ohm / 150 pF
Discharge Voltage	: Air Discharge : $\pm 2, 4, 8$ kV Contact Discharge : $\pm 2, 4, 6$ kV HCP/VCP : $\pm 2, 4, 6$ kV
Polarity	: Positive/Negative
Number of Discharge	: 10 times at each test point
Discharge Mode	: Single Discharge
Discharge Period	: 1 second

A. Observations :

Test points: N/A

Direct Application			Test Results	
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge
2, 4, 8(Air.)	+/-	N/A	N/A	A*
2, 4, 6(Cont.)	+/-	N/A	A*	N/A

Remark: A : No degradation of performance or loss of function.

*No any discharge events occurred on the test.

N/A : Not Applicable.

B. Observations :

Test points: 1. Front side. 2. Rear side. 3. Left side. 4. Right side.

Indirect Application			Test Results	
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling	Vertical Coupling
2, 4, 6	+/-	1~4	A	A

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

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3.4 Test of EN 61000-4-3

3.4.1 Methods and Procedures

Standard	Edition	Description
EN 61000-4-3	2006+A1:2008 +A2:2010	Radio-Frequency Electromagnetic Field Susceptibility Test, RS

3.4.2 Test Instruments

SGS RS EN61000-4-3 HWAYA SAC-F EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Semi Anechoic Chamber RS 16 grid points	Chance Most	8x5X3	SAC-F	2018/4/7	2019/4/6
Signal Generator	R&S	SMJ 100A	101258	2017/9/7	2018/9/6
Power Sensor	R&S	NRP-Z11	112186	2018/3/27	2019/3/26
Power Sensor	R&S	NRP-Z11	111682	2018/4/10	2019/4/9
Power Amplifier	R&S	BBA100	101075	N.C.R.	N.C.R.
Power Amplifier	R&S	BBA100	101021	N.C.R.	N.C.R.
Power Amplifier	R&S	BBA150	102229	N.C.R.	N.C.R.
High Gain Log-Periodic Antenna	R&S	HL046E	100112	N.C.R.	N.C.R.
Calibrated Broadband Log-Per. Test-Antenna	SCHWARZBECK	STLP 9149	9149-151	N.C.R.	N.C.R.
EMC Field Probes	Narda	NBM-550	F-0375	2018/2/22	2019/2/21
Test Software	R&S	EMC 32	V10.20.01	N.C.R.	N.C.R.
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)					

3.4.3 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of RS testing set-up

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3.4.4 Results of Radiated Radio Frequency Electromagnetic (RS)

Model No.:TMR 6-7211WIR

Test Mode : Mode 6
 Basic Standard : EN 61000-4-3
 Frequency range : 80 MHz - 1000 MHz, 1400 MHz - 2000 MHz,
 2000 MHz - 2700 MHz, 5100MHz - 6000 MHz
 Field strength : 20 V/m
 Modulation : 80% AM , 1KHz Sinewave
 Frequency step : 1 % of fundamental
 Polarity of Antenna : Horizontal and Vertical
 Dwell Time : 3 seconds
 Test distance : 3 m

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
1	80 - 1000	Vertical/Horizontal	A	0 degree
2	80 - 1000	Vertical/Horizontal	A	90 degree
3	80 - 1000	Vertical/Horizontal	A	180 degree
4	80 - 1000	Vertical/Horizontal	A	270 degree

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
5	1400 - 2000	Vertical/Horizontal	A	0 degree
6	1400 - 2000	Vertical/Horizontal	A	90 degree
7	1400 - 2000	Vertical/Horizontal	A	180 degree
8	1400 - 2000	Vertical/Horizontal	A	270 degree

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
9	2000 - 2700	Vertical/Horizontal	A	0 degree
10	2000 - 2700	Vertical/Horizontal	A	90 degree
11	2000 - 2700	Vertical/Horizontal	A	180 degree
12	2000 - 2700	Vertical/Horizontal	A	270 degree

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
10	5100 - 6000	Vertical/Horizontal	A	0 degree
11	5100 - 6000	Vertical/Horizontal	A	90 degree
12	5100 - 6000	Vertical/Horizontal	A	180 degree
13	5100 - 6000	Vertical/Horizontal	A	270 degree

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

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3.5 Test of EN 61000-4-4

3.5.1 Methods and Procedures

Standard	Edition	Description
EN 61000-4-4	2012	Electrical fast transient/burst requirements

3.5.2 Test Instruments

SGS EFT EN61000-4-4 HwaYa No.2 EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Burst Generator	TESEQ	NSG3060	1763	2018/5/7	2019/5/6
EFT Clamp	Thermo	CCL	612359	2017/12/21	2018/12/20
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)					

3.5.3 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of EFT testing set-up

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3.5.4 Results of Electrical Fast Transient (EFT)

Model No.:TMR 6-7211WIR

Test Mode : Mode 6
Basic Standard : EN 61000-4-4
Test Voltage : AC Input/Output : ± 1 kV,
DC Input/Output : ± 2 kV, Signal port : ± 0.5 kV
Signal/Comm. : ± 0.5 kV
Polarity : Positive/Negative
Impulse Frequency : 5 kHz
Tr/Tn : 5/50ns
Burst : 15ms/300ms

Observation :

Test Point	Polarity	Test Level (kV)	Results
L	+/-	1	N/A
N	+/-	1	N/A
L-N	+/-	1	N/A
L-N-PE	+/-	1	N/A
DC Input	+/-	2	A
Signal/Comm.	+/-	0.5	N/A

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

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3.6 Test of EN 61000-4-5

3.6.1 Methods and Procedures

Standard	Edition	Description
EN 61000-4-5	2014	Surge immunity test

3.6.2 Test Instruments

SGS Surge EN61000-4-5 HwaYa No.2 EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Surge Tester	TESEQ	NSG3060	1763	2018/5/7	2019/5/6
Surge Tester	TESEQ	NSG3060	1976	2018/5/7	2019/5/6
Surge Tester	TESEQ	CDN3061	1541	2018/5/7	2019/5/6
Universal Surge CDN	EMC Partner	CDN-UTP8	CDN-UTP8-1502	2018/5/8	2019/5/7
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3.6.3 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of SURGE testing set-up

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3.6.5 Results of Surge Test

Model No.: TMR 6-7211WIR

Test Mode : Mode 6

Test Rate : 1 pulse every minute

No. of Tests : 5 positive and 5 negative pulses

Observation Description

AC input line:

Test Point	Phase Angle (degree)	Polarity (+/-)	Test Level (kV)	Observation
L – N	0, 90, 180, 270	+/-	1	N/A
L – PE	0, 90, 180, 270	+/-	2	N/A
N – PE	0, 90, 180, 270	+/-	2	N/A

Remark: N/A : Not Applicable.

DC input line:

Test Point	Phase Angle (degree)	Polarity (+/-)	Test Level (kV)	Observation
DC input	No phase angle (degree)	+/-	2	A

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

Signal line:

Test Rate : 1 pulse every minute

No. of Tests : 5 positive and 5 negative pulses

Waveform : 10/700 μ s

Observation Description

Signal line:

Test Point	Phase Angle (degree)	Polarity (+/-)	Test Level (kV)	Observation
Signal I/O	No phase angle (degree)	+/-	1	N/A

Remark: N/A : Not Applicable.

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3.7 Test of EN 61000-4-6

3.7.1 Methods and Procedures

Standard	Edition	Description
EN 61000-4-6	2014	Immunity to conducted disturbances, induced by radio-frequency fields.

3.7.2 Test Instruments

SGS CS EN61000-4-6 HWAYA SR-D EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Signal Generator	R&S	SMC100A	102920	2018/5/14	2019/5/13
Power Sensor	R&S	NRVD	837794/029	2017/8/10	2018/8/9
Power Sensor	R&S	URV5-Z2	835640/015	2017/8/10	2018/8/9
Power Sensor	R&S	URV5-Z2	835640/016	2017/8/10	2018/8/9
Dual Directional Coupler	OSR	C21A8	33	N.C.R.	N.C.R.
Conducted Immunity System	Frankonia	CIT-10	102D3226	N.C.R.	N.C.R.
CDN	TESEQ	CDN M016	35853	2018/1/31	2019/1/30
CDN	TESEQ	CDN M116	37673	2018/4/26	2019/4/25
CDN	TESEQ	CDN ST08A	30191	2018/2/14	2019/2/13
Test Software	ar	emcware	V3.4.0	N.C.R.	N.C.R.
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3.7.3 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of CS testing set-up

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3.7.4 Results of Immunity to Conducted Disturbances (CS)

Model No.:TMR 6-7211WIR

Test Mode : Mode 6
Basic Standard : EN 61000-4-6
Frequency range : 0.15 MHz - 80 MHz
Field strength : 10 V/rms
Modulation : 80% AM, 1 kHz Sinewave
Frequency step : 1 % of fundamental
Dwell Time : 3 seconds
Coupling Method : CDN 2 Lines

Cable Description	Frequency (MHz)	Observation
AC input	0.15 – 80	N/A
DC input	0.15 – 80	A

Signal Ports

Cable Description	Frequency (MHz)	Observation
Signal/Comm.	0.15 – 80	N/A

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

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3.8 Test of IEC 61000-4-8

3.8.1 Methods and Procedures

Standard	Edition	Description
IEC 61000-4-8	2009	Power Frequency Magnetic Field Immunity Test

3.8.2 Test Instruments

SGS PFMF EN61000-4-8 HWAYA EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
Magnetic Field Generator	Narda S.T.S.	PMM 1008	0100X30601	2017/11/21	2018/11/20
AC CLAMP METER	CHAUVIN ARNOUX	96	12002769	2017/9/4	2018/9/3
Triax Elf Magnetic Field Meter	F.W. BELL	4180	1248004	2017/7/20	2018/7/19
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)					

3.8.3 EUT Operating Condition

Environment :

Temperature	Humidity
21 °C	45 %RH

Test setup : Please refer to photo of PMF testing set-up

3.8.4 Result of Immunity to power Frequency Magnetic

Model No.: TMR 6-7211WIR

Test Mode : Mode 6
 Basic Standard : IEC 61000-4-8 : 2009
 Power Frequency : 50/60 Hz
 Magnetic Field : 100 A/m(r.m.s), 1000 A/m(r.m.s)
 Coil Orientation : X, Y, Z Axis
 Observation : A

Remark: A : No degradation of performance or loss of function.

N/A : Not Applicable.

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3.9 Test of IEC 61000-4-11

3.9.1 Methods and Procedures

Standard	Edition	Description
IEC 61000-4-11	2004	Voltage dips, short interruptions and voltage variations immunity tests

3.9.2 Test Instruments

SGS DIP EN61000-4-11 HwaYa No.2 EMC					
EQUIPMENT TYPE	Manufacturer	Model Number	Serial Number	Calibration Date	Calibration Due
EMS Multi-Tester	TESEQ	INA 6502	209	2018/5/7	2019/5/6
EMS Multi-Tester	TESEQ	NSG3060	1763	2018/5/7	2019/5/6
SGS Taiwan LTD. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)					

3.9.3 EUT Operating Condition

Environment :

Temperature	Humidity
N/A °C	N/A %RH

Test setup : Please refer to photo of DIP testing set-up

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3.9.4 Results of Voltage Dips Immunity Test

Test Mode : N/A
EUT Rated Voltage : 230 Volts.
Reduction Voltage : 30, >95 % Ut
Phase Angle : 0, 180 degree
Total events : 3 dropouts
Event interval : 10 seconds

Environmental phenomena	Test specification (% reduction)	Duration (in periods of the rated frequency)	Observation
Voltage Interruptions	>95	250	N/A
Voltage dips	>95	0.5	N/A
	30	25	N/A

Remark: N/A : Not Applicable.

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Photograph of Testing General Set-up

CE Testing Set-up

Model No.: TMR 3-4811WIR

Mode_1_+



Mode_1_-



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Mode_2_+



Mode_2_-



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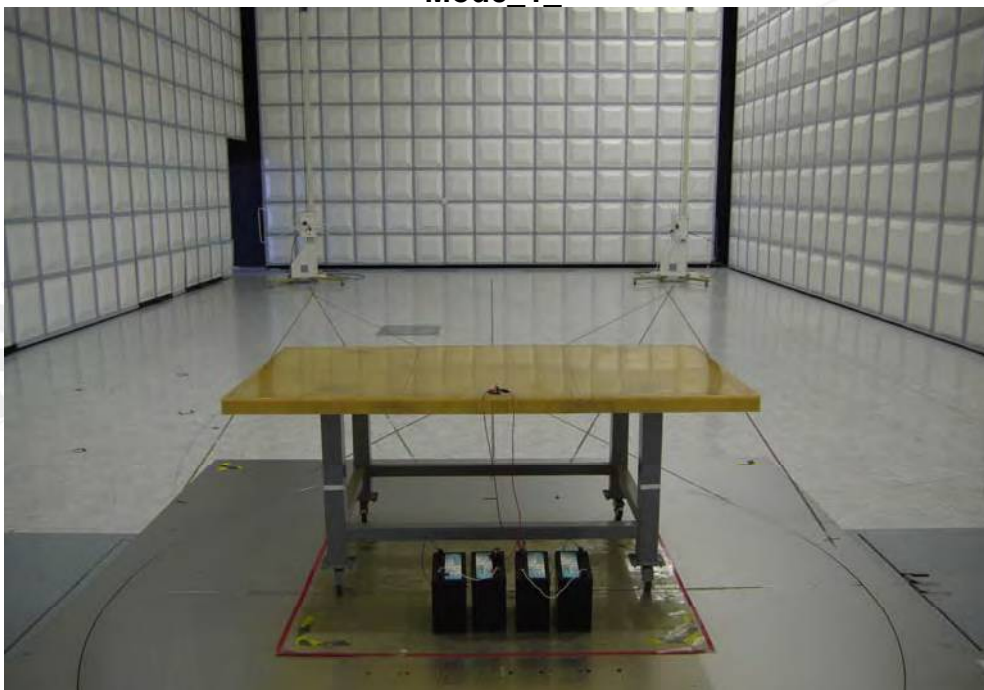
RE Testing Set-up Below 1GHz

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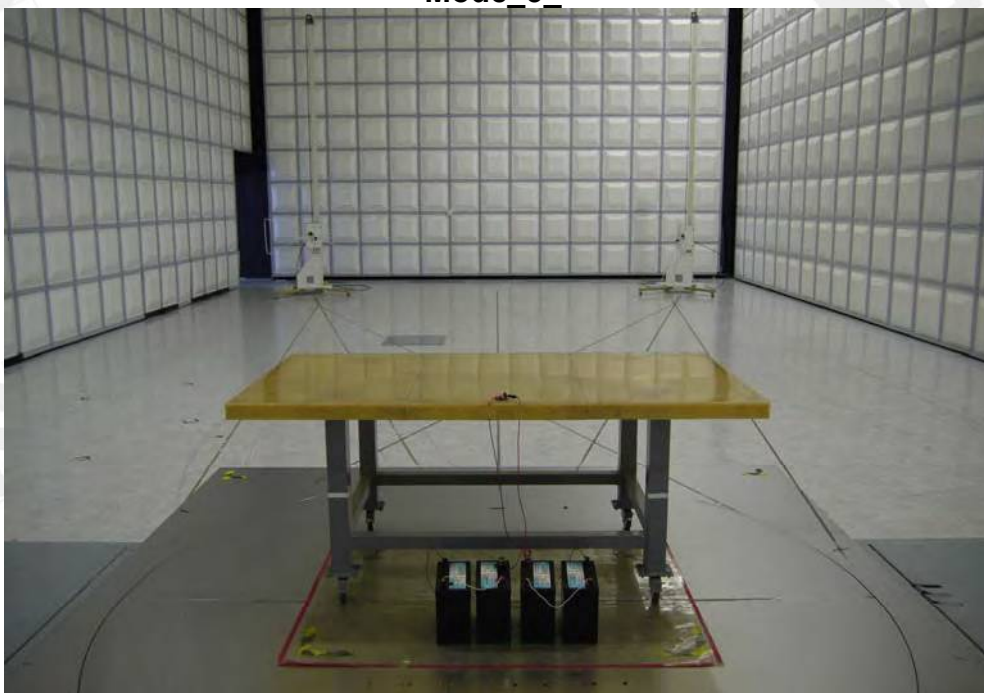
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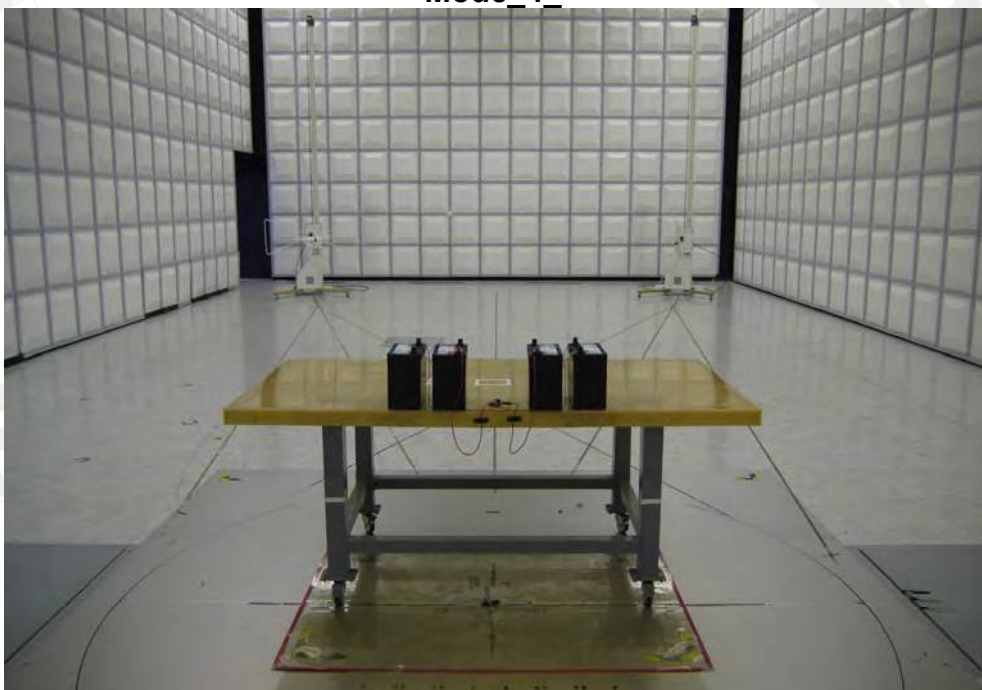
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Mode_6_-



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台灣檢驗科技股份有限公司

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ESD Testing Set-up

Model No.: TMR 6-7211WIR

Mode_6



RS Testing Set-up

Model No.: TMR 6-7211WIR

Mode_6



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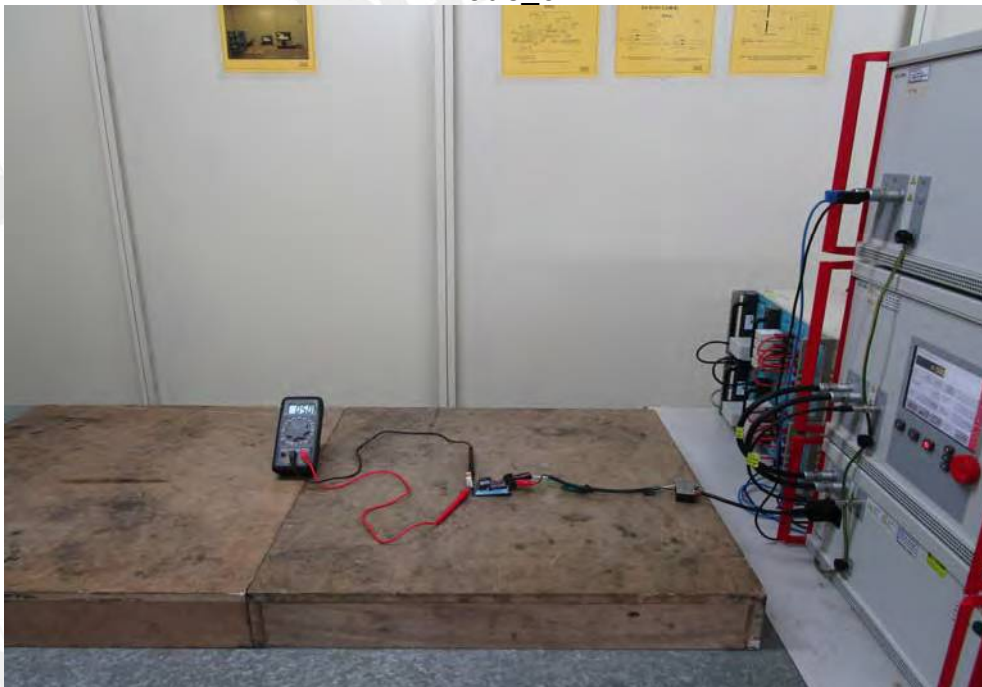
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Model No.: TMR 6-7211WIR

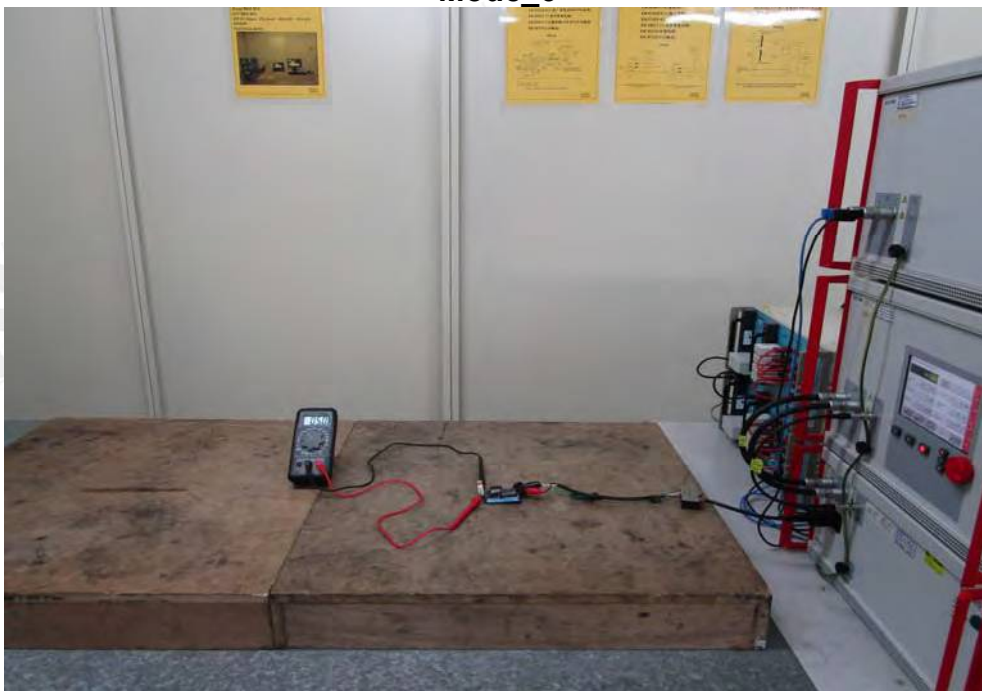
Mode_6



Surge Testing Set-up

Model No.: TMR 6-7211WIR

Mode_6



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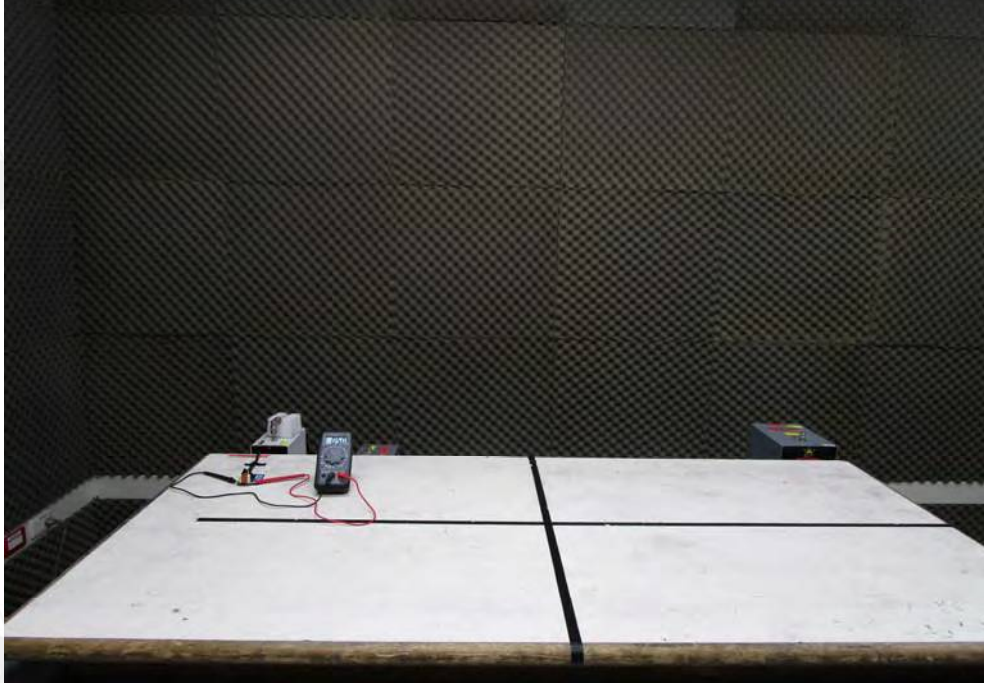
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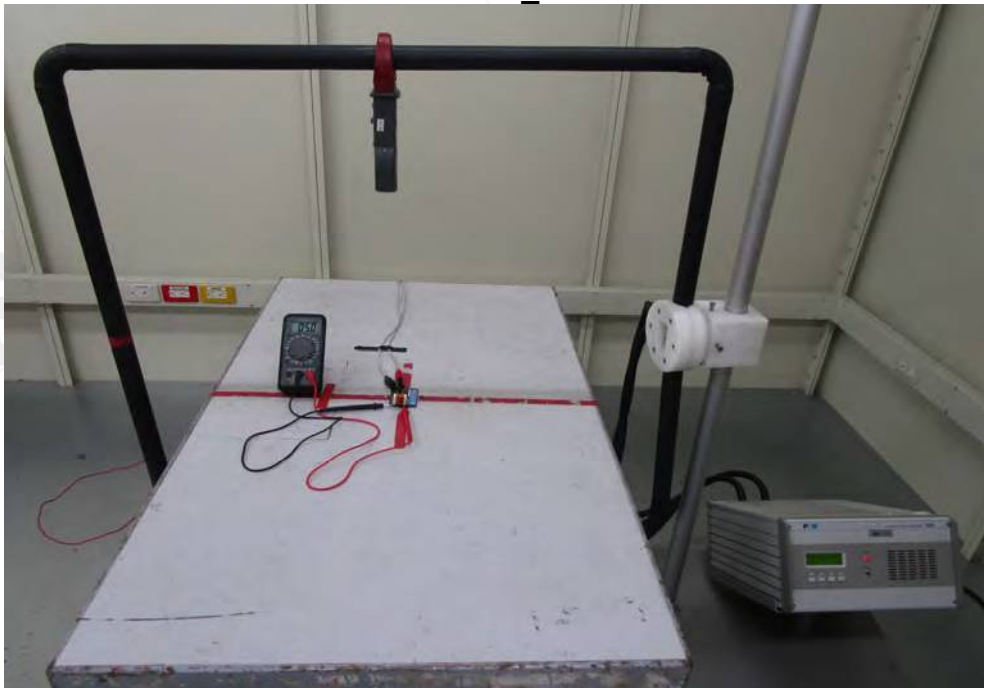
CS Testing Set-up

Model No.: TMR 6-7211WIR
Mode_6



PMF Testing Set-up

Model No.: TMR 6-7211WIR
Mode_6



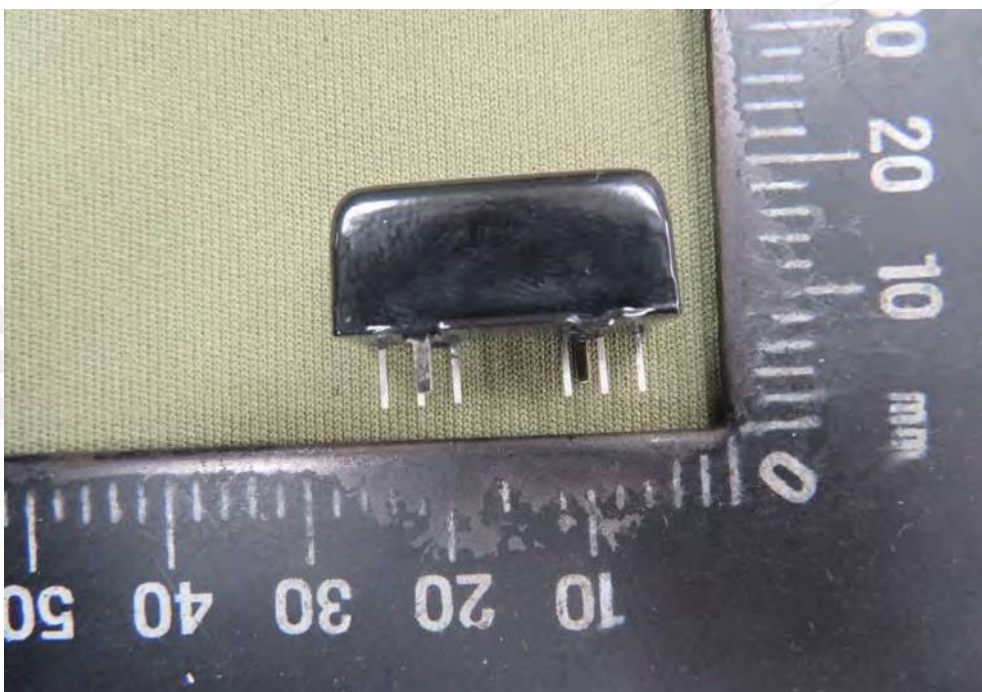
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Photographs of EUT Unit

Exterior

Model No.: TMR 3-4811WIR; TMR 6-4811WIR; TMR 6-7211WIR



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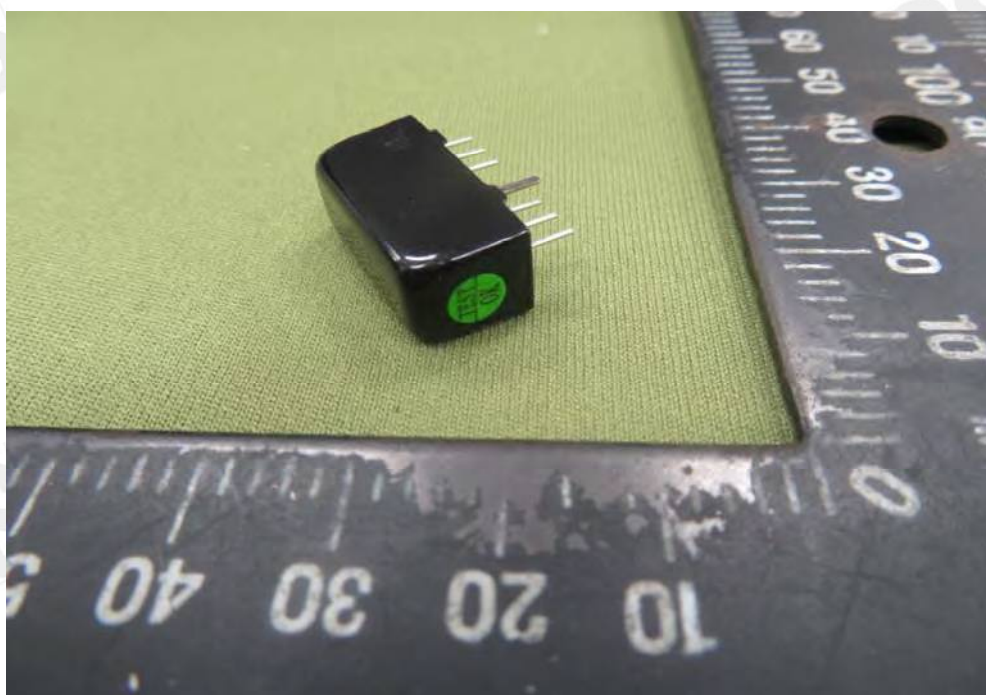
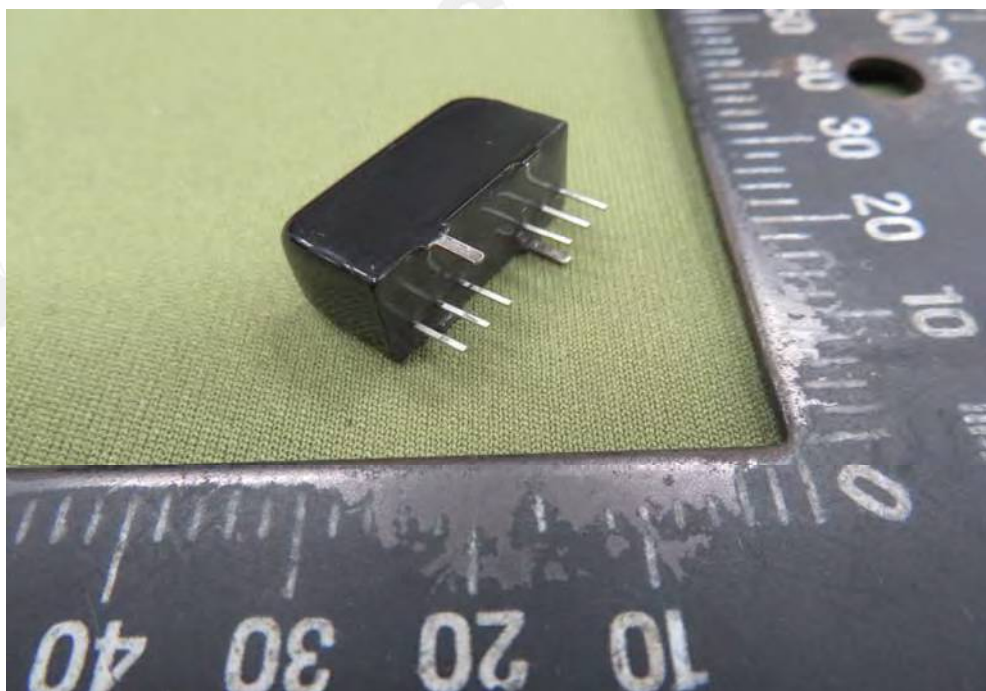
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**** End of Report ****

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TEST REPORT

EN 50155

Railway applications – Electronic equipment used on rolling stock

Report No.....:	T181022L07-RL
Date of Issue.....:	Oct.25, 2018
Total number of pages.....:	41
Testing laboratory	Compliance Certification Services Inc.
Location.....:	No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
Test Place.....:	6 F, No.605, Zhongshan Rd., Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
Applicant.....:	TRACO ELECTRONIC AG
Address.....:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland
Manufacturer.....:	TRACO ELECTRONIC AG
Address.....:	Sihlbruggstrasse 111 CH-6340 Baar Switzerland
Standards.....:	EN 50155: 2017, clause 13.4.1, 13.4.2, 13.4.3, 13.4.4, 13.4.5, 13.4.7, 13.4.9 and 13.4.11 EN 61373: 2010, clause 8, 9 and 10 DIN EN 60068-2-1 : 2008-01 DIN EN 60068-2-2 : 2008-05 DIN EN 60068-2-30 : 2006-06
Test procedure.....:	Standard
Non-standard test method.....:	N/A
Type of test equipment	DC/DC Converter
Trade mark.....:	
Model/Type designation.....:	TMR 3-4811WIR; TMR 6-7211WIR; TMR 6-4811WIR
Rating.....:	110Vdc
Operating temperature classes.....:	OT4
Declaration: CCS represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (NML) of R.O.C., or National Institute of Standards and Technology (NIST) of U.S.A. CCS's reports apply only to the specific samples tested under conditions. It is manufacture's res-ponsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components.CCS shall have no liability for any declarations, inferences or generalizations drawn by the client or others from CCS issued reports. CCS's reports must not be used by the client to claim product endorsement by the authorities or any agency of the Government. This report is the confidential property of the client. As a mutual protection to the clients, the public and CCS-self, extracts from the test report shall not be reproduced except in full with CCS's authorized written approval.	
Tested by:  Jordan Wang	Reviewed by:  Kasim Fan

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SGS Compliance Certification Services Inc.
程智科技股份有限公司

Test Location: 6F, No. 605, Zhongshan Rd., Xinhua Dist., Tainan City 712, Taiwan. / 71243 台南市新化區中山路 605 號 6F
t:(886-6) 598-0808 f:(886-6) 598-7878 www.sgs.tw www.ccsrf.com Member of the SGS Group (SGS SA)

Test item particulars:	
Protection against ingress of water.....	IPX0
Mass of equipment.(Kg).....	Approx. 0.006Kg
Testing:	
Date of receipt of test item	Jun.27.2018
Date(s) of performance of tests	Jul.18.2018 to Aug.31.2018
Possible test case verdicts:	
-Test case does not apply to the test object.	N(.A.)
-Test object does meet the requirement.	P(ass)
-Test object does not meet the requirement.	F(ail)
General Remarks:	
The test results presented in this report relate only to the object tested.	
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"(see Enclosure #) refers to additional information appended to the report.	
"(see appended table)" refers to a table appended to the report.	
Comments:	
Sample Number: L18042501-00101	
Report reference No : T180425L01-RL	
General product information :	
1. All models are identical except for model designation for marketing purpose.	
2. Unless otherwise specified the tests were performed on model : TMR 6-7211WIR	

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 程智科技股份有限公司 t:(886-6) 598-0808 f:(886-6) 598-7878 www.sgs.tw www.ccsrf.com Member of the SGS Group (SGS SA)

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	Oct.25.2018	Initial Issue	All	Kasim Fan

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8	PERFORMANCE TEST (Supply interruption)	EN 50155	12 – 14
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10	INSULATION TEST	EN 50155	18 – 20
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12	DRY HEAT TEST	EN 50155 DIN EN 60068-2-2	23 – 24
13	DAMP HEAT TEST	EN 50155 DIN EN 60068-2-30	25 – 26
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Table of Testing Summary Results

Item	Description	Test Standard	Verdict
1.1	VISUAL INSPECTION	EN 50155, clause 13.4.1	PASS
1.2	PERFORMANCE TEST (Supply variations)	EN 50155, clause 13.4.2, 5.1.1.2	PASS
1.3	PERFORMANCE TEST (Supply interruption)	EN 50155, clause 13.4.3, 5.1.1.4	PASS
1.4	PERFORMANCE TEST (Supply change over)	EN 50155, clause 13.4.3, 5.1.3	PASS
1.5	INSULATION TEST	EN 50155, clause 13.4.9	PASS
2.1	COOLING TEST	EN 50155, clause 13.4.4 EN 60068-2-1, test Ad.	PASS
2.2	DRY HEAT TEST	EN 50155, clause 13.4.5 EN 60068-2-2, test Be.	PASS
2.3	DAMP HEAT TEST	EN 50155, clause 13.4.7 EN 60068-2-30, test Db.	PASS
2.4	SHOCK TEST	EN 50155, clause 13.4.11 EN 61373, clause 10	PASS
2.5	VIBRATION TEST (Simulated long-life tests)	EN 50155, clause 13.4.11 EN 61373, clause 9	PASS
2.6	VIBRATION TEST (Function random vibration test)	EN 50155, clause 13.4.11 EN 61373, clause 8	PASS

1 CHARACTERISTIC TEST

1.1 VISUAL INSPECTION

Product	DC/DC Converter
Model/Type designation	TMR 6-7211WIR
CCS sample number	L18042501-00101

1.1.1 INSPECTION REQUIREMENT

The Visual inspection test verifies the mechanical, dimensional and appearance conformance of the Electronic Equipment

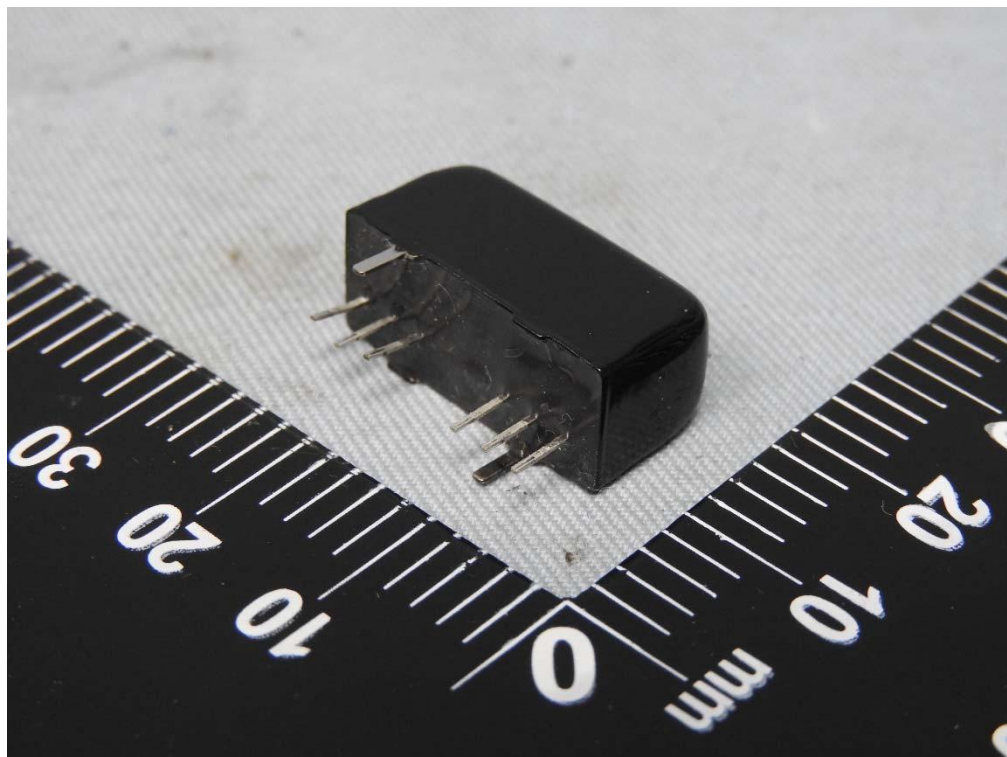
1.1.2 INSPECTION PROCEDURE

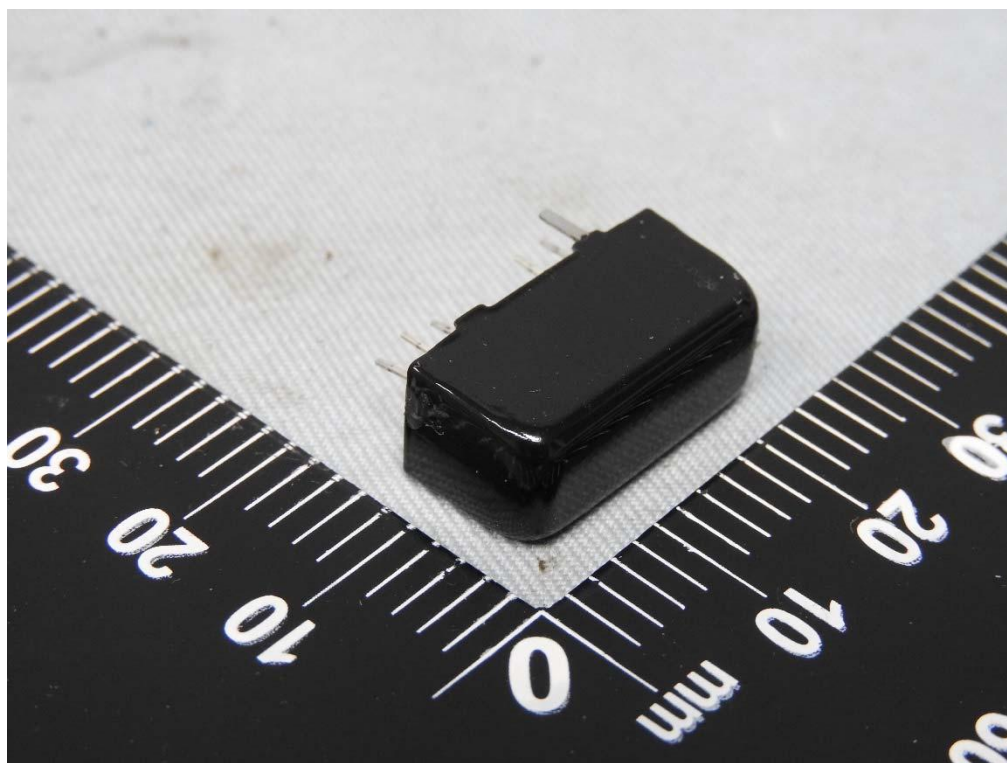
The inspection procedure was in accordance with EN 50155 clause 13.4.1

1.1.3 INSPECTION RESULT

PASS

1.1.4 EUT PHOTO





1.2 PERFORMANCE TEST (Supply variations)

1.2.1 TEST REQUIREMENT

Electronic equipment shall operate satisfactorily for all the values of the DC power supply voltage within the range defined in Table 4 measured at the terminals of the equipment, see also Figure 2.

In case of variation of the power supply voltage from zero to the maximum (e.g. intervention of circuit breaker) the equipment shall neither fail, nor be the cause of failure of other equipment. The equipment shall restart in normal operating mode when the power supply voltage is within the continuous voltage range.

Nominal voltage U_n	Limits
Minimum continuous voltage:	$0.7U_n$
Maximum continuous voltage:	$1.25U_n$

Electronic equipment shall operate for the values of the DC power supply voltage within the fluctuation range defined in Table 5 measured at the terminals of the equipment, see also Figure 3.

Voltage fluctuation can be either positive (overvoltage) or negative (dips). Temporary supply over voltages lying between U_n and $1.4 U_n$ and not exceeding 0,1 s shall not cause deviation of function (performance criterion A).

Temporary supply over voltages lying between $1.25 U_n$ and $1.4 U_n$ and not exceeding 1 s shall fulfil performance criterion B.

Temporary supply dips lying between U_n down to $0.6 U_n$ and not exceeding 0,1 s shall not cause deviation of function (performance criterion A).

Nominal voltage U_n	Limits
Minimum continuous voltage:	$0.6U_n$
Maximum continuous voltage:	$1.4U_n$

1.2.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Digital Multimeter	FLUKE	15B	2019.01.31
Digital Phosphor Oscilloscope	Tektronix	DPO 2024B	2019.02.21
Thermo Recorder	T&D	TR-73U	2019.04.25

1.2.3 TEST PROCEDURE

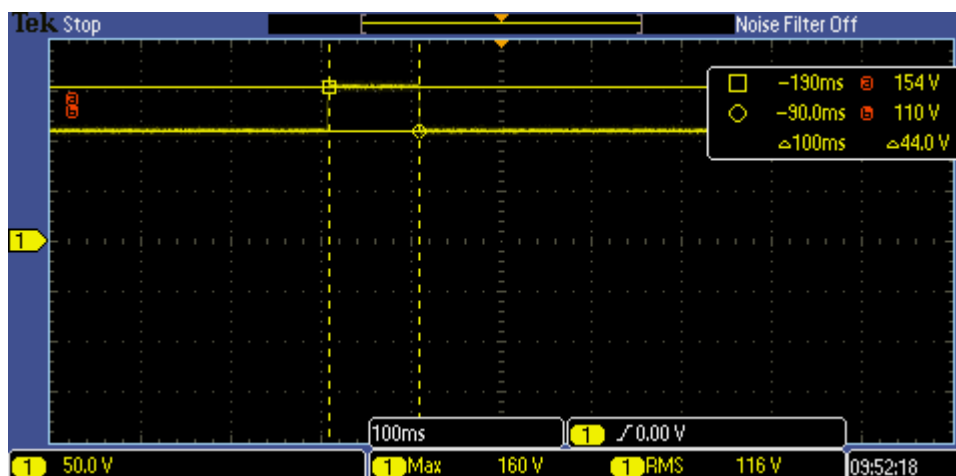
The test procedure was in accordance with EN 50155 clause 13.4.2, 5.1.1.2

1.2.4 TEST RESULTS

Temperature	23.8℃	Humidity	60.6%RH
Pressure	1003.4mbar	Test by	Jordan Wang
Test Results		PASS	

Input Voltage(Un)	Test voltage		Test times	Result / Observation
110Vdc	0.6Un	66.0Vdc	0.1s	Normal operation
110Vdc	0.7Un	77.0Vdc	10mins	Normal operation
110Vdc	Un	110.0Vdc	10mins	Normal operation
110Vdc	1.25Un	137.5Vdc	10mins	Normal operation
110Vdc	1.4Un	154.0Vdc	0.1s	Normal operation
110Vdc	1.4Un	154.0Vdc	1s	Normal operation

1.2.5 TEST PHOTO



Supply variation Test (Test Voltage: 154.0Vdc)



Supply variation Test (Test Voltage: 154.0Vdc)

1.3 PERFORMANCE TET (Supply interruption)

1.3.1 TEST REQUIREMENT

Regarding interruptions on supply voltage, there are three classes of equipment:

Class	Requirements	Duration of the interruption time Tint (See Figure 9)
S1	No performance criterion is requested but the equipment shall continue to operate as specified after the voltage interruption.	NOTE As defined in 5.1.1.4, this test is not required.
S2	The equipment shall behave according performance criterion A.	10 ms
S3	The equipment shall behave according performance criterion A.	20 ms

1.3.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Digital Phosphor Oscilloscope	Tektronix	DPO 2024B	2019.02.21
Thermo Recorder	T&D	TR-73U	2019.04.25

1.3.3 TEST PROCEDURE

The test procedure was in accordance with EN 50155 clause 13.4.3, 5.1.1.4

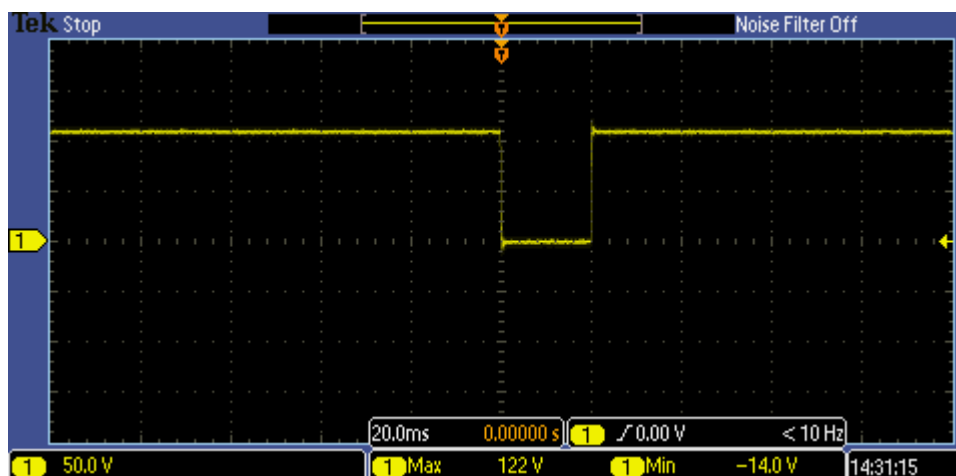
1.3.4 TEST RESULTS

Temperature	26.3°C	Humidity	73.3%RH
Pressure	999.0mbar	Test by	Jordan Wang
Test Results		PASS	

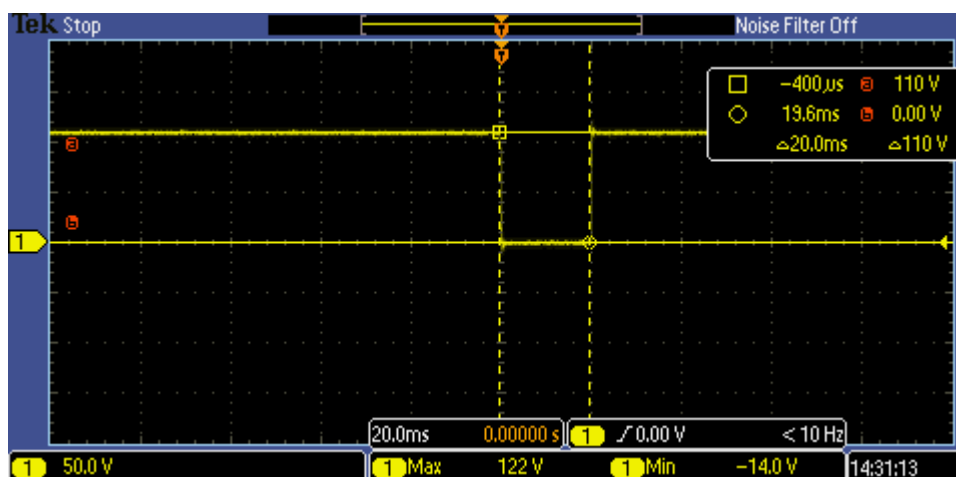
Input Voltage (Un)	Durations (ms)	Times	Class	Result /Observation
110Vdc	10ms	10	S2	No interruption
110Vdc	20ms	10	S3	No interruption

Note : Add external components when S2/S3 test.

1.3.5 TEST PHOTO



Performance test for S2



Performance test for S3

1.4 PERFORMANCE TEST (Supply change over)

1.4.1 TEST REQUIREMENT

The equipment shall operate satisfactorily under the conditions stated in Subclauses 5.1.1, 5.1.1.2, 5.1.1.6 and 5.1.3.

— Class C1: at 0,6 Un during 100 ms (without interruptions). Performance criterion A;

— Class C2: during a supply break of 30 ms starting at Un Performance criterion B.

The supply break is an open circuit and not a short circuit ("high impedance" condition).

Unless otherwise specified, the requirements of class C1 apply.

1.4.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Digital Phosphor Oscilloscope	Tektronix	DPO 2024B	2019.02.21
Thermo Recorder	T&D	TR-73U	2019.04.25

1.4.3 TEST PROCEDURE

The test procedure was in accordance with EN 50155 clause 13.4.3, 5.1.3

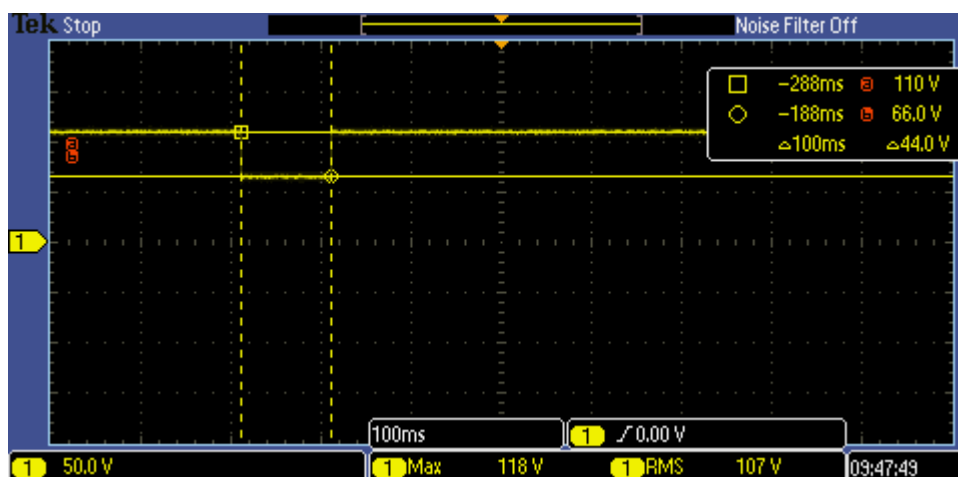
1.4.4 TEST RESULTS

Temperature	27.3°C	Humidity	61.5%RH
Pressure	998.7mbar	Test by	Jordan Wang
Test Results	PASS		

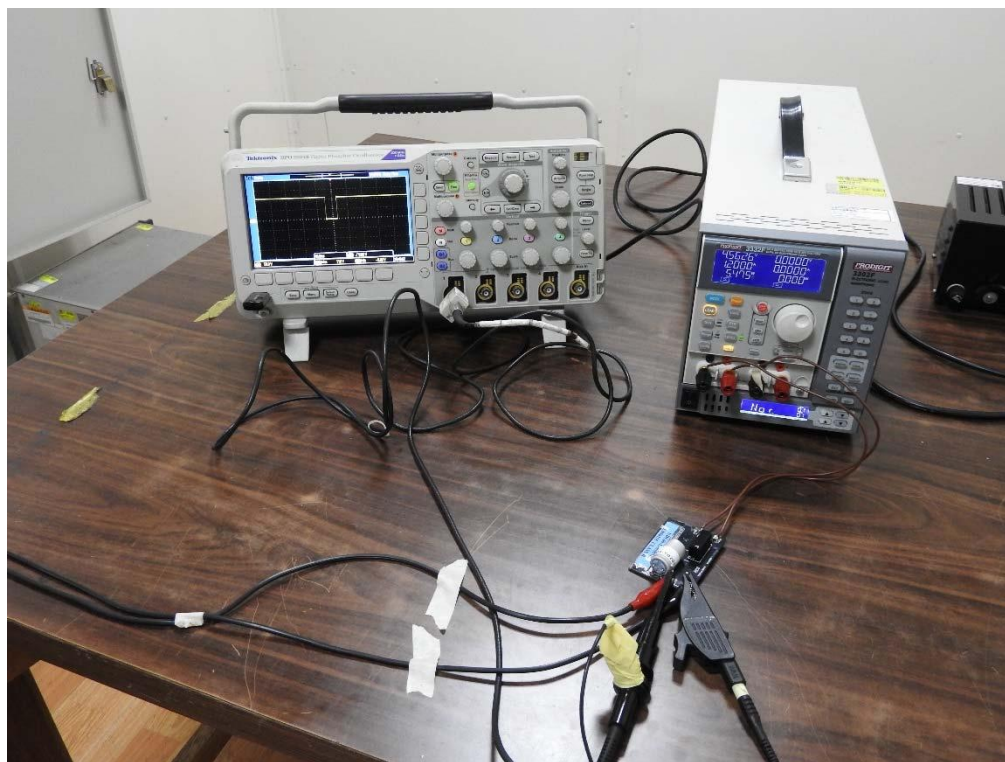
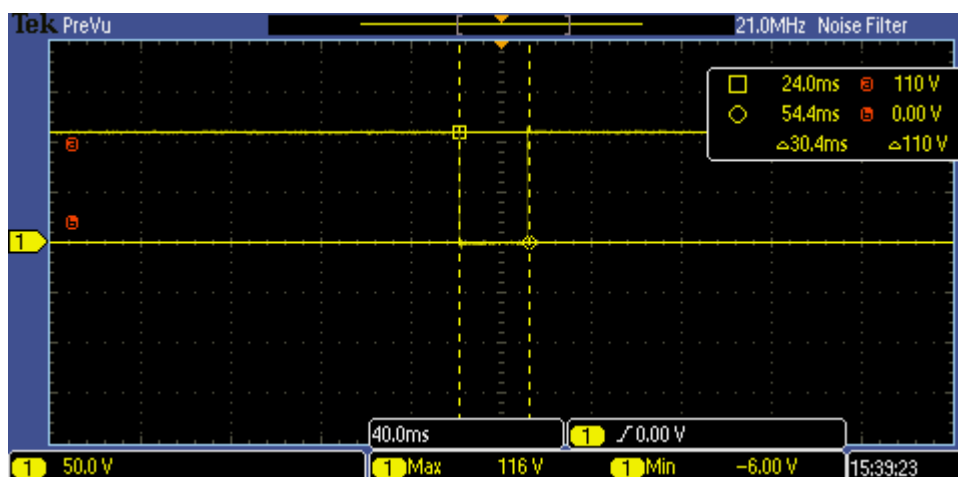
Input Voltage(Un)	Test Voltage		Class	Durations	Result / Observation
110Vdc	0.6Un	66.0Vdc	C1	100ms	No interruption
110Vdc	0	--	C2	30ms	No interruption

Note : Add external components when C2 test.

1.4.5 TEST PHOTO



Performance test for C1



Performance test for C2

1.5 INSULATION TEST

1.5.1 TEST REQUIREMENT

a) Insulation measurement test:

The insulation resistance measurement test shall be carried out at 500 V DC and the values shall be recorded for all the equipotential areas defined for the insulation test. During the test, the equipment shall not be powered on.

Test acceptance requirements:

The minimum value of the insulation resistance after the withstand test shall be higher than 20 MΩ. The equipment shall work as intended and within its specified limits after the insulation test.

b) Voltage withstand test:

Nominal battery voltage and/or I/O voltage	Test voltage
< 72Vdc or 50Vac rms	500Vac or 750Vdc
72Vdc ≤ Vdc < 125Vdc or from 50 to 90Vac rms	1000Vac or 1500Vdc
125Vdc ≤ Vdc < 315Vdc or from 90 to 225Vac rms	1500Vac or 2200Vdc

Test acceptance requirements:

Neither disruptive discharge nor flashover shall occur. After the withstand test, the equipment shall work as intended and within its specified limits.

1.5.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Electrical Safety Compliance Analyzer	EXTECH	7451	2018.11.06
Thermo Recorder	T&D	TR-73U	2019.04.25

1.5.3 TEST PROCEDURE

The test procedure was in accordance with EN 50155 clause 13.4.9

1.5.4 TEST RESULTS

Temperature	21.1°C	Humidity	43.8%RH
Pressure	1002.5mbar	Test by	Jordan Wang
Test Results		PASS	

1. Insulation measurement test (before voltage withstand test):

Insulation applied between / Test item	Test Voltage (Vdc)	Test Time (sec)	Resistance (M Ω)
Power input – Metal enclosure	500Vdc	60	9999
Power input – I/O port	500Vdc	60	9999

2. Voltage withstand test:

Test voltage applied between / Test item	Test voltage (Vdc)	Test time (sec)	Test current (μ A)	Breakdown Yes / No
Power input – Metal enclosure	1500	60	0	No
Power input – I/O port	1500	60	0	No

3. Insulation measurement test (after voltage withstand test):

Insulation applied between / Test item	Test Voltage (Vdc)	Test Time (sec)	Resistance (M Ω)
Power input – Metal enclosure	500Vdc	60	9999
Power input – I/O port	500Vdc	60	9999

1.5.5 TEST PHOTO

Insulation measurement test (before voltage withstand test)



Voltage withstand test



Insulation measurement test (after voltage withstand test)

2 ENVIRONMENTAL TEST

2.1 COOLING TEST

2.1.1 TEST REQUIREMENT

Equipment shall be tested according to its operating temperature class; low operating temperature (TTEST) shall be taken from Table 1 of this standard. Equipment is placed, without any voltage applied, in a test chamber.

The equipment shall be first conditioned by leaving it, after thermal stabilization of the chamber, for a sufficient period of time in which to achieve thermal stabilization. In any case, the stabilization time period shall not be less than 2 h, see Figure 12.

Test acceptance requirements:

During and after the test, the equipment shall work as intended and within its specified limits (performance criterion A).

2.1.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Temperature & Humidity Chamber	CTF	LY-4S-TH	2019.05.02
Thermo Recorder	T&D	TR-73U	2019.04.25

2.1.3 TEST PROCEDURE

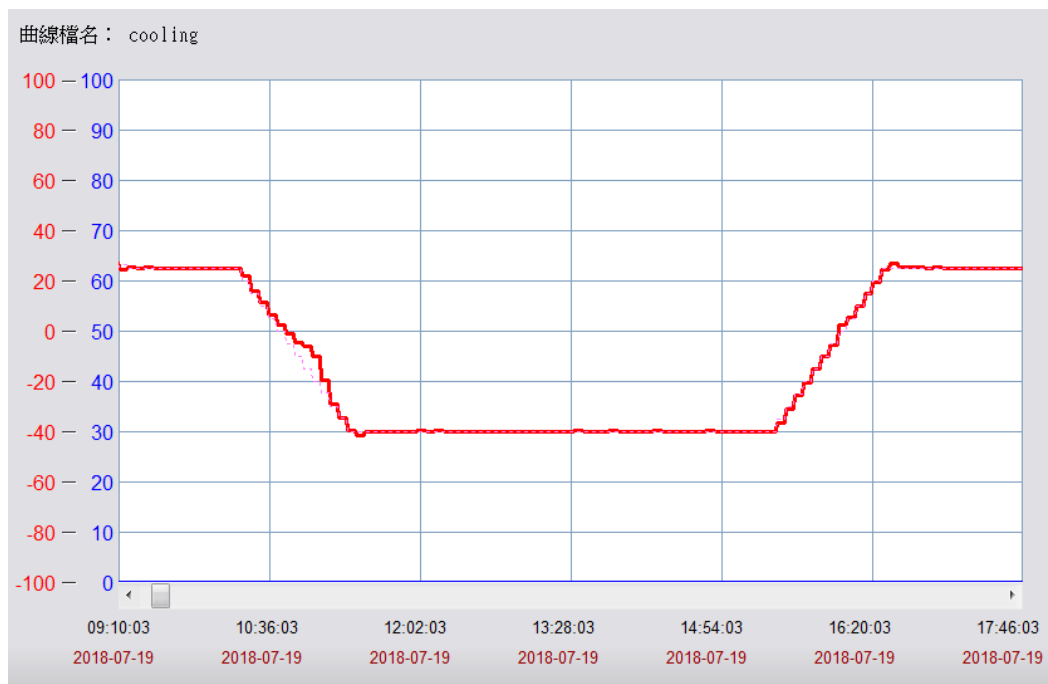
The test procedure was in accordance with EN 60068-2-1, test Ad

2.1.4 TEST RESULTS

Temperature	25.1℃	Humidity	50.7%RH
Pressure	1011.0mbar	Test by	Jordan Wang
Test Results		PASS	

Test Temperature	Durations	Performance check at low temperature	Performance check at room temperature
-40℃	2hrs	Normal operation	Normal operation

2.1.5 TEST PHOTO



2.2 DRY HEAT TEST

2.2.1 TEST REQUIREMENT

The temperature value for this test is dependent of the temperature class and the switch-on extended operating temperature class of equipment under test (see Table 1 and Table 2 for details).

Equipment shall be tested according to its operating temperature class; high operating temperature shall be taken from Table 1 and Table 2.

2.2.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Temperature & Humidity Chamber	CTF	LY-4S-TH	2019.05.02
Thermo Recorder	T&D	TR-73U	2019.04.25

2.2.3 TEST PROCEDURE

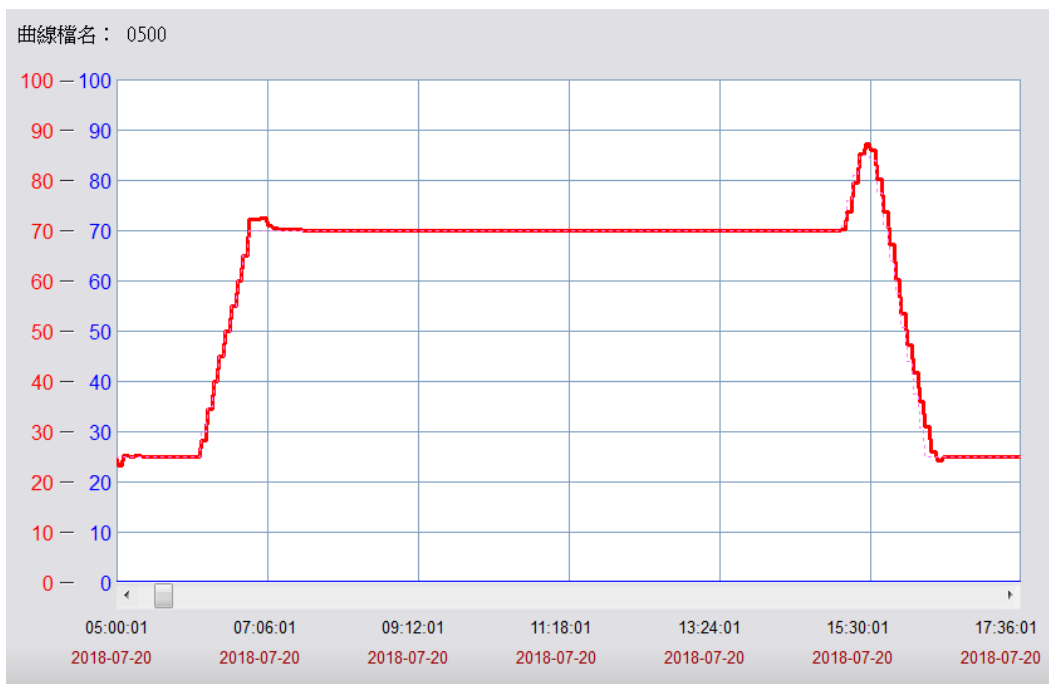
The test procedure was in accordance with EN 60068-2-2, test Be

2.2.4 TEST RESULTS

Temperature	26.2°C	Humidity	58.4%RH
Pressure	1005.1mbar	Test by	Jordan Wang
Test Results	PASS		

Test Temperature	Test Temperature Durations	Extended temperature	Extended temperature Durations	Performance check at high temperature	Performance check at room temperature
70°C	6hrs	85°C	10mins	Normal operation	Normal operation

2.2.5 TEST PHOTO



2.3 DAMP HEAT TEST

2.3.1 TEST REQUIREMENT

The equipment under test shall not be powered except during the operational check.

Temperatures: + 55 °C and + 25 °C

Humidity: reference to Figure 16 and Figure 17

Number of cycles: 2 (breathing effect)

Time: (2 × 24) h

Test acceptance requirements:

The results of all insulation and performance test (results after the first and second cycles) shall be within the specified tolerances and operation performance respectively.

Before and after the test (initial and final voltage withstand and insulation), the equipment shall work as intended and within its specified limits (performance criterion A).

2.3.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Temperature & Humidity Chamber	CTF	LY-4S-TH	2019.05.02
Thermo Recorder	T&D	TR-73U	2019.04.25

2.3.3 TEST PROCEDURE

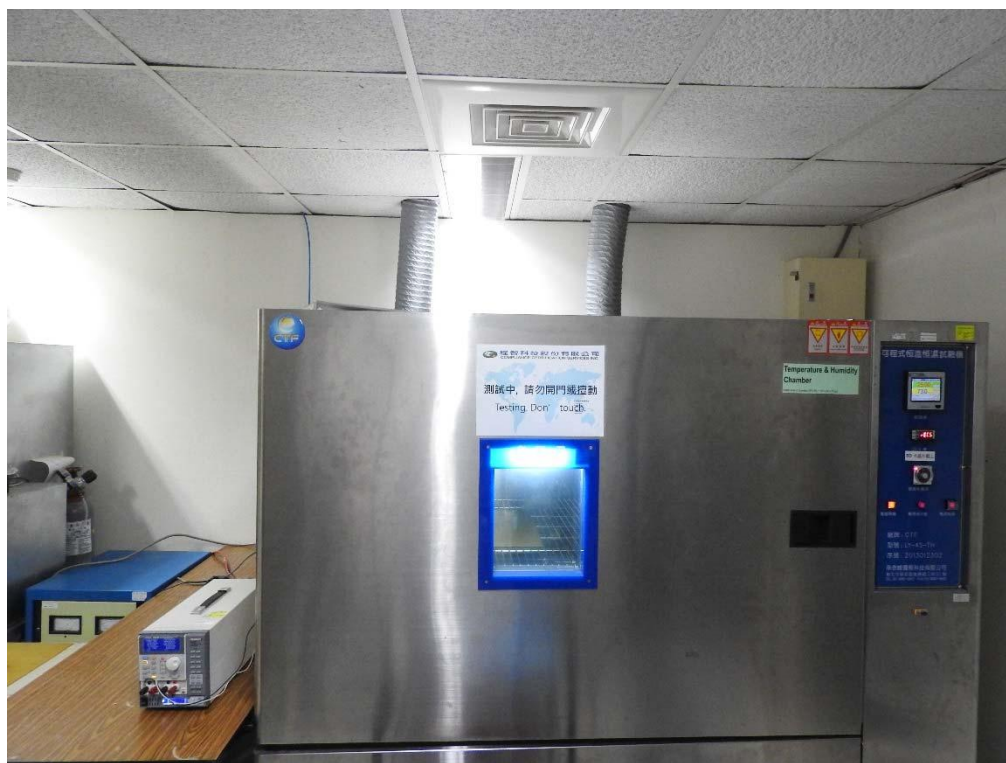
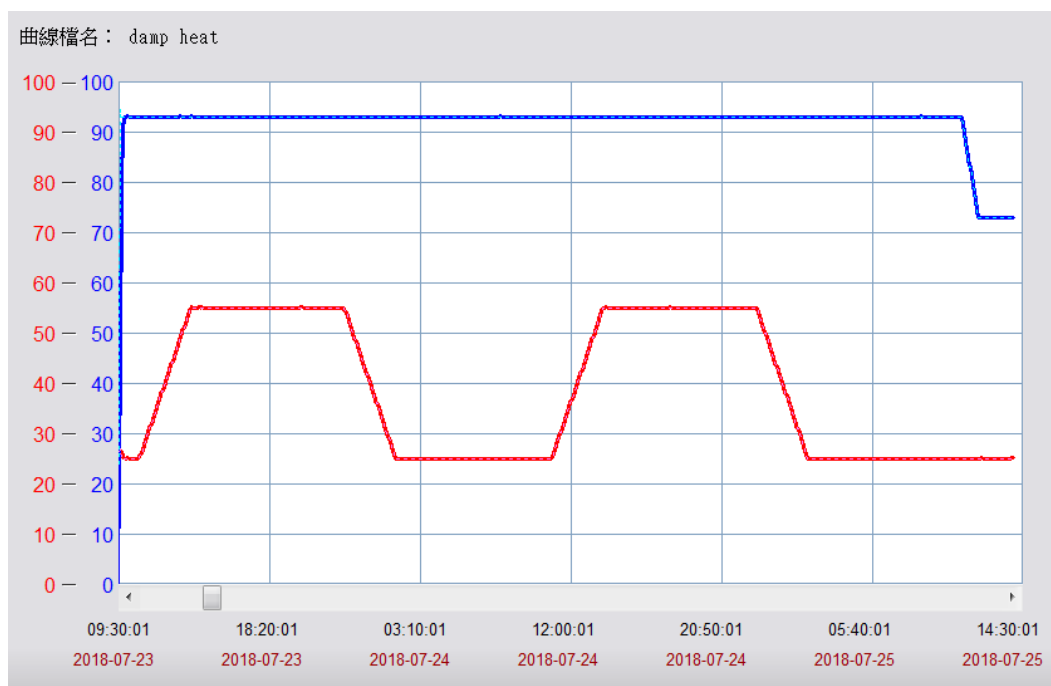
The test procedure was in accordance with EN 60068-2-30, test Db

2.3.4 TEST RESULTS

Temperature	24.8°C	Humidity	60.3%RH
Pressure	1008.4mbar	Test by	Jordan Wang
Test Results	PASS		

Performance check at secondary cycle	Performance check at room temperature	Insulation test
Meets performance A	Meets performance A	See clause 1.5

2.3.5 TEST PHOTO



2.4 SHOCK TEST

2.4.1 TEST REQUIREMENT

Shock Type	Accelerate	Duration	Axial	Test Times
Half Sine Wave	50 m/s ²	30 ms	+/- longitudinal	Each axis 3 shocks
Half Sine Wave	30 m/s ²	30 ms	+/- transverse	Each axis 3 shocks
Half Sine Wave	30 m/s ²	30 ms	+/- vertical	Each axis 3 shocks

Test acceptance requirements:

- No damage shall occur during the test
- during the test, the equipment is monitored and shall work as intended within its specified limits. (performance criterion A).

2.4.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-600VH	2019.05.08
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-300VH	2019.03.21
Thermo Recorder	T&D	TR-73U	2019.04.25

2.4.3 TEST PROCEDURE

The test procedure was in accordance with EN 61373:2010

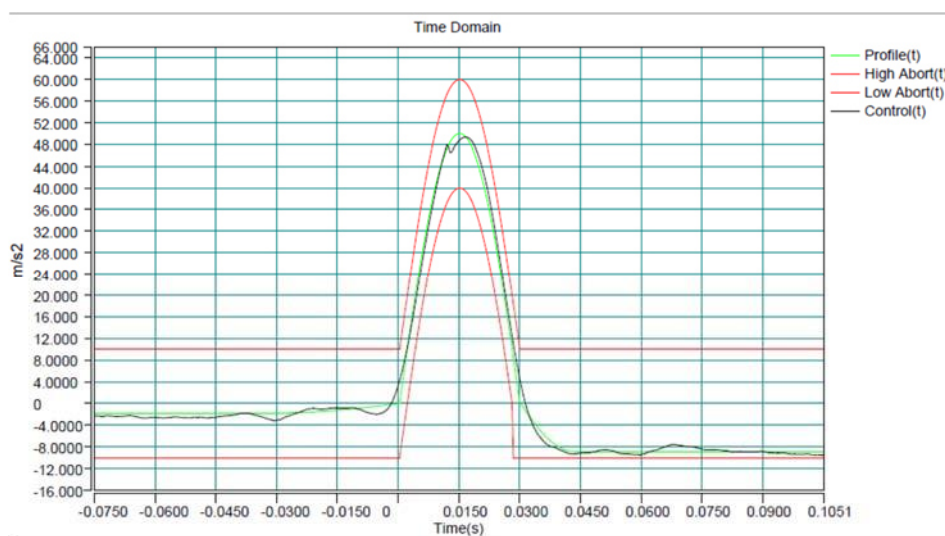
2.4.4 TEST RESULTS

Temperature	26.1°C	Humidity	63.5%RH
Pressure	1001.8mbar	Test by	Vibration source technology Co., LTD Wu Kun Ruei
Test Results		PASS	

2.4.5 TEST PHOTO

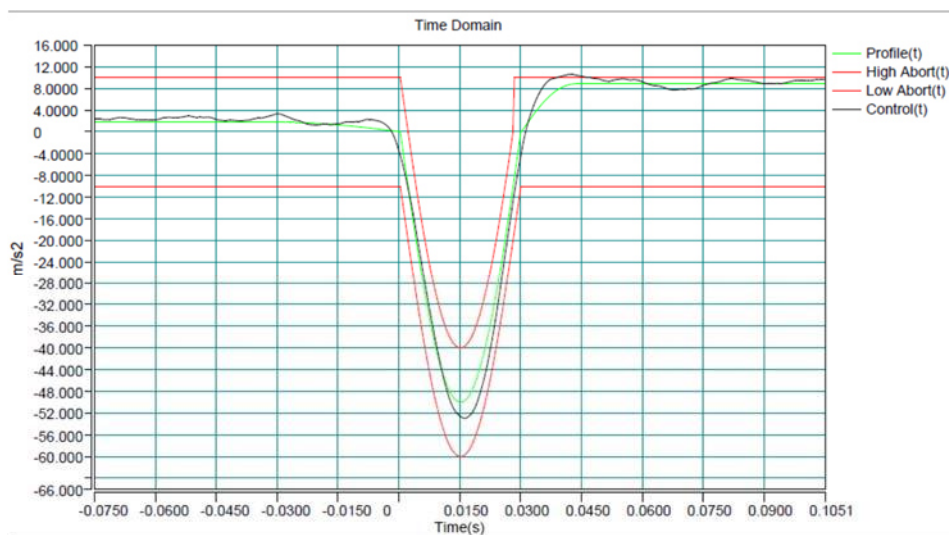
+X Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	50.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	7
Demand peak:	50.000 m/s ²	Output pulses:	14
Control peak:	49.339 m/s ²	Remain pulses:	0
Data was saved as file at time:		2018-7-31 AM 09:38:32	



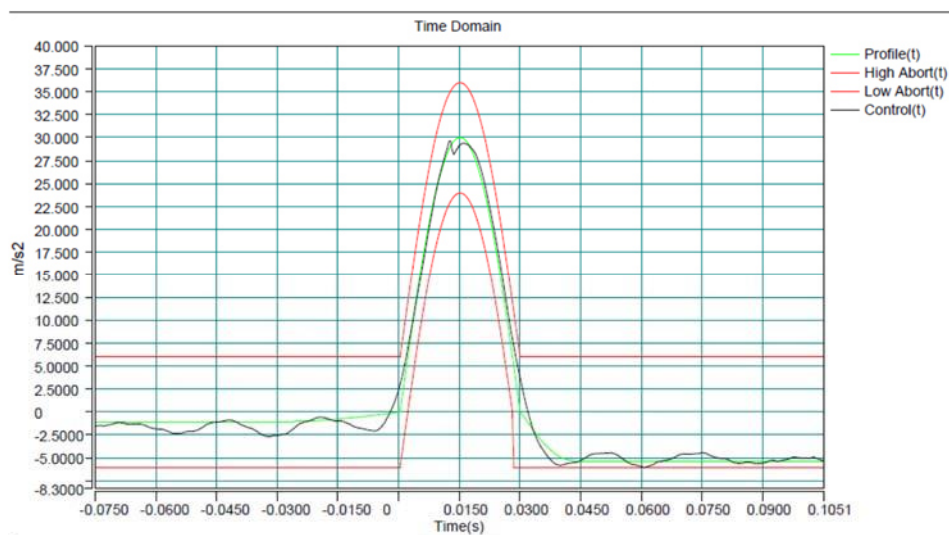
-X Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	50.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	7
Demand peak:	50.000 m/s ²	Output pulses:	14
Control peak:	52.931 m/s ²	Remain pulses:	0
Data was saved as file at time:		2018-7-31 AM 09:41:55	



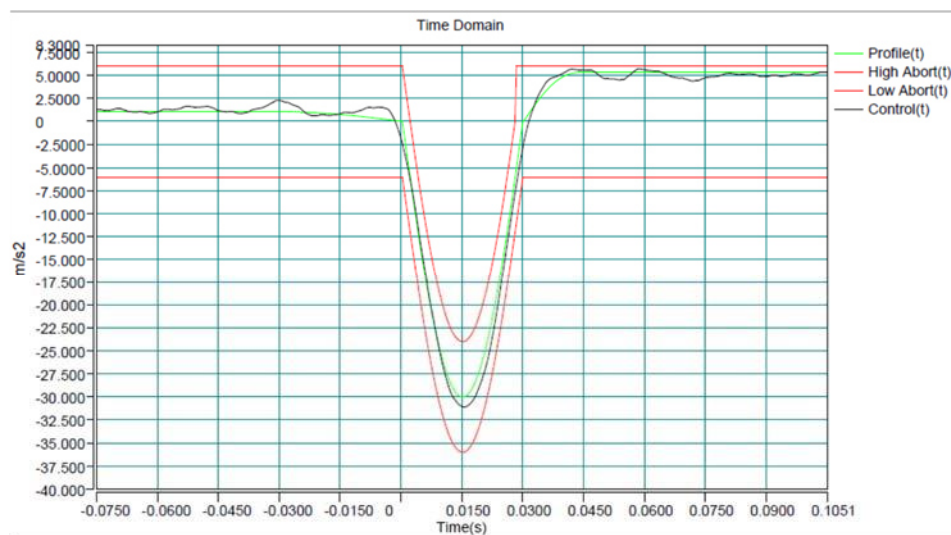
+Y Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	30.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	7
Demand peak:	30.000 m/s ²	Output pulses:	14
Control peak:	30.000 m/s ²	Remain pulses:	0
Data was saved as file at time:		2018-7-31 AM 09:22:19	



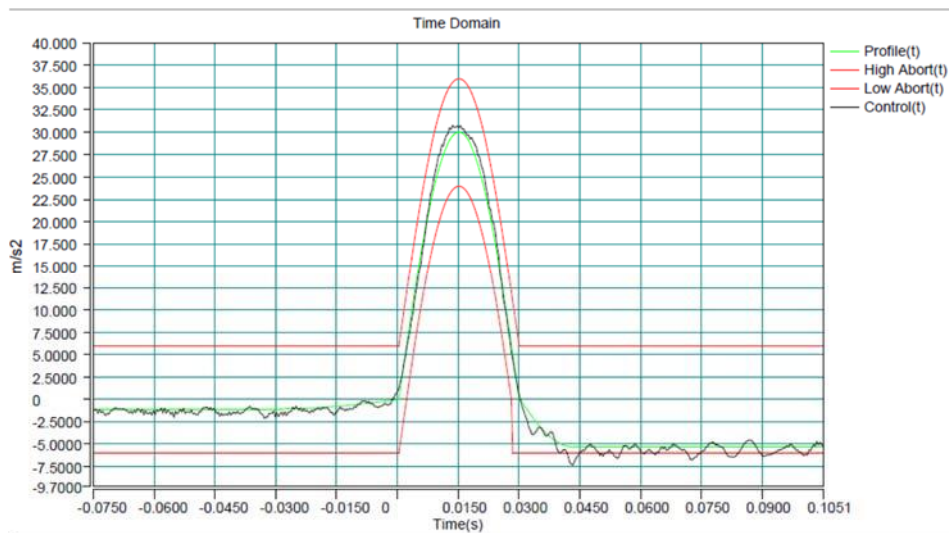
-Y Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	30.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	3
Demand peak:	30.000 m/s ²	Output pulses:	15
Control peak:	31.104 m/s ²	Remain pulses:	0
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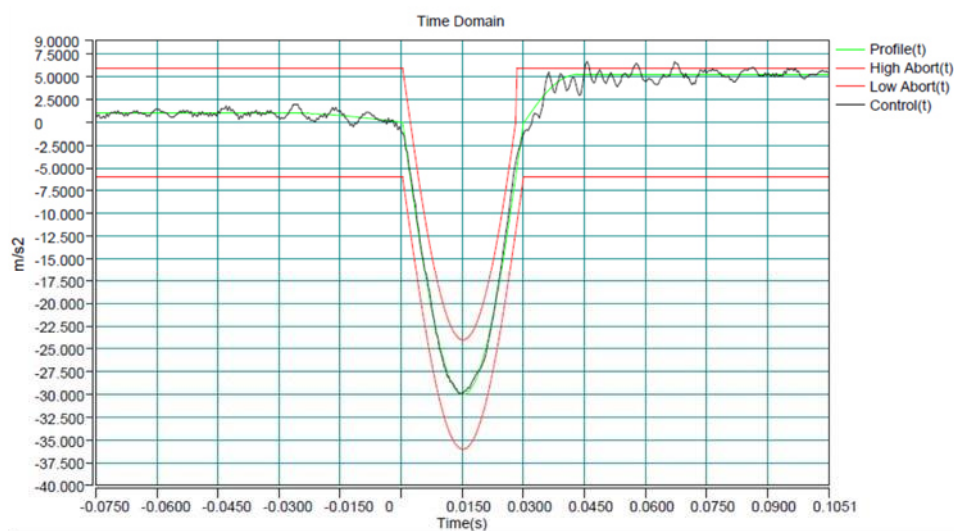
+Z Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	30.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	7
Demand peak:	30.000 m/s ²	Output pulses:	14
Control peak:	30.750 m/s ²	Remain pulses:	0
Data was saved as file at time:		2018-7-31 AM 10:47:02	



-Z Axis Test Screen

Shock Type:	Half Sine	Block Size:	4096
Mag:	30.00 m/s ²	Frame Time:	1.6000 s
Pulse Duration:	30 ms	dT:	0.000391 s
Current level:	0 dB	Current Pulses:	7
Demand peak:	30.000 m/s ²	Output pulses:	14
Control peak:	29.954 m/s ²	Remain pulses:	0
Data was saved as file at time:		2018-7-31 AM 10:49:49	



2.5 VIBRATION TEST (Simulated long-life test)

2.5.1 TEST REQUIREMENT

Axial	Accelerate	Frequency Rang	Duration
Longitudinal	3.96 m/s ² RMS	5 ~ 150 Hz	5 hrs
Transverse	2.55 m/s ² RMS	5 ~ 150 Hz	5 hrs
Vertical	5.72 m/s ² RMS	5 ~ 150 Hz	5 hrs

Test acceptance requirements:

- No damage shall be visible after the test
- after the test, the equipment shall work as intended and within its specified limits.

2.5.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-600VH	2019.05.08
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-300VH	2019.03.21
Thermo Recorder	T&D	TR-73U	2019.04.25

2.5.3 TEST PROCEDURE

The test procedure was in accordance with EN 61373:2010

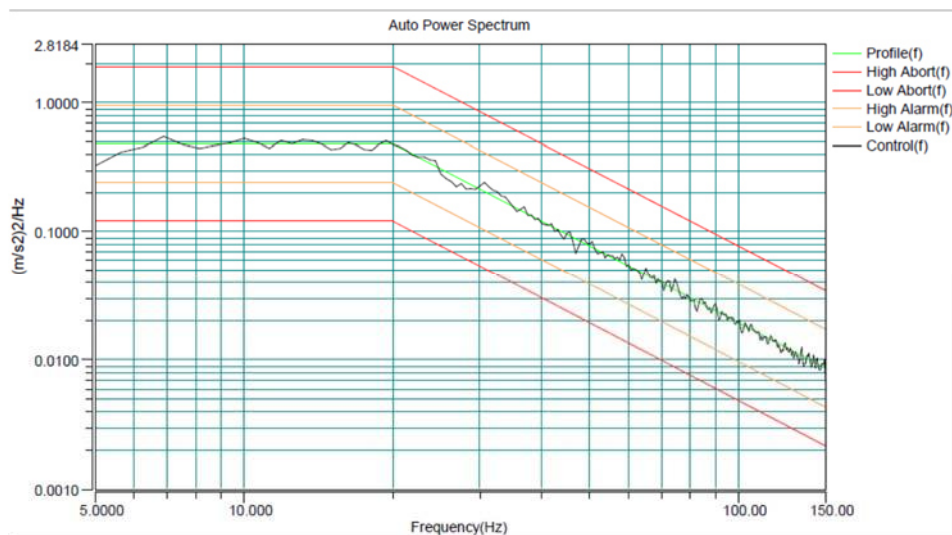
2.5.4 TEST RESULTS

Temperature	26.1°C	Humidity	63.5%RH
Pressure	1001.8mbar	Test by	Vibration source technology Co., LTD Wu Kun Ruei
Test Results		PASS	

2.5.5 TEST PHOTO

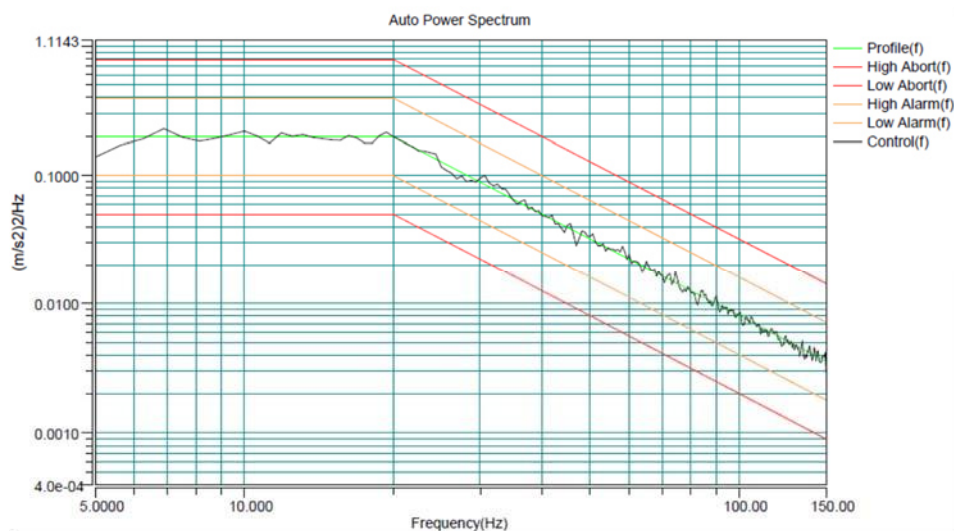
X Axis Test Screen

Current level:	0.00dB	dF:	0.625 Hz
Demand RMS:	3.960m/s2	DOF:	120
Control RMS:	3.953m/s2	Test Elapsed:	05:00:00
Frame Time:	1.6000 (s)	Remaining Time:	00:00:00
Lines:	400		
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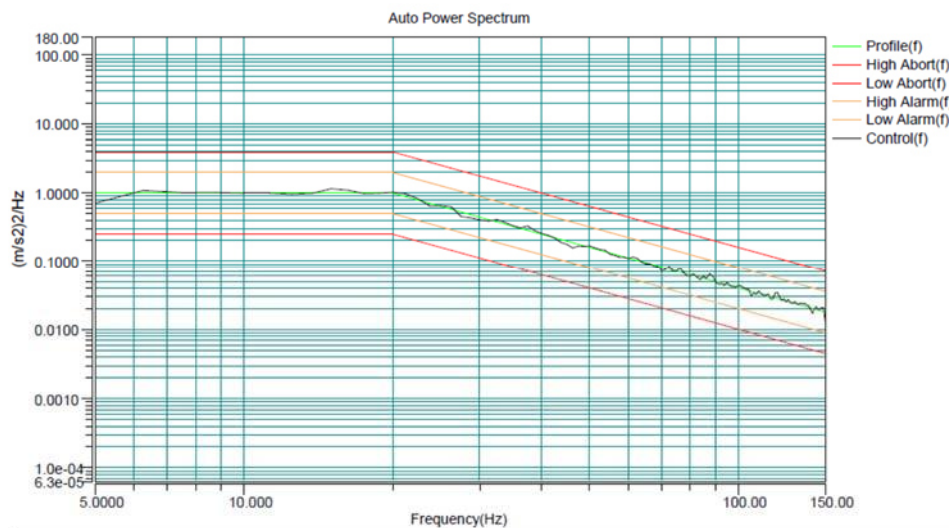
Y Axis Test Screen

Current level:	0.00dB	dF:	0.625 Hz
Demand RMS:	2.550m/s2	DOF:	120
Control RMS:	2.548m/s2	Test Elapsed:	05:00:00
Frame Time:	1.6000 (s)	Remaining Time:	00:00:00
Lines:	400		
Data was saved as file at time:		2018-7-30 PM 04:54:40	



Z Axis Test Screen

Current level:	0.00dB	dF:	1.25 Hz
Demand RMS:	5.720m/s2	DOF:	120
Control RMS:	5.760m/s2	Test Elapsed:	05:00:00
Frame Time:	0.8000 (s)	Remaining Time:	00:00:00
Lines:	200		
Data was saved as file at time:		2018-7-31 PM 04:17:16	



2.6 VIBRATION TEST (Functional random vibration test)

2.6.1 TEST REQUIREMENT

Axial	Accelerate	Frequency Rang	Duration
Longitudinal	0.700 m/s ² RMS	5 ~ 150 Hz	10 mins
Transverse	0.450 m/s ² RMS	5 ~ 150 Hz	10 mins
Vertical	1.01 m/s ² RMS	5 ~ 150 Hz	10 mins

Test acceptance requirements:

- No damage shall occur during the test
- during the test, the equipment is monitored and shall work as intended within its specified limits (performance criterion A).

2.6.2 TEST INSTRUMENT

Name of Equipment	Manufacturer	Model	Calibration Due
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-600VH	2019.05.08
Electrodynamics Type Vibration Tester	Vibration Source Technology CO., LTD	VS-300VH	2019.03.21
Thermo Recorder	T&D	TR-73U	2019.04.25

2.6.3 TEST PROCEDURE

The test procedure was in accordance with EN 61373:2010

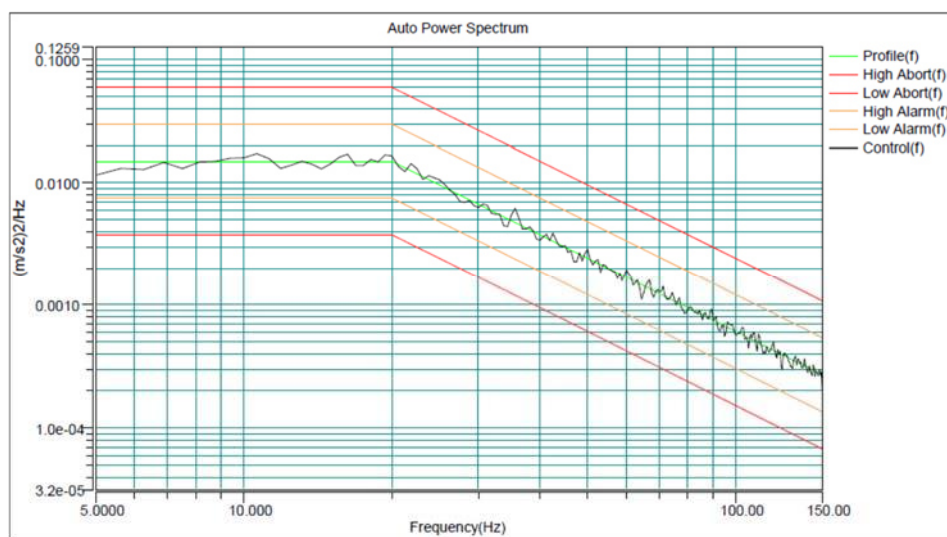
2.6.4 TEST RESULTS

Temperature	26.1°C	Humidity	63.5%RH
Pressure	1001.8mbar	Test by	Vibration source technology Co., LTD Wu Kun Ruei
Test Results		PASS	

2.6.5 TEST PHOTO

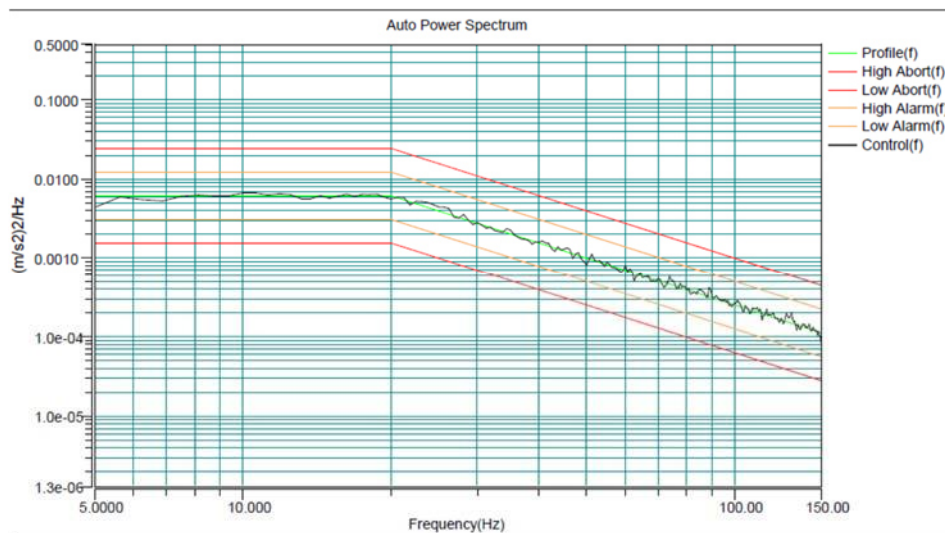
X Axis Test Screen

Current level:	0.00dB	dF:	0.625 Hz
Demand RMS:	0.700m/s2	DOF:	150
Control RMS:	0.725m/s2	Test Elapsed:	00:10:00
Frame Time:	1.6000 (s)	Remaining Time:	00:00:00
Lines:	400		
Data was saved as file at time:		2018-7-31 AM 08:51:19	



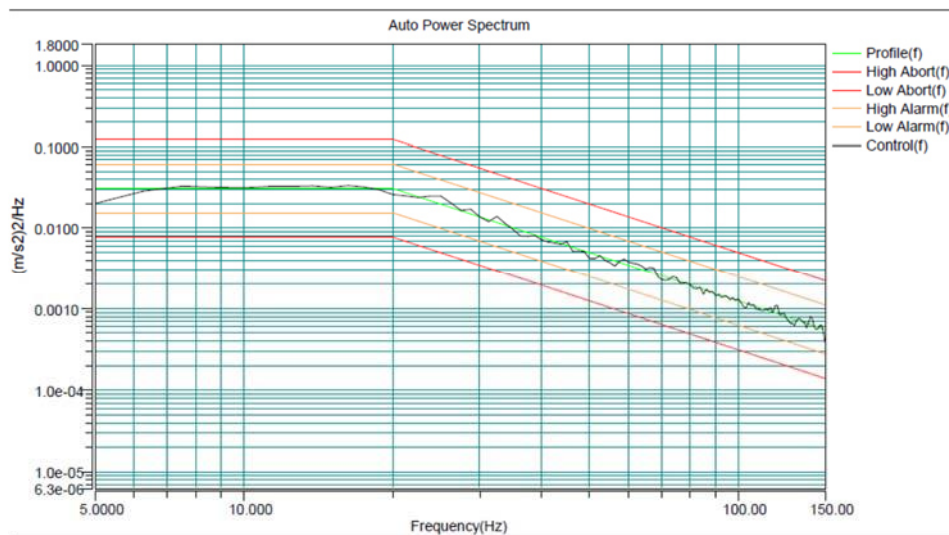
Y Axis Test Screen

Current level:	0.00dB	dF:	0.625 Hz
Demand RMS:	0.450m/s2	DOF:	150
Control RMS:	0.458m/s2	Test Elapsed:	00:10:00
Frame Time:	1.6000 (s)	Remaining Time:	00:00:00
Lines:	400		
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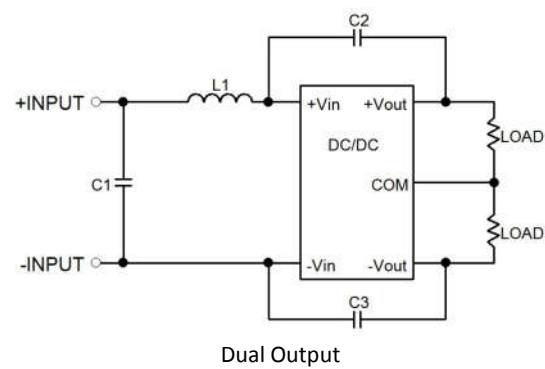
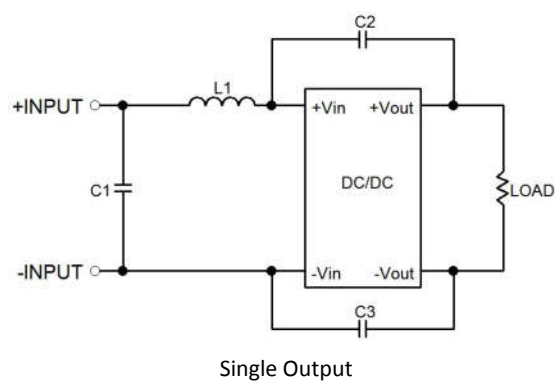


Z Axis Test Screen

Current level:	0.00dB	dF:	1.25 Hz
Demand RMS:	1.010m/s ²	DOF:	150
Control RMS:	1.060m/s ²	Test Elapsed:	00:10:00
Frame Time:	0.4000 (s)	Remaining Time:	00:00:00
Lines:	200		
Data was saved as file at time:		2018-7-31 AM 11:09:45	



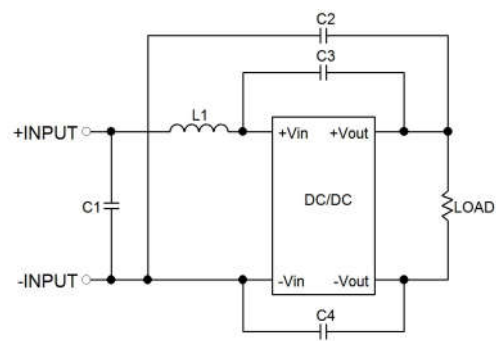
TMR 3 - Recommended external EMI filter for EN50155



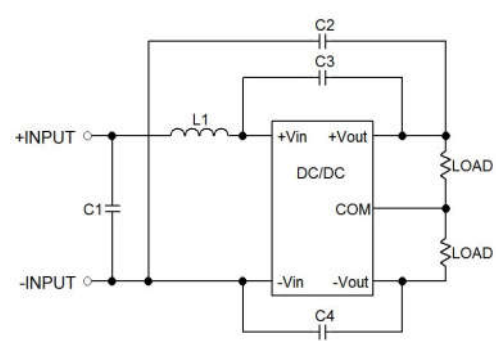
MODEL	C1	C2 、 C3	L1
TMR 3-24□□WIRzzzzzzzz	10μF/50V 1210 MLCC	1000pF/3kV 1808 MLCC	22μH, TCK-149
TMR 3-48□□WIRzzzzzzzz	4.7μF/100V 1210 MLCC	1000pF/3kV 1808 MLCC	68μH, TCK-150
TMR 3-72□□WIRzzzzzzzz	0.68μF/250V 1210 MLCC	1000pF/3kV 1808 MLCC	150μH, TCK-161

Table 1 B.O.M. of External EMI Filter

TMR 6 - Recommended external EMI filter for EN50155



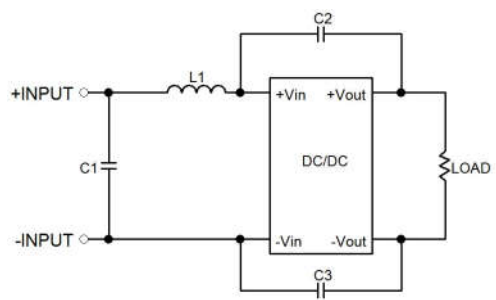
Single Output



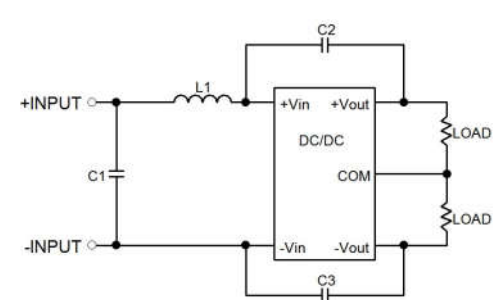
Dual Output

MODEL	C1	C2 、 C3 、 C4	L1
TMR 6-24□□WIRzzzzzzzz	10μF/50V 1210 MLCC	1000pF/3kV 1808 MLCC	22μH, TCK-149
TMR 6-48□□WIRzzzzzzzz	4.7μF/100V 1210 MLCC	1000pF/3kV 1808 MLCC	68μH, TCK-150

Table 1 B.O.M. of External EMI Filter



Single Output



Dual Output

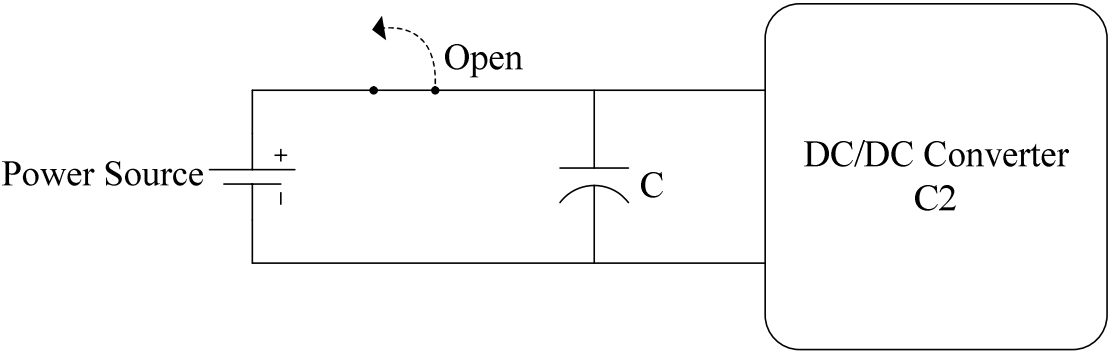
MODEL	C1	C2 、 C3 、 C4	L1
TMR 6-72□□WIRzzzzzzzz	0.68μF/250V 1210 MLCC	1000pF/3kV 1808 MLCC	150μH, TCK-161

Table 1 B.O.M. of External EMI Filter

●EFT / Surge: Add external components when test.

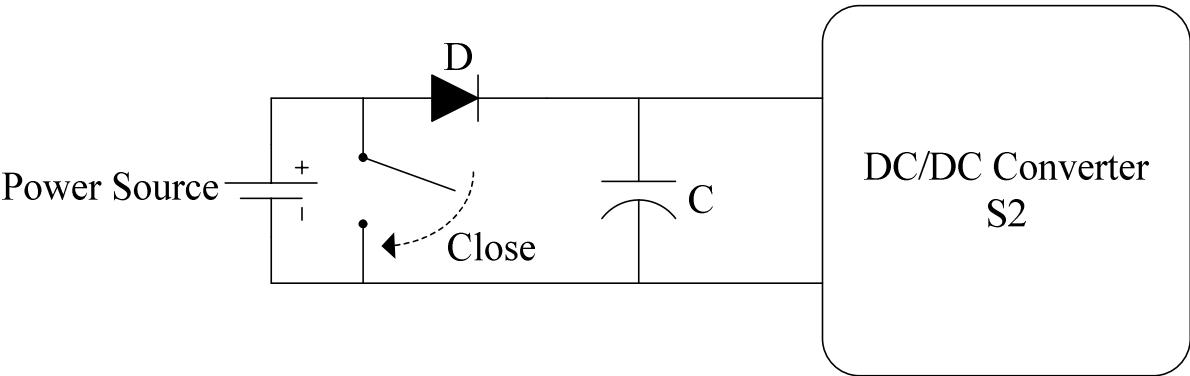
MODEL : TMR 6-7211WIR	Surge	With an aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 150μF/200V) and a TVS (SMB250A, 250V, 600Watt peak pulse power) to connect in parallel.
	Fast transient	

EN50155 C2 :



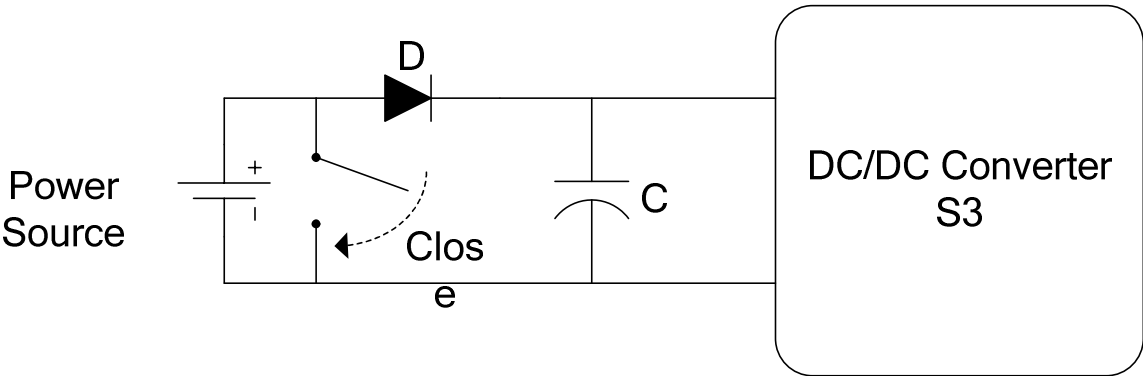
Model Series	Nominal Voltage	C2 (Capacitor)
TMR 3	24 Vin	690uF
	48 Vin	180uF
	72 Vin	100uF
	96 Vin	47uF
	110 Vin	33uF
TMR 6	24 Vin	1300uF
	48 Vin	330uF
	72 Vin	200uF
	96 Vin	90uF
	110 Vin	68uF

EN50155 S2 :



Model Series	Nominal Voltage	S2 (DIODE)	S2 (Capacitor)
TMR 3	24 Vin	Input voltage range : 9 ~ 36V : <u>NA03QSA065</u> 18 ~ 75V : <u>NA03HSA12</u> 43V ~ 160V : <u>NA03HA20</u>	230uF
	48 Vin		60uF
	72 Vin		33uF
	96 Vin		16uF
	110 Vin		12uF
TMR 6	24 Vin	Input voltage range : 9 ~ 36V : <u>NA03QSA065</u> 18 ~ 75V : <u>NA03HSA12</u> 43V ~ 160V : <u>NA03HA20</u>	440uF
	48 Vin		110uF
	72 Vin		68uF
	96 Vin		30uF
	110 Vin		22uF

EN50155 S3 :



Model Series	Nominal Voltage	S3 (DIODE)	S3 (Capacitor)
TMR 3	24 Vin	Input voltage range : 9 ~ 36V : <u>NA03QSA065</u> 18 ~ 75V : <u>NA03HSA12</u> 43V ~ 160V : <u>NA03HA20</u>	470uF
	48 Vin		150uF
	72 Vin		68uF
	96 Vin		33uF
	110 Vin		22uF
TMR 6	24 Vin	Input voltage range : 9 ~ 36V : <u>NA03QSA065</u> 18 ~ 75V : <u>NA03HSA12</u> 43V ~ 160V : <u>NA03HA20</u>	1000uF
	48 Vin		220uF
	72 Vin		150uF
	96 Vin		68uF
	110 Vin		47uF

NA03HA20		
VRRM	IF	VF
200V	3A	0.9V
LOW Vin FORWARD POWER DISSIPATION	IFSM (Half Sine Wave, 1cycle,Non-repetitive)	
0.1W (LOW Vin)	110A	

NA03HSA12		
VRRM	IF	VF
120V	3A	0.86V
LOW Vin FORWARD POWER DISSIPATION	IFSM (Half Sine Wave, 1cycle,Non-repetitive)	
0.2W (LOW Vin)	60A	

NA03QSA065		
VRRM	IF	VF
65V	3A	0.63V
LOW Vin FORWARD POWER DISSIPATION	IFSM (Half Sine Wave, 1cycle,Non-repetitive)	
0.4W (LOW Vin)	60A	