



## TEST REPORT

FOR

DC to DC CONVERTER

BRAND : 

MODEL : TMR 12-4815WI

SERIES MODEL : Refer to item 5.1 for more details.

REPORT NUMBER: 4789951652A-EN-E0-V0

ISSUE DATE: Nov. 9, 2021

Prepared for

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### **Revision History**

<b>Rev.</b>	<b>Issue Date</b>	<b>Revisions</b>	<b>Revised By</b>
--	Nov 9, 2021	Initial Issue	Cindy Hsin

Summary of Test Results				
EMISSION				
Standard	Test Item	Limit	Result	Remark
EN 55032:2015 +A11: 2020	Conducted disturbance at mains terminals ports	Class B	N/A	(Note 1)
	Conducted common mode (asymmetric mode) disturbance telecommunication ports	Class B	N/A	(Note 2)
	Radiated disturbance below 1GHz	Class B	PASS	(Note 4, 5)
	Radiated disturbance above 1 GHz	Class B	N/A	(Note 3)
EN 61000-3-2 : 2014	Harmonic current disturbance	Class A	N/A	(Note 1)
EN 61000-3-3 : 2013	Voltage Fluctuations & Flicker	Refer to 6.5.1	N/A	(Note 1)

**Note 1:** Since the EUT does not connect to mains power network directly, the test is unnecessary.

**Note 2:** Since the EUT does not contain asymmetric port, the test is unnecessary.

**Note 3:** Since the highest frequency of EUT is less than 108 MHz, the measurement above 1 GHz is unnecessary.

**Note 4:** Customers add countermeasure components to the fixture board. For the corresponding components, please refer to the appendix III.

**Note 5:** Please refer to original report no.: 4789713034A-EN-E0-V0.

Summary of Test Results (EN 55024)				
IMMUNITY				
Basic Standard	Test Item	Class / Severity	Require Performance Criteria	Result
IEC 61000-4-2: 2008 EN 61000-4-2: 2009	Electrostatic discharge immunity	Contact $\pm 4$ kV Air $\pm 8$ kV	B	PASS (Note 7)
IEC 61000-4-3: 2006+ A1: 2007+A2: 2010 EN 61000-4-3: 2006+ A1: 2008+A2: 2010	Radiated, radio frequency electromagnetic field immunity	3V/m 80%, 1kHz, AM	A	PASS (Note 7)
IEC 61000-4-4: 2012 EN 61000-4-4: 2012	Electrical fast transient/burst immunity	1kV(AC Mains) 5/50ns, 5kHz	B	N/A (Note 4)
		0.5kV(DC port) 5/50ns, 5kHz	B	PASS (Note 6, 7)
		0.5kV(Signal Lines) 5/50ns, 5kHz or 100kHz (Note 3)	B	N/A (Note 5)
IEC 61000-4-5: 2014 + A1: 2017 EN 61000-4-5: 2014	Surge immunity	AC Mains 2.0kV(Common) 1.0kV(Differential) 1.2/50us	B	N/A (Note 4)
		DC power port 0.5kV Line to ground 1.2/50us	B	PASS (Note 6, 7)
		Signal port 1.0kV(w/o primary protector) 4.0kV(w primary protector) 1.2/50us or 10/700us (Note 1)	C	N/A (Note 5)
IEC 61000-4-6: 2013+ COR1: 2015 EN 61000-4-6: 2014 + AC: 2015	Immunity to conducted disturbances, induced by radio-frequency fields	AC Mains 3V (e.m.f), 80%, 1kHz Amp. Mod. (Note 2)	A	N/A (Note 4)
		DC power port 3V (e.m.f), 80%, 1kHz Amp. Mod (Note 2)	A	PASS (Note 7)
		Signal line 3V (e.m.f), 80%, 1kHz Amp. Mod. (Note 2)	A	N/A (Note 5)
IEC 61000-4-8: 2009 EN 61000-4-8: 2010	Power frequency magnetic field immunity	50 Hz, 1 A/m(r.m.s)	A	PASS (Note 7)

Summary of Test Results (EN 55024)				
IMMUNITY				
Basic Standard	Test Item	Class / Severity	Require Performance Criteria	Result
IEC 61000-4-11: 2014+ A1:2017 EN 61000-4-11: 2004	Voltage dips, short interruptions and voltage variations immunity	Voltage dips, >95% reduction with 0.5 period	B	N/A (Note 4)
		Voltage dips, 30% reduction with 25 periods	C	
		Voltage interruptions >95% reduction with 250 periods	C	

**Note 1:** Where the coupling network for the 10/700  $\mu$ s waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20)  $\mu$ s waveform and appropriate coupling network.

**Note 2:** The frequency range is scanned as specified. However, when specified in EN 55024 Annex A, an additional comprehensive functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted tests are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz ( $\pm 1$  %).

**Note 3:** For xDSL equipment, the repetition frequency for EFT testing shall be 100 kHz .

**Note 4:** Since the EUT does not connect to mains power network directly, the test is unnecessary.

**Note 5:** Since the EUT does not contain signal port, the test is unnecessary.

**Note 6:** Customers add countermeasure components to the fixture board. For the corresponding components, please refer to the appendix III.

**Note 7:** Please refer to original report no.: 4789713034A-EN-E0-V0.

Summary of Test Results (EN 55035)				
IMMUNITY				
Basic Standard	Test Item	Class / Severity	Require Performance Criteria	Result
IEC 61000-4-2: 2008 EN 61000-4-2: 2009	Electrostatic discharge immunity	Contact ±4 kV Air ±8 kV	B	PASS (Note 7)
IEC 61000-4-3: 2006+ A1: 2007+A2: 2010 EN 61000-4-3: 2006+ A1: 2008+A2: 2010	Continuous RF electromagnetic field disturbances, swept test	80-1000MHz 3V/m 80%, 1kHz, AM	A	PASS (Note 7)
	Continuous RF electromagnetic field disturbances, spot test	1800 ;2600 ;3500 5000 MHz (±1%) 3V/m 80%, 1kHz, AM (Note 2)	A	PASS (Note 7)
	immunity levels to common wireless communication devices	Refer to Table I.1	A	PASS (Note 7)
IEC 61000-4-4: 2012 EN 61000-4-4: 2012	Electrical fast transient/burst immunity	1kV(AC Mains) 5/50ns, 5kHz	B	N/A (Note 4)
		0.5kV(DC power port) 5/50ns, 5kHz	B	PASS (Note 6, 7)
		0.5kV(Signal Lines) 5/50ns, 5kHz or 100kHz (Note 3)	B	N/A (Note 5)
IEC 61000-4-5: 2014 + A1: 2017 EN 61000-4-5: 2014	Surge immunity	AC Mains 2.0kV(Common) 1.0kV(Differential) 1.2/50us	B	N/A (Note 4)
		DC power port 0.5kV Line to ground 1.2/50us	B	PASS (Note 6, 7)
		Signal port 1.0kV (w/o primary protector) 4.0kV (w primary protector) 1.2/50us or 10/700us 0.5kV Coaxial or shielded to ground 1.2/50 (8/20) us (Note 1)	C	N/A (Note 5)

Summary of Test Results (EN 55035)				
IMMUNITY				
Basic Standard	Test Item	Class / Severity	Require Performance Criteria	Result
IEC 61000-4-6: 2013+ COR1: 2015 EN 61000-4-6: 2014 + AC: 2015	Continuous induced RF disturbances	AC Mains 0.15~10MHz, 3V 10~30MHz, 3~1V 30-80MHz, 1V with 1kHz 80% AM (Note 2)	A	N/A (Note 4)
		DC Ports 0.15~10MHz, 3V 10~30MHz, 3~1V 30-80MHz, 1V with 1kHz 80% AM (Note 2)	A	PASS (Note 7)
		Signal Line 0.15~10MHz, 3V 10~30MHz, 3~1V 30-80MHz, 1V with 1kHz 80% AM (Note 2)	A	N/A (Note 5)
IEC 61000-4-8: 2009 EN 61000-4-8: 2010	Power frequency magnetic field immunity	50 Hz, 1 A/m(r.m.s)	A	PASS (Note 7)
IEC 61000-4-11: 2004+ A1:2017 EN 61000-4-11: 2004	Voltage dips, short interruptions and voltage variations immunity	Voltage dips, <5% residual with 0.5cycles	B	N/A (Note 4)
		Voltage dips, 70% residual with 25 cycles	C	
		Voltage interruptions, <5% residual with 250 cycles	C	

**Note 1:** Where the coupling network for the 10/700  $\mu$ s waveform affects the functioning of high speed data ports, the test shall be carried out using a 1,2/50 (8/20)  $\mu$ s waveform and appropriate coupling network.

**Note 2:** The frequency range is scanned as specified. However, when specified in EN 55035 , an additional EUT contains telephony functional test shall be carried out at a limited number of frequencies. The selected frequencies for conducted immunity tests are: 0,2; 1; 7,1; 13,56; 21; 27,12 and 40,68 MHz ( $\pm 1$  %) and radiated immunity tests are 80; 120; 160; 230; 434; 460; 600; 863 and 900MHz ( $\pm 1$  %).

**Note 3:** For xDSL equipment, the repetition frequency for EFT testing shall be 100 kHz .

**Note 4:** Since the EUT does not connect to mains power network directly, the test is unnecessary.

**Note 5:** Since the EUT does not contain signal port, the test is unnecessary.

**Note 6:** Customers add countermeasure components to the fixture board. For the corresponding components, please refer to the appendix III.

**Note 7:** Please refer to original report no.: 4789713034A-EN-E0-V0.

**Table I.1 – Guidance on the selection of immunity levels  
to common wireless communication devices**

Table clause	Approximate protection distance (m)	Calculated RF field strength in V/m for frequencies and protection distances simulating different radio transmission types, assuming a given ERP						
		LTE/UMTS (0,2 W)	GSM		WiMAX/3 G (1,26 W)	WiMAX (1,26 W)	Wi-Fi (1 W)	Maximum RF field strength at any frequency
			(2 W)	(1 W)				
		800 MHz	900 MHz	1,8 GHz	2,6 GHz	3,5 GHz	5 GHz	
I.1.1	3,0	0,6	1,8	1,3	1,5	1,5	1,3	3
I.1.2	1,5	1,2	3,7	2,6	2,9	2,9	2,6	4
I.1.3	1,0	1,7	5,5	3,9	4,4	4,4	3,9	6
I.1.4	0,5	3,3	10,5	10,5	11,8	11,8	10,5	12
I.1.5	0,2	8,3	26,4	26,4	29,6	29,6	26,4	30
The protection distance is not the test distance as defined in IEC 61000-4-3:2006/AMD1:2007/AMD2:2010, but the shortest expected operating distance between the EUT and the interfering wireless communication device at which the immunity performance criteria will be satisfied.								



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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** TRACO ELECTRONIC AG  
Sihlbruggstrasse 111 CH-6340 Baar Switzerland

**MANUFACTURER:** TRACO ELECTRONIC AG  
Sihlbruggstrasse 111 CH-6340 Baar Switzerland

**EUT DESCRIPTION:** DC to DC CONVERTER

**BRAND:**



**MODEL:** TMR 12-4815WI

**SERIES MODEL :** Refer to item 5.1 for more details

**DATE of TESTED:** Mar. 2, 2021 ~ Mar. 16, 2021

APPLICABLE STANDARDS	
STANDARDS	TEST RESULTS
EN 55032 :2015 + A11: 2020 EN 55024: 2010+A1: 2015 EN 55035: 2017	PASS

Underwriters Laboratories Taiwan Co., Ltd. Tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. Based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. And all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. Will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

A handwritten signature in blue ink, appearing to read "Cindy Hsin", written over a horizontal line.

Cindy Hsin  
Project Handler

Date : Nov. 9, 2021

Approved and Authorized By:

A handwritten signature in blue ink, appearing to read "Roy Chen", written over a horizontal line.

Roy Chen  
Operations Manager

Date : Nov. 9, 2021

## 2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented EN 55032, EN 55024, and EN55035.

## 3. FACILITIES AND ACCREDITATION

Test Location	Underwriters Laboratories Taiwan Co., Ltd.,
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Description	All measurement facilities use to collect the measurement data are located at Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

Electromagnetic interference:

Test Item	Measurement Frequency Range	K	U(dB)
966-1 Test Site			
Radiated disturbance below 1 GHz	30MHz ~ 1000MHz	2	5.7

Electromagnetic sensitivity:

Test Item	Measurement Frequency Range	K	U(dB)
Radiated, radio frequency electromagnetic field immunity	80MHz ~ 6000MHz	2	1.9
Immunity to conducted disturbances, induced by radio-frequency fields (CDN)	0.15MHz ~ 80MHz	2	2.4

Test Item	K	Voltage(%)	Rise Time(%)	First Peak Current (%)	Current @ 30ns (%)	Current @ 60ns (%)
Electrostatic discharge immunity	2	2.6	6.9	3.9	4.0	4.0


Test Item	K	Peak Voltage(%)	Rise Time(%)	Pulse width(%)	Burst duration & Period (%)	Repetition rate (%)
Electrical fast transient/burst immunity	2	1.0	2.4	5.1	0.74	0.22

Test Item	K	Phase Shifting (%)	Voltage (%)	Current (%)	Front Time & Duration(For waveform of the surge voltage)(%)	Front Time & Duration(For waveform of the surge current)(%)
Surge immunity	2	0.31	3.6	2.7	1.5	5.9

Test Item	K	Magnetic field Strength(%)
Power Frequency Magnetic Field Immunity Test	2	10.0

## 5. EQUIPMENT UNDER TEST

### 5.1. Description of EUT

<b>EUT Name:</b>	DC to DC CONVERTER
<b>Brand:</b>	
<b>Model:</b>	TMR 12-4815WI
<b>Series Model:</b>	TMR 12-1210WI, TMR 12-1211WI, TMR 12-1219WI, TMR 12-1212WI, TMR 12-1213WI, TMR 12-1215WI, TMR 12-1221WI, TMR 12-1222WI, TMR 12-1223WI, TMR 12-2410WI, TMR 12-2411WI, TMR 12-2419WI, TMR 12-2412WI, TMR 12-2413WI, TMR 12-2415WI, TMR 12-2421WI, TMR 12-2422WI, TMR 12-2423WI, TMR 12-4810WI, TMR 12-4811WI, TMR 12-4819WI, TMR 12-4812WI, TMR 12-4813WI, TMR 12-4821WI, TMR 12-4822WI, TMR 12-4823WI
<b>Power Rating:</b>	48Vdc from DC source
<b>Highest Frequency within EUT:</b>	Less than 108MHz
<b>Condition of EUT:</b>	Production Unit
<b>Date Of Receipt Of Sample:</b>	Mar. 8, 2021

Note :

1. This report was issued base on original report which report number is 4789713034A-EN-E0-V0, the differences were only change models' name and the applicant. There is no additional test shall be verified. For the test data, copied from original report 4789713034A-EN-E0-V0 show on this report.

Note :

2. The models difference table as below:

Model Number	Input Range	Output Voltage
	VDC	VDC
TMR 12-1210WI	4.5 ~ 18	3.3
TMR 12-1211WI	4.5 ~ 18	5.1
TMR 12-1219WI	4.5 ~ 18	9
TMR 12-1212WI	4.5 ~ 18	12
TMR 12-1213WI	4.5 ~ 18	15
TMR 12-1215WI	4.5 ~ 18	24
TMR 12-1221WI	4.5 ~ 18	±5
TMR 12-1222WI	4.5 ~ 18	±12
TMR 12-1223WI	4.5 ~ 18	±15
TMR 12-2410WI	9 ~ 36	3.3
TMR 12-2411WI	9 ~ 36	5.1
TMR 12-2419WI	9 ~ 36	9
TMR 12-2412WI	9 ~ 36	12
TMR 12-2413WI	9 ~ 36	15
TMR 12-2415WI	9 ~ 36	24
TMR 12-2421WI	9 ~ 36	±5
TMR 12-2422WI	9 ~ 36	±12
TMR 12-2423WI	9 ~ 36	±15
TMR 12-4810WI	18 ~ 75	3.3
TMR 12-4811WI	18 ~ 75	5.1
TMR 12-4819WI	18 ~ 75	9
TMR 12-4812WI	18 ~ 75	12
TMR 12-4813WI	18 ~ 75	15
TMR 12-4815WI	18 ~ 75	24
TMR 12-4821WI	18 ~ 75	±5
TMR 12-4822WI	18 ~ 75	±12
TMR 12-4823WI	18 ~ 75	±15

Note: The customer only provided TMR 12-1215WI and TMR 12-4815WI, for the EMI pretest and choose the worst mode do the EMI and EMS final test.



## 5.2. Test Mode

The Pre-test modes :

Mode	Description	Radiated Emission
Mode 1	Full Load (TMR 12-1215WI)	v
Mode 2	Full Load (TMR 12-4815WI)	v

After pre-testing, the final test mode was displayed as below table.

Test Items		Test Mode
<b>Emission</b>	Radiated Emission	Mode 2
<b>Immunity</b>	Electrostatic Discharge	Mode 2
	Radio Frequency Electromagnetic Field	Mode 2
	Electrical Fast Transients	Mode 2
	Surge immunity	Mode 2
	Immunity to conducted disturbances, induced by radio-frequency fields	Mode 2
	Power frequency magnetic field	Mode 2

### 5.3. EUT Operation Test Setup

For Radiated Emission test :

- a. The EUT was linked to resistance load with full load during the testing.
- b. Power on the EUT and run test.

For Immunity test :

- a. The EUT was linked to resistance load with full load and the resistance load was connected with a meter during the testing.
- b. Power on the EUT and run test.

### 5.4. Monitoring of EUT for All Immunity Test

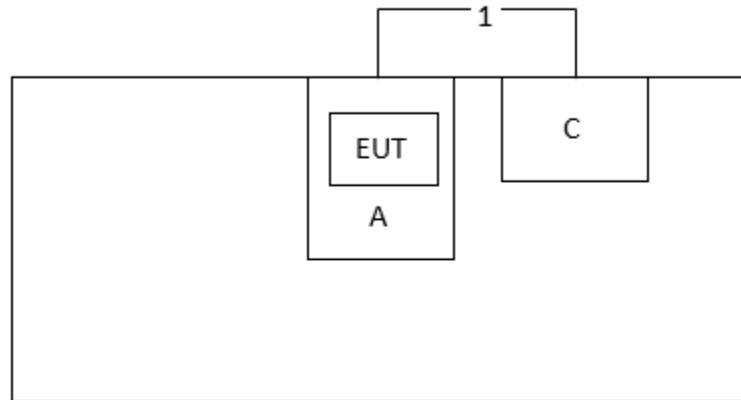
<b>Audio</b>	N/A
<b>Visual</b>	Monitor the output voltage through the meter.

### 5.5. Accessory

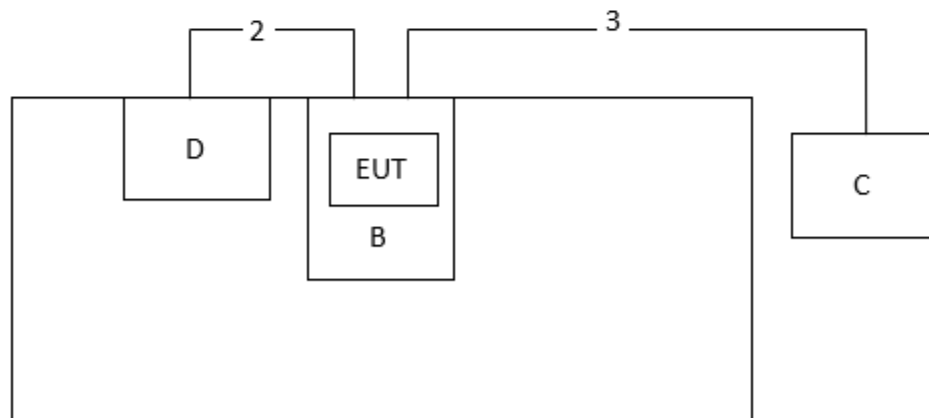
N/A

## 5.6. Block diagram showing the configuration of system tested

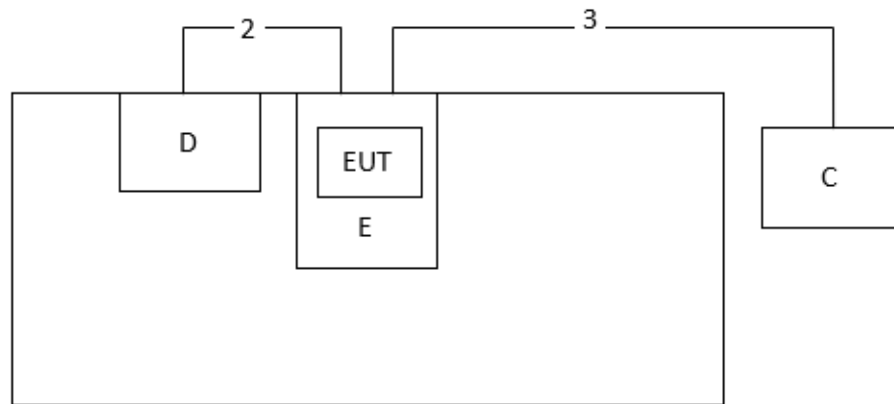
For Radiated Emission test :



For Immunity- ESD, RS, CS, PFMF test :



For Immunity- EFT, Surge test :



## 5.7. Description of support units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	FCC ID	Note
A	Fixture board-1	N/A	N/A	N/A	N/A	Provide by the customer
B	Fixture board-2	N/A	N/A	N/A	N/A	Provide by the customer
C	Power supply	GW Instek	GPD-2303S	GEQ902325	N/A	N/A
D	Meter	CNSCKJ	C85C17-V	N/A	N/A	N/A
E	Fixture board-3	N/A	N/A	N/A	N/A	Provide by the customer

Item	Connection	Shielded Type	Note
1	Power Wire *2	Non-shielded	N/A
2	Power Wire *2	Non-shielded	N/A
3	Power Wire *2	Non-shielded	N/A

## 5.8. Measuring Instrument List

Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
Radiated Disturbance					
966-1					
EMI Test Receiver	Rohde & Schwarz	ESR7	101755	2020/12/4	2021/12/3
Trilog-Broadband Antena with 5dB Attenuator	SCHWARZBECK	VULB 9168 & N-6-05	774 & AT-N0538	2021/1/13	2022/1/12
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	1686	2020/12/23	2021/12/22
Preamplifier	EMC Instrument	EMC330E	980404	2020/6/4	2021/6/3
Preamplifier	EMC Instrument	EMC051835BE	980407	2021/1/20	2022/1/19
Cables	UltraPhase&EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/8000	170111-3&170104/170223	2021/2/3	2022/2/2
Measurement Software	Farad	EZ-EMC Ver: UL-3A1	N/A	N/A	N/A

Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<b>Electrostatic discharge</b>					
ESD Generator	TESEQ	NSG 437	1125	2020/12/3	2021/12/2
Barometer	TFA	DIVA PLUS	35.1078.10.IT	2020/6/12	2021/6/11
<b>Radio frequency electromagnetic field immunity</b>					
RF and Microwave Signal Generator	Rohde & Schwarz	SMB100A	113793	2021/2/20	2022/2/19
Power amplifier	Milmega	80RF1000-300	1077558	N/A	N/A
Power amplifier	Milmega	AS0860B	1077559	N/A	N/A
Directional coupler	Werlatone	C10117-10	111786	N/A	N/A
Directional coupler	Werlatone	C8719-20	111759	N/A	N/A
Antenna	AR	ATR80M6G	346008	N/A	N/A
Antenna	SCHWARZBECK	STLP 9149	00441	N/A	N/A
RF switch	OSP	OSP	N/A	N/A	N/A
Power Meter	Rohde & Schwarz	NRP2	105524	2020/9/16	2021/9/15
Power Sensor	Rohde & Schwarz	NRP-Z91	103732	2020/9/16	2021/9/15
Power Sensor	Rohde & Schwarz	NRP-Z91	103733	2020/9/16	2021/9/15
Sound Calibrator	Brue&Kjaer	Type 4231	3016784	2020/2/14	2023/2/12
Audio Analyzer	Rohde & Schwarz	UPV	104227	2020/11/23	2021/11/22
Pressure-field 1/2" Microphone	Brue&Kjaer	Type 4192	3069928	2020/3/13	2021/3/11
Mouth Simulator	Brue&Kjaer	Type 4227	3078961	2020/3/6	2023/3/5
GPS signal generator	Keysight Technologies	N5172B	MY56200315	2021/1/15	2022/1/14
Radio Communication Analyzer	Rohde & Schwarz	CMW500	161254	2020/12/13	2021/12/12
Measurement Software	Rohde & Schwarz	EMC32, VER.10.20.01	N/A	N/A	N/A
<b>Electrical fast transient</b>					
Ultra Compact Simulator	EM TEST	UCS 500N7	P1628180275	2020/12/2	2021/12/1
Capacitive Coupling Clamp	EM TEST	HFK	P1642185790	2020/11/19	2021/11/18
Measurement Software	TESEQ	IEC.control, VER.7.1.5	N/A	N/A	N/A

Instrument					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<b>Surge</b>					
Ultra Compact Simulator	EM TEST	UCS 500N7	P1628180275	2020/12/2	2021/12/1
Telecom Surge Generator	EM TEST	TSurge7	P1620180015	2020/12/4	2021/12/3
Coupling and Decoupling Network	EM TEST	CNV 508T5	P1637184038	2020/12/7	2021/12/6
Coupling and Decoupling Network	TESEQ	CDN HSS-2	45091	2020/12/7	2021/12/6
Measurement Software	TESEQ	IEC.control, VER.7.1.5	N/A	N/A	N/A
<b>Immunity to conducted disturbances, induced by radio-frequency fields</b>					
Signal Generator	Rohde & Schwarz	SMC100A	105811	2020/10/6	2021/10/5
Power amplifier	Rohde & Schwarz	BBA150-A125B125	102340	N/A	N/A
Coupling and Decoupling Network	TESEQ	CDN M016	45073	2020/3/13	2021/3/12
Coupling and Decoupling Network	TESEQ	CDN T2-10	45003	2020/3/13	2021/3/12
Coupling and Decoupling Network	TESEQ	CDN T4-10	44939	2020/3/13	2021/3/12
Coupling and Decoupling Network	TESEQ	CDN T8-10	49203	2020/12/14	2021/12/13
EM Injection Clamp	TESEQ	CAL 801A & KEMZ 801A	75454.1, 75454.2 & 45181	2020/3/18	2021/3/17
Current Injection Probe	TESEQ	CIP 9136A	44618	2020/10/25	2021/10/24
Power - Sensor	Rohde & Schwarz	NRP-Z91	103730	2020/12/9	2021/12/8
Power - Sensor	Rohde & Schwarz	NRP-Z91	103731	2020/12/9	2021/12/8
Sound Calibrator	Bruel&Kjaer	Type 4231	3016784	2020/2/14	2023/2/12
Audio Analyzer	Rohde & Schwarz	UPV	104227	2020/11/23	2021/11/22
Radio Communication Analyzer	Rohde & Schwarz	CMW500	161254	2020/12/13	2021/12/12
Pressure-field 1/2" Microphone	Bruel&Kjaer	Type 4192	3069928	2020/3/13	2021/3/11
Mouth Simulator	Bruel&Kjaer	Type 4227	3078961	2020/3/6	2023/3/5
Measurement Software	Rohde & Schwarz	EMC32, VER.10.20.01	N/A	N/A	N/A
<b>Power frequency magnetic field immunity</b>					
Ultra Compact Simulator	EM TEST	UCS 500N7	P1628180275	2020/12/2	2021/12/1
Current Transformer	EM TEST	MC 2630	P1644186773	2020/9/4	2021/9/3
Magnetic Field Test Antenna	EM TEST	MS 100N	P1627181324	2020/9/4	2021/9/3
Current Transformer	EM TEST	MFT100	P2025241594	2020/9/4	2021/9/3
Motorized Variac	EM TEST	MV 2616 (varic NX1-260-16)	P1643186426	2020/12/2	2021/12/1



## 6. EMISSION TEST

### 6.1. Radiated Disturbance Measurement(below 1GHz)

#### 6.1.1. Limits of radiated disturbance measurement

FREQUENCY (MHz)	<input type="checkbox"/> Class A		<input checked="" type="checkbox"/> Class B	
	<input type="checkbox"/> At 10m	<input type="checkbox"/> At 3m	<input type="checkbox"/> At 10m	<input checked="" type="checkbox"/> At 3m
	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m
30 – 230	40	50	30	40
230 – 1000	47	57	37	47

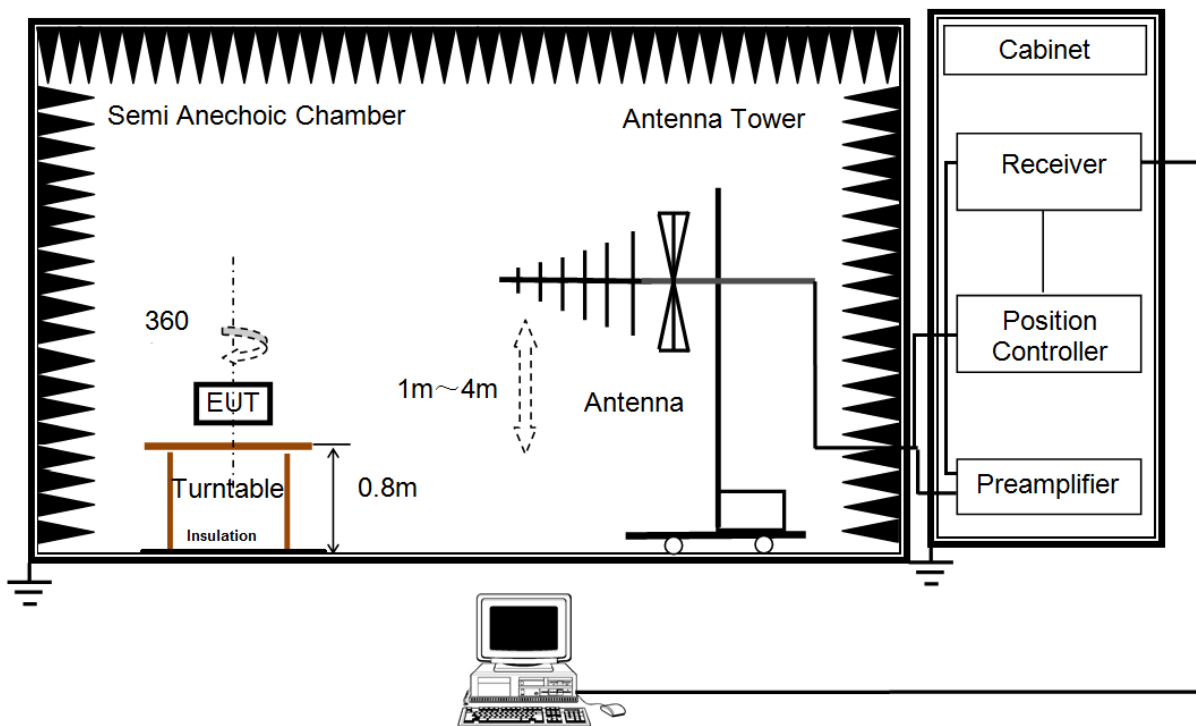
**NOTE:**

- (1) The limit for radiated test was performed according to EN55032.
- (2) The tighter limit applies at the band edges.
- (3) The test result calculated as following:  
Measurement Value = Reading Level + Correct Factor,  
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use),  
Margin Level = Measurement Value - Limit Value.

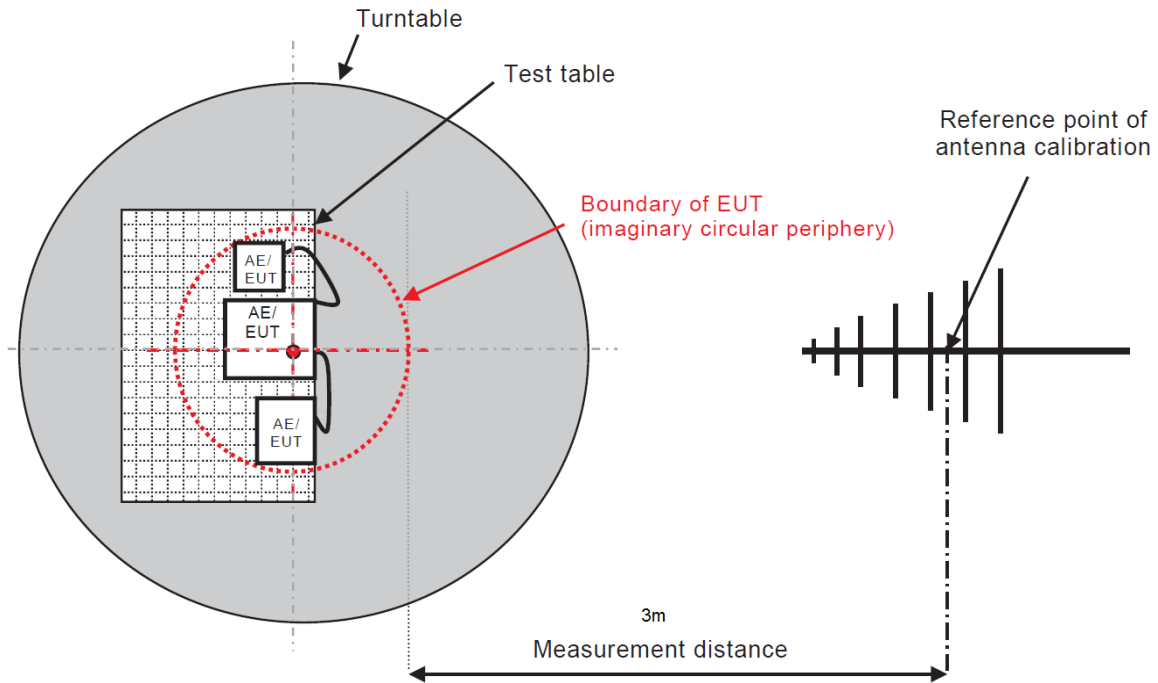
### 6.1.2. Test Procedure

- The measuring distance of at 3m shall be used for measurements at frequency from 30 to 1000MHz.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment shall be set at 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item:EUT Test Photos.

### 6.1.3. Test Setup

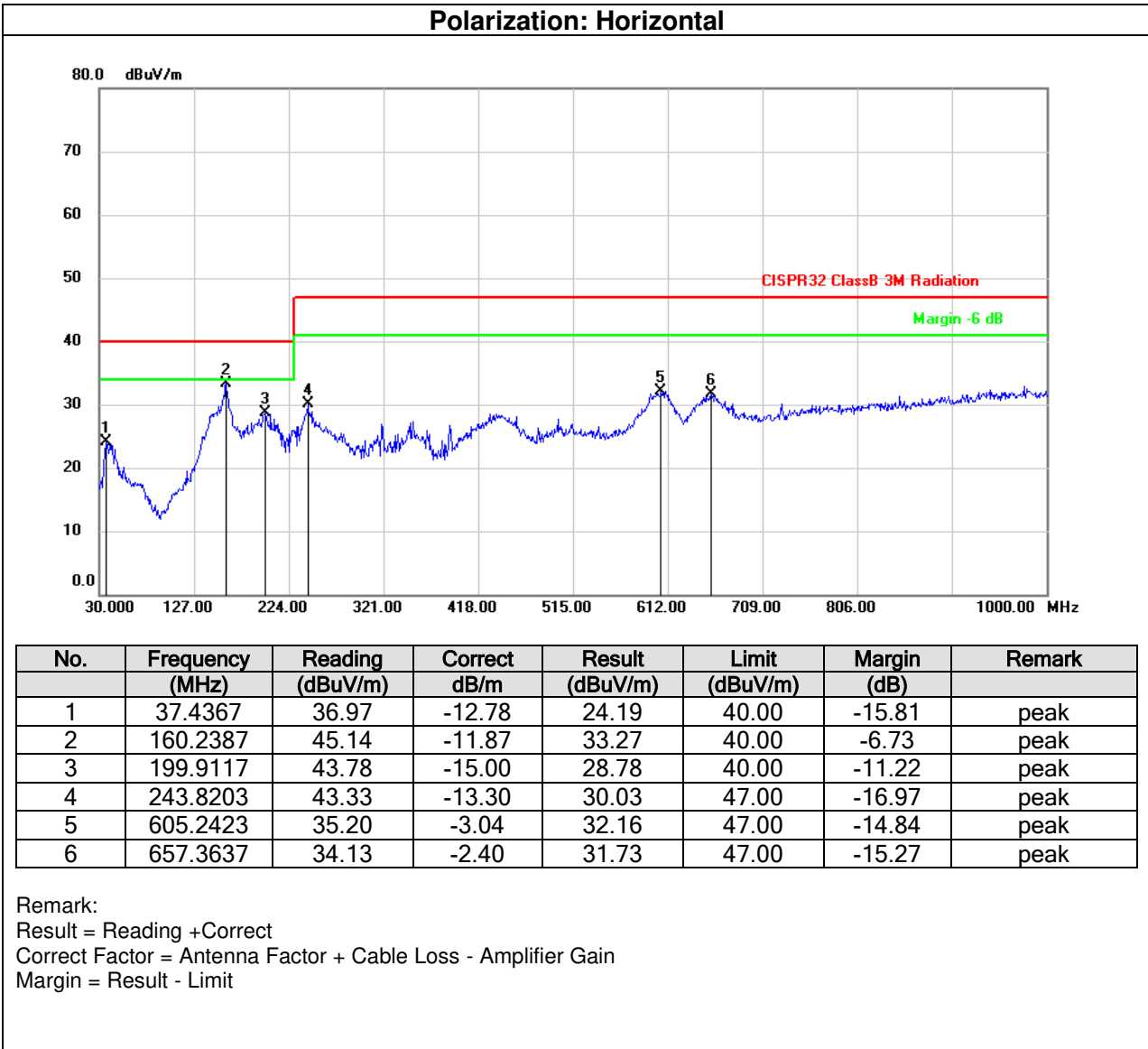


For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.



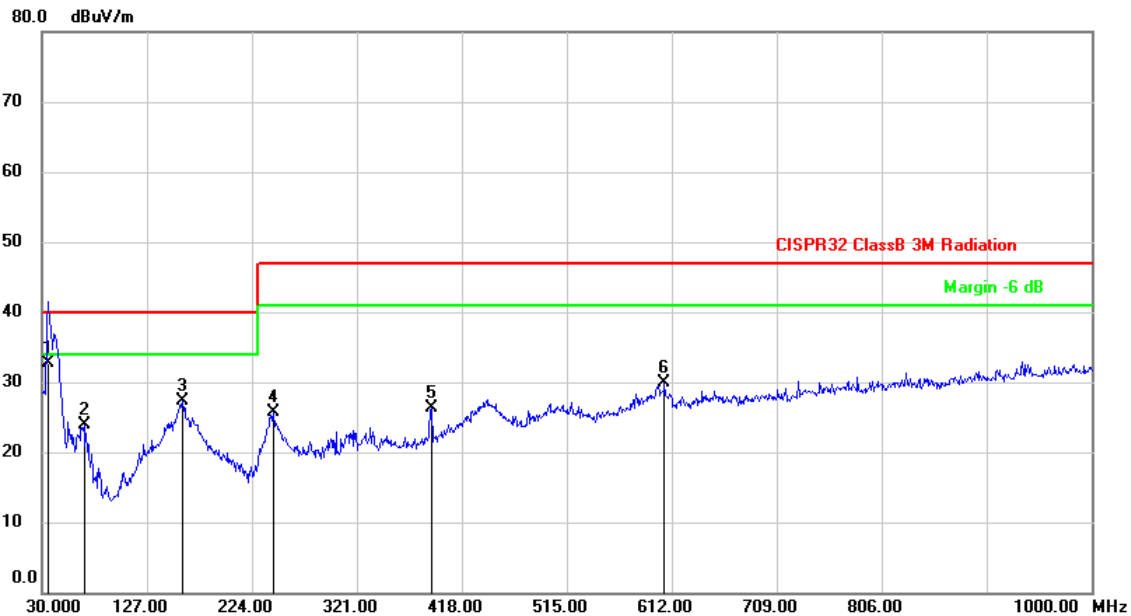
#### 6.1.4. Test Result

Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	59%RH
Tested By:	Rupert Hunag	Test Date:	Mar. 2, 2021



Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	59%RH
Tested By:	Rupert Hunag	Test Date:	Mar. 2, 2021

**Polarization: Vertical**



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	36.1433	45.78	-13.08	32.70	40.00	-7.30	QP
2	69.4790	38.19	-14.29	23.90	40.00	-16.10	peak
3	159.9800	39.10	-11.86	27.24	40.00	-12.76	peak
4	243.5293	39.08	-13.31	25.77	47.00	-21.23	peak
5	390.2580	34.78	-8.54	26.24	47.00	-20.76	peak
6	605.5333	32.93	-3.03	29.90	47.00	-17.10	peak

Remark:  
Result = Reading +Correct  
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain  
Margin = Result - Limit

## 7. IMMUNITY TEST

### 7.1. Performance Criteria

According to EN 55024/ EN 55035 standard, the general performance criteria as following:

<b>Criteria A</b>	<p>The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended.</p> <p>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, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.</p>
<b>Criteria B</b>	<p>During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.</p> <p>After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.</p> <p>If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.</p>
<b>Criteria C</b>	<p>Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.</p> <p>Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.</p>

## 7.2. Electrostatic Discharge Immunity Test

### 7.2.1. Test Specification

#### For EN 55024 & EN 55035

<b>Standard:</b>	EN 55024(Note)/ EN 55035 (refer to IEC/EN 61000-4-2)
<b>Discharge Impedance:</b>	330(1±10%)Ω / 150(1±10%)pF
<b>Discharge Voltage:</b>	Air Discharge: ±2kV/±4kV/±8kV (Direct)
<b>Polarity:</b>	Contact Discharge: ±2kV/±4kV (Direct/Indirect)
	Positive and Negative
<b>Discharge Mode of Operation:</b>	Single discharges
<b>Discharge Period:</b>	1 second minimum

### 7.2.2. Test Procedure

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

- Contact discharge was applied to conductive surfaces and coupling planes of the EUT. During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second. On each pre-selected point at least 10 single discharges (at each polarity) shall be applied. Test shall be performed at a maximum repetition rate of one discharge per second.

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5m x 0.5m, is placed parallel to, and positioned at a distance 0.1m from, the EUT, with the Discharge Electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.

Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1m from the EUT, with the Discharge Electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.

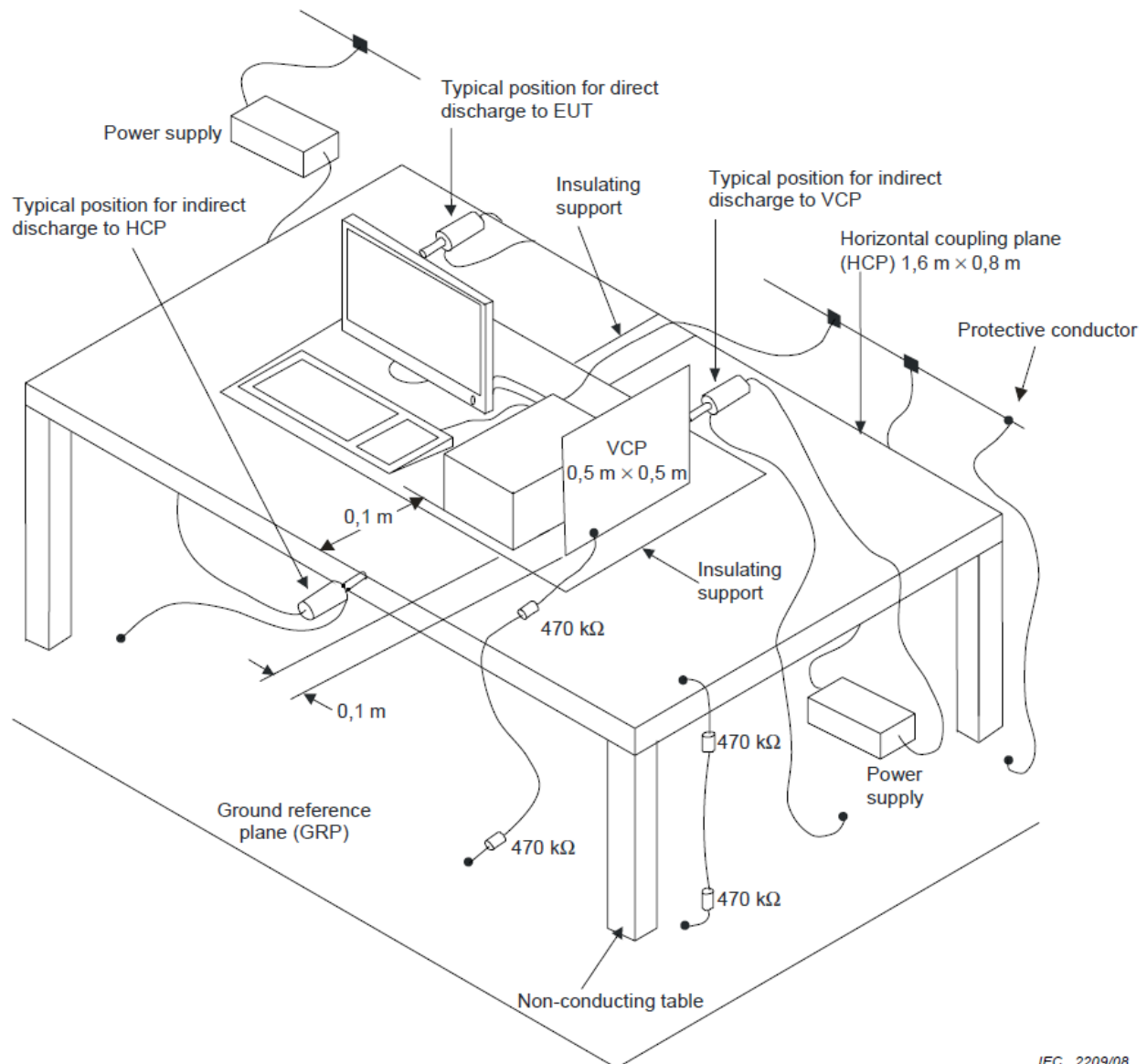
For EN 55024, Step a shall be change to 25 single discharges at each polarity.

- Air discharges at insulation surfaces of the EUT.

It was at least 10 single discharges with positive and negative at the same selected point.

- For the actual test configuration, please refer to the related Item :EUT Test Photos.

### 7.2.3. Test Setup



IEC 2209/08

A distance of 0,8 m minimum shall be provided between the EUT and the walls of the laboratory and any other metallic structure.

For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.



## 7.2.4. Test Result

### EN 55024 :

Test Mode:	Mode 2	Temperature:	24°C
Test Voltage:	48Vdc from DC source	Humidity:	30%RH
Discharge of times:	Air: 10 times Contact: 25 times	ATM pressure:	1022 hpa
Tested By:	Eric T. Fan	Test Date:	Mar. 15, 2021

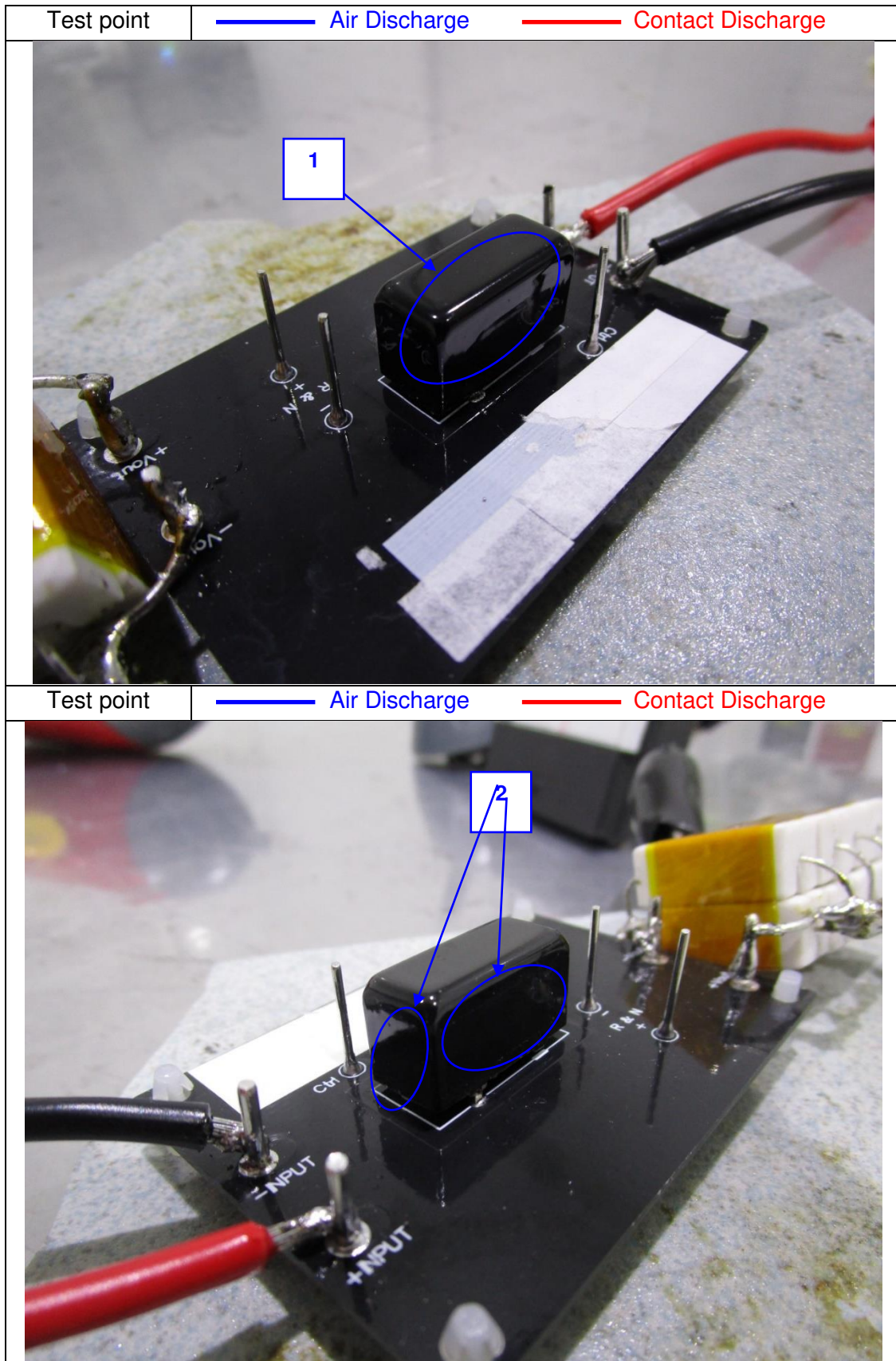
Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		-kV		2kV		4kV		-kV		-kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
1, 2	A	A	A	A	A	A	-	-	ND	ND	ND	ND	-	-	-	-
Criteria	B								B							
Results	A								-							
Judgment	PASS															
Note	There was no abnormal situation during the test compared with initial operation. ND: No Discharge, No Arcing; Meets criteria but unable to obtain an electrostatic discharge (ESD) at this test point.															

Mode	HCP Discharge								VCP Discharge							
	2kV		4kV		-kV		-kV		2kV		4kV		-kV		-kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
front	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
rear	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
left	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
right	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
Criteria	B				-				B				-			
Results	A				-				A				-			
Judgment	PASS															
Note	There was no abnormal situation during the test compared with initial operation.															

**Customer request:**

Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		15kV		2kV		4kV		6kV		8V	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
1 2	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	-	-
Criteria	B								B							
Results	-								-							
Judgment	PASS															
Note	ND: No Discharge, No Arcing; Meets criteria but unable to obtain an electrostatic discharge (ESD) at this test point.															

Mode	HCP Discharge								VCP Discharge							
	2kV		4kV		6kV		8kV		2kV		4kV		6kV		8kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
front	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
rear	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
left	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
right	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
Criteria	-				B				-				B			
Results	-				A				-				A			
Judgment	PASS															
Note	There was no abnormal situation during the test compared with initial operation.															



**EN 55035:**

Test Mode:	Mode 2	Temperature:	24°C
Test Voltage:	48Vdc from DC source	Humidity:	30%RH
Discharge of times:	Air: 10 times Contact: 10 times	ATM pressure:	1022 hpa
Tested By:	Eric T. Fan	Test Date:	Mar. 15, 2021

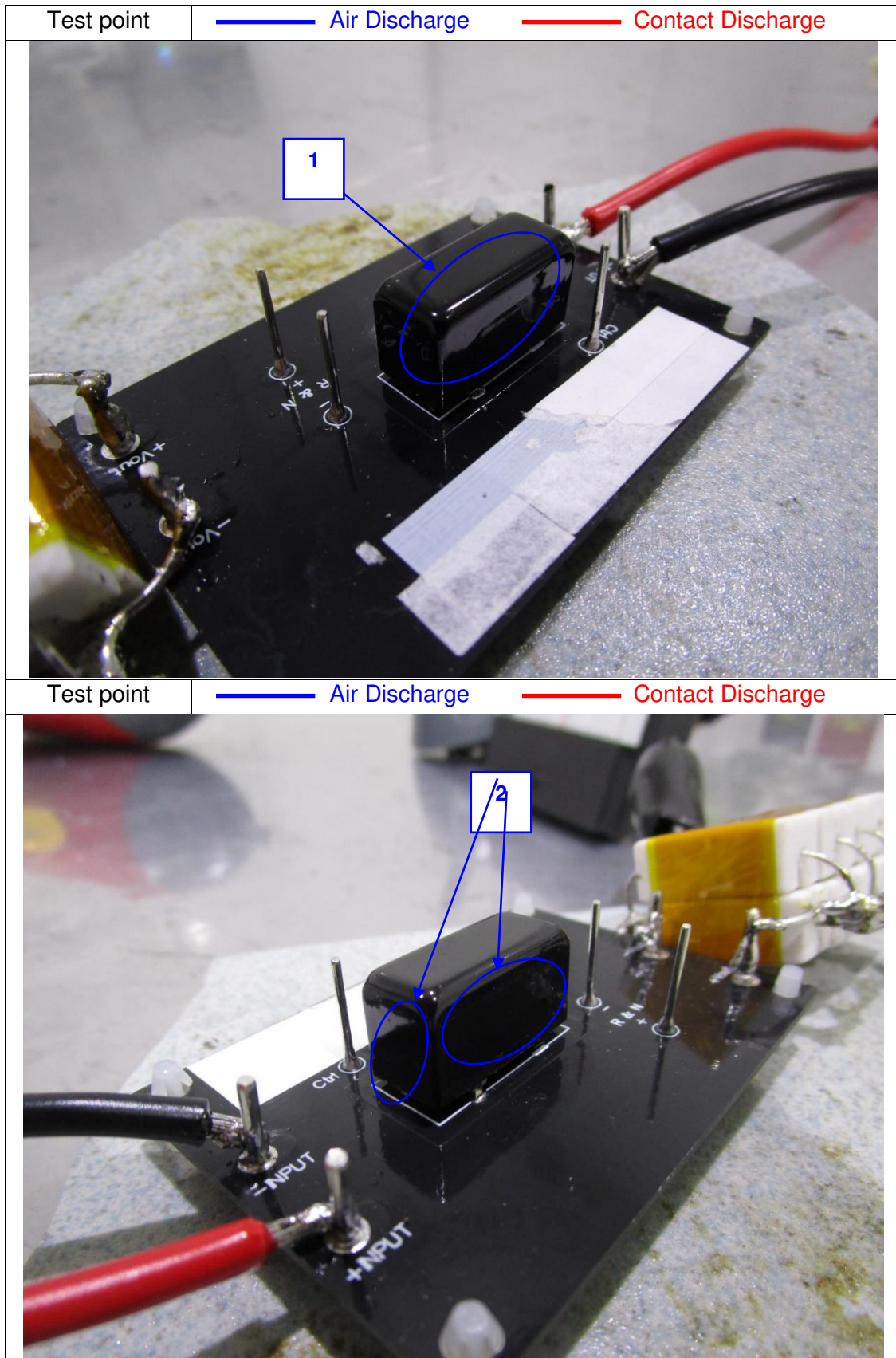
Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		-kV		2kV		4kV		-kV		-kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
1, 2	A	A	A	A	A	A	-	-	ND	ND	ND	ND	-	-	-	-
Criteria	B								-							
Results	A								-							
Judgement	PASS															
Note	There was no abnormal situation during the test compared with initial operation. ND: No Discharge, No Arcing; Meets criteria but unable to obtain an electrostatic discharge (ESD) at this test point.															

Mode	HCP Discharge								VCP Discharge							
	2kV		4kV		-kV		-kV		2kV		4kV		-kV		-kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
front	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
rear	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
left	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
right	A	A	A	A	-	-	-	-	A	A	A	A	-	-	-	-
Criteria	B				-				B				-			
Results	A				-				A				-			
Judgement	PASS															
Note	There was no abnormal situation during the test compared with initial operation.															

**Customer request:**

Mode	Air Discharge								Contact Discharge							
	2kV		4kV		8kV		15kV		2kV		4kV		6kV		8K	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
-	-	-	-	-	-	-	-	-	-	-	-	-	ND	ND	-	-
Criteria	B								B							
Results	-								-							
Judgement	PASS															
Note	ND: No Discharge, No Arcing; Meets criteria but unable to obtain an electrostatic discharge (ESD) at this test point.															

Mode	HCP Discharge								VCP Discharge							
	2kV		4kV		6kV		8kV		2kV		4kV		6kV		8kV	
Location	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
front	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
rear	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
left	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
right	-	-	-	-	A	A	-	-	-	-	-	-	A	A	-	-
Criteria	-				B				-				B			
Results	-				A				-				A			
Judgement	PASS															
Note	There was no abnormal situation during the test compared with initial operation.															





## 7.3. Radio Frequency Electromagnetic Field Immunity Test

### 7.3.1. Test Specification

For Standard EN 55024 :

<b>Standard:</b>	EN 55024 (refer to IEC/EN 61000-4-3)
<b>Frequency Range:</b>	80 MHz to 1000MHz
<b>Field Strength:</b>	3V/m (unmodulated)
<b>Modulation:</b>	80%, AM(1 kHz)
<b>Frequency Step:</b>	1%
<b>Polarity of Antenna</b>	Vertical and Horizontal
<b>Test Distance:</b>	3 meters
<b>Antenna Height:</b>	1.55 meters
<b>Dwell Time:</b>	3 s

For Standard EN 55035 :

<b>Standard:</b>	EN 55035 (refer to IEC/EN 61000-4-3)
<b>Frequency Range:</b>	80 MHz to 1000MHz
<b>Spot Frequency:</b>	1800, 2600, 3500, 5000 MHz( $\pm 1\%$ )
<b>Field Strength:</b>	3V/m (unmodulated)
<b>Immunity level to common wireless communication:</b>	See Table I.1 for test frequency and level
<b>Modulation:</b>	80%, AM(1 kHz)
<b>Frequency Step:</b>	1%
<b>Polarity of Antenna</b>	Vertical and Horizontal
<b>Test Distance:</b>	3 meters
<b>Antenna Height:</b>	1.55 meters
<b>Dwell Time:</b>	3 s

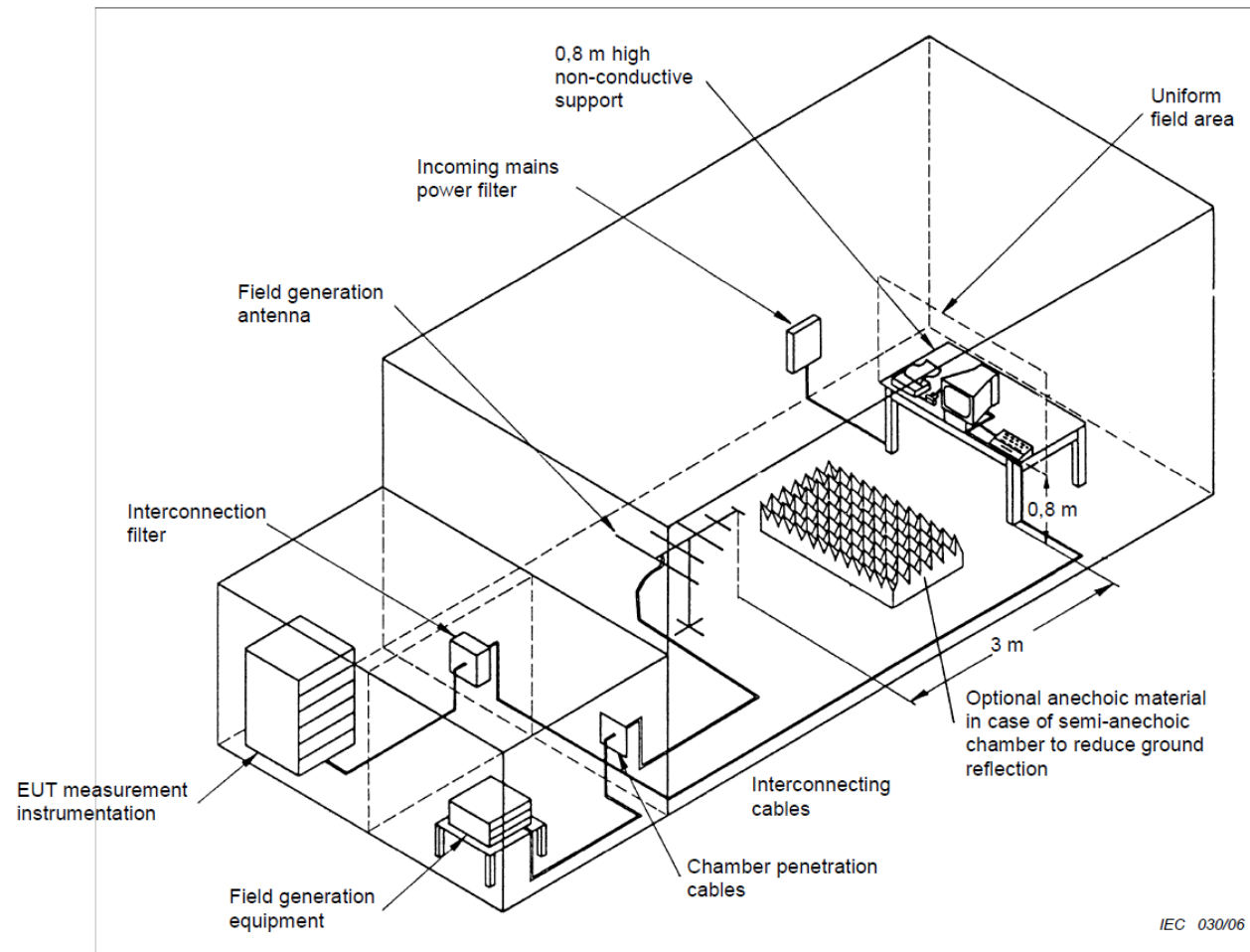
### 7.3.2. Test Procedure

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

- a. The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- b. The frequency range is swept from 80 MHz to 1000MHz with the signal 80% amplitude modulated with a 1 KHz sine wave. The rate of sweep did not exceed  $1.5 \times 10^{-3}$  decade/s. Where the frequency range is swept incrementally, the step size was 1% of fundamental.
- c. The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- d. The field strength level from 80 MHz to 1000MHz was 3V/m.
- e. A special spot frequency test point are 1800, 2600, 3500 and 5000MHz ( $\pm 1\%$ )
- f. Wireless communication devices are considered to be the most significant sources of interference for MME in the range 800 MHz to 5 GHz. Consequently testing is only required at relevant spot frequencies refer to EN 55035 Annex I.
- g. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



### 7.3.3. Test Setup



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

### 7.3.4. Test Result

#### EN 55024 :

Test Mode:	Mode 2	Temperature:	23°C
Test Voltage:	48Vdc from DC source	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Mar. 10, 2021

Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgment
80-1000	Front	H / V	3V/m	A	A	PASS
80-1000	Left	H / V	3V/m	A	A	PASS
80-1000	Right	H / V	3V/m	A	A	PASS
80-1000	Rear	H / V	3V/m	A	A	PASS

Note	There was no abnormal situation during the test compared with initial operation.
------	--

#### Customer request:

Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgment
80-1000	Front	H / V	10V/m	A	A	PASS
80-1000	Left	H / V	10V/m	A	A	PASS
80-1000	Right	H / V	10V/m	A	A	PASS
80-1000	Rear	H / V	10V/m	A	A	PASS

Note	There was no abnormal situation during the test compared with initial operation.
------	--

**EN 55035 :**

Test Mode:	Mode 2	Temperature:	23°C
Test Voltage:	48Vdc from DC source	Humidity:	53%RH
Tested By:	Rupert Huang	Test Date:	Mar. 10, 2021

Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgement
80-1000	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
1800(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
2600(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
3500(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
5000(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

Immunity Level to common wireless communication						
Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgement
800(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
900(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
1800(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
2600(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
3500(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
5000(±1%)	Front / Left / Right / Rear	H / V	3V/m	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

**Customer request:**

Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgement
80-1000	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
1800(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
2600(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
3500(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
5000(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

Immunity Level to common wireless communication						
Freq. Range (MHz)	Position ( Face )	Polarity (H or V)	Field Strength (V/m)	Criteria	Results	Judgement
800(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
900(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
1800(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
2600(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
3500(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
5000(±1%)	Front / Left / Right / Rear	H / V	10V/m	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

## 7.4. Electrical Fast Transient/Burst Immunity Test

### 7.4.1. Test Specification

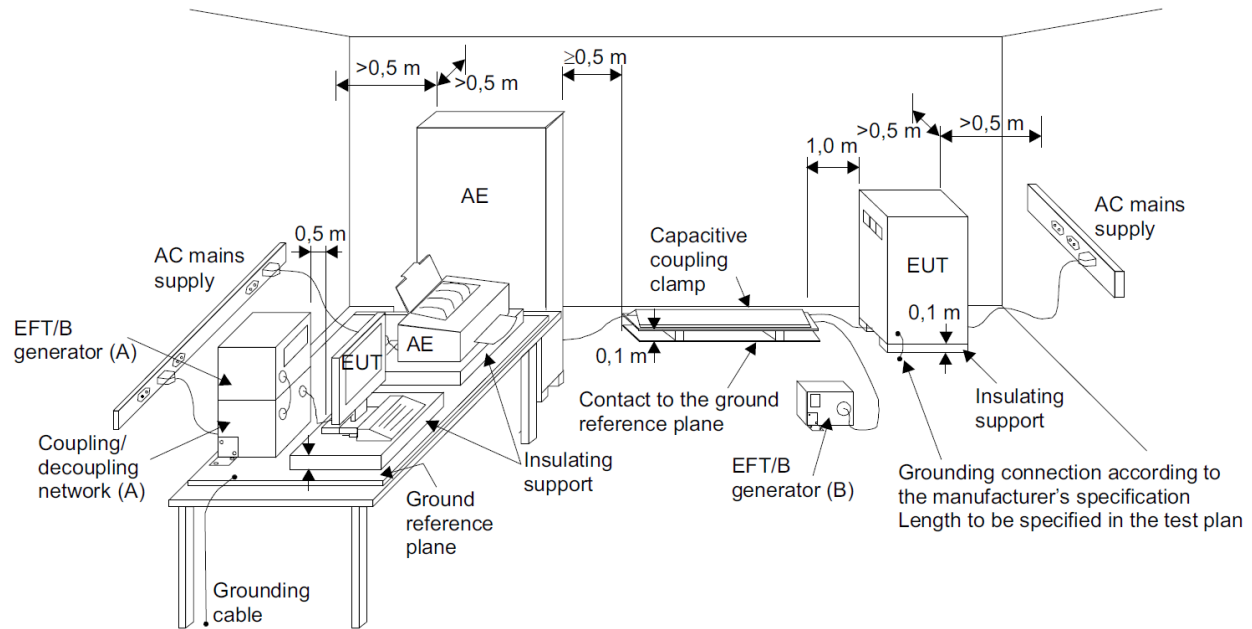
For Standard EN 55024 & EN 55035 :

<b>Standard:</b>	EN 55024/ EN55035 (refer to IEC/EN 61000-4-4)
<b>Test Voltage:</b>	0.5,1 kV(Peak)
<b>Polarity:</b>	Positive and Negative
<b>Impulse Frequency:</b>	5 or 100 kHz
<b>Impulse wave shape:</b>	5/50 Tr/Th ns
<b>Burst Duration:</b>	15ms or 0.75ms
<b>Burst Period:</b>	300ms
<b>Test Duration:</b>	1 Minute

### 7.4.2. Test Procedure

- The EUT was tested with 1000 volt discharges to the AC power input leads, 500 volt discharges to the signal/control ports.
- Both positive and negative polarity discharges were applied.
- Table-top equipment and equipment normally mounted on ceilings or walls as well as built-in equipment shall be tested with the EUT located  $(0,1 \pm 0,01)$  m above the ground reference plane.
- The EUT and the auxiliary equipment were placed on a table of 0.8 m heights above a metal ground reference plane. The size of ground plane is greater than  $0.8\text{m} \times 1\text{m}$  and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The minimum distance between the EUT and all other conductive structures (including the generator, AE and the walls of a shielded room), except the ground reference plane, shall be more than 0,5 m.
- The duration time of each test sequential was 1 minute.
- The transient/burst waveform was in accordance with IEC/EN 61000-4-4, 5/50ns.

### 7.4.3. Test Setup



IEC 645/12

- (A) location for supply line coupling
- (B) location for signal lines coupling

For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

#### 7.4.4. Test Result

##### EN 55024 :

Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 15, 2021

Repetition Frequency				5kHz						
Test Port		Test Levels (kV)						Criteria	Results	Judgement
		+0.5	-0.5	+1.0	-1.0	-	-			
DC power port	DC (+)	A	A	-	-	-	-	B	A	PASS
	DC (-)	A	A	-	-	-	-			
	DC (+&-)	A	A	-	-	-	-			
Note		There was no abnormal situation during the test compared with initial operation.								

##### Customer Request:

Repetition Frequency		5kHz								
Test Port		Test Levels (kV)						Criteria	Results	Judgement
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0			
DC power port	DC (+)	-	-	-	-	A	A	B	A	PASS
	DC (-)	-	-	-	-	A	A			
	DC (+&-)	-	-	-	-	A	A			
Note		There was no abnormal situation during the test compared with initial operation.								

**EN 55035 :**

Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 15, 2021

Repetition Frequency				5kHz						
Test Port		Test Levels (kV)						Criteria	Results	Judgement
		+0.5	-0.5	+1.0	-1.0	-	-			
DC power port	DC (+)	A	A	-	-	-	-	B	A	PASS
	DC (-)	A	A	-	-	-	-			
	DC (+&-)	A	A	-	-	-	-			
Note		There was no abnormal situation during the test compared with initial operation.								

**Customer Request:**

Repetition Frequency				5kHz						
Test Port		Test Levels (kV)						Criteria	Results	Judgement
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0			
DC power port	DC (+)	-	-	-	-	A	A	B	A	PASS
	DC (-)	-	-	-	-	A	A			
	DC (+&-)	-	-	-	-	A	A			
Note		There was no abnormal situation during the test compared with initial operation.								



## 7.5. Surge Immunity Test

### 7.5.1. Test Specification

#### For Standard EN 55024 :

<b>Standard:</b>	EN 55024 (refer to IEC/EN 61000-4-5)
<b>Waveform:</b>	1.2/50 (8/20) Tr/Th $\mu$ s , 10/700 Tr/Th $\mu$ s
<b>Test Voltage:</b>	0.5,1 kV(Line to Line) 0.5,1,2 kV(Line to Earth)
<b>Polarity:</b>	Positive and Negative
<b>Phase Angle:</b>	0°/90°/180°/270°
<b>Repetition Rate:</b>	1 per minute
<b>Times:</b>	5 times each polarity

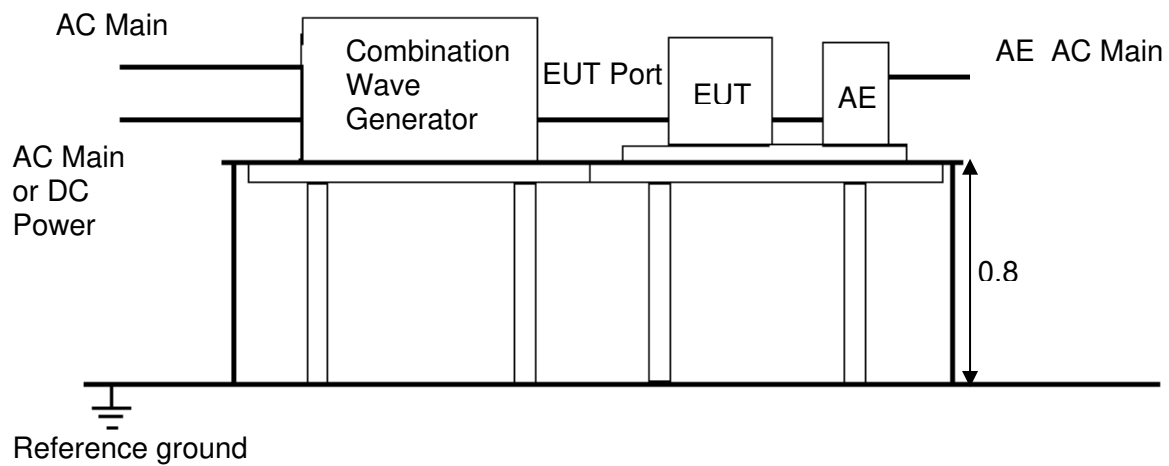
#### For Standard EN 55035 :

<b>Standard:</b>	EN 55035 (refer to IEC/EN 61000-4-5)
<b>Waveform:</b>	1.2/50 (8/20) Tr/Th $\mu$ s , 10/700 Tr/Th $\mu$ s
<b>Test Voltage:</b>	0.5,1 kV(Line to Line) 0.5,1,2 kV(Line to Earth)
<b>Polarity:</b>	Positive and Negative
<b>Phase Angle:</b>	90°/270°
<b>Repetition Rate:</b>	1 per minute
<b>Times:</b>	5 times each polarity

### 7.5.2. Test Procedure

- The EUT and the auxiliary equipment were placed on a table of 0.8m heights above a metal ground reference plane. The size of ground plane is greater than 1m×1m and project beyond the EUT by at least 0.1m on all sides. The ground plane is connected to the protective earth. The length of power cord between the coupling device and the EUT shall not exceed 2 meters (provided by the manufacturer).
- The EUT was connected to the power mains through a coupling device that directly couples the surge interference signal. The surge noise was applied synchronized to the voltage phase at the zero crossing and the peak value of the AC voltage wave (positive and negative).
- The surges were applied line to line and line(s) to earth. When testing line to earth the test voltage was applied successively between each of the lines and earth. Steps up to the test level specified increased the test voltage. All lower levels including the selected test level were tested. The polarity of each surge level included positive and negative test pulses.
- If EUT was included telecom port and connected to outdoor directly, test shall be applied to line to earth test using 10/700 surge wave form. If the wave form affects the functioning of high speed data port, the test shall be carried out using 1.2/50 wave form do the test.

### 7.5.3. Test Setup



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

#### 7.5.4. Test Result

##### EN 55024 :

Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 10, 2021

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us						Criteria	Results	Judgment
	Polarity	Phase	Voltage						
			0.5kV	1kV	2kV	-kV			
DC power port + to -	+	-	A	-	-	-	B	A	PASS
	-	-	A	-	-	-			
Note	There was no abnormal situation during the test compared with initial operation.								

##### Customer Request:

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us						Criteria	Results	Judgment
	Polarity	Phase	Voltage						
			0.5kV	1kV	2kV	-kV			
DC power port + to -	+	-	-	-	A	-	B	A	PASS
	-	-	-	-	A	-			
Note	There was no abnormal situation during the test compared with initial operation.								

**EN 55035 :**

Test Mode:	Mode 2	Temperature:	25°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 10, 2021

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us						Criteria	Results	Judgement
	Polarity	Phase	Voltage						
			0.5kV	1kV	2kV	-kV			
DC power port + to -	+	-	A	-	-	-	B	A	PASS
	-	-	A	-	-	-			
Note	There was no abnormal situation during the test compared with initial operation.								

**Customer Request:**

Wave Form EUT Ports Tested	1.2/50(8/20)Ti/Th us						Criteria	Results	Judgement
	Polarity	Phase	Voltage						
			0.5kV	1kV	2kV	-kV			
DC power port + to -	+	-	-	-	A	-	B	A	PASS
	-	-	-	-	A	-			
Note	There was no abnormal situation during the test compared with initial operation.								

## 7.6. Immunity to Conducted Disturbances Induced by RF Fields

### 7.6.1. Test Specification

#### For Standard EN 55024 :

<b>Standard:</b>	EN 55024 (refer to IEC/EN 61000-4-6)
<b>Frequency Range:</b>	0.15-80MHz
<b>Field Strength:</b>	3V (unmodulated, r.m.s.)
<b>Modulation:</b>	80% AM (1 kHz)
<b>Frequency Step:</b>	1%
<b>Dwell Time:</b>	3s

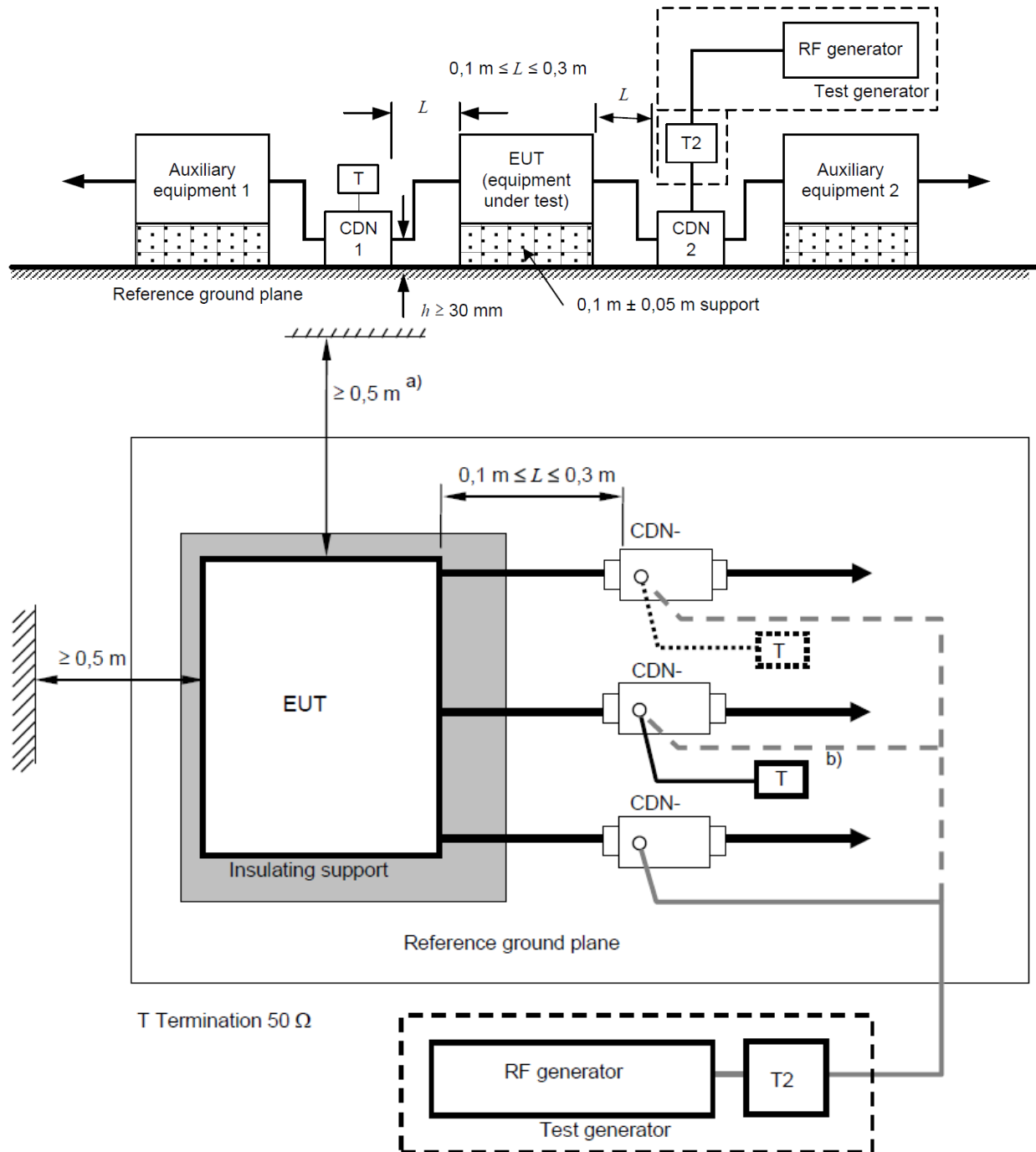
#### For Standard EN 55035 :

<b>Standard:</b>	EN 55035 (refer to IEC/EN 61000-4-6)
<b>Frequency Range:</b>	0.15-10; 10-30; 30-80MHz
<b>Field Strength:</b>	3V; 3 to 1V; 1V (unmodulated, r.m.s.)
<b>Modulation:</b>	80% AM (1 kHz)
<b>Frequency Step:</b>	1%
<b>Dwell Time:</b>	3s

### 7.6.2. Test Procedure

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

### 7.6.3. Test Setup



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

#### 7.6.4. Test Result

##### EN 55024 :

Test Mode:	Mode 2	Temperature:	22°C
Test Voltage:	48Vdc from DC source	Humidity:	65%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 9, 2021

Test Ports (Mode)	Freq. Range (MHz)	Field Strength	CDN	Criteria	Results	Judgment
DC Power Port	0.15 --- 80	3V	M016(M2)	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

##### Customer Request:

Test Ports (Mode)	Freq. Range (MHz)	Field Strength	CDN	Criteria	Results	Judgment
DC Power Port	0.15 --- 80	10V	M016(M2)	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

**EN 55035 :**

Test Mode:	Mode 2	Temperature:	22°C
Test Voltage:	48Vdc from DC source	Humidity:	65%RH
Tested By:	Eric T. Fan	Test Date:	Mar. 9, 2021

Test Ports (Mode)	Freq. Range (MHz)	Field Strength	CDN	Criteria	Results	Judgement
DC Power Port	0.15 --- 10	3V	M016(M2)	A	A	PASS
	10 --- 30	3 to 1V		A	A	PASS
	30 --- 80	1V		A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					

Test Ports (Mode)	Freq. Range (MHz)	Field Strength	CDN	Criteria	Results	Judgement
DC Power Port	0.15 --- 80	10V	M016(M2)	A	A	PASS
Note	There was no abnormal situation during the test compared with initial operation.					



## 7.7. Power frequency magnetic field immunity Test

### 7.7.1. Test Specification

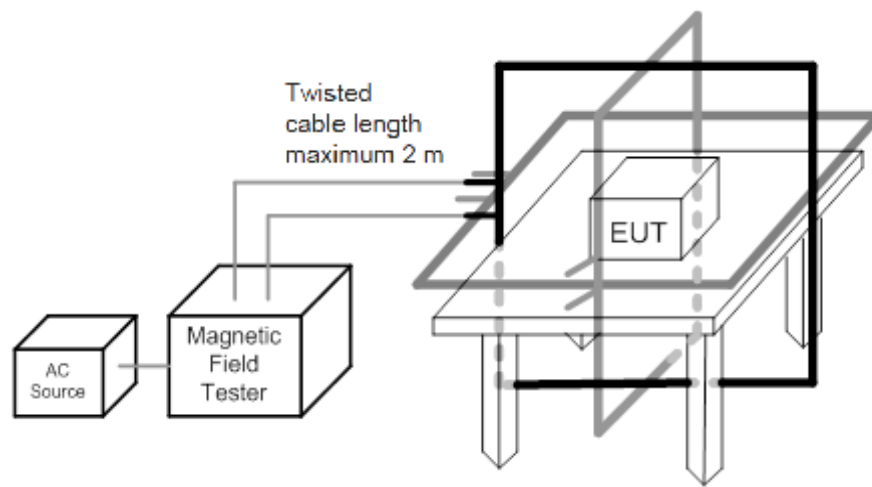
For Standard EN 55024 & EN 55035 :

<b>Standard:</b>	EN 55024/ EN 55035 (refer to IEC/EN 61000-4-8)
<b>Frequency Range:</b>	50 Hz
<b>Field Strength:</b>	1 A/m
<b>Observation Time:</b>	1 minute
<b>Inductance Coil:</b>	Rectangular type, 1mx1m

### 7.7.2. Test Procedure

- The EUT and support equipment, are placed on a table that is 0.8 meter above a metal ground plane measured 1m\*1m min. and 0.65mm thick min.
- The equipment cabinets shall be connected to the safety earth directly on the GRP via the earth terminal of the EUT.
- The cables supplied or recommended by the equipment manufacturer shall be used 1 meter of all cables used shall be exposed to the magnetic field.
- The EUT with coil shall be leave all magnetic material and wall 1m away in any axis during the test.
- The cable length from generator to coil shall be less than 2m
- The background noise shall be 20dB less than test field strength.
- Test shall be applied to three axis X, Y, Z and disturbance over 1 minute.
- All cables shall be exposed to the magnetic field for 1m of their length.

### 7.7.3. Test Setup



Note:

#### TABLE-TOP EQUIPMENT

The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimension (1 m x 1 m). The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

#### FLOOR-STANDING EQUIPMENT

The equipment shall be subjected to the test magnetic field by using induction coils of suitable dimensions. The test shall be repeated by moving and shifting the induction coils, in order to test the whole volume of the EUT for each orthogonal direction. The test shall be repeated with the coil shifted to different positions along the side of the EUT, in steps corresponding to 50% of the shortest side of the coil. The induction coil shall then be rotated by 90 degrees in order to expose the EUT to the test field with different orientations.

For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

#### 7.7.4. Test Results

##### EN 55024 :

Test Mode:	Mode 2	Temperature:	22°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Rupert Huang	Test Date:	Mar. 16, 2021

Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgement
			X	Y	Z	
1	1	A	A	A	A	PASS
2	3	/	/	/	/	
3	10	/	/	/	/	
4	30	/	/	/	/	
5	100	/	/	/	/	
X	Special	/	/	/	/	
Note	There was no abnormal situation during the test compared with initial operation.					

##### Client request:

Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgment
			X	Y	Z	
1	1	/	/	/	/	PASS
2	3	/	/	/	/	
3	10	/	/	/	/	
4	30	/	/	/	/	
5	100	A	A	A	A	
X	Special	/				
Note	There was no abnormal situation during the test compared with initial operation.					

##### (Short Term: 1s):

Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgment
			X	Y	Z	
4	300	/	/	/	/	PASS
5	1000	A	A	A	A	
X	Special	/	/	/	/	
Note	There was no abnormal situation during the test compared with initial operation.					

**EN 55035 :**

Test Mode:	Mode 2	Temperature:	22°C
Test Voltage:	48Vdc from DC source	Humidity:	52%RH
Tested By:	Rupert Huang	Test Date:	Mar. 16, 2021

Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgement
			X	Y	Z	
1	1	A	A	A	A	PASS
2	3	/	/	/	/	
3	10	/	/	/	/	
4	30	/	/	/	/	
5	100	/	/	/	/	
X	Special	/	/	/	/	
Note	There was no abnormal situation during the test compared with initial operation.					

**Customer Request:**

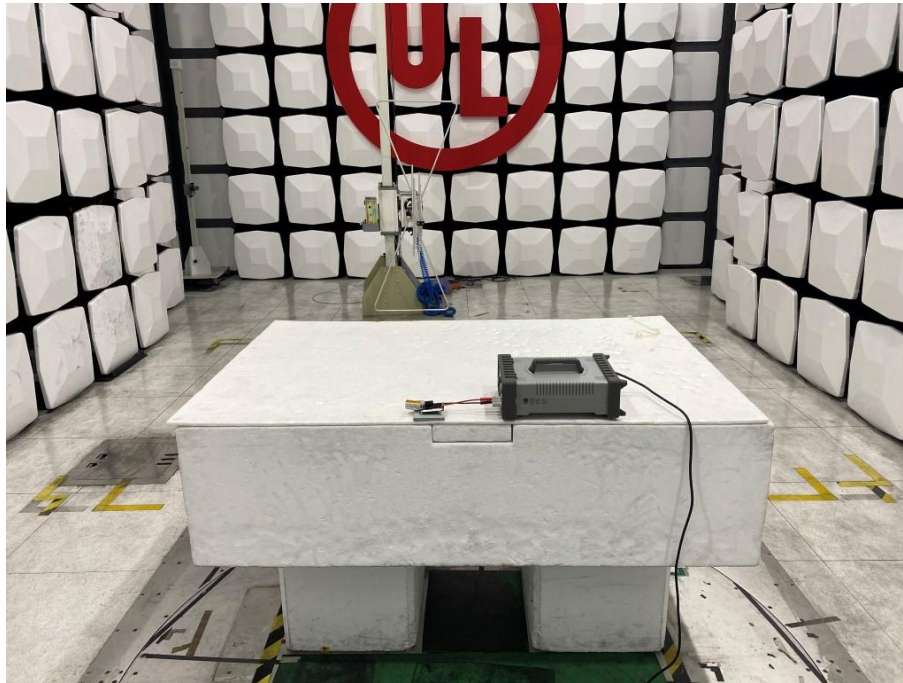
Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgement
			X	Y	Z	
1	1	/	/	/	/	PASS
2	3	/	/	/	/	
3	10	/	/	/	/	
4	30	/	/	/	/	
5	100	A	A	A	A	
X	Special	/	/	/	/	
Note	There was no abnormal situation during the test compared with initial operation.					

**(Short Term: 1s):**

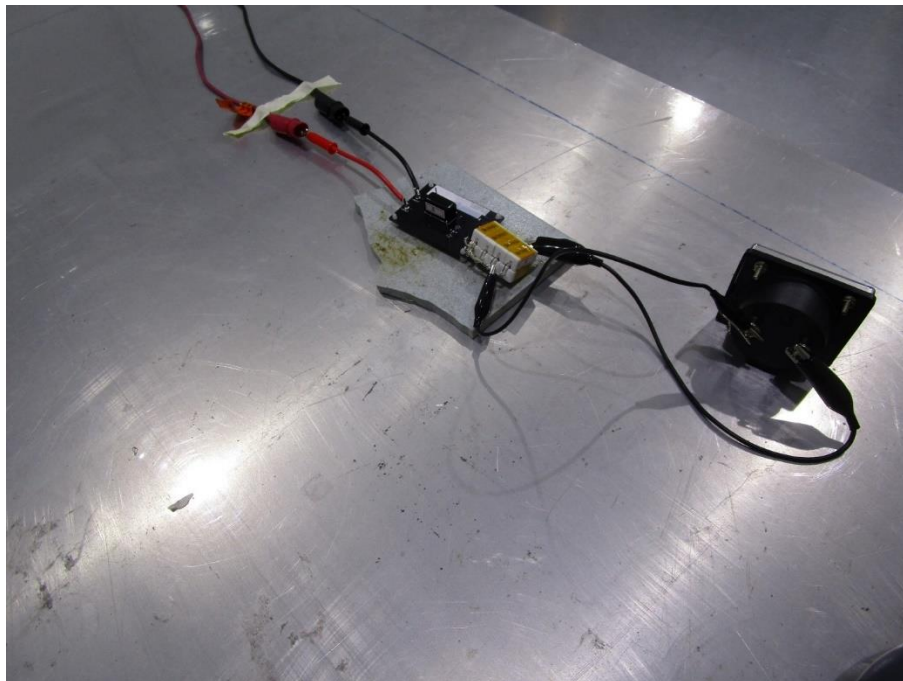
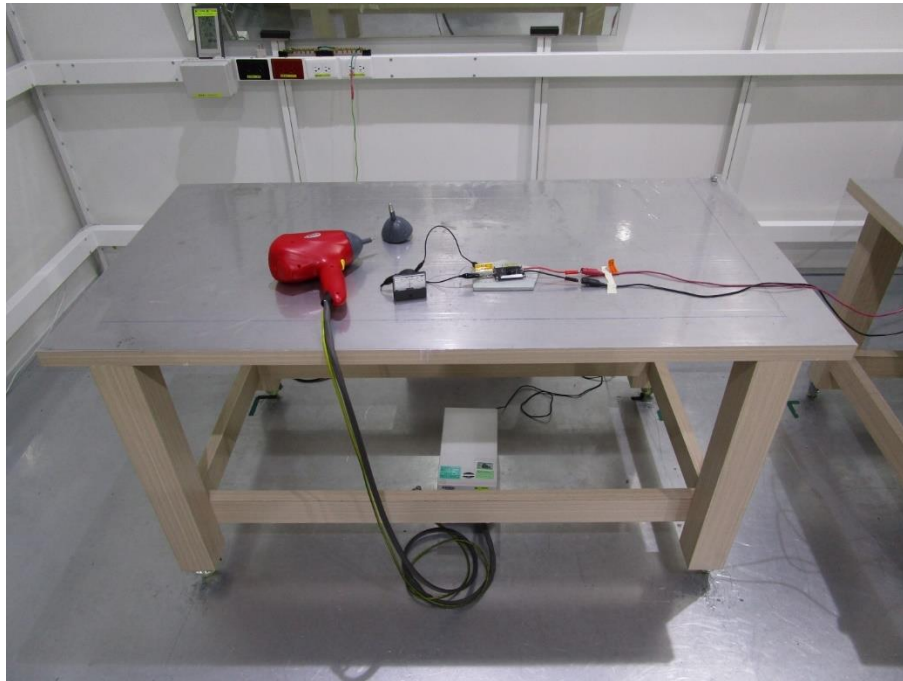
Level	Magnetic Field Strength (A/m)	Criteria	Results			Judgement
			X	Y	Z	
4	300	/	/	/	/	PASS
5	1000	A	A	A	A	
X	Special	/	/	/	/	
Note	There was no abnormal situation during the test compared with initial operation.					

## Appendix I: Photographs of EMC Test Configuration

Radiated Disturbance  
Below 1GHz

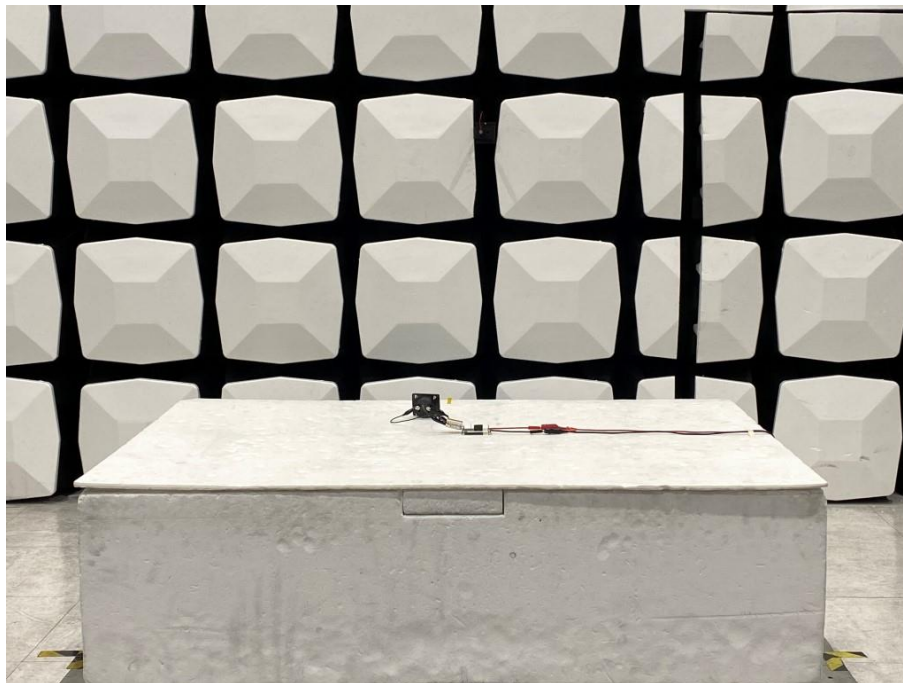
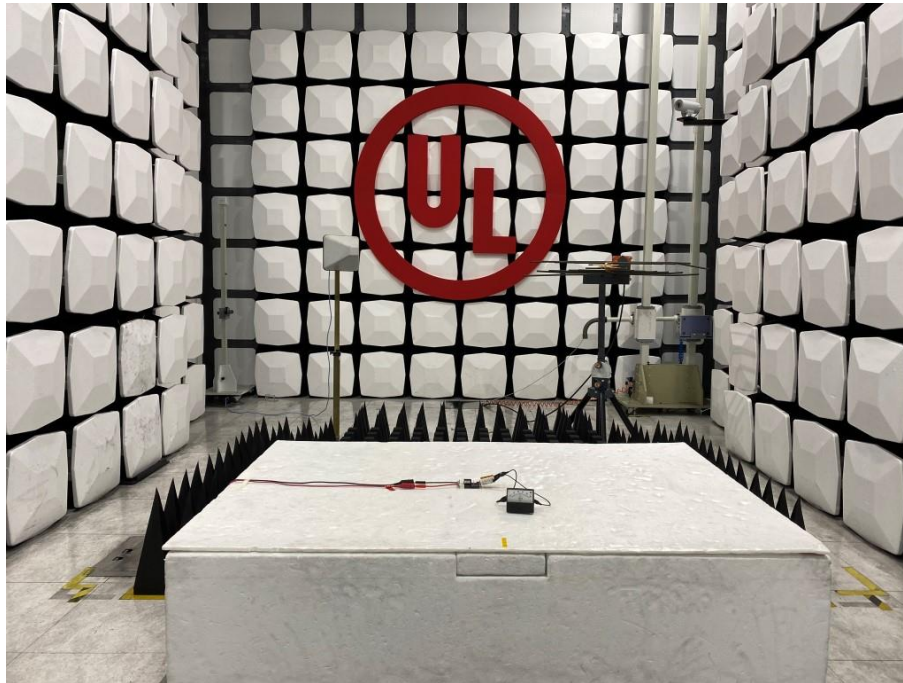


### Electrostatic Discharge Immunity

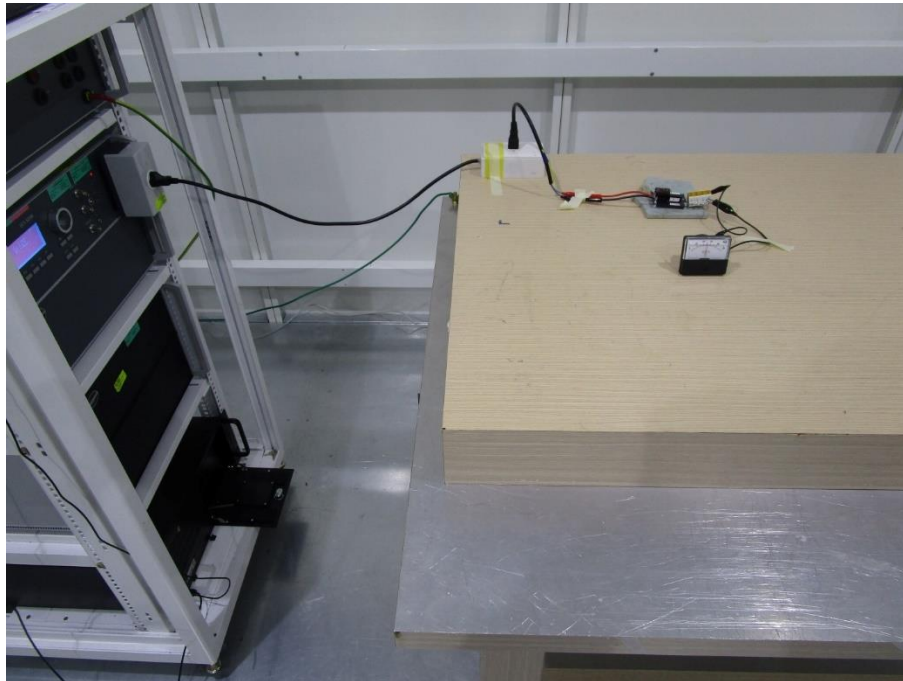




### Radio Frequency Electromagnetic Field Immunity

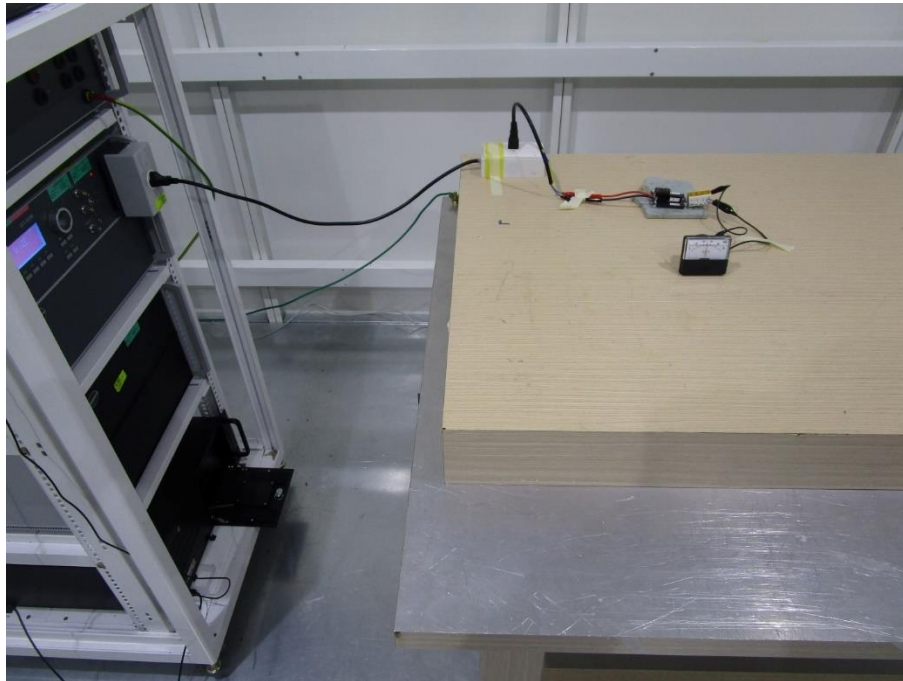


### Electrical Fast Transient Immunity

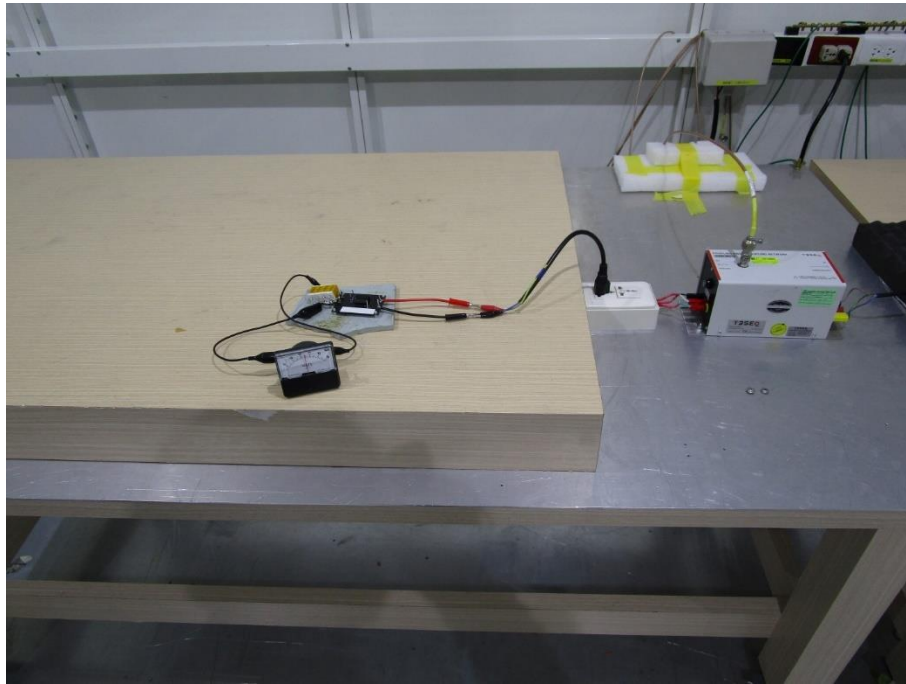




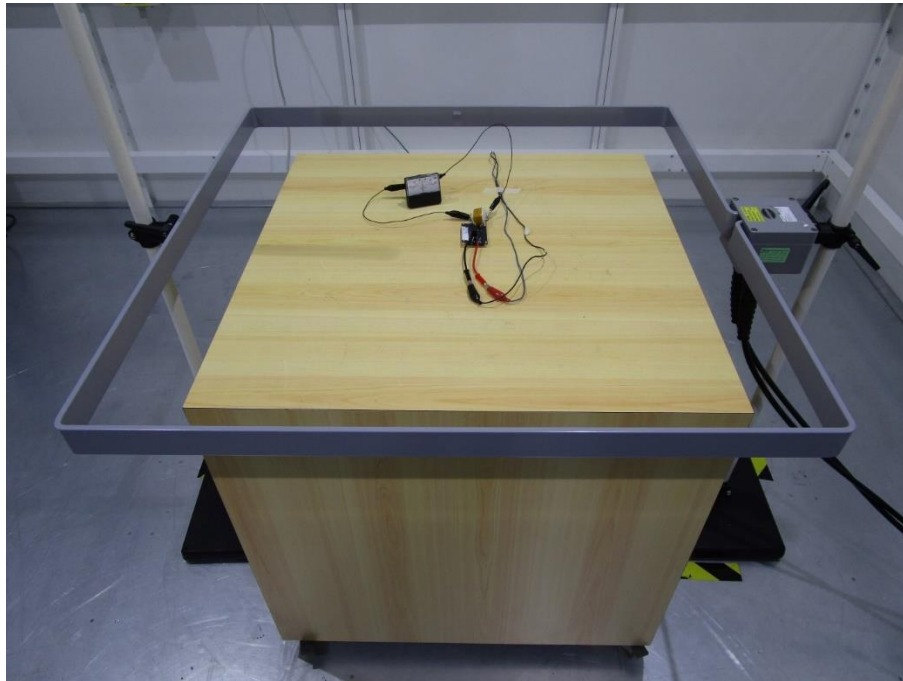
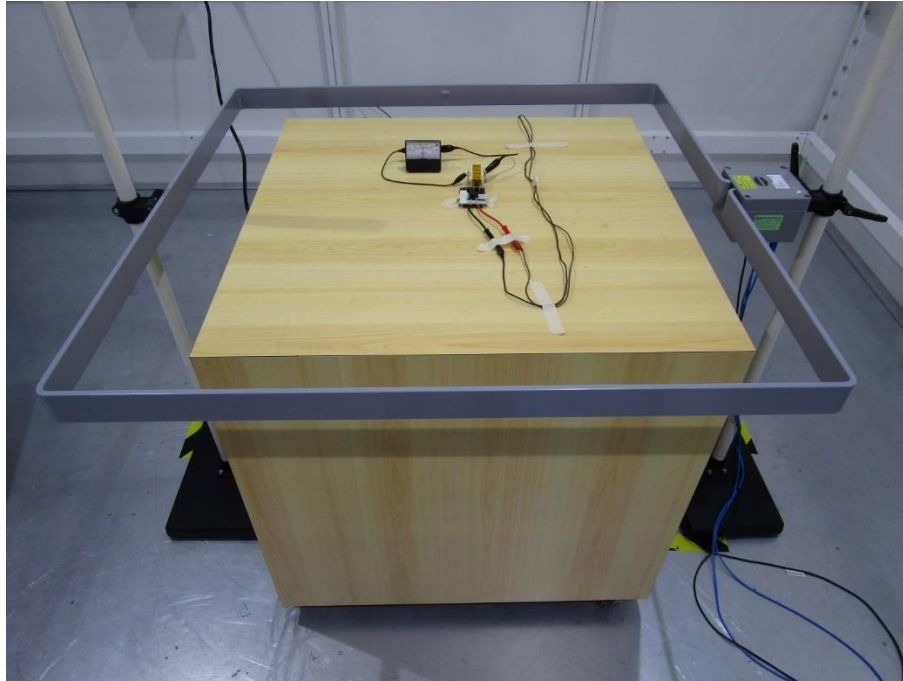
### Surge Immunity



Immunity to conducted disturbances induced by RF fields



Power frequency magnetic field immunity



## **Appendix II: Photographs of the EUT**

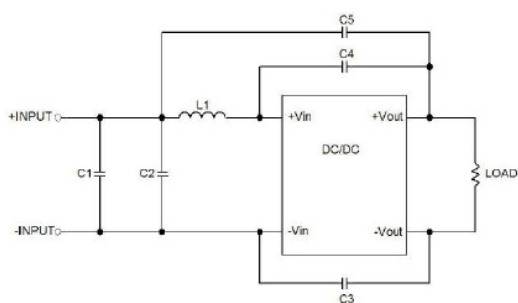
Please see the photographs of EUT in the test report no.: 4789951652-EP.

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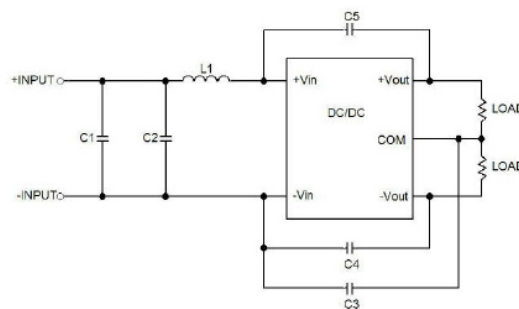
**END OF REPORT**

## Appendix III: Countermeasure file for EMI, EFT and Surge

### For EMI test requirements/Class B



Single Output

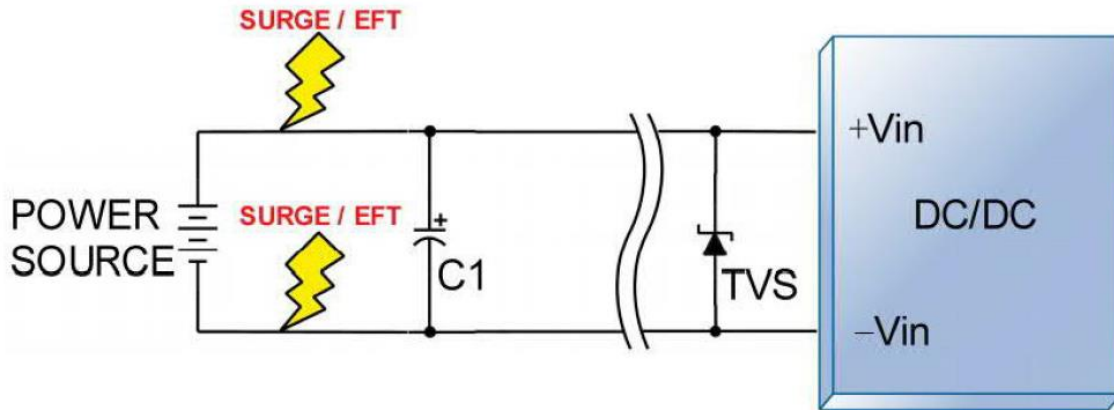


Dual Output

MODEL	C1, C2	C3	C4	C5	L1
TMR 12WI-12Vin Single Output	22μF/25V	680pF/3kV	220pF/3kV	NA	2.2μH
TMR 12WI-24Vin Single Output	10μF/50V	2200pF/3kV	NA	470pF/3kV	10μH
TMR 12-4819WI TMR 12-4811WI TMR 12-4812WI TMR 12-4813WI TMR 12-4815WI	4.7μF/100V	2200pF/3kV	1000pF/3kV	NA	47μH
TMR 12-4810WI	4.7μF/100V	220pF/3kV	NA	470pF/3kV	47μH

MODEL	C1, C2	C3	C4	C5	L1
TMR 12WI-12Vin Dual Output	22μF/25V	220pF/3kV	680pF/3kV	220pF/3kV	2.2μH
TMR 12WI-24Vin Dual Output	10μF/50V	220pF/3kV	1000pF/3kV	470pF/3kV	10μH
TMR 12WI-48Vin Dual Output	4.7μF/100V	220pF/3kV	2200pF/3kV	1000pF/3kV	47μH

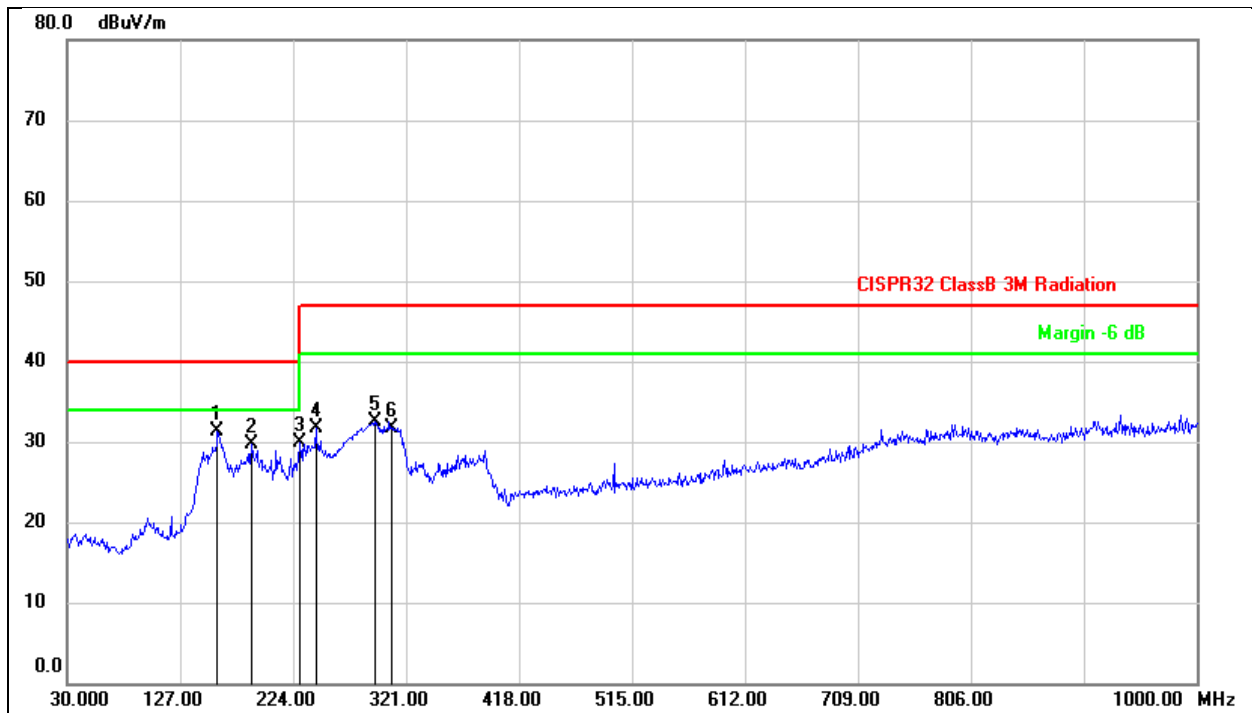
## For Electrical Fast transient & Surge Immunity test requirements



Model	Component	Specification
TMR 12WI-12Vin	C1	3300 $\mu$ F/25V
	TVS	30V/3000W
TMR 12WI-24Vin	C1	1200 $\mu$ F/50V
	TVS	70V/3000W
TMR 12WI-48Vin	C1	390 $\mu$ F/100V
	TVS	120V/3000W

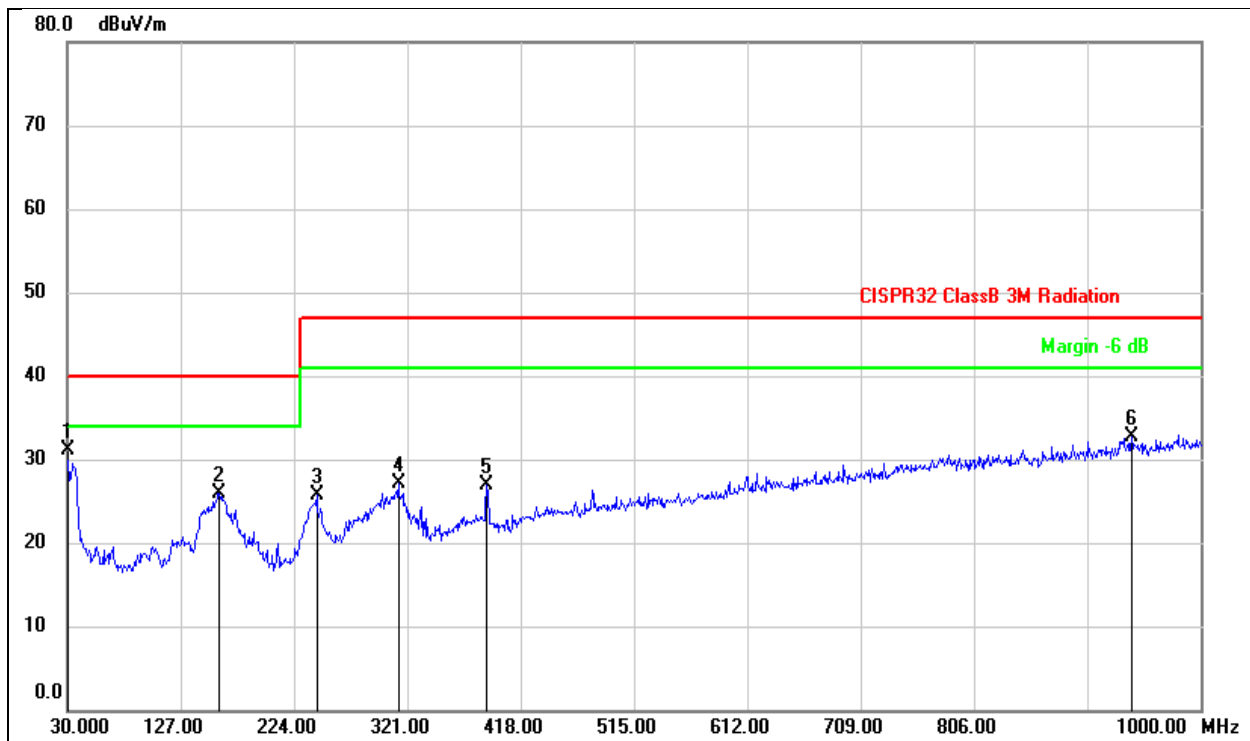
## Appendix IV: Preliminary Test Raw Data

Project No.:	4789951652	Polarziation:	Horizontal
Standard:	CISPR32 ClassB 3M Radiation	Power Source:	DC 12V
Test item:	Radiation Test	Date:	3/2/2021
Temp./Hum.(%RH):	25(C)/59%RH	Time:	9:32:55 PM
EUT:		Test By:	Rupert Hunag
Model:		Distance:	3m
Mode:	Mode 1		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	159.9477	43.16	-11.86	31.30	40.00	-8.70	peak
2	188.8860	44.22	-14.47	29.75	40.00	-10.25	peak
3	229.9817	44.57	-14.63	29.94	40.00	-10.06	peak
4	244.1760	44.94	-13.28	31.66	47.00	-15.34	peak
5	294.0987	43.68	-11.18	32.50	47.00	-14.50	peak
6	309.2306	42.59	-10.81	31.78	47.00	-15.22	peak

Project No.:	4789951652	Polarization:	Vertical
Standard:	CISPR32 ClassB 3M Radiation	Power Source:	DC 12V
Test item:	Radiation Test	Date:	3/2/2021
Temp./Hum.(%RH):	25(C)/59%RH	Time:	9:34:52 PM
EUT:		Test By:	Rupert Hunag
Model:		Distance:	3m
Mode:	Mode 1		
Note:			



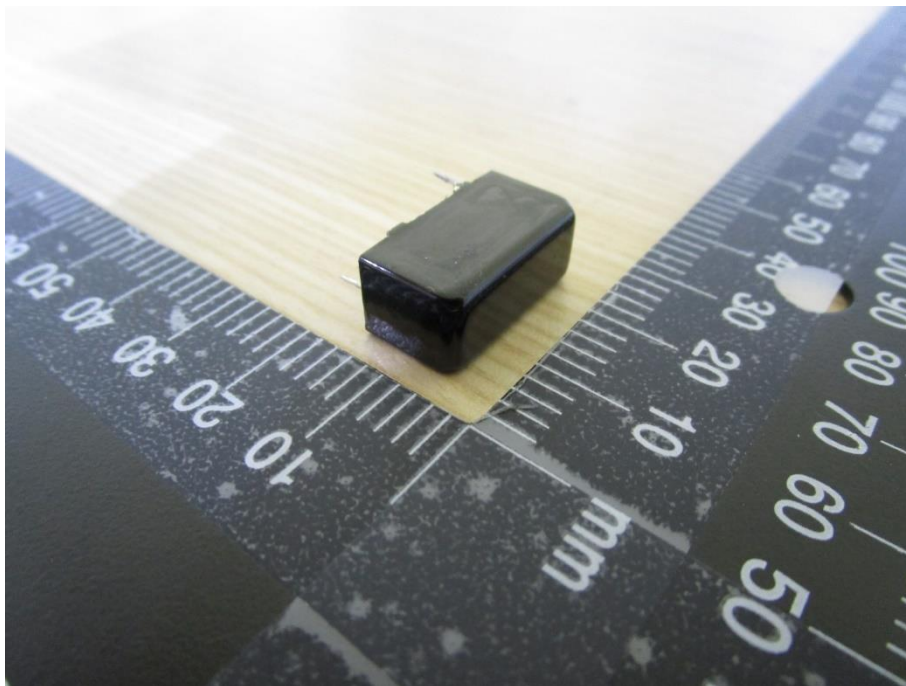
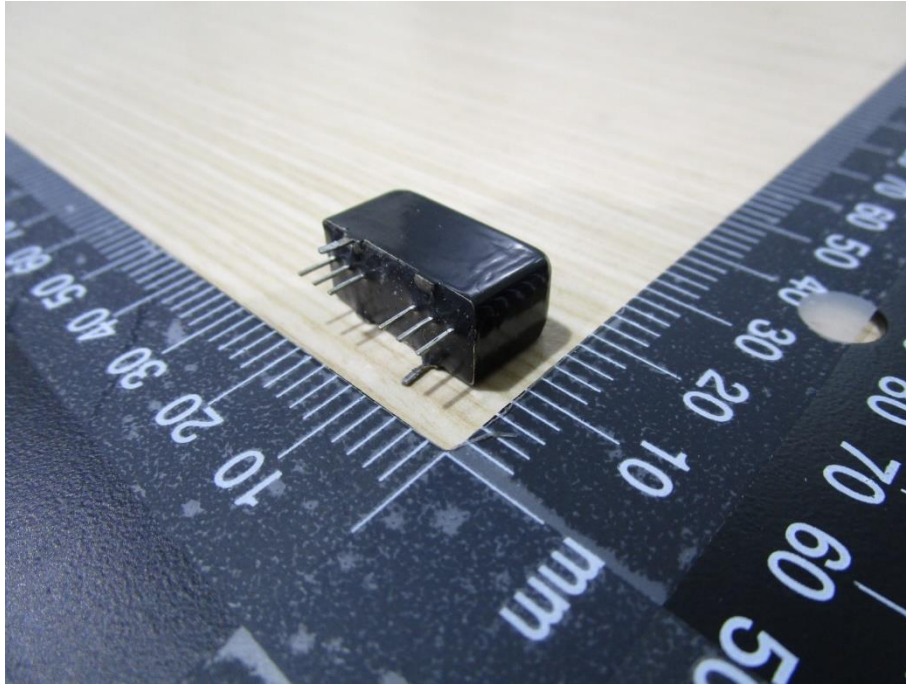
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.5497	44.79	-13.69	31.10	40.00	-8.90	peak
2	160.6590	37.79	-11.92	25.87	40.00	-14.13	peak
3	243.8527	38.96	-13.30	25.66	47.00	-21.34	peak
4	313.8220	37.64	-10.60	27.04	47.00	-19.96	peak
5	389.4497	35.52	-8.57	26.95	47.00	-20.05	peak
6	941.1857	30.30	2.36	32.66	47.00	-14.34	peak





## Product Photos

### External Photos



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