CUS350M

IMMUNITY DATA

I N D E X

Terminology Used

FG	·····	Frame GND
⏚	·····	Earth (⏚) terminal
L	·····	Live line
N	·····	Neutral line
⏦	·····	Earth
+V	·····	+ Output
-V	·····	- Output

※ Test results are reference data based on our standard measurement condition.

1.0 Summary of Immunity Test Result

MODEL: CUS350M

(1) IEC61000 Series Test Result:

Item	Standard	Test level	Test result	Page	Notes & Conditions
Electrostatic Discharge Immunity Test	IEC61000-4-2	1,2,3,4	A	R-2	
Radiated Radio-Frequency Electromagnetic Field Immunity Test	IEC61000-4-3	1,2,3	A	R-3	
Electrical Fast Transient / Burst Immunity Test	IEC61000-4-4	1,2,3,4	A	R-4	
Surge Immunity Test	IEC61000-4-5	1,2,3,(4)	A	R-5	Level4 : Common mode only
Conducted Disturbances Induced by Radio-Frequency Field Immunity Test	IEC61000-4-6	1,2,3	A	R-6	
Power Frequency Magnetic Field Immunity Test	IEC61000-4-8	1,2,3,4	A	R-7	
Voltage Dips, Short Interruptions Immunity Test	IEC61000-4-11	Dip:30% 500ms	B	R-8	
		Dip:60% 200ms	B		
		Dip:100% 20ms	B		
		Dip:1000% 5000ms	B		

Detail of test condition refer to each test page.

(2) IEC60601-1-2 Series Test Result:

Item	Standard	Test level	Test result	Page	Notes & Conditions
Electrostatic Discharge Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3,4	A	R-9	
Radiated Radio-Frequency Electromagnetic Field Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3	A	R-10	
Electrical Fast Transient / Burst Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3	A	R-11	
Surge Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3	A	R-12	
Conducted Disturbances Induced by Radio-Frequency Field Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3	A	R-13	
Power Frequency Magnetic Field Immunity Test	IEC60601-1-2 Ed.4.1	1,2,3,4	A	R-14	
Voltage Dips, Short Interruptions Immunity Test	IEC60601-1-2 Ed.4.1	Dip:30% 500ms	A	R-15	Vin:200VAC~240VAC
			B		Vin:100VAC~120VAC
		Dip:100% 10ms	A		
		Dip:100% 20ms	A		Vin:200VAC~240VAC
			A		Vin:100VAC~120VAC and Io≤40%
			B		Vin:100VAC~120VAC and Io>40%
		Dip:1000% 5000ms	B		
Radiated Field In Close Proximity Immunity Test	IEC60601-1-2 Ed.4.1	-	A	R-16	**ENCLOSURE PORT**

Detail of test condition refer to each test page.

Criteria A
1. The regulation of output voltage must not exceed 5% of initial value during test.
2. The output voltage must be within the regulation of specification after the test.
3. Smoke and fire are not allowed.

Criteria B
1. Must not have temporary function degradation that requires input restart.
2.The output voltage must be within the regulation of specification after the test.
3. Smoke and fire are not allowed.

2.0 IEC61000 Series Data

2.1 Electrostatic Discharge Immunity Test (IEC61000-4-2)

MODEL : CUS350M

(1) Equipment Used

Electro Static Discharge Simulator : NSG435 (SCHAFFNER)

Discharge Resistance : 330Ω Capacity : 150pF

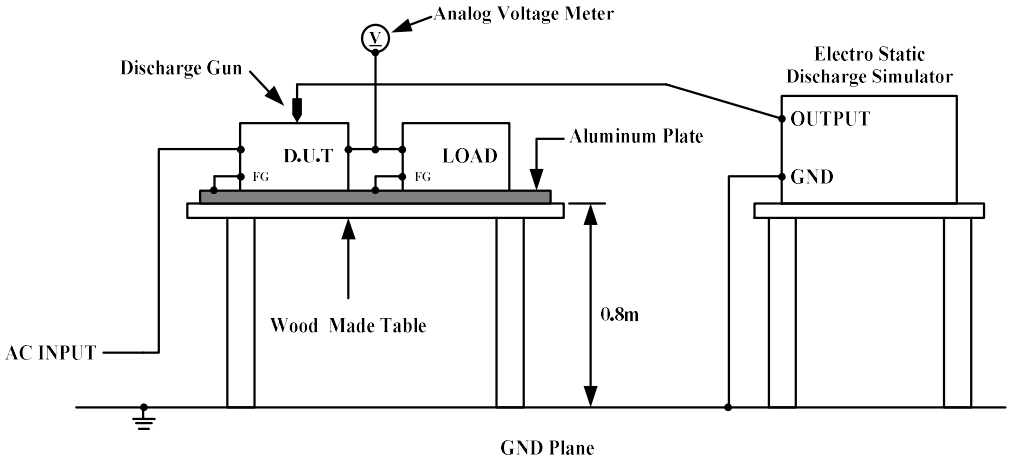
(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Polarity	: +, −
・Test Times	: 10 times	・Discharge Interval	: ＞1 second
・Ambient Temperature	: 25℃		

(3) Test Method and Device Test Point

Contact Discharge : ⏚, Mounting screw

Air Discharge : ⏚ , Input and output terminal, Mounting screw



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.

2. Output voltage to be within regulation specification after the test.

3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Contact Discharge (kV)	CUS350M-12/18/24/36/48	Air Discharge(kV)	CUS350M-12/18/24/36/48
2	PASS	2	PASS
4	PASS	4	PASS
6	PASS	8	PASS
8	PASS	15	PASS

2.2 Radiated Radio-Frequency Electromagnetic Field Immunity Test (IEC61000-4-3)

MODEL : CUS350M

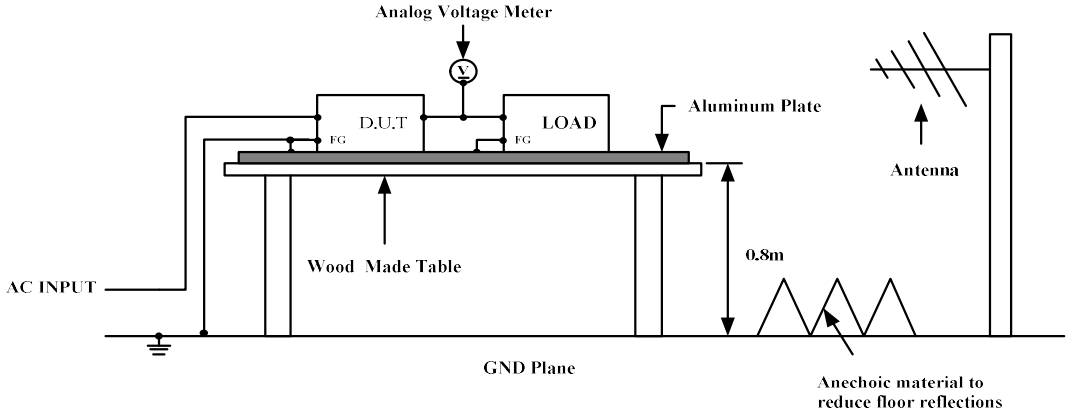
(1) Equipment Used

SML 03(RS CORPORATION)
HL 046(RS CORPORATION)
AR500W 1000A(AR CORPORATION)
FM5004(AR CORPORATION)
FP6001(AR CORPORATION)

(2) Test Conditions

・Input Voltage	:115, 230VAC	・Output Voltage	: Rated
・Output Current	:0%, 100%	・Amplitude Modulated	:80%, 1kHz
・Electromagnetic Frequency	:80～1000MHz	・Ambient Temperature	:25℃
・Wave Angle	: Horizontal and Vertical	・Distance	:3.0m
・Sweep Condition	: 1.0%Step Up, 2.8 Seconds Hold		
・Test Angle	:Top/Bottom, Both Sides, Front/Back		

(3) Test Method



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.

2. Output voltage to be within regulation specification after the test.

3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Radiation Field Strength (V/m)	CUS350M-12/18/24/36/48
1	PASS
3	PASS
10	PASS

2.3 Electrical Fast Transient / Burst Immunity Test (IEC61000-4-4)

MODEL : CUS350M

(1) Equipment Used

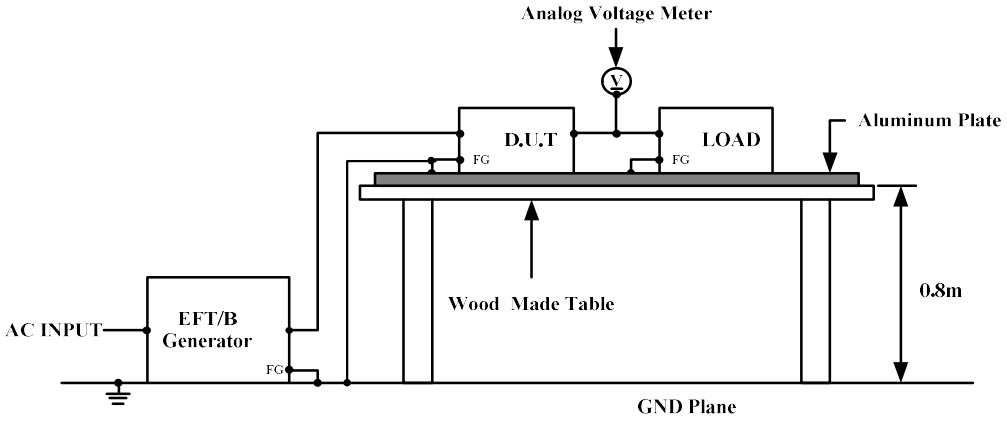
EFT/B Generator : FNS-100L (NOISEKEN)

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Test Time	: 1 minute
・Polarity	: +, −	・Ambient Temperature	: 25℃
・Number of Tests	: 3 times		

(3) Test Method and Device Test Point

Apply to (N, L, ⏚), (N, L), (N), (L), (⏚).



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.

2. Output voltage to be within output voltage regulation specification after the test.

3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Test Voltage (kV)	Repetition Rate (kHz)	CUS350M-12/18/24/36/48
0.5	5	PASS
1	5	PASS
2	5	PASS
4	5	PASS

2.4 Surge Immunity Test (IEC61000-4-5)

MODEL : CUS350M

(1) Equipment Used

Surge Generator : 6100 (SCHAFFNER)

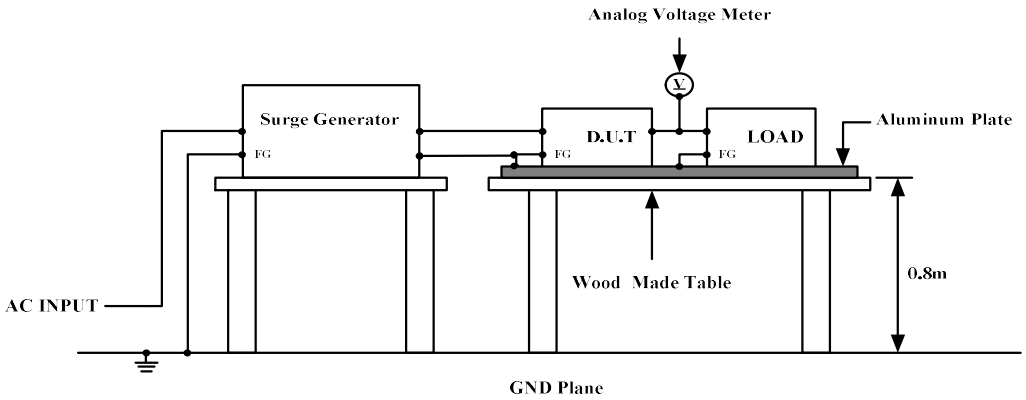
Coupling Impedance	: Common 12Ω	Coupling Capacitance	: Common 9μF
	Normal 2Ω		Normal 18μF

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0, 100%	・Number of Tests	: 5 times
・Polarity	: +, −	・Mode	: Common, Normal
・Phase	: 0, 90 deg	・Ambient Temperature	: 25℃

(3) Test Method and Device Test Points

Apply to Common mode (N-⏚, L-⏚) and Normal mode (N-L).



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.

2. Output voltage to be within regulation specification after the test.

3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Common		Normal	
Test Voltage (kV)	CUS350M-12/18/24/36/48	Test Voltage (kV)	CUS350M-12/18/24/36/48
0.5	PASS	0.5	PASS
1	PASS	1	PASS
2	PASS	2	PASS
4	PASS		

2.5 Conducted Disturbances Induced by Radio-Frequency Field Immunity Test (IEC61000-4-6)

MODEL : CUS350M

(1) Equipment Used

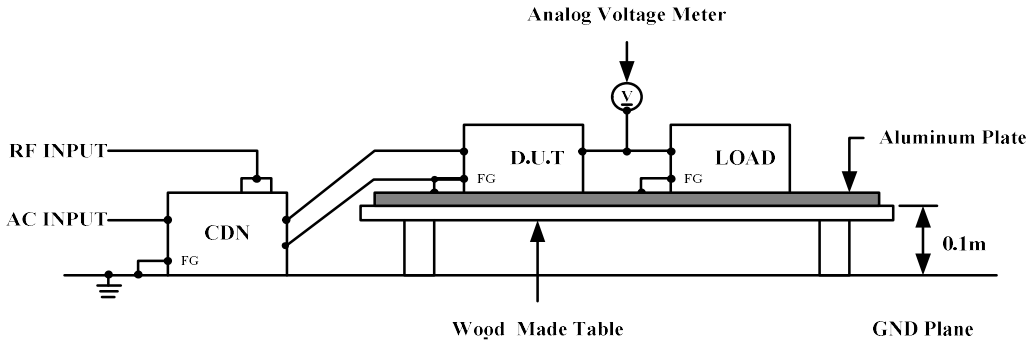
RF POWER AMPLIFIER : (AR U.S.A)

SIGNAL GENERATOR : IFR 2023A (IFR U.K)

(2) Test Conditions

- Input Voltage : 115, 230VAC
- Output Voltage : Rated
- Output Current : 100%
- Electromagnetic Frequency : 150kHz～80MHz
- Ambient Temperature : 25℃
- Sweep Condition : 1.0%Step Up, 2.8 Seconds Hold

(3) Test Method



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.
2. Output voltage to be within regulation specification after the test.
3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Voltage Level (V)	CUS350M-12/18/24/36/48
1	PASS
3	PASS
10	PASS

2.6 Power Frequency Magnetic Field Immunity Test (IEC61000-4-8)

MODEL : CUS350M

(1) Equipment Used

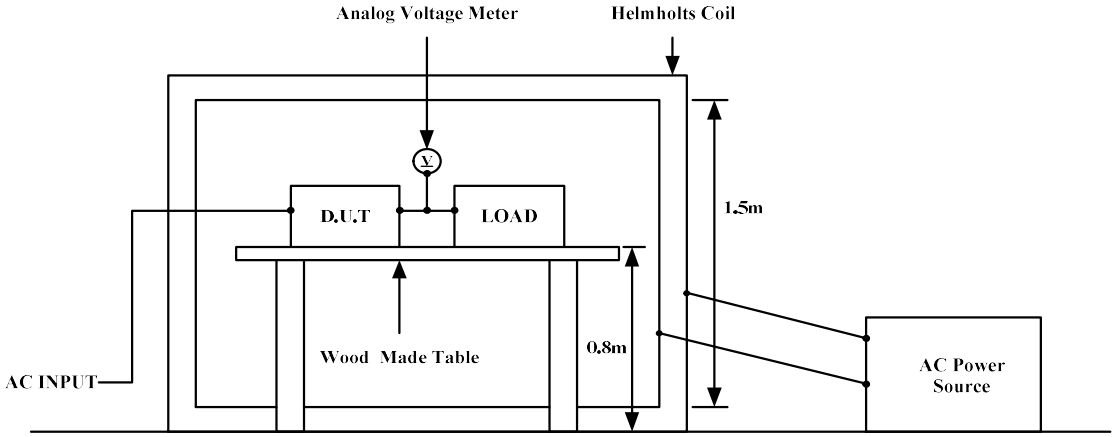
AC Power Source : 1501L (California Instrument)

Helmholts Coil : HHS5215 (Spulen)

(2) Test Conditions

・Input Voltage	:115, 230VAC	・Output Voltage	:Rated
・Output Current	:100%	・Magnetic Frequenc	:50Hz
・Ambient Temperature	:25℃	・Direction	:X, Y, Z
・Test Time	: More than 10 seconds(Each direction)		

(3) Test Method and Device Test Point



(4) Acceptable Conditions

1. Output voltage regulation not to exceed ±5% of initial value during test.

2. Output voltage to be within regulation specification after the test.

3. Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) Test Result

Magnetic Field Strength (A/m)	CUS350M-12/18/24/36/48
1	PASS
3	PASS
10	PASS
30	PASS

2.7 Voltage Dips, Short Interruptions Immunity Test (IEC61000-4-11)

MODEL ： CUS350M

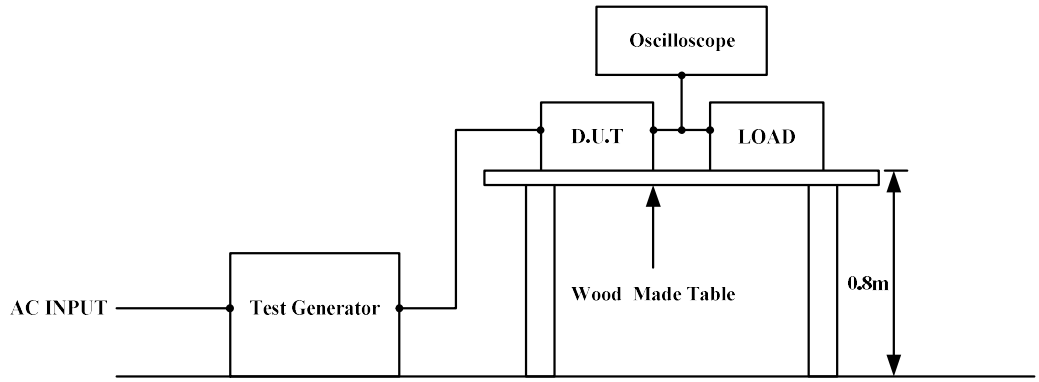
(1) Equipment Used

Test Generator ：PCR2000L（KIKUSUI）

(2) Test Conditions

・Input Voltage	：115, 230VAC	・Output Voltage	：Rated
・Output Current	：100%	・Ambient Temperature	：25℃
・Number of Tests	：3 times	・Test interval	： More than 10 seconds

(3) Test Method and Device Test Point



(4) Acceptable Conditions

1. Output voltage to be within output voltage regulation specification after the test.

2. Smoke and fire do not occur.

(5) Test Result

Test Level	Dip rate	Continue Time	CUS350M-12/18/24/36/48
70%	30%	500ms	PASS
40%	60%	200ms	PASS
0%	100%	20ms	PASS
0%	100%	5000ms	PASS

3.0 IEC60601-1-2 Series Test Data

3.1 Electrostatic Discharge Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

(1) Equipment Used

Electro Static Discharge Simulator : NSG435 (SCHAFFNER)

Discharge Resistance : 330Ω Capacity : 150pF

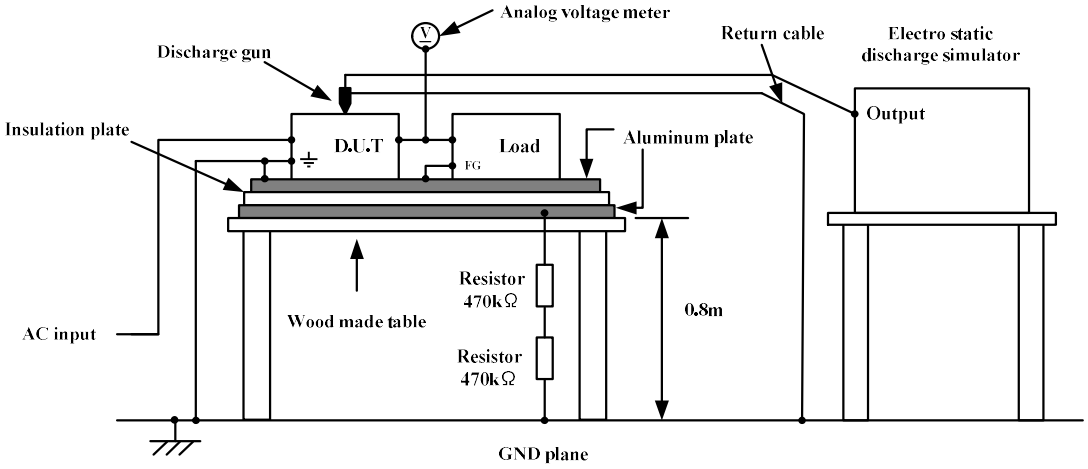
(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Polarity	: +, −
・Number of Tests	: 10 times	・Discharge Interval	: ＞1 second
・Ambient Temperature	: 25℃		

(3) Test Method and Device Test Point

Contact Discharge : ⏚ , Mounting screw.

Air Discharge : Input and Output terminal (L, N, +V, -V), ⏚ Mounting screw



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Contact Discharge (kV)	CUS350M-12/18/24/36/48	Air Discharge(kV)	CUS350M-12/18/24/36/48
2	PASS	2	PASS
4	PASS	4	PASS
6	PASS	8	PASS
8	PASS	15	PASS

3.2 Radiated Radio-Frequency Electromagnetic Field Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

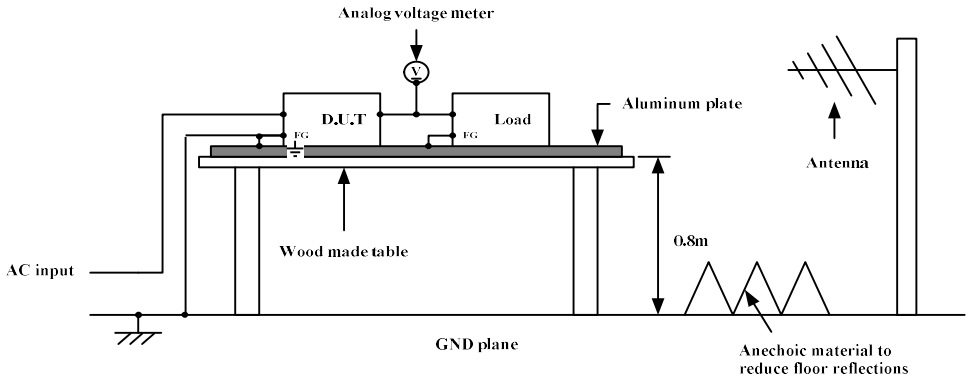
(1) Equipment Used

Signal generator	: MG3692B (Anritsu)
Power amplifier system	: AP32 SW210 (PRANA)
	: AP32 MT255 (PRANA)
Electric field sensor	: HI-6105 (ETS-Lindgren)
Bilog antenna	: AT4510 (AR)
	: VULP9118E(SCHWARZBECK)

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Distance(AM)	: 3.0m
・Wave Angle	: Horizontal and Vertical	・Distance(FM,PM)	: 0.3m
・Test Angle	: Top/Bottom, Both Sides, Front/Back	・Ambient Temperature	: 25℃
・Amplitude Modulated(AM)	: 80%, 1kHz, 1.0% step up, 0.5 seconds hold.	・Pulse Modulated(PM)	: 18Hz, 217Hz, 0.5 seconds hold
・Frequency Modulated(FM)	: 5kHz deviation, 1kHz sine, 0.5 seconds hold.		

(3) Test Method



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.
2. The output voltage must be within the regulation of specification after the test.
3. Smoke and fire are not allowed.

(5) Test Result

Modulation	Radiation Field Strength (V/m)	Electromagnetic Frequency	CUS350M-12/18/24/36/48
AM	10	80MHz ～2.7GHz	PASS
PM (18Hz)	27	385MHz	PASS
	28	810,870,930MHz	PASS
PM (217Hz)	9	710,745,780,5240,5500,5785MHz	PASS
	28	1720,1845,1970,2450MHz	PASS
FM	28	450MHz	PASS

3.3 Electrical Fast Transient / Burst Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

(1) Equipment Used

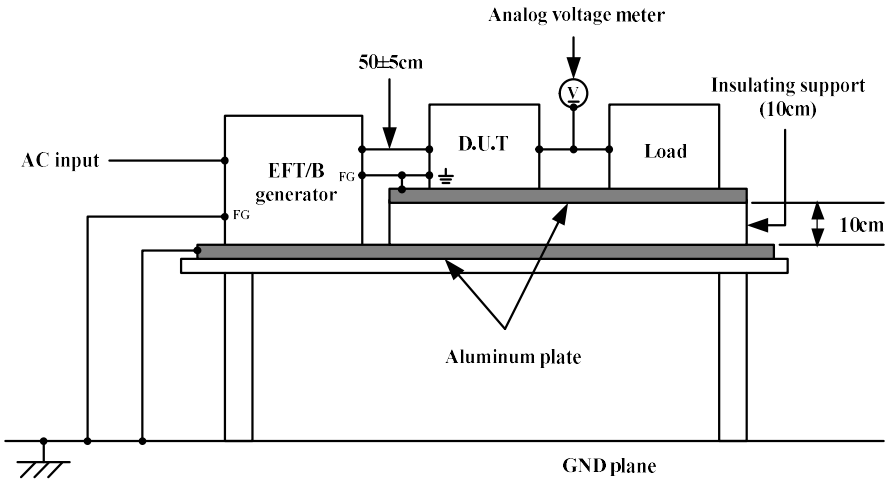
EFT/B Generator : FNS-100L (NOISEKEN)

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Test Time	: 1 minute
・Polarity	: ＋, －	・Ambient Temperature	: 25℃
・Number of Tests	: 1 time	・Pulse Frequency	: 100kHz
・Burst Time	: 15msec	・Number of Pulse	: 75pcs
・Burst Cycle	: 300msec		

(3) Test Method and Device Test Point

Apply to (N, L, ⏚).



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Test Voltage (kV)	CUS350M-12/18/24/36/48
0.5	PASS
1	PASS
2	PASS

3.4 Surge Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

(1) Equipment Used

Surge Generator : NSG3040 (TESEQ)

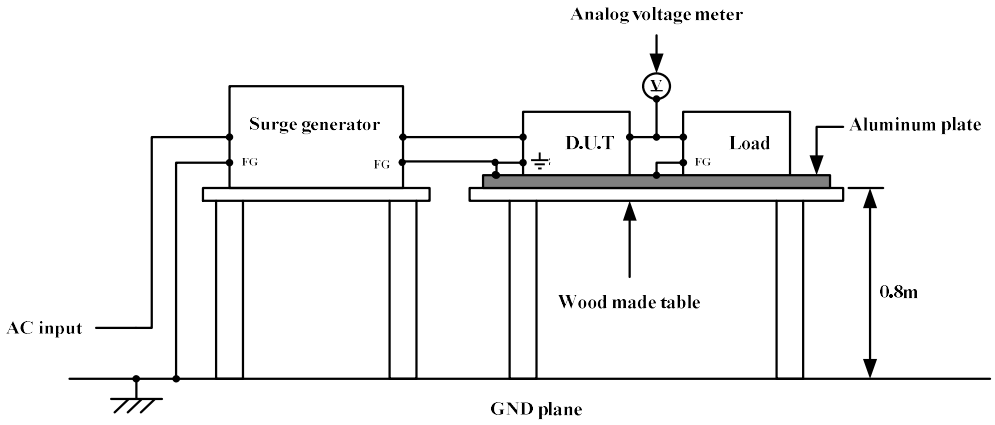
Coupling Impedance	: Common	12Ω	Coupling Capacitance	: Common	9μF
	Normal	2Ω		Normal	18μF

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 0%, 100%	・Number of Tests	: 5 times
・Polarity	: +, −	・Mode	: Common and Normal
・Phase	: 0, 90deg	・Ambient Temperatur	: 25℃

(3) Test Method and Device Test Point

Apply to Common mode (N-⏚ , L-⏚) and Normal mode (N-L).



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Common		Normal	
Test Voltage (kV)	CUS350M-12/18/24/36/48	Test Voltage (kV)	CUS350M-12/18/24/36/48
0.5	PASS	0.5	PASS
1	PASS	1	PASS
2	PASS		

3.5 Conducted Disturbances Induced by Radio-Frequency Field Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

(1) Equipment Used

Compact RF Simulator : NSG 4070-30 (TESEQ)

Coupling-Decoupling Network : CDN L-801 M2/M3 (Liithi)

(2) Test Conditions

・Input Voltage :115, 230VAC ・Output Voltage :Rated

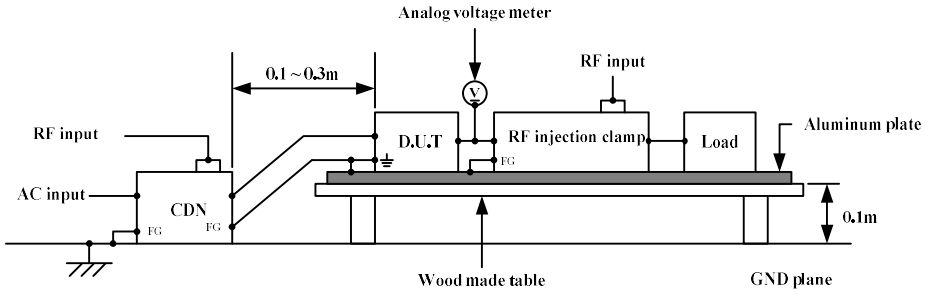
・Output Current :100% ・Electromagnetic Frequenc :150kHz～80MHz

・Ambient Temperature :25℃

・Sweep Condition :1.0% step up, 0.5 seconds hold

(3) Test Method and Device Test Point

Apply to (N, L, ⏚).



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Voltage Level (V)	CUS350M-12/18/24/36/48
1	PASS
3	PASS
10	PASS

3.6 Power Frequency Magnetic Field Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

(1) Equipment Used

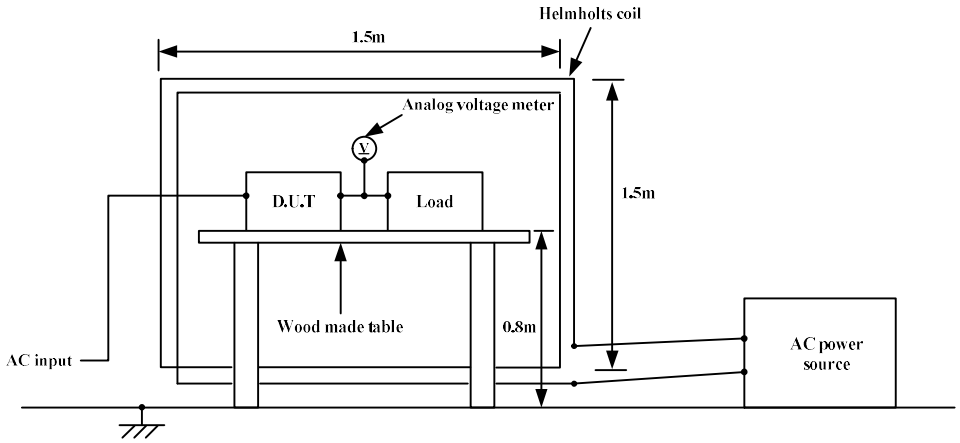
AC Power Source : NSG 1007(SCHAFFNER)

Helmholts Coil : R-1000-4-8/9-L-1M (TESEQ)

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 100%	・Magnetic Frequency	: 50Hz
・Ambient Temperature	: 25℃	・Direction	: X, Y, Z
・Test Time	: More than 10 seconds (each direction)		

(3) Test Method and Device Test Point



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Magnetic Field Strength (A/m)	CUS350M-12/18/24/36/48
1	PASS
3	PASS
10	PASS
30	PASS

3.7 Voltage Dips, Voltage Interruptions Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL: CUS350M

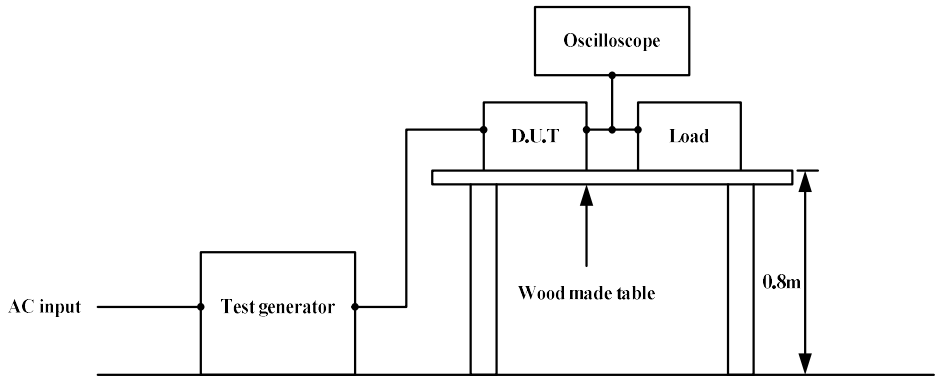
(1) Equipment Used

Test generator : PCR2000LA(KIKUSUI)

(2) Test Conditions

・Input Voltage	: 115, 230VAC	・Output Voltage	: Rated
・Output Current	: 100%	・Ambient Temperature	: 25℃
・Number of Tests	: 3 times	・Test Interval	: More than 10 seconds

(3) Test Method



(4) Acceptable Conditions

Criteria A

1. The regulation of output voltage must not exceed 5% of initial value during test.
2. The output voltage must be within the regulation of specification after the test.
3. Smoke and fire are not allowed.

Criteria B

1. Must not have temporary function degradation that requires input restart.
2. The output voltage must be within the regulation of specification after the test.
3. Smoke and fire are not allowed.

(5) Test Result

Test Level	Dip Rate	Continue Time	Phase Angles	Test result	CUS350M-12/18/24/36/48
70%	30%	500ms	0 deg	A	Vin:200~240VAC
				B	Vin:100~120VAC
0%	100%	10ms	0,45,90,135,180, 225,270,315 deg	A	
0%	100%	20ms	0 deg	A	Vin:200~240VAC
				A	Vin:100~120VAC and Io≤40%
				B	Vin:100~120VAC and Io＞40%
0%	100%	5000ms	0 deg	B	

3.8 Radiated Field In Close Proximity Immunity Test (IEC60601-1-2 Ed.4.1)

MODEL : CUS350M

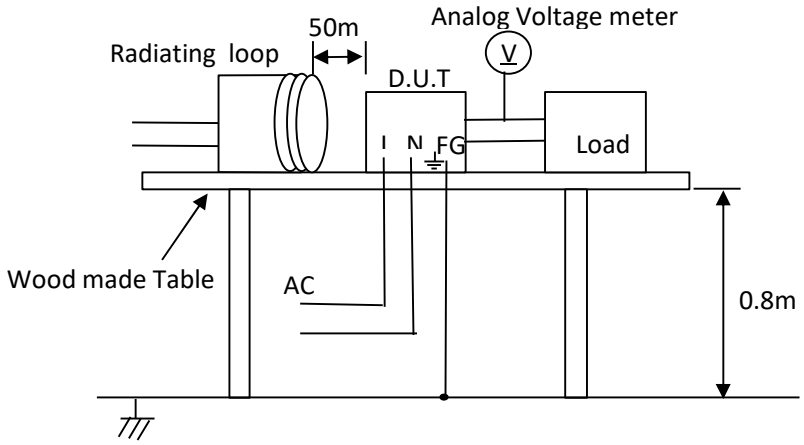
(1) Equipment Used

Signal generator	: SMC100A (R&S)
Power amplifier system	: BBA150-AB200 (R&S)
	: NFCN9734 (SCHWARZBECK)
Loop sensor	: FESP5134-40 (SCHWARZBECK)
Radiating loop	: FESP5132 (SCHWARZBECK)
	: FESP5139 (SCHWARZBECK)

(2) Test Conditions

・Input Voltage	: 100, 240VAC	・Output Voltage	: Rated
・Output Current	: Full load	・Distance	: 50mm
・Test Angle	: Top/Bottom, Both Sides, Front/Back	・Ambient Temperature	: 25℃
・Test Time	: 2sec for each coil position		

(3) Test Method (IEC61000-4-39)



(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Result

Test Frequency	Immunity test level (A/m)	Modulation	CUS350M-12/18/24/36/48
30kHz	8	Continuous waves	PASS
134.2kHz	65	Pulse Modulation 50%, 2.1kHz	PASS
13.56MHz	7.5	Pulse Modulation 50%, 50kHz	PASS