

EVALUATION DATA

MODEL NAME : ECD500A28

Tested by : *Shintaro Oki*
Shintaro Oki

Approved by : *Tomas Isaksson*
Tomas Isaksson

P R

B X

POWERBOX
A Cosel Group Company

Table of Contents

1. Input Current (by Load Current)	3
2. Efficiency (by Load Current).....	3
3. Power Factor (by Load Current)	4
4. Leakage Current	4
5. Inrush Current	5
6. Line Regulation.....	6
7. Load Regulation	6
8. Ripple Noise.....	7
9. Dynamic Load Response	7
10. Rise Time Characteristics by AC ON	8
11. Rise Time Characteristics with RC Signal.....	8
12. Fall Time / Hold-up Time	9
13. Over Current Protection.....	10
14. Minimum Input Voltage for Regulated Output Voltage	11
15. Over Voltage Protection	11
16. Conducted Emission	12
17. Radiated Emission	13
18. Figure of Test Circuitry	17

Remark:

Unless specified the test condition shall be

Input voltage / Frequency: 230 [Vac] / 50 [Hz]

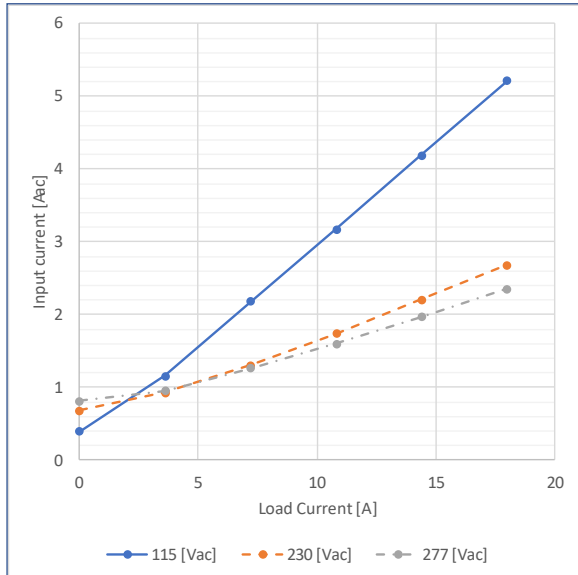
Load current: 18.0 [A]

Baseplate temperature: 25 [°C]

1. Input Current (by Load Current)

Test Circuitry : Figure A

Graph



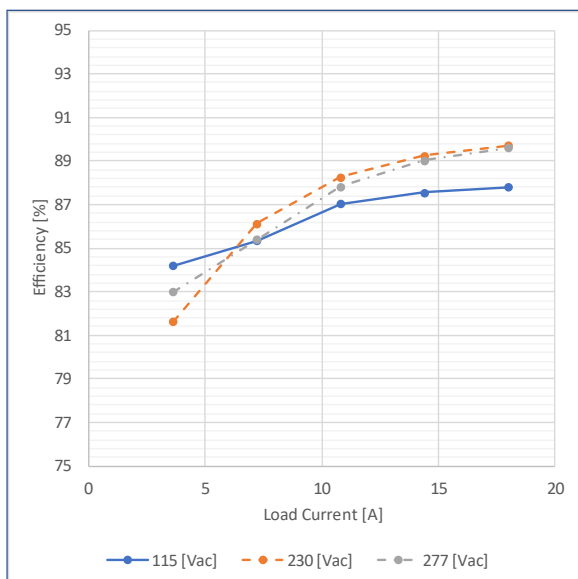
Value

Load Current [A]	Input Current [Aac]		
	Input Voltage		
	115 [Vac]	230 [Vac]	277 [Vac]
0.00	0.393	0.685	0.812
3.60	1.160	0.930	0.956
7.20	2.182	1.304	1.262
10.80	3.177	1.742	1.604
14.40	4.190	2.207	1.971
18.00	5.212	2.685	2.356

2. Efficiency (by Load Current)

Test Circuitry : Figure A

Graph



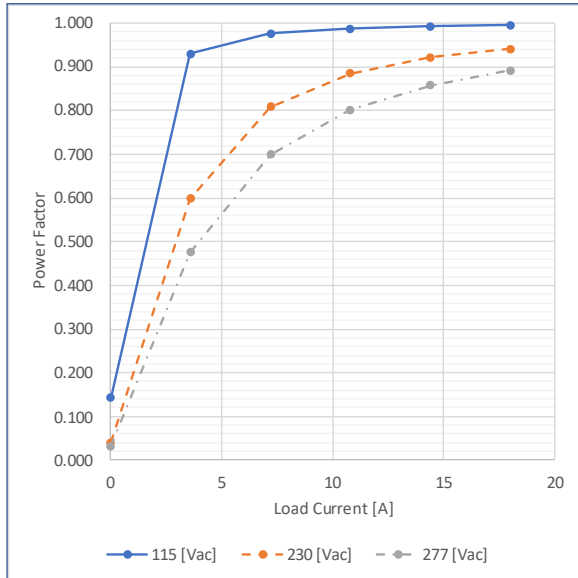
Value

Load Current [A]	Efficiency [%]		
	Input Voltage		
	115 [Vac]	230 [Vac]	277 [Vac]
0.00	-	-	-
3.60	84.196	81.619	82.994
7.20	85.354	86.129	85.399
10.80	87.030	88.261	87.827
14.40	87.565	89.244	89.033
18.00	87.798	89.704	89.614

3. Power Factor (by Load Current)

Test Circuitry : Figure A

Graph



Value

Load Current [A]	Power Factor		
	Input Voltage		
	115 [Vac]	230 [Vac]	277 [Vac]
0.00	0.142	0.040	0.032
3.60	0.930	0.598	0.475
7.20	0.976	0.808	0.699
10.80	0.987	0.885	0.802
14.40	0.992	0.921	0.858
18.00	0.995	0.941	0.891

4. Leakage Current

Test Circuitry : See table

Test Equipment: Simpson 228

Value

Standard	Testing Circuitry	Measuring Method	Leakage Current [mA]			Note
			Input Voltage			
			100 [Vac]	230 [Vac]	277 [Vac]	
IEC62368-1	Figure B-1	Both phases	0.25	0.60	0.74	Operation
		One of phases	0.44	1.20	1.45	Stand by
	Figure B-2	Both phases	0.25	0.60	0.74	Operation
		One of phases	0.44	1.20	1.45	Stand by

5. Inrush Current

Test Circuitry : Figure A

— C1: Input Voltage (200V/div)
— C4: Input Current (20A/div)

Waveform



Input Voltage : 100 [Vac]
(100ms/div)

- ① Primary Inrush Current : 12.5 [A]
- ② Secondary Inrush Current : 28.3 [A]

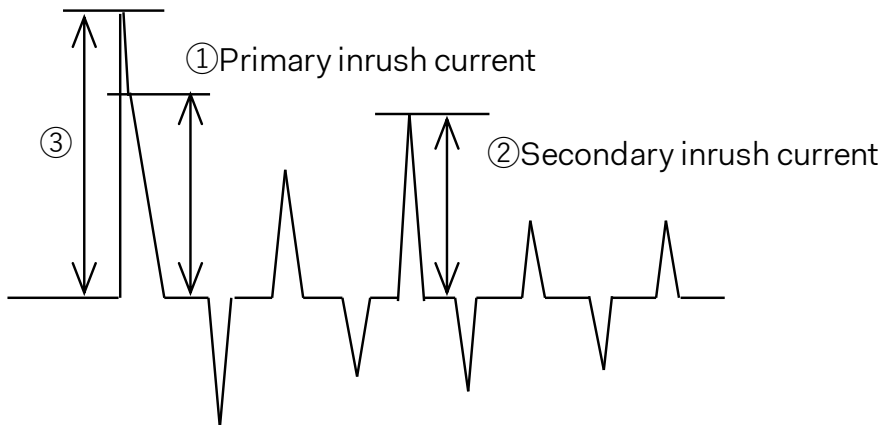


Input Voltage : 277 [Vac]
(100ms/div)

- ① Primary Inrush Current : 37.1 [A]
- ② Secondary Inrush Current : 14.0 [A]

Remark:

A surge current flown into Line-to-Line capacitor (③) would be excluded as primary inrush current (①).

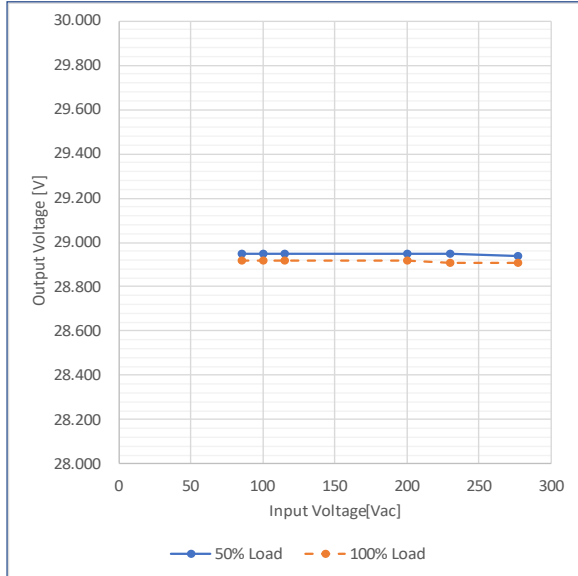


6. Line Regulation

Test Circuitry : Figure A

Change input voltage from 85 to 277 [Vac]

Graph



Value

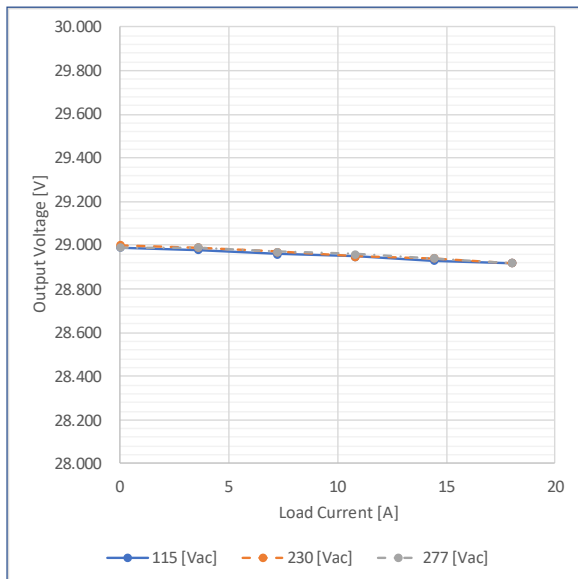
Input Voltage [Vac]	Output Voltage [V]	
	Load Factor	
	50% Load	100% Load
85.00	28.950	28.920
100.00	28.950	28.920
115.00	28.950	28.920
200.00	28.950	28.920
230.00	28.950	28.910
277.00	28.940	28.910

7. Load Regulation

Test Circuitry : Figure A

Change Load Current from 0 to 58.0 [A]

Graph



Value

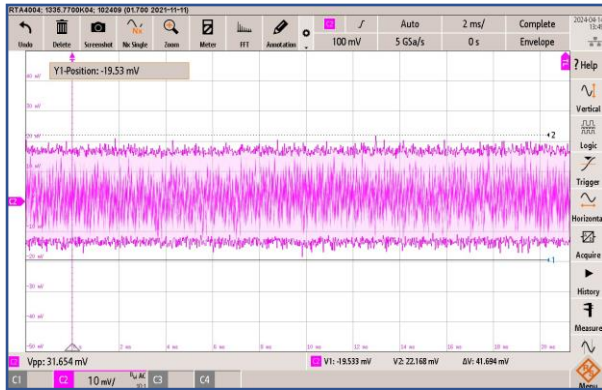
Load Current [A]	Output Voltage [V]		
	Input Voltage		
	115 [Vac]	230 [Vac]	277 [Vac]
0.00	28.990	29.000	28.990
3.60	28.980	28.990	28.990
7.20	28.960	28.970	28.970
10.80	28.950	28.950	28.960
14.40	28.930	28.940	28.940
18.00	28.920	28.920	28.920

8. Ripple Noise

Test Circuitry : Figure C

— C2: Output voltage (10mV/div)
 BW: 20MHz

Waveform



(2ms/div)

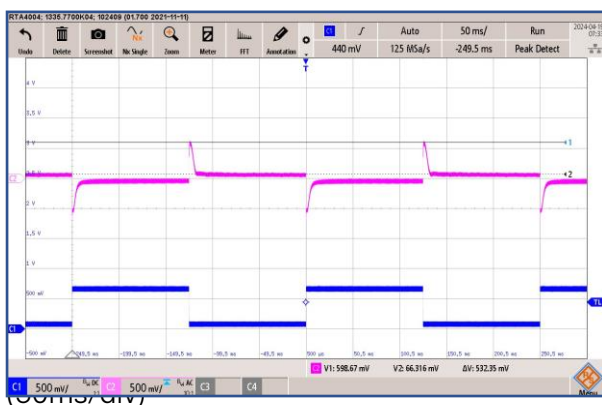
9. Dynamic Load Response

Test Circuitry : Figure A
 Load Current 1.7 [A] <-> 16 [A]

— C2: Output voltage (500mV/div)
 — C4: Output current (12A/div)

Waveform

Load changes from 10% to 90% of rated current.



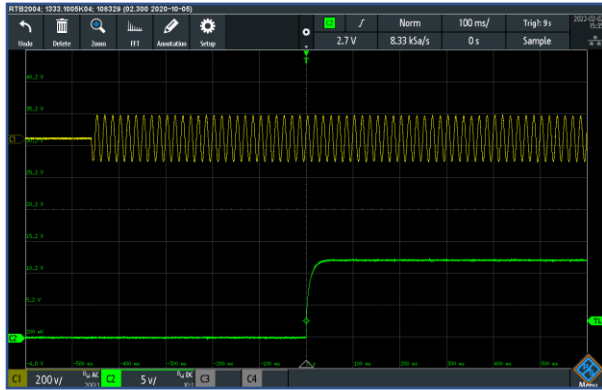
(50ms/div)

10. Rise Time Characteristics by AC ON

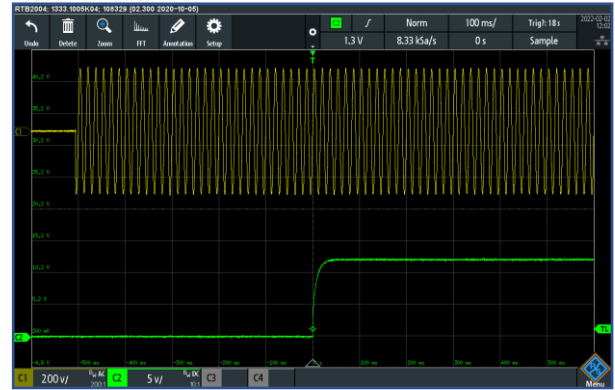
Test Circuitry : Figure A

— C1: Input voltage (200V/div)
— C2: Output voltage (5V/div)

Waveform



Input Voltage 100 [Vac]
Load Current 18.0 [A]
(100ms/div)



Input Voltage 277 [Vac]
Load Current 18.0 [A]
(100ms/div)

11. Rise Time Characteristics with RC Signal

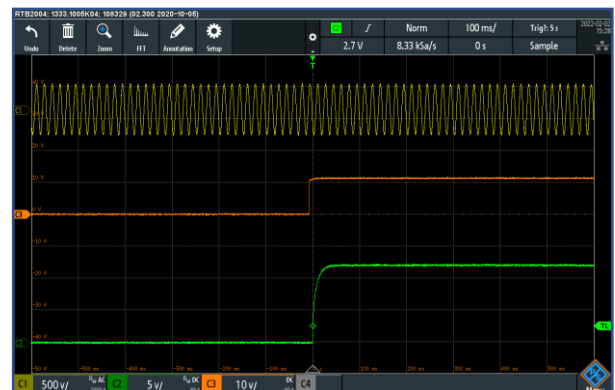
Test Circuitry : Figure D

— C1: Input voltage (500V/div)
— C2: Output voltage (5V/div)
— C3: RC signal (10V/div)

Waveform



Input Voltage 100 [Vac]
Load Current 18.0 [A]
(100ms/div)



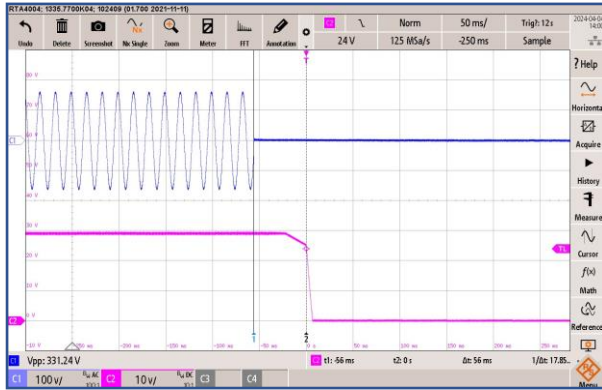
Input Voltage 277 [Vac]
Load Current 18.0 [A]
(100ms/div)

12. Fall Time / Hold-up Time

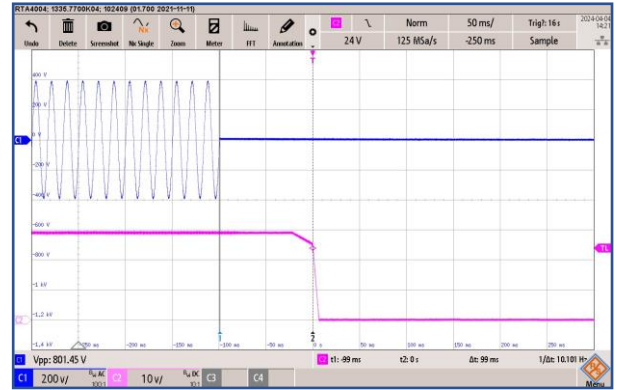
Test Circuitry : Figure A

— C1: Input voltage (200V/div)
 — C2: Output voltage (5V/div)

Waveform

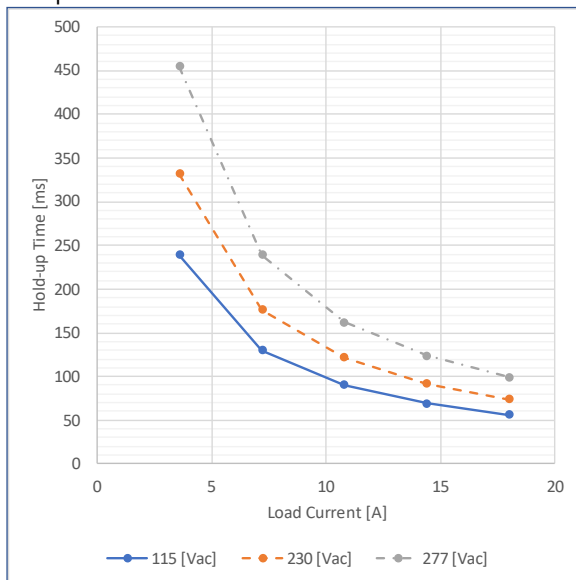


Input Voltage 115 [Vac]
 Load Current 18.0 [A]
 (10ms/div)



Input Voltage 277 [Vac]
 Load Current 18.0 [A]
 (10ms/div)

Graph



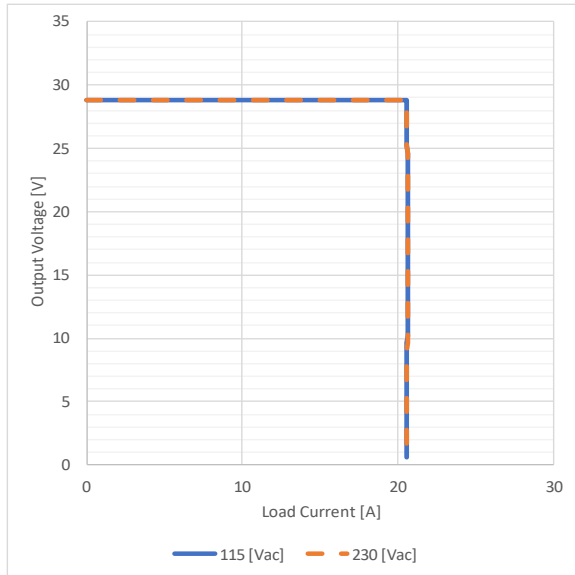
Value

Load Current [A]	Hold-up Time [ms]		
	Input Voltage		
	115 [Vac]	230 [Vac]	277 [Vac]
0.00	-	-	-
3.60	239.0	332.0	455.0
7.20	130.0	176.0	239.0
10.80	90.0	122.0	162.0
14.40	69.0	92.0	124.0
18.00	56.0	74.0	99.0

13. Over Current Protection

Test Circuitry : Figure A

Graph



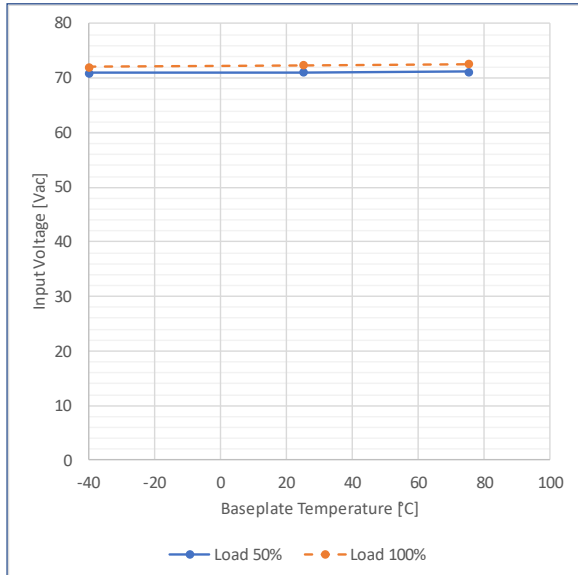
Value

Output Voltage [V]	Load Current [A]	
	Input Voltage	
	115 [Vac]	230 [Vac]
28.00	20.570	20.580
23.33	20.590	20.600
18.67	20.620	20.630
14.00	20.640	20.650
9.33	20.570	20.580
4.67	20.550	20.550
0.00		

14. Minimum Input Voltage for Regulated Output Voltage

Test Circuitry : Figure A

Graph



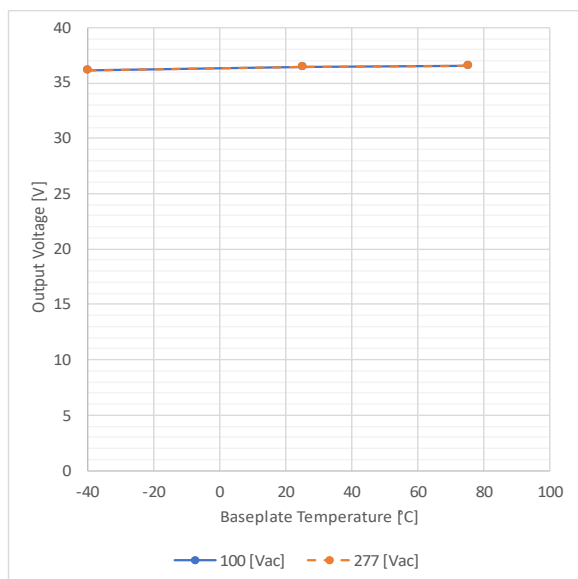
Value

Baseplate Temperature [°C]	Input Voltage [Vac]	
	Load Current	
	Load 50%	Load 100%
-40	71.0	72.0
25	71.1	72.4
75	71.2	72.6

15. Over Voltage Protection

Test Circuitry : Figure A

Graph



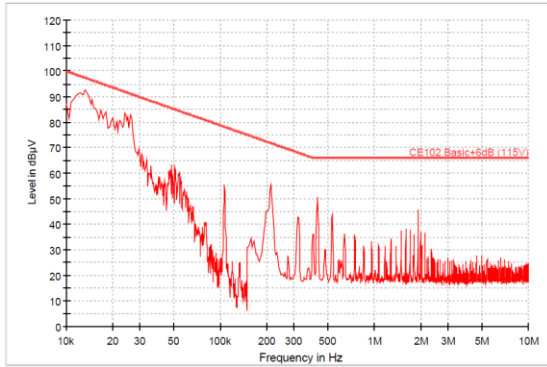
Value

Baseplate Temperature [°C]	Output Voltage [V]	
	Input Voltage	
	100 [Vac]	277 [Vac]
-40	36.160	36.160
25	36.450	36.460
75	36.570	36.570

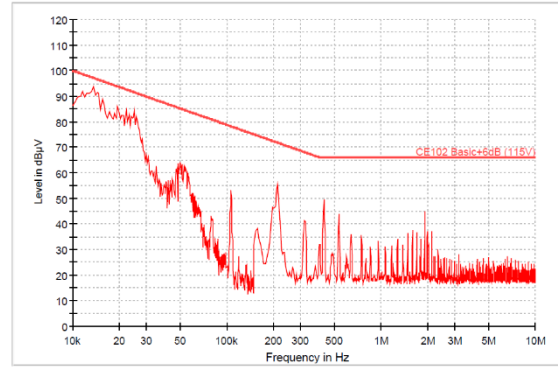
16. Conducted Emission

Input Voltage : 115Vac / 230Vac 50Hz

Load : 100 %

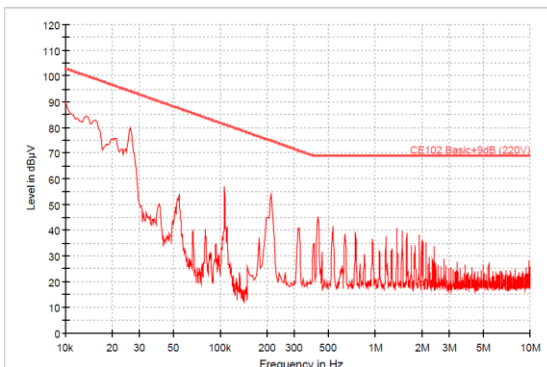


30054 0159 CE102 115V/AC EUTS L
PK+_MAXH CE102 Basic+6dB (115V)

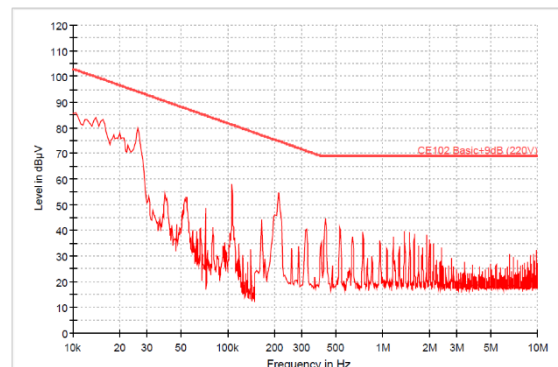


30054 0160 CE102 115V/AC EUTS N
PK+_MAXH CE102 Basic+6dB (115V)

Fig. 16.1 MIL-STD-461F CE102 Result, ECD500A28, 115V, Line and Neutral



30054 0150 CE102 230V/AC EUTS L
PK+_MAXH CE102 Basic+9dB (220V)



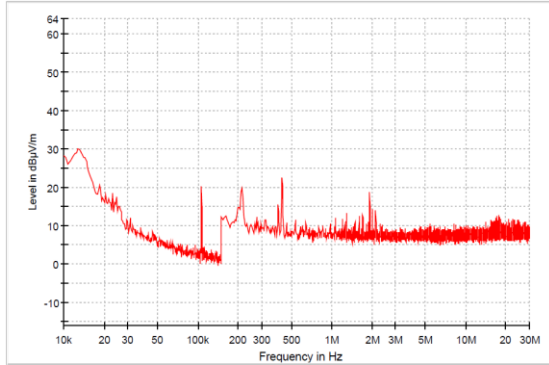
30054 0149 CE102 230V/AC EUTS N
PK+_MAXH CE102 Basic+9dB (220V)

Fig. 16.2 MIL-STD-461F CE102 Result, ECD500A28, 230V, Line and Neutral

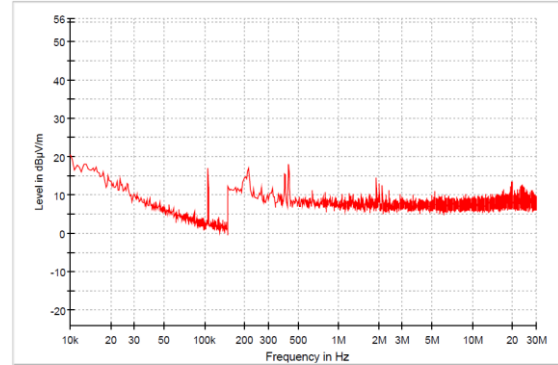
17. Radiated Emission

Input Voltage : 115Vac / 230Vac 50Hz

Load : 100 %

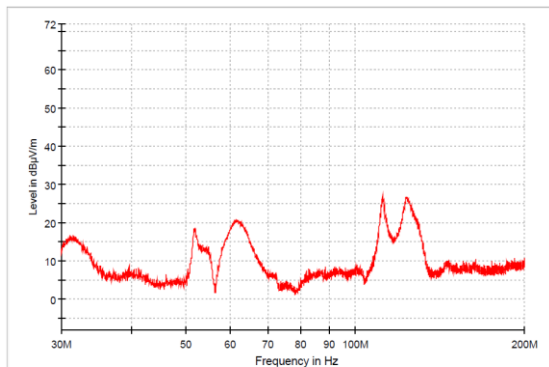


30054 0155 RE102 10k-30M 115VAC EUT5
PK+_CLRWR

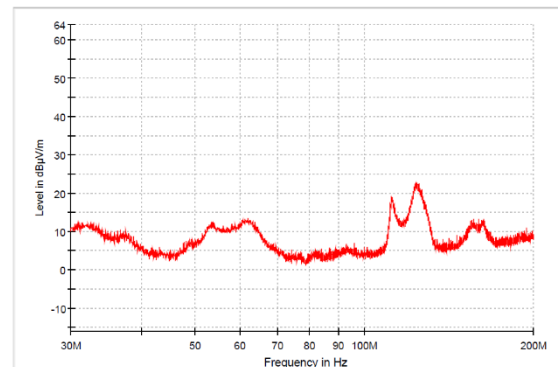


30054 0154 RE102 10k-30M 230VAC EUT5
PK+_CLRWR

Fig. 17.1 MIL-STD-461F RE102 10kHz to 30MHz Result, ECD500A28, 115V and 230V

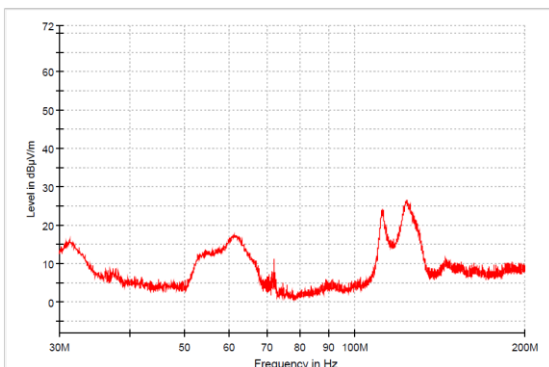


30054 0161 RE102 30M-200M 115V EUT5 VER
PK+_CLRWR

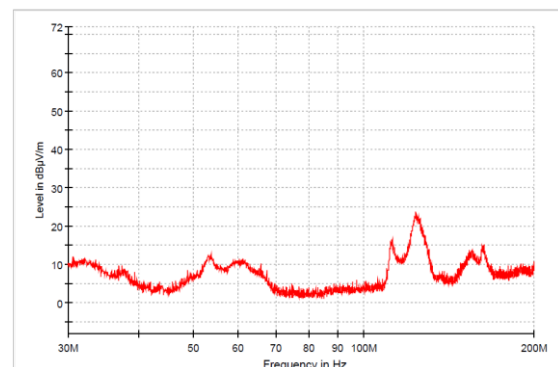


30054 0162 RE102 30M-200M 115V EUT5 HOR
PK+_CLRWR

Fig. 17.2 MIL-STD-461F RE102 30MHz to 200MHz Result, ECD500A28, 115V, Vertical and Horizontal

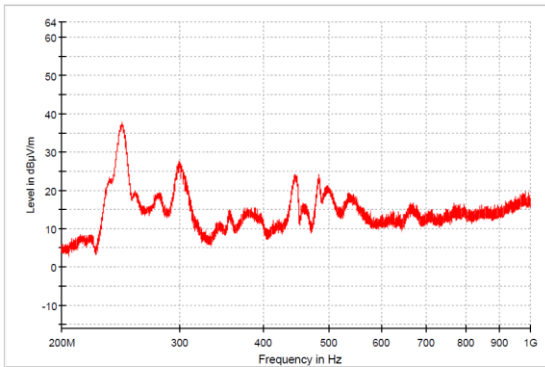


30054 0164 RE102 30M-200M 230V EUT5 VER
PK+_CLRWR

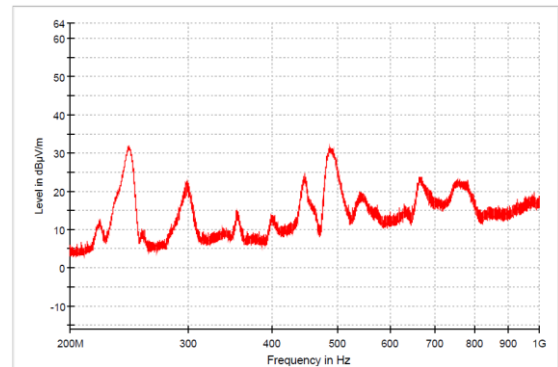


30054 0163 RE102 30M-200M 230V EUT5 HOR
PK+_CLRWR

Fig. 17.3 MIL-STD-461F RE102 30MHz to 200MHz Result, ECD500A28, 230V, Vertical and Horizontal

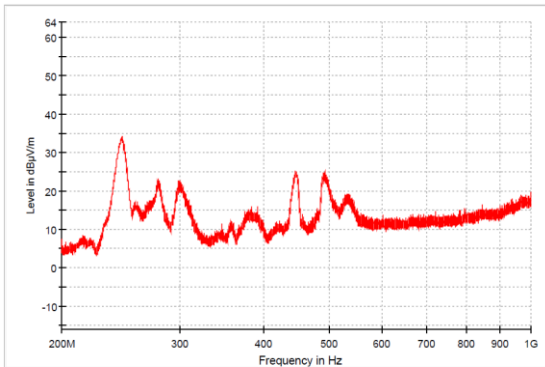


30054 0176 RE102 200M-1G 115V EUTS VER
PK+_CLRWR

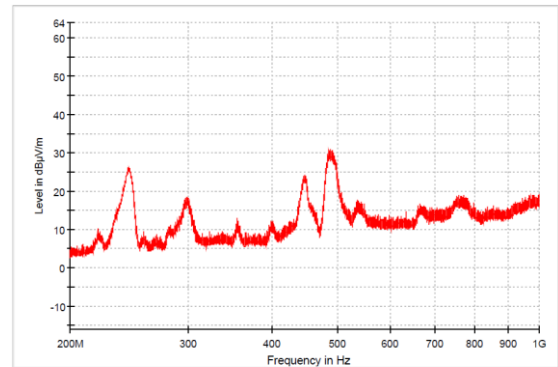


30054 0175 RE102 200M-1G 115V EUTS HOR
PK+_CLRWR

Fig. 17.4 MIL-STD-461F RE102 200MHz to 1GHz Result, ECD500A28, 115V, Vertical and Horizontal

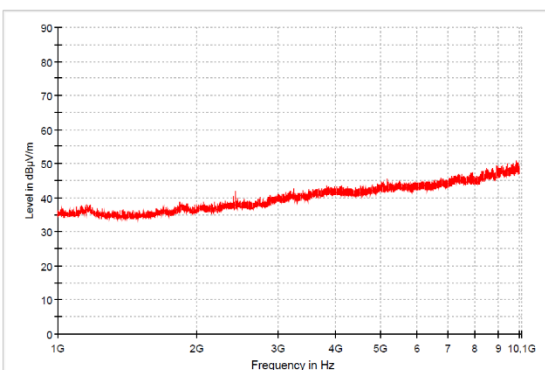


30054 0173 RE102 200M-1G 230V EUTS VER
PK+_CLRWR

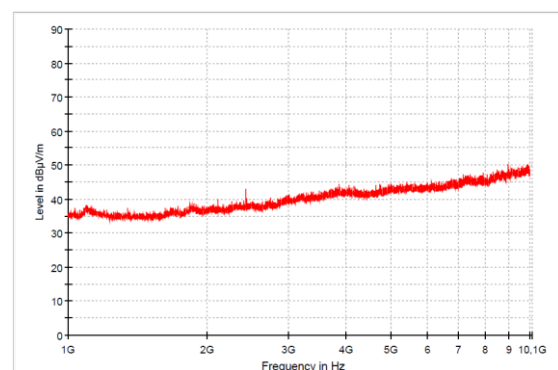


30054 0174 RE102 200M-1G 230V EUTS HOR
PK+_CLRWR

Fig. 17.5 MIL-STD-461F RE102 200MHz to 1GHz Result, ECD500A28, 230V, Vertical and Horizontal

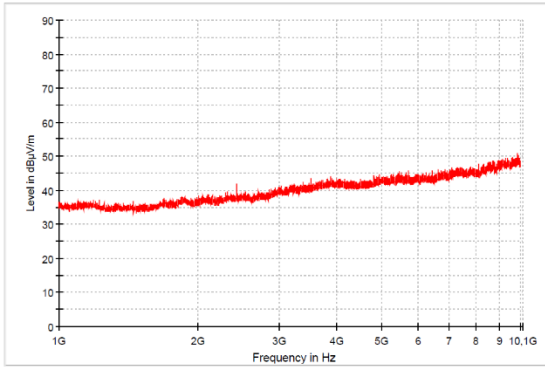


30054 0182 RE102 1G-10G 115V EUTS VER
PK+_CLRWR

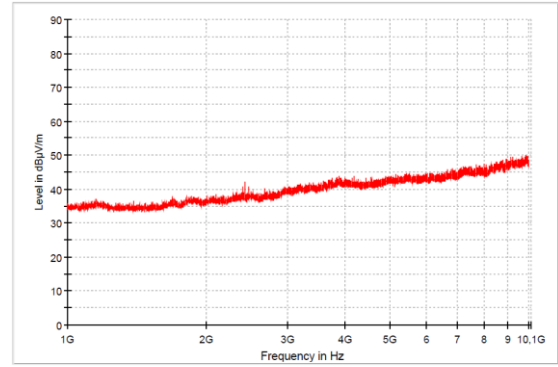


30054 0183 RE102 1G-10G 115V EUTS HOR
PK+_CLRWR

Fig. 17.6 MIL-STD-461F RE102 1GHz to 10GHz Result, ECD500A28, 115V, Vertical and Horizontal

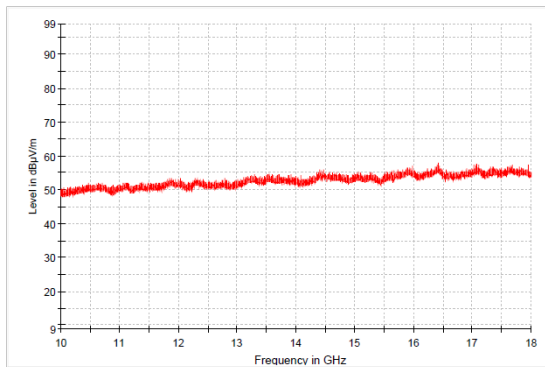


30054 0180 RE102 1G-10G 230V EUT5 VER
PK+_CLRWR

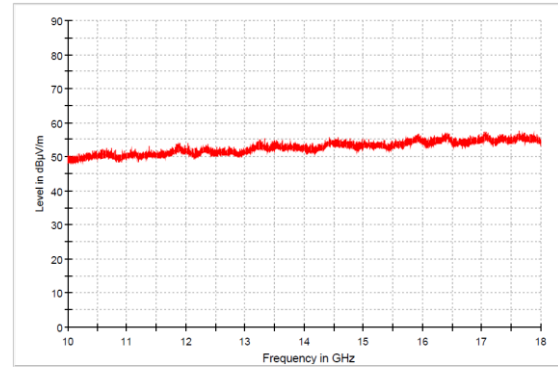


30054 0181 RE102 1G-10G 230V EUT5 HOR
PK+_CLRWR

Fig. 17.7 MIL-STD-461F RE102 1GHz to 10GHz Result, ECD500A28, 230V, Vertical and Horizontal

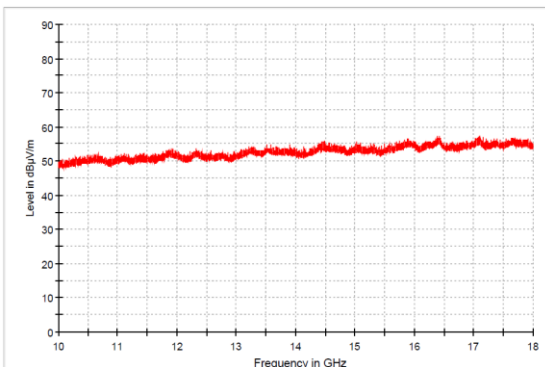


30054 0184 RE102 10G-18G 115V EUT5 VER
PK+_CLRWR

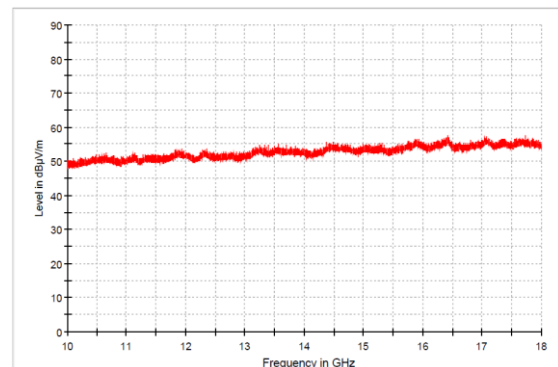


30054 0185 RE102 10G-18G 115V EUT5 HOR
PK+_CLRWR

Fig. 17.8 MIL-STD-461F RE102 10GHz to 18GHz Result, ECD500A28, 115V, Vertical and Horizontal



30054 0187 RE102 10G-18G 230V EUT5 VER
PK+_CLRWR



30054 0188 RE102 10G-18G 230V EUT5 HOR
PK+_CLRWR

Fig. 17.9 MIL-STD-461F RE102 10GHz to 18GHz Result, ECD500A28, 230V, Vertical and Horizontal



Fig. 17.10 MIL-STD-461F CE102 and RE102 test set-up

18. Figure of Test Circuitry

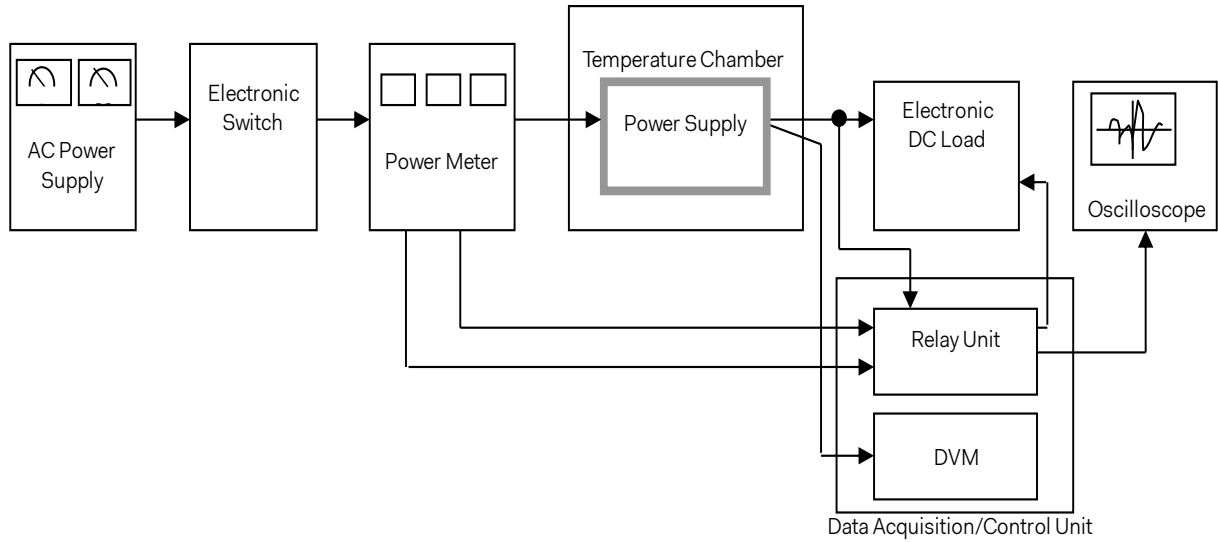


Figure A Test circuitry for general performance measurement

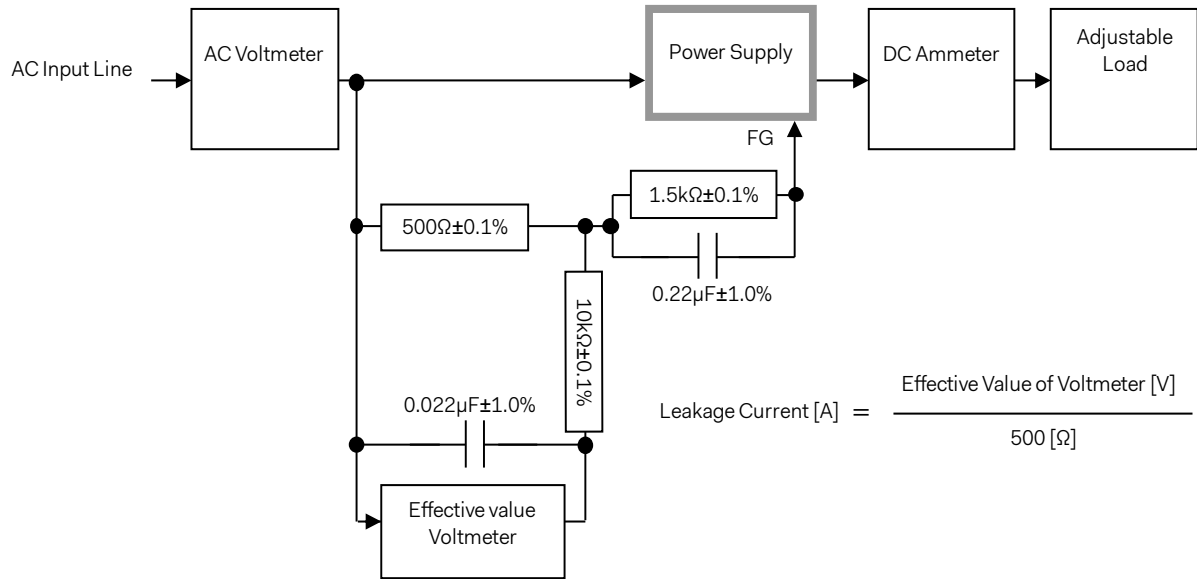


Figure B-1 Leakage current measurement (IEC62368-1, refer to IEC60990 Fig.4)

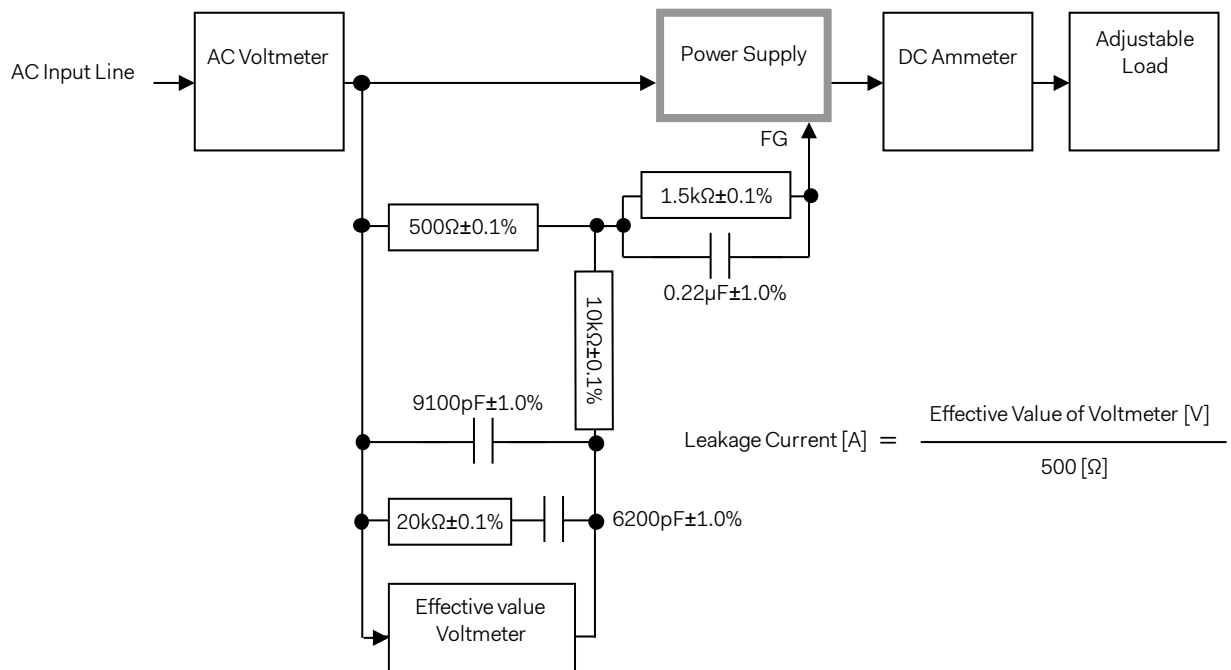


Figure B-2 Leakage current measurement (IEC62368-1, refer to IEC60990 Fig.5)

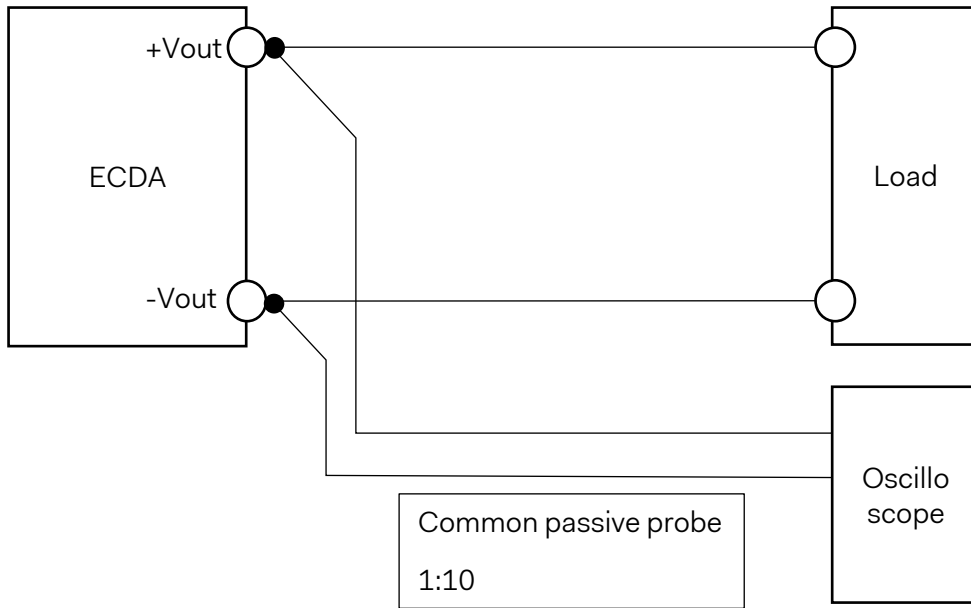


Figure C Ripple voltage measurement

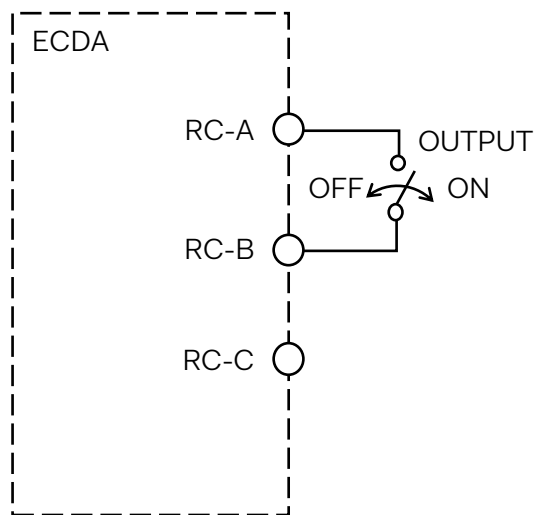


Figure D Turn on by RC measurement