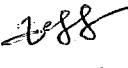




DRF120-24-1

EVALUATION DATA

DWG. No. PA618-53-01		
APPD	CHK	DWG
 24/Oct/14		 25/Jul/14

2. Characteristics

2.1	Steady state data	
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Terminology used

	Definition
V_{in} Input voltage
V_{out} Output voltage
I_{in} Input current
I_{out} Output current
T_a Ambient temperature
f Frequency

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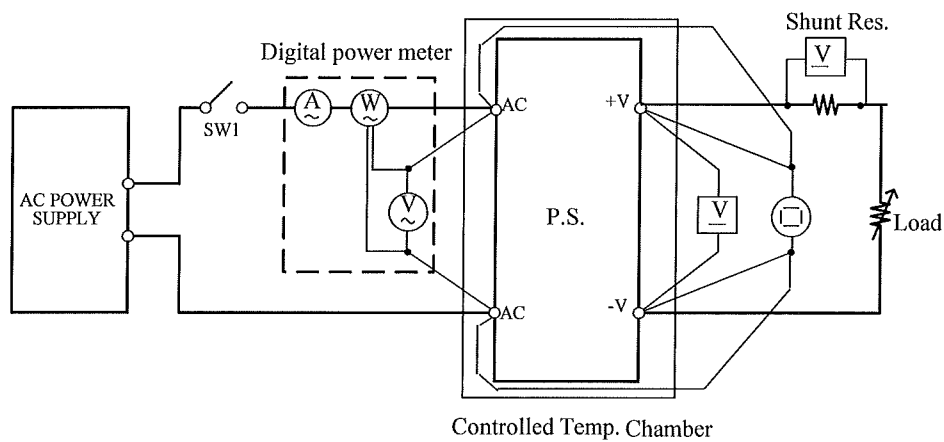
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1. Evaluation Method

1.1 Circuit used for determination

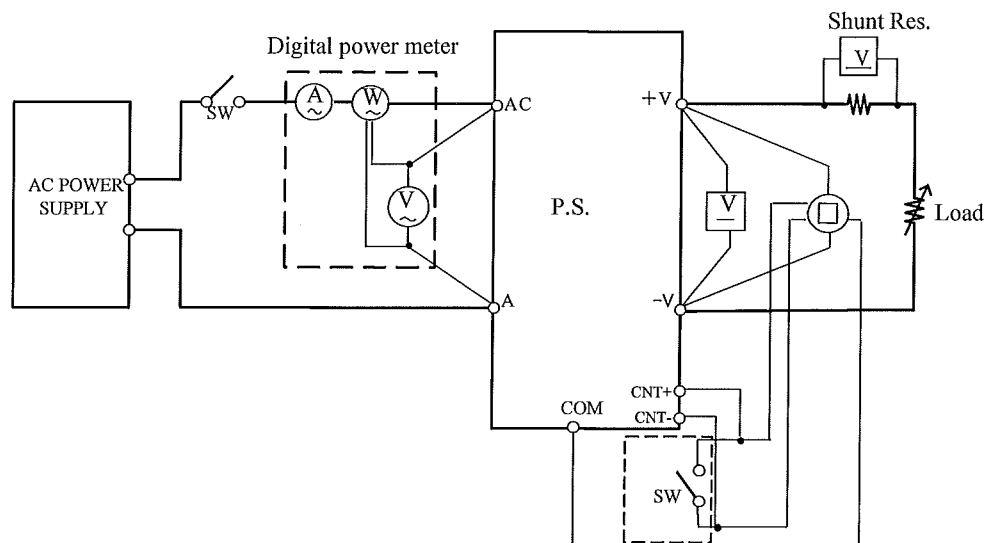
Circuit 1 used for determination

- Steady state data
- Over current protection (OCP) characteristics
- Over voltage protection (OVP) characteristics
- Output rise characteristics
- Output fall characteristics
- Hold up time characteristics



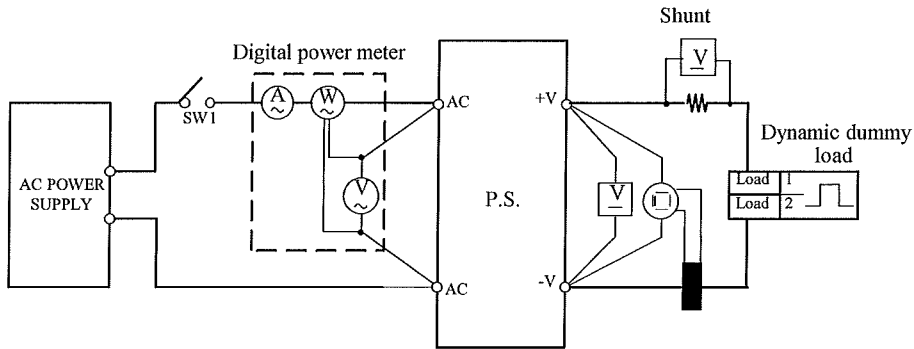
Circuit 2 used for determination

- Output rise, fall characteristics with ON/OFF Control

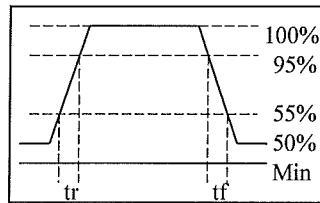


Circuit 3 used for determination

• Dynamic load response characteristics

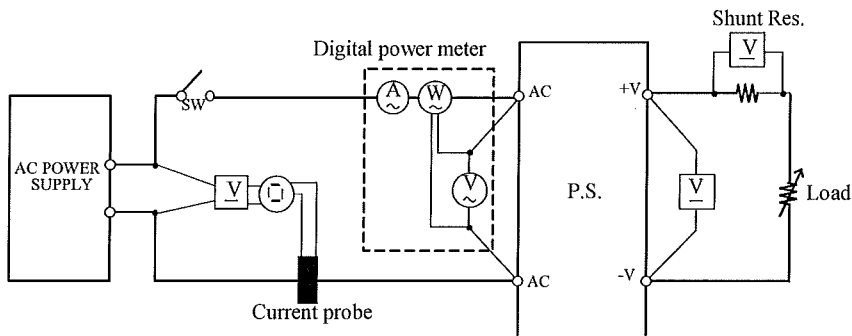


Output current waveform



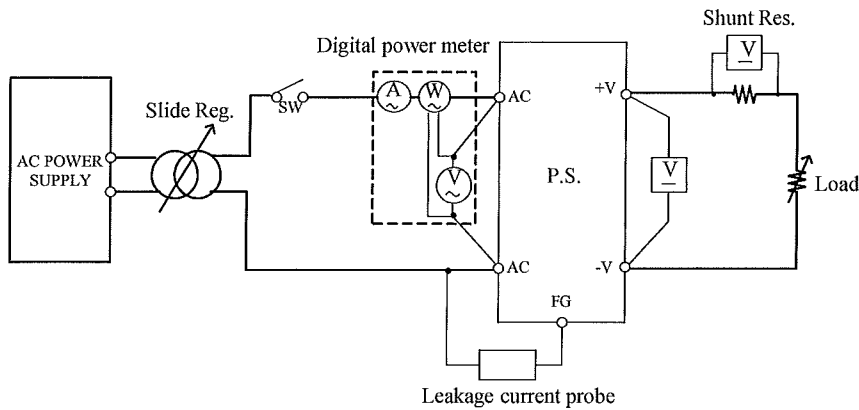
Circuit 4 used for determination

• Inrush current waveform



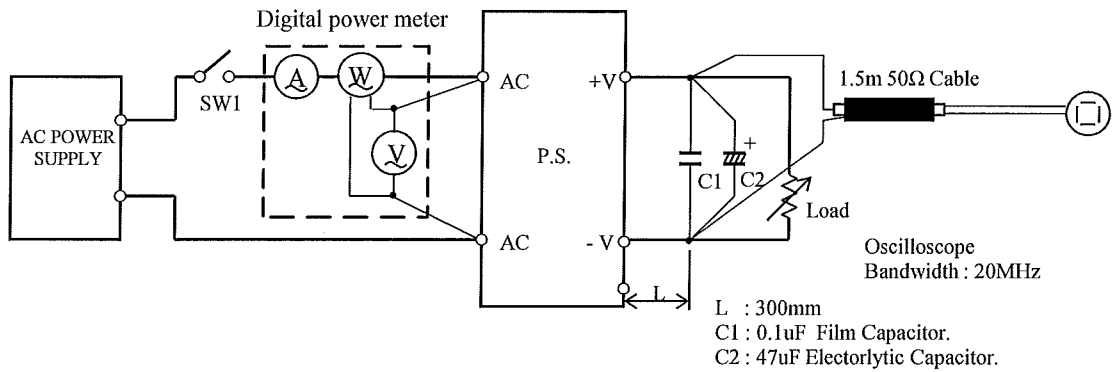
Circuit 5 used for determination

• Leakage current characteristics



Circuit 6 used for determination

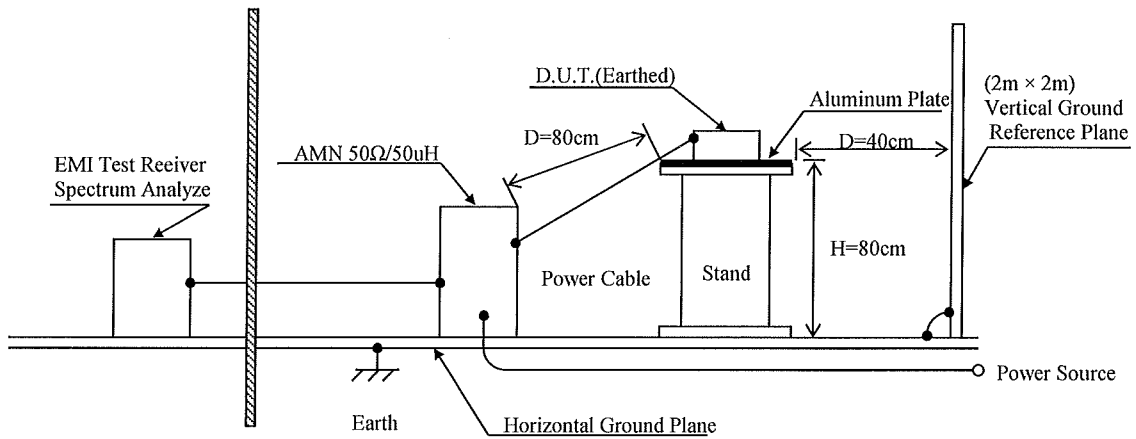
• Output ripple and noise waveform



Configuration used for determination

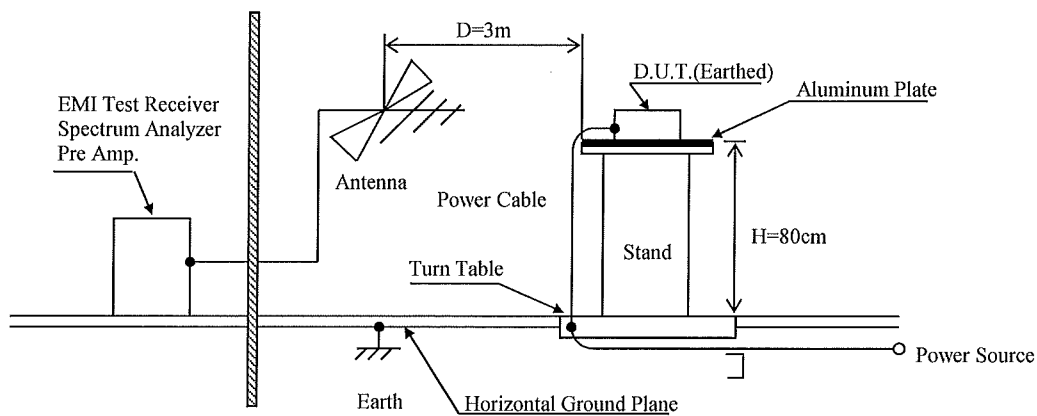
• Electro-Magnetic Interference characteristics

(a) Conducted Emission



(b) Radiated Emission

Radiated Emission



1.2 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA	DL1740/DL1740E
2	DIGITAL MULTIMETER	YOKOGAWA	JKM3174
3	DIGITAL POWER METER	HIOKI	3333
4	CURRENT PROBE/AMPLIFIER	YOKOGAWA	701931
5	DATA ACQUISITION UNIT	AGILENT	34970A
6	DYNAMIC DUMMY LOAD	CHROMA	63112A
7	CONTROLLED TEMP. CHAMBER	ESPEC	SH-641
8	LEAKAGE CURRENT METER	SIMPSON	228
9	AC SOURCE	CHROMA	61505
10	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESPI
11	LISN	TDK	NNLK8121
12	LISN	COM-POWER CORPORATION	LI-215A
13	SPECTRUM ANALYZER	AGILENT	E7402A

2 Characteristics

2.1 Steady state data

(1) Regulation - line and load, Temperature drift / Start up voltage and Drop out voltage

24V

1. Regulation - line and load

Conditions Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	264VAC	line regulation	
0%	24.024	24.025	24.024	24.025	1mV	0.004%
50%	24.025	24.026	24.026	24.026	1mV	0.004%
100%	24.025	24.025	24.025	24.025	0mV	0.000%
load regulation	1mV	1mV	2mV	1mV		
	0.004%	0.004%	0.008%	0.004%		

2. Temperature drift

Conditions Vin : 115VAC

Iout : 100%

Ta	-35°C	25°C	70°C	temperature stability	
Vout	23.943V	24.025V	24.009V	82mV	0.342%

3. Start up voltage and Drop out voltage

Conditions Ta : 25°C

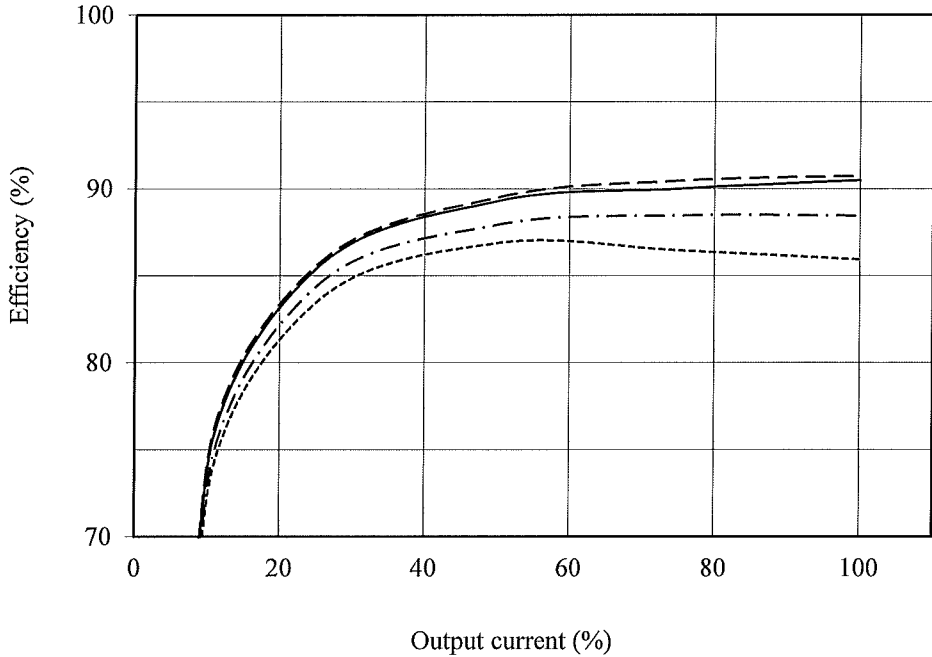
Iout : 100%

Start up voltage (Vin)	78VAC
Drop out voltage (Vin)	61VAC

(2) Efficiency vs. Output current

Conditions Vin : 85VAC -----
 : 115VAC - - - - -
 : 230VAC — — —
 : 264VAC - - - - -
 Ta : 25°C

24V

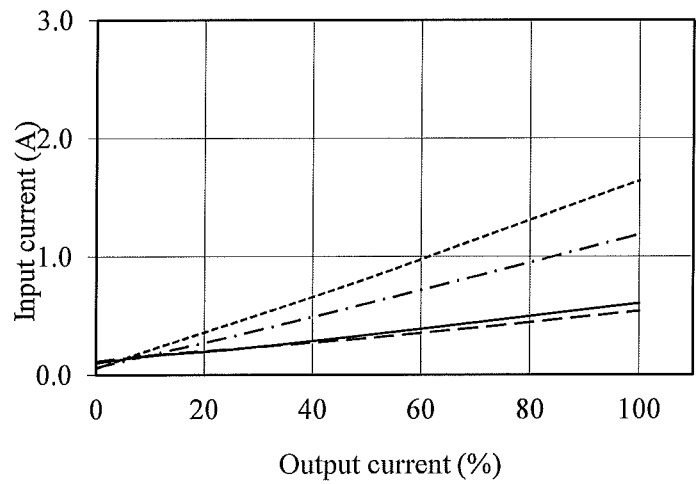


(3) Input current vs. Output current

Conditions Vin : 85VAC -----
 : 115VAC - - - - -
 : 230VAC ————
 : 264VAC - - - - -
 Ta : 25°C

24V

Vin	Input current
	Iout : 0%
85VAC	0.06A
115VAC	0.06A
230VAC	0.10A
264VAC	0.11A

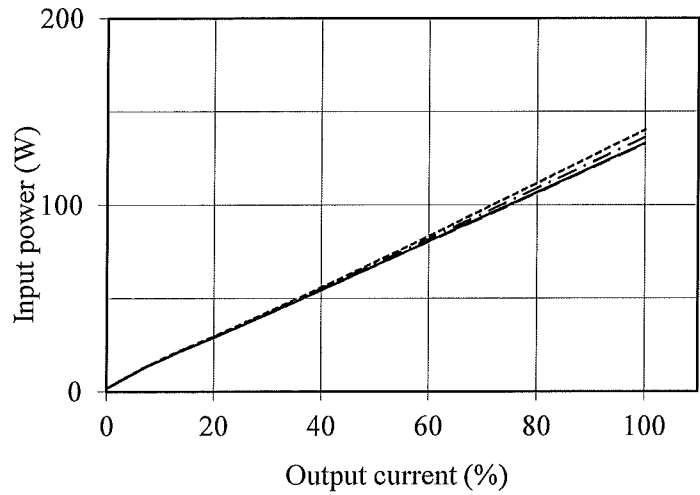


(4) Input power vs. Output current

Conditions Vin: 85VAC -----
 : 115VAC -.-.-.-
 : 230VAC ————
 : 264VAC - - - -
 Ta: 25°C

24V

Vin	Input power	
	Iout : 0%	Control OFF
85VAC	2.1W	0.32W
115VAC	2.1W	0.32W
230VAC	1.8W	0.42W
264VAC	1.8W	0.44W

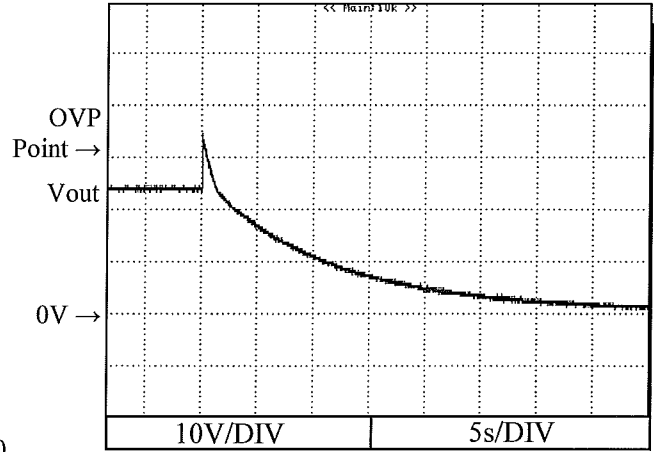
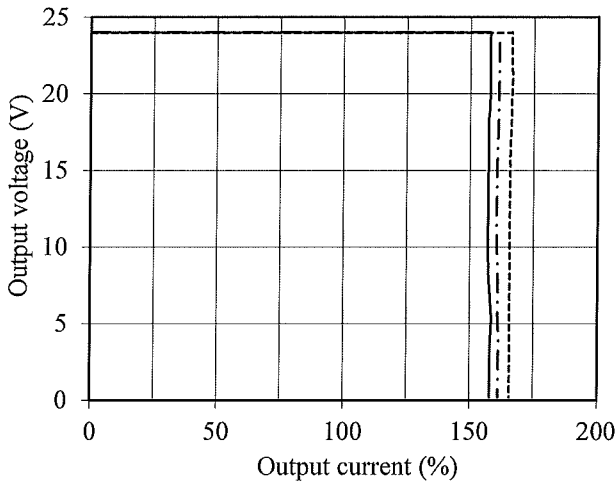


2.2 Over current protection (OCP) characteristics 2.3 Over voltage protection (OVP) characteristics

Conditions Vin : 115VAC
 Ta : -35°C
 25°C
 70°C

Conditions Vin : 115VAC
 Iout : 0%
 Ta : 25°C

24V



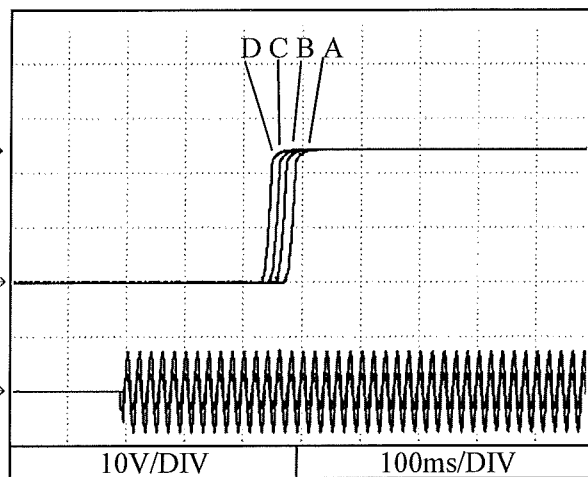
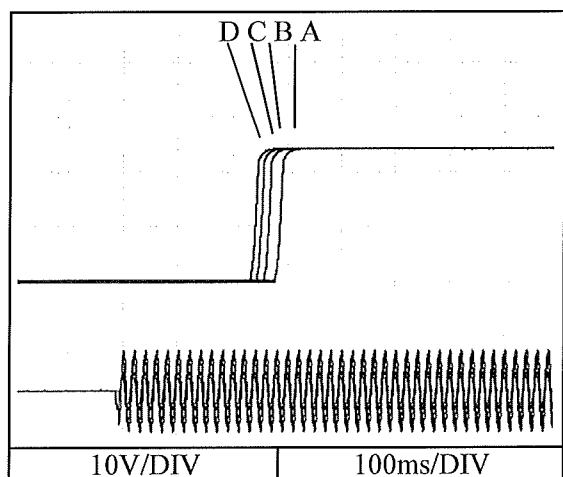
2.4 Output rise characteristics

Conditions Vin: 85VAC (A)
 : 115VAC (B)
 : 230VAC (C)
 : 264VAC (D)
 Ta: 25°C

24V

Iout : 0%

Iout : 100%



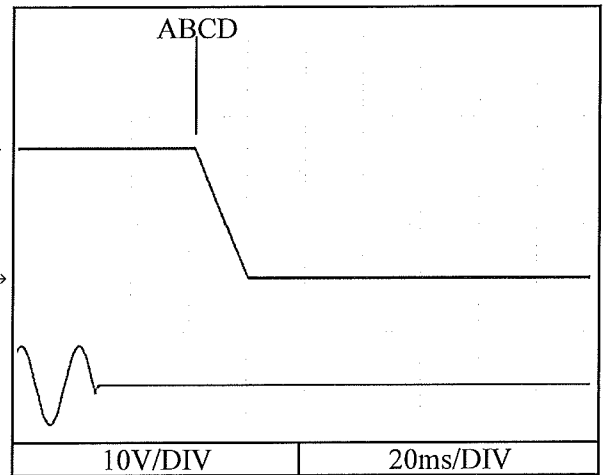
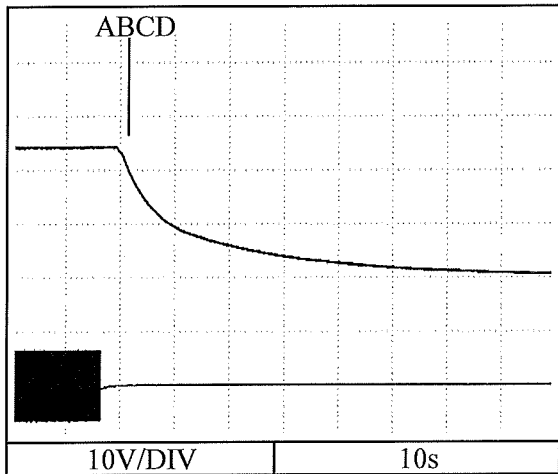
2.5 Output fall characteristics

Conditions Vin: 85VAC (A)
 : 115VAC (B)
 : 230VAC (C)
 : 264VAC (D)
 Ta: 25°C

24V

Iout : 0%

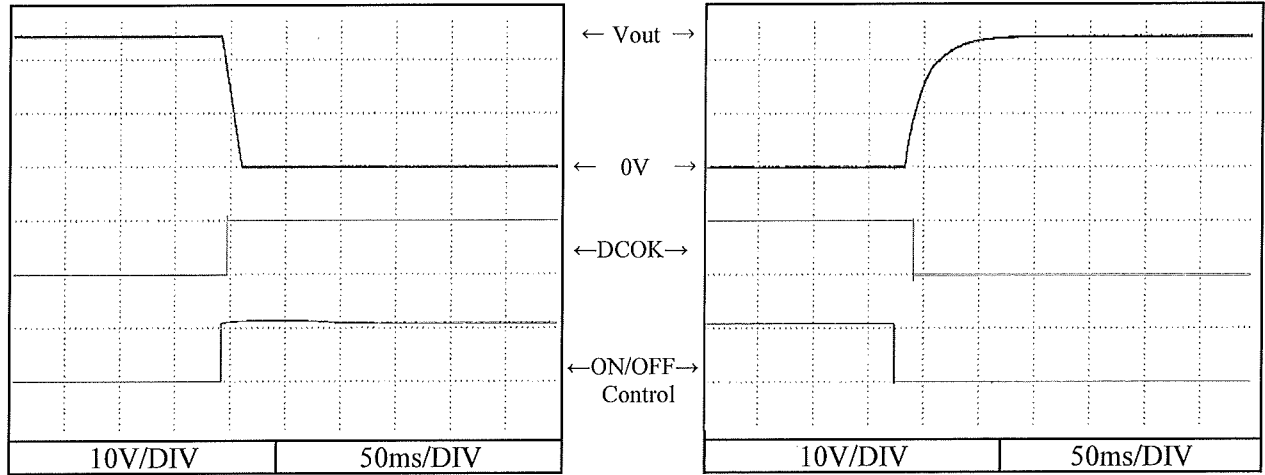
Iout : 100%



2.6 Output rise, fall characteristics with ON/OFF Control

Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

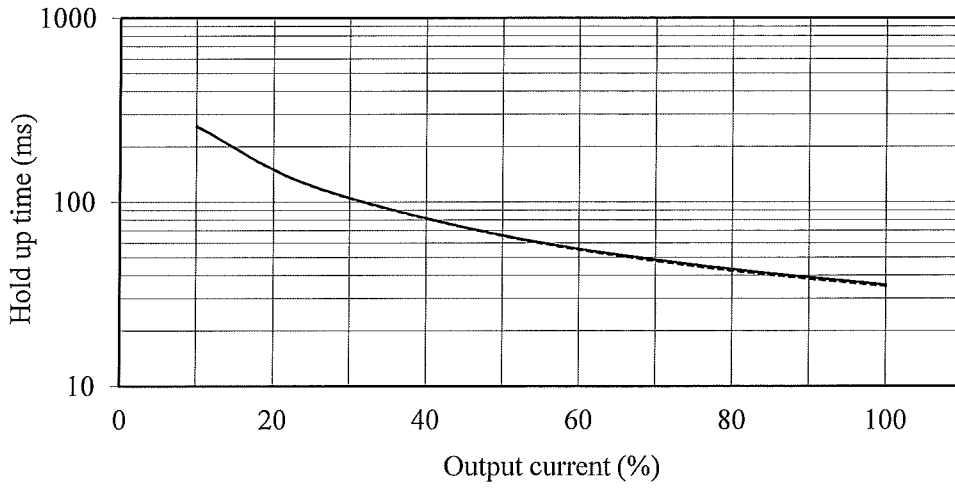
24V



2.7 Hold up time characteristics

Conditions V_{in} : 115VAC -----
 230VAC —
 T_a : 25°C

24V



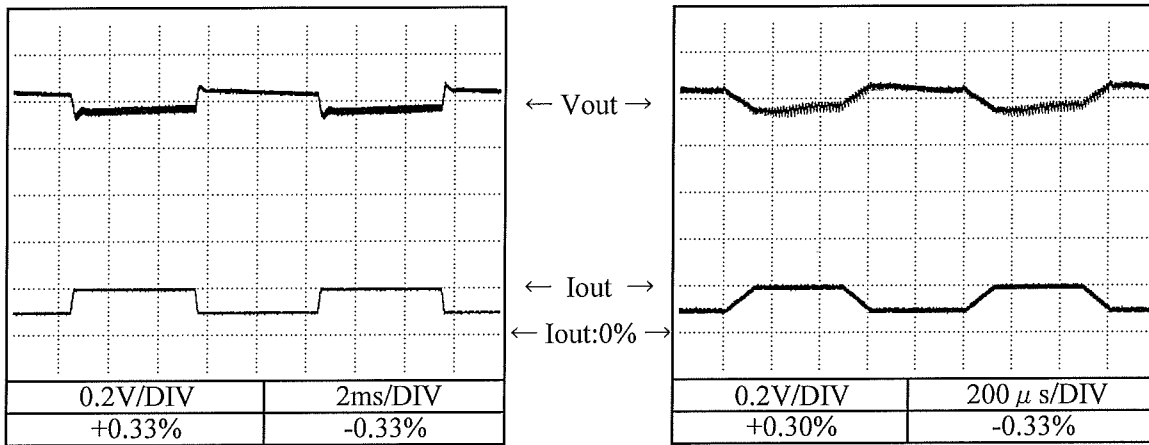
2.8 Dynamic load response characteristics

Conditions Vin : 115VAC
 Iout : 50% ↔ 100%
 (tr = tf = 50us)
 Ta : 25°C

24V

f = 100Hz

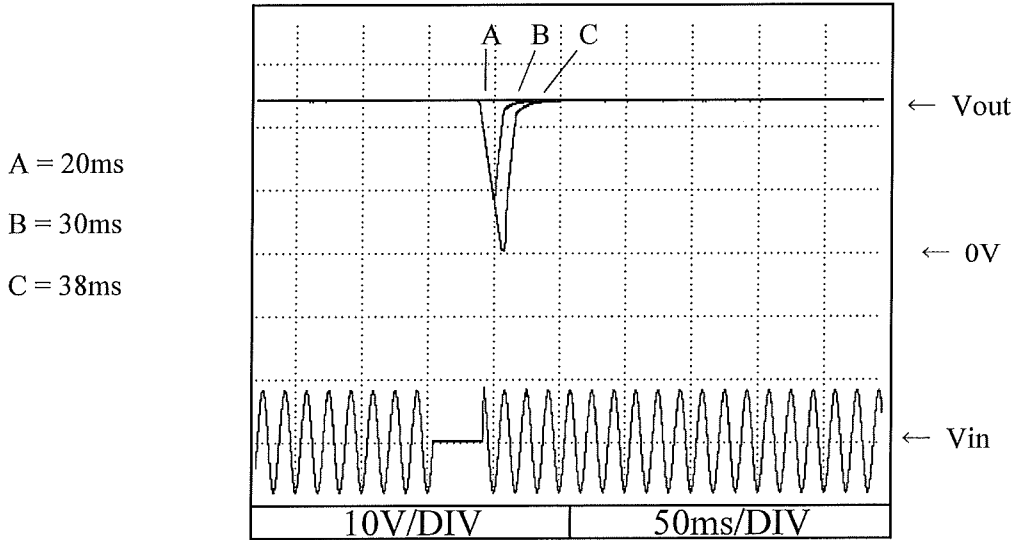
f = 1kHz



2.9 Response to brown out characteristics

Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

24V

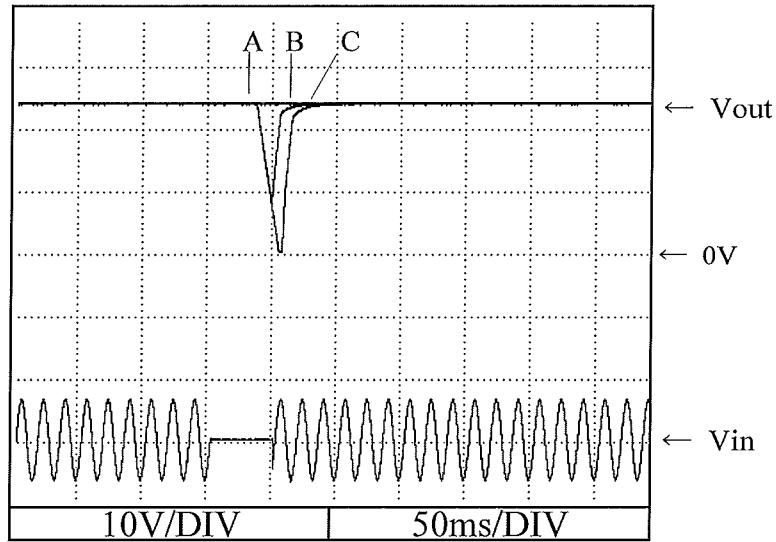


2.9 Response to brown out characteristics

Conditions V_{in} : 230VAC
 I_{out} : 100%
 T_a : 25°C

24V

A = 30ms
B = 40ms
C = 48ms

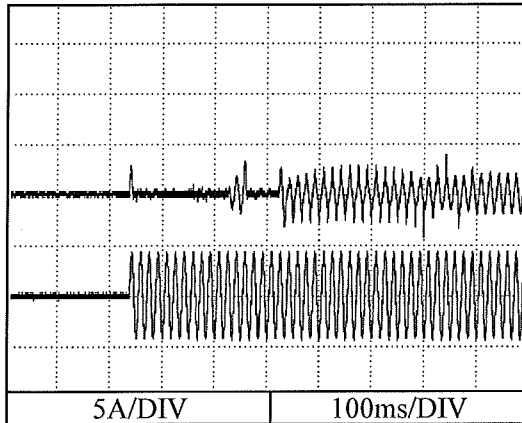


2.10 Inrush current waveform

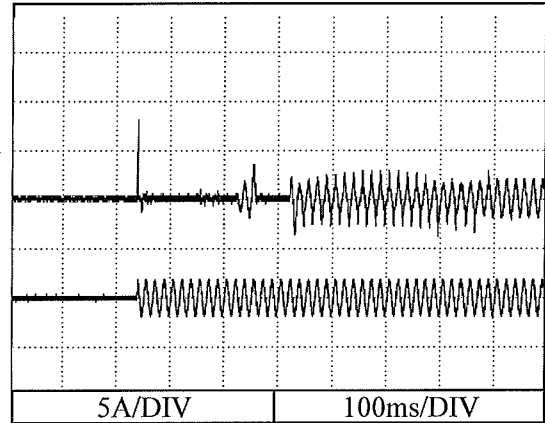
24V

Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

Switch on phase angle of input AC voltage
 $\phi = 0^\circ$

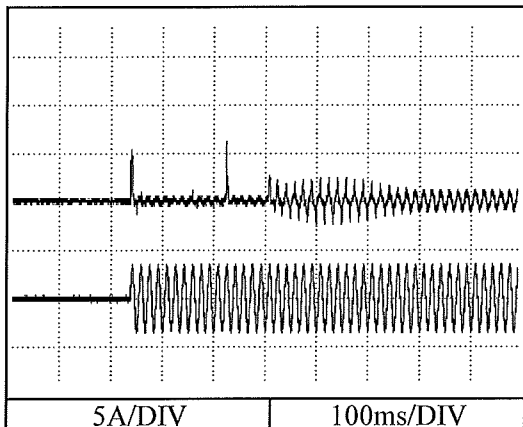


Switch on phase angle of input AC voltage
 $\phi = 90^\circ$

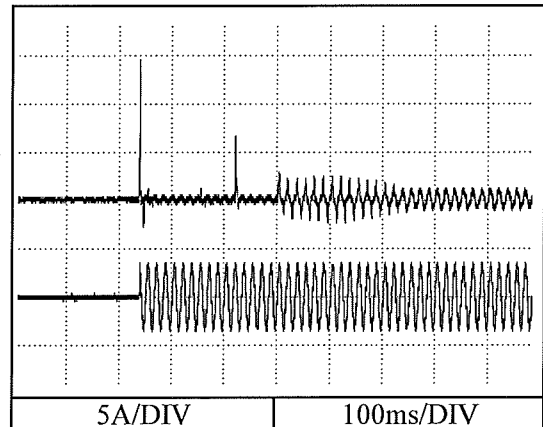


Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

Switch on phase angle of input AC voltage
 $\phi = 0^\circ$



Switch on phase angle of input AC voltage
 $\phi = 90^\circ$

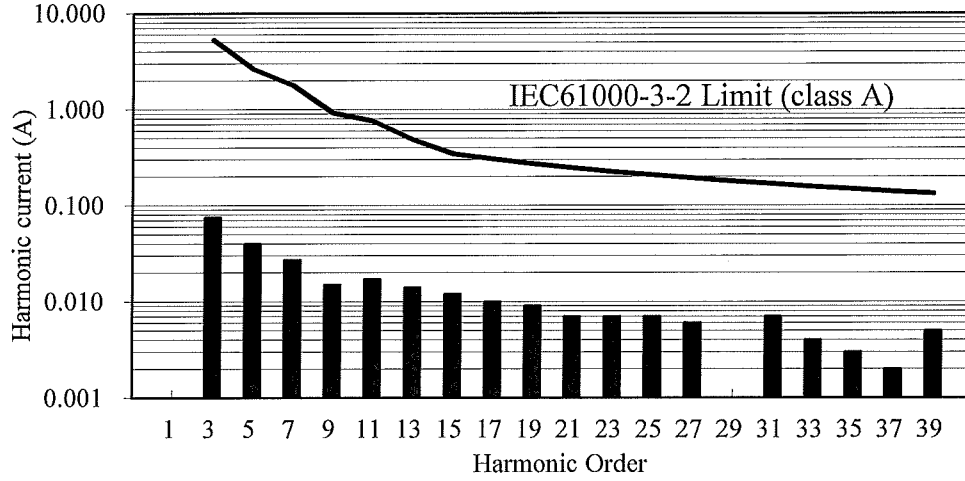


2.11 Input current harmonics

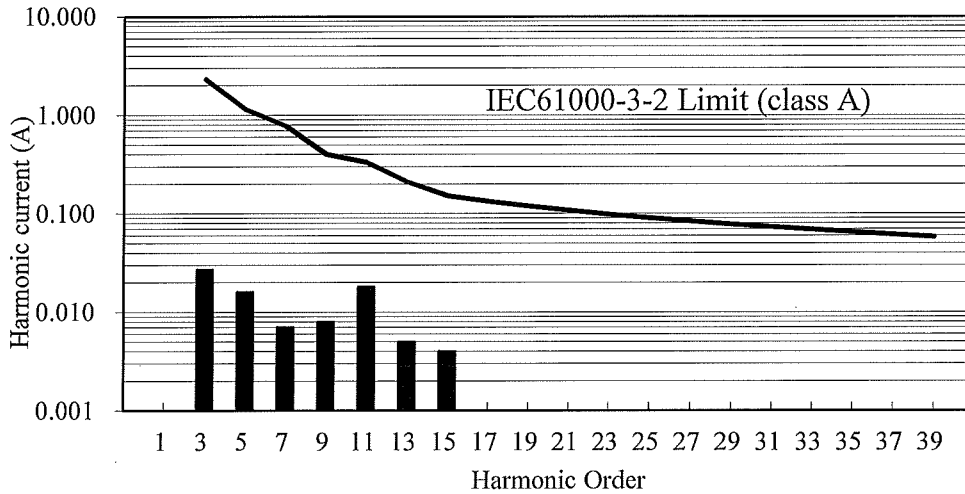
Conditions Iout : 100%
Ta : 25°C

24V

Vin : 115VAC

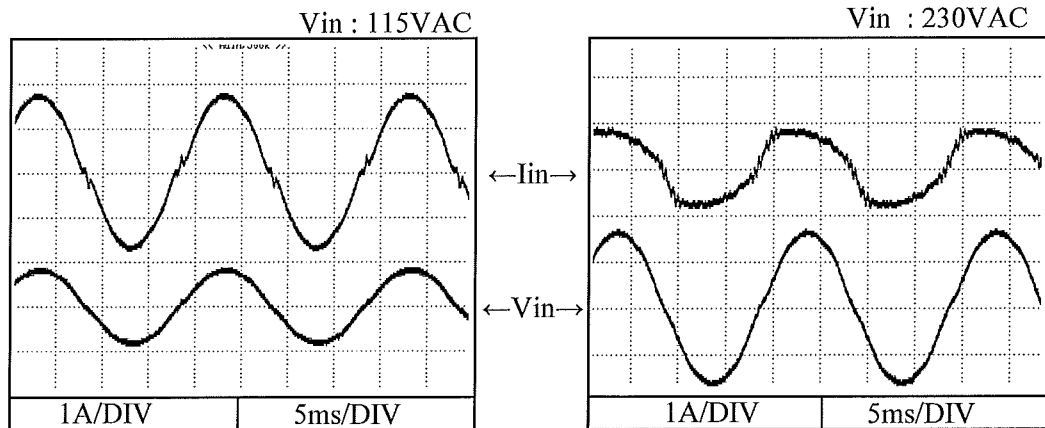


Vin : 230VAC



2.12 Input current waveform

Conditions Iout : 100%
Ta : 25°C

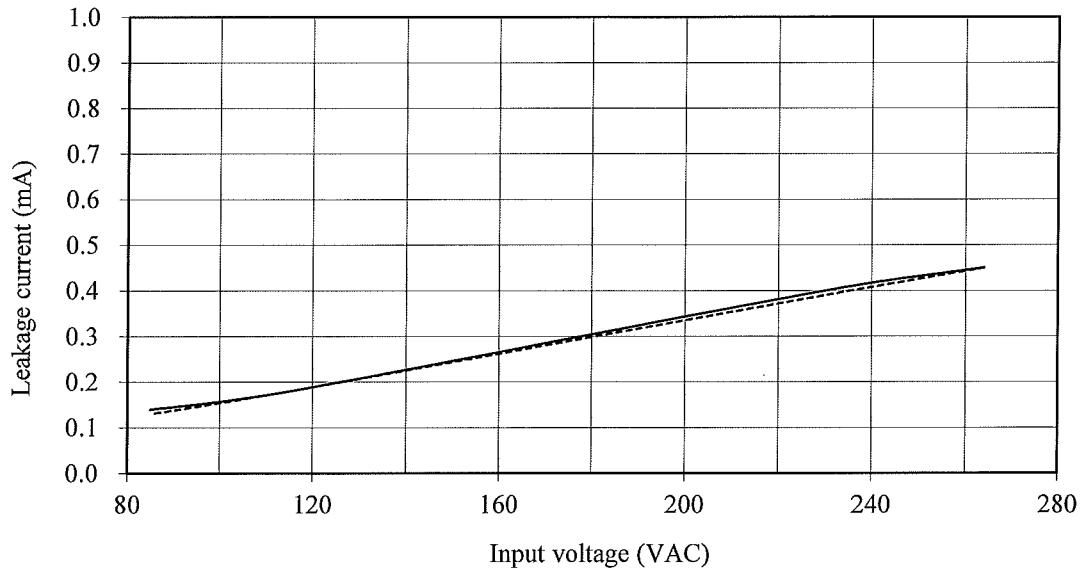


2.13 Leakage current characteristics

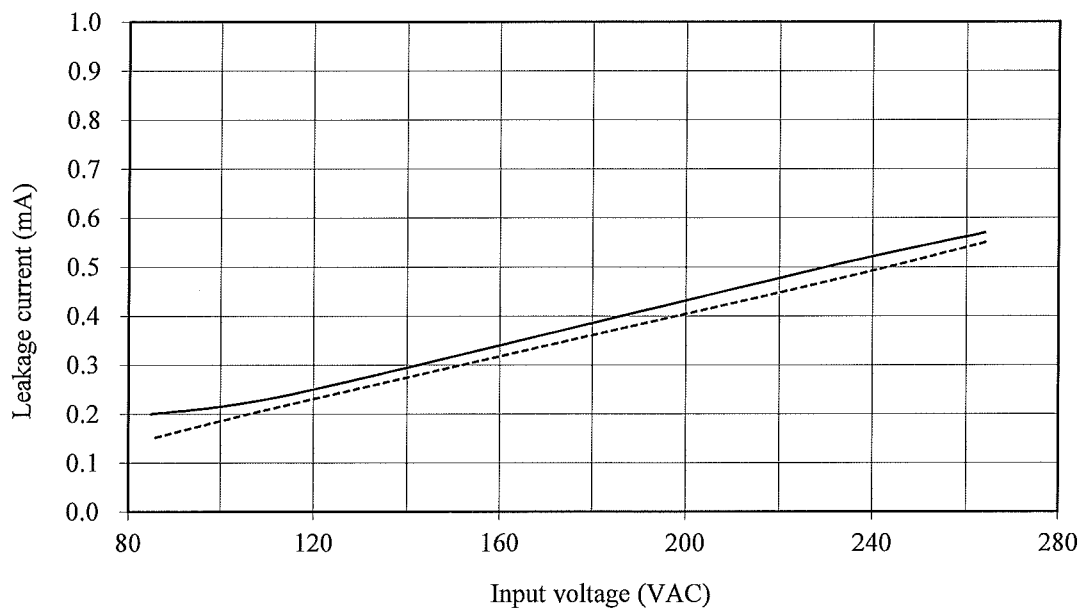
Conditions Iout : 0% -----
100% ———
Ta : 25°C

24V

f : 50Hz



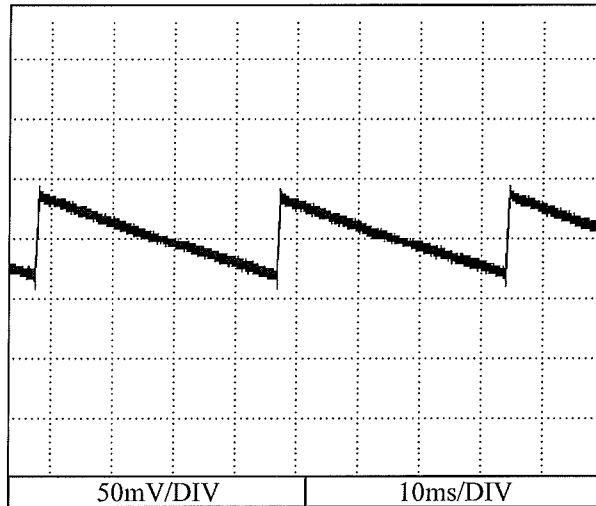
f : 60Hz



2.14 Output ripple and noise waveform

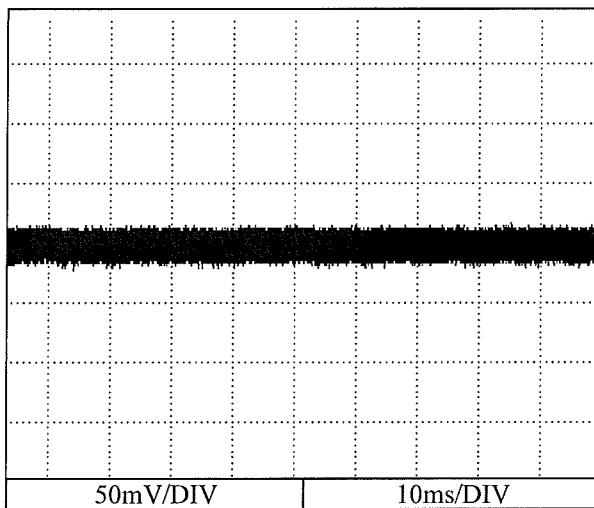
Conditions Vin : 230VAC
Iout : 0%
Ta : 25°C

24V



Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

24V



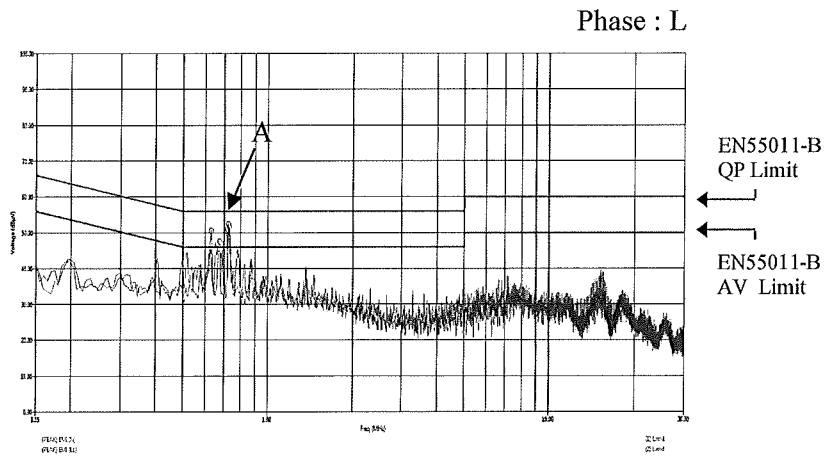
2.15 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 100%
 Ta : 25°C
 Phase N : —
 Phase L : —

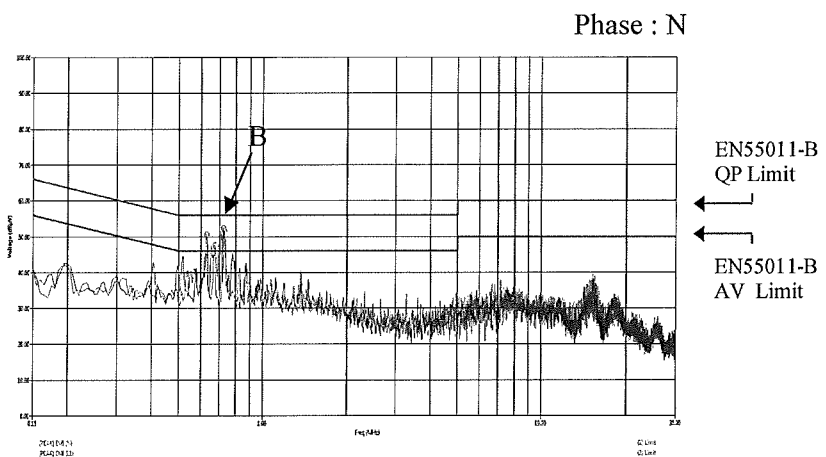
Conducted Emission

24V

Point A (0.7MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.3
AV	46.0	29.2



Point B (0.7MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	48.4
AV	46.0	29.1



2.15 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC

Iout : 100%

Ta : 25°C

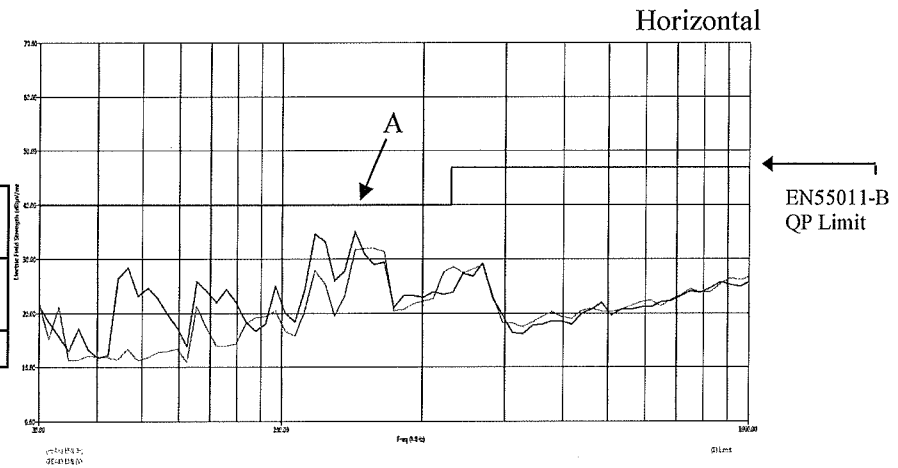
Radiated Emission

Horizontal : —

Vertical : —

24V

Point A (0.15MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	26.9



Point B (0.15MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	29.0

