SWS600

EVALUATION DATA

CA741-53-01		
APPD	CHK	DWG
20/oct/04	18/oct/04	18/oct/04

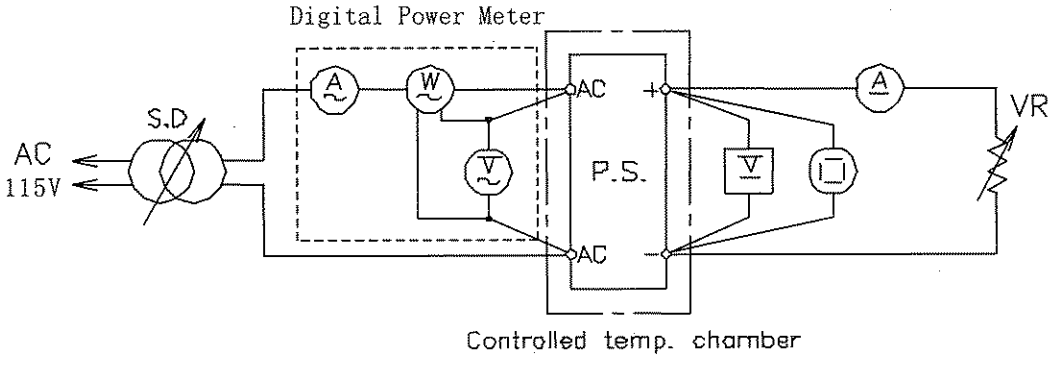
INDEX

Terminology used

	Definition	
Vin	.....	Input voltage
Vout	.....	Output voltage
Iin	.....	Input current
Iout	.....	Output current
Ta	.....	Ambient temperature

1. 1 Circuit used for determination

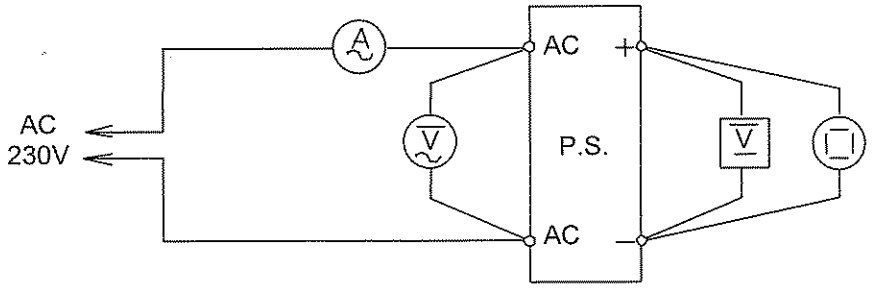
(1) Steady state data



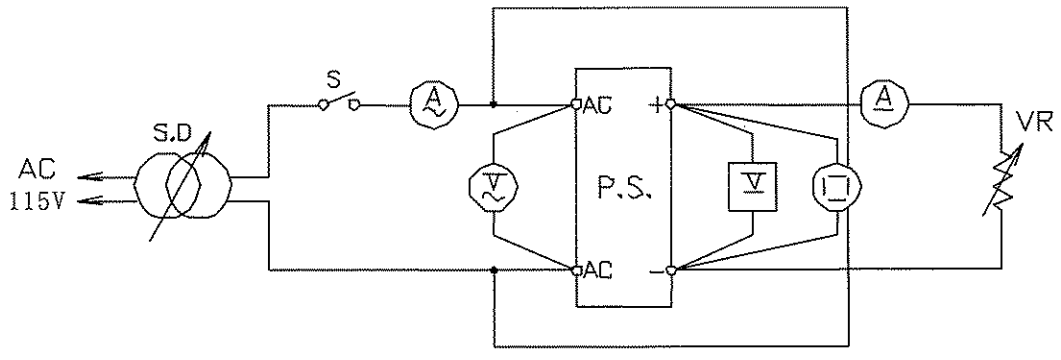
(2) Over current protection (O.C.P) characteristics

Same as steady state data.

(3) Over voltage protection (O.V.P) characteristics



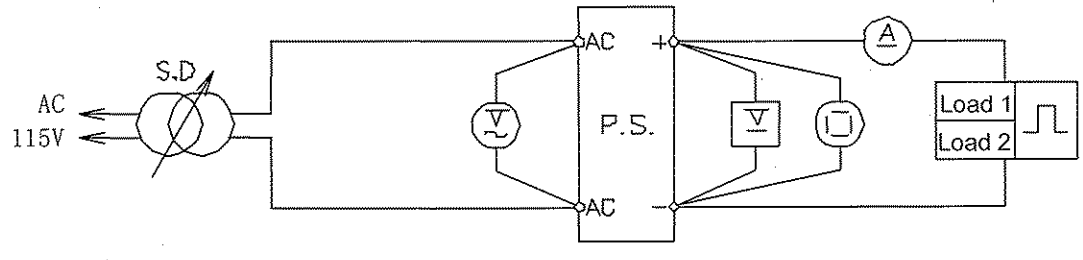
(4) Output rise characteristics



(5) Output fall characteristics

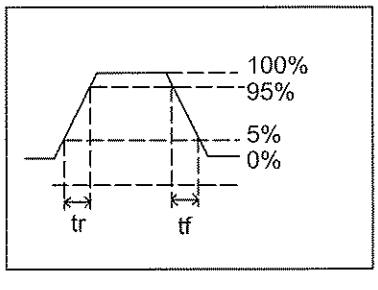
Same as output rise characteristics.

(6) Dynamic load response characteristics



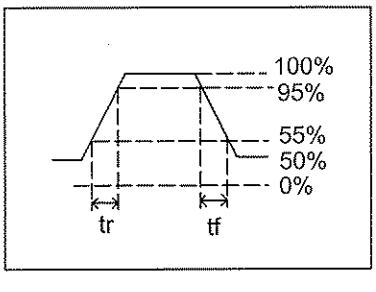
Output current waveform :

Iout 0% ⟷ 100%

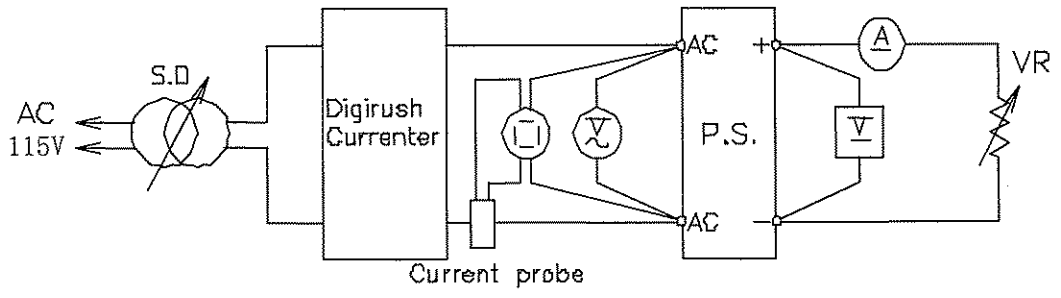


Output current waveform :

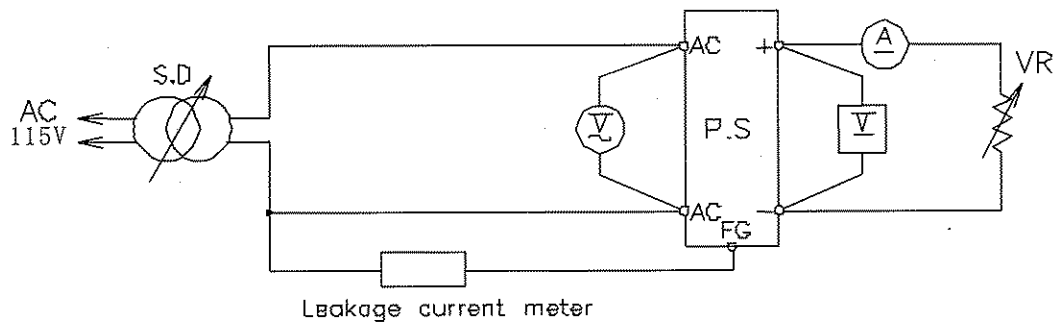
Iout 50% ⟷ 100%



(7) Inrush current characteristics



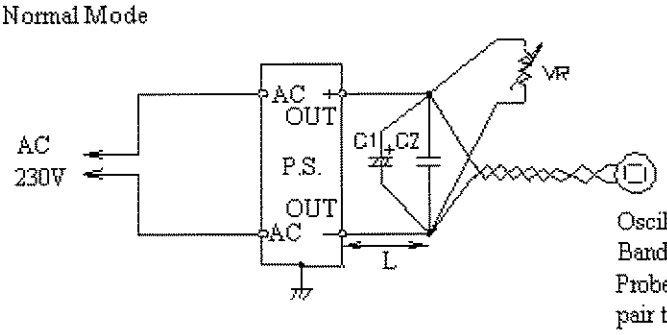
(8) Leakage current characteristics



Note : Leakage current measured through a 1k ohm resistor.
Range used : AC + DC (For SIMPSON MODEL 228)

(9) Output - ripple, noise waveform

Normal Mode

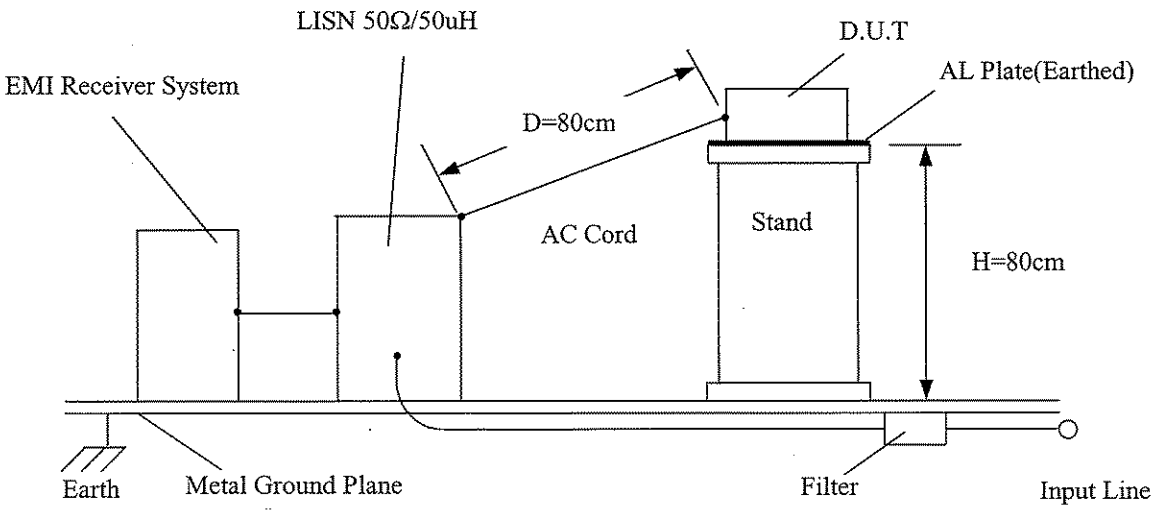


Oscilloscope
Bandwidth : 20MHz
Probe : 12inch twisted
pair terminated with C1 and C2.

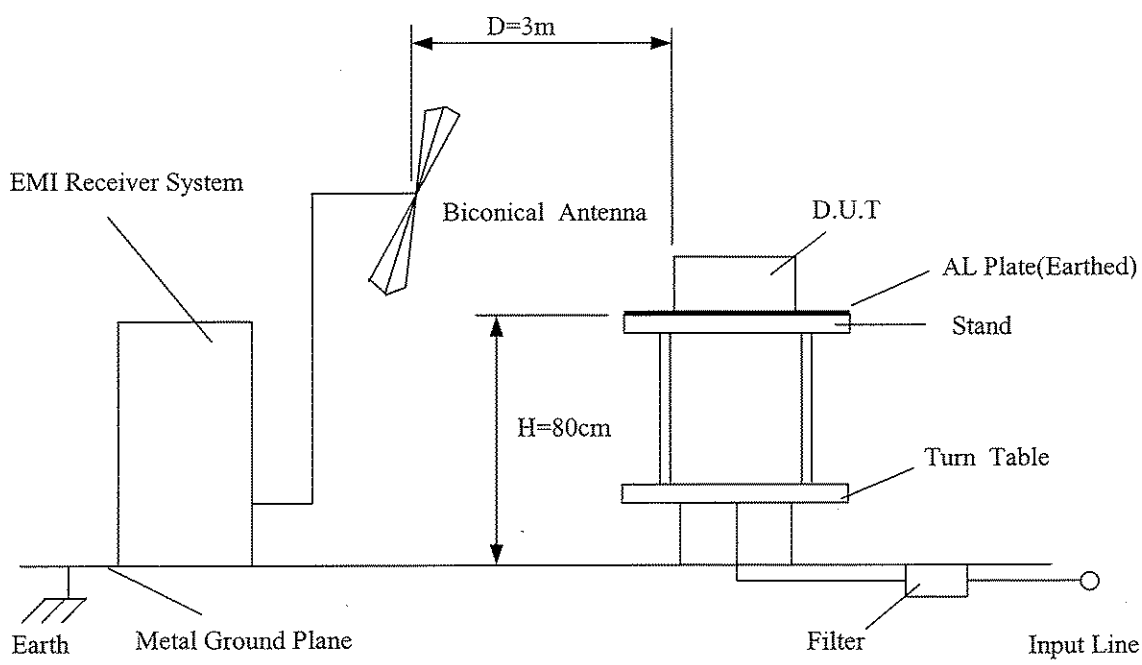
L : 150mm
C1 : 47 uF Electrolytic Capacitor
C2 : 0.1uF Film Capacitor

(10) Electro-Magnetic Interference characteristics

(a) Conducted Emission Noise



(b) Radiated Emission Noise



1.2 LIST OF EQUIPMENT USED

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	Oscilloscope	HITACHI	V-1050F
2	Digital storage oscilloscope	TEKTRONIX	TDS 540A
3	Digital volt meter	FLUKE	45
4	Digital power meter	YOKOGAWA	WT110
5	DC ampere meter	YOKOGAWA	2051
6	Dynamic dummy load	CHROMA	63201
7	Current probe/amplifier	TEKTRONIX	A6303/AM503B
8	Controlled temperature chamber	TABAI-ESPEC	SU-240
9	Leakage current meter	SIMPSON	228
10	Digirush currenter	TAKAMIZAWA CYBERNETICS	PSA-200
11	EMI receiver	HEWLETT PACKARD	HP8546A
12	LISN	EMCO	3825/2
13	Biconical antenna	EMCO	3110B

2. Characteristics

2.1 Steady state data

(1) Regulation - line and load, temperature drift

5V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	5.026V	5.026V	5.025V	5.025V	0.001V	0.020%
50%	5.026V	5.025V	5.025V	5.024V	0.002V	0.040%
100%	5.025V	5.025V	5.024V	5.024V	0.001V	0.020%
load	0.001V	0.001V	0.001V	0.001V		
regulation	0.020%	0.020%	0.020%	0.020%		

2. Temperature drift — Conditions Vin =115VAC, Iout =100%

Ta	-10°C	+25°C	+50°C	temperature stability	
Vout	5.018V	5.025V	5.029V	0.011V	0.220%

24V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	24.031V	24.029V	24.025V	24.025V	0.006V	0.025%
50%	24.030V	24.025V	24.023V	24.023V	0.007V	0.029%
100%	24.028V	24.025V	24.022V	24.022V	0.006V	0.025%
load	0.003V	0.004V	0.003V	0.003V		
regulation	0.013%	0.017%	0.013%	0.013%		

2. Temperature drift — Conditions Vin =115VAC, Iout =100%

Ta	-10°C	+25°C	+50°C	temperature stability	
Vout	24.007V	24.025V	23.996V	0.029V	0.121%

48V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	47.940V	47.940V	47.940V	47.940V	0.000V	0.000%
50%	47.940V	47.940V	47.938V	47.938V	0.002V	0.004%
100%	47.938V	47.937V	47.937V	47.936V	0.002V	0.004%
load	0.002V	0.003V	0.003V	0.004V		
regulation	0.004%	0.006%	0.006%	0.008%		

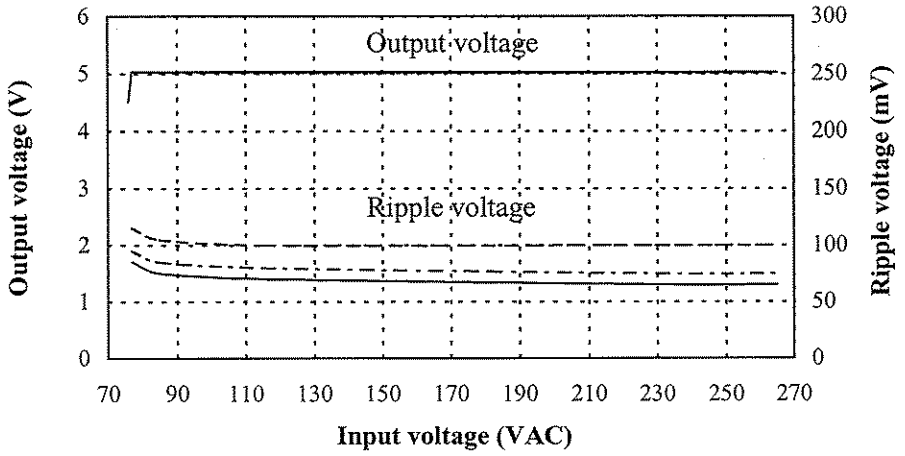
2. Temperature drift — Conditions Vin =115VAC, Iout =100%

Ta	-10°C	+25°C	+50°C	temperature stability	
Vout	47.900V	47.937V	47.950V	0.050V	0.104%

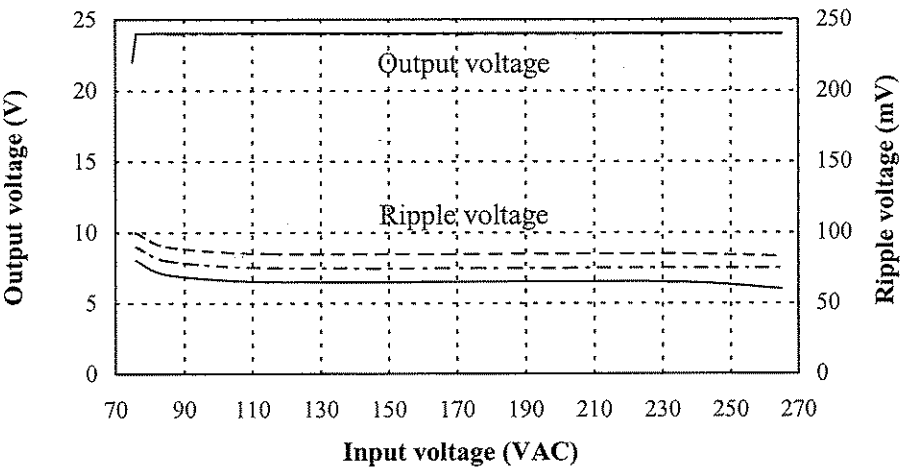
2.1 (2) Output voltage and Ripple voltage v.s. Input voltage

Conditions Iout : 100%
Ta : -10°C
: 25°C
: 50°C

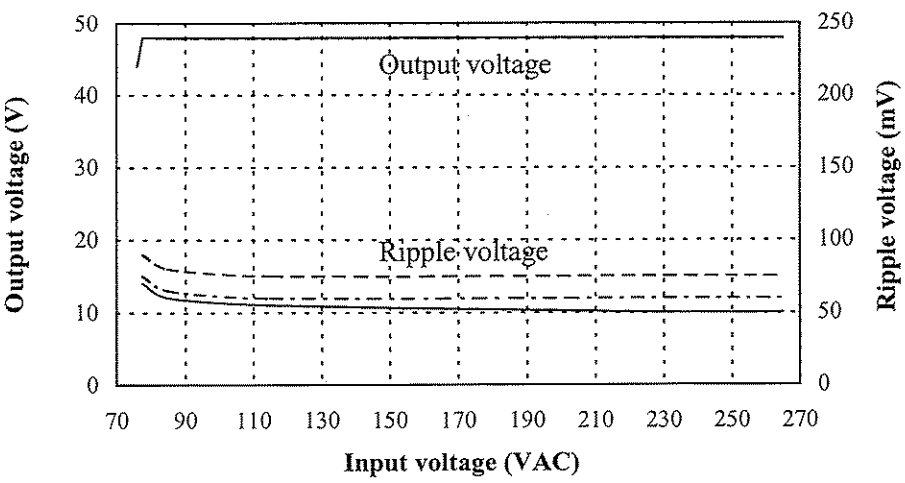
5V



24V



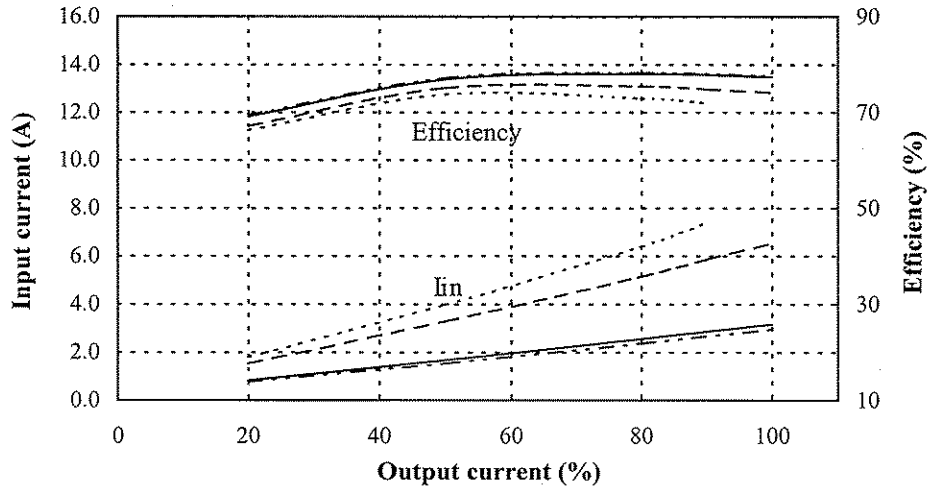
48V



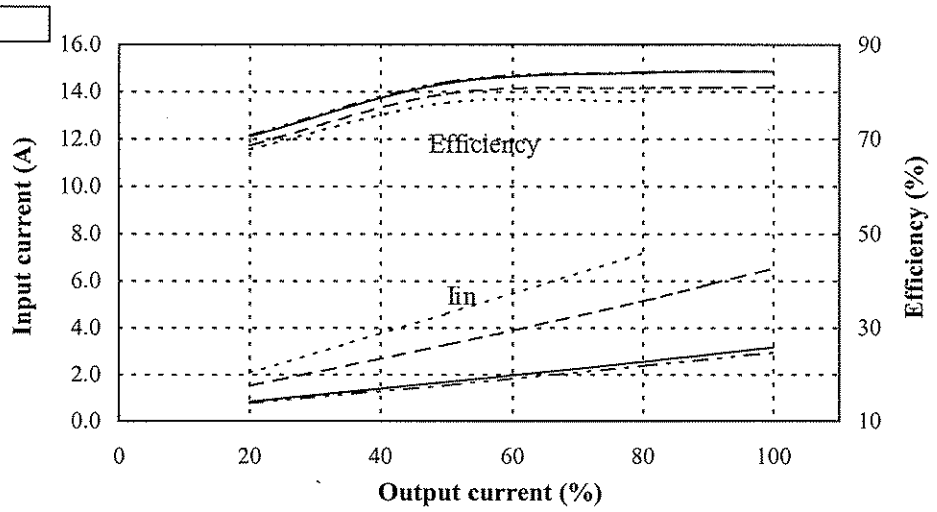
2.1 (3) Efficiency and input current v.s. Output current

Conditions Vin : 85VAC
: 115VAC
: 230VAC
: 265VAC
Ta : 25°C

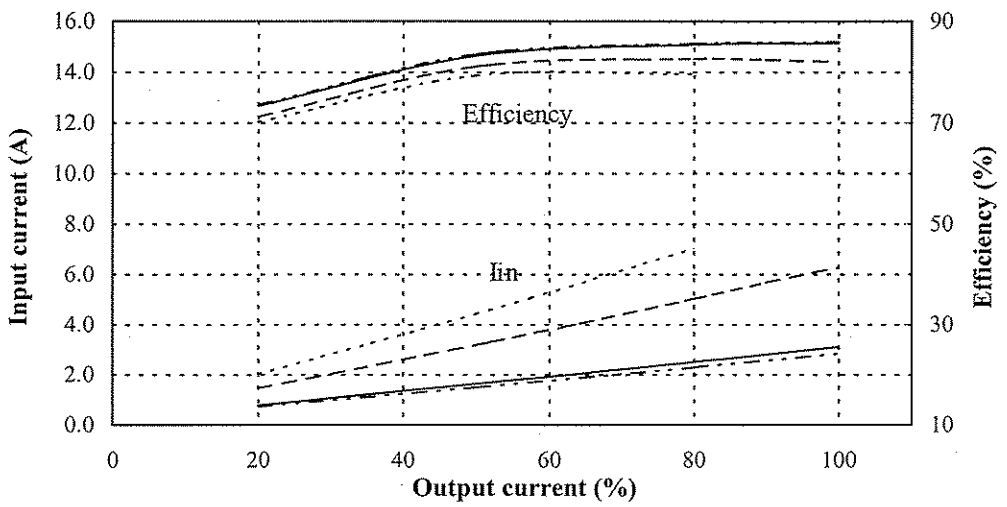
5V



24V



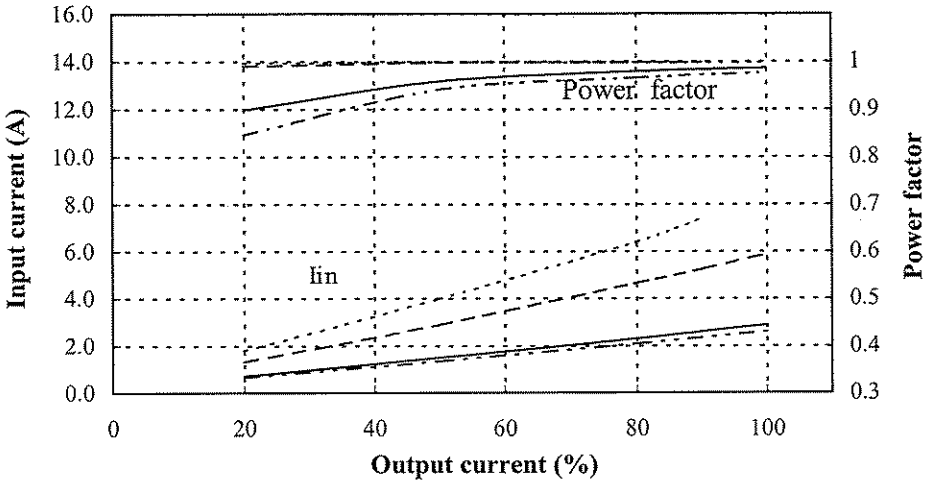
48V



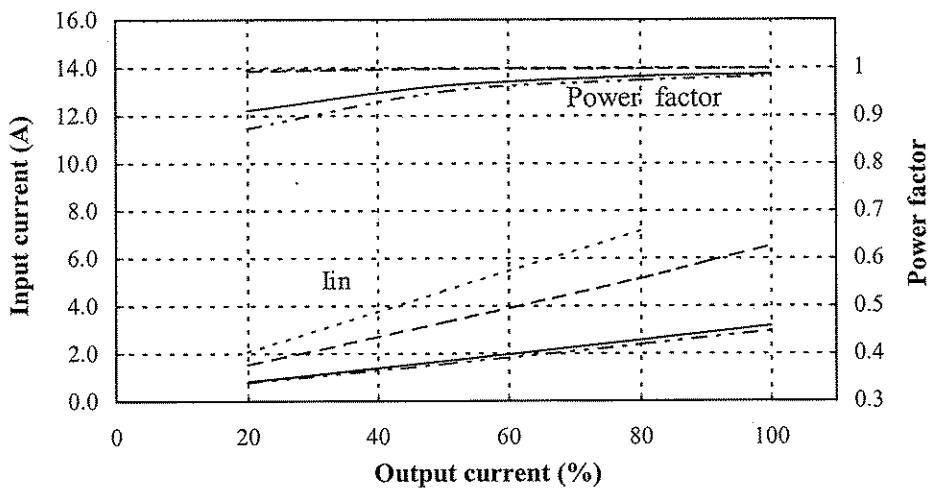
2.1 (4) Power factor and Input current v.s Output current

Conditions Vin : 85VAC ----------
: 115VAC – – – – – –
: 230VAC ——————
: 265VAC –·–·–·–·–·–
Ta : 25°C

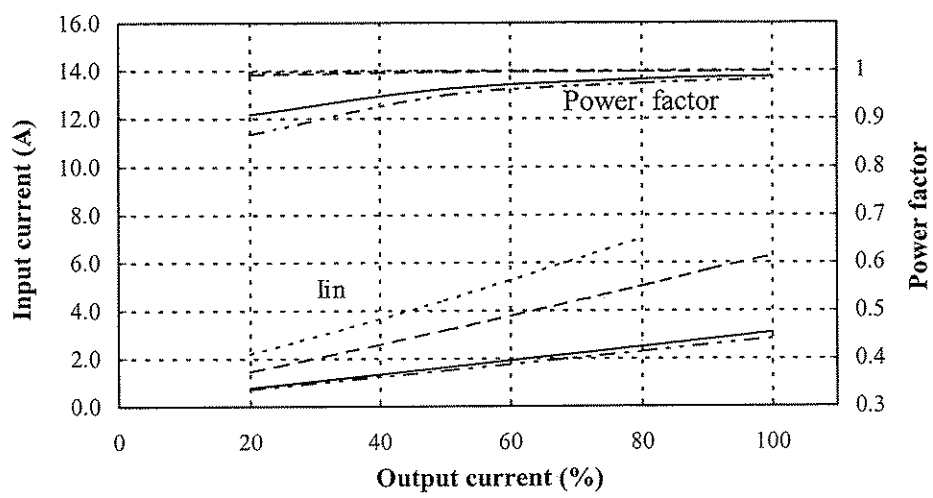
5V



24V



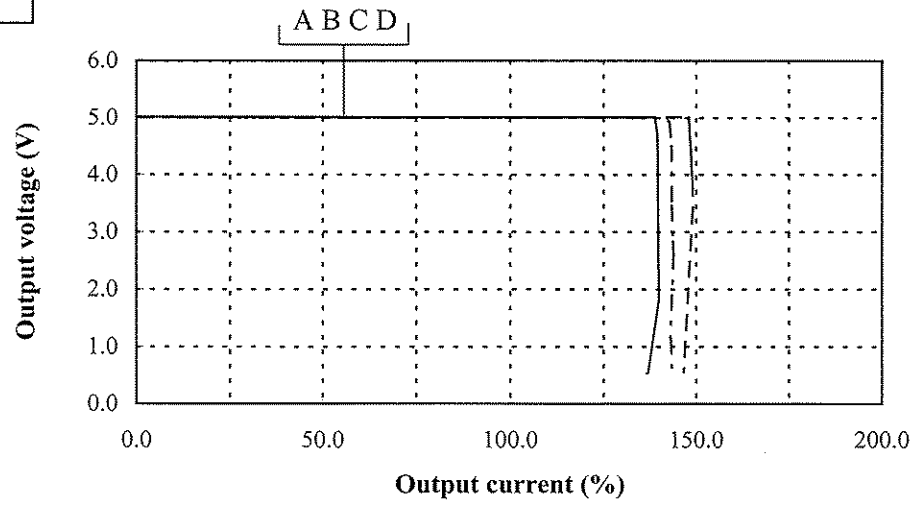
48V



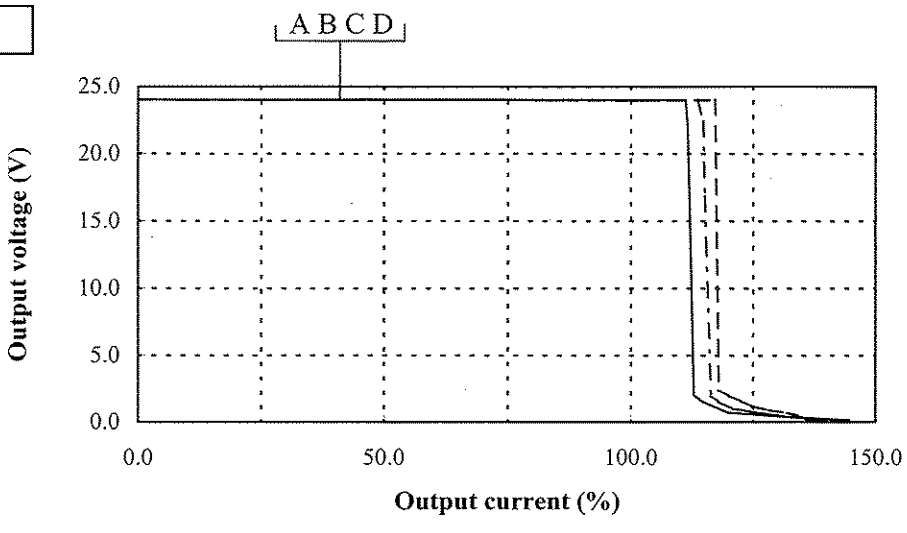
2.2 Over current protection (OCP) characteristics

Conditions Vin : 85VAC (A) Ta : -10°C
: 115VAC (B) : 25°C
: 230VAC (C) : 50°C
: 265VAC (D)

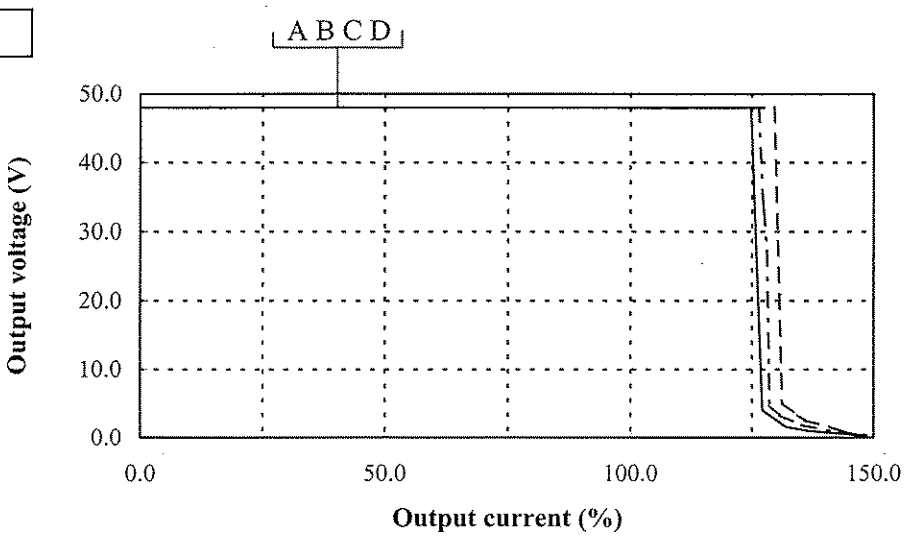
5V



24V



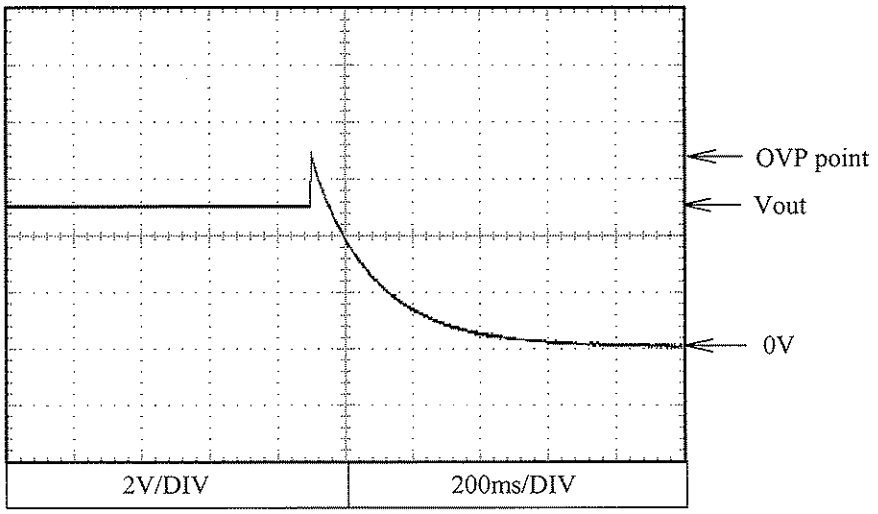
48V



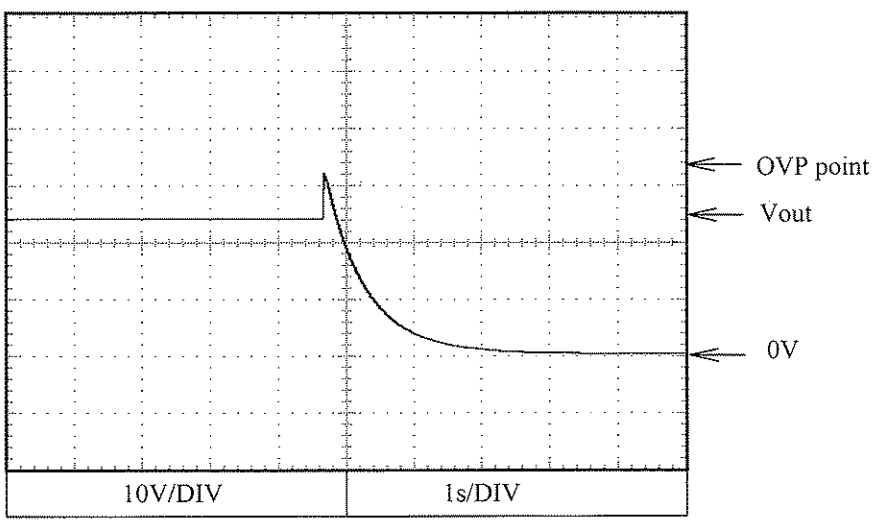
2.3 Over voltage protection (OVP) characteristics

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

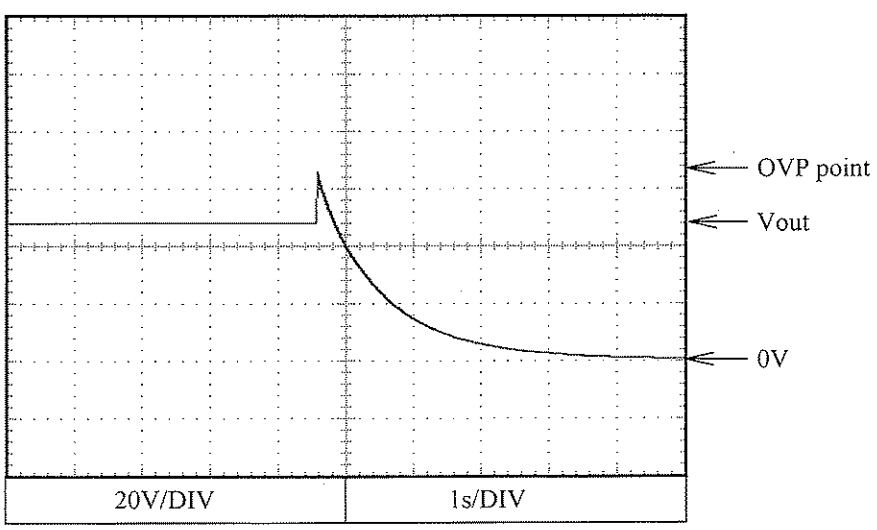
5V



24V



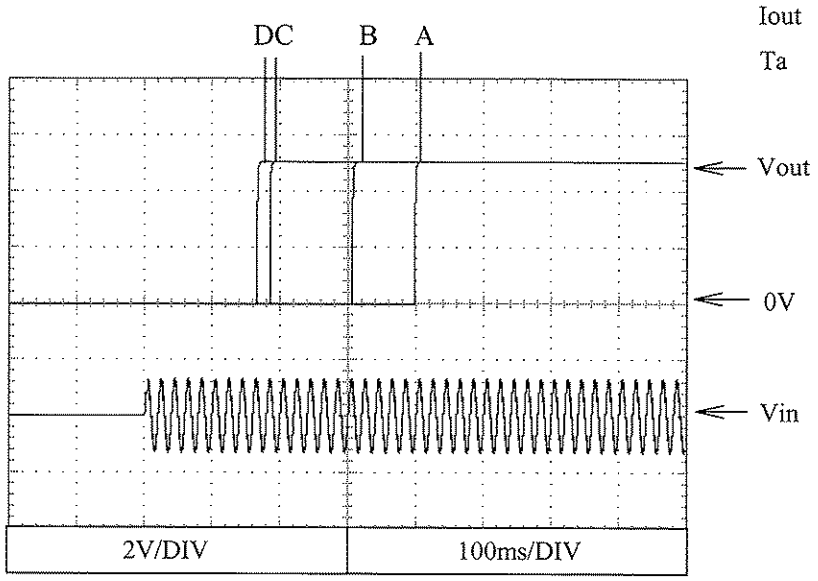
48V



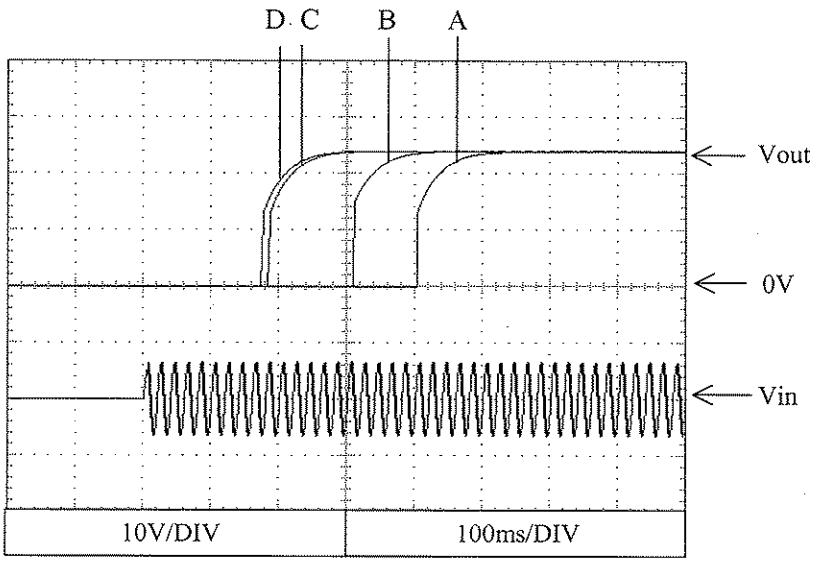
2.4 Output rise characteristics

Conditions Vin : 85VAC (A)
: 115VAC (B)
: 230VAC (C)
: 265VAC (D)
Iout : 0%
Ta : 25°C

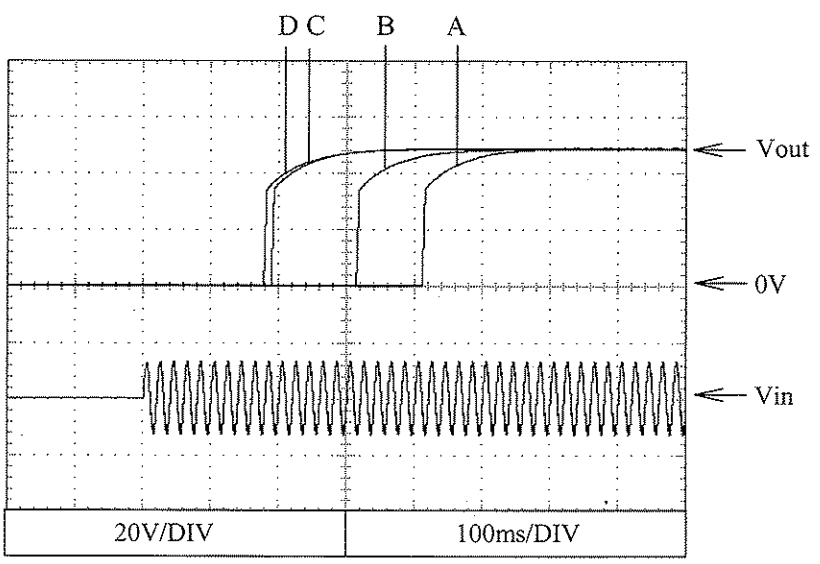
5V



24V



48V



2.4 Output rise characteristics

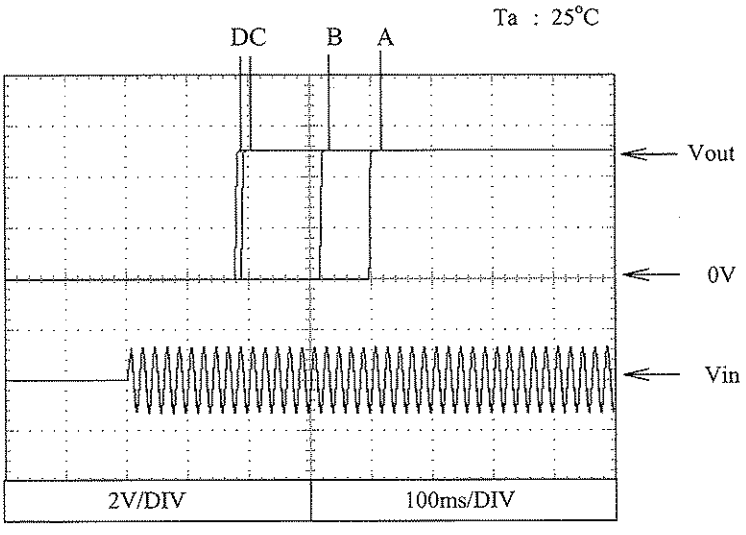
Conditions

Vin
: 85VAC (A)
: 115VAC (B)
: 230VAC (C)
: 265VAC (D)

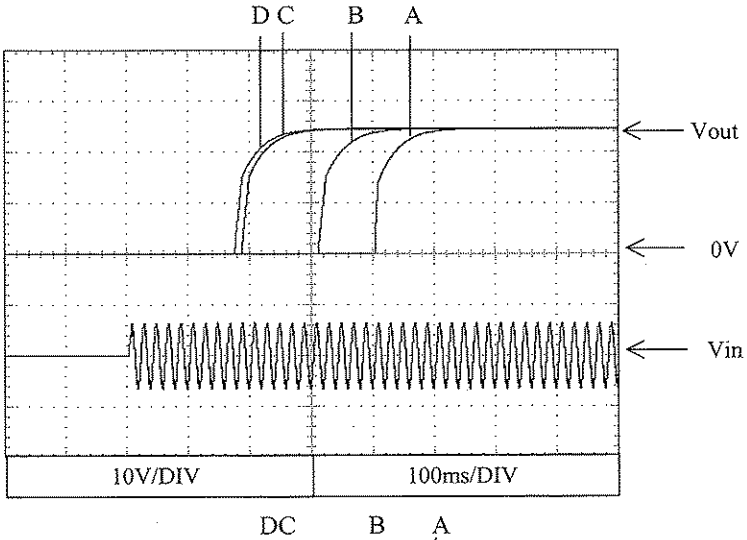
Iout
(A) : 90% (5V)
: 80%(24V,48V)
(B,C,D) : 100%

Ta : 25°C

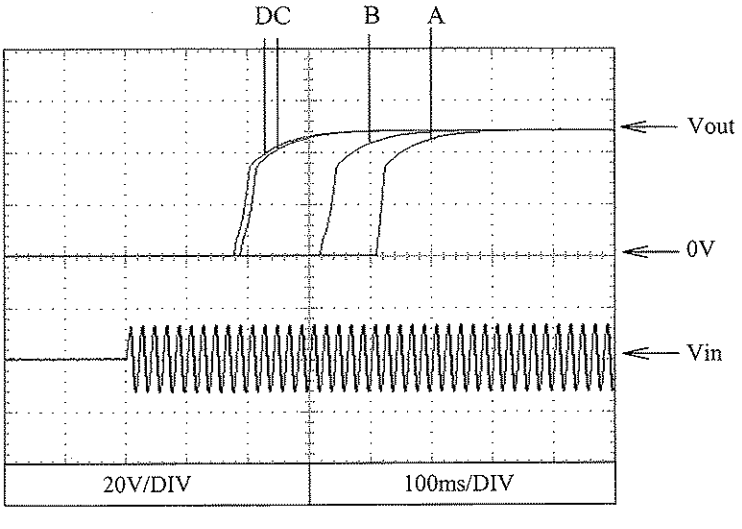
5V



24V



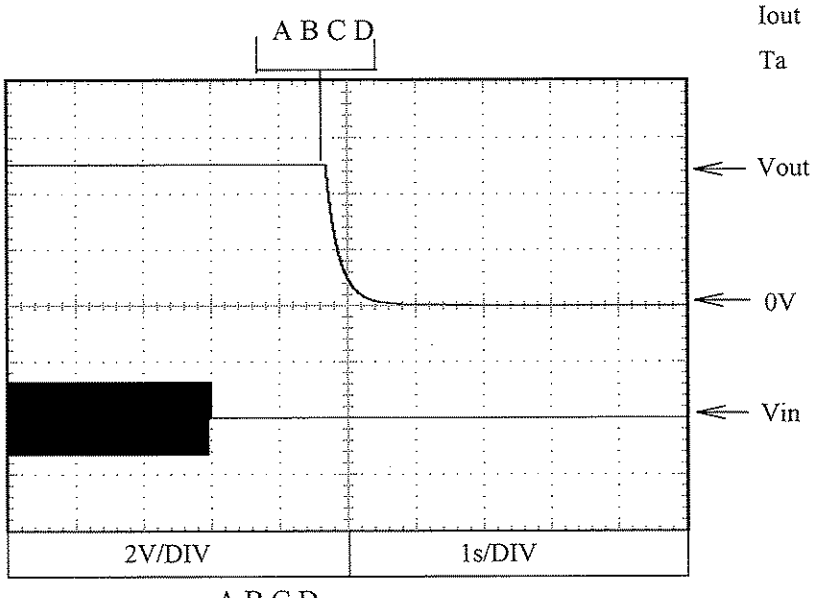
48V



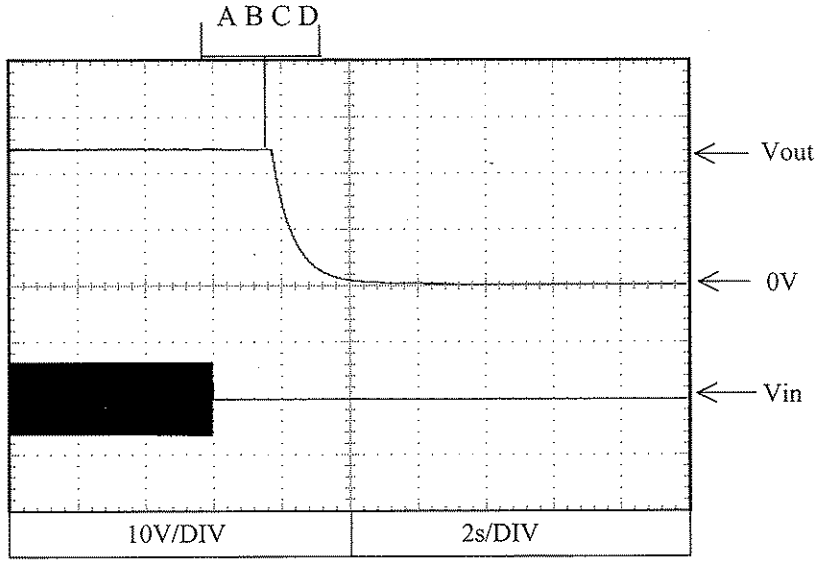
2.5 Output fall characteristics

Conditions Vin : 85VAC (A)
: 115VAC (B)
: 230VAC (C)
: 265VAC (D)
Iout : 0%
Ta : 25°C

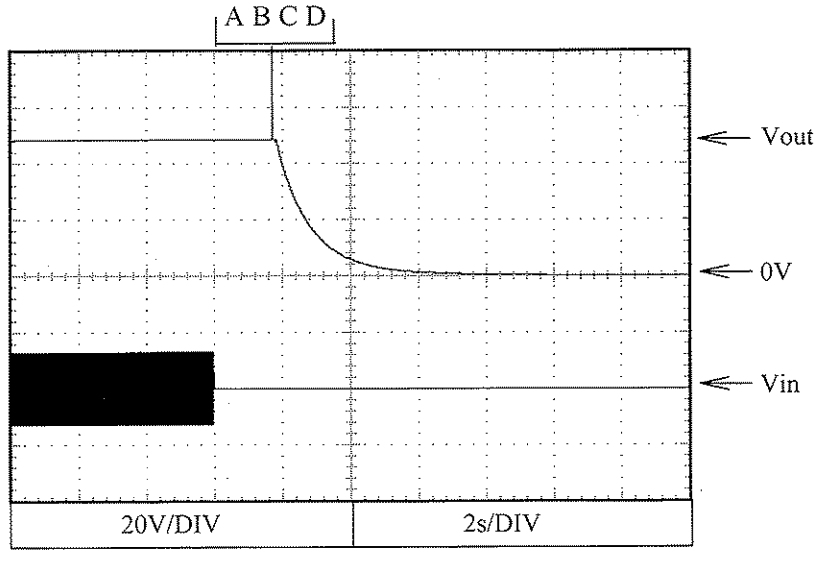
5V



24V



48V



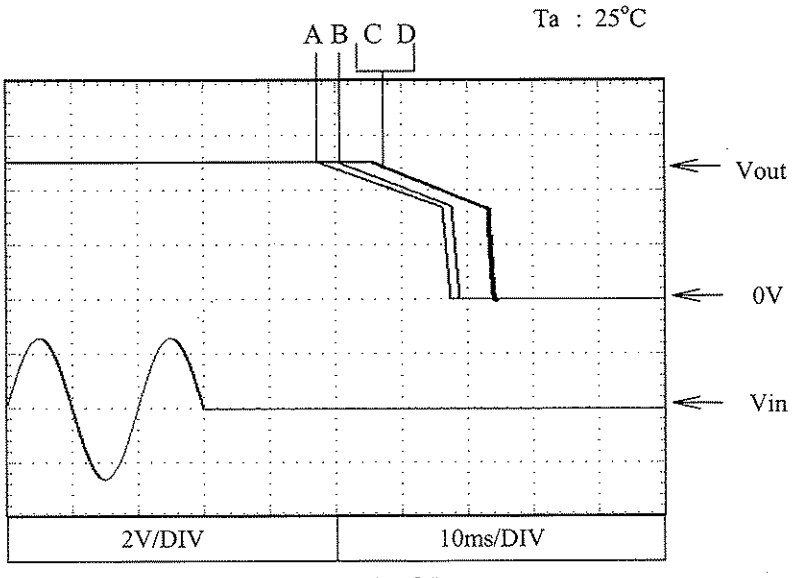
2.5 Output fall characteristics

Vin
: 85VAC (A)
: 115VAC (B)
: 230VAC (C)
: 265VAC (D)

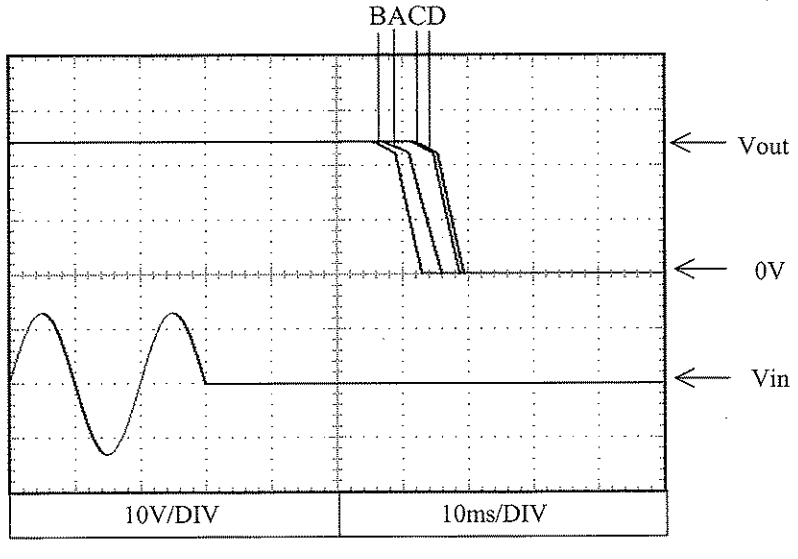
Iout
(A) : 90% (5V)
: 80%(24V,48V)
(B,C,D) : 100%

Ta : 25°C

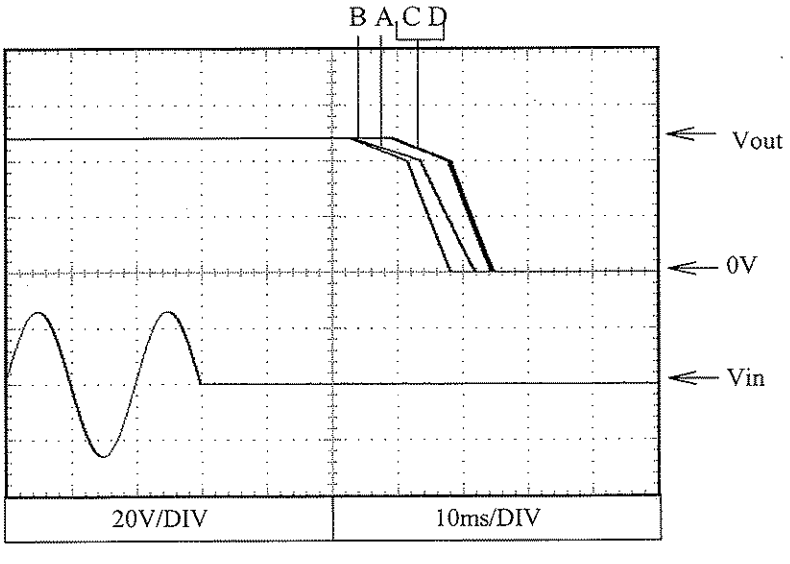
5V



24V



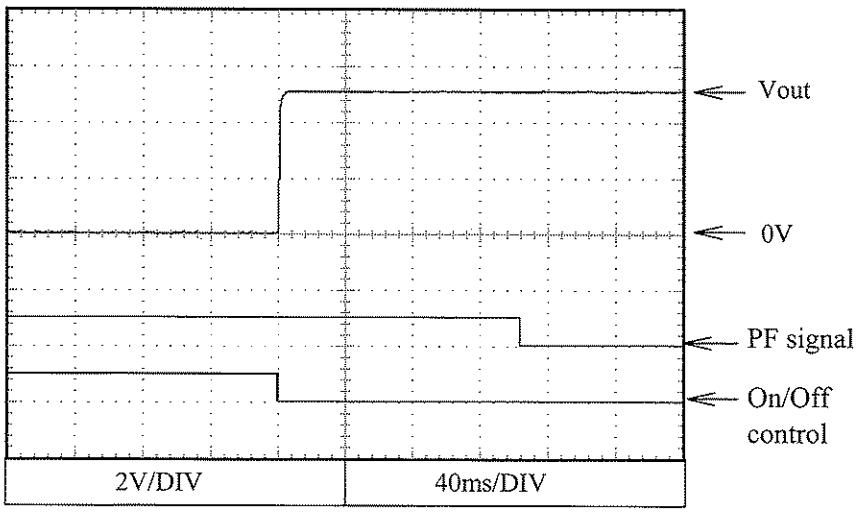
48V



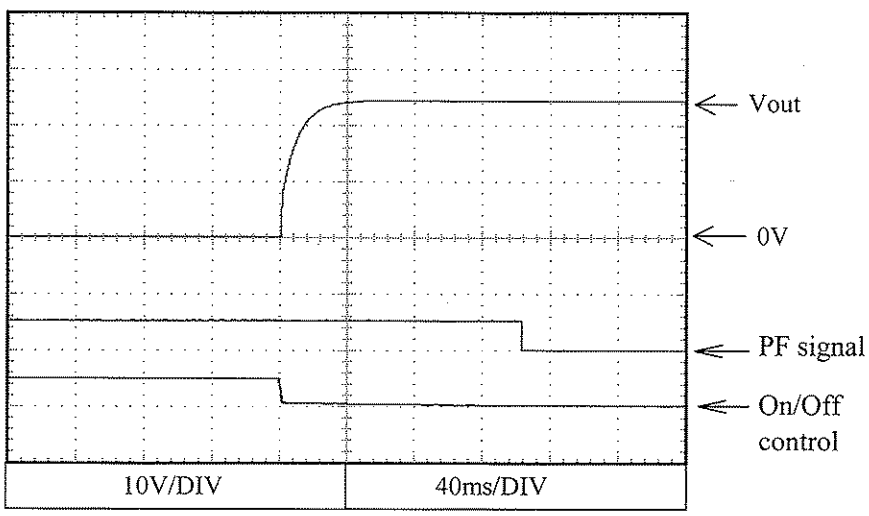
2.6 Output rise characteristics with On/Off control

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

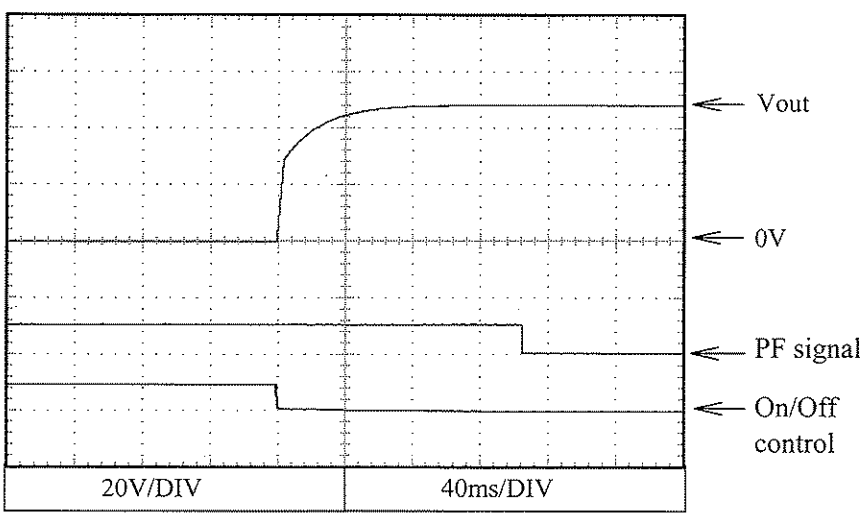
5V



24V



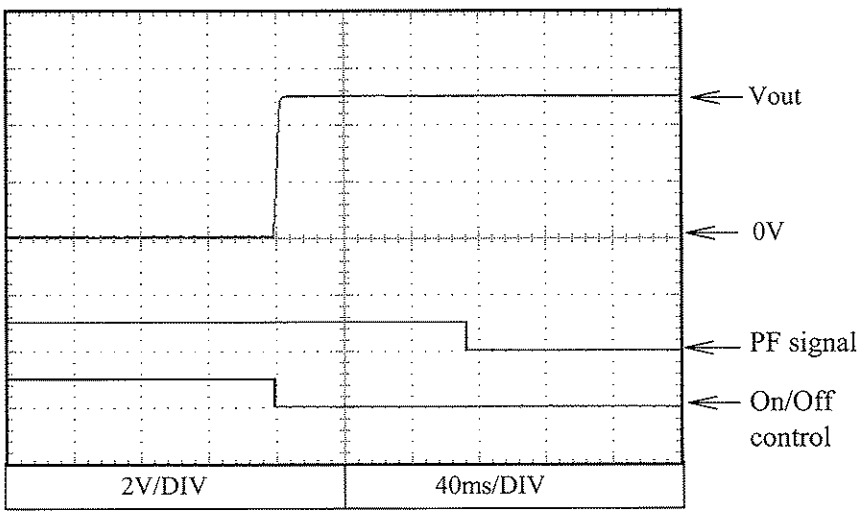
48V



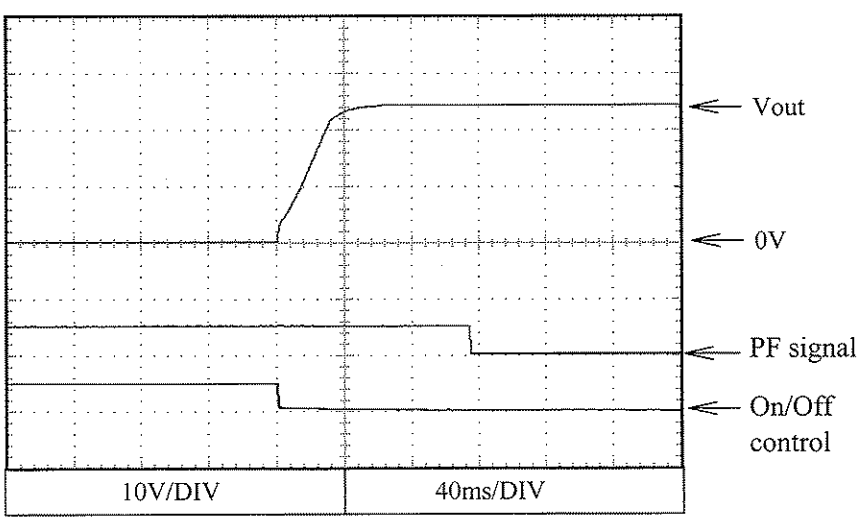
2.6 Output rise characteristics with On/Off control

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

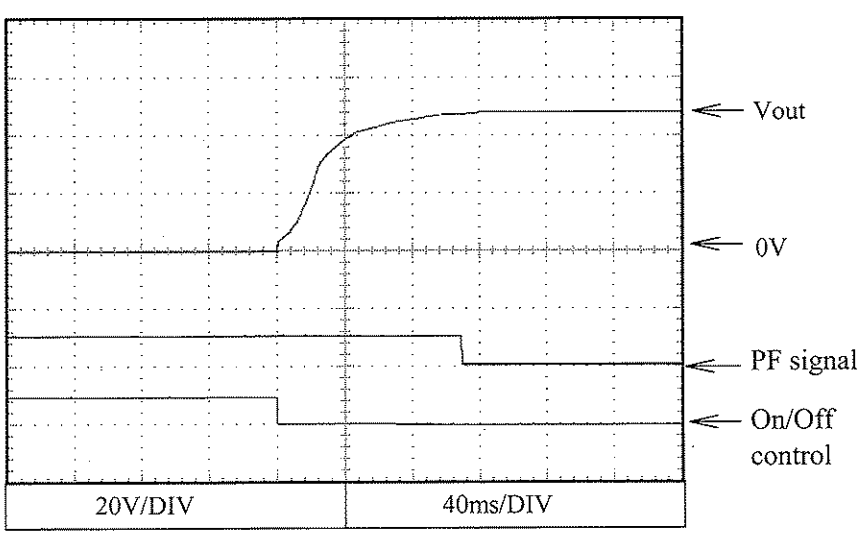
5V



24V



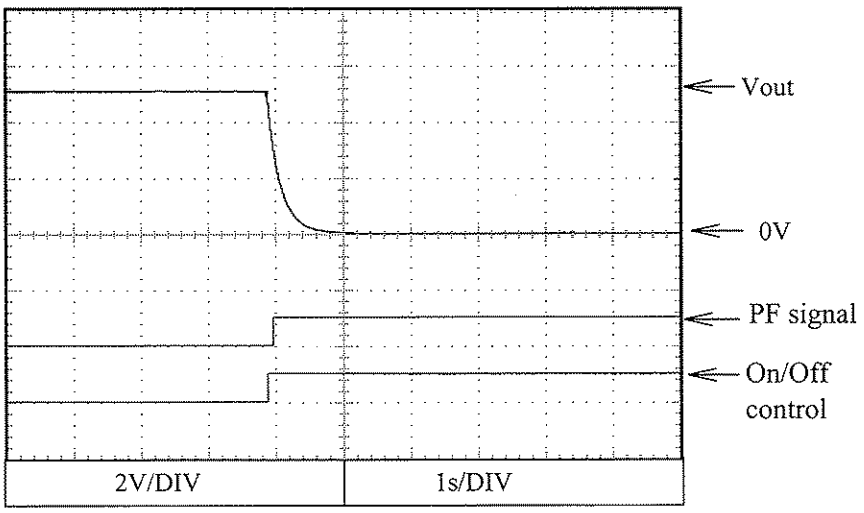
48V



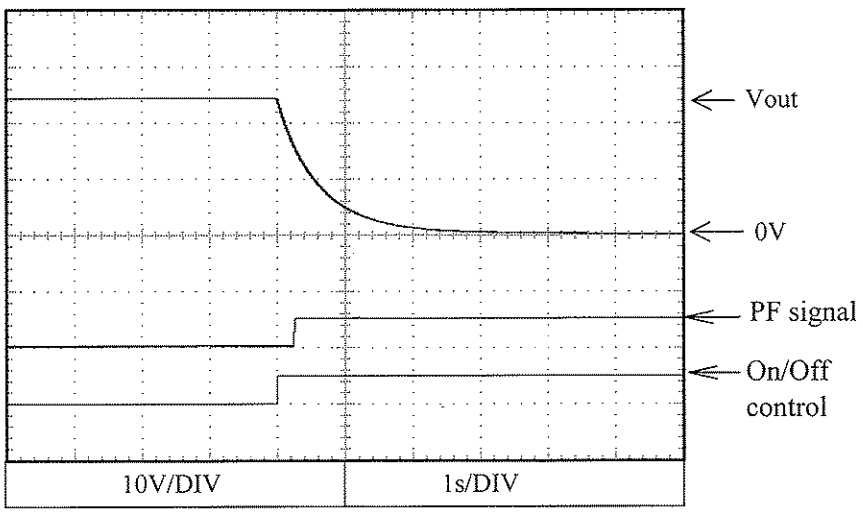
2.7 Output fall characteristics with On/Off control

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

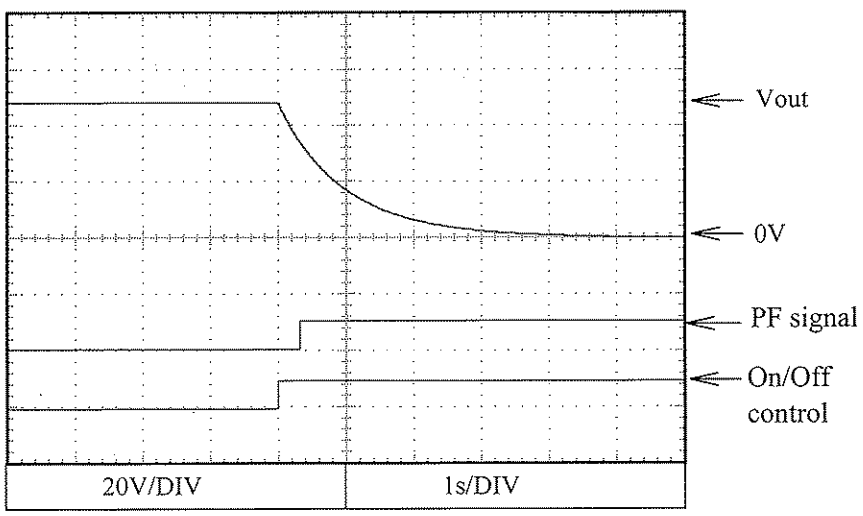
5V



24V



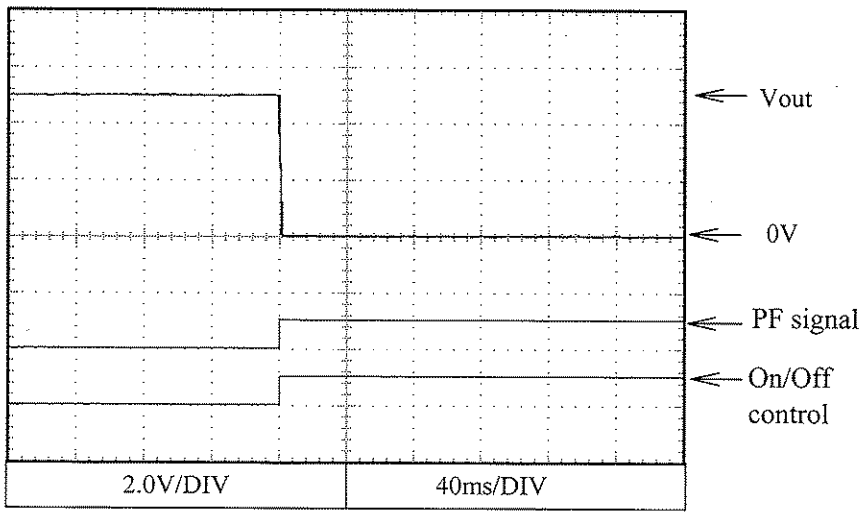
48V



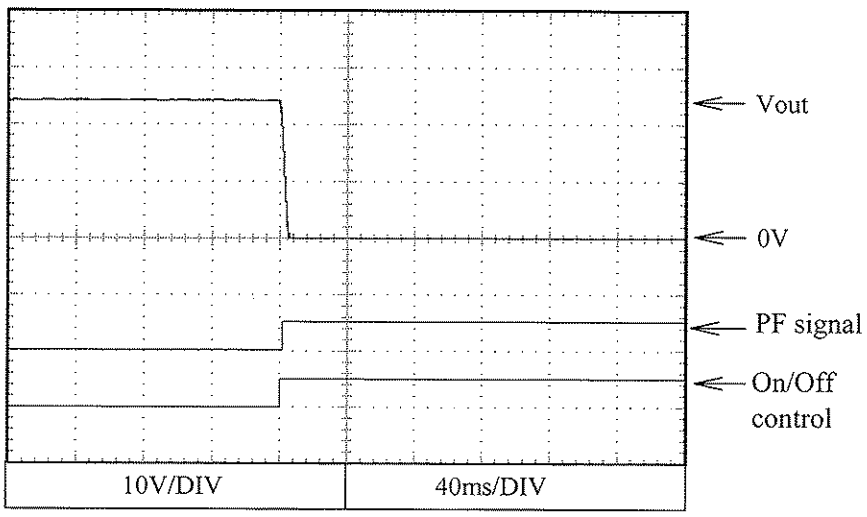
2.7 Output fall characteristics with On/Off control

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

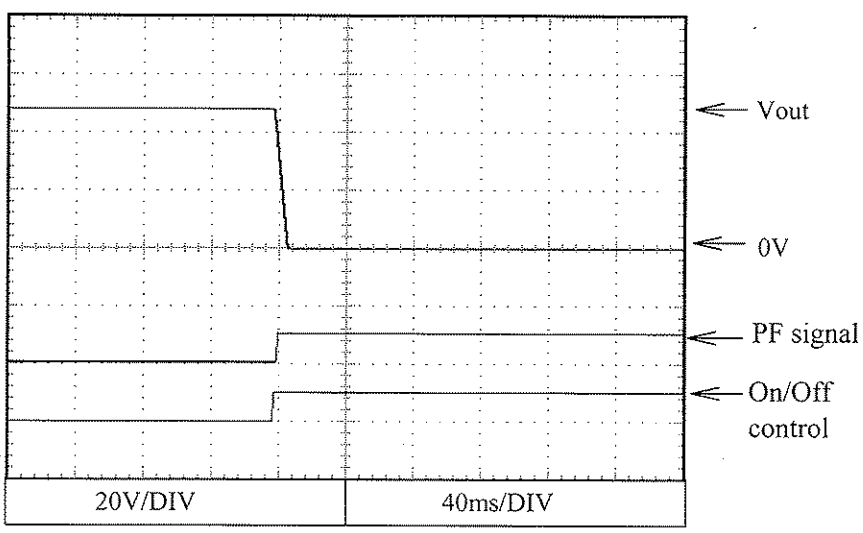
5V



24V



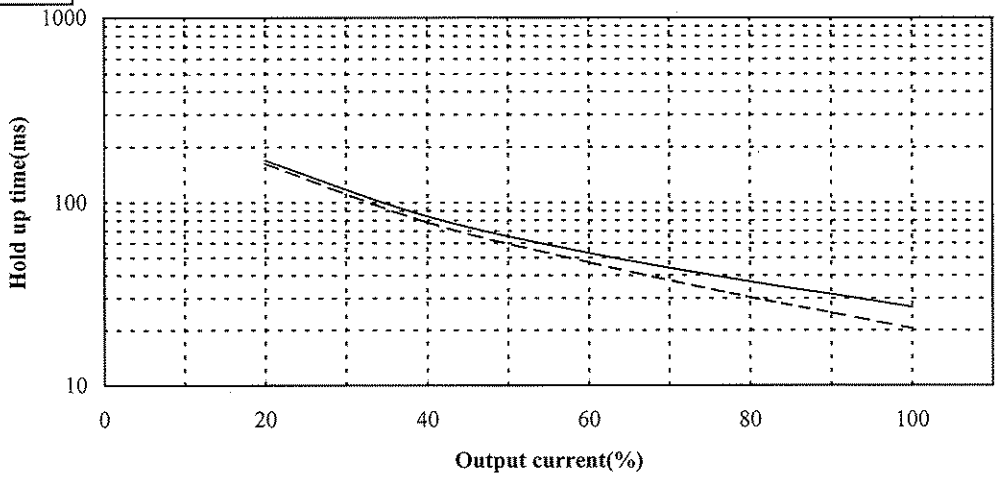
48V



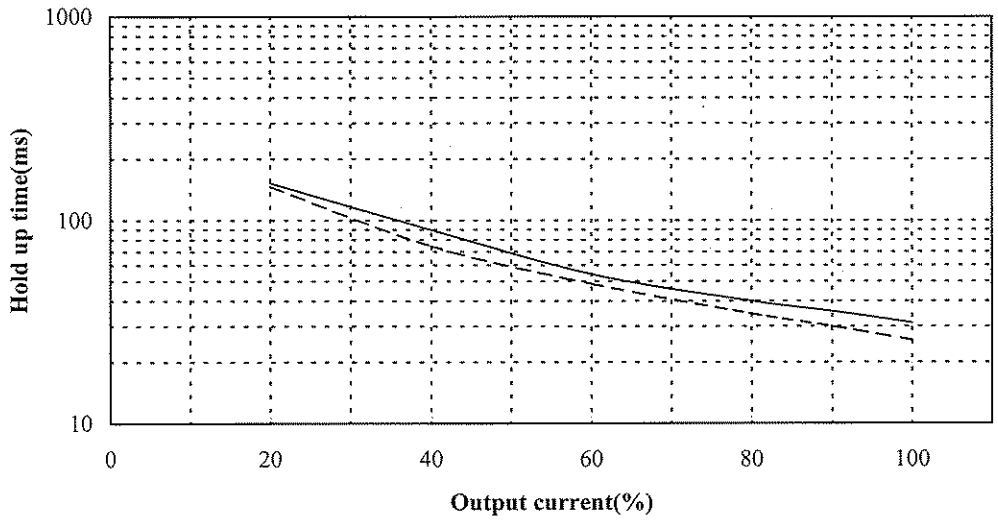
2.8 Hold up time characteristics

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

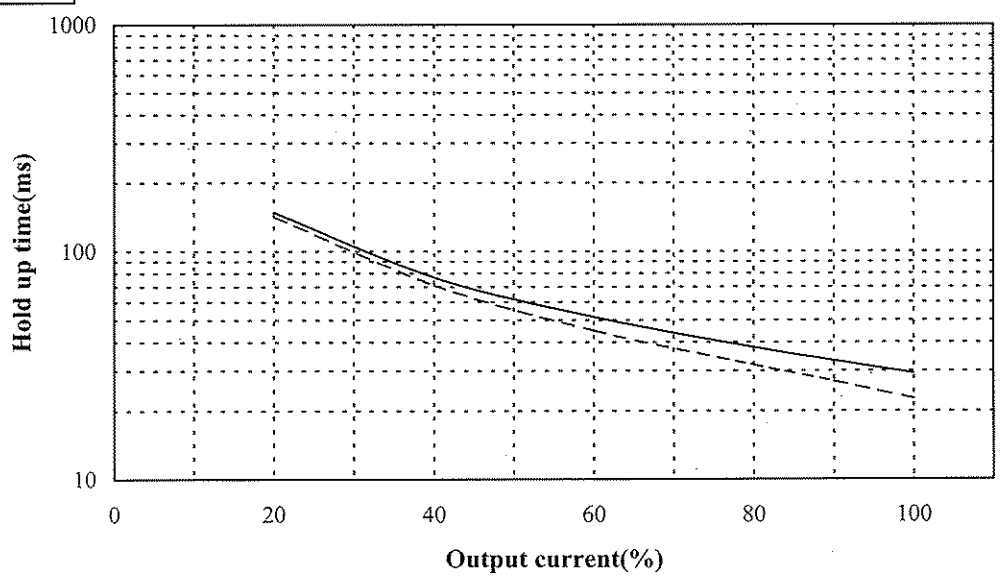
5V



24V



48V

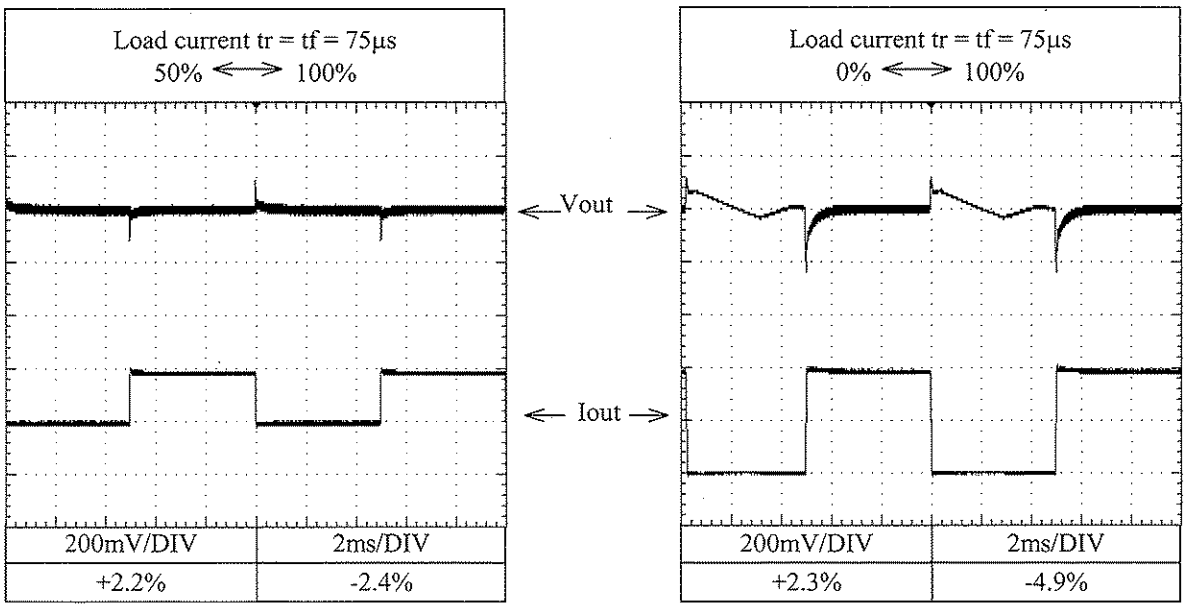


2.9 Dynamic load response characteristics

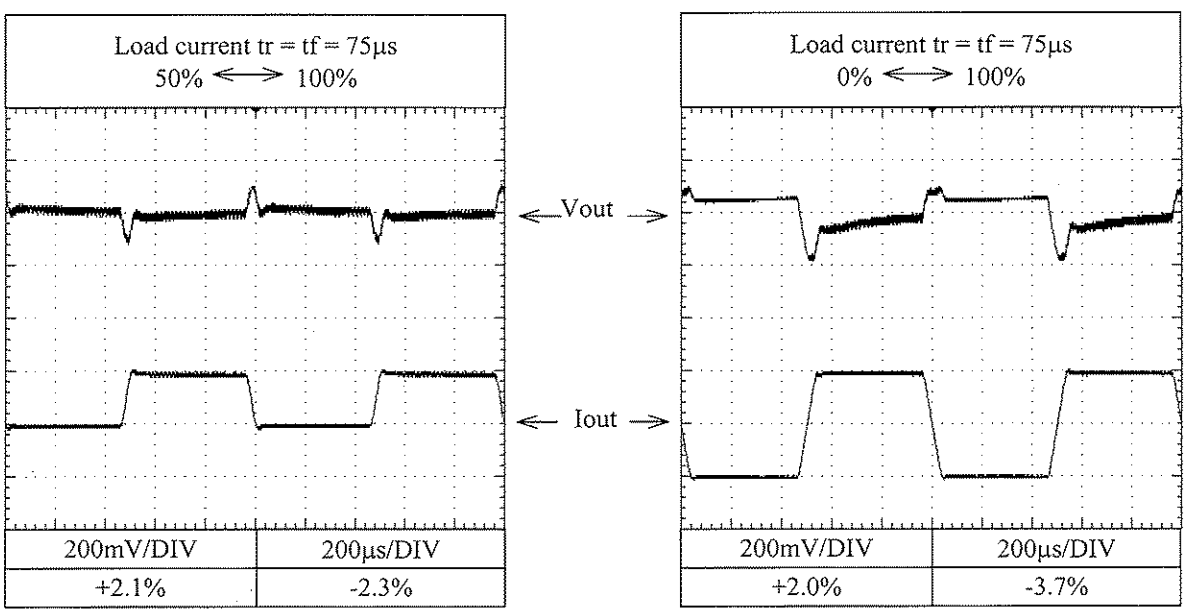
Conditions Vin : 115VAC
Ta : 25°C

5V

f=100Hz



f=1kHz

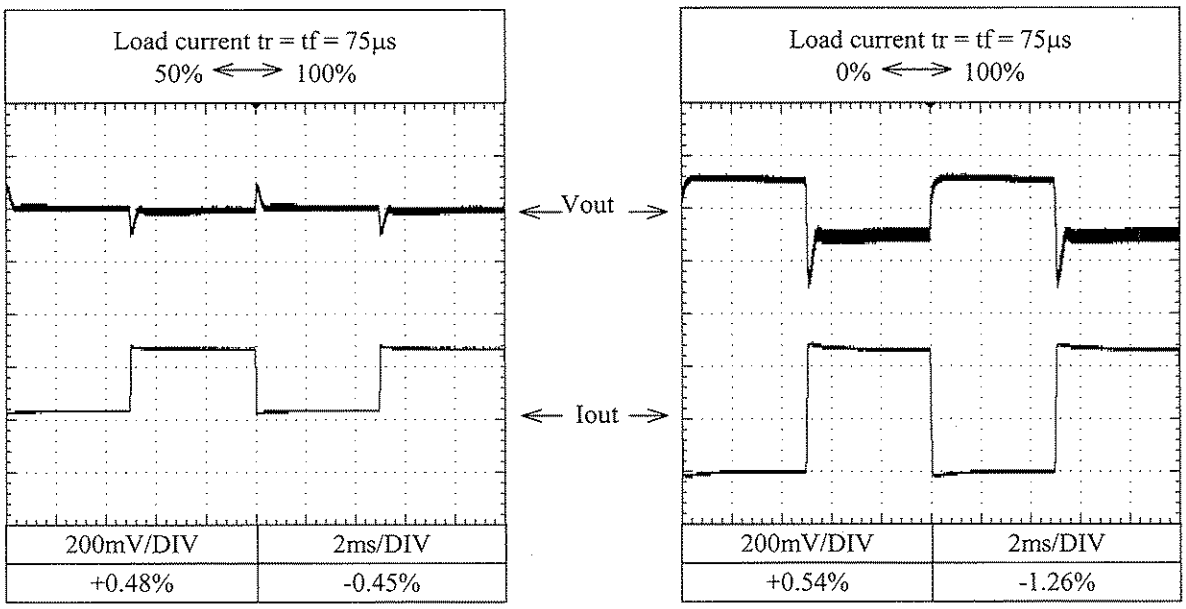


2.9 Dynamic load response characteristics

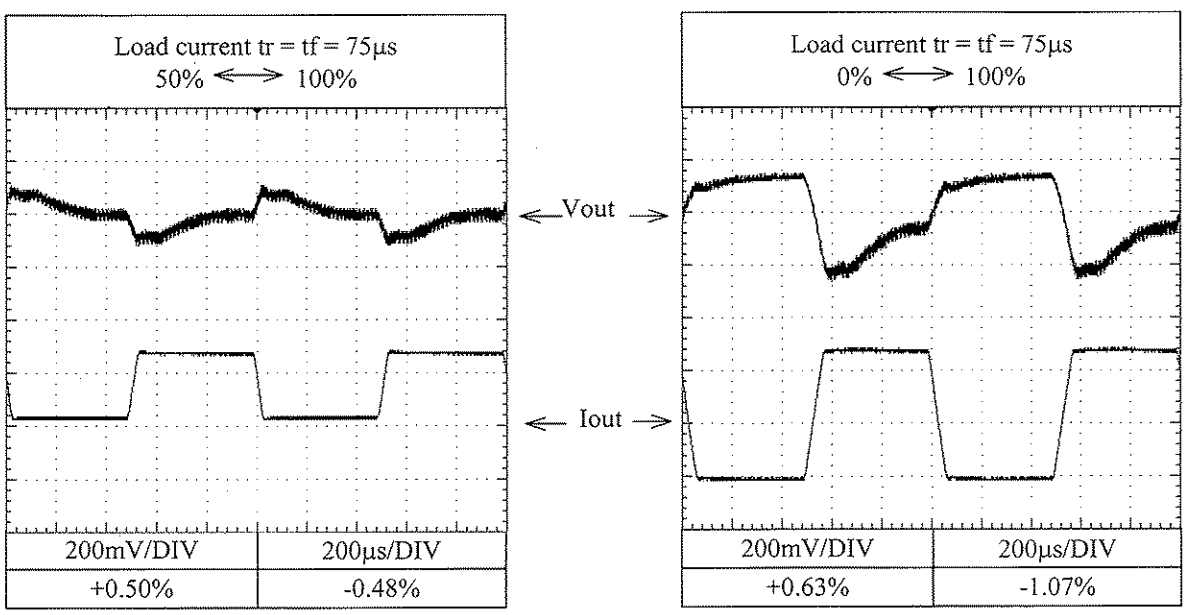
Conditions Vin : 115VAC
Ta : 25°C

24V

f=100Hz



f=1kHz

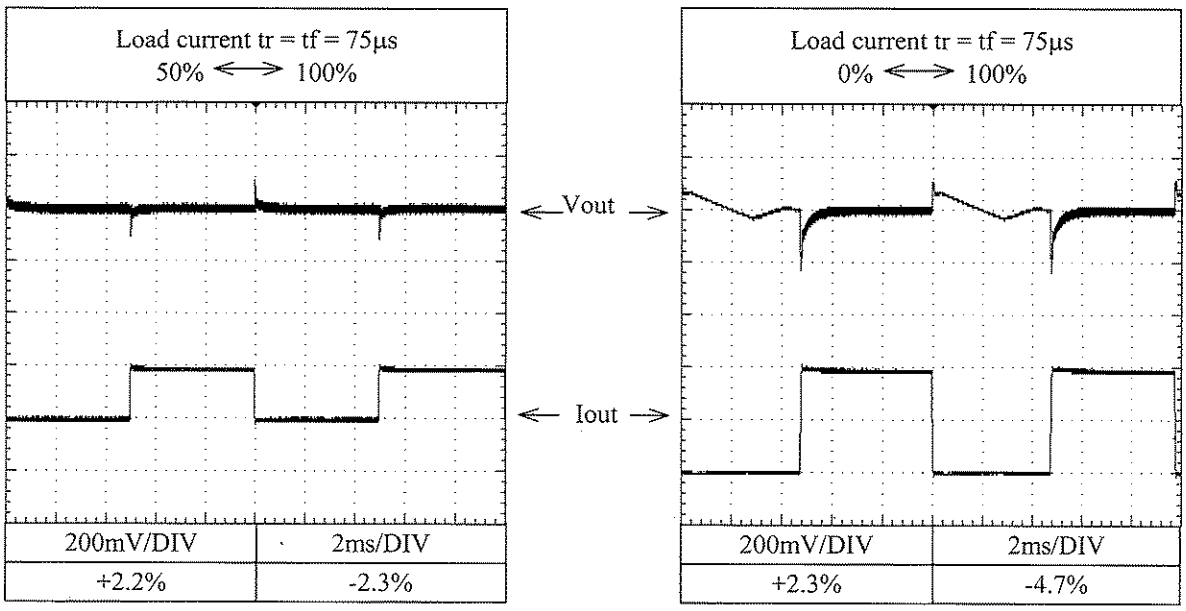


2.9 Dynamic load response characteristics

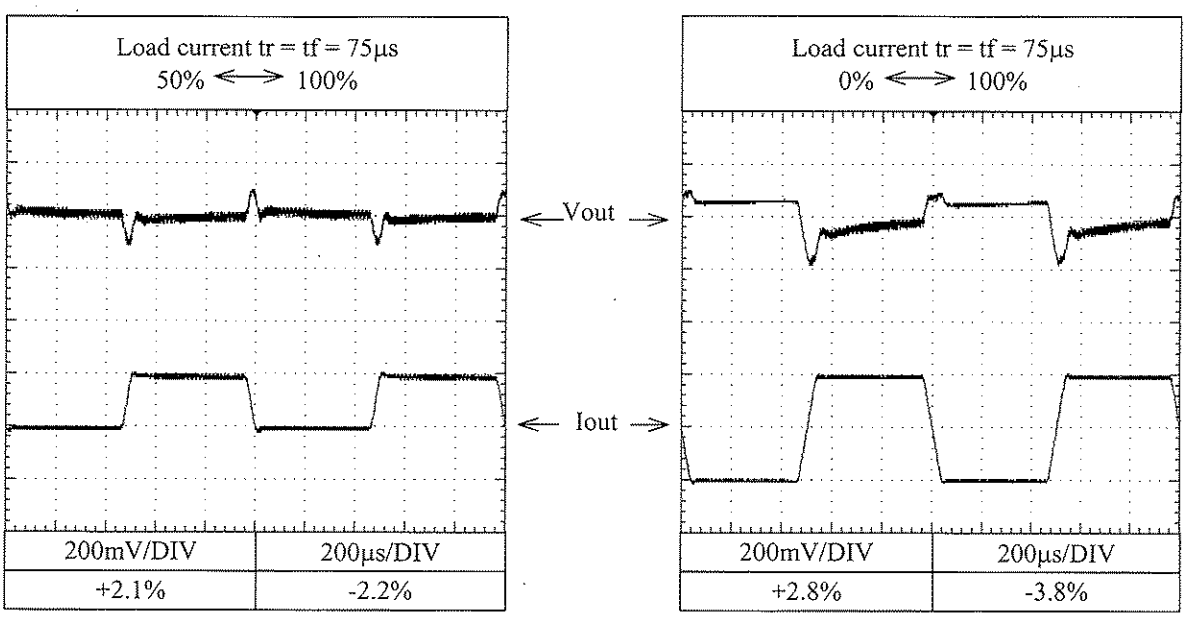
Conditions Vin : 230VAC
Ta : 25°C

5V

f=100Hz



f=1kHz

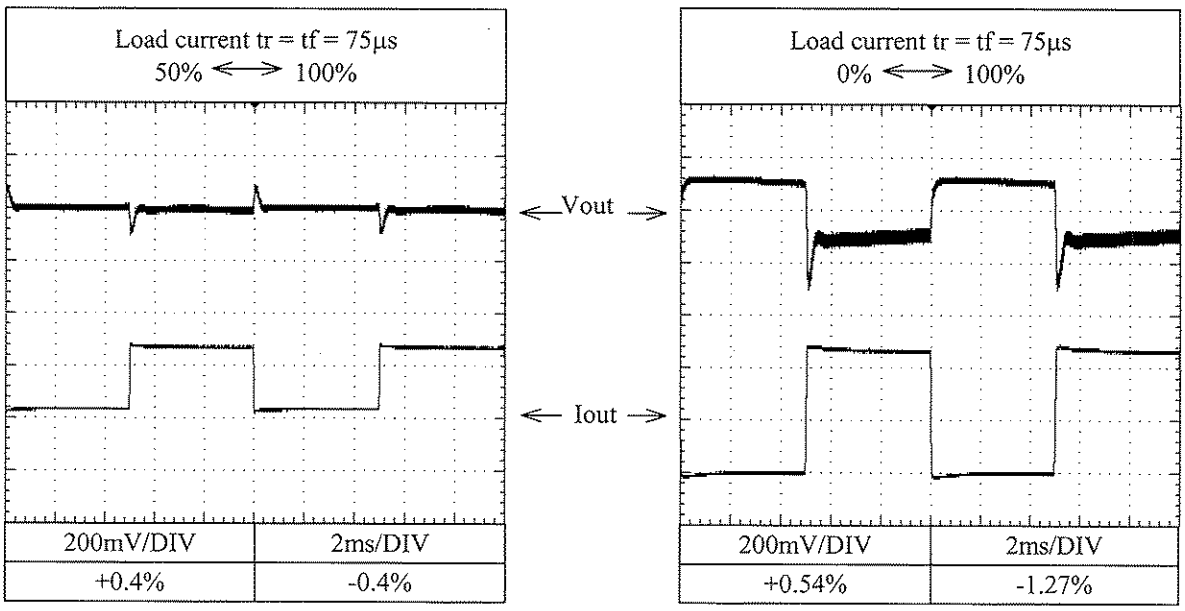


2.9 Dynamic load response characteristics

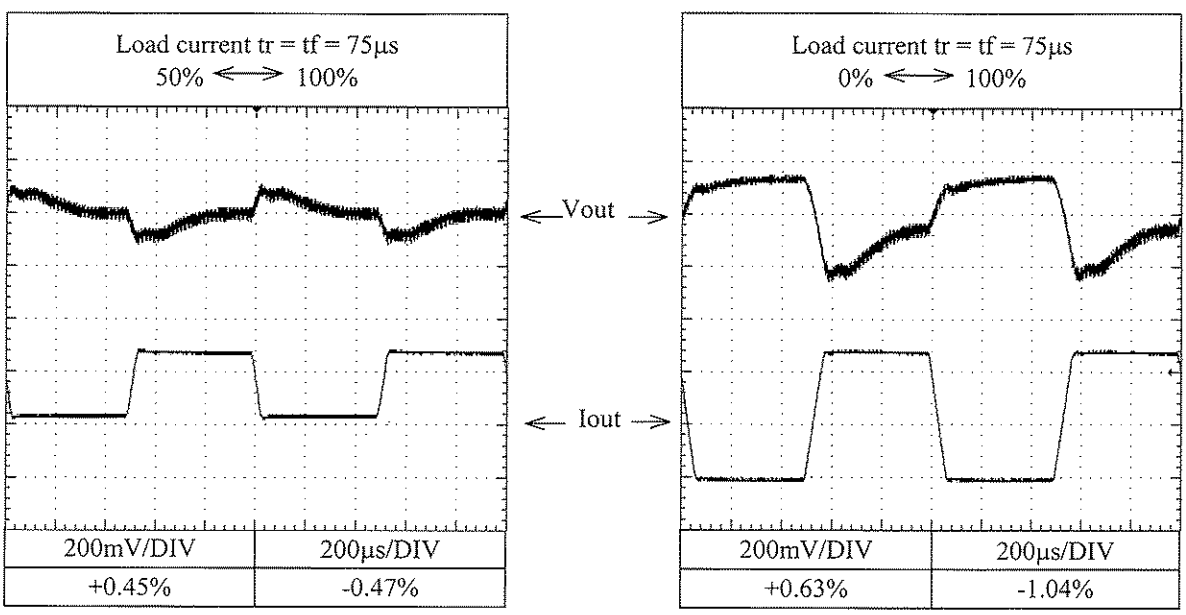
Conditions Vin : 230VAC
Ta : 25°C

24V

f=100Hz



f=1kHz

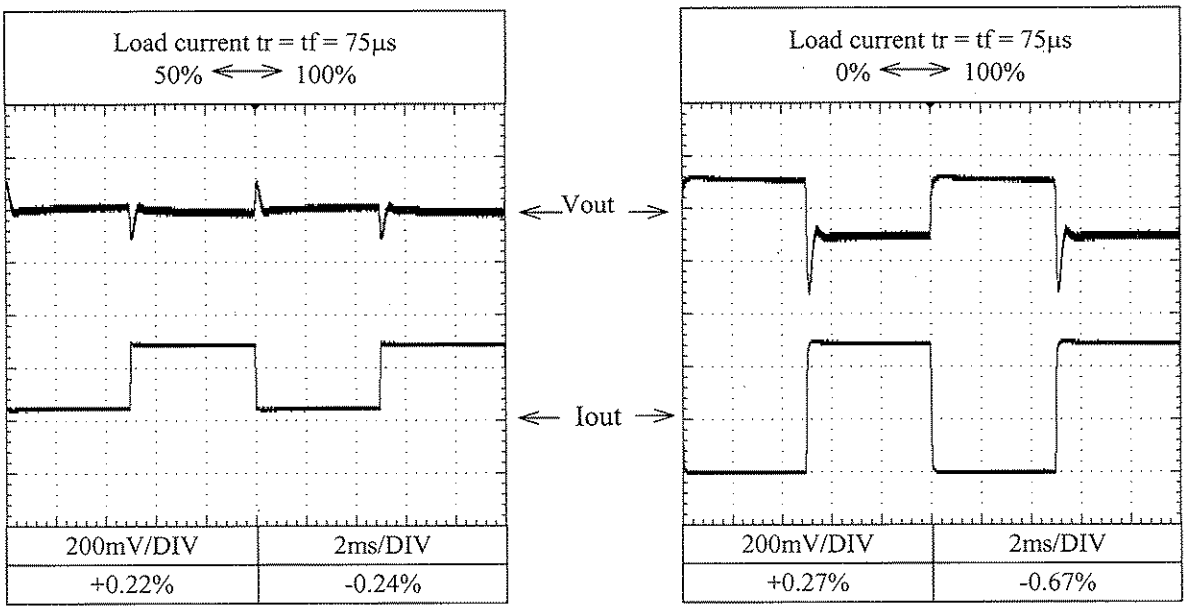


2.9 Dynamic load response characteristics

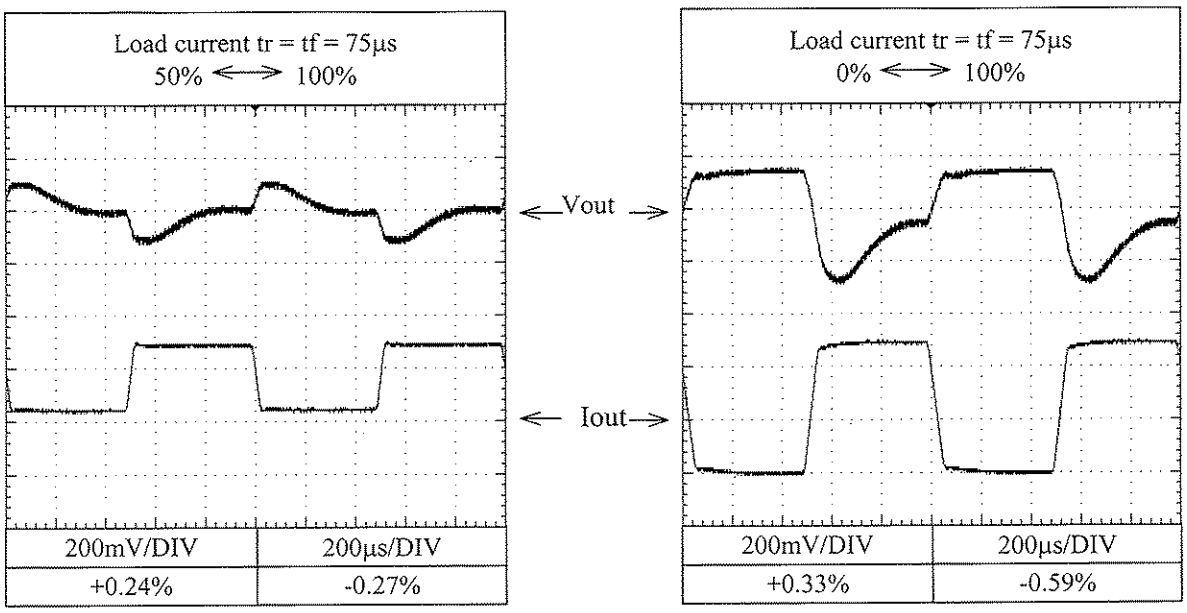
Conditions Vin : 115VAC
Ta : 25°C

48V

f=100Hz



f=1kHz

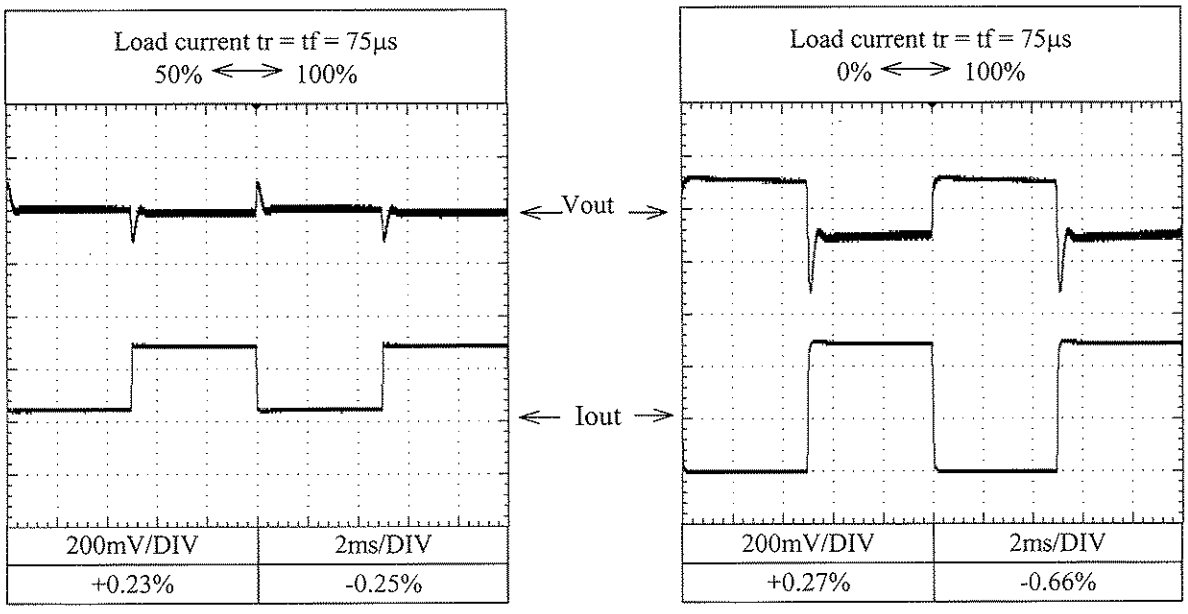


2.9 Dynamic load response characteristics

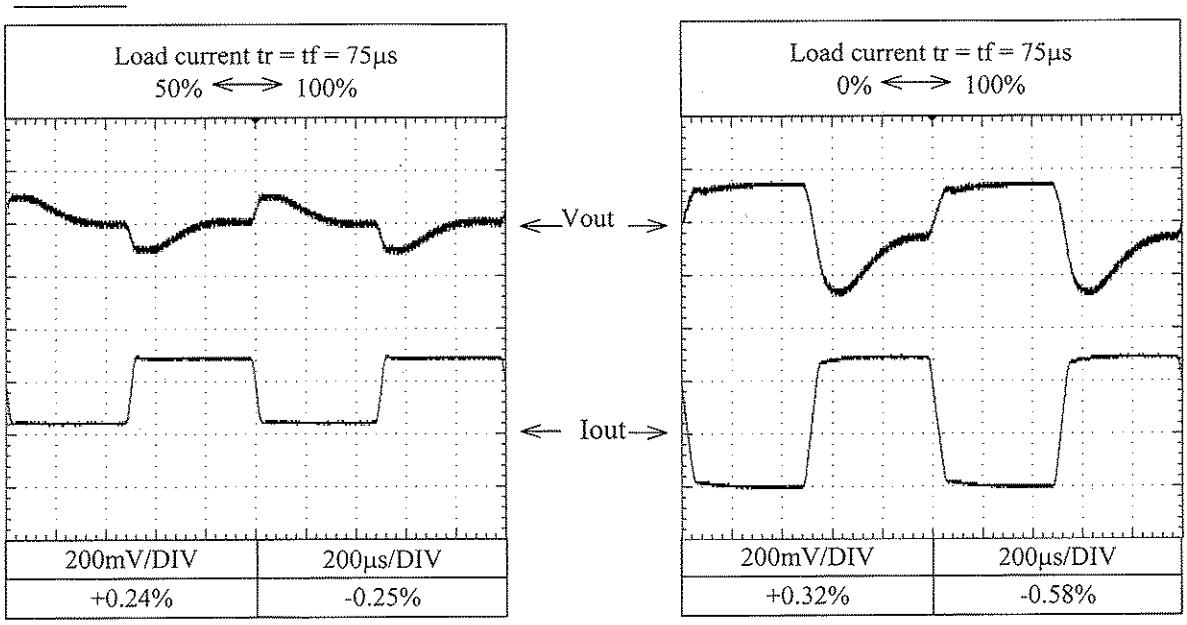
Conditions Vin : 230VAC
Ta : 25°C

48V

f=100Hz



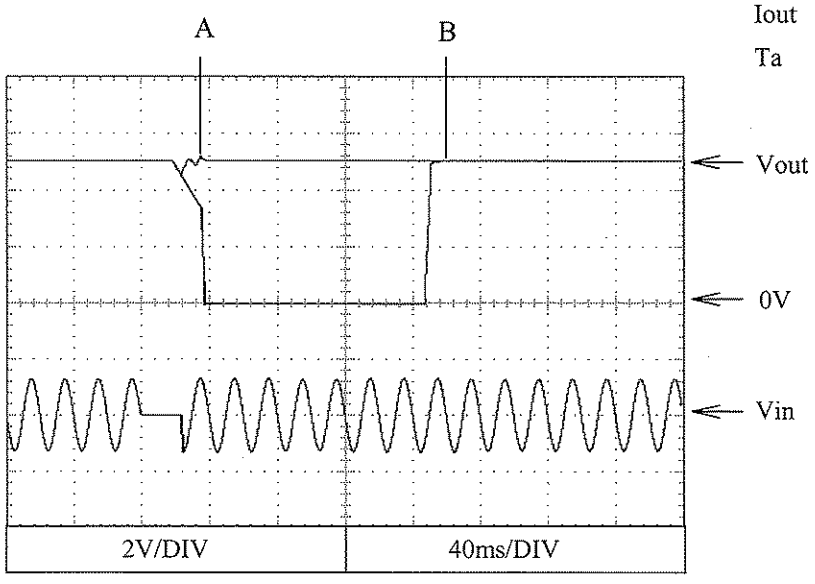
f=1kHz



2.10 Response to brown out characteristics

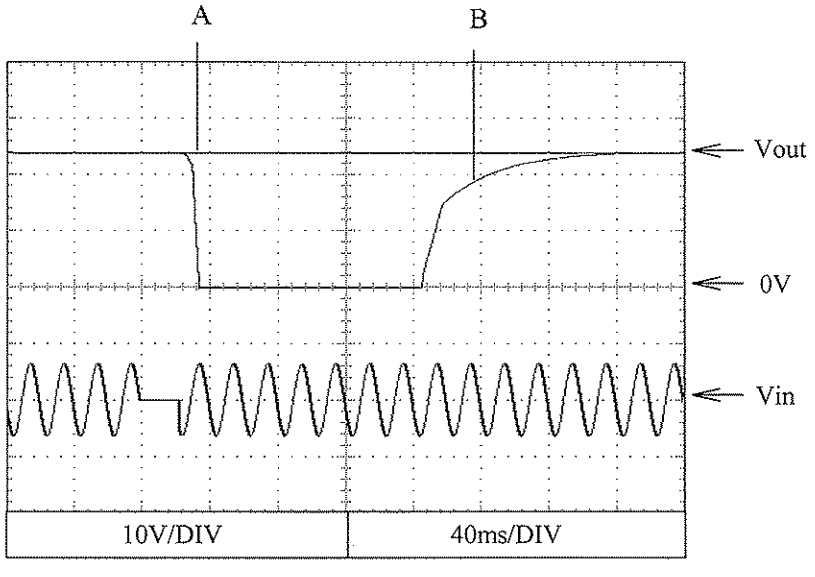
Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

5V



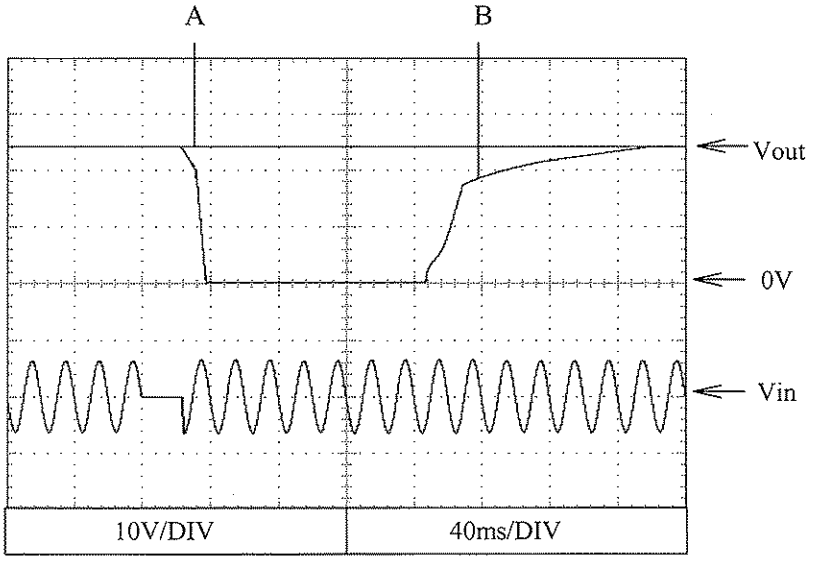
A=22ms
B=23ms

24V



A=22ms
B=23ms

48V

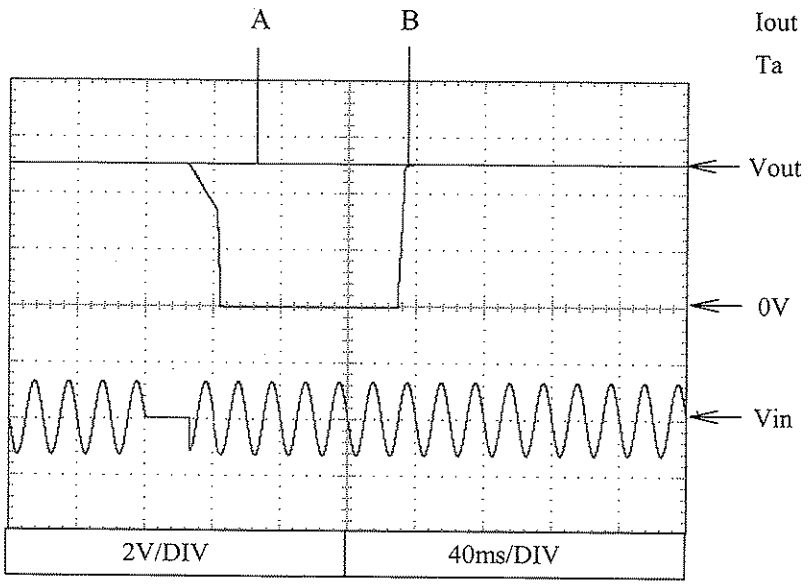


A=22ms
B=23ms

2.10 Response to brown out characteristics

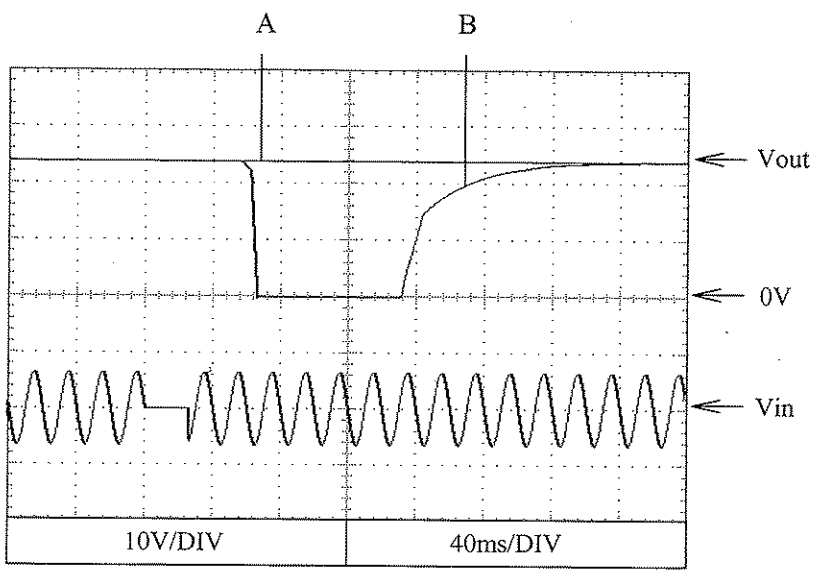
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

5V



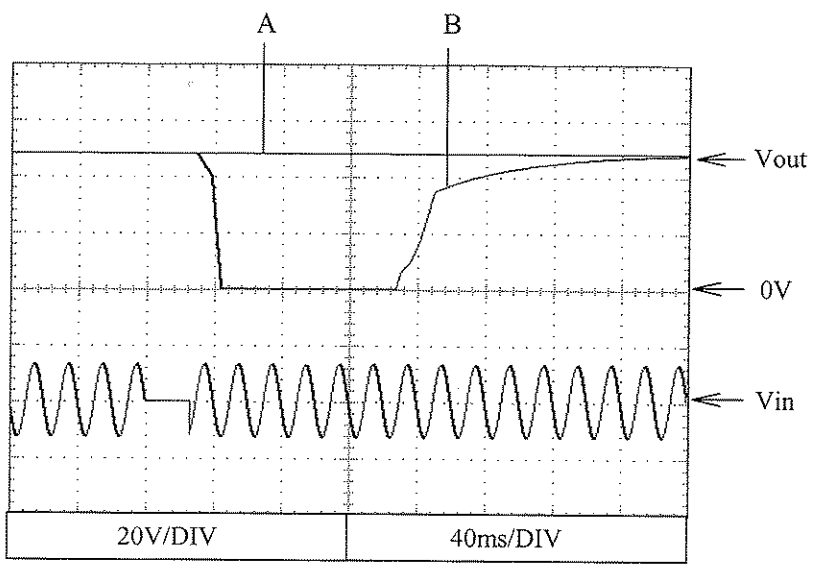
A=25ms
B=26ms

24V



A=25ms
B=26ms

48V



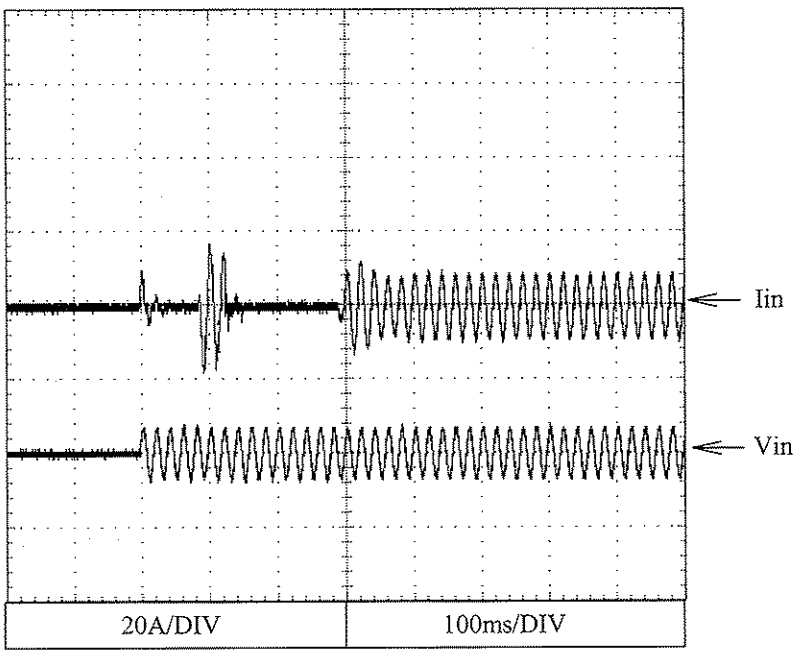
A=25ms
B=26ms

2.11 Inrush current waveform

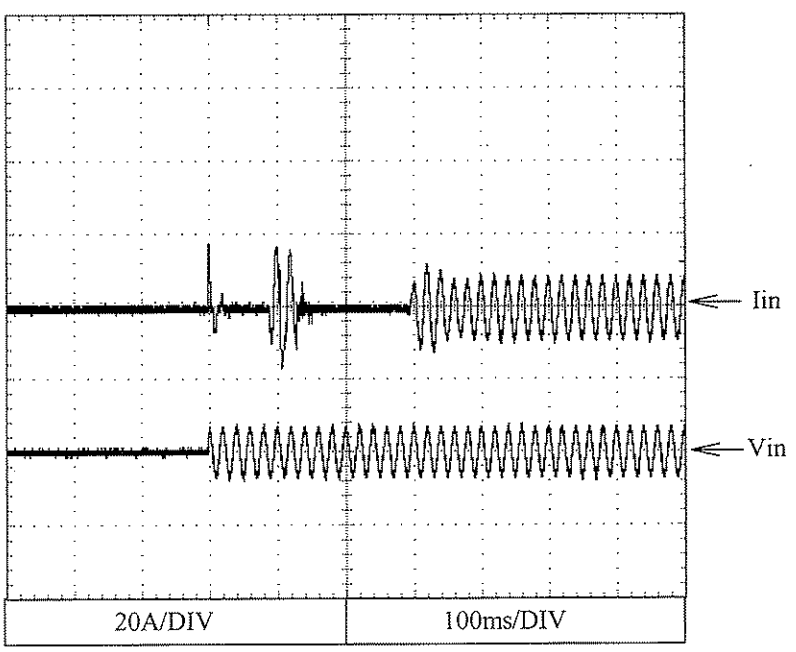
Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

5V

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



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

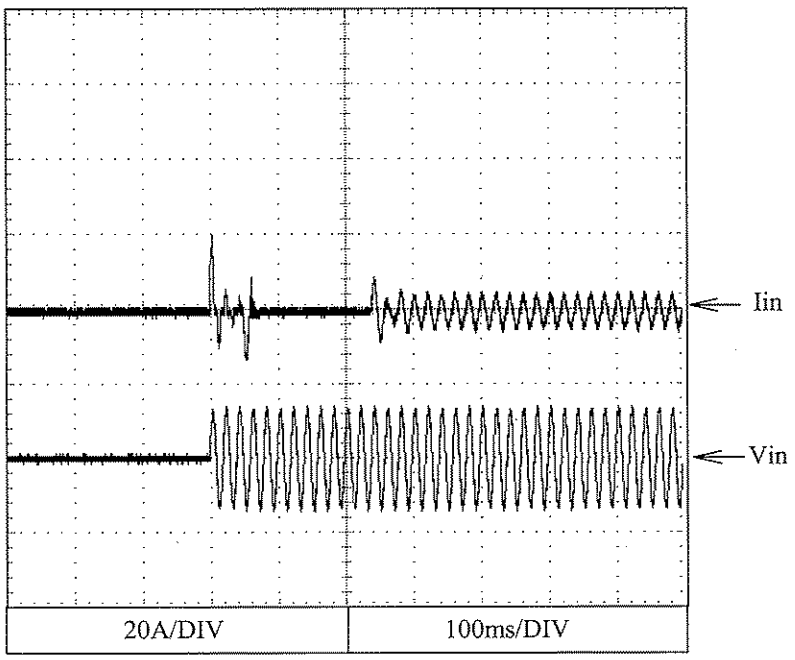


2.11 Inrush current waveform

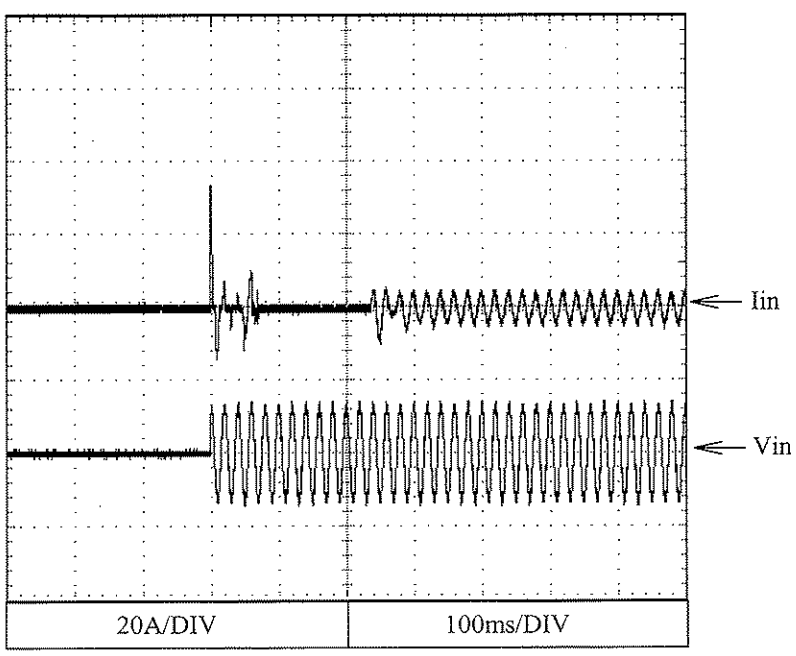
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

5V

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



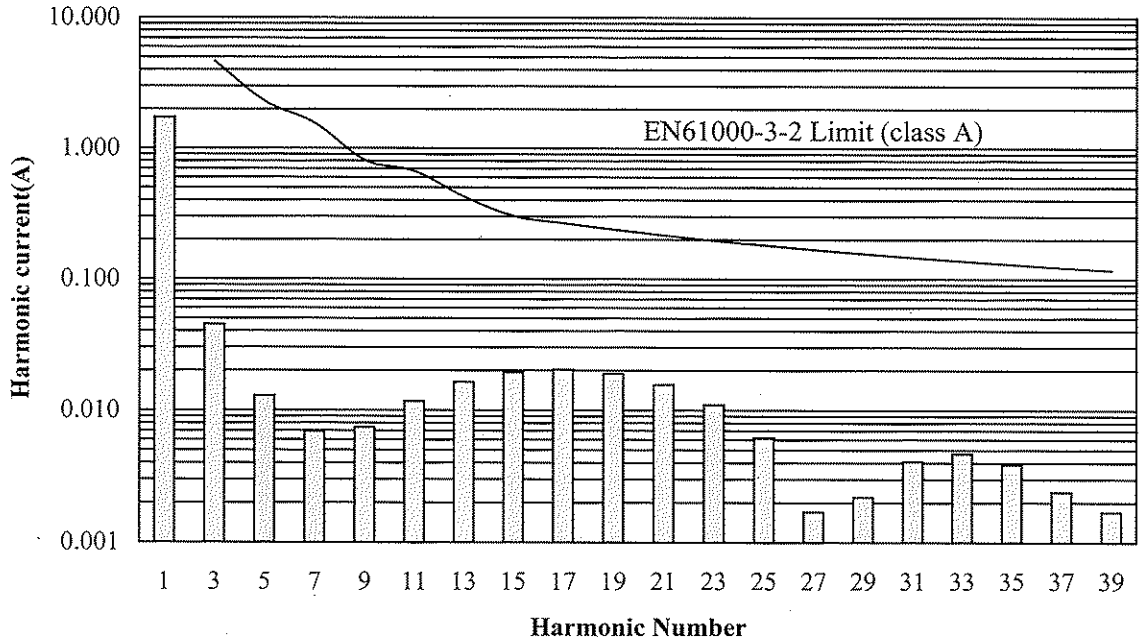
Switch on phase angle
of input AC voltage
$\phi = 90°$



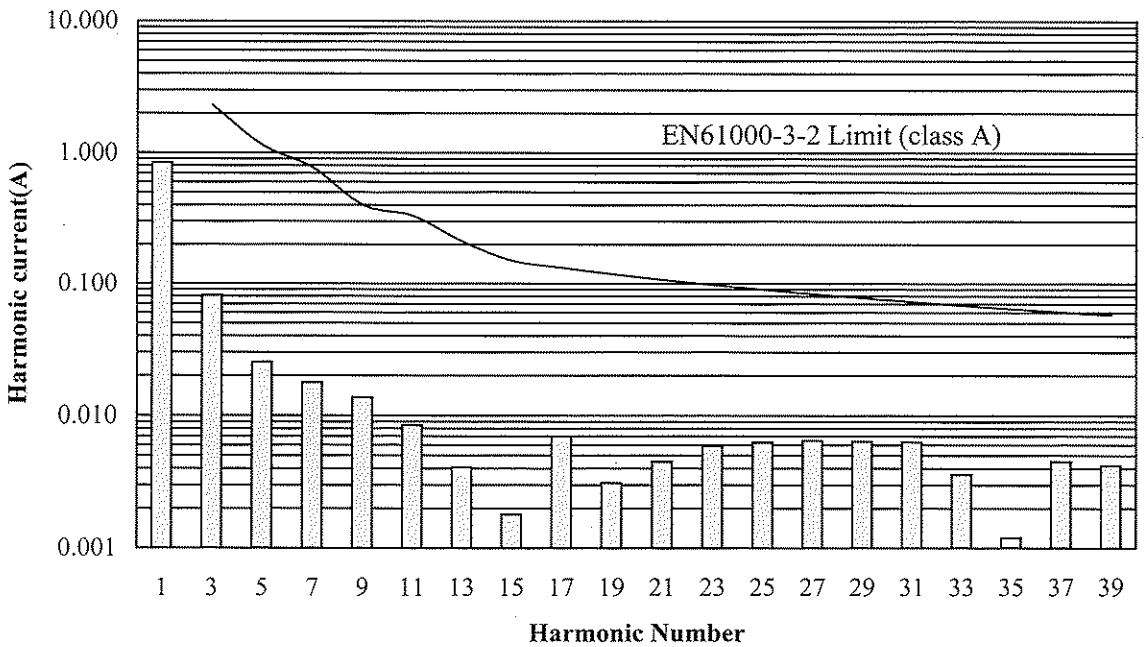
2.12 Input current harmonics

5V

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



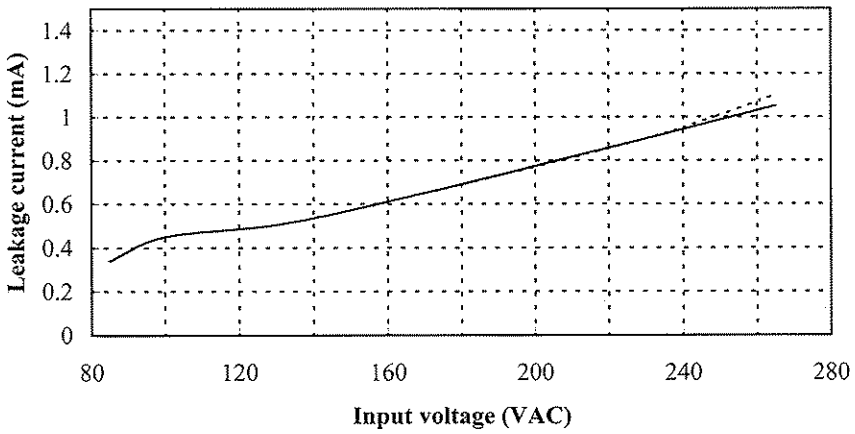
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C



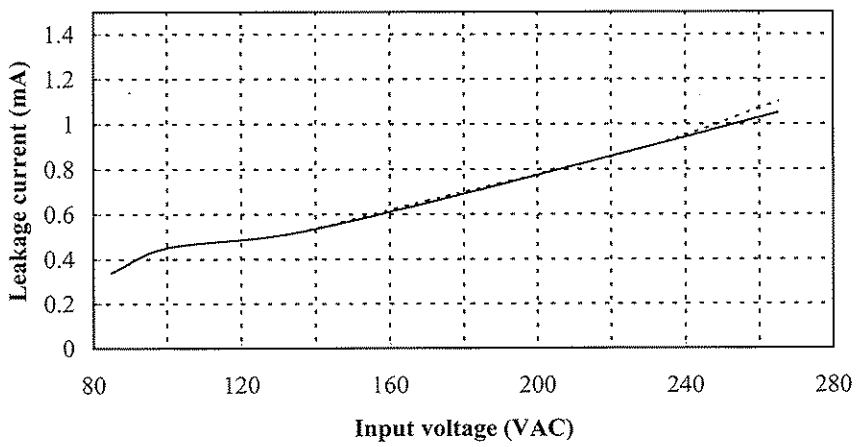
2.13 Leakage current characteristics

Conditions Iout : 0% ----------
: 100% ——————
Ta : 25°C
f : 50Hz
Equipment used : MODEL 228 (Simpson)

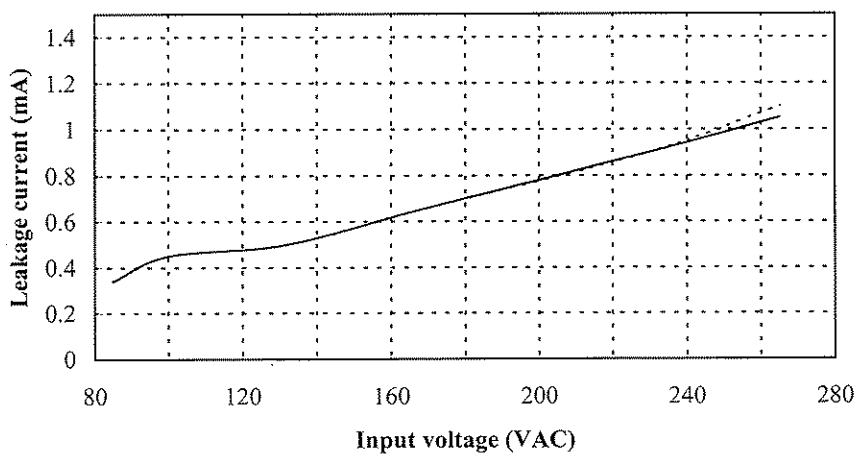
5V



24V



48V

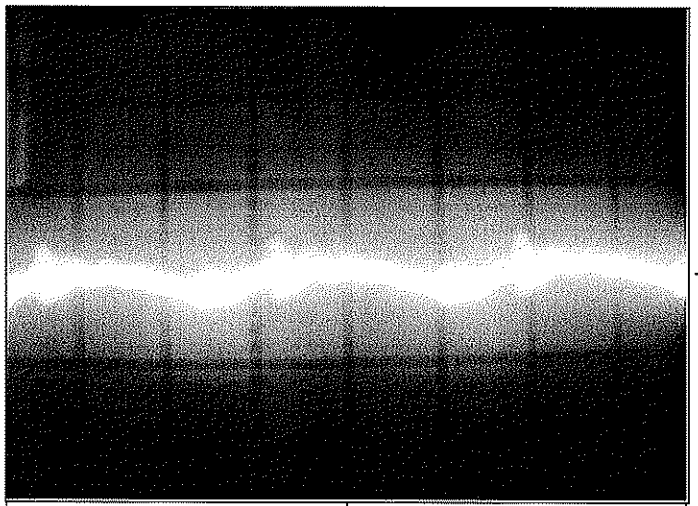


2.14 Output ripple and noise waveform

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

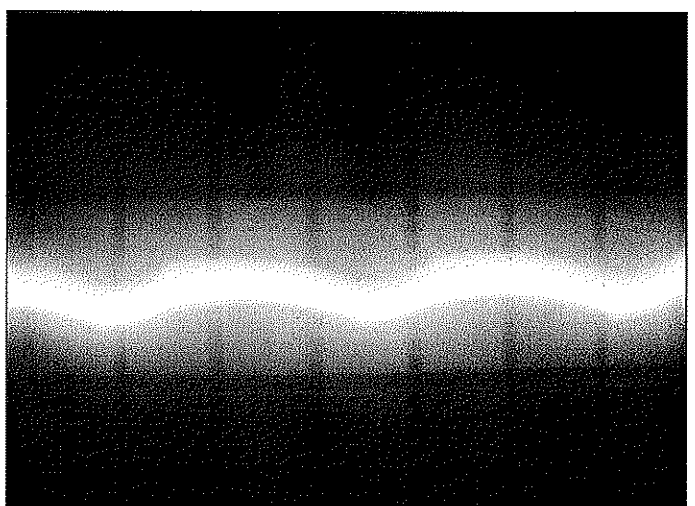
NORMAL MODE

5V



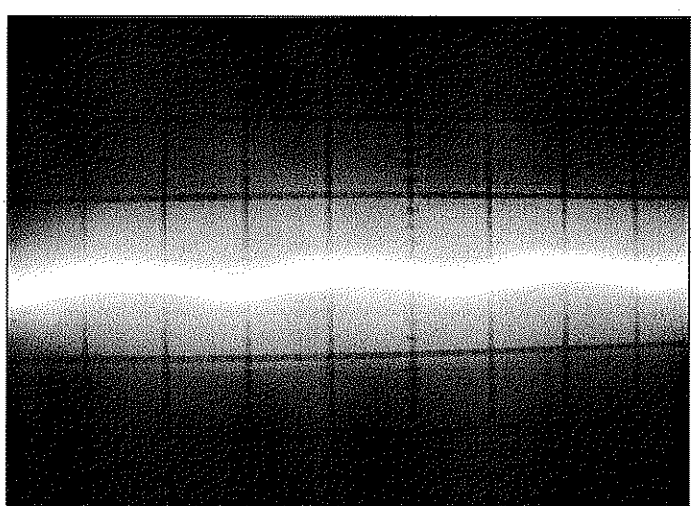
50mV/DIV | 2μs/DIV

24V



50mV/DIV | 2μs/DIV

48V



50mV/DIV | 2μs/DIV

2.15 Electro-Magnetic Interference characteristics

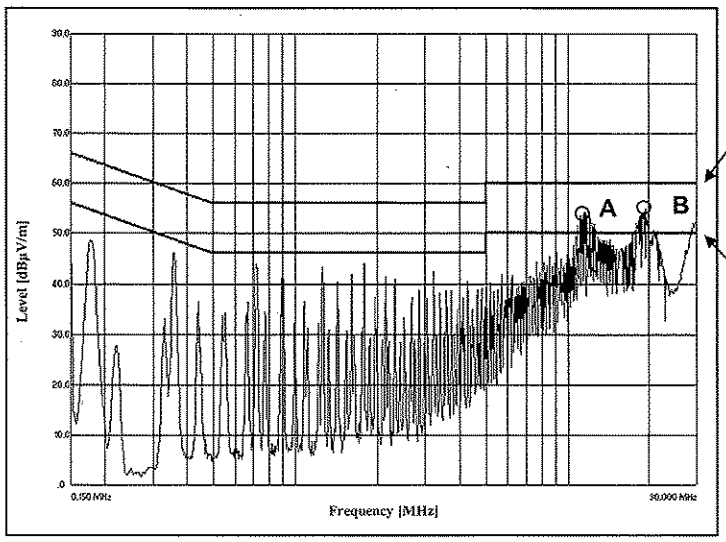
Conducted Emission

Conditions
Vin : 115VAC
Iout : 100%

5V

Ref. / Data	Point A (11.59MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	47.6
AV	50.0	42.7

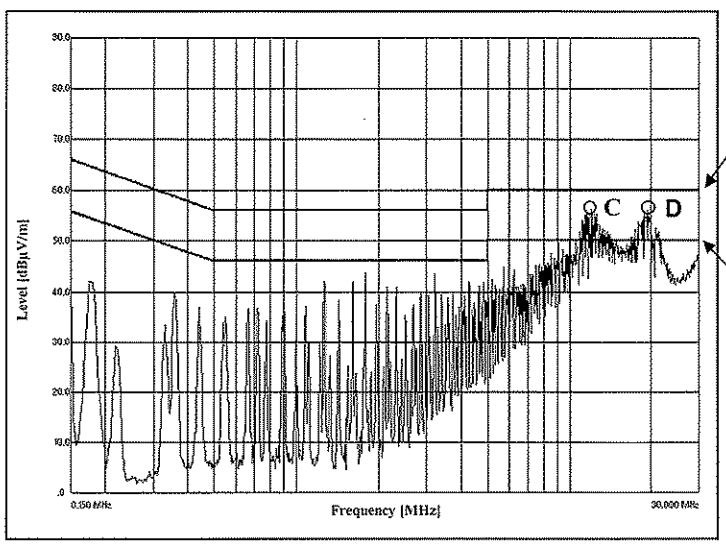
Ref. / Data	Point B (19.4MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	49.3
AV	50.0	43.5



Phase : L

Ref. / Data	Point C (11.97MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	53.9
AV	50.0	46.7

Ref. / Data	Point D (19.45MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	53.7
AV	50.0	45.5



Phase : N

2.15 Electro-Magnetic Interference characteristics

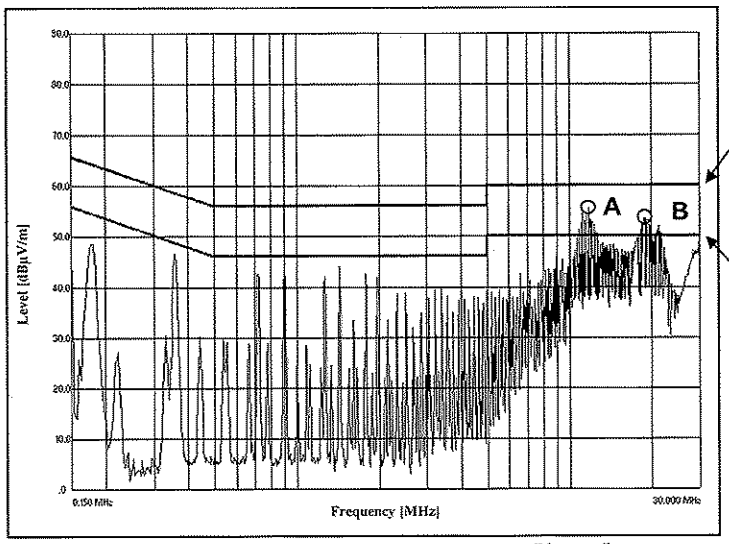
Conducted Emission

Conditions
Vin : 230VAC
Iout : 100%

5V

Ref. / Data	Point A (11.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	48.3
AV	50.0	44.5

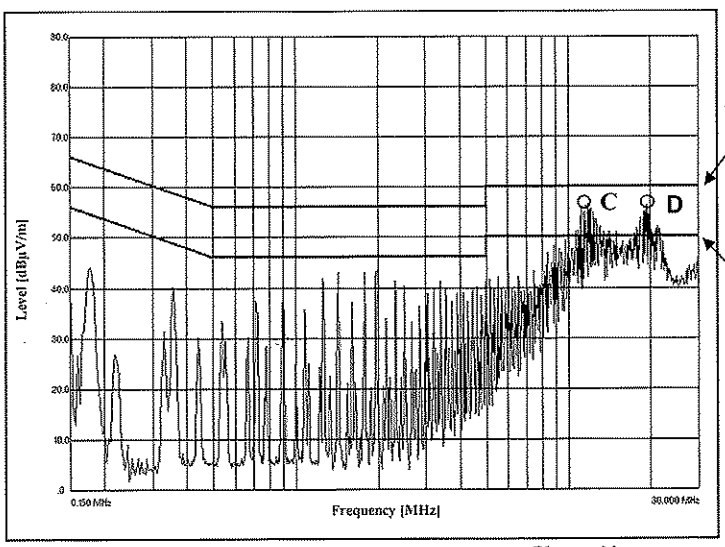
Ref. / Data	Point B (19.4MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	46.1
AV	50.0	42.4



Phase : L

Ref. / Data	Point C (11.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	56.3
AV	50.0	47.2

Ref. / Data	Point D (19.4MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	53.7
AV	50.0	47.0



Phase : N

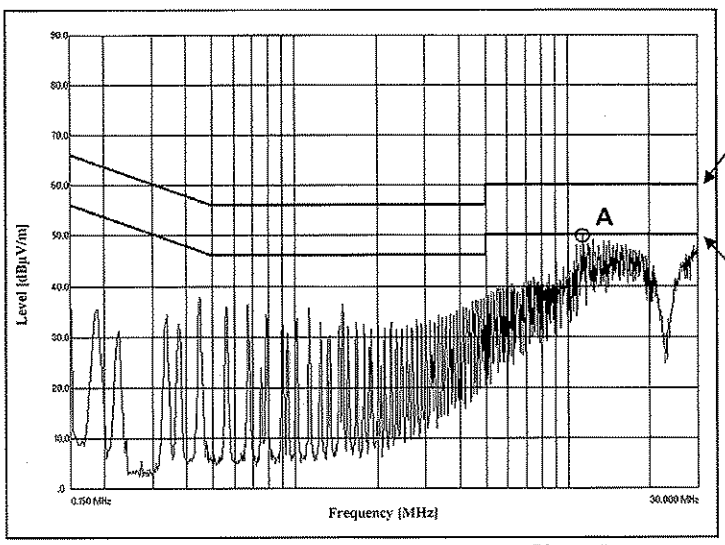
2.15 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 115VAC
Iout : 100%

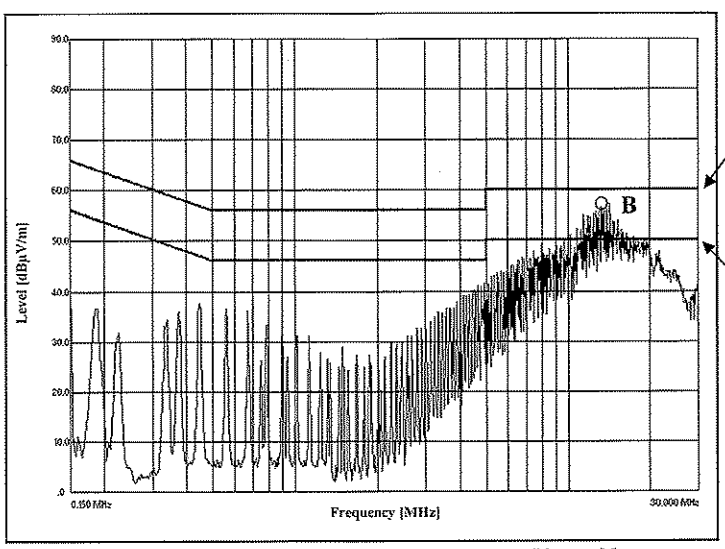
24V

Ref. / Data	Point A (10.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	49.3
AV	50.0	43.2



Phase : L

Ref. / Data	Point B (12.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	52.6
AV	50.0	46.3



Phase : N

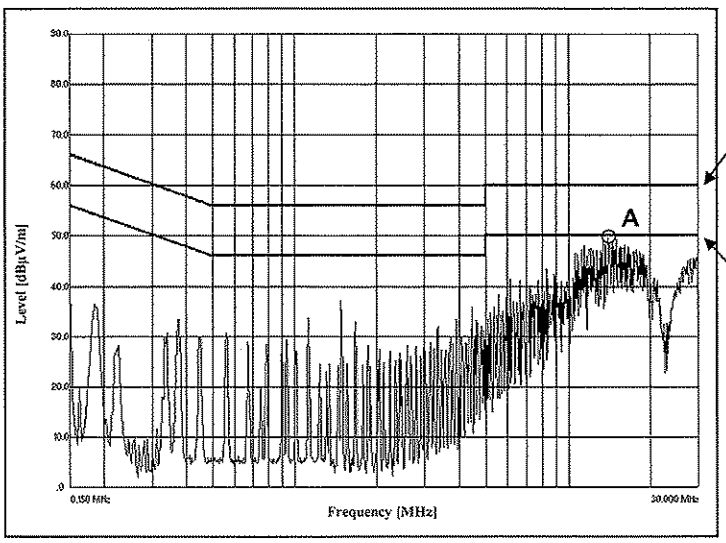
2.15 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 230VAC
Iout : 100%

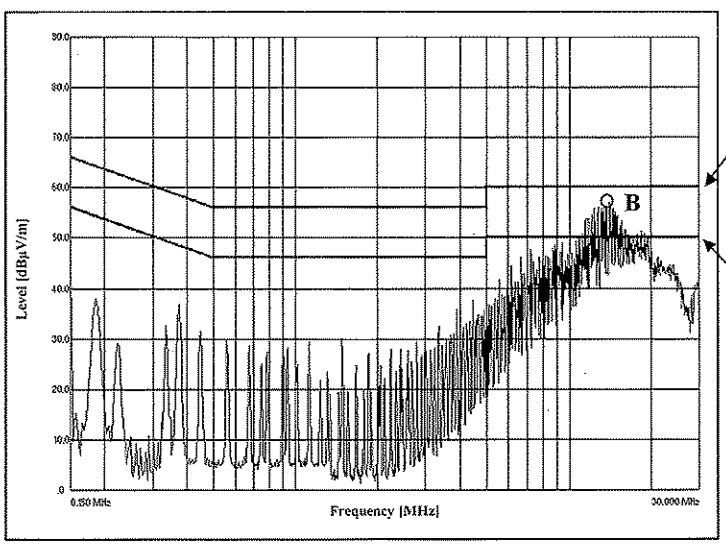
24V

Ref. / Data	Point A (12.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	48.2
AV	50.0	41.8



Phase : L

Ref. / Data	Point B (12.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	51.8
AV	50.0	45.6



Phase : N

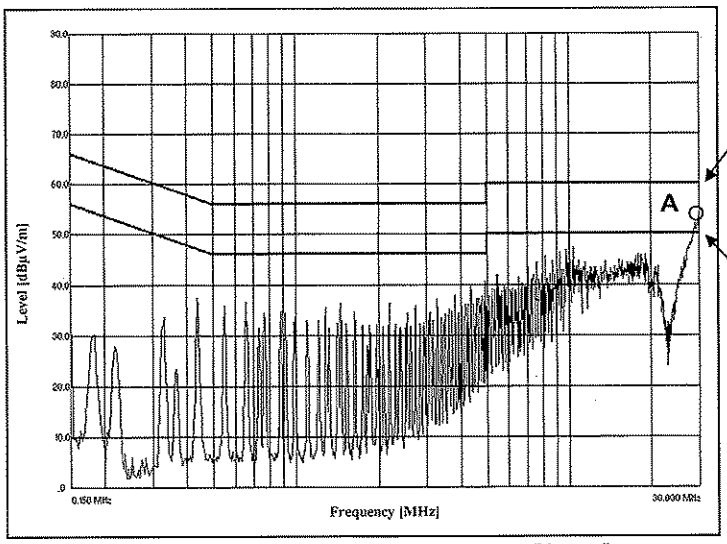
2.15 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 115VAC
Iout : 100%

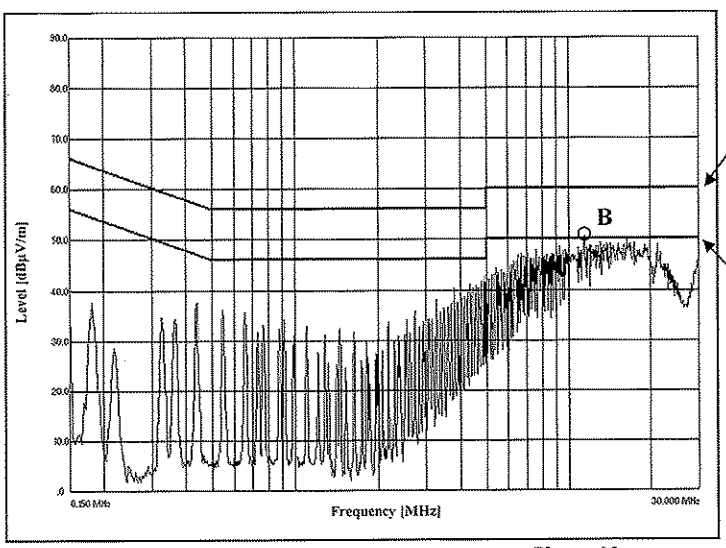
48V

Ref. / Data	Point A (29.9MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	47.5
AV	50.0	39.5



Phase : L

Ref. / Data	Point B (10.6MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	46.1
AV	50.0	39.6



Phase : N

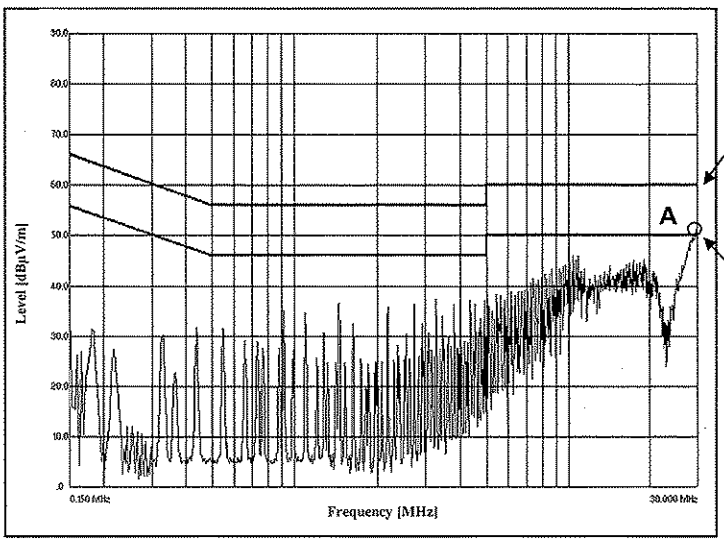
2.15 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 230VAC
Iout : 100%

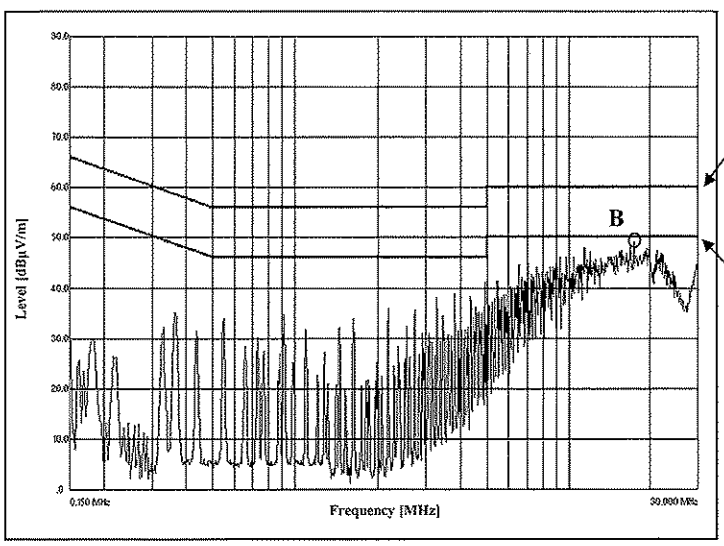
48V

Ref. / Data	Point A (29.7MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	47.4
AV	50.0	40.0



Phase : L

Ref. / Data	Point B (17.8MHz) Limit (dBμV)	Measure (dBμV)
QP	60.0	47.0
AV	50.0	40.2



Phase : N

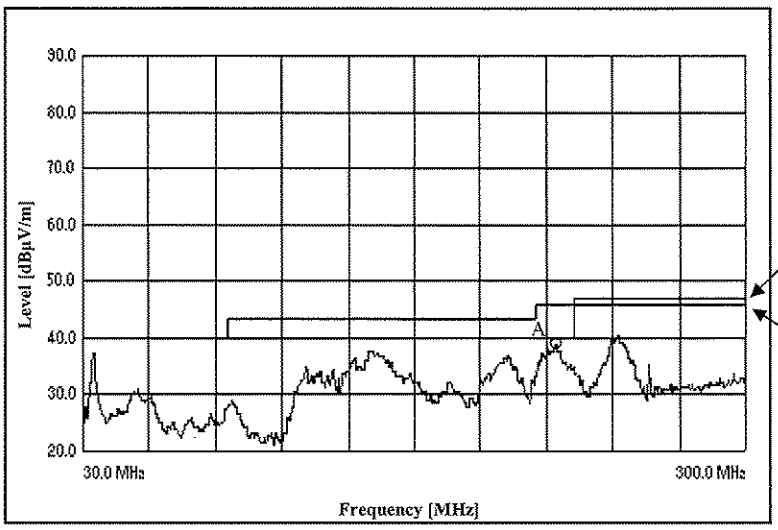
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

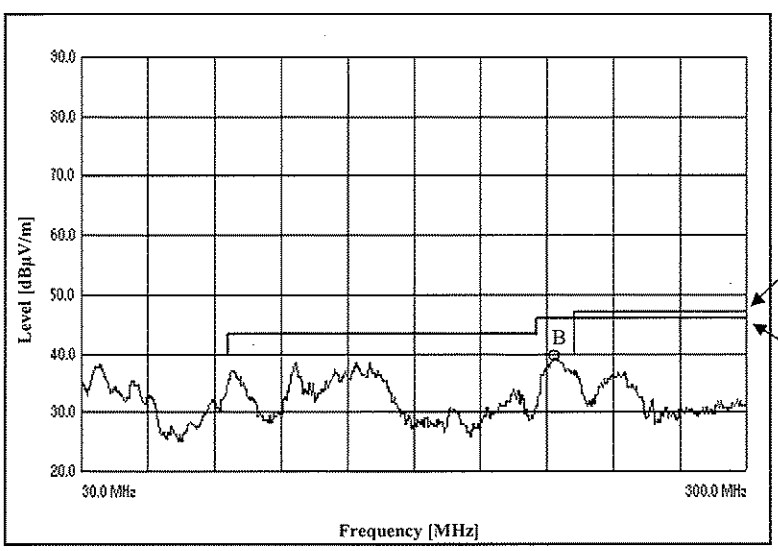
5V

HORIZONTAL:



Point A (222.4MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	36.7

VERTICAL:



Point B (219.6MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.5

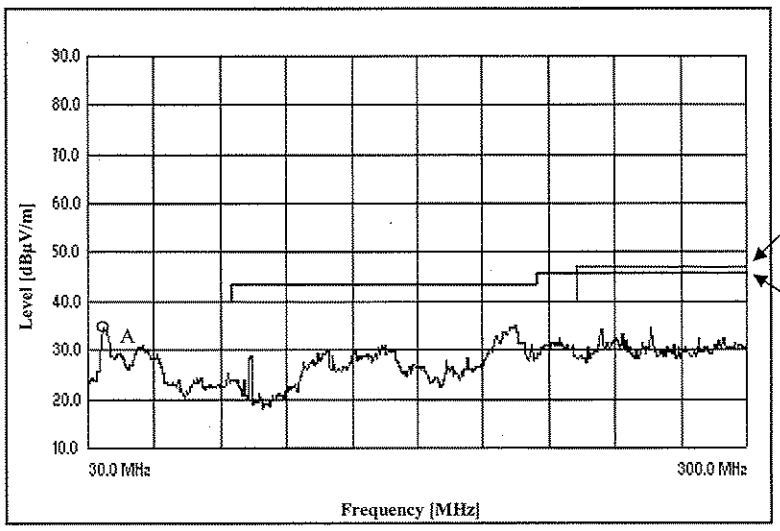
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

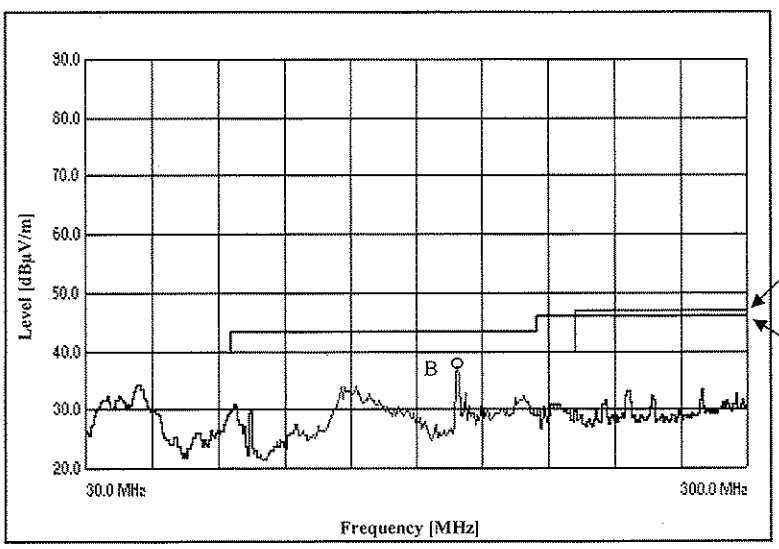
5V

HORIZONTAL:



Point A (37.4MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	35.0

VERTICAL:



Point B (181.8MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.0

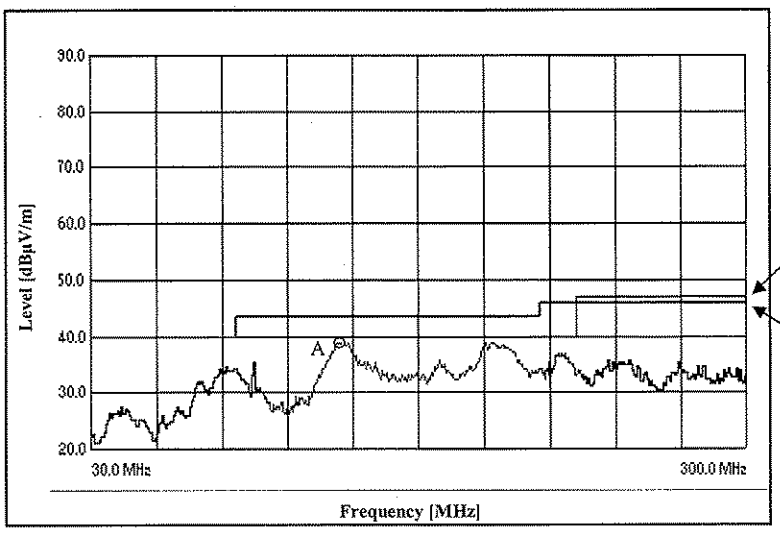
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

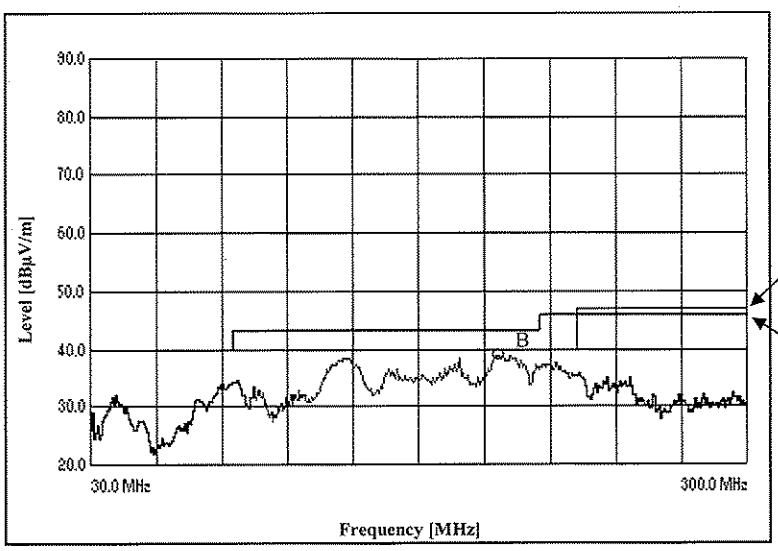
24V

HORIZONTAL:



Point A (131MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.2

VERTICAL:



Point B (196MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.6

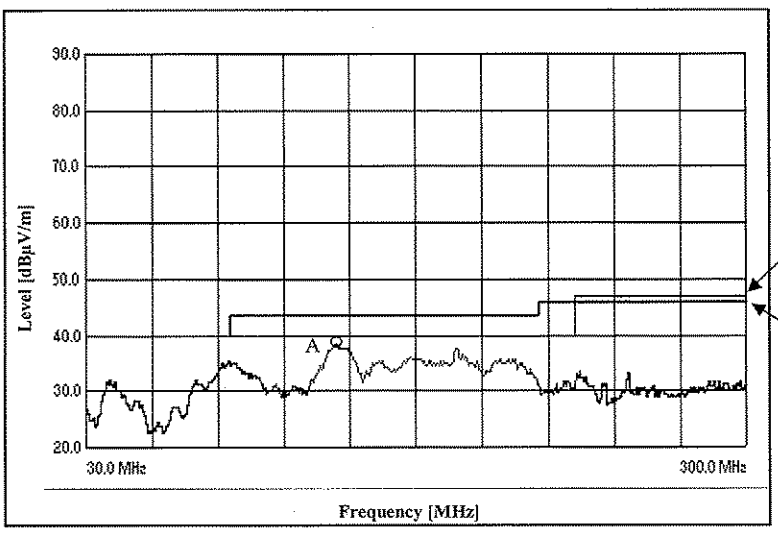
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

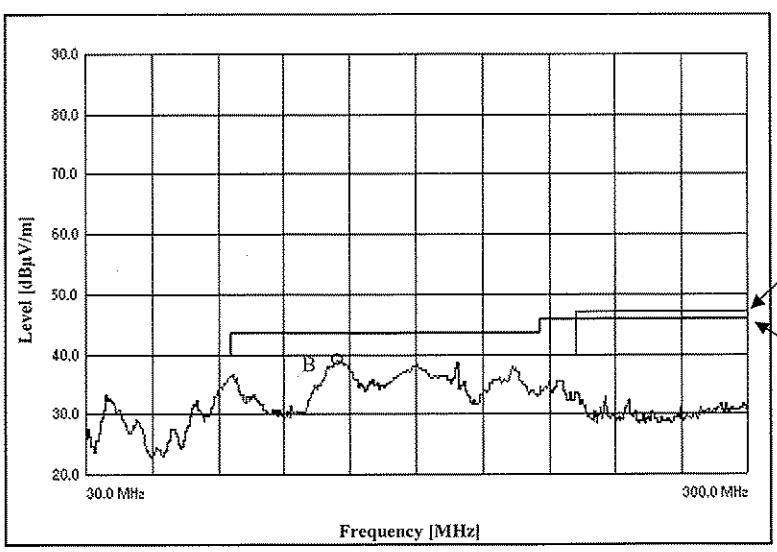
24V

HORIZONTAL:



Point A (131MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.4

VERTICAL:



Point B (131MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.0

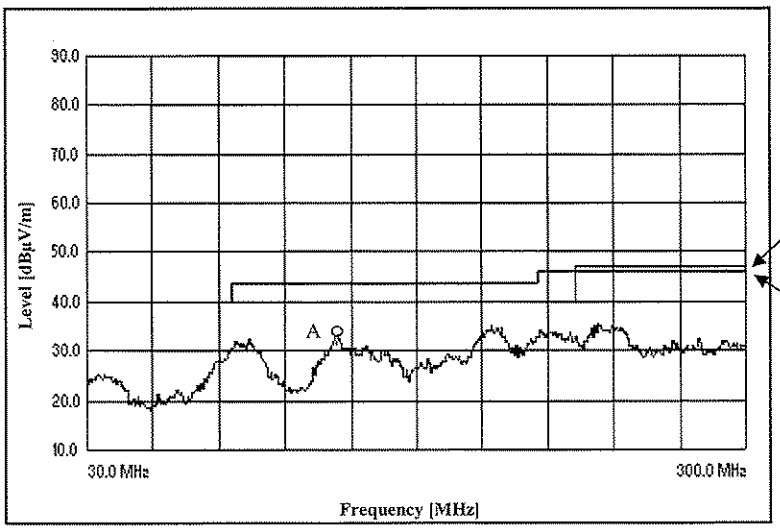
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

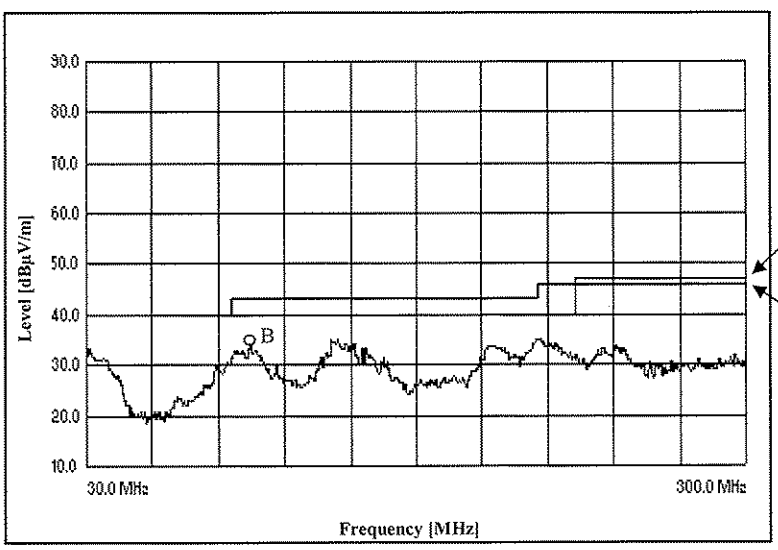
48V

HORIZONTAL:



Point A (131MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	34.8

VERTICAL:



Point B (98MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	35.1

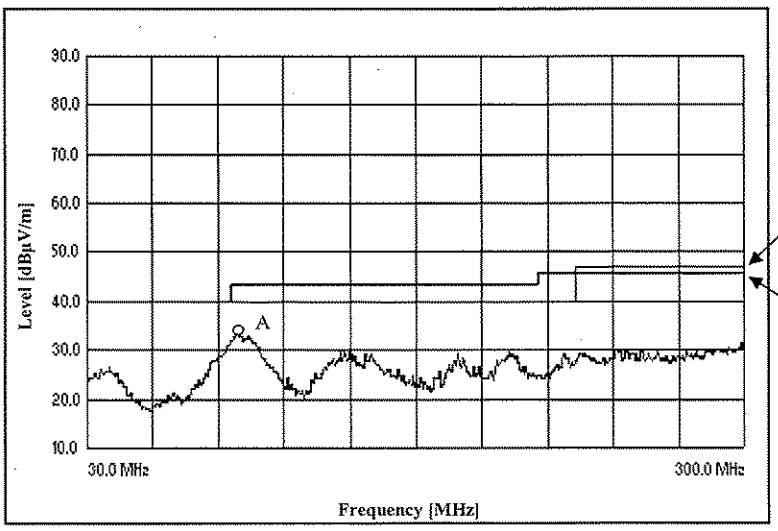
2.15 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

48V

HORIZONTAL:

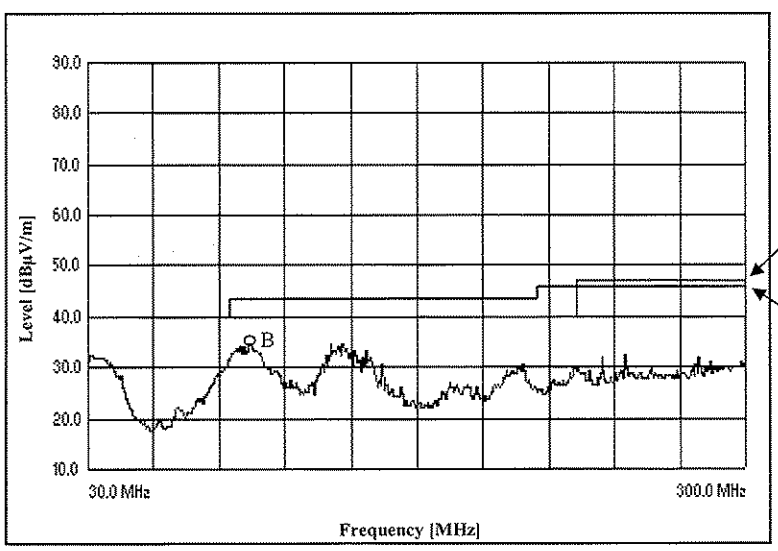


EN55011-B
EN55022-B
QP Limit

FCC Class B
QP Limit

Point A (91.4MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	33.1

VERTICAL:



EN55011-B
EN55022-B
QP Limit

FCC Class B
QP Limit

Point B (96MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	34.7