

CUS200M

EVALUATION DATA

DWG No. CA811-53-01		
APPD	CHK	DWG
Wang YQ 22-Jan-'16	Wang HL 22-Jan-'16	Zhang Bc 22-Jan-'16

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Terminology used

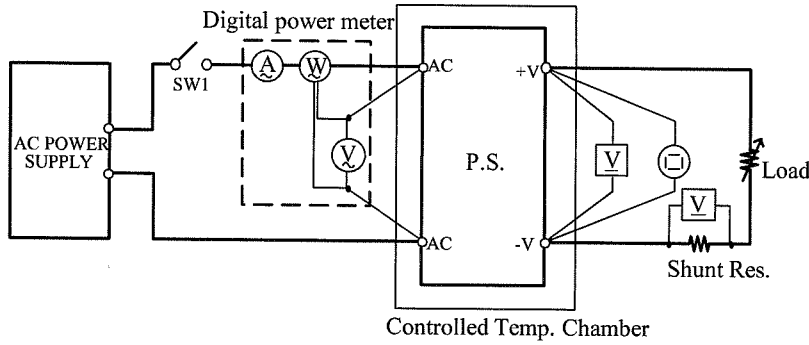
	Definition
V_{in} Input voltage
V_{out} Output voltage
I_{in} Input current
I_{out} Output current
T_a Ambient temperature
f Frequency

1. Evaluation Method

1.1 Circuit used for determination

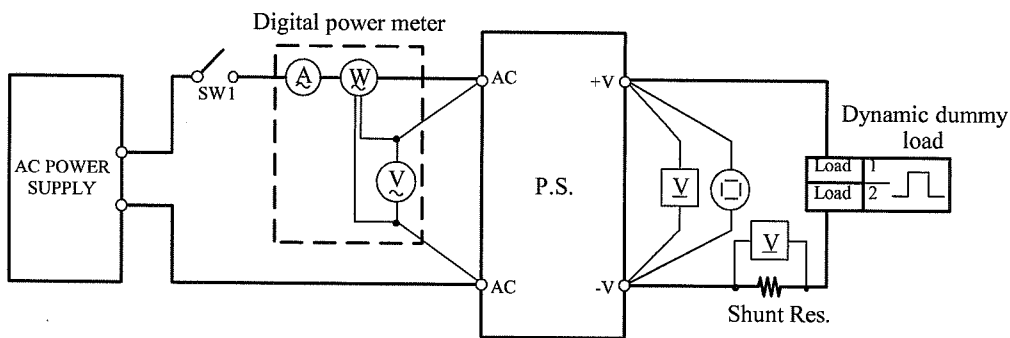
Circuit 1 used for determination

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

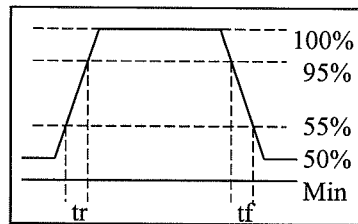


Circuit 2 used for determination

- Dynamic load response characteristics

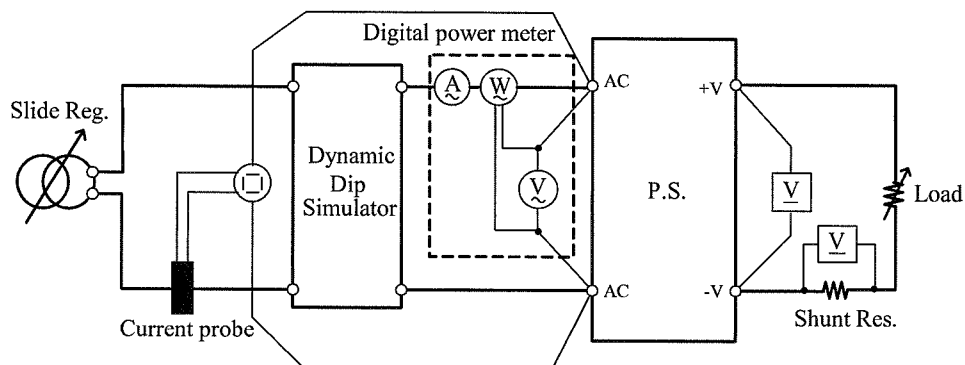


Output current waveform



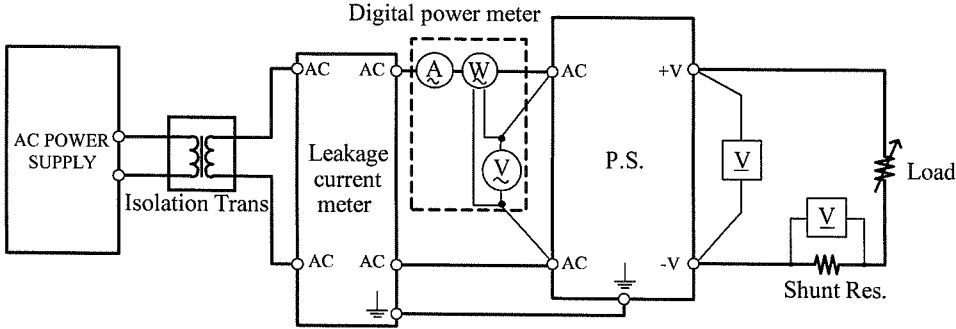
Circuit 3 used for determination

- Inrush current waveform



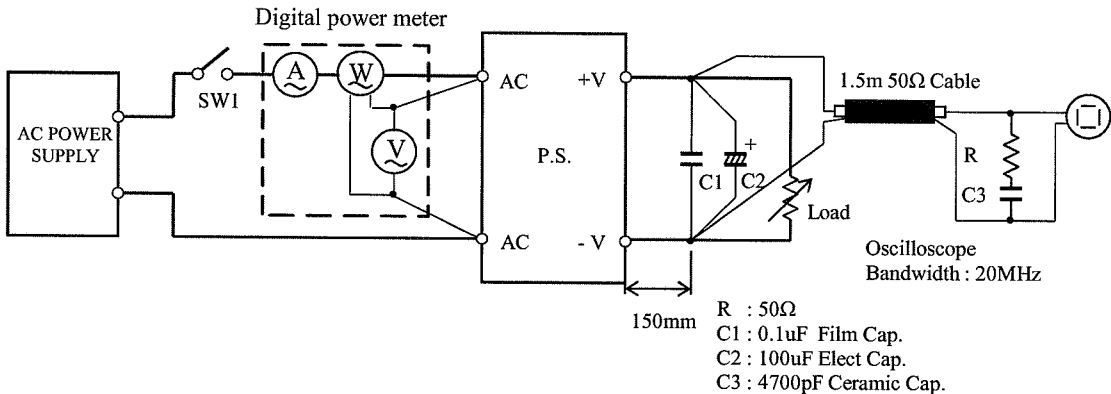
Circuit 4 used for determination

- Leakage current characteristics



Circuit 5 used for determination

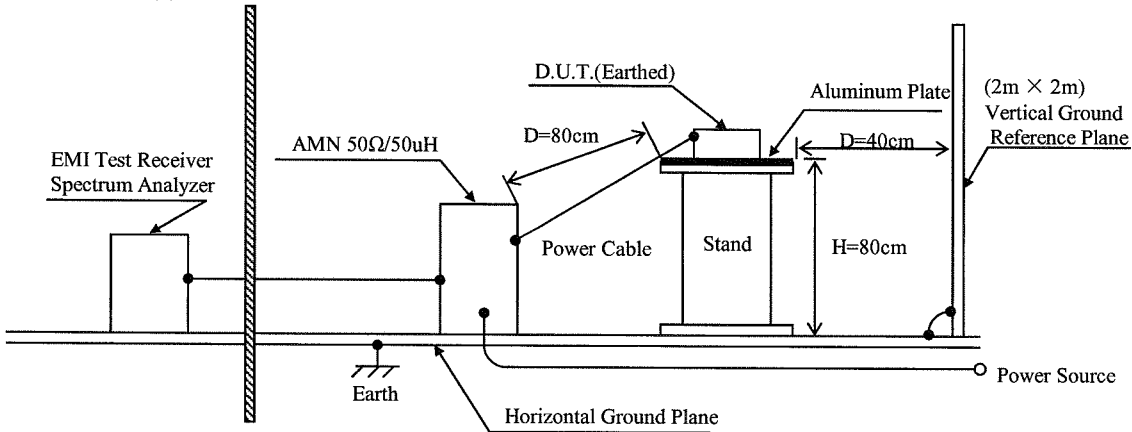
- Output ripple and noise waveform



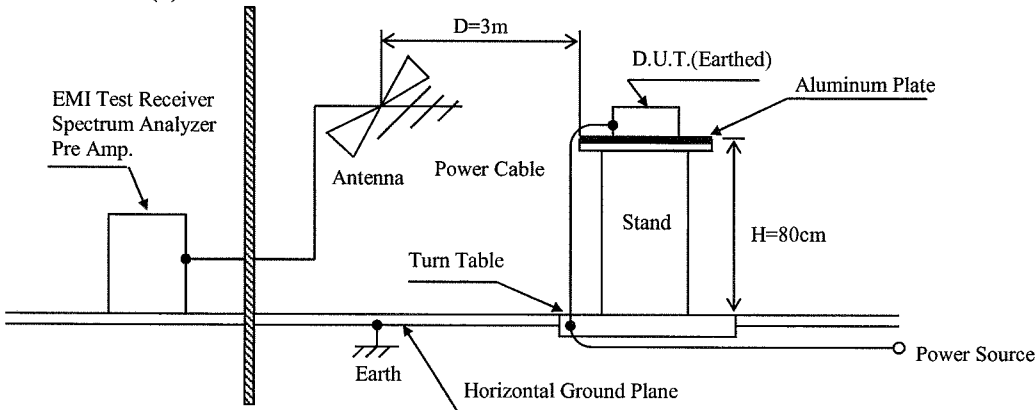
Configuration used for determination

- Electro-Magnetic Interference characteristics

(a) Conducted Emission



(b) Radiated Emission



1.2 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DLM2054
2	DIGITAL MULTIMETER	FLUKE	111
3	DIGITAL POWER METER	YOKOGAWA ELECT.	WT210
4	CURRENT PROBE	YOKOGAWA ELECT.	701932
5	DYNAMIC DUMMY LOAD	CHROMA	63201
6	CVCF	KIKUSUI	PCR2000LE
7	LEAKAGE CURRENT METER	SIMPSON	228
8	CONTROLLED TEMP. CHAMBER	TABAI-ESPEC	SH-661
9	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESCI-03
10	LISN	ROHDE & SCHWARZ	ENV216
11	BICONICAL ANTENNA	EMCO	63208

2.1 Steady state data

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

12V

1. Regulation - line and load

Condition Ta : 25°C
Istandby : 0A

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0A (0%)	12.006V	12.007V	12.008V	12.008V	2mV	0.017%
8.35A (50%)	12.001V	12.001V	12.001V	12.001V	0mV	0.000%
16.7A (100%)	-	11.994V	11.993V	11.993V	1mV	0.008%
Load regulation	5mV	13mV	15mV	15mV		
	0.042%	0.108%	0.125%	0.125%		

2. Temperature drift

Conditions Iout : 16.7A (100%)
Istandby : 0A

	Vin \ Ta	-20°C	+25°C	+50°C	Temperature stability	
Vout	115VAC	11.982V	11.994V	11.983V	12mV	0.100%
	230VAC	11.982V	11.993V	11.983V	11mV	0.092%

3. Start up voltage and Drop out voltage

Conditions Ta : 25°C
Iout : 16.7A (100%)
Istandby : 0A

Start up voltage (Vin)	79VAC
Drop out voltage (Vin)	76VAC

18V

1. Regulation - line and load

Condition Ta : 25°C
Istandby : 0A

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0A (0%)	18.005V	18.007V	18.009V	18.008V	4mV	0.022%
5.6A (50%)	18.001V	18.000V	18.000V	18.000V	1mV	0.006%
11.2A (100%)	-	17.998V	17.998V	17.998V	0mV	0.000%
Load regulation	4mV	9mV	11mV	10mV		
	0.022%	0.050%	0.061%	0.056%		

2. Temperature drift

Conditions Iout : 11.2A (100%)
Istandby : 0A

	Vin \ Ta	-20°C	+25°C	+50°C	Temperature stability	
Vout	115VAC	17.945V	17.998V	17.966V	53mV	0.294%
	230VAC	17.945V	17.998V	17.966V	53mV	0.294%

3. Start up voltage and Drop out voltage

Conditions Ta : 25°C
Iout : 11.2A (100%)
Istandby : 0A

Start up voltage (Vin)	79VAC
Drop out voltage (Vin)	76VAC

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

24V

1. Regulation - line and load

Condition Ta : 25°C
Istandby : 0A

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0A (0%)	24.027V	24.028V	24.027V	24.027V	1mV	0.004%
4.2A (50%)	24.019V	24.020V	24.019V	24.019V	1mV	0.004%
8.4A (100%)	-	24.020V	24.020V	24.020V	0mV	0.000%
Load regulation	8mV	8mV	8mV	8mV		
	0.033%	0.033%	0.033%	0.033%		

2. Temperature drift

Conditions Iout : 8.4A (100%)
Istandby : 0A

	Vin \ Ta	-20°C	+25°C	+50°C	Temperature stability	
Vout	115VAC	23.937V	24.020V	23.991V	83mV	0.346%
	230VAC	23.937V	24.020V	23.992V	83mV	0.346%

3. Start up voltage and Drop out voltage

Conditions Ta : 25°C
Iout : 8.4A (100%)
Istandby : 0A

Start up voltage (Vin)	79VAC
Drop out voltage (Vin)	76VAC

48V

1. Regulation - line and load

Condition Ta : 25°C
Istandby : 0A

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0A (0%)	48.028V	48.027V	48.031V	48.026V	5mV	0.010%
2.1A (50%)	48.006V	48.006V	48.006V	48.006V	0mV	0.000%
4.2A (100%)	-	48.006V	48.006V	48.006V	0mV	0.000%
Load regulation	22mV	21mV	25mV	20mV		
	0.046%	0.044%	0.052%	0.042%		

2. Temperature drift

Conditions Iout : 4.2A (100%)
Istandby : 0A

	Vin \ Ta	-20°C	+25°C	+50°C	Temperature stability	
Vout	115VAC	47.786V	48.006V	47.996V	220mV	0.458%
	230VAC	47.785V	48.006V	47.996V	221mV	0.460%

3. Start up voltage and Drop out voltage

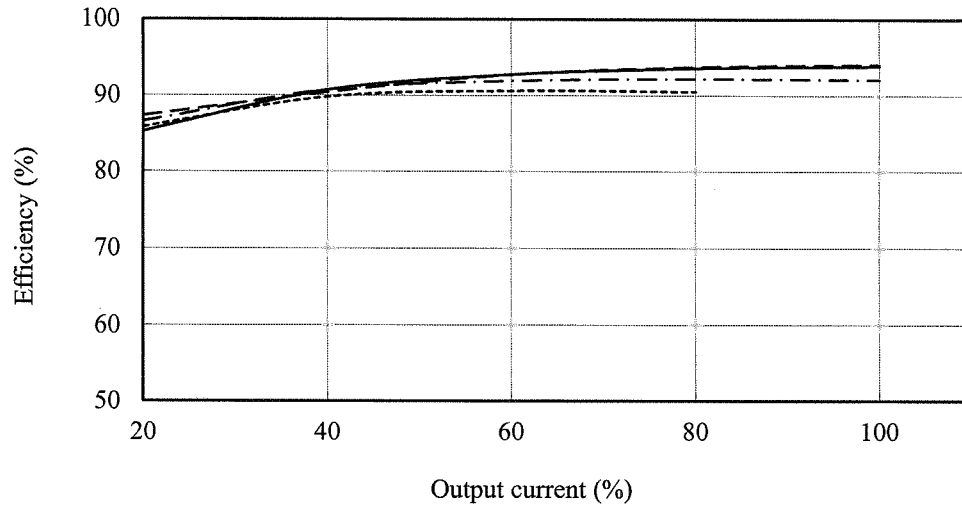
Conditions Ta : 25°C
Iout : 4.2A (100%)
Istandby : 0A

Start up voltage (Vin)	79VAC
Drop out voltage (Vin)	76VAC

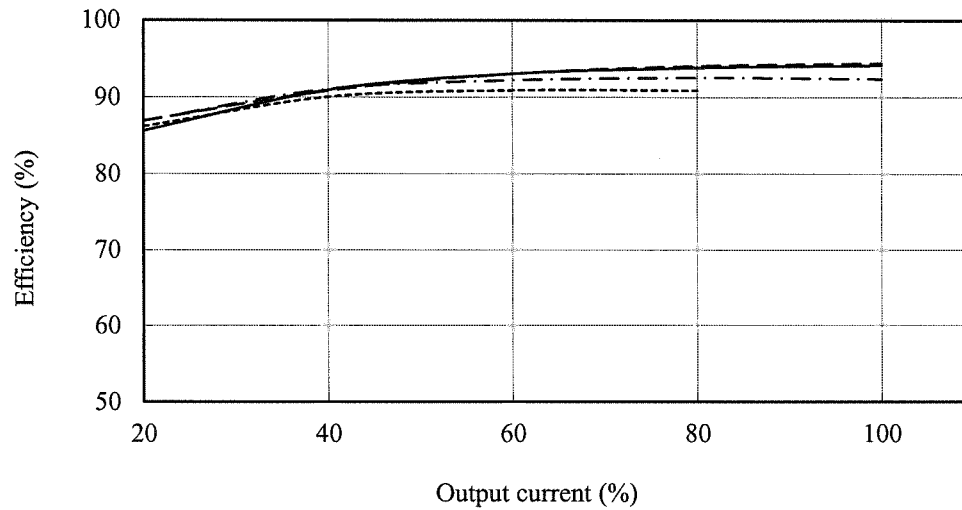
(2) Efficiency vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.-
 : 230 VAC ————
 : 265 VAC - - - -
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

12V



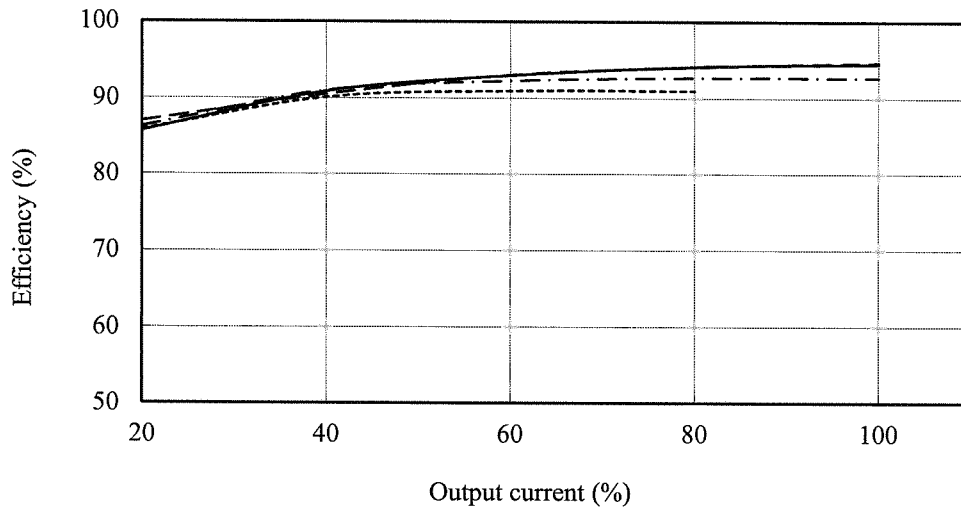
18V



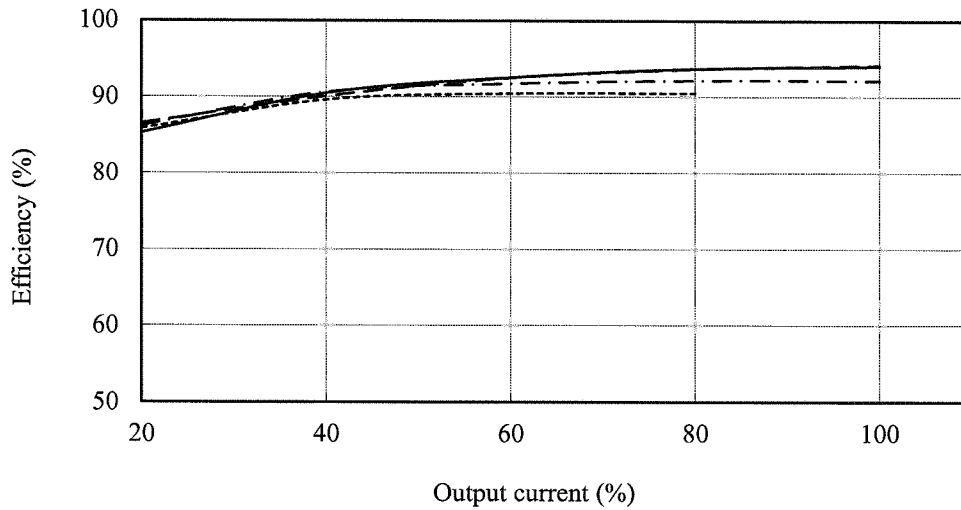
(2) Efficiency vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.-
 : 230 VAC ————
 : 265 VAC - - - -
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

24V



48V



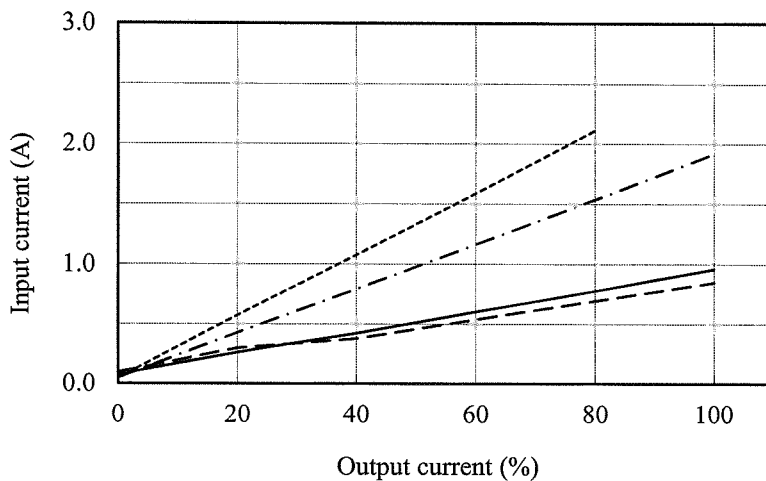
(3) Input current vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.-
 : 230 VAC ————
 : 265 VAC -.-.-.-
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

12V

Io: 0 A

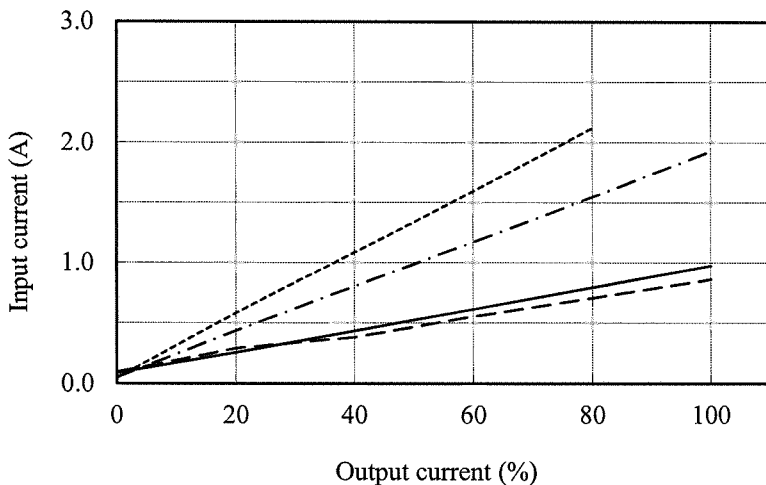
Vin	Input current
85VAC	0.046A
115VAC	0.049A
230VAC	0.077A
265VAC	0.096A



18V

Io: 0 A

Vin	Input current
85VAC	0.046A
115VAC	0.050A
230VAC	0.086A
265VAC	0.095A



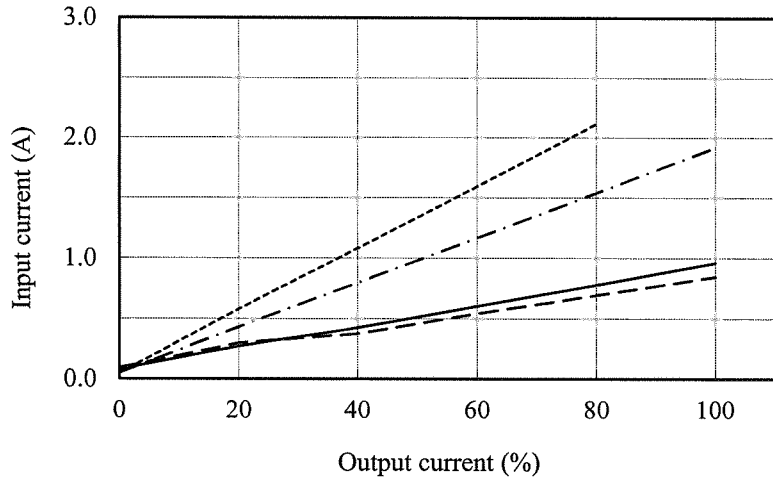
(3) Input current vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.-
 : 230 VAC ————
 : 265 VAC - - - -
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

24V

Io: 0 A

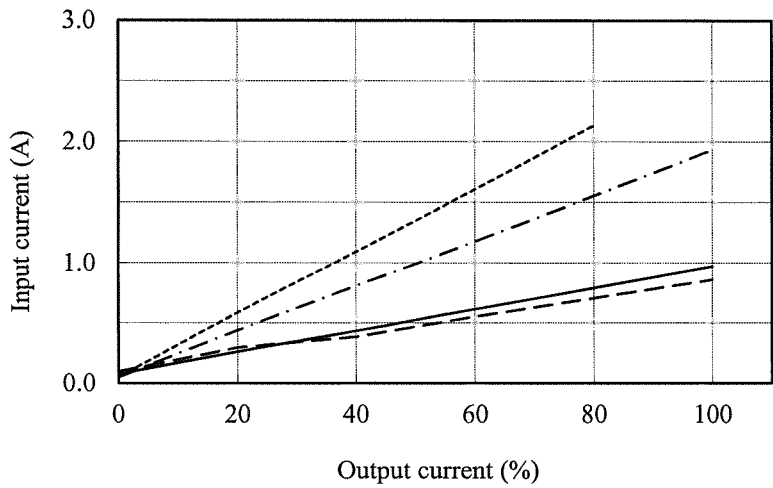
Vin	Input current
85VAC	0.047A
115VAC	0.050A
230VAC	0.080A
265VAC	0.095A



48V

Io: 0 A

Vin	Input current
85VAC	0.050A
115VAC	0.050A
230VAC	0.076A
265VAC	0.098A



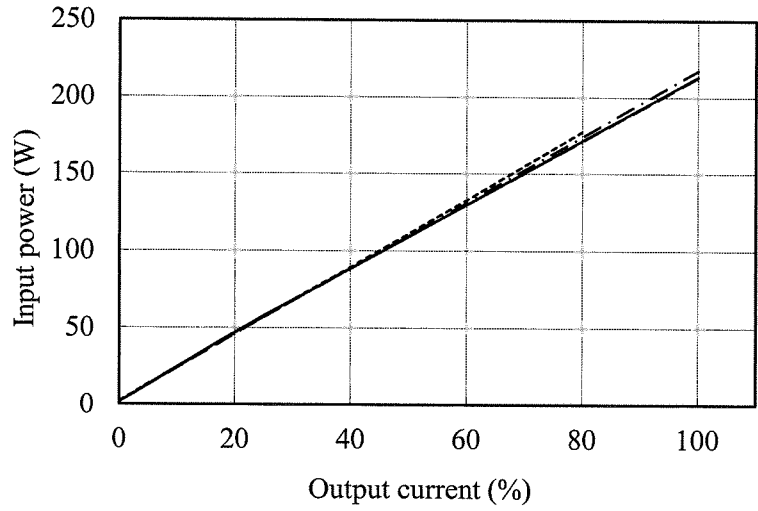
(4) Input power vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.
 : 230 VAC ———
 : 265 VAC - - - -
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

12V

Io: 0 A

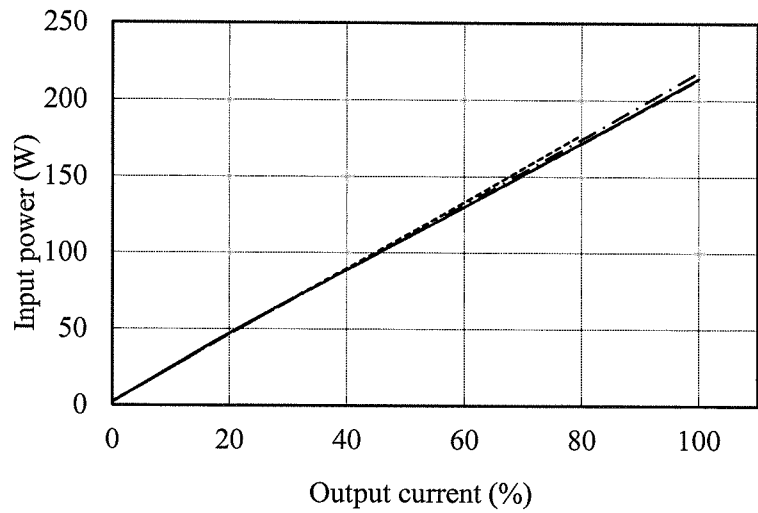
Vin	Input power
85VAC	2.18W
115VAC	1.82W
230VAC	1.62W
265VAC	1.78W



18V

Io: 0 A

Vin	Input power
85VAC	2.23W
115VAC	1.82W
230VAC	1.90W
265VAC	2.00W



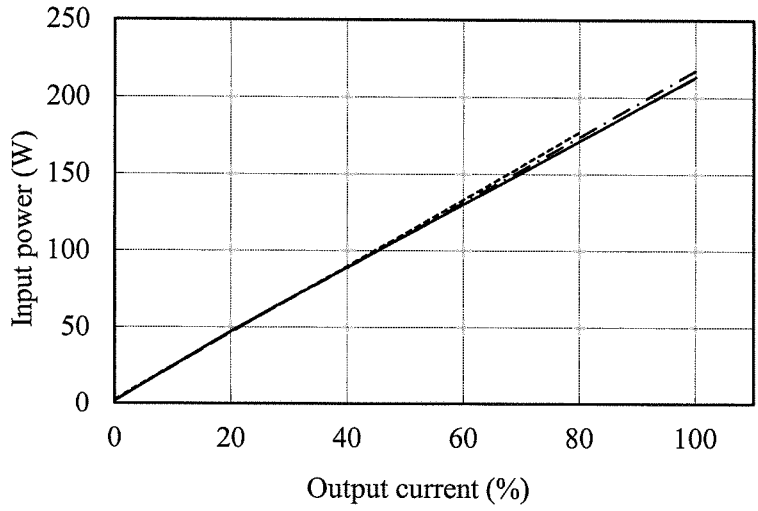
(4) Input power vs. Output current

Conditions Vin : 85 VAC -----
 : 115 VAC -.-.-.
 : 230 VAC ———
 : 265 VAC - - - -
 Ta : 25 °C
 Istandby : 0 A
 Cooling : Convection

24V

Io: 0 A

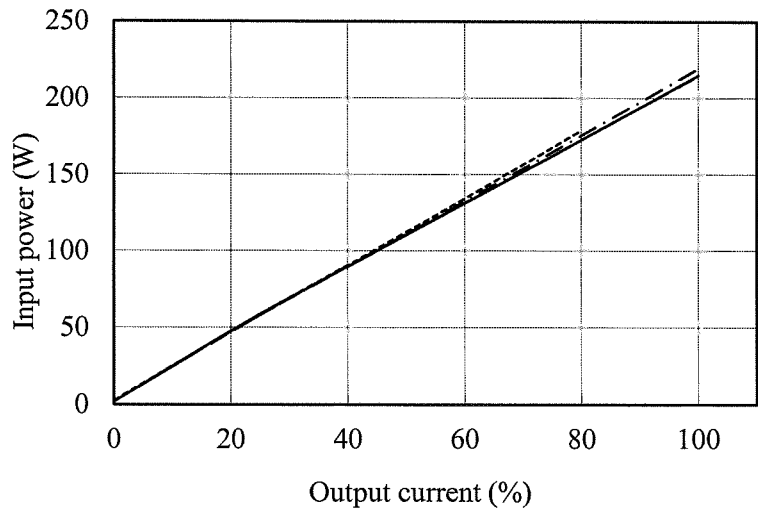
Vin	Input power
85VAC	2.41W
115VAC	1.78W
230VAC	1.60W
265VAC	1.80W



48V

Io: 0 A

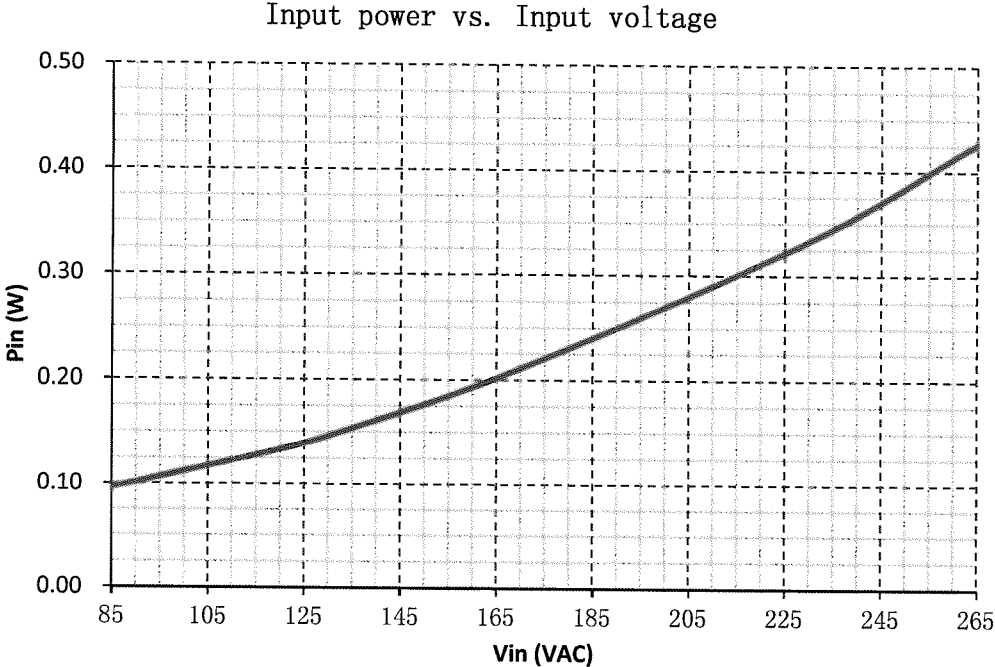
Vin	Input power
85VAC	2.62W
115VAC	1.92W
230VAC	1.80W
265VAC	2.00W



(5) Input power at Remote OFF state

Conditions Istandby : 0A
R- : 0V (Low level)
Ta : 25°C

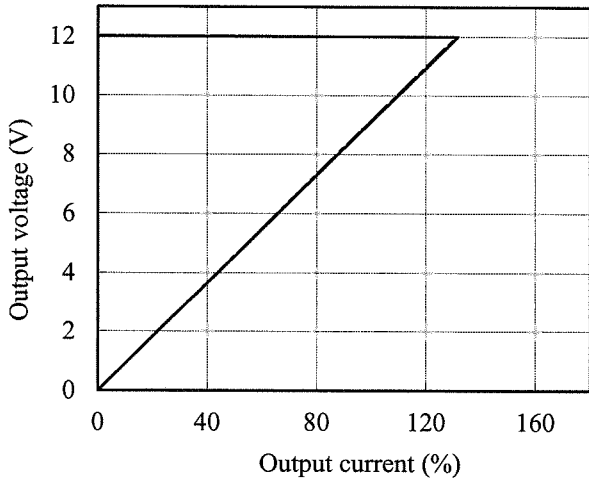
12V



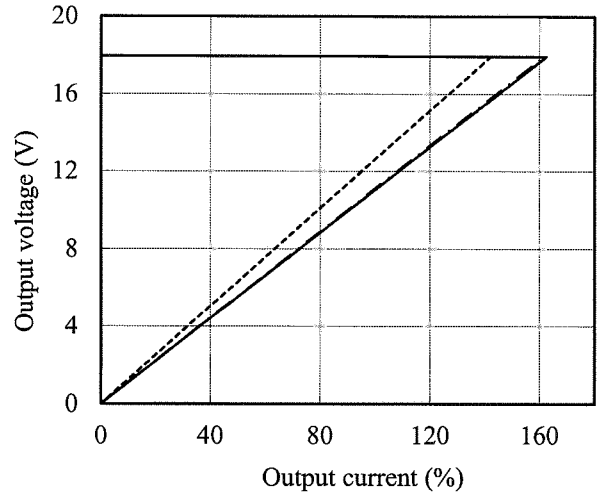
2.2 Over current protection (OCP) characteristics

Conditions Vin : 85 VAC -----
 115 VAC - - - - -
 230 VAC ———
 265 VAC - - - - -
 Istandby: 0 A
 Ta : 25 °C
 Cooling: Convection

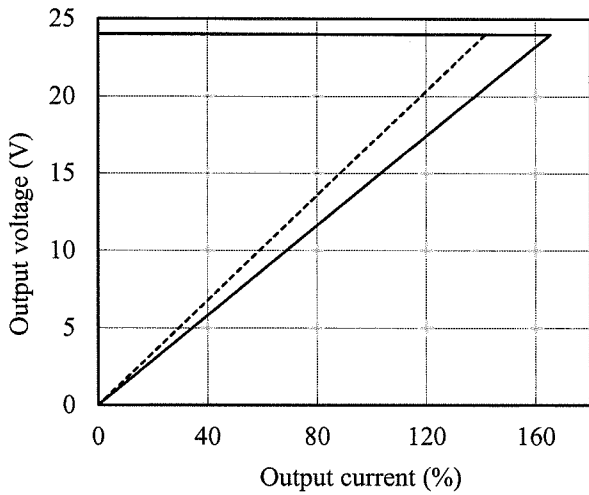
12V



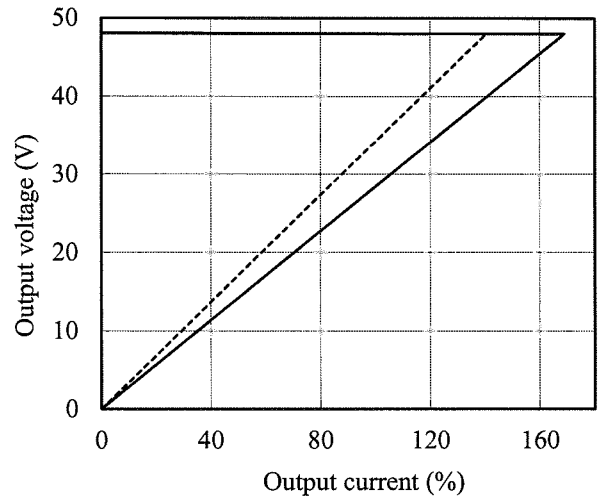
18V



24V

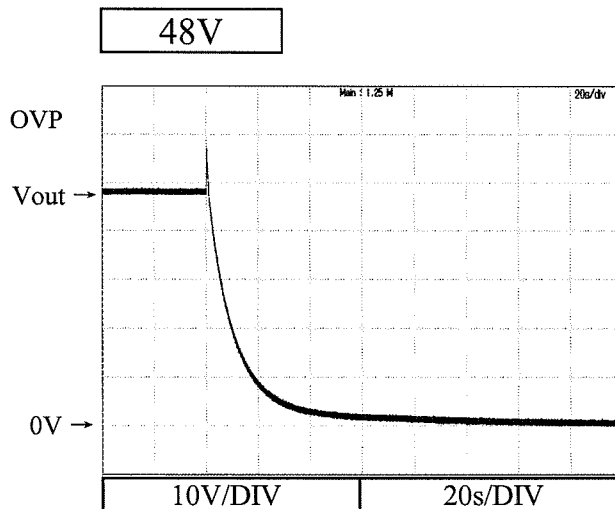
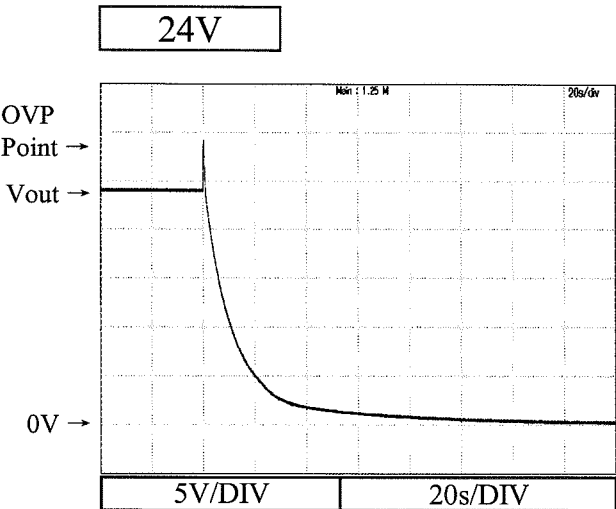
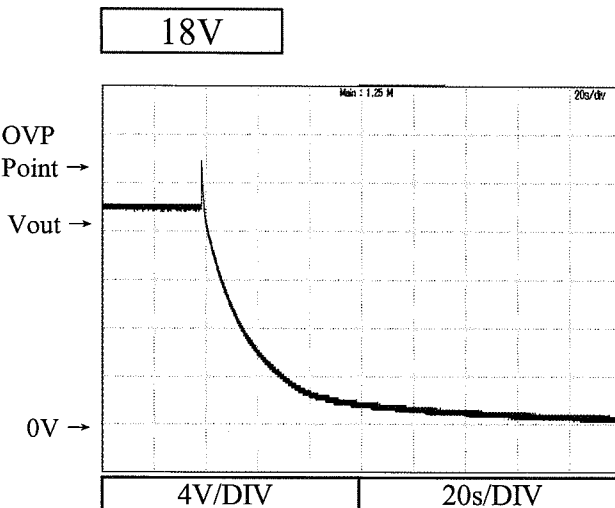
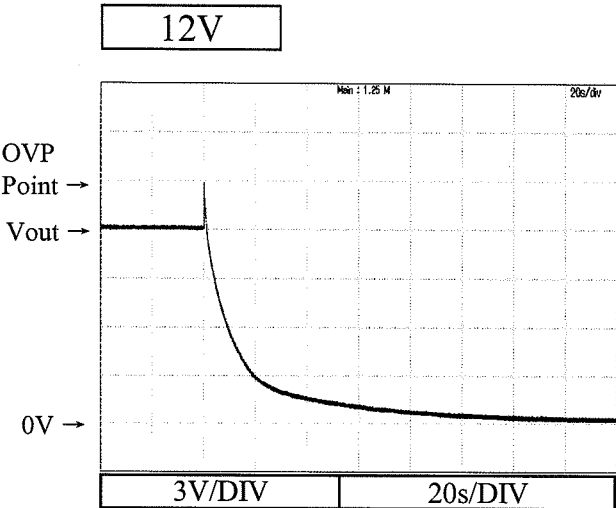


48V



2.3 Over voltage protection (OVP) characteristics

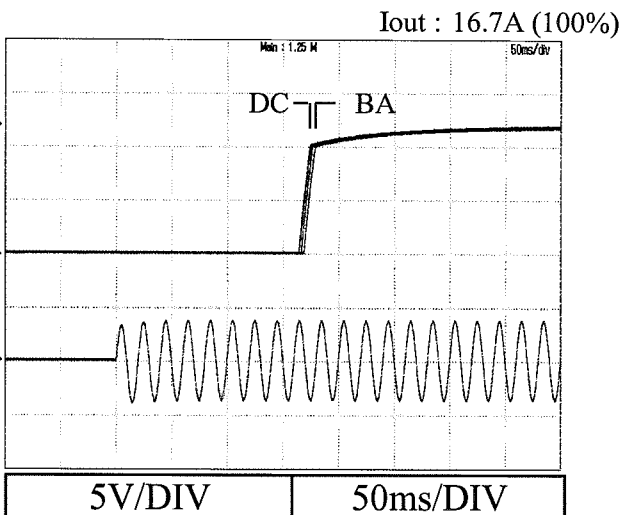
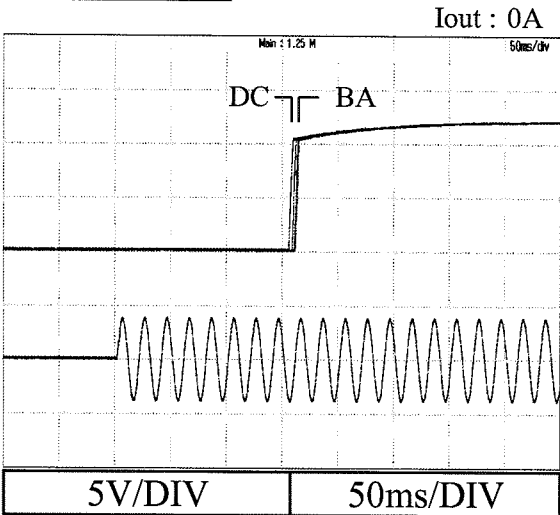
Conditions Vin : 115 VAC
Iout : 0 %
Ta : 25 °C



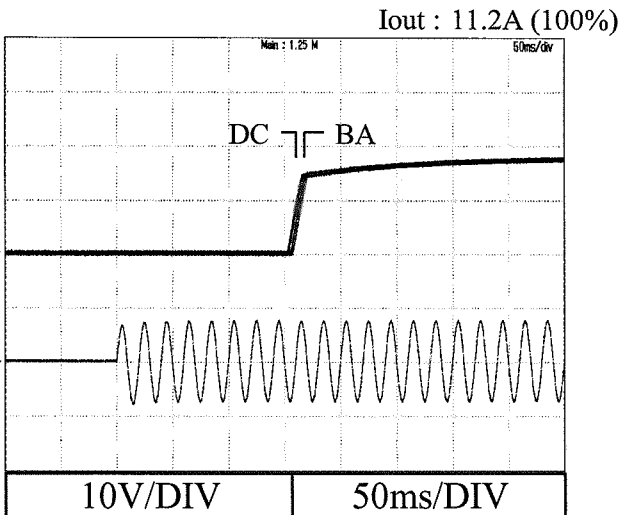
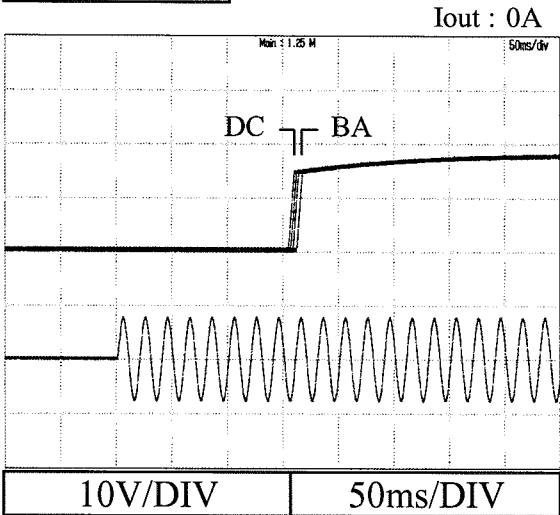
2.4 Output rise characteristics

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

12V



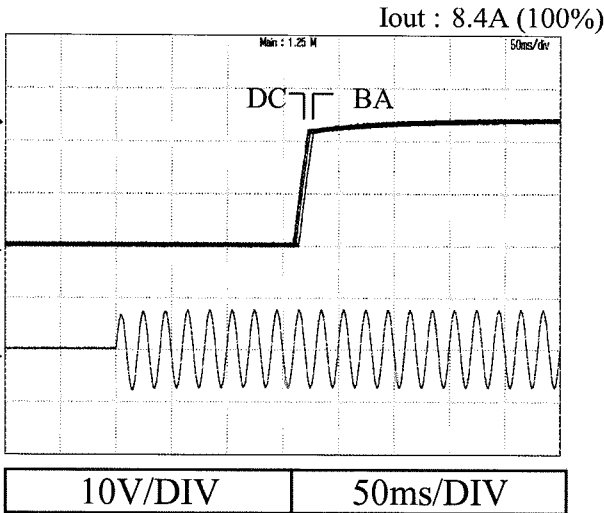
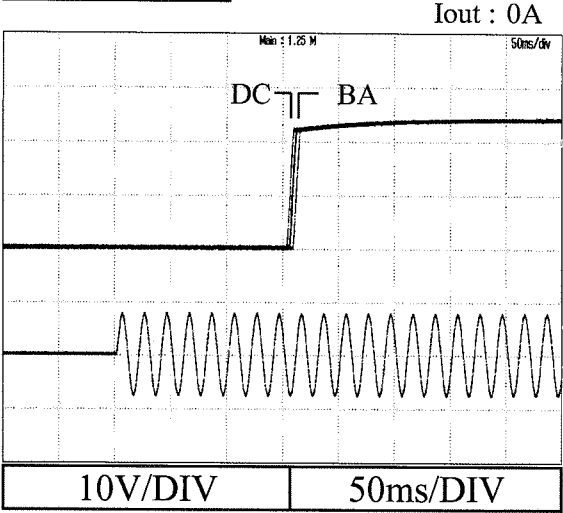
18V



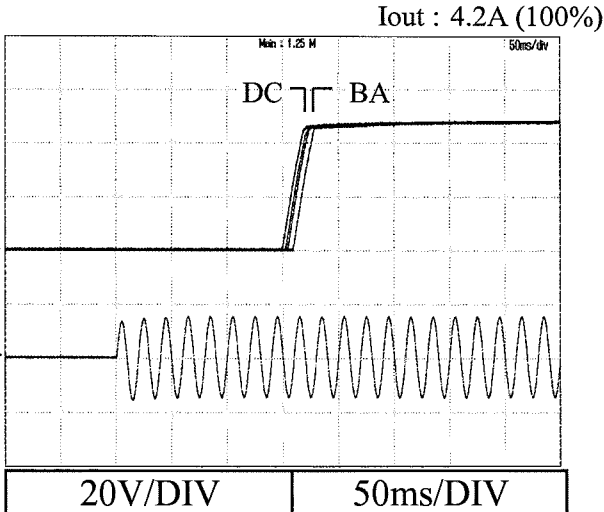
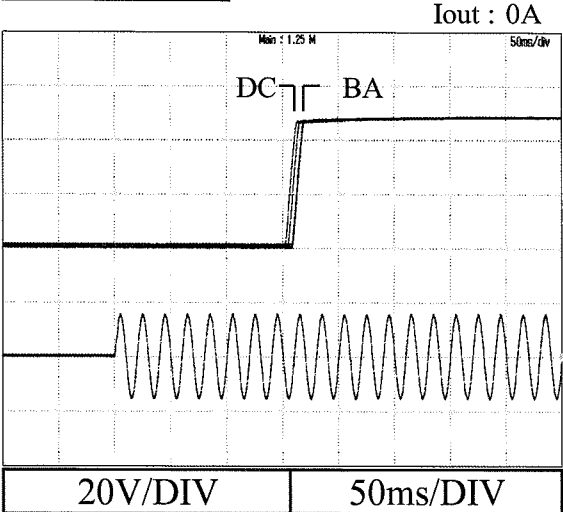
2.4 Output rise characteristics

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

24V



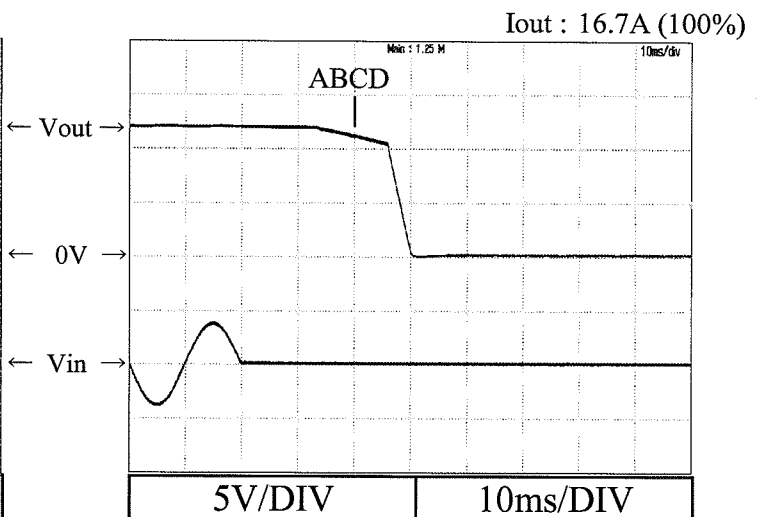
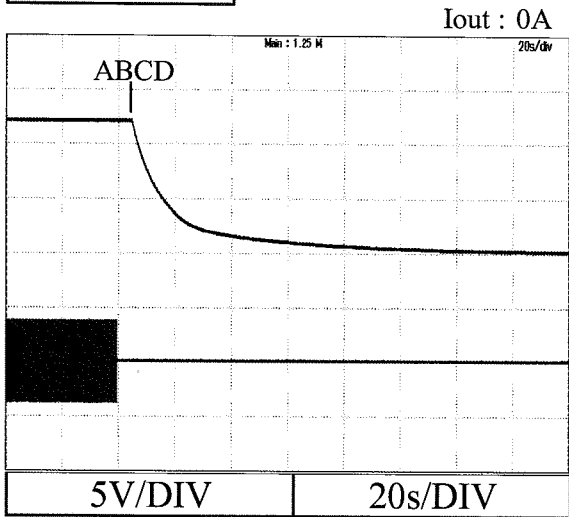
48V



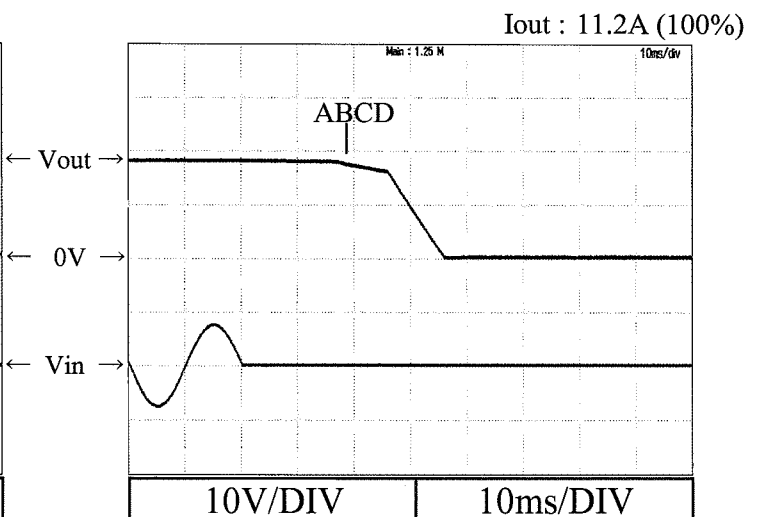
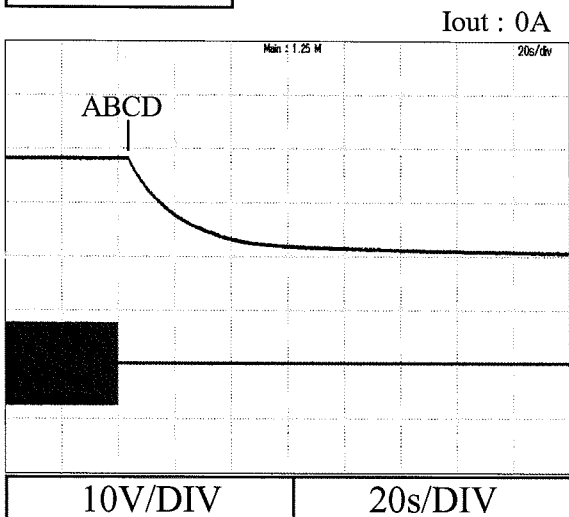
2.5 Output fall characteristics

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

12V



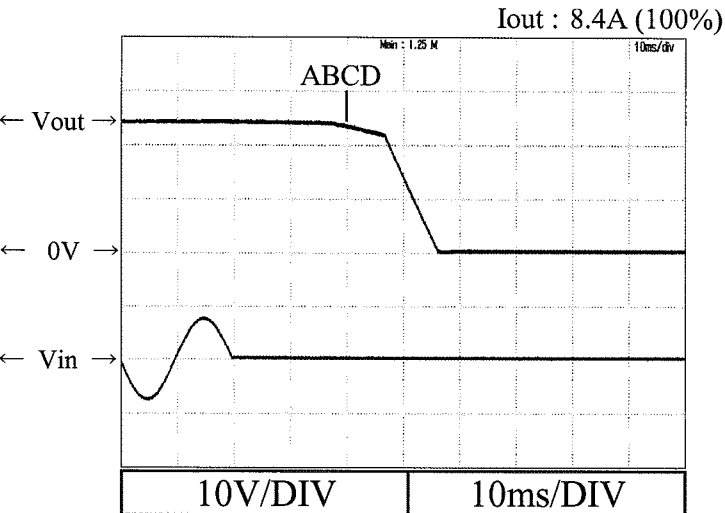
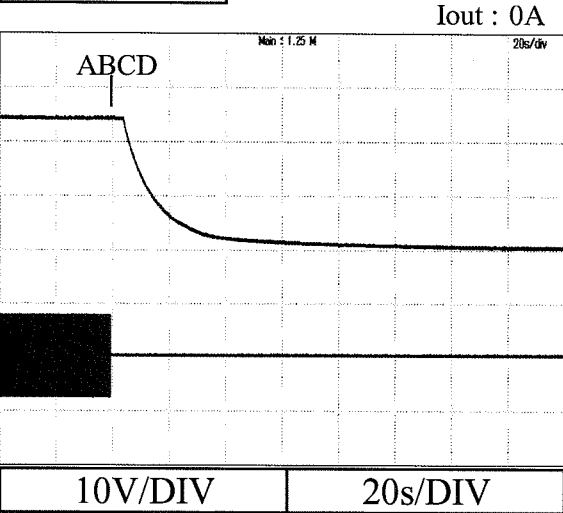
18V



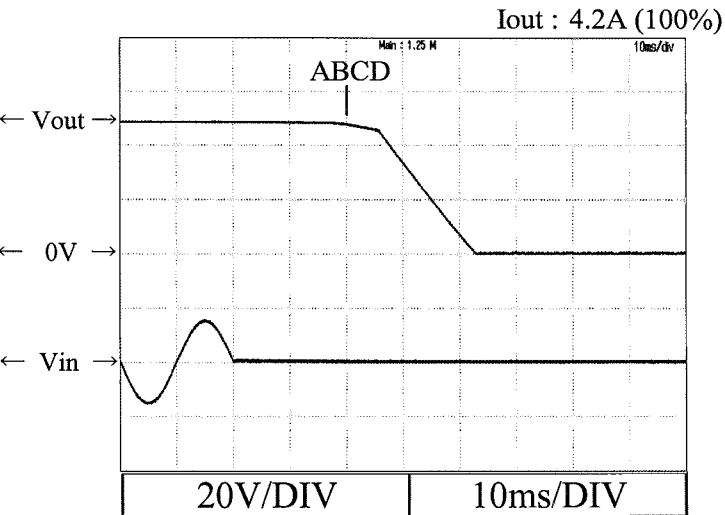
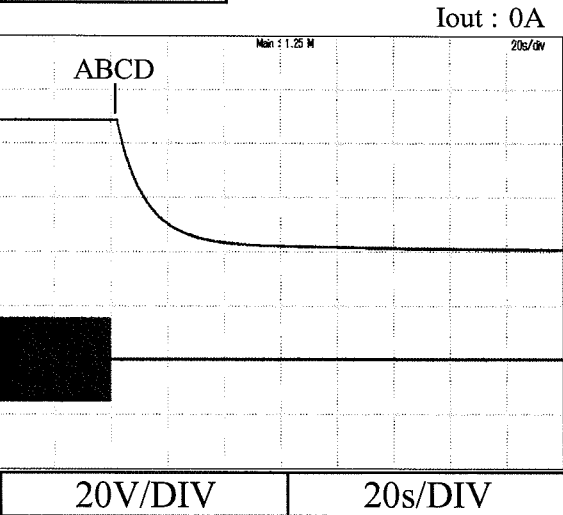
2.5 Output fall characteristics

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

24V



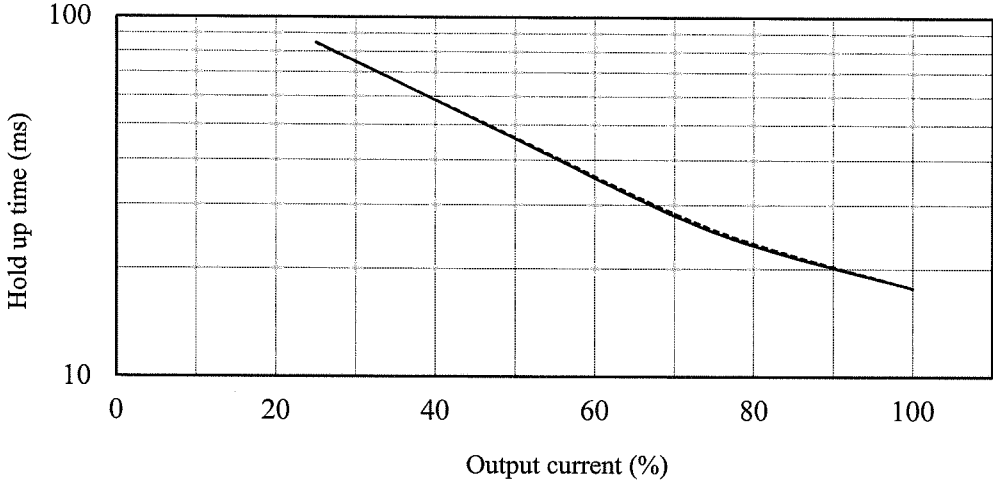
48V



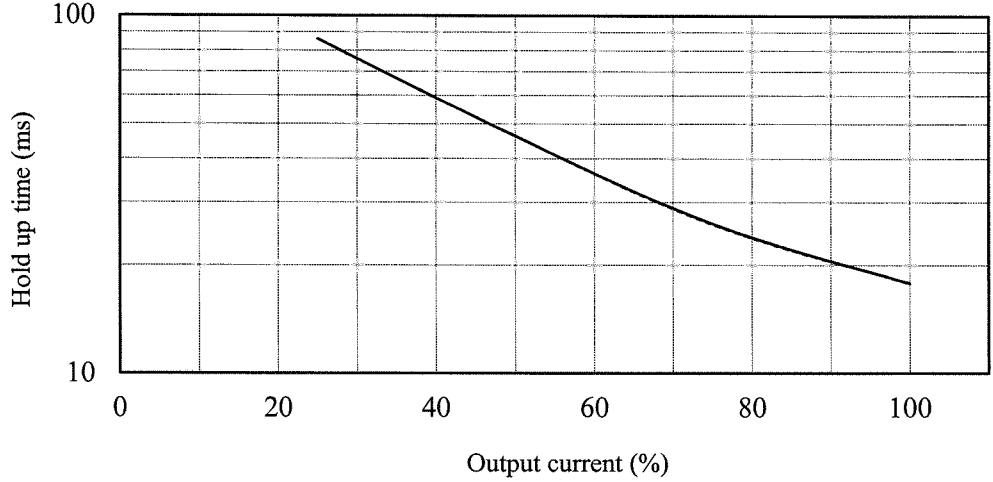
2.6 Hold up time characteristics

Conditions Vin : 115 VAC -----
 230 VAC ———
 Ta : 25 °C
 Istandby : 0 A

12V



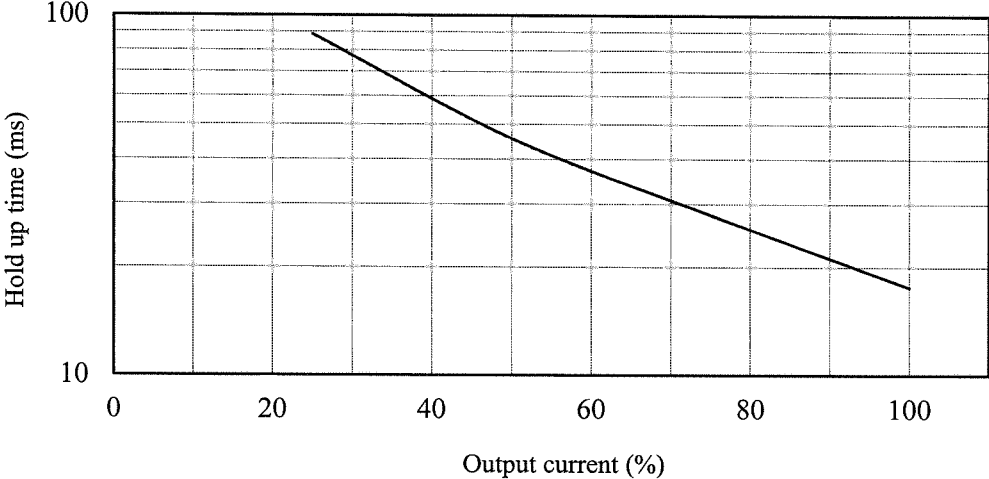
18V



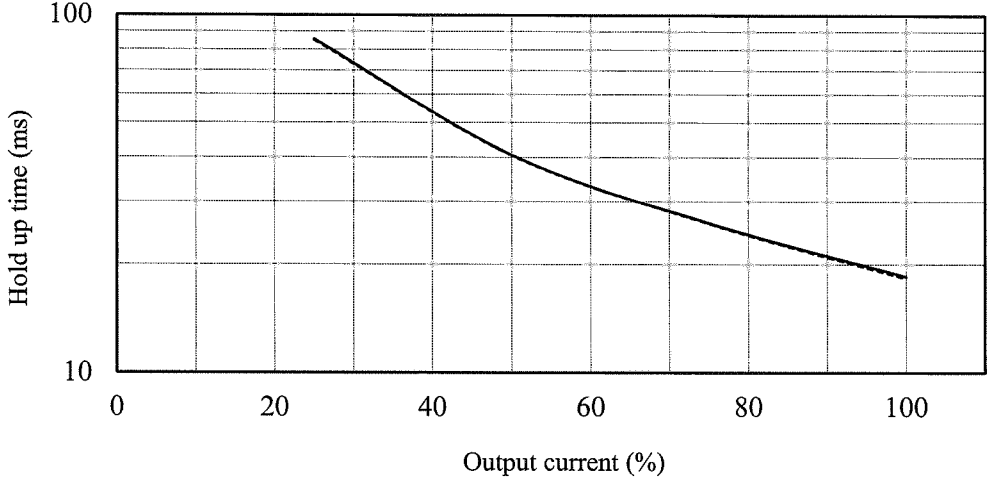
2.6 Hold up time characteristics

Conditions Vin : 115 VAC -----
 230 VAC —
 Ta : 25 °C
 Istandby : 0 A

24V

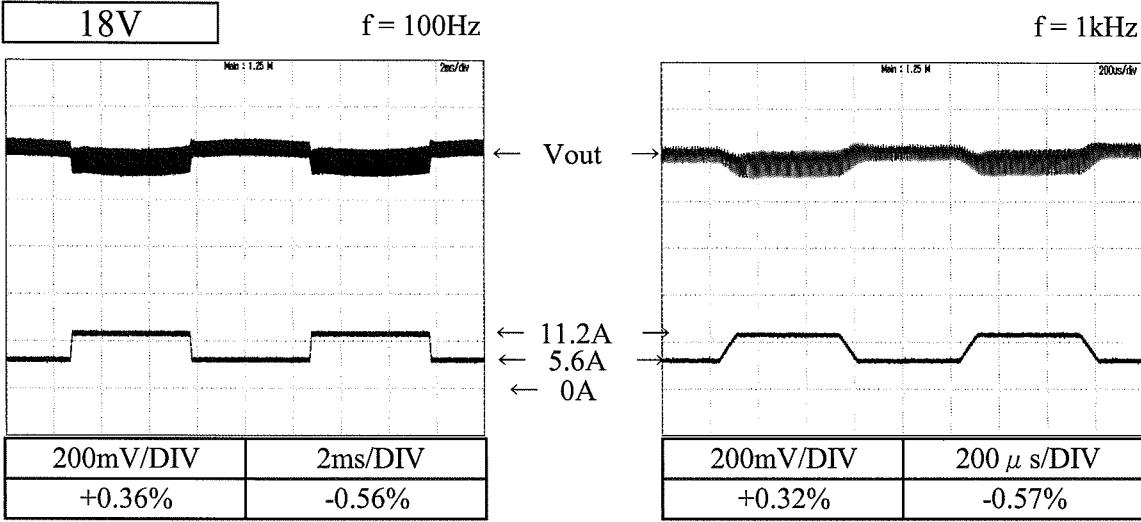
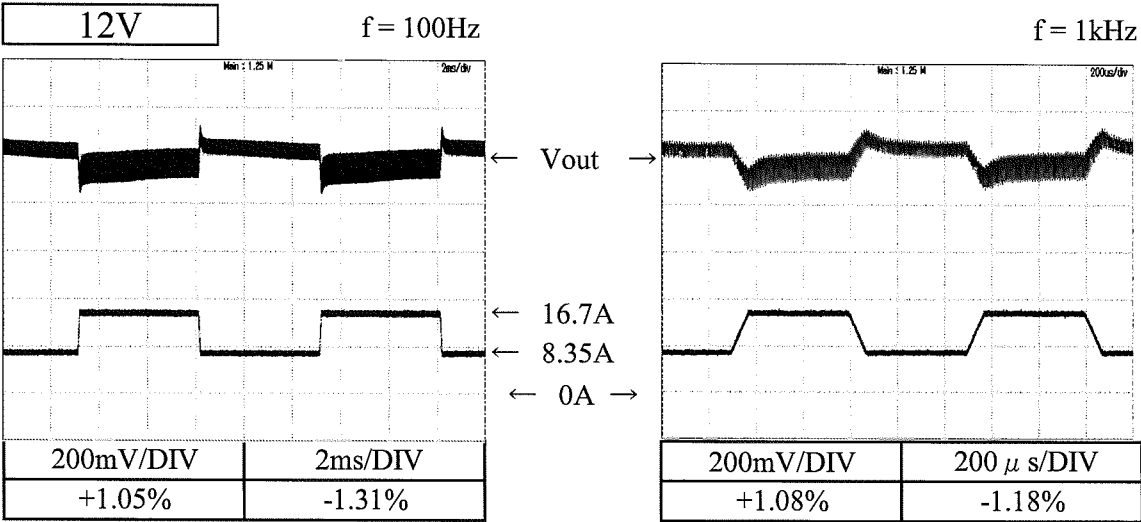


48V



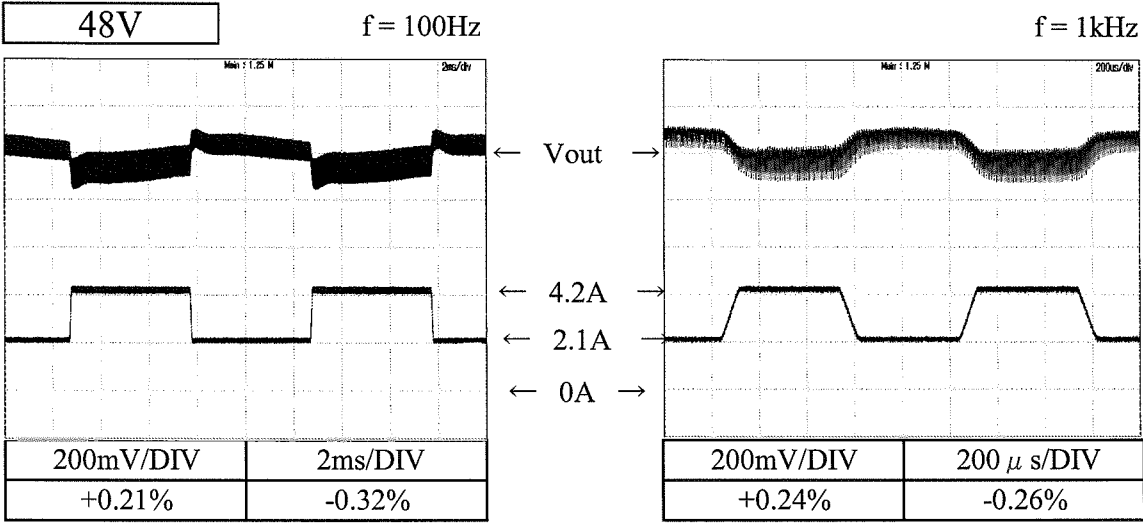
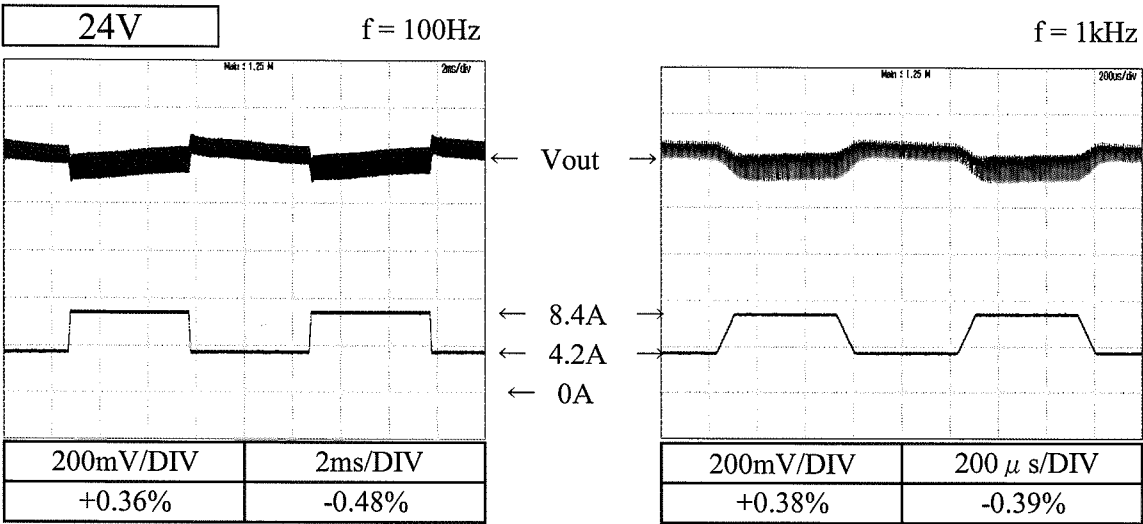
2.7 Dynamic load response characteristics

Conditions Vin : 115 VAC
 Iout : 50 % ↔ 100 %
 (tr = tf = 75us)
 Ta : 25 °C
 Istandby : 0 A



2.7 Dynamic load response characteristics

Conditions Vin : 115 VAC
 Iout : 50 % ↔ 100 %
 (tr = tf = 75us)
 Ta : 25 °C
 Istandby : 0 A



2.8 Response to brown out characteristics

Conditions: Iout : 100%
 Istandby : 0A
 Ta : 25°C
 Cooling : Convection

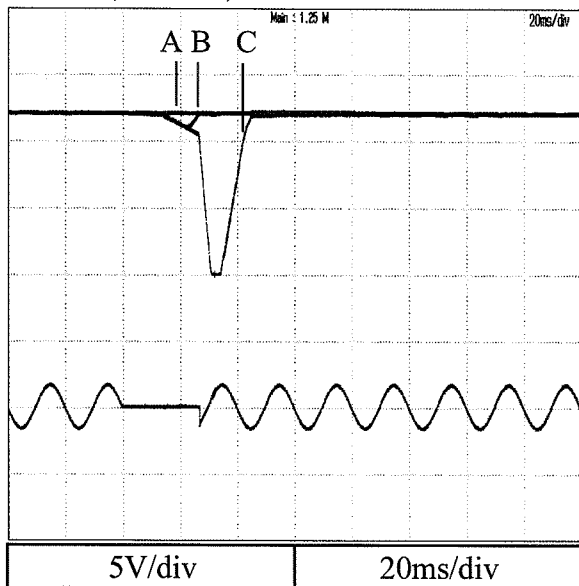
Interruption time

- A : Output voltage does not drop
- B : Output voltage drops down not reaching 0V
- C : Output voltage drops until 0V

12V

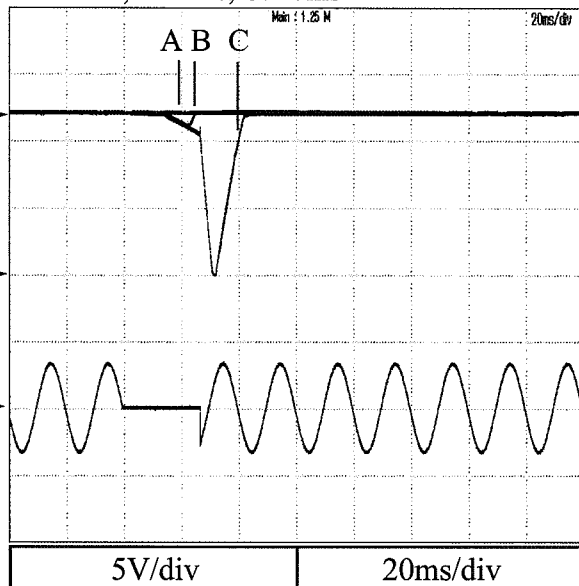
Vin :115VAC

A: 16ms, B: 22ms, C: 25ms



Vin :230VAC

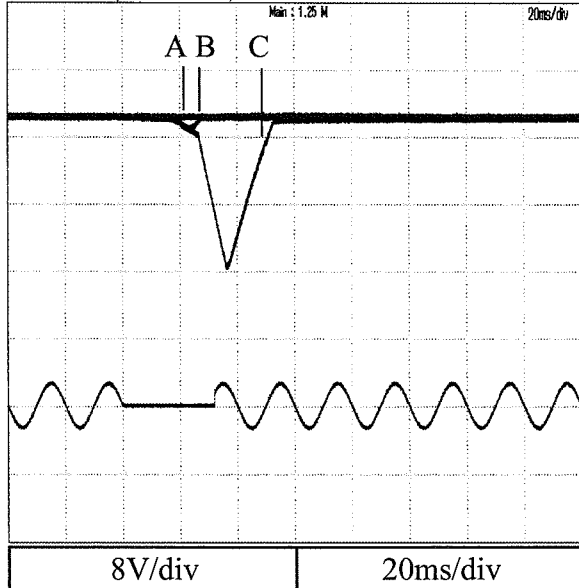
A: 16ms ,B: 22ms, C: 27ms



18V

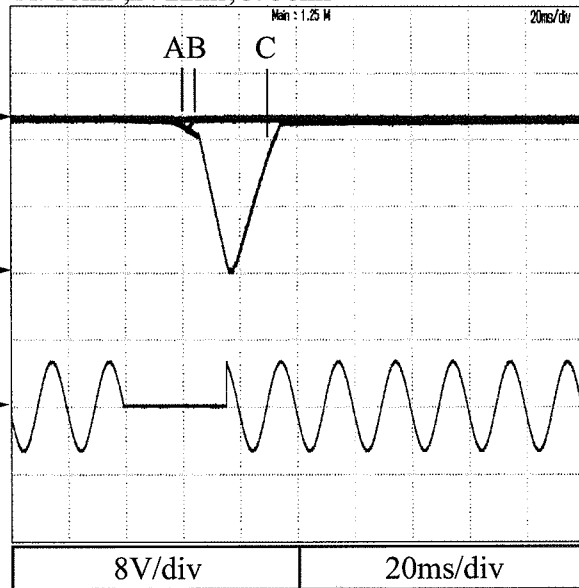
Vin :115VAC

A: 17ms, B: 22ms, C: 32ms



Vin :230VAC

A: 18ms ,B: 22ms,C: 36ms



2.8 Response to brown out characteristics

Interruption time

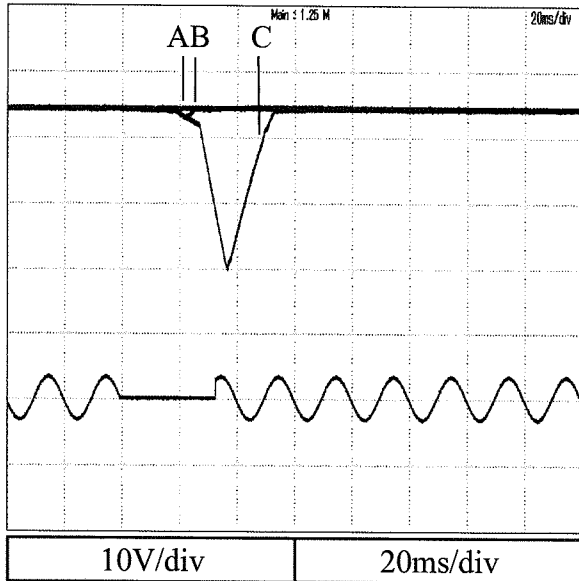
- A : Output voltage does not drop
- B : Output voltage drops down not reaching 0V
- C : Output voltage drops until 0V

Conditions: Iout : 100%
 Istandby : 0A
 Ta : 25°C
 Cooling : Convection

24V

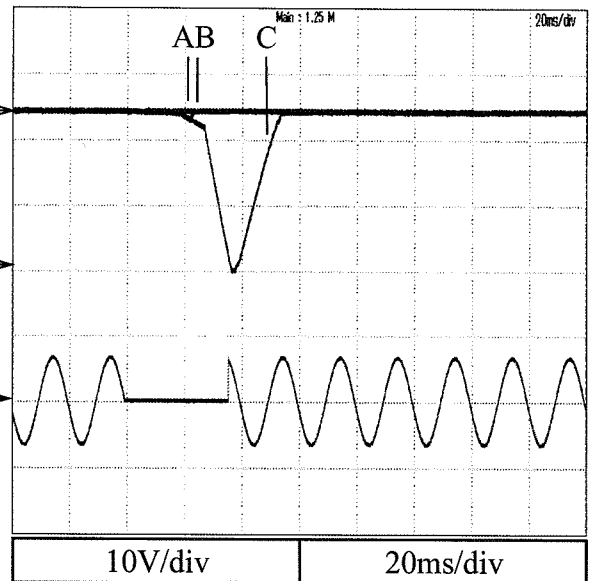
Vin :115VAC

A: 17ms, B: 22ms, C: 33ms



Vin :230VAC

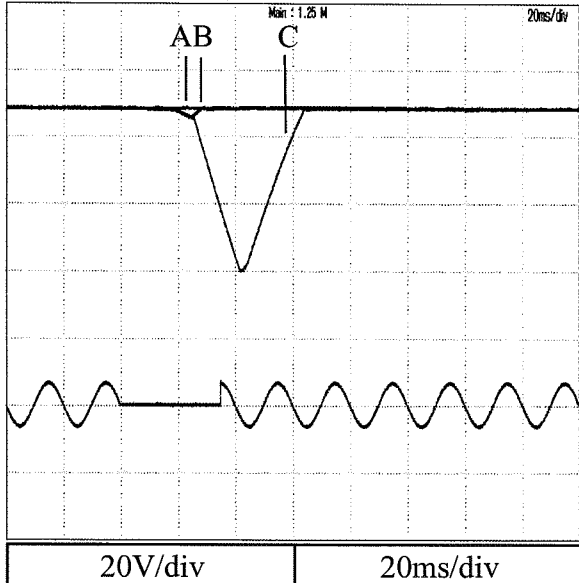
A: 18ms , B: 22ms, C: 36ms



48V

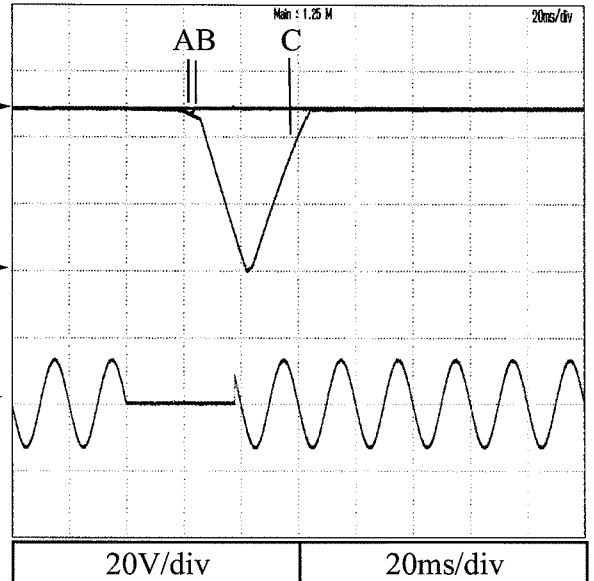
Vin :115VAC

A: 18ms, B: 22ms,C :34ms



Vin :230VAC

A: 18ms ,B: 22ms,C: 38ms

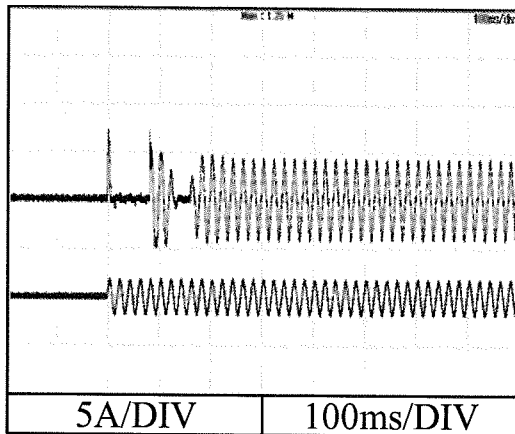


2.9 Inrush current waveform

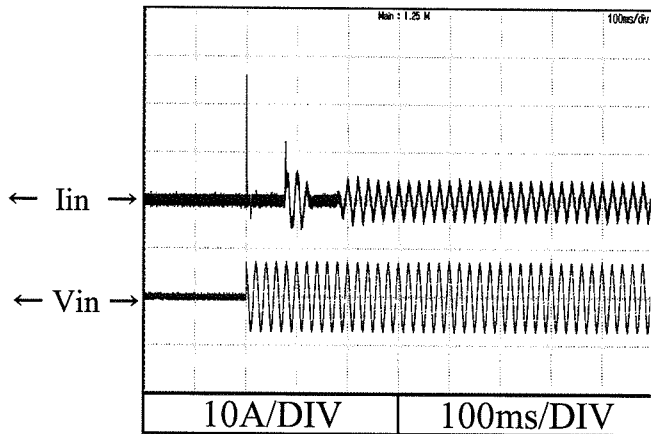
12V

Conditions V_{in} : 115 VAC
 I_{out} : 16.7A (100%)
 Istandby : 0 A
 T_a : 25 °C

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

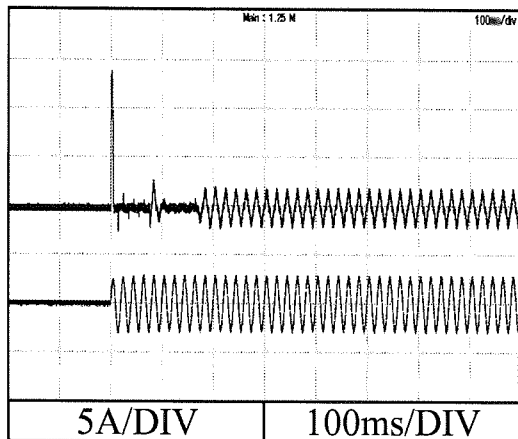


Switch on phase angle of input AC voltage
 $\phi = 90^\circ$

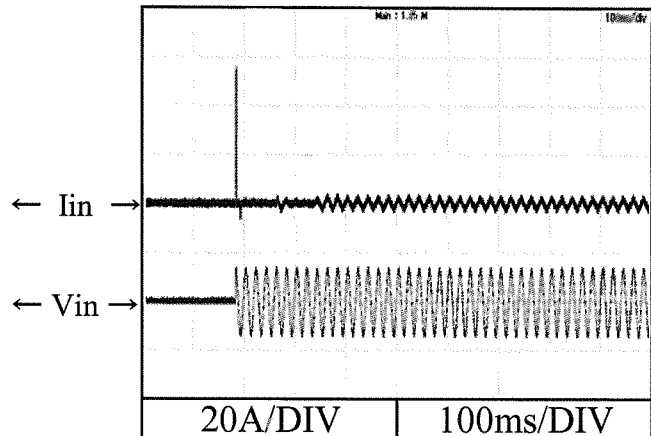


Conditions V_{in} : 230 VAC
 I_{out} : 16.7A (100%)
 Istandby : 0 A
 T_a : 25 °C

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

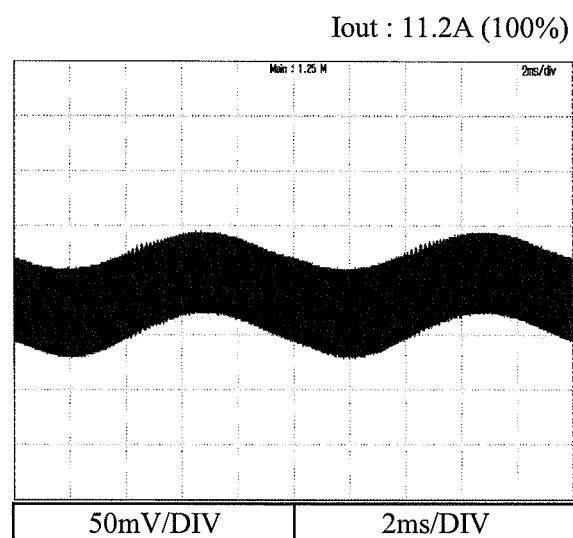
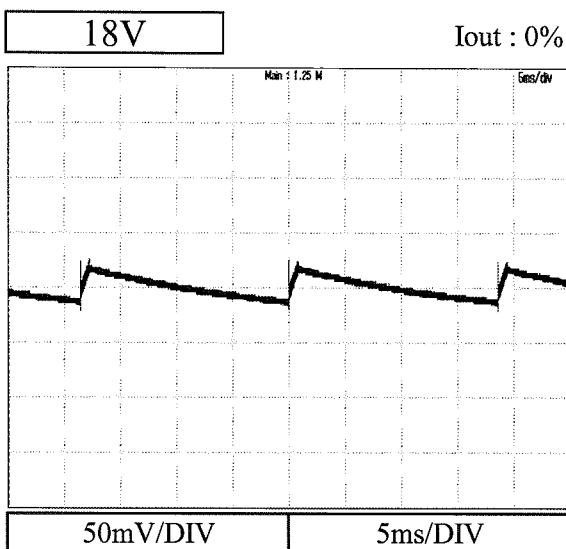
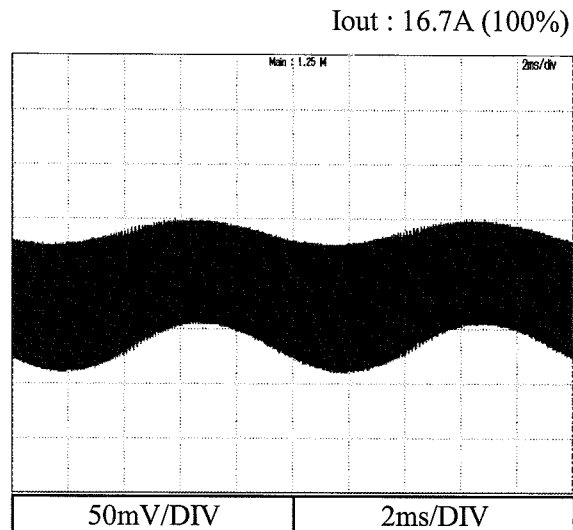
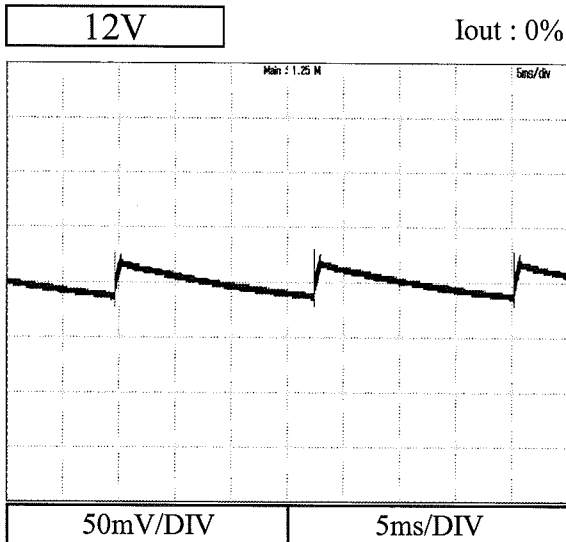


Switch on phase angle of input AC voltage
 $\phi = 90^\circ$



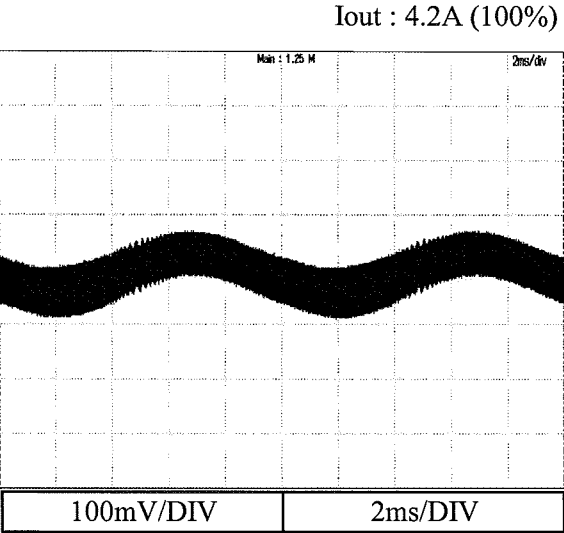
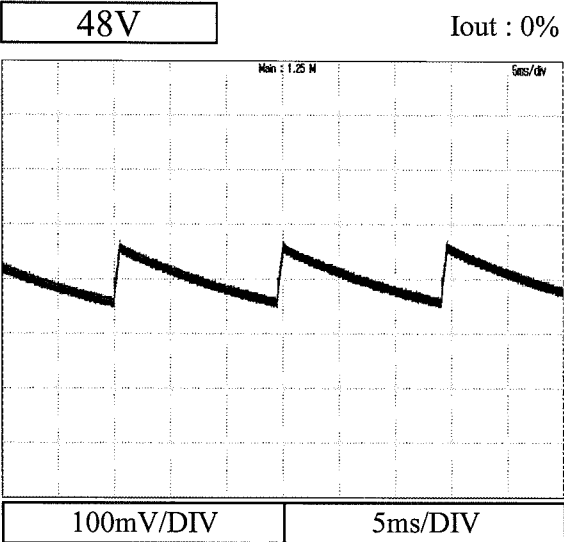
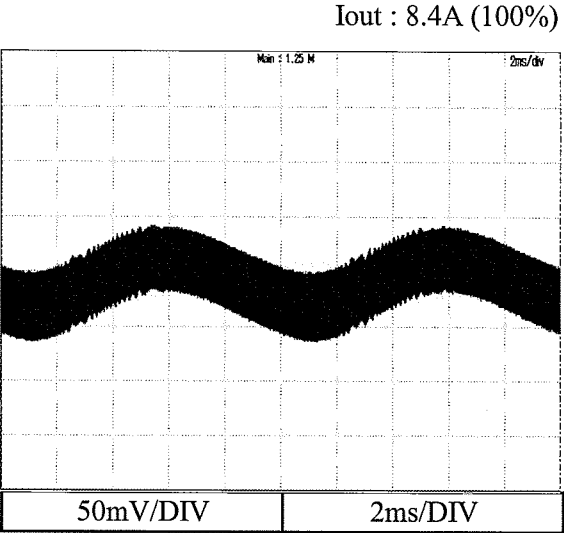
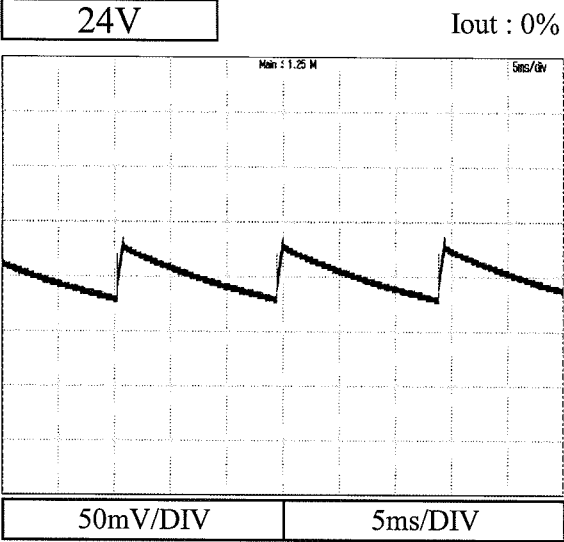
2.11 Output ripple and noise waveform

Conditions Vin : 115 VAC
Ta : 25 °C
Istandby : 0 A



2.11 Output ripple and noise waveform

Conditions Vin : 115 VAC
Ta : 25 °C
Istandby : 0 A



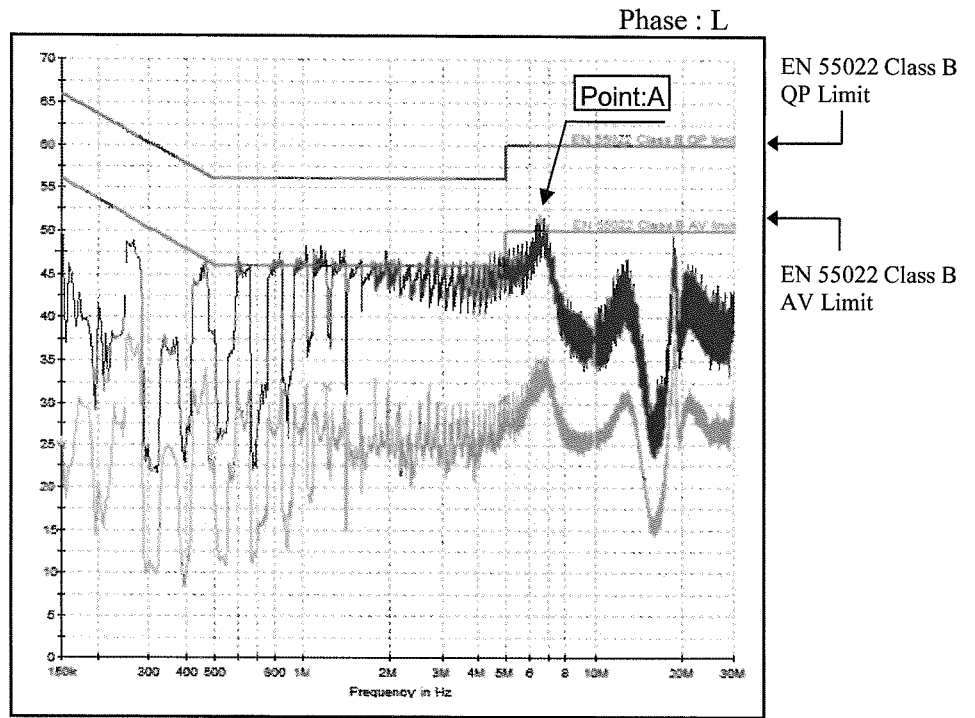
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
 Iout : 16.7A (100%)
 Istandby : 0A
 Ta : 25°C

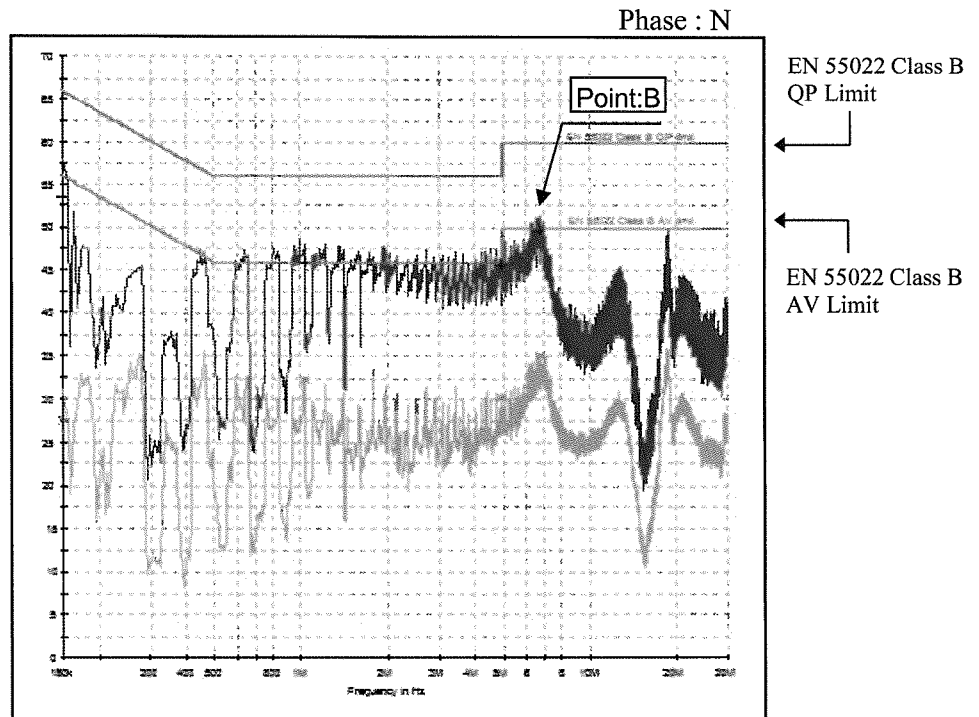
Conducted Emission

12V

Point A (6.54MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	50.1
AV	46.0	35.0



Point B (6.73MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.6
AV	46.0	35.1



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

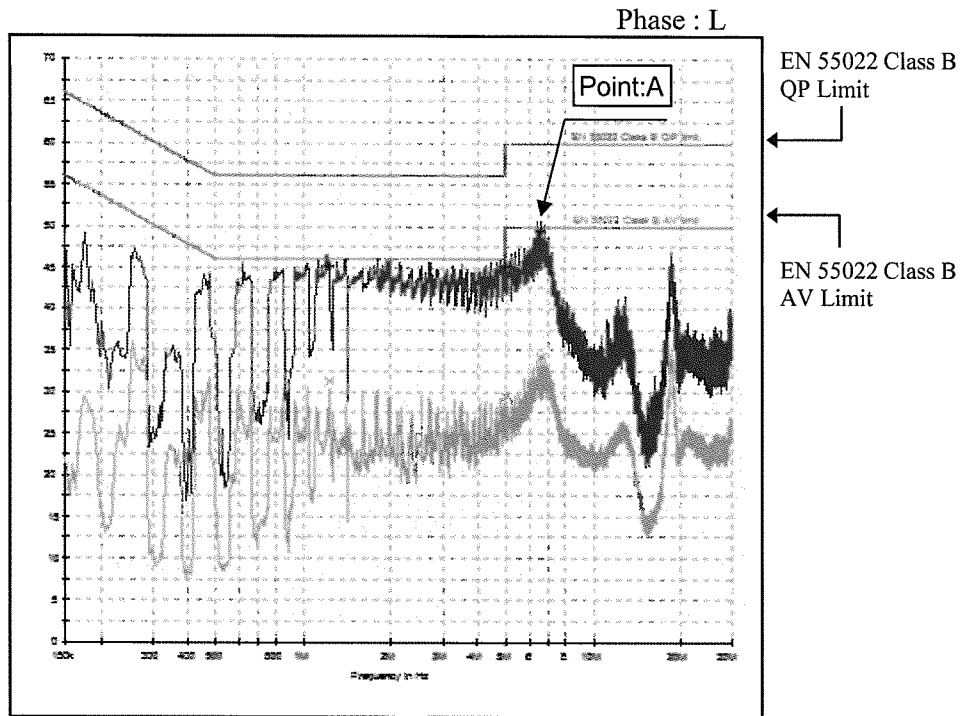
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 16.7A (100%)
 Istandby : 0A
 Ta : 25°C

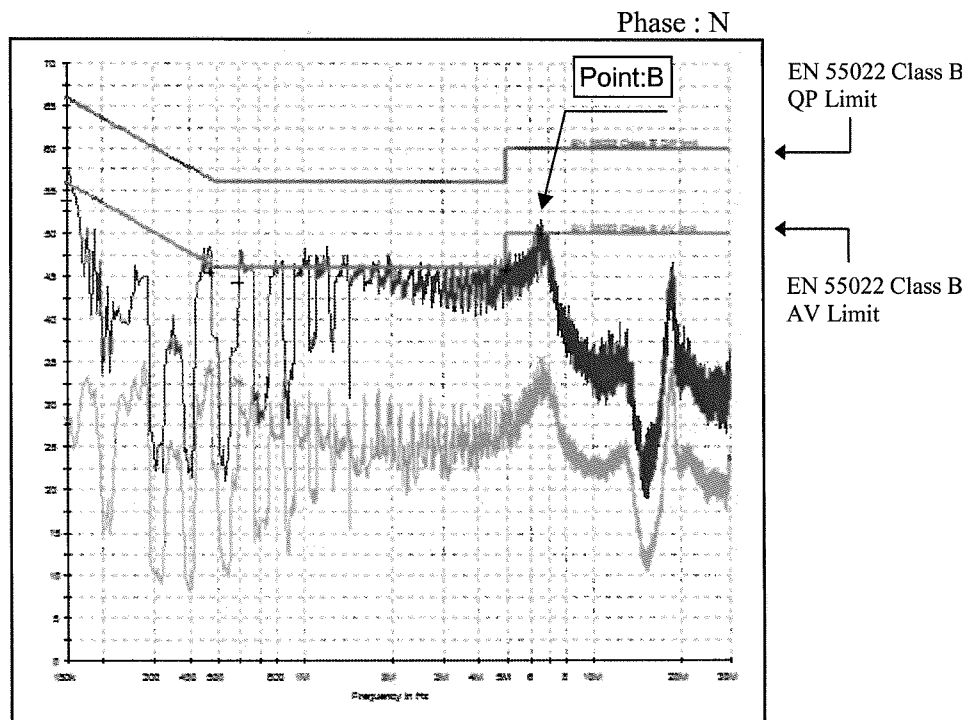
Conducted Emission

12V

Point A (6.60MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.3
AV	46.0	34.3



Point B (4.99MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	50.0
AV	46.0	35.2



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

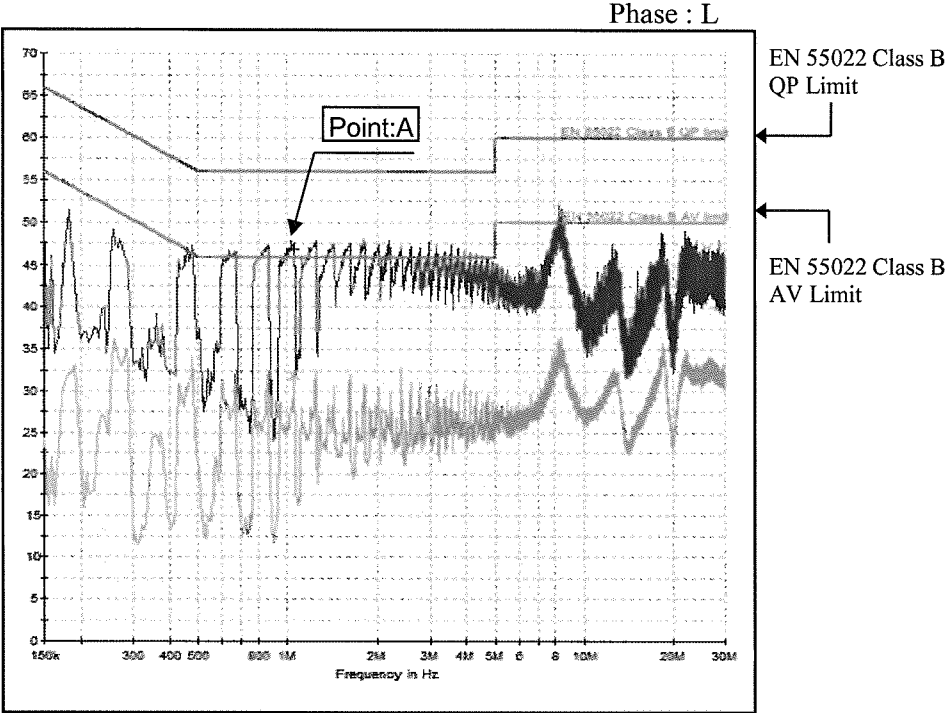
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
 Iout : 11.2A (100%)
 Istandby : 0A
 Ta : 25°C

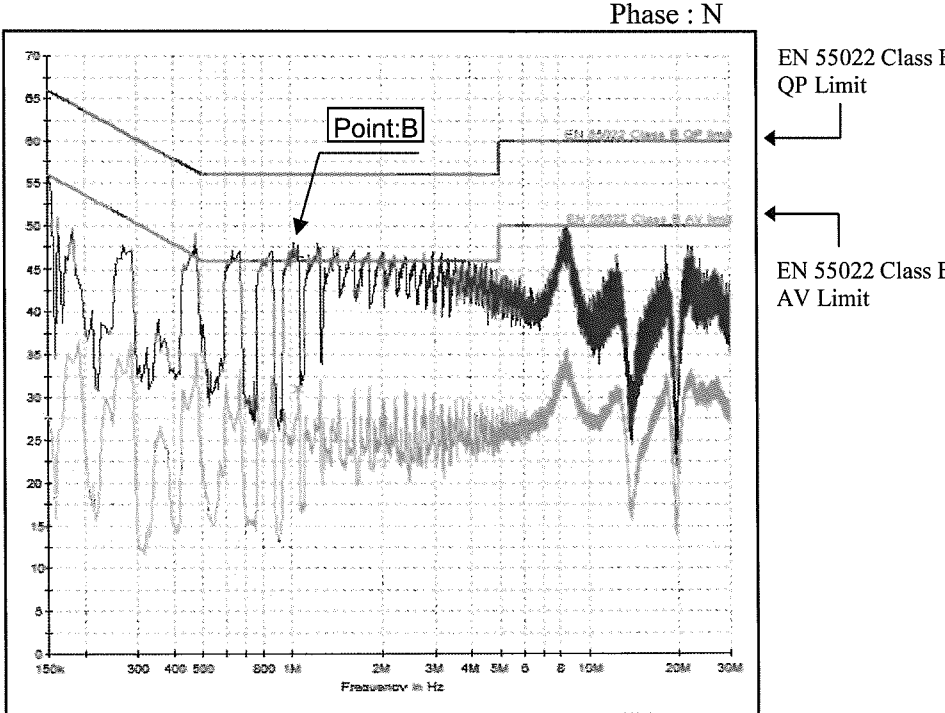
Conducted Emission

18V

Point A (1.057MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	46.8
AV	46.0	31.9



Point B (1.06MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	46.4
AV	46.0	31.0



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

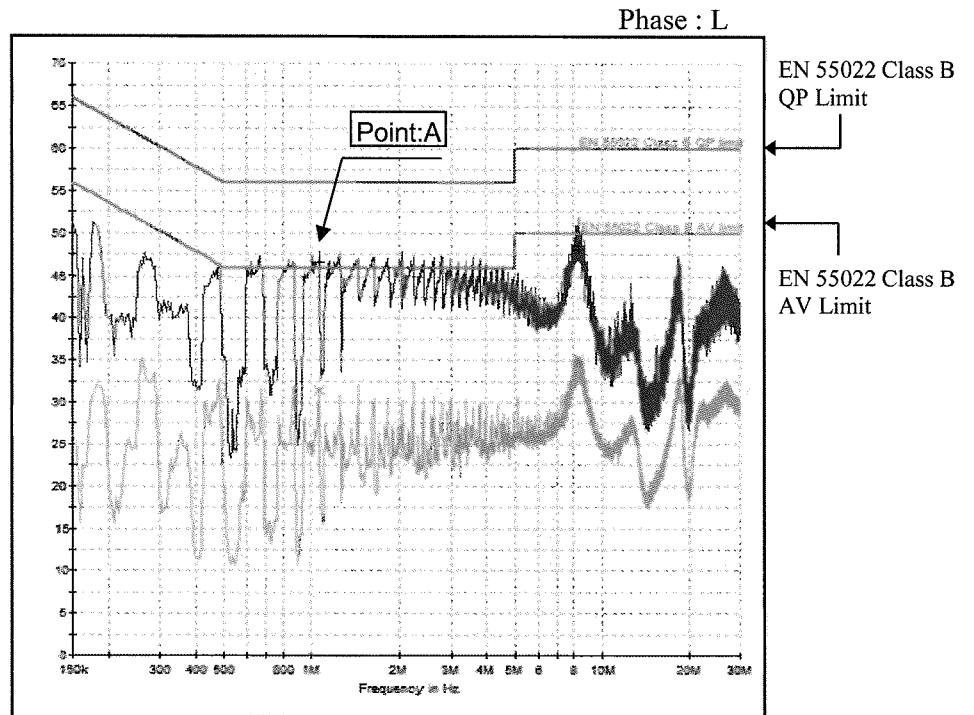
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 11.2A (100%)
 Istandby : 0A
 Ta : 25°C

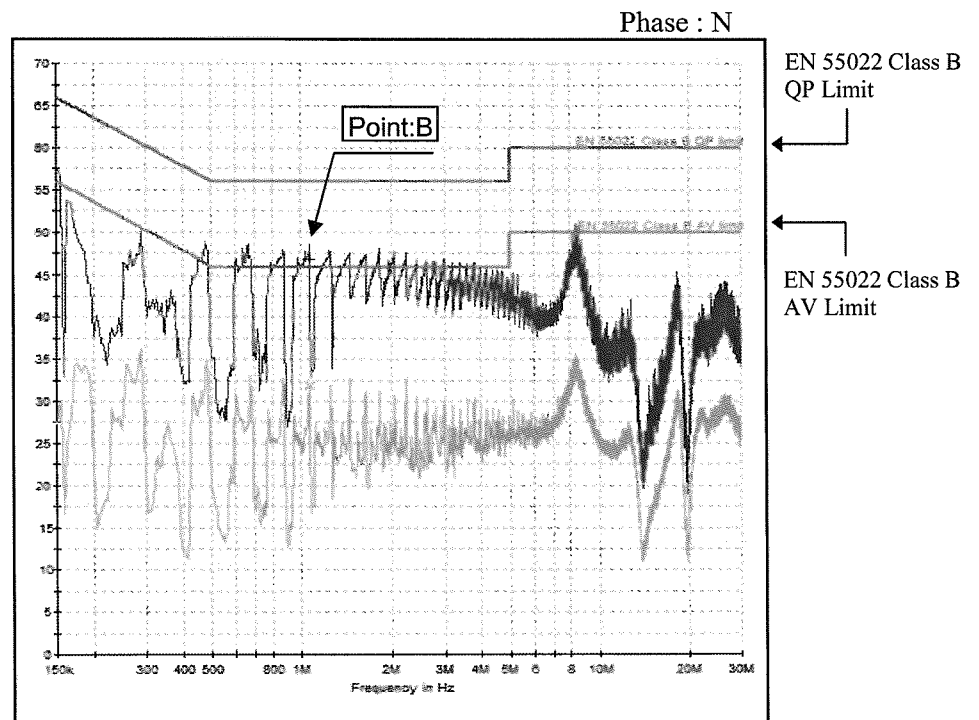
Conducted Emission

18V

Point A (8.75MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	46.6
AV	46.0	31.4



Point B (1.0665MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	46.8
AV	46.0	31.9



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

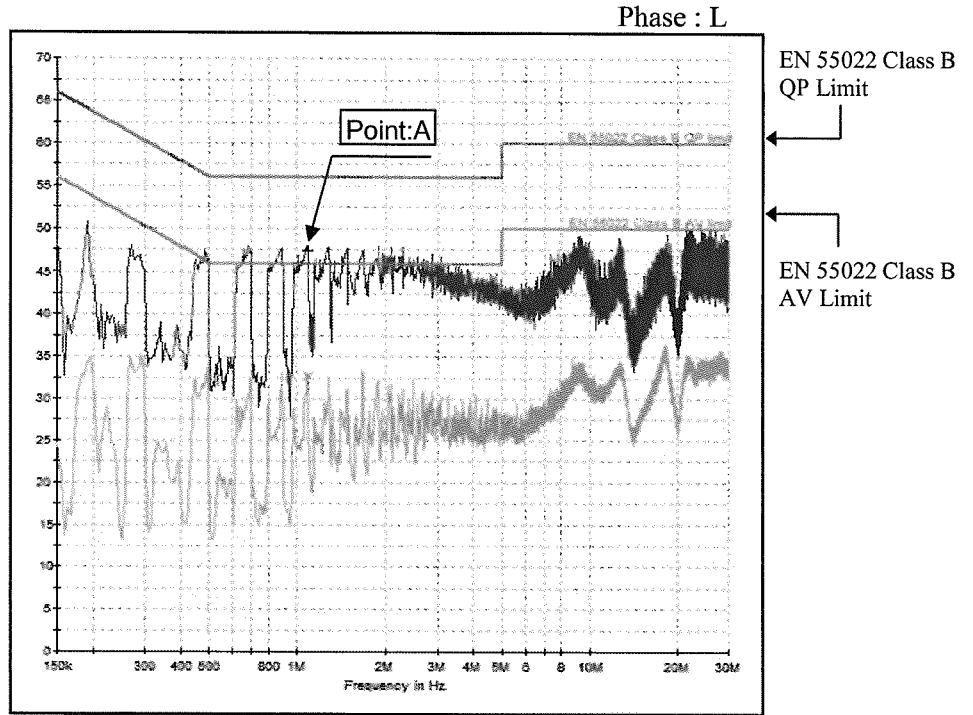
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
 Iout : 8.4A (100%)
 Istandby : 0A
 Ta : 25°C

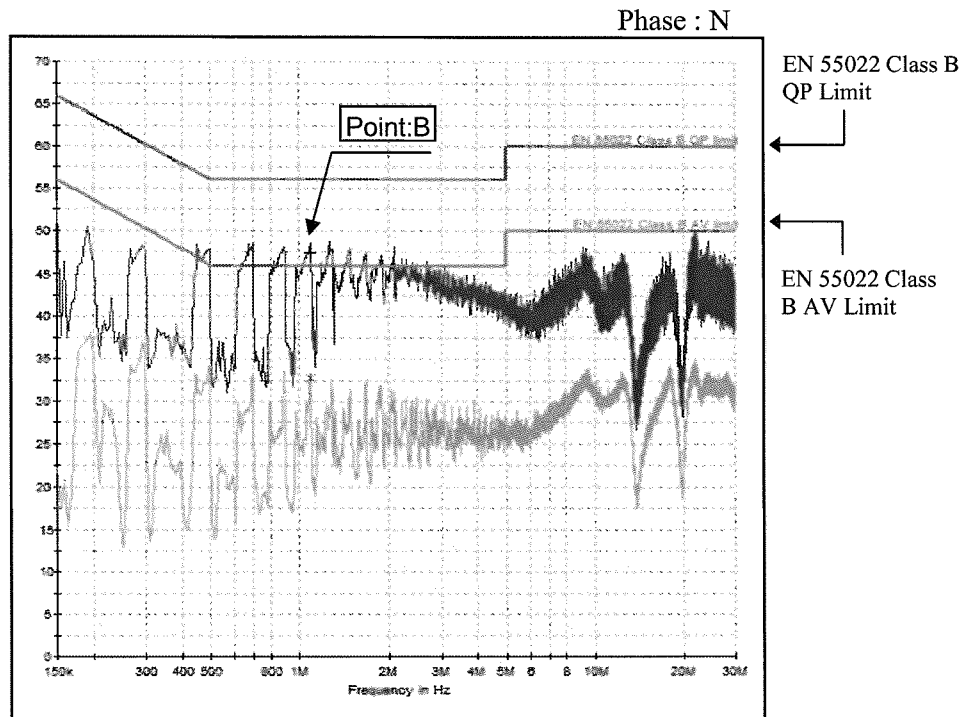
Conducted Emission

24V

Point A (1.089MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	47.3
AV	46.0	32.8



Point B (1.0915MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	47.3
AV	46.0	32.7



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

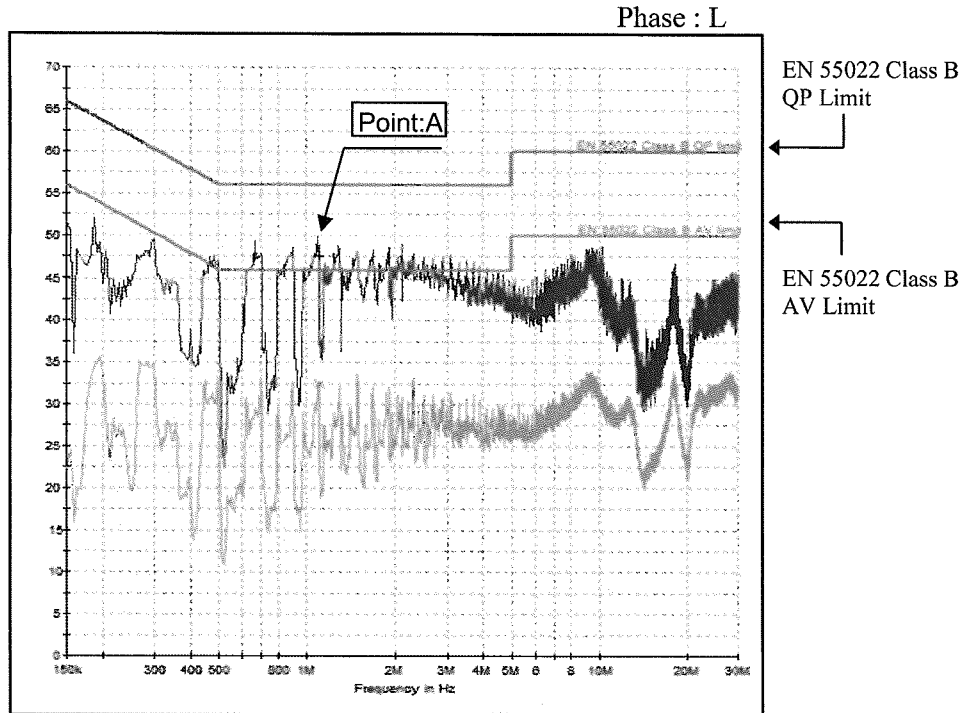
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 8.4A (100%)
 Istandby : 0A
 Ta : 25°C

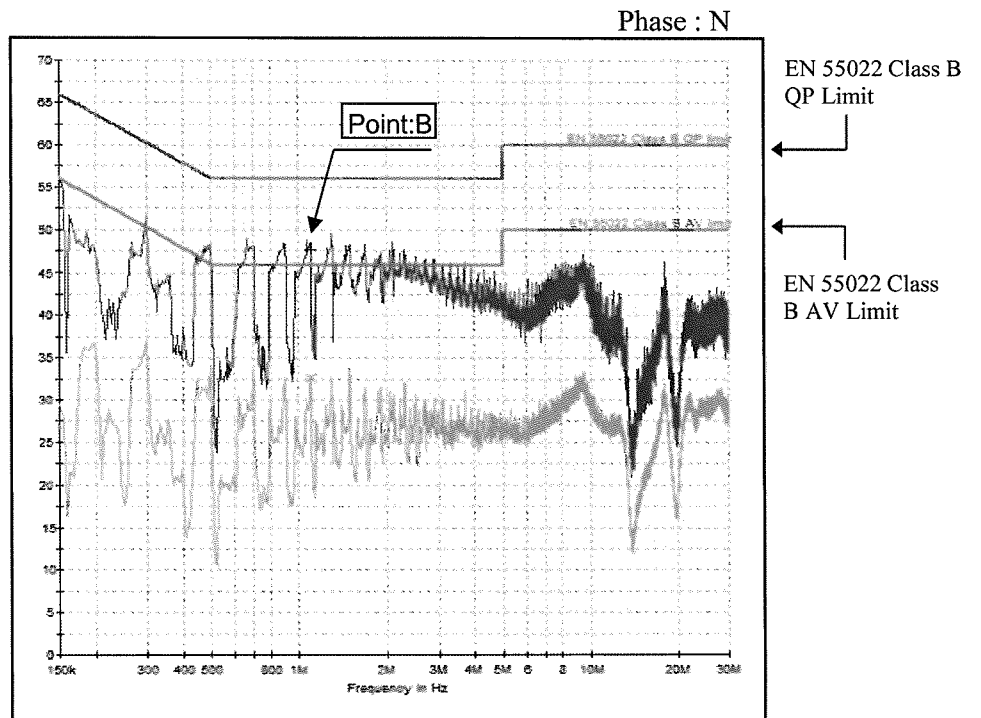
Conducted Emission

24V

Point A (1.1015MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	47.5
AV	46.0	32.4



Point A (1.101MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	47.6
AV	46.0	32.6



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

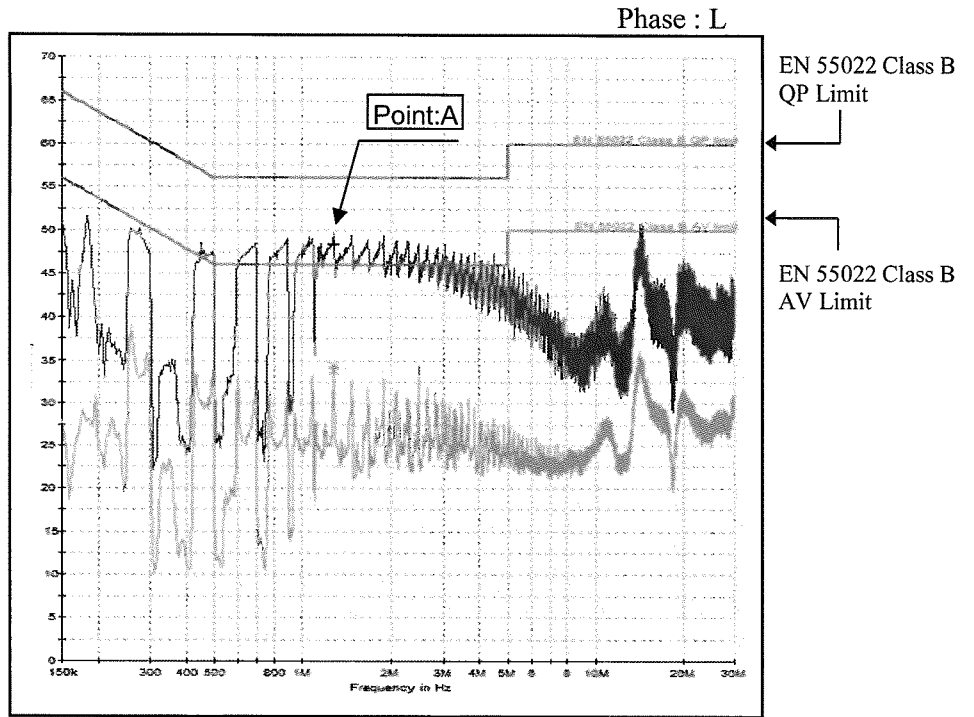
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
 Iout : 4.2A (100%)
 Istandby : 0A
 Ta : 25°C

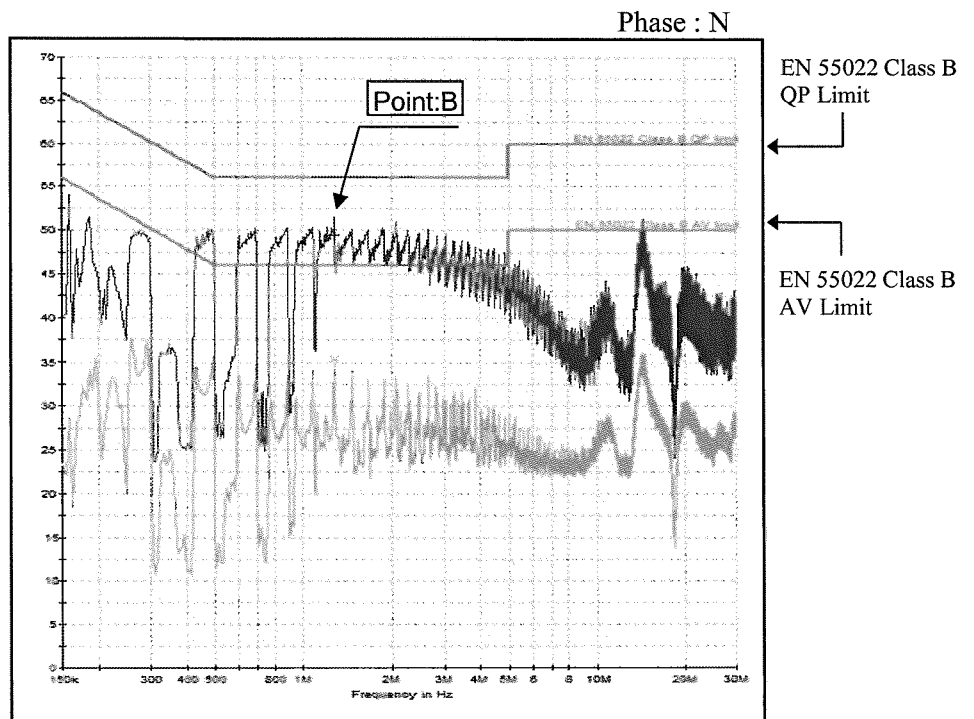
Conducted Emission

48V

Point A (1.2855MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	48.4
AV	46.0	33.9



Point B (1.283MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.4
AV	46.0	35.3



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

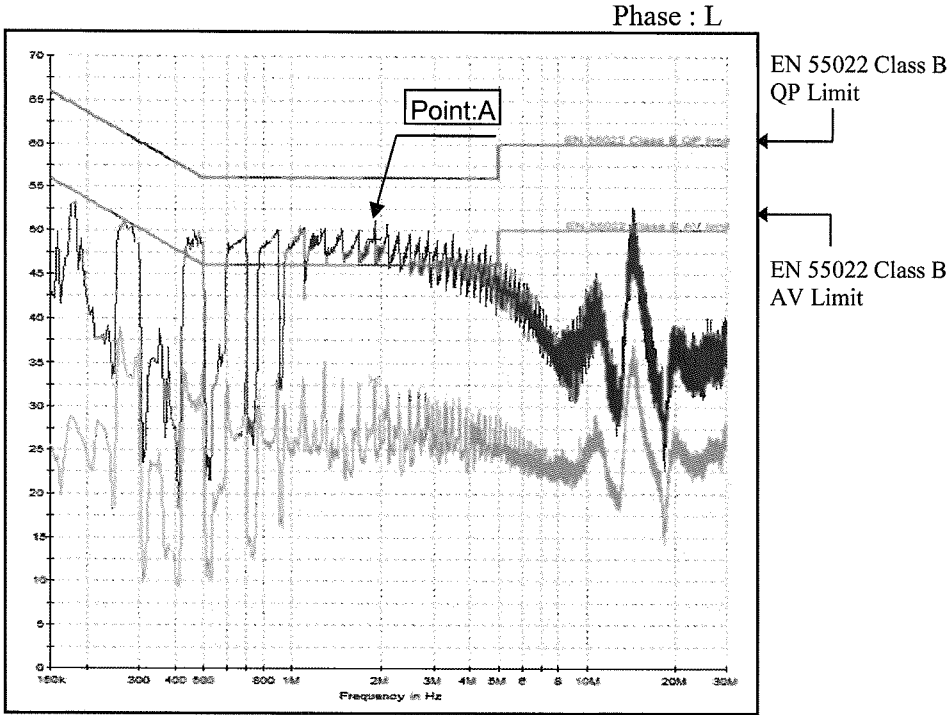
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 4.2A (100%)
 Istandby : 0A
 Ta : 25°C

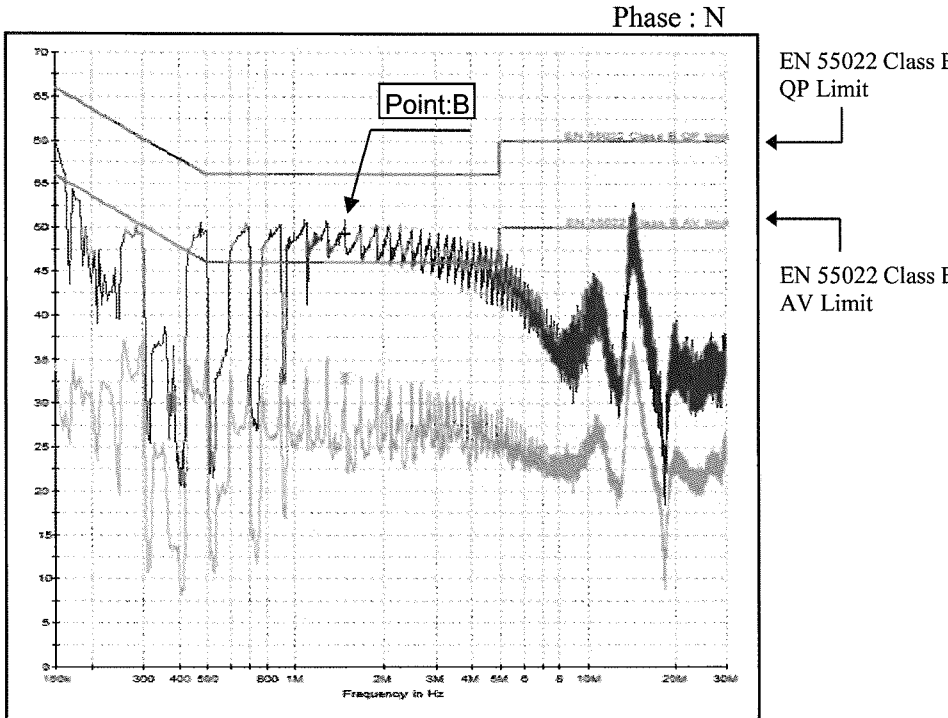
Conducted Emission

48V

Point A (1.8955MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.0
AV	46.0	33.2



Point B (1.497MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	56.0	49.2
AV	46.0	32.6



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

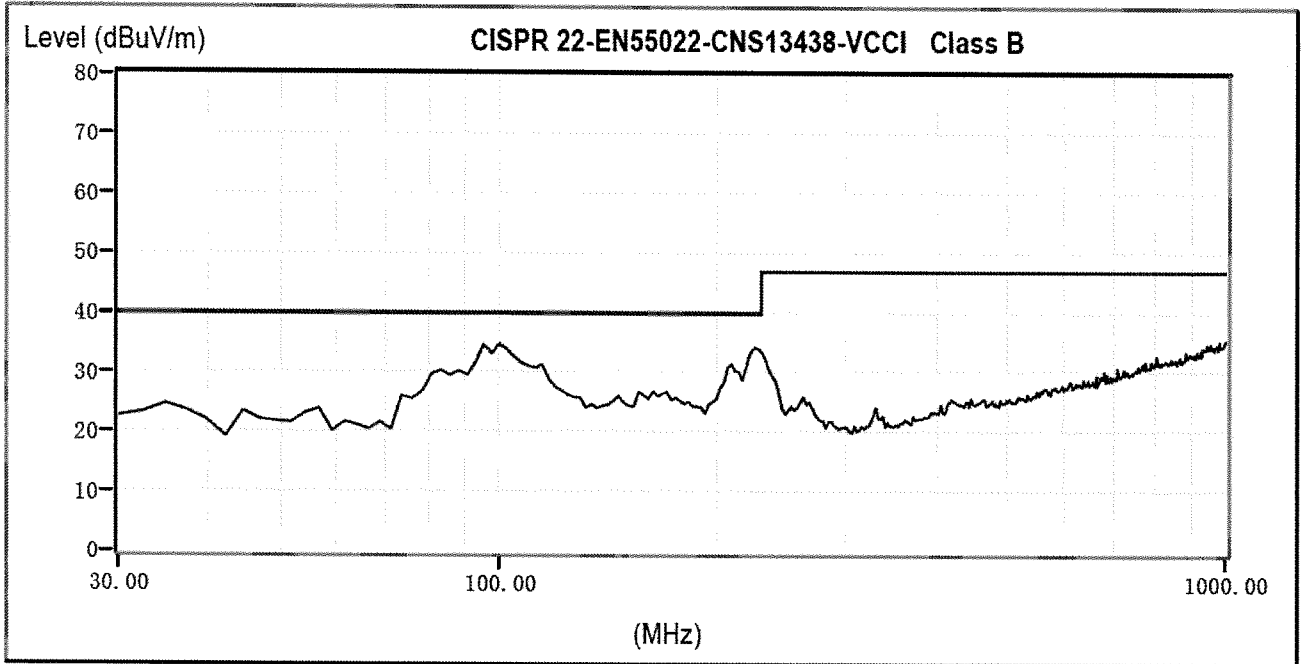
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
 Iout : 16.7A (100%)
 Istandby : 0A
 Ta : 25°C

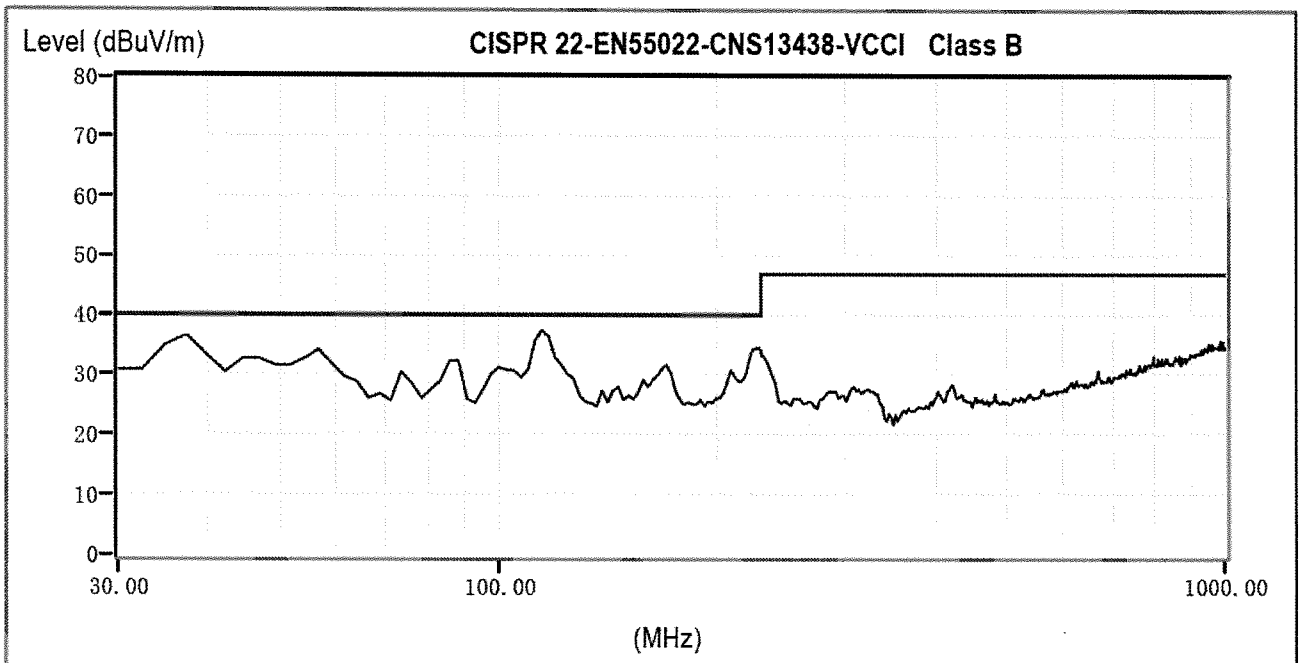
Radiated Emission

12V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
 Indication is peak values.

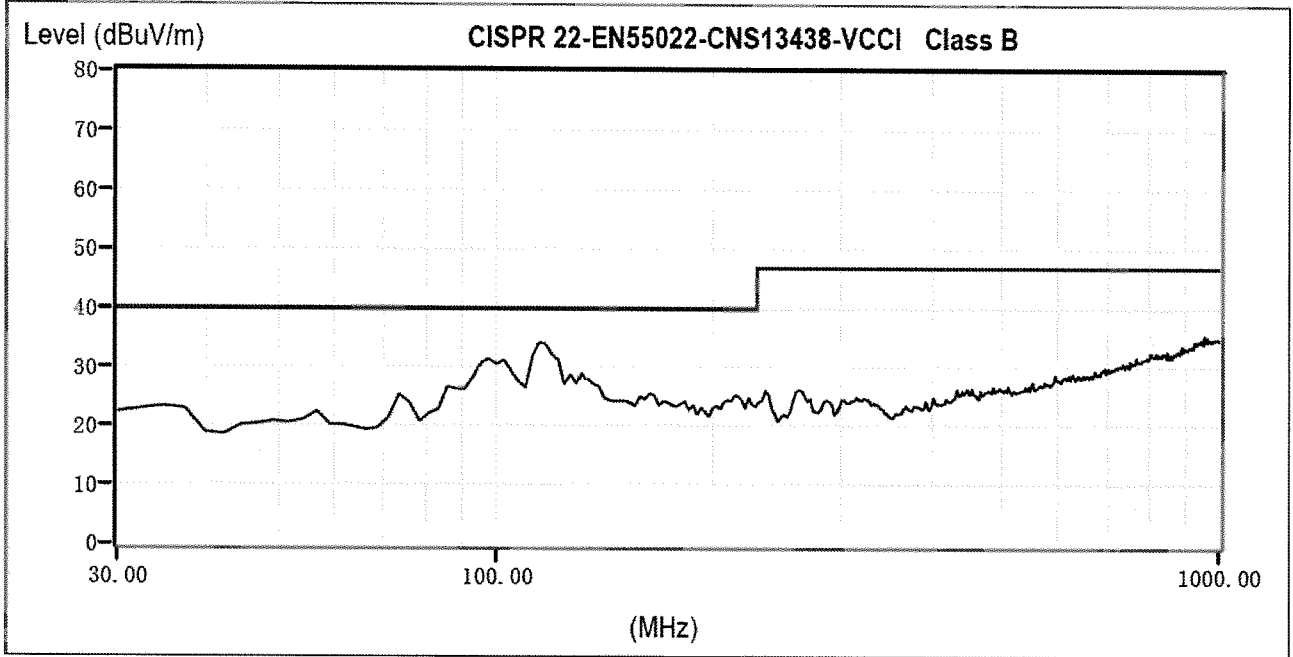
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
Iout : 16.7A (100%)
Istandby : 0A
Ta : 25°C

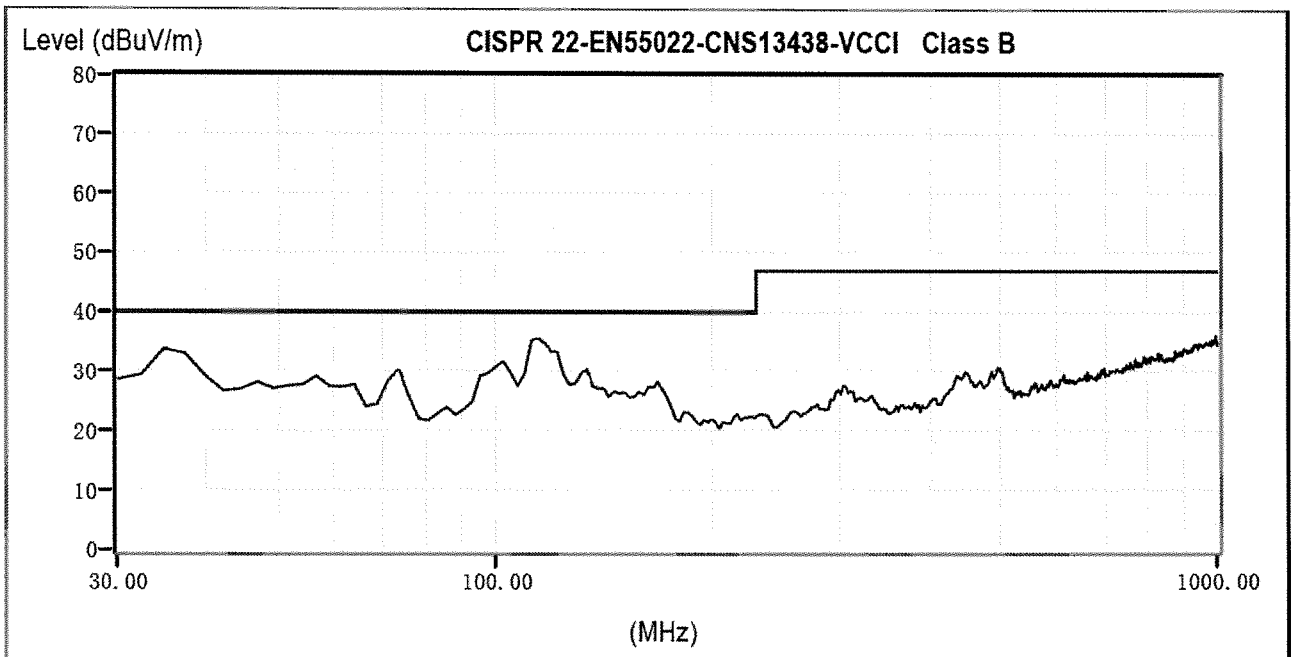
Radiated Emission

12V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
Indication is peak values.

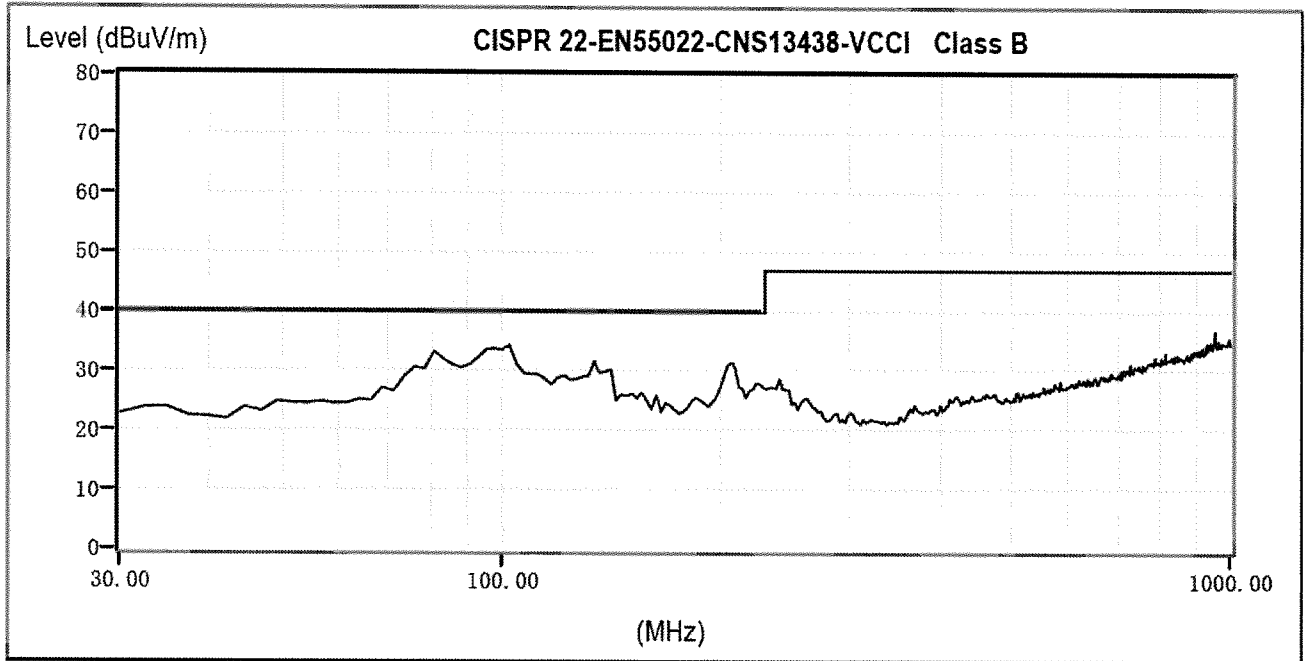
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
Iout : 11.2A (100%)
Istandby : 0A
Ta : 25°C

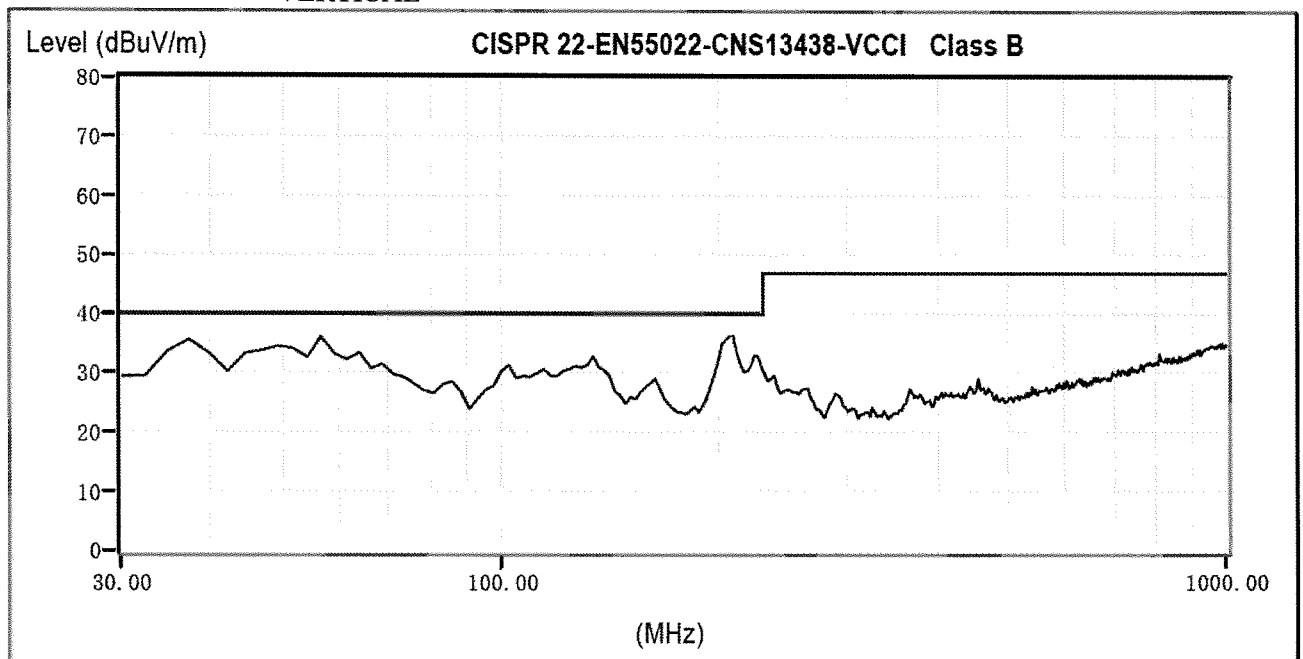
Radiated Emission

18V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
Indication is peak values.

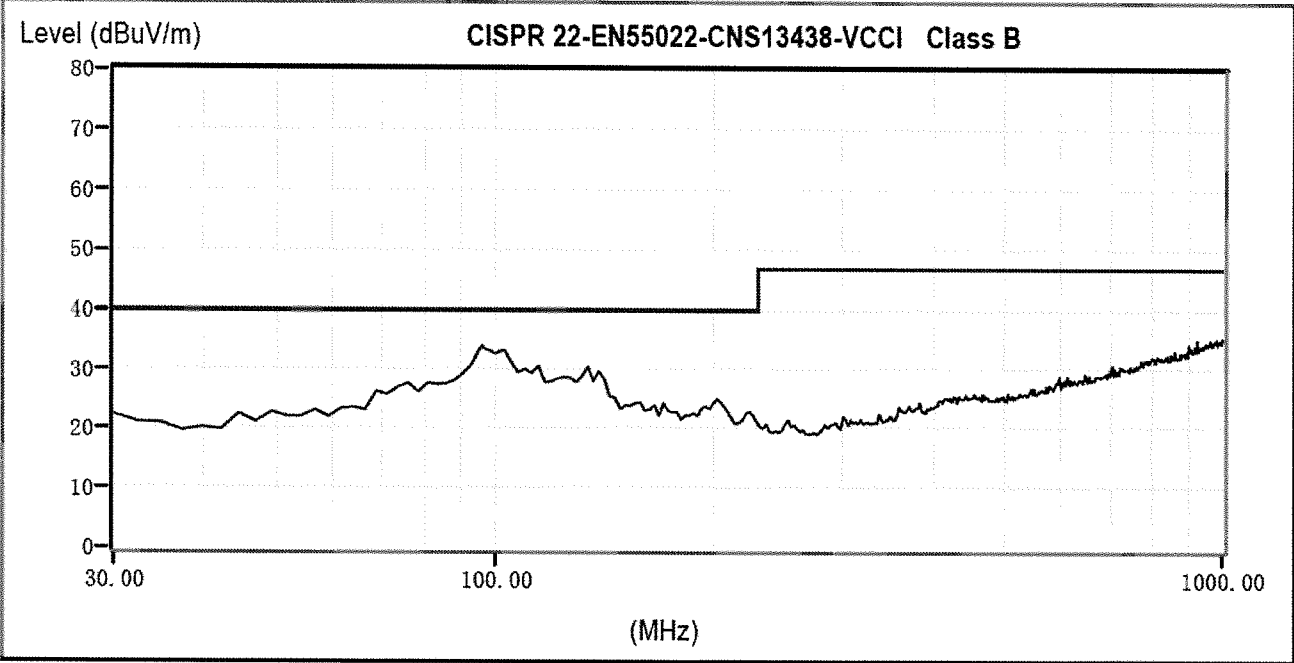
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
Iout : 11.2A (100%)
Istandby : 0A
Ta : 25°C

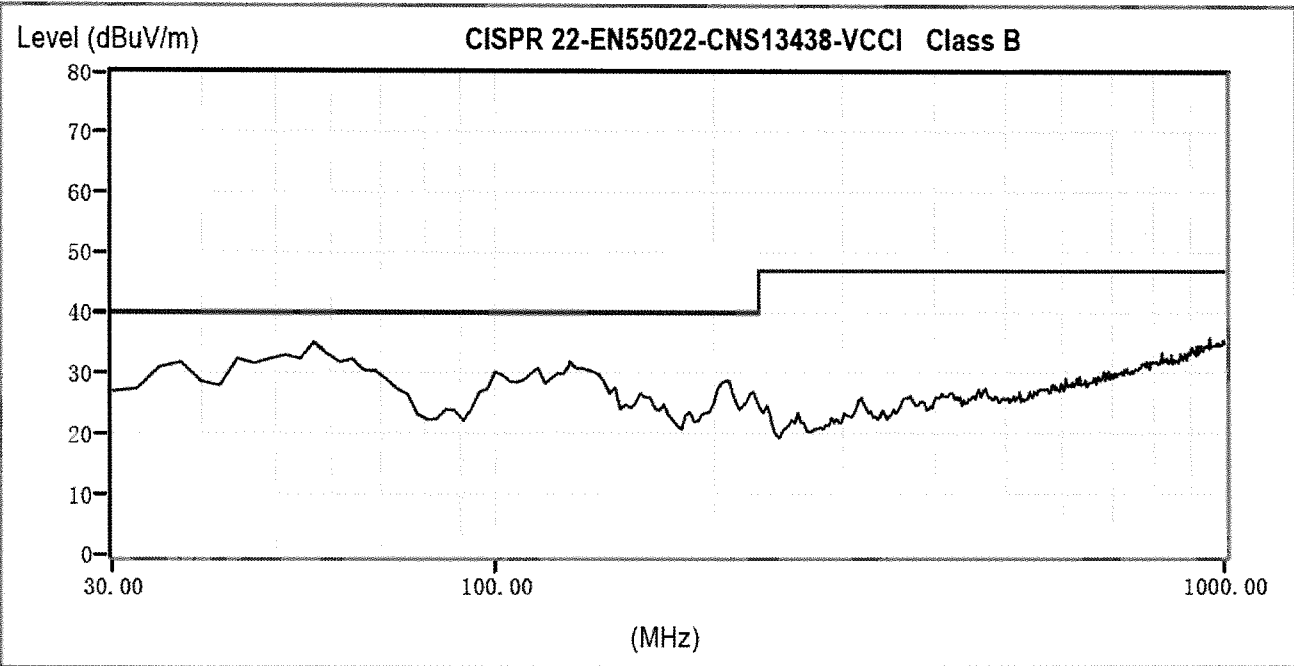
Radiated Emission

18V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
Indication is peak values.

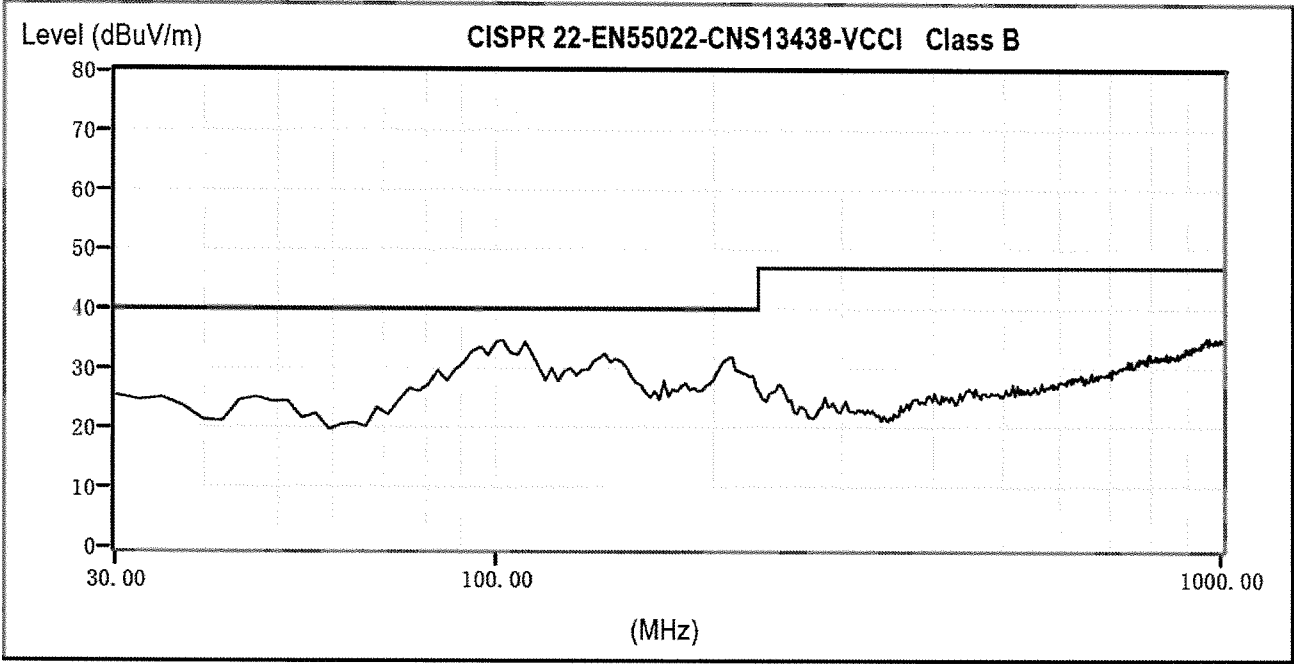
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
Iout : 8.4A (100%)
Istandby : 0A
Ta : 25°C

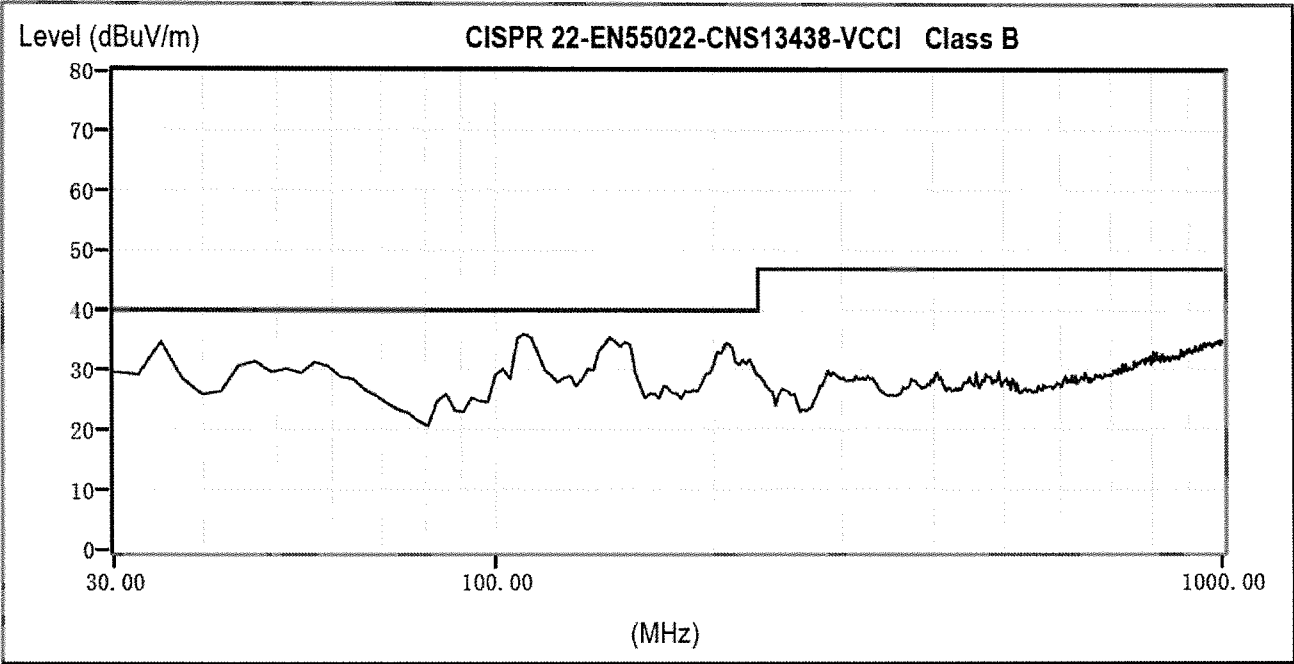
Radiated Emission

24V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
Indication is peak values.

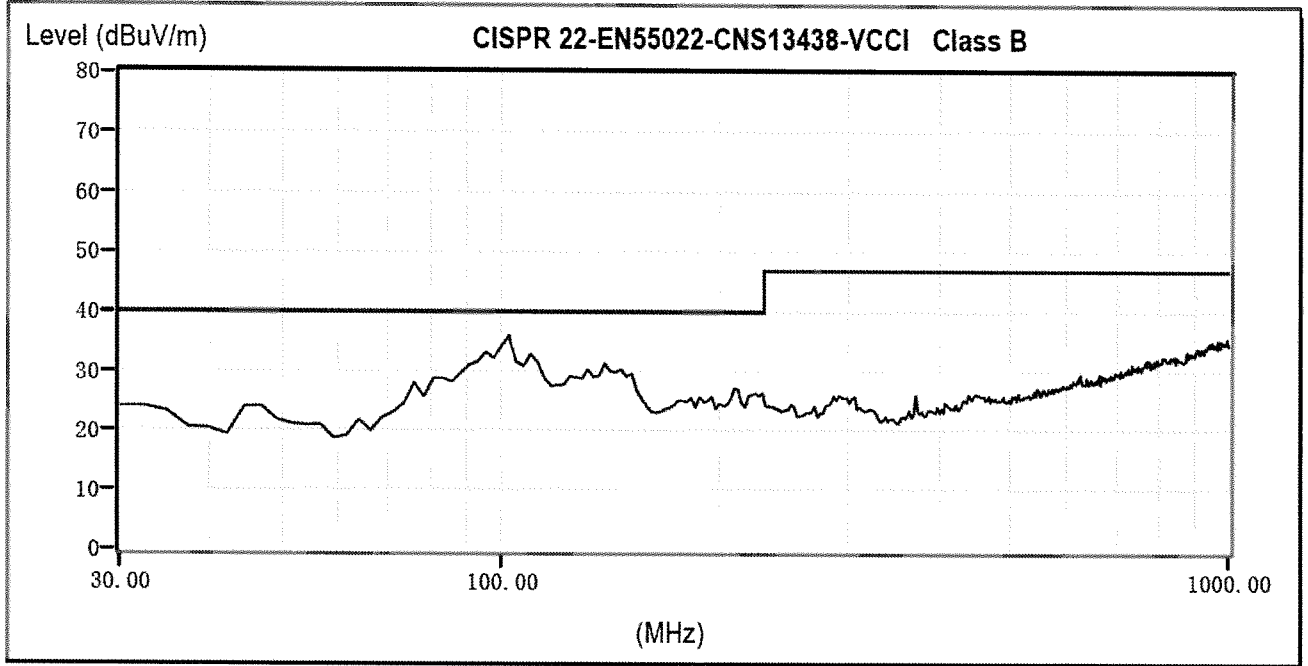
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 8.4A (100%)
 Istandby : 0A
 Ta : 25°C

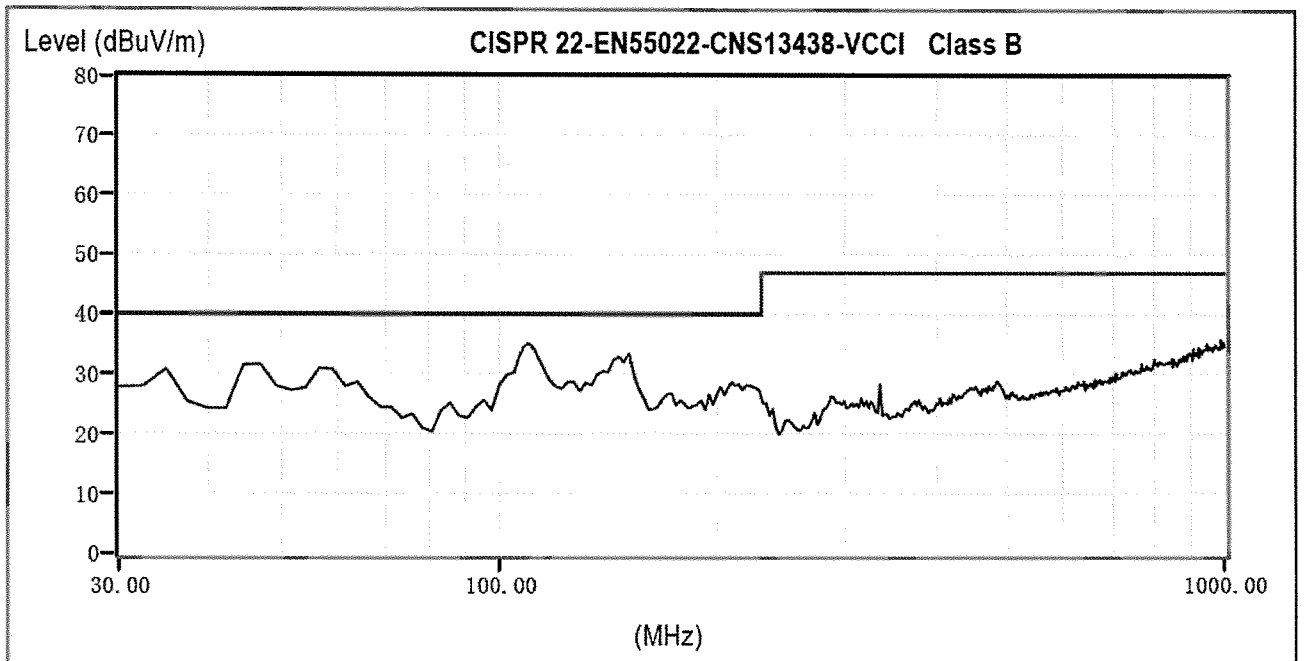
Radiated Emission

24V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
 Indication is peak values.

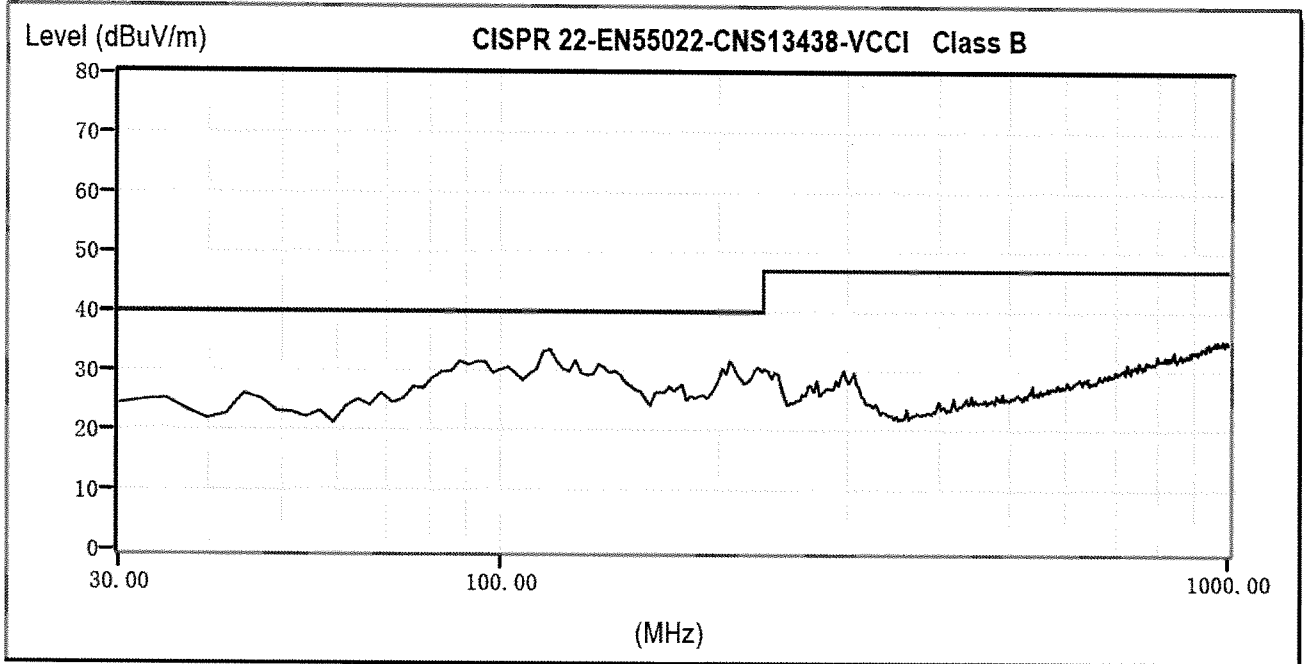
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 115VAC
Iout : 4.2A (100%)
Istandby : 0A
Ta : 25°C

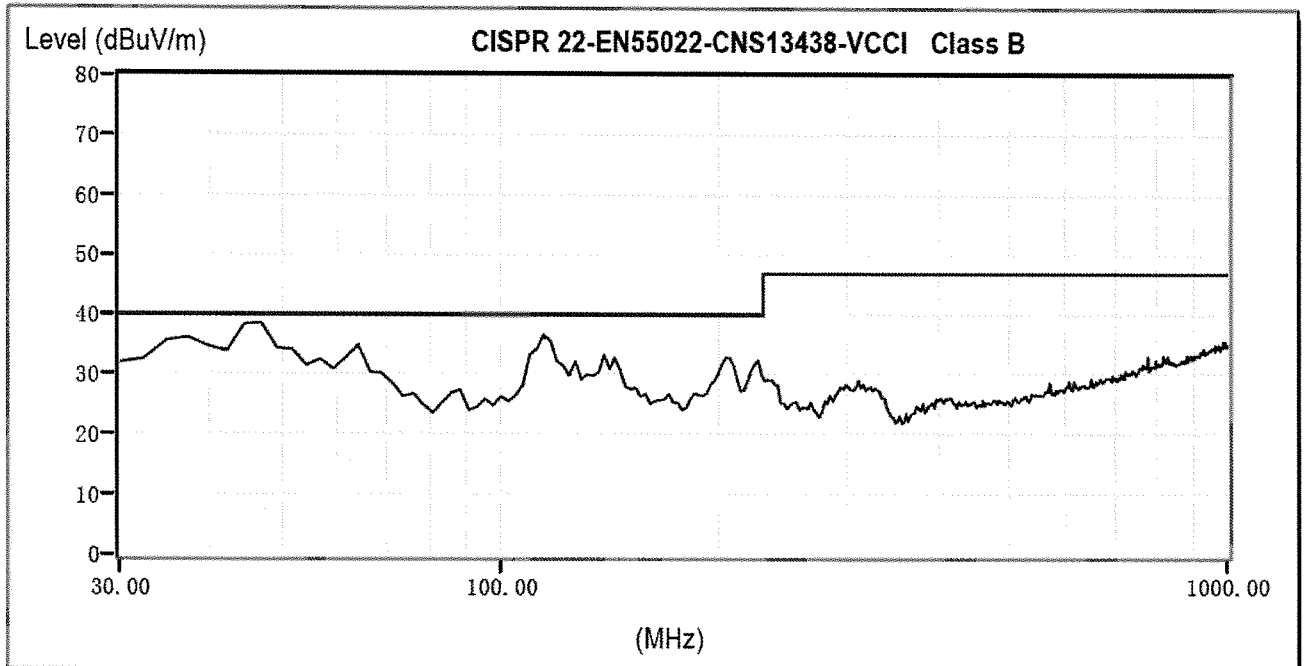
Radiated Emission

48V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
Indication is peak values.

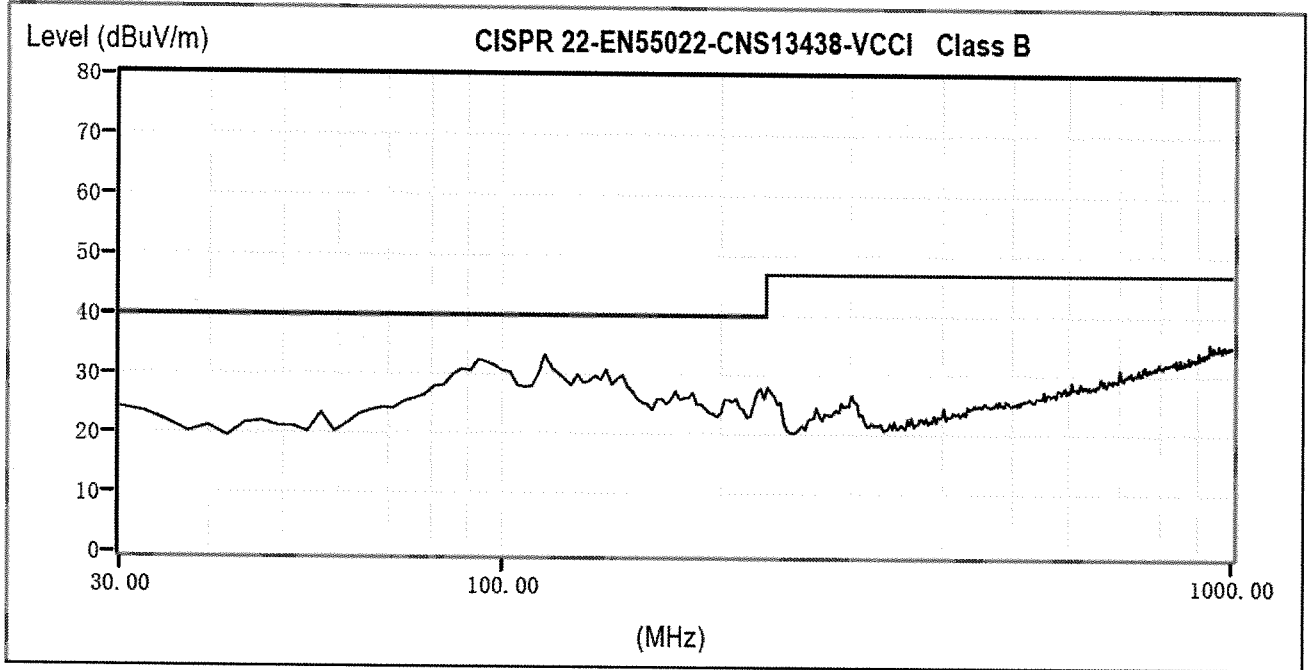
2.12 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 4.2A (100%)
 Istandby : 0A
 Ta : 25°C

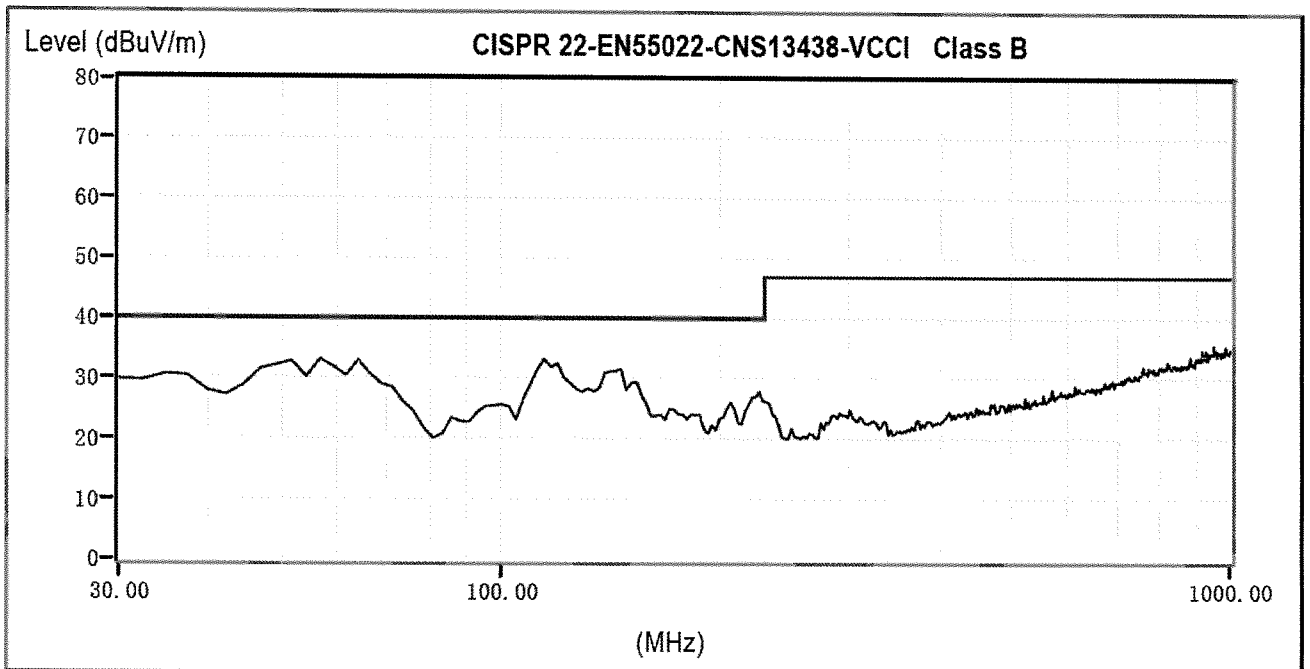
Radiated Emission

48V

HORIZONTAL



VERTICAL



Limit of EN55011-B,EN55022-B are same as its VCCI class B.
 Indication is peak values.