

DRF480-24-1

EVALUATION DATA

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Terminology used

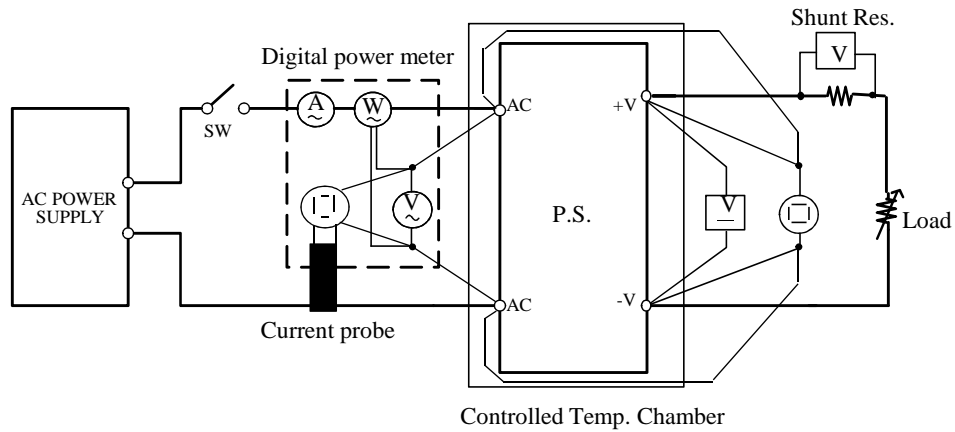
	Definition
V_{in} Input voltage
V_{out} Output voltage
I_{in} Input current
I_{out} Output current
T_a Ambient temperature
f Frequency

1. Evaluation Method

1.1 Circuit used for determination

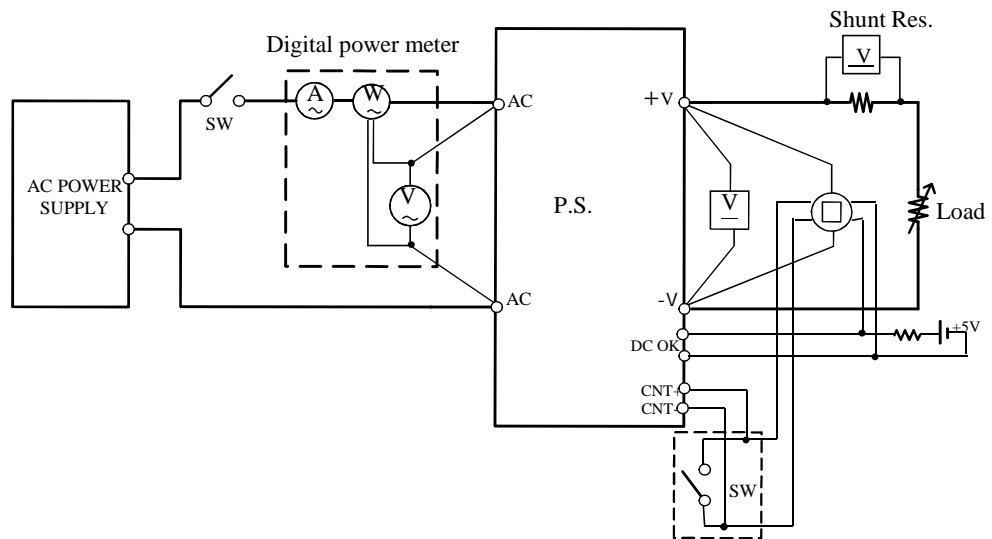
Circuit 1 used for determination

- Steady state data
- Over current protection (OCP) characteristics
- Over voltage protection (OVP) characteristics
- Output rise characteristics
- Output fall characteristics
- Hold up time characteristics
- Response to brown out characteristics
- Input Current Harmonics
- Input current



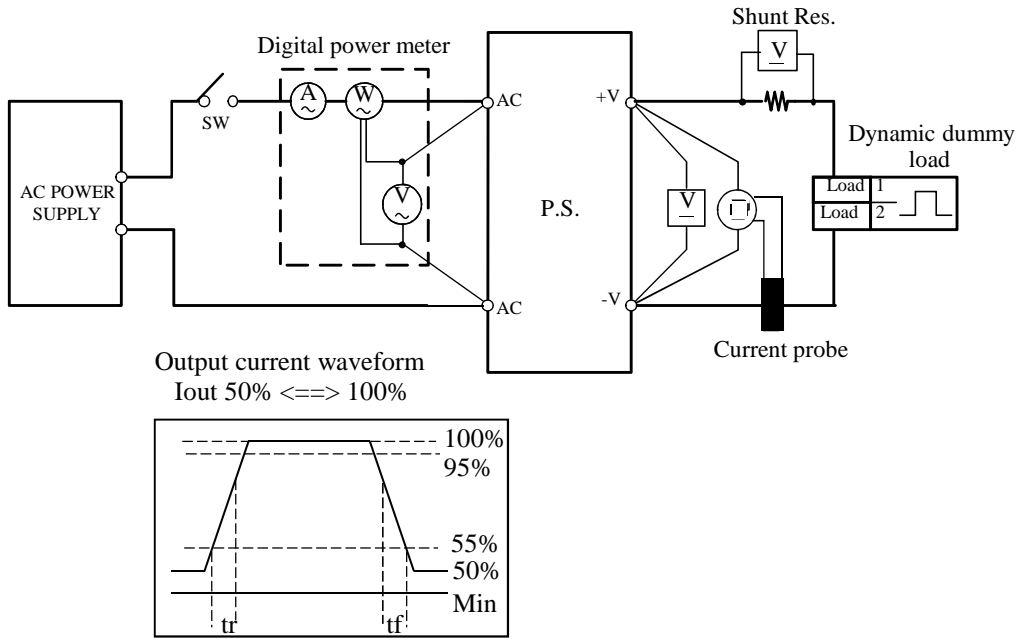
Circuit 2 used for determination

- Output rise, fall characteristics with ON/OFF Control



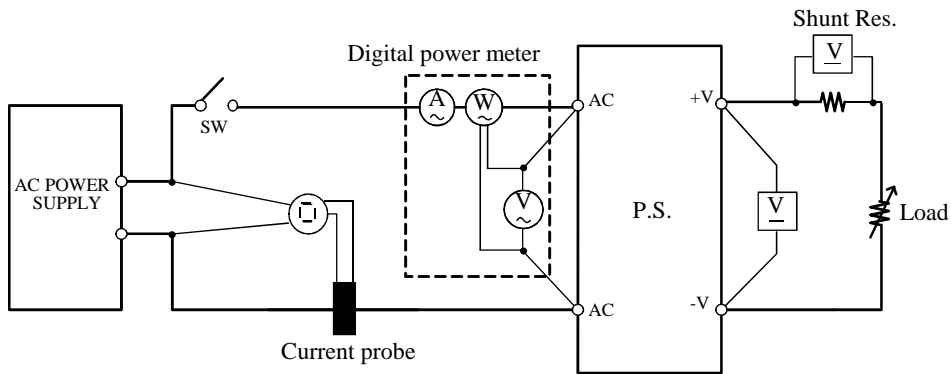
Circuit 3 used for determination

- Dynamic load response characteristics



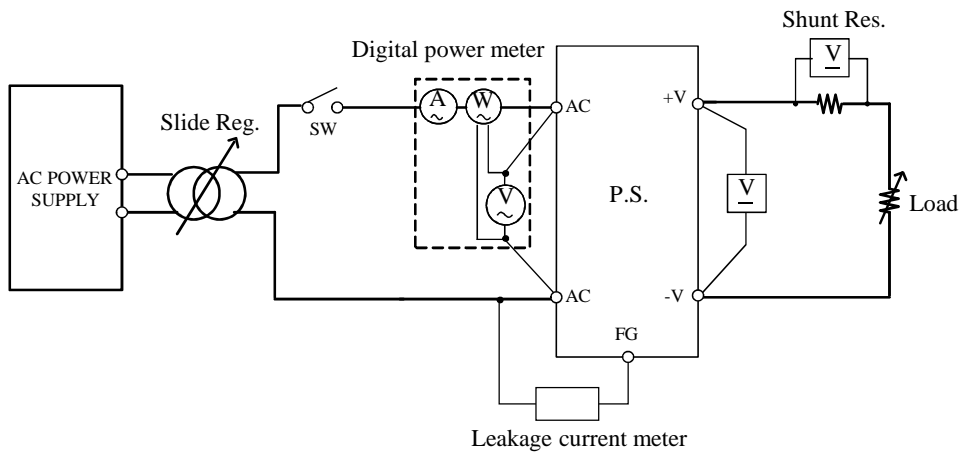
Circuit 4 used for determination

- Inrush current waveform



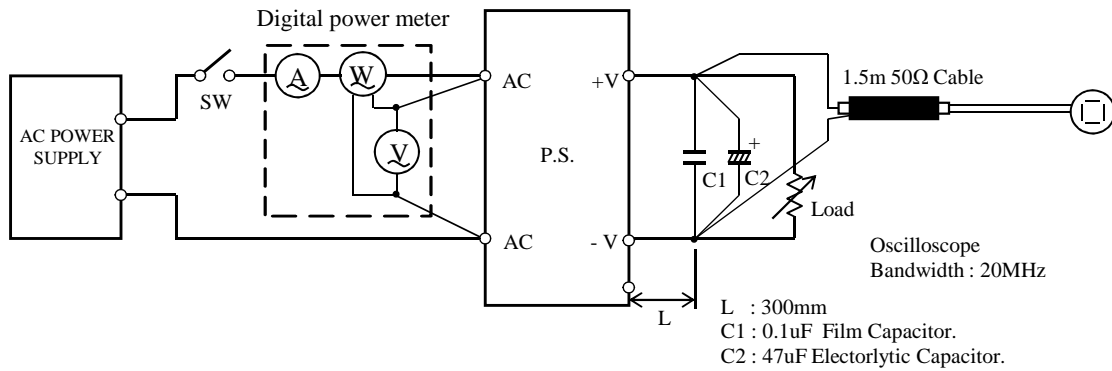
Circuit 5 used for determination

- Leakage current characteristics



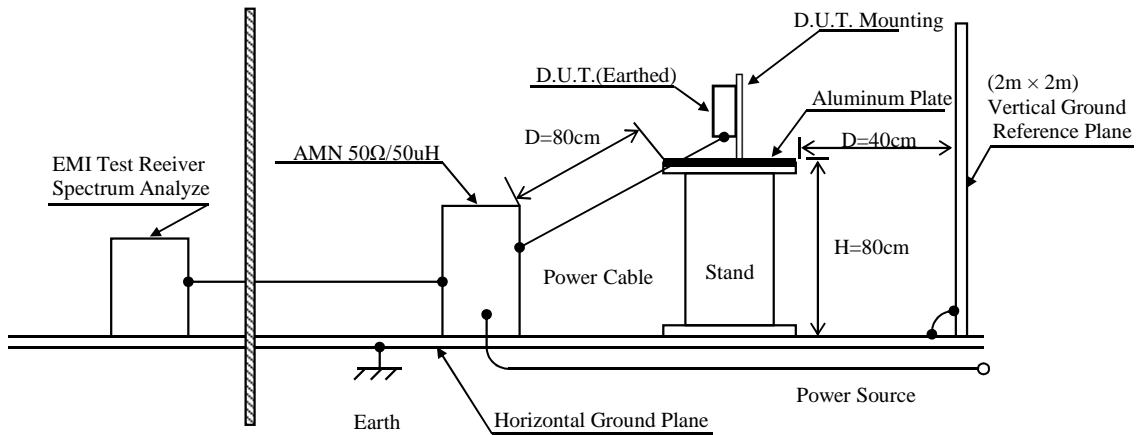
Circuit 6 used for determination

- Output ripple and noise waveform



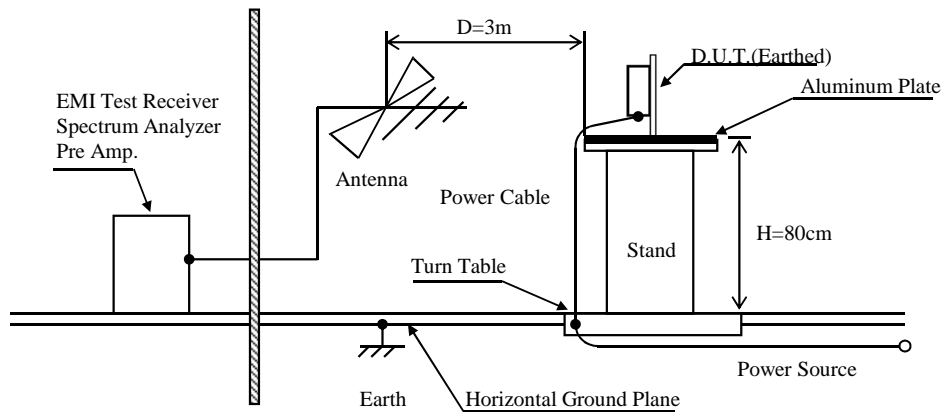
Configuration used for determination

- 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	AGILENT	34970A
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

Condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	264VAC	line regulation	
0%	24.004	24.003	24.003	24.003	1mV	0.004%
50%	23.995	23.995	23.995	23.994	1mV	0.004%
100%	23.988	23.988	23.987	23.987	1mV	0.004%
load regulation	16mV	15mV	16mV	16mV		
	0.067%	0.063%	0.067%	0.067%		

2. Temperature drift

Condition Vin : 115VAC
Iout : 100%

Ta	-25°C	25°C	60°C	temperature stability	
Vout	24.067V	23.988V	23.901V	166mV	0.692%

3. Start up voltage and Drop out voltage

Condition Ta : 25°C
Iout : 100%

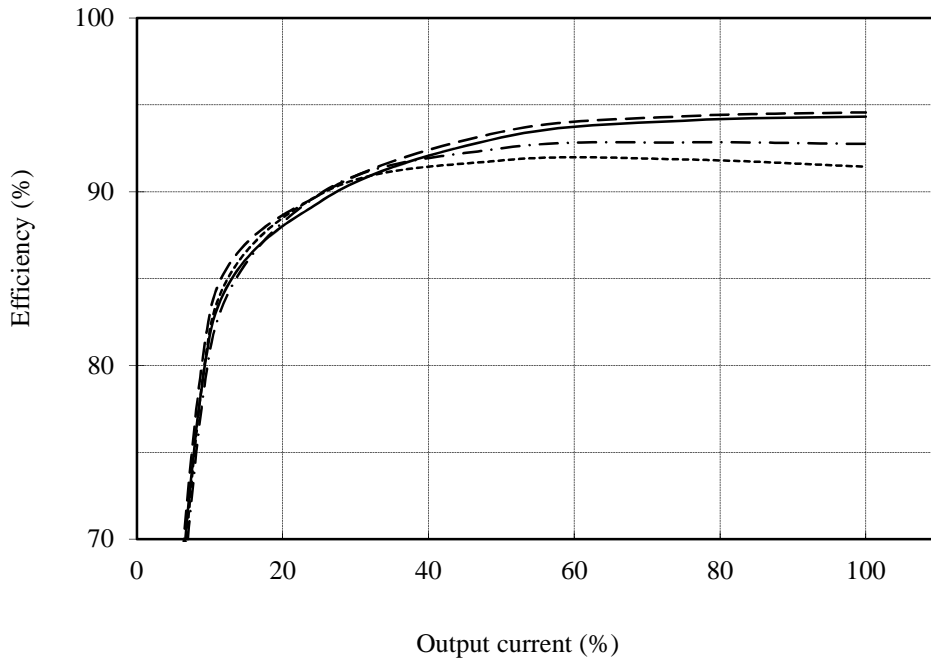
Start up voltage (Vin)	80VAC
Drop out voltage (Vin)	76VAC

DRF480-24-1

(2) Efficiency vs. Output current

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

24V

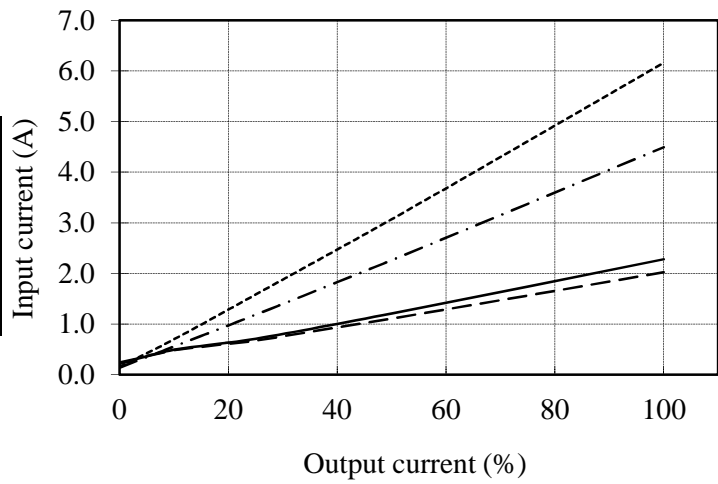


(3) Input current vs. Output current

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

24V

Vin	Input current
	Iout : 0%
85VAC	0.15A
115VAC	0.14A
230VAC	0.21A
264VAC	0.24A



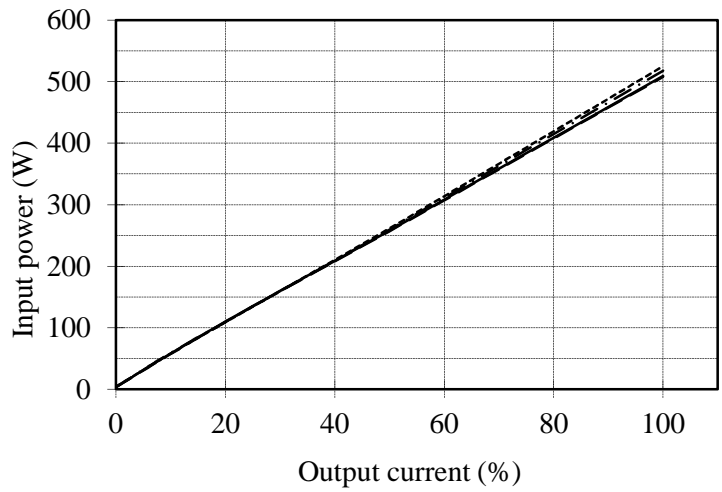
DRF480-24-1

(4) Input power vs. Output current

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

24V

Vin	Input power	
	Iout : 0%	Control OFF
85VAC	4.02W	0.27W
115VAC	3.98W	0.33W
230VAC	3.47W	0.75W
264VAC	3.39W	0.94W

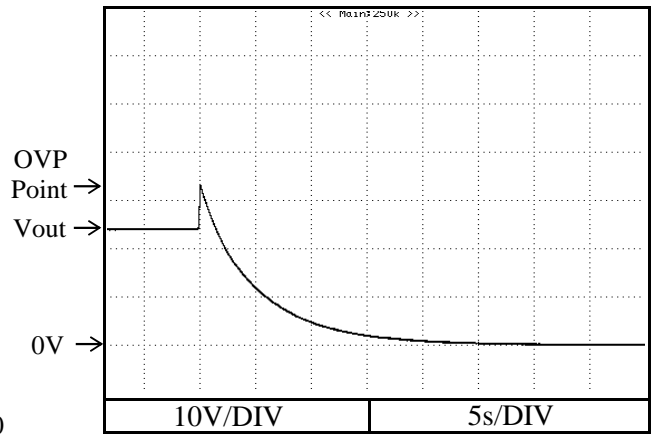
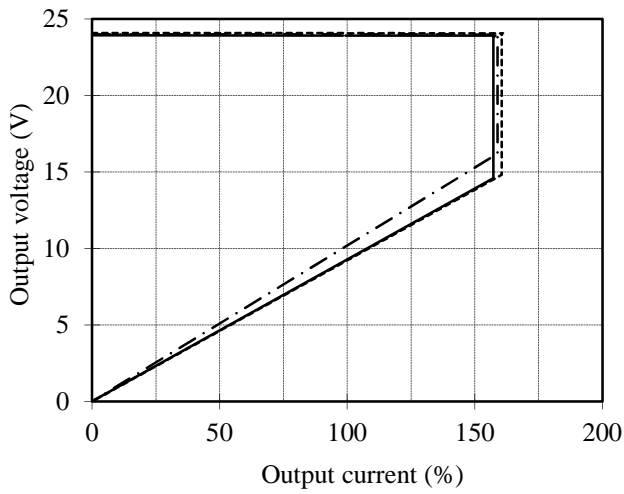


2.2 Over current protection (OCP) characteristics 2.3 Over voltage protection (OVP) characteristics

Conditions Vin : 115VAC
 Ta : -25°C - - - - -
 25°C - · - · -
 60°C ————

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

24V



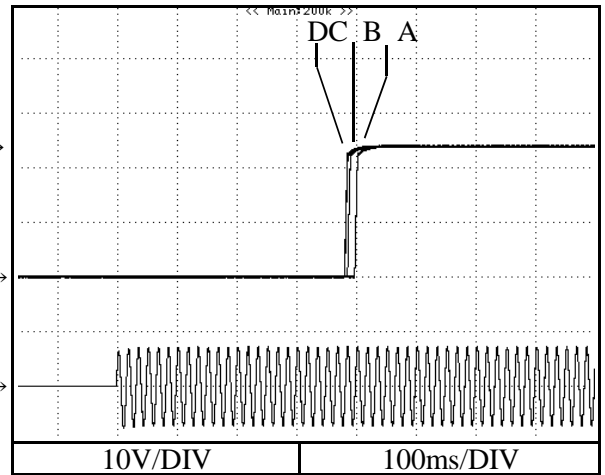
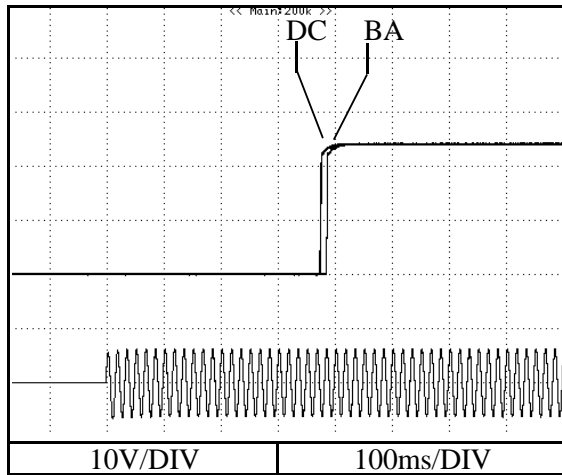
2.4 Output rise characteristics

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

24V

Iout : 0%

Iout : 100%



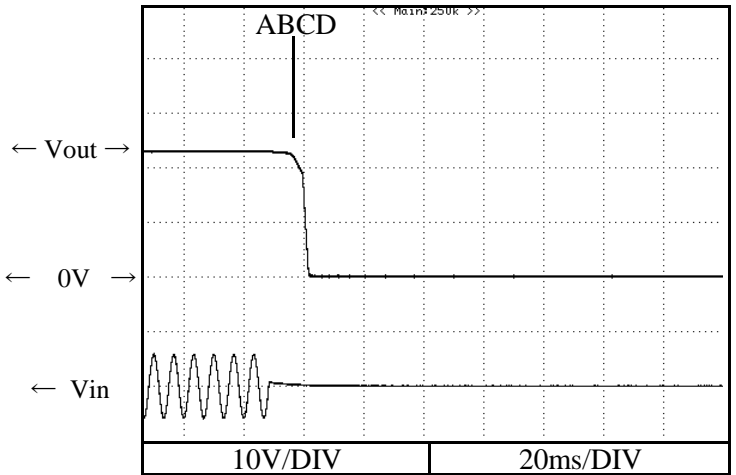
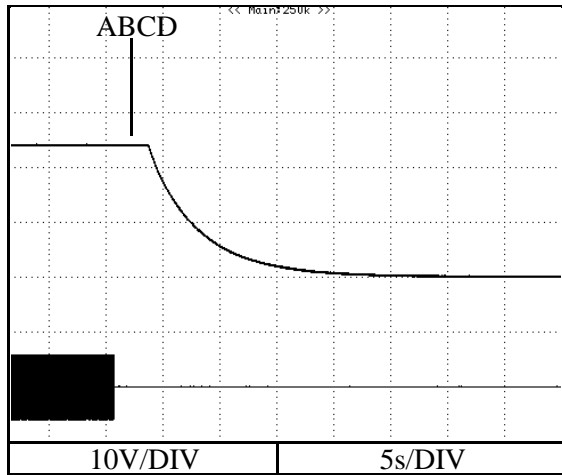
2.5 Output fall characteristics

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

24V

Iout : 0%

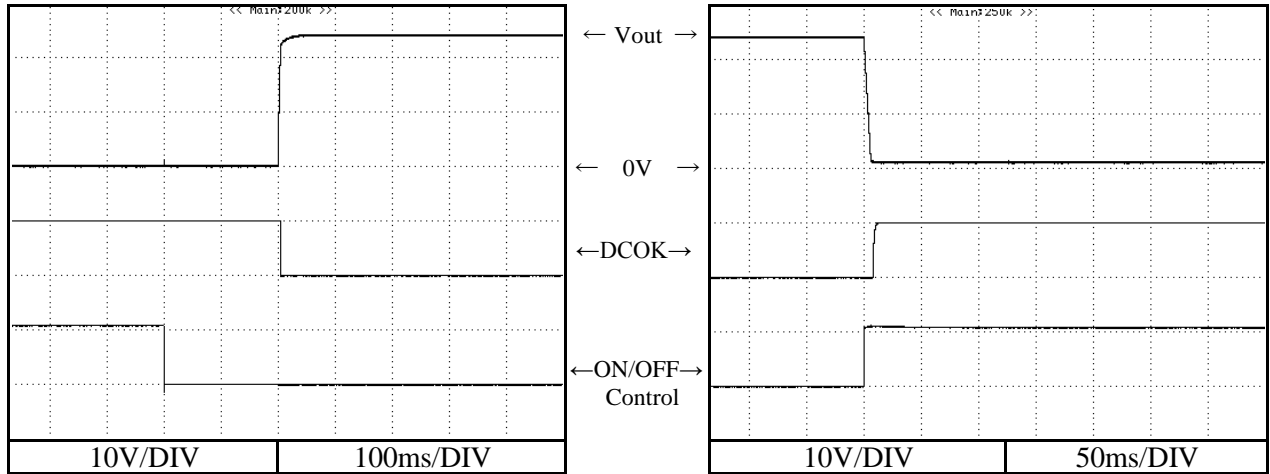
Iout : 100%



2.6 Output rise, fall characteristics with ON/OFF Control

Conditions V_{in} : 115VAC
 I_{out} : 100%
 T_a : 25°C

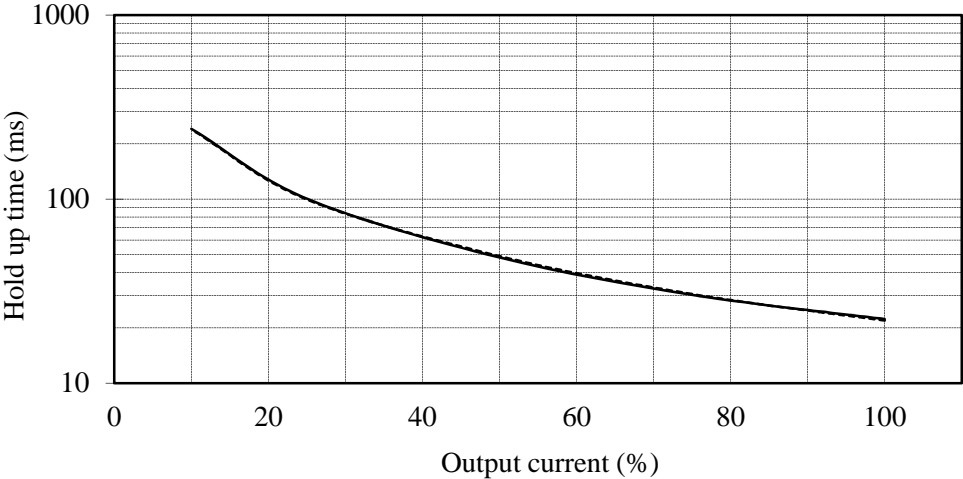
24V



2.7 Hold up time characteristics

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

24V



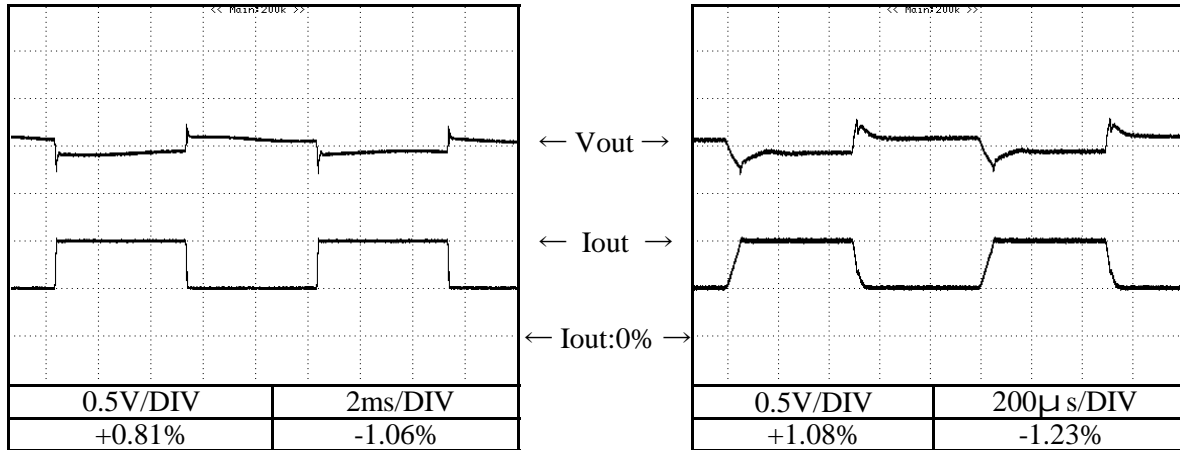
2.8 Dynamic load response characteristics

Conditions V_{in} : 115VAC
 I_{out} : 50% \leftrightarrow 100%
 (tr = tf = 50us)
 T_a : 25°C

24V

f = 100Hz

f = 1kHz

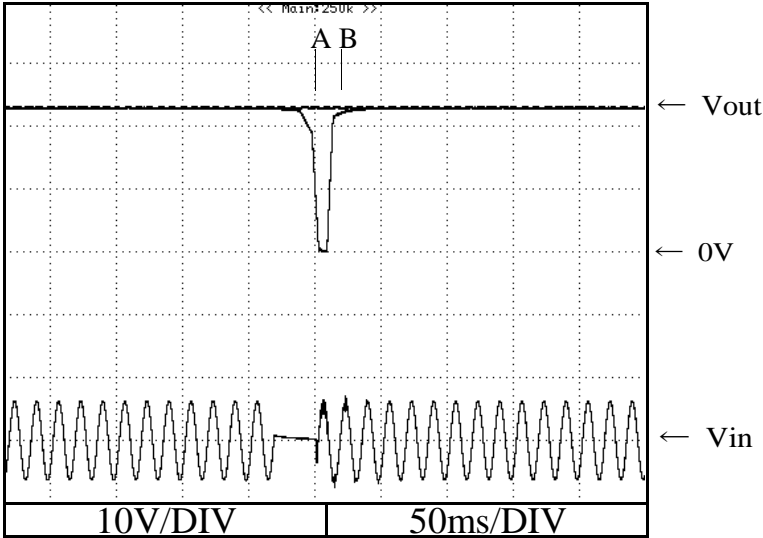


2.9 Response to brown out characteristics

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

24V

A = 20ms
B = 32ms

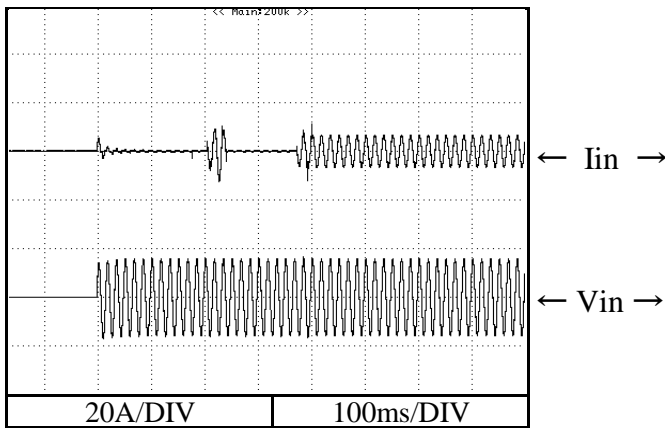


2.10 Inrush current waveform

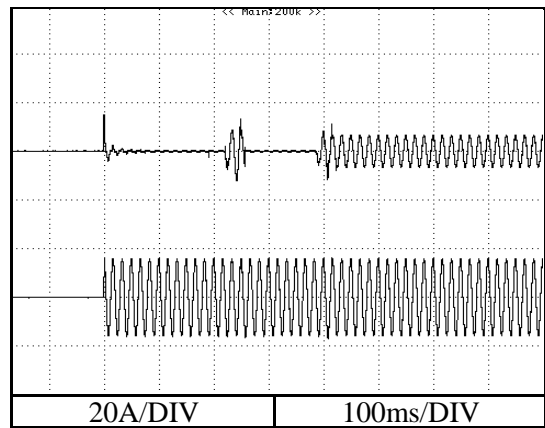
24V

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

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

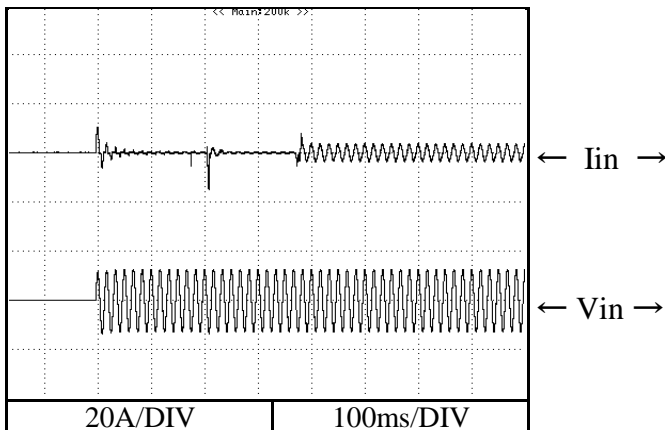


Switch on phase angle of input AC voltage
 $\phi = 90^\circ$

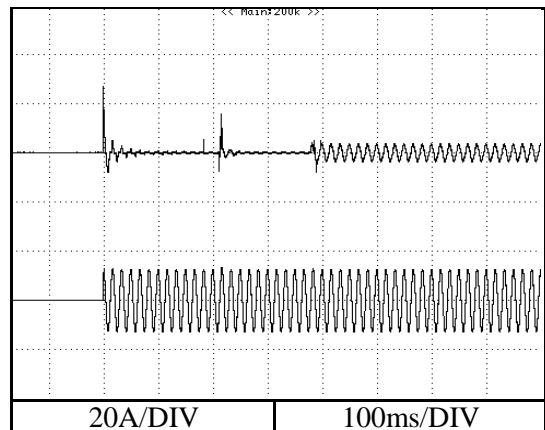


Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

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



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

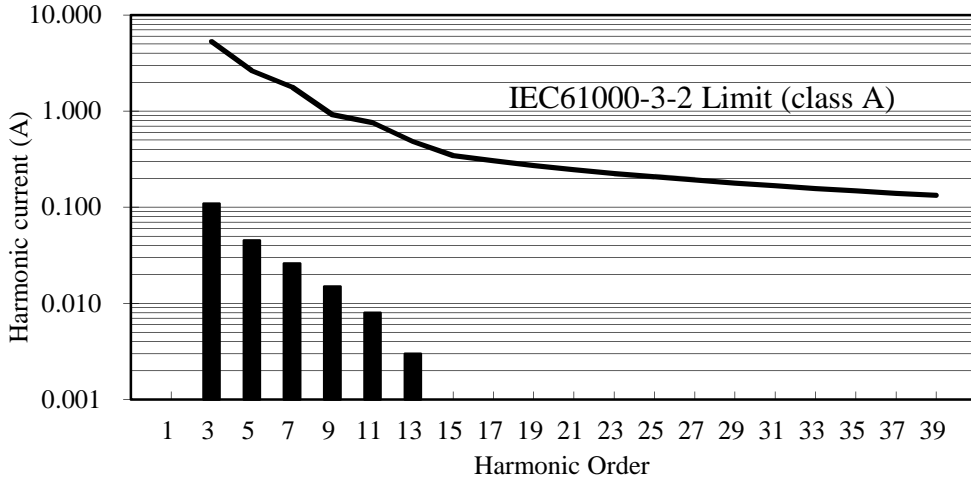


2.11 Input current harmonics

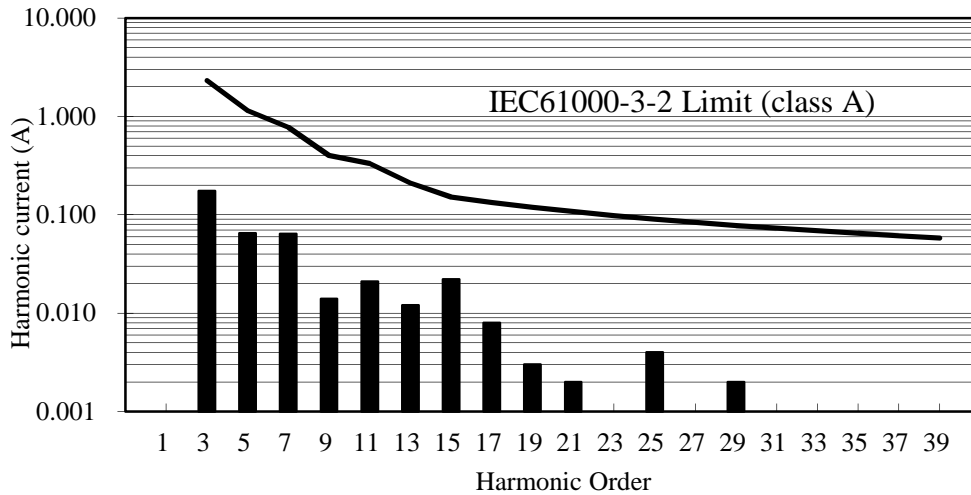
Conditions Iout : 100%
Ta : 25°C

24V

Vin : 115VAC

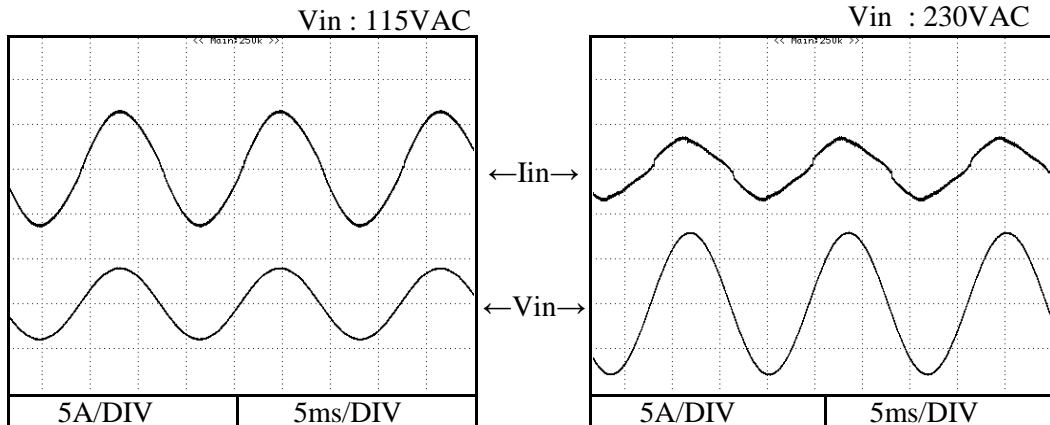


Vin : 230VAC



2.12 Input current waveform

Conditions Iout : 100%
Ta : 25°C

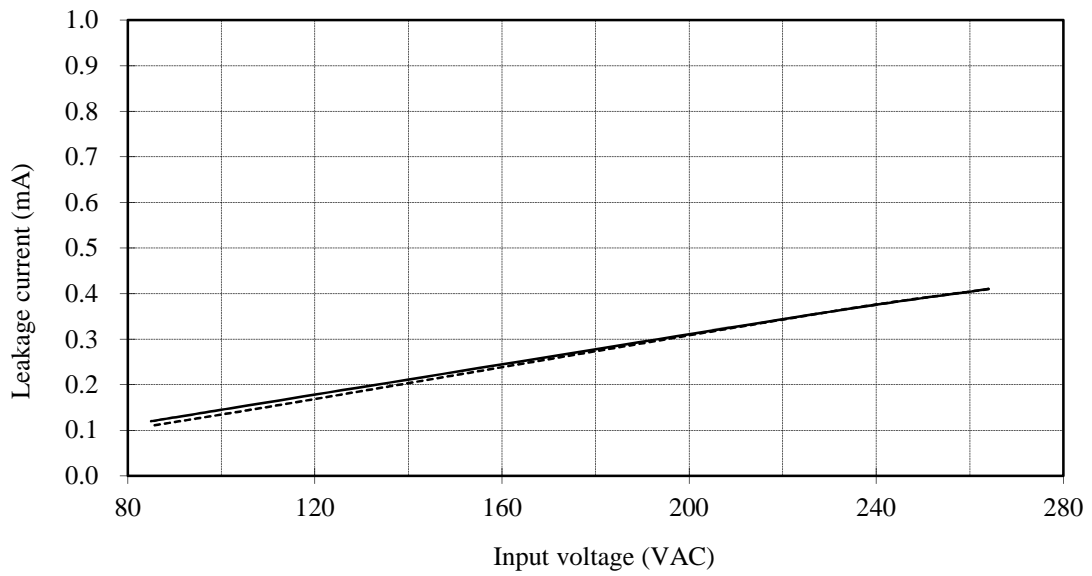


2.13 Leakage current characteristics

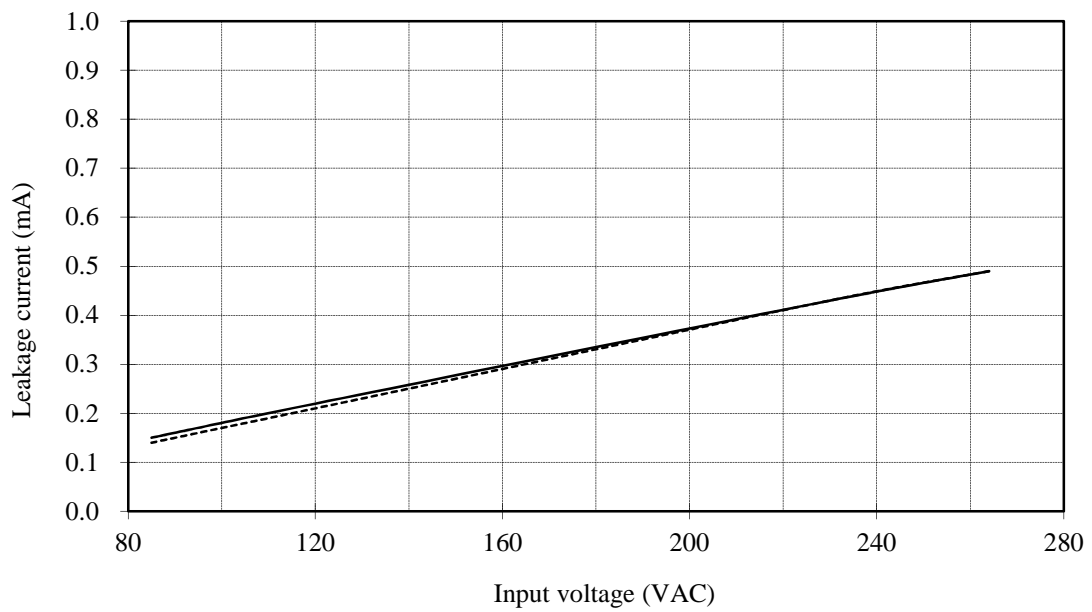
Conditions Iout : 0% -----
100% ———
Ta : 25°C

24V

f : 50Hz



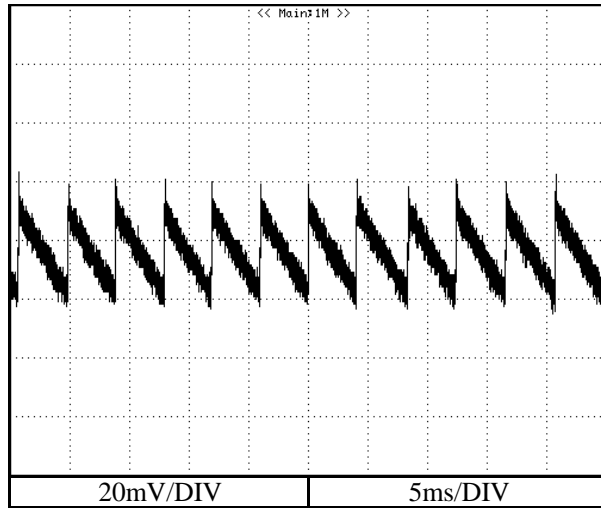
f : 60Hz



2.14 Output ripple and noise waveform

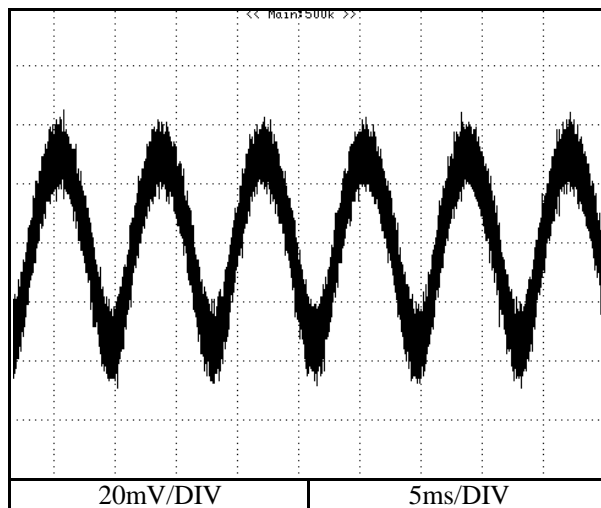
Conditions Vin : 230VAC
Iout : 0%
Ta : 25°C

24V



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

24V



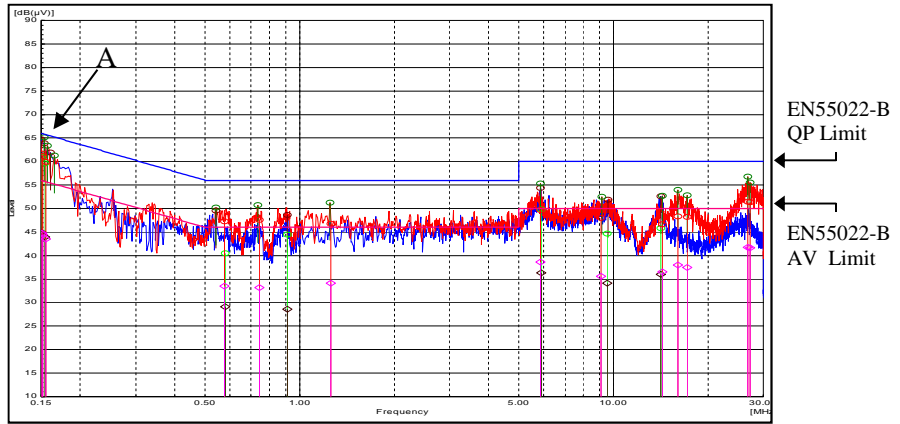
2.15 Electro-Magnetic Interference characteristics

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

Conducted Emission

24V

Point A (0.15MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	66.0	61.7
AV	56.0	44.8



2.15 Electro-Magnetic Interference characteristics

Conditions Vin : 230VAC
 Iout : 100%
 Ta : 25°C
 Horizontal : — (orange)
 Vertical : — (blue)

Radiated Emission

24V

Point A (31.5MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	35.7

