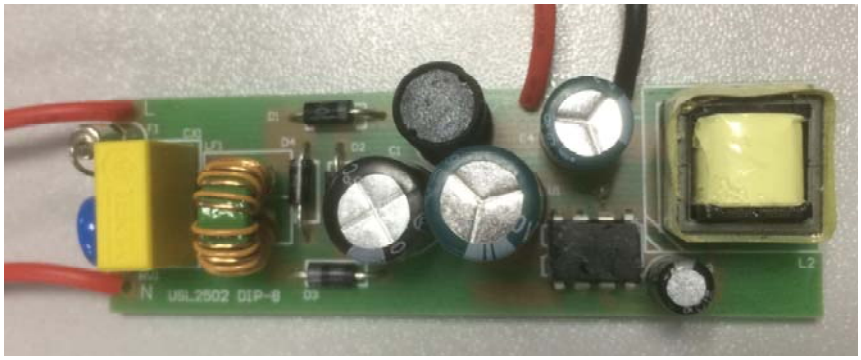
UNISONIC TECHNOLOGIES CO., LTD

24W LED Driver Module Using USL2502



Subject

USL2502 Non-Isolated LED Driver_24W_0.3A_Demo Board Manual

Key features:

●AC Input Range 176Vac~264Vac

●High Efficiency(91.84%@220Vac,full load)

●Excellent line voltage regulation and load regulation(<±3%)

●Multiple protection functions and high reliability

Revision History

Revise Date	Version	Reason/Issue
2017/9/29	A	First Issue

24W LED Driver Module Using USL2502

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24W LED Driver Module Using USL2502

1. LED Demo Board Specification

1.1. Input Characteristics

● AC input voltage rating	220Vac ~ 240Vac
● AC input frequency range	176Vac~264Vac
● AC input frequency range	47Hz ~ 63Hz

1.2. Output Characteristics

● Output Voltage	50Vdc~80Vdc
●Typical output current	300mA

1.3. Performance Specifications

● Maximum Output Power	24W

1.4. Protection Function

● Short Circuit Protection	Shut down and auto recovery
● VCC OVP&UVLO	Shut down and auto recovery
● OTP	Reduce the output current till shutdown

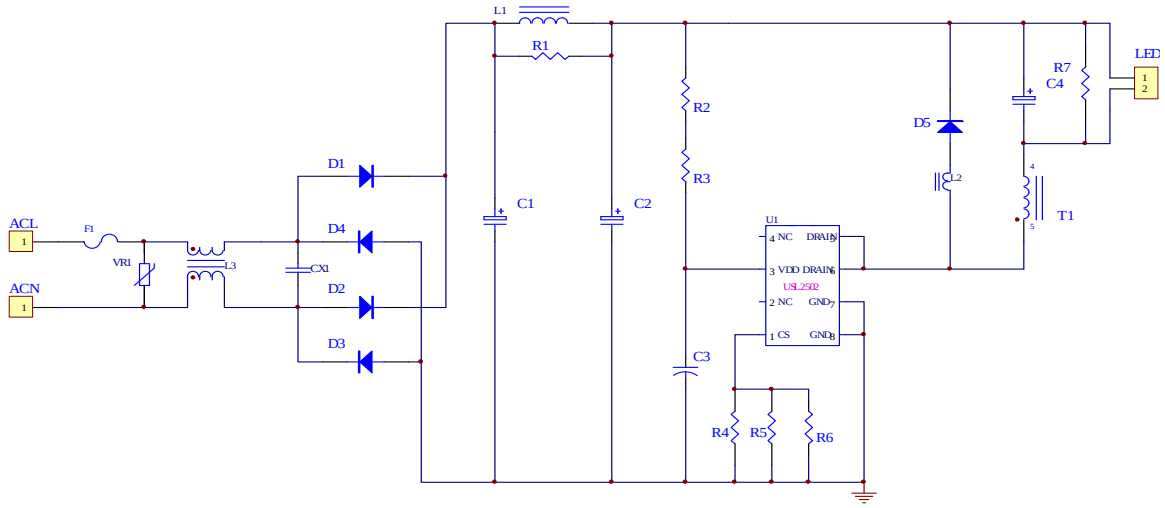
1.5. Environment

● Operation Temperature	0℃ to 40 ℃
● Operation Humidity	20% to 90% R.H
● Storage Temperature	-40℃ to 60 ℃
● Storage Humidity	0% to 90% R.H

24W LED Driver Module Using USL2502

2. LED Demo Board Information

2.1. Schematic



2.2. BOM

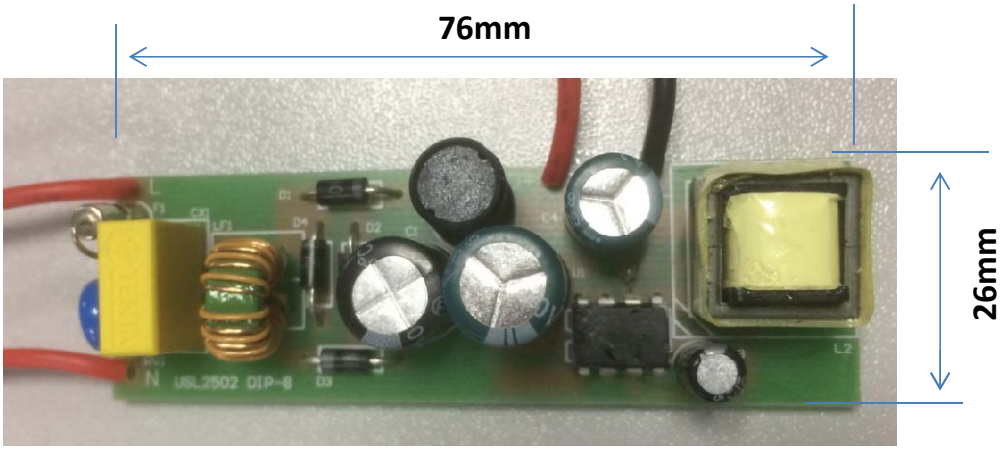
No.	Position	Description	Quantity
1	F1	Fuse 1.5A/250VAC	1
2	L1	Inductor, 8*10,1mH	1
3	L2	Resistor chip, 0R/1206 ,1/4W,±5%	1
4	L3	Common mode choke,1.3mH,9*5*3	1
5	R1	Resistor chip, 5.1K/1206 ,1/4W,±5%	1
6	R2,R3	Resistor chip, 330K/1206 ,1/4W,±5%	2
7	R4,R5,R6	Resistor chip, 2.4R/1206 ,1/4W,±1%	3
8	R7	Resistor chip, 22K/1206 ,1/4W,±5%	1
9	C1	Capacitor aluminum electrolytic, 8.2uF/400V	1
10	C2	Capacitor aluminum electrolytic, 10uF/400V	1
11	C3	Capacitor aluminum electrolytic, 10uF/50V	1
12	C4	Capacitor aluminum electrolytic, 10uF/250V	1
13	CX1	X2 capacitor, 0.1uF/275VAC	1
14	D1-D4	Diode,A7,1A/1000V	4
15	D5	Diode,ES2J,2A/600V	1
16	T1	EE13,2.0mH, Φ0.25*242T	1
17	VR1	Piezoresistor,7D471K	1
18	U1	UTC USL2502G DIP-8	1

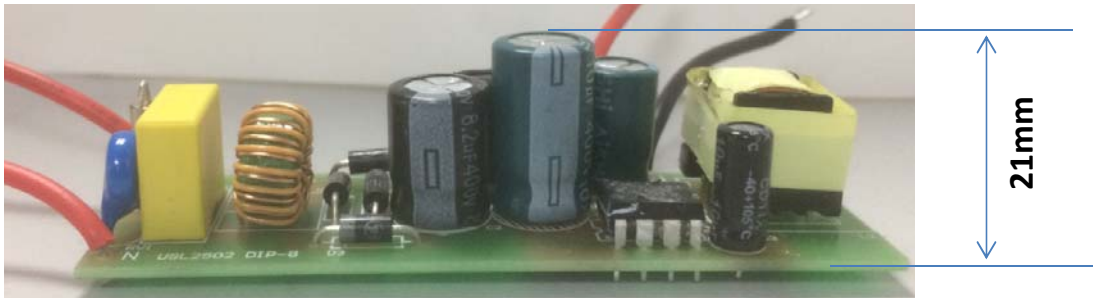
2.3. TR Design

1）Bobbin：EE13 4+4
2）Core material: PC40(TDK or equivalent)
3）Lp 2-1: 2.0mH ±5%（10KHz/1.0V）

层数	脚位	线径	匝数
N1	1脚-8脚	φ0.25mm 顺时针密绕	242T
绝缘胶带		Tape	2T

2.4. Demo Board Snapshot





3. Performance Evaluation

This document presented here is to describe the LED Driver Module performance.

The measuring data are tested at the PCB end, unless otherwise specified.

The Summarized Result :

Item	Test result
1. Input Characteristics	
Input Voltage rating	220Vac ~ 240Vac
Input Current (@Vin=176Vac, full load)	283mA
2. Output characteristics	
Maximum Output Power	24W
Output Typical Voltage	50Vdc~80Vdc
Output Typical Current	300mA
3. Protection	
Short Circuit Protection	Auto Recovery

Test Equipment:

Item	Vendor	Model No:
1.AC Source	GW INSTEK	APS-9501
2.Digital Power meter	DECTECH	3330S
3.Electronic Load	PRODIGIT	3302C
4.Digital Oscilloscope	Tektronics	DPO3012
5.Multi-meter	Keithley	2000

3.1 Input Current&PF @Full Load

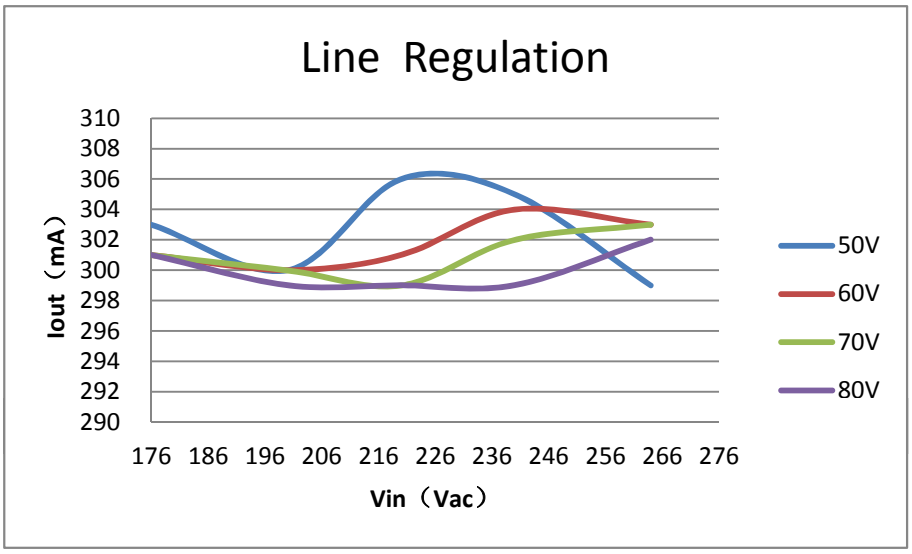
Input Voltage	Irms (mA)	PF	RESULT
176Vac/50Hz	283	0.527	N/A
200Vac/50Hz	249	0.523	
240Vac/50Hz	210	0.517	
264Vac/50Hz	192	0.521	

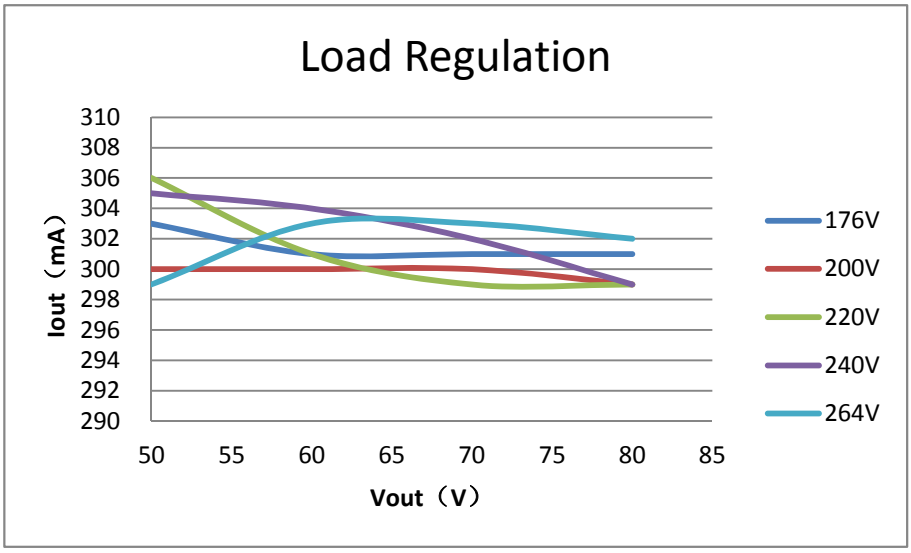
3.2 Efficiency @Full Load

Input Voltage(Vac)	Efficiency(%)
176	91.66%
200	91.58%
220	91.96%
240	91.79%
264	91.69%

3.3 Line Regulation&Load Regulation

Vout（V） / Vin	Pin(W)&Iout(mA)								Load Regulation
	50		60		70		80		
176	16.80	303	19.91	301	22.98	301	26.27	301	±0.03%
200	16.67	300	19.82	300	22.90	300	26.12	299	±0.17%
220	17.04	306	19.89	301	22.81	299	26.01	299	±1.17%
240	16.97	305	20.11	304	23.04	302	26.06	299	±1%
264	16.72	299	20.09	303	23.17	303	26.35	302	±0.07%
Line Regulation(%)	±1.17%		±0.07%		±0.07%		±0.05%		\





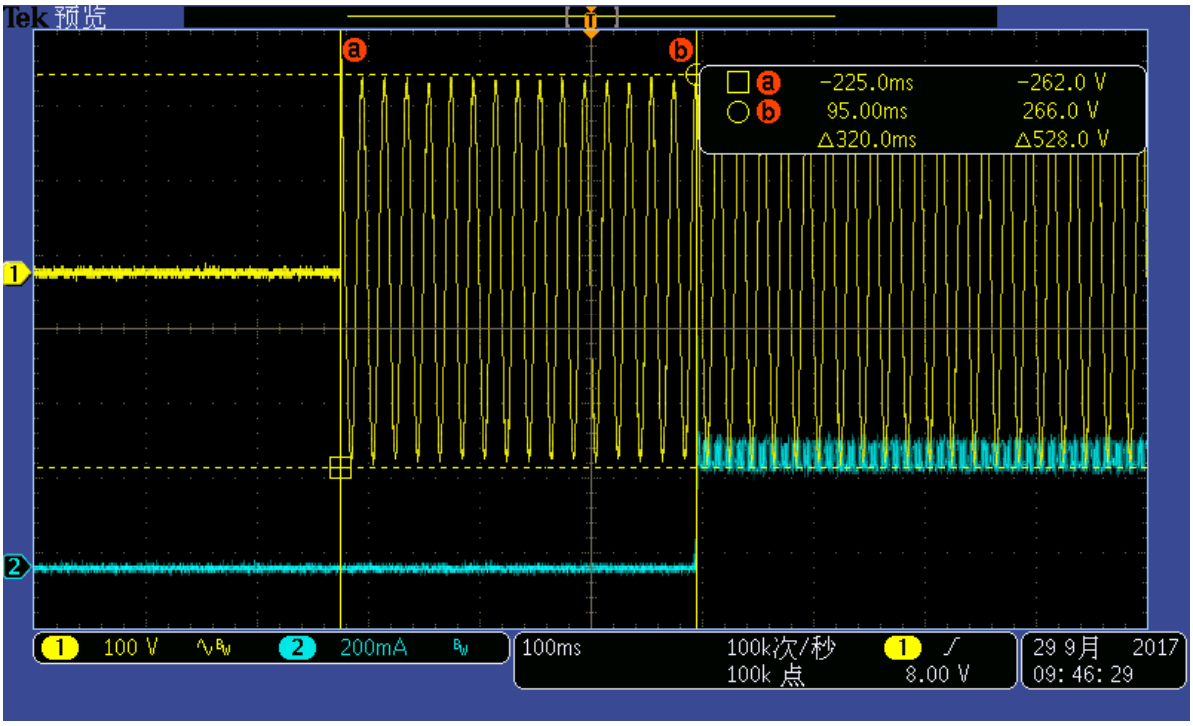
3.4 Temperature

Test@FULL LOAD Ambient 30℃

input / voltage	176Vac	264Vac
IC1(USL2502)	97.0	82.0
TR Core	80.0	84.0
TR Wire	92.0	97.0
Diode(ES2J)	78.0	76.0

3.5 Start-up Time

Input Voltage（Vac）	Start-Up Time (s)
176	0.32



4 Waveforms

4.1 Vds&Vcs waveform

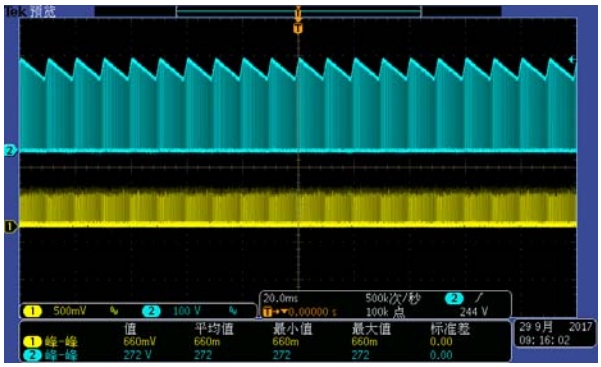


Fig.1 Vds&Vcs @Vin=176Vac Vout=80V

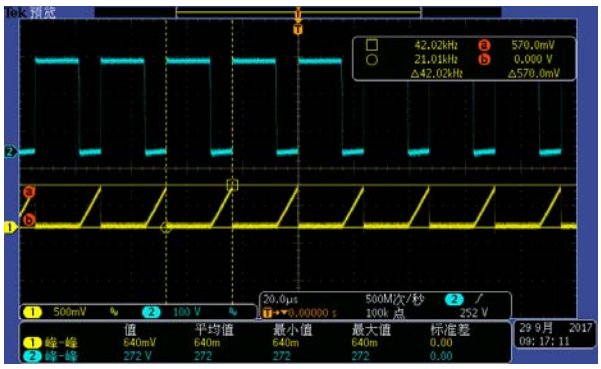


Fig.2 Spread Vds&Vcs @Vin=176Vac Vout=80V Vds=272V Vcs=570mV f=42.02KHz

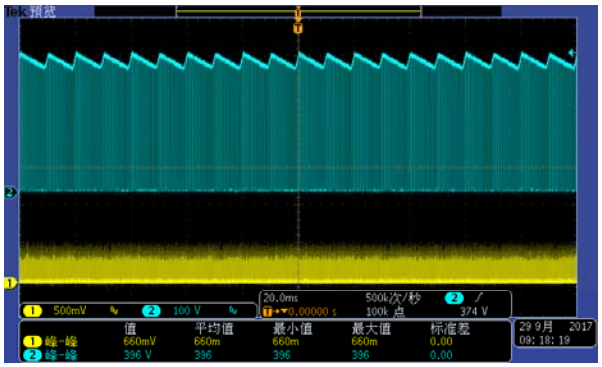


Fig.3 Vds&Vcs @Vin=264Vac Vout=80V

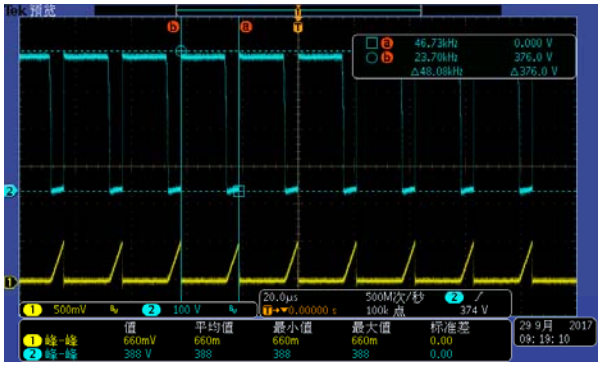


Fig.4 Spread Vds&Vcs @Vin=264Vac Vout=80V Vds=376V Vcs=660mV f=48.08KHz

4.2 VD5 waveform

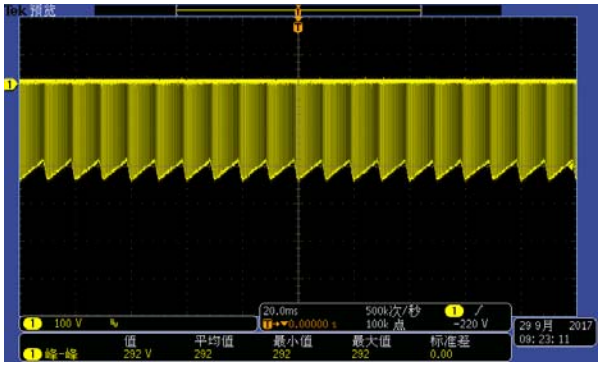


Fig.5 VD5 @Vin=176Vac Vout=80V

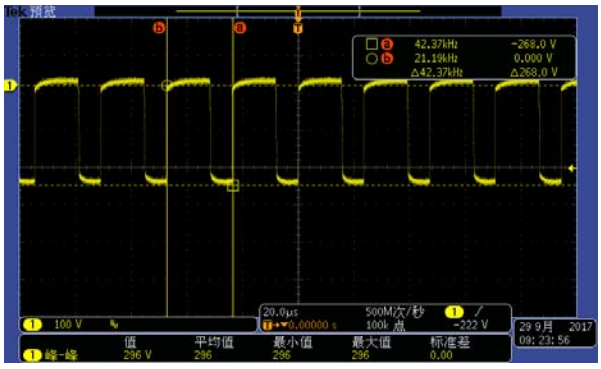


Fig.6 Spread VD5 @Vin=264Vac Vout=80V VD5=268V f=42.37KHz

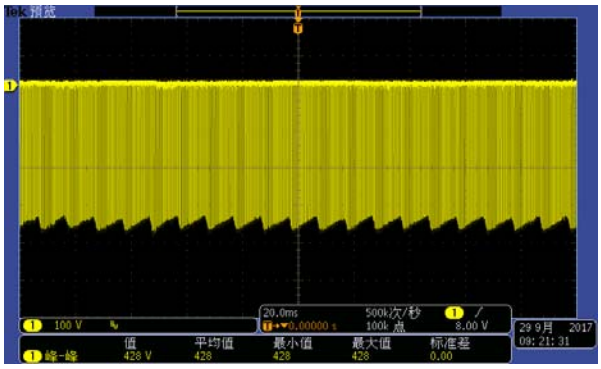


Fig.7 VD5 @Vin=264Vac Vout=80V

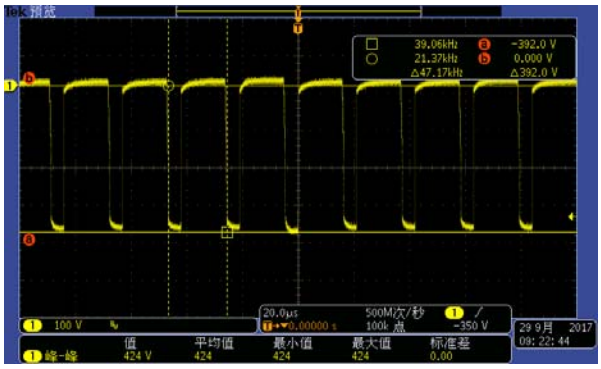


Fig.8 Spread VD5 @Vin=264Vac Vout=80V
VD5=392V f=47.17KHz

4.3 VCC waveform

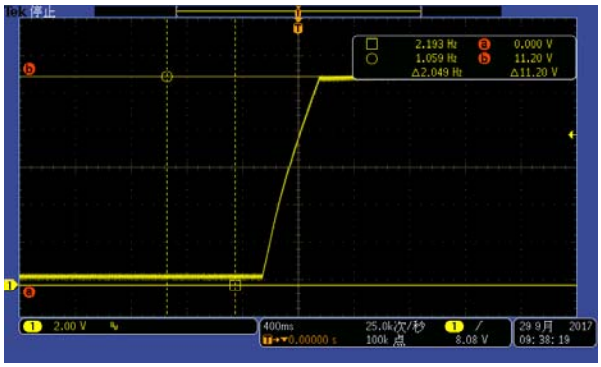


Fig.9 VCC waveform@Vin=176Vac Vout=80V
Start-up VCC=11.2V

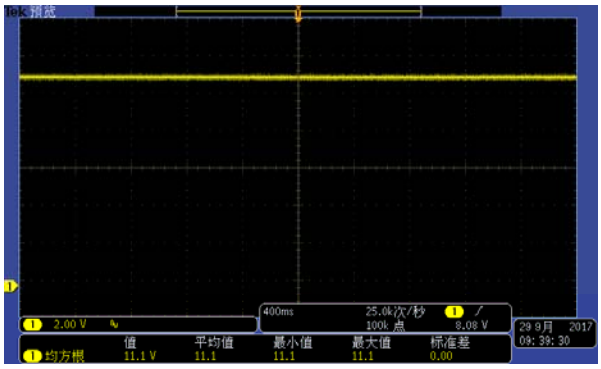


Fig.10 VCC waveform@Vin=176Vac Vout=80V
VCC=11.1V

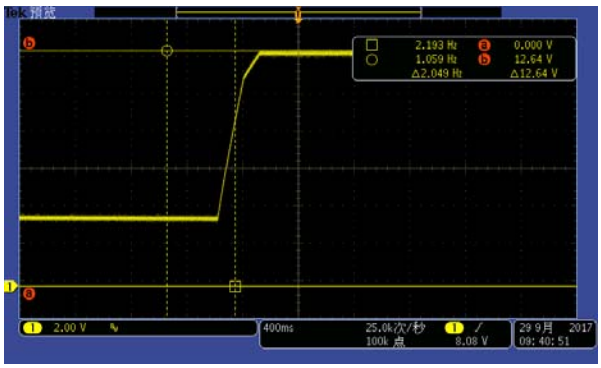


Fig.11 VCC waveform@Vin=264Vac Vout=80V
Start-up VCC=12.64V

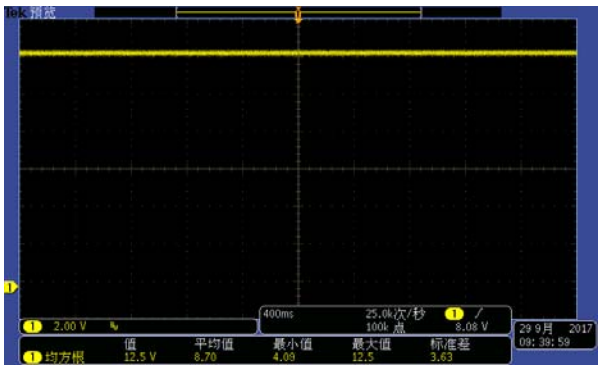
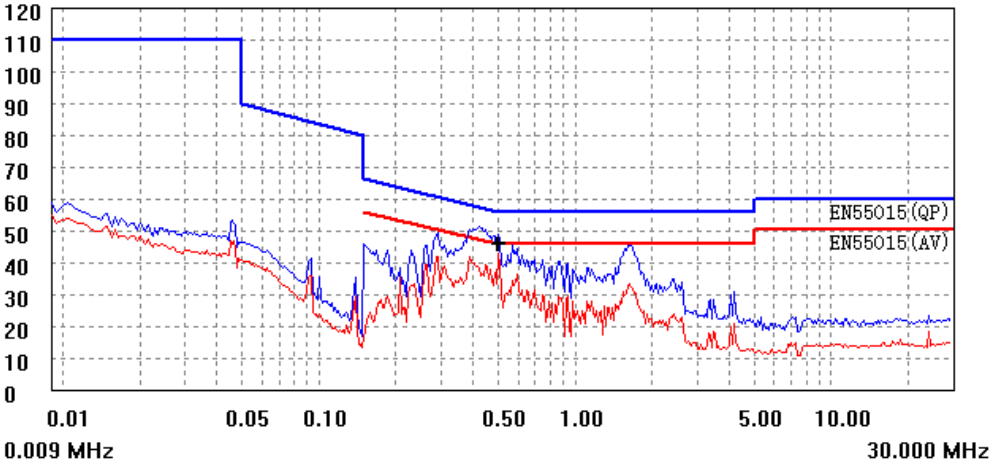


Fig.12 VCC waveform@Vin=264Vac Vout=80V
VCC=12.5V

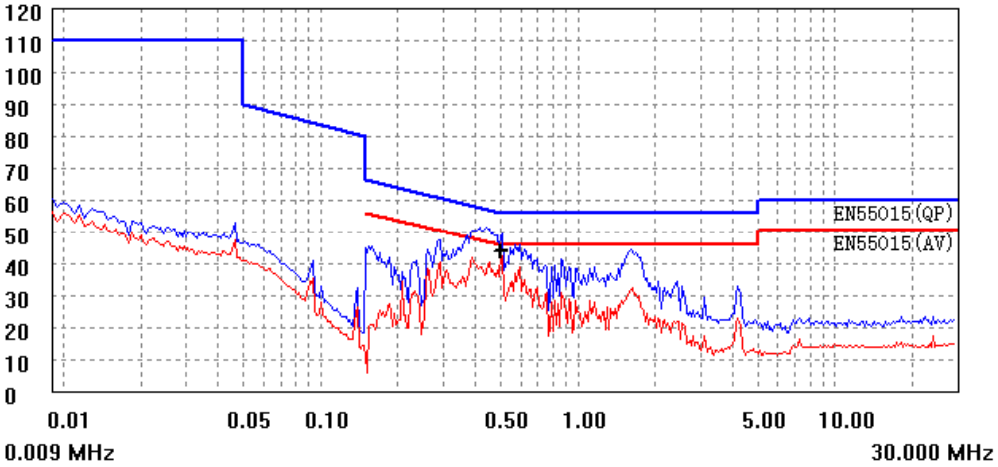
5 EMI

(Test @Vin=230Vac/50Hz, FULL Load)

5.1 Live Conduction



5.2 Netural Conduction



5.2 Vertical Radiated