BCT001 System Evaluation Report Based on 5V1A(150mW)

System Engineering

2013.06.01

Phickps

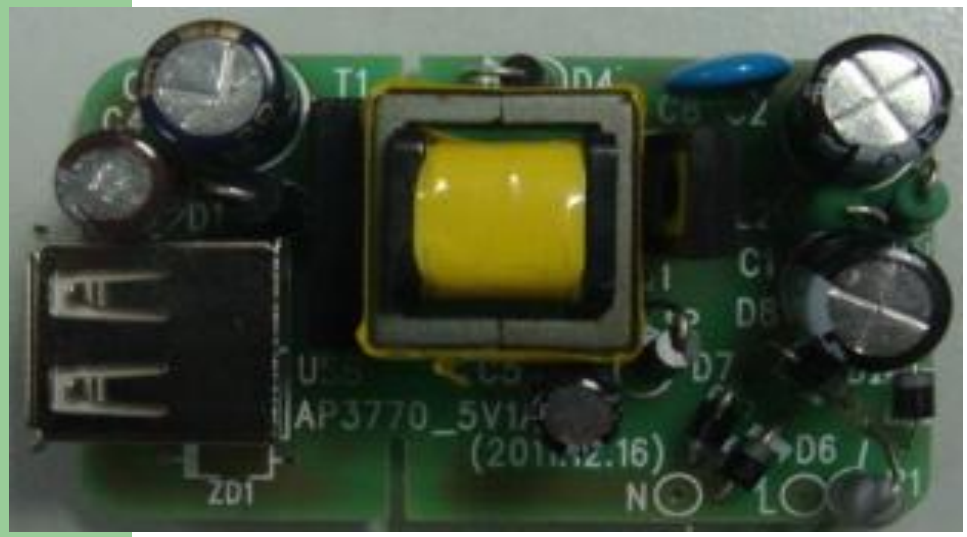
Change Contents

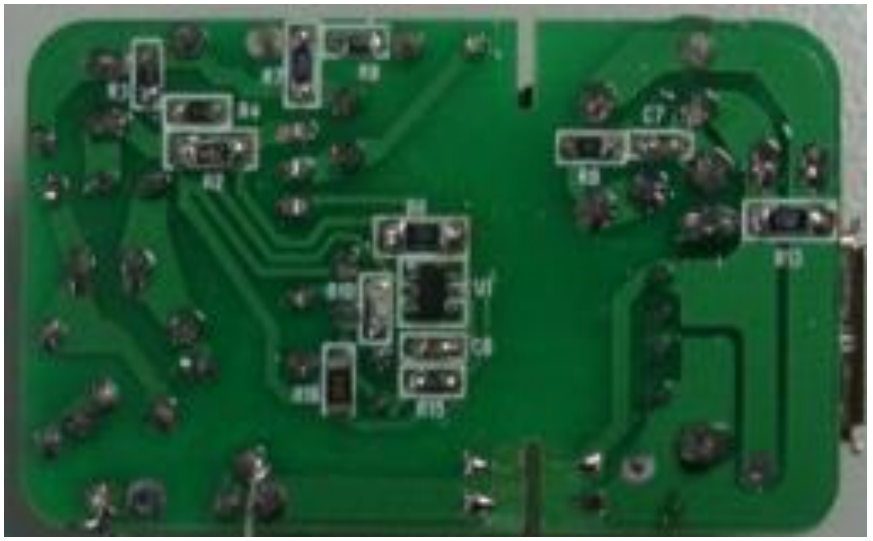
- 线补偿采用**FB**分压电阻可调
- 省去**CPC**电容
- 更小的输出纹波

Specification

Description	Min	Typ	Max	Units	Conditions
Input					
Voltage	85	50/60	264	VAC	
Frequency	47		63	Hz	
No Load Input Power			150	mW	
Output					
Output Voltage	4.75	5.0	5.25	V	
Output Ripple Voltage			150	mVpp	20M Bandwidth
Output Current	1.0		1.25	A	
Output Power (Pno)	5			W	
Output Voltage Undershoot	4			V	0A to 1A
Efficiency					
Average Efficiency	68.2			%	With 30cm AWG26 USB cable (0.165ohm)
EMI	Pass EN55022 Class B with 6dB margin				

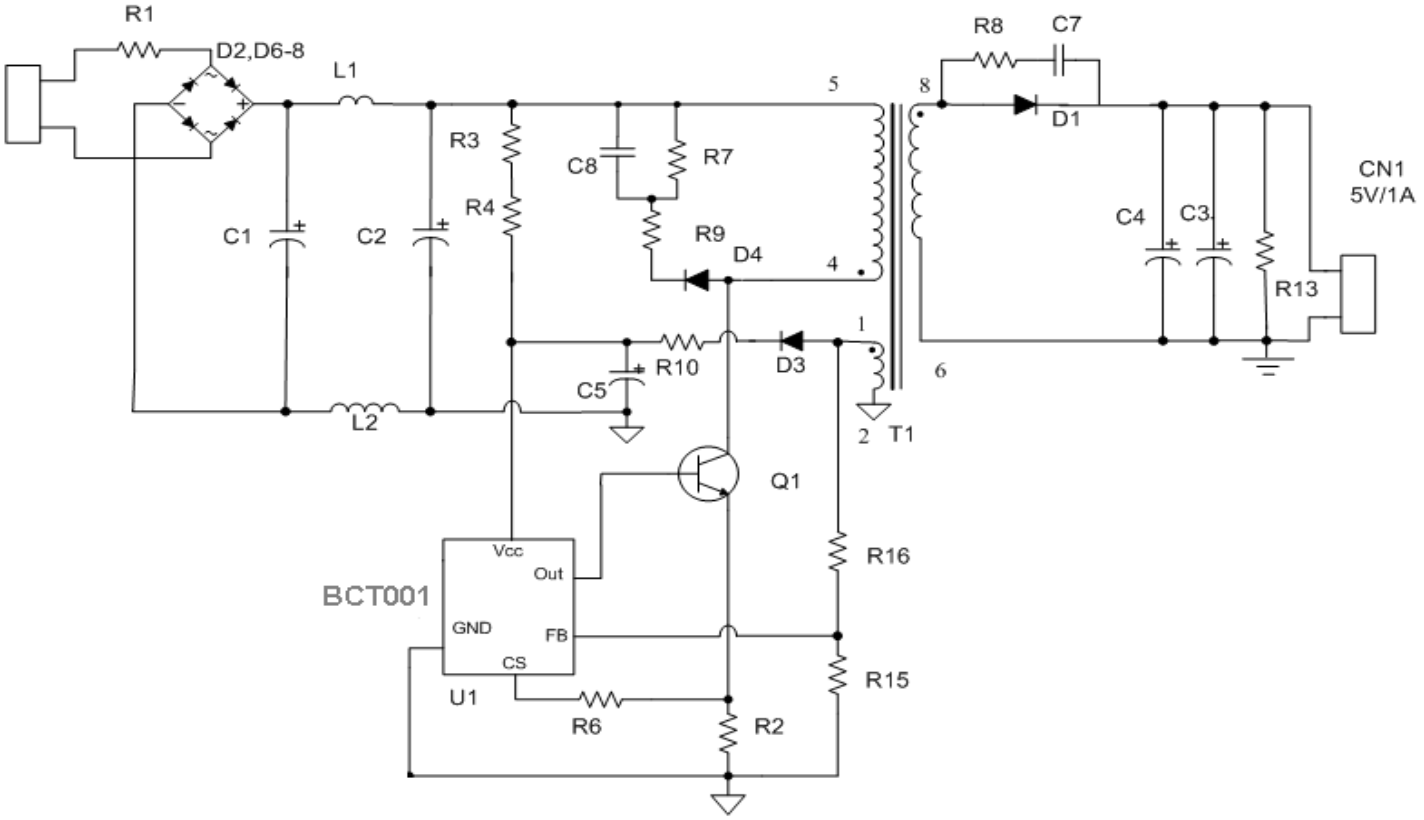
Photo of DEMO





Dimension:59.5X31X14mm

Schematic of 5V/1A DEMO board



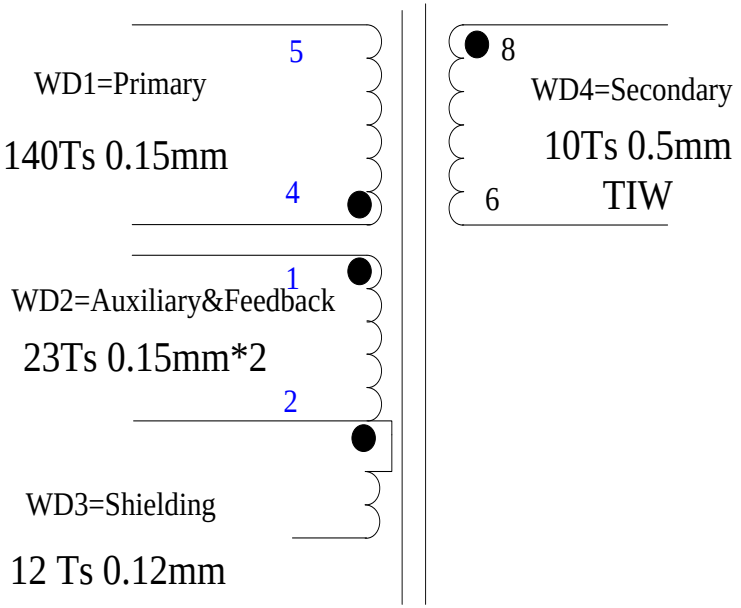
BOM of 5V/1A DEMO Board

1	L1	1mH inductance	1
2	L2	2.2uH inductance	1
3	D2,D6-8	1A7	4
4	C1, C2	400V, 6.8uF E-CAP	2
5	C3	10V, 680uF E-CAP	1
6	C4	10V,330uF	1
7	C5	50V2.2uF CAP	1
8	C7	0805-50V-470PF	1
9	C8	1KV-1nF C-CAP	1
10	R1	0.5W-10ohm resister	1
11	R2	1206-1R5, 1%	1
12	R3, R4	0805-2M, 5%	2
13	R6	1206-2K, 5%	1
14	R7	1206-200K, 5%	1
15	R8	0805-100R, 5%	1

BOM of 5V/1A DEMO Board

17	R9	0805-220R,5%	1
18	R10	0805- 3R3, 5%	1
19	R13	1206-1.2K, 5%	1
20	R15	0603-15K, 1%	1
21	R16	0603-33.2K/432K 1%	1
22	D1	APD340	1
23	D3	FR107	1
24	D4	1N4007	1
25	Q1	APT13003S	1
26	U1	BCT001A	1
27	T1	EE16, PC40	1

Transformer Specification

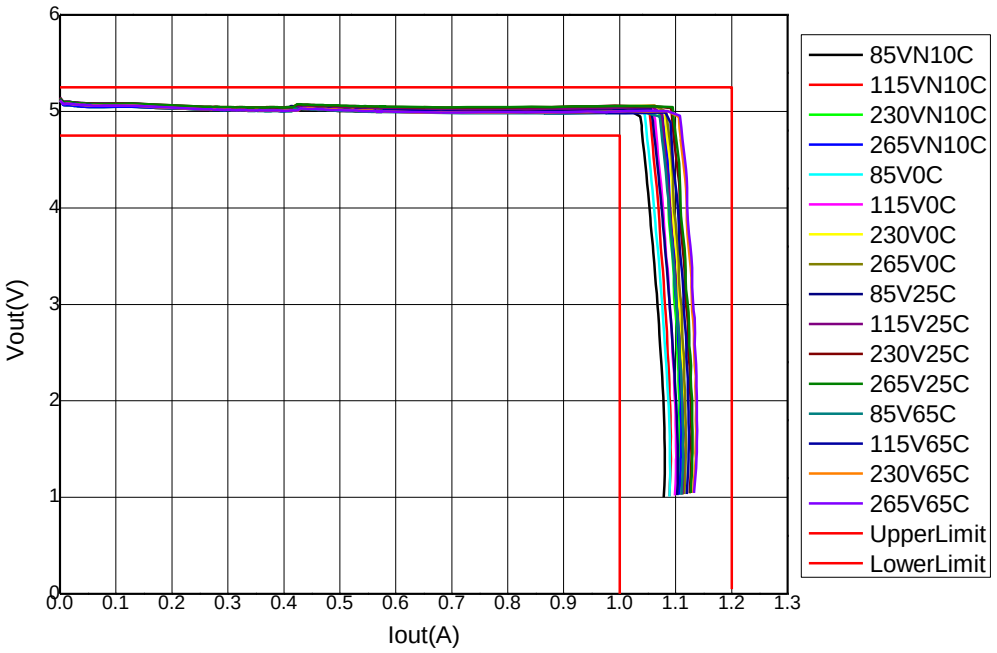


Primary Inductance	**Pin 1-2,all other windings open, measured at 1kHz, 0.4VRMS**	**2.0mH, ±7%**
Primary Leakage Inductance	**Pin 1-2, all other windings shorted, measured at 10kHz, 0.4VRMS**	**30 uH (Max.)**

Transformer Specification

Winding Sequence: Begin from the central column of the Bobbin. Primary side of the bobbin is placed on the left hand side, and secondary side of the bobbin is placed on the right hand side.	
WD 1 Primary winding	Start at Pin 4. Wind 47turns of ø0.15mm wire from left to right. Wind another 47turns on the next layer from right to left. Wind the last 46 turns from left to right. Finish on Pin 5. Wind tightly & spread evenly
Insulation	2 Layers of insulation tape , 0.05mm thick, 8.0mm wide.
WD 2 Auxiliary winding	Start at Pin 1. Wind 23 turns of two paralleled ø0.15mm wire from left to right. Finish on Pin 2. Wind tightly & spread evenly
WD 3 Wire Shielding	Start at Pin 2. Wind 12 turns of ø0.12mm wire from left to right. The terminal float. Spread evenly.
Insulation	1 Layer of insulation tape , 0.05mm thick, 8.0mm wide.
WD 4 Secondary winding	Reverse the bobbin. Start at Pin 6. Wind 10 turns of ø0.5mm Triple Insulated Wire from left to right .Terminate on Pin 8. Wind tightly & spread evenly (wire from primary to secondary side)
Insulation	2 Layers of insulation tape , 0.05mm thick, 8.0mm wide.
varnish	varnish core and bobbin

I-V Curve @ -10℃, 0 ℃, 25 ℃ and 65 ℃

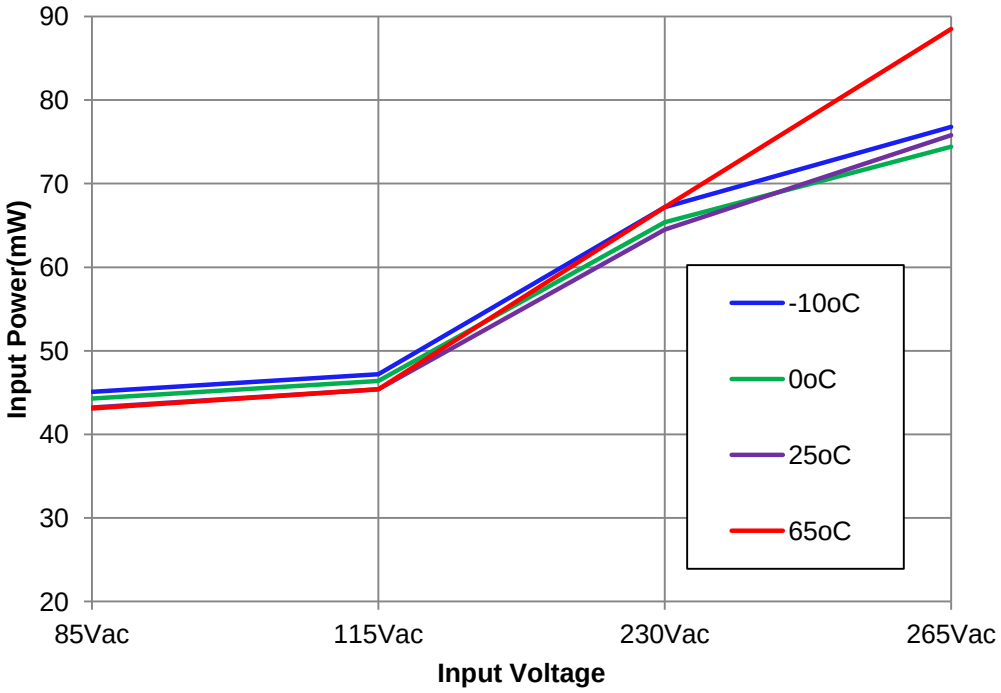


Test Result @ 25 ℃ :
CV Regulation:1.351%
CC Regulation:31.1mA
@Vo=3V

Test Result @ Full Temp. :
CV Regulation:1.675%
CC Regulation:62.1mA
@Vo=3V

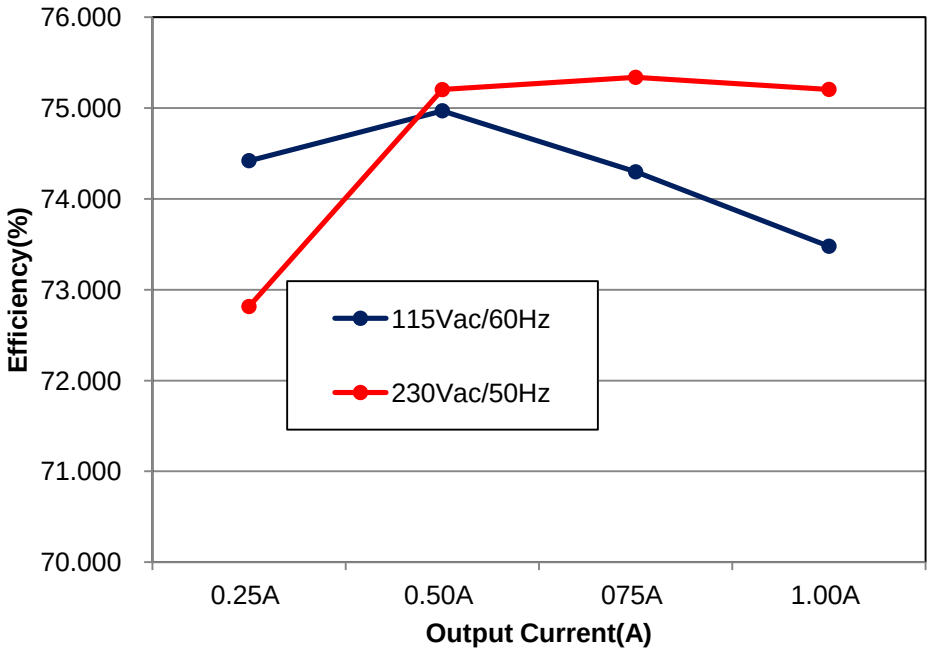
Test Condition: Tested at end of 30cm long 26# AWG cable

No Load Input Power



Vin=230VAC@25ºC
Stand by Power=64.5mW

Efficiency (with 30cm AWG26 cable)



Average Efficiency:

115Vac=74.292%

230Vac=74.640%

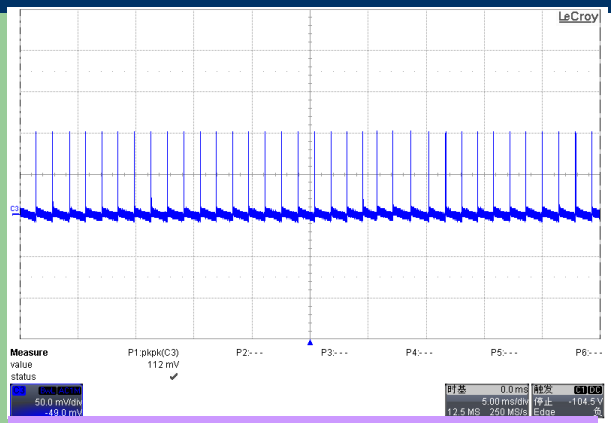
Ripple @ -10℃, 0 ℃, 25 ℃ and 65 ℃

Output Voltage Ripple (mV)		Output Loading				
		0%	25%	50%	75%	100%
@ -10℃	85V/60Hz	112	139	210	208	198
	115V/60Hz	110	144	213	210	203
	230V/50Hz	112	146	216	210	202
	265V/50Hz	106	141	206	204	197
@ 0℃	85V/60Hz	83	110	165	165	158
	115V/60Hz	80	106	157	157	154
	230V/50Hz	80	107	155	154	149
	265V/50Hz	80	107	157	154	150
@ 25℃	85V/60Hz	41.6	59.5	93.4	97.3	95.4
	115V/60Hz	43.5	58.9	87.0	91.5	88.3
	230V/50Hz	45.4	60.8	87.7	88.3	88.3
	265V/50Hz	44.8	58.9	88.3	89.6	104.3
@ 65℃	85V/60Hz	28.8	38.4	58.9	69.1	101.1
	115V/60Hz	28.8	38.4	57.0	73.6	73.0
	230V/50Hz	29.4	39.7	57.0	58.9	61.4
	265V/50Hz	30.7	38.4	57.0	59.5	63.4

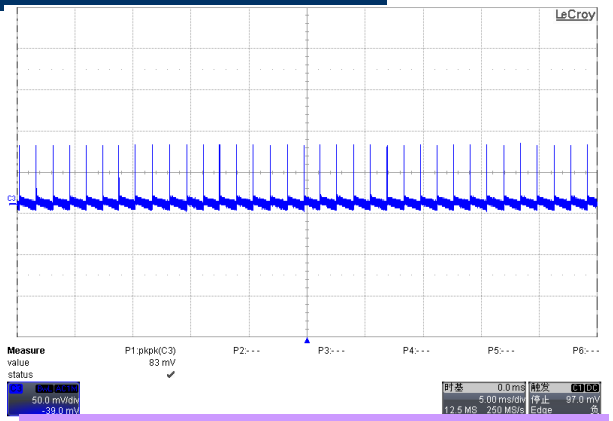
Ripple is decrease with temperature, mostly because ESR and capacitance of output cap change with temperature.

But there are still some exceptions.

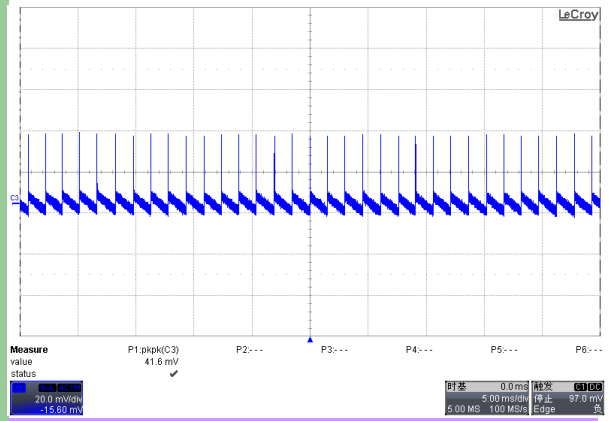
Ripple @ 85Vac, Open Load



-10℃ Vp-p=112mV

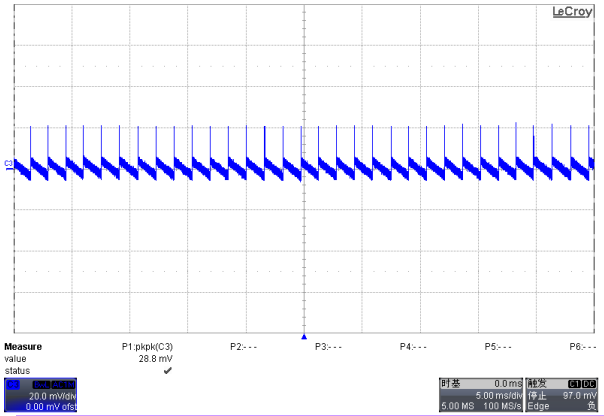


0℃ Vp-p=83mV



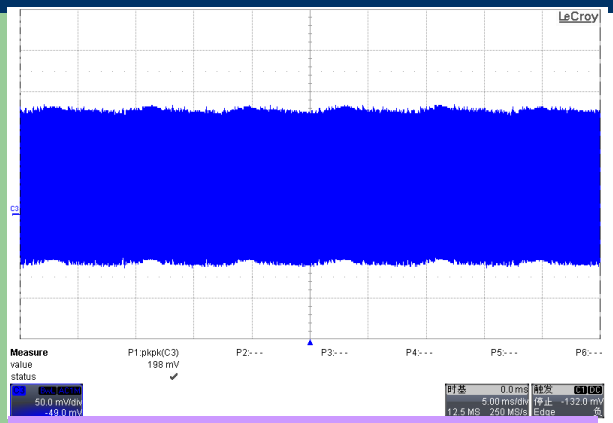
25℃ Vp-p=41.6mV

With 10uF and 0.1uF capacitor and BNC at output

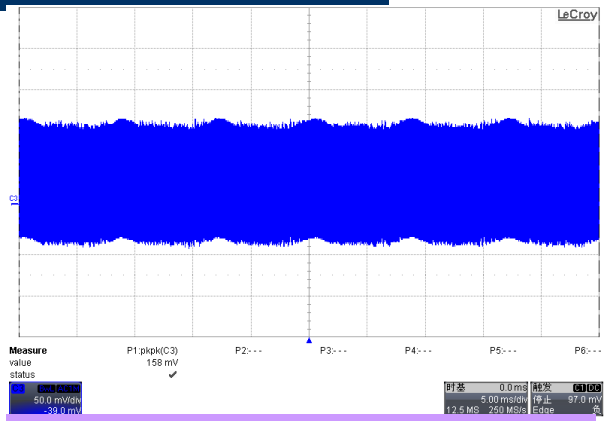


65℃ Vp-p=28.8mV

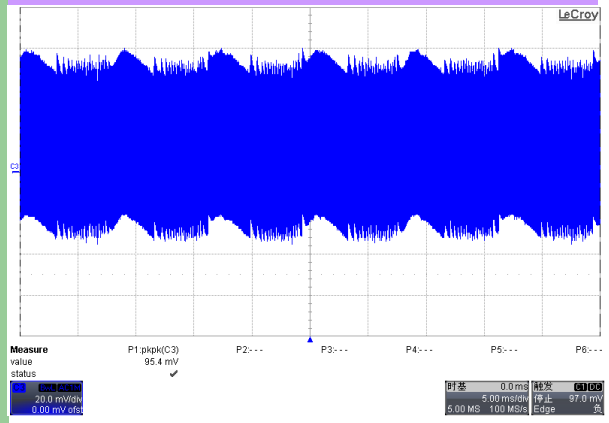
Ripple @ 85Vac, Full Load



-10℃ Vp-p=198mV

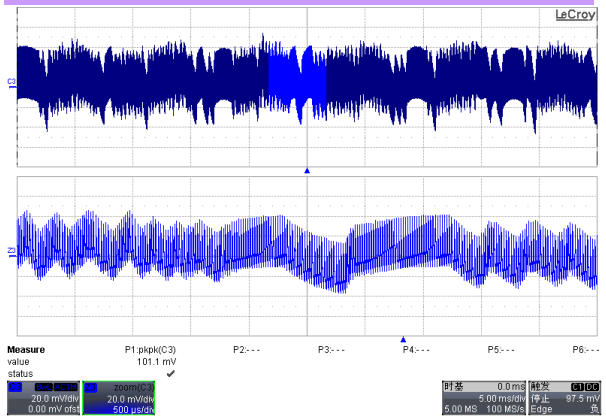


0℃ Vp-p=158mV



25℃ Vp-p=95.4mV

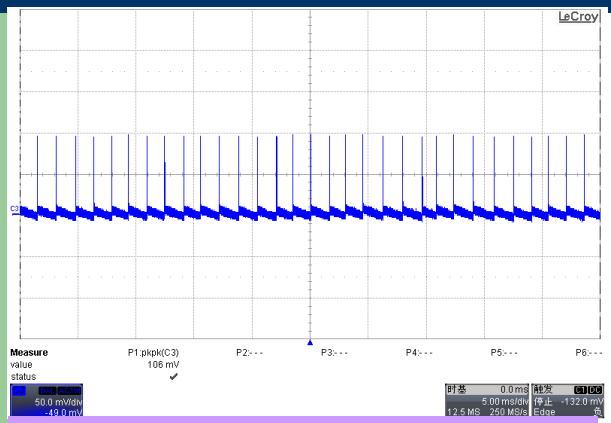
With 10uF and 0.1uF capacitor and BNC at output



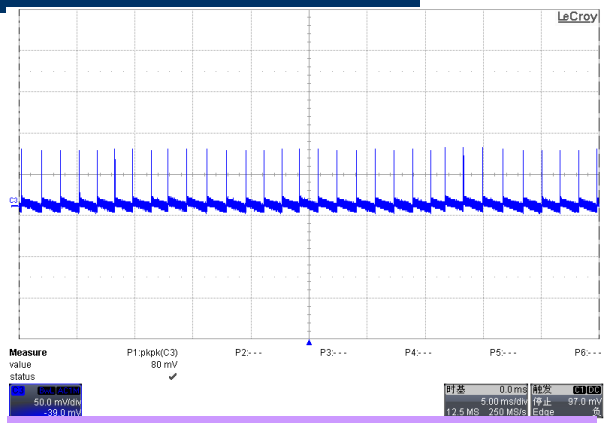
65℃ Vp-p=101.1mV

2013/11/7

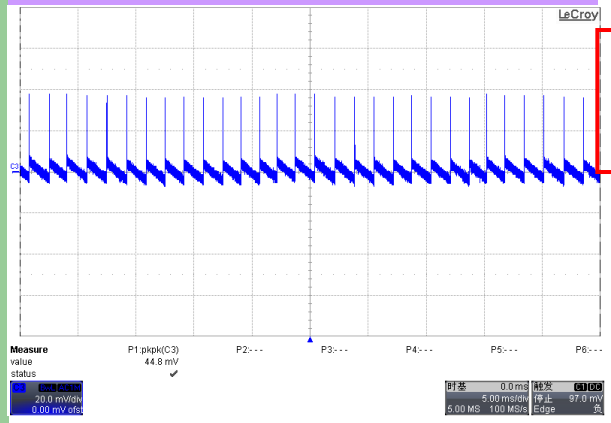
Ripple @ 265Vac, Open Load



-10℃ Vp-p=106mV

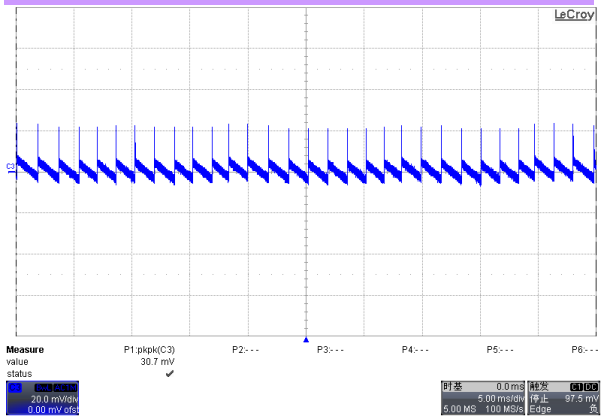


0℃ Vp-p=80.0mV



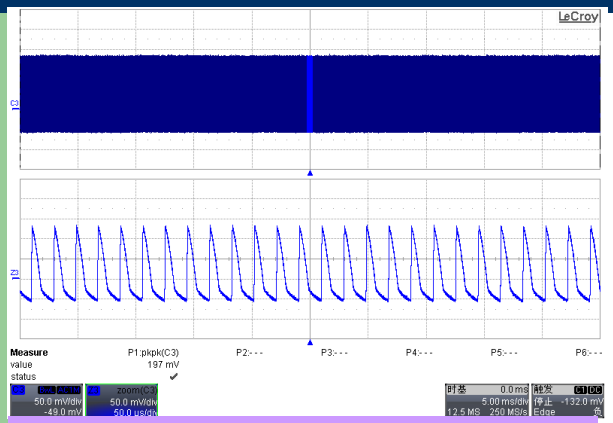
25℃ Vp-p=44.8mV

With 10uF and 0.1uF capacitor and BNC at output

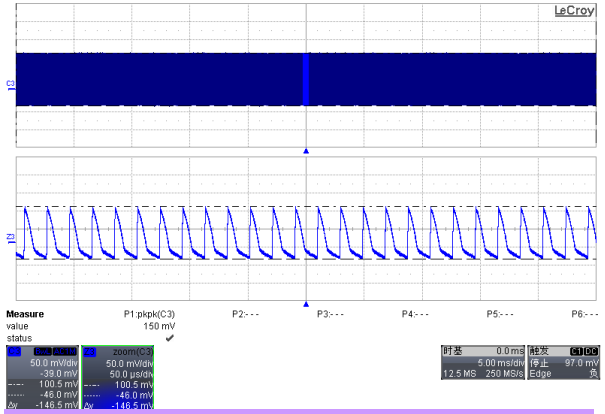


65℃ Vp-p=30.7mV

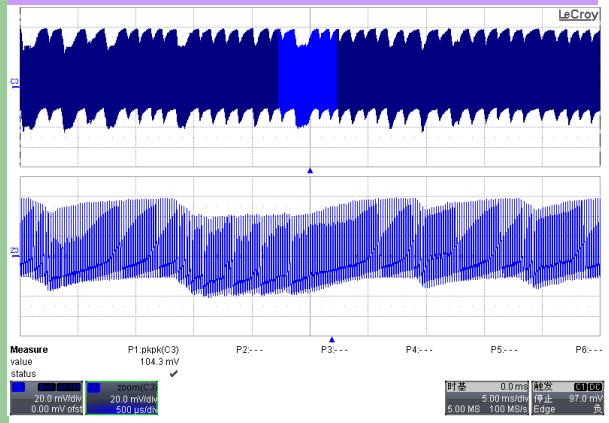
Ripple @ 265Vac, Full Load



-10℃ Vp-p=197mV

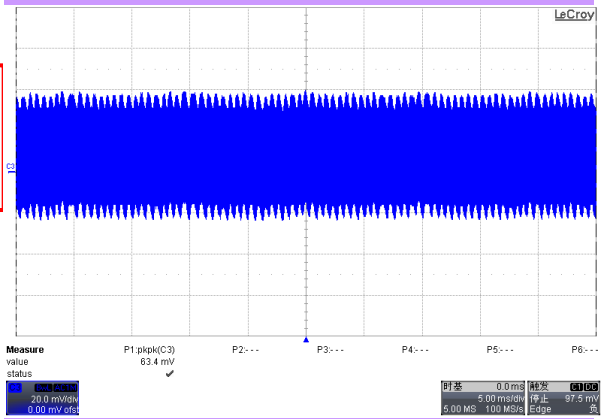


0℃ Vp-p=150mV



25℃ Vp-p=104.3mV

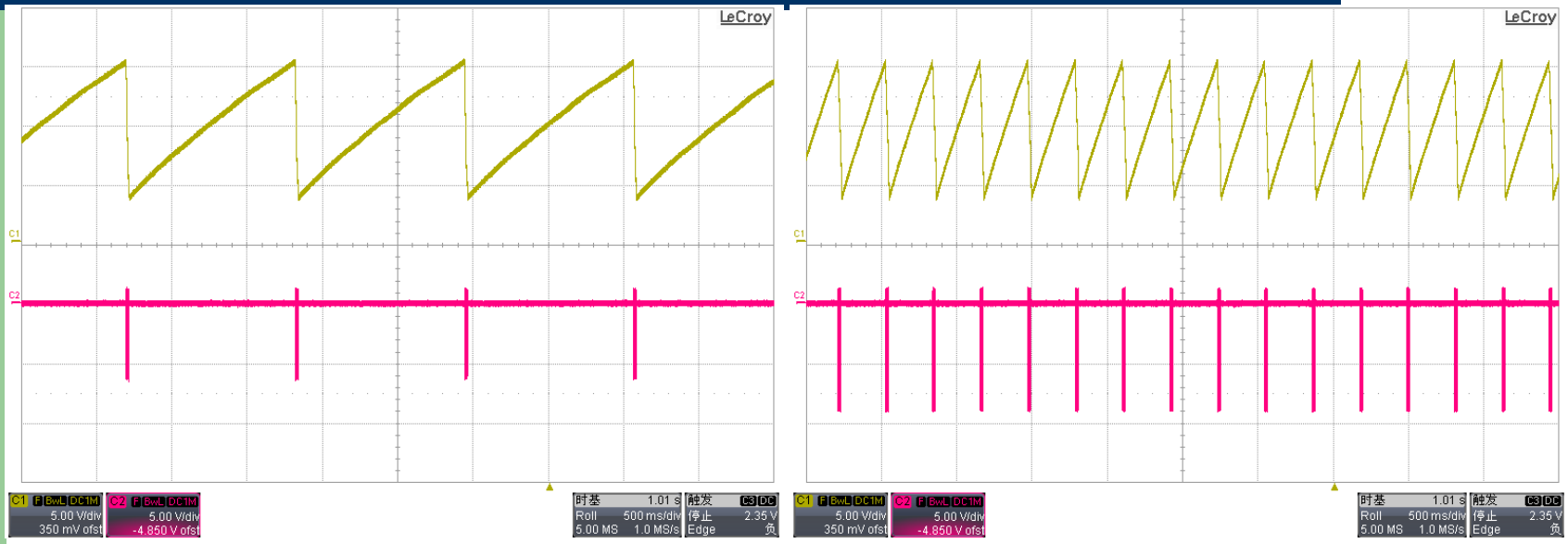
With 10uF and 0.1uF capacitor and BNC at output



65℃ Vp-p=63.4mV

2013/11/7

Hiccup Mode @ Output Short

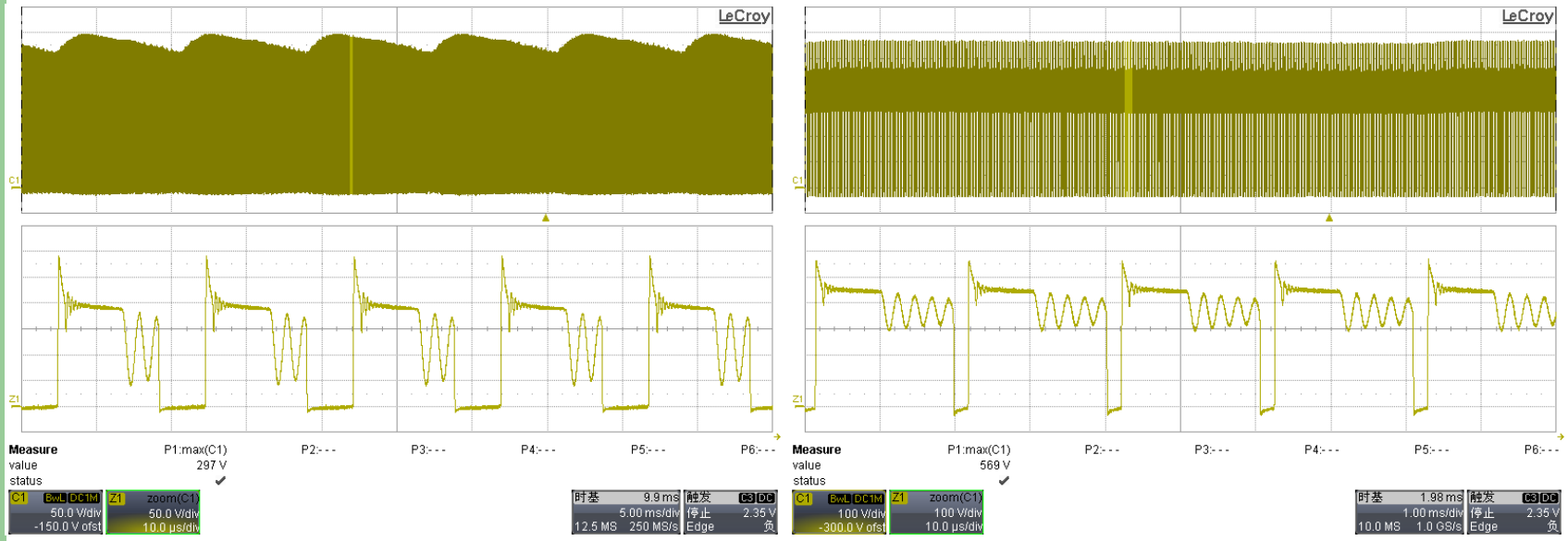


Input:85Vac

Input:265Vac

Hiccup function is OK!!

Collector Voltage



Input:85Vac

Vce=297V

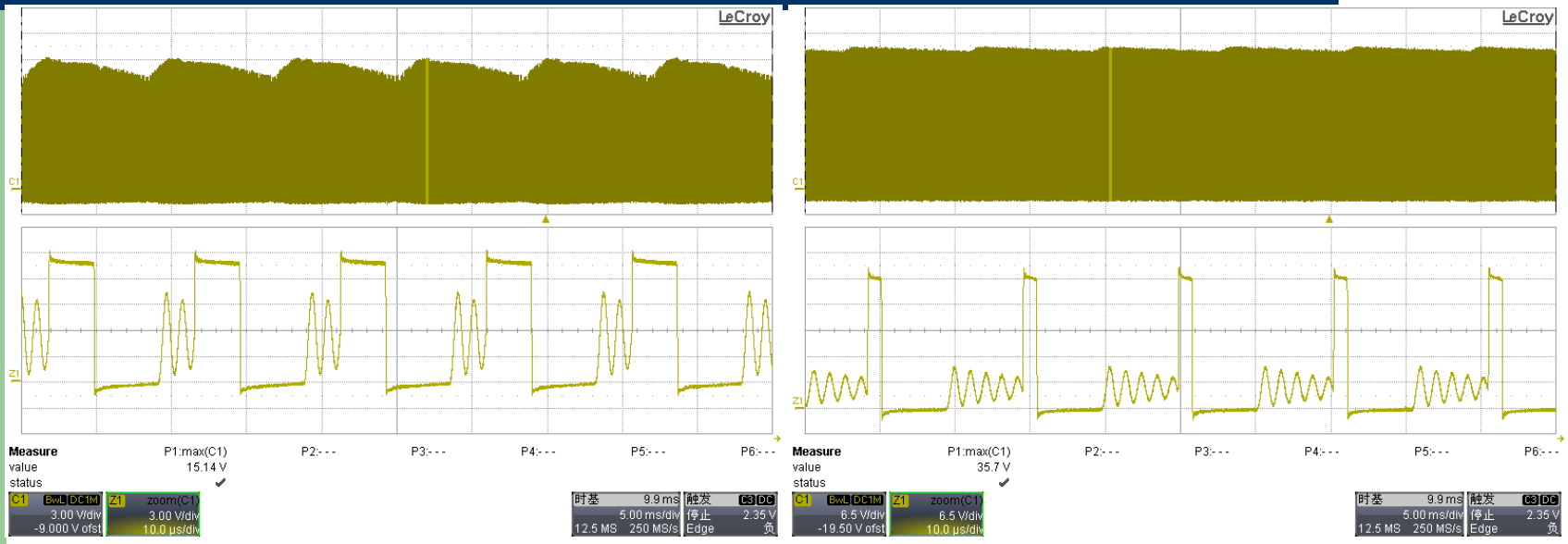
CC Mode

Io=1A

Input:265Vac

Vce=569V

Output Diode Voltage



Input:85Vac

V=15.1V

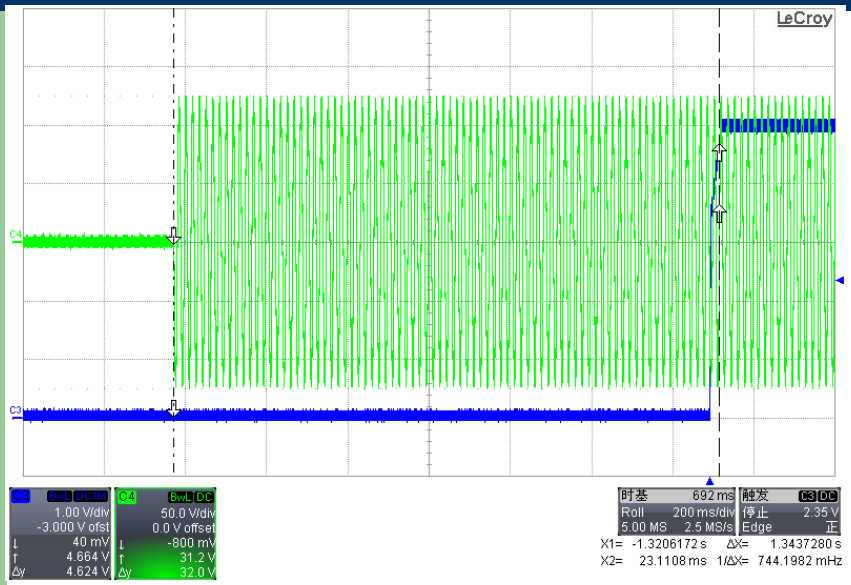
CC Mode

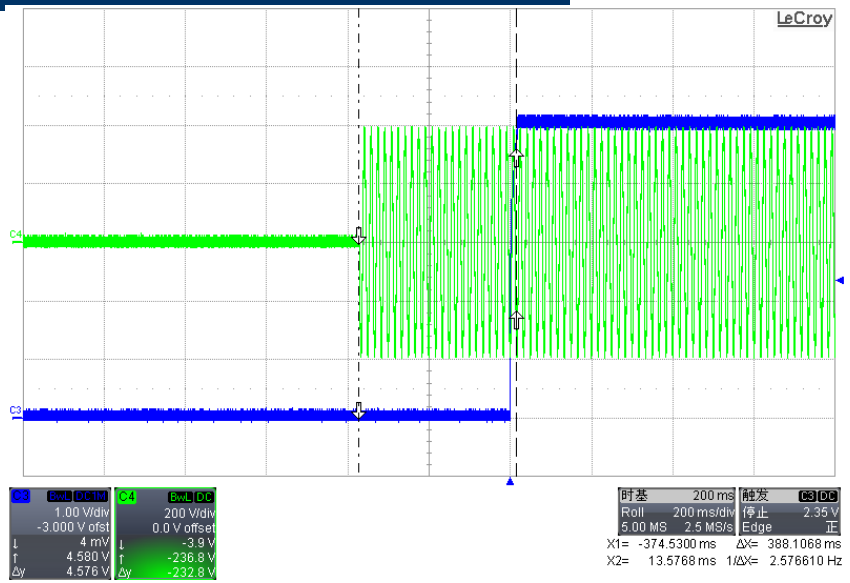
Io=1A

Input:265Vac

V=35.7V

Start-up time





Input:85Vac

Start-up time=1.34s

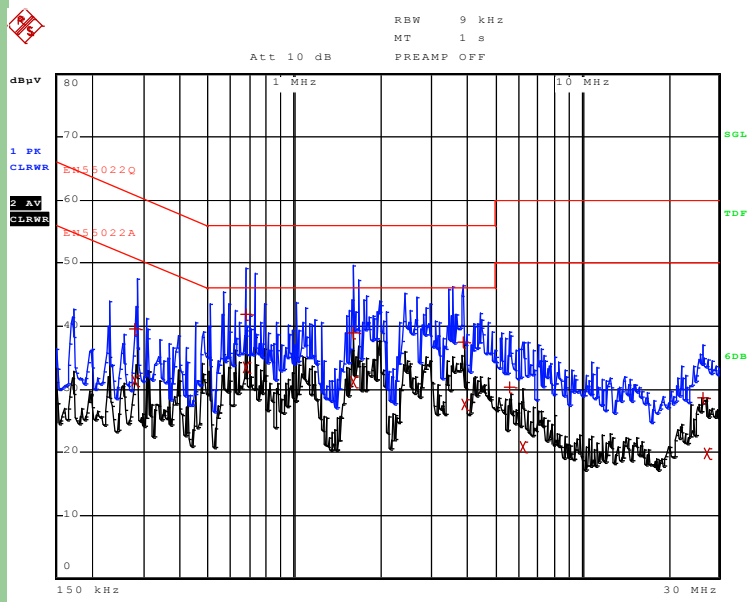
CC Mode

Io=1A

Input:265Vac

Start-up time=0.388s

Conducted EMI-Line



EDIT PEAK LIST (Final Measurement Results)

Trace1: EN55022Q
Trace2: EN55022A
Trace3: ---

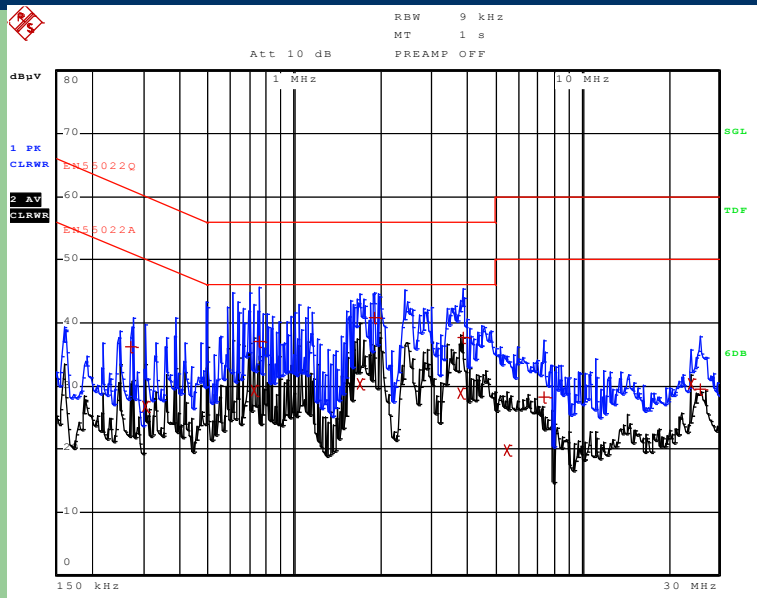
TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	282 kHz	39.51	-21.24
2	Average	282 kHz	31.47	-19.28
1	Quasi Peak	678 kHz	41.92	-14.07
2	Average	678 kHz	33.55	-12.44
1	Quasi Peak	1.614 MHz	38.95	-17.04
2	Average	1.614 MHz	31.18	-14.81
1	Quasi Peak	3.866 MHz	37.56	-18.43
2	Average	3.91 MHz	27.57	-18.42
1	Quasi Peak	5.61 MHz	30.33	-29.66
2	Average	6.254 MHz	20.86	-29.14
1	Quasi Peak	26.298 MHz	28.61	-31.38
2	Average	27.274 MHz	19.94	-30.05

Margin: 12.44dB

Test condition: Input:230V,50Hz

Load: Full Load, R Load

Conducted EMI-Neutral



EDIT PEAK LIST (Final Measurement Results)

Trace1:	EN55022Q
Trace2:	EN55022A
Trace3:	---

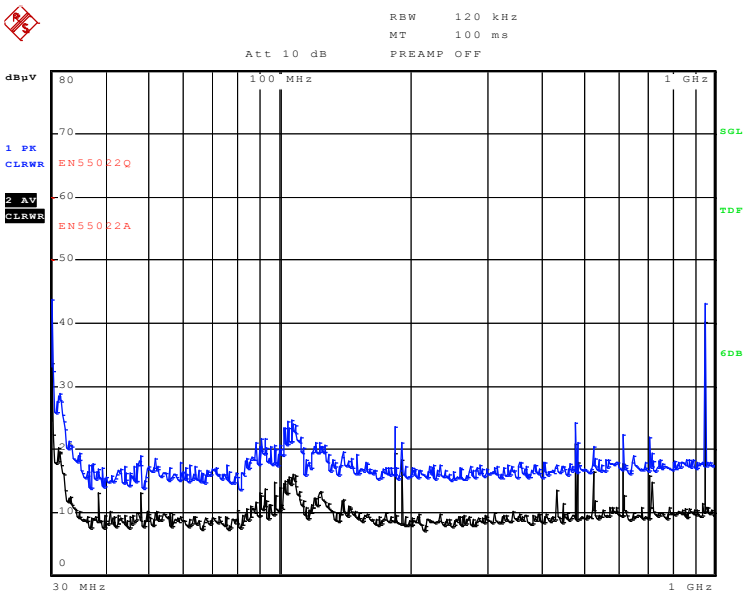
TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	274 kHz	36.32	-24.67
2	Average	302 kHz	26.75	-23.42
2	Average	722 kHz	29.26	-16.73
1	Quasi Peak	754 kHz	37.11	-18.88
2	Average	1.686 MHz	30.43	-15.56
1	Quasi Peak	1.902 MHz	40.92	-15.07
2	Average	3.786 MHz	28.90	-17.09
1	Quasi Peak	3.878 MHz	37.62	-18.37
2	Average	5.506 MHz	19.83	-30.16
1	Quasi Peak	7.426 MHz	28.18	-31.81
2	Average	24.01 MHz	30.27	-19.72
1	Quasi Peak	25.87 MHz	29.50	-30.49

Margin: 15.07dB

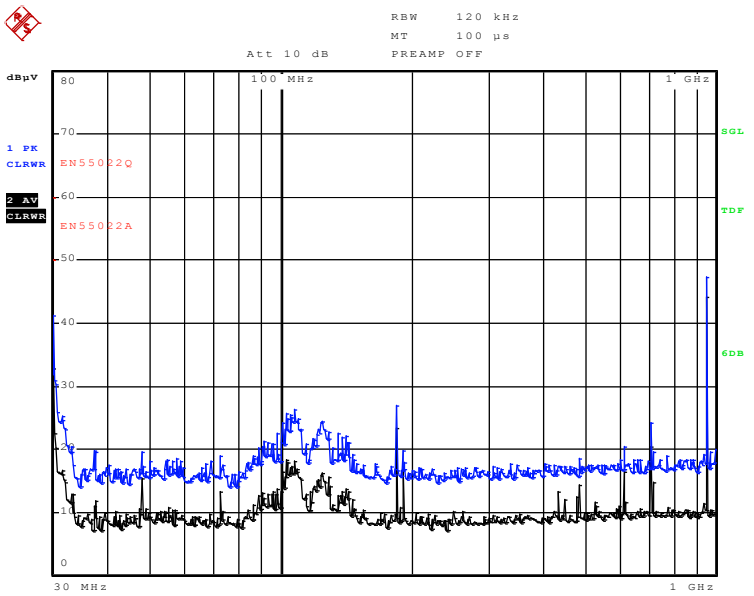
Test condition: Input:230V,50Hz

Load: Full Load, R Load

EMI(30M-1Ghz) For reference only

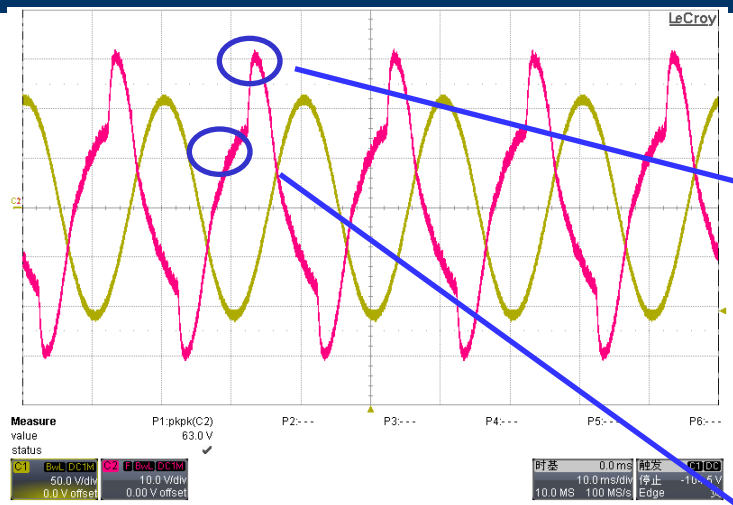


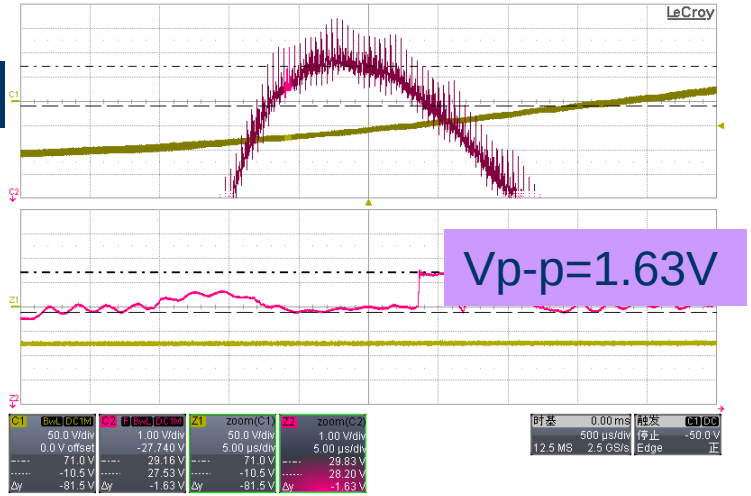
L Line



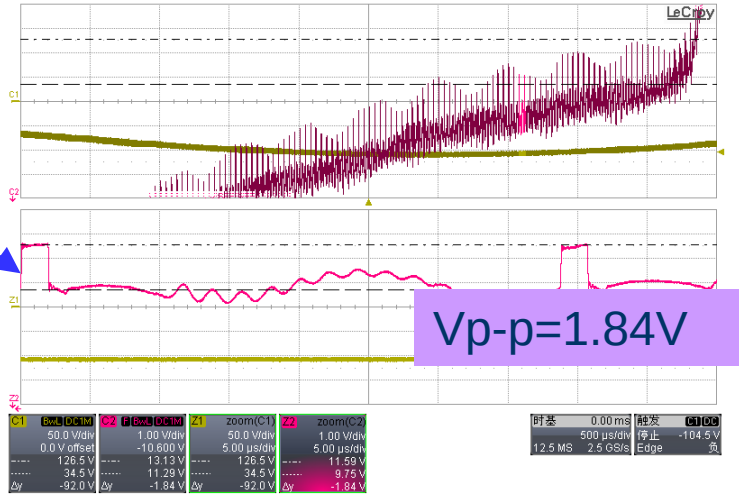
N Line

Common Mode Noise





Vp-p=1.63V



Vp-p=1.84V

CH1:RC filter Voltage

CH2:CMN Voltage

Test Result:

Vp-p =63.0V 50Hz

Test condition:

Input:254V,50Hz

Load: 10ohm R Load

Test Summary

- 补偿可调达到预期效果，3%，FB电子27K:15K；6%，54K:30K
- CPC电容省掉，系统更加稳定，补偿更加稳定，输出纹波更小。