



# ACT410 5V2.1A Application Report

## High Performance DCM&QR Mode 10W Adaptor Using ACT410

### FEATURES

- Patented primary switching regulator technology, DCM & Quasi-Resonant PWM Controller
- Integrated Line Compensation OCP/OLP protection
- No-load Standby Power < 0.1W
- Lowest total cost solution for adaptor using PWM IC(No OPTO, secondary CV/CC circuit)
- Exceed CEC Average Efficiency Requirement with Lot of Margin
- Independent Output Short Protection
- OTP, OVP, BrownOut Protection, Rcs Short/Open Protection, Transformer Winding Short Protection, Output Diode Short/Open Protection, Open Loop Protection, OVP
- Easy Design Approach with Small Component Cou

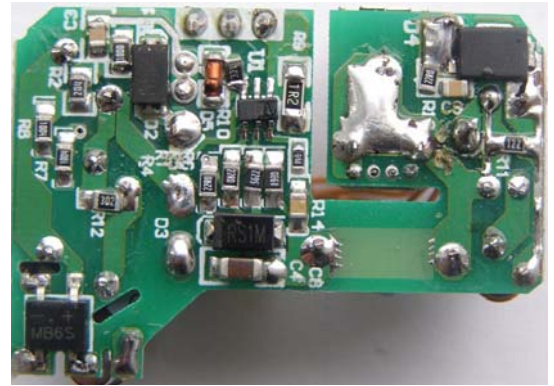
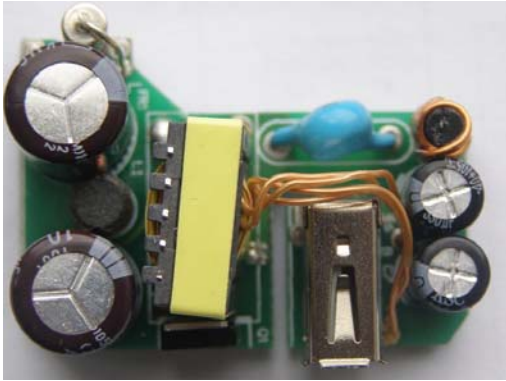
### SPECIFICATION

DESCRIPTION	CONDITION	MIN	TYP	MAX	UNITS
<b>INPUT</b>					
Voltage		90		264	VAC
Frequency		47		63	Hz
No-load Standby Power	230VAC, no Load			0.1	W
<b>OUTPUT</b>					
Voltage		4.75	5	5.25	V
Current			2100		mA
Power			10.5		W
Ripple Voltage				100	mVpp
Average Efficiency	115 or 230 VAC		76		%
<b>ENVIRONMENTAL</b>					
Conducted EMI	Y capacitor	EN55022 Class B			
Safety		EN60950/UL1950			
Surge	Differential mode			2	kV
	Common mode			2	kV
ESD	Contact			8	kV
	Through air			15	kV
Ambient Temperature	Free convection	0		50	°C

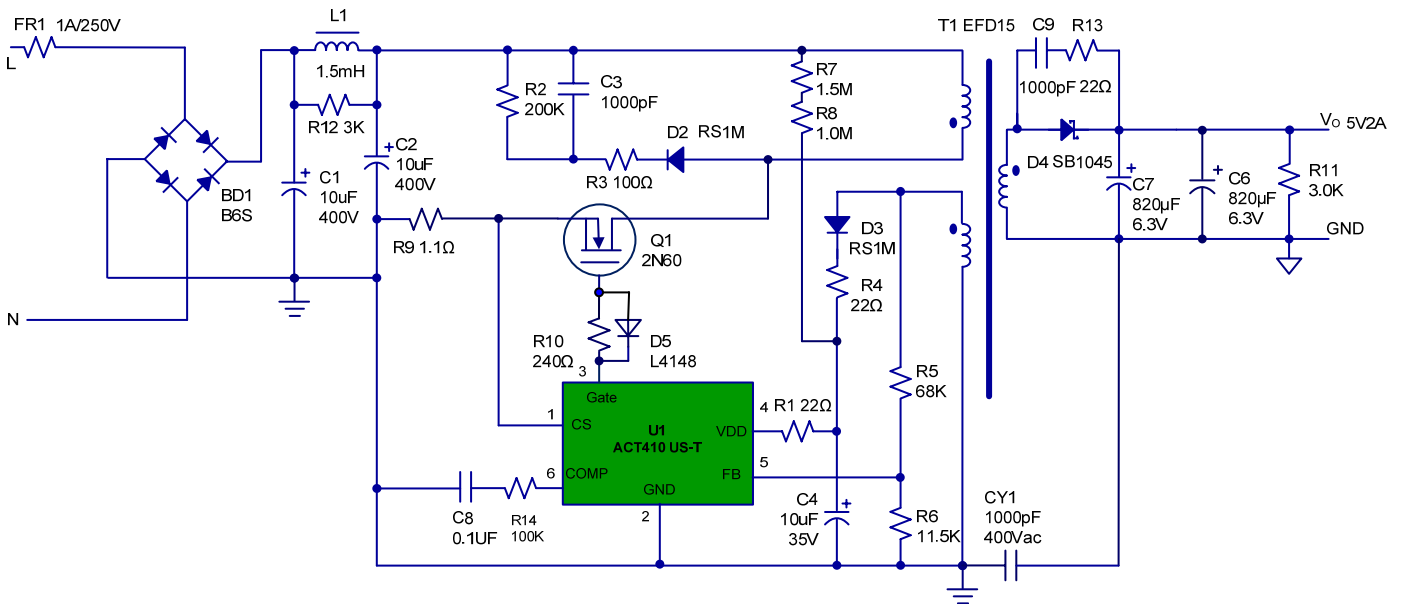
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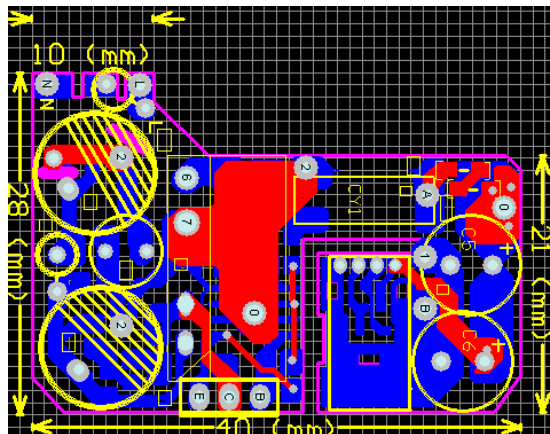
### 1. DEMO BOARD PHOTO



### 2. SCHEMATICS



### 3. PCB LAYOUT

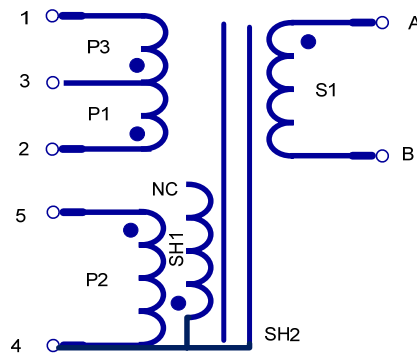


## 4.BILL OF MATERIALS

Item	Reference	Description	QTY	Manufacturer
1	U1	IC, ACT410,SOT23-6	1	Active-Semi.
2	C1,C2	Capacitor, Electrolytic, 10uF/400V, 10x15mm	2	KSC
3	C3	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	1	POE
4	C4	Capacitor, Electrolytic,10uF/35V,5x11mm	1	KSC
5	C6,C7	Capacitor, Electrolytic, 820uF/6.3V, 6.3 × 16mm	2	KSC
6	C8	Capacitor, Ceramic, 0.1uF/25V, 0805,SMD	1	POE
7	C9	Capacitor, Ceramic, 1000pF/100V, 0805,SMD	1	POE
8	CY1	Safety Y1,Capacitor,1000pF/400V,Dip	1	UXT
9	BD1	Bridge Rectifier,D1010S,1000V/1.0A,SDIP	1	PANJIT
10	D2	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	1	PANJIT
11	D3	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	1	PANJIT
12	D4	Diode, Schottky, 45V/10A, S10U45S, SMD	1	Diodes
13	D5	Diode, 1N4148 SMD	1	PANJIT
14	L1	Axial Inductor, 1.5mH, 5*7,Dip	1	SoKa
15	L2	NC	1	SoKa
16	Q1	Mosfet Transistor, 2N60,TO-251	1	Infineon
17	PCB1	PCB, L*W*T=40x28x1.6mm,Cem-1,Rev:A	1	Jintong
18	FR1	Fuse,1A/250V	1	TY-OHM
19	R2	Carbon Resistor, 200K ohm, 1206, 5%	1	TY-OHM
20	R3	Chip Resistor, 100 ohm, 0805, 5%	1	TY-OHM
21	R1,R4	Chip Resistor, 22 ohm, 0805, 5%	1	TY-OHM
22	R5	Chip Resistor, 68K ohm, 0805, 1%	1	TY-OHM
23	R6	Chip Resistor, 11.5K ohm, 0805, 1%	1	TY-OHM
24	R7	Chip Resistor, 1M ohm, 0805, 5%	1	TY-OHM
25	R8	Chip Resistor, 1.5M ohm, 0805, 5%	1	TY-OHM
26	R9	Chip Resistor, 1.1ohm, 1206, 1%	1	TY-OHM
27	R10	Chip Resistor, 240 ohm, 0805, 5%	1	TY-OHM
28	R11	Chip Resistor, 3.0K ohm, 0805, 5%	1	TY-OHM
29	R12	Chip Resistor, 3K ohm, 0805, 5%	1	TY-OHM
30	R13	Chip Resistor, 22 ohm, 1206, 5%	1	TY-OHM
31	R14	Chip Resistor, 100K ohm, 0805, 5%	1	TY-OHM
32	T1	Transformer, Lp=0.36mH, EFD15	1	

## 5. TRANSFORMER SPECIFICATION

### 5.1 Schematic



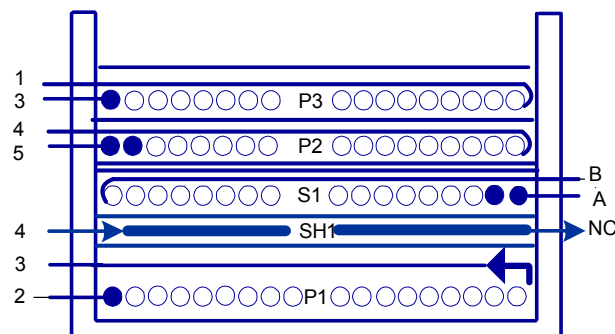
### 5.2 Build-up Table

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P1	2	3	38	2UEW	0.20Φ*1	1	0.025*11W	2
SH1	4	NC	45	2UEW	0.15Φ*3	1	0.025*11W	
S1	B	A	7	TEX-E	0.40Φ*2	1	0.025*11W	2
P2	5	4	20	2UEW	0.20Φ*2	1	0.025*11W	2
P3	3	1	38	2UEW	0.20Φ*1	1	0.025*11W	2
SH2	core	4	3	Copper wire	0.18Φ*1	1	0.025*11W	2

Note: 1. SH1, sh2 are shielding; P1, P2, and P3 are primary and S1 is secondary.

2. Reverse the direction of bobbin when do the S1.

### 5.3 Build-up Diagram



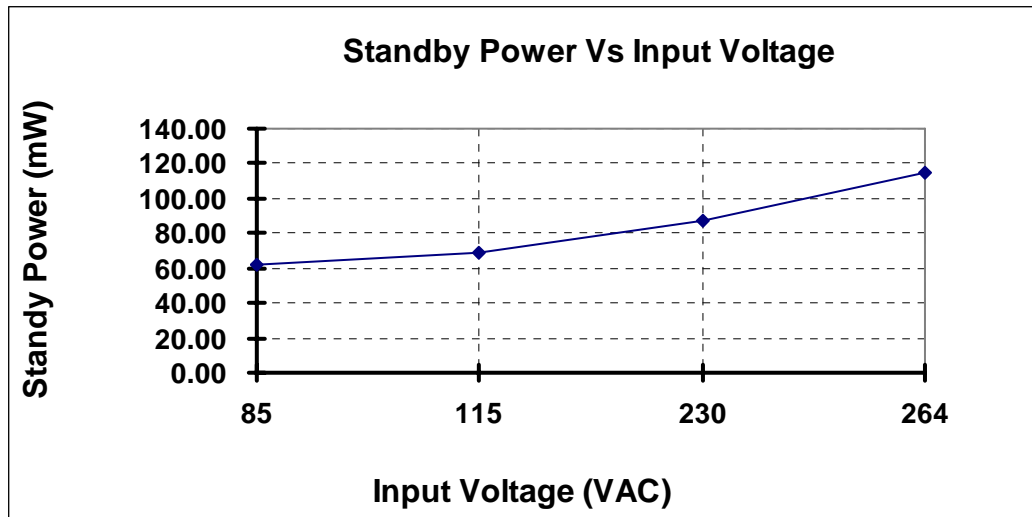
### 5.4 Electrical Specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 2 and 1 at 1Vac & 1kHz	0.36mH ± 7%
3	P1 Leakage Inductance	Inductance between 4 pins 5 with pins A-B shorted	75μH

## 6 FUNCTIONAL TEST

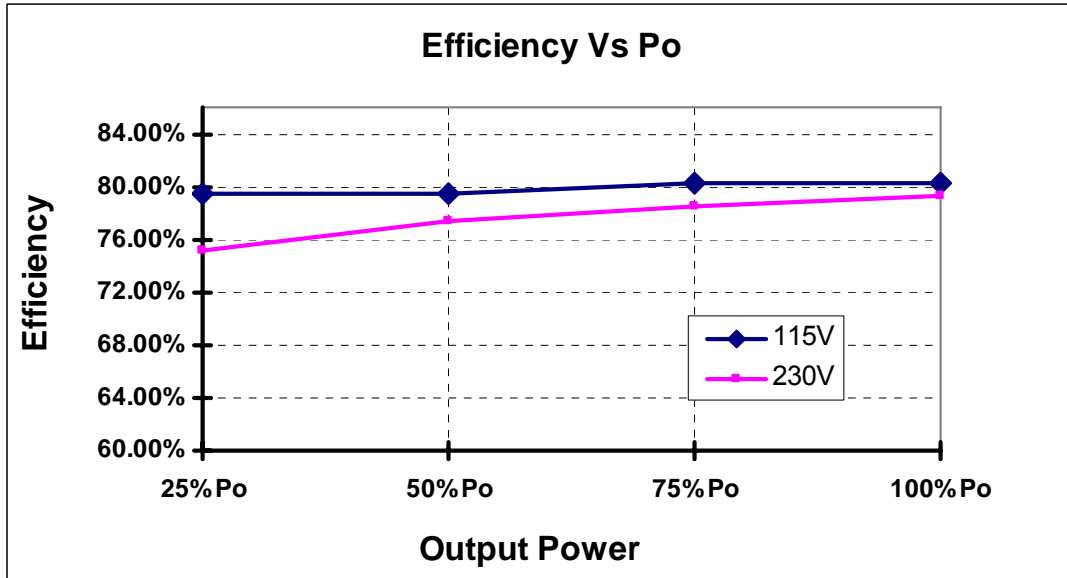
### 6.1 Standby Power

VIN(AC)	90	115	230	264	Green Mode Limit (mW)
Po =0W	62.00	69.00	87.00	115.00	100



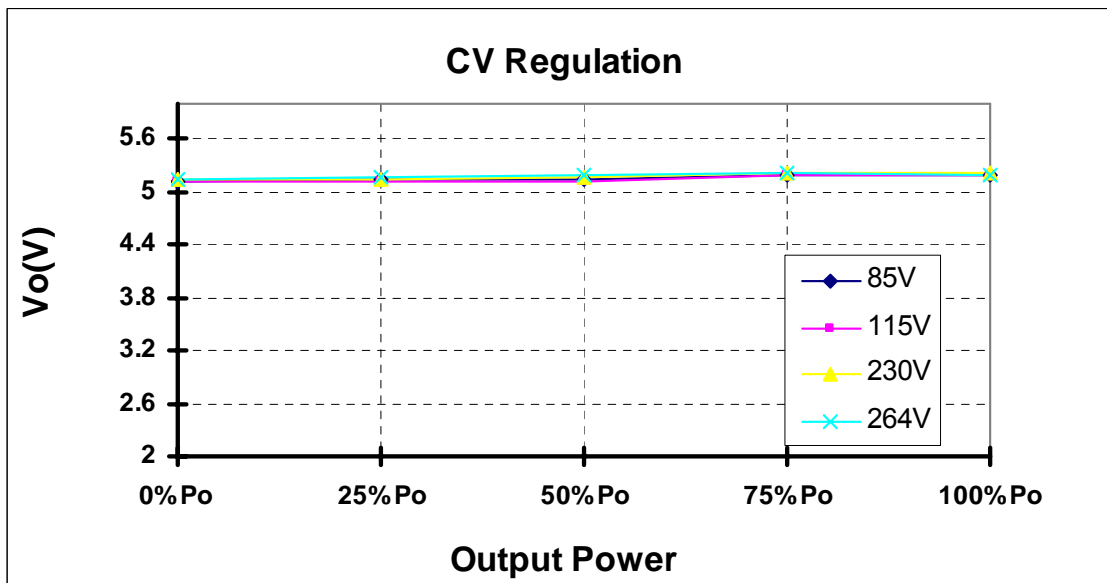
### 6.2 Efficiency(20#AWG,1.5m)

VIN (V <sub>AC</sub> )	25% Po	50% Po	75% Po	100% Po	Average Eff(%)	E,S 2.0 Limit (%)	
w	2.625	5.25	7.875	10.5			
115	78.38%	77.51%	77.24%	76.31%	77.36%	73.74%	DC cord
230	74.16%	75.28%	75.48%	75.31%	75.06%	73.74%	
115	79.41%	79.50%	80.32%	80.29%	79.88%	73.74%	PCB bottom
230	75.19%	77.33%	78.48%	79.23%	77.56%	73.74%	



### 6.3 Line and Load Regulation

VIN (V <sub>AC</sub> )	0% Po	25% Po	50% Po	75% Po	100% Po	Voltage Limit (V)
	0	525	1050	1575	2100	
	0.00	2.50	5.00	7.50	10.00	4.75V~5.25V
90	5.124	5.133	5.149	5.192	5.198	4.75V~5.25V
115	5.123	5.122	5.127	5.186	5.193	4.75V~5.25V
230	5.143	5.152	5.175	5.223	5.223	4.75V~5.25V
264	5.143	5.167	5.184	5.213	5.200	4.75V~5.25V



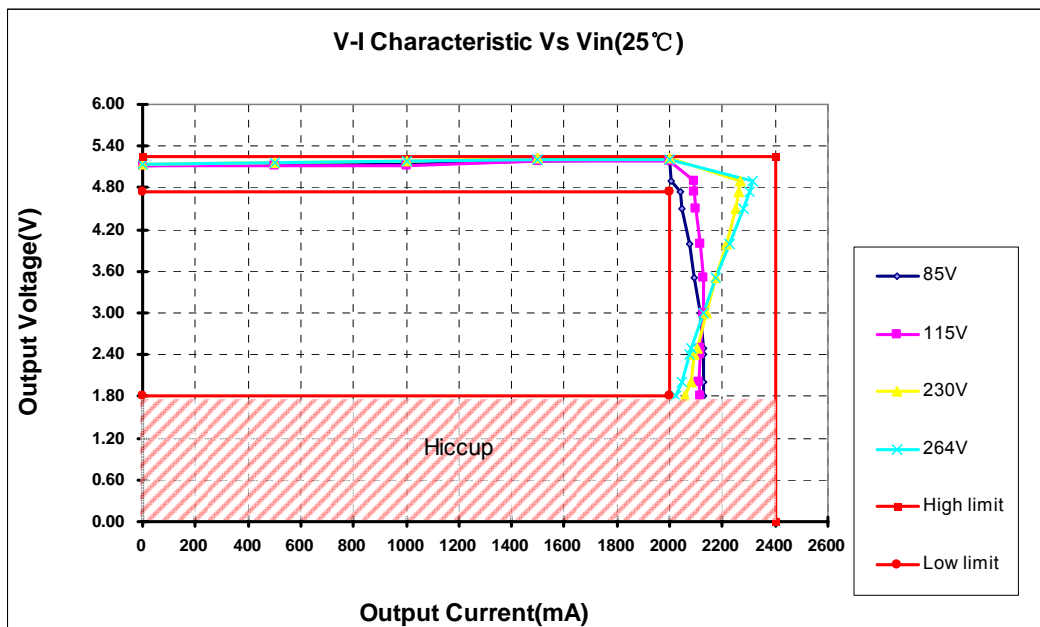
### 6.4 Ripple and Noise

VIN (V <sub>AC</sub> )	0% Po	25% Po	50%	75%	100% Po	Ripple Limit (mV)
	0	2.625	5.25	7.875	10.5	
90	10	24	68	64	44	100
115	10	27	66	64	42	100
230	8	34	52	46	30	100
264	10	38	56	53	46	100

### 6.5 Turn-on and Turn-off

VIN (V <sub>AC</sub> )	Po(W)	Turn-on		Turn-off	
		Delay (sec)	Overshoot (mV)	Delay (sec)	Overshoot (mV)
90V	0	0.900	0	3.20	0
	10.5	1.060	0	0.016	0
264V	0	0.300	0	21.0	0
	10.5	0.320	0	0.080	0

### 6.6 Current Limit and Constant Current



### 6.7 Short Circuit Protection and Release

Protection	90 V <sub>AC</sub>	115 V <sub>AC</sub>	230V <sub>AC</sub>	264 V <sub>AC</sub>
Pin (W)	0.1	0.1	0.15	0.35



Release	Delay (mS)	Overshoot (mV)
90 V <sub>AC</sub> , 0% P <sub>o</sub>	10	0
90 V <sub>AC</sub> , 100% P <sub>o</sub>	10	0
264 V <sub>AC</sub> , 0% P <sub>o</sub>	10	0
264 V <sub>AC</sub> , 100% P <sub>o</sub>	10	0

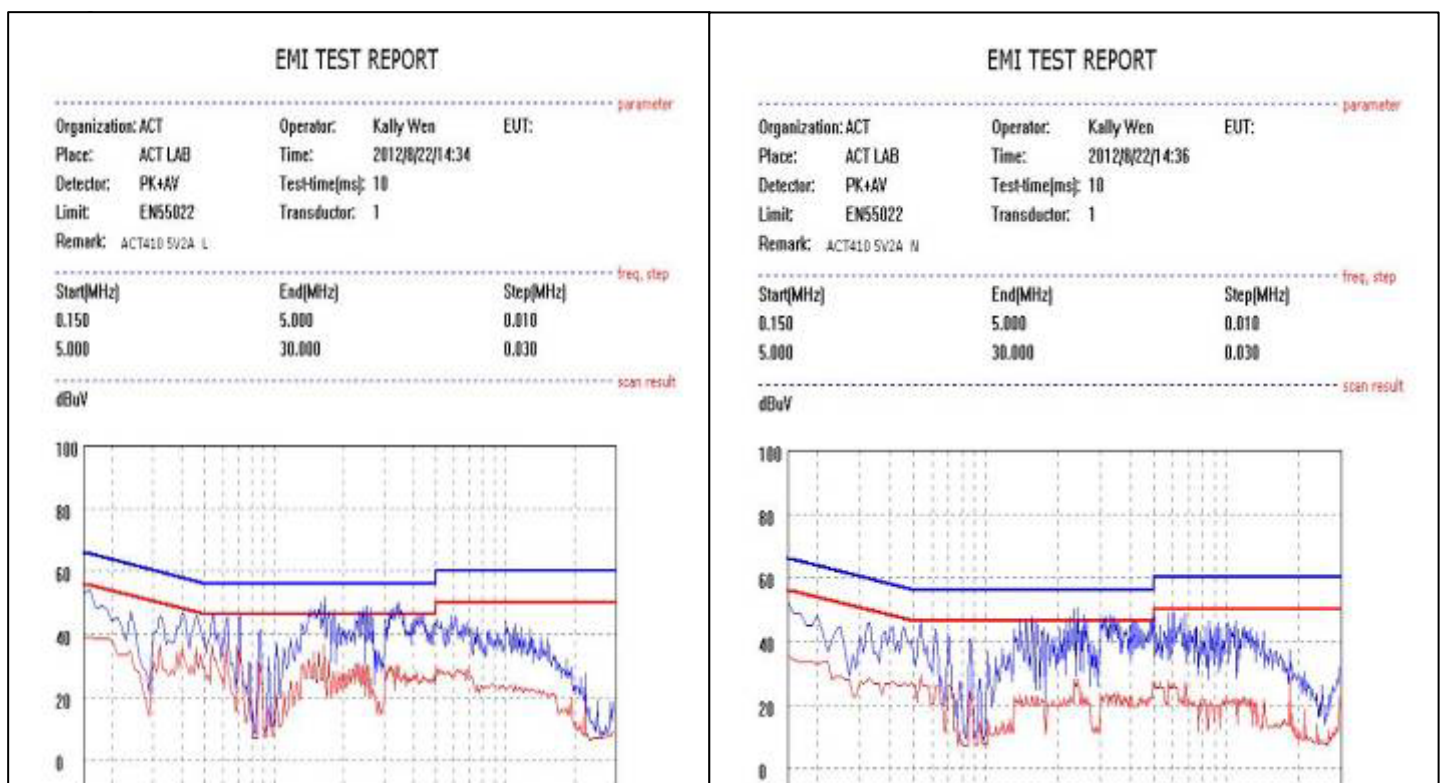
## 6.8 Dynamic Load(30ms,127.5mA/us)

Condition(Load%)	Undershoot(mV)	Overshoot(mV)
115V <sub>AC</sub> , 0%-100%	2120	880
115V <sub>AC</sub> , 50% -100%	810	630
230V <sub>AC</sub> , 0%-100%	208	224
230V <sub>AC</sub> , 50% -100%	2000	800

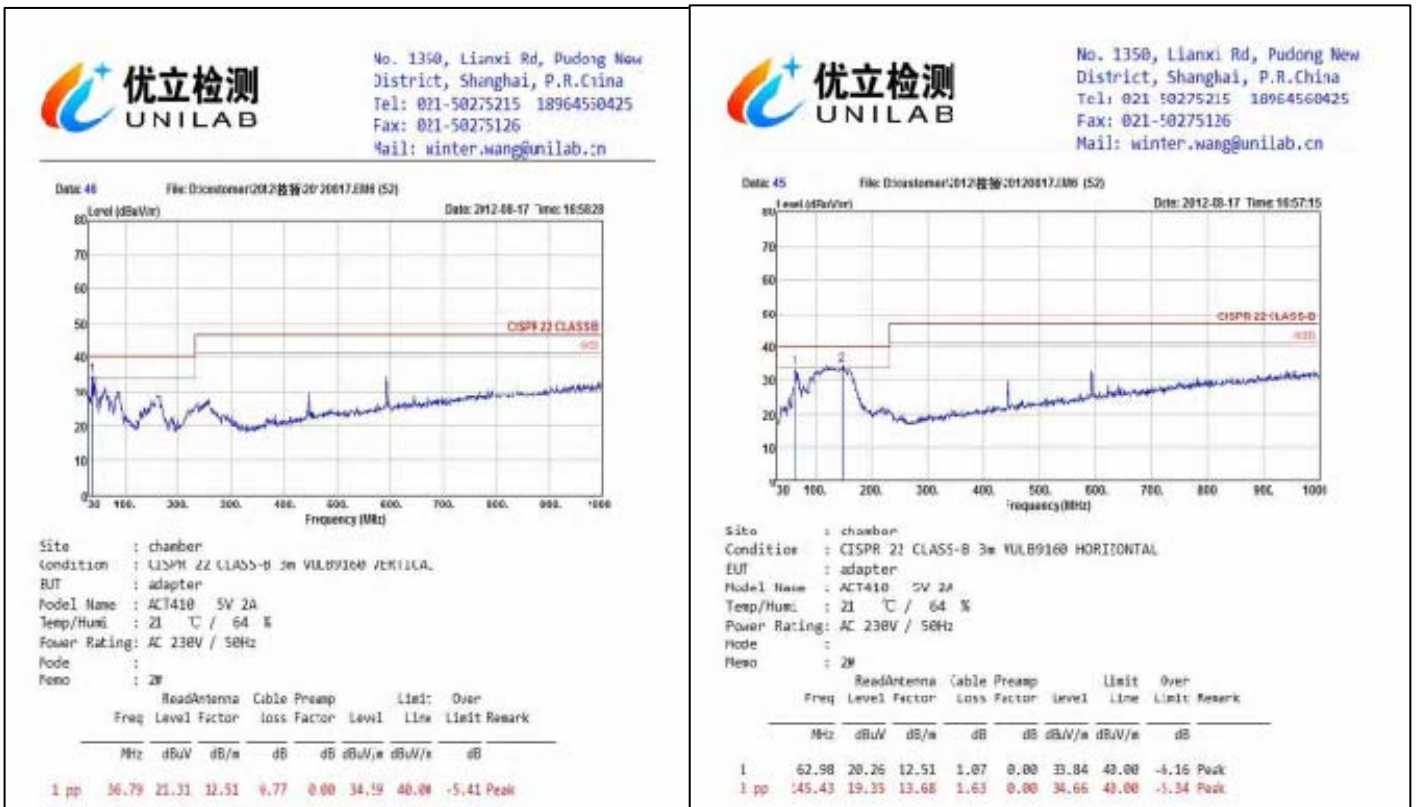
## 6.9 Brown-out Test

Condition (100% P <sub>o</sub> )	Pin (W)	V <sub>o</sub> (V)	Comment	Pass/Fail
85 V <sub>AC</sub>	14.057	5.200		
80 V <sub>AC</sub>	14.135	5.199		
75 V <sub>AC</sub>	14.270	5.208		
70 V <sub>AC</sub>	13.879	4.990		
65 V <sub>AC</sub>	12.600	4.459		
60 V <sub>AC</sub>	hiccup	hiccup		

# 7 EMC TEST



## 7.2 Radiation Test



## 7.3 Surge

Condition	Configuration	Test Limit	Pass/Fail
230 VAC, 100% Po=10W	Line – Neutral	2kV	

## 7.4 ESD

Condition	Method	Test Limit	Pass/Fail

<b>230 VAC, 100%</b> <b>Po=10W</b>	Contact Discharge	8kV	
<b>230 VAC, 100%</b> <b>Po=10W</b>	Air Discharge	15kV	

### 7.5 Key Components Temperature Test

Test condition: Ambient Temp: 40 degree C (Demo board should be sealed in the case) ;  
full load Io=2100mA

Test on IC, Transistor, transformer. Burning for 24 hours

Test Conditions	IC (°C)	Mos(°C)	Transformer(°C)	Output diode(°C)	Note
Vin=115	56	92	97	103	IO=2.1A