

High Performance QR Mode 18W Quick Changer Using ACT520

FEATURES

- Quasi-Resonant PWM Controller
- Accurate CC with line and inductance compensation
- No-load Standby Power < 30mW
- Excellent Efficiency(>80%) with Low Cost 4N65 MOSFET
- 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

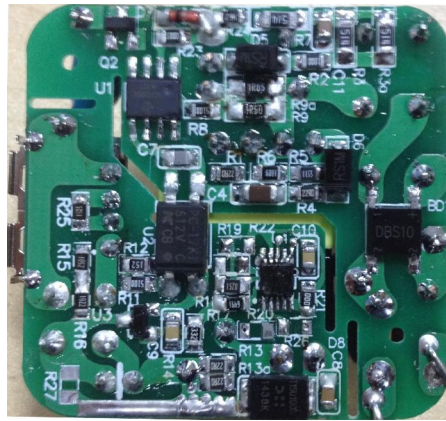
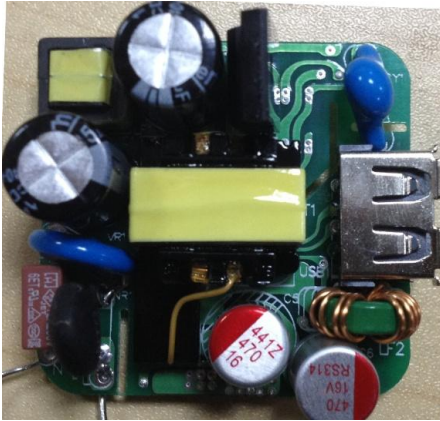
SPECIFICATION

DESCRIPTION	CONDITION	MIN	TYP	MAX	UNITS
INPUT					
Voltage		90		264	VAC
Frequency		47		63	Hz
No-load Standby Power	230VAC, no Load, Vo=12/9V			75	mW
	230VAC, no Load, Vo=5V			30	
OUTPUT					
Voltage	V1	4.75	5	5.25	V
	V2	8.55	9	9.45	V
	V3	11.4	12	12.6	V
Current		1.5	1.5	1.8	A
Power			18		W
Ripple Voltage				120	mVpp
Average Efficiency	115 or 230 VAC, Vo=5V	80			%
ENVIRONMENTAL					
Conducted EMI	Y capacitor	CISPR22/ FCC Part15 Class B			
Safety		EN60950/UL1950			
Surge	Differential mode			2	kV
	Common mode			2	kV
ESD	Contact			4	kV
	Through air			8	kV
Ambient Temperature	Free convection	0		50	°C

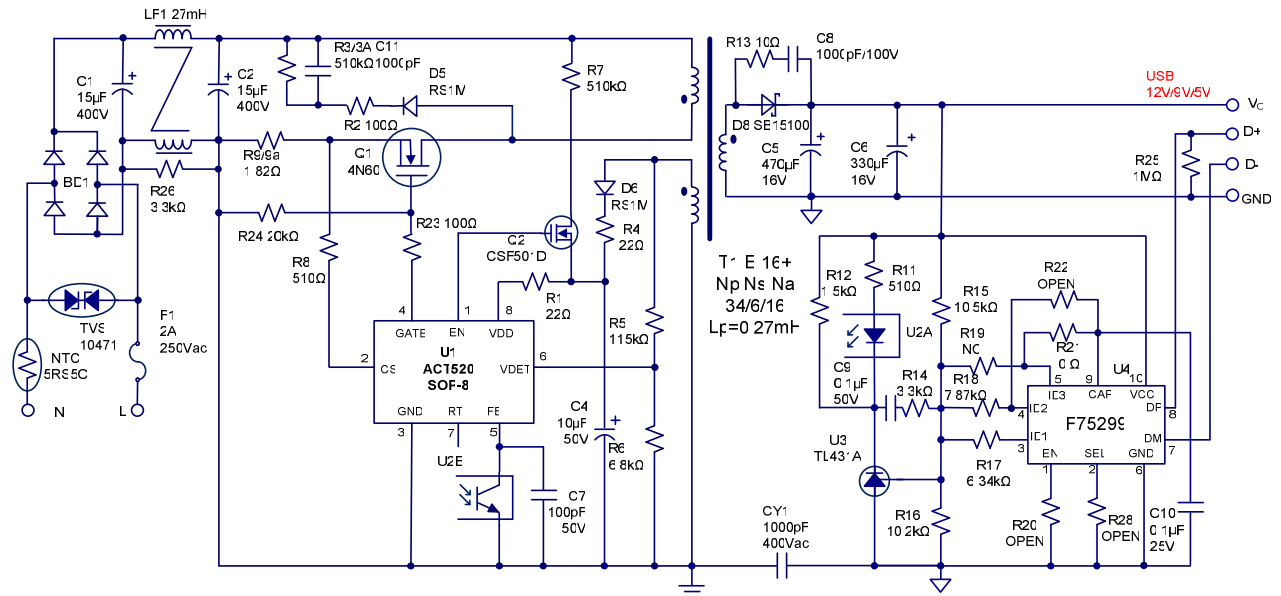
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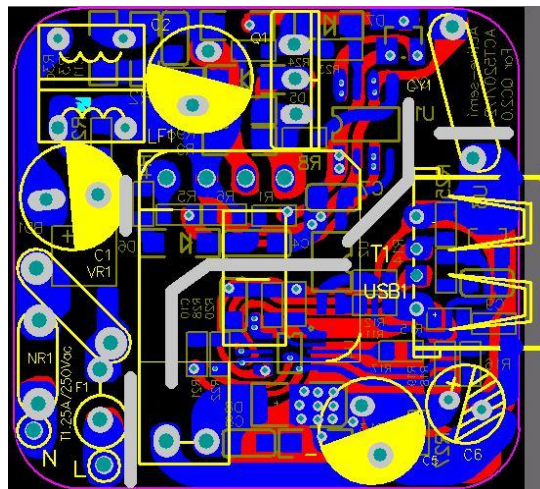
1. DEMO BOARD PHOTO



2. SCHEMATICS



3. PCB LAYOUT

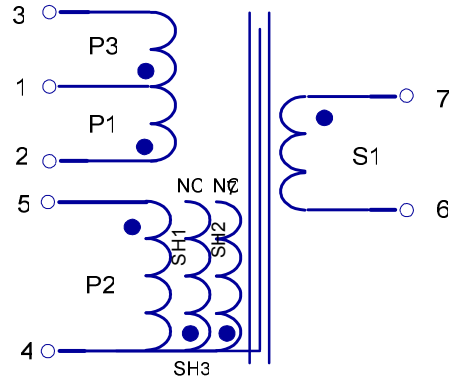


4. BILL OF MATERIALS

Item	Reference	Description	QTY	Manufacturer
1	U1	IC, ACT520,SOP-8	1	Active-Semi.
2	U2	OPTO,EL3H7D,CTR:300-600%,4PIN SMD	1	EVERLIGHT
3	U3	TL431A, Ref=2.5V,1%,SOT23-3	1	TI
4	U4	IC, F75299,SOT-10	1	Finteck
5	C1,2	Capacitor, Electrolytic,15uF/400V, 8x15mm	2	RUBYCON
6	C11,C8	Capacitor, Ceramic, 1000pF/500V, 0805,SMD	2	POE
7	C4	Capacitor, Ceramic,10uF/50V, 1206	1	POE
8	C6	Capacitor, Solid, 470uF/16V, 8x12mm	1	KSC
9	C6	Capacitor, Solid, 330uF/16V, 6.5x12mm	1	KSC
10	C9,10	Capacitor, Ceramic, 0.1uF/50V, 0805,SMD	2	POE
11	C7	Capacitor, Ceramic, 100pF/25V, 0805,SMD	1	POE
12	CY1	Safety Y1,Capacitor,1000pF/400V,Dip	1	UXT
13	BD1	BP06,1000V/1.0A,SDIP	1	PANJIT
14	D5,D6	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	2	PANJIT
15	D7	NC		
16	D8	Diode, Schottky, 100V/15A, TO-247AB	1	Diodes
17	LF1	CM Inductor, 27mH, EE8.3,D=0.2mm,90T	1	SoKa
18	Q1	N-Mosfet Transistor, 4N60,TO-220	1	AUK
19	Q2	N-Mosfet, Depletion mode,CSF501D,20mA/600V,SOT23	1	HuiJing
20	PCB1	PCB, L*W*T=39x39x1.0mm,FR-4,Rev:A	1	Jintong
21	F1	Fuse,2A/250V	1	TY-OHM
22	R3,3A,7	Carbon Resistor, 510K ohm, 1206, 5%	3	TY-OHM
23	R1,4	Chip Resistor, 22 ohm, 0805, 5%	2	TY-OHM
24	R2,23	Chip Resistor, 100 ohm, 0805, 5%	2	TY-OHM
25	R13	Chip Resistor, 10 ohm, 1206, 5%	4	TY-OHM
26	R5	Chip Resistor, 115K ohm, 0805,1%	1	TY-OHM
27	R6	Chip Resistor, 6.8K ohm, 0805, 1%	1	TY-OHM
28	R9,R9a	Chip Resistor, 1.65 ohm,1206 , 1%	2	TY-OHM
29	R8,11	Chip Resistor, 510 ohm, 0805, 5%	2	TY-OHM
30	R12	Chip Resistor, 1.5k ohm, 0805,5%	1	TY-OHM
31	R14,26	Chip Resistor, 3.3k ohm, 0805, 5%	2	TY-OHM
32	R15	Chip Resistor, 10.5K ohm, 0805, 1%	1	TY-OHM
33	R16	Chip Resistor, 10.2K ohm, 0805, 1%	2	TY-OHM
34	R17	Chip Resistor, 6.34K ohm, 0805, 1%	1	TY-OHM
35	R18	Chip Resistor, 7.87K ohm, 0805, 1%	1	TY-OHM
36	R19,R20	NC		
37	R21	Chip Resistor, 0 ohm, 0805, 5%	1	TY-OHM
38	R22,R27	NC	1	TY-OHM
39	R24	Chip Resistor, 20k ohm, 0805, 5%	1	TY-OHM
40	R25	Chip Resistor, 1M ohm, 0805, 5%	1	TY-OHM
41	T1	Transformer, Lp=0.27mH, EI16+	1	APY(安品源科技)
42	NR1	Thermal resistor, SC053	1	TY-OHM
43	VR1	10D471	1	TY-OHM
44	USB1	Small standard USB connector.	1	TY-OHM

5. TRANSFORMER SPECIFICATION

5.1. Schematics



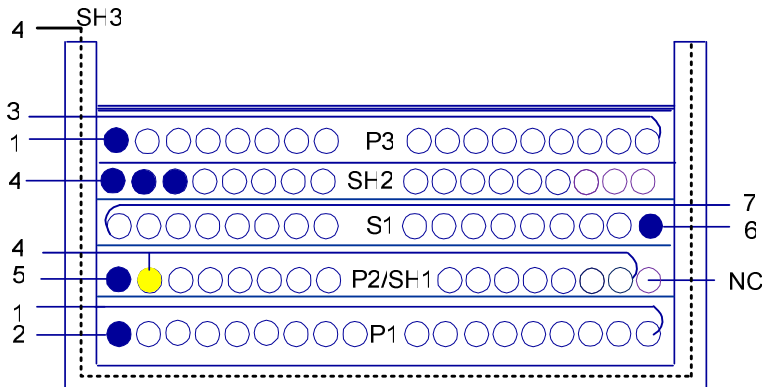
5.2. Build-up Table

Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P1	2	1	17	2UEW	0.22Φ*1	1	0.025*11W	1
P2/SH1	4	NC	16	2UEW	0.10Φ*1	1	0.025*11W	1
	5	4		2UEW	0.10Φ*1			
S1	6	7	6	TEX-E	0.40Φ*1	1	0.025*11W	2
SH2	4	NC	10	2UEW	0.10Φ*3	1	0.025*11W	2
P3	1	3	17	2UEW	0.22Φ*1	1	0.025*11W	1
SH3	CORE	4	3	Copper wire	0.12Φ*1	1	0.025*11W	2

Note: 1. SH1, SH2, SH3 are shielding; P1, P2 & P3 are primary and S1 is secondary.

2. Reverse the direction of bobbin when do the S1, P2.

5.3. Build-up Diagram



5.4. Electrical Specifications

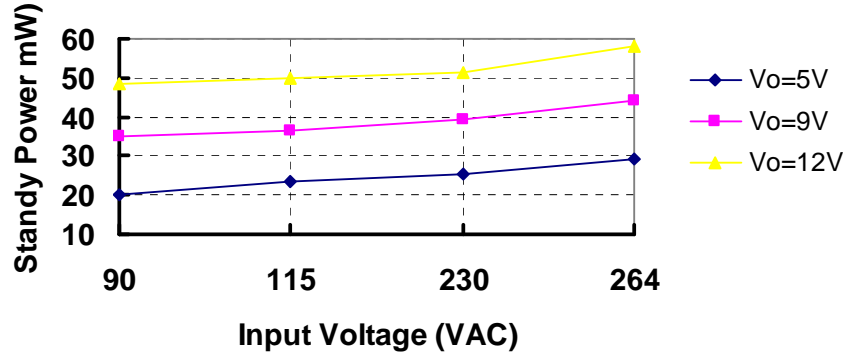
Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000 Vac
2	P1 Inductance	Inductance between pins 3 and 2 at 1Vac & 1kHz	0.27mH ± 7%
3	P1 Leakage Inductance	Inductance between pins 3 and 2 with pins 4-5 and 6-7 shorted	75μH

6. FUNCTIONAL TEST

6.1. Standby Power

VIN(AC)	90	115	230	264	Green Mode Limit (mW)	Pass/Fail
Vo=12V	48.52	49.8	51.2	58.2	75	Pass
Vo=9V	35.22	36.44	39.56	44.22	75	Pass
Vo=5V	20.11	23.44	25.42	29.12	30	Pass

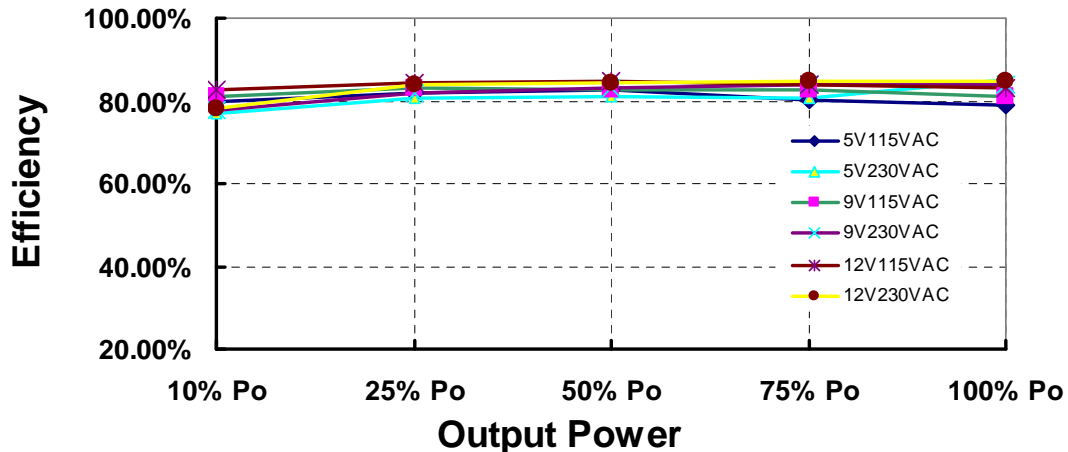
Standby Power Vs Input Voltage



6.2. Efficiency(USB terminal)

Vout	Vac	10% Po	25% Po	50% Po	75% Po	100% Po	Average Eff(%)	E,S 2.0 (average)	Commend
V	Io(mA)	150	375	750	1150	1500			
5	115	79.88%	81.88%	82.82%	80.23%	79.03%	80.99%	71.21%	USB terminal
	230	76.77%	80.77%	81.00%	80.60%	85.08%	81.86%	71.21%	
9	115	80.99%	82.99%	82.82%	82.73%	81.06%	82.40%	78.49%	USB terminal
	230	77.88%	81.88%	82.98%	83.84%	84.06%	83.19%	78.49%	
12	115	82.67%	84.48%	84.79%	84.08%	83.03%	84.09%	80.29%	USB terminal
	230	78.19%	83.75%	84.46%	84.80%	84.79%	84.45%	80.29%	

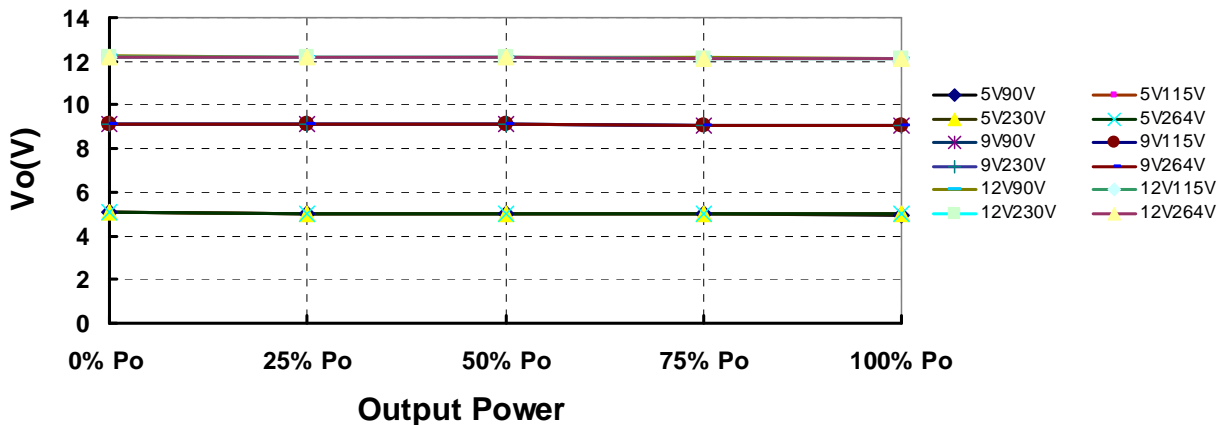
Efficiency Vs Po



6.3 Line and Load Regulation(USB terminal)

Vout (V)	VIN (V _{AC})	0% Po	25% Po	50% Po	75% Po	100% Po	Voltage Limit (V)	Pass/Fail
5	90	5.06	5.04	5.02	5.01	4.98	4.75V~5.25V	Pass
	115	5.06	5.04	5.02	5.01	4.99	4.75V~5.25V	Pass
	220	5.06	5.04	5.02	5.01	4.99	4.75V~5.25V	Pass
	264	5.06	5.04	5.02	5.01	4.99	4.75V~5.25V	Pass
9	90	9.12	9.1	9.09	9.07	9.05	8.55V~9.45V	Pass
	115	9.12	9.1	9.09	9.07	9.05	8.55V~9.45V	Pass
	230	9.12	9.1	9.09	9.07	9.06	8.55V~9.45V	Pass
	264	9.12	9.1	9.09	9.07	9.06	8.55V~9.45V	Pass
12	90	12.23	12.22	12.2	12.18	12.15	11.4V~12.6V	Pass
	115	12.21	12.19	12.17	12.15	12.14	11.4V~12.6V	Pass
	230	12.21	12.19	12.17	12.15	12.14	11.4V~12.6V	Pass
	264	12.21	12.19	12.17	12.15	12.14	11.4V~12.6V	Pass

CV Regulation



6.4 Ripple and Noise

Vout(V)	VIN (V _{AC})	0% Po	25% Po	50% Po	75% Po	100% Po	Ripple Limit (mV)	Pass/Fail
5	90	26	17	16	23	34	80	Pass
	115	25	15	15	18	25	80	Pass
	230	22	15	18	18	22	80	Pass
	264	26	42	54	66	68	80	Pass
9	90	19	24	34	48	56	100	Pass
	115	16	22	30	44	56	100	Pass
	230	17	24	28	46	58	100	Pass
	264	18	24	30	48	52	100	Pass
12	90	24	55	77	82	90	120	Pass
	115	24	50	71	85	92	120	Pass
	230	28	48	75	80	88	120	Pass
	264	30	44	72	80	88	120	Pass

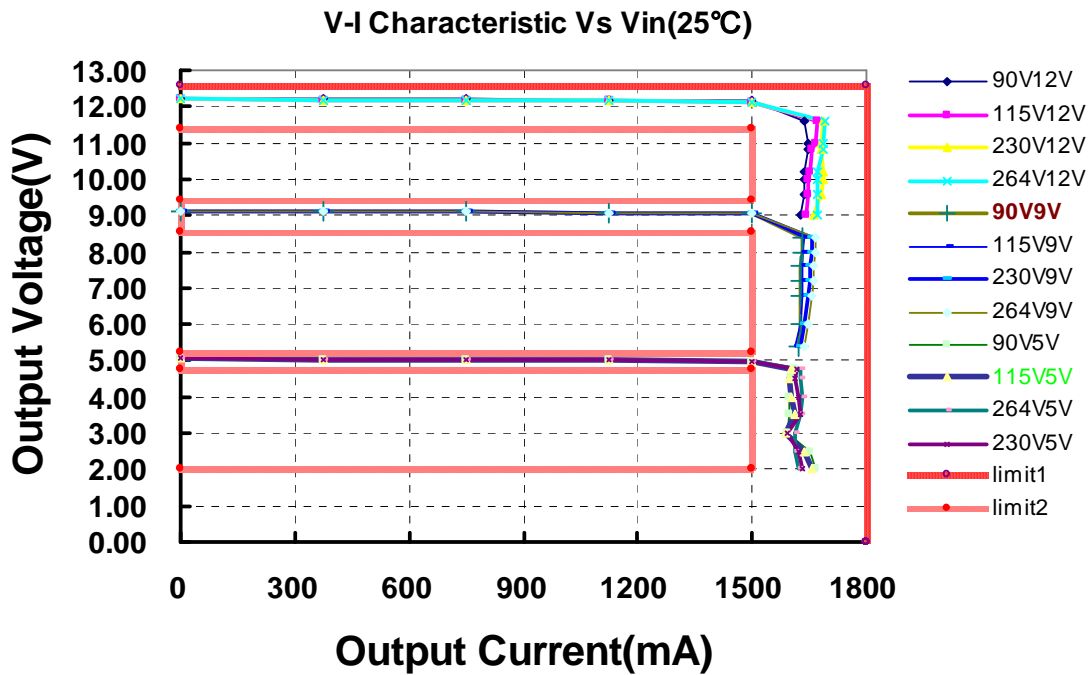
6.5 Turn-on and Turn-off

Vin	Po	Turn-on		Turn-off		Pass/Fail
		Delay (sec)	Overshoot(mV)	Delay (sec)	Overshoot(mV)	
90V, Po(W)	0	1.18	0	10	0	Pass
	18	1.21	0	0.02	0	Pass
264V, Po(W)	0	0.267	0	33	0	Pass
	18	0.258	0	0.16	0	Pass

6.6 Current limit and constant current

Condition	90 V _{AC} (mA)	115V _{AC} (mA)	230V _{AC} (mA)	264 V _{AC} (mA)
98% Vo	1639	1671	1688	1691
95% Vo	1647	1666	1681	1686
93% Vo	1646	1658	1680	1685
90% Vo	1639	1651	1685	1673
87% Vo	1635	1648	1688	1671

85% Vo	1637	1648	1683	1674
84% Vo	1628	1641	1660	1671
82% Vo	1631	1635	1658	1669
78% Vo	1630	1634	1656	1667
75% Vo	1628	1634	1654	1664
70% Vo	1625	1633	1651	1660
65% Vo	1626	1630	1645	1655
60% Vo	1627	1627	1637	1646
55%Vo	1622	1615	1627	1637
50% Vo	1612	1603	1617	1629
45% Vo	1605	1597	1614	1625
40% Vo	1597	1605	1620	1632
35% Vo	1599	1611	1626	1625
30% Vo	1595	1587	1593	1615
20% Vo	1650	1638	1622	1614
16% Vo	1669	1657	1631	1624



6.7. Short Circuit Protection and Release

Protection	90 V _{AC}	110 V _{AC}	220V _{AC}	264 V _{AC}	Pass/Fail
Pin (W)	0.105	0.144	0.28	0.36	Pass

Release	Delay (mS)	Overshoot(mV)	Pass/Fail
90 V_{AC}, 0% Po	6	0	
0			
90V_{AC}, 100% Po	8	0	
18			
264 V_{AC}, 0% Po	10	0	
0			
264 V_{AC}, 100% Po	12	0	
18			

6.8. Dynamic Load(5Voutput,1ms,127.5mA/us,22AWG1.5m)

Condition(Load%)	Undershoot(mV)	Overshoot(mV)	Pass/Fail
115V_{AC}, 0%-100%	388mV	110mV	
115V_{AC},50% -100%	150mV	98mV	
230V_{AC},0%-100%	362mV	108mV	
230V_{AC},50% -100%	146mV	114mV	

6.9. Brown-out Test

Condition(100%Po)	Pin (W)	Vo (V)
90 VAC	22.945	12.04
85 VAC	23.266	12.04
80 VAC	23.641	12.03
70 VAC	24.66	12.02
60 VAC	25.26	12.01
50 VAC	hiccup	hiccup

7. EMC TEST

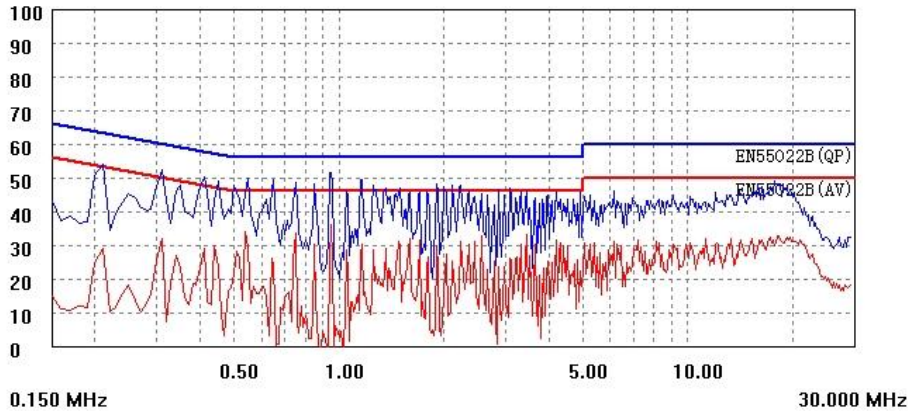
7.1. Conduction Test

EMI TEST REPORT

Organization: ACTIVE	Operator: GP	EUT: ACT520
Place:	Time: 2015/3/12/17:50	Test equipment: KH3931
Detector: PK+AV	Test-time(ms): 30	SN: 1331244
Limit: EN55022B	Transductor(PK/AV): PK / AV	JZ: 2,13,1942
Remark: QC 12V1.5A L		

Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.010
2.000	30.000	0.030

dBuV

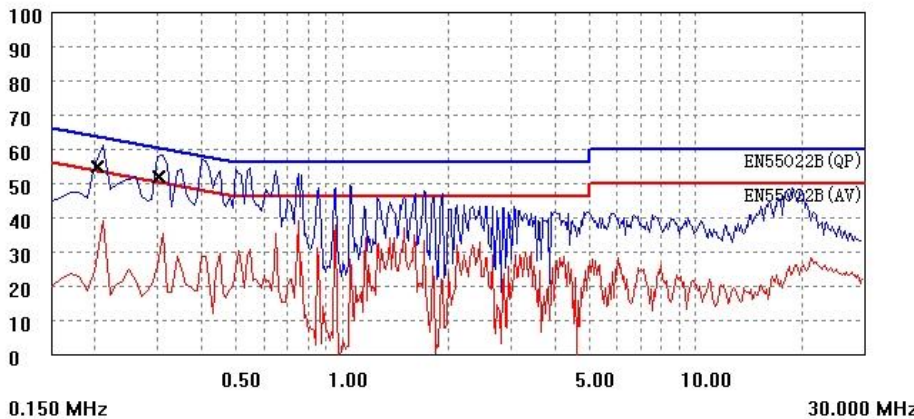


EMI TEST REPORT

Organization: ACTIVE	Operator: GP	EUT: ACT520
Place:	Time: 2015/3/12/17:47	Test equipment: KH3931
Detector: PK+AV	Test-time(ms): 30	SN: 1331244
Limit: EN55022B	Transductor(PK/AV): PK / AV	JZ: 2,14,1150
Remark: QC 12V1.5A N		

Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.010
2.000	30.000	0.030

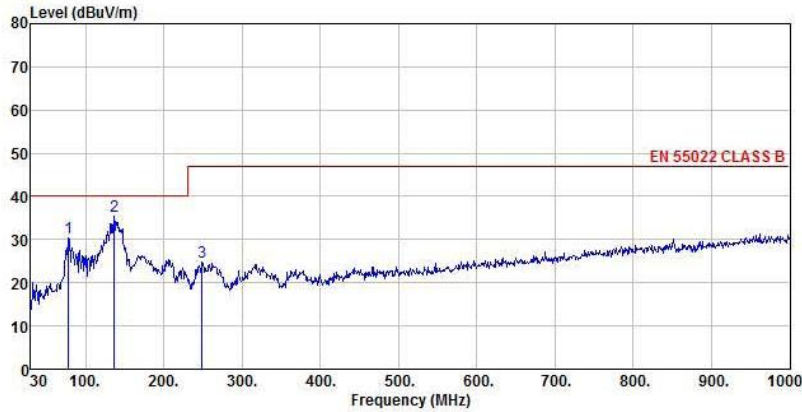
dBuV



[QP]	freq(MHz)	lev(dBuV)	Lim(dBuV)	Δ(lev-Lim)
	0.203	54.6	64.5	-9.9
	0.304	52.0	61.6	-9.6

7.2. Radiation Test

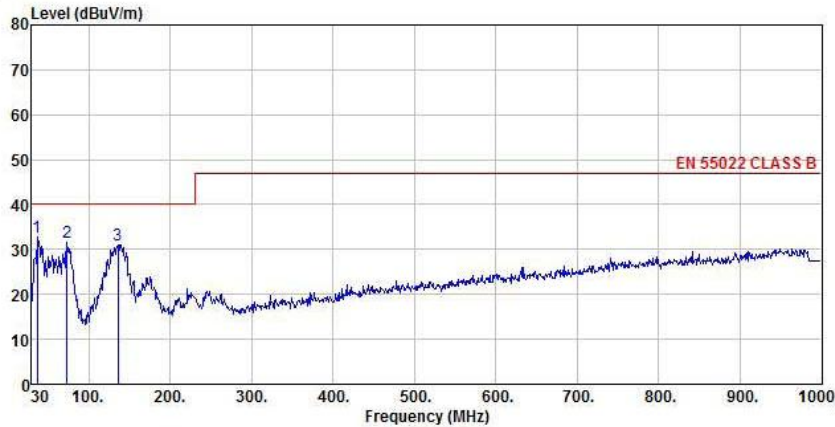
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Site : chamber
 Condition : EN 55022 CLASS B 3m VULB9160 HORIZONTAL
 EUT :
 Model Name : ACT520 QC 12V1.5A 4#
 Temp/Humi : 22 °C / 53 %
 Power Rating: AC 230V/50Hz
 Mode :
 Memo :

	Freq	ReadAntenna	Cable	Preamp	Limit	Over		
	MHz	Level	Factor	Loss	Level	Line	Remark	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB	
1	78.50	20.08	9.14	1.09	0.00	30.31	40.00	-9.69 Peak
2 pp	136.70	20.64	13.21	1.62	0.00	35.47	40.00	-4.53 Peak
3	249.22	10.81	11.92	2.15	0.00	24.88	47.00	-22.12 Peak

Data: 12



Site : chamber
 Condition : EN 55022 CLASS B 3m VULB9160 VERTICAL
 EUT :
 Model Name : ACT520 QC 12V1.5A 4#
 Temp/Humi : 22 °C / 53 %
 Power Rating: AC 230V/50Hz
 Mode :
 Memo :

	Freq	ReadAntenna	Cable	Preamp	Limit	Over		
	MHz	Level	Factor	Loss	Level	Line	Remark	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dB	
1 pp	36.79	19.63	12.51	0.77	0.00	32.91	40.00	-7.09 Peak
2	73.65	20.52	9.87	1.12	0.00	31.51	40.00	-8.49 Peak
3	135.73	16.36	13.07	1.62	0.00	31.05	40.00	-8.95 Peak

7.3. Surge

Condition	Configuration	Test Limit	Pass/Fail
220 VAC, 100% Po=18W	Line – Neutral	2kV	pass

7.4. ESD

Condition	Method	Test Limit	Pass/Fail
220 VAC, 100% Po=18W	Contact Discharge	4kV	Pass
220 VAC, 100% Po=18W	Air Discharge	8kV	pass