



# Test Report: EPP-500-54

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500W 5"×3" Green Open Frame Power Supply

## ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

## ■ RELIABILITY TEST

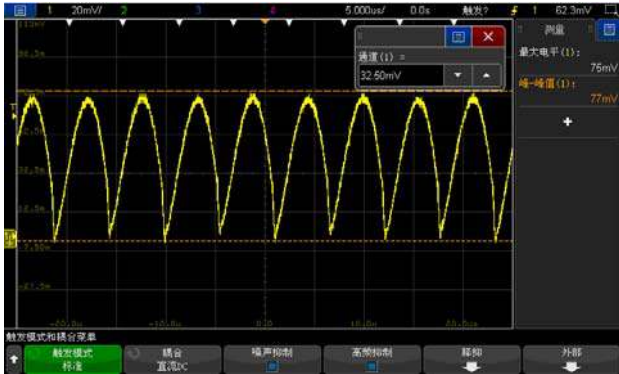
ENVIRONMENT TEST

DESIGN VERIFY TEST

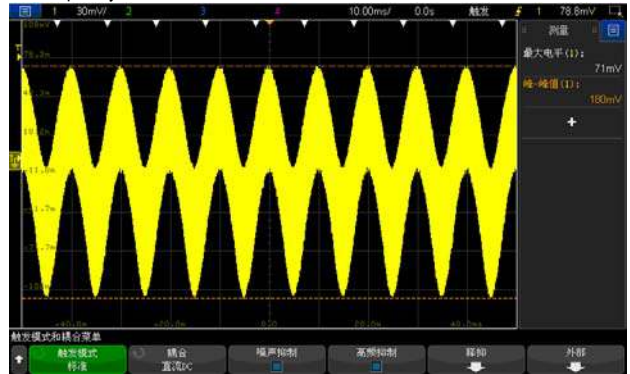
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 51V~57V	I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	49.0V~58.0V
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0%~1.0%	I/P: 80VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1 : -0.11%~0.06%
3	LINE REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1 : -0.02%~0.04%
4	LOAD REGULATION(Max)	V1: -1.0%~1.0%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1 : -0.11%~0.06%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	0.4%
6	RIPPLE & NOISE(Max )	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 180mVp-p

high frequency (V1) :



low frequency (V1):



7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 752ms 115VAC/ 784ms
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INPUT=230VAC/50HZ @ FULL LOAD

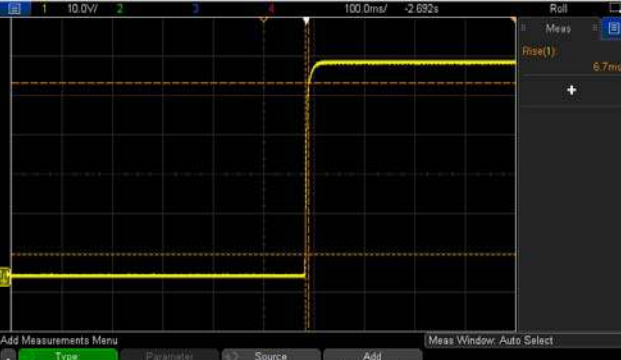
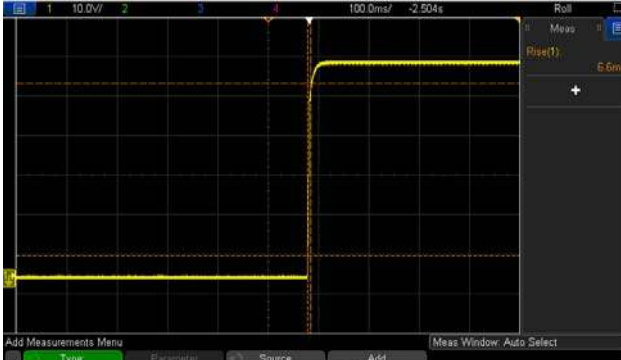
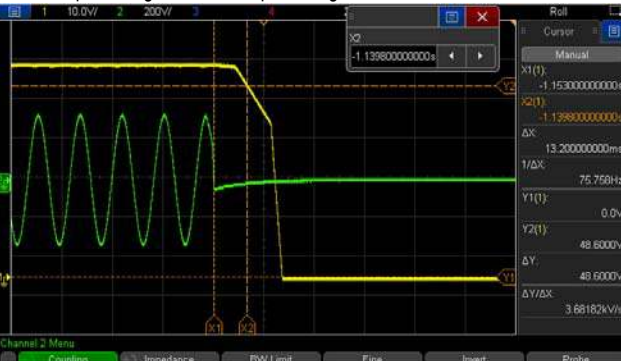
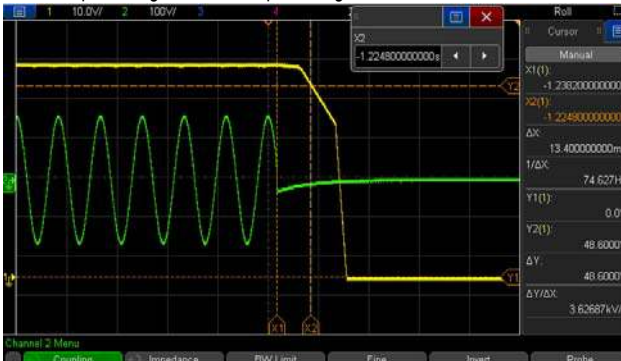
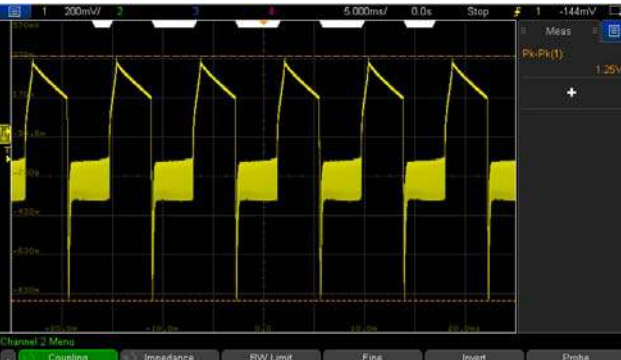
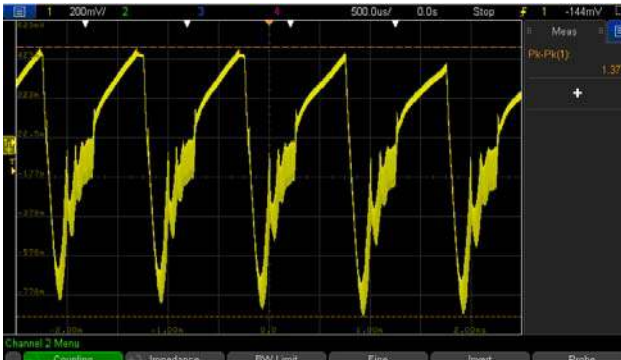
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

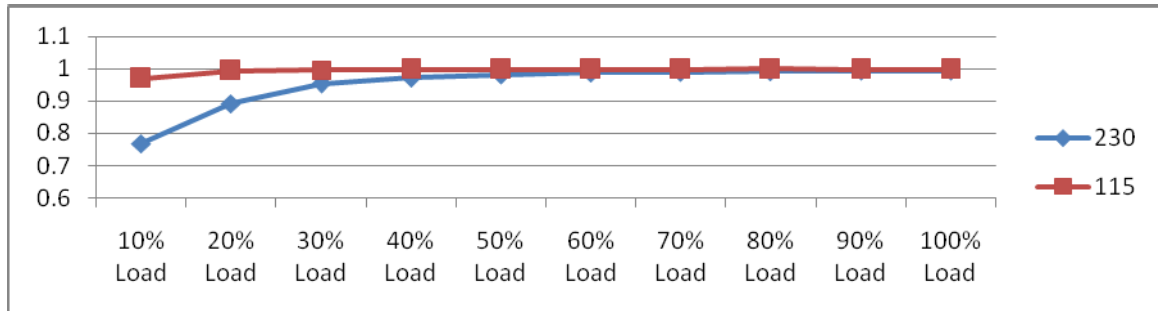


8	RISE TIME (Max) 230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 6.7ms 115VAC/ 6.6ms
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> 	
9	HOLD UP TIME (Typ.) 230VAC/10ms 115VAC/10ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 13.2ms 115VAC/ 13.4ms
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 	
10	DYNAMIC LOAD V1: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	(1) 1250mVp-p (2) 1370mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ (V1)</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ (V1)</p> 	

INPUT FUNCTION TEST

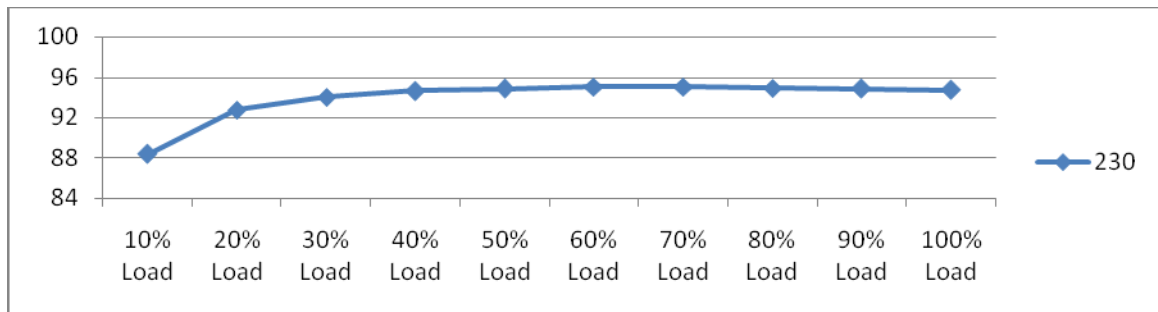
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	74V~264V
			I/P: LOW-LINE-3V=77 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:80 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 2.9A 115V/5.8A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 2.31A/ 230VAC I = 4.79A/ 115VAC
4	LEAKAGE CURRENT	<0.75mA/240VAC	I/P : 264 VAC O/P : Min LOAD Ta : 25°C	0.20mA
5	NO LOAD POWER CONSUMPTION	< 0.5W	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	0.44W
6	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF=0.993/230VAC PF=0.998/115VAC

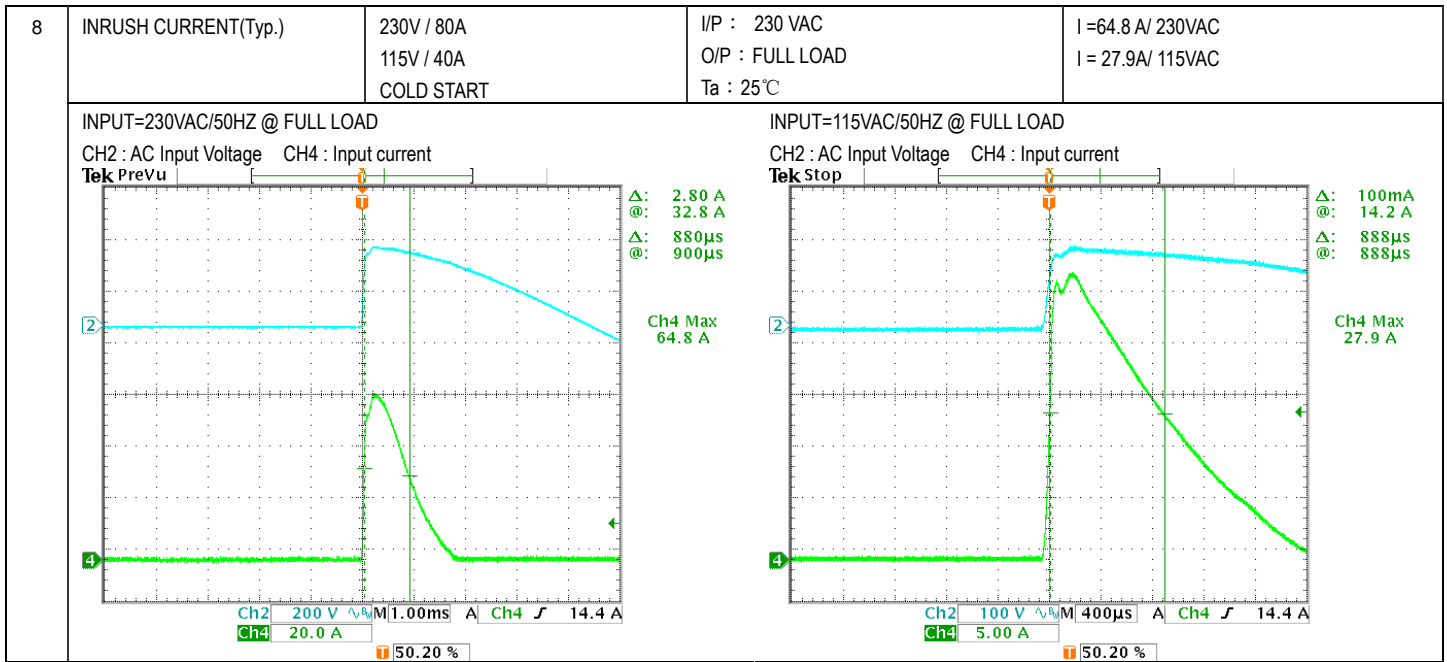
P.F vs LOAD



7	EFFICIENCY(Typ.)	94%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	94.7%
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EFFICIENCY vs LOAD





**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135%	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P: TESTING Ta:25°C	128%/ 264VAC 128%/ 230VAC 128%/115VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	59.4V~70.2V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta:25°C	64.5V/ 264VAC 64.5V/ 230VAC 64.5V/ 80VAC PROTECTION TYPE : Shut down o/p voltage, repower on to recover
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 80VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
4	OVER TEMPERATURE PROTECTION	Protection type : Shut down	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD	O.T.P Active PROTECTION TYPE : Shut down o/p voltage, recovers automatically after temperature goes down

**Control Function Test**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE SENSE	>0.3V	I/P: 230VAC O/P: FULL LOAD Ta:25°C	0.5V
2	AUXILIARY POWER	O/P:12V/0.5A TOLERANCE: ± 10%	I/P: 230VAC O/P: FULL LOAD Ta:25°C	TOLERANCE: -0.98%~1.03%



3	AUXILIARY POWER	O/P:5V/0.6A RIPPLE & NOISE:120 mVp-p TOLERANCE: ±2%	I/P: 230VAC O/P: FULL LOAD Ta:25°C	RIPPLE & NOISE:29 mVp-p TOLERANCE: -0.11%~0.13%
4	PS-ON INPUT SIGNAL	Power on: PS-ON=Hi or >2~5V Power off: PS-ON=LOW or <0~0.5V	I/P: 230VAC O/P: FULL LOAD Ta:25°C	TEST : OK
5	POWER GOOD	10ms<PG<500ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD Ta:25°C	232ms/230VAC 218ms/115VAC
6	POWER FAIL	> 1ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD Ta:25°C	7.8ms/230VAC 5.9ms/115VAC

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q5 Rated : 650 V  Q6 Rated : 650 V	AC ON/OFF I/P:High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	Q5 VDS:  Q6 VDS:  (1) 448V (2) 424V (3) 404V  (1) 504V (2) 504V (3) 428V
2	PWM Transistor (D to S) or (C to E) Peak Voltage	U900 Rated : 725 V	AC ON/OFF I/P:High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	VDS:  (1) 541V (2) 537V (3) 529V
3	O/P MOFET	Q101 Rated : 150 V  Q102 Rated : 150 V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	Q101 VDS:  Q102 VDS:  (1) 124.2V (2) 18.2V (3) 121.0V  (1) 121.8V (2) 12.0V (3) 121.8V
4	Input Capacitor Voltage	C5 Rated :270 μ / 400 V	I/P:High-Line +3V =267V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1) 392V (2) 388V (3) 396V (4) 396 V
5	Control IC Voltage Test	U1 Rated : 0V~ 16 V  U2 Rated : 0V~ 26 V	AC ON/OFF I/P:High-Line +3V =267 V O/P:(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C	U1  U2  (1) 14.1V (2) 13.9V (3) 11.1V (4) 13.5V (5) 13.5V  (1) 15.9V (2) 15.2V (3) 15.3V (4) 15.3V (5) 15.9V



6	P.F.C Transistor	Q1 Rated : 650 V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)Full Load (2)Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 572V (2) 560V (3) 484V
7	PFC Diode	D10 Rated : 650 V	AC ON/OFF I/P : High-Line +3V = 267 V O/P : (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	(1) 407V (2) 407V (3) 407V (4) 411V

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min I/P-FG:2 KVAC/min O/P-FG: 0.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P- FG: 2.4 KVAC/min O/P - FG: 0.6 KVAC/min Ta:25°C	I/P-O/P:1.40mA I/P- FG:1.17 mA O/P - FG:1.02 mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P- FG:500VDC>100MΩ	I/P-O/P: 600 VDC I/P- FG: 600 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P- FG: 9999MΩ NO DAMAGE

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL
2	CONDUCTION	EN55032 Class I: CLASS B CNS13438 Class II : CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55032/ CNS13438 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 <input type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 <input type="checkbox"/> LIGHT INDUSTRY INPUT : 1KV <input checked="" type="checkbox"/> INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report.			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																
1	TEMPERATURE RISE TEST	MODEL : EPP-500-48 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 23.4 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 44.9 °C																																																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 23.4 °C</th> <th>HIGH AMBIENT Ta= 44.9 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>70.1°C</td><td>95.1°C</td></tr> <tr><td>2</td><td>L1</td><td>75.9°C</td><td>100.9°C</td></tr> <tr><td>3</td><td>LF3</td><td>45.3°C</td><td>71.9°C</td></tr> <tr><td>4</td><td>LF1</td><td>47.4°C</td><td>74.9°C</td></tr> <tr><td>5</td><td>C1</td><td>40.9°C</td><td>68.6°C</td></tr> <tr><td>6</td><td>C2</td><td>45.5°C</td><td>73.2°C</td></tr> <tr><td>7</td><td>D10</td><td>54.6°C</td><td>79.5°C</td></tr> <tr><td>8</td><td>Q1</td><td>58.8°C</td><td>83.8°C</td></tr> <tr><td>9</td><td>Q5</td><td>85.0°C</td><td>110.9°C</td></tr> <tr><td>10</td><td>Q6</td><td>85.2°C</td><td>111.1°C</td></tr> <tr><td>11</td><td>LF2</td><td>49.2°C</td><td>76.9°C</td></tr> <tr><td>12</td><td>T1</td><td>92.3°C</td><td>108.2°C</td></tr> <tr><td>13</td><td>L2</td><td>88.5°C</td><td>108.7°C</td></tr> <tr><td>14</td><td>C5</td><td>62.5°C</td><td>84.1°C</td></tr> <tr><td>15</td><td>Q101</td><td>63.6°C</td><td>90.1°C</td></tr> <tr><td>16</td><td>Q102</td><td>60.6°C</td><td>87.3°C</td></tr> <tr><td>17</td><td>T900</td><td>58.6°C</td><td>81.9°C</td></tr> <tr><td>18</td><td>D951</td><td>52.1°C</td><td>74.2°C</td></tr> <tr><td>19</td><td>U900</td><td>72.7°C</td><td>93.9°C</td></tr> <tr><td>20</td><td>C105</td><td>47.7°C</td><td>72.3°C</td></tr> <tr><td>21</td><td>C106</td><td>47.6°C</td><td>72.8°C</td></tr> <tr><td>22</td><td>U1</td><td>66.3°C</td><td>90.0°C</td></tr> <tr><td>23</td><td>TSW1</td><td>54.0°C</td><td>77.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 23.4 °C	HIGH AMBIENT Ta= 44.9 °C	1	BD1	70.1°C	95.1°C	2	L1	75.9°C	100.9°C	3	LF3	45.3°C	71.9°C	4	LF1	47.4°C	74.9°C	5	C1	40.9°C	68.6°C	6	C2	45.5°C	73.2°C	7	D10	54.6°C	79.5°C	8	Q1	58.8°C	83.8°C	9	Q5	85.0°C	110.9°C	10	Q6	85.2°C	111.1°C	11	LF2	49.2°C	76.9°C	12	T1	92.3°C	108.2°C	13	L2	88.5°C	108.7°C	14	C5	62.5°C	84.1°C	15	Q101	63.6°C	90.1°C	16	Q102	60.6°C	87.3°C	17	T900	58.6°C	81.9°C	18	D951	52.1°C	74.2°C	19	U900	72.7°C	93.9°C	20	C105	47.7°C	72.3°C	21	C106	47.6°C	72.8°C	22	U1	66.3°C	90.0°C	23	TSW1	54.0°C	77.1°C
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22	U1	66.3°C	90.0°C																																																																																																	
23	TSW1	54.0°C	77.1°C																																																																																																	
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 130% LOAD Ta : 25°C	TEST : OK																																																																																																
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/115VAC O/P : 100 % LOAD Ta= -35 °C	TEST : OK																																																																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45°C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 45 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																																
5	TEMPERATURE COEFFICIENT	± 0.03%/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0019 %/°C (0~50°C)																																																																																																



6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC	TEST : OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35°C~ +50°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test	TEST : OK
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 3G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 45 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 45 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 45 °C LIFE TIME	(1) 691766.4 HRS (2) 133755 HRS (3) 210964.6 HRS (4) 275126.4 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 194.1K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010