



# Test Report: RPS-500-24

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500W 5"×3" Reliable Green Medical 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

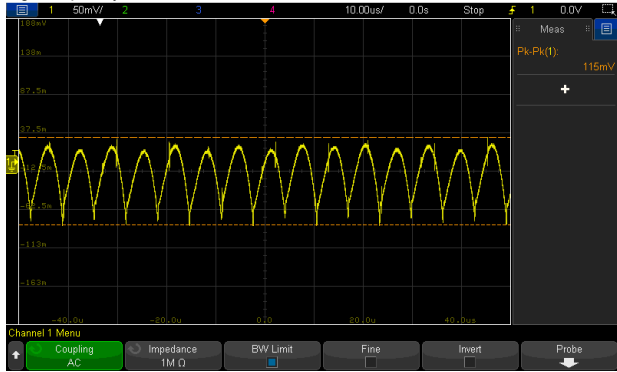
ENVIRONMENT TEST

DESIGN VERIFY TEST

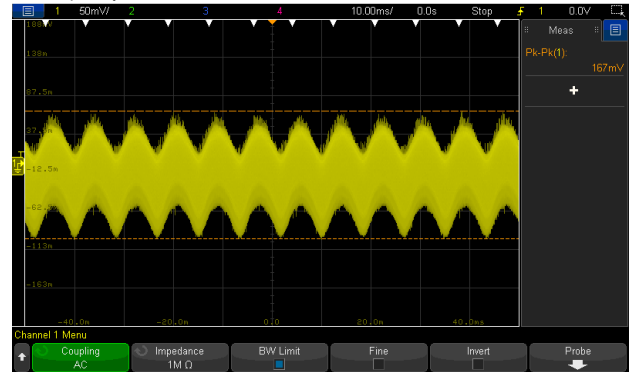
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 22.8V~ 25.2V	I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	22.0V~25.8V
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.0%~2.0%	I/P: 80VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1 : -0.05%~0.08%
3	LINE REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 80VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1 : -0.02%~0.02%
4	LOAD REGULATION(Max)	V1: -1.0%~1.0%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1 : -0.05%~0.08%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.2%
6	RIPPLE & NOISE(Max )	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 167mVp-p

high frequency (V1) :



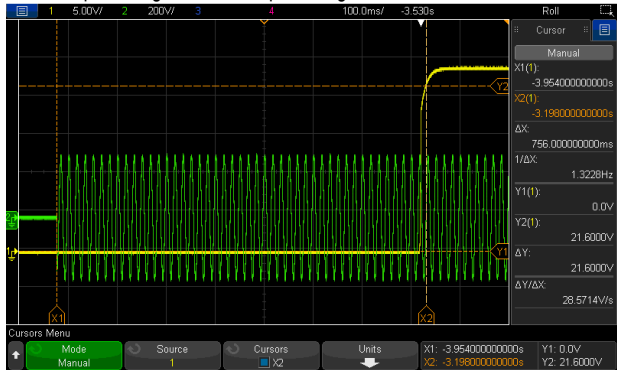
low frequency (V1) :



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/ 756ms 115VAC/ 219ms
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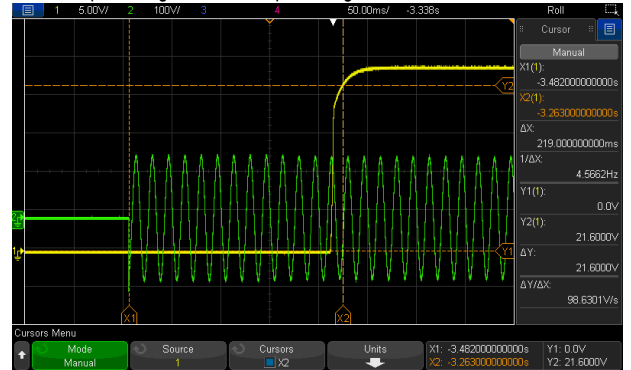
INPUT=230VAC/50HZ @ FULL LOAD

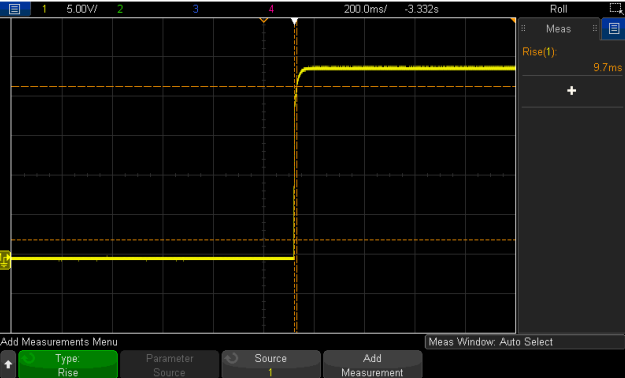
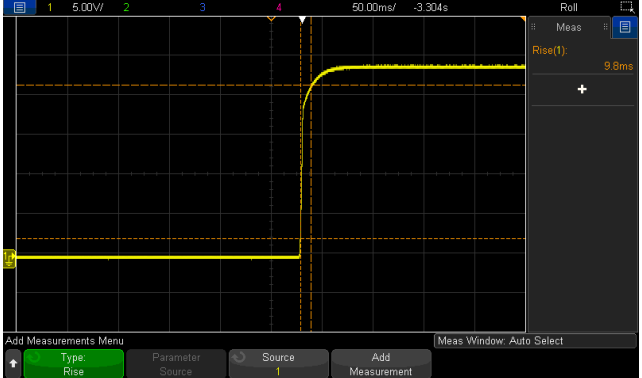
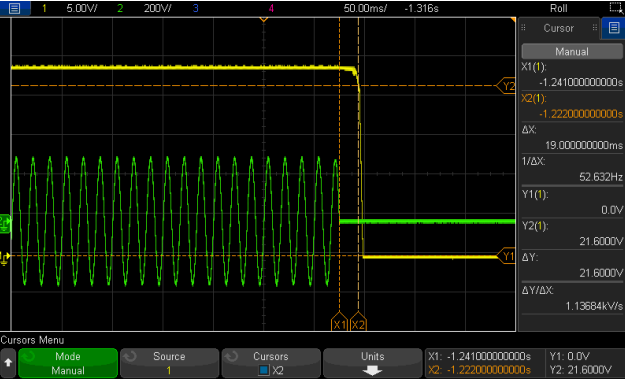
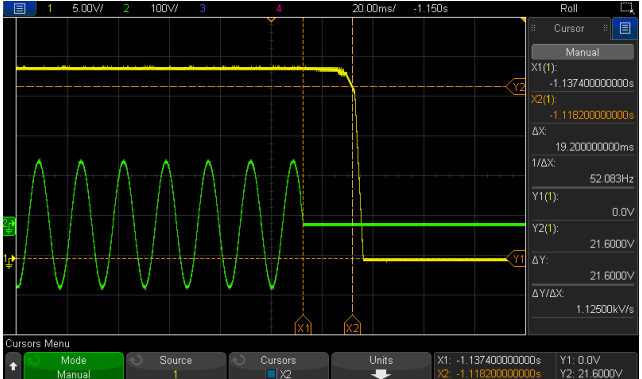
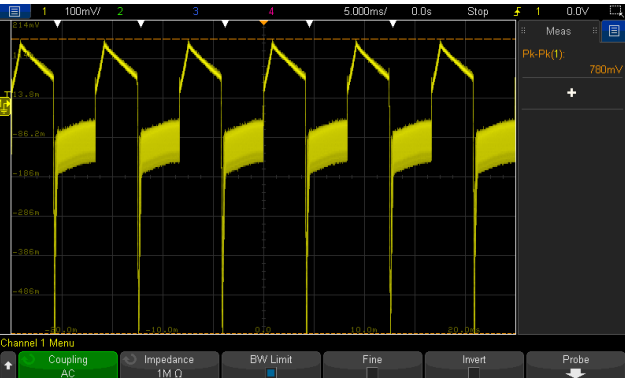
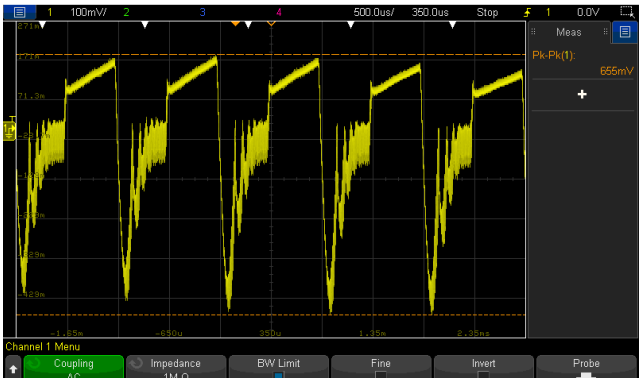
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

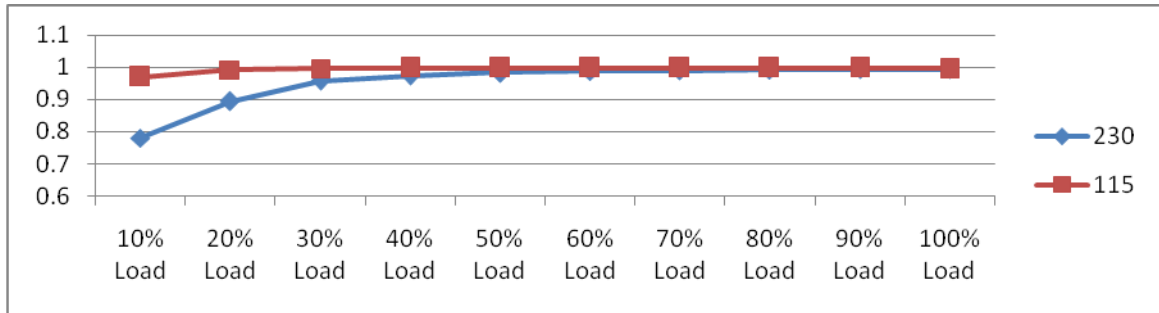


<p><b>8</b> RISE TIME (Max)</p>	<p>230VAC/30ms 115VAC/30ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/9.7ms 115VAC/9.8ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> 	
<p><b>9</b> HOLD UP TIME (Typ.)</p>	<p>230VAC/10ms 115VAC/10ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/ 19ms 115VAC/19.2 ms</p>
<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> 	
<p><b>10</b> DYNAMIC LOAD</p>	<p>V1: 2400 mVp-p</p>	<p>I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C</p>	<p>(1) (2) V1: 780mVp-p 655mVp-p</p>
<p>FULL /50% LOAD 50%DUTY / 120HZ (V1)</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ (V1)</p> 	

### INPUT FUNCTION TEST

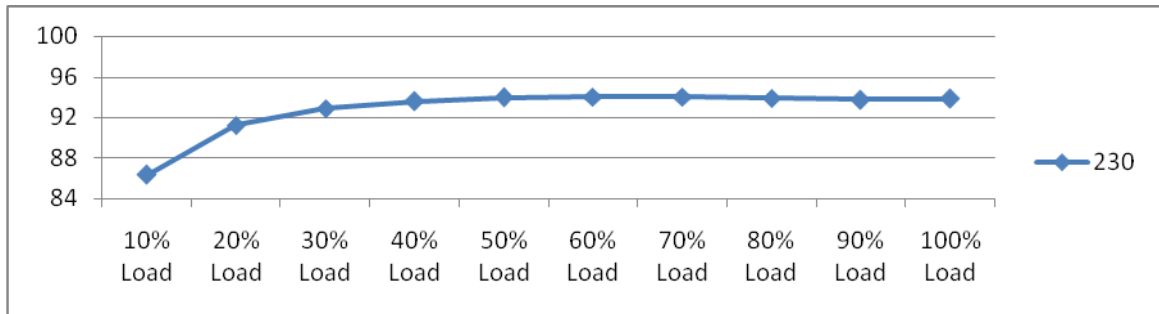
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	80VAC~264VAC 113VDC~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	74VAC~264VAC 105VDC~370VDC
			I/P: LOW-LINE-3V=77 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	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 = 2.32A/ 230VAC I = 4.80A/ 115VAC
4	LEAKAGE CURRENT	Earth: <220uA/264VAC Touch: <100uA/264VAC	I/P : 264 VAC O/P : Min LOAD Ta : 25°C	Earth: 181.2uA/264VAC Touch: 36.5uA/264VAC
5	NO LOAD POWER CONSUMPTION	< 0.5W	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	0.42W
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

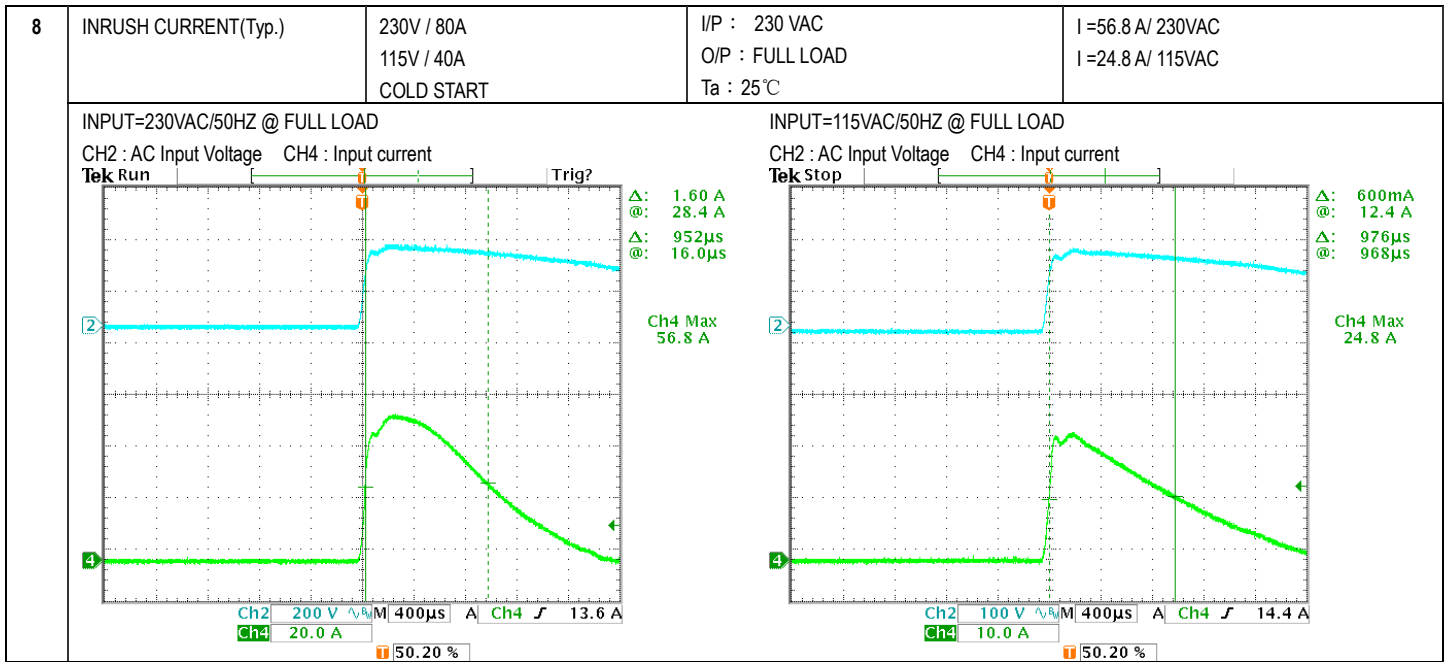
P.F vs LOAD



7	EFFICIENCY(Typ.)	93%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	93.8%
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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	120.1%/ 264VAC 120.1%/ 230VAC 120.0%/115VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	26.1V~31.2V	I/P: 264VAC I/P: 230VAC I/P: 80VAC O/P: MIN LOAD Ta:25°C	28.3V/ 264VAC 28.3V/ 230VAC 28.3V/ 80VACC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
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: -0.41%~0.32%



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:69 mVp-p TOLERANCE: -0.11%~0.12%
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	173ms/230VAC 149ms/115VAC
6	POWER FAIL	> 1ms	I/P: 230VAC I/P: 115VAC O/P: FULL LOAD Ta:25°C	8.0ms/230VAC 6.8ms/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) 414V (2) 426V (3) 410V  (1) 526V (2) 530V (3) 434V
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) 538V (2) 470V (3) 538V
3	O/P MOFET	Q101 Rated : 80 V  Q102 Rated : 80 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) 64.2V (2) 15.2V (3) 64.2V  (1) 65.0V (2) 16.1V (3) 65.0V
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) 397V (2) 393V (3) 397V (4) 397 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) 14.0V (2) 14.0V (3) 13.6V (4) 13.8V (5) 14.0V  (1) 16.5V (2) 16.5V (3) 16.5V (4) 16.4V (5) 15.7V

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) 466V (2) 414V (3) 450V
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) 429V (2) 421V (3) 429V (4) 425V

### 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: 1.5KVAC/min	I/P-O/P: 4.4 KVAC/min I/P- FG: 2.4 KVAC/min O/P - FG: 1.8 KVAC/min Ta:25°C	I/P-O/P:1.36mA I/P- FG:1.15 mA O/P - FG:0.95 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	BS EN/EN 61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL
2	CONDUCTION	BS EN/EN 55011 ( CISPR11 ) Class I: CLASS B Class II : CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	BS EN/EN 55011 ( CISPR11 ) CLASS A	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	BS EN/EN 61000-4-2 AIR: 15KV / Contact: 8KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	BS EN/EN 61000-4-4 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	BS EN/EN61000-4-5 INDUSTRY Line-Line : 2KV Line-FG : 4KV	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 : RPS-500-12 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : 320.4W Ta= 25.9 °C 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : 320.4W Ta= 45.1 °C																																																																																																										
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25.9 °C</th> <th>HIGH AMBIENT Ta= 45.1 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>76.2°C</td><td>87.8°C</td></tr> <tr><td>2</td><td>L1</td><td>85.9°C</td><td>97.2°C</td></tr> <tr><td>3</td><td>LF3</td><td>54.9°C</td><td>71.2°C</td></tr> <tr><td>4</td><td>LF1</td><td>55.2°C</td><td>69.6°C</td></tr> <tr><td>5</td><td>C1</td><td>60.3°C</td><td>72.7°C</td></tr> <tr><td>6</td><td>C2</td><td>55.2°C</td><td>70.3°C</td></tr> <tr><td>7</td><td>D10</td><td>64.1°C</td><td>80.0°C</td></tr> <tr><td>8</td><td>Q1</td><td>80.3°C</td><td>83.6°C</td></tr> <tr><td>9</td><td>C33</td><td>75.0°C</td><td>90.9°C</td></tr> <tr><td>10</td><td>Q5</td><td>95.5°C</td><td>107.1°C</td></tr> <tr><td>11</td><td>Q6</td><td>95.5°C</td><td>107.2°C</td></tr> <tr><td>12</td><td>LF2</td><td>61.8°C</td><td>79.4°C</td></tr> <tr><td>13</td><td>T1</td><td>97.8°C</td><td>107.5°C</td></tr> <tr><td>14</td><td>L2</td><td>101.3°C</td><td>105.9°C</td></tr> <tr><td>15</td><td>C5</td><td>74.8°C</td><td>82.0°C</td></tr> <tr><td>16</td><td>Q101</td><td>105.9°C</td><td>107.4°C</td></tr> <tr><td>17</td><td>Q102</td><td>108.7°C</td><td>110.4°C</td></tr> <tr><td>18</td><td>T900</td><td>70.6°C</td><td>90.4°C</td></tr> <tr><td>19</td><td>D951</td><td>61.6°C</td><td>78.6°C</td></tr> <tr><td>20</td><td>U900</td><td>75.4°C</td><td>91.9°C</td></tr> <tr><td>21</td><td>C105</td><td>84.2°C</td><td>91.7°C</td></tr> <tr><td>22</td><td>C106</td><td>86.6°C</td><td>93.9°C</td></tr> <tr><td>23</td><td>U1</td><td>80.3°C</td><td>92.5°C</td></tr> <tr><td>24</td><td>U2</td><td>84.7°C</td><td>92.7°C</td></tr> <tr><td>25</td><td>TSW1</td><td>63.0°C</td><td>97.6°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25.9 °C	HIGH AMBIENT Ta= 45.1 °C	1	BD1	76.2°C	87.8°C	2	L1	85.9°C	97.2°C	3	LF3	54.9°C	71.2°C	4	LF1	55.2°C	69.6°C	5	C1	60.3°C	72.7°C	6	C2	55.2°C	70.3°C	7	D10	64.1°C	80.0°C	8	Q1	80.3°C	83.6°C	9	C33	75.0°C	90.9°C	10	Q5	95.5°C	107.1°C	11	Q6	95.5°C	107.2°C	12	LF2	61.8°C	79.4°C	13	T1	97.8°C	107.5°C	14	L2	101.3°C	105.9°C	15	C5	74.8°C	82.0°C	16	Q101	105.9°C	107.4°C	17	Q102	108.7°C	110.4°C	18	T900	70.6°C	90.4°C	19	D951	61.6°C	78.6°C	20	U900	75.4°C	91.9°C	21	C105	84.2°C	91.7°C	22	C106	86.6°C	93.9°C	23	U1	80.3°C	92.5°C	24	U2	84.7°C	92.7°C	25	TSW1	63.0°C	97.6°C		
NO	Position	ROOM AMBIENT Ta= 25.9 °C	HIGH AMBIENT Ta= 45.1 °C																																																																																																									
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16	Q101	105.9°C	107.4°C																																																																																																									
17	Q102	108.7°C	110.4°C																																																																																																									
18	T900	70.6°C	90.4°C																																																																																																									
19	D951	61.6°C	78.6°C																																																																																																									
20	U900	75.4°C	91.9°C																																																																																																									
21	C105	84.2°C	91.7°C																																																																																																									
22	C106	86.6°C	93.9°C																																																																																																									
23	U1	80.3°C	92.5°C																																																																																																									
24	U2	84.7°C	92.7°C																																																																																																									
25	TSW1	63.0°C	97.6°C																																																																																																									
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 138% 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 : 272VAC 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	± 0.0043 %/°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) 52730.4 HRS (2) 30032.8 HRS (3) 62974.8 HRS (4) 159578 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