Test Report: RSP-1600-36

1600W Power Supply with Single Output

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Control Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

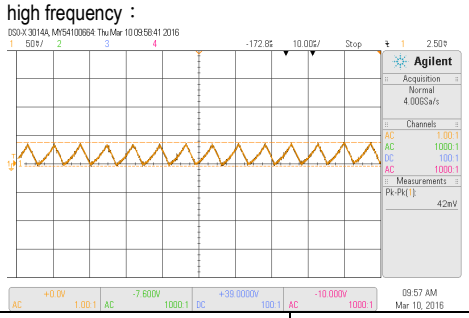
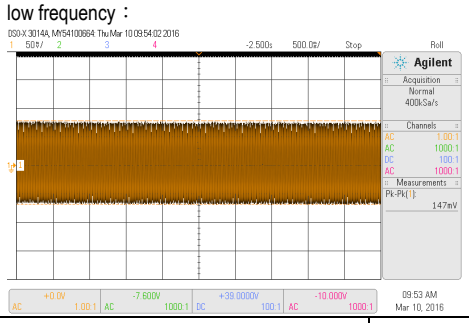
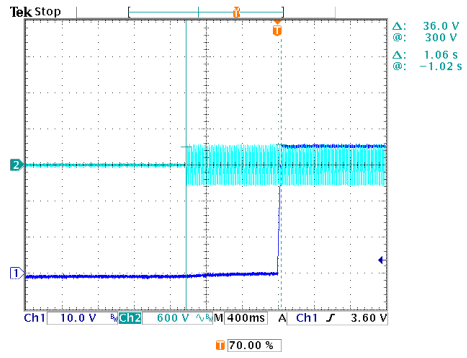
Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

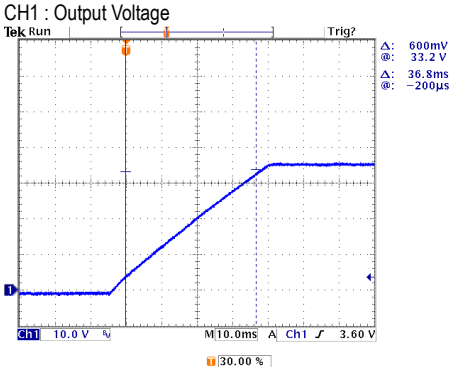
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 35.5 V~ 45V	I/P ： 230 VAC I/P ： 90 VAC O/P ：MIN LOAD Ta ：25℃	46.08V~34.19V/230VAC 46.08V~34.21V/90VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 180VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1:-0.02 %~ 0.02 %
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 180VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0.02 %~0.02 %
4	LOAD REGULATION(Max)	V1: 0.5 %~ -0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0 %~ 0.02 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	0.43 %
6	RIPPLE & NOISE(Max)	V1: 250 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1:147 mVp-p
	high frequency ：  		low frequency ：  	
7	SET UP TIME(Max)	230VAC/1500ms	I/P ： 230 VAC O/P ：FULL LOAD Ta ：25℃	230VAC/ 1056 ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage  			
8	RISE TIME (Max)	230VAC/60ms	I/P ： 230 VAC O/P ：FULL LOAD Ta ：25℃	230VAC/36.8 ms

INPUT=230VAC/50HZ @ FULL LOAD

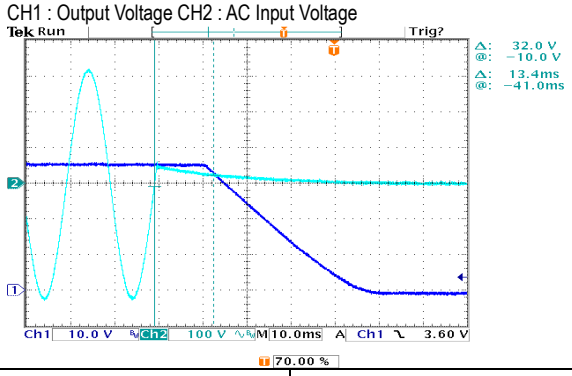
CH1 : Output Voltage



9	HOLD UP TIME (Typ.)	230VAC/10ms /FULL LOAD 230VAC/16ms /75% LOAD	I/P： 230 VAC O/P：FULL LOAD /75% LOAD Ta：25℃	230VAC/ 13.4 ms /FULL LOAD 230VAC/ 20.2 ms /75% LOAD

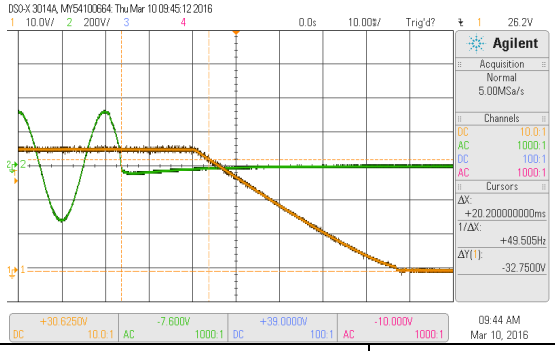
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



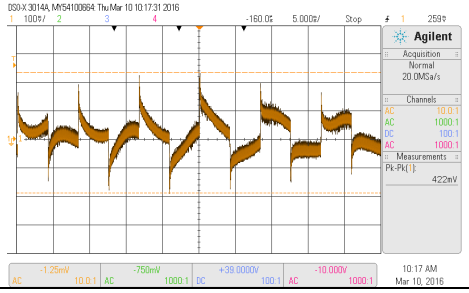
INPUT=230VAC/50HZ @75% LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

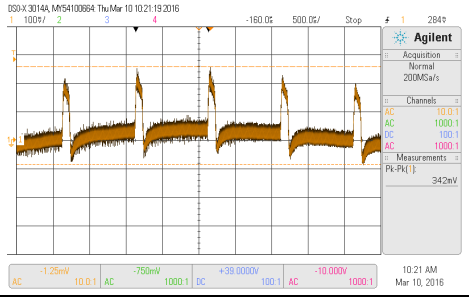


10	DYNAMIC LOAD	V1: 3600 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 422mVp-p 342mVp-p

FULL /50% LOAD 50%DUTY / 120HZ

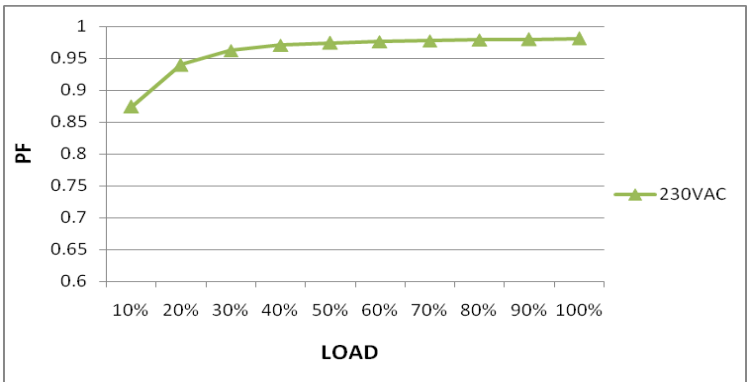


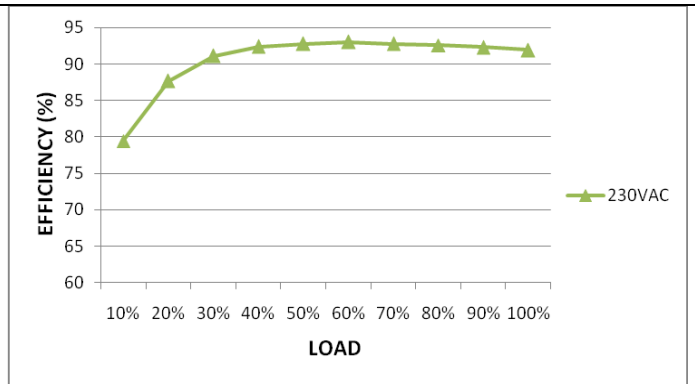
FULL /50% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90V~264VAC	I/P:TESTING O/P: FULL LOAD O/P:60% LOAD Ta:25℃	150 V~ 264 V 87V~264V
			I/P: (1)LOW-LINE-3V=87 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 8.5 A 115V/ 15 A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD (PLEASE CHECK DERATING CURVE) Ta：25℃	I =7.88A/ 230VAC I =12.45A/ 115VAC
4	LEAKAGE CURRENT	<2 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG：0.76 mA N-FG：0.76 mA
5	POWER FACTOR (Typ.)	0.97 / 230VAC	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	PF=0.9808/230VAC
	P.F vs LOAD			
6	EFFICIENCY(Typ.)	92%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	92.45%
	EFFICIENCY vs LOAD			

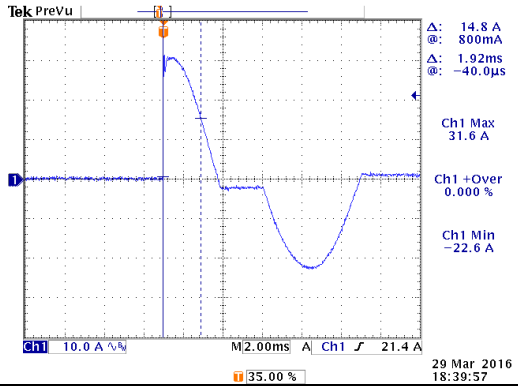




7	INRUSH CURRENT(Typ.)	230V/35 A COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =31.6A/ 230VAC T50= 1920 us/230V

INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Input current



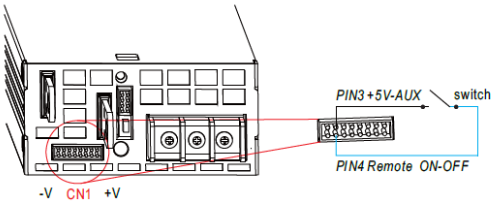
PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 115 % PROTECTION TYPE： Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 180VAC O/P:TESTING Ta:25℃	110.74%/ 264VAC 110.46%/ 230VAC 110.69%/180VAC PROTECTION TYPE： Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	47.2 V~ 56.3 V PROTECTION TYPE： Shut down o/p voltage, re-power on to recover	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	51.3V/ 264VAC 51.3V/ 230VAC 51.3V/ 90VAC PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down	I/P: 264VAC I/P: 180VAC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE： Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE： Constant current limiting, unit will	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Constant current limiting, unit will shut down o/p voltage after 5 sec. re-power on to

		shut down o/p voltage after 5 sec. re-power on to recover		recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	AUXILIARY POWER (AUX)	1. 5V±10%@0.3A ripple:150mVp-p 2. 12V±10%@0.8A ripple:250mVp-p	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	5.02V 0.3A / 72mVp-p 11.13V 0.794 A /201 mVp-p
2	REMOTE ON/OFF CONTROL	※ The power supply can be turned ON/OFF individually or along with other units by using the "Remote ON-OFF" function.		



Between Remote ON-OFF and +5V-AUX	Power Supply Status
Switch Short	ON
Switch Open	OFF

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

Between Remote ON-OFF and +5V-AUX	Power Supply Status
SW SHORT	ON
SW OPEN	OFF

3	REMOTE SENSE	S+ / S- 0.3V~0.5V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	0.3V~0.5V

4 ALARM SIGNAL

1. DC OK SIGNAL
   High (4.5 ~ 5.5V) : When the Vout≦ 80%±5%.
   Low (-0.1 ~ 0.5V) : When Vout≧ 80%±5%.
   The maximum sourcing current is 10mA and only for output.
   I/P: 230 VAC
   O/P:FULL LOAD
   Ta:25℃
   Test Result：

Vout	DC OK SIGNAL
Vout≦ 75%	5.38V
Vout≧ 85%	0.01V

2. T-ALARM

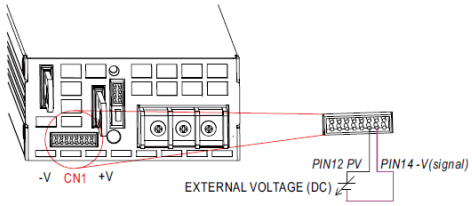
P.S.U STATUS	Vo	T-ALARM
NORMAL	100%±2%	-0.1 ~0.5V
OTP OR FAN LOCK	0V	4.5~5.5V

I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

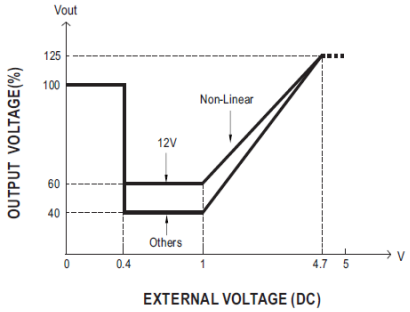
P.S.U STATUS	T-ALARM
NORMAL	0.01 V
OTP OR FAN LOCK	5.38V

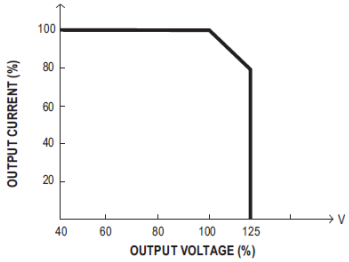
5 OUTPUT VOLTAGE PROGRAMMABLE(PV)

※ In addition to the adjustment via the built-in potentiometer, the output voltage can be trimmed by applying EXTERNAL VOLTAGE.



◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.



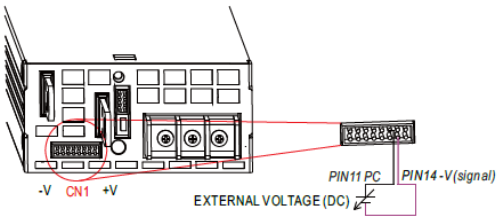


◎ The rated current should change with the Output Voltage Programming accordingly.
◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.

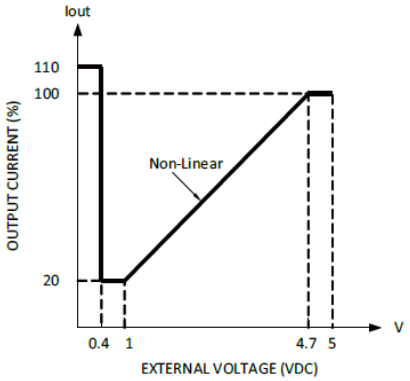
I/P: 230 VAC
O/P:FULL LOAD
Ta:25℃
Test Result：

PV / MODEL	<0.4V	1V	5V
SPEC	36V±5%	14.4V±5%	45V±5%
Vout	36.01V	14.5V	45.5V

6 OUTPUT CURRENT PROGRAMMABLE (PC)



◎ For Remote Sense / Local Sense, please refer to "Voltage Drop Compensation" section.



I/P: 230 VAC
O/P:TESTING
Ta:25℃
Test Result：

ADJ V	1V	4.7V	5V
SPEC	20%±10%	100%±10%	100%±10%
Iout	18.9%	101.1%	102.2%

7 CURRENT SHARING	< ±5%	I/P ： 230 VAC O/P ： FULL/50% LOAD	O/P ： 100% PSU1 ： 45.83 A

			Ta：25℃	PSU2：46.28 A PSU3：44.67 A PSU4：45.38 A PSU5：44.07 A PSU6：44.82 A O/P：50% PSU1：22.86 A PSU2：23.32 A PSU3：22.76 A PSU4：22.86 A PSU5：22.21 A PSU6：22.61 A

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q901 Rated 29A/600V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25℃	VDS: (1)469V (2)448V (3)428V (4)432V (5)432V (6)432V (7)436V
2	P.F.C Transistor (D to S) or (C to E) **Peak Voltage**	Q52 Rated 52A/ 600V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25℃	VDS: (1)457V/19.1A (2) 408V/18.7A (3)440 V/14.2A (4)444 V/14.6A (5)457 V/13.4A (6)428V/10.3A (7)412V/11.1A
3	Diode Peak **Voltage**	Q101 Rated 104A/150 V Q104 Rated 104A/150 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz	Q101: VDS: (1)140V (2)136V (3)138V (4)138V (5)140V (6)136V (7)136V (8)142V Q104: VDS: (1)140V (2)136V (3)136V (4)140V (5)138V (6)134V (7)138V (8)140V

			(7)0%→400% Load. (8).NO LOAD Ta:25℃	
4	**Input Capacitor Voltage**	C5 Rated: 680μ/400 V	I/P:High-Line +3V =267 V O/P: (1)Full Load Ta:25℃	(1)389V
5	**Control IC Voltage Test**	PWM IC U901 Rated 6.5 V~24V PFC IC U51 Rated 4.5V~ 15V	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. Ta:25℃	(1) 14.4V (2) 15.0V (3) 14.8V (4) 13.2V (1)13.6V (2)13.4V (3)13.4V (4)13.4V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:1.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.8 KVAC/min Ta:25℃	I/P-O/P:7.31mA I/P-FG:7.08mA O/P-FG:7.51m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 20.1GΩ I/P-FG: 15.9GΩ O/P-FG:27.4 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	17 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:100% LOAD Ta:25℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS A	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N ：2KV L,N-PE：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： RSP-1600-24
1. ROOM AMBIENT BURN-IN：1 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 28.3 ℃
2. HIGH AMBIENT BURN-IN： 3 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 52.5 ℃</td></tr>
<tr><td colspan="5">
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 28.3 ℃</th><th>HIGH AMBIENT Ta= 52.5 ℃</th></tr>
<tr><td>1</td><td>Q901</td><td>63.0℃</td><td>93.0℃</td></tr>
<tr><td>2</td><td>Q904</td><td>60.8℃</td><td>89.5℃</td></tr>
<tr><td>3</td><td>Q52</td><td>63.1℃</td><td>89.3℃</td></tr>
<tr><td>4</td><td>D50</td><td>70.3℃</td><td>97.8℃</td></tr>
<tr><td>5</td><td>BD1</td><td>44.2℃</td><td>69.2℃</td></tr>
<tr><td>6</td><td>L900</td><td>54.9℃</td><td>80.5℃</td></tr>
<tr><td>7</td><td>T3</td><td>53.4℃</td><td>80.3℃</td></tr>
<tr><td>8</td><td>RG301</td><td>71.8℃</td><td>98.9℃</td></tr>
<tr><td>9</td><td>RG302</td><td>66.6℃</td><td>92.5℃</td></tr>
<tr><td>10</td><td>T1</td><td>60.5℃</td><td>88.0℃</td></tr>
<tr><td>11</td><td>Q101</td><td>63.9℃</td><td>94.7℃</td></tr>
<tr><td>12</td><td>Q104</td><td>61.3℃</td><td>90.9℃</td></tr>
<tr><td>13</td><td>U921</td><td>43.7℃</td><td>68.2℃</td></tr>
<tr><td>14</td><td>C5</td><td>38.5℃</td><td>62.4℃</td></tr>
<tr><td>15</td><td>L100</td><td>71.9℃</td><td>96.4℃</td></tr>
<tr><td>16</td><td>ZNR1</td><td>29.2℃</td><td>53.3℃</td></tr>
<tr><td>17</td><td>L2</td><td>47.4℃</td><td>71.9℃</td></tr>
<tr><td>18</td><td>RY1</td><td>33.3℃</td><td>58.0℃</td></tr>
<tr><td>19</td><td>C101</td><td>31.3℃</td><td>55.1℃</td></tr>
<tr><td>20</td><td>T52</td><td>41.7℃</td><td>66.6℃</td></tr>
<tr><td>21</td><td>RTH21</td><td>55.7℃</td><td>82.7℃</td></tr>
<tr><td>22</td><td>RTH9</td><td>44.4℃</td><td>68.5℃</td></tr>
<tr><td>23</td><td>U671</td><td>31.3℃</td><td>55.2℃</td></tr>
<tr><td>24</td><td>U82</td><td>59.7℃</td><td>86.3℃</td></tr>
<tr><td>25</td><td>Q151</td><td>40.9℃</td><td>65.0℃</td></tr>
</table>
</td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 230 VAC
O/P：105% LOAD
Ta：25℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 230VAC/180VAC
O/P： 100 % LOAD
Ta= -35℃ / -30℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 50 ℃
NO DAMAGE</td><td>I/P： 272 VAC
O/P：FULL LOAD
Ta= 50 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %/℃(0~50℃)</td><td>I/P： 230 VAC
O/P：FULL LOAD</td><td>± 0.002 %/℃(0~50℃)</td></tr>
</table>

6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature： -45℃~ +90℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：5 CYCLE 5. Input/Output condition： STATIC	OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -35℃~ +55℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：10 CYCLE 5. Input/Output condition： 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST(13500 TIMES) 1cycle:230V/ FULL LOAD Burn In Test	OK
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：12min/sweep cycle (4) Acceleration：2G (5) Test Time：60min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C101 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 50℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 50℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 50℃ LIFE TIME	(1) 2451612HRS (2) 445544HRS (3) 480914HRS (4) 490935HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 478.8K hrs min. Telcordia SR-332 (Bellcore) ; 42.1K hrs min. MIL-HDBK-217F (25℃)	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50℃	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

12.10.30 A50-F031