



# Test Report: RST-15K-230

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15KW 3 $\psi$  4W Input With High Voltage 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

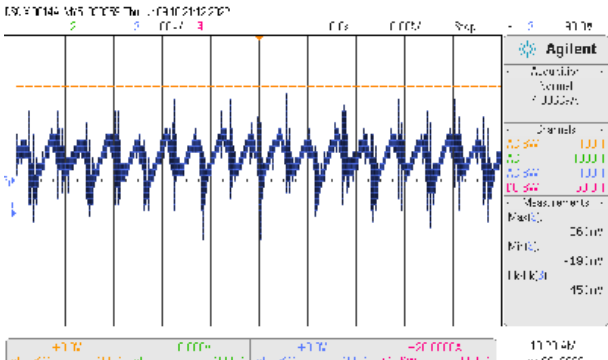
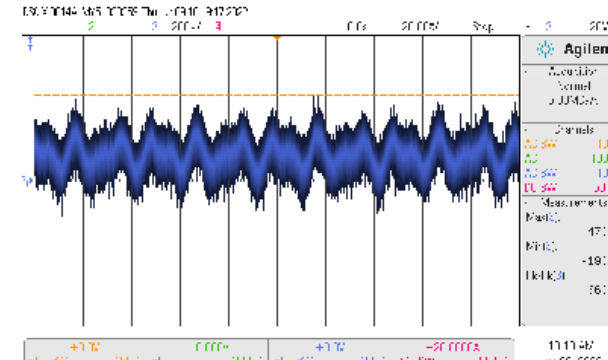
E.M.C. Test

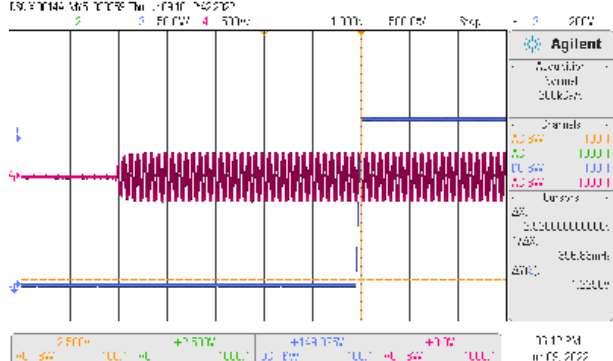
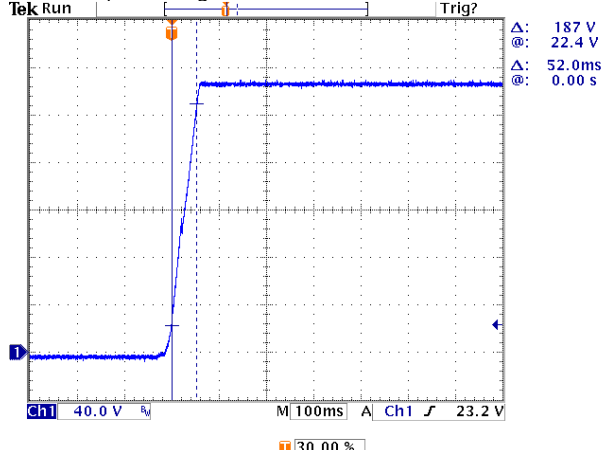
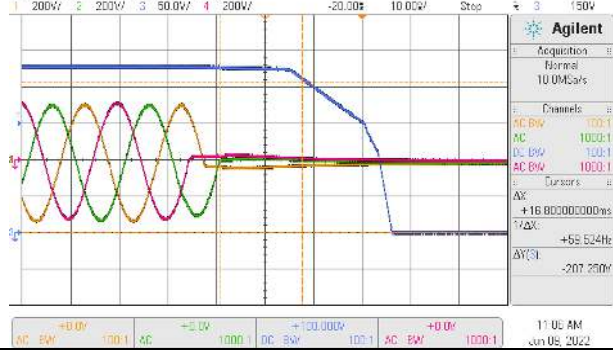
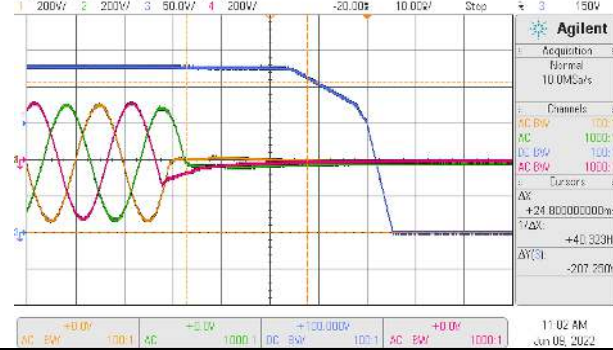
## ■ RELIABILITY TEST

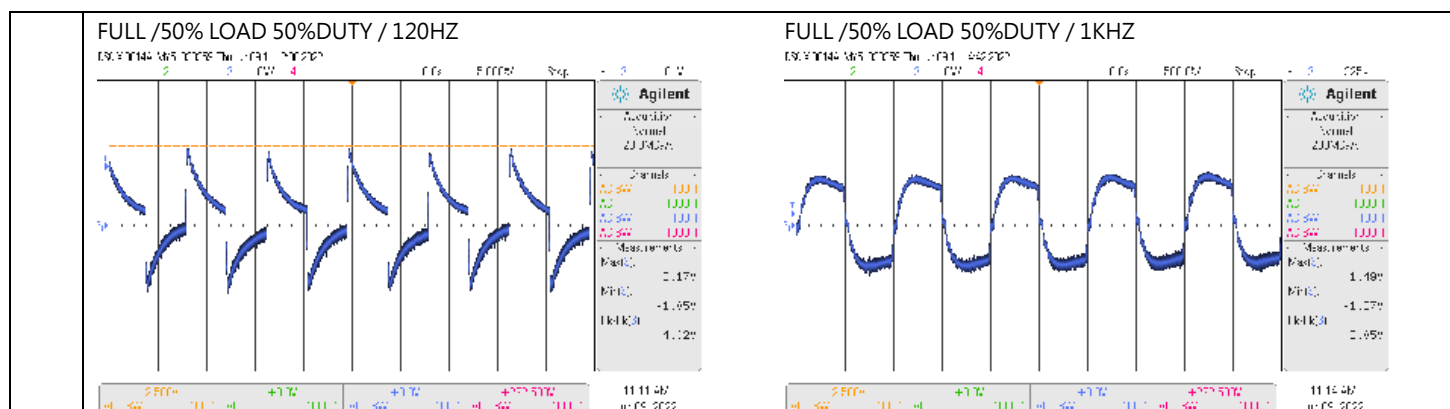
ENVIRONMENT TEST

## ■ DESIGN VERIFY TEST

### OUTPUT FUNCTION TEST

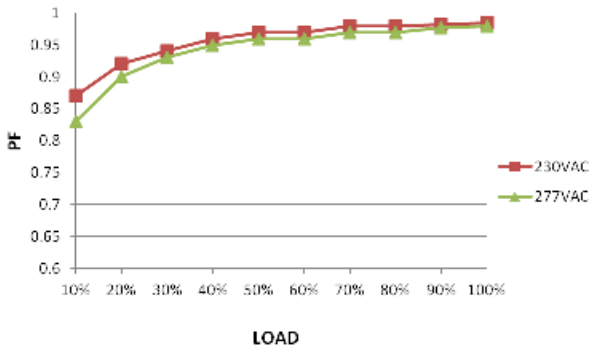
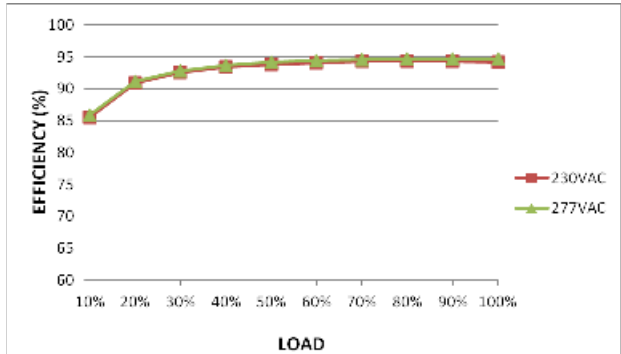
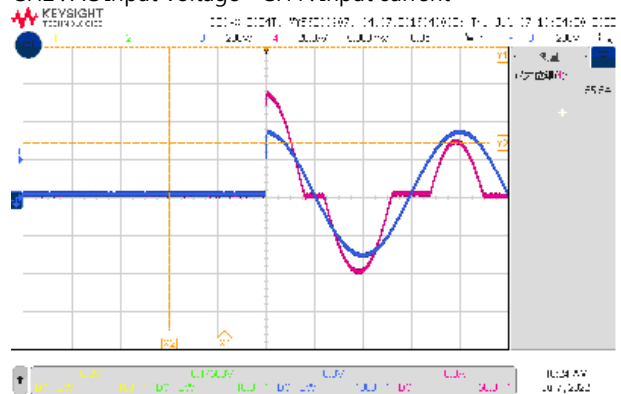
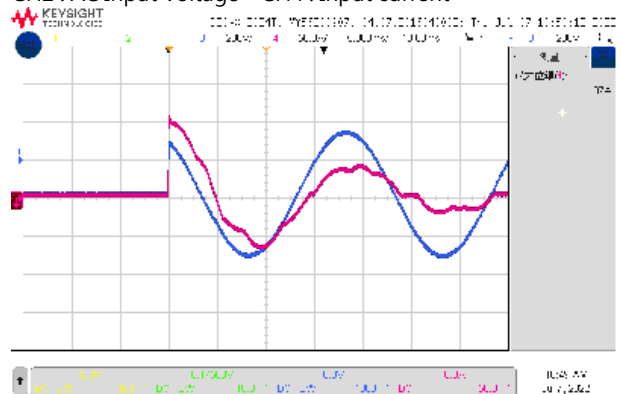
| NO                                                                                                                                                                                                                                                             | TEST ITEM                        | SPECIFICATION     | TEST CONDITION                                                          | RESULT          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------|-------------------------------------------------------------------------|-----------------|
| 1                                                                                                                                                                                                                                                              | OUTPUT VOLTAGE<br>ADJUST RANGE   | CH1 : 170V~ 260 V | I/P : 230 VAC ( $\Delta$ )<br>O/P : MIN LOAD<br>Ta : 25°C               | 154.36V~268.81V |
| 2                                                                                                                                                                                                                                                              | OUTPUT VOLTAGE(Max)<br>TOLERANCE | V1 : 1% ~ -1 %    | I/P : 196VAC /305VAC ( $\Delta$ )<br>O/P : FULL/ MIN. LOAD<br>Ta : 25°C | V1: 0 %~ 0.43 % |
| 3                                                                                                                                                                                                                                                              | LINE REGULATION (Max)            | V1 : 0.5%~ -0.5 % | I/P : 230VAC~ 305VAC ( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C       | V1: 0 %~ 0 %    |
| 4                                                                                                                                                                                                                                                              | LOAD REGULATION(Max)             | V1 : 0.5%~ -0.5 % | I/P : 230VAC ( $\Delta$ )<br>O/P ; FULL ~MIN LOAD<br>Ta : 25°C          | V1: 0.24% ~ 0 % |
| 5                                                                                                                                                                                                                                                              | OVER/UNDERSHOOT TEST             | < $\pm$ 10%       | I/P : 230VAC ( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C               | <10%            |
| 6                                                                                                                                                                                                                                                              | RIPPLE & NOISE(Max )             | V1 : 2Vp-p        | I/P : 230VAC ( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C               | V1: 660 mVp-p   |
| <div> <div> <p>high frequency :</p>  </div> <div> <p>low frequency :</p>  </div> </div> |                                  |                   |                                                                         |                 |
| 7                                                                                                                                                                                                                                                              | SET UP TIME(Max)                 | 230VAC / 3000ms   | I/P : 230 VAC ( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C              | 2520ms          |
| INPUT=230VAC/50HZ @ FULL LOAD<br>CH3 : Output Voltage CH4 : AC Input Voltage                                                                                                                                                                                   |                                  |                   |                                                                         |                 |

|                                                                                                                                                                         |                     |                                                         |                                                                                                                     |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------|
|                                                                                        |                     |                                                         |                                                                                                                     |                                          |
| 8                                                                                                                                                                       | RISE TIME (Max)     | 230VAC/200ms                                            | I/P : 230 VAC ( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C                                                          | 52 ms                                    |
| INPUT=230VAC/50HZ @ FULL LOAD<br>CH1 : Output Voltage<br>                             |                     |                                                         |                                                                                                                     |                                          |
| 9                                                                                                                                                                       | HOLD UP TIME (Typ.) | 230VAC / 10ms at full load<br>230VAC / 16ms at 75% load | I/P : 230 VAC( $\Delta$ )<br>O/P : FULL LOAD/75% LOAD<br>Ta : 25°C                                                  | Full Load / 16.8 ms<br>75% Load / 24.8ms |
| INPUT=230VAC/50HZ @ FULL LOAD<br>CH3 : Output Voltage CH1,2,4 : AC Input Voltage<br> |                     |                                                         |                                                                                                                     |                                          |
| INPUT=230VAC/50HZ @ 75% LOAD<br>CH3 : Output Voltage CH1,2,4 : AC Input Voltage<br> |                     |                                                         |                                                                                                                     |                                          |
| 10                                                                                                                                                                      | DYNAMIC LOAD        | V1: 23Vp-p                                              | I/P: 230VAC( $\Delta$ )<br>O/P:<br>(1)FULL /50% LOAD 50%DUTY / 120HZ<br>(2)FULL /50% LOAD 50%DUTY / 1KHZ<br>Ta:25°C | 4020mVp-p<br>2850mVp-p                   |



## INPUT FUNCTION TEST

| NO | TEST ITEM             | SPECIFICATION                                      | TEST CONDITION                                                                                                                                                               | RESULT                                                                                 |
|----|-----------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1  | INPUT VOLTAGE RANGE   | 196VAC~305VAC                                      | (1) I/P:TESTING<br>O/P:FULL LOAD<br>Ta:25°C                                                                                                                                  | (1) 188.4V~305V                                                                        |
|    |                       |                                                    | I/P :<br>LOW-LINE 196-3V=193V<br>HIGH-LINE 305+10V=315 V<br>O/P : FULL/MIN LOAD<br>(PLEASE CHECK DERATING CURVE)<br>ON:30 Sec OFF:30 Sec 10MIN<br>( POWER ON/OFF NO DAMAGE ) | TEST: PASS                                                                             |
| 2  | INPUT FREQUENCY RANGE | 47HZ ~63 HZ<br>NO DAMAGE                           | I/P: 196VAC ~305 VAC( $\Delta$ )<br>O/P: FULL~MIN LOAD<br>Ta:25°C                                                                                                            | TEST: PASS                                                                             |
| 3  | INPUT CURRENT (Typ.)  | Y : 400V/ 26A<br>$\Delta$ : 230V/ 45A              | I/P : 400VAC(Y)/230 VAC( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C                                                                                                          | Y : I =23.16A<br>$\Delta$ : I =40.45A                                                  |
| 4  | LEAKAGE CURRENT       | <21mA / 305 VAC( $\Delta$ )<br>< 3.5mA /530VAC (Y) | I/P : 305VAC ( $\Delta$ ) / 530V (Y)<br>O/P : Min LOAD<br>Ta : 25°C                                                                                                          | L1-FG : 20.52mA/ 1.78mA(Y)<br>L2-FG : 20.52mA/ 1.78mA(Y)<br>L3-FG : 20.52mA/ 1.78mA(Y) |
| 5  | POWER FACTOR (Typ.)   | 0.98 / 230VAC<br>0.97 / 277VAC                     | I/P : 230 VAC( $\Delta$ )<br>I/P : 277 VAC( $\Delta$ )<br>O/P : FULL LOAD<br>Ta : 25°C                                                                                       | PF=0.984/ 230VAC<br>PF=0.979/ 277VAC                                                   |
|    | P.F vs LOAD           |                                                    |                                                                                                                                                                              |                                                                                        |

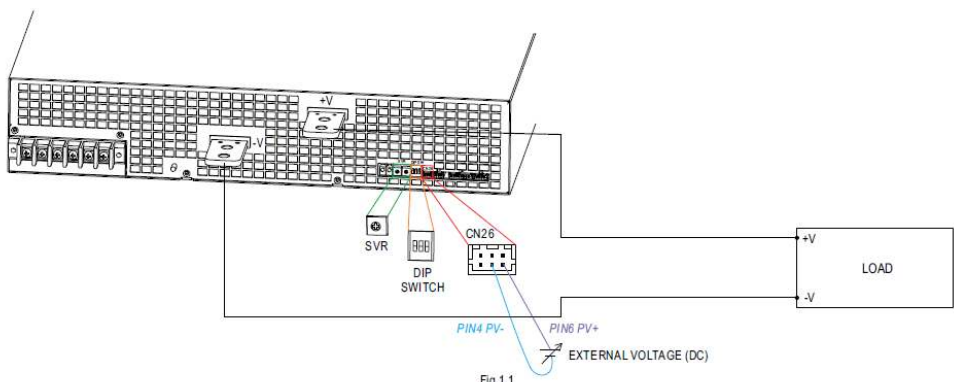
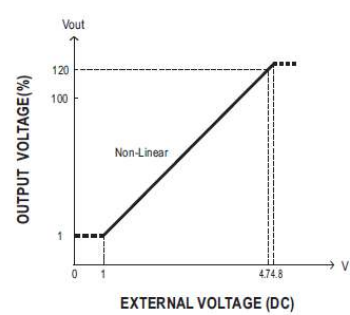
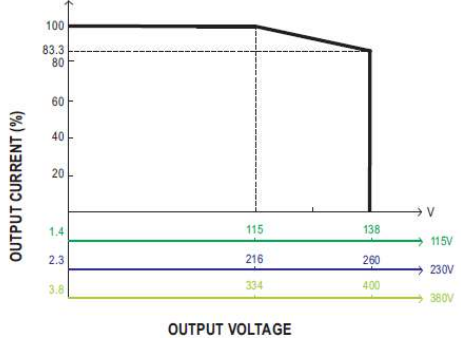
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                                                                                    |                                          |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------|
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |  |                                          |
| 6 | EFFICIENCY(Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                                 | 94%                                            | I/P:230 VAC<br>O/P:FULL LOAD<br>Ta:25°C                                            | 95.5 %                                   |
|   | EFFICIENCY vs LOAD                                                                                                                                                                                                                                                                                                                                            |                                                |                                                                                    |                                          |
| 7 | INRUSH CURRENT(Typ.)                                                                                                                                                                                                                                                                                                                                                                                                                             | Y : 400V/ 100A<br>Δ : 230V/ 150A<br>COLD START | I/P : 400VAC (Y)<br>I/P : 230 VAC (Δ)<br>O/P : FULL LOAD<br>Ta : 25°C              | Y : 55.5A<br>Δ : 107A<br>T50= 2.8 ms (Δ) |
|   | <div> <div>           Y : INPUT=230VAC/50HZ @ FULL LOAD<br/>           CH2 : AC Input Voltage CH4 : Input current            </div> <div>           Δ : INPUT=230VAC/ 50HZ @ FULL LOAD<br/>           CH2 : AC Input Voltage CH4 : Input current            </div> </div> |                                                |                                                                                    |                                          |

## PROTECTION FUNCTION TEST

| NO | TEST ITEM                   | SPECIFICATION                                                                                                                                    | TEST CONDITION                                                                         | RESULT                                                                                                                                                       |
|----|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | OVER LOAD PROTECTION        | 100 %~107 %<br>Protection type :<br>Constant current limiting, unit will shutdown after 5 sec. re-power on to recover                            | I/P : 305VAC( $\Delta$ )<br>I/P : 230VAC<br>I/P : 196VAC<br>O/P : TESTING<br>Ta : 25°C | 104.3%/ 305VAC<br>104.3%/ 230VAC<br>104.3%/ 196VAC<br>PROTECTION TYPE :<br>Constant current limiting, unit will shutdown after 5 sec. re-power on to recover |
| 2  | OVER VOLTAGE PROTECTION     | 273V~312V<br>Protection type :<br>Shut down o/p voltage, re-power on to recover                                                                  | I/P: 305VAC( $\Delta$ )<br>I/P: 230VAC<br>I/P: 196VAC<br>O/P:MIN LOAD<br>Ta:25°C       | 289V/ 305VAC<br>289V/ 230VAC<br>289V/ 196VAC<br>PROTECTION TYPE :<br>Shut down o/p voltage, re-power on to recover                                           |
| 3  | OVER TEMPERATURE PROTECTION | Protection type :<br>Shut down o/p voltage, recovers automatically after temperature goes down                                                   | I/P: 305VAC( $\Delta$ )<br>I/P: 196VAC<br>O/P:FULL LOAD                                | O.T.P. Active<br>Protection type :<br>Shut down o/p voltage, recovers automatically after temperature goes down                                              |
| 4  | SHORT PROTECTION            | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE<br>Protection type :<br>Constant current limiting, unit will shutdown after 5 sec. re-power on to recover | I/P: 305VAC( $\Delta$ )<br>I/P: 196VAC<br>O/P: FULL LOAD<br>Ta:25°C                    | NO DAMAGE<br>Protection type :<br>Constant current limiting, unit will shutdown after 5 sec. re-power on to recover                                          |

## CONTROL FUNCTION TEST

| NO                                                         | TEST ITEM             | SPECIFICATION                                                                                                                                                                                                                                                                                                                 | TEST CONDITION | RESULT |                                                            |               |                      |                 |                    |                  |
|------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|------------------------------------------------------------|---------------|----------------------|-----------------|--------------------|------------------|
| 1                                                          | AUXILIARY POWER (AUX) | <div>I/P: 230 VAC(Δ)<br/>O/P:FULL LOAD<br/>Ta:25°C<br/>Test Result : PASS</div> <table><tr><td>AUX</td><td>TOLERANCE</td><td>TEST RESULT</td></tr><tr><td>12V / 0.1A</td><td>11.4~12.6 V</td><td>11.807V/31mvp-p</td></tr></table>                                                                                            |                |        | AUX                                                        | TOLERANCE     | TEST RESULT          | 12V / 0.1A      | 11.4~12.6 V        | 11.807V/31mvp-p  |
| AUX                                                        | TOLERANCE             | TEST RESULT                                                                                                                                                                                                                                                                                                                   |                |        |                                                            |               |                      |                 |                    |                  |
| 12V / 0.1A                                                 | 11.4~12.6 V           | 11.807V/31mvp-p                                                                                                                                                                                                                                                                                                               |                |        |                                                            |               |                      |                 |                    |                  |
| 2                                                          | REMOTE ON/OFF CONTROL | <div>I/P: 230 VAC(Δ)<br/>O/P:FULL LOAD<br/>Ta:25°C<br/>Test Result : PASS</div> <table><tr><td>Between Remote ON-OFF(CN25 pin5)<br/>and 12V-AUX(CN25 pin1)</td><td>Output Status</td></tr><tr><td>Switch close (Short)</td><td>power supply ON</td></tr><tr><td>Switch open (Open)</td><td>power supply OFF</td></tr></table> |                |        | Between Remote ON-OFF(CN25 pin5)<br>and 12V-AUX(CN25 pin1) | Output Status | Switch close (Short) | power supply ON | Switch open (Open) | power supply OFF |
| Between Remote ON-OFF(CN25 pin5)<br>and 12V-AUX(CN25 pin1) | Output Status         |                                                                                                                                                                                                                                                                                                                               |                |        |                                                            |               |                      |                 |                    |                  |
| Switch close (Short)                                       | power supply ON       |                                                                                                                                                                                                                                                                                                                               |                |        |                                                            |               |                      |                 |                    |                  |
| Switch open (Open)                                         | power supply OFF      |                                                                                                                                                                                                                                                                                                                               |                |        |                                                            |               |                      |                 |                    |                  |

|       |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |    |      |       |  |  |      |                  |               |      |       |      |
|-------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|------|-------|--|--|------|------------------|---------------|------|-------|------|
| 3     | Select Overload Protection (OLP) Mode | <p><b>3. Select Overload Protection (OLP) Mode</b></p> <p>(1) Continuous Constant Current mode<br/>Have the DIP switch position-1 set as , and RST-15K will work in continuous constant current mode when the output is overloaded and the output voltage is greater than 50% of the rated output voltage.</p> <p>(2) Delay Shutdown mode<br/>Have the DIP switch position-1 set as , and RST-15K will shut down after 5 seconds of constant current operation, when the output is overloaded or short-circuited.</p> <p>I/P: 230 VAC<br/>O/P: 170 Load : CV Mode 170-2V<br/>Ta: 25°C<br/>Test Result : PASS</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |    |      |       |  |  |      |                  |               |      |       |      |
| 4     | OUTPUT VOLTAGE PROGRAMMABLE(PV)       | <p><b>1. Output Voltage Programming (or, PV / remote voltage programming / remote adjust / margin programming / dynamic voltage trim)</b></p> <p>(1) by potentiometer (SVR)<br/>(a) Have the DIP switch position-3 set as ,<br/>(b) Output voltage can be trimmed by SVR.</p> <p>(2) by Output Voltage Programming<br/>(a) Have the DIP switch position-3 set as ,<br/>(b) The output voltage can be trimmed to 1~120% by applying EXTERNAL VOLTAGE between PV+ and PV- on CN26 or CN27.</p>  <p>Fig 1.1</p>   <p>Fig 1.2</p> <p>© The rated current should change with the Output Voltage Programming accordingly.</p> <p>I/P : 230 VAC<br/>O/P : FULL LOAD<br/>Ta : 25°C<br/>TEST RESULT : PASS</p> <table border="1"> <tr> <td>PV</td><td>1V</td><td>4.7V</td></tr> <tr> <td>MODEL</td><td></td><td></td></tr> <tr> <td>SPEC</td><td>2.3V<math>\pm</math>1.75V</td><td>260V<math>\pm</math>7V</td></tr> <tr> <td>Vout</td><td>12.3V</td><td>260V</td></tr> </table> | PV | 1V | 4.7V | MODEL |  |  | SPEC | 2.3V $\pm$ 1.75V | 260V $\pm$ 7V | Vout | 12.3V | 260V |
| PV    | 1V                                    | 4.7V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |    |      |       |  |  |      |                  |               |      |       |      |
| MODEL |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |    |      |       |  |  |      |                  |               |      |       |      |
| SPEC  | 2.3V $\pm$ 1.75V                      | 260V $\pm$ 7V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |    |      |       |  |  |      |                  |               |      |       |      |
| Vout  | 12.3V                                 | 260V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |    |      |       |  |  |      |                  |               |      |       |      |

## 5 OUTPUT CURRENT PROGRAMMABLE (PC)

**2.Constant Current Programming (or, PC / remote current programming / dynamic current trim)**

(1)Default Overload Protection(OLP) 100~105% of rated current

(a)Have the DIP switch position-2 set as



(b)Output current is set default value.

(2)by Constant Current Level Programming

(a)Have the DIP switch position-2 set as



(b)The constant current level can be trimmed to 20~100% of the rated current by applying EXTERNAL VOLTAGE between PC+ and PC- on CN26 or CN27.

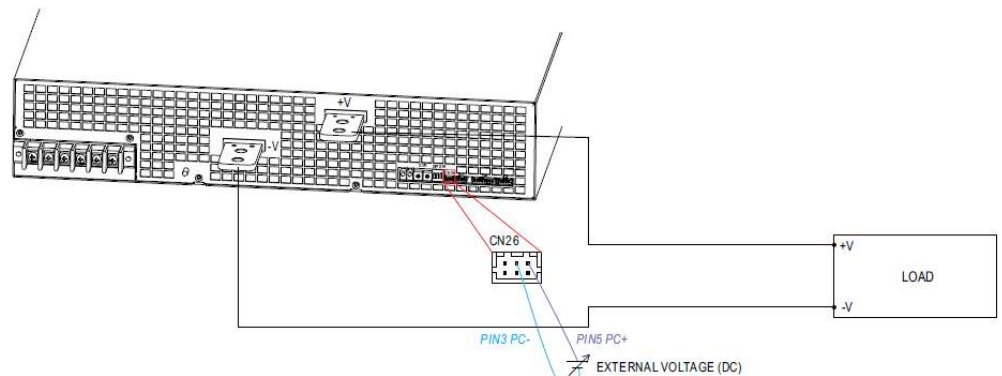


Fig 2.1

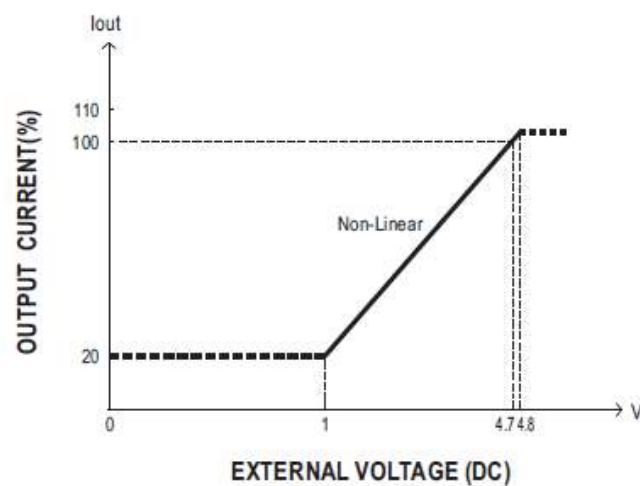


Fig 2.2

» Output will shut down after O/P voltage is below &lt;80% of Vset for 6 sec, re-power on to recover.

I/P: 230 VAC

O/P:TESTING

Ta:25°C

| ADJ V | 1V      | 4.7V     |
|-------|---------|----------|
| SPEC  | 20%±10% | 100%±10% |
| TEST  | 22.1%   | 99.8%    |

## 6 Alarm Signal Output

**5. Alarm Signal Output**

※ There are 4 alarm signals on CN99, and each signal can select two types of output circuit.

(1) Relay contact output {OTP1, OTP1-GND} ; {DC-OK1, DC-OK1-GND} ; {AC-FAIL1-GND, AC-FAIL1} ; {FAN-FAIL1-GND, FAN-FAIL1}

Normally open contact. "Short" when the alarm arises. Relay contact rating(maximum) is 30V/1A resistive.

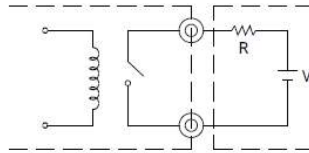


Fig 5.1

| Function   | Description                                                                                                                                                |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC-OK1     | Alarm signal of DC-OK.<br>Normally open contact. "Short" when the PSU turns on. Relay contact rating(maximum) is 30V/1A resistive.                         |
| OTP1       | Alarm signal of OTP.<br>Normally open contact. "Short" when the PSU over temperature protection occurs. Relay contact rating(maximum) is 30V/1A resistive. |
| AC_Fail_1  | Alarm signal of AC-fail.<br>Normally open contact. "Short" when the PSU input voltage is too low. Relay contact rating(maximum) is 30V/1A resistive.       |
| FAN_Fail_1 | Alarm signal of fan fail.<br>Normally open contact. "Short" when the internal fan fails. Relay contact rating(maximum) is 30V/1A resistive.                |

I/P : 230 VAC( $\Delta$ )

O/P : no load/full load

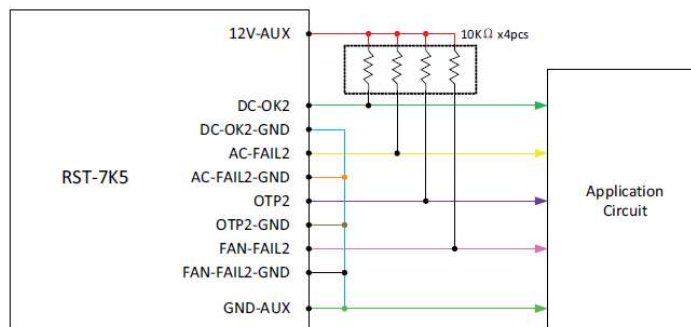
Ta : 25°C

TEST RESULT : PASS

| Power Supply Status | DC-OK1 signal | OTP1 signal | AC_Fail_1 signal | FAN_Fail_1 signal |
|---------------------|---------------|-------------|------------------|-------------------|
| OFF                 | OPEN          | SHORT       | SHORT (184VAC)   | SHORT             |
| ON                  | SHORT         | OPEN        | OPEN (189VAC)    | OPEN              |

(2) Open collector output {DC-OK2-GND, DC-OK2} ; {AC-FAIL2-GND, AC-FAIL2} ; {OTP2, OTP2-GND} ; {FAN-FAIL2, FAN-FAIL2-GND}

An external voltage source is required for this function that is shown in Fig 5.2. These signals are isolated from output. The maximum sink current is 10mA and the maximum external voltage is 20V (there is a built-in 24V zener diode in inner circuitry).



| Function  | Description                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC-OK2    | Alarm signal of DC-OK.<br>Open collector signal. Low when the PSU turns on. The maximum sink current is 10mA and the maximum external voltage is 20V.                         |
| OTP2      | Alarm signal of OTP.<br>Open collector signal. Low when the PSU over temperature protection occurs. The maximum sink current is 10mA and the maximum external voltage is 20V. |
| AC-FAIL2  | Alarm signal of AC fail.<br>Open collector signal. Low when the PSU input voltage is too low. The maximum sink current is 10mA and the maximum external voltage is 20V.       |
| FAN-FAIL2 | Alarm signal of fan fail.<br>Open collector signal. Low when the internal fan fails. The maximum sink current is 10mA and the maximum external voltage is 20V.                |

|   |                 | Power Supply Status             | DC-OK1 signal | OTP1 signal                                         | AC_Fail_1 signal | FAN_Fail_1 signal                                                                               |
|---|-----------------|---------------------------------|---------------|-----------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------|
|   |                 | OFF                             | HIGH          | LOW                                                 | LOW (184VAC)     | LOW                                                                                             |
|   |                 | ON                              | LOW           | HIGH                                                | HIGH (188VAC)    | HIGH                                                                                            |
| 7 | CURRENT SHARING | CURRENT SHARING TOLERANCE <±10% |               | I/P : 230 VAC(Δ)<br>O/P : 100/50% LOAD<br>Ta : 25°C |                  | O/P : 100%<br>PSU1 : 68.18 A<br>PSU2 : 69.23 A<br>O/P : 50%<br>PSU1 : 34.41 A<br>PSU2 : 35.41 A |

## COMPONENT STRESS TEST

| NO | TEST ITEM                                                 | SPECIFICATION                                                                                  | TEST CONDITION                                                                                                                                                                                                                                                                                                                                                                        | RESULT                                                                                                                                                                                                                                                                   |
|----|-----------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | PWM Transistor<br>( D to S) or (C to E)<br>Peak Voltage   | Q333<br>Rated : 35A/650V<br>VGS : -10V~+22V<br><br>Q334<br>Rated : 35A/650V<br>VGS : -10V~+22V | AC ON/OFF<br><br>I/P : High-Line +3V =308V<br>VDS :<br><u>VO : 230V</u><br>O/P :<br>(1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)5%→400% Load.<br>Ta : 25°C | Q333<br>AC=308V<br><u>VO : 230V</u><br>VDS :<br>(1) 533V<br>(2) 646V<br>(3) 646V<br>(4) 529V<br>(5) 525V<br>(6) 533V<br>(7) 622V<br><br>Q334<br>AC=308V<br><u>VO : 230V</u><br>VDS :<br>(1) 465V<br>(2) 513V<br>(3) 465V<br>(4) 461V<br>(5) 457V<br>(6) 465V<br>(7) 497V |
| 2  | P.F.C Transistor<br>( D to S) or (C to E)<br>Peak Voltage | Q100<br>Rated : 35A/650V<br>VGS : -8V~+19V                                                     | I/P : High-Line +3V =308 V<br>AC ON/OFF<br>O/P :<br>(1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)5%→400% Load.<br>Ta : 25°C                                 | AC=308V<br>VDS :<br>(1) 585V<br>(2) 585V<br>(3) 569V<br>(4) 565V<br>(5) 561V<br>(6) 513V<br>(7) 433V                                                                                                                                                                     |

|   |                                 |                                                     |                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                      |
|---|---------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | P.F.C DIODE                     | D108 Rated<br>20A/650V TO247                        | I/P : High-Line +3V =308V<br>AC ON/OFF<br>O/P :<br>(1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(4)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>Ta : 25°C                                                                                                                                                                         | AC=308V<br><br>(1) 489V<br>(2) 489V<br>(3) 485V<br>(4) 489V                                                                                          |
| 4 | Diode Peak Voltage              | D711~D716<br>20A/ 1200V                             | AC ON/OFF<br>I/P : High-Line +3V =308 V<br><u>VO : 230V</u><br>O/P :<br>(1)Full Load<br>(2)Output Short<br>(3)Dynamic Load Full Load/<br>Min. Load 90%Duty/1KHz<br>(4)Dynamic Load Full Load/<br>Min. Load 90%Duty/3KHz<br>(5)Dynamic Load Full Load/<br>Min. Load 90%Duty/5KHz<br>(6)Dynamic Load 100% Load/<br>Min. Load 50%Duty/120Hz<br>(7)5%→400% Load.<br>(8).NO LOAD<br>Ta : 25°C | D711(D713 、 D715):<br>VDS :<br><u>VO : 230V</u><br><br>(1) 865V<br>(2) 865V<br>(3) 873V<br>(4) 873V<br>(5) 873V<br>(6) 881V<br>(7) 897V<br>(8) 849 V |
| 5 | Input Capacitor Voltage         | C300~C302 Rated<br>390u/450V<br>Surge Voltage: 500V | I/P : High-Line +3V =308V<br>O/P : (1)Full Load input on/off<br>(2) Min load input on /Off<br>(3)Full Load /Min load Change<br>(4)Full load continue<br>Ta : 25°C                                                                                                                                                                                                                        | (1) 441V<br>(2) 441V<br>(3) 450V<br>(4) 441V                                                                                                         |
| 6 | Control IC Voltage Test         | MCU IC(control IC)<br>U901<br>Rated : 2V~3.6V       | AC ON/OFF<br><br>I/P : High-Line +3V =308 V<br>O/P(1)FULL LOAD<br>(2) Output Short<br>(3)O.L.P<br>(4)O.V.P.<br>(5)NO LOAD VRmin(LOW LINE)<br>Ta : 25°C                                                                                                                                                                                                                                   | U901 :<br>(1) 3.296V<br>(2) 3.305V<br>(3) 3.300V<br>(4) 3.305V<br>(5) 3.305V                                                                         |
| 8 | TOP SWITCHING<br>STAND BY POWER | U601<br>Rated : 4 A/800V                            | AC ON/OFF<br><u>VO : 230V</u>                                                                                                                                                                                                                                                                                                                                                            | U601                                                                                                                                                 |

|  |  |  |                                                                                     |                      |
|--|--|--|-------------------------------------------------------------------------------------|----------------------|
|  |  |  | I/P : High-Line +3V =308V<br>O/P :<br>(1)Full Load<br>(2)Remote On/Off<br>Ta : 25°C | (1) 634V<br>(2) 634V |
|--|--|--|-------------------------------------------------------------------------------------|----------------------|

## ■ SAFETY& E.M.C. TEST

### SAFETY TEST

| NO | TEST ITEM            | SPECIFICATION                                                                                 | TEST CONDITION                                                                   | RESULT                                                                                      |
|----|----------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1  | WITHSTAND VOLTAGE    | I/P-O/P: 4.3KVDC/min<br>I/P-FG : 2.8KVDC/min<br>O/P-FG: 2.8KVDC/min                           | I/P-O/P: 4.8 KVDC/min<br>I/P-FG : 3.4KVDC/min<br>O/P-FG: 3.4 KVDC/min<br>Ta:25°C | I/P-O/P: 0.03 mA<br>I/P-FG: 0.03 mA<br>O/P-FG: 0.03m A<br>NO DAMAGE                         |
| 2  | ISOLATION RESISTANCE | I/P-O/P: 500VDC>100M $\Omega$<br>O/P-FG: 500VDC>100M $\Omega$<br>I/P-FG: 500VDC>100M $\Omega$ | I/P-O/P: 500 VDC<br>I/P-FG : 500 VDC<br>O/P-FG: 500 VDC<br>Ta:25°C               | I/P-O/P: 1.54 G $\Omega$<br>I/P-FG: 3.71 G $\Omega$<br>O/P-FG: 4.15 G $\Omega$<br>NO DAMAGE |
| 3  | GROUNDING CONTINUITY | FG(PE) TO CHASSIS<br>OR TRACE < 100 m $\Omega$                                                | 100A / 4min<br>Ta:25°C                                                           | 0.6 m $\Omega$                                                                              |

### E.M.C TEST

| NO | TEST ITEM                                   | SPECIFICATION                                             | TEST CONDITION                                           | RESULT             |
|----|---------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------|--------------------|
| 1  | HARMONIC                                    | EN61000-3-12<br>CLASS A                                   | I/P:230VAC/50HZ<br>O/P:FULL LOAD<br>Ta:25°C              | PASS               |
| 2  | CONDUCTION                                  | EN55032 /EN55011<br>CLASS B                               | I/P : 230 VAC (50HZ)<br>O/P : FULL/50% LOAD<br>Ta : 25°C | PASS               |
| 3  | RADIATION                                   | EN55032 /EN55011<br>CLASS A                               | I/P : 230 VAC (50HZ)<br>O/P : FULL LOAD<br>Ta : 25°C     | PASS               |
| 4  | E.S.D                                       | EN61000-4-2<br>Level 3, 8KV air ;<br>Level 2, 4KV contact | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>Ta : 25°C       | CRITERIA A<br>PASS |
| 5  | E.F.T                                       | EN61000-4-4<br>INDUSTRY<br>INPUT : 2KV                    | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>Ta : 25°C       | PASS               |
| 6  | SURGE                                       | IEC61000-4-5<br>INDUSTRY<br>L-N : 2KV<br>L,N-PE : 4KV     | I/P : 230 VAC/50HZ<br>O/P : FULL LOAD<br>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 : RST-15K-380<br>1. ROOM AMBIENT BURN-IN : 1 HRS<br>I/P : 230VAC (Δ) O/P : FULL LOAD Ta= 25 °C<br>2. HIGH AMBIENT BURN-IN : 1.5 HRS<br>I/P : 230VAC (Δ) O/P : FULL LOAD Ta= 45 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
|    |                       | <table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 25 °C</th><th>HIGH AMBIENT Ta= 45 °C</th></tr><tr><td>1</td><td>A board-Q151</td><td>83.8</td><td>101.2</td></tr><tr><td>2</td><td>A board-D153</td><td>86.9</td><td>105.5</td></tr><tr><td>3</td><td>A board-Q100</td><td>76.9</td><td>94.5</td></tr><tr><td>4</td><td>A board-D108</td><td>81.3</td><td>99.7</td></tr><tr><td>5</td><td>A board-BD100</td><td>71.4</td><td>89.4</td></tr><tr><td>6</td><td>A board-BD151</td><td>83.7</td><td>101.8</td></tr><tr><td>7</td><td>A board-L151</td><td>38.2</td><td>57.1</td></tr><tr><td>8</td><td>D board-Q332</td><td>59.1</td><td>78.1</td></tr><tr><td>9</td><td>D board-Q334</td><td>52.7</td><td>71.4</td></tr><tr><td>10</td><td>D board-Q384</td><td>59.1</td><td>77.9</td></tr><tr><td>11</td><td>D board-Q432</td><td>59.7</td><td>78.5</td></tr><tr><td>12</td><td>D board-U401</td><td>53.7</td><td>72.4</td></tr><tr><td>13</td><td>F board-RG61</td><td>31.2</td><td>49.3</td></tr><tr><td>14</td><td>F board-T602</td><td>36.5</td><td>54.7</td></tr><tr><td>15</td><td>F board-U601</td><td>56.1</td><td>74.6</td></tr><tr><td>16</td><td>F board-T601</td><td>39.1</td><td>57.1</td></tr><tr><td>17</td><td>F board-Q671</td><td>34.9</td><td>52.5</td></tr><tr><td>18</td><td>F board-Q621</td><td>59.1</td><td>75.6</td></tr><tr><td>19</td><td>G board-D302</td><td>52.1</td><td>71.6</td></tr><tr><td>20</td><td>G board-L301</td><td>65.2</td><td>85.0</td></tr><tr><td>21</td><td>G board-C302</td><td>39.4</td><td>58.2</td></tr><tr><td>22</td><td>H board-C714</td><td>26.7</td><td>48.6</td></tr><tr><td>23</td><td>H board-R712</td><td>38.0</td><td>56.8</td></tr><tr><td>24</td><td>H board-T702</td><td>56.0</td><td>75.6</td></tr><tr><td>25</td><td>I board-RI11</td><td>34.8</td><td>52.5</td></tr><tr><td>26</td><td>I board-D713</td><td>63.9</td><td>82.1</td></tr><tr><td>27</td><td>TSW1</td><td>40.5</td><td>59.1</td></tr><tr><td>28</td><td>RTH10</td><td>41.3</td><td>61.8</td></tr><tr><td>29</td><td>RTH9</td><td>27.3</td><td>45.1</td></tr><tr><td>30</td><td>D board-Q432(left)</td><td>52.7</td><td>71.9</td></tr></table> |                        |        | NO | Position | ROOM AMBIENT Ta= 25 °C | HIGH AMBIENT Ta= 45 °C | 1 | A board-Q151 | 83.8 | 101.2 | 2 | A board-D153 | 86.9 | 105.5 | 3 | A board-Q100 | 76.9 | 94.5 | 4 | A board-D108 | 81.3 | 99.7 | 5 | A board-BD100 | 71.4 | 89.4 | 6 | A board-BD151 | 83.7 | 101.8 | 7 | A board-L151 | 38.2 | 57.1 | 8 | D board-Q332 | 59.1 | 78.1 | 9 | D board-Q334 | 52.7 | 71.4 | 10 | D board-Q384 | 59.1 | 77.9 | 11 | D board-Q432 | 59.7 | 78.5 | 12 | D board-U401 | 53.7 | 72.4 | 13 | F board-RG61 | 31.2 | 49.3 | 14 | F board-T602 | 36.5 | 54.7 | 15 | F board-U601 | 56.1 | 74.6 | 16 | F board-T601 | 39.1 | 57.1 | 17 | F board-Q671 | 34.9 | 52.5 | 18 | F board-Q621 | 59.1 | 75.6 | 19 | G board-D302 | 52.1 | 71.6 | 20 | G board-L301 | 65.2 | 85.0 | 21 | G board-C302 | 39.4 | 58.2 | 22 | H board-C714 | 26.7 | 48.6 | 23 | H board-R712 | 38.0 | 56.8 | 24 | H board-T702 | 56.0 | 75.6 | 25 | I board-RI11 | 34.8 | 52.5 | 26 | I board-D713 | 63.9 | 82.1 | 27 | TSW1 | 40.5 | 59.1 | 28 | RTH10 | 41.3 | 61.8 | 29 | RTH9 | 27.3 | 45.1 | 30 | D board-Q432(left) | 52.7 | 71.9 |
| NO | Position              | ROOM AMBIENT Ta= 25 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | HIGH AMBIENT Ta= 45 °C |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 1  | A board-Q151          | 83.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 101.2                  |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 2  | A board-D153          | 86.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 105.5                  |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 3  | A board-Q100          | 76.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 94.5                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 4  | A board-D108          | 81.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 99.7                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 5  | A board-BD100         | 71.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 89.4                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 6  | A board-BD151         | 83.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 101.8                  |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 7  | A board-L151          | 38.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 57.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 8  | D board-Q332          | 59.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 78.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 9  | D board-Q334          | 52.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 71.4                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 10 | D board-Q384          | 59.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 77.9                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 11 | D board-Q432          | 59.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 78.5                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 12 | D board-U401          | 53.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 72.4                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 13 | F board-RG61          | 31.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 49.3                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 14 | F board-T602          | 36.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 54.7                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 15 | F board-U601          | 56.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 74.6                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 16 | F board-T601          | 39.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 57.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 17 | F board-Q671          | 34.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 52.5                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 18 | F board-Q621          | 59.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 75.6                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 19 | G board-D302          | 52.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 71.6                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 20 | G board-L301          | 65.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 85.0                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 21 | G board-C302          | 39.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 58.2                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 22 | H board-C714          | 26.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 48.6                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 23 | H board-R712          | 38.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 56.8                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 24 | H board-T702          | 56.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 75.6                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 25 | I board-RI11          | 34.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 52.5                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 26 | I board-D713          | 63.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 82.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 27 | TSW1                  | 40.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 59.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 28 | RTH10                 | 41.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 61.8                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 29 | RTH9                  | 27.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 45.1                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |
| 30 | D board-Q432(left)    | 52.7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 71.9                   |        |    |          |                        |                        |   |              |      |       |   |              |      |       |   |              |      |      |   |              |      |      |   |               |      |      |   |               |      |       |   |              |      |      |   |              |      |      |   |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |              |      |      |    |      |      |      |    |       |      |      |    |      |      |      |    |                    |      |      |

|    |                                                                   |                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                               |                     |                                                                   |       |
|----|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------|-------|
|    |                                                                   |                                                                                                                                                                                                                                                                           | 31                                                                                                                                                                                                                                                                                                            | D board-Q431(left)  | 55.0                                                              | 73.9  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 32                                                                                                                                                                                                                                                                                                            | D board-Q384(left)  | 59.4                                                              | 78.9  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 33                                                                                                                                                                                                                                                                                                            | D board-Q334(left)  | 53.5                                                              | 72.7  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 34                                                                                                                                                                                                                                                                                                            | TSW1((left)         | 42.9                                                              | 62.1  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 35                                                                                                                                                                                                                                                                                                            | RTH1(left)          | 46.5                                                              | 65.4  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 36                                                                                                                                                                                                                                                                                                            | A board-Q201(left)  | 90.3                                                              | 109.5 |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 37                                                                                                                                                                                                                                                                                                            | A board-BD201(left) | 59.9                                                              | 78.4  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 38                                                                                                                                                                                                                                                                                                            | J board-D714(left)  | 25.8                                                              | 31.1  |
|    |                                                                   |                                                                                                                                                                                                                                                                           | 39                                                                                                                                                                                                                                                                                                            | G board-C302(left)  | 39.5                                                              | 59.6  |
| 2  | OVER LOAD BURN-IN TEST                                            | NO DAMAGE<br>1 HOUR ( MIN )                                                                                                                                                                                                                                               | I/P : 230 VAC( $\Delta$ )<br>O/P : 101% LOAD<br>Ta : 25°C                                                                                                                                                                                                                                                     |                     | TEST : OK                                                         |       |
| 3  | LOW TEMPERATURE<br>TURN ON TEST                                   | TURN ON AFTER 2 HOUR                                                                                                                                                                                                                                                      | I/P : 305VAC/230VAC( $\Delta$ )<br>O/P : 100%/LOAD<br>Ta= -30 °C                                                                                                                                                                                                                                              |                     | TEST : OK                                                         |       |
| 4  | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE<br>TURN ON TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 45 °C/95 %R.H<br>NO DAMAGE                                                                                                                                                                                                     | I/P : 230 VAC( $\Delta$ )<br>O/P : FULL LOAD<br>Ta= 45 °C<br>HUMIDITY= 95 %R.H                                                                                                                                                                                                                                |                     | TEST : OK                                                         |       |
| 5  | TEMPERATURE<br>COEFFICIENT                                        | ± 0.03 %/°C(0~45°C)                                                                                                                                                                                                                                                       | I/P : 230 VAC( $\Delta$ )<br>O/P : FULL LOAD                                                                                                                                                                                                                                                                  |                     | ± 0.01 %/°C(0~45°C)                                               |       |
| 6  | STORAGE TEMPERATURE<br>TEST                                       | -40~85°C                                                                                                                                                                                                                                                                  | 1. Thermal shock Temperature : -45°C~ +90°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition : STATIC                                                                                        |                     |                                                                   |       |
| 7  | THERMAL SHOCK TEST                                                | -30~45°C                                                                                                                                                                                                                                                                  | 1. Thermal shock Temperature : -35°C~ +50°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 16 CYCLE<br>5. Input/Output condition :<br>15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST<br>1cycle:230V/ FULL LOAD Burn In Test |                     |                                                                   |       |
| 8  | VIBRATION TEST                                                    | 10 ~ 500Hz, 2G 10min./1cycle,<br>60min. each along X, Y, Z axes                                                                                                                                                                                                           | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(3) Sweep Time : 10min/sweep cycle<br>(4) Acceleration : 3G<br>(5) Test Time : 180min in each axis (X.Y.Z)<br>(6) Ta : 25°C                                                                                                       |                     |                                                                   |       |
| 9  | CAPACITOR<br>LIFE CYCLE                                           | SUPPOSE C714 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME<br>(2) I/P : 230VAC O/P : FULL LOAD Ta= 45 °C LIFE TIME<br>(3) I/P : 230VAC O/P : 75% LOAD Ta= 45 °C LIFE TIME<br>(4) I/P : 230VAC O/P : 50% LOAD Ta= 45 °C LIFE TIME |                                                                                                                                                                                                                                                                                                               |                     | (1) 3341270HRS<br>(2) 732244HRS<br>(3) 777945HRS<br>(4) 872345HRS |       |
| 10 | MTBF                                                              | Conducted by Parts Stress Analysis Prediction<br>121.9K hrs min. Telcordia SR-332 (Bellcore) ; 16.2K hrs min. MIL-HDBK-217F (25°C)                                                                                                                                        |                                                                                                                                                                                                                                                                                                               |                     |                                                                   |       |
| 11 | Ongoing Reliability Test                                          | I/P : 230VAC O/P : FULL LOAD TA=50°C<br>Demonstration Mean Time Between Failure : 50,000 hours                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                               |                     |                                                                   |       |



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

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