



# Test Report: LRS-600-15

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600W Single Output Switching Power Supply

## ■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

## ■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

## ■ RELIABILITY TEST

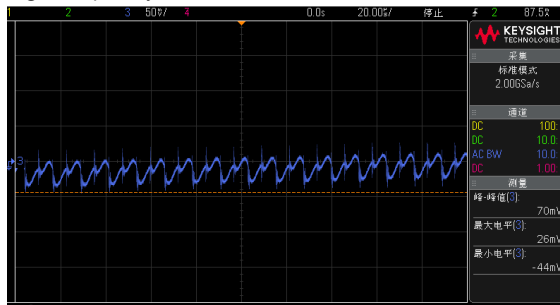
ENVIRONMENT TEST

## DESIGN VERIFY TEST

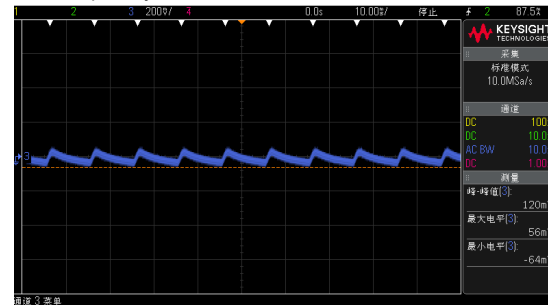
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 14.25 V~16.5 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	13.7V~17.2V/230VAC 13.7V~17.2V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0%~ +1.0%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.53%~ 0.67%
3	LINE REGULATION (Max)	V1: -0.5%~ +0.5%	I/P: 90VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: 0%~ 0.06 %
4	LOAD REGULATION(Max)	V1: -1.0%~ +1.0%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.066%~0.066%
5	RIPPLE & NOISE(Max)	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 120mVp-p

high frequency :



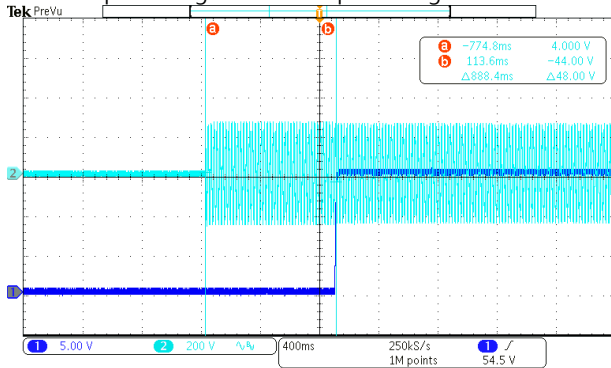
low frequency :



6	SET UP TIME(Max)	230VAC/1300ms 115VAC/1300ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/888ms 115VAC/911ms
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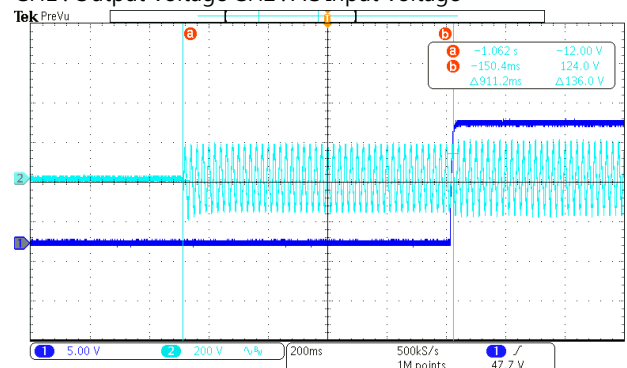
INPUT=230VAC/50HZ @ FULL LOAD

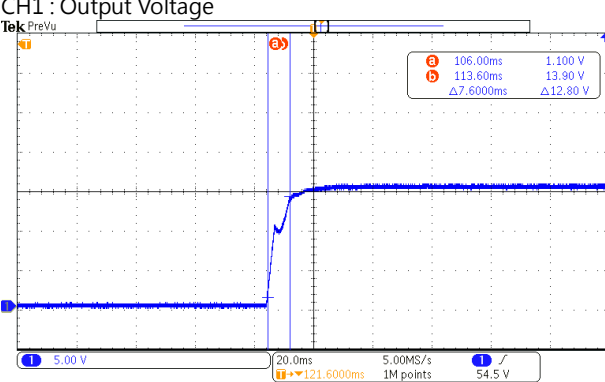
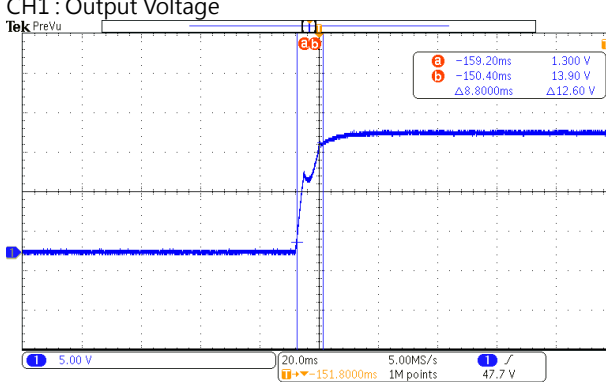
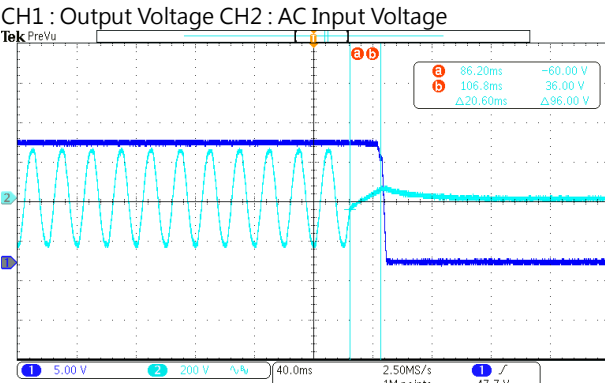
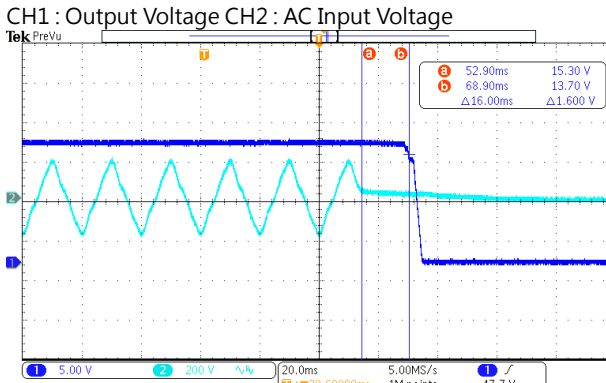
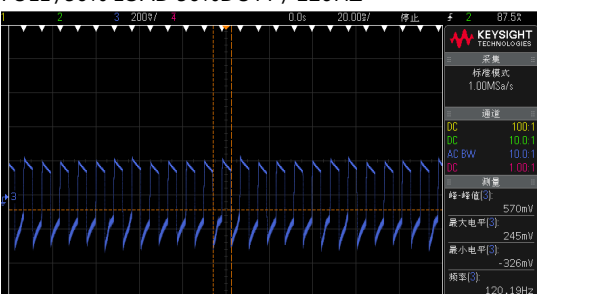
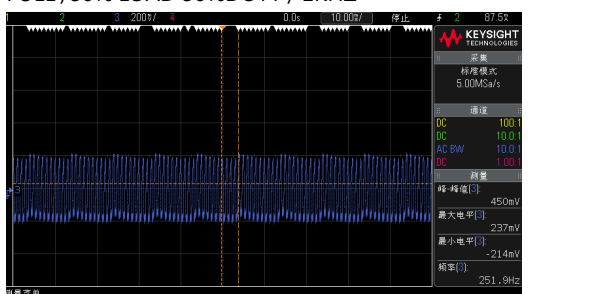
CH1 : Output Voltage CH2 : AC Input Voltage



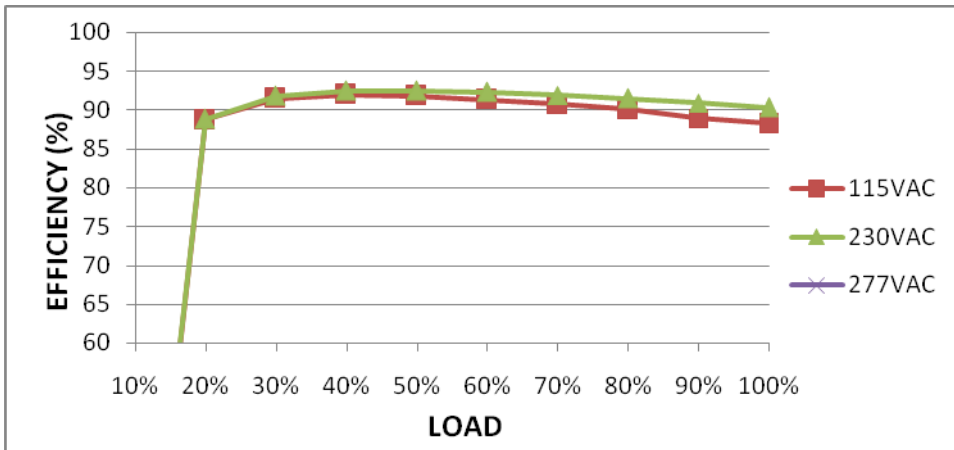
INPUT=115VAC/60HZ @ FULL LOAD

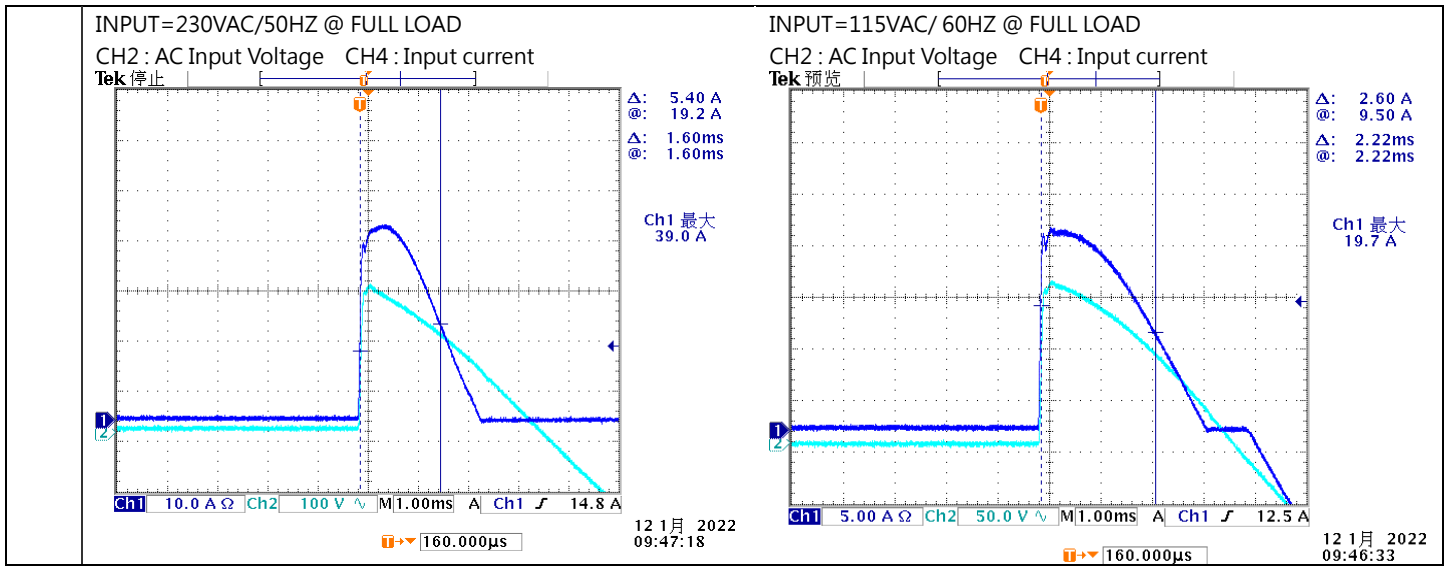
CH1 : Output Voltage CH2 : AC Input Voltage



7	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 7.6 ms 115VAC/ 8.8 ms	
<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1 : Output Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1 : Output Voltage</p> 			
8	HOLD UP TIME (Typ.)	230VAC/20ms 115VAC/16ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 20.6 ms 115VAC/16ms	
<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD</p> <p>CH1 : Output Voltage CH2 : AC Input Voltage</p> 			
9	DYNAMIC LOAD	V1: 1500mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	570mVp-p 450mVp-p	
<p>FULL /50% LOAD 50%DUTY / 120HZ</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ</p> 			

### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																								
1	INPUT VOLTAGE RANGE	90 ~ 132VAC / 180 ~ 264VAC by switch  250VDC~ 370VDC (switch on 230VAC)	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL / 50% LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL / 50% LOAD Ta:25°C	(1) 86VAC~267VAC (2)250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD (3) 250Vdc~370Vdc/FULL LOAD 250Vdc~370Vdc/50% LOAD																																								
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST:ok																																								
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: ok																																								
3	INPUT CURRENT (Typ.)	230V/7.5A 115V/12A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =5.698A/ 230VAC I =9.8A/ 115VAC																																								
4	LEAKAGE CURRENT	< 2mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.7626 mA N-FG : 0.7607 mA																																								
5	EFFICIENCY(Typ.)	90%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.34 %																																								
<p>EFFICIENCY vs LOAD</p>  <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>115VAC (%)</th> <th>230VAC (%)</th> <th>277VAC (%)</th> </tr> </thead> <tbody> <tr><td>20</td><td>88</td><td>88</td><td>88</td></tr> <tr><td>30</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>40</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>50</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>60</td><td>91</td><td>92</td><td>92</td></tr> <tr><td>70</td><td>90</td><td>91</td><td>91</td></tr> <tr><td>80</td><td>89</td><td>91</td><td>91</td></tr> <tr><td>90</td><td>88</td><td>90</td><td>90</td></tr> <tr><td>100</td><td>87</td><td>89</td><td>89</td></tr> </tbody> </table>					Load (%)	115VAC (%)	230VAC (%)	277VAC (%)	20	88	88	88	30	92	92	92	40	92	92	92	50	92	92	92	60	91	92	92	70	90	91	91	80	89	91	91	90	88	90	90	100	87	89	89
Load (%)	115VAC (%)	230VAC (%)	277VAC (%)																																									
20	88	88	88																																									
30	92	92	92																																									
40	92	92	92																																									
50	92	92	92																																									
60	91	92	92																																									
70	90	91	91																																									
80	89	91	91																																									
90	88	90	90																																									
100	87	89	89																																									
6	INRUSH CURRENT(Typ.)	230V/60A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =39A/ 230VAC I =19.7A/ 115VAC T50=2220us																																								



### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~140%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta: 25°C	116%/ 264VAC 117.5%/ 230VAC 115.7%/ 100VAC PROTECTION TYPE : Constant current limiting, unit will shutdown after 3 sec. re-power on to recover
2	OVER VOLTAGE PROTECTION	18V~21V	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P: MIN LOAD Ta: 25°C	19.7V/ 264VAC 19.5V/ 230VAC 19.6V/ 90VAC PROTECTION TYPE : Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD	O.T.P. Active: Protection type : Shut down o/p voltage, re-power on to recover

### CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	FAN ON/OFF CONTROL (Typ)	RTH3 ≥ 50°C FAN ON RTH3 ≤ 40°C FAN OFF	I/P: 230 VAC O/P: FULL LOAD	RTH3 > 50°C FAN ON RTH3 < 40°C FAN OFF

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	Q2 Rated 22A/ 600V	AC ON/OFF  I/P:High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load.  I/P:Low-Line -3V = 97V O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25°C	VDS: (1) 466V (2) 478V (3) 486V (4) 486V (5) 482V (6) 478V (7) 482V  VDS: (1) 289V (2) 319V (3) 293V (4) 311V (5) 309V (6) 303V (7) 329V
2	Diode Peak Voltage	Q101 Rated: 80A/60V  Q104 Rated 80A/60V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD  Ta:25°C	Q101: VDS: (1) 41.9V (2) 9.3V (3) 44.3V (4) 45.1V (5) 44.3V (6) 46.7V (7) 54V (8) 39.9V  Q104: VDS: (1) 45.5V (2) 21V (3) 44.3V (4) 45.1V (5) 44.3V (6) 44.3V (7) 56V (8) 39.9V

3	Input Voltage	Capacitor	C5 Rated: 1000 $\mu$ / 200V	I/P:High-Line +3V =267V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1)190V (2)188V (3)190V (4) 188V
4	Control IC Voltage Test		PWM IC U2 Rated 11.7 V~ 15.5 V  O/P IC U102 Rated 40V	AC ON/OFF  I/P:High-Line +3V =267 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(Low LINE) (6)NO LOAD(AC continue) Ta:25°C	U2 (1) 14.5V (2) 14.9V (3) 14.7V (4) 14.9V (5) 13.7V (6) 13.9V U102 (1) 12.1V (2) 11.9V (3) 12.5V (4) 16.5V (5) 12.9V (6) 11.7V
5	VCC Diode Peak Voltage		D30 Rated : 400V 2A D34 Rated : 400V 2A D200 Rated : 400V 2A	AC ON/OFF  I/P : High-Line +3V = 267 V O/P : (1) Full load (2) Full load continue (3) Dynamic Load 90%Duty/1KHz  Ta : 25°C	D30 (1)82.4 V (2)66.9 V (3) 79V  D200 (1) 57.3V (2)44.4 V (3) 56.5V  D34 (1) 60.5V (2) 45.2V (3) 61.3V

## ■ SAFETY& E.M.C. TEST

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25°C	I/P-O/P:2.487mA I/P-FG:2.203mA O/P-FG:2.489mA NO DAMAGE

2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999 MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	4 mΩ

### E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
2	RADIATION	EN55032 CLASS A	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
4	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	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 : LRS-600-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=26.2 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=47.8 °C																																																																										
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=26.2 °C</th> <th>HIGH AMBIENT Ta=45.8 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>41.4°C</td><td>64.0°C</td></tr> <tr><td>2</td><td>C5</td><td>40.4°C</td><td>64.5°C</td></tr> <tr><td>3</td><td>C6</td><td>40.4°C</td><td>63.5°C</td></tr> <tr><td>4</td><td>Q1</td><td>48.3°C</td><td>73.3°C</td></tr> <tr><td>5</td><td>Q2</td><td>51.0°C</td><td>76.6°C</td></tr> <tr><td>6</td><td>C36</td><td>40.3°C</td><td>63.1°C</td></tr> <tr><td>7</td><td>T1</td><td>74.8°C</td><td>99.8°C</td></tr> <tr><td>8</td><td>RG201</td><td>61.3°C</td><td>85.2°C</td></tr> <tr><td>9</td><td>C205</td><td>37.6°C</td><td>59.6°C</td></tr> <tr><td>10</td><td>Q100</td><td>44.9°C</td><td>68.2°C</td></tr> <tr><td>11</td><td>Q101</td><td>41.4°C</td><td>64.2°C</td></tr> <tr><td>12</td><td>Q103</td><td>70.6°C</td><td>96.5°C</td></tr> <tr><td>13</td><td>Q104</td><td>65.2°C</td><td>88.4°C</td></tr> <tr><td>14</td><td>C105</td><td>42.4°C</td><td>65.9°C</td></tr> <tr><td>15</td><td>C106</td><td>43.5°C</td><td>66.4°C</td></tr> <tr><td>16</td><td>U101</td><td>74.1°C</td><td>97.6°C</td></tr> <tr><td>17</td><td>RTH3</td><td>57.5°C</td><td>81.2°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=26.2 °C	HIGH AMBIENT Ta=45.8 °C	1	BD1	41.4°C	64.0°C	2	C5	40.4°C	64.5°C	3	C6	40.4°C	63.5°C	4	Q1	48.3°C	73.3°C	5	Q2	51.0°C	76.6°C	6	C36	40.3°C	63.1°C	7	T1	74.8°C	99.8°C	8	RG201	61.3°C	85.2°C	9	C205	37.6°C	59.6°C	10	Q100	44.9°C	68.2°C	11	Q101	41.4°C	64.2°C	12	Q103	70.6°C	96.5°C	13	Q104	65.2°C	88.4°C	14	C105	42.4°C	65.9°C	15	C106	43.5°C	66.4°C	16	U101	74.1°C	97.6°C	17	RTH3	57.5°C	81.2°C
NO	Position	ROOM AMBIENT Ta=26.2 °C	HIGH AMBIENT Ta=45.8 °C																																																																									
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14	C105	42.4°C	65.9°C																																																																									
15	C106	43.5°C	66.4°C																																																																									
16	U101	74.1°C	97.6°C																																																																									
17	RTH3	57.5°C	81.2°C																																																																									
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 113.9 * LOAD Ta : 25°C	TEST : OK																																																																								
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 * LOAD Ta= -25 °C	TEST : OK																																																																								
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45 °C/95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 45 °C HUMIDITY= 95 %R.H	TEST : OK																																																																								
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0042 %/°C(0~50°C)																																																																								

6	STORAGE TEMPERATURE TEST	-40~85°C	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC
7	THERMAL SHOCK TEST	-20~45°C	1. Thermal shock Temperature : -25°C~ +50°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta=25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta=45 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=45 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=45 °C LIFE TIME	(1) 263745HRS (2) 137472HRS (3) 324640HRS (4) 565120HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1533.4K hrs min. Telcordia SR-332 (Bellcore) ; 301.7K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQ/HUANGMK	WENF	LINKX

2020.10.1 TAG-QA-009