



# Test Report: LRS-450-15

---

450W 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

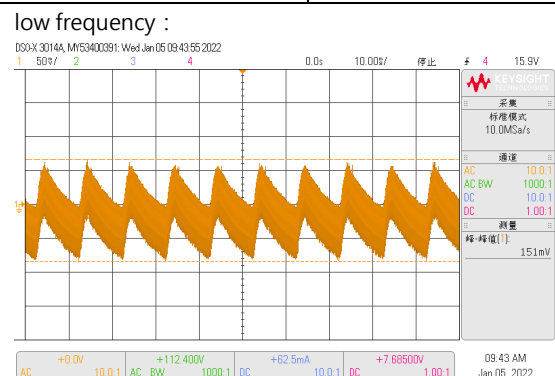
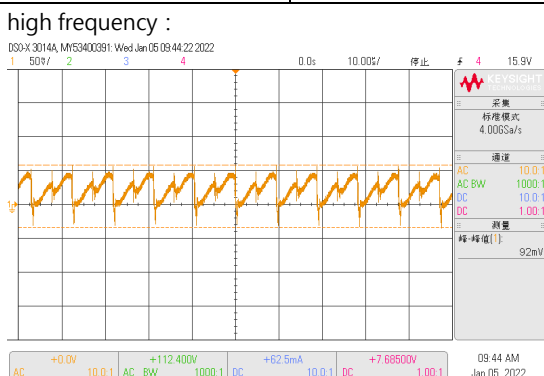
## ■ RELIABILITY TEST

ENVIRONMENT TEST

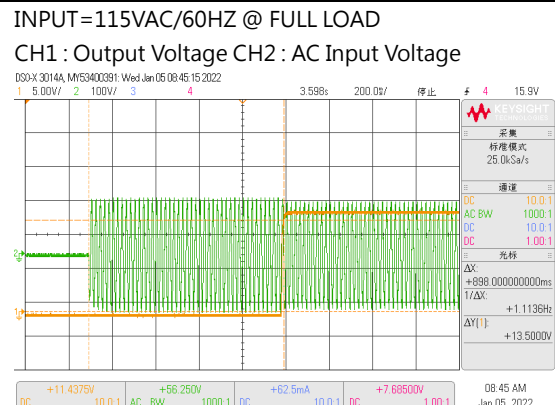
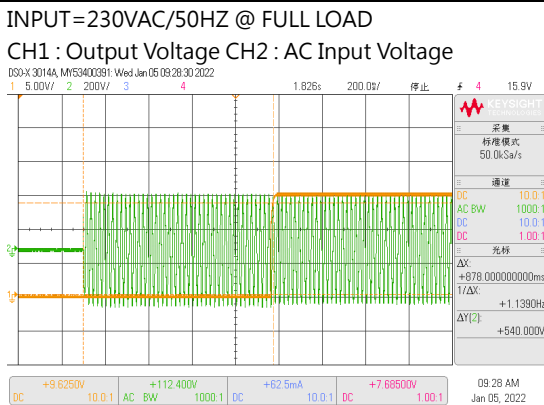
## DESIGN VERIFY TEST

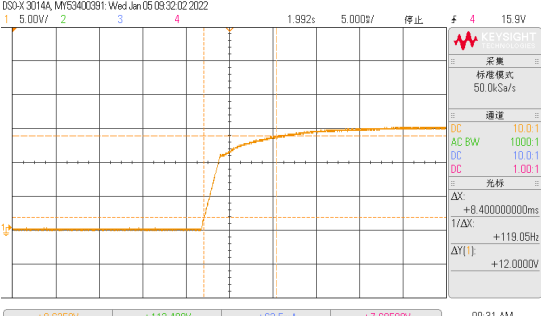
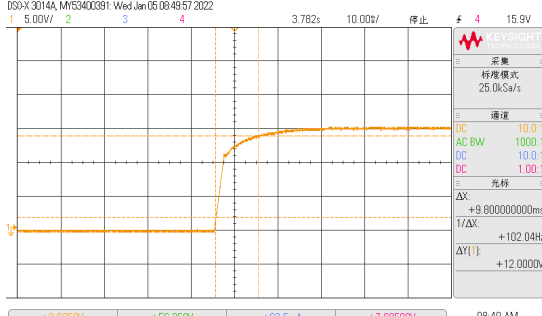
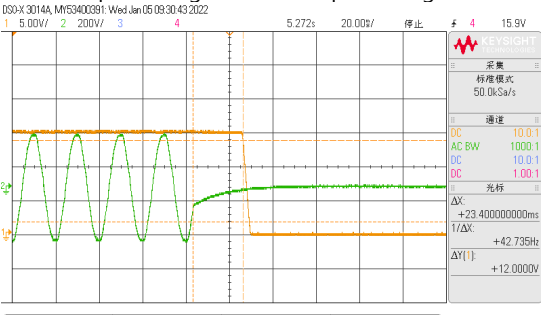
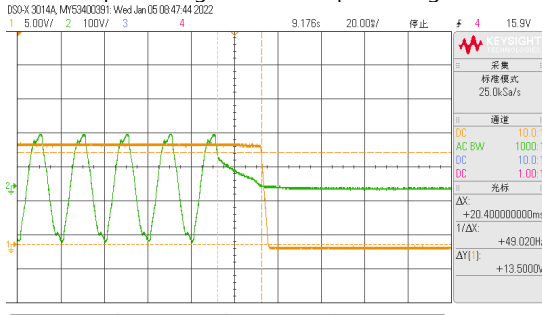
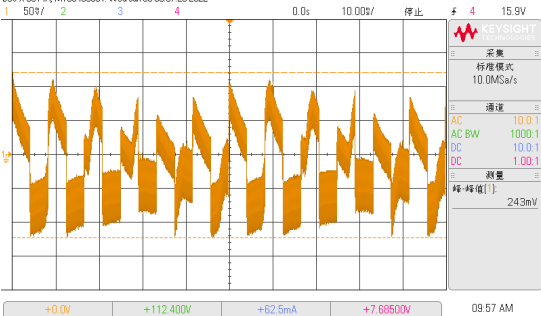
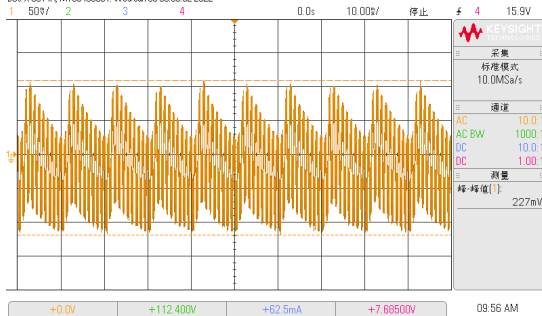
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 14.25V~16.5V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	13.634V~17.055V/230VAC 13.636V~17.056V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.5%~1.5%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: 0.13%~0.2%
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:-0.5%~0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0.067%~0.19%
5	RIPPLE & NOISE(Max)	V1: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 151mVp-p

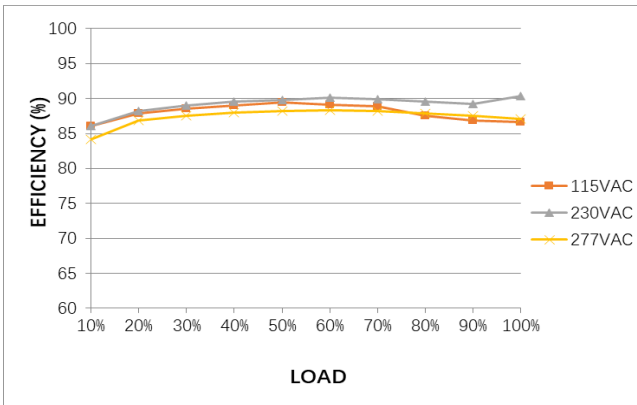


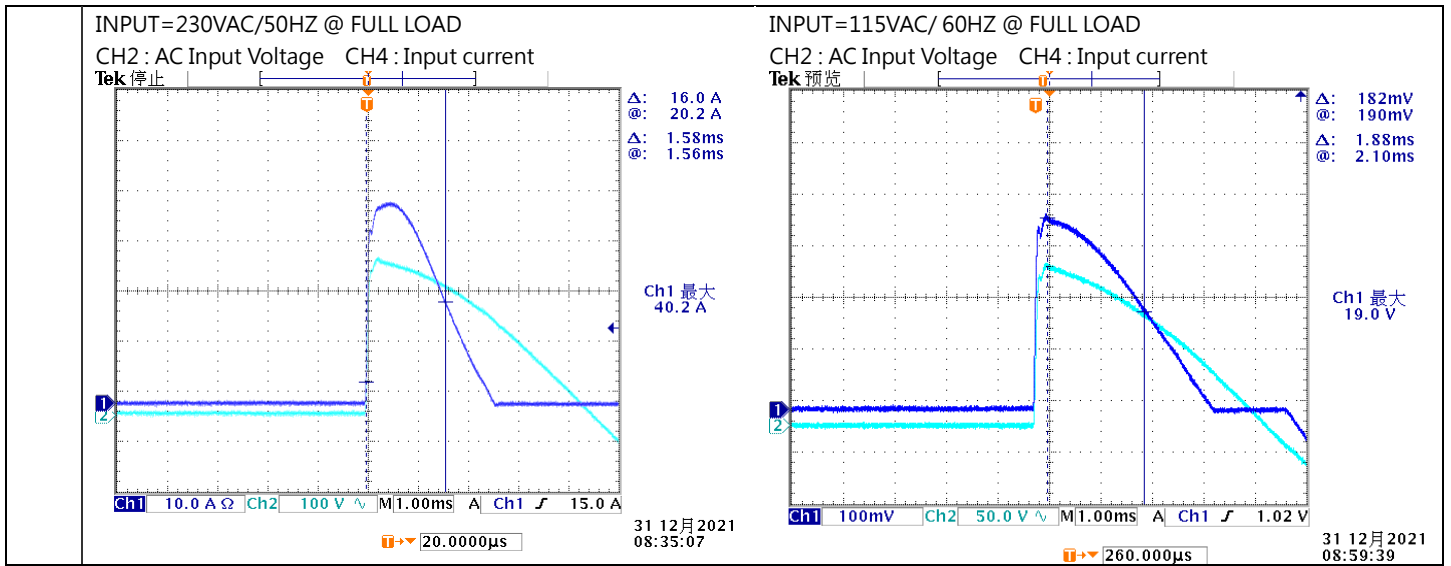
6	SET UP TIME(Max)	230VAC/1500ms 115VAC/1500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/878 ms 115VAC/898ms
---	------------------	--------------------------------	--	-------------------------------



7	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/8.4ms 115VAC/9.8ms
<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/16ms 115VAC/12ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/23.4 ms 115VAC/20.4ms
<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	243mVp-p  227mVp-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) 87VAC ~ 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+3V =267 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/6A 115V/10A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =3.759A/ 230VAC I =6.449A/ 115VAC																																												
4	LEAKAGE CURRENT	<2 mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.9362mA N-FG : 0.9382mA																																												
5	EFFICIENCY(Typ.)	90%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.32 %																																												
<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>10</td><td>85.0</td><td>87.0</td><td>85.0</td></tr> <tr><td>20</td><td>87.0</td><td>88.0</td><td>87.0</td></tr> <tr><td>30</td><td>88.0</td><td>89.0</td><td>88.0</td></tr> <tr><td>40</td><td>88.5</td><td>89.5</td><td>88.5</td></tr> <tr><td>50</td><td>89.0</td><td>90.0</td><td>89.0</td></tr> <tr><td>60</td><td>89.0</td><td>90.0</td><td>89.0</td></tr> <tr><td>70</td><td>88.5</td><td>89.5</td><td>88.5</td></tr> <tr><td>80</td><td>88.0</td><td>89.0</td><td>88.0</td></tr> <tr><td>90</td><td>87.5</td><td>88.5</td><td>87.5</td></tr> <tr><td>100</td><td>87.0</td><td>88.0</td><td>87.0</td></tr> </tbody> </table>					Load (%)	115VAC (%)	230VAC (%)	277VAC (%)	10	85.0	87.0	85.0	20	87.0	88.0	87.0	30	88.0	89.0	88.0	40	88.5	89.5	88.5	50	89.0	90.0	89.0	60	89.0	90.0	89.0	70	88.5	89.5	88.5	80	88.0	89.0	88.0	90	87.5	88.5	87.5	100	87.0	88.0	87.0
Load (%)	115VAC (%)	230VAC (%)	277VAC (%)																																													
10	85.0	87.0	85.0																																													
20	87.0	88.0	87.0																																													
30	88.0	89.0	88.0																																													
40	88.5	89.5	88.5																																													
50	89.0	90.0	89.0																																													
60	89.0	90.0	89.0																																													
70	88.5	89.5	88.5																																													
80	88.0	89.0	88.0																																													
90	87.5	88.5	87.5																																													
100	87.0	88.0	87.0																																													
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 =40.2A/ 230VAC I =19.0A/ 115VAC T50= 1880us/230V																																												



### 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	118.33%/ 264VAC 118%/ 230VAC 118.33%/100VAC PROTECTION TYPE : Constant current limiting, unit will shut down after 3sec. 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	19.6V/ 264VAC 19.6V/ 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 OK 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 18A/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) 470V (2) 482V (3) 478V (4) 474V (5) 478V (6) 486V (7) 470V  VDS: (1) 294V (2) 330V (3) 294V (4) 294V (5) 298V (6) 310V (7) 330V
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) 45V (2) 16.1V (3) 48.7V (4) 50.7V (5) 50.7V (6) 51.1V (7) 55.9V (8) 50.7V  Q104: VDS: (1) 53.3V (2) 29.1V (3) 54.9V (4) 53.3V (5) 53.3V (6) 55.7V (7) 44.6V (8) 44.8V

3	Input Voltage	Capacitor C5 Rated: 680μ / 200 V	I/P:High-Line +3V =267V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1)198V (2)202V (3)200V (4) 200V
4	Control IC Voltage Test	PWM IC U2 Rated 8.9V~ 15.5V  O/P IC U101 Rated 4V~ 37V	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) 15V (2) 13.8V (3) 13.8V (4) 15V (5) 14.8V (6) 113.8V  U101 (1)11.8V (2)11.9V (3)11.9V (4) 11.7V (5)10.1V (6) 9.9V
5	VCC Diode Peak Voltage	D30 Rated : 400V 2A  D34 Rated : 400 V 2 A  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) 61.4V (2) 53.4V/ (3) 64.7V  D200 (1) 62.8V (2) 37.9V (3) 62.0V  D34 (1) 99V (2) 42.1V (3) 99V

## ■ 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:2.503mA I/P-FG:2.214mA O/P-FG:2.445m A NO DAMAGE

2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P-FG:9999 MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	5 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-450-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=30.2 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=55.8 °C																																																																										
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=30.2 °C</th> <th>HIGH AMBIENT Ta=55.8 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>48.2°C</td><td>76.3°C</td></tr> <tr><td>2</td><td>C5</td><td>48.1°C</td><td>69.6°C</td></tr> <tr><td>3</td><td>C6</td><td>47.9°C</td><td>75.2°C</td></tr> <tr><td>4</td><td>Q1</td><td>67.0°C</td><td>89.7°C</td></tr> <tr><td>5</td><td>Q2</td><td>65.1°C</td><td>91.4°C</td></tr> <tr><td>6</td><td>C36</td><td>44.2°C</td><td>71.4°C</td></tr> <tr><td>7</td><td>T1</td><td>57.3°C</td><td>85.9°C</td></tr> <tr><td>8</td><td>RG201</td><td>56.0°C</td><td>82.8°C</td></tr> <tr><td>9</td><td>C205</td><td>46.1°C</td><td>75.5°C</td></tr> <tr><td>10</td><td>Q100</td><td>51.9°C</td><td>80.0°C</td></tr> <tr><td>11</td><td>Q101</td><td>49.3°C</td><td>77.3°C</td></tr> <tr><td>12</td><td>Q103</td><td>62.7°C</td><td>90.6°C</td></tr> <tr><td>13</td><td>Q104</td><td>66.4°C</td><td>94.0°C</td></tr> <tr><td>14</td><td>C105</td><td>48.0°C</td><td>75.7°C</td></tr> <tr><td>15</td><td>C106</td><td>49.0°C</td><td>76.3°C</td></tr> <tr><td>16</td><td>J111</td><td>60.4°C</td><td>90.2°C</td></tr> <tr><td>17</td><td>RTH3</td><td>56.0°C</td><td>83.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=30.2 °C	HIGH AMBIENT Ta=55.8 °C	1	BD1	48.2°C	76.3°C	2	C5	48.1°C	69.6°C	3	C6	47.9°C	75.2°C	4	Q1	67.0°C	89.7°C	5	Q2	65.1°C	91.4°C	6	C36	44.2°C	71.4°C	7	T1	57.3°C	85.9°C	8	RG201	56.0°C	82.8°C	9	C205	46.1°C	75.5°C	10	Q100	51.9°C	80.0°C	11	Q101	49.3°C	77.3°C	12	Q103	62.7°C	90.6°C	13	Q104	66.4°C	94.0°C	14	C105	48.0°C	75.7°C	15	C106	49.0°C	76.3°C	16	J111	60.4°C	90.2°C	17	RTH3	56.0°C	83.1°C
NO	Position	ROOM AMBIENT Ta=30.2 °C	HIGH AMBIENT Ta=55.8 °C																																																																									
1	BD1	48.2°C	76.3°C																																																																									
2	C5	48.1°C	69.6°C																																																																									
3	C6	47.9°C	75.2°C																																																																									
4	Q1	67.0°C	89.7°C																																																																									
5	Q2	65.1°C	91.4°C																																																																									
6	C36	44.2°C	71.4°C																																																																									
7	T1	57.3°C	85.9°C																																																																									
8	RG201	56.0°C	82.8°C																																																																									
9	C205	46.1°C	75.5°C																																																																									
10	Q100	51.9°C	80.0°C																																																																									
11	Q101	49.3°C	77.3°C																																																																									
12	Q103	62.7°C	90.6°C																																																																									
13	Q104	66.4°C	94.0°C																																																																									
14	C105	48.0°C	75.7°C																																																																									
15	C106	49.0°C	76.3°C																																																																									
16	J111	60.4°C	90.2°C																																																																									
17	RTH3	56.0°C	83.1°C																																																																									
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 117.1 % 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 50 °C/95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta=50 °C HUMIDITY= 95 %R.H	TEST : OK																																																																								
5	TEMPERATURE COEFFICIENT	± 0.03 %/°C(0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0029 %/°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	-20~50°C	1. Thermal shock Temperature : -25°C~ +55°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=50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=50 °C LIFE TIME	(1) 837767HRS (2) 106182HRS (3) 262870HRS (4) 407698HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1508.9K hrs min. Telcordia SR-332 (Bellcore) ; 252.2K 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