Test Report: UHP-1500-380E

1500W Conduction Cooling 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

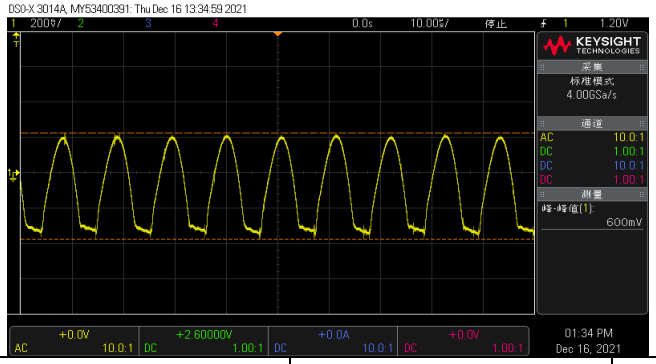
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

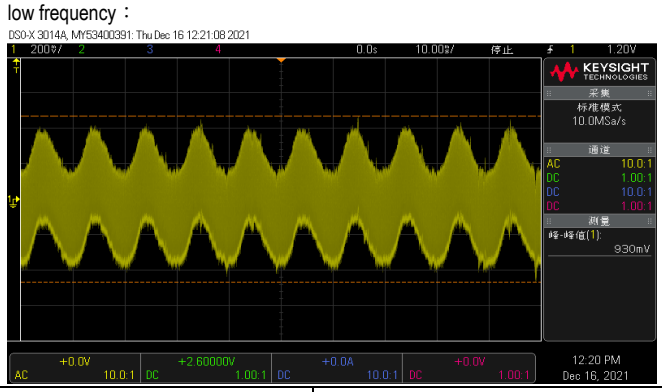
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 350V~ 420V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	343.81V~429.24V/230VAC 343.93V~429.44V /115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~ -1 %	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1:0.06%~0.02%
3	LINE REGULATION (Max)	V1: 0.5%~- 0.5 %	I/P: 90VAC ~ 264VAC O/P:FULL LOAD Ta:25℃	V1: 0.02%~-0.01%
4	LOAD REGULATION(Max)	V1: 0.5%~ -0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.01~0.01%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	0.4%
6	RIPPLE & NOISE(Max)	V1: 3800mVp-p	I/P: 230 VAC O/P:(1) FULL LOAD Ta:25℃	(1) 930 mVp-p (Max)

high frequency：



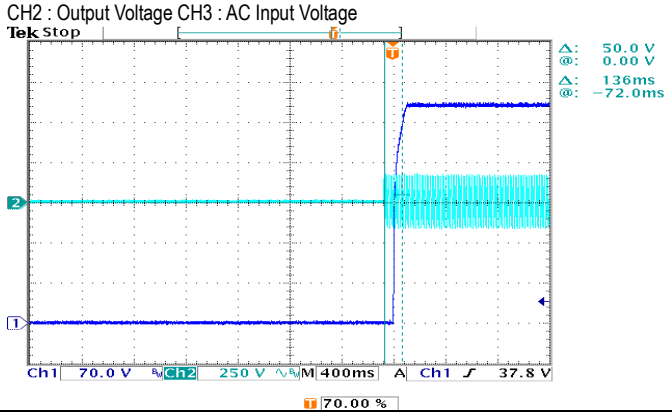
low frequency：



7	SET UP TIME(Max)	230VAC/1800ms	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/136ms

INPUT=230VAC/50HZ @ FULL LOAD

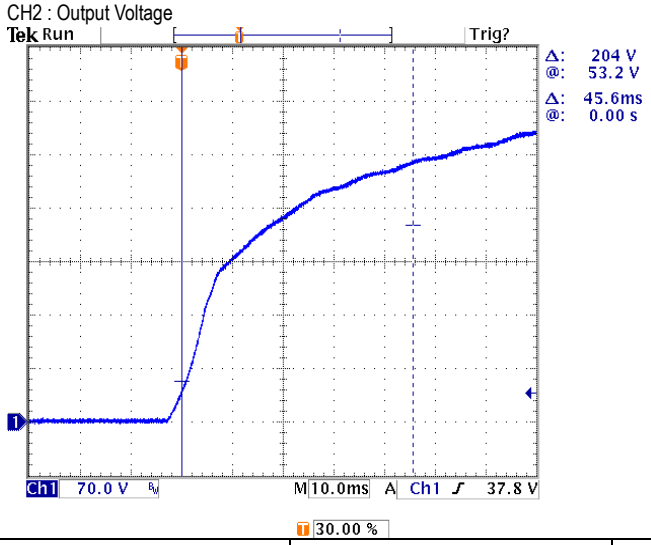
CH2 : Output Voltage CH3 : AC Input Voltage



8	RISE TIME (Max)	230VAC/60ms	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	230VAC/45.6ms

INPUT=230VAC/50HZ @ FULL LOAD

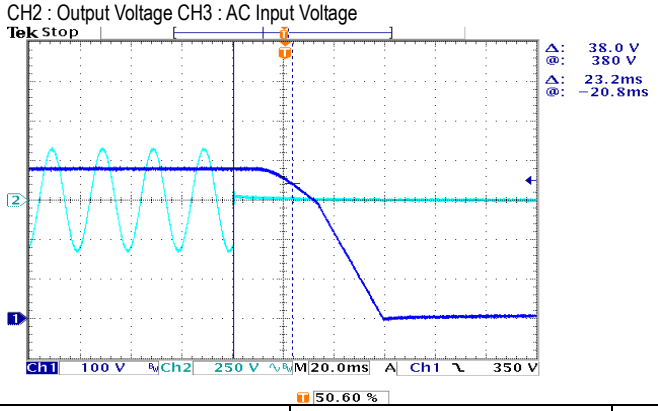
CH2 : Output Voltage



9	HOLD UP TIME (Typ.)	230VAC/10ms at full load 230VAC/16ms at 75% load	I/P： 230 VAC O/P：FULL LOAD/75% LOAD Ta：25℃	230VAC/23.2ms /full load 230VAC29.2/ms/75% load

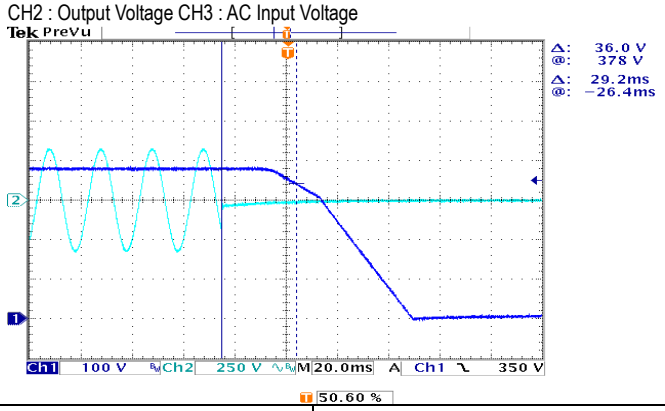
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : Output Voltage CH3 : AC Input Voltage



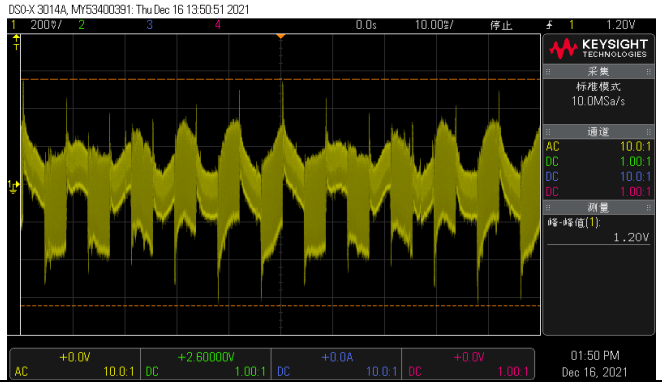
INPUT=230VAC/60HZ @ 75% LOAD

CH2 : Output Voltage CH3 : AC Input Voltage

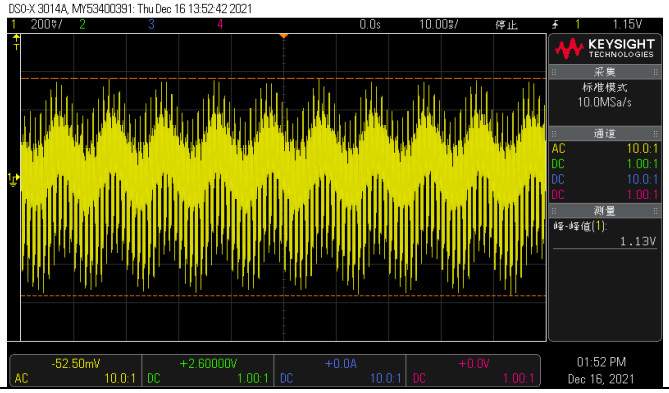


10	DYNAMIC LOAD	V1: 38000 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 1200mVp-p 1130mVp-p

FULL /50% LOAD 50%DUTY / 120HZ



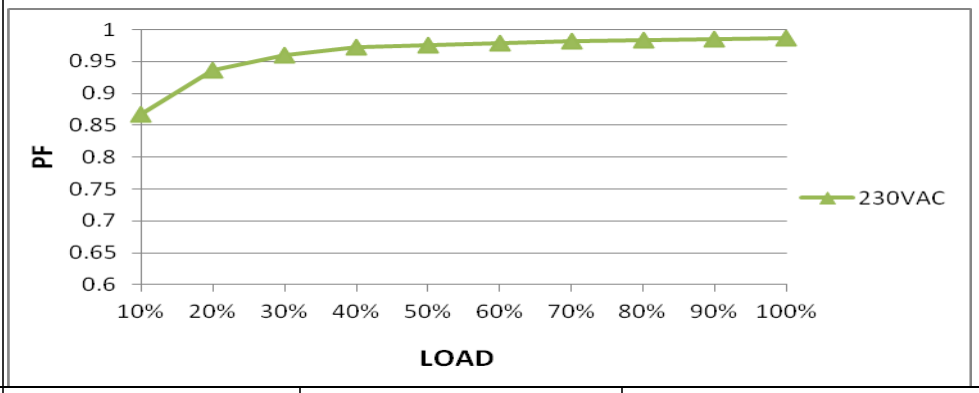
FULL /50% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

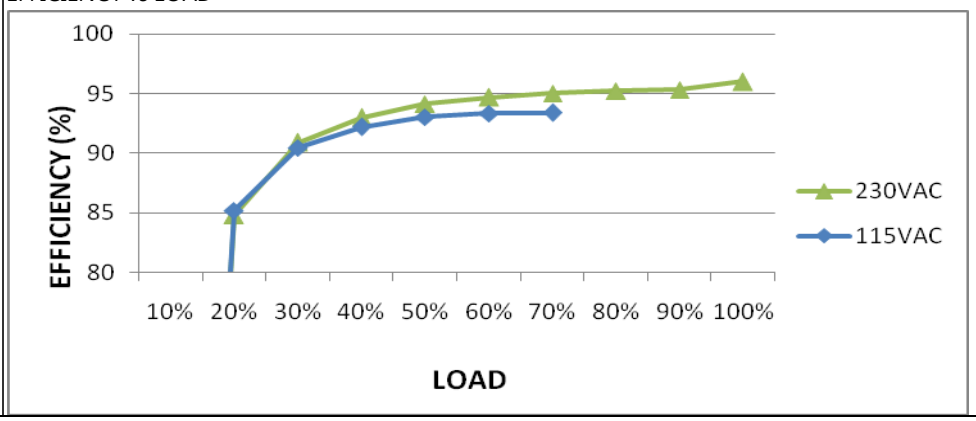
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	180V~264V full load 90V 60% load
			I/P: LOW-LINE-3V=87 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:90 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST:OK
3	INPUT CURRENT (Typ.)	230V/ 8 A	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =6.88A/ 230VAC
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.5744mA N-FG：0.5703mA
5	POWER FACTOR (Typ.)	0.95/ 230VAC	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	PF=0.987/230VAC

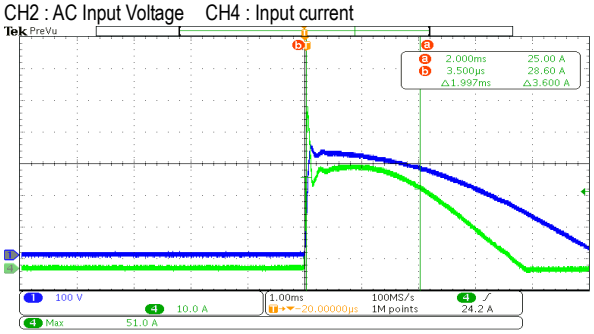
P.F vs LOAD



6	EFFICIENCY(Typ.)	95.5%	I/P:230 VAC O/P :FULL LOAD Ta:25℃	96.02%

EFFICIENCY vs LOAD

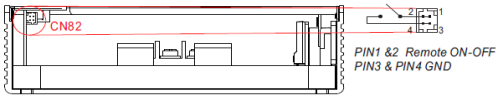


7	INRUSH CURRENT(Typ.)	230V/60A COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =51A/ 230VAC T50=1997 us/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current 			

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~ 125 %	I/P: 264VAC I/P: 230VAC I/P: 180VAC O/P:TESTING Ta:25℃	PROTECTION TYPE：Constant current limiting, unit will shutdown after 2-5 sec, re-power on to recover. 264VAC :114.6% 230VAC :114.3% 180VAC :114.8%
2	OVER VOLTAGE PROTECTION	428V~460V	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	PROTECTION TYPE：Shut down O/P voltage, re-power on to recover 264VAC :434V 230VAC :437V 90VAC :441V
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, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Constant current limiting, unit will shutdown after 2-5 sec, re-power on to recover.

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE ON/OFF CONTROL	2.Remote ON-OFF Control The power supply can be turned ON/OFF individually or along with other units in parallel by using the "Remote ON-OFF" function.  Remote ON-OFF / Power Supply Status: Short circuit – ON; Open circuit – OFF I/P: 230 VAC O/P:FULL LOAD Ta:25℃ Test Result： Between ON/OFF – Power Supply Status: SW SHORT – ON; SW OPEN – OFF		

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q903 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. (8) NO LOAD (9) 200% Load I/P:Low-Line -3V = 177V 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 (9) 200% Load Ta:25℃	VDS: (1) 429V (2) 437V (3) 441V (4) 441V (5) 441V (6) 437V (7) 457V (8) 417V (9) 465V VDS: (1) 433V (2) 441V (3) 433V (4) 433V (5) 433V (6) 429V (7) 461V (8) 417V (9) 469V

2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q51 Rated 34A/ 600V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. (8) NO LOAD (9) 200% Load I/P:Low-Line -3V = 177V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. (8) NO LOAD (9) 200% Load Ta:25℃	VDS: (1)464V (2)397V (3)462V (4)466V (5)462V (6)466V (7)442V (8)446V (9)422V VDS: (1)478V (2)390V (3)466V (4)466V (5)470V (6)470V (7)458V (8)458V (9)414V
3	Diode Peak Voltage	D201 Rated: 10A/600V D203 Rated: 10A/600V	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 (9) burst Mode (10) (6) 200% Load Ta:25℃	D201: (1)425V (2)7V (3)425V (4)421V (5)425V (6)425V (7)232V (8)425V (9)429V (10)244V	D203: (1)425V (2)11V (3)421V (4)425V (5)425V (6)421V (7)216V (8)421V (9)425V (10)240V
4	Input Capacitor Voltage	C5 Rated: 220u/450V	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℃	(1)443V (2)439V (3)444V (4)443V	

5	Control IC Voltage Test	PWM IC U800 Rated 8.85 V~ 16V MCU IC U701 Rated -0.3V~ 4V MCU IC U450 Rated 2.3V~ 6.5V	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/FULL LOAD (AC on) (7)NO LOAD(AC on) Ta:25℃	U800: (1) 16.1 V (2) 16.5V (3) 14.7 V (4) 13.5V (5) 13.5V (6) 13.3V (7) 13.3V U701: (1) 3.50 V (2) 3.54V (3) 3.50V (4) 3.46 V (5) 3.42V (6) 3.38V (7) 3.34V U450 (1)5.57V (2) 5.33V (3)5.17V (4)5.65V (5)5.09V (6) 5.09V (7) 5.09V
6	TOP SWITCHING STAND BY POWER	U601 Rated 800V	AC ON/OFF I/P:High-Line +3V =267 V O/P: (1)Full Load (2)Remote On/Off I/P:Low-Line -3V =97 V O/P: (1)Full Load (2)Remote On/Off Ta:25℃	U601 (1)551V (2)575V (1)543V (2)575V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 6KVDC/min I/P-FG :4KVDC/min O/P-FG:4KVDC/min	I/P-O/P: 6.6 KVDC/min I/P-FG: 4.4 KVDC/min O/P-FG:4.4KVDC/min Ta:25℃	I/P-O/P: 0uA I/P-FG: 0.7uA O/P-FG:0.2 u A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	12 MΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS A	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N ：2KV L,N-PE：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： UHP-1500-380E
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 33.4℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=51.6℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 33.4 ℃</th><th>HIGH AMBIENT Ta=51.6 ℃</th></tr>
<tr><td>1</td><td>BD1</td><td>94.2℃</td><td>109.8℃</td></tr>
<tr><td>2</td><td>TSW1</td><td>75.8℃</td><td>91.7℃</td></tr>
<tr><td>3</td><td>BD2</td><td>90.6℃</td><td>106.8℃</td></tr>
<tr><td>4</td><td>Q51</td><td>86.5℃</td><td>103.1℃</td></tr>
<tr><td>5</td><td>Q66</td><td>81.1℃</td><td>98.9℃</td></tr>
<tr><td>6</td><td>L2</td><td>85.2℃</td><td>103.6℃</td></tr>
<tr><td>7</td><td>C8</td><td>73.5℃</td><td>91.3℃</td></tr>
<tr><td>8</td><td>C967</td><td>71.6℃</td><td>89.0℃</td></tr>
<tr><td>9</td><td>T2</td><td>84.5℃</td><td>102.7℃</td></tr>
<tr><td>10</td><td>T1</td><td>81.0℃</td><td>100.0℃</td></tr>
<tr><td>11</td><td>C117</td><td>61.8℃</td><td>78.5℃</td></tr>
<tr><td>12</td><td>C123</td><td>62.6℃</td><td>79.3℃</td></tr>
<tr><td>13</td><td>U400</td><td>84.0℃</td><td>100.5℃</td></tr>
<tr><td>14</td><td>C400</td><td>73.7℃</td><td>90.1℃</td></tr>
<tr><td>15</td><td>D10</td><td>81.7℃</td><td>99.6℃</td></tr>
<tr><td>16</td><td>D15</td><td>91.5℃</td><td>109.8℃</td></tr>
<tr><td>17</td><td>Q901</td><td>86.4℃</td><td>106.9℃</td></tr>
<tr><td>18</td><td>Q904</td><td>83.9℃</td><td>104.8℃</td></tr>
<tr><td>19</td><td>Q910</td><td>86.2℃</td><td>107.6℃</td></tr>
<tr><td>20</td><td>R62</td><td>78.2℃</td><td>95.6℃</td></tr>
<tr><td>21</td><td>C53</td><td>91.0℃</td><td>109.1℃</td></tr>
<tr><td>22</td><td>D201</td><td>79.5℃</td><td>96.4℃</td></tr>
<tr><td>23</td><td>D208</td><td>78.7℃</td><td>95.6℃</td></tr>
<tr><td>24</td><td>RT70</td><td>73.1℃</td><td>91.1℃</td></tr>
<tr><td>25</td><td>TC</td><td>56.3℃</td><td>72.7℃</td></tr>
</table></td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 230 VAC
O/P：114% LOAD
Ta：25℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 264VAC/90 VAC
O/P ： FULL LOAD/60% LOAD
Ta= - 35 ℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 45 ℃
NO DAMAGE</td><td>I/P： 272C VAC
O/P：FULL LOAD
Ta= 45 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>±0.03%/℃(0~50℃)</td><td>I/P： 230 VAC
O/P：FULL LOAD</td><td>±0.0026%/℃(0~50℃)</td></tr>
<tr><td>6</td><td>STORAGE TEMPERATURE TEST</td><td>-40~+85℃</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +90℃
2. Temperature change rate ：25℃ / MIN
3. Dwell time low and high temperature ： 30 MIN/EACH
4. Total test cycle：10CYCLE
5. Input/Output condition： STATIC
TEST：OK</td></tr>
</table>

7	THERMAL SHOCK TEST	-30~+45℃	1. Thermal shock Temperature： -35℃~ +50℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：16CYCLE 5. Input/Output condition： 15cycle:230VAC/ FULL LOAD AC on 3 sec/AC off 1 sec TEST 1cycle:230VAC/ FULL LOAD Burn In Test TEST：OK
8	VIBRATION TEST	10~ 500Hz, 5G 12min./1cycle, period for 72min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：10min/sweep cycle (4) Acceleration：6G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃ TEST：OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C123 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta=25 ℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta=45 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta=45 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta=45 ℃ LIFE TIME	(1) 300495 HRS (2) 90585 HRS (3) 141115 HRS (4) 210477 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 597.3K hrs min. Telcordia SR-332 (Bellcore)； 63.3K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 50,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQ/HUANGMK	WENF	LINKX