Test Report: HVGC-1000-L

1000W Constant Power Mode LED Driver

■ DESIGN VERIFY TEST

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

■ SAFETY & E.M.C. TEST

Safety Test
E.M.C. Test

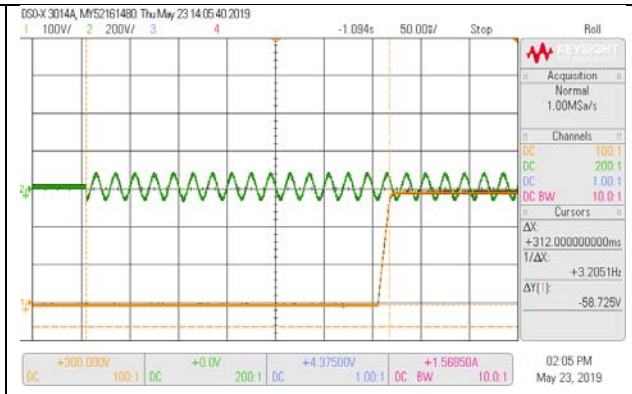
■ RELIABILITY TEST

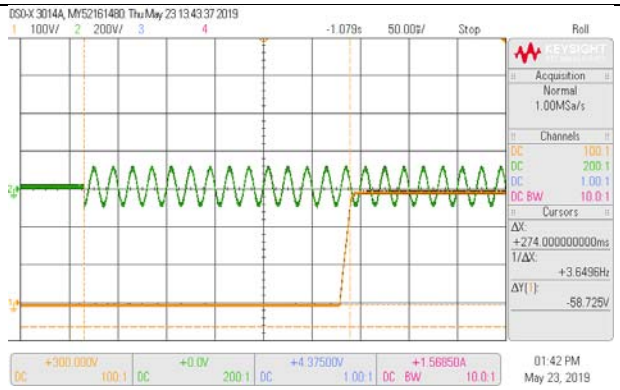
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

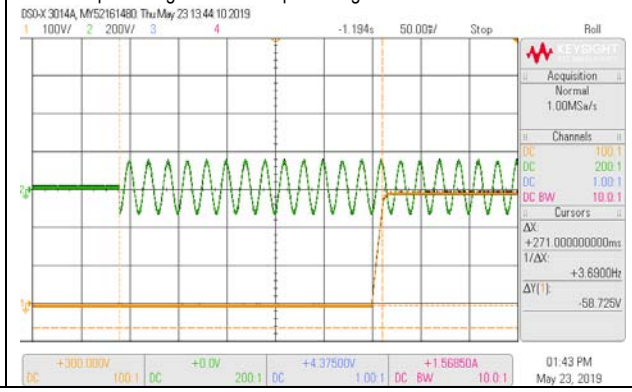
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CURRENT TOLERANCE	±5%	I/P: 347VAC I/P:480VAC O/P:LEDMAX CP: 2.64A & 3.28A Ta:25℃	CP 2.64A: 2.646A/347VAC@LED MAX-1V 2.67A/347VAC@LED MIN 2.644A/480VAC@:LED MAX-1V 2.67A/480VAC@:LED MIN 1.136% CP 3.28A: 3.28A/347VAC@:LED MAX-1V 3.266A/347VAC@:LED MIN 3.28A/480VAC@:LED MAX-1V 3.266A/480VAC@:LED MIN 0.426%
2	FULL POWER CURRENT RANGE	2640~3280mA	I/P: 347VAC O/P:LEDMAX CP: 2.64A & 3.28A Ta:25℃	385.8V/2.64A/347VAC 309.6V/3.28A/347VAC
3	OPEN CIRCUIT VOLTAGE (max)	390V	I/P: 347VAC O/P:NO LOAD CP: OPEN Ta:25℃	388.09V
4	CONSTANT CURRENT REGION	CP 2.64A: CH1:190V~ 380V CP 3.28A: CH1:150V~ 306V	I/P: 347VAC O/P:LEDMAX CP: 2.64A & 3.28A Ta:25℃	CP 2.64A: 0.168V~380 V/347VAC CP 3.28A: 0.18V~ 306V/347VAC
5	CURRENT ADJ. RANGE	CH1: 1315mA~3280mA	I/P: 347VAC I/P:480VAC O/P:CV MIN & CV MAX-1V CP: 2.64A & 3.28A Ta:25℃	1.3mA~3.286mA/347VAC@:LED MAX-1V 1.3mA~3.286mA /347VAC@:LED MIN 1.3mA~3.286mA/480VAC@:LED MAX-1V 1.3mA~3.286mA /480VAC@:LED MIN
6	CURRENT RIPPLE	3.0% max. @rated current	I/P: 347VAC O/P:50% LOAD CP: 2.64A & 3.28A Ta:25℃	CP 2.64A: 2.36% CP 3.28A: 1.87%
7	AUXILIARY POWER	Nominal 12V (Tolerance:±10%, R&N:150mVp-p)@500mA for HVGC-1000A only	I/P: 347VAC O/P: LED MIN / LEDMAX CP: 2.64A Ta:25℃	CP 2.64A: 11.867v/80mv
8	SET UP TIME	230VAC/ 500 ms (Max) 347VAC/ 500 ms (Max) 480VAC/ 500 ms (Max)	I/P: 230VAC I/P: 347VAC I/P: 480VAC O/P:LEDMAX CP 2.64A Ta:25℃	230VAC/312ms 347VAC/ 274ms 480VAC/271ms
	INPUT=230VAC/50HZ @ LEDMAX CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=347VAC/60HZ @ LEDMAX CH1 : Output Voltage CH2 : AC Input Voltage	





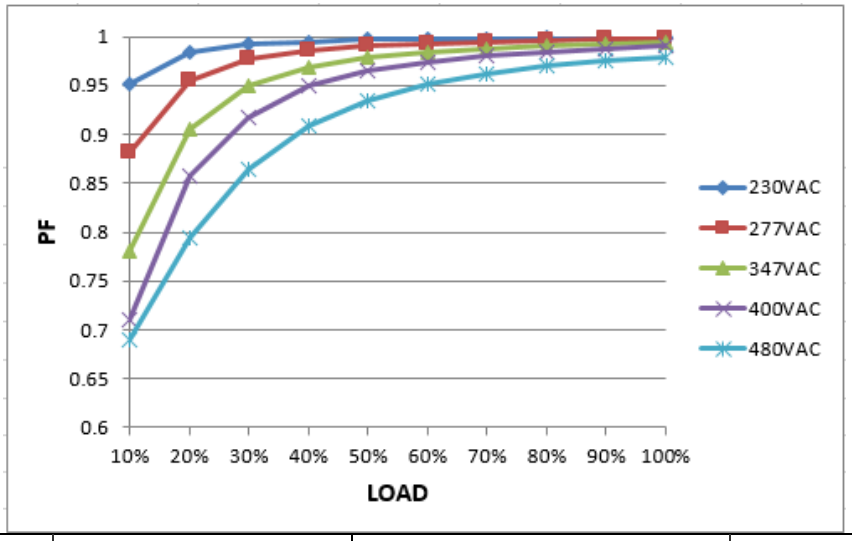
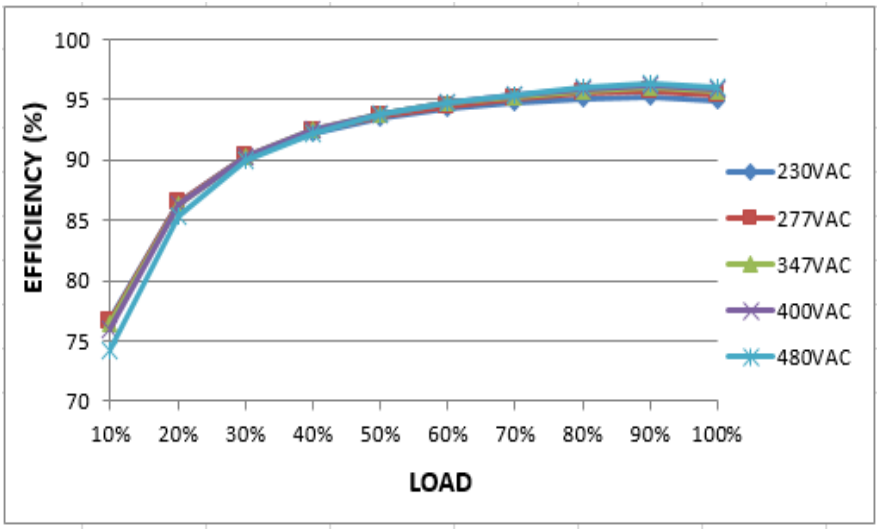
INPUT=480VAC/60HZ @ LEDMAX

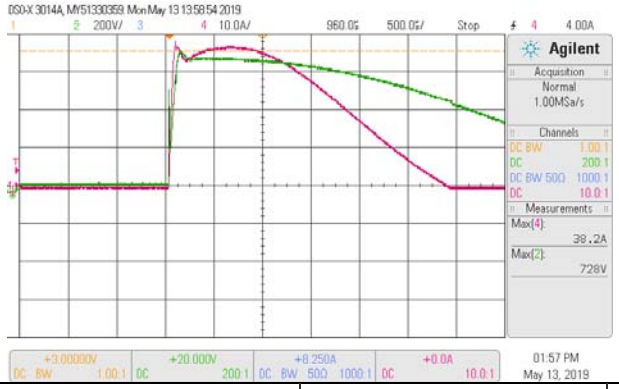
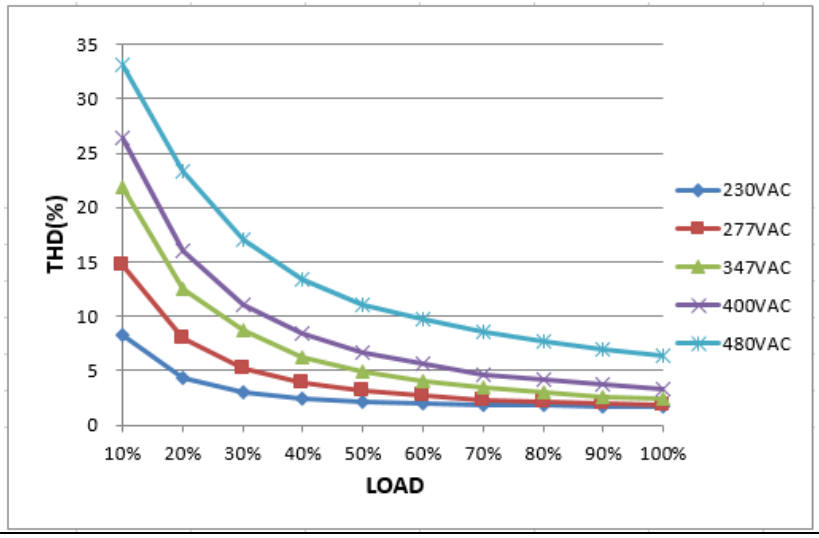
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	180VAC~528 VAC	I/P:TESTING O/P:LEDMAX CP 2.64A Ta:25℃	162V~528 V
			I/P: LOW-LINE-3V=177 V HIGH-LINE+10V=538 V O/P:FULL/MIN LOAD CP 2.64A (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	(1).TEST:OK (2).TEST :OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P: 180 VAC ~528VAC O/P:FULL~MIN LOAD CP 2.64A Ta:25℃	TEST:OK
3	INPUT CURRENT (TYP)	347VAC/ 3.15 A 480VAC/ 2.28A	I/P: 347VAC/480VAC O/P:LEDMAX CP 2.64A Ta:25℃	I =3.041A/ 347VAC I =2.233A/480VAC
4	LEAKAGE CURRENT	EN61347-1 < 0.75mA / 480VAC	I/P: 480 VAC O/P:Min LOAD Ta:25℃	L-FG: 0.4mA N-FG: 0.4mA

5	STANDBY POWER CONSUMPTION	Standby power consumption <2W for AB-Type(Dimming OFF)	I/P: 347VAC O/P:LEDMAX. CP 2.64A Dimming OFF Ta:25℃	1.08W
6	POWER FACTOR(TYP)	0.97/347VAC LEDMAX 0.95/480VAC LEDMAX 0.98/277 VAC LEDMAX 0.98/230 VAC LEDMAX 0.96/400 VAC LEDMAX	I/P: 347VAC/480VAC/277VAC/230VAC/400VAC O/P:LEDMAX CP 2.64A Ta:25℃	PF= 0.992/347V/100%LOAD PF= 0.97/480V/100%LOAD PF=0.997/277V/100%LOAD PF=0.999/230V/100%LOAD PF=0.989/400V/100%LOAD
	P.F vs LOAD			
7	EFFICIENCY (TYP)	95.5%	I/P: 347VAC O/P:LEDMAX. CP 2.64A Ta:25℃	95.8%
	EFFICIENCY vs LOAD			
8	INRUSH CURRENT (TYP)	480V/ 40A COLD START (twidth=1850 usmeasured at 50% Ipeak) COLD START	I/P: 480VAC O/P:LEDMAX CP 2.64A Ta:25℃	I =38.2A /480VAC T50= 1840 uS

	INPUT=480VAC/ 60HZ @ LEDMAX CH2 : AC Input Voltage CH1 : Input current 			
9	TOTAL HARMONIC DISTORTION	THD< 10% @ 347VAC> 80% loading	I/P： 480VVAC O/P：LEDmax 80% LOAD CP 2.64A Ta：25℃	THD： 3.93 %347V 80% THD： 3.09 %347V 100%
	THD vs LOAD 			

ROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	V1: 390V~425V PROTECTION TYPE： Shut down output voltage, re-power on to recovery	I/P: 528VAC I/P: 347VAC I/P: 180VAC CP 2.64A O/P:MIN LOAD Ta:25℃	402.89V / 528VAC 402.01V / 347VAC 403.13V/ 180VAC PROTECTION TYPE： Shut down output voltage, re-power on to recovery
2	OVER TEMPERATURE PROTECTION	PROTECTION TYPE： Shut down output voltage, re-power on to recovery	I/P: 528 VAC I/P: 180 VAC O/P:LEDMAX CP 2.64A Ta:25℃	O.T.P. Active PROTECTION TYPE： Shut down output voltage, re-power on to recovery

3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed	I/P: 528VAC I/P: 180 VAC O/P: LEDMAX CP: 2.64A &3.28A Ta:25℃	CP: 2.64A NO DAMAGE PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed CP: 3.28A NO DAMAGE PROTECTION TYPE： Constant current limiting, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q11 Rated: 18.4A /1200V	I/P:High-Line +3V =531v AC ON/OFF **CP: 2.64A&3.28A** VDS: O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short I/P:Low-Line -3V = 177V O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short Ta:25℃	CP: 2.64A Q11 VDS: (1) 914V (2) 817V (3) 889V (4) 809V (5) 930V VDS: (1) 897V (2) 809V (3) 873V (4) 809V (5) 881V	CP: 3.28A Q11 VDS: (1) 897V (2) 817V (3) 906V (4) 817V (5) 881V VDS: (1) 897V (2) 817V (3) 881V (4) 817V (5) 881V
2	P.F.C Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated: 18.4A /1200V VGS: ±25V	I/P:High-Line +3V =531V AC ON/OFF **CP: 2.64A** VDS: O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short I/P:Low-Line -3V = 177V O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short Ta:25℃	CP: 2.64A Q1 VDS: (1) 962V (2) 841V (3) 930V (4) 817V (5) 1074V VDS: (1)970 V (2) 881V (3) 873V (4) 841V (5) 857V	
3	P.F.C DIODE	D8 Rated: 15A/1200V	I/P:High-Line +3V =531 V AC ON/OFF **CP: 2.64A** O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue	**CP: 2.64A** (1)897 V (2) 889V (3) 873V (4) 809V (5) 992V	

			(5) Output Short I/P:Low-Line -3V = 177V O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short Ta:25℃	(1) 906V (2) 873V (3) 865V (4) 817V (5) 825V
4	Diode Peak **Voltage**	D100 Rated: 10A/600V VGS:25V D121 Rated: 10A/600V VGS:25V D571 Rated: 1A/200V	I/P:High-Line +3V =531 V VDS: O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short Ta:25℃	**CP: 2.64A** **CP:3.28A** **D100** **D100** VDS: VDS: (1)376 V (1)296V (2) 376V (2)296V (3) 187V (3)143V (4) 187V (4)143V (5) 388V (5)392V (6) 380V (6)380V **D121** **D121** VDS: VDS: (1) 380V (1)296V (2) 376V (2)296V (3) 187V (3)143V (4) 187V (4)143V (5) 388V (5)388V (6) 380V (6)380V **D571** (1) 67.4V (2)61.6V (3)66.4V (4)62.4V (5)67.2V (6)80.9V
5	Input Capacitor Voltage	C5 Rated: 220u/450V*2	I/P:High-Line +3V =531V CP 2.64A O/P: (1)LEDmax input on/off (2) Min load input on /Off (3)LEDmax /Min load Change (4)LEDmax continue Ta:25℃	**CP: 2.64A** (1)897V (2)849V (3)889V (4)809V
6	Control IC Voltage Test	PFC IC U1 Rated 21V~11.5V(MIN.) PWM IC U2 Rated 16V~ 8.85V(MIN.) AUX IC U500 Rated 35V~9V(MIN.)	I/P:High-Line +3V =531 V AC ON/OFF **CP: 2.64A** O/P: (1)LEDmax (2) LEDmin (3) Output Short (4) NO LOAD LOW LINE Ta:25℃	**CP: 2.64A** **U1** U500 (1) 13.1V (1) 19.4V (2) 13.1V (2) 20.8V (3) 13.1V (3) 19.4V (4) 13.1V (4) 19.4V U2 (1) 13.3V (2) 13.5V (3) 13.3V (4) 13.1V
7	STAND BY POWER PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q501 Rated 2.5A/1500V VGS：±30V	I/P:High-Line +3V =531v AC ON/OFF **CP: 2.64A** VDS: O/P: (1)LEDmax	**CP: 2.64A** Q501 VDS: (1)1204V (2)1116V

			(2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short I/P:Low-Line -3V = 177V O/P: (1)LEDmax (2) LEDmax continue (3) LEDmin (4) LEDmin continue (5) Output Short Ta:25℃	(3)1188V (4)1108V (5)1212V Q501 VDS: (1)1196 V (2) 1116V (3) 1172V (4) 1108V (5)1140 V

■ SAFETY & EMC TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	EN61347-1 I/P-O/P: 3KVAC/min I/P-FG: 2 KVAC/min<4.5mA O/P-FG:1.5KVAC/min	I/P-O/P: 3.6KVAC/min I/P-FG: 2.4KVAC/min O/P-FG: 1.8 KVAC/min Ta:25℃	I/P-O/P:3.15mA I/P-FG: 2.498mA O/P-FG:4.06mA 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: 5.62GΩ I/P-FG: 3.58G Ω O/P-FG: 30G Ω NO DAMAGE
3	GROUNDING CONTINUITY	EN61347-1 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	21mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	FCC PART 15	I/P:347VAC (50HZ) O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab
2	RADIATION	FCC PART 15	I/P: 347VAC (50HZ) O/P:LEDMAX Ta:25℃	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P: 347VAC (50HZ) O/P:LEDMAX Ta:25℃	CRITERIA A
4	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 347VAC (50HZ) O/P:LEDMAX Ta:25℃	CRITERIA A
5	SURGE	IEC61000-4-5 light industry L-N :4KV L,N-PE:8KV	I/P: 347VAC (50HZ) O/P:LEDMAX Ta:25℃	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

<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： HVGC-1000-L
1. ROOM AMBIENT BURN-IN：2.5 HRS
I/P： 347VAC O/P： FULL LOAD Ta= 25 ℃
2. HIGH AMBIENT BURN-IN： 3 HRS
I/P： 347VAC O/P： FULL LOAD Ta= 50℃</td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 347 VAC
O/P：short
Ta：25℃</td><td>TEST：OK</td></tr>
</table>

NO	Position	ROOM AMBIENT Ta= 25℃	HIGH AMBIENT Ta= 50℃
1	BD1	76.9℃	92.3℃
2	BD2	77.5℃	92.7℃
3	ZNR4	70.7℃	85.3℃
4	LF2	75.4℃	90.2℃
5	LF1	69.4℃	83.5℃
6	ZNR1	67.6℃	82.7℃
7	C6	75.3℃	92.6℃
8	C935	79.3℃	97.7℃
9	C11	73.2℃	89.7℃
10	Q10	80.6℃	99.8℃
11	Q11	80.7℃	99.4℃
12	D8	78.4℃	95.8℃
13	Q1	75.2℃	91.8℃
14	L3	88.2℃	108.8℃
15	TSW1	73.8℃	91.6℃
16	TSW2	71.2℃	89.5℃
17	L2	78.8℃	98.1℃
18	C94	78.3℃	96.5℃
19	T1	77.7℃	95.4℃
20	T2	81.1℃	99.7℃
21	C110	65.9℃	84.1℃
22	D100	76.1℃	94.9℃
23	C105	67.5℃	85.3℃
24	T1 core	78.6℃	96.8℃
25	T2 core	78.0℃	97.0℃
26	U1	71.9℃	86.3℃
27	U900	69.7℃	84.3℃
28	D5	74.0℃	90.3℃
29	U201	76.9℃	94.7℃
30	D123	78.9℃	95.8℃
31	U107	69.6℃	86.1℃
32	Q511	71.9℃	88.2℃
33	C521	74.4℃	90.8℃
34	Q501	83.6℃	102.1℃
35	D501	78.9℃	96.1℃
36	T500	78.8℃	97.4℃
37	U501	70.2℃	86.2℃
38	C573	74.0℃	90.7℃
39	C155	62.3℃	79.9℃

3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 528VAC/180VAC O/P： 100 % LOAD Ta= -45 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 ℃ NO DAMAGE	I/P： 538 VAC O/P：FULL LOAD Ta= 50 ℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	± 0.03 %(0℃~50℃)	I/P： 347 VAC O/P：FULL LOAD	± 0.008 %(0~50℃)
6	STORAGE TEMPERATURE TEST	-40~85℃	1. Thermal shock Temperature： -50℃~ +125℃ 2. Temperature change rate ：25℃ / MIN 3. Dwell time low and high temperature ： 30 MIN/EACH 4. Total test cycle：200CYCLE 5. Input/Output condition： STATIC	
7	THERMAL SHOCK TEST	-40~50℃	1. Thermal shock Temperature： -45℃~ +55℃ 2. Temperature change rate ：25℃ / 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℃	
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P： 347VAC O/P：FULL LOAD Tc= 80 ℃ LIFE TIME (2) I/P： 347VAC O/P：75% LOAD Tc= 80 ℃ LIFE TIME (3) I/P： 347VAC O/P：50% LOAD Tc= 80 ℃ LIFE TIME		(1) 50846HRS (2) 50098HRS (3) 50805HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 228.3K hrs min. Telcordia SR-332 (Bellcore) ; 68.4K 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	DANIEL GAO	SANFORD SU	VINCENT ZENG

2018.4.30 GP-A50-F010