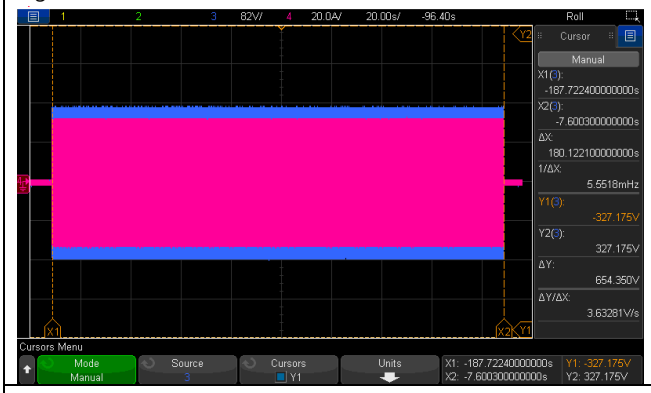
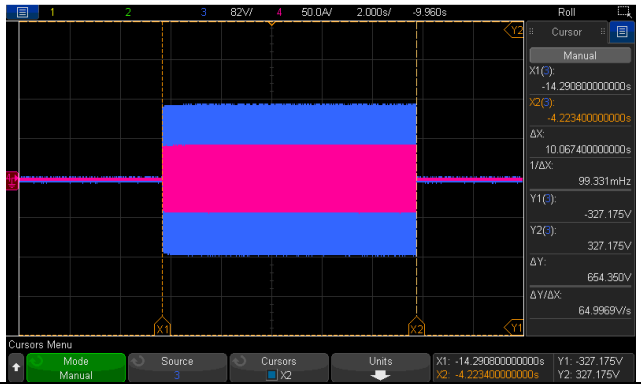
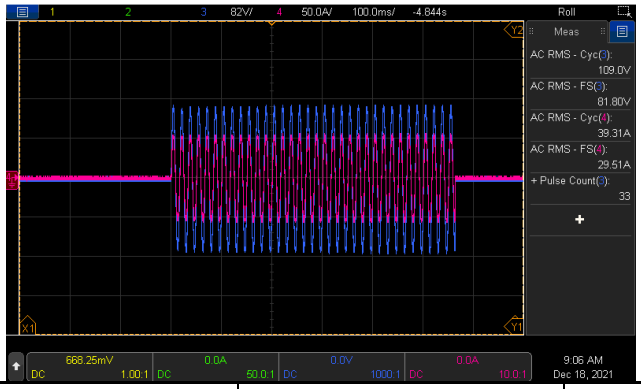
Test Report: NTU-2200-148

2200W High Reliable True Sine Wave with UPS DC-AC Power Inverter

- DESIGN VERIFY TEST
  - Output Function Test
  - Input Function Test
  - Protection Function Test
  - Control Function Test
  - APPLICATION 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	RATED POWER	2200W	IP: 48VDC Ta:25℃	2245 W
2	MAXIMUM OUTPUT POWER (TYP)	(1)2530W/180sec. (2)3300w/10sec (3)SURGE POWER 4400W FOR 30CYCLE Vin (30 ± 5 CYCLE)	IP: 50VDC OP:TESTING LOAD Ta:25℃	(1) 108.36 V / 22.12 A / 180.09 Sec (2) 108.06 V / 29.88 A / 10.07 Sec (3) 108.14 V / 39.4 A/ 33 Cycle
	CH3:O/P VAC CH4:O/P IAC Fig1  Fig2  Fig3 			
3	AC Voltage	100 / 110 / 115 / 120Vac selectable by DIP S.W	IP: 48VDC OP: FULL LOAD Ta:25℃	DIP S.W 100VAC: 98.48 V DIP S.W 110VAC: 108.38 V DIP S.W 115VAC: 113.68 V DIP S.W 120VAC: 118.36 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 48VDC OP: FULL LOAD Ta:25℃	DIP S.W 50HZ: 50.06 HZ DIP S.W 60HZ: 59.95 HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 50VDC OP: 1650W (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25℃	(1) 1.85 % / Vo(min) /1650W (2) 2.13 % / Vo(nor) /1650W (3) 2.11 % / Vo(max) /1650W

CH3:O/P VAC CH4:O/P IAC

Fig1

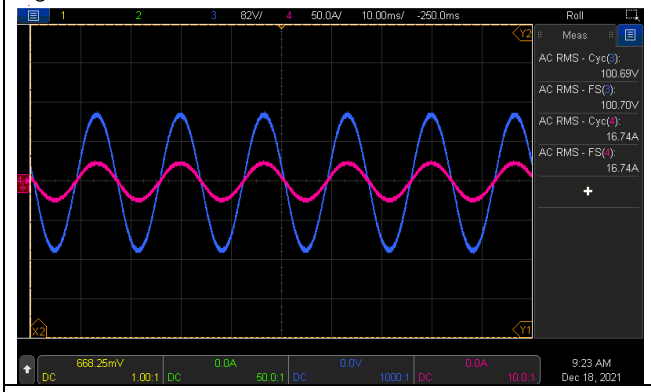


Fig2

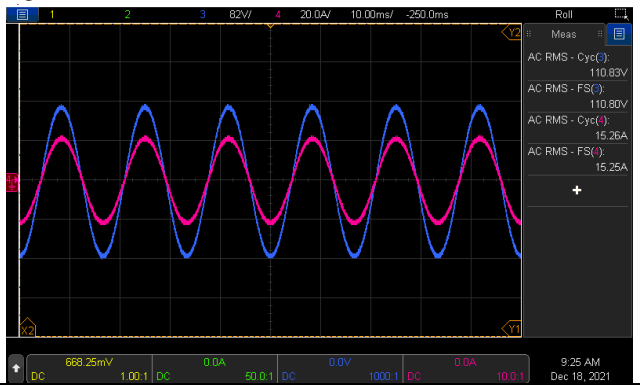
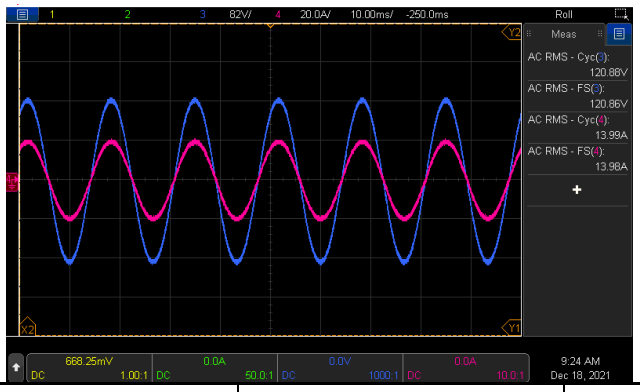


Fig3



6	AC REGULATION	±3%	IP: 50VDC OP: 1650W Ta:25℃	-1.38 %
7	Overshoot /Undershoot	<±10%	IP: 48VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25℃	(1) -6.36 % (2) 1.82 % (3) -6.54 %
8	O/P voltage DC offset	Vin(nor)= 48 V · Vo<200mV · no load : 66.7 mV / full load: 86.7 mV		

9 LED STATUS

- Statas test

LED	Statas	RESULT
Green	Inverter OK	OK
Orange	Remote off	OK
Orange	No AC Output at Saving mode	OK
Red	Inverter Fail	OK

- DC Input test

LED	Battery RANGE	RESULT
Green	50.0~62.0 Vdc±1V	50.185Vdc ~ 61.96 Vdc
Orange	44.0~50.0Vdc ±1V	44.143Vdc ~ 50.125 Vdc
Red	<44.0 Vdc ±1V > 62.0Vdc±1V	< 44.043 Vdc > 62.15 Vdc

- Load test

LED	LOAD RANGE	RESULT
Green	Min. load ~ 40%±5% LOAD	Min. load ~ 38.41 %
Orange	40%±5% ~ 80%±5% LOAD	41.18% ~ 78.64 %
Red	≧ 80%±5% LOAD	≧ 80.81%

- AC Input

LED	LOAD RANGE	RESULT
Green	Utility OK	OK
Green	Utility error	OK
Colorless	Utility disconnected	OK

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	40VDC~66VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25℃	40.183 VDC~ 66.06 VDC/NO LOAD 40.187 VDC~ 66.02 VDC/FULL LOAD

			I/P: LOW-LINE=42V HIGH-LINE=65V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 48V O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	10MIN Test： OK 12Hr Test： OK
2	DC CURRENT (TYP)	60A	IP: 48VDC OP:FULL LOAD Ta:25℃	50.2 A
3	NO LOAD DISSPATION	≦ 15W@ saving mode ≦ 25W@NON-Saving Mode	IP: 48VDC OP:NO LOAD Ta:25℃	5.98 W@ saving mode 20.8 W@NON- Saving Mode
4	SAVING MODE TO NORMAL	Po≥25W	IP: 48VDC OP: TESTING LOAD Ta:25℃	≥ 15 W
5	NORMAL TO SAVING MODE	Po≦ 10W	IP: 48VDC OP: TESTING LOAD Ta:25℃	≤ 11 W
6	OFF MODE CURRENT DRAW (Typ.)	≦ 2mA	IP: 48VDC OP: Sw off Ta:25℃	1.06 mA
7	EFFICIENCY(TYP)	1650W /91%	IP:50VDC OP: Po=1650W 110V/60HZ Ta:25℃	92.23 %

AC UPS MODE(Only for NTU)

<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>AC Taper Voltage Range</td><td colspan="3">AC input high / low line limit:No Load
<table>
<tr><th>AC Voltage</th><th>limit</th><th>Voltage Range</th><th>RESULT</th></tr>
<tr><td rowspan="4">110V</td><td>High limit (To INV mode)</td><td>Vac >128V±4V</td><td>126.7 V</td></tr>
<tr><td>Recovery to high (To AC mode)</td><td>Vac <124V±4V</td><td>121.3 V</td></tr>
<tr><td>Low limit (To INV mode)</td><td>Vac <92V±4V</td><td>90.8 V</td></tr>
<tr><td>Recovery to low (To AC mode)</td><td>Vac >96V±4V</td><td>95.4 V</td></tr>
</table></td></tr>
<tr><td>2</td><td>FREQUENCY RANGE</td><td>45 ~ 65Hz</td><td>IP:48VDC
OP: FULL LOAD
Ta:25℃</td><td>TEST: OK</td></tr>
</table>

3	TRANSFER TIME (TYP)	t<10ms±3ms inverter↔by pass	IP: 48VDC OP: (1) no load (2) full load Ta:25℃	(1) no load a. INTER→BY PASS 2.2 ms b.BY PASS→INVERTER 9.0 ms (2) full load c. INTER→BY PASS 1.72 ms d.BY PASS→INVERTER 11.6 ms

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	44V±1VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	43.983 V
2	BAT LOW SHUT DOWN	40V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	40.10 V
3	BAT LOW RESTART	50V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	50.143 V
4	BAT HIGH ALARM	62V±1VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	62.12 V
5	BAT HIGH SHUT DOWN	66V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	66.08 V
6	BAT HIGH RESTART	60V±1VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	60.06 V
7	BAT. POLARITY	By internal fuse open	IP: BAT +/-（Reverse） OP: FULL LOAD Ta:25℃	TEST：OK
8	OVER TEMPERATURE	Shut down o/p voltage: re-power on.	IP: HI LINE/LOW-LINE OP: FULL LOAD SW:ON Ta:25℃	Shut down o/p voltage, re-power on to recover LED DISPLAY: OK
9	OUTPUT SHORT	Shut down o/p voltage: re-power on	IP: 48VDC O/P: FULL LOAD SW:ON Ta:25℃	Shut down o/p voltage, re-power on to recover LED DISPLAY: OK
10	OVER LOAD (typ.)	105%~115%LOAD 180sec 115%~150%LOAD 10 sec Shut down o/p voltage, re-power on to recover	IP: 48VDC OP: TESTING SW:ON Ta:25℃	(1). 105.72 % ~ 114.55% 180.09 sec (2). 115.23% ~ 148.3% 10.066 sec Shut down o/p voltage, re-power on to recover

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	REMOTE CONTROL	(1) Power ON-OFF remote control by front panel dry contact connector (by RELAY) Open : Normal work Short : Remote off (2) IRC3	IP: 48VDC OP: FULL LOAD Ta:25℃	Open : Normal work Short : Remote off (1). TEST: Vo= 0.002 V Pin= 6.27W (2).TEST: OK

APPLICATION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: 839 · turn on OK LAMP: 1222 · turn on OK LAMP: 1622 · turn on OK	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: OK
2	INDUCTION MOTOR	0.22 HP	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: OK
3	SWITCHING POWER SUPPLY	WITH PFC: RSP-3000-48 O/P= 1743 W	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: OK
		NO PFC: SE-1000-48 · O/P= 1188 W	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: OK

COMPONENT WEAFORM TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	DC TO DC Power Transistor (D to S) or (C to E) Peak Voltage	Q106 /Q112/Q126/Q132 Rated: 200 V / 65 A	I/P: high line O/P: V(max)/Freq 60HZ VDS: O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	Q112 VDS： (1) 166V (2) 164V (3) 165V (4) 166V (5) 165V Q106 VDS： (1) 166V (2) 165V (3) 166V (4) 168V (5) 168V	Q126 VDS： (1) 169V (2) 168V (3) 169V (4) 170V (5) 170V Q132 VDSS: (1) 170V (2) 170V (3) 170V (4) 171V (5) 171V

2	DC TO DC Diode Peak Voltage	D 901 Rated : 400V/ 20 A	I/P: high line O/P: V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	 (1) 273V (2) 276V (3) 276V (4) 281V (5) 281V
3	DC BUS Capacitor Voltage	C905 Rated: 680u/315V	I/P: high line O/P: V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	C905 (1) 273V (2) 292V (3) 279V (4) 273V (5) 273V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated : 650 V/ 40 A	I/P: high line O/P:V(max)/Freq 60HZ VDS: O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	Q1： VDS： (1) 305V (2) 366V (3) 316V (4) 300V (5) 300V
5	AUX PWM MOS	Q201 Rated: 65 A/ 200 V Q504 Rated : 46 A/ 250 V	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	Q201 Q504 (1) 169V (1) 121V (2) 169V (2) 121V (3) 169V (3) 122V (4) 170V (4) 122V (5) 169V (5) 122V
6	Control IC Voltage Test	MCU IC U301 Rated 2.4 V~ 3.6 V AUX IC U201 Rated 8.2V~30V CHARGE IC U501 Rated 8.4V~30V Gate Driver IC U1 Rated 3V~18V	I/P: high line O/P:V(max) /Freq 60HZ O/P: (1)Full Load Turn On (2) Output Short (3)O.L.P(4400W) Turn On (4) NO LOAD Turn On (5) Saving mode Ta:25℃	U301 U501 (1) 3.30V (1) 12.47V (2) 3.30V (2) 12.47V (3) 3.30V (3) 12.47V (4) 3.30V (4) 12.47V (5) 3.30V (5) 12.47V U201 U1 (1) 12.2V (1) 5.07V (2) 12.2V (2) 5.07V (3) 12.2V (3) 5.07V (4) 12.2V (4) 5.07V (5) 12.2V (5) 5.07V

SAFETY &EMC TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	BAT I/P-AC O/P: 3 KVAC/min BAT I/P-AC I/P: 3 KVAC/min AC O/P-FG: 1.5 KVAC/min	BAT I/P-AC O/P 3.6 KVAC/min BAT I/P-AC I/P: 3.6 KVAC/min AC O/P-FG:1.8 KVAC/min Ta:25℃	BAT I/P-ACO/P: 11.47 mA AC O/P-FG: 11.32 mA AC O/P-FG: 7.57 mA NO DAMAGE
2	GROUNDING CONTINUITY	EN 60950 FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25℃	6mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	▓ FCC CLASS A	I/P: 24 VDC O/P: FULL LOAD/50% LOAD Ta:25℃	PASS
2	RADIATION	▓ FCC CLASS A	I/P:24 VDC O/P: :FULL/50% LOAD Ta:25℃	PASS
3	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

Reliability Test

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL：NTU-2200-124 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 24 VDC O/P： FULL LOAD Ta= 25 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 24 VDC O/P： FULL LOAD Ta= 40 ℃ I/P： 24 VDC O/P： FULL LOAD Ta= 40 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 40 ℃
1	C140	53.3℃	62.6℃
2	C144	52.4℃	61.8℃
3	T102 Coil1	61.3℃	70.0℃
4	T102 Core	57.2℃	65.4℃
5	C100	55.5℃	64.0℃
6	C105	53.0℃	61.9℃
7	T102 NTC	54.3℃	63.8℃
8	T101 Coil1	65.4℃	73.7℃
9	T101 Core	59.0℃	67.4℃
10	Q104	49.3℃	59.4℃
11	Q115	42.9℃	53.3℃
12	D902	64.0℃	71.2℃
13	D912	61.4℃	70.1℃
14	D908	67.6℃	74.8℃

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 40 ℃
15	L100	55.4℃	65.8℃
16	T501	32.7℃	43.8℃
17	Q504	31.4℃	43.4℃
18	D530	29.7℃	42.3℃
19	U501	32.2℃	44.3℃
20	LF1	44.5℃	56.1℃
21	ZNR1	35.4℃	46.9℃
22	C6	35.4℃	46.6℃
23	LF26	44.7℃	55.1℃
24	CC53	51.2℃	60.2℃
25	T201	50.3℃	61.2℃
26	T202	52.5℃	63.6℃
27	Q201	58.2℃	65.6℃
28	U301	38.7℃	49.6℃
29	R79	66.3℃	74.0℃
30	Q8	85.9℃	94.1℃
31	Q3	81.0℃	89.6℃
32	C906	44.3℃	53.9℃
33	L10	42.4℃	53.2℃
34	R275	63.1℃	75.7℃
35	R115	55.3℃	64.7℃
36	U201	57.5℃	67.3℃
37	U102	52.2℃	61.9℃
38	TSW3	44.6℃	54.7℃
39	TSW2	64.2℃	73.8℃
40	U1	43.7℃	52.7℃
41	R70	67.0℃	75.7℃
42	Q133	51.8℃	61.7℃
43	Q123	43.2℃	52.7℃
44	RTH7	50.4℃	60.4℃
45	Q125	42.1℃	52.5℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 24VDC O/P：102%LOAD Ta：25℃	TEST：OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P： 24VDC O/P：100%LOAD Ta= -30 ℃	TEST：OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 ℃ NO DAMAGE	I/P：32.5VDC O/P：FULL LOAD Ta= 38.7 ℃ HUMIDITY= 95 %R.H	TEST：OK

5	STORAGE TEMPERATURE TEST	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：10 CYCLE 5. Input /Output condition： STATIC	TEST：OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature： -30℃~ +45℃ 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:24VDC/ FULL LOAD DC ON 11sec/DC OFF 1sec TEST 1cycle:24VDC/ FULL LOAD Burn In Test	TEST：OK
7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：10min/sweep cycle (4) Acceleration：4G (5) Test Time：60min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C100 IS THE MOST CRITICAL COMPONENT (1) I/P： 24VDC O/P：FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 24VDC O/P：FULL LOAD Ta= 40 ℃ LIFE TIME (3) I/P： 24VDC O/P：FULL LOAD Ta= 40 ℃ LIFE TIME (4) I/P： 24VDC O/P：FULL LOAD Ta= 40 ℃ LIFE TIME	 (1) 455777.6HRS (2) 252858.4HRS (3) 432600.8HRS (4) 675704.3HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 344.9K hrs min. Telcordia SR-332 (Bellcore) ; 34.8K hrs min. MIL-HDBK-217F (25℃)	
10	Ongoing Reliability Test	I/P：25VDC O/P：80% LOAD TA=50℃ Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Liutt		Wangdz

2020.10.1 TAG-QA-009