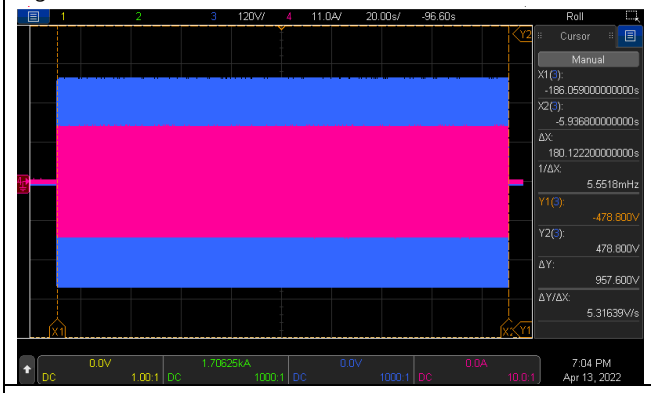
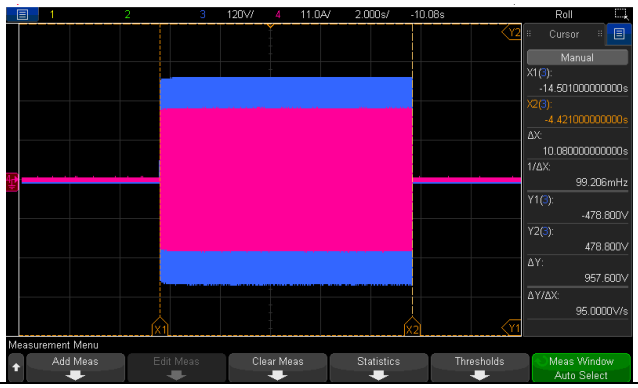
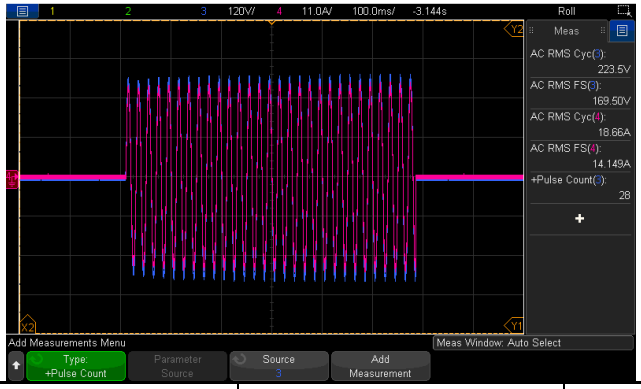
Test Report: NTU-2200-212

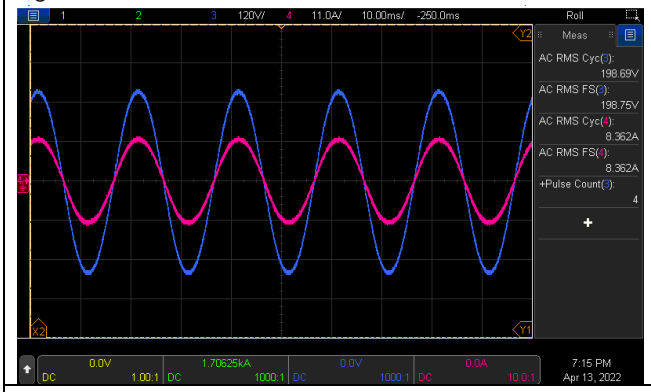
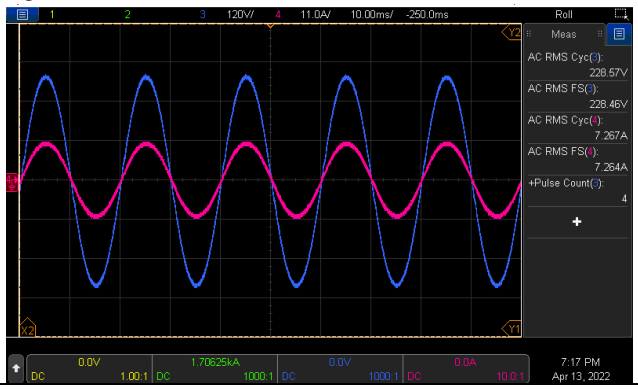
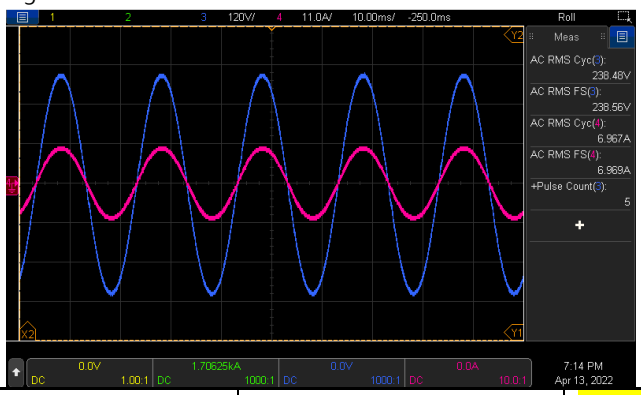
2200W High Reliable True Sine Wave with UPS DC-AC Power Inverter

- 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: 12VDC Ta:25℃	2248 W
2	MAXIMUM OUTPUT POWER (TYP)	(1)2530W/180sec. (2)3300w/10sec (3)SURGE POWER 4400W FOR 30CYCLE Vin (30 ± 5 CYCLE)	IP: 12.5VDC OP:TESTING LOAD Ta:25℃	(1) 228.7 V / 10.94 A / 180.1 Sec (2) 228.3 V / 14.3 A / 10.1 Sec (3) 224.7 V / 18.8 A/ 28 Cycle
	CH3:O/P VAC CH4:O/P IAC Fig1  Fig2  Fig3 			
3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 200VAC: 197.7 V DIP S.W 220VAC: 217.5 V DIP S.W 230VAC: 227.4 V DIP S.W 240VAC: 237.3 V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25℃	DIP S.W 50HZ: 50.04 HZ DIP S.W 60HZ: 59.96 HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 12.5VDC OP: 1650W (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25℃	(1) 1.51 % / Vo(min) (2) 1.61 % / Vo(nor) (3) 1.65 % / Vo(max)

	CH3:O/P VAC CH4:O/P IAC Fig1  Fig2  Fig3 			
6	AC REGULATION	±3%	IP: 12.5VDC OP: 1650W Ta:25℃	-1.1 %
7	Overshoot /Undershoot	<±10%	IP: 12VDC OP: (1) full load turn on (2) no load turn on (3) full /no load change Ta:25℃	(1) -5.96 % (2) 0.65 % (3) -4.6 %
8	O/P voltage DC offset	Vin(nor)= 12 V · Vo<200mV · no load : 64 mV / full load: 89 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 ●	12.5~15.5 Vdc±0.3v	12.54Vdc ~ 15.54Vdc
Orange ●	11~ 12.5Vdc ±0.3v	11.04Vdc ~ 12.46Vdc
Red ●	<11.0 Vdc ±0.3v > 15.5vdc±0.3v	< 10.92Vdc > 15.66Vdc

- Load test

LED	LOAD RANGE	RESULT
Green ●	Min. load ~ 40%±5% LOAD	Min. load ~38.9%
Orange ●	40%±5% ~ 80%±5% LOAD	41.8% ~79.3%
Red ●	≧ 80%±5% LOAD	≧ 82.3%

- 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)	10VDC~16.5VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25℃	10.03VDC~ 16.53 VDC/NO LOAD 10.05 VDC~ 16.53 VDC/FULL LOAD

			I/P: LOW-LINE=10.5V HIGH-LINE=16.2V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON:30Sec OFF:30Sec 10MIN (POWER ON/OFF NO DAMAGE) I/P: 12VDC O/P:FULL LOAD ON:30ec OFF:30ec 12Hr (POWER ON/OFF NO DAMAGE)	10MIN Test： OK 12Hr Test： OK
2	DC CURRENT (TYP)	250A	IP: 12VDC OP:FULL LOAD Ta:25℃	205 A
3	NO LOAD DISSPATION	≦ 15W@ saving mode ≦ 55W@NON-Saving Mode	IP: 12VDC OP:NO LOAD Ta:25℃	6.15 W @ saving mode 46.14 W @NON- Saving Mode
4	SAVING MODE TO NORMAL	Po≥25W	IP: 12VDC OP: TESTING LOAD Ta:25℃	≥ 22.1 W
5	NORMAL TO SAVING MODE	Po≦ 10W	IP: 12VDC OP: TESTING LOAD Ta:25℃	≤ 15.8 W
6	OFF MODE CURRENT DRAW (Typ.)	≦ 2mA	IP: 12VDC OP: Sw off Ta:25℃	0.5 mA
7	EFFICIENCY(TYP)	1650W /90%	IP:12.5VDC OP: Po=1650W/230V/50HZ Ta:25℃	91.2 %

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">230V</td><td>High limit (To INV mode)</td><td>Vac >267V±8V</td><td>264.9 V</td></tr>
<tr><td>Recovery to high (To AC mode)</td><td>Vac <260V±8V</td><td>258.4 V</td></tr>
<tr><td>Low limit (To INV mode)</td><td>Vac <193V±8V</td><td>191.1 V</td></tr>
<tr><td>Recovery to low (To AC mode)</td><td>Vac >200V±8V</td><td>199.2 V</td></tr>
</table></td></tr>
<tr><td>2</td><td>FREQUENCY RANGE</td><td>45 ~ 65Hz</td><td>IP:12VDC
OP: FULL LOAD
Ta:25℃</td><td>TEST: OK</td></tr>
</table>

3	TRANSFER TIME (TYP)	t<10ms±3ms inverter↔by pass	IP: 12VDC OP: (1) no load (2) full load Ta:25℃	(1) no load a. INTER→BY PASS 3.9 ms b.BY PASS→INVERTER 7.3 ms (2) full load c. INTER→BY PASS 1.84 ms d.BY PASS→INVERTER 7.12 ms

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT LOW ALARM	11V±0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	10.92 V
2	BAT LOW SHUT DOWN	10V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	10.05 V
3	BAT LOW RESTART	12.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	12.57 V
4	BAT HIGH ALARM	15.5V±0.3VDC	IP: TESTING OP:FULL LOAD SW:ON Ta:25℃	15.66 V
5	BAT HIGH SHUT DOWN	16.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	16.53 V
6	BAT HIGH RESTART	15V±0.3VDC	IP: TESTING OP: FULL LOAD SW:ON Ta:25℃	15.01 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: 12VDC 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: 12VDC OP: TESTING SW:ON Ta:25℃	(1). 106.7% ~ 115.8 % 180.1 sec (2). 117.1% ~ 147.6% 10.1 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: 12VDC OP: FULL LOAD Ta:25℃	(1).Open : Normal work Short : Remote off TEST: Vo= 0.003V Pin= 6.44 W (2).TEST: OK

APPLICATION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: 1002 W · turn on OK LAMP: 1510 W · turn on OK LAMP: 2019 W · 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-1600-48 O/P= 1738 W	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: OK
		NO PFC: SE-1000-48 · O/P= 1060 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: 60 V / 195A	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℃	Q106 VDS： (1) 43.9V (2) 43.9V (3) 49.6V (4) 41.5V (5) 40.3V Q126 VDS： (1) 44.3V (2) 44.3V (3) 49.3V (4) 43.3V (5) 42.2V	Q112 VDS： (1) 43.6V (2) 43.6V (3) 48.6V (4) 42.2V (5) 40.8V Q132 VDS： (1) 44.0V (2) 44.0V (3) 49.6V (4) 40.4V (5) 40.8V

2	DC TO DC Diode Peak Voltage	D 901 Rated : 1000V/ 16 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℃	 (1) 517V (2) 573V (3) 521V (4) 525V (5) 525V
3	DC BUS Capacitor Voltage	C905/C907 Rated: 680u/315V	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℃	C905 C907 (1) 253V (1) 255V (2) 253V (2) 265V (3) 251V (3) 259V (4) 257V (4) 255V (5) 257V (5) 255V
4	DC TO AC Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated : 650 V/ 30A	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) 513V (2) 598V (3) 517V (4) 533V (5) 533V
5	AUX PWM MOS	Q201 Rated: 130A/100 V Q504 Rated : 130A/100 V	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℃	Q201 Q504 (1) 57.4V (1) 37.3V (2) 57.4V (2) 37.3V (3) 57.4V (3) 37.3V (4) 57.4V (4) 37.3V (5) 57.4V (5) 37.3V
6	Control IC Voltage Test	MCU IC U301 Rated 2.4V~ 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 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℃	U301 U501 (1) 3.32V (1) 12.6V (2) 3.32V (2) 12.6V (3) 3.32V (3) 12.6V (4) 3.32V (4) 12.6V (5) 3.32V (5) 12.6V U201 U1 (1) 16.2V (1) 5.07V (2) 15.6V (2) 5.07V (3) 16.2V (3) 5.07V (4) 15.7V (4) 5.07V (5) 15.7V (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-AC O/P: 11.77mA BAT I/P-AC I/P: 11.44mA AC O/P-FG: 7.98mA 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	▓ CE CLASS A	I/P: 12 VDC O/P: FULL LOAD/50% LOAD Ta:25℃	PASS
2	RADIATION	▓ CE CLASS A	I/P:12 VDC O/P: :FULL/50% LOAD Ta:25℃	PASS
3	HARMONIC	EN61000-3-2 CLASS A	I/P: 12 VDC O/P: FULL LOAD Ta:25℃	PASS
4	E.S.D	EN61000-4-2 AIR：8KV / Contact：4KV	I/P: 12VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT: 1KV	I/P: 12VDC O/P:FULL LOAD Ta:25℃	CRITERIA A
6	SURGE	IEC61000-4-5 L-N :1KV L,N-PE:2KV	I/P: 12VDC 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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL：NTU-3200-212 1. ROOM AMBIENT BURN-IN：2 HRS I/P： 12 VDC O/P： FULL LOAD Ta= 25 ℃ 2. HIGH AMBIENT BURN-IN： 2 HRS I/P： 12VDC O/P： FULL LOAD Ta= 40 ℃		

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 40 ℃
1	C104	52.0℃	67.7℃
2	C100	43.4℃	59.2℃
3	T101 Coil	53.1℃	68.5℃
4	T101 Core	35.6℃	51.1℃

NO	Position	ROOM AMBIENT Ta= 25 ℃	HIGH AMBIENT Ta= 40 ℃
5	Q105	45.0℃	61.8℃
6	D902	38.2℃	53.6℃
7	Q115	37.6℃	54.3℃
8	Q103	44.8℃	61.6℃
9	C140	49.0℃	64.8℃
10	C145	45.3℃	60.7℃
11	T102 Coil	54.9℃	70.3℃
12	T102 Core	42.0℃	57.2℃
13	T102 NTC	40.0℃	55.3℃
14	Q133	47.3℃	63.4℃
15	RTH7	47.3℃	62.8℃
16	Q126	43.1℃	59.0℃
17	U301	33.1℃	47.6℃
18	Q201	58.4℃	75.8℃
19	T202	41.6℃	56.7℃
20	D916	38.3℃	53.5℃
21	D907	32.3℃	47.9℃
22	L100	30.4℃	45.7℃
23	CC53	30.4℃	45.9℃
24	Q8	48.1℃	63.6℃
25	Q2	52.4℃	68.3℃
26	L10	30.2℃	45.5℃
27	LF26	35.4℃	51.0℃
28	T201	36.0℃	51.5℃
29	C905	31.0℃	45.7℃
30	TSW2	42.1℃	57.6℃
31	Q5	57.5℃	73.7℃
32	Q504	26.0℃	41.8℃
33	T501	27.2℃	43.1℃
34	U501	26.0℃	41.8℃
35	R115	60.9℃	75.8℃
36	R155	56.3℃	72.2℃
37	U201	47.6℃	62.9℃
38	R275	90.7℃	101.4℃
39	U1	33.6℃	48.9℃
40	R68	49.5℃	63.8℃
41	R59	54.7℃	68.3℃
42	TSW3	32.4℃	47.8℃
43	LF2	25.6℃	40.7℃
44	ZNR1	25.7℃	41.0℃
45	C1	25.9℃	41.4℃
46	LF1	29.1℃	45.2℃
47	C2	28.1℃	43.1℃

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 12VDC O/P : 102%LOAD Ta : 25℃	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 12VDC 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 : 16.5VDC O/P : FULL LOAD Ta= 39 ℃ 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:12VDC/ FULL LOAD DC ON 11sec/DC OFF 1sec TEST 1cycle:12VDC/ 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 C104 IS THE MOST CRITICAL COMPONENT (1) I/P : 12VDC O/P : FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P : 12VDC O/P : FULL LOAD Ta= 40 ℃ LIFE TIME (3) I/P : 12VDC O/P : FULL LOAD Ta= 40 ℃ LIFE TIME (4) I/P : 12VDC O/P : FULL LOAD Ta= 40 ℃ LIFE TIME		(1) 893367HRS (2) 146565HRS (3) 468846HRS (4) 1233190HRS
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 : 12.5VDC 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