



# Test Report: NTU-2200-212

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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°C	<u>2248</u> 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°C	(1) <u>228.7</u> V / <u>10.94</u> A / <u>180.1</u> Sec (2) <u>228.3</u> V / <u>14.3</u> A / <u>10.1</u> Sec (3) <u>224.7</u> V / <u>18.8</u> A / <u>28</u> Cycle

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

Fig1

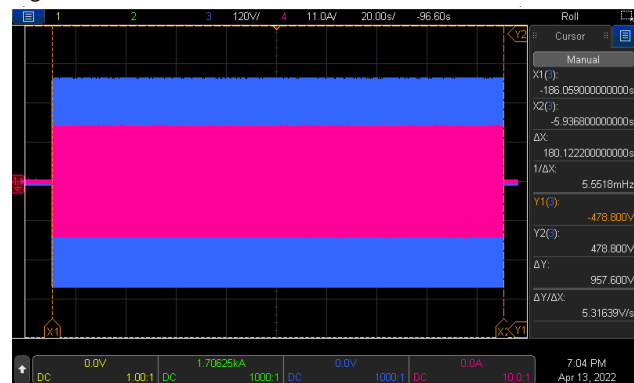


Fig2

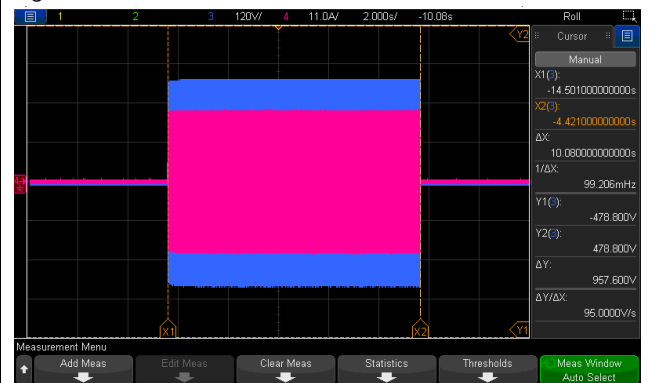
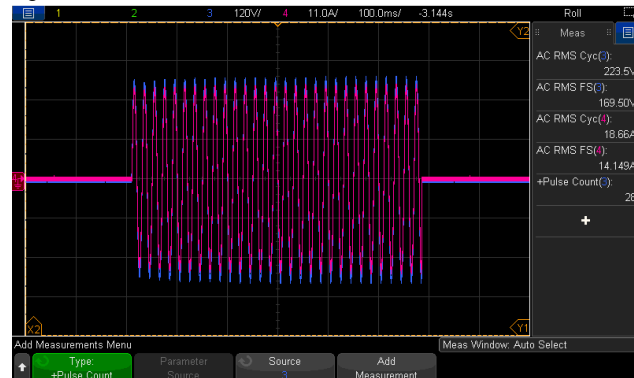


Fig3



3	AC Voltage	200 / 220 / 230 / 240Vac selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 200VAC: <u>197.7</u> V DIP S.W 220VAC: <u>217.5</u> V DIP S.W 230VAC: <u>227.4</u> V DIP S.W 240VAC: <u>237.3</u> V
4	FREQUENCY	50/60Hz (±0.1HZ) selectable by DIP S.W	IP: 12VDC OP: FULL LOAD Ta:25°C	DIP S.W 50HZ: <u>50.04</u> HZ DIP S.W 60HZ: <u>59.96</u> HZ
5	WAVEFORM	True sine wave (THD<3%)	IP: 12.5VDC OP: 1650W (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25°C	(1) <u>1.51</u> % / Vo(min) (2) <u>1.61</u> % / Vo(nor) (3) <u>1.65</u> % / Vo(max)

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

Fig1

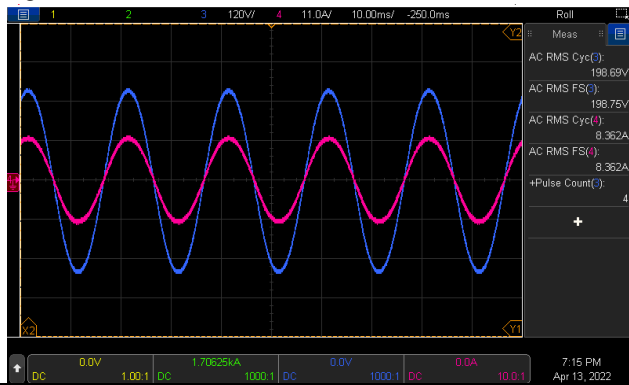


Fig2

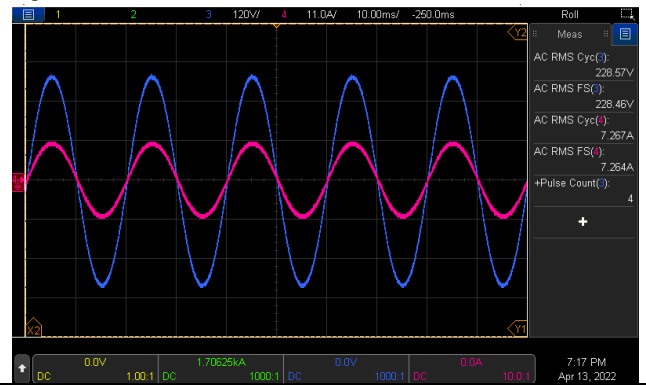
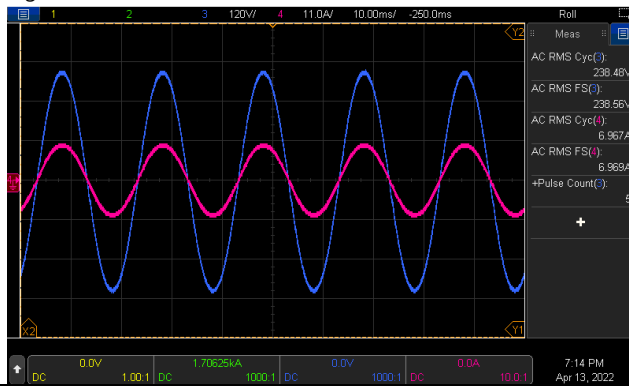


Fig3



6	AC REGULATION	±3%	IP: 12.5VDC OP: 1650W Ta:25°C	-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°C	(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	<ul style="list-style-type: none"> <li> <b>Status test</b> <table border="1"> <thead> <tr> <th>LED</th> <th>Status</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green ●</td> <td>Inverter OK</td> <td>OK</td> </tr> <tr> <td>Orange ●</td> <td>Remote off</td> <td>OK</td> </tr> <tr> <td>Orange ☀</td> <td>No AC Output at Saving mode</td> <td>OK</td> </tr> <tr> <td>Red ●</td> <td>Inverter Fail</td> <td>OK</td> </tr> </tbody> </table> </li> <li> <b>DC Input test</b> <table border="1"> <thead> <tr> <th>LED</th> <th>Battery RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green ●</td> <td>12.5~15.5 Vdc±0.3v</td> <td>12.54Vdc ~ 15.54Vdc</td> </tr> <tr> <td>Orange ●</td> <td>11~ 12.5Vdc ±0.3v</td> <td>11.04Vdc ~ 12.46Vdc</td> </tr> <tr> <td>Red ●</td> <td>&lt;11.0 Vdc ±0.3v &gt; 15.5vdc±0.3v</td> <td>&lt; 10.92Vdc &gt; 15.66Vdc</td> </tr> </tbody> </table> </li> <li> <b>Load test</b> <table border="1"> <thead> <tr> <th>LED</th> <th>LOAD RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green ●</td> <td>Min. load ~ 40%±5% LOAD</td> <td>Min. load ~38.9%</td> </tr> <tr> <td>Orange ●</td> <td>40%±5% ~ 80%±5% LOAD</td> <td>41.8% ~79.3%</td> </tr> <tr> <td>Red ●</td> <td>≥ 80%±5% LOAD</td> <td>≥ 82.3%</td> </tr> </tbody> </table> </li> <li> <b>AC Input</b> <table border="1"> <thead> <tr> <th>LED</th> <th>LOAD RANGE</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>Green ●</td> <td>Utility OK</td> <td>OK</td> </tr> <tr> <td>Green ☀</td> <td>Utility error</td> <td>OK</td> </tr> <tr> <td>Colorless ○</td> <td>Utility disconnected</td> <td>OK</td> </tr> </tbody> </table> </li> </ul>	LED	Status	RESULT	Green ●	Inverter OK	OK	Orange ●	Remote off	OK	Orange ☀	No AC Output at Saving mode	OK	Red ●	Inverter Fail	OK	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	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%	LED	LOAD RANGE	RESULT	Green ●	Utility OK	OK	Green ☀	Utility error	OK	Colorless ○	Utility disconnected	OK
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**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°C	<u>10.03VDC</u> ~ <u>16.53 VDC</u> /NO LOAD <u>10.05 VDC</u> ~ <u>16.53 VDC</u> /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: <u>OK</u> 12Hr Test: <u>OK</u>
2	DC CURRENT (TYP)	250A	IP: 12VDC OP:FULL LOAD Ta:25°C	<u>205</u> A
3	NO LOAD DISSIPATION	$\leq 15W$ @ saving mode $\leq 55W$ @NON-Saving Mode	IP: 12VDC OP:NO LOAD Ta:25°C	<u>6.15</u> W @ saving mode <u>46.14</u> W @NON- Saving Mode
4	SAVING MODE TO NORMAL	$P_o \geq 25W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	$\geq$ <u>22.1</u> W
5	NORMAL TO SAVING MODE	$P_o \leq 10W$	IP: 12VDC OP: TESTING LOAD Ta:25°C	$\leq$ <u>15.8</u> W
6	OFF MODE CURRENT DRAW (Typ.)	$\leq 2mA$	IP: 12VDC OP: Sw off Ta:25°C	<u>0.5</u> mA
7	EFFICIENCY(TYP)	1650W /90%	IP:12.5VDC OP: $P_o=1650W/230V/50HZ$ Ta:25°C	<u>91.2</u> %

AC UPS MODE(Only for NTU)

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	AC Taper Voltage Range	AC input high / low line limit:No Load			
		AC Voltage	limit	Voltage Range	RESULT
		230V	High limit (To INV mode)	$V_{ac} > 267V \pm 8V$	<u>264.9</u> V
			Recovery to high (To AC mode)	$V_{ac} < 260V \pm 8V$	<u>258.4</u> V
			Low limit (To INV mode)	$V_{ac} < 193V \pm 8V$	<u>191.1</u> V
Recovery to low (To AC mode)	$V_{ac} > 200V \pm 8V$		<u>199.2</u> V		
2	FREQUENCY RANGE	45 ~ 65Hz	IP:12VDC OP: FULL LOAD Ta:25°C	TEST: <u>OK</u>	

3	TRANSFER TIME (TYP)	$t < 10\text{ms} \pm 3\text{ms}$ inverter→by pass	IP: 12VDC OP: (1) no load (2) full load Ta:25°C	(1) no load a. INTER→BY PASS <u>3.9</u> ms b. BY PASS-INVERTER <u>7.3</u> ms (2) full load c. INTER→BY PASS <u>1.84</u> ms d. BY PASS-INVERTER <u>7.12</u> ms
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**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°C	<u>10.92</u> V
2	BAT LOW SHUT DOWN	10V±0.3VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>10.05</u> V
3	BAT LOW RESTART	12.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>12.57</u> V
4	BAT HIGH ALARM	15.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>15.66</u> V
5	BAT HIGH SHUT DOWN	16.5V±0.3VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>16.53</u> V
6	BAT HIGH RESTART	15V±0.3VDC	IP: TESTING OP: FULL LOAD SW: ON Ta:25°C	<u>15.01</u> V
7	BAT. POLARITY	By internal fuse open	IP: BAT +/- (Reverse) OP: FULL LOAD Ta:25°C	TEST: <u>OK</u>
8	OVER TEMPERATURE	Shut down o/p voltage: re-power on.	IP: HI LINE/LOW-LINE OP: FULL LOAD SW: ON Ta:25°C	Shut down o/p voltage, re-power on to recover LED DISPLAY: <u>OK</u>
9	OUTPUT SHORT	Shut down o/p voltage: re-power on	IP: 12VDC O/P: FULL LOAD SW: ON Ta:25°C	Shut down o/p voltage, re-power on to recover LED DISPLAY: <u>OK</u>
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°C	(1). <u>106.7% ~ 115.8%</u> <u>180.1</u> sec (2). <u>117.1% ~ 147.6%</u> <u>10.1</u> 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°C	(1).Open : <u>Normal work</u> Short : <u>Remote off</u> TEST: Vo= <u>0.003V</u> Pin= <u>6.44 W</u> (2).TEST: <u>OK</u>

**APPLICATION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	LAMP	LAMP: <u>1002 W</u> · turn on <u>OK</u> LAMP: <u>1510 W</u> · turn on <u>OK</u> LAMP: <u>2019 W</u> · turn on <u>OK</u>	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: <u>OK</u>
2	INDUCTION MOTOR	<u>0.22</u> HP	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: <u>OK</u>
3	SWITCHING POWER SUPPLY	WITH PFC: <u>RSP-1600-48</u> O/P= <u>1738 W</u>	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: <u>OK</u>
		NO PFC: <u>SE-1000-48</u> O/P= <u>1060 W</u>	1. Vin=HIGH LINE 2. 110V/60Hz	TEST: <u>OK</u>

**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°C	Q106                      Q112 VDS:                      VDS: (1) 43.9V                (1) 43.6V (2) 43.9V                (2) 43.6V (3) 49.6V                (3) 48.6V (4) 41.5V                (4) 42.2V (5) 40.3V                (5) 40.8V  Q126                      Q132 VDS:                      VDS: (1) 44.3V                (1) 44.0V (2) 44.3V                (2) 44.0V (3) 49.3V                (3) 49.6V (4) 43.3V                (4) 40.4V (5) 42.2V                (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°C	(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°C	C905 (1) 253V (2) 253V (3) 251V (4) 257V (5) 257V C907 (1) 255V (2) 265V (3) 259V (4) 255V (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°C	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°C	Q201 (1) 57.4V (2) 57.4V (3) 57.4V (4) 57.4V (5) 57.4V Q504 (1) 37.3V (2) 37.3V (3) 37.3V (4) 37.3V (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°C	U301 (1) 3.32V (2) 3.32V (3) 3.32V (4) 3.32V (5) 3.32V U201 (1) 16.2V (2) 15.6V (3) 16.2V (4) 15.7V (5) 15.7V U501 (1) 12.6V (2) 12.6V (3) 12.6V (4) 12.6V (5) 12.6V U1 (1) 5.07V (2) 5.07V (3) 5.07V (4) 5.07V (5) 5.07V





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

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 12VDC O/P : 102%LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 12VDC O/P : 100%LOAD Ta= -30 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 °C NO DAMAGE	I/P : 16.5VDC O/P : FULL LOAD Ta= 39 °C HUMIDITY= 95 %R.H	TEST : OK
5	STORAGE TEMPERATURE TEST	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		TEST : OK
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°C~ +45°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: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°C		TEST : OK
8	CAPACITOR LIFE CYCLE	SUPPOSE C104 IS THE MOST CRITICAL COMPONENT (1) I/P : 12VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 12VDC O/P : FULL LOAD Ta= 40 °C LIFE TIME (3) I/P : 12VDC O/P : 75% LOAD Ta= 40 °C LIFE TIME (4) I/P : 12VDC O/P : 50% LOAD Ta= 40 °C 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°C)		
10	Ongoing Reliability Test	I/P : 12.5VDC O/P : 80% LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Liutt		Wangdz

2020.10.1 TAG-QA-009