



# Test Report: RQ-65B

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65W Quad Output Switching Power Supply

## ■ 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

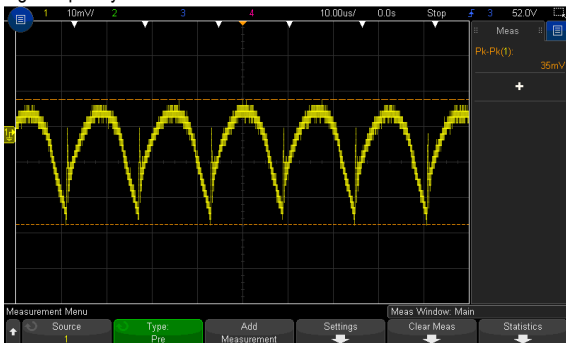
ENVIRONMENT TEST

DESIGN VERIFY TEST

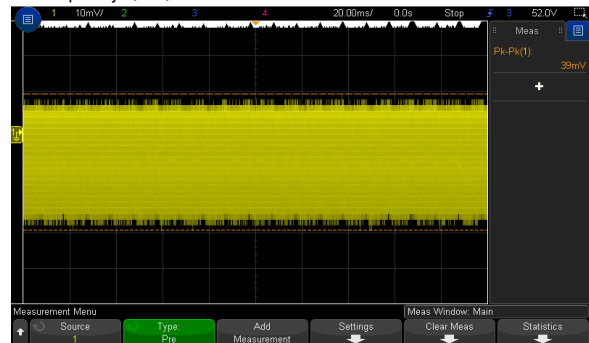
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 4.75V~ 5.5 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	4.11V~5.76V/230VAC 4.10V~5.76V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1 : -2%~2 % V2 : -5%~9 % V3 : -5%~5 % V4 : -5%~5 %	I/P: 88VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1 : -0.08%~0.06% V2 : -0.36%~2.69% V3 : -0.04%~0.12% V4 : -0.13%~0.09%
3	LINE REGULATION (Max)	V1: -0.5%~0.5% V2: -1.5%~ 1.5% V3: -0.5%~ 0.5% V4: -0.5%~ 0.5%	I/P: 88VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1 : -0.01%~0.01% V2 : -0.02%~0.35% V3 : -0.02%~0.02% V4 : -0.01%~0.01%
4	LOAD REGULATION(Max)	V1: -0.5%~0.5% V2: -3%~3% V3: -1%~1% V4: -1%~1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1 : -0.08%~0.06% V2 : -0.36%~2.69% V3 : -0.04%~0.12% V4 : -0.13%~0.09%
5	OVER/UNDERSHOOT TEST	< ±10%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.2%
6	RIPPLE & NOISE(Max)	V1: 80mVp-p V2: 120mVp-p V3: 80mVp-p V4: 80mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 39mVp-p 35 V2: 63mVp-p 39 V3: 34mVp-p 26 V4: 37mVp-p 31

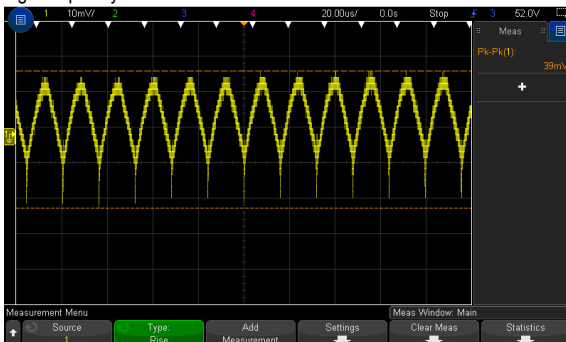
high frequency (V1) :



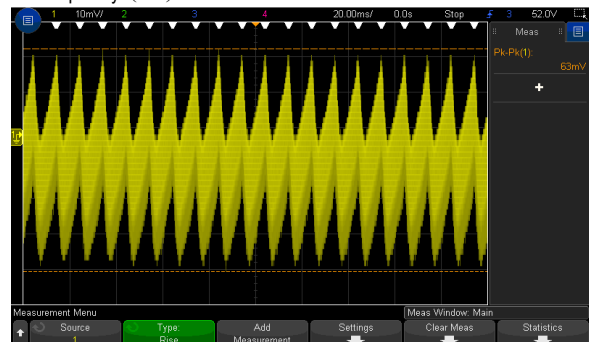
low frequency (V1) :



high frequency (V2) :

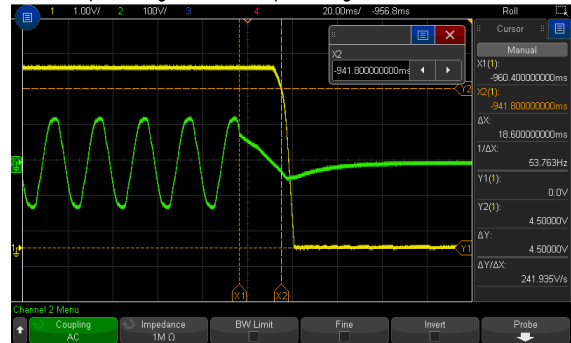
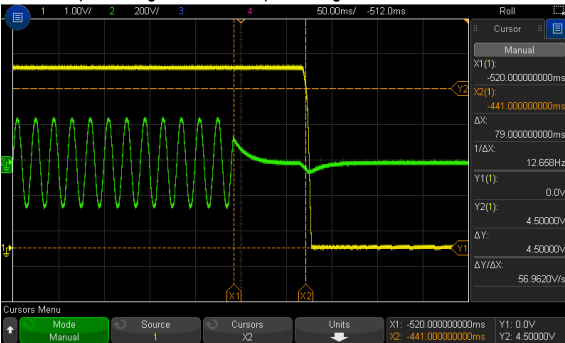


low frequency (V2) :



<p>high frequency (V3) :</p>	<p>low frequency (V3) :</p>	<p>high frequency (V4) :</p>	<p>low frequency (V4) :</p>
<p>7 SET UP TIME(Max)</p>	<p>230VAC/500ms 115VAC/1200ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/ 150ms 115VAC/ 186ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>	<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p>		
<p>8 RISE TIME (Max)</p>	<p>230VAC/20ms 115VAC/30ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/ 7.53ms 115VAC/ 8.38ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p>	<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p>		

9	HOLD UP TIME (Typ.)	230VAC/60ms 115VAC/14ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 79ms 115VAC/ 18.6ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

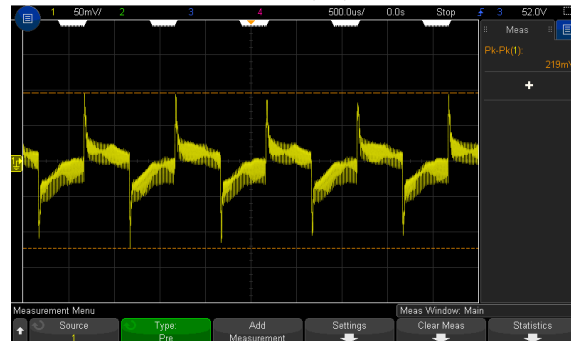


10	DYNAMIC LOAD	V1: 1000 mVp-p V2: 1200 mVp-p V3: 1000 mVp-p V4: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	(1)	(2)
				V1: 201mVp-p V2: 410mVp-p V3: 51mVp-p V4: 56mVp-p	219mVp-p 135mVp-p 51mVp-p 74mVp-p

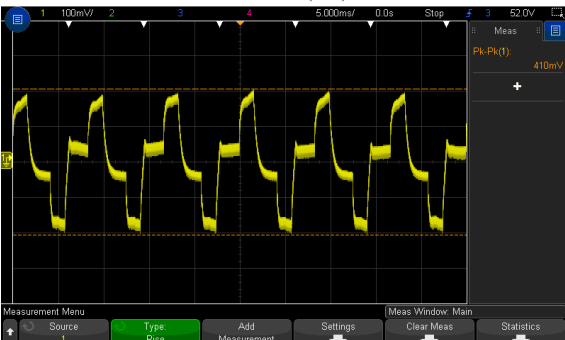
FULL /50% LOAD 50%DUTY / 120HZ (V1)



FULL /50% LOAD 50%DUTY / 1KHZ (V1)



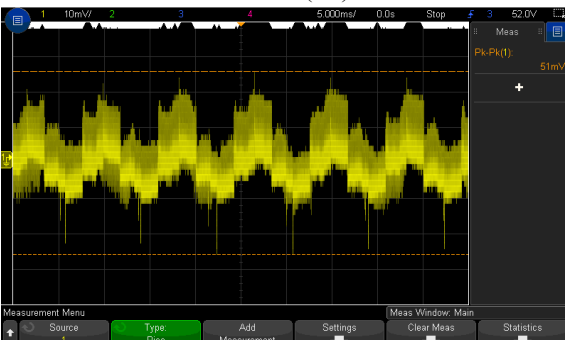
FULL /50% LOAD 50%DUTY / 120HZ (V2)



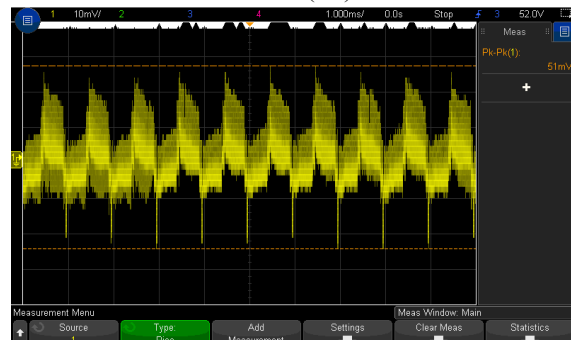
FULL /50% LOAD 50%DUTY / 1KHZ (V2)

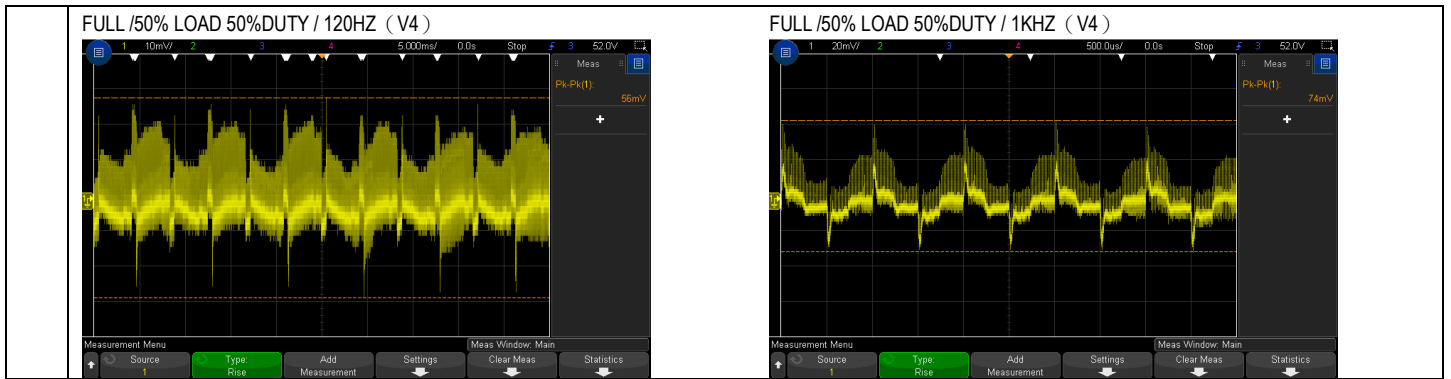


FULL /50% LOAD 50%DUTY / 120HZ (V3)



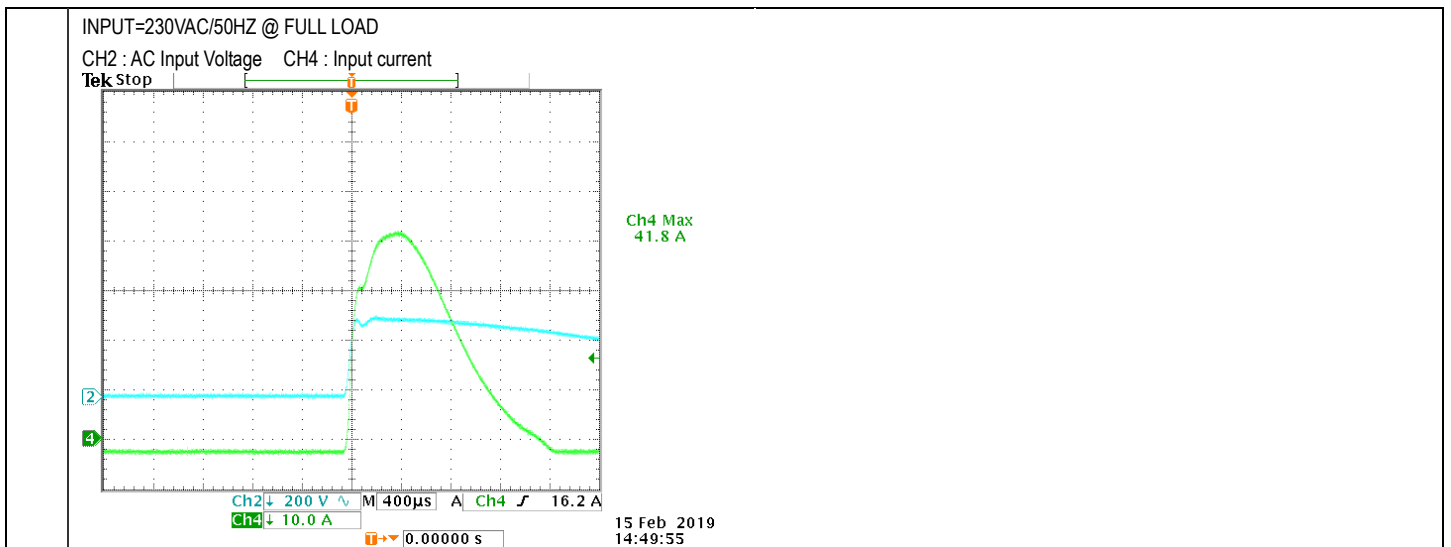
FULL /50% LOAD 50%DUTY / 1KHZ (V3)





### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																						
1	INPUT VOLTAGE RANGE	88VAC~264VAC 125VDC ~ 373VDC (Withstand 300VAC surge for 5sec. Without damage)	(1) I/P:TESTING O/P:FULL LOAD (2) I/P:DC TESTING(L:+ N:-) O/P: FULL LOAD (3) I/P:DC TESTING(L:- N:+) O/P: FULL LOAD Ta:25°C	(1) 77V~264V (2) 113.1Vdc~373Vdc/FULL LOAD (3) 113.0Vdc~373Vdc/FULL LOAD																						
			I/P: LOW-LINE-3V=85 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:88 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK																						
3	INPUT CURRENT (Typ.)	230V/ 1.2A 115V/ 2A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=0.66A/ 230VAC I=1.09A/ 115VAC																						
4	LEAKAGE CURRENT	<2 mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	0.6 mA																						
5	EFFICIENCY(Typ.)	75%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	75.4%																						
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data (230VAC)</caption> <thead> <tr> <th>Load (%)</th> <th>Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>71</td></tr> <tr><td>20%</td><td>72</td></tr> <tr><td>30%</td><td>73</td></tr> <tr><td>40%</td><td>74</td></tr> <tr><td>50%</td><td>74</td></tr> <tr><td>60%</td><td>74</td></tr> <tr><td>70%</td><td>75</td></tr> <tr><td>80%</td><td>75</td></tr> <tr><td>90%</td><td>76</td></tr> <tr><td>100%</td><td>76</td></tr> </tbody> </table>					Load (%)	Efficiency (%)	10%	71	20%	72	30%	73	40%	74	50%	74	60%	74	70%	75	80%	75	90%	76	100%	76
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90%	76																									
100%	76																									
6	INRUSH CURRENT(Typ.)	230V / 50A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	41.8A																						



### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110%~150%	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P: TESTING Ta:25°C	121.6%/ 264VAC 1123.6%/ 230VAC 115.2%/115VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	5.75V~6.75V	I/P: 264VAC I/P: 230VAC I/P: 88VAC O/P: MIN LOAD Ta:25°C	5.97V/ 264VAC 5.97V/ 230VAC 5.97V/ 88VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 88VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode, 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	Q1 Rated : 600 V	AC ON/OFF I/P: High-Line +3V =267V VDS: O/P: (1) Full Load (2) Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 570V (2) 582V (3) 570V
2	O/P Diode	D50 Rated : 200 V  D55 Rated : 100 V  D56 Rated : 60 V	AC ON/OFF I/P: High-Line +3V =267 V O/P: (1) Full Load (2) Output Short (3) Full Load Continue Ta:25°C	D50 D55 (1) 69.7V (1) 48.8V (2) 72.1V (2) 50.4V (3) 50.4V (3) 43.2V  D56 D58 (1) 55.9V (1) 185V

		D58 Rated : 200 V		(2) 55.9V (3) 53.6V	(2) 194V (3) 108V
3	Input Capacitor Voltage	C5 Rated : 150 $\mu$ / 400 V	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°C	(1) 387V (2) 382V (3) 378V (4) 371 V	
4	Control IC Voltage Test	U1 Rated : 7.2V~ 16 V	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) Ta:25°C	(1) 12.8V (2) 12.8V (3) 12.8V (4) 12.8V (5) 12.6V	
5	Clamp Diode Peak Voltage	D1 Rated :600 V	AC ON/OFF I/P : High-Line +3V = 267 V O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 554V (2) 546V	

### SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG:2 KVAC/min O/P-FG: 0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P- FG: 2.4 KVAC/min O/P - FG: 0.6 KVAC/min Ta:25°C	I/P-O/P:3.22mA I/P-FG:1..63mA O/P-FG:1.14mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M $\Omega$ I/P- FG:500VDC>100M $\Omega$ O/P- FG:500VDC>100M $\Omega$	I/P-O/P: 600 VDC I/P- FG: 600 VDC O/P - FG: 600 VDC Ta:25°C	I/P-O/P: 9999M $\Omega$ I/P-FG: 9999M $\Omega$ O/P-FG: 9999M $\Omega$ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 m $\Omega$	40 A / 2min Ta: 25°C/70%RH	5m $\Omega$

### 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°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab

3	RADIATION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 <input type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 <input checked="" type="checkbox"/> INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	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°C	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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																
1	TEMPERATURE RISE TEST	MODEL : RQ-65D 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 27.4 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 40.0°C																																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 27.4 °C</th> <th>HIGH AMBIENT Ta=40.0 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>58.4°C</td><td>72.3°C</td></tr> <tr><td>2</td><td>LF1</td><td>54.4°C</td><td>69.5°C</td></tr> <tr><td>3</td><td>C5</td><td>52.9°C</td><td>67.5°C</td></tr> <tr><td>4</td><td>Q1</td><td>89.9°C</td><td>104.3°C</td></tr> <tr><td>5</td><td>U1</td><td>72.7°C</td><td>85.4°C</td></tr> <tr><td>6</td><td>D1</td><td>74.0°C</td><td>87.1°C</td></tr> <tr><td>7</td><td>T1coil</td><td>90.7°C</td><td>104.8°C</td></tr> <tr><td>8</td><td>T1core</td><td>93.3°C</td><td>106.6°C</td></tr> <tr><td>9</td><td>D55</td><td>103.8°C</td><td>116.0°C</td></tr> <tr><td>10</td><td>D50</td><td>97.1°C</td><td>110.2°C</td></tr> <tr><td>11</td><td>D58</td><td>109.2°C</td><td>116.9°C</td></tr> <tr><td>12</td><td>C56</td><td>72.9°C</td><td>85.1°C</td></tr> <tr><td>13</td><td>RG2</td><td>95.3°C</td><td>107.9°C</td></tr> <tr><td>14</td><td>C63</td><td>78.2°C</td><td>91.1°C</td></tr> <tr><td>15</td><td>D56</td><td>107.7°C</td><td>118.1°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 27.4 °C	HIGH AMBIENT Ta=40.0 °C	1	BD1	58.4°C	72.3°C	2	LF1	54.4°C	69.5°C	3	C5	52.9°C	67.5°C	4	Q1	89.9°C	104.3°C	5	U1	72.7°C	85.4°C	6	D1	74.0°C	87.1°C	7	T1coil	90.7°C	104.8°C	8	T1core	93.3°C	106.6°C	9	D55	103.8°C	116.0°C	10	D50	97.1°C	110.2°C	11	D58	109.2°C	116.9°C	12	C56	72.9°C	85.1°C	13	RG2	95.3°C	107.9°C	14	C63	78.2°C	91.1°C	15	D56	107.7°C	118.1°C
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 122% LOAD Ta : 25°C	TEST : OK																																																																





3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/115VAC O/P : 100 % LOAD Ta= -25°C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL40°C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta=40 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03%/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0046%/°C (0~50°C)
6	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
7	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:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test		TEST : OK
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 5G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C		TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C56 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta=40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 40 °C LIFE TIME		(1) 145806.2HRS (2) 26546.6HRS (3) 48020HRS (4) 79006.2HRS
10	MTBF	2466.8K hrs min. Telcordia SR-332 (Bellcore) ; 424.2K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010