



Test Report: RSD-500D-24

500W Enclosed Type Reliable Railway DC-DC Converter

■ 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

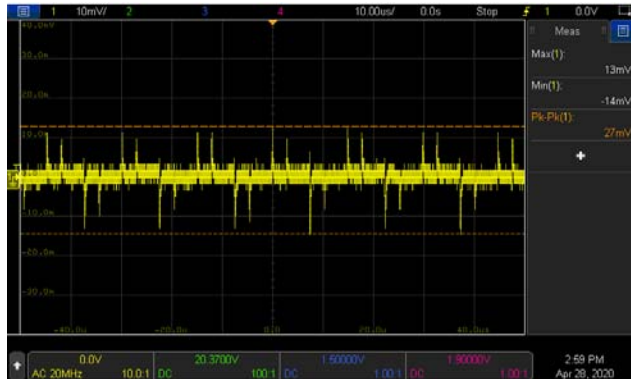
ENVIRONMENT TEST

DESIGN VERIFY TEST

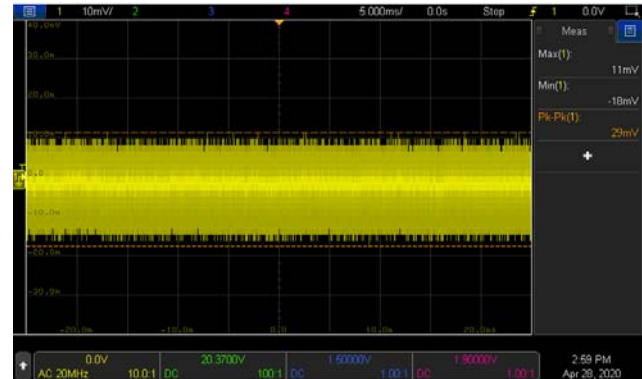
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 24V~ 28V	I/P: 110VDC O/P : MIN LOAD Ta : 25°C	23.19V~29.36V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1:-1%~+1 %	I/P:67.2 VDC /154 VDC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.09%~-0.04%
3	LINE REGULATION (Max)	V1: -0.5%~+0.5 %	I/P:67.2 VDC /154 VDC O/P:FULL LOAD Ta:25°C	V1: -0.02% ~ 0.04%
4	LOAD REGULATION (Max)	V1: -1%~ +1 %	I/P: 110VDC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.09%~ -0.03%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 110VDC O/P:FULL LOAD Ta:25°C	TEST:1.3%
6	RIPPLE & NOISE (Max)	V1:120mVp-p	I/P: 110VDC O/P:FULL LOAD Ta:25°C	V1:29mVp-p

high frequency :



low frequency :

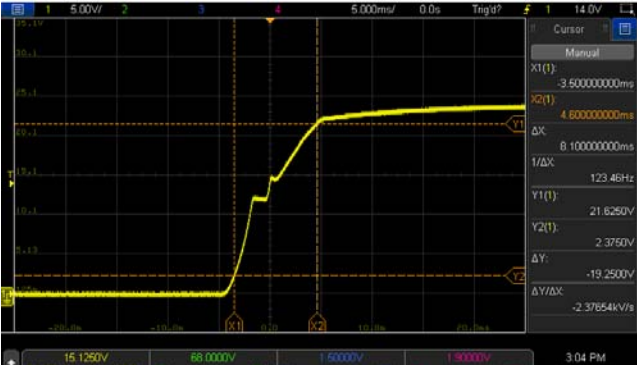

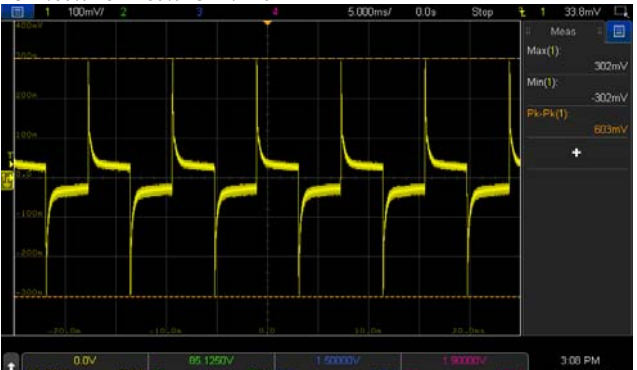
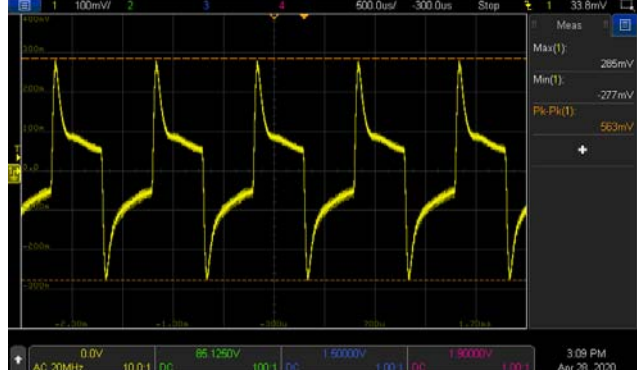


7	SET UP TIME (Max)	110VDC/ 500 ms	I/P: 110VDC O/P:FULL LOAD Ta:25°C	51.9 ms
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INPUT= 110VDC @ FULL LOAD

CH1 : Output Voltage CH2 : DC Input Voltage



8	RISE TIME (Max)	110VDC /60ms	I/P: 110VDC O/P:FULL LOAD Ta:25°C	8.1 ms
<p>INPUT=110 VDC @ FULL LOAD CH1 : Output Voltage</p> 				
9	HOLD UP TIME (TYP)	110VDC / 10ms	I/P: 110VDC O/P:FULL LOAD Ta:25°C	13.78 ms
<p>INPUT=110 VDC @ FULL LOAD CH1 : Output Voltage CH2 : dC Input Voltage</p> 				
10	TRANSIENT RECOVERY TIME	V1:2400mVp-p	I/P: 110VDC O/P:40% LOAD CHANGE 50%DUTY/120HZ	490mVp-p
11	DYNAMIC LOAD	V1:2400mVp-p	I/P: 110VDC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	603mVp-p 563mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ</p>  <p>FULL /50% LOAD 50%DUTY / 1KHZ</p> 				

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	INPUT VOLTAGE RANGE	67.2VDC~154VDC 57.6 VDC~ 67.2VDC/100ms	I/P:TESTING O/P:FULL LOAD Ta:25°C	(1) 60.62V~ 154V (2) TEST:OK																																												
			I/P: LOW-LINE-0.2=67V HIGH-LINE+3V=157V 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 CURRENT(TYP)	110VDC/ 5A	I/P: 110VDC O/P:FULL LOAD Ta:25°C	I = 4.85A																																												
3	EFFICIENCY(TYP)	93%	I/P: 110VDC O/P:FULL LOAD Ta:25°C	93.72%																																												
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>67.2VDC (%)</th> <th>110VDC (%)</th> <th>154VDC (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>86</td><td>84</td><td>82</td></tr> <tr><td>20%</td><td>91</td><td>89</td><td>87</td></tr> <tr><td>30%</td><td>93</td><td>91</td><td>89</td></tr> <tr><td>40%</td><td>93.5</td><td>92</td><td>90</td></tr> <tr><td>50%</td><td>93.8</td><td>92.5</td><td>91</td></tr> <tr><td>60%</td><td>94</td><td>93</td><td>91.5</td></tr> <tr><td>70%</td><td>94</td><td>93.5</td><td>92</td></tr> <tr><td>80%</td><td>93.8</td><td>93.5</td><td>92</td></tr> <tr><td>90%</td><td>93.5</td><td>93.5</td><td>92</td></tr> <tr><td>100%</td><td>93</td><td>93.5</td><td>92</td></tr> </tbody> </table>					LOAD (%)	67.2VDC (%)	110VDC (%)	154VDC (%)	10%	86	84	82	20%	91	89	87	30%	93	91	89	40%	93.5	92	90	50%	93.8	92.5	91	60%	94	93	91.5	70%	94	93.5	92	80%	93.8	93.5	92	90%	93.5	93.5	92	100%	93	93.5	92
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4	INRUSH CURRENT(TYP)	30 A COLD START	I/P: 110VDC O/P:FULL LOAD Ta:25°C	I=19.5A																																												
<p>INPUT= VDC @ FULL LOAD CH2 : DC Input Voltage CH4 : Input current</p>																																																
5	INTERRUPTION OF VOLTAGE SUPPLY	D-type comply with S2 level (10ms)@ full load	I/P: 110VDC SHORT O/P: TESTING Ta:25°C	13.32 ms/ Full load																																												

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105%~135% RATED OUTPUT POWER	I/P: 67.2VDC I/P: 110VDC I/P: 154VDC O/P: TESTING Ta:25°C	118.50%/ 67.2VDC 118.50%/ 110VDC 118.50%/ 154VDC PROTECTION TYPE : Constant current limiting 105%~135% rated output power with auto-recovery .
2	OVER VOLTAGE PROTECTION	CH: 28.8V~ 35V	I/P: 67.2VDC I/P: 110VDC I/P: 154VDC O/P: MIN LOAD Ta:25°C	31V/ 67.2 VDC 31V/ 110 VDC 31.2V/ 154 VDC PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	SPEC: NO DAMAGE	I/P:154/67.2VDC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE : Shut down O/P voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P:154/67.2VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting with auto-recovery recovers automatically after fault condition is removed
5	INPUT REVERSE	POWER OK	I/P:154/67.2VDC O/P: FULL LOAD Ta:25°C	NO DAMAGE
6	INPUT UNDER VOLTAGE PROTECTION	110 VIN (D-TYPE) : POWER ON >=67.2V POWER OFF <=65V	I/P: TESTING O/P: FULL LOAD Ta:25°C	TEST : POWER ON >= 60.62V POWER OFF <= 57.52V

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																				
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 10/Q12/ Q21/Q23 Rated : 26 A/ 400V	DC ON/OFF I/P: High-Line +3V =157V VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	<table border="0"> <tr> <td>Q10</td> <td>Q12</td> </tr> <tr> <td>VDS:</td> <td>VDS:</td> </tr> <tr> <td>(1) 208V</td> <td>(1) 208V</td> </tr> <tr> <td>(2) 278V</td> <td>(2) 278V</td> </tr> <tr> <td>(3) 320V</td> <td>(3) 319V</td> </tr> <tr> <td>(4) 278V</td> <td>(4) 278V</td> </tr> <tr> <td>(5) 268V</td> <td>(5) 268V</td> </tr> <tr> <td>(6) 262V</td> <td>(6) 272V</td> </tr> <tr> <td>(7) 327V</td> <td>(7) 327V</td> </tr> <tr> <td>Q21</td> <td>Q23</td> </tr> <tr> <td>VDS:</td> <td>VDS:</td> </tr> <tr> <td>(1) 210V</td> <td>(1) 210V</td> </tr> <tr> <td>(2) 270V</td> <td>(2) 276V</td> </tr> <tr> <td>(3) 314V</td> <td>(3) 314V</td> </tr> <tr> <td>(4) 274V</td> <td>(4) 274V</td> </tr> <tr> <td>(5) 270V</td> <td>(5) 268V</td> </tr> <tr> <td>(6) 268V</td> <td>(6) 268V</td> </tr> <tr> <td>(7) 290V</td> <td>(7) 312V</td> </tr> </table>	Q10	Q12	VDS:	VDS:	(1) 208V	(1) 208V	(2) 278V	(2) 278V	(3) 320V	(3) 319V	(4) 278V	(4) 278V	(5) 268V	(5) 268V	(6) 262V	(6) 272V	(7) 327V	(7) 327V	Q21	Q23	VDS:	VDS:	(1) 210V	(1) 210V	(2) 270V	(2) 276V	(3) 314V	(3) 314V	(4) 274V	(4) 274V	(5) 270V	(5) 268V	(6) 268V	(6) 268V	(7) 290V	(7) 312V
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	Clamp MOSFET (D to S) or (C to E) Peak Voltage	Q10/Q19 Rated : 26 A/ 400V VGS :±30 V	DC ON/OFF I/P:High-Line +3V =157V VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25°C	Q8 VDS: (1) 190V (2) 254V (3) 304V (4) 274V (5) 254V (6) 248V (7) 298V	Q19 VDS: (1) 190V (2) 250V (3) 302V (4) 264V (5) 256V (6) 244V (7) 242V
2	Diode Peak Voltage	Q100/Q200 Rated : 20 A/ 200V Q103/Q105 Rated : 65 A/ 200V	DC ON/OFF I/P:High-Line +3V =157 V VOmax: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD VO: O/P: (1)Full Load Ta:25°C	Q100: VOmax: VDS: (1) 120.1V (2) 99.2V (3) 182V (4) 173V (5) 171V (6) 167V (7) 158V (8) 84.3V VO: (1) 97.6V Q103: VOmax: VDS: (1) 169V (2) 172V (3) 178V (4) 177V (5) 178V (6) 179V (7) 178V (8) 176V VO: (1) 178V	Q200: VOmax: VDS: (1) 99.5V (2) 105.9V (3) 182V (4) 174V (5) 174V (6) 170V (7) 105V (8) 79.2V VO: (1) 91.3V Q105: VOmax: VDS: (1) 168V (2) 175V (3) 173V (4) 172V (5) 173V (6) 175V (7) 173V (8) 167V VO: (1) 170V
3	Input Capacitor Voltage	C5/C35 Rated: : 270u/160V °C / Series	I/P:High-Line +3V =157V 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	C5 (1) 157.3V (2) 156.9V (3) 154.4V (4) 153.8V	C35 (1) 157.5V (2) 156.6V (3) 154.4V (4) 154.8V
4	Control IC Voltage Test	PWM IC U4 Rated 7.5V~ 15 V O/P U100 /U101 Rated -0.3V~ 27 V O/P U201 Rated 0V~ 32 V	DC ON/OFF I/P:High-Line +3V =157 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P.	U4 (1) 12.32V (2) 13.84V (3) 13.92V (4) 13.84V (5) 12.32V	U201 (1) 13.6V (2) 13.6V (3) 13.6V (4) 20.6V (5) 11.9V



			(5)NO LOAD VRmin(LOW LINE) Ta:25°C	U100 (1) 10.87V (2) 10.87V (3) 10.87V (4) 10.87V (5) 10.79V	U101 (1) 10.06V (2) 10.06V (3) 10.06V (4) 10.06V (5) 9.98V
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SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	EN 60950-1 I/P-O/P:4KVDC/min I/P-FG:2.5 KVDC/min O/P-FG:2.5KVDC/min	I/P-O/P: 4.4KVDC/min I/P-FG: 3 KVDC/min O/P-FG:3KVDC/min Ta:25°C	I/P-O/P: 0.4uA I/P-FG: 0.2uA O/P-FG:0uA 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: 600 VDC I/P-FG: 600 VDC O/P-FG: 600 VDC Ta:25°C	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	EN 60950-1 FG(PE) TO CHASSIS OR TRACE <100mΩ	40A / 2min Ta:25°C	2mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RADIATION	EN55032 CLASS B	I/P: 110VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
2	CONDUCTION	EN55032 CLASS A	I/P:110VDC O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	E.S.D	EN61000-4-2 <input type="checkbox"/> MEDICAL AIR: 15KV / Contact: 8KV <input type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input checked="" type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 6KV	I/P: 110VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
4	E.F.T	EN61000-4-4 <input type="checkbox"/> LIGHT INDUSTRY INPUT: 0.5KV <input type="checkbox"/> MEDICAL <input checked="" type="checkbox"/> INDUSTRY INPUT: 2KV	I/P:110VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
5	SURGE	IEC61000-4-5 <input checked="" type="checkbox"/> INDUSTRY L-N :1KV L,N-PE:2KV	I/P: 110VDC O/P:FULL LOAD Ta:25°C	<input checked="" type="checkbox"/> CRITERIA A <input type="checkbox"/> CRITERIA B
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

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																																																																																																								
1	TEMPERATURE RISE TEST	MODEL : RSD-500D-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 110 VDC O/P : FULL LOAD Ta= 25 °C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 110 VDC O/P : FULL LOAD Ta= 55 °C																																																																																																																																																																										
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 110 VDC O/P : 118% LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 67.2 VDC / 154 VDC O/P : 100 % LOAD Ta= -45 °C	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 55 °C /95 %R.H NO DAMAGE	I/P : 157 VDC O/P : FULL LOAD Ta= 55 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	± 0.03%/°C (0~55°C)	I/P : 110 VDC O/P : FULL LOAD	± 0.0081 %/°C (0~55°C)
6	STORAGE TEMPERATURE TEST	-40~85°C	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	
7	THERMAL SHOCK TEST	-40~55°C	1. Thermal shock Temperature : -45°C~+60°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: 110 VDC / FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle: 110 VDC / 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 : 10min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C115 IS THE MOST CRITICAL COMPONENT (1) I/P : 110VDC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 110VDC O/P : FULL LOAD Ta= 55 °C LIFE TIME (3) I/P : 110VDC O/P : 75% LOAD Ta= 55 °C LIFE TIME (4) I/P : 110VDC O/P : 50% LOAD Ta= 55 °C LIFE TIME		(1) 187973.8 HRS (2) 39791.5 HRS (3) 93165.4 HRS (4) 211552.1 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 277.9K hrs min. Telcordia SR-332 (Bellcore) ; 99.1K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 110VDC 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