

TEST REPORT

Report No.: J1906056R01E Report Date: 2019/07/16 Page: 1 of 56

Applicant Name : Leishen Intelligent System Co., Ltd.
 Applicant Address : Floor 4, Yunhua Times, Bogang Avenue, Shajing, Bao'an District, Shenzhen, Guangdong, China

The following samples are submitted and identified on behalf of the applicant as:

Sample Description :

Sample Name : 16-lines Lidar
 Sample Model : C16
 Sample Quantity : 9 pcs
 Sample No. : A1、 B1、 C1、 D1、 E1、 F1、 G1、 H1、 I1
 Applicant No. : /
 Manufacturer : Leishen Intelligent System Co., Ltd.
 Receiving Date : 2019/06/06
 Test Period : 2019/06/17~2019/07/08

Test Conducted:

As requested by the applicant, for details refer to attached page(s).

Approved by



Sunday Yin, Quality Director

Reviewed by

Tom Tang

Tested by

Lin Long

Declaration : This report is invalid without "Special Seal for Testing" of LABone. The test data and results in the report only serve for the submitted test samples. LABone is not responsible for the test data and results provided by the applicant. Any change, modification or partial reproduction of this report is invalid. The test data and results issued in this report are only for the use of the entrusting party.

Suzhou LABone Testing Services Technology Co., Ltd.

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Conclusion:

Section No.	Test Name	Standard Method	CNAS Recognition	Evaluation
R01	Superimposed alternating voltage	GB/T 28046.2-2011 4.4	Yes	Conforming
R02	Momentary drop in supply voltage	GB/T 28046.2-2011 4.6.1	Yes	Conforming
R03	Reset behaviour at voltage drop	GB/T 28046.2-2011 4.6.2	Yes	Conforming
R04	Starting profile	GB/T 28046.2-2011 4.6.3	Yes	Conforming
R05	Open circuit tests-Single line interruption	GB/T 28046.2-2011 4.9.1	Yes	Conforming
R06	Short circuit protection	GB/T 28046.2-2011 4.10.2	Yes	Conforming
R07	Random vibration test	GB/T 28046.2-2011 4.1.2.7	Yes	Conforming
R08	Temperature cycle with specified change rate	GB/T 28046.3-2011 5.3.1 Table 2	Yes	Conforming
R09	Rapid change of temperature with specified transition duration	GB/T 28046.4-2011 5.3.2	Yes	Conforming
R10	Damp heat, steady-state test	GB/T 28046.4-2011 5.7	Yes	Conforming
R11	Salt spray tests-Corrosion test	GB/T 28046.4-2011 5.5.1 GB/T2423.18-2012 Severe level 2	Yes	Conforming
R12	Salt spray tests-Leakage and function test	GB/T 28046.4-2011 5.5.2	Yes	Conforming
R13	IP6X	GB/T 4208-2017	Yes	Conforming
R14	IPX7	GB/T 4208-2017	Yes	Conforming
R15	Bump test	GB/T 28046.3-2011 4.2.1 Shock Severity 1 / passenger door	Yes	Conforming
R16	Vibration	GB/T 28046.3-2011 4.1.2.4	Yes	Conforming

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R17	Shock test	GB/T 28046.3-2011 4.2.2	Yes	Conforming
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Lab Environmental Condition:

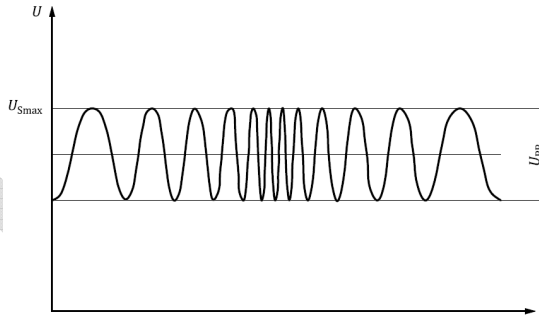
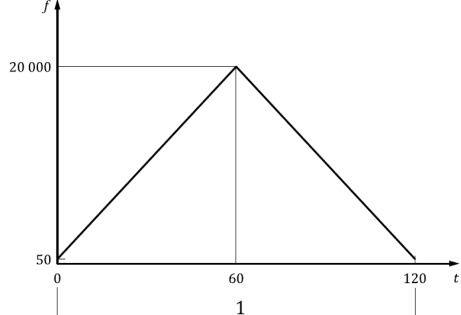
Ambient Temperature	(23±5) °C	Relative Humidity	(60±15)% RH
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Sample Detail Information:

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Test Items, Method and Results:

R01. Superimposed alternating voltage

Sample No.	A1		
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.4		
Test Method	<p>16 V for systems with nominal voltage, U_N, of 12 V; Severe level as below: Severity 2: $U_{pp}=4$ V AC ($U_N=12$ V); Frequency range: 50 Hz~20 kHz; Type of frequency sweep: triangular, logarithmic; Internal resistance of the power supply: (50~100) mΩ; Sweep duration: 120 s; Number of sweeps: 5 cycles; Test voltage with superimposed sinusoidal a.c. voltage: Frequency sweep:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>Key: 1—one cycle f— Frequency, Hz(Logarithmic scale) t— Time, seconds</p> <p>After the test, check function.</p>		

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Acceptance Criteria	The functional status shall be class A, that is, during and after the test, the sample function is normal and the radar imaging is normal.			
Deviation	/			
Test Results	During the test, sample function is normal and the radar imaging is normal; Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the A-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Bipolar Power Supply	JSDYQ-74	2018/11/05~2019/11/04
	2	Digital Phosphoroscope	JSDYQ-94	2018/11/05~2019/11/04
Remarks	/			

Sample and Test Pictures

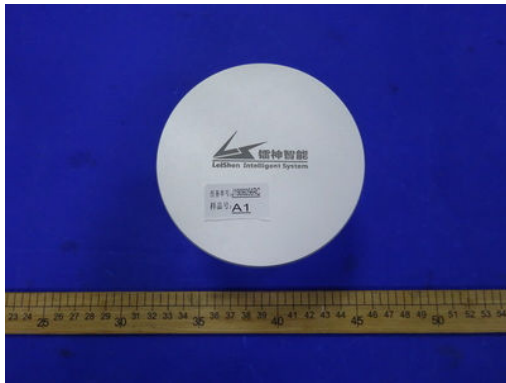


Fig.R01.1 Before the test

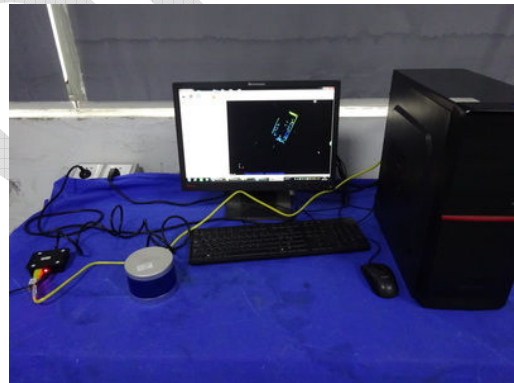


Fig.R01.2 Before the test normal function

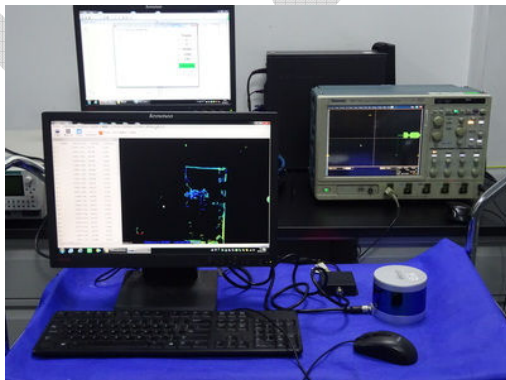


Fig.R01.3 During the test

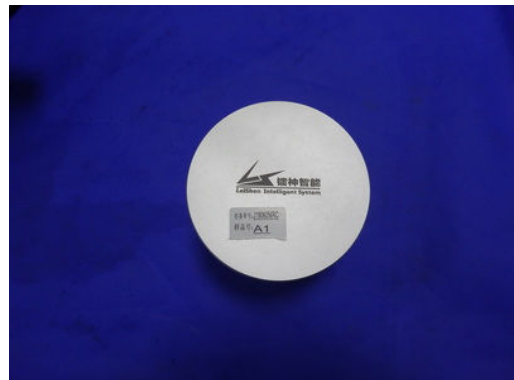


Fig.R01.4 After the test

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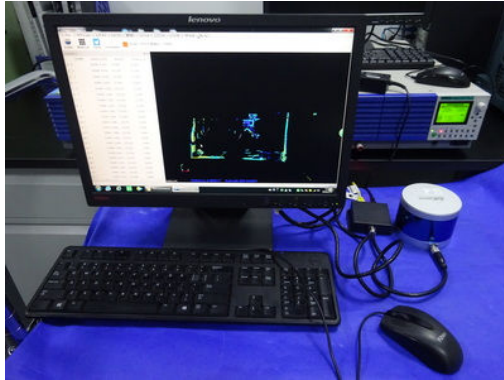


Fig.R01.5 After the test normal function

Test Curves

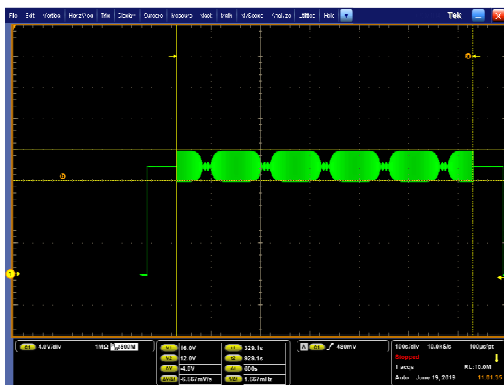


Fig.R01.6 Oscilloscope Waveform

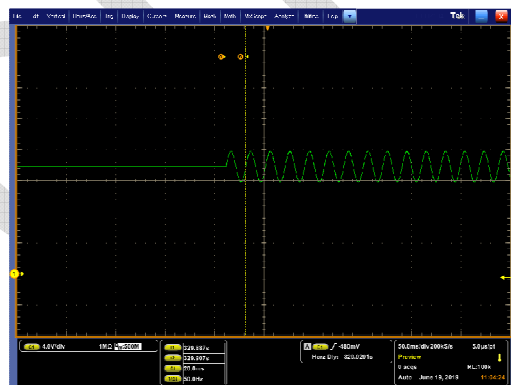


Fig.R01.7 Oscilloscope Waveform

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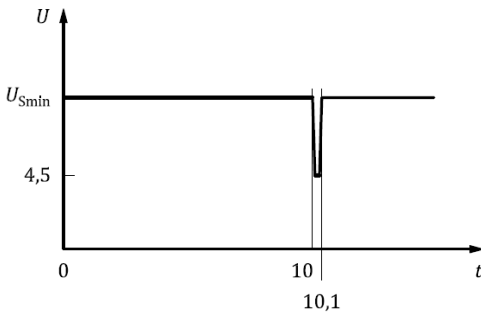
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R02. Momentary drop in supply voltage

Sample No.	A1			
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.6.1			
Test Method	<p>The sample is energized and de-energized, power-on voltage is $U_{smin}=9\text{ V}$, the voltage rise and fall time shall be not more than 10 ms, and the interval does not exceed 0.1 s.</p> <p>Test schematic photo:</p>  <p>U—Voltage, V; t — Time, seconds.</p>			
Acceptance Criteria	The functional status shall be minimum class B, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the function is the sample imaging function.			
Deviation	/			
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the B-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Bipolar Power Supply	JSDYQ-74	2018/11/05~2019/11/04
	2	Digital Phosphoroscope	JSDYQ-94	2018/11/05~2019/11/04
Remarks	/			
Sample and Test Pictures				

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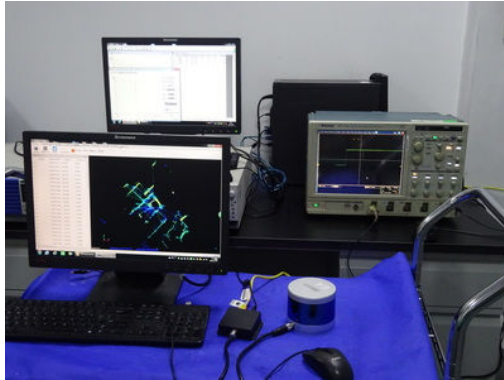


Fig.R02.1 During the test



Fig.R02.2 After the test

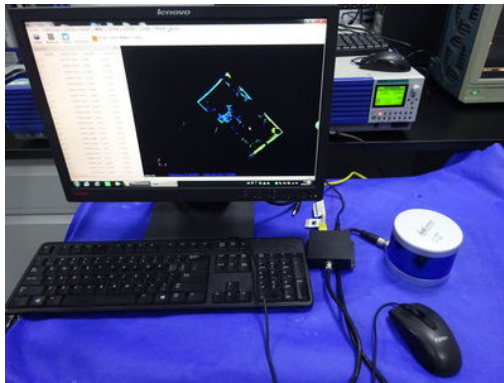
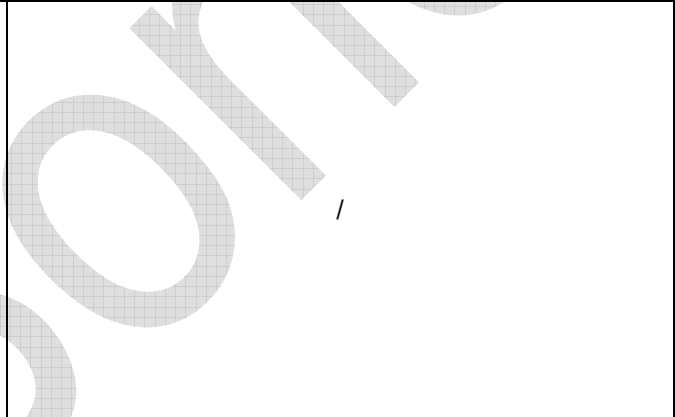


Fig.R02.3 After the test normal function



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Test Curves



Fig.R02.4 Oscilloscope Waveform

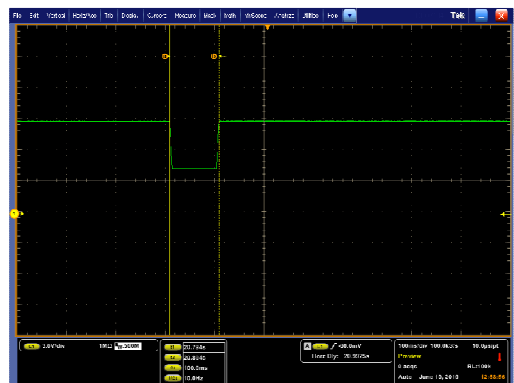


Fig.R02.5 Oscilloscope Waveform

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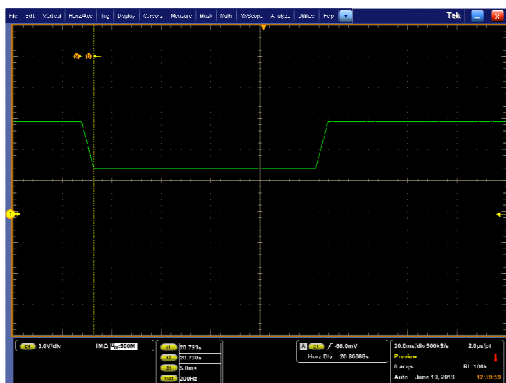


Fig.R02.6 Oscilloscope Waveform

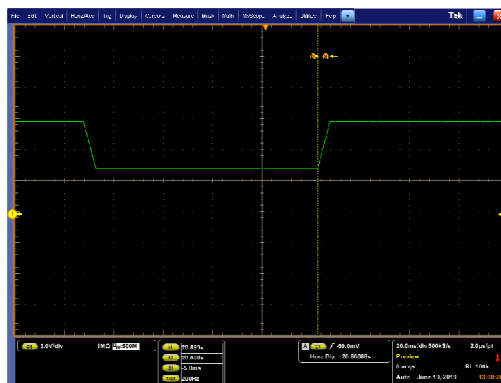


Fig.R02.7 Oscilloscope Waveform

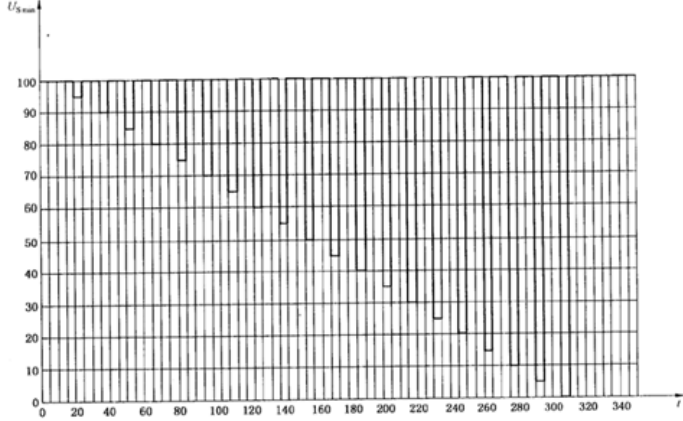
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R03. Reset behaviour at voltage drop

Sample No.	A1			
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.6			
Test Method	<p>Decrease the supply voltage by 5 % from the minimum supply voltage, $U_{smin}=9\text{ V}$ to $0.95 U_{smin}$, Hold this voltage for 5 s. Then raise the voltage to U_{smin}, hold for 10 s and perform a functional test. Then decrease the voltage to $0.9 U_{smin}$, etc. Continue with steps of 5% of U_{smin} until the lower value has reached to 0 V. Then raise the voltage to U_{smin} again.</p> <p>Test schematic photo:</p>  <p>U_{smin}— Minimum supply voltage, %; t—Time, seconds.</p>			
Acceptance Criteria	The functional status shall be minimum class C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.			
Deviation	/			
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the C-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Bipolar Power Supply	JSDYQ-74	2018/11/05~2019/11/04
2	Digital Phosphoroscope	JSDYQ-94	2018/11/05~2019/11/04	
Remarks	/			
Sample and Test Pictures				

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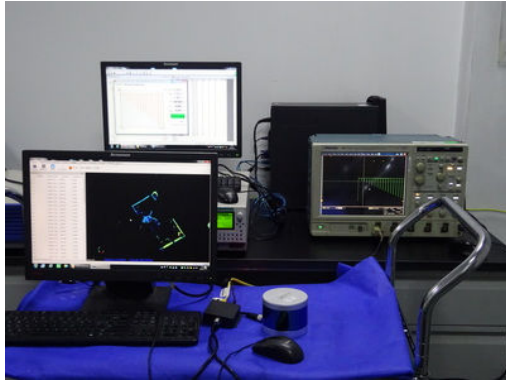


Fig.R03.1 During the test



Fig.R03.2 After the test

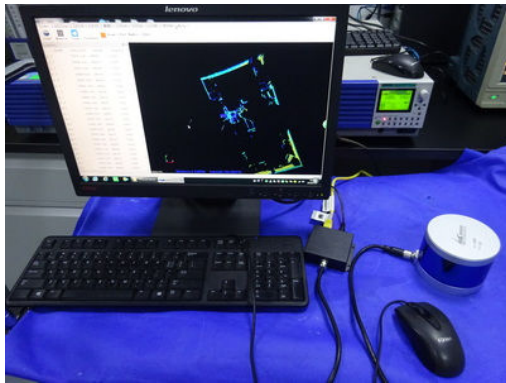


Fig.R03.3 After the test normal function



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Test Curves

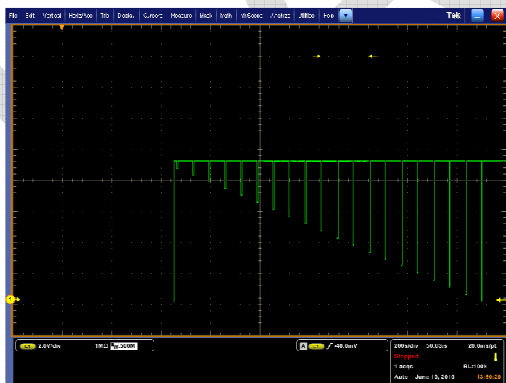


Fig.R03.4 Oscilloscope Waveform

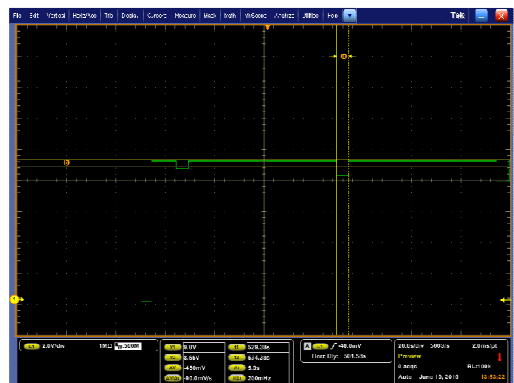


Fig.R03.5 Oscilloscope Waveform

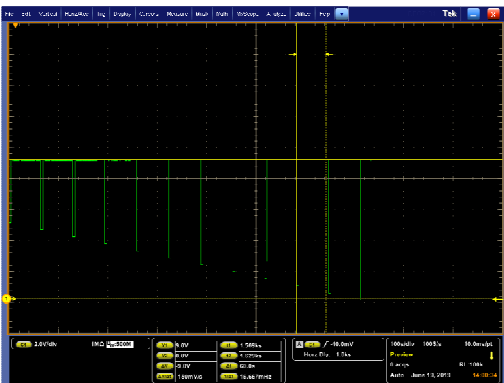
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<p>Fig.R03.6 Oscilloscope Waveform</p>	

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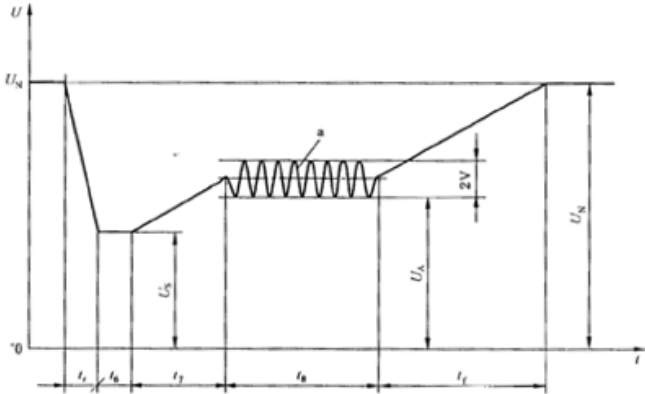
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R04. Starting profile

Sample No.	A1																																																																																			
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.6.3																																																																																			
Test Method	<p>The sample is energized according to the start-up characteristic parameters given in the figure and table. A total of 10 tests are performed with an interval of 1 s~2 s between each cycle. The starting voltage curve is as follows:</p>  <p>Test parameters as below:</p> <table border="1" data-bbox="836 1310 1390 1825"> <thead> <tr> <th colspan="5">Level/Voltage/Duration</th> <th rowspan="2">Tolerance</th> </tr> <tr> <th>I</th> <th>II</th> <th>III</th> <th>IV</th> <th></th> </tr> </thead> <tbody> <tr> <td>$U_S = 8\text{ V}$</td> <td>$U_S = 4.5\text{ V}$</td> <td>$U_S = 3\text{ V}$</td> <td>$U_S = 6\text{ V}$</td> <td></td> <td rowspan="2">+0.2 V</td> </tr> <tr> <td>$U_A = 9.5\text{ V}$</td> <td>$U_A = 6.5\text{ V}$</td> <td>$U_A = 5\text{ V}$</td> <td>$U_A = 6.5\text{ V}$</td> <td></td> </tr> <tr> <td colspan="5">$t_r = 5\text{ ms}$</td> <td rowspan="3">±10%</td> </tr> <tr> <td colspan="5">$t_b = 15\text{ ms}$</td> </tr> <tr> <td colspan="5">$t_7 = 50\text{ ms}$</td> </tr> <tr> <td rowspan="2">Code</td> <td colspan="2">Voltage V</td> <td>$t_8 = 1\text{ s}$</td> <td>$t_8 = 10\text{ s}$</td> <td>$t_8 = 1\text{ s}$</td> <td>$t_8 = 10\text{ s}$</td> <td rowspan="2">Functional status</td> <td rowspan="5">—</td> </tr> <tr> <td>$U_{S\text{ min}}$</td> <td>$U_{S\text{ max}}$</td> <td>$t_t = 40\text{ ms}$</td> <td>$t_t = 100\text{ ms}$</td> <td>$t_t = 100\text{ ms}$</td> <td>$t_t = 100\text{ ms}$</td> </tr> <tr> <td>A</td> <td>6</td> <td>16</td> <td>A</td> <td>B</td> <td>B</td> <td>A</td> </tr> <tr> <td>B</td> <td>8</td> <td>16</td> <td>A</td> <td>B</td> <td>C</td> <td>B</td> </tr> <tr> <td>C</td> <td>9</td> <td>16</td> <td>B</td> <td>C</td> <td>C</td> <td>C</td> </tr> <tr> <td>D</td> <td>10.5</td> <td>16</td> <td>B</td> <td>C</td> <td>C</td> <td>C</td> </tr> </tbody> </table>			Level/Voltage/Duration					Tolerance	I	II	III	IV		$U_S = 8\text{ V}$	$U_S = 4.5\text{ V}$	$U_S = 3\text{ V}$	$U_S = 6\text{ V}$		+0.2 V	$U_A = 9.5\text{ V}$	$U_A = 6.5\text{ V}$	$U_A = 5\text{ V}$	$U_A = 6.5\text{ V}$		$t_r = 5\text{ ms}$					±10%	$t_b = 15\text{ ms}$					$t_7 = 50\text{ ms}$					Code	Voltage V		$t_8 = 1\text{ s}$	$t_8 = 10\text{ s}$	$t_8 = 1\text{ s}$	$t_8 = 10\text{ s}$	Functional status	—	$U_{S\text{ min}}$	$U_{S\text{ max}}$	$t_t = 40\text{ ms}$	$t_t = 100\text{ ms}$	$t_t = 100\text{ ms}$	$t_t = 100\text{ ms}$	A	6	16	A	B	B	A	B	8	16	A	B	C	B	C	9	16	B	C	C	C	D	10.5	16	B	C	C	C
Level/Voltage/Duration					Tolerance																																																																															
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Code	Voltage V		$t_8 = 1\text{ s}$	$t_8 = 10\text{ s}$	$t_8 = 1\text{ s}$	$t_8 = 10\text{ s}$	Functional status	—																																																																												
	$U_{S\text{ min}}$	$U_{S\text{ max}}$	$t_t = 40\text{ ms}$	$t_t = 100\text{ ms}$	$t_t = 100\text{ ms}$	$t_t = 100\text{ ms}$																																																																														
A	6	16	A	B	B	A																																																																														
B	8	16	A	B	C	B																																																																														
C	9	16	B	C	C	C																																																																														
D	10.5	16	B	C	C	C																																																																														
Acceptance Criteria	During the working period, the functional status shall be minimum class A, that is, during the test and after the test, when the sample is in the working stage, the function is normal and the radar imaging is normal.																																																																																			

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Deviation	/			
Test Results	Sample's work voltage is 9 V~36 V, according to the clients, choose Level I; Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the A-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Bipolar Power Supply	JSDYQ-74	2018/11/05~2019/11/04
	2	Digital Phosphoroscope	JSDYQ-94	2018/11/05~2019/11/04
Remarks	/			

Sample and Test Pictures



Fig.R04.1 During the test



Fig.R04.2 After the test



Fig.R04.3 After the test normal function

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Test Curves

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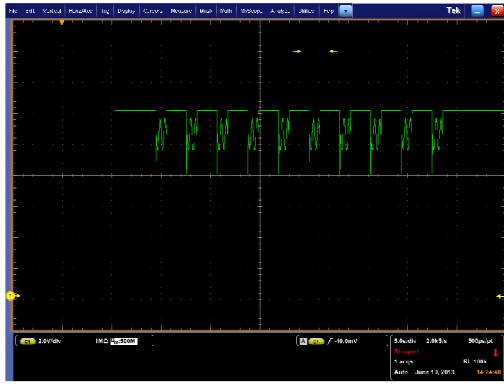


Fig.R04.4 Oscilloscope Waveform

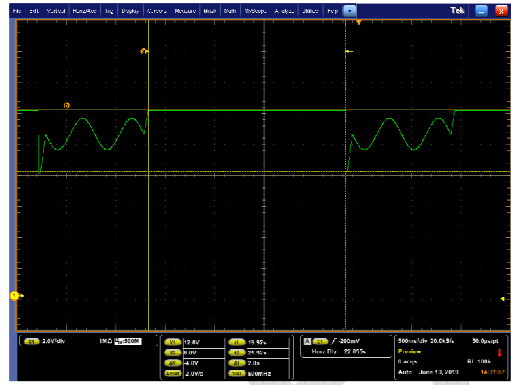


Fig.R04.5 Oscilloscope Waveform

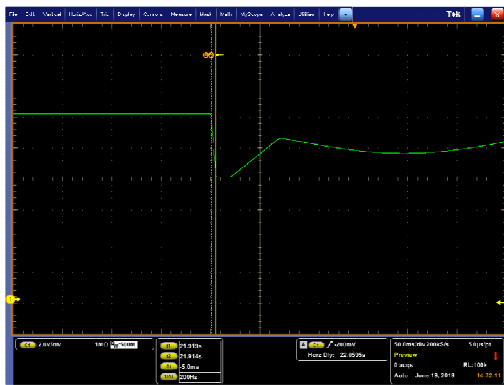


Fig.R04.6 Oscilloscope Waveform

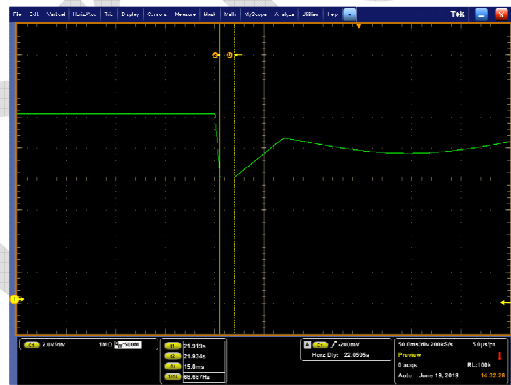


Fig.R04.7 Oscilloscope Waveform

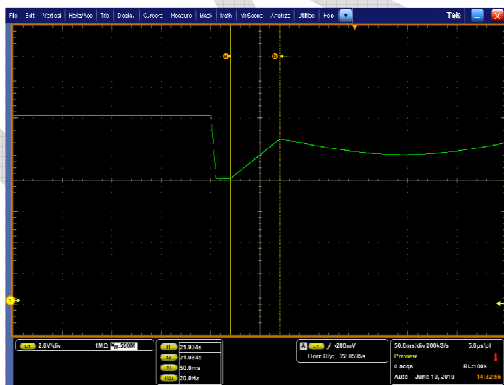


Fig.R04.8 Oscilloscope Waveform

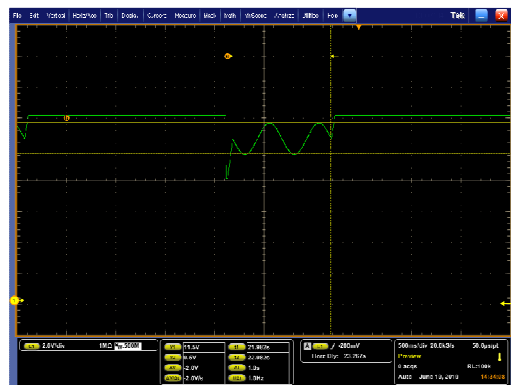


Fig.R04.9 Oscilloscope Waveform

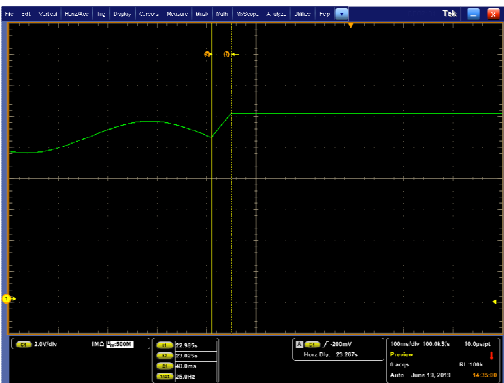
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	<p>/</p>
<p>Fig.R04.10 Oscilloscope Waveform</p>	<p>/</p>

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R05. Open circuit tests - single line interruption

Sample No.	A1			
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.9.1			
Test Method	<p>Connect and operate the sample as intended. The power supply voltage is 12 V DC. Open one circuit of the sample interface, then restore the connection.</p> <p>Repeat the test for each circuit of the sample.;</p> <p>Test conditions are as follows:</p> <p>Interruption time: (10±1) s;</p> <p>Open circuit resistance≥10 MΩ.</p>			
Acceptance Criteria	The functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.			
Deviation	/			
Test Results	Test process:			
	Step	Test results	Step	Test results
	1	White line disconnected, radar imaging is normal.	5	Orange line disconnected, radar imaging is normal.
	2	Black line disconnected, radar imaging is stuck, after reconnected, function is normal again.	6	Yellow line disconnected, radar imaging is normal.
	3	Blue line disconnected, radar imaging is stuck, after reconnected, function is normal again.	7	Light blue line disconnected, radar imaging is stuck, after reconnected, function is normal again.
	4	Light orange line disconnected, radar imaging is normal.	8	Red line disconnected, radar imaging is stuck, after reconnected, function is normal again.
	Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the C-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Programmable DC Power Supply	JSDYQ-112	2018/08/06~2020/08/05
Remarks	/			

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Sample and Test Pictures

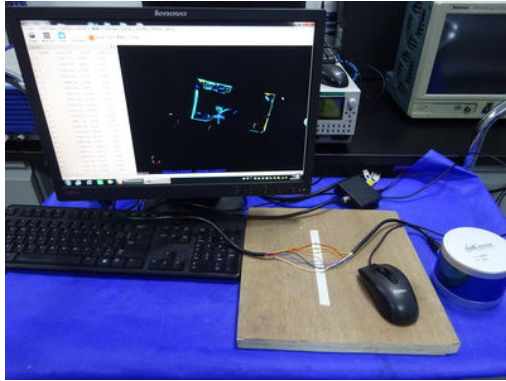


Fig.R05.1 During the test

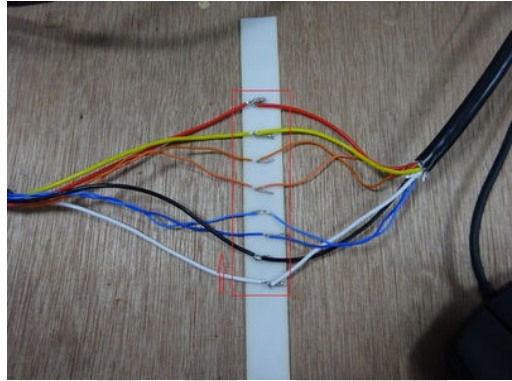


Fig.R05.2 During the test Disconnection sequence

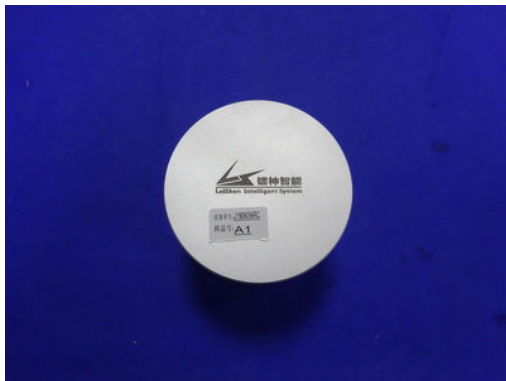


Fig.R05.3 After the test

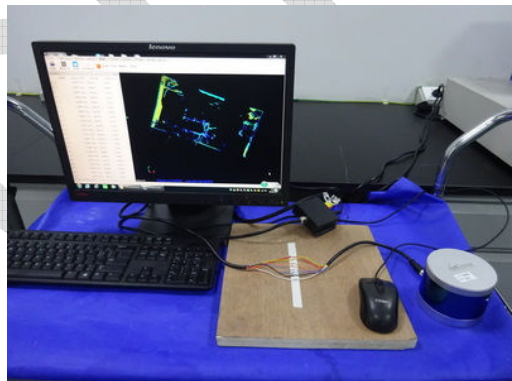


Fig.R05.4 After the test normal function

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R06. Short circuit protection

Sample No.	A1				
Refer Specs	GB/T 28046.2-2011 Road vehicles-Environmental conditions and testing for electrical and electronic equipment-Part 2: Electrical loads 4.10.2				
Test Method	The 8-core cable is defined as follows:				
	SN	Cable color and specifications	Definition	Description	Quantity
	1	Red(22 AWG)	VCC	Positive power supply	1
	2	Light blue(26 AWG)	TD_P	Positive Ethernet transmitter differential	1
	3	Blue(26 AWG)	TD_N	Negative Ethernet transmitter differential	1
	4	Light orange(26 AWG)	RD_P	Positive Ethernet receiver differential	1
	5	Orange(26 AWG)	RD_N	Negative Ethernet receiver differential	1
	6	Yellow(26 AWG)	GPS_Rec	GPS timing receiving	1
	7	White(26 AWG)	GPS_PPS	GPS timing and synchronization clock	1
	8	Black(22 AWG)	GND	Negative power supply (GND)	1
	Connect all relevant inputs and outputs of the sample in sequence for duration of(60 ± 6) s to Usmax=36 V DC and to ground. All other inputs and outputs remain open or as agreed upon.				
	The test is carried out in the following order: 1. Connected supply voltage and the ground terminals: --- Activate output; --- Stop output. 2. Cut the power. 3. Cut the ground.				
Acceptance Criteria	The functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.				
Deviation	/				
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the C-level requirement.				

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Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
		1	Programmable DC Power Supply	JSDYQ-78

Remarks /

Sample and Test Pictures

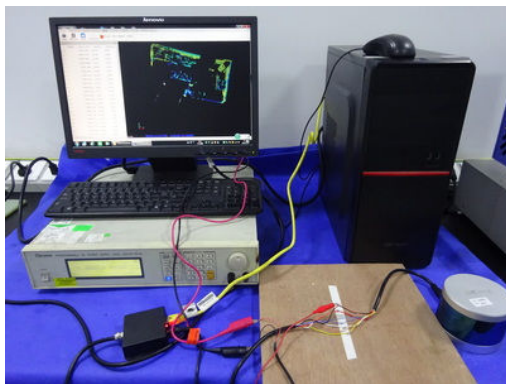


Fig.R06.1 During the test

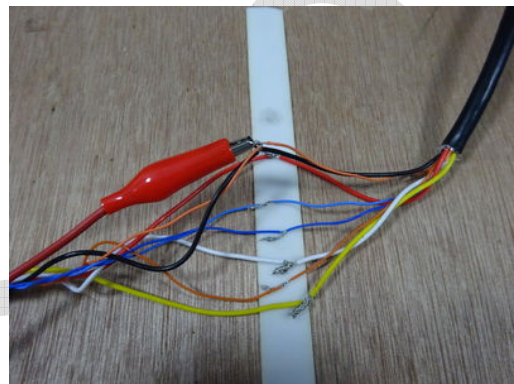


Fig.R06.2 During the test

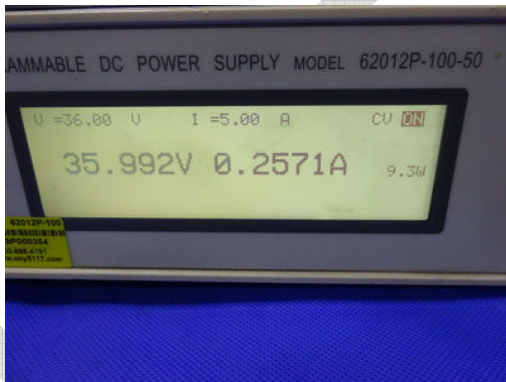


Fig.R06.3 During the test Activate output

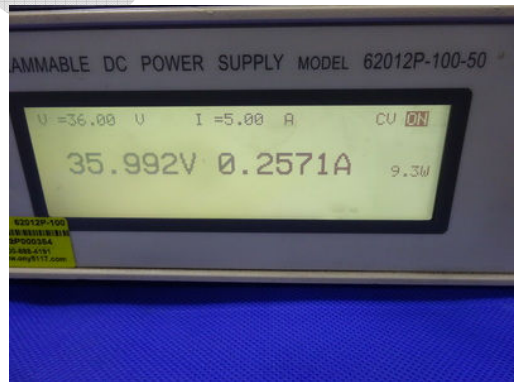


Fig.R06.4 During the test Stop output

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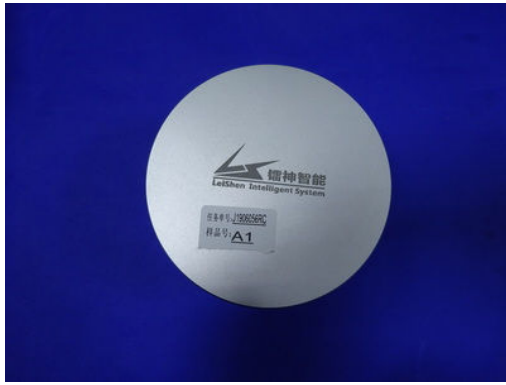


Fig.R06.5 After the test

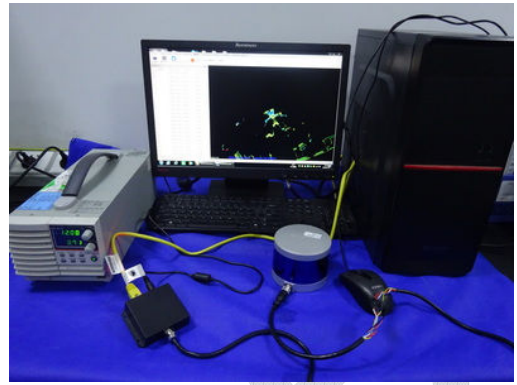


Fig.R06.6 After the test normal function

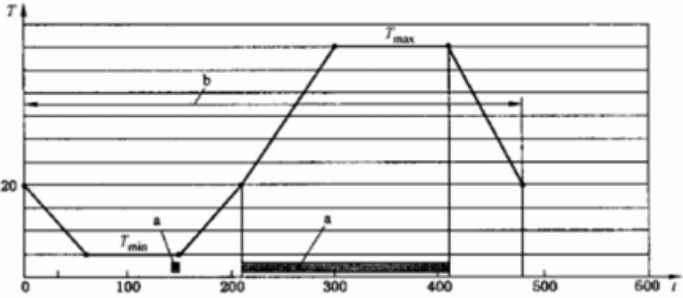
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R07. Random vibration test

Sample No.	B1																									
Refer Specs	GB/T 28046.3-2011 Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 3: Mechanical loads 4.1.2.7																									
Test Method	Temperature condition Temperature range: (-20~60) °C; One cycle of temperature and humidity change as below:																									
	<table border="1"> <thead> <tr> <th>Step</th> <th>Time(min)</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td>20</td></tr> <tr><td>2</td><td>60</td><td>-20</td></tr> <tr><td>3</td><td>150</td><td>-20</td></tr> <tr><td>4</td><td>210</td><td>20</td></tr> <tr><td>5</td><td>300</td><td>60</td></tr> <tr><td>6</td><td>410</td><td>60</td></tr> <tr><td>7</td><td>480</td><td>20</td></tr> </tbody> </table>	Step	Time(min)	Temperature(°C)	1	0	20	2	60	-20	3	150	-20	4	210	20	5	300	60	6	410	60	7	480	20	
	Step	Time(min)	Temperature(°C)																							
1	0	20																								
2	60	-20																								
3	150	-20																								
4	210	20																								
5	300	60																								
6	410	60																								
7	480	20																								
Temperature change and power on cycle curve:  <p> t—Time, min; T—Temperature, °C; a— Mode 3.2; b— one cycle. </p> <p>In the period of work mode 3.2, after the whole device temperature reaches -20 °C, the sample is energized, the function of the sample is checked and temperature is 12 V DC between the 210 min and the 410 min in a single temperature cycle, the sample is not energized for the rest of the time.</p> <p>Vibration condition</p>																										

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	Frequency range: (10~2000) Hz; Spectral density as below:			
	Frequency(Hz)		Spectral density $[(m/s^2)^2/Hz]$	
	10		18	
	20		36	
	30		36	
	180		1	
	2000		1	
RMS=57.9 m/s ²				
Test time: 8 h/axis; Test axis: X axis、Y axis、Z axis; After the test, check appearance and function.				
Acceptance Criteria	<p>1. During the work mode 3.2, the functional status shall be A, that is, during the test and after the test, the radar imaging is normal;</p> <p>2. Under other work mode, the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal;</p> <p>3. After the test, sample's cracks are not allowed.</p>			
Deviation	According to the customer's request, the test duration of each axial direction is 8 h, which is different from the standard requirements.			
Test Results	<p>During the test, under work mode 3.2, function is normal and the radar imaging is normal;</p> <p>Under work mode 3.2, sample satisfies the A-level requirement, under other work mode, sample satisfies the C-level requirement;</p> <p>Visual inspection on the sample after the test, no cracks on appearance.</p>			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	High Frequency Vibration Test Machine	VB-XK00-06	2019/05/06~2020/05/05
	2	Combined Test Chamber	HT-HK00-09	2019/05/30~2020/05/29
	3	Programmable DC Power Supply	JSDYQ-119	2018/11/05~2020/11/04
Remarks	According to the customer's request, high temperature is 60 °C.			

Sample and Test Pictures



Fig.R07.1 Before the test



Fig.R07.2 X axis

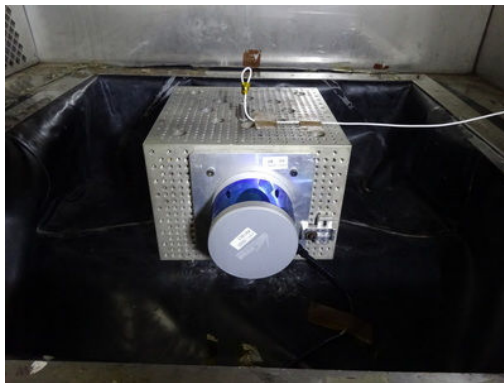


Fig.R07.3 Y axis

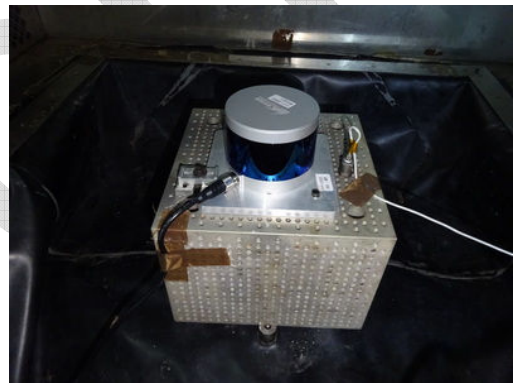


Fig.R07.4 Z axis

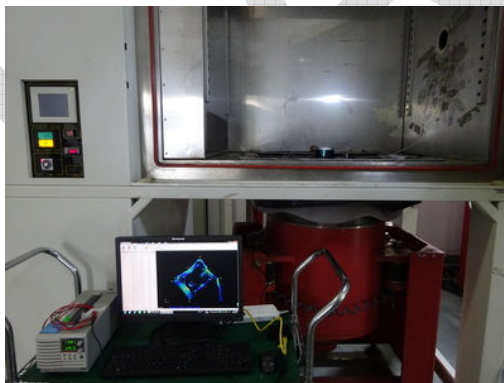


Fig.R07.5 During the test setup schematic photo

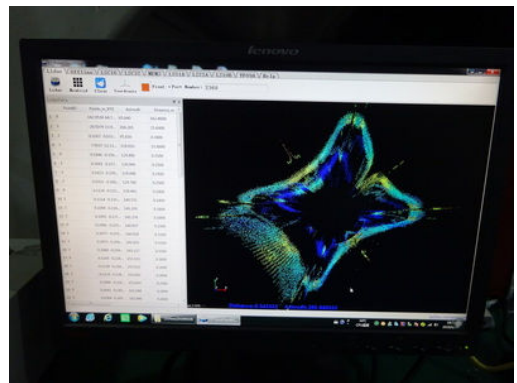


Fig.R07.6 During the test(under mode 3.2) normal function



Fig.R07.7 After the test

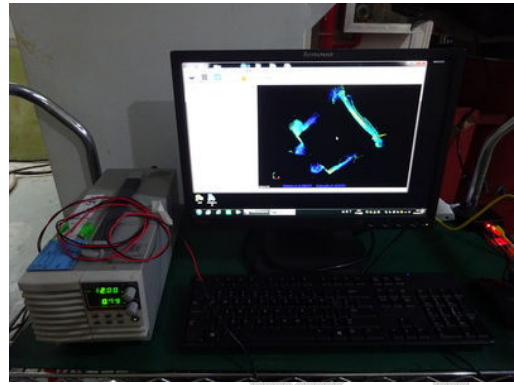


Fig.R07.8 After the test normal function

Test Curves

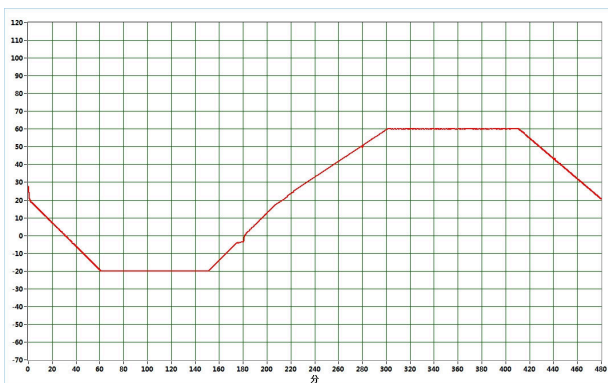


Fig.R07.9 Curves of temperature X axis

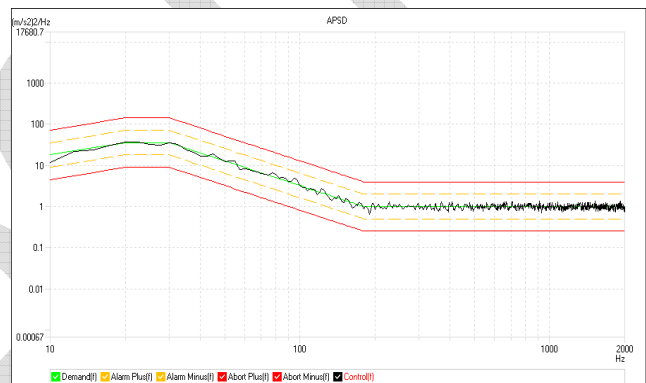


Fig.R07.10 Curves of vibration X axis

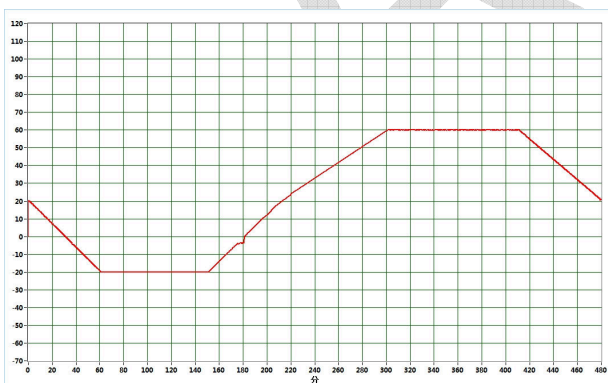


Fig.R07.11 Curves of temperature Y axis



Fig.R07.12 Curves of vibration Y axis

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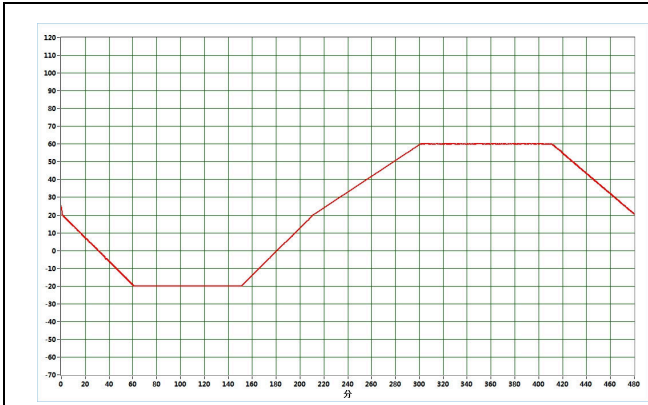


Fig.R07.13 Curves of temperature Z axis



Fig.R07.14 Curves of vibration Z axis

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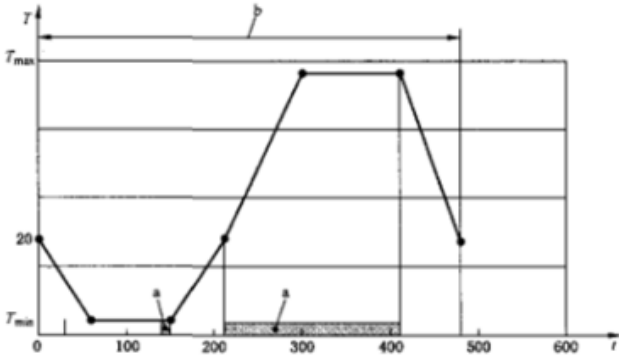
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R08. Temperature cycle with specified change rate

Sample No.	C1																
Refer Specs	GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads 5.3.1 Table 2																
Test Method	Temperature condition Temperature range: (-20~60) °C; One cycle of temperature and humidity change as below:																
	<table border="1"> <thead> <tr> <th>Time(min)</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr><td>0</td><td>20</td></tr> <tr><td>60</td><td>-20</td></tr> <tr><td>150</td><td>-20</td></tr> <tr><td>210</td><td>20</td></tr> <tr><td>300</td><td>60</td></tr> <tr><td>410</td><td>60</td></tr> <tr><td>480</td><td>20</td></tr> </tbody> </table>	Time(min)	Temperature(°C)	0	20	60	-20	150	-20	210	20	300	60	410	60	480	20
	Time(min)	Temperature(°C)															
0	20																
60	-20																
150	-20																
210	20																
300	60																
410	60																
480	20																
Temperature change and power on cycle curve:  <p>T—Temperature, °C; t—Time, min; a— Mode 3.2; b— 1 cycle.</p> <p>In the period of work mode 3.2, after the whole device temperature reaches -20 °C, the sample is energized, the function of the sample is checked and temperature is 12 V DC between the 210 min and the 410 min in a single temperature cycle, the sample is not energized for the rest of the time;</p>																	

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	Test cycle: 30 cycles; After the test, check appearance and function.			
Acceptance Criteria	1. During the work mode 3.2, the functional status shall be A, that is, during the test and after the test, the radar imaging is normal; 2. Under other work mode, the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal; 3. After the test, sample's cracks are not allowed.			
Deviation	/			
Test Results	During the test, under work mode 3.2, function is normal and the radar imaging is normal; Under work mode 3.2, sample satisfies the A-level requirement, under other work mode, sample satisfies the C-level requirement; Visual inspection on the sample after the test, no cracks on appearance.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Temperature and Humidity Test Chamber	HT-GW00-16	2018/11/15~2019/11/14
	2	Programmable DC Power Supply	JSDYQ-112	2018/08/06~2020/08/05
Remarks	According to the customer's request, high temperature is 60 °C.			
Sample and Test Pictures				
				
Fig.R08.1 Before the test		Fig.R08.2 Before the test normal function		

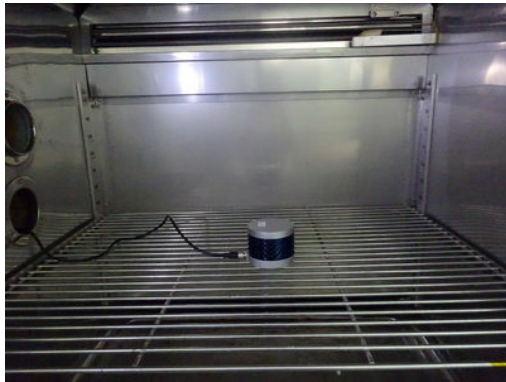


Fig.R08.3 During the test

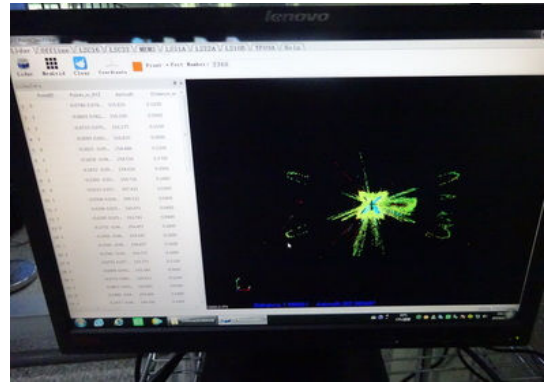


Fig.R08.4 During the test(under mode 3.2) normal function

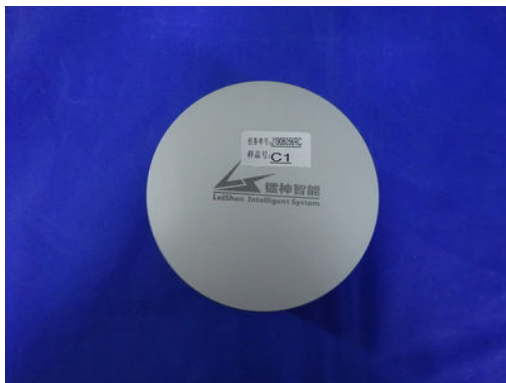


Fig.R08.5 After the test



Fig.R08.6 After the test normal function

Test Curves

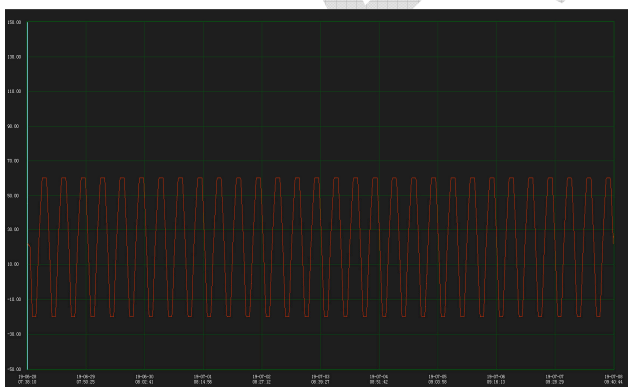


Fig.R08.7 Curves of temperature

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R09. Rapid change in temperature with specified transition duratin

Sample No.	D1			
Refer Specs	GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads 5.3.2			
Test Method	During the test, under mode 1.1, that is, sample is not connected to the harness and is not powered; Temperature range: (-20~60) °C; Dwell time: 20 min; Transfer time: ≤10 s; Test cycle: 100 cycles; After the test, check appearance and function.			
Acceptance Criteria	No abnormalities on appearance, the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.			
Deviation	/			
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the C-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Thermal Shock Test Chamber	TS-FQ00-03	2019/02/10~2020/02/09
Remarks	According to the customer's request, high temperature is 60 °C.			

Sample and Test Pictures

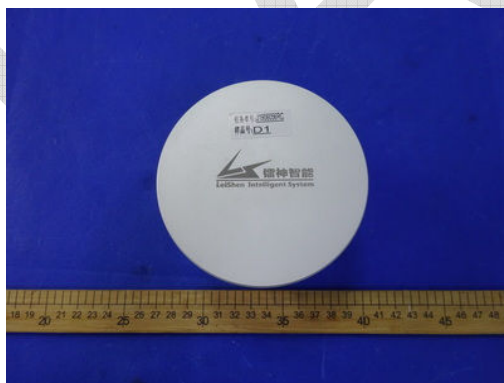


Fig.R09.1 Before the test

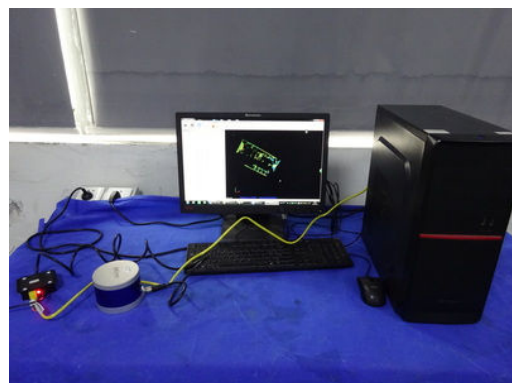


Fig.R09.2 Before the test normal function

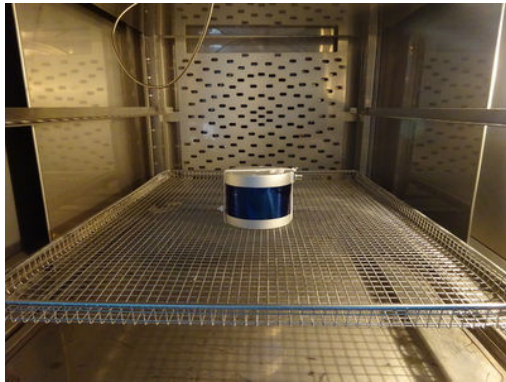


Fig.R09.3 During the test

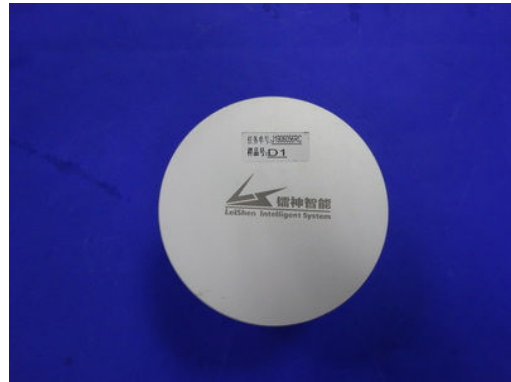


Fig.R09.4 After the test

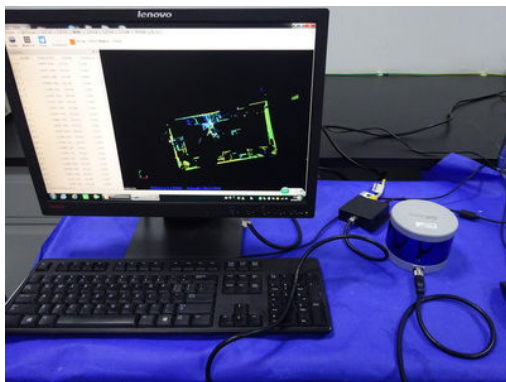
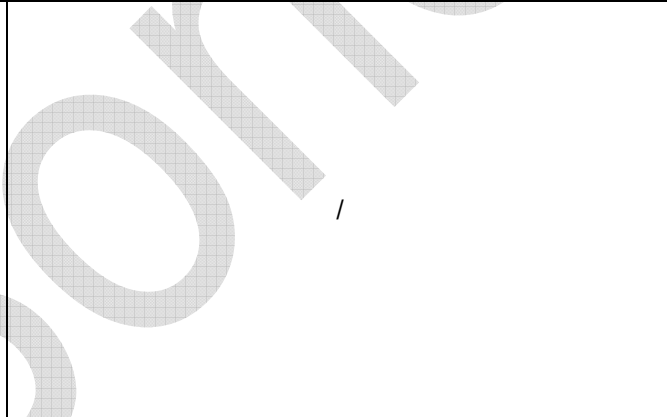


Fig.R09.5 After the test normal function



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Test Curves

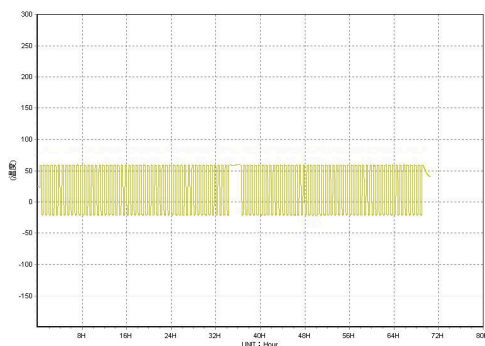


Fig.R09.6 Curves of temperature

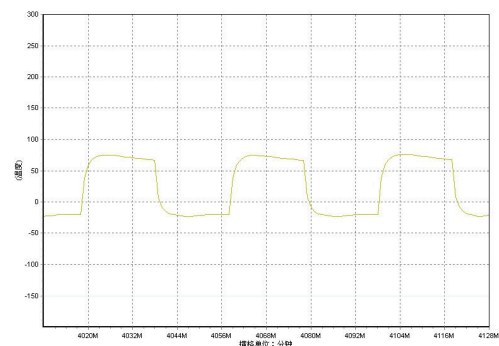


Fig.R09.7 Curves of temperature(amplification)

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R10. Damp heat, stead-state test

Sample No.	D1			
Refer Specs	GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads 5.7			
Test Method	During the test, under mode 3.2, that is, sample is connected to the harness power on with 12 V DC; Temperature range: 45 °C; Humidity: 85% RH; Test time: 96 h; After the test, check appearance and function.			
Acceptance Criteria	No abnormalities on appearance, the functional status shall be A, that is, during and after the test, the sample function is normal and the radar imaging is normal.			
Deviation	According to the customer's request, test time is 96 h; During the test, use work mode 3.2, and request sample satisfies the A-level requirement, which is different from standard requirements.			
Test Results	During the test, samples function is normal, and the radar imaging is normal; Visual inspection on the sample after the test, no abnormalities on appearance, function satisfies the A-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Temperature and Humidity Test Chamber	HT-GW00-17	2018/11/05~2019/11/04
Remarks	/			

Sample and Test Pictures



Fig.R10.1 During the test

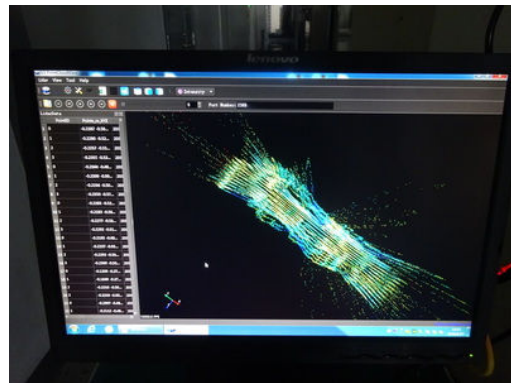


Fig.R10.2 During the test normal function


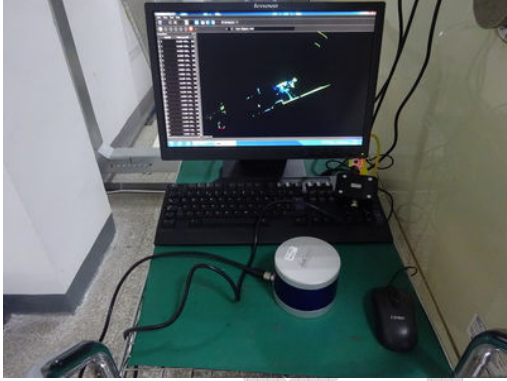
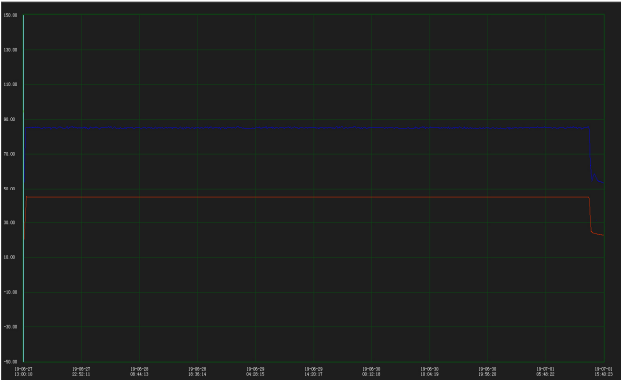
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<p>Fig.R10.3 After the test</p>	<p>Fig.R10.4 After the test normal function</p>
<p>Test Curves</p>	
	<p>/</p>
<p>Fig.R10.5 Curves of temperature</p>	<p>/</p>

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R11. Salt spray tests – corrosion test

Sample No.	E1
Refer Specs	<p>GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads 5.5.1</p> <p>GB/T 2423.18-2012 Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)</p>
Test Method	<p>During the test, under mode 1.2, that is, sample is connected to the harness and is not powered;</p> <p>One single cyclic method: 2 h salt spray + 22 h wet heat storage</p> <p>Salt spray test condition: NaCl mass percentage: (5±1) %; pH of the solution: 6.5~7.2; Temperature: 15 °C~35 °C; Settlement: (1~2) mL/(80 cm² · h); Test time: 2 h.</p> <p>Wet heat storage condition: Temperature: (40±2) °C; Humidity: (93±3)% RH; Test time: 22 h.</p> <p>Test cycle: 6 cycles.</p> <p>Sample cleaning after the test: After the test is completed, sample is placed in running tap water for 5 min, rinsed with deionized water, and the water bead is blown off with a gas stream, then dried at a temperature of (55 ± 2) °C for 1 h, at room temperature, cooling (1~2) h, the temperature of the cleaning water should not exceed 35 °C; After the test, check appearance and function, then check whether have salt solution inside the sample.</p>
Acceptance Criteria	<p>The sample has no change that will reduce the normal function (for example, the sealing function is normal, the signs and labels should be clearly visible), the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.</p>
Deviation	<p>According to the customer's request, choose Severe level 2 and test for 6 cycles, which is</p>

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	different from standard requirements.			
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance and no change that will reduce the normal function, function satisfies the C-level requirement; Disassemble the sample to check, no salt solution inside.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Cyclic Corrosion Test Chamber	SL-ATLS-04	2019/03/14~2020/03/13
	2	pH Meter	JSDYQ-133	2019/01/08~2020/01/07
	3	Oven	HT-BD00-33	2019/03/01~2020/02/29
Remarks	/			

Sample and Test Pictures

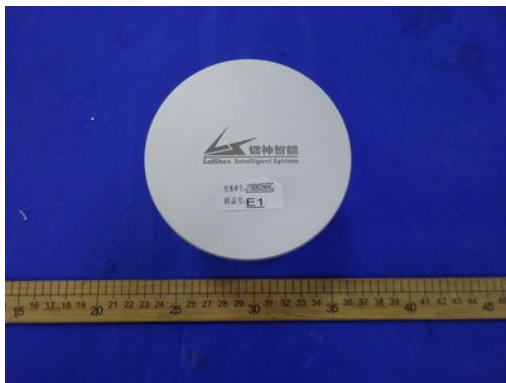


Fig.R11.1 Before the test

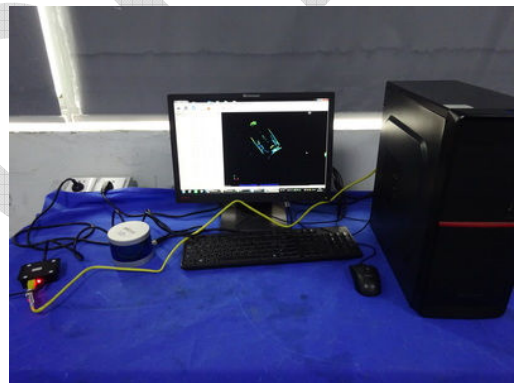


Fig.R11.2 Before the test normal function

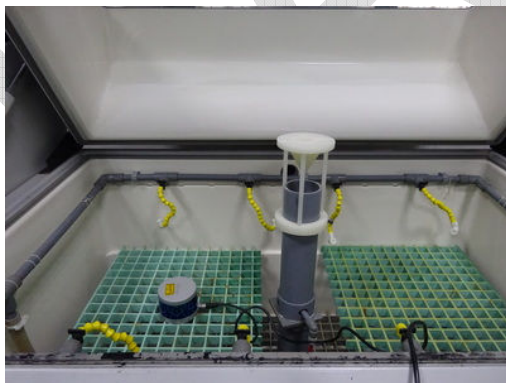


Fig.R11.3 During the test



Fig.R11.4 After the test(dry)


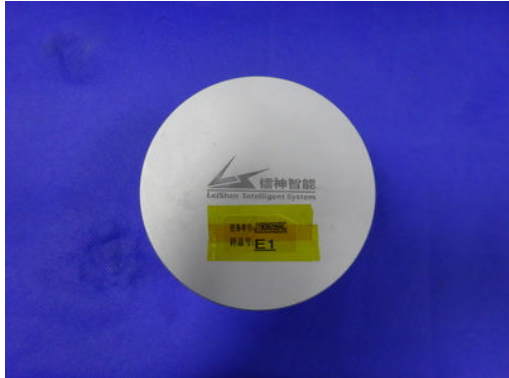
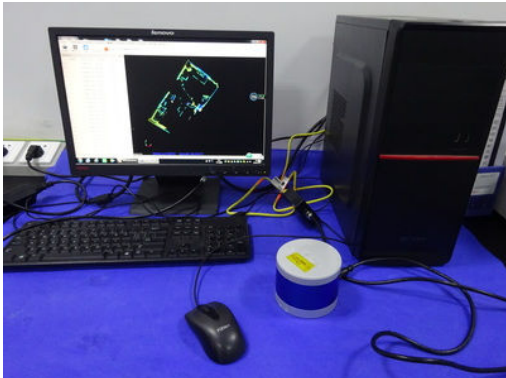


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<p>Fig.R11.5 After the test(dry) temperature</p>	<p>Fig.R11.6 After the test</p>
	
<p>Fig.R11.7 After the test normal function</p>	<p>Fig.R11.8 After the test no salt solution inside</p>
	<p style="text-align: center;">/</p>
<p>Fig.R11.9 After the test no salt solution inside</p>	<p style="text-align: center;">/</p>

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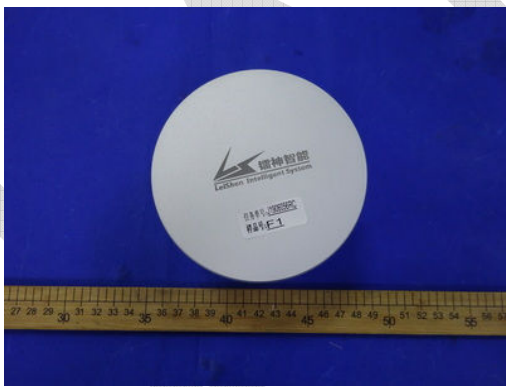
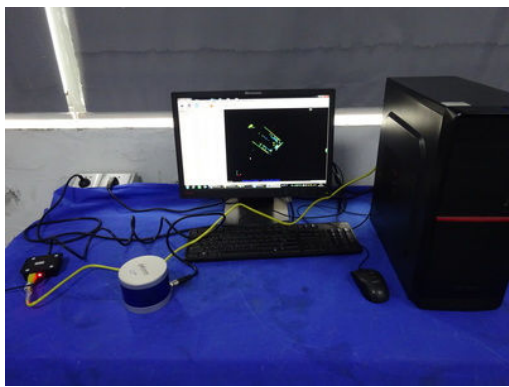
R12. Salt spray tests – leakage and function test

Sample No.	F1
Refer Specs	GB/T 28046.4-2011 Road vehicles - Environmental conditions and testing for electrical and electronic equipment - Part 4: Climatic loads 5.5.2
Test Method	<p>Between the 4 h and 5 h of a single test cycle, the sample is in work mode 3.2, that is, the sample is operated with 12 V DC voltage, and the remaining are in work mode 1.2, that is, the sample is connected to wire harness but not energized;</p> <p>One single cyclic method: 8 h salt spray + 16 h stop salt spray</p> <p>Salt spray test condition: NaCl mass percentage: (5±1) %; pH of the solution: 6.5~7.2; Temperature: (35±2) °C; Settlement: (1~2) mL/(h • 80 cm²); Test time: 8 h.</p> <p>Stop salt spray condition: Test time: 16 h.</p> <p>Test cycle: 6 cycles. Single test cycle and power cycle are as follows:</p> <div style="text-align: center;"> </div> <p>t—Time, h; a—Work mode 3.2; b—Work mode 1.2; c—Open(salt spray); d—Shut down (stop salt spray); e— one cycle.</p> <p>Treatment after the test: After the test, the sample is rinsed under running water for 5 min, then rinsed with deionized water and air-dried to remove water droplets. The temperature of the</p>

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	wash water should not exceed 35 °C. After the test, check appearance and function, then check whether have salt solution inside the sample.			
Acceptance Criteria	No abnormalities on appearance and no salt solution inside, under work mode 3.2, the functional status shall be A, that is, during and after the test, the sample function is normal and the radar imaging is normal.			
Deviation	/			
Test Results	During the test, under work mode 3.2, function is normal; Visual inspection on the sample after the test, no abnormalities on appearance, under work mode 3.2, function is normal, satisfies the A-level requirement; Disassemble the sample to check, no salt solution inside.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Salt Spray Test Chamber	SL-XK00-02	2018/08/06~2019/08/05
	2	pH Meter	JSDYQ-133	2019/01/08~2020/01/07
	3	Programmable DC Power Supply	JSDYQ-119	2018/11/05~2020/11/04
Remarks	/			
Sample and Test Pictures				
				
Fig.R12.1 Before the test		Fig.R12.2 Before the test normal function		

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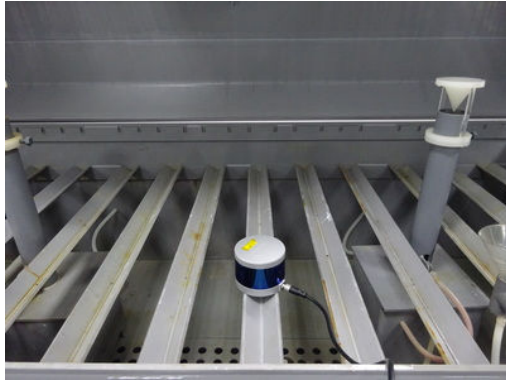


Fig.R12.3 During the test

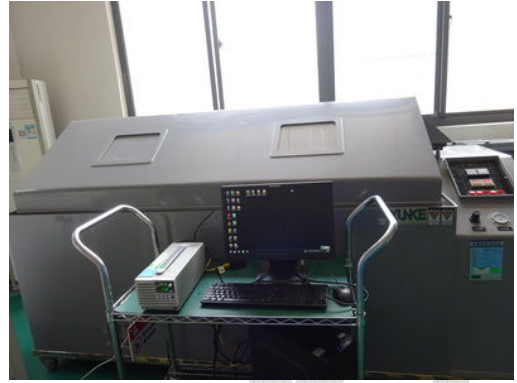


Fig.R12.4 During the test (power off)

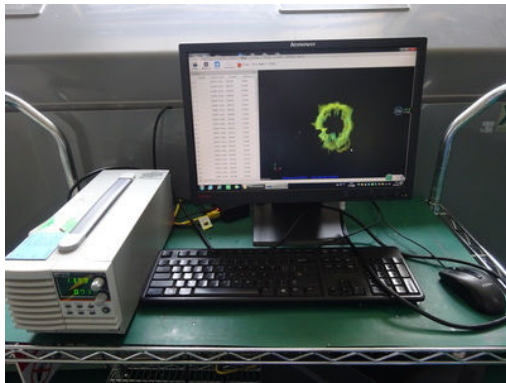


Fig.R12.5 During the test (power on)

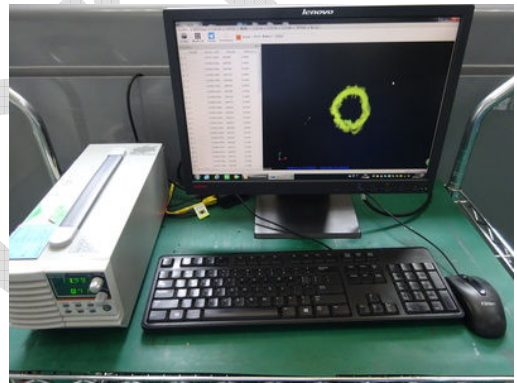


Fig.R12.6 During the test function check schematic photo

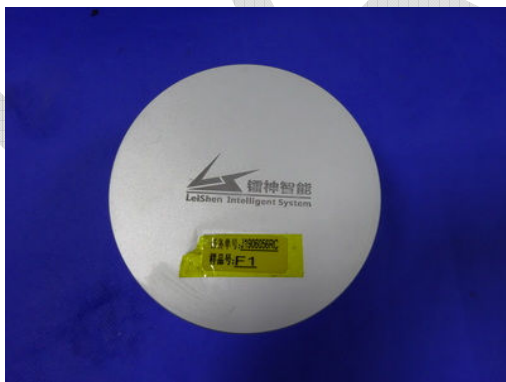


Fig.R12.7 After the test

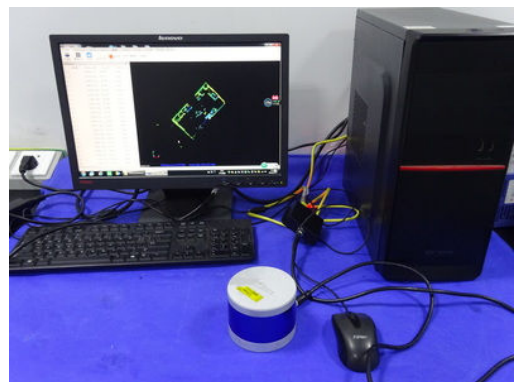


Fig.R12.8 After the test normal function

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Fig.R12.9 After the test no salt solution inside



Fig.R12.10 After the test no salt solution inside

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R13. IP6X

Sample No.	G1			
Refer Specs	GB/T 4208-2017 Degrees of protection (IP code)			
Test Method	<p>Condition 1: Prevent metal wires from approaching dangerous parts Push the test wire with a diameter of 1.0 mm and a length of 100 mm to the sample casing with a force of 1 N ± 0.1 N.</p> <p>Condition 2: Prevent solid foreign matter from entering Simulated dust: talcum powder; Dust usage: 2 kg/m³ ; Whether to pump: Yes(The pumping position is at the center of the top of the sample); Test time: 2 h; After the test, check appearance and then disassemble the sample to check whether have dust inside.</p>			
Acceptance Criteria	<p>Test wires with a diameter of 1.0 mm shall not enter the enclosure and maintain sufficient clearance from the live parts; No abnormalities on appearance and no obvious dust deposition inside.</p>			
Deviation	/			
Test Results	<p>During the test, test wires with a diameter of 1.0 mm does not enter the enclosure and maintain sufficient clearance from the live parts; Visual inspection on the sample after the test, no abnormalities on appearance; Disassemble the sample to check, no dust inside.</p>			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	IP Test Tool	IP-HT00-05	2019/03/22~2021/03/21
	2	Dust Chamber	IP-HK00-15	2019/03/01~2020/02/29
	3	Push/Pull Dynamometer	JSDYQ-14	2019/06/03~2021/06/02
	4	DC Power Supply	JSDYQ-53	2019/02/25~2020/02/24
Remarks	/			
Sample and Test Pictures				

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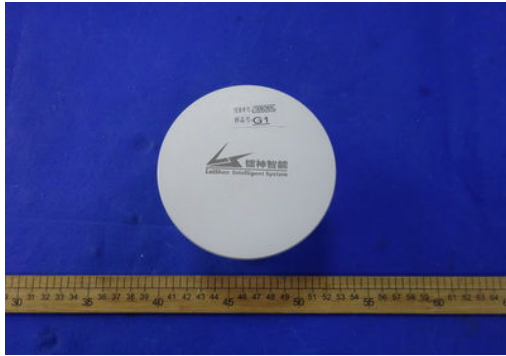


Fig.R13.1 Before the test



Fig.R13.2 Before the test normal function

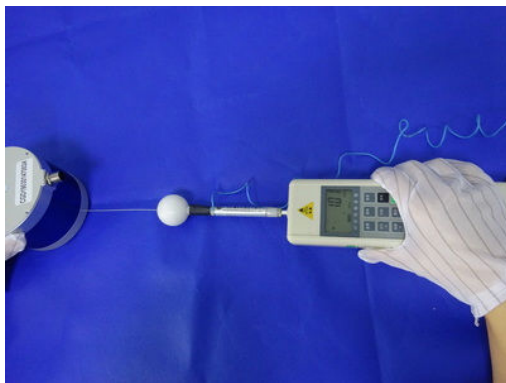


Fig.R13.3 During the test(Condition 1 schematic photo)

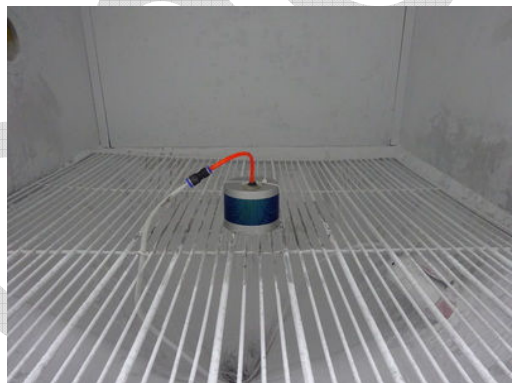


Fig.R13.4 During the test(Condition 2)



Fig.R13.5 After the test



Fig.R13.6 After the test no dust


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	/
Fig.R13.7 After the test no dust	/

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R14. IPX7

Sample No.	H1			
Refer Specs	GB/T 4208-2017 Degrees of protection (IP code)			
Test Method	The lowest point of the case with a height less than 850 mm, below the water surface distance: at least 1000 mm; Test time: 30 min; After the test, check appearance and function, then disassemble the sample to check whether have water inside.			
Acceptance Criteria	No abnormalities on appearance; If there is water inside, shall not affect the function of the sample, the radar imaging is normal.			
Deviation	/			
Test Results	Visual inspection on the sample after the test, no abnormalities on appearance, the radar imaging is normal. Disassemble the sample to check, no water inside.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	Waterproof Test Apparatus	IP-XK00-03	2019/06/03~2020/06/02
Remarks	/			

Sample and Test Pictures

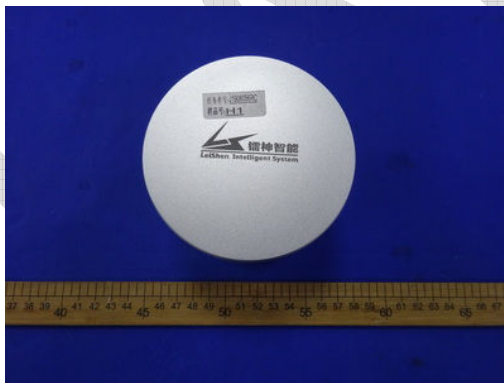


Fig.R14.1 Before the test

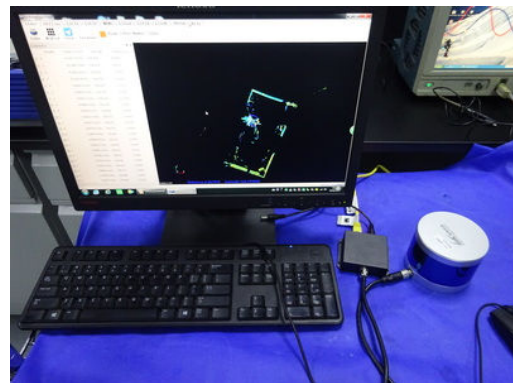


Fig.R14.2 Before the test normal function

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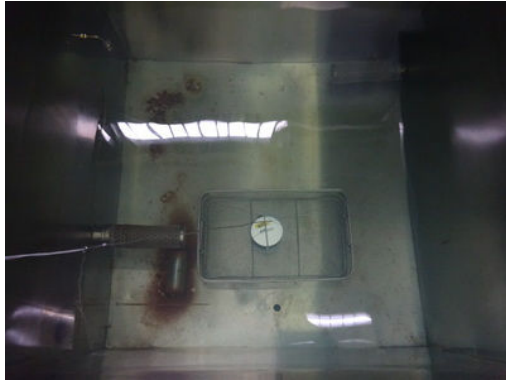


Fig.R14.3 During the test(Condition 1 schematic photo)



Fig.R14.4 After the test

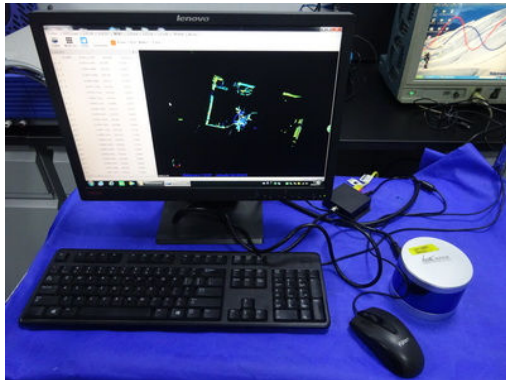


Fig.R14.5 After the test normal function



Fig.R14.6 After the test no water



Fig.R14.7 After the test no water

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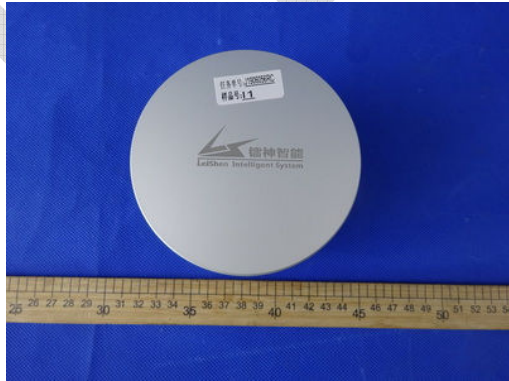
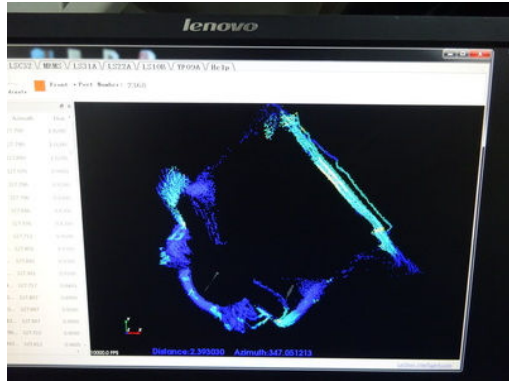
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R15. Bump test

Sample No.	I1			
Refer Specs	GB/T 28046.3-2011 Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 3: Mechanical loads 4.2.1 Impact severity 1			
Test Method	During the test, under work mode 1.2, that is, sample is connected to harness but power off; Wave form: Half sine; Acceleration: 50 g; Pulse width: 11 ms; No. of shock: 1000 shocks/face; Test position: 6 faces; After the test, check appearance and function.			
Acceptance Criteria	No mechanical damage, and the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal.			
Deviation	/			
Test Results	Visual inspection on the sample after the test, no mechanical damage on appearance, function satisfies the C-level requirement.			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	High Frequency Vibration Test Machine	VB-XK00-06	2019/05/06~2020/05/05
Remarks	/			

Sample and Test Pictures

	
Fig.R15.1 Before the test	Fig.R15.2 Before the test normal function

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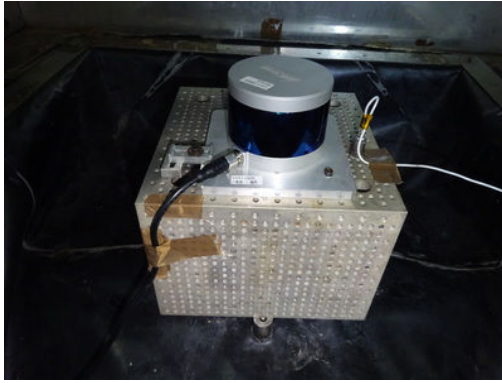


Fig.R15.3 Face 1, 3

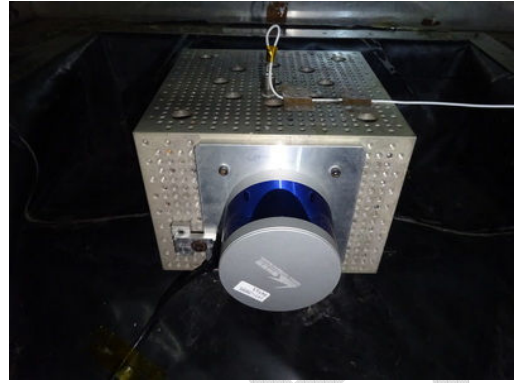


Fig.R15.4 Face 2, 4



Fig.R15.5 Face 5, 6



Fig.R15.6 After the test

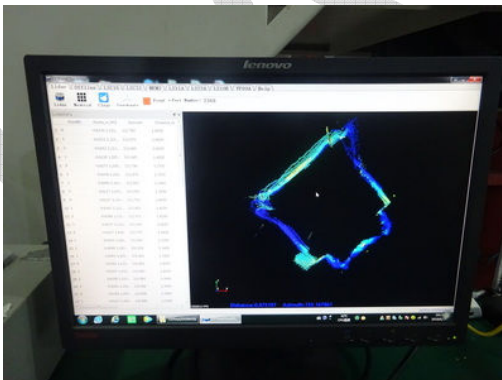


Fig.R15.7 After the test normal function

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Test Curves

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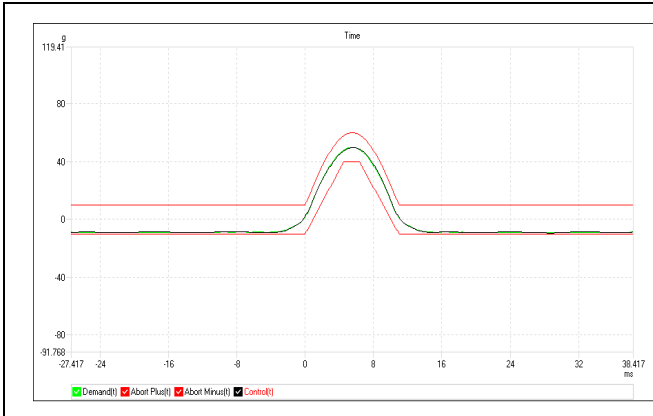


Fig.R15.8 Curves of bump Face 1

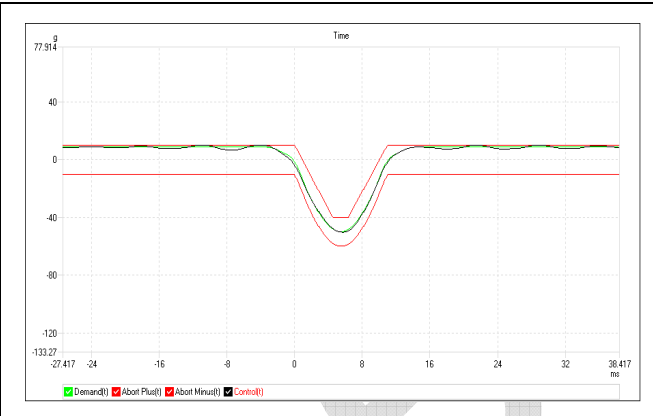


Fig.R15.9 Curves of bump Face 3

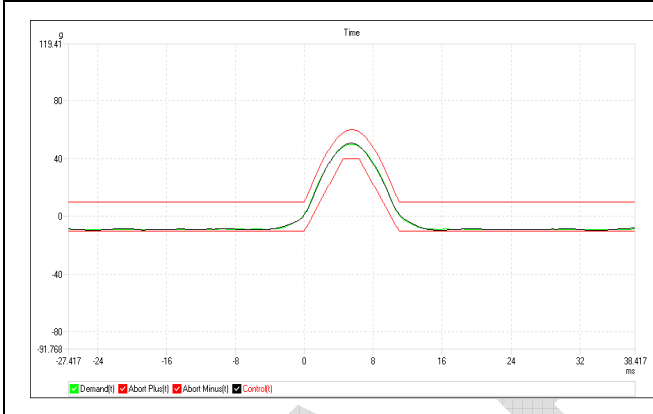


Fig.R15.10 Curves of bump Face 2

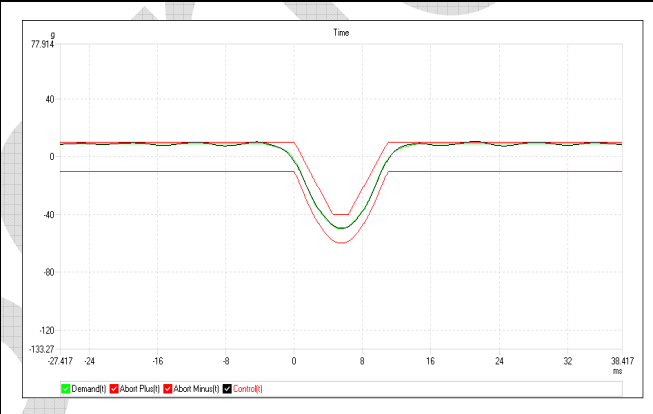


Fig.R15.11 Curves of bump Face 4

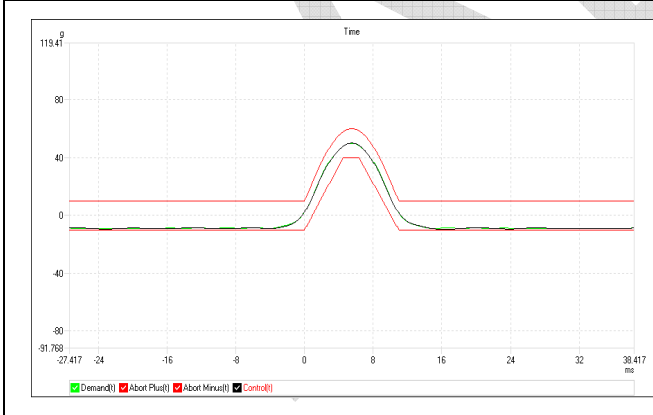


Fig.R15.12 Curves of bump Face 5

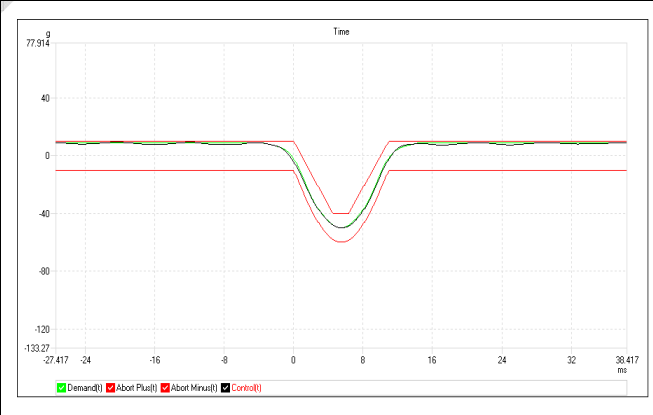


Fig.R15.13 Curves of bump Face 6

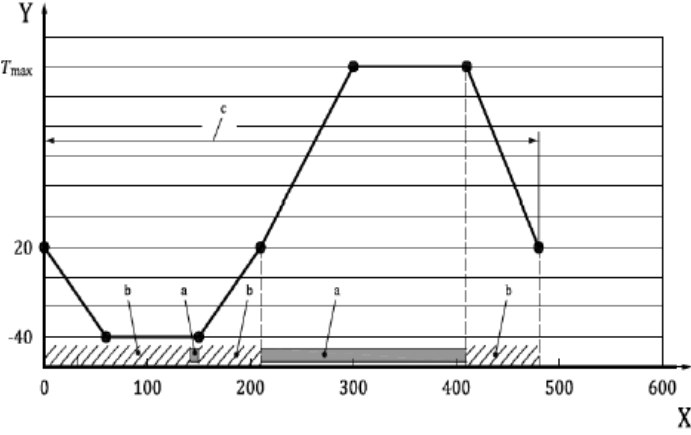
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R16. Vibration

Sample No.	I1																									
Refer Specs	GB/T 28046.3-2011 Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 3: Mechanical loads 4.1.2.4																									
Test Method	Temperature condition Temperature range: (-20~60) °C; One cycle of temperature and humidity change as below:																									
	<table border="1"> <thead> <tr> <th>Step</th> <th>Time(min)</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td>20</td></tr> <tr><td>2</td><td>60</td><td>-20</td></tr> <tr><td>3</td><td>150</td><td>-20</td></tr> <tr><td>4</td><td>210</td><td>20</td></tr> <tr><td>5</td><td>300</td><td>60</td></tr> <tr><td>6</td><td>410</td><td>60</td></tr> <tr><td>7</td><td>480</td><td>20</td></tr> </tbody> </table>	Step	Time(min)	Temperature(°C)	1	0	20	2	60	-20	3	150	-20	4	210	20	5	300	60	6	410	60	7	480	20	
	Step	Time(min)	Temperature(°C)																							
1	0	20																								
2	60	-20																								
3	150	-20																								
4	210	20																								
5	300	60																								
6	410	60																								
7	480	20																								
Temperature change and power on cycle curve:  <p>X—Time, min; Y—Temperature, °C; a— Mode 3.2, power on with 12 V DC; c— one cycle.</p> <p>In the period of work mode 3.2, after the whole device temperature reaches -20 °C, the sample is energized, the function of the sample is checked and temperature is 12 V DC between the 210 min and the 410 min in a single temperature cycle, the sample is not energized for the rest</p>																										

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	<p>of the time.</p> <p>Vibration condition Frequency range: (10~1000) Hz; Spectral density as below:</p> <table border="1" data-bbox="336 660 1465 1153"> <thead> <tr> <th>Frequency(Hz)</th> <th>Spectral density[(m/s²)²/Hz]</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>20</td> </tr> <tr> <td>55</td> <td>6.5</td> </tr> <tr> <td>180</td> <td>0.25</td> </tr> <tr> <td>300</td> <td>0.25</td> </tr> <tr> <td>360</td> <td>0.14</td> </tr> <tr> <td>1000</td> <td>0.14</td> </tr> <tr> <td colspan="2" style="text-align: center;">RMS=27.8 m/s²</td> </tr> </tbody> </table> <p>Test time: 8 h/axis; Test axis: X axis、Y axis、Z axis; After the test, check appearance and function.</p>				Frequency(Hz)	Spectral density[(m/s ²) ² /Hz]	10	20	55	6.5	180	0.25	300	0.25	360	0.14	1000	0.14	RMS=27.8 m/s ²	
Frequency(Hz)	Spectral density[(m/s ²) ² /Hz]																			
10	20																			
55	6.5																			
180	0.25																			
300	0.25																			
360	0.14																			
1000	0.14																			
RMS=27.8 m/s ²																				
<p>Acceptance Criteria</p>	<p>1. After the test, sample's cracks are not allowed, and during the work mode 3.2, the functional status shall be A, that is, during the test and after the test, the radar imaging is normal; 2. Under other work mode, the functional status shall be C, that is, during the test, one or more functions fail to meet the requirements is allowed, but required to automatically return to normal, and the radar imaging is normal;</p>																			
<p>Deviation</p>	<p>/</p>																			
<p>Test Results</p>	<p>During the test, under work mode 3.2, function is normal ; Under work mode 3.2, sample satisfies the A-level requirement, under other work mode, sample satisfies the C-level requirement; Visual inspection on the sample after the test, no cracks on appearance.</p>																			
<p>Test Instruments</p>	<table border="1"> <thead> <tr> <th>No.</th> <th>Equipment Name</th> <th>Equipment Number</th> <th>Calibration Due Date</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>High Frequency Vibration Test Machine</td> <td>VB-XK00-06</td> <td>2019/05/06~2020/05/05</td> </tr> <tr> <td>2</td> <td>Combined Test Chamber</td> <td>HT-HK00-09</td> <td>2019/05/30~2020/05/29</td> </tr> <tr> <td>3</td> <td>Programmable DC Power Supply</td> <td>JSDYQ-119</td> <td>2018/11/05~2020/11/04</td> </tr> </tbody> </table>	No.	Equipment Name	Equipment Number	Calibration Due Date	1	High Frequency Vibration Test Machine	VB-XK00-06	2019/05/06~2020/05/05	2	Combined Test Chamber	HT-HK00-09	2019/05/30~2020/05/29	3	Programmable DC Power Supply	JSDYQ-119	2018/11/05~2020/11/04			
No.	Equipment Name	Equipment Number	Calibration Due Date																	
1	High Frequency Vibration Test Machine	VB-XK00-06	2019/05/06~2020/05/05																	
2	Combined Test Chamber	HT-HK00-09	2019/05/30~2020/05/29																	
3	Programmable DC Power Supply	JSDYQ-119	2018/11/05~2020/11/04																	

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Remarks According to the customer's request, high temperature is 60 °C.

Sample and Test Pictures

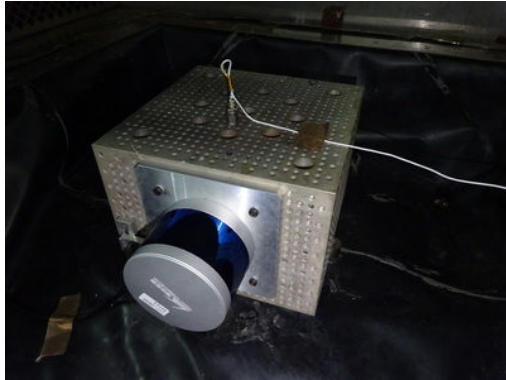


Fig.R16.1 X axis

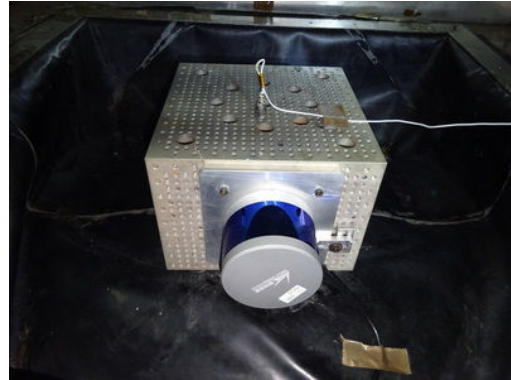


Fig.R16.2 Y axis

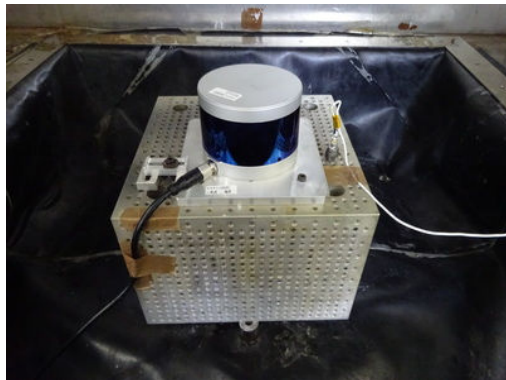


Fig.R16.3 Z axis

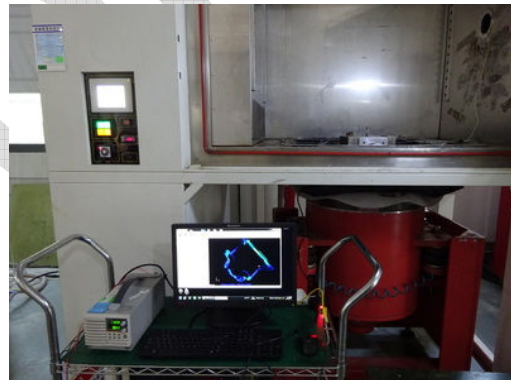


Fig.R16.4 During the test setup schematic photo

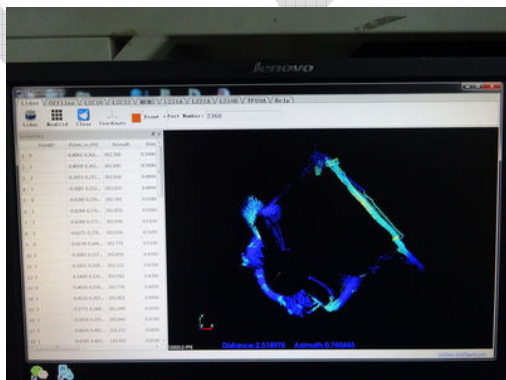


Fig.R16.5 During the test(under mode 3.2) normal function



Fig.R16.6 After the test

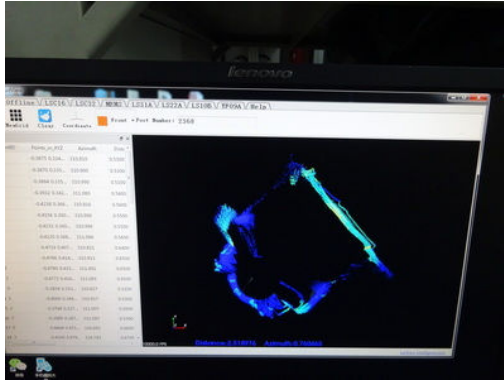


Fig.R16.7 After the test normal function

Test Curves

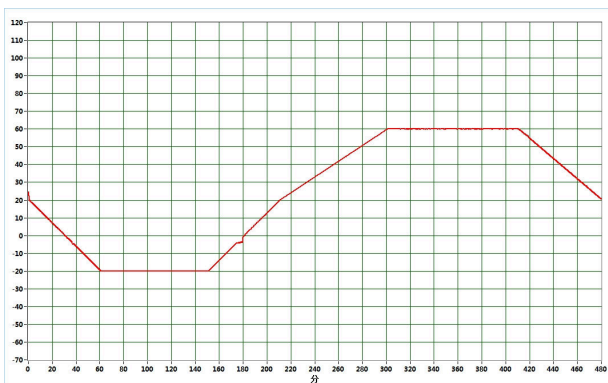


Fig.R16.8 Curves of temperature X axis

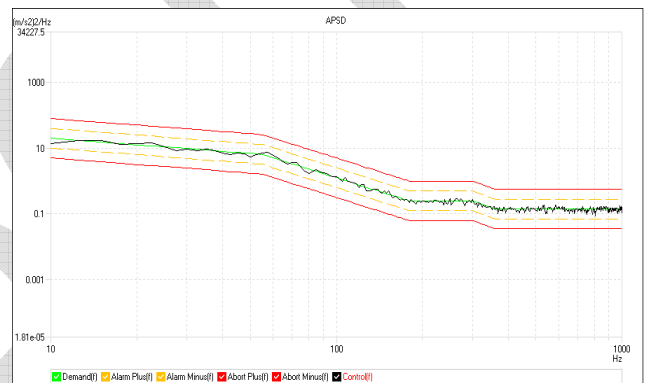


Fig.R16.9 Curves of vibration X axis

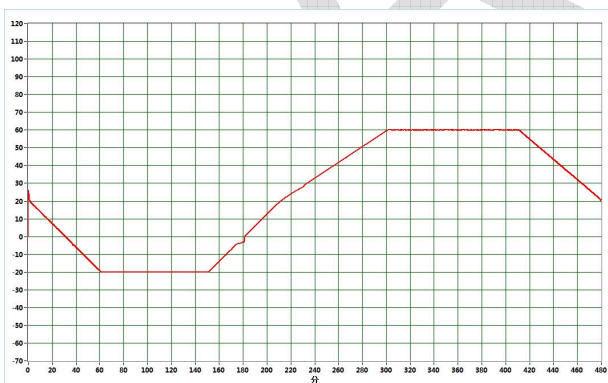


Fig.R16.10 Curves of temperature Y axis

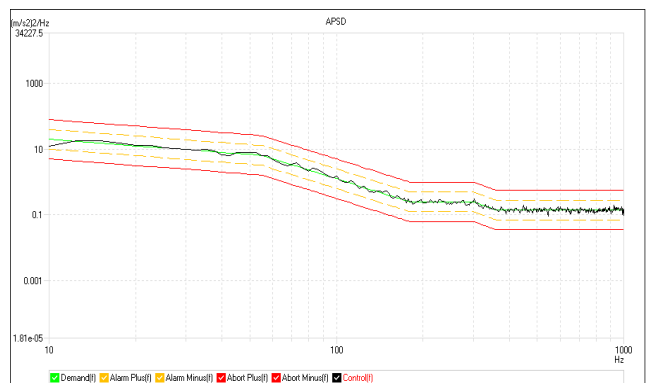


Fig.R16.11 Curves of vibration Y axis

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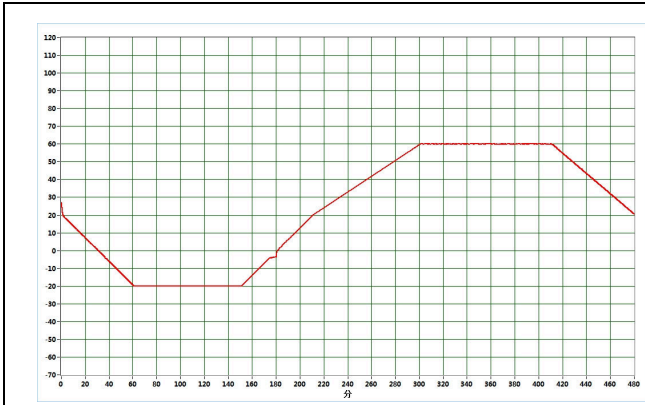


Fig.R16.12 Curves of temperature Z axis



Fig.R16.13 Curves of vibration Z axis

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R17. Shock test

Sample No.	I1			
Refer Specs	GB/T 28046.3-2011 Road vehicles -- Environmental conditions and testing for electrical and electronic equipment -- Part 3: Mechanical loads 4.2.2			
Test Method	<p>During the test, under mode 3.2, that is, sample is connected to the harness power on with 12 V DC;</p> <p>Shock type: Half sine;</p> <p>Acceleration: 500 m/s² ;</p> <p>Pulse width: 6 ms;</p> <p>No. of shock: 10 shocks/axis;</p> <p>Test axis: ±X axis、±Y axis、±Z axis;</p> <p>After the test, check appearance and function.</p>			
Acceptance Criteria	No mechanical damage on appearance, the functional status shall be A, that is, during the test and after the test, the radar imaging is normal.			
Deviation	/			
Test Results	<p>During the test, function is normal ;</p> <p>Visual inspection on the sample after the test, no mechanical damage on appearance, function satisfies the A-level requirement.</p>			
Test Instruments	No.	Equipment Name	Equipment Number	Calibration Due Date
	1	High Frequency Vibration Test Machine	VB-XK00-06	2019/05/06~2020/05/05
	2	Programmable DC Power Supply	JSDYQ-119	2018/11/05~2020/11/04
Remarks	/			
Sample and Test Pictures				

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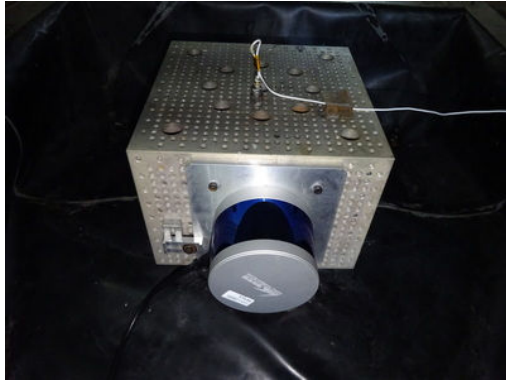


Fig.R17.1 ±X axis

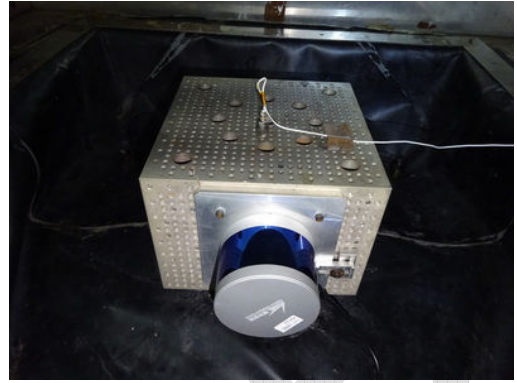


Fig.R17.2 ±Y axis

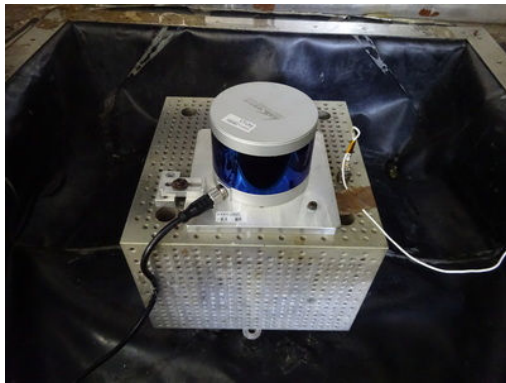


Fig.R017.3 ±Z axis

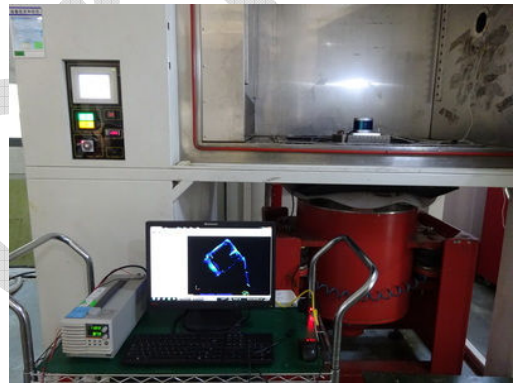


Fig.R017.4 During the test setup schematic photo

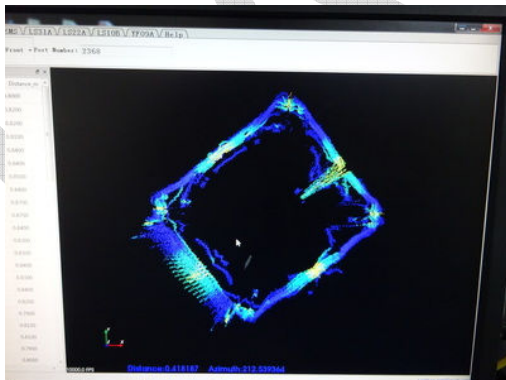


Fig.R17.5 During the test(under mode 3.2) normal function



Fig.R17.6 After the test

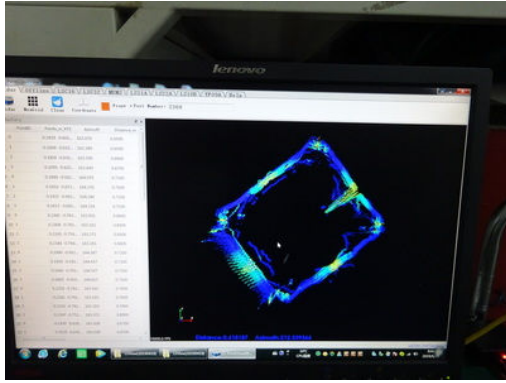


Fig.R17.7 After the test normal function

Test Curves

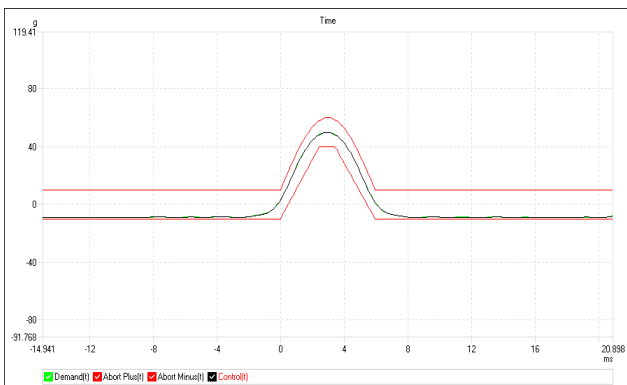


Fig.R17.8 Curves of shock +X axis

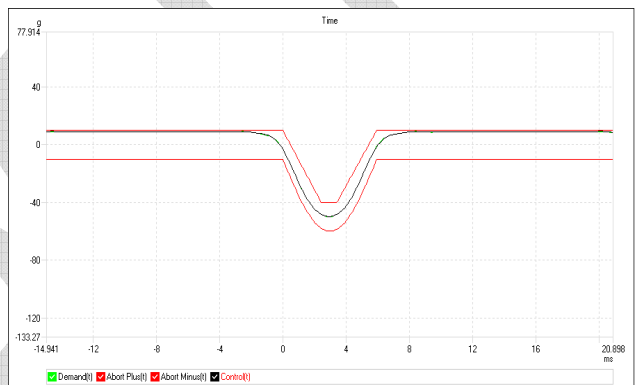


Fig.R17.9 Curves of shock -X axis

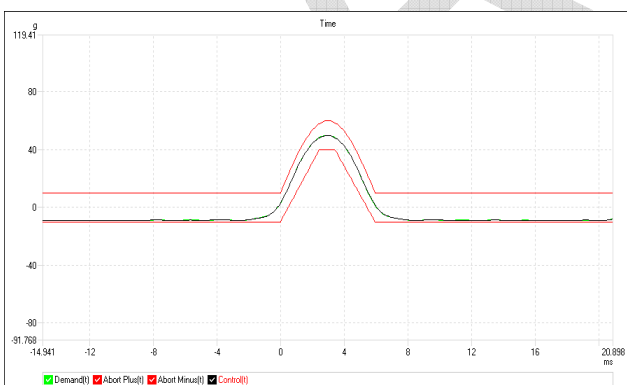


Fig.R17.10 Curves of shock +Y axis

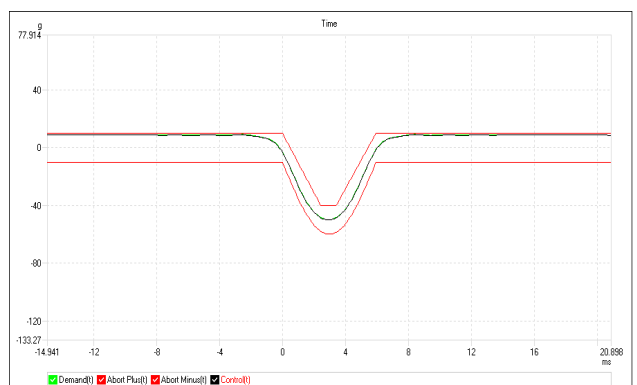


Fig.R17.11 Curves of shock -Y axis

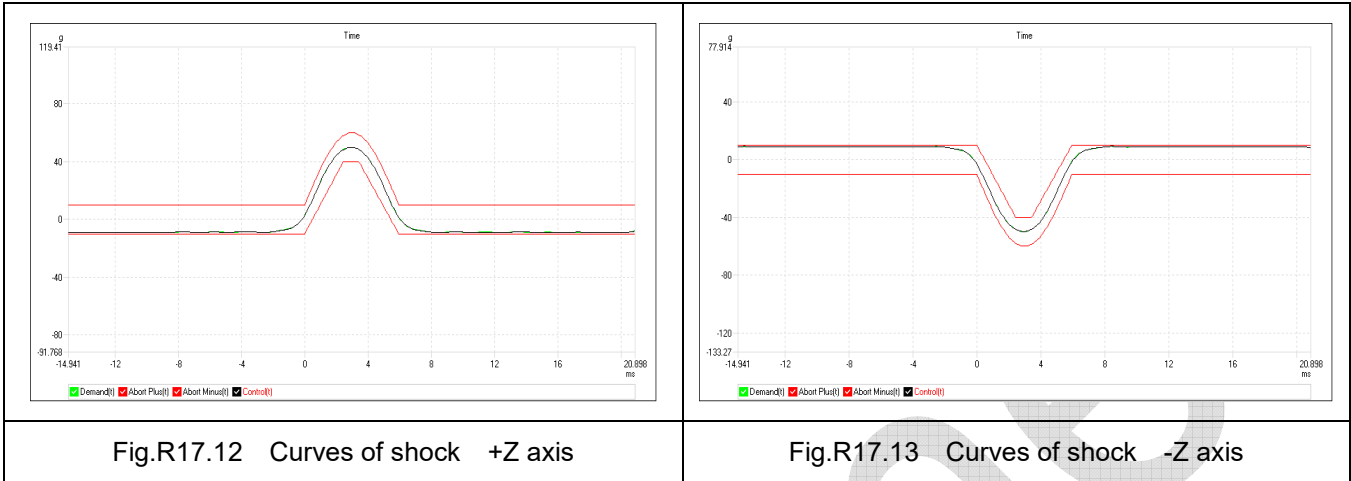
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