

IVISTA

China Intelligent Vehicle Index

No. IVISTA-SM-III.OM-TP-A0-2023

Intelligent Interaction Index Occupant Status Monitoring Test Protocol

(Version 2023)

Published by

China Automotive Engineering Research Institute Co., Ltd.

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Occupant Status Monitoring Test Protocol

1 Scope

This document specifies the test methods of IVISTA China Intelligent Vehicle Index - Intelligent Interaction Index - Occupant Status Monitoring System.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute indispensable provisions of this protocol. For dated references, only the dated edition applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

European new car assessment programme assessment protocol – Safety assist safe driving

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1

driver monitoring system; DMS

a driver status monitoring system capable of determining whether the driver is in a status of distraction or fatigue

3.2

child presence detection; CPD

a system capable of detecting that a child is intentionally or unintentionally left in the vehicle and reminding the vehicle user, surrounding pedestrians, or third-party service agencies about this

3.3

vehicle under test; VUT

a vehicle with driver status monitoring and/or child presence detection function(s)

3.4

distraction

any behavior that distracts the driver from the primary task of driving or controlling the vehicle

3.5

long distraction

a distraction behavior in which the driver's line of sight moves away from the road ahead for a long time

3.6

cumulative distraction

repeated and short-lasting distraction behaviors in which the driver's line of sight moves away from the road ahead

3.7

abnormal head pose

a behavior causing the head's forward/backward tilt angle or its horizontal rotation angle to exceed the normal range when the driver raises his/her head, lowers his/her head, or swings his/her head left and right

[Source: GB/T 41797-2022, 3.3]

3.8

in-vehicle infotainment system; IVIS

button and screen areas containing the infotainment system or vehicle control system, usually located in the center of the central console of a passenger car

3.9

center armrest

an area where an armrest is located between the driver's seat and the front passenger's seat and capable of providing elbow support for the driver and the passenger

The gearshift lever may be in this area.

3.10

passenger seat legroom

an area surrounded by the front passenger seat surface, glove box, door and center armrest

3.11

warning time

time interval from the moment when the critical point of distraction and fatigue warning is reached to the moment when the system sends out warning information

3.12

CPD warning time

time interval from the moment when the vehicle is locked to the moment when the system sends out a child presence warning

4 Test Requirements

4.1 Test site and test environment

4.1.1 Requirements for test site

The test road shall be flat and straight with a length of not less than 1 km, and the vehicle runs along a straight line during the test.

4.1.2 Requirements for test environment

- a) The driver attention monitoring test shall be carried out in a daytime environment (the luminance shall be more than 2000 lx and less than 10000 lx), and the external light source has no obvious reflection in the cab;
- b) The child presence detection test shall be carried out in a daytime environment (the luminance shall be more than 2000 lx and less than 10000 lx), and the external light source has no obvious reflection in the cab.

4.2 Requirements for the drivers

The driver is an adult aged 18~60 who has no facial and eye defects and meets the requirements of height, sitting eye height, head morphology and face length in GB/T 10000.

4.3 Test Equipment

4.3.1 Target

The child pedestrian target (CPT) shall have visual characteristics and radar reflection cross-section similar to those of a real child aged 0, 1, 3 or 6 years old, and shall have breathing simulation and heartbeat with adjustable frequency and amplitude.

Heartbeat (beats/min): 0 years old (114 ~ 150); 1 year old (98 ~ 140); 3 years old (86 ~ 123); 6 years old (81 ~ 117);

Breathing (breaths/min): 0 years (30); 1 year (22); 3 years (20); 6 years (18);

Movement: for children aged 0 and 1 year: head - left and right ($-70^{\circ} \sim 70^{\circ}$); shoulders - up and down ($0^{\circ} \sim 100^{\circ}$); hip - rotation ($0^{\circ} \sim 30^{\circ}$); for children aged 3 and 6 years old (based on the above): head - up and down ($-30^{\circ} \sim 30^{\circ}$); shoulders - left and right ($0^{\circ} \sim 100^{\circ}$); elbows ($0^{\circ} \sim 70^{\circ}$); hip - up and down ($0^{\circ} \sim 70^{\circ}$); knees - up and down ($0^{\circ} \sim 70^{\circ}$).

Note: If the VUT's manufacturer believes that CPT cannot meet the requirements of the VUT sensor for the target, please contact the IVISTA Management Center.

4.3.2 Eye tracker

- a) The sampling rate of the eye tracker for recording the driver's line of sight shall not be less than 60 Hz;
- b) Line-of-sight tracking error: $\pm 0.5^{\circ}$;
- c) Head turning angle tracking error: $\pm 0.5^{\circ}$;
- d) Eyelid closure recognition error: ± 0.1 cm.

Fix the eye tracker cameras below the front windshield in the vehicle with the mounting fixture. Install cameras 1 and 3 on the central console near the left and right A-pillars, and camera 2 on the central console directly below the rearview mirror (the specific installation positions can be adjusted based on the type of the central console of the model). Align the plane of the camera lens with face of the driver, and ensure that the latter is within the field of view of the eye tracker camera. The schematic diagram of the installation position of the eye tracker is shown in Fig. 1.

The eye tracker can record the driver's gaze area and output the label name of the corresponding area. The software system can count the number of labels according to the frame rate and convert them into the time of the driver gazing at the corresponding area.

The eye tracker can record the driver's head turning angle. The software system can give a warning when the driver's head is not turned to a sufficient angle.

The eye tracker can record the driver's eyelid closure. The software system can give a warning when the driver's eye closure time does not meet the requirements.

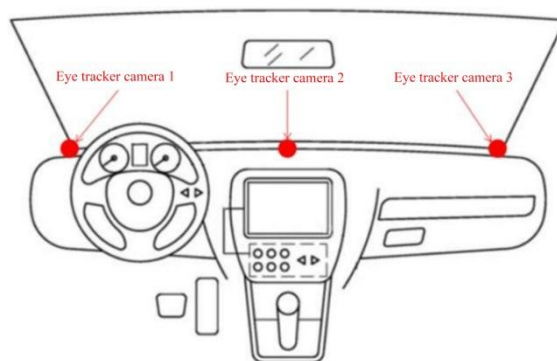


Fig. 1 Installation Position of Eye Tracker

4.3.3 Camera and microphone

4.3.3.1 Camera

- a) Resolution: $\geq 1080P$;
- b) Refresh rate: ≥ 30 fps.

4.3.3.2 Microphone

- a) Frequency response: 20 Hz ~ 20 kHz;
- b) SNR: ≥ 80 dB.

4.3.3.3 Installation of camera and microphone

Fix the camera in the vehicle with the mounting fixture, with the lens plane parallel to the central console or instrument panel touch screen (image warning display screen of attention monitoring system), so as to ensure that the vehicle screen is completely within the field of view of the camera. Integrate the microphone in the camera and ensure that the microphone can clearly record the audible warning signal from the driver attention monitoring system.

4.4 Vehicle under test

4.4.1 System initialization

If necessary, the driver status monitoring system and the child presence detection system may be initialized before the test, including the calibration of sensors such as radar and camera.

4.4.2 Vehicle condition confirmation

- a) The VUT shall be new with a traveled mileage of not more than 5000 km;
- b) After the vehicle is started, both the driver status monitoring system and the child presence detection system shall be able to be turned on normally.

4.4.3 Functional check

Before the start of the test, enable the driver status monitoring function and child presence detection function at the IVI terminal, and disable other functions such as delayed warning and temporary shutdown of child presence detection that inhibit the warning of the child presence detection system. Before the test, adjust the driver's seat, steering wheel, window and rearview mirror to the positions recommended by the manufacturer. If there is no recommended position, adjust them by the driver to an appropriate position so that the driver status monitoring system can recognize the driver's face and work normally.

Carry out pre-tests under the condition that each function contained in the driver status monitoring system and the child presence detection system is triggered to ensure that each function

works normally.

4.5 Test photos

- a) Before installing the test equipment, take photos of the front left 45° of the VUT and the nameplate of the vehicle;
- b) After the test equipment is installed, take photos of the test equipment inside and outside the VUT;
- c) Arrange video and audio recording equipment inside the VUT to record the testing process.

5 Test Methods

5.1 Attention monitoring test

5.1.1 Visual distraction test

Test steps:

- a) Adjust the system under test to the standby status, and calibrate the eye tracker for the driver to ensure that the eye tracker records gaze points the same as real gaze points;
- b) The driver starts the vehicle and increases the vehicle speed to the speed required for the activation of the driver attention monitoring system (visual distraction monitoring function);
- c) The driver watches the IVIS area/center armrest/front passenger's legroom in the vehicle according to the watching mode of long distraction and cumulative distraction, and the camera and microphone record the visual and audible warning response signals of the system.

The test engineer carries out tests in each scenario 3 times, and the test is considered successful when the system gives a warning within 1.5 s after the following critical conditions are met:

- Long distraction: The time taken by the driver to watch the IVIS/center armrest reaches 3 s;
- Cumulative distraction: The cumulative time taken by the driver to watch the IVIS/front passenger's legroom within 30 s is 10 s (the time to watch the IVIS/front passenger's legroom each time is less than 3 s; the time to watch the road surface each time is less than 2 s).

5.1.2 Abnormal head pose test

Test steps:

- a) Adjust the system under test to the standby status, and calibrate the head turning angle for the driver to ensure that the angle is 0° when the driver's head faces the front;
- b) The driver starts the vehicle and increases the vehicle speed to the speed required for the activation of the driver attention monitoring system (abnormal head pose monitoring function);
- c) The driver performs abnormal head movements by turning leftward by $\geq 45^\circ$, rightward by $\geq 45^\circ$ and downward by $\geq 30^\circ$.

The test engineer carries out tests in each scenario 3 times, and the test is considered successful when a warning is given within 1.5 s after the critical conditions are met.

Abnormal head pose: The driver's head turning angle is greater than or equal to the specified value for 3 s.

5.1.3 Fatigue monitoring test

Test steps:

- a) Adjust the system under test to the standby status, and calibrate the driver's eyelid closure to ensure that the eyelid closure is 0 mm when the driver closes his eyes;
- b) The driver starts the vehicle and increases the vehicle speed to the speed required for the activation of the driver attention monitoring system (fatigue monitoring function: eyes closed for 2 s);
- c) The driver performs fatigue behaviors with his/her eyes closed.

The test engineer carries out the tests 3 times in the test scenario, and the test is considered successful when a warning is given within 1.5 s after the critical conditions are met. Fatigue monitoring: driver's eyes closed for 2 s.

Note 1: During the driver's attention monitoring test and fatigue monitoring test, each behavior shall be maintained for an additional 1.5 s after the critical condition for the warning is reached, so as to prevent the system from terminating the judgment of abnormal behaviors and canceling the warning; if the system gives a warning signal within the time of critical condition, the test will still be deemed successful.

Note 2: When the driver performs visual distraction and eye closing behaviors, the head turning angle (heading, roll and pitch), except for abnormal head movements, shall not exceed 10°.

5.2 Child presence detection test

Test steps:

- a) Place the child dummy target on the left rear position of the vehicle, in which the seat for child aged 0 years old is installed upside down and the seat for child aged 1, 3 or 6 years old is installed upright, as shown in Fig. 2 (special seat for children with seat belt fastened);

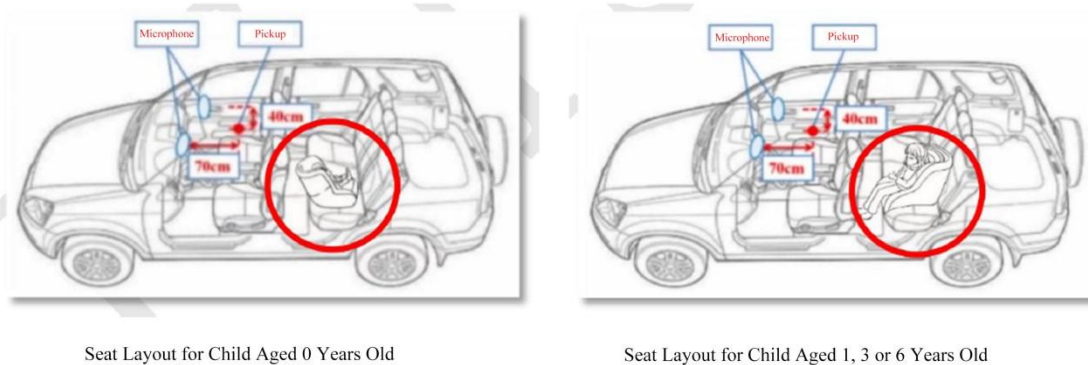


Fig. 2 Installation Position of Child Seat

- b) Close all windows, shut down the vehicle, and lock the vehicle outside;
- c) Record the vehicle locking moment and vehicle warning moment.

The test engineer carries out tests in each scenario 3 times, and the test is considered successful when a warning signal is given within 5 s after the door is locked. The warning includes vehicle whistling and flashing, remote notification to the owner and contact with a third-party organization).

Note: After each test in each test scenario of driver attention monitoring and child presence detection, the VUT shall be powered off for 2 min before the next test.