

Compliance Assessment Report

Report No.:FS18102023V1AT128

Oct 19, 2023

Client:	Hesai Technology Co., Ltd. Building L2-B, Hongqiao World Center, 201702 Shanghai, China
Task:	Functionality Compliance Assessment
Subject:	Lidar AT128
Result:	Three assessment items were confirmed to be met
Assessment authority:	DEKRA Testing and Certification (Shanghai) Ltd. 5F, No.250, Jiangchangsan Road, Shanghai, 200436 P.R. China

Confirmation of the Assessment Results


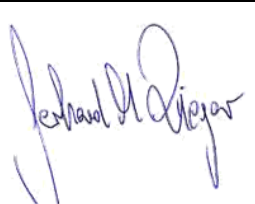
This document is an extract of the overall assessment report and only summarizes the results. The detailed results can be read in the overall report No.:FS18102023V1AT128.

Based on lidar disassembly and subsequent analysis results, the evaluated product satisfies the following three assessment items:

1. The lidar has no wireless point cloud data transmission capabilities.
2. The lidar is not capable of storing point cloud images.
3. The lidar's key components are supplied by US/EU manufacturers.

Related product information:

Product	S/N Serial Number	Product Version
AT128	AT00057225AAAAAG	29100033600

	
Edward Li	Gerhard Rieger
_____	_____
Author name	Reviewer name

Assessment authority:

DEKRA Testing and Certification (Shanghai) Ltd.

No.250, Jiangchangsan Road,
200436, Shanghai, China



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1 Task

DEKRA Testing and Certification (Shanghai) Ltd. conducted a comprehensive lidar data safety assessment on behalf of Hesai Technology Co.,Ltd. This evaluation encompassed an in-depth analysis of data transmission and storage capabilities pertinent to the lidar AT128. By virtue of its official accreditation as an independent inspection body for Testing, Inspection, and Certification (TIC), DEKRA fulfills the required independence to ensure an objective, unbiased viewpoint and to avoid conflict of interest.

The scope of the lidar assessment items include:

1. AI1: The lidar can only transfer data through a secure one-way cable. It has no wireless, cellular or Bluetooth capabilities to transmit point cloud data.
2. AI2: The lidar has no storage and mechanism to store more than one second of data.
3. AI3: The lidar's key components, SoC (equivalent to a combination of MCU and FPGA) and PHY, are supplied by US/EU manufacturers.

The assessment is based on an audit carried out at Hesai Technology Co., Ltd. The audit processes include the disassembly of a random lidar AT128 sample chosen by DEKRA's auditor, a comprehensive analysis and inspection of its fundamental principles and functions, and examination of key supporting evidences.

2 Summary of this Evaluation

The following figure provides an overview of the evaluation results:

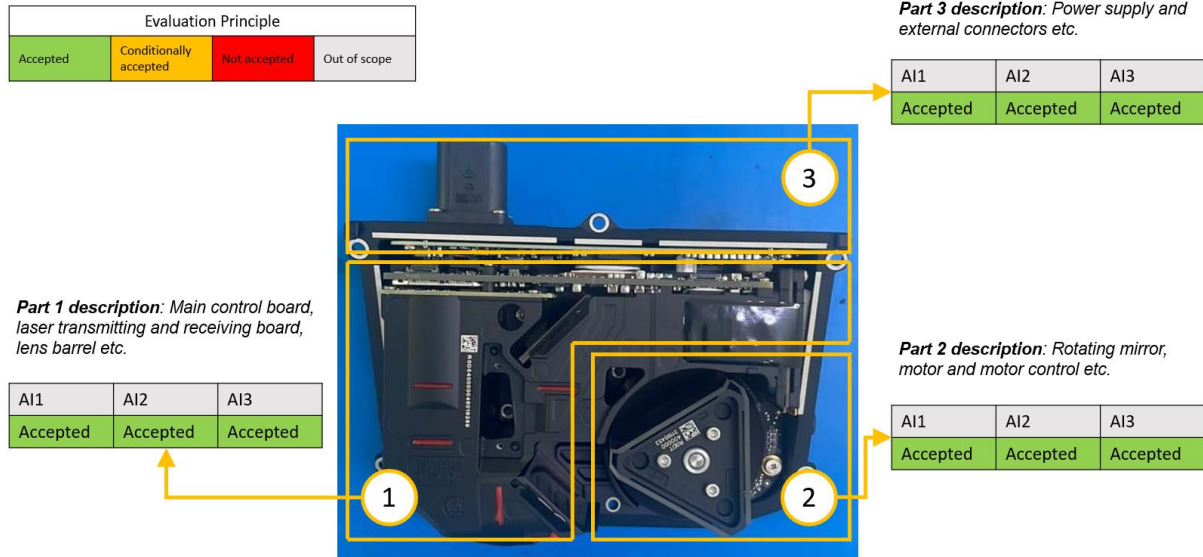


Figure1: Summary of this evaluation

For detailed results of the evaluated records see chapter 5 of this report.

3 Evaluation Period

Evaluation date: October 13, 2023

Evaluation Location:

Hesai Technology Co., Ltd.
Building 2, No. 255, Beihe Road
Jiading District, Shanghai,
P.R. China

Evaluation Method: In accordance with the established auditing protocols, a lidar AT128 sample was chosen randomly from the production line by the auditor, and subsequently disassembled on-site.

Note: After a thorough examination of traceability data in coordination with the Manufacturing Execution System (MES), DEKRA hereby affirms that the sampling machine conforms to the specifications of a standard production model, and the pertinent record data stands as comprehensive and accurate.

4 Description of the Product

Product Name: AT128

Product Serial Number: AT00057225AAAAAG



System Record Information: Completed

Version Information:

Hardware Version	Software Version
PB: 19100164800 MB: 19100175900 MDB: 19100164000 TXB: 19100211700 RXB: 19100259300	Firmware Version: 3.11b426 Software Version: 3.20.49

AT128 is a 128-channel rotating mirror lidar. It detects the distance, angle, and reflectivity of objects in a range of 120°. The point cloud frame rate is 10Hz (100ms). The AT128 lidar system is comprised of Power Board (PB), Main Control Board (MB), Motor Drive Board (MDB), Laser Emission Board (TXB), and Laser Reception Board (RXB), with the respective circuit board functions as follows:

- Power Board (PB): Provides the basic power supply for the entire lidar system.
- Main Control Board (MB): Configures and controls the Motor Drive Board, Laser Emission Board, and Laser Reception Board, while also performing analog-to-digital conversion of signals from 128 laser receiving channels. It carries out distance and reflectivity calculations, point cloud data transmission, and other functions.
- Motor Drive Board (MDB): Controls motor speed based on the configuration and control commands from the Main Control Board and provides information on motor rotation angle.
- Laser Emission Board (TXB): Drives and controls the 128 laser emission channels according to the configuration and control commands from the Main Control Board.
- Laser Reception Board (RXB): Converts optical signals from 128 laser reception channels based on the configuration and control commands from the Main Control Board.

The principle of lidar functionality is as follows:

- After the lidar starts, motor rotates at a defined frequency, meanwhile laser emitters emit and receivers receive the returned laser beams at a specified horizontal angle to detect the distance and reflectivity of obstacles.
- Controller detects the angle information of obstacle according to encoder, and combines it with distance and reflectivity information, time stamp information and lidar operating state information to form complete point cloud data and sends it in UDP protocol to the vehicle' perception system.

5 Evaluation Records

5.1 Evaluation Principle

Evaluation Result	Description
Accepted	Assessment items are satisfied
Conditionally accepted	Assessment items are satisfied under reasonable conditions which are fully explained
Not accepted	Assessment items are not satisfied
Out of scope	Assessment items are not applicable or not considered during this evaluation

5.2 Part 1 Evaluation

Part introduction

This part includes the Main Control Board (MB), Laser Emission Board (TXB), and Laser Reception Board (RXB), with each circuit board serving the following functions:

- Main Control Board (MB): Configures and controls the Motor Drive Board, Laser Emission Board, and Laser Reception Board, while also performing analog-to-digital conversion of signals from 128 laser receiving channels. It carries out distance and reflectivity calculations, point cloud data transmission, and other functions.
- Laser Emission Board (TXB): Drives and controls the 128 laser emission channels according to the configuration and control commands from the Main Control Board.

- Laser Reception Board (RXB): Converts optical signals from 128 laser reception channels based on the configuration and control commands from the Main Control Board.

Evaluation records



Figure 2.1: Part 1 photos

Note: Part 1 is comprised of Main Control Board, Laser Emission Board, and Laser Reception Board.

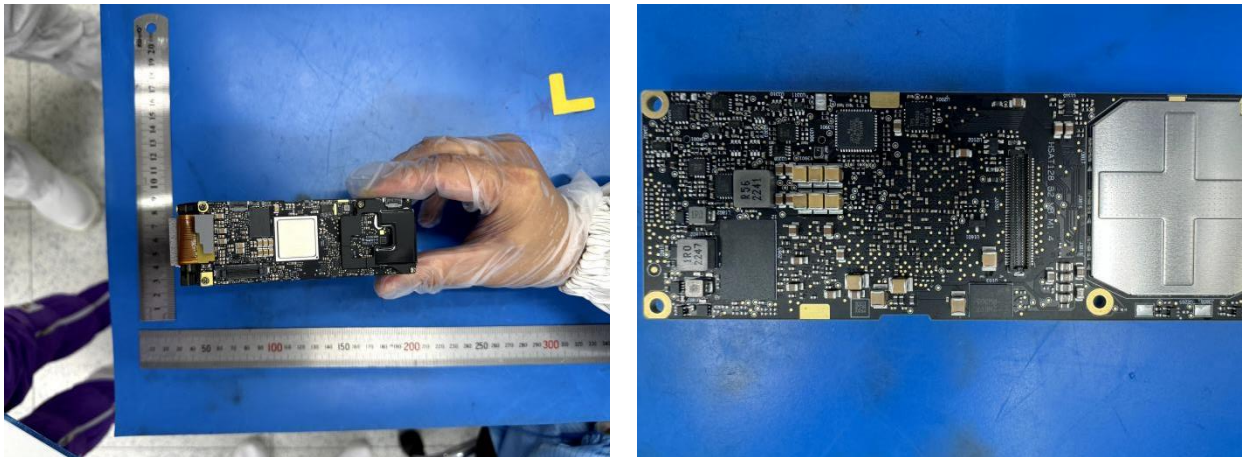


Figure 2.2: Photos of the Main Control Board - front (left) and rear (right)



Figure 2.3: Photos of the key components on the Main Control Board - front

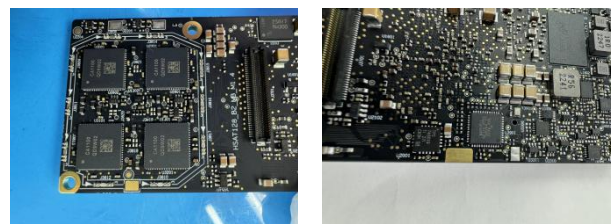


Figure 2.4: Photos of the key components on the Main Control Board - rear

Note: The Main Control Board is a single circuit board. The circuit board is double-sided. Upon examination, the core IC components included are as follows:

- Main Control IC: Model XAZU3EG, Manufacturer XILINX(USA)
- Flash: Model MT25QL512ABB8E12-0AUT, Manufacturer MICRON (USA)
- DDR: Model MT53E256MxxDx, Manufacturer MICRON (USA)
- Ethernet IC, PHY: Model 88Q2112, Manufacturer MARVELL (USA)
- Voltage Regulation IC
- ICs related to internal lidar state sampling, including temperature, voltage, current, and other sensors.
- IC devices for signal processing of 128 reception channels.

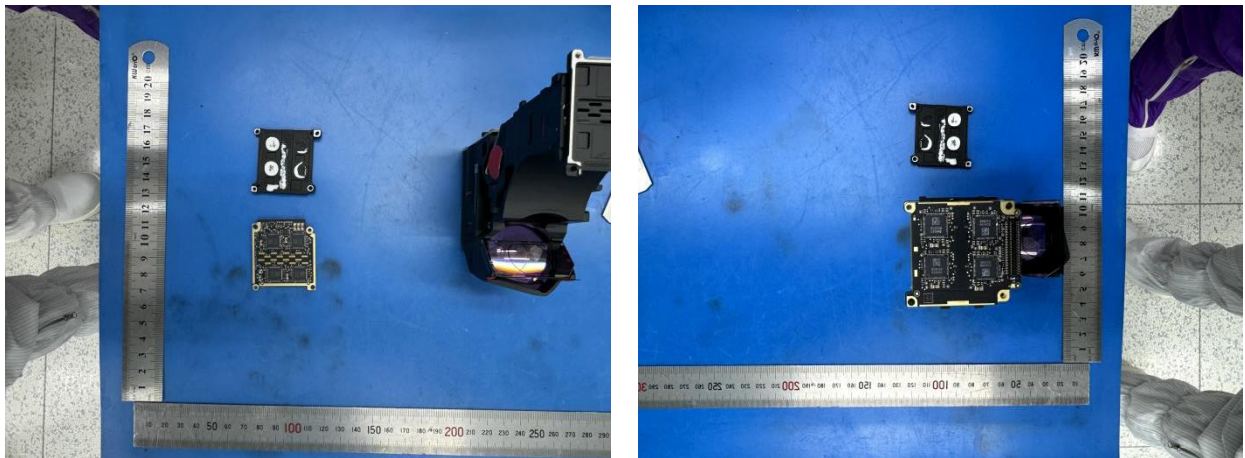


Figure 2.5: Photos of the Laser Emission Board

Note: The Laser Emission Board is a single circuit board. The circuit board is double-sided. Upon examination, all core IC components included are directly related to the drive and control of 128 laser emitters.

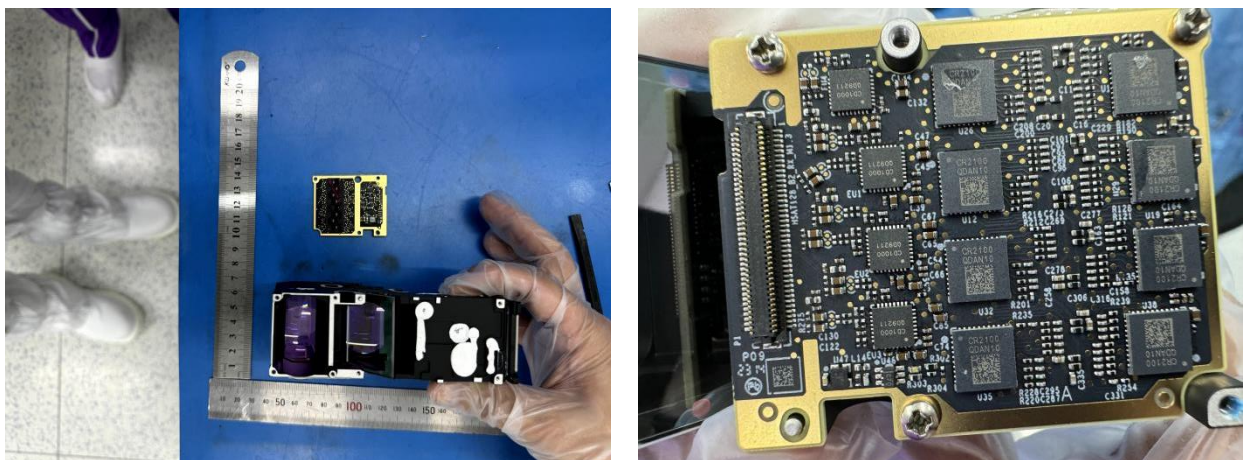


Figure 2.6: Photos of the Laser Reception Board

Note: The Laser Reception Board is a single circuit board. The circuit board is double-sided. Upon examination, all core IC components included are directly related the drive and signal process of 128 laser detectors.

During the evaluation, the following analysis and reviews are performed:

Non-Volatile Storage Audit:

The product's primary control chip, model XAZU3EG, contains no internal non-volatile memory storage. However, the product features external non-volatile memory storage with a capacity of 64MB, identified as model MT25QL512ABB8E12-0AUT.

After a thorough examination of evidence and data cross-referencing, the current storage space utilization stands at 61MB, which is allocated for software and firmware program files, production calibration and configuration parameters and log data, among other purposes. As a result, 3MB of available storage space remains.

Theoretical Point Cloud Storage Capacity Assessment:

Under single return mode, the size of a single frame of point cloud data is 0.44MB, and the calculation is as follows:

$$774 \text{ bytes} \times 600 = 464,400 \text{ bytes} = 0.44 \text{ MB}$$

The maximum point cloud storage duration within AT128's non-volatile memory can be calculated as follows:

$$\begin{aligned} \text{Maximum Point Cloud Storage Duration} &= \text{Remaining Non-volatile Memory Space} / \text{Size of a} \\ &\text{Single Frame of Point Cloud Data} * \text{Point Cloud Data Transmission Period} \\ &= 3\text{MB} / 0.44\text{MB} * 100\text{ms} \approx 682\text{ms} \end{aligned}$$

Based on the calculations above, the product does not have the capability to store point cloud data.

Evaluation result for this part

AI1	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI2	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI3	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope

5.3 Part 2 Evaluation

Part introduction

This part includes the Motor Drive Board (MDB), with the following functional description:

- It facilitates motor speed control based on the configuration and control commands from the Main Control Board, while simultaneously acquiring motor rotation angle information.

Evaluation records

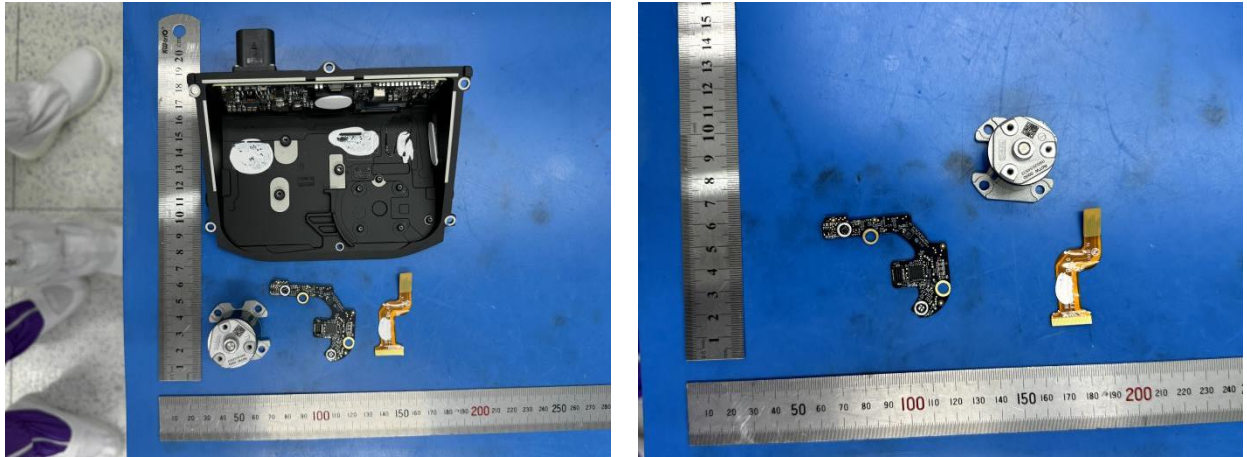


Figure 3.1: Photos of the Motor and Motor Control Board

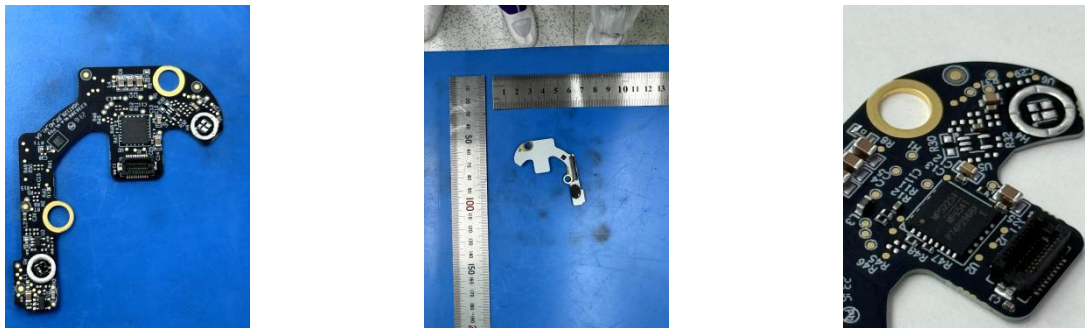


Figure 3.2: Photos of the Motor Control Board and key components

Note: The Motor Control Board is a single circuit board. The circuit board is double-sided, but the IC components are only present on the front side. The primary IC on the front side, model MP6541, serves as the motor driver IC.

Evaluation result for this part

AI1	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI2	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI3	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope

5.4 Part 3 Evaluation

Part introduction

This part includes the Power Board (PB), which serves as the primary power source for the entire lidar system.

Evaluation records

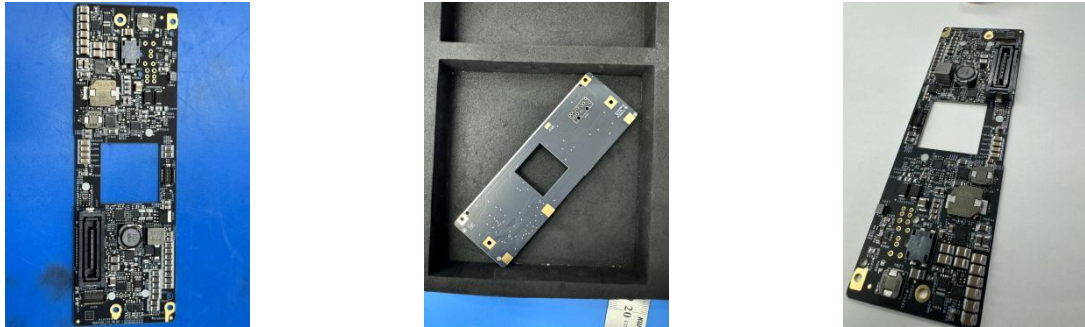


Figure 4: Photos of the Power Board and key components

Note: The Power Board is a single circuit board. The circuit board is double-sided, but the IC components are only present on the front side. The primary IC on the front side. Upon inspection, all core IC components included are related to voltage boosting and reduction functions.

Evaluation result for this part

AI1	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI2	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope
AI3	<input checked="" type="checkbox"/> Accepted	<input type="checkbox"/> Conditionally accepted	<input type="checkbox"/> Not accepted	<input type="checkbox"/> Out of scope