In-Vehicle A2B Signal Testing Based on DAQ Systems

All-in-One DAQ Solutions at Doewe Technologies

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With the rapid development of in-vehicle entertainment, audio systems, and intelligent driving technologies, the Automotive Audio Bus (A2B) system has been widely adopted in modern vehicles. The A2B system is a high-performance audio bus technology supporting multi-node audio transmission. It is extensively used in automotive audio systems, playing a crucial role in high-speed signal transmission between multiple audio devices within the vehicle. To ensure the A2B system provides high-quality audio transmission and stable performance, the signals generated by the A2B can be collected and analyzed using a Data Acquisition (DAQ) system. Analysis of these signals allows for a comprehensive assessment of the A2B system's transmission capability and audio quality.

Based on its high-performance data acquisition systems, Doewe Technologies provides a test solution for vehicle A2B acoustic collection and analysis. By collecting, analyzing, and monitoring the audio data of the vehicle A2B system, its stability, audio quality, and system response capability under actual operating conditions can be comprehensively evaluated. This provides solid data support for subsequent performance optimization, problem diagnosis, and application expansion.

This test system primarily collects and analyzes data from the following equipment: A2B audio module, camera, rain sensor, and GPS positioning module. The A2B audio module is responsible for transmitting in-vehicle audio signals; the DAQ system collects and analyzes these signals through the A2B audio module to assess their transmission quality and stability. The camera provides visual data of the cabin

environment, recording interior conditions to facilitate analysis of their relationship with audio signals. The rain sensor collects cabin environmental rain data, providing references related to environmental conditions for the test, aiding in analyzing the impact of rainfall on audio signals. The GPS positioning module is used to acquire vehicle speed, time, and geographical location information. This data is synchronized with the audio signals, providing multi-dimensional data support for the test.

In this test system, the A2B audio signals are received via the A2B acquisition card within the DAQ system. Other devices under test (DUTs), including the camera, GPS module, and rain sensor, are connected to the DAQ system controller through dedicated interfaces. Data from these devices is centrally processed to ensure the comprehensiveness and accuracy of the test results. The display module presents the test results in real-time, helping operators monitor the system status and test progress. The system's power supply module provides power support via the cigarette lighter, supplying stable power to all components to ensure normal operation during testing. The power supply module guarantees the stable operation of the DAQ system, A2B acquisition card, and other sensors, ensuring the continuity and reliability of the test data.

Figure 1 Test System Schematic Diagram

This test solution possesses several technical advantages, as detailed below:

Core Products Self-Developed: Doewe Technologies has independently developed key equipment such as storage cards, controllers, and DAQ chassis. These self-developed products ensure overall system compatibility and consistency, simplify after-sales maintenance processes, and provide more stable and reliable technical support.

Single-Device Multi-Node Audio Acquisition: The system supports simultaneous acquisition of A2B audio data from 10 nodes and 32 channels. Acquisition via a single device eliminates the need for multiple sound cards in parallel, simplifying the system architecture, improving audio data acquisition efficiency, and reducing connection complexity between devices.

Integrated Storage and Sensor Connectivity: The system is equipped with a 16TB storage card that can be directly installed in the PXIe chassis, significantly improving storage efficiency. Other sensors can be directly connected to the controller via USB, eliminating the need for external hard drives and docking stations, optimizing system space utilization, and simplifying device connections.

System Integration and Reliability: All acquisition modules are integrated within the DAQ system. This highly integrated design effectively reduces the impact of factors like vehicle vibration on system connections, lowers the risk of cable disconnection, enhances system stability and reliability, and ensures long-term stable operation in complex environments.

High-Performance Data Processing: The performance of the DAQ controller surpasses that of conventional rugged tablets, significantly improving data processing speed and system responsiveness. By optimizing data processing, it ensures test data can be transmitted in real-time and recorded accurately, meeting the demands of high-requirement test environments.

The core test equipment of this solution includes: PXIe Controller, Storage Card, and A2B Acquisition Card. The specific equipment introductions are as follows:

Storage Card:

The ASMC_PXIe-8016 PXIe Solid-State Storage Module adopts a standard modular design. Based on the NVMe protocol, it achieves up to 16TB signal storage within a compact 3U slot structure, with a transmission bandwidth exceeding 6GB/s. This storage card features high integration and flexible application, making it widely suitable for the development and testing of various types of complete machines, systems, and components. Its interface is PCI Express X8 GEN3, ensuring efficient data transfer and stability. Dimensions are 3U single-slot storage card, lightweight for easy system integration.

Figure 2 Storage Card

Controller:

The ASMC_PXIe-1216 is a 3U PXIe Blade Processor equipped with an Intel® Core™ i7-6820EQ processor, supporting Quad-Core/Eight-Thread operation with a processing speed of up to 2.8GHz, delivering powerful computing performance. This controller comes standard with 16GB RAM (supports up to 48GB) and 512GB SATA

SSD storage. It supports Windows 7/10 operating systems and features USB 3.0 x4, USB 2.0 x2, and dual 10/100/1000Mbps Ethernet ports. It is suitable for high-performance data acquisition and control tasks, widely used in military, transportation, testing, and other fields.

Figure 3 Controller

A2B Acquisition Card:

The PXIe-AUDIO Audio Test Card complies with the PXIe 2.0 specification and adopts a 3U compact design, featuring high-precision audio signal acquisition and playback functions. It supports 24-bit resolution, 48kHz sampling rate, and testing of up to 10 nodes and 32 channels on the A2B bus for both master and slave nodes, making it suitable for complex audio transmission systems. Its modular design allows flexible integration into PXIe systems, providing efficient and precise audio data acquisition and analysis.

Figure 4 A2B Acquisition Card

Combining a high-performance DAQ system, this test solution provides a complete and reliable solution for signal acquisition and analysis of vehicle A2B audio systems. Through self-developed core equipment, integrated system design, and efficient data processing capabilities, the system can efficiently and stably perform real-time acquisition and analysis of vehicle A2B audio data, ensuring the accuracy and reliability of test results. The solution offers significant advantages in multi-node audio acquisition, equipment integration, and system reliability, providing solid data support for subsequent performance optimization, problem diagnosis, and application expansion. With the continuous development of in-vehicle entertainment and intelligent driving technologies, this solution will play an increasingly important role in the testing and analysis of vehicle audio systems, driving further innovation and application of related technologies.

Doewe Technologies is always committed to achieving innovative, unique, and reliable product solutions in the field of data acquisition. We deeply understand that these elements are the cornerstone for enterprises to establish themselves in market competition. For this reason, we derive innovative inspiration from customers' real application needs, rather than merely showcasing flashy product features. By continuously optimizing and enhancing data acquisition solutions, Doewe

Technologies empowers partners to move towards an efficient and precise future. Welcome to choose Doewe Technologies and together open a new chapter in data acquisition. Contact **Tel: +86-10-64327909.**