DOEWE
TEST SOLUTION EXPERT

COMPANY PROFILE

Doewe Technologies, headquartered in Beijing, has been operating for a decade and currently has branches including the Beijing R&D Center, Chengdu R&D Center, Doewe Shanghai, Doewe Shenzhen, and Doewe Hong Kong. The company is fully committed to building its independent brand "Doewe," with its business covering two main categories: Advanced Sensing Measurement and Control (ASMC) and Professional Test and Measurement Solutions (PTMS).

The ASMC product line provides innovative high-precision sensing acquisition and data analytics solutions. PTMS focuses on industry-specific test and measurement solutions for audio, video, and RF applications. It has established the 5XC product system, serving sectors such as transportation, broadcasting, automotive electronics, consumer electronics, and university research institutes.

Through relentless effort, several of the company's products have become benchmark test instruments in their respective industries. Doewe Technologies also holds multiple core patents and software copyrights, participates in relevant industry standards working groups, and contributes to the formulation of national and industry standards. Building on past achievements, Doewe continues to increase its R&D investment. We have never forgotten our original aspiration, firmly believing that only profound technological accumulation creates value. We persistently pursue innovation in test and measurement technology, dedicated to technology development, application software services, and research in test and measurement solutions.

Leveraging its Beijing headquarters, related technical centers, and subsidiaries, Doewe Technologies has gradually established a nationwide pre-sales and after-sales service network, providing customers with professional technical consultation. Guided by the principles of "Rigorous, Efficient, Professional, Innovative," Doewe Technologies will continue steadfastly on this path, living up to the trust of every customer.

The journey ahead is long and challenging. We will accompany you on this path of growth to create a new future of technology together.

Overview

Solution Overview

This solution focuses on the A²B audio bus in new energy vehicles. Its core lies in detailed testing of the audio (or electrical) indices of A²B signals by means of an audio analyzer, with emphasis on analyzing audio signal quality. The system can perform tests not only in laboratory environments but also when deployed in vehicles, conducting tests under real driving conditions. In addition, this solution can be used for performance evaluation of in vehicle A²B products. By analyzing the A²B audio signals emitted by on board microphones or other audio devices, it can precisely test the audio indices of these devices, thereby enabling comprehensive quality inspection and performance optimization of products.

This solution can perform audio signal analysis on a finer level, using high precision testing functions to carry out real time detection of key audio indices of A²B products such as frequency response, total harmonic distortion plus noise (THD+N), signal to noise ratio (SNR), phase, etc. These indices provide accurate data support for performance evaluation of audio systems, helping users discover and solve problems with in vehicle A²B audio products in a timely manner. Moreover, this solution is applicable not only to testing of in vehicle audio systems but can also effectively support applications of A²B signals in automotive active noise cancellation (ANC) systems.

The system can monitor in real time the performance of A²B signals in noise acquisition and processing, and help evaluate noise reduction performance. By using an audio analyzer to conduct refined analysis of signal quality under noisy environments, it can comprehensively evaluate the performance of in vehicle audio systems under complex working conditions, thus providing data support for further optimization. In summary, on the basis of efficient and precise data acquisition and analysis functions, and combined with the high performance testing capability of the audio analyzer, this solution provides comprehensive performance evaluation and improvement suggestions for the A²B audio system of new energy vehicles.

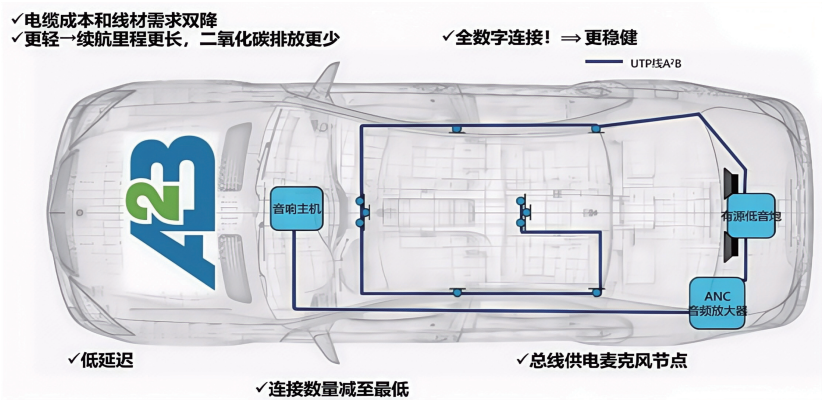

Figure 1 Wiring diagram of an automotive A²B audio system

Description of the Test System

Principle of the Test System

The system consists of hardware and software. Hardware employs an Audio Analyzer A10 and an A²B Test Option. The Audio Analyzer A10, together with the A²B option, is responsible for real time acquisition and analysis of in vehicle A²B signals. The A10 provides high precision audio signal analysis functions, including frequency response, THD+N, SNR, phase and other audio testing indices, enabling precise evaluation of A²B signals and A²B product performance. Installed on the A10, the A²B test option accomplishes data acquisition and format conversion of A²B signals. High performance modules and an Advanced Master Clock (AMC) supported by the A10 allow this system to synchronize multiple audio devices accurately, ensuring signal stability in complex environments. In addition, the A10 supports multiple interfaces such as HDMI, I²S and PDM, suitable for various testing requirements of in vehicle audio systems. The installation diagram of the option is as follows:

Figure 2 Installation diagram of the A²B

Software adopts ATC (Audio Test Center) testing software. This software provides strong functional support for the A10, enabling no code automated testing and rapid generation of test reports. ATC offers Workbench Mode and Sequence Mode: the former is suitable for real time monitoring of signal behavior, while the latter is suitable for automated operations in production testing. The software offers real time analysis of A²B signals and supports multiple functions including spectrum detection, waveform monitoring and signal quality analysis. Users can operate and control the testing process via a graphical interface.

Description of the Test System

Specific Test Workflow

At the start of testing, first connect the Device Under Test (such as MEMS microphones, loudspeakers, etc.) to the A²B test module of the Audio Analyzer A10. The A10 communicates with the ATC software installed on a Windows PC via USB. Audio signals are transmitted through the A²B bus to the A²B option on the audio analyzer; the decoded data from the option is then transmitted to the analyzer. Afterwards, the analysis software displays the test data in real time, yielding analysis results of key audio indices such as spectrum, THD+N and SNR. In this process, the input signal enters the audio analyzer via the A²B option, and the analyzer connects to ATC software on the PC through a USB cable; finally, the ATC software performs data analysis and report generation. This scheme ensures that the system can efficiently and precisely carry out comprehensive evaluation of audio signals during testing, providing reliable data support for performance optimization of in vehicle audio systems. The workflow diagram is as follows:

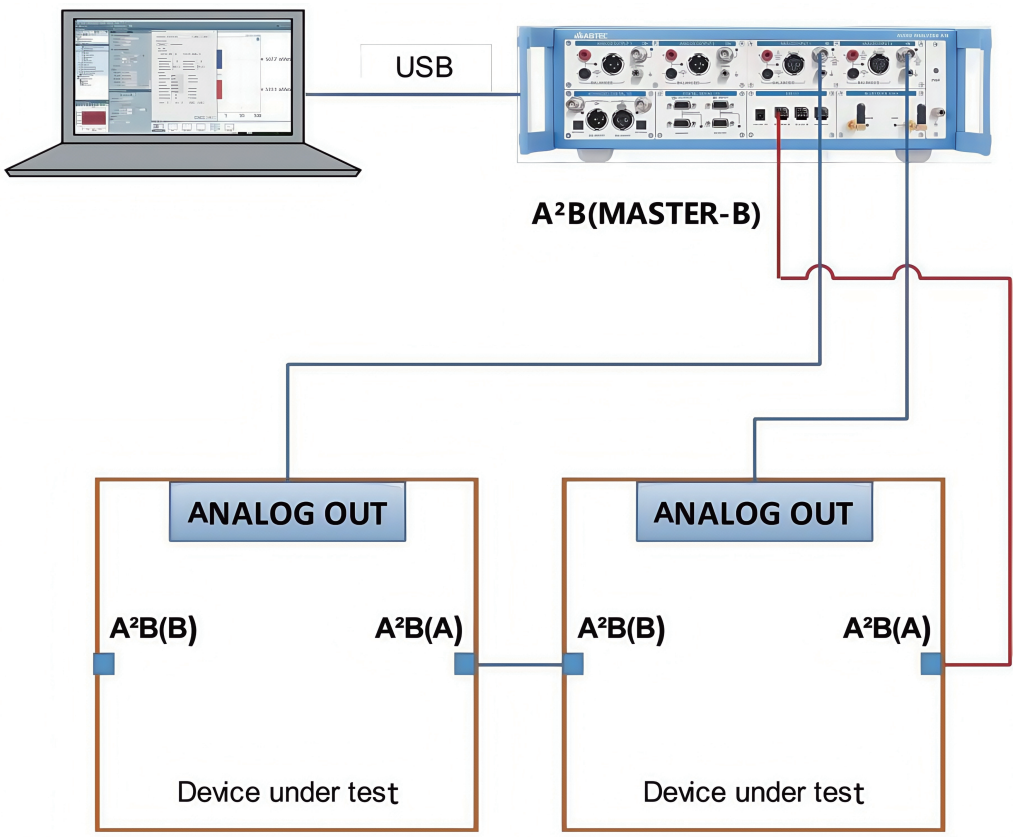

Figure 3 Overall structure diagram of the test system

Description of the Test System

Functions of ATC Testing Software

- **Signal analysis and real time feedback:** Through spectrum analysis, time domain waveform, THD+N, SNR and other functions, the software detects signal quality in real time, facilitating users' optimization and adjustment of related audio products.
- **Advanced signal generation and analysis functions:** Provides advanced signal generator functions, supports multiple signal types (e.g., sine wave, square wave), and can analyze various characteristics of signals, including frequency response, THD+N, dynamic range, etc., ensuring accuracy in signal transmission.
- **Automated testing and no code operation:** Supports no code automated testing; users can easily select and order test items, automate the testing process and generate reports in multiple formats, greatly improving testing efficiency and operational convenience.
- **Sequence Mode and Workbench Mode:** Offers two modes. Sequence Mode is suitable for fast, continuous testing, automatically judging results and generating reports; Workbench Mode provides real time signal analysis and various testing tools, suitable for more complex experimental environments and requirements.
- **Real time display of test results and report generation:** Test results—including waveform graphs, spectrum graphs, etc.—can be displayed in real time; users can quickly view test status via the graphical interface. All test data and results can be exported to PDF, Excel, CSV and other formats for subsequent analysis and sharing.
- **Flexible user interface and multi view support:** Presents an intuitive interface; users can choose different functional modules as needed. The interface supports multi view display, facilitating simultaneous viewing of multiple parameters and results, improving operational efficiency.
- **Device control and management:** Supports configuration and management of multiple devices; users can easily set up devices such as input signal sources and output configurations, comprehensively enhancing flexibility of device management and testing.
- **Multi channel analysis and real time data detection:** Supports multi channel signal analysis, can handle multiple signal sources simultaneously, and detects performance of each channel in real time, suitable for complex in vehicle audio system testing requirements.

Figure 4 ATC testing software diagram

Description of the Test System

Core Parameters of the Test System

A²B Option Parameters	
Maximum supported nodes	Up to 9 nodes (1 master + 8 slaves)
Audio channels	32 upstream and 32 downstream, enabling simultaneous acquisition and output of multiple audio signals.
A²B signal sampling rates	44.1KHz 48KHz
A²B signal output range	10Hz to 23.9520kHz
A²B signal output accuracy	±0.00002Hz ensuring high precision output.
A²B signal output flatness	±0.000001dB,20Hz~23.9520kHz
THD+N	When the master node is connected to a slave node, THD+N can reach –190dB.
SNR	SNR between master and slave nodes can reach –190 dB.

Audio Analyzer A10 Parameters	
Maximum output amplitude	26.66Vrms, suitable for testing high power devices.
Input power range	Supports DC voltage range of 0.4 V to 4.2 V.
Maximum digital output sampling rate	216kHz meeting high frequency signal acquisition needs.
Maximum input voltage	300Vrms applicable to high voltage signal testing.
Maximum bandwidth	1MHz supporting high bandwidth signal testing across multiple frequency bands.
Amplitude accuracy(1kHz)	±0.03dB,ensuring accurate amplitude output.
Amplitude flatness (5Hz-20kHz)	±0.008dB,guaranteeing amplitude flatness during testing.
Harmonic analysis	Supports independent harmonic analysis, providing comprehensive THD analysis.
Maximum FFT length	1.2M points,meeting high resolution spectrum analysis needs.
Residual input noise(22kHz BW)	1.0μV ensuring minimum noise during testing.
Maximum input sampling rate	216kHz,supporting high precision signal input and analysis.
Digital domain testing functions	Supports bit error analysis of digital signals and comparison of coded audio bit streams, suitable for precise analysis of digital signals.

Advantages and Features of the Solution

- **High precision audio signal analysis:** Through the Audio Analyzer A10 and A²B module, precise audio signal analysis can be conducted, including frequency response, THD+N, SNR and other key indices, ensuring high accuracy test results.
- **Multi node and multi channel support:** The system supports up to 9 nodes (1 master + 8 slaves), and each node supports up to 32 audio channels of data acquisition and transmission, meeting testing needs of in vehicle A²B audio systems.
- **Flexible signal output and sampling ranges:** Supports a wide signal output range (10Hz to 23.952kHz) and precise output accuracy (±0.00002Hz), satisfying diversified A²B audio testing requirements.
- **Powerful signal detection and data analysis:** Detects audio signal quality in real time, providing spectrum analysis, time domain waveforms and other real time data feedback, helping users quickly discover and solve problems.
- **Support for A²B sampling rates up to 48 kHz:** Maximum supported A²B sampling rate of 48kHz enables high quality audio signal acquisition, meeting modern high fidelity testing needs.
- **Low THD and high SNR:** THD+N can reach –190dB, SNR up to –190dB, ensuring low distortion and high fidelity during signal transmission.
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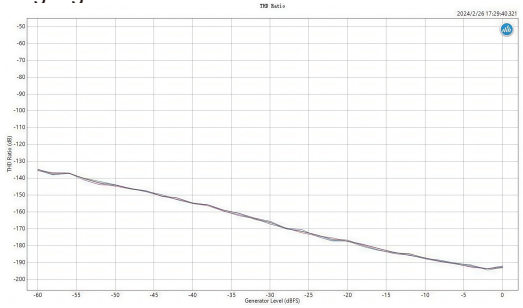


Figure 5 THD+N index illustration of the A²B option

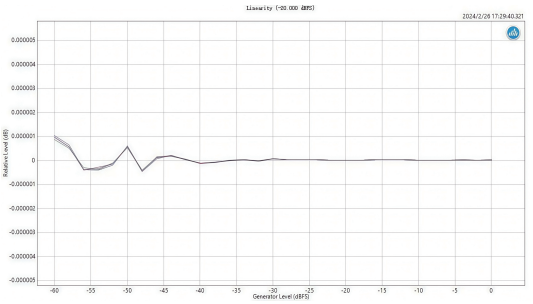


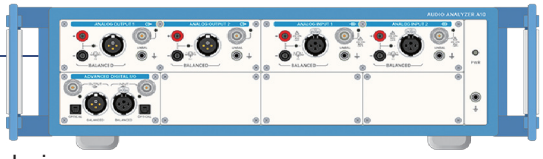
Figure 6 Gain error index illustration of the A²B

Introduction of Core Products

Overview of Audio Analyzer A10

Audio Analyzer A10 is a high performance analog audio analyzer fully benchmarked against AP's APx555. It features a high performance sine wave generator and analyzer capable of generating sine waves up to 204kHz and system residual THD+N less than –120dB, has test bandwidth exceeding 1MHz, supports all digital interfaces (ADIO/BT/I2S/HDMI/PDM/A²B) and the AMC module, and is an ideal test device for the R&D stage of audio products.

Key features



- Fully benchmarked against the APx555 audio analyzer of AP;
- Modern built in automated API interface;
- Supports HDMI, I²S, ADAS interfaces and provides efficient signal analysis;
- Supports Dolby and DTS audio decoding;
- Perfect user platform producing reports and images in multiple formats for easy sharing;
- Standard support for SPDIF/TOSLINK/AES/EBU digital interfaces, capable of generating advanced impairment signals;
- Supports AMC module, providing precise clock synchronization and signal analysis;
- Suitable for audio product R&D, supporting automated analysis of audio signals and report generation.

Core Parameters of Audio Analyzer A10

project	parameter
Maximum supported nodes	11 (1 master + 10 slaves)
Audio channels	32 upstream, 32 downstream
Audio resolution	32bit
THD+N	<-110dB（@48KHzsampling）
Frequency response range	48KHz: 20Hz~20KHz(±0.1dB) 96KHz: 20Hz~45KHz(±0.5dB) 192KHz: 20Hz~90KHz(±1dB) 384KHz: 20Hz~180KHz(±1.2dB) 768KHz: 20Hz~360KHz(±1.5dB)
Input/Output voltage range	2Vrms
Input impedance	100KΩ
Analog interface type	3.5mm TRS
A²B bus mode	supports Master/Slave
A²B cable length	up to 40 m (segment ≤10m)
A²B connector	2 pin connectors on panel, supporting Master/Slave link
Residual THD+N (20kHz BW)	< -120dB (1kHz, 2.0V)
Maximum input voltage	300Vrms

project	parameter
Maximum test bandwidth	1MHz
Maximum output amplitude (balanced)	26.66Vrms
Amplitude accuracy (1kHz)	±0.03dB
Amplitude flatness (20Hz – 20kHz)	±0.008dB
Maximum FFT length	1.2M points
Maximum input sampling rate	216kHz
DC voltage measurement	0.1μV
SMPTE, MOD, DFD, DIM	supported
Sine wave frequency range	DAC:0.001Hz~80kHz Analog:5Hz~204kHz
Frequency accuracy	3ppm
Frequency response	±0.03dB
Maximum digital output sampling rate	216 kHz
Output bit depth	8-24bit
Dolby/DTS signal sources supported	Yes (pre coded files)
Dimensions	480mm x 522mm x 153mm
Weight	9.6kg±0.8kg

Introduction of Core Products

Overview of the A²B Analysis Option

The A²B option includes separate Master and Slave boards and must be used in conjunction with the Audio Analyzer A10 to realize efficient audio testing. Combined with the A series analyzers, the A²B option provides powerful audio signal acquisition and analysis capabilities, suitable for various testing needs of in vehicle audio systems and automotive ANC systems. The option supports connection of up to 9 nodes, each supporting up to 32 audio channels, offering 32 bit depth and sampling rates of 44100kHz or 48000kHz. The option features excellent signal output accuracy and low distortion characteristics, ensuring precise audio analysis in complex in vehicle environments. The product photo is as follows:

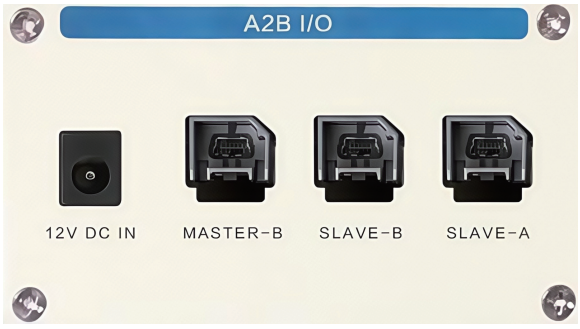


Figure 6 Product photo of the A²B

Core Parameters of the A²B Analysis Option

Parameter	Symbol	Min	Typ.	Max	Unit	Test Condition
Bus voltage	Va2b	7.8	8.0	8.2	V	Master-B→DUT
Bus current	Ia2b			500	mA	Master-B→DUT
THD+N				-190	dB	Master-B → Slave-A @ -0dB, 1KHz, 32bit
Crosstalk				-142	dB	Master-B→Slave-A @ -20dB, 10KHz, 24bit
SNR				-190	dB	Master-B →Slave-A @ -0dB, 1KHz, 32bit
Frequency response range		10		23.9520KHz	Hz	
Accuracy		±0.00002			Hz	20Hz~23.9520KHz
Flatness		±0.000001			dB	20Hz~23.9520KHz
Gain error				□0.000003	dB	Gain @ 1KHz, 32bit
Supported analyzers						A1DD,A2,A3,A4,A5,A6,A7,A8,A9,A10

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