ADLINK TECHNOLOGY INC.



White Paper

Cost-effective Solutions for Audio Testing

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Cost-effective Solutions for Audio Testing

As smart phones and tablets continue to gain popularity, multimedia content is becoming more important to consumers all the time. To provide superior multimedia experience, device innovation is not limited to improvement of display quality and size, but also audio quality. Accordingly, integration of more and better quality electro-acoustic components (i.e. receiver, speaker and microphone) is a priority in product development.

According to media reports and market research statistics, integration of electro-acoustic components into game console, smart phone, vehicle infotainment, digital camera, human-machine interaction interface, and other devices has experienced exponential growth in the past few years, especially in mobile applications. With audio quality recognized as an important factor in gaining market share, manufacturers must maximize the effectiveness of their audio testing systems.



Figure. Electro-acoustic components of consumer electronic products has presented exponential growth in the past few years

Practical challenges in audio testing

Since the range of unassisted hearing is insufficient to conduct detailed objective determination of audio signals, consumer electronic products must undergo testing utilizing specific equipment. While a dedicated device can be utilized, the cost can be prohibitive. Alternatively, a PC with sound card can function as a more affordable audio testing device for electro-acoustic components, measuring values such as maximum sound pressure level, frequency response, Total Harmonic Distortion (THD) and others. This approach, however, is becoming less satisfactory with the increasing complexity of current electronic products as well as the requirement for high quality and performance in audio components.

Increased precision requires increased performance

With the growing use of Wi-Fi networks and compatible devices, current devices provide, in addition to mobile phone function, sophisticated multimedia capabilities. The resulting vastly improved sound quality, including significantly advanced bass response and other high-end sound effects, dramatically expands the requirements for quality audio testing at the manufacturing stage. Continued use of sound cards with low resolution, low sampling rate and lower distortion/noise reduction for audio testing will be insufficient to guarantee the required level of quality control.

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Loading increases

As electro-acoustic components are added to consumer electronics product designs, testing workload expands commensurately. Formerly adequate systems testing components one at a time are unable to meet increased completion times, in addition to suffering from manual errors and omissions, all of which impede productivity and yield.



Figure. Manual testing can result in instability

Unstable testing results

During testing, consistency of test results across multiple production lines is critical, a task most available sound cards are insufficiently powerful to perform effectively. This shortcoming, coupled with unsynchronized input and output, varying time delays, and other issues, can contribute to deviation in final audio test results.

Higher development costs from limited software support

Current consumer electronics product testing is limited by little or no software support. The absence of simple software tools and easily-driven software platforms elevates requirements for manufacturer time, effort, and costs to develop their testing programs.

ADLINK's solutions for optimum audio component testing

ADLINK has introduced a variety of high-resolution dynamic signal acquisition modules, including its PXI-9527, PCI-9527 and PCIe-9529. Many established consumer electronics manufacturers utilize these modules as a cost-effective replacement for sound cards in electro-acoustic component testing. ADLINK's signal acquisition modules provide numerous advantages over commonly used sound cards. The 24-bit high-resolution, high sampling rate PXI-9527, for one, acquires fine sound measurements to distinguish subtle changes in performance. High precision, low distortion and low noise (< 3uVrms and THD+N <100dB) increase testing accuracy of the device under test (DUT) as well as ensuring quality and accuracy of sound reproduction.

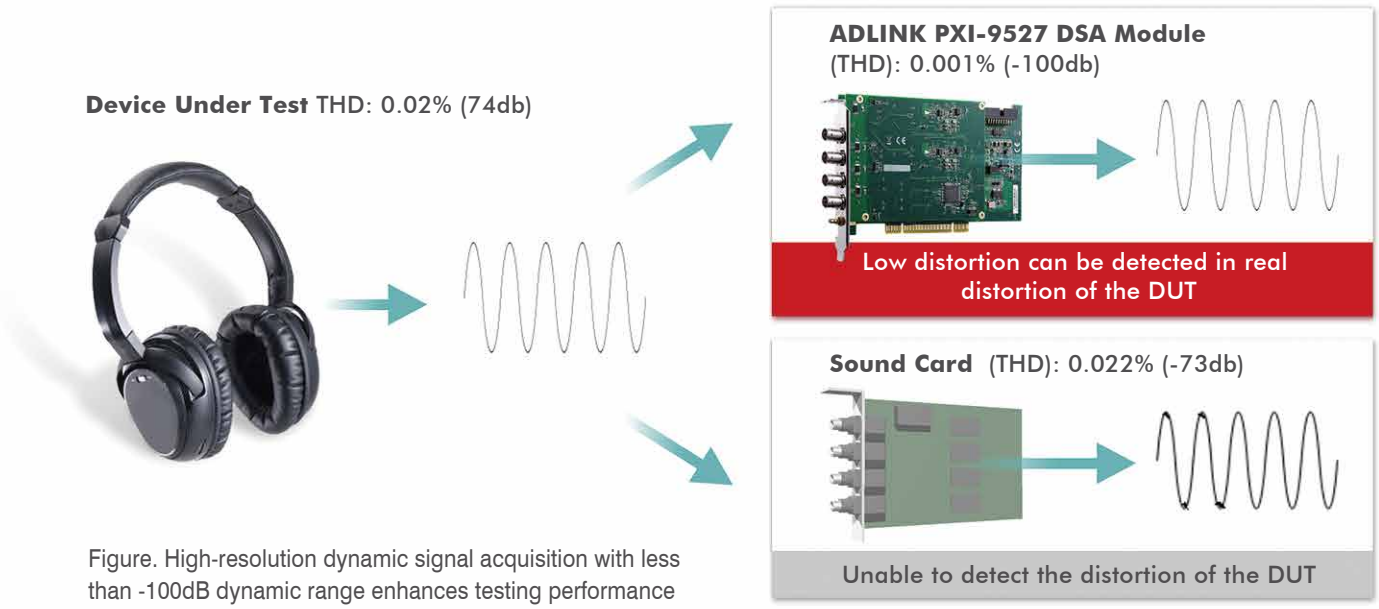


Figure. High-resolution dynamic signal acquisition with less than -100dB dynamic range enhances testing performance

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Two analog input channels and two analog output channels enable ADLINK's PXI-9527 to simultaneously handle both input and output, thereby eliminating problems of asynchronous transmission and time difference. Moreover, despite employment of different PCs across multiple testing events, results are consistent. Integrated electronic piezoelectric (IEPE) support enables direct measurement after IEPE sensor connection with no need for additional power supply.

ADLINK has further developed an easy-to-use audio test control program, allowing testing programs to be easily configured for automatic execution of related audio testing of headphone jacks, microphones, speakers, and other components with no need for programming, conserving manpower and time. For development of in-house testing programs, ADLINK's easy software platform easily provides peripheral device drivers using C or a LabVIEW system. Currently, many products require audio testing before entering the market. ADLINK offers a wide variety of different audio test solutions based on user requirements, as follows.

Mobile phone audio loop testing

Here, the PXI-9527 is utilized for testing mobile phone audio quality. The DUT is placed in a soundproof enclosure to prevent ambient noise interference. A microphone receives incoming audio and a speaker emits outgoing audio, with both connected to the PXI-9527 via analog I/O. During automated testing, the system gradually increases volume to within normal hearing range of 20Hz to 20kHz. Via the loop testing, all signals are returned to the PXI-9527, which, following Fast Fourier Transform (FFT) processing, generates a frequency response curve and distortion results determining the DUT's audio quality compliance with original design.

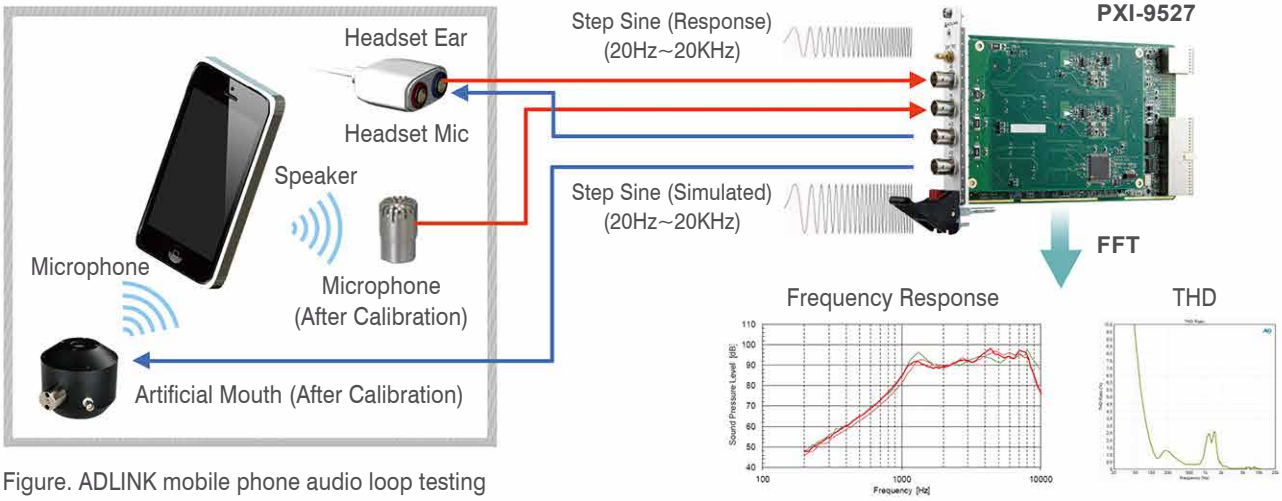


Figure. ADLINK mobile phone audio loop testing

As shown, tested items on the DUT include headset earphone and microphone, speaker and microphone, according to which the PXI-9527 which provides two analog input channels and two analog output channels. Expandability allows users to easily and quickly reconfigure test settings. If the number of electro-acoustic components to be tested, users simply need to add a switch or install another PXI-9527 without re-designing the test system.
The PXI-9527 also provides IEPE current output on each analog input channel, so no external power supply is required to power the microphone sensor, simplifying test structure.

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Figure. ADLINK audio testing program for mobile phones

In addition to SDKs for C / C ++ ,. NET, and LabVIEW users, ADLINK also provides an easy to use audio testing program for mobile phones, allowing developers to complete their testing program through simple settings.

HiFi mobile phone audio testing

HiFi-enabled mobile phones are mainly tested for Noise Level and THD+N. Again, the PXI-9527 can be used to implement testing procedures. The two analog inputs, connected to the phone's left and right channels, enable the system to compare measured values with original design specs.

Standard sound cards, often limited to measuring THD in -70dB or -80dB ranges, may well be unable to confirm whether the DUT is presenting sound accurately. As well, the default noise level of the sound card itself, up to 100μVrms, can easily exceed levels generated by the mobile phone (3 to 10μVrms).

In summary, the PCI-9527 thoroughly fulfils key indicators in HiFi-enabled mobile phone testing, and has already been implemented in production by leading manufacturers, making a clear choice for any operators planning to launch HiFi mobile phones.

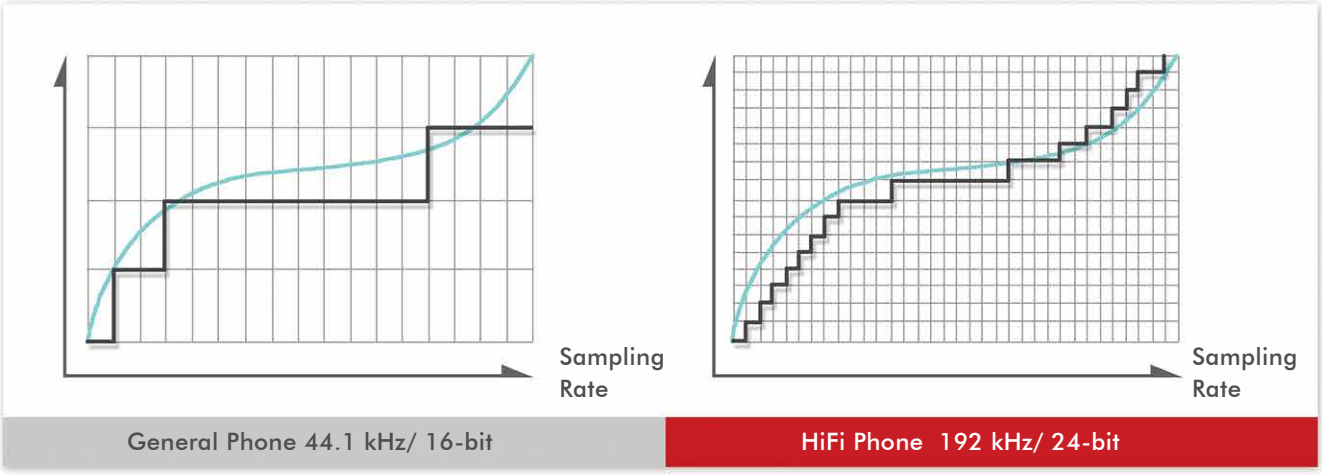


Figure. Detailed sound quality of HiFi phone at four times that of standard mobiles

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Vehicle infotainment system audio testing

Unlike phone audio testing requiring input and output channel measurement, vehicle infotainment devices require only testing of multiple speakers in front/back and left/right locations. Accordingly, the PCIe-9529 high-resolution signal acquisition module presents a powerful yet cost-effective solution, with high precision, low distortion, and low noise (THD <-100dB and SNR > 100dB), meeting all the needs of multi-channel vehicle infotainment testing. Signal-to-Noise Ratio (SNR), THD+N, channel crosstalk, volume, primary frequency and other testing parameters are all within the capabilities of the PCIe-9529, with its eight 24-bit sampling analog input channels, allowing testing of two 4-channel devices at the same time, as well as providing LabVIEW drivers to support quick self-development of in-house testing programs.

In-vehicle Infotainment System



Figure. PCIe-9529 testing two 4-channel car navigation devices at the same time

Conclusion

In response to rapidly changing market demands, consumer electronic manufacturers and contracted vendors demand significantly cost-effective yet highly functional testing solutions. ADLINK offers a variety of high-resolution dynamic signal acquisition modules allowing low-cost replacement of existing sound cards while still meeting the testing requirements of high-profile mobile devices. ADLINK's testing application is further able to automate testing processes with no programming requirement. High-performance devices and easy-to-use applications deliver shortened test time and reduced testing costs with no sacrifice in testing quality.



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About ADLINK

ADLINK Technology is enabling the Internet of Things (IoT) with innovative embedded computing solutions for edge devices, intelligent gateways and cloud services. ADLINK's products are application-ready for industrial automation, communications, medical, defense, transportation, and infotainment industries. Our product range includes motherboards, blades, chassis, modules, and systems based on industry standard form factors, as well as an extensive line of test & measurement products and smart touch computers, displays and handhelds that support the global transition to always connected systems. Many products are Extreme Rugged™, supporting extended temperature ranges, shock and vibration.

ADLINK is a Premier Member of the Intel® Internet of Things Solutions Alliance and is active in several standards organizations, including PCI Industrial Computer Manufacturers Group (PICMG), PXI Systems Alliance (PXISA), and Standardization Group for Embedded Technologies (SGeT).

ADLINK is a global company with headquarters in Taiwan and manufacturing in Taiwan and China; R&D and integration in Taiwan, China, the US, and Germany; and an extensive network of worldwide sales and support offices. ADLINK is ISO-9001, ISO-14001, ISO-13485 and TL9000 certified and is publicly traded on the TAIEX Taiwan Stock Exchange (stock code: 6166).

About the Intel® Internet of Things Solutions Alliance

From modular components to market-ready systems, Intel and the 250+ global member companies of the Intel® Internet of Things Solutions Alliance provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Close collaboration with Intel and each other enables Alliance members to innovate with the latest technologies, helping developers deliver first-in-market solutions.

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