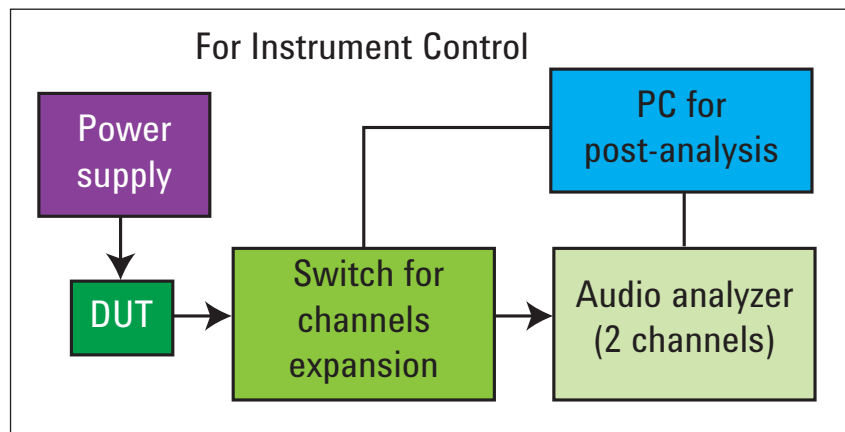


# Keysight Technologies

## Multi-Channel Audio Test using the Keysight U8903A Audio Analyzer



Application Note



## Introduction

Test requirements for car radio, CD receivers, and other devices such as GPS and entertainment systems are growing increasingly stringent. Manufacturers are expected to perform these multi-speaker and multi-channel tests while increasing throughput—without compromising test quality. This paper provides a solution for increasing overall production throughput and meeting these multi-channel testing requirements. Designed for today's automotive audio needs, the solution uses the Keysight Technologies, Inc. U8903A audio analyzer together with the Keysight 34970A/34972A data acquisition (DAQ) switch unit and the 34904A 4 x 8 switch matrix plug-in module.

## Challenges

The U8903A provides two analyzer channels yet manufacturers are required to measure multiple channels of various parameters such as voltage, dynamic range, and THD+N. To meet industry's test requirements and maintain production throughput, this testing can require six to eight channels.

For example, consider the following scenario. The required testing of car speakers typically includes multiple speakers. Various parameters for the front and rear, and right and left side speakers must be tested simultaneously. More than two channels are needed to perform such testing and prevent the creation of a bottleneck in daily production output.

## Solution

To expand the number of channels on the U8903A, a switch can be used. This switch changes the signal from the device under test (DUT) and sends the data to the audio analyzer and then a computer for post-analysis. The cover graphic shows a typical test configuration to expand the number of channels being tested simultaneously.

## Four-channels testing using the U8903A and Keysight VEE Software

Figure 1 shows this solution's typical test setup for audio testing. In this example, the DUT is a car's audio playing standard test tones. To expand the number of channels that can be tested and support simultaneous parameter testing, the 34970A/34972A DAQ/data logger switch and the 34904A 4 x 8 switch module are connected to the U8903A using a customized cable to maintain a balanced connection: the U8903A-107 XLR-to-2-BNC connectors. An automated Keysight VEE program is used to capture the frequency, AC voltage, and THD+N measurement of the test tone.

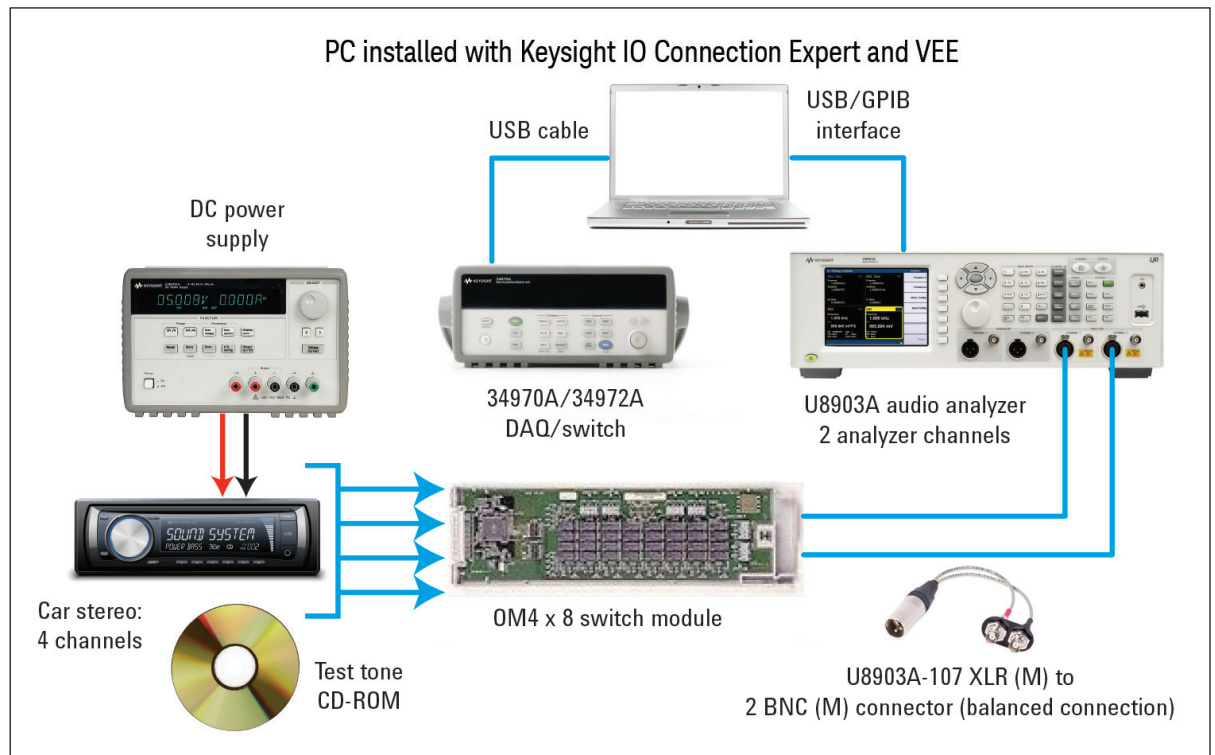


Figure 1. Typical audio testing setup using Keysight instruments

With this solution, four-channel testing is done using the following procedures:

1. Connect and power up the instruments shown in Figure 1.
2. Load the test tone CD-ROM in the car radio. In this example, two common test tones are being tested that are usually performed at a manufacturing site:
  - 1 kHz, 0 dBm
  - 1 kHz, -60 dBm for dynamic range test
3. Ensure the Keysight IO Connection Expert detects the necessary instruments before performing the test.
4. Run the automated Keysight VEE program as shown in Figure 2. Two different sets of results from this test program can be easily captured and displayed:
  - Frequency, AC voltage, and THD+N results
  - Dynamic range test of the car radio is the sum of the test tone input and the THD+N results

## Four-channels testing using the U8903A and Keysight VEE Software (continued)

As illustrated in Figure 2, the VEE program makes it easy to automate testing and simultaneously measure multiple channels and parameters.

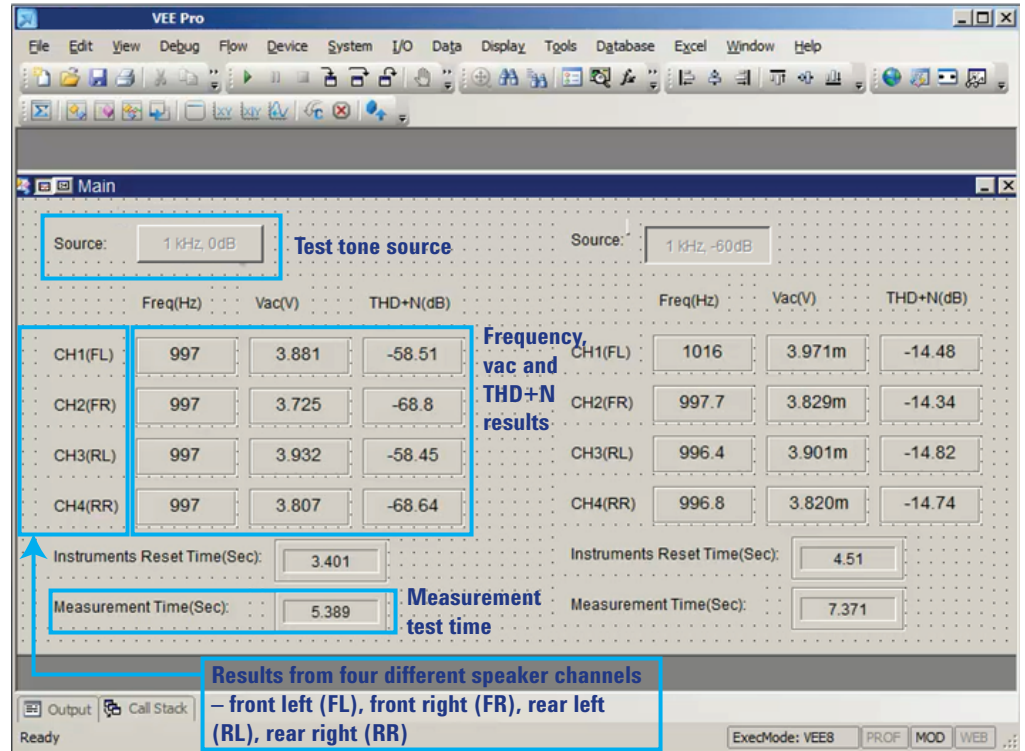


Figure 2. Example of an automated VEE program for four channels testing

With this solution, four-channel testing is done using the following procedures:

1. Connect and power up the instruments shown in Figure 1.
2. Load the test tone CD in the car radio. In this example, two common test tones are being tested that are usually performed at a manufacturing site:
  - 1 kHz, 0 dBm
  - 1 kHz, -60 dBm for dynamic range test
3. Ensure the Keysight IO Connection Expert detects the necessary instruments before performing the test.
4. Run the automated Keysight VEE program as shown in Figure 2. Two different sets of results from this test program can be easily captured and displayed:
  - Frequency, AC voltage, and THD+N results
  - Dynamic range test of the car radio is the sum of the test tone input and the THD+N results

## Solution Components

### Keysight U8903A audio analyzer

The Keysight U8903A provides the flexibility to measure and quantify both analog and digital audio performance in analog and digital IC component and module designs, wireless audio, and consumer audio applications. It contains analog domain and digital domain audio measurement in one box, making it quick and convenient to obtain complex, cross-domain measurements. The U8903A makes it easy to measure parameters such as distortion, SINAD, frequency, voltages, and FFT.

### Balanced connection cable

The balanced connection accessory is designed to reduce crosstalk and allow channel separation between the channels under test. In addition, this cable is used to provide a separate ground for multiple DUT testing. Figure 3 shows the accessory cables available for use with U8903A:

- U8903A-107 Cable - XLR (Male) to 2 BNC (Male) connector for the analyzer
- U8903A-108 Cable - XLR (Female) to 2 BNC (Male) connector for the generator

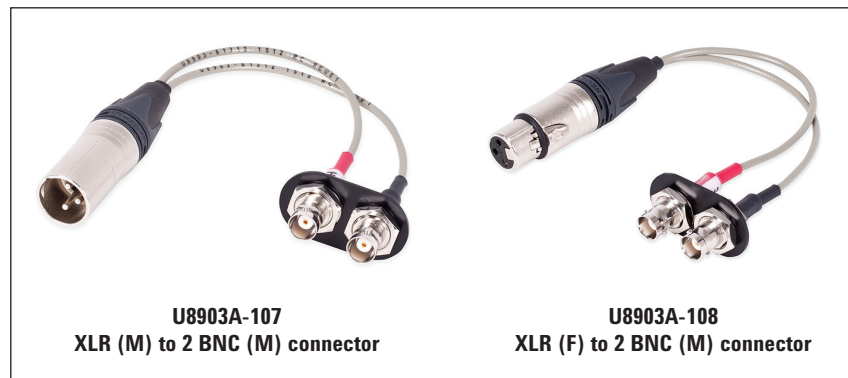


Figure 3. Keysight XLR to 2 BNC connector cables simplify measurement needs

## Keysight 34970A/34972A data acquisition /data logger switch unit

The Keysight 34970A/34972A DAQ/data logger switch unit consists of a three-slot mainframe with a built-in 6½-digit digital multimeter, and eight different switch and control modules. A complete selection of plug-in modules provides high quality measurements, switching, and control capabilities when it is connected to the U8903A audio analyzer and measures more than two channels at one time. The modules allow the number of channels to be expanded or changed based on audio testing needs.

## Keysight 34904A 4 x 8 two-wire matrix module for 34970A/34972A

The Keysight 34904A provides the flexibility to connect different instruments to multiple points on the DUT at the same time. Rows or columns may be connected between multiple modules to build 8 x 8, 4 x 16 or larger matrices, with up to 96 cross points in a single frame.

## Conclusion

Multi-channel testing is easily achieved using a combination of the Keysight U8903A audio analyzer, Keysight 34970A/34972A DAQ/data logger switch unit, and the Keysight 34904A 4 x 8 two-wire matrix module. In addition to car audio, this solution can be used to test other media devices such as MP3 players, DVD players, and televisions. Keysight instruments support SCPI commands, allowing users to easily program and automate the instruments and perform testing in their high volume manufacturing environment.

**myKeysight**

**myKeysight**

[www.keysight.com/find/mykeysight](http://www.keysight.com/find/mykeysight)

A personalized view into the information most relevant to you.



[www.lxistandard.org](http://www.lxistandard.org)

LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.



**Three-Year Warranty**

[www.keysight.com/find/ThreeYearWarranty](http://www.keysight.com/find/ThreeYearWarranty)

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



**Keysight Assurance Plans**

[www.keysight.com/find/AssurancePlans](http://www.keysight.com/find/AssurancePlans)

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



[www.keysight.com/go/quality](http://www.keysight.com/go/quality)

Keysight Technologies, Inc.

DEKRA Certified ISO 9001:2008

Quality Management System

**Keysight Channel Partners**

[www.keysight.com/find/channelpartners](http://www.keysight.com/find/channelpartners)

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

[www.keysight.com/find/audioanalyzer](http://www.keysight.com/find/audioanalyzer)

[www.keysight.com/find/freeaudiotips](http://www.keysight.com/find/freeaudiotips)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

**Americas**

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

**Asia Pacific**

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

**Europe & Middle East**

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:  
[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)  
 (BP-07-01-14)