Keysight Technologies
Automatic Audio Test for Design Verification and Production using the U8903B Audio Analyzer

Application Note

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Introduction

The Keysight Technologies, Inc. U88903B test sequence function provides users with a flexible and easy-to-use interface, making it quick and convenient to create automated test sequences. Most automated test programs can be created in just a few minutes without the need to know PC programming languages or other development tools, and all of the operation can be done using the U8903B's front panel.

The test sequence function can:

– Implement a series of measurements in a predefined sequence. There is no limit to the number of measurements. (Test time duration is correlated to the number of defined measurements: the more tests, the longer the test time.)

– Customize the setting of each measurement to suit your application.

– Set the limit of each measurement result and make FAIL/PASS judgments automatically.

– Generate test reports automatically and export them as Microsoft Word (.docx) documents for file management and use in design verification test, hardware qualification, and production test.

– Save a test sequence as a file for use by other U8903B audio analyzers.

This application note demonstrates how to create a test sequence using the Keysight U8903B. The test sequence example consists of six commonly-used audio measurements that are widely used to test consumer and professional audio devices, broadcast devices, and internet audio. The sequence includes measurements for level, frequency response, THD+N, phase, crosstalk, and signal-to-noise ratio (see Figure 1). Throughout this application note, bold text is used to indicate keys on the instrument. Text in [ ] refers to softkeys presented on the instrument's screen.

Figure 1. A test sequence example consisting of six audio measurements

Process Overview

There are four basic steps to creating a test sequence:

1. Create a standard test sequence with default settings.

2. Modify the default settings and default test report content to fit your measurement requirements.

3. If desired, set the FAIL/PASS judgment limits for each desired measurement result.

4. Run the test sequence and generate a test report.

To illustrate this process, the following sections explain how to create a test sequence consisting of the six basic measurements shown in Table 1.

Table 1. The example test sequence consisting of six basic measurements

Sequence	Measurement Item
1	AC level (Amplitude)
2	Stepped frequency sweep (Frequency response)
3	THD+N (Total harmonic distortion plus noise)
4	Phase
5	Crosstalk
6	SNR (Signal-to-noise ratio)

Note: Connect the device under test (DUT) to the U8903B audio analyzer before running the test sequence. In this example, the phase and crosstalk require two channels for measurement so the DUT needs two input and output channels.

Creating a Standard Test Sequence with Default Settings

The initial step is to create a standard test sequence consisting six measurements. The parameters of each measurement use default settings.

1. Press **Menu** on the front panel. Use **Arrow** to highlight "Test Seq App" in the menu, and press **Enter** to select the test sequence function.

2. Use **Arrow** to highlight "IO Configuration." Press [Add Measurement], which highlights "AC Level" and press **Enter** to select the "AC Level" measurement item. On the U8903B screen the "AC Level" measurement will be added under "IO Configuration."

3. Repeat Step 2 above to add the following measurements: frequency response, THD+N, phase, crosstalk, and signal-to-noise ratio. Note that the U8903B uses "Stepped Freq Sweep" in place of "Frequency Response" and it is the same as the frequency response measurement.

4. Use **Arrow** to highlight "Test 1" under "Project." Press [Status] to enable the test sequence. The status will change from "Disable" to "Enable" and a tick mark will appear near Test 1 and each of the measurements.

Figure 2. Creating a standard test sequence with default settings

Once completed, the U8903B display should look like Figure 2, indicating that you have set up a test sequence with six measurements. At this stage, all measurements, as well as IO Configuration, use default settings. Next, these settings must be checked and the parameters configured to suit your test requirements.

Modifying Default Settings and Test Report Content

In this step, we modify the settings of "IO Configuration" and each measurement. It is assumed that you are familiar with the U8903B input and output configuration and know how to set each measurement in the test sequence. If you are not, please read the U8903B User Manual for detailed operating instructions.

Modify the setting of "IO Configuration"

Use **Arrow** to highlight "IO Configuration" and press Enter to access the IO Configuration interface. Here, you can modify the "Output Configuration" (audio generator) and "Input Configuration" (audio analyzer). Use **Arrow** to switch between "Output Configuration" and "Input Configuration." Check the current settings and use the softkeys to modify the parameters to suit your test application.

For example, the default setting of "Input Configuration" is 4 channels. To change it to 2 channels for our measurement, use **Arrow** to highlight "Input Configuration," press [Channels] and select "2" in the pull-down menu. The number under [Channels] will change from 4 to 2. The display of the U8903B screen should look like Figure 3.
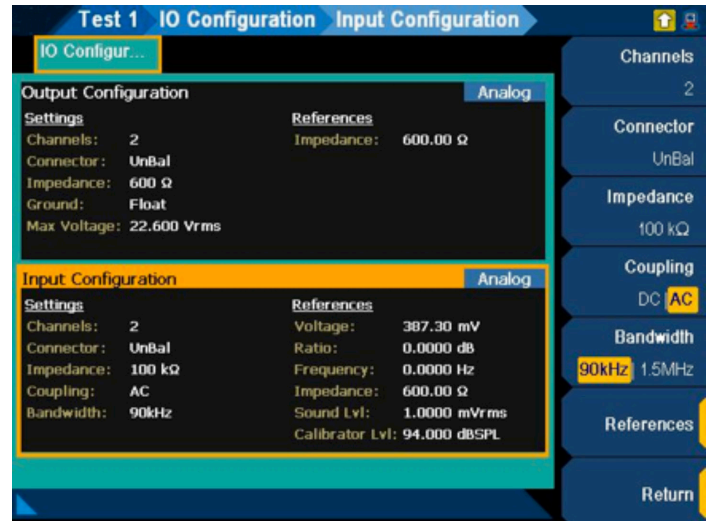
Modifying Measurement Settings and Test Report Content

Modify measurement settings

Press [Return] to go back to the test sequence main screen. Use **Arrow** to highlight the "AC Level" measurement. Press [Settings] to modify the "AC Level" measurement. Check the current setting and use the softkeys to modify specific settings to suit your test application.

Repeat the above step to modify the settings of the other five measurements.

Modify the test report content

After finalizing the configuration of the measurement, use **Arrow** to highlight the "AC Level" or "Gain" tab on the top of screen. On the U8903B screen a tick mark will appear next to "AC Level" or "Gain." This means the test results of "AC Level" or "Gain" will be included in the test report. If this value does not need to be included on the test report press [Status] to disable the test result.

For example, if the test result is not wanted on the test report, press [Status]. [Status] will change from "Enable" to "Disable" and the tick mark next to "Gain" will disappear.

Press [Return] to go back to the test sequence on the main screen. Continue modifying each of the settings for the other measurements to suit your test application and indicate what content to included in the test report. The main screen of U8903B should look like Figure 4.

Figure 3. Modified setting of IO Configuration

Figure 4. Modify the default setting and test report content to fit your measurement requirement.

Setting FAIL/PASS Measurement Limits

In production test or design verification test, engineers want to set a limit to the test results. If the test result exceeds the limit, the FAIL sign appears for this measurement. This PASS/FAIL judgment provides convenience for the test engineers, especially, if there are hundreds of measurements in the test sequence.

Setting these limits is very easy. For example, to set limits for the "AC Level" measurement use **Arrow** to highlight the "AC Level" tab on the top of the screen. Press [Edit Limits] and select [Upper Limit] and/or [Lower Limit] to set the "AC Level" limits. The default setting enables all limits.

Running the Test Sequence and Generating a Test Report

Press ON/OFF to run a test sequence and choose from one of three ways to run the test sequence:

- [Start Test App] – this runs the entire test sequence you just created.

- [Start Test App from Here] – this starts running the test from the measurement that you have highlighted. This is useful when you just want to run part of the test sequence.

- [Start Selected Measurement] – This only runs one measurement, which is determined by what you highlight.

After the test sequence is finished, a test report is generated automatically. From the main test sequence screen, use **Arrow** to access the "Report" tab on the top of the screen. Now, you can read the first page of the test report. Press **Arrow** down to read the beginning of the first page and use the scroll knob to read the rest of the page. Press **Arrow** right to access other pages. You can export the test report to an external USB thumb drive. The document is an Microsoft Word document (.docx) and includes date and time stamps on each page of the report.

Using Other U8903BF Test Sequence Function Features

Sharing test sequences

Test sequences can be created on any U8903B unit and shared with other U8903B units. From the test sequence main screen, press **Arrow** to the "Project" tab on the top of the screen. Press [Save Project] to save the test sequence as a file into internal memory or to an external USB thumb drive. Press [Open Project] to load the test sequence from the external USB thumb drive.

Using a "Project" or "Test"

A large test sequence, called a "Project," can be divided into many sub-test sequences called "Test." This is a convenient way to manage your automated tests. Normally, the audio input/output configurations are complicated: different channels, different connectors, different impedance, float/grounding, etc. Switching between different input/output configurations is time consuming and impacts test speed. The U8903B test sequence packs measurements with the same input/output configuration into one "test," making the automated tests fast and easy to manage.

Customizing PASS/FAIL messages

The U8903B provides more than just PASS/FAIL judgment, it displays a Pass Message or a Fail Message. This message can be customized to provide instructions about what actions to take if the measurement is passed or failed. From the test sequence main screen, press **Arrow** to the "Project" tab on the top of screen and press [Properties] to input the pass and fail messages.

Identifying DUTs

The U8903B can show the DUT's name (product name or model number) at the start of the test sequence. This helps users to identify which DUT they are testing with the test sequence.

Conclusion

Automated testing is considered complicated, costly, and time consuming. Test engineers may spend days on programming and even need to use graphic programming tools like Labview or VEE. Additional hardware costs for PCs and GPIB cards also are required. The Keysight U8903B test sequence function changes this situation. Any test engineer, even if they know nothing about PC programming languages or programming tools, can create a simple automated test in a few minutes, with no additional hardware required. This function is especially useful in design verification test, hardware qualification test and production test.

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