

Dolby® compliance testing with

Audio analyzers and test software from Rohde & Schwarz enable Dolby® licensees to subject their new products to the required, comprehensive compliance tests before they are launched on the market. The software saves considerable time and automatically generates a test report that merely needs to be sent to Dolby® Laboratories.



Fig. 1: The R&S®UPP audio analyzer and the new test program make Dolby compliance testing fast, convenient and error-free. In this example, the R&S®SFC compact modulator modulates the Dolby test data streams onto the RF carrier.

Rohde & Schwarz T&M equipment

Rohde & Schwarz is a test partner of Dolby® Laboratories

Dolby® Laboratories, Inc.*, headquartered in San Francisco, California, USA, was founded in 1965 by Ray Dolby. The company quickly made a name for itself with noise reduction methods for analog audio equipment. It now specializes in digital multichannel sound formats. Dolby® technologies have become an integral part of audio applications in broadcasting, cinema and home entertainment. For example, Dolby Digital® is an audio coding/decoding technology that provides up to 5.1 discrete audio channels for all types of surround sound applications. Dolby Digital Plus® further optimized audio coding technology, expanding it to 7.1 channels.

* Dolby®, Dolby Digital® and Dolby Digital Plus® are registered trademarks of Dolby Laboratories, Inc.



Test requirements defined by Dolby

Different Dolby technologies are used, depending on the device type and the application. The test requirements also depend on the device under test (DUT) – TV sets and A/V receivers require different tests. For each application, Dolby has created packages that help developers to integrate Dolby technologies into audio devices. These packages, called system development kits (SDK), also contain all test instructions. All Dolby tests follow the same basic scheme (Fig. 2):

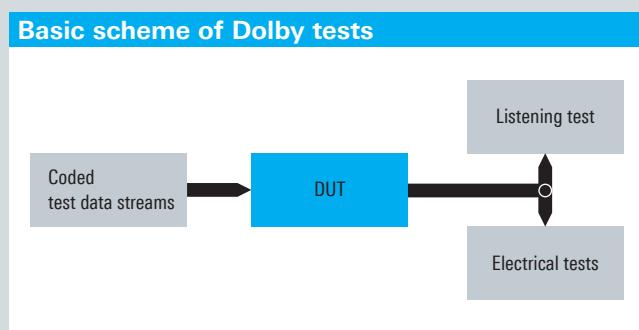


Fig. 2: Basic configuration for Dolby tests.

- The coded test data streams provided by the Dolby SDK are fed to the DUT.
- The DUT processes the data streams and outputs them as decoded audio signals over its various interfaces.
- Electrical tests are used to determine device characteristics and quality parameters such as level stability, distortion, etc.
- In addition, listening tests are defined in which, for example, channel assignment is checked. There are also tests that determine to what extent a DUT is able to compensate defined transmission errors such that they cannot be heard.

Today's consumer electronics equipment offers a wide range of interfaces. Dolby has defined tests for all these interfaces – for example, for analog outputs (loudspeaker or headphone outputs, line out) as well as for digital interfaces in line with the S/P-DIF or HDMI™ standard. In addition, Dolby has defined Internet-enabled tests, in which test data streams are read from an external hard disk into a TV set and decoded there.

The use of Dolby technologies is permitted only when licensed by Dolby Laboratories. Every new device must pass a compliance test in line with Dolby Laboratories specifications before it is put on the market. This requirement ensures that the implemented technology, e.g. in a TV set, functions exactly as defined by Dolby. To make work easier for licensees when developing new devices, Dolby provides defined test signals and detailed test instructions for compliance tests. These tests are quite extensive and place some demands on the user, since they require close attention to numerous conditions and their interdependencies. Although made easier by predefined device settings, the tests can take several hours, depending on the DUT, and must be performed exactly in line with the instructions. Up to now, test results and graphs had to be manually entered into documents specified by Dolby.

The R&S®UPP audio analyzer (Fig. 1) and the new test program from Rohde&Schwarz not only make all these tasks considerably easier and more convenient to perform, they also ensure that no errors occur. The program prompts users to enter the configuration settings and, based on these settings, automatically selects the suitable subtests. Under program control, the test signals are played and the measurements performed. While the individual steps are being carried out, a test report is automatically generated and only needs to be sent to Dolby Laboratories.

Fast and error-free – the Rohde & Schwarz solution

The first test program Rohde&Schwarz implemented is the one for the Dolby software development kit (SDK) called "Dolby Digital Plus® Decoder for Consumer Broadcast Products"; the program is used as an example in the following description. This SDK is designed for TV sets and set-top boxes that use Dolby Digital® and/or Dolby Digital Plus®. The test sequence is controlled by the R&S®UPP audio analyzer's built-in computer. Fig. 3 shows a typical test setup for TV sets.

In this example, the R&S®SFC compact modulator (see page 40) modulates the Dolby test data streams onto the RF carrier. The streams are fed to the antenna input of the DUT, which demodulates the RF signal and decodes the audio signals.

The R&S®UPP can perform measurements on analog outputs (line out, loudspeakers or headphones) and on the S/P-DIF and HDMI™ audio return channel (ARC) digital interfaces. If the DUT has output lines for coded audio signals (S/P-DIF or HDMI™ with compressed signals in line with IEC 61937), these signals can be decoded for the measurement directly on the R&S®UPP.

Listening tests are also supported. For this purpose, the loudspeakers are connected to the TV set via an A/V receiver.

The heart of the test setup is the R&S®UPP audio analyzer. Its test program guides the user through the entire sequence, and the built-in computer executes the Dolby test program. It is best to use the R&S®UPP800 with eight channels, because this model can handle all possible interfaces and can measure all analog channels in parallel even with 7.1 applications (Dolby Digital Plus®). The analyzer needs to be equipped with the options for measurements on digital interfaces.

The R&S®SFC compact modulator is used to generate RF antenna signals. Since TV standards are different in Europe and the USA, for example, the R&S®SFC must be equipped with the appropriate coder options.

The actual test is preceded by a configuration section in which the user is prompted to enter information e.g. about the manufacturer, the type and the model designation of the DUT. Entering the correct information about the DUT's inputs and outputs is crucial to the test sequence, for the individual test steps are defined on the basis of this information (Fig. 4). Since the test program adapts all measurements to the specific DUT in accordance with the relevant guidelines, test engineers do not need to study the many pages of the Dolby test instructions.

Often it is desirable to perform electrical and listening tests at separate times because their test setups are different. The test program gives users flexibility in configuring the test sequence and defining the order of the tests. It is also possible to execute only parts of the test program and perform the skipped tests later; individual tests can be repeated at any time. Passed, failed and aborted test steps are automatically

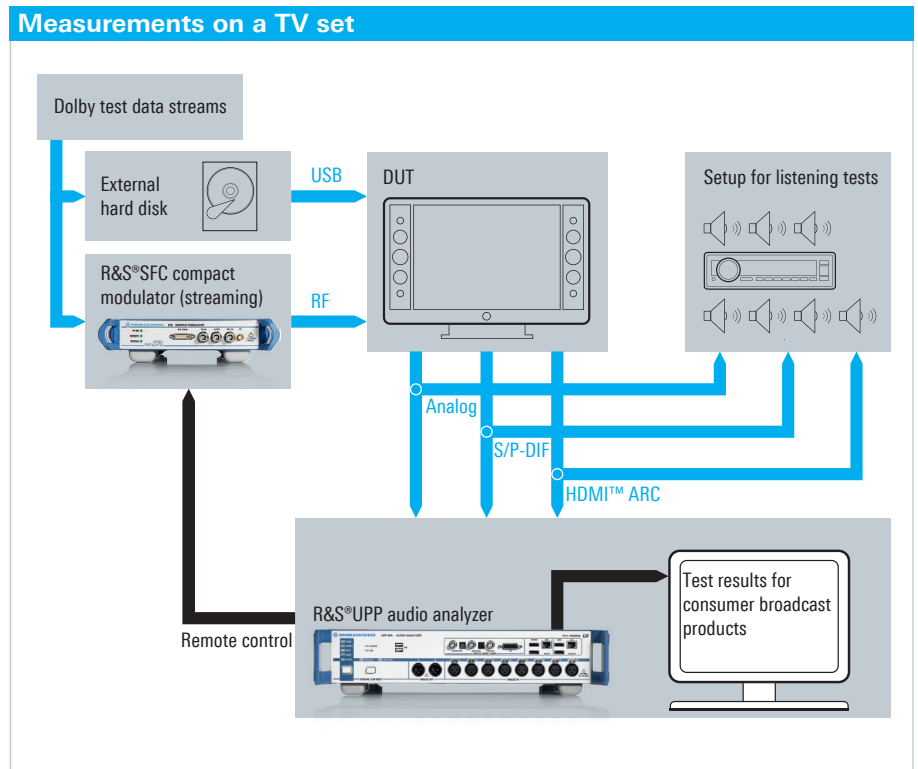
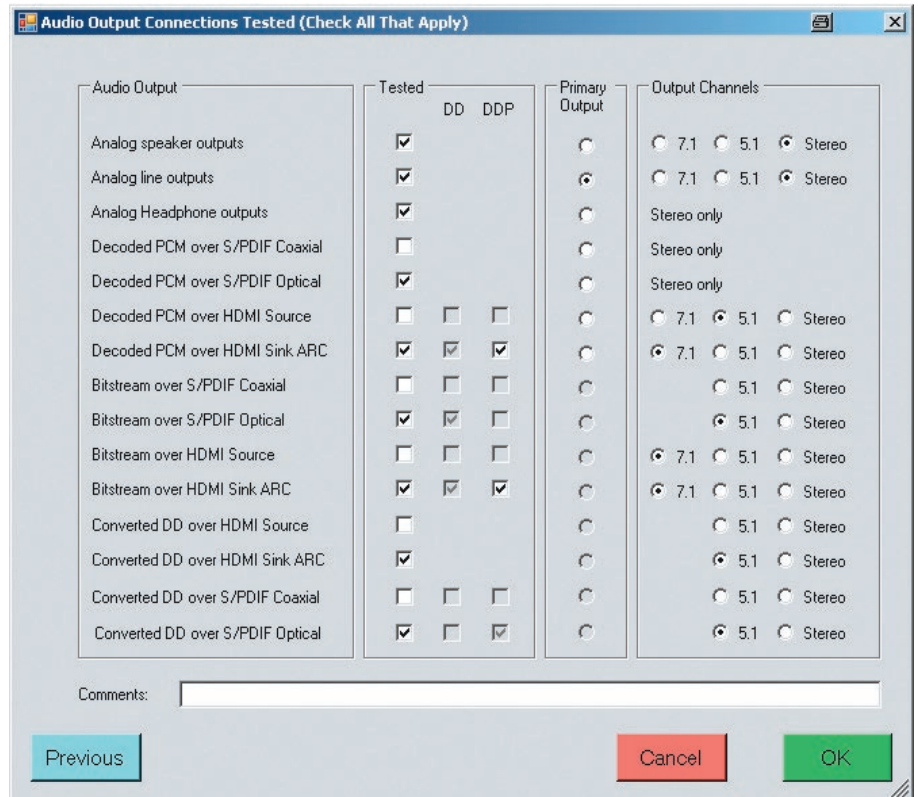


Fig. 3: Typical test setup for Dolby measurements including electrical tests and listening tests on TV sets.

Fig. 4: Entering the audio output configuration.



marked in a list, so that the user always has an overview of which tests still need to be performed (Fig. 5).

The above example begins with the electrical tests. The Dolby test data streams – for the SDK described here, well over a thousand files – are saved to the R&S®SFC compact modulator’s built-in hard disk. Controlled by the test program, each required data stream is started, modulated onto the RF carrier and fed in the suitable format to the TV set’s antenna input.

The measurements are performed on the R&S®UPP audio analyzer. Each test step begins with a window telling the user how to configure the DUT, which connections need to be made and what to do next (Fig. 6).

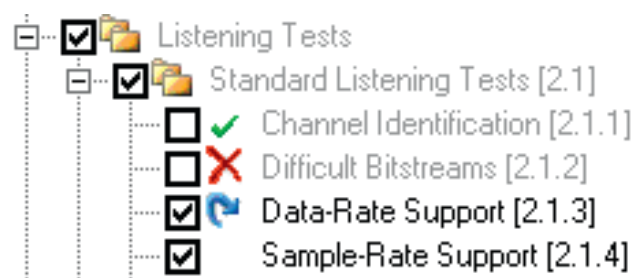
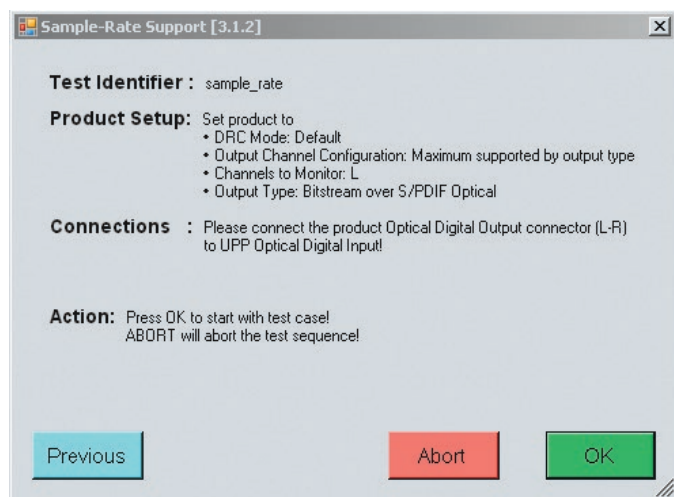


Fig. 5: Passed, failed and aborted test steps are marked.

Fig. 6: Preventing errors: The software provides detailed instructions for the test sequence.



Now the required test case can be started. It often comprises a series of individual tests for which different test data streams are used. Users do not have to bother with all these details; the R&S®UPP audio analyzer and R&S®SFC compact modulator play the right test signals, and the measurements are performed exactly in line with Dolby specifications. This avoids errors in the test sequence, and the entire test procedure takes much less time than with the manual method used in the past.

In most cases, the individual test steps will end with a PASS, and the test result including graphs will automatically be entered in the test report. But if difficulties arise, the user will be informed as to why the test could not be properly performed.

In the Internet-enabled tests, test signals are fed to the DUT’s USB interface, simulating modern TV sets’ capability to receive films via the Internet. Unlike the electrical tests described above, the test signals must be read manually from an external hard disk via the DUT. The program guides users also through these tests and tells them which Dolby test data stream to play from which directory. Measurements are likewise automatically controlled by the R&S®UPP.

With listening tests, the procedure is different. The test signals are played via the R&S®SFC, but now they must be acoustically evaluated by the tester. For example, the tester must listen to the signals to verify whether the loudspeaker assignment matches the coding of the individual channels and enter in a report whether the listening results agree with those stipulated. Here, too, the R&S®UPP audio analyzer’s test program guides the user through the entire test sequence. Once all test steps are completed, the test report merely needs to be sent to Dolby Laboratories.

Summary

The Rohde&Schwarz test program makes compliance testing easier for Dolby Laboratories licensees. It automates the required tests and helps save time because users no longer have to work through the extensive instructions. The program guides users through the entire test and prevents relevant DUT information from being omitted. The test report is generated automatically.

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