The R&S®SMU / R&S®AMU 200 A / R&S®AFQ Generators

Standard-compliant DVB-H signals for all tests on mobile devices

The signal generators of the R&S®SMU* family as well as the R&S®AMU 200 A and R&S®AFQ from Rohde & Schwarz are capable of generating all of the signals needed to test the latest generation of mobile radio devices with DVB-H functionality.

* This family includes the R&S®SMU 200 A, R&S®SMJ 100 A and R&S®SMATE generators.

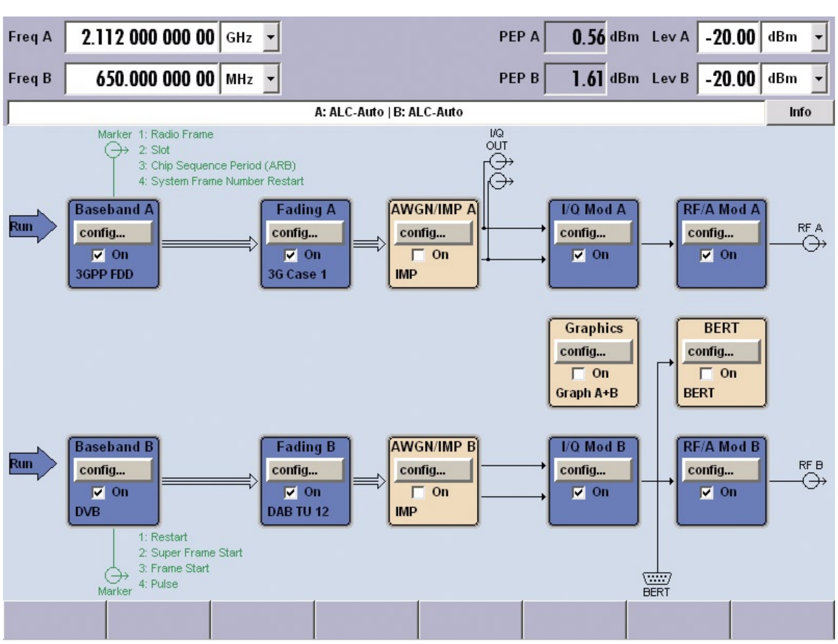
Combined: mobile radio and mobile television

Owing to the pilot project during the Football World Cup 2006, the new DVB-H television standard for mobile terminals (Digital Video Broadcasting Handhelds) has made its way into the public consciousness. Many mobile phones with DVB-H capabilities have already been presented as well. As mobile radio and mobile television converge, there is increasing demand for additional tests among producers who need to perform functional testing of DVB-H and mobile radio components.

The necessary standard-compliant DVB-H test signals (in accordance with ETSI EN 302 304) can now be generated using new options for the R&S®SMU generator family. Available options are:

- R&S®SMJ-K52 for the R&S®SMJ 100 A vector signal generator
- R&S®AMU-K52 for the R&S®AMU 200 A baseband signal generator
- R&S®AFQ-K252 for the R&S®AFQ 100 A arbitrary waveform generator using R&S®WinIQSIM2™

FIG 1 User interface of the R&S®SMU 200 A in the version with two paths. The upper path generates a 3GPP signal, and the lower path a DVB-H signal. Fading simulators are used in both paths.



Test signals for all DVB-H scenarios

These generators can deliver signals that comply with all common mobile radio standards (such as 3GPP and WiMAX). In combination with their new DVB-H functions, they provide an ideal test platform for DVB-H-compatible mobile phones. For tests involving combined scenarios with mobile radio and DVB-H, now only a single signal generator is needed to generate both signal types, either one at a time or simultaneously. Due to their extensive remote control capabilities, the Rohde & Schwarz generators can be used for automated tests in production.

Since DVB-H receivers are sometimes transported at higher speeds (e. g. in automobiles) so that Doppler effects and reflections have to be taken into account, the optional R&S®SMU-B14 fading simulator is recommended to simulate distorted channels. The simulator allows you to study how different DVB-H settings influence reception in terminals moving at higher speeds.

The R&S®SMU 200 A delivers its top performance when simulating co-existent mobile radio and broadcast standards in the configuration with two paths (R&S®SMU-B202 / -B203 option). This means that two complete vector signal generators are available in one instrument, each of which has the functions and capabilities described above.

A generator configured in this manner can generate a DVB-H signal on one path and a mobile radio signal on the other. Each signal is output on a separate RF connector. These two signals can then be used for testing DVB-H-compatible mobile phones for simultaneous reception of mobile radio and broadcast services (FIG 1).

If you need to simulate DVB-H on multiple channels, you can generate a DVB-H signal using both paths and implement test scenarios with adjacent channels structured to meet your requirements, for example.

If the memory depth of the R&S®SMU200A (i.e. the approx. 28 s duration of a test signal with the R&S®SMU-B9 memory option) is not adequate for certain applications, you

DVB-H versus DVB-T

DVB-H is the latest extension of the DVB standards (in addition to DVB-T, DVB-C, DVB-S) and expands the range of functions provided by DVB-T. DVB-H was created in response to new requirements. Compared to a television set in your living room at home, a mobile phone that is expected to deliver TV service has a much smaller display and must use much less power due to its battery. The appearance and ergonomics of DVB-H-compatible mobile phones must also meet minimum requirements. For example, a long rod antenna is unacceptable for reception so that the transmitted power is subject to careful consideration. These phones are also expected to provide satisfactory television reception in trains and automobiles, which means that the transmission technology must be designed to accommodate high speeds. DVB-H satisfies all of these requirements.

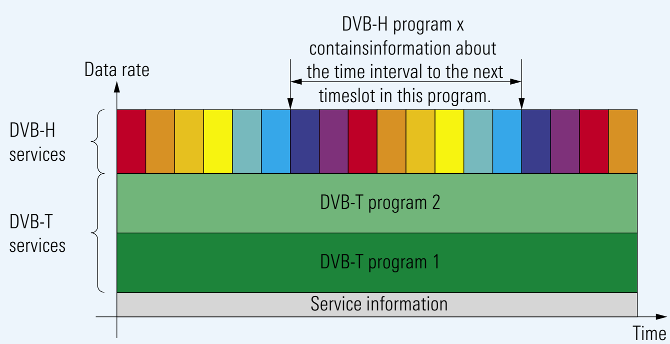


FIG 2 Schematic diagram of a DVB multiplex signal consisting of two DVB-T sections and eight DVB-H components with time division multiplexing.

The DVB standard is based on orthogonal frequency division multiplexing (OFDM), a technique used in all of the state-of-the-art radio standards. With OFDM, the transmitted signal is modulated onto multiple carriers (instead of just a single carrier). This makes the system less susceptible to in-channel distortion and other interference.

OFDM also makes it possible to set up single frequency networks (SFN) in which adjacent transmitters output signals on the same frequency and are time-synchronized. This permits larger cells with higher output power levels since cell interference is not a problem to be considered. In addition, constructive superposition of signals from two different transmitters at cell boundaries can boost the received power level.

There exists a relationship between the number of OFDM carriers used for transmission, the maximum possible speed of the terminal and the cell size of an SFN. The more OFDM carriers there are, the lower the maximum speed. On the other hand, additional OFDM carriers increase the range of a cell. DVB-T has two transmission modes with different numbers of carriers: 2K (1705 carriers) and 8K (6817 carriers). To provide a design compromise in networks between the maximum speed and the cell size, DVB-H also offers a 4K mode with 3409 carriers.

In order to decrease the susceptibility to interference at high speeds, it is possible to encode data over multiple OFDM symbols (one symbol represents the data of all carriers in a timeslot).

There are also certain distinctions in terms of power consumption. In DVB-T, the different services in a channel are transmitted continuously using a fixed data rate. This means that the receiver unit must continuously be active. In DVB-H, however, time slicing is used to achieve the longest possible battery life: A DVB-H data stream contains a specific service only in a periodically repeated timeslot in which it is transmitted with a selectively high data rate (FIG 2). It also contains information about when the next timeslot will be received. The data of a timeslot is buffered and routed to the video decoder at the actual data rate. During the time interval between two timeslots, the receiver unit powers down, which in theory can produce power savings of up to 90 %.

Information about when the next timeslot can be expected is transmitted in the data link layer (instead of the physical layer). This represents a significant difference compared to DVB-T. The terrestrial variant of the standard provides for direct transmission of video streams, while DVB-H transmits the content in IP packets. Packetization involves the use of multiprotocol encapsulation (MPE), and then the content undergoes forward error correction (MPE-FEC). The time slicing functionality is implemented as part of this process. The resulting transport stream consists of MPE-FEC frames and can be inserted directly into a DVB-T multiplex. This serves as a basis for the co-existence of DVB-H and DVB-T.

can use the new R&S®WinIQSIM2™ tool for signal generation. The DVB-H signals generated with this Windows® software can be replayed as a baseband signal using the R&S®AFQ100A arbitrary waveform generator and then converted to the RF by means of the R&S®SMU200A. This is a way to generate transmit sequences lasting up to one and a half minutes.

For test applications requiring sequences of user-definable length, Rohde & Schwarz offers the R&S®SFU broadcast test system [*] which is capable of generating the necessary DVB-H signals in realtime.

Clear and convenient menus, as always

The menus used to make settings for the DVB-H option are seamlessly integrated into the user interface of the Rohde & Schwarz signal generators. The number of DVB-H superframes to be generated (which determines the duration of the transmit sequence) is specified in the main menu (FIG 3). This menu provides information about the main signal parameters such as sample rate, data rate and duration of a repetition cycle.

The System Configuration menu displays the DVB-H signal path with the relevant components (FIG 4). All system parameters can be set by the user at precisely the locations in the signal flow where they have their actual effect. This presentation format also helps less experienced users to easily make settings, e. g. regarding the data sources, for which there are two variants:

- A standard-compliant DVB-H transport stream (ts or tps file or Rohde & Schwarz gts format) can be fed in and the video contained in the stream will be reproduced on the terminal. The R&S®DV-ASC advanced stream combiner software tool makes it possible to generate transport streams from IP streams in ip4 or ip6 format with unique contents.
- Standard-compliant null packets containing PRBS data can be used for non-content-dependent analysis of the transmitted signal.

Users who want to know exactly which system parameter settings cause which changes in the TPS bits can simply click "TPS Settings" in the main menu to view the transmission parameter signaling bits (TPS).

Summary

The signal generators of the R&S®SMU family as well as the R&S®AMU200A are already equipped to handle the latest challenges resulting from the convergence of mobile radio and DVB-H. These generators provide a convenient set of test features in a single instrument.

Volker Ohlen

More information and data sheet at www.rohde-schwarz.com (search term: SMU-K52)

REFERENCES
[*] R&S®SFU Broadcast Test System: Universal test platform for digital TV. News from Rohde & Schwarz (2004), No. 183, pp 39–43

FIG 3 Main menu of the DVB-H option.

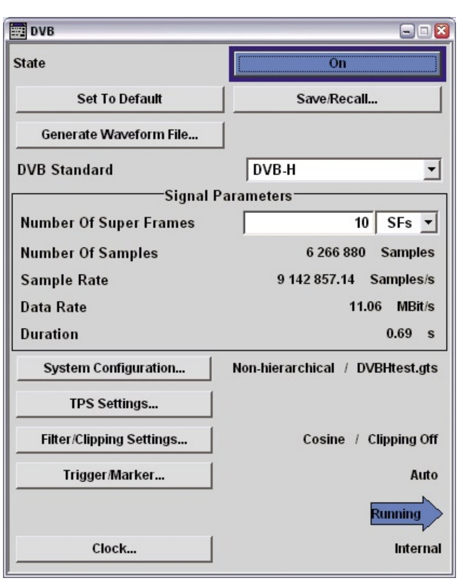


FIG 4 Menu allowing easy setting of all parameters in the system diagram.