Mobile system measures network coverage in a moving vehicle

The new R&S® TSM-DVB DVB-T/H diversity test receiver has been designed for mobile coverage measurements in digital terrestrial transmitter networks. While broadcasters have traditionally carried out stationary measurements, digital networks are now also making mobile measurements necessary. In combination with the R&S® ROMES coverage measurement software, the handy test receiver is ideal for this task.

Since DVB-T is not optimized for reception in a moving vehicle, – as is the case with GSM or UMTS – mobile coverage measurements are subject to significant limitations when performed with conventional receivers. The common 8K FFT mode, in particular, only allows measurements at walking speed in many cases since reception would otherwise be interrupted. The vehicle has to be stopped repeatedly in order to perform sample measurements; detailed information on actual coverage is practically impossible.

The R&S® TSM-DVB (FIG 1) makes all this a thing of the past. With its two sophisticated DVB-T receive paths for diversity reception (FIG 2) and two antennas, it considerably increases the receive power and even allows measurements at speeds of up to 150 km/h. Coverage measurements in city traffic and even on freeways are no longer a problem.

Rohde & Schwarz recommends a two-phase measurement concept to help ensure optimum DVB-T radio coverage. In the first phase, you perform mobile, fast, and cost-efficient overview measurements with the R&S® TSM-DVB. In the second phase, you perform detailed...
and high-precision stationary measurements with the R&S®EFA TV test receiver and an antenna raised on a 10 m mast in accordance with the CCIR guidelines.

**Versatile and mobile solution**

The R&S®TSM-DVB DVB-T/H diversity test receiver is integrated into a small robust aluminum case; its 12 V supply voltage is suitable for use in vehicles. Its low weight and high sensitivity (up to –92 dBm) also make it ideal for indoor applications. Measurement data such as bit error ratio, modulation error ratio, and carrier/noise ratio can be easily recorded and displayed with the R&S®ROMES coverage measurement software [1] (FIG 3). In combination with a laptop and a GPS receiver, a complete mobile coverage measurement system is provided. Owing to its modular software structure, the system can be expanded with the R&S®DVMD MPEG-2 measurement decoder [2] and the R&S®DVO digital video quality analyzer [3]. With the R&S®TSM-DVB-Z4 MPEG decoder, which is available as an option, you can display the picture contents on the laptop. Rohde & Schwarz also offers customized solutions for integrating the instruments into racks, transit cases, or backpacks.

The R&S®TSM-DVB has two transport stream outputs. During diversity reception, the same transport stream is available at both outputs. When hierarchical reception is used, the high-priority (HP) transport stream can be output at one output and the low-priority (LP) transport stream at the other. But you can also

![FIG 3 Typical screenshot of drive test results using the R&S®ROMES coverage measurement software.](image)
operate the diversity test receiver as two autonomous receivers; in this case, two different transport streams are output.

The R&S®TSM-DVB is equipped with commercial tuners and demodulators. They not only have a favorable impact on the instrument’s price, but also allow you to obtain practical information about reception capabilities with consumer equipment.

**Model 10 for DVB-H networks**

Model 10 of the R&S®TSM-DVB can also receive and measure signals in DVB-H networks. Digital video broadcasting for handheld terminals (DVB-H) is an enhancement of the DVB-T standard; the transmission parameters are optimized for reception with mobile equipment. Various manufacturers have already announced plans to launch instruments with an integrated DVB-H receiver. Although DVB-H is essentially compatible with DVB-T, DVB-T receivers cannot handle these signals. This is due to various enhancements made to DVB-H that were created to allow interference-free reception even when a vehicle is in motion. The bandwidth, for example, is limited to 5 MHz and allows you to use the frequency ranges of mobile radio networks. A method referred to as time slicing (FIG 4) reduces power consumption similar to the timeslot method used by GSM and enables the receiver to switch off its frontend intermittently. A new 4K mode is a good compromise between the 2K and 8K FFT modes. Moreover, a new Reed-Solomon error correction technique improves the carrier/noise ratio. Instead of MPEG-2, newer standards such as H.264 are used for video compression. They allow video transmission at a low bandwidth.

In DVB-H networks, model 10 can not only determine the measurement parameters already used in DVB-T and supply the parameter data in the transport stream. It also offers information about the (native or in-depth) inner interleaver used and about transmission parameter signaling (TPS) such as DVB-H signaling, time slicing, and MPE-FEC.

All this makes the R&S®TSM-DVB a universal receiver that enables you to perform trouble-free coverage measurements both in pure DVB-T or DVB-H networks and in combined networks.

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**Measured parameters**

- Signal strength
- Bit error ratio (BER)
- Modulation error ratio (MER)
- Packet error ratio (PER)
- Carrier/noise ratio (C/N)
- Status information: AGC locked, Carrier locked, TPS locked, Viterbi locked, MPEG Synchro locked, MPEG Data locked, Uncorrected MPEG Packet
- FFT mode
- Constellation
- Guard interval
- Hierarchy
- Code rate
- Cell identity (CI)
- Inner interleaver\(^1\): native, in-depth
- DVB-H TPS field\(^1\): DVB-H signaling, time slicing, MPE-FEC
- Constellation diagram\(^1\)

**Receive characteristics**

- VHF channels: 5 to 12
- UHF channels: 21 to 69
- Bandwidth: 5\(^1\)/ 6 / 7 / 8 MHz
- Sensitivity (depending on the DVB-T mode): –20 dBm to –92 dBm
- FFT modes: 2K, 4K\(^1\), and 8K

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\(^1\) Model 10 of the R&S®TSM-DVB.

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**REFERENCES**


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**FIG 4**

The time slicing method in DVB-H yields lower power consumption in mobile equipment as compared to DVB-T.