Efficient coverage analysis for terrestrial broadcast networks

In combination with an R&S®ETL or R&S®ETH TV analyzer, the new R&S®BCDRIVE broadcast drive test software quickly and reliably performs measurements to acquire the geographical distribution of the signal quality during drive tests. The system delivers accurate results with a single drive test – for multiple frequencies and for a large number of terrestrial broadcast standards. The intelligent functionality for displaying vast amounts of measured data in Google Earth makes it possible to recognize critical reception areas with pinpoint accuracy.

New possibilities for an ordinary task

Operators of terrestrial broadcast networks have to completely and reliably cover specific regions and areas. For this reason, they use complex simulation programs during the planning phase to predict and check the coverage that will be provided by planned transmitter sites. Yet because the propagation characteristics of a region are complex and cannot be determined in detail, a series of real field measurements must be performed after commissioning to verify the actual coverage situation.

Most terrestrial broadcast signals are received at a stationary position, which is why coverage specifications are frequently designed for this type of reception. In order to analyze the coverage conditions in this situation, a test vehicle is driven to a number of separate locations to take a representative stationary measurement at each. The vehicle is often equipped with a 10 m antenna mast in order to ensure that the reception conditions resemble those of rooftop antennas to the greatest extent possible. Since this method is highly time-consuming, in most cases it is only possible to approach a coarsely meshed network of measurement points in practice. Hence, the actual coverage of a region is analyzed with less detailed information.

In contrast, measurements performed continuously while the test vehicle is moving provide information about the reception at many different locations in a short amount of time. However, at increasing vehicle speed and in the case of pronounced multipath reception, the Doppler effect will cause the signal quality to decrease, meaning that the signal quality does no longer represent stationary reception conditions. Still, these types of measurements are useful for the following tasks:

- Analysis of the receive field strength, since this is not affected by the Doppler effect
- Analysis of broadcast services intended for mobile reception and that therefore explicitly include the Doppler effect in their coverage requirements
- Preparation for subsequent stationary measurements, which are then limited to locations where mobile reception was not possible

System overview

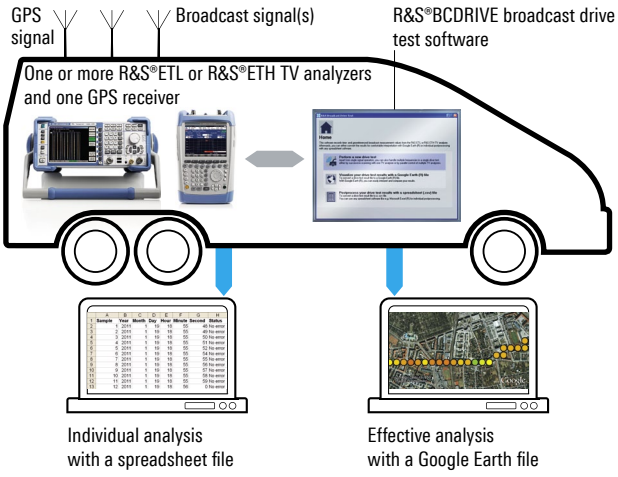

Fig. 1 In combination with the R&S®ETL or R&S®ETH TV analyzers, the R&S®BCDRIVE broadcast drive test software quickly and reliably performs measurements to acquire the geographical distribution of the signal quality.

R&S®BCDRIVE: intelligent and efficient

No matter what method is performed — stationary measurements, mobile measurements or a combination of the two — the new R&S®BCDRIVE broadcast drive test software from Rohde&Schwarz gives users a tool for performing coverage analyses quickly with a minimum of resources. The program can control one or more R&S®ETL or R&S®ETH TV analyzers to accurately perform all measurements required for quality assessment and root cause analysis at one-second intervals — in accordance with a variety of terrestrial broadcast standards

R&S®ETH – full support of DVB-T/DVB-H and ISDB-T					
	Receive field strength	Signal synchronization	Modulation error ratio	Bit error rates	Channel impulse response
DVB-T / DVB-H	●	●	●	●	●
ISDB-T	●	●	●	●	●

R&S®ETL – support of many broadcast standards								
	Receive field strength	Signal synchroni-zation	Modulation error ratio	Bit error rates	Channel impulse response	Signal-to-noise ratio	MPX level / peak deviation	RDS bit error rate
ATSC ATSC Mobile DTV	●	○	○	○	○			
DAB / T-DMB	●	●	●	●	●			
DTMB	●	○	○	○ 1)	○ 1)			
DVB-T / DVB-H	●	●	●	●	●			
DVB-T2	●	●	●	●	●			
FM (radio)	●						●	○
ISDB-T	●	●	●	●	●			
Analog TV	○					○		

● Mobile measurement ○ Stationary measurement 1) For OFDM signals

Fig. 2 The R&S®ETH and R&S®ETL TV analyzers support a variety of broadcast standards and provide all measurements required for signal quality assessment — in many cases for mobile reception as well.

(Figs. 1 and 2). R&S®BCDRIVE can even be run directly on the R&S®ETL so that no additional controller is required during the drive test. All that is additionally required is a USB GPS receiver (e.g. R&S®TSMX-PPS) and a measurement antenna for the desired frequency range. The transducer function included in the R&S®BCDRIVE broadcast drive test software makes use of the measurement antenna characteristics and automatically converts the signal power into the more reliable receive field strength value.

The software provides two methods for performing a complete analysis of all the frequencies transmitted in a terrestrial broadcasting network during a single drive test. Firstly, each frequency is measured by a dedicated TV analyzer. Advantage: Maximum measurement speed delivering maximum spatial resolution, particularly for mobile measurements. Secondly, a single TV analyzer can also be used to measure multiple frequencies cyclically in series — but at the expense of the measurement speed and lower resultant spatial resolution. Both methods can also be combined as needed to achieve a well-balanced compromise between cost and speed (Fig. 3).

Maximum user friendliness

R&S®BCDRIVE performs as much of the configuration as possible. For example, the software works in the background to automatically identify any available R&S®ETL or R&S®ETH TV analyzer and to configure them for field measurements by activating the preselector or automatically adjusting the expected input level.

The clearly structured, task-oriented operating concept requires just a few easy configuration steps to quickly achieve the desired results. Help texts and context-related tooltips explain the function and effect of each specific setting.

When performing stationary analysis at several predetermined locations, the software ensures that all instruments are correctly configured upon arrival at each measurement point and that recording can be started at the press of a button.

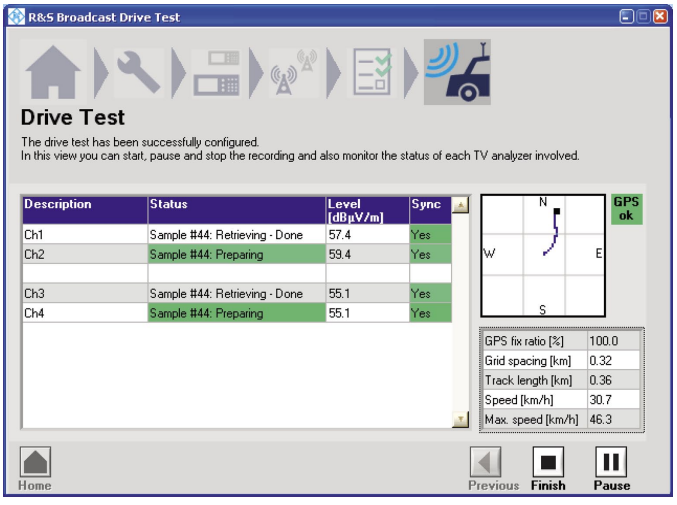

Fig. 3 This view in R&S®BCDRIVE shows a well-balanced compromise for measuring multiple frequencies during a single drive: Two R&S®ETL TV analyzers are used in parallel. The first measures channels 1 and 2 in series; the second measures channels 3 and 4 in series.

Intelligent presentation of the measurement results

The software exports the recorded data in a format that can be displayed in Google Earth and organizes the often vast amounts of data in a way that makes critical reception areas immediately apparent. For this purpose, each numeric measured value can initially be displayed on the map as a color gradient ranging from red to yellow to green in accordance with user-defined limits. Depending on the zoom level, the software aggregates adjacent values in a single spot. The color of the spot indicates the poorest of all the aggregated values.

Up to three independent color gradients can be displayed at the same time, differentiated by the size of the measurement points. The color spots can be used to show the correlation between different types of measured values for the same frequency, such as the receive field strength, modulation error ratio and bit error rate. However, it is also possible to directly compare a single measured value type, e.g. the receive field strength at different frequencies. For advanced correlation analysis, Google Earth provides the appropriate feature for displaying external data, such as 3D building models or coverage prediction results of the simulation tool used beforehand.

For more in-depth analyses, clicking any measurement point on the map opens an extensive, detailed view listing all results available for this location (Figs. 4 and 5). For more specific testing, the R&S®BCDRIVE broadcast drive test software can export data in the .csv format for spreadsheet programs used for fully customized analyses.

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For more information and ordering information, visit:
http://www.rohde-schwarz.com/product/BCDRIVE.html

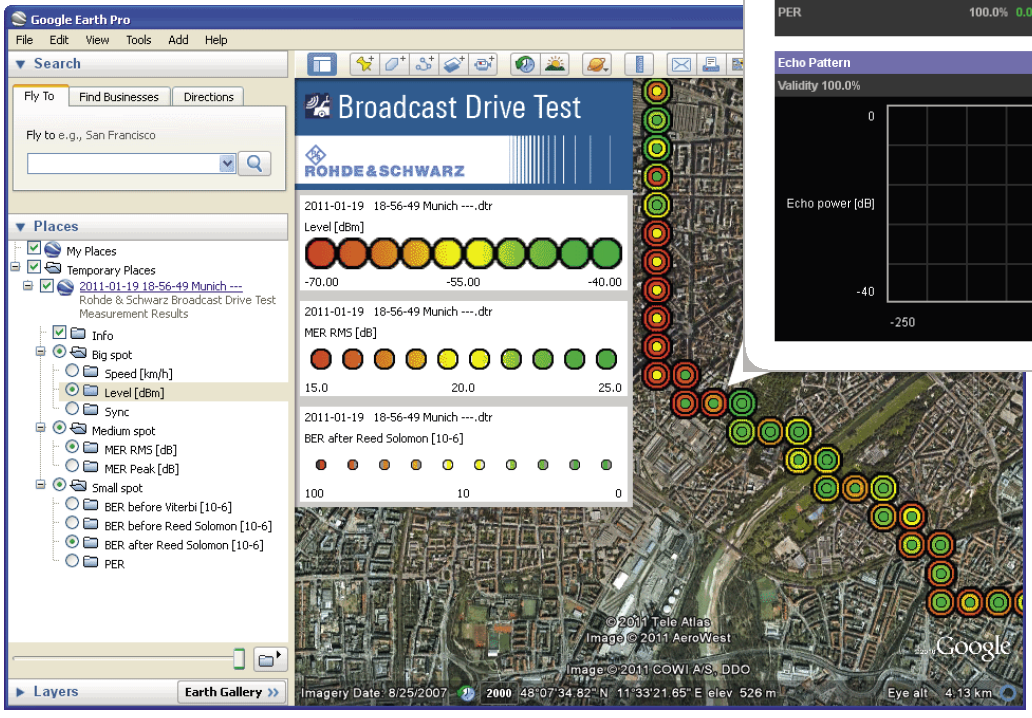

Fig. 4 Functionality for displaying measurement results in Google Earth for direct color-based correlation analysis of the various measurements. In this example, the receive level is indicated by the outer ring of the color spot, the modulation error ratio by the middle ring and the bit error ratio by the center of the color spot for each measurement location. Clicking each of these locations opens a detailed view on a white background (Fig. 5). Depending on the zoom level in Google Earth, adjacent measurement points are aggregated automatically to ensure that the display remains discernible.

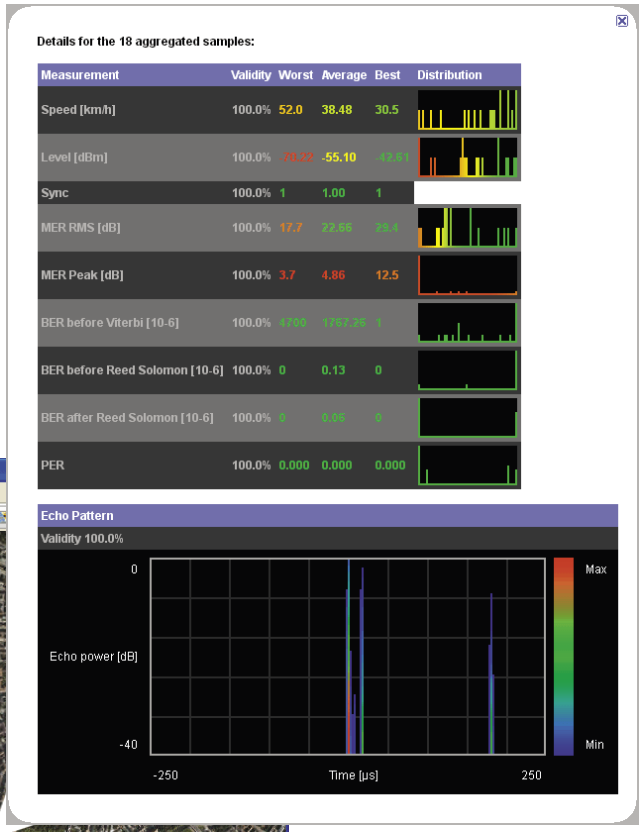

Fig. 5 Clicking one of the measurement points opens a summary of all values measured for that location.