New direction finders cope with next generation signals

In 2018, the German Federal Network Agency (BNetzA) completed the modernization of its nationwide VHF/UHF direction finder network. Station by station, the authority had replaced legacy direction finders with state-of-the-art equipment. In total, the BNetzA acquired 34 R&S®DDF550 wideband direction finders, together with a comprehensive set of accessories and services, and is now well prepared to handle future radio signals.

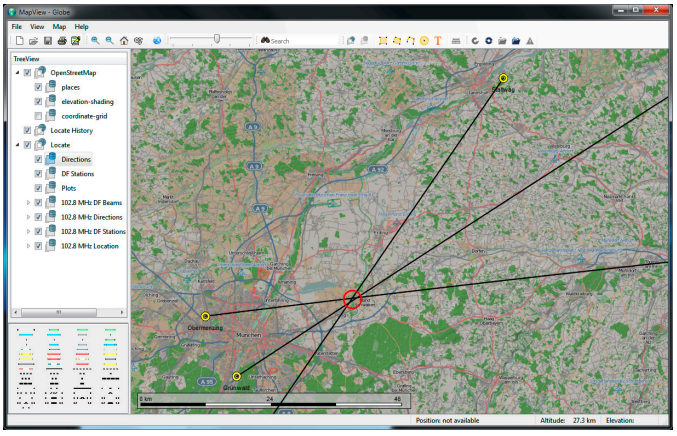
To stay one step ahead of changes in radio spectrum utilization and technology, the BNetzA modernized its radio measurement and location systems with advanced R&S®DDF550 wideband VHF/UHF direction finders. The DF units take bearings on emitters to help verify and pinpoint signal sources. Whether identifying an interfering emitter or verifying a licensed transmitter, the direction finder provides crucial information by delivering the emitter's geolocation data.

Combining three direction finding (DF) antennas enhances the system's sensitivity and accuracy over the entire frequency range from 20 MHz to 3 GHz. An issue of priority for the BNetzA was the antennas' ability to switch between horizontal and vertical polarization. The R&S®ADD157 dual-polarized VHF/UHF DF antenna meets this requirement, allowing operators to take bearings on vertically and horizontally polarized signals.

The BNetzA also appreciates the direction finders' immunity against reflected wavefronts. This is achieved by using DF antennas (R&S®ADD050SR) with nine antenna elements and a large diameter at the fixed monitoring stations. Where size matters, e.g. on mobile platforms, the compact R&S®ADD253 wideband DF antenna, which covers the entire VHF/UHF range, is used.

One of the BNetzA's direction finding stations installed in Grünwald near Munich, Germany.

Three direction finders triangulate and pinpoint an emitter's location in R&S®MapView.



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Depending on whether the focus is on enhanced sensitivity or higher immunity to strong signals, e.g. in the vicinity of strong transmitters, antenna elements can be switched to active or passive mode.

The R&S®DDF550 provides up to 80 MHz realtime bandwidth and fast signal processing. It can take bearings on short-duration signals, enabling the system to detect and geolocate even shortest emissions. This means that the direction finder can also intercept and locate fast, frequency-agile emitters, bursts and pulses that have become common in modern wireless communications.

The R&S®MapView geographic information software displays the measurement results, i.e. bearings and locations, on a digital map. The software supports a wide variety of map data, such as OpenStreetMap (OSM), and commercially available map formats. The software's quick zoom function and other features help to provide visual results in a fast, optimized manner.

A major requirement of the BNetzA was high flexibility in terms of infrastructure, system integration and operation. Rohde&Schwarz accommodated these needs.

The BNetzA can control their direction finders using their own spectrum monitoring software as well as a new software package supplied by Rohde&Schwarz. In many cases, operators use their local monitoring station and unmanned remote systems at the same time. To enable this, the direction finders must be accessible from multiple workstations. In order to avoid conflicts when multiple operators try to command the same direction finder, the software features integrated access control. Flexibility is also required to handle different types of remote control links, as some remote sites are connected via fast DSL, while others rely on slower 3G mobile phone links.

For optimal receiving quality and coverage, the DF antennas are mounted on top of tall masts, where they are at risk of being struck by lightning. To avoid damage caused by lightning strikes, the antennas come with built-in, effective lightning protection that has been specifically designed not to interfere with incoming wavefronts. Other accessories of interest are weatherproof cabinets that allow the DF equipment to be installed outdoors close to the antennas. This does away with the need for long cables, reducing cable loss and increasing the direction finders' sensitivity.

Combined R&S®ADD157, R&S®ADD050SR and R&S®ADD070 direction finding antennas, installed in Grünwald near Munich, Germany.

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