Tracking down interference – in vehicles and on foot

No signal goes undetected – the R&S®DDF007 portable direction finder turns any vehicle into a high-precision mobile direction finder in just a few minutes. On foot, when tracking down interference in buildings or in difficult terrain, the direction finder helps operators pinpoint the location of a signal source. With its integrated wideband receiver and compact DF antennas, this compact device is unique on the global market. Designed for flexibility and a broad scope of applications, the R&S®DDF007 redefines what modern direction finding can do.

Fig. 1 Short-duration radio interference can be easily located using two – or preferably three – compact DF stations installed at exposed sites. The figure shows an R&S®DDF007 portable direction finder with the R&S®ADD107 compact VHF / UHF DF antenna mounted on a wooden tripod.
**Full range of functions in a handheld format**

The R&S®DDF007 portable direction finder (Fig. 1) has a wide 20 MHz to 6 GHz frequency range that covers all important radio services. Above 173 MHz, it uses the high-precision correlative interferometer DF method. The DF system includes the R&S®DDF007 and a compact DF antenna with integrated GPS module, electronic compass and optional magnetic mount vehicle adapter (Fig. 2). The direction finder’s integrated wideband receiver offers ample functionality for signal detection and display, including a panorama scan function for the fast scanning of wide frequency ranges and a fast spectrogram (waterfall) display. The direction finder also has a map display function including triangulation that visualizes DF results on a map and makes it possible to locate transmitters by means of a running fix (Fig. 3).

The R&S®DDF007 is based on the R&S®PR100 portable receiver and includes the full functionality of that device. All R&S®PR100 options are also available for the R&S®DDF007.

**Unmatched versatility and flexibility**

**Locating radio interference sources**

When radio interference, such as caused by defective electronic equipment, degrades or even disrupts radiocommunications, quick and effective action is needed. Interference often originates from inside buildings or densely built-up areas, making it difficult to locate its sources. This is the type of scenario where the R&S®DDF007 compact DF system comes into its own. Within minutes, it turns any vehicle into a DF system that can quickly detect and home in on interference sources. To identify the rooms in a building from which interference originates, the R&S®HE300 portable directional antenna is used instead of a DF antenna (Fig. 4).

---

**Key features of the R&S®DDF007**

**Wide frequency range**
- DF mode: 20 MHz to 6 GHz
- Receive mode: 9 kHz to 7.5 GHz

**Integrated, fast wideband receiver**
- Fast spectrum monitoring
- Detailed IF spectrum display at high bandwidths
- Demodulation of wideband signals
- Signal analysis in receive mode (option)

**High-precision DF method**
- Correlative interferometer DF method in the range above 173 MHz

**Integrated map display (option)**
- Integration of OpenStreetMap (OSM) digital maps
- Triangulation based radiolocation
- Integration of application-specific maps (option)

**Control and system software**
- R&S®DF7-CTL control software
- R&S®RAMON software components (options)

**Innovative, compact DF antennas and accessories**
- Multi-element DF antennas in the range above 173 MHz
- Integrated GPS module and electronic compass
- Vehicle adapter with magnetic mount (option)
- Lightweight wooden tripod (option)

**Compact, lightweight lithium-ion battery pack**
- Two hours of DF operation or four hours of receive operation (with receiving antenna) on a single battery charge

**Detailed technical information and product brochure at** [www.rohde-schwarz.com](http://www.rohde-schwarz.com)
Locating short-duration radio interference
Short-duration radio interference can be located using two, or preferably three, compact DF stations including the R&S®DDF007. The compact DF antennas are mounted on lightweight wooden tripods and installed temporarily at exposed sites, for example on the roofs of tall buildings (Fig. 1). The complete equipment for a DF station can be carried, and the DF station set up, by just one person.

The R&S®DDF007 uses automatic or manual triangulation to locate a signal source. Manual triangulation requires no extra equipment. To locate a signal source at close range, the operator can turn a DF station into a mobile direction finder quickly and easily.

Locating public mobile radios
Public mobile radios, which are hardly any larger than cell phones, are widely used since they are readily available and can be operated without a license. They are frequently used for mobile applications, and their emissions typically last only a few seconds. This makes it difficult to reliably locate a signal source, especially in built-up areas.

Small, handy, and easy to operate – with a patented DF method requiring significantly less hardware

Single-channel correlative interferometer DF method
The correlative interferometer DF method is based on measuring the phase differences between a reference element and the other elements of a DF antenna. A patented Rohde & Schwarz method makes it possible to carry out this measurement by means of a single receiver. To measure the phase angle between the signals of two antenna elements – independently of the frequency and phase modulation of the signal to be DF’d – the phase of one of the two signals is shifted in four steps (0°/90°/180°/270°) in the quadrature multiplexer and then added to the second signal. The receiver measures the amplitude of the sum signal after each phase shift. From the four amplitude values obtained, the phase angle between the two signals can be calculated. This measurement is performed for each antenna element.

The single-channel interferometer DF method developed by Rohde & Schwarz offers clear advantages over most conventional interferometer direction finders that use at least two receivers. The two receive paths must be in phase and need to be calibrated accordingly since otherwise measurement times will be significantly extended. Moreover, the local oscillator signals need to be multiplied and distributed in-phase. This means that more hardware is necessary compared to a single-channel interferometer direction finder – an additional receive path, in-phase multiplication and distribution of the local oscillator signals, a calibration signal generator, calibration signal distribution and an additional cable to the DF antenna for the calibration signal.
The problem can be solved using a DF network with two, or preferably three, R&S®DDF007 based DF stations. The DF stations are interconnected via PCs and radio links (for example GSM or UMTS). One PC in the network locates the target radio, using automatic triangulation, and displays the result on a map. The DF network can also be remotely controlled.

Location results can be significantly affected by DF errors, depending on the distance between the direction finder and the transmitter. High DF accuracy is therefore mandatory. Here again, the R&S®DDF007 is at the cutting edge – in conjunction with the compact multi-element DF antenna, it offers DF accuracy unparalleled for an instrument of this size.

Locating interference in security-critical areas
Locating interference in security-critical areas such as airports, seaports or military bases, or during large events, calls for high flexibility. Here, the extremely versatile R&S®DDF007 DF system comes into its own. It can be deployed as a fixed or mobile DF station, or as a portable manual direction finder for indoor applications. The integrated high-performance wideband receiver makes it possible to scan the spectrum at high speed and identify, analyze and record signals (Fig. 5). To perform detailed signal analysis, classification and demodulation/decoding in realtime, the R&S®DDF007 is connected to a PC running the R&S®GX430 signal analysis and processing software. The R&S®DDF007 in receive mode transfers the demodulated signals as I/Q data with a bandwidth of up to 500 kHz to the external PC via its Ethernet interface.

Summary
The compact DF system based on the R&S®DDF007 portable direction finder offers functional diversity and performance previously not found in a system of this size. It can be used as a fixed or mobile DF station, or as a portable manual direction finder for indoor applications, and can be reconfigured within minutes to meet the requirements of a given task. The R&S®DDF007 comes with a wide range of powerful software options and add-ons, making it an excellent choice for all applications that call for a compact and flexible yet powerful DF system.

The R&S®PR100 portable receiver can be enhanced to include the functionality of the R&S®DDF007 portable direction finder. Apart from the DF antenna, this merely requires a firmware update plus the enable code. Operators can perform this upgrade on site.

Philipp Strobel