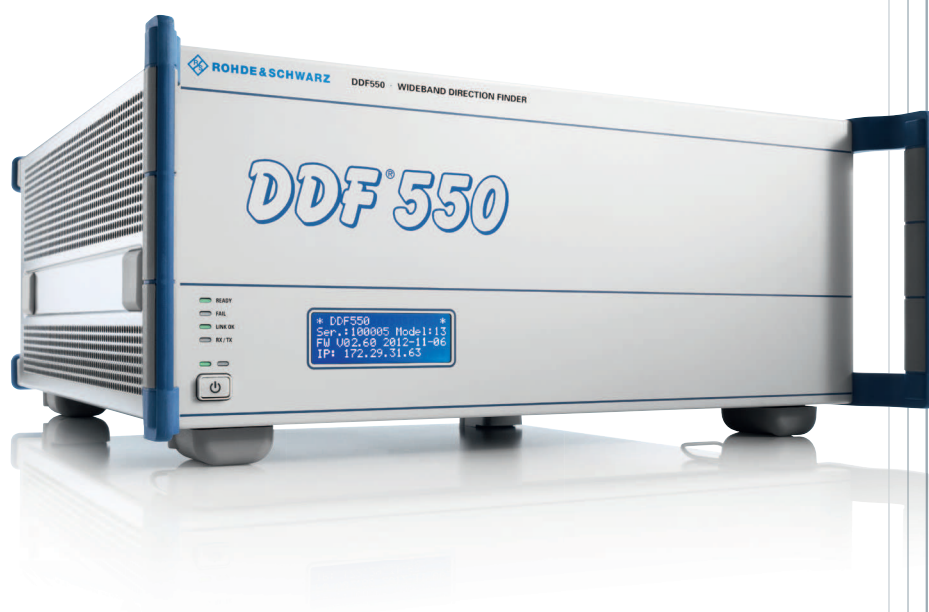


# R&S® DDF550 Wideband Direction Finder

## Fast and precise direction finding



# R&S®DDF550 Wideband Direction Finder

## At a glance

The fast R&S®DDF550 wideband direction finder offers outstanding realtime bandwidth and DF scan speed as well as high DF accuracy, sensitivity and immunity to reflections. The unit has compact dimensions and is optionally available as a DC-powered model, which makes it ideal for mobile applications.

The R&S®DDF550 can be operated with virtually all R&S®ADDx multichannel DF antennas. From the wide range of R&S®ADDx DF antennas, the right antenna(s) can be chosen for every application. The R&S®ADDx DF antennas have a large number of antenna elements and therefore offer a very wide aperture and exceptionally high performance. All antennas come with integrated lightning protection that does not impair DF accuracy.

For fast, automatic location of frequency-agile signals, multiple R&S®DDF550 direction finders can be combined and operated in synchronized DF scan mode in conjunction with an optional, automatic preclassifier. ITU-compliant measurement methods can optionally be added to the R&S®DDF550.

### Key facts

- High DF accuracy, sensitivity and immunity to reflections
- High DF scan speed due to outstanding 80 MHz realtime bandwidth (VHF/UHF/SHF<sup>1)</sup>)
- Easy integration into mobile platforms due to compact size and optional DC power supply
- DF antennas with integrated, extendible lightning protection causing no impairment of DF accuracy

<sup>1)</sup> SHF available in 2nd quarter of 2013.



# R&S®DDF550

## Wideband Direction Finder

### Benefits and key features

#### Direction finding of short-duration signals with high probability of intercept

- High DF scan speed due to outstanding 80 MHz realtime bandwidth
- Direction finding of short-duration and frequency-agile signals with high probability of intercept

▷ [page 4](#)

#### Reliable DF results even in challenging environments

- Higher immunity to reflections due to DF antennas with a very large number of antenna elements (VHF/UHF/SHF)
- Stable bearings in VHF/UHF/SHF range even with a 50% share of reflections

▷ [page 4](#)

#### Innovative DF antennas

- Active/passive switchover with just a mouse click
- Exceptionally high DF sensitivity
- Integrated, extendible lightning protection
- Easy replacement of DF antennas

▷ [page 5](#)

#### Precise direction finding of weak signals

- High DF sensitivity due to large number of antenna elements
- Adjustable coherent signal integration in wideband DF and DF scan mode for enhanced DF sensitivity

▷ [page 6](#)

#### Accurate and reliable location of short-duration signals

- GPS based synchronization of multiple R&S®DDF550 (time-synchronized DF scan mode)
- Optional preclassifier detects LPI signals and summarizes individual results into a condensed result

▷ [page 7](#)

#### Effective measurements in line with ITU recommendations

The R&S®DDF550 fulfills all ITU recommendations for direction finders and receivers:

- Option for comprehensive, ITU-compliant measurement methods including, for example:
  - Frequency and frequency offset, field strength, modulation, spectrum occupancy and bandwidth

▷ [page 7](#)

# Direction finding of short-duration signals with high probability of intercept

The R&S®DDF550 is designed for high-speed monitoring of wide frequency ranges. Bearings of short-duration signals and fast, frequency-agile transmitters operating at unknown frequencies are taken with high probability of intercept. This is mainly due to the large 80 MHz realtime bandwidth in the VHF/UHF range. In many applications, this bandwidth makes it possible – without activating the DF scan mode – to take bearings of all signals in the 80 MHz range in parallel and with maximum probability of intercept. Frequency ranges exceeding 80 MHz are traversed in DF scan mode at very high speed, which is enabled by the fast synthesizer. The R&S®DDF550 also delivers accurate bearings of state-of-the-art, fast frequency-hopping signals.

# Reliable DF results even in challenging environments

## Multi-element DF antennas

Due to multipath propagation (especially in urban areas), not only the direct wave but also reflections arrive at the DF antenna. The R&S®ADDx multichannel DF antennas offer higher immunity to such reflections than most other commercially available antennas, since they feature an exceptionally large number of antenna elements. Virtually all Rohde&Schwarz DF antennas use nine antenna elements in the VHF/UHF range, or eight in the UHF/SHF range, while commercially available DF antennas typically have only five. The R&S®ADDx antennas were designed to provide stable bearings even with a 50% share of reflections. If only five antenna elements are used, substantial DF errors can be expected in certain frequency ranges.<sup>1)</sup>

<sup>1)</sup> For details, see “R&S®ADDx Multichannel DF Antennas” Product Brochure (PD 0758.1106.12).

# Innovative DF antennas

## **Active/passive switchover with just a mouse click**

Up until now, users have had to decide what is more important to them: the higher sensitivity offered by active DF antennas or the higher immunity to strong signals provided by passive DF antennas.

The R&S®ADD050SR, R&S®ADD153SR and R&S®ADD253 DF antennas for the first time make it possible to bypass the active circuitry of the antenna elements. The user can switch the active elements to passive mode by a simple mouse click. These DF antennas thus offer the advantages of both the active and the passive mode.<sup>1)</sup>

## **Exceptionally high DF sensitivity**

The antenna elements of the R&S®ADD153SR, R&S®ADD157 and R&S®ADD253 DF antennas are equipped with PIN diodes, allowing the electrically active structure to change very quickly in the VHF/UHF range. As a result, these elements are always optimally adapted to the receive frequency and offer exceptionally high sensitivity.<sup>1)</sup>

## **Integrated, extendible lightning protection**

All installed Rohde&Schwarz DF antennas that are at risk of being struck by lightning have built-in, effective, extendible lightning protection. The lightning protection concept was taken into account in development right from the start and does not impair DF accuracy.<sup>1)</sup>

## **Easy replacement of DF antennas**

Unlike other commercially available antennas, DF antennas from Rohde&Schwarz do not need to be individually calibrated. The precisely manufactured R&S®ADDx DF antennas behave exactly as predicted in theory. A DF antenna from Rohde&Schwarz can be replaced with the same model without having to manage new calibration data and store it in the direction finder.<sup>1)</sup>

# Precise direction finding of weak signals

## High DF sensitivity due to large number of antenna elements

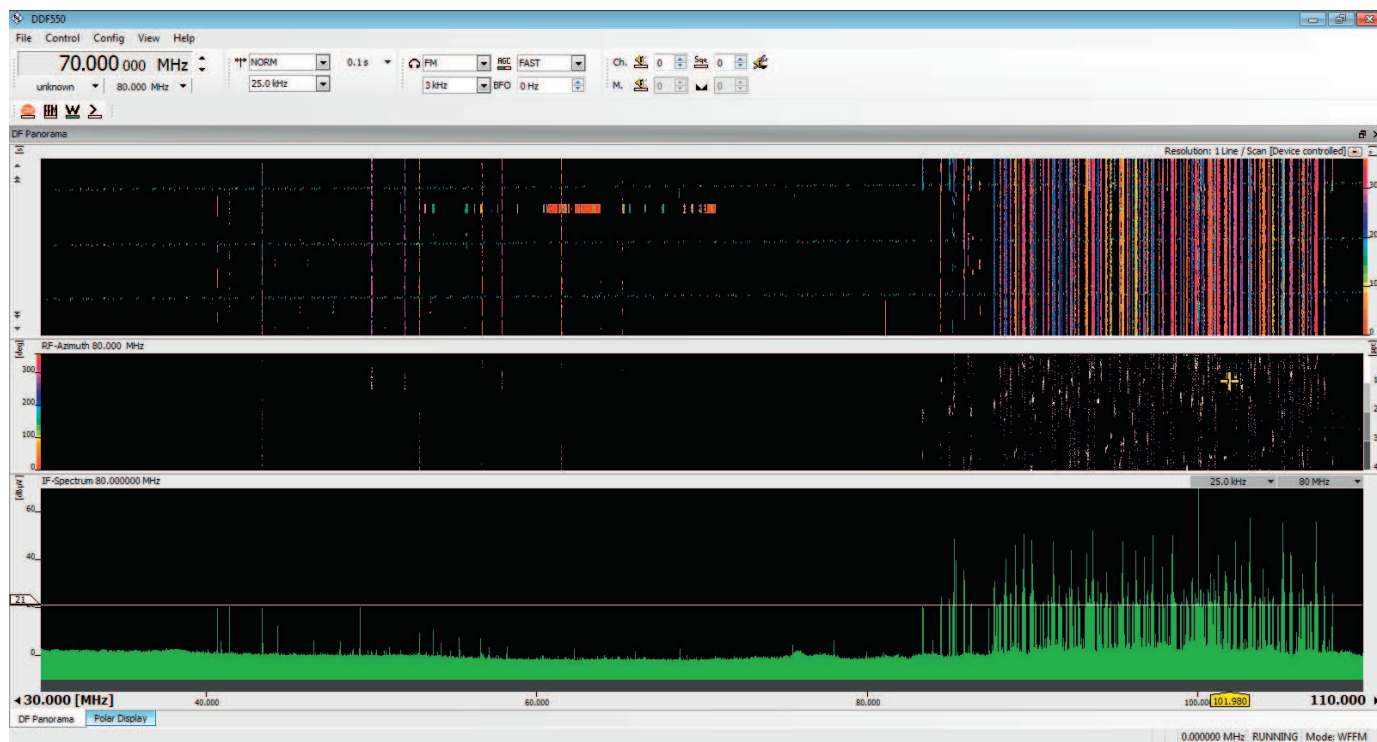
Featuring an exceptionally large number of antenna elements, the R&S®ADDx multichannel DF antennas offer higher sensitivity for use with the R&S®DDF550 than DF antennas with identical diameter but fewer elements. A higher number of antenna elements means a higher number of spatial sampling points, resulting in higher system gain.<sup>2)</sup>

## Adjustable coherent signal integration in wideband DF and DF scan mode for enhanced DF sensitivity

The R&S®DDF550 performs parallel averaging of the voltages measured on the individual elements of a DF antenna relative to a reference element. This is done on a large number of frequency channels simultaneously, both in wideband DF and DF scan mode, the process being referred to as coherent signal integration. In a first step, all antenna voltages for all frequency channels measured are stored and, after the selected averaging time, the averaged voltage value is output for each channel. Next, bearings are calculated from the averaged antenna voltages. As the averaging time increases, the impact of noise decreases significantly, resulting in a corresponding increase in DF sensitivity. Coherent signal integration will improve DF sensitivity by 29 dB for an emission of 1 s duration and by 24 dB for a 300 ms burst signal. As a prerequisite for this method, the channels to be covered must fall within the R&S®DDF550 realtime bandwidth (25 kHz channel resolution).

<sup>2)</sup> For details, see "R&S®ADDx Multichannel DF Antennas" Product Brochure (PD 0758.1106.12).

R&S®DDF550 graphical user interface displaying 80 MHz realtime bandwidth.



# Accurate and reliable location of short-duration signals

## GPS based synchronization of multiple R&S®DDF550 (time-synchronized DF scan mode)

To locate short-duration signals, all direction finders in a radiolocation network should be synchronized so that they take bearings on the same frequency at the same time. This is the only way to ensure that bearings will be delivered by all direction finders – even for very short emissions – allowing the precise location of a signal source to be calculated.

Using the R&S®DDF550-TS time-synchronous scanning option and suitable GPS receivers, multiple R&S®DDF550 direction finders can be synchronized by means of the GPS 1 pps signal. This is an essential prerequisite for using the R&S®DDF550 in radiolocation systems such as the R&S®SCANLOC for the automatic location of frequency-agile transmitters.

## Optional preclassifier detects LPI signals and summarizes individual results into a condensed result

Only a specific portion of the signals received by the DF antenna is of interest in practical applications. The R&S®DDF550-CL preclassifier option automatically separates specific LPI<sup>3)</sup> signals, such as frequency-hopping, chirp and burst signals, from conventional signals. The individual DF results of an emission are automatically averaged and summarized to give a condensed result. This procedure enhances radiolocation accuracy and minimizes the amount of data to be transferred between the DF stations in a radiolocation network.

<sup>3)</sup> Low probability of intercept.

# Effective measurements in line with ITU recommendations

The R&S®DDF550 fulfills all ITU recommendations for direction finders and receivers.

## Option for comprehensive, ITU-compliant measurement methods

As an option, the R&S®DDF550 can be furnished with comprehensive, ITU-compliant measurement methods. These include:

- Frequency and frequency offset in line with ITU-R SM.377<sup>4)</sup>
- Field strength in line with ITU-R SM.378
- Modulation in line with ITU-R SM.328
- Spectrum occupancy in line with ITU-R SM.182/SM.328 (on control PC)
- Bandwidth in line with ITU-R SM.443
- Detection of mono and stereo transmissions from FM broadcast transmitters

<sup>4)</sup> Depending on the application, an external reference frequency with higher accuracy may be required, e.g. a GPS reference frequency.

# System components

## DF antennas for the R&S®DDF550

The R&S®DDF550 can be operated with virtually all R&S®ADDx multichannel DF antennas (see table).

## R&S®ADD-LP extended lightning protection

All installed Rohde&Schwarz DF antennas that are at risk of being struck by lightning include a lightning rod as standard. This rod safely diverts lightning strikes and in most cases prevents damage to the DF antenna.

The higher a DF antenna is located, the higher the likelihood that lightning will not strike the rod but instead will laterally impact the DF antenna and cause significant damage. The R&S®ADD-LP extended lightning protection is recommended for installation heights of more than 20 m above ground (e.g. masts > 20 m, tall buildings, mountaintops). The R&S®ADD-LP consists of two crossed lightning rods that in most cases prevent lateral impacts since the rods protrude beyond the DF antenna.

## R&S®DDF1XZ, R&S®DDF5XZ, R&S®DDF7XZ DF antenna cable sets

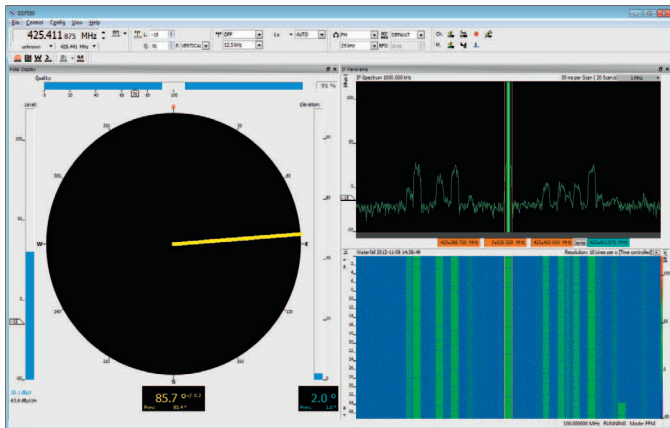
To connect the DF antenna(s) to the R&S®DDF550 direction finder, different cable sets are available for different frequency ranges. The R&S®DDF1XZ is available for the HF range. The R&S®DDF5XZ (0.3 MHz to 1.3 GHz) and R&S®DDF7XZ (0.3 MHz to 3 GHz) are used in the VHF/UHF range. Each of these cable sets consists of four coaxial RF cables and one control cable. Special lengths are available on request.

## R&S®RAMON control software

The R&S®DDF550 can be operated from a standard PC using the R&S®DDF550-Control remote control software supplied with the R&S®DDF550. R&S®DDF550-Control is part of the R&S®RAMON software family and can be used together with other, optional R&S®RAMON software modules to integrate the wideband direction finder into complex radiomonitoring systems.

R&S®DDF550-Control supports the fixed frequency mode (FFM), the wideband fixed frequency mode (WFFM) up to 80 MHz, and the scanning of frequency ranges wider than 80 MHz. Results can be displayed in various formats:

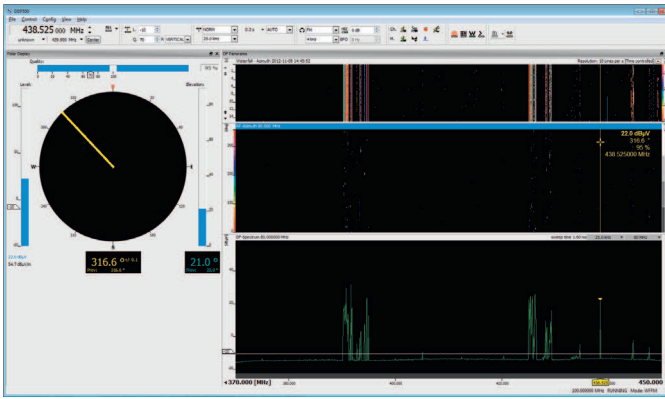
- Polar display with DF quality and level bargraph indication for a specific frequency
- Histogram for a specific frequency
- IF spectrum plus selectable DF result window (DF values versus frequency) and waterfall
- RF spectrum with DF result window and waterfall, plus selectable polar display and histogram



R&S®DDF550-Control: Graphical display of results obtained in fixed frequency mode (FFM), including polar display, IF spectrum and waterfall.

DF antenna	Frequency range	Application
R&S®ADD119	300 kHz to 30 MHz	mobile
R&S®ADD050SR	20 MHz to 450 MHz	stationary and transportable
R&S®ADD153SR	20 MHz to 1.3 GHz	mobile and stationary
R&S®ADD157	20 MHz to 1.3 GHz (vertical polarization) 40 MHz to 1.3 GHz (horizontal polarization)	mobile and stationary
R&S®ADD170	800 MHz to 2 GHz	mobile
R&S®ADD070	1.3 GHz to 3 GHz	stationary and transportable
R&S®ADD070M	1.3 GHz to 3 GHz	mobile
R&S®ADD253	20 MHz to 3 GHz	mobile and stationary





R&S®DDF550-Control: Graphical display of results obtained in wideband fixed frequency mode (WFFM), including RF spectrum, DF values versus frequency and waterfall, plus polar display for a selected channel.

The R&S®DDF550 can be extended with R&S®RAMON options to add versatile functionality:

- Automatic signal detection and preclassification
- Remote control of one or multiple R&S®DDF550 over WAN networks with intelligent data reduction
- Configuration of radiolocation systems, with result display for single frequencies or frequency ranges on digital maps
- Configuration of DF and radiolocation servers for multi-user systems
- Extended storage capabilities and offline analysis of DF and radiolocation results

## Application example

Mobile DF system with the R&S®DDF550 and the R&S®ADD253.



### Powerful mobile DF system

The R&S®DDF550 wideband direction finder's compact design and optional DC power supply make it ideal for integration into mobile platforms. The compact R&S®ADD253 wideband DF antenna, which covers the entire VHF/UHF range, ideally complements the direction finder. The result is a DF system with impressive performance:

- Fast direction finder offering up to 40 GHz/s DF scan speed in a compact 4 HU unit
- Seamless coverage of 20 MHz to 3 GHz frequency range with a single R&S®ADD253 VHF/UHF wideband DF antenna mounted on a vehicle roof or a mast
- R&S®ADD253 multi-element DF antenna in compact form with nine elements for the VHF/UHF range and eight elements for the UHF range
- Preclassification and automatic filtering of short-duration and frequency-agile signals with the optional R&S®DDF550-CL preclassifier
- Synchronization of multiple R&S®DDF550 direction finders via GPS using the R&S®DDF550-TS option

The R&S®ADD253 VHF/UHF wideband DF antenna can be mounted on a vehicle roof using the R&S®AP502Z1 vehicle adapter. If the lower VHF range is of particular interest, it is recommended that the mobile DF system be calibrated on a turntable. This requires the R&S®DDF550-COR option.

# Specifications in brief

Specifications in brief		
<b>Frequency range</b>	base unit	20 MHz to 3 GHz
	base unit with R&S®DDF550-HF option <sup>2)</sup>	300 kHz to 3 GHz
	base unit with R&S®DDF550-FE option <sup>2)</sup>	20 MHz to 6 GHz
	base unit with R&S®DDF550-HF and R&S®DDF550-FE option <sup>2)</sup>	300 kHz to 6 GHz
<b>DF mode</b>		
DF method	VHF/UHF/SHF <sup>3)</sup>	correlative interferometer
	HF	Watson-Watt
Realtime bandwidth	VHF/UHF	80 MHz
	HF	20 MHz
Instrument DF accuracy		≤ 0.5° RMS
System DF accuracy <sup>1)</sup>	in reflection-free environment, including lightning protection; depends on DF antenna	see "R&S®ADDx Multichannel DF Antennas" Specifications, PD 0758.1106.22
	1 MHz to 30 MHz, with the R&S®ADD119	≤ 2° RMS
	20 MHz to 1.3 GHz, with the R&S®ADD050SR and the R&S®ADD153SR or the R&S®ADD157	≤ 1° RMS, typ. 0.5° RMS
	1.3 GHz to 3 GHz, with the R&S®ADD070	≤ 2° RMS, typ. 1° RMS
Minimum burst duration	for multiple burst emissions	20 μs
DF scan speed	HF, 1.25 kHz channel resolution, 100% channel occupancy	> 1 GHz/s
	VHF/UHF, 25 kHz channel resolution, 100% channel occupancy	> 40 GHz/s

<sup>1)</sup> Measurement in reflection-free environment. The RMS error is calculated from the bearings of evenly distributed samples versus azimuth and frequency.

<sup>2)</sup> Available on request.

<sup>3)</sup> SHF available in 2nd quarter of 2013.

**For data sheet, see PD 5214.5310.22 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)**

# Ordering information

Designation	Type	Order No.
Wideband Direction Finder, for mobile applications, with AC power supply	R&S®DDF550	4074.2002.03
Wideband Direction Finder, for mobile applications, with DC power supply	R&S®DDF550	4074.2002.13
<b>Options</b>		
HF Frequency Range Extension <sup>1)</sup>	R&S®DDF550-HF	4074.1006.02
Frequency Extension	R&S®DDF550-FE	4074.1058.02
Service Kit	R&S®DDF-SK	4060.0454.02
Preclassifier <sup>1)</sup>	R&S®DDF550-CL	4074.0851.02
Time-Synchronous Scanning <sup>1)</sup>	R&S®DDF550-TS	4074.0900.02
ITU Measurement Software	R&S®DDF550-IM	4074.0800.02
DF Error Correction	R&S®DDF550-COR	4074.0951.02
Enhanced Measurement Speed <sup>1)</sup>	R&S®DDF550-EMS	4074.1206.02
<b>DF system accessories</b>		
HF DF Antenna	R&S®ADD119	4053.6509.02
Super-Resolution VHF DF Antenna	R&S®ADD050SR	4071.7003.02
Super-Resolution VHF/UHF DF Antenna	R&S®ADD153SR	4071.6007.02
Dual Polarized VHF/UHF DF Antenna	R&S®ADD157	4069.4800.02
UHF DF Antenna for GSM	R&S®ADD170	4055.7502.12
UHF DF Antenna	R&S®ADD070	4043.4003.12
Mobile UHF DF Antenna	R&S®ADD070M	4059.6000.02
VHF/UHF Wideband DF Antenna	R&S®ADD253	4071.4004.12
Extended Lightning Protection	R&S®ADD-LP	4069.6010.02
VHF/UHF DF Antenna Cable Set	R&S®DDF5XZ	4064.6728.xx <sup>2)</sup>
UHF DF Antenna Cable Set	R&S®DDF7XZ	4064.8043.xx <sup>2)</sup>
Electronic Compass	R&S®GH150	4041.8501.02
GPS Navigator/GPS Receiver	R&S®GINA	4055.6906.04
Vehicle Adapter	R&S®AP502Z1	0515.1419.02
Mast Adapter	R&S®ADD150A	4041.2655.02
Tripod with Adapter	R&S®ADD1XTP	4063.4409.02
Intermediate Mast	R&S®KM051	4041.9008.02
Antenna Adapter, with cable outlet	R&S®ADD071Z	4043.7002.02
Antenna Adapter, without cable inlet/flange	R&S®ADD071Z	4043.7002.03
19" Rack Adapter	R&S®ZZA-411	1096.3283.00

<sup>1)</sup> Available on request.

<sup>2)</sup> The DF antenna cable sets are available in various lengths, designated by the last two digits of the order number.

Service options		
Extended Warranty, one year	R&S®WE1DDF550	Please contact your local Rohde&Schwarz sales office.
Extended Warranty, two years	R&S®WE2DDF550	
Extended Warranty, three years	R&S®WE3DDF550	
Extended Warranty, four years	R&S®WE4DDF550	
Extended Warranty with Calibration Coverage, one year	R&S®CW1DDF550	
Extended Warranty with Calibration Coverage, two years	R&S®CW2DDF550	
Extended Warranty with Calibration Coverage, three years	R&S®CW3DDF550	
Extended Warranty with Calibration Coverage, four years	R&S®CW4DDF550	

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.

To find your nearest Rohde&Schwarz representative, visit

[www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

## Service you can rely on

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

## About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

## Environmental commitment

- | Energy-efficient products
- | Continuous improvement in environmental sustainability
- | ISO 14001-certified environmental management system

Certified Quality System  
**ISO 9001**

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