R&S®DDF550
Wideband Direction Finder
Fast and precise direction finding

ROHDE&SCHWARZ

Product Brochure | Version 12.00

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)
- 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
- Direction finding of signals in the frequency range up to 6 GHz

Benefits

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. Additionally, with the R&S®DDF550-EMS [1] enhanced measurement speed and R&S®DDF550-ID EMS identification options, the minimum signal duration can be further decreased, so that even short-duration signals can be detected and located. The R&S®DDF550 also delivers accurate bearings of state-of-the-art, fast frequency hopping signals.

[1] The R&S®DDF550-EMS option is export restricted.

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 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. [2]

[2] 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®ADD011SR, R&S®ADD011P, R&S®ADD050SR, R&S®ADD153SR, R&S®ADD157 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. [2)]

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. [2)]

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. [2)]

Easy replacement of DF antennas

Unlike 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. [2)]

Precise direction finding of weak signals

High DF sensitivity due to large number of antenna elements

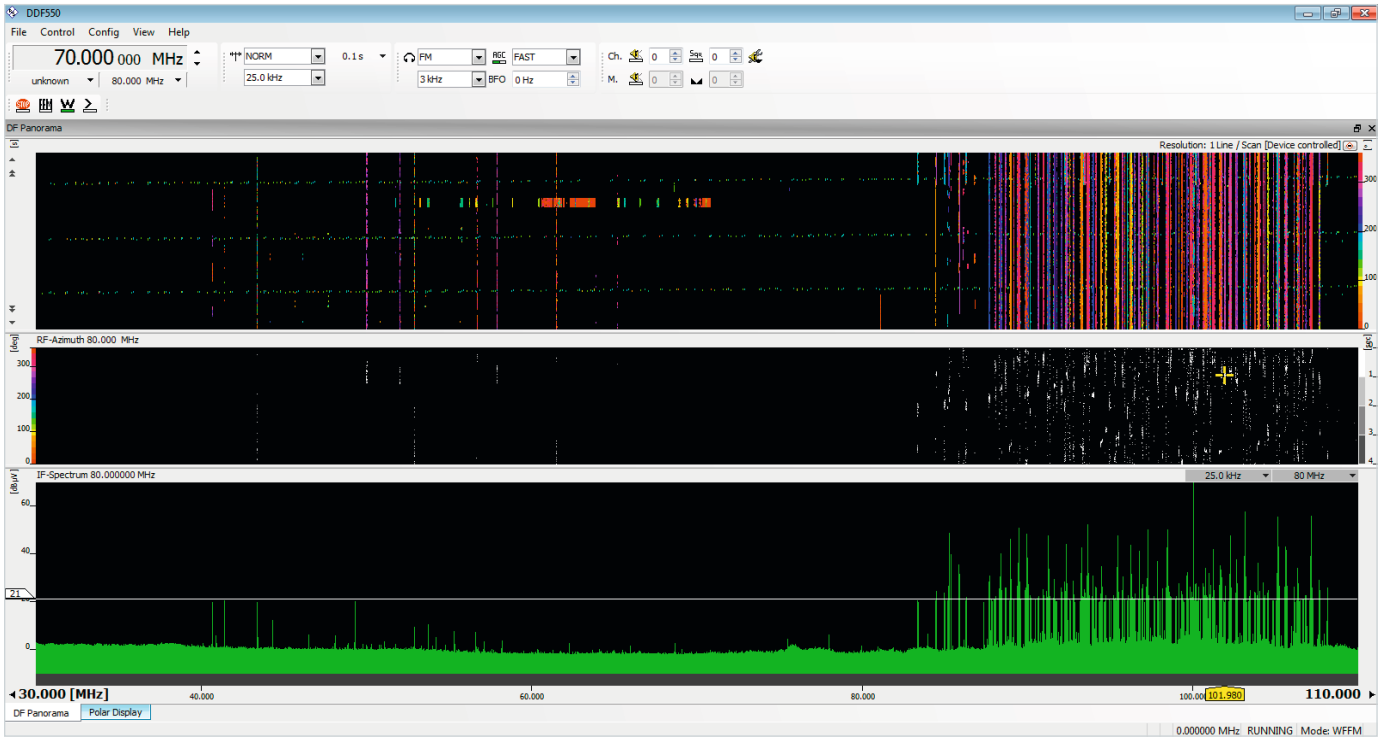
Featuring an exceptionally large number of antenna elements, the R&S®ADDx multichannel DF antennas offer higher sensitivity for use with the R&S®DDF550 than DF antennas with identical diameter but fewer elements. A higher number of antenna elements means a higher number of spatial sampling points, resulting in higher system gain. [3)]

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).

[3)] 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 R&S®DDF550-IGT internal GPS time synchronization option or any other GPS 1 pps signal. This is an essential prerequisite for using the R&S®DDF550 in radiolocation systems 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 [4] 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.

[4] Low probability of intercept.

Special and exceptionally powerful receive path for signal measurement

The number of radio services and transmitters is continuously growing, which results in an increasing cumulative load on the antenna input and the receiver input. Digital broadcasting services in particular, such as DVB-T and DAB with their high bandwidths, are changing antenna and receiver linearity requirements. The problem is intensified if the DF antenna is in the vicinity of strong transmitters – which can hardly be avoided in metropolitan areas.

If the number of strong signals becomes too high, intermodulation products may become visible in the spectrum. In the worst case, they would mask signals of interest and make direction finding impossible.

In many applications, it is good practice to reduce the realtime bandwidth in order to increase sensitivity, linearity and immunity to strong signals.

Special and exceptionally powerful receive path

When the user sets a realtime bandwidth of 20 MHz (or less), both receive channels of the R&S®DDF550 in the VHF/UHF/SHF range automatically switch over to an exceptionally powerful receive path. This second path has been optimized for precise signal measurement.

Improved analog architecture of the receive path

To minimize the detrimental influence of strong signals outside the receive bandwidth, these signals must be filtered out as far as possible already in the analog part of the RF frontend. This works best with narrow receive bandwidths. Filters can be used that take effect in the spectrum considerably earlier and thus filter more strongly. The R&S®DDF550 includes various filters that are selected depending on the set realtime bandwidth:

- Special filters in preselection optimized for the narrower realtime bandwidth
- Special IF filter with 20 MHz bandwidth

Especially powerful analog/digital converters

The performance of commercially available analog/digital converters is influenced by the receive bandwidth: the narrower the receive bandwidth, the better the performance. This is why the R&S®DDF550 features two different analog/digital converters that can be selected depending on the set realtime bandwidth. When a realtime bandwidth of 20 MHz (or less) has been set, a particularly high-resolution converter is used.

Considerable advantages in the case of weak signals and dense signal scenarios

The receive path with 20 MHz realtime bandwidth, which was specially developed for precise signal measurement, offers a number of advantages in both DF and receive mode:

- Significant reduction of the noise floor due to narrower bandwidth
- Less limitation (due to strong signals outside the receive bandwidth) of the dynamic range in the analog/digital converter thanks to narrower analog filters
- Significant improvement (18 dB (typ.)) of the intermodulation-free dynamic range through the use of a special analog/digital converter

These measures lead to a much improved signal-to-noise ratio, especially with strong signals in the vicinity of the receive bandwidth. The second receive path is therefore particularly suitable for measuring weak signals and/or dense signal scenarios where many strong signals are present (typically in large cities).

Powerful hardware developed by Rohde&Schwarz

In-house development and manufacture of all DF system components, including the DF antenna

All components of the DF system that is based on the R&S®DDF550 are developed and manufactured by Rohde&Schwarz, ensuring above-average performance and quick implementation of technical innovations. Particularly for DF antennas, recent years have seen major improvements, such as active/passive switchover developed and introduced by Rohde&Schwarz.

Rohde&Schwarz benefits from its many years of experience in the development and production of antennas, receivers and digital signal processing equipment.

Signal processing at maximum speed based on powerful FPGAs

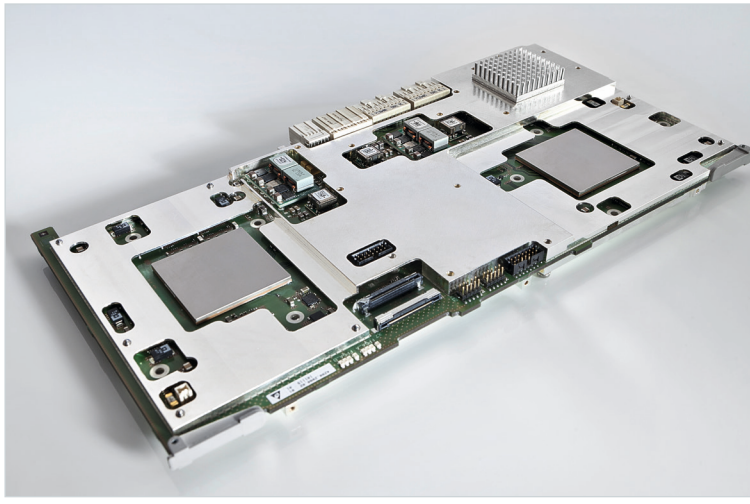
The large number of powerful field programmable gate arrays (FPGA) implemented in the R&S®DDF550 delivers above-average signal processing speed. FPGAs are much more powerful than the digital signal processors (DSP) and PC processors that many competitor products use for signal processing.

Use of powerful Rohde&Schwarz ASICs

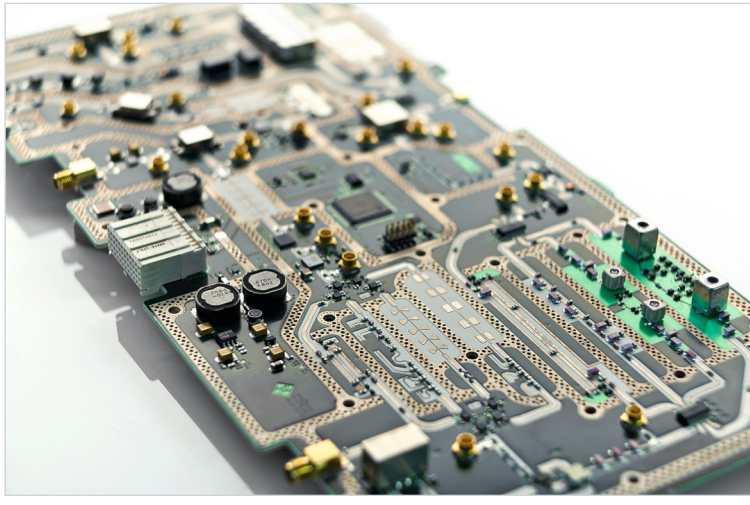
At specific points in the signal processing chain, all data must be processed simultaneously. The processing speed of the entire chain therefore essentially depends on the performance at these points. This is why Rohde&Schwarz uses its own application-specific integrated circuits (ASIC).

High immunity to strong signals thanks to sophisticated preselection

Apart from wanted signals, a spectrum usually also contains strong signals, such as those from TV and radio broadcast transmitters. In order not to impair DF results, these out-of-band signals must be sufficiently suppressed by preselection. The R&S®DDF550 is equipped with sophisticated preselectors developed by Rohde&Schwarz based on decades of experience. In contrast to most competitor products, the R&S®DDF550 has tracking and bandpass filters that can be selected depending on the set realtime bandwidth. This preselection capability goes far beyond ITU recommendations and leads to above-average immunity to strong signals.



Module with powerful FPGA for high-speed signal processing.



VHF/UHF/SHF preselection of the R&S®DDF550 with bandpass and tracking filters.

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 [5)]
- 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.1880 (with remote control PC and R&S®ARGUS software packages)
- Bandwidth in line with ITU-R SM.443
- Detection of mono and stereo transmissions from FM broadcast transmitters

[5)] Depending on the application, an external reference frequency with higher accuracy may be required, e.g. a GPS reference frequency.

Direction finding up to 6 GHz

Fast, effective radiolocation of interferers

Together with the R&S®ADD078SR DF antenna, the R&S®DDF550 delivers precise DF results up to 6 GHz. Until now, this has only been possible up to 3 GHz. DF bearings can now be taken on transmitters up to 6 GHz, for example in the frequency bands of the following services:

- WLAN
- WiMAX™
- Microwave systems

The R&S®DDF550 effectively detects and locates interference in the corresponding frequency bands.

Locating target transmitters previously required the use of rotatable directional antennas, which have disadvantages regarding manageability and measurement speed. The R&S®DDF550 immediately displays the bearing, significantly simplifying direction finding during test drives.

High DF accuracy and immunity to reflections in the VHF/UHF range are also achieved in the SHF range.

Hardware-accelerated multichannel signal processing

The R&S®DDF550 digital direction finder optionally provides hardware-accelerated signal processing for the R&S®CA120 multichannel signal analysis system (see also product brochure, PD 3606.9327.12 or data sheet, PD 3606.9327.22). For this purpose, the R&S®DDF550 needs to be equipped with the R&S®DDF550-SP signal processing board. The board supports up to three different high-performance signal processing functions implemented in field programmable gate array (FPGA) technology.

Multichannel signal detection and analysis in a networked system

Equipped with the R&S®DDF550-SP hardware-accelerated signal processing option, the R&S®DDF550 supports parallel multichannel signal detection and analysis. The following high-performance signal processing functions are implemented in field programmable gate array (FPGA) technology:

- Multichannel signal extraction: R&S®DDF550DDCE
- Calculation of high-resolution spectra: R&S®DDF550-HRP
- Detection of frequency agile signals: R&S®DDF550-ST

The R&S®CA120 multichannel signal analysis system ideally complements the R&S®DDF550 when equipped with the following options:

- Multichannel signal processing: R&S®CA120MCP, R&S®CA120FFP
- Detection of fixed frequency and burst signals: R&S®CA120DSC
- Detection of frequency hopping signals: R&S®CA120ST

Thanks to the detailed interface description, system integrators can directly access the receiver data streams for processing in their own external systems.

Parallel multichannel output of more than 100 channels

Within the direction finder's realtime bandwidth, more than 100 channels (manually set by the user) with a maximum bandwidth of 30 kHz each or 32 channels with a maximum bandwidth of 300 kHz each can be simultaneously output over the 1 Gbit Ethernet interface. As a result, a large number of signals are available as an I/Q baseband data stream that can be processed in external systems (R&S®DDF550DDCE option).

Equipped with the R&S®CA120MCP and R&S®CA120FFP options, the R&S®CA120 multichannel signal analysis system processes the extracted signals online and supports multichannel content recovery in a signal scenario with many signals through audio demodulation, classification, demodulation/decoding and recording.

Multichannel digital downconversion (DDC) signal extraction from the R&S®DDF550 realtime bandwidth with R&S®DDF550DDCE and R&S®CA120FFP

If multiple signals in the R&S®DDF550 realtime bandwidth are active at the same time, users can extract these signals by means of digital downconverters. The maximum number of DDCs computed in parallel depends on the set DDC bandwidth (for details, see the R&S®CA120 data sheet, PD 3606.9327.22). In a typical HF application with an R&S®DDF550 realtime bandwidth of up to 20 MHz and a DDC bandwidth of up to 30 kHz, well over 100 signals can be extracted and output simultaneously. The downconverted signals are available as digital I/Q streams on one of the R&S®DDF550 LAN interfaces.

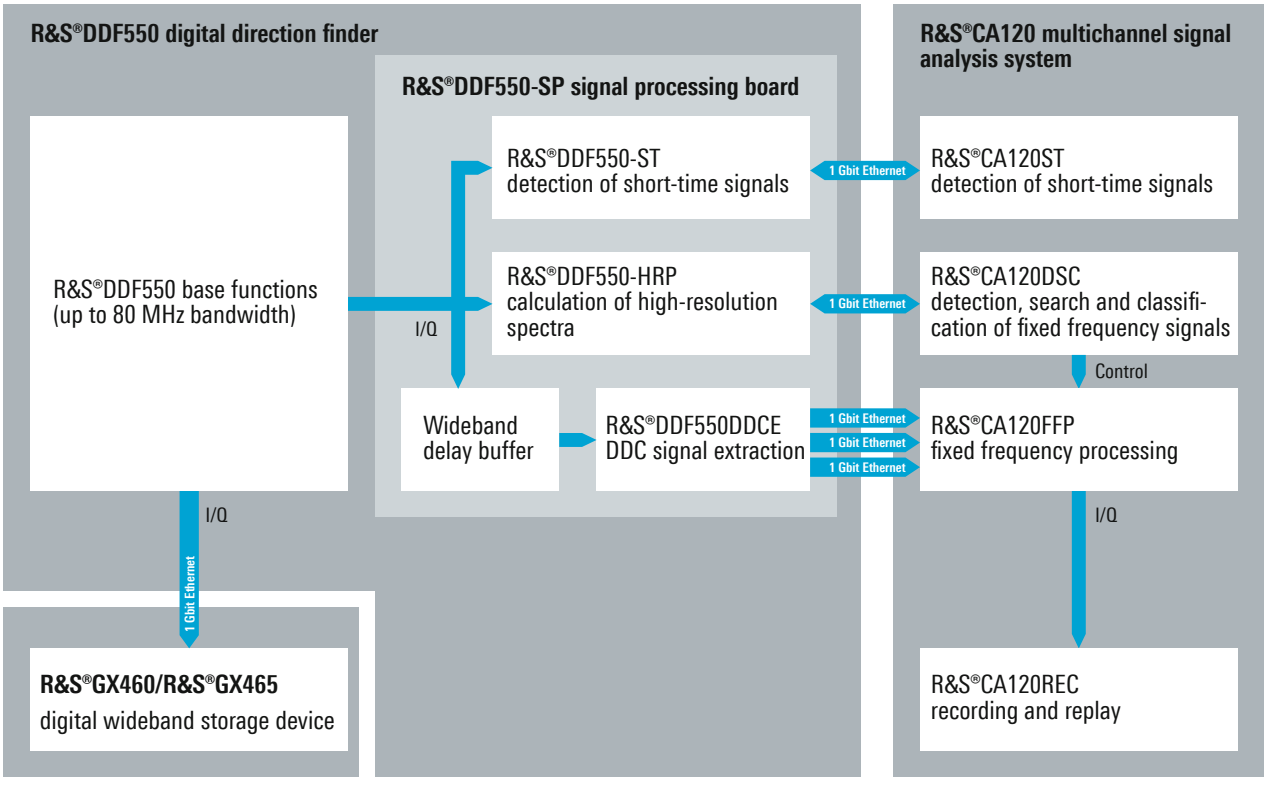
The R&S®CA120 multichannel signal analysis system further processes the extracted signals online (audio demodulation, classification, demodulation/decoding and recording) to provide optimum support for multichannel content recovery from a signal scenario.

Automatic detection of fixed frequency and burst signals with R&S®DDF550-HRP and R&S®CA120DSC

The signal detector provides a detection result for each detected signal matching user-defined selection criteria in the realtime bandwidth of the R&S®DDF550. The automatically computed detection threshold adapts independently to the noise floor characteristic that varies within a frequency range. In scenarios where certain signals or frequency ranges are of no interest, the detector algorithm can be parameterized with a list of frequency ranges that may be ignored. The detector will generate no messages for signals in these ranges.

The R&S®CA120 taps the detection spectra at the LAN interface of the R&S®DDF550 and processes them. The R&S®CA120 assigns the results to signals, manages lists of active and inactive signals and uses digital downconverters (R&S®DDF550DDCE) to automatically process detected signals, thereby providing optimum support for signal search and signal monitoring.

R&S®DDF550 with R&S®DDF550-SP: support for hardware-accelerated signal processing with R&S®CA120



The R&S®DDF550-SP signal processing board with options. The results are processed in the R&S®CA120 multichannel signal analysis system.

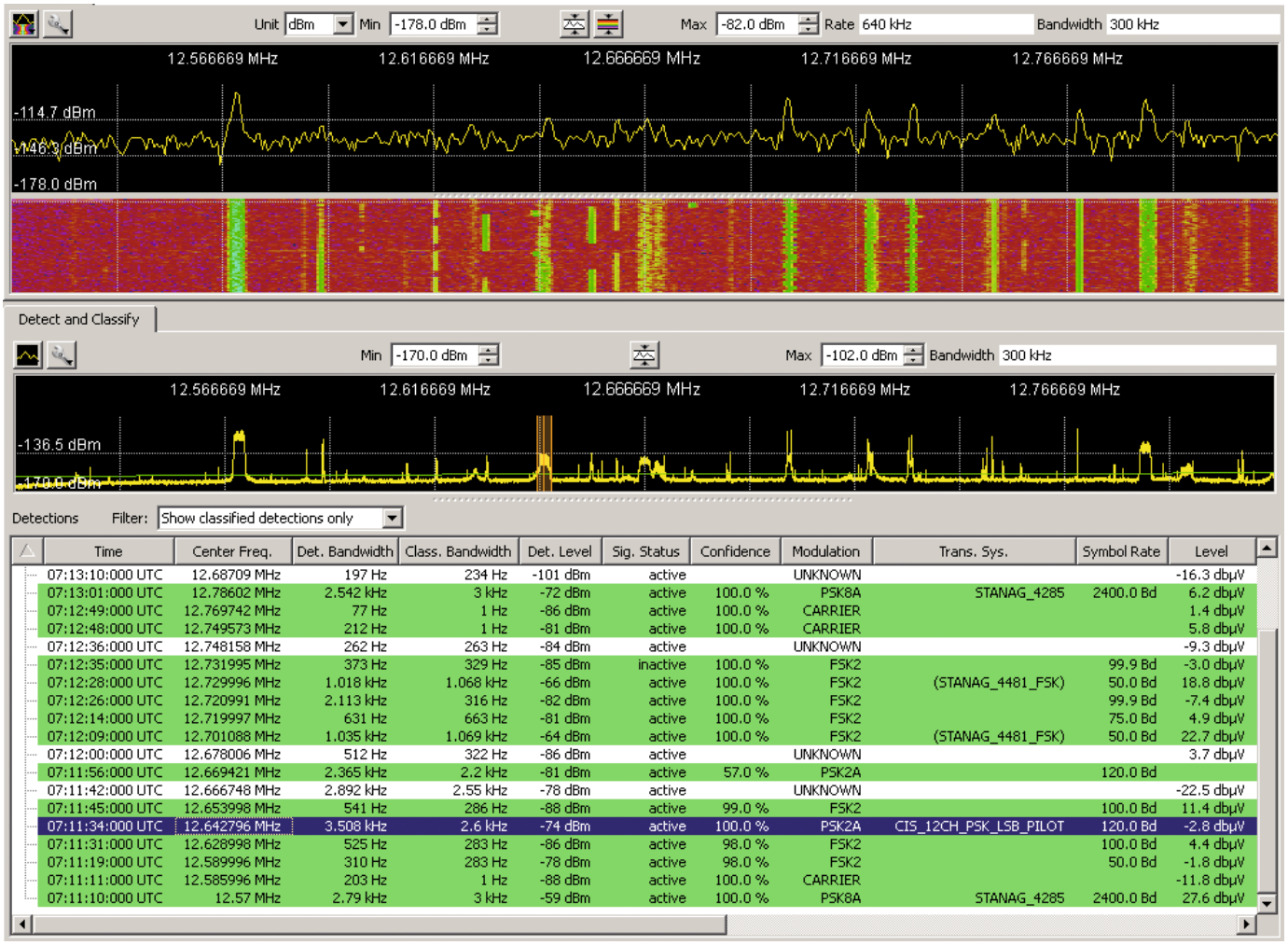
Automatic detection of frequency agile short-time signals with R&S®DDF550-ST

When used with R&S®CA120, the R&S®DDF550-ST option delivers a result for each short-time signal that is detected within the realtime bandwidth of the R&S®DDF550 and matches user-defined selection criteria. The results are output on the 1 Gbit Ethernet interface for further processing.

By measuring, classifying and sorting the results, the R&S®CA120 multichannel signal analysis system with the R&S®CA120ST and R&S®CA120PS options optimally supports the detection and monitoring of frequency agile short-time signals.

With its automatic profile separation and online recombination capabilities, R&S®CA120 provides the enhanced online dehopping solution.

With its automatic detection and classification capability, R&S®CA120 can monitor complete signal scenarios and informs the user about any signals or events of interest.



Time	Center Freq.	Det. Bandwidth	Class. Bandwidth	Det. Level	Sig. Status	Confidence	Modulation	Trans. Sys.	Symbol Rate	Level
07:13:10:000 UTC	12.68709 MHz	197 Hz	234 Hz	-101 dBm	active		UNKNOWN			-16.3 dbµV
07:13:01:000 UTC	12.78602 MHz	2.542 kHz	3 kHz	-72 dBm	active	100.0 %	PSK8A	STANAG_4285	2400.0 Bd	6.2 dbµV
07:12:49:000 UTC	12.769742 MHz	77 Hz	1 Hz	-86 dBm	active	100.0 %	CARRIER			1.4 dbµV
07:12:48:000 UTC	12.749573 MHz	212 Hz	1 Hz	-81 dBm	active	100.0 %	CARRIER			5.8 dbµV
07:12:36:000 UTC	12.748158 MHz	262 Hz	263 Hz	-84 dBm	active		UNKNOWN			-9.3 dbµV
07:12:35:000 UTC	12.731995 MHz	373 Hz	329 Hz	-85 dBm	inactive	100.0 %	FSK2		99.9 Bd	-3.0 dbµV
07:12:28:000 UTC	12.729996 MHz	1.018 kHz	1.068 kHz	-66 dBm	active	100.0 %	FSK2	(STANAG_4481_FSK)	50.0 Bd	18.8 dbµV
07:12:26:000 UTC	12.720991 MHz	2.113 kHz	316 Hz	-82 dBm	active	100.0 %	FSK2		99.9 Bd	-7.4 dbµV
07:12:14:000 UTC	12.719997 MHz	631 Hz	663 Hz	-81 dBm	active	100.0 %	FSK2		75.0 Bd	4.9 dbµV
07:12:09:000 UTC	12.701088 MHz	1.035 kHz	1.069 kHz	-64 dBm	active	100.0 %	FSK2	(STANAG_4481_FSK)	50.0 Bd	22.7 dbµV
07:12:00:000 UTC	12.678006 MHz	512 Hz	322 Hz	-86 dBm	active		UNKNOWN			3.7 dbµV
07:11:56:000 UTC	12.669421 MHz	2.365 kHz	2.2 kHz	-81 dBm	active	57.0 %	PSK2A		120.0 Bd	
07:11:42:000 UTC	12.666748 MHz	2.892 kHz	2.55 kHz	-78 dBm	active		UNKNOWN			-22.5 dbµV
07:11:45:000 UTC	12.653998 MHz	541 Hz	286 Hz	-88 dBm	active	99.0 %	FSK2		100.0 Bd	11.4 dbµV
07:11:34:000 UTC	12.642796 MHz	3.508 kHz	2.6 kHz	-74 dBm	active	100.0 %	PSK2A	CIS_12CH_PSK_LSB_PILOT	120.0 Bd	-2.8 dbµV
07:11:31:000 UTC	12.628998 MHz	525 Hz	283 Hz	-86 dBm	active	98.0 %	FSK2		100.0 Bd	4.4 dbµV
07:11:19:000 UTC	12.589996 MHz	310 Hz	283 Hz	-78 dBm	active	98.0 %	FSK2		50.0 Bd	-1.8 dbµV
07:11:11:000 UTC	12.585996 MHz	203 Hz	1 Hz	-88 dBm	active	100.0 %	CARRIER			-11.8 dbµV
07:11:10:000 UTC	12.57 MHz	2.79 kHz	3 kHz	-59 dBm	active	100.0 %	PSK8A	STANAG_4285	2400.0 Bd	27.6 dbµV

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.

DF antenna	Frequency range	Application
R&S®ADD011SR	300 kHz to 30 MHz	stationary and transportable
R&S®ADD011P	300 kHz to 30 MHz	portable
R&S®ADD119	300 kHz to 30 MHz	mobile
R&S®ADD015	1 MHz to 30 MHz	mobile and stationary
R&S®ADD216	300 kHz to 3 GHz	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®ADD070	1.3 GHz to 3 GHz	stationary and transportable
R&S®ADD253	20 MHz to 3 GHz	mobile and stationary
R&S®ADD078SR	1.3 GHz to 6 GHz	mobile and stationary
Discontinued antennas		
R&S®ADD050	20 MHz to 200 MHz	stationary
R&S®ADD150 [1)]	20 MHz to 1.3 GHz	mobile and stationary
R&S®ADD153	20 MHz to 1.3 GHz	mobile and stationary
R&S®ADD170	800 MHz to 2 GHz	mobile
R&S®ADD070M	1.3 GHz to 3 GHz	mobile

[1)] Depending on the hardware version, modifications may be required.

R&S®DDF1XZ, R&S®DDF5XZ, R&S®DDF7XZ, R&S®DDF3C-7 DF antenna cable sets

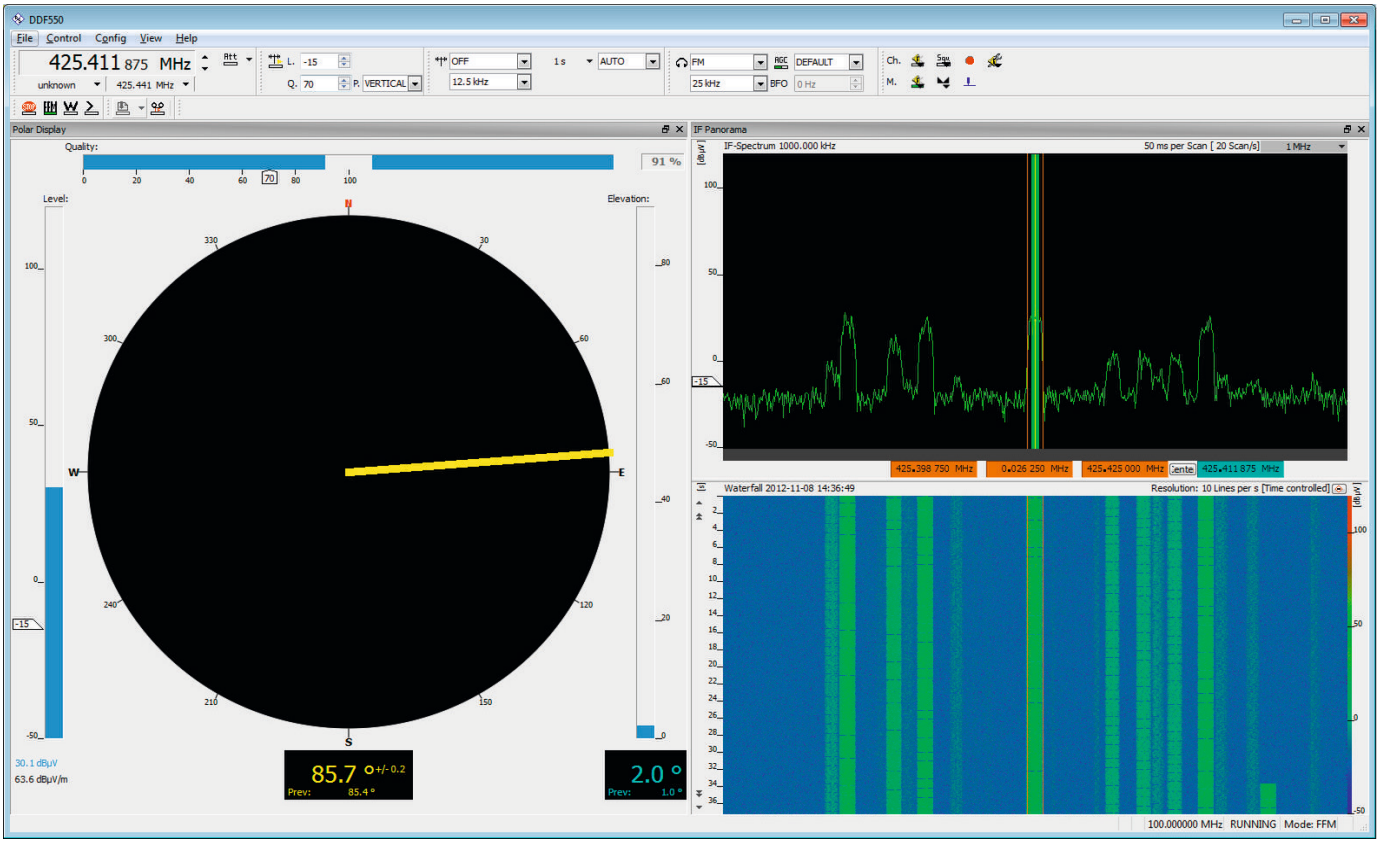
To connect the DF antenna(s) to the R&S®DDF550 direction finder, different cable sets are available for different frequency ranges. The R&S®DDF1XZ is available for the HF range. The R&S®DDF5XZ (0.3 MHz to 1.3 GHz) and R&S®DDF7XZ (0.3 MHz to 3 GHz) are used in the VHF/UHF range. The R&S®DDF3C-7 (0.3 MHz to 6 GHz) is used in the VHF/UHF/SHF range. Each of these cable sets consists of four coaxial RF cables and one control cable. Special lengths are available on request.

R&S®DDF550-IGT internal GPS time synchronization

By means of the R&S®DDF550-IGT internal GPS time synchronization, the R&S®DDF550 can be synchronized in time to ensure that all R&S®DDF550 within a radiolocation network measure on the same frequency at the same time.

In addition, R&S®DDF550-IGT serves as an internal GPS, e.g. to show the position of the R&S®DDF550 on a map.

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



R&S®RAMON and R&S®ARGUS 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.

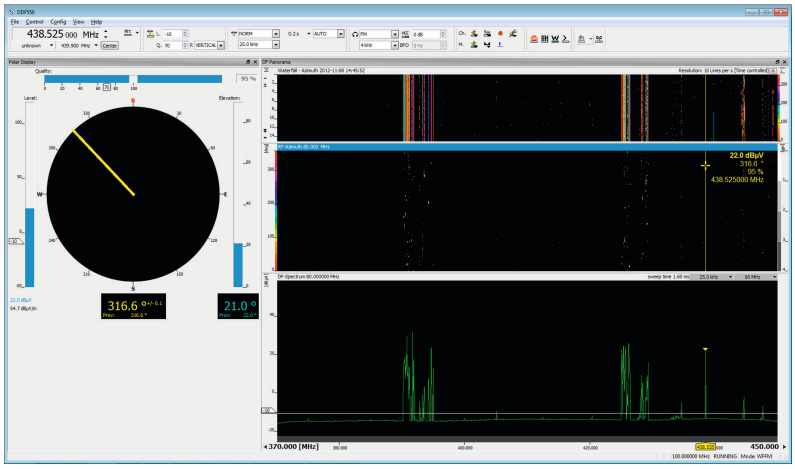
R&S®DDF550-Control supports the fixed frequency mode (FFM), the wideband fixed frequency mode (WFFM) up to 80 MHz, and the scanning of frequency ranges wider than 80 MHz. Results can be displayed in various formats:

- 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

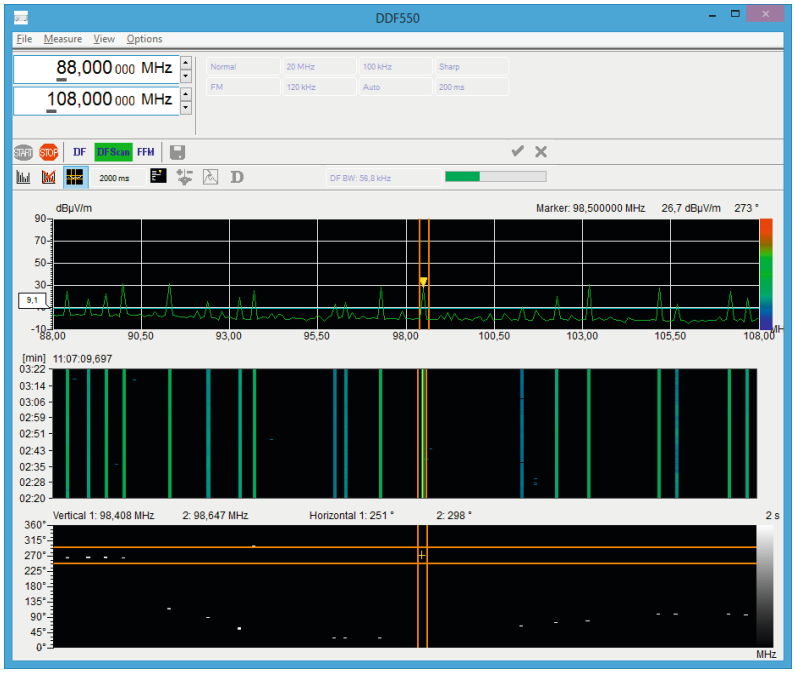
The R&S®DDF550 can be extended with R&S®RAMON options to add versatile functionality:

- 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

The R&S®DDF550 can also be used with R&S®ARGUS monitoring software packages for ITU-compliant measurements and evaluation. Combined with the R&S®DDF550-IM option and suitable R&S®ARGUS options, it is able to make complex radiomonitoring tasks easier – even for inexperienced users.



R&S®DDF550-Control (R&S®RAMON): 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.



R&S®DDF550-ARGUS Control: Graphical display of results obtained in DF scan mode, including RF spectrum, DF values versus frequency and waterfall.

Application example

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 and map display of multiple R&S®DDF550 direction finders via GPS using the R&S®DDF550-TS and R&S®DDF550-IGT options

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.

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

Specifications in brief		
Frequency range	base unit	20 MHz to 6 GHz
	with R&S®DDF550-HF, receive option	8 kHz to 6 GHz
	with R&S®DDF550-HF2, DF option	300 kHz to 6 GHz
DF mode		
DF method	VHF/UHF/SHF	correlative interferometer
	HF	Watson-Watt
Realtime bandwidth	VHF/UHF/SHF	80 MHz
	HF	20 MHz
Instrument DF accuracy		≤ 0.2° RMS (typ.)
System DF accuracy [1]	depends on DF antenna (i.e. R&S®ADD011SR (.1x), R&S®ADD050SR, R&S®ADD153SR and R&S®ADD078SR), in reflection-free environment, with lightning protection, in line with report ITU-R SM 2125	
	300 kHz to 1300 MHz	0.5° RMS (typ.)
	1.3 GHz to 6 GHz	1° RMS (typ.)
DF sensitivity	depends on DF antenna, for 2° RMS DF fluctuation, 2 s integration time and 250 Hz (HF)/ 600 Hz (VHF/UHF/SHF) DF bandwidth (i.e. R&S®ADD011SR (.1x), R&S®ADD050SR, R&S®ADD153SR and R&S®ADD078SR), in line with report ITU-R SM 2125	
	300 kHz to 30 MHz	0.7 µV/m (typ.)
	20 MHz to 6 GHz	3 µV/m to 20 µV/m (typ.)
Minimum signal duration		1 ms
	with R&S®DDF550-EMS [2] option	100 µs
Minimum burst duration	for multiple burst emissions	20 µs
DF scan speed		
HF (1.25 kHz channel resolution, 100% channel occupancy Watson-Watt method, wideband fixed frequency mode, selectivity normal)	base unit	> 5 GHz/s, in line with report ITU-R SM.2125
VHF/UHF (25 kHz channel resolution, 100% channel occupancy correlative interferometer method, wideband fixed frequency mode)	base unit	> 40 GHz/s, in line with report ITU-R SM.2125

[1] Measurement in reflection-free environment. The RMS error is calculated from the bearings of evenly distributed samples versus azimuth and frequency.
[2] The R&S®DDF550-EMS option is export restricted.

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

Designation	Type	Order No.
Wideband direction finder, with AC power supply	R&S®DDF550	4074.2002.08
Wideband direction finder, with DC power supply	R&S®DDF550	4074.2002.18
Options		
Documentation of calibration values	R&S®DDF550-DCV	4074.1170.02
HF frequency range extension (receive option)	R&S®DDF550-HF	4074.1006.02
HF frequency range extension (DF option)	R&S®DDF550-HF2	4074.1429.02
Service kit	R&S®DDF-SK	4060.0454.02
Preclassifier	R&S®DDF550-CL	3025.2829.02
Time-synchronous scanning	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, requires R&S®DDF550-ID [1]	R&S®DDF550-EMS	4501.0504.02
Enhanced measurement speed, requires R&S®DDF550-ID [1]	R&S®DDF550-EMS	4074.1570.02
EMS identification, required for R&S®DDF550-EMS	R&S®DDF550-ID	4074.1206.02
Internal GPS time synchronous	R&S®DDF550IGT2	4079.8209.05
Options for hardware-accelerated signal processing (in combination with R&S®CA120)		
Signal processing board	R&S®DDF550-SP	4074.1106.02
DDC signal extraction [2]	R&S®DDF550DDCE	4074.0700.02
High-resolution panorama spectrum [2]	R&S®DDF550-HRP	4074.0745.02
Detection of short-time signals [3]	R&S®DDF550-ST	4074.0722.02
DF system accessories		
Super-resolution HF DF antenna, diameter: 100 m	R&S®ADD011SR	4078.0004.02
HF DF antenna	R&S®ADD011P	4099.2006.02
Compact LF UHF DF antenna	R&S®ADD216	4068.3000.02
HF DF antenna	R&S®ADD119	4053.6509.02
Super-resolution VHF DF antenna	R&S®ADD050SR	4071.7003.12
Super-resolution VHF/UHF DF antenna	R&S®ADD153SR	4071.6007.12
Dual polarized VHF/UHF DF antenna	R&S®ADD157	4069.4800.22
UHF DF antenna	R&S®ADD070	4043.4003.02/.12 [4]
VHF/UHF wideband DF antenna	R&S®ADD253	4071.4004.12
Centric mast HF DF antenna	R&S®ADD015	4200.7002.04/.54/.84 [5]
Super-resolution UHF/SHF DF antenna	R&S®ADD078SR	4098.4005.02
Extended lightning protection, for R&S®ADD15x and R&S®ADD253	R&S®ADD-LP	4069.6010.02
Extended lightning protection, for R&S®ADD050SR	R&S®ADD-LP	4069.6010.03
HF DF antenna cable set	R&S®DDF1XZ	4064.6286.xx [6]
VHF/UHF DF antenna cable set	R&S®DDF5XZ	4064.6728.xx [6]
UHF DF antenna cable set	R&S®DDF7XZ	4064.8043.xx [6]
DF antenna cable set, for R&S®ADD078SR	R&S®DDF3C-7	4098.4757.xx [6]
Antenna interconnection cable set, for interconnecting R&S®ADD078SR with R&S®ADD15x	R&S®DDF3CX	4098.4763.10
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

[1] R&S®DDF550-EMS option is export restricted.
[2] R&S®DDF550-SP is required.
[3] R&S®DDF550DDCE is required.
[4] Model .02 for DF antenna system with R&S®ADD15x and R&S®ADD050SR.
[5] Last two digits of the order number designate the cable length (cable length: 8 m (EF400)/5 m (RG214)/8 m (RG214)).
[6] The DF antenna cable sets are available in various lengths, designated by the last two digits of the order number.

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