R&S®DDF550
WIDEBAND DIRECTION FINDER

Fast and precise direction finding

ROHDE & SCHWARZ

Make ideas real

AT A GLANCE

The fast R&S®DDF550 wideband direction finder has outstanding real-time bandwidth and direction finding (DF) scan speeds as well as high DF accuracy, sensitivity and immunity to reflections. The unit is compact dimensions and comes in a DC-powered model ideal for mobile applications.

The R&S®DDF550 can be operated with virtually all R&S®ADDx multichannel DF antennas. There is a R&S®ADDx DF antenna for any application. R&S®ADDx DF antennas have a large number of elements for very wide apertures and exceptional performance. All antennas have 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 together with an optional, automatic preclassifier. ITU-compliant measurements can be added to the R&S®DDF550.

BENEFITS

KEY FACTS

▶ High DF accuracy, sensitivity and reflection immunity

▶ High DF scan speed thanks to 80 MHz real-time bandwidth (VHF/UHF/SHF)

▶ Easy integration into mobile platforms thanks to compact size and optional DC power supply

▶ DF antennas with integrated, extendible lightning protection do not impair DF accuracy

▶ DF for signals in the frequency range up to 6 GHz

DIRECTION FINDING FOR SHORT-DURATION SIGNALS WITH HIGH PROBABILITY OF INTERCEPT

The R&S®DDF550 is designed for high-speed monitoring of wide frequency ranges. Bearings are taken for short-duration signals and fast, frequency agile transmitters operating at unknown frequencies with high probability of intercept. The 80 MHz real-time bandwidth in the VHF/UHF range makes it possible. In many applications, the bandwidth allows bearings to be taken in parallel with maximum probability of intercept for all signals in the 80 MHz range – all without activating the DF scan mode. Frequency ranges exceeding 80 MHz are traversed in DF scan mode at very high speed thanks to the fast synthesizer. The R&S®DDF550-EMS[1] enhanced measurement speed and R&S®DDF550-ID EMS identification options help further reduce the minimum signal duration, 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

Multipath propagation (especially in urban areas) means DF antennas will pick up both direct waves and reflections. R&S®ADDx multichannel DF antennas are more immune to such reflections than most commercially available antennas, thanks to 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.

INNOVATIVE DF ANTENNAS

Active/passive switchover with just a mouse click

Up until now, users have had to choose: higher sensitivity with active DF antennas or greater immunity to strong signals with passive DF antennas.

The R&S®ADD011SR, R&S®ADD011P, R&S®ADD050SR, R&S®ADD557SR and R&S®ADD253 DF antennas are the first that can bypass the active circuitry of antenna elements. Users can switch active elements to passive mode with a mouse click. The DF antennas have the advantages of both active and passive modes.

Exceptionally high DF sensitivity

The R&S®ADD557SR and R&S®ADD253 DF antenna elements have PIN diodes that allow electrically active structures to change very quickly in the VHF/UHF range. The elements are always optimally adapted to the receive frequency and are very sensitive.

Integrated, extendible lightning protection

All Rohde & Schwarz DF antennas at risk of being struck by lightning have built-in, effective, extendible lightning protection. The lightning protection concept was included in its development from the very start and does not impair DF accuracy.

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.

PRECISE DIRECTION FINDING OF WEAK SIGNALS

High DF sensitivity with a large number of antenna elements

When used with the R&S®DDF550, R&S®ADDx multichannel DF antennas have an exceptionally large number of antenna elements for higher sensitivity than DF antennas with an identical diameter but fewer elements. More antenna elements means more spatial sampling points for higher system gain.

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

The R&S®DDF550 uses an average of the voltage measured from individual DF antenna elements relative to reference elements. It does so on a large number of frequency channels in parallel, both in wideband DF and DF scan mode as coherent signal integration. First, the antenna voltage for all measured frequency channels is stored and the average voltage value is output for each channel based on the selected average time. Next, bearings are calculated from the average antenna voltage. As average time increases, the impact of noise decreases significantly for greater DF sensitivity. Coherent signal integration improves DF sensitivity by 29 dB for an emission of 1 s and by 24 dB for a 300 ms burst signal. The covered channels must fall within the R&S®DDF550 real-time bandwidth (25 kHz channel resolution).

R&S®DDF550 graphical user interface displaying 80 MHz realtime bandwidth.
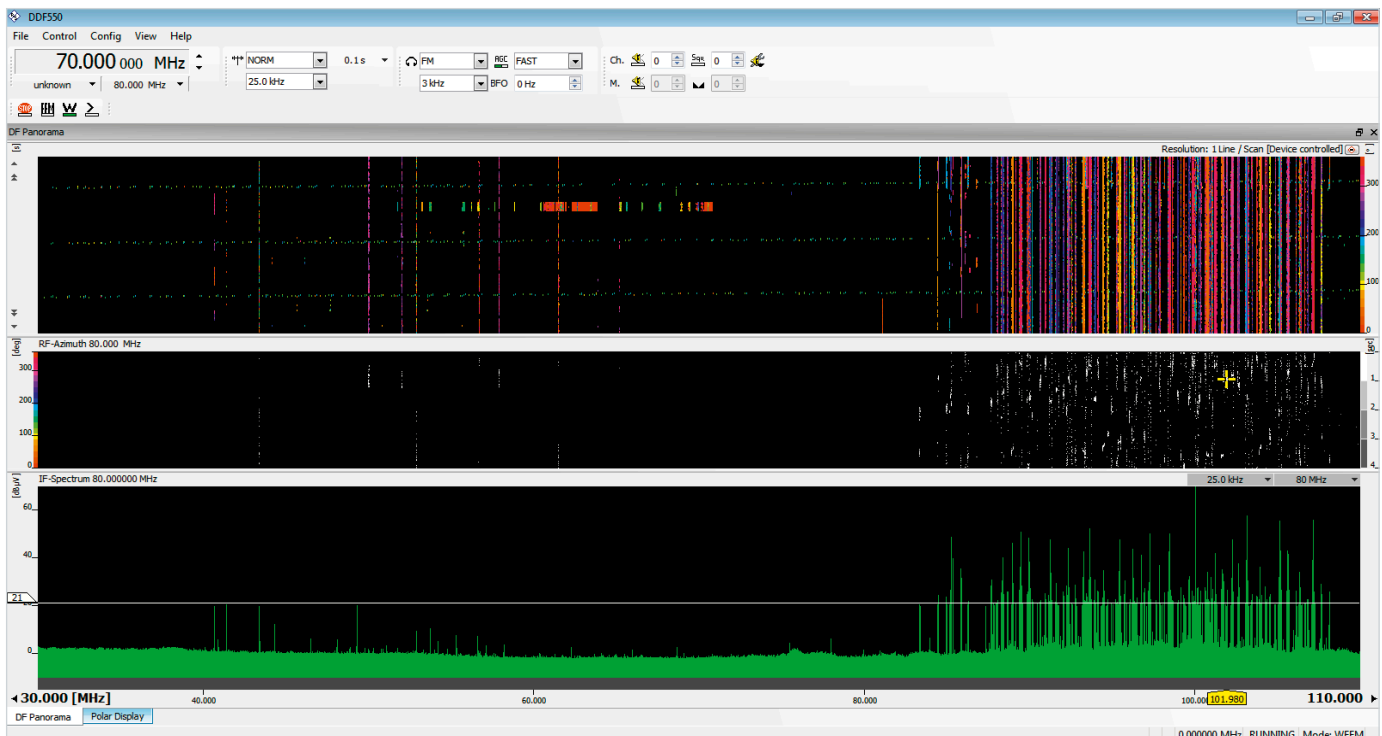
ACCURATE AND RELIABLE LOCATION OF SHORT DURATION SIGNALS

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

To locate short signals, all direction finders in a radiolocation network should be synchronized so that they can take bearings on the same frequency at the same time to ensure that bearings are delivered by all direction finders – even for very short emissions – and the precise calculation of signal source locations.

The R&S®DDF550-TS time-synchronous scanning option and suitable GPS receivers let multiple R&S®DDF550 direction finders be synchronized with the R&S®DDF550IGT2 internal GPS time synchronization option or any other GPS 1 pps signals, essential when using the R&S®DDF550 in radiolocation systems for automatic location of frequency agile transmitters.

Optional preclassifier detects LPI signals and summarizes individual results

Only a specific portion of the signals received by the DF antenna are of interest in practical applications. The R&S®DDF550-CL preclassifier option automatically separates specific LPI [1] signals (frequency hopping, chirp and burst signals) from conventional signals. The individual DF results of an emission are automatically averaged and summarized. The procedure enhances radiolocation accuracy and minimizes the amount of data to be transferred between the DF stations in a radiolocation network.

[1] Low probability of intercept.

SPECIAL AND VERY POWERFUL RECEIVE PATH FOR SIGNAL MEASUREMENT

The number of radio services and transmitters continues to grow, increasing the cumulative load on antenna and receiver inputs. Digital broadcasting services (DVB-T and DAB) have high bandwidths and have changed antenna and receiver linearity requirements. If a DF antenna is near strong transmitters – which are hard to avoid in urban areas – the problem is even worse.

If there are too many strong signals, intermodulation products may appear in the spectrum. They can mask signals of interest and make direction finding impossible.

In many applications, it is good to reduce real-time bandwidth for greater sensitivity, linearity and immunity to strong signals.

Special and very powerful receive path
When the user sets real-time bandwidth to 20 MHz (or less), both the R&S®DDF550 receive channels in the VHF/UHF/SHF range automatically switch to a very powerful receive path. This second path is optimized for precise signal measurements.

Improved analog receive path architecture
To minimize the detrimental influence of strong signals outside the receive bandwidth, these signals must be filtered out in the analog part of the RF frontend. This works best with narrow receive bandwidths. Filters that take effect in the spectrum much earlier perform better. The R&S®DDF550 includes various filters selected based on the set real-time bandwidth:
▶ Special filters in preselection optimized for narrower real-time bandwidths
▶ Special IF filter with 20 MHz bandwidth

Very powerful analog/digital converters
The commercially available analog/digital converter performance is influenced by the receive bandwidth: the narrower the receive bandwidth, the better the performance. The R&S®DDF550 has two different analog/digital converters that can be selected based on the set real-time bandwidth. When real-time bandwidth of 20 MHz (or less) is set, a very high-resolution converter is used.

Big advantages with weak signals in dense signal scenarios
The receive path with 20 MHz real-time bandwidth was specially developed for precise signal measurement and has many benefits in both DF and receive mode:
▶ Significant noise floor reduction due to narrower bandwidth
▶ Fewer limits (from strong signals outside the receive bandwidth) on the dynamic range in the analog/digital converter thanks to narrower analog filters
▶ Significant improvement (18 dB (typ.)) in the intermodulation-free dynamic range thanks to a special analog/digital converter

These help improve the signal-to-noise ratio, especially with strong signals near the receive bandwidth. The second receive path is 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 DF system components in the R&S®DDF550 are developed and manufactured by Rohde & Schwarz for above-average performance and quick implementation of technical innovations. Recent years have seen major improvements in DF antennas, such as the active/passive switchover that Rohde & Schwarz developed and introduced.

Rohde & Schwarz benefits from years of experience in developing and producing antennas, receivers and digital signal processing equipment.

Signal processing at maximum speed with powerful FPGAs

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

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 depends on performance at these points. Rohde & Schwarz has in-house application-specific integrated circuits (ASIC) for this.

Immunity to strong signals with sophisticated preselection

Apart from wanted signals, a spectrum also contains strong signals from TV and radio broadcast transmitters. To make sure DF results are not impaired, these out-of-band signals must be sufficiently suppressed with preselection. The R&S®DDF550 has sophisticated preselectors from 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 based on the set real-time bandwidth. The preselection capability far exceeds ITU recommendations for above-average immunity from strong signals.
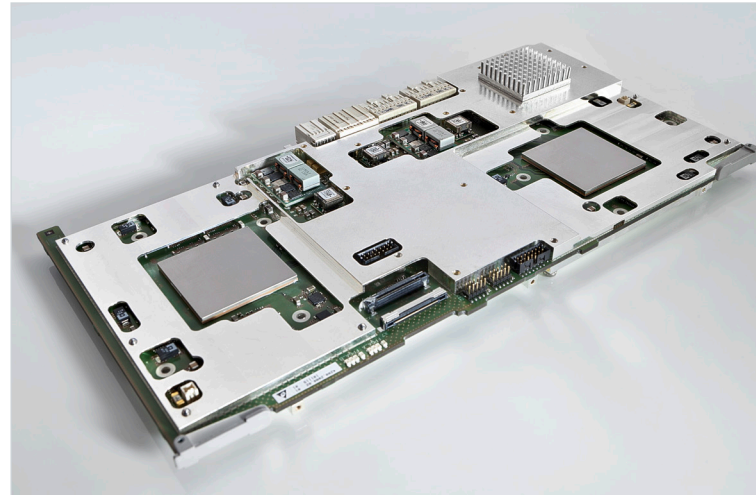
Module with powerful FPGA for high-speed signal processing.
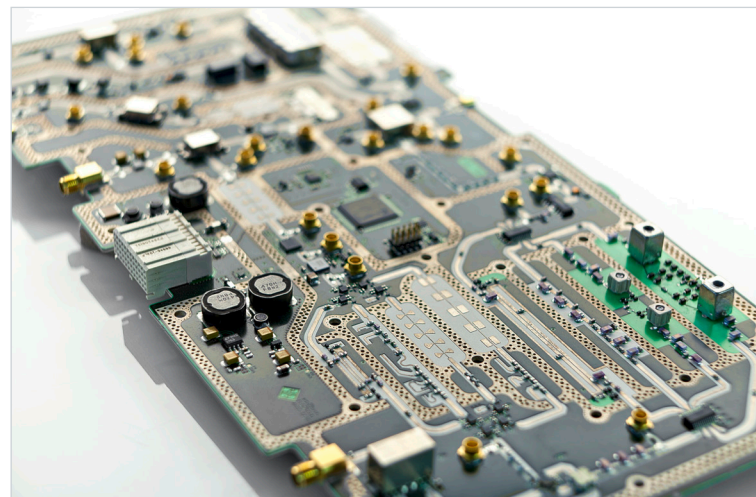
VHF/UHF/SHF preselection of the R&S®DDF550 with bandpass and tracking filters.

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 [1]
▶ 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

[1] 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®ADD557SR and R&S®ADD078SR DF antennas, the R&S®DDF550 delivers precise DF results up to 6 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.

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HARDWARE-ACCELERATED MULTICHANNEL SIGNAL PROCESSING

The R&S®DDF550 digital direction finder provides hardware-accelerated signal processing for the R&S®CA120 multichannel signal analysis system (see, PD 3606.9327.12 product brochure or PD 3606.9327.22 data sheet). The R&S®DDF550 needs the R&S®DDF550-SP signal processing board. The board supports up to three different high-performance signal processing functions using 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 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

The detailed interface description lets system integrators directly access the receiver data streams for processing in their own external systems.

Parallel multichannel output of over 100 channels

In the direction finder real-time bandwidth with over 100 channels (manually set by the user) and 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. 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).

When 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 R&S®DDF550 real-time bandwidth with R&S®DDF550DDCE and R&S®CA120FFP

If multiple signals in the R&S®DDF550 real-time bandwidth are active at the same time, users can extract them with digital downconverters (DDC). The maximum number of DDCs computed in parallel depends on the set DDC bandwidth (see the R&S®CA120 data sheet, PD 3606.9327.22). In a typical HF application with an R&S®DDF550 real-time 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 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 the R&S®DDF550-HRP and R&S®CA120DSC

The signal detector provides results for each detected signal that matches user-defined criteria in the real-time R&S®DDF550 bandwidth. 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 not of interest, the detector algorithm can be parameterized with a list of frequency ranges to be ignored. The detector will generate no messages for signals in this range.

The R&S®CA120 taps and processes detection spectra at the R&S®DDF550 LAN interface. 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 for optimum signal search and signal monitoring support.

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.

R&S®DDF550 digital direction finder

R&S®DDF550-SP signal processing board

R&S®CA120 multichannel signal analysis system

R&S®DDF550 base functions (up to 80 MHz bandwidth)

I/Q

R&S®DDF550-ST detection of short-time signals

R&S®DDF550-HRP calculation of high-resolution spectra

Wideband delay buffer

R&S®DDF550DDCE DDC signal extraction

1 Gbit Ethernet

R&S®CA120ST detection of short-time signals

R&S®CA120DSC detection, search and classification of fixed frequency signals

Control

R&S®CA120FFP fixed frequency processing

I/Q

I/Q

1 Gbit Ethernet

R&S®GX460/R&S®GX465 digital wideband storage device
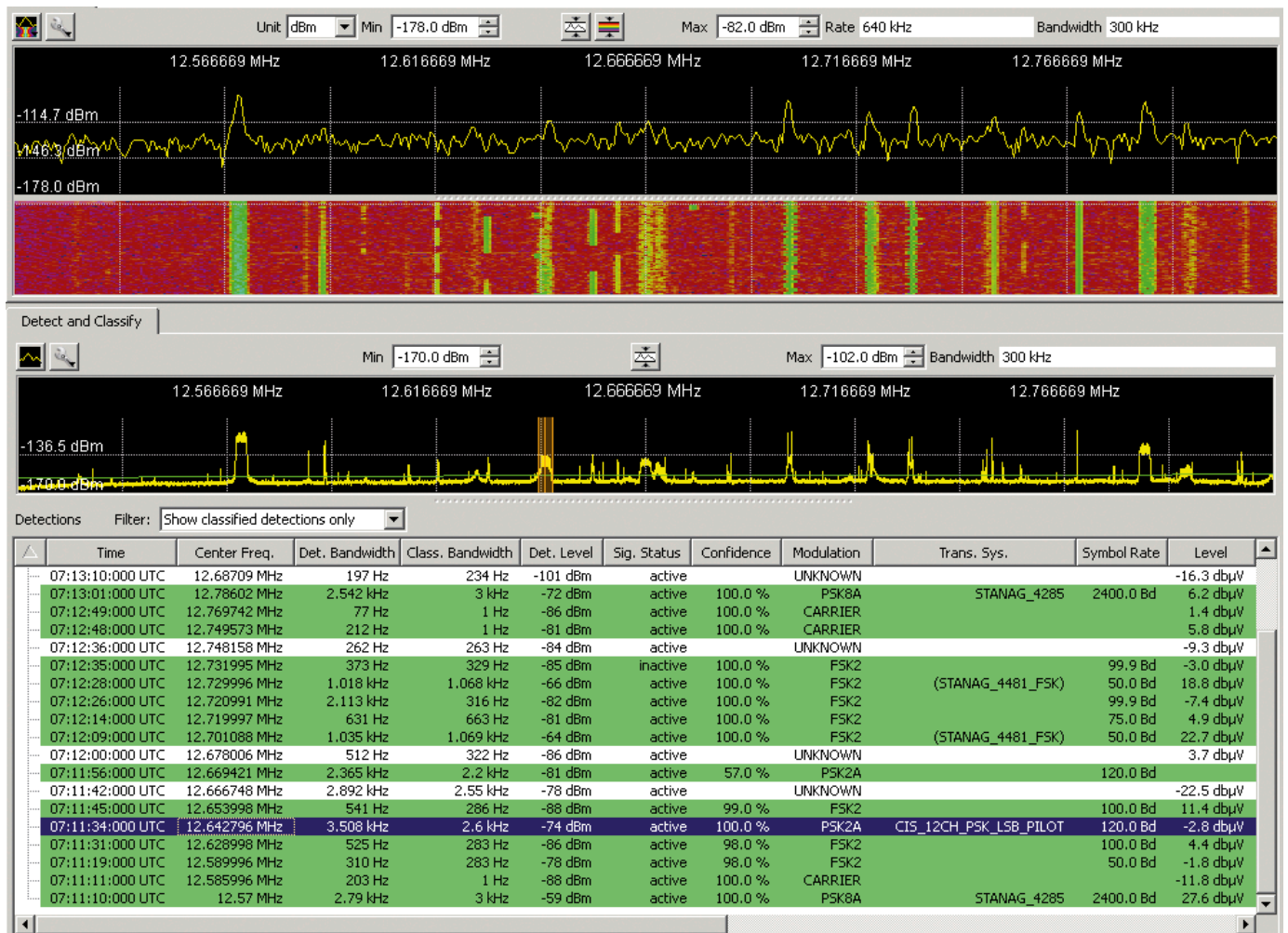
R&S®CA120REC recording and replay

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

The R&S®CA120 lets the R&S®DDF550-ST option deliver results for each short-time signal detected within the real-time R&S®DDF550 bandwidth and matches user-defined selection criteria. The results are output on the 1 Gbit Ethernet interface for further processing.

By measuring, classifying and sorting results, the R&S®CA120 multichannel signal analysis system with the R&S®CA120ST and R&S®CA120PS options provide optimum support when detecting and monitoring frequency agile short-time signals.

Automatic profile separation and online recombination capabilities make R&S®CA120 an enhanced online dehopping solution.

Automatic detection and classification capabilities let R&S®CA120 monitor complete signal scenarios and inform users of 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 come standard with a lightning rod. This rod safely diverts lightning strikes and in most cases prevents damage to the DF antenna.

The higher a DF antenna, the greater the likelihood that lightning will not strike the rod but instead will laterally strike 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 prevent lateral impact in most cases, 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®ADD253	20 MHz to 3 GHz	mobile and stationary
R&S®ADD078SR	1.3 GHz to 6 GHz	mobile and stationary
R&S®ADD557SR	20 MHz 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
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

[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®DDF550IGT2 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®DDF550IGT2 serves as an internal GNSS (GPS, GLONASS, Beidou), 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.
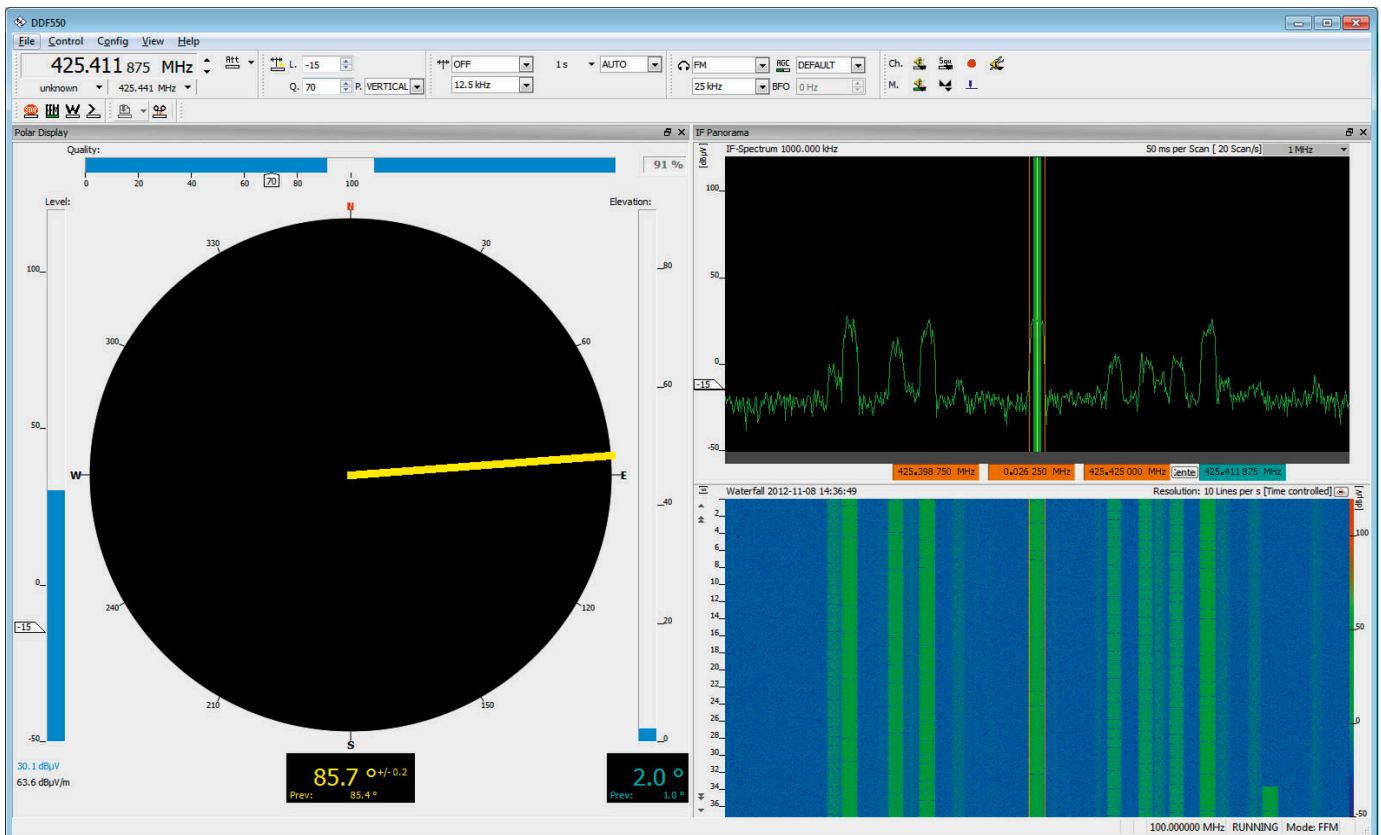
R&S®RAMON and R&S®ARGUS software

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.
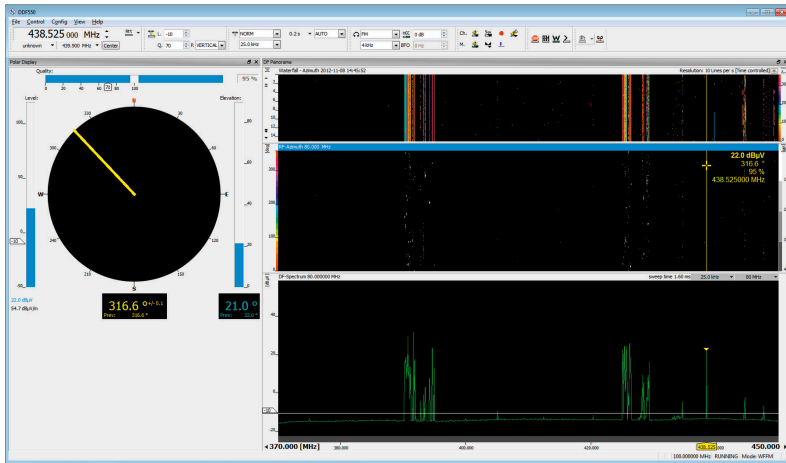
R&S®DDF550-Control supports the fixed frequency mode (FFM), the wideband fixed frequency mode (WFFM) up to 80 MHz, and the scanning of frequency ranges wider than 80 MHz. Results can be displayed in various formats:
▶ Polar display with DF quality and level bargraph indication for a specific frequency
▶ 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 functions:
▶ 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 results displayed 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.
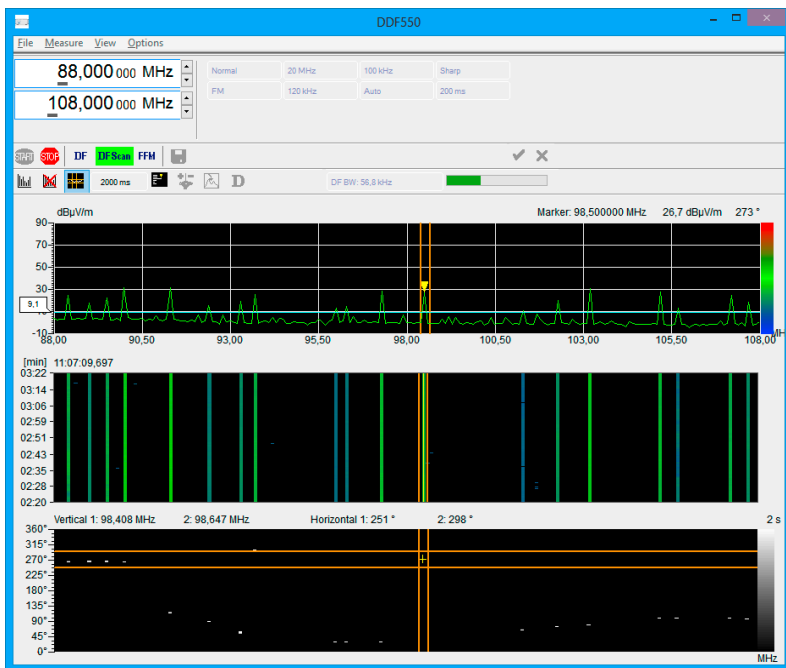
R&S®DDF550-ARGUS Control: Graphical display of results obtained in DF scan mode, including RF spectrum, DF values versus frequency and waterfall.

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APPLICATION EXAMPLE

Powerful mobile DF system

The compact R&S®DDF550 wideband direction finder 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 is well-suited for the direction finder. The result is a DF system with impressive performance:

▶ Fast direction finder with up to 40 GHz/s DF scan speed in a compact 4 U design
▶ 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 mast
▶ The compact R&S®ADD253 multi-element DF antenna 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.

SPECIFICATIONS IN BRIEF

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, correlative interferometer
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.

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

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

Designation	Type	Order No.
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
Accessories: cable sets for DF		
HF DF antenna cable set, 0.3 MHz to 30 MHz, length: 5 m	R&S®DDF1XZ	4064.6286.05
HF DF antenna cable set, 0.3 MHz to 30 MHz, length: 30 m	R&S®DDF1XZ	4064.6286.30
HF DF antenna cable set, 0.3 MHz to 30 MHz, length: 100 m	R&S®DDF1XZ	4064.6286.11
HF DF antenna cable set, 0.3 MHz to 30 MHz, length: 150 m	R&S®DDF1XZ	4064.6286.15
HF DF antenna cable set, 0.3 MHz to 30 MHz, length: 250 m	R&S®DDF1XZ	4064.6286.25
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 5 m	R&S®DDF5XZ	4064.6728.05
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 10 m	R&S®DDF5XZ	4064.6728.10
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 20 m	R&S®DDF5XZ	4064.6728.20
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 30 m	R&S®DDF5XZ	4064.6728.30
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 40 m	R&S®DDF5XZ	4064.6728.40
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 50 m	R&S®DDF5XZ	4064.6728.50
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 80 m	R&S®DDF5XZ	4064.6728.80
VHF/UHF DF antenna cable set, 0.3 MHz to 1.3 GHz, length: 100 m	R&S®DDF5XZ	4064.6728.11
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 5 m	R&S®DDF7XZ	4064.8043.05
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 10 m	R&S®DDF7XZ	4064.8043.10
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 20 m	R&S®DDF7XZ	4064.8043.20
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 30 m	R&S®DDF7XZ	4064.8043.30
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 40 m	R&S®DDF7XZ	4064.8043.40
UHF DF antenna cable set, 0.3 MHz to 3 GHz, length: 50 m	R&S®DDF7XZ	4064.8043.50
VHF/UHF/SHF DF antenna cable set, 0.3 MHz to 6 GHz, length: 5 m	R&S®DDF3C-7	4098.4757.05
VHF/UHF/SHF DF antenna cable set, 0.3 MHz to 6 GHz, length: 10 m	R&S®DDF3C-7	4098.4757.10
VHF/UHF/SHF DF antenna cable set, 0.3 MHz to 6 GHz, length: 20 m	R&S®DDF3C-7	4098.4757.20
VHF/UHF/SHF DF antenna cable set, 0.3 MHz to 6 GHz, length: 30 m	R&S®DDF3C-7	4098.4757.30
Accessories: rack adapter		
19" rack adapter	R&S®ZZA-411	1096.3283.00
Direction finding antennas		
The R&S®DDF550 is compatible with the R&S®ADD011P, R&S®ADD011SR, R&S®ADD119, R&S®ADD015, R&S®ADD050SR, R&S®ADD216, R&S®ADD253, R&S®ADD557SR and R&S®ADD078SR DF antennas.		
Trainings		
Introduction to direction finding	R&S®DDF550-TI	4101.2203.02
R&S®DDF550 basic service training	R&S®DDF550-TBS	4101.2210.02

[2] R&S®DDF550-SP is required.
[3] R&S®DDF550DDCE is required.

Rohde & Schwarz

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