

# R&S® DDF5GTS

## High-Speed Scanning Direction Finder

Fast, accurate direction  
finding



# R&S®DDF5GTS

## High-Speed Scanning Direction Finder

### At a glance

The R&S®DDF5GTS high-speed scanning direction finder offers outstanding realtime bandwidth and DF scan speed as well as high DF accuracy, sensitivity and immunity to reflections. Thanks to the integrated super-resolution DF method, the direction finder is ideal for complex signal scenarios.

The R&S®DDF5GTS can be operated with virtually all R&S®ADDx multichannel DF antennas. From the wide range of R&S®ADDx antennas, the right antenna(s) can be chosen for every application. The R&S®ADDx multichannel 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®DDF5GTS direction finders can be combined and operated in synchronized DF scan mode in conjunction with an optional, automatic preclassifier. The R&S®DDF5GTS complies with all ITU recommendations and can be extended with an option to include ITU-compliant measurement methods. With its optional DC power supply, the R&S®DDF5GTS is ideal for mobile applications.

#### Key facts

- Exceptionally fast DF scan speed thanks to three-channel architecture and wide realtime bandwidth
- High DF accuracy, sensitivity and immunity to reflections
- Integrated super-resolution DF method
- Monitoring and DF performance in line with ITU recommendations and ITU Handbook on Spectrum Monitoring
- Performance verification in line with ITU recommendations



# Direction finding of extremely fast frequency agile signals with high probability of intercept

The R&S®DDF5GTS is designed for high-speed monitoring of wide frequency ranges. Bearings of short bursts and fast, frequency agile transmitters operating at unknown frequencies are taken with high probability of intercept. This is mainly due to the use of three coherent receive channels and the exceptionally large 80 MHz realtime bandwidth. 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, thanks to the fast synthesizer.

The R&S®DDF5GTS also delivers accurate bearings of state-of-the-art frequency hopping transmitters with up to 2000 hops/s and of repetitive pulses with a duration of only 10 µs.

## Increase in measurement speed

With the R&S®DDFGTS-EMS option, the measurement speed of the R&S®DDF5GTS can be further increased to take the bearings of extremely short emissions, making it possible to reliably locate even one-time emissions with a duration of 300 µs.<sup>1)</sup>

<sup>1)</sup> The R&S®DDFGTS-EMS option is subject to export control.

# 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 DF antennas, since they feature an exceptionally large number of antenna elements. Virtually all Rohde & Schwarz DF antennas use nine antenna elements in the HF/VHF/UHF range, or eight in the UHF/SHF range, while commercially available DF antennas typically have fewer antenna elements. 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).

# Super-resolution DF method

## Direction finding for co-channel signals

Conventional DF methods are based on the assumption that a specific frequency is occupied exclusively by a single transmitter. However, if additional transmitters are operating on the same frequency, direction finding may be impaired – a problem referred to as co-channel interference. In this case, the DF result depends on the ratio of the transmitter levels. If one of the transmitters is clearly stronger than the others, its bearing is displayed with a slight error. If the transmitters have similar levels, the DF result is usually incorrect. This applies equally to all conventional DF methods, including correlative interferometer, Doppler and Watson-Watt.

Co-channel interference is regularly seen in practice:

- In single-frequency networks such as those used in DAB/DVB, multiple transmitters broadcast the same signal on the same frequency from different sites. This is done to improve transmission quality
- Defective electronic equipment may produce electromagnetic interference on a frequency that is also used by transmitters
- Sometimes, specific transmitters are intentionally jammed. In this case, an interfering signal is sent on the same frequency
- In the HF range, propagation conditions are continuously changing. Emissions may sometimes travel much farther than originally planned and therefore be received in areas where a different station transmits on the same frequency

## Super-resolution technology

Users of the R&S®DDF5GTS can switch to super-resolution DF mode with a mouse click. This sophisticated signal processing technology is now available for the R&S®DDF5GTS. It enables the direction finder to resolve a wave field with multiple signals present on the same frequency. The number, angle of incidence, receive level and DF quality of the signals are precisely calculated and displayed. In super-resolution mode, the R&S®DDF5GTS can take the bearings of several different signals on the same frequency in parallel. The actually achievable performance depends, among other factors, on the receive frequency set on the DF system as well as on the angles of incidence and S/N ratios of the signals.

## Maximum performance

Reliable estimation of the number of waves is an important prerequisite when using super-resolution DF methods in automated measurements. This estimation provides information about the number of the signals present on the same frequency. The super-resolution algorithm implemented in the R&S®DDF5GTS employs an improved method for estimating the number of waves. This method contributes significantly to the excellent performance of the R&S®DDF5GTS in super-resolution mode.

## Super-resolution DF antennas

The super-resolution DF method requires DF antennas whose antenna elements can be combined into various subgroups. The R&S®ADDxxxSR multichannel DF antennas offer this capability. They can be used to cover frequency ranges between 300 kHz and 6 GHz and deliver high performance in super-resolution DF mode thanks to their exceptionally wide apertures.



VHF/UHF DF antenna system (from bottom to top):  
R&S®ADD070, R&S®ADD050SR and R&S®ADD157 with R&S®ADD-LP.



# 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®ADD011P, R&S®ADD011SR, 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 electronic circuitry of the antenna elements. The user can switch the active elements to passive mode by a simple mouse click. These DF antennas 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®ADD253 and R&S®ADD157 DF antennas are equipped with PIN diodes in the frequency range from 20 MHz to 1.3 GHz (vertical polarization), allowing the electrically active structure to change very quickly. As a result, these elements are always optimally adapted to the receive frequency and offer exceptionally high sensitivity.<sup>1)</sup>

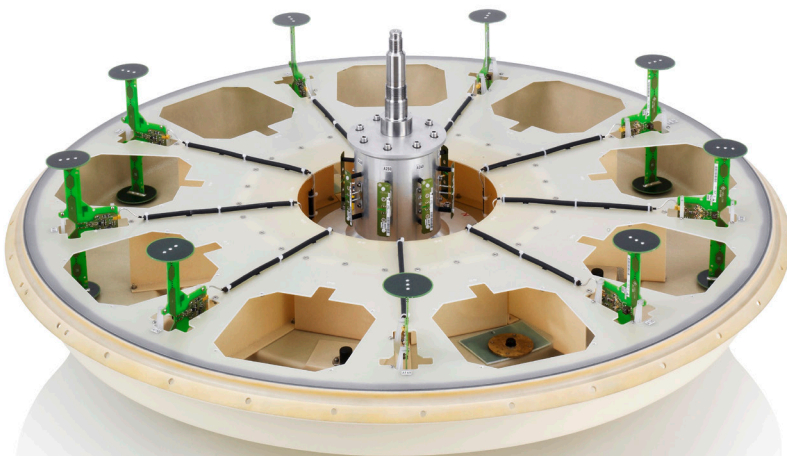
## Integrated, extendible lightning protection

All installed Rohde&Schwarz DF antennas that are at risk of being struck by lightning have effective, extendible lightning protection. This 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 Rohde&Schwarz DF antenna can be replaced with the same model without having to manage new calibration data and store it in the direction finder.<sup>1)</sup>

<sup>1)</sup> For details, see R&S®ADDx multichannel DF antennas product brochure (PD 0758.1106.12).



R&S®ADD253 mobile VHF/UHF broadband DF antenna (with opened cover).

# 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®DDF5GTS 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>1)</sup>

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

The R&S®DDF5GTS 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 mode 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 has been reached, 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.



# Accurate and reliable location of short-duration signals

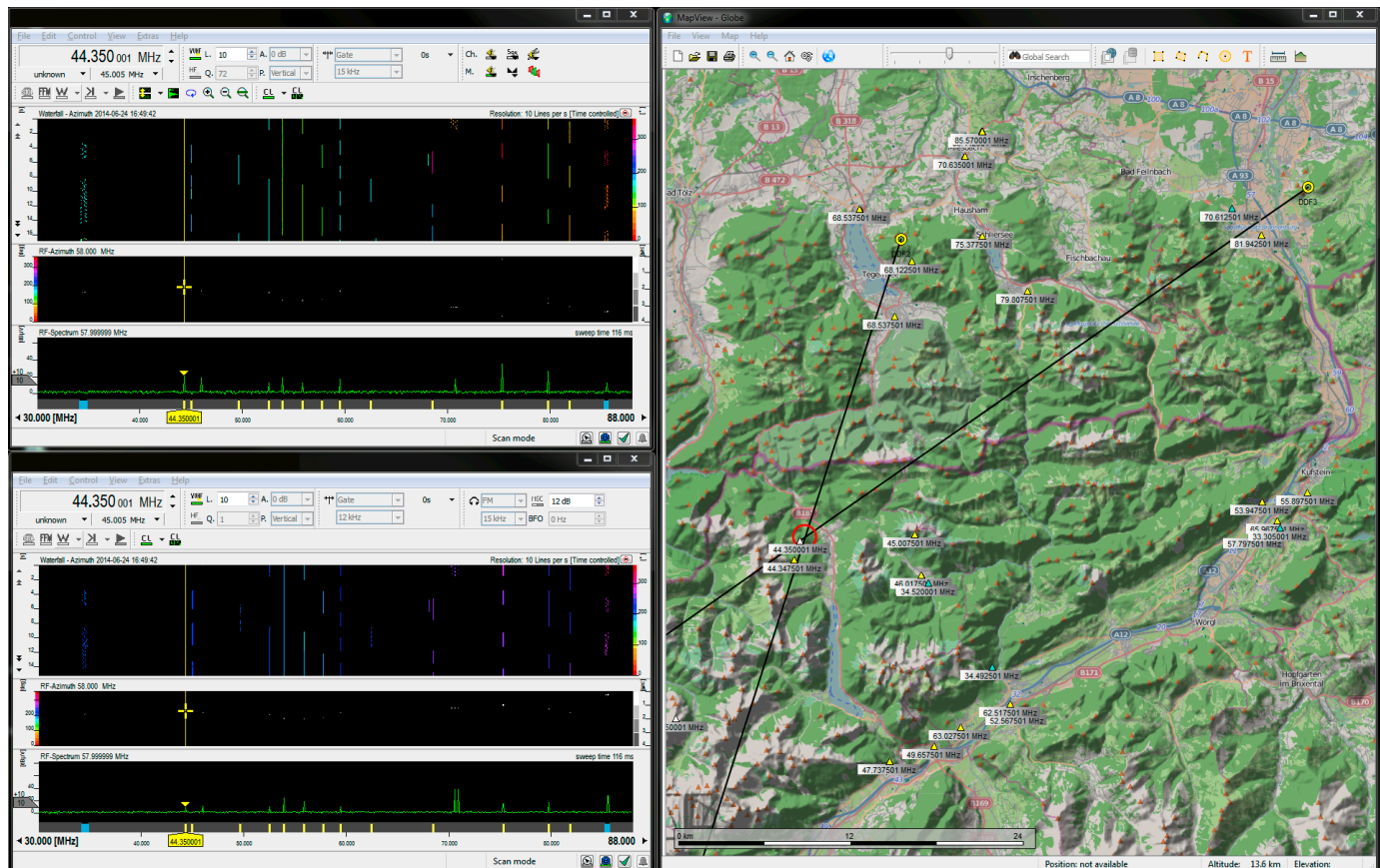
## GPS-based synchronization of multiple R&S®DDF5GTS (time-synchronized DF scan mode)

Thanks to its high realtime bandwidth and three-channel architecture, the R&S®DDF5GTS provides outstanding DF scan speed and high probability of intercept for short-duration signals. To locate these signals, at least two direction finders must take the bearings of the same signal. The time-synchronous DF scan mode is an essential prerequisite in order to make sure that all direction finders in a radiolocation network take bearings on the same frequency at the same time.

Using the R&S®DDFGTS-TS option, the R&S®DDFGTS can be synchronized to the GPS pulse per second (PPS). This can be done with most conventional GPS modules with PPS. To obtain top time accuracy, however, it is recommended to use the optional, integrated R&S®DDF-IGT GPS module, eliminating the need for additional components.

## Optional preclassifier for detecting LPI signals and summarizing 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®DDFGTS-CL preclassifier option automatically separates specific LPI 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.



R&S®SCANLOC radiolocation network with two R&S®DDF5GTS.



# 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®DDF5GTS 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®DDF5GTS 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®DDF5GTS 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 (typ. 18 dB) 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).

# Effective measurements in line with ITU recommendations

The R&S®DDF5GTS complies with all ITU recommendations for direction finders and receivers.

## Option for comprehensive, ITU-compliant measurement methods

The R&S®DDFGTS-IM option enables ITU-compliant measurements of signal parameters for AM, FM and PM modulated signals. The modulation index, occupied bandwidth and phase deviation can be determined, for example. The minimum, maximum and average values over a user-defined measurement period are displayed.

The R&S®DDFGTS-IM option covers the following ITU recommendations:

- ITU-R SM.377 <sup>1)</sup> (frequency and frequency offset measurements)
- ITU-R SM.378 (field strength measurements)
- ITU-R SM.328 (determination of modulation modes)
- ITU-R SM.443 (bandwidth measurements)
- ITU-R SM.1880 (determination of spectral occupancy, with remote control PC and R&S®ARGUS software package)

The R&S®DDF5GTS fulfills the following ITU hardware recommendations:

- ITU-R SM.1836 (measurements of IF filter edge steepness)
- ITU-R SM.1837 (IP3 measurements)
- ITU-R SM.1838 (noise figure measurements)
- ITU-R SM.1840 (sensitivity measurements)

<sup>1)</sup> Depending on the application, an external reference frequency with higher accuracy may be required, e.g. a GPS reference frequency.



Rear view.

# Receive mode with integrated antenna matrix

Depending on the operating mode, the R&S®DDF5GTS can be used as a precise scanning direction finder or as a fast monitoring receiver.

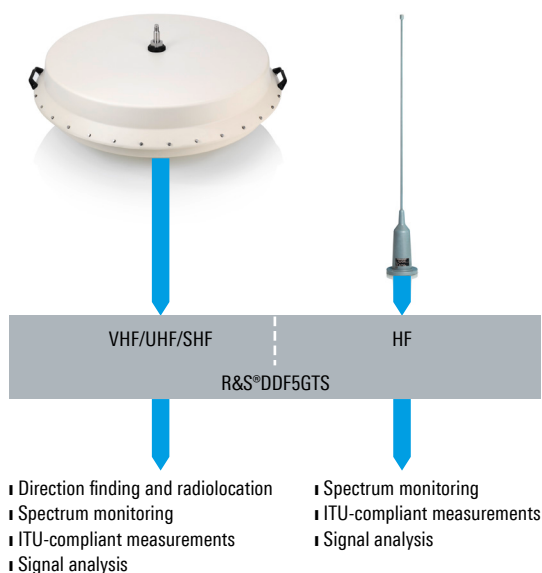
## Very fast panorama scan

As a monitoring receiver, the panorama scan function of the R&S®DDF5GTS allows extremely fast scanning to provide optimum support for signal search. The R&S®DDF5GTS offers very fast scan speeds in DF scan mode. In panorama scan mode, the scan speed is even higher since no switching of antenna elements is required. This makes the panorama scan ideal for detecting extremely short burst signals that would be lost in DF mode.

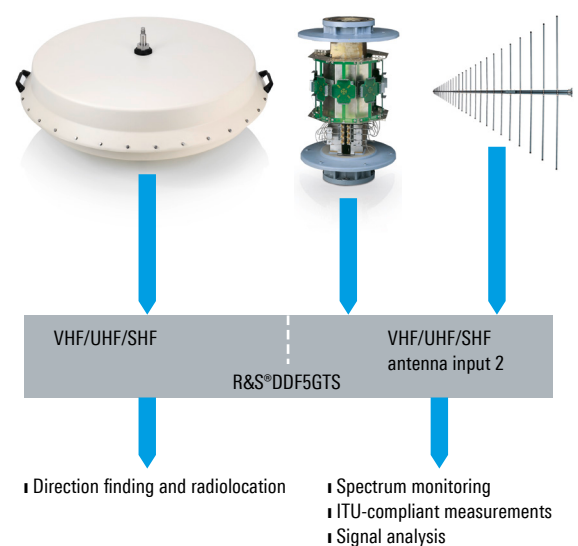
## Integrated antenna matrix

In receive mode, special receiving antennas are often required for signal analysis. Depending on the operating mode, the DF antenna or the receiving antenna is used, which previously required an external antenna matrix. The R&S®DDF5GTS is the first direction finder with an integrated antenna matrix for connecting three VHF/UHF/SHF receiving antennas and three HF receiving antennas (instead of a HF DF antenna) in addition to the VHF/UHF/SHF DF antenna. For HF, the R&S®DDF5GTS-HF HF frequency range extension option is required.

### Mixed use of the R&S®DDF5GTS for HF and VHF/UHF/SHF



### Use of the R&S®DDF5GTS for VHF/UHF/SHF with special receiving antennas



Once the system has been configured, the R&S®DDF5GTS automatically selects the appropriate antenna, based on the selected operating mode and frequency.

Mixed operation is also possible, for example:

- DF mode using a DF antenna in the VHF/UHF/SHF range for radiolocation ▷ switchover to receive mode using a receiving antenna in the HF range for radiomonitoring/signal analysis (R&S®DDFGTS-HF HF frequency range extension option) (see upper figure)
- DF mode using a DF antenna for radiolocation ▷ switchover to receive mode using ITU-compliant receiving antennas for radiomonitoring/signal analysis (see lower figure)

### Independent DDC channel

During wideband DF operation, the R&S®DDF5GTS can be used to demodulate and listen to any given signal on any frequency within the realtime bandwidth.

### Selection of the antenna element with maximum signal level

DF antennas usually consist of multiple antenna elements arranged in a circle. Due to reflections and spatial proximity of the antenna elements, the direct wave is superimposed at the reference antenna element. Depending on the receive frequency, this can cause nulls in the horizontal radiation pattern of the reference antenna element. DF antennas feature higher demodulation sensitivity in the reference direction, depending on the angle of incidence.

In receive mode, the R&S®DDF5GTS automatically selects the antenna element with the highest signal level for signal reception. Selecting the appropriate element can significantly increase the signal-to-noise ratio. As a result, weak signals that would otherwise be hidden in the spectrum can be detected and demodulated.



# 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®DDF5GTS 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

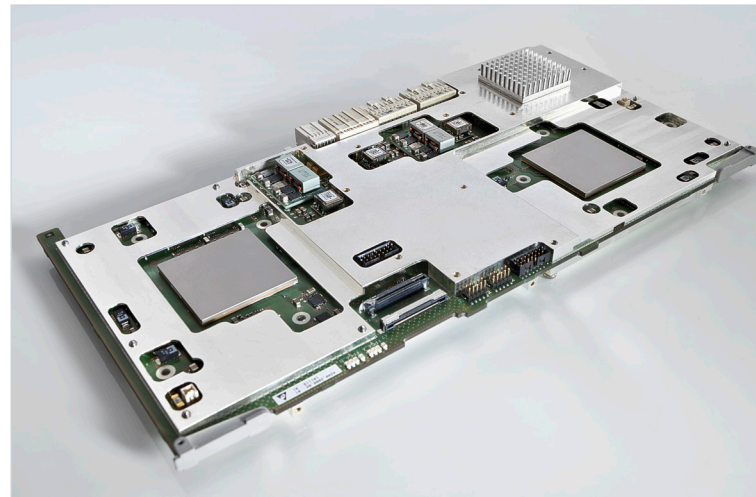
The large number of powerful field programmable gate arrays (FPGA) implemented in the R&S®DDF5GTS delivers above-average signal processing speed. FPGAs are much more powerful than the digital signal processors (DSP) and PC processors that many competitor products use for signal processing.

## Use of powerful Rohde&Schwarz ASICs

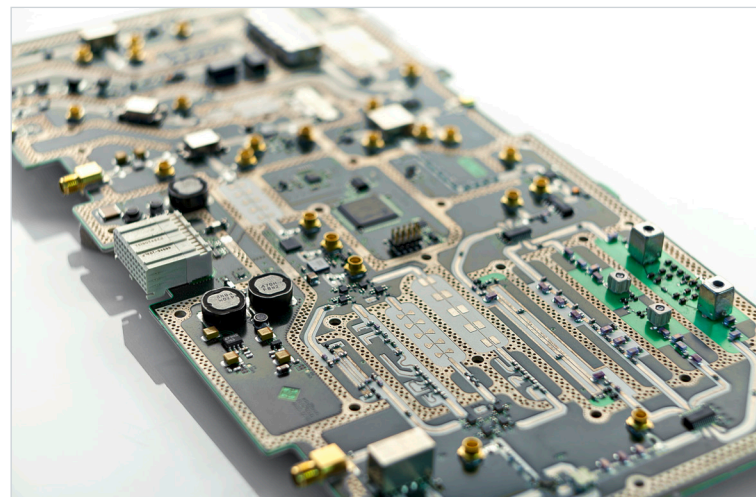
At specific points in the signal processing chain, all data must be processed simultaneously. The processing speed of the entire chain therefore essentially depends on the performance at these points. This is why Rohde&Schwarz uses its own application-specific integrated circuits (ASIC).

## 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®DDF5GTS is equipped with sophisticated preselectors developed by Rohde&Schwarz based on decades of experience. In contrast to most competitor products, the R&S®DDF5GTS 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®DDF5GTS with bandpass and tracking filters.

# Hardware-accelerated multichannel signal processing

The R&S®DDF5GTS 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®DDF5GTS needs to be equipped with the R&S®DDFGTS-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®DDFGTS-SP hardware-accelerated signal processing option, the R&S®DDF5GTS supports parallel multichannel signal detection and analysis. The following high-performance signal processing functions are implemented in field programmable gate array (FPGA) technology:

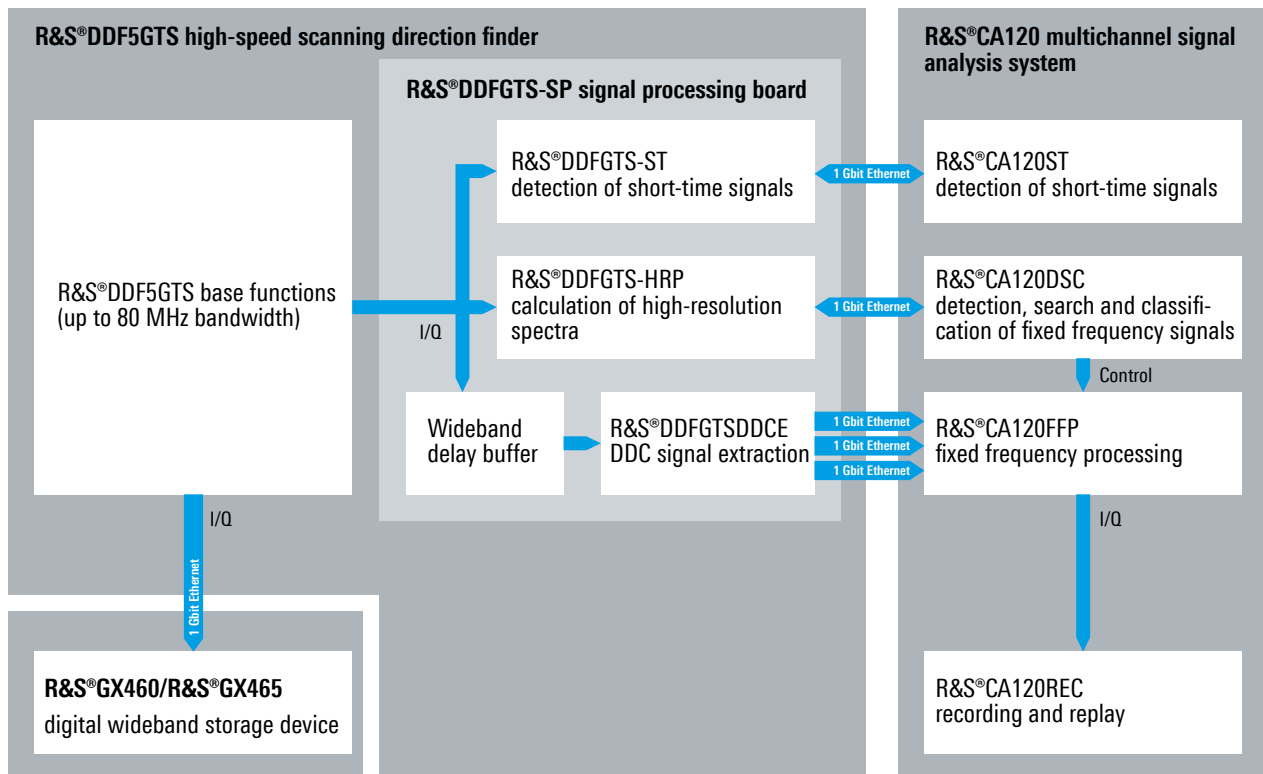
- Multichannel signal extraction: R&S®DDFGTSDDCE
- Calculation of high-resolution spectra: R&S®DDFGTS-HRP
- Detection of frequency agile signals: R&S®DDFGTS-ST

The R&S®CA120 multichannel signal analysis system ideally complements the R&S®DDF5GTS 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.

## R&S®DDF5GTS with R&S®DDFGTS-SP: support for hardware-accelerated signal processing with R&S®CA120



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

### **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®DDFGTSDDCE 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®DDF5GTS realtime bandwidth with R&S®DDFGTSDDCE and R&S®CA120FFP**

If multiple signals in the R&S®DDF5GTS 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®DDF5GTS 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®DDF5GTS 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®DDFGTS-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®DDF5GTS. 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.

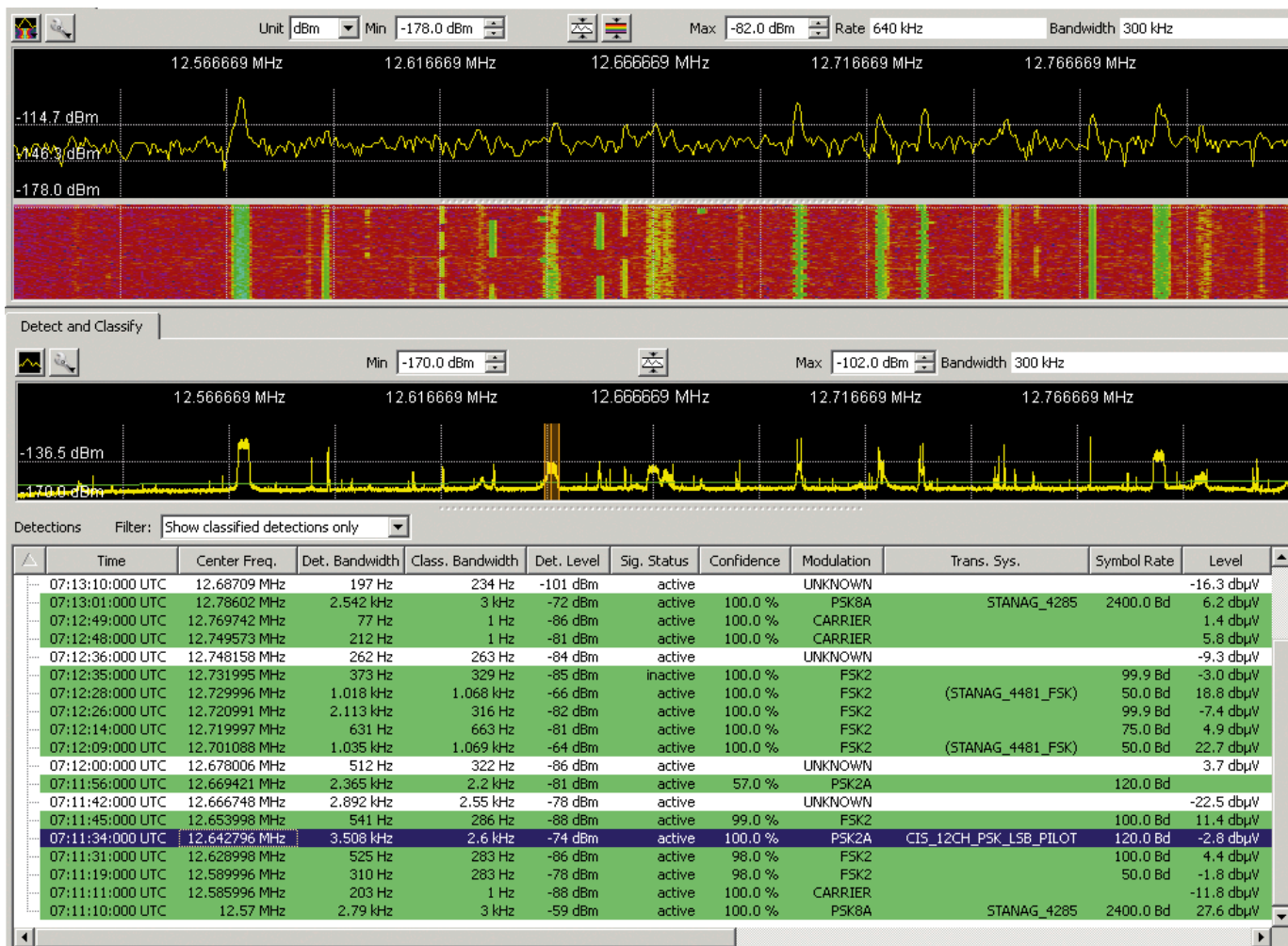
The R&S®CA120 taps the detection spectra at the LAN interface of the R&S®DDF5GTS and processes them. The R&S®CA120 assigns the results to signals, manages lists of active and inactive signals and uses digital downconverters (R&S®DDFGTSDDC) to automatically process detected signals, thereby providing optimum support for signal search and signal monitoring.

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

When used with R&S®CA120, the R&S®DDFGTS-ST option delivers a result for each short-time signal that is detected within the realtime bandwidth of the R&S®DDF5GTS 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.



# System configuration

## DF antennas for the R&S®DDF5GTS

The R&S®DDF5GTS 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, mountain-tops). 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®ACD001 with R&S®GX125 <sup>1)</sup>	see product information	mobile, on ships
R&S®ADD011SR	300 kHz to 30 MHz	stationary and transportable
R&S®ADD011P	300 kHz to 30 MHz	mobile
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
<b>Discontinued antennas</b>		
R&S®ADD050	20 MHz to 200 MHz	stationary
R&S®ADD070M	1.3 GHz to 3 GHz	mobile
R&S®ADD170	800 MHz to 2 GHz	mobile
R&S®ADD150 <sup>2)</sup>	20 MHz to 1.3 GHz	mobile and stationary
R&S®ADD153	20 MHz to 1.3 GHz	mobile and stationary

<sup>1)</sup> Requires R&S®DDF5GTS model .25.

<sup>2)</sup> Depending on the production version, a hardware modification may be required.

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

To connect the DF antenna(s) to the R&S®DDF5GTS, 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.

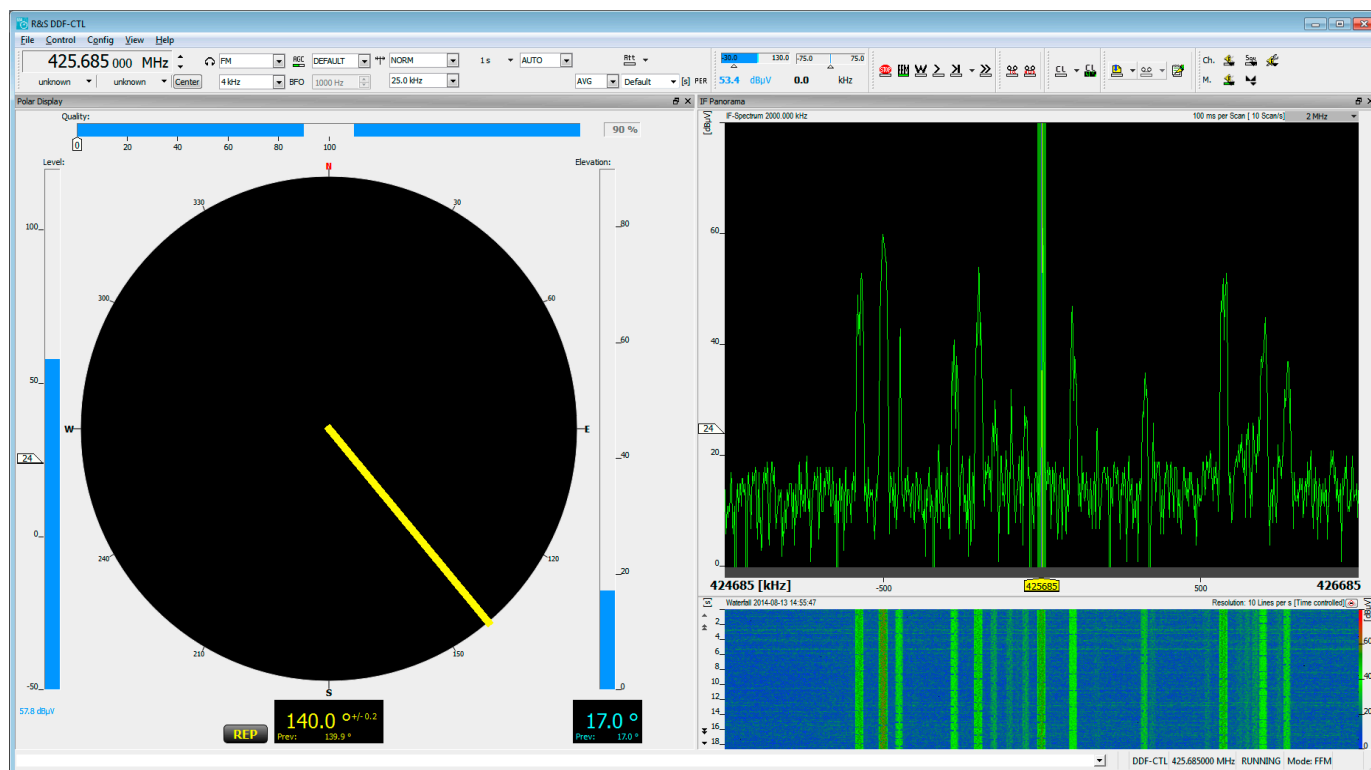
## R&S®DDFGTSIGT2 internal GPS time synchronization

With the R&S®DDFGTSIGT2 internal GPS time synchronization option, the R&S®DDF5GTS can be synchronized in time to ensure that all direction finders within a radiolocation network measure on the same frequency at the same time.

The R&S®DDFGTSIGT2 option also serves as an internal GPS, e.g. to show the position of the R&S®DDF5GTS on a map.

## R&S®RAMON and R&S®ARGUS software

The R&S®DDF5GTS can be operated from a standard PC using the R&S®DDF-CTL control software supplied with the R&S®DDF5GTS. R&S®DDF-CTL 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 direction finder into complex radiomonitoring systems.



R&S®DDF-CTL: graphical display of fixed frequency mode (FFM), including polar display, IF spectrum and waterfall.

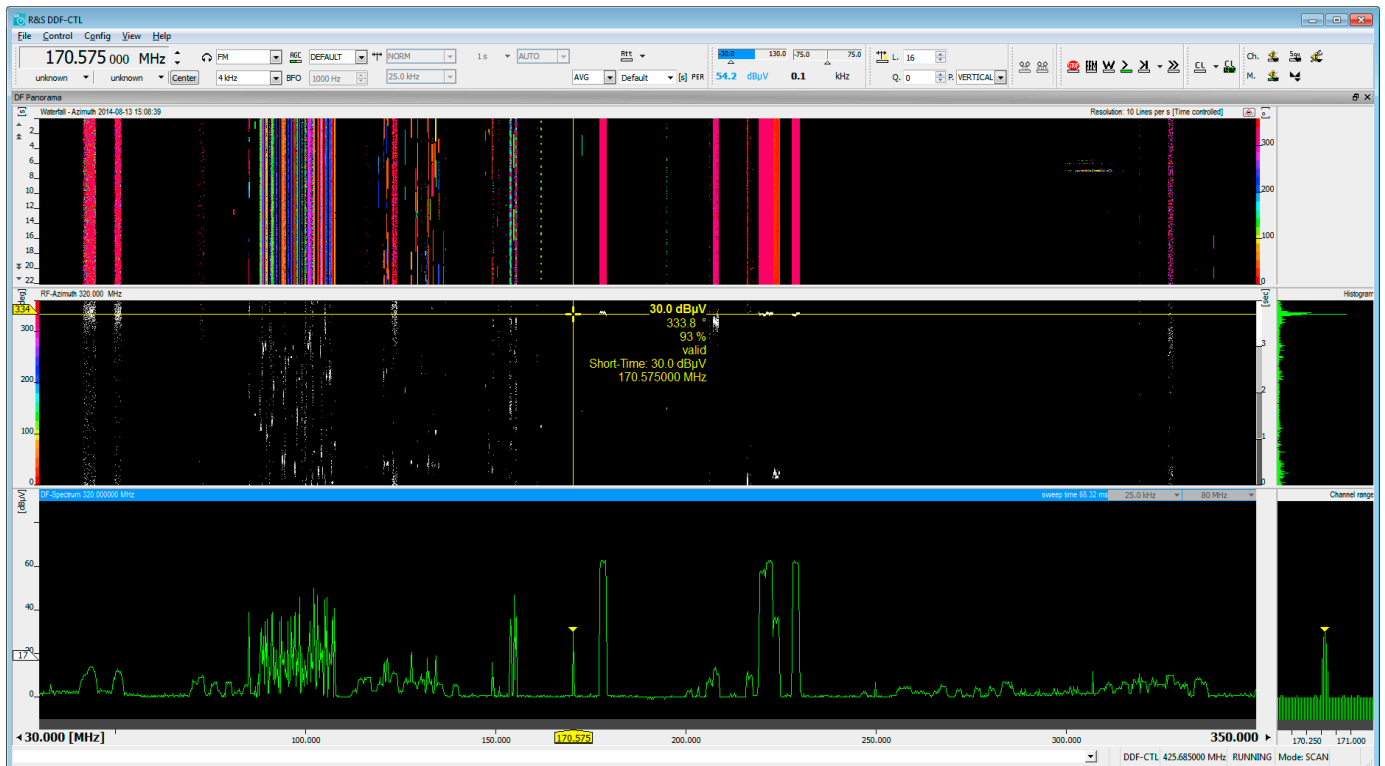
R&S®DDF-CTL supports the fixed frequency mode (FFM), the wideband fixed frequency mode (WFFM) up to 80 MHz, and the scanning of frequency ranges wider than 80 MHz. Results can be displayed in various formats:

- Polar display with DF quality and level bargraph 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®DDF5GTS can be extended with R&S®RAMON options to add versatile functionality:

- Automatic signal detection and preclassification
- Remote control of one or more R&S®DDF5GTS 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®DDF5GTS can also be used with R&S®ARGUS monitoring software packages for ITU-compliant measurements and evaluation. Combined with the R&S®DDFGTS-IM option and suitable R&S®ARGUS options, it can simplify complex radiomonitoring tasks – even for inexperienced users.



R&S®DDF-CTL (R&S®RAMON): graphical display of scan mode, including spectrum, DF values versus frequency, waterfall and histogram.

# Specifications in brief

Specifications in brief		
<b>Frequency range</b>		
Frequency range in DF mode	base unit	20 MHz to 6 GHz
	with R&S®DDFGTS-HF option	300 kHz to 6 GHz
Frequency range in receive mode	base unit	20 MHz to 6 GHz
	with R&S®DDFGTS-HF option	8 kHz to 6 GHz
<b>DF mode</b>		
DF method	standard	correlative interferometer, Watson-Watt, super-resolution
	with R&S®DDFGTS-VM option	vector matching
Realtime bandwidth	VHF/UHF/SHF	80 MHz
	HF	20 MHz
Instrument DF accuracy		typ. 0.2° RMS
System DF accuracy <sup>1)</sup>	depends on DF antenna; here for example 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 (limited to one modulation type) and recommendation ITU-R SM.854	
	300 kHz to 1300 MHz	typ. 0.5° RMS
	1.3 GHz to 6 GHz	typ. 1° RMS
DF sensitivity	depends on DF antenna; for 2° RMS bearing fluctuation, 1 s integration time and 250 Hz (HF) or 600 Hz (VHF/UHF/SHF) DF bandwidth; here for example with 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 1300 MHz	typ. 0.7 µV/m
	1.3 GHz to 6 GHz	typ. 3 µV/m to 20 µV/m
DF scan speed in VHF/UHF/SHF (25 kHz channel resolution, 100% channel occupancy, correlative interferometer method, wideband fixed frequency mode)	base unit	60 GHz/s, in line with report ITU-R SM.2125
DF scan speed in HF (1.25 kHz channel resolution, 100% channel occupancy, Watson-Watt method, wideband fixed frequency mode)	base unit	10 GHz/s, in line with report ITU-R SM.2125
Minimum signal duration	for a single burst signal, in line with report ITU-R SM.2125	
	base unit	1 ms
	with R&S®DDFGTS-EMS option <sup>2)</sup>	60 µs
Minimum burst duration	for multiple burst signals	10 µs

<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> The R&S®DDFGTS-EMS option is subject to export control.

**For R&S®DDF5GTS data sheet, see PD 3606.8137.22**

**For R&S®ADDx multichannel DF antennas data sheet, see PD 0758.1106.22**

**For R&S®ADDx multichannel DF antennas product brochure, see PD 0758.1106.12 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)**



# Ordering information

Designation	Type	Order No
High-speed scanning direction finder, AC power supply	R&S®DDF5GTS	4073.9203.02
High-speed scanning direction finder, DC power supply	R&S®DDF5GTS	4073.9203.12
<b>Options</b>		
HF frequency range extension	R&S®DDFGTS-HF	4074.1270.02
Synchronization	R&S®DDFGTS-TS	4074.0922.02
Internal GNSS module, antenna included	R&S®DDFGTSIGT2	4079.8209.04
ITU measurement software	R&S®DDFGTS-IM	4074.0822.02
Documentation of calibration values	R&S®DDFGTS-DCV	4074.1187.02
Preclassification	R&S®DDFGTS-CL	3025.2912.02
Enhanced measurement speed, requires R&S®DDFGTS-ID <sup>1)</sup>	R&S®DDFGTS-EMS	4501.0604.02
Enhanced measurement speed, requires R&S®DDFGTS-ID <sup>1)</sup>	R&S®DDFGTS-EMS	4074.1587.02
EMS identification	R&S®DDFGTS-ID	4074.1229.02
DF error correction	R&S®DDFGTS-COR	4074.0974.02
DF method vectormatching	R&S®DDFGTS-VM	4074.1506.02
Signal processing board	R&S®DDFGTS-SP	4074.1129.02
High resolution panorama spectrum <sup>2)</sup>	R&S®DDFGTS-HRP	4200.3842.02
Detection of short-time signals <sup>3)</sup>	R&S®DDFGTS-ST	4200.3820.02
DDC signal extraction <sup>2)</sup>	R&S®DDFGTSDDCE	4074.0716.02
<b>External accessories</b>		
DF antennas and accessories: see R&S®ADDx multichannel DF antennas product brochure, PD 0758.1106.12		

<sup>1)</sup> The R&S®DDF5GTS-EMS option is subject to export control.

<sup>2)</sup> Requires R&S®DDFGTS-SP option.

<sup>3)</sup> Requires R&S®DDFGTSDDCE option.

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