

SignalShark

Real-Time Handheld Analyzer

Real-Time Handheld Analyzer SignalShark®, for the Detection, Analysis, Classification and Localization of RF Signals between 8 kHz and 8 GHz. Solves complex measurement and analysis tasks reliably and quickly with the same RF performance as comparable desktop instruments.

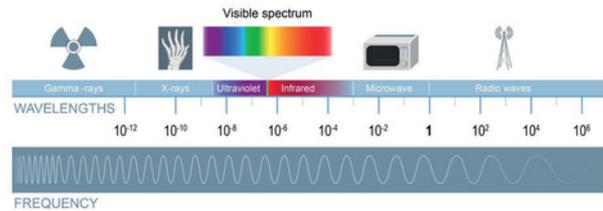
- › Frequency range 8 kHz to 8 GHz
- › Wideband frequency monitoring with an extremely fast scan rate of up to 50 GHz/s
- › Covers whole frequency bands with a 40 MHz real-time instantaneous bandwidth and a very high frequency resolution
 - › FFT overlap at least 75 %
 - › FFT size: up to 16 384
- › Reliable signal detection due to signal duration with 100 % POI
 - › > 3.125 μ s without attenuation and spectral growth
 - › > 1.41 μ s with IQ Analyzer
 - › > 2 ns with attenuation proportional to the spectral growth
- › Measures weak signals in the presence of strong transmitters with a receiver based High Dynamic Range (HDR)
- › ITU-compliant measurements and applications
- › Two independent FFT and receiver path allowing signal visualization as well as signal analysis and demodulation at a time.
- › Common used SCPI standard for remote control
- › VITA 49 streaming (sample rate up to 25.6 MHz) allowing storage and post processing of the signal raw data.
- › VITA 49 FFT streaming span up to 40 MHz for overview display
- › High level accuracy



Take up the frequency spectrum challenges of today and tomorrow



ELECTROMAGNETIC SPECTRUM



and many more...

Seven Senses for Signals

Description

Like a Shark, that highly efficient hunter in the ocean, Narda SignalShark derives its success in measurement from the inter-play of its highly developed senses. Its 40 MHz real-time bandwidth captures the spectrum of even very short-pulsed signals $> 3.125\mu\text{s}$ with a POI of 100 %. This guarantees a consistent awareness of all spectrum events. Due to its distinguished analysis functions as real-time spectrum, spectrogram and persistence, measured signals are analyzed with a very high frequency and time resolution.

Applications

More and more devices have to share the available frequency ranges because of the rapid development in new technologies such as the Internet of Things (IoT), machine-to-machine (M2M) or car-to-car (C2C) communications and expanding 4G/5G mobile networks. Whether making a wideband measurement of an entire frequency range, detecting hidden signals, reliably capturing very short impulses or localizing interference signals, SignalShark provides comprehensive measurement solutions for the increasingly complex RF spectrum

Tasks and Views

Customer applications have formed the basis for the design of the SignalShark family and the layout of the graphical user interface (GUI). This is most clearly seen in the concept of Tasks and Views. All SignalShark devices are supporting the same GUI. The devices can be accessed with remote desktop software via a network.

Tasks

Measurements often consist of a workflow of several steps, such as locating a signal in the spectrum, measuring its level and analyzing its behavior. This involves switching between different measurement modes and settings in each mode when a general-purpose analyzer is used. However, with the SignalShark, the entire measurement workflow is handled by one or more measurement tasks. These tasks are shown as screen tabs, just like the web pages displayed by a web browser. Each task encapsulates all the measurement parameters and the underlying measurement engine mode. All the measurements in a task are performed at the same time. Up to six measurement visualizations (Views) can be added to adapt a task as required. The SignalShark provides several task modes to support a wide variety of measurement applications.

Spectrum (Scan) Task

This task supports measurement of the spectrum over the full frequency span of 8 kHz to 8 GHz in a single measurement at a maximum measurement speed of 50 GHz/s.

Real-Time Spectrum Task

Real-Time Spectrum task enables spectrum measurements with a frequency span of up to 40 MHz in real-time. All frequencies within the frequency span are acquired simultaneously with no time gaps and with a FFT frame overlap of 75%. The FFT frame overlap increases to 87.5% for frequency spans of 20 MHz or less. A second digital down converter is used at the same time for analyzing and demodulating the IQ data of a separate channel within the 40 MHz real-time bandwidth. The frequency and bandwidth of this channel are selectable.

Auto DF Task

This task supports the use of the Narda Automatic DF Antenna (ADFA). Each bearing cycle can be as short as 1.2 ms and even the bearings of pulsed signals can be reliably determined as long as the minimum pulse and gap durations are somewhat longer than 2 cycle times. The optional available map and localization functionality, which is integrated into the SignalShark GUI, allows the reliable localization of transmitters. The sophisticated state of the art algorithm based on the bearing statistics

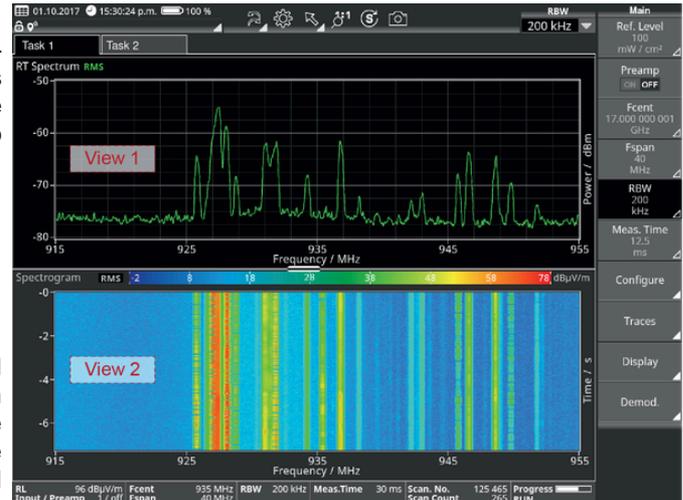


Fig. 1. RT Spectrum view (View 1) and Spectrogram view (View 1) in a task (Task 2)

reliably eliminates the influence of false bearings on the localization result, as long as there are enough line of sight bearings available from enough locations.

Real-Time Streaming Task

IQ data can be streamed at sample rates of up to 25.6 MHz using the VITA 49 protocol (option). The stream sink can be an external device connected via the LAN interface or a third party application running on the SignalShark itself for deeper analysis or decoding of signals.

IQ Analyzer Task

IQ Analyzer with 1.6 GB ring buffer, real-time trigger, time domain analysis and spectrograms with time resolution down to nanoseconds. Up to 1.6 GB of IQ data can be continuously recorded in a ring buffer. This allows recording of a 40 MHz channel over 5 seconds. Narrower channels can be recorded for a correspondingly longer time. Short-term or sporadic signals can be detected via various trigger functions. The recorded values can be displayed simultaneously as a IQ Spectrum View, IQ Spectrogram View, and a IQ Magnitude View. The special feature here is that it is possible to switch between a high time resolution and a high frequency resolution even after the measurement. This allows a signal to be analyzed in its entire depth. Up to eight markers support the determination of signal parameters.

“Time-Gated Measurement” (TGM) function (built-in in the IQ Analyzer Task)

“Time-Gated Measurement” enables signals to be measured at specified time slots. For time division multiplex signals like TDD, where the uplink and downlink are transmitted on the same frequency but at different time slots, the function enables ‘filtering’ to a specific time slot. The time slot can be defined via the Magnitude view. To use the “Time-Gated Measurement” function, the options ‘IQ Analyzer, Recorder, Trigger, Magn. View’ and ‘Spectrogram’ are required.

“SignalShark 5G Analyzer” (Sk5G) Software

SignalShark 5G Analyzer (Sk5G) is an EMF analysis and measurement software for 5G signals in the FR1 band that can be installed on SignalShark. It allows the maximum channel field strength to be extrapolated directly from a 5G traffic signal. To do so, a speed test is initiated on an end device (e.g., smartphone). This ensures that the base station directs a traffic beam with maximum power at the end device. The beam is captured by the isotropic measuring antenna. The software then records a spectrogram of the traffic signal for each antenna axis, automatically selecting the resource blocks with maximum power, calculating the averaged power per resource element, and then extrapolating to the maximum possible channel power. The measurement takes some seconds and runs mostly automatically, significantly reducing the required working time and eliminating the potential sources of error associated with the various mechanical measurements that would be needed using the conventional method. In addition, the software enables an isotropic measurement of the channel power over time to verify the smart power lock function of the base station. To use the software for measurements an isotropic antenna is required. The options ‘Spectrogram’ and ‘SCPI Remote Control’ and the option ‘SignalShark 5G Analyzer Measurement’ must as well be installed on the designated SignalShark. Also needed is a 5G-capable device (e.g. smartphone), to create a traffic beam directed to the measurement antenna. With the software alone, without the ‘SignalShark 5G Analyzer Measurement’ option installed, the user can still load and analyze stored measurements to evaluate these measurements.

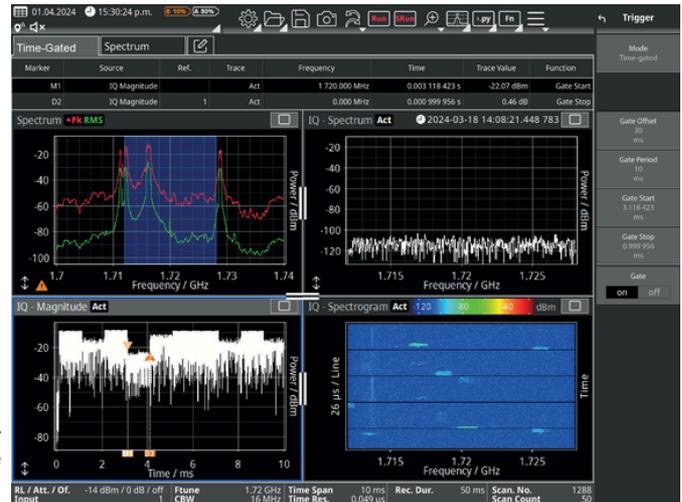


Fig. 2. Time Gated Measurement function in the IQ Analyzer Task

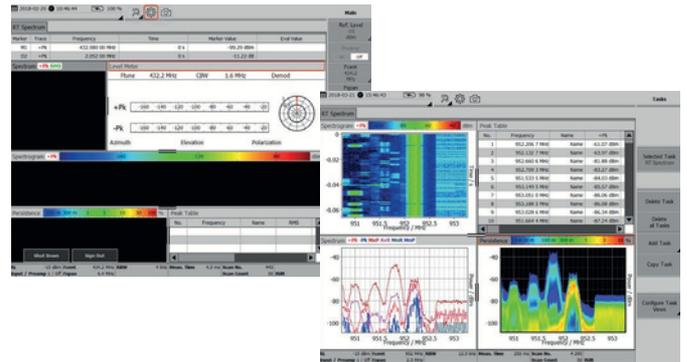
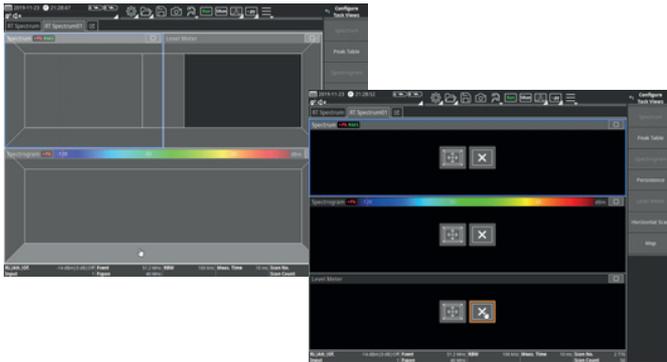


Fig. 3. SignalShark 5G Analyzer Software, 5G EMF Extrapolation view

Views

Measurements are visualized by means of different views. The frequency domain and channel level can be viewed at the same time, for example, by adding a spectrum view and a level meter view to a measurement task. Up to six views can be added to a task. As default each new task opens with a Spectrum view.

The currently selected view is marked by a blue border. The content and layout of the “Button Bar” to the right, and the “Measurement Information Bar” at the bottom, depends on the currently selected view. The type, arrangement and size of a view can be adapted by the user. It is possible to save the current configuration and arrangement of Tasks and Views into setup files.



Tasks and Views

		Measurement Engine or Task Mode					
		<i>Spectrum (Scan)</i>	<i>RT (Real-Time) Spectrum</i>	<i>Auto DF</i>	<i>RT Streaming</i>	<i>IQ Analyzer</i>	<i>SignalShark 5G Analyzer</i>
View	<i>Spectrum</i>	ü	RT	ü		ü	
	<i>Peak Table (of Spectrum)</i>	ü	RT	ü			
	<i>Spectrogram</i>	ü	RT				
	<i>Level Meter</i>		ü				
	<i>Persistence</i>		RT				
	<i>Map</i>	ü	ü	ü			
	<i>Bearing</i>			ü			
	<i>Horizontal Scan</i>		ü				
	<i>IQ Magnitude (zero span, scope)</i>					ü	
	<i>IQ Spectrum</i>					ü	
	<i>IQ Spectrogram</i>					ü	
	<i>VITA 49 FFT Streaming</i>					ü	
	<i>VITA 49 IQ Streaming</i>					ü	
	<i>5G EMF Extrapolation</i>						ü
<i>5G 'Smart Power Lock' Test</i>						ü	

Device Features

Options(Views)andScripts

An extensive set of equipment comprising frequency scanner/receiver, transmitter detector, spectrum analyzer, signal analyzer, directional antennas, amplifier, compass, triangulation software and maps was usually necessary in order to reliably detect, analyze and localize RF signals and interference. The SignalShark combines all these functions in one device.

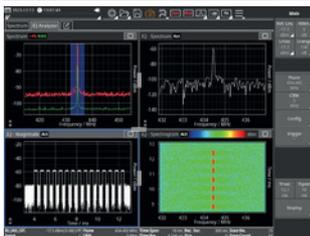
Options (Views)



40 MHz real-time Spectrum, Marker and Peak Table (included in all Basic Sets)

A Panorama scan display that provides extremely fast scanning over the entire frequency range and is ideal for detecting, monitoring and analyzing any kind of signal.

An ideal complement: Mark suspect signals in the spectrum and save them in a transmitter table with relevant parameters such as center frequency, bandwidth, antenna type, and polarization. This table can then be recalled and worked through successively at each measurement location and in every operating mode of the instrument.



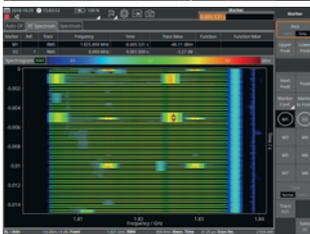
IQ Analyzer, Recorder, Trigger, Magn. View [option]

In the IQ Analyzer Task, recorded IQ values can be displayed simultaneously as an IQ Spectrum View, IQ Spectrogram View and IQ Magnitude View. The special feature here is that it is possible to switch between a high time resolution and a high frequency resolution even after the measurement. This allows a signal to be analyzed in its entire depth. Therefore it is optimal when it comes to detection, analysis and documentations of hop ping signals as well as of interference signals caused by faulty oscillator, welding systems, defective relays or lamps, jammers etc. It trigger on short pulsed signals down to ns and has a high time resolution analysis in IQ Spectrogram View and IQ Magnitude View. Up to eight markers support the determination of signal parameters.



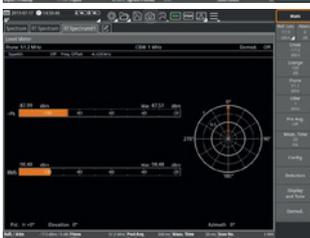
“Time-Gated Measurement” function

The “Time-Gated Measurement” function is a built-in key component of the IQ analyzer, facilitating precise measurement of signals at designated time slots. For time division multiplex signals, such as TDD, where the uplink and downlink are transmitted on the same frequency but at different time slots, the function enables targeted filtering to a specific time slot, enabling effective interference analysis. The time slot can be defined through the Magnitude View, allowing for precise control over the measurement process.



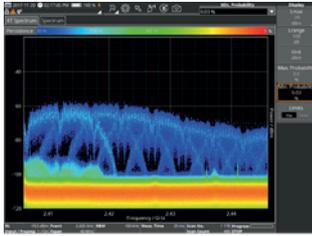
Spectrogram [option]

The Waterfall diagram is ideal for long term monitoring of the RF spectrum and for detecting permanent, sporadic or frequency hopping signals. Transmitters with variable output power and/or bandwidth can also be identified. Visual representation of the recorded spectra versus time. Colors represent the signal level. The smallest selectable time resolution is 31.25 μ s. The high resolution makes it possible to display even the frame structures from for services like UMTS, LTE 5G.



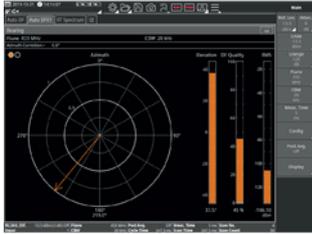
Level Meter incl. Compass values [option]

The option allows you to make selective measurements at a defined frequency (F_{cent}) e.g. for monitoring the field strength of a communications channel. The measurement is in real-time and there are no time gaps. The results are shown from an independent receiver path with steep channel filters for clean separation of even closely spaced frequencies and has a CBW range from 25 Hz to 40 MHz for detection and evaluation of pulsed signals (radar) as well as broadband signals.



Persistence (of real-time Spectrum) [option]

The Polychrome spectrum displays spectra as level versus frequency where color indicates rate of occurrence. Persistence allows sporadic to CW (continuous waveform) signals to be detected easily. It can also be described as a visual detection of signal under signal, e.g. a detection of interferers/jammers hidden under a signal.



Automatic DF Antenna Control, Bearing View [option]

A view for Direction finding, showing azimuth, elevation, DF quality, and omnidirectional RMS level derived from the Narda automatic DF antenna (ADFA). The ADFA elevation is calibrated between +40° und -20°.



Mapping and Localization [option]

SignalShark simplifies localization of transmitters by autonomously evaluating all the available bearing results and plotting them as a heatmap. It uses a statistical distribution of bearing lines that represents the uncertainty in the bearing. The result is a map on which the possible locations of the transmitter are plotted and color-coded according to their probability. Make a drive test using a vehicle mount-adapter, combine bearings from more than 2 SignalSharks (NSL Remote DF) or mount the ADFA 2 180° upside down. There are many features developed to facilitate and broaden the possibilities for most individual cases.



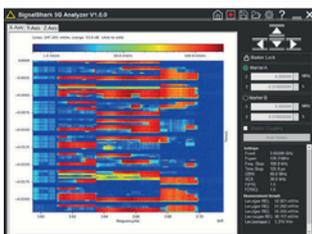
Analog Demodulation [option]

for signal identification and decoding. AM, Pulse, CW, ISB, USB, LSB, FM, PM, or IQ signals can be demodulated with squelch and AGC function. The demodulated signal can be stored as WAV-file.



Horizontal Scan [option]

plots the signal strength versus the angle of incidence on a polar diagram. The display allows you to more easily see the difference between the received signal and the reflections that occur. The SignalShark automatically calculates the bearing of the signal source based on the horizontally measured values.



5G EMF Extrapolation,

The 5G EMF extrapolation View allows the maximum channel field strength to be extrapolated directly from a 5G traffic signal.

A downstream with maximum power is requested using a suitable user equipment (e.g. a smartphone). The Signal-Shark 5G Analyzer records an isotropic spectrogram and calculates the average field strength of a 5G resource element as well as the extrapolated maximum channel field strength.

5G 'Smart Power Lock' Test,



The 5G Smart Power Lock test feature measures the isotropic channel power of a given 5G channel over an adjustable time and displays this value as a line graph. It also calculates a moving average value that can indicate whether the Smart Power Lock function of the given base station is working correctly.

A downstream with maximum power is requested using a suitable user equipment (e.g. a smartphone).



SCPI Remote Control [option]

SCPI(StandardCommandsfor Programmable Instruments) is a language that makes it possible to control the SignalShark using standard syntax, command structure and data interchange format. All remote commands are described in Command reference guide for SignalShark

The SCPI Remote Control allows the Narda Script Launcher to be installed.



VITA 49 [option]

isapacket-based exchange protocol for RF devices. The Vita49 standard provides a communications format that is hardware and supplier-independent

Shows the basic measurement parameter settings while streaming IQ data according to the Vita 49 standard

IQ Data stream can be used for classification, decoding (3rd party SW) of signals.

Narda Python Scripts

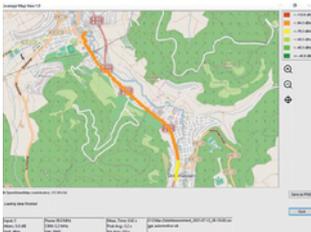
NSL (NardaScriptLauncher) is a free software from Narda that allows SignalShark users to select and run Python scripts from within the SignalShark application. To control the handheld SignalShark analyzer the “Option, SCPI Remote Control” is required.

- › Automate routine tasks
- › Provide guided measurements for novices using message boxes or wizards
- › Add new measurement evaluation functions
- › Provide complete measurement automation
- › New scripts constantly released to be downloaded for free
- › Possibility to write programs or additions via Python, using a Narda template, customized for specific needs



NSL Remote DF (NSL Net DF)

makes it possible to create a localization with several SignalShark devices in a network. The user can scan the network to obtain information on all available SignalShark devices, synchronize all devices with configuration settings of the master device, monitor spectrum reception on all devices simultaneously, and use the bearing information to perform localization on the master SignalShark device.



NSL Coverage Map

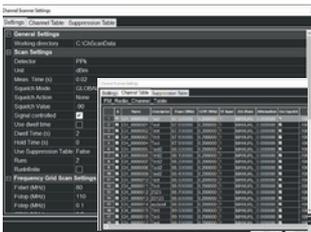
The user can configure settings for the coverage map and take location-dependent level measurements with distinct color-coding.

Drive test for coverage, field strength correlated to color scheme



NSL DF Autopilot

The function allows the SignalShark to be connected to a navigation system. The coordinates determined by the SignalShark heatmap localization are set as target in the navigation system, thus *There is no need to look at the heatmap while driving and only one person is needed.*



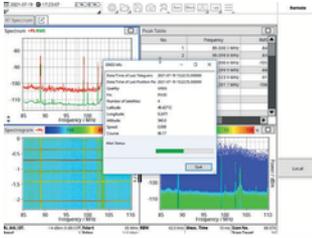
NSL Channel Scanner

A memory/frequency scan that makes it possible to monitor predefined channels in the spectrum. It is comparable to a channel scan on a radio. If one of the monitored channels exceeds a definable level value, an action (“Action”) previously defined by the user can be executed. It is also possible, to scan a frequency grid. This can be used to create a channel table.



NSL Limit Line

enables triggering on signals in the spectrum. The trigger level can be defined by a horizontal line or by a trigger mask. The trigger mask can be created and edited in the settings editor in various ways.



NSL GNSS

displays information about the current GNSS reception and issues a warning message if the quality of the GNSS reception falls below a certain level.



NSL MS Word

takes a Word (.docx) template file as the basis for a measurement report. It reads all settings from the current measurement, makes a screenshot of each view and generates a measurement report as MS Word document



NSL Tools

- > NSLCopySettings, copies selectable parameters such as Fcent, RBW and Attenuator from onetasktoanother task.
- > NSLGo2desktop, emulates the Windows-Key + “D-Key” keystroke to go to the Windows desktop
- > NSLSavePeak Table, allows to save the information of a peak table in CSV format.
- > NSLIQstream Control, allows to configure and start an IQ stream easily.
- > NSLPeaktrigger, uses the peak table view of SignalShark to stop the measurement when reachingorexceeding a user defined level.
- > NSLSignalShark WOL, allows to switch on a network connected SignalShark via WakeOn-LAN.



NSL Converter

- > ConvertSignalShark Spectrum Data (from HDF5 (.h5) file format to csv file format)
- > ConvertSignalShark Spectrogram Data (from HDF5 (.h5) file format to csv file format)
- > ConvertIDA (csv-based transmitter tables) to SignalShark (xml-based transmitter tables)
- > ConvertSRM (csv-based transmitter tables) to SignalShark (xml-based transmitter tables)
- > Converta Template Generated CSV Table (from csv-based transmitter tables to xml-based transmitter tables)



NSL IQ Recorder

enables the recording of IQ data in WAV format.

Allows the user to setup and start/record the IQ streams by using SignalShark SCPI commands and save them as an IQ WAV file. The WAV file format is a universal format supported by many monitoring software products and SDR programs.

Definitions and Conditions

Conditions

Unless otherwise noted, specifications apply after 30 minutes warm-up time within the specified environmental conditions. The product is within the recommended calibration cycle.

Specifications with limits

These describe product performance for the given parameter covered by warranty. Specifications with limits (shown as $<$, \leq , $>$, \geq , \pm , max., min.) apply under the given conditions for the product and are tested during production, considering measurement uncertainty.

Specifications without limits

These describe product performance for the given parameter covered by warranty. Specifications without limits represent values with negligible deviations, which are ensured by design (e.g. dimensions or resolution of a setting parameter).

Typical values (typ.)

These characterize product performance for the given parameter that is not covered by warranty. When stated as a range or as a limit (shown as $<$, \leq , $>$, \geq , \pm , max., min.), they represent the performance met by approximately 80% of the instruments. Otherwise, they represent the mean value. The measurement uncertainty is not taken into account.

Nominal values (nom.)

These characterize expected product performance for the given parameter that is not covered by warranty. Nominal values are verified during product development but are not tested during production.

Uncertainties

These characterize the dispersion of the values attributed to the measurands with an estimated confidence level of approximately 95%. Uncertainty is stated as the standard uncertainty multiplied by the coverage factor $k=2$ based on the normal distribution. The evaluation has been carried out in accordance with the rules of the "Guide to the Expression of Uncertainty in Measurement" (GUM).

Specifications^a

SignalSharkBasicUnit(40 MHz RTBW)

Frequency		Frequency			
range	Scan rate (basic unit, full span)	RBW (RT Spectrum)	RBW (Scan Spectrum)	CBW (Level Meter)	EMC filter bandwidth (Spectrum and Level Meter)
	8 kHz to 8 GHz	> 50 GHz/s	30 GHz/s (typ.)	1 Hz to 800 kHz	1 Hz to 6.25 MHz
					25 Hz to 40 MHz
					Detectors (Spectrum and Level Meter)
					10 Hz, 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz and 1 MHz
					+Pk, RMS, -Pk, Avg and Sample
					CISPR Detectors(LevelMeter)
					Cpeak (quasi-peak), CRMS & CAvg (EMC filter with CISPR bandwidth must be selected)
SSB phase noise	f	df = 1 kHz	df = 10 kHz	df = 100 kHz	df = 1 MHz
	10 MHz	< -120 dBc (1/Hz)	< -130 dBc (1/Hz)	< -135 dBc (1/Hz)	< -112 dBc (1/Hz)
	1 GHz	< -90 dBc (1/Hz)	< -101 dBc (1/Hz)	< -101 dBc (1/Hz)	< -132 dBc (1/Hz)
Internal reference frequency		Deviations: < 1 ppm (includes initial deviation, aging within the first 2 years, and temperature response)			
Amplitude					
HDR (High Dynamic Range)	SignalShark can detect low level signals even in the presence of very strong signals. It does this by combining high sensitivity with a wide intermodulation-free dynamic range. The DANL and IP2 / IP3 values stated below are valid at the same setting.				
DANL (Noise Figure) @ attenuator = 0 dB, no preamp	1 MHz ≤ f ≤ 44 MHz	< -160 dB (mW/Hz)		(resultant noise figure < 14 dB)	
	44 MHz < f ≤ 3 GHz	< -159 dB (mW/Hz)		(resultant noise figure < 15 dB)	
	44 MHz < f ≤ 3 GHz	-162 dB (mW/Hz) (typ.)		(resultant noise figure 12 dB)	
	3 GHz < f ≤ 8 GHz	< -152 dB (mW/Hz)		(resultant noise figure < 22 dB)	
2 nd order intercept point (IP2, 2 tones) @ attenuator = 0 dB, no preamp	4 MHz ≤ f < 42 MHz ^b	> 60 dBm			
	42 MHz ≤ f ≤ 8 GHz	40 dBm (typ.)			
3rd order intercept point (IP3, 2 tones) @ attenuator = 0 dB, no preamp	3 MHz < f ≤ 44 MHz	> 20 dBm		26 dBm (typ.)	
	MHz < f ≤ 44 MHz	4 dBm		> 6 dBm	
	630 MHz < f ≤ 3 GHz	14 dBm		3 dBm (typ.)	
	44 MHz < f ≤ 3 GHz	3 dBm		12 dBm (typ.)	
	3 GHz < f ≤ 8 GHz	3 dBm		9 dBm (typ.)	
	8 GHz < f ≤ 8 GHz	8 dBm		< ± 2 dB	
Level uncertainty	kHz ≤ f ≤ 8 GHz	8 kHz		dB < -120	
Residual spurs ^c @ attenuator = 0 dB	≤ f ≤ 44 MHz	44 MHz		dBm < -115	
	< f ≤ 3 GHz	3 GHz < f ≤ 6 GHz		dBm < -110	
	6 GHz < f ≤ 8 GHz	8 GHz		dBm < -105	
	> 80 dB	> 80 dB		dBm exceptions < -100 dBm	
				exceptions < -100 dBm	
				exceptions < -95 dBm	
				exceptions < -85 dBm	
IF rejection					
Image rejection					

^a RF data apply in the temperature range 20 °C to 26 °C at a relative humidity of between 25 and 75 %

^b Component at f1 + f2 is measured in the direct band (Fcent ≤ 64 MHz in real-time mode)

^c Typically with only few exceptions. These are documented in the calibration certificate

Real-Time Spectrum			
Signal duration for 100% POI	RT Spectrum @ RBW = 800 kHz	> 3.125 μ s without attenuation and spectral growth	
		> 2 ns with attenuation proportional to the spectral growth	
	IQ Analyzer @ CBW = 40 MHz, RBW = 1.532 MHz and 87.5 % FFT Overlap	> 1.41 μ s with IQ Analyzer	
		> 2 ns with attenuation proportional to the spectral growth	
Spectrum rate	1.6 million spectra / s	@ RBW = 800 kHz and 75 % FFT Overlap	
FFT overlap	Fspan > 20 MHz	75 %	
	Fspan \leq 20 MHz, RBW \leq 400 kHz	87.5 %	
RF Input			
Type (switchable)	1 x N-connector, 50 Ω (female) 3 x SMA-connector, 50 Ω (female)		
RF destruction limit	20 dBm		
Max. nominal RF level	15 dBm		
Maximum DC voltage	25 V		
Return loss (VSWR)	12 kHz \leq f \leq 3 MHz	> 9.54 dB	12 (VSWR < 2.00)
	3 GHz < f \leq 6 GHz	dB (typ.) 10	(VSWR = 1.67 (typ.))
	6 GHz < f \leq 8 GHz	dB (typ.) 60	(VSWR = 1.93 (typ.))
Isolation between used and unused inputs	8 kHz \leq f \leq 1 GHz	dB (nom.) 50	
	3 GHz	dB (nom.) 35	
	8 GHz	dB (nom.)	
General Specifications			
Attenuator	0 to 30 dB (0.5 dB steps)		
Digitizer	16 bit		
GNSS	Embedded receiver and antenna (GPS / QZSS, GLONASS, BeiDou, Galileo) Coordinates representation as decimal degree (DegDec - ddd.ddddd)		
Internal non-removable memory	ssD, mSATA	30 GB system partition 28 GB configuration settings and user data	
Removable memory	microSD (SDXC) / USB 2.0 / USB 3.0		
External power supply	Basic unit, DC input: 10 to 48 VDC AC adapter, input: 100V-240VAC, output: 12VDC, 5.5A Plug type: Non-Locking Power Plug S1017		
Battery <i>In many countries, the battery is available from several public distributors.</i>	2 x Lithium-ion rechargeable battery pack, hot-swappable during operation Operating time: approx. 3 hours (typical, with both batteries) Charging time: approx. 4.2 hours (nominal, with both batteries charging in base device) Charging time: approx. 3 hours (nominal, with external charger)		
Dimensions (H x W x D)	230 mm x 335 mm x 85 mm (9.06" x 13.19" x 3.35")		
Weight	Approx. 4.1 kg / 9.04 lb (with one battery)		
Country of origin	Germany		
Recommended calibration interval	24 months		

Interfaces	
10MHz Reference input	1 x SMA-connector, 600 Ω (female)
PPS/Trigger input	1 x SMA, 100 kΩ (female)
GNSS Antenna Input (for additional, external GNSS antenna)	1 x SMA, 50 Ω, female (DC voltage for active antennas is supplied)
Display Size and Resolution:	10.4", 1024 x 768 pixels, Color Resistive touch
Video	1 x Display Port
Audio	1 x 3.5 mm headphone jack Built-in loudspeaker Built-in microphone
Ethernet	1 x GigE (10/100/1000Base-T), RJ45
USB (Host)	1 x USB 3.0, 1 x USB.2.0
SD card slot	1 x microSD-card (SDXC)
Remote Control and Streaming	
Remote control protocol	SCPI
FFT streaming	VITA49 compliant
IQ streaming	VITA49 IQ streaming, sample rate up to 25.6 MHz ^d
Remote Software	Remote Desktop for PC, Tablet and Smartphone (Windows, Android, IOS)
Additional Functions	
Noisepowerdensity measurement	Can be measured with up to eight markers at a time. Can be measured with up to eight markers at a
Channel power measurement	time. According to ITU-R SM.443-4, with additional automatic center frequency and channel power
Occupied bandwidth measurement	mea- surement. Can be measured with up to eight markers at a time.
Field strength measurement	According to ITU-R SM.378-7
CISPR Detectors	Cpeak (quasi-peak), CRMS & CAvg (EMC filter with CISPR bandwidth must be selected)
Modulation detectors	AM, FM and PM. Up to 4 different detectors are available simultaneously
Frequency offset measurement	For CBW ≤ 1 MHz (using modulation detectors)
Analog demodulation and recording	AM, Pulse, CW, ISB, USB, LSB, FM, PM, or IQ signals can be demodulated with squelch and AGC function. The demodulated signal can be stored as WAV-file.
Tone search	For PIM and interference hunting. The level of one of the detectors modulates the pitch of an audible tone.
Automatic DF	Automatic bearing of transmitters using a Narda Automatic DF Antenna.
Automatic transmitter localization (Heatmap)	Automatic calculation of the transmitter location.
TDOA localization ^e	Integrated GPS with high-accuracy timestamp for TDOA applications. With additionally available software package
Time-Gated Measurement (TGM)	Buit-in in the IQ Analyzer Task. Enables signals to be measured at specified time slots.
5G 'Smart Power Lock' Test	Calculates a moving average value that can indicate whether the Smart Power Lock function of the given base station is working correctly.

^d Applies for integrated 1 Gbit Ethernet interface.

^e Requires additional software

Environmental Conditions		
MIL-PRF-28800F Class 2		Operating temperature Storage temperature Operating humidity Random vibration Functional shock Transit drop -10 °C to + 55 °C with battery -10 °C to + 55 °C with external power supply 0 °C to + 40 °C with external power supply when charging batteries < 29 g/m ³ (< 93 % RH at +30 °C), non-condensing IP 54 (with antenna attached and interface protectors closed) IP 67 (stored in the hardcase) 1K3 (IEC 60721-3) extended to - 20 °C to + 70 °C
Operating temperature		(batteries removed) 2K4 (IEC 60721-3) restricted to - 20 °C to + 70 °C
Humidity		7K2 (IEC 60721-3) extended to - 10 °C to + 55 °C
IP class		1M3 (IEC 60721-3)
Climate	Storage	2M3 (IEC 60721-3)
	Transport	7M3 (IEC 60721-3)
	Operating	
Mechanical	Storage	
	Transport	
	Operating	
Compliance		
EMC	European Union	Complies with RED Directive 2014/53/EU and EN 301 489-1 V2.2.3, EN 301 489-52 V1.2.1 IEC/EN 61326 -1: 2021
	Immunity	IEC/EN: 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, 61000-4-6, 61000-4-11
	Emission	IEC/EN: 61000-3-2, 61000-3-3, IEC/EN 55011 (CISPR 11) Class B
Safety		Complies with European Low Voltage Directive 2014/35/EU and IEC/EN 61010-1:2010
Material		Complies with European RoHS Directive 2011/65/EU, (EU)2015/863 and EN 63000:2018

Ordering Information

The SignalShark Basic Unit is included in the Basic Sets. Application Packages as well as Software Options and Accessories that provide additional signal analysis capabilities are also available. Your local Narda sales representative can provide information about all the possible options and will be pleased to offer advice.

Basic Unit Sets

SignalShark Basic Set	Part number
<p>The Basicset contains the SignalShark as well as basic accessories and supports 40 MHz real-time spectrum analysis, marker and peak table.</p> <p>Includes:</p> <ul style="list-style-type: none"> › SignalShark 3310/01 Basic Unit › 2x Battery Pack, Rechargeable › Power Supply 12VDC, 5.5A, 100V-240VAC, plug* › Touch pen for resistive touch screen › 40 MHz real-time Spectrum, Marker and Peak Table › Electronic manual (English) › Safety Instructions › SignalShark3310 - QuickStartGuide 	3310/101

*Please choose Power Cord 2260/90.65 -.69

Application Packages

The application packages make it easy to adapt SignalShark to your requirements. Each package typically consists of application-dependent hardware accessories and/or firmware options, and costs less than purchasing the items individually. Additional packages can be purchased as and when required.

Your local Narda sales representative will be happy to assist you in the selection of the right packages for your applications.

App. Package, Off-Site Extension	Part number
<p>This Application Package provides suitable accessories for applications that involve operation in vehicles or outdoors. A hard shell case with wheels and a retractable handle provides secure (IP 67) the transport of the SignalShark and all accessories. The DC adapter enables powering the device from a vehicle. An easily and quickly worn carry strap provides hands-free support for viewing the SignalShark allowing even long-term measurements to be made comfortably.</p> <p>Includes:</p> <ul style="list-style-type: none"> › Power Supply DC Vehicle Adapter, screw plug (2259/92.12) › Double Charger Set, External for 2259/92.16 (2259/92.17)* <p>Consists of: 2x single bay charger - Charger Set, External (2259/92.14)</p> <ul style="list-style-type: none"> › Vehicle power adapter for charger set 2259/92.17 (2259/92.15) <p>Consists of: Car/Truck Power Adapter (2259/92.18) Power Splitter Cable (2259/92.19)</p> <ul style="list-style-type: none"> › Carrying Strap for Basic Unit (3300/90.08) › Headphone, 3.5mm Plug (3300/90.14) › 10.4" Screen Protector Film (3310/90.04) › Hardcase for SignalShark 3310 (3310/90.05) 	3310/94.07
*Please choose Power Cord 2260/90.70 -.74	
App. Package, Remote Control	Part number
<p>Option VITA49 requires option SCPI Remote Control for device setup and streaming control. This application package makes it easy to obtain the greatest benefits of SignalShark's remote control functionality.</p> <p>Includes:</p> <ul style="list-style-type: none"> › Option, SCPI Remote Control (3310/95.012) › Option, VITA 49 (3310/95.14) 	3310/94.10
App. Package, Receiver	Part number
<p>The Receiver Application Package guarantees situational awareness by providing gapless analysis of entire signal bands. It also enables demodulation of AM, FM, LSB, USB, and CW signals.</p> <p>Includes:</p> <ul style="list-style-type: none"> › Option, Spectrogram (3310/95.002) › Option, Level Meter incl. Compass values (3310/95.003) › Option, Analog Demodulation (3310/95.007) 	3310/94.01
App. Package, Direction Finding Basic	Part number
<p>This Application Package provides comprehensive functions to support hunting of interference signals and hidden transmitters. The device based GPS and the antenna handle with built-in electronic compass makes it possible to conveniently take bearings on a transmitter from various locations.</p> <p>Includes:</p> <ul style="list-style-type: none"> › Active Antenna Handle for SignalShark, 8 kHz to 8 GHz (3300/10) › Arm Support for Active Antenna Handle (3100/90.10) › Option, Mapping and Localization (3310/95.006) › Option, Horizontal Scan (3310/95.011) 	3310/94.02

App. Package, Antenna Basic Kit (Mobile Operators)*	Part number
<p>This Application Package provides you with a lightweight yet robust directional antenna for the frequency range from 400 MHz to 8 GHz and covers cellular communication as well as other service bands. The Package also includes an antenna adapter that allows you to use your own antennas together with the Antenna Handle. This enables you to benefit from the integrated compass, low noise amplifier, and automatic polarization detector in the handle when using your own</p> <p>Includes:</p> <ul style="list-style-type: none"> > Directional Antenna 3, 400 MHz to 8 GHz (3100/13) > Antenna Adapter, N Male (3100/15) 	3106/92.03

*Additionaloption 3310/95.006 "Mappingand Localization" isrecommended for Open StreetMapbased visualization and heat-map localization as well as the Active Antenna Handle for SignalShark, 8 kHz to 8 GHz (3300/10).

App. Package, Antenna Extension Kit	Part number
<p>This ApplicationPackage complementsand completes the Antenna Basic Kit Application Package so that you can makethe bestuse of the entire frequency rangefrom 8 kHz to 8 GHz.</p> <p>Includes:</p> <ul style="list-style-type: none"> > Directional Antenna 1, 20 MHz to 250MHz (3100/11) > Directional Antenna 2, 200 MHz to 500MHz (3100/12) > LoopAntenna,H-Field, 8 kHz to 30 MHz(3100/14) 	3106/92.04

App. Package, Automatic DF 2, 10 MHz to 8 GHz *	Part number
<p>ThisApplicationPackageprovidesbasicequipmentand options for vehicle based, automatic direction finding (bearing).</p> <p>Includes:</p> <ul style="list-style-type: none"> > Automatic DF-Antenna 2 (3361/01) > USB Stick: Software and Manuals, ordered Options (3310/93.01) > RF-Cable, DC to 8 GHz, N to SMA, 50 Ohm, 5 m (3603/02) > Option, Automatic DF Antenna Control, Bearing View (3310/95.005) > Tool, Allen Wrench 3 mm (3300/90.19) > ADFA Vehicle Mounting Kit for autom. DF Antenna (3300/90.04) <p>incl. the "Automatic DF-Antenna Handling and Safety Instructions" multilingual (3360/98.12)</p> <ul style="list-style-type: none"> > Shipping Carton with Inlet for autom. DF-Antenna 	3310/94.06

*Additionaloption3310/95.006"MappingandLocalization" isrecommendedforOpenStreetMapbased visualization and heat-map localization.

App. Package, Automatic DF 2, 10 MHz to 8 GHz, Hardcase *	Part number
<p>ThisApplicationPackageprovidesbasicequipmentandoptionsfor vehicle based, automatic direction finding (bearing).</p> <p>Includes:</p> <ul style="list-style-type: none"> > Automatic DF-Antenna 2 (3361/01) > USB Stick: Software and Manuals, ordered Options (3310/93.01) > RF-Cable, DC to 8 GHz, N to SMA, 50 Ohm, 5 m (3603/02) > Option, Automatic DF Antenna Control, Bearing View (3310/95.005) > Tool, Allen Wrench 3 mm (3300/90.19) > ADFA Vehicle Mounting Kit for autom. DF Antenna (3300/90.04) <p>incl. the "Automatic DF-Antenna Handling and Safety Instructions" multilingual (3360/98.12)</p> <ul style="list-style-type: none"> > Hardcase for Automatic DF Antenna (3360/90.01) 	3310/94.12

*Additionaloption3310/95.006"MappingandLocalization" isrecommendedforOpenStreetMapbased visualization and heat-map localization.

Software Options

Software options allow the adaptation of the device feature set to your needs.

Description	Part number
40 MHz real-time Spectrum, Marker and Peak Table (included in SignalShark 3310 Basic Set). Via the "Spectrum (Scan)"-, "RT (Real-Time) Spectrum"-, "Auto DF"-, and "IQ Analyzer"-Tasks, the following View(s) can be accessed: <ul style="list-style-type: none"> › Spectrum View › Peak Table (of Spectrum) View 	Included in Basic Set
Option, Spectrogram Via the "Spectrum (Scan)"- and "RT (Real-Time) Spectrum"-Tasks, the following View(s) can be accessed: <ul style="list-style-type: none"> › Spectrogram View 	3310/95.002
Option, Level Meter incl. Compass values Via the "RT (Real-Time) Spectrum"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › Level Meter View 	3310/95.003
Option, Persistence (of real-time Spectrum) Via the "RT (Real-Time) Spectrum"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › Persistence View 	3310/95.004
Option, Automatic DF Antenna Control, Bearing View Via the "Auto DF"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › Bearing View 	3310/95.005
Option, Mapping and Localization Via the "Spectrum (Scan)"-, "RT (Real-Time) Spectrum"-, and "Auto DF"-Tasks, the following View(s) can be accessed: <ul style="list-style-type: none"> › Map View › Heatmap › ... 	3310/95.006
Option, Analog Demodulation (see "Additional Functions" on page 14) Via the "RT (Real-Time) Spectrum"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › Spectrum View › Level meter View^f 	3310/95.007
Option, Horizontal Scan Via the "RT (Real-Time) Spectrum"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › Horizontal Scan View 	3310/95.011
Option, SCPI Remote Control	3310/95.012
Option, VITA 49 ^g Via the "RT Streaming"-Task, the following View(s) can be accessed: <ul style="list-style-type: none"> › VITA 49 FFT Streaming View › VITA 49 IQ Streaming View 	3310/95.014

^f Requires Option 3310/95.003 "Option, Level Meter incl. Compass values"

^g Requires Option 3310/95.012 "Option, SCPI Remote Control"

Description	Part number
<p>Option, IQAnalyzer, Recorder, Trigger, Magn. View</p> <p>Via the “<i>IQ Analyzer</i>”-Task, the following View(s) can be accessed:</p> <ul style="list-style-type: none"> › IQ Magnitude View › IQ Spectrum View › IQ Spectrogram View <p>“Time-Gated Measurement” function is a built-in key component of the IQ analyzer, facilitating precise measurement of signals at designated time slots.</p>	<p>3310/95.018</p>
<p>Option, SignalShark 5G Analyzer Measurement^h</p> <p>Via the “<i>SignalShark 5G Analyzer</i>”-software, the following View(s) can be accessed:</p> <ul style="list-style-type: none"> › 5G EMF Extrapolation View › 5G ‘Smart Power Lock’ Test View 	<p>3310/95.020</p>

^h Requires Option 3310/95.002 “Option, Spectrogram” and Option 3310/95.012 “Option, SCPI Remote Control”

Accessories

Accessory Description	Part number
Power Supply 12VDC,5.5A, 100V-240VAC, Non-Locking Power Plug S1017, choose Power Cord 2260/90.65-.69	2259/92.09
Power Supply DC Vehicle Adapter, screw plug	2259/92.12
Battery Pack Set, rechargeable, Li-Ion, 2 x RRC2057, Li-Ion, 7V5 , 6.4Ah	2259/92.16
Double Charger Set, external, for 2259/92.16, choose Power Cord 2260/90.70 -.74	2259/92.17
Consists of: 2x single bay charger - Charger Set, External (2259/92.14)	
Vehicle power adapter for charger set 2259/92.17	2259/92.15
Consists of: Car/Truck Power Adapter (2259/92.18) Power Splitter Cable (2259/92.19)	
External GNSS Antenna, active	3300/90.05
Touch pen for resistive touch screen	3300/90.07
Carrying Strap for Basic Unit	3300/90.08
RF Adapter, N Male to SMA Female, 50 Ohm	3300/90.13
Headphone, 3.5mm Plug for SignalShark	3300/90.14
Hardcase for SignalShark 3310	3310/90.05
Recovery media for SignalShark Quad Core	3310/90.25
10.4" Screen Protector Film	3310/90.04
Tripod, Non-Conductive, 1.65 m, 1/4", with Carrying Bag	2244/90.31
Tripod, Non-Conductive, 1.65m, reinforced, 3/8"-16 UNC (for ADFA 2 only)	3300/90.16
Tripod Quick-Release Coupling, 3/8"-16 UNC (for 3300/90.16)	3300/90.17
ADFA Non-Conductive Antenna Mast Mounting Kit	3300/90.23
RF and Control-Cable for Automatic DF-antennas, DC to 8 GHz, N to SMA, 50 Ohm, 5 m	3603/02
RF and Control-Cable for Automatic DF-antennas, DC to 8 GHz, N to SMA, 50 Ohm, 15 m	3603/03
RF and Control-Cable for Automatic DF-antennas, DC to 8 GHz, N to SMA, 50 Ohm, 10 m	3603/07
Antennas*	Part number
Directional Antenna 1, 20 MHz to 250 MHz	3100/11
Directional Antenna 2, 200 MHz to 500 MHz	3100/12
Directional Antenna 3, 400 MHz to 8 GHz	3100/13
Loop Antenna, H-Field, 8 kHz to 30 MHz	3100/14
Antenna Adapter, N Male for Handle 3100/10 and 3300/10	3100/15
Arm Support for Active Antenna Handle	3100/90.10
Active Antenna Handle for SignalShark, 8 kHz to 8 GHz	3300/10
Automatic DF-Antenna 2 Basic Set, 10 MHz to 8 GHz ¹	3361/101
Antenna, Three-Axis, E-Field, 200 MHz to 8 GHz	3502/03

*There is a separate DF antenna datasheet, which provides detailed information about the direction-finding antennas available from Narda.

¹ Requires Option 3310/95.005 "Option, Automatic DF Antenna Control, Bearing View"

SignalShark Family

There are several different instrument types in the SignalShark family:

SignalShark Handheld, SignalShark Remote Unit, SignalShark Outdoor Unit Modem R[n] Basic Set, SignalShark DF Receiver Module and SignalShark EMF Monitoring System, R[n].

For more information, please visit our website www.narda-sts.com

SignalShark Handheld



SignalShark Remote Unit



SignalShark Outdoor Unit



SignalShark DF Receiver Module



SignalShark EMF Monitoring System



SignalShark and Narda DF Antennas documentation



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