narda
Safety Test Solutions

# Datasheet SignalShark 3320

SignalShark

**Real-Time Remote Analyzer**

Real-Time Remote Analyzer SignalShark® 3320, for the Detection, Analysis, Classification and Localization of RF Signals between 8 kHz and 8 GHz.
Supports automatic direction finding and TDOA.
Solves complex measurement and analysis tasks reliably and quickly with outstanding RF performance.
Embedded Windows based open platform for third-party applications.

- 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 µs without attenuation and spectral growth
  - > 1.41 µs 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.
- Modular design
  - Stand-alone unit with the possibility to mount for 19'' rack usage, as 1HU single / dual devices.
  - Third-party applications can additionally be hosted on the embedded Windows based device
  - Can also be operated by an additional touch screen (USB + Display Port) or via Remote Desktop
  - Can handle additional USB devices like mass storage, LTE modem, printer or sensors and actors

# Take up the frequency spectrum challenges of today and tomorrow

## Seven Senses for Signals

### Description

The SignalShark is available in different forms. The form factor of the remote analyzer version is ideal for remote control applications. It can be easily mounted in a 19” rack or even in a small custom housing or a tight corner of a vehicle, thanks to its compact size. The use of well-documented SCPI reference commands and VITA 49 compliant IQ streaming allows easy integration into every software environment.

The SignalShark is equipped with an excellent RF front-end with outstanding sensitivity and dynamic range, and which also provides four switchable RF inputs. In Scan mode, it operates as a super-fast spectrum analyzer. It computes FFTs of up to 16,384 points with at least 75% overlap within its real-time bandwidth of 40 MHz. This means that every signal event can be detected reliably, even if it is extremely short and infrequent.

There is an independent receiver path in addition to the spectrum path. The center frequency and channel bandwidth of this path are freely selectable within the 40 MHz real-time bandwidth. The receiver path is equipped with functions for channel level measurements, modulation analysis, audio demodulation, and IQ streaming.

The SignalShark supports the use of Narda automatic direction-finding antennas (ADFA). Bearing cycles as short as 1.2 ms can be achieved. The integrated map and localization software allows reliable homing-in on the signal, even in an urban environment.

The SignalShark is an excellent choice for every localization system based on TDOA, thanks to precise timestamp synchronization and Vita 49 IQ streaming. The reference clock can be selected from the PPS signal of the internal GNSS receiver, or that of the ADFA’s GNSS receiver, or from a dedicated PPS input.

The powerful CPU of the SignalShark can run third-party software and scripts, which makes it easy to extend the capabilities of the SignalShark or to build up a customized stand-alone system..

## Applications

The SignalShark is ideal for applications requiring high sensitivity, high dynamic range, reliable detection of very short and infrequent signal events, and transmitter localization. These requirements are all essential for radio monitoring. Radio monitoring can take different forms, depending on the why it is needed. For example, regulators may monitor the spectrum to ensure that vital public safety and security services run reliably, and that licensed parts of the spectrum are used only by the license holders. The armed forces need to know the actual usage of the spectrum in order to gather tactical or strategic information about potential enemies. Police and intelligence agencies may be interested in the content or at least the meta-data of some signal transmissions, and may also need to locate transmitters used for eavesdropping. Cellular network providers need to be able to quickly trace the source of harmful interference.

The high sensitivity and high dynamic range of the SignalShark ensures that the signals of interest are not hidden in the noise floor and that signal artifacts due to intermodulation will not be confused with real signals. The extraordinarily high FFT overlap in real-time spectrum mode ensures reliable detection of extremely short and/or infrequent signal events. Modulation analysis and occupied bandwidth measurements help regulators to make sure that spectrum usage is as intended. The audio demodulator assists in the classification of analog modulated transmissions under investigation. IQ streaming enables third-party software to also be used to classify and decode digital transmissions. The use of Narda automatic DF antennas with the integrated statistical localization algorithm allows localization of transmitters, based on AOA. The SignalShark has already been proven to be easily integrated into third-party TDOA systems. Its superior synchronization properties are essential for reliable TDOA-based localization.

Although the SignalShark is optimized for radio monitoring, it can certainly also be used in most applications where a general-purpose spectrum analyzer would normally be required, often providing better RF performance, higher speed, and ease of integration. Its open platform for third-party software and scripts allows fully customized stand-alone solutions that can replace the large, complicated systems that were previously necessary

## Mechanical design

SignalShark remote unit is supplied as a single device, with rubber feet, for desktop use.

*Fig. 1. Single devices with rubber feet for desktop use.*

The modular concept makes it possible to easily and quickly convert the device for 19“ rack use. Either as a dual device or a single device mounted with a blank module, optionally with the blank module to the right or left of the device.

*Fig. 2. Device mounted with an optional blank module and the optional rack mounting kit.*

The blank module as well as a mounting kit can be procured as optional equipment. Mounting instruction for 19’’ rack can be downloaded at www.narda-sts.com.

*Fig. 3. The optional blank module and the optional rack mounting kit (see Ordering Information)*

The remote unit has an optimized mechanical design to provide cooling that is effective not only for desktop use but particularly for rack applications where multiple instruments are close together.

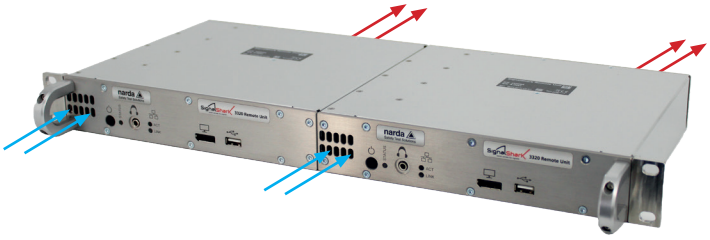


*Fig. 4. A dual device mounted with the optional rack mounting kit. At the cold front, air enters and passes through to cool the device and exits as warm air at the back.*

## 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

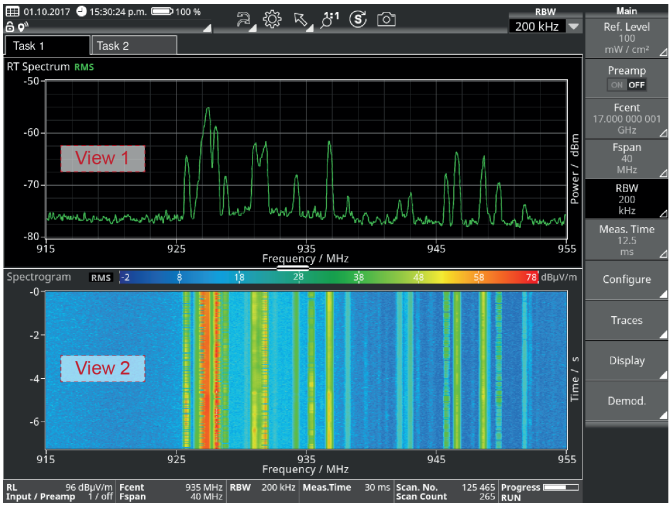



*Fig. 5. RT Spectrum view (View 1) and Spectrogram view (View 1) in a task (Task 2)*

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.

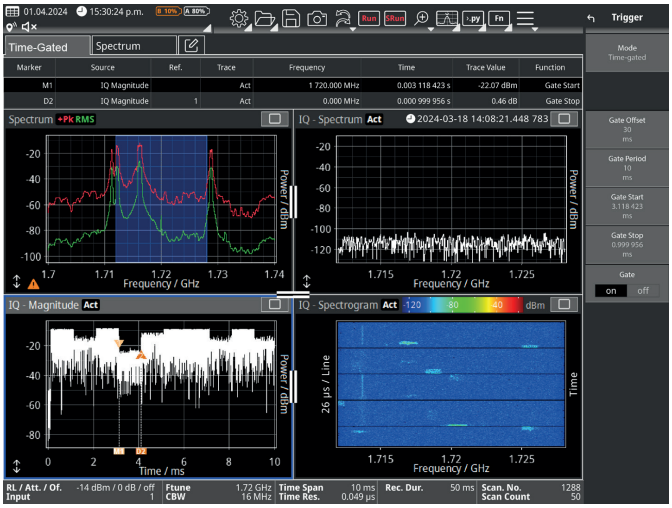



*Fig. 6. Time Gated Measurement function in the IQ Analyzer Task*

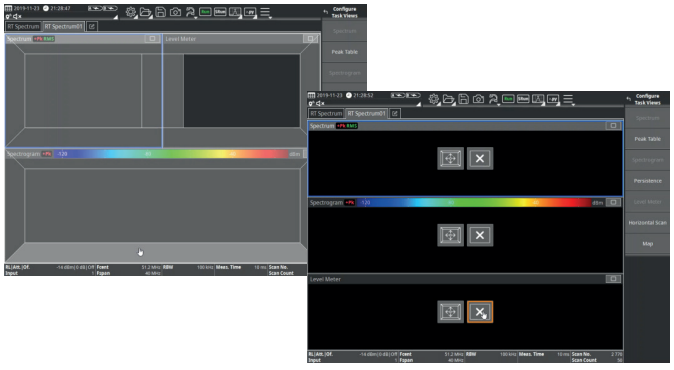

*Fig. 7. SignalShark 5G Analyzer Software, 5G EMF Extrapolation view*

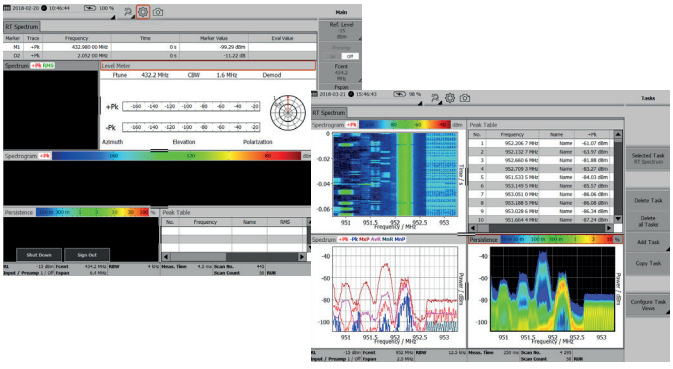
## Views

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 | | | | | |
|---|---|---|---|---|---|---|---|
| | | ***Spectrum (Scan)*** | ***RT (Real-Time) Spectrum*** | ***Auto DF*** | ***RT Streaming*** | ***IQ Analyzer*** | ***SignalShark 5G Analyzer*** |
| **View** | ***Spectrum*** | ✓ | RT | ✓ | | ✓ | |
| | ***Peak Table*** *(of Spectrum)* | ✓ | RT | ✓ | | | |
| | ***Spectrogram*** | ✓ | RT | | | | |
| | ***Level Meter*** | | ✓ | | | | |
| | ***Persistence*** | | RT | | | | |
| | ***Map*** | ✓ | ✓ | ✓ | | | |
| | ***Bearing*** | | | ✓ | | | |
| | ***Horizontal Scan*** | | ✓ | | | | |
| | ***IQ Magnitude*** *(zero span, scope)* | | | | | ✓ | |
| | ***IQ Spectrum*** | | | | | ✓ | |
| | ***IQ Spectrogram*** | | | | | ✓ | |
| | ***VITA 49 FFT Streaming*** | | | | ✓ | | |
| | ***VITA 49 IQ Streaming*** | | | | ✓ | | |
| | ***5G EMF Extrapolation*** | | | | | | ✓ |
| | ***5G ‘Smart Power Lock’ Test*** | | | | | | ✓ |

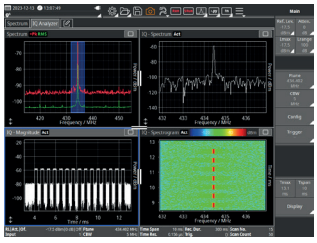
# Device Features

## Options (Views) and Scripts

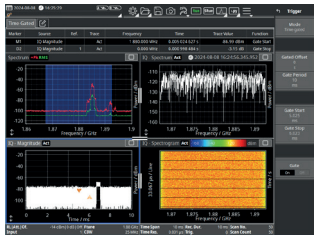
An extensive set of equipment comprising frequency scanner/receiver, transmitter detector, spectrum analyzer, signal analyzer, directional antennas, amplifier, compass, triangulation software and maps was usually necessary in order to reliably detect, analyze and localize RF signals and interference.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

### Options (Views)

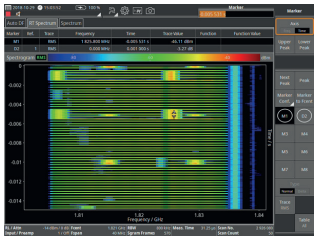
**40 MHz real-time Spectrum, Marker and Peak Table (included in all Basic Sets)**
A Panorama scan display that provides extremely fast scanning over the entire frequency range and is ideal for detecting, monitoring and analyzing any kind of signal.
An ideal complement: Mark suspect signals in the spectrum 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.



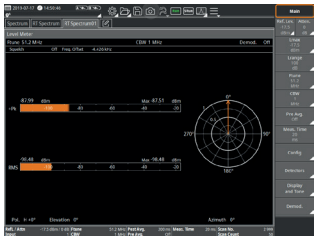
**IQ Analyzer, Recorder, Trigger, Magn. View [option]**
In the IQ Analyzer Task, recorded IQ values can be displayed simultaneously as an IQ Spectrum View, IQ Spectrogram View and IQ Magnitude View. The special feature here is that it is possible to switch between a high time resolution and a high frequency 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 hopping 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.



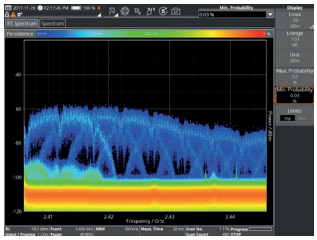
**“Time-Gated Measurement” function**
The “Time-Gated Measurement” function is a built-in key component of the IQ analyzer, facilitating precise measurement of signals at designated time slots. For time division multiplex signals, such as TDD, where the uplink and downlink are transmitted on the same 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.



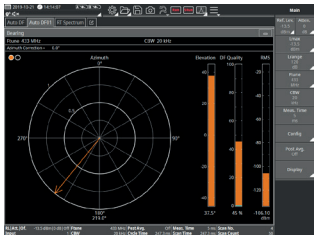
**Spectrogram [option]**
The Waterfall diagram is ideal for long term monitoring of the RF spectrum and for detecting permanent, sporadic or frequency hopping signals. Transmitters with variable output power and/or bandwidth can also be identified.
Visual representation of the recorded spectra versus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



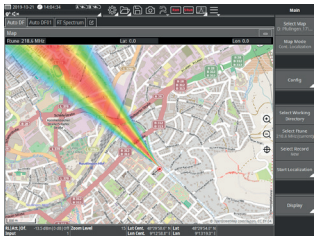
**Level Meter incl. Compass values [option]**
The option allows you to make selective measurements at a defined frequency (Fcent) e.g. for monitoring the field strength of a communications channel. The measurement is in real-time and there are no time gaps.
The results are shown from an independent receiver 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.

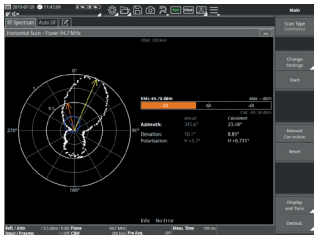


**Automatic DF Antenna Control, Bearing View [option]**
A view for Direction finding, showing azimuth, elevation, DF quality, and omnidirectional RMS level derived from the Narda automatic DF antenna (ADFA). The ADFA elevation is calibrated between +40° und -20°.



**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..

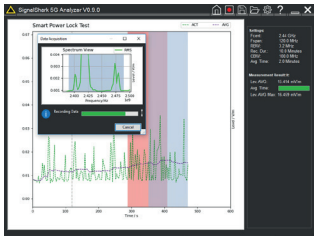
**Analog Demodulation [option]**
for signal identification and decoding. AM, Pulse, CW, ISB, USB, LSB, FM, PM, or IQ signals can be demodulated with squelch and AGC function. The demodulated signal can be stored as WAV-file



**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.

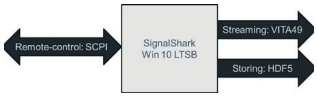
**5G EMF Extrapolation,**
The 5G EMF extrapolation View allows the maximum channel field strength to be extrapolated directly from a 5G traffic signal.

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 (Standard Commands for 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.



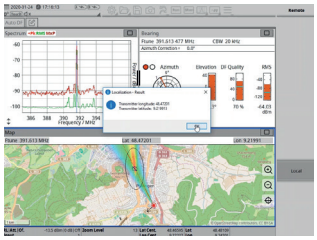

**VITA 49 [option]**
is a packet-based exchange protocol for RF devices. The Vita49 standard provides a communications format that is hardware and supplier-independent
Shows the basic measurement parameter settings while streaming IQ data according to the Vita 49 standard

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

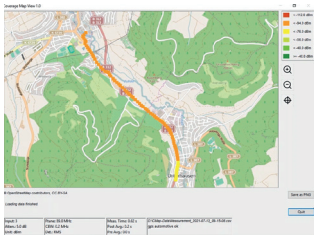
## Narda Python Scripts

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

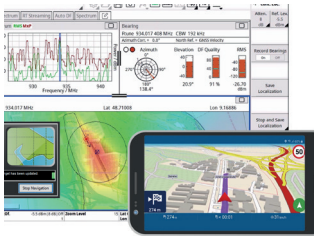


**NSL Remote DF (NSL Net DF)**
makes it possible to create a localization with several SignalShark devices in a network. The user can scan the network to obtain information on all available SignalShark devices, synchronize all devices with configuration settings of the master device, monitor spectrum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

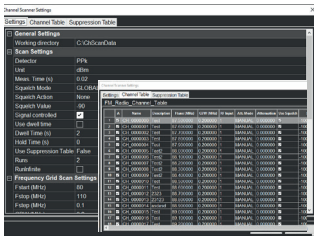


**NSL Coverage Map**
The user can configure settings for the coverage map and take location-dependent level measurements with distinct color-coding.

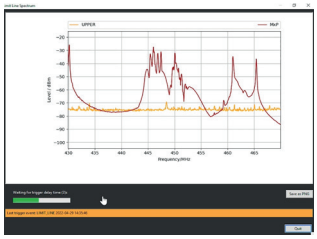
Drive test for coverage, field strength correlated to color scheme



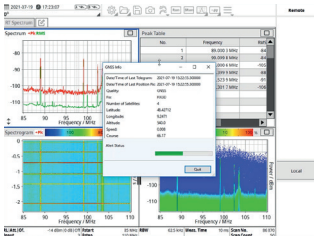
**NSL DF Autopilot**
The function allows the SignalShark to be connected to a navigation system. The coordinates determined by the SignalShark heatmap localization are set as target in the navigation system, thus *There is no need to look at the heatmap while driving and only one person is needed*.



**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.

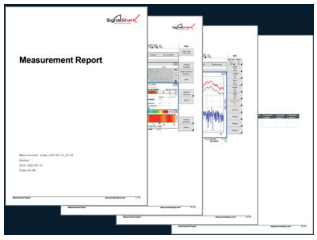


**NSL Limit Line**
enables triggering on signals in the spectrum. The trigger level can be defined by a horizontal line or by a trigger mask. The trigger mask can be created and edited in the settings editor in various ways.



### 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

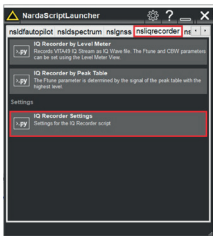
takes a Word (.docx) template file as the basis for a measurement report. It reads all settings from the current measurement, makes a screenshot of each view and generates a measurement report as MS Word document


### NSL Tools

- NSL Copy Settings, copies selectable parameters such as Fcent, RBW and Attenuator from one task to another task.
- NSL Go 2 desktop, emulates the Windows-Key + “D-Key” keytroke to go to the Windows desktop
- NSL Save Peak Table, allows to save the information of a peak table in CSV format.
- NSL IQ Stream Control, allows to configure and start an IQ stream easily.
- NSL Peak trigger, uses the peak table view of SignalShark to stop the measurement when reaching or exceeding a user defined level.
- NSL SignalShark WOL, allows to switch on a network connected SignalShark via WakeOn-LAN.


### NSL Converter

- Convert SignalShark Spectrum Data (from HDF5 (.h5) file format to csv file format)
- Convert SignalShark Spectrogram Data (from HDF5 (.h5) file format to csv file format)
- Convert IDA (csv-based transmitter tables) to SignalShark (xml-based tansmitter tables)
- Convert SRM (csv-based transmitter tables) to SignalShark (xml-based transmitter tables)
- Convert a 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 <, ≤, >, ≥, ±, 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 <, ≤, >, ≥, ±, 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]

## SignalShark Remote Unit

| | | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | | | | | | |
| Frequency range | | 8 kHz to 8 GHz | | | | |
| Scan rate | | > 50 GHz/s | | @ RBW = 1.6 MHz (resolution 800 kHz) | | |
| (basic unit, full span) | | 30 GHz/s (typ.) | | @ RBW = 100 kHz (resolution 50 kHz) | | |
| RBW (RT Spectrum) | | 1 Hz to 800 kHz | | | | |
| RBW (Scan Spectrum) | | 1 Hz to 6.25 MHz | | | | |
| CBW (Level Meter) | | 25 Hz to 40 MHz | | | | |
| EMC filter bandwidth (Spectrum and Level Meter) | | 10 Hz, 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz and 1 MHz | | | | |
| Detectors (Spectrum and Level Meter) | | +Pk, RMS, -Pk, Avg and Sample | | | | |
| CISPR Detectors (Level Meter) | | Cpeak (quasi-peak), CRMS & CAvg (EMC filter with CISPR bandwidth must be selected | | | | |
| SSB phase noise | **$f_c$** | **df = 1 kHz** | **df = 10 kHz** | **df = 100 kHz** | **df = 1 MHz** | **df = 10 MHz** |
| | **10 MHz** | < -120 dBc (1/Hz) | < -130 dBc (1/Hz) | < -135 dBc (1/Hz) | | |
| | **1 GHz** | < -90 dBc (1/Hz) | < -101 dBc (1/Hz) | < -101 dBc (1/Hz) | < -112 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) | | | | |
| | GPS aided, averaged over 24 h | Deviations: | | < $\pm 1 \cdot 10^{-11}$ | $\pm 1 \cdot 10^{-12}$ (typ.) | |
| | | (requires adequate GNSS signal and constant GNSS antenna position) | | | | |
| **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.<br><br>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) | | |
| | 2nd 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 | | | |
| | | 3 MHz < f ≤ 44 MHz | 26 dBm (typ.) | | | |
| | | 44 MHz < f ≤ 630 MHz | > 4 dBm | | | |
| | | 630 MHz < f ≤ 3 GHz | > 6 dBm | | | |
| | | 44 MHz < f ≤ 3 GHz | 14 dBm (typ.) | | | |
| | | 3 GHz < f ≤ 8 GHz | > 5 dBm | | | |
| | | 3 GHz < f ≤ 8 GHz | 12 dBm (typ.) | | | |
| Level uncertainty | | 9 kHz ≤ f ≤ 8 GHz | < ± 2 dB | | | |
| Residual spurs[c] @ attenuator = 0 dB | | 8 kHz ≤ f ≤ 44 MHz | < -120 dBm | exceptions < -100 dBm | | |
| | | 44 MHz < f ≤ 3 GHz | < -115 dBm | exceptions < -100 dBm | | |
| | | 3 GHz < f ≤ 6 GHz | < -110 dBm | exceptions < -95 dBm | | |
| | | 6 GHz < f ≤ 8 GHz | < -105 dBm | exceptions < -85 dBm | | |
| IF rejection | | > 80 dB | | | | |
| Image rejection | | > 80 dB | | | | |

*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 µs 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 µs 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 ≤ 20 MHz, RBW ≤ 400 kHz | 87.5 % | |
| **RF Input** | | | |
| Type (switchable) | 1 x N-connector, 50 Ω (female)<br>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 ≤ f ≤ 3 MHz | > 9.54 dB | (VSWR < 2.00) |
| | 3 GHz < f ≤ 6 GHz | 12 dB (typ.) | (VSWR = 1.67 (typ.)) |
| | 6 GHz < f ≤ 8 GHz | 10 dB (typ.) | (VSWR = 1.93 (typ.)) |
| Isolation between used and unused inputs | 8 kHz ≤ f ≤ 1 GHz | 60 dB (nom.) | |
| | 3 GHz | 50 dB (nom.) | |
| | 8 GHz | 35 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)<br>Coordinates representation as decimal degree (DegDec - ddd.ddddd) | | |
| Internal non-removable memory | ssD, mSATA | 30 GB system partition<br>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<br>AC adapter, input: 100V-240VAC, output: 12VDC, 5.5A<br>Plug type: Locking Power Plug S10KS17 | | |
| Dimensions (H x W x D) (without connectors) | 43.5 mm × 220 mm × 204 mm (1.71" × 8.66" × 8.03") | | |
| Weight | Approx. 2.1 kg / 4.63 lb (stand-alone unit) | | |
| Country of origin | Germany | | |
| Recommended calibration interval | 24 months | | |
| **Interfaces** | | | |
| 10 MHz 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<br>(DC voltage for active antennas is supplied) | | |
| Video | 1 x Display Port | | |
| Audio | 1 x 3.5 mm headphone jack | | |
| 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 | | |
|---|---|---|
| Noise power density measurement | | Can be measured with up to eight markers at a time. |
| Channel power measurement | | Can be measured with up to eight markers at a time. |
| Occupied bandwidth measurement | | According to ITU-R SM.443-4, with additional automatic center frequency and channel power measurement. 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. |

| Environmental Conditions | | |
|---|---|---|
| MIL-PRF-28800F Class 2 | | Operating temperature<br>Storage temperature<br>Operating humidity<br>Random vibration<br>Functional shock<br>Transit drop |
| Operating temperature | | -20 °C to + 55 °C |
| Humidity | | < 29 g/m³ (< 93 % RH at +30 °C), non-condensing |
| Climate | Storage | 1K3 (IEC 60721-3) extended to - 40 °C to + 70 °C |
| | Transport | 2K4 (IEC 60721-3) restricted to - 40 °C to + 70 °C |
| | Operating | 7K2 (IEC 60721-3) extended to - 20 °C to + 55 °C |
| Mechanical | Storage | 1M3 (IEC 60721-3) |
| | Transport | 2M3 (IEC 60721-3) |
| | Operating | 7M3 (IEC 60721-3) |

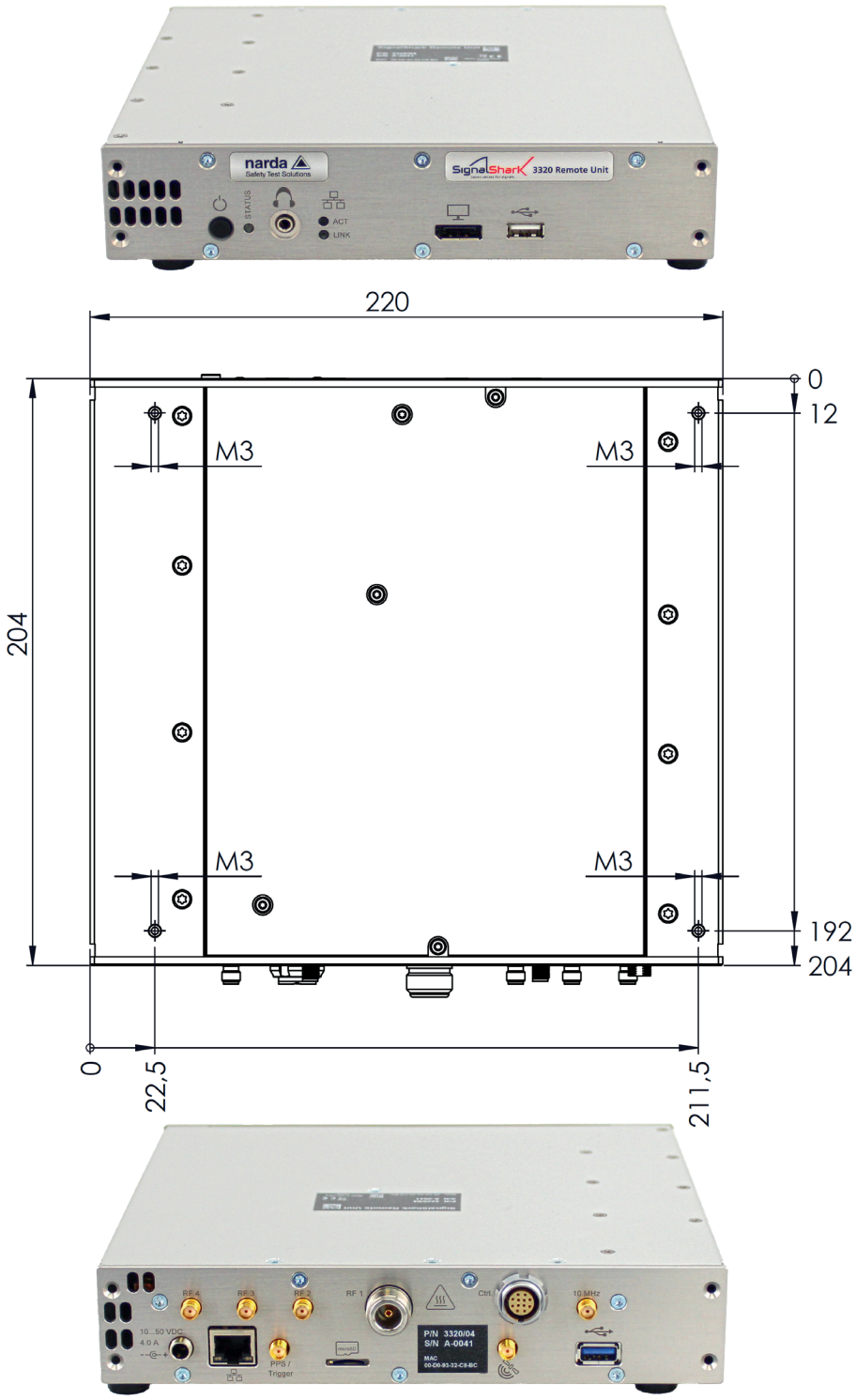
| Compliance | | |
|---|---|---|
| EMC | European Union | Complies with RED Directive 2014/53/EU and EN 301 489-1 V2.2.3, EN 301 489-52 V1.2.1 IEC/EN 61326 -1: 2021 |
| | Immunity | IEC/EN: 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-5, 61000-4-6, 61000-4-11 |
| | Emission | IEC/EN: 61000-3-2, 61000-3-3, 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 |

*d Applies for integrated 1 Gbit Ethernet interface.*

*e Requires additional software*

# Drawing - SignalShark 3320/104

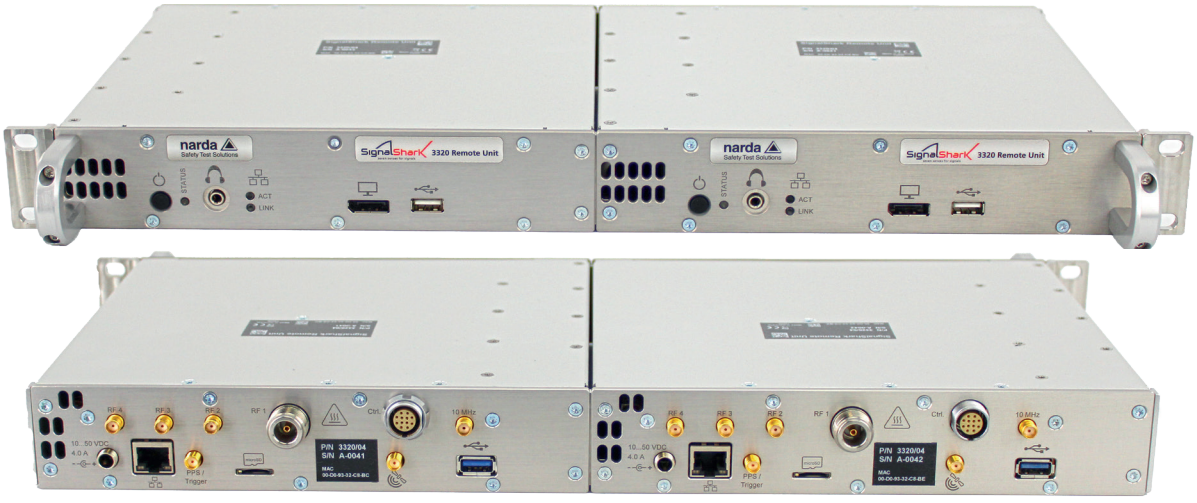
**H = 43.5 mm (1 HU), without rubber feet**




**All dimensions are given in mm.**

## SignalShark single device, mounted with blank module for 19” rack usage


## SignalShark dual device, mounted for 19” rack usage



# 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 Set

| SignalShark Remote Unit, Basic Set | Part number |
|---|---|
| The Basic set contains the SignalShark Remote Unit as well as basic accessories and supports 40 MHz real-time spectrum analysis, marker, peak table and SCPI remote control functions.<br>**Includes:**<br>› SignalShark 3320/04 Basic Unit<br>› Power Supply 12VDC, 5.5A, 100V-240VAC*<br>› Equipment feet set for desktop use<br>› 40 MHz real-time Spectrum, Marker and Peak Table<br>› Option, SCPI Remote Control<br>› Electronic manual (English)<br>› Safety Instructions<br>› SignalShark 3320 - Quick Start Guide | **3320/104** |

*Please choose Power Cord 2260/90.65 -.69

| Mounting Kit for 19'' Rack | Part number |
|---|---|
| The rack-mount set contains necessary parts to prepare SignalShark Remote Unit for 19'' rack-mount usage. For a single device rack-mount usage the "Blank Module for Single Device Rack Mounting" 3320/90.06 is required.<br>**Includes:**<br>› 12 pcs M3x8 flat-head screws*<br>› 4 pcs M3x35 lens-head screws*<br>› 2 pcs lateral air cover<br>› 2 pcs central mounting part<br>› 2 pcs lateral mounting bracket<br>› 2 pcs front handle rack<br>› Mounting instructions for 19'' rack (to be downloaded) | **3320/90.05** |

* Requires a Torx screwdriver TX10 which is not included in the Mounting Kit

| Blank Module for Single Device Rack Mounting | Part number |
|---|---|
| The blank module can be mounted on the left or right side of the device, for rack-mount usage of a single device. Requires "Mounting Kit for 19'' Rack" 3320/90.05. | **3320/90.06** |

## 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, Receiver | Part number |
|---|---|
| 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.<br>**Includes:**<br>› Option, Spectrogram (3310/95.002)<br>› Option, Level Meter incl. Compass values (3310/95.003)<br>› Option, Analog Demodulation (3310/95.007) | **3310/94.01** |

| App. Package, Direction Finding Basic | Part number |
|---|---|
| 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.<br>**Includes:**<br>› Active Antenna Handle for SignalShark, 8 kHz to 8 GHz (3300/10)<br>› Arm Support for Active Antenna Handle (3100/90.10)<br>› Option, Mapping and Localization (3310/95.006)<br>› Option, Horizontal Scan (3310/95.011) | **3310/94.02** |

| App. Package, Automatic DF 2, 10 MHz to 8 GHz * | Part number |
|---|---|
| This Application Package provides basic equipment and options for vehicle based, automatic direction finding (bearing).<br>**Includes:**<br>› Automatic DF-Antenna 2 (3361/01)<br>› USB Stick: Software and Manuals, ordered Options (3310/93.01)<br>› RF-Cable, DC to 8 GHz, N to SMA, 50 Ohm, 5 m (3603/02)<br>› Option, Automatic DF Antenna Control, Bearing View (3310/95.005)<br>› Tool, Allen Wrench 3 mm (3300/90.19)<br>› ADFA Vehicle Mounting Kit for autom. DF Antenna (3300/90.04) incl. the “Automatic DF-Antenna Handling and Safety Instructions” multilingual (3360/98.12)<br>› Shipping Carton with Inlet for autom. DF-Antenna | **3310/94.06** |

*Additional option 3310/95.006 “Mapping and Localization” is recommended for Open Street Map based visualization and heatmap localization.

| App. Package, Automatic DF 2, 10 MHz to 8 GHz, Hardcase * | Part number |
|---|---|
| This Application Package provides basic equipment and options for vehicle based, automatic direction finding (bearing).<br>**Includes:**<br>› Automatic DF-Antenna 2 (3361/01)<br>› USB Stick: Software and Manuals, ordered Options (3310/93.01)<br>› RF-Cable, DC to 8 GHz, N to SMA, 50 Ohm, 5 m (3603/02)<br>› Option, Automatic DF Antenna Control, Bearing View (3310/95.005)<br>› Tool, Allen Wrench 3 mm (3300/90.19)<br>› ADFA Vehicle Mounting Kit for autom. DF Antenna (3300/90.04) incl. the “Automatic DF-Antenna Handling and Safety Instructions” multilingual (3360/98.12)<br>› Hardcase for Automatic DF Antenna (3360/90.01) | **3310/94.12** |

*Additional option 3310/95.006 “Mapping and Localization” is recommended for Open Street Map based visualization and heatmap localization

## Software Options

Software options allows the adaption of the device feature set to your needs.

| Description | Part number |
|---|---|
| 40 MHz real-time Spectrum, Marker and Peak Table (included in SignalShark 3320 Basic Set).<br><br>Via the "*Spectrum (Scan)*"-, "*RT (Real-Time) Spectrum*"- "*Auto DF*"-, and "*IQ Analyzer*"-Tasks, the following View(s) can be accessed:<br>› Spectrum View<br>› Peak Table (of Spectrum) View | **Included in Basic Set** |
| Option, Spectrogram<br><br>Via the "*Spectrum (Scan)*"- and "*RT (Real-Time) Spectrum*"-Tasks, the following View(s) can be accessed:<br>› Spectrogram View | **3310/95.002** |
| Option, Level Meter incl. Compass values<br><br>Via the "*RT (Real-Time) Spectrum*"-Task, the following View(s) can be accessed:<br>› Level Meter View | **3310/95.003** |
| Option, Persistence (of real-time Spectrum)<br><br>Via the "*RT (Real-Time) Spectrum*"-Task, the following View(s) can be accessed:<br>› Persistence View | **3310/95.004** |
| Option, Automatic DF Antenna Control, Bearing View<br><br>Via the "*Auto DF*"-Task, the following View(s) can be accessed:<br>› Bearing View | **3310/95.005** |
| Option, Mapping and Localization<br><br>Via the "*Spectrum (Scan)*"-, "*RT (Real-Time) Spectrum*"-, and "*Auto DF*"-Tasks, the following View(s) can be accessed:<br>› Map View<br>› Heatmap<br>› ... | **3310/95.006** |
| Option, Analog Demodulation (see "Additional Functions" on page 16)<br><br>Via the "*RT (Real-Time) Spectrum*"-Task, the following View(s) can be accessed:<br>› Spectrum View<br>› Level meter View[f] | **3310/95.007** |
| Option, Horizontal Scan<br><br>Via the "*RT (Real-Time) Spectrum*"-Task, the following View(s) can be accessed:<br>› Horizontal Scan View | **3310/95.011** |
| Option, SCPI Remote Control (included in SignalShark 3320 Basic Set) | **3310/95.12**<br>**Included in Basic Set** |
| Option, VITA 49[g]<br><br>Via the "*RT Streaming*"-Task, the following View(s) can be accessed:<br>› VITA 49 FFT Streaming View<br>› 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 |
|---|---|
| Option, IQ Analyzer, Recorder, Trigger, Magn. View<br><br>Via the "*IQ Analyzer*"-Task, the following View(s) can be accessed:<br>› IQ Magnitude View<br>› IQ Spectrum View<br>› IQ Spectrogram View<br><br>"Time-Gated Measurement" function is a built-in key component of the IQ analyzer, facilitating precise measurement of signals at designated time slots. | **3310/95.018** |
| Option, SignalShark 5G Analyzer Measurement[h]<br><br>Via the "*SignalShark 5G Analyzer*"-software, the following View(s) can be accessed:<br>› 5G EMF Extrapolation View<br>› 5G 'Smart Power Lock' Test View | **3310/95.020** |

*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, Locking Power Plug S10KS17, choose Power Cord 2260/90.65 -.69 (included in SignalShark 3320 Basic Set) | **2259/92.10** |
| Power Supply DC Vehicle Adapter, screw plug | **2259/92.12** |
| External GNSS Antenna, active | **3300/90.05** |
| RF Adapter, N Male to SMA Female, 50 Ohm | **3300/90.13** |
| Headphone, 3.5mm Plug for SignalShark | **3300/90.14** |
| Recovery media for SignalShark Quad Core | **3310/90.25** |
| 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** |
| 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** |
| Tripod, Non-Conductive, 1.65 m, 1/4”, with Carrying Bag | **2244/90.31** |

| Antennas* | Part number |
|---|---|
| Automatic DF-Antenna 2 Basic Set, 10 MHz to 8 GHz[i] | **3361/101** |

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

*i 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

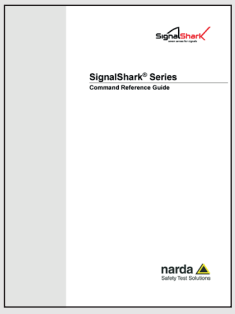
## SignalShark Remote Unit


## SignalShark Outdoor Unit

## SignalShark DF Receiver Module

## SignalShark EMF Monitoring System

## SignalShark and Narda DF Antennas documentation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