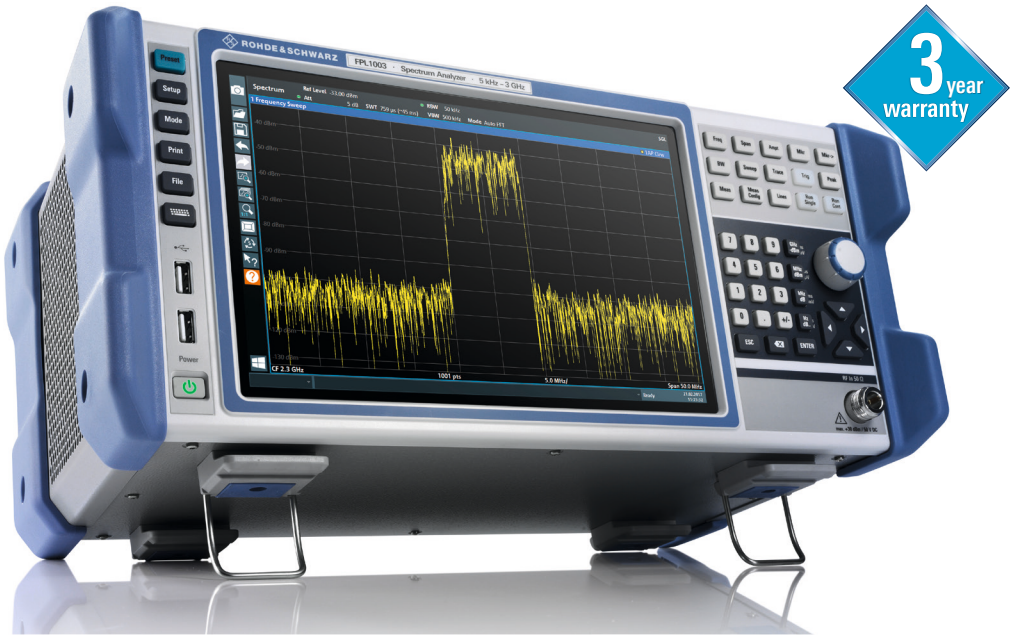
FPL1000
Spectrum Analyzer
Experience high performance wherever you take it



FPL1000 Spectrum Analyzer At a glance

The FPL1000 spectrum analyzer makes measuring fast and simple. The intuitive touch-screen is straightforward and easy to use. With its solid RF performance, light weight and small footprint, the FPL1000 combines the functionality of a benchtop instrument with the portability of a handheld instrument.

In an RF lab, the FPL1000 is as indispensable as an oscilloscope or multimeter. It is a single measuring instrument for a variety of measurement tasks. It supports not only spectrum analysis, but also highly accurate power measurement with power sensors and analysis of analog and digitally modulated signals.

The solid RF performance makes the FPL1000 the ideal instrument for use in the lab, production and service. The 1 dB attenuator step size (FPL1-B25 option) al-lows you to perform measurements at the instrument's max. dynamic range. The preamplifier (FPL1-B22 op-tion) extends the sensitivity level. Thanks to its high sensi-tivity and low phase noise performance, even small inter-fering signals next to the carrier can be analyzed.

Using the FPL1000 is as intuitive as using a smartphone. Simple swiping gestures adjust the cen-
ter frequency or the reference level. Two-finger gestures change the span or the displayed power level, while the 10.1" screen with 1280 × 800 pixel resolution provides a clear display of the signal. Furthermore, the user can freely arrange the layout of the measurement results on the dis-play. Using the MultiView display mode, even different measurement modes can be combined and all the results can be displayed on one screen.

The FPL1000 has a depth of only one hand length. It fits into any workplace and leaves enough space for DUTs and other measurement instruments.

Its light weight and battery operation capability lets you take it anywhere to perform measurements. The optional battery pack provides three hours of operation. Thanks to its rich set of accessories, the FPL1000 is suitable for field measurements. For transport, a protective hard cover is available as well as a padded carrying bag that allows the instrument to be operated while in the bag. A shoulder harness simplifies portable operation.

Key facts

- Frequency range 5 kHz to 3 GHz
- SSB phase noise: –108 dBc (1 Hz) at 10 kHz offset (1 GHz carrier)
- DANL with preamplifier: –167 dBm from 10 MHz to 2 GHz
- Lightweight with small footprint
- Battery or 12/24 V DC operation (option)
- Use with power sensors (option)
- 40 MHz analysis bandwidth (option)
- Analog and digital signal analysis (option)

FPL1000 Spectrum Analyzer Benefits and key features

One instrument for multiple applications
- Spectrum analysis
- Signal analysis
- Power measurements with power sensors

▷ page 4

Solid RF performance
- Low spurious responses
- Low displayed average noise level (DANL)
- Signal analysis bandwidth 40 MHz
- Low level measurement uncertainty
- Precise spectral measurements due to low phase noise

▷ page 5

Intuitive user interface
- High-resolution display
- Multipoint touchscreen
- Flexible arrangement of results and MultiView
- Toolbar
- Quiet operation

▷ page 6

Fully portable
- Battery pack and 12/24 V power supply
- Carrying bag and shoulder harness
- Low power consumption

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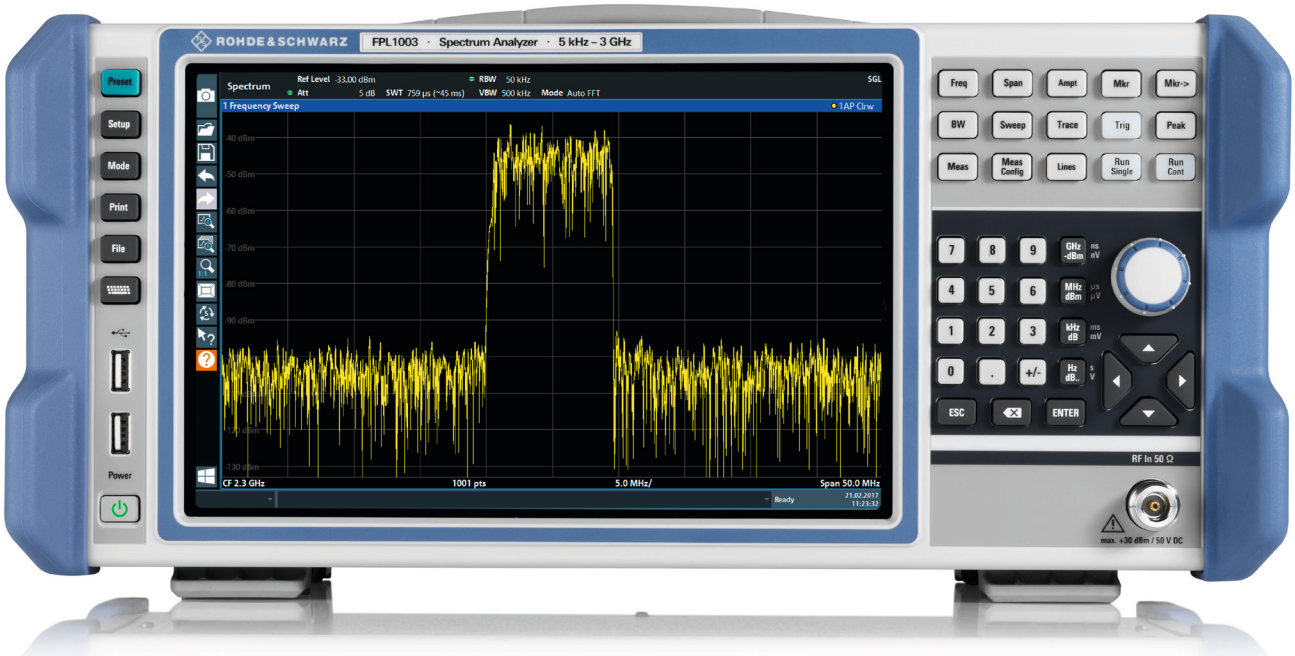


One instrument for multiple applications

The FPL1000 is a single measuring instrument for many types of measurements. You can use it for spectral measurements, for highly accurate power measurements with power sensors and for analyzing analog and digitally modulated signals.

Spectrum analysis

Even in its basic configuration, the FPL1000 is a true allrounder. The basic configuration for spectral measurements includes:

- Spectrum analysis
- Wide range of spectral measurement functions such as channel power, ACLR, signal-to-noise ratio, spurious, harmonic distortions, third-order intercept point, AM modulation depth
- Versatile marker functions

Other features that typically require costly options are already included in the base unit, e.g.:

- Spectrogram measurements to display the spectrum vs. time
- Trace zoom function
- Gated sweep for accurate display of pulsed signals
- Narrowband resolution bandwidth down to 1 Hz

The FPL1000 base unit supports various advanced spectrum measurement modes as standard.

Signal analysis

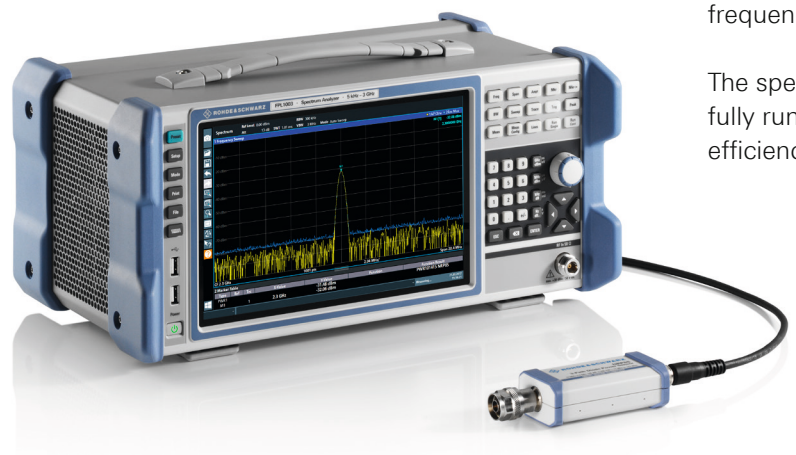
Suitable measurement applications are available for analyzing analog and digitally modulated signals. The FPL1-K7 option turns the FPL1000 into an ana-log modulation analyzer for amplitude, frequency and phase modulated signals.

The VSE-K70 vector signal analysis option analyzes digitally modulated single-carrier signals. In addition, the base unit's I/Q analyzer supports the magnitude and phase presentation of I and Q within the analysis bandwidth. The I/Q data can be exported for further analysis with third-party software products.

Power measurements with power sensors

For applications requiring high level accuracy, the FPL1-K9 option allows the FPL1000 to be used with NRP power sensors in a range from –67 dBm to +45 dBm and frequencies up to 110 GHz.

The FPL1-K9 option and an NRP power sensor turn the FPL1000 into a power meter.



The spectrum analyzer and the power meter modes are fully running in parallel thus improve the measurement efficiency with one single instrument.

Solid RF performance

Featuring a phase noise of –108 dBc (1 Hz) at 10 kHz offset (1 GHz carrier), a third-order intercept point of +20 dBm, 1 Hz to 10 MHz resolution bandwidth and –167 dBm displayed average noise level, the FPL1000 is comparable to higher class analyzers. This makes it the ideal tool for use in the lab, in production and for service tasks. The 1 dB attenuator step size (FPL1-B25 op-tion) and the preamplifier (FPL1-B22 option) extend the usable dynamic range and sensitivity.

Low spurious responses

In order to distinguish spurs in the signal from spurs of the measuring instrument, a low spurious response is required. Within 10 MHz offset from the carrier signal, the specified spurious response of the FPL1000 is –70 dB lower than the signal level. This is over 10 dB better than comparable analyzers in this class. At higher offset, the specified value is even –80 dB, which is 20 dB better than comparable analyzers. This makes the FPL1000 the perfect tool for identifying interferers even when they are significantly below the carrier level.

Low displayed average noise level (DANL)

A low displayed average noise level (DANL) is required to detect signals with low levels. In addition, when you search for interferers above a certain level, a low DANL allows you to use a higher resolution bandwidth and to increase the measurement speed. With a typical DANL of –152 dBm, which can be improved to –167 dBm with a preamplifier, the FPL1000 can identify even small spurious emissions.

Signal analysis bandwidth 40 MHz

The signal analysis bandwidth defines the frequency range in which all level and phase information over a given time is captured. The FPL1-B40 option extends the analysis bandwidth from 10 MHz to 40 MHz, making the FPL1000 the only instrument in its class that can de-modulate analog and digitally modulated signals with up to 40 MHz bandwidth.

The FPL1-K7 option lets you analyze the amplitude, frequency and phase of analog modulated signals. More-over, the VSE-K70 vector signal analysis option makes it possible to demodulate modulated single-carrier signals and analyze them in detail.

The I/Q analyzer is the standard function for digital signal analysis. It displays the magnitude and phase parameters and the FFT spectrum. The captured I/Q data can be trans-ferred to third-party software tools (e.g. Matlab® or Python) for further analysis.

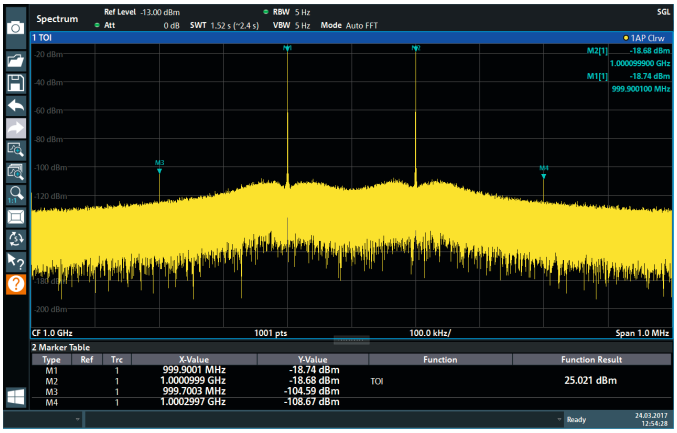
Low level measurement uncertainty

Another unique feature in this class is the low level mea-surement uncertainty of 0.5 dB. The instrument's high measuring accuracy ensures precise and reliable test re-sults, which often makes it possible to dispense with a separate power sensor.

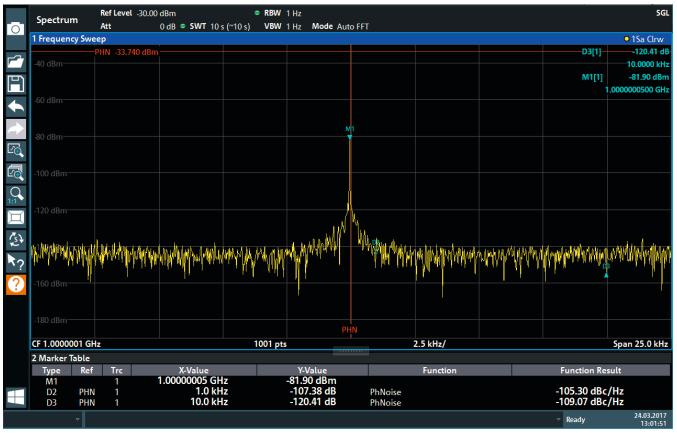
Precise spectral measurements due to low phase noise

The low phase noise of –108 dBc (1 Hz) at 10 kHz offset to the carrier (1 GHz carrier) yields significant advantages for spectral measurements as well. It enables accurate adja-cent channel power measurements of narrowband carri-ers. Unwanted spurs close to the carrier can be detected.

Measurement of the third-order intercept point (TOI).



Simple phase noise measurement with a marker function.



Intuitive user interface

Operating the FPL1000 is as intuitive as using a smartphone. You can configure the instrument and perform measurements with the touchscreen. A one-finger swipe across the screen adjusts the center frequency or the reference level. Two-finger gestures adjust the displayed span or level range.

High-resolution display

The 10.1" screen with 1280 × 800 pixel resolution provides a precise representation of the signal. The soft menu keys and the information fields are arranged in such a way that the signal appears true to detail with the highest possible resolution.

Innovative user interface

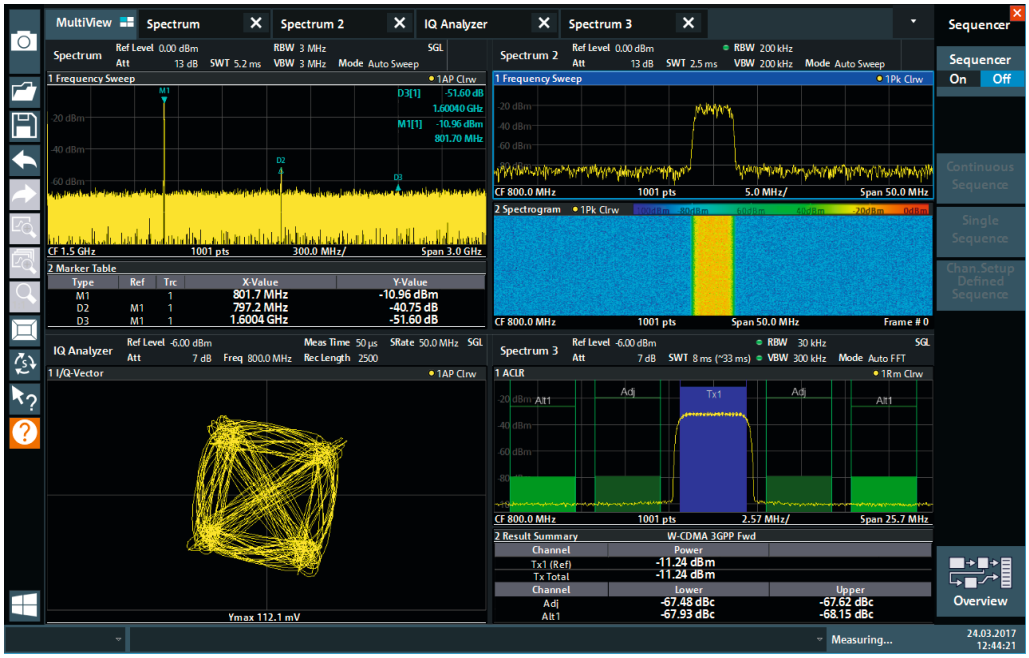
Within a measurement application, different measurement items can be easily added using drag and drop. The combined results can be arranged as desired on the display.

Flexible arrangement of results and MultiView

Different measurements, for example spectrum measurements and an analog demodulation measurement, can be opened on different tabs in parallel. A simple click activates the measurement of interest, maximizing relevant windows and fading out the others. The MultiView function displays all tabs on one screen. With the sequencer, all measuring channels are measured consecutively, one after the other. The user is provided with constantly updated results and no annoying, time-consuming parameter adjustments are necessary.

Toolbar

Overlapping and frequently used functions – such as loading or saving configurations, taking screenshots, the help menu or the zoom function – can be easily accessed at any time via the toolbar menu.



Screenshot of the FPL1000 with MultiView. The sequencer consecutively performs a spectrum measurement, an adjacent channel power measurement, an I/Q analysis and a spectrogram measurement. The results are displayed clearly and simultaneously. The toolbar on the left allows fast access to the most common menu functions. Different measurements can be activated with the tabs at the top.

Fully portable

The FPL1000 spectrum analyzer can be used almost everywhere. With a depth of only 23 cm, it fits into any workplace and leaves enough space for DUTs and other measuring instruments. Due to its low weight of 6 kg and the carrying handle, you can take it wherever you need it.

Battery pack and 12/24 V power supply

The optional battery pack provides three hours of operation. With additional batteries and an additional charger, the operating time can be extended without interruption.

When the FPL1000 is used in vehicles, the optional 12/24 V DC power supply conveniently supplies power via the car socket.

Carrying bag and shoulder harness

A padded carrying bag is available for keeping the FPL1000 well protected during transport. Ventila-tion slits and a transparent cover allow the instrument to be operated while inside the bag. This lets you use the FPL1000 at any location and under adverse environmental conditions.

Users who need the functionality of a benchtop instrument and the flexibility of a handheld instrument can use the shoulder harness. Measurements where the instrument needs to be carried, such as interference hunt-ing, are almost as convenient as with pure handheld instruments.

Fully portable configuration with optional transport bag and shoulder harness.

An optional carrying bag is available for transporting the FPL1000. With the FPL1-B31 battery option, the instrument can be operated while inside the bag.

10.1" high-resolution display

10.1" high-resolution display
- 1280 × 800 pixel resolution

Hardkeys
- For setup, presets, etc.

Two USB 2.0 ports
- For storage media
- For connecting accessories

Soft menu selection

- Quick access to key tools
- Hardware settings at a glance

Measurement setup buttons

Control knob

Numerical keypad

- With unit keys for frequency and level

RF input

FPL1-K7 AM/FM/φM analog demodulation

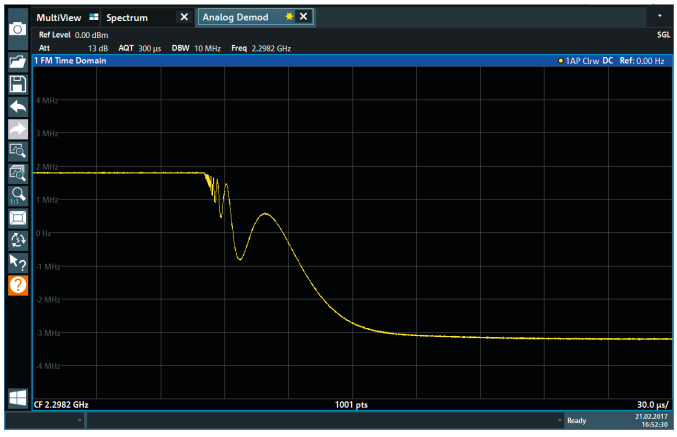
The FPL1-K7 option converts the FPL1000 into an analog modulation analyzer for amplitude, frequency and phase modulated signals. It measures the character-istics of the useful modulation and other items such as re-sidual FM or synchronous modulation. Typical applications of the FPL1-K7 include:

- Transient and settling measurements on oscillators such as VCOs and PLLs
- Troubleshooting AM/FM transmitters
- Simple chirp analysis of pulsed or continuous wave signals

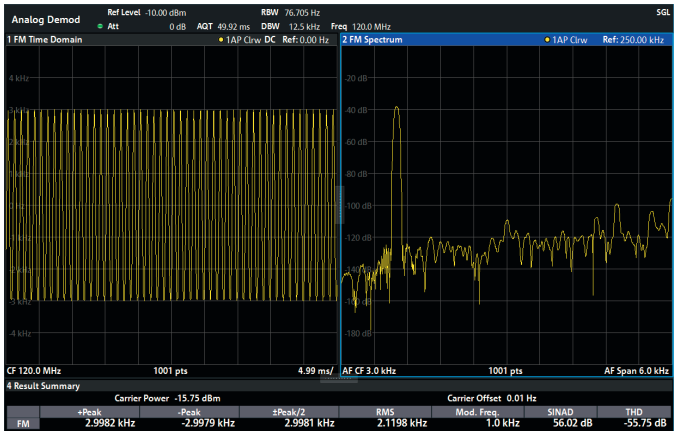
Display and measurement capabilities

- Modulation signal versus time
- FFT spectrum of modulation signal
- RF signal power versus time
- FFT spectrum of RF signal
- Table with numeric display of:
  - Deviation or modulation depth, +peak, –peak, ± peak/2 and RMS weighted
  - Modulation frequency
  - Carrier frequency offset
  - Carrier power
  - Total harmonic distortion (THD) and SINAD

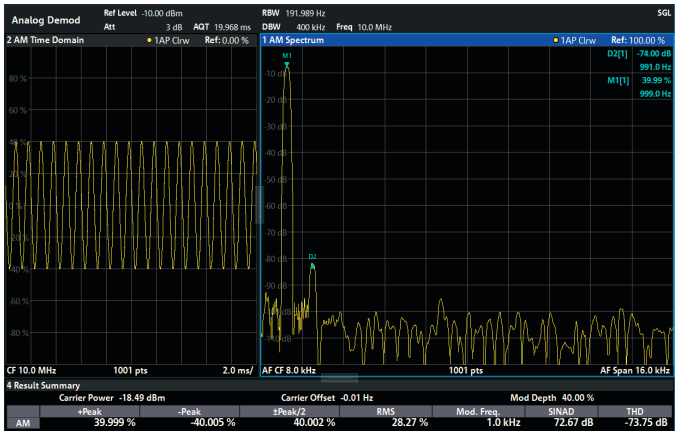
Frequency settling behavior of an oscillator.



Display of the modulating signal and its spectrum together with peak and RMS deviation.



THD measurement on an amplitude modulated signal: the first harmonic of the modulation signal is well suppressed by 74 dB.



FPL1-K30 Noise figure and gain measurements

The FPL1-K30 noise figure and gain measurement option [1] allows you to characterize the most important am-plifiers specifications. Using the Y-factor method, the noise figure and gain are measured with high accuracy indepen-dent of the instruments own noise figure.

Typical applications for the FPL1-K30 include the characterization of amplifiers.

The following parameters can be measured at a specified frequency or in a selectable frequency range:

- Noise figure in dB
- Gain in dB
- Y-factor in dB

The noise source is controlled by the 28 V output on the FPL1-B5 additional interfaces option on the back of the instrument. With an optional FPL1-B22 RF preamplifier, the sensitivity of the measurement can be im-proved for measuring devices with a low noise figure, e.g. LNAs.

The advantage of the FPL1-K30 compared to conven-tional noise measurement systems is that a wide variety of other RF measurements can also be performed with one instrument, for example measurement of harmonics, inter-modulation, spurious responses.

[1] The FPL1-K30 requires the FPL1-B5 additional interfaces option and a noise source with a 28 V DC power input, for instance the NoiseCom NC346 series.

Simultaneous view of graphs for noise figure, gain and Y-factor versus frequency and a table of the results in numerical format.

VSE-K70 Vector signal analysis

The FPL1000 analyzes and demodulates digitally modulated single-carrier signals with up to 40 MHz analysis bandwidth. Universities and research facilities will benefit from the instrument's flexibility in analyzing proprietary signals. Developers of mobile communications devices and components can easily use the predefined standard settings.

When analyzing digital modulation signals, the FPL1000 receives and digitizes the signal, which is then analyzed by the VSE-K70 option [1]. The software runs directly on the FPL1000 or on an external con-trol PC.

[1] VSE base software and FSPC license dongle required.

The VSE-K70 vector signal analysis option is a power-ful tool for analyzing individual digitally modulated signals down to the bit level. The clear operating concept simplifies the measurement despite many analysis functions, including a digital equalizer for channel response correction, correction of common I/Q errors and the display of many measured values as a graph or in table format.

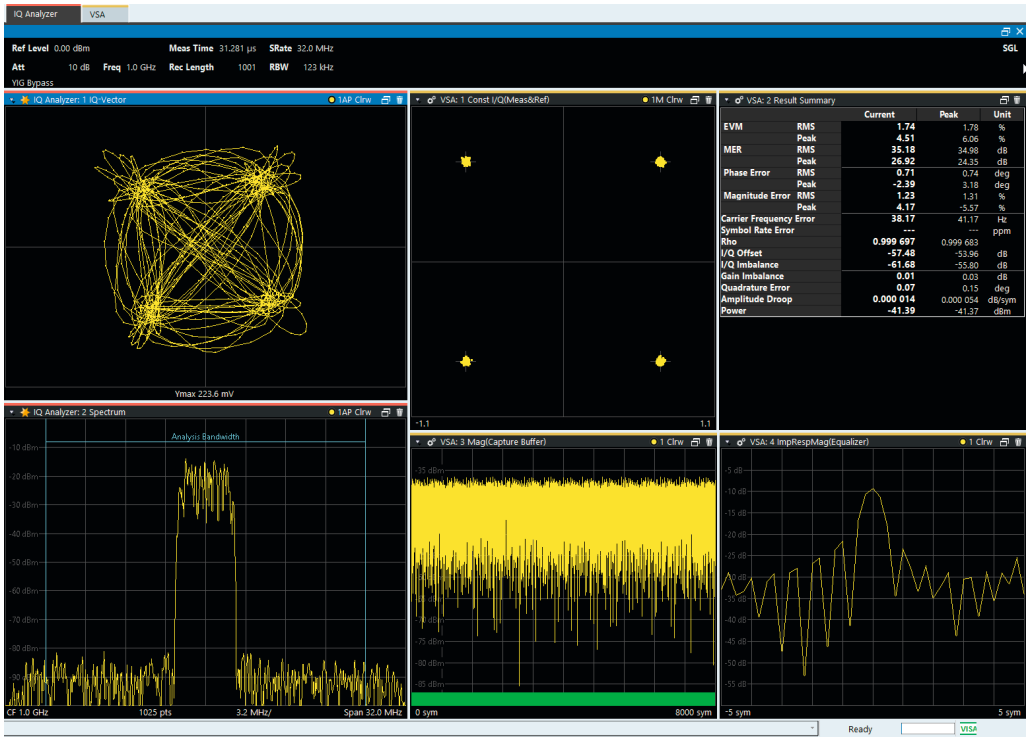
Flexible modulation analysis from MSK to 4096QAM

- Modulation formats:
  - 2FSK, 4FSK, 8FSK
  - MSK, GMSK, DMSK
  - BPSK, QPSK, offset QPSK, DQPSK, 8PSK, D8PSK, π/4-DQPSK, 3π/8-8PSK, π/8-D8PSK
  - 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM, 1024QAM, 2048QAM, 4096QAM
  - 16 APSK (DVB-S2), 32 APSK (DVB-S2), 2 ASK, 4 ASK, π/4-16QAM (EDGE), –π/4-16QAM (EDGE)

Numerous standard-specific presets

- User-definable constellations and mappings
- GSM, GSM/EDGE
- 3GPP WCDMA, EUTRA/LTE, CDMA2000®
- TETRA, APCO25
- Bluetooth®, ZigBee
- DECT, DVB-S2

Analysis of a ZigBee signal with the VSE-K70.



VSE-K106 EUTRA/LTE NB-IoT measurement software

The FPL1000 can be used to analyze cellular 3GPP NB-IoT signals. It captures the signal, which is then ana-lyzed by the VSE-K106 EUTRA/LTE NB-IoT measure-ment software [1].

This solution can perform all relevant measurements on 3GPP NB-IoT signals:

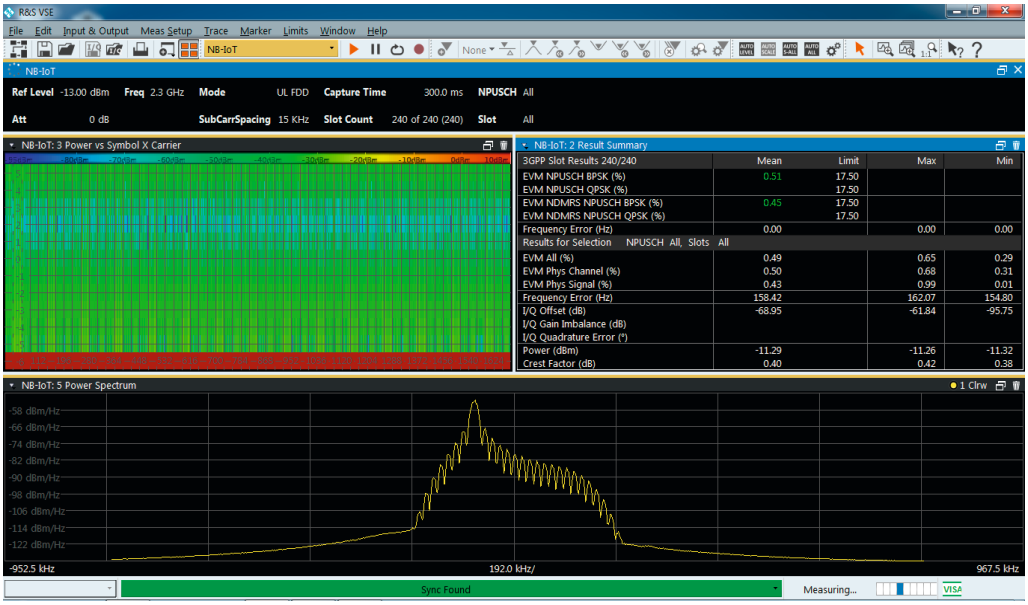
- UL signals from NB-IoT modules and devices
- DL signals from base stations
- Signal demodulation and EVM measurements
- Spectral measurements/ACLR in line with 3GPP
- Time alignment error (TAE) measurements

It works in all three NB-IoT operation modes:

- In-band
- Guard band
- Standalone mode

[1] VSE base software and FSPC license dongle required.

Demodulation and EVM measurement of an NB-IoT UL signal with the VSE-K106 measurement application.



Specifications in brief

Specifications in brief		
Frequency		
Frequency range		5 kHz to 3 GHz
Aging per year		1×10^{-6}
	with FPL1-B4 option	1×10^{-7}
Frequency resolution		0.01 Hz
Bandwidth		
Resolution bandwidth (–3 dB)	sweep filters	100 kHz to 10 MHz in 1/2/3/5 sequence
	FFT filters	1 Hz to 50 kHz in 1/2/3/5 sequence
I/Q demodulation bandwidth		10 MHz
	with FPL1-B40 option	40 MHz
Displayed average noise level (DANL)		
RF preamplifier off	5 MHz ≤ f < 2 GHz	–152 dBm (typ.)
RF preamplifier on (option FPL1-B22)	10 MHz ≤ f < 2 GHz	–167 dBm (typ.)
Intermodulation		
	1 dB compression of input mixer	+7 dBm (nom.)
	third-order intercept point (TOI) 300 MHz ≤ f_{in} < 3 GHz	+20 dBm (typ.)
Phase noise	f = 1 GHz, 10 kHz frequency offset	–108 dBc (1 Hz) (typ.)
Total measurement uncertainty	1 MHz ≤ f < 3 GHz	0.5 dB

Ordering information

Designation	Type	Order No.
Signal and Spectrum Analyzer	FPL1003	1304.0004.03
Accessories supplied		
Power cable and quick start guide		
Options		
OCXO Reference Frequency	FPL1-B4	1323.1902.02
Additional Interfaces	FPL1-B5	1323.1883.02
GPIB Interface	FPL1-B10	1323.1890.02
Second Hard Disk (SSD)	FPL1-B19	1304.0427.02
RF Preamplifier	FPL1-B22	1323.1719.02
1 dB Steps for Electronic Attenuator	FPL1-B25	1323.1990.02
DC Power Supply 12/24 V	FPL1-B30	1323.1877.02
Internal Li-Ion Battery	FPL1-B31	1323.1725.02
40 MHz Analysis Bandwidth	FPL1-B40	1323.1931.02
Firmware		
AM/FM/φM Measurement Demodulator	FPL1-K7	1323.1731.02
Power Sensor Measurement with NRP Power Sensors	FPL1-K9	1323.1754.02
Noise Figure Measurement Application	FPL1-K30	1323.1760.02
Software		
License Dongle	FSPC	1310.0002K02
Vector Signal Explorer Base Software	VSE	1320.7500.02
Vector Signal Analysis	VSE-K70	1320.7522.02
EUTRA/LTE NB-IoT	VSE-K106	1320.7900.02
Recommended extras		
Protective Hard Cover	FPL1-Z1	1323.1960.02
Soft Carrying Bag for transport and outdoor operation	FPL1-Z2	1323.1977.02
H-Style Shoulder Harness (requires FPL1-Z2)	FPL1-Z3	1323.1683.02
Spare Lithium-Ion Battery Pack	FPL1-Z4	1323.1677.02
Anti-Glare Screen Protector for outdoor operation	FPL1-Z5	1323.1690.02
Lithium-Ion Battery Charger for charging spare batteries	FSV-B34	1321.3950.02
19" Rackmount Kit	FPL1-Z6	1323.1954.02
Headphones		0708.9010.00
Matching pads, 50/75 Ω		
L Section, matching at both ends	RAM	0358.5414.02
Series Resistor, 25 Ω, matching at one end (taken into account in instrument function RF INPUT 75 Ω)	RAZ	0358.5714.02
High-power attenuators		
Attenuator 100 W, 3/6/10/20/30 dB, 1 GHz	RBU100	1073.8495.xx (xx = 03/06/10/20/30)
Attenuator 50 W, 3/6/10/20/30 dB, 2 GHz	RBU50	1073.8695.xx (xx = 03/06/10/20/30)
Attenuator 50 W, 20 dB, 6 GHz	RDL50	1035.1700.52
Connectors and cables		
N-type Adapter for RT-Zx probes IEC/	RT-ZA9	1417.0909.02
IEEE Bus Cable, length: 1 m IEC/IEEE	PCK	0292.2013.10
Bus Cable, length: 2 m	PCK	0292.2013.20
DC block		
DC Block, 10 kHz to 18 GHz (type N)	FSE-Z4	1084.7443.02

Warranty		
Base unit		3 years
All other items		1 year
Options		
Extended Warranty, one year	WE1	Please contact your local Rohde&Schwarz sales office.
Extended Warranty, two years	WE2	
Extended Warranty with Calibration Coverage, one year	CW1	
Extended Warranty with Calibration Coverage, two years	CW2	