# MICRAN

# R42 Vector Network Analyzer

Installation and Quick Start Guide (ver.1.3)

Phone: +7 3822 900-037

Homepage: http://micran.com

Support: pribor@micran.ru

# 1. Overview

This manual describes basic information necessary to use the R4213/R4226 instruments. It provides installation instructions, operation procedures for calibration, measurements and analysis of measurement results.

The new generation of high performance vector network analyzers R4213/4226 is a suitable instrument for testing of passive and active devices as well as solutions for complex tasks. Up-to-date Micran patented software and hardware solutions allow you to combine the huge set of the microwave (MW) measurements in only one device, reduce instrument cost, and enhances accuracy and measurement repeatability. The major features of the R4213/4226 are described as follows:

- Vector measurements of transmission and reflection losses, power measurements in continuous or pulse mode;
- Optional noise figure, vector and scalar mixer measurements;
- Various SOLT/TRL calibration types, automatic calibration procedure ability;
- Post-calibration circuits fixturing, reference plane conversions;
- Save/load measured data, user settings and calibrations;
- Data averaging, smoothing, accumulation, limit testing;
- Display various statistical information;
- Scalar and vector math operations with traces;
- Data display flexible settings;
- Multifunctional marker measurements and analysis;
- Internal reporting tool.

Micran VNA simplifies measurement cases for development, serial manufacture and verification of RF and MW products. It is an ideal solution for wireless communications, aerospace and defense, computer, medical, automotive, etc.

Figure 1-1 shows VNA R4213 instrument with some accessories included.



Figure 1-1 VNA R4213 analyzer and accessories

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# 2. Installation Notes

#### 2.1 Package Contents

Please check all packaged items supplied with the analyzer have been provided (see Table 2-1) and not damaged.

Name	Qty	Notes	
VNA R42xx		R4213/ R4246 with custom options*	
NKMM Calibration Kit		Type-N/3.5mm/2.4mm	
R4M-EC4 series electronic calibrator	1	Available with Type-N/3.5mm connectors	
RF cable		Type-N	
RF Jumpers		DPA/DMA options only	
Ethernet cable		Cat.5E	
Power cable		EU, plug CEE7 Standard Sheet VII, 250V, 10A	
Flash drive		Graphit 2.x software, SCPI programming guide and	
		examples are included	
Wrench 19mm	1	R4226 only	

\* Please contact vendor to retrieve full available options list.

#### 2.2 **Operating Requirements**

Ensure that the operating environment (Table 2-2) and power supplied to analyzer (Tab 2-3) meet the following requirements. Provide appropriate ventilation at the workplace to satisfy the specifications and measurement accuracy of the analyzer, keep from vibration and strong electromagnetic influences.

Table 2-2 Operating Environments

Temperature	15°C to 35°C	
Humidity	40 to 80%	
Atmospheric pressure	537 to 800 mm Hg	

Table 2-3 Power requirements

Voltage	198 to 242 VAC	
Frequency	50 Hz	
Maximum power consumption	100 VA (150 VA for R4226)	
Maximum heating-up time	30 minutes	
Maximum continuous operation time	16 hours	

Use the supplied cable to connect the power cable receptacle on the rear panel of the VNA and a threewire power outlet with the grounding prong firmly connected in the ground slot. It's strongly recommended to use extra grounding pin () on the rear panel if grounding resistance is not validated.

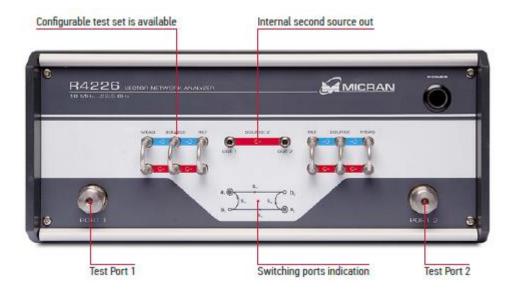


Figure 2-1 VNA R4226 front panel

Micran network analyzers are designed in accordance with virtual device concept. VNA is controlled by remote PC using *Graphit* software. PC minimum system requirements are:

- Windows® 7/8/10;
- Dual-core CPU 2.4 GHz x86/x64;
- Ethernet LAN 100 Mbit/s;
- GPU memory 512 MB;
- DRAM 1 GB;
- Display resolution 1280 × 720;
- Keyboard + mouse or sensor display;
- 80 Mb of free disk space for software installation.

Connect analyzer and PC by means of supplied *Ethernet* cable directly, or using hub to operate in a local area network (see connectors on Figure 2-2). Use configurator on the rear panel to select network profile, described in Table 2-4.

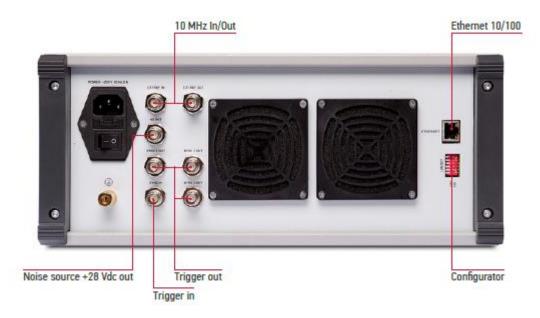


Figure 2-2 VNA R4226 rear panel

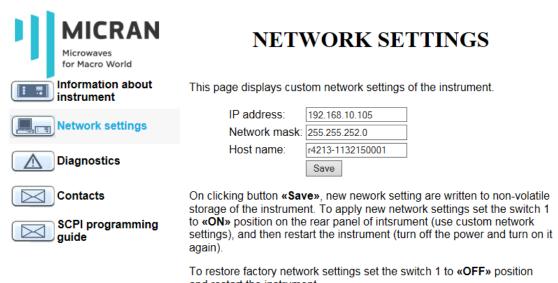
### 2.3 Network Settings

Table 2-4 Configurator settings

# <b>1</b>	Function	State		
#Jumper		ON	OFF	
1	Network configuration select	User IP/mask settings	Default IP/mask settings (IP 169.254.0.254 mask 255.255.0.0)	
2	Automatic mode	Use predefined <i>hostname</i> (if DHCP server is available), allow server to assign IP automatically	Use currently selected by jumper #1 network settings	
3-5	Not used	-	-	
6	<i>Reset</i> (must be OFF)	Blocks analyzer operation, processes hardware reset.	Default state	

In non-automatic mode it's necessary to select User IP/mask settings (jumper #1 is ON) if two or more analyzers are expected to operate in common LAN. Produce following steps to modify user network parameters:

- a. Turn off the analyzer's power, connect VNA directly to PC with jumpers #1-2 (Table 2-4) set to "OFF" state.
- b. Go to "169.254.0.254" address in a WEB-browser to access instrument remote interface.
- c. Locate and click "Network settings" on the start page.
- d. Modify IP address and network mask (Fig.2-3).
- e. Perform "Save".
- f. Power-off the analyzer, set jumper #1 to "ON". The instrument is ready to work.

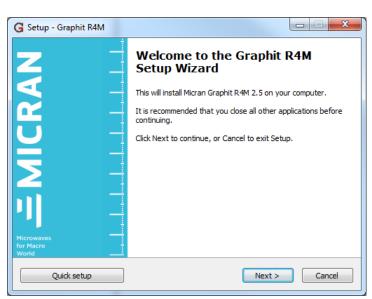


and restart the instrument.

Figure 2-3 Modifying networks settings through remote interface.

# 2.4 Software Setup

Locate *Install* folder on the supplied *Flash*-drive and run *install\_graphit\_2.5.x.exe*. Select software language at startup (*Russian* is default) and follow the instructions to complete setup. "Quick setup" button allows you to skip setup steps and performs full installation (Fig.2-4)



#### ATTENTION! THE SETUP PROGRAM REQUIRES WINDOWS® ADMINISTRATOR PRIVILEGES.

Figure 2-4 Software installation wizard

#### 2.5 Connecting to analyzer

Run *Graphit R4M* application using *Start menu -> Applications -> Micran Graphit R4M* or *Windows®* desktop icon. Connection dialog will automatically appear after software's loading (Fig.2-5). User should select required instrument from the Favorite or Instrument Search list. It's recommended to add address of the analyzer to the favorites list or enable *"Use by Default"* option to speed-up the connection procedure next time. Editing and removing of favorites are available. Double click on selected analyzer or press *"Connect"* to establish TCP/IP connection and perform instrument initialization. *"Show All"* option displays all available instruments in the current local network. Connection to unsupported device will be refused.

		Favor	rite Instrument	5	
Description	Instrument address	Туре	Serial number	State	Add
P4226A 1133190021	r4226-1133190021.tetz	P4226A	1133190021	Free	Add
ocalhost					
					Edit
					Remove
					V Instrument Count
					💸 Instrument Search
		Inst	rument Search		
Description	Instrument address	Туре	Serial number	State	Add to Favorites
P4226/5 1133180038	r4226-1133180038.tetz	P4226/5	1133180038	Free	Add to ravorites
R4226 1133150001	r4226-1133150001.tetz	R4226	1133150001	Free	
P4226/2 1133200056	r4226-1133200056.tetz	P4226/2	1133200056	Busy	Retry Search
P4226A 1133190021	r4226-1133190021.tetz	P4226A	1133190021	Free	Netty Search
					Show All
					Use by Default
					0

Figure 2-5 Connection window

#### 2.6 **Options activation**

R4213/R4226 analyzers can be supplied with some software options:

- *IIP* pulse measurements;
- SCHP scalar mixer measurements using frequency conversion.

Option activation procedure is quite simple: click "System"->"License Keys..." on the program's main menu and install the option by adding supplied License file (\*.lk) to the list (Fig.2-6), no further reboot is needed.

icense Keys								
#	Company	Supplier	Instrument(s)	Options	Expiration date			
L	Test Inc.	Micran	R4213 1132150001	IIP,SCHP	None	4		
						_		
						-		

Figure 2-6 Option activation

#### 2.7 Emulation mode

*Graphit R4M* application can be run in demo mode using integrated *Emulator* utility (Fig.2-7). Add new instrument and specify *127.0.0.1* IP-address or *localhost* as instrument address in the connection window (see chapter 2.5), and *Emulator* will start automatically.



Figure 2-7 Software device emulator

Emulator sends to *Graphit* S-parameters data taken from *Touchstone*<sup>®</sup> S2P file (*DUT.s2p* by default) which can be changed before connection or during measurements. To expand the simulated frequency range of the instrument, adjust "Start" and "Stop" parameters in the "More settings" section before connection procedure. In addition, *Emulator* implements few simple trigger functions and allows user to specify "Hot" and "Cold" noise data for the Noise Figure measurements.

# 3. Basic Operations

#### 3.1 Basic control elements

- *Main Menu* performs calibrations management and information displaying, power and sweep control, gives access to diagram/trace/marker parameters (context menu duplicate), user profile management, view settings;
- *Toolbars* quick access to main operations and properties (bars can be replaced or turned ON/OFF manually);
- Control Panels set analyzer parameters and modify sweep settings, process trace functions;
- *Channel Status Bars* display basic sweep and correction parameters (extract hint by using mouse hover to get string description) for each channel;
- *Diagram* graphic area for one or more traces; data and mathematical traces can be linked to various measurements and channels;
- *Trace List* displays traces of the diagram, selects one or more traces; it's allowed to change some trace properties directly by mouse double-clicking on appropriated list cell;
- Add Marker Button the button for adding a new marker to the diagram.
- Instrument Status Panel displays main hardware information and settings.

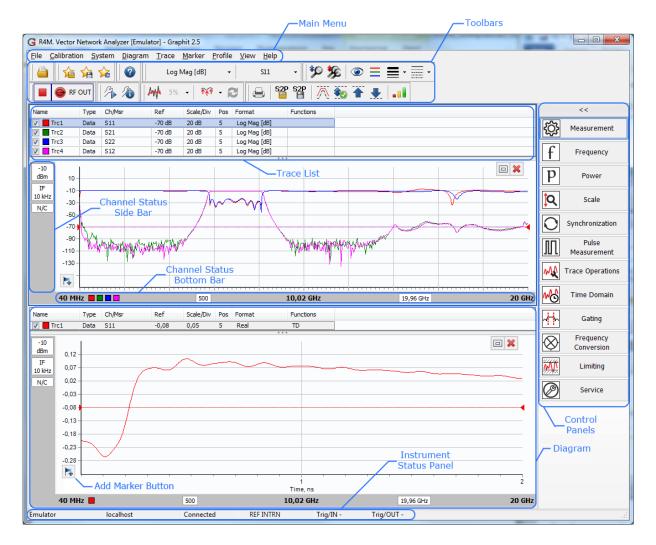


Figure 3-1 Basic control areas and panels of *Graphit 2.5* 

# 3.1 Control Panels

Use control panels to set analyzer parameters, to modify sweep settings for the selected channel, to apply various functions for the selected trace(-s). Expand or hide panel area by clicking on the "<>" button (Fig.3-2) or press corresponded panel's button to access controls. Table 3-1 represents item types used in control panels.



Figure 3-2 Control panels

See function for each available panel below:

- Measurement sweep-to-sweep averaging, sweep type (frequency / power), IF bandwidth, noise source control (IKSH option for noise measurements), port 1 external reference (SPA option for the mixer measurements).
- *Frequency* frequency range, point number, frequency list management, full span and zero span quick buttons.
- *Power* output power value (or modify power sweep span), output / input attenuation.
- *Scale* trace format, reference level value and position, scale division, scale mode selection, quick buttons for the autoscaling selected trace(-s) and all traces of the selected diagram.
- Synchronization trigger IN / OUT settings, pulse generator and reference oscillator configuration.
- *Pulse Measurement* pulse mode selection and time gate parameters.
- Trace Operations accumulation, smoothing, phase delay functions, statistics displaying.
- *Time Domain* time domain transform and its parameters (VOP option).
- *Gating* Gating function settings for the time domain transform (VOP option).

- *Frequency Conversion* conversion state, LO frequencies and conversion rule, displayed stimulus selection.
- *Limiting* show / hide limit lines, tabular representation of limit lines with custom drawing ability.
- Service custom hardware settings (optional).

Table 3-1 Control panel items

Item	Image	Description	
Button	Autoscale Trace	Simple button	
Switch	Frequency Conversion	ON / OFF switch (similar to classical checkbox)	
Dropdown list	Sweep Type Frequency Erequency Power	Button with popup –styled list (acts like classical <i>combo</i> )	
Numeric edit	Center       4,5 GHz         ↓       4,5 GHz         ↓       7       8       9       GHz         ↓       7       8       9       GHz         ↓       4       5       6       MHz         ↓       1       2       3       kHz         ↓       ↓       Hz       Hz         ↓       ↓       Hz       Hz         ↓       □       ±       ,       Hz	<ul> <li>Numeric edit field with on-screen keyboard and custom increment.</li> <li>Use unit buttons to simplify input procedure</li> <li>Right-click on the numeric field calls popup menu with increment settings and memory buffer operations, recent values list</li> <li>Scrolling value is available when focused</li> <li>Some controls have value presets (like "Points", "IF Filter", etc.) to speed up input procedure</li> </ul>	

#### 3.2 Measurement Sequence

This section describes the basic measurement procedure using *R4213/R4225* and presents an example of the S-parameters measurement of arbitrary bandpass filter. Follow next few instructions below.

#### 3.2.1 Defining measurement parameters

- Reset user settings using menu Profile -> Restore Default Settings
- Select data format for each S-parameter (logarithmic magnitude by default) by selecting trace(s) in the list and modifying format in *Scale* control panel
- Specify frequency range and the number of measurement points in *Frequency* control panel
- Adjust the power level in *Power* control panel
- Select the IF bandwidth in *Measurement* control panel
- Run sweep by using tool button or *System -> Measurement* menu item; it's required to heat-up instrument for 30 minutes before calibration or measurements

#### 3.2.2 Calibration

- Run calibration wizard from *Calibration* menu of by using <sup>2</sup> tool button
- Select calibration method *Guided* (step-by-step manual procedure), *Automatic* (using electronic calibrator module) or *Unguided* (fully manual calibration procedure) and press *Next*
- Select *Ports to Calibrate (Ports 1, 2* if transmission correction is needed), DUT connectors and *Calibration Kit.* Use *Calibration Kits...* button to import kit from a file to the list at the first run. Supported connectors will be automatically added from the loaded kit. Or connect to electronic calibrator in opened dialog.
- Choose *Calibration Variant (SOLT/TRL)* and *Calibration Type* from the lists. Check desired measurement options (*Isolation, Unknown THRU,* etc...) if available
- Follow the wizard's instructions to perform calibration
- Click Apply to finish calibration procedure or Back to repeat one or more calibration steps

#### 3.2.3 Measurements and Analysis

- Connect the DUT
- Adjust the scale manually or using Autoscale functions
- Enable desirable trace functions
- Analyze measured data with markers, their relations (which are created by connecting two various markers with link, wired from mode icon 
   ), limiting lines or statistics (Fig.3-3)
- Prepare report using *Diagram -> Report* menu
- Save user settings by clicking *Profile -> Save* menu item

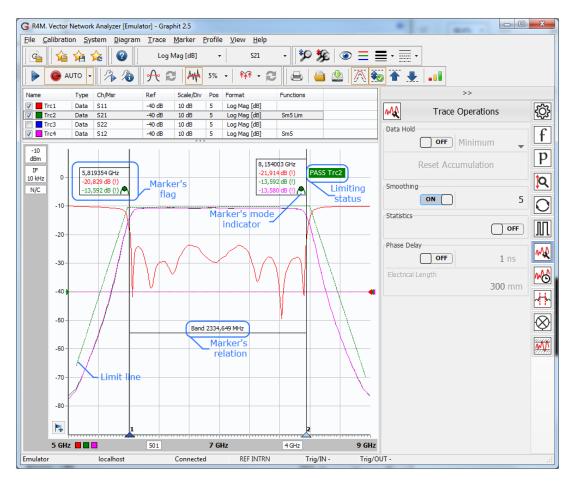


Figure 3-3 Example of the bandpass filter measurement