Rohde&Schwarz Products: Handheld Spectrum Analyzer R&S®FSH

FSHRemote
Remote Control and Data Access
for the R&S®FSH

Application Note

FSHRemote is a program for reading data, and controlling a Handheld Spectrum Analyzer R&S®FSH from a remote computer.

The physical connection can be via either a fixed phone network, a mobile phone network or LAN/Internet. Use FSHRemote from a PC to control all the functions of the FSH or to read any measurement data. Undertake a diverse range of monitoring tasks with the R&S®FSH under remote control. No need for a PC at the R&S®FSH end.

ROHDE & SCHWARZ

Contents

1 Introduction

FSHRemote is a Program for connecting an R&S®FSH handheld spectrum analyzer to a remote computer, and providing complete control of all functions from the computer.

The physical connection can be either with a serial cable, a telefone modem connected to a fixed phone network (POTS), a mobile phone (or other wireless user equipment) over a mobile phone network, or via LAN/Internet using a serial server (LAN-RS232 converter).

Use FSHRemote from a PC to remote control all the functions of the R&S®FSH or to read any measurement data. Undertake a diverse range of monitoring tasks with the R&S®FSH, such as spectrum analysis or power measurements.

An important design feature of FSHRemote is that the R&S®FSH can be connected directly to a modem, mobile phone, or serial server (LAN-RS232 converter); there is no need for a PC at the R&S®FSH end.

The Handheld Spectrum Analyzer R&S®FSH is abbreviated to FSH for the remainder of this Application Note.

2 Software Features

FSHRemote is simple to install and simulates the user interface of the FSH in a somewhat altered form on the screen of the PC. The following functions are provided:

- Connection management between the PC and the FSH either:
  - direct device-to-device using the optical serial RS-232-C cable,

which comes with FSH
- via a fixed phone network with two telephone modems
- via a mobile phone network with two Mobile phones as wireless modems
- via a fixed phone network with one telephone modem and one wireless modem
- via LAN/Internet with a serial server (LAN-RS232 converter) and a LAN/Internet connection

- frequency and measurement range settings

- Selection of type of measurement

- level settings

- marker functions

- either manual trigger or continuous recording of measurement values

- time-controlled reading and storing of measurement results

3 Hardware and Software Requirements

Hardware Requirements

CPU: Pentium 300 MHz or better

Hard Disk: 8 MBytes free

Monitor: SVGA color monitor, resolution 800x600 or better

Modem: either 56K telephone modems, GPRS mobile phones or wireless modems that can transmit data on two or more time slots (for example GPRS classes 6 or 10), or other appropriate mobile phones, a serial server (LAN-RS232 converter), with a fixed IP address, providing long range connection through LAN/Internet host and a serial device.

Software Requirements

Microsoft 32-bit operating system (Windows 95/98/NT/2000/ME/XP)

FSH firmware version 5.0 or later

Remote control software R&S®FSH-K1 must be activated in the FSH (Option Key)

4 Installing and Starting FSHRemote

To install FSHRemote execute the file setup.exe with a double click. The installation wizard is activated; the first option is choose the language (English or German) for the installation.

Follow the instructions from the wizard. In the course of the installation select the directory of your choice in which the program is to be installed.

FSHRemote requires approximately 8 MB RAM on a hard disk. The wizard also adds an entry for FSHRemote in the Start menu of the computer.

No other parameters are required for installation.

For de-installation, Rohde & Schwarz supplies the program uninstall.exe, which removes FSHRemote completely from the computer.

Warning: *De-install removes the program files and also the directory in which FSHRemote in installed. Make sure you have archived any other files or subdirectories present in the directory before de-installation.*

To start the program select FSHRemote from the Program submenu in the Windows Start menu. When FSHRemote starts, the Registration form appears. Please register the installation; it is free and does not result in any further commitments for you or your company.

If FSHRemote has not been registered, you can still start the program by clicking the *Continue* button.

Fig 1 Registration form

If you complete the Registration form, you will be sent a keycode. Enter the code into the Registration form and click the Continue button. The Main Window for FSHRemote appears.

Once FSHRemote has been registered, the registration form does not appear any more.
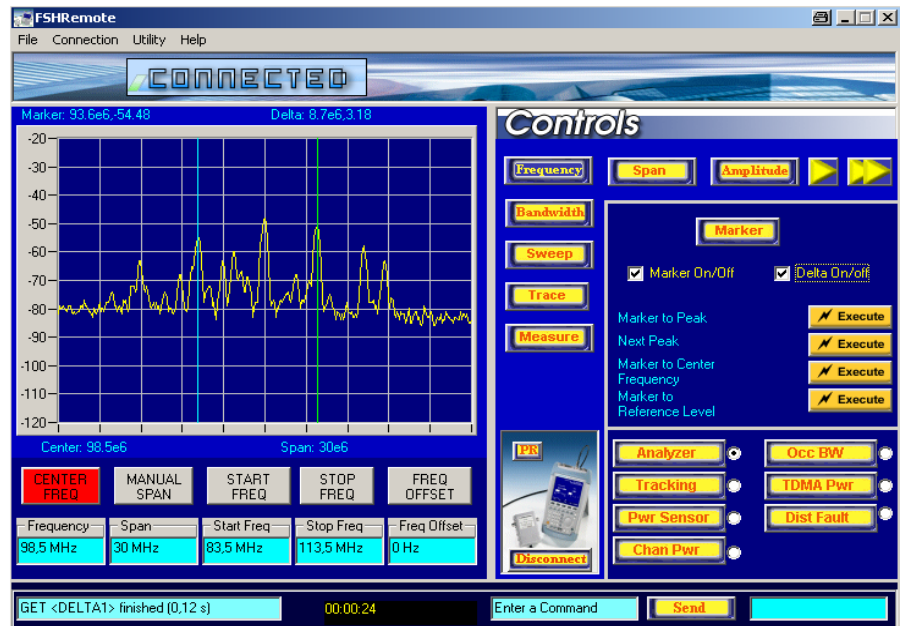
Fig 2 FSHRemote Main Window

5 Connecting the Computer to the FSH

There are five options for transferring data between the PC and the FSH:

- Direct device-to-device using the optical RS-232-C cable supplied with the FSH.

- Via a fixed phone network with one telephone modem and one wireless modem.

- Via a mobile phone network with two mobile phones (or alternative suitable wireless devices) as wireless modems.

- Via a fixed phone network with two telephone modems.

- Via LAN/Internet with a serial server (LAN-RS232 converter). This option requires some basic knowledge of the necessary settings needed for a successful TCP/IP connection

Configuring the Communication Devices

Before first use you have to configure the modems or mobile phones in use, as required for all the communication options apart from the direct device-to-device connection with the serial optical cable. From the *Utility* menu select *Set Devices*. The device at the FSH-end must be configured to communicate with the PC.

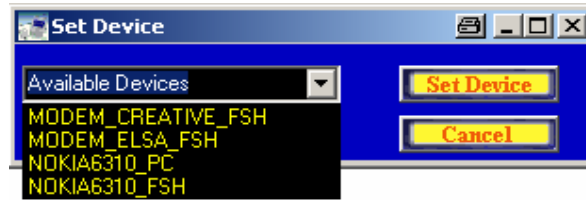Fig 3 Modem Selection

From the *Available Devices* drop-down menu, select the device to con-figure. The AT instructions required to configure a modem or mobile phone are stored in the SETTINGS.INI file, which must be stored in the same directory as FSHRemote. For further information about SETTINGS.INI see Appendix A.

As the majority of modems are functionally compatible, you can use the set-tings for the Creativ Labs modem for many other modems too. The settings for mobile phones are also extremely similar, so that the values from the supplied SETTINGS.INI can often be used.

Select or enter manually the COM port to which the device is connected. The default baud rate is 19200, which is more than adequate. Click on the button *Set Device* to store the configuration. Once the values are saved the *Set Device* window disappears.

Store the selected values in the modem. If, as is the case with somef mo-bile phones, the values cannot be stored, either leave the mobile phone switched on, or re-enter the values each time after switching the mobile phone on.

In the case of an LAN/Internet connection the usage of the Set Device dialog box is not possible as every serial server has its own way of saving its settings. There are several main parameters, which have to be set:

1. The IP address of the server: After setting a fixed IP address for the server, this will be the address which FSHRemote uses to access FSH. The IP address must be fixed and not dynamically allocated - FSHRemote does not scan the entire domain, but connects to a specified IP address. The instructions on setting a fixed IP address for your serial server can be found in its documentation.

2. The logical port of the server: This is the second main parameter to establish a TCP/IP connection and corresponds to the TCP layer. A serial server may have a number of available ports. When used as a host, it listnens on a particular port for a connection request. This is the port, on which the service for converting network and RS232 data is available. There are serial servers on which you can associate any port with this service, and some where it is fixed and cannot be changed. Please refer to your serial server's documentation for instructions on altering the port for the TCP/IP connection.

3. Operating mode: In the case of listening for a connection request, the serial server has to be set in Host-Based mode. Please refer to your serial server's documentation for its available operating modes.

4. Once the network settings allowing the serial server to communicate with the network have been made, one of its serial ports has to be set accordingly, to be able to establish a connection to the FSH via its optical cable. The main parameter to be set here is the baud rate – it must be the same as the baud rate set on the FSH. Any baud rate,

which is supported by both the serial server and the instrument is applicable. We recommend using the highest baud rate of 115200. Please refer to your serial server's manual for instructions on setting the baud rate of its RS232 ports.

5. Additional notes:

   a. Some serial servers need a special null modem adapter (cross link cable) to be able to connect to the FSH optical cable. Please see the appendix for the wiring of such an adapter. In our tests for this purpose we used the serial server of Moxa Inc. NPort Express.

   b. Another serial server which we have tested, is the AXIS 2490 Serial Server from AXIS Communications. A special setting, which has to be made here is to deactivate its telnet options as otherwise there are problems with binary data transfers. In this case no additional null modem adapter is necessary before the FSH optical cable.

Connecting the PC, FSH and Modems / Serial Server (LAN-RS232 converter)

From the *Connection* menu select the connection method used:

- *Direct Serial Port Connection.*

- *Two Modems Connection* with a telephone modem at each end.

- *Two Mobile Phones Connection* with a mobile phone at each end.

- *Modem to Mobile Phone Connection* with a telephone modem connected to the PC and a mobile phone at the FSH.

- *Mobile Phone to Modem Connection* with a mobile phone connected to the PC and a telephone modem at the FSH.

- *TCP/IP Connection* with the FSH connected to a serial server, which is connected to the network and a PC with a network connection.
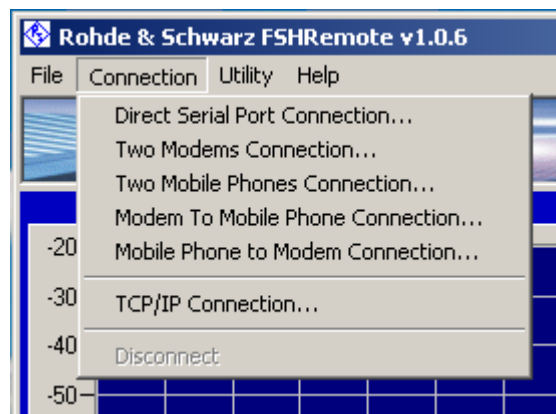

Fig 4 Connection Menu

Note: *The direct connection is particularly useful for getting started with FSHRemote and the FSH, as the reaction of the FSH to instruc-*

tions from the program are simple to observe. The data transfer rate is the fastest possible, and is not subject to additional delays also possible with, for example, a wireless modem. The data transfer is free, too!

Direct connection via the serial port:

If the computer is close to the FSH, it can be connected directly to the serial port of the PC using the optical RS-232-C serial cable.

Once the cable has been connected at both ends, select *Direct Serial Port Connection.*

The *Connect* window opens to set the connection data. Select the COM port and the baud rate and click on *Connect*. Make certain the value for baud rate matches the value set up for the FSH; otherwise the connection fails and displays an error message.
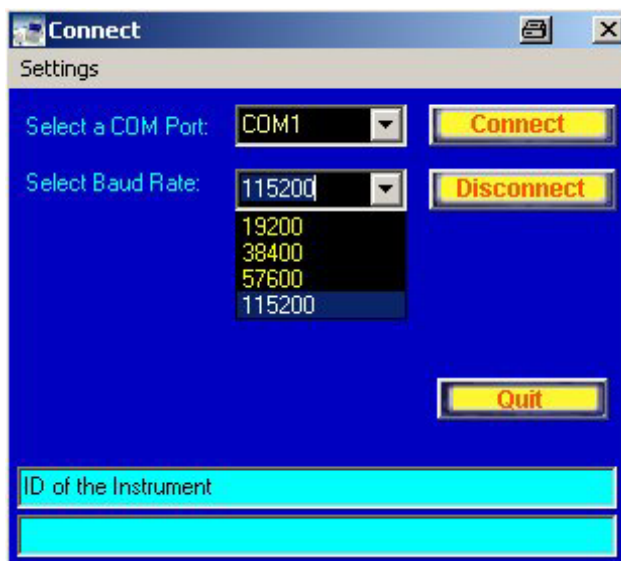

Fig 5 The Connect window for Direct Serial Port Connection

Once the connection has been established, the serial number of the connected FSH is displayed and the *Connect* window is closed.

With a telephone modem at each end:

Make sure to have set up the modem at the FSH end according to the instructions given above. Connect one modem to the PC and the fixed phone network, and the other to the FSH using the optical RS-232-C serial cable and (of course) also to the telephone line.

As both the FSH and the modem are data end equipment of equal status, an additional null modem (crosslink) cable must be connected to the RS-232-C cable using a male-male gender changer. Small adapters with these functions are also commercially available (see picture).

Fig 6 Connect the FSH to a modem or mobile phone using a null modem
adapter (crosslink cable) and a male-male gender changer

To establish the connection select *Two Modems Connection* from the
Connection menu. The *Connect* window opens to specify the connection
set up.

Fig 7 The Connect menu for Two Modems Connection

Select the COM port and the baud rate for the PC side of the connection.
As the modem is connected directly to the PC a relatively high data rate (up
to 115 kbaud) can be selected.

The baud rate that the modem on the FSH side uses to transfer data is
specified in the SETTINGS.INI file. If 19200 baud is selected, the FSH must
be set up for 19200, too. See additional information in Appendix A.

Data transfer with 19200 baud should always be possible with a 56-k modem. For higher data rates, perform a test. Enter the telephone number of the target modem and click on *Dial Number*. If the connection is successfully established, a picture of an FSH appears on the FSHRemote main menu beneath the *Measure* button.

Note: *Some modems and mobile phones cannot sufficiently supply the optical RS-232-C serial cable with power. A separate power supply and buffer amplifier must be incorporated in the set up instead of the null modem adapter and the gender changer. A circuit diagram for a suitable buffer amplifier is included in Appendix A.*

With a mobile phone at each end

Make sure to have set up the mobile phone at the FSH end according to the instructions given above. Connect the PC to a mobile phone using the serial cable supplied with the GPRS mobile phone (or wireless terminal). Connect the FSH to the other mobile phone using the optical RS-232-C serial cable, with a null modem adapter and a male-male adapter as described above for a telephone modem.

To establish the connection select *Two Mobile Phones Connection* from the *Connection* menu. The *Connect* window opens to specify the connection set up.
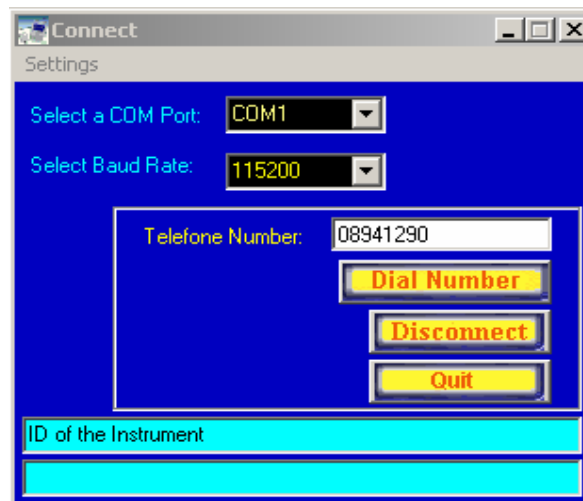
Select the COM port and the baud rate for the PC side of the connection, as determined by the attached mobile phone. The baud rate that the mobile phone on the FSH side uses to transfer data is specified in the SETTINGS.INI file and is stored in the mobile phone with Set Devices. If 19200 baud is selected, the FSH must be set up for 19200, too.

We recommend the use of 2 GPRS mobile phones with a baud rate of 19200 baud. See additional information in Appendix A.

Enter the data (!) telephone number of the mobile phone attached to the FSH and click on *Dial Number*. The connection can take several minutes, please be patient. If the connection is successfully established, a picture of an FSH appears on the FSHRemote main menu beneath the *Measure* button.

Mixed telephone modem and mobile phone modem connection:

Connect the modem and mobile phone to the PC and FSH as described above.

Enter the connection data, as described above, using *Connection - Modem to Mobile Phone Connection* or *Connection - Mobile Phone to Modem Connection* as applicable*.* We recommend a baud rate of 19200 for the connection.

Note: *Each window includes the buttons Save Settings and Load Settings. Save Settings saves the current settings for COM port, baud rate, and phone number. Load Settings recalls the last saved settings. No need to re-enter the same data each time a connection is established.*
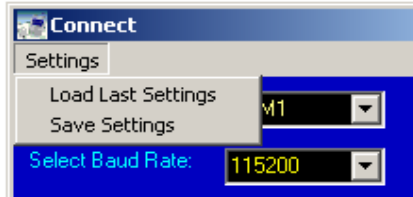

Fig 8 Saving and recalling connection settings

Warning: *If an FSH running in battery mode is switched off and back on, the baud rate is reset to 19200. If you are working with higher baud rates, de-activate the Auto Power Down function and connect FSH to an uninteruptable power supply.*

TCP/IP connection with a serial server (LAN-RS232 converter) and a network connection:

Make sure to have set up the serial server at the FSH end according to the instructions given above. Connect the PC to the LAN/Internet network, and the serial server to the FSH using the optical RS-232-C serial cable, and to the network.
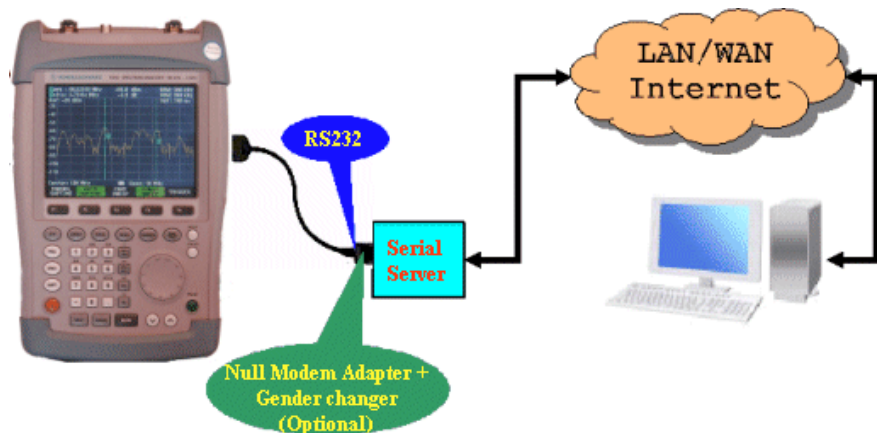

Fig 9 LAN/Internet connection using the TCP/IP protocol

As both the FSH and the serial server may be data end-equipment of equal status, an additional null modem (crosslink) cable may have to be connected to the RS-232-C cable using a male-male gender changer. Small adapters with these functions are commercially available. There are also serial servers, which do not need these additional adapters. Refer to the manual of your serial server to see which is the case. To establish a connection to the serial server with the specified IP address, it has to match the range of IP addresses the PC with FSHRemote can communicate within its current sub group. This range of addresses is determined by the setting of the PC's own IP address and the network sub-mask setting, which can be found in the Control Panel / Network settings

under "Properties" for the "Internet Protocol" (TCP/IP) components. The IP communication protocol can be tested with the following command:

```
C:\>ping <hostname>
```

If the serial server is not visible you may have to change the settings of its IP address, network sub-mask, (standard gateway). Please refer to the manual of your serial server in this case.
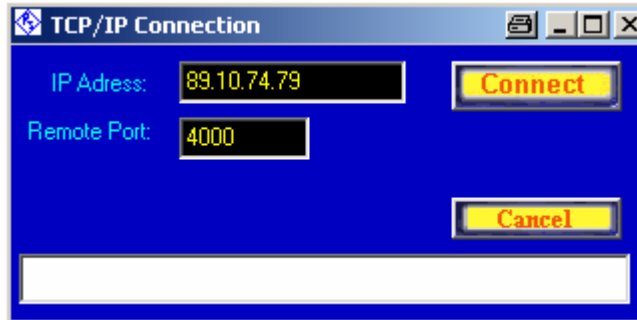

Fig 10 TCP/IP Connection dialog box

Note: *The settings for the IP address and the port number in the TCP/IP Connection dialog box are automatically saved after a connection has been established, so that you don't have to enter them manually every time.*

Warning: *If an FSH running in battery mode is switched off and back on, the baud rate is reset to 19200. If you are working with higher baud rates, de-activate the Auto Power Down function and connect FSH to an uninteruptable power supply.*

6 Operating FSHRemote

Once a connection is established between the FSH and the PC, FSHRemote displays "Connected" in its main window, a picture of an FSH and at the bottom of the main window the elapsed time since the connection has been established.

Fig 11 The display once a connection is established

Setting the FSH

FSHRemote provides access to all the functions that can be set directly on an FSH:

- Frequency
- Span
- Level settings
- Bandwidth
- Sweep
- Trace
- Marker functions

Additionally, the Measure Button and the switches that appear on the lower right provide access to all the measuring options of the FSH such as Analyzer*, Tracking, Pwr Sensor, TDMA Power, Chan Pwr, Occ BW and Dist Fault* The *PR* and *Disconnect* buttons are only usable while a connection to the FSH exists. *PR* activates a *PRESET* of FSH, *Disconnect* ends the connection.

Use the input field to the left of the *Send* button to manually input any command from the "Remote Control for R&S FSH FSH-K1" Operating Manual. The field to the right shows the response from the FSH. Note that all

commands must be preceded by a CMD, GET or SEND, followed by the required command. You may use the Return key of your PC instead of the *Send* button to send your commands to FSH.

Example: read the measured spectrum

The arrow key on the upper right retrieves the current measurement data from the FSH. The time required depends on the type of connection. With a modem to modem fixed line connection, the retrieval time is less than an second; for a GPRS connection the retrieval can take up to 4 seconds depending on the quality of the mobile radio connection. For sweep times of more than 1 second, the sweep time must be added, too. For each query the FSH sends about 1.2 kByte data to the PC (2.4 kByte if Auto Peak Detector is used).

The key requests continuous reading of the measurement data. The repeat rate depends on the type of connection. For a GPRS connection and a short sweep time, a rate of about 0,25 s^{-1} (a measurement every 4 seconds) is obtained, for a fixed line connection, about 1 s^{-1} (a measurement every second) is obtained. If sweep time is set to values above 1 second, repetition rate is decreased accordingly.

In Continuous mode, stop data retrieval with the button before entering a command. To read the current values, click on the software button as appropriate. To establish the center frequency set on the FSH, first click on the *Frequency* button. Beneath the measurement display, user interface elements for setting frequency appear; click on *Center Frequency*, to send the query from FSHRemote to the FSH. The current value for center frequency is displayed beneath the buttons.

Note: *If you are working in single sweep mode and wish to initiate a new sweep, click on the* *button. If you only wish to update the display without initating a new sweep, click on the* *button and then on the* *button.*

To alter a value enter the new value in the window and press Return. Enter the value in either:

-       scientific notation. For example; 100e-3 for 0,1 or 98,5e6 for 98,5 MHz)

-       suitable SI abbreviations for the unit. For example; 100 m for 100e-3 or 10 M for 10e6

-       decimal separator: use , (comma) or . (dot) according to the country settings of your operating system

Almost all the functions provided by the FSH can be used. To work with markers, click on the *Marker* button. FSHRemote checks which markers are active and displays them in the measurement curve. Switch on the marker, respectively the delta marker, by activating the selection box *Marker On/Off* or *Delta On/Off*. read the current values of the markers use the soft buttons beneath the measurement display. In order to set a new value for a marker enter the new setting in the text filed beneath its soft button and press ENTER. The marker goes to the specified new position.

Note the status messages displayed at the bottom of the FSHRemote window. These messages show information about the current action as well

as the time required for the action. Before beginning a new action, wait until the "finished" message from the preceding action is displayed.

Fig 12 Status Messages

Note: *Some functions of the FSH require the connection of measurement bridges, calibration standards or similar equipment. In remote operation, an operator must have access to the FSH to complete the test set up. Only use such functions when the correct set up has been confirmed.*

Saving measurement data:

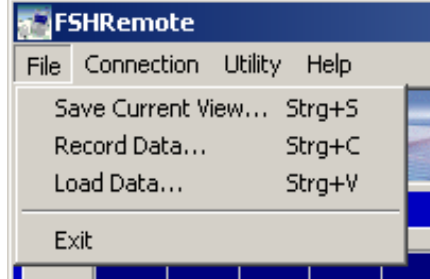The *File* menu includes functions to save measurement data.

Fig 13 The Edit Menu

Save Current View writes the currently displayed data to an ASCII file. Depending on the detectors activated, frequency and the accompanying level values, or frequency, minimum and maximum levels (with the AUTOPEAK detector) are stored.

Use *Load data* to recall and display a set of stored values.

Record Data writes the current values at a time interval which can be set to any value from 1 second to about 50 days. Select *Record Data* and enter time interval in the **Record Time Interval** dialog box:

Fig 14 The Record Time Interval dialog box

Then enter the name of the file to store the data in. The smallest possible interval is determined by the type of connection between the PC and the FSH. With a mobile radio connection, data transfer can be up to 4 seconds, which has consequences for the minimum interval. Add sweep time, if sweep time is set to values above 1 second.

To stop recording data, click on .

Note: *In order to keep the data traffic low FSHRemote keeps track of the main FSH settings such as the frequency, span, etc. in an internal database. Click on the soft buttons underneath the measurement display to update these values. If the instrument is presetted using the PR button these values are presetted as well.*

7 Additional Information

For general information about using the FSH and its features, see the FSH Operating Manual and the FSH-K1 (Remote Control) Operating Manual.

Please send any comments or suggestions about this application note to **TM-Applications@rsd.rohde-schwarz.com**.

If you have a request for support for your own programs for remote-controlling the FSH, please send it to the above address.

Please note further, that a complete solution for spectrum monitoring is available from Rohde&Schwarz called R&S®_ARGUS Spectrum Monitoring System. FSH is well suited for integration into ARGUS. For detailed information please refer to **www.argus.rohde-schwarz.com** or contact us via e-mail to **argus@rohde-schwarz.com** .

8 Ordering Information

Handheld Spectrum Analyzer

R&S®FSH3 with Preamplifier	100 kHz to 3 GHz	1145.5850.03
R&S®FSH3 with Tracking Generator	100 kHz to 3 GHz	1145.5850.13
R&S®FSH3 with Tracking Generator and Preamplifier	100 kHz to 3 GHz	1145.5850.23
R&S®FSH6 with Preamplifier	100 kHz to 6 GHz	1145.5850.06
R&S®FSH6 with Tracking Generator and Preamplifier	100 kHz to 6 GHz	1145.5850.26

Remote Control (required)

Remote Control using RS-232-C R&S®FSH-K1	1157.3458.02

For additional information about the FSH, see the Rohde & Schwarz website at www.rohde-schwarz.com. Use "FSH" as a search string.

9   Appendix A

The SETTINGS.INI File

The SETTINGS.INI file contains the commands to configure the modems and mobile phones used for the connection. Use any text editor to modify and extend the file.

SETTINGS.INI consists of a number of blocks. The first block, DEVICES, contains the names of the modems used; enter the names of your choice. The supplied example file includes two telephone modems and two mobile phones. The following blocks begin with the names of the example devices, and include the commands for the corresponding device.

```
[DEVICES]
INIT1=MODEM_CREATIVE_FSH          Modem at FSH, eg: Creative Labs
INIT2=MODEM_ELSA_FSH              Modem at FSH, eg: ELSA
INIT3=NOKIA6310_PC               Mobile phone at the PC eg: Nokia 6310,
INIT4=NOKIA6310_FSH              Mobile phone at the FSH eg:Nokia 6310,

[MODEM_CREATIVE_FSH]              commands for CREATIVE modem at FSH
INIT1=ATQ0
INIT2=AT&F
INIT3=ATS0=1
INIT4=AT&C0
INIT5=AT+IPR=19200
INIT6=ATQ1
INIT7=AT&W0

[MODEM_ELSA_FSH]                 commands for ELSA modem at FSH
INIT1=ATQ0
INIT2=AT&F
INIT3=ATS0=1
INIT4=AT&C0
INIT5=AT%B=19200
INIT6=ATQ1
INIT7=AT&W0

[NOKIA6310_PC]                   commands for Nokia 6310 at PC
INIT1=ATQ0
INIT2=AT+CGATT=1
INIT3=AT&W0

[NOKIA6310_FSH]                  commands for Nokia 6310 at FSH
INIT1=ATQ0
INIT2=ATS0=1
INIT3=AT+CGATT=1
INIT4=AT+IPR=19200
INIT5=ATQ1
INIT6=AT&W0
```

To define a modem, add the name to the DEVICES block and add a block with the defined name containing the AT commands for the modem. Devices that are not required can be deleted.

The commands have the following meanings:

ATQ0 switches the output of the modem result codes on. ATQ1 switches the output of the modem result codes off.

ATS0=1 sets the modem to respond to an incoming call at the first ring tone

AT&W0 saves the settings permanently in modem memory 0

AT+CGATT=1 switches a mobile phone into GPRS mode

AT+IPR=19200 or AT%B=19200 sets the baud rate for the modem at the FSH end to 19200 baud. This baud rate must also be set as the Serial Baud-Rate in the setup of the FSH itself.

Note: *The modem or mobile phone at the FSH must be configured using SETTINGS.INI prior to the first connection. At the PC end, the default values of modems can be used, mobile phones have to be configured as well.*

For further commands and information about the commands, please see the manual supplied with your modem or mobile phone.

Recommended Wiring for a Null Modem Adapter

The cables supplied with modems, mobile phones, and the FSH are normally intended for connecting the device to a PC. To connect the FSH to a modem or mobile phone, a null mode adapter is required to connect to the supplied cable. The diagram below shows the wiring required between two male plugs.

Note that all pins on both ends are connected, apart from pin 9.
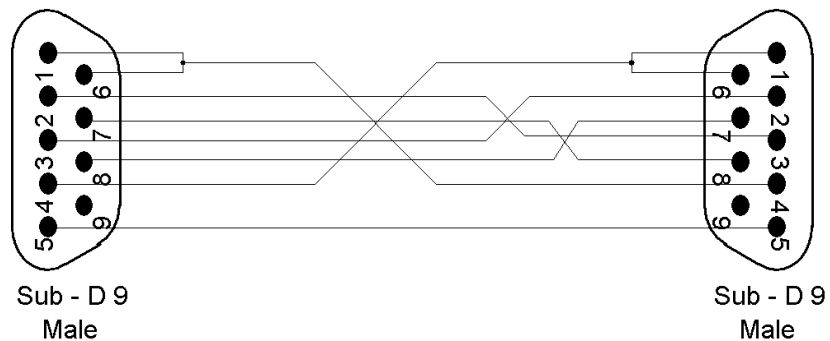

Fig 15 Wiring for a null modem adapter

The wiring can also consist of a null mode cable, connected to a gender changer to change the female plug into a male plug.

Recommended Wiring for a Buffer Amplifier

Some modems or mobile phones do not have enough power or the necessary level to power the FSH's optical RS-232-C cable. In such cases a buffer amplifier and 5V power supply is required.

The assembly of an amplifier corresponding to the diagram below makes no particularly special requirements and can be assembled on a normal experimental board or with a simple printed circuit board.
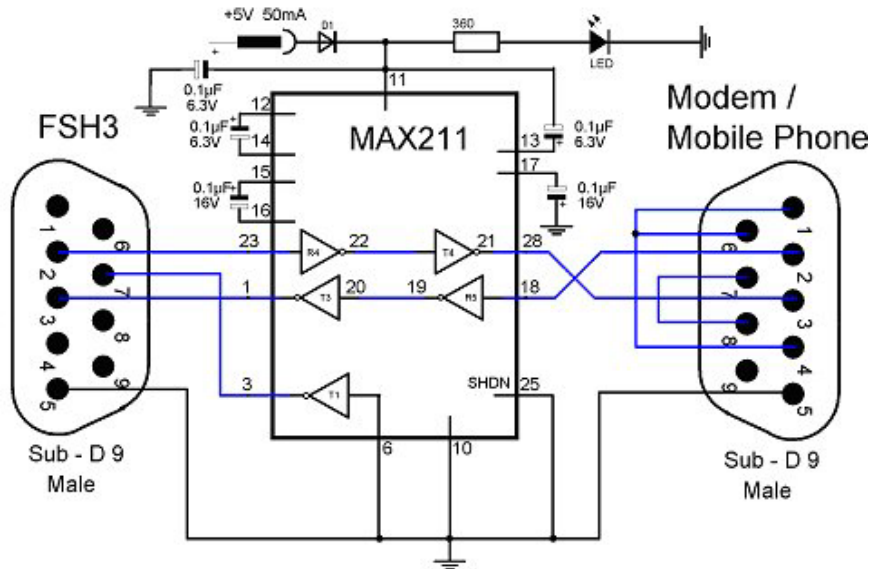

Fig 16 Wiring for a null modem adapter with a buffer amplifier

The connections from pins 1,4 and 6, or 7 and 8, from the modem support the data handshake without which many modems will not function correctly. The connection from pin 2 on the modem side to pin 3 on the FSH side transfers data from the modem to the FSH. The connection from pin 2 on the FSH side to pin 3 on the modem side transfers data from the FSH to the modem. The connection to pin 7 on the FSH side provides power for the optical RS-232-C serial cable.

Additional notes

<u>Data telephone number:</u>

Some mobile radio operators provide a separate telephone number for data communications as opposed to the 'normal' number for voice calls. Only the data telephone number supports the necessary high baud rate for remote control. A connection to a voice call number with a data rate of usually only 9600 baud will probably be too slow to operate the FSH successfully.

<u>Baud rate for telephone modems:</u>

The specified maximum modem baud rate usually only applies in the direction from the network to the PC or the connected terminal. In the other direction from the PC to the network, the majority of modems have a maximum data rate of 33,000 baud. This is too slow to set the FSH for a baud rate of 38,400, so the FSH must be set for a baud rate of 19,200. The modem on the FSH side must also be set to this speed using the SETTINGS.INI file.

<u>Baud rate for mobile phone connections:</u>

The majority of mobile phone networks are optimised for maximum data rates from the base station to the mobile phone, too. The direction from the mobile phone to the base station, as required when the FSH connected to a mobile phone sends data, is mostly notably slower.

Class 6 and class 10 GPRS mobile phones can in principle use two time slots to upload data, resulting in a maximum data rate to the base station of 28,800 baud. However, this data rate is still not enough to operate the FSH with a quicker baud rate than 19,200. UMTS networks will be the first to offer still higher data rates. In GPRS there is also an additional delay time in data transfer in both directions of 0.5 seconds.

<u>Error messages:</u>

Error messages are generated when a function cannot run, or failed to complete.

Some FSH models do not support all functions. For example, if the tracking generator is not built in, an error message is generated if an attempt is made to switch on tracking. The error code of the error message is displayed; for details see "Acknowledge Response" in the FSH-K1 Operating Guide.

<u>Internet connections and firewalls:</u>

If the local area network of the PC with FSHRemote and/ or the local area network of the serial server providing the FSH with an IP address (if they are not directly connected to the internet) are hidden behind firewalls, certain settings to these firewalls may have to be made, to allow the access in both directions.

1. The serial server of FSHRemote is behind the firewall of its LAN: The firewall administrator has to open a port in the firewall and associate it with the service of the serial server so that it is visible from the outside world. Please note that opening ports

in the firewall may present a threat to the network from outside attacks.

2. The PC with FSHRemote is behind the firewall of a LAN: In this case the administrator of the firewall has to allow this PC to access IPs outside the LAN's domain.

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