



University  
of Pardubice  
Faculty  
of Electrical Engineering  
and Informatics

# The Remote Control of Rohde&Schwarz Devices

Matěj Petkov

# INTRODUCTION

---

- Since the 1970s, as the automation of measuring instruments reached a high level, the remote control of these devices has become an inevitable part of the domain. The development of faster and more accurate measuring instruments has led to a need for some sophisticated and (more importantly) standardized way of communication.
- In answer to this demand, several standards have been published which cover issues of physical layer and communication protocols. The last extension of the standards was published in 1990 and introduced the idea of unified programming language known as SCPI.
- All advantages of the standardization enabled to create a custom-made application for remote control of many Rohde&Schwarz instruments which the Department of Electrical Engineering is equipped by.



# OBJECTIVES

---

- Assessment of possibilities of realization of the remote control of R&S instruments
- Design of a suitable method of assembling ATE (Automatic Test Equipment) system with emphasis on simplicity and speed of data transmission
- Creation of GUI application for remote control with following capabilities:
  - ❑ reading measured data and sending commands into instruments
  - ❑ setting instruments' parameters
  - ❑ export of measured data (primarily as numerical values for further processing, alternatively as graphical output)



# MATERIAL & METHOD

---

## SCPI Commands

- *Standard Commands for Programmable Instruments*
- SCPI is a universal programming „language“ of measuring instruments with its own specific **hierarchical** syntax
- SCPI are sent to the instrument in the form of **text string** → the translation is provided by VISA library (see below)
- There are two forms of SCPI: „**command**“ and „**query**“, each used for one direction of communication with an instrument



# MATERIAL & METHOD



## VISA Library

- *Virtual Instrument Software Architecture*
- Library of functions and protocols which enable the communication between PC and an instrument
- VISA extracts SCPI used in a high-level programming language (Matlab) and sends it to an instrument in a comprehensible form

LAYERS	PROTOCOLS
7. Application	SCPI
<b>6. Presentation</b>	XDR (VXI-11)
<b>5. Session</b>	ONC-RPC
4. Transport	TCP / UDP
3. Network	IP
2. Data link	Ethernet / 802.3
1. Physical	802.3 / 10BASE-T

# MATERIAL & METHOD

---

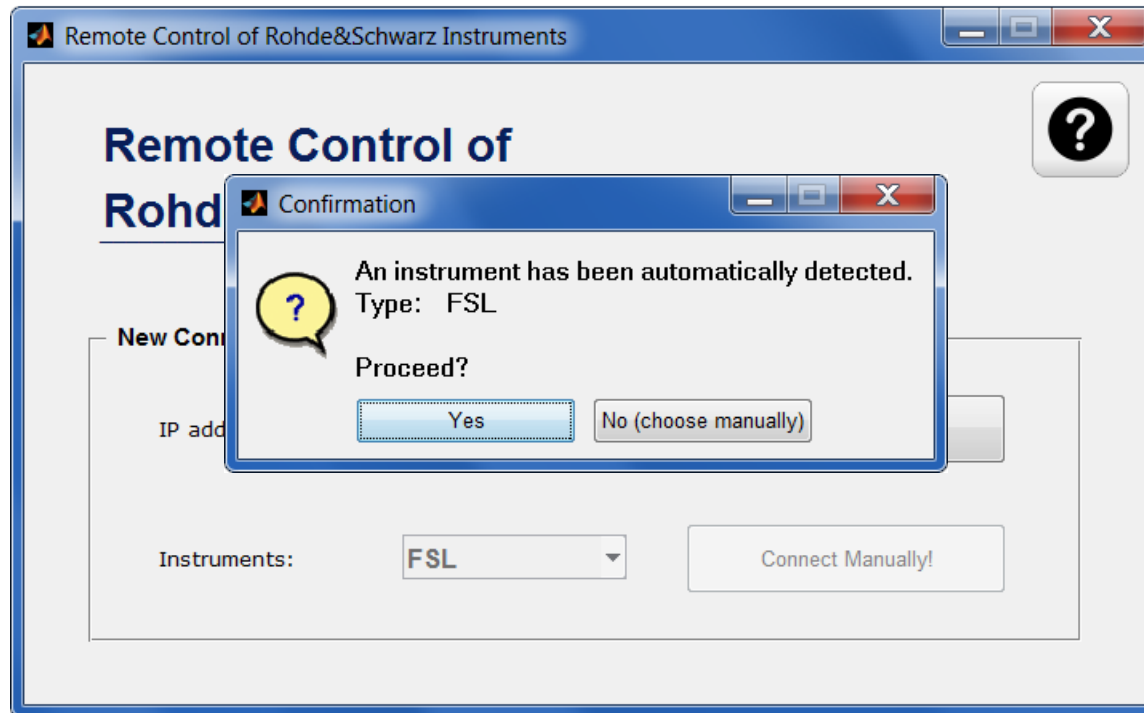
## Summary of conditions for development and successful use of application for remote control

- The following conditions had been recognized as the best way to fulfill the stated objectives:
  - the requirement of speed and simplicity satisfies the connection via *Ethernet*
  - the communication between PC and an instrument is provided by *SCPI* which require *VISA library* installed on controlling computer
  - the use of *MATLAB environment* is highly convenient because of the ease of further data processing



# MATERIAL & METHOD

## The Connection Window



# MATERIAL & METHOD

## GUI for Remote Control of R&S FSL Spectrum Analyzer

The screenshot displays the FSL-GUI software interface, which is designed for the remote control of an R&S FSL Spectrum Analyzer. The interface is organized into several functional panels:

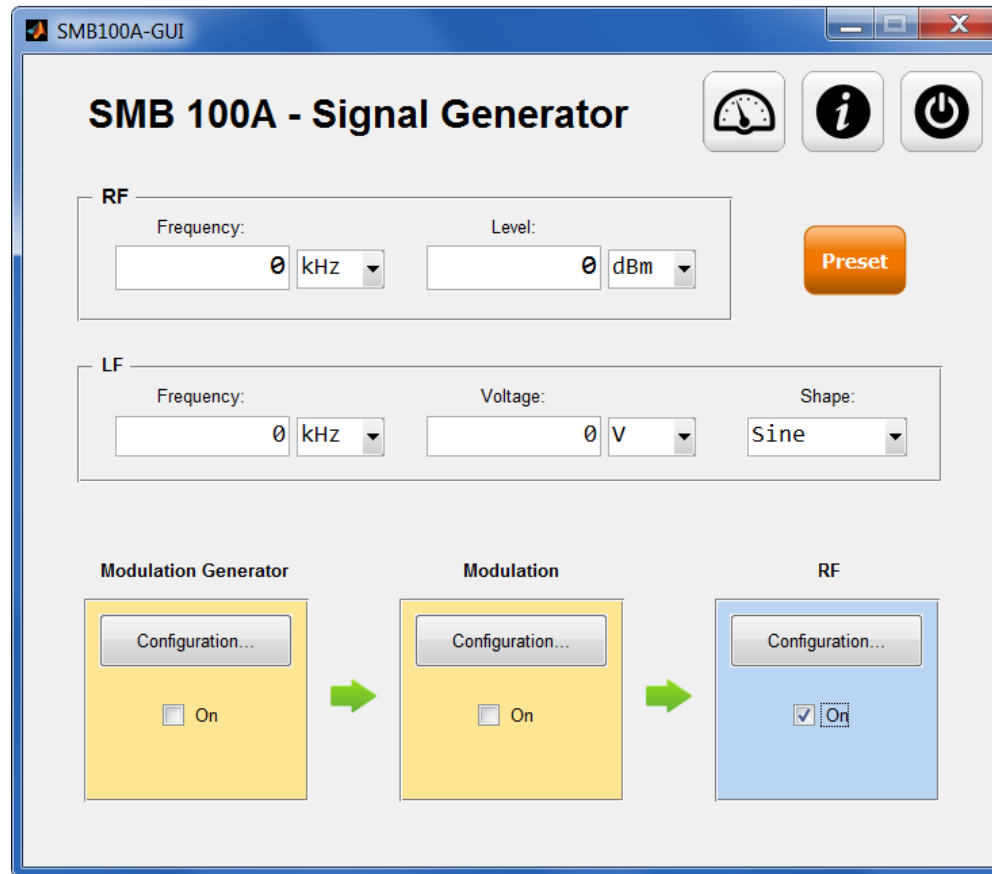
- Options:** Includes icons for help, information, and power, along with a prominent orange "Preset" button.
- Frequency:** Features input fields for Center, Span, Start, and Stop frequencies, all currently set to 0 kHz. A "Full Span" button is also present.
- Trace Mode:** Offers selection options for "Write", "Max Hold", "Min Hold", and "Average".
- Sweep Options:** Configures "Sweep Time" (0.025 - 16000 s) and "Sweep Count" (0 - 32767), both currently set to 0.
- Settings:** Includes buttons for "Single Sweep" and "Continuous Sweep", and an "Update time" field set to 1 sec.
- Markers:** Four marker panels (Marker #1 to #4) are shown, each with X and Y position inputs (in kHz and dBm) and "Turn OFF" buttons. Marker #1 has a "Delta" section. Navigation buttons for "Minimum", "Maximum", and "Read Marker Position" are provided.
- Manual Data Cursor:** A "Turn ON" button is located at the bottom left.
- Export Options:** Includes a "Sweep Points" field (101 - 32001) set to 0, a "Back up Workspace" checkbox (checked), and buttons for "To Workspace", "As CSV", "As Image", and "As Figure".

The central area of the GUI is a plot window with a grid, currently empty, representing the spectrum analyzer's display.



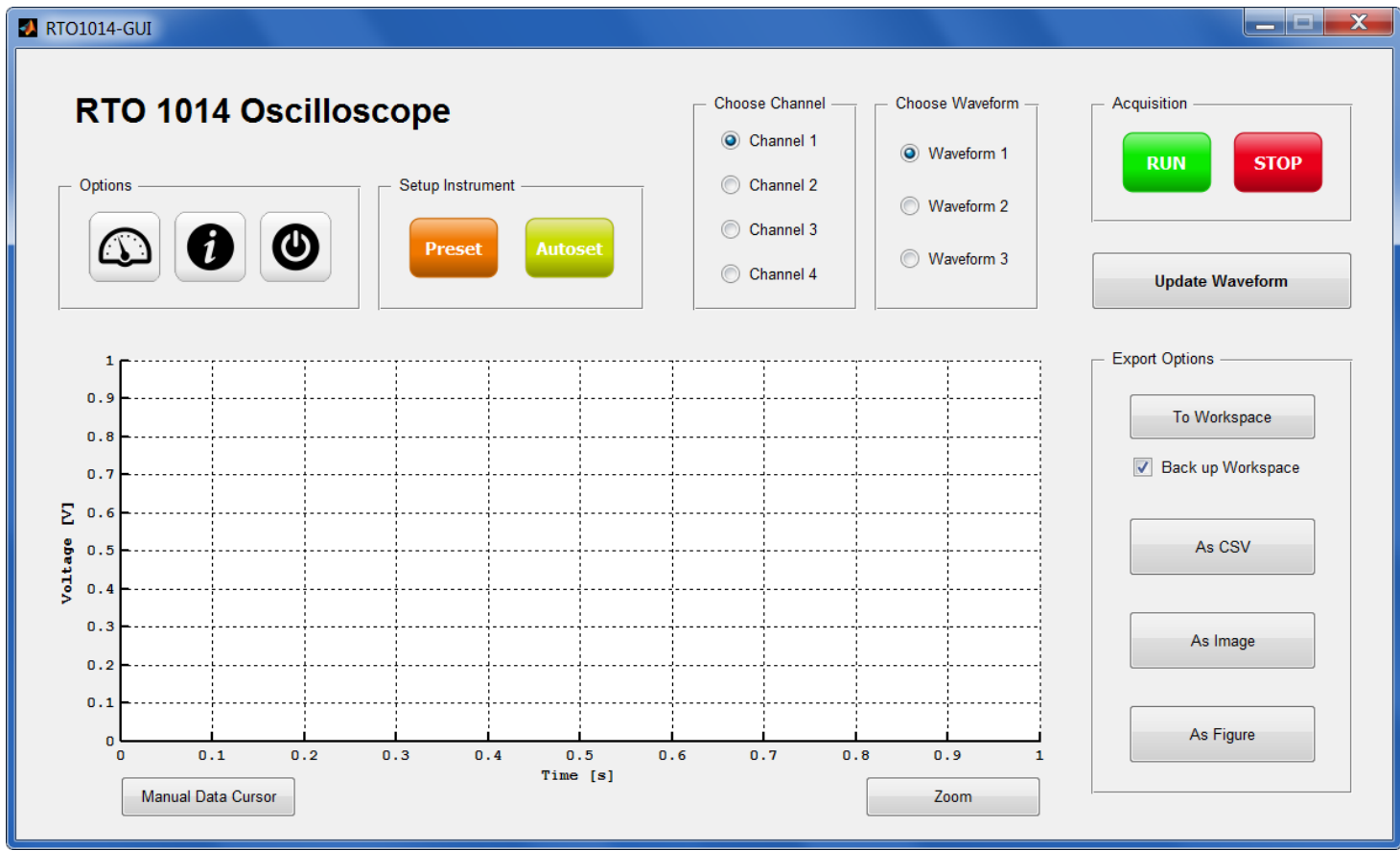
# MATERIAL & METHOD

## GUI for Remote Control of R&S SMB100A Signal Generator



# MATERIAL & METHOD

## GUI for Remote Control of R&S RTO1014 Oscilloscope



# RESULTS

---

- All stated objectives have been fulfilled
- While the application was still in development the designed way of assembling ATE system (via Ethernet using SCPI + VISA) already proved itself to be successful not only in testing measurements, but also in actual tasks
- The application has been tested during the developing phase which enabled to incorporate all the potential suggestions (either functional or just graphical) so the result would have fit its future utilization



