Products: R&S® SMU200A, R&S® SMJ100A, R&S® SMATE200A, R&S® SMIQ0xB

R&S® FM-ARB

PC Software for generating
FM/PM/AM signals in the ARB

Application Note

The software R&S® FM-ARB creates waveforms with Frequency Modulation, Phase Modulation or Amplitude Modulation. Those waveforms can be directly transferred to the selected Arbitrary Waveform Generator or saved to a file for later use.

Contents

The following abbreviations are used troughout the application note for R&S test equipment:

- The vector signal generator R&S® SMU200A is referred to as SMU

- The vector signal generator R&S® SMJ100A is referred to as SMJ

- The vector signal generator R&S® SMATE200A is referred to as SMATE

- The vector signal generator R&S® SMIQ is referred to as SMIQ

1 Overview

R&S® FM-ARB is a program for generating waveforms with frequency modulation, phase modulation or amplitude modulation for use with the arbitrary waveform generators SMU, SMJ, SMATE and SMIQ0xB. The waveforms can be directly transferred to a connected ARB via GPIB. Furthermore the waveform can be saved to a file for later use.

2 Software Features

R&S® FM-ARB is used to generate waveforms with frequency or amplitude modulation. The program offers:

- Generation of FM signals
- Generation of PM signals
- Generation of AM (double, upper and lower sideband) signals
- Direct transfer of the generated waveform to the instrument
- Save waveform to a file for later use

3 Hardware and Software Requirements

Instrument Requirements

One of the following instruments with the designated options is required

Instrument	Options
R&S® SMU200A	R&S® SMU-B10 or R&S® SMU-B11
R&S® SMJ100A	R&S® SMJ-B10 or R&S® SMJ-B11
R&S® SMATE200A	R&S® SMATE-B10 or R&S® SMATE-B11
R&S® SMIQ0xB	R&S® SMIQ-B60

Hardware Requirements

	Minimum	Recommended
CPU	450 MHz	450 MHz or higher
RAM	128 Mbyte	256 Mbyte
Hard disk	5.5 Mbyte free space	10 Mbyte free space
Monitor	VGA 800 x 600	XGA 1024 x 768 or better
IEEE bus	National Instrument or Agilent IEEE bus interface	National Instrument IEEE bus interface

Software Requirements

	Minimum	Recommended
OS	Windows NT 4.0/ 2000 / XP	Windows XP
IEEE bus	Driver V 2.20	Driver V 2.20 or higher

4 Connecting the Computer and the Instrument

Connect the computer on which the R&S® FM-ARB is running via IEEE bus to the desired instrument. Several instruments can be connected at the same time, such as a SMU and a SMJ. Selection is done via the instrument's IEC/IEEE bus address. Make sure the addresses are unambiguously specified. An address can not be assigned twice.

5 Installing the Software

The setup file "FM-ARB_<Version Number>.exe" is necessary for installing the R&S® FM-ARB software on the PC. The software can be downloaded from the R&S® FM-ARB homepage [7].

Execute the installation program and select the installation directory. During installation, program files are copied to a directory of your choice. A new menu item FM-ARB is created in the START menu of your Windows system.

6 Starting and Operating the Software

When starting the R&S® FM-ARB software the following display is shown:
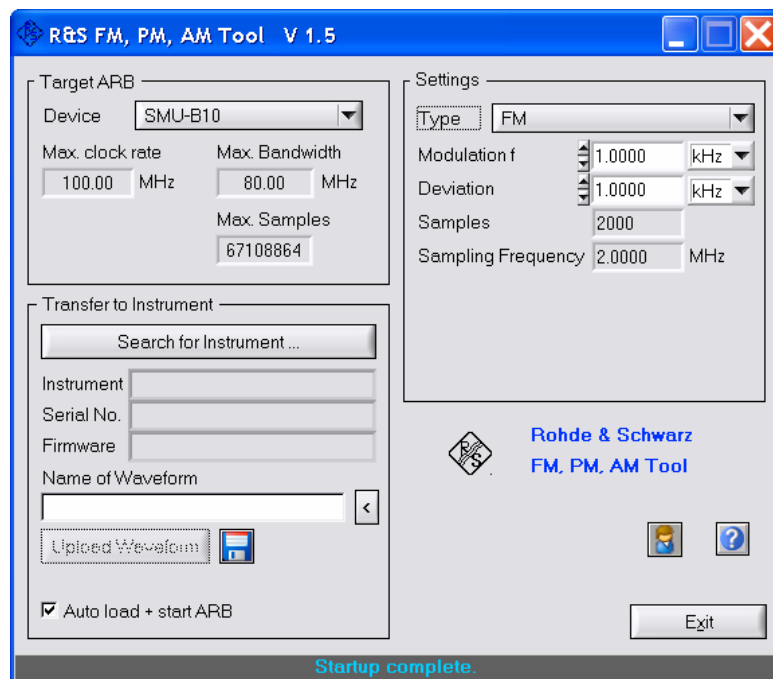
Target ARB

Select Target ARB

Selection of the ARB for which the waveform should be generated. Available are the following ARBs:

- R&S® SMU-B10 and R&S® SMU-B11
- R&S® SMJ-B10 and R&S® SMJ-B11
- R&S® SMATE-B10 and R&S® SMATE-B11
- R&S® SMIQ-B60

Max. Clock Frequency (read only)

Indication of the maximum possible clock frequency for the selected ARB.

Max. Bandwidth (read only)

Indication of the maximum possible bandwidth for the selected ARB.

Settings

Type of Modulation

Selection of the type of modulation for which the waveform should be generated. Selected can be Frequency Modulation, Phase Modulation or Amplitude Modulation. For Amplitude Modulation it can be chosen between double side band, upper side band and lower side band (each with or without carrier).

Available are the flowing modulations

- FM   – Frequency modulation
- FM two tone   – Frequency modulation with two signals
- PM   – Phase modulation
- AM   – Amplitude modulation

In case of Amplitude Modulation one of the following forms can be chosen:

- Normal   – Double sideband with carrier
- USB wo. carrier – Upper sideband with suppressed carrier
- LSB wo. carrier – Lower sideband with suppressed carrier
- USB w. carrier   – Upper sideband with carrier
- LSB w. carrier   – Lower sideband with carrier
- DSSC   – Double sideband suppressed carrier
- ISB with carrier – Independent sideband with carrier
- ISB w/o carrier   – Independent sideband w/o carrier

Modulation Frequency

Frequency of the modulating signal. The maximum frequency is dependent on the maximum clock frequency of the ARB.

$$f_{mod} \leq \frac{f_{max \; clock \; frequency}}{oversampling}$$ whereas the minimum oversampling factor is 4.

Deviation (Frequency/Phase Modulation)

Deviation of the modulating signal. The maximum deviation depends on the maximum clock frequency of the ARB as well as the I/Q bandwidth of the selected instrument.

The required bandwidth of a FM signal is

$$B = 2 * (f_{deviation} + f_{mod})$$

The maximum deviation is therefore dependent on the selected modulation frequency and the I/Q bandwidth of the instrument.

Modulation Depth (Amplitude Modulation)

Modulation depth of the AM signal. Can be set between 0% and 100%. A modulation depth of 0% means an unmodulated signal.

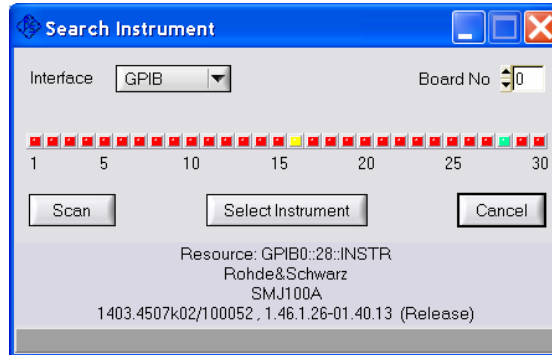### Oversampling (read only)

Indicates the current oversampling rate.

Sampling Frequency (read only)

Indicates the current sampling frequency.

Transfer to Instrument

Search for Instrument

Opens the following dialog and scans the IEC/IEEE bus for connected instruments.

Green LED   indicates an instrument which can be chosen

Yellow LED   indicates an instrument which can not be chosen

Red LED   indicates that no instrument is listening on this address

To select an instrument click on a green LED.

Information on selected Instrument (read only)

Information about the selected instrument is given:

- Name of the instrument
- Serial number
- Firmware version
- IEC/IEEE address

Name of Waveform

Name of the waveform to be generated. The waveform can be selected under this name once transferred to the instrument.

Transfer Waveform

Transfers the waveform to the selected ARB. In case of SMU, SMJ and SMATE a separate window is opened allowing to chose where the waveform should be saved to.
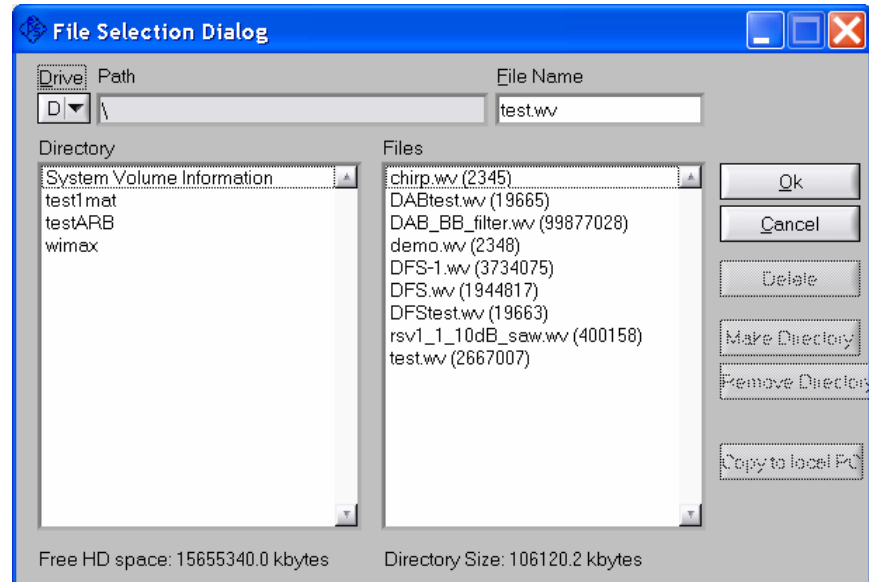
The Transfer Waveform button is only available if the following conditions are met:

- Instrument selected
- Name for waveform given

Auto load and start waveform

If checked the waveform is automatically loaded into the ARB memory and the state of the ARB is set to ON. For instruments with two baseband generators installed the path can be selected.

Save to File

Saving a waveform file with the current modulation parameters. The following dialog is opened:
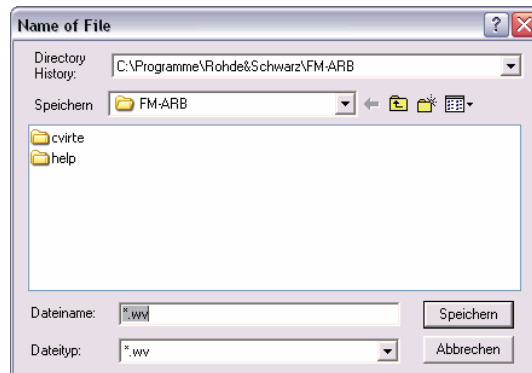
The waveform can be saved either as *.wv File for later use or as *.ibn file for use in the Multi Carrier Mixed Mode in R&S® WinIQSIM™ [8].

7   References

[1] Signal Generator R&S® SMU200A – Product Brochure
  PD 0758.0197.12

[2] Signal Generator R&S® SMJ100A – Product Brochure
  PD 5213.5074.12

[3] Signal Generator R&S® SMATE200A – Product Brochure
  PD 0758.1893.12

[4] R&S® SMU200A website: www.rohde-schwarz.com/product/SMU

[5] R&S® SMJ100A website: www.rohde-schwarz.com/product/SMJ

[6] R&S® SMATE200A website: www.rohde-schwarz.com/product/SMATE

[7] R&S® FM-ARB homepage: www.rohde-schwarz.com/appnote/1GP59

[8] R&S® WinIQSIM™ website: www.rohde-schwarz.com/product/WinIQSIM

8   Ordering information

Type of instrument		
R&S® SMU200A	Vector Signal Generator	1141.2005K02
R&S® SMU-B102	Frequency option 2.2 GHz, 1st RF path	1141.8503.02
R&S® SMU-B103	Frequency option 3 GHz, 1st RF path	1141.8603.02
R&S® SMU-B104	Frequency option 4 GHz, 1st RF path	1141.8603.02
R&S® SMU-B106	Frequency option 6 GHz, 1st RF path	1141.8803.02
R&S® SMU-B202	Frequency option 2.2 GHz, 2nd RF path	1141.9400.02
R&S® SMU-B203	Frequency option 3 GHz, 2nd RF path	1141.9500.02
R&S® SMU-B13	Baseband Main Module	1141.8003.04
R&S® SMU-B10	Baseband Generator with ARB (64 Msamples)	1141.7007.02
R&S® SMU-B11	Baseband Generator with ARB (16 Msamples)	1159.8411.02
R&S® SMJ100A	Vector Signal Generator	1403.4507K02
R&S® SMJ-B103	Frequency option 3 GHz	1403.8502.02
R&S® SMJ-B106	Frequency option 6 GHz	1403.8702.02
R&S® SMJ-B13	Baseband Main Module	1403.9109.02
R&S® SMJ-B10	Baseband Generator with ARB (64 Msamples)	1403.8902.02
R&S® SMJ-B11	Baseband Generator with ARB (16 Msamples)	1403.9009.02
R&S® SMATE200A	Vector Signal Generator	1400.7005K02
R&S® SMATE-B103	Frequency option 3 GHz, 1st RF path	1401.1000.02
R&S® SMATE-B106	Frequency option 6 GHz, 1st RF path	1401.1200.02
R&S® SMATE-B203	Frequency option 3 GHz, 2nd RF path	1401.1400.02
R&S® SMATE-B206	Frequency option 6 GHz, 2nd RF path	1401.1600.02
R&S® SMATE-B13	Baseband Main Module	1401.2907.02
R&S® SMATE-B10	Baseband Generator with ARB (64 Msamples)	1401.2707.02
R&S® SMATE-B11	Baseband Generator with ARB (16 Msamples)	1401.2807.02

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