

# R&S®SMJ100A

## Vector Signal Generator

### Release Notes

### Firmware Version 2.20.360.68

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81671 Munich, Germany

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The following abbreviations are used throughout this document:

R&S®SMJ100A is abbreviated as R&S SMJ100A.

# Table of Contents

<b>1</b>	<b>INFORMATION ON THE CURRENT VERSION AND HISTORY .....</b>	<b>4</b>
1.1	Version 2.20.360.68.....	4
1.2	Version 2.20.360.54.....	4
1.3	Version 2.20.230.131.....	5
1.4	Version 2.20.230.58.....	5
1.5	Version 2.10.111.189.....	7
1.6	Version 2.10.111.153.....	7
1.7	Version 2.10.111.116.....	8
1.8	Version 2.10.111.53.....	9
1.9	Version 2.05.269.101.....	10
1.10	Version 2.05.269.83.....	10
1.11	Version 2.05.269.77.....	11
1.12	Version 2.05.222.34.....	13
1.13	Version 2.05.222.24.....	13
1.14	Version 2.05.104.56.....	16
1.15	Version 2.05.104.54.....	16
1.16	Version 2.05.104.33.....	16
1.17	Version 2.04.303.32.....	19
1.18	Version 2.04.303.31.....	19
1.19	Version 2.04.303.16.....	19
1.20	Version 2.04.303.03.....	20
1.21	Version 2.04.202.....	21
1.22	Version 2.04.201.....	21
1.23	Version 2.02.170.....	22

1.24	Version 2.02.145 .....	23
1.25	Version 2.02.130 .....	23
1.26	Version 2.02.116 .....	24
1.27	Version 2.02.65 .....	24
1.28	Version 1.40.21 .....	25
1.29	Version 1.40.20 .....	26
1.30	Version 1.40.19 .....	26
1.31	Version 1.40.13 .....	26
1.32	Version 1.35.14 .....	27
1.33	Version 1.35.13 .....	27
1.34	Version 1.35.10 .....	28
1.35	Version 1.30.08 .....	29
<b>2</b>	<b>FIRMWARE UPDATE .....</b>	<b>30</b>
2.1	Local Firmware Update.....	31
2.2	Remote Firmware Update .....	33
<b>3</b>	<b>OPEN SOURCE ACKNOWLEDGEMENT.....</b>	<b>35</b>
<b>4</b>	<b>CUSTOMER SUPPORT .....</b>	<b>36</b>

# 1 Information on the Current Version and History

## 1.1 Version 2.20.360.68

Released : March 2012

### Fixed Issues

ARB : Memory overflow when loading > 100 different waveforms	10069
General : instruments without AWGN option K62 may have wrong RF level	10060

## 1.2 Version 2.20.360.54

Released : February 2012

### New Functionality

- SMJ-K85 LTE Release 10 (Advanced)
- SMJ-K87 1xEV-DO Rev. B
- SMJ-K353 DAB+ waveforms
- SMJ-K354 T-DMB/DAB waveforms
- SMJ-K266 Galileo waveforms (generated with WinIQSIM2)
- SMJ-K294 Glonass waveforms (generated with WinIQSIM2)

### Modified Functionality (general)

- GSM : slot attenuation extended to 70 dB

### Fixed Issues

Command SOUR:IQ:OUTP:EXT:LOG:TYPE SSI28 not working	10033
Command BB:C2K:LINK Forward/Reverse not working	10013
Chinese online help shows some strange characters	9992

**Release Notes for LTE/EUTRA can be found in the separate document  
SMx\_K55\_K69\_K81\_K84\_K85\_Release\_Notes.pdf**

### Release Notes for 3GPP-FDD

General : Increased the dynamic range for dynamic power control to 60 dB if the power step size is at least 1 dB.

HSUPA Uplink: Selection between LEVATT and USER 1 connectors for HARQ Feedback.

## 1.3 Version 2.20.230.131

Released : December 2011

### Known Issue

Firmware Update by GPIB requires a manual reboot after installation.

### Fixed Issues

ARB/multi segment : Append button missing	9945
Patch Dll (OrgLayer.dll) from V2.20.230.58 now integrated in the package	9946
ESR Bit 6 is set when going to LOCAL	9549
All digital modulations: Armed trigger is ignored in rare cases	9905

Release Notes for LTE/EUTRA can be found in the separate document [SMx\\_K55\\_K69\\_K81\\_K84\\_Release\\_Notes.pdf](#)

## 1.4 Version 2.20.230.58

Released : July 2011

### New Functionality

- SMU-K84 (LTE Release 9)
- SMU-K86 (IEEE 802.11 AC)

### Modified Functionality

- LXI-Webserver : VNC viewer integrated
- Remote : Emulation of other instruments possible changing \*IDN? and \*OPT? responses
- GSM : Support of VAMOS (AQPSK) modulation
- ARB/multi carrier : arbitrary carrier spacing possible
- Custom DigMod : support of APCO25(8PSK)
- Support of RF frequency multipliers
- GSM : extended range for trigger delay

### Fixed Issues

Changing slope for baseband trigger and clock without effect	9265
Some help issues	9465
Digital I/Q Interface : transmission of sample rate to receiver missing after	9599

soft reboot	
K48 (WLAN) : problems setting duration in Single Trigger mode	9673

**Release Notes for LTE/EUTRA can be found in the separate document  
SMx\_K55\_K69\_K81\_K84\_Release\_Notes.pdf**

## Release Notes for 3GPP-FDD

### New Features

- General Uplink:
  - Instead of specifying the level of the total signal (i.e. the average power), it is possible now to specify the level during specific parts of the signal, like e.g. during the PRACH message part or during the first slot with active DPCCH by specifying a "level reference".
  - The scheduling of uplink signals now can be visualized in a "scheduling list".
- HSDPA Downlink:
  - The leveling for H-Set fixed reference channels was simplified by introducing the possibility of configuring the total HS-PDSCH power.
- HSPA+ Downlink:
  - The modulation and number of HS-PDSCH channelization codes in H-Set fixed reference channels now can be randomly varied over time, as needed for type 3i enhanced performance requirements tests.
  - The generation of the "other user's channels" (OCNS) for type 3i enhanced performance requirements tests is possible now.

### Changed Features

- General Uplink:
  - The 1024 chips delay of the uplink signal can be switched off now, if needed.
- HSDPA Uplink:
  - The scheduling of HS-DPCCH transmissions now is possible in a more flexible way.
  - Real time generation of the HS-DPCCH channel now is possible also in case the HS-DPCCH is scheduled by the HS-DPCCH scheduling table.
- HSUPA Uplink:
  - The generation of E-DPDCH channels now can be restricted to the I or Q branch, if needed.
  - The scheduling of E-DCH packets now is possible in a more flexible way. The former DTX patterns have been replaced by an E-DCH scheduling table. This does not apply for E-DCH fixed reference channels (FRCs) with enabled HARQ Simulation.
  - The E-DPCCH and E-DPDCH channels now are generated in real time if UL-DTX or dynamic power control is activated.
- HSPA+ Uplink:
  - UL-DTX now is possible also for other channels than DPCCH. The configuration of two UL-DTX cycles is possible and all dependencies between the transmissions of the channels are taken into account, in line with 3GPP TS 25.214.
  - Now dynamic power control is possible also in combination with UL-DTX. The application of externally received power control commands is made in compliance with 3GPP TS 25.214; UL-DPCCH gaps are taken into account.
  - Real time generation of the HS-DPCCH channel now is possible also if the HS-DPCCH contains HSPA+ content.

**Fixed Issues**

- General
    - The code allocation for compressed mode method SF/2 was incorrect.
  - General Uplink
    - The PCPCH Channel Coding was not working correctly.
    - Data sources were read out at the wrong positions in case of uplink compressed mode method SF/2.
  - General Downlink:
    - In certain cases the TFCI state of DPCH channels was configured to be off (DTX) after selecting a reference measurement channel.
- The generation of AICH and AP-AICH channels was incorrect.

**1.5 Version 2.10.111.189****Released : Feb 2011****New Functionality**

- Support of new processor board FMR9

**Modified Functionality**

- A complete list of changed for LTE can be found in the separate document SMx\_K55\_K69\_Release\_Notes.pdf
- 3GPP-FDD: Updated test model "TS34121\_R8\_Table\_C\_11\_1\_3\_Subtest5" according to the changes in 3GPP TS 34.121 version 8.8.0.

**Fixed Issues**

LTE : only one out of two installed options K81 used	9920
Drive C:\ is filling up due to internal debug trace files	9202
3GPP-FDD: Closed loop HARQ feedback	9123
- The feedback timing was corrected. This can cause the need of recalibration of the additional user delay.	
- Sometimes the packets were sent with the wrong redundancy version in case of RSN 3 (only for 2 ms TTI length)	
3GPP-FDD: Bugfix for the uplink FRC transport block size (only for "User" FRCs with 2ms TTI size and an E-TFCI of 127)	9124
APCO Coding could be combined with 8FSK and 16FSK	9138
Internal adjustment may overrule calibration value for reference oscillator	9111
BBOUT: has be reinitialized too often	9070
AWGN: noise only mode not working with digital baseband output	9066
Listmode not working correctly with external I/Q modulation	9065

**1.6 Version 2.10.111.153****Released : Nov 2010**

**New Functionality**

- SMJ-K81 (LTE logfile generation)
- SMJ-K253 (Playing of DAB/TDMB waveforms)

**Modified Functionality**

- A complete list of changed for LTE can be found in the separate document SMx\_K55\_K69\_Release\_Notes.pdf
- Module support : newest release 7 of B9/B10/B11 supported
- New icon at desktop and tray bar to ease returning from remote desktop
- ARB sequencing : several improvements
- 3GPP-FDD : all supported features are in line with release 9 of the 3GPP specifications.
- Frequency- and phase offset available in the baseband domain

**Fixed Issues**

CW/Modulation switching using control lists not working reliably at lower symbol rates	8969
1xEVDO : sporadic overdriving in base band domain (spectral regrowth)	8903
Blockdiagram : AWGN block not displayed correctly if no B9/B10/B11 is installed	8855
3GPP-FDD (HARQ feedback) : The feedback timing was corrected. This can cause the need of recalibration of the additional user delay. Sometimes the packets were sent with the wrong redundancy version in case of RSN 3 (only for 2 ms TTI length)	8888
FM-Stereo : instabilities using audio source LFGEN	8695
LTE : preset causes memory leak which may lead to crash	8565

## 1.7 Version 2.10.111.116

**Released : May 2010****Fixed Issues**

Multi segment info file: creating file via SCPI results in empty MARKER tags and file is not loadable; fixed	8264
Multi segment / playlist: several improvements	
WLAN: Armed trigger not working in coupled mode; fixed	8279
1xEVDO:DL table not editable; fixed	8280
GSM/EDGE: data and control list not selectable; fixed	8286
Multi segment waveforms: marker not considered; fixed	8296
ARB: Create Test Signal creates error message "file not found"; fixed	8297
I/Q settings: parameter Baseband Gain not in save/recall; fixed	8307
TETRA: filter selection not correct and can cause a system hang up; fixed	8341
1xEVDO: crest factor not reproduceable when switch state on; fixed	8488

1xEVDO: memory leak when switching state to off; fixed

8493

## 1.8 Version 2.10.111.53

**Released: Feb 2010**

### **New Functionality**

- SMJ-K68 (Tetra 2)
- SMJ-K69 (LTE closed loop BS test)
- NRP-Z power sensors : Info and update dialog (from Setup)
- ARB : Sequencing with play lists

### **Modified Functionality**

- \*RST / **PRESET** key has been speeded up
- ARB/multi segment mode : several improvements (single trigger with different clock rates)
- ARB/multi carrier mode : support of clipping
- External triggering: choice between "sync to external trigger" (with skipping first samples, default) and outputting from first sample (new).
- All digital standards: setups can now be saved in differential format
- Optimized file dialog (tree view)
- Sweep : new mode "Extern Start/stop"
- Custom Dig Mod : new modulation AQPSK
- AWGN : C/N range extended to +40 dB
- Head panel (Frequency, level and status information) renewed
- Internal Graphics can be controlled remotely (eg. SOUR:BB:GRAP:SMAR:STAT ON;SOUR:BB:GRAP:STAT ON)
- 3GPP-FDD: Uplink Signaling (in HS-DPCCH channel) for DC-HSDPA.
- Bluetooth : Upgraded to Core Specification 4.0 and added Low Energy Enhancements
- Several enhancements for LTE/EUTRA (see separate release notes)
- SMJ-K80 (BERT/BLERT) : timeout introduced
- ExBox : Default for word alignment changed from MSB to LSB

### **Fixed Issues**

\*RST during manual **PRESET** or vice versa may lead to crash  
 Search function in online help improved

6487

6637

Leading "0" is network addresses removed (LXI- and Ethernet dialog)	6692
Lost focus in edit field validates entry	7383
Setting range for I/Q impairments limited to 10% (formerly 50%)	7796
Custom Dig Mod : Formula for calculating modulation index has been corrected to $m = \frac{\text{max}-\text{min}}{\text{max}+\text{min}}$ .	7952
BBOU : output level has been too low when internal driving was below -6dbfs	7958
Marker info missing when generating waveform from digital modulation signal	7971
B90: sometimes error message appears during adjustment	7989
Custom Dig Mod : several minor problems with CList editor and documentation	8022
I/Q impairments/Optimization mode: changed I/Q bandwidth ignored	8121
TD-SCDMA: remote commands	8123
BB:TDSCdma:UP:CELL1:SLOT1:PRAC:MSG:DATA:PATT and BB:TDSCdma:UP:CELL:ENH:DCH:HSUPA:BPAYload? Not working	8124
SCPI: octal pattern (eg. Using with data sources) not working	8129
Wimax : IE "TLV Encoded information for the overall channel" ("Frame Duration Code", "Frame Number") missing	8233

## 1.9 Version 2.05.269.101

**Released : Oct 2009**

### Fixed Issues

Sometimes an error message "DSP: unknown command" appears at first switching on a digital standard: fixed	7920
Sometimes error messages occurs from modulation coder DSP and at last "Zero signal measured" -> "Modulation coder output deactivated.." and no output signal is available (more often with GPS); fixed	7919
AWGN doesn't work correctly in V2.05.269.xx (with DacBoard 1141.8090.xx only); fixed	7918
Blanking of output signal improved (now as few as possible)	7818
ARB: Same Segment + Single Trigger: Sequence Length Unit = Samples does not work correctly; fixed	7816

## 1.10 Version 2.05.269.83

**Released : July 2009**

### Fixed Issues

*tst? returns always 1 (=error): fixed	7760
List mode: error message while learning list: fixed	7752

## 1.11 Version 2.05.269.77

Released : May 2009

### New Functionality

- SMJ-K58 (Sirius)
- SMJ-K352 (Playback of HD Radio streams)

### Modified Functionality

- List mode :
  - Max value of dwell time increased
  - The mode STEP now can be remote controlled:
- [:SOURce]:LIST:INDEX <nr> addresses the specified index
- [:SOURce]:LIST:TRIGger:EXEC executes a single list step
- Accelerated operation of LTE and Wimax
- Frequency Offset has been extended to 67 GHz
- Factory preset resets computer name
- Suppression of test signal when performing local I/Q modulator adjustment (CAL:IQM:LOC?)
- Phase offset : extension of range (-999.99 deg to 999.99 deg)
- Adjustment uses external reference if activated
- List mode : dwell time extended to 100 s
- User correction : warning when leaving frequency limits
- Instrument can be shut down remotely using SYSTem:SHUTdown
- Booting speeded up by typ. 20 s
- New filter Lowpass (EVM optimized) useful for WLAN and other OFDM standards

### Fixed Issues

Possible hangup after fast changing digital standards remotely : fixed	7681
GSM : some parameters missing after recalling a setup : fixed	7520
SRQ handling over VXI11 delayed by 200 ms : fixed	7423
Signal of Marker 4 (output at User connector) corrupt : fixed	7566
List mode : sporadic errors when switching between several lists very fast : fixed	7550
List mode : Reset did not work with mode step : fixed	7468

## EUTRA/LTE

### Downlink

- TDD special subframes: automatic adjustment of parameters is now fully supported

## Uplink

- PUSCH allocations are now displayed correctly in the time plan for frequency hopping type.
- PUCCH allocations and PUCCH region is displayed in the time plan.
- PRACH is displayed in the time plan.

## 3GPP-FDD

### New Features

- HSUPA / HSPA+ Uplink
  - Fixed reference channels (FRC): Transport block size and channel allocation now is user configurable (User-FRC).
  - Uplink test models according to TS34.121 tables C.10.1.4, C.11.1.3, C.11.1.4
- HSPA+ Uplink
  - Uplink DPCCH slot format 4
  - UL-DTX mode for CPC simulation ("DPCCH Gating")
- HSPA+ Downlink
  - F-DPCH slot formats 1 to 9 ("Enhanced F-DPCH")
  - Fixed reference channel H-Set 12 for Dual Cell HSDPA tests ("DC-HSDPA")
  - Downlink test models for Home base station tests ("Home NodeB")

### Changes

- Support for old release 4 uplink DPCCH slot formats 4 and 5 is discontinued.

### Problems eliminated

- Uplink compressed mode: The configuration of TG pattern 2 was not recognized correctly.

## Wimax

### New features

- 2 Antenna STC modes (Matrix A and B) for AMC2x3
- Power offset of Baseband B
- MIMO UL Basic IE added to UL-MAP

### Bugfixes

- Fixed bug in HARQ CRC
- Fixed pilot carrier bug for 4 Antenna STC modes
- Fixed dedicated pilot flag in DL-MAP for PUSC

## GPS

- Unlimited Play-Time.
- Satellite Elevation Mask made configurable (2.5, 5, 7.5 and 10°).
- Satellite Handover (Based on Optimal Availability Algorithms) in AUTO SV UPDATE Mode.

- Ephemeris Projection in (AUTO SV Modes) overcoming the 2 hours Ephemeris validity Problem.
- 3GPP2 (CDMA2000) Test Scenarios available.
- Sensitivity Assistance Data (CDMA2000) available.
- SPOT view (Satellite/Receiver View, HDOP, PDOP, Next Handover Query...).

## 1.12 Version 2.05.222.34

Released : Jan 2009

### Fixed Issues

WiMax: Restore settings from a two channel device to a one channel device causes a crash if coupled mode was switched on; fixed	7328
Marker signals are delayed to the IQ signals (only V2.05.222.24 affected): fixed	7373
Menu SETUP: entry "Reference oscillator" missing (only V2.05.222.24 affected): fixed	7389
RF output with (all) IQ modulations: level is up to 6 dB too low (only V2.05.222.24 affected): fixed	7402

## 1.13 Version 2.05.222.24

Released : Nov 2008

### New Functionality

- SMJ-K41 (GSM EDGE +)
- SMJ-K60 (Bluetooth)

### Modified Functionality

- RF can be optionally blanked when external reference is missing
- Chinese online help now available
- Internal adjustment uses external reference oscillator if selected and connected
- List mode (sub mode STEP) is now also available with SCPI triggering
- New command [:SOURce[1|2]:SWEep[:FREQuency]:RUNNing? to poll sweep state
- 1xEVDO (SMx-K47) : Forward/Downlink is now generated in realtime with immediate signal update and uninterrupted output at parameter changes.

### Fixed Issues

Phase Offset was set to 0° after triggering : fixed	5746
ARB Multi Segment: Marker signal faulty with trigger mode Single/Next	6660

Trigger: fixed	
Custom Digital Modulation : bits of data editor are hard to read : fixed	6965
GPS : critical database error occurred after loading setup : fixed	7025

## EUTRA/LTE

### Compatibility

- All supported features are in line with the following official 3GPP specifications:
  - TS36.211 v.8.3.0
  - TS36.212 v.8.3.0
  - TS36.213 v.8.3.0
- This version of the SMx-K55 is compatible with R&S FSV-K100/-K101/-K102 and R&S FSQ-K100/-K101/-K102/-K104/K105 EUTRA PC-Software.

### General Features

- New specific LTE filter for enhanced ACLR performance. Depending on the user's requirement, the filter can be selected as optimized for EVM (Default) or optimized for ACP.
- Time Domain Windowing for uplink and downlink is supported. Note that Time Domain Windowing in the downlink will degrade EVM substantially, due to the definition of the EVM in 3GPP.
- Enhanced Test Models (36.141) are supported by means of setup files

### Downlink

- Support of TDD
- PHICH: The configurable ACK/NACK pattern (8 bits for normal CP, 4 bits for extended CP) for one PHICH group now consists of '1','0' and '-' (DTX).

### Uplink

- Update to 3GPP version 8.3.0 (PUCCH, PUSCH).
- n\_PRS updated to version 8.3.0
- Support of PRACH

### Changes and Bug fixes

#### Downlink

- Initialization of PRS generator (X2) is selectable between v.8.2.0 and v.8.3.0 (default). This has an effect on the reference signals, scrambling and PHICH mapping. N\_c will be fixed to 1600 as defined in 3GPP in case of v.8.3.0.
- Control region for PDCCH extended to 4 symbols in case of small channel bandwidths (< 10RBs).
- Scrambling can be activated individually for PCFICH and PDCCH
- Power levels can be set individually for PCFICH, PHICH and PDCCH. Power setting for PHICH is applied to every single ACK/NACK BPSK symbol. Normalization of a PHICH group (not yet defined in 3GPP) can be achieved herewith.

- Bug fix: PHICH mapping in case of extended cyclic prefix.
- Normalization for transmit diversity as defined in 36.211 added.
- Added dependencies for “User”-PDSCH allocations: all user allocations use the same settings for modulation, pre-coding, scrambling and channel coding.
- Bug fix: scrambling for PBCH

### **Uplink**

- PUSCH frequency hopping type 2 adjusted to v.8.3.0.
- DRS group and sequence hopping adjusted to v.8.3.0.
- Position of PUSCH DRS in case of extended cyclic prefix changed from 4th symbol to 3rd symbol in slot.
- Bug fix: PUCCH mapping to resource blocks.
- Bug fix: scrambling for PUSCH in case channel coding is activated.

## **3GPP-FDD**

### **New Features**

- HSPA+ Downlink
  - fixed reference channel H-Set 11
- HSPA+ Uplink
  - 4PAM modulation for E-DPDCH channels
  - fixed reference channel FRC 8
  - HS-DPCCH signaling for UEs in MIMO mode

### **Changes**

- H-Sets: Now up to 8 HARQ processes are possible (up to 16 for MIMO).
- H-Sets: Now longer redundancy version sequences for HARQ simulation are possible.

### **Problems eliminated**

- H-Sets with HARQ simulation: Now the transport block size is signaled only at initial transmissions (in HS-SCCH types 1 and 3).
- The TPC bits in the F-DPCH channel were always 0 – fixed.

## **Wimax**

### **New features**

- Moving Offset mode for Chase HARQ (RCT test 9.1.24)
- Sub-DL-UL Maps
- Included Ack Disable flag for HARQ subbursts

### **Bugfixes**

- Fixed available modulation and coding selections for Chase HARQ
- Fixed incorrect sounding carrier allocations

## 1.14 Version 2.05.104.56

**Released : Aug 2008**

### Fixed Issues

Under rare conditions the guaranteed maximum level could not be reached: fixed

6899

## 1.15 Version 2.05.104.54

**Released : Aug 2008**

### New Functionality

- SMJ-B90 (LO sync board for MIMO)

### Modified Functionality

- XM-Radio : frame counter implemented

### Fixed Issues

Custom Digital modulation : bit clock now used falling slope with external data and symbol clock

6627

GSM : Instrument crashes using external retrigger mode : fixed

6754

Remote control : transfer fails if character 0x0A is in first block of binary data : fixed

6783

## 1.16 Version 2.05.104.33

**Released : July 2008**

### New Functionality

- SMJ-K57 (FM stereo)
- SMJ-K59 (HSPA+)
- Support of new synthesizer SSYN (1141.4220)

### Modified Functionality

- Software update in one file and over LAN
- LXI Class C including web server
- Sophisticated hardcopy function
- Factory preset, standard Preset/\*RST does not reset reference oscillator or power on state (level)

- Several layouts of external keyboards supported
- All windows can be resized in height using <REARR> button
- Busy display for Preset/Save/Recall and switching digital standards
- Custom Digital Modulation : support of QAM128, several improvements of data list editor
- All sweeps support now shapes sawtooth and triangle
- Phase continuous frequency setting
- Setting times for level/frequency reduced by typ. 150  $\mu$ s
- Display of NRP-Z81 peak power

### Fixed Issues

Several hyperlinks in online help not working : fixed	5323
Level sweep without dropouts : fixed	6533
Trigger not stored in multisegment waveform : fixed	6589
Several bugs with multi segment waveform : fixed	5205
ARB file selection dialog improved (tool tipp with all comments) : fixed	5884
DigMod: Pure Gauss parameter not accessible from SCPI : fixed	6168
Several small changes in user manual / online help : fixed	6334
DigMod: 16QAM Edge not properly working : fixed	6434

## EUTRA/LTE

### Compatibility

- All supported features are in line with the following official 3GPP specifications unless not revised by the according CRs listed below:
  - TS36.211 v.8.2.0
  - TS36.212 v.8.2.0
  - TS36.213 v.8.2.0
- The following CRs are implemented:
  - R1-081248: PRS sequence generation for downlink reference signal
  - R1-081518: Draft CR on Correction of the number of subcarriers in PUSCH transform precoding
  - R1-081520: Draft CR on Correction of PUCCH resource index for PUCCH format 2
  - R1-081576: Correction of the number of subcarriers in PUSCH precoding
  - R1-081577: Correction of PHICH mapping
  - R1-081578: Correction of PUCCH resource index for PUCCH format 2
- The Downlink of this version of the SMx-K55 is compatible with FSQ-SW LTE K100/K101/K102 Version 2.2 BETA 3

### General Features

- Updated bandwidth definitions 1.4MHz and 3MHz (previously supported by user defined settings)
- Support of User Filter: user-defined TX-filter can be generated (e.g. by means of R&S FiltWiz) and then uploaded to the SMx-K55.

### Downlink

- Full support of P-SYNC, S\_SYNC and DL Reference Signal derived from CELL ID
- Supports channel coding for PDSCH
- Support channel coding for PBCH
- Supports scrambling for PDSCH and PBCH
- Full MIMO and Transmit Diversity support (all precoding and CDD formats)
- Support of PCFICH
- Support of PHICH
- Support of PDCCH: An arbitrary bit stream (PN9, data list, pattern...) is used by the SMx-K55 (can be uploaded from external if needed), and PDCCH processing starts with "scrambling" (see 36.211, 6.8.2). The next steps of PDCCH are performed as defined in 36.211. The user is responsible for the content of the several PDCCHs (see 36.212, 5.3.3.1 DCI Formats) and the multiplexing of them. SMx-K55 does the scrambling, layer mapping, precoding and RE mapping including permutation and cyclic shifting.

### Uplink

- Support of new definitions of reference signal sequences
- Update on demodulation and sounding reference signals
- Support of group and sequence hopping
- Supports channel coding for PUSCH including multiplexing of data and control information
- Supports scrambling of PUSCH
- Support of all PUCCH formats

## 3GPP-FDD

### New Features

- HSPA+
  - higher order modulation: downlink 64QAM
  - CPC: HS-SCCH less operation
  - MIMO support
  - new H-Sets 7-9 (3GPP Rel.7)
- new H-Set 10 (3GPP Rel. 8)
- more flexibility in the H-Set configuration („User“ – H-Set)
- The user gets support by the user interface for selecting the right ARB sequence length when generating H-Set signals.
- For H-Sets, the (least necessary) UE-category is displayed.
- third OCNS-Mode „HSDPA 2“ (according to TS 25.101)
- E-AGCH: now with user coding

### Bugfixes / Changes

- Computationally expensive realtime-signals (e.g. RMC384 or H-Set3) were sporadically shifted in time after retrigger: fixed.
- Conflicts between H-Sets and OCNS in the channel configuration are avoided now.
- When switching off the OCNS-Mode, the OCNS-Channel state is switched off now (in previous releases the channels were only converted to normal DPCHs, but with state on).
- When generating H-Set 6, the database was read out at the wrong positions: fixed.
- HARQ-Feedback:

- Immediately after retrigger, the packets were sent with random retransmission sequence number (RSN): fixed.
- When changing from one RSN to another, the last 1024 chips of the old packet were sent already with the new RSN: fixed.

## Wimax

- CSTD (Cyclic Delay Diversity)
- Coupled Baseband Modes (Baseband B is controlled from Baseband A for STC configurations)
- Transmit Diversity with 4 antennas
- Band AMC modes for 2x3 AMC
- Band bitmap for sounding
- Additional user definable power boosting for each zone
- Time Plan displays inactive zones in grey (such as SISO zones on Antenna 1)
- Multiple PDUs per burst
- DCD and UCD added for OFDM mode
- UL-MAP and DL-MAP in one burst for OFDM mode

## 1.17 Version 2.04.303.32

**Released : April 2008**

### Fixed Issues

Sometimes the device does not shut down correctly : fixed 6424  
 Sporadic bit errors in GSM and 3GPP FDD signal generation ( problem was observed only in combination with UNICOD version > 6.00 ): fixed

## 1.18 Version 2.04.303.31

**Released : Feb 2008**

### Fixed Issues

Sporadic extension of setting times for level and frequency : fixed 6273  
 Wrong display of AWGN values in display mode baseband : fixed 6290

## 1.19 Version 2.04.303.16

**Released : Oct 2007**

### New Functionality

- SMJ-B18 (baseband digital out board)
- SMJ-K47 : 1xEVDO Rev. A

- SMJ-K53 : T-DMB / DAB

#### Modified Functionality

- Support of R&S EX-IQ-Box 1409.5505.02

#### Fixed Issues

XM-Radio. No markers in physical layer mode "Terrestrial A" and "Terrestrial B"	5834
IEEE 802.16 WiMAX: system crash possible when changing from uplink to downlink, standard is active and predefined settings are used	6000
IEEE 802.11 n: Indikator „MOD OFF“ does not disappear when this standard is activated	6042

## 1.20 Version 2.04.303.03

Released : Aug 2007

#### New Functionality

- SMJ-K54 : IEEE 802.11n (WlanN)

#### Fixed Issues

CDMA2000: new default setting (one channel switch to ON to avoid error messages when setting state to ON)	5263
Sometimes a system crash occurs when toggling LEVEL/DIAGRAM buttons very often	5353
WiMax:	
- Subchannel rotation fixed for uplink PUSC zones including FastFeedback and Ranging bursts	
- Fix in uplink AMC2x3 mode	
- STC Matrix B mode fixed	5355
ARB: sine generator: error message when using sine generator immediately after switching on EUTRA (SMJ-K55)	5356
Custom Digital Modulation: List editor: system crash when using "goto"-command	5385
FM: source is "INTERNAL + EXTERNAL": sensitivity not visible in dialog	5433
W3GPP: Enhanced channel 11: selecting "config data" shows no reaction (menu don't open)	5542
ARB: Loading AMIQ/SMIQ waveforms sometimes causes an error message	5597
SCPI: all return values of "...:stat?" is OFF/ON instead of 0/1 (bug in V2.04.202 only)	5610
Custom Digital Modulation: "user filter" doesn't work in path B	5655
CDMA2000: "Set To Default" resets settings in path A and B (not the selected path only!)	5751
W3GPP: error message when selecting "PRACH Preamble only" with trigger mode "Armed Auto external"	5801
W3GPP: copy BS1 to BS2 doesn't copy all relevant parameters	5802
WLAN: when setting state to ON the filter settings are always the default one, not the displayed one!	5816

AWGN: Doesn't work if no option B9/10/11 (bug in V2.04.202 only)	5833
GSM: Recall doesn't set the frames	5882
WLAN: sequence length not limited correctly	5894
CDMA2000: unknown exception when using predefined settings RC4 with frame length = 80 ms	5930

### WiMAX

- Corrigendum2/D4 compatibility
- Uplink Sounding
- Added Zone\_Switch\_IE in DL-MAP
- Mixed STC Matrix A and B configuration within the same zone
- CID\_Switch\_IE inclusion in DL-MAP can be toggled
- Added Collaborative Spatial Multiplexing in uplink

## 1.21 Version 2.04.202

**Released : March 2007**

### Fixed Issues

- Sometimes at startup an error message occurs „... uncod SDRAM ...“; only with V2.04.201

## 1.22 Version 2.04.201

**Released : March 2007**

### New Functionality

- SMJ-K55 : EUTRA/LTE
- SMJ-K56 : XM-Radio
- SMJ-K6 : Support of external Pulse Sequencer Software

### Modified Functionality

- TD-SCDMA : Predefined Settings / Testmodels
- NRP power sensors : persistent power display in block diagram
- List mode : level setting without interruption/blanking
- ARB Multi segment : several improvements / bugfixes
- Armed/Triggered state visible in block diagram
- Security Menu : possibility to switch off USB port and LAN for file transfer
- New optimization mode "high quality" to reduce modulation frequency response

**3GPP**

- 3GPP HSDPA H-SET6 Extensions
- 3GPP HSUPA Extensions (E-DPDCH with new symbol rates 15ksps and 30 kps, separate channel powers possible, HARQ State)

**WiMAX**

- HARQ
- Offline Filter
- AMC 2x3
- Fast Feedback Bursts
- Dedicated Pilots for AMC 2x3 and PUSC
- Switchable Subchannel Rotation for Uplink PUSC
- DCD and UCD Bursts
- New modulation QAM 5/6
- Extension of DL-MAP (CID-SWITCH-IE, bursts of all zones, MAC Header and CRC on, ...)

**Enhancements of noise**

- AWGN : Extended S/N Range -50 dB to +30 dB

**Fixed Issues**

ARB test sine signals : some remote commands not working	4376
CustomDigMod/FSK : envelope not constant with root cosine filter and some roll-off factors	4763
ARB sequence length : maximum depending on ARB size	4815
3GPP FDD : Save waveform not working for uplink	4850
WLAN : predefined frames not working correctly	4903
WiMax/3GPP : clipping not working correctly	4907
WiMax : output power not correct when using more than 15 frames	4913
Save/Recall : 'exclude frequency" and "exclude level" without impact	5109
Data lists exceeding 256 Mbyte cannot be loaded to B9	5161

**1.23 Version 2.02.170****Released : Feb 2007****Fixed Issues**

Error message "I/Q out level is below minimum..." with option SMJ-B16	4866
Error messages while graphic is running and trigger mode is armed	4885
Sometimes trigger input 1 and 2 does not work immediately after power on	5069
MCCW: spectrum not perfect with 3 or 15 carriers	5087

Sometimes a system crash happens at power on	5151
Error message „General plugin error“ in GSM after PRESET and :BB:GSM:MODE SINGLE	5197
:syst:time xx,xx,xx and :syst:date xx,xx,xx doesn't work anymore	5272
Sometimes system hangup while doubleclicking menu points (e.g.GPIB or Ethenet)	5280

## 1.24 Version 2.02.145

**Released : Nov 2006**

### Modified Functionality

- Improvement of the level adjustment (new internal adjustment “level attenuation”)

### Fixed Issues

GUI: Sometimes GUI is frozen after PRESET (you cannot open any new window in the application after PRESET)	4884
GUI: Some menus have an unnecessary horizontal scroll bar (bug in V2.02.130 only)	
Menu SETUP-HARDWARE CONFIG: memory leak caused system hang up	5025
Testcase Wizard: error message “Fader Insertion Loss Limit Exceeded; value set to limit” when using test case 8.4 with antenna diversity ON	5034

## 1.25 Version 2.02.130

**Released : Sept 2006**

### New Functionality

- Support of new main board with FMR7 (first version)
- New menu SETUP – UPDATE for updating internal FPGA

### Fixed Issues

Custom Digital Modulation: *.vam files couldn't be selected via IEEE bus	4270
Custom Digital Modulation: symbol rate not accessible via GUI	4845
Option SMJ-B16: error message “I/Q out level is below minimum for ‘optimize I/Q signals for RF output’ enabled” sometimes doesn't disappear (V2.02.116 only)	4866

## 1.26 Version 2.02.116

**Released : Aug 2006**

### **New Functionality**

- Support of new digital standard DVB (SMJ-K52)
- Support of new option SMJ-K256 (XM RADIO Waveforms)

### **Modified Functionality**

- Power sensor: Offset mode implemented
- TD-SCDMA: new marker mode "Frame Active Part"
- Internal adjustment: reference frequency mode not changed to "internal" during internal adjustment
- GPIB channel address: now saved immediately to support hard power off
- PhaseModulation: SCPI: default unit changed from degree to rad (due to SCPI norm)
- 3GPP Power Control: new marker mode "Dynamic Power Control" for marker 4

### **Fixed Issues**

GSM/EDGE:'Recall Predefined Frame' cannot copy to frame 2	4074
Custom Digital Modulation: ASK: graphic for 'Modulation Settings' empty	4131
ARB Multi Segment: Recall GUI Problem	4623
Multi Carrier: "Division by zero" if all carriers are switched off	4639
WLAN: „Generate Waveform File..." doesn't work	4665
ARB: *.wv files which need options SMJ-K11 til SMJ-K20 does not work	4670
ARB: tag "clock rate": precision too low	4708
List mode: system hang up while editing via "Insert Range..."	4713
Data list: saving long lists via SCPI does not work correctly	4722
System crash while switching off incompatible modulations internally	4748
"Generate Waveform File..." doesn't work if file exists already	4773
3GPP HSUPA: "Code Domain" graphic: E-DPDCH displayed not correctly	4779
3GPP uplink: SCPI: channel numbering wrong („1" sets channel 2 and so on)	4794

## 1.27 Version 2.02.65

**Released : May 2006**

### **New Functionality**

- Support of SMJ-B9 - Baseband with ARB(128Msamples)
- Digital standard TD-SCDMA with two options  
SMJ-K50 (basic functions)  
SMJ-K51 (Enhanced BS/MS test)

- Digital standard SMJ-K45 (3GPP FDD HSUPA)
- Support of WinIQSIM2 options K2xx
- Support of NRP-Zxx power sensors (power viewer and user correction)
- "Generate Waveform File" for all digital standards (for multi carrier/ multi segment)

#### Modified Functionality

- Support of user filter files generated with R&S FiltWiz
- Import of list mode and user correction data from CSV and TXT files
- WiMAX (SMJ-K49) : several extensions including WiBro and multi zones
- 3GPP FDD (SMJ-K43) : parameter range of BER / BLER extended to 50%, 3 power steps for HS-DPCCH
- Setup menu : Display of instruments TCP/IP address and BIOS version
- Unit keys [k][M] now working as multipliers for parameters with only one unit  
eg. 38.4 [k] -> 38400
- list mode : frequency and level display dotted when list mode running
- SCPI: Error Queue entries with path indication A/B
- phase modulation: unit rad and degree supported (attention: default is rad now!)

#### Fixed Issues

Renaming files with MMEM:MOVE did not work	2875
Eye diagram did not work correctly	3417
Save/Recall with :MMEM:LOAD:STAT / :MMEM:STOR:STAT not working	3473
3GPP HSDPA : bursts have been cut instead of wrapped around at end of sequence	3902
sporadic crashes when handling big ARB waveforms	4026
inconsistent block diagram in REMOTE state	4029
SCPI commands for ARB multi segment SOUR:BB:ARB:WSEG: missing	4210
sporadic errors in output signal, when I/Q graphic is running	4214
SCPI commands FSIM:DEL:GRO<group>:PATH1:CORR only working for group1	4640

## 1.28 Version 1.40.21

**Released : April 2006**

#### Fixed Issues

- WLAN: save/recall not possible if CDMA2000 and 3GPP FDD is not available
- Bugfix with new calibration data from level (RFM V2.0; internal use only)

## 1.29 Version 1.40.20

**Released : March 2006**

### Fixed Issues

- “DSP communication error” sometimes occurs (only in V1.40.19); fixed
- Bugfix with new calibration data from level (RFM V2.0; internal use only)

## 1.30 Version 1.40.19

**Released : Feb 2006**

### Modified Functionality

- New level calibration for factory purposes supported
- Improvement of settling time with IQ modulation on

### Fixed Issues

- In rare cases the level adjustment failed with error “DACIF...”; fixed

## 1.31 Version 1.40.13

**Released : Nov 2005**

### New Functionality

- Generation of HSDPA H-Sets (SMJ-K43)
- Support of WiMAX OFDMA mode (SMJ-K49)
- Support of ARB multi carrier
- Support of parameter variation with mouse wheel

### Modified Functionality

- UCOR level range extended to 100 dB
- Several improvements of file dialog
- Several improvements of AWGN dialog (SMJ-K62)

### Fixed Issues

List-Mode : dwell time of first step not correct	2703
Custom DigMod : support of CW switching incorrect	2966
:SYST:SERR? does not respond “no error” if everything is ok	3225
Changing the remote interface VXI11 <-> GPIB causes crash of instrument	3360

ARB: no independent sine test signal output possible on path A/B	3365
Pulse modulation deactivates digital modulation	3687
Internal graphics stops when both paths are triggered by marker 1	3699
3GPP FDD : TFCI setting of S-CCPCH not allowed	3716
List mode : online help missing	3849
FM external impedance only switchable if FM is ON	3870
Setups of older firmware versions cannot be read	3877
Power-on-preset not working	3879
All standards : units of single trigger duration harmonized	3892
Input of values with leading floating point (eg. ".5") not supported	3906
Pop-ups not operable without mouse (eg. ARB multi segment)	3911
Multi carrier/SCPI : unit [dB] not accepted	3938
Sweep : Attenuator switches in fixed mode (occasionally)	3966
Power Up/Down (RF level) not supported by remote interface	3973
All standards / SCPI : instrument crashes when pattern length exceeds 32	3987
3GPP FDD : Update problem when changing UE4 paramaters with active additional Ues	3992
WLAN : given RF level not referred to burst power	4012
Multi carrier : Set To Default does not reset output signal	4015
Custom DigMod : symbol rate remains unchanged after recall	4066
CDMA2000 : SCPI command BB:C2K:MSTation1:CHANnel1:DATA:RATE not working	4088
3GPP FDD : progress bar missing after fast parameter change (occasionally)	4094
Some standards : pattern editor not operable after leaving with ESC before	4096
All standards : trigger delay ignored when trigger source is other baseband	4117
WLAN : chip rate can be set to 100 MHz (fixed:limited to 40 MHz)	4132
Range of level in attenuator fixed mode wrong (occasionally)	4138
Displayed baseband signal level wrong with AWGN	4174
Sometimes no baseband signal with external clock and internal trigger	4176
:swe:res:all does not work	4195

## 1.32 Version 1.35.14

**Released : Oct 2005**

### **Modified Functionality**

- Improvement of Calibration

## 1.33 Version 1.35.13

**Released : Aug 2005**

### **Modified Functionality**

- Loading from setups from elder versions improved

**Fixed Issues**

- In rare cases the message "Device key missing" at start of the instrument occurs; fixed

## 1.34 Version 1.35.10

Released : Jul 2005

**New Functionality**

- Support of digital standard SMJ-K44 (GPS)
- Support of digital standard SMJ-K48 (WLAN IEEE 802.11 (a/b/g))
- Support of digital standard SMJ-K49 (WiMax IEEE 802.16 (d))
- phase offset available in baseband block menu
- Custom digital modulation: display type of modulation directly in the baseband block

**Modified Functionality**

- Custom digital modulation – Modulation Type -Variable FSK: 4/8/16FSK with free selectable deviations available now
- Custom digital modulation: display type of modulation directly in the baseband block
- „User Marker / Aux I/O Settings ...“ now directly in menu "Trigger/Marker"
- separate "\*"rst" for path A and B possible via :SOURce<HW>:PRESet and DEvice:PRESet
- Digital standard 3GPP FDD: Channel Coding - Transport Channel: max value of "Transport Blocks" now 24
- GSM/EDGE: External Clock: trigger delay and trigger inhibit available

**Fixed Issues**

- I/Q impairments: user settings lost when switching baseband state to off and on again; fixed
- SCPI order „:freq? min|max“ and „:pow? min|max“ does not work; fixed
- Editing a bit pattern: in very rare cases the system crashes while editing the pattern; fixed
- In some cases the tooltip lost the units; fixed
- File dialog: sometimes two lines are highlighted and/or no focus; fixed
- Digital standard 3GPP FDD: sometimes no marker output at first start; fixed

- Digital standard 3GPP FDD: unnecessary info messages when selecting “Set To Default” or “Recall 3GPP FDD Settings”; fixed
- Custom digital modulation: error message using modulation 4FSK with coding GSM; fixed (now no selection of coding GSM with modulation 4FSK allowed)
- GSM/EDGE: switching to external clock produces an error message “settings conflict ..”; fixed
- Sometimes no min/max check while changing parameters via rotary knob; fixed
- No capitals with external keyboard possible (i.e. file dialog); fixed
- CList editor: cursor left/right has no function; fixed (now: same functionality as rotary knob)
- Sweep: setting a new frequency in mode STEP results in a wrong output frequency (always max value of step mode); fixed
- Sweep: mode STEP: variation with rotary knob works til min/max is reached, then no further variation possible; fixed

## 1.35 Version 1.30.08

**Released : June 2005**

**First version!**

## 2 Firmware Update

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**ATTENTION**

It is strongly recommended to do **no firmware downgrade** below the version the device was delivered originally (this is the version you can see if you select "Factory Default" starting with Backup/Recovery).

---

This R&S SMJ firmware revision consists of only one file:

**SMJ100A\_2.20.360.68.exe**

There are two possible ways to update your instrument:

### Local Firmware Update

The firmware update is performed directly on the instrument, typically using a USB memory stick. Mouse and keyboard have to be connected to the instrument. For instruments without front panel display (like the SMATE) an external monitor is required too. The appropriate VGA plug is located on the rear panel.

The front panel keys like **PRESET** or **SETUP** can be emulated performing a right-click on the block diagram.

See Chapter 2.1 for details.

### Remote Firmware Update

Alternatively the firmware update can be performed over LAN or SCPI from an external PC (running Windows XP). Connect the instrument via LAN or SCPI to the PC and run the firmware update from the PC.

See Chapter 2.2 for details.

---

**ATTENTION****Important Note for updating without SP2:**


Please contact your local R&S service department in order to update your instrument. Alternatively the needed files and packages can be installed manually. In this case download the file SystemSetup4SignalGenerators.zip and follow the instructions given in readme.txt.

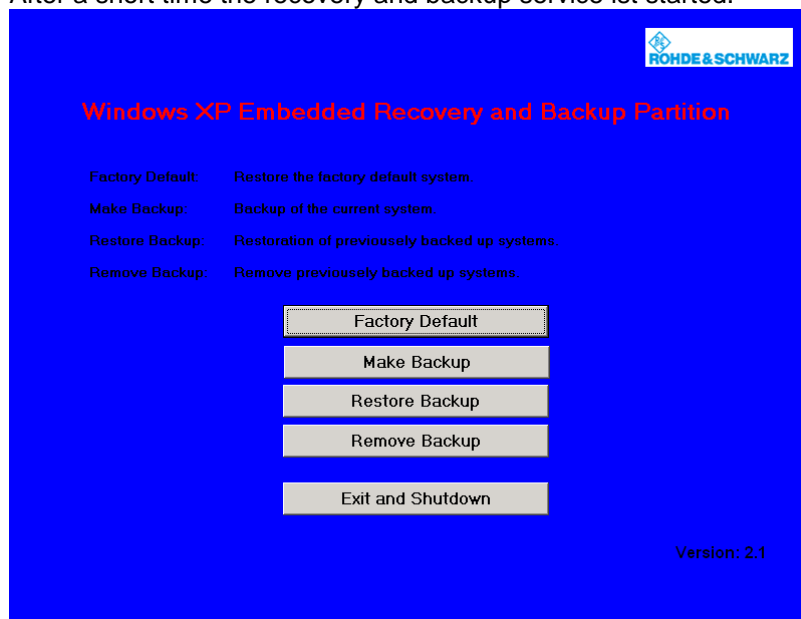
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## 2.1 Local Firmware Update

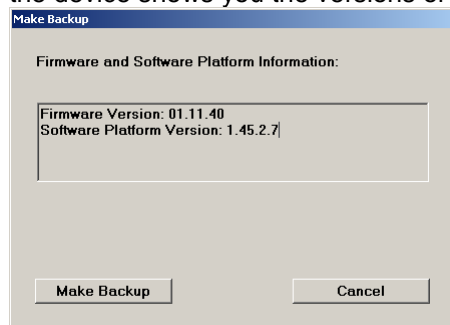
### 1. Save the current version

It is recommended to save the current/running version. This can be done very easily and completely intuitive with an USB keyboard and an USB mouse.

- Switch off the device and switch it on again. When the device is starting now you see the Bootmanager window (blue background, white field inside and a red selection line) after a short time. If you see this window press the cursor key  under the rotary knob, select **Backup/Recovery** and confirm this with pressing the key **BACKSPACE** on the device or **Enter** on the USB keyboard..
- After a short time the recovery and backup service ist started.



Select **Make Backup** via mouse or keyboard. The menu disappears and the device shows you the versions of what will be stored.



Select **Make Backup**, follow the instructions and the device starts working. The backup process takes some minutes. Please do not switch off the device, otherwise your backup may be corrupt. It's safe to switch off the device with the **Exit and Shutdown** button, when the menu is shown again.

If you want to restore a previously saved version select **Restore Backup** in the

same way.

## 2. Install the new firmware version on the R&S SMJ100A

- Switch off the instrument.
- Connect the external mouse and keyboard to the USB interface.
- Switch on the instrument.
- **Access Windows XP desktop**
  - Operating with the mouse
    - Wait until R&S SMJ100A firmware boot window with the progress bars appears.
    - Click on the **Abort** button in the boot window. Booting of the instrument firmware is aborted and the Windows XP desktop is displayed.
  - Operation with the keyboard
    - Wait until R&S instrument firmware has booted and the application has started.
    - Press **Alt** + **F4** to close the application. The Windows XP desktop is displayed.
- **Install new firmware version**
  - Plug in the USB memory stick which contains the update file.
  - Double-click the item **SMJ100A\_2.20.360.68.exe**
  - Select Next / Install and wait until installation has finished.
  - Confirm that you want to reboot the instrument in order to activate the firmware update (the instrument then restarts automatically, the USB memory stick has to be removed)

## 3. Execute Internal Adjustments

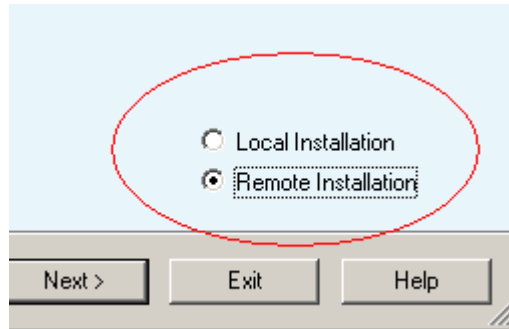
- Press the **PRESET** key on the instrument front panel.
- Press the **SETUP** key, select **Internal Adjustments** and execute **Adjust All**.  
This process updates internal instrument adjustments and will take several minutes. Adjustments requiring external measurement equipment are not affected by the firmware update and need not to be performed.

The firmware has been updated and the installation is completed.

## 2.2 Remote Firmware Update

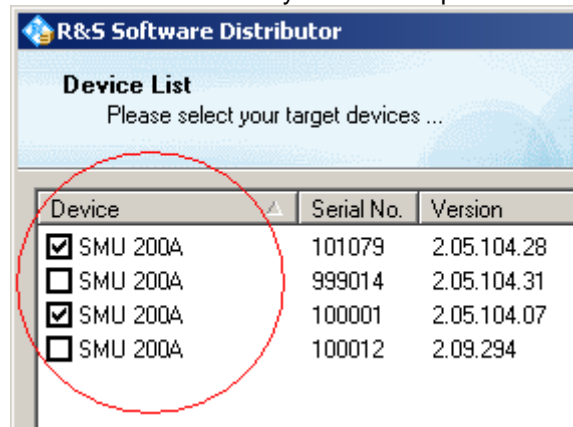
### 1. Install firmware

- Run **SMJ100A\_2.20.360.68.exe** on your PC
- Select "Remote Installation"



and click the button "Next>"

- After scanning SCPI and your LAN subnet all found instruments are listed. Select the instruments you want to update:



### ATTENTION



Please be careful and check twice if you have selected the correct instruments. Depending on your company's network structure also instruments of other departments will show up!

- Additional help will be displayed after clicking the button "Help"
- Start installation by selecting "Install"
- Confirm that you want to reboot the instrument in order to activate the firmware update (the instrument then restarts automatically)

### 2. Execute internal adjustments

- Press the **PRESET** key on the instrument front panel

Press the **SETUP** key, select **Internal Adjustments** and execute **Adjust All**.

This process updates internal instrument adjustments and will take several minutes.

Adjustments requiring external measurement equipment are not affected by the firmware update and need not to be performed.

## 3 Open Source Acknowledgement

This instrument firmware makes use of valuable open source software packages. The most important of them are listed together with their corresponding open source license information in a separate Open Source Acknowledgement document. This document also contains the verbatim license texts and can be downloaded from [www.rohde-schwarz.com](http://www.rohde-schwarz.com).

The OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>) includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com).  
LINUX® is a trademark of Linus Torvalds.

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

## 4 Customer Support

### Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

### Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

#### USA & Canada

Monday to Friday	(except US public holidays)
8:00 AM – 8:00 PM	Eastern Standard Time (EST)
Tel. from USA	888-test-rsa (888-837-8772) (opt 2)
From outside USA	+1 410 910 7800 (opt 2)
Fax	+1 410 910 7801
E-mail	<a href="mailto:CustomerSupport@rohde-schwarz.com">CustomerSupport@rohde-schwarz.com</a>

#### East Asia

Monday to Friday	(except Singaporean public holidays)
8:30 AM – 6:00 PM	Singapore Time (SGT)
Tel.	+65 6 513 0488
Fax	+65 6 846 1090
E-mail	<a href="mailto:CustomerSupport@rohde-schwarz.com">CustomerSupport@rohde-schwarz.com</a>

#### Rest of the World

Monday to Friday	(except German public holidays)
08:00 – 17:00	Central European Time (CET)
Tel. from Europe	+49 (0) 180 512 42 42*
From outside Europe	+49 89 4129 13776
Fax	+49 (0) 89 41 29 637 78
E-mail	<a href="mailto:CustomerSupport@rohde-schwarz.com">CustomerSupport@rohde-schwarz.com</a>

\* 0.14 €/Min within the German fixed-line telephone network, varying prices for the mobile telephone network and in different countries.