

# R&S®VTC/VTE/VT

## Video Testers

### Release Notes

### Firmware Version 02.20.0.1

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The following abbreviations are used throughout this document: R&S VTC/VTE/VT is abbreviated as R&S VTC/VTE/VT.

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# 1 Information on the Current Version and History

## 1.1 Version 02.20.0.1 (August 2020)

### New Functionality

- HDMI RX/TX 600 MHz module (R&S VT-B2363)
  - Support Characters Error Detection (CED) for SCDC
- Audio analysis (R&S VT-K2150)
  - Filter CCIR 1k / CIRR 2k is supported
  - New measurement Peak Level and Quasi Peak Level
- CEC/DDC Analyzer (R&S VT-K2391)
  - Save tracer files additionally as an csv file.

### Improvements

- HDMI analyzer (R&S VT-K2365)
  - :AUDIO Tab: Layout bit display as 2 Channel or 8 Channel
- Video analyzer (R&S VT-B2370)
  - Analog Video Input improving the synchronization time
- HDMI TX (R&S VT-K364)
  - Seamless change of video pattern

### Fixed Issues

- HDMI RX (R&S VT-B2363 / R&S VT-K2364)
  - Support HLG flag with the EDID
  - Display of Video Resolution for HDMI VICs 1 to 4
  - EDID support now H14b VSDB no more fails by CTS HF2-26 and CTS HF2-16
  - HDCP1.4: Ri check fails for video formats with low frame rate <30Hz
  - HDCP2.2 does not work with DVI signals
- HDMI 2.0 CTS Source Test (R&S VT-K2368)
  - HF1-21 - it fails with VIC63/64/77 and 78; Vic 91 and 92 are working fine
- HDMI 1.4 CTS Source Test (R&S VT-K2367)
  - 7-33/7-33a: Interoperability issues with various devices.
- HDMI TX (R&S VT-B2363 / R&S VT-K364)
  - Some monitor did not display 4k signals correctly

- Support of Deep Color by 4:2:0 signal  
(Please see known issues for format 4096 x 2160p)
- HDCP Re-Authentication with certain repeater failed.
- 4k 4:2:2 signal now supports BT2020
- 4k signal with scrambling off fixed
- Output Tab: Video Code description showed inaccurate pixel clocks
- Component format settings will now be updated by changing the HDMI standard
- Sometimes interlace format did not work correctly
- SCDC view now detects if sink device is not connected or if it is not supported by the connected sink device.
- Improved SCDC handling without rereading the EDID values
- RGB->YCbCr conversion matrix corrected.
- AV distortion analyzer (R&S VT-K2111)
  - Setting of APL limit for BlackFrame detection is working
- Video analyzer (R&S VT-B2370) / Audio analysis (R&S VT-K2150)
  - Old measurement values are no longer present after re-plug
- Video analyzer (R&S VT-B2370)
  - Fixed instable/frozen scope display via HDMI
- Video measurements (R&S VT-K2101)
  - Fixed SinX/X test measurements.
  - Fixed Vector Scope: Auto measurement with VESA standards.
- Broadcast TX modulator (R&S VT-B600)
  - Fixed transport player issues with DABplus streams.

#### Known Issues

- HDMI 2.0 CTS Source Test (R&S VT-K2368)
  - HF1-25 6G-Non2160p Deep Color: AVMUTE flag will be ignored during the tests.
- HDMI TX (R&S VT-B2363 / R&S VT-K364)
  - Format 4096 x 2160p/ 4:2:0 signal with Deep Color fails.
- HDMI analyzer (R&S VT-K2365)
  - HDCP Tab shows only zero (0) by attempted HDCP 2.2 connections, however, the HDCP operation is working.
- Audio analysis (R&S VT-K2150)
  - Freq. Resp./Phase Diff.: No measurement possible if signal level is less than -3.5dBfs.

## 1.2 Version 02.10.0.0 (April 2016)

### New Functionality

- New HDMI CEC/DDC analyzer supported (R&S VT-K2391).
- HDMI RX (R&S VT-K2364) supports deep color 16 bit signals.
- HDMI TX (R&S VT-K364) signal library is extended by HDR content.
- Broadcast TX modulator (R&S VT-B600): HEVC stream library is supported (R&S LIB-K78).
- Audio analysis (R&S VT-K2150): S/PDIF input compressed audio is supported.

### Fixed Issues

- HDMI TX (R&S VT-K364)
  - In rare cases, the DDC bus may block which requires a restart of the software.
- HDMI RX (R&S VT-K2364)
  - Sometimes HDCP 1.4 authentication can take few seconds. In rare cases, a reconnect is necessary.
  - In rare cases, there is no video picture or a distorted picture at the HDMI analyzer, video analyzer and AV distortion analyzer.
- Video measurements (R&S VT-K2101), video component measurement:
  - Scope: The blanking area is shifted by 2 pixels.
  - Not all VESA standards lead to a valid measurement result.
- Broadcast TX modulator (R&S VT-B600), DVB T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.

### Known Issues

- HDMI CEC/DDC analyzer (R&S VT-K2391):
  - "SCDC Read" function returns wrong values.  
Use the "SCDC" tab of the HDMI analyzer or HDMI generator for reading the correct values.
- HDMI TX (R&S VT-K364):

- Pixel repetition factors > 4 lead to an incorrect video output.
- HDMI RX (R&S VT-K2364):
  - In rare cases, there is no video picture or a distorted picture at the HDMI analyzer, video analyzer and AV distortion analyzer.
- Audio analysis (R&S VT-K2150), "Quality" tab:
  - Left hand scale not visible on Mos-LQ graphs, if the range (max-min) is small.
- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video composite measurement (R&S VT-K2101):
  - Level accuracy for  $\sin x/x$  measurement not sufficient.
- Video measurements (R&S VT-K2101), video component measurement:
  - In rare cases, measurement of some parameters switched off (not reproducible so far).
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly
- Remote issue:
  - In rare cases, the firmware blocks after intensive usage of the remote interface. A firmware restart solves the issue.
- Installation:
  - Broadcast TX modulator (R&S VT-B600) firmware update:
    - Do not use remote installation option of setup program. The close application functionality of broadcast TX modulator works not correct.
    - Use the local installation option or close the broadcast TX modulator and the VTC/VTE/VTs application manually before starting remote installation.

### 1.3 Version 02.00.2.0 (February 2016)

#### New Functionality

- HDMI RX/TX 600 MHz module (R&S VT-B2363) supports the following features:
  - HDCP 1.4 and 2.2 repeater mode

#### Known Issues

- HDMI TX (R&S VT-K364)
  - In rare cases, the DDC bus may block which requires a restart of the software.
  - Pixel repetition factors > 4 lead to an incorrect video output.
- HDMI RX (R&S VT-K2364)
  - Sometimes HDCP 1.4 authentication can take few seconds. In rare cases, a reconnect is necessary.

- In rare cases, there is no video picture or a distorted picture at the HDMI analyzer, video analyzer and AV distortion analyzer.
  - Video Analyzer: Slope cursor position may be inaccurate (max. +/- 2 pixel).
- Audio analysis (R&S VT-K2150) "Quality" tab:
  - Left hand scale not visible on Mos-LQ graphs, if the range (max-min) is small.
- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video composite measurement (R&S VT-K2101):
  - Level accuracy for  $\sin x/x$  measurement not sufficient.
- Video measurements (R&S VT-K2101), video component measurement:
  - Scope: The blanking area is shifted by 2 pixels.
  - Not all VESA standards lead to a valid measurement result.
  - In rare cases, measurement of some parameters switched off (not reproducible so far).
- Remote issue:
  - In rare cases, the firmware blocks after intensive usage of the remote interface. A firmware restart solves the issue.
- Broadcast TX modulator (R&S VT-B600), DVB T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.4 Version 02.00.0.1 (November 2015)

### New Functionality

- HDMI RX/TX 600 MHz module (R&S VT-B2363) supports the following features:
  - HDCP 1.4 and 2.2 encryption and decryption
  - HDCP 1.4 and 2.2 analysis

- Dynamic Range and Mastering (DRAM) InfoFrame display and generation.
- EDID supports HDR Static Metadata Data Block
- HDMI TX 300 MHz module (R&S VT-B360) supports the following feature:
  - Dynamic Range and Mastering (DRAM) InfoFrame generation.

#### Fixed Issues

- HDMI RX/TX 600 MHz module (R&S VT-B2363)
  - Video analyzer HDMI formats with pixel clock over 525 MHz are shown correctly.
  - In rare cases, the video generator does not start.
  - HDMI analyzer cannot synchronize on VIC99 with RGB and 12Bit deep color.
  - Wrong colors at some VICs (SDTV) and 4:2:2.

#### Known Issues

- HDMI RX/TX 600 MHz module (R&S VT-B2363):
  - HDCP1.4 and 2.2 does not support repeater mode.
- HDMI TX (R&S VT-K364)
  - In rare cases the DDC bus may block which requires a restart of the software.
  - Pixel repetition factors > 4 lead to an incorrect video output.
  - Usage of deep color may lead to a corrupted signal for some VICs.
- HDMI RX (R&S VT-K2364)
  - Sometimes HDCP 1.4 authentication can take few seconds. In rare cases a reconnect is necessary.
  - In rare cases, there is no video picture or a distorted picture at the HDMI analyzer, video analyzer and AV distortion analyzer.
  - Video Analyzer: Slope cursor position may be inaccurate (max. +/- 2 pixel).
- Audio analysis (R&S VT-K2150) "Quality" tab:
  - Left hand scale not visible on Mos-LQ graphs, if the range (max-min) is small.
- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video composite measurement (R&S VT-K2101):
  - Level accuracy for  $\sin x/x$  measurement not sufficient.
- Video measurements (R&S VT-K2101), video component measurement:
  - Not all VESA standards lead to a valid measurement result.
  - In rare cases, measurement of some parameters switched off (not reproducible so far).
- Remote issue:



- In rare cases, the firmware blocks after intensive usage of the remote interface. A firmware restart solves the issue.
- Broadcast TX modulator (R&S VT-B600), DVB T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.5 Version 01.98.0.0 (August 2015)

### New Functionality

- HDMI RX/TX 600 MHz module (R&S VT-B2363) supported. The new module supports the following features:
  - HDMI TX (R&S VT-K364)
  - HDMI RX (R&S VT-K2364)
  - HDMI 1.4 CTS Source Test (R&S VT-K2367) with the following test cases:  
7-16, 7-17, 7-18, 7-19, 7-23, 7-24, 7-25, 7-26, 7-27, 7-28, 7-29, 7-30, 7-31, 7-32, 7-33, 7-33a, 7-34, 7-35, 7-36, 7-37, 7-38, 7-39, 7-40
  - HDMI 2.0 CTS Source Test (R&S VT-K2368) with the following test cases:  
HF1-13, HF1-10, HF1-11, HF1-12, HF1-21, HF1-22, HF1-31, HF1-32, HF1-14, HF1-15, HF1-16, HF1-24, HF1-25, HF1-26, HF1-33, HF1-34, HF1-35, HF1-41, HF1-36, HF1-37, HF1-38, HF1-39, HF1-43, HF1-40, HF1-47, HF1-48, HF1-49, HF1-18, HF1-28, HF1-51, HF1-52, HF1-44, HF1-45, HF1-53
  - HDMI 1.4 CTS Sink Test (R&S VT-K367) with the following test cases:  
8-15, 8-16, 8-17, 8-18, 8-19, 8-20, 8-21, 8-22, 8-23, 8-24, 8-25, 8-27, 8-28, 8-29, 8-30, 8-31
  - HDMI 2.0 CTS Sink Test (R&S VT-K368) with the following test cases:  
HF2-9, HF2-5, HF2-23, HF2-24, HF2-6, HF2-7, HF2-8, HF2-36, HF2-37, HF2-38, HF2-25, HF2-31, HF2-32, HF2-35, HF2-39, HF2-41, HF2-26, HF2-53, HF2-10, HF2-54

- HDMI TX 300 MHz module (R&S VT-B360):
  - New HDMI 1.4 CTS test cases for HDMI CTS sink test (R&S VT-K365): 8-27, 8-28
- HDMI CTS RX/TX 600 MHz module (R&S VT-B2362):
  - New HDMI 2.0 CTS test case for HDMI CTS sink test (R&S VT-K365): HF2-54
- Time domain analyzer (R&S VT-B2380):
  - Eye pattern result data can be read via remote control (`:READ:ARRay:TDA:SCOPE:EYE?`).
  - HDMI CTS source test (R&S VT-K2385): New CTS test for HDMI2.0: HF1-7 "TMDS 6G Clock Jitter"
- Video analyzer (R&S VT-B2370): New remote control commands
  - For querying the sync status of the video signal:  
`:READ:SCALar:VIDeo:SIGNal? SYNCok|UNSYnc`
  - For switching the external synchronization for analog component signals: `ROUTE{hw}:VIDeo:SSElect ON|OFF`
- HDMI analyzer (R&S VT-K2365):
  - Improvements on CTS test: HF1-12 "TMDS Prot 6G" – Basic Prot and Scrambling: Additional video formats.
- AV distortion analyzer (R&S VT-K2111):
  - Configuration of APL synchronization is supported.

#### Modified Functionality

- Audio analysis (R&S VT-K2150):
  - Frequency response measurement at low frequencies is improved.
- HDMI analyzer, HDMI CTS source test (R&S VT-K2365):
  - The test case HF1-51 now requires the HDMI CTS RX/TX 600 MHz module (R&S VT-B2362) or the HDMI RX/TX 600 MHz module (R&S VT-B2363). This is due to new 6G capability requirement in the CTS 2.0 V7.
- Video measurements (R&S VT-K2101), video component measurement:
  - Name changes: "Field Period" to "Frame Period", "Field Frequency" to "Frame Frequency".
  - Default location windows are changed for "Linear Distortions", "ST Dist" parameters in YCbCr (PbPr) configuration.
- Video measurements (R&S VT-K2101), video composite and component measurement:
  - When leaving the Auto measurement, the measurement values are marked as invalid.
  - Occasionally, it was observed that some parameters showed the status "OFF" if there was no sync. These parameters now show "Signal?" status.

- If you try to load an incompatible configuration (RGB, YCbCr (PbPr), PAL, NTSC), an error message is shown. Previously, loading of the configuration was simply ignored.
- Time domain analyzer (R&S VT-B2380):
  - Eye pattern representation is improved.
  - HDMI CTS source test (R&S VT-K2385): During execution of HDMI1.4, 7-1 EDID Related Behavior the DUT, it is requested to read the EDID. A timeout has been implemented for this reading to avoid an infinite test time.
- On some older R&S VTC/VTE images, a Realtek sound driver, which shadows the Microsoft sound driver, has been installed. The setup removes the Realtek sound driver if it is detected.
- MHL analyzer, MHL CTS system source test (R&S VT-K2355):
  - If one test is selected, all other tests are automatically deselected.

### Fixed Issues

- HDMI analyzer, HDMI RX 300 MHz module (R&S VT-B2361):
  - In rare cases, the values "H Front Porch Pixels" and "H Sync Pixels" were not shown correctly if the DUT changed. This has been corrected.
- Video analyzer: After a large number of input changes, a deadlock situation was observed. This resulted in a SCPI time out error. In addition, the HDMI input was not working anymore within the Auto measurement. This has been corrected.
- Time domain analyzer, HDMI CTS source test (R&S VT-K2385):
  - Center of eye not always detected correctly. This has been corrected.

### Known Issues

- HDMI RX/TX 600 MHz module (R&S VT-B2363):
  - HDCP1.4 and 2.2 is not supported yet.
  - Video analyzer HDMI formats with pixel clock over 525 MHz are not shown correctly.
  - In rare cases, the video generator does not start. Restart the application.
  - In rare cases, there is no video picture or a distorted picture at the HDMI analyzer. Restart the application.
  - HDMI analyzer cannot synchronize on VIC99 with RGB and 12Bit deep color.
  - Wrong colors at some VICs (SDTV) and 4:2:2.
- Audio analyzer, "Quality" tab:
  - Left hand scale not visible on Mos-LQ graphs, if the range (max-min) is small.
- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video composite measurement (R&S VT-K2101):

- Level accuracy for  $\sin x/x$  measurement not sufficient.
- Video measurements (R&S VT-K2101), video component measurement:
  - Not all VESA standards lead to a valid measurement result.
  - In rare cases, measurement of some parameters switched off (not reproducible so far).
- Firmware issue:
  - In rare cases, the firmware blocks after intensive usage of the remote interface. A firmware restart solves the issue.
- Broadcast TX modulator (R&S VT-B600), DVB T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.6 Version 01.90.0.2 (March 2015)

### New Functionality

- New CTS tests for Time Domain Analyzer (R&S VT-K2385):
  - HDMI1.4: 7-1 EDID Related Behavior, 7-8 TMDS Clock Duty Cycle, 7-10 TMDS Data Eye Diagram, 7-11 +5V Power, 7-12 Hot Plug Detect, 7-13 DDC/CEC Capacitance and Voltage, 7-15 Line Degradation.
  - HDMI2.0: HF1-6 TMDS 6G Clock Duty Cycle.
- New CTS tests for HDMI Analyzer (R&S VT-K2365):
  - HDMI1.4: 7-33a Interoperability with multiple VSDB.
  - HDMI2.0: HF1-36 3D Audio (L-PCM) Packet Format, HF1-37 3D Audio (One Bit) Packet Format, HF1-38 MS Audio (L-PCM and 61937) Packet Format, HF1-39 MS Audio (One Bit) Packet Format, HF1-40 CEA-861-F Audio, HF1-41 3D Audio IEC Sample Packet.
- Newly produced R&S VTS instruments come with a new CPU. This allows the AV Distortion Analysis (R&S VT-K2111) to be run on these instruments.

- AV Delay Measurement for time code synchronization with test tone (R&S VT-K2111).
- Additional configuration parameters for "Freeze" in AV Distortion Analysis (R&S VT-K2111).

#### Modified Functionality

- Analog Video Component Measurement (R&S VT-K2101): the default setting for the "Line Counter" in the "Location Editor" has been changed to "Full Field".
- Video Analyzer scope uses improved interpolation filters.
- Limit Values for Time Domain Analyzer CTS tests (R&S VT-K2385) are now part of the CTS report.
- Improved CTS report format for Time Domain Analyzer (R&S VT-K2385).
- Implementation of the dependencies of the Audio Analyzer options VT-K2151, VT-K2158 and VT-K2159 corrected.
- HDMI CTS Sink Test HF2-25 (R&S VT-K365) can now be configured.

#### Fixed Issues

- Analog video component measurement (R&S VT-K2101): Interchannel delay measurement became unstable in very rare cases.
  - Interchannel delay measurement works reliably now.
- Improvements on Video Analyzer vector scope:
  - Recognizes an SMPTE color bar now.
  - Handles VESA signals properly now.
- HDMI Analyzer 6G CTS tests (R&S VT-2365): dynamically created EDIDs did not contain an HF-VSDB. As a consequence 6G end products did not output a 6G signal.
  - This problem has been solved.
- Audio Analyzer (R&S VT-K2150): accuracy of THD+N measurements improved.
- Audio Analyzer (R&S VT-K2150): accuracy of frequency measurement improved.
- Compressed Audio Support (R&S VT-K2151): improved measurement for sampling rates above 48 kHz.

#### Known Issues

- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Time Domain Analyzer CTS Tests (R&S VT-K2385):
  - Limit mask cannot be centered manually.
  - Center of eye not always detected correctly.
- Video composite measurement (R&S VT-K2101):
  - Level accuracy for  $\sin x/x$  measurement not sufficient.

- Video component measurement (R&S VT-K2101):
  - Not all VESA standards lead to a valid measurement result.
  - In rare cases measurement of some parameters switched off (not reproducible so far).
- HDMI Analyzer (R&S VT-B2361) :
  - In rare cases the values "H Front Porch Pixels" and "H Sync Pixels" are not shown correctly if the DUT changes (not reproducible so far).
- Broadcast TX modulator (R&S VT-B600), DVB T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.7 Version 01.80.0.0 (November 2014)

### New Functionality

- Board HDMI CTS RX/TX 600 MHz supported (R&S VT-B2362).
- CTS tests for Time Domain Analyzer supported (R&S VT-K2385):
  - HDMI1.4: 7-2 TMDS  $V_L$ , 7-3 TMDS  $V_{Off}$ , 7-4 TMDS  $T_{Rise}$   $T_{Fail}$ , 7-6 TMDS Inter Pair Skew, 7-7 Intra Pair Skew.
  - HDMI 2.0: HF1-1 TMDS 6G  $V_L$  and  $V_{Swing}$ , HF1-2 TMDS 6G  $T_{Rise}$   $T_{Fail}$ , HF1-3 TMDS 6G Inter Pair Skew, HF1-4 TMDS 6G Intra Pair Skew, HF1-5: TMDS 6G Differential Voltage.
- Audio Analyzer: Extension of Compressed Audio (R&S VT-K2151):
  - E-AC3, MPEG1 and 2, MPEG2 AAC, MPEG4 AAC.
- Improvements for Video measurement (R&S VT-K2101):
  - Additional filter for composite noise measurements.
  - Additional filter for component noise measurements.
  - New C/L gain measurements for composite signals.
  - Measurement of Gain S2 and Phase S2 for composite signals supported.

- Video Analyzer: Support of STANAG 3350 / Part 6: Analogue video standard for aircraft system applications.
- Hardcopy function available.
- Selftest for board HDMI CTS RX/TX 600 MHz supported (VT-B2362).

#### Modified Functionality

- Video measurement (R&S VT-K2101):
  - Auto correction of location windows if sync to video content is shifted for component signals.
  - For composite chroma noise AM and PM measurements the instrument displays "> 55 dB" if the specified measurement range is exceeded.
- Audio Analyzer: Frequency response representation in dB with reference to 1kHz.

#### Fixed Issues

- Improvements on Video measurement (R&S VT-K2101):
  - The parameters for composite multiburst measurements have 11 locations, but only 10 are shown in the chart.
  - ➔ All 11 locations are shown in the chart now.
  - Parameter Inter channel amplitude for component signals delivers correct results independent from DC offset.
- Improvements on Video Analyzer Scope:
  - Improved measurement of level cursor difference for digital signals.
- TMDs time domain analyzer (R&S VT-B2380)
  - User defined EDID configuration works now reliably.

#### Known Issues

- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video analysis (R&S VT-K2100):
  - HDMI2.0 signals with 4:2:0 coding are currently not supported.
- Broadcast TX modulator (R&S VT-B600), DVB-T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.

- Broadcast TX modulator (R&S VT-B600), DVB-C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.8 Version 01.70.0.0 (September 2014)

### New Functionality

- Support of Time Domain Analyzer Board (R&S VT-B2380).
- Completion of HDMI CTS sink tests (R&S VT-K365).
- Extended functionality for MHL generator (R&S VT-B2350).
- Video Analyzer: Vector Scope supported.
- Audio Analyzer: POLQA measurement supported (R&S VT-K2159).
- Audio Analyzer: PESQ measurement supported (R&S VT-K2158).
- Audio Analyzer: Compressed Audio for AC3 supported (R&S VT-K2151).
- HDMI Analyzer: Sample EDID files are installed (R&S VT-B2360/2361).
- HDMI Analyzer: Indication of compressed audio formats in EDID for CTS Test ID 7-36 supported (R&S VT-K2365).
- Improvements for Video measurement (R&S VT-K2101):
  - Group Nonlinear distortions for component signals supported.
  - Group Timing measurements for component signals supported.
  - Group Jitter measurements for component signals supported.
  - Filter settings for NTSC noise measurements can be configured.
  - 2T Pulse KPB for composite signals supported.
- Update of old BIOS versions with firmware update.

### Modified Functionality

- None.

### Fixed Issues

- Improvements for Audio Analyzer:
  - Cross talk measurement has been improved.
  - Frequency Response measurement has been improved.
- Improvements on Video measurements (R&S VT-K2101):
  - Component noise measurements on ramp signal improved.
  - Composite noise measurements improved.
  - Precision of inter channel delay measurement for analog component signals is consistent with specification.



- HDMI Generator: HDCP was switched off by mistake if bcaps register is set to 0 (R&S VT-B360)
  - Fixed.

#### Known Issues

- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video analysis (R&S VT-K2100):
  - HDMI2.0 signals with 4:2:0 coding are currently not supported.
- Broadcast TX modulator (R&S VT-B600), DVB-T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB-C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.
- TMDS time domain analyzer (R&S VT-B2380)
  - User defined EDID configuration might fail occasionally

## 1.9 Version 01.60.0.3 (May 2014)

#### New Functionality

- Extension of video auto measurements for composite video signals (R&S VT-K2101):
  - Chrominance Nonlinear Gain S1 and S3 (C NL Gain S1/S3)
  - Chrominance Nonlinear Phase S1 and S3 (C NL Phase S1/S3)
  - AM/PM Noise Measurement (Chroma Noise AM/PM)
  - Bar Width (Lum Bar Duration)
- Video measurements (R&S VT-K2101): First version of auto measurements for component video signals supported.
- Additional HDMI 2.0 (3G mode) compliance test ids (R&S VT-K2365/VT-K365).
- Enhanced TMDS Protocol Analyzer (R&S VT-B2350/VT-B2351/VT-B2360/VT-B2361).

- Completion of HDMI TX 300 MHz (R&S VT-B360).
- HDMI TX CEC Tracer supported (R&S VT-K2366).

#### Modified Functionality

- None.

#### Fixed Issues

- Video analysis (R&S VT-K2100):
  - Auto measurement for composite signals: The following parameters are now measured correctly: "Field Jitter", "Vtxt Basic Amplitude", "Vtxt Decoding Margin", "Vtxt Timing Margin".
  - "Scope" tab: If the "Composite..." input is selected and a preset is triggered, the measurement of composite signals is stopped.
  - If the "Auto" tab is selected, the measurement starts correctly now.
  - "Scope" tab: For signals in M/NTSC standard, the line counting in line and field is not supported. Line numbers for the 2nd field should be entered as 263..525.
  - Line numbers for the 2<sup>nd</sup> field can now be entered by selecting "Field 2".
- Online help: Repeated opening and closing of the help in fast sequence may lead to malfunction of the application.
  - Online help works now correctly.
- Live picture: In very rare cases, no live picture is being displayed.
  - Live picture is now reliably displayed.

#### Known Issues

- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video analysis (R&S VT-K2100):
  - HDMI2.0 signals with 4:2:0 coding are currently not supported.
- Video measurement (R&S VT-K2101):
  - Interchannel delay measurement for analog component signals is not precise
- Broadcast TX modulator (R&S VT-B600), DVB-T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.

- Broadcast TX modulator (R&S VT-B600), DVB-C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.10 Version 01.50 (November 2013)

### New Functionality

- HDMI moving pictures supported (R&S VT-K361).
- HDMI TX user defined supported (R&S VT-K362).
- HDMI TX CTS sink test supported (R&S VT-K365).
- Final version of HDMI CTS source test supported (R&S VT-K2365).
- CEC tracer supported (R&S VT-K2366).
- Video measurements (R&S VT-K2101): Video auto measurements for composite video signals supported.

### Fixed Issues

- Tooltip conflict with numeric input and error in file editor.
- Display font size and color set do not work correctly.
- Sporadically wrong aspect ratio of live video in applications.
- MHL RX/TX (R&S VT-B2350): Short frame and audio drop outs when connecting an MHL sink.
- HDMI-TX (R&S VT-B360): Inter channel phase errors in 8 channel mode.
- AV distortion analyzer (R&S VT-K2111):
  - Live video eventually stops. An application switch restarts it.
  - Update of trace limit lines happens only if subtab is changed.
- Video analysis (R&S VT-K2100), "Scope" tab: Numerical display of slope cursor position corrected.

### Known Issues

- AV distortion analyzer (R&S VT-K2111):
  - Component signal sampling rate and video frequency not coupled.
- Video analysis (R&S VT-K2100):
  - HDMI2.0 signals with 4:2:0 coding are currently not supported.
  - "Auto" tab: The following parameters are only available for demonstration purposes: "Field Jitter", "Vtxt Basic Amplitude", "Vtxt Decoding Margin", "Vtxt Timing Margin". Measurement accuracy for these parameters will be available in next version.

- "Scope" tab: If the "Composite..." input is selected and a preset is triggered, the measurement of composite signals is stopped. A subsequent switch to the "Component..." input and return to the "Composite..." input restarts the scope measurement again.
- "Scope" tab: For signals in M/NTSC standard, the line counting in line and field is not supported. Line numbers for the 2nd field should be entered as 263..525.
- Online help: Repeated opening and closing of the help in fast sequence may lead to malfunction of the application.
- Live picture: In very rare cases, no live picture is being displayed. Restart the application to restore the signal.
- Broadcast TX modulator (R&S VT-B600), DVB-T2 coder (R&S VT-K616):
  - L1 post scrambled malfunction, if number of PLPs > 2.
  - Malfunction at 1.7 MHz channel bandwidth, if T2MI interface is used.
  - Malfunction for some single PLP setups, if time interleaving is disabled.
  - Malfunction of BBFrame header parser and L1 signal processing.
  - Missing P1 FEF symbol, if FEF length is small.
  - Multi PLP time interleaver malfunction, if number of blocks is large for one PLP.
  - 10 MHz channel bandwidth supported.
- Broadcast TX modulator (R&S VT-B600), DVB-C2 coder (R&S VT-K617):
  - Short FEC frame, 4096QAM, CR 5/6 and data slice type 1 combination not working correctly.
  - Notch width greater than 255 not working correctly.
  - Malfunction of ISSY feature at data slice type 1.
  - PN15 is not working correctly.

## 1.11 Version 01.42 (August 2013)

### New Functionality

- Broadcast TX modulator supported (R&S VT-B600).

### Modified Functionality

- MHL RX/TX (R&S VT-B2350): Support of MHL 1.3 (replacing MHL 1.2).
- MHL RX PackedPixel (R&S VT-B2351): Support of MHL 1.3 (replacing MHL 1.2).

## 1.12 Version 01.40 (July 2013)

### New Functionality

- HDMI TX 300 MHz module is supported (R&S VT-B360).
- MHL RX PackedPixel module is supported (R&S VT-B2351).
- HDMI RX (R&S VT-B2361): 4k EDID is available.

- Video analyzer: analog component input is supported (R&S VT-K2371).
- CBUS tracer is supported (R&S VT-K2356).

#### Fixed Issues

- AV distortion analyzer:
  - Sometimes signal loss causes incorrect PFP results.
  - Settings: tooltip of "Average" parameters are not in exponential format.
  - Learning via time code: "Accept" button becomes not available if frame number 0 is missing.
- Video analyzer:
  - "Scope" tab: wrong level value inside the blanking period of digital signals.
  - Preset is not working.
- R&S VTC hardkeys on the front panel: LOCAL, HCOPY and INFO are working.
  - Pressing the LOCAL hardkey changes the instrument mode from remote to local.
  - Pressing the HCOPY hardkey shows a popup window.
  - Pushing the INFO hardkey shows a popup window.
- MHL TX: reading EDID failed after startup.
- MHL RX/TX: HDCP on AUX output works not reliable.
- "Setup" > "Service" > "Selftest" is disabled.

#### Known Issues

- HDMI RX/TX HEC works not correctly depending on the cable length.
- HDMI TX (R&S VT-B360): inter channel phase errors in 8-channel mode.
- Video analyzer, analog component input (R&S VT-K2371):
  - External synchronization is not supported yet.
  - Input Tab: Live video with input format 1280x720p@100/120Hz is sometimes disturbed.
- AV distortion analyzer:
  - Live video eventually stops. An application switch restarts it.
  - Analog Component input is not supported yet.
- MHL RX/TX: Short frame and audio drop outs when connecting an MHL sink.

## 1.13 Version 01.30 (March 2013)

#### New Functionality

- Audio analysis supported (R&S VT-K2150).
- HDMI CTS source test supported (R&S VT-K2365).
- AV distortion analyzer: log and audio supported.
- MHL CTS 2.0 in a preliminary version supported.

**Modified Functionality**

- MHL RX/TX module supports HDMI on AUX output.
- Zoom view of live video charts.

**Fixed Issues**

- SOURCE:ROSCillator:... remote commands fail without MHL module.
- MHL TX CTS test streams contain old product descriptions in SPD InfoFrames.
- AV distortion analyzer:
  - Start/stop problems via remote control.
  - Application crash after change of video resolution.
  - Displays a wrong HDMI video resolution when a MHL module is plugged in.
  - Recording buffer will not be cleared after "Abort".
  - Frame drops with signal from analog composite input.
- HDMI RX (4kx2k SMPTE):
  - Wrong active pixel value (4095 instead of 4096) is corrected.
  - Application/measurement is not starting when enabled via remote.
  - Multiple reconnections of the input connector cause a picture freeze.
- Video analyzer: selected video line of composite input does not fit to displayed video line.

**Known Issues**

- Video analyzer, "Scope" tab: wrong level value inside the blanking period of digital signals.
- R&S VTC hardkeys on the front panel: LOCAL, HCOPY and INFO do not work.
- AV distortion analyzer, settings: tooltip of "Average" parameters are not in exponential format.
- MHL TX: reading EDID failed after startup.
- MHL RX/TX HDCP on AUX output works not reliable.
- "Setup" > "Service" > "Selftest" is not implemented yet. Test returns always fail after executing.

## 1.14 Version 01.20 (October 2012)

**New Functionality**

- HDMI RX module supported (R&S VT-B2360 / R&S VT-B2361).
- Analog A/V RX module supported (R&S VT-B2370).
- AV distortion analyzer: trace functionality.
- HDMI real time analyzer supported.

**Modified Functionality**

- MHL analyzer/generator: all CTS system tests supported.
- Video analyzer: composite and HDMI input signal supported.
- AV distortion analyzer: composite and HDMI input signal supported.

**Fixed Issues**

- MHL analyzer, "CTS" tab:
  - "EDID Reading Test" issue.
  - "Audio Clock Regeneration Test" configuration fails.
- AV distortion analyzer:
  - Erroneous display of reference file name in "Self Referenced" synchronization.
  - "Loop Detection" measurement results on "List" tab: decimal places are always 0.
- MHL generator, "CTS" tab: if "RCP Test" is selected, test configuration is not shown.
- Setup, "System" tab: critical error after selecting "Dynamic DNS" under "LAN Services".

**Known Issues**

- HDMI analyzer:
  - R&S VT-B2361 is only supported with installed K0 demo option.
  - H4kx2k (SMPTE) wrong value of active pixel: 4095 instead of 4096.
- Video analyzer, "Scope" tab:
  - "Vblank 2" composite rescale mode results in "Vblank 1".
  - Wrong level value inside the blanking period of digital signals.
  - Waveform refresh rate very low for 4k signals.
- AV distortion analyzer:
  - "Trace" tab: if a high number of cycles is recorded, navigation in recorded cycles fails temporarily.
  - Audio measurement not working.
- Preset/reset of current application not working.

## 1.15 Version 01.10 (August 2012)

**New Functionality**

- AV inspection (R&S VT-K2110)
- AV distortion analyzer: failure point measurement
- Audio playback

**Modified Functionality**

- MHL analyzer/generator: all CTS system tests (excluding HDCP) supported.

**Fixed Issues**

- Change of computer name impairs the device functionality.
- Program start sometimes stalls after power on.
- MHL generator: LED indicating active output.
- MHL analyzer: CTS/3.2.3.1 video formats test fixed.
- AV distortion analyzer: crash after pressing frequently start/stop.

**Known Issues**

- Preset/reset of current application not working.
- AV distortion analyzer: audio measurement not working.

## 1.16 Version 01.00 (May 2012)

**New Functionality**

- First release.

**Known Issues**

- HDMI AUX supports only DVI.



## 2 Modifications to the Documentation

The R&S broadcast TX modulator (R&S VT-B600) can only be remote controlled via the features "sockets" or "raw TCPIP". The port number is 5030.

The information required to establish the connection is:

- IP address of the instrument or instrument name (computer name)
- Port number = 5030

Example for a typical VISA TCPIP raw socket resource string:

"TCPIP::IP-ADDRESS::5030::SOCKET"

## 3 Firmware Update

Your instrument is delivered with the latest firmware version available. Firmware updates are provided on the Rohde & Schwarz Home Page ([http://www.rohde-schwarz.com/firmware/vtc\\_vte\\_vts](http://www.rohde-schwarz.com/firmware/vtc_vte_vts)), by Rohde & Schwarz service centers or sales offices.

You can install the new firmware version by using either the USB or the LAN interface:

- For an update using the USB interface, store the downloaded update file on a memory stick.
- For an update using the LAN interface (due to speed recommended), store the downloaded update file on a network directory.

### Further information

- Installing software options  
See user manual, chapter "Basic Instrument Configurations".
- Connecting the instrument to a network (LAN)  
See the user manual, chapter "Operating Concepts".
- Sharing and accessing instrument drives  
See the user manual, chapter "Operating Concepts".
- Making a backup before installing new firmware  
See the user manual, chapter "Installed Software".

### 3.1 Update Information

The firmware update consists of one file:

- R&S VTC: *SetupRsVtc(Release).exe*
- R&S VTE: *SetupRsVte(Release).exe*
- R&S VTS: *SetupRsVts(Release).exe*

If the ATV multistandard coder (R&S VT-K695) is used, the following file is necessary too:

- Video signals: *AtvVideoBasic\_02.10.00.00.msi*

The update is performed under control of the Windows 7 operating system. Windows 7 can only be accessed if a mouse and optional an external keyboard is connected.

## 3.2 Remote Installation (Recommended Procedure)

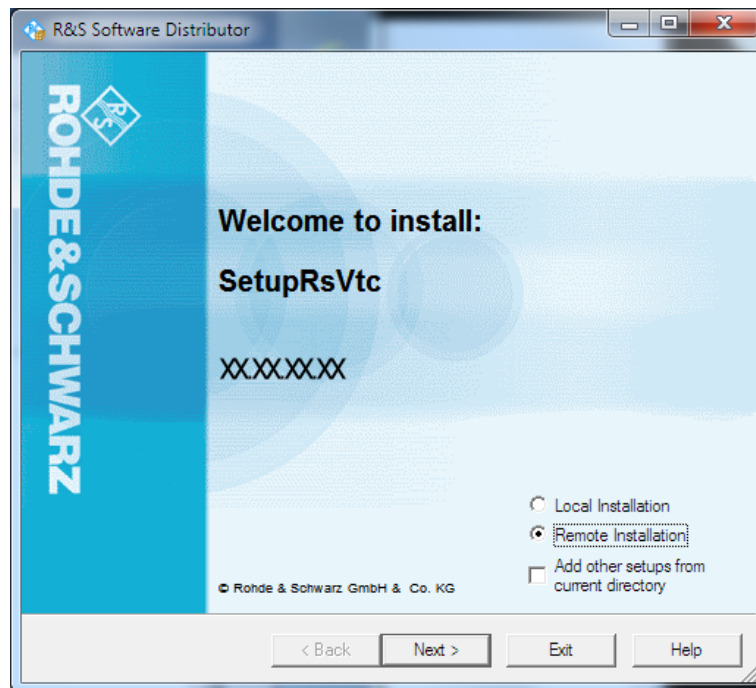
This is the recommended way to install a new firmware version. You can update several instruments simultaneously.

Prerequisites:

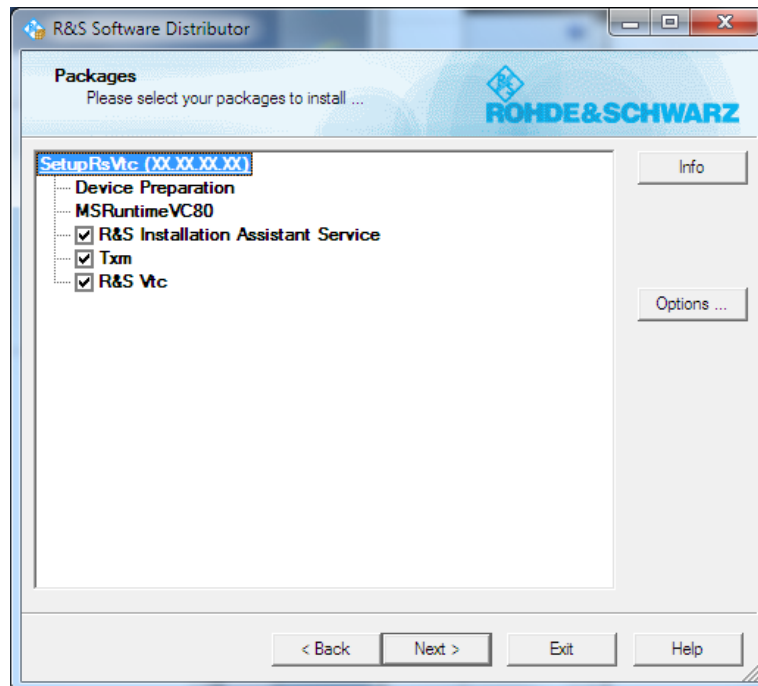
- The instruments are connected to the LAN.
- The downloaded update file is stored on a network directory.
- The external host computer that you use for the installation is also connected to the LAN.

### Performing the installation

1. Execute the setup file (see Update Information on page 30), for example *SetupRsVtc(Release).exe*.  
The R&S Software Distributor is displayed (e.g. for the R&S VTC).

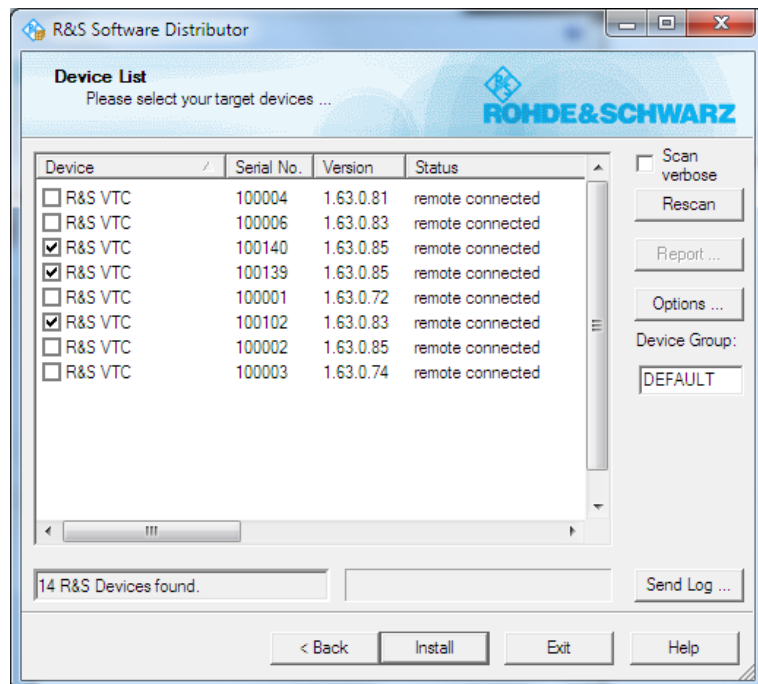


2. Select "Remote Installation".
3. Click "Next>".



All packages that you need to install are already selected.

4. Click "Next>".
5. In the "Device" column, select all instruments that you want to update.



6. Click "Install".  
The installation process itself is self-explanatory.
7. After the installation, click "Exit".

### 3.3 Local Installation

The updating process consists of 2 steps:

1. Preparing the instrument for the installation.  
R&S VTC/VTE: see [Preparing the R&S VTC/VTE for the Installation](#) on page 29  
R&S VTS: see [Preparing the R&S VTS for the Installation](#) on page 29
2. Installing the new firmware version. The procedure is the same for R&S VTC/VTE/VTs.  
See [Installing the New Firmware Version](#) on page 30

#### 3.3.1 Preparing the R&S VTC/VTE for the Installation

1. Switch off the R&S VTC/VTE.
2. Connect a mouse and/or external keyboard to the USB interface.
3. Switch on the R&S VTC/VTE.
4. Wait until the R&S VTC/VTE firmware has booted and the application has started.
5. Access the Windows 7 desktop.
  - Operation with mouse: Click the "Close" button of the R&S VTC/VTE application.
  - Operation with keyboard: Press ALT+F4 to close the application.

The Windows 7 desktop is displayed.

6. Copy the setup file.
  - a) Using the Windows Explorer, open the folder containing the setup file.
  - b) Delete all files in D:\DeviceInstallation\.
  - c) Copy the update file to D:\DeviceInstallation\.

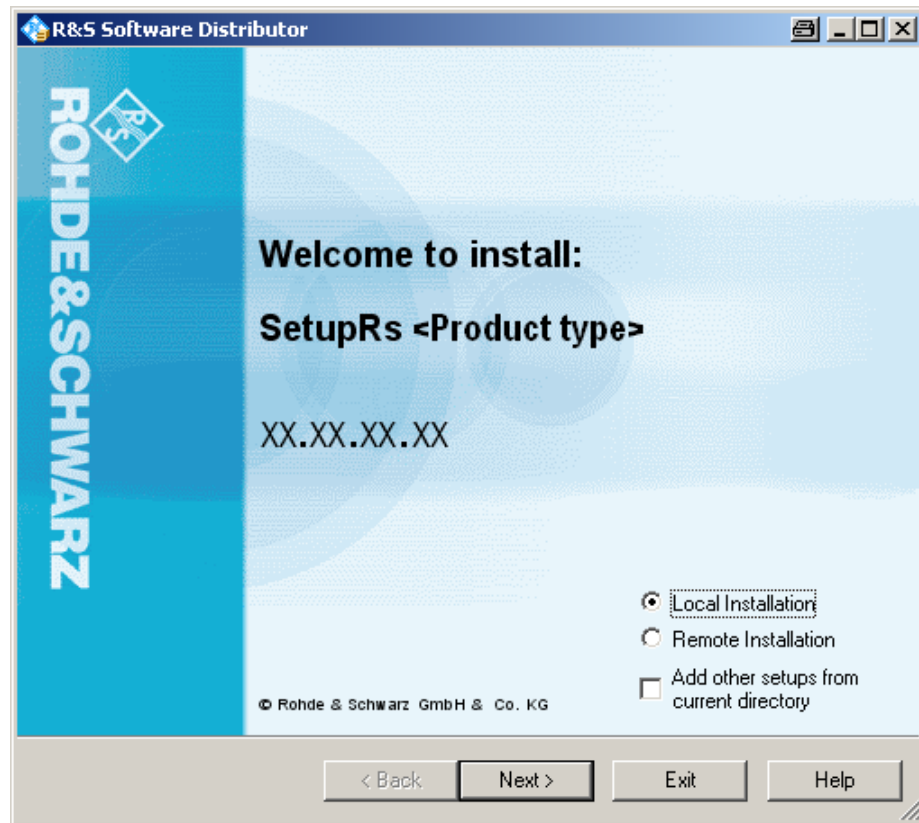
Proceed with the installation as described on page 30.

#### 3.3.2 Preparing the R&S VTS for the Installation

1. Switch on the R&S VTS.
2. Wait until the R&S VTS firmware has booted and the application has started.
3. Using Remote Desktop or VNC, start remote operation of the R&S VTS .
4. Click the "Close" button of the R&S VTS application to access the Windows 7 desktop.  
The Windows 7 desktop is displayed.
5. Copy the setup file.
  - a) Using the Windows Explorer, open the folder with the setup file.
  - b) Delete all files in D:\DeviceInstallation\.
  - c) Copy the setup file to D:\DeviceInstallation\.

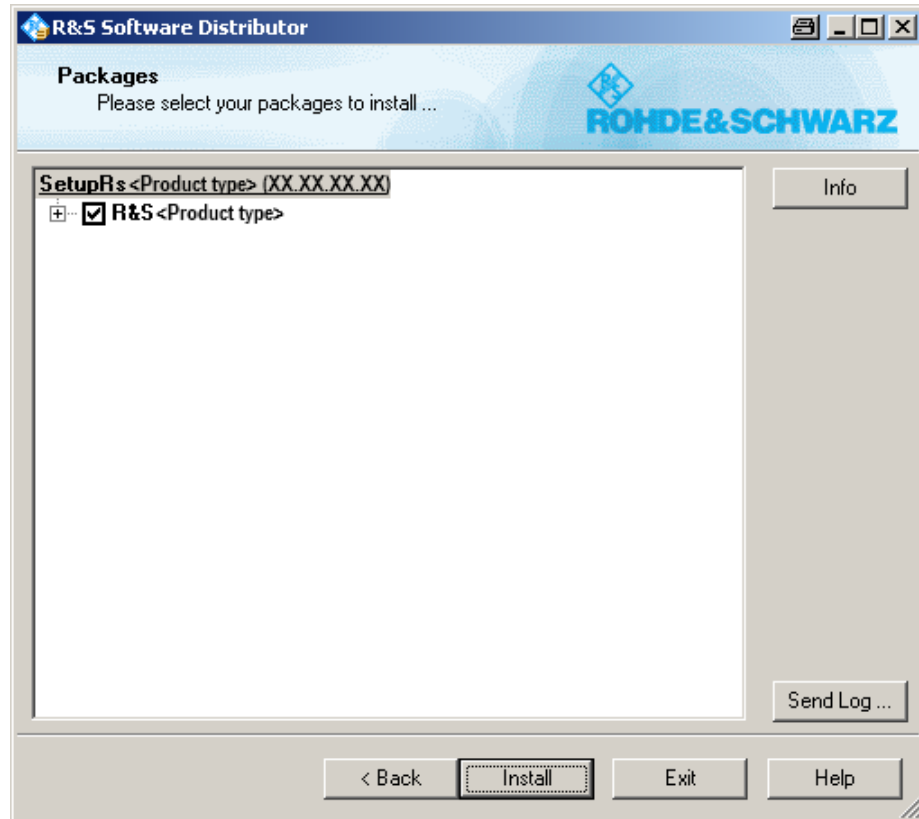
### 3.3.3 Installing the New Firmware Version

1. Execute the setup file (see Update Information on page 30).  
The R&S Software Distributor is displayed.



2. Select the installation type:  
"Local Installation": If you start your setup file from the instrument hard disk or an external storage medium (USB memory stick, CD-ROM with external drive) connected to the instrument.  
"Remote Installation": If your setup files are on an external host computer that is connected to your instrument.  
**Note:** A remote installation allows you to update instruments simultaneously.

3. Click "Next>".



4. Click "Install".  
The installation process itself is self-explanatory.
5. After the installation, click the "Exit" button.
6. For the ATV multistandard coder (R&S VT-K695) only:  
Execute *AtvVideoBasic\_02.10.00.00.msi* to install the new video signals (if available).

### 3.4 Performing an Update of Boot Devices

1. In the toolbar, tap the setup icon.



2. In the "Setup" dialog, select the "Hardware Settings" tab.
3. Select the "Update" subtab.
4. Tap "PCI FPGA" to check if an update is necessary.

If no action takes place, an update is not necessary and the update is complete.

Otherwise, the PCI update is starting.

**NOTICE! Risk of instrument failure**

The installation takes some minutes. Please be patient and do not switch off the R&S VTC/VTE/VTs during the installation.

During the installation, a boot device(s) update ("PCI update") is performed. If you switch off the R&S VTC/VTE/VTs during this boot device(s) update, the R&S VTC/VTE/VTs will fail and has to be returned to the R&S service center in Munich. Be aware that only the R&S service center in Munich is able to fix this failure.

After the installation, a reboot is performed.



## 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.

#### Europe, Africa, Middle East

Phone +49 89 4129 12345

[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)

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