R&S®RTO2000
Digital Oscilloscope
Instrument Security Procedures

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Contents

1 Overview

Securing important information is crucial in many applications.

Generally, highly secured environments do not allow any test equipment to leave the area unless it can be proven that no user information leaves with the test equipment, e.g. to be calibrated.

"Regarding sanitization, the principal concern is ensuring that data is not unintentionally released" [1].

This document provides a statement regarding the volatility of the memory types used and specifies the steps required to sanitize an instrument.

The procedures in this document follow "NIST Special Publication 800-88: Guidelines for Media Sanitization" [1].

In addition, recommendations are provided to safeguard information on the R&S RTO.

References

See the following literature for further information.

[1] **Kissel Richard L. [et al.]** Guidelines for Media Sanitization = Special Publication (NIST SP) = NIST SP - 800-88 Rev 1. - Gaithersburg : [s.n.], December 17, 2014.

[2] **National Industrial Security Program Authorization Office** Defense Security Service (DSS) Assessment and Authorization Process Manual (DAAPM). - May 6, 2019.

[3] **ACSC Australian Cyber Security Centre** Australian Government Information Security Manual, January 2020.

2 Instrument Models Covered

Table 2-1: Digital Oscilloscope models

Product name	Order number
R&S RTO2002	1329.7002.02
R&S RTO2004	1329.7002.04
R&S RTO2012	1329.7002.12
R&S RTO2014	1329.7002.14
R&S RTO2022	1329.7002.22
R&S RTO2024	1329.7002.24
R&S RTO2032	1329.7002.32
R&S RTO2034	1329.7002.34
R&S RTO2044	1329.7002.44
R&S RTO2064	1329.7002.64

3 Security terms and definitions

Terms defined in Guidelines for Media Sanitization

NIST Special Publication 800-88 [1]

- **Sanitization**
  "Media sanitization refers to a process that renders access to target data on the media infeasible for a given level of effort."
- **Clear**
  "Clear applies logical techniques to sanitize data in all user-addressable storage locations for protection against simple non-invasive data recovery techniques; typically applied through the standard Read and Write commands to the storage device, such as by rewriting with a new value or using a menu option to reset the device to the factory state (where rewriting is not supported)."
- **Purge**
  "Purge applies physical or logical techniques that render Target Data recovery infeasible using state of the art laboratory techniques."
- **Destroy**
  "Destroy renders Target Data recovery infeasible using state of the art laboratory techniques and results in the subsequent inability to use the media for storage of data."

Control of media

Another option is to keep physical media holding sensitive information within the classified area, see [1], paragraph 4.4.

Volatile memory

"Memory components that do not retain data after removal of all electrical power sources, and when reinserted into a similarly configured system, are considered volatile memory components." [2]

The volatile memory in the instrument does not have battery backup. It loses its contents when power is removed from the instrument.

If the instrument is battery operated, e.g. handhelds, it retains data in the volatile memory as long as the battery is installed.

Typical examples are RAM, e.g. SDRAM.

Non-volatile memory

"Components that retain data when all power sources are discontinued are non-volatile memory components." [2].

In the context of this document, non-volatile memory components are non-user accessible internal memory types, e.g. EEPROM, Flash, etc.

Media

Media are types of non-volatile memory components. Media are user-accessible and retain data when you turn off power.

In the context of this document, media types are Hard Disk Drives (HDD), Solid State Drives (SSD), Memory Cards, e.g. SD, microSD, CFast, etc., USB removable media, e.g. Pen Drives, Memory Sticks, Thumb Drives, etc. and similar technologies.

4 Types of Memory and Information Storage in the R&S RTO

The Digital Oscilloscope contains various memory components.

The following table provides an overview of the memory components that are part of your instrument. For a detailed description regarding type, size, usage and location, refer to the subsequent sections.

Memory type	Size	Content	Volatility	User Data	Sanitization procedure
SDRAM/ DDR3 (CPU board)	8 Gbyte or 16 Gbyte (with option B110)	Temporary information storage for operating system and instrument firmware	Volatile	Yes	Turn off instrument power
SDRAM/ DDR2 (main board)	**Two-channel models R&S RTO20x2:** 892 Mbyte + 256 Mbyte (FPGA) or with option B110: 3584 Mbyte + 256 Mbyte (FPGA)	• Waveform data • Measurement data	Volatile	Yes	Turn off instrument power
	Four-channel models R&S RTO20x4: 1792 Mbyte + 256 Mbyte (FPGA) or with option B110: 7168 Mbyte + 256 Mbyte (FPGA)				
EEPROM (board assembly)	32 kbyte up to 1 Mbyte	Hardware information: • Serial number • Product options • Calibration correction data	Non-volatile	No	None required (no user data)
Flash (CPU board)	8 Mbyte	BIOS	Non-volatile	No	None required (no user data)
Solid-State Drive (SSD) (removable)	256 Gbyte	• Operating system • Instrument firmware • Instrument states and setups • Limit lines • Waveform data • Measurement results and screen images	Non-volatile	Yes	Remove SSD from instrument
EEPROM (R&S RTO-B1 and -B6)	Option R&S RTO-B1: 128 Mbit Option R&S RTO-B6: 256 Mbit	• Component information • FPGA configuration	Non-volatile	No	None required (no user data)
RAM/DDR3 (R&S RTO-B1)	2 Gbit	• Waveform data	Volatile	Yes	Turn off instrument power
SDRAM/ DDR2 (R&S RTO-B6)	4 Gbit	• Waveform data	Volatile	Yes	Turn off instrument power

4.1 Volatile Memory

The volatile memory in the instrument loses its contents as soon as power is removed from the instrument. The volatile memory is not a security concern.

Removing power from this memory meets the memory sanitization requirements specified in the "Clearing and Sanitization Matrix" in Section 5.2.5.5.5 of the ISFO Process Manual for the Certification and Accreditation of Classified Systems under the NISPOM.

SDRAM/DDR3

The SDRAM/DDR3 on the CPU board has a size of 8 Gbyte or 16 Gbyte and contains temporary information storage for operating system and instrument firmware. The SDRAM/DDR3 loses its memory as soon as power is removed.

Sanitization procedure: Turn off instrument power

SDRAM/DDR2

The size of the SDRAM/DDR2 on the main board depends on the R&S RTO model:

- **Two-channel models R&S RTO20x2:**
  892 Mbyte + 256 Mbyte (FPGA)
  or with option B110:
  3584 Mbyte + 256 Mbyte (FPGA)
- **Four-channel models R&S RTO20x4:**
  1792 Mbyte + 256 Mbyte (FPGA)
  or with option B110:
  7168 Mbyte + 256 Mbyte (FPGA)

The SDRAM/DDR2 contains waveform and measurement data. It loses its memory as soon as power is removed.

Sanitization procedure: Turn off instrument power

RAM/DDR3 (option R&S RTO-B1)

The MSO option R&S RTO-B1 has one 2 Gbit DDR3 RAM. The DDR3 RAM contains waveform data. It loses its memory as soon as power is removed.

Sanitization procedure: Turn off instrument power

SDRAM/DDR2 (option R&S RTO-B6)

The waveform generator option R&S RTO-B6 has one 4 Gbit DDR2 SDRAM. The DDR2 SDRAM contains waveform data. It loses its memory as soon as power is removed.

Sanitization procedure: Turn off instrument power

4.2 Non-Volatile Memory

The R&S RTO contains various non-volatile memories. Out of these, only the removable Solid-State Drive contains user data. The SSD can be physically removed from the R&S RTO and left in the secure area.

All non-volatile memories of the R&S RTO are not a security concern.

EEPROM

Each board assembly in the R&S RTO Digital Oscilloscope has one EEPROM device with a size of 32 kbyte up to 1 Mbyte. The EEPROM contains information related to the installed hardware, such as board serial number, product options and calibration correction data. The EEPROM does not hold user data nor can the user access the EEPROM storage.

Sanitization procedure: None required (no user data)

Flash

The CPU board of the R&S RTO Digital Oscilloscope has one 8 Mbyte flash memory device. It contains the BIOS. The flash memory does not hold user data nor can the user access the flash memory.

Sanitization procedure: None required (no user data)

Solid-State Drive (SSD)

The removable SSD is located on the rear of the R&S RTO. Its size depends on the model you have ordered.

The SSD is used to store:

- Operating system
- Instrument firmware and firmware options (measurement personalities) with option license keys
- Instrument states and setups
- Trace data
- Limit lines, transducer tables
- Screen images

The SSD holds user data and is non-volatile. Hence, user data is not erased when power is removed from the instrument.

The removable SSD can be removed from the Digital Oscilloscope to make sure that no user data is stored within the Digital Oscilloscope. This can be done without opening the instrument.

The R&S RTO, equipped with the removable SSD, addresses the needs of customers working in highly sensitive areas.

Sanitization procedure: Remove SSD from instrument

EEPROM (options R&S RTO-B1 and R&S RTO-B6)

The MSO option R&S RTO-B1 has one 128 Mbit EEPROM. The waveform generator option R&S RTO-B6 has one 256 Mbit EEPROM. Both EEPROMs contain information related to the installed hardware, such as component information and FPGA configuration. The EEPROMs do not hold user data nor can the user access the EEPROM storage.

Sanitization procedure: None required (no user data)

5 Instrument Declassification

Before you can remove the Digital Oscilloscope from a secured area (for example to perform service or calibration), all classified user data needs to be removed. You can declassify the Digital Oscilloscope as follows:

1. Turn off the Digital Oscilloscope and disconnect the power plug. This will sanitize the volatile memory.
2. To remove the SSD (containing user data), perform the following steps:
   a) Locate the SSD.

Figure 5-1: Location of the R&S RTO SSD

   b) Unscrew the two knurled screws.
   c) Remove the SSD at the rear of the instrument.

Following these steps removes all user data from the Digital Oscilloscope. The Digital Oscilloscope can now leave the secured area.

These declassification procedures meet the needs of customers working in secured areas.

Once the R&S RTO is outside the secured area, installing a second non-classified removable SSD (without any user data) allows the Digital Oscilloscope to function properly for service or other needs.

Prior to re-entering the secured area, the non-classified removable SSD (without the user data) is removed. When the R&S RTO is back within the secured area, the original classified removable SSD can be reinstalled.

- To hold classified user data in secure areas, use the removable SSD comes with the instrument.
- To hold non-classified user data in non-secure areas, use a second SSD (R&S RTO-B19).

Validity of instrument calibration after declassification

The calibration makes sure that measurements comply to government standards. Rohde & Schwarz recommends that you follow the calibration cycle suggested for your instrument.

The EEPROM is the only memory type used to hold permanent adjustment values required to maintain the validity of the R&S RTO's calibration. Therefore, replacing one removable SSD with another, does not affect the validity of the instrument’s calibration.

After exchanging the removable SSD, perform a self-alignment once:

Note that the instrument has sufficient warm-up time before you perform the self-alignment.

1. From the "File" menu, select "Self Alignment".
2. Tap "Start Alignment".

Using the permanent and temporary values, the necessary adjustment information is then stored in the R&S RTO. Rohde & Schwarz recommends that you perform the self-alignment function once a week.

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