

# R&S<sup>®</sup>SMC100A

## Signal Generator

### Instrument Security Procedures



1176.9087.02 – 02

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## 1 Overview

In many cases, it is imperative that the R&S SMC Signal Generators are used in a secured environment. Generally these 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. Security concerns can arise when devices need to leave a secured area e.g. to be calibrated or serviced.

This document describes the types of memory and their usage in the R&S SMC. It provides a statement regarding the volatility of all memory types and specifies the steps required to declassify an instrument through memory clearing or sanitization procedures. These sanitization procedures are designed for customers who need to meet the requirements specified by the US Defense Security Service (DSS).

## 2 Instrument Models Covered

*Table 2-1: Signal Generator models*

Product name	Order number
R&S SMC100A	1411.4002.02

The Signal Generator base unit must be ordered together with one of the following frequency options:

- R&S SMC-B101
- R&S SMC-B103

## 3 Security Terms and Definitions

### **Clearing:**

As defined in Section 8-301a of DoD 5220.22-M, "National Industrial Security Program Operating Manual (NISPOM)", clearing is the process of eradicating the data on media so that the data can no longer be retrieved using the standard interfaces on the instrument. Hence, clearing is typically used when the instrument is to remain in an environment with an acceptable level of protection.

### **Sanitization:**

As defined in Section 8-301b of DoD 5220.22-M, "National Industrial Security Program Operating Manual (NISPOM)", sanitization is the process of removing or eradicating stored data so that the data cannot be recovered using any known technology. Instrument sanitization is typically required when an instrument is moved from a secure to a non-secure environment, such as when it is returned for service of calibration.

The memory sanitization procedures described in this document are designed for customers who need to meet the requirements specified by the US Defense Security Service (DSS). These requirements are specified in the "Clearing and Sanitization Matrix" in Section 14.1.16 of the ISFO Process Manual for the Certification and Accreditation of Classified Systems under the NISPOM.

### **Instrument declassification:**

A term that refers to procedures that must be undertaken before an instrument can be removed from a secure environment, such as is the case when the instrument is returned for calibration. Declassification procedures include memory sanitization or memory removal, or both. The declassification procedures described in this document are designed to meet the requirements specified in DoD 5220.22-M, "National Industrial Security Program Operating Manual (NISPOM)", Chapter 8.

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

The Signal Generator 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 (CPU board)	256 Mbyte	Temporary information storage for operating system and instrument firmware	Volatile	Yes	Turn off instrument power
EEPROM (RF module, processor module)	4 x 4 kbyte up to 1 Mbyte	<ul style="list-style-type: none"> <li>• Module-specific data: <ul style="list-style-type: none"> <li>– Serial number</li> <li>– Revision</li> <li>– Options</li> </ul> </li> <li>• Calibration correction data</li> <li>• Initial CPU configuration data</li> </ul>	Non-volatile	No	None required (no user data)
Smart card (processor module)	32 kbyte	Hardware information: <ul style="list-style-type: none"> <li>• Serial number</li> <li>• Product options</li> <li>• Operation time</li> <li>• Power-on count</li> </ul>	Non-volatile	No	None required (no user data)
Flash (processor board)	256 Mbyte	<ul style="list-style-type: none"> <li>• Operating system</li> <li>• Instrument firmware</li> <li>• Boot code</li> <li>• Maintenance and recovery system</li> <li>• User data, instrument and password settings</li> </ul>	Non-volatile	Yes	"Sanitize internal memory" procedure (see "Flash" on page 5)

## 4.1 Volatile Memory

The volatile memory in the instrument does not have battery backup. It 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 NIS-POM.

### SDRAM

The SDRAM on the CPU board has a size of 256 Mbyte and contains temporary information storage for operating system and instrument firmware. The SDRAM loses its memory as soon as power is removed.

**Sanitization procedure:** Turn off instrument power

## 4.2 Non-Volatile Memory

The R&S SMC contains various non-volatile memories. Out of these, only the internal Flash memory contains user data as well as instrument configuration in its Journaling Flash File System (JFFS) area. The Flash memory can be sanitized via "Sanitize internal memory" procedure.

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

### EEPROM

The RF module as well as the processor module of the R&S SMC Signal Generator are equipped with in total four serial EEPROM devices with a size of 4 kbyte up to 1 Mbyte. The EEPROMs contain module-specific data, calibration correction data and initial processor configuration data. In addition, the current setting of the "Standby" button is saved here in order to restart the instrument properly in case of power loss. The EEPROM does not hold user data nor can the user access the EEPROM storage.

**Sanitization procedure:** None required (no user data)

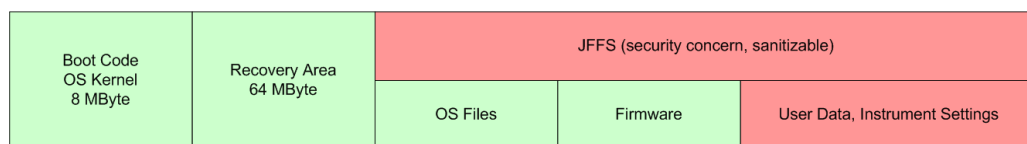
### Smart card

The processor module of the R&S SMC Signal Generator is equipped with a smart card with a size of 32 kbyte. It contains information related to the installed hardware, such as the serial number of the module, product options, operating time and power-on cycle count. The smart card does not hold user data nor can the user access the storage.

**Sanitization procedure:** None required (no user data)

### Flash

The single-chip Flash memory, located on the processor board, has a size of 256 Mbyte of storage. The Flash contains boot code, maintenance and recovery system, the operating system and instrument firmware. Furthermore user data, instrument and password settings are stored here.



**Figure 4-1: Logical sections of the Flash memory**

The Flash memory is logically divided into three sections:

- **Boot code/OS kernel:**  
The 8 Mbyte memory section contains boot code and the operating system kernel. This area is initialized during production and can be updated in case of firmware update. It cannot be accessed by the user and is not modified during instrument operation.
- **Recovery area:**  
The 64 Mbyte memory section contains recovery data which is used to restore the factory instrument configuration if required. This area is initialized during production. It cannot be accessed by the user and is not modified during instrument operation.
- **Journaling Flash File System (JFFS):**  
The remaining memory section is controlled by a Journaling Flash File System (JFFS). This area is shared between operating system files, instrument firmware and user data. Operating system files and instrument firmware are encapsulated in

preconfigured, read-only squashFS file systems. Both can not be modified during instrument operation nor can they be modified in parts. During firmware update, they are replaced in total.

In the remaining JFFS area the following information is stored:

- User data and instrument settings (automatically or manually saved instrument setups)
- Passwords
- LAN and USB port enable/disable states
- Internal adjustment data

The R&S SMC provides a sanitizing procedure that ensures that user data is irretrievably removed from the instrument.

**Sanitization procedure:** "Sanitize internal memory" procedure

To sanitize the internal Flash memory, press the rotary knob and hold it while switching on the instrument. When the maintenance system appears, execute the "Sanitize internal memory" procedure.

After activating the sanitizing procedure, the following steps occur:

- The file `rootfs.squashfs` (read-only, encapsulating operating system files) and the file `optfs` (read-only, encapsulating instrument firmware) are temporarily saved in SDRAM.
- A full sector erase command as per manufacturer data sheet is applied to every single sector of the JFFS area. This explicitly includes sectors which might be declared as defect.
- Every addressable location of the JFFS area is overwritten by a single character.
- Again, a full sector erase command as per manufacturer data sheet is applied to every single sector of the JFFS area, including defect sectors.
- The JFFS file system is recreated and operating system files as well as instrument firmware are restored.
- Passwords are reset to factory values, USB and Ethernet interfaces are enabled.

The "Sanitize internal memory" procedure meets the memory sanitization requirements specified in the "Clearing and Sanitization Matrix" in Section 14.1.16 of the ISFO "Manual for the Certification and Accreditation of Classified Systems under the NISPOM".

## 5 Instrument Declassification

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

1. Turn off the Signal Generator. This will sanitize the volatile memory.
2. To sanitize the internal Flash memory, press the rotary knob and hold it while switching on the instrument again.

After a few seconds, the screen of the maintenance system appears.

Now you have the option to save the instrument configuration including firmware and user data (but without passwords) to a USB mass memory, for example a memory stick. To perform this operation, it is recommended that you use a USB hub and an external keyboard.

To save the instrument configuration, proceed as follows:

1. Connect the USB hub and the keyboard to the instrument
2. Connect the USB memory to the hub too.
3. Execute "Backup internal memory to USB" and follow the instructions.  
To protect user data, this operation requires that you know the security password.
4. Wait until the operation is completed.
5. Remove the USB memory and keep it in the secure area.

To sanitize the internal memory, perform the following steps:

1. Execute "Sanitize internal memory".
2. Wait until the operation is completed.

Afterwards the power can be removed or the instrument can be rebooted. During the first reboot after sanitizing the internal adjustments are performed. Since permanent adjustment values are located in the instrument's EEPROMs, the validity of the Signal Generator's calibration is maintained throughout the sanitization.

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

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

After service and re-entering the secured area, you have the option to restore the instrument configuration:

1. Power on the instrument and wait until it is operational.
2. Plug in the memory stick containing the classified user data and instrument configuration and follow the instructions.

The procedure is exactly the same as a firmware update.

Note that instrument passwords are not restored by this procedure and must be set separately.

#### **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 SMC's calibration. Therefore, performing the declassification procedure does not affect the validity of the instrument's calibration.

## 6 Special Considerations for USB Ports and LAN Services

There are special considerations for R&S SMC USB ports and LAN services to avoid unauthorized data access in a high-security location.

### 6.1 Special Considerations for USB Ports

USB ports can pose a security risk in high-security locations. Generally, this risk comes from small USB pen drives, also known as memory sticks or key drives. They can be easily concealed and can quickly read/write several Gbyte of data.

#### Disabling USB ports

You can disable the USB ports of the R&S SMC in the setup dialog:

1. Select "Setup", "Security", "USB Storage" and then "Disable".
2. Enter the **Security Password** and confirm with "Accept".

When disabled, no USB storage device will be accepted by the instrument. Other non-memory USB devices (such as keyboards and mice) are not affected.

The enable/disable state of the USB port is stored on the Flash memory.

### 6.2 Special Considerations for LAN Ports

To protect the instrument against unauthorized data access in your high-security location, you can disable the LAN interface.

#### Disabling LAN ports

You can disable the LAN ports of the R&S SMC in the setup dialog:

1. Select "Setup", "Security", "LAN Services" and disable "LAN Interface".
2. Enter the **Security Password** and confirm with "Accept".

When disabled, no LAN connection can be established with the instrument.



The enable/disable state of the LAN port is stored on the Flash memory.

For more information concerning the security features, refer to the R&S SMC100A Operating Manual.

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Mühldorfstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

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

Internet: [www.rohde-schwarz.com](http://www.rohde-schwarz.com)

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