SIM Toolkit Device Requirements to improve Mobile Connect Customer Experience

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Table of Contents

1 Introduction

1.1 Overview

This document presents the requirements for the device to improve the user experience of the Mobile Connect SIM applet authenticator.

The ETSI TS 102 223 [1] describes the interface between the UICC and the terminal within detailed information on SIM Toolkit commands and events. In addition to this specification, the following requirements insist not only on protocol but also on user interface expected.

1.2 Scope

This document covers the device requirements for the SIM Toolkit proactive commands used for the Mobile Connect service and does not affect other SIM Toolkit applications.

This document aims to improve the user experience by providing device manufacturer recommendations for SIM Toolkit handling and should directly improve the user experience of the Mobile Connect.

A table with an overview of the different requirements outlined in this document can be found below, along with a clarification to whether they are:

- compliant with the ETSI TS 102 223 [1] technical specification,
- they expand existing requirement ETSI TS 102 223 [1] technical specification
- or they represent a new requirement not covered by this specification.

Command Used for Mobile Connect Service	Behaviour Proposed for:	Relationship with ETSI TS 102 223
DISPLAY TEXT	Basic functionality	Compliant in terms of parameters and the text format.
	Button Handling and TERMINAL RESPONSE result value	Recommends expansion to not display "Back" button on the screen but to allow the user to retrieve it through the contextual menu
	Timeout Handling	Compliant in terms of the value in the "Duration" tag.
	Immediate Response Parameter	Recommends expansion for the device to only display the "OK" button if the Immediate Response parameter is present in this command.
	Idle Mode	New requirement, not covered by specification
	Locked Screen – Manual Unlocking with Notification	New requirement, not covered by specification

Command Used for Mobile Connect Service	Behaviour Proposed for:	Relationship with ETSI TS 102 223
	External Interactions	New requirement, not covered by specification
GET INPUT	Basic functionality	Compliant in terms of the parameters and the text format. Recommends expansion for the device to display only the message, input field and buttons
	Button Handling	Recommends expansion to clarify TERMINAL RESPONSE result value and terminal behaviour according to user MMI action
	Timeout Handling	New requirement, not covered by specification
	Idle Mode	New requirement, not covered by specification
	Locked Screen – Manual Unlocking with Notification	New requirement, not covered by specification
	External Interactions	New requirement, not covered by specification
	Logs	New requirement, not covered by specification

1.3   Abbreviations

Term	Description
STK	SIM Toolkit
MSSP	Managed Security Service Provider

1.4   References

Ref	Doc Number	Title
[1]	ETSI TS 102 223	Smart Cards; Card Application Toolkit (CAT) Available at http://www.etsi.org/deliver/etsi_ts/102200_102299/102223/12.01.00_60/ts_102223v120100p.pdf
[2]	RFC 2119	"Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt
[3]	ETSI TS 102 225	Smart Cards; Secured packet structure for UICC based applications (Release 9) http://www.etsi.org/deliver/etsi_ts/102200_102299/102225/09.00.00_60/ts_102225v090000p.pdf

1.5   Conventions

 "The key words "must", "must not", "required", "shall", "shall not", "should", "should not", "recommended", "may", and "optional" in this document are to be interpreted as described in RFC2119 [2]."
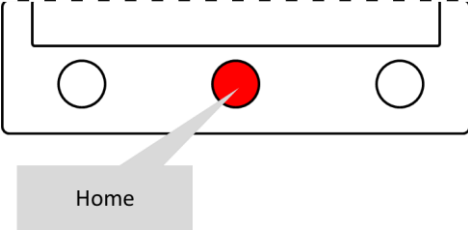
1.5.1   Buttons: physical vs virtual

The terminals may have one or more physical or virtual buttons. In the tests described in this document, the user will interact with the following functions.

- **Home**: Get the user to the terminal home screen
- **Back**: Get the user to the previous function in the module
- **Multitasking**: Displays the list of running processes and lets the user choose a process to get it back at screen

NOTE: Some buttons presented in the above list may be not implemented depending on the device's OS, manufacturer.

1.5.2   User's action description and MMI

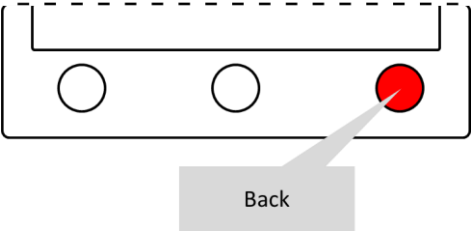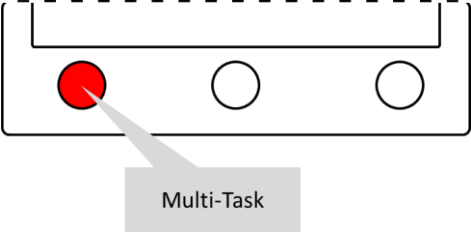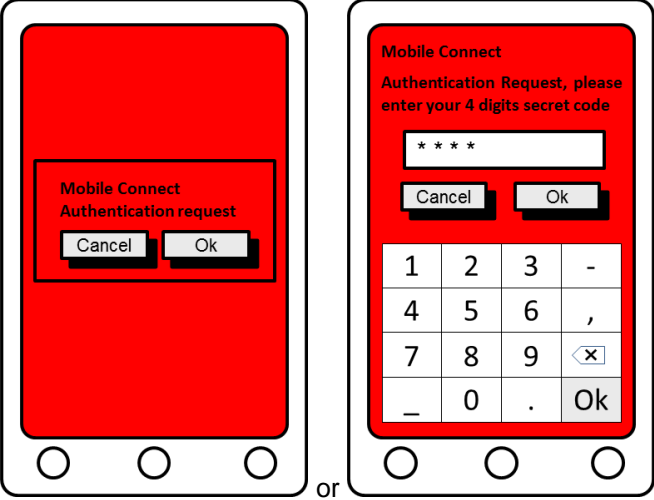| User's action number	user's action description	MMI representation
1	user's action description	**Ok** User presses the "OK" button in a window displayed after a STK command was sent, either DISPLAY TEXT or GET INPUT
2	User presses the Ok button	**Cancel** User presses the "Cancel" button in a window displayed after a STK command was sent, either DISPLAY TEXT or GET INPUT
3	User presses the Cancel button	Home If available, the Home button returns the user to the terminal home screen

User's action number	user's action description	MMI representation
4	User presses the Home button	If available, the "Back" button returns the previous terminal screen
5	User presses the Back button	If available, the Multitasking button shows the list of the running processes
6	User presses the Multitasking button	or
7	User clicks in the red area	
8	no user action	User unlock the terminal using the appropriate method: PIN code, password, swipe, facial recognition, voice recognition, pattern, fingerprint, etc…

Table 1: User's action description / MMI

2 Requirements

2.1 STK Proactive Commands Used, Events and TERMINAL PROFILE

In order to support the 3 STK commands "DISPLAY TEXT", "GET INPUT" and "SEND SHORT MESSAGE" and the event "EVENT_FORMATTED_SMS_PP_ENV", the TERMINAL PROFILE shall return a convenient TERMINAL PROFILE.

Mobile Connect requires a TERMINAL PROFILE who matches with these binary masks:

- Byte 1 AND 0x12 == 0x12

    o Bit 2: SMS-PP data download

    o Bit 5: SMS-PP data download

- Byte 2 AND 0xE0 == 0xE0

    o Bit 6: UCS2 Entry supported

    o Bit 7: UCS2 Display supported

    o Bit 8: DISPLAY TEXT

- Byte 3 AND 0x05 == 0x05

    o Bit 1: DISPLAY TEXT

    o Bit 3: GET INPUT

- Byte 4 AND 0X02 == 0X02

    o Bit 2: SEND SHORT MESSAGE

- Byte 9 AND 0X01 == 0X01

    o Bit 1: DISPLAY TEXT

2.2 Expected Device Behaviour

2.2.1 DISPLAY TEXT

The device shall be compliant with the DISPLAY TEXT proactive command as described in ETSI TS 102 223 [1] regarding the parameters and the text format.

The device must handle the 3 text encoding:

- Data Coding Scheme 00 → GSM default alphabet 7 bits packed
- Data Coding Scheme 04 → GSM default alphabet 8 bits
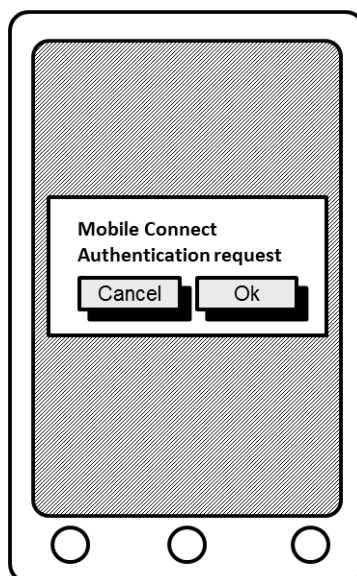- Data Coding Scheme 08 → 16 bits UCS2 alphabet

Figure 1: DISPLAY TEXT: User Interface expected

The following specification expands the DISPLAY TEXT command specification described in ETSI TS 102 223 [1]: it is recommended not to display any "Back" button on the screen but to allow the user to retrieve it due to the contextual menu.

2.2.1.1   Buttons Handling

The following specification is a clarification of what is described in **ETSI TS 102 223 [1]** with details on user's action and device behaviour expected accordingly.

On reception of the DISPLAY TEXT SIM Toolkit proactive command, the device must display on its screen the text contained and the two options which are "OK" and "Cancel". In addition to the text and the OK/Cancel buttons, most of the devices offers users the option to do different actions with other buttons (virtual, tactile or physical). The following paragraph describes the device behaviour expected and the return code associated in the TERMINAL RESPONSE.
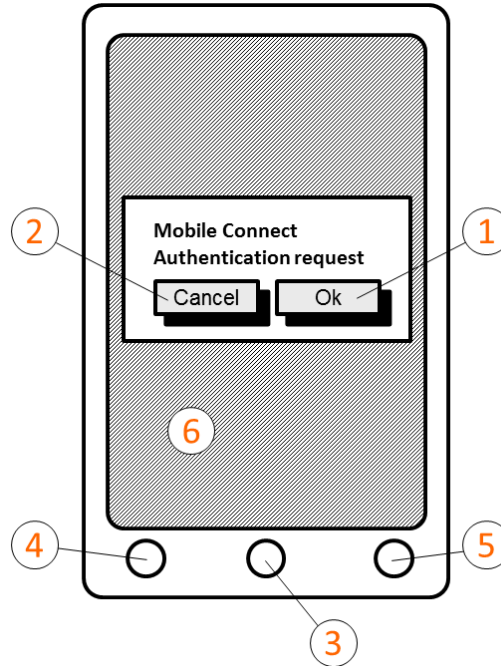
Figure 2: DISPLAY TEXT User's action Overview

The device must return the result of the user's action to the applet in the TERMINAL RESPONSE.

The returned code and the device behaviour must follow the principles detailed below:

User's action	Mobile Connect Result	STK Result	Returned code (hex)	Device behaviour
OK pressed (1)	Validation	Command performed successfully	00	Window closing
Cancel pressed (2)	Cancellation	Proactive UICC session terminated by the user	10	Window closing
Home pressed (if present) (3)	Cancellation	Proactive UICC session terminated by the user	10	Window closing
Back pressed (if present) (4)	Cancellation	Backward move in the proactive UICC session requested by the user	11	Window closing
Multi task button (if present) (5)	None	*None*	*None*	No action, The user is able to reactivate the window using the Multi-task button (if no action is completed by the

User's action	Mobile Connect Result	STK Result	Returned code (hex)	Device behaviour
				user before the timeout the device must close the STK channel including in the TERMINAL RESPONSE the returned code 12)
User clicks beside the displayed window (if possible) (6)	None	*None*	*None*	No action (window still displayed)
No user action (timeout)	Cancellation	No response from user	12	Window closing after the timeout

Table 2: DISPLAY TEXT result code according to user's action

NOTE: Certain buttons presented in the above table may be not implemented depending on the device's OS, manufacturer, etc.

2.2.1.2   Timeout Handling

The DISPLAY TEXT STK command could contain a value in the **"Duration" tag. The Device shall be compliant with duration parameter as defined in ETSI TS 102 223 [1].**

2.2.1.3   Immediate Response Parameter

Some DISPLAY TEXT commands could be sent to the device including the tag **"Immediate response".** In this case, **the device must directly send back to the SIM card a TERMINAL RESPONSE** containing the "Command performed successfully" information. Nevertheless, **the device must continue to display the window on the device until the timeout has been reached or the user selects the "Ok" button.**

The following specification completes the Immediate Response Parameter specification described in **ETSI TS 102 223 [1]**: If the "immediate response" parameter is present in the DISPLAY TEXT STK proactive command, the device must only display the **"Ok" button.**
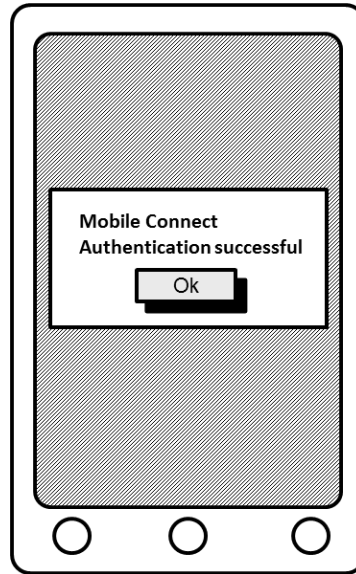
Figure 3: DISPLAY TEXT with immediate response tag: User Interface expected

2.2.1.4   Idle Mode

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new requirement.

If the device is in idle mode, it must get out of standby mode when receiving a DISPLAY TEXT STK proactive command to display the associated window.

Once the STK command handling is done (e.g. the user has selected the "OK" button), the device must return to its initial state.

2.2.1.5   Locked Screen – Manual Unlocking with Notification

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new requirement: if the device is in **idle mode and locked** when receiving a DISPLAY TEXT STK proactive command, **it must get out of standby mode, display a message on the screen and allow the user to manually unlock** their device. Once unlocked, the device must display the window associated to this DISPLAY TEXT command.
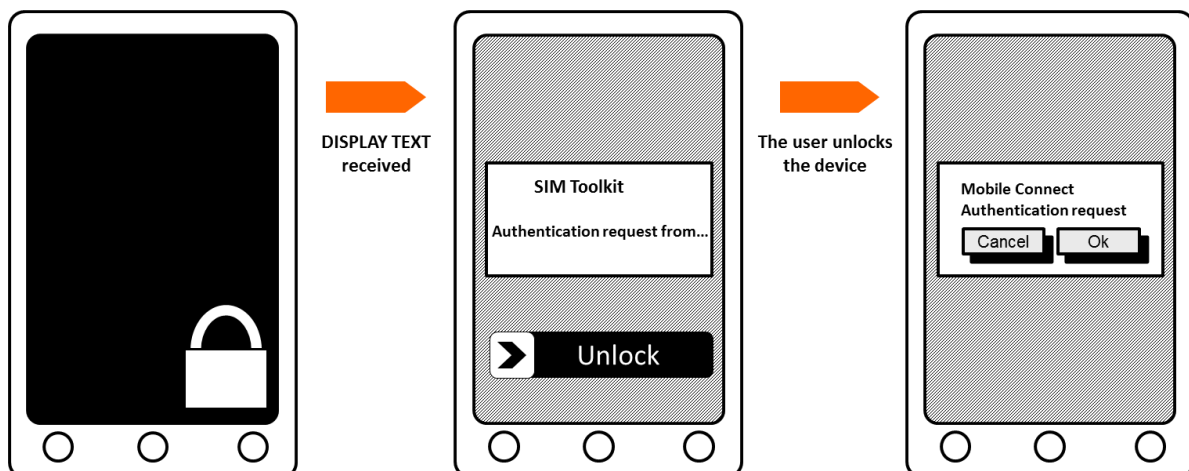
Figure 4: DISPLAY TEXT arriving on a device in locked screen: Steps expected

2.2.1.6   External Interactions

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new requirement.

The device must implement the following behaviour to avoid conflicts between call/SMS and the DISPLAY TEXT STK proactive command:

- An incoming phone call arrives during the DISPLAY TEXT process → The user must be able to accept, to reject this call or to stay on the DISPLAY TEXT window. If the user rejects the call, the DISPLAY TEXT window is still displayed on the device screen. As long as the timeout of the DISPLAY TEXT command is not reached, the DISPLAY TEXT will always be displayed on the device screen regardless of the call being accepted or rejected.
- An incoming text SMS arrives during the DISPLAY TEXT process → The DISPLAY TEXT window is still displayed on the device screen
- A DISPLAY TEXT command is sent during an established phone call → The DISPLAY TEXT window must be displayed on the device screen. Once the STK command handling (*i.e.* user select OK, Cancel, timeout, …), the DISPLAY TEXT window is closed but the phone call must stay connected during this process
- A DISPLAY TEXT command is sent at the same time as an incoming call establishment or an incoming text SMS → The device must handle the DISPLAY TEXT STK command without any issues with the incoming call or the incoming text SMS

2.2.2   GET INPUT

The device must be compliant with the GET INPUT SIM Toolkit proactive command as described in the ETSI TS 102 223 [1] specification regarding the parameters and the text format.

As specified in the ETSI TS 102 223 [1], the device must handle the three text encoding:

- Data Coding Scheme 00 → GSM default alphabet 7 bits packed
- Data Coding Scheme 04 → GSM default alphabet 8 bits
- Data Coding Scheme 08 → 16 bits UCS2 alphabet

The device must also support the **command qualifier** describing the user entry:

- bit 1:

  - 0 = digits (0 to 9, *, #, and +) only;
  - 1 = alphabet set.

- bit 2:

  - 0 = SMS default alphabet;

- 1 = UCS2 alphabet.

  - bit 3:

    - 0 = terminal may echo user input on the display;
    - 1 = user input shall not be revealed in any way (see note).

  - bit 4:

    - 0 = user input to be in unpacked format;
    - 1 = user input to be in SMS packed format.

In the Get Input command, Mobile Connect uses only the digits. When the bit 1 of the command qualifier is equal to 0, and if the device integrates a virtual keyboard, it must **directly display the digits keyboard**.

The following specification completes the Immediate Response Parameter specification described in **ETSI TS 102 223 [1]**: The device shall only display **the message, the input field and the buttons** and no other information, nor the allowed characters or the expected length (e.g. "Digits (0-9,*,#,+) 1-9") or any title on the top of the window.

If the command qualifier indicates **that the user input shall not be revealed in any way** (which should be the case for Mobile Connect), the terminal shall prevent, as mentioned in the ETSI TS 102223, the text string from being identified by any means (*e.g.* stars could be displayed instead of characters).

The device **should not display on the screen the "Back" button**. This should be accessible through the contextual menu.

Moreover, the device must handle the min-max characters that are required in the STK command due to the "Response length" value.

It is recommended to use the wording **"OK" instead of "Send".**

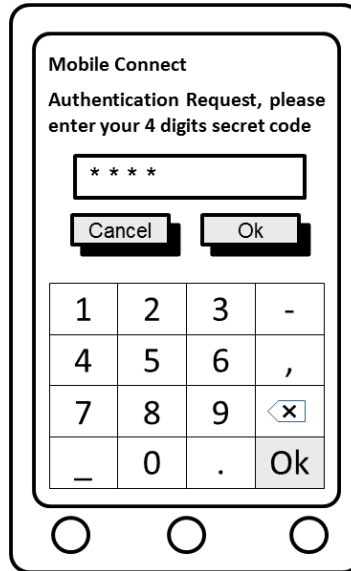The picture below represents the expected display:

Figure 5: GET INPUT: User Interface expected

2.2.2.1   Buttons Handling

The following specification is a clarification of what is described in **ETSI TS 102 223 [1]** with details on user's action and device behaviour expected accordingly. On reception of the GET INPUT SIM Toolkit proactive command, the device must display on its screen the text contained, a field allowing the user to enter numeric characters and the two options which are "OK" and "Cancel" (if not displayed on the screen, the "Cancel" option must be found in a contextual menu). It is highly recommended to display on the screen the "Cancel" button in addition to the "OK".

The device must return the result code of the user's action including the characters entered to the applet in the TERMINAL RESPONSE.

User's action number	User's action	Mobile Connect Result	STK Result	Returned code (hex)	Device behaviour
1	OK pressed	Validation	Command performed successfully	00	Window closing
2	Cancel pressed	Cancellation	Proactive UICC session terminated by the user	10	Window closing
3	Home pressed (if present)	Cancellation	Proactive UICC session terminated by the user	10	Window closing
4	Back pressed (if present)	Cancellation	Backward move in the proactive UICC session requested by the user	11	Window closing

5	Multi task button (if present)	None	*None*	*None*	No action, The user is able to reactivate the window using the Multi-task button (if no action is completed by the user before the timeout the device must close the STK channel including in the TERMINAL RESPONSE the returned code 12)
6	User clicks beside the displayed window (if possible)	None	*None*	*None*	No action (window still displayed)
7	No user action (timeout)	Cancellation	No response from user	12	Window closing after the timeout

Figure 6: **GET INPUT result code according to user's action**

NOTE: Certain buttons present in the above array may be not implemented
                  depending on the device's OS, manufacturer, etc.

2.2.2.2   Timeout handling

The GET INPUT command could contain a value in a "Duration" tag**. This is a new
requirement and is not** described in **ETSI TS 102 223 [1]:** An ETSI change request is
ongoing, its validation being expected in December 2016. **Even if this requirement is not
yet specified in the ETSI TS 102 223 [1], this feature which is already implemented in
most devices, is required for the Mobile Connect service.**

The duration parameter is encoded in 2 Bytes. The first one indicates the time unit used and
the second one contains the time interval.

- The time unit is encoded as below:

    - 00 → Minutes
    - 01 → Seconds
    - 02 → Tenths of seconds

- The time interval contains a value between 1 and 255.

If during a GET INPUT command the user does not perform any actions on their device, the
window must be closed when the duration value is reached. The device must also send to
the SIM card the status code 12 in the TERMINAL RESPONSE.

2.2.2.3   Idle Mode

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new
requirement: **If the device is in the idle mode, it must get out of standby mode** when
receiving a GET INPUT STK proactive command to display the associated window.

Once the STK command handling is completed (e.g. the user has entered characters and
selected the "OK" button), the device must return to its initial state.

2.2.2.4   Locked Screen – Manual Unlocking with Notification:

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new
requirement**:** if the device is in **idle mode and locked** when receiving a GET INPUT STK
proactive command**, it must get out of standby mode, display a message on the screen
(notification) and allow the user to manually unlock** the device. Once unlocked, the
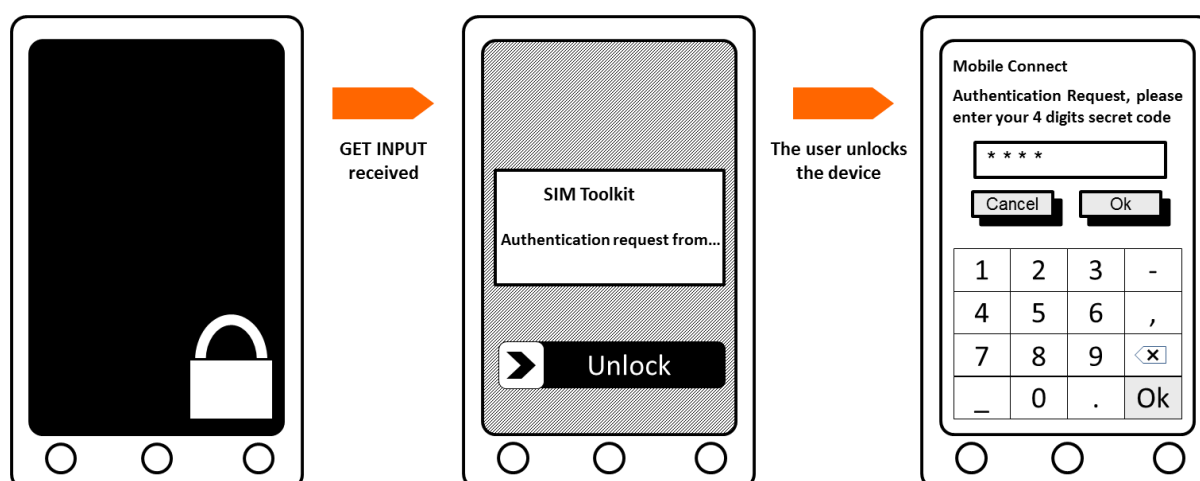device must display the window associated to this GET INPUT command.

Figure 7: GET INPUT arriving on a device in locked screen: Steps expected

2.2.2.5   External Interactions

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new
requirement. The device must implement the following behaviour to avoid conflicts between
call/SMS and the GET INPUT STK proactive command:

- An incoming phone call arrives during the GET INPUT process → The user must be
  able to accept this call, to reject this call or to stay on the GET INPUT window. If the
  user rejects the call, the GET INPUT window is still displayed on the device screen.
  As long as the timeout of the DISPLAY TEXT command is not reached, the DISPLAY
  TEXT will always be displayed on the device screen regardless of the call being
  accepted or rejected.
- An incoming text SMS arrives during the GET INPUT process → The GET INPUT
  window is still displayed on the device screen
- A GET INPUT command is sent during an established phone call → The GET INPUT
  window must be displayed on the device screen. Once the STK command handling

(*i.e.* user select OK, Cancel, timeout, …), the GET INPUT window is closed but the phone call must stay connected during this process

- A GET INPUT command is sent at the same time as an incoming call establishment or an incoming text SMS → The device must handle the GET INPUT STK command without any issues with the incoming call or the incoming text SMS

2.2.3 Logs

The following specification is not described in **ETSI TS 102 223 [1]** and is therefore a new requirement**.** In order to avoid security issues, **the device must not log the STK exchanges**. Specifically, the exchanges of the DISPLAY TEXT, the GET INPUT and the SEND SHORT MESSAGE commands.

Annex A   Document Management

A.1   Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	July 2016	New document, in collaboration with Orange	PDATA/PSMC	Olivier Gruson and Anne-Claire Laval/ ORANGE

A.2   Other Information

Type	Description
Document Owner	PDATA
Editor / Company	Olivier Gruson and Anne-Claire Laval/ ORANGE Ahmer Javaid (GSMA)

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