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Smart Phone Tool Test Assertions and Test Plan

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Abstract

As mobile devices proliferate, incorporating a host of integrated features and capabilities, their use can be seen everywhere in our world today. Mobile communication devices contain a wealth of information. In the investigative community their use is not restricted to data recovery alone as in criminal cases, but also civil disputes and proceedings, and their aggregate use in research and criminal incident recreation continues to increase. Due to the exploding rate of growth in the production of new mobile devices appearing on the market each year is reason alone to pay attention to test measurement means and methods. The methods a tool uses to capture, process, and report data must incorporate a broad range of capabilities to meet the demand as a robust data acquisition tool. In general, a forensic examination conducted on a mobile device is only a small subset of the larger field of digital forensics. Consequentially, tools possessing an exhaustive array of capabilities to acquire data from these portable mobile devices are relatively few in number.

This paper defines assertions and test cases for mobile device applications capable of acquiring data from mobile devices operating over a Global System for Mobile communication (GSM) and Code Division Multiple Access (CDMA) networks, used to determine whether a specific tool meets the requirements producing measurable results.[•] The assertions and test cases are derived from the requirements defined in the document entitled: Smart Phone Tool Specification. Test cases describe the combination of test parameters required to test each assertion. Test assertions are described as general statements of conditions that can be checked after a test is executed. Each assertion appears in one or more test cases consisting of a test protocol and the expected test results. The test protocol specifies detailed procedures for setting up the test, executing the test, and measuring the test results.

Your comments and feedback are welcome; revisions of this document are available for download at: http://www.cftt.nist.gov.

[•] NIST does not endorse nor recommend products or trade names identified in this paper. All products used in this paper are mentioned for use in research and testing by NIST.

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1. Introduction

The need to ensure the reliability of mobile device forensic tools intensifies as the embedded intelligence and ever-increasing storage capabilities of mobile devices expand. The goal of the Computer Forensic Tool Testing (CFTT) project at the National Institute of Standards and Technology (NIST) is to establish a methodology for testing computer forensic software tools. This is accomplished by the development of both specific and common rules that govern tool specifications. We adhere to a disciplined testing procedure, established test criteria, test sets, and test hardware requirements, that result in providing necessary feedback information to toolmakers so they can improve their tool's effectiveness; end users benefit in that they gain vital information making them more informed about choices for acquiring and using computer forensic tools, and lastly, we impart knowledge to interested parties by increasing their understanding of a specific tool's capability. Our approach for testing computer forensic tools is based on established well-recognized international methodologies for conformance testing and quality testing. For more information on mobile device forensic methodology please visit us at: http://www.cftt.nist.gov.

The Computer Forensic Tool Testing (CFTT) program is a joint project of the National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice, and the National Institute of Standards and Technology's (NIST's) Office of Law Enforcement Standards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, U.S. Internal Revenue Service Criminal Investigation Division Electronic Crimes Program, U.S. Department of Homeland Security's Bureau of Immigration and Customs Enforcement, U.S. Customs and Border Protection, and the U.S. Secret Service. The objective of the CFTT program is to provide measurable assurance to practitioners, researchers, and other applicable users that the tools used in computer forensics investigations provide accurate results. Accomplishing this requires the development of specifications and test methods for computer forensics tools and subsequent testing of specific tools against those specifications.

The central requirement for a sound forensic examination of digital evidence is that the original evidence must not be modified (i.e., the examination or capture of digital data from a mobile device and associated media must be performed without altering the device or media content). In the event that data acquisition is not possible using current technology to access information without configuration changes to the device (e.g., loading a driver), the procedure must be documented.

2. Purpose

This document defines test assertions and test cases derived from requirements for mobile device forensic tools capable of acquiring the internal memory from GSM smart phones and Subscriber Identity Modules (SIM), and the internal memory of CDMA smart phones. The test assertions are described as general statements of conditions that can be checked after a test is executed. Each assertion generates one or more test cases consisting of a test protocol and the expected test results. The test protocol specifies detailed procedures for setting up the test, executing the test, and measuring the test results.

3. Scope

The scope of this specification is limited to software tools capable of acquiring the internal memory of smart phones both (GSM and CDMA) and SIMs. While smart phones often have companion PC-based software that provides users the ability to synchronize data between the device and a personal computer this test assertion and test plan does not address device data synchronized with PCs. The assertions and test cases are specific to data stored in the internal memory of the smart phone or SIMs. The test cases are general and capable of being adapted to other types of mobile device forensic software.

4. Test Assertions

The primary goal of the test assertions, presented below in Table 1, is to determine a tool's ability to accurately acquire specific data objects populated onto the device or SIM. An accurate acquisition copies data objects from the powered device (i.e., active) such that the bytes of the acquired data object are identical to the bytes of the data object on the device. The ID column identifies the assertion. For instance SPT-CA-01 (i.e., Smart Phone Tool-Core Assertion-#) is a core assertion. An assertion for optional features, SPT-AO-01 (i.e., Smart Phone Tool-Assertion Optional-#) is an optional assertion and only tested if a tool supports the feature. The Test Assertion column states the assertion and the comments column provides additional information pertaining to the assertion.

Table 1: Test Assertions

ID	Test Assertion	Comments
SPT-CA-01	If a cellular forensic tool provides support for connectivity of the target device then the tool shall successfully recognize the target device via all tool-supported interfaces (e.g., cable, Bluetooth, IrDA).	Connect supported device via tool-supported interface(s); Acquire data.
SPT-CA-02	If a cellular forensic tool attempts to connect to a non-supported device then the tool shall notify the user that the device is not supported.	Attempt acquisition of a non-supported device.
SPT-CA-03	If connectivity between the mobile device and cellular forensic tool is disrupted then the tool shall notify the user that connectivity has been disrupted.	Begin acquisition; Disconnect interface or interrupt connectivity (i.e., unplug cable) during acquisition.
SPT-CA-04	If a cellular forensic tool completes acquisition of the target device without error then the tool shall have the ability to present acquired data objects in a useable format via either a preview-pane or generated report.	Acquire device data; Review data for readability in a useable format.

SPT-CA-05	If a cellular forensic tool completes acquisition of the target device without error then subscriber-related information shall be presented in a useable format.	Acquisition of MSISDN, IMSI
SPT-CA-06	If a cellular forensic tool completes acquisition of the target device without error then equipment related information shall be presented in a useable format.	Acquisition of IMEI/MEID/ESN
SPT-CA-07	If a cellular forensic tool completes acquisition of the target device without error then address book entries shall be presented in a useable format.	Acquisition of address book entries (i.e., contact name, phone number)
SPT-CA-08	If a cellular forensic tool completes acquisition of the target device without error then maximum length address book entries shall be presented in a useable format.	Acquisition of maximum length address book entries (i.e., contact name)
SPT-CA-09	If a cellular forensic tool completes acquisition of the target device without error then address book entries containing special characters shall be presented in a useable format.	Acquisition of address book entries containing special characters (e.g., #, !, *)
SPT-CA-10	If a cellular forensic tool completes acquisition of the target device without error then address book entries containing blank names shall be presented in a useable format.	Acquisition of address book entries containing blank names
SPT-CA-11	If a cellular forensic tool completes acquisition of the target device without error then email addresses associated with address book entries shall be presented in a useable format.	Acquisition of email addresses associated with address book entries
SPT-CA-12	If a cellular forensic tool completes acquisition of the target device without error then graphics associated with address book entries shall be presented in a useable format.	Acquisition of graphic files associated with address book entries
SPT-CA-13	If a cellular forensic tool completes acquisition of the target device without error then datebook, calendar, note entries shall be presented in a useable format.	Acquisition of datebook/ calendar and notes
SPT-CA-14	If a cellular forensic tool completes acquisition of the target device without error then maximum length datebook, calendar, note entries shall be presented in a useable format.	Acquisition of maximum length datebook/calendar, and notes

SPT-CA-15	If a cellular forensic tool completes acquisition of the target device without error then call logs (incoming/outgoing/missed) shall be presented in a useable format.	Acquisition of incoming, outgoing and missed calls
SPT-CA-16	If a cellular forensic tool completes acquisition of the target device without error then the corresponding date/time stamps and the duration of the call for call logs shall be presented in a useable format.	Acquisition date/time stamps data and duration of call(s) associated with call logs
SPT-CA-17	If a cellular forensic tool completes acquisition of the target device without error then ASCII text messages (i.e., SMS, EMS) shall be presented in a useable format.	Acquisition of ASCII text messages
SPT-CA-18	If a cellular forensic tool completes acquisition of the target device without error then the corresponding date/time stamps for text messages shall be presented in a useable format.	Acquisition of date/time stamps associated with text messages
SPT-CA-19	If a cellular forensic tool completes acquisition of the target device without error then the corresponding status (i.e., read, unread) for text messages shall be presented in a useable format.	Acquisition of status flags associated with text messages
SPT-CA-20	If a cellular forensic tool completes acquisition of the target device without error then the corresponding sender / recipient phone numbers for text messages shall be presented in a useable format.	Acquisition of sender / recipient phone numbers associated with text messages
SPT-CA-21	If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated audio shall be presented in a useable format.	Acquisition MMS messages and embedded audio data
SPT-CA-22	If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated graphic files shall be presented in a useable format.	Acquisition of MMS messages and embedded graphic data images are reported
SPT-CA-23	If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated video shall be presented in a useable format.	Acquisition of MMS messages and embedded video data
SPT-CA-24	If a cellular forensic tool completes acquisition of the target device without error then stand-alone audio files shall be presented in a useable format via either an	Acquisition of device supported stand-alone audio files

	internal application or suggested third-party application.	
SPT-CA-25	If a cellular forensic tool completes acquisition of the target device without error then stand-alone graphic files shall be presented in a useable format via either an internal application or suggested third-party application.	Acquisition of stand-alone device supported graphic files are reported
SPT-CA-26	If a cellular forensic tool completes acquisition of the target device without error then stand-alone video files shall be presented in a useable format via either an internal application or suggested third-party application.	Acquisition of stand-alone device supported video files are reported
SPT-CA-27	If a cellular forensic tool completes acquisition of the target device without error then device specific application related data shall be acquired and presented in a useable format via either an internal application or suggested third-party application.	Acquisition of pre-loaded (i.e., stock) device supported application data (e.g., word docs, spreadsheet, power-point)
SPT-CA-28	If a cellular forensic tool completes acquisition of the target device without error then Internet related data (i.e., bookmarks, visited sites) cached to the device shall be acquired and presented in a useable format.	Acquisition of Internet related data (i.e., bookmarks, URL history)
SPT-CA-29	If a cellular forensic tool provides the user with an "***Acquire All***" device data objects acquisition option then the tool shall complete the acquisition of all data objects without error.	Acquire all supported device data objects
SPT-CA-30	If a cellular forensic tool provides the user with an "***Select All***" individual device data objects then the tool shall complete the acquisition of all individually selected data objects without error.	Acquire all supported device data objects by individually selecting each supported data object
SPT-CA-31	If a cellular forensic tool provides the user with the ability to "***Select Individual***" device data objects for acquisition then the tool shall acquire each exclusive data object without error.	Acquire each supported device data object individually
SPT-CA-32	If a cellular forensic tool completes two consecutive logical acquisitions of the target device without error then the payload (data objects) on the mobile device shall remain	Perform two consecutive logical acquisitions; check mobile device for payload modifications

	consistent.	
SPT-AO-01	If a cellular forensic tool provides support for connectivity of the target SIM then the tool shall successfully recognize the target SIM via all tool-supported interfaces (e.g., PC/SC reader, proprietary reader, smart phone itself).	Connect SIM via tool-supported interface(s); Acquire data.
SPT-AO-02	If a cellular forensic tool attempts to connect to a non-supported SIM then the tool shall notify the user that the SIM is not supported.	Attempt acquisition of a non-supported SIM.
SPT-AO-03	If a cellular forensic tool loses connectivity with the SIM reader then the tool shall notify the user that connectivity has been disrupted.	Begin acquisition; Disconnect interface or interrupt connectivity (i.e., remove SIM from reader) during acquisition.
SPT-AO-04	If a cellular forensic tool completes acquisition of the target SIM without error then the SPN shall be presented in a useable format.	Acquisition of SPN
SPT-AO-05	If a cellular forensic tool completes acquisition of the target SIM without error then the ICCID shall be presented in a useable format.	Acquisition of ICCID
SPT-AO-06	If a cellular forensic tool completes acquisition of the target SIM without error then the IMSI shall be presented in a useable format.	Acquisition of IMSI
SPT-AO-07	If a cellular forensic tool completes acquisition of the target SIM without error then the MSISDN shall be presented in a useable format.	Acquisition of MSISDN
SPT-AO-08	If a cellular forensic tool completes acquisition of the target SIM without error then ASCII Abbreviated Dialing Numbers (ADN) shall be presented in a useable format.	Acquisition of ADNs (i.e, name, phone number)
SPT-AO-09	If a cellular forensic tool completes acquisition of the target SIM without error then maximum length ADNs shall be presented in a useable format.	Acquisition of maximum length ADNs (i.e., contact name)
SPT-AO-10	If a cellular forensic tool completes acquisition of the SIM without error then ADNs containing special characters shall be	Acquisition of ADNs containing special characters (e.g., #, !, *)

	presented in a useable format.	
SPT-AO-11	If a cellular forensic tool completes acquisition of the SIM without error then ADNs containing blank names shall be presented in a useable format.	Acquisition of ADNs containing blank names
SPT-AO-12	If a cellular forensic tool completes acquisition of the target SIM without error then Last Numbers Dialed (LND) shall be presented in a useable format.	Acquisition of LNDs
SPT-AO-13	If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding date/time stamps for LNDs shall be presented in a useable format.	Acquisition of date/time stamps associated with LNDs
SPT-AO-14	If a cellular forensic tool completes acquisition of the target SIM without error then ASCII SMS text messages shall be presented in a useable format.	Acquisition of incoming SMS messages
SPT-AO-15	If a cellular forensic tool completes acquisition of the target SIM without error then ASCII EMS text messages shall be presented in a useable format.	Acquisition of incoming EMS messages
SPT-AO-16	If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding date/time stamps for all text messages shall be presented in a useable format.	Acquisition of date/time stamps associated with text messages
SPT-AO-17	If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding status (i.e., read, unread) for text messages shall be presented in a useable format.	Acquisition of status flags associated with text messages
SPT-AO-18	If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding sender / recipient phone numbers for text messages shall be presented in a useable format.	Acquisition of sender / recipient phone numbers associated with text messages
SPT-AO-19	If the cellular forensic tool completes acquisition of the target SIM without error then deleted text messages that have not been overwritten shall be presented in a useable format.	Acquisition of non-overwritten deleted text messages
SPT-AO-20	If a cellular forensic tool completes acquisition of the target SIM without error then location related data (i.e., LOCI) shall	Acquisition of Location data

	be presented in a useable format.	
SPT-AO-21	If a cellular forensic tool completes acquisition of the target SIM without error then location related data (i.e., GRPSLOCI) shall be presented in a useable format.	Acquisition of GPRS Location data
SPT-AO-22	If a cellular forensic tool provides the user with an "***Acquire All***" SIM data objects acquisition option then the tool shall complete the acquisition of all data objects without error.	Acquire all supported SIM data objects
SPT-AO-23	If a cellular forensic tool provides the user with an "***Select All***" individual SIM data objects then the tool shall complete the acquisition of all individually selected data objects without error.	Acquire all supported SIM data objects by individually selecting each supported data object
SPT-AO-24	If a cellular forensic tool provides the user with the ability to "***Select Individual***" SIM data objects for acquisition then the tool shall acquire each exclusive data object without error.	Acquire each supported SIM data object individually
SPT-AO-25	If a cellular forensic tool completes acquisition of the target device / SIM without error then the tool shall present the acquired data in a useable format via supported generated report formats.	Acquire device/SIM; Acquired data presented in the generated report accurately reflects the data on the original device/SIM
SPT-AO-26	If a cellular forensic tool completes acquisition of the target device / SIM without error then the tool shall present the acquired data in a useable format in a preview-pane view.	Acquire device/SIM; Acquired data presented in the preview-pane accurately reflects the data on the original device/SIM
SPT-AO-27	If the case file or individual data objects are modified via third-party means then the tool shall provide protection mechanisms disallowing or reporting data modification.	Alter case file; Attempt to re-open altered case file with application
SPT-AO-28	If the SIM is password-protected then the cellular forensic tool shall provide the examiner with the opportunity to input the PIN before acquisition.	Input correct SIM PIN; Acquire SIM
SPT-AO-29	If a cellular forensic tool provides the examiner with the remaining number of authentication attempts then the application should provide an accurate count of the remaining PIN attempts.	Input incorrect PIN; Check tool output for correct number of remaining PIN attempts
SPT-AO-	If a cellular forensic tool provides the	Input incorrect PUK; Check

30	examiner with the remaining number of PUK attempts then the application should provide an accurate count of the remaining PUK attempts.	tool output for correct number of remaining PUK attempts
SPT-AO-31	If the cellular forensic tool supports a physical acquisition of the target device then the tool shall complete the acquisition without error.	Physical Acquisition; Data is presented in a useable format.
SPT-AO-32	If the cellular forensic tool supports the interpretation of address book entries present on the target device then the tool shall report recoverable active and deleted data or address book data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted address book entries
SPT-AO-33	If the cellular forensic tool supports the interpretation of calendar, tasks, or notes present on the target device then the tool shall report recoverable active and deleted calendar, tasks, or note data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted calendar, notes entries
SPT-AO-34	If the cellular forensic tool supports the interpretation of call logs present on the target device then the tool shall report recoverable active and deleted call or call log data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted call logs
SPT-AO-35	If the cellular forensic tool supports the interpretation of SMS messages present on the target device then the tool shall report recoverable active and deleted SMS messages or SMS message data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted SMS messages
SPT-AO-36	If the cellular forensic tool supports the interpretation of EMS messages present on the target device then the tool shall report recoverable active and deleted EMS messages or EMS message data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted EMS messages
SPT-AO-37	If the cellular forensic tool supports the interpretation of audio files present on the target device then the tool shall report recoverable active and deleted audio data or audio file data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted audio files
SPT-AO-38	If the cellular forensic tool supports the interpretation of graphic files present on the	Physical acquisition; Acquisition of active and

	target device then the tool shall report recoverable active and deleted graphic file data or graphic file data remnants in a useable format.	deleted graphic files
SPT-AO-39	If the cellular forensic tool supports the interpretation of video files present on the target device then the tool shall report recoverable active and deleted video file data or video file data remnants in a useable format.	Physical acquisition; Acquisition of active and deleted video files
SPT-AO-40	If the cellular forensic tool supports display of non-ASCII characters then the application should present address book entries/ADNs in their native format.	Acquisition of address book entries/ADNs containing non-ASCII characters
SPT-AO-41	If the cellular forensic tool supports proper display of non-ASCII characters then the application should present text messages in their native format.	Acquisition of text messages containing non-ASCII characters
SPT-AO-42	If the cellular forensic tool supports stand-alone acquisition of internal memory with the SIM present, then the contents of the SIM shall not be modified during internal memory acquisition.	Acquire data in Stand-alone acquisition mode; Check SIM status flags (e.g., Read, Unread) associated with text messages
SPT-AO-43	If the cellular forensic tool supports hashing for individual data objects then the tool shall present the user with a hash value for each supported data object.	Acquire data; Check known hash values for consistency
SPT-AO-44	If the cellular forensic tool supports acquisition of GPS data then the tool shall present the user with the longitude and latitude coordinates for all GPS-related data in a useable format.	Acquire data; Check GPS data for consistency

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5. Assertion Measurement

The following sections provide an overview of how individual test assertions are measured.

5.1 Connectivity

Connectivity between the mobile device and forensic software is required to acquire data from a mobile device.

***Assertion*:** SPT-CA-01 If a cellular forensic tool provides support for connectivity of the target device then the tool shall successfully recognize the target device via all tool-supported interfaces (e.g., cable, Bluetooth, IrDA).
***Test Action*:** Attempt to acquire data objects from a tool supported mobile device.
***Conformance Indicator*:** Successful acquisition of at least one data object.

***Assertion*:** SPT-CA-02 If a cellular forensic tool attempts to connect to a non-supported device then the tool shall notify the user that the device is not supported.
***Test Action*:** Attempt to acquire data objects from a non-supported mobile device.
***Conformance Indicator*:** Notification of attempting to acquire data from a non-supported mobile device.

***Assertion*:** SPT-CA-03 If connectivity between the mobile device and cellular forensic tool is disrupted then the tool shall notify the user that connectivity has been disrupted.
***Test Action*:** Disrupt connectivity during mobile device acquisition.
***Conformance Indicator*:** Notification of acquisition disruption.

***Assertion*:** SPT-AO-01 If a cellular forensic tool provides support for connectivity of the target SIM then the tool shall successfully recognize the target SIM via all tool-supported interfaces (e.g., PC/SC reader, proprietary reader, smart phone itself).
***Test Action*:** Attempt to acquire data objects present on a supported SIM.
***Conformance Indicator*:** Successful acquisition of at least one data object.

***Assertion*:** SPT-AO-02 If a cellular forensic tool attempts to connect to a non-supported SIM then the tool shall notify the user that the SIM is not supported.
***Test Action*:** Attempt to acquire data objects from a non-supported SIM.
***Conformance Indicator*:** Notification of attempting to acquire data from a non-supported SIM.

***Assertion*:** SPT-AO-03 If a cellular forensic tool loses connectivity with the SIM reader then the tool shall notify the user that connectivity has been disrupted.
***Test Action*:** Disrupting connectivity during stand-alone SIM acquisition.
***Conformance Indicator*:** Notification of connectivity disruption during acquisition.

5.2 Data Acquisition and Interpretation

Sections 5.2.1 through 5.2.8 describes assertion measurements for acquisition of supported data objects. Review acquired data for completeness and accuracy.

5.2.1 Presentation

***Assertion*:** SPT-CA-04 If a cellular forensic tool completes acquisition of the target device without error then the tool shall have the ability to present acquired data objects in a useable format via either a preview-pane or generated report.
***Test Action*:** Acquire data objects outlined above in sections 5.2.1 through 5.5.2 from the target mobile device.
***Conformance Indicator*:** Acquired data is presented in either a preview-pane view or generated report.

5.2.2 Subscriber and Equipment Related Data

***Assertion*:** SPT-CA-05 If a cellular forensic tool completes acquisition of the target device without error then subscriber-related information shall be presented in a useable format.
***Assertion*:** SPT-CA-06 If a cellular forensic tool completes acquisition of the target device without error then equipment related information shall be presented in a useable format.
***Test Action*:** Acquire subscriber and equipment related data (MSISDN, IMEI, MEID/ESN) from the mobile device internal memory.
***Conformance Indicator*:** Acquired data matches known data.

***Assertion*:** SPT-AO-04 If a cellular forensic tool completes acquisition of the target SIM without error then the SPN shall be presented in a useable format.
***Assertion*:** SPT-AO-05 If a cellular forensic tool completes acquisition of the target SIM without error then the ICCID shall be presented in a useable format.
***Assertion*:** SPT-AO-06 If a cellular forensic tool completes acquisition of the target SIM without error then the IMSI shall be presented in a useable format.
***Assertion*:** SPT-AO-07 If a cellular forensic tool completes acquisition of the target SIM without error then the MSISDN shall be presented in a useable format.
***Test Action*:** Acquire subscriber and equipment related data (SPN, ICCID, IMSI, MSISDN) from the SIM.
***Conformance Indicator*:** Acquired data matches known data.

5.2.3 Personal Information Management (PIM) Data

***Assertion*:** SPT-CA-07 If a cellular forensic tool completes acquisition of the target device without error then address book entries shall be presented in a useable format.
***Assertion*:** SPT-CA-08 If a cellular forensic tool completes acquisition of the target device without error then maximum length address book entries shall be presented in a useable format.
***Assertion*:** SPT-CA-09 If a cellular forensic tool completes acquisition of the target device without error then address book entries containing special characters shall be presented in a useable format.
***Assertion*:** SPT-CA-10 If a cellular forensic tool completes acquisition of the target device without error then address book entries containing blank names shall be presented in a useable format.
***Assertion*:** SPT-CA-11 If a cellular forensic tool completes acquisition of the target device without error then email addresses associated with address book entries shall be presented in a useable format.
***Assertion*:** SPT-CA-12 If a cellular forensic tool completes acquisition of the target device without error then graphics associated with address book entries shall be presented in a useable format.
***Assertion*:** SPT-CA-13 If a cellular forensic tool completes acquisition of the target device without error then datebook, calendar, note entries shall be presented in a useable format.

***Assertion*:** SPT-CA-14 If a cellular forensic tool completes acquisition of the target device without error then maximum length datebook, calendar, note entries shall be presented in a useable format.
***Test Action*:** Populate device with known PIM data; Acquire PIM data.
***Conformance Indicator*:** Acquired PIM data matches known PIM data.

***Assertion*:** SPT-AO-08 If a cellular forensic tool completes acquisition of the target SIM without error then ASCII Abbreviated Dialing Numbers (ADN) shall be presented in a useable format.
***Assertion*:** SPT-AO-09 If a cellular forensic tool completes acquisition of the target SIM without error then maximum length ADNs shall be presented in a useable format.
***Assertion*:** SPT-AO-10 If a cellular forensic tool completes acquisition of the SIM without error then ADNs containing special characters shall be presented in a useable format.
***Assertion*:** SPT-AO-11 If a cellular forensic tool completes acquisition of the SIM without error then ADNs containing blank names shall be presented in a useable format.
***Test Action*:** Populate the SIM with known Abbreviated Dialing Numbers (ADNs); Acquire ADNs.
***Conformance Indicator*:** The acquired list of ADNs matches the known list of ADNs.

5.2.4 Call Logs

***Assertion*:** SPT-CA-15 If a cellular forensic tool completes acquisition of the target device without error then call logs (incoming/outgoing/missed) shall be presented in a useable format.
***Assertion*:** SPT-CA-16 If a cellular forensic tool completes acquisition of the target device without error then the corresponding date/time stamps and the duration of the call for call logs shall be presented in a useable format.
***Test Action*:** Populate the internal memory of the target device with call log data; Acquire call log data.
***Conformance Indicator*:** Acquired call log data matches known call log data.

***Assertion*:** SPT-AO-12 If a cellular forensic tool completes acquisition of the target SIM without error then Last Numbers Dialed (LND) shall be presented in a useable format.
***Assertion*:** SPT-AO-13 If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding date/time stamps for LNDs shall be presented in a useable format.
***Test Action*:** Populate the internal memory of the target SIM with Last Numbers Dialed (LND); Acquire LNDs.
***Conformance Indicator*:** The acquired list of LNDs matches the known list of LNDs.

5.2.5 Text Messages (SMS, EMS, MMS)

***Assertion*:** SPT-CA-17 If a cellular forensic tool completes acquisition of the target device without error then ASCII text messages (i.e., SMS, EMS) shall be presented in a useable format.
***Assertion*:** SPT-CA-18 If a cellular forensic tool completes acquisition of the target device without error then the corresponding date/time stamps for text messages shall be presented in a useable format.
***Assertion*:** SPT-CA-19 If a cellular forensic tool completes acquisition of the target device without error then the corresponding status (i.e., read, unread) for text messages shall be presented in a useable format.
***Assertion*:** SPT-CA-20 If a cellular forensic tool completes acquisition of the target device without error then the corresponding sender/recipient phone numbers for text messages shall be presented in a useable format.

***Test Action*:** Populate the internal memory of the target device with text messages (i.e., SMS, EMS); Acquire text messages. Actively delete to see blank entries.
***Conformance Indicator*:** Acquired text message data matches known text message data.

***Assertion*:** SPT-CA-21 If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated audio shall be presented in a useable format.
***Assertion*:** SPT-CA-22 If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated graphic files shall be presented in a useable format.
***Assertion*:** SPT-CA-23 If a cellular forensic tool completes acquisition of the target device without error then MMS messages and associated video shall be presented in a useable format.
***Test Action*:** Populate the internal memory of the target device with Multi-media messages (MMS); Acquire MMS messages.
***Conformance Indicator*:** Acquired MMS message data matches known MMS message data.

***Assertion*:** SPT-AO-14 If a cellular forensic tool completes acquisition of the target SIM without error then ASCII SMS text messages shall be presented in a useable format.
***Assertion*:** SPT-AO-15 If a cellular forensic tool completes acquisition of the target SIM without error then ASCII EMS text messages shall be presented in a useable format.
***Assertion*:** SPT-AO-16 If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding date/time stamps for all text messages shall be presented in a useable format.
***Assertion*:** SPT-AO-17 If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding status (i.e., read, unread) for text messages shall be presented in a useable format.
***Assertion*:** SPT-AO-18 If a cellular forensic tool completes acquisition of the target SIM without error then the corresponding sender/recipient phone numbers for text messages shall be presented in a useable format.
***Test Action*:** Populate the internal memory of the target SIM with text messages (i.e., SMS, EMS); Acquire text messages.
***Conformance Indicator*:** Acquired text message data matches known text message data.

Assertion: SPT-AO-19 If the cellular forensic tool completes acquisition of the target SIM without error then deleted text messages that have not been overwritten shall be presented in a useable format.
Test Action: Populate the internal memory of the SIM with text messages (i.e., SMS, EMS); Delete one SMS and EMS message, do not overwrite; Acquire text messages.
***Conformance Indicator*:** Acquired text message data that has been deleted matches known text message data.

5.2.6 Stand-alone Multi-media Data

***Assertion*:** SPT-CA-24 If a cellular forensic tool completes acquisition of the target device without error then stand-alone audio files shall be presented in a useable format via either an internal application or suggested third-party application.
***Assertion*:** SPT-CA-25 If a cellular forensic tool completes acquisition of the target device without error then stand-alone graphic files shall be presented in a useable format via either an internal application or suggested third-party application.

***Assertion*:** SPT-CA-26 If a cellular forensic tool completes acquisition of the target device without error then stand-alone video files shall be presented in a useable format via either an internal application or suggested third-party application.
***Test Action*:** Populate the internal memory of the target device with audio, graphics and video file data; Acquire stand-alone multi-media data.
***Conformance Indicator*:** The acquired stand-alone data matches the known stand-alone data.

5.2.7 Application Data

Sections 5.2.6 Pertains to the acquisition of data created by pre-loaded or native applications present on the device. Review acquired data for completeness and accuracy.

***Assertion*:** SPT-CA-27 If a cellular forensic tool completes acquisition of the target device without error then device specific application related data shall be acquired and presented in a useable format via either an internal application or suggested third-party application.
***Test Action*:** Populate the internal memory of the target device using pre-loaded device (i.e., stock) applications with application data (e.g., text documents, spreadsheet, power-point, pdf); Acquire application data.
***Conformance Indicator*:** The acquired application data matches the known application data.

5.2.8 Internet Related Data

***Assertion*:** SPT-CA-28 If a cellular forensic tool completes acquisition of the target device without error then Internet related data (i.e., bookmarks, visited sites) cached to the device shall be acquired and presented in a useable format.
***Test Action*:** Populate the internal memory of the target device with Internet related data (e.g., cached web-site URLs, bookmarks, downloaded files); Acquire Internet related data.
***Conformance Indicator*:** The acquired Internet related data matches the known Internet related data.

5.3 Location Related Data

***Assertion*:** SPT-AO-20 If a cellular forensic tool completes acquisition of the target SIM without error then location related data (i.e., LOCI) shall be presented in a useable format.
***Assertion*:** SPT-AO-21 If a cellular forensic tool completes acquisition of the target SIM without error then location related data (i.e., GRPSLOCI) shall be presented in a useable format.
***Test Action*:** Populate the internal memory of the target SIM with LOCI and GRPSLOCI data; Acquire LOCI and GPRSLOCI data.
***Conformance Indicator*:** The acquired LOCI and GPRSLOCI data matches the known LOCI and GPRSLOCI data.

5.4 Tool Acquisition Variations

Assertion*:** SPT-CA-29 If a cellular forensic tool provides the user with an "Acquire All***" data objects acquisition option then the tool shall complete the acquisition of all data objects without error.
Assertion*:** SPT-CA-30 If a cellular forensic tool provides the user with an "Select All***" individual data objects then the tool shall complete the acquisition of all individually selected data objects without error.

Assertion**:** SPT-CA-31 If a cellular forensic tool provides the user with the ability to "***Select Individual***" data objects for acquisition then the tool shall acquire each exclusive data object without error.
Test Action**:** Acquire device data objects by specifying ***acquire all*** which automatically selects all supported data objects for acquisition; ***select all*** which all supported data objects are individually selected for acquisition; ***select individual*** which each supported data object is selected exclusively for acquisition.
Conformance Indicator**:** Successful acquisition of the selected device data objects.

Assertion**:** SPT-AO-22 If a cellular forensic tool provides the user with an "***Acquire All***" SIM data objects acquisition option then the tool shall complete the acquisition of all data objects without error.
Assertion**:** SPT-AO-23 If a cellular forensic tool provides the user with an "***Select All***" individual SIM data objects then the tool shall complete the acquisition of all individually selected data objects without error.
Assertion: SPT-AO-24 If a cellular forensic tool provides the user with the ability to "***Select Individual***" SIM data object for acquisition then the tool shall acquire each exclusive data object without error.
Test Action**:** Acquire SIM data objects by specifying ***acquire all*** which automatically selects all supported data objects for acquisition; ***select all*** which all supported data objects are individually selected for acquisition; ***select individual*** which each supported data object is selected exclusively for acquisition.
Conformance Indicator**:** Successful acquisition of the selected SIM data objects.

5.5 Device Data Not Modified

Assertion**:** SPT-CA-32 Data objects present on the device are not modified by acquisition.
Test Action**:** Perform two consecutive logical device internal memory acquisitions
Conformance Indicator**:** Data objects present on the mobile device remain consistent.

5.6 Generated Reports / Preview-Pane

Assertion**:** SPT-AO-25 If a cellular forensic tool completes acquisition of the target device/SIM without error then the tool shall present the acquired data in a useable format via supported generated report formats.
Test Action**:** Acquire supported populated data objects from the target device internal memory; Generate tool supported reports.
Conformance Indicator**:** The acquired data objects presented in the generated report matches the known populated data.

Assertion**:** SPT-AO-26 If a cellular forensic tool completes acquisition of the target device/SIM without error then the tool shall present the acquired data in a useable format in a preview-pane view.
Test Action**:** Acquire supported populated data objects from the target device internal memory; Display acquired data in preview-pane mode.
Conformance Indicator**:** The acquired data objects presented in preview-pane mode matches the known populated data.

5.7 Case File/Data Protection

***Assertion*:** SPT-AO-27 If the case file or individual data objects are modified via third-party means then the tool shall provide protection mechanisms disallowing or reporting data modification.
***Test Action*:** Modify a saved case file with a hex editor; re-open the modified case file with the mobile device tool.
***Conformance Indicator*:** Notification that the case file has been altered.

5.8 SIM PIN/PUK Authentication

***Assertion*:** SPT-AO-28 If the SIM is password-protected then the cellular forensic tool shall provide the examiner with the opportunity to input the PIN before acquisition.
***Test Action*:** Password protect the target SIM; Attempt to acquire data from the password-protected SIM by entering the password.
***Conformance Indicator*:** The tool successfully acquires all requested data.

***Assertion*:** SPT-AO-29 If a cellular forensic tool provides the examiner with the remaining number of authentication attempts then the application should provide an accurate count of the remaining PIN attempts.
***Test Action*:** Begin acquisition on a password protected SIM; Input incorrect PIN.
***Conformance Indicator*:** The correct number of remaining PIN attempts are reported.

***Assertion*:** SPT-AO-30 If a cellular forensic tool provides the examiner with the remaining number of PUK attempts then the application should provide an accurate count of the remaining PUK attempts.
***Test Action*:** Begin acquisition on a password protected SIM whose PIN attempts have been exhausted; Input incorrect PUK.
***Conformance Indicator*:** The correct number of remaining number of PUK attempts are reported.

5.9 Physical Acquisition

***Assertion*:** SPT-AO-31 If the cellular forensic tool supports a physical acquisition of the target device then the tool shall complete the acquisition without error.
***Test Action*:** Acquire populated data from the internal memory of the target device.
***Conformance Indicator*:** The acquired data matches the known data populated onto the device.

***Assertion*:** SPT-AO-32 If the cellular forensic tool supports the interpretation of address book entries present on the target device then the tool shall report recoverable active and deleted data or address book data remnants in a useable format.
***Assertion*:** SPT-AO-33 If the cellular forensic tool supports the interpretation of calendar, tasks, or notes present on the target device then the tool shall report recoverable active and deleted calendar, tasks, or note data remnants in a useable format.
***Assertion*:** SPT-AO-34 If the cellular forensic tool supports the interpretation of call logs present on the target device then the tool shall report recoverable active and deleted call or call log data remnants in a useable format.
***Assertion*:** SPT-AO-35 If the cellular forensic tool supports the interpretation of SMS messages present on the target device then the tool shall report recoverable active and deleted SMS messages or SMS message data remnants in a useable format.

***Assertion*:** SPT-AO-36 If the cellular forensic tool supports the interpretation of EMS messages present on the target device then the tool shall report recoverable active and deleted EMS messages or EMS message data remnants in a useable format.
***Assertion*:** SPT-AO-37 If the cellular forensic tool supports the interpretation of audio files present on the target device then the tool shall report recoverable active and deleted audio data or audio file data remnants in a useable format.
***Assertion*:** SPT-AO-38 If the cellular forensic tool supports the interpretation of graphic files present on the target device then the tool shall report recoverable active and deleted graphic file data or graphic file data remnants in a useable format.
***Assertion*:** SPT-AO-39 If the cellular forensic tool supports the interpretation of video files present on the target device then the tool shall report recoverable active and deleted video file data or video file data remnants in a useable format.
***Test Action*:** Acquire populated data from the internal memory of the target device that has been deleted but not overwritten.
***Conformance Indicator*:** The acquired data provides data remnants matching the known data populated onto the device.

5.10 Non-ASCII Character Presentation

***Assertion*:** SPT-AO-40 If the cellular forensic tool supports display of non-ASCII characters then the application should present address book entries/ADNs in their native format.
***Test Action*:** Populate device and SIM with known non-ASCII data address book entries; Acquire address book entries.
***Conformance Indicator*:** Acquired address book entries match the known list of non-ASCII address book entries.

***Assertion*:** SPT-AO-41 If the cellular forensic tool supports proper display of non-ASCII characters then the application should present text messages in their native format.
***Test Action*:** Populate device and SIM with known non-ASCII text messages; Acquire text messages.
***Conformance Indicator*:** Acquired text messages match the known list of non-ASCII text messages.

5.11 Stand-alone Acquisition

***Assertion*:** SPT-AO-42 If the cellular forensic tool supports stand-alone acquisition of internal memory with the SIM present, then the contents of the SIM shall not be modified during internal memory acquisition.
***Test Action*:** Populate the internal memory of the target SIM with text messages (i.e., SMS, EMS); Do not read text messages ensuring the status flags are marked as UNREAD; Acquire the internal memory of the mobile device in stand-alone acquisition mode.
***Conformance Indicator*:** The status flags for text messages present on the SIM maintain their status as UNREAD.

5.12 Hashing

***Assertion*:** SPT-AO-43 If the cellular forensic tool supports hashing for individual data objects then the tool shall present the user with a hash value for each supported data object.
***Test Action*:** Populate and acquire supported data objects.

***Conformance Indicator*:** The hash values for acquired data objects match hash values of the populated data objects.

5.13 GPS Reporting

***Assertion*:** SPT-AO-44 If the cellular forensic tool supports acquisition of GPS data then the tool shall present the user with the longitude and latitude coordinates for all GPS-related data in a useable format.
***Test Action*:** Populate the internal memory of the target device with known GPS coordinate data; Acquire the internal memory of the device.
***Conformance Indicator*:** The acquired data matches the known data populated onto the device.

6. Abstract Test Cases

Abstract test cases describe the combinations of test parameters required to fully test each assertion and the results expected for the given combination of test parameters. The test cases are abstract in that they do not prescribe the exact environment in which the tests are to be performed. They are written at the next level above the actual test environment, thus abstract test cases allowing substitution and variation of setup environment variables under dissimilar products and options prior to engagement in official testing. Section 5.1 lists test cases i.e., SPT-01 through SPT-13. Section 5.2 lists optional test cases i.e., SPT-14 through SPT-40.

6.1 Test Cases for Core Features

SPT-01 Acquire mobile device internal memory over tool-supported interfaces (e.g., cable, Bluetooth, IrDA).

SPT-02 Attempt internal memory acquisition of a non-supported mobile device.

SPT-03 Begin mobile device internal memory acquisition and interrupt connectivity by interface disengagement.

SPT-04 Acquire mobile device internal memory and review reported data via the preview-pane or generated reports for readability.

SPT-05 Acquire mobile device internal memory and review reported subscriber and equipment related information (e.g., IMEI/MEID/ESN, MSISDN).

SPT-06 Acquire mobile device internal memory and review reported PIM related data.

SPT-07 Acquire mobile device internal memory and review reported call logs.

SPT-08 Acquire mobile device internal memory and review reported text messages.

SPT-09 Acquire mobile device internal memory and review reported MMS multi-media related data (i.e., text, audio, graphics, video).

SPT-10 Acquire mobile device internal memory and review reported stand-alone multi-media data (i.e., audio, graphics, video).

SPT-11 Acquire mobile device internal memory and review application related data (i.e., word documents, spreadsheet, presentation documents).

SPT-12 Acquire mobile device internal memory and review Internet related data (i.e., bookmarks, visited sites.

SPT-13 Acquire mobile device internal memory by selecting a combination of supported data elements.

This test case may be executed with the following variations:

Variation IM_Comp*:** Acquire mobile device internal memory by selecting the ***acquire all function, if supported by the tool.

***Variation IM_SlctAll*:** Acquire mobile device internal memory by selecting all supported data objects individually for acquisition. *Note: This variation requires one acquisition of all individually selected data objects.*

***Variation IM_SlctIndv*:** Acquire mobile device internal memory by performing an acquisition for each supported data object individually. *Note: This variation requires an acquisition for each individual supported data object*.

6.2 Test Cases for Optional Features

The following test cases are defined for tool features that might be implemented for some cellular forensic tools. If a tool provides the optional feature, the tool is tested as if the test case were core. If the tool does not provide the capability defined, the test case does not apply.

SIM Acquisition

SPT-14 Acquire SIM memory over supported interfaces (e.g., PC/SC reader).

SPT-15 Attempt acquisition of a non-supported SIM.

SPT-16 Begin SIM acquisition and interrupt connectivity by interface disengagement.

SPT-17 Acquire SIM memory and review reported subscriber and equipment related information (i.e., SPN, ICCID, IMSI, MSISDN).

SPT-18 Acquire SIM memory and review reported Abbreviated Dialing Numbers (ADN).

SPT-19 Acquire SIM memory and review reported Last Numbers Dialed (LND).

SPT-20 Acquire SIM memory and review reported text messages (SMS, EMS).

SPT-21 Acquire SIM memory and review recoverable deleted text messages (SMS, EMS).

SPT-22 Acquire SIM memory and review reported location related data (i.e., LOCI, GPRSLOCI).

SPT-23 Acquire SIM memory by selecting a combination of supported data elements.

This test case may be executed with the following variations:

Variation SIM_Comp*:** Acquire mobile device SIM memory by selecting the ***acquire all function, if supported by the tool.

***Variation SIM_SlctAll*:** Acquire mobile device SIM memory by selecting all supported data elements individually for acquisition. Note: This variation requires one acquisition of all individually selected data objects.

***Variation SIM_SlctIndv*:** Acquire mobile device SIM memory by performing an acquisition for each supported data object individually. Note: This variation requires an acquisition for each individual supported data object.

Presentation

SPT-24 Acquire mobile device internal memory and review reported data via supported generated report formats.

SPT-25 Acquire mobile device internal memory and review reported data via the preview pane.

SPT-26 Acquire SIM memory and review reported data via supported generated report formats.

SPT-27 Acquire SIM memory and review reported data via the preview-pane.

Password-Protected SIM

SPT-28 Attempt acquisition of a password-protected SIM.

Case File/Data Protection

SPT-29 After a successful mobile device internal memory, alter the case file via third-party means and attempt to re-open the case.

SPT-30 After a successful SIM acquisition, alter the case file via third-party means and attempt to re-open the case.

Physical Acquisition

SPT-31 Perform a physical acquisition and review data output for readability.

SPT-32 Perform a physical acquisition and review reports for recoverable deleted data.

Non-ASCII Character Presentation

SPT-33 Acquire mobile device internal memory and review data containing non-ASCII characters.

SPT-34 Acquire SIM memory and review data containing non-ASCII characters.

PIN/PUK attempts

SPT-35 Begin acquisition on a PIN protected SIM to determine if the tool provides an accurate count of the remaining number of PIN attempts and if the PIN attempts are decremented when entering an incorrect value.

SPT-36 Begin acquisition on a SIM whose PIN attempts have been exhausted to determine if the tool provides an accurate count of the remaining number of PUK attempts and if the PUK attempts are decremented when entering an incorrect value.

Stand-alone acquisition

SPT-37 Perform a stand-alone mobile device internal memory acquisition and review the status flags for text messages present on the SIM.

Hashing

SPT-38 Acquire mobile device internal memory and review hash values for vendor supported data objects.

SPT-39 Acquire SIM memory and review hash values for vendor supported data objects.

GPS Reporting

SPT-40 Acquire mobile device internal memory and review data containing GPS longitude and latitude coordinates.

The following traceability matrices relate core requirements to core assertions. The requirements are defined in the document entitled: Smart Phone Tool Specification.

Requirements to Assertions (Core Features)

		Assertions															
		01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Requirements (Core Features)	**SPT-CR-01**	•															
	SPT-CR-02		•														
	SPT-CR-03			•													
	SPT-CR-04	•			•												
	SPT-CR-05	•				•	•	•	•	•	•	•	•	•	•	•	•
	SPT-CR-06	•															

Requirements to Assertions (Core Features – Cont.)

		Assertions															
		17	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Requirements (Core Features)	**SPT-CR-01**													•	•	•	
	SPT-CR-02																
	SPT-CR-03																
	SPT-CR-04																
	SPT-CR-05	•	•	•	•	•	•	•	•	•	•	•	•				
	SPT-CR-06																•

The following traceability matrices relate optional requirements to optional test assertions.

Requirements to Assertions (Optional Features)

		Assertions													
		01	02	03	04	05	06	07	08	09	10	11	12	13	14
Requirements (Optional Features)	SPT-RO-01	•													
	SPT-RO-02		•												
	SPT-RO-03			•											
	SPT-RO-04	•			•	•	•	•	•	•	•	•	•	•	•
	SPT-RO-05 -15	•													

Requirements to Assertions (Optional Features – Cont.)

		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31-39	40-41	42	43	44
Requirements (Optional Features)	SPT-RO-01								•	•	•											
	SPT-RO-04	•	•	•	•	•	•	•														
	SPT-RO-05											•										
	SPT-RO-06												•									
	SPT-RO-07														•					•		
	SPT-RO-08													•								
	SPT-RO-09																	•				
	SPT-RO-10																		•			
	SPT-RO-11															•						
	SPT-RO-12																•					
	SPT-RO-13																			•		
	SPT-RO-14																				•	
	SPT-RO-15																					•

The following traceability matrices relate core assertions to core test cases.

Assertions to Test Cases (Core Features)

		Test Cases (SPT- 01 – 13)												
		01	02	03	04	05	06	07	08	09	10	11	12	13
Assertions (Core Features)	SPT-CA-01	•												
	SPT-CA-02		•											
	SPT-CA-03			•										
	SPT-CA-04	•			•									
	SPT-CA-05					•								
	SPT-CA-06					•								
	SPT-CA-07						•							
	SPT-CA-08						•							
	SPT-CA-09						•							
	SPT-CA-10						•							
	SPT-CA-11						•							
	SPT-CA-12						•							
	SPT-CA-13						•							
	SPT-CA-14						•							
	SPT-CA-15							•						
	SPT-CA-16							•						
	SPT-CA-17								•					
	SPT-CA-18								•					
	SPT-CA-19								•					
	SPT-CA-20								•					
	SPT-CA-21									•				
	SPT-CA-22									•				
	SPT-CA-23									•				
	SPT-CA-24										•			

	SPT-CA-25										•			
	SPT-CA-26										•			
	SPT-CA-27											•		
	SPT-CA-28												•	
	SPT-CA-29	•												•
	SPT-CA-30	•												•
	SPT-CA-31	•												•
	SPT-CA-32	•												

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The following traceability matrices relate optional assertions to test cases.

Assertions to Test Cases (Optional Features)

		Test Cases (SPT-13 – 25)											
		14	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24/26**	**25/27**
Assertions (Optional Features)	**SPT-AO-01**	•									•		
	SPT-AO-02		•										
	SPT-AO-03			•									
	SPT-AO-04				•								
	SPT-AO-05				•								
	SPT-AO-06				•								
	SPT-AO-07				•								
	SPT-AO-08					•							
	SPT-AO-09					•							
	SPT-AO-10					•							
	SPT-AO-11					•							
	SPT-AO-12						•						
	SPT-AO-13						•						
	SPT-AO-14-18							•					
	SPT-AO-19								•				
	SPT-AO-20-21									•			
	SPT-AO-22-24										•		
	SPT-AO-25											•	
	SPT-AO-26												•

Assertions to Test Cases (Optional Features – Cont.)

Assertions (Optional Features)	28	29	30	31	32	33	34	35	36	37	38	39	40
SPT-AO-27		•	•										
SPT-AO-28	•												
SPT-AO-29								•					
SPT-AO-30									•				
SPT-AO-31				•									
SPT-AO-32					•								
SPT-AO-33					•								
SPT-AO-34					•								
SPT-AO-35					•								
SPT-AO-36					•								
SPT-AO-37					•								
SPT-AO-38					•								
SPT-AO-39					•								
SPT-AO-40						•	•						
SPT-AO-41						•	•						
SPT-AO-42										•			
SPT-AO-43											•	•	
SPT-AO-44													•