SCM MICROSYSTEMS
POD INTERFACE QUALIFICATION TOOL
For
OPENCABLE™ CABLE-READY TV RECEIVER

USER'S GUIDE

Second Generation POD Tool™
Rev 2.1

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1. INTRODUCTION

1.1. Scope

The POD Interface Qualification Tool for OpenCable Cable-ready TV Receiver (or "***POD Tool")*** is a piece of dedicated test equipment for developing and certifying cable-ready TV receivers, according to the *OpenCable HOST/POD Interface Specification* [1] and the *OpenCable POD Copy Protection System* [2].

The ***POD Tool*** is co-developed by CableLabs® and SCM Microsystems, to be used as a reference tool during certification tests, as described in the *OpenCable Host Device Acceptance Test Plan* [3].

The second generation ***POD Tool - Rev 2.0*** builds on the success of the initial product release with significantly enhanced analysis capabilities to improve its use as a diagnostics device, and now fully emulates the behavior of a POD module. Incorporating SCM's own fully interoperable POD technology, the second generation ***POD Tool – Rev 2.0*** is the ultimate reference device for receiver manufacturers needing to validate their designs to ensure interoperability between their receivers and POD modules that will be deployed by cable operators.

The ***POD Tool Hardware*** operates in combination with the ***POD Tool Software*** running on a remote PC connected via Ethernet. The ***POD Tool*** covers all host interface channels: In-band, Out-of-band, Data and Extended channels, and includes database management, scenario editor and trace monitoring features to easily execute complex and repetitive test routines.

The User Interface allows adding, managing, executing, monitoring and controlling multiple test scenarios, including those defined by CableLabs for certification.

As [3] will evolve, SCM will be releasing additional test scripts on its web site: www.scmmicro.com. Test scenarios for copy protection validation are only available upon completion of a license agreement with CableLabs and are distributed as part of the CableLabs deliverables.

Figure 1: POD Tool Overview

1.2. OpenCable HOST/POD Interface

The POD module interface is depicted in Figure 2.

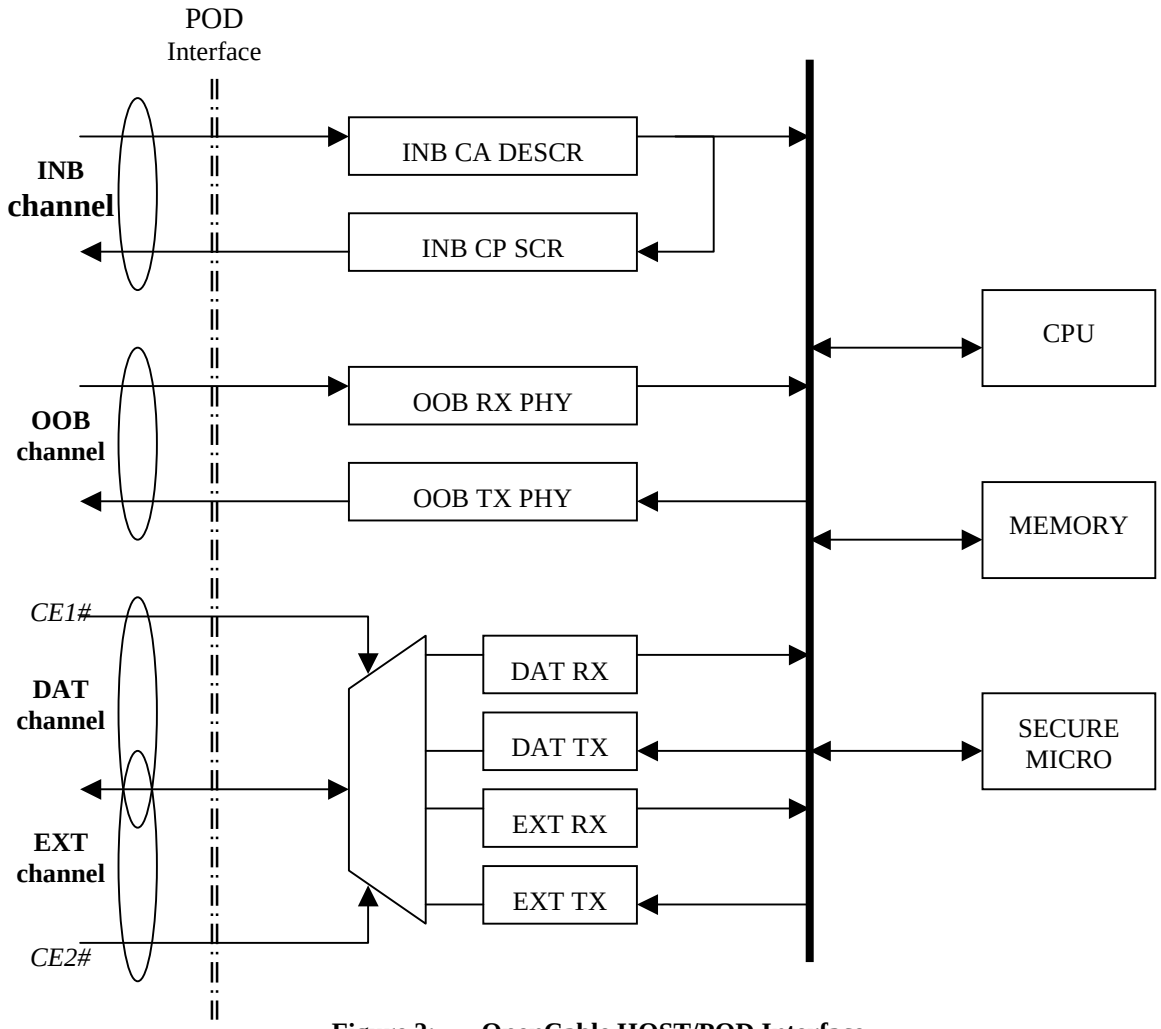


Figure 2: OpenCable HOST/POD Interface

The POD module interface consists of four logical interfaces:

- The In-Band (INB) channel carries the MPEG2 transport stream back and forth between the host and the POD module. The INB channel interface consists of two MPEG parallel transport streams, compliant with [5]. The first stream provides the module with the network-protected data, while the second stream provides the host with the copy-protected data.
- The Out-Of-Band (OOB) channel is used to connect the OOB RF front end in the host, with the OOB PHY and MAC layers in the module. The OOB channel interface consists of two signals to carry downstream messages and 4 signals to carry upstream messages.
- The Data (DAT) channel supports all local transactions between the host and the module. It allows the POD application to take advantage of the host resources and vice versa. It supports the copy protection authentication, key negotiation and derivation. The DAT channel is used to initialize the Extended channel. This interface complies with the PCMCIA standard [4].
- The Extended (EXT) channel provides the host with the network messages that are broadcast or narrowcast through the OOB channel. The data is recovered from the OOB channel by the module, demultiplexed and passed over the EXT channel according to [1]. The same data path applies when the host wants to send messages to the cable head-end through the module. The EXT channel is also used when the host supports a DOCSIS modem. In this case, the module receives and sends network messages across the EXT channel, which come from and is sent to the DOCSIS modem by the host. The DAT and EXT channels are sharing the same signal across the interface. The DAT channel is enabled by the signal CE1#, while the EXT channel is enabled by CE2#.

1.3. References

[1] IS-POD-INT03-000714: *OpenCable HOST/POD Interface Specification*

[2] IS-POD-CP-INT03-000714: *OpenCable POD Copy Protection System*

[3] P-ATP-OC-HOST-W07- 0008: *OpenCable Host Device Acceptance Test Plan*

[4] PCMCIA PC Card standard: Personal Computer Memory Card International Association

[5] ISO/IEC 13818-1: MPEG System Level

1.4. System Overview

The ***POD Tool*** consists of the ***POD Tool Hardware***, the ***POD Tool Software*** and the ***POD Tool Test Library*** as described in Figure 3.

When the ***POD Tool*** is used for development and qualification, it acts primarily as a POD module emulator to stimulate the tested host according to pre-defined test scenarios and check responses (**Simulation mode**). When used for solving interoperability issues between two real devices (e.g. host and POD module), it acts as a POD interface transaction recorder and verifier (**Spy mode**).

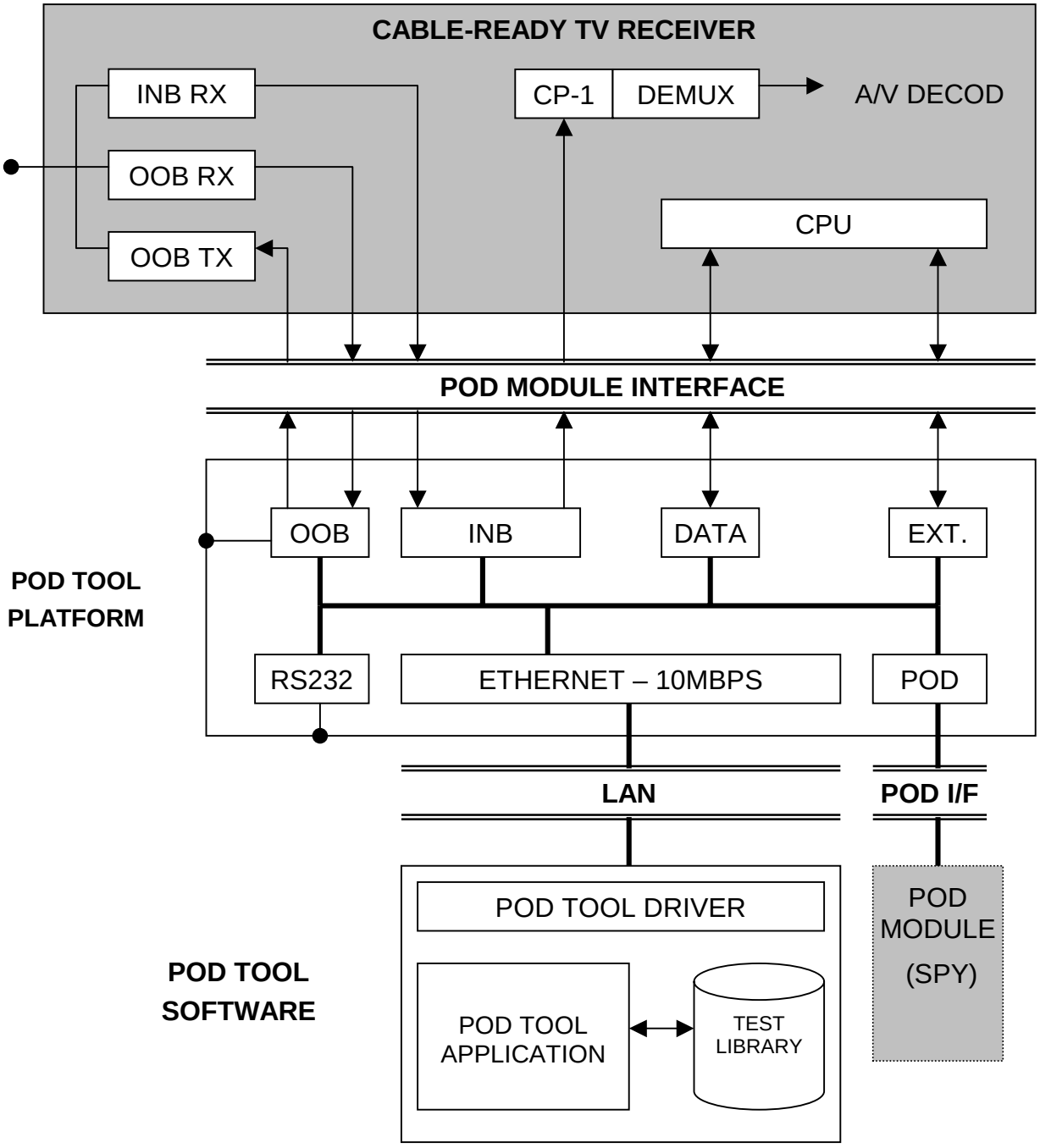


Figure 3: POD Tool Architecture

The ***POD Tool*** covers the four channels of the interface (e.g. In-band, Out-of-band, Data and Extended channels) up to the level that is relevant for the POD Interface. For example, the ***POD Tool*** checks all layers of the Data Channel from the Physical to the Application layers since it is a local channel across the interface. However, it checks only the Physical and Link layer of the In-band Channel since the MPEG transport and application consistency is controlled further down by the Demux and the A/V decoder in the receiver.

Channel	Test Level
In-band	Physical[1], Link[2]
Out-of-Band	Physical[3]
Data Channel	Physical, Link, Transport, Session, Application
Extended Channel	Physical, Link[4]

[1] Physical tests include continuity on all signals and parametric test (e.g. VIH, VIL, Setup and Hold time) for receiver inputs. Receiver outputs are checked by connecting an external oscilloscope on the strobe pins of the POD Tool Platform's PCMCIA Extender.

[2] The POD Tool performs a local transport encryption of the incoming clear transport stream when testing the Host copy protection capability.

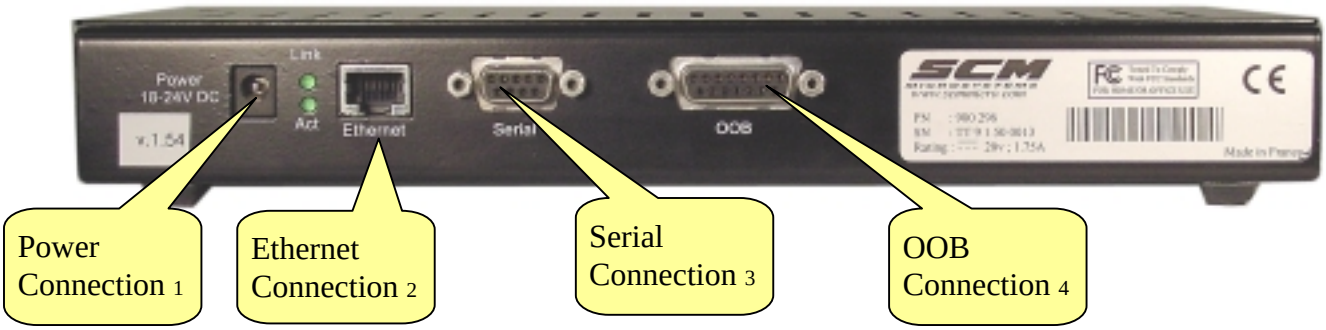
[3] The POD Interface OOB signals are available for further RF testing of the host OOB transmitter and receiver on LVDS connectors.

[4] The POD Tool performs a test of the Host Extended Channel bandwidth by setting the Host in the "Loop Back" mode.

2. INSTALLATION

2.1. POD Tool Hardware

2.1.1 Back Inputs & Outputs



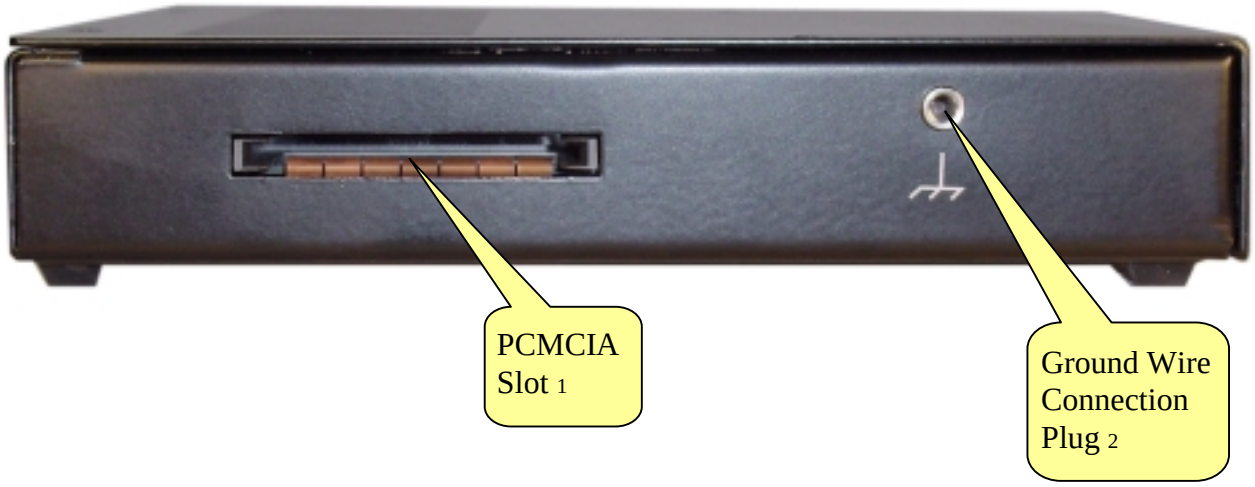
The ***POD Tool Hardware*** includes the following I/Os which connect to the back:

1. A power cord (18 – 24 V DC);
2. An RJ45 Ethernet interface;
3. Straight through RS232 serial cable;
4. DB15 female connector for LVDS Out Of Band (OOB) interface:

Pin	Type	Signal
1	POWER	+5V
2	IN	ETX+
3	IN	QTX+
4	IN	ITX-
5	OUT	DRX+
6	OUT	CRX+
7	OUT	CTX-
8	POWER	GND

Pin	Type	Signal
9	IN	ETX-
10	IN	QTX-
11	IN	ITX+
12	POWER	GND
13	OUT	DRX-
14	OUT	CRX-
15	OUT	CTX+

2.1.2 Side Inputs & Outputs



The ***POD Tool Hardware*** includes the following I/Os which connect to the side:

1. A PCMCIA probe ;
2. A flying wire with a ground clip (Ground Wire)*

* Due to double isolation and power supply leakage in some set-top boxes, the box and ***POD Tool*** ground potential difference can be too high for the interface and destroy it. In order to prevent this destruction, a flying wire and a ground clip are provided with the ***POD Tool***. This wire connects to the ground plug located on the same side as the POD interface flat cable connector. The ground clip must be attached to the POD set-top box ground before connecting the POD interface flat cable. Non-respect of this precaution can result in permanent damage to the ***POD Tool*** that is not covered by warranty.

2.1.3. SET-UP

The ***POD Tool Hardware*** needs to have its IP address configured before the first use, to be recognized over the local Ethernet network.

1. Connect the serial link cable to the platform and the serial port of the PC.
2. Plug in the platform power cord.
3. Launch the HyperTerminal Windows utility on the PC
4. Turn on the platform power (Reset Button).
5. Press the letter "c" in the Test PC to launch the configuration dialog
6. Follow the instructions given by the POD Tool to configure the TCP/IP parameters (tool's own IP address, sub-network mask…)

The configuration is automatically saved in the ***POD Tool Hardware*** and will be used thereafter, until the user modifies it again.

2.1.4. Firmware upgrade

The ***POD Tool Firmware*** may need to be upgraded before first use with the second generation software if it is a version previous to 2.56. To check the firmware version of the pod tool connect the ***POD Tool*** to the PC via the Ethernet cable. Install the ***POD Tool*** Software (see 2.2.1). Select the initialization script and press the start button. From there you will be able to view the firmware version number in the Active POD window.

For ***POD Tools*** with firmware versions greater than or equal to 1.54, use the following procedure:

- Connect the serial cable to both your PC and the ***POD Tool***
- Power on the ***POD Tool***
- Copy both Podsoft.bin and Update2_0.exe to the desktop:
- Open a DOS window and enter the following command:
  Update2_0 COMx Podsoft.bin (COMx is the Port used)

*** **WARNING: Do not** interrupt the flash upgrade process when started (even if you receive an error message, the upgrade process should be relaunched automatically). It takes 2 to 3 minutes while dots are streaming. **Do not** reset the ***POD Tool*** until prompted by the DOS window to do so.

For ***POD Tools*** with a firmware version less than 1.54, use the following procedure :

- Connect the serial cable to both your PC and the ***POD Tool***
- Power on the ***POD Tool***
- Copy the following files to the desktop: Podsoft.bin, Update2_0.exe, and UpdatePT.exe
- Open a DOS window and enter the following command:
  UpdatePT COMx Podsoft.bin (COMx is the Port used)

*** **WARNING: Do not** interrupt the flash upgrade process when started (even if you receive an error message, the upgrade process should be relaunched automatically). It takes 2 to 3 minutes while dots are streaming**. Do not** reset the ***POD Tool*** until prompted by the DOS window to do so.

- Wait for the DOS window to tell the user to reset the ***POD Tool*** and reset the Tool
- In the DOS window enter the following command:
  Update2_0 COMx Podsoft.bin (COMx is the Port used)

2.2. POD Tool Software

2.2.1. Original Install

WINDOWS 2000 Installation procedure:

To install the application, insert the CD ROM disk. Run **Setup.exe**.

After completing the installation procedure, run C:\Program Files\SCM Microsystems\SCM POD Tool\regall.bat

WINDOWS 98/NT Installation procedure:

To install the application, insert the CD ROM disk. Run **Setup.exe**.

After completing the installation procedure, go to C:\Program Files\SCM Microsystems\SCM POD Tool\WSC and register all of the .wsc files in the folder (Right mouse click).

2.2.2. Software Upgrade

The original ***POD Tool Software*** can be upgraded to the second generation software by first uninstalling all previous versions of the software on the machine. This can be done by going to the control panel, add/remove programs, and removing SCM Pod Tool. Once this is done reboot the computer and install the second generation software by following the steps outlined above (2.2.1).

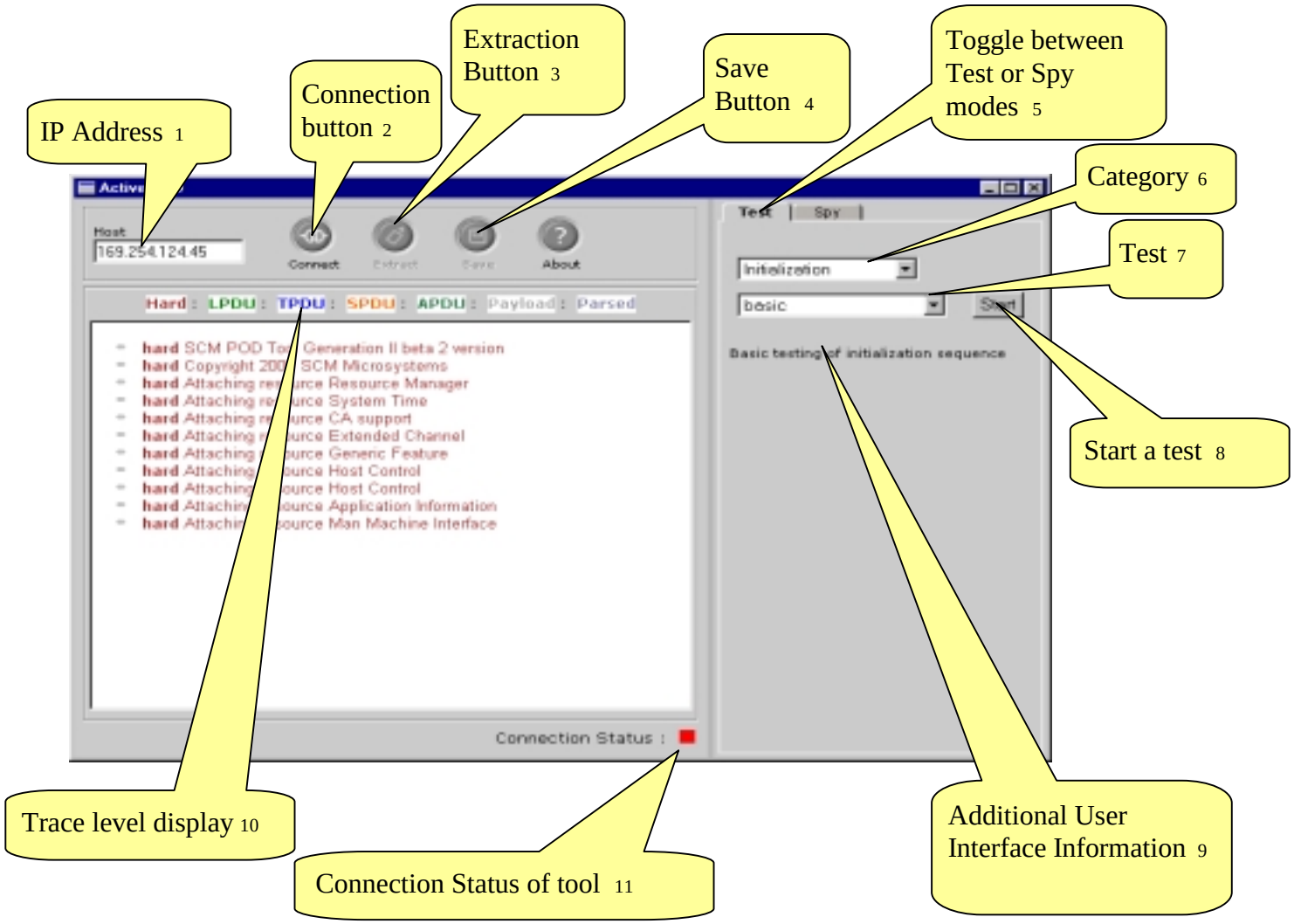
3. Simulation Mode

3.1 . Overview

The tool operates as an access module simulator with respect to a receiver.

3.1.1. Main Menu

The following menu is the main menu of the POD Tool.

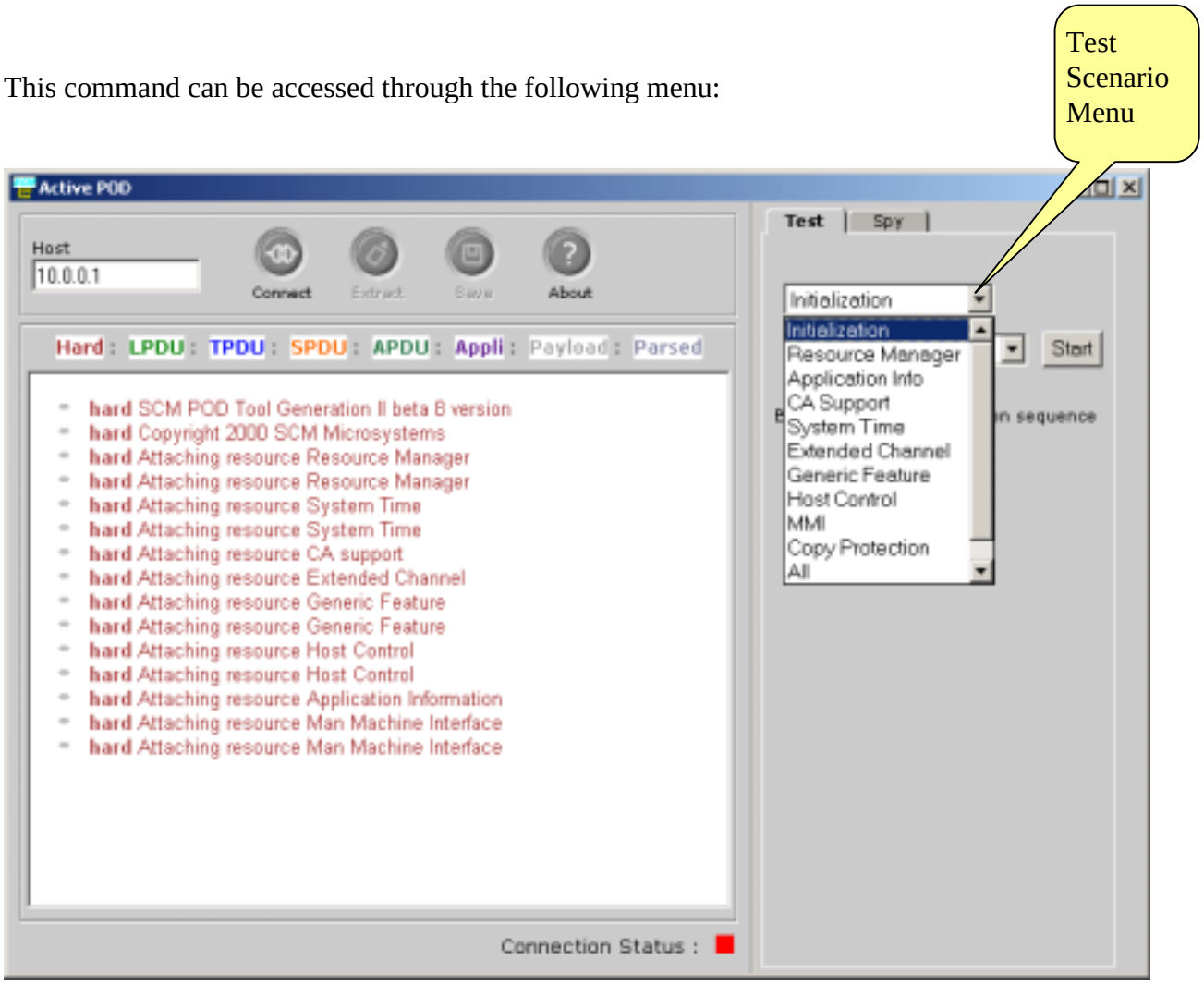


3.1.2. Definitions of main menu items:

1. **IP Address**: This is the IP Address of the POD Tool which can be configured through the hyper terminal.
2. **Connection Button**: This will start the connection to the POD Tool.
3. **Logical Extraction**: Allows the user to extract previously ran traces from the Active POD window.
4. **Save**: Saves the trace buffer content.
5. **Select emulation or spy mode**: Allows the user to chose between test (emulation) and spy mode.
6. **Category**: The user can choose from a variety of tests to run.
7. **Test**: Allows the user to choose the test to run from each category.
8. **Start**: Starts a chosen test.
9. **User Interface**: Additional UI appears in this zone containing a description of the test.
10. **Trace level display**: User can activate or deactivate any trace level they want to view (Hard, LPDU, TPDU, SPDU, APDU, Payload, or Parsed).
11. **Status**: Red shows the tool is disconnected, yellow means the tool is connected, and green the tool is connected and active.

3.1.3. Test Scenario Selection

This command can be accessed through the following menu:



3.2. Definition of tests

3.2.1. Initialization

The following scenarios tests module initialization and transport connection:

Basic: opens the transport connection and opens the Resource Manager.

Basic with poll: functions the same as basic, with the exception that the tpdu polling packets are displayed.

Basic with poll and lpdu: functions the same as basic, with the exception that tpdu polling packets and lpdu packet are displayed.

Reduced buffer size: works the same as basic with poll and lpdu but works with a negotiated buffer size of 16 for the data channel and 20 for the extended channel.

Send TC Delete: functions the same as basic, except that after 5 seconds of empty polling the POD tool sends a TC Delete to the host. Two buttons are available to send either a TC delete or a TC Request.

After this point all scenarios start by opening a transport connection, and then opening the Resource Manager. After the Resource Manager opens other active resources will receive an open signal.

3.2.2. Resource Manager

These scenarios test Resource Manager. The active resource is the Resource Manager:

Basic: opens TC and Resource Manager.

Open twice: opens the Resource Manager twice.

3.2.3. Application Info

These scenarios test Application Info. Active resources are Resource Manager and Application Info.

Basic: basic testing of the Application Info.

3.2.4. CA Support

These scenarios test CA Support. CA Support always report supporting 3 CA system IDs : 0x1234, 0x4567, 0x89AB. Active resources are Resource Manager and CA Support.

Always descramble: opens CA Support and will always reply to CAPMT APDU with a CAPMT reply and descrambling possible.

Never descramble: opens CA Support and always will reply to CAPMT APDU with a CAPMT reply and descrambling not possible (because there is no entitlement).

3.2.5. System Time

Once: opens the system time resource and asks for the time once.

10 sec period: opens the system time resource and asks for the time with a 10 sec period.

60 sec period: opens the system time resource and asks for the time with a 60 sec period.

Open twice: opens two system time resources and asks for the time once on each of them.

Open twice 10/60 sec period: opens two system time resources and will ask for the time with a period of 10 and 60 seconds.

3.2.6. Extended Channel

The following scenarios will test the Extended Channel. Active resources are both Resource Manager and the Extended Channel.

Basic: opens the Extended Channel resource and will provide two buttons for interactive testing; Lost Flow and New Flow Request.

3.2.7. Generic Feature

The following scenarios will test the Generic Feature. Active resources are Resource Manager and Generic Feature.

Basic: opens the Generic Features and report two features supported.

Open twice: opens two Generic Features per session.

3.2.8. Host Control

These scenarios test Host Control. Active resources are Resource Manager and Host Control.

Basic: opens Host Control.

Open twice: opens two sessions of the Host Control.

OOB tuning: the OOB tuning will open Host Control and provide interactive interface to test OOB tuning.

3.2.9. MMI

The following scenarios will test MMI. All active resources are also Resource Manager, Application Info and MMI.

Basic: opens the MMI resource.

Open twice: opens two sessions of the MMI resource.

3.2.10. Copy Protection

These following scenarios will test Copy Protection. Active resources are Resource Manager and Copy Protection.

Basic: opens a session of the Copy Protection resource and will start the key negotiation.

3.2.11. All

These scenarios will test all of the resources together. Active resources are Resource Manager, System Time, CA Support, Extended Channel, Generic Feature, Host Control, Application Info, MMI and Copy Protection.

Basic: opens all resources.

Open/close: opens all the resources, then will close all of them after 5 secs. Once this is done it will close the transport connection after 5 secs.

3.2.12. Interactive

These scenarios test all resources together. Active resources are: Resource Manager, System Time, CA Support, Extended Channel, Generic Feature, Host Control, Application Info, MMI and Copy Protection.

Basic: provides the interactive interface to open/close all resources.

3.3. Execution of tests

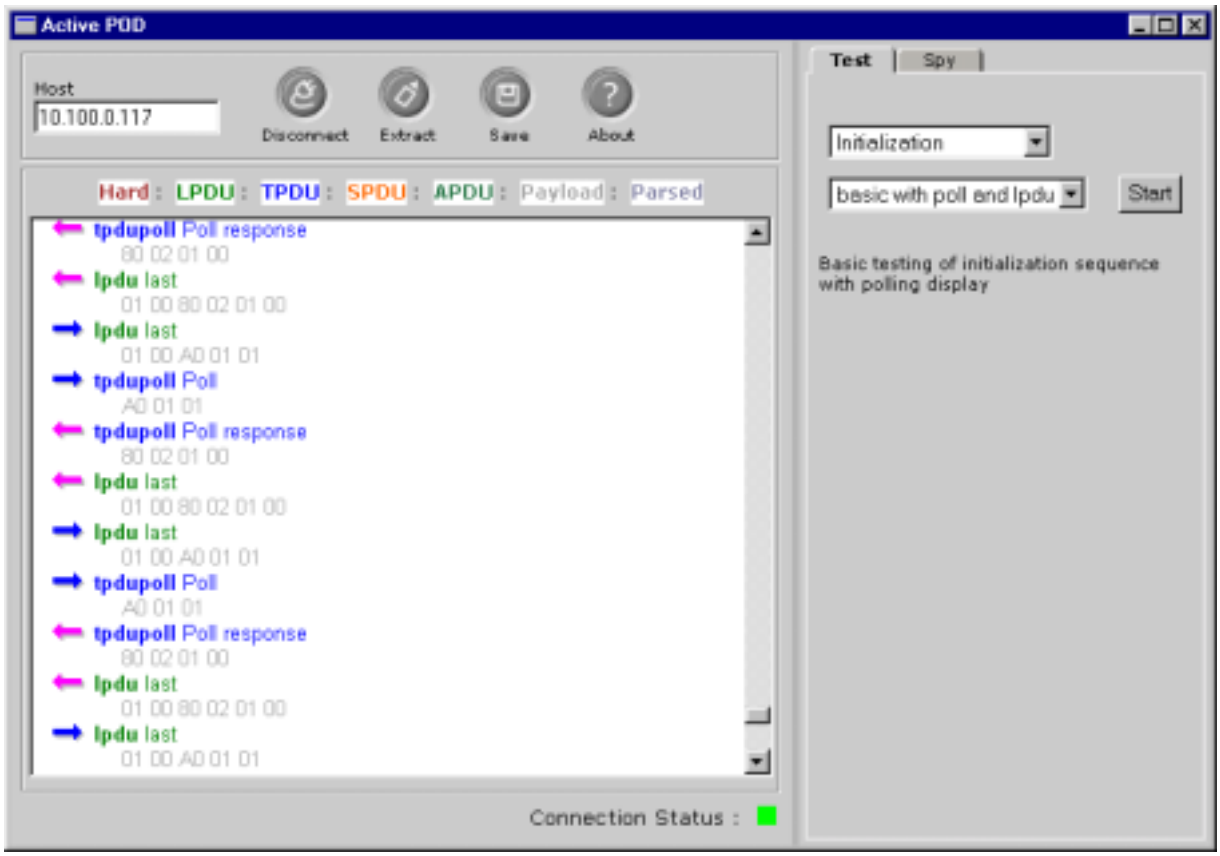
3.3.1 Test Script Launch

The user must have first chosen a test (see section 3.1.4).

The user selects the test on the right side of the pane, and then clicks the **Start** button to start the test.

3.3.2 Monitoring

The following window is displayed as the tests are executed:



The left window provides general information on the test in progress. The successive scenarios are displayed as they are executed. At the end of the test, the result is displayed. This may be a success, a blocking error, a major error or a minor error.

The right side shows basic information about what type of test was run. The connection status indicator will remain green as long as the host is polling module.

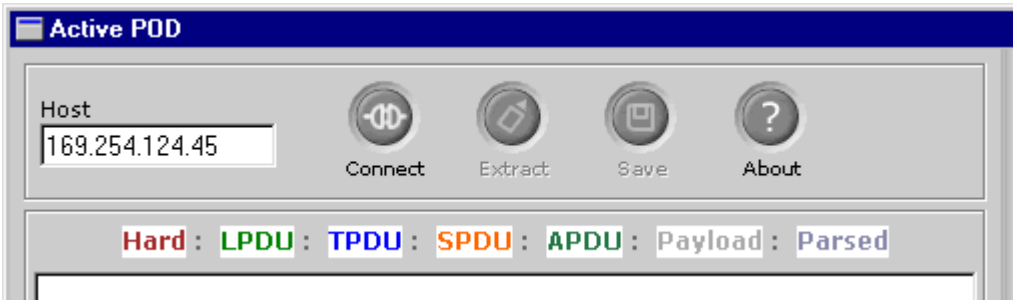
3.3.3 Interrupting a test

The user can interrupt the scenarios at any time during their execution by choosing Extract, above the pane on the left.

3.3.4 Choosing the type of traces

The user may also select which trace level will be displayed; showing/hiding a trace level is dynamic and can occur anytime. There is a choice between traces of a given level; Hard, LPDU, TPDU, SPDU, APDU, and for interpretation levels: Payload or Parsed.

This choice is made by activating or deactivating any of the traces by using the following menu:



3.3.5 Printing result

If a printer is connected to the PC, the POD Tool Software can print trace files acquired during tests. For printing, right click in trace window and select **Print**.

4. Spy mode

4.1. Overview

In spy mode, the tool no longer operates as an access module simulator with respect to a receiver, but as a spy on the POD interface between a receiver and a real module. This function is limited to the observation and interpretation of exchanges conducted on the control bus between the receiver and the module.

The user can configure the POD Tool in spy mode by using a command from the menu. A real module must be connected to the hardware platform of the tool.

In spy mode, the tool displays traces as they are captured on the POD interface, with no analysis or processing (raw format of traces: time stamping, origin, LPDU).

When the rate of information exchange on the control bus between the receiver and the module is too high for the hardware platform to record all the data, the user is informed by the trace screen.

Another command is available to the user to stop the spy / hardware spy mode (i.e. reconfigure the tool in the access module simulator mode). The user can then analyze the traces recorded during the spy session: scrolling of trace window using lifts, interpretation of POD objects regarding transport, session or application.

In the spy mode, the tool does not allow access to the simulation functions of an access module: test management.

4.2. Spy Mode Scenario Selection

This mode is accessed through the following menu:

After a spy session, the user must select extract if they would like to start a new session.

4.3. Definition of Tests

4.3.1. Detailled LPDU

The Detailled LPDU will display the exchange at the hardware level at startup then switch to the interpreted mode for LPDU.

4.3.2. Detailed HW

Detailed HW will display the exchange at the hardware level.

4.3.3. Changes only HW

Changes only HW will display exchange at the hardware level, but remove spurious reading of the status register if the content is not changing.

4.3.4. Detailled LPDU

The detailed LPDU will display exchange at the hardware level at startup then switch to the interpreted mode for an LPDU.

4.3.5. Changes only LPDU

This mode is the same as "Changes only HW" at startup with the exception that it will switch to the interpreted mode for an LPDU.