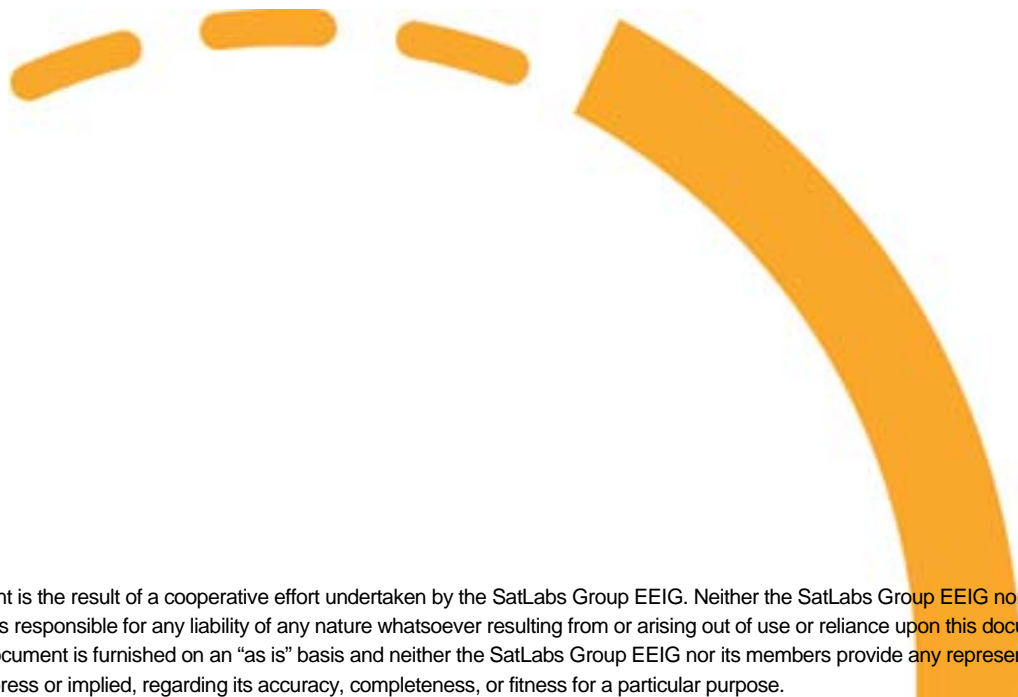




SatLabs Compliance/Interoperability Hub Verification Test Plan

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1 References

- [1] ETSI EN 301 790 v1.5.1, "Digital Video Broadcasting (DVB); Interaction channel for satellite distribution systems" (2009-05)
- [2] ETSI TR 101 790 v1.4.1, "Digital Video Broadcasting (DVB); Interaction channel for Satellite Distribution Systems; Guidelines for the use of EN 301 790" (2009-07)
- [3] SatLabs System Recommendations (Version 1.2) (2005-09)
- [4] SatLabs System Recommendations (Version 1.3 and Version 2.1) (2010-01)
- [5] SatLabs System Recommendations - QoS specifications, v1.1 (2010-01)
- [6] SatLabs System Recommendations - M&C specifications, v1.1 (2010-01)
- [7] IETF Internet-Draft "The SatLabs Group DVB-RCS MIB", draft-combes-ipdvb-mib-rcs-08.txt (2009-11)
- [8] SatLabs Recommendations for Hub Verification Testing, v1.0 (2010-02)
- [9] SatLabs Interoperable PEP (I-PEP) v1 - Transport Extension and Session Framework for Satellite Communications: Air Interface Specification (2005-10)
- [10] ETSI EN 302 307 v1.1.2: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications" (2006-06)

2 Acronyms

For the purposes of the present document, the following abbreviations apply:

ACM	Adaptive Coding and Modulation
ACQ	Acquisition burst
ATM	Asynchronous Transfer Mode
CCM	Constant Coding and Modulation
CMT	Correction Message Table
CRA	Continuous Rate Assignment
CSC	Common Signalling Channel
DVB	Digital Video Broadcast
DVB-S	Digital Video Broadcast via Satellite as specified in EN 300 421
DVB-S2	Digital Video Broadcast via Satellite, 2 nd Generation, as specified in EN 302 307
EN	European Norm
FCT	Frame Composition Table
FEC	Forward Error Correction
FTP	File Transfer Protocol
HTB	Hub verification Test Bed
IP	Internet Protocol
I-PEP	interoperable Performance Enhancement Proxy
LAN	Local Area Network
M&C	Management and Control
MAC	Medium Access Control
MIB	Management Information Base
MPEG	Motion Pictures Expert Group
MSDP	Multicast Software Download Protocol
NCR	Network Clock Reference
NIT	Network Information Table
PAT	Program Association Table
PEP	Performance Enhancement Proxy
PID	Packet Identifier
PMT	Program Map Table
QoS	Quality of Service
RCS	Return Channel via Satellite
RCST	Return Channel via Satellite Terminal
RMT	RCS Map Table
SCT	Superframe Composition Table
SNMP	Simple Network Management Protocol
SPT	Satellite Position Table
SSR	SatLabs System Recommendations
SYNC	Synchronization
TBTP	Terminal Burst Time Plan
TCT	Time-slot Composition table
TFTP	Trivial File Transfer Protocol
TIM	Terminal Information Message
TRF	Traffic
VCM	Variable Coding and Modulation

3 Introduction

The test plan contained in this document is the basis for the SatLabs Hub Verification Testing. It is based on the following documents:

- ETSI EN 301 790 v1.5.1 (2009-05) [1]
- ETSI TR 101 790 v1.4.1 (2009-07) [2]
- SatLabs System Recommendation (SSR) v1.2 [3] and v1.3 [4], defining SatLabs v1.3 profile
- SatLabs System Recommendation (SSR) v2.1 [4], defining SatLabs v2 profile
- SatLabs System Recommendations - Quality of Service specifications (SSR QoS) [5], defining the harmonised QoS functionality (MAC and IP layers). It is referenced by both SSR v1.3 and v2.1.
- SatLabs System Recommendations - Management and Control Planes Specifications (SSR M&C) [6], defining the harmonised management functionality. It is referenced by SSR v2.1 only.
- DVB-RCS Management Information Base (MIB) file [7], that is an annex to the SSR M&C
- SatLabs Hub Recommendations [8]

In this document the test cases for hub verification testing are given.

The scope for the current version is to validate basic hub compliance with SatLabs System Recommendations, ensuring that SatLabs compliant terminals can log in and operate within the network provided by the Hub under test.

Note that the mobility and mesh extensions defined in ETSI EN 301 790 V1.5.1 are out of the scope of the present document.

4 Definitions

4.1 Compliance Testing

The general definition of compliance is as follows:

“Conformance/Compliance is exclusively considered in relation to a specific requirement or requirement document (e.g. specification, standard, guideline). Conformance/Compliance is the fact that a system or component meets the requirement(s) of a specification, standard or similar document.

Conformance/Compliance testing is the process of verifying that an implementation performs in accordance with a particular standard or specification. Conformance testing is exclusively concerned with the external behaviour of an implementation. Service and functional behaviour is tested in order to find logical errors and with this to ensure the prerequisites for interoperability.

Conformance/Compliance testing is not intended to be exhaustive, and a successfully passed test suite does not imply a 100-percent guarantee. But it does ensure, with a reasonable degree of confidence, that the implementation is consistent with its specification, and it does increase the probability that implementations will interwork.”

Based on the general definitions above, the SatLabs definition of Hub DVB-RCS compliance is as follows:

Compliance to Version 1 guarantees that a SatLabs terminal can logon to the DVB-RCS hub, maintain its synchronisation, make capacity requests as well as use the corresponding capacity allocations. Compliance also covers IP encapsulation, on both forward and return links, which means that the transport of IP datagrams to and from terminals is enabled.

Compliance to Version 1.3 further covers Quality of Service support. DVB-S2 [10] related profiles are also supported. Optionally it also covers I-PEP [9].

Compliance to Version 2.1 further covers support in the hub for harmonised terminal management (HM&C).

The present hub verification test plan is intended to be used for testing hub compliance to all versions as defined above. The tested functionality is limited to the scope offered by the test cases and described in this document.

4.2 Protocol Implementation Conformance Statement (PICS)

The following Table forms a template to collect Protocol Implementation Conformance Statement (PICS) for the hub under test. Each of the fields given in the table must be filled in to create a specific testing profile. The information given in the filled PICS is basis for the configuration of the relevant parameters in the Hub verification Test Bed (HTB).

Hub Verification Test Bed Settings

PICS ID	PICS/Explanation	PICS
DVBS	True, if the hub transmits DVB-S in the Forward Link	
DVBS2	True, if the hub transmits DVB-S2 in the Forward Link	
SECTION_PACKING	True, if the hub supports DSM-CC section packing in return link direction	
QoS	True, if the hub supports the QoS requirements of the SatLabs System Recommendations (SSR QoS)	
HM&C	True, if the hub supports the management and control interface and MIB as described in the SatLabs System Recommendations (SSR M&C)	
PEP	True, if the hub supports I-PEP as described in the SatLabs System Recommendations	

4.3 Protocol Implementation Extra Information for Testing (PIXIT)

The following Table forms a template to collect Protocol Implementation Extra Information for Testing (PIXIT) for a hub verification test session. Each of the fields given in the table must be filled in to create a specific test setup. The information given in the filled PIXIT is required by the HTB to perform a specific test case. This information is to be provided by the hub operator or manufacturer before verification testing starts.

PIXIT Table

PIXIT_ID	PIXIT	Value
MAC_ADDR	MAC address of the HTB to be used for logging in to the network	
RCST_CAP_FIELD	Compatibility requirements of the 24 bit field "RCST capability" in CSC burst shall be specified if required to allow the HTB to log in.	
INITIAL_IP_ADDR	IP address to be used for the HTB	
FL_SAT	Satellite to be used (orbital position)	
FL_FREQ	The frequency to receive the hub forward link	
FL_POL	Forward link polarization	
FL_FEC	The FEC on the forward link	
FL_TYPE	The forward link modulation system (DVB-S or DVB-S2 CCM). DVB-S2 VCM/ACM is currently not supported by the test equipment.	
FL_ROLLOFF	Roll-off factor (0.35 for DVB-S)	
POP_ID	Population ID	

The HTB installed at the SatLabs laboratory operates with a transmission frequency band of 13.75- 14.5 GHz over satellite and a receive band of 10.95-12.75 GHz. For L-band testing, the standard Rx and Tx L-bands are supported (950-2150 MHz and 950 -1450 MHz respectively). Other configurations must be discussed with the SatLabs Laboratory.

The TRF profiles 1 and 2 ATM cells or 1 MPEG cell are supported by the HTB, and will be utilized as signalled in the TCT. 4 ATM cells and multiple MPEG cells per TRF burst are not supported.

4.4 Test Case Overview

The following table provides an overview on the hub verification test cases with a total of 11 test cases. It links each Test Case with the Capability sets, defined in the SatLabs Hub Recommendations.

Test Case ID	Test Case Name	Capability set	Applicability/ PICS	Comments
FLA_S_01	All FL tables received for DVB-S	Basic	DVBS	Only one of the FL test cases will be executed, depending on the nature of the forward link
FLA_S2_01	All FL tables received for DVB-S2	Basic	DVBS2	
LOGON_01	Logon and synchronization	Basic		
PING_01	Basic capacity request handling, IP connectivity and resource allocation	Basic		
CAP_REQ_01	Basic capacity request handling for best effort traffic only	Basic		Default Channel ID (0) only
QoS_01	Capacity request and traffic handling for enhanced QoS	QoS	QoS	3 request classes
LOGOFF_01	Logoff of terminal	Basic		
M&C_SD_01	Support of software download	M&C	HM&C	Validate that the MSDP stream is running indicating support of this functionality. The HTB itself cannot be upgraded through MSDP.
M&C_CONF_01	Support of configuration file download	M&C	M&C	
M&C_SNMP_01	Support of SNMP functionality and SatLabs MIB	M&C	M&C	These tests are ad-hoc tests to be agreed with the hub provider as they require hub-initiated actions.
IPEP_01	Support of I-PEP functionality	PEP	PEP	

Note: As the HTB shall be able to log on to a network using DVB-S or DVB-S2 on the forward link, the test cases are developed to support either DVB-S or DVB-S2 forward links.

4.4.1 Test Group - Forward Link Acquisition

The test in this section verifies that the forward link complies with DVB-RCS specifications and SatLabs System Recommendations, and that a terminal can find the necessary signalling information to start the logon procedure.

Reason for having this test

Compliance with the specified forward link signalling contents represents essential functionality for a SatLabs compliant hub. The SSR specifies which tables and descriptors that shall be present in the forward link to operate a SatLabs compliant terminal.

Test Case ID	FLA_S_01	
Test Case Name	All FL tables received for DVB-S	
Objective / Test Purpose	Verify that the HTB is able to proceed with the Logon procedure after having received all tables with information related to the configured population ID correctly formatted for DVB-S FL configuration: NIT, RMT, PAT, PMT, SCT, FCT, TCT, TIM-B and SPT	
Test Method	Step	Description
	1	HTB receives NIT, RMT, PAT, PMT, NCR, SCT, FCT, TCT, TIM-B and SPT finds the corresponding transponder changes and logon information related to the configured Population ID. FL signalled as DVB-S.
	2	HTB reports the correct reception of all applicable tables and descriptors and is ready to proceed to logon
PASS/FAIL Criteria	The HTB has correctly received all tables and descriptors in step 1.	
Remarks	Applicable to DVBS	

Test Case ID	FLA_S2_01	
Test Case Name	All FL tables received for DVB-S2	
Objective / Test Purpose	Verify that the HTB is able to proceed with the Logon procedure after having received all tables with information related to the configured population ID correctly formatted for DVB-S FL configuration: NIT, RMT, PAT, PMT, SCT, FCT, TCT, TIM-B and SPT	
Test Method	Step	Description
	1	HTB receives NIT, RMT, PAT, PMT, NCR, SCT, FCT, TCT, TIM-B and SPT finds the corresponding transponder changes and logon information related to the configured Population ID. FL signalled as DVB-S2.
	2	HTB reports the correct reception of all applicable tables and descriptors and is ready to proceed to logon
PASS/FAIL Criteria	The HTB has correctly received all tables and descriptors in step 1.	
Remarks	Applicable to DVBS2	

4.4.2 Test Group – Logon and Synchronization

The test in this section verifies that the HTB is able to properly log on to the network under test and maintain synchronisation. At the same time, the success of this test case will confirm:

- SatLabs compliant NCR timing reference resulting in the return link transmission time reference compliant with the SatLabs timing recommendations (including NCR optional payload timing offsets if present as well as handling of SPT). In other words, the CSC burst is detected by the hub when the HTB sends the burst according to SatLabs time reference.

Note: The HTB does not distinguish between normal TIM logon messages and TIMs where the status field Wake-up bit is set to “1”.

Reason for having these tests

The test represents essential functionality for a SatLabs compliant hub.

Test Case ID	LOGON_01	
Test Case Name	Logon and maintaining synchronization	
Objective / Test Purpose	Verify that the HTB enters the Fine Sync state on receipt of a logon TIM and transmission of SYNCs to the Hub	
Test Method	Step	Description
	1	Initiate Logon procedure, HTB checks that the forward link tables are as expected
	2	HTB sends CSC bursts
	3	HTB receives logon TIM and checks for correct formatting and content of the TIM
	4	If ACQ_Assign_Descriptor is present,, the HTB sends ACQ bursts until a CMT for ACQ is received, otherwise the assigned SYNC bursts are sent
	5	The HTB receives a CMT for SYNC with time and frequency correction values within the threshold defined in the TIM logon.
	6	The HTB remains in the fine sync state for 5 minutes
PASS/FAIL Criteria	<ul style="list-style-type: none"> • Correct forward link tables in step 1 • Correct TIM in step 3 • Correct CMT in step 5 • Remain in Fine Sync state in step 6 	
Remarks		

4.4.3 Test Group – IP Traffic & Capacity Requesting Handling

The tests in this section address capacity request handling and end-to-end IP connectivity through the hub. It is assumed that the tests are performed when the network is not congested.

After logging on, the HTB requests return link capacity if needed, or the hub may assign CRA capacity to the HTB. The HTB may then transmit IP traffic in the assigned time slots.

The test cases in this group are:

- PING_01
Validates basic IP connectivity through the hub
- CAP_REQ_01
Validates that the capacity request handling by the hub is compatible with the SatLabs System Recommendations for basic QoS with one request class using Channel ID 0 and best effort.
- QoS_01
Validates that the capacity request handling by the hub is compatible with the SatLabs System Recommendations for enhanced QoS with three request class using configured Channel IDs and DSCP values.

Reason for having these tests

Verification of IP traffic operations including capacity request handling are essential functions of a DVB-RCS network. For the enhanced QoS option, the test case validates interoperability for the capacity request functionality for the supported QoS classes.

Test Case ID	PING_01	
Test Case Name	Ping	
Objective / Test Purpose	Basic IP connectivity	
Test Method	Step	Description
	1	Log on the HTB to the network
	2	Start Ping transmission
	3	Verify that PING responses are received
PASS/FAIL Criteria	Step 1 and 3	
Remarks	If CRA is assigned by the hub, the HTB may not need to send capacity requests as the PING traffic has a low bandwidth requirement	

Test Case ID	CAP_REQ_01	
Test Case Name	Basic Capacity Request handling (best effort)	
Objective / Test Purpose	Verify capacity request handling using the default best effort Channel ID 0. UDP packets are transmitted in both directions.	
Test Method	Step	Description
	1	Logon the HTB
	2	Start UDP transmission with 1500 bytes packet size at a data rate of 100 kbps in both directions
	3	Verify that the hub allocates TRF timeslots in the TBTP corresponding to the requested capacity taking into account the current loading of the network. Note: If the network is not in congestion, the hub may allocate FCA so the allocated capacity may be higher than requested. Similarly, if the network is in congestion, the allocated capacity may be less than requested. The objective of the test is to validate that the mechanisms and behaviour are compliant with the SatLabs recommendations.
	4	Verify that the traffic is passed in both directions without significant error.
PASS/FAIL Criteria	<ul style="list-style-type: none"> Quasi error-free UDP packet transmission in step 4; Usual error occurrences as they must be expected in usual UDP transmission shall not be deemed as fail criteria for the terminal. 	
Remarks	This test assumes a terrestrial Internet connection in addition to the HTB access through the DVB-RCS network.	

Test Case ID	QoS_01	
Test Case Name	Capacity request and traffic handling for enhanced QoS	
Reference	SSR QoS	
Objective / Test Purpose	Verify capacity request handling for the configured request classes. UDP packets are transmitted in both directions as separate streams for each request class.	
Test Method 2	Step	Description
	1	Logon the HTB
	2	Verify the QoS configuration with respect to Channel IDs and DSCP parameters for the different QoS classes. The parameters shall allow > 50 kbps in each class.
	3	Start UDP transmission with 1500 bytes packet size at a data rate of 50 kbps for each request class in both directions.
	4	Verify that the hub allocates TRF timeslots in the TBTP corresponding to the requested capacity.
	5	Verify that the traffic is passed in both directions without significant error and with acceptable delay and jitter for all request classes, taking into account the class of service offered
PASS/FAIL Criteria	<ul style="list-style-type: none"> Quasi error-free UDP packet transmission in step 5; Usual error occurrences as they must be expected in usual UDP transmission shall not be deemed as fail criteria for the terminal. 	
Remarks		

4.4.4 Test Group – Logoff

The test in this section is to validate that the hub supports normal terminal log off requirements.

Reason for having these tests

The logoff compliance to the recommendations is not very critical with respect to interoperability of terminals in the same DVB-RCS network. The test is therefore included mainly for completeness.

Test Case ID	LOGOFF_01	
Test Case Name	RCST initiated Logoff	
Objective / Test Purpose	Verify that the hub complies with the RCST initiated logoff procedure.	
Test Method	Step	Description
	1	Initiate Logoff from HTB side
	2	HTB sends a Logoff Request
	3	The hub may send a logoff message
	4	Execute a test case with logon
PASS/FAIL Criteria	The terminal shall be allowed to re-enter the network with a new logon after logging off.	
Remarks		

4.4.5 Test Group – M&C

The tests in this section validate that the hub supports key M&C functionality as specified in the SatLabs System Recommendations version 2.1:

- Configuration file download when the terminal logs on
- Support for software download of new images
- SNMP terminal management

Reason for having these tests

Interoperable management of RCSTs is a key feature for a hub supporting SSR M&C.

Test Case ID	M&C_SD_01	
Test Case Name	Software download using MSDP	
Reference	SSR M&C	
Objective / Test Purpose	The test case verifies the presence of a MSDP software image download service. The image file itself is not verified.	
Test Description	The HTB looks for the MSDP software download service and verifies the presence of the stream.	
Test Method	Step	Description
	1	The HTB is logged on to the network
	2	The HTB looks for the signalled MSDP service
	3	The HTB verifies the successful download of a complete file over the MSDP service. Note. The file contents itself is not validated.
PASS/FAIL Criteria	The HTB is capable of receiving a file download using the MSDP client in the HTB	
Remarks		

Test Case ID	M&C_CONF_01	
Test Case Name	Configuration File download	
Objective / Test Purpose	The hub shall support the download of a configuration file to the HTB	
Reference	SSR M&C	
Test Description	<p>When the HTB has achieved the Fine Sync State, the hub shall provide the HTB with the full path name for the configuration file download, including the protocol type (TFTP or FTP) and the associated server IP address or hostname.</p> <p>The hub shall start the download process of the HTB by sending the appropriate SNMP command “set dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstControl.dvbRcsCtrlDownloadFileCommand”.</p> <p>The HTB shall update the object dvbRcsRcstDownloadedConfigFileVersion (get dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstState.dvbRcsRcstDownloadedConfigFileVersion) with the version of the downloaded configuration file.</p> <p>The hub shall activate the downloaded configuration file by sending “set dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstControl.dvbRcsCtrlActivateConfigFileCommand”.</p> <p>When this new configuration file is activated, the object dvbRcsRcstActivatedConfigFileVersion shall be updated with this file version (get dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstState.dvbRcsRcstActivatedConfigFileVersion).</p>	
Test Method	Step	Description
	1	Logon the HTB
	2	Verify that the hub provides a path name for the configuration file download, including the protocol type (TFTP or FTP) and the associated server IP address or hostname
	3	Verify that the hub starts the download process by sending the appropriate SNMP command “Set dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstControl.dvbRcsCtrlDownloadFileCommand”
	4	The HTB updates the object dvbRcsRcstDownloadedConfigFileVersion (get dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstState.dvbRcsRcstDownloadedConfigFileVersion) with the version of the downloaded configuration file.

	<p>The HTB activates the downloaded configuration file by the command "Set dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstControl.dvbRcsCtrlActivateConfigFileCommand"</p>
<p>PASS/FAIL Criteria</p>	<p>The HTB is capable of receiving the configuration file. The configuration file provided by the hub shall contain:</p> <ul style="list-style-type: none"> - Configuration file identifier (string type) - Ethernet IP address (parameter dvbRcsNetworkLanInetAddress in section 17.2.3.1.2 of XX) - Ethernet IP address prefix length (parameter dvbRcsNetworkLanInetPrefixLength in section 17.2.3.1.2 of XX) - SNMP write community string (char string) - SNMP read community string (char string) - SLA/QoS parameters (see section 17.2.3.1.4 of XX) - Operational Population ID (parameter dvbRcsFwdStartPopId in section 17.2.3.2.1 of XX)
<p>Remarks</p>	

Test Case ID	M&C_SNMP_01	
Test Case Name	Hub support for SNMP terminal management	
Reference	SSR M&C	
Objective / Test Purpose	<p>The test case verifies that the Hub uses the interoperable MIB for terminal management.</p> <p>Note: This optional test case requires management commands using SNMP function calls to exercise the SNMP and SatLabs MIB functionality. The test case generically receives and responds to SSR compliant requests.</p>	
Test Description		
Test Method	Step	Description
	1	The HTB is logged on to the network
	2	The operator issues an SNMP command such as "Get dvbRcsMibObjects.dvbRcsRcst.dvbRcsRcstState.dvbRcsRcstFaultStatus"
	3	Verify that the HTB receives the command
	4	The HTB responds with a message
PASS/FAIL Criteria	The HTB sends an SNMP request using the SatLabs MIB	
Remarks	SNMP functionality is also used in the 2 other M&C test cases	

4.4.6 Test Group – I-PEP

The test in this section validates that the hub supports I-PEP functionality as specified as an option in the SatLabs System Recommendations version 1.3. In this test the hub capabilities related to transporting TCP data via I-PEP are validated.

Reason for having these tests

Verify that the hub I-PEP functionality complies with the SSR.

Test Case ID	IPEP_01	
Test Case Name	TCP and data transfer	
References	SSR 1.3 and 2.1	
Objective / Test Purpose	Validate that the I-PEP implementation of the hub allows for a TCP connection establishment, data transfer and connection tear-down according to the I-PEP specifications.	
Test Description	<p>After the HTB is logged onto the network, a TCP application is started which initiates the download of data from the application server via the hub I-PEP server to the HTB terminal and I-PEP client and further to the application client.</p> <p>The TCP connection and data reception is verified. The I-PEP analyser is used to validate the TCP connection establishment, the data transfer and the TCP connection tear-down. Monitoring shall be done between the HTB and the I-PEP client at I-PEP level and between the I-PEP client and application client at TCP connection level.</p>	
Test Method	Step	Description
	1	Log on the HTB
	2	Start a TCP/I-PEP connection (e.g., FTP file download) between the application client via the I-PEP client and HTB to a TCP application at the hub side.
	3	Check the correct establishment of the TCP/I-PEP connection
	4	Check the data transfer and packet format between the HTB via the I-PEP client to the application client (i.e. using the I-PEP analyser).
	5	Stop the TCP/I-PEP connection
	6	Check the correct tear-down of the TCP/I-PEP connection
PASS/FAIL Criteria	<p>Verify the reliable data transfer from the application server to the application client via the I-PEP link:</p> <ul style="list-style-type: none"> • TCP/I-PEP establishment successful and acknowledged • TCP/I-PEP tear-down successful and acknowledged <p>confirming the I-PEP functionality of the hub.</p>	
Remarks		