Open Alliance 10BASE-T1S Physical Coding Sublayer Test Suite

This suite of tests has been developed to help implementers identify problems that 10BASE-T1S devices may have with PCS functions.

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INTRODUCTION

This particular suite of tests has been developed to help implementers evaluate the functionality of the PCS sublayer of their 10BASE-T1S device.

These tests determine if a product conforms to specifications defined in IEEE 802.3 Clause 147. Completing all tests in this suite does not guarantee that the tested device will operate with other devices. However, combined with satisfactory operation when tested under the OPEN Alliance 10BASE-T1S Interoperability Test Suite, these tests provide a reasonable level of confidence that the Device Under Test (DUT) will function properly in many 10BASE-T1S automotive environments.

The tests contained in this document are organized in such a manner as to simplify the identification of information related to a test and to facilitate the actual testing process. Tests are organized into groups, primarily in order to reduce setup time in the lab environment; however, the different groups typically also tend to focus on specific aspects of device functionality. A three-part numbering system is used to organize the tests, where the first number indicates the section of the IEEE 802.3 Standard on which the test suite is based. The second and third numbers indicate the test's group and test numbers within that group, respectively. This format allows for adding future tests to the appropriate groups without requiring the renumbering of subsequent tests.

ABBREVIATION/SYMBOLS

DUT	Device Under Test
PCS	Physical Coding Sublayer
MII	Media Independent Interface
PMD	Physical Medium Dependent
PMA	Physical Medium Attachment

1 NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes the requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[1] IEEE 802.3-2022, Clause 147. Physical Coding Sublayer (PCS), Physical Medium Attachment (PMA) sublayer, and baseband medium, type 10BASE-T1S

[2] OPEN Alliance TC14 10BASE-T1S Implementation Specification, Version 1.0

[3] OPEN Alliance TC14 OPEN Alliance 10BASE-T1S PMD Transceiver Interface Specification- Version 1.5

[4] Open Alliance 10BASE-T1S Sleep/Wake-up Specification, Version 1.0

2 ORGANIZATION OF TESTS

The test definitions are intended to describe the motivations, resources, procedures, and methodologies pertinent to each test.

2.1 Elementary Test Structure

Specifically, each test description consists of the following fields, as shown in Table 1. A brief description of each field is provided.

Purpose	The purpose is a brief statement outlining what the test attempts to achieve. The test is written at the functional level.
References	This section specifies source material *external* to the test suite, including specific subsections pertinent to the test definition or any other references that might help understand the test methodology and/or test results. External sources are always referenced by number when mentioned in the test description. Any other references not specified by number are stated in the test suite document itself.
Resource Requirements	The requirements section specifies the test hardware and/or software needed to perform the test. This is generally expressed in terms of minimum requirements; however, specific equipment manufacturer/model information may be provided in some cases.
Discussion	The discussion covers the assumptions made in the design or implementation of the test, as well as known limitations. Other items specific to the test are covered here.
Test Setup	The setup section describes the initial configuration of the test environment. Small changes in the configuration should not be included here and are generally covered in the test procedure section below.
Test Procedure	The procedure section of the test description contains the systematic instructions for carrying out the test. It provides a cookbook approach to testing and may be interspersed with observable results.
Observable Results	This section lists the specific observables that the tester can examine to verify that the DUT is operating correctly. When multiple values for an observable are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail outcome for a particular test is generally based on the successful (or unsuccessful) detection of a specific observable.

Potential Issues	This section describes known issues with the test procedure, which may affect test results in certain situations. It may also refer the reader to test suite appendices and/or whitepapers that provide more detail regarding these issues.

Table 1: Elementary Test Structure

2.2 DUT Requirements

For the purposes of this test suite, the DUT is one port of a 10BASE-T1S capable device that includes a 10BASE-T1S PHY mounted on a PCB with an MDI connector and any necessary circuitry such as a low pass filter or common mode choke. All tests will be performed at the MDI connector of the DUT.

Please see the additional requirements listed in Table 2:

	Required Capabilities		
Test Number and Name	MII/MAC(*1)	MDIO(*2)	Comment
Test 147.3.1 - PCS Reset		✓	
Test 147.3.2.4 - Enabling Transmit	✓		
Test 147.3.2.4 - Disabling Transmit	✓		
Test 147.3.2.4 - ENCODE	✓		
Test 147. 3.2.8 - Self Synchronizing Scrambler	✓		
Test 147.3.2.4 – Transmitting WUP	✓		
Test 147.3.2.9 - Jabber Functional Requirement scrambler	✓	✓	
Test 147.3.3.1 - Enabling Receive	✓		
Test 147.3.3.4 - DECODE	✓		
Test 147.3.3.8 - Self-synchronizing descrambler	✓		
Test 147.3.3.1 - Disabling Receive : ESDOK	✓		
Test 147.3.3.1 - Disabling Receive : ESDERR	✓		
Test 147.3.3.1 - Disabling Receive : ESDJAB	✓		
Test 147.3.4 - Loopback	✓	✓	
Test 147.3.6 - Carrier Sense	✓		
Test 147.3.5 - Collision Detection	✓		
Test 147.3.3 – Receiving WUP	✓		

Table 2: DUT Requirements

(*1) If MII access is not available, the access to the MAC layer via SPI, etc, may provide an alternative way to perform the test
(*2) MDIO register access or equivalent.

3 TEST CASES

The following test cases shall be performed on all 10BASE-T1S PHYs.

3.1 GROUP 1: PCS Functions

This section verifies the integrity of the 10BASE-T1S PCS Functions.

3.1.1 147.3.1 – PCS Reset

Purpose	To verify that the PCS properly initializes upon receipt of a reset request from the management entity and passes frames as expected.
References	[1] IEEE 802.3-2022 – Subclause 147.3.1 – PCS Reset function
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	Reference [1] states that the PCS is reset when power for the device containing the PMA has not yet reached the operating state or upon receiving a reset request from the management entity. The PCS Reset function should cause all state diagrams to take the open-ended pcs_reset branch upon execution of PCS Reset. Since PCS Reset is distinct from pma_reset, the behavior on the wire is undefined by the standard. This test will verify if a pcs_reset can be performed; normal data operation resumes as expected. NOTE: Transmission/Reception is allowed following a PCS reset.
Test Setup	Connect the DUT to the Test Station via the line tap.
Test Procedure	1. Perform PCS reset (to check transmit) 2. Monitor and decode transmissions from the DUT. a. If available, monitor and decode transmissions on the DUT's MII (or equivalent) transmit path. 3. Send two frames from DUT to the Receive station to verify the DUT is operational. 4. Perform a PCS reset. (to check receive) 5. Send two frames from the Transmit station to the DUT to verify the DUT is operational following the reset. 6. Monitor and decode transmissions from the DUT to MII.
Observable Results	a. In step 2, The frame which is properly scrambled and 4B/5B encoded should be observed on the Differential Manchester Encoded data stream at TX pin or LINE+/- of PMD b. In step 3, after a frame is sent from DUT the Recerive station should receive a frame as observed on the MII interface of the DUT. c. In step 4, After the reset, the DUT restarts to receive. d. In step 5, after a frame is sent the DUT should receive a frame as observed on the MII interface. At the end of the packet when ESD is received, the DUT should receive RXD[3:0] = 0000 to the MII (or equivalent interface), if accessible.

Potential Issues	If the ability to control the PCS Reset request is not available, this test cannot be performed.

3.2 GROUP 2: PCS Transmit

This section verifies the integrity of the 10BASE-T1S PCS Transmit function.

3.2.1 Test 147.3.2.4 – Enabling Transmit (Asserting TX_EN) : SYNC, SSD, and Transmit Encoding

Purpose	To verify that the DUT PCS transmits correctly when enabling TX_EN
References	[1] IEEE 802.3-2022 – Subclause 147.3.2 – PCS Transmit
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	Upon asserting TX_EN, the PCS Transmit function passes two SYNC symbols [1] to the PMA, followed by two SSD symbols [1] that replace the first 16 bits of the packet preamble. Following the second SSD, data should be the 4B/5B symbols as indicated in [1]. After the SYNC/SSD symbol sequence, all data is scrambled followed by 4B/5B encoding and differential Manchester encoding.
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to transmit a frame that has a known payload to the test station. 2. Monitor and decode transmissions from the DUT on the TX pin or LINE+/- of PMD.
Observable Results	Upon TX_EN assertion, the PCS Transmit shall transmit: a. Two (2) Sync symbols b. Two (2) SSD symbols c. Scrambled data and 4B/5B encoded symbols
Potential Issues	

3.2.2 Test 147.3.2.4 – Disabling Transmit (DE-asserting TX_EN) : SYNC, SSD, and Transmit Encoding

Purpose	To verify that the PCS correctly transmits the expected sequence when TX_EN is de-asserted.
References	[1] IEEE 802.3-2022 – Subclause 147.3.2 – PCS Transmit
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)

Discussion	Upon de-assertion of TX_EN, the PCS Transmit generates a special code ESD. When there is no Transmit error, ESD is followed by ESDOK [1]. When there is a transmit error, ESD is followed by ESDERR [1].
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to transmit a frame with a known payload to the test station. 2. De-assert TX_EN
Observable Results	Upon TX_EN de-assertion, the PCS Transmit shall transmit: a. Special Code ESD b. Where there is no transmit error, the ESD is followed by ESDOK c. Where there is a transmit error, the ESD is followed by ESDERR
Potential Issues	If the ability to cause Jabber condition and the condition where TX_ER is asserted is not available test coverage will decrease.

3.2.3 Test 147.3.2.4/Test 147.3.2.8 – Functions: ENCODE and Self-synchronizing scrambler

Purpose	To verify the ENCODE and Scrambling functions on PCS.
References	[1] IEEE 802.3-2022 – Subclause 147.3.2.4 and 147.3.2.8
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The ENCODE and Scrambling functions of PCS are expected to scramble 4B symbol followed by 5B symbol encoding as defined in [1]
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to transmit a frame that has a known frame to the test station 2. Observe and scrambled and 4B5B encoded 5B symbol output on TX pin or LINE+/- pin of PMD.
Observable Results	The output of scrambled and encoded 5B symbols shall correspond to Table 147-4B/5B Encoding in [1] and 147.2.8.
Potential Issues	

3.2.4 Test 147.3.2.4 – Transmitting WUT

Purpose	To verify the function to transmit WUT (Wake Up Tone).
References	[1] IEEE 802.3-2022 – Subclause 147.3.2.4 – Functions [4] Open Alliance 10Base-T1S Sleep/Wake-up Specification, Version 1.0

Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS transmit function shall support WUP command upon WUPRQ request. The WUP shall comprise a SUSPEND, Wake-Up tone (WUT), COMMIT and ESD/ESDOK. SUSPEND is comprised of 6 T symbols. The WUT is comprised of 12 periods of a 625KHz tone. COMMIT is comprised of 24 to 26 J symbols. The total length of the WUP command shall meet the range from 32usec to 32.8usec.
Test Setup	Connect the DUT to the Test Station to generate MII traffic
Test Procedure	1. Cause WUP command transmission on DUT 2. Observed WUP command on 10BASE-T1S bus line (PMA output).
Observable Results	WUP command sequence, which is comprised of SUSPEND, Wake-Up Tone, COMMIT, and ESD/ESDOK.
Potential Issues	

3.2.5 Test 147.3.2.9 – Jabber Functional Requirement

Purpose	To verify that the PCS sends ESD and ESDJAB symbols when data transmission exceeds a time duration determined by xmit_max_timer
References	[1] IEEE 802.3-2022 – Subclause 147.3.2.9 - Jabber Function Requirement
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS transmit function shall be capable of halting a transmission if the packet being transmitted continues longer than the specified time duration and sending ESD, ESDJAB symbol sequence to notify the receivers.
Test Setup	Connect the DUT to the Test Station to generate MII traffic
Test Procedure	1. Cause Jabber condition on DUT by transmitting a packet for a time exceeding the duration specified by xmit_max_timer. 2. Observe the PCS transmit output and check if the transmitter returns to normal operation mode after a duration determined by the unjab_timer if implemented.
Observable Results	Verify that the PCS transmits ESD and ESDJAB symbols to notify Jabber condition to receivers and that the transmitter returns to normal operation after unjab_time elapsed. If auto-recovery is not implemented, the transmitter will not transmit any packet until the reset occurs.
Potential Issues	DUT may not be able to cause a Jabber condition as the test case.

3.3 GROUP 4: PCS Receive

3.3.1 Test 147.3.3.1 – Enabling Receive (Asserting RX_DV) : SYNC, SSD, Self-synchronizing descrambler

Purpose	To verify that the DUT PCS transitions to the data receiving state
References	[1] IEEE 802.3-2022 – Subclause 147.3.3 – PCS Receive
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	Upon receiving two SSD symbols, PCS receives function passes four symbols (x5 (0101 in 4B)) to MII while the descrambler is synchronizing, and after the synchronization, five symbols (x5) are output.
Test Setup	Connect the DUT to the Transmit Station
Test Procedure	1. Cause the DUT to enable the receiver and test station to transmit a packet 2. Monitor the bus (LINE+/-) and PCS output indirectly or directly.
Observable Results	Upon receiving at least two SSDs, which are transmitted from the Transmit station a. RX_DV is asserted within 4 us of frame start on LINE b. Preamble, which is comprised of symbols (value x5) and Start of Frame Delimiter (xD symbol) are sent to MII If an unexpected symbol is received after J, RX_ER is asserted with RXD symbol E.
Potential Issues	

3.3.2 Test 147.3.3.4/Test 147.3.3.8 – DECODE and Self-synchronizing descrambler

Purpose	To verify the PCS DECODE and Descrambling functions on PCS
References	[1] IEEE 802.3-2022 – Subclause 147.3.3.4 and 147.3.3.8
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The DECODE and Descrambling functions in PCS are expected to take 5B symbol and return descrambled 4-bit value defined in 147.3.3.4 and 147.3.3.8.
Test Setup	Connect the DUT to the Transmit Station
Test Procedure	1. Cause the DUT to enable the receiver and the Transmit station to transmit a packet 2. Monitor the bus (LINE+/-) for scrambled 5B symbols and PCS data output (RXD3:0) indirectly or directly

Observable Results	Scrambled 5B symbol, which is monitored on the bus, is descrambled and decoded to 4-bit value as specified.
Potential Issues	

3.3.3 Test 147.3.3.1 Disabling Receive (De-Asserting RX_DV) : ESDOK

Purpose	To verify that the PCS correctly disables receive and de-asserts RX_DV.
References	[1] IEEE 802.3-2022 – Subclause 147.3.3.1 – PCS Receive
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS receiver leaves the DATA state and transitions to the GOOD_ESD state when ESD or ESDBRS is followed by ESDOK and the PCS receive function is disabled by de-asserting RX_DV.
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to enable the receiver and the Transmit station to transmit a packet with ESDOK 2. Monitor the bus and PCS data output (RXD3:0) indirectly or directly.
Observable Results	Upon receiving ESDOK, the PCS shall cause the following: Pass 4B ”0000” to MII and de-assert RX_DV
Potential Issues	

3.3.4 Test 147.3.3.1 Disabling Receive (De-Asserting RX_DV) : ESDERR

Purpose	To verify that the PCS correctly disables receive and de-asserts RX_DV.
References	[1] IEEE 802.3-2022 – Subclause 147.3.3.1 – PCS Receive
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS receiver leaves the DATA state and transitions to the BAD_ESD state when ESD or ESDBRS is followed by ESDERR, and the PCS receive function is disabled by de-asserting RX_DV and asserting RX_ERR.
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to enable the receiver and the transmit station to transmit a packet with ESDERR 2. Monitor the bus and PCS data output (RXD3:0) indirectly or directly.

Observable Results	Upon receiving ESDERR, the PCS shall cause the following: a. Pass 4B ”0000” to MII with RX_ER is asserted
Potential Issues	

3.3.5 Test 147.3.3.1 Disabling Receive (De-Asserting RX_DV) : ESDJAB

Purpose	To verify that the PCS correctly disables receive and de-asserts RX_DV.
References	[1] IEEE 802.3-2022 – Subclause 147.3.3.1 – PCS Receive
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS receiver leaves the DATA state and transitions to the BAD_ESD state when ESD or ESDBRS is followed by ESDJAB, and the PCS receive function is disabled by de-asserting RX_DV and asserting RX_ERR.
Test Setup	Connect the DUT to the Test Station
Test Procedure	1. Cause the DUT to enable the receiver and the Transmit station to transmit a packet with ESDJAB. 2. Monitor the bus and PCS data output (RXD3:0) indirectly or directly.
Observable Results	Upon receiving ESDJAB, the PCS shall cause the following: Pass 4B”0000” to MII with RX_ER asserted. The Jabber event can be reported to the management entity (MDIO register) if it’s implemented
Potential Issues	

3.3.6 Test 147.3.4 – PCS Loopback

Purpose	To verify that the PCS Loopback function as required.
References	[1] IEEE 802.3-2022 – Subclause 147.3.4 - PCS Loopback
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS shall be placed in loopback mode. In this mode, the PCS shall accept 4B data from the MII transmit path and return it on the receive path to the MII. [1]
Test Setup	Connect DUT to the Test station
Test Procedure	1. Enable loopback on PCS 2. Generate MII traffic to PCS (The loopback bit in MDIO register 3.0.14 is set to 1.) 3. Observe data on the Receive path of MII

Observable Results	Verify that data generated on the Transmit path from the MII is looped back to the MII Receive path. Also, PMA shall not send data during the loopback mode.
Potential Issues	

3.3.7 Test 147.3.6 – Carrier Sense

Purpose	To verify the Carrier Sense function
References	[1] IEEE 802.3-2022 – Subclause 147.3.6 - Carrier Sense
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	When operating in half-duplex mode, the 10BASE-T1S PHY senses when the media is busy and conveys this information to the MAC by asserting the MII CRS signal.
Test Setup	Connect DUT to Test Station
Test Procedure	1. Cause the DUT to transmit a frame to the Receive station 2. Monitor CRS output directly or indirectly 3. Cause the DUT to receive a frame from the Transmit station 4. Monitor CRS output directly or indirectly
Observable Results	CRS is asserted while the DUT transmits or receives a packet. CRS is not asserted until a DME encoded signal is present on the bus (LINE+/-)
Potential Issues	

3.3.8 Test 147.3.5 – Collision Detection(The case when DUT is transmitting)

Purpose	To verify the Collision Detection function as required
References	[1] IEEE 802.3-2022 – Subclause 147.3.5 - Collision Detection
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receiver station (refer to Appendix B – Test Stations)
Discussion	When operating in half-duplex mode, the 10BASE-T1S PHY shall detect when a transmission initiated locally results in a corrupted signal at the MDI as a collision. When collisions are detected, the PHY shall assert the signal COL on the MII for the duration of the collision or until TX_EN signal is deasserted..
Test Setup	Connect DUT to the Test station
Test Procedure	1. Cause the DUT to transmit a frame to the Transmit station in half-duplex mode, and the Transmit station intentionally causes a collision on the bus 2. Monitor CRS and COL directly or indirectly

Observable Results	The DUT asserts COL while the collision is detected. Also, CRS is asserted while the bus is busy, whether it is in a collision condition or not.
Potential Issues	

3.3.9 Test 147.3.3 – Receiving WUP

Purpose	To verify the correct reception of a WUP command as per the 10BASE-T1S Sleep/Wake-up Specification
References	[1] IEEE 802.3-2022 – Subclause 147.3.3 [4] Open Alliance 10Base-T1S Sleep/Wake-up Specification, Version 1.0
Resource Requirements	10BASE-T1S Transmit station (refer to Appendix B – Test Stations) 10BASE-T1S Receive station (refer to Appendix B – Test Stations)
Discussion	The PCS component of the TC14-TC10 Sleep/Wake-up Specification lies outside the scope of clause 147, the IEEE 802.3 -2022 specification. However, it is included in this test specification for coverage purposes.
Test Setup	Connect the DUT to the Transmit Station to generate MII traffic
Test Procedure	1. Set DUT into low power (WUS_LOW_POWER) state 2. The transmit station sends WUP command to the DUT. 3. Observe implementation-dependent wake up behavior of the DUT.
Observable Results	WUP command from the Transmit station wakes up DUT, and the Transmit station and the DUT can communicate on the 10BASE-T1S bus line.
Potential Issues	

APPENDICES

A Appendix A –Testing Devices Without MII Access

Purpose: To detail the tests that can be performed on a device without MII (or any equivalent MII) access and to detail the modifications to the Procedures and Observable Results.

Discussion: Without MII access, the number of tests that can be performed on a DUT will decrease. Typically, the only observation points that will be available are packet counters or packets that are forwarded through another port on the DUT, such as the SPI interface. Also, the transmissions available from the DUT will depend on the command sets that are disclosed. This may limit testability and test coverage.

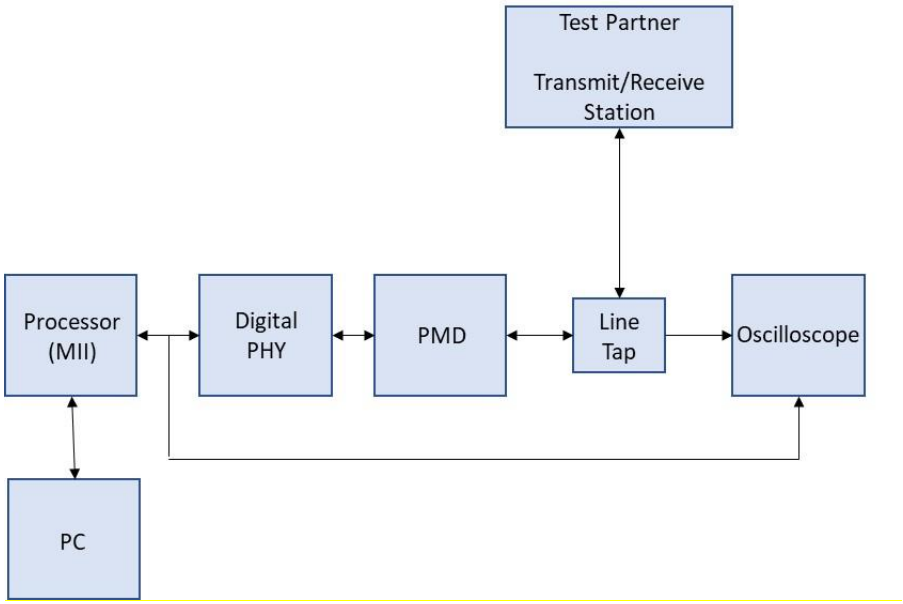

Figure 1: 10Base T1S Test Setup (PMD + Digital PHY)

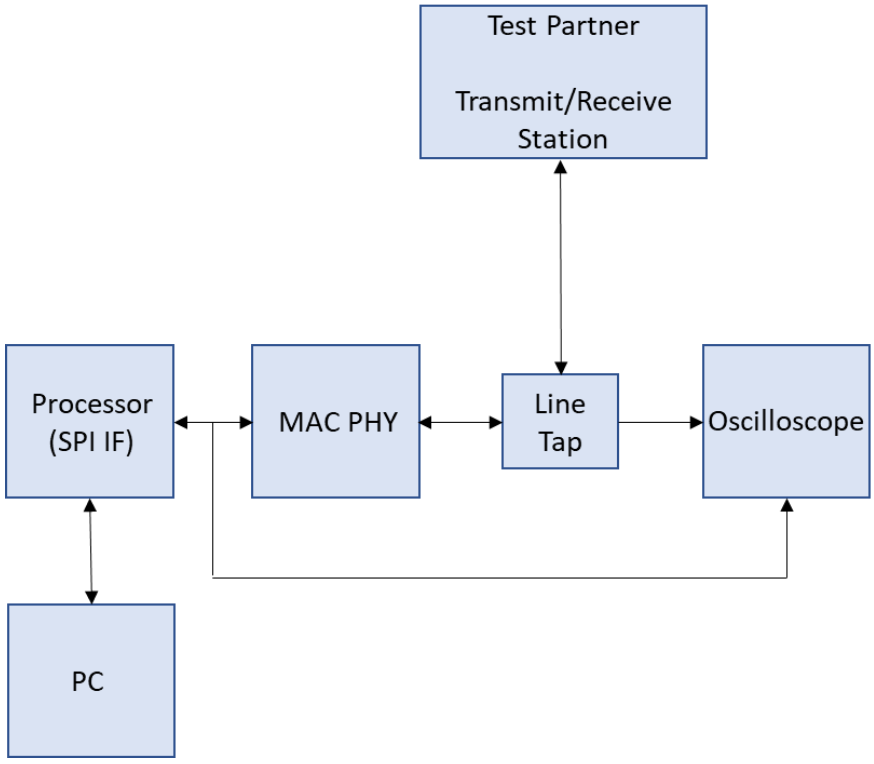

Figure 2: 10Base T1S Test Setup (MAC PHY)

B Appendix B – Test Stations

Purpose: To provide the requirements of the test stations used during 10BASE-T1S PCS testing.

Discussion:

Two test stations may be required to perform all tests specified in this document. The 10BASE-T1S Receive Test Station will examine transmissions from the DUT, and the 10BASE-T1S Transmit Test Station will transmit the necessary test patterns to test the receiver of the DUT. It is possible to combine both stations into one setup. It is generally assumed that a validated 10BASE-T1S Transmit Test Station will suffice for all tests, as it must capture received signals from the DUT and emit test patterns. The Receive Test Station with a line tap and an Oscilloscope is only necessary for validation of the Transmit Station.

The 10BASE-T1S Transmit Test Station will consist of software and hardware that is capable of transmitting arbitrary differential Manchester-encoded 5B symbols to the DUT. The ability to send arbitrary sequences, such as invalid transitions of the PCS Transmit State Machine, is essential to thoroughly test the receiver of the DUT. The test setup is shown in Figure 1. Note that the MII test station may be necessary for some tests, but may be replaced with higher layers or a loopback in some tests.

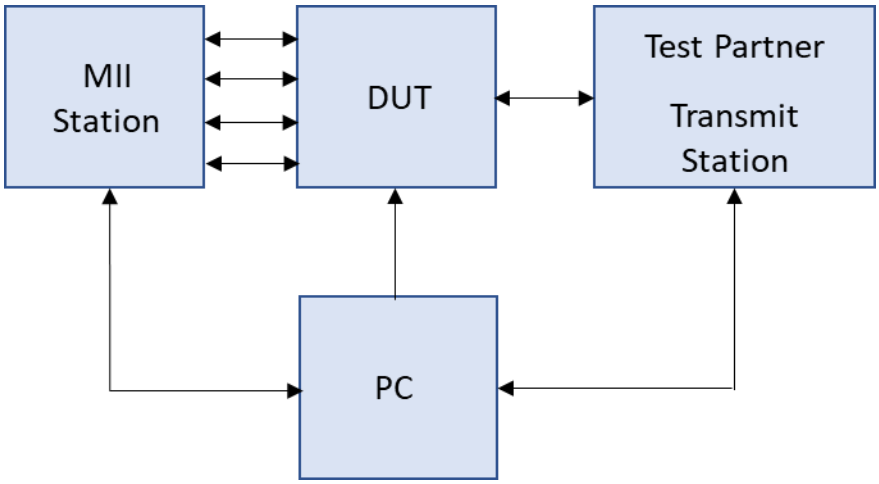

Figure 3: 10BASE-T1S Transmit Station Setup

The 10BASE-T1S Receive Test Station will consist of an oscilloscope and software to capture and decode the transmissions from the DUT. The DUT will connect to the test station through the Line Tap as specified in Appendix 5.C. The software will download the capture from the oscilloscope and decode the 5B differential Manchester-encoded symbols, using knowledge of the 10BASE-T1S encoding, to create the MII data stream.

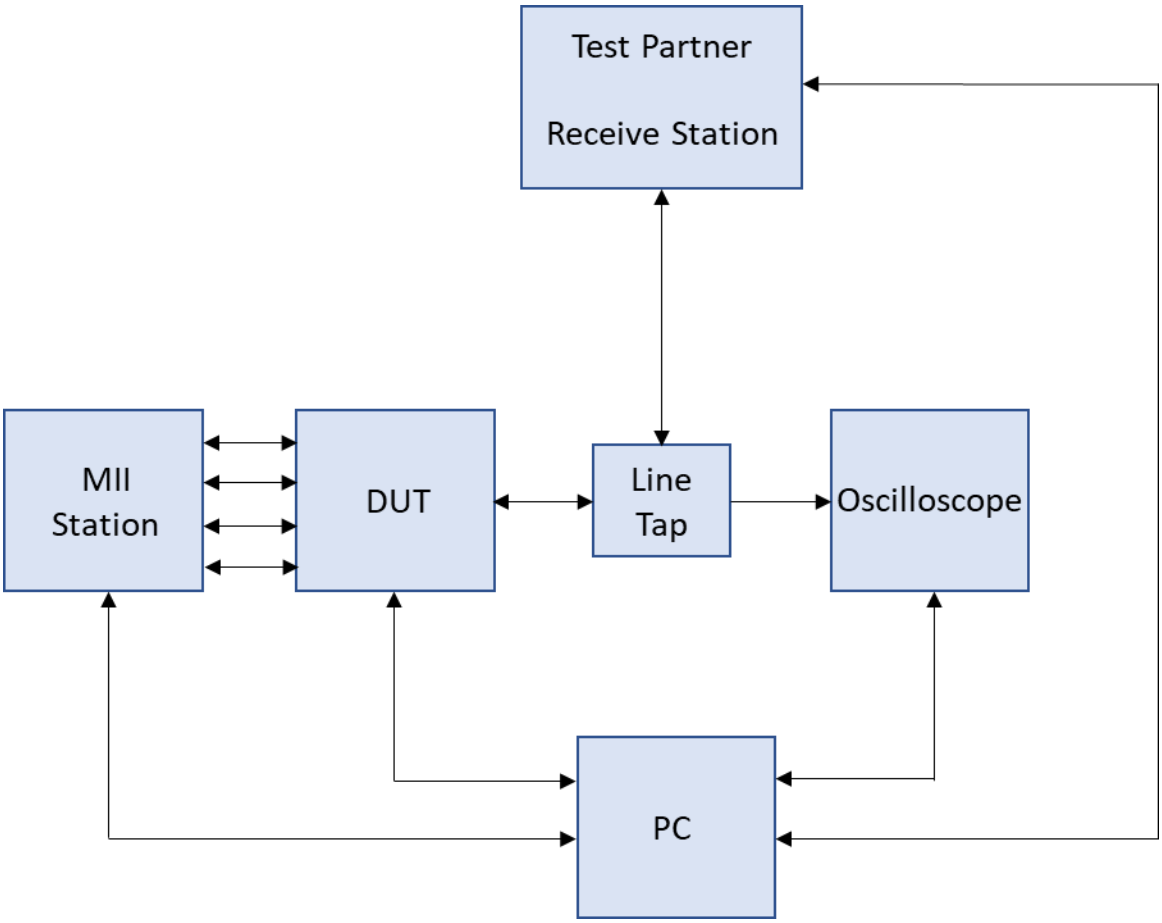

Figure 4: 10BASE-T1S Receive Station Setup

C Appendix C – Line Tap

Purpose: To provide the requirements of a line tap that will be used, in conjunction with an oscilloscope, to capture the transmissions from the DUT.

Discussion: The line tap will be a signal splitter or high-impedance probe, which can be attached to the line directly.