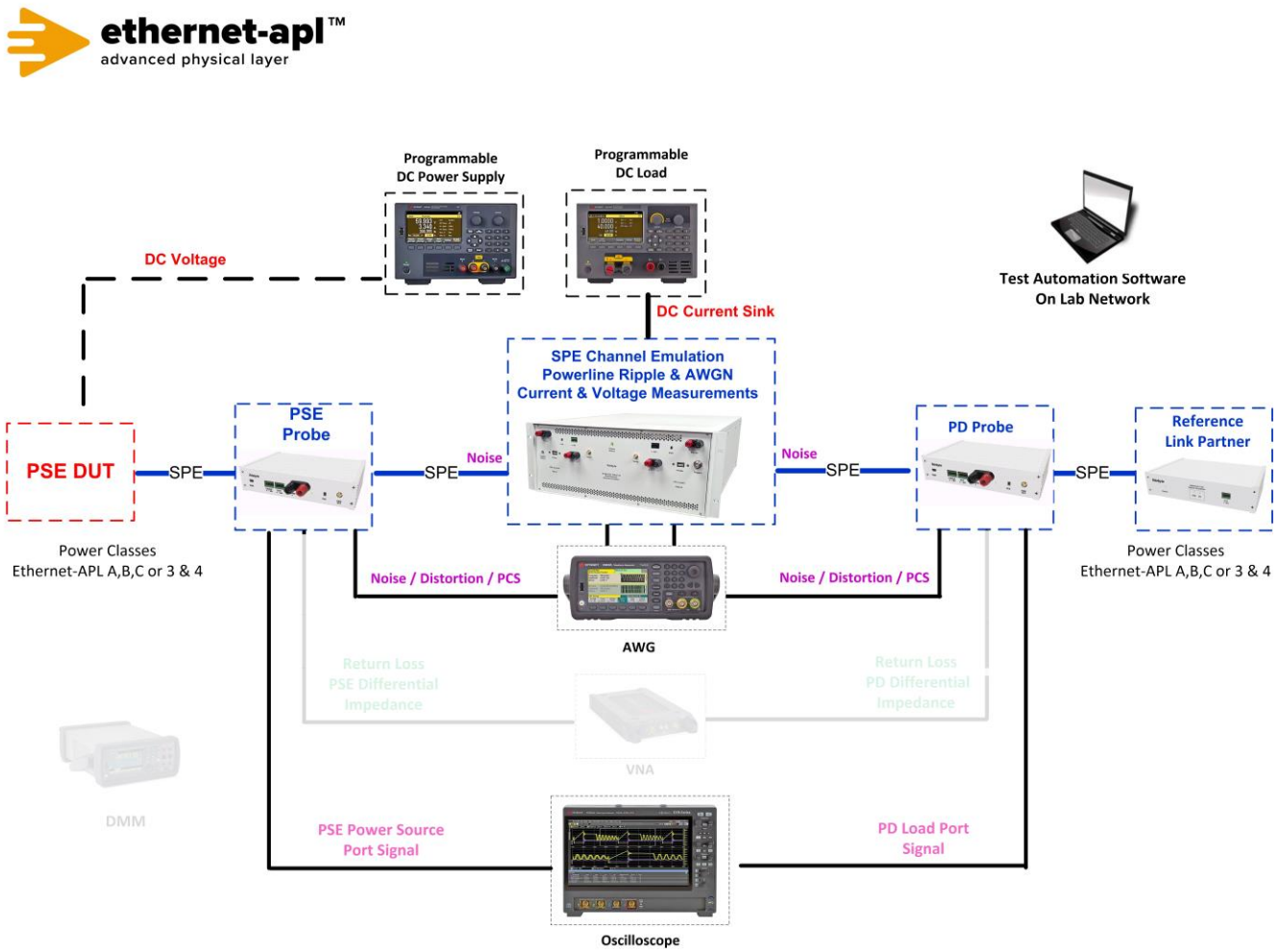
Test Type (Data or Power): Data
Test Name: 98.1.1 Advertisement and Auto-Negotiation Verification

Purpose/Description: To verify that the Ethernet–APL Device properly encodes valid operating modes in its advertised abilities via Auto-Negotiation and links properly based on link-partner advertised abilities.

Required Test Equipment for PSE:

1. PD Probe
2. 4950 Channel Emulator (for current measurements)
3. PSE Probe
4. Programmable DC Power Supply (to power the PSE DUT)
5. Programmable DC Load (to draw current from PSE DUT)
6. AWG
7. Oscilloscope
8. Test Automation Software
9. Telebyte Model 4925 Link Partner

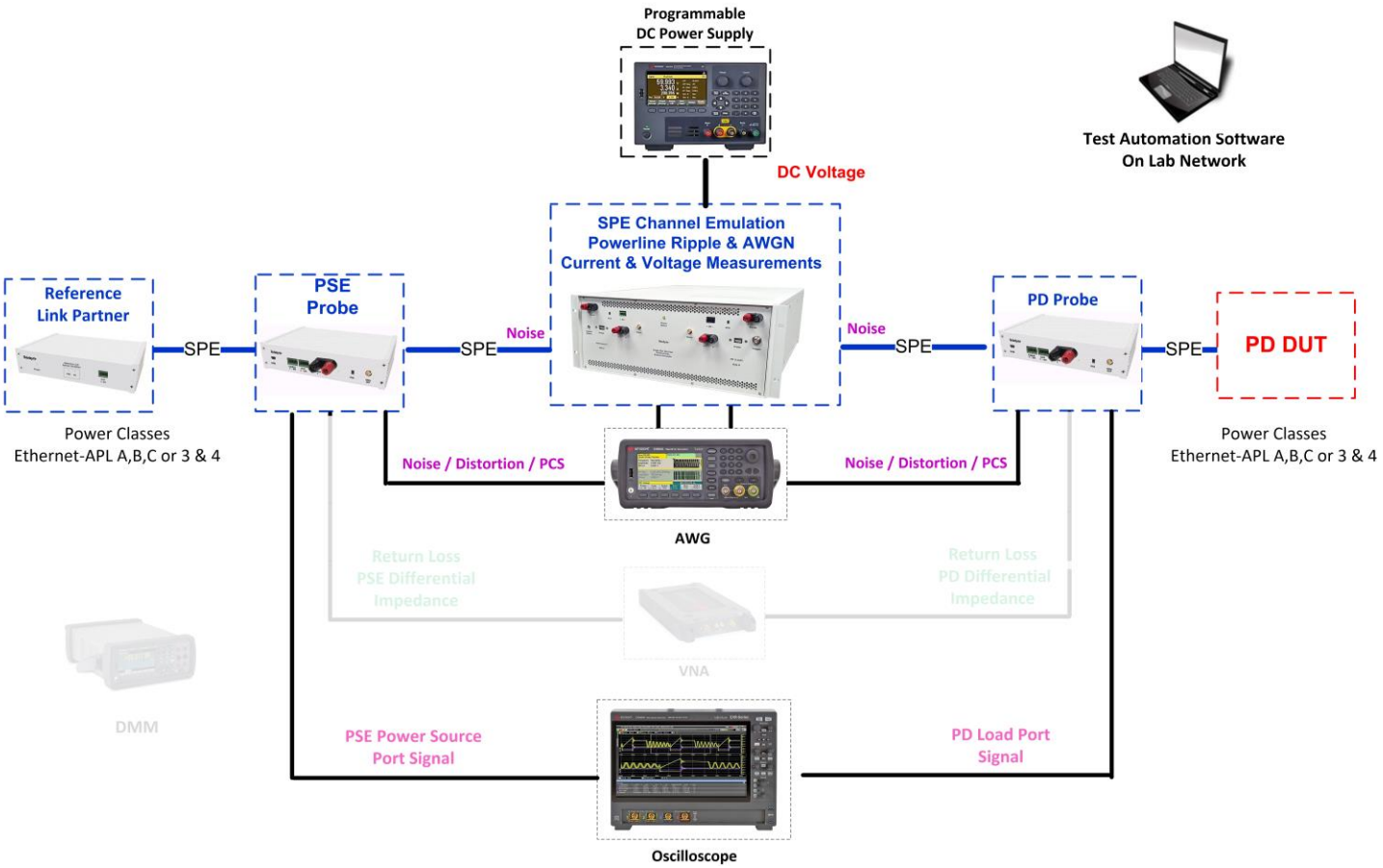
Test Setup / Connection Diagram (PSE):



Required Test Equipment for PD:

1. PD Probe
2. 4950 Channel Emulator (for current measurements)
3. PSE Probe
4. Programmable DC Power Supply (to power the PD Load DUT)
5. AWG
6. Oscilloscope
7. Test Automation Software
8. Telebyte Model 4925 Link Partner

Test Setup / Connection Diagram (PD):



Device Under Test Setup:

- DUT as 10BASE-T1L and enable auto-negotiation
- Note if the DUT is a Trunk or a Spur Port
- Enter the Power Class for the Device Under Test (Trunk: Class 3 or 4, Spur: Class A, B or C) into the test automation software
- A test station capable of Auto-Negotiation, 10BASE-T1L link signaling, and arbitrary packet generation and capturing and decoding ternary symbols.
- A line-monitoring system capable of decoding Auto-Negotiation DME pages.
- Link Partner will be a Slave M/S bit = 0 DUT will be in default configuration

Expected Results (Pass/Fail Criteria):

Part A: DUT advertises valid capabilities.

Step	Status	Description
A:1	PASS	The DUT advertises capabilities that match the expected values per the vendor claimed APL segment type (Spur or Trunk).
A:1	FAIL	The DUT does not advertise capabilities matching its APL segment type (Spur or Trunk).
A:1	WARN	If the DUT sets M/S to 1, the possibility exists that a link would not occur with link partners that also have M/S set to 1 and a matching T[4] value.

Part B: DUT links with compatible link partner.

Step	Status	Description
B:3	PASS	The DUT properly links at the expected operating mode.
B:3	FAIL	The DUT does not link at the expected operating mode.

Part C: DUT spur port when LP advertises but does not request increased transmit level.

Step	Status	Description
C:2	PASS	The DUT properly links at the spur (1.0 Vpp) operating mode.
C:2	FAIL	The DUT does not link at the spur (1.0 Vpp) operating mode.
	N/A	The DUT is not a spur port.

Part D: DUT behavior with incompatible link partner (spur to trunk, trunk to spur).

Step	Status	Description
D:3	INFO	D:3 INFO Report if spur (1.0 Vpp) or trunk (2.4 Vpp) link signaling is attempted by the DUT when link_control_[10BASE-T1L] = ENABLE. Note if link signaling is observed and what voltage. (APL expects Spurs connected to Trunks to disable communications).

Part E DUT behaves properly with incompatible link partner (spur to trunk, trunk to spur).

Step	Status	Description
E:5	PASS	If no link is seen in E:4, then the DUT's management prevents link when a spur is connected to a trunk, or vice versa. If a link is seen in E:4, then the DUT properly does not enable communication when a spur is connected to a trunk, or vice versa.
E:5	FAIL	If a link is established but communication support is enabled when it should not be (per [6] IEEE802.3cg-2019 Annex 98.B).
	INFO	Report if a link is indicated.

Part F: DUT behavior when link partner prefers master or slave port role (M/S is always 0).

Step	Status	Description
F:5	PASS	The DUT behaves properly when the link partner prefers Master or Slave operation, and the transmitted nonce value is either higher or lower than that from the DUT.
F:4	FAIL	If the DUT is a trunk, and spur (1.0 Vpp) link signaling is attempted by the DUT when link_control_[10BASE-T1L] = ENABLE. If Trunk, is 2.4 Vpp signaling observed from DUT?
F:4	FAIL	If the DUT is a spur, and trunk (2.4 Vpp) link signaling is attempted by the DUT when link_control_[10BASE-T1L] = ENABLE. If Spur is 1.0 Vpp signaling observed from DUT?
F:4	FAIL	If the DUT should be MASTER, but no signaling is seen from the DUT when link_control_[10BASE-T1L] = ENABLE. If Master, is there no >1ms gap between DME & link signaling
F:4	FAIL	If the DUT should be SLAVE, but signaling is seen from the DUT when link_control_[10BASE-T1L] = ENABLE instead of SEND_Z. If Slave, is there a >1ms gap between DME & link signaling

Part G: DUT behavior when link partner forces master or slave port role (M/S is always 1).

Step	Status	Description
G:3	PASS	The DUT behaves properly when the link partner is forced to Master or Slave operation.
G:3	FAIL	If the DUT is a trunk, and should be MASTER and spur (1.0 Vpp) link signaling is attempted by the DUT when link_control_[10BASE-T1L] = ENABLE. If Trunk, is 2.4 Vpp signaling observed from DUT?
G:3	FAIL	If the DUT is a spur, and should be MASTER and trunk (2.4 Vpp) link signaling is attempted by the DUT when link_control_[10BASE-T1L] = ENABLE. If Spur is 1.0 Vpp signaling observed from DUT?
G:3	FAIL	If the DUT should be MASTER, but no signaling is seen from the DUT when link_control_[10BASE-T1L] = ENABLE. If Master, is there no >1ms gap between DME & link signaling
G:3	FAIL	If the DUT should be SLAVE, but signaling is seen from the DUT when link_control_[10BASE-T1L] = ENABLE instead of SEND_Z. If Slave, is there a >1ms gap between DME & link signaling
G:3	INFO	If the DUT advertises with M/S = 1, report the behavior when a Configuration Fault occurs (for example, if the DUT sets T[4] to 0 and the test station also sets T[4] to 0). If DUT sets M/S =1 by default, note as INFO when Config faults occur.

Notes:

References:

[1] IEEE Std. 802.3-2022 subclause 45.2.7.22 (AN LP Base Page ability register)
[2] IEEE Std. 802.3-2022 subclause 45.2.7.24 (AN LP Next Page ability register)
[3] IEEE Std. 802.3-2022 subclause 98.3 (State diagram variable to AN register mapping)
[4] IEEE Std. 802.3-2022 subclause 45.2.7 (Auto-Negotiation registers)
[5] IEEE Std. 802.3-2022 subclause 45.2.7.26 (10BASE-T1L capability advertisement)
[6] IEEE Std. 802.3-2022 Annex 98B.3
[7] Ethernet–APL Port Profile Specification v1.1 – clause 4.1