Impact of Patch Cords on PoE Performance

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AEM

Standards Reference for Power Delivery over 4/2/1 pair Cabling

- IEEE Std 802.3af-2003 DTE Power via media dependent interface (MDI)

- IEEE Std 802.3at-2009 DTE Power Enhancements

- IEEE P802.3bt DTE Power via MDI over 4-Pair Task Force
  - 10M/100M/1G/2.5G/5G/10G (4-pair,2-pair)

- IEEE Std 802.3bu-2016 1-Pair Power over Data Lines (PoDL)
  - 10M/100M/1G/10G (2.5G/5G) (1-pair)

❖ An objective of Power over Ethernet: A PSE designed to the standard does not introduce non-SELV (Safety Extra Low Voltage*) power into the wiring plant.

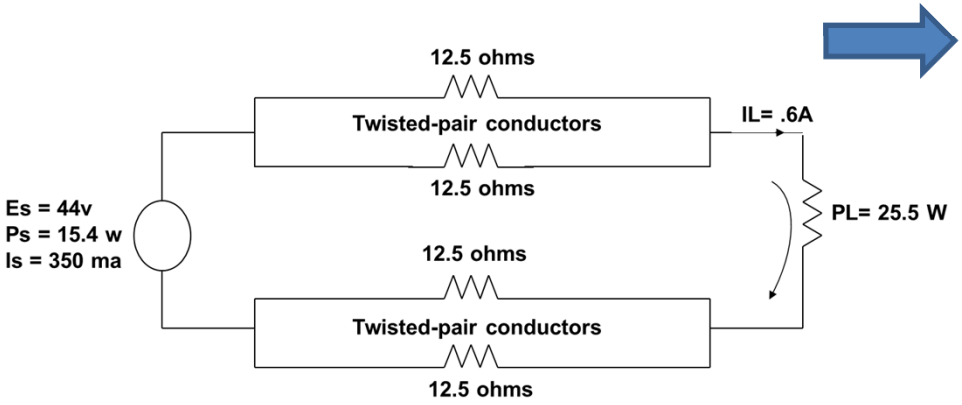
Standards Reference for Power Delivery over 4/2/1 pair Cabling

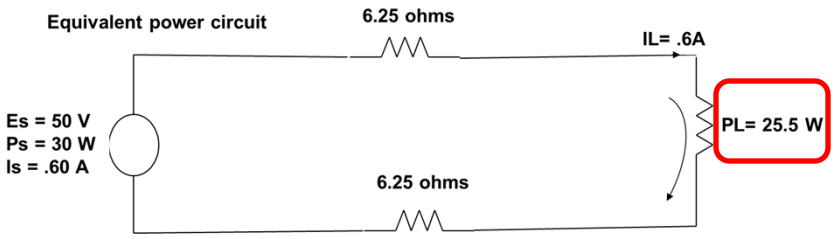
- ISO/IEC/TIA guidelines to support (SELV) limited power source (LPS) applications. Guidelines include considerations for temperature rise and current capacity of bundled cabling.

  - ISO/IEC TR29125 and TIA TSB-184 (2009)
  - ISO/IEC TS29125 and TIA TSB-184-A (2017)

Standards Reference for Power Delivery over 2 pair Cabling

IEEE 802.3at - 2 pair



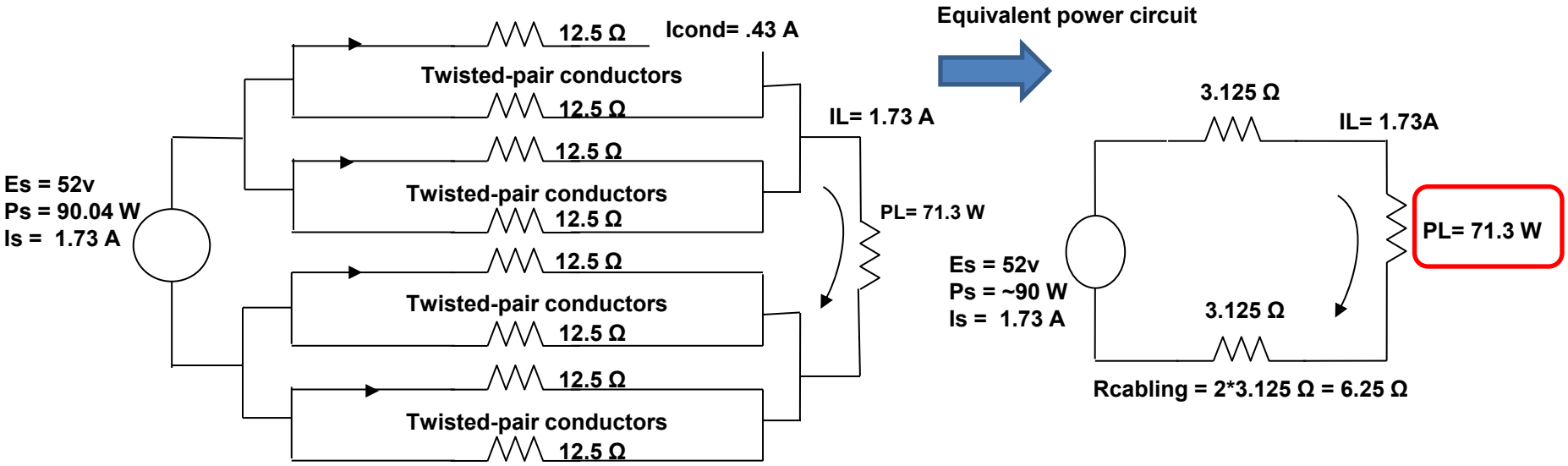


Max power at the output of the power supply: 30 W =50V*.6A

<u>For a 12.5 ohm power loop resistance:</u>
Max Power dissipated in the cable: (0.6^2)*12.5= 4.5 W
Power at the powered device: =30-4.5=25.5 W

Standards Reference for Power Delivery over 4 pair Cabling

IEEE 802.3bt – 4 pair



Requirements for Channels to be compliant for PoE delivery

- As specified in ANSI/TIA-568.2-D & TIA TSB-184A D3.0
    - DC Loop Resistance for Cat3,5e/6/6A shall not exceed 25 Ohms
    - DC Resistance UnBalance < 200mOhms or 3% of UnBal in pair
    - DC Resistance UnBalance between pairs <200mOhms or 7% of UnBal between pairs

Patch Cord Specifications

- ANSI/TIA-568.2-D specifies requirements for Modular Cords.
- ONLY NEXT & Return Loss are specified
- No requirements for DC Resistance, DC Res UnBalance

Impact of Patch Cords on Channel Measurements

- Patch Cord contribution to Channels can be significant for Shorter Channels
- Resistance UnBalance in Patch Cords can impact Data Transmission during Power Delivery

DC Resistance Measurements – Patch

Patch Cord	DC Resistance				DC Res UnBalance within pair				DC Res UnBalance between pairs					
	12	36	45	78	12	36	45	78	12-36	12-45	12-78	36-45	36-78	45-78
Cat6A Patch Cord, 26AWG, PCB Plug, 2m -A	0.7	0.69	0.762	0.792	0.021	0.005	0.043	0.05	0.003	0.015	0.022	0.017	0.025	0.008
Cat6A Patch Cord, 26 AWG, PCB Plug, 2m -B1	1.026	0.725	0.767	0.806	0.246	0.001	0.012	0.019	0.061	0.05	0.04	0.01	0.02	0.01
Cat6A Patch Cord, 26 AWG, PCB Plug, 2m -B2	0.86	0.769	0.803	0.858	0.037	0.009	0.016	0.025	0.022	0.014	0.006	0.008	0.022	0.013
Cat6A Patch Cord, 26AWG, Wired Plug, 2m-A	0.664	0.651	0.669	0.708	0.015	0.014	0.011	0.023	0.003	0.001	0.011	0.004	0.014	0.01
Cat6A Patch Cord, 26AWG, Wired Plug, 2m-B	0.698	0.738	0.756	0.995	0.028	0.046	0.026	0.15	0.009	0.014	0.069	0.005	0.059	0.054
Cat5e PatchCord, 26 AWG, Molded Plug, 1m	0.54	0.505	0.631	1.134	0.001	0.023	0.03	**0.307**	0.009	0.022	0.128	0.031	0.137	0.105
Cat5e Patch Cord, 26 AWG, Molded Plug, 2m-A	0.628	0.587	0.607	0.645	0.045	0.005	0.004	0.017	0.009	0.004	0.005	0.005	0.014	0.009
Cat5e Patch Cord, 26 AWG, Molded Plug, 2m-B	0.629	0.601	0.615	0.661	0.031	0.003	0.009	0.019	0.007	0.003	0.008	0.004	0.015	0.011
Self Crimped Patch Cord, 26 AWG, 0.3m	0.635	1.845	0.618	1.344	0.367	0.845	0.253	0.925	0.259	0.023	0.071	0.236	0.188	0.048

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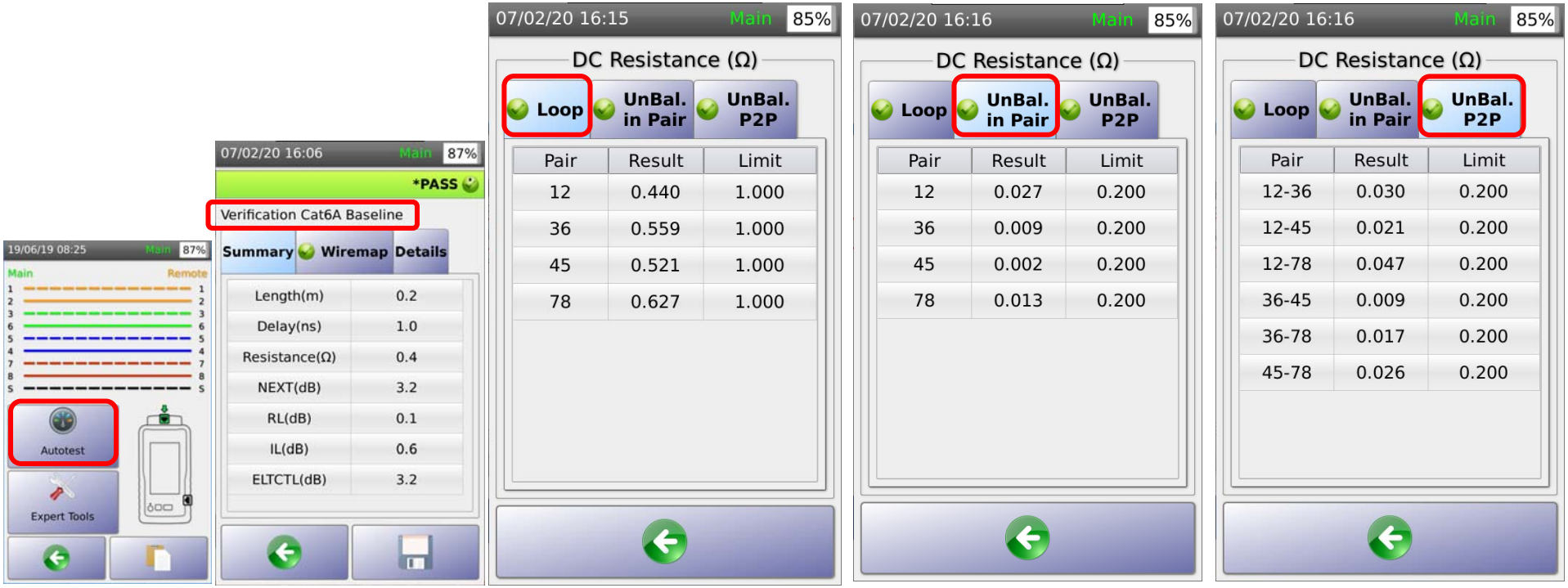
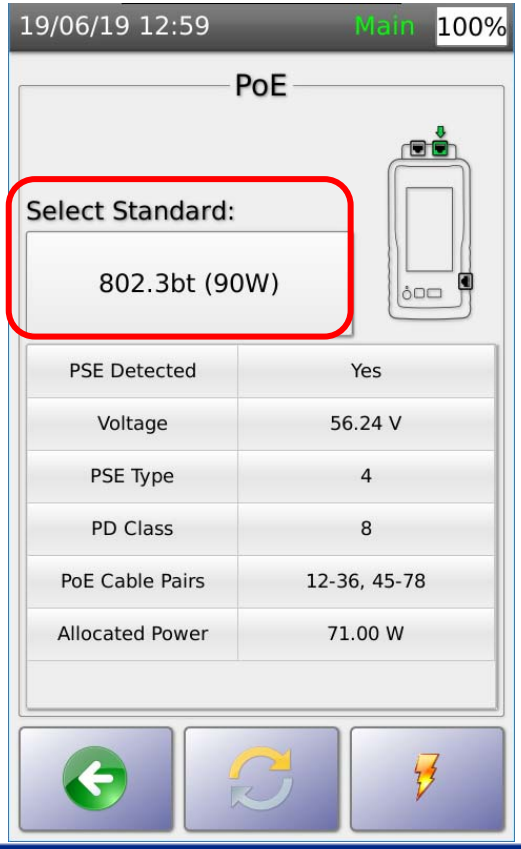
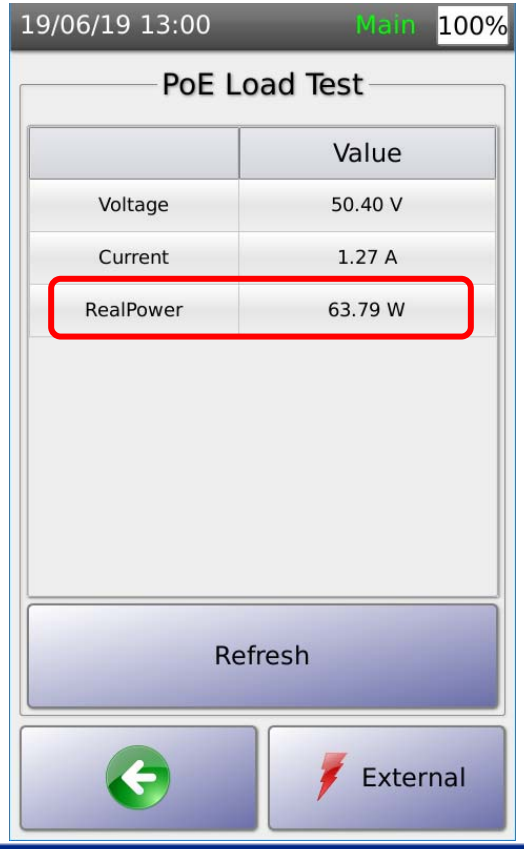
DC Resistance Measurements – Patch Cord

DC Resistance Measurements – Patch Cord



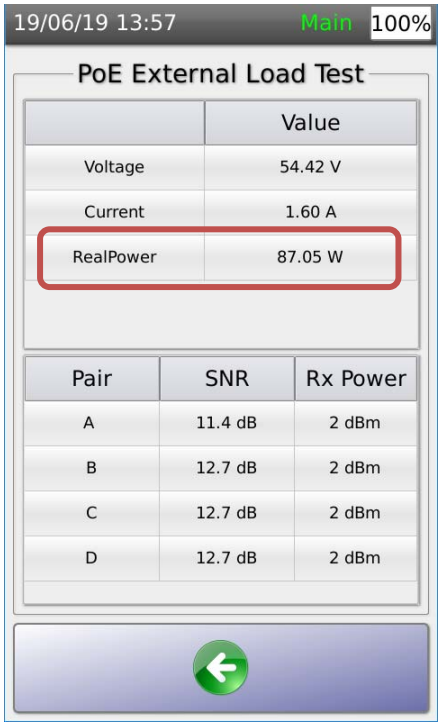
PoE Internal Load Testing



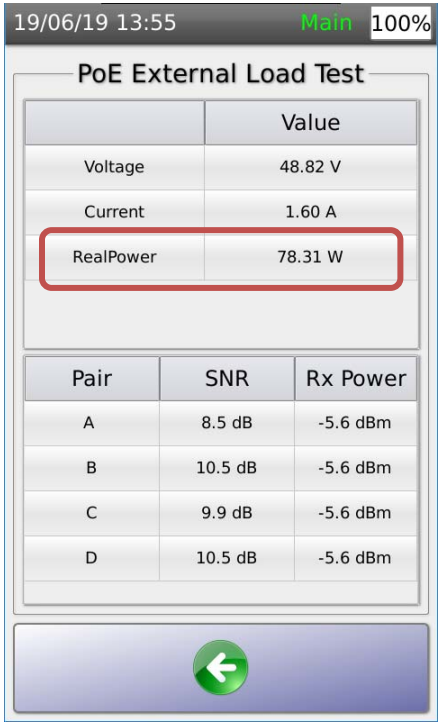


PoE Load Testing in presence of Data Transmission

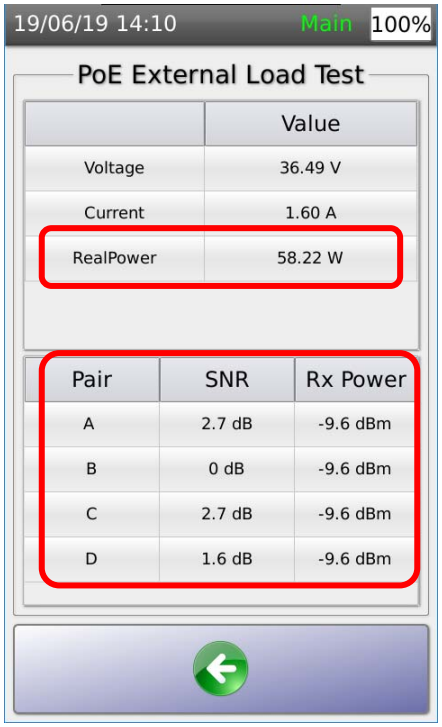
2m Patch Cord



100m Compliant Channel



100m Non-Compliant Channel



Summary

- Need to take into consideration DC Loop Resistance & DC Res UnBalance of Patch Cords for PoE Power delivery.

- Non compliant Patch Cords can cause reduced Signal Margin & Data Transmission errors.