Testing & Troubleshooting for SPE

Christian Schillab

Marketing Engineer EMEA
Fluke Networks

Agenda

- Who we are
- The motivation for testing SPE cabling systems in comparison with the traditional rational for the certification of new built cabling systems
- The key performance parameters in a SPE system
- Adapting cabling tester for SPE
- Trouble shooting a SPE cabling system
- The challenges for the installed base of cable testers in the testing of SPE

Who We Are

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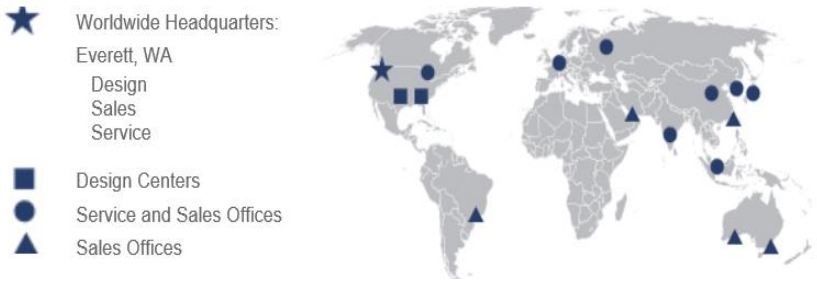

- Started in 1992 (part of FLUKE)
- Worldwide Presence
- Over 700 employees
- Service customers in more than 120 countries

Part Of The Fluke Family

FLUKE

FLUKE Process Instruments

FLUKE Calibration

FLUKE Biomedical

FLUKE networks

FORTIVE

Professional Instrumentation

Field Solutions

- FLUKE
- QUALITROL Defining Reliability
- GORDIAN
- INDUSTRIAL SCIENTIFIC
- accruent

Product Realization

- Tektronix
- Pacific Scientific Energetic Materials Company

Health

- ASP
- Invetech
- Censis

Sensing Tech.

- SPT Specialty Product Technologies
- setra
- Gems Sensors & Controls
- Hygienic by Design Anderson-Negele
- Hengstler Dynapar

Industrial Technologies

Transportation Tech.

- Gilbarco Veeder-Root
- GTT Global Traffic Technologies
- TELETRAC NAVMAN

Franchise Distribution

- Matco Tools
- Hennessy Industries, Inc.

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Driving Forces For The Certification Of Newly Installed Cabling

$M_1I_1C_1E_1$

Building automation

(Commercial Building)

Datacenter

Factory automation

$M_3I_3C_3E_3$

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Obtain the manufacturers' warranty … Guarantee todays and future applications

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Deployment is driven by cabling standards

Verify the performance headroom between the installation and the application requirement
(accommodate environmental changes and variation in the applications load)

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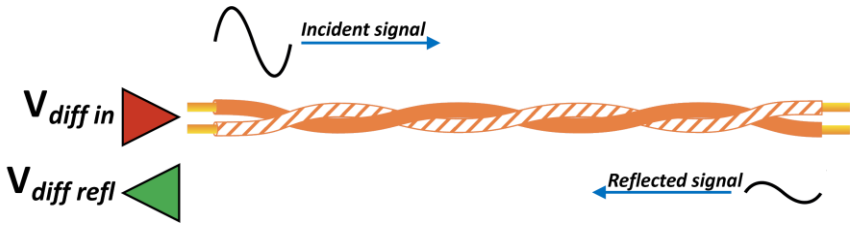
Parameter: Insertion Loss

- In dB, the signal loss down the cable

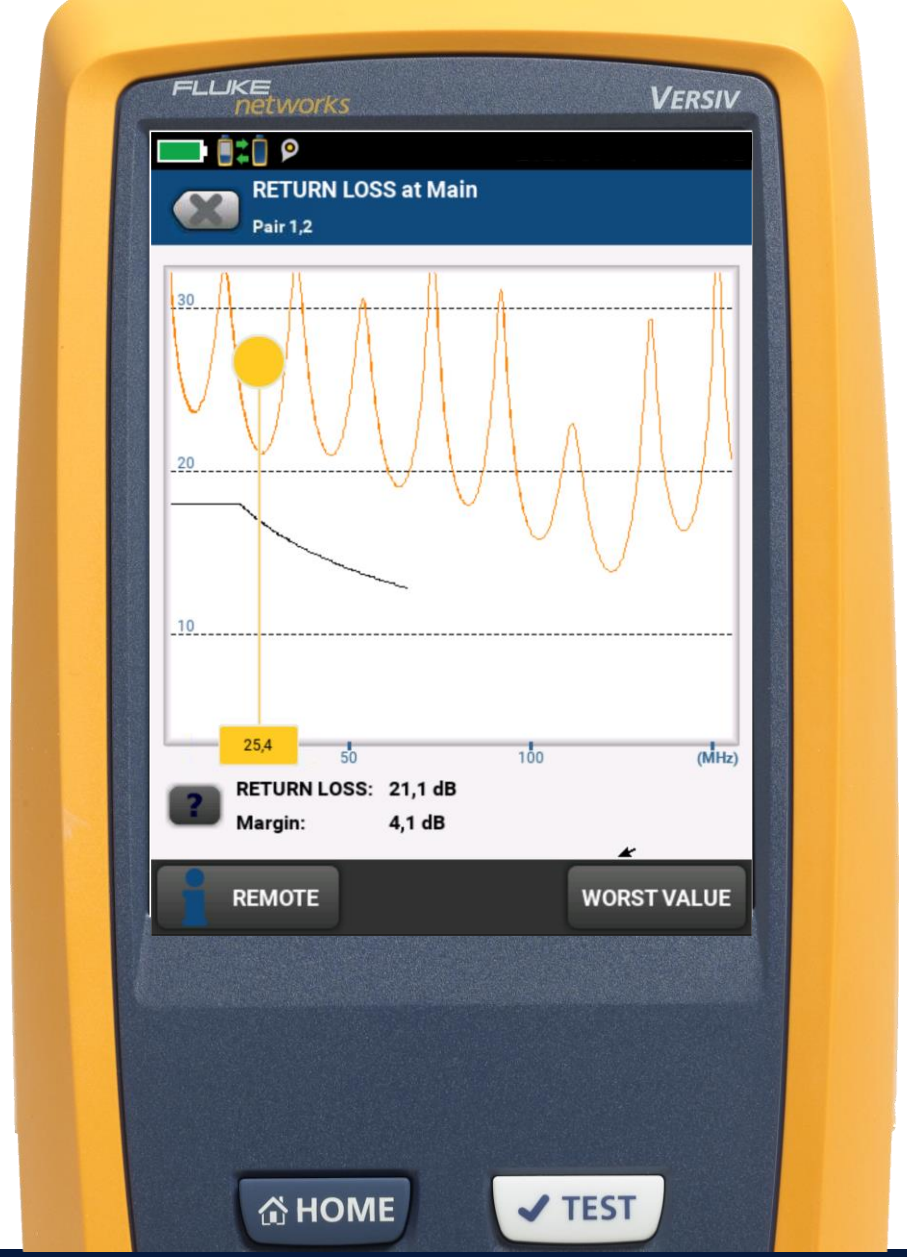
- Probably the most important of all parameters
- Depends on …
  - Length
  - Cable construction (Diameter, Shield, Twist Rate, …)
  - Materials used
  - Ambient temperature
- Workmanship and installation is secondary

Parameter: Return Loss

- In dB, the reflected signal on the same pair

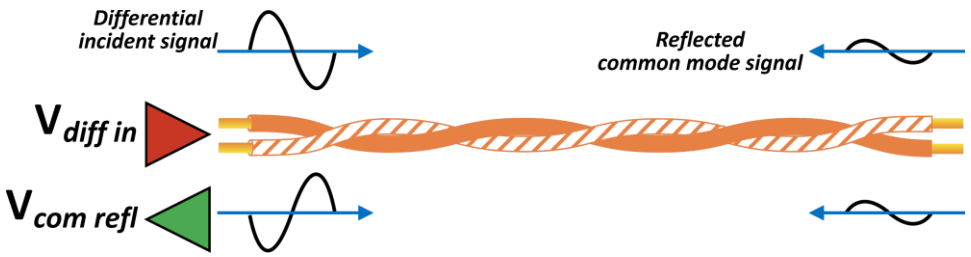


- Depends on the cable design and quality of the manufacturing process
- Workmanship and handling of the cable is critical



Parameter: TCL

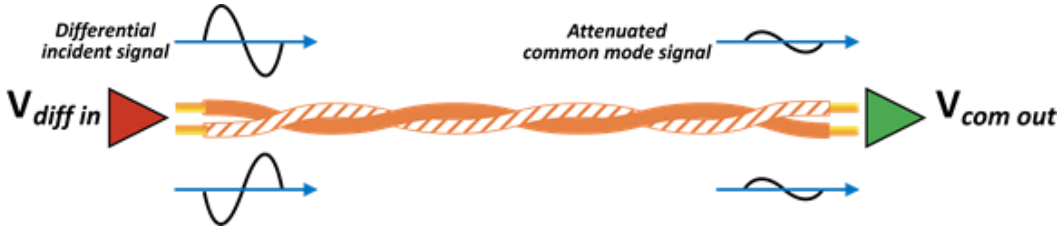
- **T**ransverse **C**onversion **L**oss
- In dB, the ratio of a common-mode voltage measured on a wire pair at the near-end relative to a differential-mode voltage applied to the near-end of the same pair



- Depends on quality of the design and manufacturing of cables and connectors
- Workmanship and handling of the cable is less critical (RL will suffer more)

Parameter: ELTCTL

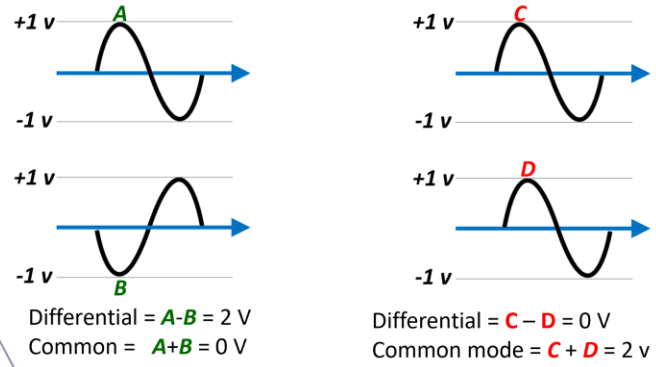
- **E**qual **L**evel **T**ransverse **C**onversion **T**ransfer **L**oss
- In dB, the normalized ratio of a common-mode voltage measured on a wire pair at the far-end relative to a differential-mode voltage applied to the near-end of the same pair



- Depends on quality of the design and manufacturing of cables
- Often considered an optional parameter for shielded system
- Workmanship and handling of the cable is less critical (RL will suffer first)

TCL / ELTCTL are Balance Parameters

- In Laymen's Terms: It stands for the conversion from a desired "good" differential mode signal into an undesired "bad" common mode signal and vice versa in case of EMI



- The topic is complex, but it is well explained in the new "Balance e-Book"
  click HERE or scan →

SCAN ME

Single Pair Ethernet System Alliance

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Adapting Cabling Tester For SPE

- Are these SPE Adapters from the recent automation show “Real” products ?

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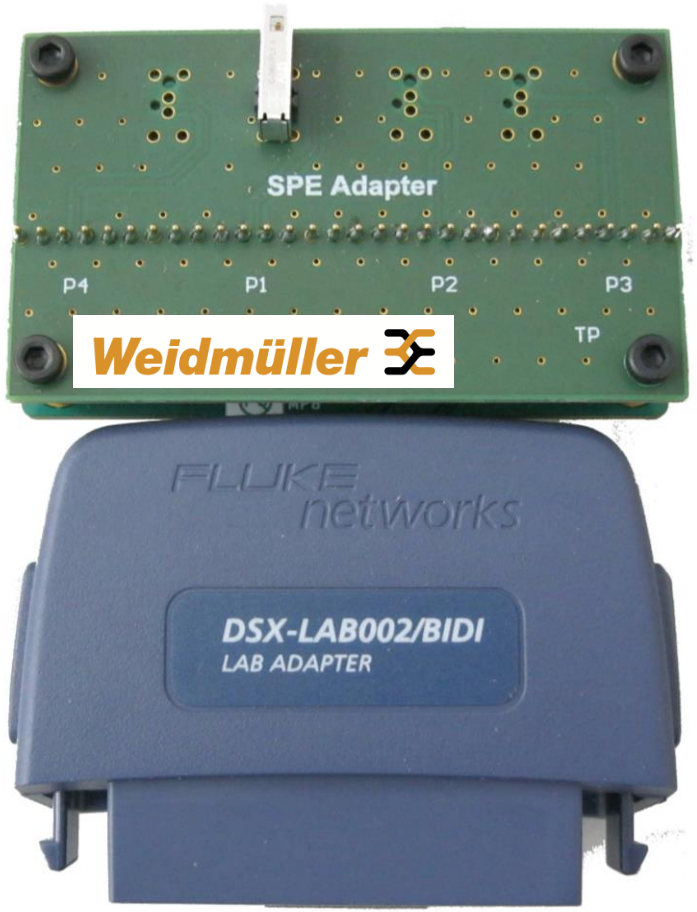
Adapting Cabling Tester For SPE

- Solution based on the “Laboratory Adapter” for the DSX-5000/8000
- Ideal for assembly houses .... Lower running cost because only the top “daughter board” needs to be replaced
- Fully functional for field trials
- Source: Weidmüller
- Will eventually be replaced by a regular End2End/Channel/Patch Cord adapter
  - Which housing M8 / M12 / Push Pull / All ?

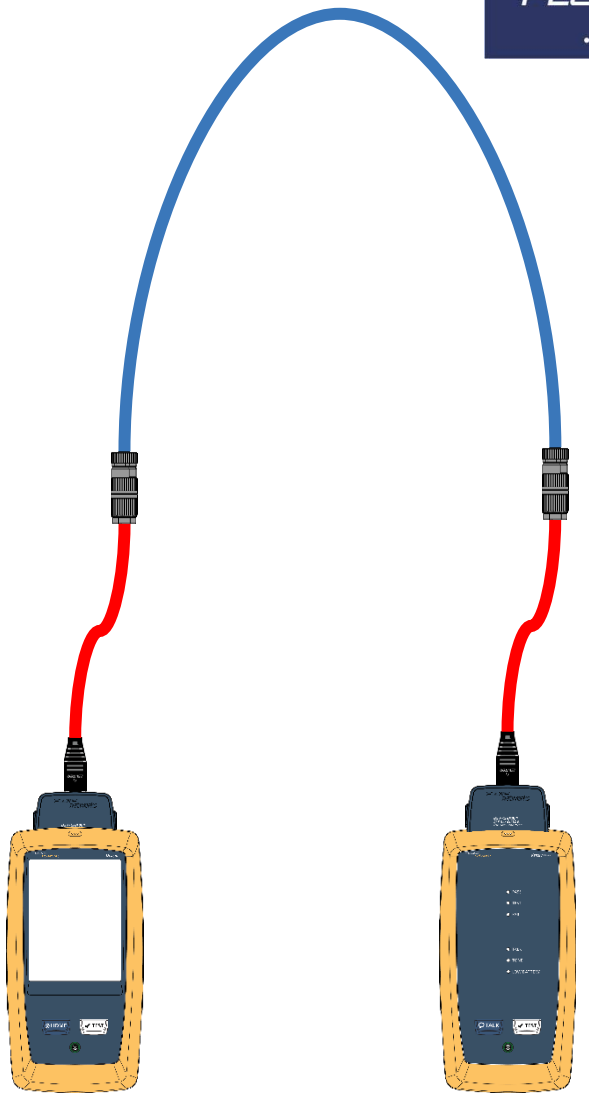


Pictures Courtesy of Weidmüller Interface GmbH & Co. KG

Adapting Cabling Tester For SPE

We discourage the use of hybrid courts to adapt to SPE

1. The RL, TCL, ELTCTL, would need to be 12+ dB better then the test limit to not dominate the test result



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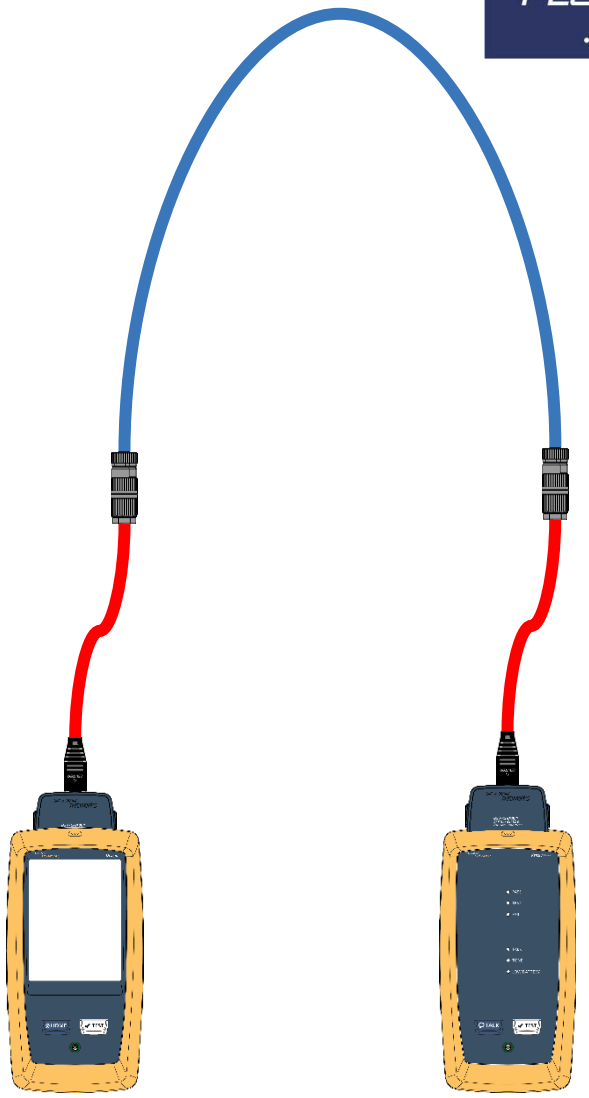

Adapting Cabling Tester For SPE

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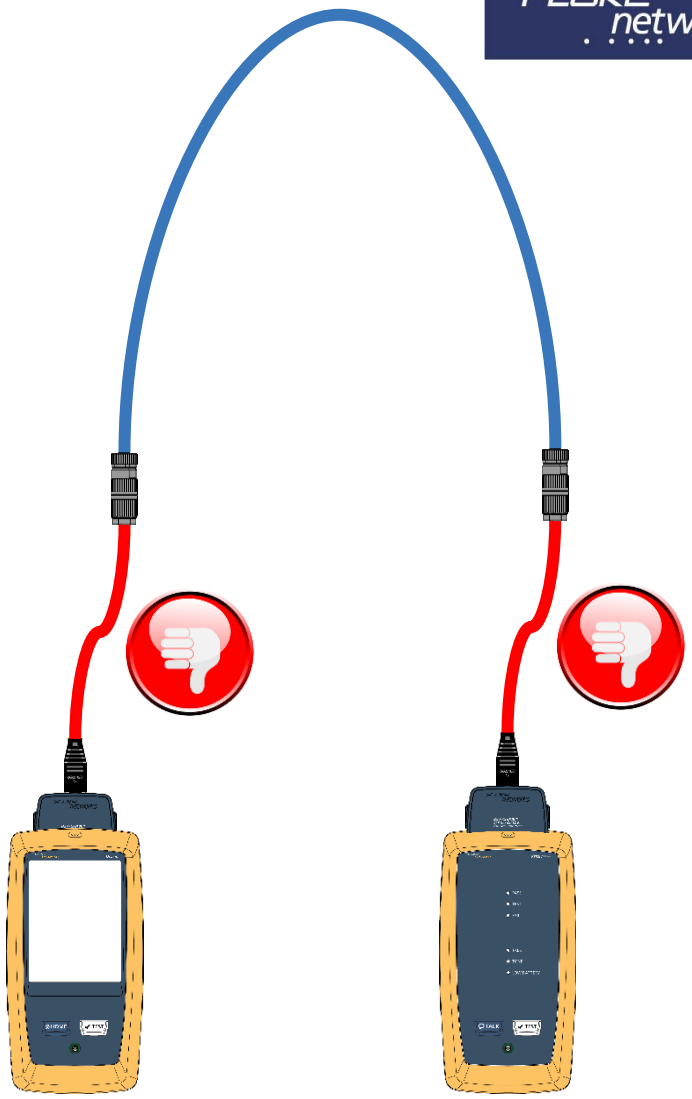
1. The RL, TCL, ELTCTL, would need to be 12+ dB better then the test limit to not dominate the test result
2. A calibration process works well for IL but not for low frequency RL, TCL, ELTCTL
3. Verification of the condition of the hybrid cord is very complex



Needs For Testing A New Generation Of Connecting Hardware

1. Conceptional
   & Design In Phase

Laboratory
Grade Tools

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2. Experimental Phase
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Needs For Testing A New Generation Of Connecting Hardware

1. Conceptional
   & Design In Phase
2. Experimental Phase
   (Early Implementers)
3. Implementation Tests
4. Large Scale Deployment
   (Tornado)

Laboratory
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Field Test Tools

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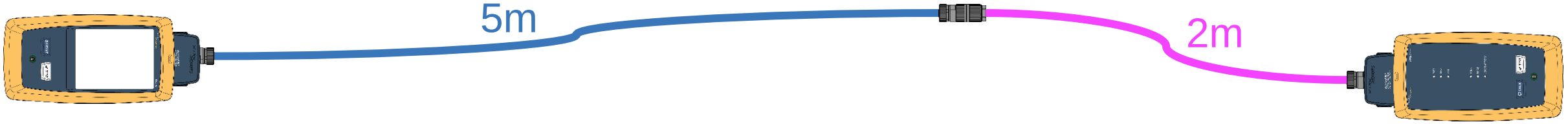
Trouble Shoot SPE Links



- The link is causing problem
- The RL margin is negative

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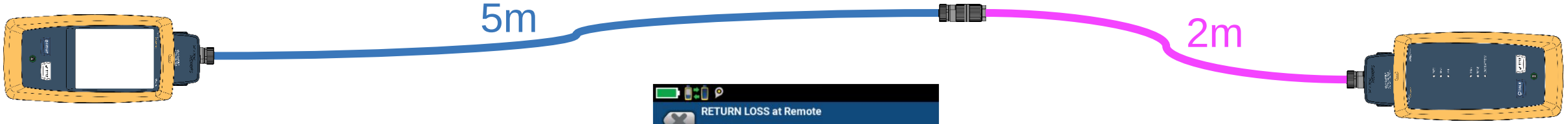

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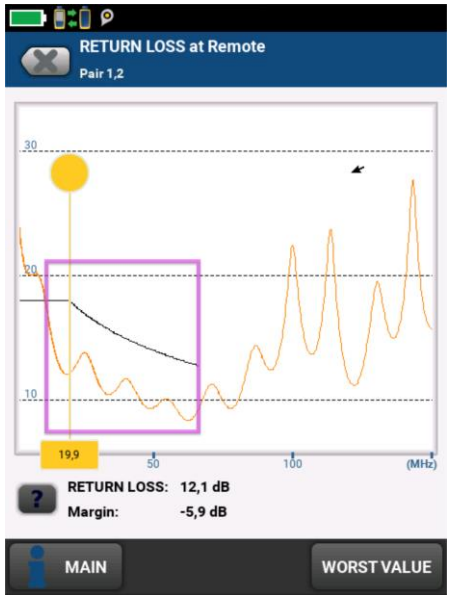

- The RL margin is negative but saved by the 3dB Rule
- The RL plot suggest a cable problem

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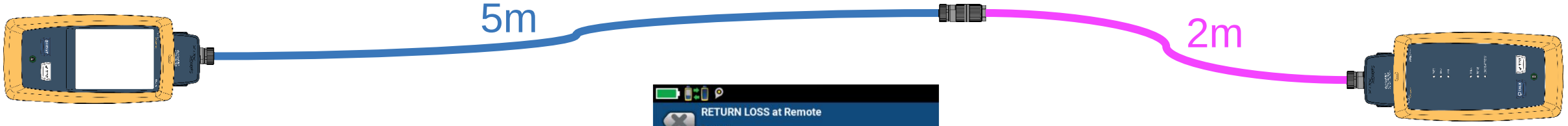

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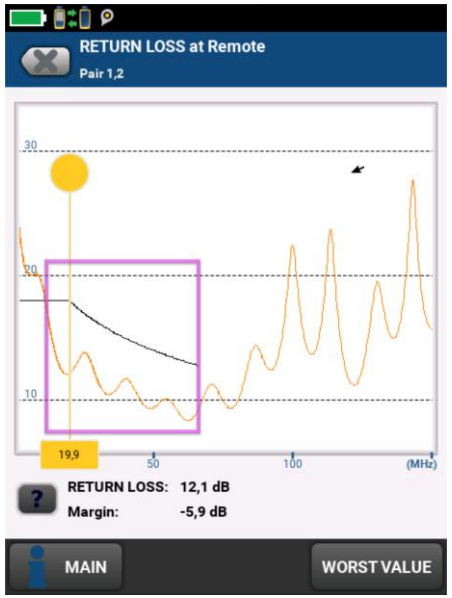

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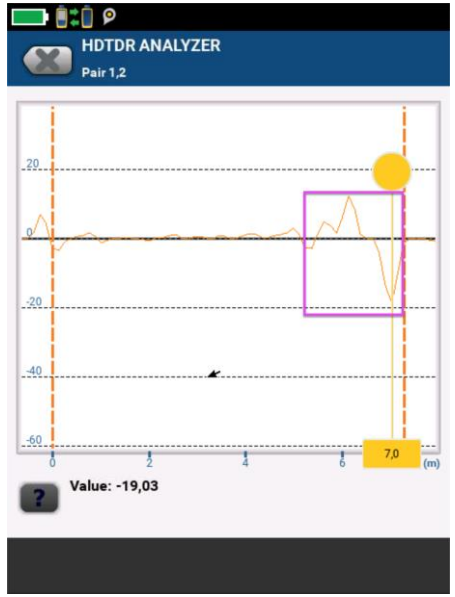

- The HDTDR confirm a problem in the second segment

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The challenges for the installed base of cable testers in the testing of SPE

- Multiple housing M8 / M12 / PushPull / etc… will require “universal” adapters.
  - Hybrid cords have not proven to be a good alternative
- Many testers in the field today can not measure TCL and ELTCTL
- Some of the long range version e.g.: 10Base-T1L specify performance down to 0.1 MHz
  - The installed base of testers starts testing at 1.0 MHz
  - Sounds trivial but represents a decade in frequency
  - For IL the 0.1 …. 1.0 MHz extension may not offer significant findings.
    For other parameters significant issues may be found < 1.0 MHz depending on topology
  - Some testers may be modifiable through SW

Conclusion

- Testing SPE links is feasible with some of the installed field testers
- A mass roll out will require a ruggedized adapter with a universal adaption for different housing
- SPE testing is ready for you!

Thank You For Your Attention! … Questions?

- Please fell free to reach out to us if you have questions
  Christian.Schillab@FlukeNetworks.com

- If you want to stay updated on news around Industrial Ethernet Testing click HERE or scan →

SCAN ME