Common Mistakes Made in Certification Specifications and Testing

Jim Davis

Regional Marketing Engineer

Fluke Networks

2017
BICSI CANADIAN
CONFERENCE & EXHIBITION
MAY 8-11 • VANCOUVER, BRITISH COLUMBIA, CANADA
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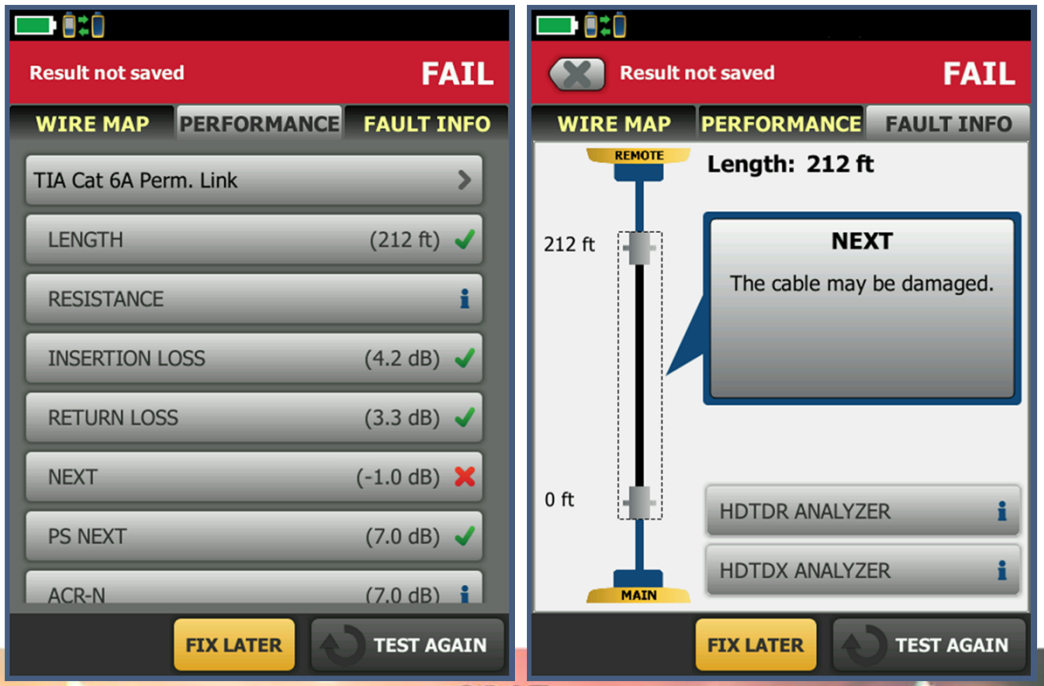
Common Mistake #1

Failing to specify a Permanent Link test

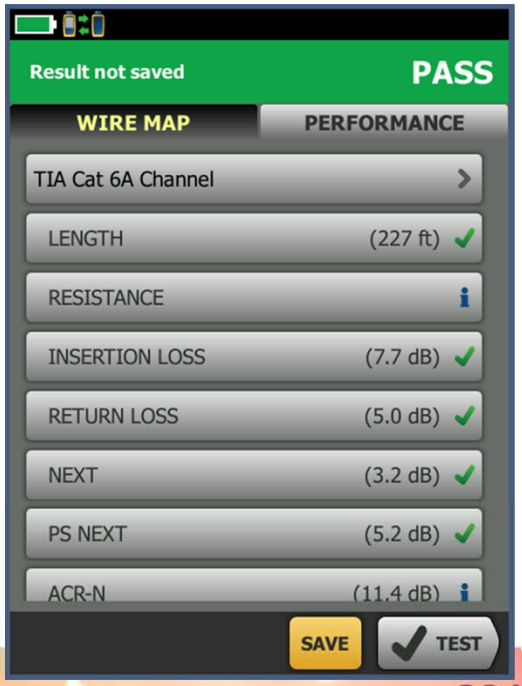
#1 Permanent Link or Channel?

- Kevin our tech “Tested to Cat 6A per ~~ANSI/EIA/TIA-568”~~ **ANSI/TIA-568-C.2**



#1 Permanent Link or Channel?

- Kevin knows that a Channel test is easier to PASS
- Test spec did not specify Permanent Link or Channel



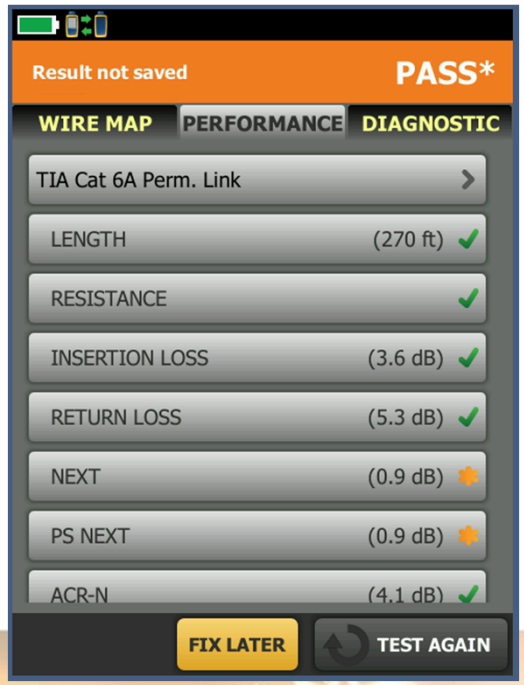
The test report says Cat 6A, so we're good right?

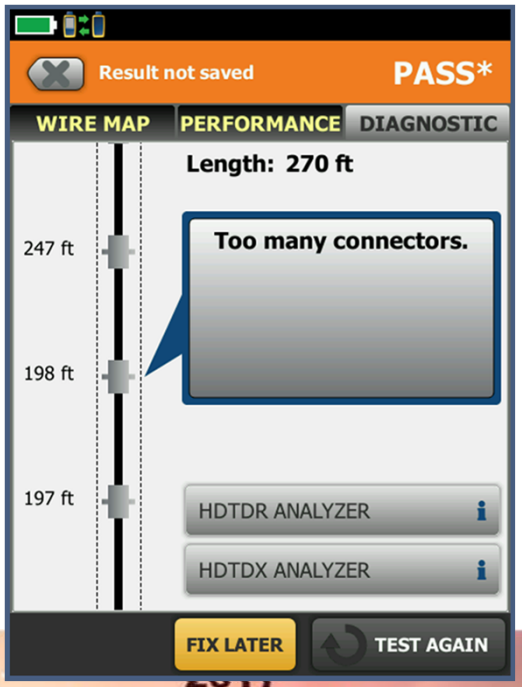
Common Mistake #2

Not agreeing if PASS* (marginal result) is acceptable

#2 Not agreeing if PASS* is acceptable

- Field tester standard ANSI/TIA-1152
  - *Any fail or fail* shall result in an overall fail. In order to achieve an overall pass condition, all individual results shall be pass or pass*.*



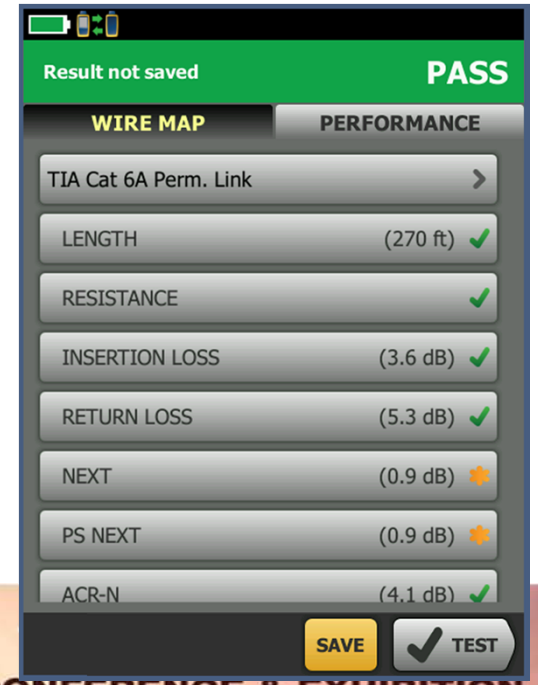


Unless you specified otherwise, this is a **PASS**.

Although the tester has identified four connections.

#2 Not agreeing if PASS* is acceptable

- Field tester standard ANSI/TIA-1152 - deviation
  - Technically should be displayed as a PASS. But test equipment vendors have been asked to make it more obvious the Autotest contains one or more marginal results



Do You Accept These Results?

Generic Results Management Software

Cable ID: 012
Headroom 0.7 dB (NEXT 45-78)
Test Limit: TIA Cat 6a Perm. Link
Limits Version: V4.0
Date / Time: 12/28/2015 11:09:41 AM
Cable Type: Cat 6a U/UTP
NVP: 69.0%

PASS
Project Debateable Test Result
Operator: Jim
Tester Main S/N: 12345
Tester Smart Remote S/N: 54321
Software Version: V6.0 Build 3
Calibration Date: 01/21/2015 (Main), 01/21/2015 (Remote)

Wire Map (T568B) 1 2 3 4 5 6 7 8
PASS
| | | | | | | |
1 2 3 4 5 6 7 8

Pair	Length (m)	Limit	Prop. Delay ns	Limit	Delay Skew ns	Limit	Resistance ohms	Limit	Impedance ohms	Limit	Insertion Loss Result (dB)	Insertion Loss Limit (dB)	Freq. MHz
12	4.3	90.0	21	498	0	44	2.1				28.9	31.1	250.0
78	-3.5		17.8	1							28.7	31.1	250.0
											28.9	31.1	250.0
											26.0	28.8	218.5

NEXT

12-36	1.7	202.0	3
12-45	5.8	148.0	3
12-78	7.3	125.0	4
36-45	5.2	132.5	3
36-78	4.2	225.5	3
45-78	0.7 *	156.5	3

							Remote Results Worst Margin Margin (dB)	Freq. MHz	Limit (dB)	Worst Value Margin (dB)	Freq. MHz	Limit (dB)
						.0	0.1	41.0	17.9	4.1	203.0	10.9
						.0	2.3	4.8	21.0	4.1	199.0	11.0
						.2	0.6	40.3	18.0	2.9	175.0	11.6
						.6	-3.1	16.9	19.9	-0.8	220.5	10.6
						.8	5.0	185.5	37.5	5.1	187.5	37.4
12-45	5.8	148.0	39.1	5.9	148.5	39.0	2.3	225.0	36.1	2.3	225.0	36.1
12-78	7.3	125.0	40.3	7.4	235.5	35.8	11.8	204.0	36.8	11.8	204.0	36.8
36-45	5.2	132.5	39.9	6.0	241.5	35.6	3.3	238.5	35.7	3.3	238.5	35.7
36-78	4.2	225.5	36.1	4.2	225.5	36.1	5.1	137.5	39.6	5.1	137.5	39.6
45-78	0.7 *	156.5	38.7	0.8	158.0	38.6	1.7	152.0	38.9	1.8	154.0	38.8

Common Mistake #3

Failing to specify which parameters are to be tested

#3 What parameters are to be tested

- Field testers are covered by ANSI/TIA-1152
- **Myth:** Covers all the test parameters in ANSI/TIA-568-C.2
- Scope: *This Standard includes requirements for field test instruments that are used to test balanced twisted-pair cabling as specified in the ANSI/TIA-568-C series of structured cabling standards. This Standard specifies the reporting and accuracy performance requirements of field testers for balanced twisted-pair cabling measurements.*
- **Fact:** You need to specify the parameters to be tested

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#3 What parameters are to be tested?

- Some are missing

	Balance Twisted Pair Certification	
	ANSI/TIA-568-C.2 (Cabling System Standard)	ANSI/TIA-1152 (Field Tester Standard)
Wire Map	✓	✓
Length	✓	✓
Propagation Delay	✓	✓
Delay Skew	✓	✓
DC Loop Resistance	✓	
DC Resistance Unbalance within a pair	✓	
DC Resistance Unbalance between pairs	✓	
Insertion Loss	✓	✓
NEXT, PS NEXT	✓	✓
Return Loss	✓	✓
ACR-F, PS ACR-F	✓	✓
TCL, ELTCTL	✓	
PS ANEXT, PS AACR-F [1)]	✓	✓

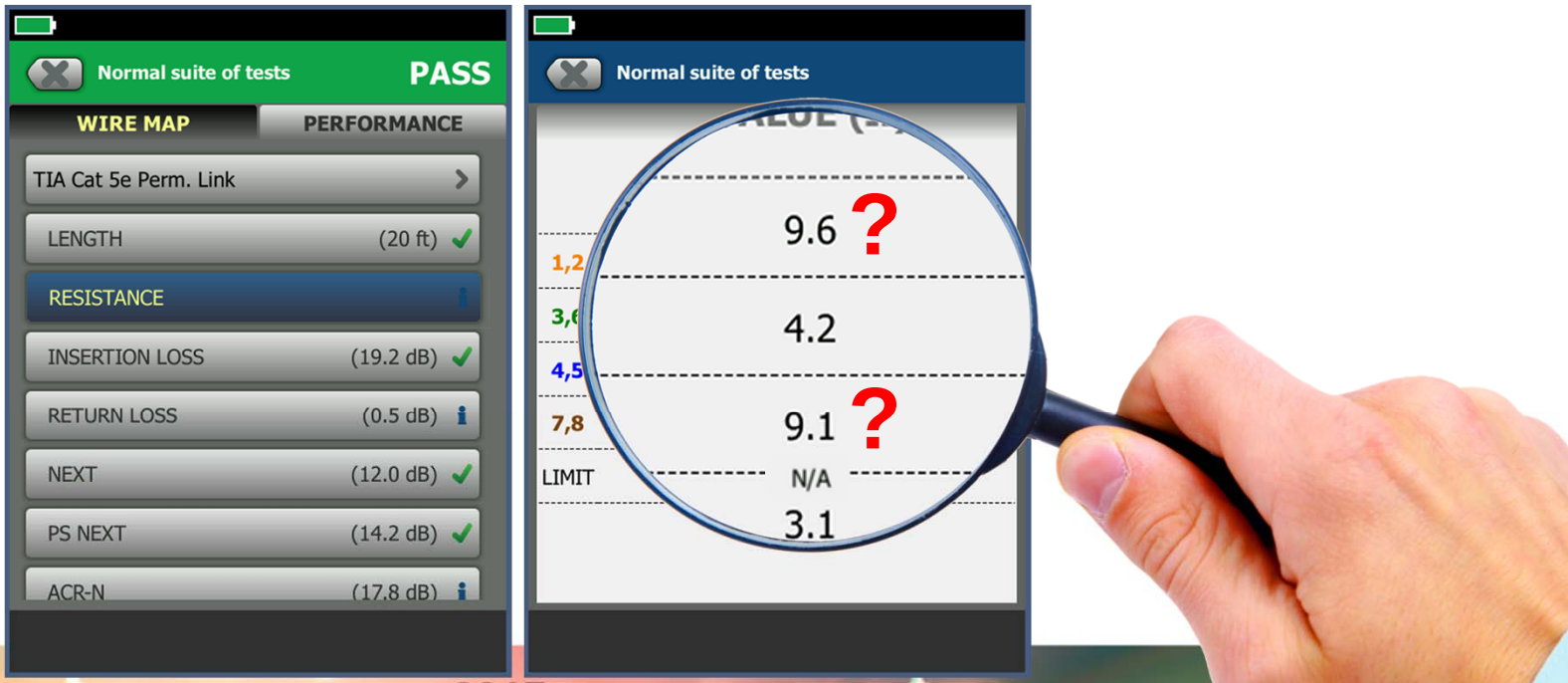
Important for PoE
"Optional" in "A" revision of 1152

Balance

1) Category 6 A only

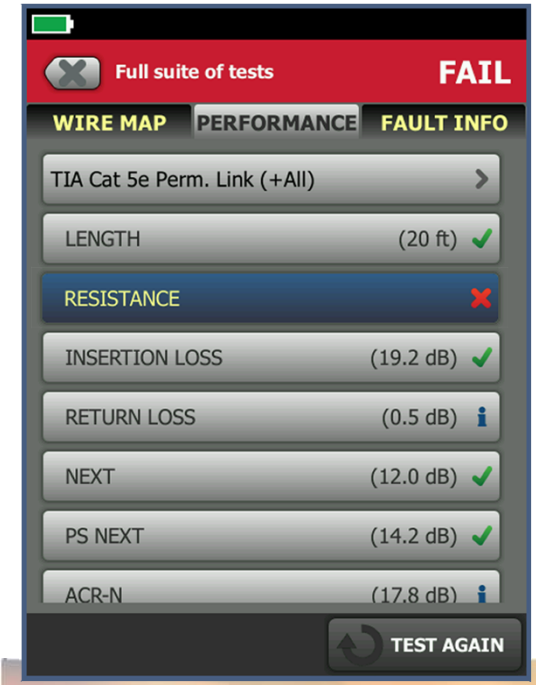
“Normal” Category 5e AUTOTEST

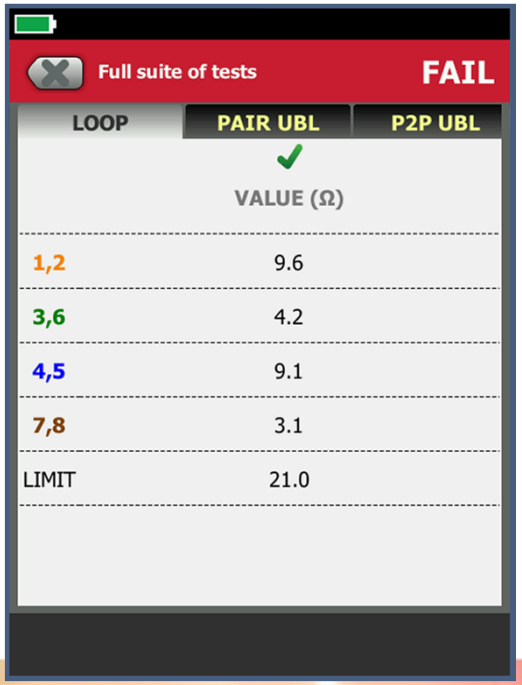
- The customer’s control panel was having issues

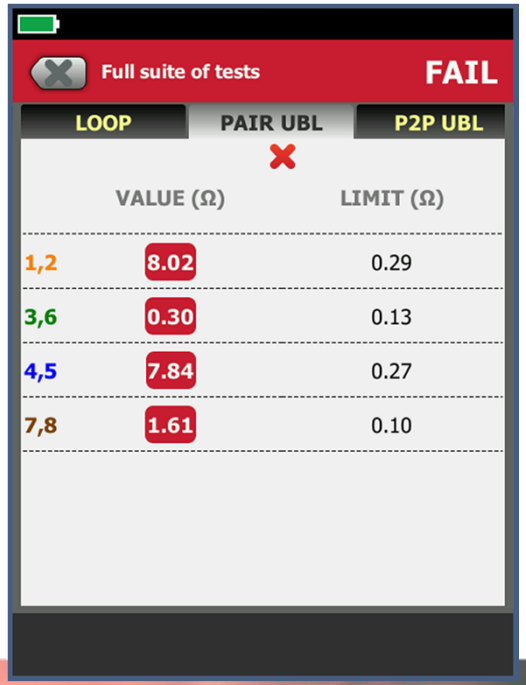


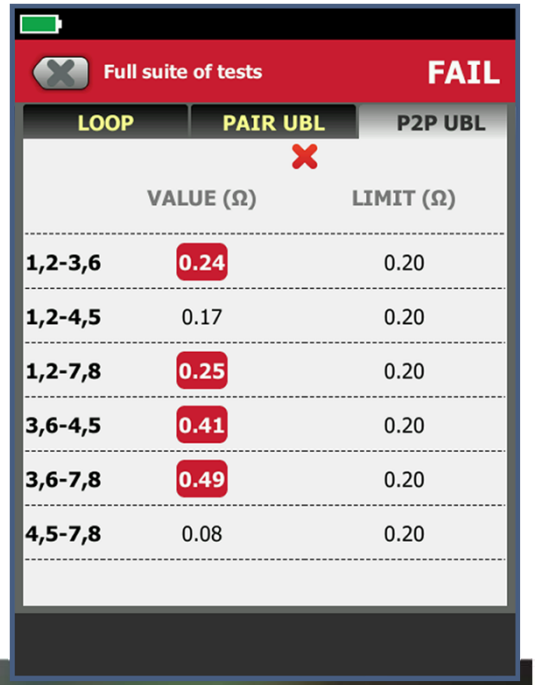
“Full” Category 5e AUTOTEST

- The customer’s control panel was having issues
- Mode of failure: **DC Contact Resistance issue**







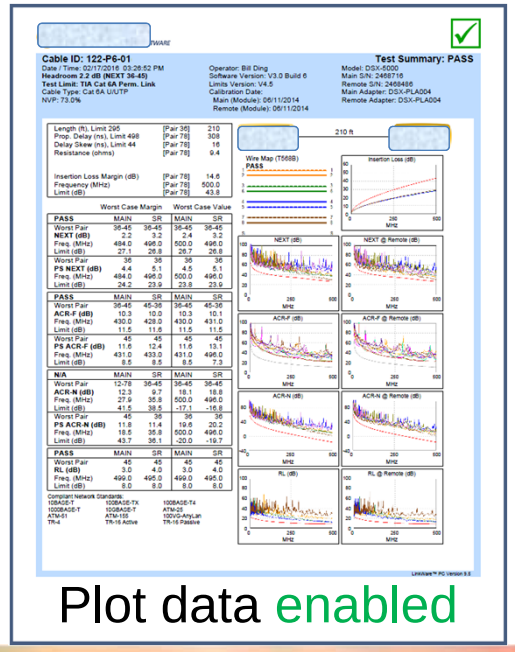


Common Mistake #4

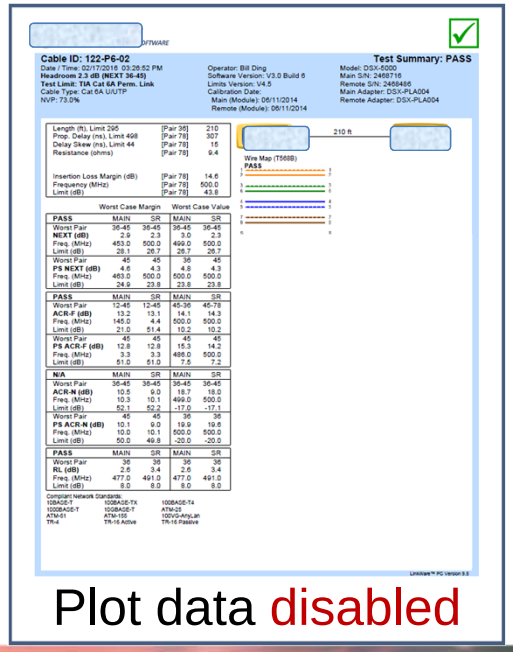
Failing to specify plot (graphical) data

#4 Failing to specify plot (graphical) data

- Not a requirement in any of the cabling standards
- Without plot data, your reports will look a little empty



Plot data enabled



Plot data disabled

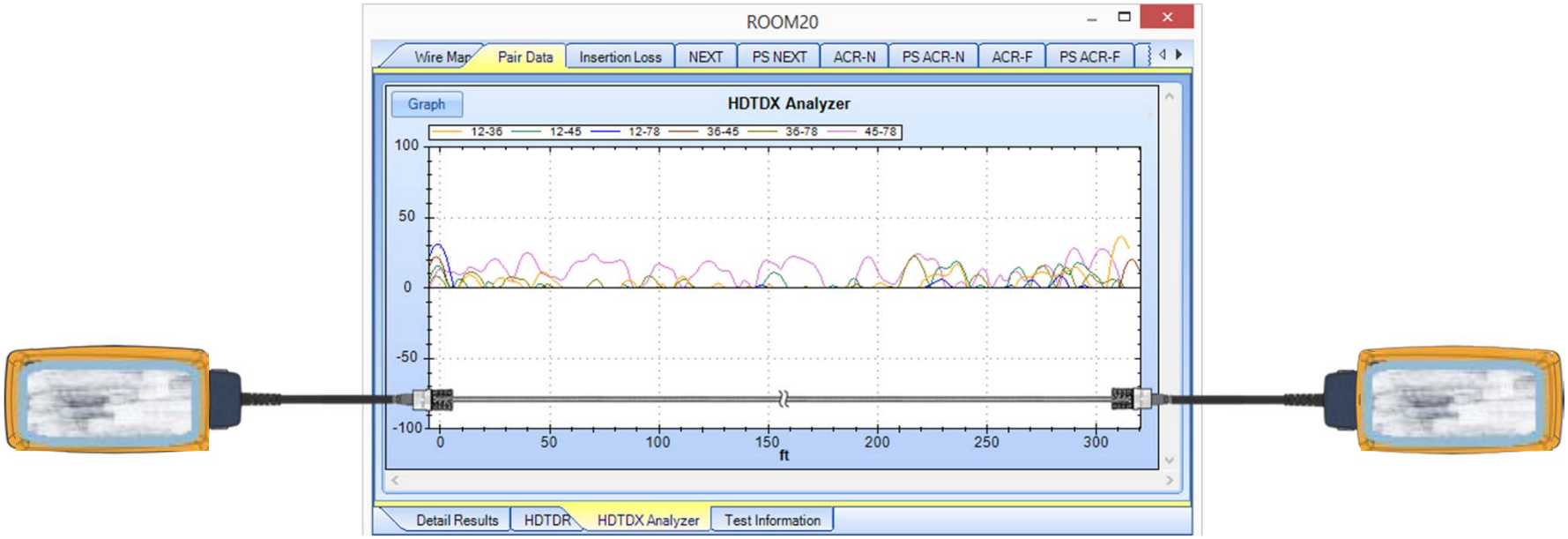
#4 Failing to specify graphical data

- Without Plot Data, Fault Identification in the Frequency Domain is a Challenge
- Is this Cable, Connector, or Installation?

	Worst Case Margin		Worst Case Value	
FAIL	MAIN	SR	MAIN	SR
Worst Pair	36-45	12-78	12-45	12-78
NEXT (dB)	-7.7F	-6.1F	-2.6	-5.6
Freq. (MHz)	88.8	10.8	248.5	245.0
Limit (dB)	42.7	57.3	35.4	35.5
Worst Pair	36	78	45	78
PS NEXT (dB)	-6.6F	-4.5F	-2.5	-4.3
Freq. (MHz)	88.8	10.9	248.5	245.0
Limit (dB)	40.2	54.9	32.7	32.9

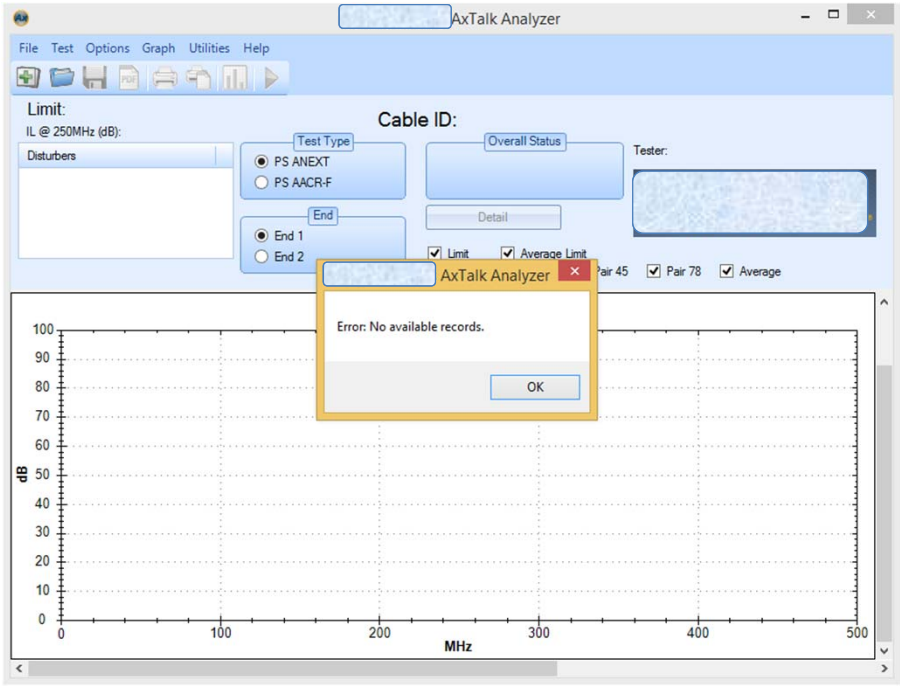
#4 Failing to specify graphical data

- With plot data, TDR Can Help to Find the Cause of Failing Results
- We able to confirm there was a cable issue



#4 Failing to specify graphical data

- Alien Crosstalk requires plot data from your in-channel tests
- Without plot data, you'll be re-testing those links



Common Mistake #5

Failing to agree on Alien Crosstalk testing

#5 Failing to agree on Alien Crosstalk testing

- **Myth:** ANSI/TIA specifies Alien Crosstalk testing, but it's optional

- **Reality check #1:**
  - Most cabling vendors offering a warranty do not require it

- **Reality check #2:**
  - Unless the test specification explicitly states that Alien Crosstalk is not required, the end user has a right to demand it, even if the cabling vendor does not require it for their warranty program (we have seen this happen)
- **Reality Check #3:**
  - This test will be requited for Category 8 installations

Common Mistake #6

Failing to agree on a sampling plan for Alien Crosstalk testing

#6 Failing to agree on a sampling plan

- ANSI/TIA does not specify a sampling plan
- You have to look to ISO/IEC 14763-2:
- Equal selection of
  - short, medium & long in length links

- Failure to do so could result in 100% alien crosstalk testing be demanded

Total no. of links/channels(N)	Sample size
3-150	3 or 0,1 x N (whichever is the greater)
151 – 3,200	33 [a]
3,201 – 35,000	126 [a]
35,001 – 150,000	201 [a]
150,001 – 500,000	315 [a]

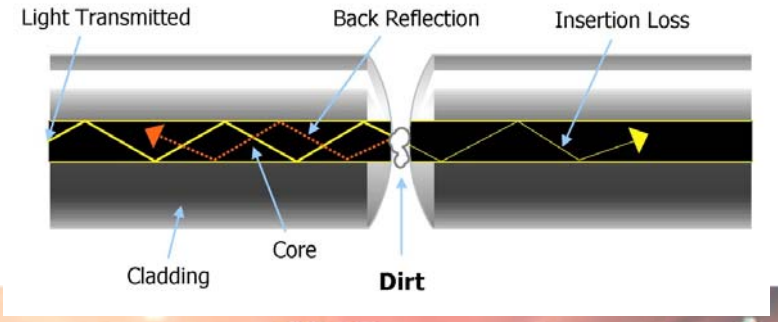
[a] Equivalent to acceptance quality level (AQL) of 0,4 %, normal inspection, general inspection level I as defined in ISO 2859 series for populations of up to 500,000 links.

Fiber Mistakes

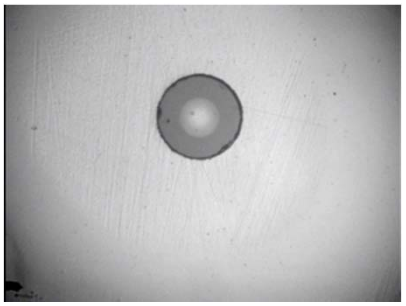
A COMMENT ON FIBER CLEANING

#1 Problem: Dirt!

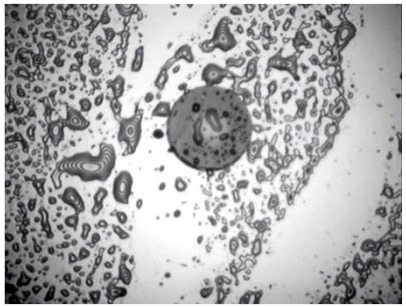
- **Contaminated connector end-faces: Leading cause of fiber link failures**
- **Particles of dust and debris trapped between fiber end faces cause signal loss, back reflection, and damaged equipment**
- **Many Sources of contamination:**
  - ***Equipment rooms & Telecommunication rooms in filthy environments***
  - ***Improper or insufficient cleaning tools, materials, procedures***
  - ***Debris and corrosion from poor quality adapter sleeves***
  - ***Hands of technicians***
  - ***Airborne***



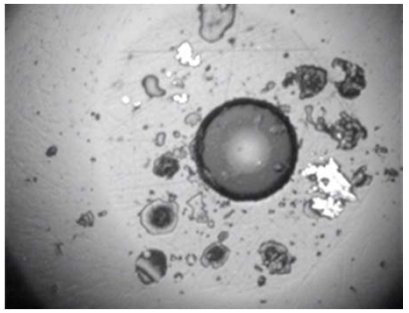
Inspection images



Good Connector



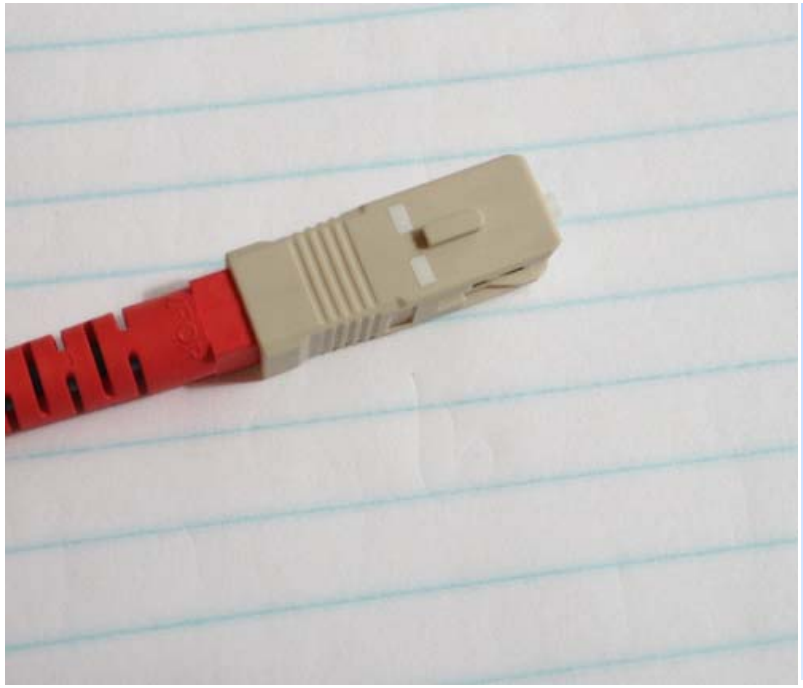
Fingerprint on Connector



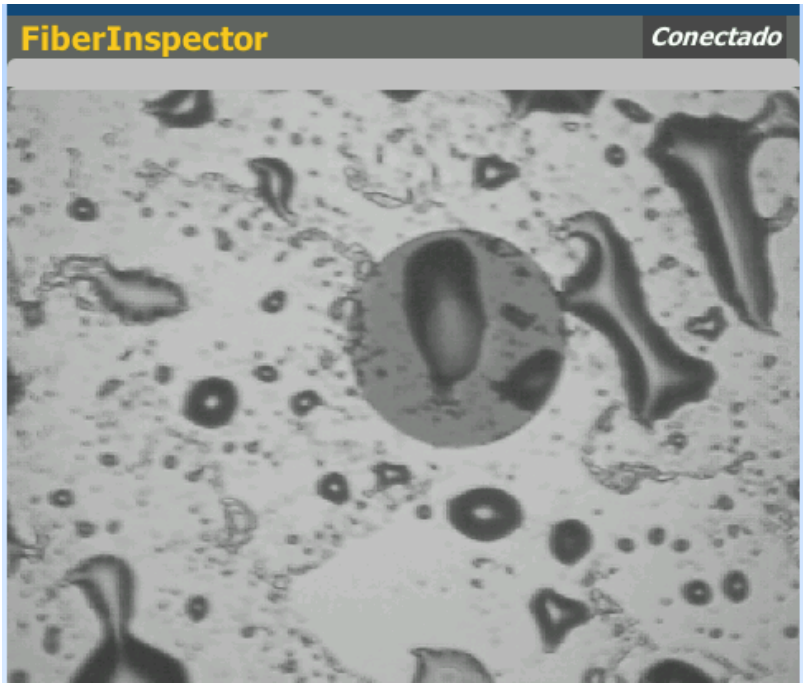
Dirty Connector

Real images

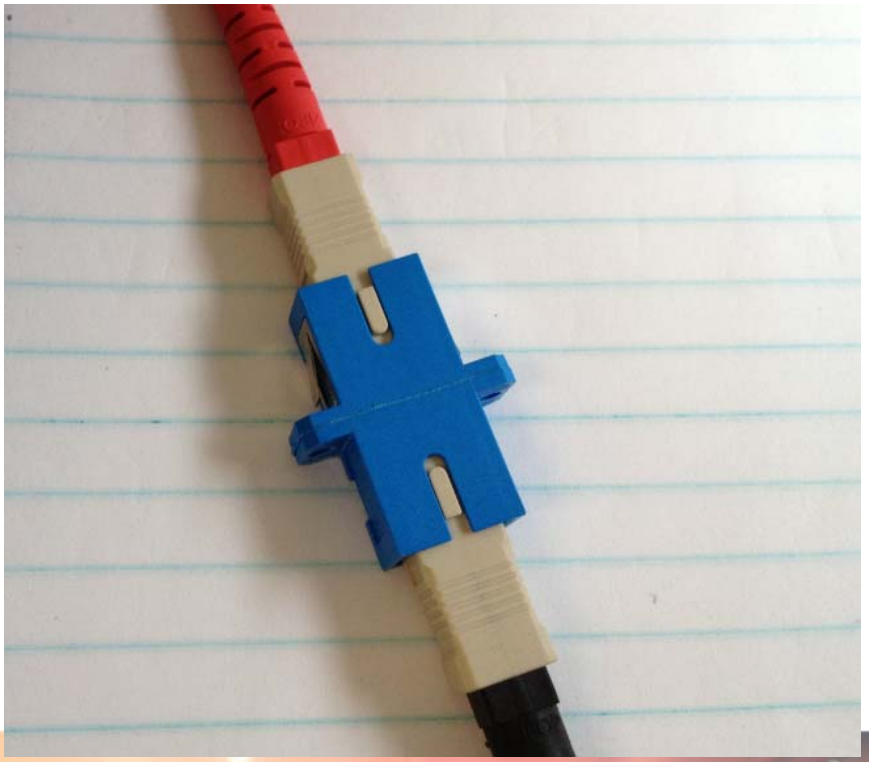
A Clean Connector



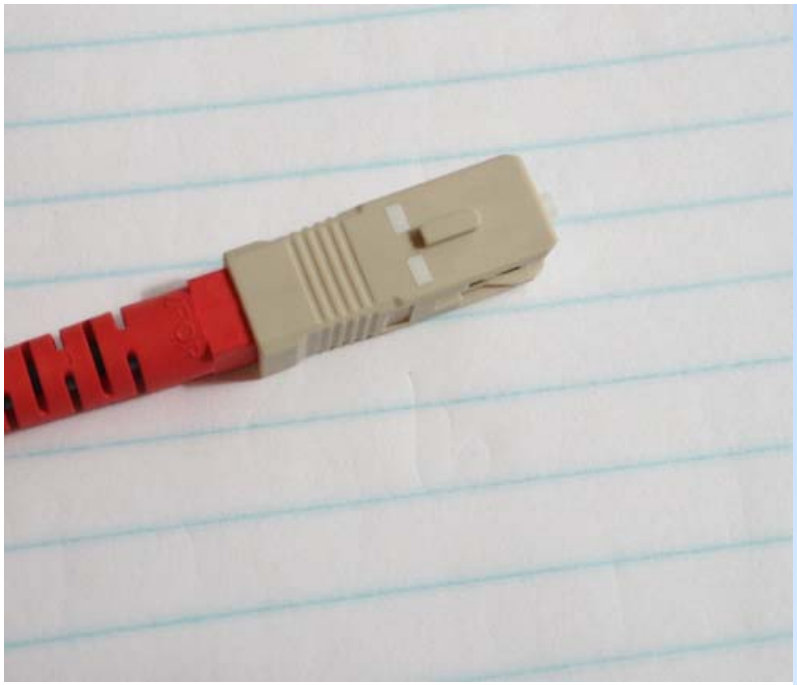
Connector with a Finger Print



This part of the presentation is only for those >17 years old

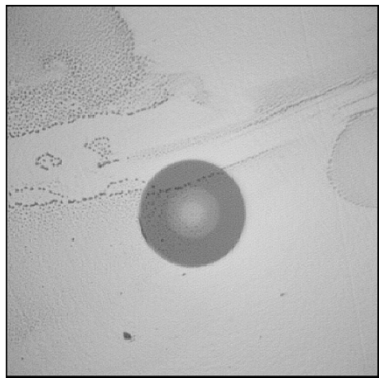


Notice the ring where the contact occurred in the center



Fiber Inspection

- We all know how important it is
- It is rare that calls to our Technical Assistance Center from techs have ANY inspection equipment – but they tell us they have cleaned it
- Cleaning without inspection can result in this:

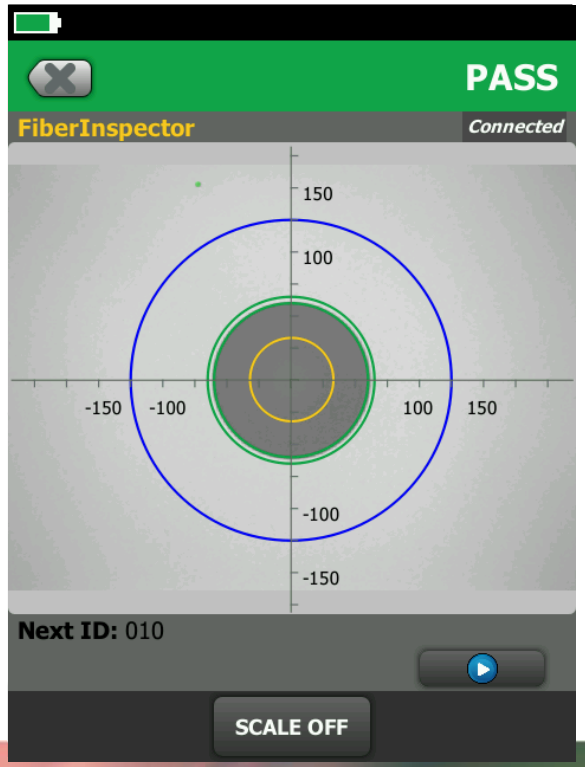


- Solvent pens are better than IPA

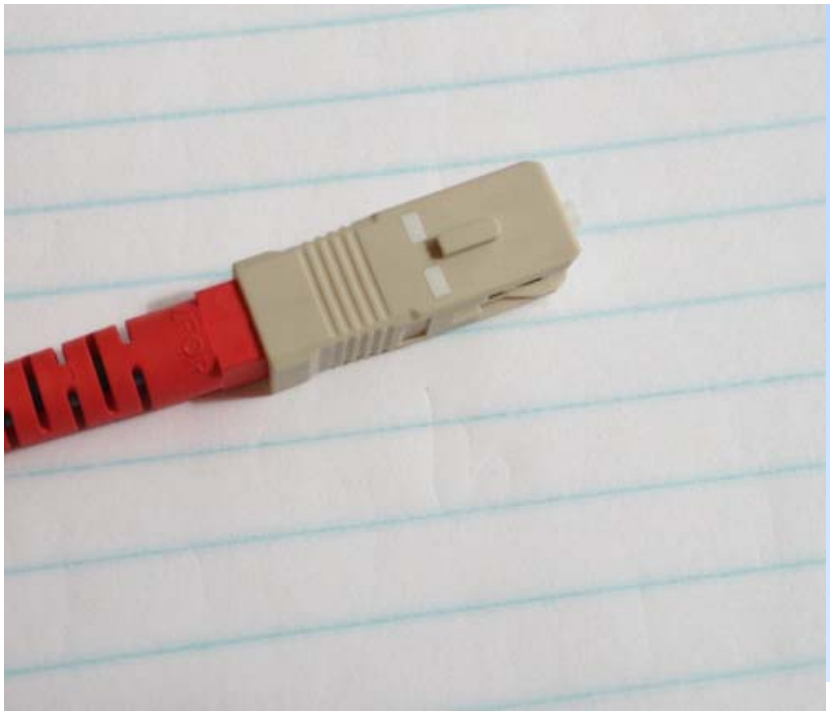
How Automated Analysis Works

IEC 61300-3-35 UPC Multimode Specification

	PC polished connectors, multimode fibers	
Zone Name	**Scratches**	**Defects**
Core	No limit <= 3 um 0 > 3 um	2 <= 3 um None > 3 um
Cladding	No limit <= 5 um 0 > 5 um	No limit < 2 um 5 from 2 um to 5 um None > 5 um
Adhesive	No limit	No limit
Contact	No limit	No >= 10 um



Cleaned ***and*** Inspected



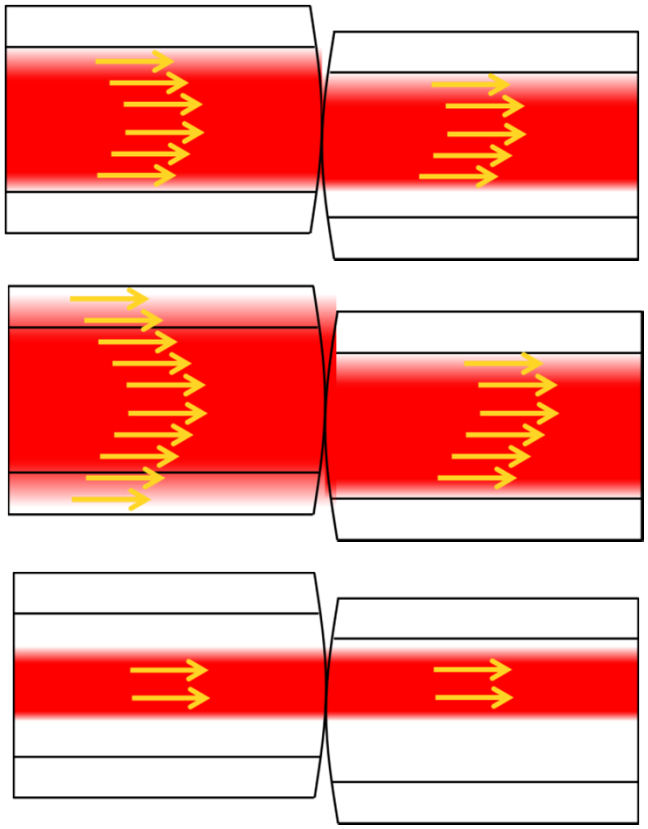
Common Mistake #7

Not being Encircled Flux compliant

#7 Not being Encircled Flux compliant

- Did you agree to ANSI/TIA-568.3-D or ISO/IEC 11801?
- Then you agreed to be Encircled Flux compliant
- Annex E, Section 2.2 of ANSI/TIA-568.3-D
  - For multimode cabling, cabling standards describe that attenuation measurements are taken according to ANSI/TIA-526-14-C.
  - TIA 526-14-C specifies that the output of the launch cord meet specific launch conditions. For example, the encircled flux launch condition can be achieved by using a universal controller or a matched controller (see TSB-4979).

Encircled Flux Improves Precision



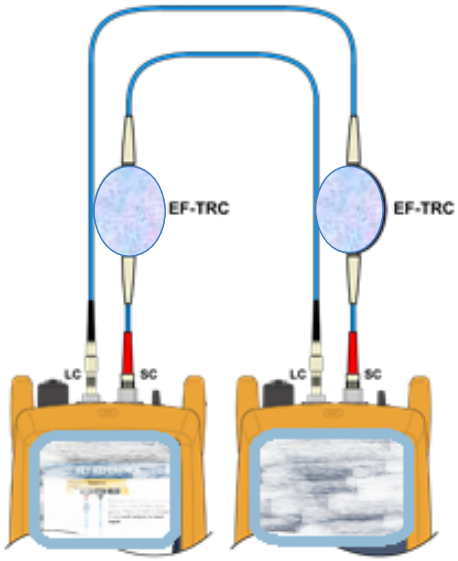
- EF compliant = just enough light
  - Measure the right loss
  - Passes good links
  - Fails bad links
- Overfilled = too much light near the edge
  - Measures high loss
  - Fails good links
- Underfilled = not enough light near the edge
  - Measures low loss
  - Passes “everything”

Common Mistake #8

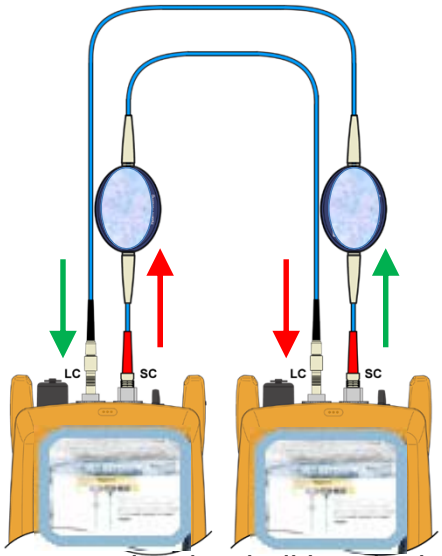
Failing to specify a reference method

#8 Failing to specify a reference method

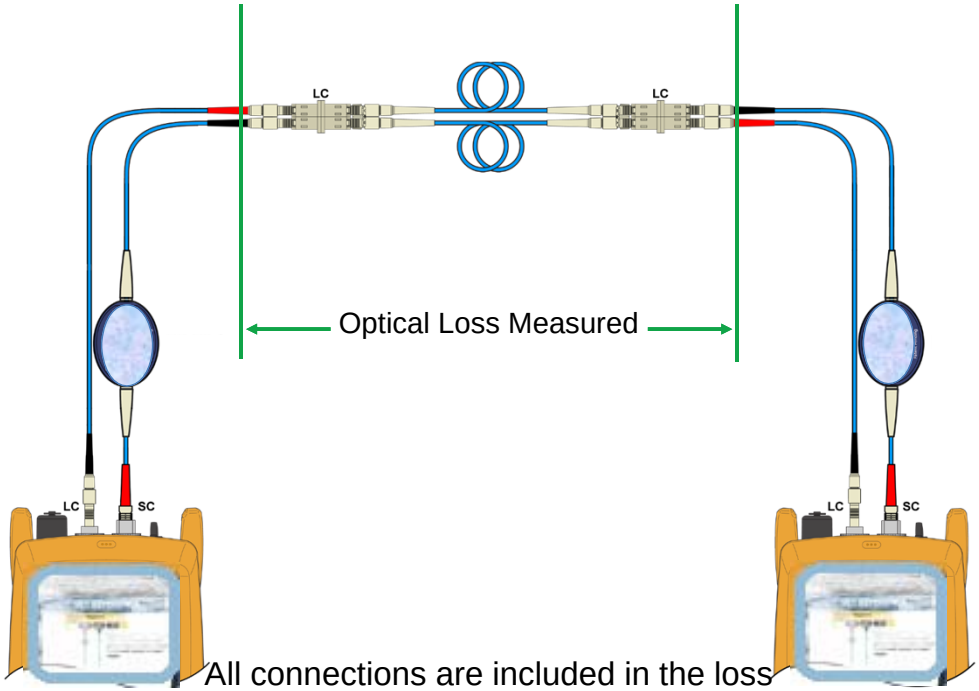
- **Myth:** ANSI/TIA-568.3-D requires a 1 jumper reference
- Section 7.3.1
  - The one cord reference method is preferred for both multimode and single-mode links. Other methods as detailed in the above standards may be applied. Test documentation should include the test method applied
- If you want a 1 jumper (one cord) reference, you must specify it in your test specification
- Most cabling vendors will reject other reference methods



1 Jumper Reference

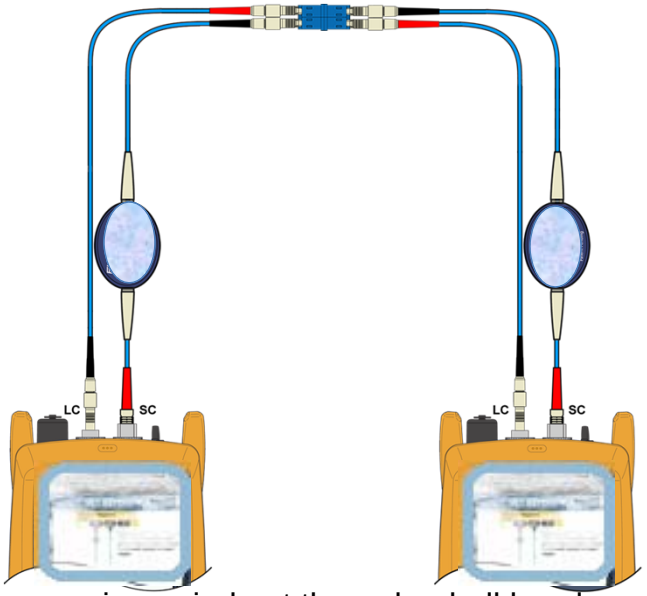


Direct connection (No bulkhead adapter!)

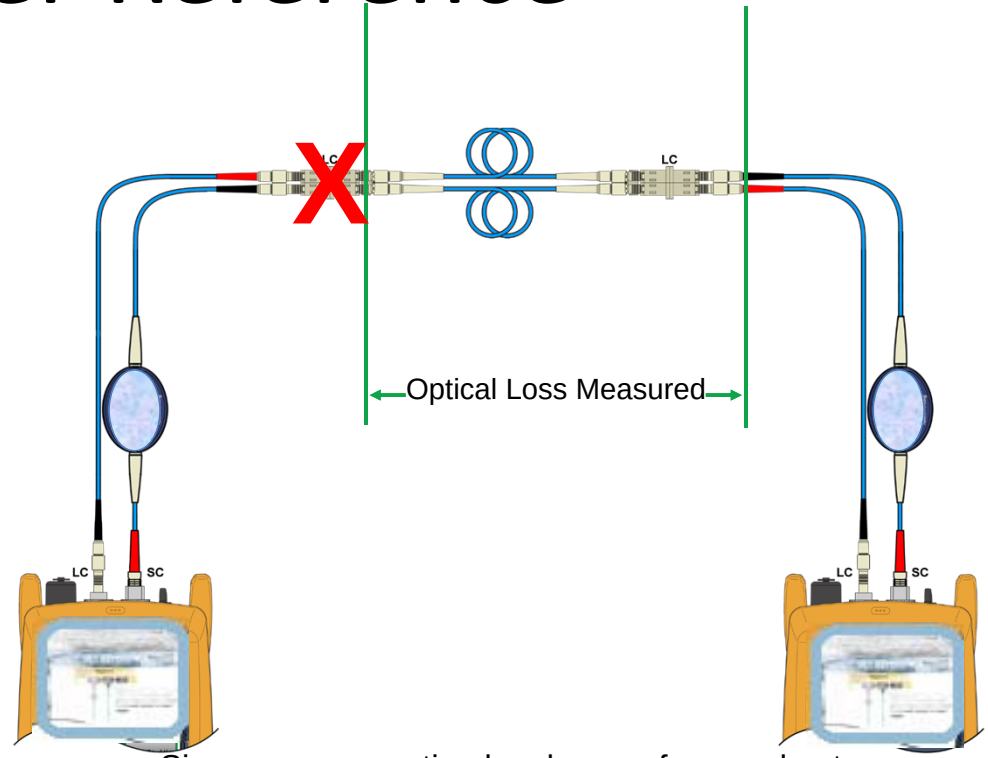


All connections are included in the loss measurement

2 Jumper Reference

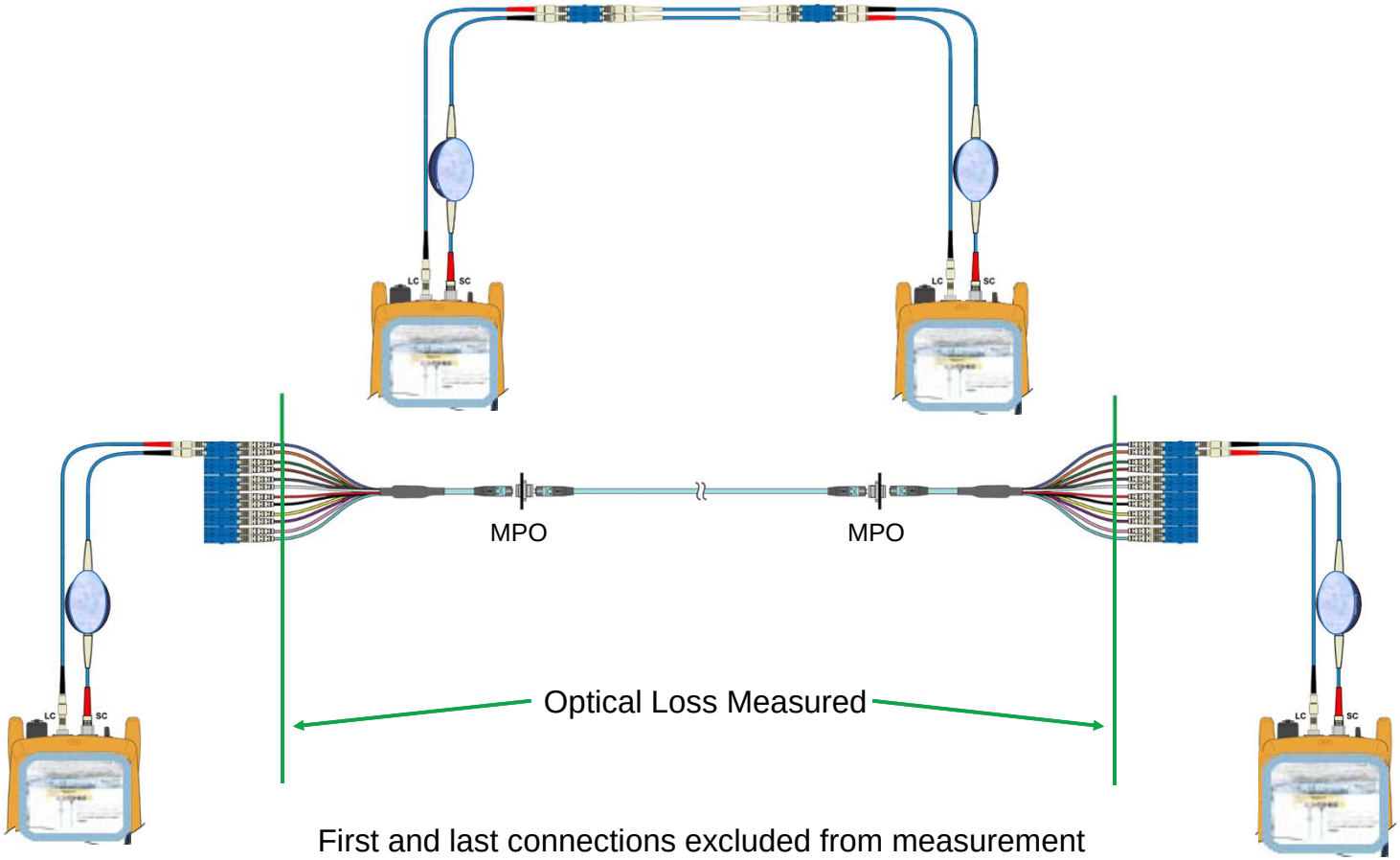


Reference is carried out through a bulkhead adapter



Since one connection has been referenced out, you are only measuring one connection here

3 Jumper Reference



First and last connections excluded from measurement

Common Mistake #9

Failing to specify test reference cords

#9 Failing to specify test reference cords

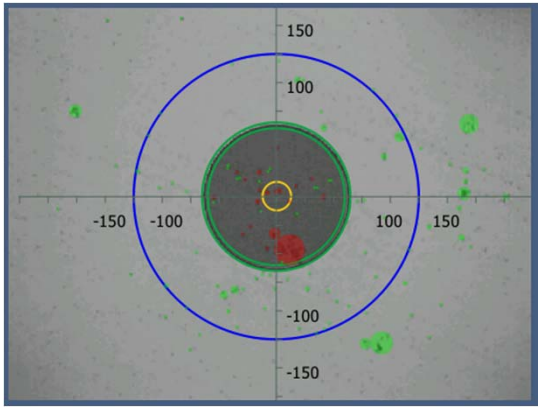
- ANSI/TIA-568.3-D
  - ANSI/TIA-526-7-A and ANSI/TIA-526-14-C recommend the use of reference-grade terminations on test cords
- ANSI/TIA-526-7-A (**Singlemode**)
  - **0.2 dB** for a reference grade to reference grade connection
- ANSI/TIA-526-14-C (**Multimode**)
  - **0.1 dB** for a reference grade to reference grade connection

Common Mistake #10

Failing to document test reference cord losses

#10 Failing to document test reference cord losses

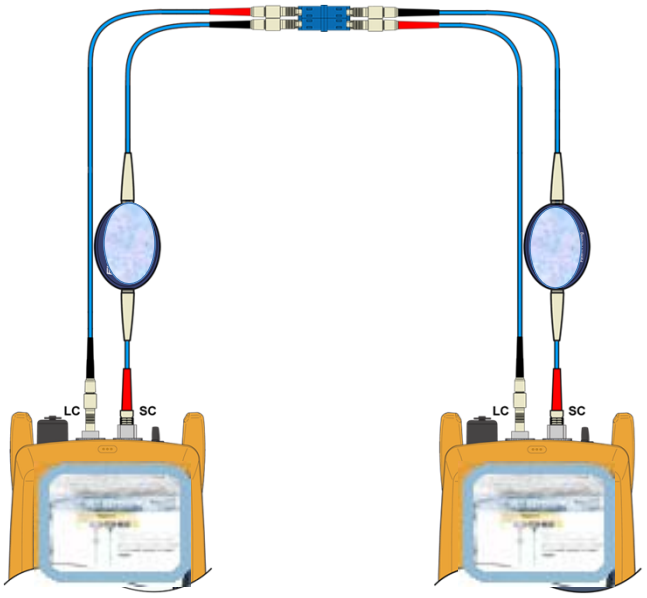
- Test reference cords will “wear out” with use
- Poor/damage cords will destroy your installation



Inspected to IEC 61300-3-35

- If you have specified a 1 jumper reference
  - Require them to be verified every 288 tests
  - Verification of test reference cords to be saved and submitted

Verification of “Known Good” Leg of TRC



Expected Test Results are:

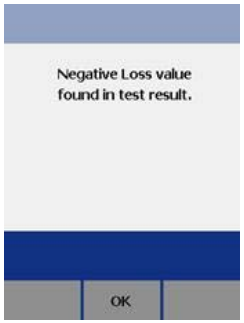
- 0.1 dB for Multimode
- 0.2 dB for Single-Mode

Common Mistake #11

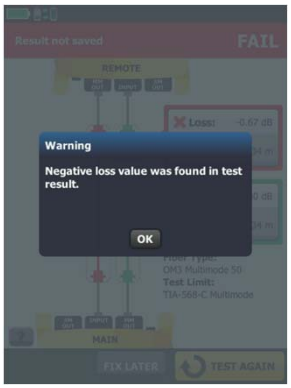
Specify negative losses are to be rejected

#11 Specify neg. losses are to be rejected

- ANSI/TIA-568.3-D
  - No text specifically stating a negative loss result is to be classified as a FAIL
  - *……Consult the equipment manual to determine the sign of power loss readings, as a reading of the wrong sign is often an indication of improper setting of the reference power level*.



Tester A
Warning given



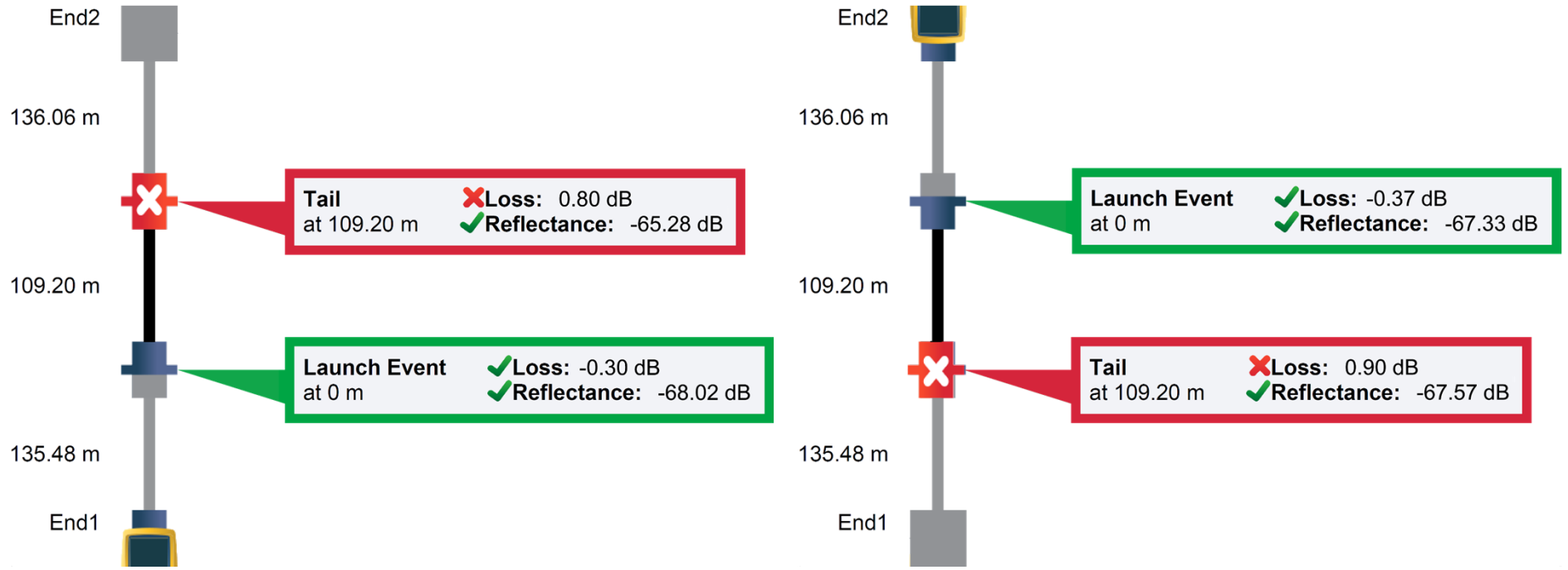
Tester B
Warning & fail given

Common Mistake #12

Failing to specify bi-directional averaging for OTDRs

#12 Failing to specify bi-directional averaging for OTDRs

- A mismatch in backscatter between the test and installed fiber can cause a negative loss event and/or a false failure



#12 Failing to specify bi-directional averaging for OTDRs

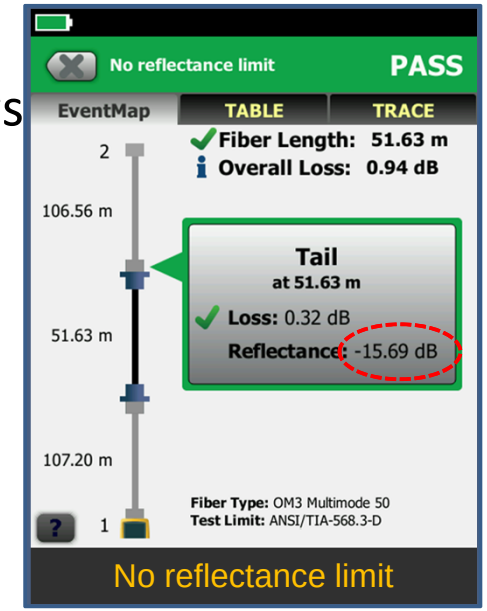
- Bi-directional averaging resolves any mismatches

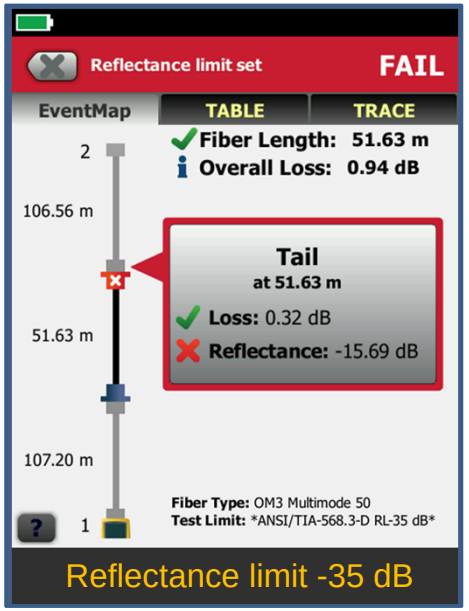
Common Mistake #13

Failing to agree on a reflectance limit

#13 Failing to agree on a reflectance limit

- OTDR loss event measurements heavily rely on good reflectance
- Poor reflectance can result in
  - Optimistic / negative loss readings
  - Errors when the application runs
- Agree on a reflectance limit
- As a guide (talk to your vendor)
  - -35 dB for multimode
  - -40 dB for singlemode
  - -55 dB for APC singlemode





Same link tested

Twisted pair lessons learned today

- Ensure your standards reference are current
  - Look to www.ihs.com for the latest versions – invest in copies
- Specify Permanent Link or Channel testing
  - Permanent Link required by most cabling vendor warranty programs
- Call out what tests are to be conducted
  - Find potential DC contact resistance issues during the installation process
- Require graphical data
- Specify whether marginal passes are acceptable or not
- State whether Alien Crosstalk testing is required or not
  - If required, agree on a sampling plan in writing

Fiber lessons learned today

- If you are testing to ANSI/TIA or ISO/IEC, you must be EF compliant
- Specify a fiber reference method
- Specify negative losses are to be retested
- Test reference cords:
  - Specify them and verify their performance every 288 tests
- If OTDR testing:
  - Specify bi-directional averaging and agree on a reflectance limit

Final word

- It is much easier to argue your point when you have a copy of the standard in your hand – please invest in copies of standards

www.ihs.com

www.iso.org

Thank you for your time

Jim.Davis@flukenetworks.com

Regional Marketing Engineer – Americas

Fluke Networks