- **Measurement & Training services**
- Optical, protocol, video, power, power quality & energy
- **Power quality & EMC**
- Fixed and portable PQ & energy monitoring, EMC immunity
- **Telecommunication & networks**
- Wireless & wireline testing, optical transport testing
- **Video & CATV**
- HDTV/SDTVwaveform monitoring, MPEG analyzers
- **Fiber**
- Physical layer testing, protocol testing, fiber splicers & cleaning

OTDR measurement software providing maximum intelligence and simplicity for expert-level characterization.

iOLM

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Application Engineering

March 2015

EXFO

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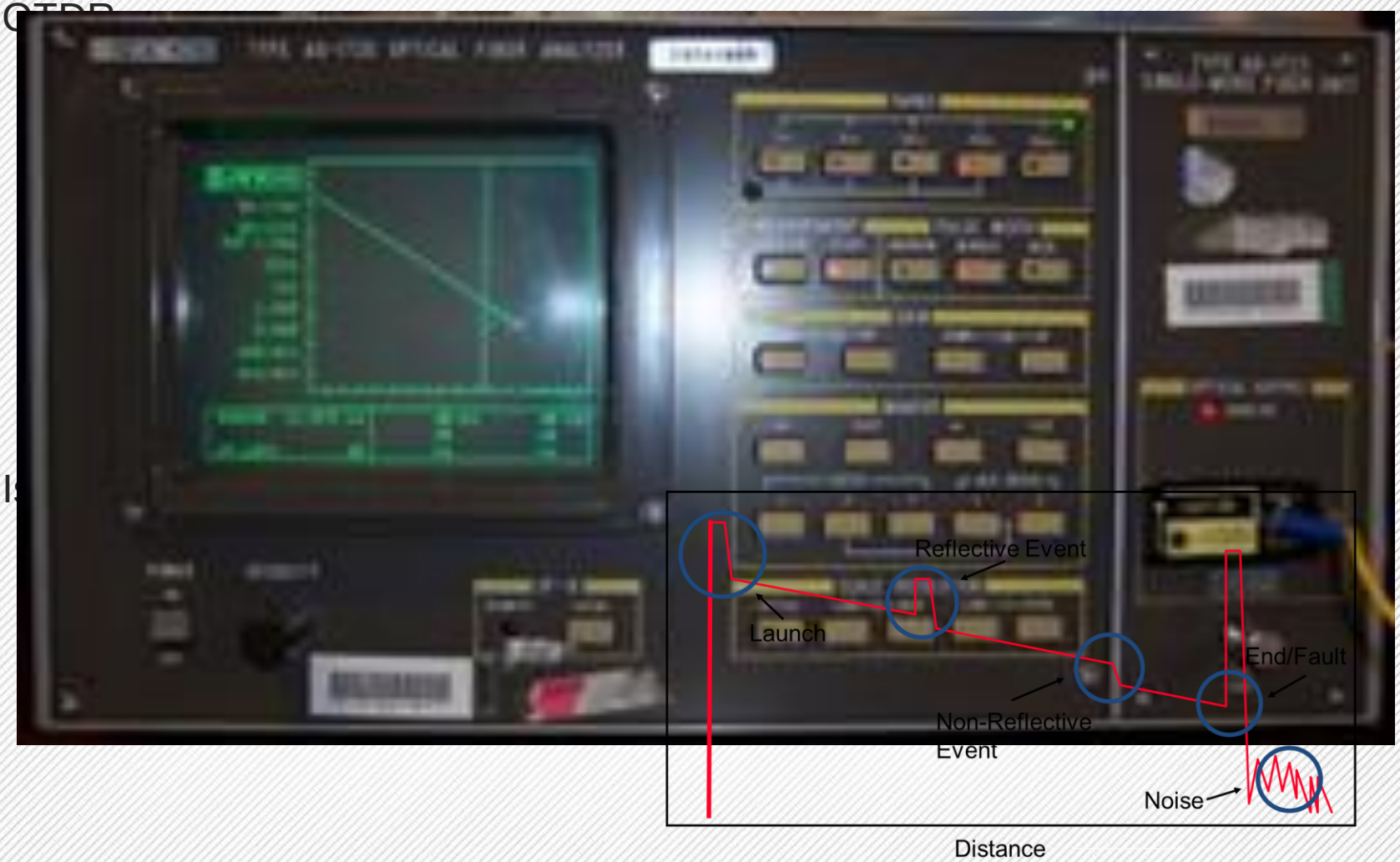
OTDR

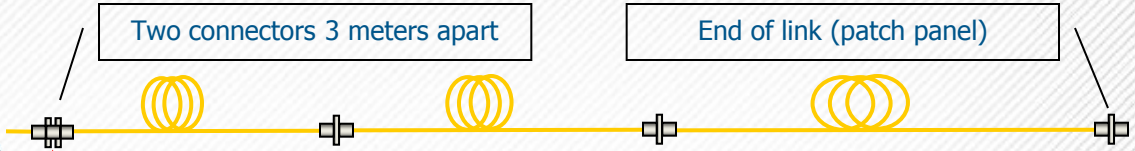
› OTDR

› Is

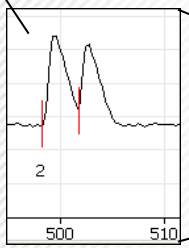


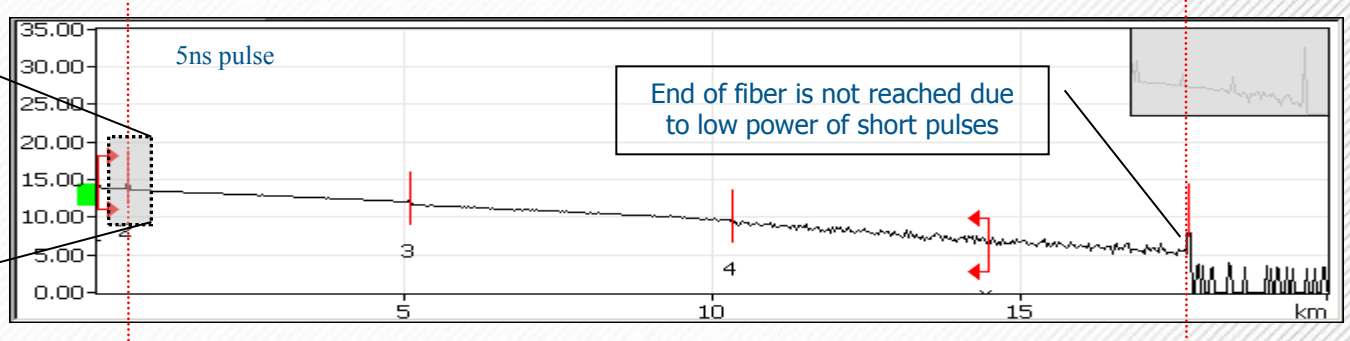
Pulse width & Resolution

- Short pulses will give a better resolution but less dynamic range:



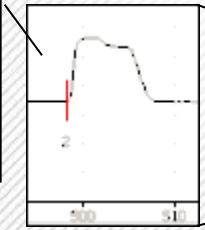
Connectors are measured for distance and marked as separate events

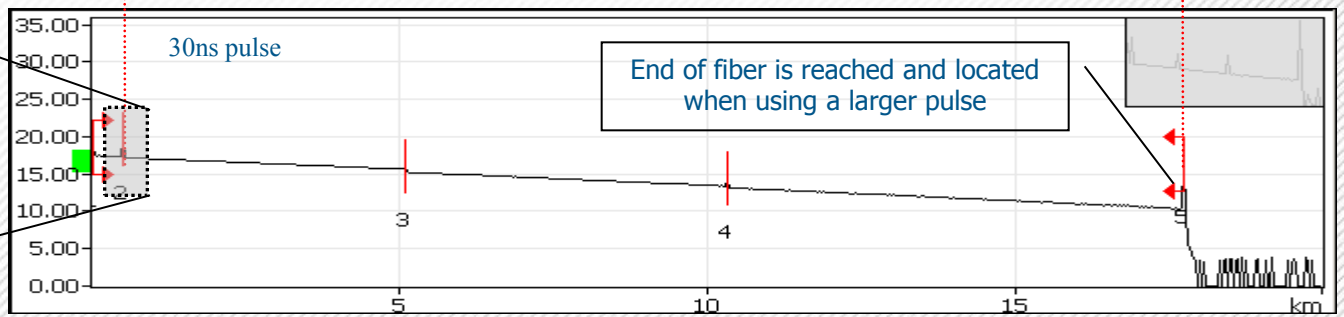




- Long pulses will give a better dynamic range but less resolution

Connectors are « merged » and identified as one event





OTDR Challenges

- OTDR
  - Characterise the fibre & events in a link.
  - Ensure that it has been installed correctly and prove that the link will carry the traffic it is designed for
- Is it a perfect tool?
  - Different pulse widths give different power & different resolution
- **Challenges**
- **Different engineers will use different settings = different results**
- **Wrong diagnosis may lead to the wrong solution.**

OTDR Challenges continued

- **Growth of fibre optic installations**
  - Number of optical connections increasing
    - FTTH Europe – End of 2014 nearly 60Million homes passed*
    - Growth of data centres >50,000 optical connections/data centre
  - To install & test all these links we have lots of new engineers
    - Level of training ?
    - Can they choose the right settings?
      - 5s @ 250ns
      - 15s @ 100ns
    - Can they interpret the trace/results given to them
    - **Wrong diagnosis may lead to the wrong solution**

*FTTH Europe IDATE data Dec 2014

OTDR Challenges continued

Different types of networks

Good old days

- Long haul
- Access

Today

- Metro
- FTTH
  - PT 2 PT
  - Single split
  - Cascaded split
- FTTA
- Mobile backhaul
- DAS
- Data Centers

Different networks require different OTDR settings to be tested correctly

OTDR Challenges continued

- **Volume of links to be tested**
  - Some jobs can take testers months to test
  - Time to report!!!!

Challenges Summary

- Different settings = Different results
- Different skills level = Different results
- Different skills level = Interpretation of results
- Different network types = Requiring different settings
- Volume of work (time to complete/time to report)

System failure

Repeat Truck rolls

Re-tests

Delays

Solutions

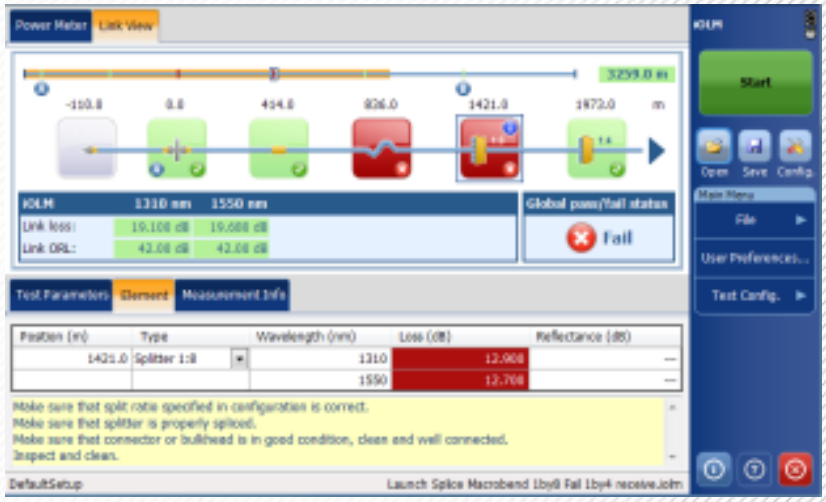
Multi pulse – Icon based view

Get multiple OTDR fast acquisitions @every pulses & @every wavelength

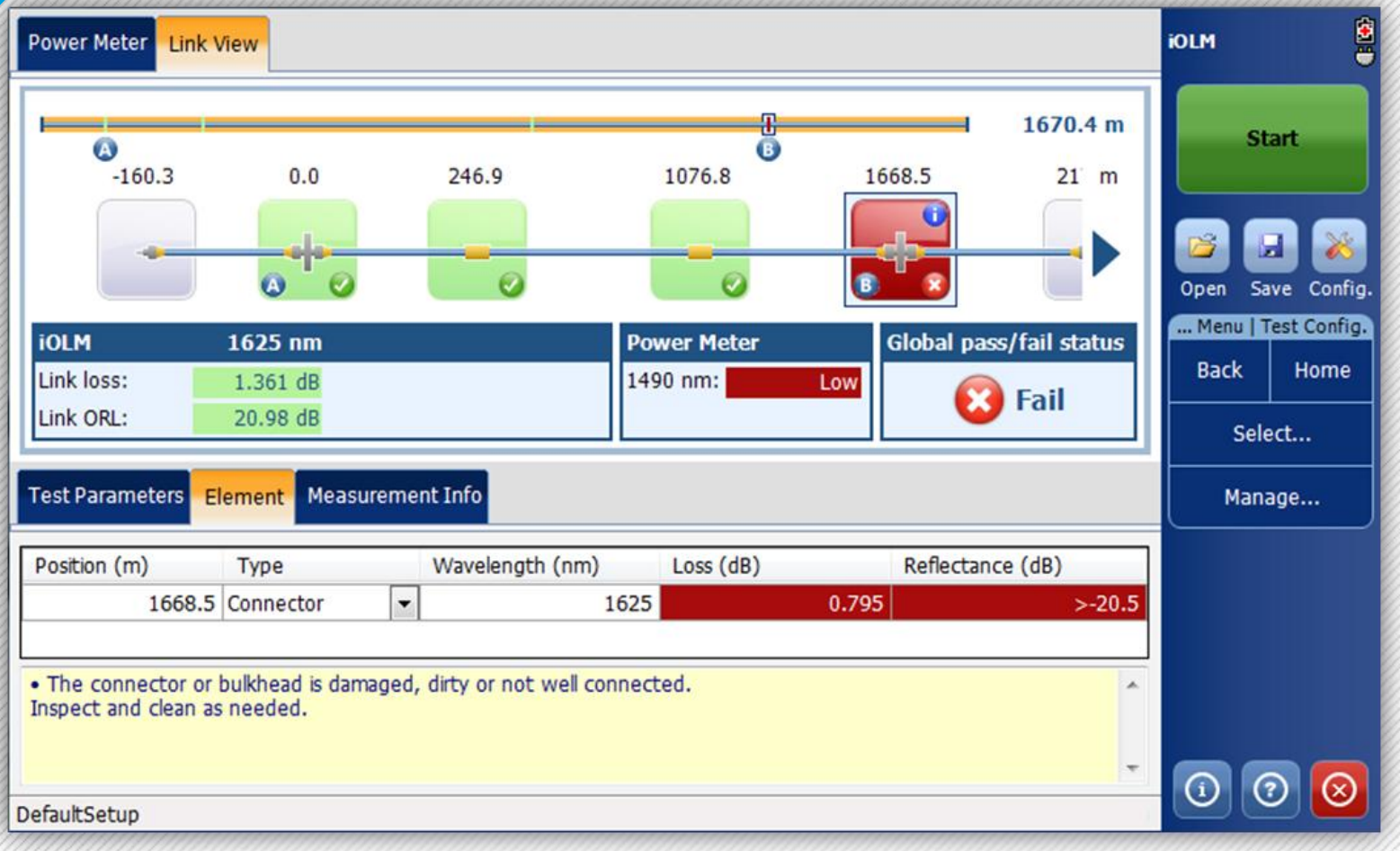
Analyze OTDR traces

Combine results

Display optical link view



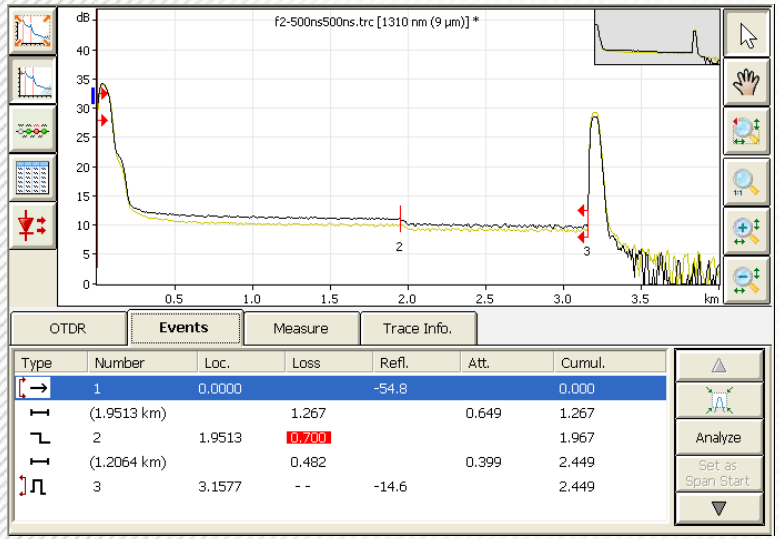
iOLM



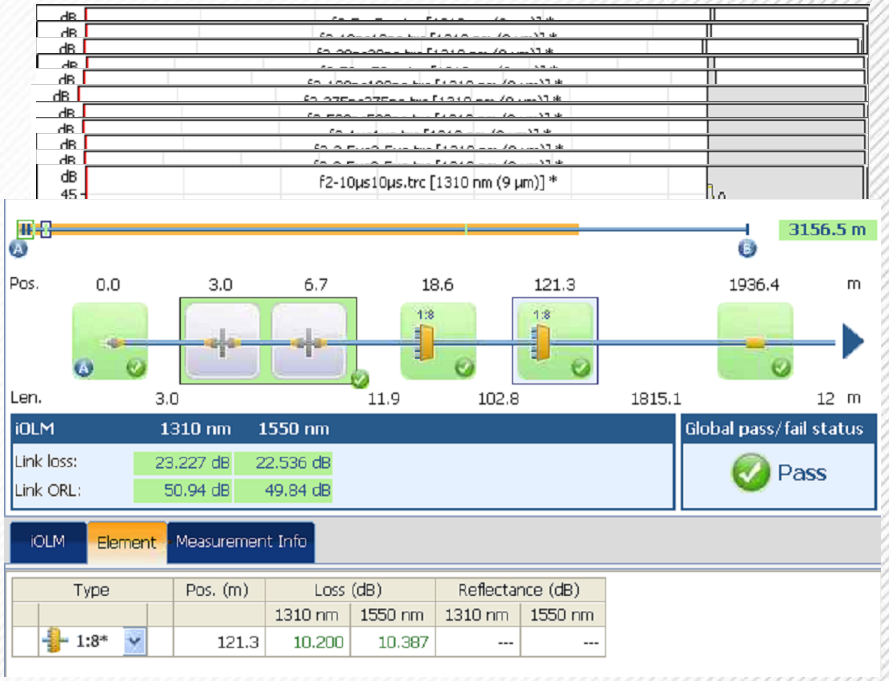
- Each event has an Icon
- Pass/Fail within config
- Different networks can have their own config
  - Adapts dynamically to what the instrument sees
    - No fixed pulse widths

iOLM vs OTDR

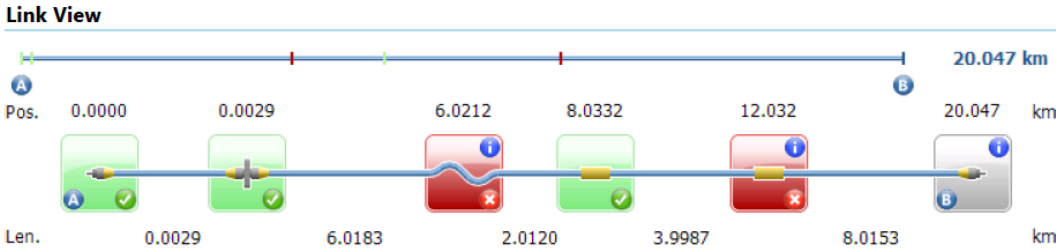
› OTDR: Single pulse



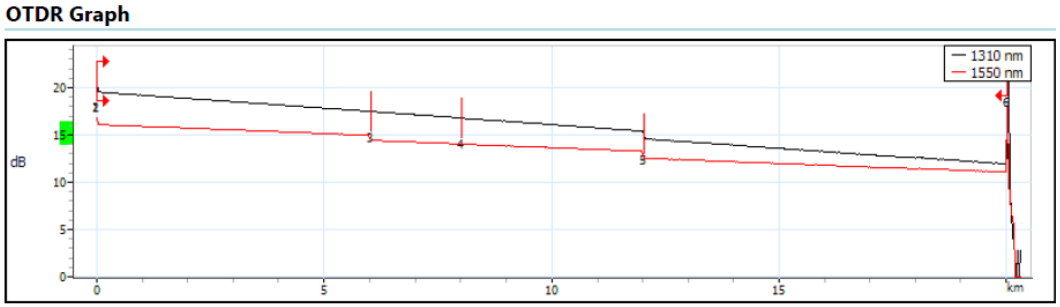
- IOLM™: Multipulses with smart recognition and diagnostic



iOLM - Reporting



Icon based view



OTDR trace

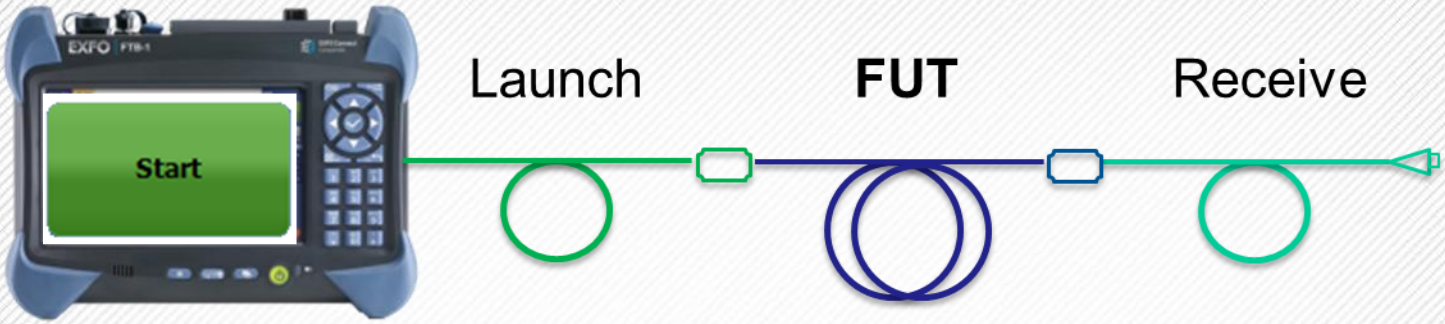
Element Table

Type	No.	Pos. (km)	Loss (dB) 1310 nm	Loss (dB) 1550 nm	Refl. (dB) 1310 nm	Refl. (dB) 1550 nm	Diagnostic
Connector (A)	1	0.0000	-0.065	-0.035	-67.7	-72.1	
Connector	2	0.0029	0.329	0.271	-56.1	-56.8	
Macrobend	3	6.0212	0.010	0.535	---	---	• Inspect the fiber in this area to search for excessive bending or cable compression.
Splice	4	8.0332	0.031	0.030	---	---	
Splice	5	12.032	0.817	0.728	---	---	• Make sure that the fiber is properly spliced. The loss could be due to a low-reflectance (APC) connector. • Make sure that the fiber is properly spliced. The loss could be due to a low-reflectance (APC) connector.
Connector (B)	6	20.047	---	---	-14.8	>-16.5	• To characterize loss and include the element in link loss and ORL, a receive fiber is required. • Element reflectance is greater than the indicated value. It is not possible to determine beyond any doubt that the value is pass. • Element reflectance is greater than the indicated value. It is not possible to determine beyond any doubt that the value is pass.

Event table

Further solutions: Certification

Use iOLM with launch and receive cords to measure loss



- ISO_IEC 11801-2002 Fiber Link
- ISO_IEC 11801-2002 OF-2000 CH
- ISO_IEC 11801-2002 OF-300 CH
- ISO_IEC 11801-2002 OF-500 CH
- ISO_IEC 11801-2010_ISP
- ISO_IEC 11801-2010_OS1_OMx
- ISO_IEC 11801-2010_OS2_OMx
- ISO_IEC 11801-2010_OSP
- ISO_IEC 14763-3 _2011_OS1_OMx
- ISO_IEC 14763-3 _2011_OS2_OMx

iOLM Report

Pass

Element Table

Type	No.	Pos./Len. (km)	Loss (dB) 1310 nm	Loss (dB) 1550 nm	Refl. (dB) 1310 nm	Refl. (dB) 1550 nm	Att. (dB/km) 1310 nm	Att. (dB/km) 1550 nm	Diagnostic
Connector		0.5061	0.546	0.552	---	---			
Section		0.5061	0.190	0.103			0.375	0.203	
Connector (A)	1	0.0000	0.333	0.342	-65.2	-65.8			
Section		0.1572	0.049	0.003			0.311	0.020	
Connector (B)	2	0.1572	---	---	-56.2	-47.8			• To characterize loss and include the element in link loss and ORL, a receive fiber is required.

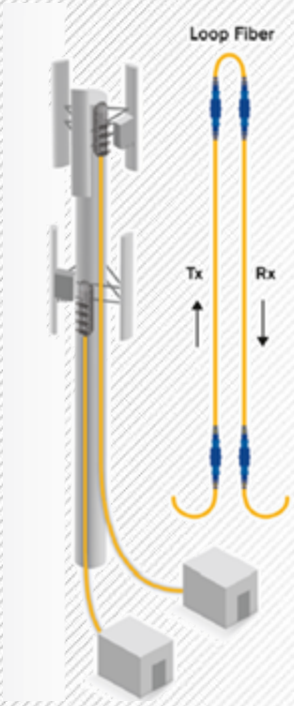
iOLM Pass/Fail Thresholds

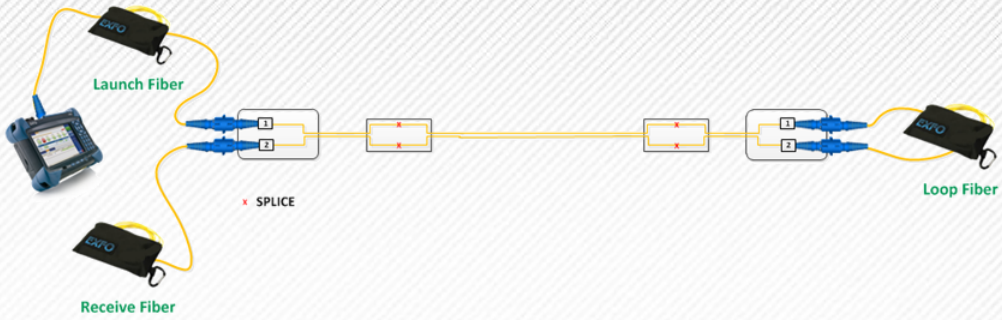
ANSI_TIA-568-C3_ISP

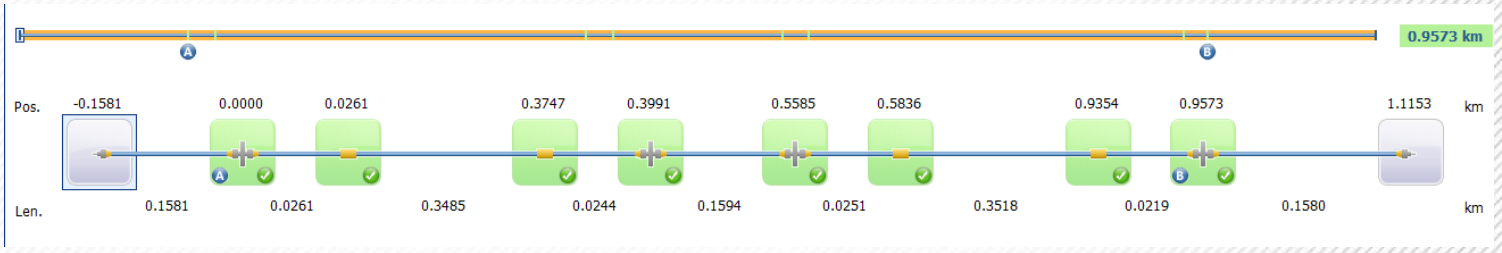
iOLM Parameters and Settings

Test configuration:	ANSI_TIA-568-C3_ISP	Fiber core size:	9 µm
Launch fiber:	0.5099 km	IOR (1550 nm):	1.473000
Receive fiber:	0.0000 km	Backscatter (1550 nm):	-81.87 dB

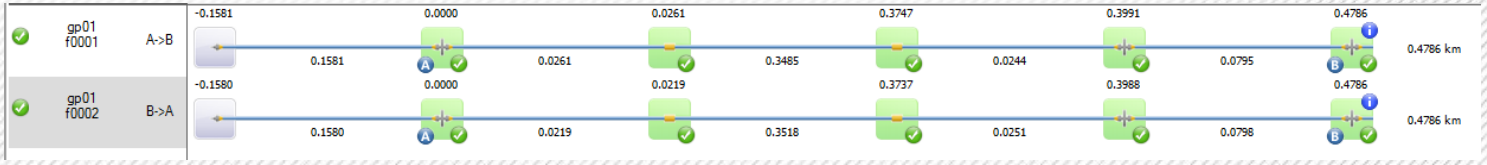
Further solutions: Loopback





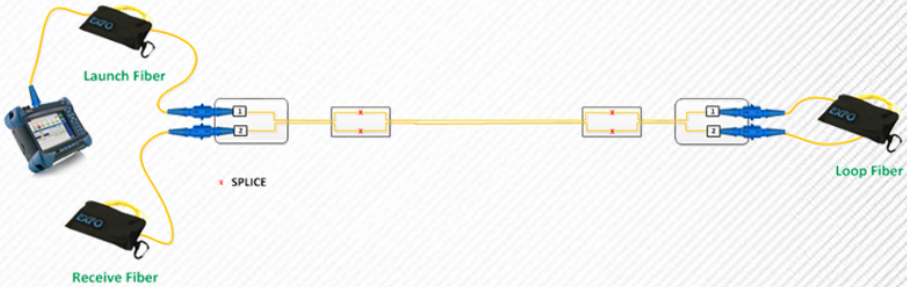


Offline software FastReporter2 – automatically generate individual link files



Loopback : Advantages

- **Loopback testing**
- Test two fibers together
- Software post processing will distinguish between fibers for reporting
  - Incl Bi-directional loopback
- Great for FTTA, Data Center & DAS applications



- **Key Benefits**
  - 50% less testing time
  - Single ended test, less test equipment required
  - Simple icon based view

Conclusion

- Different settings = different results ✓
- Different skills level = different results ✓
- Different skills level = interpretation of results ✓
- Different network types = requiring different settings ✓
- Volume of work (time to complete/time to report) ✓

Multi-pulse icon based view will address the challenges

Using additional tools such as Certification, Loopback & efficient reporting will improve productivity.

Conclusion

- Different settings = different results ✓
- Different skills level = different results ✓
- Different skills level = interpretation of results ✓
- Different network types = requiring different settings ✓
- Volume of work (time to complete/time to report) ✓

System failure

Repeat Truck rolls

Re-tests

Delays

Questions

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