

# The Changing Requirements in Structured Cabling Testing

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## The Category 8 Application

- IEEE 802.3bq 25G/40GBASE-T published 8 September 2016
  - Defines minimum transmission characteristics for the application on a twisted pair channel
- ANSI/TIA-568-C.2-1 published 30 June 2016
  - Defines Category 8 Channels and Permanent Links
    - Includes Resistance Unbalance, TCL, ELTCTL
- ANSI/TIA-1152-A published 10 November 2016
  - Defines tester measurement and accuracy requirements for Category 8
- ISO/IEC Standards expected soon
  - ISO/IEC 11801-99-1 Class I/II Channels and Permanent Links - 2017
  - IEC 61935-1 Ed5.0 tester measurement and accuracy requirements – 2018
  - ISO/IEC 11801 Edition 3.0 - 2017





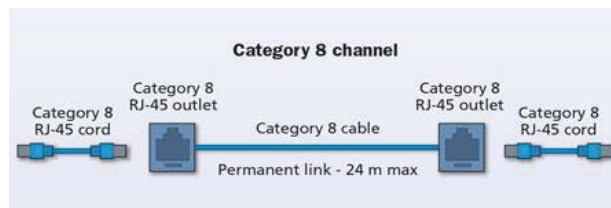
## Why 25G/40G on Twisted Pair?

- At lower power and cost
  - Can be built into switch and server motherboards
    - No SFP Transceiver required as with fiber
    - Lower cost and more flexible than TwinAx Direct Attach cables
    - Can Auto-Negotiate at different rates
  - Expected to be a data center application only
    - 24m Permanent Link, maximum 3m of patch cord at either end
    - Top of Rack and End of Row Switch data center architectures
- Category 6A and 10GBASE-T followed similar path



## Category 8 is Modular Plug!

- The manufacturers of active equipment have asked for an RJ45-compatible plug configuration, and therefore for the international use of Category 8, Category 8.1 for ISO. This solution is backward-compatible with the billions of RJ45 connections installed worldwide.
  - Active equipment manufacturers will be using RJ45 style jacks
    - Connection is either via a traditional channel model or via direct connect.
      - To field test you need Cat 8 Channel Adapters with RJ45 jacks and Permanent Link leads..





# To summarise the Cat 8 types

- We will need to be able to field test these types of Category 8 solutions.
  - All have a maximum frequency of 2GHz
  - All require the need for Channel Testing
  - All require the need for Permanent Link Testing

Component Category	Link Class	Max. Frequency	Responsible Standards Body	Usage	25GBASE-T	40GBASE-T	Compatible with RJ 45
Cat 8	Cat 8 Link	2GHz	ANSI/TIA	Nth America	Yes	Yes	Yes
Cat 8.1	Class I	2GHz	ISO/IEC	International	Yes	Yes	Yes
Cat 8.2	Class II	2GHz	ISO/IEC	International	Yes	Yes	No



# Field test requirements

- With the new ANSI/TIA-1152-A and Draft IEC 61935-1 Ed. 5 we also get some changes in field testing.
  - We carry out all the usual parametric tests but now out to 2GHz, to cover all types of Cat 8.
  - Wiremap has a requirement, when testing Cat 8 installations, to check the shield continuity along the path of the cabling.
    - Prevents the field tester being fooled by ground paths via racking and the earth connections.
  - Optional tests added to support the emerging IEEE 802.3bt PoE++ standard.
    - Channel dc loop resistance is to be below 25Ω
      - Cat 8 is 6.4 Ω
    - Current imbalance between pairs is to be minimised. This is achieved with Resistance Unbalance measurements within the pair and between pairs.

	Copper Certification	
	ISO/IEC 11801 Edition 3 Conformance Requirements	IEC 61935-1 Edition 5 Field Test Requirements
Wire Map *	✓	✓
Length	✓	✓
Propagation Delay	✓	✓
Delay Skew	✓	✓
dc Loop Resistance	✓	✓
Resistance Unbalance **	✓	Optional
Insertion Loss	✓	✓
NEXT, PS NEXT	✓	✓
Return Loss	✓	✓
ACR-F, PS ACR-F	✓	✓
TCL, ELTCTL	✓	Optional
Coupling Attenuation	✓	Optional
PS ANEXT, PS AACR-F	✓	✓

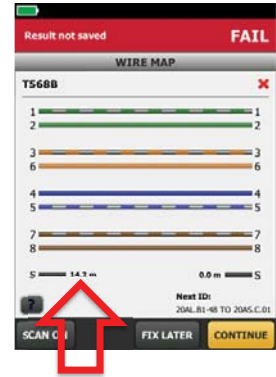
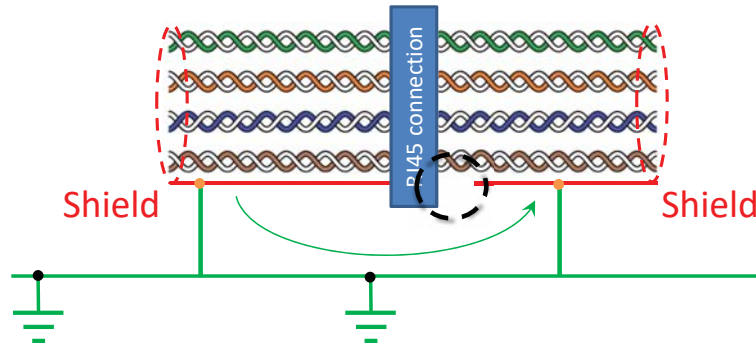
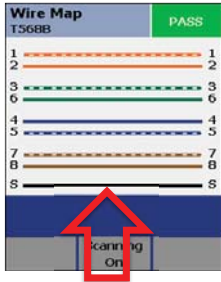
\* For Level 2G testers screen continuity is tested along the path of the cabling.  
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 \*\* Proposed Measurement requirement to support IEEE 802.3bt DTE Power over MDI  
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# Shield Continuity (RF)

An ordinary continuity test would show this as connected.



Don't let your tester be fooled by grounding!



## TIA HAS CHANGED THEIR FIBER TEST STANDARDS.





# Standards Updates and Changes

- TIA-568.3-D specifies the requirements for fiber-optic cable, connectors, connecting hardware and cords
  - Incorporates polarity content from 568-C.0
  - Uses same Optical Measurement method as 568-C.0
    - OLTS is preferred method for Tier 1, Tier 2 is OLTS Plus OTDR trace.
  - Now includes Passive Optical Network (PON) Components
  - Supports parallel optics and array connectors
  - Adds specifications for WBMMF (OM5)
  - OM1, OM2 and OS1 demoted to legacy and not recommended status
  - OM3 and OM4 loss lowered to 3.0dB/km
  - RL for SM connectors and splices raised to 35dB minimum
  - Loss when using reference grade connectors is decreased, 0.3dB for MM and 0.5dB for singlemode. This will effect your testing budget.
  - Specifies Encircled Flux launch conditions as a must use.



# ANSI/TIA-568.3-D Loss Calculations

- In the context of testing correctly, this guidance changes the way we think of links when calculating Pass / Fail limits.

– *Link Attenuation Allowance (dB) = Cabled Fiber Attenuation Allowance (dB) + Connections Attenuation Allowance (dB) + Fiber Splices Attenuation Allowance (dB) + Test Cord Attenuation Allowance (dB)*

– *Where;*

*Cabled Fiber Attenuation Allowance (dB) = Maximum Cabled Fiber Attenuation Coefficient (dB/km) × Length(km)*

*Connections Attenuation Allowance (dB) = Number of Connections within the link × Connection Loss Allowance (dB/connection)*

*Fiber Splices Attenuation Allowance (dB) = Number of Splices × Fiber Splice Loss Allowance (dB/splice)*

*Test Cord Attenuation Allowance for one-cord reference method = 2 × Test Cord Loss Allowance*

*Test Cord Attenuation Allowance for two-cord reference method = 1 × Test Cord Loss Allowance*

*Test Cord Attenuation Allowance for three-cord reference method = 0 × Test Cord Loss Allowance*

**Note: The number of connections within the link excludes the connections on the ends of the link to the test cords that are accounted for subsequently as Test Cord Attenuation Allowance.**

- **Does your tester support this new test methodology?**





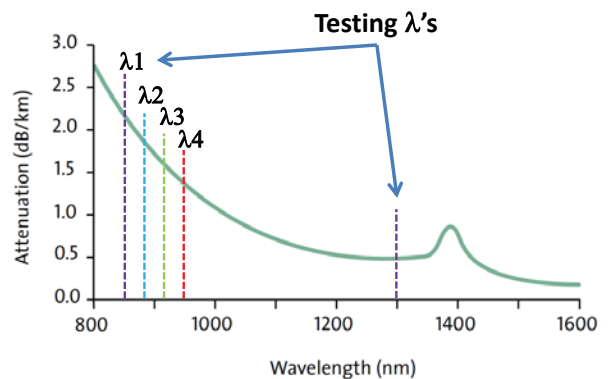
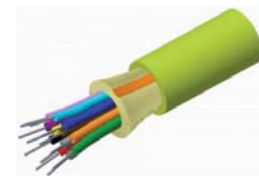
## Wideband Multimode Fiber OM5 (WBMMF)

- Optical characteristics other than bandwidth remain essentially the same as OM4 fiber.
- New Wavelengths Available – Short Wave Division Multiplexing
  - Allows a higher data rate down the fiber by using four wavelengths at the same data rate.
    - Four wavelengths at 25GB equals 100GB.



## Wideband Multimode Fiber OM5 (WBMMF)

- Field Testing is the same as OM4
- Test with traditional duplex fiber OLTS
  - Encircled Flux compliant
  - Wavelengths at 850/1300nm
    - Bounds all wavelengths between
- The jacket will be lime green

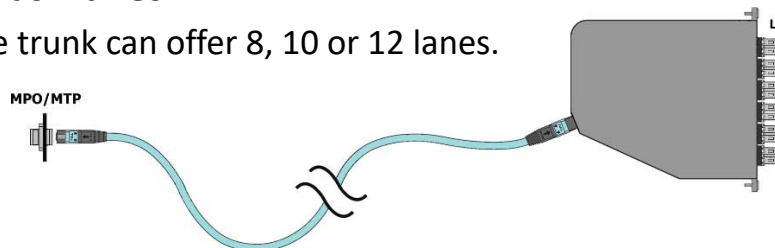


# TESTING MPO/MTP BASED FIBER SYSTEMS



## MPO/MTP Fiber Testing

- Modern Fiber optic systems today are usually based on MPO/MTP style of pre-terminated fibers
  - They are available in MM and SM (SM uses APC polish)
  - 12 or 24 cores are common, 16 or 32 cores are coming
  - Data speeds are achieved by using combinations of cores, often referred to as “lanes”
    - A 12 core trunk can offer 8, 10 or 12 lanes.





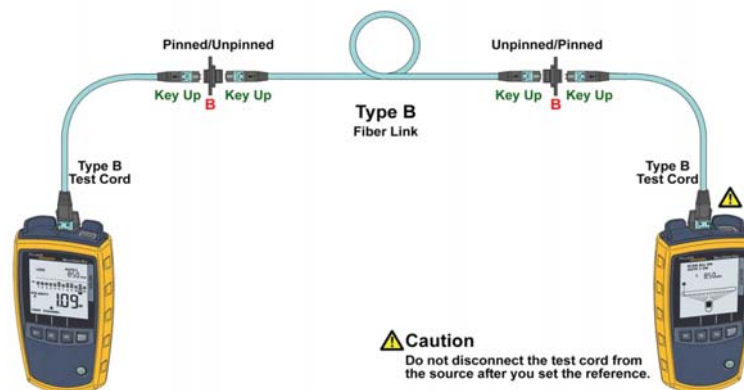
## Changes are coming to testing MPO/MTP solutions

- New Test Standard coming
  - ISO/IEC TR 61282-15 is the required document.
  - 850nm only, EF compliance required for MMOF
  - You can use an OLTS – painful and long winded
  - You can use a new Multi-Fiber tester – a far better way
- Why the new standard?
  - Current standards treat a cassette as 2 connectors
    - Means we have a link budget that can be too high for the application
      - Link passes testing, but the application will not operate.
  - New Leaf and Spine technology
    - Very difficult to test with a traditional OLTS.



## Advanced MPO/MTP Fiber Testing

- Specially designed multi-fiber testing solutions where all 12 cores are tested simultaneously.
  - Significantly reduces the chances of testing errors and is quicker







## Advanced MPO/MTP Fiber Testing

- New testing approach leverages off tried and trusted techniques.
  - It provides flexibility in testing
    - Test Trunk cables in one pass
    - Test cassettes in one pass
    - Allows the use of Reference Cords
    - Greatly speeds up the installation testing
    - Provides the required documentation to prove system is compliant with current standards.
  - Exact same test method works for either MM or SM cabling.
- Note: The tester must still be Encircled Flux compliant at the output to give the correct result if testing Multimode MPO/MTP solutions.



## Advanced MPO/MTP Fibre Testing

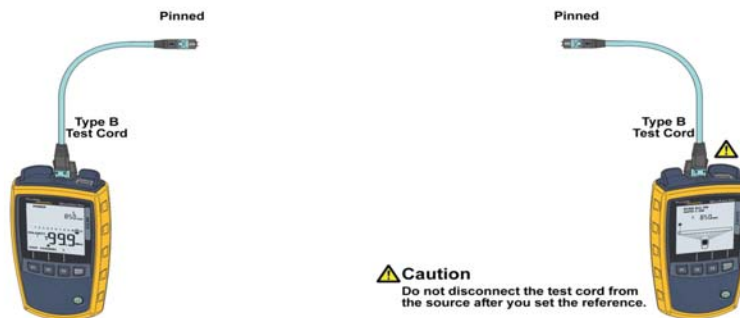
- Setting a Reference
  - Same approach as an LSPM, but we are actually setting 12 individual references.





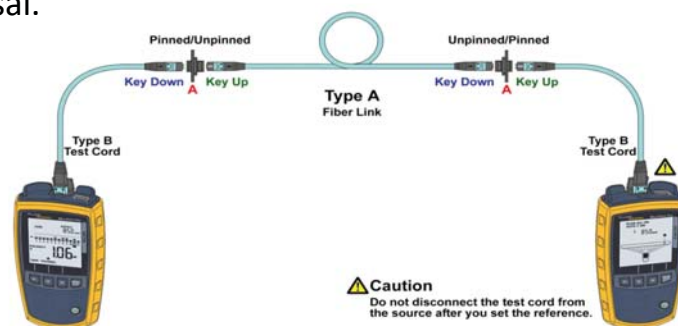
## Advanced MPO/MTP Fibre Testing

- We add a “Known Good” tail Test Reference Cord to facilitate measurement.
  - Note: the Launch and Tail Cords need to reflect the correct pinning for the trunk under test.



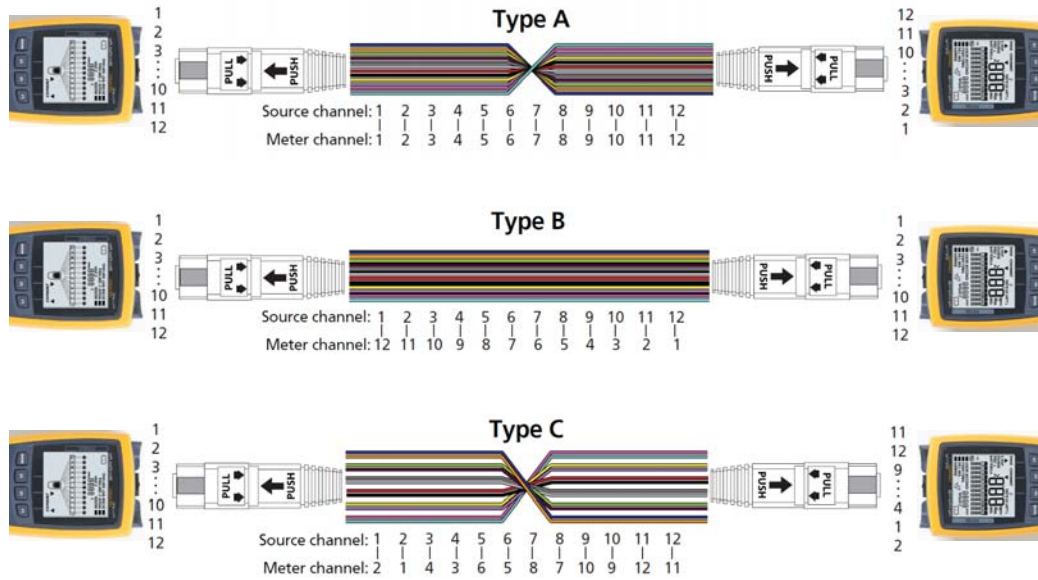
## Advanced MPO/MTP Fibre Testing

- We connect our source and meter to the trunk to be tested and record the 12 loss measurements.
  - Gives us loss and importantly polarity confirmation.
    - Look for a tester that can detect all 4 types of polarity, A, B, C and Universal.



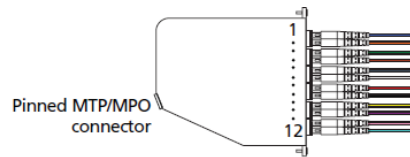


# Trunk and Patch Cord Polarity

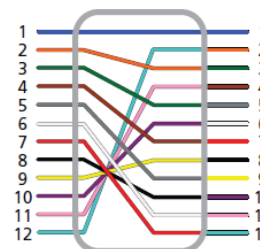


# Array Connector Polarity

- Universal polarity management method is an enhanced polarity management method that is not included but meets the intent of the TIA standard.
- Applies to cassettes/modules
- Measured Polarity is Type is considered "Universal"



Signal paths inside the module



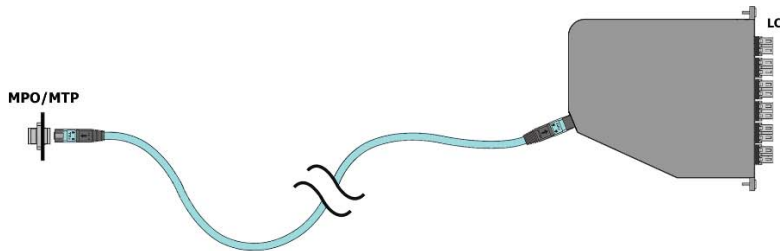
MTP/MPO connector: 1 2 3 4 5 6 7 8 9 10 11 12  
 Single-fiber connectors: 1 3 5 7 9 11 12 10 8 6 4 2





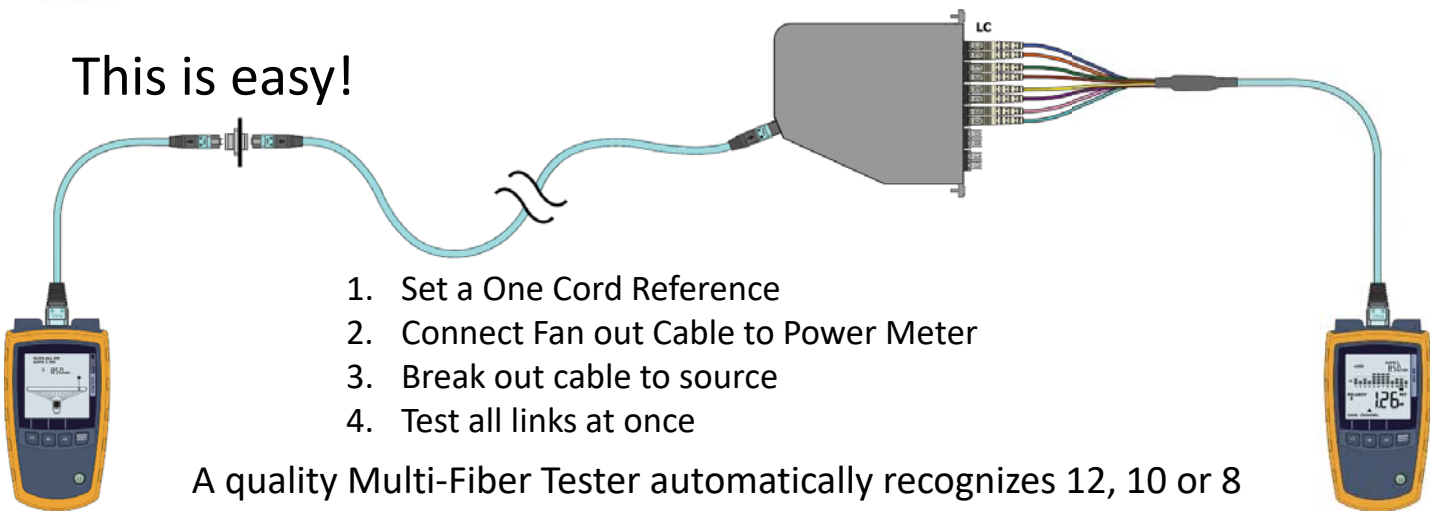
## Testing Leaf-Spine Solutions

- Leaf spine architecture uses MPO to LC cables
- So how do you test it?



## Leaf Spine with a Multi-Fiber Tester

This is easy!



1. Set a One Cord Reference
2. Connect Fan out Cable to Power Meter
3. Break out cable to source
4. Test all links at once

A quality Multi-Fiber Tester automatically recognizes 12, 10 or 8 fibers.





## 16, 24 or 32 Fiber MPO Links?

- You may hear of a FOCUS-18 connector
  - This is a proposal for a 16/32 way MPO
    - Supports more technologies, sometimes referred to as “Base-8”
    - Only one Polarity
    - Stacked to get 32 lanes
- For these higher fibre count links, you are going to need a breakout cord.

