

Technical Note 004

Optical fibre testing of Permanent Links and Links with LSPM To the requirements of ISO/IEC 14763-3:2014 One-Test-Cord Reference Method

Text in *red italics underlined* is derived from the new ISO/IEC 14763-3: 2014 standard
Text in *blue italics* is derived from the AS/NZS ISO/IEC 14763-3: 2012 and also applies to 2014 standard

1. Applicability

The following applies to optical fibre permanent link and link testing of cabling installations in Australia and New Zealand seeking performance conformance to ISO/IEC 11801 using ISO/IEC 14763.3 Ed2: 2014 light source and power meter (LSPM) testing methods. ISO/IEC 14763-3: 2014 will be the basis for the next revision of AS/NZS ISO/IEC 14763.3: 2012.

It is expected that there will be some modification to ISO/IEC 14763-3: 2014 to make it more applicable to the Australian and New Zealand cabling industry when AS/NZS ISO/IEC 14763.3 is revised. Items significantly different from the 2012 standard are shown here in red text underlined. [Underlined in case of black & white printing.]

2. Background

The test configuration reference planes of a permanent link contains the connecting components at both ends and all the cable and components between the end components.

Either One-Test-Cord Reference Method or Enhanced Three-Test-Cord Reference Method (See TN-002) may be used to test a Permanent Link and Link. Both reference methods include the contribution of the end connectors and both meet ISO/IEC 14763.3¹ requirements.

Note: The One-Test-Cord Reference Method is known to be quicker and easier to do and is less expensive to establish and maintain because there are no Substitution Test Cords.

3. Link definition

Permanent Link is horizontal cabling between floor distributor and telecommunications outlet. Link is any other cabling usually comprising a single fixed cable with connectors at each end. Hereinafter the word 'Link' is used to collectively describe both a permanent link and a link.

4. Bi-directional Testing

Clause 9.1.1.4 of AS/NZS ISO/IEC 14763.3¹ states;

For a link comprising a single fixed cable and terminating connectors, uni-directional testing may be performed. Where the link is of a complex construction (e.g. two links joined by a fibre CP) or where there is a risk that components within the cabling under test cause differences in attenuation depending on the direction of transmission (e.g. damage/stress on components during installation or maintenance, or fixed fibres when joined have differences in performance or index of refraction) then bi-directional measurements shall be carried out.

It is expected that the new AS/NZS version of 14763-3 standard will continue to state that; *For Australia and New Zealand testing of links and channels with light source and power meter shall be bi-directional and at least at two appropriate wavelengths.*

For bi-directional testing using LSPM, *the worst of the two measured results shall be considered as the overall measured result.*²

5. Test Cords

Both multimode and singlemode fibre reference settings use the following test cords;³

- LTC Launch Test Cord (2 – 10 m with reference connector at link interface end)
- TTC Tail Test Cord (2 – 10 m with reference connector at link interface end)

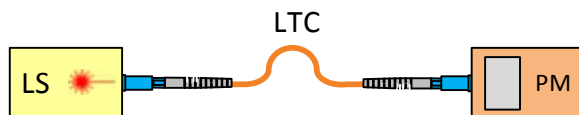
The LTC for multimode fibres *shall meet the launch modal distribution*⁴ at the output of the launch test cord. For multimode, this is also known as meeting **Encircled Flux** requirements. *The singlemode launch condition requires that launch cords contain a minimum of two single air-coiled turns or mandrel wraps of 35 mm to 50 mm in diameter. However this is usually provided within the test instrument and it is then not necessary to include an external wrap on the launch test cord.*⁴

The LTC and TTC for multimode and singlemode must have a connector end face that will mate with the link connectors. All connectors should be inspected and cleaned as necessary before reference setting and before each and every individual test. All test cords shall be inspected and tested for proper functioning.

6. One-Test-Cord Reference Method for Optical Fibre Links

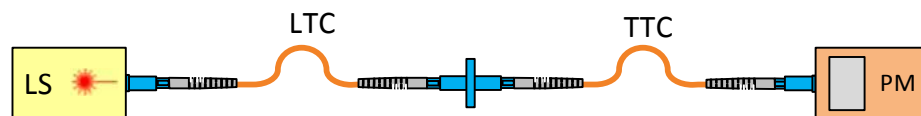
Clause 9.1.1.3 of ISO/IEC 14763.3¹ sets out the following method:-

- 6.1. Allow the light source to warm up following the tester manufacturer's recommendations on warm up. This could take up to 15 minutes.
- 6.2. Connect the LTC to the light source at one end and to the power meter at the other end. Ensure EF compliance of the LTC for multimode fibre and modal distribution for singlemode.



- 6.3. Set the reference to 0.0 dB or record the reference power in dBm or watts.

- 6.4. The attenuation of the connectors on the launch test cord and tail test cord may be verified by connecting these cords together and verifying the attenuation of this connection is no more than the expected attenuation of one pair of reference grade connectors.⁵



Disconnect the LTC from the power meter and connect it to the TTC using a Reference Adaptor. Connect the other end of the TTC to the power meter.

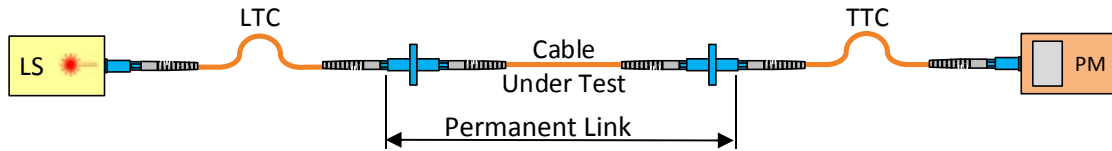
The attenuation of the reference-to-reference connection must not exceed,

- MMF 0.1 dB, SMF 0.2 dB.

Note: If the attenuation is more than the allowable value, clean all end faces, inspect then reconnect and re-test. Re-set the reference if necessary. Use alternate test cords if necessary.

Disconnect the LTC from the TTC at the reference adaptor but do not disconnect the other ends from the light source or power meter; otherwise re-set the reference as per Item 6.2.

- 6.5. Connect the LTC to the cleaned fibre connector at the Near End of the link.
Do not remove test cords from the testers; otherwise re-set the reference as per Item 6.2.
At the far end, connect the TTC to the cleaned connector of the link.



- 6.6. Measure the attenuation of the link, which includes the two end connectors.
- 6.7. During testing reference power measurements shall be repeated periodically⁶ i.e. the launch, substitution and tail test cords be connected together on occasions to ensure the value is still below the maximum allowed in Item 6.4.

7. Treatment of Link Test Results

Clause 9.1.1.8 of ISO/IEC 14763.3 Ed2:2014 contains the following formulae;

Using the One- or Three-Test-Cord Reference Method, the PASS limit for link attenuation is;

MMF Limit = (2 x 0.5 dB) + Σ (cable attenuation) + Σ (embedded connector attenuation)

SMF Limit = (2 x 0.75 dB) + Σ (cable attenuation) + Σ (embedded connector attenuation)

[These formulae are from Corrigenda 1 to ISO/IEC 14763-3 Ed2 dated 17.03.2015.](#)

Table 6 Allowable Attenuation Values

Component and Wavelength	ISO/IEC 14763-3 Ed2: 2014 Attenuation (Loss) Maximum
Mated Ref to Ref Connection at 850 & 1300 nm at 1310 & 1550 nm	MMF 0.10 dB SMF 0.20 dB
Mated Ref to Non-Ref Connection at 850 & 1300 nm at 1310 & 1550 nm	<u>MMF 0.50 dB</u> (new value) <u>SMF 0.75 dB</u> (new value)
Non-Ref to Non-Ref at all wavelengths	MMF & SMF 0.75 dB
Splice at 850 & 1300 nm at 1310 & 1550 nm	0.30 dB
MMF All multimode fibres at 850 nm at 1300 nm	3.50 dB/km 1.50 dB/km
SMF at 1310 & 1550 nm OS1 OS2	1.00 dB/km 0.40 dB/km

Ref = Reference Connector

Non-Ref = Non-reference (embedded) Connector

8. Apparent Gains

It is expected that the following will continue to be contained in AS/NZS ISO/IEC 14763.3 Ed2.

*Apparent gains shall not exceed the measurement uncertainty.*⁶

- Measurement uncertainty using the enhanced three-test-cord reference method for; MMF is ≤ 0.09 dB and SMF is ≤ 0.11 dB.⁷
- Measurement uncertainty using the one-test-cord reference method for; MMF is ≤ 0.09 dB and SMF is ≤ 0.11 dB.⁷

9. Mated Connections in Close Proximity

It is expected that the following will continue to be contained in AS/NZS ISO/IEC 14763.3 Ed2.

Mated connections in close proximity *shall be considered as two mated connector interfaces when determining optical attenuation budget.*⁸

This applies to MPO Cassettes, Stub connectors and Pigtailed.

10. Measurement Uncertainty

The measurement uncertainty for MMF is the same for both the one-test-cord reference and the enhanced three-test-cord reference methods.

The measurement uncertainty for SMF is the same for both the one-test-cord reference and the enhanced three-test-cord reference methods.

References

¹ [ISO/IEC 14763.3 Ed2 2014](#)

³ [ISO/IEC 14763.3 Ed2 Clause 3.2 & 6.3.3.1](#)

⁵ [ISO/IEC 14763.3 Ed2 Clause 9.1.1.3, Para 6](#)

⁷ [AS/NZS CT001-02 Calculation V5.8](#)

² [ISO/IEC 14763.3 Ed2 Clause 9.1.1.5](#)

⁴ [ISO/IEC 14763.3 Ed2 Clause 6.4 & 6.5](#)

⁶ [AS/NZS ISO/IEC 14763.3:2012 Appn ZZ2 Cl 5.3.5](#)

⁸ [AS/NZS ISO/IEC 14763.3:2012 Appn ZZ2 Cl 9.1.1.3](#)