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Media	Optical Fibre

Technical Note 004

Optical fibre testing of Permanent Links and Links with LSPM
To the requirements of AS/NZS ISO/IEC 14763-3:2012
One-Test-Cord Reference Method

Text in *blue Italics* is derived from the AS/NZS ISO/IEC 14763-3:2012 standard

1. Applicability

The following applies to optical fibre permanent link and link testing of cabling installations seeking performance conformance to AS/NZS 3080 using AS/NZS ISO/IEC 14763.3:2012 light source and power meter (LSPM) testing methods.

2. Background

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

Either One-Test-Cord Reference Method or 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 both end connectors and both reference methods meet AS/NZS ISO/IEC 14763.3 requirements[1].

> Note: The One-Test-Cord Reference Method is known to be quicker and easier to do, have less measurement uncertainty 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 9.1.1.2 of AS/NZS ISO/IEC 14763.3 [1] states;

For compliance testing of a link composed of known and unknown components, (e.g. Where the link is of a complex construction like 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, like 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.*

Appn ZZ2 Cl 9.1.1.2 of AS/NZS ISO/IEC 14763.3:2012 states;

*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 one of the two measured results **shall** be considered as the overall measured result.* [2]

5. Test Cords

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

- LTC Launch Test Cord (1 – 5 m with reference connector at link interface end)
- TTC Tail Test Cord (1 – 5 m with reference connector at link interface end)

The LTC for multimode fibres shall meet the launch modal condition [4] at the output of the launch test cord. 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. [4]

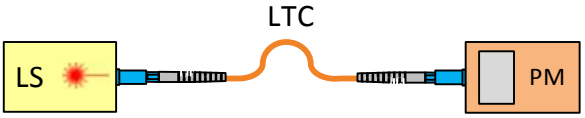
The LTC and TTC for multimode and singlemode must have a connector end face that will mate with the link connectors. All connectors should be inspected and cleaned as necessary before reference setting and before each and every individual test. All test cords shall be inspected and tested for proper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

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

Clause 9.1.1 of ISO/IEC 14763.3:2014 sets out the following method:-

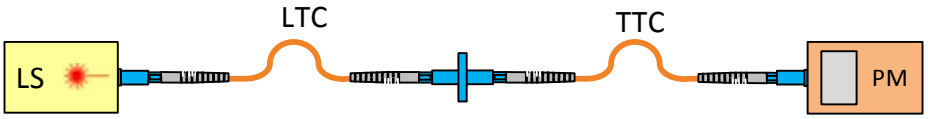
6.1. Allow the light source to warm up following the tester manufacturer's recommendations. This could take up to 15 minutes.

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.



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 should be verified by connecting these cords together and verifying the attenuation of this connection is no more than the expected attenuation between two reference grade connectors.



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.

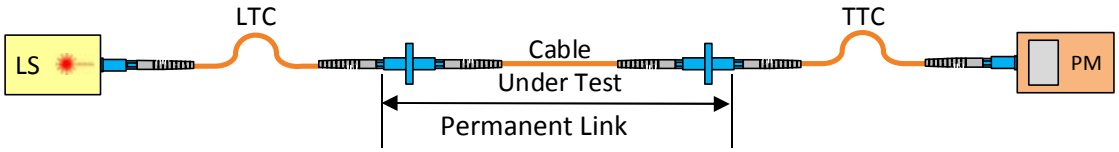
The attenuation of the reference-to-reference connection must be no greater than;

- 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.
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, to improve test result reliability and accuracy and to reduce measurement uncertainty, the attenuation of the connectors on the launch test cord and tail test cord should be verified from time to time by connecting these cords together and verifying that the attenuation of this connection is still no more than the expected attenuation between two reference grade connectors. This is a repeat of the measurement in Item 6.4.

7. Treatment of Link Test Results

Clause 9.1.1.8 of AS/NZS ISO/IEC 14763.3:2012 [1] contains the following formulae;

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

MMF Limit = (0.4 dB) + Σ (cable attenuation) + Σ (embedded connector attenuation)
SMF Limit = (0.6 dB) + Σ (cable attenuation) + Σ (embedded connector attenuation)

These formulae will be updated to be in line with corrigenda to ISO/IEC 14763-3 Ed2 when adopted by AS/NZS.

Table 6 Allowable Attenuation Values

Component and Wavelength	**AS/NZS ISO/IEC 14763-3:2012 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 Non-Ref to Non-Ref at all wavelengths	 MMF 0.30 dB SMF 0.50 dB 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

For Australia and New Zealand, AS/NZS ISO/IEC 14763.3:2012 Appendix ZZ states;

Apparent gains shall not exceed the measurement uncertainty. [5]

- *Measurement uncertainty using the 3-test-cord reference method for; MMF is ≤0.2 dB, and SMF is ≤0.4 dB* [6]
- *Measurement uncertainty using the 1-test-cord reference method for; MMF and SMF is 0.0 dB* [7]

9. Mated Connections in Close Proximity

For Australia and New Zealand, AS/NZS ISO/IEC 14763.3:2012 Appendix ZZ states;

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

This applies to MPO Cassettes, Stub connectors and Pigtails.

References

[1] AS/NZS ISO/IEC 14763-3:2012

[2] AS/NZS ISO/IEC 14763.3:2012 Clause 9.1.1.3

[3] AS/NZS ISO/IEC 14763.3:2012 Clause 6.3.3 & 6.3.4

[4] AS/NZS ISO/IEC 14763.3:2012 Clause 6.4 & 6.5

[5] AS/NZS ISO/IEC 14763.3:2012 Appn ZZ2 Cl 5.3.5

[6] AS/NZS ISO/IEC 14763.3:2012 App ZZ2 Cl 10.2.2

[7] AS/NZS ISO/IEC 14763.3:2012 Appn ZZ2 Cl 10.2.2

[8] AS/NZS ISO/IEC 14763.3:2012 App ZZ2 Cl 9.1.1.3