



Optical fibre testing of Expanded Beam links with Light Source & Power Meter One-Test-Cord Reference Method

This best practice test procedure has been developed as part of a series by VTI Services to cover unique connectors not adequately covered in AS/NZS 14763.3:2017. For example, mated connectors types of higher attenuation than specified within the standards and/or connector types where reference grade connectors are not available. The test methodology achieves low measurement uncertainty and high repeatability while utilising available patch cords and uses the One-Test-Cord Reference Method similar to that utilised in AS/NZS 14763.3.

The following example is for a link under test with Expanded Beam (EB) connectors both ends and EB-SC breakout test cords. Connectors other than SC can be used if capable of connection to the LSPM.

***Inspect/clean/inspect all interfacing connectors of the test cords and the link under test.
Dirty connector ends cause the biggest problems on fibre systems.***

1. Set the Reference

1.1. Warm up and stabilise the light source as per manufacturer’s recommendations. (e.g. 10 min) Select a SC-SC Launch Test Cord (LTC) with reference grade connectors at both ends. Clean/inspect both connector ends. MMF LTC must meet Encircled Flux requirements.

1.2. Connect the LTC to the light source at one end and to the power meter at the other end.



1.3. Test this 1-test-cord system and set the reference to 0.0 dB or record the reference.

1.4. Disconnect the LTC from the power meter ensuring the connector end stays clean, **but do not disconnect the other end from the light source**; if it does, re-set the reference as per Item 1.

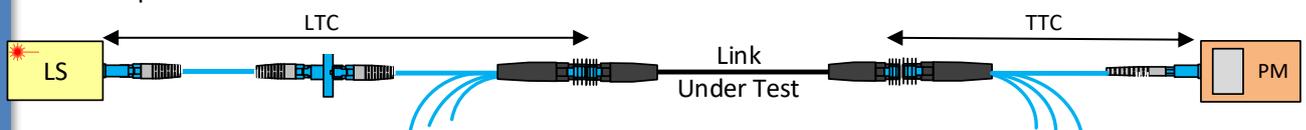
2. Test the Link Under Test

2.1. Select two EB to SC breakout test cords; one for gender-change as part of the Launch Test Cord (LTC), the other as the Tail Test Cord (TTC).

2.2. Clean & protect the SC connectors and connect one SC to the Ref Setting cord to extend the LTC, **but do not disconnect the connector at the LS**; if it does, re-set the reference as per Item 1. Use a singlemode SC adaptor with ceramic sleeve (for better alignment of fibres, even on MMF connectors

2.3. Clean the EB connector lenses at the near-end of the link under test. Connect the clean LTC EB connector to the EB connector on link under test.

2.4. Select the other EB to SC breakout test cord, clean the connectors on both ends of the TTC. Clean the EB at the far-end of the link and connect the EB on the TTC. Connect the SC connector on the TTC to the power meter.



2.5. Measure and record the attenuation of the link under test.



VTI SERVICES

2.6. Test the next fibre of the EB under test using the next SC breakout connectors, **but do not disconnect the LTC from the light source**; if it does, re-set the reference as per Item 1.

3. Treatment of Link Test Results

Using the One-Test-Cord Reference Method, the PASS limit (or Loss Budget) for link attenuation is calculated as follows;

MMF PASS Limit = 2.0 + (link attenuation) + (embedded connector/splice attenuation)

SMF PASS Limit = 3.0 + (link attenuation) + (embedded connector/splice attenuation)

Where:-

2.0 and 3.0 are offset values* for 2 EB test cord interfacing connectors added after reference setting
 (link attenuation) = fibre length x dB/km

(embedded connector/splice attenuation) = loss of any extra mated connectors or splices in the fibre between the two interfacing connectors

Table 1 Allowable Budget Attenuation Values in AS/NZS 14763.3

Component and Wavelength	Budget Attenuation (Loss) Maximum
MMF 850 & 1300 , SMF 1310 & 1550 nm	
Connector Mated SC, LC, ST (Non-Ref to Non-Ref) (Random to Random) Mated EB	MMF 0.75 dB
	SMF 0.75 dB
Connector Mated SC, LC, ST (Ref to Non-Ref) (Test Cord to Random) Mated EB	MMF 1.0 dB *
	SMF 1.5 dB *
Connector Mated SC, LC, ST (Ref to Ref) (Test Cord to Test Cord)	MMF 0.10 dB
	SMF 0.20 dB
Splice All wavelengths	MMF 0.30 dB SMF 0.30 dB
Fibre MMF multimode OM1, OM3 & OM4 at 850 nm at 1300 nm	3.5 dB/km 1.5 dB/km
Fibre MMF multimode OM5 at 850 nm at 1300 nm	3.0 dB/km 1.5 dB/km
Fibre SMF at 1310, 1383 & 1550 nm OS1a OS2	1.0 dB/km 0.4 dB/km

Ref = Reference Connector Non-Ref = Non-reference (random) Connector PC = Physical Contact

* A typical value base on connector manufacturer's specifications for this style of connector

4. Measurement Uncertainty

Table 2 Measurement Uncertainty Values

Link Connector	Measurement Uncertainty	Reference Method
EB	SMF ± 0.24 dB MMF ± 0.27 dB when attenuation is ≤1.9 dB, and MMF ± (0.14 x attenuation) when attenuation is >1.9 dB	1-Test-Cord