CERTECH's Quality Plan

Optical Fibre Cable Testing Using OTDR

This quality plan has been prepared by VTI Services for, or on behalf of, the installation contractor and CERTECH in accordance with AS/NZS 14763.2 for installation/s that are intended to be covered by CERTECH's installation specifications.

The following requirements apply to testing of installed optical fibre cabling using an Optical Time Domain Reflectometer (OTDR), primarily for: -

- conformance and acceptance of initial installations, and/or
- upgrade to existing installations and/or
- acceptance of maintenance and repair activities.

Applicable standards are: -

1. AS/NZS 11801.1 Generic cabling for customer premises – Part 1: General requirements
2. AS 11801.2 Generic cabling for customer premises – Part 2: Office premises
3. AS 11801.3 Generic cabling for customer premises – Part 3: Industrial premises
4. AS 11801.4 Generic cabling for customer premises – Part 4: Single tenant homes
5. AS 11801.5 Generic cabling for customer premises – Part 5: Data centres
6. AS 11801.6 Generic cabling for customer premises – Part 6: Distributed building services
7. AS/NZS 14763.3 Implementation and operation of customer premises cabling – Part 3: Testing of optical fibre cabling

Link includes a permanent link and consists of a cable and a single (mated) connector at both ends.

The version of any undated referenced standards within this document is that which is current at the date of the project document.

Testing – General

Standards	AS/NZS 11801.1 Information technology – generic cabling for customer premises, Part 1: General requirements AS/NZS 14763.2 Implementation and operation of customer premises cabling, Part 2: Planning and installation AS/NZS 14763.3 Implementation and operation of customer premises cabling – Part 3: Testing of optical fibre cabling
Test Configuration	Link
Optical Fibre Cabling Type	OM3 OM4 OM5 OS1a OS2
Test methodology	AS/NZS 14763.3
Direction of test	Two directions per core
Wavelength	MM 850 nm and 1300 nm (optional) SM 1310 nm and 1550 nm

Tester Calibration	Equipment in calibration at time of test.

Testing – Optical Time Domain Reflectometer (OTDR) Setup

Range	Longer than (cable + launch & tail test cords), but no more than 3 times longer
Pulse Width	5-10 nanoseconds (nS) recommended, but not exceeding 40 nS
Index of Refraction	Values as specified in AS/NZS 14763.3 or Default values in OTDR tester or Values in cable specification sheet
Averaging Time	30 seconds (S) recommended, but not less than 15 seconds (S)
Event Threshold	0.10 dB Note, events reported at 0.10 – 0.20 dB are deemed conditionally compliant (acceptable)
MM Launch conditions	Encircled Flux modal conditions according to AS/NZS 14763.3 Annex A, is achieved by: - - Conditioner device in launch test cord, or - Documented manufacturer's claim, or - Compliance Statement from manufacturer
SM Launch Conditions	According to AS/NZS 14763-3 Clause 6.5, is by: - Documented manufacturer's claim or - Compliance Statement from manufacturer
Test Cord Verification	Both Launch and Tail test cords with interfacing reference connectors: - - shall be verified each time tester is started
Launch Cord	At least 100m
Tail Cord	At least 100m
Recorded Attenuation Result Assessment	Highest value from single direction testing Average value from bi-directional testing
Recorded ORL Result Assessment	Lowest value, not averaged

Acceptance Requirements for Optical Fibre Link Attenuation

The attenuation acceptance requirements for optical fibre links and embedded components shall be calculated, based on Table 1, for the optical loss/attention allowance for each component and cable utilised for the creation of the link.

Table 1 Allowable Budget Loss/Attenuation for Components

Component and Wavelength	AS/NZS 11801.1 Attenuation (Loss) Maximum
Mated Ref to Ref Connection	
MMF at 850 & 1300 nm	0.10 dB
SMF at 1310 & 1550 nm	0.20 dB
Mated Ref to Non-Ref Connection	
MMF at 850 & 1300 nm	0.50 dB
SMF at 1310 & 1550 nm	0.75 dB
Non-Ref to Non-Ref Connection	
At all wavelengths MMF	0.75 dB
SMF	0.75 dB
Splice	
At all wavelength, MMF	0.30 dB
SMF	0.30 dB
Connector with splice at tester interface	
MMF	0.80 dB
SMF	1.05 dB
Connector with splice embedded in link	
MMF	1.05 dB
SMF	1.05 dB
MPO/MTP Cassette at tester interface	
MMF	1.25 dB
SMF	1.50 dB
MPO/MTP Cassette embedded in link	
MMF	1.50 dB
SMF	1.50 dB
MMF Cable OM3, OM4	
at 850 nm	3.50 dB/km
at 1300 nm	1.50 dB/km
MMF Cable OM5	
at 850 nm	3.00 dB/km
at 1300 nm	1.50 dB/km
SMF Cable at 1310 & 1550 nm	
OS1a	1.00 dB/km
OS2	0.40 dB/km

Ref = Reference Connector Non-Ref = Non-reference (Random) Connector
MPO/MPT loss values are not yet included in AS/NZS 11801-1 and are for further study.

Acceptance requirements for Optical Return Loss

The Optical Return Loss limits for a mated connector shall be that as specified in Table 2.

Where the individual optical return loss of an individual mated connector cannot be determined, the requirements for the combination of two or more connectors shall be that specified within Table 2.

Table 2 Allowable Optical Return Loss for Mated connectors

Component	Project Return Loss	AS/NZS 11801-1 Return Loss
Connector ORL (Optical Return Loss)		(Further from Zero is better)
{ = minus Reflectance} Mated MM		PC 20 dB
Mated SM		PC 35 dB
Mated SM		APC 60 dB

Measurement Uncertainty

Measurement Uncertainty is: -

- Stated in tester documentation by the tester manufacturer, or
- Contained within the test data

Tests To Be Carried Out

The following elements of the extended test group are to be tested against the standards and specific requirements of this Quality Plan.

Test	AS/NZS 14763.3	Sample Size
Local and remote interface connector attenuation	YES	100%
Local and remote interface connector return Loss	YES	100%
Embedded connecting hardware attenuation	YES	100%
Embedded connecting hardware return loss	YES	100%
Continuity	YES	100%
Maintenance of Polarity	YES	100%

Test Result Analysis

For a PASS, the OTDR test results shall: -

1. clearly show the launch and tail cords on the traces for all fibres in the cable, and
2. not exceed the Loss Budget, calculated from the sum of all the components under test, and
3. not exceed the Loss Budget for the component under test; and
4. not exceed the ORL of the component under test

Handling of Apparent Gains After Averaging

Apparent gains greater than 0.09 dB are deemed unacceptable.

Handling of Marginal Pass Results

- Marginal pass results are unacceptable.

Handling of Fail and Marginal Fail Results

All Fail and Marginal Fail results are unacceptable.

Handling of Unacceptable Results or Activities

All unacceptable results and/or activities shall be repaired and/or replaced and re-tested until such time as they achieve acceptance.

Documentation of Test Results

All optical fibre test results for each tested core of an optical fibre cable shall include as a minimum: -

a) Test equipment
   1. Type and manufacturer
   2. Serial number and calibration status
   3. Level and software version

b) Details of cabling interface adaptors (type, reference number, manufacturer)
c) Details of cabling under test
d) Date and time of test
e) Any relevant environmental conditions
f) Tester operators' names. Not the tester or installer company name.
g) Measured result of each parameter
h) Required result of each parameter for a PASS

Details of cabling includes: -

a) Optical fibre type
b) Cable ID (Identification)
c) Core ID (Identification)
d) Interface connector type at both ends of the link
e) Splices associated with interface connectors
f) MPO/MTP cassette associated with the interface connector
g) Embedded MPO/MTP cassette (not associated with interface connectors)
h) Embedded splices
i) Embedded connectors (not associated with interface connectors)
j) Test Results
   1. Attenuation Loss dB
   2. Link Length m
   3. Propagation Delay ns (length x 5 ns)
   4. ORL Optical Return Loss of fibre and events
   5. Length to embedded events and event type

Additional Specified Requirements

Visual inspection of fibre end-faces

When testing for transmission requirements, visual inspection of each fibre end-face shall be conducted in accordance with AS/NZS 14763.3 Annex B.

Independent test result verification

All optical fibre results shall be independently verified by an approved NATA inspection body as compliant to the standards and requirements specified within this quality plan.

Any report that achieves a partial compliance or a non-compliance status shall be deemed non-compliant.

CERTECH's NATA approved inspection body is VTI Services.

The cost of this service is to be borne by the installer.
A copy of the NATA Report is to be provided to the Specifier and Installer on creation.

Handling of anomalies
Test results containing non-specified or incorrect requirements shall be deemed as acceptable or unacceptable for the following elements: -

Item	Unacceptable	Acceptable	Conditions
Optical Fibre Length	X		No more than 10 metre variation to LSPM results
Test Standard e.g. TIA	X		Verify against AS/NZS 14763.3 requirements

Handling of non-compliant NATA reports
All elements that result in a partial or non-compliant status shall be made compliant repaired and/or replaced and retested with the test data resubmitted to the NATA inspection body until a NATA Statement of Compliance and associated report is issued by the NATA inspection Body.

This Quality Plan has been approved by the Specifier: -

Representative Name:.....Tom Boer.....

Signature:.....  .....

Date:.....30.05.2022.....