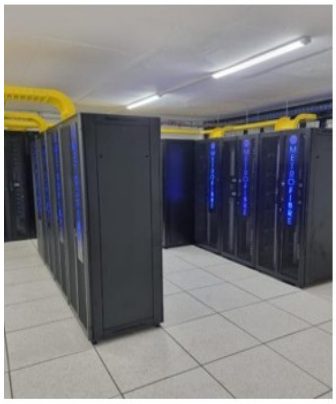
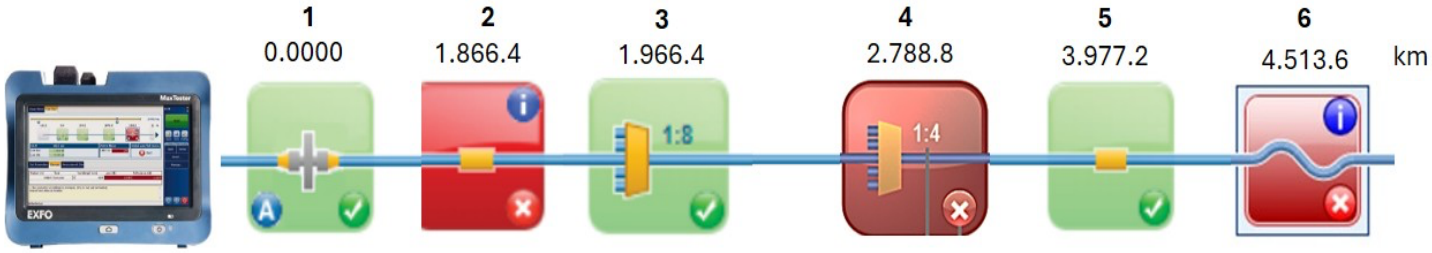
Advanced GPON Fault-Finding Manual





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Document Breakdown

Item	Details
Document title	Advanced GPON Fault-Finding Manual
Network model	OLT → feeder fibre → 1:4 splitter → four 1:16 splitters → = 64 ONTs
Audience	Instructors, senior fibre technicians, Network Operations Center (NOC) engineers, and field maintenance teams.
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1. Introduction

This formal guideline outlines a systematic approach to troubleshooting on a Passive Optical Network (PON) network. The architecture chosen is a 1:4 Primary Splitter + Four 1:16 Secondary Splitters and thus, a 64 Optical Network Terminal (ONT) PON. Even though several different architectures are being deployed today, the fault-finding methodologies outlined in this guide will invariably remain relevant and can be applied across the board.

How difficult can it be to find a PON fault using intelligent Optical Link Mapper (iOLM)? You press start, sit back and whoopee, the fault is displayed. Piece of cake, right? Wrong. Please continue reading.

2. Purpose, Safety and Learning Outcomes

Technicians will be taught how to use iOLM as the primary fault-finding method on a Gigabit Passive Optical Network (GPON) access network, with a 1:4 first-stage splitter feeding four 1:16 second-stage splitters. Explained is how to approach, configure, test, interpret, repair and document faults affecting all ONTs, a group of ONTs, or only one ONT.

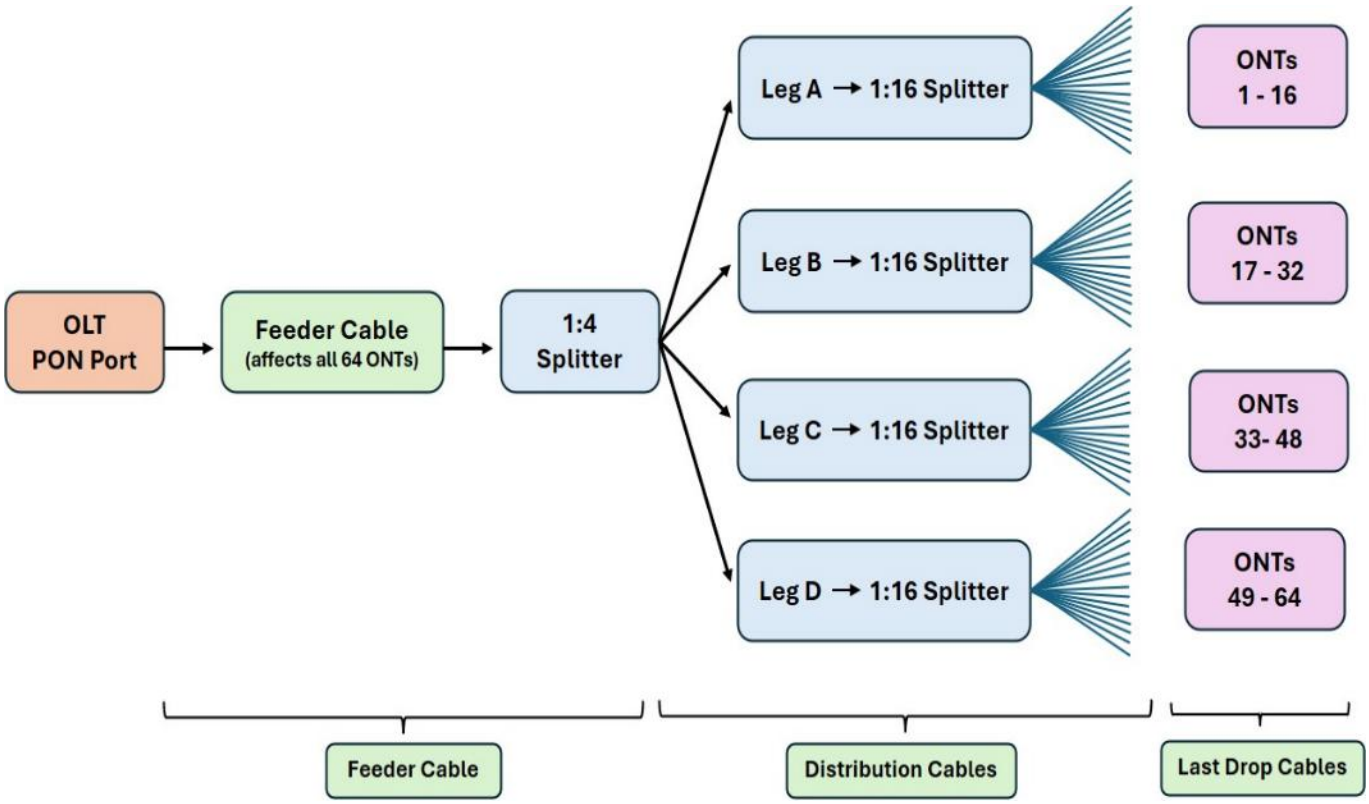
> **Key principle:**
> Always isolate the outage by impact first. The number of affected ONTs tells one which part of the PON is most likely faulty before one deploys the iOLM test.

Learning outcomes

1. Explain the role of an Optical Line Terminal (OLT), feeder cables, splitters, distribution cables, drop cable, and an ONT.
2. Configure iOLM for a multi-stage PON route.
3. Use launch/receive cables and apply clean/inspect practices correctly.
4. Interpret icon-based events, loss values, reflections and pass/fail flags.
5. Locate feeder, distribution, splitter, connector, macro and micro-bends, and drop cable faults.
6. Calculate a practical optical loss budget, which contains a safety margin.
7. Produce before-and-after reports suitable for Network Operations Center (NOC) closure and quality assurance (QA).

3. GPON Architecture and Fault Domains

For 1:4 Primary Splitter + Four 1:16 Secondary Splitters (64 ONT PON)



Fault domain	Customers affected	Main tests	Likely cause
Optical Line Terminal (OLT) / PON port	Up to 64	OLT alarm review, PON power meter, service profile check	Small Form-factor Pluggable (SFP) laser, PON card, admin shutdown, provisioning fault
Feeder fibre before 1:4	64	iOLM from OLT, power at 1:4 input	Fibre cut, ODF patch/coupler, dirty connector, closure in handhole outside PoP fault
1:4 splitter	16 to 64	Power at input/output, iOLM event loss	Splitter damage, connector contamination, incorrect patching, or splicing
Distribution leg to 1:16	16	iOLM from ONT or from field closure	Fibre cable break, macro or micro-bend, faulty splice or connector
1:16 splitter	1 to 16	iOLM splitter loss from ONT; power on outputs	Damaged splitter, wrong port, bad connector, or splice

Drop fibre and ONT	1	iOLM from ONT side. Also use a Visual Fault Locator (VFL), and PON Power Meter	Dirty connector, macro or micro-bend, fibre cable damage, ONT failure
Important VFL implementation note: VFLs are usually classified as Class II or Class 2M. They are safe for momentary exposure due to the human blink reflex. NEVER look directly into a VFL. Beware of "overpowered" devices, which are dangerous and often illegal. An output power level of 1 mW to 5 mW provides a clear, visible trace on fibres up to 5 km, while remaining within safe, standardized laser classifications. Do not risk damage to your eyes!			

4. Optical Theory for GPON Fault Finding

Technicians must distinguish between absolute power and loss. dBm is an absolute optical power level. dB is a relative loss or gain. iOLM reports event loss in dB, while PON power meters typically report live downstream/upstream power in dBm.

Item	Typical field value	Training interpretation
OLT transmit power	+1 to +5 dBm	Confirm with PON power meter or OLT diagnostics before suspecting the fibre. Too much power can result in unstable service or total outage, not common, but possible.
ONT receive level See table below	Often around Rx Max -8 to Rx Min -27 dBm depending on class/vendor	Below receiver sensitivity i.e.-28, -29, -30 etc. causes an unstable service or total outage. Above Rx Max, very rare i.e. -7, -6, -5 etc. causes packet loss, high latency, or a total outage.
1:4 splitter loss	± 7 to 8 dB	Major expected loss event. Do not treat it as a fault if within design limit.
1:16 splitter loss	± 13 to 15 dB	Largest expected second-stage event in this topology.
Fusion splice	Preferably <0.10 dB	Higher loss indicates a poor splice or a macro or micro bend at the splice.
Connector	Preferably <0.50 dB	High loss or high reflectance usually means a dirty/damaged connector.

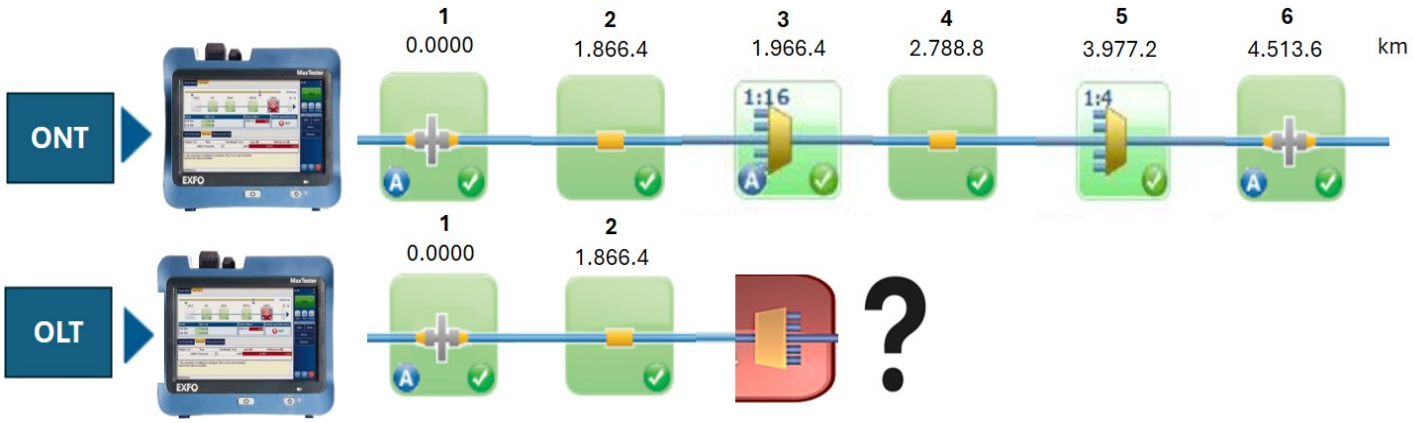
Typical ONT levels			
Class	**Rx Max**	**Rx Min**	**Power Budget**
B+	-8.0 dBm	-27.0 dBm	28 dB max
C+	-10.0 dBm	-30.0 dBm	32 dB max
C++	-10.0 dBm	-32.0 dBm	35 dB max

5. iOLM Capabilities and Limitations

iOLM is an advanced Optical Time-Domain Reflectometer (OTDR) based application that performs multiple acquisitions, automatically selects test parameters, detects events and presents the fibre route as a simplified event map. This helps technicians focus on the fault location instead of manually interpreting a raw OTDR trace.

To begin with, the trouble with PON iOLM testing is, that once a splitter or cascaded splitters are in place, iOLM testing can be performed ONLY from the ONT (customer) end, producing a link view made of easy-to-understand icons, showing the losses and reflections becoming to the pertinent fibre all the way to the OLT, which of course includes a high loss event through the splitter/s.

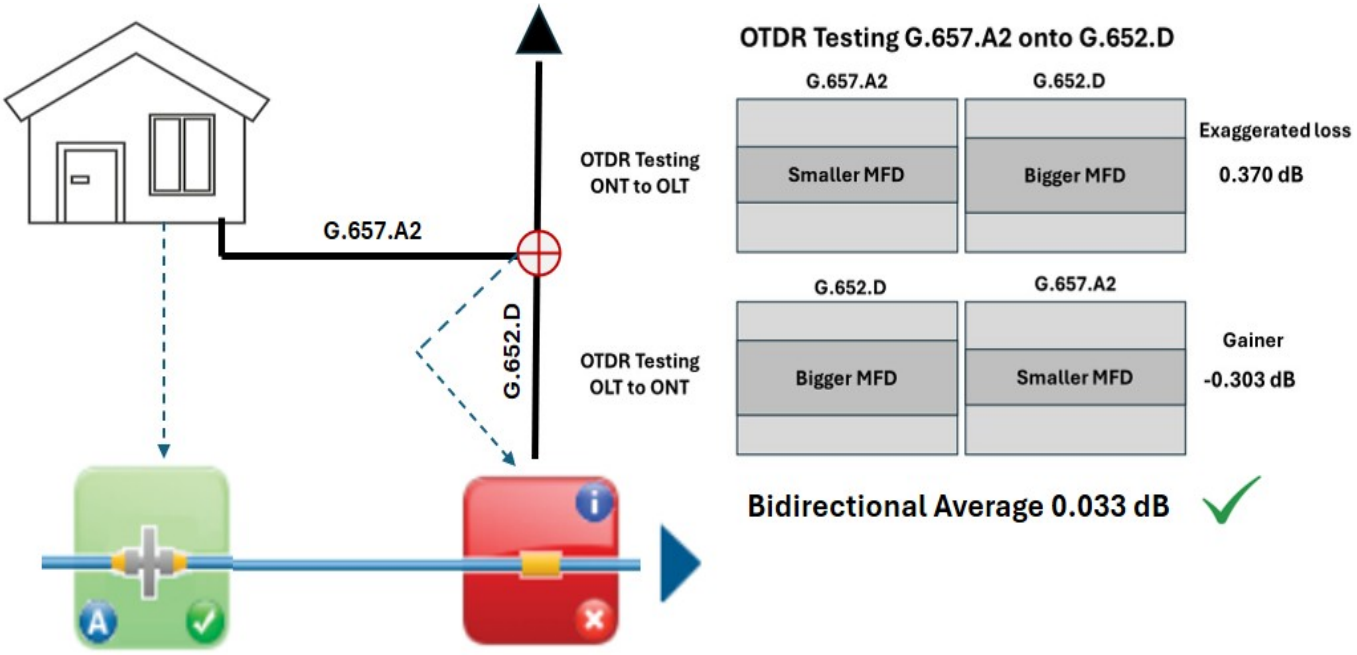
From the OLT end however, with the splitter/s in place, a conventional looking trace / link view is generated up to the first splitter. At this splitter, the downstream pulses are split and with diminished intensity they simultaneously travel down the feeder, distribution and last-drop fibres. Meanwhile, backscatter and reflections from these pulses are guided back up the fibres (in the upstream direction), merging at the splitter, after that, they barrel along back to the iOLM. At the iOLM, the converged light from each of the splitter legs appear as overlapping backscatter and reflections, taking it well beyond the bounds of possibility to determine which fibre-leg might be responsible for any excessive loss or reflection.



Traditional OTDR	iOLM
Technician selects pulse width and range manually	Application performs intelligent acquisition and analysis
Trace interpretation requires experience	Events are presented in a block diagram format, representing connectors, splices, splitters, bends and end of the fibre
Higher risk of missing events hidden by dead zones	Multiple acquisitions with different pulse widths and distance settings, improve event identification or use a launch cable
Manual reporting often varies by technician	Standardized pass/fail reports improve repeatability
Important iOLM implementation note: For PON testing, define the splitter stages correctly. In this training topology, Stage 1 is 1:4 and Stage 2 is 1:16. If the splitter ratio is unknown, use the unknown ratio option only as a temporary discovery method; then update the route profile so pass/fail analysis becomes meaningful.	

The Fusion Splice where the ONT Drop Cable meets the Distribution Cable

Testing with an OTDR or iOLM from the ONT toward the OLT will show a fictitious exaggerated loss of 0.3-something, where G.657.A2 is spliced onto G.652.D. This is due to a mismatch in Mode Field Diameters (MFDs). Testing from the other side will reveal a -0.0-somemething "gainer" meaning that the bidirectional loss is a very respectable 0.03-something. To the uninformed, this ambiguity can create delays and unnecessary rework.



6. Required Equipment and Preparation

Equipment	Purpose	Critical notes
iOLM-capable OTDR	Main event-map test instrument.	Use the PON/FTTx-appropriate module with high dynamic range and PON-optimized response. Also confirm the correct connector type.
Launch cable	Allows near-end connector and the first event to be characterized i.e. eliminates dead zones.	Use correct length and keep it clean and labelled. 100m is typically sufficient.
Receive cable	Enables one to certify the very last connector of your fibre link.	Useful for acceptance testing and full link reports. 2km lengths are typically used.
PON power meter	Checks live downstream/upstream optical levels. Broadband vs Filtered models. Single & Dual port applications.	Use when testing live OLTS and ONTs.
Fibre microscope	Checks connector end faces.	Inspect before connecting connectors.

	This continues to be the biggest cause of loss.	
Connector and coupler cleaning kits	Removes contamination.	Inspect-clean-inspect-connect.
VFL	Short-range visual fault finding or tracing.	Useful on drop cables and patch panels, but not a substitute for iOLM.

Connector discipline

1. Inspect the connector end-face using a fibre microscope.
2. Clean if contaminated.
3. Inspect again.
4. Connect only after a perfectly clean result.
5. Cap unused connectors and couplers immediately to protect against accidental damage (i.e. when dropped).

7. Detailed iOLM Implementation Procedure

Before you tap the Start button:
Confirm using a PON power meter, whether the PON is live and whether testing will interrupt service i.e. is the OLT port is carrying traffic. Follow your company isolation and customer-impact procedure. OLTS ports are typically protected against damage from 1625 & 1650nm OTDR signals.

Step 1 - Define the fault scope

From NOC alarms, Customer Relationship Management (CRM) tickets or OLT/ONT status, decide whether the issue is with all 64 ONTs or one 1:16 group, or only one customer.

Step 2 - Select the correct test point

Use a PON power meter to determine if the link is live or not at the proposed test point - this will determine the test wavelengths: 1310/1550/1625nm for dark or 1625/1650nm for live fibres.
All ONTs down: start at OLT/ODF towards the 1:4 splitter.
One group down: test the affected 1:4 output or relevant field closure.
Single ONT down: test from the 1:16 splitter output or from the customer end depending on availability or ease of access.

Step 3 - Configure route details

Enter project name, OLT, PON ID, splitter stages 1:4 and 1:16, expected link end, wavelength and pass/fail thresholds.

Step 4 - Connect launch fibre, if required

Connect iOLM port to launch fibre, then to the link under test. Verify correct connector type and type of polish.

Step 5 - Run iOLM Auto Test

Allow the application to complete all acquisitions. Do not disturb the fibre during acquisition.

Step 6 - Read the event map

Identify launch fibre connector, drop cable, 1:16 splitter, distribution cable events, 1:4 splitter, feeder cable events, OLT location and receive lead. Upstream testing is always the primary recommendation.

Step 7 - Locate the first FAIL event
The first fail event often explains all subsequent symptoms. Record the distance and event type.

Step 8 - Correlate distance with records
Compare iOLM distance with route drawings, handhole records, splice closure data, splitter and distribution cabinet locations.

Step 9 - Repair and retest
After the repair, run the same test again and save before/after traces.

Step 10 - Close the report
Attach event map, root cause, corrective action, measured loss and final PASS result.

8. Event Interpretation and Fault Signatures

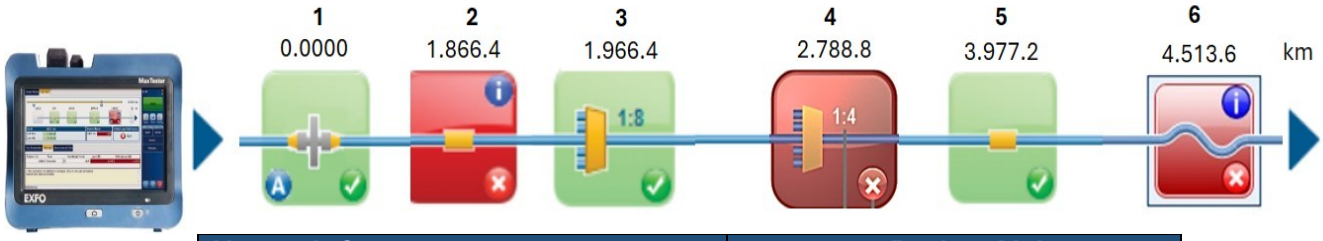
iOLM event	Healthy appearance	Fault appearance	Action
Connector	Small loss, acceptable reflectance	High loss and/or high reflectance	Inspect, clean, re-seat, replace patch lead or mid-coupler, if needed
Fusion splice	Very small loss	Loss above threshold	Locate closure, re-splice and retest bi-directionally and with multiple wavelengths if needed
Macro bend	Unexpected, localized attenuation	Worse at longer wavelength	Straighten bend, reroute cable, replace damaged section
1:4 splitter	Large, planned event around 7-8 dB	Missing events or excessive loss	Check splitter input/output, patching and distribution cabinet condition
1:16 splitter	Large, planned event around 13-15 dB	Excessive loss or no downstream visibility	Check affected splitter and output ports
Fibre break	Premature end of fibre before expected endpoint	No further downstream events visible	Dispatch to distance location and repair cable cut/break

Healthy Link and Optical Budget Examples

Important iOLM implementation note:
Test from the ONT.

Not healthy looking

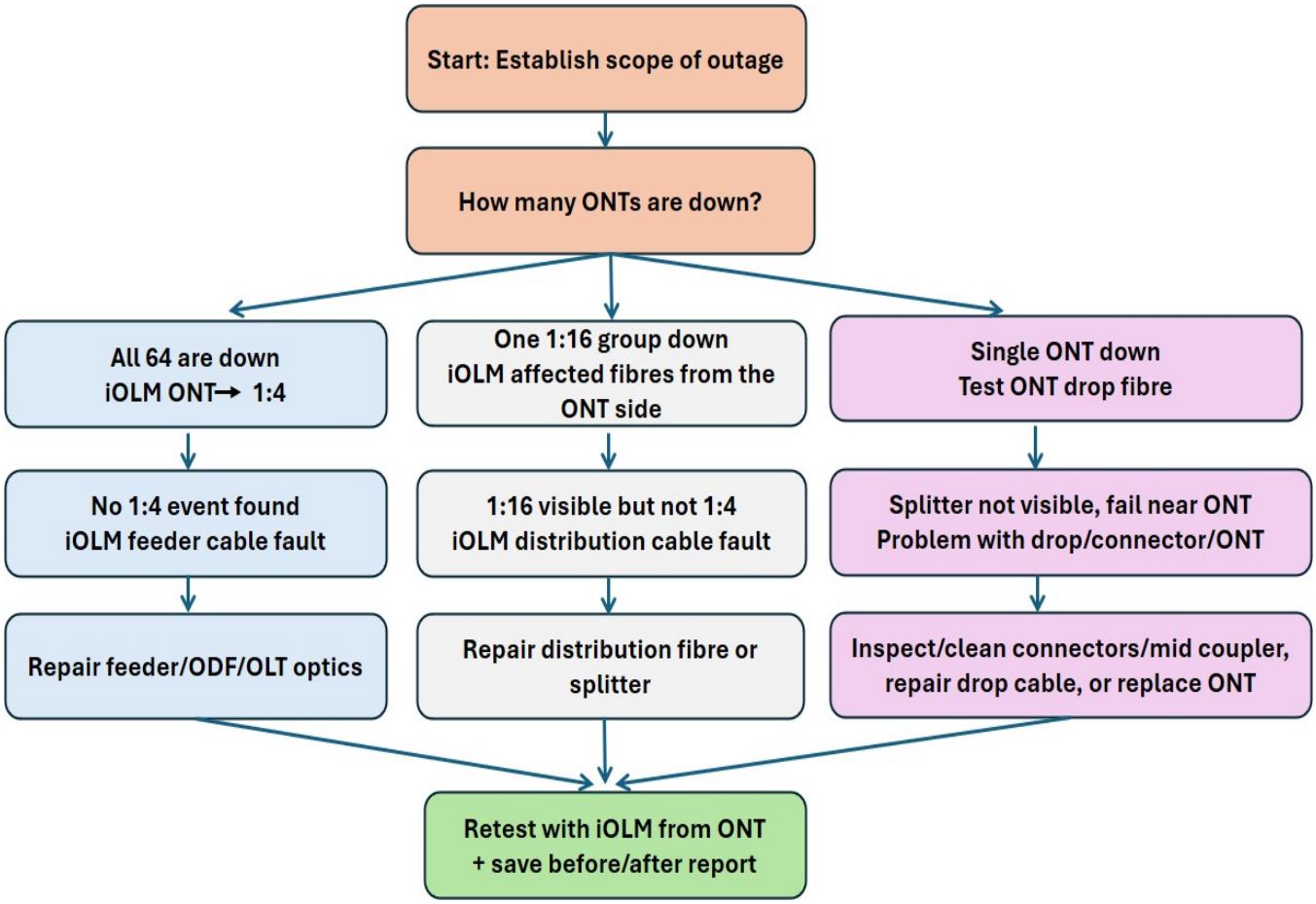
Bad splice, faulty 1:4 splitter, and a macro bend.



Network Component	Loss Budget Values
Fibre attenuation 1310 nm to 1625 nm	< 0.35 dB/km
Fibre attenuation 1550 nm	< 0.3 dB/km
Connectors (mated)	< 0.5 dB
Reflectance APC Connectors	< -55 dB
Splices	< 0.1 dB
Engineering / Safety margin	3.0 dB

Splitter Ratio	Theoretical Loss (dB)	Typical Insertion Loss (dB)
1:2 splitter	3.0	3.5
1:4 splitter	6.0	7.0
1:8 splitter	9.0	10.5
1:16 splitter	12.0	13.5
1:32 splitter	15.0	17.0
1:64 splitter	18.0	20.5
1:128 splitter	21.0	23.5
Actual values may vary slightly based on connector types (SC/APC vs. LC/UPC) and manufacturing precision.		

9. ONT Outage Workflows



Scenario A: all 64 ONTs offline

1. Verify OLT PON port admin and operational status.
2. Measure OLT Tx power if accessible.
3. Run iOLM from OLT/ODF toward field.
4. If 1:4 splitter is not detected, treat as feeder/ODF fault.
5. If 1:4 is detected but all outputs fail, inspect 1:4 cabinet, splitter and common patching.
6. Repair, run final iOLM from ONT side, verify ONTs recover.

Scenario B: one 1:16 group offline

1. Identify affected ONT range and associated 1:4 output.
2. Confirm other groups are online to rule out OLT and feeder.
3. Run iOLM from ONT toward the affected 1:16 splitter.
4. If 1:16 event appears but 1:4 does not, inspect distribution cable and closures.
5. If 1:16 appears with excessive loss, inspect and if necessary, replace the splitter.
6. If only some ONTs on the 1:16 are offline, move to individual/drop-level testing.

10. Single ONT Outage Workflow

A single ONT outage should normally be treated as a drop-side fault until proven otherwise, because the OLT, feeder, 1:4 splitter and 1:16 splitters are already supporting other active customers.

1. Confirm ONT electrical power and other LED lights.
2. Measure received power from OLT with PON Power meter.
3. Check customer patch lead and wall box.
4. Run iOLM from the ONT to the 1:16 splitter.
5. If high reflective connector is shown, inspect and clean customer patch cord and pigtail connectors.
6. If macro-bend appears, physically inspect routing around bends in TP box, ceilings, conduits and entry points.
7. If premature end appears, replace or repair drop cable.
8. If optical path passes but ONT remains offline, escalate provisioning/ONT hardware check.
9. **Very, very uncommon:** But if the ONT Rx Max level registers too much power i.e. -7, -6, -5, -4, etc. and attenuator can be installed in the TP box, or on the ONT.
   Attenuators provide a set loss, ranging from 1dB to 20dB.
   An ONT attenuator reduces the strength of the incoming optical signal to a specific, safe level. It prevents the ONT receiver from being overloaded or permanently damaged by an optical signal that is too "hot".

11. Practical Scenarios and Example Traces

Feeder cable break: No splitter/s detected

Feeder cable break: 1:16 detected, no 1:4

Dirty connector: 100m launch cable used - high reflectance near customer

Macro bend: High loss in the drop cable

Scenario	iOLM observation	Diagnosis	Corrective action
Feeder break	End of fibre at 2.1 km; no 1:16 event	Fault before 1:16 splitter	Repair feeder fibre/ODF path
Distribution break	1:16 at 220 m; break at 3.1 km; no 1:4 event.	Fault between 1:16 and 1:4 splitters.	Inspect distribution cabinet, joint closures, cable route.
Dirty connector	High reflection and a ± 1.8 dB loss at customer.	Contaminated or damaged connector.	Inspect/clean/replace connector.
Macro bend	A ± 3.2 dB localized loss in drop cable.	Bent or crushed drop cable.	Reroute or replace drop section.

12. NOC Escalation, Mean Time to Repair (MTTR), and Reporting

Role	Responsibility	Escalation trigger
L1 NOC	Alarm/ticket verification, outage grouping, customer impact	Multiple ONTs, unclear symptoms
L2 NOC / Fibre support	Remote OLT diagnostics, iOLM report review, dispatch instruction	Power level anomaly, suspected feeder or splitter fault
Field technician	Physical testing, iOLM capture, repair and restoration	Fault distance mapped to field asset
L3 / Engineering	Design issue, chronic high loss, route record mismatch	Repeated faults, insufficient optical margin, undocumented plant

Mean Time to Repair (MTTR) item	Record
Fault detected time	
Dispatch time	
Arrival time	
Fault located time	
Repair completed time	
Service restored time	
Final iOLM report saved	Yes / No

13. Acceptance Testing and QA Standards

For new builds or repaired sections, acceptance should prove that the link has the expected event map, expected splitter losses, acceptable connector/splice losses, and sufficient optical margin. Reports should be archived against the OLT/PON/splitter/ONT identifiers.

1. Run iOLM with correct route profile and splitter stages.
2. Verify every planned event appears at the expected distance.
3. Investigate unplanned reflective events.
4. Confirm total loss is within design budget.
5. Save report with naming convention: OLT_PON_Splitter_ONT_Date_Tech.
6. Attach photos of repaired closure or cabinet where required.
7. Obtain technician and supervisor sign-off.

15. Competency Assessment

Assessment task	Pass criteria
Set up tester and launch fibre	Correct connector discipline and route naming
Configure 1:4 + 1:16 PON profile	Correct splitter ratios and thresholds selected
Interpret healthy event map	Correctly identify splitter events and total loss
Diagnose all ONT outages	Correctly isolates feeder/OLT/1:4 domain
Diagnose one-group outage	Correctly isolates distribution/1:16 domain
Diagnose single ONT outage	Correctly isolates drop/connector/ONT domain
Complete report	Includes trace, distance, root cause, action, and PASS

Assessment exercises with answers

Exercise 1

When measured from the OLT, iOLM shows a fibre end at 2.1 km and no 1:4 splitter. What is the fault domain?
Answer: Feeder fibre or ODF path before the 1:4 splitter.

Exercise 2

When measured from the ONT, the 1:16 event appears at 4.8 km, then a break appears at 7.1 km. What should you inspect?
Answer: The distribution fibre closure between the 1:4 output and the affected 1:16 splitter.

Exercise 3

Can iOLM be used from the OLT all the way to the ONT?
No, at best, we can show the existence of the 1:4 splitter. Beyond that, the trace cannot be interpreted.

Exercise 4

The 1:16 splitter loss is 18.5 dB instead of around 13-15 dB. What action is required?
Answer: Inspect input/output connectors and replace the splitter if excessive loss is confirmed.

Exercise 5

iOLM passes when testing upstream, but the ONT remains offline. What are the next checks?
Answer: A connector faulty downstream, ONT power/hardware, provisioning, serial number registration, OLT service profile and customer equipment.

14. iOLM Setup: Field Implementation Standard

The most common reason for poor iOLM results is incorrect preparation rather than a faulty instrument. The technician must control connector cleanliness, test points, wavelength, route definition, splitter profile and report naming before the acquisition starts.

Setup item	Required standard	Why it matters
Project / job name	Use site, OLT, PON, splitter and technician reference	Allows for the NOC and QA team to find traces later.
Test direction	Record ONT→OLT, OLT→splitter, or splitter→ONT	Direction affects which events are visible and how losses are interpreted.
Splitter profile	Stage 1 = 1:4, Stage 2 = 1:16	Incorrect splitter ratios can cause false fail/pass results.
Launch fibre	Use correct fibre type, length and connector polish. NB: Use a filtered launch fibre if your OTDR test port is not filtered. The OLT signal WILL damage a standard OTDR or iOLM port!	Allows characterization of the near-end connector and reduces dead-zone impact.
Receive fibre	Use for acceptance testing where end connector must be evaluated	Improves confidence in the far-end event.
Wavelength	Use approved wavelength set for the task. 1625 or 1650nm only for live links and 1310, 1550 and 1625nm for dark links.	Different wavelengths reveal different fault signatures.
Threshold set	Use company GPON acceptance thresholds	Ensure that every technician judges events consistently.

15. iOLM Test Profile for 1:4 + 1:16 GPON

Create a saved iOLM test profile for this topology so technicians do not have to manually reconfigure every job. The profile should include the expected splitter stages and the event thresholds accepted by the company.

Profile parameter	Recommended setting for this manual	Training note
Application mode	iOLM / FTTx / PON route profile	Use the PON-capable mode available on the tester.
Splitter stage 1	1:4	Expected primary splitter loss around 7 to 8 dB.
Splitter stage 2	1:16	Expected secondary splitter loss around 13 to 15 dB.
Splitter stage 3	None, unless route has another splitter	Avoid adding phantom splitters.
Unknown splitter option	Use only for discovery or undocumented networks	Once identified, change to actual ratio for pass/fail reporting.
IOR / backscatter	Company fibre standard or instrument default	Keep consistent across the network to improve distance accuracy.
Pass/fail thresholds	Company acceptance policy	Use the same threshold set for commissioning and repairs.

16. Wavelength Strategy for Fault Finding

Wavelength selection affects what the iOLM reveals. Longer wavelengths are usually more sensitive to macro-bends, while shorter wavelengths may be useful for general continuity and event location. Follow company rules for testing live PONs and avoid interfering with active service.

Use case	Suggested approach	Interpretation
Construction / acceptance testing	Test at approved non-service or standard OTDR wavelengths according to company policy.	Confirm end-2-end event map and budget.
Suspected macro-bend	Compare shorter and longer wavelength behaviour.	A bend usually shows higher loss at the longer wavelength.
Feeder break	Use iOLM from OLT or nearest ODF.	The break appears as an unexpected end before the 1:4 splitter.
Drop fault	If possible, test from 1:16 splitter output or the customer side.	Short distances require clean launch leads and careful setup.
Live network	Use live-fibre-safe procedures and PON power meter first.	Never interrupt active customers without authorization.

17. How to Read the iOLM Screen in the Field

iOLM screens present a link view/event map, event table, global pass/fail status, distance scale and detailed diagnostics. Train technicians to read the display in the same order every time.

1. Check overall status: PASS, FAIL or WARNING.
2. Confirm that expected events appear in the correct order. When measured from ONT: launch connector, endpoint, drop events, 1:16 splitter, distribution events, 1:4 splitter, feeder events, OLT port, and receive lead.
3. Open the first failed event on the events table.
4. Record event type, distance, loss, reflectance and diagnostic message.
5. Compare distance with plant records and physical access points.
6. Do not ignore earlier warning events just because a later event fails - the earlier warning may be the root cause.

iOLM field shown	What it means	Technician action
Distance	Approximate fibre distance from the test point	Map to route drawings, slack loops and closures.
Loss	Attenuation caused by an event	Compare with accepted threshold.
Reflectance	Amount of reflected light at reflective events	Clean or replace reflective connectors when excessive.
Element type	Connector, splice, splitter, bend, end of fibre, unknown	Use element type to select physical inspection method.
Diagnosis / acquisitions	iOLM suggested issue	Use actionable diagnostic advice as guidance and always verify physically.
Total link loss	Accumulated measured loss	Compare it to design and power budgets.

18. Directional Testing: ONT to OLT and OLT to First Splitter

Directional testing is important because some events appear differently depending on test direction. For fault restoration, one direction may be sufficient to locate a hard break. For acceptance and disputed losses, test both directions where practical.

Direction	Best for	Limitations
OLT to First Splitter	Feeder faults, primary splitter visibility.	Downstream splitters and high losses will reduce visibility beyond splitter stages.
ONT to OLT	Customer-side confirmation, drop and secondary splitter approach.	May require customer access and careful live-service control.
Splitter to ONT	Single ONT/drop faults.	Does not prove feeder or primary splitter health.
Splitter to OLT	Distribution/feeder isolation from field cabinet.	Requires access to the correct splitter output or fibre route.
Best practice: For serious or repeat faults, keep bidirectional traces in the job record. A single direction trace can locate a fault, but bi-directional evidence is stronger for QA and disputes.		

19. Detailed Multiple ONT Fault Isolation Matrix

Symptom	iOLM result	Likely fault domain	Next action
All 64 ONTs offline	No light from OLT with no valid trace	OLT/SFP/PON card/configuration	Check OLT alarms, SFP, admin status and optical output.
All 64 ONTs offline	Break before 1:4 splitter	Feeder fibre or ODF	Dispatch to feeder distance and inspect ODF and first closure.
All 64 ONTs offline	1:4 detected but abnormal loss	Primary splitter or distribution cabinet	Measure input/output power and inspect splitter cabinet.
16 ONTs offline	1:16 detected with no 1:4 detected	Distribution leg	Inspect cable between 1:4 output and 1:16 splitter.
16 ONTs offline	1:16 detected with excessive loss	Secondary splitter	Inspect input connector, output tray and replace splitter if required.
Several ONTs in same 1:16 group offline	Splitter healthy with faults after selected outputs	Drop distribution to customers	Test affected output/drop fibres individually.
Random ONTs across different groups unstable	Event map passes but power margin low	Budget/design/systemic connector issue	Review optical budget, connector cleanliness and OLT/ONT optics.

20. Detailed Single ONT Fault Isolation Matrix

Field symptom	iOLM observation	Likely cause	Action
ONT has no electrical power light	No fibre test needed first	Power supply/customer power	Restore power or replace PSU.
ONT LOS red	Fibre end before ONT	Broken drop cable	Repair/replace drop fibre.
ONT LOS red	High-loss connector close to ONT	Dirty/damaged connector	Clean, inspect, replace connector/patch lead.
Intermittent service	Macro-bend event on drop	Bend/crush/kink	Correct routing and retest.
Low power, no obvious fail	Total loss near budget limit	Accumulated losses	Clean all connectors, inspect splices and verify budget.
iOLM PASS, ONT offline	Optical path OK	ONT/provisioning/service config	Check serial, profile, OLT registration and replace ONT if required.

21. Practical Field Work Instructions

Work instruction A: All customers on the PON are down

1. Confirm outage in NOC systems.
2. Check OLT PON port status and alarms.
3. If the PON port is down or no transmit power is present, resolve OLT/SFP issue first.
4. If the OLT is transmitting, connect iOLM at ODF using a launch fibre.
5. Run the Point-to-Point profile.
6. If the first fail is before the 1:4 splitter, dispatch tech to feeder route.
7. After repair, verify the 1:4 splitter event is visible, by running iOLM from ONT side.
8. Confirm customer recovery and save report.

Work instruction B: One splitter group is down

1. Identify which 1:4 output serves the affected 1:16 splitter.
2. Check whether neighboring 1:16 groups are healthy.
3. Test from the closest accessible ONT access point toward the affected splitter.
4. If no 1:4 event is detected, inspect distribution fibre.
5. If the 1:16 event has excessive loss, inspect splitter input and cabinet.
6. Repair or replace faulty component.
7. Retest and confirm the group recovers.

Work instruction C: One ONT is down

1. Confirm ONT electrical power and customer equipment.
2. Inspect and clean customer fibre connectors.
3. Measure ONT receive power from OLT with PON power meter.
4. Test drop fibre using iOLM from the closest practical side.
5. Repair connector, bend or break.
6. If the optical path passes, escalate ONT registration/provisioning.
7. Save final trace and close ticket.

22. iOLM Report Naming and Evidence Pack

Use a consistent naming convention and attach enough evidence for a reviewer to understand the fault without calling the technician back.

Evidence item	Minimum requirement
File name	OLT-PON
Before trace	Required for all repair faults where practical
After trace	Required for all repairs and acceptance testing
Photos	Closure/cabinet/drop before and after where relevant
Power readings	Record OLT/ONT or splitter readings when used
Ticket notes	Fault distance, physical location, root cause and action
Customer recovery	ONT online confirmation or NOC verification

23. Quality Assurance Review Checklist

QA question	Pass requirement
Was the correct test profile used?	1:4 and 1:16 splitter stages configured correctly.
Are all planned events visible?	OLT/feeder, 1:4, distribution, 1:16 and endpoint where expected.
Is the first fail event identified?	Distance and event type recorded.
Is the repair supported by an after trace?	After trace shows PASS or improved measurements.
Is the optical budget acceptable?	Total loss plus margin within design class.
Are notes clear enough for future use?	Route, closure, port and action are documented.

24. Trainer-Led Practical Lab Plan

Lab	Setup	Expected trainee outcome
Lab 1: healthy PON trace	Known-good route or simulated event table	Trainee identifies all planned events and calculates loss.
Lab 2: feeder break	Insert disconnect before primary splitter	Trainee diagnoses all-ONT fault before 1:4.
Lab 3: distribution break	Disconnect one leg between 1:4 and 1:16	Trainee diagnoses one-group outage.
Lab 4: dirty connector	Contaminate training connector safely or use sample trace	Trainee identifies reflectance and cleaning action.
Lab 5: macro-bend	Introduce controlled bend on spare fibre	Trainees compare wavelength behaviour and straighten the bend.
Lab 6: report pack	Provide before/after traces	Trainee completes closure report and QA checklist.

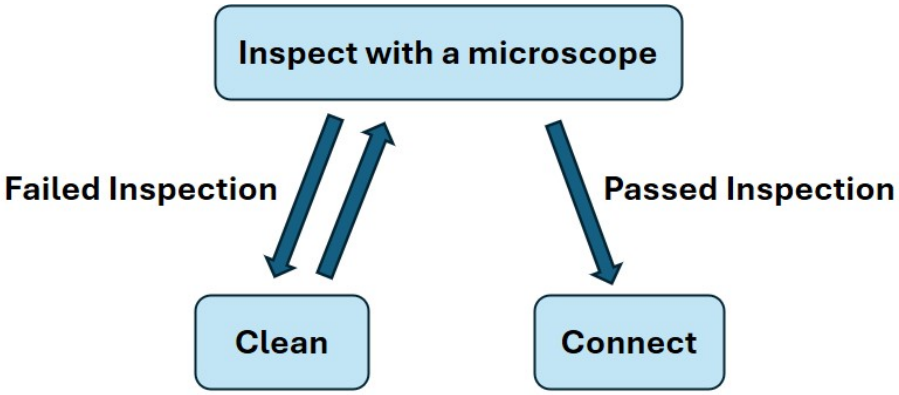
25. Final Technician Field Card

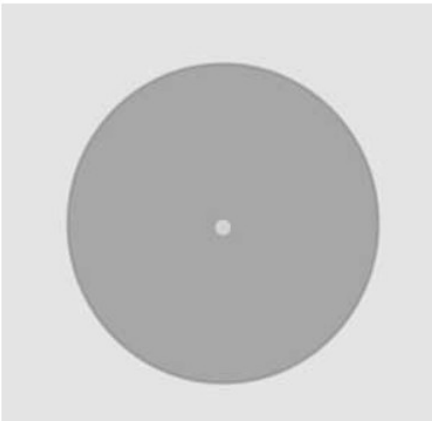
Field logic:
All 64 down = OLT, feeder or 1:4.
One group down = 1:4 output, distribution fibre or 1:16.
One ONT down = drop fibre, connector, customer patching, ONT or provisioning.

Question	Action
Is the OLT transmitting?	Check alarms and power before fibre dispatch.
Does iOLM show the 1:4 splitter?	No = feeder fault. Yes = continue downstream.
Does iOLM show the affected 1:16 splitter?	No = drop cable fault. Yes = inspect splitter.
Is the first fail a connector?	Inspect/clean/replace connector.
Is the first fail a bend?	Find physical bend/crush and reroute or replace.
Is the first fail a break?	Repair at mapped distance.
Does iOLM pass but service fails?	Check ONT hardware, registration and provisioning.

26. Connector Cleaning

Best practices:
Always start and finish with dry cleaning, as it is the most efficient.
It is suggested that in some instances, 3-clicks are necessary when using a one-click cleaner.
Research revealed that there is an incremental cleanliness improvement after click-1, -2, and -3. No difference is noticeable amongst click-3 and -4.

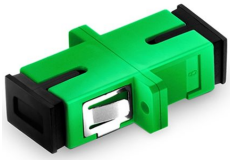




1. Always make sure that the fibre is not active, before inspecting or cleaning.
2. Visually inspect the connector end-face first with a fibre microscope.
3. If the inspection fails, always start with dry cleaning.
4. A mechanical one-click cleaner is an efficient way to clean connectors (see best practice) or use a lint-free wipe.
5. If the connector is still not clean after a 3rd-click or wipe, perform an isopropyl alcohol moistened lint-free wipe clean on the connector, followed by a dry clean.
6. Every time you disconnect, you must carry out an inspection and, if needed, the cleaning procedure.
7. Do not leave unused connectors uncapped.
8. When you remove a dust cap, inspect the connector to ensure it is clean, before connecting.
9. When not in use, always put the protective cap back on the one-click cleaner.
10. Choose the correct one-click cleaner size based on your connector type i.e. 1.25 versus 2.5 mm.

27. Mid-Coupler/Adaptor Cleaning

1. A mid-coupler one-click cleaner, equipped with a long tip, is a push-type dry cleaning tool designed to remove dust and debris from ferrules. This can be achieved without unplugging the internal pigtail. Choose the correct cleaner size based on your connector type i.e. 1.25 versus 2.5 mm.



2. Dry swabs are also effective in this regard and must be given a 360-degree rotation, when pushed in and pulled out.
3. Please note that the ceramic sleeves inside the adapter are tightly fitted - so carefully rotate the swab in the coupler.
4. Unused mid-coupler ports must always be kept sealed with dust caps
5. Should a dust cap drop on the floor, clean it thoroughly, before placing it back in a port.
6. Never spray fluid directly into a mid-coupler port.

28. Cleaning Test Equipment Ports

1. It is recommended that you consult with your supplier in this regard, especially in situations involving expensive and/or specialized equipment.

29. Network Documentation

Accurate documentation allows for easier troubleshooting and faster repairs.

It is uncommon for fibre projects to pan out exactly as initially planned. Field conditions such as subsurface utilities, culverts, dolomite, hard rock, and other topography problems, calls for real-time decision making and are all common sources of blueprint deviations.

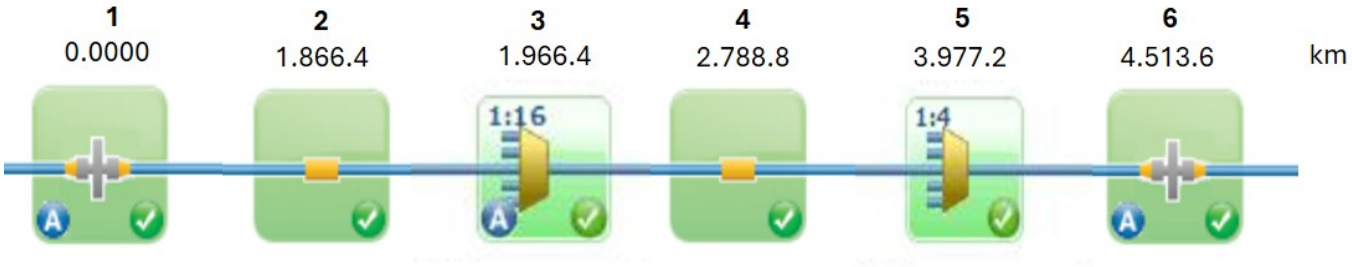
As-built drawings address this by providing an updated version of a design blueprint which reflects exactly what was built and not only what was planned.

Changes made both during construction and after construction (during maintenance), must all be updated on drawings to help operators maintain high service reliability and performance.

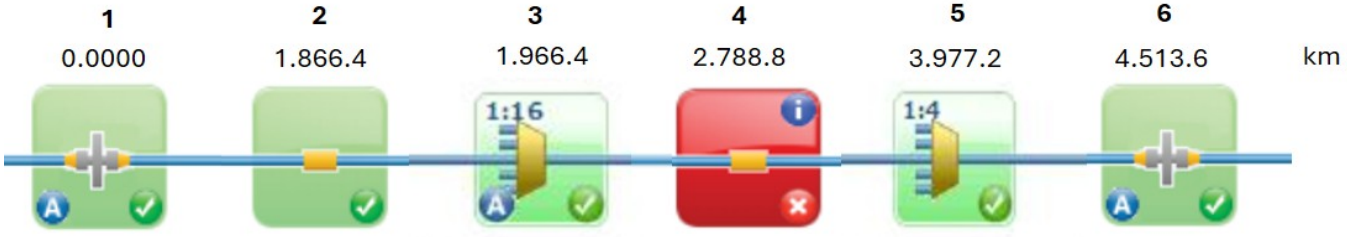
30. Test Documentation

Testing without formal documentation is meaningless for troubleshooting, audit, and inspection purposes.

Saved documentation of all tests is a top priority. The data accumulated and saved from these tests will become an invaluable resource in the future.



During repairs, you can immediately compare your current trace against historical records to pinpoint the exact location and nature of a fault.



Recorded test records speed up repair and maintenance, since it allows for comparing what is supposed to be there with what is there.

31. Labelling

Good labelling practices reduce the following:

- Maintenance confusion and uncertainty
- Troubleshooting time
- Accidental service interruptions

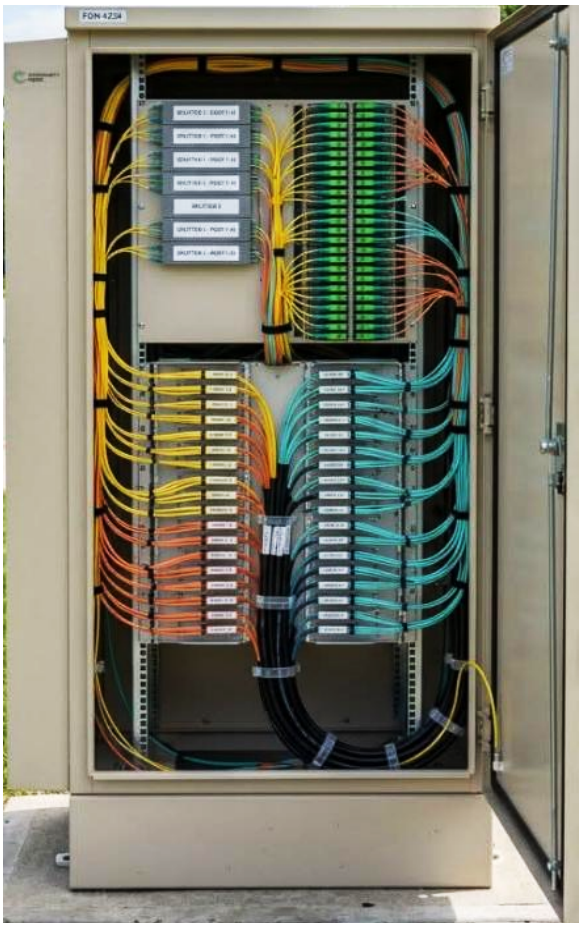
Ensure your naming and numbering system and your system drawings reflect the same information.

Well-structured labelling reduces dependency on individual installer memory and improves long-term infrastructure manageability.

Proper labelling allows for easier troubleshooting and faster repairs. These benefits not only save time but also save money.

Avoid handwritten labels or tags; use durable, thermal-transfer printed labels that resist fading or peeling.

Can labels be placed directly on fibre bends? No. Placement should avoid interfering with the routing and bend radius presence.



Thermal labels are the most effective as they are resistant to temperature changes, they don't fade with handling and will remain visible for more than 10 years.

If you are adding, removing or changing anything, you must make sure that you update both the label/s and the master document at the same time.

Without delay replace any labels that show signs of deterioration, a few minutes spent on replacing a label today could save unnecessary troubleshooting time. If technicians can’t quickly find the correct cable, patch cord, etc., those minutes can add up quickly.

ANSI/TIA-606-C provides a uniform administration and labelling standard for telecommunications infrastructure.

Glossary of Terms used
As-Built Network Drawings: They are final, updated drawings that show the exact physical layout of a telecom, fibre optic, or structured cabling network as it was built, rather than how it was originally planned.
Attenuator: An ONT attenuator reduces the strength of the incoming optical signal to a specific, safe level and prevents the ONT receiver from being overloaded. They provide a set loss, ranging from 1dB to 20dB.
Feeder cables: Feeder cables are the initial large fibre count cables that run from the OLT to local convergence cabinets or distribution points. **Distribution cables:** Extends the network from where the feeder cable ends to bypassing homes. **Drop cables:** The term “drop” refers to the final connection between a distribution cable and the customer location.
Filtered launch fibre/cable: A specialised iOLM or OTDR test cord that integrates an optical filter (typically 1625 nm or 1650 nm) to test live fibre networks without interrupting active traffic.
GPON: It is an acronym that stands for Gigabit Passive Optical Network, and as the name implies, it is an optical, passive network that works in the order of Gigabits per second.
iOLM: An intelligent Optical Link Mapper is an innovative and easy-to-use software application that uses multipulse acquisitions and advanced algorithms to deliver information on every event/component in a fibre link.
Launch cable: A launch cable is utilized when testing with an OTDR or iLOM to remove any dead zones or aid with identifying issues at the point where the iLOM/OTDR connects to the fibre. The launch cable provides the needed distance for the pulse to settle and to recover normal sensitivity, to measure backscattered light accurately
Macro bend: A visible curve in a fibre optic cable that exceeds the minimum bend radius, causing light to leak out of the core and reduce signal strength.
Micro bend: A micro bend loss refers to small scale "bends" in the fibre, often from pressure exerted on the fibre itself i.e. being squashed.
MFD: Mode Field Diameter defines the size of the power distribution in a single-mode fibre, not all the light is confined to the core of the fibre. The light is distributed through both the core and the cladding. The "mode field" is the distribution of light through the core and cladding of a particular fibre.
NOC: A fibre Network Operations Centre is a central control room where teams monitor fibre optic cables and network devices to prevent or fix internet outages
ODF: An Optical Distribution Frame is a high-density modular frame designed to organize, splice, and manage large volumes of fibre optic connections in data centers, central offices, PoP’s, or a fibre distribution cabinet (FDC).
OLT: The Optical Line Terminal is the operator-side device that orchestrates communication with the hundreds or thousands of ONT units on the customer side.
ONT: The Optical Network Terminal is a customer’s endpoint device, connecting them to an optical network.
PON power meter: A test instrument used to simultaneously measure and test upstream and downstream optical signals.
PoP: A Point of Presence / Central Office is the physical location that houses servers, routers, and switches to connect users to the internet.
Rx Max: The maximum receive overload limit. Signals stronger than specified can overload the optical receiver inside the ONT. Typically range from -8 dBm to -10 dBm, depending on the vendor.
Rx Min: The minimum optical power the ONT receiver needs to detect the signal. For GPON, this typically ranges from -26 to -28 dBm, depending on the vendor.
SFP: Small Form-factor Pluggable laser.
Splitters: An optical splitter is a passive optical device that divides the incoming optical signals into multiple outputs.
TP box: A Termination Point box is a small wall-mounted plastic enclosure installed inside a home or office to connect the incoming outdoor fibre optic cable to your indoor network.