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ISIS Practice
For All people involved in the plan, build, repair & test activities of fibre network

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Field Engineer testing practices for the Fibre to the Premises (FTTP) network

This document describes the practices for testing of the FTTP network at Build, installation and troubleshooting on Lead to cash (L2C).

About this document ...

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Content approval

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Version History

Version No.	Date	Author	Comments
Issue 9	20-Jan-2023	Timothy Wyatt	Updated power for commissioning at CBT Note on New PON's added to section 5. Part code added for patch cord. Note added 5.2 to tohhle on and off at each SASA to pass commissioning.
Issue 8	03-Mar-2022	Timothy Wyatt	Change of document ownership
Issue 7	16-Feb-2022	Dominic Bottomley	Addition of Discrete Façade Solution, a refinement of the commissioning process, clarification on use of 4 Port Light Source and changes to Light Loss Reading Documentation
Issue 6	28-May-2021	Dominic Bottomley	Introduction of Optical Test head along with major revision and change to section order & content
Issue 5	22-Mar-2021	Stan Edwards	Temporary change of document ownership and approver
Issue 4	16-May-2019	John Rich	MDU testing added
Issue 3	14-Feb-2019	Eilir Owen	Reinstated with new author and approver contact
Issue 2	14-Dec-2017	John Rich	Newsite and CE Process
Issue 1	14-Feb-2017	John Rich	New document

Table of Content

1 *Introduction*

This document describes the practices for testing the FTTP network at Plan & Build, Lead to Cash (L2C) and Trouble to Resolve (T2R). This document assumes that all engineers who carryout work as described here are trained and equipped with the prescribed test equipment.

2 *Scope*

This document covers the testing of Fibre to the Premises network using the Optical Test Head (OTH) and the testing process at each stage of the network.

Exchange – Fixed Rack Based Optical Test Head (OTH) – Policy can be found here – NWK/LNK/C584

EPT/ANS/A040 - One Fibre Network – Build Quality Manual for Engineers

3 *Safety*

Any person working on any part of the fibre network will have to conform and carry out work adhering to all the safety ISIS and relevant regulations

ISIS directive: EPT/COF/D050

4 *Cleaning*

Any person working on any part of the fibre network will have to conform and carry out relevant fibre cleaning methods.

Fibre Cleaning Process - AEI/AEC/B331

With the introduction of additional physical connectors and reflectors into the network engineers should take additional care to avoid contamination. Before connecting any fibre end both male and female ends should be cleaned using only Openreach approved cleaning devices. If available an Indirect Viewing Aid (IDVA) can be used to check the end faces of the connector for contamination and Damage.

Engineers should where possible carry out regular visual inspections of all optical test equipment connector's surfaces (including connector patch cords and adapters) to confirm clean and undamaged.

5 *How to test different stages of FTTP build for Brownfield SDUs Using OTH*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared "Ready for Service" (RFS). In the instance where there is an Optical Test Head (OTH) follow the steps below detailed in the following sections.

Before testing a **new** PON using the OTH, please ensure all reflectors have been removed from the PON you are testing, as left in refelctors which have not yet been associated may cause issues.

Testing is to be completed by the build teams as they build each SASA and CBT. A reflector is to be left in each CBT only once testing has been completed and the reflector has been associated.

5.1 Continuity Testing of Spine

At this stage, build assumes that OTH is present and exchange has been connected. Spine from the Exchange should be acceptance tested to the LW350 specification irrespective of the fibre circuit that will use the actual fibre. Detail on the LW350 spec can be found at ISIS practice: EPT/ANS/A019

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Splice Patch fibre Optical SC/APC between 1-2m, item code 023650 onto element 1 fibre 1.
- Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit.
- Connect the Patch fibre Optical SC/APC to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify a High Reflective Device (HRD).
- Once HRD is identified, take note of the distance and measurement.
- Disconnect Patch fibre Optical SC/APC and test all other fibres in the element to dis at that noted distance with a tolerance of +/- 2m.
- Repeat this process with every element within the cable.

5.2 Testing at the Splitter

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected and splitter device has been installed & spliced.

Note: It is important to check that the splitter is connected to the correct head-end.

As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port.

- Splice Patch fibre Optical SC/APC between 1-2m, item code 023650 onto the spare outgoing fibre from the SASA.
- SC/APC patch cord needs to be reduced to a minimum of 1m and a maximum of 2m in length.
- Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit.
- Connect the Patch fibre Optical SC/APC to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify a Splitter event and High Reflective Device (HRD). ~1-2m apart.
- Once HRD is identified, OTH has proved continuity and can progress to the next stage of the build.

Note: This can be done on spare splitter outputs that are not yet terminated to a CBT.

Note: Note: Auto toggle needs to be toggle on and off at each SASA to pass commissioning

5.3 Commission at the Connectorised Block Terminal (CBT)

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced and CBT tail cable has had all required ports spliced through. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision. Also due to the speed in which OTH can test, the practise is to test all active ports.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

Note: It is important to check that the CBT is connected to the correct SASA.

As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port.

- Take a power reading using a suitable Optical Power Meter (OPM) on port 1. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm).
- If power level is within spec, begin reflector testing.
- Insert reflector, item code 101834, into the highest spliced port and run OTH reflector test. If peak is visible continue to perform all ports testing.
- Once all active ports have been tested, bring the reflector down to port 1 and associate/reference that peak. Leave HRD in the first available port.
- The associatied/referenced peak will allow the OTH to monitor the network and detect any new events/changes in life.
- Once all CBTs from a splitter has been tested, the PON can be commissioned ready for service (RFS).

5.4 Commission at the Optical Network Termination (ONT)

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Note: Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Prior to provision, move the HRD into the next available port, then take a power reading at CBT using a suitable OPM on port 1. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm). Take note of the power level.
- Post provision, take a power meter reading at the inside out cable SC/APC connector. Power level needs to be less than 1dB difference from the CBT power reading at 1490nm in order for service to work.
- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.
- Should still be able to see the CBT peak.

Note: The peak can shift slightly in distance.

Once all ports have been consumed by customers, remove the reflector completely.

6 *How to test different stages of FTTP build for Greenfield SDUs Using OTH*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS). As Plan & Build (P&B) for Greenfield/Newsites is 100% up to the ONT, FND or build partners are responsible for the entire topology. In the instance where there is an Optical Test Head (OTH) follow the steps below.

6.1 Continuity Testing of Spine

At this stage, build assumes that OTH is present and exchange has been connected. Spine from the Exchange should be acceptance tested to the LW350 specification irrespective of the fibre circuit that will use the actual fibre. Detail on the LW350 spec can be found at ISIS practice: EPT/ANS/A019

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Splice SC/APC pig tail Splice SC/APC pig tail, item code 023327, onto element 1 fibre using SC back-to-back uniter, item code 055831, connect the SC/APC pigtail and SC/APC reflector, item code 105000.
- Run OTH test to identify HRD.
- Once HRD is identified, take note of the distance.
- Disconnect SC/APC pigtail and test all other fibres in the element to dis at that noted distance with a tolerance of +/- 2m.
- Repeat this process with every element in the spine cable.

6.2 Testing at the Splitter

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected and splitter device has been installed & spliced. It is important to check that the splitter is connected to the correct head-end. As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port. As the splitter outputs are connectorised it is not possible to splice on an SC/APC connector.

- Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary.
- Connect MPO-to-SC/APC patch chord into port 1 (currently does not exist, in development).
- Connect the SC/APC connector to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify Splitter event and HRD ~1m apart.
- Once HRD is identified, OTH has proved continuity and can progress to the next stage of the build.

- If no MPO-SC/APC test lead available, use a CBT 8 Port Connectorised 5m Tail Cable, item code 109033, and use the CBT reflector, item code 101834.

6.3 Commission at the CBT

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed and connectorised splitter and CBTs have been connected. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision. Due to the speed in which OTH can test, the practise is to test all active ports. As Greenfield/Newsites is pre-connectorised, all ports are active but some may not be required.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Take a power reading using a suitable OPM on port 1. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm).
- If power level is within spec, begin reflector testing.
- Insert reflector, item code 101834, into port 1 and run OTH test. If peak is visible continue to perform all ports testing.
- If there is no spare port for a reflector to be left in situ, save as a baseline test.
- If there is a spare port, install a reflector to be left in situ and save that trace as a baseline reference with the CBT/ID.
- The baseline reference will allow the OTH to monitor the network and detect any new events/changes in life.
- The next stage of build can continue.

6.4 Commission at the ONT

At this stage, build assumes that OTH is present and the network has been built to the ONT. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Take a power meter reading at the inside out cables SC/APC connector. Power level needs to be less than 1dB difference from the CBT power reading at 1490nm in order for service to work.
- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.
- Repeat this process until all ONTs have been tested. Then the PON can be commissioned RFS.

7 How to test different stages of FTTP build for Brownfield MDUs Using OTH

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS). In the instance where there is an Optical Test Head (OTH) follow the steps below.

7.1 Continuity Testing of Spine

At this stage, build assumes that OTH is present and exchange has been connected. Spine from the Exchange should be acceptance tested to the LW350 specification. Detail on the LW350 spec can be found at ISIS practice: EPT/ANS/A019Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Splice SC/APC pig tail, item code 023327, onto element 1 fibre 1.
- Connect the SC/APC connector to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify HRD.
- Once HRD is identified, take note of the distance.
- Disconnect SC/APC pigtail and test all other fibres in the element to dis at that noted distance with a tolerance of +/- 2m.
- Repeat this process with every element in the spine cable.

7.2 Testing at the external Splitter (MDU up to 30 address points)

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected and splitter device has been installed & spliced regardless if the splitter module is in an external node or an internal basement box. It is important to check that the splitter is connected to the correct head-end. As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port.

Note: For medium MDU the splitter node is located outside the building.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Splice SC/APC patch cord (i/c 023650), onto one of the splitter output fibres.
- SC/APC patch lead needs to be reduced to a maximum of 1m in length.
- Connect the SC/APC connector to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify Splitter event and HRD ~1m apart.
- Once HRD is identified, OTH has proved continuity and can progress to the next stage of the build.

7.3 Testing at the internal Splitter (MDU 31 – 60+ address points)

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected and splitter device has been installed & spliced. It is important to check that the splitter is connected to the correct head-end. As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port.

Note: For Large MDU an internal splitter will most likely be located in a Budi Box. This can house up to three 32 way splitters and has connectorised MTP outputs.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Connect a SC/APC connector output from each splitter to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test to identify Splitter event and HRD.
- Once HRD is identified, OTH has proved continuity and can progress to the next stage of the build

7.4 Test at the FDP

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed and connected, splitter device has been installed and cables transitioned from external to internal sheaths and FDP box connected and spliced. The FDP is the closest component to a CBT, therefore it proves value to test at this point before finishing P&B. Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Insert Plug jack reflector, item code 105000, into port 1 and run OTH test. If peak is visible continue to perform all active ports testing.
- Once all FDPs from a splitter has been tested, the PON can be commissioned ready for service (RFS).

7.5 Commission at the Breakout box

Note: The Breakout box can also be known as a Point of Entry box or a Slimbox depending on the topology of the MDU.

At this stage, build assumes that OTH is present and the spine, splitter and internal components have been built and tested. At the final stage of P&B it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Take a power reading at the first Breakout box using a suitable OPM. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm).
- If power level is within spec, begin reflector testing.

- Insert Plug Jack reflector into SC/APC coupler inside Breakout box and run a test. If the peak is visible, continue to test all Breakout boxes from that FDP.
- At the last Breakout box, leave the reflector in situ and save that peak as the baseline test.

Note: The baseline reference will allow the OTH to monitor the network and detect any new events/changes in life.

7.6 Commission at the ONT

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test. The difficultly with MDUs is knowing where to move the reflector, this is heavily dependent on the systems:

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made

- Prior to provision, run a pre-provision test, this test will show which customers have taken up service and which haven't. Move the reflector to a Breakout box of a customer who has <u>not</u> taken up service.
- Also prior to provision, take a power reading at the Breakout box using a suitable OPM. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm). Take note of the power level.
- Post provision, take a power meter reading at the inside out cables SC/APC connector. Power level needs to be less than 1dB difference from the Breakout box power reading at 1490nm in order for service to work.
- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.

Once all ports have been consumed by customers, remove the reflector completely.

8 *How to test different stages of FTTP build for Greenfield MDUs Using OTH*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS). There is no difference between the MDU Brownfield and Greenfield topology in terms of physical cables and components, therefore the testing process is identical to the Brownfield MDU process (section 7) however P&B finishes at the ONT, therefore the responsibility lies with FND and/or build partners.

9 *How to test different stages of FTTP build for Discrete Façade Solutions Using OTH*

Add link to DFS Policy or placeholder.

9.1 Continuity Testing of Spine

This process is the same as the Brownfield Spine testing process documented in section 5.1.

9.2 Testing at the Splitter

This process is the same as the Brownfield Splitter testing process documented in section 5.2.

9.3 Commission at the DNA Connectorised Block Terminal (CBT)

There is no significant difference from the CBT process Brownfield CBT testing documented in section 5.3, however it is been detailed below.

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced and CBT tail cable has had all required ports spliced through. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision. Also due to the speed in which OTH can test, the practise is to test all active ports.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Take a power reading using a suitable Optical Power Meter (OPM) on port 1. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm).
- If power level is within spec, begin reflector testing.
- Insert reflector, item code (tbc), into port 1 and run OTH test. If peak is visible continue to perform all ports testing. If peak not visible engineer to view trace, locate point of failure and rectify.
- Once all active ports have been tested, bring the reflector back to port 1 and save that trace as a baseline reference with the CBT/ID. Leave HRD in the first available port.
- The baseline reference will allow the OTH to monitor the network and detect any new events/changes in life.
- Once all CBTs from a splitter has been tested, the PON can be commissioned ready for service (RFS).

9.4 Commission at the Optical Network Termination (ONT) from a DNA CBT

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Prior to provision, move the HRD into the next available port at the CBT, then take a power reading at the CBT using a suitable OPM on your designated port. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm). Take note of the power level.
- Post provision, take a power meter reading at the inside out cable SC/APC connector. Power level needs to be less than 1dB difference from the CBT power reading at 1490nm in order for service to work.

- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.
- Should still be able to see the CBT peak.
- The peak can shift slightly in distance.
- Once all CBT ports have been consumed by customers, remove the reflector completely.

9.5 Commission of the RTRYVA cable at the CSP

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced and RTRYVA cable has been installed, had all fibres extended to an EMU box, and theses fibres have been dimensioned to a CSP at the customers location. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision. Also due to the speed in which OTH can test, the practise is to test all active ports.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Splice SC/APC patch cord (i/c 023650) onto the incoming fibre.
- SC/APC patch cord needs to be reduced to a maximum of 1m in length.
- Take a power reading using a suitable Optical Power Meter (OPM). Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm). If power level is within spec, begin reflector testing.
- Connect the SC/APC patch cord to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test. If peak is visible continue to next CSP’s on cable run. If peak not visible engineer to view trace, locate point of failure and rectify.
- Repeat above process for all fibres dimensioned into that CSP.
- Once all CSP’s on the RTRYVA cable run have been tested, leave the reflector connected in the furthest CSP and save that trace as a baseline reference.
- This baseline will allow the OTH to monitor the network and detect any new events/changes in life.
- Once all CSPs from a splitter have been tested, the PON can be commissioned ready for service (RFS).

9.6 Commission at the Optical Network Termination (ONT) from a RTRYVA cable

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Prior to provision, HRD will be in the furthest CSP from the splitter. If required, move the HRD to the next furthest CSP available.
- Take a power reading at the CSP using a suitable OPM. Power level needs to be greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm). Take note of the power level.
- Post provision, take a power meter reading at the inside out cable SC/APC connector. Power level should be less than 1dB difference.
- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.
- Should still be able to see the HRD peak at the designated CSP.
- The peak can shift slightly in distance.
- Once all dimensioned fibres have been consumed by customers along the RTRYVA cable run, remove the reflector completely

9.7 Commission of the Mpack cable at the Slim box

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced, Mpack cable has been installed, had all fibres extended to a Nexan Drop box and theses fibres have been dimensioned to a Slim box at the customer’s location and spliced to a SC/APC connector. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision. Also due to the speed in which OTH can test, the practise is to test all active ports.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Connect SC/APC connector to an Optical Power Meter (OPM) and take a power reading. Power level needs to be greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm). If power level is within spec, begin reflector testing.
- Connect the SC/APC patch cord to the female side of the SC/APC Plug Jack reflector, item code 105000.
- Run OTH test. If peak is visible, repeat with all dimensioned fibres at this Slim box location. If peak not visible engineer to view trace, locate point of failure and rectify.
- Repeat above process for all fibres dimensioned in all Slim boxes.
- Once all Slim boxes on the Mpack cable run have been tested, leave the reflector connected in the furthest Slim box and save that trace as a baseline reference.
- This baseline will allow the OTH to monitor the network and detect any new events/changes in life.
- Once all Slim boxes from a splitter have been tested, the PON can be commissioned ready for service (RFS).

9.8 Commission at the Optical Network Termination (ONT) from a Mpack cable

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation. Again, it is important that the power level at this point is well within the optical power budget in order for service to transmit, in addition to an OTH test.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Prior to provision, HRD will be in the furthest Slim box from the splitter on that run of Mpack cable. If required, move the HRD to the next furthest Slim box available.
- Take a power reading at the Slim box using a suitable OPM. Power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm). Take note of the power level.

- Post provision, take a power meter reading at the inside out cable SC/APC connector. Power level should be less than 1dB difference.
- Plug inside out cable SC/APC connector into ONT and run OTH trace. If ONT peak is visible, save the trace as a new baseline reference with the ONT peak labelled as the ONT serial number.
- Should still be able to see the HRD peak at the designated Slim box.
- The peak can shift slightly in distance.

Once all dimensioned fibres have been consumed by customers along the Mpack cable run, remove the reflector completely.

10 *How to test different stages of FTTP build for Brownfield SDUs Using Fast Test App*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

For all information regarding using FastTest App see the ISIS EPT/COF/D983 – Auto Toggle Practices & Procedures.

11 *How to test different stages of FTTP build for Greenfield SDUs Using Fast Test App*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

For all information regarding using FastTest App see the ISIS EPT/COF/D983 – Auto Toggle Practices & Procedures.

12 *How to test different stages of FTTP build for Brownfield MDUs Using Fast Test App*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

For all information regarding using FastTest App see the ISIS EPT/COF/D983 – Auto Toggle Practices & Procedures.

13 *How to test different stages of FTTP build for Greenfield MDUs Using Fast Test App*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

For all information regarding using FastTest App see the ISIS EPT/COF/D983 – Auto Toggle Practices & Procedures.

14 *How to test different stages of FTTP build for Discrete Façade Solutions Using Fast Test App*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

For all information regarding using FastTest App see the ISIS EPT/COF/D983 – Auto Toggle Practices & Procedures.

15 *How to test different stages of FTTP build for Brownfield SDUs Using Light Source and Power Meter*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

There are 3 basic requirements which are mandatory to be tested during the Build of the FTTP Network:

- Continuous Light from Head-end to CBT
- Light of sufficient power to enable ONT to achieve sync
- The CBT is connected to the right head-end port

No PON network can be sent for commissioning until all 3 basic requirements have met and any issues resolved – The FBC must validate that these requirements have been fully met before build record returns have been submitted.

15.1 Continuity Testing of Spine

Auto Toggle test to confirm correct light to be connected through the correct allocated Splitter / SASA in the Job Pack. Spine from the Exchange should be acceptance tested to the LW350 specification irrespective of the fibre circuit that will use the actual fibre. Detail on the LW350 spec can be found at ISIS practice: LW350

15.2 Testing at the splitter

On one of the output fibres of the splitter (following connection of the splitter to the spine) Auto toggle test to confirm correct head-end light is feeding the CBT’s. On Greenfield sites where no CBT’s are to be connected through at initial build, record the Optical Power Meter (OPM) reading at 1490nm in dBm for the splitter on the Auto toggle system (or NGWFMT if still using the AOC to toggle).

- On the incoming fibre of the specified splitter apply a Live Fibre Indicator to the fibre, activate the device and confirm the fibre is lit.
- Use the auto toggle app on Candid or Fast test or Call the AOC and request them to depower the specified PON.

- Using the Live Fibre indicator confirm that light has been removed from the fibre under test.
- Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made. Whilst the light is disabled on the PON complete an OTDR test at 1310nm and 1550nm wavelengths using the relevant Auto test mode to check the quality of the network.
- After testing Auto toggle, the system will repower the circuit. If toggling via the AOC request, they reconnect light to the splitter.
- Once you have confirmed the correct Splitter routing build out to the CBT's from this point.
- Measure and record for the AOC the Optical Power on one output fibre of the splitter. (Measure in dBm and at 1490nm)

15.3 Commission at the CBT.

A toggle test is required on the first port of each CBT to confirm correct splitter allocation and prove end to end fibre connectivity. The optical power level needs to be greater than -25dBm at 1490nm (e.g. -22dBm is greater than -25dBm).

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Clean Optitap Patch cord connections at both ends as well as the test device connections and connect to Anritsu / EXFO power meter port of the OTDR. Alternatively use an Optical Power Meter.
- Remove the protective cap from Port 1 on the CBT, clean the port using the recommended Openreach Fibre cleaner. Connect the Optitap Patch cord and screw together the protective caps to minimise contamination.
- Confirm you are receiving light with the Power Meter mode of your tester.
- Use Auto Toggle or call the AOC to remove the light from the PON. Once confirmed switch the tester to OTDR mode.
- Whilst the light is disabled on the PON complete an OTDR test at 1310nm and 1550nm wavelengths using the relevant Auto test mode.
- If calling the AOC request the AOC to return light to the PON. Once returned measure the Optical Power with the tester using the Optical power meter function, set to measure at 1490nm and in dBm.

- Request the AOC to manually record this reading against the CBT on the system. (Auto Toggle will automatically return light. Record the test results in the system)

15.4 Commission at the ONT.

On L2C installation it is assumed that the network is lit and in service following the build activity and that the CBT has been tested on all ports (Fibre Cities – Optical Test Head). The engineer on the L2C activity will complete the installation of Fibre Drop Cable and splicing of indoor/outdoor cable. The following process is designed to confirm the installation will be successful.

15.4.1 Testing the installation

Please ensure that ONT serial number activation process has been applied.

- Before commencing any testing, clean the connector and the Optical Power Meter (OPM) port using the recommended Openreach Fibre cleaner
- Connect the OPM to the connector and take an Absolute Power meter Reading at 1490nm dBm.
- Clean the Port on the ONT and insert the connector and check the ONT achieves Sync by visually inspecting the Sync LED.
- If the OPM reading is better than -27dBm and the ONT achieves Sync the circuit passes the L2C testing.

15.4.2 OGEA Service Test

An OGEA test must be carried out after commissioning and authenticating the ONT and hub to record upstream and downstream speeds attained. This is done via the FT+ app on iPhone.

16 *How to test different stages of FTTP build for Greenfield SDUs Using Light Source and Power Meter*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

17 *How to test different stages of FTTP build for Brownfield MDUs Using Light Source and Power Meter*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

18 *How to test different stages of FTTP build for Greenfield MDUs Using Light Source and Power Meter*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

19 *How to test different stages of FTTP build for Discrete Façade Solutions Using Light Source and Power Meter*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS). The process for the Spine and Splitter are no different to the process documented in section 15.1 and 15.2.

19.1 Commission at the DNA Connectorised Block Terminal (CBT)

This process is the same as documented in section 15.3 with the exceptions that the DNA CBT test lead is still to be confirmed (i/c tbc)

19.2 Commission at the CSP from a RTRYVA

At this stage, build assumes that exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced and RTRYVA cable has been installed, had all fibres extended to an EMU box, and theses fibres have been dimensioned to a CSP at the customers location. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Splice SC/APC patch cord (i/c 023650) onto the incoming fibre.
- Take a power reading using a suitable Optical Power Meter (OPM). Power level needs to be greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm).
- Use Auto Toggle or call the AOC to remove the light from the PON. Once confirmed switch the tester to OTDR mode.
- Whilst the light is disabled on the PON complete an OTDR test at 1310nm and 1550nm wavelengths using the relevant Auto test mode.
- If calling the AOC request the AOC to return light to the PON. Once returned measure the Optical Power with the tester using the Optical power meter function, set to measure at 1490nm and in dBm.
- If power level is acceptable, remove patch cord and wrap remaining fibre back into CSP for L2C engineer.
- Record the test results in the system
- Move on to next CSP requiring testing.

Once all dimensioned fibres have been consumed by customers along the RTRYVA cable run, remove the reflector completely.

19.3 Commission of the Mpack cable at the Slim box

At this stage, build assumes that exchange has been connected, spine cable has been installed & connected, splitter device has been installed & spliced, Mpack cable has been installed, had all fibres extended to a Nexan Drop box and theses fibres have been dimensioned to a Slim box at the customer’s location and spliced to a SC/APC connector. It is important that the power level at this point is well within the optical power budget in order to support a L2C provision.

Inspect all connectors to be used using an Indirect Viewing Aid (if available) and clean using a Sticklers cleaning kit if necessary. This must be completed before any and all connections made.

- Connect the SC/APC connector to EXFO power meter port of the OTDR. Alternatively use an Optical Power Meter.
- Take a power reading at 1490nm in dBm. Power level needs to be greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm).
- Use Auto Toggle or call the AOC to remove the light from the PON. Once confirmed switch the tester to OTDR mode.
- Whilst the light is disabled on the PON complete an OTDR test at 1310nm and 1550nm wavelengths using the relevant Auto test mode.
- If calling the AOC request the AOC to return light to the PON. Once returned measure the Optical Power with the tester using the Optical power meter function, set to measure at 1490nm and in dBm.
- If power level is acceptable, complete all fibre testing of dimensioned fibres at that Slim box location.
- Wrap fibres back away and move on to the Slim Box for testing.
- Record the test results in the system

Once all Slim boxes from a splitter have been tested, the PON can be commissioned ready for service (RFS).

19.4 Commission at the Optical Network Termination (ONT)

This process is the same as documented in section 15.4, 15.4.1 & 15.4.2

20 *Incremental FTTP build*

It is the responsibility of the Build team/Agent to test the network to the last point of build when the network is declared “Ready for Service” (RFS).

There are 3 basic requirements which are mandatory to be tested during the Build of the FTTP Network:

- Continuous Light from Head-end to CBT
- Light of sufficient power to enable ONT to achieve sync

— The CBT is connected to the right head-end port.

20.1 Incremental FTTP build testing with OTH

At this stage, build assumes that OTH is present, exchange has been connected, spine cable has been installed & connected and splitter device has been installed & spliced. It is important to check that the splitter is connected to the correct head-end. As the OTH uses an out of band wavelength (1650nm), there is no need to turn off any port.

Follow section 5.2, 5.3 and 5.4 for How to test different stages of FTTP build for Brownfield SDUs Using OTH. This will allow testing of the Splitter, CBT and ONT.

Follow sections 7.4, 7.5 and 7.6 for How to test different stages of FTTP build for Brownfield MDUs Using OTH.

20.2 Incremental FTTP build testing without OTH

This test must only to be used once the Splitter has been released for service and there is no longer an option for the AOC to power down the PON as this will disrupt service to the customers already in service. (As with the Build commission testing all tests are measured on the first port only of each Unique incrementally built CBT)

Before testing at the CBT, check that you have light on the spare splitter output fibres to be used.

20.2.1 At the splitter

— Splice SC/APC pig tail onto a spare splitter output fibre.

— Clean SC/APC pig tail connector as well as any test device connectors and connect to a suitable OPM. Take a power reading at 1490nm dBm and record the result. If light level is acceptable continue with CBT testing.

20.2.2 At the CBT

— Remove the protective cap from Port 1 on the CBT, connect the Optitap Patch cord and screw together the protective caps to minimise contamination. Only clean the port if you suspect it has become dirty following the protective cap removal.

— Confirm you are receiving light with the Power Meter mode of your tester, measure the Optical Power with the OPM function set to 1490nm dBm. Power level needs to be greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm).

— Record the test results against the CBT on the appropriate system.

20.2.3 At Discrete Façade Solutions

With all incremental testing for DFS, follow existing guide in section 19.

Caution: Do not disconnect any live customers to perform light loss testing.

21 *L2C - Testing on service installation*

At this stage, build assumes that OTH is present and the network has been commissioned RFS and Service Delivery has provided a L2C installation.

The Engineer on the L2C activity will complete the installation of the external drop cable, a CSP (or direct entry) and through to the fitting of the internal cable. There are multiple other cables in use for the L2C installation so please refer to FTTP Connectorised L2C Practices – EPT/COF/C004 and L2C FTTP Installation Process & Quality Manual – EPT/ANS/A069.

21.1 Testing the installation

- Before commencing any testing, clean all the end face connectors on the Optical Power Meter (OPM) and SC/APC Connector of the internal fibre cable using the recommended Openreach Fibre cleaner.
- Connect the OPM3C to the SC/APC Connector and take an Absolute Power meter Reading at 1490nm dBm.
- Clean the Port on the ONT and connect the SC/APC. Check the ONT achieves Sync by visually inspecting the Sync LED.
- Being careful to take into account the ONT s/n activation process.
- If the OPM reading is better than -27dBm and the ONT achieves Sync the circuit passes the L2C testing.

21.2 OGEA Service Test

An OGEA test must be carried out after commissioning and authenticating the ONT and hub to record upstream and downstream speeds attained. This is done via the FT+ app on iPhone.

21.3 Trouble shooting on the L2C Installation

If the ONT does not sync or the OPM tests fail to meet the required Power level the engineer can trouble shoot the installation. The Engineer will already know the OPM reading from the installation test at the ONT.

Engineers can utilise a Visible Light Source, item code 093689, and Power meter to aid in identification of problems.

- The engineer moves to the CBT- the engineer prepares the OPM and Optitap patch cord by cleaning the end face using the recommended Openreach Fibre cleaner.
- Connect the OPM3C to the port of the CBT and take an absolute Power Meter reading at 1490nm dBm (Ensuring the dust caps are used to protect the fibre drop cable against contamination).
- The reading at the CBT is them compared with the result at the ONT. If the reading is greater than -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm), the engineer can assume the issue is with either the Drop cable, CSP or internal fibre cable and can rectify the issue.
- Note: Engineers can get additional support and guidance on poor light levels from the DCoE.

Warning: Only OTDRs with the filtered out of band capability are to be connected to a live (i.e. light can be detected on the fibre) network. Using an OTDR without a filtered out of band wavelength will cause service interruption to the entire PON network connected to the OTDR.

22 *Using a 4 Port Light Source*

The Light Source 6E, item code 094894, (VeEx 4 Port Light Source) can be used to send 4 optical tones of different frequency down a fibre cable. This reduces the need to have 4 separate Light Sources. The Light Source should be checked beforehand with a Live Fibre Indicator to make sure all 4 tones are being received correctly. If used correctly the Light Source 6E can enable the proving of fibre continuity in a quick and cost effective manner.

Note: When used as an Optical Tone the Light Source 6E sends a modulated wave and as such it is at half power. Any light readings taken with this light source require compensation for this loss of power. It is the view of the Chief Engineers that the Light Source 6E is best used as indication only to prove fibre continuity and any loss testing should still be completed using the Light Source 5C & Optical Power Meter 3C.

23 *Light Loss Result Recording*

The light loss recording process was changed as of the 8th November 2021. Only the Standardised LLR documentations for ODF or OCR can be submitted into commissioning. For supplementary information please speak to the Fibre Build Change & Transformation team. Guidance on FTTP Commissioning can be found in ISIS NWK/LNK/C574 - Overview of the FTTP Commissioning Process.

Example of Light Loss Reading sheet

TEST RESULTS FOR

*Exchange Name	*Cab No	*LLUMS PON ID	SDU THP	MDU THP	Total THP	No Of CBTs Tested	Total THP Tested
Newport	V8097	573647	86	0	86	0	0

MDU ID (if applicable)

* Tested by :	1
* Build Company	1
* Date :	01/01/1900

SNN Validation

Invalid SNN	Validation required
0	0

* Splitter test results are mandatory, when you request to commission without any CBT/MDU alternate fault.

SPLITTER TEST RESULTS

SPLITTER ID	SASA DEVICE ID	Fibre ID / ON number	Optical Power Result			ADC REF # Auto Toggle
TMZBODU5	1	ON67698 F208				
TMZBODU5	2	ON67698 F209				
TMZBODU5	3	ON67698 F210				
TMZBODU5	4	ON67698 F211				

Alert - After Running the macro if any cells indicate red color, please revisit the data and correct again

EXCHANGE + HEADEND INFORMATION											CBT PORT TEST RESULTS		MDU Details (if applicable)			
WP	EXCHANGE AREA	HEADEND ID	SLOT	PORT	SASA ID	MAIN SPLITTER NODE ID	CBT ID or FDP	THP Count	ODF / OCR ID	Cable ID / Fibre no	Optical Power (+/-35dBm)	CBT PORT	R Code	Customer Address	RAD	ADC REF # Auto Toggle Fails
	Newport	BAALM2	11	12	SASA1	TMZBODU5	CBZOMC20	12	ODF 10	ON67698 F208						
	Newport	BAALM2	11	12	SASA1	TMZBODU5	CBZOMC25	11	ODF 10	ON67698 F208						
	Newport	BAALM2	11	12	SASA1	TMZBODU5	CBZOMC2T	7	ODF 10	ON67698 F208						
	Newport	BAALM2	11	13	SASA2	TMZBODU5	CBZOMC2N	12	ODF 10	ON67698 F209						
	Newport	BAALM2	11	13	SASA2	TMZBODU5	CBZOMC2R	12	ODF 10	ON67698 F209						
	Newport	BAALM2	11	13	SASA2	TMZBODU5	CBZOMC2V	4	ODF 10	ON67698 F209						
	Newport	BAALM2	11	14	SASA3	TMZBODU5	CBZOMC2P	12	ODF 10	ON67698 F210						
	Newport	BAALM2	11	14	SASA3	TMZBODU5	CBZOMC2Q	9	ODF 10	ON67698 F210						
	Newport	BAALM2	11	15	SASA4	TMZBODU5	CBZOMC2V	7	ODF 10	ON67698 F211						

24 *Appendix A - Supporting information when testing through Splitter devices*

A passive splitter device directs the optical path from a single path to multiple pathways without the need for any extra equipment or power. Across a 2:32 way PON splitter an approximate power loss of 16.5dB should be measured. Losses greater than 17.6dB should be investigated as the device may have reached end of life.

25 *Appendix B – Devices*

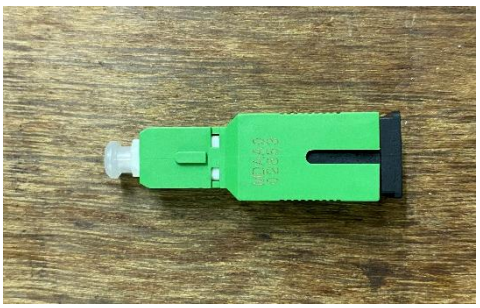
Sticklers cleaning kit

Please check AEI/AEC/B331 for the relevant item codes.

Optitap Reflector (for CBT's)

Item code – 101834

SC/APC Reflector



Item code – 105000

Visible Light Source (VLS)

Item code – 093689

Sometimes referred to a Visual Fault Locator or Red light.

Live Fibre Indicator (LFI)

Item code - 819272

Optical Power Meter 3C (OPM)

Item code - 026457

Optical Light Source 5C (OLS)

Item Code – 026456

Optical Light Source 6E (VeEx)

Item Code – 094894 (Local Purchase only)

4 port light source able to send 4 different optical tones at the same time. For indication only. Not to be used for Loss measurements when being used as an optical tone.

Optical Time Domain Reflectometer 10b (OTDR)

Item code – 819351

EXFO also provide a Dual port variant sometimes referred to as the EXFO OTDR or Max730 which has Tri-wavelength 1310/1550/1625nm

Item Code – 078755

Anritsu MT9090 OTDR 10a

Item code – 078754

(Anritsu OTDR is near End of life and is replaced by the EXFO Max tester).

Dual Wavelength 1310/1550nm

Optitap Patch cord

Item code – 088329

26 References

EPT/COF/C007 - Connectorised MDU Installation Practices

EPT/ANS/A040 - One Fibre Network – Build Quality Manual for Engineers

NWK/LNK/C541 - FTTP - Brownfield - Scale Architecture - Policy

27 Glossary

Glossary of Terms

End of Document