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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

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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

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:

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

- Splice SC/APC pig tail, item code 023327 onto element 1 fibre 1.
- 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 a High Reflective Device (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.

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 SC/APC pig tail onto one of the splitter output fibres.
- SC/APC pig tail needs to be a minimum of 1m in length due to resolution distances (if the HRD is too close to the splitter the OTH will not be able to see the splitter event).
- Using SC back-to-back uniter, connect the SC/APC pigtail and SC/APC reflector.
- 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.

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

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.

- Take a power reading using a suitable Optical Power Meter (OPM) on port 1. 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.
- Insert reflector, item code 101834, into port 1 and run OTH test. If peak is visible continue to perform all ports testing.
- 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).

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.

- 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 -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 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

- Splice SC/APC pig tail Splice SC/APC pig tail, item code 023327, onto element 1 fibre 1.
- 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.

— Connect MPO-to-SC/APC patch chord into port 1 (currently does not exist, in development).
— Using SC back-to-back uniter, item code 055831, connect the SC/APC connector and SC/APC 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.

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.

— Take a power reading using a suitable OPM on port 1. 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.
— 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.

- 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/A019

- Splice SC/APC pig tail, item code 023327, onto element 1 fibre 1.
- 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.

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.

- Splice SC/APC pig tail, item code 023327, onto one of the splitter output fibres.
- SC/APC pig tail needs to be a minimum of 1m in length due to resolution distances (if the HRD is too close to the splitter the OTH will not be able to see the splitter event).
- Using SC back-to-back uniter, item code 055831, connect the SC/APC pigtail and 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.

- Using SC back-to-back uniter, item code 055831, connect one of the splitter output connectors and SC/APC 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.

- 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.

- Take a power reading at the first Breakout box using a suitable OPM. 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.
- 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:

- 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 not 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 -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 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 6) 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 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.

10 *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.

11 *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.

12 *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.

13 *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.

13.1 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: EPT/ANS/A019

13.2 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.

- 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)

13.3 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 -26dBm at 1490nm (e.g. -22dBm is greater than -26dBm).

- 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.
- 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)

13.4 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.

13.4.1 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 -27.5dBm and the ONT achieves Sync the circuit passes the L2C testing.

13.4.2 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.

14 *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).

15 *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).

16 *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).

17 *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.

17.1 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.

17.2 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.

17.2.1 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.

17.2.2 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.

18 *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.

18.1 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 -27.5dBm and the ONT achieves Sync the circuit passes the L2C testing.

18.2 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.

18.3 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.

19 *How to test different stages of FTTP build using CE fall-back process.*

This process can only be used on PON's with no working customers (it must never be used for incremental build).

For authority please contact the Chief Engineer policy team.

The limits set for this method may appear higher but this is not the case. It allows for an Additional 3dBm for the sending Power of the OLS at 1mW.

This process is being controlled via the CE team as it is being monitored for a potential wider deployment across Openreach.

Engineers will require;

- up to 4 of the latest Optical light source 5c (depending on number of splitters in the TM joint)
- Cleared to work at the Hydra Cables in the Optical Head-end equipment.
- Building and keys to access the Head-end equipment
- Optical fibre cleaning kits
- For each Optical Power Meter an SC/FC to SC/FC coupler and 2 metre patch cord.
- Optical Power Meter
- Method of recording and submitting commissioning data for each work point

19.1 At the Head-end Equipment

Engineer refers to the OCR mapping job pack to identify the Sheld Card and Port feeding the splitter – Engineers call the AOC before disconnecting the fibre and with the use of a Live Fibre indicator they toggle off the light to confirm the correct port before disconnecting.

Once light has returned, take an Optical power meter reading (dBm) at 1490nm at the Head-end. If the Head-end is sending at less than -2dBm then the Head-end equipment should be reported as faulty (This will not stop the next steps of the commissioning process).

Trim all the Optical power Meters to a 1Mw output.

Clean all patch cords and connectors using the recommended Openreach Fibre cleaners.

Set each OLS to a different Frequency Modulation and record which modulation you connect to which Hydra (the connectors previously attached to the Head-end Port).

Note: The batteries in the OLS typically last between 40 and 72hrs depending on age, type and state. If you suspect they will fail before you finish commissioning the PON change them.

If using multiple OLS's record which frequency was connected to which Head-end port. Confirm the correct Head-end port is spliced through to the correct work points (CBT's) – If working on Newsites the Power meter reading at this point should also be taken ensuing the Optical Power is greater than -26dBm (using this method)

19.2 Confirm the correct Head End is connected to the correct Splitter

With either a Live Fibre indicator or compatible Optical Power meter check on the Testers display that the correct Tone is being received on the correct Splitter. If working on Newsites, a Power Meter reading can be taken with this method. The loss at this point must be better than 26dBm on the output fibres of the Splitter.

Note: The Optical Power meter reading on the Liver Fibre indicator is only to be used as a guide.

When working on Newsites and a more accurate reading is required, connect an Optical Power meter and splice on a test tail. The Optical Power at this location must be better than -26dBm (e.g. -22dBm is better than -26dBm)

19.3 Commissioning testing at the CBT

First clean all test ports and patch cord ends before connecting to the first port of a CBT.

Connect the Optical Power meter and take a reading in dBm – Providing the optical power is better than -29dBm the network is within limits for FTTP service.

19.4 Recovering the Equipment at the Head end

As the Light sources are recovered – check that you accurately recorded the correct modulated Tone on Hydra

Recommemended – Check the quality of the splicing through spine to the splitter/CBT with an OTDR test at 1310nm & 1550nm (the 1550nm pulse should not get through the WDM splitter). The 1310nm trace should detect any significant event before the Splitter- visibility beyond the splitter will be more difficult to discern.

Complete the documentation recording all the Optical Power readings from each WP/CBT, noting if all premises being from the WP are within reach, noting the designation for the WP (UG / OH) and if any of the customers will require a survey activity – e.g. buried service.

Fitting Optical Light Sources at the Head End Equipment

- Engineers will need keys to access the Head End equipment racks – ordered via BASOL.
- Before the fibre is disconnected, record work activity at that location using the "Now " process.
- Clean all Patch Cord and Hydra connectors under test with a One Click fibre cleaner.
- Test for Power on the Head End Port to confirm light is present – Light can be toggled for added confidence.
- Set each Light Source to 1310nm and a different modulation tone – 2kHz, 1kHz, 330Hz or 270Hz.
- Once testing is complete clean each hydra connector with the One-Click Cleaner before reconnecting to its respective Head End port.

*These are the High Level steps – There are some lower levels activities e.g. Adjusting the output of each Light Source to 1mWatt at 1310nm.

New FTTP Commissioning Process using New Light Source Tester

The New Optical Light Source now has 4 tone frequencies which can be applied to the fibre. The new Optical Power Meter and the older OLS 5c can display the type of tone being applied to the Fibre under test. With this information the engineer can both identify which of up to 4 fibres are feeding the Splitter Node and CBT and record an accurate Power Level measurement (dBm) at 1310nm to that point.

1. Engineer – Fits up to 4 light sources to the specific fibres at the Headend equipment feeding the PON. It will never be more than 4 fibres at a Large Splitter joint because the joint cannot accommodate more than 4 splitters.
2. Each Light Source is set to a different Frequency Tone – 2kHz, 1kHz, 330Hz or 270Hz
3. The field engineers connect a power meter at port One of the CBT and record the frequency detected and the Optical Power Level at 1310nm on the Work Point Tracker sheet. (**Power level must be greater than -29dBm**)
4. The tracker sheet is returned to the commissioning duty to enable the PON to be closed and recorded as ready for service.

*These are the High Level steps – There are some lower levels activities e.g. Adjusting the output of each Light Source to 1mWatt at 1310nm.

1. At Head End Equipment – Fit enough Light Sources for the number of fibres feeding the Splitter Devices in the Splitter Node. Set each to 1310nm and unique modulation tone (2kHz, 1kHz, 330Hx or 270Hz) and record what equipment Card Slot and Port has which Light Source Tone.
2. At Splitter Node – Use the new Live Fibre Identifier on the input fibre to each splitter device to identify the tone and hence confirm connection to the correct incoming spine fibre.
3. At CBT – Connect the Power Meter to port one and –
   - Identify the tone at 1310nm and hence confirm the CBT is connected to the correct Head End Slot/Port and Splitter Node/Splitter Device.
   - Measure the Optical Power at 1310nm - must be better than **-29dBm** (e.g. -22dBm)
4. Fill in Work Tracker Sheet
   - Record Head End Card Slot and Port feeding CBT
   - Record Optical Power Level in dBm,
   - Confirm CBT designation – Overhead or Underground
   - Confirm that all designated premises are within reach
   - Indicate if Digs are required to provide customers service

When working on a PON for example where you have more than 4 splitters feeding the entire scheme the existing Toggling method can still be used to avoid additional travel back to the Head-end site, but the data should be recorded on the tracking sheet- When using the toggling method the limit of -26dBm must be used and testing will be still done at 1490nm.

TEST RESULTS FOR:	Ruthin V45

Tested by :	
Company :	
Date :	

Light Source Tone	Head End ID	Card Slot	Port
270Hz			
330Hz			
1kHz			
2kHz			

WP	Exchange Area	HEADEND ID	SLOT	PORT	T-CODE SPLITTER NODE ID	SASA DEVICE ID	CBT ID (CBAC)	CBT PORT 1 TEST RESULTS AT 1310nm		SERVICE PROVISION NOTES	
								Optical Power (dBm)	TONE DETECTED (Hz)	Can All Designated Premises be Served From CBT? Y/N	All Premises Within Policy Reach of CBT? Y/N
	Cable Plan	OCR Plan	OCR Plan	OCR Plan		Jointing FNC Plan		Commission Agent	Commission Agent	Build Agent	Build Agent
1					TMADTAP		CBACJQB				
2					TMADTAP		CBACJQD				
3					TMADTAP		CBACJQE				
4					TMADTAP		CBACJQA				
5					TMADTAP		CBACJQA				
6					TMADTAP		CBACJQG				
7					TMADTAP		CBACJPY				
8					TMADTAP		CBACJQE				
9					TMADTAP		CBACJQF				
10					TMADTAP		CBACJQE				
11					TMADTAP		CBACJQD				
12					TMADTAP		CBACJPK				
13					TMADTAP		CBACJQC				
14					TMADTAP		CBACJPZ				
15					TMADTAP		CBACJPK				

Sample commissioning data tracking template – To be returned to the commissioning team

20 *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.

21 *Appendix B – Devices*

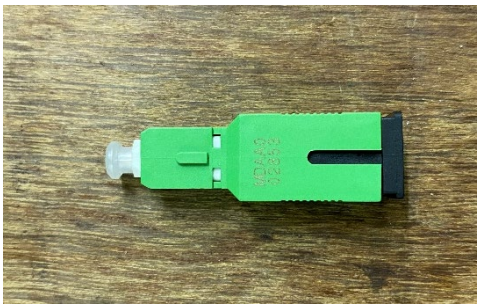
Sticklers cleaning kit

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 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

Optical Time Domain Reflectometer 10a (OTDR)

Item code – 078754

(Sometimes referred to as the Anritsu OTDR or MT9090)

Dual Wavelength 1310/1550nm

Optitap Patch cord

Item code – 088329

22 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

23 Glossary

Glossary of Terms

End of Document