Turn Up DWDM Network

This chapter explains how to turn up and test a Cisco ONS 15454 SDH dense wave division multiplexing (DWDM) network. For DWDM topology reference information, refer to the *Cisco ONS 15454 SDH Reference Guide*.

Note The procedures and tasks in this chapter apply to DWDM (Software Release 4.5) nodes only.

There are two main DWDM network types: metro core, where the channel power is equalized and dispersion compensation is applied, and metro access, where the channels are not equalized and dispersion compensation is not applied. The DWDM network topologies supported are hubbed rings, multihubbed rings, meshed rings, linear configurations, and single-span links.

Before You Begin

This section lists the chapter procedures (NTPs). Turn to a procedure for applicable tasks (DLPs).

1. NTP-D238 Verify DWDM Node Turn Up, page 7-1—Complete this procedure before beginning network turn up.
2. NTP-D239 Provision a DWDM Ring, Linear Configuration, or Single-Span Link, page 7-3—Complete as needed.

NTP-D238 Verify DWDM Node Turn Up

Purpose	Use this procedure to verify that each ONS 15454 SDH is ready for DWDM network turn up before adding nodes to a network.
Tools/Equipment	None
Prerequisite Procedures	Chapter 5, "Turn Up a DWDM Node"
Required/As Needed	Required
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Complete the "DLP-D60 Log into CTC" task on page 3-23 at a node on the network that you will test.If you are already logged in, proceed to Step 2.

Step 2 Verify DWDM node provisioning. See the "NTP-D237 Provision the DWDM Node" procedure on page 5-3.

Step 3 Verify node cabling. See the "NTP-D244 Install Fiber-Optic Cables on DWDM Cards" procedure on page 2-43.

Step 4 Click the **Alarms** tab.

- **a.** Verify that the alarm filter is not turned on. See the "DLP-D227 Disable Alarm Filtering" task on page 9-29 for instructions.
- **b.** Verify that no unexplained alarms are displayed. If alarms are displayed, investigate and resolve them before continuing. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide* for procedures.

Step 5 Verify that the SW Version displayed in the node view status area matches the software version shown in your site plan. If the software is not the correct version, install the correct version from the ONS 15454 SDH software CD.

Step 6 Click the **Provisioning > General** tabs. Verify that all general node information settings match the settings of your site plan. If not, see the "NTP-D81 Change Node Management Information" procedure on page 12-2.

Step 7 Click the **Provisioning > Timing** tabs. Verify that timing settings match the settings of your site plan. If not, see the "NTP-D85 Change Node Timing" procedure on page 12-22.

Step 8 Click the **Provisioning > Network** tabs. Ensure that the IP settings and other CTC network access information is correct. If not, see the "NTP-D201 Change CTC Network Access" procedure on page 12-4.

Step 9 Click the **Provisioning > Protection** tabs. Verify that all protection groups have been created according to your site plan. If not, see the "NTP-D203 Modify or Delete Card Protection Settings" procedure on page 12-15.

Step 10 Click the **Provisioning > Security** tabs. Verify that all users have been created and that their security levels match the settings indicated by your site plan. If not, see the "NTP-D205 Modify Users and Change Security" procedure on page 12-24.

Step 11 If Simple Network Management Protocol (SNMP) is provisioned on the node, click the **Provisioning > SNMP** tabs. Verify that all SNMP settings match the settings of your site plan. If not, see the "NTP-D87 Change SNMP Settings" procedure on page 12-31.

Step 12 Provision the network using the "NTP-D239 Provision a DWDM Ring, Linear Configuration, or Single-Span Link" procedure on page 7-3.

Stop. You have completed this procedure.

NTP-D239 Provision a DWDM Ring, Linear Configuration, or Single-Span Link

Purpose	Use this procedure to provision a DWDM ring, a linear configuration, or a single-span link. For more information about DWDM topologies, refer to the *Cisco ONS 15454 SDH Reference Manual*.
Tools/Equipment	Optical power meter or spectrum analyzer
Prerequisite Procedures	NTP-D238 Verify DWDM Node Turn Up, page 7-1
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Complete the "DLP-D60 Log into CTC" task on page 3-23 at a node on the network where you want to provision a DWDM ring..

Step 2 Complete the "DLP-D380 Provision OSC Terminations" task on page 7-5.

Step 3 Complete the "DLP-D381 Provision the Ring ID" task on page 7-5.

Step 4 Complete the "DLP-D382 Check Span Attenuation" task on page 7-6.

Step 5 Complete the "DLP-D383 Create a Test OCHNC" task on page 7-7.

Step 6 Verify that the amplifiers are turned on. After detecting input power, if the optical safety remote interlock (OSRI) command is disabled, the amplifiers at both ends of the span automatically switch on.

a. From node view, choose **Provisioning > WDM-ANS > Port Status**.

b. Find the amplifier row and verify that the Link Status column says Regulated.

Note The OPT-BST switches on only if an optical service channel (OSC) link is detected as closed for more than three seconds.

c. To verify that OSRI is off, go to the OPT-BST amplifier card view and choose **Maintenance > ALS**. In the ALS Command drop-down menu choose **OSRI Off** and click **Apply**.

Step 7 Verify that the amplifiers have switched to constant gain mode. The amplifiers automatically calculate their gain and then they switch to Constant Gain Mode.

a. Go to the OPT-BST amplifier card view.

b. Choose **Provisioning > Opt. Ampli. Line > Parameters**.

c. The Mode column should list Gain.

Note For the gain mode calculation to be accurate, only one channel must be present at the amplifier receive (Rx) port. After the mode switches from Control Power to Control Gain, the Automatic Power Control (APC) regulates the power.

Step 8 Create the remaining channels according to your site plan. See the "NTP-D260 Provision a DWDM Optical Channel Network Connection" procedure on page 8-99.

Note The amplifiers automatically calculate the optical output power to maintain a constant power level on each channel every time a channel is created on the DWDM network. APC starts every 10 minutes. If the span length changes, APC modifies amplifier gains and express variable optical attenuation (VOA). For more information about APC, refer to the *Cisco ONS 15454 SDH Reference Manual.*

Step 9 Complete the "DLP-D384 Verify the Optical Receive Power" task on page 7-8.

Step 10 Complete the "DLP-D385 Verify the OSNR" task on page 7-9.

Step 11 Repeat the amplifier verification performed in Step 7. If needed, verify that the added channels are equalized within +/–1 dB at the monitor output port (MON Tx) of the OPT-BST amplifier or the OSC-CSM. See the "DLP-D384 Verify the Optical Receive Power" task on page 7-8.

Step 12 Check the amplifier gain tilt. Tilt is monitored on the OPT-PRE MON port. The pass or fail values are provided by MetroPlanner. Set up all channel links and repeat the amplifier verification. See the "DLP-D385 Verify the OSNR" task on page 7-9.

Step 13 (Optional) Create new channel links with pass-through connections. Pass-through channel connections can be provided between channel input and output ports for the AD-xC-xx.x, the 4MD-xx.x, the 32 MUX-O, and the 32 DMX-O. The user can set up pass-through connections in nodes that might require more add or drop channel capability or configuration. See the "DLP-D386 Convert a Pass-Through Connection to an Add/Drop Connection" task on page 7-10.

Step 14 (Optional) Convert a pass-through connection to an add or drop connection. See the "DLP-D386 Convert a Pass-Through Connection to an Add/Drop Connection" task on page 7-10.

Step 15 Go to network view and choose the next node to provision or log into the OADM node. Repeat this procedure for all the nodes in the network.

Step 16 (Optional) The following verification steps might be needed for an intermediate node if a pass-through connection is created. The intermediate node is defined as a node or nodes between the source and destination in your channel:

- Verify that the added channels are at the specified power level. See the "DLP-D384 Verify the Optical Receive Power" task on page 7-8 for instructions.
- Verify that the added channels are equalized with the express channels within 1 dB.
- If the channels are not equalized with the express channels within +/–1 dB, check the attenuation of the VOAs.
- Also check all the fiber adapters to minimize their insertion losses. See the "NTP-D112 Clean Fiber Connectors" procedure on page 17-22 for instructions.

Step 17 Perform the "DLP-D387 DWDM Node Acceptance Test" task on page 7-11.

Stop. You have completed this procedure.

DLP-D380 Provision OSC Terminations

Purpose	This task creates the DWDM OSC terminations required for network setup.
Tools/Equipment	None
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Step 1 In node view, click the **Provisioning > DCC/GCC/OSC** tabs.

Step 2 Click the **OSC** tab.

Step 3 In the OSC Terminations area, click **Create**.

Step 4 In the Create OSC Terminations dialog box, click the ports where you want to create the OSC termination. To select more than one port, press the **Shift** key or the **Ctrl** key.

Note OSC on the DWDM node refers to the section data communications channel (DCC), which is used for ONS 15454 SDH DCC terminations.

Step 5 Click **OK**. Ports are automatically placed in service. Until all network OSC terminations are created and the ports are in service, the following alarms might appear: EOC (SDCC Termination Failure) and power failure alarms on the OPT-BST or OSC-CSM, such as TRUE LOS alarms.

Step 6 Return to your originating procedure (NTP).

DLP-D381 Provision the Ring ID

Purpose	This task creates a DWDM ring ID.
Tools/Equipment	None
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Step 1 Display the node (login) view.

Step 2 Click the **Provisioning > DCC/GCC/OSC** tabs.

Step 3 Click the **OSC** tab.

Step 4 In the DWDM Ring ID pane, click **Create**.

Step 5 In the DWDM Ring ID dialog box, enter the following information:

- Ring ID—Enter the same ID for all nodes on the ring. Choose a number from 1 to 255.

- West Line—Select a card from the drop-down menu. Selectable cards are OSCM or OSC-CSM. Slots 1 to 8 represent the west side of the node.
- East Line—Select a card from the drop-down menu. Selectable cards are OSCM or OSC-CSM. Slots 10 to 17 represent the east side of the node.
- Click **OK**.

Step 6 Return to your originating procedure (NTP).

DLP-D382 Check Span Attenuation

Purpose	This task checks span attenuation between two DWDM nodes.
Tools/Equipment	None
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Make sure the OPT-BST is off by performing one of the following:

- Use the OSRI command in Cisco Transport Controller (CTC). Go to the OPT-BST card view and choose **Maintenance**. In the ALS Command column, click on the cell and a drop-down menu appears. Choose **OSRI On** and click **Apply**.
- Disable all client interfaces. Set the client trunk port to the out of service (OOS) state. Go to card view on the appropriate card. Choose **Provisioning > Optical Line.** In the State column, click on the field that corresponds with the port you want to change. A drop-down menu appears. Choose **OOS** and click **Apply**.

Step 2 Check span attenuation by calculating the difference between transmitted OSC power at the beginning of the span and the receive power at the end of the span. These calculated values must be consistent with the data provided by the MetroPlanner installation file +/– 2 dB.

- To read the transmit power on an OSCM card at the beginning of the span, go to the OSCM card view and choose **Provisioning > Optical Line > Parameters.** Make note of the line-Tx (OSC output) power level. Next go to the OPT-BST card view and choose **Inventory**. Make note of the insertion loss for the IL03 (OSC Rx > line Tx). Subtract the power level from the insertion loss. Use this value to subtract power on the receiver to calculate the span.
- To read the transmit power on an OSC-CSM card at the beginning of the span, go to the OSC-CSM card view and choose **Provisioning > Optical Line**. Read the power value for Line 3-Tx (output OSC).
- To read the transmit power on the OSC COM Tx port of an OPT-BST amplifier, go to card view on the OPT-BST amplifier and choose **Provisioning > Optical Line**. Read the power value for Line 2-Tx (output OSC).
- To read the receive power on an OSC-CSM card, go to card view on the OSC-CSM and choose **Provisioning > Optical Line**. Read the power value for Line 3-Rx (input OSC).

Step 3 Turn on the OPT-BST amplifier. Use the OSRI command in Cisco Transport Controller (CTC). Go to the OPT-BST card view and choose **Maintenance**. In the ALS Command column, click on the cell and a drop-down menu appears. Choose **OSRI Off** and click **Apply**.

Step 4 (Optional) If the calculated span attenuation values are not consistent, check the fiber connection between the line Tx port and the connector at each end of the span. Also check the fiber connection between the OSCM and the OPT-BST.

Step 5 (Optional) If the calculated span attenuation values are still not consistent, clean the fiber connectors. See the "NTP-D112 Clean Fiber Connectors" procedure on page 17-22.

Step 6 Return to your originating procedure (NTP).

DLP-D383 Create a Test OCHNC

Purpose	This task tests the DWDM optical channel network connections (OCHNCs) on your DWDM network. The test OCHNCs can be required by your site plan, or you can create test OCHNCs that will be removed after the test is completed.
Tools/Equipment	Tunable laser
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23 DLP-D380 Provision OSC Terminations, page 7-5 DLP-D381 Provision the Ring ID, page 7-5
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Check the fiber connections. See the "NTP-D112 Clean Fiber Connectors" procedure on page 17-22 for instructions.

Step 2 Create a test channel for each wavelength that you want to test according to your site plan. See the "NTP-D260 Provision a DWDM Optical Channel Network Connection" procedure on page 8-99.

Step 3 Use a tunable laser and perform a sweep of the set of wavelengths at the source and destination of your test OCHNC. The tunable laser can be used if no transponder, line cards, or other ITU interfaces are present. Only wavelengths with circuits will be tested. Test circuits can have different destinations, but it is not recommended.

Note For information about using a tunable laser, refer to the tunable laser user guide.

Step 4 Return to your originating procedure (NTP).

DLP-D384 Verify the Optical Receive Power

Purpose	This task verifies the optical receive power.
Tools/Equipment	Optical power meter
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Using an optical power meter, check the receive optical power on both ends of the span:

a. Identify a transmit port on an AD-xC-xx.x card or a 32 DMX-O card in the node that you want to test and connect it to the optical power meter.

b. Read the values displayed on the optical power meter. These values must be consistent with the data provided by the MetroPlanner installation file +/–1 dB.

Note For information about using an optical power meter, refer to the optical power meter user guide.

Step 2 If the optical power is too low, check the following depending on your node configuration:

- Check the fiber connections between the OPT-BST amplifier or the OSC-CSM and the OPT-PRE amplifier.
- Check the fiber connections between the OADM cards and if needed, clean the connectors. See the "NTP-D112 Clean Fiber Connectors" procedure on page 17-22.

Step 3 If the power coming from the AD-xC-xx.x card is higher than required, put an external optical attenuator before the client interface input in order to meet the requirement.

Step 4 If the power coming from the 32 DMX-O card is higher than required, you can regulate the VOA in CTC. From the 32 DMX-O card view, choose **Provisioning > Optical Chn > Parameters**. The VOA columns, including the VOA set point, can be manually set according to your site plan.The VOA set point affects the power calibration parameters.

Step 5 Return to your originating procedure (NTP).

DLP-D385 Verify the OSNR

Purpose	This task verifies the optical signal-to-noise ratio (OSNR). OSNR is the ratio between the signal power level and the noise power level.
Tools/Equipment	Optical spectrum analyzer
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 Using an optical spectrum analyzer, check the receive optical OSNR on both ends of the span:

a. Identify a monitor LINE Rx port on an OPT-PRE amplifier or OSC-CSM card in the node that you want to test and connect it to the optical spectrum analyzer.

b. Read the values displayed on the optical spectrum analyzer. These values must be consistent with the data provided by the MetroPlanner installation file +/–1 dB.

Note For information about using a spectrum analyzer, refer to the spectrum analyzer user guide.

Step 2 If the OSNR is too low, check the following depending on your node configuration:

- Check the fiber connections between the OPT-BST amplifier or the OSC-CSM and the OPT-PRE amplifier and if needed, clean the connectors. See the "NTP-D112 Clean Fiber Connectors" procedure on page 17-22.
- On the near-end OPT-BST amplifier, check the equalization of the added channels at the monitor output.
- On the OPT-PRE amplifier, check the output power on both COM-Tx and DC-Tx ports.
- On the far-end OPT-PRE amplifier, check the amplifier gain tilt at the monitor output.

Note The purpose of this step is not to improve the signal-to-noise ratio (SNR), but to match the per channel power level within the receive (Rx) port power range.

Step 3 Return to your originating procedure (NTP).

DLP-D386 Convert a Pass-Through Connection to an Add/Drop Connection

Purpose	This task converts a pass-through connection to two add or drop connections.
Tools/Equipment	None
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite
Security Level	Provisioning or higher

Step 1 In node view, delete the unidirectional OCHNC from the affected nodes.

Step 2 Remove the pass-through cabling. See the "NTP-D244 Install Fiber-Optic Cables on DWDM Cards" procedure on page 2-43.

Step 3 Delete the relevant OSC connection. See "NTP-D241 Delete a DWDM OSC Termination" procedure on page 12-22.

Step 4 Connect the proper client interface. A pass through connection can be connected in both OADM and HUB node sites.

- For a hub node—Connect the 32 DMX-O output port to the 32 MUX-O input port.
- For an OADM node—Connect the AD-xC-xx.x drop (output) port to the AD-xC-xx.x add (input) port.

Step 5 From node view, choose **Provisioning > WDM-ANS > Port Status** and click the **Launch ANS** button.

Step 6 Create two new bidirectional OCHNCs (one heading east, the other heading west). See the "NTP-D260 Provision a DWDM Optical Channel Network Connection" procedure on page 8-99.

Step 7 If it is necessary, add an optical attenuator between the CH Tx port of the OADM card and the client Rx port.

Note If the channel is coming from a 32 DMX-O, the optical power can be adjusted in CTC by modifying the value of the internal per channel VOA.

Step 8 Return to your originating procedure (NTP).

DLP-D387 DWDM Node Acceptance Test

Purpose	Use this procedure to test each node in a network topology.
Tools/Equipment	None
Prerequisite Procedures	DLP-D60 Log into CTC, page 3-23
Required/As Needed	As needed
Onsite/Remote	Onsite or remote
Security Level	Provisioning or higher

Step 1 From the View menu, choose **Go to Network View**.

Step 2 Click the **Alarms** tab:

a. Verify that the alarm filter is not turned on. See the "DLP-D227 Disable Alarm Filtering" task on page 9-29 for instructions.

b. Verify that no unexplained alarms are displayed on the network. If unexplained alarms are displayed, resolve them before continuing. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide*.

Step 3 Click the "DLP-D139 Export CTC Data" task on page 9-4 to export the alarm information.

Step 4 Click the **Conditions** tab. Verify that no unexplained conditions are displayed on the network. If unexplained conditions are displayed, resolve them before continuing. Refer to the *Cisco ONS 15454 SDH Troubleshooting Guide*.

Step 5 Complete the "DLP-D139 Export CTC Data" task on page 9-4 to export the condition information.

Step 6 If a node fails any test, repeat the test while verifying correct setup and configuration. If the test fails again, refer to the next level of support.

After all tests are successfully completed and no alarms exist in the network, the network is ready for service.

Step 7 Return to your originating procedure (NTP).