



Australian Government

Department of Education, Employment and Workplace Relations

ICTOPN5118A Plan and configure dense wavelength division multiplexing systems

Release: 1

ICTOPN5118A Plan and configure dense wavelength division multiplexing systems

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to prepare the activity plans and specifications required by field technical staff to deploy a dense wavelength division multiplexing (DWDM) optical network suitable for a metropolitan area network (MAN) or long haul applications. It involves provisioning DWDM fibre and power cabling work, provisioning of splicing cabinets and patch panels, and providing specification details for installation and construction teams. DWDMs use optical multiplexing techniques to increase the carrying capacity of a fibre network by transmitting multiple optical wavelengths each carrying high speed data stream over a single fibre. DWDM systems offer up to 128 wavelengths, with each wavelength carrying up to 100 Gbps. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement but users should confirm requirements with the relevant federal, state or territory authority.
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Application of the Unit

Application of the unit	Technical officers and supervisors apply the skills and knowledge in this unit when planning installation activities for the deployment of high capacity networks using optical technologies. Optical networks using DWDM provide services in Next Generation Networks (NGN) using emerging technologies. NGN services include internet protocol TV (IPTV), video on demand (VoD), interactive TV and cloud computing.
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for DWDM planning activities	1.1. Obtain relevant legislation, codes, regulations and standards for compliance when conducting work 1.2. Scope the work by obtaining project plan from appropriate personnel and arrange for site access to comply with security arrangements 1.3. Notify appropriate personnel of identified safety hazards at the work site
2. Plan DWDM installation activities and develop specifications	2.1. Follow occupational health and safety (OHS) and environmental requirements for the given work and identify and avoid other services 2.2. Identify tools, safety equipment, plant and machinery for installation work activities 2.3. Conduct physical inspections of proposed DWDM sites and verify that backbone dark fibre is accessible and available according to cabling plan 2.4. Verify proposed backbone and customer fibre cable routes to the splicing cabinet and fibre patch panel and identify barriers to the cable installation 2.5. Verify proposed power cabling route from distribution board and circuit breakers and identify barriers to the cable installation 2.6. Modify cable plan if required and notify appropriate personnel 2.7. Prepare fibre installation specifications and power cable and grounding specifications according to cabling plan and safe work practices and manufacturer's instructions 2.8. Verify proposed location of associated hardware racks, cabinets and ironwork and confirm access to enterprise local area network (LAN)
3. Prepare DWDM shelf configuration and specifications according to customer requirements	3.1. Prepare a configuration document including configuration plans and specifications for the installation team 3.2. Specify location of DWDM shelves or racks and the shelf interconnection fibre cabling layout according to cabling plan 3.3. Specify the individual DWDM units and circuit card types required to suit customer requirements
4. Plan preliminary optical tests	4.1. Verify backbone fibres at patch panel and conduct bidirectional optical time domain reflectometer (OTDR) test and record measurement results and OTDR images 4.2. Conduct bidirectional optical loss test set (OLTS)

ELEMENT	PERFORMANCE CRITERIA
	<i>measurement</i> of insertion loss on backbone fibres from patch panel to patch panel at adjacent sites and record measurement results

ELEMENT	PERFORMANCE CRITERIA
5. Complete documentation and obtain sign off	5.1. Provide results of optical measurements to design team 5.2. Complete and provide updated specification documentation to installation team 5.3. Submit documentation to appropriate person for approval and sign off

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

- analytical skills to:
 - analyse specific customer requirements
 - evaluate different types of technical data
 - identify details relating to the project from the approved network plan
- communication skills to discuss project brief with enterprise design and installation personnel, vendors, customers and contractors
- literacy skills to:
 - interpret technical documentation
 - write reports project briefs in required formats
- numeracy skills to:
 - interpret results and evaluate different types of technical data
 - analyse site survey data
- planning skills to:
 - consider current, new technology, facilities and features when developing options
 - plan, prioritise and monitor own work and that of others
- problem solving skills to address specific customer requirements
- research skills to:
 - analyse impacts on planning processes
 - obtain and study information relating to new technology or technology features
 - obtain geographical site information
 - study relevant legislation and associated operational codes
 - technical skills to identify barriers to plan realisation and interpret test results

Required knowledge

REQUIRED SKILLS AND KNOWLEDGE

- configuration of DWDM shelf
- DWDM principles of operation
- electrostatic discharge
- features and operating requirements of test equipment:
 - hand-held optical power meter
 - optical spectrum analyser
 - OTDR
 - transmission test set
- functions of optical add drop multiplexer
- internet protocol (IP) addressing, subnet mask, dynamic host configuration protocol (DHCP) and default gateway
- International Telecommunications Union (ITU) wavelength grid for DWDM
- optical fibre connector types and characteristics
- optical fibre types and characteristics
- path protection and protection switching
- physical optical loopbacks and software loopbacks
- protocols used on optical DWDM systems
- ring topologies and linear network topologies
- specific OHS requirements that impact on the safe inspection of optical connectors and the safe measurement of optical power from laser transmission systems

Evidence Guide

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Evidence of the ability to:

- plan DWDM installation activities
- develop installation specifications
- prepare DWDM shelf configuration and specifications
- plan preliminary optical tests.

Context of and specific resources for assessment

Assessment must ensure:

- sites on which testing, installation and configuring of a DWDM system may be conducted
- use of test equipment currently used in industry
- manufacturer's technical documentation
- relevant regulations and specifications.

Method of assessment

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct observation of the candidate undertaking DWDM planning tasks
- review of data gathered, reports and project plans prepared by the candidate
- oral or written questioning to assess knowledge of planning and configuring of DWDM systems.

Guidance information for assessment

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:

- ICTOPN5121A Test and commission a dense wavelength division multiplexing transmission system.

Aboriginal people and other people from a non-English speaking background may have second language issues.

Access must be provided to appropriate learning and assessment support when required.

EVIDENCE GUIDE

	Assessment processes and techniques must be culturally appropriate, and appropriate to the oral communication skill level, and language and literacy capacity of the candidate and the work being performed. In all cases where practical assessment is used it will be combined with targeted questioning to assess required knowledge. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. Where applicable, physical resources should include equipment modified for people with special needs.
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Range Statement**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Relevant legislation, codes, regulations and standards may include:

- Australian Communications Industry Forum (ACIF) standards and codes
- AS Communications Cabling Manual (CCM) Volume 1
- AS/NZS 3000:2007
- AS/NZS 3080:2003
- AS/NZS 3084:2003
- AS/NZS 3085.1:2004
- AS/NZS IEC 61935.1:2006
- AS/NZS IEC 61935.2:2006
- AS/NZS ISO/IEC 14763.3:2007
- AS/NZS ISO/IEC 15018:2005
- AS/NZS ISO/IEC 24702:2007
- cabling security codes and regulations
- Environmental Protection Acts
- OHS

RANGE STATEMENT	
	• road and traffic control legislation and codes • technical standards AS/ACIF S008:2006 and AS/ACIF S009:2006.

RANGE STATEMENT	
<i>Scope the work</i> may include:	• cable route • cable supports • cable types • distribution areas (DA) • enclosures • equipment required • fibre hubs • optical splitters • project type: • large residential • medium residential • small business • standard residential.
<i>Appropriate personnel</i> may be:	• consultant • planning engineer • project engineer • project supervisor • site supervisor.
<i>Safety hazards</i> may refer to:	• access points that may contain: • hazardous light (non-visible laser) • radio frequency (RF) emission • active lasers without safety labels • active optical fibres • contact with remote power feed • electrical supply that requires mandatory separation from communications cable • exposed fibres • unsafe support structures • unsafe weather: • heavy rains • high winds • severe heat or cold • thunderstorms.
<i>OHS and environmental requirements</i> may relate to:	• identifying other services, including power and gas • personal protective equipment • earmuffs • gloves • head protection

RANGE STATEMENT

- masks
- protective suits
- safety boots
- safety glasses
- safe working practices, such as the safe use and handling of:
 - chemicals
 - materials
 - tools and equipment
- safety equipment:
 - flashing lights
 - safety barriers
 - warning signs and tapes
 - witches hats
- special access requirements
- environmental considerations:
 - clean-up protection
 - stormwater protection
 - waste management.

RANGE STATEMENT	
<i>Other services</i> may include:	• alarms • electrical services • fire sprinkler systems • gas and water mains • high voltage (HV) power • other service provider networks.
<i>Tools, safety equipment</i> may include:	• personal protective equipment • test equipment: • local area network (LAN) Cat tester • network analyser • OTDR • passive optical network (PON) meter • tools: • fibre cleaning kit • fibre splicer • labeller • screw drivers • spanners • tagging tool.
<i>Plant and machinery</i> may include:	• back hoes • bobcats • cable hauling equipment • cable lifters • diggers • elevated work platforms (EWP) • excavators • jacks and trolleys • tensioning equipment.
<i>Fibre installation specifications</i> may include:	• connector types • fibre management system • identification label • patch cord type • splicing cabinet location.
<i>Power cable and grounding specifications</i> may include:	• cable colour code • cable termination lug type • cable wire gauge • identification label • overhead route • under floor cable route.

RANGE STATEMENT	
Associated hardware may include:	• cabinets • equipment racks: • 19 inch • 23 inch • 535 mm • European Telecommunications Standards Institute (ETSI) compliant • fibre distribution troughing • ironwork • LAN hubs and routers • rectifier cabinet.
Configuration document may include:	• circuit card locations • contents of each shelf • filler card locations.
Optical time domain reflectometer (OTDR) test may include:	• bidirectional 'footprint' test: • at 1310 nm • at 1550 nm • at 1625 nm • fibre loss • splice losses and their locations.
Optical loss test set (OLTS) measurement may include fibre insertion loss from:	• A to B at: • 1310 nm • 1550 nm • 1625 nm • B to A at: • 1310 nm • 1550 nm • 1625 nm.

Unit Sector(s)

Unit sector	Telecommunications
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Optical networks
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