



Australian Government

Department of Education, Employment and Workplace Relations

ICTOPN6129A Analyse optical transmission systems

Release: 1

ICTOPN6129A Analyse optical transmission systems

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to analyse optical transmission systems deployed by service providers in core and access networks. Network service providers adapt their existing optical networks to meet the demand for higher bandwidths for Next Generation Networks (NGN). Upgrading to 128 channels at transmission rates of up to 100 Gbit/s has a significant effect on the network's tolerance to optical impairments, such as noise level, chromatic dispersion and polarisation mode dispersion (PMD). Before an existing network is upgraded, its characteristics must be characterised and verified to ensure it will support the new modulation requirements of the equipment. 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	Experienced technical staff from telecommunications carriers, service providers or other private and public organisations who have experience in the optical transmission area apply the skills and knowledge in this unit.
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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 to conduct characterisation tests on existing optical network	1.1. Obtain relevant legislation, codes, regulations and standards and follow occupational health and safety (OHS) and environmental requirements for the given work 1.2. Identify hazards and work safely according to relevant safety legislation and company work practices using personal protective equipment 1.3. Construct test procedures for each test to be conducted 1.4. Notify customer and arrange for site access
2. Conduct link characterisation tests and analyse existing optical network	2.1. Perform optical tests to characterise the existing fibre link 2.2. Analyse the results of the optical tests, and determine the extent and nature of future upgrades based on the tests
3. Document the analysis of optical network with recommendations	3.1. Produce final drawings and plans of proposed upgrade requirements for optical transmission and submit to project manager according to enterprise policy 3.2. Prepare a report on the measured performance of the network and recommendations on future upgrades

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- communication skills to:
 - liaise with internal and external personnel on technical and operational matters
 - relate to work associates, supervisors, team members and clients
- literacy skills to:
 - interpret technical documentation, such as equipment manuals, specifications and service orders
 - write reports using standard formats

REQUIRED SKILLS AND KNOWLEDGE

- numeracy skills to interpret results and evaluate different types of technical data
- planning and organisational skills to plan, prioritise and monitor own work and that of others
- problem solving and contingency management skills to:
 - adapt testing procedures to requirements of particular situations
 - modify activities depending on operational contingencies, risk situations and environments
- safety awareness skills to:
 - apply precautions and required action to minimise, control or eliminate hazards that may exist during work activities especially when dealing with infra-red laser light
 - select and use required personal protective equipment conforming to industry and OHS standards
 - work systematically with required attention to detail without injury to self or others, or damage to goods or equipment
- technical skills to:
 - backup and restore
 - clean optical fibre connector
 - examine optical fibre connector for contamination and assess whether cleaning is required
 - install software
 - measure DC and AC voltages
 - measure optical power using handheld optical power meter
 - select and use appropriate test equipment
 - setup IP addresses and subnet masks

Required knowledge

- attenuation characteristics of optical fibres
- chromatic dispersion (CD) test
- dense wavelength division multiplexing (DWDM) principles of operation
- dispersion
- dispersion characteristics of various fibres
- dispersion compensation devices
- electrostatic discharge precaution
- features and operating requirements of test equipment including:
 - hand-held optical power meter
 - optical spectrum analyser
 - transmission test set
- functions of optical add drop multiplexer (OADM) and reconfigurable optical add-drop multiplexer (ROADM)

REQUIRED SKILLS AND KNOWLEDGE

- gain equalisation
- insertion loss test
- International Telecommunications Union (ITU) wavelength grid for DWDM
- measurement of dispersion
- methods to reduce dispersion
- optical amplifier operation
- optical fibre connector types and characteristics
- optical fibre types and characteristics
- optical return loss (ORL) test
- optical signal to noise ratio (OSNR) test
- optical time domain reflectometer (OTDR) test
- path protection and protection switching
- performance qualification of 40 Gbit/s and 100 Gbit/s transceivers
- polarisation mode dispersion (PMD) test
- protocols used on optical DWDM systems
- reflectance
- 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:

- conduct four of the following measurements:
 - OTDR testing from both ends
 - OLTS loss test
 - ORL
 - CD
 - PMD
 - non-linearity (four wave mixing)
 - OSNR
- analyse complex optical measurement results
- recommend the most appropriate upgrades for the existing system.

Context of and specific resources for assessment

Assessment must ensure:

- sites on which link characterisation testing may be conducted
- use of test equipment currently used in industry
- test equipment and manufacturer's technical documentation.

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 performing integration
- review of test documentation completed by the candidate
- oral or written questioning to assess knowledge of test and commissioning procedures.

Guidance information for assessment

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

- ICTOPN5118A Plan and configure dense wavelength division multiplexing systems

EVIDENCE GUIDE

- ICTOPN5119A Perform acceptance test and commission an optical network
- ICTOPN5120A Plan for an optical system upgrade and cut over
- ICTOPN5122A Test the performance of specialised optical devices.

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.

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.

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

RANGE STATEMENT

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
- Australian building codes and regulations
- compliance with appropriate Australian Communications and Media Authority (ACMA) technical standard requirements for underground, aerial, Category 5 or Category 6, 6A, 7 or 7A, and unshielded twisted pairs (UTP)
- Environmental Protection Acts
- fire regulations
- International Electrotechnical Commission (IEC):
 - IEC 61282-3 Technical report on calculation of PMD
 - IEC 61290-1 Gain of optical amplifiers
 - IEC 61290-2 Power measurements on optical amplifiers
 - IEC 61291 Generic specs for optical amplifiers
 - IEC 61291-4 Performance template for multi-channel optical amplifiers
 - IEC 61941 Standard on PMD measurement for single mode optical fibre
- OHS
- relevant international standards
- technical standards AS/ACIF S008:2006 and AS/ACIF S009:2006.

OHS and environmental requirements may relate to:

- decommissioning and isolating worksite and lines prior to commencement
- flashing lights
- gas and other hazard detection equipment
- identifying other services, including power and gas
- safe working practices, such as the safe use and handling of:
 - asbestos
 - chemicals

RANGE STATEMENT	
	• materials • tools and equipment • work platforms • safety barriers • safety equipment • special access requirements • suitable light and ventilation • trench guards • warning signs and tapes • witches hats • environmental considerations: • clean-up protection • noise, dust and clean-up management • stormwater protection • waste management.
Hazards may include:	• infra-red laser light at transmitter ports and fibres • needle stick injuries from fractured optical fibres.
Personal protective equipment may include:	• dust protection • earmuffs • eye protection • gloves • hard hats • personal reflecting jackets • safety boots • safety glasses • traffic signs • warning signs and tapes.
Test procedures may include:	• expected measurement results • test conditions • test instrument settings • test instruments required • test setup.
Optical tests may include:	• tests: • CD • non-linearity (four wave mixing) • optical loss test set (OLTS) • ORL

RANGE STATEMENT

	• OSNR • OTDR testing from both ends • PMD • wavelength: • 1310 nm • 1550 nm • 1625 nm.
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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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