Australian Government

Department of Education, Employment and Workplace Relations

ICTRFN8180A Analyse a cellular mobile network system

Release: 1

ICTRFN8180A Analyse a cellular mobile network system

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to analyse the detailed architecture and operation of individual cellular mobile elements and develop a plan to integrate emerging cellular technologies. 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.

Application of the Unit

Application of the unit	Telecommunications engineers and senior technical officers apply the skills and knowledge in this unit to analyse and manage cellular mobile networks and prepare to upgrade to Next Generation Mobile Networks (NGMG).

Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

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.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research mobile network systems and interfaces to interconnected networks	1.1. Analyse the ***interfaces*** between a cellular mobile network and customers, including the public switched telephone network (PSTN) and internet to validate the interoperability of the individual systems 1.2. Research the ***latest generation*** of mobile radio systems and develop a plan for integration of ***emerging cellular technologies*** to meet future demands and customer expectations
2. Analyse constraints imposed by frequency spectrum allocations	2.1. Analyse techniques to ***increase system capacity*** for a fixed spectrum bandwidth 2.2. Plan the ***frequency allocation*** for a cellular network from the derived specifications 2.3. Develop a simulation that plots the ***carrier to interference radiation*** pattern for a given cell geometry in a reflective environment
3. Analyse the operations of the major subsystems of a cellular network	3.1. Evaluate the major ***subsystem functions*** of the cellular network and analyse the ***subsystem components*** to determine capability for upgrades 3.2. Research and report how the major subsystems ***interface to other network subsystems*** 3.3. Simulate the transmission path for a cellular network
4. Analyse system capability	4.1. Simulate traffic flow measurements in a microcellular environment. 4.2. Produce an analytical report on cellular mobile convergence with a plan for cellular mobile system integration to existing networks

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 issues

REQUIRED SKILLS AND KNOWLEDGE

- work effectively within group
- literacy skills to:
  - interpret technical documentation
  - prepare documents in agreed format
- numeracy skills to:
  - take measurements
  - interpret results
- PC skills to:
  - carry out desktop research
  - do word processing
  - use statistical data
- planning and organisational skills to plan simulations to aid analysis
- problem solving and contingency management skills to:
  - adapt testing procedures to requirements of particular sites
  - modify activities depending on differing operational contingencies, risk situations and environments
- research skills to:
  - evaluate different types of technical data and compare with theoretical values and approved specifications
  - gather and record data from measurements
  - gather data, observe and analyse interfacing issues
- task management skills to:
  - adhere to all safety requirements
  - work systematically with required attention to detail
- technical skills to:
  - enable 'login' into cellular network elements for tests and analysis
  - recognise and interrogate cellular network elements alarms
  - recognise different transmission techniques
  - record fault conditions
  - select and use appropriate test equipment and practices to suit different network applications

Required knowledge

- allocations and bandwidth requirements of cellular systems
- approved specifications
- efficiency and system capacity given the spectrum allocation, number of channels required and Grade of Service
- equipment subsystem diagnosis and repair procedures
- features and differences between major frequency bands and their allocation of

REQUIRED SKILLS AND KNOWLEDGE
licenses • features and operating requirements of cellular test equipment • interworking with existing systems • key features of cellular mobile radio systems • major element functions of a mobile radio system • major frequency bands and their allocation of licenses • microcellular systems • minimising latency • network components and their functions • overview knowledge of transmission lines, transmitter and receiver architecture • radio spectrum in use, specifying restrictions and characteristics • radio frequency (RF) and electromagnetic energy (EME) hazards • specific knowledge related to antenna performance and mobile components and their impact on mobile spectrum interference • spectrum efficiency • system configuration procedures • testing network components • the types of adjustments that need to be made when measuring cellular transmission • the types of networks that will influence the transmission either on the radio path and/or transmission line

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 a frequency allocation for a cellular network • analyse techniques to increase system capacity for a fixed spectrum bandwidth • develop a plan for integration of emerging cellular technologies • analyse the interfaces between a mobile network and customers • research and report the interfacing of major subsystems to other network subsystems • produce an analytical report on cellular mobile convergence with a plan for cellular mobile system integration to existing networks.
Context of and specific resources for assessment	Assessment must ensure: • sites on which cellular network analysis, research and simulation may be conducted • use of test equipment currently used in industry • manufacturer's and enterprise 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: • evaluation of reports prepared by the candidate • review of test documentation and reports completed by the candidate • oral questioning or written questioning to assess required.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example: • ICTPMG8143A Manage a telecommunications project.

EVIDENCE GUIDE	
	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 regional contexts) may also be included.	
Interfaces may include:	• A • Abis • Iu • Iur • Iub

RANGE STATEMENT	
	• Iu-CS (circuit switch) • Iu-PS (packet switch) • S1
Latest generation may include:	• 3G • high speed packet access (HSPA)
Emerging cellular technologies may include:	• 2 x 2 multiple input-multiple output (MIMO) • 4 x 4 MIMO • 4G • long term evolution (LTE) • SF-frequency division multiple access (FDMA)
Increase system capacity may include:	• cellular re-use • orthogonal frequency division multiple access - multiple input-multiple output (OFDM - MIMO) • OFDMA • overlay • underlay.

Frequency allocation may include:	• patterns:
	  • 7/21
	  • 4/12
	  • 3/9
	  • 1/1.

Carrier to interference radiation may include:	• carrier interference:
	  • carrier to adjacent (C/A)
	  • carrier to interference (C/I)
	  • carrier to reflection (C/R).

Subsystem functions may include:	• cellular elements:
	  • AUC
	  • base station controller (BSC)
	  • base transceiver station (BTS)
	  • eNode B
	  • node B
	  • home location register (HLR)
	  • HSS
	  • mobile station (MS)
	  • mobile services switching centre (MSC)
	  • SAE

RANGE STATEMENT	
	• transcoder • visitor location register (VLR) • burst timing and content • logical channels • multiplexing • radio path • signal protocols.
Sub-systems components may include:	• alarm gathering unit • charging unit • clocking unit • common channel signalling unit • gateway gprs support node (GGSN) • HSS • MME • operation and maintenance unit • SAE gateway • serving GPRS support node (SGSN) • statistical unit.
Interface to other network sub-systems may include:	• application parts: • Base Station System Application Part (BSSAP) • integrated services user parts (ISUP) • managed application provider (MAP) • SYGTRAN.

Unit Sector(s)

Unit sector	Telecommunications

Co-requisite units

Co-requisite units		

Competency field

Competency field	Radio frequency networks