



Australian Government

Department of Education, Employment and Workplace Relations

ICTRFN7182A Produce a radio link budget

Release: 1

ICTRFN7182A Produce a radio link budget

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to analyse the technical performance of fixed and mobile radio systems and to plan and calculate link budgets. 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	Telecommunications engineers apply the skills and knowledge in this unit as part of their work with radio systems for a telecommunications service provider. The job role includes responsibility for establishing the layout of the digital radio system to minimise transmission loss and optimise the system performance.
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

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. Analyse suitability of radio systems	1.1. Analyse the spectral efficiency of functional elements of mobile radio systems for determining optimal frequency utilisation 1.2. Analyse the features of radio systems to evaluate the effectiveness of a particular application 1.3. Compare the features and specifications of antennas used in radio systems to assist with radio link budget 1.4. Report on the suitability of radio systems, including recommendations to improve network performance
2. Calculate a radio link budget	2.1. Calculate path loss using variables in appropriate propagation models for a power link budget 2.2. Evaluate the power link budget against allowable power margins specifications 2.3. Evaluate modulation types and spectral efficiency 2.4. Confirm radio power link budget achieves specified reliability
3. Complete evaluation and planning documentations	3.1. Complete an evaluation report on performance of radio systems with recommendations on improvements to the system 3.2. Document the processes carried out to determine the optimal power link budget for a radio system

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- analytical skills to review complex information to make judgements
- communication skills to work effectively within a group and present information
- information technology skills for word processing and desktop research
- literacy skills to prepare reports given a specific format
- numeracy skills to:
 - calculate link budgets
 - gather and record data from measurements
- research skills to gather data and information

REQUIRED SKILLS AND KNOWLEDGE

- technical skills to operate test equipment

Required knowledge

- HF, VHF, UHF and microwave receiving techniques
- modulation methods:
 - AM
 - FM
 - digital formats
- multiplexing systems
- operation of transmitters and receivers
- organisational policy and procedures
- personal safety issues
- propagation methods
- radio communications systems
- radio frequency (RF) losses
- RF technologies
- workplace and industry environment

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:

- analyse the signal degradation characteristics of radio paths and calculate power budgets for various distances and antenna heights versus transmitted power
- research the constraints imposed by mobile phone frequency allocations and simulate carrier to interference radiation patterns around a cell site
- complete evaluation report on radio system performance and document processes used to determine power link budget.

Context of and specific resources for assessment

Assessment must ensure:

- telecommunications operations site
- mobile telephony devices and equipment
- networked computers and relevant software.

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:

- oral or written questioning to assess required knowledge
- review of link budget reports completed by the candidate for different communication scenarios
- direct observation of the candidate analysing radio systems and calculating link budgets.

Guidance information for assessment

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

- ICTPMG7145A Undertake a telecommunications project
- ICTTEN7193A Plan a transmission network.

Aboriginal people and other people from a non-English

EVIDENCE GUIDE

	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.
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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.

Functional elements may include:

- code division multiple access (CDMA)
- frequency division multiple access (FDMA)
- time division multiple access (TDMA)
- wideband code division multiple access (WCDMA).

Radio systems may include:

- 3G
- 4G

RANGE STATEMENT	
	• CDMA • GPRS • Global system for mobiles (GSM) • trunked • WCDMA • worldwide interoperability for microwave access (WiMAX).
Path loss refers to:	• received power to transmitted power ratio and may depend on: • antenna height • atmospheric absorption • distance • rain • reflection coefficient.
Variables may include:	• clutter factor • Doppler effect on mobile transmission • frequency • Fresnel distance and absorption • K factor • point-to-multipoint • point-to-point • Raleigh fading and counter measures • reflection coefficient.
Modulation types may include:	• FM • AM • orthogonal frequency division multiplex (OFDM) • COFDM • quaternary phase shift keying (QPSK) • 16 quadrature amplitude modulation (QAM) • 256 QAM.
Specified reliability may include:	• drop outs • outage time • power margin • signal fading.

Unit Sector(s)

Unit sector	Telecommunications
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Co-requisite units

Co-requisite units		

Competency field

Competency field	Radio frequency networks
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