Australian Government

Department of Education, Employment and Workplace Relations

ICTRFN3155A Construct and test a radio communications device

Release: 1

ICTRFN3155A Construct and test a radio communications device

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to construct and test a radio communications transmitting or receiving device. This is an entry level and foundation unit in radio communications. 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	Technical staff in the field of radio communications apply the skills and knowledge in this unit to assemble and test a radio transmitter or receiver. Relevant job roles include radio maintenance technician, radio installer and radio repairer.

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. Prepare to construct radio communications device	1.1. Prepare for construction applying all relevant ***legislation***, ***codes***, ***regulations and standards*** and identify any ***safety issues*** 1.2. Determine details of ***radio communications device*** to be constructed from ***project specifications*** 1.3. Produce wiring diagram, ***component list*** and ***block diagram*** of the radio communications device to prepare for the construction and testing of the device 1.4. Draw up plans showing the ***method of construction*** and the ***enclosure details*** 1.5. Designate suitable ***test points*** along the signal flow paths on circuit diagram for testing of the functional blocks 1.6. Produce test setups to evaluate the performance of the radio communications device 1.7. Obtain ***tools*** and ***test equipment***
2. Construct and test radio communications device	2.1. Assemble radio communications device according to circuit diagram and layout drawing 2.2. Test ***performance*** and operation of individual functional blocks and overall radio communications device according to the test regime 2.3. Transmit or receive signals to evaluate the qualitative performance through radio communications device
3. Complete documentation and clean up worksite	3.1. Document results of test procedures and compare with initial project specifications 3.2. Finalise project report and make recommendations for improvement to the radio communications device 3.3. Remove waste from worksite according to environmental requirements and restore site to safe condition

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE
This section describes the skills and knowledge required for this unit.

REQUIRED SKILLS AND KNOWLEDGE

Required skills

- communication skills to liaise with technical, operational and business related matters
- literacy skills to interpret technical documentation and write reports in required formats
- numeracy skills to take test measurements, interpret results and evaluate performance
- planning and organisational skills to plan, prioritise and monitor own work
- problem solving skills to troubleshoot and manage contingencies to adapt construction and test procedures to requirements of radio communications device
- research skills to source components from supplier catalogues, databases and websites
- safety awareness skills to:
  - apply precautions and required action to minimise, control or eliminate hazards that may exist during work activities
  - select and use required personal protective equipment conforming to industry and occupational health and safety (OHS) standards
  - work systematically with required attention to detail without injury to self or others, or damage to goods or equipment
- technical skills to:
  - operate an oscilloscope and radio frequency (RF) test equipment
  - solder, construct and prepare wires and cables
  - use hand tools

Required knowledge

- electrical symbols and circuit diagrams
- general principles of radio communications and radio propagation
- identification of:
  - components
  - device pinouts
  - part numbers
  - polarities
  - ratings
- operation and characteristics of:
  - amplifiers
  - demodulators
  - mixers
  - modulators
  - oscillators

REQUIRED SKILLS AND KNOWLEDGE
• principles of modulation • terminology related to radio communications.

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 and prepare for construction of a radio communications device • prepare wiring diagram and component list • construct radio communications device • test radio communications device.
Context of, and specific resources for assessment	Assessment must ensure: • site where radio communications device may be constructed and tested • use of test instruments currently used in industry • relevant regulatory and equipment documentation that impact on work activities.
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 constructing and testing a radio communications device • oral or written questioning of required skills and knowledge • evaluation of report prepared by the candidate outlining construction, testing procedures, results and recommendations.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example: • ICTTEN2140A Use hand and power tools • ICTRFN3175A Operate and maintain radio communications technical instruments and field equipment. Aboriginal people and other people from a non-English speaking background may have second language issues.

EVIDENCE GUIDE	
	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.	
Relevant legislation, ***codes***, ***regulations and standards*** may include:	• Australian Communications Industry Forum (ACIF) standards and codes • Australian Communications and Media Authority (ACMA) technical standards • AS Communications Cabling Manual (CCM) Volume 1 • Australian standards • Broadcasting Services Act 1992 • enterprise standards

RANGE STATEMENT	
	• fire regulations • manufacturer's enterprise operating policy and procedures • OHS Act • Privacy Act • Radiocommunications Act 1992 • spectrum management regulations • statutory requirements.
Safety issues may relate to:	• drilling metal and printed circuit boards • etching printed circuit board • folding metal • soldering • tapping • threading • using metalwork guillotine, notcher or bender.

Radio communications device may include:	• amateur band transceiver
	• amateur band transverter
	• low noise converter
	• radio receiver:
	  • AM broadcast receiver
	  • FM stereo broadcast receiver
	  • global positioning system (GPS) receiver
	  • single side band (SSB) receiver
	  • very high frequency (VHF) weather satellite receiver
	• radio transmitter:
	  • amateur band transmitter
	  • low power FM stereo transmitter.

Project specifications may include:	• modulation type:
	  • amplitude modulation:
	  • amplitude shift keying (ASK)
	  • double side band full carrier (DSBFC)
	  • double side band suppressed carrier (DSBSC)
	  • single side band suppressed carrier (SSBSC)
	  • frequency modulation:
	  • analog
	  • frequency shift keying (FSK)

RANGE STATEMENT	

	• phase modulation:
	  • analog
	  • binary phase shift keying (BPSK)
	• spread spectrum:
	  • direct sequence
	  • frequency hopping
	• operating frequency band:
	  • high frequency (HF)
	  • low frequency (LF)
	  • medium frequency (MF)
	  • ultra-high frequency (UHF)
	  • very high frequency (VHF)
	  • very low frequency (VLF)
	• schematic diagram of radio device
	• supply voltage
	• type of radio communications device:
	  • radio transmitter:
	  • RF output power
	  • radio receiver:
	  • sensitivity
	  • transceiver.

Component list may include:	• component description:
	  • inductor winding details
	  • power or voltage rating
	  • style
	• manufacturer
	• supplier details.

Block diagram may include:	• functional blocks:
	  • amplifiers:
	  • audio frequency (AF)
	  • intermediate frequency (IF)
	  • RF
	  • bandpass IF filter
	  • demodulator
	  • direct digital synthesizer (DDS)
	  • low pass filter (LPF)
	  • microcontroller
	  • mixer

RANGE STATEMENT	
	• modulator • oscillator • power supply.
Method of construction may include:	• dead bug • kitset • perforated matrix board • physical layout drawing of the device • printed circuit board • rats nest point-to-point wiring • veroboard.
Enclosure details may include:	• die cast box • folded sheet metal • plastic box.
Test points may include:	• ground 0 volts • mixer output • oscillator output • positive supply line.
Tools may include:	• desoldering braid • drill bits • hand reamer • lead free solder • long nosed pliers • nibbling tool • power drill • safety glasses • screwdrivers • solder sucker • soldering fume extractor • soldering iron and stand • spring loaded side cutters.
Test equipment may include:	• AC voltmeter • frequency counter • modulation meter • multimeter • noise and distortion meter • oscilloscope • RF power meter • RF probe • RF signal generator

RANGE STATEMENT	
	• spectrum analyser.

Performance may include:	• receiver:
	  • image frequency response
	  • quieting
	  • sensitivity
	  • signal to noise ratio
	  • SINAD
	• transmitter:
	  • carrier frequency
	  • harmonic levels
	  • modulation depth
	  • modulation quality
	  • RF output power
	  • spurious oscillations.

Unit Sector(s)

Unit sector	Telecommunications

Co-requisite units

Co-requisite units		

Competency field

Competency field	Radio frequency networks