

Amateur Operator's Certificate of Proficiency (Foundation) Syllabus and Examination.

The Amateur Licence (amateur foundation station) [the Foundation Amateur Licence] may be obtained by persons holding the Amateur Operator's Certificate of Proficiency (Foundation) (AOCP(F)).

The Foundation Amateur Licence is considered to be the entry level for Amateur radio in Australia. The syllabus and related examination for the AOCP(F) correspondingly reflects the minimum level of knowledge, skills and experience required to safely assemble a Foundation Amateur station and to operate it safely without interference to other users and services.

Syllabus

Section

Assessment Objectives

1. Nature of Amateur Radio

Nature of Amateur Radio

1.1 Recall that Amateur radio is intended to facilitate hobby radiocommunications.

Types of licences

1.2 Recall that Amateur radio activities are authorised under an amateur licence. Other forms of licences authorise types of radiocommunications such as Citizens Band (CB), Land mobile, Point to Point Links and Broadcasting.

Recall that the Amateur Service operates on frequency bands allocated for Amateur use.
Recall that the Amateur Service shares some frequency bands with other services.

Allocation of frequency bands 1.3 Recall that services such as the broadcasting, aeronautical and maritime services are allocated frequency bands appropriate to their purpose.

2. Licence Conditions

Licence Conditions 2.1 Recall that operation under a Foundation Amateur Licence is subject to conditions in the *Radiocommunications Act 1992*, the *Radiocommunications Regulations 1993*, the *Radiocommunications Licence Conditions (Amateur Licence) Determination No.1 of 1997* and the *Radiocommunications Licence Conditions (Apparatus Licence) Determination 2003*.

Purpose of the Amateur Service 2.2 Recall that an Amateur Licence primarily authorises the operation of an Amateur station for self-training in radiocommunications, intercommunications between Amateurs and technical investigations into radiocommunications.

Communications by Amateur stations 2.3 Recall that, except in relation to a distress or emergency situation, or where authorised by an Inspector, an Amateur Licence only authorises Amateur-to-Amateur communications.

2.4 Recall that the messages may be passed on behalf of third parties as long as they do not relate to the business or financial affairs of any person.

Distress and Urgency Signals 2.5 Recall that distress communications are signalled by the use of 'Mayday' and that these communications have priority over all other communications.
Recall that persons hearing a 'Mayday' communication are responsible for passing the information on to an appropriate authority.
Recall that some urgent situations not warranting the use of 'Mayday' are signalled by the use of 'Pan Pan'. These communications should receive priority and should be reported to an appropriate authority.

Station identification	2.6	Recall that correct station identification is required at the beginning of a transmission, or series of transmissions, and at least every 10 minutes during a series of transmissions. Recall that any transmission, even a test transmission, must contain station identification.
Amateur Callsigns	2.7	Identify from supplied reference material, the categories of callsigns used in the Australian Amateur Service. Identify callsign suffixes applicable to each licence category, prefixes and state designators.
Encoded messages	2.8	Recall that the transmission of messages that are encoded for the purpose of obscuring their meaning is not permitted except for the purposes specified in the Amateur LCD.
Entertainment not permitted	2.9	Recall that the transmission of any form of entertainment is not permitted.
Authorised frequency bands and emissions	2.10	Recall that the Foundation Amateur Licence authorises operation on certain frequency bands and the use of certain emission modes. Recall in what document the bands and modes are specified.
Permitted power output	2.11	Recall that the Foundation Amateur Licence restricts the transmitter output power to a maximum of 10 watts.
Type of equipment allowed	2.12	Recall that the Foundation Amateur Licence only authorises the use of unmodified commercially manufactured transmitting equipment.
Notification of change of address	2.13	Recall the requirement to notify the Australian Communications and Media Authority (ACMA) of any change of address.
Harmful interference	2.14	Recall that a licensee must not operate an Amateur station if operation causes harmful interference to radiocommunications.

Use of Amateur stations	2.15	Recall that an amateur station cannot be used for financial gain.
	2.16	Recall that the licensee of a Foundation amateur station may only permit a suitably qualified person to operate the licensee's station.
	2.17	Recall that the licensee of a Foundation amateur station must not operate an amateur station using automatic or computer controlled mode.
	2.18	Recall that the licensee of a Foundation amateur station must not operate an amateur station directly connected to a public telecommunications network and that the Internet is considered to be part of a public telecommunications network.
Inspection of Amateur Licences	2.19	Recall that Inspectors have the right to require an Amateur to produce his/her licence.
Restriction of operation to avoid interference	2.20	Recall that the ACMA, in order to avoid interference, has the right to restrict the operation of an Amateur station.
Use of the Licence Condition Determinations (LCDs)	2.21	Identify, using the LCDs applicable to the Amateur Licence, specific licence conditions as they apply to the Foundation Licence. The candidate will be supplied with the LCDs.

3. Technical Basics

Units of measurement, abbreviations and multiple / sub-multiple prefixes	3.1	Recall the units of, and abbreviations for, Voltage, Current, Resistance and Power. Recall the engineering prefixes milli, kilo and Mega.
Meaning of DC and AC	3.2	Recall what is meant by the abbreviations DC and AC.
Audio and Radio Frequencies	3.3	Recall, using supplied reference material, the range of frequencies described as AF,

(Audio Frequency) and RF, (Radio Frequency).

Meaning of AM and FM	3.4	Recall what is meant by the abbreviations AM and FM. Describe how the radio frequency carrier is modified for AM and FM.
Meaning of Voltage, Current, Resistance and Power	3.5	Recall the meaning of Voltage, Current, Resistance and Power.
Simple Calculations	3.6	Recall, using supplied reference material, the relationship between Voltage, Current, Resistance and Power. Calculate an unknown value given the value of the remaining components.
Excessive and incorrect polarity	3.7	Recall that electronic circuits can be damaged by applying an excessive voltage or voltage of wrong polarity.
Unit of Frequency	3.8	Recall the unit of frequency.
The Sine wave	3.9	Recall the graphic representation of a sine wave and that sine waves are produced by oscillators.
Mains Electricity Supply	3.10	Identify from supplied reference material the voltage and frequency of the mains electricity supply used in Australia.
Range of human hearing	3.11	Identify from supplied reference material the range of frequencies for normal human hearing.
Audio frequencies used in radiotelephony	3.12	Identify from supplied reference material the range of audio frequencies commonly used in radiotelephony.
Frequency ranges for HF,	3.13	Identify from supplied reference material the frequency bands for HF, VHF and UHF.

VHF and UHF

The relationship between frequency and wavelength

3.14 Recall the relationship between frequency and wavelength. Convert from one to the other using supplied reference material.

4. Transmitters and Receivers

Block or 'concept' diagrams of simple transmitters and receivers

4.1 Identify, using supplied block diagrams, the names of the stages in a simple transmitter and receiver.

Importance of proper transmitter adjustment

4.2 Recall that improper adjustment of a transmitter can cause harmful interference to other radiocommunications users, both inside and outside the frequency bands allocated to Amateurs.

4.3 Recall that all components of transmitter emissions must be contained within the radiofrequency bands allocated to Amateurs.

Identification of waveforms

4.4 Identify, with the aid of supplied diagrams, a radio frequency carrier waveform, an audio frequency waveform and a modulated waveform.

4.5 Identify, using supplied block diagrams, where the carrier, audio and modulated waveforms occur in a simple transmitter.

Types of Amplitude Modulation

4.6 Recall that Single Sideband (SSB) is a form of Amplitude Modulation (AM).

Transmitter output matching

4.7 Recall that the final power amplifier stage of a transmitter must be connected to a correctly matched transmission line and antenna to avoid possible damage to the

transmitter and/or cause interference to other radiocommunications services.

Effect of AF gain control on output modulation	4.8	Recall the need to ensure AF gain (microphone gain), where fitted, is correctly adjusted to avoid over modulation of AM or FM transmitters.
Effects of over modulation	4.9	Recall that excessive modulation of AM or FM transmitters may cause distorted output and interference to adjacent frequencies.
Transceiver controls	4.10	Recall, using a supplied diagram or physical transceiver, the purpose of the following controls: AF, RF, Squelch, Mode, VFO, RIT, Band and Carrier control.
Receiver terms	4.11	Recall the meaning of the terms sensitivity, selectivity and stability as they apply to a receiver.

5. Transmission lines and Antennas

Types of transmission lines	5.1	Identify, from a supplied diagram, photograph or physical examples, common co-axial and balanced transmission lines. Recall their typical characteristic impedance.
Co-axial connectors	5.2	Identify, from a supplied diagram, photograph or physical examples, co-axial connectors commonly used in radiocommunications.
Testing of transmission lines	5.3	Understand the reason for continuity and isolation testing a co-axial cable terminated with co-axial connectors. Describe the continuity testing procedure.
Antenna purpose	5.4	Recall that the purpose of an antenna is to convert electrical signals into radio waves, and vice versa.
Antenna length to frequency	5.5	Recall the relationship between the physical length of the antenna and the frequency of

relationship		operation.
Identification of common antennas	5.6	Identify, from supplied diagrams, a half-wave dipole, folded dipole, 1/4 wave ground plane, Yagi, and end-fed wire antenna.
Choice of Antenna	5.7	Recall that the on-air performance of an amateur station can be improved significantly by the correct choice of antenna. Identify, using supplied reference material, the symbol for an antenna.
Antenna directional characteristics	5.8	Recall the meaning of the terms polarization, omni-directional, bi-directional, unidirectional and gain as they apply to antennas.
Polarisation	5.9	Recall that the polarisation and directivity of an antenna is determined by its physical construction and orientation.
Effective Radiated Power (ERP)	5.10	Recall, using supplied reference material, that ERP is the product of transmitter power and antenna gain. Recall that antenna gain is generally expressed in decibels.
Antenna Matching	5.11	Recall the need to match an antenna to a transmission line and to minimise the Standing Wave Ratio (SWR).
Antenna Tuning Unit	5.12	Recall the uses, purposes and adjustment of a typical manual ATU.
Baluns	5.13	Recall that, when feeding a balanced antenna with an unbalanced transmission line (coaxial cable), the preferred practice is to use a balun.
Standing wave ratios (SWR)	5.14	Recall the correct placement, use and adjustment of an SWR Meter.
Acceptable SWR	5.15	Recall that an SWR equal to, or less than, 1.5 indicates a satisfactory antenna match.
Testing transmitters	5.16	Recall that, when testing a transmitter, a non-radiating load (dummy load) is commonly

used to prevent a signal from being radiated.

6. Propagation

Propagation basics	6.1	Recall that radio waves travel in straight lines, unless diffracted, reflected or refracted.
Effect of distance on radio waves	6.2	Recall that radio waves get weaker with distance as they propagate from the antenna.
Communication Range	6.3	Recall that communication range at VHF/UHF is dependant on antenna height, a clear path, transmitter power and receiver sensitivity.
Effect of obstacles and structures on VHF and UHF signals	6.4	Recall that VHF and UHF signals are obstructed by hills and large structures.
Long distance communications on VHF and UHF	6.5	Recall that unusual atmospheric conditions may at times provide extended range.
The Ionosphere	6.6	Recall, using supplied reference material, that the ionosphere comprises layers of ionised gas at varying heights above ground.
Factors effecting HF propagation	6.7	Recall that ionospheric propagation is dependent on time of day, season, frequency and solar activity.
Ionospheric Refraction	6.8	Recall that long-distance HF communication relies on propagation by ionospheric refraction.

7. Interference

Sources of radio interference	7.1	Recall that broadcast radio and television receivers can suffer interference from local sources other than radiocommunications transmitters. These sources include electrical and electronic equipment and high voltage electricity supply lines.
	7.2	Recall that interference to other radiocommunications services, including broadcast radio and television reception, can be caused by the faulty operation of radiocommunications transmitters.
	7.3	Recall that radiocommunications transmitters can be the source (but not necessarily the cause) of interference to nearby electronic and radio equipment. Recall that technical solutions can generally resolve the interference.
Interference & Electromagnetic Compatibility (EMC)	7.4	Recall that the ability of electronic or radio equipment to operate properly, without interference, in the presence of electromagnetic radiation, such as radiocommunications transmissions, refers to the EMC of the equipment. This is also known as the equipment's radiofrequency immunity.
Interference pathways	7.5	Recall that radiocommunications transmissions that are the source of interference, may be induced into nearby electronic or radio equipment through conduction along electrical mains wiring or from direct pickup by the equipment.
Amateur transmissions and EMC	7.6	Recall that interference resulting from EMC problems may be dependent on the power, frequency and type of emission of the radiocommunications transmitter and its distance from the affected equipment.
Antenna location and EMC	7.7	Recall that interference resulting from EMC problems can be minimised by careful selection and siting of antennas.
Transmission modes and	7.8	Recall that some transmission modes are more likely than others to cause objectionable

interference		interference to broadcast radio and television reception and to telephones.
Filters	7.9	Recall that the immunity of most types of equipment can be increased by fitting suitable filters in external cabling such as antenna, power supply or interconnections between equipment.
		Recall that the filters should be fitted as close to the affected devices as possible.
Simple 'choke' filter	7.10	Recall how to construct a simple RF choke using ferrite rod or toroid.
RF Earthing	7.11	Recall that the function of the RF earth connection in an Amateur station is to provide a path to ground to minimise RF currents entering the mains earth system and causing interference to other electronic equipment. Identify, from supplied diagrams, the symbol representing an earth connection.
Diplomacy and EMC	7.12	Recall that EMC problems have the potential for causing neighbourhood disputes. Understand the need for diplomacy, the sources of advice available and the role of the ACMA.
Harmful Interference	7.13	Recall that a licensee must not operate an Amateur station if its operation causes harmful interference to other users or services.

8. Operating Practices and Procedures

Equipment practices	8.1	Demonstrate connecting a transmitter/receiver safely to a power supply, microphone, transmission line and antenna.
Knowledge of the frequencies and emissions that may be	8.2	Recall, using the relevant LCDs and band plans, the frequencies and emissions that may be used under a Foundation Licence. Recall that Amateur band plans, by agreement,

used under a Foundation licence		play an important part in managing interference between Amateur stations. Relevant reference material will be supplied.
Requirement not to transmit on frequencies in use	8.3	Recall and demonstrate the requirement to listen on a frequency before transmitting to ensure that interference will not be caused to other stations using the frequency.
Operating practices	8.4	Demonstrate, by making on-air contacts using appropriate calling procedures, the correct operation of HF <u>and</u> VHF <u>or</u> UHF transmitter/receivers in modes consistent with the conditions of a Foundation Amateur Licence. Demonstrate the use of a signal strength meter to make meaningful signal reports.
Operating through a repeater	8.5	Recall and demonstrate, using supplied reference material, the correct use of voice repeaters including the use of Continuous Tone Coded Squelch System (CTCSS) and Dual Tone Multiple Frequency (DTMF) access control systems.
	8.6	Recall and demonstrate the need for leaving adequate breaks between transmissions when using voice repeaters.
Making a "CQ" call and changing to a working frequency	8.7	Demonstrate an all-stations (CQ) call on HF and VHF <u>or</u> UHF, making a contact and initiating a change of frequency (QSY) from the calling channel to a working channel.
Abbreviations	8.8	Recall that there are internationally recognised abbreviations that are commonly used in communications.
Transmitter measurements	8.9	Recall and demonstrate the measurement, or estimation, of the output power of a transmitter. Measure the SWR using a suitable measuring device.
Correcting simple equipment	8.10	Recall and demonstrate the correction of simple problems such as high SWR, excessive

maladjustments

modulation, and excessive RF output power.

9. Safety

Dangerous voltages	9.1	Recall that high voltages and high currents are dangerous.
Equipment must not be modified	9.2	Recall that the Foundation Licensee must not make modifications to any Amateur radio transmitting equipment.
Electrical safety - equipment to be approved	9.3	Recall that any mains operated equipment sold, hired or supplied must be approved by an Electricity Authority or other relevant authority. Recall that approved equipment will have an approval label.
Awareness of State Electricity Authority requirements	9.4	Recall that it is necessary to check relevant requirements regarding unqualified persons wiring and testing mains operated equipment. This includes leads, plugs and sockets connected to the household mains supply.
Electrical Earthing	9.5	Recall why most mains operated equipment should have a safety earth connection.
Fuses	9.6	Recall that fuses prevent excessive currents that may cause heat damage or fires.
Correct fuse to be used	9.7	Recall that a correct fuse must be fitted to all electrical equipment.
Replacing fuses	9.8	Recall the precautions to be taken when replacing faulty fuses including the selection of a fuse rated in accordance with an equipment manufacturer's specifications or electricity supply authority requirements.
Station layout for physical safety	9.9	Recall that the layout of an Amateur station should take account of physical safety issues. Recall that trailing cables are trip hazards and dangerous.
Power lead safety	9.10	Recall that frayed or damaged power leads are dangerous and should be replaced or

repaired by an Authorised person.

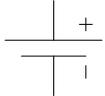
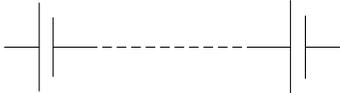
Know location and desirability of a Mains OFF switch	9.11	Recall the desirability for a clearly marked switch to turn off all station equipment in case of emergency.
Actions to be taken in the event of an accident involving electricity	9.12	Recall that, in the event of an accident involving electricity, the first action is to safely switch off the power.
Electric shocks	9.13	Recall that a casualty of electric shock must not be touched unless the power has been switched off.
Call for Help – use of resuscitation techniques	9.14	Recall that emergency services need to be called immediately and that Cardio Pulmonary Resuscitation (CPR) may need to be administered.
Battery safety	9.16	Recall that batteries contain chemicals and emit fumes and may explode if punctured or exposed to flames or sparks.
Antennas and safety	9.17	Recall that it is important for all persons (and animals) to be kept at a safe distance from antennas.
Radio waves can be dangerous	9.18	Recall that electromagnetic radiation (EMR) can be dangerous. Higher frequencies and power levels increase the danger.
	9.19	Recall that the distance from an antenna that is a safe distance depends on the ERP, operating frequency, antenna type and orientation.
Antenna erection	9.20	Recall that antenna erection is potentially dangerous and should be carried out by

suitably experienced persons.

Securing and siting antennas	9.21	Recall that antennas and their fittings must be suitably located and secured and must never be connected to, or sited close to, mains poles and lines.
Lightning protection	9.22	Recall that it is good practice to install lightning protection on antennas, disconnect antennas from any radio equipment prior to a thunderstorm and never operate during a thunderstorm.
Safe use of headphones	9.23	Recall that excessive volume when wearing headphones can cause damage to human hearing.
Station Security	9.24	Recall that an operable Amateur station must not be accessible to unauthorised persons.

Notes to the Amateur Operator's Certificate of Proficiency (Foundation) Syllabus and Examination:

1. The examination comprises:
 - a) One multi-choice question paper (25 questions covering both theory and 'regulations'). Questions may be drawn from any part of the syllabus other than Part 8; and
 - b) A practical assessment of operating knowledge and skills. Assessment will be based primarily on Part 8 of the syllabus, however the assessment may address matters included in Parts 2 and 9 of the syllabus.
2. Where possible, the practical assessment will be carried out under actual operating conditions.
3. The examination may be undertaken in one session or as part of a course of training.
4. Thirty (30) minutes is allowed for the multi-choice paper where the examination is undertaken at one session.
5. A certificate of proficiency will be issued to persons who both correctly answer 18 (70%) of the multi-choice questions and demonstrate competence in all elements of the practical component of the examination.
6. The following symbols may be used in the examination

Description	Symbol
Cell	
Battery	
Fuse	
Lamp	
Resistor	
Switch (SPST)	
Antenna	

Earth	
Microphone	
Loudspeaker	

7. Examination candidates will be supplied with reference materials in order to facilitate some of the assessment requirements. The materials may include look up tables, formula sheets, diagrams, photographs, relevant LCDs, band plans and physical examples.

8. Under the heading 'Assessment Objective', the syllabus uses the words 'recall', 'understand', 'demonstrate' and identify to denote the differing levels of answer required:

Recall indicates the requirement to recall a fact and apply it directly to the assessment question or situation. This may be with the use of supplied reference material.

Understand indicates the need for more detailed knowledge of the subject.

Demonstrate indicates that the candidate is required to display an ability to carry out a physical task.

Identify indicates that the candidate is required to identify particular objects, diagrams or other matters from a supplied set of alternatives.

9. Reference to an 'Inspector' means an Inspector appointed under the *Radiocommunications Act 1992*.
10. Reference to a 'transceiver' means a combined transmitter and receiver.