Foundation Licence
Training Part 1

Gateway to Amateur Radio
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VK3DAC
Introduction

- The foundation licence has been introduced to act as an entry point into amateur radio.
- The study for the foundation licence involves radio theory and practice.
- The requirements for the licence are defined in the Licence Conditions Determination (LCD). All Amateurs should have a copy of the LCD.
- The content for the training is defined by the foundation licence syllabus document.
Introduction

- The syllabus has 9 sections. These are:
  - Nature of Amateur Radio
  - Licence Conditions
  - Technical Basics
  - Transmitters and Receivers
  - Transmission Lines and Antennas
  - Propagation
  - Interference
  - Safety
  - Operating Practices and Procedures
Introduction

- To study for the Foundation Licence you should obtain the following documents:
  - Foundation licence syllabus document
  - The Foundation Licence Conditions Determination (LCD)
  - The Foundation Licence Manual, that covers the required radio theory
Introduction

- The documentation can be obtained from the WIA web site [www.wia.org.au](http://www.wia.org.au) and [www.acma.gov.au](http://www.acma.gov.au)
- You will also need to arrange for assessment. This is via a WIA accredited assessor, usually associated with a radio club. For an assessor near you look at [www.silvertrain.com.au/assessors](http://www.silvertrain.com.au/assessors)
- The WIA Office will be able to assist with the assessment details, (03)9729 0400
Introduction

- This program is intended to assist those attempting this licence, as well as to be a guide to instructors providing the training for this licence.
- The information in this program can be found in the Foundation Licence Manual.
- The foundation licence manual should be studied in conjunction with this training program.
This Program

- This program will follow the 9 sections in the foundation licence syllabus document.
- Questions, that are typical of the type of question asked in the theory examination, are included at the end of each section of this program.
- Section 8 of the syllabus, the practical, is not included in this presentation as it must be studied and then assessed “hands on”
This Program

The foundation licence exam has the following specified number of questions:

- Section 1 and 2 combined – 7 questions
- Section 3 – 2 questions
- Section 4 – 2 questions
- Section 5 – 2 questions
- Section 6 – 2 questions
- Section 7 – 5 questions
- Section 8 – Practical
- Section 9 – 5 questions
This Program

- The theory exam duration is 30 minutes and includes both regulations and theory.
- The theory exam consists of 25 multiple choice questions.
- You must answer 18 of the 25 questions correctly to be assessed as competent for the theory (i.e., 70%).
This Program

- The practical is covered in section 8 of the Foundation Licence Syllabus.
- The duration of the practical is 30 to 40 minutes.
- All sections of the practical must be attempted and answered correctly. This means the candidate must achieve 100%.
- Practical requires “hands on” activity.
Section 1 The Nature of Amateur Radio
Section 1 Nature of Amateur Radio

- Amateur radio facilitates the hobby of amateur radio
- All radio amateurs must have a licence
- There are other forms of licence such as CB, Marine, Point to Point Links and Broadcasting
- Amateurs operate on bands that are allocated for amateur use
- Amateurs must not operate outside the allocated bands
Section 1 Nature of Amateur Radio

- The amateur service shares frequencies with other band users.
- Other users such as aeronautical, broadcasting and maritime have bands allocated to them for their purposes.
- Amateur operators must not operate on bands allocated for other purposes.
- The Licence Conditions Determination (LCD) indicate the bands allocated for amateur operation – use the LCD’s to look up a Foundation Licence frequency allocation.
Amateur Band Plan

- Amateur band plans help amateurs make best use of the frequency spectrum and provide for better on-air operating.
- The band plans are an agreed position between amateurs and the WIA.
- Band plans can be found in the Foundation Licence manual.
Section 1 Nature of Amateur Radio

The following is a typical question you may be asked in the foundation licence theory exam:

A Radio Amateur’s licence allows the amateur to operate on the:

A. Marine band
B. Broadcast band
C. Amateur band
D. Aeronautical band
Section 1 Nature of Amateur Radio

- The answer is:
- C. An amateur’s licence allows them to operate only on the allocated amateur bands
Foundation Licence holders are subject to conditions that are defined in four government documents. These documents are:

- Radiocommunications Act 1992
- Radiocommunications Regulations 1993
- Radiocommunications Licence Conditions (Apparatus Licence) Determination 2003
Section 2 Licence Conditions

- The primary function of an Amateur Licence is to authorise a person to:
  - Self train in radio communications
  - Communicate with other amateur radio operators
  - Conduct technical investigations into radio communications
Section 2 Licence Conditions

- An amateur licence allows intercommunication between other radio amateurs. The exception being when:
  - There is an emergency or distress situation
  - Where authorised by a Radio Inspector
Radio Amateurs are permitted to send “third party” messages to other amateurs in Australia on behalf of a third person provided it is not for gain, commercial purpose an advertisement or entertainment or relate to the business or financial affairs of any person.

Australian amateurs are not permitted to send third party messages via amateurs in other countries unless there is an arrangement with Australia.
Section 2 Licence Conditions

- A ‘Mayday’ is a distress message and has priority over all other communications
- Mayday messages must be passed to the appropriate authorities
- Urgent messages are associated with ‘Pan Pan’ calls
- ‘Pan Pan’ calls should receive priority and should be reported to the appropriate authority
Section 2 Licence Conditions

- Radio Amateurs must provide correct station identification at the beginning and end of each transmission.
- Identification must be given at least every 10 minutes during transmissions.
- Identification requirements apply to all transmissions including test transmissions.
Section 2 Licence Conditions

- Callsigns in the Australian Amateur Service must be able to be identified.
- VK = Australia
- 0 through 9 indicates the state or territory
- The following letters are personal identification
- Foundation licence holders have a prefix plus a four letter callsign commencing with F (FXXX)
- Standard licence holders have a prefix plus a three letter callsign commencing with H, L, M, N, P or V(XX)
- Advanced licence holders have a prefix plus a two or three letter callsign.
Section 2 Licence Conditions

- Transmission of messages that are encoded for the purpose of obscuring their meaning are not permitted, except for the purposes specified in the amateur LCD.

- Transmissions containing any form of commercial entertainment are not permitted.

- Foundation Licence holders are only allowed to use specified frequency bands and emission modes. These are specified in the Licence Conditions Determination.

- Foundation Licence holders are not permitted to use “digital modes”
Section 2 Licence Conditions

- A Foundation Licence holder is limited to a maximum of 10 watts peak envelope power on SSB and 10 watts average power on AM, FM and CW
- Equipment used by Foundation Licence holders is limited to commercially made transmitting equipment
- Foundation licence holders are not permitted to build or modify transmitting equipment
Section 2 Licence Conditions

- Any Amateur Operator’s change of address must be notified to the ACMA.
- Radio Amateurs must not operate an Amateur station to cause harmful interference to radiocommunications.
- In order to avoid interference the ACMA has the right to restrict the operation of an Amateur Station.
Section 2 Licence Conditions

- Radio inspectors have a right to require an Amateur to produce their licence.
- A Foundation Licensee can allow a suitably licenced person to operate their station.
- Otherwise the station should be kept locked and secure to prevent unlawful operation.
- Every radio amateur including foundation licence holders should have a copy of the Licence Conditions Determination and have a general understanding of the LCD contents.
Section 2 Licence Conditions

- Foundation licence holders are not permitted to operate an amateur station in an automatic mode or a computer controlled mode.
- Foundation licence holders are not permitted to operate an amateur station connected to the public telephone network including internet.
Section 2 Licence Conditions

- An amateur station licence authorises radio amateurs to use radio communication as specified by the LCD.
Section 2 Licence Conditions

- The bands that radio amateurs are allocated are:
  A. To make use of manufactured radio equipment
  B. To allow use of the bands independent of the sun spot cycle
  C. To minimize the likelihood of interference to other services
  D. Totally eliminate interference
Section 2 Licence Conditions

- A Foundation Licence holder may allow other persons operate their station if the person:
  
  A. Is another licenced amateur
  B. Is an Australian citizen
  C. Has a Commonwealth passport
  D. Is a member of the same family
Section 2 Licence Conditions

- An amateur with a call sign VK4NSW would indicate:
  A. A New South Wales amateur
  B. A Victorian amateur with a full call licence
  C. A Queensland amateur with a standard licence
  D. A Queensland amateur with a Foundation licence
Section 2 Licence Conditions

What authorises amateur radio activities in Australia:

A. the LCD
B. the WIA
C. certificate 3 in Electrotechnology
D. an amateur licence
Section 2 Licence Conditions

- While listening to a frequency not in the amateur band you hear a mayday call. You must:
  A. Tune to another frequency
  B. Contact an advanced amateur
  C. Report and provide assistance
  D. Advise the person to change to an amateur frequency
Section 2 Licence Conditions

- Who can require you to produce your amateur licence:
  
  A. State police
  B. WIA
  C. ACMA Radio Inspectors
  D. a person receiving interference
Section 2 Licence Conditions

- The transmitting equipment that a Foundation Licence holder should use is:
  
  A. commercial equipment, unmodified
  B. surplus military equipment
  C. equipment that meets a commercial specification
  D. Mains operated equipment only
Section 3 Technical Basics
The universe is made up of matter.

All matter is made of atoms. Atoms are made up of electrically charged particles called protons and electrons.

These charged particles give rise to electricity as we understand it, and apply in today's electronic applications including Amateur Radio.
Section 3 Technical Basics

Static Electricity

Static electricity is produced by moving electrons from one place to another by applying a force.

We often see or feel the result of static electricity such as:

- The slight electric shock when we cross a carpet or get out of a car
- Lightning
Section 3 Technical Basics

- When two bodies are charged to different potentials there is an electric potential between the bodies.
- Like charges repel
- Unlike charges attract
Section 3 Technical Basics

Electric Current
An electric current is an ordered movement of electrons from the negative terminal to the positive terminal of an electricity source, such as a battery.

Current is measured in amperes (amps).
Section 3 Technical Basics

- The battery produces an abundance of electrons from a chemical reaction.
- The battery produces a voltage called an electromotive force (EMF).
Conductors and Insulators

- Metal wires that join circuits are conductors
- Most metals are good conductors in particular aluminium and copper
- A small amount of electrical pressure (voltage) can make electrons move along a conductor
Section 3 Technical Basics

Conductors and Insulators

- Insulators do not allow electric current to pass easily
- Insulators are plastics, dry wood, ceramic, porcelain, glass etc
- Very large electrical pressure (very high voltage) must be applied to move electrons in insulators
- These voltages usually damage the insulating material
Section 3 Technical Basics

- Direct current (DC) electrons flow in one direction, direct current comes from a battery.
- Alternating current (AC) the electrons flow in one direction stop and then flow in the other direction. Alternating current comes from an alternator and is the type of electricity that is the 240v mains power.
Section 3 Technical Basics

- The amount of electrons that can move down a wire is dependent on how thick the wire is and how long it is.
- The thicker the wire the lower the resistance to the electrons.
- The longer the wire the higher the resistance to the electrons.
- If the electrical pressure is increased more electrons can be made to flow along a given conductor.
Section 3 Technical Basics

- Current is measured in Amperes (Amps), abbreviation A symbol I
- Electrical pressure is measured in Volts, abbreviation V or E
- Electrical resistance is measured in Ohms, the symbol is the Greek capital letter Omega
Section 3 Technical Basics

Mathematically:

where:  
\[ I = \text{the current in amperes} \]
\[ E = \text{the EMF in volts} \]
\[ R = \text{resistance in ohms} \]

Formula transposition:

\[ E = I \times R \]
If \( I \) is unknown, cover \( I \) and find remaining.
Therefore,  
\[ I = \frac{E}{R} \]

If \( R \) is unknown, cover \( R \) and find remaining.
Therefore,  
\[ R = \frac{E}{I} \]
Section 3 Technical Basics

Symbols

- Cell or battery
- Fuse
- Open and closed switch
- Resistor
- Antenna
- Earth
- Microphone
- Speaker
Section 3 Technical Basics

- Resistance is the opposition to current flow
- Resistors are components that exhibit resistance
- Resistor colour code
- Size related to power dissipation
Section 3 Technical Basics

- Power is the rate at which energy is changed from one form to another or work is done.
- There are three power formulas:

\[ P = \text{power in Watts} \]
\[ P = I^2R \]
\[ P = \frac{E^2}{R} \]
\[ P = E \times I \]

where:
- \( E \) = volts
- \( I \) = current
- \( R \) = resistance
Section 3 Technical Basics

- Unit of power is the watt
- 1 volt applied to a circuit causing 1 amp of current to flow will cause 1 watt of power to be dissipated
Section 3 Technical Basics

- $22kV = 22000$ Volts
- $2mV = \text{two thousandths of a volt}$
- $22k\text{Ohms} = 22$ thousand Ohms
- $1\text{MOhm}= \text{One million Ohms}$
- $15mA= 15$ thousandths of an amp
- $120\text{micro amp}= 120$ millionths of an amp

Note that there are a number of multiple and submultiple units. Those most often used in radio and electronics are shown below.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Numerical Equivalent</th>
</tr>
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<tbody>
<tr>
<td>giga (G)</td>
<td>$1,000,000,000 = 10^9$</td>
</tr>
<tr>
<td>mega (M)</td>
<td>$1,000,000 = 10^6$</td>
</tr>
<tr>
<td>kilo (k)</td>
<td>$1,000 = 10^3$</td>
</tr>
<tr>
<td>milli (m)</td>
<td>$0.001 = 10^{-3}$</td>
</tr>
<tr>
<td>micro (μ)</td>
<td>$0.000001 = 10^{-6}$</td>
</tr>
<tr>
<td>nano (n)</td>
<td>$0.000000001 = 10^{-9}$</td>
</tr>
<tr>
<td>pico (p)</td>
<td>$0.000000000001 = 10^{-12}$</td>
</tr>
</tbody>
</table>
Section 3 Technical Basics

- Frequency is measured in Hertz, abbreviation Hz
- Hertz is the number of cycles an AC has per second
- The 240 volt electricity supply is 50 Hz
- Audible frequency range 20Hz to 15kHz
- Voice frequency for radiotelephony 300Hz to 3kHz
Section 3 Technical Basics

Radio Frequencies

- 300kHz to 3MHz Medium frequency (MF)
- 3MHz to 30MHz High frequency (HF)
- 30MHz to 300 MHz Very high frequency (VHF)
- 300MHz to 3000MHz Ultra high frequency (UHF)
Section 3 Technical Basics

- Frequency
- Period
- Wavelength
- Cycle

Radio waves travel at the speed of light, abbreviation C, which is 300 million metres per second
Section 3 Technical Basics

- Converting frequency to wavelength and vice versa

Conversion chart - frequency to wavelength

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Wavelength (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>0.2</td>
</tr>
<tr>
<td>700</td>
<td>0.3</td>
</tr>
<tr>
<td>500</td>
<td>0.5</td>
</tr>
<tr>
<td>300</td>
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</tr>
<tr>
<td>2</td>
<td>150.0</td>
</tr>
<tr>
<td>1</td>
<td>300.0</td>
</tr>
</tbody>
</table>

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Section 3 Technical Basics

Electric current is:

A. The voltage applied to a conductor
B. The opposition offered to electrons in a circuit
C. Movement of electrons from negative to positive
D. The rate at which electrical energy is changed to light energy
Section 3 Technical Basics

Good conductors are:

A. Silicon and germanium
B. Glass and porcelain
C. Wood and Ceramic
D. Copper and Aluminium
If 10 volts is applied to a circuit consisting of a resistance of 5 ohms the resultant current will be:

A. 0.5 amp
B. 2 amp
C. 15 amp
D. 20 amp
Section 3 Technical Basics

1000 volts is often represented as:

A. 1mV  
B. 1MV  
C. 1nV  
D. 1kV
End of part 1

- Continue with part 2.