

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

The Amateur Licence (amateur standard station) [the Standard Amateur Licence] may be obtained by persons holding the Amateur Operator's Certificate of Proficiency (**Standard**) [AOCP(S)].

The Standard Amateur Licence is applicable for persons having an intermediate knowledge of radiocommunications at the hobby level. The syllabus and related examination for the AOCP(S) correspondingly reflects the level of knowledge, skills and experience required to safely assemble a Standard Amateur station and to operate it safely without interference to other users and services.

This syllabus assumes that persons contesting the AOCP(S) examination are also familiar with the subject material in the syllabus applicable to the Amateur Operator's Certificate of Proficiency (Foundation).

<u>Syllabus</u>		<u>Assessment Objectives</u>
	Section	
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.

Allocation of frequency bands

- 1.3 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.
- 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 an 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*, the *Radio Licence Conditions (Apparatus Licence) Determination 2003* and any printed on the licence.

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 particular conditions apply to the transmission of messages on behalf of a third party or messages to Amateurs in another country.

Distress and

- 2.5 Recall that Emergency and Distress Communications are signalled by the use of 'Mayday'

Urgency signals

and that these communications have priority over all other communications.

Recall that all persons hearing a Mayday call are responsible for passing the information on to appropriate authorities.

Recall that some urgent situations not warranting the use of 'Mayday' are signalled by the use of 'PAN PAN'. These calls should receive priority and should be reported to the 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 the categories of callsigns used in the Australian Amateur Service. Identify callsign suffixes applicable to each licence category, callsign prefixes and state designators.

Secret messages

2.8

Recall that the transmission of secret coded or encrypted messages is generally not permitted.

Entertainment not permitted

2.9

Recall that the transmission of any form of entertainment is not permitted.

Amateur frequency bands and emissions

2.10

Recall that an 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 the maximum transmitter output power permitted under an Amateur Licence.

Notification of change of address

2.12

Recall the requirement to notify the Australian Communications and Media Authority (ACMA) of any change of address.

Harmful interference	2.13	Recall that a licensee must not operate an Amateur station if operation causes harmful interference to other radio services.
Authorised use of Amateur stations	2.14	Recall that an Amateur licensee may authorise a suitably qualified person to operate the licensee's Amateur station. Recall that a person authorised by an Amateur licensee to operate the licensee's Amateur station may only operate the station within the limits of the licence regardless of whether the person holds higher qualifications. Recall that a person without Amateur qualifications may communicate via an Amateur Station provided the station is under the full control of a qualified operator at all times.
Inspection of Amateur licences	2.15	Recall that Inspectors have the right to require an Amateur to produce his/her licence.
Restriction of operation to avoid interference	2.16	Recall that ACMA, in order to avoid interference, has the right to restrict the operation of an Amateur station. Recall that, in order to avoid interference, an Inspector may give directions to a licensee about the installation, maintenance and operation of an Amateur station.
Use of the Licence Condition Determinations	2.17	Recall specific licence conditions from the Radiocommunications Licence Conditions Determinations applicable to the Amateur Licence.
3. Mathematics	3.1	Understand addition, subtraction, multiplication and division.

4. Technical Basics

		Understand fractions, percentage, and decimal notation.
		Recall units and sub-units; (mega, kilo, UNIT, micro, and pico).
		Understand how to calculate using simple formulae.
Mains power	4.1	Recall the voltage and frequency of the mains supply used in Australia.
		Recall the voltages and relationship between the single phase Active, Neutral and Earth.
		Recall the colour code of mains wiring.
		Understand the reason for the Earth connection (if provided) on mains operated equipment.
		Recall the purpose of a fuse and switch in the Active lead of mains operated equipment.
Mains power supplies	4.2	Recall the different types of rectifier and smoothing circuits (i.e. half wave, full wave and bridge).
	4.3	Understand the need for rectifier diodes to have a sufficient peak inverse voltage (PIV) rating.
Voltage and current	4.4	Understand the meaning of voltage, electrical pressure, electromotive force and potential difference.
		Understand the meaning of electrical current.

Resistance	4.5	Understand the meaning of electrical resistance. Calculate the total value of resistors used in series, parallel and series-parallel combinations. <i>Note: Calculations will only involve resistors of the same value.</i>
	4.6	Identify the value of a resistor using the resistor colour code.
Ohm's Law	4.7	Understand the relationship between voltage, current and resistance.
Power in DC circuits	4.8	Understand how to calculate the power in a DC circuit using current and voltage, current and resistance or voltage and resistance.
Capacitance	4.9	Recall that the unit of capacitance is the Farad. Recall that capacitor consists of two conducting surfaces separated by an insulator. Recall that the capacitance of a capacitor is influenced by the area and separation of the plates and the type of the insulator between the plates.
	4.10	Understand that capacitors have a breakdown voltage and that they need to be used within that voltage. Recall that some capacitors are polarised and must be correctly connected.
	4.11	Recall the dangers of stored charges on large or high voltage capacitors.
	4.12	Understand and apply the formulae for calculating the combined values of capacitors in series, parallel and series-parallel combinations. <i>Note: Calculations will only involve capacitors of the same value.</i>

Inductance	4.13	Recall that the unit of inductance is the Henry.
		Recall that an inductor is normally a coil formed by a number of turns of wire.
		Recall that an inductor is able to store energy in its magnetic field. The ability of an inductor to store and use that stored energy is known as inductance.
	4.14	Recall that the inductance of a coil increases with increasing number of turns, increasing coil diameter and decreasing spacing between turns.
	4.15	Understand and apply the formulae for calculating the combined values of inductors in series, parallel and series-parallel combinations. <i>Note: Calculations will only involve inductors of the same value.</i>
AC circuits	4.16	Understand that the root mean square (RMS) value of a sine wave has the same heating effect as a direct current of the same value and that it is equal to 0.707 of its peak value.
	4.17	Recall that the period (time) of a sine wave is equal to $1/f$ seconds and that the frequency of a sine wave is equal to $1/T$ (where f = frequency in Hertz and T = time in seconds).
	4.18	Understand that AC waveforms are expressed in degrees and that a complete cycle is equal to 360 degrees.
Impedance and reactance	4.19	Recall that the term 'reactance' describes the opposition to current flow in a purely inductive or capacitive circuit.
	4.20	Recall that impedance is the total opposition to current flow in an AC circuit.

Tuned circuits	4.21	Recall that at resonance $X_L = X_C$ and that the impedance is resistive.
	4.22	Recall that the Q factor is an indicator of the amount of losses in a tuned circuit.
	4.23	Recall the impedance of series and parallel tuned circuits at resonance.
Transformers	4.24	Recall that a transformer usually consists of two or more coils of wire which are mutually coupled by a common magnetic field. A transformer may have a core material to increase the mutual coupling of the magnetic field. Recall Faraday's law of induction. "When relative motion exists between a conductor and a magnetic field a voltage is induced into the conductor".
	4.25	Recall the relationship between the voltage ratio and turns ratio and current ratio of a transformer.
	4.26	Recall the cause and effects of eddy currents and the need for laminations (or ferrites) in transformers.
Solid state devices	4.27	Recall the forward voltage drop across typical semiconductor diodes.
	4.28	Recall that a Zener diode can be used as a voltage regulator.
	4.29	Recall that the varactor (varicap) diode behaves as a voltage variable capacitor.
	4.30	Identify the symbols of NPN and PNP transistors and the Field Effect Transistor (FET).
	4.31	Recall the basic external operational characteristics of NPN and PNP transistors and field effect transistors (FETs). Identify NPN or PNP transistors or a field effect transistor used in a common-emitter or

common-source configuration.

Candidates are not required to have knowledge of the internal workings of a transistor. Questions about transistor circuits will be simple and limited to common emitter or common source configurations.

5. Transmitters and Receivers

Block diagrams of simple transmitters

5.1 Identify the stages of a simple amplitude modulation (AM), single sideband (SSB) transmitter.

Identify the stages of a simple frequency modulation (FM) transmitter.

The questions may involve a power supply, audio input stage, carrier oscillator, variable frequency oscillator (VFO), mixer (frequency converter), frequency multipliers, modulators, output amplifiers and output filters.

Mixers

5.2 Understand that mixers can be used to convert a signal on one frequency to another frequency.

Understand that the mixing process also produces unwanted frequencies that must (usually) be filtered out.

Modulation

5.3 Recall the meaning of the term peak deviation as it applies to frequency modulation.

Recall the meaning of depth of modulation as it applies to amplitude modulation.

5.4 Understand the basic principles of AM single sideband (SSB), AM double sideband (DSB) and FM modulators.

Recall the relationship between the modulating audio and AM and FM output signals.

Recall the advantages and disadvantages of AM (SSB) and FM signals.

5.5 Recall that Morse code, Radio Teletype (RTTY), Frequency Shift Keying (FSK), Phase Shift Keying (PSK) and Packet radio are types of digital transmissions.

Recall that the bandwidth of a data transmission is dependent on the data transfer rate and the modulation type.

Amplifiers

5.6 Understand the meaning of the terms 'linear' and 'non-linear' in relation to amplifiers.

Understand the need for linear amplification and recall which forms of modulation require a linear amplifier.

Determine the efficiency of an amplifier given the DC input power and the RF output power.

5.7 Understand the implications of the different types of modulation on the rated output power of a power amplifier (PA).

Understand the term 'duty cycle' in relation to transmitters.

5.8 Recall the basic function of automatic level control (ALC) in a transmitter.

Recall the function and use of a manual radio frequency (RF) power control.

Transmission quality

5.9 Recall the effects of frequency drift and the importance of its minimisation.

	5.10	Recall that transmitters may radiate unwanted emissions such as harmonics and other spurious signals.
		Recall the use of low and band pass filters in minimising the radiation of unwanted emissions.
	5.11	Recall the meaning of the term 'parasitic oscillation'.
	5.12	Understand that over modulation causes harmonics and other spurious emissions.
Receiver parameters and terminology	5.13	Understand the meaning of 'receiver sensitivity'.
	5.14	Understand the meaning of 'receiver selectivity'.
	5.15	Recall, in simple terms, the meaning of 'signal to noise ratio' as applied to a receiver specification.
Simple block diagrams of a Receiver	5.16	Identify the stages of a superheterodyne receiver and the basic functions of each stage. <i>The questions may involve a power supply, audio output stage, variable frequency oscillator (VFO), other oscillators, mixer (frequency converter), frequency multipliers, demodulators, amplifiers and filters.</i>
Frequency converters	5.17	Recall that the combined function of a mixer and a local oscillator is as a frequency converter.
IF amplifier	5.18	Recall the basic important characteristics of intermediate frequency (IF) amplifiers.

- 5.19 Recall that crystal and ceramic filters can be used to improve IF selectivity.
 - Automatic Gain Control 5.20 Understand the purpose of an automatic gain control (AGC).
 - Transceivers 5.21 Recall that a transceiver's transmitter and receiver often share oscillators and IF amplifier stages.
- Recall the function and use of the receiver incremental tune (RIT) control.

6. Transmission lines and Antennas

- Transmission line basics 6.1 Understand that the velocity factor of a transmission line is the ratio of the velocity of radio waves in the transmission line to that in free space and that the velocity factor is always less than unity (1).
- Recall that transmission line loss increases with increasing frequency.
- Recall that low loss transmission lines are particularly important at VHF and higher frequencies.
- Baluns 6.2 Understand that, when feeding a balanced antenna with unbalanced transmission line (coaxial cable), it is preferred practice to use a balun to prevent feedline radiation.
- Recall that feedline radiation increases the possibility of interference to nearby electronic devices.
- Standing waves 6.3 Understand that standing waves are caused by the interaction of forward and reflected waves on a transmission line.

		Understand that standing waves occur when there is a mismatch between the transmission line impedance and the load (antenna) impedance.
	6.4	Recall that the standing wave ratio (SWR) is a measure of the ratio of forward and reflected waves on a transmission line. Understand that SWR can be determined by forward and reflected voltage, current or power.
	6.5	Understand that standing waves may increase transmission line loss. Recall that an SWR of 1.5:1 or less is acceptable.
Antenna Matching Units (ATU)	6.6	Understand that an ATU (also known as an antenna matching unit (AMU) or transmatch), can 'tune-out' reactive components of the antenna system feed-point impedance (before or after the transmission line) and can transform antenna system impedances to an acceptable resistive value. Understand that if the ATU is located at the transmitter, it will have no effect on the actual SWR on the transmission line between the ATU and antenna.
Antennas	6.7	Recall the relationship between the physical length of the antenna and the frequency of operation.
	6.8	Recall that a low angle of vertical radiation is desirable for long distance communications.
Identification of common antennas	6.10	Identify a half-wave dipole, folded dipole, 1/4 wave ground plane, Yagi, and end-fed wire antenna.

6.11 Recall the current and voltage distribution on the dipole and $\lambda/4$ ground plane antennas.
Recall the feedpoint impedances of half-wave dipoles, folded dipoles and quarter wave ground plane antennas.

Radiated Power

6.12 Understand that the effective radiated power (ERP) of a transmission system is determined by the transmitter power and gains and losses in the antenna system.

Calculate ERP for typical transmission systems.

7. Propagation

Electromagnetic radiation

7.1 Understand the relationship between wavelength and frequency.

Recall that the unit of frequency of an electromagnetic wave is the Hertz.

Recall that the velocity of electro-magnetic radiation is 300 million metres per second.

Recall that an electro-magnetic wave has electric and magnetic fields, at right angles to each other and at right angles to the direction of travel.

Recall that the direction of the electric field relative to the surface of the Earth determines the polarisation of the signal.

Recall that transmit and receive antennas should have the same polarisation.

7.2 Recall that under free space conditions electro-magnetic waves travel in straight lines and spread out.

Ionosphere

7.3 Understand that the ionosphere comprises layers of ionised gasses and that the ionisation is caused primarily by solar emissions including ultra-violet radiation and charged solar

particles.

Recall the ionospheric layers (D, E, F1 and F2) and relative heights to each other.

Recall that the cycles of the Sun influence HF radiocommunications.

- 7.4 Recall that the F2 layer provides the furthest refractions for HF signals (about 4000km) and that the F1 and F2 layers combine at night.

Recall that multiple refractions (hops) permit world-wide propagation.

- 7.5 Recall that fading effects the strength of the received signal.

- 7.6 Recall that the highest frequency that will be refracted over a given path is known as the 'maximum usable frequency' (MUF).

Recall that the optimum working frequency (OWF) is 15% lower than the MUF.

- 7.7 Recall that the D layer absorbs the lower radio frequencies during daylight hours and that it disappears at night.

- 7.8 Recall that seasonal changes affect the ionosphere and the suitability of different frequency bands for ionospheric communications.

8. Interference and Electromagnetic Compatibility (EMC)

Interference -

- 8.1 Understand that amateur transmissions may enter television and radio receivers through

Points of entry into
electronic
equipment

the radiofrequency or intermediate frequency stages.

Recall that amateur transmissions can enter audio stages via long speaker leads or other interconnections.

Understand that television receivers and most broadcast radio receivers employ superheterodyne circuits.

Recall that frequencies used in television receivers include 50 – 225 and 470 - 854 MHz (RF), 33-40 MHz (IF) and 0-5 MHz (video baseband).

Recall that frequencies used in broadcast radio receivers include 525 – 1606 kHz and 88 -108 MHz (RF) and, typically, 455 kHz and 10.7 MHz (IF).

- 8.2 Understand that mast-head amplifiers and distribution amplifiers used for television reception are generally wide band devices and are easily overloaded by strong signals.
- 8.3 Understand the non-linearity of an overloaded audio amplifier can demodulate RF signals.
- 8.4 Identify the response curves of low pass, high pass, band pass and band stop (notch) filters.
- 8.5 Understand the use of high pass, low pass, bandpass and bandstop (notch) filters in providing interference immunity to affected electronic devices.
- 8.6 Recall typical uses for low pass, high pass, band pass and band stop filters.
- Understand the use of ferrite beads or toroids in filtering.

Filters

EMC

- 8.7 Recall that reducing field strength to the minimum required for effective communication is good radio practice.
- 8.8 Recall that balanced antenna systems tend to cause fewer electro magnetic compatibility (EMC) problems than unbalanced antennas.
- Recall that the transmission line (balanced or unbalanced) should leave the antenna at right-angles to minimise EMC problems.
- 8.9 Understand that EMC problems in motor vehicles can interfere with the operation of computerised engine management and other electronic systems.
- Recall suitable precautions to minimise EMC problems in vehicles.
- 8.10 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.

9. Operating Practices and Procedures.

Equipment practices

- 9.1 Demonstrate connecting a transmitter/receiver safely to a power supply, microphone, transmission line and antenna.

Authorised frequencies and emissions

- 9.2 Identify frequencies and emissions that may be used under an Amateur licence.
- Recall that Amateur band plans, by agreement, play an important part in managing interference between Amateur stations.

Requirement not to transmit on frequencies in use Operating practices	9.3	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.
	9.4	Demonstrate, by making on-air contacts using appropriate calling procedures, the correct operation of HF and VHF/UHF transmitters. Demonstrate the use of a signal strength meter to make meaningful signal reports.
Operating through a repeater	9.5	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.
	9.6	Recall and demonstrate the need for leaving adequate breaks between transmissions when using voice repeaters.
Make an all-stations call and change frequency	9.7	Demonstrate an all-stations (CQ) call on HF and VHF or UHF, contacting another station and initiating a change of frequency (QSY) from the calling channel to a working channel.
Transmitter measurements	9.8	Recall and demonstrate the measurement, or estimation, of the output power of a transmitter. Demonstrate the measurement of SWR.
Correcting simple equipment maladjustments	9.9	Recall and demonstrate the correction of simple equipment maladjustments including high SWR, excessive modulation and excessive RF output power.
Recognised abbreviations	9.10	Recall that there are internationally recognised abbreviations that are commonly used in communications.

Questions will be based on the list of abbreviations in Appendix C.

Phonetic alphabet 9.11 Recall that there is an internationally recognised phonetic alphabet and that its use is recommended.

Questions will be based on the phonetic alphabet in Appendix D.

10. Safety

Dangerous voltages 10.1 Recall that high voltages and high currents are dangerous.

Electrical safety - equipment to be approved 10.2 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 10.3 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 10.4 Recall why most mains powered radiocommunications equipment should have a safety earth connection.

Fuses 10.5 Recall that fuses prevent excessive currents that may cause heat damage or fires.

Correct fuse to be used 10.6 Recall that a correct fuse must be fitted to all electrical equipment.

Replacing fuses 10.7 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 safety	10.8	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	10.9	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	10.10	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.	10.11	Recall that, in the event of an accident involving electricity, the first action is to safely switch off the power.
Electric shocks	10.12	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	10.13	Recall that emergency services need to be called immediately and that Cardio Pulmonary Resuscitation (CPR) may need to be administered.
Battery safety	10.14	Recall that batteries contain chemicals and emit fumes and may explode if punctured or exposed to flames or sparks.
Antennas and safety	10.15	Recall that it is important for all persons (and animals) to be kept at a safe distance from antennas.
Radio waves can be dangerous	10.16	Recall that electromagnetic radiation (EMR) can be dangerous. Recall that the level of danger varies with frequency, power and proximity.

Safe distance	10.17	Recall that the distance from an antenna that is safe depends on the ERP, operating frequency, antenna type and orientation.
Antenna erection	10.18	Recall that antenna erection is potentially dangerous and should be carried out by suitably experienced persons.
Securing and siting antennas	10.19	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	10.20	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.	10.21	Recall that excessive volume when wearing headphones can cause damage to human hearing.
Station security	10.22	Recall that an operable Amateur station must not be accessible to unauthorised persons.

11. Measurements

Frequency measurements	11.1	Recall the uses and limitations of crystal calibrators, digital frequency counters and standard frequency transmissions.
RF Power measurements	11.2	Recall that RF output power measurements are to be made with suitably calibrated power measurement device.
SWR measurements	11.3	Recall that SWR measurements should be made with a suitable measuring device and that frequent checking of SWR is a good practice to avoid transmitter damaged and potential interference.

Multimeter
measurements

11.4

Understand the use of a multimeter to measure voltage, current and resistance.

Notes to the Amateur Operator's Certificate of Proficiency (Standard) Syllabus and Examination.

1. The examination comprises:
 - a) one multi-choice question paper (50 questions) covering theory.
 - questions may be drawn from all Parts of the syllabus other than Parts 1, 2 and 9; and
 - b) one multi-choice question paper (30 questions) covering regulations.
 - questions may be drawn from Parts 1 and 2 of the syllabus; and
 - c) a practical assessment of operating knowledge and skills.
 - assessment will be based primarily on Part 9 of the syllabus, however the assessment may address matters included in Parts 2 and 10 of the syllabus; and
 - where possible, the practical assessment will be carried out under actual operating conditions.
2. See the Amateur Examination Policy Information Paper for information about exemptions.
3. A pass in the Theory or Regulations, or demonstrated competence in the practical component of the examination, will remain valid until a pass in all Parts of the examination is obtained.
4. The examination may be undertaken in one session or as part of a course of training.
5. Sixty (60) minutes is allowed for the theory paper where the examination is undertaken at one session.
Thirty (30) minutes is allowed for the regulations paper where the examination is undertaken at one session.
6. Subject to exemptions, a certificate of proficiency will be issued to persons who correctly answer 70% of the questions in both the Theory and Regulations papers and demonstrate competence in all elements of the practical component of the examination.

7. 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 Radiocommunications Licence Conditions Determinations, 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 materia;

Understand - indicates the need for a more detailed knowledge of the subject;

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

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.

Appendix A

Formula

This formula sheet will be provided to candidates in the examination and may be used to answer any question.

$$R_T = R_1 + R_2 + R_3$$

$$L_T = L_1 + L_2 + L_3$$

$$I = \frac{E}{R}$$

$$P = EI$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

$$E = IR$$

$$P = \frac{E^2}{R}$$

$$C_T = C_1 + C_2 + C_3$$

$$R = \frac{E}{I}$$

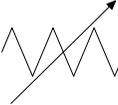
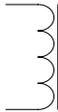
$$P = I^2 R$$

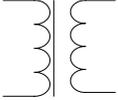
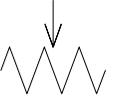
$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

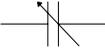
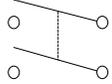
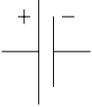
$$\lambda = \frac{c}{f}$$

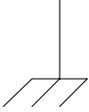
Amplifier efficiency % = Power Out / Power In x 100

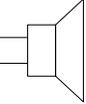
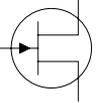
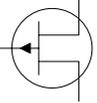
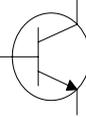
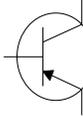
Symbols that may be used in the 'Standard' Examination

Description	Unit	Symbol	Description	Unit	Symbol
Resistor, general	Ohm		Inductor, general	Henry	
Resistor, variable	Ohm		Inductor, iron cored	Henry	

Resistor, pre-set	Ohm		Transformer		
Description	Unit	Symbol	Description	Unit	Symbol
Resistor, potentiometer	Ohm		Lamp	(Watt)	
Capacitor, general	Farad		Switch, SPST		

Capacitor, variable	Farad		Switch, DPST		
Description	Unit	Symbol	Description	Unit	Symbol
Cell or Battery	Volt		Fuse	Amp	
Semiconductor Diode			Antenna		

Light Emitting Diode (LED)			Earth		
Description	Unit	Symbol	Description	Unit	Symbol
Variable Capacitance Diode (Varactor, Varicap)			Chassis		
Zener Diode			Crystal	Hertz	

Loudspeaker			Microphone		
Field Effect Transistor (FET) (N Channel)			Field Effect Transistor (FET) (P Channel)		
Description	Unit	Symbol	Description	Unit	Symbol
Transistor (NPN)			Transistor (PNP)		

Abbreviations

Code	Used as a Question	Used as an Answer or statement
QRK	What is the readability of my signals?	The readability of your signals is ...
QRM	Are you being interfered with?	I am being interfered with
QRN	Are you troubled by static?	I am troubled by static
QRO	Shall I increase transmitter power?	Increase transmitter power
QRP	Shall I decrease transmitter power?	Decrease transmitter power
QRS	Shall I send more slowly?	Send more slowly
QRT	Shall I stop sending?	Stop sending
QRZ	Who is calling me?	You are being called by ...
QRV	Are you ready?	I am ready
QSB	Are my signals fading?	Your signals are fading
QSL	Can you acknowledge receipt?	I am acknowledging receipt
QSO	Can you communicate with ... direct?	I can communicate with ... direct

QSY	Shall I change frequency?	Change to another frequency
QTH	What is your location?	My location is
BK	Signal used to interrupt a transmission on progress	
CQ	General call to all stations	
CW	Continuous wave or Morse code	
DE	From, used to separate the callsign of the station called from that of the calling station	
K	Invitation to transmit	
MSG	Message	
PSE	Please	
R	Received	
RX	Receiver	
TX	Transmitter	
UR	Your	

Phonetic Alphabet

A	Alpha	J	Juliet	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	W	Whiskey
E	Echo	N	November	X	X-ray
F	Foxtrot	O	Oscar	Y	Yankee
G	Golf	P	Papa	Z	Zulu
H	Hotel	Q	Quebec		
I	India	R	Romeo		