

# Amateur Radio Basic Qualification – The Essentials

## Section One: Regulatory and Legal Requirements

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# 1 Introduction

These notes were prepared from Issue 3 of RIC-7 “Basic Qualification Question Bank for Amateur Radio Operator Certificate Examinations”, published April 2007. They cover 100% of testable material on the Basic Qualification examination, but do not go beyond what is absolutely necessary to know in order to pass the examination. The candidate is encouraged to perform their own research on topics that are not fully covered here.

# 2 The Essentials

## 2.1 Industry Canada

- Industry Canada is the department that is responsible for the administration of the Radiocommunication Act.
- The Radiocommunication Act grants authority to make “Radiocommunication Regulations” and “Standards for the Operation of Radio Stations in the Amateur Radio Service”.
- The Radiocommunication Regulations defines the “amateur radio service”. (Note that this is a *different* document from the Radiocommunication Act.)

## 2.2 Operator Certificates

- There is no fee associated with obtaining an Amateur Radio Operator Certificate.
- An Amateur Radio Operator Certificate is valid for life. (This is actually a relatively recent thing, effective April 1, 2000. Prior to that it was necessary to renew each year and there was an associated fee.)
- Industry Canada requires address information from you when you obtain a radio licence.
- Industry Canada must be notified of any change in postal address.

- The Amateur Radio Operator Certificate should be retained at the address given to Industry Canada, and a copy must be retained at the station (if that is at a different address).
- The holder of a radio authorization shall, at the request of a duly appointed radio inspector, show the radio authorization or a copy thereof to the inspector within 48 hours after the request.

## 2.3 Breaking the Rules

- Out of band transmissions are prohibited. You are only allowed to operate in designated amateur bands (frequency ranges).
- The sending of false or deceptive signals is prohibited. This includes sending false emergency signals when there is no real emergency.
- A person found guilty of transmitting a false or fraudulent distress signal, or interfering with or obstructing any radio communication without lawful cause, may be liable, on summary conviction, to a penalty of a fine not exceeding \$5000, or a prison term of one year, or both.
- No person shall decode an encrypted subscription programming signal without permission of the lawful distributor.
- No person shall, without lawful cause, interfere with or obstruct any radiocommunication.
- The Minister may suspend a radio authorization where the holder has contravened the Act, the Regulations, or the terms and conditions of the authorization. This includes cases where the radio authorization was obtained through misrepresentation.
- If the holder of a radio authorization has failed to comply with a request to pay fees or interest due, the Minister may suspend their radio authorization. This is the *only case* where the Minister may suspend or revoke a radio authorization *without notice*.
- Radio inspectors are not above the law and require a warrant to enter dwellings without the consent of the occupant.

## 2.4 Basic Qualification

- There are no age limits with respect to eligibility to hold an Amateur Radio Operator Certificate.
- The Basic examination is the first and only examination that must be passed before an Amateur Radio Operator Certificate is issued.

- The holder of an “Amateur Digital Radio Operator’s Certificate” has equivalency for the Basic and Advanced qualifications.
- After obtaining the Basic qualification, additional qualifications may be earned in *any order*.
- Two Morse code qualifications are available: “5 wpm” and “12 wpm”.
- Holders of a Basic Qualification only cannot transmit on frequencies below 30 MHz (but more on this later).

## 2.5 Higher Qualifications

- Licensed radio amateurs may install, place in operation, repair, or maintain radio apparatus on behalf of another person if the other person is the holder of a radio authorization to operate in the amateur service. (If the other person *doesn’t* have any type of radio operator certificate, they are out of luck – no one may operate on radio equipment on their behalf.)
- Individuals with Advanced Qualification may build transmitting equipment for use in the amateur service. (With Basic Qualification only, transmitting equipment must be either a commercial pre-assembled product or a packaged kit designated for amateur use.)
- Holders of a Morse Code qualification, Basic Qualification with Honours, or Advanced Qualification may transmit on frequencies below 30 MHz.

## 2.6 Licensing

- Amateur stations must be licensed (i.e. operated by licensed operators) at all times. There are no exemptions in the amateur service.
- Amateur stations may be used to communicate with other similarly licenced stations.
- Radio amateurs may not transmit superfluous signals, or profane or obscene language or messages.
- Radio amateurs may not operate or permit to be operated equipment that is not performing to the Radiocommunication Regulations.
- Radio amateurs may not use equipment to amplify the output of licence-exempt transmitters.

## 2.7 Communication

- Discussion on amateur bands is limited to messages of a technical nature or personal remarks of relative unimportance.
- Commercial or business use of amateur bands is prohibited.
- Radio amateurs may not broadcast information to the general public.
- False or deceptive amateur signals or communications may not be transmitted.
- Secret codes or ciphers may not be used in the amateur service.
- Procedural signals or “prowords” may be used in the amateur service if they do not obscure the meaning of a message.
- Transmission of commercially recorded material on amateur bands is not allowed. It’s recommended to turn down the volume of music playing in the background if you are operating an amateur station.

## 2.8 Location

- The holder of an Amateur Radio Operator Certificate may operate an amateur radio station *anywhere* in Canada.
- A “beacon” station may transmit one-way communications.
- Installation of a “repeater”, or any other radio apparatus which automatically re-transmits radio signals *within the same frequency band*, can only be done by the holder of Basic and Advanced Qualifications.
- Installation of a radio apparatus to be used specifically for an amateur radio club station can only be done by the holder of Basic and Advanced Qualifications.

## 2.9 Responsibility

- Both the control operator and the station licensee are responsible for the proper operation of an amateur station.
- If you transmit from another amateur’s station, both of you are responsible for proper operation.
- Any qualified amateur chosen by the station owner may be the control operator of an amateur station.
- An amateur station must have a control operator whenever the station is transmitting. The control operator must be at the station’s control point.

- The owner of an amateur station may permit *any person* to operate the station under the supervision and in the presence of the holder of the operator certificate.

## 2.10 Interference

- A transmission that disturbs other communications is called “harmful interference”.
- You may never deliberately interfere with another station’s communications.
- Some amateur radio bands are designed “Amateur Secondary”. Amateurs are allowed to use the frequency band only if they do not cause interference to primary users.
- If two amateur stations want to use the same frequency, both station operators have an equal right to operate on the frequency.
- Where interference to the reception of radiocommunications is caused by the operation of an amateur station, the Minister may require that the necessary steps for the prevention of the interference be taken by the radio amateur.
- Radio amateur operation must not cause interference to other radio services operating in the 430 to 450 MHz band and in the 902 to 928 MHz band. (This is because these bands, among others, are designated “Amateur Secondary”.)
- The operator of an amateur station may conduct technical experiments, trials, or tests using station apparatus, provided that these experiments do not interfere with other stations.

## 2.11 Exceptional Circumstances

- In the amateur radio service, it is permissible to broadcast radio communications required for the immediate safety of life of individuals or the immediate protection of property.
- In an emergency situation, a large number of standard regulations cease to apply.
- Amateur radio stations may communicate with *any station* involved in a real or simulated emergency.
- Business communications are still not permitted under any circumstances, even in an emergency.
- If you hear an unanswered distress signal on an amateur band where you do not have privileges to communicate, those privileges are temporarily granted and you should offer assistance if possible.

- Similarly, an amateur radio station in distress may use *any means* of radiocommunication, including transmissions in unqualified bands.
- During a disaster, an amateur station may make transmissions necessary to meet essential communication needs and assist relief operations when normal communication systems are overloaded, damaged, or disrupted.
- In an emergency, *there are no limitations* on the power output that can be used by a station in distress.
- During a disaster, most communications are handled by “emergency nets” using predetermined frequencies in amateur bands. Operators not directly involved with disaster communications are requested to avoid making unnecessary transmissions on or near frequencies being used for disaster communications.
- Messages from a recognized public service agency may be handled by amateur radio stations during peacetime and civil emergencies and exercises.
- It is permissible to interfere with the working of another station if your station is directly involved with a distress situation.

## 2.12 Message Passing

- No payment of any kind is allowed for third-party messages sent by an amateur station. (If it were allowed, it would count as a commercial service, which cannot be operated with an amateur licence.)
- Radiocommunications transmitted by any amateur station may be divulged or used under any circumstances.
- Radiocommunications, other than broadcasts or amateur transmissions, may be subject to penalties if they are divulged, intercepted, or used. There are a few exceptions: where it is for the purpose of preserving or protecting property, or for the prevention of harm to a person; where it is for the purpose of giving evidence in a criminal or civil proceeding in which persons are required to give evidence; or where it is on behalf of Canada, for the purpose of international or national defence or security.

## 2.13 Identification

- Licenced amateur stations are given a “callsign” that is used to identify the licensee.
- The call sign of a Canadian amateur radio station typically starts with the letters “VA”, “VE”, “VO”, or “VY”.
- Amateur stations transmit their call sign to identify themselves on the air.

- Amateur stations must identify themselves at the beginning and end of a contact, and at least every thirty minutes during communication. (Each station transmits its own call sign at the beginning and end of communications.)
- Unidentified communications are usually not allowed, with the exception of control signals for model crafts.
- Either English or French may be used to identify a Canadian amateur station.

## 2.14 International Regulations and Third-Party Traffic

- If a non-amateur friend is using your station to talk to someone in Canada, and a foreign station breaks in to talk to your friend, you need to find out if Canada has a third-party agreement with the foreign station's government to pass radio traffic before communications can continue.
- Radio amateurs may use their stations to transmit international communications on behalf of a third party only if such communications have been authorized by the countries concerned.
- The International Telecommunication Union regulates communication between countries, including international radiocommunication.
- If a country has notified the ITU that it objects to international amateur communications, a person operating a Canadian amateur station is forbidden from contacting them.
- Amateur third-party communications are transmissions of non-commercial or personal messages to or on behalf of a third party.
- International communications on behalf of third parties may only take place if the countries concerned have authorized such communications.
- Messages originated from the Canadian Forces Affiliated Radio Service (CFARS) and messages originated from the United States Military Affiliated Radio System (MARS) do not count as "communications on behalf of a third party".
- There exist a large number of countries with "reciprocal operating arrangements" with Canada. Essentially, what this means is that licenced Canadian amateurs automatically receive qualifications to operate in those countries, and amateurs licenced in those countries automatically receive qualifications to operate in Canada. One such country is the United States; it is *not necessary* for US radio amateurs to obtain a Canadian amateur station licence before operating in Canada.



## 2.15 Privileged Abilities

- When a station is used by someone other than the owner, the allowed operating privileges are defined by the largest set of privileges *shared* by both the station owner and the control operator. For example, if someone else with additional qualifications operates your station, only the privileges allowed by your qualifications are allowed.
- In order to operate below 30 MHz, you must earn any Morse code qualification, or an Advanced qualification, or attain a mark of 80% or higher on the Basic exam.
- The licensee of an amateur station may operate radio controlled models on all frequencies above 30 MHz.

## 2.16 Band Plan

- The band plan dictates the range of frequencies that are available for use in the amateur service. Each frequency range, or “band”, has different electromagnetic characteristics associated with it – more on these later.
- Bands may also be divided into “sub-bands” for specific purposes. For example, the 144–148 MHz band has a sub-band for voice communications and a sub-band for digital communications.
- It is common practice to refer to bands by their wavelength instead of their frequency range. There is a simple equation that can be used to calculate the approximate operating frequency given the wavelength of a band. The general law is  $f = \frac{c}{\lambda}$ , where  $f$  is the frequency in Hertz,  $c$  is the speed of light in meters per second, and  $\lambda$  is the wavelength in meters. If we wish to express the frequency in megahertz, we can write the constant  $c$  as “300 mega-meters per second”. Then, keeping the wavelength  $\lambda$  in meters, take the approximate frequency in megahertz to be  $f \approx \frac{300}{\lambda}$ .
- Now, having said that, the correct value for  $c$  is slightly lower than this, so the value for  $f$  over-estimates the true value. This is important because on the Basic exam there are several questions which are of the form “The  $x$ -metre amateur band corresponds to which of the following frequency ranges?” and for very large or very small values of  $x$  the fact that this formula is an approximation can result in finding the wrong answer. So, if you don’t feel that it’s necessary for you to memorize the entire band plan and the frequency ranges for each named band, remember that the answer from this formula is always an over-estimate. Take the next smallest answer to the frequency you calculate if you don’t fall within one of the given ranges. If there are two answers that would include the number you calculate, take the one that includes frequencies lower than your calculated  $f$ .

- Let's do an example that you might see on the exam. What's the frequency range for the 20-meter band? Calculate  $f \approx \frac{300}{20} = 15$ . There are two answers that might match this: one includes 15.000 MHz as the lower bound, and the other includes 14.350 MHz as the upper bound. These are the closest two answers, and the second one (14.000 to 14.350 MHz) turns out to be correct – remember that  $f$  overapproximates the true frequency, so if your calculated  $f$  falls on the edge of one of the answers, that answer is wrong.
- There is one important exception to this rule regarding the “15 meter band”. The frequency range for this band does not correspond to the given wavelength of the band, even when it is being calculated correctly. If you use the formula here, you will make a mistake; this one needs to be memorized. The 15 meter band corresponds to the 21.000 to 21.450 MHz frequency range.

### 2.16.1 Bandwidth

- You will learn more about the technical nature of bandwidth in a later section. For now it suffices to know a few basic facts and figures that pertain to regulations.
- The bandwidth of an amateur station is determined by measuring the frequency band occupied by the transmitted signal at a level of 26 dB below the maximum amplitude of that signal. (A 26 dB reduction corresponds to an amplitude that is  $\frac{1}{400}$  of the original value.)
- Below 28 MHz, the maximum authorized bandwidth is 6 kHz, with the exception of the frequency range 10.1 to 10.15 MHz, where the maximum authorized bandwidth is 1 kHz.
- The maximum authorized bandwidth in the frequency range of 28 to 29.7 MHz is 20 kHz.
- The maximum authorized bandwidth in the frequency range of 50 to 148 MHz is 30 kHz.
- Bandwidth generally increases with frequency – consult the band plan for details.
- You will need to know the bandwidth required to use several modes of operation (which has implications for which frequency ranges can be used for these modes).
  - CW (Morse telegraphy) – 150 Hz
  - AMTOR/RTTY – 170 to 200 Hz
  - Packet radio – varies depending on the speed of data transfer, but can be done with less than 1000 Hz of bandwidth

- SSB – 3000 Hz
- Slow-scan television – 3000 Hz
- FM – 5000 to 15000 Hz
- Fast-scan television – 6 MHz

## 2.17 Transmit Power

- Radio amateurs must use only the minimum legal transmitter power necessary to communicate.
- Transceiver power is measured at the antenna terminals of the transmitter or amplifier.
- The holder of only a Basic qualification may use up to 250 watts of power, or 560 watts “peak equivalent power” (PEP) for single sideband operation.
- With an Advanced qualification, up to 1000 watts of power may be used.

## 2.18 Retransmission

- A repeater station is an amateur station that automatically retransmits the signals of other stations.
- An unmodulated carrier may be transmitted only for brief tests on frequencies below 30 MHz. (Above 30 MHz, you run the risk of accidentally activating a repeater with your carrier, which is a bad idea.)
- Radiotelephone signals in a frequency band below 29.5 MHz cannot be automatically retransmitted, unless these signals are received from a station operated by a person qualified to transmit on frequencies below 29.5 MHz.

## 2.19 Transmitter Control

- When operating on frequencies below 148 MHz, the frequency stability must be comparable to crystal control. (And above 148 MHz you’re almost certainly using crystal control or something even better.)
- A reliable means to prevent or indicate overmodulation must be employed at an amateur station if radiotelephony (voice) is used.
- The maximum percentage of modulation permitted in the use of radiotelephony by an amateur station is 100 percent.
- All amateur stations, regardless of the mode of transmission used, must be equipped with a reliable means of determining the operating radio frequency.

## 2.20 ITU Regulations

- In addition to complying with the Radiocommunication Act and Radiocommunication Regulations, Canadian radio amateurs must also comply with the regulations of the International Telecommunication Union (ITU).
- Messages of a technical nature or personal remarks of relative unimportance may be transmitted to an amateur station in a foreign country.
- It is forbidden to transmit international messages on behalf of third parties unless those countries make special arrangements.
- Radiocommunications between countries shall be forbidden if the administration of one of the countries objects.
- Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of amateurs.
- The ITU Radio Regulations do not say anything about band restrictions for radio amateurs who have not demonstrated proficiency in Morse code. (This is why a Morse code qualification is no longer necessary.)

## 2.21 International Operation

- Canada is located in ITU Region 2.
- Australia, Japan, and Southeast Asia are in ITU Region 3.
- A Canadian radio amateur operating a station in the territory of another country is subject to frequency band limits applicable to radio amateurs licensed in that country. For example, a Canadian operator using a station in the United States is subject to whatever frequency band limits apply to US radio amateurs.
- The European Conference of Postal and Telecommunications Administrators (CEPT) license allows for international operation in any of the 32 CEPT countries.
- Canadian radio amateurs may apply for a CEPT licence in any CEPT country.
- Canadian radio amateurs holding Basic and 12 wpm qualifications will be granted CEPT Class 1 recognition.
- Canadian radio amateurs holding Basic qualification only will be granted CEPT Class 2 recognition (operation only above 30 MHz).
- The reverse also applies – foreign radio amateurs holding CEPT Class 1 licences will receive recognition in Canada equivalent to Basic and 12 wpm qualifications, and those with Class 2 licences receive recognition equivalent to Basic qualification only.

## 2.22 License Exams

- The fee for taking an examination for an Amateur Radio Operator Certificate by an accredited volunteer examiner is to be negotiated.
- The fee for taking the exam at an Industry Canada office is \$20 per qualification.
- An accredited volunteer examiner must hold Basic, Advanced, and 12 wpm qualifications.
- A disabled candidate taking a Morse code sending test may be allowed to recite the examination text in Morse code sounds.
- Examinations for disabled candidates may be given orally or tailored to the candidate's ability to complete the examination.

## 2.23 Antenna Structures

- There is no requirement to receive prior approval from Industry Canada to construct an antenna or its support structure.
- However, prior to an installation for which community concerns could be raised, radio amateurs must consult with their land-use authority, and possibly their neighbours.
- For the purposes of environmental filing, amateur stations are considered to be Type 2 (non-site-specific).

## 2.24 RF Exposure

- Health Canada has published safety guidelines for the maximum limits of RF energy near the human body.
- Safety Code 6 gives RF exposure limits for the human body.
- According to Safety Code 6, frequencies in the range of 30 to 300 MHz cause the greatest risk from RF energy. The limit of exposure to RF in this frequency range is the lowest because the human body absorbs RF energy the most in this range.
- The maximum safe power output to the antenna of a VHF or UHF hand-held radio is not specified by Safety Code 6. The exemption for portable equipment was withdrawn in 1999.
- The maximum exposure levels of RF fields to the general population in the frequency range 10 to 300 MHz is 28 volts-RMS per meter. (This is a measurement of electric field strength, or "E-field".) In the frequency range 30 to 300 MHz, the maximum

exposure level is 0.073 amperes-RMS per meter. (This is a measurement of *magnetic* field strength, or “H-field”.)

- Permissible exposure levels of RF fields increase as frequency is increased above 300 MHz or below 10 MHz.

## 2.25 Interference

- “Radio-sensitive equipment” is defined as “any device, machinery, or equipment other than radio apparatus, the use or functioning of which is or can be adversely affected by radiocommunication emissions”.
- In the event of interference to third-party electronics systems, if the field strength of the amateur station signal is below 1.83 volts per meter, it will be deemed that the affected equipment’s lack of immunity is the cause. If the field strength is above this, it will be deemed that the transmission is the cause of the problem.
- Broadcast transmitters are not included in the list of field strength criteria for resolution of immunity complaints.