



# Radio Operators License Handbook

by Edward M. Noll



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#### SECOND EDITION

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# Preface

This handbook will serve as a practical study guide for the aspiring radio operator, as well as a ready reference for those working in the field. The laws, rules, regulations, and accepted operating procedures, as they apply to the radio operator, are given in this volume. Information needed by the nonlicensed operator as well as that needed to pass the lower-grade FCC licenses is included.

A knowledge of the internal operation, critical adjustments, and maintenance of radio transmitters and other electronic gear is not required to obtain these lower-grade licenses, so this type of information has been omitted. These licenses are concerned only with the persons who operate the equipment and carry on voice or code communications.

Chapter 1 covers the various types of operator licenses and tells when they are necessary. In addition, many helpful operating rules and procedures are given in this chapter. The nonbroadcast services—Maritime, Aviation, Public Safety, Industrial, Land Transportation, and Citizens band—are thoroughly discussed in Chapter 2.

The additional information needed in the operation of broadcast stations is given in Chapter 3. The functions that can be performed by the third-class operator with a broadcast endorsement, plus the details of log-keeping, and other information to give you a better technical understanding of station operations are included. Chapter 4 gives the procedures for obtaining a license and the requirements for each classification.

The final three chapters contain questions and answers similar to those given on the actual examination. Element I concerned with basic law is covered in Chapter 5, while Chapter 6 is devoted to Element II, which covers basic operating practices. The test for the third-class license is based on these Elements I and II. To obtain the broadcast endorsement to the third-class license, a test based on Element IX must also be passed; this element is covered in Chapter 7.

Two simple self-tests, patterned after the FCC-style of testing are given. These tests are based on Elements I and II, and Element IX. Answers to the test are given in Appendix VI.

All information needed to secure an FCC license up to, but not including, the second-class license is given in this handbook. Just being able to answer the questions on the exam, however, does not make you an operator. Therefore, much additional information and hints of value to the operator have been included. If the material in this handbook is mastered, you should not only be able to pass the test with flying colors, but be a good operator as well.

EDWARD M. NOLL

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# **Radio Operators**

Radio operators number in the millions in this decade of two-way radio growth. Radio operators are radio operators for a variety of reasons. If you pilot a small boat or fly a small plane, your reason for being a radio operator involves the safety and convenience offered by your two-way radio equipment. Such stations are licensed in the Marine or Aviation Radio Services, respectively.

Perhaps you are a radio operator because two-way radio expedites your business procedures, as in the Industrial, Citizens, or other Land Radio Services. Your radio operating reason may be a desire for personal-convenience communications (Citizens Radio Service), or a hobby activity (Amateur Radio Services). Your association with radio operation may be as a public service in one of the Public Safety Radio Services.

Some radio operators need not be licensed; others require an FCC license of a particular class. Whether or not you are a licensed operator, you are responsible for the proper operation of the station with which you are associated. It is your duty to know the appropriate laws, rules and regulations, permissible communications, and established procedures for the particular radio service with which you are concerned.

For the most part, those persons involved in radiocommunications have always displayed a certain nobility toward, and respect for, the wonders of radio. Radio waves have been, and are, an instrument of mercy and safety, public service and convenience, basic research and accomplishment, and entertainment and good will. They should not become an instrument of callousness, lawbreaking and selfish exploitation.

#### LICENSE CONSIDERATIONS

This handbook is concerned with the nonlicensed operator, through the lower-grade FCC licenses, up to, but not including, the second-class radio license. These licenses are concerned with radio operation only and do not involve the technical aspects of two-way radio equipment.

Radio transmitters require a *station license*. The operator of the transmitter and station does, or does not, require an *operator license* depending on the radio service to be rendered. For example, in the Citizens Radio Service a station license is required, but the operator is not licensed. However, the operators of any radio transmitter are responsible to the licensee of the station, and operate with his authorization.

In the aviation and maritime services both *station* and *operator* licenses are required. If you have a station license for a small boat or small plane, you also require a restricted radiotelephone operator permit, as a minimum *operator license*. No examination is required for this license. In other mobile and maritime radio services, higher-grade licenses are required. These involve taking an FCC examination.

In some radio services an operator license is required for operating a station that transmits only on a frequency lower than 25 MHz. This regulation applies in particular to the landtransportation, industrial, and public-safety radio services. Sometimes a license is not required for a low-frequency mobile station if that station is under the jurisdiction of its associated base station, at which point there is a licensed operator.

It is necessary to pass Elements I and II to obtain a *third-class operator permit*. This grade of license is required for those radio services in which it is imperative that the operator know the appropriate rules, regulations, and operating procedures. Such an examination is taken at a district office of the Federal Communications Commission.

To obtain a *restricted radiotelephone operator permit*, it is only necessary to fill out FCC Form 753. A sample of the form is shown in Fig. 1-1. This application together with an \$8.00 fee is mailed to the Federal Communications Commission, Gettysburg, Pa. Certain broadcast stations may also be operated with a third-class operators permit provided this license has an appropriate *broadcast endorsement*. Thus, if you wish to operate certain radio broadcast stations, it is necessary that you pass Elements I, II, and IX which are covered in this license handbook. (Refer to Chapters 5, 6, and 7.)

Specific operator requirements and authority as they appear in the FCC Rules and Regulations, Part 13, are as follows:

(e) Radiotelephone third-class operator permit:

(1) Ability to transmit and receive spoken messages in English.

(2) Written examination elements: 1 and 2.

(f) Radiotelegraph third-class operator permit:

(1) Ability to transmit and receive spoken messages in English.

(2) Transmitting and receiving code test of twenty (20) words per minute plain language and sixteen (16) code groups per minute.

(3) Written examination elements: 1, 2, and 5.

(g) Restricted radiotelephone operator permit:

No oral or written examination is required for this permit. In lieu thereof, applicants will be required to certify in writing to a declaration which states that the applicant has need for the requested permit; can receive and transmit spoken messages in English; can keep at least a rough written log in English or in some other language in general use that can be readily translated into English; is familiar with the provisions of treaties, laws, and rules and regulations governing the authority granted under the requested permit; and understands that it is his responsibility to keep currently familiar with all such provisions.

License authorities are as follows:

(g) Radiotelephone third-class operator permit. Any station except:

(1) Stations transmitting television, or

(2) Stations transmitting telegraphy by any type of the Morse Code, or

(3) Any of the various classes of broadcast stations other than noncommercial educational fm broadcast stations using transmitters with power rating of 10 watts or less, re-

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063441	crime for which the penalty imposed was a fine of \$500 or more, or an imprisonment of more than one year?	freely, without mental reservation or purpose of evasion; and that I will well and faithfully discharge the duties of the office obtained through my employment under this Permit if granted.
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mote pickup broadcast stations and ST broadcast stations, or

(4) Class I-B coast stations at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts, or

(5) Class II-B or Class III-B coast stations, other than those in Alaska, at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts, or

(6) Ship stations or aircraft stations other than those at which the installation is used solely for telephony and at which the power in the antenna of the unmodulated carrier wave is not authorized to exceed 250 watts:

*Provided*. That (1) such operator is prohibited from making any adjustments that may result in improper transmitter operation, and (2) the equipment is so designed that the stability of the frequencies of the transmitter is maintained by the transmitter itself within the limits of tolerance specified by the station license, and none of the operations necessary to be performed during the course of normal rendition of the service of the station may cause off-frequency operation or result in any unauthorized radiation. and (3) any needed adjustments of the transmitter that may affect the proper operation of the station are regularly made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph as may be appropriate for the class of station involved, who shall be responsible for the proper functioning of the station equipment, and (4) in the case of ship radiotelephone or aircraft radiotelephone stations when the power in the antenna of the unmodulated carrier wave is authorized to exceed 100 watts, any needed adjustments of the transmitter that may affect the proper operation of the station are made only by or under the immediate supervision and responsibility of an operator holding a first- or second-class radiotelegraph license, who shall be responsible for the proper functioning of the station equipment.

(h) Restricted radiotelephone operator permit. Any station except:

(1) Stations transmitting television, or

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(2) Stations transmitting telegraphy by any type of the Morse Code, or

(3) Any of the various classes of broadcast stations other than remote pickup, broadcast STL, and fm intercity relay stations, or

(4) Ship stations licensed to use telephony for communication with Class I coast stations on frequencies between 4000 kHz and 30 MHz, or

(5) Radio stations provided on board vessels for safety purposes pursuant to statute or treaty, or

(6) Coast stations, other than those in Alaska, while employing a frequency below 30 MHz, or

(7) Coast stations at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts;

(8) At a ship radar station the holder of this class of license may not supervise or be responsible for the performance of any adjustments or tests during or coincident with the installation, servicing or maintenance of the radar equipment while it is radiating energy: Provided. That nothing in this subparagraph shall be construed to prevent any person holding such a license from making replacements of fuses or of receiving type tubes: Provided, That, with respect to any station which the holder of this class of license may operate, such operator is prohibited from making any adjustments that may result in improper transmitter operation, and the equipment is so designed that the stability of the frequencies of the transmitter is maintained by the transmitter itself within the limits of tolerance specified by the station license, and none of the operations necessary to be performed during the course of normal rendition of the service of the station may cause off-frequency operation or result in any unauthorized radiation, and any needed adjustments of the transmitter that may affect the proper operation of the station are regularly made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment. Additional information and fees are given in Appendix V.

# §13.62 Special privileges.

In addition to the operating authority granted under §13.61, the following special privileges are granted the holders of commercial radio operator licenses:

(b) The holder of any class of radiotelephone operator's license, whose license authorizes him to operate a station while transmitting telephony, may operate the same station when transmitting on the same frequency, any type of telegraphy under the following conditions:

(1) When transmitting telegraphy by automatic means for identification, for testing, or for actuating an automatic selective signaling device, or

(2) When properly serving as a relay station and for that purpose retransmitting by automatic means, solely on frequencies above 50 MHz, the signals of a radiotelegraph station, or

(3) When transmitting telegraphy as an incidental part of a program intended to be received by the general public, either directly or through the intermediary of a relay station or stations.

(c) The holder of a commercial radio operator license of any class with broadcast endorsement may operate broadcast stations under the following conditions:

(1) A duty operator in a standard broadcast station of any operating power, or one employing a directional antenna provided the station authorization does not require that the ratio of the antenna currents in the elements be held within a tolerance which is less than 5% or the relative phase of those currents within a tolerance which is less than  $3^{\circ}$ , an fm broadcast station of any authorized power, or a noncommercial educational fm broadcast station. Adjustments of transmitting equipment, except when under the immediate supervision of the radiotelephone first class operator is limited to the following:

(i) Those necessary to commence or terminate transmitter emissions as a routine matter.

(ii) Those external adjustments that may be required as a result of variations of primary power supply.

(iii) Those external adjustments which may be necessary to insure modulation within the limits required.

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(iv) Those adjustments necessary to effect any changes in operating power which may be required by the station's instrument of authorization.

(v) Those necessary to change between nondirectional and directional or between differing radiation patterns, provided that such changes require only activation of switches and do not involve the manual tuning of the transmitter final amplifier or antenna phasor equipment. The switching equipment shall be so arranged that the failure of any relay in the directional antenna to activate properly will cause the emissions of the station to terminate.

(2) A noncommercial educational fm broadcast station with authorized transmitter power output of more than 10 watts but not in excess of 1 kW: *Provided*, That adjustments of transmitting equipment by such operators, except under the supervision of a radiotelephone first- or second-class operator, shall be limited to those adjustments set forth in subparagraph (1), (i), (ii), and (iii) of this paragraph.

(3) A noncommercial educational fm broadcast station with authorized transmitter power output of 10 watts or less: *Provided*, That adjustments of transmitting equipment by such operators, except under the immediate supervision of a radiotelephone first- or second-class operator or a radiotelegraph first- or second-class operator, shall be limited to those adjustments set forth in subparagraph (1), (i), (ii), and (iii) of this paragraph.

(4) Should the broadcast transmitting apparatus be observed to be operating in a manner inconsistent with the station's instrument of authorization and none of the adjustments specifically described under subparagraph (1), (2), or (3) of this paragraph are effective in bringing it into proper operation, an operator holding a lesser grade license than that which authorizes unlimited adjustment, with respect to the class of broadcast station involved, and not acting upon the supervision of a person holding the higher grade license permitting such unlimited adjustment, shall terminate the station's emissions.

(5) Except in the case of noncommercial educational fm broadcast stations with authorized transmitter output power of 10 watts or less, the special operating authority granted in this section with respect to broadcast stations is subject to the condition that there shall be in regular fulltime employment at the station one or more operators of a class authorized to make or supervise all adjustments, whose primary duty shall be to effect and insure the proper functioning of the transmitting equipment. In the case of a noncommercial educational fm broadcast station with authorized transmitter output power of 10 watts or less such operator(s) shall nevertheless be available on call to make or supervise any needed adjustments.

(d) When an emergency action condition is declared, a person holding any class of radio operator license or permit who is authorized thereunder to perform limited operation of a standard broadcast station may make any adjustments necessary to effect operation in the emergency broadcast system in accordance with the station's National Defense Emergency Authorization: *Provided*, That the station's responsible first-class radiotelephone operator(s) shall have previously instructed such person in the adjustments to the transmitter which are necessary to accomplish operation in the Emergency Broadcast System.

#### ESSENTIAL PROVISIONS FOR RADIO OPERATORS

All radio operators, licensed or not, should know and are responsible for knowing the following laws and regulations.

#### Station License

A radio station, other than one belonging to and operated by the Federal Government, shall not be operated unless it is properly licensed by the Federal Communications Commission and the station license is posted or kept available as specified by the rules governing the particular service and/or class of station.

#### **Operator Licenses or Permit**

Except as may be provided otherwise by the rules governing a particular service and/or class of station, a radio station required to be licensed by the Commission shall be operated only by a properly licensed radio operator who has his license or verification card or his permit in his possession or posted in accordance with the Commission's rules governing the particular service in which he is employed. If the license or permit has been sent in to the Commission for replacement, duplicate, etc., a copy of the application for such replacement, duplicate, etc., shall be exhibited in lieu of the license.

The holder of a restricted radiotelephone operator permit as issued to a United States citizen may operate any station in the fixed and mobile services while using radiotelephony, except:

- 1. Coast stations other than in Alaska, while using a frequency below 30 MHz; or
- Ship stations licensed to use telephony for communication with Class 1 coast stations on frequencies between 4000 kHz and 30 MHz.
- 3. Radio stations provided on board vessels for safety purposes pursuant to statute or treaty.

Coast stations in the above categories which this grade of operator may operate are limited to those at which the antenna power is not authorized to exceed 250 watts. The transmitting equipment of any station must be so designed that the stability of the operating frequencies is maintained by the transmitter itself within the limits of tolerance specified by the Commission; adjustments to the radio transmitter, which may cause off-frequency operation or result in improper transmitter operation, shall be made only by, or in the presence of, a person holding a first- or second-class operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper operation of the equipment.

### **Nature of Communications**

Only such communications as are authorized by the rules governing the radio station operated may be transmitted. False calls, false or fraudulent distress signals, superfluous and unidentified communications, and obscene and profane language are specifically prohibited.

#### **Priority of Communications**

Distress calls and messages shall have absolute priority over all other communications. Distress calls may be made without regard to interference to other stations, with due consideration, however, being given to any other distress calls or messages which may be transmitted at the same time. Routine operation shall not be resumed until the distress signals and messages have been cleared.

The order of priority for communications in the mobile service shall be as follows:

- 1. Distress calls, distress messages, and distress traffic.
- 2. Communications preceded by the urgency signal.
- 3. Communications preceded by the safety signal.
- 4. Communications relating to radio direction-finding.
- 5. Communications relating to the navigation and safe movement of aircraft.
- 6. Communications relating to the navigation, movements, and needs of ships, and weather observation messages destined for an official meteorological service.
- 7. Government radiotelegrams: Priorite Nations.
- 8. Government communications for which priority has been requested.
- 9. Service communications relating to the working of the radiocommunication service or to communications previously exchanged.
- 10. Government communications other than those shown in 7 and 8 above, and all other communications. (Art. 37).

#### Secrecy of Radiocommunications

The contents of a radiocommunications shall not be divulged to any person or party other than to whom it is addressed, except as specifically provided in section 605 of the Communications Act.

#### Identification of Communications

When not required to identify itself by some other provisions of the Rules and Regulations, every radio station shall identify itself by its regularly designated call signal or other approved method at the time of each transmission, and as frequently as is practicable during tests or during an exchange of long communications.

# **Prevention of Interference**

Inasmuch as most radio transmission in the mobile services is conducted on radio channels which are shared by many stations, as on a "party line," it is necessary that certain precautions be observed to avoid unnecessary congestion and interference.

In order to avoid interference with communications in progress, an operator shall listen on the frequencies on which he intends to receive for a period sufficient to ascertain that he will be able to hear the station he is calling and that his transmission will not cause harmful interference. He shall not attempt to call if interference is likely to result.

Attempts to establish communication beyond the normal range of installed equipment usually results in unnecessary occupation of the calling frequency. Except in emergencies, such calling should be avoided.

In order to eliminate the need for undue repetition of communications, voice transmission should be made with maximum articulation. It is well to remember that speech is generally rendered almost unintelligible by speaking too close to the microphone, and it is often lost in extraneous noise when the microphone is held at too great a distance.

#### Radio Log

Radio logs are required to be kept in certain radio services. These logs must be kept by a person having actual knowledge of the facts to be entered who shall also sign the log as prescribed by the Commission. Logs shall be made available on request by authorized Commission representatives. No log or portion thereof shall be erased, obliterated, or willfully destroyed within the period of retention required by the Rules and Regulations. Any necessary correction may be made only by the person originating the entry; he shall strike out the erroneous portion, initial the correction made, and indicate the date of correction.

#### **Notice of Violations**

Any licensee who appears to have violated any provision of the Communications Act of 1934, as amended, or of the Rules and Regulations of the Federal Communications Commission, shall be served with a notice calling the facts to his attention and requesting a statement concerning the matter. Within 10 days from receipt of such notice, or such period as may be specified, the licensee shall send a written answer to the Commission field office, or to the monitoring station originating the official notice. If an answer cannot be sent or an acknowledgment made within such 10 day period by reason of illness or other unavoidable circumstances, acknowledgment and answer shall be made at the earliest practicable date, shall be complete in itself, and shall not be abbreviated by reference to other communications or answers to other notices. If the notice of violation relates to lack of attention to, or improper operation of, the transmitter, the name and license number of the operator shall be given.

### **Penalties**

The general penalty for violation of the Communications Act (first offense) consists of a fine of not more than \$10,000 or imprisonment for a term of not more than one year, or both.

The penalty for violation of the Commission's regulations or the international radio regulations consists of a fine of not more than \$500 for each and every day during which such offense occurs.

The Commission has authority, as public convenience, interest, or necessity requires, to suspend the license (permit) of any operator on proof sufficient to satisfy the Commission that the operator:

- (a) Has violated any provision of any act, treaty, or convention binding on the United States, which the Commission is authorized to administer, or any regulation made by the Commission under any such act, treaty, or convention; or
- (b) Has failed to carry out a lawful order of the master or person lawfully in charge of the ship or aircraft on which he is employed; or
- (c) Has wilfully damaged or permitted radio apparatus or installations to be damaged; or
- (d) Has transmitted superfluous radio communications or signals or communications containing profane or obscene words, language, or meaning, or has knowingly:
  - 1. Transmitted false or deceptive signals or communications; or
  - 2. Transmitted a call signal or letter which has not been assigned by proper authority to the station he is operating; or

- (e) Wilfully or maliciously interfered with any other radio communications or signals; or
- (f) Obtained or attempted to obtain, or has assisted another to obtain or attempt to obtain, an operator's license by fraudulent means.

### **Distress Procedure**

The international radiotelephone distress signal consists of the spoken expression MAYDAY. This signal shall be used to announce that the ship, aircraft, or other vehicle that sends the distress signal is threatened by serious and imminent danger and requests immediate assistance. The distress signal shall be followed by the distress messages containing the identity of the station in distress, its position, the nature of the distress, and the nature of the assistance requested.

The international radiotelephone urgency signal consists of the word PAN, spoken three times, and is to be used when the calling station has a very urgent message to transmit concerning the safety of the ship, aircraft, or other vehicle, or concerning the safety of some person on board or sighted from on board.

The international radiotelephone safety signal consists of the word SECURITY spoken three times, and announces that the station is about to transmit a message concerning the safety of navigation, or giving important meterological warnings.

The distress *call* sent by radiotelephony comprises:

- 1. The distress signal MAYDAY spoken three times;
- 2. The words THIS IS, followed by the identification of the mobile station in distress, the whole repeated three times.

The distress call should be followed as soon as possible by the distress message, which comprises:

- 1. The distress signal MAYDAY;
- 2. The name of the ship, aircraft, or vehicle in distress;
- 3. Particulars of its position, the nature of the distress, and the kind of assistance desired;
- 4. Any other information which might facilitate the rescue.

As a general rule, a ship shall signal its position in latitude and longitude, using figures for the degrees and minutes, together with one of the words NORTH or SOUTH and one of the words EAST or WEST.

As a general rule, and if time permits, an aircraft shall transmit in its distress message the following information: estimated position and time of the estimate; heading in degrees (state whether magnetic or true); indicated air speed; altitude; type of aircraft; nature of distress, type of assistance desired, and any other information which might facilitate the rescue (including the intention of the person in command, such as forced alighting on the sea or crash landing).

After the transmission by radiotelephony of its distress message, the mobile station may be requested to transmit suitable signals followed by its call sign or other identification, to permit direction-finding stations to determine its position. This request may be repeated at frequent intervals if necessary. In radiotelephony, the signal is made by holding the transmitter on the air for the specified period of time, without speaking into the microphone other than to identify the station.

Immediately before a crash landing or forced landing (on land or sea) of an aircraft, as well as before total abandonment of a ship or an aircraft, the radio apparatus should be set for continuous emission, if considered necessary and circumstances permit.

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# **Radio Services**

This chapter covers each of the major two-way radio services and categories with particular emphasis on operator license requirements and responsibility. Discussions of typical operations and installations are given. There is some coverage of station license considerations, plus operating frequency bands and important spot frequencies for the various radio services.

#### MARITIME RADIO SERVICES

The maritime industry was the first enthusiastic and worldwide user of two-way radio. Early in this century radio stations were installed on sea-going vessels. Military, government, and private land stations were set up to maintain contact with these radio-equipped vessels. Obviously, the two major divisions of the maritime service are stations on land and stations on shipboard. There are, of course, a number of subdivisions of both land and shipboard stations.

Two-way radio is compulsory on most vessels. There must be an efficient radio installation in operating condition and in charge of, and operated by, a qualified operator or operators on any ship of the United States (other than a cargo ship of less than 500 gross tons) to be navigated in the open seas outside of a harbor or port. No such vessel may leave or attempt to leave any harbor or port of the United States for a voyage on the open seas unless it is so equipped. Furthermore, any vessel, regardless of size, that is transporting more than six passengers for hire and is navigated in the open seas or any tidewater within the jurisdiction of the United States adjacent or contiguous to the open seas must be equipped with an acceptable radio installation. The FCC may exempt from the provision of this part any vessel or class of vessel where the route or condition of the voyage or other condition or circumstances are such as to render a radio installation unreasonable, unnecessary, or ineffective.

Most vessels on which a radio installation is compulsory must include a main radiotelegraph installation and, in most cases, an emergency or reserve radiotelegraph installation. For cargo ships of less than 1600 gross tons, a radiotelephone may be installed in lieu of a radiotelegraph installation.

Three major categories of coast stations are: public, limited, and marine-utility stations. The public and limited stations are further subdivided into three additional categories, Classes I, II, and III. A public coast station is one that is said to be open to public correspondence. Public correspondence itself refers to any telecommunications which the offices and stations must, by reason of their being at the disposal of the public, accept for transmission. When suitable rates are filed, it is possible to charge for such correspondence. A limited coast station is one that is not open to public correspondence but serves mainly the operational and business needs of ships.

Be it public or limited, a Class-I coast station provides a mobile radio service to ships at sea, including such service over distances up to several thousand miles. Class-I coast below 150 kHz or between 5000 and 25,000 kHz. A Class-II coast station provides a maritime service primarily of a regional character. Frequency assignments are not made below 150 kHz or between 5000 and 25,000 kHz. The Class-III coast station provides a maritime service of a local nature and does not operate on any frequency below 25 MHz. The marine-utility station is one that is readily portable for use as a limited coast station at unspecified points ashore within a designated local area.

Two main categories of ship stations are also public and limited. A limited ship station is not open to public correspondence and must confine itself to the operational and business needs of shipping. Public ship stations are also further classified according to their hours of service for telegraphy in a public correspondence service. These categories are based on whether they provide continuous service of public correspondence or a limited service.

The equipment aboard those vessels on which a radio installation is compulsory must meet specific requirements. The installations are inspected and are issued safety certificates attesting to their compliance with the radio requirements of the Safety Convention.

#### **Operator Requirements**

In general, the classes of operator licenses required for the compulsory shipboard radio installations are above the license classes which are the major concern of this handbook. From the classes of ship and coast stations covered in the previous paragraphs, it is apparent that most operators must have a radiotelegraph license. Except for certain low-power coast stations, the grade of license must be at least a second-class radiotelegraph grade. For those vessels equipped with a compulsory radiotelephone installation only, a minimum secondclass radiotelephone license is needed. Certain of the harbor land-mobile stations which are associated with a larger coast station do not require a licensed operator. However, in this case the communications are under the control of the properly licensed operator of the main station.

One might conclude from the previous discussion that lower license grades have no place in the maritime radio service. However, some ship and coast stations operate with a power of less than 250 watts. There are many types of vessels excluded from the compulsory radio installations. These are the teeming numbers of small commercial and pleasure boats, sailing boats, certain vachts, etc. Two-way radio installations on these boats require a station license and an operators license. The station-license application is made on FCC Form 502; the operator license application is made on Form 753. The operator license is a restricted radiotelephone operators permit. and it is obtained without an examination. The fact that the license does not require an examination does not excuse the operator from knowing the laws, rules and regulations, and operating procedures associated with the particular radio services.

The primary objective of two-way radio in the maritime radio services is safety of life and property. Thus, all operators are responsible for knowing distress procedure. Important reminders concerning FCC rules as they apply to ship radiotelephone and the distress procedure follow.

### Ship Radiotelephone Rule Reminders

- 1. Post station license.
- 2. Have operator license available.
- 3. Listen on 2182 kHz.
- 4. Use 2182 kHz only for calling distress, urgency ,or safety.
- 5. Listen before transmitting. Avoid interference with distress or other communications in progress.
- 6. When you hear MAYDAY—listen. Don't talk unless you can help.
- 7. No ragchewing.
- 8. Talk 3 minutes, wait 10 minutes.
- 9. Give your call sign.
- 10. Keep a log.
- 11. Answer violation notices.
- 12. Use of indecent language or profanity on the air is a criminal offense.
- 13. FALSE OR FRAUDULENT DISTRESS SIGNALS ARE PROHIBITED.

## If You Are In Distress

- 1. Send radiotelephone alarm signal, if possible, to attract attention of other ships.
- 2. Say slowly and distinctly on the distress frequency of 2182 kHz:
  - a. MAYDAY, MAYDAY, MAYDAY This is (Call Sign, repeated 3 times)
  - b. Give the name of your ship.
  - c. Give your geographical position.
  - d. Tell the nature of the distress.
  - e. Explain what kind of assistance you need.
  - f. Give any information that will help you to be rescued. (For example, color of ship, type of ship, length of ship, etc.)
- 3. Repeat distress call and distress message at intervals until you get an answer.
- 4. Try any other available frequency to get help, if you get no answer to your distress call sent on 2182 kHz.

5. Give priority to DISTRESS, URGENCY, and SAFETY messages in that order.

Let us consider some of the rules in more detail. The radiotelephone transmitter of a ship station operating on frequencies below 30 MHz may be operated only by a licensed operator. The licensed operator may permit others to speak over the microphone if he starts, supervises, and ends the operation, makes the necessary log entries, and gives the necessary identification.

The license usually held by radio operators aboard small vessels not required to carry a radio installation for safety purposes is the restricted radio operators permit. This is a lifetime permit. However, it does not authorize transmitter adjustments that may affect the proper operation of the station. Any needed adjustments must be made by the holder of a first- or second-class radiotelegraph or radiotelephone license only. It is not necessary to post the restricted radiotelephone-operator permit if it is kept on the operator's person. However, other classes of licenses must be conspicuously posted at the principal location at which the station is operated.

The frequency of 2182 kHz is the calling and distress frequency. Ship radiotelephone stations in the 1600- to 3500-kHz band must maintain an efficient listening watch on this frequency while the station is open and not transmitting on other frequencies. All shipboard transmitters in this band must be capable of transmitting on this frequency, and if the transmitter is used for other than safety communications, it shall also be capable of transmitting on at least two other so-called working frequencies. There are also certain intership frequencies that may be employed. These frequencies are limited to use for safety and operational communications, and in the case of commercial transport vessels, for business communications.

The transmissions from a ship should be confined to the allocated frequencies. However, a ship may transmit on frequencies not included on the ship's station license when directed to do so by U. S. Government stations or foreign coast stations.

A number of definite operating procedures must be obeyed. Before transmitting, always listen on the channel to be used so as to minimize interference. You must give your call sign whenever you call another vessel or coast station, and also when you finish the conversation. Except when talking on the intership frequencies where the maximum time limit for conversations is three minutes, you must break and announce your call signs if your ship-to-shore conversation lasts more than 15 minutes. Make your calls short (not more than 30 seconds) and do not call that same station again for two minutes. If a call sign has not as yet been assigned, you may identify your station by announcement of the vessel name and name of the licensee.

If you hear a radio conversation not intended for you, you cannot lawfully use the information in any way. Do not forget that safety is the primary reason for having shipboard radio. Distress and safety must have absolute priority. This is the reason for the setting aside of the distress frequency of 2182 kHz. You transmit on this frequency when you are in distress, and you maintain a watch on this frequency so that you might help another in distress.

It is necessary to keep a radio log. Each page must be numbered, must have the name of the vessel and call sign, and must be signed by the operators. Start and end of the watch on 2182 kHz must be recorded. All distress and alarm signals and related communications transmitted or intercepted and all urgency and safety signals and related communications transmitted shall be recorded in the log as completely as possible.

A record of all installations, service or maintenance work performed, which may affect the proper operation of the station, must also be entered by the licensed operator doing the work, including his signature, address, class of license, serial number, and expiration date of his license. Use the 24-hour system in the radio log; that is 8:45 A.M. is written as 0845 and 1:00 P.M. becomes 1300.

Radio logs must be retained for at least one year—three years if they contain entries concerning distress or disaster. If at any time you receive an official notice of violation from the FCC, you must reply to it within ten days of receiving the receipt.

#### **Transmitters**

Each radiotelephone transmitter used in a ship station must be type accepted under Part 83 of the Commission's Rules. Except for transmitting equipment required to comply with Title III, Part II of the Communications Act, no application for modification of license is required for the deletion, addition, or replacement of radiotelephone and radar transmitters which operate in the frequency bands specified on the license. The additional or replacement transmitters must be type accepted or type approved, as appropriate.

Transmitters for the band 1605-3500 kHz which are installed in a ship station after January 1, 1972 must be capable of single sideband emission, and these stations must also be equipped for transmission in the band 156-158 MHz. These same requirements apply to all ship stations in the band 1600-3500 kHz after January 1, 1977.

#### 2182 Kilohertz

This is the calling and distress frequency for ship radiotelephone stations in the 1605-3500 kHz band and these stations must maintain an efficient listening watch on 2182 kHz while the station is open and not transmitting on other frequencies. (Rule 83.223). All ship stations in this band must be capable of transmitting on 2182 kHz.

#### 156.8 Megahertz

This is the calling and distress frequency for ship radiotelephone stations in the 156-162 MHz band and these stations must maintain a watch (Rule 83.224) and be capable of transmission on 156.8 MHz (Rule 83.106).

### Recommended Channels for Ship Stations Using Channels in the 1605-3500 Kilohertz Band

Ship radiotelephone stations in the 1605-3500 kHz band if used for other than safety communications shall be capable of transmitting on at least two working frequencies (Rule 83.106(a)). There are five intership frequencies in the band: 2003 kHz—Great Lakes area only; 2142 kHz—Pacific Coast area south of latitude 42 degrees north on a day only basis; 2638 kHz—all areas; 2738 kHz—all areas except Great Lakes and Gulf of Mexico; 2830 kHz—Gulf of Mexico only. Use of these intership frequencies is limited to safety and operational communications, except that commercial transport vessels may use them also for business communications. (Rule 83.358 (a)).

# Recommended Channels for Ship Radiotelephone Stations Using Channels in the 156-158 Megahertz Band

Ship radiotelephone stations in the band 156-158 MHz must be capable of transmitting on 156.8 MHz, 156.3 MHz, and at least one more working frequency (Rule 83.106). Table 2-1 has been prepared as a guide. It will assist you in deciding what channels to install in your vhf radio, and to determine which channels to use in a particular situation. The table covers both commercial and recreational usage for radios with 4, 6, 8, 12, 16, or 24 channel capability. The final selection will be determined by comparing this table with the facilities available in your area of interest.

Channel Designators	TYPE OF COMMUNICATIONS Points of communications	Commercial vessels Channel capability							Recreational vessels Channel capability							
		4	6	8	12	16	24		4	6	8	12	16	24		
		No. of recommended channels of each group											p			
		Select channels used in area of operation														
16	DISTRESS, SAFETY & CALLING			Į	1	1						1				
(mandatory)	Intership & ship to coast	1	1	1	1	1	1		1	1	1	1	1	1		
06	INTERSHIP SAFETY	1	1	1	1	1	1	Π	1	1	1	1	1	1		
(mandatory)	Intership		l	l												
65, 66, 12, 73,	PORT OPERATIONS		1	2	2	3	6	Π		1	1	2	3	7		
14, 74, 20	Intership & ship to coast															
13	NAVIGATIONAL		1	1	1	1	1	Π				1	1	ł		
	Intership & ship to coast															
15 and	ENVIRONMENTAL				1	2	2	Π			1	1	2	2		
162.550 Mc/s	Ship receive only															
17	STATE CONTROL				1	1	1	Π				1	1	1		
	Ship to coast															
07, 09, 10, 11,	COMMERCIAL	1	1	1	2	2	4	Π								
18, 19, 79, 80	Intership & ship to coast				[											
67, 08, 77, 88	COMMERCIAL Intership			1	1	1	3	Π								
68	NONCOMMERCIAL							Π	1	1	1	1	1	1		
	Intership & ship to coast							Ľ								
09, 69, 71, 78	NONCOMMERCIAL							Π		1	1	1	1	3		
	Ship to coast															
70, 72	NONCOMMERCIAL Intership											1	2	2		
24, 84, 25,	PUBLIC CORRESPONDENCE	1	1	1	2	4	5	Π	1	1	2	2	3	5		
85, 26, 86,	Ship to public coast															
27, 87, 28																
24, 84, 25, 85, 26, 86, 27, 87, 28	PUBLIC CORRESPONDENCE Ship to public coast	1	1	1	2	4	5		1	1	2	2	3	5		

Table	2-1.	Channel	Designations
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#### Marine Radiotelephone

Marine radiotelephones operate in the 1605-3500 kHz and 156-158 MHz bands. The distress and calling frequencies are 156.8 MHz and 2182 kHz. A ship-to-shore radiotelephone



(A) Medium frequency (mf).



(B) Very high frequency (vhf). Courtesy Raytheon Company Fig. 2-1. Ship to shore radiotelephones.

as installed in a pleasure boat is shown in Fig. 2-1A. The mounting position is convenient to the helmsman. To the left of the two-way radio is a radio direction finder. Such a unit can be used to take bearings on low-frequency shore-beacon stations and a-m radio-broadcast stations. Another unit is shown in Fig. 2-1B.

The unit shown in Fig. 2-2 is more typical of a commercial boat. Often a higher-powered unit is employed, and additional electronic gear, such as direction finders and depth finders are included.

The unit shown in Fig. 2-3 is a piece of navigation equipment. The unit operates on the aircraft-frequency spectrum between 108 and 118 MHz. There are many aircraft-beacon stations (VOR) along the coasts that transmit in this range. The OMNI direction finder can be used to obtain a very accurate bearing by tuning in one or several of these aeronautical beacon stations.



Courtesy Raytheon Company Fig. 2-2. Radiotelephone unit for a small commercial boat.

No new DSB (conventional a-m) ship stations may be installed after January 1, 1972. However, where authorized prior to January 1, 1972, DSB transmitters may continue to be authorized to the same licensee until January 1, 1977. (January 1, 1977 is the date for discontinuance of DSB aboard all vessels.) The expression "to the same licensee" means that if an owner of a boat equipped with a DSB transmitter sells his boat during that interim period of January, 1972 to January, 1977, the radio is not re-licensable. However, the owner can



Courtesy Triton Marine Products Fig. 2-3. Direction finder for taking bearings on aircraft beacon stations.

transfer a DSB set from an old boat to a new one in his own name and a new license would be granted for the period up to January 1, 1977; in this case a vhf radio would not be required.

Coast Stations will discontinue the use of DSB on January 1, 1972; however they will continue to receive DSB until January 1, 1977. After January 1, 1972 Coast Stations will have capability of transmitting A3H (full carrier) so that operation with DSB Ship Stations will not be impaired before the date of January 1, 1977 (the date of discontinuance of all DSB).

After January 1, 1972, any new installation in the 1600-4000 kHz range will be SSB and only Ship Stations that already have vhf will be granted authorization for SSB. This is being done in an effort to force all short range communications to take place on vhf.

After January 1, 1977, 2 MHz frequencies will be available only to Public and limited Coast Stations where service is also provided on vhf.

After January 1, 1977 Public Coast Stations serving lakes or rivers will not be authorized to use frequencies in the band 2000-2850 kHz (except on the Mississippi River system and Great Lakes).

#### **AVIATION RADIO SERVICES**

The Aviation Radio Services set aside portions of the spectrum for radiocommunication and radionavigation facilities

WRH

for aircraft operators, aeronautical enterprises, and organizations that require radio-transmitting facilities for safety purposes and other necessities. The radio stations are allocated on the basis of a number of categories—airborne-aeronautical advisory, aeronautical multicom, aeronautical enroute, aeronautical metropolitan, flight test, flying school, airdrome, aeronautical utility, aeronautical search and rescue mobile, aeronautical fixed, operational, radionavigation land, and civil air patrol.

Most of these stations require a licensed operator. Again, insofar as installation and maintenance are concerned, a higher grade license is needed, first- or second-class radiotelephone. If radiotelegraphy is employed, the operator must have at least a third-class radiotelegraph license. Certain stations require a second-class radiotelegraph license.

In general, communications in the aviation services shall be restricted to safe, expeditious, and economical operation of aircraft, and the protection of life and property in the air. Some of the Aviation Radio Services, namely aeronautical public service, aeronautical advisory, aeronautical multicom stations, and civil air patrol land and mobile stations may conduct additional communications in accordance with the particular service of which they are a part.

As in other radio services, each transmitter must be licensed. Except for certain land mobile units used at airdromes and for other aeronautical applications, each station must be operated by a licensed operator. Quite often only a *restricted radiotelephone operator permit* is needed. Although no examination is required in obtaining a permit, as mentioned in Chapter 1, the operator is responsible for knowing the laws and FCC rules and regulations that apply to the particular radio service with which he is associated.

In summary, application must be made for both station and operator licenses for airborne and ground aeronautical radio stations. FCC Forms 404, 406 and 753 are used.

#### **Operator Requirements**

Practically all airborne and aeronautical ground radio stations require that the operators be licensed. In most cases the license is only a restricted radiotelephone permit. As covered previously, no examination is required, and the license is issued for life. For example, such a license is required if you
fly a private aircraft that employs two-way radio. Such an operator license is also required for the operator of a two-way radio used in a small private airfield.

Again, although the operator holds only a restricted permit, he must be familiar with the appropriate operating procedures and rules that apply to the particular radio station. Installation, maintenance, and any adjustments that influence the radiation from the transmitter must, of course, be made by an operator with a second-class radiotelephone license or higher. If radiotelegraphy or other form of coded transmission is used, the operator must have an appropriate radiotelegraph license or permit.

For higher-powered stations and more complex equipment using directional antennas and other facilities, higher grade licenses are often required. Usually for transmitters with authorized powers in excess of 250 watts, the minimum grade license is a second-class type.

### **Station Categories**

There are a variety of airborne and ground aeronautical stations. The four classifications of airborne stations are: air carrier, private, flight test and flying school, and aeronautical public service. An air-carrier aircraft station is one aboard an aircraft engaged in, or essential to, the transportation of passengers or cargo for hire. A private aircraft station is one aboard an aircraft not operated as an air carrier.

An exception to the allocation of air carrier or private aircraft stations involves the weight of the aircraft. If it is less than 10,000 pounds, it may be considered, at the option of the applicant, as a private aircraft even though it is actually engaged in air-carrier operations.

Obviously, station licenses are also granted to aircrafts used at test facilities or in flying schools. Licenses can also be obtained for aircraft used for the handling of public correspondence in the same manner as such services are available to ships in the Maritime Radio Service. These stations can handle messages for hire. Facilities must be made available for the use of all persons and without discrimination, such stations shall intercommunicate with any other stations similarly licensed when necessary for the handling of traffic.

Aircraft radio stations using radiotelephony, when transmitting during the normal rendition of service, shall be operated by persons holding any class of commercial radio operator license or permit. All transmitter adjustments or test during, or coincident with, the installation, servicing, or maintenance of a radio station that may affect the proper operation of such station, shall be made by or under the immediate supervision or responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment.

There is even a greater variety of aeronautical ground stations. Airdrome control stations provide communications limited to the necessity of safe and expeditious operation of aircraft using the airdrome facilities or operating within the airdrome control area. Such stations are required to monitor the following frequencies during hours of operation—121.5 MHz, 122.5 MHz and, in some cases 122.7 MHz, 122.9 MHz and 3023.5 kHz.

In association with the airdrome there are also certain land mobile stations called aeronautical utility and aeronautical search and rescue mobile stations. Such stations can be installed in fuel trucks, airdrome repair trucks, emergency vehicles, etc.

Throughout the United States there are numerous radionavigation land stations that guide and give instructions to aircraft enroute. Most of these stations are operated by the Federal Aviation Agency. These stations along with the airdrome radio facilities provide radionavigation coverage that extends from destination to destination, both on and off the civil air routes.

For this fundamental purpose there are certain other station classifications operated by the FAA, or through private ownership if the applicant justifies the need for the facility and the government is not prepared to render this service. These stations are aeronautical enroute, aeronautical metropolitan, aeronautical fixed, and operational stations.

Small airports and landing areas can be allocated aeronautical-advisory and aeronautical-multicom station licenses. When operated at a landing area not served by an airdrome control station, communications must be limited to the necessity and safe and expeditious operation of private aircraft, pertaining to the condition of runways, types of fuel available, wind conditions, weather information, dispatching, or other necessary information. Also, on a secondary basis, information concerning ground transportation and food or lodging can also be handled.

The same information can be communicated via an aeronautical advisory station in an area served by an airdrome control station, with the exception that information concerned with runway conditions, fuel, and weather, are handled by the airdrome control station.

A multicom station can be used to direct activities associated with such aeronautical activities as fighting forest fires, aerial advertising, parachute jumping, etc.

Ground base facilities can also be provided for flying schools, flight-test facilities, and civil air patrol.

All of the various aeronautical ground stations just covered must be operated by FCC-licensed operators, with the exception of the FAA stations operated by government employees. Also, certain land mobile stations do not require an operator; usually such vehicles are associated with an airdrome control station or other aeronautical ground station which is under the control of a licensed operator.

### Aeronautical Radiocommunication and Radionavigation

There are many electronic aids to aircraft navigation; they can be considered in the four general categories of communication, navigation, traffic control, and landing. Most of the modern-day aeronautical radio activity occurs in the frequency spectrum between 108 and 136 MHz. Radionavigation uses the spectrum between 108 and 118 MHz; air traffic control, 118 to 136 MHz. Spotted throughout this spectrum are frequencies assigned to both aircraft and aeronautical ground stations. For example, in flying a private aircraft you will find the frequencies of the various ground stations given on navigation maps and/or charts. These aeronautical ground stations monitor certain aircraft frequencies and you can quickly establish contact enroute by setting your aviation radio to an appropriate frequency.

Many aviation radio units have dual-reception facilities. Thus it is possible to receive a radio navigation signal continuously at the same time that a two-way radio contact is being made with an aeronautical ground station. Such a unit is often referred to as a one and one-half communicator because it has a single transmitter and two receivers. Most modern flying is done via the vhf Omnidirectional Range stations. These are called VOR or OMNI stations. In the vhf frequency spectrum there is largely static-free reception, and the bending and false beams of the older lowfrequency radio range stations are not present. A reliable directional pattern can be produced at these frequencies. A complex revolving antenna pattern that uses electronic switching generates a rotating beam that has a directional accuracy of 1° throughout the entire  $360^\circ$  of rotation.

A simple nondirectional antenna on the aircraft picks up the signal. The signal information is such that a definite bearing can be established, and an associated left-right indicator on the receiver shows whether you are heading to the left or the right of the station, or whether you are flying left or right away from the OMNI station.

A more elaborate installation would include two 1½-communicators. Hence, simultaneous bearings on two "OMNI" range stations could be obtained. The one communications receiver and transmitter could be set permanently to one often-used communications channel. The second communicator could then be used for making enroute frequency shifts to a variety of less-used channels.

An elaborate installation in an Apache aircraft is shown in Fig. 2-4. Two communicators can be seen at the bottom of the center panel of radio equipment. Notice that each has COM (communications) and NAV (navigation) sides. The meters to go with the navigation sides are the two similar meters shown to the left center of the center panel of the radio equipment. These meters indicate bearing and right-left positioning of aircraft with respect to the "OMNI" range stations being received by the NAV sections of the receivers.

At the top of the center panel is a radio direction finder. This receiver can be tuned to the low-frequency range stations or to a-m broadcast stations. The meter on the left of the ADF receiver shows relative bearing with relation to the aircraft heading.

The second unit of the center panel is a distance-measuring (DME) unit. In operation it sends out an interrogating signal to a special range facility called a Vortac station. The Vortac station, in turn, sends back a signal to the aircraft unit. By utilizing the time of travel of the interrogation signal and the return signal, it is possible to determine the distance to the



Courtesy National Aeronautical Corporation Fig. 2-4. Aircraft radio installation.

Vortac station. The actual range in nautical miles is indicated by the meter on the left side of the instrument. A groundspeed indicator, the meter at the top left of the center panel, operates in conjunction with the distance-measuring unit. It reads ground speed in flying toward or away from the Vortac station.

#### **Emergency and Distress**

121.5 MHz is a universal simplex clear channel for use by aircraft in distress or condition of emergency. It will not be assigned to aircraft unless other frequencies are assigned and available for normal communications needs. The channel is available, as follows:

- 1. For emergency communications when circumstances beyond the control of the pilot prevent communication between the aircraft and ground stations on other regularly assigned channels.
- 2. For emergency direction finding purposes.
- 3. For establishing air-to-ground contact by aircraft in distress, emergency or when lost.

- 4. In connection with search and rescue operations, to provide a common channel for aircraft (either civil or military) not equipped to transmit on 123.1 MHz. This includes communications between aircraft, and between aircraft and ground stations. Stations, having the capability should change to 123.1 MHz as soon as practicable.
- 5. To provide a common frequency for survival communications and for survival radio beacons (emission A2).
- 6. For air/ground communications between aircraft and ocean station vessels for safety purposes when service on other vhf channels is not available.

The frequency 243 MHz is available to survival craft stations which are also equipped to transmit on 121.5 MHz.

### **Equipment Tests**

Aircraft stations are authorized to make routine tests when required for the proper maintenance of the station, provided that precautions are taken to avoid interference with any other station. A call from an aircraft in flight on the frequency 121.5 MHz for the purpose of making an unannounced or unanticipated test of the alertness of a ground station is not permitted.

### **Station Operation**

Private and air carrier aircraft radio stations are generally limited to communications relating to the necessities of safe aircraft operation. Aeronautical public service stations, may be authorized for use aboard aircraft to provide a means of conducting public correspondence. The licensee of a radio station is responsible at all times for the proper operation of his station. Thousands of other aircraft stations use the same frequencies that are assigned to your station. Be brief, transmit only essential messages. Your calls will receive quicker response, repeats will be fewer, and a general improvement in aircraft safety communications will result if the following precautions are taken:

- 1. Shorten or eliminate test calls while on the ramp or in flight.
- 2. Be sure the channel is clear before transmitting.
- 3. Tune your receiver to the correct receiving channel before transmitting.

#### **Station Identification**

Aircraft stations frequently cause confusion by failure to properly identify themselves when calling or working by radiotelephone. Aircraft radio stations are normally identified by use of the FAA registration number. After the first communication of each series, the last two characters of the registration number may be used if the practice is initiated by the ground station operator.

# PUBLIC SAFETY RADIO SERVICES

The Public Safety Radio Services provide a service of radiocommunication essential to the discharge of either nonfederal governmental functions or the alleviation of an emergency endangering life or property. FCC licensed as well as nonlicensed operators and dispatchers are required for these services.

Specific radio station assignments are made under the categories of local government, police, fire, special emergency, highway, forestry-conservation, and state guard. It is to be noted that many of these radio services are closely related. Hence they are suited to the setting up of radio control centers. For maximum benefit and minimum interference and confusion, there should be close cooperation in the selection of operating frequencies.

The radio operator in the Public Safety Service must be a good operator and develop a good understanding of police and emergency procedures. The Public Safety Radio Services are rather closely knit in a manner similar to the individual services that come under both the marine and aviation radio services. For example, a police radio operator or dispatcher should also be familiar with fire and special-emergency radio procedures. The Industrial and Land-transportation radio categories encompass more divergent fields of interest.

In summary, the public service radio operator is much more closely linked with the general public in comparison to the get-a-job-done objectives of the Land Transportation and Industrial Radio Services, or the safe-journey objectives of an aircraft or boat station in the aviation or marine radio services. The public safety radio operator and dispatcher is a responsible public servant.

# **Operator Requirements**

Public safety radio stations that operate on assigned frequencies above 25 MHz can be operated by unlicensed persons when so authorized by the station licensee. Such operators may be stationed at either control or dispatch points. Mobile stations operating below 25 MHz may also be operated by unlicensed operators if such a station is associated with, and under the control of, a licensed operator at the base station of the licensee. If the mobile station is not associated with a base station, it is necessary that the operator have a commercial radio operator license or permit of any class.

In the case of base and fixed stations operating below 25 MHz, the control point must be under the control of a person with a commercial radio operator license or permit. At a dispatch point the operator need not be licensed provided the station is under the direct supervision and responsibility of a person holding a license or permit who is on duty at a control point. The foregoing regulations apply only if the transmitter meets certain technical requirements.

For each of the radio services a station license must be obtained. Application is made on FCC Form 400. The exact FCC regulations are as follows:

#### § 89.163 Operator requirements.

(a) Operation during the course of normal rendition of service—radiotelephone.

(1) The following classes of stations transmitting on frequencies above 25 MHz may be operated by an unlicensed person, if authorized to do so by station licensee:

(i) From a control point—a mobile, a base or fixed station.

(ii) From a dispatch point—a base or fixed station.

(2) Mobile stations transmitting on frequencies below 25 MHz may be operated by an unlicensed person when such station is associated with and under the operational control of a base station of the same licensee. Mobile stations not associated with such a base station must be operated by a person holding a commercial radio operator license or permit of any class issued by the Commission.

(3) Base stations and fixed stations transmitting on frequencies below 25 MHz shall be operated as follows:

(i) From a control point, only a person holding a commercial radio operator license or permit of any class issued by the Commission shall operate a base station or fixed station.

(ii) From a dispatch point, an unlicensed person may operate a base station or fixed station after being authorized to do so by the station licensee: *Provided*, however, That such operation shall be under the direct supervision and responsibility of a person who holds a commercial radio operator license or permit of any class issued by the Commission and who is on duty at a control point meeting the requirements of § 89.113.

(e) Licensed operator required. Notwithstanding any other provisions of this section, unless the transmitter is so designed that none of the operations necessary to be performed during the course of normal rendition of service may cause off-frequency operation or result in any unauthorized radiation, and unless the transmitter is so installed that all controls which may cause improper operation or radiation are not readily accessible to the person operating the transmitter, such transmitter shall be operated by a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph as may be appropriate for the type of emission being used, issued by the Commission.

### Frequency Advisory

The almost continuous activity in the Public Safety Radio Services requires wise conservation of frequency spectrum and effective operating procedures. Coded signals and special fill-in form transmissions are prevalent to conserve air time and expedite safety activities quickly and effectively. Frequency advisory committees are especially necessary to permit the wise allocation of frequencies and minimum interference among stations that share the same frequency or operate on nearby channels.

An operating-procedure manual has been published under the direction of a national organization, The Associated Public-Safety Communications Officers, Inc. (APCO). This organization acts in a frequency-advising capacity and has done

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much to consolidate and standardize law enforcement methods and operating procedures as they involve communications.

### **Radio-Control** Centers

The need and growth of public safety radio operations has forced the development of large urban and county radio-control centers. The radio-control center of the police radio system of Bucks County, Pennsylvania, meets the requirements of an expanding suburbia (Fig. 2-5). It is an accelerated growth area that was a rural county only a few years ago. Public Safety Radio Services have been coordinated into a radio-control center, which includes both police and fire radio-control points (Fig. 2-6). Civil defense and other special



Fig. 2-5. Police radio-control center in Bucks County, Pa.

emergency radio services are housed at the same location. Emergency power is available.

The surrounding townships and municipalities are a part of the same police radio system that utilizes four vhf frequency assignments as major outlets. Interzone and coordination communication facilities are also available. In two years, message handling has risen to a level of tens of thousands per year. The radio-center staff includes a licensed communications director and technician, plus a chief dispatcher and nine radio dispatchers. Twenty-four hour service is provided for most of



Fig. 2-6. Fire-control position at radio-control center in Bucks County, Pa.

the counties full-time police agencies, and for practically all of the part-time departments.

Such radio-control centers provide a high order of efficiency and effective coordination. The shared and cooperative use of frequencies reduces interference and speeds message handling. Coordination with other public-safety radio services reduces confusion and permits smooth handling of disaster activities.

A very unusual emergency radio-operating center has been constructed at Rockville in Montgomery County, Maryland (Fig. 2-7). It is a solid well-built installation protected from adverse weather, heat, shock, nuclear radiation, etc. Facilities can house a staff of 75 persons for thirty days on stocked supplies. Power is made available by its own generating plant. Police, fire, and rescue radio systems are a part of the installation, including their respective dispatching rooms. The radio systems are in operation continually on a county-wide basis. The system points up the frequency-conservation advantage of radio-control centers in that 166 fire vehicles operate on two assigned frequencies and a total of 109 police patrol cars share three frequencies.

State police, because of the larger land area under their jurisdiction, must rely on two-way radio for rather long-dis-



Fig. 2-7. Montgomery County, Md., emergency operating center.

tance liaison as well as more localized communications. Base stations (Fig. 2-8), are strategically located around the state in a manner than can facilitate local and interzone communications. Some radio-relay facilities are also in order along turnpikes and express highways. Elaborate systems require maintenance facilities. A representative test bench and array of test equipment are shown in Fig. 2-9.

### INDUSTRIAL RADIO SERVICES

In the Industrial Radio Services part of the radio spectra has been set aside for radiocommunication and control facilities for various industrial enterprises which, for safety purposes or other necessity, require radio-transmitting facility in order to function efficiently. These radio services may not be used for a common-carrier service or to carry program material of any kind that will be used in any way in connection with radio broadcasting.

The radio stations are allocated on the basis of a number of categories—power, petroleum, forest, motion picture, relay press, special industrial, business, industrial radio location, manufacturers, and telephone-maintenance radio services.



Fig. 2-8. Pennsylvania State Police base station and emergency generator.



Fig. 2-9. Pennsylvania State Police two-way radio-maintenance facility.

The four general classifications of stations are: mobile- base, fixed, mobile-relay, and fixed-relay stations. The mobile service, as in the radio services discussed previously, involves communications between mobile and base stations or among mobile stations. A fixed-station radio service is a service of radiocommunications among specified fixed locations. A fixed relay station is established to receive radio signals directed to it from any source, and to retransmit them automatically for reception at one or more fixed locations. A mobile relay station is, in effect, a base station in the mobile service which is authorized primarily to retransmit automatically, on a mobile service frequency, communications originated by mobile stations.



Fig. 2-10. Industrial radio station types.

The functional block diagram of Fig. 2-10 demonstrates the purpose of the four major industrial station types. Notice that the fixed relay station is a retransmission point located between two fixed stations. However, the mobile relay station is a permanent station that is used to provide a service of retransmission for a given mobile system where some of the mobile units must be operated at a further distance than the basic coverage area of the installation, or on the opposite side of an obstruction to radio propagation.

In the industrial radio services, permissible communications are those considered essential to the efficient conduct of that portion of the enterprise for which the licensee is eligible to hold a station license, subject to the condition that harmful interference is not caused to safety communications of stations licensed under this part.

Permissible communications are also those related directly to the safety of life or the protection of property. In fact, a station licensee under this part may communicate with other stations without restriction as to type, service, or license, when the communication to be transmitted involves safety of life or the protection of property.

In the Industrial Radio Services, frequency assignments are allocated within the following bands: 1.6 to 6 MHz, 25 to 50 MHz, 152 to 174 MHz, and 450 to 460 MHz. For some of the services it is only necessary to make application using FCC Form 400. In other services, the form must be submitted together with evidence of frequency coordination. Frequency coordination, when required, must consider all stations operating on the requested frequency within 75 miles of the proposed station, and all stations operating on any adjacent frequency within 15 kHz of the requested frequency and within 35 miles.

Most stations are allocated for what is referred to as simplex operation. In a simplex operation (Fig. 2-11), mobile and base



Fig. 2-11. Simplex and duplex operation.

stations operate on the same frequency. In a conversation only one station can transmit at a time. Usually this is referred to as push-to-talk operation, where a given mobile or base station switches between transmit and receive with the use of a microphone switch. In some of the Industrial Radio Services full duplex operation is permitted. In this mode of transmission more than one frequency is used and the radiocommunication can be telephonelike with both transmitters and receivers operating continuously during the communications.

### **Operator Requirements**

A person holding a commercial radio operator license of any class issued by the Commission shall operate a base station or fixed station with an allocated frequency below 25 MHz. A control point refers to a location from which the transmitter is turned on and off and where the person immediately responsible for the operation of the transmitter is stationed.

From a dispatch point an unlicensed person may operate a base station or fixed station after being authorized to do so by the station licensee, provided that the operation shall be under the direct supervision and responsibility of a person who holds a suitable license and who is on duty at the control point.

The operator of a mobile station that operates below 25 MHz shall hold a commercial radio operator license or permit. However, such a person may be unlicensed if the mobile station, during the course of normal rendition of service, is associated with and under the operational control of the base station of the same station licensee.

If the station transmits radiotelegraphy of any type of the Morse code, it must be operated by a person holding a commercial radiotelegraph operator license or permit.

For stations allocated on frequencies above 25 MHz, an unlicensed person, after being authorized by the station licensee, may operate from a control point, a mobile, base, or fixed station, or from the dispatch point of a fixed or base station.

Again, it is important to understand that all transmitter adjustments or tests during or coincident with the installation, servicing, or maintenance of a radio station, which may affect the proper operation of such station, shall be made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio license. The control point is the key location of a two-way radio installation. It is this point at which the person immediately responsible for the operation of the transmitter is located, and appropriate monitoring facilities are installed. This position must be under the control and supervision of the licensee.

The monitoring facility at the control point must include a carrier-operated device which will provide a visual indication when the transmitter is radiating or a pilot lamp or meter which will provide continual visual indication when the transmitter control circuits have been placed in a condition to produce radiation. At the control point the person responsible for the operation of the transmitter must be able to aurally monitor all transmissions originating at dispatch points. Facilities must be included which will permit the person responsible for the operation of the transmitter to disconnect dispatch-point circuits, and to turn the transmitter carrier on and off at will.

Station identification is also the control operator's responsibility. The assigned call letters should be transmitted at the end of each transmission or exchange of transmissions, or once each 15 minutes of the operating period, whichever the licensee may prefer. Mobile stations may use simple unit identifiers which must be kept on file in the station records of the associated base station.

### **Station Categories**

Three of the categories of the Industrial Radio Services have to do with natural products; these are the power, petroleum, and forest-product services. Power-radio allocations are made to persons engaged in the generation, transmission, or distribution of electrical energy or to persons engaged in the distribution of manufactured or natural gas by means of a pipeline. The service also includes those engaged in the distribution of water or steam. It also applies to the activities associated with the collection, transmission, storage, or purification of water or the generation of steam preparatory to such distribution. The petroleum radio allocations are made to those engaged in prospecting for, producing, collecting, refining, or transporting by means of pipeline, petroleum or petroleum products.

It is apparent that in these systems one can anticipate the use of a number of fixed radio stations, because of the great distances over which these products are transported by pipe-

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line. Of course, base-mobile installations are essential at many locations, such as main distribution centers, prospecting sites, etc. Allocations are available for those persons engaged in tree logging, tree farming, or related woodland operations.

In a large industry a subsidiary corporation can be set up to handle radiocommunications on a nonprofit basis for the parent company or other subsidiaries of the parent corporation. It is also permissible to set up a separate nonprofit corporation or association to handle radiocommunications for persons engaged in one or more of the acceptable activities of the various radio services. Cooperative arrangements are also acceptable when made between two or more persons for the use of radio station facilities. All such persons must be eligible to hold a station license in one of the Industrial Radio Services. It is possible then to share the use of a base station which is licensed to one member of the group. Fixed stations can be operated in the same manner.

In the industrial radio category there are three rather closely related industrial and business services. These are: special industrial, manufacturers, and business radio services. In the manufacturers category the manufacturing activity should include the mechanical or chemical transformation of organic or inorganic substances into new products within establishments usually described as plants, factories, shipyards, or mills, and which employ in that process, power-driven machines and material-handling equipment. The radio service also includes those establishments engaged in assembling components of manufactured products in plants, factories, shipyards, or mills.

The manufacturers radio does not apply to those establishments primarily engaged in the wholesale or retail trade, or in service activities even though they fabricate any or all of the products of commodities handled. These activities are appropriate to the business radio service, which includes any person engaged in a commercial activity. The business radio service also applies to professional people; educational, philanthropic, or ecclesiastical institutions; and hospitals, clinics, and other medical associations.

Still another category is the special-industrial radio service. Allocations are set aside for persons regularly engaged in the operation of farms, ranches, or similar land installations, or for persons engaged in the operation of mines. Special industrial also applies to commercial business operations engaged in the construction of roads, bridges, sewers, pipelines, airfields, etc. Special-industrial allocations are also made to those engaged in specialized services essential to industrial operations or public health, such as soil conservation, seeding, fertilizing, spraying, etc. This service also extends to such varied activities as patroling and repairing of gas and liquid transmission pipelines, water disposal systems, distribution systems of public utilities, cementing, logging, supplying of materials and services to large industrial organizations, delivery of ice or fuel, delivery and pouring of ready-mixed concrete or hot asphalt, etc.



Courtesy Kaar Engineering Fig. 2-12. Business radiotelephone installation.

It is apparent that almost any industrial activity is included somewhere in the list of permissible uses for the various industrial radio services. The business radio service has become increasingly popular because of the great help of two-way radiocommunications in professional and service activities. Many wholesale or retail businesses use two-way radio to great advantage. Modern equipment is compact, efficient, and very reliable. The microphone and control unit mount conveniently below the dashboard of a car, as shown in Fig. 2-12. Battery-powered hand-held units (Fig. 2-13), can be used by a person who must move about a large area on foot. Combination mobile and hand-carried units (Fig. 2-14), are also appropriate for some business activities. For most activities in the Industrial Radio Services, the various pieces of equipment can be operated by unlicensed persons if the transmit frequency is above 25 MHz. Of course, any such operation is only legal when it is authorized by the licensee who is responsible for the correct operation of the radio station. Just as you are responsible for knowing the law pertinent to the operation of an automobile, you are also responsible for knowing the law attendant to the operation of a radio station that may be a part of the very same automobile.



Fig. 2-13. Hand-held two-way radio.

Courtesy Motorola Communications & Electronics Inc.

Two other categories in the Industrial Radio Services involve the news and entertainment media of motion picture and press. Allocations in the motion-picture radio service are made to those engaged in the production or filming of motion pictures. Relay press allocations are made to persons engaged in the publication of a newspaper or any operation of an established press association.

There are also telephone maintenance and public correspondence categories for those engaged in rendering a wireline or wire-line and radiocommunications service to the public for hire. Most of these activities are assigned in the 150-MHz frequency range.

In Pennsylvania a telephone-maintenance radio service is operated by the privately owned Denver and Ephrata Telephone Company (Fig. 2-15). The base-station transmitter is unattended and is located on a ridge not too far from the central office. This location provides a site of high-average terrain relative to the service area of the telephone company. The transmitter is remotely controlled from the central office. Automatic switching and monitoring facilities are installed at the central office. From the central office, digital, ringing, and voice signals are switched and routed among base transmitter, mobile units, and regular land telephones.



Fig. 2-14. Combination portable/mobile unit.

Mobile units are installed in the company's service trucks and cars. The base-station receiver is tuned to the mobile frequency. It picks up the digital information sent out from the mobile transmitter and routes it over wire line to the central office. The central office rings the appropriate phone and establishes contact. The circuit is now completed over a land





line to the base transmitter; the base transmitter goes on the air and completes the link to mobile receiver.

By proper selection of mobile frequencies, full duplex operation is possible between a mobile and any regular land telephone. Full duplex operation is also possible between two mobile units.

The control panel of the mobile unit is shown in Fig. 2-16. The key switch has operate and standby positions. On standby the unit rests and waits for an incoming call. In addition to a ring, a green light comes on whenever the particular mobile unit has been called. Whenever the radio system is busy, the



Fig. 2-16. Control panel of a mobile radiotelephone.

amber light comes on. A red light indicates the mobile transmitter is in operation and on the air. The system is planned for five-channel operation; these channels are selected by the push buttons at the top of the panel.

# IMTS Telephone System

An effective dial mobile telephone system is in operation. This is referred to as the improved mobile telephone system (IMTS). For this service there are eleven channels allocated in the 150-MHz band. When such a telephone is installed in your car or other land vehicle, you will be able to dial any telephone in your area without contacting a mobile service operator. Furthermore, in traveling into other cities you will be able to dial into their radio system and make calls to any telephone in the area. It is to be anticipated that the system will become nationwide and from any location you will be able to dial any telephone in this country.

A basic plan of such a system is shown in Fig. 2-17. For a large coverage area there is a centrally located group of highpowered transmitters, one for each channel and in any given location, up to a maximum of eight channels. Base receivers spotted conveniently around the area feed signals over wirelines to the central office. The most favorable signal is switched into the telephone system for use. In small-coverage areas it is possible that a single low-powered base transmitter and single co-sited receiver is adequate.

Each mobile unit consists of the transmitter-receiver combination and control unit, plus the channel-switching facilities and signaling circuits. Each unit is equipped to operate on at least all of the channels active in a phone area. For subscribers who are on the road, the mobile set may be equipped with additional channels up to a maximum of eleven. Full duplex operation will be included.

A special and very significant feature of the IMTS system is a feature referred to as multichannel access. A mobile unit automatically seeks an idle channel. Thus, when a mobile unit is activated, it will automatically seek an idle channel and establish a link from mobile to base station. The next call in either direction will then be completed over that channel. When this channel is occupied, all other mobiles in the area will automatically seek another idle base-station channel to establish still another connection. It is anticipated that each



(A) Basic plan.



(B) Subscriber mobile telephone.

Fig. 2-17. IMTS mobile telephone system.

channel will be able to serve a maximum of forty to sixty mobile units. The entire operation will be automatic, and in most cases it will not be necessary to call through a mobile service operator.

# LAND TRANSPORTATION RADIO SERVICES

The Land Transportation Radio Services set aside parts of the radio spectrum to be employed for radio communication and control facilities in certain land-transportation operations. Such facilities may not be used either to render a commoncarrier communications service or to carry broadcast-program material.

Communications must be related directly to the safety of life or the protection of important property. Permissible communications may also involve the efficient operation of the transportation system described in the application and defined in the rules of eligibility for the particular service.

In general, both the station and operator requirements are the same as those applicable to the Industrial Radio Services. For stations that transmit above 25 MHz, the operators need not be licensed, but they must be authorized to operate by the licensee. For stations that transmit on frequencies below 25 MHz, operator licenses are required except for mobile operators who operate under the jurisdiction of a base station, at which point a licensed operator is on duty. Refer to the operator requirements as discussed under the Industrial Radio Services.

#### **Station Categories**

There are four major categories in the Land Transportation Service; these are motor carrier, railroad, taxicab, and automobile emergency radio services. In the taxicab radio service, certain frequencies are set aside for base and mobile units, mobile use only, and base use only. Since there is considerable communication activity in handling a fleet of taxicabs, frequency allocations are often made in pairs, one frequency for the base station and a second frequency for the mobile units. Thus, the base station is able to hear all of the mobile units, but each mobile unit can only receive the base station. A mobile unit does not hear the other mobile units, and thus considerable two-way radio confusion is avoided. Radiocommunication can then be handled more efficiently and effectively from the base station.

Those eligible for licensing in the automobile emergency radio service are associations of owners of private automobiles who provide a private emergency road service for disabled vchicles, and those regularly engaged in the business of providing for the general public, emergency road service for disabled vehicles. Communications must be limited to the safety of life or the protection of important property, and communications required for dispatching repair trucks, tow trucks, or other road-service vehicles to disabled vehicles. Also, associations or owners of private automobiles which provide emergency road service may transmit communications for the purpose of reporting traffic conditions on occasions of abnormal vehicular congestion.

#### **Motor Carrier Radio**

An active category of the Land Transportation Service has to do with motor carriers. Frequencies are available for persons engaged in providing a common or contract motor-carrier passenger-transportation service between urban areas, or for those who operate such a service within such an area. Frequencies are available for those persons primarily engaged in providing a common or contract motor-carrier property-transportation service between urban areas or for local distribution or collection of property. Trucking concerns are a principal user of these radio assignments.

One of the earliest motor-carrier radio systems is operated by the Lansdale Transportation Company. They operate a 250-watt remote controlled transmitter from their central office. Motor-carrier trucks, repair trucks, and service cars are equipped with mobile stations. The base-station antenna is well over 150 feet above the ground level and reliable communications is maintained within a radius of 30 miles with some consistent communications even beyond this limit.

The control point is shown in Fig. 2-18. Through the window the control-point operator can observe the loading areas below as well as maintain contact with trucks in transit. Microphone and operational controls are in front of the operator. To his left and above are the required monitoring facilities; these include a carrier-operated device and the required aural monitors.



Fig. 2-18. Radio control and traffic-dispatch point of Lansdale Transportation Co.

#### **Railroad Radio**

Railroads have a variety of applications for two-way radio when regularly engaged in the transportation of passengers or property. Facilities may be used in connection with operation or maintenance including use in connection with motor vehicles engaged in the pick-up, delivery, or transfer of property between stations. Since railroads stretch out over considerable distances, there is a need for relay as well as repeater stations.

In lieu of call letters for identification, the railroad radio services may use the name of the railroad and train number, caboose number, engine number, or name of fixed wayside stations. Unit identifiers may also be employed if they are kept on record. The Citizens Radio Service has had a phenomenal growth, as attested by the hundreds of thousands of transmitters now in operation. Segments of the frequency spectrum have been set aside in the Citizens Radio Service to provide for a private short-distance radiocommunications service for the business or personal activities of licensees, for radio signaling, and for the control of remote objects or devices by means of radio. Any citizen of the United States who is eighteen or more years of age (or twelve years for a Class-C station) may obtain a station license in this service if his application meets the requirements of the Citizens Radio Service. Partnerships, associations, trusts, or corporations meeting the requirements of the Citizens Service, including any state, territorial, or local governmental entity, or any service organization or association, including civil defense, may also be licensed.

A station license is required. For Class-A stations, FCC Form 400 must be completed; for station Classes B, C, or D, FCC Form 505 must be completed. You may not operate your Citizens radio equipment under another person's license, nor may you lend your call sign to someone else. No radio operator license is required for the normal operation of a Citizens radio station. However, you are still responsible for knowing and abiding by the laws, rules and regulations, and operating procedures applicable to the Citizens Radio Service.

Citizens radio station users must expect and tolerate interference not only from other legally operating Citizens radio stations, but sometimes from stations legally operating in other radio services. Class-C and -D radio-station users must expect and tolerate interference from industrial, scientific and medical equipment in the 26.96 to 27.28 MHz band. Licensees of Class-A stations must apply for a new authorization before shifting frequency to avoid interference; licensees of Class-B, -C, or -D stations may shift to any of the frequencies available in their respective classes without securing any further authorization.

A commercial radio operator license of the proper class (minimum second-class radiotelephone license) is required for adjustment to any Citizens radio transmitter during installation, testing, or servicing, that may cause the transmitter to operate off-frequency or in a manner which may in other ways violate the rules. For Class-A stations authorized to use telegraphy, a commercial radiotelegraph operator license (minimum third-class radiotelegraphy) of the proper class is required.

# **Restrictions On Use**

The FCC has had to be very specific in stating those activities that cannot be engaged in by Citizens radio users. There have been numerous improper interpretations of the applicable rules and regulations. Too often regulations have been broken by those who have had just a very short-term, and largely nontechnical association with two-way radio. It is unfortunate that they often flout the law and take it into their own hands instead of using due process in the organization of this new service. The radio spectrum is indeed finite and there are pressing needs for frequency spectra for a great variety of radio services. If the radio spectrum were used in accordance with each individual's personal inclinations, it would indeed reduce radio transmission to a useless hodgepodge. Order and responsibility must prevail if efficient and effective use of the radio spectrum is to be sustained.

Citizens radio stations must not be used for any purpose contrary to the law or for broadcasting to the public in any way, or for unnecessary or frivolous communications. All communications must be necessary and must relate to the personal or business activities of the licensee concerned.

Except as may be specifically authorized on the station license, the transmission or reception of messages for third parties is prohibited, and no charge may be made for the use of a Citizens radio station. They likewise may not be used as links in the physical circuits of other radio services, although certain classes of these stations may be used for the mechanical control or turning on and off of stations in other services. The licensee is responsible at all times for the operation of stations licensed to him. Exact statements of prohibited uses are as follows:

(a) A Citizens radio station shall not be used:

(1) For engaging in radio communications as a hobby or diversion, i.e., operating the radio station as an activity in and of itself. NOTE: The following are typical, but not all inclusive, examples of the types of communications evidencing a use of Citizens radio as a hobby or diversion which are prohibited under this rule:

"You want to give me your handle and I'll ship you out a card the first thing in the morning"; or "Give me your 10-20 so I can ship you some wallpaper." (Communications to other licensees for the purpose of exchanging socalled "QSL" cards.)

"I'm just checking to see who is on the air."

"Just calling to see if you can hear me. I'm at Main and Broadway."

"Just heard your call sign and thought I'd like to get acquainted"; or "Just passing through and heard your call sign so I thought I'd give you a shout."

"Just sitting here copying the mail and thought I'd give you a call to see how you were doing." (Referring to an intent to communicate based solely on hearing another person engaged in the use of his radio.)

"My 10-20 is Main and Broad Streets. Thought I'd call so I can see how well this new rig is getting out."

"Got a new mike on this rig and thought I'd give you a call to find out how my modulation is."

"Just thought I would give you a shout and let you know I am still around. Thanks for coming back."

"Clear with Venezuela. Just thought I'd let you know I was copying you up here."

"Thought I'd give you a shout and see if you knew where the unmodulated carrier was coming from."

"Just thought I'd give you a call to find out how the skip is coming in over at your location."

"Go ahead breaker. What kind of a rig are you using? Come back with your 10-20."

(2) For any purpose, or in connection with any activity, which is contrary to Federal, State, or local law.

(3) For the transmission of communications containing obscene, indecent, or profane words, language, or meaning.

(4) To carry communications for hire, whether the remuneration or benefit received is direct or indirect.

(5) To communicate with stations authorized or operated under the provisions of other parts of this chapter, with unlicensed stations, or with United States government or foreign stations, except for communications pursuant to  $\S$  95.85 (b) and 95.121. (6) For any communication not directed to specific stations or persons, except for: (i) Emergency and civil defense communications as provided in §§ 95.85 (b) and 95.121 respectively, (ii) test transmissions pursuant to § 95.93, and (iii) communications from a mobile unit to other units or stations for the sole purpose of requesting routing directions, assistance to disabled vehicles or vessels, information concerning the availability of food or lodging, or any other assistance necessary to a licensee in transit.

(7) To convey program material for retransmission, live or delayed, on a broadcast facility.

Note: A Class-A, Class-B, or Class-D station may be used in connection with the administrative, engineering, or maintenance activities of a broadcasting station; a Class-A, Class-B, or Class-C station may be used for control functions by radio which do not involve the transmission of program material; and a Class-A, Class-B, or Class-D station may be used in the gathering of news items or preparation of programs; *Provided*, That the actual or recorded transmissions of the Citizens radio station are not broadcast at any time in whole or in part.

(8) To interfere maliciously with the communications of another station.

(9) For the direct transmission of any material to the public through public address systems or similar means.

(10) To transmit superfluous communications, i.e., any transmissions which are not necessary to communications which are permissible.

(11) For the transmission of music, whistling, sound effects, or any material for amusement or entertainment purposes, or solely to attract attention.

(12) To transmit the word "MAYDAY" or other international distress signals, except when a ship, aircraft, or other vehicle is threatened by grave and imminent danger and requests immediate assistance.

(13) For transmitting communications to stations of other licensees which relate to the technical performance, capabilities, or testing of any transmitter or other radio equipment, including transmissions concerning the signal strength or frequency stability of a transmitter, except as necessary to establish or maintain the specific communication. (14) For relaying messages or transmitting communications for a person other than the licensee or members of his immediate family, except: (i) communications transmitted pursuant to emergency and approved business uses and, (ii) upon specific prior Commission approval, communications between Citizens radio stations at fixed locations where public telephone service is not provided.

(15) For advertising or soliciting the sale of any goods or services.

(16) For transmitting messages in other than plain language. Abbreviations, including nationally or internationally recognized operating signals, may be used only if a list of all such abbreviations and their meanings are kept in the station records and made available to any Commission representative on demand.

(b) A Class-D station may not be used to communicate with, or attempt to communicate with, any unit of the same or another station over a distance of more than 150 miles.

(c) A licensee of a Citizens radio station who is engaged in the business of selling Citizens radio-transmitting equipment shall not allow a customer to operate under his station license. In addition, all communications by the licensee for the purpose of demonstrating such equipment shall consist only of brief messages addressed to other units of the same station.

It is the licensee's responsibility to see that his equipment is at all times operating in accordance with the rules of the Citizens Radio Service. Off-frequency operation can be guarded against by having measurements made by a properly licensed person who has the frequency-measuring equipment and the skill required to use it. Frequency checks should be made at least each six months. A licensed commercial operator of an appropriate class is required for any adjustments that might affect the proper operation of the system. Therefore it is not wise to tamper with any CB transceiver unless you are properly licensed and equipped.

The Citizens Radio Service, when properly used, is a valuable communications tool for the professional man (such as the doctor and the engineer), the small business man, and the plain citizen. Improperly used, it can be made useless to everyone because of excessive interference.

#### **Station Categories**

The four channel classifications are A, B, C, and D. Radio control of remote objects or devices comes under the heading of Class-B and Class-C operation. Class-C operation applies only to radio control, and six specific frequencies between 26.995 and 27.255 MHz are assigned to this service. The maximum power input is 30 watts on 27.255 MHz, and it is limited to 5 watts on the other five channels. Radio remote control can also be used on the single Class-B frequency of 465 MHz. A Class-B station may also use voice transmission on this frequency.

For voice communications there are 48 Class-A channels between 462.55 and 466.45 MHz. Either of two forms of modulation, amplitude or frequency, may be used, and a maximum power input of 60 watts is permissible. There are no restrictions on antenna heights.

Class-D assignments are the most popular and they consist of 23 channels located between 26.965 and 27.255 MHz. All 23 channels may be used for communications between units of the same station. However, only certain designated channels may be employed for communication between units of different stations.

Inasmuch as short-range transmission is intended, the maximum power input for these stations is limited to 5 watts. Furthermore, the antenna must fall within at least one of the following categories:

- 1. The antenna and its supporting structure does not exceed 20 feet in height above ground level.
- 2. The antenna and its supporting structure does not exceed by more than 20 feet the height of any natural formation, tree or man-made structure on which the antenna is mounted.
- 3. The antenna is mounted on the transmitting-antenna structure of another authorized station, and it does not exceed the height of the antenna supporting structure of the other station.
- 4. The antenna is mounted on and does not exceed the height of an antenna mounting structure otherwise used solely for receiving purposes, which structure itself complies with condition 1 or 2 above.

#### **Citizens Band Equipment and Uses**

The Citizens Radio Service has many uses, and it is particularly attractive because low-cost efficient equipment is available, and almost everyone is eligible for such a license. The family base-mobile installation is particularly popular. The base station unit (Fig. 2-19A) is installed at home, and a mobile transceiver (Fig. 2-19B) is installed in the family car. When one member of the family is shopping or running errands, he or she is able to maintain contact with home; delays, plan changes, and additional shopping activities can be confirmed and arranged via two-way radio. Often the time of departure from a man's business or place of employment is quite indefinite. At a reasonable distance from home, a mobile-to-home contact can be made to let the family know he is on the way home, or possibly to do some last-minute errands on the home trip.



(A) Base unit of family station.

(B) Mobile unit in auto.

Fig. 2-19. Family base-mobile CB installation.

Of course, the two-way radio is handy in case of a car breakdown or other delays. In many localities it is not only possible to call home, but by calling a station operated by a garage or service station, assistance can be obtained if necessary. This is often quite helpful on long trips, because breakdowns on turnpikes often involve considerable delay if you have to await the routine scheduled trip of a repair truck along the highway. It is to be anticipated that a national calling frequency on the Citizens band will be used on a nationwide basis. Therefore a variety of services can be arranged for via two-way radio, such as lodging, repairs, location and traffic guidance, medical assistance, etc. Channel 9 has been set aside for emergency use.

Citizens radio can be a special boon to the small business man. Any type of pickup and/or delivery service can derive benefit in terms of reporting delays, breakdowns, changes in routing and last minute pickups or deliveries. A home oildelivery service represents only one example of many small businesses that can use Citizens band radio to advantage. Enroute trucks can be informed of call-ins from customers right after the phone calls have been completed and while the trucks may be in the very vicinity of the customer's location. Parts jobbers in the service fields use Citizens radio to advan-



Courtesy Raytheon Company Fig. 2-20. Hand-held CB transceiver.

tage in making their deliveries to retail stores and service shops. Communications can even be maintained between the main store and outlying branches of various types of businesses.

Professional people can use Citizens radio for maintaining contact between car and office. Late call-ins or emergencies can be radioed to the doctor as he makes his rounds. A veterinarian making his farm calls can keep in close touch with his office.



Fig. 2-21, CB boat radiotelephone.

There is quite a variety of Citizens radio equipment. Base stations in general are designed to operate from 110-volt ac, while the mobile units operate from the dc of the car battery. Some transceivers can be used with either type of input power. Still other equipment is of the hand-held type (Fig. 2-20), and is battery operated. Conventional batteries can be used in such a unit, or the more recent rechargeable types can be employed. With the latter type it is possible to recharge the batteries overnight using a small charging unit that is driven by 110-volt ac power.

Citizens radio can have many public-service functions, being used for liaison work for trade shows, fairs, or other large private or public events. Emergency activities, traffic control, parades, sporting events, etc. can often be expedited with two-way radio gear.

Citizens band operation need not be confined to land transportation. Transceivers can be installed in aircraft or boat
(Fig. 2-21). Furthermore, contacts can be made with base stations as well as other types of mobile stations. For example, an aircraft unit can communicate with a unit installed in a car moving along the highway, or a contact can be established between a small pleasure boat and a car driving along the shore.

# 3

## Radio Broadcast Operation

In recent years, radio announcers and other nontechnical broadcast personnel have become increasingly involved with several of the more technical phases of radio broadcasting. Two reasons for this trend are station economies and the development of more stable and trouble-free transmitters.

In fact, it is now advisable that any person who wishes to enter the field of broadcasting, whether it is programming, announcing, or the technical phases, would do well to hold as a minimum qualification any grade of radio operator license with a broadcast endorsement. Elements I, II, and IX of the FCC examination must be passed.

The license endorsement is valid in standard a-m broadcast stations of any operating power and in most a-m stations that use directional antennas. The endorsement is not valid in certain a-m stations with critical directional antenna patterns. Endorsement is valid in all fm broadcast stations, commercial and educational. In each of the mentioned station categories such a license is valid, provided certain technical requirements are met.

#### **TECHNICAL CONSIDERATIONS**

The Federal Communications Commission is concerned with the technical makeup of the signal that is radiated from the antenna of a radio broadcast station. Certain strict technical requirements have been set down with regard to this radiated signal so that it may be used effectively by the radio receivers tuned to its frequency. This broadcast signal must not interfere unduly, within the state of the science, with stations operating on other channels. Likewise, its radiation must be such that it does not interfere, within certain established interference conditions, with stations in other areas operating on the same frequency. Hence, the radiated power output of the broadcast station must be held within FCC specified limits.

Each broadcast station must operate on its assigned frequency within a very tight tolerance. Broadcast channels are closely spaced, and the radiated signal must not drift in frequency so as to interfere with stations operating on adjacent channels.

The voice or music signal that is applied to the radio-frequency wave must be added in an efficient and correct manner. Stated technically, the radio-frequency carrier must be properly modulated by the voice or music signal. When a radio-frequency carrier is modulated fully, it is said to be 100% modulated. Only the strong peak-audio passages modulate the carrier to this full extent. The average content of voice or music may modulate the carrier approximately 70%.

If the voice or music components are too strong in comparison to the strength of the radio-frequency carrier, the transmitter is said to be overmodulated. When the transmitter is overmodulated, the signal, as it is recovered in a radio receiver tuned to the station frequency, may be distorted. When a transmitter is overmodulated, it generates what are called spurious signals. These signals appear on frequencies other than the one which has been assigned to the station. Thus overmodulation can cause interference in the reception of broadcast stations using other frequencies.

A transmitter can also be inadequately modulated. In this case the radio carrier is too strong in comparison to the audio that it is to convey. Under these conditions the broadcast station does not attain its maximum range of transmission and the signals sound weak in all but those locations close to the broadcast antenna.

In summary, the FCC imposes strict requirements in terms of the strength of a signal radiated from the antenna of a

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broadcast station, the frequency of the radiated signal, and whether or not this radio carrier is modulated correctly by the voice and music components.

#### The Operator's Responsibilities

The meters and indicators with which the broadcast operator is concerned provide a visual indication of just how well the broadcast transmitter is meeting the technical requirements and considerations. Thus the surveillance of these meters is of significance both in terms of the quality of the broadcast transmission, and the station's compliance with the FCC technical standards.

The broadcast operator must keep a routine watch on these meter readings. He must make appropriate adjustments to keep the meter readings within specified limits. In fact, a regular log of these meter readings must be kept, manually or automatically, to ensure compliance with FCC rules and regulations. If the readings do not meet or stay within certain limits, appropriate corrections must be made or, in the extreme case, the transmitter must be shut down and the necessary repairs and adjustments made.

Proper attitudes toward technical operating responsibilities are very important, because improper operation may bring an FCC citation or, in the extreme case, may result in a fine or loss of license.

#### WHAT THE METERS TELL

There are several key monitoring meters; two of these meters are the final plate voltage and the final plate current. Typical meter faces are shown in Chapter 6. The final plate voltage must be of correct value for operation of the stage that generates the final high-powered radio-frequency carrier. The normal voltage is usually several thousands of volts. If the voltage is too low the final stage will not generate a strong enough rf carrier. If the final plate voltage is too high, the power output may be too great or the associated equipment may be damaged.

The final plate-current meter indicates how much current the final rf power amplifier is drawing. It is an indication of how well this stage is operating, and whether or not it is supplying the proper level of power to its output circuit. Most transmitters provide facilities for making adjustments on these quantities so that operation of the transmitter may be set at some optimum plate voltage and plate current.

A third meter is the power-output meter. It provides a measure of the power that is being transferred from the final stage of the transmitter to the radiating antenna, via the transmission line. This output is read on an rf antenna-current meter, or a calibrated indicator called a reflectometer.

The output-meter reading is very important because it tells just how well the rf power being generated by the transmitter is transferred to the antenna and how well the antenna system is operating. Depending on system design, the actual reading may change with weather and moisture conditions. Adjustments can usually be made to compensate for weather and terrain effects.

Another key indicator is the frequency meter. This meter shows if the frequency of the generated rf carrier drifts from its assigned value. The meter scale is calibrated in hertz or kilohertz. The calibrations found on either side of the zeroreading center tell whether the frequency of the carrier is above or below the assigned value.

The final meter of importance is the modulation meter. This meter indicates how effectively the voice or music components are modulating the rf carrier. The calibration is given in percentage, showing 100% when the carrier is being fully modulated. Lower level of modulation is indicated by a lower percentage reading. If the voice or music components are made too strong for proper modulation of the rf carrier, the meter will indicate a modulation percentage in excess of 100. Often a flasher or clacking relay will indicate when the transmitter is being overmodulated.

#### **FCC** Limits

It would be an impractical and uneconomical design situation if a transmitter would have to be operated according to a precise authorization. The FCC allows certain drifts in operating conditions provided they do not exceed specified limits. As the state of the broadcast science has progressed, these tolerances have been tightened to provide more reliable and interference-free broadcasting. On the a-m broadcast band the frequency stability of the carrier must be such that it does not drift in excess of  $\pm 20$  hertz. On the much higher-frequency fm broadcast band, the maximum permissible drift or deviation of the carrier center frequency is  $\pm 2000$  hertz.

Relative to modulation, the average peak modulation should be not less than 85% and no more than 100%. These percentages refer to the higher amplitude passages to be transmitted. Of course, many of the weaker voice and music components will modulate less than 85% as observed on the modulation meter. The average peak amplitude should be kept high so as to maintain the proper range of transmission. However, the level must not exceed 100% to avoid distortion and splatter into adjacent channels.

Normally the operating power may not exceed the rated power by more than 5%, nor be less than the rated power output by more than 10%.

Some meters are calibrated to show these limit points. Other more elaborate meters also include automatic warning systems that respond whenever the transmitter conditions exceed specific limits.

#### THE ENDORSEMENT OPERATOR

Except at times when the operation of the station is under the immediate supervision of an operator holding a valid radiotelephone first-class operator license, adjustment of the transmitting equipment by the endorsement operator shall be limited to the following:

- 1. Adjustment necessary to turn the transmitter on and off.
- 2. Adjustment of the external controls as may be required for voltage fluctuation in the power supply.
- 3. Adjustment of external controls to maintain modulation of the transmitter within the prescribed limits.
- 4. Adjustment of external controls necessary to effect routine changes in operating power which are required by the station's instrument of authorization.
- 5. Adjustment of external controls necessary to effect operation in accordance with a national defense emergency authorization during an emergency action condition.
- 6. Switching steps to change between directional and nondirectional operation, or between two directional patterns.

It is the responsibility of the station licensee to make certain that the persons doing the logging and meter reading be properly instructed. When necessary, step-by-step instructions shall be posted for those transmitter adjustments which the lesser grade operator is authorized to make.

In the event that the transmitter is observed to be operating in a manner inconsistent with its instrument of authorization when an operator holding a valid first-class radiotelephone license is not immediately available and none of the above adjustments is effective in correcting the condition, the transmitter shall be shut down.

The endorsement operator must keep a transmitter log when on duty or an approved automatic logging system must be installed. Typical a-m and fm transmitter logs are shown in Fig. 3-1. Notice that there is a column for each of the key

_	POWER		FREQU	JENCY	LO	CATION
IME	FINAL PLATE CURRENT	FINAL PLATE VOLTAGE	ANTENNA CURRENT	FREQUENCY DEVIATION	REMAR	lks
FM T	CALL LETTI RANSMITT	ERS ER LOG	FREQU	JENCY	D	

Fig. 3-1. Typical transmitter logs.

meter readings discussed previously, with the exception of the modulation meter. The modulation-meter reading is a changing quantity that follows the voice and music variations. The modulation-meter readings need not be recorded, but the modulation peaks must be kept within established limits. The general transmitter log requirements are as follows:

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#### § 73.113 Operating Log.

(a) The following entries shall be made in the operating log:

(1) An entry of the time the station begins to supply power to the antenna and the time it stops.

(2) An entry of each interruption of the carrier wave, where restoration is not automatic, its cause and duration followed by the signature of the person restoring operation (if operator other than the licensed operator on duty).

(3) An entry, at the beginning of operation and at intervals not exceeding one-half hour, of the following (actual readings observed prior to making any adjustments to the equipment) and, when appropriate, an indication of corrections made to restore parameters to normal operating values:

(i) Operating constants of last radio stage (total plate voltage and plate current).

(ii) Antenna current or common point current (if directional) without modulation, or with modulation if the meter reading is not affected by modulation.

(iii) Frequency monitor reading.

(4) An entry each day of the following where applicable:

(i) Antenna base current(s) without modulation, or with modulation if the meter reading is not affected by modulation, for each mode of operation:

(a) Where remote antenna meters or a remote common point meter are normally employed but are defective.

(b) Where required by the station license for directional antenna operation.

(ii) Where there is remote control operation of a directional antenna station, readings for each pattern taken at the transmitter (within 2 hours of commencement of operation with each pattern) of:

(a) Common point current without modulation, or with modulation if the meter reading is not affected by modulation.

(b) Base current(s) without modulation, or with modulation if the meter reading is not affected by modulation.

(c) Phase monitor sample loop current(s) without modulation or with modulation if the meter reading is not affected by modulation.



(d) Phase indications.

(5) Any other entries required by the instrument of authorization or the provisions of this part.

(6) The entries required by § 17.49 (a), (b) and (c) of this chapter concerning daily observations of tower lights.

(b) Automatic devices accurately calibrated and with appropriate time, date and circuit functions may be utilized to record the entries in the operating log: *Provided*, That:

(1) They do not affect the operation of circuits or accuracy of indicating instruments of the equipment being recorded;

(2) The recording devices have an accuracy equivalent to the accuracy of the indicating instruments;

(3) The calibration is checked against the original indicators at least once a week and the results noted in the maintenance log;

(4) Provision is made to actuate automatically an aural alarm circuit located near the operator on duty if any of the automatic log readings are not within the tolerances or other requirements specified in the rules or instrument of authorization;

(5) Unless the alarm circuit operates continuously, devices which record each parameter in sequence must read each parameter at least once during each 10-minute period and clearly indicate the parameter being recorded;

(6) The automatic logging equipment is located at the remote control point if the transmitter is remotely controlled, or at the transmitter location if the transmitter is manually controlled;

(7) The automatic logging equipment is located in the near vicinity of the operator on duty and is inspected by him periodically during the broadcast day; and

(8) The indicating equipment conforms with the FCC requirements except that the scales need not exceed 2 inches in length and arbitrary scales may not be used.

The broadcast station is also responsible for a program log. Quite often this is also the task of the endorsement operator on duty. Automatic program logging is also permissible. Quite often this is done on tapes with the appropriate insertion of additional required time information. Some general FCC requirements for a program log are as follows:

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#### § 73.112 Program Log.

(a) The following entries shall be made in the program log:

(1) An entry of the time each station identification announcement (call letters and location) is made.

(2) An entry briefly describing each program broadcast, such as "music," "drama," "speech," etc., together with the name or title thereof, and the sponsor's name, with the time of the beginning and ending of the complete program. If a mechanical record is used the entry shall show the exact nature thereof, such as "record," "transcription," etc., and the time it is announced as a mechanical record. If a speech is made by a political candidate, the name and political affiliations of such speaker shall be entered.

(3) An entry showing that each sponsored program broadcast has been announced as sponsored, paid for, or furnished by the sponsor.

(4) An entry showing for each program of network origin, the name of the network originating the program.

(b) No provision of this section shall be construed as prohibiting the recording or other automatic maintenance of data required for program logs. However, where such automatic logging is used, the licensee must comply with the following requirements:

(1) The licensee, whether employing manual or automatic logging or a combination thereof, must be able accurately to furnish the Commission with all information required to be logged:

(2) Each recording, tape, or other means employed shall be accompanied by a certificate of the operator or other responsible person on duty at the time or other duly authorized agent of the licensee, to the effect that it accurately reflects what was actually broadcast. Any information required to be logged which cannot be incorporated in the automatic process shall be maintained in a separate record which shall be similarly authenticated;

(3) The licensee shall extract any required information from the recording for the days specified by the Commission or its duly authorized representative and submit it in written log form, together with the underlying recording, tape or other means employed.

Study complete details in Appendix IV Sec. 73.112.

#### STATION PLANS

If a station is to be made acceptable for operation by a third-class endorsement operator, the various indicating meters and operating controls must be made accessible to the operator at his normal on-duty position as announcer and/or control-board operator. A typical station arrangement is shown in Fig. 3-2. In this plan the entire station is incorpo-



Courtesy RCA

Fig. 3-2. Typical station arrangement.



Fig. 3-3. Station WIFI control panel shown with an operator on duty.

rated into a compact arrangement which includes transmitter, control room, and studio. The key transmitter readings can be observed when the front panel of the transmitter faces the control console. The equipment rack to the left of the operating position houses the frequency and modulation monitors. From his operating position the control-room operator can also look through a window into the studio.

Actually, there are three basic acceptable arrangements. In some installations the transmitter is installed in such a manner that it is visible through an appropriate window. Such is the case for fm broadcast station WIFI, Philadelphia (Fig. 3-3). The third-class endorsement announcer/operator can keep a



Fig. 3-4. Operating position of station WDVR.

watch on transmitter meters from the operating position at the control console. Modulation and frequency meters are located on an equipment rack to the operator's left.

A second acceptable arrangement is shown in Fig. 3-4. In the case of fm broadcast station WDVR, Philadelphia, the control console position looks into the studio. The transmitter proper is located in an adjacent room and is not in the range of vision of the operator on duty. In this case, however, a duplicate set of key meters are mounted on the equipment rack to the rear of the operator (Fig. 3-5). These meters are connected via wires to the metering circuits of the transmitter. The equipment rack in back of the operating position also houses the frequency and modulation monitors.



Fig. 3-5. Meter-monitoring grouping in a control room.

#### **Remote Control**

A third acceptable arrangement uses remote-control facilities. In this arrangement the transmitter may be located at a site which is quite a distance from the control-console operating position. However, at the operating position there will be a remote-control panel which can be used to control transmitter circuits and operation over interconnecting telephone lines. In this case appropriate metering facilities that can be used to evaluate the transmitter performance from the operting position are installed in the control room. Likewise, suitable switches and controls are included that permit the required transmitter adjustments covered to be made remotely. The FCC requires that certain other stipulations be met before a remote control installation can be authorized:

#### §73.67 Remote Control Operation

(a) Operation by remote control shall be subject to the following conditions:

(1) The equipment at the operating and transmitting positions shall be so installed and protected that it is not accessible to or capable of operation by persons other than those duly authorized by the licensee.

(2) The control circuits from the operating positions to the transmitter shall provide positive on and off control and shall be such that open circuits, short circuits, grounds or other line faults will not actuate the transmitter and any fault causing loss of such control will automatically place the transmitter in an inoperative position.

(3) A malfunction of any part of the remote control equipment and associated line circuits resulting in improper control or inaccurate meter readings shall be cause for the immediate cessation of operation by remote control.

(4) Control and monitoring equipment shall be installed so as to allow the licensed operator at the remote control point to perform all the functions in a manner required by the Commission's rules.

(5) The indications at the remote control point of the antenna current meter or, for directional antennas, the common point current meter and remote base current meters,



**Courtesy Mosely Associates** 

Fig. 3-6. Remote-control panel.

shall be read and entered in the operating log each half hour.

(6) The indications at the transmitter, if a directional antenna station, of the common point current, base currents, phase monitor sample loop currents and phase indications shall be read and entered in the operating log once each day for each pattern. These readings must be made



Courtesy WEJL and Bauer Electronics Fig. 3-7. Automatic log installation.





within two hours after the commencement of operation for each pattern.

A typical remote-control metering panel is shown in Fig. 3-6. In the example, as many as 25 meter readings can be taken over the interconnecting wire lines. To take a sample of a given current at the transmitter, appropriate relays are activated by dialing. This sample will then operate the remote meter, and its reading can be compared with the normal value shown on the index. The control below the index chart can then be used to make the necessary adjustment to establish a normal reading for the particular circuit under scrutiny.

A-m broadcast station WEJL, Scranton, Pennsylvania, uses an automatic-log installation (Fig. 3-7). The unit is housed in the light panel of the equipment rack. The recording log is shown at the lower right of the panel. Samples of antenna current, plate voltage, plate current, and frequency deviation are recorded on calibrated paper, as shown in Fig. 3-8.

The log-alarm unit also includes a frequency meter and a power meter. In the case of the frequency meter, two limit positions, ten hertz on each side of center, are set up. Whenever the carrier frequency drifts beyond the ten-hertz limit, a warning light is turned on and an alarm is sounded (in the case of WEJL, in the control room and in the station hallway).

The power alarm is set for 90% and 105% power conditions. If these limits are exceeded the alarm circuits will also be energized.

Three switches are located at the lower left. One turns the power on; the second and third switches select either automatic or manual control of the switching process that samples and records the meter readings on the logging paper.

The indicator lights at the bottom center show the particular parameter being monitored at the instant. Calibrate and tower lights-on positions are also included.

## 4

## License Procedures And Operator Requirements

The examination for the third-class radiotelephone permit and broadcast endorsement can be taken at a district office of the FCC. A list of offices is given on pages 96 and 97. Application Form 756 must be completed. This form (pages 98 and 99) plus the appropriate license fee must be submitted to the local office prior to taking the examination. An application for a restricted radiotelephone operator permit is made by submitting Form 753 and the \$8.00 fee to the FCC office in Gettysburg, Pa. No examination is required.

The radio spectrum, being finite, must be regulated to provide space for the many services available. Frequencies must be allocated in segments according to the services each sector can best render. Rules of procedure must be established, and assignment and technical regulations enforced, if the universal benefits of communications are to be derived for all.

In the United States the regulatory agency is the Federal Communications Commission (FCC), established under the Communications Act of 1934. Important extracts of this act and the Rules and Regulations appear in the appendices. The United States is also bound by certain international agreements, because radio waves do not observe boundaries in their travels.

All the extracts in the appendices are of significance in preparing for the commercial radio operator's examinations. More than just a preparation for a test, they emphasize the responsibilities of a license holder. As a license holder, it is assumed that you know and will abide by the rules and regulations established for the radio service or services with which you are concerned.

Copies of the complete Rules and Regulations for the various radio services are available on subscription from the U.S. Government Printing Office, Washington 25, D.C. If your interest is in two-way radio, you should subscribe to Volume V (\$3.75), which includes aviation, public safety, industrial, and land-transportation radio services. If you have an additional interest in Citizens band radio, Volume VI (\$2.50) is available. For the maritime services, there is Volume IV (\$3.00). For broadcast services, Volume III is available at \$7.00.

Elements I and II are about the basic laws and operating practices. The answers given in following chapters to the test questions for Elements I and II are short, concise and yet adequate, to fit in with the direct answers associated with a multiple-choice type of examination. After many answers, the specific laws and regulations given in the appendices are referenced. Read the specific laws carefully. This step will improve your understanding and help you better retain the information you need to know.

Notice that safety and distress laws and procedures are stressed. You may never use this information while you are a license holder—but if a distress situation does arise in which you must play a part, there is no more-important knowledge.

The third-class radiotelephone permit is obtained by passing FCC examination elements I and II. Additional element IX must be passed to obtain the broadcast endorsement. Element IX relates to basic broadcasting, dealing mostly with definitions, responsibilities, and operating procedures.

Chapters 5, 6, and 7 give the answers to the study-guide questions suggested by the FCC. Know the exact answer to each question and you will have no trouble passing the appropriate FCC elements. Firm your knowledge by studying each reference to the appendices that follow Chapter 7.

#### § 13.22 Examination requirements.

Applicants for original licenses will be required to pass examinations as follows:

(f) Radiotelephone third-class operator permits:

(1) Ability to transmit and receive spoken messages in English.

(2) Written examination elements: 1 and 2.

(h) Restricted radiotelephone operator permit:

No oral or written examination is required for this permit. In lieu thereof, applicants will be required to certify in writing to a declaration which states that the applicant has need for the requested permit; can receive and transmit spoken messages in English; can keep at least a rough written log in English or in some other language in general use that can be readily translated into English; is familiar with the provisions of treaties, laws, and rules and regulations governing the authority granted under the requested permit; and understands that it is his responsibility to keep currently familiar with all such provisions.

#### § 13.27 Eligibility for reexamination.

An applicant who fails an examination element will be ineligible for 2 months to take an examination for any class of license requiring that element. Examination elements will be graded in the order listed (see § 13.21), and an applicant may, without further application, be issued the class of license for which he qualifies.

#### § 13.61 Operating Authority.

(g) Radiotelephone third-class operator permit. Any station except:

(1) Stations transmitting television, or

(2) Stations transmitting telegraphy by any type of the Morse Code, or

(3) Any of the various classes of broadcast stations other than noncommercial educational fm broadcast stations using transmitters with power rating of 10 watts or less, remote pickup broadcast stations and ST broadcast stations, or (4) Class I-B coast stations at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts, or

(5) Class II-B or Class III-B coast stations, other than those in Alaska, at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts, or

(6) Ship stations or aircraft stations other than those at which the installation is used solely for telephony and at which the power in the antenna of the unmodulated carrier wave is not authorized to exceed 250 watts: Provided, That (1) such operator is prohibited from making any adjustments that may result in improper transmitter operation, and (2) the equipment is so designed that the stability of the frequencies of the transmitter is maintained by the transmitter itself within the limits of tolerance specified by the station license, and none of the operations necessary to be performed during the course of normal rendition of the service of the station may cause off-frequency operation or result in any unauthorized radiation, and (3) any needed adjustments of the transmitter that may affect the proper operation of the station are regularly made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph as may be appropriate for the class of station involved (as determined by the scope of the authority of the respective licenses as set forth in paragraphs (a), (b), (e), and (f) of this section and § 13.62), who shall be responsible for the proper functioning of the station equipment, and (4) in the case ship radiotelephone or aircraft radiotelephone stations when the power in the antenna of the unmodulated carrier wave is authorized to exceed 100 watts, any needed adjustments of the tranmitter that may affect the proper operation of the station are made only by or under the immediate supervision and responsibility of an operator holding a first- or second-class radiotelephone license, who shall be responsible for the proper functioning of the station equipment.

(h) Restricted radiotelephone operator permit. Any station except:

(1) Stations transmitting television, or

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(2) Stations transmitting telegraphy by any type of the Morse Code, or

(3) Any of the various classes of broadcast stations other than remote pickup, broadcast STL, and fm intercity relay stations, or

(4) Ship stations licensed to use telephony for communication with Class I coast stations on frequencies between 4000 kHz and 30 MHz, or

(5) Radio stations provided on board vessels for safety purposes pursuant to statue or treaty, or

(6) Coast stations other than those in Alaska, while employing a frequency below 30 MHz, or

(7) Coast stations at which the power in the antenna of the unmodulated carrier wave is authorized to exceed 250 watts;

(8) At a ship radar station the holder of this class of license may not supervise or be responsible for the performance of any adjustments or tests during or coincident with the installation, servicing or maintenance of the radar equipment while it is radiating energy: Provided, That nothing in this subparagraph shall be construed to prevent any person holding such a license from making replacements of fuses or of receiving type tubes: Provided, That, with respect to any station which the holder of this class of license may operate, such operator is prohibited from making any adjustments that may result in improper transmitter operation, and the equipment is so designed that the stability of the frequencies of the transmitter is maintained by the transmitter itself within the limits of tolerance specified by the station license, and none of the operations necessary to be performed during the course of normal rendition of the service of the station may cause off-frequency operation or result in any unauthorized radiation, and any needed adjustments of the transmitter that may affect the proper operation of the station are regularly made by or under the immediate supervision and responsibility of a person holding a first- or second-class commercial radio operator license, either radiotelephone or radiotelegraph, who shall be responsible for the proper functioning of the station equipment.

#### §13.62 Special privileges.

The holder of a third-class radiotelephone operator permit with a broadcast endorsement may operate broadcast stations under the following conditions:

(1) A duty operator in a standard broadcast station of any operating power, or one employing a directional antenna provided the station authorization does not require that the ratio of the antenna currents in the elements be held within a tolerance which is less than 5% or the relative phase of those currents within a tolerance which is less than  $3^{\circ}$ , an fm broadcast station of any authorized power, or a noncommercial educational fm broadcast station. Adjustments of transmitting equipment, except when under the immediate supervision of the radiotelephone first class operator is limited to the following:

(i) Those necessary to commence or terminate transmitter emissions as a routine matter.

(ii) Those external adjustments that may be required as a result of variations of primary power supply.

(iii) Those external adjustments which may be necessary to insure modulation within the limits required.

(iv) Those adjustments necessary to effect any changes in operating power which may be required by the station's instrument of authorization.

(v) Those necessary to change between nondirectional and directional or between differing radiation patterns, provided that such changes require only activation of switches and do not involve the manual tuning of the transmitter final amplifier or antenna phasor equipment. The switching equipment shall be so arranged that the failure of any relay in the directional antenna to activate properly will cause the emissions of the station to terminate.

(2) A noncommercial educational fm broadcast station with authorized transmitter power output of more than 10 watts but not in excess of 1 kW: *Provided*, That adjustments of transmitting equipment by such operators, except under the immediate supervision of a radiotelephone first- or second-class operator shall be limited to those adjustments set forth in subparagraph (1), (i), (ii), and (iii) of this paragraph. (3) A noncommercial educational fm broadcast station with authorized transmitter power output of 10 watts or less: *Provided*, That adjustments of transmitting equipment by such operators, except under the immediate supervision of a radiotelephone first- or second-class operator or a radiotelegraph first- or second-class operator, shall be limited to those adjustments set forth in subparagraph (1), (i), (ii), and (iii) of this paragraph.

(4) Should the broadcast transmitting apparatus be observed to be operating in a manner inconsistent with the station's instrument of authorization and none of the adjustments specifically described under subparagraph (1), (2), or (3) of this paragraph are effective in bringing it into proper operation, an operator holding a lesser grade license than that which authorizes unlimited adjustment, with respect to the class of broadcast station involved, and not acting under the supervision of a person holding the higher grade license permitting such unlimited adjustment, shall terminate the station's emissions.

(5) Except in the case of noncommercial educational fm broadcast stations with authorized transmitter output power of 10 watts or less, the special operating authority granted in this section with respect to broadcast stations is subject to the condition that there shall be in regular fulltime employment at the station one or more operators of a class authorized to make or supervise all adjustments, whose primary duty shall be to effect and insure the proper functioning of the transmitting equipment. In the case of a noncommercial educational fm broadcast station with authorized transmitter output power of 10 watts or less such operator(s) shall nevertheless be available on call to make or supervise any needed adjustments.

(d) When an emergency action condition is declared, a person holding any class of radio operator license or permit who is authorized thereunder to perform limited operation of a standard broadcast station may make any adjustments necessary to effect operation in the emergency broadcast system in accordance with the station's National Defense Emergency Authorization: *Provided*, That the station's responsible first-class radiotelephone operator(s) shall have previously instructed such person in the adjustments to the transmitter which are necessary to accomplish operation in the Emergency Broadcast System.

#### § 1.1103 Payment of fees.

(a) Each application for which a fee is prescribed must be accompanied by a remittance in the full amount of the fee. In no case will an application for which a fee is prescribed be accepted for filing or processed prior to payment of the full amount specified. Applications for which no remittance is received, or for which an insufficient amount is received, may be returned to the applicant.

(d) All fees will be charged irrespective of the Commission's disposition of the application. Applications returned to applicants for additional information or corrections will not require an additional fee when resubmitted. Refunds will be made only in the case of payments in excess of the fee prescribed in this part.

#### § 1.1117 Schedule of fees.

(a) Except as provided in paragraph (c) of this section, applications filed on or after August 1, 1970, under this part must be accompanied by the fees prescribed below:

Applications for new renewal, duplicate or replacement operator license:

First-class license, either radiotelephone or	
radiotelegraph	\$5
Second-class license, either radiotelephone or	
radiotelegraph	4
Third-class permit, either radiotelephone or	
radiotelegraph	3
Restricted radiotelephone permit	8
Application for endorsement of operator license	2
Application for a verification card (FCC Form	
758-F) or for a verified statement (FCC Form 759)	2

(c) Whenever an application requests both an operator license and an endorsement the required fee will be the fee prescribed for the license document involved.

### Mailing Address for

Dist. No.	Office Location	Dist. No.	Office Location
1	BOSTON, MASSACHUSETTS 02109 1600 Custom House India & State Streets Phone: Area Code 617 223-6608		BEAUMONT, TEXAS 77701 239 Federal Building 300 Willow Street Phone: Area Code 713 835-3911
2	NEW YORK, NEW YORK 10014 748 Federal Building 641 Washington Street Phone: Area Code 212 620-5745	10	DALLAS, TEXAS 75202 707 Thomas Building 1314 Wood Street Phone: Area Code 214 749-3243
3	PHILADELPHIA, PENNSYLVANIA 19106 1005 U. S. Customhouse Second & Chestnut Streets Phone: Area Code 215 597-4412	11	LOS ANGELES, CALIFORNIA 90012 U. S. Courthouse, Room 1758 312 N. Spring Street Phone: Area Code 213 688-3276
4	BALTIMORE, MARYLAND 21201 819 Federal Building 31 Hopkins Plaza Phone: Area Code 301 962-2727	11SD	SAN DIEGO, CALIFORNIA 92101 Fox Theatre Building 1245 Seventh Avenue Phone: Area Code 714 234-6211
5	5 NORFOLK, VIRGINIA 23510 Granby & York Streets 400 Federal Building Phone: Area Code 703 627-7471		SAN PEDRO, CALIFORNIA 90731 300 South Ferry Street Terminal Island Phone: Area Code 213 831-9281
6	ATLANTA, GEORGIA 30303 1602 Gaslight Tower 235 Peachtree Street N. E. Phone: Area Code 404 562-6381	12	SAN FRANCISCO, CALIFORNIA 94111 323A Custom House 555 Battery Street Phone: Area Code 415 556-7700
65	SAVANNAH, GEORGIA 31402 238 Post Office Building York & Bull Streets Phone: Area Code 912 232-7602	13	PORTLAND, OREGON 97204 314 Multnomah Building 319 S.W. Pine Street Phone: Area Code 503 226-3361
7	M1AM1, FLORIDA 33130 919 Federal Building 51 S. W. First Avenue Phone: Area Code 305 350-5541	14	SEATTLE, WASHINGTON 98104 8012 Federal Office Building 909 First Avenue Phone: Area Code 206 583-7653
71	TAMPA, FLORIDA 33602 738 Federal Building 500 Zack Street Phone: Area Code 813 228-7711	15	DENVER, COLORADO 80202 504 New Customhouse 19th St. between California & Stout Streets Phone: Area Code 303 297-4054

### **Commission Field Offices**

Dist. No.	Office Location	ſ	Dist. No.	Office Location
8	NEW ORLEANS, LOUISIANA 70130 829 Federal Building South 600 South Street Phone: Area Code 504 527-2094		16	ST. PAUL, MINNESOTA 55101 691 Federal Building Fourth and Robert Streets Phone: Area Code 612 725-7819
8M	MOBILE, ALABAMA 36602 439 U.S. Court House 113 St. Joseph Street Phone: Area Code 205 433-3581		17	KANSAS CITY, MISSOURI 64106 1703 Federal Building 601 East 12th Street Phone: Area Code 816 374-5526
9	HOUSTON, TEXAS 77002 5636 Federal Building 515 Rusk Avenue Phone: Area Code 713 226-0611		18	CHICAGO, ILLINOIS 60604 1872 U. S. Courthouse 219 South Dearborn Street Phone: Area Code 312 353-5306
19	DETROIT, MICHIGAN 48226 1029 Federal Building Washington Blvd. & LaFayette Street Phone: Area Code 313 226-6077		23	ANCHORAGE, ALASKA 99501 54 U.S. Post Office Building 4th Avenue between F & G Streets Phone: Area Code 907 272-2822
20	BUFFALO, NEW YORK 14203 328 Federal Office Building 121 Elliott Street Phone: Area Code 716 842-3216		24	WASHINGTON, D. C. 20554 Room 216 1919 M Street, N.W. Phone: Area Code 202 632-7000
21	HONOLULU, HAWAII 96808 502 Federal Building P.O. Box 1021 Phone: 546-5640		_	GETTYSBURG, PENNSYLVANIA 17325 P. O. Box 441 Phone: Area Code 717 334-3109
22	SAN JUAN, PUERTO RICO 00903 322 Federal Building P.O. Box 2987 Phone: 772-4562			

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New Third Clas	e Permit		Replacement							
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UNITED STATES OF AMERICA

Form Approval. Budget Bareau He. 52-R080 12

PCC Perm 798 April 1988

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#### APPLICANT'S CERTIFICATION

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### Element I-Basic Law

I-l. Where and how is an operator license or permit obtained? —Request an application form and examination schedule from the nearest FCC field office. Submit the application in the prescribed form, including all subsidiary forms and documents accompanied by the prescribed fee, properly completed and signed, in person or by mail, to the office of your choice (usually the closest one). This office will make the final arrangements. (R.R. 13.11a).

I-2. When a licensee qualifies for a higher grade of FCC license or permit, what happens to the lesser grade license? — The license or permit held will be cancelled upon issuance of the new license. (R.R. 13.26).

I-3. Who may apply for an FCC license?—Normally, commercial licenses are issued only to citizens of the United States. (R.R. 13.5A).

I-4. If a license or permit is lost, what action must be taken by the operator?—The commission must be notified immediately and a properly executed application for a duplicate should be submitted. A statement must be included regarding the circumstances involved in the loss of the license. The operator must exhibit in lieu of the original document a signed copy of the submitted application. (R.R. 13.71 and 13.72).

I-5. What is the usual license term for radio operators?— Five years. (R.R. 13.4a).

I-6. What government agency inspects radio stations in the United States?—The Federal Communications Commission. (SEC 303n).

I-7. When may a license be renewed?—The application may be filed at any time during the final year of the license term or during a one-year period after the date of expiration of the license. During this one-year grace period any prior license is not valid. (R.R. 13.11a).

I-8. Who keeps the station log?—Person or persons competent to do so having actual knowledge of the facts required. They shall sign the appropriate log when starting duty and again when going off duty. (R.R. 73.111).

I-9. Who corrects errors in the station log?—Only the person originating the entry. (R.R. 3.111).

**I-10.** How may errors in the station log be corrected?—The person originating the entry shall strike out the erroneous portion, initial the correction made and indicate the date of correction. (R.R. 3.111).

I-11. Under what conditions may messages be rebroadcast? —Only by the express authority of the originating station. (SEC. 325a).

I-12. What messages and signals may not be transmitted?— Unnecessary, unidentified, or superfluous communications; obscenity, indecency, profanity, and false signals using any call or signal which has not been assigned by proper authority to the radio station concerned. (R.R. 13.66, 13.67 and 13.68).

I-13. May an operator deliberately interfere with any communication or signal?—No. (R.R. 13.69).

I-14. What type of communication has top priority in the mobile service?—Distress calls, distress messages, and distress traffic. (ART. 37).

I-15. What are the grounds for suspension of operator's license?—Violation of any provision of any act, treaty, or convention binding on the United States; failure to carry out a lawful order of the master or person lawfully in charge of ship or aircraft on which he is employed; damaging or permitting the damage of any radio apparatus or installation; transmission of profane or obscene language, false or deceptive signals, or call signals or letters not assigned to the station in operation; willful or malicious interference with other radiocommunications or frequencies; obtaining, attempting to obtain, or assisting another to obtain or attempt to obtain an operator's license by fraudulent means. (SEC. 303m).

I-16. When may an operator divulge the contents of an intercepted message?—He may divulge the contents of any radiocommunications broadcast or transmission by others for use of the general public or relating to ships in distress. (SEC. 605).

1-17. If a licensee is notified that he has violated an FCC rule or provision of the Communications Act of 1934, what must he do?—He must reply within ten days to the office of the commission originating the official notice. The answer to each notice shall be complete in itself and shall not be abbreviated by reference to other communications or other notices. In every instance the answer shall contain a statement of the action taken to correct the condition or omission complained of, and to preclude its recurrence. Information concerning equipment of concern, and name and license number of operator in charge. (R.R. 1.89).

I-18. If a licensee receives a notice of suspension of his license, what must he do?—No order of suspension of any operator's license shall take effect until 15 days after a notice in writing of the cause has been given to the operator. He may make written application to the commission at any time within said 15 days for a hearing upon such order. If, after a hearing, a license is ordered suspended, the operator shall send his license to the office of the Commission in Washington, D.C., on or before the effective date of such order. (R.R. 1.85).

I-19. What are the penalties provided for violation of the provisions of the Communications Act of 1934 or a rule of the FCC?—Penalties for violation of the Act provide for a fine of not more than \$10,000.00 or imprisonment for a term not exceeding one year, or both. The penalty provided for violation of FCC rules is a fine of not more than five hundred dollars (\$500) for every day during which said offense occurs. (SEC. 501 and 502).

I-20. Define harmful interference.—Any emission, radiation, or induction which endangers the function of a radionavigation service or other station services, or seriously degrades, obstructs, or repeatedly interrupts a radiocommunications service operating in accordance with the regulations.

# 6

### Element II—Basic Operating Practice

Each radiotelephone operator should know and abide by the rules and accepted procedures of operation. Courtesy and consideration are two very important factors in minimizing unnecessary interference and maintaining reliable communications on active channels. The radiotelephone license holder should be an example to operators of lower grade, and he should do everything possible to encourage proper operations in the service or services with which he is concerned.

A fine summary of radiotelephone operating practice, recommended by the FCC, follows:

A licensed radio operator should remember that the station he desires to operate should be licensed by the Federal Communications Commission. In order to prevent interference and to give others an opportunity to use the airways, he should avoid unnecessary calls and communications by radio. He should remember that radio signals normally travel outward from the transmitting station in many directions, and therefore these transmitted signals could be intercepted by unauthorized persons.

Before making a radio call, the operator should listen on the communications channel to insure that interference will not be caused to communications which may already be in progress. At all times in radiocommunications the operator should be courteous. Station identification should be made clearly and distinctly so as to avoid unnecessary repetition of call letters and enable other stations to clearly identify all calls.

An operator normally exhibits his authority to operate a station by posting a valid operator license or permit at the transmitter control point.

While a radio transmitter is in a public place, it should at all times be either attended by or supervised by a licensed operator; or the transmitter should be made inaccessible to unauthorized persons.

A radio transmitter should not be on the air except when signals are being transmitted. The operator of a radiotelephone station should not press the push-to-talk button, except when he intends to speak into the microphone. Radiation from a transmitter may cause interference even when voice is not transmitted.

When radiocommunications at a station are unreliable or disrupted due to static or fading, it is not a good practice for the operator to continuously call other stations in attempting to make contact, because his calls may cause interference to other stations that are not experiencing static or fading.

A radiotelephone operator should make an effort to train his voice for most effective radiocommunication. His voice should be loud enough to be distinctly heard by the receiving operator, and it should not be too loud, since it may become distorted and difficult to understand at the receiving station. He should articulate his words and avoid speaking in a monotone as much as possible. The working range of the transmitter is affected to some extent by the loudness of the speaker's voice. If the voice is too low, the maximum range of the transmitter cannot be attained; if the voice is too loud, the range may be reduced to zero due to the signals becoming distorted beyond intelligibility. In noisy locations the operator sometimes cups his hands over the microphone to exclude extraneous noise. Normally, the microphone is held from 2 to 6 inches from the operator's lips.

It is important in radiotelephone communications that operators use familiar and well-known words and phrases in order to insure accuracy and eliminate undue repetition of words. Some radio operating companies, services, networks, associations, etc., select and adopt standard procedure words and phrases for expediting and clarifying radiotelephone conversations. For example in some services, "Roger" means "I have received all of your last transmission," "Wilco" means "Your last message received, understood, and will be complied with," "Out" or "Clear" means "This conversation is ended and no response is expected," "Over" means "My transmission is ended, and I expect a response from you," "Speak slower" means "Speak slowly," "Say Again" means "Repeat," and "Words twice" means "Give every phrase twice."

Often in radiotelephone communications a "phonetic alphabet" or word list is useful in identifying letters or words that may sound like other letters or words of different meanings. For example "group" may sound like "scoop," or "bridge" may sound like "ridge." A phonetic alphabet or word list consists of a list of 26 words each word beginning with a different letter for identifying that particular letter. If the letters in "Group" are represented in a phonetic alphabet by George, Roger, Oboe, Uncle and Peter, the "Group" is transmitted as "Group, G as in George, R as in Roger, O as in Oboe, U as in Uncle, P as in Peter."

In making a call by radio, the call sign or name of the called station is generally given 3 times followed by the call letters of the calling station given 3 times.

In testing a radiotelephone transmitter, the operator should clearly indicate that he is testing, and the station call sign or name of the station, as required by the rules, should be clearly given. Tests should be as brief as possible.

If a radio station is used only for occasional calls, it is a good practice to test the station regularly. Regular tests may reveal defects or faults which, if corrected immediately, may prevent delays when communications are necessary. Caution should be observed by persons testing a station to make certain their test message will not interfere with other communications in progress on the same channel. Technical repairs or adjustments to radiotelephone communication stations are made only by or under the immediate supervision and responsibility of operators holding first- or second-class licenses.

When a licensed operator in charge of a radiotelephone station permits another person to use the microphone and talk over the facilities of the station, he should remember that he continues to bear responsibility for the proper operation of the station. If an operator wishes to determine the specifications for obstruction marking and lighting of antenna towers, he should look in Part 17 of the Rules and Regulations of the FCC. If he wishes to determine the specifications for a particular station, he should examine the station authorization issued by the Commission.

#### GENERAL (SERIES "O")

II-1. What should an operator do when he leaves a transmitter unattended?—The transmitter should be made inaccessible to unauthorized persons.

II-2. What are the meanings of clear, out, over, roger, words twice, repeat and break?—Refer to the appropriate words in the summary. "Repeat" means to transmit message or section of message again to make certain it has been copied correctly. "Break" means that the transmitting station will pause briefly for an acknowledgment from the station copying his message, or that the receiving station wishes to break in on the transmitting station to request a repeat.

II-3. How should a microphone be treated when used in noisy locations?—The operator can cup his hand over the microphone to exclude extraneous noise.

II-4. What may happen to the received signal when an operator has shouted into a microphone?—The range of the transmission may be decreased, because the signal may become distorted beyond intelligibility.

II-5. Why should radio transmitters be off when signals are not being transmitted?—Radiation from the transmitter may cause interference even though voice or other information is not being transmitted.

II-6. Why should an operator use well-known words and phrases?—It is advisable to insure accuracy and save time from undue repetition of words.

II-7. Why is the station call sign transmitted?—So that other stations may clearly identify all calls. Call signs must also be given at prescribed times according to the FCC Rules related to the particular radio service.
II-8. Where does an operator find specifications for obstruction marking and lighting where required for the antenna towers of a particular radio station?—Data may be found in Part 17 of the FCC Rules and Regulations.

II-9. What should an operator do if he hears profanity being used at his station?—He should take steps to prevent the profanity from going out on the air.

II-10. When may an operator use a station without regard to certain provisions of the station's license?—In a period of emergency during which normal communications are disrupted. (R. R. 2.405.)

II-11. Who bears the responsibility if an operator permits an unlicensed person to speak over his station?—The licensed operator continues to bear responsibility for the proper operation of the station.

II-12. What is meant by a phonetic alphabet in radiotelephone communications?—It is a list of words helpful in identifying letters or words that may sound like other letters or words that have different meanings.

II-13. How does the licensed operator of a station normally exhibit his authority to operate the station?—A valid operator license must be displayed at the transmitter control point.

**II-14. What precautions should be observed when you are testing a station on the air?**—Be certain testing does not interfere with other communications in progress on the same channel. Clearly indicate that you are testing. *Technical repairs and adjustments* are the responsibility of the holder of a first- or second-class license.

#### MARITIME (SERIES "M")

**II-M1.** What is the importance of the frequency 2182 kHz? —This frequency is the international distress frequency for radiotelephony. It can be used by ships, aircraft, and survival craft using frequencies in the 1605 to 3500 kHz spectrum. This frequency is also the international general radiotelephone calling frequency for the maritime mobile service. It may be used by ship stations and aircraft stations operating in the maritime mobile service. (R. R. 83.352, 83.353a.)

II-M2. Describe completely what action should be taken by a radio operator who hears a distress message; a safety message.—If he is in the vicinity beyond any possible doubt, the operator should immediately acknowledge receipt. However, in areas where reliable communication with one or more coast stations are practicable, a ship station may defer this acknowledgment for a short interval so that a coast station may acknowledge receipt. If not in the vicinity beyond any possible doubt, the operator shall allow a short interval of time to elapse before acknowledging receipt of the message in order to permit stations nearer to the mobile station in distress to acknowledge receipt of the message without interference.

The acknowledgment of the receipt of a distress message is then made according to established radiotelegraph and radiotelephone operating procedures. On order of the master or person responsible for the ship he is on, the operator shall supply the name of his ship and position and the speed at which it is proceeding toward, and the approximate time it will take to reach the station in distress. However, it is important that the station shall be certain that it will not interfere with the emission of other stations better situated to render immediate assistance to the station in distress.

A station may relay the distress message in any of the following cases: (1) station in distress is not able to transmit a distress message, (2) when a responsible person considers that further help is necessary, (3) when the station is not in position to render assistance but has heard that the distress message has not been acknowledged. Read R.R. 83.240, 83. 241, and 83.242 carefully.

A safety signal indicates that the station is about to transmit a message concerning the safety of navigation or giving important meteorological warning. Such a station should be given its proper priority of transmission according to ART. 37. (R.R. 83.239, 83.240, 83.241, 83.242, 83.249 and ART. 37.)

II-M3. What information must be contained in distress messages? What procedure should be followed by a radio operator in sending a distress message? What is a good choice of words to be used in sending a distress message?—Distress message should contain following information:

- a. Distress call.
- b. Name of ship.
- c. Geographical position.
- d. Nature of distress.
- e. What kind of assistance is needed.
- f. Any additional information that will help in the rescue, such as type of ship, color, length, etc.

The international radiotelegraph distress signal is S O S  $(\dots - - - \dots)$ ; the international radiotelephone distress signal is the word "MAYDAY." The radiotelephone distress procedure shall consist of a radiotelephone alarm signal whenever possible, the distress call, and the distress message. This distress transmission shall be made slowly and distinctly, each word being clearly pronounced. Words should be simple and to the point. On advisement, it may be necessary to transmit suitable signals followed by call sign or name to permit direction-finding stations to determine position.

The distress message can be repeated at intervals until an answer is received. If there are no answers, the message may be repeated on any other available frequency on which attention might be attracted.

It is important that you go over each rule and regulation very carefully, word by word. (R.R. 83.234 and 83.238.)

II-M4. What are the requirements for keeping watch on 2182 kHz? If a radio operator is required to stand watch on an international distress frequency, when may he stop listening? —Each station on board a ship navigating the Great Lakes and licensed to transmit on telephony within the band 1600 to 3500 kHz shall maintain an efficient watch on 2182 kHz, whenever the station is not being used for transmission on that channel or for communications on other radio channels. Except for stations on board vessels required by law to be fitted with radiotelegraph equipment, each ship station licensed to transmit telephony within the band 1600 to 3500 kHz shall maintain an efficient 2182-kHz watch whenever such station is not being used for transmission on that channel or for communication on other radio channels for transmit telephony within the band 1600 to 3500 kHz shall maintain an efficient 2182-kHz watch whenever such station is not being used for transmission on that channel or for communication on other radio channels. (R.R. 83.223.)

**II-M5. Under what circumstances may a coast station contact** a land station by radio?—To facilitate the transmission or reception of safety communications to or from a ship or aircraft station. (R.R. 81.302a2.)

II-M6. What do distress, safety, and urgency signals indicate? What are the international urgency, safety, and distress signals? In the case of a mobile radio station in distress, what station is responsible for the control of distress-message traffic?—A distress signal indicates that a mobile station is threatened by grave and eminent danger and requests immediate assistance. The urgency signal indicates that the calling station has a very urgent message to transmit concerning the safety of a ship, aircraft, or other vehicle, or the safety of a person. The safety signal indicates that the station is about to transmit a message concerning the safety of navigation or giving important meteorological warning. These signals are as follows:

	Radiotelegraph	Radiotelephone
Distress	SOS	MAYDAY
Urgency	XXX	PAN
Safety	ТТТ	SECURITY

Whenever possible the mobile station in distress is responsible for the control of distress-message traffic. (R.R. 83.234 through 83.249.)

II-M7. In regions of heavy traffic why should an interval be left between radiotelephone calls? Why should a radio operator listen before transmitting on a shared channel? How long may a radio operator in the mobile service continue attempting to contact a station which does not answer?-An interval should be left between radiotelephone calls to permit the shared use of the channel. An operator should listen before transmitting on a shared channel to make certain that he does not interfere with communications in progress. A call shall not continue for more than 30 seconds. If the called station does not reply, a second call should not be made until after an interval of two minutes. If there is no reply to a call sent three times at intervals of two minutes, the calling shall cease and shall not be renewed until after an interval of fifteen minutes. However, if there is no reason to believe that harmful interference will be caused, the call sent three times at intervals of two minutes may be repeated after a pause of not less than three minutes. (R.R. 83.366 and Summary.)

II-M8. Why are test transmissions sent? How often should they be sent? What is the proper way to send a test message? How often should the station call sign be sent?—If the station is used at infrequent intervals, test transmissions can be sent out to ascertain if the transmitter continues to operate in a normal manner. If the station has not been in operation, the transmitter can be checked with a test transmission according to an adopted schedule (once each 24 hours is often considered appropriate). When tests are required, precautions should be taken to prevent any emission that will cause harmful interference. Radiation must be reduced to the lowest practicable value and entirely suppressed if possible. The licensed operator shall listen carefully before test emissions so as not to interfere with transmission in progress.

The official call sign of the testing station followed by the word "test" shall be announced as a warning that test emissions are to be made. If any other station transmits the word "wait," testing shall be suspended an appropriate interval of time.

During tests the operator then announces the word "testing" followed by a voice transmission test by numerical count. Test signals should be transmitted that do not conflict with normal operating signals or that will actuate automatic alarms. The test signal shall have a duration not exceeding 10 seconds.

At the conclusion of the test a voice announcement of the official call sign, name of the ship or station, and general location is to be made. It is customary to give the call sign three times. The test transmission shall not be repeated until at least one minute has elapsed or, in a region of heavy traffic, a period of at least five minutes shall elapse before another test transmission is made on key frequencies. (R.R. 83.365 and Summary.)

II-M9. In the mobile service, why should radiotelephone messages be as brief as possible?—Transmissions should be brief to give other stations a chance to use the channel and to minimize interference. (Summary.)

II-M10. What are the meanings of: clear, out, over, roger, words twice, repeat, and break?—Refer to the operating summary at the beginning of this chapter.

**II-M11.** Does the Geneva 1959 treaty give other countries the authority to inspect US vessels?—Yes, when the mobile station visits another country. The license or a copy certified by the authority which has issued it should be permanently exhibited in the station. (ART 21.)

II-M12. Why are call signs sent? Why should they be sent clearly and distinctly?—Call signs should be sent and transmitted clearly and distinctly so that the station may be identified exactly by other stations and transmission time kept to a minimum. (Summary.)

**II-M13.** How does the licensed operator of a ship's station exhibit his authority to operate a station?—The original license should be exhibited at a conspicuous place at the principal location on board ship. For certain stations of a portable nature and when the operator holds a restricted radiotelephone operator permit, the person may have on his person either the operator license or a verification card. (R.R. 83.156.)

**II-M14.** When may a code station not charge for messages it is requested to handle?—No charge shall be made for the transmission of distress messages and replies thereto in connection with situations involving the safety of life and property at sea, or for any information concerning danger to navigation as designated. Except for effective tariffs on file with the commission, no charge shall be made for the service of any public coast station. (R.R. 81.179.)

**II-M15.** What is the difference between calling and working frequencies?—Calling frequencies are used for transmissions from a station solely to secure the attention of another station for a particular purpose. A working frequency is used strictly for carrying on radiocommunications for a purpose other than calling by any station or stations using telegraphy, telephony, or facsimile. (R.R. 83.6.)

#### **ELEMENTS I and II SELF-TEST**

- 1. When a licensee qualifies for a higher grade license, the lesser grade license
  - A. is cancelled.
  - B. must be returned to the FCC.
- C. is still valid.
- D. may be used as a verification card.

2.	<ul><li>When a license or permit is lost</li><li>A. must notify FCC within 30 days.</li><li>B. must submit application for a duplicate immediately.</li></ul>	the C. D.	licensee may not operate. is dropped to a lower grade.
3.	Radio station inspection is done	by	the
	A. FBI. B. FCC.	C. D.	FAA. CIA.
4.	<ul><li>Station logs are signed</li><li>A. by FCC inspectors.</li><li>B. when new equipment is installed.</li></ul>	C. D.	at local sunrise. when starting and going off duty.
5.	<ul><li>An error in the log is corrected</li><li>A. erasure and dating.</li><li>B. erasure and signing by the person correcting the log.</li></ul>	l by C. D.	rewriting the entire page. striking, dating, and signing by the person correcting the log.
6.	Profanity on the air		
	<ul><li>A. is legal.</li><li>B. is a violation of FCC rules and regulations.</li></ul>	C. D.	is permitted because it empha- sizes a situation. must be used on the proper fre- quency.
7.	The urgency signal has		
	<ul><li>A. more priority than a distress signal.</li><li>B. more priority than a security signal.</li></ul>	C. D.	less priority than a safety signal. a TTT radiotelegraph signal.
8.	An operator may divulge the cor	ıten	ts of a
	A. distress message.	C.	marine radiotelephone conversa-
	D. Dusmess transaction.	D.	commercial shipping instructions.
9.	When a licensee receives a notice	e of	suspension it shall take effect
	A. immediately. B. in 15 days.	C. D.	in 30 days. in 24 hours.
10.	A spurious emission that interru	ipts	a radiocommunication service
	<ul><li>A. is permissible at low power.</li><li>B. is permissible on shared channels.</li></ul>	C. D.	is a strong c-w signal. is harmful interference.
11.	"Over" means		
	A. change over to a new fre- quency.	C. D.	change c-w speed. my transmission is ended and a

B. change to another mode of reply is expected. transmission.

<ul><li>B. operating on a wrong frequency.</li></ul>	D. posting a wrong license.
<ul><li>13. Accuracy is improved by</li><li>A. using long descriptive words and sentences.</li><li>B. talking fast.</li></ul>	C. using well-known words. D. shouting into the microphone.
14. Lights of an antenna tower show	ld be inspected every
A. 24 hours. B. 48 hours.	C. week. D. 30 days.
15. A coast station may contact a la	and station
A. for a friendly chat. B. to handle ship traffic.	<ul> <li>C. to aid in transmission of safety messages.</li> <li>D. to relay press traffic.</li> </ul>
16 During on emergency	
<ul> <li>A. every station should get on the air.</li> <li>B. certain provisions of a sta- tion license need not be fol- lowed when normal com- munications are disrupted.</li> </ul>	<ul><li>C. shout into the microphone.</li><li>D. chase distress messages off your channel.</li></ul>
17. If in operating on a busy chann tion after 7½ minutes of calling	el you cannot contact the desired sta-
<ul><li>A. wait 15 minutes or until propagation conditions im- prove.</li><li>B. increase power above legal limit.</li></ul>	C. shout louder into microphone. D. change over to sideband.
<ul> <li>A. wait 15 minutes or until propagation conditions im- prove.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language</li> </ul>	C. shout louder into microphone. D. change over to sideband.
<ul> <li>A. wait 15 minutes or until propagation conditions improve.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language</li> <li>A. is seldom used in radiocommunications.</li> <li>B. helps to clarify phrases.</li> </ul>	<ul><li>C. shout louder into microphone.</li><li>D. change over to sideband.</li><li>C. is a method of clarifying c-w.</li><li>D. helps to clarify letters.</li></ul>
<ul> <li>A. wait 15 minutes or until propagation conditions improve.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language <ul> <li>A. is seldom used in radio-communications.</li> <li>B. helps to clarify phrases.</li> </ul> </li> <li>19. When testing</li> </ul>	<ul><li>C. shout louder into microphone.</li><li>D. change over to sideband.</li><li>C. is a method of clarifying c-w.</li><li>D. helps to clarify letters.</li></ul>
<ul> <li>A. wait 15 minutes or until propagation conditions improve.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language</li> <li>A. is seldom used in radiocommunications.</li> <li>B. helps to clarify phrases.</li> <li>19. When testing</li> <li>A. do it in a hurry and don't waste time listening.</li> <li>B. always use maximum assigned power.</li> </ul>	<ul> <li>C. shout louder into microphone.</li> <li>D. change over to sideband.</li> <li>C. is a method of clarifying c-w.</li> <li>D. helps to clarify letters.</li> <li>C. be certain testing does not interfere with communications in progress.</li> <li>D. shout into microphone.</li> </ul>
<ul> <li>A. wait 15 minutes or until propagation conditions improve.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language</li> <li>A. is seldom used in radiocommunications.</li> <li>B. helps to clarify phrases.</li> <li>19. When testing</li> <li>A. do it in a hurry and don't waste time listening.</li> <li>B. always use maximum assigned power.</li> <li>20. When you receive a distress metabolic distribution of the state of the sta</li></ul>	<ul> <li>C. shout louder into microphone.</li> <li>D. change over to sideband.</li> <li>C. is a method of clarifying c-w.</li> <li>D. helps to clarify letters.</li> <li>C. be certain testing does not interfere with communications in progress.</li> <li>D. shout into microphone.</li> <li>ssage</li> </ul>
<ul> <li>A. wait 15 minutes or until propagation conditions improve.</li> <li>B. increase power above legal limit.</li> <li>18. The phonetic language <ul> <li>A. is seldom used in radiocommunications.</li> <li>B. helps to clarify phrases.</li> </ul> </li> <li>19. When testing <ul> <li>A. do it in a hurry and don't waste time listening.</li> <li>B. always use maximum assigned power.</li> </ul> </li> <li>20. When you receive a distress met <ul> <li>A. throw your carrier on the air and be ready to help.</li> <li>B. try to keep everyone off your channel.</li> </ul> </li> </ul>	<ul> <li>C. shout louder into microphone.</li> <li>D. change over to sideband.</li> <li>C. is a method of clarifying c-w.</li> <li>D. helps to clarify letters.</li> <li>C. be certain testing does not interfere with communications in progress.</li> <li>D. shout into microphone.</li> <li>ssage</li> <li>C. be certain you will not interfere with stations better situated to render assistance.</li> <li>D. shut down your station.</li> </ul>

12. Overmodulation can be caused by

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21.	An operator required to stand w quency may stop listening	atch	on an international distress fre-
	A. when he is handling traffic on another channel.	C. D.	when he is 300 miles from shore. on legal holidays.
	B. when it is dark.		
22.	. The radiotelephone urgency signal is		
	A. MAYDAY. B. PAN.	C. D.	SECURITY. XXX.
23.	The proper way to start a test n	iessa	ge on a clear channel is
	A. turn on transmitter quickly and shout TEST.	C.	give station call sign and word TEST; then listen on channel be-
	B. repeat word TESTING and call sign for 20 seconds.	D.	fore proceeding. call a friend and tell him to keep channel open.
24.	The word "clear" when used at	end o	of transmission means
	<ul><li>A. there is to be clear weather.</li><li>B. the channel is free of signals.</li></ul>	C. D.	propagation is good. communications have been con- cluded with contacted station.
25.	Call signs		
	<ul><li>A. are a fad of radio oper- ators.</li><li>B. help to identify stations exactly.</li></ul>	C. D.	can be changed by operator when he gets tired of old one. are a useless tradition.
26.	Who may make application for a	a rad	lio operator's license?
	<ul><li>A. Citizens.</li><li>B. Nationals of the United States.</li></ul>	C. D.	FCC certified alien pilots. All of the above.
27.	An operator's license may be rer	newe	d
	<ul><li>A. a year before expiration.</li><li>B. within a year after expiration.</li></ul>	C. D.	within two years after expiration. as in A and B above.
28.	If your channel is active and yo	u ha	ve business traffic
	<ul><li>A. put your carrier on the air.</li><li>B. tell others to get off the channel.</li></ul>	C. D.	you may not deliberately in- terfere with communications. call the FCC and say you want a new channel.

#### 29. Which is not ground for a license suspension?

- A. Damaging radio apparatus. C. Failure to carry out orders ofB. Use of indecent language. master of ship.
  - D. Overmodulation.

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B. \$10,000 or one year suspenboth. sion or both. D. \$500. A. repeat every word one by C. use phonetic language. D. repeat every letter twice. one. B. give every phrase twice. A. shout louder into the micro- C. increase power. phone. D. change channel. B. cup the hands around the microphone. radio tower? A. Part 17 FCC Rules and C. Local authority. Regulations. D. Local airport. B. FAA office. C. 1 minute. A. 30 seconds. B. 20 seconds. D. 2 minutes. A. at the end of each trans- C. only when convenient. mission or exchange. D. either A or B. B. every 30 minutes. A. Use any number of photostatic copies. tion. B. Use verification card 758F. D. Carry station license. A. Individual making application. a local government station. B. Responsible officer for a D. A friend of applicant who has a first-class license. station to be operated by a

#### 32. "Words Twice" means

#### 33. When operating in a noisy location

## 34. Where does an operator find specifications for obstruction lights on a

#### 35. A call to another station should not continue for more than

- 36. An assigned call or identifier must be transmitted

#### 37. You are called upon to service many stations in the Land-Mobile Services. How can you do the work legally with only one posted license?

C. Use driver's license for identifica-

#### 38. Who may not sign an application for a station license?

- company.
- C. Responsible appointed official for

#### 31. What are the penalties for violating the Communications Act? A. \$500 or 1 year suspension. C. \$5000 or one year suspension or

- D. 30 days.
- 30. If a licensee is informed he has violated an FCC rule he must reply within
  - A. 24 hours. C. 10 days.
    - B. a week.

- 39. In periods of emergency
  - tion license need not be re- D. reduce transmitter power. garded.
  - B. you may not transmit under any circumstances.
- 40. All license applications must be
  - A. signed by the applicant.
  - B. notarized.

- A. certain provisions of sta- C. you must call FCC district office.
  - C. sent to National Bureau of Standards.
  - D. sent to FAA.



# Element IX– Broadcast Endorsement

It is essential that the person preparing to take the examination for the broadcast endorsement be familiar with the material contained in Appendices III and IV. These extracts from the FCC Rules and Regulations include the answers to the following questions.

IX-1. What is meant by the following words or phrases: Standard broadcast station (R.R. 73.2), standard broadcast band (R.R. 73.1), standard broadcast channel (R.R. 73.3), fm station (73.310), fm band (73.310), daytime (R.R. 73.6), nighttime (73.7), broadcast day (73.9) and EBS (73.910)?— Refer to appropriate definition in Appendix IV.

IX-2. Make the following transformations: Kilohertz to hertz, kilovolts to volts, milliamperes to amperes—To convert kilohertz to hertz it is necessary to multiply the number of kilohertz by 1000. To convert kilovolts to volts it is necessary to multiply the number of kilovolts by 1000. To convert milliamperes to amperes it is necessary to divide the number of milliamperes by 1000.

IX-3. Draw the faces of the following meters and know how to read each: Ammeter, voltmeter, frequency monitor meter,

and VU meter (for % of modulation).—As per most scaled devices, such as a thermometer or a foot-rule, transmitter meter scales have several major calibration marks which are labeled. Many additional calibration points are marked off, but they are not labeled. Nevertheless they do represent specific values of whatever quantity is being read. For example, in the case of the ammeter, each small division represents 0.2 ampere. (Note that there are ten such divisions between labeled calibration points.) The ammeter reading, consequently, is 5.4 amperes. The modulation meter is reading 70% the frequency meter, +2 hertz; and the voltmeter, 3.5 kilowatts (3500 volts). Refer to questions 36 through 40 of self-test.



**IX-4. What should an operator do if the remote antenna ammeter becomes defective?**—A remote antenna ammeter is not required; therefore, authority to operate without it is not necessary if it becomes defective. However, if the remote antenna ammeter does become defective the antenna base current may be read and logged once daily for each mode of operation, pending the return to service of the regular remote meter. (R.R. 73.58.)

IX-5. What should an operator do if the remote control devices at a station so equipped malfunction?—It shall be cause

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for the immediate cessation of remote-control operation. (R.R. 73.67.)

IX-6. What is the permissible percentage of modulation for a-m and fm stations?—The percentage of modulation shall be maintained as high as possible consistent with good quality of transmission. In no case shall it be less than 85% on peaks or more than 100% on negative peaks of frequent recurrence during any selection which is transmitted at the highest level of the program under consideration. (R.R. 73.14 and 73.55.) For fm, the deviation shall not exceed  $\pm 15$  kHz. (R.R. 73.268.)

IX-7. What is the permissible frequency tolerance of standard broadcast stations? Of fm stations?—The operating frequency of the a-m broadcast station shall be maintained within 20 Hz of the assigned frequency. The center frequency of each fm broadcast station shall be maintained within 2000 Hz of the center frequency. (R.R. 73.59 and 73.269.)

IX-8. What stations may be operated by a third-class broadcast operator?—A-m stations with a power of 10 kW or less and utilizing a nondirectional antenna and fm stations with transmitter outputs of 10 kW or less.

IX-9. What are the power limitations on broadcast stations?—The operating power of each station will be maintained as near as practicable to the licensed power and shall not exceed the limits of 5% above and 10% below the licensed value, except in an emergency when, due to causes beyond the control of the licensee, it becomes impossible to operate with full power. (R.R. 73.57.)

IX-10. What logs must be kept by broadcast stations according to the Rules and Regulations of the FCC?—Program and operating logs. (R.R. 73.111.)

**IX-11. Who keeps the logs?**—They must be kept by person or persons competent to do so, having knowledge of the facts required. (R.R. 73.111.)

IX-12. What entries are made in the program log? In the operating log?—Read R.R. 73.112 and 73.113 in Appendix IV.

IX-13. When may abbreviations be used in the station's logs?

-Only when proper meaning or explanation is contained elsewhere in the log. (R.R. 13.111.)

**IX-14.** How and by whom may station logs be corrected?—A correction must be made only by the person originating the entry, who shall strike out the erroneous portion, initial the correction made, and indicate the date. (R.R. 73.111.)

IX-15. According to the Rules and Regulations of the FCC, how long must the station's logs be retained?—For a period of two years. (R.R. 73.115.)

IX-16. What information must be given an FCC inspector at any reasonable hour?—Program, operating, and maintenance logs, equipment performance measurements, a copy of the most recent antenna resistance or commonpoint impedance measurement submitted to the commission, and a copy of the most recent field intensity measurement to establish performance of the directional antenna. (R.R. 73.116.)

**IX-17.** What is included in a station identification and how often is it given?—Call letters and location. At the beginning and end of each time of operation, and on the hour and either on the half-hour or quarter-hour following the hour, and at the quarter-hour preceding the next hour. Time of announcements can be made so as not to disturb the continuity of the program material. (R.R. 73.117.)

**IX-18. What should an operator do if the modulation monitor** becomes defective?—The station may be operated without the monitor pending its repair or replacement for a period not in excess of 60 days provided appropriate log entries are made, the engineer in charge of the radio district is notified, and the degree of modulation is monitored with an oscilloscope or other acceptable means. (R.R. 73.56.)

**IX-19. What should an operator do if the frequency monitor** becomes defective?—The station may be operated without the monitor, pending its replacement or repair for a period not in excess of 60 days, provided appropriate log entries are made, the engineer in charge of the radio district is notified, and the frequency of the station is compared with an external frequency source of known accuracy at sufficiently frequent intervals. (R.R. 73.252.) IX-20. When should minor corrections to the transmitter be made, before or after logging the meter reading?—Logging should be done prior to making any adjustment to the equipment. When appropriate, an indication of the correction made to restore operation to normal should be noted. (R.R. 73.113.)

IX-21. Should the sponsor's name ever be omitted when reading commercials on the air?—No. (R.R. 73.119.)

IX-22. When should an operator announce a program as recorded?—Whenever the element of time is of significance and the presentation of material would create, either intentionally or otherwise, the impression on the part of the listening audience that the event or program being broadcast is in fact occurring simultaneously with the broadcast. (R.R. 73.118.)

IX-23. How often should the tower lights be checked for proper operation?—Once each 24 hours. (R.R. 17.47.)

**IX-24.** What record is kept of tower light operation?--On and off times for each day, time of daily check of proper operation, and in the event of any observed or otherwise known failure of a tower light. (R.R. 17.49.)

**IX-25. What should an operator do if the tower lights fail?**— The failure is to be reported immediately by telephone or telegraph to the nearest airways communication station or office of the FAA if not corrected within thirty minutes. (R.R. 17.48.)

**IX-26.** What is EBS?—It refers to Emergency Broadcast Station consisting of broadcast station and its interconnecting facilities which have been authorized by the commission to operate in a controlled manner during a war, threat of war, public peril or disaster, or national emergency. (R.R. 73.910.)

**IX-27. What is an emergency action condition?**—The condition which exists after the transmission of an emergency action notification and before the transmission of the emergency action termination. (R.R. 73.908.)

IX-28. What equipment must be installed in broadcast stations in regard to the reception of an emergency action notification?—Necessary equipment to receive emergency action notification or termination by means of reception of broadcast messages. This equipment must be maintained in a state of readiness for reception, including arrangements for human listening watch or automatic alarm devices, or both. (R.R. 73.933.)

IX-29. How often should EBS test transmissions be sent?— During what time period are they sent?—They should be made once each week on an unscheduled basis between the hours of 8:30 A.M. and local sunset. (R.R. 73.961 (c).)

IX-30. During a period of emergency action condition what should all nonparticipating stations do?—All other broadcast stations will observe broadcast silence. (R.R. 73.923 (a).)

IX-31. If the tower lights of a station are required to be controlled by a light-sensitive device, and this device malfunctions, when should the tower lights be on?—They shall burn continuously. (R.R. 17.25 (a) (3).)

#### ELEMENT IX SELF-TEST

1.	One million hertz is how many	kilohertz?
	A. One million.	C. One hundred.
	B. One thousand.	D. Ten thousand.
_		
2.	The remote antenna meter beco	mes defective. You must
	A. call FCC.	C. continue operation.
	B. shut down transmitter.	D. notify FAA.
3.	What deviation constitutes 100 transmitter?	% modulation for an fm broadcast
	A. ±75 kHz. 1/0 - 4	C. 2000 Hz.
	B. $\pm 25$ kHz.	D. 20 Hz.
4.	Your modulation meter reads m	uch above 100% on peaks. You must
	A. increase plate voltage.	C. reduce volume level.
	B. decrease plate current.	D. readjust modulation meter.
5.	A third-class broadcast operator	may operate
	A a directional arm station	C a talavision station
	B. a radiotelegraph transmitter.	D. none of above
		21 none of above.
6.	A broadcast station must keep	
	A. only one log.	C. no program log.
	B. emergency log only.	D. program and operating logs.
7.	An operating log must include	
	A. time of sign-on and sign-off.	C. service interruptions.
	B. plate current readings.	D. all of above.

8. A program log must not include			
A. name of sponsor. B. identification times.	C. name of announcer. D. time of spot commercial.		
9. Station logs may be corrected by	the the		
A. general manager. B. chief engineer.	C. FCC inspector. D. person making mistake.		
10. FCC inspector must be given up	on request		
<ul><li>A. any station log.</li><li>B. income report for the week.</li></ul>	<ul><li>C. names of all employees and their incomes.</li><li>D. all of above.</li></ul>		
11. If a modulation monitor fails			
<ul><li>A. the station must be shut down.</li><li>B. notify the chief engineer.</li></ul>	C. forget about keeping the log. D. turn up the volume level.		
12. Scheduled operating logging sho	uld be made		
<ul><li>A. each hour only.</li><li>B. after corrective adjustments.</li></ul>	C. prior to corrective adjustments. D. at end of the day only.		
13. An announcement of prerecorded	d material must be made		
A. at sign-off time. B. on the half-hour.	<ul><li>C. to avoid any false impression that program is live.</li><li>D. only on network shows.</li></ul>		
14. What is considered a broadcast	day?		
<ul><li>A. Local sunrise to midnight local time.</li><li>B. Local sunrise to sunset.</li></ul>	C. 6:00 A.M. to 8:00 P.M. D. Daytime.		
15. 2000 volts is how many kilovolts?			
A. 2000.	C. 20.		
B. 2.	D. 1/2000.		
16. Frequency of the fm band is			
A. 540 to 1600 kHz. B. 88 to 108 MHz.	C. 2000 Hz. D. ±75 kHz.		
17. If reading on meter #3 (IX-3) of	lropped 10%, what would it read?		
A. 3000. B. 3150.	C. 2000. D. 350.		
18. With overmodulation, meter #1	(IX-3) would read		
A. 89%. B. 100%.	C. above 100%. D. under 85%.		
19. If meter reading of meter #4 (	IX-3) increased 5% it would read		
A. 5.5.	C. 2.70.		
B. 6.	D. 5.67.		

20. If the remote control syste	m fails, you should
A. shut down the station. B. call the chief engineer.	C. call the FCC inspector. D. call the telephone company.
21. What does reading of meter	r #2 (IX-3) indicate?
<ul> <li>A. A-m station operating t far off frequency.</li> <li>B. Fm station operating to far off frequency.</li> </ul>	<ul> <li>C. More than 5% off frequency.</li> <li>D. Operation can be considered normal.</li> </ul>
22. Frequency tolerance for an	a-m station is
A. 20 Hz. B. 2000 Hz.	C. 0.001%. D. 0.0001%.
23. Frequency tolerance for an	fm station is
A. 0.0001%. B. 0.001%.	C. 2000 Hz. D. 20 Hz.
24. What are the maximum an station?	d minimum power limits for a 10-kW a-m
A. 11 and 9 kW.	C. 11 and 9.5 kW.
B. 10.5 and 9.5 kW.	D. 10.5 and 9 kW.
25. Who always keeps radio sta	ation logs?
<ul><li>A. A person competent to so and with knowledge facts.</li><li>B. A chief engineer.</li></ul>	do C. A general manager. of D. An operator at the transmitter.
26. May abbreviations be used i	in logs?
A. Never.	C. According to log list.
B. Anytime.	D. After approval by FCC inspector.
27. Logs must be retained for	
A. one year.	C. five years.
B. two years.	D. indefinitely.
28. Call letters and location mu	st be given
A. at sign-on.	C. on the hour.
B. sign-off.	D. all of the above.
29. If frequency meter fails	
A. station must be shut do	wn. C. forget about logging it.
B. notify chief engineer.	D. turn up power output.
30. When can sponsor's name h	be omitted from a commercial?
A. Never.	C. When station manager approves.
B. Upon his request.	D. During nonprime time.
31. Tower lights must be check	ed
A. daily.	C. monthly.
B. weekly.	D. hourly.

#### 32. What is the procedure to follow if tower lights fail?

A. Shut down station.

C. Call FAA if repair is not possible in one-half hour.

B. Call FCC immediately.

D. Wait for morning.

#### 33. What record must be kept of tower light operation?

- C. Daily inspection.
- B. Failures.

- A. On and off times.
- D. All of above.
- 34. What is emergency action condition?
- 35. During a period of emergency action condition what should nonparticipating stations do?





### 36. What is percentage modulation indicated by meter A?

А.	90.	C.	100.
Β.	-2.	D.	96.

#### 37. What does meter B suggest?

- A. Your fm transmitter is off frequency.
- B. Everything is just fine with D. Temperature is too low. a-m transmitter.

#### 38. Arbitrary meter is reading

- A. 70.
- B. 70+.
- 39. Voltmeter is reading
  - A. 1550 volts.
  - B. too high.

#### 40. Ammeter is reading

- A. 325 milliamperes.
- B. too high.

C. Problem is arising because a-m transmitter is 20 Hz low.

- C. high.
- D. low.
- C. 1500 volts.
- D. 1450 volts.
- C. 350 milliamperes.
- D. 350 amperes.

#### Appendix I

## Extracts From the Geneva, 1959, Treaty

#### SECTION III

#### **TECHNICAL CHARACTERISTICS**

PARAGRAPH 93. Harmful interference: Any emission, radiation or induction which endangers the functioning of radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with these Regulations.

#### ARTICLE 21

#### INSPECTION OF MOBILE STATIONS

838 SEC. 1. (1) The governments or appropriate administrations of countries which a mobile station visits, may require the production of the license for examination. The operator of the mobile station, or the person responsible for the station, shall facilitate this examination. The license shall be kept in such a way that it can be produced upon request. As far as possible, the license, or a copy certified by the authority which has issued it, should be permanently exhibited in the station.

#### **ARTICLE 37**

PARAGRAPH 1496. The term "communication" as used in this Article means radiotelegrams as well as radiotelephone calls. The order of priority for communications in the mobile service shall be as follows:

1. Distress calls, distress messages, and distress traffic.

2. Communications preceded by the urgency signal.

3. Communications preceded by the safety signal.

4. Communications relating to radio direction-finding.

5. Communications relating to the navigation and safe movement of aircraft.

6. Communications relating to the navigation, movements, and needs of ships, and weather observation messages destined for an official meteorological service.

7. Government radiotelegrams: Priorite' Nations.

8. Government communications for which priority has been requested.

9. Service communications relating to the working of the radiocommunications previously exchanged.

10. Government communications other than those shown in 7 and 8 above, and all other communications.

#### Appendix II

## Extracts From the Communications Act of 1934, as Amended

SEC. 303 Except as otherwise provided in this Act, the Commission from time to time, as public convenience, interest, or necessity requires shall—(m) (1) Have authority to suspend the license of any operator upon proof sufficient to satisfy the Commission that the licensee

(A) Has violated any provision of any Act, treaty, or convention binding on the United States, which the Commission is authorized to administer, or any regulation made by the Commission under any such Act, treaty, or convention; or

(B) Has failed to carry out a lawful order of the master or person lawfully in charge of the ship or aircraft on which he is employed; or

(C) Has willfully damaged or permitted radio apparatus or installations to be damaged; or

(D) Has transmitted superfluous radio communications or signals or communications containing profane or obscene words, language, or meaning, or has knowingly transmitted

(1) False or deceptive signals or communications, or

(2) A call signal or letter which has not been assigned by proper authority to the station he is operating; or

(E) Has willfully or maliciously interfered with any other radio communications or signals; or

(F) Has obtained or attempted to obtain, or has assisted another to obtain or attempt to obtain, an operator's license by fraudlent means.

(n) Have authority to inspect all radio installations associated with stations required to be licensed by any Act, or which are subject to the provisions of any Act, treaty, or convention binding on the United States, to ascertain whether in construction, installations, and operation they conform to the requirements of the rules and regulations of the Commission, the provisions of any Act, the terms of any treaty or convention binding on the United States, and the conditions.

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SEC. 325 (a) No person within the jurisdiction of the United States shall knowingly utter or transmit, or cause to be uttered or transmitted, any false or fraudulent signal of distress, or communication relating thereto, nor shall any broadcasting station rebroadcast the program or

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any part thereof of another broadcasting station without the express authority of the originating station.

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SEC. 501 Any person who willfully and knowingly does or causes or suffers to be done any act, matter, or thing, in this Act prohibited or declared to be unlawful, or who willfully or knowingly omits or fails to do any act, matter, or thing in this Act required to be done, or willfully and knowingly causes or suffers such omission or failure, shall, upon conviction thereof, be punished for such offense, for which no penalty (other than a forfeiture) is provided in this Act, by a fine of not more than \$10,000 or by imprisonment for a term not exceeding one year, or both; except that any person, having been once convicted of an offense punishable under this section, who is subsequently convicted of violating any provision of this Act punishable under this section, shall be punished by a fine of not more than \$10,000 or by imprisonment for a term not exceeding two years; or both.

SEC. 502 Any person who willfully and knowingly violates any rule, regulation, restriction, or condition made or imposed by the Commission under authority of this Act, or any rule, regulation, restriction, or condition made or imposed by any international radio or wire communications treaty or convention, or regulations annexed thereto, to which the United States is or may hereafter become a party, shall, in addition to any other penalties provided by law, be punished, upon conviction thereof, by a fine of not more than \$500 for each and every day during which such offense occurs.

SEC. 605 No person receiving or transmitting, or assisting in transmitting, any interstate or foreign communication by wire or radio shall divulge or publish the existence, contents, substance, purport, effect, or meaning thereof, except through authorized channels of transmission or reception, to any person other than the addressee, his agent, or attorney, or to a person employed or authorized to forward such communication to its destination, or to proper accounting or distributing officers of the various communicating centers over which the communication may be passed, or to the master of a ship under whom he is serving, or in response to a subpoena issued by a court of competent jurisdiction, or on demand of other lawful authority; and no person not being authorized by the sender shall intercept any communication and divulge or publish the existence, contents, substance, purport, effect, or meaning of such intercepted communication to any person; and no person not being entitled thereto shall receive or assist in receiving any interstate or foreign communication by wire or radio and use the same or any information therein contained for his own benefit or for the benefit of another not entitled thereto; and no person having received such intercepted communication or having become acquainted with the contents, substance, purport, effect, or meaning of the same or any part thereof, knowing that such information was so obtained, shall divulge or publish the existence, contents, substance, purport, effect, or meaning of the same or any part thereof, or use the same or any information therein contained for his own benefit or for the benefit of another not entitled thereto: *Provided*, That this section shall not apply to the receiving, divulging, publishing, or utilizing the contents of any radio communication broadcast, or transmitted by amateurs or others for the use of the general public, or relating to ships in distress.

#### Appendix III

### Extracts From the FCC Rules and Regulations

SEC. 1.85 Suspension of operator licenses. Whenever grounds exist for suspension of an operator license, as provided in section 303(m) of the Communications Act, the Chief of the Safety and Special Radio Services Bureau, with respect to amateur operator licenses, or the Chief of the Field Engineering Bureau, with respect to commercial operator licenses, may issue an order suspending the operator license. No order of suspension of any operator's license shall take effect until 15 days' notice in writing of the cause for the proposed suspension has been given to the operator licensee, who may make written application to the Commission at any time within said 15 days for a hearing upon such order. The notice to the operator licensee shall not be effective until actually received by him, and from that time he shall have 15 days in which to mail the said application. In the event that physical conditions prevent mailing of the application before the expiration of the 15-day period, the application shall then be mailed as soon as possible thereafter, accompanied by a satifactory explanation of the delay. Upon receipt by the Commission of such application for hearing, said order of suspension shall be designated for hearing by the Chief, Safety and Special Radio Services Bureau, or the Chief, Field Engineering Bureau, as the case may be, and said order of suspension shall be held in abeyance until the conclusion of the hearing. Upon the conclusion of said hearing, the Commission may affirm, modify, or revoke said order of suspension. If the license is ordered suspended, the operator shall send his operator license to the office of the Commission in Washington, D.C., on or before the effective date of the order, or, if the effective date has passed at the time notice is received, the license shall be sent to the Commission forthwith.

(b) Within 10 days from receipt of notice or such other period as may be specified, the licensee shall send a written answer, in duplicate, direct to the office of the Commission originating the official notice. If an answer cannot be sent nor an acknowledgment made within such 10-day period by reason of illness or other unavoidable circumstances, acknowledgment and answer shall be made at the earliest practicable date with a satisfactory explanation of the delay.

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(c) The answer to each notice shall be complete in itself and shall not be abbreviated by reference to other communications or answers to other notices. In every instance the answer shall contain a statement of action taken to correct the condition or omission complained of and to preclude its recurrence. In addition:

(1) If the notice relates to violations that may be due to the physical or electrical characteristics of transmitting apparatus and any new apparatus is to be installed, the answer shall state the date such apparatus was ordered, the name of the manufacturer, and the promised date of delivery. If the installation of such apparatus requires a construction permit, the file number of the application shall be given, or if a file number has not been assigned by the Commission, such identification shall be given as will permit ready identification of the application.

(2) If the notice of violation relates to lack of attention to or improper operation of the transmitter, the name and license number of the operator in charge shall be given.

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XSEC. 2.405 Operation during emergency. The licensee of any station (except amateur, standard broadcast, fm broadcast, noncommercial educational fm broadcast, or television broadcast) may, during a period of emergency in which normal communication facilities are disrupted as a result of hurricane, flood, earthquake or similar disaster, utilize such station for emergency communication service in communicating in a manner other than that specified in the instrument of authorization: Provided: (a) That as soon as possible after the beginning of such emergency use, notice be sent to the Commission at Washington. D.C., and to the Engineer in Charge of the district in which the station is located, stating the nature of the emergency and the use to which the station is being put, and (b) That the emergency use of the station shall be discontinued as soon as substantially normal communication facilities are again available, and (c) That the Commission at Washington, D.C., and the Engineer in Charge shall be notified immediately when such special use of the station is terminated: Provided further, (d) That in no event shall any station engage in emergency transmission on frequencies other than, or with power in excess of, that specified in the instrument of authorization or as otherwise expressly provided by the Commission, or by law: And provided further, (e) That the Commission may, at any time, order the discontinuance of any such emergency communication undertaken under this section.

NOTE: Further information regarding operation of broadcast stations during periods of emergency is found in Part 73.98 of the Rules.

SEC. 13.4 Term of licenses. (a) Except as provided (otherwise) --commercial operator licenses will normally be issued for a term of five years from the date of issuance. A restricted radiotelephone operator permit will normally be issued for lifetime of the operator.

SEC. 13.5 *Eligibility for new license*. (a) Normally, commercial licenses are issued only to citizens and other nationals of the United States. As an exception, in the case of an alien who holds an Aircraft

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Pilot Certificate issued by the Civil Aeronautics Administration or the Federal Aviation Agency and is lawfully in the United States, the Commission, if it finds that the public interest will be served thereby, may waive the requirement of U. S. nationality.

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SEC. 13.11 Procedure. (a) General. Applications shall be governed by applicable rules in force on the date when application is filed. The application in the prescribed form and including all required subsidiary forms and documents, properly completed and signed, and accompanied by the prescribed fee shall be submitted in person or by mail to the field office at which the applicant desires his application to be considered and acted upon, which office will make the final arrangements for conducting any required examination. Whenever an examination is to be taken at a designated examination point away from the office, the application shall be submitted in advance of the examination to the field office having jurisdiction over the area in which the examination is to be taken. Subject to other provisions of this paragraph, if the application is for renewal of license it may be filed at any time during the final year of the license term or during a 1 year period of grace after the date of expiration of the license sought to be renewed. During this 1 year period of grace an expired license is not valid. A renewed license issued upon the basis of an application filed during the grace period will be dated currently and will not be back-dated to the date of expiration of the license being renewed. A renewal application shall be accompanied by the license sought to be renewed. If the prescribed service requirements for renewal without examination are fulfilled, the renewed license may be issued by mail. If the service record on the reverse side of the license does not fully describe or cover the service desired by the applicant to be considered in connection with license renewal (as might occur in the case of service rendered at U.S. Government stations), the renewal application shall be supported by documetary evidence describing in detail the service performed and showing that the applicant actually performed such service in a satisfactory manner. A separate application must be submitted for each license involved, whether it requests renewal, new license, endorsement, duplicate, or replacement.

SEC. 13.26 Canceling and issuing new licenses. If the holder of a license qualifies for a higher class in the same group, the license held will be canceled upon the issuance of the new license. Similarly, if the holder of a restricted operator permit qualifies for a first- or second-class operator license of the corresponding type, the permit held will be canceled upon issuance of the new license.

SEC. 13.65 Damage to apparatus. No licensed radio operator shall willfully damage, or cause or permit to be damaged, any radio apparatus or installation in any licensed radio station.

SEC. 13.66 Unnecessary, unidentified, or superfluous communications. No licensed radio operator shall transmit unnecessary, unidentified, or superfluous radio communications or signals. SEC. 13.67 Obscenity, indecency, profanity. No licensed radio operator or other person shall transmit communications containing obscene, indecent, or profane words, language, or meaning.

SEC. 13.68 False signals. No licensed radio operator shall transmit false or deceptive signals or communications by radio, or any call letter or signal which has not been assigned by proper authority to the radio station he is operating.

SEC. 13.69 *Interference*. No licensed radio operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal.

SEC. 13.70 Fraudulent licenses. No licensed radio operator or other person shall alter, duplicate, or fraudulently obtain, or assist another to alter, duplicate, or fraudulently obtain an operator license. Nor shall any person use a license issued to another or a license which he knows to have been altered, duplicated, or fraudulently obtained.

SEC. 13.71 Issue of duplicate or replacement licenses. (a) An operator whose license, permit or authorization has been lost, mutilated or destroyed shall immediately notify the Commission. A properly executed application for duplicate should be submitted to the office of issue, embodying a statement of the circumstances involved in the loss, mutilation or destruction of the license or permit for which a duplicate is desired. If the license or permit has been lost, the applicant must state that reasonable search has been made for it, and further, that in the event it be found either the original or the duplicate will be returned for cancellation. The applicant should also submit documentary evidence of the service that has been obtained under the original license or permit, or a statement under oath or affirmation embodying that information.

(b) The holder of any license, permit or authorization whose name is legally changed may make application for a replacement document to indicate the new legal name, by submitting a properly executed application to the office of issue, accompanied by the license, permit or authorization affected and by documentary evidence of the legality of the name change.

SEC. 13.72 Exhibiting signed copy of application. When a duplicate or replacement operator license or permit has been requested, or request has been made for renewal upon service or for an endorsement or a verification card, the operator shall exhibit in lieu of the original document a signed copy of the application which has been submitted by him.

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SEC. 81.179 Message charges. (a) (1) No charge shall be made for the service of any public coast station unless effective tariffs applicable to such service are on file with the Commission, pursuant to the requirements of Section 203 of the Communications Act and Part 61 of this chapter.

(2) No charge shall be made for the service of any station subject to this part, other than a public coast station, except as provided by and in accordance with § 81.352.

(b) No charge shall be made by any station in the maritime mobile service of the United States for the transmission of distress messages and replies thereto in connection with situations involving the safety of life and property at sea.

(c) No charge shall be made by any station in the maritime mobile service of the United States for the transmission receipt, or relay of the information concerning dangers to navigation designated in § 83.303 (b) of this chapter, originating on a ship of the United States or of a foreign country.

SEC. 81.302 Points of communications. (a) Subject to the conditions and limitations imposed by the terms of the particular coast station license or by the applicable provisions of this part with respect to the use of particular radio channels, public coast stations using telephony are authorized to communicate:

(1) With any ship station or aircraft station operating in the maritime mobile service for the transmission or reception of safety communication;

(2) With any land station for the purpose of facilitating the transmission or reception of safety communication to or from a ship or aircraft station;—

SEC. 83.6 Operational definitions. (f) Calling. Transmissions from a station solely to secure the attention of another station, for a particular purpose.

(g) Working. Radiocommunication carried on, for a purpose other than calling, by any station or stations using telegraphy, telephony or facsimile.

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SEC. 83.165 Posting of operator license. When a licensed operator is required for the operation of a station subject to this part, the original license of each such operator while he is employed or designated as radio operator of the station shall be posted in a conspicuous place at the principal location on board ship at which the station is operated: *Provided*, That in the case of stations of a portable nature, including marine-utility stations, or in the case where the operator holds a restricted radiotelephone operator permit, the operator may in lieu of posting have on his person either his required operator license or a duly issued verification card (FCC form 758-F) attesting to the existence of that license.

SEC. 83.223 Watch on 2182 kHz. (a) Each ship station on board a ship navigating the Great Lakes and licensed to transmit by telephony on one or more frequencies within the band 1600 to 3500 kHz shall, during its hours of service for telephony, maintain an efficient watch for the reception of class A3 and A3H emissions on the radio channel of which 2182 kHz is the assigned frequency, whenever the station is not being used for transmission on that channel or for communication on other radio channels.

(b) Except for stations on board vessels required by law to be fitted with radiotelegraph equipment, each ship station (in addition to those

ship stations specified in paragraph (a) of this section) licensed to transmit by telephony on one or more frequencies within the band 1600 to 3500 kHz shall, during its hours of service for telephony, maintain an efficient watch for the reception of class A3 and A3H emissions on the radio channel of which 2182 kHz is the assigned frequency, whenever such station is not being used for transmission on that channel or for communication on other radio channels. When the ship station is in Region 1 or 3, such watch shall, insofar as is possible, be maintained at least twice each hour for three minutes commencing at  $\times$  h. 00 and  $\times$  h. 30, Greenwich mean time (G. M. T.).

SEC. 83.234 Distress signals. (a) The international radiotelegraph distress signal consists of the group "three dots, three dashes, three dots"  $(\ldots -- \ldots)$ , symbolized herein by SOS, transmitted as a single signal in which the dashes are slightly prolonged so as to be distinguished clearly from the dots.

(b) The international radiotelephone distress signal consists of the word MAYDAY, pronounced as the French expression "m'aider."

(c) These distress signals indicate that a mobile station is threatened by grave and imminent danger and requests immediate assistance.

SEC. 83.238 Radiotelephone distress call and message transmission procedure. (a) The radiotelephone distress procedure shall consist of:

(1) The radiotelephone alarm signal (whenever possible);

(2) The distress call;

(3) The distress message.

(b) The radiotelephone distress transmissions shall be made slowly and distinctly, each word being clearly pronounced to facilitate transcription.

(c) After the transmission by radiotelephony of its distress message, the mobile station may be requested to transmit suitable signals followed by its call sign or name, to permit direction-finding stations to determine its position. This request may be repeated at frequent intervals if necessary.

(d) The distress message, preceded by the distress call, shall be repeated at intervals until an answer is received. This repetition shall be preceded by the radiotelephone alarm signal whenever possible.

(e) When the mobile station in distress receives no answer to a distress message transmitted on the distress frequency, the message may be repeated on any other available frequency on which attention might be attracted.

SEC. 83.239 Acknowledgment of receipt of distress message. (a) Stations of the maritime mobile service which receive a distress message from a mobile station which is, beyond any possible doubt, in their vicinity, shall immediately acknowledge receipt. However, in areas where reliable communication with one or more coast stations are practicable, ship stations may defer this acknowledgment for a short interval so that a coast station may acknowledge receipt.

(b) Stations of the maritime mobile service which receive a distress

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message from a mobile station which, beyond any possible doubt, is not in their vicinity, shall allow a short interval of time to elapse before acknowledging receipt of the message, in order to permit stations nearer to the mobile station in distress to acknowledge receipt without interference.

SEC. 83.240 Form of acknowledgment. (a) The acknowledgment of receipt of a distress message is transmitted, when radiotelegraphy is used, in the following form:

(1) The call sign of the station sending the distress message, sent three times;

(2) The word DE;

(3) The call sign of the station acknowledging receipt, sent three times;

(4) The group RRR;

(5) The distress signal SOS.

(b) The acknowledgment of receipt of a distress message is transmitted, when radiotelephony is used, in the following form:

(1) The call sign or other identification of the station sending the distress message, spoken three times;

(2) The words THIS IS;

(3) The call sign or other identification of the station acknowledging receipt, spoken three times;

(4) The word RECEIVED;

(5) The distress signal MAYDAY.

SEC. 83.241 Information furnished by acknowledging station. (a) Every mobile station which acknowledges receipt of a distress message shall, on the order of the master or person responsible for the ship, aircraft, or other vehicle carrying such mobile station, transmit as soon as possible the following information in the order shown:

(1) Its name;

(2) Its position, in the form prescribed in Sec. 83.236 (c);

(3) The speed at which it is proceeding towards, and the approximate time it will take to reach, the mobile station in distress.

(b) Before sending this message, the station shall ensure that it will not interfere with the emissions of other stations better situated to render immediate assistance to the station in distress.

SEC. 83.242 Transmission of distress message by a station not itself in distress. (a) A mobile station or a land station which learns that a mobile station is in distress shall transmit a distress message in any of the following cases:

(1) When the station in distress is not itself in a position to transmit the distress message;

(2) When the master or person responsible for the ship, aircraft, or other vehicle not in distress, or the person responsible for the land station, considers that further help is necessary;

(3) When, although not in a position to render assistance, it has heard a distress message which has not been acknowledged. When a mobile station transmits a distress message under these conditions, it shall take all necessary steps to notify the authorities who may be able to render assistance. (b) The transmission of a distress message under the conditions prescribed in paragraph (a) of this section shall be made on either or both of the international distress frequencies (500 kHz radiotelegraph; 2182 kHz radiotelephone) or on any other available frequency on which attention might be attracted.

(c) The transmission of the distress message shall always be preceded by the call indicated below, which shall itself be preceded whenever possible by the radiotelegraph or radiotelephone alarm signal. This call consists of:

(1) When radiotelegraphy is used:

(i) The signal DDD SOS SOS SOS DDD;

(ii) The word DE;

(iii) The call sign of the transmitting station, sent three times.

(2) When radiotelephony is used:

(i) The signal MAYDAY RELAY, spoken three times;

(ii) The words THIS IS;

(iii) The call sign or other identification of the transmitting station, spoken three times.

(d) When the radiotelgraph alarm signal is used, an interval of two minutes shall be allowed, whenever this is considered necessary, before the transmission of the call mentioned in subparagraph (c) (1) of this section

SEC. 83.247 Urgency signals. (a) The urgency signal indicates that the calling station has a very urgent message to transmit concerning the safety of a ship, aircraft, or other vehicle, or the safety of a person  $\ldots$ 

(c) In radiotelephony, the urgency signal consists of the word PAN, spoken three times and transmitted before the call.

SEC. 83.249 Safety signals. (a) The safety signal indicates that the station is about to transmit a message concerning the safety of navigation or giving important meteorological warnings.

(b) In radiotelegraphy, the safety signal consists of three repetitions of the group TTT, sent with the individual letters of each group, and the successive groups clearly separated from each other. It shall be sent before the call.

(c) In radiotelephony, the safety signal consists of the word SECUR-ITY, spoken three times and transmitted before the call.

(d) The safety signal and call shall be sent on one of the international distress frequencies (500 kHz radiotelegraph; 2182 kHz radiotelephone). However, stations which cannot transmit on a distress frequency may use any other available frequency on which attention might be attracted.

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SEC. 83.352 Frequencies for use in distress. (a) The frequency 2182 kHz is the international distress frequency for radiotelephony. It shall be used for this purpose by ship, aircraft, and survival craft stations using frequencies in the authorized bands between 1605 and 4000 kHz when requesting assistance from the maritime services.

SEC. 83.353 Frequencies for calling. (a) The international general radiotelephone calling frequency for the maritime mobile service is

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2182 kHz. It may be used as a carrier frequency for this purpose by ship stations and aircraft stations operating in the maritime mobile service.—

SEC. 83.365 *Procedure in testing.* (a) Ship stations must use every precaution to insure that, when conducting operational transmitter tests, the emissions of the station will not cause harmful interference. Radiation must be reduced to the lowest practicable value and if feasible shall be entirely suppressed. When radiation is necessary or unavoidable, the testing procedure described below shall be followed:

(1) The licensed radio operator or other person responsible for operation of the transmitting apparatus shall ascertain by careful listening that the test emissions will not be likely to interfere with transmissions in progress; if they are likely to interfere with the working of a coast or aeronautical station in the vicinity of the ship station, the consent of the former station(s) must be obtained before the test emissions occur;

(2) The official call sign of the testing station, followed by the word "test," shall be announced on the radio channel being used for the test, as a warning that test emissions are about to be made on that frequency;

(3) If, as a result of the announcement prescribed in subparagraph (2) of this paragraph, any station transmits by voice the word "wait," testing shall be suspended. When, after an appropriate interval of time such announcement is repeated and no response is observed, and careful listening indicates that harmful interference should not be caused the operator shall proceed as set forth in subparagraph (4) of this paragraph;

(4) Testing of transmitters shall, insofar as practicable be confined to working frequencies without two way communications; however, 2182 kHz and 156.8 MHz may be used to contact other ship or coast stations when signal reports are necessary. U.S. Coast Guard stations may be contacted on 2182 kHz for test purposes only when tests are being conducted during inspections by Commission representatives or when qualified radio technicians are installing equipment or correcting deficiencies in the station radiotelephone equipment. In these cases the test shall be identified as "FCC" or "technical" and logged accordingly;

(5) When further testing is necessary beyond the two "test" announcements specified in subparagraphs (2) and (3) of this paragraph, the operator shall announce the word "testing" followed in the case of a voice transmission test by the count "1, 2, 3, 4, \* \* etc." or by test phrases or sentences not in conflict with normal operating signals. The test signals in either case shall have a duration not exceeding 10 seconds. At the conclusion of the test, there shall be voice announcement of the official call sign of the testing station. This test transmission shall not be repeated until a period of at least 1 minute has elapsed; on the frequency 2182 kHz or 156.8 MHz a period of at least 5 minutes shall elapse before the test transmission is repeated.

(b) When testing is conducted on any frequency within the bands 2173.5 to 2190.5 kHz, 156.75 to 156.85 MHz, 480 to 510 kHz (survival craft transmitters only), or 8362 to 8366 kHz (survival craft transmitters only), no test transmissions shall occur which are likely to actuate any

automatic alarm receiver within range. Survival craft stations shall not be tested on the frequency 500 kHz during the 500 kHz silence periods.

SEC. 83.366 General radiotelephone operating procedure. (a) Calling coast stations. (1) Use by ship stations of the frequency 2182 kHz for calling coast stations, and for replying to calls from coast stations, is authorized; however, whenever practicable such calls and replies shall be made on the appropriate ship-shore working frequency.

(2) Use by ship stations and marine utility stations on board ship of the frequency 156.8 MHz for calling coast stations and marine utility stations on shore, and for replying to calls from such stations, is authorized; however, whenever practicable such calls and replies shall be made on the appropriate ship-shore working frequency.

(b) Calling ship stations. (1) Except when other operating procedure is used to expedite safety communication, ship stations, before transmitting on the intership working frequencies 2003, 2638, 2738, or 2830 kHz, shall first establish communication with other ship stations by call and reply on 2182 kHz: *Provided*, That calls may be initiated on an intership working frequency when it is known that the called vessel maintains a simultaneous watch on such working frequency and on 2182 kHz.

(2) Except when other operating procedure is used to expedite safety communication, the frequency 156.8 MHz shall be used for call and reply by ship stations and marine utility stations on board ship before establishing communication on either of the intership working frequencies 156.3 or 156.4 MHz.

(c) Change to working frequency. After establishing communication with another station by call and reply on 2182 kHz or 156.8 MHz, stations on board ship shall change to an authorized working frequency for the transmission of messages which, under the provisions of this subpart, cannot be transmitted on the respective calling frequencies.

(d) Authorized use of 2003, 2142, 2638, 2738, and 2830 kHz. The intership working frequencies 2003, 2638, and 2830 kHz shall be used for transmissions by ship stations in accordance with the provisions of SECS. 83.176, 83.177, and 83.358.

(e) Simplex operation only. All transmission on 2003, 2142, 2638, 2738, and 2830 kHz by two or more stations, engaged in any one exchange of signals or communications, shall take place on only one of these frequencies, i.e., the stations involved shall transmit and receive on the same frequency: *Provided*, That this requirement is waived in the event of emergency when by reason of interference or limitation of equipment single-frequency operation cannot be used.

(f) Limitation on duration of calling. Calling a particular station shall not continue for more than 30 seconds in each instance. If the called station is not heard to reply, that station shall not again be called until after an interval of 2 minutes. When a station called does not reply to a call sent three times at intervals of 2 minutes, the calling shall cease and shall not be renewed until after an interval of 15 minutes; however, if there is no reason to believe that harmful interference will be caused to other communications in progress, the call sent three times at intervals of 2 minutes may be repeated after a pause of not less than 3 minutes. In event of an emergency involving safety, the provisions of this paragraph shall not apply.

(g) Limitation on duration of working. Any one exchange of communications between any two ship stations on 2003, 2142, 2638, 2738, or 2830 kHz, or between a ship station and a limited coast station on 2738 or 2830 kHz shall not exceed 3 minutes in duration after the two stations have established contact by calling and answering. Subsequent to such exchange of communications, the same two stations shall not again use 2003, 2142, 2638, 2738, or 2830 kHz for communication with each other until 10 minutes have elapsed: *Provided*, That this provision shall in no way limit or delay the transmission of communications concerning the safety of life or property.

(h) Transmission limitation on 2182 kHz and 156.8 MHz. Any one exchange of signals by ship stations on 2182 kHz or 156.8 MHz (including calls, replies thereto, and operating signals) shall not exceed 2 minutes: *Provided*, That this time limitation is not applicable to the transmission of distress, alarm, urgency, or safety signals, or to messages preceded by one of these signals.

(i) Limitation on business and operational communication. On frequencies above 30 MHz, the exchange of all business and operational communication shall be limited to the minimum practicable transmission time. In the conduct of ship-shore communication, other than distress, stations on board ship shall comply with instructions given by the limited coast station or marine utility station on shore with which they are communicating, in all matters relative to operating practices and procedures and to the suspension of transmission in order to minimize interference.

(j) 2182 kHz silence period in Regions 1 and 3. Transmission by ship or survival craft stations when in Regions 1 and 3 (except in the territorial waters of Japan and the Philippines) is prohibited on any frequency (including 2182 kHz) within the band 2173.5-2190.5 kHz during each 2182 kHz silence period, i.e., for 3 minutes twice each hour beginning at  $\times$  h. 00 and  $\times$  h. 30, Greenwich mean time: *Provided*, That this provision is not applicable to the transmission of distress, alarm, urgency, or safety signals, or to messages preceded by one of these signals.


Appendix IV

## Extracts From the FCC Rules and Regulations

SEC. 17.25 Specifications for the lighting of antenna structures over 150 feet up to and including 300 feet in height. (a) Antenna structures over 150 feet up to and including 300 feet in height above the ground shall be lighted as follows: ...

(3) All lights shall burn continuously or shall be controlled by a light sensitive device adjusted so that the lights will be turned on at a north sky light intensity level of about 35 foot candles and turned off at a north sky light intensity level of about 58 foot candles.

SEC. 17.47 Inspection of tower lights and associated control equipment. The licensee of any radio station which has an antenna structure requiring illumination pursuant to the provisions of section 303(q) of the Communications Act of 1934, as amended, as outlined elsewhere in this part:

(a) (1) Shall make an observation of the tower lights at least once each 24 hours either visually or by observing an automatic and properly maintained indicator designed to register any failure of such lights, to insure that all such lights are functioning properly as required; or alternatively,

(2) Shall provide and properly maintain an automatic alarm system designed to detect any failure of such lights and to provide indication of such failure to the licensee.

(b) Shall report immediately by telephone or telegraph to the nearest Flight Service Station or office of the Federal Aviation Agency any observed or otherwise known failure of a code or rotating beacon light or top light not corrected within thirty minutes, regardless of the cause of such failure. Further notification by telephone or telegraph shall be given immediately upon resumption of the required illumination.

(c) Shall inspect at intervals not to exceed 3 months all automatic or mechanical control devices, indicators, and alarm systems associated with the tower lighting to insure that such apparatus is functioning properly.

SEC. 17.49 Recording of tower light inspections in the station record. The licensee of any radio station which has an antenna structure requiring illumination shall make the following entries in the station record of the inspections required by SEC. 17.47.

(a) The time the tower lights are turned on and off each day if manually controlled;

(b) The time the daily check of proper operation of the tower lights was made, if automatic alarm system is not provided;

`(c) In the event of any observed or otherwise known failure of a tower light:

(1) Nature of such failure.

(2) Date and time the failure was observed, or otherwise noted.

(3) Date, time, and nature of adjustments, repairs, or replacements made.

(4) Identification of Flight Service Station (Federal Aviation Agency) notified of the failure of any code or rotating beacon light or top light not corrected within thirty minutes, and the date and time such notice was given.

(5) Date and time notice was given to the Flight Service Station (Federal Aviation Agency) that the required illumination was resumed.

(d) Upon completion of the periodic inspection required at least once every three months:

(1) The date of the inspection and the condition of all tower lights and associated tower lighting control devices, indicators and alarm systems.

(2) Any adjustments, replacements, or repairs made to insure compliance with the lighting requirements and the date such adjustments, replacements, or repairs were made.

SEC. 73.1 Standard broadcast station. The term standard broadcast station means a broadcasting station licensed for the transmission of radiotelephone emissions primarily intended to be received by the general public and operated on a channel in the band 535-1605 kHz.

SEC. 73.2 Standard broadcast band. The term standard broadcast band means the band of frequencies extending from 535 to 1605 kHz.

SEC. 73.3 Standard broadcast channel. The term standard broadcast channel means the band of frequencies occupied by the carrier and two side bands of a broadcast signal with the carrier frequency at the center. Channels shall be designated by their assigned carrier frequencies. The 107 carrier frequencies assigned to standard broadcast stations shall begin at 540 kHz and be in successive steps of 10 kHz.

SEC. 73.6 Daytime. The term daytime means that period of time between local sunrise and local sunset.

SEC. 73.7 Nighttime. The term nighttime means that period of time between local sunset and local sunrise.

SEC. 73.8 Sunrise and sunset. The terms sunrise and sunset mean, for each particular location and during any particular month, the time of sunrise and sunset as specified in the instrument of authorization.

SEC. 73.9 Broadcast day. The term "broadcast day" means that period of time between local sunrise and 12 midnight local standard time.

SEC. 73.14 Technical Definitions. (a) Combined audio harmonics. The term combined audio harmonics means the arithmetical sum of the amplitudes of all the separate harmonic components. Root sum square harmonic readings may be accepted under conditions prescribed by the Commission.

(b) Effective field. The term effective field or effective field intensity is

the root-mean-square (RMS) value of the inverse distance fields at a distance of 1 mile from the antenna in all directions in the horizontal plane. IN ANT

(c) Operating power. Operating power is the power that is actually supplied to the radio station antenna. E = VOITAGE I = CUERENT in Amp

(d) Maximum rated carrier power. Maximum rated carrier power is the maximum power at which the transmitter can be operated satisfactorily and is determined by the design of the transmitter and the type and number of vacuum tubes used in the last radio stage.

(e) Plate input power. Plate input power means the product of the during direct plate voltage applied to the tubes in the last radio stage and the the cher total direct current flowing to the plates of these tubes, measured without modulation.  $E \times I$ 

(f) Antenna power. Antenna input power or antenna power means the product of the square of the antenna current and the antenna resistance at the point where the current is measured.  $\mathcal{I}$ 

(g) Antenna current. Antenna current means the radio-frequency current in the antenna with no modulation.

(h) Antenna resistance. Antenna resistance means the total resistance of the transmitting antenna system at the operating frequency and at the point at which the antenna current is measured.

(i) *Percentage modulation (amplitude)*. Percentage modulation with respect to an amplitude modulated wave means the ratio of half the difference between the maximum and minimum amplitudes of the amplitude modulated wave to the average amplitude expressed in percentage.

SEC. 73.51 Operating power; how determined. (a) Except as provided in paragraph (b) of this section, the operating power shall be determined by the direct method (the square of the antenna current times the antenna resistance at the point where the current is measured and at the operating frequency). (b) Operating power shall be determined on a temporary basis by the indirect method: (1) In case of an emergency where the licensed antenna system has been damaged by causes beyond the control of the licensee (see SEC. 73.45), or (2) Pending completion of authorized changes in the antenna system, or (3) If any change is made in the antenna system. (See Sec. 73.45.)

SEC. 73.55 *Modulation*. The percentage of modulation shall be maintained as high as possible consistent with good quality of transmission and good broadcast practice. In no case is it to exceed 100 percent on negative peaks of frequent recurrence. Generally, it should not be less than 85 percent on peaks of frequent recurrence; but where necessary to avoid objectionable loudness modulation may be reduced to whatever level is necessary, even if the resulting modulation is substantially less than 85 percent on peaks of frequent recurrence.

SEC. 73.56 Modulation monitors. (a) Each station shall have in operation, either at the transmitter or at the place the transmitter is controlled, a modulation monitor of a type approved by the Commission.

(b) In the event that the modulation monitor becomes defective the station may be operated without the monitor pending its repair or replacement for a period not in excess of 60 days without further authority of the Commission: *Provided*, That: (1) Appropriate entries shall be made in the maintenance log of the station showing the date and time the monitor was removed from and restored to service. (2) The Engineer in Charge of the radio district in which the station is located shall be notified both immediately after the monitor is found to be defective and immediately after the repaired or replacement monitor has been installed and is functioning properly. (3) The degree of modulation of the station shall be monitored with a cathode ray oscilloscope or other acceptable means.

SEC. 73.57 Operating power; maintenance of. (a) The operating power of each station shall be maintained as near as practicable to the licensed power and shall not exceed the limits of 5 percent above and 10 percent below the licensed power, except that in an emergency when due to causes beyond control of the licensee it becomes impossible to operate with full licensed power, the station may be operated with reduced power for a period not to exceed 10 days, provided the Commission and the Engineer in Charge of the radio district in which the station is located shall be notified immediately after the emergency develops and also upon the resumption of licensed power. (b) In addition to maintaining the operating power within the above limitations, stations employing directional antenna systems shall maintain the ratio of the antenna currents in the elements of the system within 5 percent of that specified by the terms of the license or other instrument of authorization.

SEC. 73.58 Indicating instruments. (a) Each standard broadcast station shall be equipped with indicating instruments which conform with the specifications set forth in Sec. 73.39 for measuring the dc plate circuit current and voltage of the last radio frequency amplified stage; the radio frequency base current of each antenna element; and, for stations employing directional antenna systems, the radio frequency current at the point of common input to the directional antenna. (b) In the event that any one of these indicating instruments becomes defective when no substitute which conforms with the required specifications is available, the station may be operated without the defective instrument pending its repair or replacement for a period not in excess of 60 days without further authority of the Commission: Provided, That: (1) Appropriate entries shall be made in the maintenance log of the station showing the date and time the meter was removed from and restored to service. (2) The Engineer in Charge of the radio district in which the station is located shall be notified both immediately after the instrument is found to be defective and immediately after the repaired or replacement instrument has been installed and is functioning properly. (3) If the defective instrument is the antenna current meter of a nondirectional station which does not employ a remote antenna ammeter, or if the defective instrument is the common point meter of a station which employs a directional antenna, and does not employ a remote common point meter, the operating power shall be determined by the indirect method in accordance with Sec. 73.52 during the entire time the station is operated without the antenna current meter or common point meter. However, if a remote antenna ammeter or a remote common point meter is employed and the antenna current meter or common point meter becomes defective, the remote meter may be used in determining operating power by the direct method pending the return to service of the regular meter, provided other meters are maintained at same value previously employed. (c) If conditions beyond the control of the licensee prevent the restoration of the meter to service within the above allowed period, informal request in accordance with Sec. 1.549 of this chapter may be filed with the Engineer in Charge of the radio district in which the station is located for such additional time as may be required to complete repairs of the defective instrument.

(d) Remote antenna ammeters and remote common point meters are not required; therefore, authority to operate without them is not necessary. However, if a remote antenna ammeter or common point meter is employed and becomes defective, the antenna base currents may be read and logged once daily for each mode of operation, pending the return to service of the regular remote meter.

SEC. 73.59 Frequency tolerance. The operating frequency of each station shall be maintained within 20 Hz of the assigned frequency.

SEC. 73.67 *Remote control operation*. (3) A malfunction of any part of the remote control equipment and associated line circuits resulting in improper control or inaccurate meter readings shall be cause for the immediate cessation of operation by remote control.

SEC. 73.111 General requirements relating to logs. (a) The licensee or permittee of each standard broadcast station shall maintain program, and operating, logs as set forth in Sections 73.112, and 73.113. Each log shall be kept by the station employee or employees (or contract operator) competent to do so, having actual knowledge of the facts required, who in the case of program and operating logs shall sign the appropriate log when starting duty, and again when going off duty. (b) The logs shall be kept in an orderly and legible manner, in suitable form, and in such detail that the data required for the particular class of station concerned is readily available. Key letters or abbreviations may be used if proper meaning or explanation is contained elsewhere in the log. Each sheet shall be numbered and dated. Time entries shall be either in local standard or daylight saving time and shall be indicated accordingly. (c) No log or preprinted log or schedule which becomes a log, or portion thereof, shall be erased, obliterated, or willfully destroyed within the period of retention provided by the provisions of this part. Any necessary correction shall be made only pursuant to Sections 73.112 and 73.113, and only by striking out the erroneous portion, or by making a corrective explanation on the log or attachment to it as provided in those sections. (d) Entries shall be made in the logs as required by Sections 73.112 and 73.113. Additional information such as that needed for billing purposes or for the cuing of automatic equip-

ment may be entered on the logs. Such additional information, so entered, shall not be subject to the restrictions and limitations in the Commission's Rules on the making of corrections and changes in logs.

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SEC. 73.112 Program log. (a) The following entries shall be made in the program log: (1) For each program: an entry identifying the program by name or title, an entry of the time each program begins and ends, an entry classifying each program as to type (news, religious, entertainment, sports), an entry classifying each program as to source, an entry for each program presenting a political candidate showing the name and political affiliation of such candidate. (2) For commercial matter: an entry identifying the sponsor(s) of the program, the person(s) who paid for the announcement, or the person(s) who furnished materials or services of any kind (such as records, transcriptions, talent, scripts, etc.), an entry showing the total amount of commercial continuity within each commercially sponsored program, an entry showing the duration of each commercial announcement, an entry which shows either the beginning time of each such announcement or which divides the log to show the fifteen minute time segment within which the announcement was broadcast, and an entry showing that the appropriate announcements (sponsorship, furnishing material, or services, etc.) have been made. (3) For Public service announcements: an entry showing that a public service announcement has been broadcast together with the name of the organization or interest on whose behalf it has been made. (4) For other announcements: an entry of the time that each station identification is made (call letters and licensed location), an entry for each announcement presenting a political candidate showing the name and political affiliation of such candidate, and entry showing that a mechanical reproduction announcement has been made. The licensee whether employing manual or automatic logging or a combination thereof must be able accurately to furnish the Commission with all information required to be logged.

Manually kept log. Where, in any program log, or preprinted program log, or program schedule which upon completion is used as a program log, a correction is made before the person keeping the log has signed the log upon going off duty, such correction, no matter by whom made, shall be initialed by the person keeping the log prior to his signing of the log when going off duty, as attesting to the fact that the log as corrected is an accurate representation of what was broadcast. If corrections or additions are made on the log after it has been so signed, explanation must be made on the log or on an attachment to it, dated and signed by either the person who kept the log, the station program director or manager, or an officer of the licensee.

SEC. 73.113 Operating log. (a) The following entries shall be made in the operating log by the properly licensed operator in actual charge of the transmitting apparatus only: (1) An entry of the time the station begins to supply power to the antenna and the time it stops. (2) An entry of each interruption of the carrier wave, where restoration

is not automatic, its cause and duration followed by the signature of the person restoring operation (if licensed operator other than the 3 hours licensed operator on duty). (3) An entry, at the beginning of operation and at intervals not exceeding one-half hour, of the following (actual readings observed prior to making any adjustments to the equipment) and, when appropriate, and indication of corrections made to restore parameters to normal operating values: (i) Operating constants of last radio stage (total plate voltage and plate current). (ii) Antenna current or common point current (if directional) without modulation. (iii) Frequency monitor reading. (4) An entry each day of the following where applicable: (i) Antenna base current(s) without modulation for each mode of operation: (a) Where remote antenna meters or a remote common point meter are normally employed but are defective. (b) Where required by the station license for directional antenna operation. (ii) Where there is remote control operation of a directional antenna station, readings for each pattern taken at the transmitter (within two hours of commencement or operation with each pattern) of: (a) Common point current without modulation. (b) Base current(s) without modulation. (c) Phase monitor sample loop current(s) without modulation. (d) Phase indications. (5) Any other entries required by the instrument of authorization or the provisions of this part. (6) The entries required by Section 17.49 and (c) of this chapter. (b) Automatic devices accurately calibrated and with appropriate time, date and circuit functions may be utilized to record the entries in the operating log: Provided, That: (1) They do not affect the operation of circuits or accuracy of indicating instruments of the equipment being recorded; (2) The recording devices have an accuracy equivalent to the accuracy of the indicating instruments; (3) The calibration is checked against the original indicators at least once a week and the results noted in the maintenance log; (4) Provision is made to actuate automatically an aural alarm circuit located near the operator on duty if any of the automatic log readings are not within the tolerances or other requirements specified in the rules or instrument of authorization; (5) Devices which record each parameter in sequence must read each parameter at least once during each 10-minute period and clearly indicate the parameter being recorded; (6) The automatic logging equipment is located at the remote control point if the transmitter is remotely controlled, or at the transmitter location if the transmitter is manually controlled; (7) The automatic logging equipment is located in the near vicinity of the operator on duty and is inspected by him periodically during the broadcast day; and (8) The indicating equipment conforms with the requirements of Sec. 73.39 except that the scales need not exceed 2 inches in length and arbitrary scales may not be used.

SEC. 73.115 Retention of logs. Logs of standard broadcast stations shall be retained by the licensee or permittee for a period of 2 years: *Provided, however,* That logs involving communications incident to a disaster or which include communications incident to or involved in an investigation by the Commission and concerning which the licensee or permittee has been notified, shall be retained by the licensee or per-

mittee until he is specifically authorized in writing by the Commission to destroy them: *Provided*, *further*, That logs incident to or involved in any claim or complaint of which the licensee or permittee has notice shall be retained by the licensee or permittee until such claim or complaint has been fully satisfied or until the same has been barred by statute limiting the time for the filing of suits upon such claims. NOTE: Application forms for licenses and other authorizations require that certain operating and program data be supplied. It is suggested that these application forms be kept in mind in connection with maintenance of station program and operating records.

SEC. 73.116 Availability of logs and records. The following shall be made available upon request by an authorized representative of the Commission: (a) Program, operating and maintenance logs. (b) Equipment performance measurements required by Sec. 73.47. (c) Copy of most recent antenna resistance or common-point impedance measurements submitted to the Commission. (d) Copy of most recent field intensity measurements to establish performance of directional antennas required by Sec. 73.151.

SEC. 73.117 Station identification. (a) A licensee of a standard broadcast station shall make station identification announcement (call letters and location) at the beginning and ending of each time of operation and during operation (1) on the hour and (2) either on the half hour or at the quarter hour following the hour and at the quarter hour preceding the next hour: Provided, (b) Such identification announcement need not be made on the hour when to make such announcement would interrupt a single consocutive speech, play, religious service, symphony concert, or operatic production of longer duration than 30 minutes. In such cases the identification announcement shall be made at the beginning of the program, at the first interruption of the entertainment continuity, and at the conclusion of the program. (c) Such identification announcement need not be made on the half hour or quarter hours when to make such announcement would interrupt a single consecutive speech, play, religious service, symphony concert, or operatic production. In such cases an identification announcement shall be made at the first interruption of the entertainment continuity and at the conclusion of the program: Provided, That an announcement within 5 minutes of the times specified in paragraph (a) (2) of this section will satisfy the requirements of identification announcements. (d) In the case of variety show programs, baseball game broadcasts, or similar programs of longer duration than 30 minutes, the identification announcement shall be made within 5 minutes of the hour and of the times specified in paragraph (a) (2) of this section. (e) In the case of all other programs the identification announcement shall be made within 2 minutes of the hour and of the times specified in paragraph (a) (2) of this section. (f) In making the identification announcement the call letters shall be given only on the channel of the station identified thereby, except as otherwise provided in Sec. 73.287 of the Commission's rules governing fm broadcast station.

SEC. 73.118 Mechanical reproductions. (a) No mechanically reproduced program consisting of a speech, news event, news commentator, forum,

panel discussion, or special event in which the element of time is of special significance, or any other program in which the element of time is of special significance and presentation of which would create, either intentionally or otherwise, the impression or belief on the part of the listening audience that the event or program being broadcast is in fact occurring simultaneously with the broadcast, shall be broadcast without an appropriate announcement being made either at the beginning or end of such reproduction or at the beginning or end of the program in which such reproduction is used that it is a mechanical reproduction or a mechanically reproduced program: *Provided, however*, That each such program of one minute or less need not be announced as such.

SEC. 73.119 Sponsored programs, announcement of. (a) When a standard broadcast station transmits any matter for which money, services, or other valuable consideration is either directly or indirectly paid or promised to, or charged or received by, such station, the station shall broadcast an announcement that such matter is sponsored, paid for, or furnished, either in whole or in part, and by whom or on whose behalf such consideration was supplied: Provided, however, That "service or other valuable consideration" shall not include any service or property furnished without charge or at a nominal charge for use on, or in connection with, a broadcast unless it is so furnished in consideration for an identification in a broadcast of any person, product, service, trademark, or brand name beyond an identification which is reasonably related to the use of such service or property on the broadcast. (e) The announcement required by this section shall fully and fairly disclose the true identity of the person or persons by whom or in whose behalf such payment is made or promised, or from whom or in whose behalf such services or other valuable consideration is received, or by whom the material or services referred to in paragraph (d) of this section are furnished. Where an agent or other person contracts or otherwise makes arrangements with a station on behalf of another, and such fact is known to the station, the announcement shall disclose the identity of the person or persons in whose behalf such agent is acting instead of the name of such agent.

SEC. 73.252 Frequency monitor. (a) The licensee of each station shall have in operation, either at the transmitter or at the place where the transmitter is controlled, a frequency monitor of a type approved by the Commission which shall be independent of the frequency control of the transmitter. (b) In the event that the frequency monitor becomes defective the station may be operated without the monitor pending its repair or replacement for a period not in excess of 60 days without further authority of the Commission: Provided, That: (1) Appropriate entries shall be made in the maintenance log of the station showing the date and time the monitor was removed from and restored to service. (2) The Engineer in Charge of the radio district in which the station is located shall be notified both immediately after the monitor is found to be defective and immediately after the repaired or replacement monitor has been installed and is functioning properly. (3) The frequency of the station shall be compared with an external frequency

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source of known accuracy at sufficiently frequent intervals to insure that the frequency is maintained within the tolerance prescribed in Sec. 73.269. An entry shall be made in the station log as to the method used and the results thereof. (c) If conditions beyond the control of the licensee prevent the restoration of the monitor to service within the above allowed period, informal request in accordance with Sec. 1.549 of this chapter may be filed with the Engineer in Charge of the radio district in which the station is located for such additional times as may be required to complete repairs of the defective instrument.

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SEC. 73.269 *Frequency tolerance*. The center frequency of each fm broadcast station shall be maintained within 2000 Hz of the assigned center frequency.

SEC. 73.310(a) Fm broadcast band. The band of frequencies extending from 88 to 108 MHz, which includes those assigned to noncommercial educational broadcasting.

Fm broadcast station. A station employing frequency modulation in the fm broadcast band and licensed primarily for the transmission of radiotelephone emissions intended to be received by the general public.

\*

SEC. 73.907 Emergency Action Notification. The Emergency Action Notification is the notice to stations in the Radio Broadcast Services to operate in accordance with the Emergency Broadcast System Plan.

SEC. 73.908 *Emergency Action Condition*. The Emergency Action Condition is the period of time between the transmission of an Emergency Action Notification and the transmission of the Emergency Action Termination.

SEC. 73.910 Emergency Broadcast System (EBS). The Emergency Broadcast System (EBS) is a system of facilities and personnel of nongovernment broadcast stations and other authorized facilities licensed or regulated by the Federal Communications Commission, including approved and authorized integral facilities or systems, arrangements, procedures, and interconnecting facilities, which have been authorized by the Commission to operate in a controlled manner during a grave national crisis or war.

SEC. 73.913 National Defense Emergency Authorization (NDEA). An authorization issued by the Commission permitting controlled operation of a station operating in the Radio Broadcast Services during an Emergency Action Condition.

SEC. 73.916 Emergency Broadcast System Plan. The Emergency Broadcast System Plan is the document containing the detailed description of how stations operating in the Radio Broadcast Services will be notified and operated in the Emergency Broadcast System.

\*

SEC. 73.932 Emergency Action Notification Procedures. All broadcast stations are to be furnished complete instructions on color coded cards (yellow, white, red, blue). Each card specifies the procedure to be

sk

followed (texts of these cards are included in Annex V of the EBS Plan). Immediately upon receipt of an Emergency Action Notification (yellow card), all standard, commercial fm, and noncommercial educational fm broadcast stations with a transmitter output of over 10 watts, and television broadcast stations, including all such stations operating under equipment or program test authority, will proceed as set forth in paragraph (a) or (b) of this section, as applicable:

(a) Receipt of the Emergency Action Notification without Attack Warning:

(1) Discontinue normal program and follow the detailed transmission procedures set forth on the White Card entitled "Broadcast Message" EAN-1. This White Card has been furnished to all licensed broadcast stations for posting in all studios and broadcast operating positions.

(2) Upon completion of these detailed transmission procedures, all licensed broadcast stations which do not hold a National Defense Emergency Authorization (NDEA) shall discontinue operation for the duration of the Emergency Action Condition.

(b) Receipt of the Emergency Action Notification with Attack Warning:

(1) Discontinue normal program and follow the detailed transmission procedures set forth on the Red Card entitled "Broadcast Message" EAN-2. This Red Card has been furnished to all licensed broadcast stations for posting in all studios and broadcast operating positions.

(2) Upon completion of these detailed transmission procedures, all licensed broadcast stations which do not hold a National Defense Emergency Authorization (NDEA) shall discontinue operation for the duration of the Emergency Action Condition.

(c) A station which normally broadcasts a substantial part of its programming in a language other than English may broadcast the required announcements as well as EBS programming, in such foreign language sequentially with the broadcast in English, provided such station has been authorized to do so as part of an approved Detailed State Emergency Broadcast System (EBS) Operational Plan.

(d) Noncommercial educational fm broadcast stations with a transmitter power output of 10 watts or less will, upon receipt of an Emergency Action Notification, interrupt the program in progress and broadcast the appropriate Emergency Action Notification Message as provided in paragraph (a) of this section, but without the transmission of the Attention Signal. Such stations will then discontinue operation and maintain radio silence in accordance with the Basic Emergency Broadcast System (EBS) Plan.

(e) International broadcast stations will cease broadcasting immediately upon receipt of an Emergency Action Notification and will maintain radio silence in accordance with the Basic Emergency Broadcast System (EBS) Plan.

SEC. 73.933 Radio Monitoring Requirement. (a) In order to ensure the effectiveness of the Third Method of the Emergency Action Notification System, all broadcast station licensees must install and operate during their hours of broadcast operation equipment capable of receiving Emergency Action Notifications or Terminations transmitted by other radio broadcast stations. This equipment must be maintained in operative condition, including arrangements for human listening watch or automatic alarm devices, and shall have its termination at each transmitter control point. However, where more than one broadcast transmitter is controlled from a common point by the same operator, only one set of equipment is required at that point.

(b) The off-the-air monitoring assignment of each standard, fm, and television broadcast station is specified in the Detailed State Emergency Broadcast System (EBS) Operational Plan. Particular attention should be paid to avoiding "closed loops" in monitoring assignments.

(c) Prior to commencing routine operation or originating any emissions under program test, equipment test, experimental, or other authorizations or for any other purpose, licensees or permittees shall first ascertain whether an Emergency Action Condition exists and, if so, shall operate only in accordance with the Basic Emergency Broadcast System (EBS) Plan and Detailed State Emergency Broadcast System (EBS) Operational Plan.

SEC. 73.940 Emergency Action Termination. The Emergency Action Termination is the notice to stations in the Radio Broadcast Services to discontinue controlled operations imposed by an outstanding Emergency Action Notification and return to normally licensed operations.

SEC. 73.961 Tests of the Emergency Action Notification System. Tests of the Emergency Action Notification System will be made at regular intervals with appropriate entries in the station operating log, as follows:

(a) Test transmissions using the First Method of the Emergency Action Notification System utilizing the facilities of the Associated Press (AP) and the United Press International (UPI) Radio Wire Teletype Networks will be conducted twice each week. These tests will be conducted on Saturday at 9:30 A.M., e.s.t., and on Sunday at 8:30 P.M., e.s.t. The Blue Card, identified as First Method EAN Tests, which has been furnished to all standard, fm, and television broadcast stations, sets forth details of these test transmissions.

(b) Test transmissions using the Second Method of the Emergency Action Notification System via dedicated teletype network between the White House Communications Agency, specified control points of the nationwide commercial Radio and Television Broadcast Networks, the American Telephone and Telegraph Co. and other specified points will be conducted once each week at a selected time in accordance with the test procedures set forth in the Emergency Broadcast System (EBS) Standing Operating Procedures (EBS SOP-3). Testing of the internal alerting facilities of the nationwide commercial Broadcast Networks is not necessary since these facilities are utilized in day-to-day operations.

(c) Test transmissions of the Third Method of the Emergency Action

Notification System will be conducted by standard, fm, and television broadcast stations once each week on an unscheduled basis between the hours of 8:30 A.M. and local sunset. Noncommercial educational fm broadcast stations with a transmitter output of 10 watts or less are not required to conduct these tests. The Blue Card, identified as Third Method EAN Tests, which has been furnished to all standard, fm, and television broadcast stations, sets forth details of these test transmissions.

#### Appendix V

### Information Concerning Commercial Radio Operator Licenses and Permits

#### THE APPLICATION

 An applicant must normally be a citizen or national of the United States. Under certain circumstances U.S. nationality may be waived for:

1) Alien aircraft pilots, and 2) Citizens of a U.S. Trust Territory.

- (2) Except for Restricted Radiotelephone Operator Permit, submit in advance a completed application Form 756 and appropriate fee to the office which will administer the examination. If examination is to be taken at an FCC office the forms may be obtained and completed at the time of the examination. To request a Restricted Radiotelephone Operator Permit for which no examination is required, submit FCC application Form 753 and fee by mail to Commission's office at Gettysburg, Pa. 17325.
- (3) The Commission has not established any age limit for applicants who wish to obtain commercial radio operator licenses, except that radiotelegraph first-class operator licenses may not be issued to applicants under twenty-one (21) years of age, applicants for examination for an Aircraft Radiotelegraph Endorsement must be at least eighteen (18) years of age, and applicants for the Restricted Radiotelephone Operator Permit must be at least fourteen (14).
- (4) Each radio operator application form inquires as to the applicant's criminal record, if any, the status of his citizenship, and his physical ability to perform the duties of a radio operator.

#### **EXAMINATIONS**

(5) If applying for a Radiotelegraph type license, must successfully pass the prescribed code test consisting of both transmitting and receiving the International Morse Code for a period of one minute without error. This test is computed counting 5 letters per word or group with punctuation and numerals counting as 2 letters. It may be written in either pencil or ink. Semiautomatic keys and typewriters may be used for the 25 WPM test if furnished by the applicant. The speed requirements are as follows:

Radiotelegraph Third Class Operator Permit	16 code groups per minute and 20 words per minute,
Radiotelegraph Second Class Operator License	16 code groups per minute and
	20 words per minute, 
Radiotelegraph First Class Operator License	20 code groups per minute and 25 words per minute, 

(6) Must be able to transmit and receive spoken messages in English and successfully pass written examination elements as follows:

en examination re-
1 and 2.
1, 2, and 3.
1, 2, 3, and 4.
1, 2, and 5.
1, 2, 5, and 6.
1, 2, 5, and 6.

The Commission's examination elements consist of the following: No. 1, Basic Law—Provisions of laws, treaties and regulations with which every operator should be familiar. (20 Questions, multiple choice type) No. 2, Basic Operating Practice— Operating procedures and practices generally followed or required in communicating by radiotelephone stations. (20 Questions, multiple choice type)

*No. 3, Basic Radiotelephone*—Technical, legal and other matters applicable to operating radiotelephone stations other than broadcast. (100 Questions, multiple choice type)

No. 4, Advanced Radiotelephone—Advanced technical, legal and other matters particularly applicable to operating various classes of broadcast stations. (50 Questions, multiple choice type)

No. 5, Radiotelegraph Operating Practice—Radio operating procedures and practices generally followed or required in communicating by radiotelegraph stations primarily other than in the maritime mobile services of public correspondence. (50 Questions, multiple choice type)

No. 6, Advanced Radiotelegraph—Technical, legal and other matters applicable to operating all classes of radiotelegraph stations including maritime mobile services of public correspondence, message traffic routing and accounting, radio navigational aids, etc. (100 Questions) No. 7, Aircraft Radiotelegraph—Special endorsement on Radiotelegraph First and Second Class Operator Licenses. Theory and practice in operation of radio communication and navigational systems in use on aircraft. (100 Questions, multiple choice type; code test of 20 code groups per minute and 25 WPM plain language.)

*No. 8, Ship Radar Techniques--*Special endorsement on Radiotelegraph First or Second Class Operator Licenses. Specialized theory and practice applicable to proper installation, servicing and maintenance of ship radar equipment in use for marine navigational purposes. (50 Questions, multiple choice type)

No. 9, Basic Broadcast—Special endorsement on Radiotelephone Third Class Operator License. Specialized elementary theory and practice in operation of standard (a-m) and fm broadcast stations. (20 Questions, multiple choice type)

- (7) Except insofar as the requirement of one-year service for eligibility for Radiotelegraph First Class Operator License, as outlined under Item 12 herein, may be considered a training requirement, there are no educational or training requirements set up by the Commission as a prerequisite to taking an examination.
- (8) Examinations for commercial radio operator licenses are conducted at each radio district office of the Commission on the days designated by the Engineer in Charge of the office. In addition to the radio district offices of the Commission, examinations are held in certain other cities on dates designated by the Engineer in Charge of the radio district in which these cities are located. A list of designated examination points will be forwarded upon request or when necessary to answer inquiries regarding such points. Specific dates and times of examinations should be obtained from the Engineer in Charge of the office concerned in each instance. Available facilities do not permit extension of the regular radio operator license examination procedure to applicants overseas. It is suggested that applicants overseas arrange for examination when they are able to appear at one of the Commission's designated examination points.
- (9) The holder of a license, who applies for another class of license or special endorsement, will be required to pass only the additional written examination elements for the new class of license. Applicants should bring with them and present any licenses, permits and verification cards they may hold to the examiner at the time of examination. If the holder of a license qualifies for a higher class license in the same group, the license held will be submitted for cancellation and returned to the licensee upon issuance of the new license. Since code tests are not considered as "elements," credit for them is not generally allowed and it is necessary to re-qualify.
- (10) An applicant who fails an examination element will be ineligible for a period of two months to take an examination for any class of license requiring that element. Examination elements will be graded in the order listed (not necessarily the same day completed), and an applicant may, without further application, be issued the class of license or permit for which he qualifies. *Seventy-five percent* is the passing grade for written examination elements.

(11) Any person who obtains or attempts to obtain, or assists another to obtain or attempt to obtain an operator license or permit by fraudulent means is committing a Federal offense for which severe penalties may be imposed.

#### **PRIOR EXPERIENCE REQUIRED**

- (12) An applicant for a radiotelegraph first-class operator license shall have had an aggregate of one year of satisfactory service as an operator manipulating the key of a manually operated public ship or coast station handling public correspondence by radiotelegraphy.
- (13) To obtain employment as the sole radio operator on most cargo ships it is required that the licensed operator must have had at least six months prior satisfactory service as a qualified radiotelegraph operator in a station on board a ship or ships of the United States.

#### FEE SCHEDULE

(14) The following application filing fees must accompany applications for radio operator licenses and permits: \$5 for first class, \$4 for second class, \$3 for third class, and \$2 for commercial operator license endorsements, duplicates, renewals, and replacements, and \$8 for restricted radiotelephone operator permits. Whenever an applicant requests both an operator license and an endorsement, the required fee will be the fee prescribed for the license document involved. Fees should be paid by check or money order payable to the Federal Communications Commission, If an examination is to be taken at a place away from a field office, the application and fee should be filed in advance at the field office administering the examination.

#### VERIFICATION OF LICENSE HOLDING

- (15) Operators holding a radio operator license of the diploma form (other than Restricted Radiotelephone Operator Permit) may obtain a Verification Card, FCC Form 758-F, attesting to license holding. Verification Cards may be carried on the person of the operator in lieu of the license when operating a station at which the posting of an operator license is not required. When such Verification Cards are used the original license or permit must be readily accessible for inspection by an authorized government representative.
- (16) If an operator is required to post his radio operator license at more than one station he may post the original license or permit at one station and post Verified Statements, FCC Form 759, at the other stations..
- (17) Verification Cards or Verified Statements may be obtained by filing a properly completed application Form 756. The license or

permit must accompany the request for verification. In lieu of the license or permit the operator shall exhibit a signed copy of the application which has been submitted by him until action is taken on the request.

#### **RENEWALS, DUPLICATES, AND REPLACEMENTS**

- (18) An operator whose license or permit of the diploma form (other than Restricted Radiotelephone Operator Permits) has been lost, mutilated or destroyed, shall immediately notify the Commission. An application Form 756 for a duplicate may be submitted to the office issuing the original license or permit embodying a statement attesting to the facts thereof. A replacement Restricted Radiotelephone Operator Permit may be requested by filing application Form 753 and the required fee with the Commission's Gettysburg, Pa. office.
- (19) The holder of any license or permit whose name is legally changed may make application for a replacement document to indicate the new legal name, by submitting a properly completed application and the required fee to the office of original issue, accompanied by the license or permit affected.
- (20) Licenses are normally renewable at any time within the last year of the license term or during a one-year period of grace after the date of expiration. During this grace period, an expired license is not valid. At this time it is not necessary to show service under a license sought to be renewed. (Renewal applications, when accompanied by the expiring license, should be filed at the nearest District Office. If the expiring license has been lost, destroyed, or mutilated, the application should be filed at the office which issued the original document. Applications may be by mail and should be submitted through the use of FCC Form 756.)
- (21) When a duplicate or replacement operator license or permit has been requested or request has been made for renewal, or for an endorsement, in lieu of the license or permit, the operator shall exhibit a signed copy of the application which has been submitted by him.

#### **GENERAL INFORMATION**

- (22) All licenses and permits other than amateur are considered to be commercial licenses and permits. Radio operator license requirements are usually governed by the type of emission involved and whether or not the operator's duties include making adjustments to transmitters.
- (23) A license is not required for the operation of or repairs to radio or television *receiving* equipment.
- (24) The Commission does not issue licenses for radio engineers, television engineers, television cameramen, radio mechanics, radio announcers or studio console operators. Persons who are employed at these jobs are required to hold operator licenses of

the proper type and class issued by the Commission only if their duties include the operation of radio transmitting and/or video transmitting equipment.

- (25) Restricted radiotelephone operator permits are normally issued for the lifetime of the holder. Commercial operator licenses and permits of other classes are normally issued for a term of five years from the date of issue.
- (26) The minimum requirement of persons wishing to obtain employment as an operator at a standard (a-m) or fm broadcast station is a Radiotelephone Third-Class Operator Permit with the Basic Broadcast endorsement. (Examination Elements 1, 2, and 9). A nonrenewable Provisional Radio Operator Certificate, which carries with it all the authority now embraced by a Radiotelephone Third-Class Operator Permit endorsed for Broadcast use, may be obtained by mail and without examination. The holder is expected to fulfil the examination requirements within the one year term of the certificate. Application may be made on FCC Form 756-C, which may be obtained from any of the Commission's Field Engineering Offices.
- (27) Holders of Restricted Radiotelephone Operator Permits, Radiotelephone and Radiotelegraph Third-Class Operator Permits are in general prohibited from making adjustments that may result in improper transmitter operation. The Commission's Rules require that radio transmitting equipment operated by holders of these operator permits shall be so designed that none of the operations necessary to be performed during the course or normal rendition of service may cause off-frequency operation or result in any unauthorized radiation. Any needed adjustments to transmitters operated by holders of the Restricted Radiotelephone Operator Permit and Radiotelephone and Radiotelegraph Third-Class Operator Permits should be made by or in the presence of the holder of a higher class license of the proper grade.
- (28) In general anyone wishing to obtain employment as an operator at a ship radiotelegraph station should hold a Radiotelegraph First- or Second-Class Operator License. Restricted Radiotelephone Operator Permits are valid for the normal operation of radiotelephone equipment installed in most aircraft, at certain ground stations, and on most boats where radio equipment is not mandatory.
- (29) The class of commercial radio operator license which is normally required as sufficient authority to install, service, and maintain radiotelephone transmitting equipment on board aircraft and small boats and most radio transmitting equipment in the landmobile services is the Radiotelephone Second-Class Operator License. Successful completion of Commercial Examination Elements 1, 2, and 3 is required prior to the issuance of class license.

### Answers to Self-Tests

#### ELEMENTS I AND II SELF-TEST

- 1. A.
- 2. B. If the original is found meanwhile it is necessary that you return either one, original or duplicate, to the FCC.
- 3. B.
- 4. D. Station logs must be signed when the operator goes on and off duty. Likewise log records must be signed by the licensed maintenance technician and must also include data on the nature of the transmitter repairs.
- 5. D.
- 6. B.
- 7. B.
- 8. A.
- 9. B.
- 10. D.
- 11. D. 12. A.
- 12. A. 13. C.
- 14. A.
- 15. C.
- 16. B.
- 17. A. The operator must learn to be patient under adverse propagation conditions. Repeated calls should be only made if one is certain the transmissions cause no interference or hamper other communications that share the same frequency.
- 18. D.
- 19. C.
- 20. C.
- 21. A.
- 22. B.
- 23. C.
- 24. D.
- 25. B.
- 26. D.

- 27. D. Questions 26 and 27 show a method of questioning that is often used in FCC examinations. You are to select the most complete answer. In Question 27, both A and B are correct but the proper answer is D in terms of multiple-choice evaluation.
- 28. C.
- 29. D. Overmodulation is to be avoided because it limits the effective transmission range of the station because of speech distortion. However, it is not direct grounds for license suspension.
- 30. C.
- 31. B.
- 32. B.
- 33. B. This is a problem when one must transmit from a location near operating machinery or in traffic. The development of noise-cancelling microphones has aided this problem. They must be close-talked to be really useful. Close-talk but do not shout.
- 34. A.
- 35. A.
- 36. D.
- 37. B.
- 38. D.
- 39. A.
- 40. A.

#### ELEMENT IX SELF-TEST

- 1. B. One kilohertz equals one thousand hertz. In one million hertz there are one thousand kilohertz.
- 2. C. The remote antenna meter

reading is not a compulsory one and operation can continue. However, you should always notify the chief engineer or the first-class radiotelephone operator in charge.

- 3. A.
- 4. C. Too high an audio level can cause overmodulation. If a decrease in the volume level setting does not overcome the problem it is your responsibility to notify the chief engineer or the first-class radiotelephone operator in charge.
- 5. B.
- 6. D.
- 7. D.
- 8. C.
- 9. D. You should strike out the erroneous portion (not erase) and initial the correction made and the date of correction.
- 10. A.
- 11. B. In this case there is no need to take the station off the air. Again it is the responsibility of the operator to notify the chief engineer or the first-class radiotelephone operator in charge.
- 12. C. Minor readjustments are always made after the official logging.
- 13. C.
- 14. A.
- 15. B. One kilovolt equals one thousand volts, therefore two thousand volts is the same as two kilovolts.
- 16. B.
- B. 10% of the 3500 volt reading is 350 volts. Reading would be 3150 volts (3500 - 350).
- 18. C.
- 19. D. The present reading is 5.4

and 5% of this figure is 0.27. This would be an increase to 5.67.

- 20. A. In fact, failure of the remote control system would usually shut down the transmitter automatically.
- D. Carrier is only slightly off frequency and operation can be considered normal.
- 22. A.
- 23. C.
- D. The limits are 5% above assigned power and 10% below assigned power.
- 25. A.
- 26. C. Abbreviations may be used if a list of such abbreviations is kept at some other point in the log.
- 27. B.
- 28. D.
- 29. B. This is not a condition for shutting down the station. However, it is your responsibility to notify immediately the chief engineer or the radiotelephone operator in charge.
- 30. A.
- 31. A.
- 32. C.
- 33. D.
- 34. This is the condition that exists after the transmission of an emergency action notification and before the transmission of the emergency action termination.
- 35. All other broadcast stations will observe broadcast silence.
- 36. D.
- 37. C.
- 38. A.
- 39. C.
- 40. C.

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HE WIE HUN.

# RADIO OPERATORS LICENSE HANDBOOK by Edward M. Noli SECOND EDITION

#### **Coverage Includes:**

- BROADCAST LICENSE ENDORSEMENT
- MARINE RADIOTELEPHONE

# AVIATION RADIO CITIZENS BAND

This book has been written as a radio operator's guide and handbook it is not a text on the critical adjustment and maintenance of radio and electronic equipment. The book is primarily concerned with the laws, rules, regulations, and accepted operating procedures of nonlicensed operators and operators holding licenses up to, but not including the second-class license. Radio announcers and other broadcast personnel are also informed about some of the more technical phases of radio broadcasting. It serves as a comprehensive study guide to prepare anyone to take the FCC Third-Class License exam.

The first four chapters give information and explanations on the material needed to obtain the lower-grade FCC operating licenses. Subjects included are radio operators, radio services, radio broadcast operation, license procedures, operator requirements, basic laws, operating practices, and the broadcast endorsement.

The last three chapters contain questions and answers based on FCC Elements I, II, and IX. A test based on Elements I and II must be passed to obtain a third-class license. The Element IX test must be passed to receive a broadcast endorsement for the third-class license.

To familiarize you with the type tests given by the FCC, two sample tests are included in the book—one on Elements I and II, the other based on Element IX. The answers to these tests appear in Appendix VI.

The first four appendices contain extracts from the FCC Rules and Regulations, the Geneva 1959 Treaty, and the Communications Act of 1934. Appendix V is filled with information concerning commercial radio operator licenses and permits.



#### **About the Author**

In addition to being an accomplished author of technical books, lessons, articles, and instruction manuals, Ed Noll is also a consulting engineer and lecturer. His other SAMS books include: First-Class Radiotelephone License Handbook; Second-Class Radiotelephone License Handbook; Radar License Endorsement Handbook; Science Projects in Electronics; FET Principles, Experiments, and Projects; and SWL Antenna Construction Projects.

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