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ABSTRACT

The study guide contains reference material necessary for the applicant preparing to take the Federal Communications Commission (FCC) examination for a Radiotelephone Third Class Operator Permit with the endorsement to operate certain AM and FM broadcast radio stations. To obtain a permit, the applicant must successfully complete examination elements 1 and 2. Operating privileges under this class license include operation of aeronautical land stations, marine coast stations, and some ship stations. To obtain operating privileges at broadcast stations, the applicant must also complete examination element 9. Element 1 consists of basic law. Provision of laws, treaties, and regulations with which every operator should be familiar are covered. Element 2 consists of basic operation practice. Radio operating procedures and practice generally followed or required in communicating means of radio telephone stations are discussed. Element 9 of the study guide contains paraphrased material based on the commission's rules and regulations and general information on broadcast operator duties. References are made to the rule sections, and the applicant should consult those sections for detailed information. Also appended are the six types of meters with which the operator should be familiar (volts, kilowatts, amperes, degrees, milliamperes, modulation). (BR)

third class broadcast operator permit study guide

This Study Guide contains reference material to assist the applicant preparing to take the Federal Communications Commission examination for a Radiotelephone Third Class Operator Permit with the endorsement to operate broadcast radio stations. The holder of this permit is authorized to operate certain AM and FM broadcast stations.

The material in this guide outlines the nature and scope of the examination. The actual test questions are multiple choice in which several possible answers are suggested and the applicant selects the best answer.

For general information on operator licenses and permits see FE Bulletin No. 4.

This Bulletin, examination schedules, and application forms may be obtained by writing to any FCC field office, or the Federal Communications Commission, Washington, D.C. 20554.

introduction

To obtain a Radiotelephone Third Class Operator Permit, the applicant must successfully complete examination elements one and two. Operating privileges under this class license include operation of aeronautical land stations, marine coast stations, and some ship stations. To obtain operating privileges at broadcast stations, the applicant must also complete examination element nine.

Element One consists of basic law. Provisions of laws, treaties, and regulations with which every operator should be familiar are covered.

Element Two consists of basic operating practice. Radio operating procedures and practices generally followed or required in communicating by means of radiotelephone stations are covered.

Element Nine consists of basic broadcast. Basic regulatory matters applicable to the operation of standard, commercial FM, and noncommercial educational FM broadcast stations are covered.

This study guide is not intended to be a text book or a question and answer manual providing complete training for passing the examination. A number of books and other reference materials, issued by commercial publishers, and courses of instruction which will aid the applicant in preparing for the examination are available. Practical knowledge of broadcast station equipment and operating procedures is also desirable.

When the term "third class operator" is used in this guide, it means a person holding a Radiotelephone Third Class Operator Permit endorsed for broadcast station operation. The term "license" is used generally in this guide to denote an authorization from the Commission. It includes "license", "permit", and "authorization".

KEY TO ABBREVIATIONS

Art	Refers to a provision of the Geneva, 1968, radio regulations.
Sec.	Refers to a section of the Communications Act of 1934, as amended.
R & R	Refers to a provision of the Rules and Regulations of the FCC.

element one

BACKGROUND

The Federal Communications Commission was created by the Communications Act of 1934 for the purpose of regulat ng interstate and foreign commerce in comrnunication by wire and radio. One of the general powers given to the Commission is the authority to prescribe the qualifications of station operators, to classify them according to the duties to be performed, and, except for alien aircraft pilots, to issue commercial operator licenses only to United States citizens and nationals. (Section 1 and 303(1)(1))

OBTAINING NEW LICENSES

To obtain a commercial Radiotelephone Third Class Operator Permit or higher operator authorization, an applicant first files the appropriate application forms (FCC Form 756 and FCC Form 756B) and fee with the Commission field office nearest him or having jurisdiction over the place where he wishes to be examined. If the applicant passes the examination and there are no doubts as to his nationality, character, or physical condition, a license will be routinely issued. (R&R 1.83 and 1.84)

RENEWING LICENSES

Operator licenses are normally issued for a five year term and may be renewed for a like term by filing an application at any time during the final year of the license term or within a one year period of grace after the expiration date. If the renewal application is filed before the license expiration date, the operator may continue operating unless he hears otherwise from the Commission.

If the renewal application is filed after the license expiration date but during the one year grace period, the license may still be renewed but the operator has no continuing operating atuhority and he may not operate until he receives the renewal license. (R&R 13.11(a))

DUPLICATE AND REPLACEMENT LICENSES

Should an operator license become lost, mutilated, or destroyed, or the operator's name has been changed, a duplicate or replacement license may be requested by filing an application with the Commission field office which issued the original license. If the old license is available, it must accompany the application for a duplicate or replacement; if it is found later, it must be returned to the Commission for cancellation. (R&R 13.71)

POSTING OPERATOR LICENSES

Most third class operator permits are required to be posted at the operator's place of duty. When an application for a duplicate, replacement, or renewal of a commercial operator license is submitted, the license then held, if available, must accompany the application. In this case the operator may post a signed copy of the application submitted by him in lieu of the license document. (R&R 13.72)

CANCELLING OPERATOR LICENSES

If the holder of a lower class license qualifies for a higher class license, the lower class license will be cancelled upon issuance of the new license. (R&R 13.26)

FAILING AN EXAMINATION ELEMENT

An applicant who fails a commercial operator examination element will be ineligible to retake that same element for a two month period. (R&R 13.27)

OFFICIAL NOTICE OF VIOLATION

Operators are expected to abide by the Commission's rules governing the station they are operating. An operator who violates these rules may be served with a written notice calling these facts to his attention and requesting a statement concerning the matter. FCC Form 793 may be used for this purpose. Within ten days from receipt of such notice or such other period as may be specified, the operator must send a written answer to the office of the Commission originating the Official Notice. (R&R 1.89)

SUSPENSION OF OPERATOR LICENSES

The Commission has the authority to suspend the license of any operator who has:

(1) 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;

(2) 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;

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

(4) transmitted superfluous radio communications or signals or communications containing profane or obscene words, language, or meaning;

(5) knowingly transmitted false or deceptive communications;

(6) knowingly transmitted a call signal or letter which has not been assigned by proper authority to the station he is operating;

(7) willfully or maliciously interferred with any other radio communications or signals;

(8) obtained or attempted to obtain, or has assisted another to obtain or attempt to obtain, an operator's license by fraudulent means. (Section 303(m)(1))

No order of suspension of any operator's license shall take effect until fifteen days' notice in writing

has been given to the operator licensee stating the cause for the proposed suspension. He may make written application to the Commission at any time within the fifteen day period 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 fifteen days in which to file the application. In the event that physical conditions prevent mailing of the application at the expiration of the fifteen-day period, the application shall then be mailed as soon as possible thereafter, accompanied by a satisfactory explanation of the delay. Upon receipt by the Commission of application for hearing, the order of suspension shall be held in abeyance until the conclusion of the hearing which shall be conducted under such rules as the Commission may prescribe. Upon the conclusion of the hearing the Commission may affirm, modify, or revoke its order of suspension. (Section 303(m)(2) and R&R 1.85)

HARMFUL INTERFERENCE

Harmful interference is 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 radio communications service. (ART 1, Paragraph 93)

PRIORITY OF COMMUNICATIONS

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

1. Distress calls, distress messages, and distress traffic.
2. Communications proceeded by the urgency signal.
3. Communications preceeded by the safety signal.
4. Others.

(ART 37, Paragraph 1496)

FALSE DISTRESS AND REBROADCASTING

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 any part thereof of another broadcasting station without the express authority of the originating station. (Section 325(a))

PENAL PROVISIONS

Any person who knowingly and willfully violates any provision of the Communications Act shall, upon conviction for first offense, be punished by a fine of not more than $10,000 or by imprisonment for a term not exceeding one year, or both. For a second offense he shall be punished by a fine of not more than $10,000 or by imprisonment for a term not exceeding two years, or both. (Section 501)

Any person who willfully and knowingly violates any rule, regulation, restriction, or condition made or imposed by the Commission or imposed by any international treaty or convention which the

Commission enforces, may, upon conviction, be punished by a fine of not more than $500 for every day during which the offense occurs. (Section 502)

SECRECY OF COMMUNICATIONS

No person shall divulge or publish the existence, contents, or substance of any communications to any person other than the person to whom the communication was directed. No person having received any intercepted communication shall use that communication or information for his own benefit or the benefit of another not entitled to receive it. The above does not apply to receiving, divulging, publishing, or utilizing the contents of any radio communication which is broadcast or transmitted by amateurs or others for the use of the general public, or which relates to ships in distress. (Section 605)

INSPECTION OF RADIO INSTALLATIONS

The Commission shall 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, installation, 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 of the license or other instrument of authorization under which they are constructed, installed, or operated. (Section 303(n))

STATION LOGS

A number of radio services require the keeping of logs. The logs shall not be erased, obliterated, or willfully destroyed. Generally, necessary correction may be made to a log by the person originating the entry.

DISTRESS TRAFFIC

Each station licensee shall give absolute priority to radiocommunications or signals relating to ships or aircraft in distress. The control of distress traffic is the responsibility of the mobile station in distress. Any station which becomes aware that a mobile station is in distress may retransmit the distress message when there is reason to believe that the distress call it has intercepted has not been received by any station in a position to render air. (R&R 2.401, 2.402, and 2.403)

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. (R&R 2.405)

element two

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 can 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 be already in progress. At all times in radio communications the operator should be courteous.

Station identification should be made clearly and distinctly so that unnecessary repetition of call letters is avoided and to 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. 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 radio communications 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 distance 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 distance range of the transmitter cannot be attained and if the voice is too loud the distance 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 save time from 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", and "Say again" means "Repeat".

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 meaning. For example "group" may sound like "scoop," or "Bridge" may sound like "ridge." A phonetic alphabet 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 the phonetic alphabet by Golf, Romeo, Oscar, Uniform, and Papa, the word "Group" is transmitted as "Group, G as a Golf, R as in Romeo, O as in Oscar, U as in Uniform, P as in Papa."

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. Technical repairs or adjustments to radio telephone 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.

element nine

This section of the Study Guide contains paraphrased material based on the Commission's Rules and Regulations and general information on broadcast operator duties. References are made to the rule sections and the applicant should consult those sections for additional detailed information. The element nine broadcast endorsement examinations contain questions on the following subjects:

- Broadcast Service Definitions and Terms
- Broadcast Operator License or Permit Requirements
- Operator Responsibilities
- Operator Position
- Modulation and Modulation Monitors
- Station Operating Power and Adjustments
- Transmitter Indicating Instruments
- Common Electrical Units and Terms Used by Operators
- Directional Antenna Monitors and Antenna Current Ratios
- Operation of Remote Control Equipment
- Posting of Operator Permits
- Station Inspections
- FM Stereophonic and Subsidiary Communications Transmissions
- General Log Requirements
- Program Logs
- Operating (transmitter) logs
- Station Identification
- Broadcast of Recorded Material
- Sponsor Identification
- Lotteries
- Broadcast of Telephone Conversations
- Emergency Broadcast System and System Test Transmissions
- Tower Lighting
- Duplicate and Renewed Commercial Operator Permits

DEFINITIONS

Standard Broadcast (AM) Station—A broadcast station transmitting amplitude modulated (voice type) emissions primarily intended to be received by the general public, and operated on a frequency in the 535 kHz to 1605 kHz band. (R&R 73.1)

Standard Broadcast Band—The band of frequencies extending from 535 kHz to 1605 kHz. (R&R 73.2)

FM Broadcast Station—A broadcast station transmitting frequency modulated radiotelephone (voice type) emissions primarily intended to be received by the general public, and operated on a channel in the 88 MHz to 108 MHz band. (R&R 73.310)

FM Broadcast Band—The band of frequencies extending from 88 MHz to 108 MHz. (R&R 73.310)

FM Stereophonic Broadcast—the transmission of a stereophonic program by an FM broadcast station utilizing the main channel and a stereophonic subchannel. (R&R 73.310)

FM Subsidiary Communications Authorization (SCA)—An authorization granted to an FM station for the simultaneous transmission of one or more signals on assigned subcarrier frequencies within the station's assigned channel. Special decoding equipment is required to receive program material furnished on the SCA subchannel. Such material, although broadcast related, is normally intended for paying subscribers. (R&R 73.293)

Daytime—That period of time between local sunrise and local sunset. (R&R 73.6)

Nighttime—That period of time between local sunset and local sunrise. (R&R 73.7)

Sunrise and Sunset—For each particular location and during any particular month, the times of sunrise and sunset are specified on most AM broadcast station licenses. This is necessary because not all standard (AM) broadcast stations are permitted to operate at night. In order to control objectionable

skywave interference stations which are permitted to operate at night are frequently required to change their modes of operation These changes may involve the use of directional antenna systems, a reduction in operating power, or both, and normally occur at the sunrise and sunset times listed in the station license. (R&R 73.8)

Broadcast Day—That period of time between local sunrise and 12 midnight local time. (R&R 73.9)

Nominal Power—The power of a standard broadcast station as specified in a system of classification which includes the following values: 50 kW, 25 kW, 10 kW, 5 kK, 1 kW, .5 kW, 0.25 kW. (R&R 73.14)

PERMIT REQUIRED

Except for a very limited number of standard broadcast stations using critical directional antenna arrays, licensees of AM and FM broadcast stations may employ third class operators for the routine station operation. If a station licensee elects to use third class operators, however, he is subject to additional requirements. For this reason not all stations may want to employ third class operators, but may continue to employ first class operators. The third class operator privileges do not include operation of television stations, nor do they include operation of AM stations with critical directional arrays. (R&R 73.93, 73.265, and 73.565)

OPERATOR RESPONSIBILITIES

Transmitter operators are responsible for proper operation of the equipment. A first class operator may repair a transmitter, maintain it, and make major adjustments. A third class operator may only make minor routine operating adjustments. At AM and FM broadcast stations, a third class operator may make adjustments only of external controls necessary to turn the transmitter on and off, to compensate for voltage fluctuations in the primary power supply, and to maintain modulation levels of the transmitter within prescribed limits.

Third class operators at standard (AM) broadcast stations may also make adjustments of external controls necessary to carry out routine changes in operating power required by the station authorization, and to effect changes between non-directional and directional or between differing directional radiation patterns, provided that such changes require only the activation of switches and do not involve the manual tuning of the transmitter's final amplifier or antenna phasor equipment. The switching equipment must be so arranged that the failure of any relay in the directional antenna system to activate properly will cause all transmission to terminate.

It is extremely important that transmitter operators know how to read and evaluate the required meters and monitors, and to know when adjustments are to be made or when the station's first class operator should be notified of impending problems. The operator must also know when the transmitter should be turned off because of serious malfunction. Detailed charts or instructions should be available to the operator so that he can readily determine that the transmitter is operating correctly and within the terms of FCC Rules and station license. (R&R 73.93, 73.265, and 73.565)

NORMAL OPERATING POSITION

The normal operating position is to be located so that the transmitter, and all monitors and metering equipment are readily accessible, and sufficiently close to the operator so that deviations from normal indications can be observed. If operation by remote control is authorized, the normal operating position must be placed so that all remote controls and remote instruments are readily accessible and located sufficiently close to the operator so that deviations from normal indications can be observed. (R&R 73.93, 73.265, and 73.565)

MODULATION AND MODULATION MONITORS

The percentage of modulation at AM and FM broadcast stations should be maintained at as high a level as possible consistent with good quality of transmission. Generally, the modulation should not be less than 85 percent on peaks of frequent recurrence. However, it may be less than 85 percent when necessary to avoid objectionable loudness. At AM broadcast stations, modulation must not exceed 100 percent on negative peaks and 125 percent on any positive peak. At FM broadcast stations, modulation must not exceed 100 percent on either positive or negative peaks. (R&R 73.55, 73.268, and 73.568)

Each station must have in operation a modulation monitor which the operator uses to determine whether the modulation is at the proper level. The modulation monitor consists of a meter and a peak flasher. The meter does not indicate the peak modulation, but indicates a value somewhat less than the peak modulation. The "peak flasher" indicates modulation peaks. Generally the peak flasher is set so that when it flashes, it is an indication that the modulation is excessive and that corrective action must be taken by the operator. (R&R 73.50, 73.56, 73.253, 73.268, 73.553, and 73.568)

OPERATING POWER

Each AM and FM broadcast station is authorized to operate at a specified operating power as indicated on the station license. Operating power for AM stations is normally the antenna input power and for FM stations it is the transmitter output power. The operating power must be maintained as near as possible to the value specified by the station license and shall not be more than 105 percent nor less than 90 percent of this level. Noncommercial educational FM broadcast stations licensed to operate with transmitter output power of 10 watts or less may be operated at less than the authorized power, but not more than 105 percent of the authorized power.

Non-directional AM broadcast stations employ only a single antenna tower. Power determined by the **direct** method is equal to the product of the antenna resistance and the square of the antenna current. Directional AM broadcast stations employ multiple radiating elements. Power determined by the direct method for these stations is equal to the product of the resistance common to all antenna towers (common point resistance) and the square of the current common to all antenna towers (common point current). At FM broadcast stations, if power is

determined by the direct method, it is read directly from the RF transmission line meter. This meter must be calibrated each six months to give a direct indication of the power supplied to the antenna.

Generally, AM broadcast stations must determine the operating power by the direct method. FM broadcast stations may determine the operating power by either method, but most use the indirect method.

For both AM and FM broadcast stations, operating power determined by the **indirect** method is equal to the product of the plate voltage (Ep) and the plate current (Ip) of the last radio stage, and an efficiency factor F:

$$\text{Operating Power} = Ep \times Ip \times F$$

When the power of an AM station is determined by the **indirect** method, the calculated value of $Ep \times Ip$ or $Ep \times Ip \times F$ is to be entered in the operating log when required transmitter meter readings are taken. (R&R 73.51, 73.52, 73.267, and 73.567)

INDICATING INSTRUMENTS

Each transmitter is equipped with meters to indicate plate voltage and plate current. These meters indicate the operating constants of the transmitter amplifier. Each transmitter has normal operating levels of plate voltage and plate current and the operator should know what corrective actions should be taken when the meters indicate abnormal values.

At the place in the circuit where the antenna resistance or common point resistance is measured, an antenna ammeter is inserted to measure current into the antenna system. This meter is a direct indication as to whether the station is operating at, above, or below the licensed power. This meter indication should be maintained as close as possible to the licensed operating current and the operator should know what actions are necessary when the meter indications deviate from that value. Usually the antenna ammeter is located at the base of the tower and not easily accessible to the operator on duty. For this reason most stations use a remote antenna ammeter which is located at the normal operating position of the person on duty. The remote antenna ammeter indication may be entered in the operating log in lieu of the base current meter indication provided the remote meter is calibrated once weekly. (R&R 73.39, 73.58, 73.258, and 73.558)

ELECTRICAL TERMS

Three common electrical terms are volts, amperes, and watts. One thousand volts is a kilovolt (kV) and 1000 watts is a kilowatt (kW). One one-thousandth (1 1000) of an ampere is a milliampere (mA). The operator should know how to use these terms interchangeably. For instance:

2000 volts is the same as 2 kilovolts
.5 kilovolts is the same as 500 volts
200 watts is the same as .2 kilowatts
20 kilowatts is the same as 20,000 watts
.5 amperes is the same as 500 milliamperes
250 milliamperes is the same as .25 amperes

DIRECTIONAL ANTENNA MONITORS AND ANTENNA CURRENT RATIOS

Non-directional AM stations use a single antenna tower and transmit the radio signal with equal strength in all directions from the station. Directional AM stations utilize more than one antenna tower. By establishing the position of each tower, the power radiated by each tower, and the phase of the signal in each tower, different signal strengths can be radiated in various directions. Directional antenna systems are used to improve the signal over desired areas and to reduce the signal in the direction of other stations to prevent interference.

To determine if a directional antenna system is radiating the signal according to a specified radiation pattern, an instrument called an antenna monitor is installed at the station. The antenna monitor enables the operator to determine if the radio frequency (RF) current in each tower is of the correct value and if the phase of the signal radiated by each tower is also correct. Some antenna monitors indicate the ratio of current in each tower to the current in one tower called the reference tower.

If the signal arrives at each tower at the same time, the current in each tower is said to be "in phase." In most directional antenna systems, the time the radio frequency signal reaches each tower from the transmitter is not the same. The time difference or phase is measured in degrees. For each directional antenna tower, the station license contains a list of the required signal phases and antenna base current ratios. The antenna base current ratio for a tower is calculated by dividing the current meter reading for that tower by the current meter reading of the designated reference tower. The ratio, either calculated or read on the antenna monitor, must not deviate more than 5 percent from the value on the station license. Operators on duty at AM stations using directional antenna systems should know how to read the antenna monitor meters, and should know how to use charts, tables or other instructions to determine if the station is operating correctly, if attention by the station's first class operator is required, or if the station must terminate operation. (R&R 73.69, and 73.95)

REMOTE CONTROL EQUIPMENT AND OPERATION

Some broadcast stations have the main studio at one location and the transmitter and associated equipment at another location. Rather than have an operator on duty at the transmitter, the controls and metering functions of the transmitter may be located at the studio or other location and the operator on duty at this control point. A remote control authorization must be obtained by the licensee from the Commission. Equipment must be installed at the control point that will permit the operator to perform all monitoring and operating functions required by the Commission's rules. If any part of the remote control equipment, meters, or the associated control circuits have a malfunction which results in improper control or meter readings, operation of the transmitter by remote control must cease and an operator placed on duty at the

transmitter until the malfunction has been corrected. (R&R 73.67, 73.274, and 73.575)

POSTING OF OPERATOR PERMITS

The operator must post his permit or posting statement at the place where he is on duty at the transmitter control point. FCC Form 759 is a posting statement used by operators employed at more than one station. The permit is posted at one station and FCC Forms 759 are posted at other stations where the operator is employed. The station license and other operating authorizations must be posted at the transmitter control point with all terms visible. (R&R 73.92, 73.264 and 73.564)

STATION INSPECTION AND AVAILABILITY OF RECORDS

The licensee of any radio station shall make the station available for inspection by representatives of the Commission at any reasonable hour. Proofs of performance, logs, measurement records, and other documents required to be maintained must also be available for inspection. (R&R 73.97, 73.263, 73.63, 73.116, 73.286, 73.586)

FM STEREO AND SUBSIDIARY COMMUNICATIONS AUTHORIZATIONS

In addition to monaural operation, FM stations may elect to broadcast stereo programming. This is accomplished by inserting a subchannel within the main FM channel assignment. In addition to the stereophonic subchannel, an entirely different subchannel may also be used. Stations using this subchannel operate under a Subsidiary Communications Authorization (SCA). Programs transmitted by way of the Subsidiary Communications Authorization cannot be received without a special multiplex receiver. Most SCA subcarriers are used for the transmission of subscription background music. Other SCA uses are for detailed weather forecasting, special time signals, and other material of a broadcast nature expressly designed and intended for business, professional, educational, religious, trade, labor, agriculture or other groups engaged in any lawful activity. (R&R 73.293, 73.295, 73.297, 73.593, 73.595, and 73.596)

GENERAL LOG REQUIREMENTS

Broadcast stations are required to keep several kinds of logs. The transmitter operator on duty is required to keep the **operating** (transmitter) log and frequently is responsible for keeping the **program** log. All logs must be kept by a station employee who is competent to do so having actual knowledge of the facts. Operating and Program logs must be signed by the person keeping the logs both at the beginning and end of his period of duty. The logs must be orderly and legible and in such detail that data required is readily available. Each log page must be numbered and dated and times shown in local time. If the area observes "advanced time" during summer months, the log should so indicate.

No log or preprinted log or schedule which

becomes a log may be erased or obliterated during the period of required retention. Corrections must be made by striking out the erroneous portion or by a corrective explanation on the log or attached to it. Any corrections or changes, no matter by whom made, must be initialed by the person keeping the log prior to his signing off duty. If changes must be made after the operator has signed off duty, an explanation must be made on the log or an attachment, dated and signed by the person who kept the log or other officials of the station depending on whether the log was a program or operating log. (R&R 73.111, 73.112, 73.113, 73.281, 73.282, 73.283, 73.581, 73.582 and 73.583)

PROGRAM LOG

Stations are required to keep program logs of the material broadcast each day. The transmitter operator often must complete the program log in addition to his duties of keeping the transmitter operating log. The program log contains entries identifying each program by name or title and the time the program began and ended. Each program must be identified in the log as to its type and source.

Program log entries for commercial matter must indicate the amount of time devoted to commercial matter during an hourly segment (beginning on the hour) or the duration of each commercial message during the hourly segment. Each sponsored program or announcement must be identified as such during its broadcast, and an indication is required in the log to show this was done. Log entries for each public service announcement must include the name of the organization or interest on whose behalf it was broadcast.

Entries must be made of the time each required station identification was broadcast.

An entry for each announcement of or in behalf of a political candidate is required and must include the name and political affiliation of the candidate.

FM-broadcast stations utilizing a subsidiary communications authorization must also describe the material transmitted on the SCA sub-channel. This information may be kept on a special column of the station's regular program log. In the event of a change in the general description of the material transmitted, an entry must be made indicating the time of each such change and a description thereof. (R&R 73.112, 73.282, 73.295, 73.582, and 73.595)

OPERATING LOG

The operator in actual charge of the transmitter at AM and FM broadcast stations must record certain meter readings in the operating log at the beginning of operation in each mode and at intervals not exceeding three hours. These entries must be the readings observed prior to making any adjustments of the transmitter, and if adjustments are made to restore parameters to their proper operating values, the corrected indications are to be logged. If any parameter deviation is beyond a prescribed tolerance, a notation describing the nature of the corrective action taken to return the parameter to the proper operating value must be entered. Indications of all parameters whose value is affected by modulation of the carrier should be read without modulation. The operator signs the log when

he begins duty and again when going off duty to indicate the time period which he was in charge of the transmitting equipment. An entry is required for the daily check of the tower lighting system to assure proper illumination of the tower. The time the transmitter begins to supply power to the antenna and the time it ceases is also recorded.

At all standard (AM) broadcast stations, the following entries shall be made in the operating log:

1. Last stage plate voltage meter reading.
2. Last stage plate current meter reading.
3. Antenna current or common point current reading.

At AM broadcast stations employing directional antenna systems, additional operating log entries may include:

1. Remote antenna base current meter readings, or antenna monitor sample current meter readings.
2. Antenna monitor phase readings, if operation is by direct control.

At FM broadcast stations operating with a transmitter power output above 10 watts, the following entries shall be made in the operating log:

1. Last stage transmitter plate voltage meter reading.
2. Last stage transmitter plate current meter reading.
3. RF transmission line meter reading (only FM stations determining the operating power by the direct method need log this).

An FM station operating under a Subsidiary Communications Authorization must keep a log of its operation. The log may be included as part of the operating log for the main channel or may be kept separately. Entries are required of the time the subcarrier generator is turned on and when it is turned off (excluding subcarrier interruptions of 5 minutes or less). An entry is also required for the time modulation is applied to the subcarrier and the time the modulation is removed from the subcarrier.

FM broadcast stations with an operating power of 10 watts or less are only required to log the time the station begins to supply power to the antenna, the time it stops, and entries concerning the daily observations of tower lights. (R&R 73.113, 73.283, 73.295, 73.583, and 73.595)

STATION IDENTIFICATION

Broadcast station identification announcements shall be made at the beginning and ending of each time of operation and hourly, as close to the hour as feasible, at a natural break in program offerings. Official station identification shall consist of the station's call letters immediately followed by the name of the community or communities specified on the license as the station's location. (R&R 73.1201)

BROADCAST OF TAPED OR RECORDED MATERIAL

Any taped or recorded program material in which time is of special significance, or by which an affirmative attempt is made to create the impression that it is occurring simultaneously with the broadcast, must be announced at the beginning as taped or recorded. The language of the announcement shall be clear and in terms commonly understood by the public. (R&R 73.1208)

REBROADCAST

The term "rebroadcast" means off-the-air reception by radio of a program originated by another radio station and its simultaneous or subsequent retransmission to the public. No broadcast station shall rebroadcast a program or part of a program of another broadcast station without the permission of the originating station. A copy of the written consent of the licensee originating the program shall be kept by the station rebroadcasting the program. (R&R 73.1207)

SPONSOR IDENTIFICATION

When a broadcast station transmits matter for which it receives or expects to receive any compensation such as money, services, or other consideration, the station must announce that the matter is sponsored or furnished and also announce the name of the sponsor. However, when a commercial product or service is advertised, use of the sponsor's corporate name, trade name, or name of the product or service will suffice if it is clear that the product name identifies the sponsor. Broadcast station licensees are responsible to insure that their employees or others connected with program material are fully aware that accurate sponsor identification must be obtained and broadcast. Sponsored programs and announcements that do not promote a specific commercial service or product must also be identified by the name of the actual sponsor. Operators keeping program logs must be alert to insure that sponsored matter is announced at the time of the broadcast and the sponsor is correctly identified in the program log. (R&R 73.119 and 73.289)

LOTTERIES

Broadcast stations are prohibited from transmitting announcements or programs promoting or containing other information that would promote lotteries. A lottery is any scheme in which money or a prize of value is awarded to a person selected by lot or chance, if a condition of winning is that a person must have furnished any money, purchased a particular product or service, or have in his possession a product sold by the sponsor. For example, a door prize given away to a person selected from tickets purchased to gain entry to a particular event is considered a lottery, and the door prize drawing cannot be promoted by radio announcements. Prizes given away to winners selected by lot when "no purchase is necessary" to enter the drawing would not be considered lottery prizes and announcements promoting these "free entry" drawings may be broadcast. Broadcast station operators who are monitoring program material should be aware of the prohibition of broadcasting any type of lottery promotion. (R&R 73.122 and 73.292)

BROADCAST OF TELEPHONE CONVERSATIONS

Before broadcasting a telephone conversation or recording a telephone conversation for later broadcast, the parties to the conversation must be

informed of the intention to broadcast the conversation. However, station employees who may be presumed to be aware that their telephone conversations are intended for broadcast are not required to be advised of the broadcasting of their calls. Also, no notice of broadcast is required for persons originating calls to programs which normally broadcast telephone conversations coming into the program. (R&R 73.1206)

EMERGENCY BROADCAST SYSTEM AND SYSTEM TEST TRANSMISSIONS

The Emergency Action Notification as it applies to broadcast stations is the notice of the existence of an Emergency Action Condition. An Emergency Action Condition is a national, state, or local area emergency situation posing a threat to the safety of life or property. The FCC provides each broadcast station with a checklist, in summary form, of actions to be taken by the station's operators upon receipt of an Emergency Action Notification, Emergency Action Termination, or test transmission received.

Each station must have in operation at the control point a monitor receiver for receiving the Emergency Action Notification or termination announcements transmitted by a designated control station. During National level emergency conditions certain stations will continue operating. Other stations not participating in the National level emergency plan must discontinue operations for the duration of the National Level Emergency Action Condition.

Each station is required to transmit at least once each week an EBS test transmission announcement and signal. All station operators must be thoroughly familiar with the procedures for transmitting the EBS signals and be prepared to take appropriate action in the event of an actual alert. The operator must also be familiar with the operation of the EBS monitor receiver and procedures to follow upon receipt of a test or alert signal from another station.

TOWER LIGHTING

Once each day, the operator is required to check for the proper operation of the tower lighting system. Most tower lighting systems are turned on and off with an automatic actuation switch controlled by a photocell. Stations using the photocell are required to burn the lights continuously if the automatic actuation switch does not operate properly. Any observed or otherwise known outage or improper functioning of a code or rotating beacon light or top light not corrected in 30 minutes should be reported by telephone or telegraph to the nearest Flight Serve Station or office of the Federal Aviation Administration. Notice should also be given to the Flight Service Station or FAA office when the situation has been corrected. (R&R 17.47 and 17.98)

DUPLICATE AND RENEWED COMMERCIAL OPERATOR PERMITS

If an operator's license or permit is lost or destroyed, a duplicate license or permit may be obtained by application to the FCC office where the lost or destroyed document was issued. As long as the license or permit has not expired, the operator may continue to operate the station. If the operator's

license is required to be posted at his place of duty, a copy of the application, FCC Form 756, submitted for the duplicate license may be posted in lieu of the license pending receipt of the duplicate license.

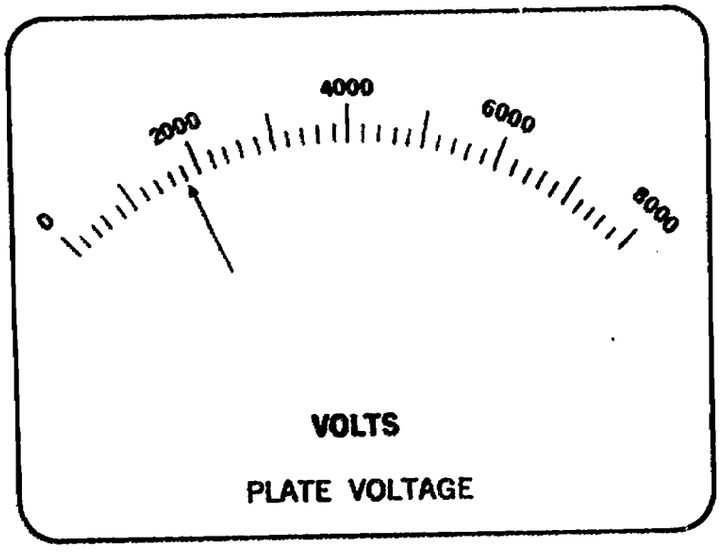
Operator licenses may be renewed any time during the final year of the license term or within a one year grace period after the expiration of the license by submitting FCC Form 756 to the nearest FCC field office. If the application for renewal is submitted before the license expires, the operator may continue operating unless he hears otherwise from the Commission. A duplicate copy of the renewal application should be posted in lieu of the license since the license being renewed must accompany the application.

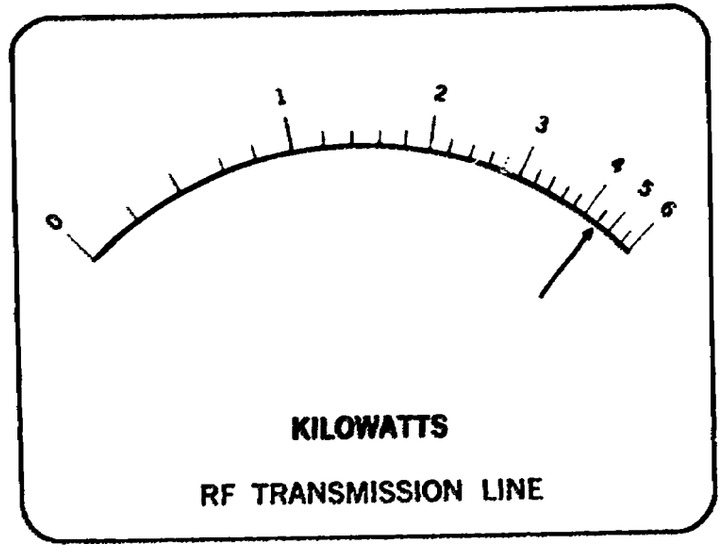
If the renewal application is submitted during the grace period, the license may still be renewed but the operator has no operating authority between the expiration of the previous license and the issuance of the renewed license. (R&R 13.11, 13.71 and 13.72)

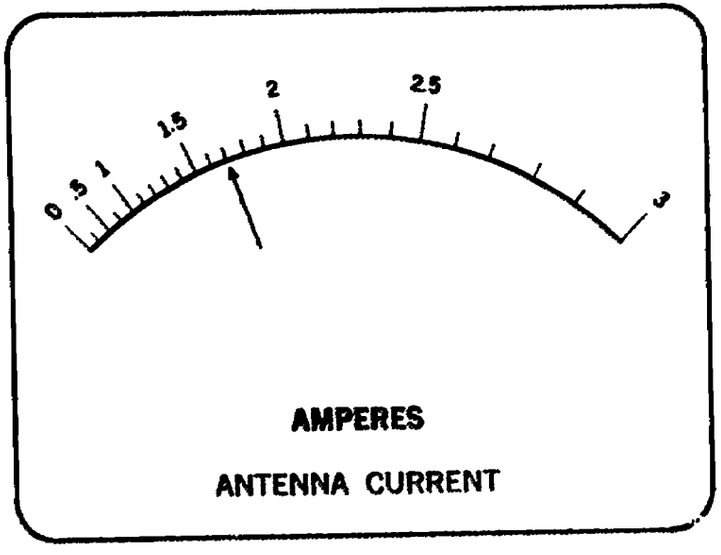
The following sample questions are typical of those contained in the element nine examinations. The asterisk indicates the correct answer.

1. Station identification must be given
   - *A. on the hour
   - B. on the half hour
   - C. at 30 minute intervals
   - D. after a commercial
   - E. after each newscast
2. The plate voltmeter reads 2 kilovolts. This is the same as
   - A. .002 volts
   - B. 2 volts
   - C. 20 volts
   - D. 200 volts
   - *E. 2000 volts
3. The plate voltmeter at an FM broadcast station reads 2 kilovolts and the plate current meter reads 500 milliamperes. With an efficiency of 70 percent, the operating power as determined by the indirect method is
   - A. 140 watts
   - B. 350 watts
   - *C. 700 watts
   - D. 1000 watts
   - E. 1400 watts
4. The antenna resistance at a standard broadcast station is 40 ohms and the antenna current is 5 amperes. The power calculated by the direct method is
   - A. 8 watts
   - B. 200 watts
   - C. 900 watts
   - *D. 1000 watts
   - E. 8000 watts
5. Tower one of a three tower directional antenna array is the reference tower. The antenna current for tower one is 6 amperes. The antenna current for tower two is 2 amperes, and the antenna current for tower three is three amperes. The antena base current ratio of tower two is:
   - *A. .33
   - B. .5
   - C. 1
   - D. 2
   - E. 3

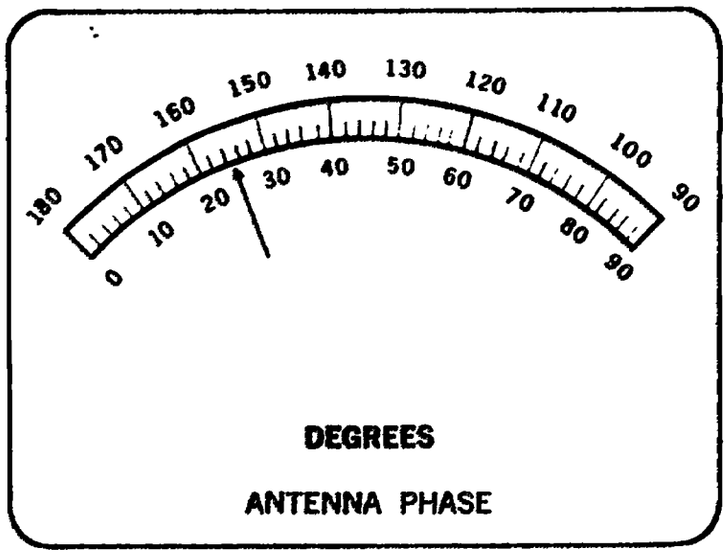
appendix

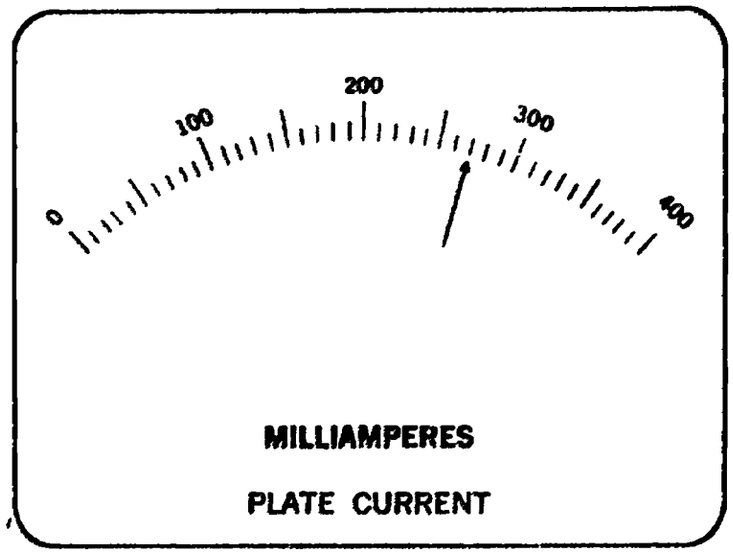


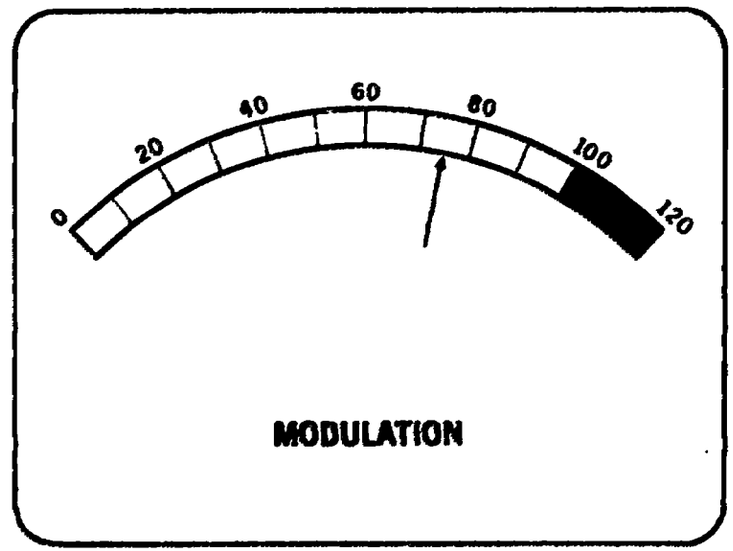




The meters shown are similar to the ones an operator will use in the operation of broadcast stations. The operator should be familiar with these meters, know how to read them, and know what they are used for.







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