Text of Rules Governing FM

(Adopted by the FCC, June 22, 1940; Amended Oct. 3, 1940)

SUB-PART B. RULES GOVERNING HIGH FREQUENCY BROADCAST STATIONS

DEFINITIONS [1]

Sec. 3.201 *High-frequency broadcast station.* The term "high-frequency broadcast station" means a station licensed primarily for the transmission of radiotelephone emissions intended to be received by the general public and operated on a channel in the high-frequency broadcast [2] [3] band.

Sec. 3.202 *High-frequency broadcast band.* The term "high-frequency broadcast band" means the band of frequencies extending from 43,000 to 50,000 kc., both inclusive.

Sec. 3.203 *Frequency modulation.* The term "frequency modulation" means a system of modulation of a radio signal in which the frequency of the carrier wave is varied in accordance with the signal to be transmitted while the amplitude of the carrier remains constant.

Sec. 3.204 *Center frequency.* The term "center frequency" means the frequency of the carrier wave with no modulation. (With modulation the instantaneous operating frequency swings above and below the center frequency. The operating frequency with no modulation shall be the center frequency within the frequency tolerance).

Sec. 3.205 *High-frequency broadcast channel.* The term "high-frequency broadcast channel" means a band of frequencies 200 kc. wide and is designated by its center frequency. Channels for high-frequency broadcast stations begin at 43,100 kc. and continue in successive steps of 200 kc. to and including the frequency 49,900 kc.

Sec. 3.206 *Service area.* The term "service area" of a high-frequency broadcast station means the area in which the signal is not subject to objectionable interference or objectionable fading. (High-frequency broadcast stations are considered to have only one service area; for determination of such area see *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*)

Sec. 3.207 *Antenna field gain.* The term "antenna field gain" of a high frequency broadcast antenna means the ratio of the effective free space field intensity produced at one mile in the horizontal plane expressed in millivolts per meter for 1 kw. antenna input power to 137.6.

Sec. 3.208 *Free space field intensity.* The term "free space field intensity" means the field intensity that would exist at a point in the absence of waves reflected from the earth or other reflecting objects.

Sec. 3.209 *Frequency swing.* The term "frequency swing" is used only with respect to frequency modulation and means the instantaneous departure of the carrier frequency from the center frequency resulting from modulation.

Sec. 3.210 *Multiplex transmission.* The term "multiplex transmission" means the simultaneous transmission of two or more signals by means of a common carrier wave. (Multiplex transmission as applied to high-frequency broadcast stations means the transmission of facsimile or other aural signals in addition to the regular broadcast signals.)

Sec. 3.211 *Percentage modulation.* The term "percentage modulation" with respect to frequency modulation means the ratio of the actual frequency swing to the frequency swing required for 100 percent modulation expressed in percentage. (For high-frequency broadcast stations, a frequency swing of 75 kc. is standard for 100% modulation.)

Sec. 3.212 *Experimental period.* The term "experimental period" means that period of time between 12 midnight and sunrise. This period may be used for experimental purposes in testing and maintaining apparatus by the licensee of any high-frequency broadcast station, on its assigned frequency and with its authorized power, provided no interference is caused to other stations maintaining a regular operating schedule within such period.

Sec. 3.213 *Main studio.* The term "main studio" means, as to any station, the studio from which the majority of its local programs originate, and/or from which a majority of its station announcements are made of programs originating at remote points.

[1] Other definitions which may pertain to high-frequency broadcast stations are included in Sections 2.1 to 2.35 and Sections 3.1 to 3.16, and the Communications Act of 1934, as amended.

[2] See Section 3.228 concerning multiplexing, aural and facsimile programs.

[3] High-frequency broadcast stations must use frequency modulation exclusively in accordance with Section 3.227(b).

ALLOCATION OF FACILITIES [4]

Sec. 3.221 *Basis of licensing high frequency broadcast stations.* High frequency broadcast stations shall be licensed to serve a specified area in square miles. The contour bounding the service area and the radii of the contour shall be determined in accordance with the Standards of Good Engineering Practice for High Frequency Broadcast Stations.

Sec. 3.222 *Service areas; definitions.* For the purpose of determining the areas to be served by high frequency broadcast stations, the following definitions apply:

(a) "Basic trade areas" and "limited trade areas" consist of areas the boundaries of which are determined by the Commission on the basis of showings made in applications as to retail trading areas or consumer trading areas and from government data.[5] Each basic trade area includes one "principal city." The boundaries of the basic trade areas are adjoining and the aggregate of all such areas is the total area of the United States. Each "limited trade area" includes one city. The boundaries of limited trade areas are not necessarily adjoining. Such areas may include portions of other limited trade areas and may extend into more than one basic trade area.

(b) "Principal city" means the largest city or the city or cities designated as "principal city" by the Commission, within a basic trade area. "City" means any city, town, or borough in a basic trade area except the principal city. Each "city" has a limited trade area.

(c) "Rural area" means all land area outside incorporated towns or cities with population greater than 2,500 and where the density of population is less than 150 per square mile. Incorporated towns or cities with population from 2,500 to 5,000 without a high frequency broadcast station and not adjacent to larger cities may be considered rural area.

Sec. 3.223 *Service areas established.* The Commission in considering applications for high frequency broadcast stations will establish service areas. Such stations will be licensed to serve areas having the following characteristics:

(a) An area comprising a limited trade area and a city. The station shall render good service to the city and its service area shall conform generally with the limited trade area.

(b) An area comprising a basic trade area and a principal city. The station shall render good service to the principal city and its service area shall conform generally with the basic trade area.

(c) An area of at least 15,000 square miles comprising primarily a large rural area, and particularly that part of basic trade areas which cannot be served by stations assigned basic trade areas due to economic and technical limitations. The service area may include one or more principal city or cities, provided that in rendering service to such cities, the service to rural areas which the station is designated to serve is not impaired. The transmitter of such a station shall be located in such a manner that the service area, (1) shall extend into two or more basic trade areas, (2) shall not conform generally with a basic trade area, and (3) shall not merely extend beyond a basic trade area.

(d) An area having substantially different characteristics (social, cultural, or economic) from those areas specified in subsections (a), (b) and (c) of this section where, by reason of special conditions, it is shown that a need (which cannot be supplied by a station serving areas under subsections (a), (b) or (c) of this section) for the proposed service both program and technical exists which makes the establishment of the service area in the public interest, convenience or necessity. The Commission will give particular consideration in this connection to competitive advantages which such stations would have over other stations established under other provisions.

(e) In case it is not economically and technically feasible for a station assigned a basic or limited trade area to serve substantially all such area, the Commission will establish the service area on the basis of conditions which obtain in the trade area.

(f) In case an applicant proposes a change in an established service area, the applicant shall make a full showing as to need for such change and the effect on other stations serving the area.

Sec. 3.224 *Time of operation.* All high-frequency broadcast stations shall be licensed for unlimited time operation.

Sec. 3.225 *Showing required.* Authorization for a new high frequency broadcast station or increase in facilities of an existing station [5a] will be issued only after a satisfactory showing has been made in regard to the following matters:

(a) That the area which the applicant proposes to serve has the characteristics of an area described in Sec. 3.223 hereof.

(b) Where a service area has been established in which one or more existing high frequency broadcast stations are in operation, that the contours of any new station proposed to serve such area will compare with those of the existing station or stations as nearly as possible, or that the service area already established should be modified.

(c) That objectionable interference will not be caused to existing stations or that if interference will be caused the need for the proposed service outweigh the need for the service which will be lost by reason of such interference.

(d) That the proposed station will not suffer interference to such an extent that its service would be reduced to an unsatisfactory degree. (For determining objectionable interference, see *Standards of Good Engineering Practice for High Frequency Broadcast Stations.*)

(e) That the technical equipment proposed, the location of the transmitter, and other technical phases of operation comply with the regulations governing the same, and the requirements of good engineering practice. (See technical regulations herein and *Standards of Good Engineering Practice for High Frequency Broadcast Stations.*)

(f) That the applicant is financially qualified to construct and operate the proposed station; and, if the proposed station is to serve substantially the same area as an existing station, that applicant will be able to compete effectively with the existing station or stations.

(g) That the program service will include a portion of programs particularly adapted to a service utilizing the full fidelity capability of the system, as set forth in the Standards of Good Engineering Practice for High Frequency Broadcast Stations.

(h) That the proposed assignment will tend to effect a fair, efficient, and equitable distribution of radio service among the several states and communities.

(i) That the applicant is legally qualified, is of good character, and possesses other qualifications sufficient to provide a satisfactory public service.

(j) That the facilities sought are subject to assignment as requested under existing international agreements and the Rules and Regulations of the Commission.

(k) That the public interest, convenience, and necessity will be served through the operation under the proposed assignment.

Sec. 3.226 *Channel assignments.* The channels set forth below with the indicated center frequencies are available for assignment to high frequency broadcast stations to serve the areas provided in Sec. 3.223:

(a) An applicant for a station to serve an area specified in Sec. 3.223 (a) or (b), to be located in a principal city or city which has a population less than 25,000 (city only) shall apply for one of the following channels:

48900	49500
49100	49700
49300	49900

(b) An applicant for a station to serve an area specified in Sec. 3.223 (a) or (b), to be located in a principal city or city which has a population greater than 25,000 (city only) shall apply for one of the following channels:

44500	46700
44700	46900
44900	47100
45100	47300
45300	47500
45500	47700
45700	47900
45900	48100
46100	48300
46300	48500
46500	48700

(c) An applicant for a station to serve primarily a large rural area, specified in Sec. 3.223 (c) or an area specified in Sec. 3.223 (d) shall apply for one of the following channels:

43100	43900
43300	44100
43500	44300
43700	

Sec. 3.227 *Special provisions concerning assignments.* (a) Stations located in the same city shall have substantially the same service area.

(b) High frequency broadcast stations shall use frequency modulation exclusively.

(c) Stations serving a substantial part of the same area shall not be assigned adjacent channels.

(d) One channel only will be assigned to a station.

Sec. 3.228 *Facsimile broadcasting and multiplex transmission.* The Commission may grant authority to a high frequency broadcast station for the multiplex transmission of facsimile and aural broadcast programs provided the facsimile transmission is incidental to the aural broadcast and does not either reduce the quality of or the frequency swing required for the transmission of the aural program. The frequency swing for the modulation of the aural program should be maintained at 75 kc. and the facsimile signal added thereto. No transmission outside the authorized band of 200 kc. shall result from such multiplex operation nor shall interference be caused to other stations operating on adjacent channels. The transmission of multiplex signals may also be authorized on an experimental basis in accordance with Sec. 3.32, subpart A.

Sec. 3.229 *Proof of performance required.* —Within one year of the date of first regular operation of a high frequency broadcast station, continuous field intensity records along several radials shall be submitted to the Commission which will establish the actual field contours, and from which operating constants required to deliver service to the area specified in the license are determined. The Commission may grant extensions of time upon showing of reasonable need therefor.

Sec. 3.230 *Multiple ownership.* (a) No person (including all persons under common control [6]) shall, directly or indirectly, own, operate, or control more than one high frequency broadcast station that would serve substantially the same service area as another high frequency broadcast station owned, operated, or controlled by such person.

(b) No person (including all persons under common control) shall, directly or indirectly, own, operate, or control more than one high frequency broadcast station, except upon a showing (1) that such ownership, operation, or control would foster competition among high frequency broadcast stations or provide a high frequency broadcasting service distinct and separate from existing services, and (2) that such ownership, operation, or control would not result in the concentration of control of high frequency broadcasting facilities in a manner inconsistent with public interest, convenience, or necessity: *Provided, however,* That the Commission will consider the ownership, operation, or control of more than six high frequency broadcast stations to constitute the concentration of control of high frequency broadcasting facilities in a manner inconsistent with public interest, convenience, or necessity.

Sec. 3.231 *Normal license period.* All high frequency broadcast station licenses will be issued so as to expire at the hour of 3 a.m., Eastern Standard Time, and will be issued for a normal license period of one year, expiring as follows:

(a) For stations operating on the frequencies 48900, 49100, 49300, 49500, 49700, and 49900, April 1.

(b) For stations operating on the frequencies 44500, 44700, 44900, 45100, 45300,

[4] The rules relating to allocation of facilities are intended primarily for the information of applicants. Nothing contained in said rules shall be regarded as any recognition of any legal right on behalf of any person to a grant or denial of any application.

[5] There are several current and recognized authorities on retail trading areas or consumer trading areas from which the applicant may prepare its showing and to which the Commission will give consideration in making its determination. Among these recognized authorities are the following: J. Walter Thompson (Retail Shopping Areas), Hearst Magazines, Inc. (Consumer Trading Areas), Rand McNally Map Company (Trading Areas), and Hagstrom Map Company's Four-Color Retail Trading Area Map. Although the foregoing sources of data are expressly recognized, the Commission will also give consideration to data furnished from other sources which may have probative value on which the applicant may desire to prepare its showing. See separate release of the Commission "Concerning Applications For High Frequency Broadcast Stations."

[5a] Special authorizations which do not involve experimental authorization may be granted pursuant to Section 1.365.

[6] The word "control" as used herein is not limited to majority stock ownership but includes actual working control in whatever manner exercised.

(*Continued on page 378*)

Text of Rules Governing FM

(*Continued from page 374*)

45500, 45700, 45900, 46100, 46300, and 46500, May 1.

(c) For stations operating on the frequencies 46700, 46900, 47100, 47300, 47500, 47700, 47900, 48100, 48300, 48500, and 48700, June 1.

(d) For stations operating on the frequencies 43100, 43300, 43500, 43700, 43900, 44100, and 44300, July 1.

EQUIPMENT

Sec. 3.241 *Maximum power rating.* The Commission will not authorize the installation of a transmitter having a maximum rated power more than twice the operating power of the station.

Sec. 3.242 *Maximum rated carrier power; how determined.* (a) The maximum rated carrier power of a standard transmitter shall be determined by the manufacturer's rating of the equipment.

(b) The maximum rated carrier power of a composite transmitter shall be determined by the sum of the applicable commercial ratings of the vacuum tubes employed in the last radio stage.

Sec. 3.243 *Frequency monitor.* The licensee of each high-frequency broadcast station shall have in operation at the transmitter a frequency monitor independent of the frequency control of the transmitter. It shall have a stability of 20 parts per million. For detailed requirements thereof see *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*

Sec. 3.244 *Modulation monitor.* The licensee of each high-frequency broadcast station shall have in operation at the transmitter an approved modulation monitor. For detailed requirements thereof see *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*

Sec. 3.245 *Required transmitter performance.* (a) The external performance of high-frequency broadcast transmitters shall be within the minimum requirements prescribed by the Commission contained in the *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*

(b) The transmitter center frequency shall be controlled directly by automatic means which do not depend on inductances and capacities for inherent stability.

(c) The transmitter shall be wired and shielded in accordance with good engineering practice and shall be provided with safety features in accordance with the specifications of article 810 of the current National Electrical Code as approved by the American Standards Association.

Sec. 3.246 *Indicating instruments.* The direct plate circuit current and voltage shall be measured by instruments having an acceptable accuracy. (See *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*)

Sec. 3.247 *Auxiliary and duplicate transmitters.* See Sections 3.63 and 3.64 for provisions governing the use of auxiliary and duplicate transmitters at high-frequency broadcast stations.

Sec. 3.248 *Changes in equipment and antenna system.* Licensees of high-frequency broadcast stations shall observe the following provisions with regard to changes in equipment and antenna system:

(a) No changes in equipment shall be made:

1. That would result in the emission of signals outside of the authorized channel.

2. That would result in the external performance of the transmitter being in disagreement with that prescribed in the *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*

(b) Specific authority, upon filing formal application [7] therefor, is required for a change in service area or for any of the following changes:

(1) Changes involving an increase in the maximum power rating of the transmitter.

(2) A replacement of the transmitter as a whole.
whole.

(3) Change in the location of the transmitter antenna.

(4) Change in antenna system, including transmission line, which would result in a measurable change in service or which would affect the determination of the operating power by the direct method. If any change is made in the antenna system or any change made which may affect the antenna system, the method of determining operating power shall be changed immediately to the indirect method.

(5) Change in location of main studio to outside of the borders of the city, state, district, territory, or possession.

(6) Change in the power delivered to the antenna.

(c) Specific authority, upon filing informal request therefor, is required for the following change in equipment and antenna;

(1) Change in the indicating instruments installed to measure the antenna current or transmission line, direct plate circuit voltage and the direct current of the last radio stage, except by instruments of the same type, maximum scale reading and accuracy.

(2) Minor changes in the antenna system and/or transmission line which would not result in an increase of service area.

(3) Changes in the location of the main studio except as provided for in subparagraph (b) 5.

(d) Other changes, except as above provided for in this section or in *Standards of Good Engineering Practice for High-frequency Broadcast Stations* prescribed by the Commission may be made at any time without the authority of the Commission, provided that the Commission shall be promptly notified thereof, and such changes shall be shown in the next application for renewal of license.

TECHNICAL OPERATION

Sec. 3.251 *Operating power; how determined.* The operating power, and the requirements for maintenance thereof, of each high-frequency broadcast station shall be determined by the *Standards of Good Engineering Practice for High-frequency Broadcast Stations.*

Sec. 3.252 *Modulation.* (a) The percentage of modulation of all stations shall be maintained as high as possible consistent with good quality of transmission and good broadcast practice and in no case less than 85 percent on peaks of frequent recurrence during any selection which normally is transmitted at the highest level of the program under consideration.

Sec. 3.253 *Frequency tolerance.* The operating frequency without modulation of each broadcast station shall be maintained within 2000 cycles of the assigned center frequency.

OPERATION

Sec. 3.261 *Minimum operating schedule; service.* (a) Except Sundays, the licensee of each high-frequency broadcast station shall maintain a regular daily operating schedule which shall consist of at least three hours of operation during the period 6 a.m. to 6 p.m., local standard time and three hours of operation during the period 6 p.m. to midnight, local standard time. In an emergency, however, when due to causes beyond the control of the licensee, it becomes impossible to continue operating, the station may cease operation for a period not to exceed ten days, provided that the Commission and the inspector in charge of the radio district in which the station is located [8] shall be notified in writing immediately after the emergency develops.

(b) Such stations shall devote a minimum of one hour each day during the period 6 a.m. to 6 p.m., and one hour each day during the period 6 p.m. to midnight, to programs not duplicated simultaneously as primary service in the same area by any standard broadcast station or by any high-frequency broadcast station. During said one hour periods, a service utilizing the full fidelity capability of the system, as set forth in the *Standards of Good Engineering Practice for High-frequency Broadcast Stations*, shall be rendered. However, the Commission may, upon request accompanied by a showing of reasons therefor, grant exemption from the foregoing requirements, in whole or in part, for periods not in excess of three months.

(c) In addition to the foregoing minimum requirements, the Commission will consider, in determining whether public interest, convenience, and necessity has been or will be served by the operation of the station, the extent to which the station has made or will make use of the facility to develop a distinct and separate service from that otherwise available in the service area.

[7] See *Standards of Good Engineering Practice for High-frequency Broadcast Stations* for specific application form required.

[8] See Appendix No. 3, Part 1.

Standards of Good Engineering Practice

Governing High Frequency (FM) Broadcast Stations: 43-50 Mc.

(Adopted by the FCC, June 28, 1940)

1. Engineering Standards of Allocation.

(a) Section 3.225 prescribes three groups of channels for the use of high frequency broadcast stations. The stations within each group of channels have a specific purpose in the plan of allocation and provide a service to a particular type of area. Section 3.222 of the rules requires that high-frequency broadcast stations be licensed on the basis of an area in square miles in the service area and that the contour bounding the service area and the radii of this contour shall be determined in accordance with these standards. A high-frequency broadcast station has but one service, that which corresponds to primary service of standard broadcast stations. No service from sky waves or secondary service is obtainable. No intermittent service is recognized. Therefore, the extent of the service is determined by the point at which the primary service signal is no longer of sufficient intensity to provide broadcast service. The field intensity necessary for service is given:

* * *

TABLE I, Service—(median field intensity)—City areas near factories, car lines, or busy streets, 1 mv/m; rural areas away from highways, 0.05 mv/m. The above figures are based on the absence of objectionable fading and the usual noise levels encountered in the two areas and also predicated upon the absence of interference from other high-frequency broadcast stations.

* * *

(b) The service area is established as follows: On a topographic map of the proposed service area of the station at least 8 radials separated by approximately 45° are drawn in the several directions from the proposed location of the transmitter. From these radials there should then be plotted profile graphs of each radial. An appropriate scale should be used with distance in miles from the antenna plotted as abscissa and the elevation as ordinate in feet plotted by 40 to 100-foot contour intervals. The profile graphs should then be divided into sectors with respect to the distance in miles, each sector being not more than approximately one-tenth of the roughly estimated distance to the desired service contour, and from these sectors the average elevation for each sector or several sectors may be readily determined. This map and the profile graphs are then used in the determination of the radii of the service area of high-frequency broadcast stations as set out below.

(c) To determine the radii of the service contour the graph [Figure 1, see next page] and description [Annex I, see third page] concerning the range of high-frequency broadcast stations should be used. The method of use and an example are contained in Annex I. The height of the transmitting antenna used in connection with Figure 1 should be the proposed height of the antenna above the average elevation between the antenna and the 1 mv/m or 0.05 mv/m contour, whichever is under investigation. This determination, of course, involves the assumption of the antenna height above the average elevation and from this assumption a determination is made of the distance to the desired contour. The average elevation over the distance just found to the desired contour may then be determined and checked with the assumed height. If the assumption was in error, it may then be modified and the problem repeated to reduce the error in the distance to the desired contour. This cut and try process must be repeated until the error is negligible.

The foregoing process of determining the extent of the 1 mv/m or 0.05 mv/m contours shall be followed in determining the boundary of the station's predicted service area. The boundaries of the service area of both the 1 mv/m and the 0.05 mv/m contour must be established and submitted with each application for a high frequency broadcast station.

(d) The distances along each radial to the 0.05 and/or the 1 mv/m contours should then be plotted on the topographic map required by (c) above or polar coordinate paper. The area within each contour should then be measured (by planimeter or other approximate means) to determine the area which the proposed station will serve. The station is rated on basis of the area within the 0.05 mv/m contour or the contour free of interference if greater than the 0.05 mv/m contour.

2. Objectionable Interference.

(a) Section 3.225 (f) requires that the proposed station shall not suffer interference to such an extent that its service will be reduced to an unsatisfactory degree. Objectionable interference will be considered to exist when the signal for 50% of the distance in any sector on a radial as determined from Section 1 (d) of these standards exceeds 0.005 mv/m at the 0.05 mv/m contour of the desired station. In the case of a station protected to the 1 mv/m contour, objectionable interference occurs when the signal for 50% of the distance in any sector exceeds 0.1 mv/m. At other field intensities the following ratios of the desired to undesired signals shall govern.

* * *

TABLE II, channel separation and ratio of desired to undesired signals—Same channel, 10:1 median field intensity; adjacent channel (200 kc), 2:1 median field intensity.

In the absence of measurements to determine the extent of the service contours of the desired station and the interference contours of the undesired station, the signals shall be determined by use of the Graph I in the manner heretofore described. Measurements to determine the extent of one or both of the signals involved are preferable. Measurements should be made in accordance with Annex II associated herewith.

* * *

(b) The signal intensity for 0.05 mv/m 50% distance is interpreted to mean the contour bounded by the sector on a radial on the map of 1(c) above wherein the signal of the station for 50% of the distance represented by the sector on the radial is equal to 0.05 mv/m. The boundary of the service area shall be taken as the outer edge of the sector nearest the transmitter wherein the signal is the desired value for 50% of the distance. For the methods of measurement of this signal see Annex II, *"Field Intensity Measurements of High-frequency Broadcast Stations."*

3. Transmitter Location.

(a) The transmitter location should be as near the center of the proposed service area as possible consistent with the applicant's ability to find a site with sufficient elevation to provide service throughout the area. Location of the transmitter at a point of high elevation is necessary to reduce to a minimum the shadow effect on propagation due to built-up city areas, hills, and other obstructions which may reduce materially the intensity of the station's signals in a particular direction. The transmitter site should be selected consistent with the purpose of the station, i.e., whether it is intended to serve a small city, a metropolitan area or a large region. Inasmuch as service may be provided by signals of 1 mv/m or greater field intensities in built-up urban areas, and inasmuch as signals in excess of 0.05 mv/m will provide service in rural areas away from highways, considerably more latitude in the exact geographical location of the transmitter is permitted for a high-frequency broadcast station than for a standard broadcast station; however, the necessity for a high elevation for the antenna may render this problem more difficult. In general, the transmitting antenna of a station should be located at the most central point at the highest elevation available. Where a directive antenna is used, a central location may not be desirable and, in fact, the availability of suitable sites may make necessary the use of directive antennas. The antenna height above the average elevation of the service area is the most important factor in obtaining coverage with a high frequency broadcast station. Doubling the height of the antenna is equivalent to increasing the power by four times. The power is only one of several important factors (See Annex I and Fig. 1).

(b) The transmitter site should be selected such that the 1.0 mv/m contour encompasses all the urban population within the area proposed to be served and the 0.05 mv/m contour provides the maximum obtainable service consistent with the area desired to be served. While no standards with respect to blanket area are established, every precaution must be taken not to locate a station in a residential area.

4. Operating Power; Determination and Maintenance.

(a) Section 3.251 requires that the operating power and the requirements for maintenance thereof of each high-frequency broadcast station shall be determined in accordance with the *Standards of Good Engineering Practice.* The operating power must be determined by one of two methods:

(1)[1] Indirect measurement, by means of the plate input power to the last radio stage in accordance with (b) below, or;

(2) By measurement of the antenna or transmission line current required to produce the service area set out in (e) below.

(b) The operating power determined by indirect measurement of the plate input power of the last radio stage is the product of the plate voltage (Ep), the total plate current of the last radio stage (Ip) and the factor of 0.60, that is

Operating power = Ep x Ip x 0.60

(c) The operating power maintained by the antenna or transmission line current, required to obtain the service area as proposed in the application and specified in the station license shall be the direct method. The proof of performance from continuous field intensity recordings shall be used to establish the service area. These data shall be submitted to and approved by the Commission before any licensee will be authorized to operate with the power indicated by this method. If any change is made in the antenna system or any change made which may affect the antenna system, the method of determining operating power shall be changed immediately to the indirect method.

(d) The licensee of a broadcast station shall maintain the antenna or transmission line current of the station within the prescribed limits of the authorization at all times except that in an emergency when, due to causes beyond the control of the licensee, it becomes impossible to operate with full licensed power, the station may be operated at reduced power for a period of not to exceed ten days, provided that the Commission and the Inspector in Charge shall be notified in writing immediately after the emergency develops.

5. Proof of Performance of High-frequency Broadcast Stations.

(a) Section 3.227 requires that within one year from the date of the first regular operation of a high-frequency broadcast station a survey to determine the performance of the station shall be made and submitted to the Commission to establish the actual field intensity contours from which the operating constants required to deliver service to the entire area specified in the license can be determined. This proof of performance shall be established by continuous field intensity records generally along the several radials shown on the topographic map submitted with the application for construction permit. The measured radials shall be carried to a point sufficiently beyond the locations of the predicted service contours to arrive at an accurate determination of the boundary of the service area of the station as predicted in the original application. The field intensities for the several sectors along each radial shall be determined as outlined in Annex II, *Field Intensity Measurements of High-frequency Broadcast Stations.*

The survey data submitted shall include a topographic map similar to that submitted with the application with the original radials and the actual paths followed by the car in making the measurements plotted thereon. The field intensity for each sector shall be shown either on the map or in tabular form accompanying it with necessary notation to identify the sector to which the field applies and the extent of the 0.05 mv/m contour and/or the 1.0 mv/m contour plotted.

[1] Until Jan. 1, 1941, high-frequency broadcast stations will be permitted to determine the operating power by the indirect method for a period of one year after the beginning of regular operation.

6. Technical Equipment Pursuant to Section 3.245.

(a) Design. The general design of the high-frequency broadcast transmitting equipment (main studio microphones, amplifiers, lines or other circuits between studios and transmitter, and transmitter) shall be in accordance with the following specifications: For points not specifically covered, the principles set out shall be followed. The equipment shall be so designed that:

(1) The maximum rated carrier power as determined under Section 3.242 is in accordance with the requirements of Section 3.241.

(2) The equipment is capable of satisfactory operation at the authorized operating power or the proposed operating power with frequency swing plus and minus 75 kilocycles. At any frequency between 50 and 15,000 cycles at a swing of 75 kilocycles, the combined audio frequency harmonics generated by the transmitting system shall not be in excess of 2 percent (root mean square value).

(3) The transmitter and associated studio equipment shall be capable of transmitting a band of frequencies from 50 to 15,000 cycles within 2 decibels of the level of 1,000 cycles. In addition provision shall be made for pre-emphasis of the higher frequencies in accordance with impedance-frequency characteristics of a series inductance resistance network having a time constant of 100 microseconds.

(4) The noise in the output of the transmitter in the band 50 to 15,000 cycles shall be at least 60 decibels below the audio frequency level represented by a frequency swing of 75 kc. (100% modulation).

(5) The transmitter shall be equipped with suitable indicating instruments in accordance with the requirements of Section 3.246 and other instruments as are necessary for proper adjustment and maintenance of operation of the equipment.

(6) Adequate provision shall be made for varying the transmitter power output between sufficient limits to compensate for excessive variations in line voltage, or other factors which may affect the power output. The assigned center frequency shall be maintained within the allowed tolerance by automatic means which are not dependent upon inductances or capacitors for inherent stability and capable of maintaining the operating frequency within the limits of plus or minus 2,000 cycles specified by Section 3.246.

(7) Means should be provided for connection and continuous operation of the approved modulation monitor and approved frequency monitor.

(b) All high-frequency broadcast transmitters shall be constructed in accordance with Section 12B of the *Standards of Good Engineering Practice Concerning Standard Broadcast Stations.*

(c) All high-frequency broadcast transmitters shall be wired and shielded in accordance with Section 12C of the *Standards of Good Engineering Practice Concerning Standard Broadcast Stations.*

(d) The installation of all high-frequency broadcast transmitters shall be in accordance with Section 12D of the *Standards of Good Engineering Practice Concerning Standard Broadcast Stations.*

(e) Spare tubes for high-frequency broadcast stations shall be provided in accordance with Section 12E of the *Standards of Good Engineering Practice Concerning Standard Broadcast Stations.*

(f) Operation. In addition to specific requirements of the rules governing high-frequency broadcast stations, the following operating requirements shall be specified:

(1) The maximum percentage of modulation shall be maintained in accordance with Section 3.252. However, precautions shall be taken so as not to substantially alter the dynamic characteristics of musical programs.

(2) Spurious emissions, including radio frequency and audio frequency harmonics shall be maintained at as low a level as practicable at all times in accordance with good engineering practice.

(g) Studio equipment. Studio equipment shall be subject to all the above requirements where applicable except as follows:

(1) If properly covered by an underwriter's certificate, it will be considered as satisfying safety requirements.

(2) Section 8191 of Article 810 of the National Electrical Code shall apply for voltages only in excess of 500 volts.

No specific requirements are made rela-

(Continued on page 383)

SIGNAL RANGE FOR HIGH FREQUENCY BROADCAST STATIONS

(THE RANGE IS BASED ON THEORETICAL CONSIDERATIONS OF THE PROPAGATION OF 46MC OVER LAND WITH A CONDUCTIVITY $\sigma = 5\times10^{-14}$ e.m.u. AND A DIELECTRIC CONSTANT $\epsilon = 15$ AND A RECEIVING ANTENNA HEIGHT OF 30 FEET-CALCULATED FOR A SPHERICAL EARTH.)

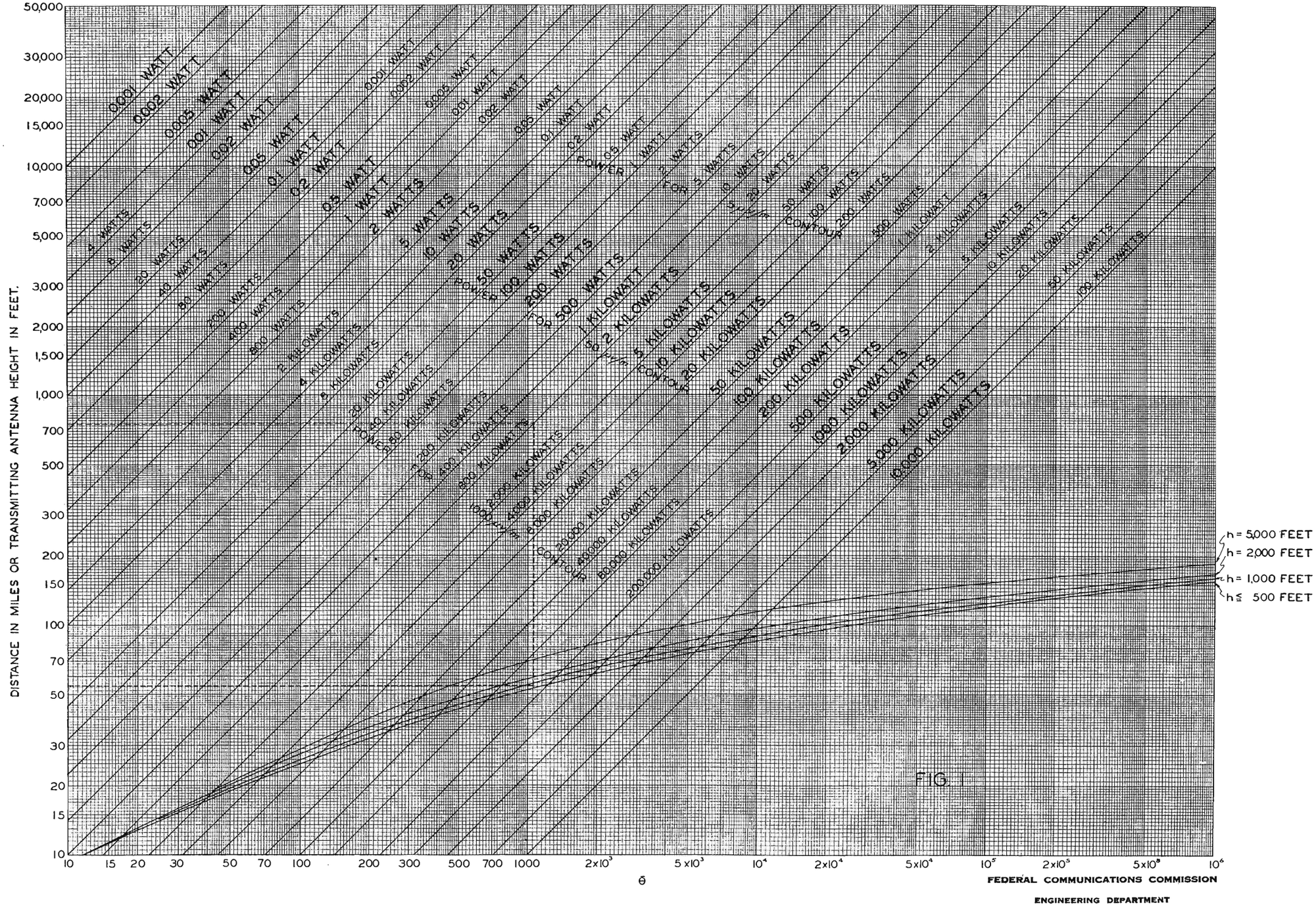

FIG. 1

FEDERAL COMMUNICATIONS COMMISSION

ENGINEERING DEPARTMENT

Standards of Good Engineering Practice Governing FM

(*Continued from page 379*)

tive to the design and acoustical treatment of studios. However, the design of studios, particularly the main, shall be compatible with the required performance characteristics of high frequency broadcast stations.

7. Indicating Instruments.

Section 3.237 requires that each high-frequency broadcast station have suitable indicating instruments for determining the plate circuit current and voltage to the final stage of the transmitter. In addition, high frequency broadcast stations are required to provide a suitable radio frequency ammeter to measure the antenna or transmission line current.

The requirements and specifications contained in the *Standards of Good Engineering Practice Concerning Standard Broadcast Stations*, Section 13, sub-sections A, B, (except a(6) and h), D, E, G, and H shall apply to indicating instruments used by high-frequency broadcast stations in compliance with this rule:

8. Requirements for Approval of Transmitters.

Sections 3.224, 3.241, 3.245 and 3.246 concerning the design, construction and technical operation of high-frequency broadcast equipment. In order to facilitate the filing of and action on applications for construction permits specifying equipment of standard manufacture, the Commission will approve, as complying with the technical requirements, such equipment by type subject to the following conditions and in accordance with the following procedure:

(a) Approval of equipment by the Commission is only to the effect that insofar as can be determined from the data supplied the equipment complies with the current requirements of good engineering practice and the technical Rules and Regulations of the Commission. The approval may be withdrawn upon subsequent inspection or operation showing the equipment is not as represented or does not comply with the technical rules and regulations of the Commission and the requirements of good engineering practice.

(b) Such approval shall not be construed to mean that the equipment will be satisfactory as the state of the art progresses and/or as the rules and regulations of the Commission may be changed as deemed advisable.

(c) Applicants specifying equipment of approved manufacture need not submit detailed descriptions and diagrams where the correct type number is specified provided the equipment, including the antenna tuning unit, is identical with that approved.

(d) In passing on equipment, no consideration is given by the Commission to patent rights.

(e) For approval of high-frequency broadcast transmitters, manufacturers shall submit FCC Form 319 completed with respect to all pertinent sections and the data set forth below, both of which shall be verified before a notary public.

(1) Photograph or drawings, or any evidence that construction is in accordance with the requirements of good engineering practice.

(2) Data and curves showing overall audio frequency response from 50 to 15,000 cycles for approximately 25, 50, and 100% modulation.

(3) Data on audio frequency harmonics for 25, 50, and 100% modulation for the fundamental frequencies of 50, 100, 400, 1,000, 5,000, 10,000 and 15,000 cycles.

(4) Data showing performance of pre-emphasis circuits.

(5) Carrier hum and extraneous noise generated within the equipment and measured as the level below 100% modulation.

(6) How output power is varied to compensate for power supply voltage variations.

(7) Data and curves on mean frequency stability for variations in ambient temperatures over the range encountered in practice.

(8) Data and curves on frequency stability for variations in power supply voltage from 85 to 115 per cent normal.

(9) Net sale price

(f) For approval of automatic frequency control equipment or modulation equipment for high frequency broadcast transmitters, manufacturers shall complete FCC Form 319 with respect to all pertinent sections as required for complete transmitters.

ANNEX I

Description of Chart to be Used for Determining the Range of High-frequency Broadcast Stations

THE CHART [on opposite page] may be used in the following way for determining for a 30-foot receiving antenna the distance to the 50 microvolt per meter contour for a high-frequency station operating in the 42 to 50 mc. band. This distance is determined by the values of the transmitting antenna height, the antenna power and the antenna field gain. The method of using the chart is illustrated by the following example which is shown as a dashed line on the chart. In this example the transmitting antenna height is 750 feet; the antenna power is 500 watts and the antenna field gain is 2. The effective power to be used in connection with the chart is determined by multiplying the antenna power by the square of the antenna field gain; thus for the example the effective power would be 500 x 2 x 2 = 2000 watts or 2 kw. To determine the distance to the 50 microvolt per meter contour in the example given follow the 750-foot horizontal line over to the 45° line marked 2 kw. and proceed vertically downward to the point half way between the curved lines marked 1,000 feet and 500 feet; finally proceed horizontally again to the left to find that the expected range is 54.5 miles. By reversing the above procedure, the chart can, of course, be used for determining the power required for a given antenna height in order to cover a certain distance.

Additional power scales have been placed on the chart so that the distance to the 5 and 1,000 microvolt per meter contours may also be easily determined. In general, by using the scale marked θ at the bottom of the chart, the distance to any desired contour may be determined.

$$\theta = h \times P^{1/2} \times G \times \frac{50}{F}$$

h = transmitting antenna height expressed in feet.
$P^{1/2}$ = square root of the antenna power expressed in kilowatts
G = antenna field gain
F = desired field intensity expressed in microvolts per meter.

Having determined θ by means of the above formula, the corresponding distance is determined by proceeding vertically on the chart at that value of θ to the appropriate curved line and then horizontally to the left to determine the distance.

ANNEX II

Field Intensity Measurements of High-frequency Broadcast Stations

WHERE REQUIRED by the *Standards of Good Engineering Practice Concerning High-frequency Broadcast Stations*, field intensity measurements shall be made with suitable measuring equipment having associated therewith a continuous recording device, the chart of which is either directly driven from the speedometer of the automobile in which the equipment is mounted, or so arranged that distances and identifying land marks may be readily noted. The measuring equipment must be calibrated against recognized standards of field intensity and so constructed that it will maintain an acceptable accuracy of measurement while in motion or stationary. The equipment should be so operated that the recorder chart can be calibrated directly in field intensity in order to facilitate analysis of the chart.

Measurements made to determine the performance of high-frequency broadcast stations in connection with interference studies of high-frequency broadcast stations should be made along roads which parallel as nearly as possible the radials shown on the topographic map submitted with the application for construction permit. Locations shall be noted on the recorder chart as frequently as necessary to determine the exact location of the car in order to definitely fix the relation between the measured field intensity and the location.

Where measurements are made to determine the signal in connection with problems of interference with other high-frequency broadcast stations, they shall be carried to a point well beyond the 0.005 or 0.1 mv/m contours, whichever is pertinent to the particular problem, in order that the data may be adequate to accurately determine any interference.

After measurements are completed, the recorder chart shall be divided into sections, each section representing the projection of the actual path followed in making the measurements upon the sector of the radial from the topographic map along which the measurements are made. The field intensities in each section of the chart shall be analyzed to determine the intensity expected 50 per cent of the distance (medium field) throughout the section and this median field intensity is then associated with the corresponding sector of the radial. The sectors must not be longer than one-tenth the service radius or more than 5 miles. The outer boundary of each sector along the radial shall then be considered as the extent of a particular field intensity contour in the particular direction of a radial.

When making measurements at some distance from the station, stationary records should be made to determine the conditions of fading of the signal.

Sufficient data are not available to establish the long distance interference propagation characteristics. In any case under study measurements should be made similar to that in the standard band. Also, special studies will be necessary to establish the variation of the signal in the service area with seasons, sun spot cycles etc.

9. Requirements for Approval of Frequency Monitors.

Section 3.243 requires that the licensee of each high frequency broadcast station shall have in operation at the transmitter a frequency monitor independent of the frequency control of the transmitter. The frequency monitor shall be capable of maintaining an accuracy within at least one-half (1,000 cycles) of the permitted frequency deviation of the high-frequency broadcast station. Visual indication of the operating frequency shall be provided. (Further detailed specifications to be established).

10. Requirements for Approval of Modulation Monitors.

Section 3.235 requires all high-frequency broadcast stations to have in operation a modulation monitor. This monitor should have substantially the same performance as the std B/C monitor. (Further detailed specifications to be established).

11. Approved Equipment.

[To be supplied.]

12. High-frequency Broadcast Application Forms.

The Communications Act of 1934, as amended, and the rules and regulations of the Commission require that an application be made to the Commission for various authorizations. In order to be of aid to applicants there is set out below the correct forms to be submitted in making application for various authorizations applicable to high-frequency broadcast stations.

In general, these forms shall be completed in full, answering each specific section. The only exception is in the technical sections when in the case of standard equipment which has been approved by type number by the Commission or when no change in such equipment is involved, in which cases the manufacturer's name and type number of the approved equipment may be stated, or should be noted "no change" in each section applicable. All applications involving actual operation, such as license to cover construction permit renewal of license, etc., shall be completed in full regardless of whether such information has been previously filed with the Commission.

FCC Form 319—Application for high-frequency broadcast station construction permit or modification thereof shall be used for all applications for authority:

(1) To erect a new high-frequency broadcast station.

(2) Any change in assignment involving construction as listed in (3) to (6) below:

(3) To install new transmitter.

(4) To make any change affecting the maximum rated carrier power or type number of equipment.

(5) To change the location of the existing transmitter.

(6) To install new antenna system or make substantial change in an existing antenna system which may result in an increase in service.

(7) For modification of any outstanding construction permit which has not been covered by license.

FCC Form 320—Application for High-frequency Broadcast Station License shall be used for all applications for license:

(1) To cover construction permit.

(2) For regular authorization covering experimental authorization.

FCC Form 321—Application for Modification of High-frequency Broadcast Station License shall be used for all applications for modification of any term of an existing regular license of a high-frequency broadcast station where a construction permit is not required:

(1) Change of frequency.

(2) Change of coverage where the equipment at present installed is capable of satisfactory operation at the proposed coverage.

(3) Change or location of main studio.

(4) Change of name of licensee where no change in ownership is involved.

FCC Form 322—Application for Renewal of High-frequency Broadcast Station License shall be used for all applications for renewal of regular licenses of all high frequency broadcast stations.

FCC Rules Governing Television

Effective June 20, 1940

VISUAL BROADCAST SERVICE

4.61 *Defined.*—The term "visual broadcast service" means a service rendered by stations broadcasting images for general public reception. There are two classes of stations recognized in the visual broadcast service, namely: Television broadcast stations and facsimile broadcast stations.

TELEVISION BROADCAST STATIONS

4.71 *Defined.*—The term "television broadcast station" means a station licensed for the transmission of transient visual images of moving or fixed objects for simultaneous reception and reproduction by the general public. The transmission of synchronized sound (aural broadcast) is considered an essential phase of television broadcast and one license will authorize both visual and aural broadcast as herein set forth.

4.72 *Purpose.*—A license for a television broadcast station will be issued for the purpose of carrying on research, which must include engineering experimentation tending to develop uniform transmission standards of acceptable technical quality, and which may include equipment tests, training of technical personnel, and experimental programs.

4.73 *Licensing requirements, necessary showing.*—A license for a television broadcast station will be issued only after a satisfactory showing has been made in regard to the following:

(1) That the applicant has a definite program of research and experimentation in the technical phases of television broadcasting, which indicates reasonable promise of substantial contributions to the development of the television art.

(2) That upon the authorization of the proposed station the applicant can and will proceed immediately with its program of research.

(3) That the transmission of signals by radio is essential to the proposed program of research and experimentation.

(4) That the program of research and experimentation will be conducted by qualified personnel.

(5) That the applicant is legally, financially, technically, and otherwise qualified to carry forward the program.

(6) That public interest, convenience or necessity will be served through the operation of the proposed station.

4.74 *Charges.*—No charges either direct or indirect shall be made by the licensee of a television station for the production or transmission of either aural or visual programs transmitted by such station.

4.75 *Announcements.*—(*a*) *Station identification.* A licensee of a television broadcast station shall make station identification announcement (call letters and location) at the beginning and ending of each time of operation and during operation (other than purely test operation) on the hour and half hour as provided below:

(1) Such identification announcement during operation need not be made when to make such announcement would interrupt a single consecutive 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 first interruption of the entertainment continuity and at the conclusion of such program.

(2) In case of variety-show programs, baseball-game broadcasts, or similar program of longer duration than 30 minutes, the identification announcement shall be made within 5 minutes of the hour and half hour.

(3) In case of all other programs (except as provided in paragraphs (1) and (2) of this section) the identification announcement shall be made within 2 minutes of the hour and half hour.

(4) In making the identification announcement, the call letters shall be given only on the channel of the station identified thereby.

(*b*) At the time station identification announcements are made, there shall be added the following:

"This is a special television broadcast made by authority of the Federal Communications Commission for experimental purposes."

4.76 *Operating requirements.* (*a*) Each licensee of a television broadcast station shall diligently prosecute its program of research from the time its station is authorized.

(*b*) Each licensee of a television station will from time to time make such changes in its operations as may be directed by the Commission for the purpose of promoting experimentation and improvement in the art of television broadcasting.

4.77 *Frequency assignment.* (*a*) The following groups of channels are allocated for assignment to television broadcast stations licensed experimentally.

GROUP A

Channel No.	
1	50,000- 56,000 kc
2	60,000- 66,000 kc
3	66,000- 72,000 kc
4	78,000- 84,000 kc
5	84,000- 90,000 kc
6	96,000-102,000 kc
7	102,000-108,000 kc

GROUP B

Channel No.	
8	162,000-168.000 kc
9	180,000-186,000 kc
10	186,000-192,000 kc
11	204,000-210,000 kc
12	210,000-216,000 kc
13	234,000-240,000 kc
14	240,000-246,000 kc
15	258,000-264,000 kc
16	264,000-270,000 kc
17	282,000-288,000 kc
18	288,000-294,000 kc

GROUP C

Any 6000 kc band above 300,000 kc excluding band 400,000 to 401,000 kc.

(*b*) No television broadcast station will be authorized to use more than one channel in group A except for good cause shown. Both aural and visual carriers with side bands for modulation are authorized but no emission shall result outside the authorized channel.

(*c*) No person (including all persons under common control) shall, didectly or indirectly, own, operate or control more than three television stations on channels in group A, and no such person shall, directly or indirectly, own, operate or control on channels in group A more than one television station which would serve in whole or substantial part the same service area as another station operated or controlled by such person. This paragraph (*c*) shall not apply to stations which do not transmit programs for public reception.

(*d*) Channels in Groups B and C may be assigned to television stations to serve auxiliary purposes such as television relay stations. No mobile or portable station will be licensed for the purpose of transmitting television programs to the public directly.

4.78 *Power.* The operating power of a television station shall be adequate for but not in excess of that necessary to carry forward the program of research and in no case in excess of the power specified in its license.

4.79 *Reports.* (*a*) A report shall be filed with each application for renewal of station license which shall include a statement of each of the following:

(1) Number of hours operated.

(2) Full data on research and experimentation conducted including the type of transmitting and studio equipment used and their mode of operation.

(3) Data on expense of operation during the period covered.

(4) Power employed, field intensity measurements and visual and aural observations and the types of instruments and receivers utilized to determine the service area of station and the efficiency of respective types of transmissions.

(5) Estimated degree of public participation in reception, and the results of public observation as to the efficiency of types of transmission.

(6) Conclusions, tentative and final.

(7) Program for further developments in television broadcasting.

(8) All developments and major changes in equipment.

(9) Any other pertinent developments.

(*b*) Special or progress reports shall be submitted from time to time as the Commission shall direct.

NATIONAL TELEVISION SYSTEMS COMMITTEE

Chairman: W. R. G. Baker, General Electric Co.
Director, Engineering Dept., Radio Manufacturers Assn.

MEMBERSHIP

Columbia Broadcasting System, 485 Madison Ave., New York City—Adrian Murphy, executive director of television; Dr. Peter C. Goldmark, alternate.

Don Lee Broadcasting System, 5515 Melrose Ave., Hollywood, Cal.—Harry R. Lubcke, director of television.

Allen B. DuMont Laboratories, Passaic N. J.—Allen B. DuMont, president; Dr. T. T. Goldsmith, alternate.

Farnsworth Television & Radio Corp., Fort Wayne, Ind.—B. Ray Cummings, vice-president in charge of engineering; P. J. Herbst, alternate.

General Electric Co., Schenectady, N. Y.—Dr. E. F. W. Alexanderson; I. J. Kaar, alternate.

Hazeltine Corp., 42-23 Little Neck Parkway, Little Neck, N. Y.—Daniel E. Hartnett, chief engineer; W. A. MacDonald, alternate.

John V. L. Hogan, 730 Fifth Ave., New York City—Lynne C. Smeby, alternate.

Hughes Tool Co., RCA Bldg., New York City—Albert I. Lodwick; A. F. Murray, alternate.

Institute of Radio Engineers, 580 Fifth Ave., New York City—Dr. A. N. Goldsmith; H. A. Wheeler, alternate.

Philco Corp., Tioga & C Sts., Philadelphia—D. B. Grimes or F. J. Bingley, alternates.

Radio Corporation of America, Camden, N. J.—E. W. Engstrom; Dr. C. B. Jolliffe, alternate.

Stromberg Carlson Telephone Mfg. Co., Rochester, N. Y.—R. H. Manson, vice-president; Dr. George Town, alternate.

Zenith Radio Corp., 6001 Dickens Ave., Chicago—John R. Howland; J. E. Brown, alternate.

Bell Telephone Laboratories, 463 West St., New York City.

Television Productions, 1501 Broadway, New York City—Paul C. Raiburn.

PANELS

Panel No. 1—Peter C. Goldmark, CBS, chairman. System Analysis: The analysis of foreign and proposed American television systems.

Panel No. 2—Dr. A. N. Goldsmith, New York, chairman. Subjective Aspects: The influence of physiological and psychological factors in the determination of system characteristics.

Panel No. 3—J. E. Brown, Zenith Radio Corp., chairman. Television Spectra: Consideration of sound and picture channel widths and locations.

Panel No. 4—E. W. Engstrom, RCA Mfg. Co., chairman. Transmitter Power: The consideration of transmitter output ratings, modulation capabilities and the relation between power requirements of picture and sound channels.

Panel No. 5—B. Ray Cummings, Farnsworth Television and Radio Co., chairman. Transmitter Characteristics: Consideration of essential system characteristics of the transmitter (signal polarity, black level, etc.)

Panel No. 6—I. J. Kaar, General Electric Co., chairman. Transmitter-Receiver Coordination: Consideration of the essential factors requiring coordination in the design of receivers and transmitters (side-band distribution, audio pre-emphasis, etc.)

Panel No. 7—D. E. Hartnett, Hazeltine Service Corp., chairman. Picture Resolution: Consideration of the factors influencing picture detail (aspect ratio, frame frequency, interlace, etc.

Panel No. 8—Dr. T. T. Goldsmith, Allen B. DuMont Laboratories, chairman. Synchronization: Consideration of methods and means of accomplishing synchronization.

Panel No. 9—David B. Smith, Philco Corp., chairman. Radiation Polarization: Consideration of the factors influencing a choice of the polarization of the radiated wave.

FCC Regulations Governing Standard Broadcast Services

Part 3 of Rules and Regulations, Effective June 25, 1940, as Revised to Oct. 5, 1940

[See page 374 for Subpart B, Specific Rules Governing High-Frequency (FM) Broadcast Stations]

NOTE

The following parallel reference table will show the section numbers of Part 3 which were made effective Aug. 1, 1939, with the corresponding new section numbers of Part 3 recently adopted and now in effect. These rules include the rules governing high-frequency broadcast stations, adopted by the Commission on June 21, 1940 [see Page 394], together with all amendments to date.

Old Section Nos.	*New Section Nos.*
Subpart A—Rules Governing Standard Broadcast Stations	
3.1 to 3.16	3.1 to 3.16
3.21 3.34	3.21 3.34
3.41 3.46	3.41 3.46
3.51 3.64	3.51 3.64
3.71 3.86	3.71 3.86
Subpart B—Rules Governing High-Frequency Broadcast Stations	
New Sections	3.201-3.213
New Sections	3.221-3.231
New Sections	3.241-3.248
New Sections	3.251-3.253
New Section	3.261
Subpart C—General Rules Applicable to Both Standard and High-Frequency Broadcast Stations	
3.88 to 3.94	3.401 to 3.408
3.101 3.104	3.421 3.424

SUBPART A—RULES GOVERNING STANDARD BROADCAST STATIONS

Definitions[1]

3.1 *Standard broadcast station.* The term "standard broadcast station" means a station licensed for the transmission of radio-telephone emissions primarily intended to be received by the general public and operated on a channel in the band 550-1600 kilocycles, inclusive.

3.2 *Standard broadcast band.* The term "standard broadcast band" means the band of frequencies extending from 550-1600 kilocycles, inclusive, both 550 kilocycles and 1600 kilocycles being the carrier frequencies of broadcast channels.

3.3 *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. Carrier frequencies assigned to standard broadcast stations shall begin at 550 kilocycles and be in successive steps of 10 kilocycles.

3.4 *Dominant station.* The term "dominant station" means a class I station, as hereinafter defined, operating on a clear channel.

3.5 *Secondary station.* The term "secondary station" means any station except a class I station operating on a clear channel.

3.6 *Daytime.* The term "daytime" means that period of time between local sunrise and local sunset.

3.7 *Nighttime.* The term "nighttime" means that period of time between local sunset and 12 midnight local standard time.

3.8 *Sunrise and sunset.* The terms "sunrise and sunset" mean, for each particular location and during any particular month, the average time of sunrise and sunset as specified in the license of a broadcast station. (For tabulation of average sunrise and sunset times for each month at various points in the United States, see "Average Sunrise and Sunset Time".

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

3.10 *Experimental period.* The term "experimental period" means that time between 12 midnight and local sunrise. This period may be used for experimental purposes in testing and maintaining apparatus by the licensee of any standard broadcast station on its assigned frequency and with its authorized power, provided no interference is caused to other stations maintaining a regular operating schedule within such period. No station licensed for "daytime" or "specified hours" of operation may broadcast any regular or scheduled program during this period.

3.11 *Service Areas.* (a) The term "primary service area" of a broadcast station means the area in which the ground wave is not subject to objectionable interference or objectionable fading.

(b) The term "secondary service area" of a broadcast station means the area served by the sky wave and not subject to objectionable interference. The signal is subject to intermittent variations in intensity.

(c) The term "intermittent service area" of a broadcast station means the area receiving service from the ground wave but beyond the primary service area and subject to some interference and fading.

3.12 *Main studio.* The term "main studio" means, as to any station, the studio from which the majority of its local programs originate and/or from which a majority of its station announcements are made of programs originating at remote points.

3.13 *Portable transmitter.* The term "portable transmitter" means a transmitter so constructed that it may be moved about conveniently from place to place, and is in fact so moved about from time to time, but not ordinarily used while in motion. In the standard broadcast band, such a transmitter is used in making field intensity measurements for locating a transmitter site for a standard broadcast station. A portable broadcast station will not be licensed in the standard broadcast band for regular transmission of programs intended to be received by the public.

3.14 *Auxiliary transmitter.* The term "auxiliary transmitter" means a transmitter maintained only for transmitting the regular programs of a station in case of failure of the main transmitter.

[1] Other definitions which may pertain to standard broadcast stations are included in sections 2.1 to 2.35 and the Communications Act of 1934, as amended.

3.15 *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.

3.16 *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.

ALLOCATION OF FACILITIES

3.21 *Three classes of standard broadcast channels.*

(a) *Clear channel.* A "clear channel" is one on which the dominant station or stations render service over wide areas and which are cleared of objectionable interference within their primary service areas and over all or a substantial portion of their secondary service areas.

(b) *Regional channel.* A "regional channel" is one on which several stations may operate with powers not in excess of 5 kilowatts. The primary service area of a station operating on any such channel may be limited, as a consequence of interference, to a given field intensity contour.

(c) *Local channel.* A "local channel" is one on which several stations may operate with powers not in excess of 250 watts. The primary service area of a station operating on any such channel may be limited, as a consequence of interference, to a given field intensity contour.

3.22 *Classes and power of standard broadcast stations.*

(a) *Class I station.* A "class I station" is a dominant station operating on a clear channel and designed to render primary and secondary service over an extended area and at relatively long distances. Its primary service area is free from objectionable interference from other stations on the same and adjacent channels, and its secondary service area free from interference, except from stations on the adjacent channel, and from stations on the same channel in accordance with the channel designation in section 3.25 or in accordance with the "Engineering Standards of Allocation." The operating power shall be not less than 10 kilowatts nor more than 50 kilowatts. (Also see section 3.25 (a) for further power limitation.)

(b) *Class II station.* A "class II station" is a secondary station which operates on a clear channel (see section 3.25) and is designed to render service over a primary service area which is limited by and subject to such interference as may be received from class I stations. A station of this class shall operate with power not less than 0.25 kilowatts nor more than 50 kilowatts. Whenever necessary, a class II station shall use a directional antenna or other means to avoid interference with class I stations and with other class II stations, in accordance with the Engineering Standards of Allocation.

(c) *Class III station.* A "class III station" is a station which operates on a regional channel and is designed to render service primarily to a metropolitan district[1a] and the rural area contiguous thereto. Class III stations are subdivided into two classes:

(1) *Class III-A station.* A "class III-A station" is a class III station which operates with power not less than 1 kilowatt nor more than 5 kilowatts, and the service area of which is subject to interference in accordance with the Engineering Standards of Allocation.

(2) *Class III-B station.* A "class III-B station" is a class III station which operates with a power not less than 0.5 kilowatt nor more than 1 kilowatt night and 5 kilowatts daytime, and the service area of which is subject to interference in accordance with the Engineering Standards of Allocation.

(d) *Class IV station.* A "class IV station" is a station operating on a local channel and designed to render service primarily to a city or town and the suburban and rural areas contiguous thereto. The power of a station of this class shall not be less than 0.1 kilowatt nor more than 0.25 kilowatt, and its service area is subject to interference in accordance with the Engineering Standards of Allocation.

3.23 *Time of operation of the several classes of stations.*[2] The several classes of standard broadcast stations may be licensed to operate in accordance with the following:

(a) "Unlimited time" permits operation without a maximum limit as to time.

(b) "Limited time" is applicable to Class II (secondary stations) operating on a clear channel only. It permits operation of the secondary station during daytime, and until local sunset if located west of the dominant station on the channel, or if located east thereof, until sunset at the dominant station, and in addition during night hours, if any, not used by the dominant station or stations on the channel.

(c) "Daytime" permits operation during the hours between average monthly local sunrise and average monthly local sunset. (For exact time of sunset at any location, see "Average and Sunset Times.")

(d) "Sharing time" permits operation during hours which are so restricted by the station license as to require a division of time with one or more other stations using the same channel.

(e) "Specified hours" means that the exact operating hours are specified in the license. (The minimum hours that any station shall operate are specified in section 3.71.)

3.24 *Broadcast facilities; showing required.* An authorization for a new standard broadcast station or increase in facilities of an existing station[3] will be issued only after a satisfactory showing has been made in regard to the following, among others:

[1a] The term "metropolitan district" as used in this subsection is not limited in accordance with the definition given by the Bureau of the Census but includes any principal center of population in any area.

[2] Formal application required for change in time of operation of existing broadcast station.
See Standards of Good Engineering Practice for form number.

[3] Formal application required. See Standards of Good Engineering Practice for form number.

(a) That the proposed assignment will tend to effect a fair, efficient, and equitable distribution of radio service among the several states and communities.

(b) That objectionable interference will not be caused to existing stations or that if interference will be caused the need for the proposed service outweighs the need for the service which will be lost by reason of such interference. That the proposed station will not suffer interference to such an extent that its service would be reduced to an unsatisfactory degree. (For determining objectionable interference, see Engineering Standards of Allocation and Field Intensity Measurements in Allocation.)

(c) That the applicant is financially qualified to construct and operate the proposed station.[4]

(d) That the applicant is legally qualified. That the applicant (or the person or persons in control of an applicant corporation or other organization) is of good character and possesses other qualifications sufficient to provide a satisfactory public service.

(e) That the technical equipment proposed, the location of the transmitter, and other technical phases of operation comply with the regulations governing the same, and the requirements of good engineering practice. (See technical regulations herein and Locations of Transmitters of Standard Broadcast Stations.)

(f) That the facilities sought are subject to assignment as requested under existing international agreements and the Rules and Regulations of the Commission.

(g) That the public interest, convenience, and necessity will be served through the operation under the proposed assignment.

FREQUENCY ALLOCATIONS BY CLASSES OF STATIONS

3.25 *Clear channels; classes I and II.* The frequencies in the following tabulation are designated as clear channels and assigned for use by the classes of stations as given:

(a) To each of the channels below there will be assigned one class I station and there may be assigned one or more class II stations operating limited time or daytime only: 640, 650, 660, 670, 700, 720, 740, 750, 760, 770, 800, 810, 820, 830, 850, 860, 870, 980, 990, 1000, 1070, 1090, 1130, 1150, 1170, and 1190 kilocycles. The power of the Class I stations on these channels shall not be less than 50 kilowatts.

(b) To each of the channels below there may be assigned class I and class II stations: 680, 710, 790, 970, 1020, 1040, 1050, 1060, 1080, 1100, 1110, 1140, 1160, 1180, 1460, 1470, 1480 and 1490 kilocycles.

3.26 *Regional channels; classes III-A and III-B.* The following frequencies are designated as regional channels and are assigned for use by class III-A and class III-B stations[5]: 550, 560, 570, 580, 590, 600, 610, 620, 630, 780, 880 890, 900, 920, 930, 940, 950, 1010, 1120, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1320, 1330, 1340, 1350, 1360, 1380, 1390, 1400, 1410, 1430, 1440, 1450, 1530, and 1550 kilocycles.

3.27 *Local channels; class IV.* The following frequencies are designated as local channels and are assigned for use by class IV stations: 1200, 1210, 1310, 1370, 1420, and 1500 kilocycles.

3.28 *Assignment of stations to channels.* The individual assignments of stations to channels shall be made in accordance with the standards of good engineering practice prescribed and published from time to time by the Commission for the respective classes of stations involved. (For determining objectionable interference, see Engineering Standards of Allocation and Field Intensity Measurements in Allocation, section C.)

3.29 *Assignment of class IV stations to regional channels.* On condition that interference will not be caused to any class III station, and that the channel is used adequately and properly for class III stations and subject to such interference as may be received from class III stations, class IV stations may be assigned to regional channels.

3.30 *Station location.*

(a) Each standard broadcast station shall be considered located in the State and city where the main studio is located.

(b) The transmitter of each standard broadcast station shall be so located that primary service is delivered to the city in which the main studio is located, in accordance with the Standards of Good Engineering Practice, prescribed by the Commission.

3.31 *Authority to move main studio.* The licensee of a standard broadcast station shall not move its main studio outside the borders of the city, State, district, Territory, or possession in which it is located without first making written application[6] to the Commission for authority to so move, and securing written permission for such removal. A licensee need not obtain permission to move the main studio from one location to another within a city or town, but shall promptly notify the Commission of any such change in location.

3.32 *Special experimental authorizations.*

(a) Special experimental authorizations[7] may be issued to the licensee of a standard broadcast station in addition to the regular license upon proper application therefor[6] and satisfactory showing in regard to the following, among others:

(1) That the applicant has a program of research and experimentation which indicates reasonable promise of contribution to the development and practical application of broadcasting, and will be in addition to and advancement of the work that can be accomplished under its regular license.

(2) That the experimental operation and experimentation will be under the direct supervision of a qualified engineer with an adequate staff of engineers qualified to carry on the program of research and experimentation.

(3) That the public interest, convenience, and necessity will be served by granting the authorization requested.

(b)[8] In case a special experimental authorization permits additional hours of operation, no licensee shall transmit any commercial or sponsored program or make any commercial announcement during such time of operation. In case of other additional facilities, no additional charge shall be made by reason of transmission with such facilities.

(c) A special experimental authorization will not be extended after the actual experimentation is concluded.

(d) The program of research and experimentation as outlined in the application for a special experimental authorization shall be adhered to in the main unless the licensee is authorized to do otherwise by the Commission.

(e) The Commission may require from time to time a broadcast station holding such experimental authorization to conduct experiments that are deemed desirable and reasonable.

(f) A supplemental report shall be filed with and made a part of each application for an extension of a special experimental authorization and shall include statements of the following:

(1) Comprehensive summary of all research and experimentation conducted.

(2) Conclusions and outline of proposed program for further research and development.

(3) Comprehensive summary and conclusions as to the social and economic effects of its use.

3.33 *Directional antenna; Showing required.*

(a) No application for authority to install a directional antenna[9] will be accepted unless a definite site and full details of the design of the directional antenna are given with the application. (See Data Required with Applications Involving Directional Antenna Systems.)

(b) No application for an authorization to operate a directional antenna during the broadcast day will be accepted unless proof of performance of the directional antenna taken during equipment test period is submitted with the application. (See Field Intensity Measurements in Allocation, section B.)

3.34 *Normal license period.* All standard broadcast station licenses will be issued so as to expire at the hour of 3 a.m., Eastern Standard Time, and will be issued for a normal license period of 1 year, expiring as follows:

(a) For stations operating on the frequencies 640, 650, 660, 670, 680, 700, 710, 720, 740, 750, 760, 770, 790, 800, 810, 820, 830, 850, 860, 870, 970, 980, 990, 1000, 1020, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1460, 1470, 1480, and 1490 kilocycles, February 1.

(b) For stations operating on the frequencies 550, 560, 570, 580, 590, 600, 610, 620, 630, 780, 880, 890, 900, and 920 kilocycles, April 1.

(c) For stations operating on the frequencies 930, 940, 950, 1010, 1120, 1220, 1230, 1240, 1250, 1260, 1270, 1280, and 1290 kilocycles, June 1.

(d) For stations operating on the frequencies 1300, 1320, 1330, 1340, 1350, 1360, 1380, 1390, 1400, 1410, 1430, 1440, 1450, 1530, and 1550 kilocycles, August 1.

(e) For stations operating on the frequencies 1200, 1210, and 1310 kilocycles, October 1.

(f) For stations operating on the frequencies 1370, 1420, and 1500 kilocycles, December 1.

EQUIPMENT

3.41 *Maximum rated carrier power; tolerances.* The maximum rated carrier power of a standard broadcast transmitter shall not be less than the authorized power nor shall it be greater than the value specified in the following table:

Class of station	Maximum power authorized to station	Maximum rated carrier power permitted to be installed[1]
		watts
Class IV	100 or 250 watts	250
Class III	500 or 1,000 watts	1,000
	5,000 watts	5,000
Class II	250, 500, or 1,000 watts	1,000
	5,000 or 10,000 watts	10,000
	25,000 or 50,000 watts	50,000
Class I	10,000 watts	10,000
	25,000 or 50,000 watts	50,000

[1] The maximum rated carrier power must be distinguished from the operating power. (See sections 2.18 and 2.19.)

3.42 *Maximum rated carrier power; how determined.* The maximum rated carrier power of a standard broadcast transmitter shall be determined as the sum of the applicable power ratings of the vacuum tubes employed in the last radio stage.

(a) The power rating of vacuum tubes shall apply to transmitters employing the different classes of operation or systems of modulation as specified in Power Rating of Vacuum Tubes prescribed by the Commission.

(b) If the maximum rated carrier power of any broadcast transmitter, as determined by paragraph (a) of this section, does not give an exact rating as recognized in the Commission's plan of allocation, the nearest rating thereto shall apply to such transmitter.

(c) Authority will not be granted to employ, in the last radio stage of a standard broadcast transmitter, vacuum tubes from a manufacturer or of a type number not listed until the manufacturer's rating for the class of operation or system of modulation is submitted to and approved by the Commission. These data must be supplied by the manufacturer in accordance with Requirements for the Approval of the Power Rating of Vacuum Tubes, prescribed by the Commission.

3.43 *Changes in equipment; authority for.* No licensee shall change, in the last radio stage, the number of vacuum tubes to vacuum tubes of different power rating or class of operation, nor shall it change system of modulation without the authority of the Commission.[10]

3.44 *Other changes in equipment.* Other changes except as provided for in these rules or Standards of Good Engineering Practice, prescribed by the Commission, which do not affect the maximum power rating or operating power of the transmitter or the operation or precision of the frequency control equipment may be made at any time without authority of the Commission, but in the next succeeding application for renewal of license such changes which affect the information already on file shall be shown in full.

(*Continued on page 392*)

[4] See Money Required to Construct and Complete Electrical Tests of Stations of Different Classes and Powers.

[5] See section 3.29 in regard to assigning class IV stations to regional channels.

[6] Formal application required. See standards of Good Engineering Practice for form number.

[7] Special authorizations which do not involve experimental operation may be granted pursuant to section 1.365.

[8] The Commission on September 24, 1940, advanced the effective date of section 3.32 (b) to March 29, 1941.

[9] Formal application required. See Standards of Good Engineering Practice for form number.

[10] Formal application required. See Standards of Good Engineering Practice for form number.

FCC Regulations Governing Standard Broadcast Services

Part 3 of Rules and Regulations, Effective June 25, 1940, as Revised to Oct. 5, 1940

(Continued from page 391)

3.45 *Radiating system.*

(a) All applicants for new, additional, or different broadcast facilities and all licensees requesting authority to move the transmitter of an existing station shall specify a radiating system the efficiency of which complies with the requirements of good engineering practice for the class and power of the station. (Also see Use of Common Antenna by Standard Broadcast Stations or Another Radio Station.)

(b) The Commission will publish from time to time specifications deemed necessary to meet the requirements of good engineering practice. (See Minimum Antenna Heights or Field Intensity Requirements and Field Intensity Measurements in Allocation, section A.)

(c) No broadcast station licensee shall change the physical height of the transmitting antenna, or supporting structures, or make any changes in the radiating system which will measurably alter the radiation patterns, except upon written application to and authority from the Commission.[11]

(d) The antenna and/or supporting structure shall be painted and illuminated in accordance with the specifications supplied by the Commission pursuant to section 303 (q) of the Communications Act of 1934, as amended. (See Standard Lamps and Paints.)

(e) The simultaneous use of a common antenna or antenna structure by two standard broadcast stations or by a standard broadcast station and a station of any other class or service will not be authorized unless both stations are licensed to the same licensee. (See Use of Common Antenna by Standard Broadcast Stations or Another Radio Station.)

3.46 *Transmitter.*

(a) The transmitter proper and associated transmitting equipment of each broadcast station shall be designed, constructed, and operated in accordance with the standards of good engineering practice in all phases not otherwise specifically included in these regulations.

(b) The transmitter shall be wired and shielded in accordance with good engineering practice and shall be provided with safety features in accordance with the specifications of article 810 of the current National Electrical Code as approved by the American Standards Association.

(c) The station equipment shall be so operated, tuned, and adjusted that emissions are not radiated outside the authorized band[12] which cause or which, in accordance with the Standards of Good Engineering Practice, are considered as being capable of causing interference to the communications of other stations. The spurious emissions, including radio frequency harmonics and audio frequency harmonics, shall be maintained at as low level as required by good engineering practice. The audio distortion, audio frequency range, carrier hum, noise level, and other essential phases of the operation which control the external effects shall at all times conform to the requirements of good engineering practice.

(d) Whenever, in this section, the term "good engineering practice" is used, the specifications deemed necessary to meet the requirements thereof will be published from time to time. (See Construction, General Operation and Safety of Life Requirements.)

TECHNICAL OPERATIONS

3.51 *Operating power: how determined.* The operating power of each standard broadcast station shall be determined by:

(a) Direct measurement of the antenna power in accordance with section 3.54.[13]

(1) Each new standard broadcast station.

(2) Each existing standard broadcast station after June 1, 1941.

(b) Indirect measurement by means of the plate input power to the last radio stage on a temporary basis in accordance with sections 3.52 and 3.53.

(1) In the case of existing standard broadcast stations and pending compliance with paragraph (a) (2) of this section.

(2) In case of an emergency where the licensed antenna has been damaged or destroyed by storm or other cause beyond the control of the licensee or pending completion of authorized changes[14] in the antenna system.

(c) Upon making any change[13] in the antenna system, or in the antenna current measuring instruments, or any other change which may change the characteristics of the antenna, the licensee shall immediately make a new determination of the antenna resistance (see section 3.54) and shall submit application for authority to determine power by the direct method on the basis of the new measurements.

3.52 *Operating power; indirect measurement.* The operating power determined by indirect measurement from the plate input power of the last radio stage is the product of the plate voltage (*Ep*), the total plate current of the last radio stage (*Ip*) and the proper factor (*F*) given in the following tables: that is

Operating power = *Ep* x *Ip* x *F*

A. Factor to be used for stations employing plate modulation in the last radio stage[1]

Maximum rated carrier power of transmitter:[2]	*Factor (F) to be used in determining the operating power from the plate input power*
100-1,000 watts	0.70
5,000 and over watts	.80

B. Factor to be used for stations of all powers using low-level modulation[1]

Class of power amplifier in the last radio stage:	*Factor (F) to be used in determining the operating power from the plate input power*
Class B	0.35
Class BC[3]	.65

C. Factors to be used for stations of all powers employing grid modulation in the last radio stage[1]

Type of tube in the last radio stage:	*Factor (F) to be used in determining the operating power from the plate input power*
Table C[1]	0.25
Table D[1]	.35

[1] See Power Rating of Vacuum Tubes.

[2] The maximum rated carrier power must be distinguished from the operating power. (See section 2.18 and 2.19.)

[3] All linear amplifier operation where efficiency approaches that of class C operation.

3.53 *Application of efficiency factors.* In computing operating power by indirect measurement the above factors shall apply in all cases, and no distinction will be recognized due to the operating power being less than the maximum rated carrier power. (See Plate Efficiency of Last Radio Stage.)

3.54 *Operating power: direct measurement.* The antenna input power determined by direct measurement is the square of the antenna current times the antenna resistance at the point where the current is measured and at the operating frequency. Direct measurement of the antenna input power will be accepted as the operating power of the station, provided the data on the antenna resistance measurements are submitted under oath giving detailed description of the method used and the data taken. The antenna current shall be measured by an ammeter of accepted accuracy.[15] These data must be submitted to and approved by the Commission before any licensee will be authorized to operate by this method of power determination.[16] The antenna ammeter shall not be changed to one of different type, maximum reading, or accuracy without the authority of the Commission. If any change is made in the antenna system or any change made which may affect the antenna system, the method of determining operating power shall be changed immediately to the indirect method. (See Further Requirements for Direct Measurements of Power.)

3.55 *Modulation.*

(a) A licensee of a broadcast station will not be authorized to operate a transmitter unless it is capable of delivering satisfactorily the authorized power with a modulation of at least 85 percent. When the transmitter is operated with 85 percent modulation, not over 10 percent combined audio frequency harmonics shall be generated by the transmitter.

(b) All broadcast stations shall have in operation a modulation monitor approved by the Commission.

(c) The operating percentage of modulation of all stations shall be maintained as high as possible consistent with good quality of transmission and good broadcast practice and in no case less than 85 percent on peaks of frequent recurrence during any selection which normally is transmitted at the highest level of the program under consideration.

(d) The Commission will, from time to time, publish the specifications, requirements for approval, and a list of approved modulation monitors. (See Approved Modulation Monitors and also Requirements for Approval of Modulation Monitors.)

3.56 *Modulation: data required.* A licensee of a broadcast station claiming a greater percentage of modulation than the fundamental design indicates can be procured shall submit full data showing the antenna input power by direct measurement and complete information, either oscillograms or other acceptable data, to show that a modulation of 85 percent or more, with not over 10 percent combined audio harmonics, can be obtained with the transmitter operated at the maximum authorized power.

3.57 *Operating power, maintenance of.* The licensee of a broadcast station shall maintain the operating power of the station within the prescribed limits of the licensed power at all times except that in an emergency when, due to causes beyond the control of the licensee, it becomes impossible to operate with the full licensed power, the station may be operated at reduced power for a period of not to exceed 10 days, provided that the Commission and the Inspector in Charge[17] shall be notified in writing immediately after the emergency develops. (See Operating Power Tolerance.)

3.58 *Indicating instruments.* Each broadcast station shall be equipped with suitable indicating instruments of accepted accuracy to measure the antenna current, direct plate circuit voltage, and the direct plate circuit current of the last radio stage. These indicating instruments shall not be changed or replaced.

3.59 *Frequency tolerance.* The operating frequency of each broadcast station shall be maintained within 50 cycles of the assigned frequency until January 1, 1940, and thereafter the frequency of each new station or each station where a new transmitter is installed shall be maintained within 20 cycles of the assigned frequency, and after January 1, 1942, the frequency of all stations shall be maintained within 20 cycles of the assigned frequency.

[11] Informal application may be made, except in controversial cases or directional antenna; then formal application shall be made.

[12] See Construction, General Operation and Safety of Life Requirements.

[13] Program tests on equipment, including a new or different antenna system, will not be authorized unless application for authority to determine power by the direct method has been granted or is submitted simultaneously with the application for license to cover the construction permit and the application for license will not be granted until such time as the application for direct measurement is approved.

[14] Changes shall not be made except upon making proper request and obtaining approval thereof in accordance with sections 3.45 and 3.58.

[15] See Indicating Instruments Pursuant to section 3.58.

[16] Formal application required. See Standards of Good Engineering Practice for form number.

[17] See Field Offices of the Commission.

without authority of the Commission, except by instruments of the same type, maximum scale reading, and accuracy. (See Indicating Instruments Pursuant to section 3.58.)

3.60 *Frequency monitor.* The licensee of each standard broadcast station shall have in operation at the transmitter a frequency monitor independent of the frequency control of the transmitter. The frequency monitor shall be approved by the Commission. It shall have a stability and accuracy of at least 5 parts per million. (See Approved Frequency Monitors and also Requirements for Approval of Frequency Monitors.)

3.61 *New Equipment; restrictions.* The Commission will authorize the installation of new transmitting equipment in a broadcast station or changes in the frequency control of an existing transmitter only if such equipment is so designed that there is reasonable assurance that the transmitter is capable of maintaining automatically the assigned frequency within the limits specified in section 3.59.

3.62 *Automatic frequency control equipment; authorization required.* New automatic frequency control equipment that may effect the precision of frequency control or the operation of the transmitter shall be installed only upon authorization[18] from the Commission. (See Approved Equipment.)

3.63 *Auxiliary transmitter.* Upon showing that a need exists for the use of an auxiliary transmitter[19] in addition to the regular transmitter of a broadcast station, a license therefor may be issued provided that:

(a) An auxiliary transmitter may be installed either at the same location as the main transmitter or at another location.

(b) A licensed operator shall be in control whenever an auxiliary transmitter is placed in operation.

(c) The auxiliary transmitter shall be maintained so that it may be put into immediate operation at any time for the following purposes:

(1) The transmission of the regular programs upon the failure of the main transmitter.

(2) The transmission of regular programs during maintenance or modification[20] work on the main transmitter, necessitating discontinuance of its operation for a period not to exceed five days.

(3) Upon request by a duly authorized representative of the Commission.

(d) The auxiliary transmitter shall be tested at least once each week to determine that it is in proper operating condition and that it is adjusted to the proper frequency, except that in case of operation in accordance with paragraph (c) of this section during any week, the test in that week may be omitted provided the operation under paragraph (c) is satisfactory. A record shall be kept of the time and result of each test operating under paragraph (c). Tests shall be conducted only between midnight and 9 a.m., local standard time.

(e) The auxiliary transmitter shall be equipped with satisfactory control equipment which will enable the maintenance of the frequency emitted by the station within the limits prescribed by these regulations.

(f) An auxiliary transmitter which is licensed at a geographical location different from that of the main transmitter shall be equipped with a frequency control which will automatically hold the frequency within the limits prescribed by these regulations without any manual adjustment during operation or when it is being put into operation.

(g) The operating power of an auxiliary transmitter may be less than the authorized power, but in no event shall it be greater than such power.

3.64 *Duplicate main transmitters.* The licensee of a standard broadcast station may be licensed for duplicate main transmitters provided that a technical need[21] for such duplicate transmitters is shown and that the following conditions are met.

(a) Both transmitters are located at the same place.

(b) The transmitters have the same power rating.

(c) The external effects from both transmitters is substantially the same as to frequency stability, reliability of operation, radio harmonics and other spurious emissions, audio frequency range and audio harmonic generation in the transmitter.

OPERATION

3.71 *Minimum operating schedule.* Except Sundays, the licensee of each standard broadcast station shall maintain a minimum operating schedule of two-thirds of the total hours that it is authorized to operate between 6 a.m. and 6 p.m., local standard time, and two-thirds of the total hours it is authorized to operate beween 6 p.m. and midnight, local standard time, except that in an emergency when, due to causes beyond the control of the licensee, it becomes impossible to continue operating, the station may cease operation for a period of not to exceed 10 days, provided that the Commission and the Inspector in Charge[22] shall be notified in writing immediately after the emergency develops.

3.72 *Operation during experimental period.* The licensee of each standard broadcast station shall operate or refrain from operating its station during the experimental period as directed by the Commission in order to facilitate frequency measurement or for the determination of interference. (Stations involved in the after-midnight frequency monitoring programs are notified of their operating and silent schedule.)

3.73 *Specified hours.* If the licensee of a station specifies the hours of operation, the schedule so specified shall be adhered to except as provided in sections 3.71 and 3.72.

3.74 *Sharing time.* If the licenses of stations authorized to share time do not specify hours of operation, the licensees shall endeavor to reach an agreement for a definite schedule of periods of time to be used by each. Such agreement shall be in writing and each licensee shall file the same in triplicate original with each application to the Commission for renewal of license. If and when such written agreements are properly filed in conformity with this section the file mark of the Commission will be affixed thereto, one copy will be retained by the Commission, one copy forwarded to the Inspector in Charge, and one copy returned to the licensee to be posted with the station license and considered as a part thereof. If the license specifies a proportionate time division, the agreement shall maintain this proportion. If no proportionate time division is specified in the license, the licensees shall agree upon a division of time. Such division of time shall not include simultaneous operation of the stations unless specifically authorized by the terms of the license.

3.75 *Sharing time; equivalence of day and night hours.* For the purpose of determining the proportionate division of time of the broadcast day for sharing time stations 1 night hour shall be considered the equivalent of 2 day hours.

3.76 *Sharing time; experimental period.* If the license of a station authorized to share time does not specify the hours of operation, the station may be operated for the transmission of regular programs during the experimental period provided an agreement thereto is reached with the other stations with which the broadcast day is shared and further provided such operation is not in conflict with section 3.72. Time-sharing agreements for operation during the experimental period need not be submitted to the Commission.

3.77 *Sharing time; departure from regular schedule.* A departure from the regular operating schedule set forth in a time-sharing agreement will be permitted only in cases where an agreement to that effect is reduced to writing, is signed by the licensees of the stations affected thereby and filed in triplicate by each licensee with the Commission prior to the time of the proposed change. If time is of the essence, the actual departure in operating schedule may precede the actual filing of written agreement, provided appropriate notice is sent to the Commission and the Inspector in Charge.[23]

3.78 *Sharing time stations; notification to Commission.* If the licensees of stations authorized to share time are unable to agree on a division of time, the Commission shall be so notified by statement to that effect filed with the applications for renewals of licenses. Upon receipt of such statement the Commission will designate the applications for a hearing and, pending such hearing, the operating schedule previously adhered to shall remain in full force and effect.

3.79 *License to specify sunrise and sunset hours.* If the licensee of a broadcast station is required to commence or cease operation of the station at the time of sunrise or sunset, the license will specify the hour of the day during each month of the license period when operation of such station will commence or cease. (See Average Sunrise and Sunset Time.)

3.80 *Secondary station; filing of operating schedule.* The licensee of a secondary station authorized to operate limited time and which may resume operation at the time the dominant station (or stations) on the same channel ceases operation shall, with each application for renewal of license, file in triplicate a copy of its regular operating schedule, bearing a signed notation by the licensee of the dominant station of its objection or lack of objection thereto. Upon approval of such operating schedule, the Commission will affix its file mark and return one copy to the licensee authorized to operate limited time, which shall be posted with the station license and considered as a part thereof. Departure from said operating schedule will be permitted only in accordance with the procedure set forth in section 3.77.

3.81 *Secondary station; failure to reach agreement.* If the licensee of a secondary station authorized to operate limited time and a dominant station on a channel are unable to agree upon a definite time for resumption of operation by the station authorized limited time, the Commission shall be so notified by the licensee of the station authorized limited time. After receipt of such statement the Commission will designate for hearing the applications of both stations for renewal of license, and pending the hearing the schedule previously adhered to shall remain in full force and effect.

3.82 *Departure from schedule; material violation.* In all cases where a station licensee is required to prepare and file an operating schedule, any deviation or departure from such schedule, except as herein authorized, shall be considered as a violation of a material term of the license.

3.83 *Local standard time.* All references herein to standard time or local standard time refer to local standard time as determined and fixed by the Interstate Commerce Commission.

3.84 *Daylight saving time.* If local time is changed from standard time to daylight saving time at the location of all stations sharing time on the same channel, the hours of operation of all such stations on that channel shall be understood to refer to daylight saving time, and not standard time, as long as daylight saving time is observed at such locations. This provision shall govern when the time is changed by provisions of law or general observance of daylight saving time by the various communities, and when the time of operation of such stations is specified in the license or is mutually agreed upon by the licensees: *Provided, however,* That when the license specifies average time of sunrise and sunset, local standard time shall be observed. In no event shall a station licensed for daytime only operate on regular schedule prior to local sunrise, or shall a station licensed for greater daytime power than nighttime power or for a different radiation pattern for daytime operation than for nighttime operation operate with the daytime power or radiation pattern prior to local sunrise.

3.85 *Changes in time; agreement between licensees.* Where the local time is not changed from standard time to daylight saving time at the location of all stations sharing time on the same channel, the hours of operation of such stations shall be understood to have reference to standard time, and not daylight saving time, unless said licensees mutually agree upon a new schedule which shall be effective only while daylight saving time is observed at the location of some of these stations.

3.86 *Local standard time; license provisions.* The time of operation of any broadcast station which does not share time with other stations on the same channel shall be understood to have reference to local standard time unless modification of such license with respect to hours of operation is authorized by the Commission.

---

[18] Formal application required. See Standards of Good Engineering Practice for form number.

[19] All regulations as to safety requirements and spurious emissions applying to broadcast transmitting equipment shall apply also to an auxiliary transmitter. (See Use of Frequency and Modulation Monitors at Auxiliary Transmitter.)

[20] This includes the equipment changes which may be made without authority as set forth elsewhere in the Rules and Regulations and the Standards of Good Engineering Practice or as authorized by the Commission by letter or by construction permit. Where such operation is required for periods in excess of 5 days, request therefor shall be made in accordance with section 1.365.

[21] Such as licensees maintaining 24-hour schedule and needing alternate operation for maintenance, or development work is being carried on requiring such alternate operation.

[22] See Field Offices of the Commission.

[23] See Field Offices of the Commission.

FCC Regulations Governing Broadcast Services

SUBPART C—General Rules Applicable to Both Standard and High-Frequency Broadcast Stations

[For Rules 3.201-3.261 Governing High-Frequency Broadcast Stations, see page 374]

3.401 *Station license; posting of.* The station license and any other instrument of authorization or individual order concerning construction of the equipment or the manner of operation of the station shall be posted in a conspicuous place in the room in which the transmitter is located in such manner that all terms thereof are visible and the license of the station operator shall be posted in the same manner. (See secs. 2.51 and 2.52.)

3.402 *Licensed operator required.* The licensee of each station shall have a licensed operator or operators of the grade specified by the Commission on duty during all periods of actual operation of the transmitter at the place where the transmitting equipment is located. (See sec. 2.53.)

3.403 *Licensed operator; other duties.* The licensed operator on duty and in charge of a standard broadcast transmitter may, at the discretion of the licensee, be employed for other duties or for the operation of another radio station or stations in accordance with the class of operator's license which he holds and by the rules and regulations governing such other stations: *Provided, however,* That such duties shall in nowise interfere with the power operation of the standard broadcast transmitter.

3.404 *Logs.* The licensee of each broadcast station shall maintain program and operating logs and shall require entries to be made as follows:

(a) In the program log:

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

(2) An entry of the time the program begins and ends. "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.

(b) 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 the time the program begins and ends.

(3) An entry of each interruption to the carrier wave, its cause, and duration.

(4) An entry of the following each 30 minutes:

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

(ii) Antenna current.

(iii) Frequency monitor reading.

(iv) Temperature of crystal control chamber if thermometer is used.

(5) Log of experimental operation during experimental period. (If regular operation is maintained during this period, the above logs shall be kept.)

(i) A log must be kept of all operation during the experimental period. If the entries required above are not applicable thereto, then the entries shall be made so as to fully describe the operation.

3.405 *Logs; retention of.* Logs of standard broadcast stations shall be retained by the licensee for a period of 2 years, except when required to be retained for a longer period in accordance with the provisions of section 2.54.

3.406 *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 on the hour and half hour as provided below:

(b) Such identification announcement during operation need not be made when to make such announcement would interrupt a single consecutive 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 first interruption of the entertainment continuity and at the conclusion of such program.

(c) In 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 half hour.

(d) In case of all other programs (except as provided in paragraph (b) and (c) of this section) the identification announcement shall be made within 2 minutes of the hour and half hour.

(e) In making the identification announcement the call letters shall be given only on the channel of the station identified thereby.

3.407 *Mechanical records.* Each broadcast program consisting of a mechanical record or a series of mechanical records shall be announced in the manner and to the extent set out below:

(a) A mechanical record or a series thereof, of longer duration than 30 minutes, shall be identified by appropriate announcement at the beginning of the program, at each 30 minute interval, and at the conclusion of the program: *Provided, however,* That the identifying announcement at each 30 minute interval is not required in case of a mechanical record consisting of a single, continuous, uninterrupted speech, play, religious service, symphony concert, or operatic production of longer duration than 30 minutes.

(b) A mechanical record, or a series thereof, of a longer duration than 5 minutes, and not in excess of 30 minutes, shall be identified by an appropriate announcement at the beginning and end of the program:

(c) A single mechanical record of a duration not in excess of 5 minutes shall be identified by appropriate announcement immediately preceding the use thereof;

(d) In case a mechanical record is used for background music, sound effects, station identification, program identification (theme music of short duration), or identification of the sponsorship of the program proper, no announcement of the mechanical record is required.

(e) The identifying announcement shall accurately describe the type of mechanical record used, i.e., where an electrical transcription is used it shall be announced as a "transcription" or an "electrical transcription," or as "transcribed" or "electrically transcribed," and where a phonograph record is used it shall be announced as a "record."

3.408 *Rebroadcast.*

(a) The term "rebroadcast" means reception by radio of the program[1] of a radio station, and the simultaneous or subsequent retransmission of such program by a broadcast station.[2]

(b) The licensee of a standard or high-frequency broadcast station may, without further authority of the Commission, rebroadcast the program of a United States standard or high frequency broadcast station, provided the Commission is notified of the call letters of each station rebroadcast and the licensee certifies that express authority has been received from the licensee of the station originating the program.[3]

(c) The licensee of a standard or high-frequency broadcast station may, without further authority of the Commission, rebroadcast on a noncommercial basis a noncommercial program of an international broadcast station, provided the Commission is notified of the call letters of each station rebroadcast and the licensee certifies that express authority has been received from the licensee of the station originating the program.

(d) No licensee of a standard broadcast station shall rebroadcast the program of any other class of United States radio station without written authority having first been obtained from the Commission upon application accompanied by written consent or certification of consent of the licensee of the station originating the program.[4] [5]

(e) In case of a program rebroadcast by several standard broadcast stations, such as a chain rebroadcast, the person legally responsible for distributing the program or the network facilities may obtain the necessary authorization for the entire rebroadcast both from the Commission and from the person or licensee of the station originating the program.

Attention is directed to section 325 (b) of the Communications Act of 1934, which reads as follows:

> No person shall be permitted to locate, use, or maintain a radio broadcast studio or other place or apparatus from which or whereby sound waves are converted into electrical energy, or mechanical or physical reproduction of sound waves produced, and caused to be transmitted or delivered to a radio station in a foreign country for the purpose of being broadcast from any radio station there, having a power output of sufficient intensity, and/or being so located geographically that its emissions may be received consistently in the United States, without first obtaining a permit from the Commission upon proper application therefor.[6]

BROADCASTS BY CANDIDATES FOR PUBLIC OFFICE

3.421 *General requirements.* No station licensee is required to permit the use of its facilities by any legally qualified candidate for public office, but if any licensee shall permit any such candidate to use its facilities, it shall afford equal opportunities to all other such candidates for that office to use such facilities, provided that such licensee shall have no power of censorship over the material broadcast by any such candidate.

3.422 *Definitions.* The following definitions shall apply for the purposes of section 3.421:

(a) "A legally qualified candidate" means any person who has met all the requirements prescribed by local, state, or federal authority as a candidate for the office which he seeks, whether it be municipal, county, state, or national, to be determined according to the applicable local laws.

(b) "Other candidates for that office" means all other legally qualified candidates for the same public office.

3.423 *Rates and practices.* The rates, if any, charged all such candidates for the same office shall be uniform and shall not be rebated by any means, directly or indirectly; no licensee shall make any discrimination in charges, practices, regulations, facilities, or services for or in connection with the service rendered pursuant to these rules, or make or give any preference to any candidate for public office or subject any such candidate to any prejudice or disadvantage; nor shall any licensee make any contract or other agreement which shall have the effect of permitting any legally qualified candidate for any public office to broadcast to the exclusion of other legally qualified candidates for the same public office.

3.424 *Records; inspection.* Every licensee shall keep and permit public inspection of a complete record of all requests for broadcast time made by or on behalf of candidates for public office, together with an appropriate notation showing the disposition made by the licensee of such requests, and the charges made, if any, if request is granted.

The Following Rule is Quoted for the Information of Licensees and Permittees of all Classes of Broadcast Stations:

43.1 *Information as to ownership, operation, interests therein, contracts, etc.* Licensees and permittees of all classes of broadcast stations shall file reports as follows:

(a) Within 30 days after becoming licensees or permittees all such licensees or permittees shall file with the Commission original reports containing the information required in accordance with the forms adopted and furnished by the Commission and the instructions in such forms.

(b) Thereafter, and within 30 days of the occurrence of any event which

(*Continued on page 397*)

[1] As used in sec. 3.408, program includes any complete program or part thereof, or any signals if other than A-3 emission.

[2] In case a program is transmitted from its point of origin to a broadcast station entirely by telephone facilities in which a section of such transmission is by radio, the broadcasting of this program is not considered a rebroadcast.

[3] The notice and certification of consent shall be given within three (3) days of any single rebroadcast, but in case of the regular practice of rebroadcasting certain programs of a standard broadcast station several times during a license period, notice and certification of consent shall be given for the ensuing license period with the application for renewal of license, or at the beginning of such rebroadcast practice if begun during a license period.

[4] The broadcasting of a program relayed by a relay broadcast station (sec. 4.21) is not considered a rebroadcast.

[5] Informal application may be employed.

[6] Formal application required. See Standards of Good Engineering Practice for form number.