

Executive and Staff Personnel of the Federal Communications Commission

Headquarters Office: Postoffice Building, Washington, D. C., Phone District 1654

Commissioners and Assistants

Anning S. Prall, Chairman and Member of Each Division (Democrat; term 1936-1942).
Secretary: Dean G. Jenkins.
Assistant Secretary: Maud W. Gossett.
Clerk: Eleanor A. Hildbrandt.
Eugene O. Sykes, Chairman of Broadcast Division (Democrat; term 1934-1941).
Assistant Secretary: Annette E. Hutterly.
Clerk: Lucille S. Smith.
Norman S. Case, Vice Chairman of Broadcast Division (Republican; term 1934-1938).
Secretary: Henry M. Barry.
Assistant Secretary: Minnie Sparks.
Paul A. Walker, Chairman of Telephone Division (Democrat; term 1934-1939).
Secretary: Omar L. Crook.
Assistant Secretary: Lonah J. Ferro.
Thad H. Brown, Vice Chairman of Telephone Division (Republican; term 1934-1940).
Secretary: Joseph E. Keller.
Assistant Secretary: Rose M. Lefebvre.
Irvin Stewart, Chairman of Telegraph Division (Democrat; term 1934-1937).
Secretary: William V. Whittington.
Assistant Secretary: Ruth T. Koppialky.
Clerk: Catherine G. Bailey.
George Henry Payne, Vice Chairman of Telegraph Division (Republican; term 1934-1943).
Assistant Secretary: Abraham Miller.
Assistant Secretary: Alice Redington.
Clerk: Elizabeth B. Welter.

Secretary's Office

Vacant: Secretary.
Secretary: Laura I. Hollingsworth.
John B. Reynolds, Assistant Secretary.
Secretary: Pansy E. Wilshire.

Division Directors

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Secretary: Virginia A. Abrams.
R. T. Bartley, Director of Telegraph Division.
Secretary: Irene Garretson.
A. G. Patterson, Director of Telephone Division.
Secretary: Perle Knight.

Law Department

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Secretary: Agnes M. Min.
George B. Porter, Assistant General Counsel (Broadcast Division).
Secretary: Elizabeth Childress.
Secretary: Margaret B. McMahon.
Carl F. Arnold, Assistant General Counsel (Telegraph Division).
Secretary: Louise Duncan.
William H. Bauer, Head Attorney.

Broadcast Division Attorneys

David H. Deibler, Principal Attorney.
Fanney Neyman, Principal Attorney.
Terry Berry, Senior Attorney.
James D. Cunningham, Senior Attorney.
A. Y. Dalrymple, Senior Attorney.
George M. Harrington, Senior Attorney.
Andrew G. Haley, Attorney.

Wm. H. Churchwell, Assistant Attorney.
Walter Johnson, Junior Attorney.
Hugh B. Hutchinson, Junior Attorney.
Mary Elizabeth Erickson, Junior Attorney.
Stephen Tully, Junior Attorney.
Frank U. Fletcher, Junior Attorney.
Telegraph Division Attorneys:
James A. Kennedy, Principal Attorney.
Marshall S. Orr, Attorney.
Theodore L. Bartlett, Attorney.
Anno Perry Neal, Assistant Attorney.
Robert M. Fenton, Junior Attorney.
Violet Lewry, Junior Attorney.
J. Fred Johnson, Jr., Principal Examiner.
Max H. Aronson, Examiner.
Telephone Division Attorneys:
Elmer D. Hays, Senior Attorney.
Elizabeth C. Smith, Attorney.
Basil P. Cooper, Assistant Attorney.
Walter D. Humphrey, Principal Examiner.
James L. McDowell, Attorney.

Engineering Department

T. A. M. Craven, Chief Engineer.
Secretary: Miriam Eastburn.
Andrew D. Ring, Assistant Chief Engineer (Broadcasting).
Secretary: Helvi Mustaparta.
E. K. Jett, Assistant Chief Engineer (Telegraph).
Secretary: Euna Wiley.
Andrew Cruse, Assistant Chief Engineer (Telephone).
Gerald C. Gross, Principal Scientist (Chief of International Section).
Secretary: Lillian Conley.
William D. Terrell, Chief, Field Section.
Secretary: Mary E. Poloske.

Lynda P. Wheeler, Principal Physicist.
Broadcast Division Engineers:
John A. Willoughby, Senior Engineer.
George P. Anair, Senior Engineer.
James P. Buchanan, Jr., Associate Engineer.
R. A. Norton, Associate Engineer.
George C. Davls, Associate Engineer.
Ralph L. Clark, Associate Engineer.
Harold Link, Associate Engineer.
Telegraph Division Engineers:
E. M. Webster, Principal Engineer.
Raymond Asserson, Sen or Engineer.
Edwin Lee White, Senior Engineer.
A. T. Jenkins, Senior Engineer.
Marion H. Woodward, Senior Engineer.
William N. Krebs, Engineer.
Paul M. Lion, Engineer.
L. C. Quintance, Associate Engineer.
Leslie I. Brady, Assistant Engineer.
B. J. Shimmel, Assistant Engineer.
H. B. Broyles, Assistant Engineer.
S. H. Pearce, Assistant Engineer.
Glenn E. Nielsen, Senior Engineering Aide.
Telephone Division Engineers:
Manfred Poespen, Principal Engineer.
R. D. Jones, Principal Engineer.
George J. Dempsey, Associate Engineer.
Edward W. Allen, Associate Engineer.
James A. Beaver, Jr., Engineering Aide.

Examining Department

David G. Arnold, Chief Examiner.
Secretary: Gwendolyn Marcyes.
P. W. Seward, Assistant Chief Examiner.
Examiners:
John P. Bramhall, Principal Examiner.
Melvin H. Dalberg, Principal Examiner.
George H. Hill, Senior Examiner.
Rose H. Hyde, Senior Examiner.
Ralph L. Walker, Senior Examiner.
Robert L. Irwin, Examiner.

Licenses Bureau

Wm. P. Massing, Chief.
Secretary: Ruth Richter.
Chief of Broadcast Section: Clara M. Iehl.
Chief of Commercial Section: John Palmer.
Chief of Amateur Section: J. B. Beadle.

Accounting, Statistical and Tariff Department

William J. Norlett, Chief.
Secretary: Frances Groom.
Riley A. Gwynn, Assistant Chief.
Secretary: Doreen Clark.

Docket Section

Mary Belle Anthony, Chief.

Information (Press) Section

G. Franklin Wisner, Chief.

Other Sections

Robert E. Hodson, Minute Clerk.
L. A. Corridon, Chief of Audits & Accounts.
Paul Sheehy, Chief of Duplicating Section.
T. A. Gates, Chief Supplies.
W. Theodore Pierson, Chief of Mails and Files.

Members of Former FEDERAL RADIO COMMISSION

Feb. 23, 1927—July 10, 1934

Admiral W. H. G. Bullard, Pennsylvania.
March 15, 1927—November 24, 1927 (Deceased)
Orestes H. Caldwell, New York.
March 15, 1927—February 23, 1929
Eugene O. Sykes, Mississippi.
March 15, 1927—
Henry A. Bellows, Minnesota.
March 15, 1927—October 31, 1927
Colonel John F. Dillon, California.
March 15, 1927—October 8, 1927 (Deceased)
Sam Pickard, Kansas.
November 1, 1927—January 31, 1929
Harold A. Lafount, Utah.
November 14, 1927—July 10, 1934
Ira E. Robinson, West Virginia.
March 29, 1928—January 15, 1932
General C. McK. Saltzman, Iowa.
May 2, 1929—July 19, 1932
William D. L. Starbuck, New York.
May 2, 1929—May 23, 1934
Thad H. Brown, Ohio.
January 21, 1933—
James H. H. Hanley, Nebraska.
April 1, 1933—July 10, 1934

FIELD OFFICES OF THE FEDERAL COMMUNICATIONS COMMISSION

Director of Field Section: William D. Terrell, Washington, D. C.

District No.	Address	Phone No.	Inspectors	District No.	Address	Phone No.	Inspectors
1	U. S. Customhouse, Boston, Mass.	Hubbard 6739	Charles C. Kolster, <i>Inspector in Charge</i> Walter J. Dutterworth Myron A. Tong Roger E. Phelps Nathan Hallenstein	13	New Courthouse Bldg., Portland, Ore.	Tabor 3925	Kenneth G. Clark, <i>Inspector in Charge</i> Robert Landsburg Stacy W. Norman Lee R. Dawson
2	641 Washington St., New York City	Canal 6-2100	Arthur Batcheller, <i>Inspector in Charge</i> Charles F. Manning Eugene C. Cochran Walter J. Howell Arthur S. Fish Forest F. Redfern Howard C. Looney	14	New Federal Bldg., Seattle, Wash.	Seneca 3100	Landon C. Herndon, <i>Inspector in Charge</i> George V. Wilse Alfred K. Robinson Sigfred F. Berge
3	Customhouse, Philadelphia, Pa.	Market	Louis E. Kenney, <i>Inspector in Charge</i> Ivan H. Loucks	15	Customhouse, Denver, Colo.	Keystone 4151	Edwin S. Heiser, <i>Inspector in Charge</i>
4	Fort McHenry, Baltimore, Md.	South 2370	George E. Stouling, <i>Inspector in Charge</i> L. A. Newcomb Hyman A. Cohen Edward W. Chapin Charles A. Eller	16	Main Post Office Bldg., St. Paul, Minn.	Cedar 2577	C. W. Loeber, <i>Inspector in Charge</i>
5	New Postoffice Bldg., Norfolk, Va.	24963	Edward Bennett, <i>Inspector in Charge</i> William R. Foley	17	Federal Bldg., Kansas City, Mo.	Harrison 2920	William J. McDonnell, <i>Inspector in Charge</i> W. D. Johnson
6	411 Federal Annex, Atlanta, Ga.	Jackson 1661	George S. Turner, <i>Inspector in Charge</i> George Llewellyn George K. Rollings Paul H. Herndon	18	Engineering Bldg., Chicago, Ill.	State 8900	H. D. Hayes, <i>Inspector in Charge</i> Jesse E. Brown H. T. Gallaher
7	P. O. Box 150, Miami, Fla.	2-4788	Joe H. McKinney, <i>Inspector in Charge</i>	19	New Federal Bldg., Detroit, Mich.	Randolph 4268	Emery H. Lee, <i>Inspector in Charge</i> John A. Russ Richard J. Cotton Glen W. Earnhart
8	Customhouse, New Orleans, La.	Main 6380	Theodore G. Deiler, <i>Inspector in Charge</i>	20	Federal Bldg., Buffalo, N. Y.	Washington 1744	Milton W. Grinnell, <i>Inspector in Charge</i> Frank J. Smith
9	Prudential Bldg., Galveston, Tex.	1832	Louis L. McCabe, <i>Inspector in Charge</i>	21	Aloha Tower, Honolulu, Hawaii	3979	James M. Chapple, <i>Inspector in Charge</i>
10	Federal Bldg., Dallas, Tex.	2-5943	Frank M. Kratochvil, <i>Inspector in Charge</i> Harry D. Plekett	..	Grand Island, Neb. (Central Frequency Monitoring Station)	Grand Island 1240	Benjamin E. Wolf, <i>Inspector in Charge</i> Joseph Anderson W. I. Abbott H. Underwood Graham Ralph J. Henton
11	Rives-Strong Bldg., Los Angeles, Cal.	Mich. 6008	Bernard H. Linden, <i>Inspector in Charge</i> John H. Homsy Victor G. Rowe James A. Homsy	..	Naval Training Station, Great Lakes, Ill. (Monitoring Station)	575	Irving L. Weston, <i>Inspector in Charge</i> Irl D. Ball
12	Customhouse, San Francisco, Cal.	Sutter 6208	V. Ford Greaves, <i>Inspector in Charge</i> Francis V. Sloan Paul R. Fenner Frank L. Kellogg Herbert H. Smith	..	45 Broadway, New York, New York	Whitehall 4-5930	Accounting Field Office Jack E. Buckley, <i>Accountant in Charge</i>

Extracts from FCC Rules and Regulations Applicable to Broadcast Stations

EXCERPTS PERTAINING TO BROADCAST STATIONS FROM GENERAL RULES AND REGULATIONS

23. Where an emergency exists affecting safety to life or property, the Commission may, in its discretion, waive any part or all of its regulations governing the filing of applications.

The licensee of any radio transmitting station may, during a period of emergency in which the normal communication facilities are disrupted as a result of hurricane, flood, earthquake, or similar disaster, utilize such station for emergency communication service in communicating with points other than those specified in the station license, provided (1) that at the beginning of such emergency use immediate notice be sent to the Commission and the inspector in charge of the district in which the station is located stating the nature of the emergency and the use to which the station is being put, and (2) that the emergency use of the station shall be discontinued as soon as substantially normal communication facilities are again available and the Commission and the inspector in charge be notified immediately when such special use of the station is terminated. The Commission may at any time order the discontinuance of such service.

27. All station licenses will be issued so as to expire at the hour of 3 a. m., Eastern Standard Time. The normal license periods and expiration dates are as follows:

a. Broadcast station licenses will be issued for a normal license period of 6 months, expiring as follows:

(1) For stations operating on the frequencies 640, 650, 660, 670, 680, 700, 720, 740, 750, 760, 770, 790, 800, 810, 820, 830, 850, 860, 870, 970, 980, 990, 1,000, 1,020, 1,040, 1,050, 1,060, 1,070, 1,080, 1,090, 1,100, 1,110, 1,130, 1,140, 1,150, 1,160, 1,170, 1,180, 1,190 kilocycles August 1 and February 1.

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

(3) For stations operating on the frequencies 930, 940, 950, 1,010, 1,120, 1,220, 1,230, 1,240, 1,250, 1,260, 1,270, 1,280, 1,290 kilocycles October 1 and April 1.

(4) For stations operating on the frequencies 1,300, 1,320, 1,330, 1,340, 1,350, 1,360, 1,380, 1,390, 1,400, 1,410, 1,430, 1,440, 1,450, 1,460, 1,470, 1,480, 1,490 kilocycles November 1 and May 1.

(5) For stations operating on the frequencies 1,200, 1,210, 1,310 kilocycles December 1 and June 1.

(6) For stations operating on the frequencies 1,370, 1,420, 1,500 kilocycles January 1 and July 1.

30. The following list of the radio districts gives the address of each field office of the Commission and the territory embraced in each district:

District No. 1. Customhouse, Boston.—Territory: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.

District No. 2. Federal Building, 641 Washington St., New York City.—Territory: New York (Albany, Bronx, Columbia, Delaware, Dutchess, Greene, Kings, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Schenectady, Suffolk, Sullivan, Ulster, and Westchester Counties); New Jersey (Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union, and Warren Counties).

District No. 3. Room 1200, New U. S. Customhouse, 2nd and Chestnut Sts., Philadelphia, Pa.—Territory: Pennsylvania (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Dauphin, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Perry, Philadelphia, Schuylkill, and York Counties); New Jersey (Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem Counties); Delaware (Newcastle County).

District No. 4. Fort McHenry, Baltimore, Md.—Territory: Maryland. District of Columbia, Virginia (Arlington, Clark, Fairfax, Fauquier, Frederick, Loudoun, Page, Prince William, Rappahannock, Shenandoah, and Warren Counties); Delaware (Kent and Sussex Counties).

District No. 5. 402 New Post Office Bldg., Norfolk, Va.—Territory: Virginia. (All except district 4); North Carolina (All except district 6).

District No. 6. 411 Federal Annex, Atlanta, Ga.—Territory: Alabama, Georgia, South Carolina, Tennessee, North Carolina (Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, and Yancey Counties).

District No. 7. P. O. Box 150, Miami, Fla.—Territory: Florida, Puerto Rico, Virgin Islands.

District No. 8. 326 Customhouse, New Orleans, La.—Territory: Arkansas, Louisiana, Mississippi, Texas (City of Texarkana only).

District No. 9. 209 Prudential Bldg., Galveston, Tex.—Territory: Texas (Aransas, Brazoria, Brooks, Calhoun, Cameron, Chambers, Fort Bend, Galveston, Goliad, Harris, Hidalgo, Jackson, Jefferson, Jim Wells, Kenedy, Kleberg, Matagorda, Nueces, Refugio, San Patricio, Victoria, Wharton, and Willey Counties).

District No. 10. 464 Federal Bldg., Dallas, Tex.—Territory: Texas (All except district 9 and the city of Texarkana); Oklahoma, New Mexico.

District No. 11. 1105 Rives-Strong Bldg., Los Angeles, Calif.—Territory: Arizona, Nevada (Clark County); California (Imperial, Kern, Inyo, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties).

District No. 12. 328 Customhouse, San Francisco, Calif.—Territory: California (All except district 11); Nevada (All except Clark County); Guam, American Samoa.

District No. 13. 207 New U. S. Courthouse, Portland, Ore.—Territory: Oregon, Idaho (All except district 14).

District No. 14. 808 Federal Office Bldg., Seattle, Wash.—Territory: Alaska, Washington, Idaho (Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai,

Latah, Lewis, Nez Perce, and Shoshone Counties); Montana (Beaverhead, Broadwater, Cascade, Deerledge, Flathead, Gallatin, Glacier, Granite, Jefferson, Lake, Lewis and Clark, Lincoln, Madison, Meagher, Mineral, Missoula, Pondera, Powell, Ravalli, Sanders, Silver Bow, Teton, and Toole Counties).

District No. 15. 538, Customhouse, Denver, Colo.—Territory: Colorado, Utah, Wyoming, Montana (Except district 14).

District No. 16. 927 Main Post Office Bldg., St. Paul, Minn.—Territory: North Dakota, South Dakota, Minnesota, Michigan (Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft Counties); Wisconsin (All except district 18).

District No. 17. 410 Federal Bldg., Kansas City, Mo.—Territory: Nebraska, Kansas, Missouri, Iowa (All except district 18).

District No. 18. 2022 Engineering Bldg., Chicago, Ill.—Territory: Indiana, Illinois, Iowa (Allamakee, Buchanan, Cedar, Clayton, Clinton, Delaware, Des Moines, Dubuque, Fayette, Henry, Jackson, Johnson, Jones, Lee, Linn, Louisa, Muscatine, Scott, Washington, and Winnebuck Counties). Wisconsin (Columbia, Crawford, Dane, Dodge, Grant, Green, Iowa, Jefferson, Kenosha, Lafayette, Milwaukee, Ozaukee, Racine, Richland, Rock, Sauk, Walworth, Waukesha, and Waukesha Counties).

District No. 19. 1025 New Federal Bldg., Detroit, Mich.—Territory: Michigan (All except district 16); Ohio, Kentucky, West Virginia.

District No. 20. 514 Federal Bldg., Buffalo, N. Y.—Territory: New York (All except district 2); Pennsylvania (All except district 3).

Territory No. 21. Aloha Tower, Honolulu, T. H.—Territory: Territory of Hawaii.

EXCERPTS PERTAINING TO BROADCAST STATIONS FROM RULES OF PRACTICE AND PROCEDURE*

(103.5) Any amendment to an application shall be subscribed and verified in the same manner as was the original application.

(103.9) Each application shall be specific with regard to frequency or frequencies, power, hours of operation, and all other terms of the instrument of authorization requested. An application for broadcast facilities in the band 550 kc to 1600 kc shall be limited to one specific frequency. An application for a radio station construction permit or license requesting alternative facilities will not be accepted.

(103.10) Upon proper request by the licensee of a broadcast station, or by the licensee of, or applicant for, a service other than broadcasting, the Commission may grant special temporary authority for the operation of a station for a limited time, or in a manner and to an extent, or for a service other or beyond that authorized in its existing license; *Provided, however*, That if request is for a broadcast station to utilize additional hours of operation, approval may not be granted if another broadcast station is licensed to operate in the same locality during the hours requested.

In any event, no such request will be considered unless:

(a) It is received in the Commission at least ten days previous to the date of proposed operation.

(b) If request is for operation upon a clear channel, it shall be supported by the consent of the dominant clear channel station.

(c) Request for any frequency shall be supported by the consent of each station licensed for operation upon the frequency, where consenting station is located at a distance less than that given in the latest published table of recommended separations.

(d) Request made by a sharing time station shall be supported by the consent of the station with which the licensee requesting the same shares time.

Consent shall be forwarded direct to the Commission by the consenting station and shall show whether the same is for simultaneous operation or whether consenting station is giving up the time sought by applicant.

Any or all of the foregoing requirements of paragraphs (a), (b), (c) and (d), may be waived by the Commission in cases of emergency, the nature of which shall be fully explained by the licensee in the request for authorization.

(103.23) Any licensee receiving official notice of a violation of the terms of the Communications Act of 1934, any legislative act, executive order, treaty to which the United States is a party or of the rules and regulations of the Federal Communications Commission, which are binding upon licensee or the terms and conditions of a license, shall, within 3 days from such receipt, send a written reply direct to the Federal Communications Commission at Washington, D. C., and a copy thereof to the office of the Commission originating the official notice, when the originating office is other than the office of the Commission in Washington, D. C. The answer to each notice shall be complete in itself and shall not be abbreviated by reference to other communications or answers to other notices. If the notice relates to some violation that may be due to the physical or electrical characteristics of the transmitting apparatus, the answer shall state fully what steps, if any, are taken to prevent future violations, and if any new apparatus is to be installed, the date such apparatus was ordered, the name of the manufacturer, and a promised date of delivery.

If the installation of such apparatus requires a construction permit, the file number of the application shall be given, or if a file number has not been assigned by the Commission, such identification as will permit of ready reference.

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

* Rules of Practice and Procedure may be obtained from Supt. of Documents, Washington, D. C., for 10 cents.

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FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 302)

RULES GOVERNING REGULAR BROADCAST STATIONS (FULL TEXT)

69. The band of frequencies extending from 550 to 1,500 kilocycles, both inclusive, is allocated for use by broadcast stations. This band of frequencies is referred to herein as the "broadcast band."

CLASSES OF BROADCAST STATIONS

70. For the purposes of allocation of frequencies, power, and time of operation, broadcast stations are classified as follows:

A. Frequency and Power Designations

- a. Clear channel.
- b. High power regional.
- c. Regional.
- d. Local.

B. Time Designation

- a. Unlimited time.
- b. Limited time.
- c. Daytime.
- d. Sharing time.
- e. Part time.
- f. Specified hours.

DEFINITIONS

71. The term "broadcast station" means a station used for the dissemination of radiotelephone emissions intended to be received by the public.

72. The term "clear channel station" means a station licensed to operate on a frequency designated as a clear channel. (See par. 116.)

73. The term "high power regional station" means a station licensed to operate simultaneously with one or more stations assigned to the same frequency designated for such use and with an authorized power of not less than 5 kilowatts. (See par. 119.)

74. The term "regional station" means a station licensed to operate simultaneously with one or more stations assigned to the same frequency designated for such use, and with an authorized power of not less than 250 watts nor more than 1,000 watts at night, and not more than 5,000 watts during daytime. (See par. 120.)

75. The term "local station" means a station licensed to operate with other stations assigned to the same frequency designated for such use, and with an authorized power of 100 watts at night and not more than 250 watts during daytime. (See par. 121.)

76. The term "unlimited time station" means a station licensed to operate without a maximum limit as to time.

77. The term "limited time station" means a station licensed to operate, on a frequency designated as a clear channel, during daytime, and until local sunset, or until sunset at the dominant clear channel station, and in addition during night hours, if any, not used by the dominant clear channel station.

78. The term "daytime station" means a station licensed to operate during the hours between 6 a. m. and local sunset, or until sunset at the dominant station if farther west than the daytime station.

79. The term "sharing time station" means a station the operating hours of which are so restricted by the station license as to require a division of time with one or more other stations using the same frequency in the same geographical area.

80. The term "part-time station" means a station, the operating hours of which are specified in the station license as a fraction of the total hours of the broadcast day, and the use of the same frequency during the remainder of the time not assigned to any other station in the same geographical area.

81. The term "specified hours station" means a station the exact operating hours of which are specified in the license.

82. The term "Canadian exclusive frequency" means a frequency in the broadcast band which is reserved for exclusive use by stations located in the Dominion of Canada.

83. The term "Canadian shared frequency" means a frequency in the broadcast band used simultaneously by broadcast stations located in the Dominion of Canada and the United States, its Territories and possessions.

84. The term "daytime" means that period of time between 6 a. m. and local sunset.

85. The term "nighttime" means that period of time between local sunset and 12 midnight.

86. The term "sunset" means, for each particular location and during any particular month, the average time of sunset as specified in the license of a broadcast station. For a tabulation of average sunset time for each month at various points in the United States see paragraph 181.

87. The term "broadcast day" means that period of time between 6 a. m. and 12 midnight, local standard time.

88. The term "experimental period" means that period of time between 12 midnight and 6 a. m. This period may be used for experimental purposes by the licensee of any 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 and provided further that no "daytime" station or "specified hours" station may broadcast any commercial or sponsored program during this period.

89. 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.

90. 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 broadcast band, such a transmitter is used for making field intensity measurements in locating a satisfactory site before the erection of a permanent

transmitter. A portable broadcast station will not be licensed for regular transmission of programs intended to be received by the public.

91. The term "auxiliary transmitter" means a transmitter maintained only for transmitting the regular program of a station in case of failure of the main transmitter.

92. The term "authorized power" or "licensed power" means the power assigned to a station by the Commission, and specified in the instrument of authorization.

93. The term "maximum rated carrier power" means the power determined by the design of a transmitter and type and number of vacuum tubes used in the last radio stage. This power is to be distinguished from the operating power; in general it is the maximum power at which the transmitter can be operated satisfactorily.

94. The term "operating power" means the power that is actually transmitted by the station. This power is determined by one of several methods hereinafter set out. (See par. 134.) The operating power shall be the same as the licensed power.

95. The term "plate input power" means the product of the direct plate voltage applied to the tubes in the last radio stage and the total direct current flowing to these tubes, measured without modulation.

96. The term "last radio stage" means the oscillator or radio-frequency power amplifier stage that supplies power to the antenna.

97. The term "antenna input power" or "antenna power" means the product of the total antenna resistance and the square of the antenna current at the operating frequency.

98. The term "modulation" means the process whereby the frequency or amplitude of a radio wave is varied in accordance with a sound wave.

99. The term "modulator" means the last audio frequency amplifier stage which modulates a radio stage.

100. The term "modulated stage" means the radio-frequency amplifier stage to which the modulator is coupled and which is modulated.

101. The term "percentage modulation" means the ratio of half the difference between the maximum and minimum amplitudes of a modulated wave to the average amplitude, expressed in percentage.

102. The term "maximum percentage of modulation" means the greatest percentage of modulation that may be obtained by a transmitter without producing in its output more than 10 per cent combined audio harmonics.

103. The term "combined audio harmonics" means the sum of the amplitudes of all the various harmonic components.

104. The term "high level modulation" means that the plate circuit of the last radio stage is modulated.

105. The term "low level modulation" means that a radio stage before the last one is modulated, and the last radio stage operates only as a linear power amplifier.

106. The term "grid bias modulation in the last radio stage" means that the grid bias of the last radio stage is varied by the audio-frequency power supplied by the modulator. If such modulation is employed in other than the last radio stage it is low-level modulation.

107. The term "antenna resistance" means the total resistance of the transmitting antenna system at the operating frequency and at the point at which the antenna current is measured.

108. The term "antenna current" means the radio-frequency current in the antenna with no modulation.

109. The licensee of a 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 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.

ALLOCATION OF FACILITIES

115. Within the broadcast band a separation of 10 kilocycles will be maintained between the carrier frequencies assigned for use by broadcast stations. The carrier frequencies assigned will be multiples of 10 between 550 and 1,500 kilocycles, both included. The national standard of radio frequency maintained by the Bureau of Standards, Department of Commerce, shall be the basis for all frequency measurements and assignments will be made on the basis of this standard.

116. The following frequencies are designated as clear channels and are allocated for use by clear-channel stations:

640, 650, 660, 670, 680, 700, 710, 720, 740, 750, 760, 770, 790, 800, 810, 820, 830, 850, 860, 870, 970, 980, 990, 1,000, 1,020, 1,040, 1,050, 1,060, 1,070, 1,080, 1,090, 1,100¹, 1,110, 1,130, 1,140, 1,150, 1,160, 1,170, 1,180 and 1,190 kilocycles.

117. The authorized power of a dominant clear channel station shall be not less than 5 kilowatts nor more than 50 kilowatts.

119. The following frequencies are designated as high power regional frequencies and allocated for use by high power regional stations permitted to operate simultaneously with a power not less than 5 kilowatts:

1,400, 1,470, 1,480 and 1,490 kilocycles.

120. The following frequencies are designated as regional frequencies and are allocated for use by regional stations, which are permitted to operate simultaneously unless otherwise restricted:²

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¹ See Executive Agreement Series No. 34, "Radio broadcasting, arrangement between the United States of America and the Dominion of Canada." Copies of this agreement may be obtained from the Superintendent of Documents.

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(Continued from page 304)

550, 560, 570, 580, 590, 600, 610, 620, 630, 780, 880, 890, 900, 920, 930, 940, 950, 1,010, 1,120, 1,220, 1,230, 1,240, 1,250, 1,260, 1,270, 1,280, 1,290, 1,300, 1,320, 1,330, 1,340, 1,350, 1,360, 1,380, 1,390, 1,400, 1,410, 1,430, 1,440, and 1,450 kilocycles.

The operating power of such a station shall not be less than 250 watts, nor during nighttime greater than 1,000 watts, nor during daytime greater than 5,000 watts.

120.1 (a) The following frequencies are allocated for assignment to special broadcast stations on an experimental basis: 1530, 1550 and 1570 kilocycles. Two or more stations may be licensed for simultaneous operation on each frequency.

(b) Licenses for special broadcast stations will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development and practical application of high fidelity broadcasting, and will be in addition to and advancement of the work done by other classes of regular broadcast stations.
2. That the program of research and experimentation includes a thorough study of advanced antenna design, field intensity surveys and plans for a comprehensive analysis of the response of listeners.
3. That the transmitter and all studios will be equipped so that transmission will be of high fidelity.
4. That the 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.
5. That the programs transmitted, either sponsored or sustaining, will not interfere with the proper prosecution of the program of research and experimentation.
6. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program of research and experimentation.
7. That the program of research and experimentation will be reasonably independent of the income derived from sponsored programs.
8. That the public interest, convenience and necessity will be served through the operation of the proposed station.

(c) The Commission may require from time to time a licensee of a special broadcast station to conduct experiments that are deemed desirable and reasonable for the development of the service.

(d) The program of research and experimentation as offered in compliance with the requirements of obtaining a license for a special broadcast station, shall be adhered to in the main unless the licensee is authorized to do otherwise by the Commission.

(e) The authorized power of a special broadcast station will not exceed 1 kilowatt. However, the licensee may operate at less than the authorized power where such operation facilitates experimentation.

(f) The licensee of a special broadcast station is not required to adhere to a regular schedule, but shall actively conduct a program of research and experimentation or transmission of programs.

(g) A supplemental report shall be filed with and made a part of each application for a renewal of license of a special broadcast station and shall include statements of the following in the order designated:

1. Comprehensive summary of all research and experimentation conducted.
2. Conclusions and outline of proposed program for further research and development.
3. Number of hours operated, including percentage of sponsored programs.
4. Fidelity characteristics of the equipment, including the transmitter, studio equipment and the telephone lines over which the programs are regularly carried from the studio to the transmitter and the methods used to determine such characteristics.

(h) All rules applying to regular broadcast stations shall apply equally to special broadcast stations, except where in conflict with any term of this rule.

121. The following frequencies are designated as local frequencies and allocated for use by local stations, which are to operate simultaneously, unless otherwise restricted, with a power of 100 watts during nighttime and not to exceed 250 watts during daytime:

1,200, 1,210, 1,310, 1,370, 1,420, and 1,500 kilocycles.

122. The following frequencies are designated as Canadian exclusive frequencies reserved for use by broadcast stations located in the Dominion of Canada and will not be assigned to any station licensed by the Commission:

690, 730, 840, 910, 960, and 1,030 kilocycles.

123.

124. The following shows the classification of each carrier frequency in the broadcast band:

CLASSIFICATION OF FREQUENCIES IN BROADCAST BAND

Frequency (kilocycles)	Classification	Frequency (kilocycles)	Classification
550	Regional	1,030	Canadian exclusive
560	Regional	1,040	Clear
570	Regional	1,050	Clear—Canadian shared
580	Regional	1,060	Clear
590	Regional	1,070	Clear
600	Regional—Canadian shared	1,080	Clear
610	Regional	1,090	Clear
620	Regional	1,100	Clear—Canadian shared
630	Regional—Canadian shared	1,110	Clear
640	Clear	1,120	Regional—Canadian shared
650	Clear	1,130	Clear
660	Clear	1,140	Clear
670	Clear	1,150	Clear
680	Clear	1,160	Clear
690	Canadian exclusive	1,170	Clear
700	Clear	1,180	Clear
710	Clear	1,190	Clear
720	Clear	1,200	Local
730	Canadian exclusive	1,210	Local
740	Clear	1,220	Regional
750	Clear	1,230	Regional
760	Clear	1,240	Regional
770	Clear	1,250	Regional
780	Regional—Canadian shared	1,260	Regional
790	Clear	1,270	Regional
800	Clear	1,280	Regional
810	Clear	1,290	Regional
820	Clear	1,300	Regional
830	Clear	1,310	Local
840	Canadian exclusive	1,320	Regional
850	Clear	1,330	Regional
860	Clear	1,340	Regional
870	Clear	1,350	Regional
880	Regional—Canadian shared	1,360	Regional
890	Regional	1,370	Local
900	Regional	1,380	Regional
910	Canadian exclusive	1,390	Regional
920	Regional	1,400	Regional
930	Regional—Canadian shared	1,410	Regional
940	Regional	1,420	Local
950	Regional	1,430	Regional
960	Canadian exclusive	1,440	Regional
970	Clear	1,450	Regional
980	Clear	1,460	Regional—high power
990	Clear	1,470	Regional—high power
1,000	Clear	1,480	Regional—high power
1,010	Regional	1,490	Regional—high power
1,020	Clear	1,500	Local

EQUIPMENT

125. The maximum rated carrier power of broadcast transmitters authorized to be installed in the several classes of stations shall be as given in the following table:

LIMIT OF MAXIMUM RATED CARRIER POWER

Class of station	Authorized power	Maximum rated carrier power permitted to be installed
Local	100 watts 100 watts night and 250 watts day	100 watts 250 watts
Regional and high-power regional	250 to 1,000 watts 2,500 to 5,000 watts	1,000 watts 5,000 watts
High-power regional and clear channel	The maximum rated carrier power of transmitters installed in stations with an authorized power greater than 5,000 watts shall be not more than twice the authorized power.	

126. The maximum rated carrier power of a broadcast transmitter shall be the same as the sum of the power ratings of all the vacuum tubes in the last radio stage. The power rating of a vacuum tube is determined by its design and class of operation or system of modulation as set out in paragraph 127, tables A, B, and C. These tables shall apply to transmitters employing the different systems of modulation or classes of operation in the last radio stage as follows:

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(Continued from page 808)

(1) Table A applies to transmitters employing high-level modulation or plate modulation of the last radio stage.

(2) Table B applies to transmitters employing low-level modulation or the last radio stage operating as a linear power amplifier.

(3) Table C applies to transmitters employing grid bias modulation in the last radio stage.

127. The approved power ratings of vacuum tubes for operation in the last radio stage of broadcast transmitters are fixed as set out in the following tables:

TABLE A¹

Power Rating of Vacuum Tubes for High-Level Modulation or Plate Modulation in the Last Radio Stage

Power Rating (watts)	Amperex	Collins	De Forest	Eitel McCullough	Federal Telegraph	Heintz & Kaufman	Hy-grade Sylvania	RCA Mfg. Co.	United Electronics	Western Electric
50				.50T						211D 211E 248A 276A
75	HF 100 203-A 211 838 852 860	C-203A C-211	509-A 511 552 560		F-309-A F-311-A F-352-A	154	203-A 211 852 860	203-A 211 838 311 361-A 260A 260A 261A 284A 296A		242A 242B 242C 260A 261A 284A 296A
100					F-102-A F-108-A					
125	HF200 203H 211C 211D 211H 805	C-200 C-201 C-211D		150T				803 805	905	
250	204-A HF-300	C-204A C-300	504-A 561 571		F-204-A F-212-E F-331-A	354	204-A 212-D 831 861	204-A 831 861	304-A 312-E	212D 212E
350	849		549	300T	F-100-A F-349-A		849	849	949	270A
500						255				251A
750	851		551	500T	F-351-A		851	851	951	279A
1,000					F-346-A	1,554	846	846		
2,500					F-328-A F-3652-A	3,054	820-B	1,652		228A
5,000			507 548 563		F-307-A F-320-A F-320-B F-348-A F-353-A		207 848 863 891 892	207 848 863 891 892		220B
10,000					F-101-B F-110-A F-110-X F-116-A F-332-A F-332-B F-332-C F-358-A		858			232A 232B
40,000							862 898			298-A

If in an application to the Commission a vacuum tube of a type number and power rating not given in the foregoing tables is specified for operation in the last radio stage, it may be accepted provided there is also submitted to and approved by the Commission, the manufacturer's rating of the vacuum tube for the system of modulation or class of service contemplated. These data must be supplied by the manufacturer.

TABLE B¹

Power Rating of Vacuum Tubes for Low-Level Modulation or Last Radio Stage Operating as Linear Power Amplifier

Power Rating (watts)	Amperex	Collins	De Forest	Eitel McCullough	Federal Telegraph	Heintz & Kaufman	Hy-grade Sylvania	RCA Mfg. Co.	United Electronics	Western Electric
25						154		203-A		
50	HF-200 203 H 211 H			150-T		354		803		242-B 242-C
75	HF-300 212 E		504-A		F-304-A F-312-A		204-A 212-D	204-A	804-A 312-E	212D 212E
125			549	300-T	F-100-A F-349-A		849	849	949	270A
250			551	500-T	F-351-A	255 1,554	851	851	951	251A
500					F-346-A	3,054	846	846		279A
1,000					F-328-A F-3652-A		820-B	1,652		228A
2,500			507 569		F-307-A F-320-A F-320-B F-368-A		207 863	207 863 892		220B
5,000					F-358-A			858		
8,500					F-101-B F-110-A F-110-X F-116-A F-332-A F-332-B F-332-C					232A
25,000								862 898		298-A

TABLE C¹

Power Rating of Vacuum Tubes for Grid Bias Modulation in the Last Radio Stage

Power Rating (watts)	Amperex	Collins	De Forest	Eitel McCullough	Federal Telegraph	Heintz & Kaufman	Hy-grade Sylvania	RCA Mfg. Co.	United Electronics	Western Electric
50						354				212E 270A
100										
125				300T						
250				500T		255				
500						1,554				
2500					F-307-A	3,054				

¹ These tables apply only to tube ratings for use in the last radio stage of broadcast transmitters and may not be applicable to any other service.

(Continued on page 812)

PAUL F. GODLEY

Consulting Radio Engineer

Montclair, N. J.

"25 Years of Professional Background"

FCC Rules and Regulations Applicable to Broadcast Services

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128. If the maximum rated carrier power of any broadcast transmitter, as determined by paragraphs 126 and 127, does not give an exact rating as recognized in the Commission's plan of allocation, the nearest rating thereto shall apply to such transmitter.

129. No licensee shall change the number of vacuum tubes, change to vacuum tubes of different power rating or class of operation in the last radio stage, or change system of modulation without the authority of the Commission.

130. Other changes 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 must be shown in full.

*131. (a) All applicants for new, additional, or different broadcast facilities and all licensees requesting authority to move the location of the 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.

(b) The Commission will publish from time to time specifications deemed necessary to meet the requirements of good engineering practice.

(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.

(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.

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*MINIMUM ANTENNA HEIGHTS REQUIRED FOR BROADCAST STATIONS PURSUANT TO RULE 131

A review of the antenna systems employed by broadcast stations reveals that there are now many antennas in use that the radiating efficiency does not comply with the requirements of good engineering practice. In many cases a material improvement in the coverage of the station could be accomplished by erecting an efficient radiating system. This increase in coverage may be more than could be accomplished by doubling the power.

It is the obligation of the licensee of every station to make efficient usage of the assignment granted by the Commission. It is not the intention of the Commission at this time to require all stations with questionable radiating systems to install antennas having the required efficiency, but it is the intention not to grant additional facilities to licensees of broadcast stations unless they are making efficient usage of the assignment already granted. That is, the licensee of a broadcast station requesting more power, change in time of operation, different frequency, or move of the transmitter, must have an antenna for the assignment requested that meets with the minimum requirements before favorable consideration will be given.

The attached graph shows the minimum physical height of antenna proper or minimum effective field intensity that stations must have before additional facilities will be granted.

These minimum actual physical vertical heights of antennas permitted to be installed are shown by curves A, B, C and D of Figure 1 as follows:

A—Local Channel Stations, 100 watts night and day or 100 watts night and 250 watts day, or a minimum effective field intensity at one mile of 40 mv/m for 100 watts.

B—Regional Channel, limited time, day, etc., Stations 250 watts to 1000 watts night and day, or a minimum effective field intensity at one mile of 150 mv/m for 1 kilowatt.

C—All stations other than Dominant Clear Channel Stations having an operating power night or day greater than one kilowatt and less than 25 kilowatts, or a minimum effective field intensity at one mile of 175 mv/m for one kilowatt.

D—All Dominant Clear Channel Stations and all other stations having a maximum operating power night or day of over 10 kilowatts, or a minimum effective field intensity at one mile of 200 mv/m for one kilowatt.

The heights given on the graph for the antenna apply regardless of whether the antenna is located on the ground or on a building. Except for the reduction of shadows locating the antenna on a building does not necessarily increase the efficiency. In applying these curves the maximum operating power shall determine which curve is applicable.

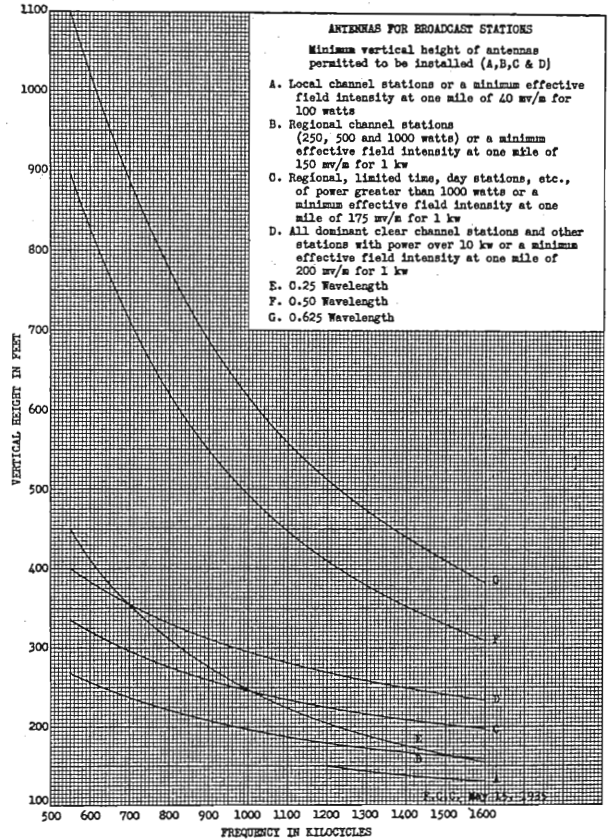
In case it is contended that the required antenna efficiency can be obtained without antennas of the height specified, a complete field intensity survey must be supplied to the Commission showing that the field intensity at a mile without attenuation fulfills at least the minimum requirements. This field survey must be made by a qualified engineer using equipment of acceptable accuracy.

To obtain the maximum efficiency of which any antenna is capable, a good ground or counterpoise system must be employed.

At the present state of the art, it appears that where a vertical radiator is employed the ground system should consist of radial wires at least $\frac{1}{4}$ wave length long. There should be as many of these radials as practicable and in no event less than 70. These wires should be buried only deep enough to provide

Antenna Regulations Promulgated by FCC

(According to Rule 131)



THIS graph shows the minimum physical height of antenna proper or minimum effective field intensity that stations must have before additional facilities will be granted under Rule 131 adopted Oct. 31, 1935, by FCC. The minimum actual physical vertical heights of antennas permitted to be installed are shown by curves A, B, C, and D as follows:

A—Local channel stations, 100 watts night and 250 watts day, or a minimum effective field intensity at one mile of 40 mv/m for 100 watts.
B—Regional channel, limited time, day etc. stations 250 watts to

1000 watts night and day, or a minimum effective field intensity at one mile of 150 mv/m for one kilowatt.

C—All stations other than dominant clear channel stations having an operating power night or day greater than one kilowatt and less than 25 kilowatts, or a minimum effective field intensity at one mile of 175 mv/m for one kilowatt.

D—All dominant clear channel stations and all other stations having a maximum operating power night or day of over 10 kilowatts, or a minimum effective field intensity at one mile of 200 mv/m for 1 kilowatt.

mechanical protection (not greater than 12 inches). However, they should not be permitted to rest on the surface.

In many cases a counterpoise or combination counterpoise and ground system may be superior to a ground, especially where a good ground cannot be obtained.

It should be borne in mind that the above specifications are the minimum and where possible better antenna and ground systems should be installed.

Before any change is made in the antenna, details should be submitted to the Commission for approval in order that it may be definitely determined that the installation will meet the requirements of Rule 131 and that it does not constitute an objectionable hazard to air commerce. These data may be submitted by letter setting out full details.

FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 312)

*132. (a) The transmitter proper and associated transmitting equipment of each broadcast station shall be designed, constructed and operated in accordance with 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 37 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 which cause or are 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 a level as required by good engineering practice. The program 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 rule, the term "good engineering practice" is used, the specifications deemed necessary to meet the requirements of good engineering practice will be published from time to time.

(e) This rule shall be effective upon its adoption provided, however, that existing broadcast stations shall be allowed one year in which to meet the requirements herein. (Adopted November 12, 1935.)

(Continued on page 318)

*INTERPRETATIONS OF "GOOD ENGINEERING PRACTICE" UNDER FCC RULE 132

The pertinent sections of Article 37 of the National Electrical Code read as follows:

(j) The transmitter shall be enclosed in a metal frame, or grill, or supported from the operating space by a barrier or other equivalent means, all metallic parts of which are effectually connected to ground.

(k) All external metallic handles and controls accessible to the operating personnel shall be effectually grounded. No circuit in excess of 150 volts should have any parts exposed to direct contact. A complete dead-front type of switchboard is preferred.

(l) All access doors shall be provided with interlocks which will disconnect all voltages in excess of 750 volts when any access door is opened.

Referring to paragraph (a) of the above rule, at present good engineering practice shall be interpreted as follows:

In general the transmitter must be constructed either on racks and panels or in totally enclosed frames protected as required by the sections of Article 37 of the National Electrical Code as quoted above. The final stages of high power transmitters may be assembled in open frames providing the equipment is enclosed by a protective fence. Means must be provided for making all tuning adjustments, requiring voltages in excess of 750 volts to be applied to the circuit, from the front panels with all access doors closed. Front bleeder resistors should be installed across all condenser banks to remove any charge which may remain after the high voltage circuit is opened. All meters which have more than 1000 volts potential to ground on the movement shall be protected by a cage or cover in addition to regular case even if bakelite.

All plate supply and other high voltage equipment including transformers, filters, rectifiers, and motor generators, must be protected so as to prevent injury to operating personnel. This protection should include commutator guards on all high voltage rotating machinery.

The transmitter panels or units shall be wired in accordance with standard switchboard practice, either with insulated leads properly cabled and supported or with rigid bus bar properly insulated and protected. Wiring between units of the transmitter with the exception of circuits carrying R. F. energy shall be installed in conduits or approved fibre or metal raceways to protect them from mechanical injury. Circuits carrying low-level R. F. between units shall be of either concentric tube, two-wire balanced lines or properly shielded to prevent the pickup of modulated R. F. energy from the output circuits.

Each stage (including the oscillator) preceding the modulated stage shall be properly shielded and filtered to prevent feedback from any circuit following the modulated stage. An exception to this requirement will be made in the case of high-level modulated transmitters of approved manufacture which have been properly engineered to prevent reaction.

The crystal chamber, together with the conductor to the oscillator circuit, must be totally shielded. The crystal chamber must be so constructed, insulated and temperature-controlled that the maximum temperature variation at the crystal shall not be greater than 0.1 degree Centigrade. An exception would be made in the case of transmitters employing so-called "AT" or zero coefficient crystals wherein the maximum allowable temperature variation at the crystal is 1.0 degree Centigrade. A thermometer must be installed in such a manner that the temperature at the crystal can be accurately measured and the temperature logged each half hour in accordance with Rule 142. It is preferable that the tank circuit of the oscillator tube be installed in the temperature-controlled chamber. In case an excessive shift in frequency is found during warmup periods the crystal oscillator must be operated continuously. The Commission will take special precautions to ascertain that composite crystal chambers and oscillator units meet the requirements of "good engineering practice" before the station is considered as having satisfactorily complied with Rule 132.

The radio frequency energy operating the monitor must be obtained from some stage in the transmitter prior to the modulated stage and the monitor circuits must be such that the monitor can be operated continuously without

heterodyning the carrier. In addition, the monitor and the radio frequency line from the transmitter must be thoroughly shielded to prevent regeneration in the transmitter.

The transmitter power supply shall be so constructed that the maximum plate voltage regulation between no modulation and 100% modulation shall not exceed 5%. Adequate provision shall also 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.

A complete set of spare tubes for the transmitter and frequency monitor should be on hand at all times, the spares to include thyratron tubes, when used.

No requests for new broadcasting facilities will be granted unless the equipment proposed to be installed conforms with the definitions of "good engineering practice" as outlined herein.

It is the obligation of the licensee of each existing station to take the necessary steps to assure that the transmitting equipment complies with Rule 132 and these definitions of "good engineering practice". Any changes in the transmitter for which a construction permit is necessary by other rules, application therefore must be made in the regular manner.

There is sufficient time before November 12, 1936, for all licensees to file the necessary applications and install the required equipment.

Each station will be visited in the near future by an inspector of the Field Section of the Commission's Engineering Department and a detailed inspection will be made. Any points not clear or on which a ruling is desired should be discussed with him. However, this does not relieve the licensee's responsibility to proceed to comply with the requirements of this rule.

The inspector will again visit the station on or prior to November 12, 1936, to determine if the equipment complies in all details.

The purpose of this rule is to improve broadcast reception and to protect the lives of the station operators. Many frequency deviations are caused by poor equipment. The mutual interference caused by such deviations will thus be reduced as the deviations are reduced. The continuity of service and fidelity of transmission will be improved. This rule is for the good of the licensees as well as the listeners and the cooperation of all licensees is requested in assisting the Commission in the administration thereof.

The Commission will, from time to time, further define "good engineering practice" as the state of the art progresses and as the needs for the improvement in technical broadcasting demand.

JOHN BARRON

Consulting Radio Engineer



Specializing
in
Broadcast
and
Allocation
Engineering



EARLE BUILDING

TELEPHONE NATIONAL 7757

WASHINGTON, D. C.

FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 314)

TECHNICAL OPERATION

134. The operating power of a broadcast station will be determined either by direct measurement or indirect measurement by means of the plate input power to the last radio stage.

a. Unless specifically authorized by the Commission to do otherwise, the licensee of a broadcast station shall compute its operating power by indirect method by means of the plate input power to the last radio stage.

b. Any licensee who has at any time been authorized by the Commission to compute operating power by any other method (e.g., by antenna input direct measurement, or radiated power measurement computed from field intensity measurements) shall, upon making any change in the antenna system or in the antenna current measuring instruments, or any other change which may change the characteristics of the antenna, revert to the use of the indirect measurement of antenna input until further order of the Commission.

135. The operating power shall be determined by indirect measurement from the plate input power of the last radio stage by multiplying the plate voltage (E_p) by the total plate current of the last radio stage (I_p) and by the proper factor (F) given in the following tables according to the power and system of modulation used; that is

$$\text{Operating power} = E_p \times I_p \times F$$

A. FACTOR TO BE USED FOR STATIONS USING HIGH-LEVEL MODULATION

Maximum rated carrier power of transmitter	Factor (F) to be used in determining the operating power from the plate input power
Watts	
100	0.50
250-1,000	0.60
2,500-50,000	0.65

B. FACTOR TO BE USED FOR STATIONS OF ALL POWERS USING LOW-LEVEL MODULATION

Maximum percentage of modulation	Factor (F) to be used in determining the operating power from the plate input power
85 to 100	0.33

C. FACTOR TO BE USED FOR STATIONS OF ALL POWERS USING GRID BIAS MODULATION IN THE LAST RADIO STAGE

Maximum percentage of modulation	Factor (F) to be used in determining the operating power from the plate input power
85 to 100	0.22

136. 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.

137. 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. 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. 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.

138. The operating power of a broadcast station determined by the radiated power computed from field intensity measurements may be accepted in lieu of antenna input power, provided a sufficient number of measurements are taken to insure accuracy and an analysis of the antenna system is submitted indicating the relative distribution of the radiation (i.e., ground and sky wave radiation). The data on the antenna resistance, complete description of the antenna system with dimensions and method of taking field intensity measurements and of relating these measurements to the operating power shall be submitted to and approved by the Commission before any licensee will be authorized to operate by this method of power determination. 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.

* 139. (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 per cent. When the transmitter is

operated with 85 per cent modulation, not over 10 per cent combined audio frequency harmonics shall be generated by the transmitter.

(b) All broadcast stations shall, on and after November 1, 1936, 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 per cent 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.

140. A licensee of a broadcast station will not be authorized to operate a transmitter with an operating power greater than the maximum rated carrier power of the transmitter.

141. 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 per cent or more, with not over 10 per cent combined audio harmonics, can be obtained with the transmitter operated at the maximum authorized power.

142. The licensee of a broadcast station shall maintain the operating power of the station in exact accord with its 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 shall be notified in writing immediately after the emergency develops.

143. 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, without authority of the Commission, except by instruments of the same type, maximum scale reading, and accuracy.

144. Each broadcast station shall be so operated that the frequency is maintained between the limits of 50 cycles per second above to 50 cycles per second below the assigned frequency.

145. The licensee of a broadcast station shall make provision for the checking of the frequency of the emitted wave by means independent of the fre-

(Continued on page 318)

*MODULATION MONITORS FOR BROADCAST STATIONS

Rule 139, as amended, section (b), requires all broadcast stations to have in operation on and after November 1, 1936, a modulation monitor approved by the Commission. The modulation monitors will be approved by type after tests at the Bureau of Standards in the same manner that frequency monitors, as required by Rule 145, are approved. Any manufacturer desiring to submit a monitor for approval should supply the Commission with full details and if the specifications appear to meet the requirements, the Commission will request the Bureau of Standards to issue shipping instructions. Below are given the specifications that the modulation monitor must meet to be tested at the Bureau of Standards before it will be approved by the Commission. Approval will be given based on the test data taken at the Bureau, but the Bureau of Standards does not approve and disapprove the monitor as this is entirely in the hands of the Commission.

The specifications pursuant to Rule 139, section (d), are as follows:

1. A DC meter for setting the average rectified carrier at a specific value and to indicate changes in carrier intensity during modulation.

2. A peak indicating light or similar device that can be set at any predetermined value from 50 to 120 per cent modulation to indicate on positive peaks, and/or from 50 to 100 per cent negative modulation.

3. A semi-peak indicator with a meter having the characteristics given below shall be used with a circuit such that peaks of modulation of duration between 40 and 90 milliseconds are indicated to 90 per cent of full value and the discharge rate adjusted so that the pointer returns from full reading to 10 per cent of zero within 500 to 800 milliseconds. A switch shall be provided so that this meter will read either positive or negative modulation and, if desired, in the center position it may read both in a full-wave circuit.

The characteristics of the indicating meter are as follows: Speed—The time for one complete oscillation of the pointer shall be 200 to 350 milliseconds. The damping factor shall be between 16 and 200. The useful scale length shall be at least 2.3 inches. The meter shall be calibrated for modulation from 0 to 100 per cent and in decibels below 100 per cent with 100 per cent being 0 DB.

The accuracy of the reading on percentage of modulation shall be ± 2 per cent for 100 per cent modulation, and ± 4 per cent of full scale reading at any other percentage of modulation.

4. The frequency characteristics curve shall not depart from a straight line more than $\pm \frac{1}{2}$ DB from 30 to 10,000 cycles. The amplitude distortion or generation of audio harmonics shall be kept to a minimum.

5. The modulation meter shall be equipped with appropriate terminals so that an external peak counter can be readily connected.

6. Modulation will be tested at 115 volts ± 5 per cent and 60 cycles, and the above accuracies shall be applicable under these conditions.

7. All specifications not already covered above, and the general design, construction, and operation of these units must be in accordance with good engineering practice.

FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 317)

quency control of the transmitter and capable of the accuracy specified in paragraph 144.

146. 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 of 50 cycles per second above to 50 cycles per second below the assigned frequency.

147. New automatic frequency control equipment and changes in existing automatic frequency control equipment that may affect the precision of frequency control or the operation of the transmitter shall be installed only upon authorization from the Commission.

148. Upon showing that a need exists for the use of an auxiliary transmitter² in addition to the regular transmitter of a broadcast station, a licensee may be issued therefor provided that:

a. An auxiliary transmitter shall be installed only at the same location as the main transmitter, except that upon satisfactory showing of technical necessity therefor the Commission may authorize 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 upon failure of the main transmitter, or upon request by a duly authorized Government representative.

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. A record shall be kept of the time and result of test. Tests shall be conducted only between 1 a. m. and 12 noon.

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.

149. If a licensee of a broadcast station has duplicate transmitting equipment and arranges for alternate operation, one such duplicate shall be considered as an auxiliary transmitter subject to the above conditions: *Provided*,

² All regulations applying to broadcast transmitting equipment shall apply also to an auxiliary transmitter.

however, That duplicate equipment for alternate operation may be licensed when the Commission is satisfied that desirable experimental work is being carried on, in which case the licensee shall be subject to the regulations governing experimental stations.

150. Within two days after each use of the auxiliary transmitter, except for testing, the Commission and the inspector in charge shall be notified in writing of the date, time, and power at which the auxiliary transmitter is operated, and the reasons for each use.

OPERATION

151. Except Sundays, the licensee of each broadcast station shall maintain a minimum regular operating schedule of two thirds of the hours that it is authorized to operate during each broadcast day, 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 shall be notified in writing immediately after the emergency develops.

152. If the minimum operating schedule herein required is not adhered to, the licensee may, after hearing, be required to share time with other stations, or be limited to operation during daytime or during specified hours.

153. A licensee of an unlimited time station may operate the station on any schedule of hours during the broadcast day and the experimental period, provided the minimum regular schedule is maintained during the broadcast day.

154. If the licensee of a sharing time station specifies the hours of operation, the schedule so specified shall be adhered to until otherwise ordered by the Commission.

155. If the licensees of sharing time stations 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 order the file mark of the Commission will be affixed thereto, 1 copy will be retained by the Commission, 1 copy forwarded to the inspector in charge, and 1 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

(Continued on page 320)

COMPLETE UNITS ——— RADIO COMMUNICATIONS ——— COMPONENT PARTS



JENKINS & ADAIR, INC.

CHICAGO

U. S. A.

ENGINEERS

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MANUFACTURERS

FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 318)

not include simultaneous operation of the stations unless specifically authorized by the terms of the license.

156. 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.

157. If the licensees of sharing time stations are unable to agree on a division of time, the Commission shall be so notified by statement to that effect filed with application for renewal of license. Upon receipt of such statement the Commission will designate the application for a hearing and, pending such hearing, the operating schedule previously adhered to shall remain in full force and effect.

158. If the licensee of a broadcast station is required to cease operation of the station at the time of sunset at some point within the United States, the licensee will specify the hour of the day during each month of the license period when operation of such station shall cease. (See par. 181.)

159. The licensee of a limited time station that is authorized to resume operation at the time the unlimited time station on the same frequency ceases operation, shall, with each application for renewal of license, file in triplicate a copy of his regular operating schedule, signed and approved by the licensee of the unlimited time station. Upon receipt of such operating schedule, properly executed, the Commission will affix its file mark, retain 1 copy, forward 1 copy to the inspector in charge, and return 1 copy to the licensee of the limited time station, who shall post it with the station license, and it shall be considered as a part thereof. Departure from said operating schedule will be permitted only in accordance with the procedure set forth in paragraph 156.

160. If the licensees of the limited time and unlimited time stations are unable to agree upon a definite time for resumption of operation by the limited time station, the Commission shall be so notified by the licensee of the limited time station. 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.

161. Any broadcast station, other than a day or limited time station, that is licensed for operation part time on a channel on which the entire available broadcast time (i.e., the broadcast day) has not been designated for use in the same geographical area, may operate only during the hours specified in the license.

162. 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.

163. In all cases where specific hours of operation are fixed in the license any deviation or departure therefrom, except as authorized by the Commission, shall be considered as a violation of the material terms of the license.

164. Upon completion of construction of a broadcast station in exact accord with the terms of the construction permit, and prior to the filing of application for license, the permittee is authorized to test the equipment between the hours of 1 a. m. and 6 a. m., local standard time, for a period not to exceed 10 days. *Provided*, That the Commission and the inspector in charge are notified two days in advance of the beginning of such equipment tests: *And provided further*, That the Commission may cancel or change the period and/or date of the beginning of such authority as may appear to be in the public interest, convenience, and necessity.

165. When construction is completed in exact accord with the terms of the construction permit, and after an application for station license has been filed with the Commission, showing the transmitter to be in satisfactory operating condition, the permittee is authorized to conduct program tests in exact accord with the terms of the permit, for a period not to exceed 30 days: *Provided*, That the Commission and the inspector in charge of the proper district are notified two days in advance of the beginning of such program tests: *And provided further*, That the Commission may cancel or change the period and/or date of the beginning of such authority as may appear to be in the public interest, convenience and necessity.

166. If local time is changed from standard time to daylight-saving time at the location of all stations sharing time on the same frequency, the hours of operation of all such stations on that frequency shall be understood to refer to daylight-saving time, and not standard time, as long as daylight-saving time is observed. This provision shall govern when the time is changed by provision 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 sunset, local standard time shall be used.

167. 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 frequency, the hours of operation on this frequency 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.

168. The time of operation of any broadcast station which does not share time with the other stations on the same frequency shall be understood to have reference to local standard time unless modification of such license with respect to hours of operation is made by the Commission.

169. The station license shall be posted in a conspicuous place in the room in which the transmitter is located, and the license of the station operator shall be posted in a conspicuous place in a room occupied by the operator while on duty.

170. The licensee of each station shall keep a licensed operator or operators of the grade specified by the secretary of the Commission on duty during all periods of actual operation of the transmitter at the place where the transmitting equipment is located.

171. A licensed operator on duty and in charge of the transmitter may, at the discretion of the licensee, be employed for additional operator's duties commensurate with the grade of operator's license which he holds.

LOG RECORDS

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

A. THE PROGRAM LOG

a. An entry of the time each station and call announcement is made, with an indication of the type of announcement.

b. An entry briefly describing each program broadcast, such as "music", "drama", "speech", etc., with the time of the beginning and ending. If a mechanical reproduction is used, that fact shall be noted, together with an indication whether announcement thereof was made. If a speech is made by a political candidate, the name and political affiliations of such speaker shall be entered.

B. THE OPERATING LOG

a. An entry of the time the station begins to supply power to the antenna, and the time it stops.

b. An entry of the time the program begins and ends.

c. An entry of each interruption to the carrier wave, its cause and duration.

d. An entry of the following each 30 minutes:

- (1) Operating constants of last radio stage (total plate current and plate voltage).
- (2) Antenna current.
- (3) Frequency check.
- (4) Temperature of crystal control chamber.

(Continued on page 322)

BLILEY
Type BC 46 Isolantite variable air-gap oven mounting maintains its temperature within 1°C. at 50°C. Approved by F. C. C.

QUARTZ
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CRYSTALS
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BLILEY ELECTRIC COMPANY
UNION STATION BUILDING
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FCC Rules and Regulations Applicable to Broadcast Services

(Continued from page 320)

173. Each log shall be kept by the person or persons competent to do so, having actual knowledge of the facts required, and who shall sign the log when starting duty and again when going off duty. The logs shall be made available upon request by authorized Government representatives.

174. The exact form of logs is not prescribed, but they shall be kept in an orderly manner, and in such detail that the information required is readily available. Key letters or abbreviations may be used if the explanation of each is given plainly in the log.

175. Each licensee of a broadcast station shall announce the call letters and location as frequently as practicable during the hours of operation, and in any event before or after each program being broadcast. In no event shall more than 30 minutes elapse between such announcements, and in so far as practicable these announcements shall be made on the hour and half hour. These requirements are waived when such announcements would interrupt a single continuous, uninterrupted sweep, play, symphony concert or operatic production of longer duration than 30 minutes; and in such cases the announcement of the call letters and location shall be made as soon as possible.

176. Each broadcast program consisting of a mechanical reproduction, or a series of mechanical reproductions, shall be announced in the manner and to the extent set out below:

1. A mechanical reproduction, or a series thereof, of longer duration than fifteen minutes, shall be identified by appropriate announcement at the beginning of the program, at each fifteen minute interval, and at the conclusion of the program; provided, however, that the identifying announcement at each fifteen minute interval is waived in case of a mechanical reproduction consisting of a single, continuous, uninterrupted speech, play, symphony concert or operatic production of longer duration than fifteen minutes;
2. A mechanical reproduction, or a series thereof, of a longer duration than five minutes and not in excess of fifteen minutes, shall be identified by an appropriate announcement at the beginning and end of the program;
3. A single mechanical reproduction of a duration not in excess of five minutes, shall be identified by appropriate announcement immediately preceding the use thereof;
4. In case a mechanical reproduction 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 reproduction is required.

5. The exact form of the identifying announcement is not prescribed but the language shall be clear and in terms commonly used and understood by the listening public. The use of the applicable identifying words such as "a record", "a recording", "a recorded program", "a mechanical reproduction", "a transcription", "an electrical transcription", will be considered sufficient to meet the requirements hereof. The identifying words shall accurately describe the type of mechanical reproduction used, i.e. where a transcription is used it shall be announced as a "transcription" or an "electrical transcription" and where a phonograph record is used it shall be announced as a "record" or a "recording".

177. The term "rebroadcast" means reception by radio of the program¹ of a radio station, and the simultaneous or subsequent retransmission of such program by a broadcast station.²

177.1 (a) The licensee of a regular or international broadcast station may, without further authority of the Commission, rebroadcast the program of a United States regular 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

(b) No licensee of a regular or international 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.⁴

¹ As used herein "program" means any complete program or part thereof, or any signals if other than A₂ 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 must be given within three (3) days of any single rebroadcast, but in case of the regular practice of rebroadcasting certain programs of a regular broadcast station several times during a license period, notice and certification of consent must 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 (Rule 1000) is not considered a rebroadcast.

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The Ever Present DANGER of OFF-FREQUENCY OPERATION!

INSURE against OFF-FREQUENCY OPERATION! Regularly scheduled Frequency Measurements are the answer. Almost two hundred commercial radio stations avail themselves of this INEXPENSIVE INSURANCE AGAINST OFF-FREQUENCY TRANSMISSION.

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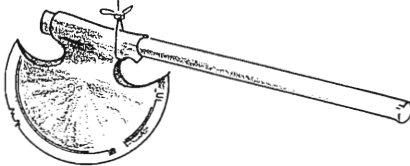
- FC-2 FREQUENCY CONTROL UNIT
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(c) No licensee of any other class of broadcast station (television, facsimile, high frequency or experimental) shall rebroadcast the program of any other radio station without written authority first having been obtained from the Commission.

(d) Authority will not be granted to rebroadcast in the United States the program of an international broadcast station located within the limits of the North American continent, except upon a satisfactory showing that no wire or other facilities exist for transmitting the program to the area served by the station proposing the rebroadcast.

(e) A licensee of an international broadcast station may authorize the rebroadcast of its programs by any station outside the limits of the North American continent without permission from the Commission, provided that the station rebroadcasting the programs cannot be received consistently in the United States.

(f) An application for authority to rebroadcast the program of any radio station shall be accompanied by written consent or certification of consent of the licensee of the station originating the program.

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

177.2 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.

178. Attention is directed to section 315 of the Communications Act of 1934, which reads as follows:

If any licensee shall permit any person who is a legally qualified candidate for any public office to use a broadcasting station, he shall afford equal opportunities to all other such candidates for that office in the use of such broadcasting station, and the Commission shall make rules and regulations to carry this provision into effect: *Provided*, That such licensee shall have no power of censorship over the material broadcast under the provisions of this paragraph. No obligation is hereby imposed upon any licensee to allow the use of its station by any such candidate.

Any violation of this section of the act shall be sufficient grounds for the revocation or denial of a broadcast license. (See par. 172.)

179. Each station licensee shall give absolute priority to radio communications or signals relating to ships or aircraft in distress, and shall cease transmitting upon such frequencies and at such times, when such transmissions may, in any way, interfere with the reception of radio distress signals or traffic relating thereto.

180. No station licensee shall resume operations until the need for distress traffic no longer exists, or it is determined that the station will not interfere with distress traffic as it is then being routed and the operation of the station shall again be discontinued if the routing of distress traffic is so changed that the station will interfere. The status of distress traffic may be ascertained by communication with Government and commercial stations. The Commission may hereafter require the licensees of certain stations to keep an effective continuous watch on the distress frequency, 500 kilocycles (410 kilocycles in the Great Lakes area).

PAUL F. GODLEY

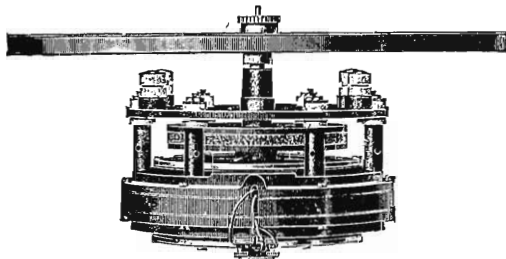
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properly designed to have a constant velocity down to 300 cycles, and an essentially constant amplitude below this frequency. Due to their correct dampening (spring oil-damped method) they show no resonance points over the whole range. This feature simplifies the proper use of equalization which is especially necessary for slow speed direct recording to raise the higher frequencies, and to compensate the loss in record materials. Their durability is warranted, as no deterioration materials are used. These recording heads are individually tested, numbered, and sealed, bearing the name of Georg Neumann & Co. which is a guarantee of high quality workmanship and performance.

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AVERAGE SUNSET TIME: FCC RULE NO. 181

E—EASTERN STANDARD TIME.

C—CENTRAL TIME.

M—MOUNTAIN TIME.

P—PACIFIC TIME.

Rule 181. The average time of sunset for each month at various points, as fixed for the purpose of these regulations, is as follows:

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Aberdeen, S. Dak. (C)	5:16	6:00	6:45	7:15	8:00	8:30	8:15	7:45	6:45	5:45	5:00	4:45	Fort Worth, Texas (C)	6:45	6:15	6:00	7:00	7:15	7:45	7:45	7:15	6:30	6:15	6:00	5:30	5:30
Ableton, Tex. (C)	6:00	6:30	6:45	7:15	8:00	8:15	7:45	7:30	6:45	5:45	5:00	4:45	Frankfort, Ky. (C)	6:45	6:15	6:45	6:15	6:45	7:00	7:00	6:30	6:45	6:00	5:30	4:45	
Ada, Okla. (C)	5:45	6:15	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Frederick, Md. (E)	5:15	5:45	6:15	6:45	7:15	7:45	7:30	7:00	6:15	5:30	5:00	4:45	
Alexandria, La. (C)	4:30	5:00	5:15	5:45	6:00	6:30	6:45	6:45	6:15	5:15	4:45	4:00	Grand Rapids, Mich. (C)	4:30	5:15	5:45	6:00	7:00	7:30	7:15	6:45	6:15	5:30	5:00	4:15	
Albany, Ga. (C)	5:00	5:30	6:45	7:00	7:30	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Gainesville, Fla. (E)	6:45	6:15	6:00	7:00	7:15	7:30	7:30	7:15	6:30	6:00	5:30	5:30	
Albany, N. Y. (E)	4:45	5:00	6:00	6:30	7:15	7:30	7:30	7:00	6:00	5:15	4:30	4:15	Galveston, Tex. (C)	6:45	6:15	6:00	6:45	7:00	7:15	7:15	6:30	6:00	5:45	5:30	5:15	
Albuquerque, N. Mex. (M)	5:15	5:45	6:15	6:45	7:15	7:30	7:15	7:00	6:15	5:15	4:45	4:00	Greenwich, Conn. (E)	5:45	6:15	6:00	6:30	7:00	7:15	7:15	6:45	6:15	5:30	5:00	4:45	
Alexandria, La. (C)	4:30	5:00	5:15	5:45	6:00	6:30	6:45	6:45	6:15	5:15	4:45	4:00	Glendale, Calif. (P)	5:45	6:15	6:00	6:30	6:45	7:00	7:00	6:45	6:00	5:15	4:30	4:15	
Altoona, Pa. (E)	5:15	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Grand Forks, N. Dak. (C)	5:00	5:45	6:00	7:15	8:00	8:30	8:15	7:45	6:45	5:45	4:45	4:30	
Americus, Ga. (E)	6:00	6:30	6:45	7:00	7:30	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Grand Junction, Colo. (M)	6:15	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:30	5:00	5:00	
Ames, Iowa (C)	5:45	6:15	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Grand Rapids, Mich. (C)	4:30	5:15	5:45	6:00	7:00	7:30	7:15	6:45	6:15	5:30	5:00	4:15	
Anderson, Ind. (C)	4:45	5:15	5:45	6:15	6:45	7:15	7:15	7:15	6:45	5:40	4:30	4:15	Great Falls, Mont. (M)	6:00	5:45	6:30	7:15	8:00	8:30	8:15	7:45	6:45	5:45	4:45	4:30	
Annapolis, Md. (E)	5:00	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:00	4:30	4:15	Greely, Colo. (M)	5:00	5:30	6:00	7:15	8:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	
Armore, Okla. (C)	5:45	6:15	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Green Bay, Wis. (C)	4:30	5:15	6:00	6:30	7:15	7:45	7:30	7:00	6:00	5:15	4:30	4:15	
Ashland, Ky. (C)	4:30	5:15	5:30	6:00	6:30	7:00	7:00	6:30	5:45	4:15	3:15	3:15	Greensboro, N. C. (E)	5:15	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:00	5:00	
Astoria, Ore. (P)	5:45	6:15	7:00	7:45	8:15	8:00	7:30	6:30	5:30	4:30	3:30	3:30	Greenville, Miss. (C)	5:15	5:45	6:15	6:30	7:00	7:15	7:15	6:45	6:15	5:30	5:00	5:00	
Atlanta, Ga. (C)	4:45	5:15	5:45	6:15	6:30	6:45	6:45	6:30	5:45	4:30	3:30	3:30	Greenville, N. C. (E)	5:15	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	5:00	
Atlantic City, N. J. (E)	5:00	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	Greenville, S. C. (E)	5:00	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	5:00	
Augusta, Maine (E)	4:30	5:00	5:15	5:45	6:00	6:30	6:45	6:45	6:15	5:15	4:45	4:00	Griffin, Ga. (C)	4:45	5:15	5:45	6:00	6:30	6:45	6:45	6:15	5:30	5:00	4:30	4:30	
Austin, Tex. (C)	5:45	6:15	6:45	7:00	7:15	7:30	7:30	7:15	6:45	5:30	4:30	4:30	Gulfport, Miss. (C)	5:15	5:45	6:00	6:15	6:45	7:00	7:00	6:45	6:00	5:30	5:00	5:00	
Baltimore, Md. (E)	5:00	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:00	4:30	4:45	Hagerstown, Md. (E)	5:15	5:45	6:15	6:45	7:15	7:15	7:15	6:45	6:15	5:30	5:00	4:45	
Bangor, Me. (E)	4:15	5:00	5:45	6:15	6:30	7:00	7:15	7:15	6:45	5:45	4:15	4:00	Hammond, Ind. (C)	5:00	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	4:45	
Baton Rouge, La. (C)	5:45	6:00	6:30	6:45	7:00	7:15	7:15	7:00	6:30	5:30	4:45	4:15	Harrisburg, Pa. (E)	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:30	4:45	4:45		
Berkley, Calif. (P)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:00	4:00	4:45	Harrisonburg, Va. (E)	5:15	6:00	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:45	5:00	5:00	
Berrien Springs, Mich. (C)	4:30	5:15	5:45	6:30	7:00	7:15	7:15	6:45	5:45	4:15	3:15	3:15	Hartford, Conn. (E)	5:15	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:00	5:00	
Beverly Hills, Calif. (P)	5:00	5:45	6:00	6:30	7:00	7:30	7:15	7:00	6:00	5:15	4:45	4:30	Havre, Mont. (M)	4:45	5:45	6:30	7:15	7:45	8:30	8:15	7:30	6:30	5:30	4:45	4:45	
Billingham, Mont. (M)	5:00	5:45	6:15	7:00	7:30	8:00	8:00	7:30	6:30	5:30	4:45	4:30	Helena, Mont. (M)	5:00	5:45	6:30	7:15	8:00	8:30	8:15	7:45	6:45	5:45	5:00	4:45	
Birmingham, N. Y. (E)	5:00	5:30	6:15	6:45	7:15	7:45	7:45	7:00	6:15	5:00	4:45	4:30	Hibbing, Minn. (C)	4:45	5:30	6:15	7:00	7:45	8:15	8:00	7:30	6:30	5:30	4:30	4:15	
Birmingham, Ala. (C)	5:00	5:30	6:00	6:30	7:00	7:30	7:15	7:00	6:00	5:00	4:30	4:30	Hickory, N. C. (E)	5:00	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	4:45	
Black, N. Dak. (C)	5:00	5:30	6:45	7:00	7:15	7:30	7:30	7:00	6:00	5:15	4:30	4:30	Hollywood, Calif. (P)	5:00	5:30	6:00	6:30	6:45	7:00	7:00	6:45	6:00	5:15	4:45	4:45	
Bluefield, W. Va. (E)	5:30	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:15	5:15	Honolulu, Hawaii (local)	5:45	6:00	6:15	6:15	6:30	6:45	6:45	6:00	5:30	5:15	5:15	5:15	
Blytheville, Ark. (C)	5:15	5:45	6:00	6:30	7:00	7:15	7:15	6:45	5:45	4:30	4:00	4:45	Hort Springs, Ark. (C)	5:30	6:00	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:45	5:15	5:00	
Boise, Idaho (M)	5:45	6:15	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:30	4:45	4:45	Houston, Tex. (C)	5:00	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:45	5:00	4:45	
Boston, Mass. (E)	4:30	5:15	5:45	6:30	7:00	7:15	7:15	6:45	5:45	4:30	3:30	3:30	Hudson Falls, N. Y. (E)	4:45	5:30	6:00	6:30	7:15	7:30	7:30	7:00	6:00	5:15	4:30	4:15	
Brady, Texas (C)	6:00	6:30	6:45	7:00	7:30	7:45	7:45	7:15	6:45	5:40	4:30	4:30	Huntington, W. Va. (E)	5:30	6:00	6:30	7:00	7:30	8:00	8:00	7:30	6:30	5:30	5:00	5:15	
Bradford, Conn. (E)	4:45	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:00	5:15	4:30	4:30	Huron, S. Dak. (C)	5:15	6:00	6:45	7:15	7:45	8:15	8:15	7:45	6:45	5:45	5:00	5:00	
Bradford, N. Y. (E)	4:30	5:00	5:30	6:00	6:30	7:00	7:15	7:15	6:45	5:45	4:30	4:30	Hammond, Ind. (C)	5:00	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	4:45	
Brookings, S. Dak. (C)	4:15	5:00	6:30	7:15	7:45	8:15	8:15	7:30	6:45	5:40	4:30	4:30	Independence, Mo. (C)	5:15	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:00	5:00	
Brooklyn, N. Y. (E)	4:45	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:00	5:15	4:45	4:30	Indianapolis, Ind. (C)	4:45	5:15	6:45	6:15	6:45	7:15	7:15	6:45	6:00	5:00	4:30	4:15	
Buffalo, N. Y. (E)	5:00	5:45	6:15	7:00	7:30	8:00	8:00	7:15	6:30	5:30	4:45	4:45	Ingwood, Calif. (C)	5:00	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:45	5:00	4:45	
Buena Vista, Tenn. (C)	4:30	5:00	5:30	6:00	6:30	7:00	7:15	7:15	6:45	5:40	4:30	4:30	Ironwood, Mich. (C)	4:45	5:30	6:00	6:45	7:30	7:30	7:00	6:15	5:30	5:00	4:45		
Butte, Mont. (M)	4:15	5:00	6:15	7:00	8:00	8:15	8:15	7:45	6:45	5:40	4:45	4:45	Ithaca, N. Y. (E)	5:00	5:30	6:15	6:45	7:15	7:45	7:45	7:15	6:30	5:45	4:45	4:30	
Calumet, Mich. (C)	4:30	5:15	6:00	6:45	7:00	7:30	7:45	7:45	7:00	6:15	5:15	4:15	Jackson, Miss. (C)	5:00	5:45	6:15	6:45	7:00	7:15	7:15	6:45	6:15	5:30	5:00	4:45	
Cambridge, Mass. (E)	5:15	5:45	6:30	7:00	7:30	7:45	7:45																			

AVERAGE SUNSET TIME: FCC RULE No. 181

E—EASTERN STANDARD TIME. C—CENTRAL TIME. M—MOUNTAIN TIME. P—PACIFIC TIME.

Rule 181. The average time of sunset for each month at various points, as fixed for the purpose of these regulations, is as follows:

(Continued from Page 324)

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Norman, Okla. (C)	5:46	6:16	6:30	7:00	7:30	7:45	7:45	7:15	6:45	6:00	5:30	5:16	Sioux Falls, S. Dak. (C)	6:16	6:00	6:30	7:15	7:45	8:15	8:00	7:30	6:45	6:45	6:00	5:30	4:16
North Platte, Nebr. (C)	5:46	6:15	6:45	7:15	7:30	7:45	7:45	7:15	6:45	6:00	5:30	5:16	Somerville, Mass. (E)	4:30	5:15	5:45	6:30	7:00	7:15	7:15	6:45	6:00	5:30	5:00	4:30	4:16
Oakland, Calif. (P)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	5:00	4:45	South Bend, Ind. (C)	4:45	5:15	5:45	6:30	7:00	7:15	7:15	6:45	6:00	5:30	5:00	4:30	4:16
Oil City, Pa. (E)	5:15	5:45	6:30	7:00	7:30	7:30	7:45	7:15	6:45	6:00	5:30	4:45	South Madison, Wis. (C)	4:45	5:30	6:00	6:45	7:15	7:45	7:30	7:00	6:15	5:15	4:30	4:16	4:16
Oklahoma City, Okla. (C)	5:45	6:15	6:30	7:00	7:30	7:45	7:45	7:15	6:45	6:00	5:30	5:16	Spartanburg, S. C. (E)	5:45	6:15	6:30	7:00	7:45	7:45	7:45	7:15	6:30	5:45	5:00	4:30	4:16
Olean, N. Y. (E)	5:00	5:45	6:15	6:30	7:00	7:45	7:45	7:15	6:30	5:30	5:00	4:45	Spokane, Wash. (P)	4:30	5:15	6:00	6:45	7:15	7:45	7:45	7:00	6:00	5:30	5:00	4:15	4:00
Olympia, Wash. (P)	4:45	5:30	6:15	7:00	7:45	8:15	8:00	7:30	6:30	5:30	4:45	4:15	Springfield, Ill. (C)	5:00	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	4:30
Omaha, Nebr. (C)	5:15	6:00	6:30	7:00	7:30	7:30	8:00	7:30	6:30	5:45	5:00	5:00	Springfield, Mass. (E)	4:45	5:15	6:00	6:30	7:00	7:30	7:30	7:00	6:45	6:00	5:15	4:30	4:15
Orlando, Fla. (E)	5:45	6:15	6:30	6:45	7:15	7:30	7:30	7:00	6:30	5:30	5:00	5:00	Springfield, Mo. (C)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:00	5:45	5:00	4:30	4:15
Palmdale, Tex. (C)	5:00	5:30	6:00	6:30	7:00	7:15	7:15	6:45	6:00	5:15	4:45	4:45	State College, N. Mex. (M)	5:30	5:45	6:15	6:30	7:00	7:15	7:15	7:00	6:15	5:30	5:00	4:30	4:15
Palm Springs, Tex. (C)	5:45	6:15	6:30	6:45	7:15	7:30	7:30	7:00	6:30	5:45	5:00	5:15	State College, Pa. (E)	5:00	5:45	6:15	6:45	7:15	7:45	7:45	7:15	6:15	5:30	5:00	4:30	4:15
Pampa, Tex. (C)	5:00	6:30	6:45	7:15	7:45	8:00	8:00	7:30	7:00	6:15	5:45	5:30	Stevens Point, Wis. (C)	4:45	5:30	6:00	6:45	7:15	7:45	7:45	7:00	6:15	5:15	4:30	4:15	4:15
Paragould, Ark. (C)	5:15	6:45	6:15	6:30	7:00	7:15	7:15	7:00	6:15	5:30	5:00	4:45	Stockton, Calif. (P)	5:15	5:45	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:30	5:00	4:45	4:45
Paris, Tex. (C)	5:30	6:00	6:30	7:00	7:15	7:30	7:30	7:15	6:30	5:45	5:15	5:15	Superior, Wis. (C)	4:45	5:30	6:15	6:45	7:00	7:30	7:30	7:00	6:15	5:15	4:30	4:15	4:15
Paterson, N. J. (E)	4:45	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	Syracuse, N. Y. (E)	5:00	5:30	6:15	6:45	7:15	7:45	7:45	7:15	6:15	5:30	4:45	4:30	4:15
Peoria Heights, Ill. (C)	4:00	4:30	5:00	5:30	6:00	6:30	6:30	6:00	5:15	4:45	4:30	4:30	Tacoma, Wash. (P)	4:45	5:30	6:15	7:00	7:45	8:15	8:00	7:30	6:30	5:30	4:30	4:15	4:15
Petersburg, Va. (E)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	5:00	5:00	Tallahassee, Fla. (E)	6:00	6:30	6:45	7:00	7:30	7:45	7:45	7:15	6:45	6:00	5:45	5:45	5:45
Pittsburg, Pa. (E)	5:15	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:00	5:00	Tambridge, Okla. (E)	5:15	6:00	6:30	7:00	7:30	7:30	7:00	6:30	5:45	5:45	5:15	5:00	4:45
Plattsburg, N. Y. (E)	4:45	5:15	6:00	6:30	7:00	7:45	7:45	7:00	6:30	5:15	4:45	4:45	Tampa, Fla. (E)	6:00	6:15	6:45	7:00	7:15	7:30	7:30	7:15	6:30	6:00	5:30	5:30	5:30
Pocahontas, Mo. (E)	5:15	6:30	6:30	6:45	7:15	7:45	7:45	7:15	6:30	5:45	5:00	5:00	Tempe, Tex. (C)	5:45	6:15	6:45	7:00	7:15	7:30	7:30	7:15	6:30	6:00	5:30	5:30	5:30
Ponca, P. R. (AST)	6:15	6:30	6:30	6:45	7:15	7:45	7:45	7:15	6:30	5:45	5:00	5:00	Terre Haute, Ind. (C)	4:45	5:30	6:00	6:30	6:45	7:15	7:15	6:45	6:00	5:15	4:45	4:30	4:30
Portland, Maine (E)	4:30	5:15	5:45	6:30	7:00	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Thomassville, Ga. (E)	6:00	6:30	6:45	7:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	4:30	4:30
Portland, Oreg. (P)	4:45	5:30	6:15	7:00	7:30	7:30	7:30	7:00	6:15	5:15	4:45	4:45	Toledo, Ohio (E)	5:30	6:00	6:45	7:15	7:45	8:15	8:15	7:30	6:45	6:00	5:15	5:00	5:00
Portsmouth, N. H. (E)	4:30	5:15	5:45	6:30	7:00	7:30	7:15	6:45	6:00	5:15	4:15	4:15	Topeka, Kans. (C)	5:30	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:15	5:00	5:00
Poyntney, Wis. (C)	4:45	5:30	6:00	6:45	7:15	7:45	7:45	7:00	6:15	5:15	4:30	4:15	Trenton, N. J. (E)	5:00	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:15	4:45	4:30	4:30
Providence, R. I. (E)	4:45	5:15	5:45	6:30	7:00	7:30	7:15	6:45	6:00	5:00	4:30	4:15	Troy, Ala. (C)	5:00	5:30	6:45	7:15	6:30	6:45	6:45	6:30	5:45	5:15	4:45	4:45	4:45
Pueblo, Colo. (M)	5:00	5:30	6:00	6:30	7:00	7:30	7:15	6:45	6:00	5:15	4:45	4:45	Tucson, Ariz. (M)	5:45	6:15	6:30	7:00	7:15	7:30	7:30	7:15	6:30	6:00	5:30	5:15	5:15
Pullman, Wash. (P)	4:30	5:15	6:00	6:30	7:00	7:15	7:45	7:00	6:00	5:00	4:15	4:00	Tulsa, Okla. (C)	5:30	6:00	6:30	7:00	7:30	7:45	7:45	7:15	6:30	5:45	5:15	5:15	5:15
Queens, N. Y. (E)	4:45	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:00	5:15	4:45	4:30	Tupaculoosa, Ala. (C)	5:15	5:45	6:00	6:30	6:45	7:00	7:00	6:45	6:00	5:30	5:00	4:45	4:45
Quincy, Ill. (C)	5:00	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Tusculum, Ill. (C)	4:45	5:30	6:00	6:30	7:00	7:15	7:15	6:45	6:00	5:15	4:45	4:30	4:30
Racine, Wis. (C)	4:45	5:15	6:00	6:30	7:00	7:30	7:30	7:00	6:00	5:15	4:30	4:15	Twin Falls, Idaho (M)	5:45	6:00	6:30	6:45	7:15	7:45	7:45	7:00	6:15	5:15	4:30	4:15	4:15
Raleigh, N. C. (E)	5:30	6:00	6:15	6:45	7:15	7:30	7:30	7:00	6:00	5:15	4:15	4:15	Tyler, Texas (C)	5:45	6:00	6:30	6:45	7:15	7:30	7:30	7:00	6:30	5:45	5:15	5:15	5:15
Reading, Pa. (E)	5:00	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Union City, Tenn. (C)	5:00	5:30	6:00	6:30	7:00	7:15	7:15	6:45	6:00	5:15	4:45	4:45	4:45
Reading, N. Y. (E)	4:45	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Urbana, Ill. (C)	4:45	5:30	6:00	6:30	7:00	7:00	7:15	6:45	6:00	5:15	4:45	4:30	4:30
Richmond, Va. (E)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	5:00	5:00	Utica, N. Y. (E)	4:45	5:30	6:00	6:30	6:45	7:15	7:45	7:45	7:00	6:15	5:15	4:45	4:30
Riohoke, Va. (E)	5:30	6:00	6:30	7:00	7:15	7:45	7:45	7:15	6:30	5:45	5:15	5:00	Vermillion, S. Dak. (C)	5:15	6:00	6:30	7:00	7:15	7:45	8:00	7:30	6:45	5:45	5:00	5:00	5:00
Rock Island, Ill. (C)	4:45	5:30	6:00	6:30	7:00	7:15	7:30	7:00	6:15	5:30	4:45	4:30	Vicksburg, Miss. (C)	5:15	5:45	6:15	6:30	7:00	7:15	7:15	6:45	6:15	5:30	5:00	5:00	5:00
Rome, Ga. (C)	5:00	5:30	6:00	6:30	7:00	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Walla Walla, Wash. (P)	4:30	5:15	6:00	6:45	7:00	7:15	7:45	7:45	7:00	6:00	5:15	4:15	4:15
Roseburg, Ore. (P)	5:00	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Washington, D. C. (E)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	5:00	4:45	4:45
Rutland, Vt. (E)	4:45	5:15	6:00	6:30	7:00	7:30	7:30	7:00	6:00	5:15	4:30	4:15	Waterbury, Vt. (E)	4:30	5:15	6:00	6:30	7:00	7:15	7:30	7:30	7:00	6:00	5:15	4:30	4:15
Sacramento, Calif. (P)	5:15	5:45	6:15	6:45	7:15	7:30	7:30	7:00	6:15	5:30	4:45	4:45	Waterloo, Iowa (C)	6:00	6:45	6:15	6:45	7:30	7:45	7:45	7:15	6:15	5:30	4:45	4:30	4:30
Salem, Oreg. (P)	5																									

FCC Rules and Regulations Pertaining to Relay, International, Television, Facsimile, High Frequency And Experimental Broadcast Stations

(Effective September 15, 1936)

GENERAL

980. The operating frequency of the broadcast stations as listed below shall be maintained within plus or minus the percentage of the assigned frequency as given in Table I.

Table I.

Station	Tolerance
Relay Broadcast	
(a) 1622 to 2830 kc	0.04%
(b) 31,100 to 41,400 and above	{ 10 watts 0.05% above 10 watts 0.05% (was 0.1%)
International Broadcast	0.01%
Television Broadcast	0.05%
Facsimile Broadcast	0.05% or less as required.
High Frequency Broadcast	0.01%
Experimental Broadcast	0.05% or less as required.

981. (a) The licensee of each broadcast station listed in Rule 980, except relay broadcast stations, shall operate at the transmitter a frequency monitor independent of the frequency control of the transmitter.

(b) The frequency monitor shall be designed and constructed in accordance with good engineering practice and shall have an accuracy sufficient to determine that the operating frequency is within one-half (½) of the allowed tolerance.

(c) The licensee of each relay broadcast station shall provide the necessary means for determining that the frequency of the station is within the allowed tolerance.

(d) The frequency of all stations listed in Rule 980 shall be checked at each time of beginning operation and as often thereafter as necessary to maintain the frequency within the allowed tolerance.

982. (a) Licenses for the following classes of broadcast stations will be normally issued for a period of one year expiring as follows:

Class of Station	Date of Expiration
Relay Broadcast	
(a) 1622 to 2830 kc	October 1
(b) 31,100 to 41,400 kc and above	December 1
International Broadcast	November 1
Television Broadcast	February 1
Facsimile Broadcast	March 1
High Frequency Broadcast	April 1
Experimental Broadcast	May 1

(b) Each licensee shall submit the application for renewal of license at least 60 days prior to the expiration date (Rule 103.15).

(c) A supplemental report shall be submitted with each application for renewal of license of a station operating on frequencies allocated on an experimental basis in accordance with the regulations governing each class of station.

983. (a) No frequency allocated on an experimental basis to broadcast stations listed in Rule 980 will be assigned exclusively to any licensee. In case interference will be caused by simultaneous operation, licensees shall endeavor to arrange satisfactory time division. If such agreement cannot be reached, the Commission will determine and specify the time division.

(b) The Commission may from time to time require the licensee of a station assigned a frequency or frequencies on an experimental basis to conduct experiments that are deemed desirable and reasonable for the development of the service.

(c) The program of research and experimentation as offered by an applicant in compliance with the requirements for obtaining a license on an experimental frequency shall be adhered to in the main, unless the licensee is authorized to do otherwise by the Commission.

(d) A licensee of a station assigned a frequency or frequencies on an experimental basis is not required to adhere to a regular schedule of operation but shall actively conduct a program of research and experimentation or transmission of programs, provided, however, licensees of experimental broadcast stations which are licensed to conduct special intermittent experiments, such as to develop and test commercial broadcast equipment, are required to operate only when there is a need therefor.

(e) A supplementary statement shall be filed with and made a part of each application for construction permit for a broadcast station which requests any frequency above 30,000 kilocycles, confirming the applicant's understanding:

1. That all operation upon these frequencies is on an experimental basis.
2. That these frequencies may not be the best suited to the particular service assigned.
3. That they may not be allocated eventually for such service.

984. (a) The licensee of each class of broadcast station listed in Rule 980 shall maintain adequate records of the operation, including:

1. Hours of operation.
2. Program transmitted.
3. Frequency check.
4. Pertinent remarks concerning transmission.
5. Research and experimentation conducted.
6. And any additional information specified in the regulations governing each class of station or for completing the supplemental report as required.

(b) The above information shall be made available upon request by authorized Commission representatives.

985. The licensee of each class of broadcast station listed in Rule 980 may make any changes in the equipment that are deemed desirable or necessary, provided:

1. That the operating frequency is not permitted to deviate more than the allowed tolerance.
2. That the emissions are not permitted outside the authorized band.
3. And that the power output complies with the regulations governing the same.

986. All classes of broadcast licenses authorize A₁ emission only unless otherwise specified on the license. In case A₁, or A₂ emission, or both is necessary or helpful in carrying on any phases of experimentation, application setting out fully the needs should be made to, and authority therefor received from, the Commission.

987. In case all the general rules and regulations and the specific rules governing each class of broadcast station do not cover all phases of operation or experimentation with respect to external effects, the Commission may make supplemental or additional orders in each case as deemed necessary for operation in the public interest, convenience, and/or necessity.


RELAY BROADCAST STATIONS

1000. The term "relay broadcast station" means a station licensed to transmit from points where wire facilities are not available, programs for broadcast by one or more broadcast stations or orders concerning such programs.

1001. (a) A license for a relay broadcast station will be issued only to the licensee of a regular broadcast station; provided however, in cases where it is impractical, impossible, or prohibited by laws or regulations for the licensee of a regular broadcast station to install, operate or maintain the necessary equipment under its legal control, the Commission may grant special temporary authority for each event to other persons to operate as a relay broadcast station equipment already licensed for another service, or equipment which may be installed under Section 319 (b) of the Communications Act of 1934 without a construction permit.

(b) The license of a relay broadcast station authorizes the transmission of commercial or sustaining programs, or orders concerning such programs, to be broadcast by its regular broadcast station and other broadcast stations transmitting the same programs simultaneously or a chain program to the network with which the licensee is regularly affiliated. The license of a relay station will not authorize transmission of programs to be broadcast solely by other broadcast stations not aforementioned.

(c) The Commission may license a special relay broadcast station to the



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holder of other classes of broadcast licenses provided the relay station will be used wholly in conjunction with the experimentation or relaying of programs for broadcast by that broadcast station.

(d) Each application for temporary authority to operate a relay broadcast station from a person other than a licensee of a regular broadcast station shall be accompanied by an application for authority to broadcast the program from the licensee of the regular broadcast station proposing the broadcast.

(e) An application for special temporary authority to operate another class of station as a relay broadcast station shall specify a group of frequencies allocated in Rule 1003; provided, however, in case of events of national interest and importance which cannot be transmitted successfully to the nearest available wire facilities on these frequencies, other frequencies under the jurisdiction of the Commission may be requested, if it is shown that the operation thereon will not cause interference to established stations.

(f) An application for special temporary authority to operate on frequencies not allocated by Rule 1003 or to operate another class of station as a relay broadcast station must be received by the Commission not less than ten days prior to the actual event to be broadcast, and shall contain complete information concerning the frequencies requested, the license of the station to be used, and the information specified in Rule 1002 (b), (1) (2) (3) (4). In case of emergencies, which shall be fully explained in the application, the Commission may waive the ten-day requirement specified herein.

1002. (a) The license of a relay broadcast station does not authorize operation except as provided in subsections (b), (c) and (d) of this Rule.

(b) An application which may be submitted either by letter or telegram, for authority to operate temporarily a relay broadcast station for each event or series of associated events to be broadcast, must be received at least two days before the first proposed operation, and shall include:

1. A statement as to the period of use desired.
2. Identification and succinct description of the event proposed to be broadcast.
3. A statement concerning the availability of wire facilities.
4. Location of the program transmitter and receiver.

(c) Relay broadcast stations licensed on the experimental frequencies allocated in Rule 1003 (c) may be operated at any time for experimental purposes without notice to the Commission if no interference results to established stations and the program transmitted is not rebroadcast.

(d) In case of events occurring about which the licensee had no means of obtaining information two days in advance, such as earthquakes, airplane accidents, fires, etc., the application to and authority from the Commission as required in subsection (b) of this rule will be waived, provided the Commission is advised by telegram sent before the broadcast as to the details of the events and the expected duration of the broadcast.

1003. (a) The following groups of frequencies are allocated for assignment to relay broadcast stations:

Group A	Group B	Group C
1622 kc	1606 kc	1646 kc
2058	2022	2090
2150	2102	2190
2790	2758	2830

(b) One group including all four frequencies will be assigned each station. The first application from any metropolitan area shall specify Group A; the second Group B, and the third Group C, the fourth Group A again, etc. Outstanding assignments not following this order will not be changed unless a need therefor develops. Additional applications shall specify the next unassigned group in sequence or any other group if it appears interference will be avoided thereby.

(c) The following groups of frequencies are allocated for relay broadcast stations on an experimental basis (experimental frequencies):

Group D	Group E	Group F	Group G
31,100 kc	38,900 kc	39,700 kc	Any four frequencies above 86,000 kc except in band 400,000 to 401,000 kc
34,600	39,100	39,900	
37,600	39,300	40,800	
40,600	39,500	41,400	

(d) One group including all four frequencies will be assigned each station. Any four specific frequencies under Group G which appear most suitable for the experimental work to be conducted may be assigned.

(e) The licensee of a station on Group D, E, F or G shall carry on research and experimentation for the advancement of the relay broadcast art and development of these very high frequencies for relay broadcast services. An application for authority to construct a station for operation on the experimental frequencies shall include a statement concerning the research and experiments to be conducted. The research and experiments shall indicate reasonable promise of substantial contribution to the development of the program relay services.

(f) A license authorizes operation on only one of the four assigned frequencies at any one time. In case it is desired to transmit programs and spoken orders concerning such programs simultaneously, two licenses are required though each may specify the same group of frequencies.

1004. In case two or more stations are assigned for the same group of frequencies in the same area and have been authorized to operate under Rule 1002 (b), the licensees shall endeavor to select frequencies to avoid interference. If a mutual agreement to this effect cannot be reached, the Commission shall be notified and it will specify the frequencies on which each station is to be operated.

1005. A relay broadcast station shall be operated with a power output not in excess of that necessary to transmit the program and orders satisfactorily to the receivers, and in no event greater than the licensed power.

1006. The licensee of a relay broadcast station assigned the experimental frequencies under Rule 1003 (c) shall submit a supplemental report with and made a part of each application for renewal of license as follows:

1. Number of hours operated for experimental purposes.
2. Developments in the relay broadcast service.

3. Propagation characteristics of the frequencies assigned with regard to relay broadcast service.
4. All developments or major changes in equipment.
5. Any other pertinent developments.

INTERNATIONAL BROADCAST STATIONS

1010. The term "international broadcast station" means a station licensed for the transmission of broadcast programs for international public reception. Frequencies for these stations are allocated from bands assigned (between 6,000 and 26,000 kilocycles) for broadcasting by Article 7, General Radio Regulations, annexed to the International Telecommunication Convention, Madrid, 1932.

1011. A license for an international broadcast station will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development of the international broadcast service.
2. That the station will render an international broadcast service.
3. That the program production and experimentation will be conducted by qualified persons.
4. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.
5. That the public interest, convenience and necessity will be served through the operation of the proposed station.

1012. (a) A licensee of an international broadcast station shall not make any charge directly or indirectly for the transmission of programs, but may transmit the programs of a regular broadcast station or network, including commercial programs, if the call letter designation when identifying the international broadcast station is given on its assigned frequency only and the statement is made over the international broadcast station that the program of a broadcast station or network (identify by call letters or name of network) is being broadcast. In case of the rebroadcast of the program of any broadcast station, Rule 177 applies.

(b) No licensee of any other broadcast station or network shall make any additional charge, directly or indirectly for the simultaneous transmissions of programs by the international broadcast station, nor shall commercial accounts be solicited by a licensee of another broadcast station or network or by others acting in their behalf upon presentation that the commercial program will also be transmitted by an international broadcast station.

(c) Station identification and program announcements shall be made with international significance suited for the foreign nation or nations for which the service is primarily intended or in which the reception is believed to be best on account of the frequency, season, hour of operation, etc.

1013. (a) The following groups of frequencies are allocated for assignment to international broadcast stations on an experimental basis:

Group A	Group B	Group C	Group D	Group E	Group F	Group G	Group H	Group I
kc	kc	kc	kc	kc	kc	kc	kc	kc
6020	9510	11,710	15,110	15,250	17,700	21,460	25,625	
6040	9530	11,750	15,150	15,270	17,780	21,480	25,650	
6060	9570	11,770	15,170	15,290	17,800	21,520	25,675	
6080	9590	11,700	15,190	15,310		21,540	25,725	
6100		11,810	15,210	15,330			25,750	
6140		11,830	15,230				25,800	
		11,850					25,825	
		11,870					25,850	
		11,890					25,875	

(b) A separate license and call letter designation will be issued for each frequency except that where frequencies in two or more groups are required to maintain a particular international broadcast service to certain foreign country or countries, one frequency from each of the groups required may be authorized by one license and one call letter designation. In such cases these frequencies shall be used consecutively during a day as required and they shall not be used simultaneously either on the same transmitter or different transmitters.

(c) Not more than one frequency in any group in subsection (a) of this rule will be assigned to a station.

(d) An applicant shall select the frequency which it is believed is best suited to the experiments to be conducted, for reception in the foreign country or countries for which the service is intended, and for a minimum of interference to other international broadcast stations.

(e) Applicants shall file a separate application for each frequency or frequencies requested in different groups as provided in subsection (b) of this rule.

1014. (a) No international broadcast station will be licensed for a power output rating less than 5 kilowatts.

(b) While conducting apparatus experiments and in case adequate signal is delivered in the foreign country being served, the operating power output may be less than 5 kilowatts.

1015. A supplemental report shall be filed with and made a part of each application for renewal of license and shall include statements of the following:

1. The number of hours operated on each frequency.
2. A list of programs transmitted of special international interest.
3. Outline of reports of reception and interference and conclusions with regard to propagation characteristics of the frequency assigned.
4. Research and experiments being carried on to improve transmission and to develop international broadcast and the frequencies assigned.
5. All developments or major changes in equipment.
6. Any other pertinent developments.

VISUAL BROADCAST SERVICE

1030. The term "visual broadcast service" means a service rendered by stations broadcasting images for general public reception. There are two classes

(Continued on page 330)

Facsimile Broadcast Stations in the United States

(Licensed by FCC as of January 1, 1937)

Call Letters	Licensee and Location	Frequencies in Kilocycles	Power in Watts	Call Letters	Licensee and Location	Frequencies in Kilocycles	Power in Watts
W7XBD	Oregonian Publishing Co. Portland, Ore.	1614, 2398, 3492.5	1,000	W9XAG	The Journal Co. Milwaukee, Wis.	1614, 2398, 3492.5	1,000
W2XNB	Radio Pictures, Inc. Long Island City, N. Y.	1614, 2012, 2398, 23100 41000, 86000-400000	1,000	W9XAF	The Journal Co. Milwaukee, Wis.	4797.5, 6426, 8665	500

(Continued from page 329)

of stations recognized in the visual broadcast service, namely: television broadcast stations and facsimile broadcast stations.

TELEVISION BROADCAST STATIONS

1031. 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 the synchronized sound (aural broadcast) is considered an essential phase of television broadcasting and one license will be issued for both visual and aural broadcast as hereinafter set out.

1032. A license for a television broadcast station will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development of the television broadcast art.
2. That the program of research and experimentation will be conducted by qualified engineers.
3. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.
4. That the public interest, convenience and/or necessity will be served through the operation of the proposed station.

1033. (a) A licensee of a television broadcast station shall not make any charge, directly or indirectly, for the transmission of either aural or visual programs.

(b) In the case of experimental televising of the production of a commercial broadcast program, all commercial announcements not a part of the entertainment content of the name of the sponsor or product or the televising of the trade-mark, symbol, slogan or product of the sponsor; provided, however, that when the program transmission is incidental to the experiments being conducted and not featured, and subject to interruptions as the experiments may require, the commercial announcements may be broadcast aurally.

(c) No licensee of any other broadcast station or network shall make any additional charge, directly or indirectly, for the simultaneous transmission of the aural or visual program by a television broadcast station, nor shall commercial accounts be solicited by the licensee of another broadcast station or network, or by others acting in their behalf upon the representation that the commercial program will also be transmitted by a television broadcast station.

(d) The synchronized sound (aural) program of a television broadcast station may be broadcast by a regular broadcast station, provided:

1. That no announcements or references shall be made over the regular broadcast station regarding the operation of the television broadcast station, except the mere statement that the program being transmitted is the sound or aural program of a television broadcast station (identify by call letters).
2. That the call letter designation when identifying the television broadcast station shall be given on its assigned frequency only.

1034. (a) The following groups of frequencies are allocated by bands for assignment to television broadcast stations on an experimental basis:

Group A	Group B	Group C	Group D
2000 to 2100 kc	42,000 to 56,000 kc	60,000 to 80,000 kc	Auy 6,000 kc frequency band above 110,000 kc excluding 400,000 to 401,000 kc.

(b) A licensee of a television station for Group A shall carry forward a comprehensive program of experimentation to determine the secondary or rural coverage of the station, and shall suitably locate receiving equipment and other apparatus, and shall make the necessary measurements to determine the quality and characteristics of the secondary or sky-wave service area. Television transmission only will be authorized in this band, and each license will authorize the entire band. No aural broadcast will be authorized therein.

(c) A license for a television broadcast station in groups B, C or D will specify a frequency band wherein two adjacent carrier frequencies shall be selected, one for the visual and one for the aural broadcast. The lower carrier frequency shall be for visual broadcast and the higher carrier frequency for the aural broadcast.

(d) A licensee will be granted only one station in each frequency group for operation in the same service area.

(e) An application may be made for one frequency band (to include the visual and the aural carriers) in groups B, C and D. However, if it is desired to operate in more than one group, it will be necessary to make separate applications for a station in each group.

(f) Applicants shall specify the band width of the emissions required for the proposed transmission.

(g) Carrier frequencies shall be so selected and emissions controlled that no emission from any cause will result outside the frequency band authorized by the license.

(h) An applicant shall select a frequency band in the group which is believed best suited for the experiments to be conducted and will cause the least or no interference to established stations.

1035. The power output rating of a television broadcast station shall not be in excess of that necessary to carry forward the program of research. The operating power may be maintained at the maximum rating or less, as the conditions of operation may require.

1036. A supplemental report shall be filed with and made a part of each application for renewal of license and shall include statements of the following:

1. Number of hours operated for transmission of television programs.
2. Comprehensive report of research and experimentation conducted.
3. Conclusions and program for further developments of the television broadcast service.
4. All developments and major changes in equipment.
5. Any other pertinent developments.

FACSIMILE BROADCAST STATIONS

1040. The term "facsimile broadcast station" means a station licensed to transmit images of still objects for record reception by the general public.

1041. A license for a facsimile broadcast station will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development of the facsimile broadcast service.
2. That the program of research and experimentation will be conducted by qualified engineers.
3. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.
4. That the public interest, convenience and/or necessity will be served through the operation of the proposed station.

1042. (a) A licensee of a facsimile broadcast station shall not make any charge, directly or indirectly, for the transmission of programs.

(b) No licensee of any other broadcast station or network shall make any additional charge, directly or indirectly, for the transmission of programs by a facsimile broadcast station, nor shall commercial accounts be solicited by any licensee of another broadcast station or network, or others acting in their

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High Frequency Broadcast Stations in the United States

All Authorized to Use Frequencies 31600, 35600, 38600, 41000 Kilocycles, Unless Otherwise Indicated

(Licensed by FCC as of January 1, 1937)

Call Letters	Licensee, Location and Affiliated Broadcasting Station	Power in Watts	Call Letters	Licensee, Location and Affiliated Broadcasting Station	Power in Watts
W6XAS	Julius Brunton & Sons Co., San Francisco (KJBS)	10	W5XWJ	Evening News Ass'n, Detroit, Mich. (WVWJ)	100
W6XAZ	The Journal Company, Milwaukee (WTMJ)	500	W2XDV	Columbia Broadcasting System, New York City (WABC)	500
W6XKG	Ben S. McGlashan, Los Angeles (KGFJ)	100	*W4XH	The Voice of South Carolina, Spartanburg, S. C. (WSPA)	500
W6XER	Midland Broadcasting Co., Inc., Kansas City (KMBC)	600	W1XER	Shepard Broadcasting Service, Boston, Mass. (WNAC)	600
W6XHW	Columbia Broadcasting System, Minneapolis (WCCO)	100	W2XDG	National Broadcasting Co., Inc., New York City (WEAF-WJZ)	5,000
W6XPD	Pulitzer Publishing Co., St. Louis (KSD)	50	W2XHG	National Broadcasting Co., Inc., Bound Brook, N. J. (WJZ)	1,500
W6XOR	Star-Chronicle Publishing Co., St. Louis	100	W9XBS	National Broadcasting Co., Inc., Chicago (WMAQ-WENR)	2,600
W6XJL	Stromberg-Carlson Telephone Mfg. Co., Victor Township, N. Y. (WHAM)	100	W1XKB	Westinghouse E. & M. Co., E. Springfield, Mass. (WBZA)	500
W6XKH	WBEW, Inc., Buffalo, N. Y. (WBEW)	100	W1XKA	Westinghouse E. & M. Co., Boston, Mass. (WBZ)	50
W6XAU	WKY Radiophone Co., Oklahoma City (WKY)	100	W3XKA	Westinghouse E. & M. Co., Philadelphia Pa. (KYW)	50
*W2XMN	E. H. Armstrong, New York City	40,000	W8XKA	Westinghouse E. & M. Co., Pittsburgh (KDKA)	150
W1XEQ	E. Anthony & Sons, Inc., Fairhaven, Mass. (WNBH)	100	W4XCA	Memphis Commercial Appeal, Inc., Memphis, Tenn. (WMC)	250
W3XEV	The Baltimore Radio Show, Inc., Baltimore, Md. (WFBR)	100	W3XES	Monumental Radio Co., Baltimore, Md. (WCAO)	300
W3XJL	Head of the Lakes Broadcasting Co., Superior, Wis. (WEBC)	50	W4XBW	WDDO Broadcasting Corp., Chattanooga, Tenn. (WDDO)	100
	† Has a frequency of 26400 kc. only.		W3XEX	WTAR Radio Corp., Norfolk, Va. (WTAR)	50

* Construction permit for 25950 kc. frequency.
† Special frequency modulation of 41600, 86500-111000 kc.

below, upon representation that images concerning that commercial program will be transmitted by a facsimile station.

1043. (a) The following frequencies are allocated for assignment to facsimile broadcast stations on an experimental basis provided no interference is caused to the television stations operating in the band 2000-2100 kilocycles:

2012 kc.	2016 kc.	2096 kc.
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(b) If the facsimile program of research and experimentation cannot be properly carried forward on the frequencies in subsection (a) of this rule due to the characteristics of these frequencies, applicants may request and be assigned any frequency specified in Rule 1073 on an experimental basis.

(c) Other frequencies under the jurisdiction of the Commission may be assigned for experimental operation of facsimile broadcast stations on an experimental basis provided a sufficient need therefor is shown and no interference will be caused to established radio stations.

(d) Each facsimile broadcast station will be licensed for only one frequency except in subsection (b) of this rule more than one frequency may be licensed to one station if need therefor is shown.

(e) Each applicant shall specify the frequency or frequencies desired and the maximum modulating frequencies proposed to be employed.

(f) The operating frequency of a facsimile broadcast station shall be maintained in accordance with the frequency assignments as shown by Rule 980 provided, however, where a more strict adherence to the assigned frequency is necessary to prevent interference, the Commission will specify the tolerance.

(g) A facsimile broadcast station authorized to operate on frequencies regularly allocated to other stations or services shall be required to abide by all rules governing the stations regularly operating thereon, which are applicable to facsimile broadcast stations and are not in conflict with Rules 980 to 986, inclusive, and Rules 1020 to 1039, inclusive, excluding Rule 1035.

1044. The power output rating of a facsimile broadcast station shall not be in excess of that necessary to carry forward the program of research. The operating power may be maintained at the maximum rating or less, as the conditions of operation may require.

1045. A supplemental report shall be filed with and made a part of each application for renewal of license and shall include statements of the following:

1. Number of hours operated for transmission of facsimile programs.
2. Comprehensive report of research and experimentation conducted.
3. Conclusions and program for further developments of the facsimile broadcast service.
4. All developments and major changes in equipment.
5. Any other pertinent developments.

HIGH FREQUENCY BROADCAST STATIONS

1050. The term "high frequency broadcast station" means a station licensed on frequencies above 25,000 kilocycles for transmission of aural programs for general public reception. The frequencies for these stations are allocated on an experimental basis.

1051. A license for a high frequency broadcast station will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and experimentation which indicates reasonable promise of substantial contribution to the development of very high frequency broadcasting.
2. That data will be taken on the propagation characteristics of these frequencies; on the shadows cast by buildings, hills, large bridges, etc.; on the noise level in different parts of the city; on the field intensity necessary to render good broadcast service; on antenna design and characteristics with respect to propagation; and on other allied phases of broadcast coverage.
3. That the research and experimentation will be conducted by qualified engineers.
4. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.
5. That the public interest, convenience and necessity will be served through the operation of the proposed station.

1052. (a) A licensee of a high frequency broadcast station shall not make any charge, directly or indirectly, for the transmission of programs, but may transmit the programs of a regular broadcast station or network including commercial programs, if the call letter designation when identifying the high frequency broadcast station is given on its assigned frequencies only and the statement is made over the high frequency broadcast station that the program of a broadcast station or network (identify by call letters or name of network) is being broadcast. In case of the rebroadcast of the program of any broadcast station, Rule 177 applies.

(b) No licensee of any other broadcast station or network shall make any additional charge, directly or indirectly, for the simultaneous transmissions of programs by the high frequency broadcast station, nor shall commercial accounts be solicited by a licensee of another broadcast station or network, or by others acting in their behalf upon representation that the commercial program will also be transmitted by a high frequency broadcast station.

1053. (a) The following groups of frequencies are allocated for high frequency broadcast stations on an experimental basis:

Group A	Group B	Group C	Group D	Group E
25,950 kc	26,400 kc	31,600 kc	40,300 kc	Any four frequencies above 86,000 kc except in the band
26,050	26,450	35,600	41,200	200 kc
26,100	26,500	38,600	41,600	400,000 to 401,000 kc
26,150	26,550	41,000	41,800	

(b) Frequencies in groups A and B will be assigned exclusively for amplitude modulation with a band width for high fidelity transmission (30 kilocycles maximum). Frequencies in groups C and E will be assigned for either amplitude modulation with the above band width or frequency modulation with a total band width not greater than 200 kilocycles. Frequencies in group D will be assigned exclusively for frequency modulation with a band width not greater than 200 kilocycles.

(c) In groups A, B and D only one frequency from each group will be assigned a licensee for operation in the same service area. A separate license and call letters will be assigned for each frequency. In group C all four fre-

(Continued on page 332)

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1901

Experimental Broadcast Stations in the United States

(Licensed by FCC as of January 1, 1937)

Call Letters	Licensee and Location	Frequencies in Kilocycles	Power in Watts	Call Letters	Licensee and Location	Frequencies in Kilocycles	Power in Watts
W3XDD	Bell Telephone Laboratories New York City	560, 900, 1340	5,900	W3XL	National Broadcasting Co. Bound Brook, N. J.	1614, 2398, 3492.5, 4797.5, 6425, 8655, 12862.5, 17310	100,000
W1XEY	Connecticut State College Storrs, Conn.	86000-400000, 401000	500	W2XKI	National Broadcasting Co. New York City	175000-180000	15
W8XO	Crosley Radio Corp. Mason, Ohio	700	500,000	W1XAC	Shepard Broadcasting Service Quincy, Mass.	61600	100
W10XR	National Broadcasting Co. (Portable or Mobile)	1614, 3492.5, 4797.5, 6425, 8655, 12862.5, 17310, 26700, 26000, 27100, 31100, 34600, 37600, 40600, 86000-40000, 401000	100	W1XEH	Travelers Broadcasting Service Avon, Conn.	63600	150
				WEXAR	Westinghouse E. & M. Co. Saxonburg, Pa.	980	50,000 500,000

(Continued from page 331)

quencies and in group E any four frequencies will be authorized by each license. A license authorizes operation on only one of the four assigned frequencies at any one time.

(d) An applicant shall file separate application for each frequency requested in groups A, B or D. Each application therefor shall specify all four frequencies in Group C and any four frequencies in Group E.

(e) An applicant shall select the frequency which it is believed is best suited for the experiments to be conducted and which will cause the least or no interference to established stations.

(f) A licensee operating on a frequency in Groups A or B shall request reports concerning any reception outside the North American Continent. The request for reports shall be made several times each day, when the station identification is given.

1054. (a) No high frequency broadcast station will be licensed for an output power rating greater than 1000 watts unless the applicant can show that greater power is needed to carry on a special program of research.

(b) While conducting apparatus experiments and in case adequate signal for reliable service can be delivered with less power, the operating output may be reduced accordingly.

1055. Each high frequency broadcast station transmitter shall be equipped with automatic frequency control apparatus so designed and constructed that it is capable of maintaining the operating frequency within plus or minus 0.01% of the assigned frequency.

1056. A supplemental report shall be filed with each and made a part of the application for renewal of license and shall include statements of the following, among others:

1. The number of hours operated.
2. Data taken in compliance with Rule 1051 (2).
3. Outline of reports of reception and interference and conclusions with regard to propagation characteristics of the frequency assigned.
4. Research and experiments being carried on to improve transmission and to develop broadcasting on the very high frequencies.
5. All developments or major changes in equipment.
6. Any other pertinent developments.
7. Comprehensive summary of all reports received. See Rule 1053 (f).

EXPERIMENTAL BROADCAST STATIONS

1070. The term "experimental broadcast station" means a station licensed to carry on development and research for the advancement of broadcast services along lines other than those prescribed by other broadcast rules.

1071. (a) Licenses for experimental broadcast stations will be issued only after a satisfactory showing has been made in regard to the following, among others:

1. That the applicant has a program of research and development which cannot be successfully carried on under any of the classes of broadcast stations already allocated, or is distinctive from those classes.
2. That the program of research has reasonable promise of substantial contribution to the development of broadcasting, or is along lines not already thoroughly investigated.
3. That the program of research and experimentation will be conducted by qualified persons.
4. That the applicant is legally and financially qualified and possesses adequate technical facilities to carry forward the program.
5. That the public interest, convenience and necessity will be served through the operation of the proposed station.

(b) A separate experimental broadcast station license will be issued for each major development proposed to be carried forward. When it is desired to carry on several independent developments, it will be necessary to make satisfactory showing and obtain a license for each.

1072. (a) A licensee of experimental broadcast stations shall broadcast programs only when they are necessary to the experiments being conducted. No regular program service shall be broadcast unless specifically authorized by the license.

(b) A licensee of an experimental broadcast station shall not make any charge, directly or indirectly, for the transmission of programs, but may transmit the programs of a regular broadcast station or network including commercial programs, if the call letter designation when identifying the experimental broadcast station is given on its assigned frequency only and the statement is made over the experimental broadcast station that the program of a broadcast station or network (identify by call letters or name of network) is being broadcast in connection with the experimental work. In case of the re-broadcast of the program of any broadcast station, Rule 177 applies.

*Also available for assignment to general experimental stations in services other than broadcast.

1073. (a) The following frequencies are allocated for assignment to experimental broadcast stations:

1,614, 2,396, 2,398, 2,400, 3,490, 3,492.5, 3,495, 4,795, 4,797.5, 4,800, 6,420, 6,425, 6,430, 8,650, 8,655, 8,660, 12,855, 12,862.5, 12,870, 17,300, 17,310, 17,320, 23,100, 25,700, 26,000, 27,100, 30,100, 31,100, 31,900, 33,100, 34,600, 35,600, 37,100, 37,900, 38,000, 40,100, 40,600, 41,000, 86,000 to 400,000, 401,000 and above.

(b) A license will be issued for more than one of these frequencies upon a satisfactory showing that there is need therefor.

(c) The frequencies suited to the purpose and in which there appears to be the least or no interference to established stations shall be selected.

(d) In cases of important experimentation which cannot be conducted successfully on the frequencies allocated in subsection (a) of this Rule, the Commission may authorize experimental broadcast stations to operate on any frequency allocated for broadcast stations or any frequencies allocated for other services under the jurisdiction of the Commission upon satisfactory showing that such frequencies can be used without causing interference to established services.

1074. (a) The operating frequency of an experimental broadcast station shall be maintained in accordance with the frequency tolerance as shown by Rule 980, provided, however, where a more strict adherence to the assigned frequency is necessary to prevent interference, the Commission will specify the tolerance.

(b) The power output rating of an experimental broadcast station will not be in excess of that necessary to carry on the program of research. The operating power may be maintained at the maximum rating or less, as the conditions of operation may require.

1075. A supplemental report shall be filed with and made a part of each application for renewal of license and shall include statements of the following, among others:

1. The number of hours operated.
2. Comprehensive report on research and experiments conducted.
3. Conclusions and program for further development of the broadcast service.
4. All developments and major changes in equipment.
5. Any other pertinent developments.

1076. An experimental broadcast station authorized to operate on frequencies regularly allocated to other stations or services, shall be required to a degree by all rules governing the stations operating regularly thereon which are applicable to experimental broadcast stations and are not in conflict with Rules 980 to 986, inclusive, and Rules 1070 to 1075, inclusive.

PAUL F. GODLEY

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Montclair, N. J.

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Television Broadcast Stations in the United States

(Licensed by FCC as of January 1, 1937)

Call Letters	Licensee and Location	Power in Watts	Call Letters	Licensee and Location	Power in Watts
2,000-2,100 Kilocycles					
W9XK ¹	University of Iowa, Iowa City, Ia.	100	W0XAK ²	Kansas State College of Agriculture & Applied Science, Manhattan, Kan.	125
W9XG ³	Purdue University, W. LaFayette, Ind.	1,500			
42,000-56,000 and 60,000-86,000 Kilocycles					
W2XAX	Columbia Broadcasting System, Inc., New York City	50	W5XAN	Sparks-Withington Co., Jackson, Mich.	100
W6XAO ⁴	Don Lee Broadcasting System, Los Angeles	150	WDXAT ⁵	Dr. George W. Young, Minneapolis, Minn.	500
W8XD ⁶	The Journal Co., Milwaukee, Wis.	500	WIXG	General Television Corp., Boston	500
W8XE	Philco Radio & Television Corp., Philadelphia	10,000	W0XAL ⁷	First National Television Co., Kansas City	300
W8XEP	RCA Mfg. Co., Camden, N. J.	30,000	W0XUI ⁸	University of Iowa, Iowa City, Ia.	100
W10XX	RCA Mfg. Co., Camden, N. J. (portable-mobile)	50	W2XBS	National Broadcasting Co., New York City	12,000
W2XDR ⁹	Radio Pictures, Inc., Long Island City, N. Y.	1,000	W3XPF	Farnsworth's Television Inc., Philadelphia	1,000

¹ Also licensee of station WSUI, Iowa City, Iowa.
² Also licensee of station KSAC, Manhattan, Kan.
³ Also licensee of station KRLJ, Los Angeles
⁴ Also licensee of station WTMJ, Milwaukee

⁵ Also licensee of station WQRY, Long Island City, N. Y. on 1550 kc.
⁶ Also licensee of station WDQY, Minneapolis
⁷ Also licensee of station KXBY, Kansas City, Mo.
⁸ Also licensee of station WBAW, W. LaFayette, Ind.

U. S. and Foreign Television Laboratories and Experimental Services

(See log of U. S. experimental stations above)

United States

RCA MANUFACTURING Co.—RCA Victor Division, Camden, N. J. Telephone: Camden 8000. Vice President in Charge of Research and Engineering: L. M. Clement, Director of General Research; E. W. Engstrom, Television Scientist; Vladimir Zworykin. (Experimental stations).

PHILCO RADIO & TELEVISION Co.—Ontario & C Streets, Philadelphia, Pa. Telephone: Nebraska 5100. Chief Television Engineer: A. F. Murray. (Experimental station).

FARNSWORTH TELEVISION Inc.—127 E. Mermaid Lane, Philadelphia, Pa. Telephone: Chestnut Hill 5906. Director: Philo T. Farnsworth. Chief Engineer: A. H. Brally. (Experimental station).

BELL TELEPHONE LABORATORIES—463 West St., New York City. (Visual transmission and coaxial cable experimentation).

FIRST NATIONAL TELEVISION Corp.—Power & Light Bldg., Kansas City, Mo. Telephone: Harrison 5818. Director: Sidney Q. Noel. (Experimental station).

DON LEE BROADCASTING SYSTEM—Television division, 7th & Bixel St., Los Angeles, Cal. Telephone: Vaudlike 7111. Director: Harry Lubcke. (Experimental station).

ATLANTIC BROADCASTING Corp.—Subsidiary of Columbia Broadcasting System, 485 Madison Ave., New York City. Telephone: Wickersham 2-2000. Technical Director: Edwin K. Cohan. (Experimental station).

NATIONAL BROADCASTING Co.—RCA Bldg., New York City. Telephone: Circle 7-8900. Director of Research & Development: C. W. Horn. Chief Engineer: O. B. Hanson. Development Engineer: Robert M. Morris. (Experimental station).

RADIO PICTURES Inc.—41 Park Row, New York City. Telephone: Cortlandt 7-9796. Director: John V. L. Hogau. (Experimental station).

INTERNATIONAL TELEVISION RADIO Corp.—71 W. 23rd St., New York City. Telephone: Stuyvesant 9-2416. President: William H. Priess.

NATIONAL TELEVISION Corp.—52 Vanderbilt Ave., New York City. Telephone: Vanderbilt 3-0018.

SPARKS-WITHINGTON Co.—Jackson, Mich. (Experimental station).

THE MILWAUKEE JOURNAL—333 W. State St., Milwaukee, Wis. Telephone: Marquette 6000. Director: Walter J. Damm. (Experimental station).

PURDUE UNIVERSITY—West Lafayette, Ind. Telephone: 2917. Directors: Dr. C. F. Harding, Prof. R. H. George, H. J. Heim. (Experimental station).

UNIVERSITY OF IOWA—Iowa City, Ia. Director of Television: Prof. E. B. Kurtz. (Experimental station).

KANSAS STATE COLLEGE OF AGRICULTURE—Manhattan, Kan. (Experimental station).

DR. GEORGE W. YOUNG—Radio Station WJGY, Minneapolis, Minn. Telephone: Cherry 3377. Technical Director: George K. Jacobson. (Experimental station).

PECK TELEVISION Corp.—51 Vesey St., New York City. Telephone: Barclay 7-2925. Director: William Hoyt Peck.

Foreign

BRITISH BROADCASTING Corp.—Broadcasting House, London W-1, England. Telephone: Welbeck 4408. Director of Television: Gerald Cook. Chief Engineer: Sir Noel Ashbridge. (Operates television broadcasting service, all others either producing transmitting or receiving equipment, or both.)

ELECTRIC & MUSICAL INDUSTRIES Ltd. (EMI)—Blythe Road, Hayes, Middlesex, England. Telephone: Southall 2408. Technical Director: I. Schloenberg. Affiliated with Marconi-E.M.I. Television Co. Ltd., the Gramophone Co., and H.M.V. (the Gramophone Co.).

BAIRD TELEVISION Ltd.—Crystal Palace, London SE-19, England. Telephone: Sydenham 6930. Managing Director: John Leslie Baird. Technical Director: Capt. A. G. D. West. (Associated with Gaumont British Films, which also owns Bush Radio Ltd.).

MARCONIPHONE Co. Ltd.—210 Tottenham Court Road, London, England. Telephone: Museum 4144. Chief of Television Department: A. S. Radford. (Manufactures IMV receivers.)

THE GRAMOPHONE Co. Ltd.—Hayes, Middlesex, England. Telephone: Southall 2408.

EDISON SWAN ELECTRIC Co. Ltd.—155 Charing Cross Road, London WC-2, England. Telephone: Gerard 8600. Manager of Radio Division: W. W. Burnham.

SCOPHONY Ltd.—Thornwood Lodge, Camden Hill, London W-8, England. Telephone: Park 8181. Director: Solomon Sagall. (Associated with E. K. Cole Ltd., producer of EKCO receivers.)

BUSH RADIO Ltd.—Woodger Road, Shepherds Bush, London, England. Telephone: Shepherds Bush 5341-4. (Manufacturers Baird receivers.)

GENERAL ELECTRIC Co. Ltd.—Magnet House, Kingsway, London, England. Telephone: Temple Bar 8000. Director of Research: C. C. Paterson.

FERRANTI Ltd.—Radio Works, Moston, Manchester 10, England. Telephone: Faulstich 2271. Manager of Television Department: M. K. Taylor.

PYE RADIO Ltd.—Radio Works, Cambridge, England. Telephone: Cambridge 3434. Technical Director: T. A. W. Robinson.

A. C. COSSOR Ltd.—Cossor Works, Highbury Grove, London, England. Telephone: Canonbury 1234. Chief of Television Department: L. H. Bedford.

HALCYON RADIO Ltd.—Sterling Works, Dagenham, Essex, England. Telephone: Seven Kings 3466.

FERNSEH A. G.—Berlin Zehlendorf Goerzallee, Berlin, Germany. Telephone: H4 Zehlendorf 0111. President: Dr. Paul Goertz.

TELEFUNKEN G. m. b. H.—(Affiliated with RCA). Berlin, Germany. Director: Dr. Rukop.

DR. ARTHUR KRONE—Grunewald Wangenheimstrasse, Berlin-Charlottenberg, Germany.

REICHSPOST MINISTERIUM—Collaborating with Reichs-Rundfunk-Gesellschaft, Leipziger Strasse, Berlin W-66, Germany. Director: Dr. Giess.

RADIO AKTIENGESELLSCHAFT—Weissenway 10, Berlin, Germany. Telephone: G9 Albrecht 1111. Director: Dr. Sigmund Loeve.

REICHS-RUNDFUNK-GESELLSCHAFT—German Broadcasting Co., Rundfunk Haus, Berlin, Germany. Director: Dr. Berner Nestel.

COMPAGNIE DES COMPTEURS—R. Barthelmy Radio T.S., 198 Terr., Blvd. St. Germain, Paris, France. Director: Dr. R. Barthelmy.

N. V. PHILIPS' GLOBILAMPEN-FABRIKKN—(Philips Works) Eindhoven, Holland. President: Dr. A. F. Philips. Director: Dr. Balh van der Pol.

EMYRADIO (SARL)—19 Rue de l'Ancienne Comedie, Paris, France. Telephone: Danton 48-79.

ENTE ITALIANO AUDIZIONI RADIOPHONICHE—(EIAR), Italian Broadcasting Co., Turin, Italy. Director of Television: Alessandro Banfi.

JAPAN BROADCASTING Corp.—Television laboratory, Kinuta, near Tokyo. Director: Dr. K. Takayanagi, on leave from Hamamatsu Engineering College.

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National Press Bldg. Washington, D. C.

● An Organization of Qualified Radio Engineers Dedicated to the Service of Broadcasting

● See Page 303

Location of Transmitters of Broadcast Stations

(Prepared by Broadcast Section, Engineering Department, Federal Communications Commission)

THE FEDERAL Communications Commission has no rules or regulations concerning the location of transmitters of broadcast stations. The Communications Act of 1934 requires that the Commission pass upon sites, and pursuant thereto applicants desiring to obtain approval of sites for broadcast transmitters are required to supply the Commission with extensive technical data concerning the proposed site. These data are reviewed by the Engineering Department while the application is in regular routing through the Commission.

The Engineering Department makes a complete report to the Commission for its consideration in passing upon the application. In making the report the Engineering Department is guided by the data supplied by the applicant and what it considers good engineering practice. In some cases Field Division supplies supplemental data, and the applicants may be required to supply additional data if the case could not be properly reported from the data supplied in the application.

To insure uniformity several empirical standards on the location of transmitters of broadcast stations have been adopted, based on the extensive experience of the Engineering Department and all data available along this line. Heretofore there has been little published data on sites, and this paper is offered as a guide and for the information of those who desire to know the Engineering Department's standards.

Importance of Sites

IT IS ONLY recently that the importance of selecting the proper site for broadcast transmitters has been fully realized. The coverage success of a broadcast station is dependent in a large measure upon selecting the proper site which may directly determine the efficiency of the radiating system and the field intensity throughout any desired center of population. Recent engineering surveys of transmitters reveal that the efficiency of radiating systems varies from approximately 5.7 per cent to 57 per cent, the location of the transmitter and the antenna being in a large measure responsible for this wide variation. A 1,000-watt station with a 57 per cent efficient antenna would be equivalent to a 10,000-watt transmitter with 5.7 per cent antenna efficiency, other conditions being the same.

It has been found that certain low-power stations are much more successful in covering centers of population than high-powered stations, due to the efficiency of the radiating system and the location of the transmitter. If data were available on the primary coverage of all broadcast stations and tabulated according to power, it would undoubtedly reveal that power alone is of minor importance in determining the coverage and that there are other factors which are more influential.

As a matter of fact, the percentage of modulation is more important than power, and the effec-

tiveness of the site and antenna efficiency of the radiating system are more important than either. The operating power of a station and the minimum percentage of modulation are fixed by the Commission, and every licensee of a broadcast station should select a site from which a maximum city and rural service may be had and the minimum amount of interference produced with other stations.

By the Commission's plan of allocation, power is allocated by steps which increase by approximately twice the next lower step. A study of the transmitter locations and radiating systems indicates that these two factors may have a materially greater effect than these small power steps. A station assigned 500 watts may by the mere expediency of selecting a suitable location and efficient radiating system increase the effective coverage much more than by increasing the power by twice or even more as given in the above example.

Primary Objectives

THE THREE primary objectives to be attained in the selection of a site for the transmitter of a broadcast station are as follows:

1. To serve adequately the center of population in which the studio is located and give maximum coverage to adjacent areas.
2. To produce minimum cross-talk interference to the receptions of other stations assigned to adjacent channels.
3. Pass requirements of Federal Communications Commission.

If a site is engineeringly correct, presumably it will pass the requirements of the Federal Communications Commission.

The table herewith is offered as a general guide to be used in determining the approximate size of broadcast transmitters. That is, from this table it may be determined whether or not the station should be located in the center of the city or at some distance from the city.

In case the power and the population of the city are such that it should be located at some distance from the center of the city, the approximate distance is given as well as the population of the so-called "blanket area". The "blanket area" of a broadcast station is defined as that area in which the

average broadcast receiver would not receive satisfactorily, without cross-talk, other stations operating on a frequency separated by 50 kilocycles or more. If the city under consideration is of irregular shape, the table may not apply, but the general principles set out will still hold.

Another factor to be considered is the relation of the site to airports and airways. There are no regulations or laws with respect to distance from airports and airways, but a distance of three miles from each is used as a guide. In case a suitable location is found at less distance than this, it may be satisfactory if the towers are suitably painted and lighted in conformity with Aeronautics Bulletin No. 9* or if the towers are not higher than the surrounding objects. The latter is poor radio engineering. In selecting a site, the local aeronautical authorities should always be consulted if there is any question concerning erecting a hazard to aviation, and in case of towers over 200 feet high this should always be done.

Sites Within Cities

IN SELECTING a site in the center of a city, it is usually necessary to place the radiating system on the top of a building. This building should be large enough to permit the necessary spacing and height of towers. Great care must be taken to avoid selecting a building surrounded by taller buildings or any building higher than the antenna and in the direction which it is desired to serve. Such a building will tend to cast shadows in the field intensity, which may materially reduce the coverage of the station in that direction.

If from Table A it is determined that a site should be selected removed from the city, then there are several general conditions to be followed in determining the exact site. The table gives the approximate distance from the center of the city. Three maps should be given consideration if available:

1. Map of the density of population and number of people by sections in the area.
2. Geographical contour map with contour intervals of 20 to 50 feet.

*This bulletin may be obtained from U. S. Government Printing Office, Washington, D. C., without charge.

3. Map showing the type, nature and depth of the soil in the area with special reference to the condition of the moisture throughout the year.

From these maps a site should be selected that is approximately the required distance from the city with a minimum population in the "blanket area" and with a minimum number of intervening hills between it and the center of the city. In general, because of ground conditions, it is better to select a site in a low area rather than on top of a hill, and the only condition under which a site on top of a hill should be selected is that it is only possible by this means to avoid a substantial number of hills between the site and the center of a city with consequent field shadows.

If a compromise must be made between probable field shadows from intervening hills and locating the transmitter on top of a hill, it is generally better to compromise in favor of the lower area where an efficient radiating system may be erected and take the losses due to shadows being caused by the hills if not too numerous or too high. Several transmitters have been located on top of hills, but so far as is known not a single installation has given the average efficiency of propagation and coverage.

Ideal Broadcast Locations

THE IDEAL location of a broadcast transmitter is in a low area of marshy or "crawfishy" soil or area which is damp the maximum percentage of time and from which a straight line view over the entire center of population may be had, and the tall buildings in the business section of the city would cast a shadow across the minimum residential area.

The type and condition of the soil or earth immediately around a site is very important. Important, but to a less extent, is the soil or earth between the site and the principle area to be served. Sandy soil is considered the worst type, with glacial deposits and mineral ore areas next. Alluvial, marshy areas and salt water bogs have been found to have the least absorption of the signal. One is fortunate to have available such an area, and, if not available, the

(Continued on page 338)

Guide in Determining Station Sites

TABLE A

Power of Station	Population of City or Metropolitan Area	Radius of Blanket Area 100 to 125 MV/M	Site Distance from Center of City (Business or Geographical)	Maximum Percentage of Total Population in "Blanket Area"
50-100 w.	5,000-50,000	0.3 to 0.4 mi.	½ to 2 mi. or center of business section	0.50
50-100 w.	75,000 and up	0.3 to 0.4 mi.	of business section	0.75
250-500 w.	5,000-150,000	0.6 to 0.9 mi.	1 to 3 mi. or center of business section	0.75
250-500 w.	200,000 and up	0.6 to 0.9 mi.	of business section	0.75
1,000 w.	5,000-200,000	1.25 mi.	2 to 5 mi. or center of business section	1.0
1,000 w.	250,000 and up	1.25 mi.	of business section	1.0
5-10 kw.	All	2.7 to 3.75 mi.	7.5 to 10 mi.	1.0
25-50 kw.	All	4.5 to 6.0 mi.	12.0 to 20 mi.	1.0

BROADCAST EQUIPMENT TYPES ACCEPTED AND RECORDED BY FCC

These manufacturers have filed with the Engineering Department of the FCC blue prints and specifications of the apparatus herein described. Applicants intending to use any of this equipment need not file with the FCC blue prints and other descriptive matter in presenting applications covering use of such equipment. Mention of the type number will be sufficient.

American Piezo Supply Co.—40th & Woodlawn Ave., Kansas City, Mo.
 Type No. C-X-1: Automatic Frequency Control Unit.
 Type No. C-X-1-P: Automatic Frequency Control Unit with Power Supply.
 Type No. C-X-7-C: Automatic Frequency Control Unit.
 American Sales Co.—44 W. 18th St., New York City.
 Catalogue No. 601: 50 watt Broadcast Transmitter (includes REL Cat. No. 285 AFCU).
 Biley Electric Co.—Union Station Bldg., Erie, Pa.
 Type No. BC-46: Automatic Temperature Control Unit.
 Collins Radio Co.—Cedar Rapids, Ia.
 Type No. 10L: Automatic Frequency Control Unit.
 Type No. 10S: Automatic Frequency Control Unit.
 Type No. 10S-1: Automatic Frequency Control Unit.
 Type No. 20A: 500-watt Broadcast Transmitter.
 Type No. 20C: 1000-watt Broadcast Transmitter.
 Type No. 20C-1: 1000-watt Broadcast Transmitter.
 Type No. 20C-2: 1000-watt Broadcast Transmitter.
 Type No. 20D: 1000-watt Broadcast Transmitter.
 Type No. 21C: 5000-watt Broadcast Transmitter.
 Type No. 40A: Automatic Frequency Control Unit.
 Type No. 40A-1: Automatic Frequency Control Unit.
 Type No. 40C: Automatic Frequency Control Unit.
 Type No. 300B-100 W: 100-watt Broadcast Transmitter.
 Type No. 300B-250W: 250-watt Broadcast Transmitter.
 Type No. 300C: 250-watt Broadcast Transmitter.
 Type No. 300C-1: 250-watt Broadcast Transmitter.
 Type No. 300D: 100-watt Broadcast Transmitter.
 Type No. 300D-1: 100-watt Broadcast Transmitter.
 Type No. 300D-2: 100-watt Broadcast Transmitter.
 Type No. 300D-3: 100-watt Broadcast Transmitter.
 Type No. 300F: 250-watt Broadcast Transmitter.
 Commercial Radio Equipment Co.—7205 Baltimore St., Kansas City, Mo.
 Type No. FC-2: Automatic Frequency Control Unit.
 DeForest Radio Co.—(Now owned by RCA Victor Co. Inc., Camden, N. J.)
 Type No. ABM-104: Automatic Frequency Control Unit Model B.
 Type No. 107-A: 50-watt Broadcast Transmitter Model TBM 104.

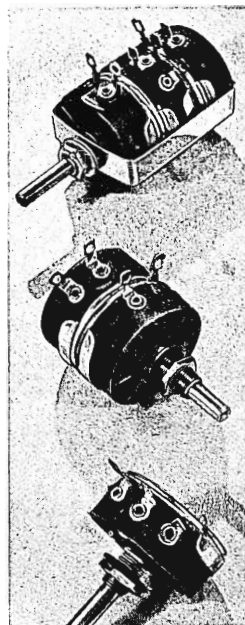
Type No. 107-B: 100-watt Broadcast Transmitter Model TBM 105.
 Type No. 109-C: 250-watt Broadcast Transmitter.
 Type No. 104-A: 500-watt Broadcast Transmitter.
 Type No. 116-A: 1000-watt Broadcast Transmitter.
 Type No. 105-B: 5000-watt Broadcast Transmitter.
 Doolittle & Falknor Inc.—1306 W. 74th St., Chicago.
 Type No. OB-1: Automatic Frequency Control Oscillator and Amplifier Unit (includes Type 1-B ATCC).
 Type No. OB-2: Automatic Frequency Control Unit (includes Type 1-B ATCC).
 Type No. OB-5: Automatic Frequency Control Unit (includes Type TC-1 ATCU).
 Type No. TC-1: Automatic Temperature Control Unit (includes Type 2-A ATCC).
 Type No. 100-B: 100-watt Broadcast Transmitter (includes Type OB-2 or OB-5 AFCU).
 Type No. 250-B: 250-watt Broadcast Transmitter (includes Type OB-2 or OB-5 AFCU).
 Hygrade Sylvania Corp.—Electronics Dept., Clifton, N. J.
 Type No. 120-A: 100-watt Broadcast Transmitter (only one built for WNRA).
 Type No. 121-A: 100-watt Broadcast Transmitter.
 Type No. 162-A: 250-watt Broadcast Transmitter.
 Type No. 190-A: 500-watt Broadcast Transmitter.
 Type No. 210-A: 750-watt Broadcast Transmitter (Rated 500-watt for Broadcast Service).
 Type No. 241-A: 1-kw. Broadcast Transmitter.
 Type No. 260-A: 5-kw. Broadcast Transmitter.
 Type No. 270-A: 10-kw. Broadcast Transmitter.
 International Broadcasting Equipment Co.—312 W. 51st Street, Chicago.
 Type No. 6-B: Automatic Frequency Control Unit (for use WE equipment).
 Type No. 52-A: Automatic Frequency Control Unit.
 Kluge Radio Co.—1041 No. Bonnie Brae, Los Angeles, Cal.—(Formerly National Broadcasting Equipment Co., Scottsbluff, Neb.)
 Type No. 4-B: 100-watt Broadcast Transmitter.
 Type No. 4-C: 250-watt Broadcast Transmitter.
 Type No. 4-D: 100-watt Broadcast Transmitter.
 Piezo Electric Laboratories—612 Rockland Ave., New Dorp, N. Y.
 Type No. TC-210: Automatic Temperature Control Oven and Relay Unit.
 Type No. TC-350: Automatic Temperature Control Oven and Relay Unit.
 Type No. OB-10: Oscillator and Amplifier Unit (Oscillator and first buffer, no ATCU or crystal).
 Type No. OB-20: Amplifier Unit (second buffer).
 Precision Piezo Service—427 Asia St., Baton Rouge, La.
 Type No. 50-M: Automatic Temperature Control Unit.

R. C. Powell & Co. Inc.—(No longer in business).
 Type No. 3-K: Automatic Temperature Control Chamber.
 Type No. 1-K: Automatic Frequency Control Unit.
 Type No. 43-B: 100-watt Broadcast Transmitter.
 Type No. 21-K: 250-watt Broadcast Transmitter.
 Type No. 8-K: 1000-watt Broadcast Transmitter.
 Premier Crystal Laboratories Inc. 53 Park Row, New York City.
 Type No. 350-A: Automatic Frequency Control Unit.
 RCA Victor Co. Inc.—Camden, N. J.
 Type No. EX-4170: Automatic Frequency Control Unit.
 Type No. UL-4252-X: Automatic Frequency Control Unit.
 Type No. OA-1A: Automatic Frequency Control Unit.
 Type No. OA-1B: Automatic Frequency Control Unit.
 Type No. 100-E: 100-watt Broadcast Transmitter.
 Type No. 100-W: 100-watt Broadcast Transmitter.
 Type No. 250-W: 100/250-watt Broadcast Transmitter.
 Type No. ET-4230: 100-watt Broadcast Transmitter.
 Type No. ET-4240: 100-watt Broadcast Transmitter.
 Type No. ET-4240-A: 100-watt Broadcast Transmitter.
 Type No. ET-4250: 250-watt Broadcast Transmitter.
 Type No. ET-4250-A: 250-watt Broadcast Transmitter.

Type No. 1001-C: 500/1000-watt Broadcast Transmitter (NG 250 watts).
 Type No. 1001-D: 500/1000-watt Broadcast Transmitter.
 Type No. ET-4251-AA: 1-kw. Amplifier Unit.
 Type No. AA-4251: 1-kw. Power Amplifier and Modulator Unit (added to Type ET-4250 makes Type 1001-D).
 Type No. 1005-B: 5-kw. Broadcast Transmitter.
 Type No. 1005-C (5-C): 5-kw. Broadcast Transmitter.
 Type No. 5-C-1: 5-kw. Broadcast Transmitter.
 Type No. A-10-A: 10-kw. Power Amplifier.
 Type No. 1050-B: 50-kw. Broadcast Transmitter.
 Type No. 50-C: 50-kw. Power Amplifier.
 Type No. 50-C: 50-kw. Broadcast Transmitter.
 Type No. 500-A: 500-kw. Power Amplifier and Modulator Unit.
 Radio Engineering Laboratories Inc.—100 Wilbur Ave., Long Island City, N. Y.
 Catalogue No. 285: Automatic Frequency Control Unit.
 Catalogue No. 256: 100-watt Broadcast Transmitter.
 D. V. Tostenson—Moorhead, Minn.
 Type No. 1-C: Automatic Frequency Control Unit.
 Type No. 3-B: Automatic Temperature Control Chamber.
 Type No. 101-B: 100-watt Broadcast Transmitter.

WIRE-WOUND

Controls



IN the major networks and many broadcasting stations, CLAROSTAT wire-wound controls are at work day in and day out. Absolute dependability; smooth operation; silent performance even in the most critical circuits—these features have made CLAROSTAT the standard controls.

- ★ **POTENTIOMETERS**
Single-unit controls. Widest resistance range. Standard tapers. With or without switch.
- ★ **T-PAD CONTROLS**
Triple-unit controls. Continuous attenuation range from 0.5 to 30 decibels in 90% of rotation. Complete attenuation in last 10%. Practically linear per degree of rotation. Constant impedance to input and output.
- ★ **L-PAD CONTROLS**
Dual-unit controls. Same characteristics as for T-Pad, but with constant impedance to either source or output.
- ★ **MIXER CONTROLS**
Dual-unit controls to attenuate microphones and sound-recording pickups.
DATA: Loose-leaf engineering bulletins covering every resistance requirement, are yours for the asking. Also, we welcome your special problems.

CLAROSTAT
 MANUFACTURING CO.
 Incorporated
 285 North Sixth St.
 Brooklyn, N. Y.

Western Electric Co.—195 Broad-
way, New York City.
Type No. 700-A: Automatic Fre-
quency Control Unit.
Type No. 702-A: Automatic Fre-
quency Control Unit.
Type No. D-90684: Automatic
Frequency Control Unit.
Type No. 20-A: 100/250-watt
Broadcast Transmitter.
Type No. 301-A: 100-watt Broad-
cast Transmitter.
Type No. 12-A: Former code num-
ber.
Type No. 302-A: 250-watt Broad-
cast Transmitter.
Type No. 303-A: 500-watt Broad-
cast Transmitter.
Type No. 304-A: 1-kw. Broadcast
Transmitter.
Type No. 301-B: 100-watt Broad-
cast Transmitter.
Type No. 12-B: Former code num-
ber.
Type No. 302-B: 250-watt Broad-
cast Transmitter.
Type No. 303-B: 500-watt Broad-
cast Transmitter.
Type No. 304-B: 1-kw. Broadcast
Transmitter.
Type No. 302C: 250-watt Broad-
cast Transmitter.
Type No. 303C: 500-watt Broad-
cast Transmitter.
Type No. 304C: 1000-watt Broad-
cast Transmitter.
Type No. 306-A: 50-kw. Broadcast
Transmitter.
Type No. 306-B: 50-kw. Broadcast
Transmitter.
Type No. 3500-1: 100-watt Broad-
cast Transmitter.
Type No. 310-A: 100-watt Broad-
cast Transmitter.
Type No. 310-B: 250-watt Broad-
cast Transmitter.
Type No. 310-C: 500-watt Broad-
cast Transmitter.
Type No. 310-D: 1000-watt Broad-
cast Transmitter.

Type No. 351E-1: 250-watt Broad-
cast Transmitter.
Type No. 352E-1: 500-watt Broad-
cast Transmitter.
Type No. 353E-1: 1-kw. Broad-
cast Transmitter.
Type No. 355B-1: 5-kw. Broad-
cast Transmitter (Type No.
301B transmitter with D-97088
amplifier).
Type No. 355D-1: 5-kw. Broad-
cast Transmitter (Former Type
No. 5-kw. AC).
Type No. 407-A: 50-kw. Broadcast
Transmitter.
Type No. D-94989: 5-kw. Broad-
cast Transmitter.
Type No. D-94990: 5-kw. Broad-
cast Transmitter.
Type No. D-94991: 5-kw. Broad-
cast Transmitter.
Type No. D-94992: 5-kw. Broad-
cast Transmitter.
Type No. D-94993: 1-kw. Broad-
cast Transmitter.
Type No. D-94994: 1-kw. Broad-
cast Transmitter.
Type No. D-94995: 50-kw. Broad-
cast Transmitter.
Type No. D-96020: 1-kw. Broad-
cast Transmitter.
Type No. D-96021: 1-kw. Broad-
cast Transmitter.
Type No. D-97088: 5-kw. Power
Amplifier (may be used with
301-A or B, 302-A or B, 303-A
or B or 304-A or B).
Type No. D-97088: Modified for
2½-kw. Broadcast Transmitter.
Type No. D-96847: 5-kw. Broad-
cast Transmitter.
Type No. D-96847: Modified 2½-
kw. Broadcast Transmitter.
Western Radio Engineering Co.
Inc.—Fifth & St. Peter St., St.
Paul, Minn.
Type No. F-100-A: Automatic
Frequency Control Unit.

THIS QUESTION OF POLICY

FOR fifteen years, the Fairchild Aerial Camera Corporation has manufactured the finest precision instruments. Every item of equipment goes through a careful period of development and is thoroughly tested before it is delivered. It has always been the policy of the Fairchild Aerial Camera Corporation to deliver a product only after it has proven itself by actual performance.

THIS same policy will apply to the sound recording and sound reproducing equipment now under manufacture and development. Watch for future announcements of complete sound equipment for broadcast station use!



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• A precision machine, compact outfit that positively eliminates all waver — Records in either direction at 33 1/3 or 78 R.P.M.—90, 110 or 130 lines per inch—110 volt AC 100% synchronous motor — Constant speed rim belt drive — Reinforced black leatherette carrying cases—Unequalled value — Superlative performance — Also stationary machines, amplifiers, cutting heads, special acetate pickup, etc.

UNIVERSAL Recording Machines

• Three Models

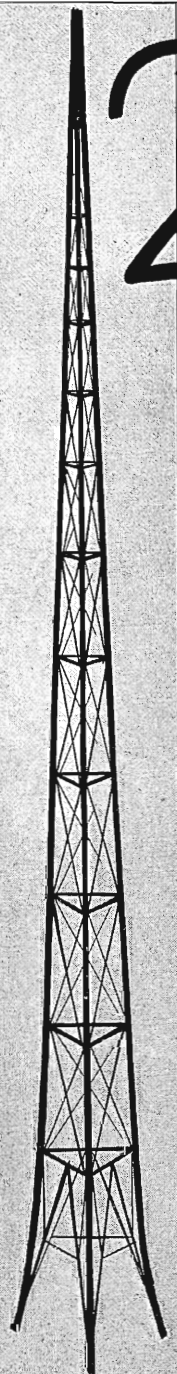
Professional
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School and College

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Aluminum Discs
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20 YEARS on the JOB

SINCE 1917 installers of U. S. Government radio towers—since 1922, of commercial broadcasting towers. Nearly 200 installations. That's the Hartenstine-Zane record — and experience.

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COMPLETE VERTICAL RADIATOR INSTALLATION including:

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Old towers inspected, serviced and repainted.

Hartenstine-Zane Co. Inc.

ENGINEERS AND BUILDERS



225 BROADWAY

NEW YORK

Location of Broadcast Transmitters

(Continued from page 334)

next best condition must be selected.

If a site is to be selected to serve a city which is on a general sloping area, it is generally better to select a site below the city than above the city.

Careful consideration must be given to selecting a site, so that the number of people in the blanket area is a minimum. The last column of Table A gives the percentage of the total population of the city or metropolitan area that may be permitted in the blanket area. In general, broadcast transmitters operating with approximately the same power can be grouped in the same approximate area and thereby reduce the crosstalk interference between them.

By the Commission policy, stations serving the same area must have a frequency separation of 50 kilocycles, and this practice is observed in practically all cases. It is presumed that owners of any radio receiving sets would have no difficulty in separating signals separated in frequency by 50 or more kilocycles when the receiver is located not in the blanket area of either station. This is not strictly true, however, of some old receiving sets and any set in a poor state of repair and alignment, as they may not have the capability of separating stations operating on frequencies 50 or more kilocycles separated. This is especially true when the transmitters of the stations are so located that in certain areas there are large differences in the field intensities from the stations and on the higher frequencies. If this condition could be alleviated without impairing the coverage of the stations and at the same time protect all receivers, this would be desirable.

In cases of several stations serving large cities, the principle of grouping transmitters could not be advantageously applied to all stations located in the area because generally any station has some field shadow and accordingly may not well serve certain parts of the city. Another station with the transmitter across the city would serve this area well, so that between the two they would serve all the areas well.

The ideal arrangement would be to group the transmitters of the stations operating nearest in frequency and between which there may be some possibility of crosstalk interference.

If the city is of irregular shape, it is often possible to take advantage of this in selecting a suitable location that will give a maximum coverage and at the same time maintain a minimum of people within the blanket area. The maps giving the density of population will be a key to this. The map giving the elevation by contours will be a key to the obstructing hills between the site and city. The map of the soil conditions will assist in determining the efficiency of the radiating system that may be erected and the absorption of the signal encountered in the surrounding area.

In finally selecting the site, consideration must be given to the required space for erecting an efficient radiating system. It is the

general practice to use direct grounds consisting of a radial buried wire system. If the area is such that it is not possible to get such a ground system in soil that remains moist throughout the year, it probably will be found better to erect a counterpoise. A counterpoise properly erected may be as efficient as the best possible ground, and, if it is not possible to secure an excellent ground, the counterpoise should always be given consideration. It, like the antenna itself, must of course be designed properly for the operating frequency and other local conditions.

It is always highly desirable, and whenever possible, a field intensity survey should be made to determine that the site selected will come up to the expectations and meet the requirements. Often two or more sites may be selected that appear to be of equal promise. It is only by means of field intensity surveys taken with a transmitter at the different sites that it can be determined which is more desirable. There are many considerations of inefficiency that cannot be determined by any other method. An engineer with experience in selecting a site can generally do a good job by inspection, but he can never be certain without the survey.

The field survey should prove the following things:

1. A minimum field intensity of 10 to 25 millivolts per meter will be obtained over the business area of the city.
2. A minimum field intensity of at least 2 to 5 millivolts per meter will be obtained over the residential section.
3. The absorption of the signal is the minimum of any obtainable sites in the area. As a guide in this respect the absorption of the signals from other stations in that area should be followed as well as the results of tests on other sites.
4. The field intensity at the outer limit of the blanket radius does not exceed 100 to 125 millivolts per meter.

In the absence of field surveys, the average conditions are presumed to prevail. If a compromise must be made between sandy soil, high elevations, and intervening territory, a field intensity survey should be made from several sites.

In conclusion let it be said that there are now many stations licensed to operate with specific powers which could undoubtedly gain a better coverage of their primary areas by selecting more suitable sites and erecting efficient radiating systems than could be obtained by a one or two step increase in power. As commercial surveys become more popular this fact will become evident throughout the industry.

In making the final determination of a site, it cannot be stressed too much the need for a field intensity survey to establish the exact conditions and the consideration of the results with the field intensities considered in comparison not only with other sites in the same area but with other existing stations in the same and other areas. The selection of a proper site for a broadcast station is an important engineering problem and can only be done properly by experienced radio engineers.

FREQUENCY MONITORS

Approved by FCC Under Rule 145

Manufacturer	Type	Approval No.
DeForest Radio Co. (Now owned by RCA Mfg. Co.)	ABM-106 Model A	1451
General Radio Co.	Oscillator Type 475A	1452
	Deviation Meter Type 681	
	Quartz Plate Type 376-J or L	
Western Electric Co.	1-A	1453
	Oscillator 700-A modified	
RCA Victor Co.	EX-4180	1454
Doolittle and Falknor, Inc.	FD-1	1455
Bremer Broadcasting Corp.	A	1456
H. O. Boehme, Inc.	5-M	1456
International Broadcasting Equipment Co.	Type 60	1457
Piezo Electric Laboratories	PM-125-A	1458
Pillar of Fire	A	1459
Hygrade Sylvania Corp.	Model 30J	1460

MODULATION MONITORS

Approved by FCC Under Rule 139

Manufacturer	Type	Approval No.
General Radio Co.	731-A	1551
RCA Mfg. Co., Inc.	66-A	1552
RCA Mfg. Co., Inc.	66-B	1553

Manufacturers of Low Temperature COEFFICIENT CRYSTALS FOR BROADCAST STATIONS

(Products Approved by FCC)

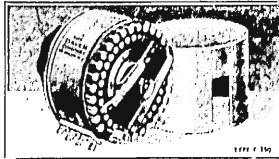
American Piezo Supply Co.—P. O. Box 6026, Kansas City, Mo.	Hollister Crystal Co.—Wichita, Kan.
Bellefonte Engineering Laboratories—Bellefonte, Pa.	Precision Piezo Service—Baton Rouge, La.
Bibley Electric Co.—Union Station Bldg., Erie, Pa.	Premier Crystal Laboratories Inc.—53 Park Row, New York City.
William W. L. Burnett—4814 Idaho St., San Diego, Cal.	RCA Mfg. Co.—Camden, N. J.
Collins Radio Co.—Cedar Rapids, Ia.	Scientific Radio Service—Hyattsville, Md.
Commercial Radio Equipment Co.—216 East 74th St., Kansas City, Mo.	Western Electric Co.—195 Broadway, New York City.
Hipower Crystal Co.—2035 Charleston St., Chicago, Ill.	Precision Crystal Laboratories—P. O. Box 326, Springfield, Mass.

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"TEE" ATTENUATOR

TYPE "T-330"

This is the first compact 30 step "T" attenuator ever offered at a low cost. It is perfect as a mixer and a master gain control for low level mixing.

The new Attenuator has zero insertion loss, constant impedance both in and out of all settings and at all frequencies within the desired range, and the lowest attainable noise level.

30 Steps of Attenuation.
Laminated positive wiping type switch.
Low noise level. Below -130 Db.
Shielded from electrical disturbances.
Rugged—light weight.
Size only 2 3/4" diameter by 2 1/16" in depth.
Zero insertion loss.
Frequency error: None over the range of 30 to 17,000 Cps.

Resistors, unifilar wound.

Price, \$17.50

Write for Bulletin 534

THE FOLLOWING IMPEDANCES STOCKED FOR IMMEDIATE SHIPMENT:

30/30	200/200	600/600
50/50	250/250	30/50
125/125	500/500	50/200
	500/200	

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WMAL	WCKY	WIBX
WEAF	WINS	WIP
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WHN	KYW	WKRC
WMCA	WNEW	WPEN

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	Davohms

THE DAVEN COMPANY

158-160 SUMMIT STREET ★ NEWARK, N. J.

FREQUENCY-POWER MILEAGE SEPARATION TABLES*

As Recommended by Chief Engineer to Federal Communications Commission

AVERAGE DAY SEPARATION BETWEEN BROADCAST STATIONS

Class & Power	Frequency Difference Kc.	Local, Regional, limited time and day													
		Local			Regional, limited time and day								Clear		
		50 w.	100 w.	250 w.	250 w.	500 w.	1 kw.	2.5 kw.	5 kw.	10 kw.	5 kw.	10 kw.	25 kw.	50 kw.	
Local	0	65	80	100											
	10	25	30	38	85	95	108	128	145	163	145	163	190	213	
	20	12	15	20	57	67	80	100	117	135	117	135	162	185	
	30	8	11	16	47	57	70	90	107	125	107	125	152	175	
50 w.	0	80	80	100											
	10	30	34	41	93	103	116	146	153	171	153	171	198	220	
	20	15	16	21	61	71	84	104	121	139	121	139	166	190	
	30	11	12	17	48	58	71	91	108	126	108	126	153	176	
100 w.	0	100	100	100											
	10	38	41	46	105	115	128	148	165	183	165	183	210	233	
	20	20	21	24	69	79	92	112	129	147	129	147	174	197	
	30	16	17	18	51	61	74	94	111	129	111	129	156	179	
250 w.	0	100	100	100											
	10	38	41	46	105	115	128	148	165	183	165	183	210	233	
	20	20	21	24	69	79	92	112	129	147	129	147	174	197	
	30	16	17	18	51	61	74	94	111	129	111	129	156	179	
Regional, limited time & day	0	230	260	300	350	400	450	500	600	800	900	1000			
	10	85	93	105	125	140	153	174	192	212	192	212	240	265	
	20	57	61	69	81	91	104	124	141	159	141	159	186	210	
	30	47	48	51	58	68	81	100	118	136	118	136	163	185	
250 w.	0	230	260	300	350	400	450	500	600	800	900	1000			
	10	85	93	105	125	140	153	174	192	212	192	212	240	265	
	20	57	61	69	81	91	104	124	141	159	141	159	186	210	
	30	47	48	51	58	68	81	100	118	136	118	136	163	185	
500 w.	0	260	260	300	350	400	450	500	600	800	900	1000			
	10	95	103	115	140	152	185	200	220	250	220	250	277	300	
	20	67	71	79	91	100	112	132	150	167	150	167	194	217	
	30	57	58	61	68	72	85	105	122	140	122	140	167	190	
1 kw.	0	300	300	300	350	400	450	500	600	800	900	1000			
	10	108	116	128	153	162	175	197	215	235	215	235	265	290	
	20	80	84	92	104	112	120	140	157	175	157	175	200	225	
	30	70	71	74	81	85	91	111	128	146	128	146	173	196	
2.5 kw.	0	350	350	350	350	400	450	500	600	800	900	1000			
	10	128	146	148	174	185	197	218	235	255	235	255	285	310	
	20	100	104	112	124	132	140	153	170	188	170	188	215	238	
	30	90	91	94	100	105	111	119	136	154	136	154	181	204	
5 kw.	0	400	400	400	400	400	450	500	600	800	900	1000			
	10	145	153	165	192	200	215	235	250	270	250	270	300	325	
	20	117	121	129	141	150	157	178	200	213	200	213	240	263	
	30	107	108	111	118	122	128	136	143	161	143	161	188	211	
10 kw.	0	450	450	450	450	450	450	450	500	700	800	900	1000		
	10	163	171	183	212	220	235	255	270	290	270	290	320	345	
	20	135	139	147	159	167	175	188	200	213	200	213	240	263	
	30	125	126	129	136	140	146	154	161	170	161	170	196	219	
Clear	0	700	700	700	700	700	700	700	700	700	700	700	700	700	
	10	145	153	165	192	200	215	235	250	270	250	270	300	325	
	20	117	121	129	141	150	157	178	200	213	200	213	240	263	
	30	107	108	111	118	122	128	136	143	161	143	161	188	211	
5 kw.	0	800	800	800	800	800	800	800	800	800	800	800	800	800	
	10	163	171	183	212	220	235	255	270	290	270	290	320	345	
	20	135	139	147	159	167	175	188	200	213	200	213	240	263	
	30	125	126	129	136	140	146	154	161	170	161	170	196	219	
10 kw.	0	900	900	900	900	900	900	900	900	900	900	900	900	900	
	10	190	198	210	240	250	265	285	300	320	300	320	345	370	
	20	162	166	174	186	194	200	215	227	240	227	240	260	280	
	30	152	153	156	163	167	173	181	188	196	188	196	208	231	
25 kw.	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
	10	213	220	233	265	277	290	310	325	345	325	345	370	395	
	20	185	190	197	211	217	225	238	250	263	250	263	280	300	
	30	175	176	179	185	190	196	204	211	219	211	219	231	242	
50 kw.	0	172	172	173	176	179	181	187	191	197	191	197	205	212	

AVERAGE NIGHT SEPARATION BETWEEN BROADCAST STATIONS

Class & Power	Frequency Difference Kc.	Local, Regional, High Power Regional, Clear														
		Local			Regional					High Power Regional		Clear				
		50 w.	100 w.	250 w.	500 w.	1 kw.	5 kw.	10 kw.	5 kw.	10 kw.	25 kw.	50 kw.				
Local	0	130	185													
	10	40	50	82	90	107	180	220	180	220	290	345				
	20	15	18	41	49	57	85	100	130	147	175	197				
	30	8	11	16	38	46	74	89	118	138	155	178				
50 w.	0	130	185													
	10	40	50	82	90	107	180	220	180	220	290	345				
	20	15	18	41	49	57	85	100	130	147	175	197				
	30	8	11	16	38	46	74	89	118	138	155	178				
100 w.	0	185	185													
	10	50	53	98	106	114	183	225	220	237	293	350				
	20	18	21	46	54	62	90	105	138	156	183	206				
	30	12	13	32	40	48	76	91	113	131	158	181				
Regional	0	11	11	28	36	44	72	87	106	124	151	174				
	10	50	53	98	106	114	183	225	220	237	293	350				
	20	18	21	46	54	62	90	105	138	156	183	206				
	30	12	13	32	40	48	76	91	113	131	158	181				
250 w.	0	640	800	1000												
	10	82	98	126	153	185	290	345	290	345	425	495				
	20	41	46	55	65	78	110	145	155	172	200	225				
	30	30	32	35	43	51	79	94	118	136	163	186				
500 w.	0	800	800	1000												
	10	90	106	153	160	190	300	355	300	355	435	505				
	20	49	54	65	74	85	127	150	170	188	215	235				
	30	38	40	43	46	54	82	97	124	142	169	192				
1 kw.	0	1000	1000	1000												
	10	107	114	185	190	200	305	360	350	370	440	510				
	20	57	62	78	85	94	135	160	187	205	232	255				
	30	46	48	51	54	58	86	100	132	150	177	200				
High Power Regional	0	1600	2000													
	10	180	183	290	300	305	335	390	480	500	530	550				
	20	85	90	110	127	135	163	187	250	268	295	320				
	30	74	76	79	82	86	102	117	158	175	205	225				
5 kw.	0	2000	2000													
	10	220	225	345	355	360	390	405	550	570	625	620				
	20	100	105	145	150	160	187	203	287	305	325	350				
	30	89	91	94	97	100	117	128	175	192	220	243				
10 kw.	0	2000	2000													
	10	220	225	345	355	360	390	405	550	570	625	620				
	20	100	105	145	150	160	187	203	287	305	325	350				
	30	89	91	94	97	100	117	128	175	192	220	243				
Clear	0	180	220	290	300	350	480	550	480	550	645	730				
	10	130	138	155	170	187	250	287	250	287	305	400				
	20	110	113	118	124	132	158	175	158	175	205	230				
	30	105	106	108	110	113	125	133	125	143	150	178				

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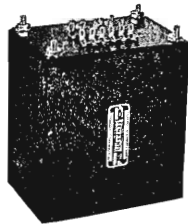
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