FIFTH ANNUAL REPORT

of the

FEDERAL RADIO COMMISSION

to the

CONGRESS OF THE UNITED STATES

For the Fiscal Year
1931

▼

COMMISSIONERS

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IRA E. ROBINSON HAROLD A. LAFOUNT
WILLIAM D. L. STARBUCK

JAMES W. BALDWIN, *Secretary*

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FIFTH ANNUAL REPORT OF THE FEDERAL RADIO COMMISSION

FEDERAL RADIO COMMISSION,
Washington, D. C., December 7, 1931.

To the Senate and House of Representatives of the United States of America in Congress assembled:

Herewith is submitted the Fifth Annual Report of the Federal Radio Commission covering the fiscal year ended June 30, 1931.

PERSONNEL

No change occurred during the fiscal year in the membership of the commission. The commissioners appointed February 24, 1930, from the five radio zones remained as follows:

	Commissioner	Term expires
First zone	W. D. L. Starbuck	February 23, 1934.
Second zone	Ira E. Robinson	February 23, 1932.
Third zone	Eugene O. Sykes	February 23, 1933.
Fourth zone	Charles McK. Saltzman	February 23, 1936.
Fifth zone	Harold A. Lafount	February 23, 1935.

At the close of the fiscal year the commission included 182 employees, all of whom have a civil-service status except the attorneys of the legal and examiners' division.

The system of utilizing examiners for the holding of public hearings having been adopted, a chief examiner and three examiners were appointed. During the year representatives of the Personnel Classification Board made a survey of the positions in the commission in order that they might be properly classified with respect to other Government departments.

ORGANIZATION

The reorganization of the commission's force, which was referred to in the last annual report, has been accomplished and has resulted in a more efficient and expeditious operation of the commission. During the year an examiners' division was added to the organization. In order to further facilitate the work of the commission, a docket section, with responsibilities similar to those of the office of the clerk of a court, was organized as a part of the office of the secretary for the preparation of the hearing calendar, the publication of the reports of examiners, and the preparation of the docket for commission action.

During the year the commission organized an additional section of the license division to handle applications received from amateurs,

this duty having previously been performed by the radio division of the Department of Commerce, due to lack of personnel and adequate housing facilities of the commission.

VOLUME OF WORK

The volume of work done by the commission during the year far exceeded that of preceding years. More than 30,000 formal matters required commission action. Applications for permits and licenses were received at a rate averaging over 550 per week. The commission held 176 formal meetings; sat en banc to hear the proceedings or arguments in 30 cases; granted 27,747 applications and denied 584. During the year over 113,000 communications were received by the commission.

STAGGERED LICENSE PERIOD

Since the organization of the commission, licenses for broadcasting stations were issued for a period of 90 days and all terminated on the same day. Four times each year this practice caused an enormous load to be suddenly thrown on the limited personnel available for the examination of all broadcasting applications for the renewal of license. To avoid this unfortunate peak load and to bring about a system which would cause the work to be more uniformly distributed throughout the year, all broadcasting stations have been divided into six classes, each class having a different date on which licenses of that class terminated. At the same time, due to greater stabilization in the broadcast field and less necessity for the shifting of stations, the commission increased the period for which a broadcasting license is granted from three months to six months.

RULES AND REGULATIONS

During the four years of its existence the commission has promulgated rules and regulations in the form of "general orders." In the growth and development of the art it has been necessary not only to adopt, from time to time, new and additional orders but to revise, modify, enlarge, or repeal previous orders. These orders have reached such a volume that codification is now desirable. The commission has taken the necessary steps to have all its rules and regulations studied with a view to a general revision and codification. It is expected that the new compilation will be ready for issue during the present calendar year.

HEARINGS

Prior to this fiscal year all public hearings were held with the commission sitting en banc or were heard by one commissioner. During the fiscal year ended June 30, 1930, 240 formal hearings were held. It was found that such system of holding hearings was no longer permissible, as the time involved prevented commissioners from attending to a great amount of other work. On September 1, 1930, the system of holding public hearings by examiners was instituted in accordance with adopted rules of practice and procedure.

The increasing familiarity with the system now in vogue by those appearing before the commission has resulted in a considerable speeding up of the conduct of the hearings and the securing of a record clearly setting out both sides of the questions in issue. Upon this record the commission is able to make its determination of facts and base its decisions. At the close of the year the examiners were practically current in their reports of cases heard, leaving them free to handle the approximately 200 applications which the commission has found necessary to designate for hearing at the beginning of the new fiscal year. Provisions have been made in the hearing procedure to safeguard the rights of applicants and all other interested parties. All pertinent facts may be shown, and, in addition, full argument may be made or briefs may be submitted, and all parties may except to the report submitted by the examiner. The record of hearing and examiner's report, together with any exceptions which have been filed, are presented to the commission for its decision, and, in addition, provision is made for the oral argument before the commission. The right to argue cases before the commission is granted only upon petition therefor.

In preparing the hearing docket, applications are grouped as much as possible in order that applications from the same territory or for the same facility may be heard at the same time. This is done in order to avoid the expense to applicants or licensees incident to repeated trips to Washington to participate in hearings. It frequently happens that a licensee who has been assigned a desirable broadcasting facility finds himself under the necessity of defending his right to the facility from a group of applicants therefor or from successive applicants. Inasmuch as there is no provision under the law whereby such an applicant who is unsuccessful in his effort can be required to reimburse the licensee for the expense to which he has been put in defending his right to the facility, the plan of grouping related applications is of great value to licensees and justifies some delay in handling applications which such a plan of necessity entails.

COMMERCIAL RADIO

There is popular belief that the principal duty of the Radio Commission pertains to radio broadcasting. Although the importance of broadcasting in the daily lives of our people is duly appreciated by the commission, it is proper to state that this interesting use of radio is only one of a long list of radio services administered by the commission under the provisions of the radio act of 1927. Some of the other services are of very great importance to the commerce and industry of this country, to safety of lives at sea, in the development and operation of aviation, in the prevention of crime and the detection of criminals, in the scientific research and development of radio, and in other national services. In addition to the broadcasters, our commercial radio companies, with their far-flung network of telegraph and telephone stations, reaching the uttermost parts of the earth, the great maritime fleet of the country, the rapidly growing aviation transport lines, the municipal and State police systems, the technical research laboratories, and many other services, all present problems to the Radio Commission in requests for additional frequencies. These requests present many technical problems.

The number of frequencies for all purposes for the entire world is limited. It has been often said that the United States is using more than its share of frequencies. The United States to-day is the foremost radio country of the world. The very remarkable use that this country is making of the frequencies assigned to it, together with the stupendous contribution which this country is making in the technical advance and development of radio, must be carefully considered when such a statement is made. Many interesting details as to the use which this country is making of its radio facilities are contained in the report of the chief engineer hereto appended. A brief reference to some of these services are as follows:

Fixed radiotelegraph.—The great network of radiotelegraph circuits operated by commercial companies of the United States has become a most important factor in international communication and has contributed much in making the United States the foremost radio country of the world. These circuits reach almost every nation of the earth, directly or indirectly, and are of great value to commerce and industry in this country. They are commercial assets of the Nation. As in the case of all other classes of radio service, the number of frequencies available is limited and the demands by other nations for the use of additional frequencies is constantly growing. Much time and study has been devoted in the commission to bring about the most economical use of wave lengths and such assignments as would enable the best service to be rendered to the people of this country.

Radiotelephone.—In the use of the radiotelephone the United States has led the world during the year. Compared with the provisions for international telephone communication that existed five years ago, the opportunities to-day are astounding. To-day over 86 per cent of the world's telephones are offered commercial interconnection in one network by the use of radio for the intercontinental circuits. During the fiscal year a new radiotelephone circuit has been opened to South America, and the construction of a station to communicate with Bermuda has been commenced. Tests are under way for the installation of radiotelephone communication to Hawaii, and probably to the Far East. It is possible for any telephone subscriber in the United States to speak from his home or office to passengers on the larger passenger lines on the North Atlantic. The commission has authorized the establishment of low-power radiotelephone stations in several of the principal harbors of the United States for the control and dispatch of big boats and small harbor craft.

The number of frequencies available and suitable for the radiotelephone service is very limited, and the commission has had many difficulties in providing for this service.

Aviation.—The needs of aircraft for radio facilities are greater than the needs of any other utility, due to the fact that no other form of communication is available. Since the International Conference of 1927 set aside certain blocks of frequencies for the use of aircraft, aviation in the United States has grown by leaps and bounds, and the task of providing the necessary frequencies for aircraft communication has been a most difficult one. The success achieved in providing sufficient channels to meet the needs of aviation in this country

has been possible only with the assistance and cooperation of the commercial aviation companies. In all the major aviation routes there has been installed radio communications between airplane and ground and ground and airplane. Thus, a pilot flying an airplane can at all times be in communication with one or more airports, and the officials responsible for the operation of the aircraft may at all times be in touch with the aircraft in flight. Thus, many flights which could not have been made without radio can now be safely made with radio. Aviation radio has added materially to the safety of all passengers carried in aircraft.

Police radio.—The development of the use of radio by city and State police departments has been an outstanding development during the past year. The Federal Radio Commission adopted a coordinated plan for the use of a number of frequencies for police use in such a way that maximum service would be rendered in each section of the country. Many city police departments have installed radio transmitters controlled by a central police official. Automobiles carrying patrolmen on the streets were equipped with receiving sets. Thus, from a police headquarters the police cars are ordered to the site of crimes or disturbances and immediate police control can be established. This has made it possible to very materially decrease the time required for dispatching police units and contributed to the reduction of crime in the cities so equipped. A few States have extended this to state-wide police service, but this phase of the work has not developed as far as the city police departments.

Experimentation and research.—During the year the commission has continued its policy of encouraging technical experimentation and research in the development and improvement of radio by the issue of licenses and the assignment of frequencies designated for this purpose. On many occasions permission has been given for special experiments of major importance or for the development of special equipment on other frequencies. The technical contributions from the radio laboratories of this country in the development of the art have done much in making the United States the foremost radio country of the world.

Experimental visual broadcasting.—In the field of visual broadcasting rapid strides have been made, but as yet the commission has not recognized commercial television. There has been a great improvement in the quality of images transmitted and in the amount of detail which it is possible to transmit. However, the present number of visual broadcasting frequencies present a severe limitation on the number of stations which may be operated without interference and on the character of the image which can be transmitted. The commission has therefore encouraged the investigation of the use of frequencies above 30,000 kilocycles for the purpose of visual broadcasting.

AMATEUR

At the close of the fiscal year there were approximately 22,000 amateur stations in the United States licensed by the commission. The story of the useful and constructive service rendered by amateur stations during the year is most interesting. In addition to many instances of useful service, the long-distance amateur service con-

tributes to the development of data concerning transmission effects on high frequencies. More detailed data concerning this service are set forth in the report of the chief engineer.

BROADCASTING

The past year has seen almost a complete revolution in the type of equipment used in broadcasting stations. By the commission's General Order No. 111 all stations were required to have equipment which was capable of more than 75 per cent modulation. Such equipment results in the approach to an equalization between the service area and the nuisance area of a broadcasting station, thus extending materially the service area for most stations. In many cases the changes in equipment which were necessary to meet the requirements of this general order likewise resulted in improved quality of transmission. In less than a year all stations were brought to the high level of service of which only a few stations boasted at the beginning of the year. The broadcasting stations of this country should be congratulated upon their willing cooperation in bringing this condition about.

In addition to the improvements in the equipment which gave more complete coverage for the stations, General Order No. 105 required that all full-time stations use the time assigned to them. Thus, full use is made of all the broadcast assignments.

The development of broadcast transmitters, and particularly the frequency control of such transmitters, has been very rapid. At an informal hearing held April 20, 1931, the radio broadcasting industry unanimously agreed that much stricter frequency maintenance is possible in the operation of broadcast transmitters. It was developed that a ±50-cycle tolerance could be met by modern broadcast equipment, and that if stations maintain their frequency within ±50 cycles per second there would be a large decrease in the amount of heterodyne interference. The commission, therefore, by General Order No. 116, promulgated on June 22, 1931, required that installations thereafter made must be capable of maintaining the frequency of the station within ±50 cycles, and that within one year all broadcasting stations must be brought within that degree of efficiency.

The interference caused by harmonics of one class of stations to another class is extremely disturbing to all classes of radio communication. While in the design of broadcast transmitters manufacturers have made an attempt to keep harmonics to a minimum, there have been some cases of broadcasting stations causing interference to communications carried on the higher frequencies. Each case which has been brought to the attention of the commission has been handled individually, and the broadcasting stations have in every case cooperated to reduce the interference. The continual improvements which have been made in broadcast transmitters have assisted materially in the solution of this problem.

The commission has on many occasions authorized the use of low-power transmitters for picking up, directly for rebroadcast purposes, events of national interest at points where wire lines were not available. This has made possible the description of many events which would not be available without such equipment.

During the year 11 new broadcasting stations were authorized, while 20 were deleted from the active records. Of the 20 deleted, 5 were consolidated with other stations, 2 were consolidated into 1 new station, 2 voluntarily relinquished their licenses, 1 which had been inactive since 1928 was dropped, and 10 were denied the renewal of their licenses.

Interesting data on certain broadcasting problems are set forth in the report of the chief engineer.

INTERNATIONAL RADIO

International Radio Conference of 1932.—Although the Federal Radio Commission has been given national jurisdiction over radio by the Congress of the United States, it is a well-known scientific fact that radio waves are not confined by national boundary lines and, as a matter of fact, are capable of causing serious international interference. For this reason it is necessary for periodic conferences to be held among all the nations of the world, in order to draw up certain international rules and regulations governing radio which will permit the best and most economic use of the ether to be made. The last such conference was held in Washington in 1927. It was attended by 79 nations of the world, and resulted in the adoption of what is known as the "International Radiotelegraph Convention and General Regulations Annexed Thereto."

The next world conference of this nature is scheduled for Madrid in September, 1932.

Preparation by the United States for such conferences involves the formulation of proposals which will best serve to govern radio for the ensuing five years. It is evident that the United States, as the foremost radio-using nation in the world, must be very active in the formulation of such proposals. The Federal Radio Commission, with the cooperation of other Government departments and the principal commercial communications companies of the United States, has, in conjunction with the Department of State, organized frequent meetings at which the various representatives interested could discuss such proposals. These were then transmitted to the International Bureau of the Telegraph Union at Berne, Switzerland, for incorporation into the Book of Proposals for general circulation to the nations of the world. In the preparation for the 1927 conference, over 2,000 separate proposals were submitted by the various nations.

International Radio Technical Consulting Committee.—In order to keep up to date with the technical progress that is being made in radio, the 1927 International Convention provided for the establishment of a technical committee, known as the International Technical Consulting Committee on Radio Communications (C. C. I. R.), to meet every two years in order to consider technical recommendations which would be consistent with the technical progress made since the holding of the last world conference. The second of these meetings was held in Copenhagen, Denmark, from May 27 to July 8, 1931. Three members of the staff of the Federal Radio Commission attended this conference.

At the request of the Department of State, the Federal Radio Commission, with the cooperation of the other Government departments

and the principal commercial communications companies, prepared technical proposals to be submitted to this conference, and a number of these recommendations were adopted by the conference in the final 20 "opinions" adopted. These opinions, which are technical recommendations for the guidance of all nations, cover such topics as the organization of a commercial radiotelephone service between mobile stations and the land network; the establishment of a world frequency list; a definition of the power of a transmitter; the setting up of reasonable tolerances for various types of stations; methods for the comparison of frequency standards; reduction of interference in the shared bands; the elimination of nonessential emissions; the reduction of the frequency band used by a transmitter; and the suppression of harmonics.

LEGAL ASPECTS OF RADIO

The legal problems which have confronted the commission during the past year have been many and varied. Their complexity, due to the formative state of radio law, has severely taxed the commission's legal staff. There are many important questions yet to be answered authoritatively by the higher courts, ranging from most important fundamentals, such as whether the radio act itself is constitutional, and the question as to whether the test of "public interest, convenience, or necessity" as laid down by the act is a sufficient limitation on the powers vested in the commission, to questions of less importance, but which must eventually be settled by the courts, such as what constitutes a "radio signal" as that term is used in the act. Through this maze of unsettled and unformed law it has been necessary for the legal staff of the commission to pick its way in the handling of the 57 appeal cases to which the commission was a party and of the 321 cases heard before the commission or its examiners. In addition to the research work and procedural matters requiring attention in these 378 formal cases, the legal division has examined more than 10,000 applications received during the fiscal year to determine the legal sufficiency of such applications prior to their submission to the commission for its formal consideration, and has prepared briefs and opinions on the many and varied questions submitted to it by the commission.

One of the outstanding developments in the legal aspect of broadcasting occurring during the fiscal year was the decision by the Court of Appeals of the District of Columbia in the case of KFKB Broadcasting Association, Inc., *v.* Federal Radio Commission.

In this case the court upheld the commission's action in denying the renewal of a broadcasting license for the reason that the character of program broadcast during the previous license term did not meet the legislative requirement that such programs should serve public interest, convenience, and necessity. The court in its opinion said that the commission had exercised its undoubted right of taking note of this broadcaster's past conduct which was not censorship. In the same opinion the court upheld the commission's contention that broadcasting should not be a mere adjunct of a particular business, but should be of a public character.

Steps have been taken in conjunction with the Department of Justice to more actively prosecute criminal violations of the radio

act of 1927, as amended. So far as concerns prosecutions for unlawful radio transmission—that is, transmission by an unlicensed station—comparatively few cases have come to the attention of the commission. Prosecution of such cases involves the necessity of showing the interstate character of the elusive, intangible radio impulse from the unlicensed station, or that it has interfered with an interstate signal. It is the intention of the commission to make every effort toward the prosecution of all such cases.

Several instances have come to the attention of the commission in which amateur radio transmitters have been used in connection with liquor and narcotic activities. These cases have been handled in connection with the proper agencies of the Government.

During the past fiscal year there was presented to the commission a question of far-reaching importance, involving a determination as to whether or not the Radio Corporation of America and its subsidiary companies had been adjudicated guilty of monopoly within the language of section 13 of the radio act of 1927, as amended. After a public hearing on the subject a majority of the commission held the view that the provisions of this section of the law had not been violated. This question is treated in detail in the report of the general counsel which is appended hereto.

During the year there has been widespread complaint against stations broadcasting fortune telling, lotteries, games of chance, gift enterprises, or similar schemes offering prizes dependent in whole or in part upon lot or chance. By reason of the widespread complaint against this class of program the commission found it necessary to issue a statement giving its position regarding them. After mature deliberation the commission announced that there exists a doubt that such programs are in the public interest and that complaint from a substantial number of listeners will result in the station's application for renewal of its license being set for a hearing. Copies of this statement were mailed to each broadcasting station licensed by the commission.

It is believed that this warning has had the effect of materially limiting this class of program, and in such instances as came to the attention of the commission after its issuance the programs were discontinued voluntarily by the station after the matter had been brought to its attention.

A detailed statement of the work of the legal division of the commission is set forth in the report of the general counsel hereto appended.

STATEMENTS OF FACT AND GROUNDS FOR DECISION

Section 16 of the radio act of 1927, as amended, requires the Federal Radio Commission, in all appeals from its decisions, to file with the Court of Appeals of the District of Columbia a "copy of its decision * * * and a full statement in writing of the facts and the grounds for its decision as found and given by it." In line with this provision the commission, in February, 1931, decided to issue a decision or a statement in writing of the facts and the grounds for its decision in all cases where the decision is adverse to a party of record in the case, or in all cases which may be appealed under the

provisions of section 16 of the act. Very little precedent has been established in the field of radio law, either through pronouncements of the courts or of the commission. The issuance of opinions by the commission has served two distinct purposes—first, to apprise the parties and the courts of the position taken by the commission as well as the reasons therefor; and, second, to make known certain definite elements essential in reaching a determination on the standard of public interest, convenience, and necessity.

It would seem necessary that a litigant be advised as to the position of the commission in order that he may fully protect his interests upon appeal. It is also important that there exist certain well-defined principles which the radio profession may reasonably expect the commission to consider in arriving at a decision upon any application. If these purposes are served, the commission will better be able to carry out the duties imposed upon it by the Congress in the radio act of 1927.

The commission desires to express its appreciation of the assistance and coperation received during the year from the Radio Division, the Aeronautics Branch, and the Bureau of Standards, Department of Commerce; the Department of State; the War Department; the Navy Department; the Coast Guard, Treasury Department; and the Interdepartment Radio Advisory Committee. The cooperation of these agencies has facilitated the work of the commission in many instances.

Respectfully submitted.

C. McK. SALTZMAN, *Chairman.*

ORGANIZATION CHART
—FEDERAL RADIO COMMISSION—

The government of the Commission is vested in five members appointed by the President by and with the advice and consent of the Senate. There are elected, by the members, a Chairman and a Vice Chairman.

EXAMINERS DIVISION
The Examiners Division is supervised by a Chief Examiner and is charged with the duty of hearing applicants on their applications for radio facilities which have been designated by the Commission for a hearing; the submission of written reports and recommendations thereon to the Commission.

LEGAL DIVISION
The General Counsel is the chief legal adviser of the Commission and the head of the Legal Division.

RESEARCH AND DRAFTING SECTION
The Research and Drafting Section is supervised by an Assistant General Counsel and is responsible for the preparation for trial and trial of cases in which the Commission is a party arising under the Radio Act of 1927, as amended; the drafting of decisions, orders, rules, and advising the Commission concerning legal phases of international treaties and agreements.

HEARING AND RECORD SECTION
The Hearing and Record Section is supervised by an Assistant General Counsel and is charged with the duty of representing the Commission at all formal hearings.

ADMINISTRATIVE SECTION
The Administrative Section is supervised by an Assistant General Counsel and is responsible for the legal examination of all legal phases relating to all applications for radio facilities and the preparation of recommendations thereon to the Commission; to investigate complaints of alleged violations of the Radio Act of 1927 as amended and/or rules and orders made thereunder.

ENGINEERING DIVISION
The Chief Engineer is the chief technical adviser of the Commission and head of the Engineering Division.

PRESS SECTION
This Section is responsible for the preparation and release of all Press releases; the distribution to the press of Commission orders, publications, etc. The head of the Section acts as contact man with the members of the press.

BROADCASTING SECTION
The Broadcasting Section is supervised by an Assistant Chief Engineer and is responsible for the technical examination of all matters relating to applications for radio broadcasting facilities (550 to 1500 kc); preparation and presentation of expert testimony at formal hearings; study and preparation of technical regulations; study and research to determine ways and means of making better use of the facilities available.

COMMERCIAL COMMUNICATIONS SECTION
The Commercial Communications Section is supervised by an Assistant Chief Engineer and is responsible for the technical examination of all matters relating to applications for radio communications facilities (10 to 550 kc and above 1500 kc); preparation and presentation of expert testimony at formal hearings; study and preparation of technical regulations; study and research to determine ways and means of making better use of the facilities available.

INTERNATIONAL AND INTERDEPARTMENTAL RELATIONS SECTION
The International and Interdepartmental Relations Section is supervised by an Engineer and is charged with the duty of coordinating the international and interdepartmental relations of the Commission and to make plans for United States participation in the organized preparatory work for international radio conferences and technical meetings; to advise the Commission concerning technical engineering phases of international treaties, agreements, etc.

OFFICE OF THE SECRETARY
The Secretary is the Chief Administrative Officer of the Commission; pursuant to Section 214 of the Act approved June 10, 1921, (U. S. C. Title 31, Sec. 22) the Secretary is designated the Budget Officer of the Commission.

MINUTE SECTION
This Section is charged with the preparation and preservation of minutes of Commission meetings.

ASSISTANT SECRETARY
The Assistant Secretary is charged with the immediate supervision and direction of the work in the Divisions and Sections here indicated and acts for the Secretary in the latter's absence.

LICENSE DIVISION
The License Division is charged with the receipt of all applications for radio facilities, the administrative examination thereof, the maintenance of records showing Commission action thereon; the issuance of licenses and orders in conformity therewith.

DOCKET SECTION
The Docket Section is charged with the preparation of the Hearing Calendar, the publication of reports of Examiners and the preparation of the dockets for Commission action.

DISBURSING OFFICE
The Disbursing Office is charged with the disbursement of all moneys appropriated for use by the Commission; the maintenance of fiscal control records.

DIVISION OF MAIL AND FILES
The Division of Mail and Files is the depository of all the files of the Commission (except technical files) and is charged with the receipt, recording, indexing and classifying of all mail received in and sent out of the Commission.

CORRESPONDENCE SECTION
The Correspondence Section is charged with the receipt of all correspondence of a general character and the preparation of replies thereto.

DUPLICATING SECTION
The Duplicating Section is charged with the mimeograph, multigraph and addressograph work of the Commission and the preparation of such material for mailing.

SUPPLY SECTION
The Supply Section is charged with the procurement, storage and issue of all supplies

TELEPHONE SECTION
The Telephone Section is charged with the operation of the telephone switchboard and the examination and audit of vouchers for telephone service.

SUB CLERICAL SECTION
The sub clerical section is charged with performance of miscellaneous custodial work.

APPROVED APRIL 30, 1931
—FEDERAL RADIO COMMISSION—
BY [illegible]
SECRETARY

83414—31. (Face p. 11.)

REPORT OF THE SECRETARY

JAMES W. BALDWIN

ORGANIZATION

The work begun last year incidental to the reorganization of the commission was carried into and completed in the fiscal year 1931. The completion of this work gives to the commission a staff and personnel to which the problems received in the commission may be assigned for thorough study before they are presented for commission action. There is appended hereto a chart showing in detail the organization of the commission and the duties and responsibilities assigned to each division and section.

During the year an additional section was created in the license division to handle matters related to the licensing of approximately 22,000 amateurs. There was organized during the year a docket section. This section is charged with the responsibility of preparing calendars of cases to be heard before the commission examiners, the publication of the reports of examiners, the receipt of exceptions to such reports, and the publication of the opinions of the commission.

GENERAL

The year 1931 was a very busy one. There were more than 30,000 formal matters requiring commission action. The commission held 176 formal meetings, and sat en banc to hear the proceedings in the R. C. A. cases growing out of the decision of the District Court of Delaware, to hear oral argument in 27 cases, and to hear revocation proceedings in 2 cases. The commission granted 27,747 applications and denied 584. There were handed down 203 decisions in docket cases, of which 132 were denied, 58 were granted, 6 were granted in part, and 7 were dismissed.

FINANCES

In order to have current and accurate information concerning the commission's finances, there was created a fiscal control section, the maintenance of which furnishes information from day to day concerning the status of the commission's funds as they are allocated for the different objects of expenditure.

For the fiscal year 1931 there was appropriated $450,000. This sum is accounted for as follows:

01 Personal services	$328,978.56
02 Supplies and materials	11,479.50
05 Communications	3,181.12
06 Travel expenses	6,412.04
07 Local transportation	849.70
08 Printing and binding	34,811.29
11 Rents	44,011.50
12 Repairs and alterations	959.96
18 Miscellaneous	250.00
30 Furniture, fixtures, equipment	13,746.28
Total	444,179.94

The following is a report of the activities of the license division:

LICENSE DIVISION

George S. Smith, Chief

The license division has been charged with the receipt of all applications for radio facilities, the administrative examination thereof, the maintenance of records showing commission action thereon, and the issuance of instruments of authority in conformity therewith.

This division has undergone considerable expansion and for the purpose of better administration was reorganized into three sections: (1) The amateur section receives and records all applications for amateur radio-station licenses and issues all licenses for that service; (2) the broadcast section receives and records all applications for broadcast radio stations and issues all instruments of authority relative thereto; (3) the commercial section receives and records applications for all radio stations, exclusive of amateur and broadcast. This section issues all instruments of authority for 20 different classifications of stations.

AMATEUR SECTION

Since the creation of the amateur section there were received 20,609 license applications and there were granted and issued 20,204 station licenses. The applications received and licenses issued necessitated the preparation of 61,017 card records, all of which have been currently maintained.

BROADCAST SECTION

This section received 3,784 applications as compared with 3,970 for the previous year, a decrease of 186 applications. There were prepared and issued 3,233 instruments of authority, as compared with 3,345 during last year, a decrease of 112.

Twenty radio broadcasting stations were deleted from the active records, five of which were consolidated with other licensed stations, and two of which were consolidated into one new station. A list of the stations deleted and/or consolidated is set forth as follows:

Radio broadcasting stations deleted during the fiscal year 1931

Call letters	Grantee and location	Date of deletion
WBBS	Boston Broadcasting Co., Boston, Mass.	June 11, 1931
WBBW	Ruffner Junior High School, Norfolk, Va.	Do.
WBBY	Washington Light Infantry, Charleston, S. C.	July 15, 1930
WCHI	Radiophone Broadcasting Corporation, Chicago, Ill.	Oct. 31, 1930
WMAF	Round Hills Radio Corporation, South Dartmouth, Mass.	June 2, 1931
WMAY	Kingshighway Presbyterian Church, St. Louis, Mo.	June 12, 1931
WMBJ	Rev. John W. Sproul, Penn Township, Pa.	Feb. 21, 1931
WRK	S. W. Doron and John C. Slade, doing business as Hamilton Radio Service, Hamilton, Ohio.	Sept. 29, 1930
KPHA	Waldo L. Hawkins and Dr. A. R. Craig, doing business as The Hawkins-Craig Syndicate, Gunnison, Colo.	Jan. 7, 1931
KPSN	Pasadena Star-News Publishing Co., Pasadena, Calif.	Apr. 30, 1931
KPWF	Pacific-Western Broadcasting Federation, Los Angeles, Calif.[1]	June 30, 1931
KTNT	Norman Baker, Muscatine, Iowa.	July 1, 1931
KZM	Leon P. Tenney, Hayward, Calif.	June 29, 1931

[1] Construction permit only.

Radio broadcasting stations consolidated during the fiscal year 1931

Call letters	Grantee and location	Date of consolidation	Call letters and location of station consolidated with
WCSO	The WGAR Broadcasting Co., Springfield, Ohio.	June 12, 1931	WFJC, to form new station WGAR, Cleveland, Ohio.
WFJC	The WGAR Broadcasting Co., Akron, Ohio.	do	WCSO, to form new station WGAR, Cleveland, Ohio.
WGBC	Memphis Broadcasting Co., Memphis, Tenn.	June 17, 1931	WNBR, Memphis, Tenn., under call letters WNBR-WGBC.
WISJ	Badger Broadcasting Co., Madison, Wis.	June 4, 1931	WIBA, Madison, Wis.
WMAC	Clive B. Meredith, Cazenovia, N. Y.	Oct. 31, 1930	WSYR, Syracuse, N. Y., under call letters WSYR-WMAC.
WSSH	Tremont Temple Baptist Church, Boston, Mass.	May 15, 1931	WAAB, Boston, Mass.
WTNT	Life & Casualty Insurance Co. of Tennessee, Nashville, Tenn.	Dec. 16, 1930	WLAC, Nashville, Tenn.

Eleven new radio broadcast stations were authorized to be constructed, making a total of 612 authorized stations, as compared with 621 for the previous year. A list of the new stations is set forth as follows:

New radio broadcasting stations authorized during the fiscal year 1931

Call letters	Applicant and location	Frequency	Power	Hours of operation
		Kilocycles	*Watts*	
WGAR	The WGAR Broadcasting Co., Cleveland, Ohio.	1,450	500	Unlimited.
WSYB	Philip Weiss, trading as Philip Weiss Music Co., Rutland, Vt.	1,500	100	Do.
KGVO	Mosby's Incorporated, Missoula, Mont.	1,420	100	Daytime.
WBEO	The Lake Superior Broadcasting Co., Marquette, Mich.	1,310	100	Unlimited.
WWSW	William S. Walker, Pittsburgh, Pa.	1,500	100	Do.
WBHS	W. T., M. M., W. C., and V. F. Hutchens, doing business as The Hutchens Co., Huntsville, Ala.	1,200	50	Share with WFBC.
WJMS	Marina Johnson, Prop., trading as Johnson Music Store, Ironwood, Mich.	1,420	100	Daytime.
WAGM	Aroostook Broadcasting Corporation, Presque Isle, Me.	1,420	100	Unlimited.
WDEV	Harry C. Whitehill, Waterbury, Vt.	1,420	50	Daytime.
WEEU	Raymond A. Gaul, Harold O. Landis, and H. S. Crummer, doing business as Berks Broadcasting Co., Reading, Pa.	830	1,000	Do.
WFEA	Rines Hotel Co., Manchester, N. H.	1,430	500	Unlimited when no interference is caused with other stations operating on 1,430 kilocycles.

In order to solve a major problem of administration concerning the method and policy of handling the applications for renewal of licenses, a plan staggering the license periods of all radio broadcast stations was adopted. The 612 stations have been segregated into six groups according to operating frequency, and each group has been assigned a fixed license term of six months. The text of the license plan that was adopted by the commission on April 16, 1931, is set forth as follows:

The commission ordered:

That the licenses of radio broadcasting stations expiring at 3 a. m., eastern standard time, April 30, 1931, which may be regularly granted hereafter will be for the periods hereinafter mentioned and that thereafter succeeding licenses be for a term of six months.

Stations operating on the frequencies 640, 650, 660, 670, 680, 700, 710, 720, 740, 750, 760, 770, 790, 800, 810, 820, 830, 850, 860, 870, 970, 980, 990, 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, and 1,190 kilocycles will be licensed for a period of three months ending 3 a. m., eastern standard time, August 1, 1931.

Stations operating on the frequencies 550, 560, 570, 580, 590, 600, 610, 620, 630, 780, 880, 890, 900, and 920 kilocycles will be licensed for a period of four months ending 3 a. m., eastern standard time, September 1, 1931.

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, and 1,290 kilocycles will be licensed for a period of five months ending 3 a. m., eastern standard time, October 1, 1931.

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, and 1,490 kilocycles will be licensed for the period of six months ending at 3 a. m., eastern standard time, November 1, 1931.

Stations operating on the frequencies 1,200, 1,210, and 1,310 kilocycles will be licensed for a period of seven months expiring at 3 a. m., eastern standard time, December 1, 1931.

Stations operating on the frequencies 1,370, 1,420, and 1,500 kilocycles will be licensed for a period of eight months ending at 3 a. m., eastern standard time, January 1, 1932.

Provided, however, That applications for renewal of station licenses which have been designated for hearing or which may be issued for shorter periods of time than those hereinabove enumerated, pending decision of the commission, or licenses which may be granted for shorter periods of time than those hereinbefore enumerated, for the purpose of affording an opportunity to investigate such stations, shall not be affected by this action.

A complete list of radio broadcasting stations of the United States, arranged into three parts—(*a*) alphabetically by call signals; (*b*) alphabetically by States and cities; (*c*) by frequency—was compiled and published and placed on sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. Supplements have been prepared on a monthly basis for distribution to the general public.

COMMERCIAL SECTION

This section received a total of 6,246 applications, as compared with 4,573 during the previous year, an increase of 1,673 applications. There were issued 5,395 instruments of authority as compared with 4,310 for last year, an increase of 1,085.

The instruments of authority that were issued were comprised of construction permits, licenses, modification of construction permits and/or licenses, consent to voluntary and involuntary assignment of construction permits and/or licenses, extension of licenses, special authorizations, and emergency authorizations.

Lists of radio stations arranged numerically by frequency assignment have been compiled on a semimonthly basis, and copies have been regularly sent to the International Bureau of the Telegraph Union, Berne, Switzerland, for registration on behalf of the United States Government. These lists were necessarily comprehensive and contained the following information: Frequency (kilocycles), wave lengths (meters), date of notification of the frequency to the International Bureau, call signals, location of station, type of emission, antenna power, nature of service and countries with which communication is proposed or already established, proposed date of completion or date of placing station into operation, administration or operating company, and remarks.

Lists of police and fire, experimental relay broadcasting, and experimental visual broadcasting radio stations have been prepared from time to time for the use of the general public and press.

With certain exceptions and subject to specific limitations, all licenses for the following services which were in full force and effect on November 14, 1930, were extended to 3 o'clock a. m., eastern standard time, October 1, 1931:

Point-to-point.
Coastal.
Marine relay.
Ships above 1,500 kilocycles.
Aeronautical and aeronautical point-to-point.
Aircraft.
Police.
Mobile press.

Licenses for all other commercial services have been issued for a period not exceeding one year, with the exception of special experimental, which have been issued for a period of time not exceeding three months.

There follows herewith a tabulation arranged according to service, which shows the number of new stations authorized, the number of stations deleted, and the total number of authorized radio stations.

Nature of service	Number of new radio stations authorized	Number of radio stations deleted	Total number of radio stations as of June 30, 1931
Aeronautical and point-to-point aeronautical	110	37	170
Agriculture	None.	6	9
Aircraft	123	61	202
Amateur	(1)	(1)	22,759
Broadcasting	11	20	612
Coastal	8	13	145
Fire	1	3	5
Forestry	None.	None.	2
General experimental	31	100	113
Geophysical	11	24	113
Marine relay	28	8	34
Mobile press	1	None.	3
Motion pictures	6	2	5
Point-to-point	34	123	207
Police	25	6	62
Power	2	21	23
Relay broadcasting	2	3	13
Ships	134	96	2,213
Special experimental	41	18	47
Temporary pick-up for rebroadcast	6	None.	4
Visual broadcasting	6	8	21
Grand totals	590	569	26,994

[1] No figures available.

The following is a report of the division of mail and files:

DIVISION OF MAIL AND FILES

EDWARD L. PAYNE, Chief

The past year has seen a rapid growth in the activities of the division of mail and files. In addition to the establishment of proper procedure for the expeditious handling of correspondence, this division has constructed and installed a numerical filing system, known as the duplex filing system. This system provides for the classification of correspondence and other material by subjects and is composed at the present time of several hundred main subjects and subdivisions. Under this system, files also are maintained for individual radio stations, in order that a history of the station may be available. A card-index system has likewise been constructed and installed for the recording of correspondence and other material.

This division has been made the sole depository for all files of the commission, with the exception of the license files. The applications and licenses of amateur operators, numbering about 20,000, are maintained in this division. Files which have been maintained in other parts of the office have now been transferred to this division and are being consolidated, along with other old correspondence, into the new filing system. This consolidation is taking place gradually, and it is expected that it will be completed during the next year. The receipt of incoming mail and the dispatch of outgoing mail has also been centralized in this division.

The statistics for the year show the receipt and dispatch of mail as follows:

Incoming mail	113,720
Outgoing mail	164,855
Total	278,575

Inasmuch as no statistics were maintained for the previous years, no comparative statement can be made. There is no doubt, however, that there has been a substantial increase in the volume of mail.

GENERAL ORDERS

The commission adopted 24 general orders during the year, a number of which are treated elsewhere in this report. Their text is printed in Appendix A.

REPORT OF THE CHIEF ENGINEER

Dr. C. B. Jolliffe

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GENERAL

For the purpose of allocation of frequencies and technical regulation, radio stations are classified into various services, as follows:

- Broadcasting.
- Fixed point-to-point:
  - Radiotelegraph.
  - Radiotelephone.
  - Press (telegraph).
- Maritime:
  - Coastal telegraph.
  - Coastal telephone.
  - Ship telegraph.
  - Ship telephone.
  - Harbor telephone.
  - Marine relay.
  - Mobile press.
- Aviation.
- Police.
- Alaska.
- Broadcast pick-up.
- Motion picture.
- Experimental visual broadcasting.
- Experimental relay broadcasting.
- General experimental.
- Special experimental.
- Amateurs.
- Geophysical prospecting.
- Fire.
- Emergency communication for power companies.

There have been many demands for other classes of service, but the allocation of frequencies to new services is always given careful consideration and the needs weighed in comparison with its relation to existing services. When it can be shown that there is a public need for radio communications for a new service it must then be fitted into the radio spectrum in accordance with the needs. The extensive use of the radio spectrum is making this more and more difficult. The allocation of frequencies to services and stations is being continually studied, with the view of organizing all communications so that the maximum use is made of the limited facilities available.

Such studies require special and careful consideration of the problems involved, and in each of the two sections dealing with allocation of frequencies men have been assigned exclusively to research work in the respective fields. These men deal with the routine work of the commission only in so far as it is necessary in order to be acquainted with the problems involved. By continual study of such matters as interference between stations, allocation of frequencies to services and stations, new equipment, transmission phenomena, and scientific development in various laboratories it is possible to propose regulations and allocations which insure that operation of all stations is in accordance with good engineering practice and that full use is made of the frequency spectrum.

In connection with the routine work of the commission, the engineering division examines all applications for instruments of authorization and makes an engineering report which is considered by the commission when action is taken on the application. Many of these reports are of major importance and the preparation involves much original study. In case an application is set for hearing and technical questions are involved, an engineer presents engineering testimony at the hearing and gives assistance to the legal division in the conduct of the case.

BROADCAST SECTION

V. Ford Greaves, Chief

ALLOCATION OF BROADCAST FACILITIES

The basic plan of allocation of broadcast facilities, General Order 40, has been maintained. Changes have been made from time to time upon applications from station licensees and as the result of hearings.

On June 30, 1931, there was a total of 612 licensed broadcast stations. Of this number, 420 were authorized to operate simultaneously at night. An analysis of the various types of stations authorized is given in Table I.

Table I.—*Broadcast stations in operation June 30, 1931*

	Clear	Regional	Local	Total
Number of stations operating simultaneously at night	45	187	188	420
Number of day stations [1]	15	23	8	46
Number of limited-time stations [2]	21			21
Number of part-time stations [3]		5	8	13
Number of stations sharing time [4]	22	133	77	232
Total number of stations	90	284	268	612
Number of frequencies used	40	44	6	90

[1] Operate from 6 a. m. to sunset. (See General Orders 41 and 105.)
[2] Operate during daylight at dominant station and at night when dominant station is not in operation. (See General Orders 48 and 105.)
[3] Operate portion of time, remainder of time on same frequency not allocated in the same geographical location.
[4] 2 to 4 stations in same geographical location operate on same frequency at different hours.

The method of evaluating the broadcast facilities which are assigned to stations of various classes as given in General Order 92 has been followed. The 1930 census, which was published during the year, made it necessary to revise the proportions of the broadcasting facilities due each zone and State. The status of assignments of facilities to zones and States as of June 30, 1931, is given in Table II, the units due being based on the preliminary announcement of the official population of the various States as published by the United States Census Bureau.

TABLE II.—*Details of quota units by zones and States*

(Total broadcasting facilities of the United States, 400 units)

State	Units due	Units assigned	Net amount over or under quota	
			Units	Per cent
ZONE 1				
New York	35.10	39.20	+4.10	+12
Massachusetts	11.85	9.98	−1.87	−16
New Jersey	11.21	11.53	+0.32	+3
Maryland	4.56	4.10	−0.46	−10
Connecticut	4.46	3.55	−0.91	−20
Porto Rico	4.32	0.40	−3.92	−91
Maine	2.23	2.20	−0.03	−1
Rhode Island	1.91	1.40	−0.51	−27
District of Columbia	1.33	1.30	−0.03	−2
New Hampshire	1.31	0.80	−0.51	−39
Vermont	1.00	0.60	−0.40	−40
Delaware	0.67	0.70	+0.03	+4
Virgin Islands	0.06	.....	−0.06	−100
Total	80.00	75.76	−4.24	−5
ZONE 2				
Pennsylvania	27.64	20.24	−7.40	−27
Ohio	19.06	18.65	−0.40	−2
Michigan	13.86	11.40	−2.46	−18
Kentucky	7.54	7.62	+0.08	+1
Virginia	6.94	9.50	+2.56	+37
West Virginia	4.95	4.90	−0.05	−1
Total	80.00	72.31	−7.69	−10
ZONE 3				
Texas	16.23	22.77	+6.54	+40
North Carolina	8.53	7.52	−1.01	−11
Georgia	8.09	7.95	−0.14	−2
Alabama	7.39	6.22	−1.17	−16
Tennessee	7.29	12.83	+5.54	+76
Oklahoma	6.67	9.00	+2.33	+35
Louisiana	6.33	8.60	+2.27	+46
Mississippi	5.60	3.00	−2.60	−46
Arkansas	5.17	4.40	−0.77	−15
South Carolina	4.82	1.70	−3.12	−65
Florida	4.09	8.35	+4.26	+104
Total	80.00	92.54	+12.54	+16
ZONE 4				
Illinois	22.50	33.84	+11.34	+50
Missouri	10.72	12.05	+1.33	+12
Indiana	9.53	7.48	−2.05	−21
Wisconsin	8.66	7.95	−0.71	−8
Minnesota	7.59	9.01	+1.42	+19
Iowa	7.30	11.45	+4.15	+57
Kansas	5.56	4.71	−0.85	−15
Nebraska	4.08	7.23	+3.15	+77
South Dakota	2.04	3.01	+0.97	+48
North Dakota	2.02	2.99	+0.97	+48
Total	80.00	99.72	+19.72	+25
ZONE 5				
California	36.85	36.43	−0.42	−1
Washington	10.16	15.80	+5.64	+56
Colorado	6.74	9.42	+2.68	+40
Oregon	6.19	9.15	+2.96	+48
Montana	3.48	3.00	−0.48	−14
Utah	3.27	6.60	+3.33	+102
Idaho	2.89	2.60	−0.29	−10
Arizona	2.83	2.60	−0.23	−8
New Mexico	2.77	4.03	+1.26	+45
Hawaii	2.39	1.40	−0.99	−41
Wyoming	1.46	0.20	−1.26	−86
Nevada	0.59	0.80	+0.21	+36
Alaska	0.38	1.00	+0.62	+163
Total	80.00	93.03	+13.03	+16

SUPPLEMENT TO THE
FIFTH ANNUAL REPORT
of the
FEDERAL RADIO COMMISSION
FOR THE FISCAL YEAR
1931

December 7, 1931.

The following additional data, released by the Census Bureau after the printing of the above mentioned report, may be inserted in the publication:

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Table IV.-Number of receiving sets in United States

ZONE 2

State	Number of families	Number of Receiving sets	Percentage of families owning receiving sets
(insert)-Pennsylvania	2,239,179	1,076,770	48.1

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Table IV.-Number of receiving sets in United States

ZONE 4

State	Number of families	Number of Receiving sets	Percentage of families owning receiving sets
Illinois (insert) -	1,934,445	1,075,134	55.6
(insert)-Grand total- United States (Average population per family - 4.1)	29,980,146	12,078,345	40.3

James W. Baldwin,
Secretary.

5809

TABLE II.—*Details of quota units by zones and States*—Continued

SUMMARY

	Total units due	Total units assigned	Net amount over or under quota	
			Units	Per cent
Zone 1	80	75.76	−4.24	−5
Zone 2	80	72.31	−7.69	−10
Zone 3	80	92.54	+12.54	+16
Zone 4	80	99.72	+19.72	+25
Zone 5	80	93.08	+13.08	+16
Total	400	433.36	+33.36	+8

This is a fair balance of broadcasting facilities as between zones, considering the inequalities in the sizes of the zones and the differences in the distribution of population as shown in Table III.

TABLE III.—*Relation of radio facilities to size and population of zones*

	Total facilities due	Portion of total facilities assigned	Portion of total United States population	Portion of total United States area	Average population per square mile
	Per cent	*Per cent*	*Per cent*	*Per cent*	
Zone 1	20	17.5	24	4	209
Zone 2	20	16.7	22	7	111
Zone 3	20	21.3	23	22	37
Zone 4	20	23.0	22	15	41
Zone 5	20	21.5	10	49	7

As a part of the 1930 census a count was made of the number of receiving sets in the United States. For the purpose of comparison with the tables above, Table IV is given, which shows that portion of these data now available, classified according to zones and States.

TABLE IV.—*Number of receiving sets in United States*

ZONE 1

State	Number of families	Number of receiving sets	Percentage of families owning receiving sets
New York	3,162,118	1,829,123	57.8
Massachusetts	1,034,527	590,105	57.0
New Jersey	997,816	625,639	62.7
Maryland	330,057	180,445	54.6
Connecticut	330,600	213,531	64.6
Porto Rico	(1)	(1)	(1)
Maine	196,272	77,[illegible]	39.2
Rhode Island	165,311	94,394	57.1
District of Columbia	136,014	67,860	49.9
New Hampshire	119,460	53,111	44.4
Vermont	80,480	36,913	44.6
Delaware	59,205	27,189	45.9
Virgin Islands	(1)	(1)	(1)

ZONE 2

State	Number of families	Number of receiving sets	Percentage of families owning receiving sets
Ohio	1,700,877	810,767	47.7
Michigan	1,169,157	699,195	59.8
Kentucky	610,268	111,452	18.3
Virginia	530,002	96,569	18.2
West Virginia	374,646	87,469	23.4

[1] Compilation not released by Census Bureau at time of going to press.

TABLE IV.—*Number of receiving sets in United States*—Continued

ZONE 3

State	Number of families	Number of receiving sets	Percentage of families owning receiving sets
Texas	1,333,280	257,696	18.9
North Carolina	645,245	72,320	11.2
Georgia	654,009	64,906	9.9
Alabama	592,530	56,491	9.5
Tennessee	601,578	86,230	14.3
Oklahoma	585,348	121,978	20.6
Louisiana	486,424	54,384	11.2
Mississippi	492,354	25,475	5.4
Arkansas	439,408	40,248	9.2
South Carolina	366,365	28,027	7.7
Florida	377,828	58,448	15.5

ZONE 4

State	Number of families	Number of receiving sets	Percentage of families owning receiving sets
Illinois	(1)	(1)	(1)
Missouri	941,821	352,252	37.4
Indiana	844,488	351,640	41.6
Wisconsin	713,576	364,435	51.1
Minnesota	608,206	287,580	47.3
Iowa	596,905	309,327	48.6
Kansas	486,055	189,537	38.5
Nebraska	343,781	164,324	47.8
South Dakota	161,382	71,361	44.2
North Dakota	146,382	59,352	40.3

ZONE 5

State	Number of families	Number of receiving sets	Percentage of families owning receiving sets
California	1,618,535	830,946	51.3
Washington	1,426,019	180,220	42.2
Colorado	268,531	101,376	37.8
Oregon	267,690	116,209	43.5
Montana	137,010	45,809	33.4
Utah	116,284	47,739	41.1
Idaho	106,515	32,560	30.3
Arizona	106,580	19,295	18.1
New Mexico	98,820	11,404	11.5
Hawaii	(1)	(1)	(1)
Wyoming	57,218	19,482	34.0
Alaska	(1)	(1)	(1)
Nevada	25,780	7,980	30.9

[1] Compilation not released by Census Bureau at time of going to press.

TECHNICAL IMPROVEMENTS IN BROADCASTING

In recent years there has been rapid development in the improvement of radio broadcast transmitters. When installed in a station these improvements result in an increase in the service area of the station and in improvement in the service rendered to the listeners. These improved transmitters were installed in some stations, and others made modifications in licensed transmitters to include these improvements. However, there was not universal adoption by all, and the net improvement possible could not be realized because of the failure of adoption by all. Thus there was not complete use of all broadcast facilities.

In order that the radio listeners may be given the best service possible, it is essential that all licensees of broadcast stations be required to install modern equipment and make full use of the facilities allocated. It is a well-accepted principle of radio regulation that, in

order to enjoy the privileges of making use of a portion of the limited radio facilities available, the user must keep his equipment up to a standard "consistent with good engineering practice." During the past year the Federal Radio Commission has, in General Order 111 (first issued as General Order 97) and General Order 116, defined "good engineering practice" with respect to broadcast stations. These regulations require all stations to install equipment in accordance with this standard.

As a result of these regulations there is now taking place in the broadcast stations of the United States a complete modernization of equipment. When completed this will result in a marked improvement in the service rendered by broadcast stations and a reduction in the amount of interference. In this modernization program the engineering division has given much engineering advice to stations and has assisted in every way possible. The stations have, in general, cooperated fully in this work, and there has been a general desire on the part of stations to improve equipment in order to improve service to the public.

General Order 111 requires that all stations have transmitting equipment capable of 75 per cent modulation or more. The area which a station can serve satisfactorily, provided there is no interference (service area), is a function of two factors—carrier power used and the amount of modulation which is applied to the power used (percentage modulation). The area over which a station is capable of producing interference (nuisance area) is a function of carrier power only. It is desirable that the ratio of "nuisance area" to "service area" be as small as possible. An increase in the percentage modulation of a station increases the service area of that station without increasing the nuisance area and has the effect of an increase in the power of the station. For example, it can be shown that increasing the percentage modulation of a station from 40 to 80 per cent, for example, gives the same result in increase of signal delivered by the output of a given receiving set as if the carrier power were increased four times. That is, a station operating with a power of 500 watts and 80 per cent modulation would deliver a program at the output of a given radio receiver with an intensity equal to that from a station of 2,000 watts and 40 per cent modulation. The interference area of the 500-watt station, however, would be very much less than that of the 2,000-watt station.

The improvements resulting from increased percentage modulation can be fully realized only if there is no interference within the service area of the station. On the broadcast frequencies on which two or more stations operate simultaneously at night, heterodyne interference exists in the greater portion of the territory between the stations. This heterodyne interference is the limiting factor in the service of most regional and local stations.

The present regulations permit broadcast stations to deviate a maximum of ±500 cycles per second from the assigned frequency. If two stations are operating on their assigned frequencies and within their tolerance, the heterodyne beat note may have any frequency between zero and 1,000 cycles per second. A beat note having a frequency between 100 and 1,000 cycles per second is very annoying

and is well reproduced in the audio system of the modern radio receiver. However, frequencies below 100 cycles per second are in general rapidly attenuated by the modern radio receiver. It has frequently been urged that the Federal Radio Commission reduce the allowable deviation from assigned frequency for broadcasting stations, and thus reduce very materially the heterodyne interference between stations operating simultaneously on the same frequency.

The feasibility of a change in the regulations was dependent on the equipment available. In order to determine this, an informal hearing was held April 20, 1931, before the chief examiner. There was almost unanimous agreement that it was reasonable to reduce the allowable frequency deviation of broadcast stations from the assigned frequency to ±50 cycles per second. It was further shown that equipment capable of maintaining this stability at all frequencies between 550 and 1,500 kilocycles was available from several sources.

Frequency measurements of broadcast stations made by the radio division, Department of Commerce, showed that several stations were operating within the tolerance limit proposed. Where two or more stations operating on the same frequency were maintaining their assigned frequency within ±50 cycles per second, observation showed that there was material increase in the good service area of these stations.

Following this hearing the commission adopted General Order 116, which reads in part as follows:

* * * * * * *

2. On and after one year from the effective date of this order all radio broadcasting stations operating between 550 and 1,500 kilocycles shall maintain the assigned frequency between the limits of 50 cycles per second above to 50 cycles per second below the assigned frequency, and said stations are hereby required to make provision for the checking of the frequency of the emitted wave by means independent of the frequency control of the transmitter, said independent means having capability of the accuracy above mentioned.

3. On and after the effective date of this order the commission will authorize the installation of new transmitting equipment in broadcasting stations or changes in the frequency control equipment at present licensed for operation only if such equipment is so designed that there is reasonable assurance that the transmitter is capable of maintaining the assigned frequency to the accuracy set forth in paragraph 2 above.

* * * * * * *

This order is a recognition of the greatest technical advancement in the broadcast transmitter art in recent years. The general improvement due to the reduction of the frequency deviation tolerance to ±50 cycles per second may be realized from the fact that under the old regulation heterodyne interference limited the good service radius of the average 1-kilowatt station to about 20 miles, which is an area of approximately 315 square miles. With all stations operating in accordance with the new order the service radius of this station would be extended to about 44 miles, or an area of 1,500 square miles, or an increase in the area served of approximately 4.6 times. Similar improvements would be realized by all regional and local stations. Thus, when all regional and local stations comply with this order, many persons not now receiving service from such stations because of heterodyne interference will receive good service free of interference.

It will, of course, require some time to accomplish full operation in accordance with this order, but public interest and the general gain to the listening public and to the broadcast stations themselves require that all stations use every effort to make their equipment and operations comply with this regulation as soon as possible.

In the development of broadcast transmitters to meet the specific requirements of "good engineering practice" in General Orders 111 and 116, attention has been given to detailed improvements throughout the transmitting equipment, and many incidental improvements in the service and reliability of broadcast stations will result because of the replacement and redesign of transmitters. One of the most important of these improvements is in audio frequency circuits, which to a large extent determine the quality of the program transmitted. The new broadcast transmitters in general transmit programs which are very faithful reproductions of the original programs, and thus give listeners a marked improvement in the programs delivered by their receiving sets.

There has also been a marked reduction in the amount of harmonics and other spurious emissions radiated by modern broadcast transmitters. In the intensive use of the radio spectrum it is necessary to protect all stations and services against interference which is not essential to the service being carried on by other stations. Since many commercial stations operate on frequencies higher than those used for broadcasting, harmonics radiated by broadcasting stations will cause interference to these services and may disrupt a particular service completely. It is extremely difficult to fix maximum limits for the amount of power or the intensity of the field which may be permitted. A harmonic radiation of a given intensity may under one condition cause no interference, while under another set of circumstances may cause interference which is destructive to another service.

Every case of interference due to harmonics from broadcasting stations has been considered with the individual station involved. In most cases there has been complete cooperation by the station which has taken steps to eliminate the interference. In the new broadcast transmitters which have been produced commercially, special attention has been given to the reduction of harmonics, with the result that interference from this source has been materially reduced. More intensive use of the high-frequency spectrum, however, will make this problem increasingly difficult.

There is considerable research being carried on by laboratories and by stations which will undoubtedly result in improvements in transmitting sets and make it possible to get greater use from the limited number of broadcast frequencies. Synchronization of broadcast stations is considered separately below.

The principal cause of interference between broadcasting stations is that portion of the power which leaves the transmitting antenna at an angle, goes to the reflecting layer ("heaviside layer"), is there reflected back, and returns to the earth at a distance from the transmitting station with an intensity much greater than that portion of the power that travels along the surface of the earth. The portion of the radiation so reflected is usually referred to as the "sky wave." The intensity of this sky wave is variable, and while it makes possible

reception from distant stations, such reception is unreliable because of the waxing and waning of its intensity (fading).

In order to reduce interference from this source, considerable work has been done in an attempt to develop an antenna system which will concentrate the radiated power along the ground and reduce the power radiated in the "sky wave."

Experiments are being made with antenna structures to reduce the power radiated in the sky wave. The results reported on these structures, in the broadcast band, are not as yet very promising.

The commission has given every possible encouragement to experiments which promise to result in the improvement of broadcasting or which may make possible more efficient use of the broadcast-frequency spectrum, thus resulting in better service being rendered to the broadcast listeners.

SYNCHRONIZATION OF BROADCAST STATIONS

The problem of operating broadcast stations on the same frequency with exact or partial synchronization has been given attention by several broadcasting and engineering organizations. Many experiments have been carried on, and the engineering division of the commission has cooperated in most of these experiments by making observations of test transmissions and in some cases giving engineering advice concerning the experiments and observations. The commission has granted special authority for special transmissions and has endeavored in every way to assist and encourage such tests.

At the present time three experimental operations and one regular operation involving synchronization of broadcasting stations are authorized for operating during broadcasting hours.

(1) Stations WTIC and WEAF, located at Hartford, Conn., and New York City, respectively, operate one-half time on 660 kilocycles with 50 kilowatts power, and station WBAL, 10 kilowatts power, and station WJZ, 30 kilowatts power, located at Baltimore, Md., and New York City, respectively, operate on 760 kilocycles one-half time. The four stations during the other one-half time operate on frequencies not shared by other stations. This is, in effect, one experiment, stations WTIC and WBAL normally sharing time on 1,060 kilocycles. The frequencies of two stations operating simultaneously in these cases are maintained exactly the same by means of a low-frequency synchronizing current transmitted by wire from a central point to each station.

(2) Stations WHO–WOC, located at Des Moines and Davenport, Iowa, respectively, operate on 1,000 kilocycles, each station having 5 kilowatts power. The frequencies of these two stations are maintained approximately equal by means of special automatic frequency control of each transmitter and observations at a monitoring station halfway between the two stations.

(3) Stations WCAH, Columbus, Ohio; WHP, Harrisburg, Pa.; WHEC, Rochester, N. Y.; and WOKO, Albany, N. Y., operating on 1,430 kilocycles, 500 watts power at each station. Station WFEA, Manchester, N. H., will be added to this group at a later time. These stations are synchronized only partially. All stations have special

frequency control which will maintain the beat-note interference between the stations at a frequency below audibility. There is no form of monitoring or direct control among the stations other than occasional listening tests which may be necessary.

(4) In addition to these experimental operations, stations WBZ, 15 kilowatts, and WBZA, 1 kilowatt, at Boston, Mass., and Springfield, Mass., respectively, operate regularly on the same frequency and with the same program synchronized by means of wire line control similar to (1) above.

In all of these operations the stations carry the same programs when synchronized, except in the third case, where the separation and power are such that different programs may be carried during daylight hours. All these experiments are being observed very carefully, but as yet no general conclusions can be drawn.

The most exact of the three methods is that in which a wire line is maintained between the stations for the purpose of synchronization (1 and 4 above). In this method a low-frequency current of the order 5,000 cycles is transmitted from a central point to both stations. The radio frequency of each station is then obtained by multiplying the frequency of the synchronizing current by electric means to the assigned frequency of the station. This method, which results in exact synchronization, requires considerable special terminal equipment at each station and the continuous maintenance of a wire line between the stations.

A less involved method (2 above), with consequent reduction in the precision of control, is that in which special frequency-control equipment is installed in each station and the frequency is observed by a monitoring station midway between the stations which are synchronized. This method involves a wire connection between the monitoring station and one of the broadcast stations, assuming two stations are being synchronized. The synchronization is maintained either by continuous manual or automatic adjustment of the frequency of one station to that of the other station.

The third method (3 above) is capable of still less precision. The stations operate independently of each other, but with automatic frequency controls that have been previously adjusted to give as exactly the same frequency as possible.

The reason for synchronizing broadcast stations is to make it possible to give a better class of service to a larger number of listeners, and thus make more complete use of all broadcast frequencies. From the standpoint of results, the problem is divided into two distinct parts:

(1) The operation of "booster" stations for a principal station on a frequency now occupied by the single principal station (clear channel) thus extending the good-service area of that station without changing materially the present service.

(2) The operation of several lower power stations on a frequency now used by several stations in such a way that each station increases its good-service area.

A clear channel is assigned to a single station in order that the program of that station may be received at any point within its range

free of interference. Such a station will provide interference-free reception within a normal service area, and in addition it also serves listeners who do not have the benefit of a station in the immediate vicinity and who must depend for service from stations at a distance. Such reception is not always reliable, due to fading and nonradio interference. However, it is the only type of reception which is available for a large number of people in the United States. Synchronization which is carried on in these channels should not deprive people of the latter class from reception to which they are accustomed and should not impair the normal good-service area of any existing station.

On regional and local stations, however, there is a different set of circumstances. On any channel on which more than one station operates simultaneously at night there is, at a certain distance from each station, interference which makes it impossible for listeners to use that station. Thus such stations have only a service area adjacent to the station and no possibility of a service beyond the interference limits. Each station so operating on the same frequency can maintain its frequency so that the heterodyne interference is below audibility, and the service area of each station can be somewhat extended. If, however, the stations are already serving the area which they are designed to serve, other stations may be added with precision frequency control to give other communities service without destroying the present service. Consequently, on regional and local channels the requirements as to the result of the synchronization experiments are not as rigorous as on clear channels.

In all cases of synchronization the principal difficulty is caused by the sky wave—that is, the power which is radiated from a broadcast antenna and which is not transmitted along the earth but at an angle to it. This radiation goes to the ionized layer (heaviside layer) and is reflected to the earth. This type of radiation, which varies in intensity, is responsible for the normal fading of radio signals. The combination of this signal of variable strength with a signal of constant intensity results in the appearance of fading within the normal-service area of the other station on the same frequency and the destruction of the quality of the signals. This type of interference has been generally recognized as a limitation to the service of broadcast stations on the same frequencies, even though they be exactly synchronized. Attention has been directed toward the study of antenna systems which will suppress a large amount of the power which is radiated in the sky wave and increase the radiation along the earth.

An alternate method which has been used is to adjust the relative powers of the two stations to such values that the indirect radiation of each station is of intensity below the point where it would cause interference within the good-service area of the other station or by adjustment of power to place the areas of poor quality where the population is small.

The experiments which are being carried out are demonstrating the advantages and disadvantages of the synchronization of broadcast stations and are yielding very valuable data, which will make possible the determination of the value of such operation.

THE EMPIRICAL STANDARDS USED AS BASIS FOR ENGINEERING TESTIMONY IN HEARINGS CONCERNING BROADCAST STATIONS (550–1,500 KILOCYCLES)

In making recommendations to the commission and giving testimony at hearings before the commission on applications concerning broadcast stations in the band 550–1,500 kilocycles, the engineering division is confronted with the problem of using standards of radio transmission. To insure uniformity it has been necessary to adopt many empirical standards of reception, interference, service, etc., that have not previously been published. In making up these standards the division has used all sources of information now available, and as more and more technical broadcasting data are obtained these standards will necessarily change. Since many of the standards are also based on present-day average receiving sets, average standards of listeners, present design of antennas, etc., they will, of course, be changed as the art progresses.

The empirical standards set out below were prepared and averaged upon data obtained from the following sources:

1. Evidence given in hearings by expert radio engineers.
2. Experience of engineers of the engineering division, based upon their personal experiences and observations in the field and on studies of reports and publications on the subject.
3. Averages of many hundred field-intensity measurements made by the radio division, Department of Commerce.
4. Study of the channel interference reports made by the radio division, Department of Commerce, which cover all points in the United States where offices are located.
5. Several complete surveys made on individual stations by the radio division of the Department of Commerce and by other engineers with respect to service area and interference.
6. Various published formulas on radio transmission.
7. Characteristics of receiving sets.

Figure 1, page 37, shows in graphical form the data as derived from the various sources as indicated. Differences between curves are in many cases very large. During the past year the radio supervisors have made many measurements on the intensity of broadcast stations, both day and night. These measurements, shown in Figure 2, page 39, were taken at many points in the entire United States, and represent the actual conditions that are encountered. The plain circles show day measurements and solid circles night measurements. All of the readings were reduced to a power of 1 kilowatt before plotting. These measurements were taken on stations of various frequencies within the broadcast band and no attempt was made to differentiate between different portions of the band or between different seasons of the year. Each circle is the average of from 4 to 50 readings taken on one station during a given period.

These measurements represent the largest collection of field-intensity measurements that have been taken, and undoubtedly come nearest to presenting the average broadcast transmission range in the United States. It is expected that many more measurements will be

made, and if these justify it the curve will be changed. The curves given in Figure 2, page 39, are used as the basis for values of field intensity given below. While they may be approximate, they do represent the best present knowledge concerning average radio transmission in the United States in the range of frequencies 550–1,500 kilocycles. The transmission of a particular station over a particular area may depart considerably from these values, but to determine that fact the data must be obtained as the result of an individual study of the station. Beyond about 50 miles from a station the field intensity in general varies ("fading"), due to natural phenomena. Under these conditions average values were used.

The problem that is most difficult to solve and at the same time the most important to consider with respect to service on a channel on which more than one station operates simultaneously at night is the interference range or "nuisance area" of a station. The nuisance area of a broadcasting station is here defined as that area over which interference may be caused to reception of other stations operating on the same frequency. Generally speaking, the nuisance area is beyond the service range of a station and extends to many times the radius of the good-service area. For example, a 1-kilowatt station has an average good-service radius of approximately 40 miles and a nuisance radius of about 1,000 miles. A 1-kilowatt station located less than 1,000 miles from a second 1-kilowatt station will have mutual interference that will limit the good-service radius to less than 40 miles.

Interference to broadcast radio reception in its general meaning is defined as any spurious or extraneous sound accompanying radio reception, but as used in connection with this work it refers to objectionable sounds which are present over 10 per cent of the time. The good-service area of a station is defined as that area in which satisfactory reception free from interference is obtained at least 90 per cent of the time.

The field intensities necessary to render *good* service are divided into three classes, depending upon the noise level of the area to be served. The nature of the area and the necessary field intensities are given in Table V, as follows:

TABLE V

Area	Signal
	Millivolts per meter
Business city	10
Residential city	3
Rural	0.6

For *fair* service the signal is one-half the above values, and for *poor* service, one-fourth. The figures are all subject to change if the noise level is unusual or fading is experienced.

The average distance over which average stations of various powers can be expected to give the above classes of service are set out in Table VI, as follows:

TABLE VI

Power	Field intensity	Average radius	Power	Field intensity	Average radius
	Millivolts per meter	*Miles*		*Millivolts per meter*	*Miles*
100 watts	10	2	5 kilowatts	10	14
	2	10		2	44
	1	18		1	67
	0.5	30		0.5	93
250 watts	10	8	10 kilowatts	10	18
	2	15		2	55
	1	26		1	81
	0.5	41		0.5	115
1 kilowatt	10	6	50 kilowatts	10	32
	2	26		2	79
	1	41		1	120
	0.5	63		0.5	160

The distances in Table VI were taken from Figure 2 (day). The average of the day reading is taken as determining the service radius of a station and the average of night readings is taken as determining the nuisance radius. This is not entirely fair, as 50 per cent of the night measurements are above the average night curve, and since the nuisance area is defined as that area where interference is created over 10 per cent of the time, it is seen from this that the average station may create interference more than 10 per cent of the time, whereas the service range of a station is determined by service 90 per cent of the time.

General Order No. 40 divides broadcasting stations into three classes, namely, clear channel, regional channel, and local channel stations. The dominant station assigned to a clear channel is presumably given sufficient power to provide service to the large rural areas, and since only one station is assigned to operate at night on such channel, there is no interference from other stations in the United States. Other stations which are assigned to the same frequency are restricted in operation to such periods (daylight and limited time) that no interference will be caused to reception of the dominant station.

The good-service area of a clear channel station is empirically defined as that area which receives a field intensity of 0.5 millivolts per meter or more. Fundamentally, such a station renders service with field intensities far below this value and consequently to a larger area, but fading and local interference make the service necessarily of an intermittent character. A field intensity of 0.5 millivolts may be subject to fading and will undoubtedly be subject to local interference in many places. The primary purpose of such a station is to serve a center of population and a large rural area that is not within the service range of any other station and can not be economically served by any other means than clear channel stations. The power of the dominant clear channel stations range from 5 to 50 kilowatts.

Regional channel stations are divided into two groups—high-power regional stations and low-power regional stations. The low-power regional stations operate with night power from 250 to 1,000

watts. The high-power regional stations are assigned from 5 kilowatts to 10 kilowatts.

The service area of a regional station is empirically defined as that area receiving a field intensity of 1 millivolt per meter or more. In making up the separation tables, service tables, and in all reference to such stations, this is considered the service area of such stations, and they are not given protection and are not expected to give regular service to the area outside this limit. The purpose of the regional stations is to serve a center of population and a small surrounding area or region.

The service area of a local station, which is assigned power not exceeding 100 watts at night, is empirically defined as that area receiving a field intensity of 2 millivolts per meter or more. Local stations are assigned to serve local centers of population, and as the field intensity necessary for good service in populous residential districts is 2 millivolts per meter, this is the extent to which the separation tables provide for this class of stations.

A summary of the classes of stations and the approximate separation of stations of the same power assigned the same frequency, which is necessary to give the class of service indicated, as determined from Figure 2, is given in Table VII, frequency maintenance assumed to be ±50 cycles per second.

TABLE VII

Channel	Power (night)	Boundary of service	Frequencies	Approximate separation necessary to give service
	Watts	*Millivolts per meter*		*Miles*
Local	5- 100	2	6	200
Regional	250- 1,000	1	40	1,050
High-power regional	5,000-10,000	1	4	2,000
Clear	5,000-50,000	0.5 and extent of intermittent service.	40	(1)

[1] Not duplicated.

Another factor which must be taken into account in assigning frequencies to broadcast stations is the geographical separation of stations on adjacent frequencies. The present plan of broadcast allocations provides for the assignment of stations on frequencies separated by 10 kilocycles. Receiving sets are not at present made which will give good quality of reception and at the same time be selective enough to accept a signal on one frequency and reject a signal of equal intensity having a frequency 10 kilocycles removed therefrom. The selectivity of receiving sets of different design varies widely. Many confidential quantitative measurements on receiving sets have been made available to the engineering division. From a study of the selectivity of radio receivers and on observations and testimony concerning objectionable interference, it has been determined that on the average the empirical values given in Table VIII represent the ratio of field intensity of the desired

station to the field intensity of the undesired station which should be maintained for good service.

TABLE VIII

Frequency separation	Ratio of desired to undesired signals
0	20 to 1.[1]
10 kilocycles	4.65–0.85 to 1.
20 kilocycles	3 times the selectivity at 10 kilocycles.
30 kilocycles	7.5 times the selectivity at 10 kilocycles.
40 kilocycles	15 times the selectivity at 10 kilocycles.

[1] Frequency maintenance ± 50 cycles per second.

Tables IX and IXA combine the data given in Tables VII and VIII with the data from the curves in Figure 2 and give the average separation between stations of different power and class for the same and adjacent frequencies in order to give on the average the service area specified above.

Tables VII, VIII, IX, and IXA assume that the frequency of all stations will be maintained to within ±50 cycles per second of the assigned frequency. With all stations maintaining their frequency within 50 cycles per second of the assignment, the frequency of the average heterodyne note to be expected between stations would be 50 cycles. Under such conditions it is believed that a ratio of desired to undesired signals of 20 to 1 would give satisfactory reception. If the frequency is maintained within only 500 cycles per second of the assigned frequency, an average heterodyne note of 500 cycles would result, and a ratio of desired to undesired signal of 100 to 1 would be considered necessary. This is the condition that will exist until General Order No. 116 is effective.

When the heterodyne note has the frequency of 50 cycles, it is a question whether the cross talk or beat note will be the more objectionable, and it may vary somewhat with the type of receiving set used. A ratio of 20 to 1 between desired and undesired signals represents a modulation of the desired signal of 5 per cent at 50 cycles, or 5 per cent cross talk, providing each of the stations employ the same percentage of modulation and have comparable programs. These ratios are considered satisfactory for the majority of rural areas where the standard of reception is not the highest; but in metropolitan areas, where programs may be selected from several stations, it is admitted that this is not a sufficiently high standard and the service would not be considered as satisfactory by most listeners.

In determining the mileage separation on adjacent frequencies, in Tables IX and IXA, the ratio between the desired and undesired signals at 10-kilocycle frequency separation is given as varying from 4.65 to 1 to 0.85 to 1. A study of the characteristics of many receiving sets reveals that the ratio necessary to prevent interference varies widely with different sets. The limit of common commercial broadcast receivers was found to lie within the ratios of 1 to 10 and 10 to 1. Old receivers with vacuum tubes of impaired emission, changed tuning, etc., will undoubtedly be less selective, and the characteristics

of new receiving sets studied. Many reports from listeners are now received complaining of cross-talk interference, and a study of these cases reveals that the separation is often greater than that set out in Tables IX and IXA. It can not be expected, however, that any plan of allocation will protect completely the poor grade of receivers and those in improper operating condition. Likewise, the full opportunities of allocation possible based on the better grade of receiving sets can not be realized, but an average must be used.

As the mileage separation becomes greater a lower ratio is used between the desired and undesired signal, varying from 4.65 to 1 down to 0.85 to 1 on a sliding scale inversely with the mileage separation. This sliding scale is justified and represents the true condition, on account of the fact that as the separation becomes greater the consistency with which the interfering signal is received becomes less, due to the fact that interference is caused by fading signals which are intermittent.

The ratios used for 20, 30, and 40 kilocycle separation are based on a study of many receivers, with an endeavor made to protect a majority of the receivers located in the proper service areas of stations. A fixed ratio is used throughout with respect to the ratio used on the 10-kilocycle separation. All of the separations used in Tables IX and IXA are to protect the service areas of stations to the field-intensity values given in Table VII 90 per cent of the time under average conditions and average degree of propagation that is encountered throughout the United States. It is recognized that the absorption varies widely throughout different parts of the United States and that the table may be excessively conservative for certain areas of the country and give unnecessary protection in other areas. This is taken into consideration in studying any individual case.

All of the average values herein set out must necessarily give way to actual measurements in any particular case. However, it does not follow that the average measurements do not represent a particular case if one or two measurements taken at selected times do not agree. To show that these empirical and average standards do not apply in any particular case requires a series of measurements, extended over a considerable period of time, which take in periods of known good propagation. Isolated measurements of field intensities of a station, particularly at distances greater than 50 to 100 miles from the station, are of little value when standing alone and do not represent what interference may be expected from that station.

TABLE IX.—*Average day separation between broadcast stations recommended by engineering division, Federal Radio Commission, based on frequency maintenance of ± 50 cycles* *

Day power	Frequency difference in kilocycles	Local		Regional			High-power regional		Clear			
		50 watts	100 watts	250 watts	500 watts	1 kilowatt	2.5 kilowatts	5 kilowatts	5 kilowatts	10 kilowatts	25 kilowatts	50 kilowatts
Local: [1]												
50 watts	0	95	120	155	190	240	285	315	315	380	450	520
	10	37	47	62	100	120	157	187	197	222	242	257
	20	18	22	28	48	59	80	101	109	126	151	171
	30	12	15	31	38	46	60	73	98	120	145	165
	40	9	12	28	35	43	57	69	95	117	142	162
100 watts [1]	0	120	120	155	190	240	285	315	315	380	450	520
	10	47	50	85	108	128	160	190	200	226	245	260
	20	22	25	41	51	62	88	104	112	130	156	175
	30	15	16	32	39	47	61	73	99	122	148	166
	40	12	12	29	36	44	58	69	96	118	144	163
Regional: [2]												
250 watts	0	155	155	250	260	310	380	430	430	490	580	660
	10	82	86	101	119	129	176	208	216	241	266	276
	20	38	41	57	67	78	99	120	126	148	171	191
	30	31	32	39	46	54	68	80	106	128	153	173
	40	28	30	31	40	48	62	74	100	122	147	167
500 watts [2]	0	190	190	260	260	310	380	430	430	490	580	660
	10	106	108	119	136	146	188	218	223	248	266	283
	20	48	51	67	74	85	106	127	135	156	181	201
	30	38	39	46	51	59	73	85	111	133	158	178
	40	36	36	40	43	51	65	77	103	125	150	170
1 kilowatt [2]	0	240	240	310	310	310	380	430	430	490	580	660
	10	120	123	139	146	154	191	221	231	256	278	291
	20	59	62	78	85	98	114	135	145	167	192	212
	30	46	47	54	60	66	80	92	118	140	165	185
	40	43	44	48	51	54	68	80	106	128	153	173
High-power regional: [3]												
2.5 kilowatts	0	285	285	380	380	380	380	430	490	490	580	660
	10	157	160	176	183	191	206	235	245	270	290	310
	20	80	83	99	106	114	128	149	157	188	213	233
	30	60	61	68	73	80	92	104	130	152	177	197
	40	57	58	62	65	68	75	87	113	135	160	180
5 kilowatts [3]	0	315	315	430	430	430	430	430	560	560	580	660
	10	187	190	206	213	221	235	247	273	305	330	340
	20	101	104	120	127	135	149	161	187	209	234	254
	30	72	73	80	85	92	104	116	142	164	189	209
	40	69	69	74	77	80	87	95	121	143	168	185
Clear:												
5 kilowatts [4]	0	315	315	430	430	430	490	560	560	630	710	810
	10	197	200	216	223	231	245	273	283	308	333	350
	20	109	112	128	135	145	167	187	195	217	242	262
	30	98	99	106	111	118	130	142	147	168	194	214
	40	95	96	100	103	106	113	121	124	146	171	191
10 kilowatts [4]	0	380	380	490	490	490	490	560	620	620	710	810
	10	222	225	241	248	258	270	296	308	330	355	378
	20	126	130	146	156	167	188	209	217	232	270	277
	30	120	122	126	133	140	152	164	189	179	211	234
	40	117	118	123	126	128	135	143	146	151	176	196
25 kilowatts [4]	0	450	450	580	580	580	580	580	710	710	710	810
	10	242	245	265	268	275	290	320	338	355	375	395
	20	151	156	171	181	192	213	234	242	270	270	290
	30	145	146	153	156	166	177	189	194	211	212	231
	40	142	143	147	150	153	160	168	171	176	181	201
50 kilowatts [4]	0	520	520	660	660	660	660	660	810	810	810	810
	10	257	260	276	283	291	310	340	350	375	396	410
	20	171	175	191	201	213	233	254	262	277	299	315
	30	165	166	173	178	185	197	209	214	224	231	250
	40	162	163	167	170	173	180	188	191	196	201	205

* These separations are calculated to minimize objectionable interference in the good service areas of stations about 90 per cent of the time approximately as follows:

[1] 50 to 250 watts local channels, 2 millivolts, 7 to 15 miles.

[2] 250 watts to 2.5 kilowatts regional channels, 1 millivolt, 26 to 55 miles.

[3] 5 to 10 kilowatts high-power regional channels, 1 millivolt, 65 to 80 miles.

[4] 5 to 50 kilowatts clear channels, 0.5 millivolt, 90 to 160 miles.

TABLE IXA.—*Average night separation between broadcast stations recommended by engineering division, Federal Radio Commission, based on frequency maintenance of ±50 cycles* *

Night power	Frequency difference in kilocycles	Local		Regional			High-power regional		Clear			
		50 watts	100 watts	250 watts	500 watts	1 kilowatt	2.5 kilowatts	5 kilowatts	5 kilowatts	10 kilowatts	25 kilowatts	50 kilowatts
Local: [1]	0	140	200									
	10	40	52	106	144	196	302	400	444	522	617	697
50 watts	20	18	22	39	52	71	107	147	162	197	232	257
	30	12	13	31	38	46	60	72	98	120	145	165
	40	9	10	28	35	43	57	69	95	117	142	163
	0	200	200									
	10	52	55	109	147	199	305	403	447	525	620	700
100 watts [1]	20	22	25	42	55	74	110	150	165	200	235	260
	30	13	16	32	39	47	61	73	99	121	146	165
	40	10	13	29	36	44	58	70	96	116	143	163
Regional: [2]	0			560	770	1,050						
	10	106	109	126	163	218	321	419	463	541	636	716
250 watts	20	39	42	58	71	90	126	166	181	216	251	281
	30	31	32	39	45	54	68	84	109	128	158	178
	40	28	29	33	38	46	62	74	100	122	147	167
	0			770	770	1,050						
	10	144	147	163	170	232	326	426	470	548	643	723
500 watts [2]	20	52	55	71	78	97	128	173	188	223	258	288
	30	38	39	45	52	60	74	91	112	134	159	179
	40	35	36	38	43	51	65	77	103	126	150	170
	0			1,050	1,050	1,050						
	10	196	199	215	223	280	386	484	478	556	651	731
1 kilowatt	20	71	74	90	97	105	141	181	196	231	266	291
	30	46	47	54	60	67	82	99	119	141	166	186
	40	43	44	48	51	54	68	80	106	128	153	173
High-power regional: [3]	0						1,900	1,950				
	10	302	305	321	328	386	450	448	492	570	665	745
2.5 kilowatts	20	107	110	126	133	141	156	196	210	245	280	305
	30	60	61	68	74	82	96	113	134	156	181	201
	40	57	58	62	66	68	76	87	113	135	160	180
	0						1,950	1,950				
	10	400	403	419	426	434	448	460	504	582	677	757
5 kilowatts [3]	20	147	150	166	173	181	196	207	222	257	292	317
	30	72	73	84	91	99	113	126	151	175	198	218
	40	69	70	74	77	80	87	96	123	144	169	188
Clear:	0											
	10	444	447	463	470	478	492	504	530	608	703	783
5 kilowatts [4]	20	162	165	181	186	196	210	222	248	283	318	343
	30	98	99	106	112	119	134	151	158	180	205	226
	40	96	96	100	103	108	113	122	126	148	173	193
	0											
	10	522	525	541	548	556	570	582	606	640	725	805
10 kilowatts [4]	20	197	200	216	223	231	245	257	288	308	340	365
	30	120	121	128	134	141	156	175	180	192	217	237
	40	117	118	122	125	128	135	144	148	164	179	199
	0											
	10	617	620	636	643	651	665	677	708	725	750	830
25 kilowatts [4]	20	232	235	251	258	265	280	292	318	340	366	390
	30	145	146	153	159	166	181	198	205	217	232	252
	40	142	143	147	150	158	160	169	173	179	196	206
	0											
	10	697	700	716	723	731	745	677	788	805	880	860
50 kilowatts [4]	20	257	260	281	288	291	305	317	348	365	390	410
	30	165	166	173	179	186	201	218	225	237	252	280
	40	162	163	167	170	173	180	189	198	190	206	210

* These separations are calculated to minimize objectionable interference in the good service areas of stations about 90 per cent of the time approximately as follows:

[1] 50 to 250 watts local channels, 2 millivolts, 7 to 10 miles.

[2] 250 to 1,000 watts, regional channel, 1 millivolt, 30 to 40 miles.

[3] 5 to 10 kilowatts high-power regional, 1 millivolt, 65 to 90 miles.

[4] 5 to 50 kilowatts clear channels, 0.5 millivolt, 95 to 160 miles and extent of intermittent service.

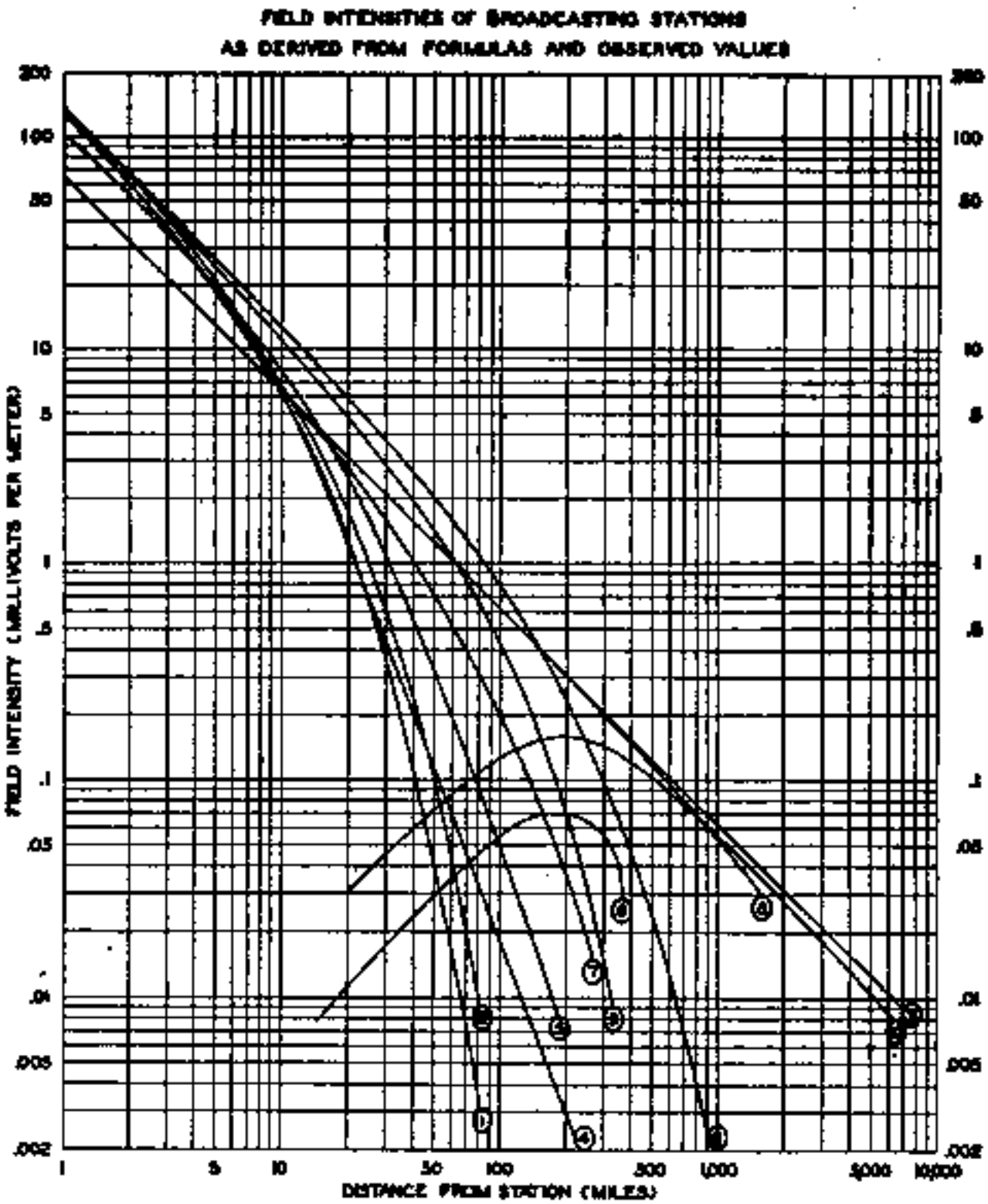


FIGURE 1

LEGEND FOR FIGURE 1

(1) Bell Laboratory—ground wave:

$$E=\frac{19.42\times 10^4}{D}\sqrt{P_r}\ e^{\frac{-101.5\ a\ D}{\lambda^{0.5}}}$$

$a=0.0246$ for suburban territory in northeastern United States

(Proceedings of I. R. E., August, 1929.)

(2) Hogan—ground wave:

$$E=\frac{5.8\sqrt{P_r}}{D}\ e^{-a\ D\sqrt{f}}$$

$a=0.002$ for Detroit territory

(Testimony before the Federal Radio Commission November 22, 1930, Docket 790 WWJ.)

(3) Hogan—sky wave:

$$E=\frac{2.9\sqrt{P_r}}{D}$$

(Testimony before the Federal Radio Commission February 18, 1930, Docket 679 WTMJ.)

(4) Van der Pol—ground wave:

$$E=\frac{300\sqrt{P_r}}{D}\times\frac{2+0.2p}{2+p+0.6p^2}$$

$$p=\frac{\pi}{6\times10^{16}\times\delta\times\lambda}$$

(C. C. I. R. Document No. 70, March 21, 1931.)

(5) Eckersley—ground wave.
(Proceedings of I. R. E., July, 1930.)

(6) Eckersley—maximum sky wave.
(Proceedings of I. R. E., July, 1930.)

(7) Average of day measurements made by United States supervisors of radio.

(8) Average of night measurements made by United States supervisors of radio.

(9) Barron—ground wave:

$$E=\frac{379\pi h\ I\ f}{10^7\ D}(1-a)^D$$

$$a=0.01$$

(Testimony before the Federal Radio Commission June 26, 1931, Docket 1183 WAAT.)

(10) Barron—average sky wave:

$$E=\frac{190\pi h\ I\ f\ \cos\ \theta}{10^7\ D}$$

(Testimony before the Federal Radio Commission June 26, 1931, Docket 1183 WAAT.)

(11) Austin-Cohen—ground wave:

$$E=\frac{300\sqrt{P_r}}{D}\ e^{\frac{-a\ Dkm}{\lambda^{0.5}}}$$

$$a=0.0014 \text{ for sea water}$$

(C. C. I. R. Document No. 70, March 21, 1931.)

These curves are plotted for the following values, unless otherwise noted above:

E=field intensity, millivolts per meter.
P_r=radiated power=500 watts.
P_i=antenna power=1,000 watts.
a=absorption coefficient.
λ=wave length=800 meters.
D=distance in miles.
δ=conductivity of ground=10^{-13}.
f=frequency=1,000 kilocycles per second.
h=effective height of transmitting antenna=105 feet.
I=current at base of antenna, amperes=$\sqrt{\frac{P_i}{R}}$
R=total antenna resistance=10 ohms.
θ=angle between ground and sky ray at transmitter.

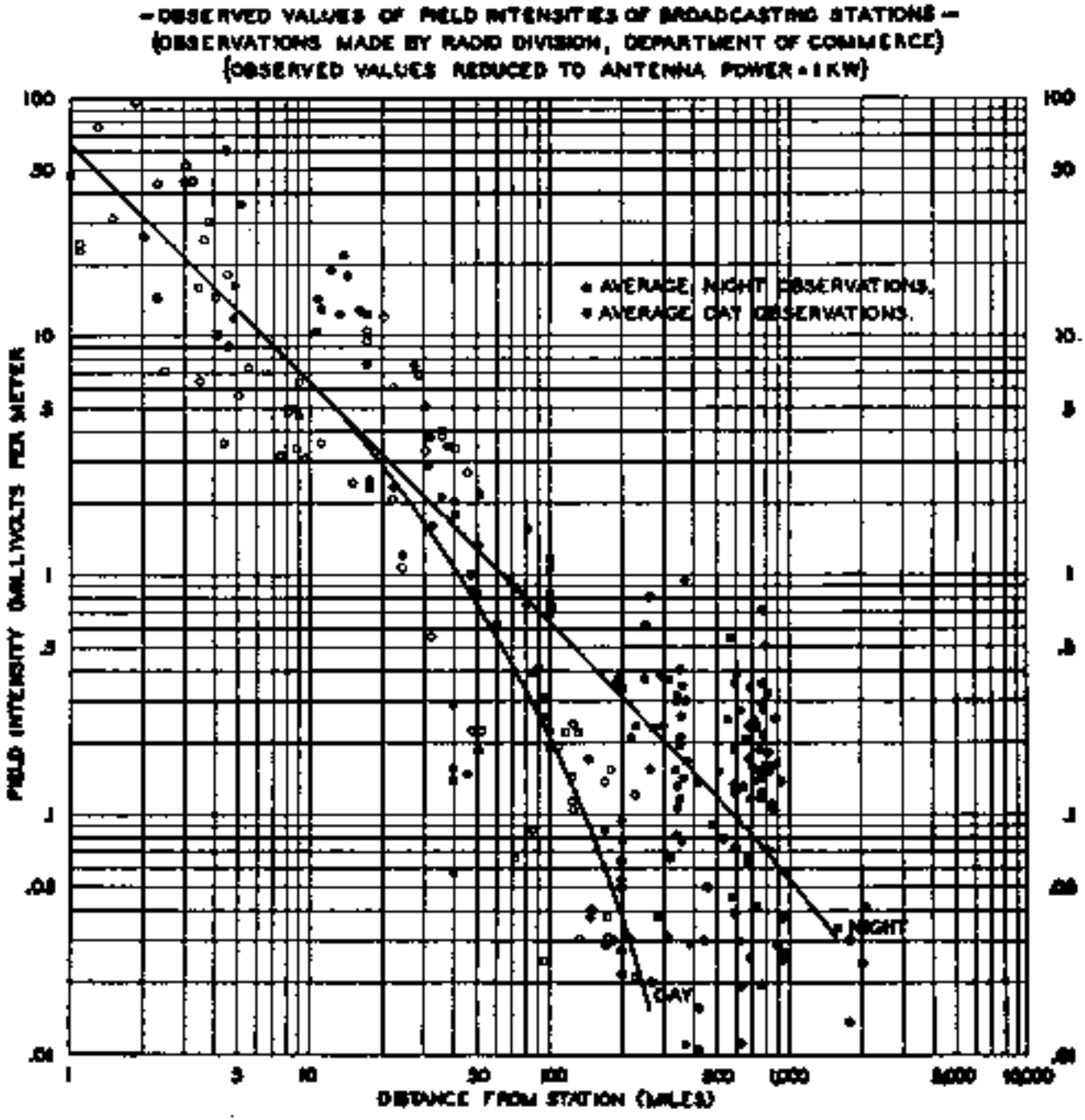

— OBSERVED VALUES OF FIELD INTENSITIES OF BROADCASTING STATIONS —
(OBSERVATIONS MADE BY RADIO DIVISION, DEPARTMENT OF COMMERCE)
(OBSERVED VALUES REDUCED TO ANTENNA POWER = 1 KW)
• AVERAGE NIGHT OBSERVATIONS.
• AVERAGE DAY OBSERVATIONS.
NIGHT
DAY
FIELD INTENSITY (MILLIVOLTS PER METER)
DISTANCE FROM STATION (MILES)
100
50
10
5
1
.5
.1
.05
.01
1
5
10
50
100
500
1000
5000
10000

FIGURE 2

COMMERCIAL COMMUNICATIONS SECTION

E. K. Jett, *Acting Chief*

GENERAL

Radio engineers of the world who attended the first meeting of the International Technical Consulting Committee on Radio Communications at The Hague in 1929 recognized that it is technically possible to operate radiotelegraph stations with a frequency separation of approximately 0.1 per cent, in Opinion No. 18, as follows:

ALLOCATION OF FREQUENCIES ABOVE 6,000 KILOCYCLES—GENERAL GROUPING OF FREQUENCIES

The C. C. I. Radio, with a view to the development of world communications on frequencies above 6,000 kilocycles, recommends, to facilitate the methodical use of these in the future as fast as progress in the technic is made, that, in the bands in this part of the spectrum exclusively reserved for fixed services, only frequencies expressed as far as possible in numbers multiples of 5 be allocated by the administrations.

It is understood that the present state of the art, especially in the higher frequencies, does not always permit two stations to work simultaneously on two frequencies differing only by 5 kilocycles and that present practice shows that a difference of frequencies of about 0.1 per cent between two telegraph stations is generally desirable in order to secure sufficient protection against interference.

However, when the various conditions permit it, telegraph stations may work with a frequency interval less than 5 kilocycles.

It is further recommended that, in any band exclusively reserved for fixed services, the frequencies used by a single administration or a single private enterprise should, as far as possible, be grouped together.

The communication band width of a radiotelegraph station is used as a unit. The band width necessary for any other type of emission is determined in each case by the type of emission.

The commission has desired to conform to this opinion and reallocate the high-frequency spectrum above 1,500 kilocycles to services and stations in accordance therewith. A plan to take this action was prepared, but no action could be taken to place it in effect because of stay orders of the Court of Appeals of the District of Columbia. These stay orders, however, were modified by the court, May 23, 1931, and the new plan can now be presented to the commission. The communication companies have been consulted and have cooperated fully in this work and are in agreement with the changes proposed. In order that changes consistent with such a plan could be made and special cases of interference could be rectified, General Orders 62, 88, and 88 amended, were repealed by General Order 117.

The total number of frequencies available for assignment to stations of the various services under the proposed plan is given in Table X. All of these frequencies, however, are not available to the United States.

TABLE X.—*Number of frequencies allocated to all services*

A. LOW AND MEDIUM FREQUENCY RANGE, 10 TO 1,500 KILOCYCLES

Service	10 to 100 kilocycles	100 to 550 kilocycles	550 to 1,500 kilocycles	Total each service	Total all bands
1. Fixed	184	2		186	186
2. Government	22	161		183	183
3. Maritime					65
(a) Coastal telegraph		53		53	
(b) Ship telegraph		9		9	
(c) Maritime calling		2		2	
(d) Direction finding		1		1	
4. Guard bands		79		79	79
5. State police		1		1	1
6. Aircraft		2		2	2
7. Broadcast			96	96	96
8. Shared					53
(a) Government and fixed		7		7	
(b) Government and fixed—Alaska		6		6	
(c) Government and coastal telegraph		4		4	
(d) Government, fixed and coastal telegraph		6		6	
(e) Government and ship telegraph		2		2	
(f) Government, coastal telegraph and ship telegraph		2		2	
(g) Government, coastal telegraph, ship telephone, and ship telegraph		1		1	
(h) Government and aeronautical		2		2	
(i) Government and Canada—Aeronautical		4		4	
(j) Fixed and coastal telegraph		26		26	
(k) Coastal telegraph and ship telegraph		1		1	
Total	206	372	96	674	674

B. MEDIUM-HIGH FREQUENCY RANGE, 1,500 TO 6,000 KILOCYCLES

Service	1,500 to 3,000 kilocycles	3,000 to 6,000 kilocycles	Total each service	Total all bands
9. Fixed		194	193	193
10. Government	34	67	101	101
11. Maritime				77
(a) Coastal telegraph		7	7	
(b) Coastal telephone		11	11	
(c) Coastal harbor	20		20	
(d) Ship telegraph		11	11	
(e) Ship telephone		12	12	
(f) Ship harbor	12		12	
(g) Fire	2		2	
(h) Maritime calling	2		2	
12. Guard bands	3	2	5	5
13. Emergency				20
(a) Municipal police	15		15	
(b) State police	4		4	
(c) Power		1	1	
14. Experimental				128
(a) General experimental	4	4	8	
(b) Experimental visual broadcasting	118		118	
(c) Experimental visual broadcast sound track	2		2	
15. Special				11
(a) Broadcast pick-up	6		6	
(b) Motion picture	2		2	
(c) Agriculture		3	3	
16. Amateur	72	95	167	167
17. Aviation	66	76	142	142
18. Shared				140
(a) General communication		100	100	
(b) Government and amateur		16	16	
(c) Government and aviation		7	7	
(d) Broadcast pick-up and aviation	6		6	
(e) Experimental visual broadcast and geophysical	6		6	
(f) Government and experimental visual broadcast	2		2	
(g) Aviation and maritime calling		1	1	
(h) Ship telegraph and coastal telegraph		2	2	
Total	376	598	974	974

TABLE X.—*Number of frequencies allocated to all services*—Continued

C. HIGH-FREQUENCY RANGE, 6,000 TO 26,000 KILOCYCLES

Service	6,000 to 8,000 kilocycles	8,000 to 10,000 kilocycles	10,000 to 12,000 kilocycles	12,000 to 14,000 kilocycles	14,000 to 16,000 kilocycles	16,000 to 18,000 kilocycles	18,000 to 21,550 kilocycles	21,550 to 23,000 kilocycles	23,000 to 26,000 kilocycles	Total each service	Total all bands
19. Fixed	100	111	125	61	89	46	106	11		709	709
20. Government	2	36	2	12	1	28	6	3	21	126	126
21. Maritime											218
(a) Coastal telegraph	17	20	15	21		13		28		114	
(b) Coastal telephone	8	3	3	1		3		3		16	
(c) Ship telegraph	8	9	6	7		10		7		47	
(d) Ship telephone	3	3		6		1		3		15	
(e) Mobile press	2	2	2			2		2		10	
(f) Maritime calling	1	1	1	1		1		1		6	
22. Guard band	1									1	1
23. Amateur	31				27					58	58
24. Aviation	16	1		1		1				19	19
25. Experimental											74
(a) Relay broadcast	14	10	14		16	3	5			62	
(b) General experimental	2	2		2		2			4	12	
26. Shared, Government and fixed		2								2	2
27. Unreserved									175	175	175
Total	200	200	168	134	133	167	177	58	200	1,877	1,877
Total number of frequencies allocated to all services											2,625

FIXED SERVICE—RADIOTELEGRAPH

In the United States there are seven communication companies authorized to conduct public radiotelegraph communication service between the United States and other nations of the world. There are radio channels of communication to practically all nations of the world, either directly or indirectly, through foreign communication agencies. A continual effort is being made by the operating companies to extend their service by opening new circuits and improving the reliability of existing circuits.

Table XI shows the extent of the international radiotelegraph service from the United States and the number of frequencies used for this service.

TABLE XI.—*Points of communication and number of frequencies used in international point-to-point radiotelegraph service*

Company	Number of licensed frequencies			Points of communication		
	10 to 100 kilocycles	1,000 to 6,000 kilocycles	6,000 to 23,000 kilocycles			
				42 POINTS		
1. R. C. A. Communications (Inc.).	11	4	96	England.	Czechoslovakia.	Cape of Good Hope.
				Italy.	China.	Canada.
				Holland.	Philippine Islands.	Russia.
				Turkey.	Hawaii.	Iceland.
				Norway.	Java.	Spain.
				Venezuela.	Switzerland.	Santo Domingo.
				France.	Chile.	Cuba.
				Brazil.	Denmark.	Dutch Guiana.
				Sweden.	Curacao.	Porto Rico.
				Germany.	St. Martin.	Panama.
				Poland.	Nicaragua.	Mexico.
				Belgium.	Persia.	India.
				Colombia.	Syria.	Fiji Islands.
				Argentina.	French Indo-China.	Liberia.
				22 POINTS		
2. Mackay Radio & Telegraph Co.	[1] 11	[1] 8	82	Japan.	Australia.	China.
				Dutch East Indies.	Hawaii.	Guam.
				Philippine Islands.	Midway Island.	England.
				France.	Germany.	Hungary.
				Portugal.	Colombia.	Venezuela.
				Spain.	Argentina.	Chile.
				Peru.	Brazil.	Cuba.
				Austria.	Czechoslovakia.	
				16 POINTS		
3. Press Wireless (Inc.).	------	[1] 27	20	Hawaii.	South America.	
				England.	Mexico.	Italy.
				China.	Cuba.	France.
				Philippine Islands.	New Zealand.	Canada.
				Australia.	Central America.	Germany.
				Nova Scotia.	Alaska.	
				4 POINTS		
4. Globe Wireless (Ltd.).	------	------	10	Hawaii.	Guam.	
				Philippine Islands.	China.	
				10 POINTS		
5. Tropical Radio Telegraph Co.	5	------	7	Nicaragua.	Panama.	Salvador.
				Costa Rica.	Cuba.	Guatemala.
				Porto Rico.	Mexico.	Colombia.
				Honduras.		
6. U. S. Liberia Radio Corporation.	------	------	[2] 2	Liberia.		
7. Southern Radio Corporation.	------	------	[2] 2	Bolivia.		

[1] Licensed at present for domestic communication only.
[2] The U. S. Liberia Radio Corporation and Southern Radio Corporation shared with each other a total of 2 frequencies.

There is no company at present authorized to conduct a nationwide domestic point-to-point radio service. International communication companies are permitted to use frequencies above 6,000 kilocycles for domestic communications on condition that no interference to international service will result. Long-established domestic radio circuits on the Pacific coast and between these points and New York City continue in operation. Radio is used also for communication between certain points in the States of Oklahoma, Texas, and Kansas, where wire-line facilities are inadequate to serve the industries centered in these localities.

A new type of domestic public press service, known as multiple address radiotelegraph, was authorized by the issuance of permits for the construction of radio stations at San Francisco, Calif.; Denver, Colo.; Chicago, Ill.; Atlanta, Ga.; and Carlstadt, N. J. These stations will be used for the transmission by radiotelegraph on two low frequencies, supplemented by the use of five high frequencies during daylight hours only, of information intended for publication by newspapers and press agencies. The messages will be recorded automatically by receiving printer instruments located at points throughout the United States.

The three high-frequency channels in the medium-high-frequency band, 1,500–6,000 kilocycles, allocated for agriculture service continue to be used to advantage by the Federal-State Marketing Service of California for the dissemination of market reports and other agricultural information throughout the State by radiotelegraph. In addition, the commission granted this licensee the use of two high-frequency channels in the band above 6,000 kilocycles for daylight use within the State of California, subject to the limitation that no interference shall result from the use of these frequencies to any international service.

FIXED SERVICE—RADIOTELEPHONE

International radiotelephone communication has had further growth and development during the year. To provide for an additional telephone circuit between the United States and Europe and to provide greater reliability of service, a permit was issued for the construction at Bradley, Me., of a second low-frequency transoceanic radiotelephone station. This station will be used to augment the present circuits, particularly at times when the high frequencies become erratic in operation, due to magnetic storms or other peculiar phenomena which at times seriously interrupt the high-frequency circuits. It has been determined, by systematic observation, that a combination of low and high frequency channels leads to far more reliable radiotelephone service than either portion of the radio spectrum used separately.

The volume of traffic over the present trans-Atlantic radio circuits and estimates of future growth show that ultimately more circuits may be required to provide the necessary service to Europe and other parts of the world. At present about 92 per cent of the world's telephones are offered commercial interconnection in one network by the use of radio for the intercontinental circuits.

Several new connections have been planned, some of which are under construction. A permit has been granted for the construction of new facilities at Lawrenceville, N. J., to provide, upon completion, about December 1, 1931, a public telephone service to Bermuda. The corresponding station in Bermuda is being established by Imperial & International Communications (Ltd.), of London, and will be operated in conjunction with the Bermuda Telephone Co. There is now under construction a radiotelephone station at Dixon, Calif., through which telephone service will be provided to the Hawaiian Islands, through the system of the Mutual Telephone Co. in the Hawaiian Islands, and at a later time to Australia, the Philippine Islands, Japan, and countries in the Far East.

All international radiotelephone stations in the United States are operated by the American Telephone & Telegraph Co. or its associated companies. The number of frequencies used and the points of communication are given in Table XII.

TABLE XII.—*Points of communication and number of frequencies used in international point-to-point radiotelephone service*

Company	Number of licensed frequencies		Points of communication
	10 to 100 kilocycles	8,000 to 23,000 kilocycles	
American Telephone & Telegraph Co.	2	15	England: Connection with telephone network of western Europe and with Australia, Java, Canary Islands, and Ceuta, Africa. Argentina: Connection with telephone networks of Argentina, Chile, and Uruguay. Brazil. Bermuda.
Transpacific Communications Co.	.....	6	This company is not yet licensed, but construction permits issued for communication with Hawaii and other points in the Pacific and Far East.

MARITIME

Maritime mobile service, which includes both radiotelegraph and radiotelephone communications between ships and the shore and between ships at sea, uses groups of frequencies below 550 kilocycles and above 1,500 kilocycles. The use of low frequencies for radiotelegraph is long established and carries a large amount of the present traffic. In the last few years, however, the use of frequencies above 1,500 kilocycles has been rapidly developed.

The assignment of these frequencies is now made under a plan which was formulated in 1929. Because of new developments, principally radiotelephony, this plan is not now entirely satisfactory. Early in 1930 a proposed revision of this plan, based on a frequency separation between stations of approximately 0.1 per cent, was worked out in cooperation with representatives of the commercial operating companies.[1] However, it has not been possible to put this plan into effect because of the existence of stay orders issued by the Court of Appeals of the District of Columbia. These stay orders have been modified, and it is now possible to proceed with the reallocation of frequencies to maritime services. The changes in frequency assignments necessary are being worked out in cooperation with the operating companies in such a way as to cause the minimum amount of confusion and interruption to service.

The increasing use of frequencies above 1,500 kilocycles by ocean-going vessels makes it possible for passengers on board ship to have a direct radiotelegraph message service with land stations in all parts of the world. Satisfactory communication with ships at great distances from land is now being maintained by the use of relatively

[1] See Annual Report of Federal Radio Commission for year ending June 30, 1930, p. 65, for details of this plan.

low-power and inexpensive installations, as compared with transmitters necessary for equivalent service using frequencies below 500 kilocycles. The medium frequencies are more reliable at the present stage of development for consistent contact with shore over comparatively shorter distances, and the majority of ships continue to operate only in this band.

The steamship *Leviathan*, of the United States, and the steamships *Olympic*, *Majestic*, *Homeric*, *Belgenland*, and *Empress of Britain* are now equipped to provide radiotelephone connection either to Europe or the United States. Communication with either the British or American land stations is possible at practically all times during the passage between New York and Europe. A passenger on these ships may therefore speak by telephone at any stage of the journey to any telephone subscriber in the United States, Canada, Mexico, or Cuba, on the one hand, or to any telephone subscriber in Europe.

A new type of service, designated as "public coastal harbor telephone service," was authorized by the granting of a permit for the construction of a radiotelephone station on Staten Island, N. Y., to provide general public telephone communication with any and all harbor vessels equipped for this service. Three subsequent construction permits have been issued, authorizing the installation of additional stations of this class at Seattle, Wash., San Francisco, Calif., and Wilmington (near Los Angeles), Calif. Applications have been filed for authority to erect similar stations at Boston, Mass. Statistics indicate that this service may be required at other harbors of major importance, and frequency allocations have been made with this in view.

The stations now being established will provide service primarily for tugboats, car ferries, and other small harbor craft. They will, however, provide public telephone service with ocean vessels or other craft while such vessels are within transmission range. Connections will be made to the public telephone wire network at each of these harbors. The frequencies selected for this service are in the vicinity of 2,500 kilocycles for land stations and of 2,300 kilocycles for ship stations.

The commission granted a construction permit for the erection of a radiotelegraph land station near Cincinnati, Ohio, in response to a growing need for communication with vessels traversing the Mississippi, Ohio, and Missouri Rivers. The site near Cincinnati was chosen because of its advantageous location on the Ohio River, midway between the terminus of navigation at Pittsburgh and the juncture with the Mississippi River near Cairo, Ill. Communication with any vessel on the Ohio River will be over a maximum distance of approximately 750 miles, which will allow the use on board ship of inexpensive low-power radiotelegraph equipment. At the beginning of this service, message traffic is anticipated from eight different companies operating a total of 47 ships.

Marine relay service, which has existed for several years in connection with the routing of marine traffic between the major coastal telegraph stations, was officially recognized as a separate service by the commission by the adoption of General Order 100. This order defines marine relay service as a radiotelegraph communication service carried on between coastal stations communicating with one another for the relaying of maritime mobile communications or

messages pertaining thereto. The order limits the service to the exchange of operating signals and the movement of message traffic destined to or originating at maritime mobile stations at times when the use of other means of communication would cause undue delay, and the service is not to be used for the regular routing of traffic. Licenses for this service are issued only to coastal radiotelegraph stations that provide service to ocean going and Great Lakes vessels. The frequencies authorized are those already assigned to individual coastal stations.

AVIATION

The application of radio to the needs of aviation has kept pace with the rapid development of aviation, and the Federal Radio Commission has made every effort to provide frequencies to meet the needs of the service. Because of the extreme congestion in all portions of the radio spectrum, great care had to be exercised in the frequency allocation to this new service. The needs of aviation have been met, however, by careful planning and through the cooperation of all users of radio frequencies, including Government departments, commercial radio operating companies, and the operators of air transport lines.

The increased safety in aviation and the increase in reliability of air transportation are in a large measure due to radio. Transport airplanes which are now flying over the air routes are in constant communication with the airports, reporting positions and other pertinent information and receiving instructions and assistance from the ground. Practically every established air transport line now flying a regular schedule is equipped with 2-way radio communication.

In addition to the service supplied their own airplanes, the transport companies provide service to itinerant aircraft or other aircraft which may come over their lines. Twenty-four-hour service is available in many cases.

At the time the plan of frequency assignments to aviation was originally developed the air transport companies were operating a large number of more or less disconnected routes. During the last year, however, there has been a reorganization of these companies which has resulted in three major transcontinental lines, an Atlantic coast line, and one international line to the nations south of the United States, each with a number of "feeder" systems. These lines are the principal ones now interested in radio communication.

This reorganization of air transport companies necessitated a readjustment of frequency assignments to meet the needs. This was done by means of General Order 99, and amendments were made to that order as the experience and needs of operations required.

Under the present organization, as provided by General Order 99 and subsequent amendments, there are five major chains of communication—the northern transcontinental chain, from New York to San Francisco via Chicago and Salt Lake City; the midtranscontinental chain, from New York to Los Angeles via St. Louis (Mo.), Tulsa (Okla.), and Albuquerque (N. Mex.); the southern transcontinental chain, from Boston to Los Angeles via Albany (N. Y.), Cleveland (Ohio), Memphis (Tenn.), Little Rock (Ark.), Dallas

and El Paso (Tex.); the eastern continental chain, from New York to Miami either by Atlanta (Ga.) or Charleston (S. C.); and the southern international chain, extending from Miami (Fla.) and Brownsville (Tex.) to the West Indies, Mexico, and Central and South America. These routes have shorter routes which connect with the main route, and, as far as communications are concerned, they operate as integral parts of the main route. A complete picture of the extent of the aviation communication systems is given in the map in Figure 3.

Radiotelephone is used in all communications with airplanes except on the southern international chain where radiotelegraph is used.

The frequencies assigned to these chains under the provisions of General Order 99 and amendments are, with a few exceptions, available for use on all points on the chain. The responsibility of distributing the use of these frequencies over a chain to reduce interference to a minimum is left to the air transport company flying airplanes over the route.

All frequencies assigned for aviation purposes are designated in three classes, as follows:

(*a*) Frequencies used for distress, calling, and aids to navigation.

(*b*) Frequencies used by aeronautical or aircraft stations on a chain or chains for communication purposes either between aeronautical stations and aircraft or between aeronautical stations.

(*c*) Other aviation frequencies.

The distress, calling, and navigational frequencies are as follows:

278 kilocycles, airport frequency: Calling and working frequency from all ground stations to aircraft. Power not to exceed 15 watts. Aeronautical stations licensed to use this frequency are required to provide service, without discrimination, for all and any aircraft.

333 kilocycles: International air calling frequency to be used only beyond the limits of the United States, and then only for communication between aircraft and foreign stations.

375 kilocycles: Radio compass.

500 kilocycles: International calling and distress frequency for ships and aircraft over the seas.

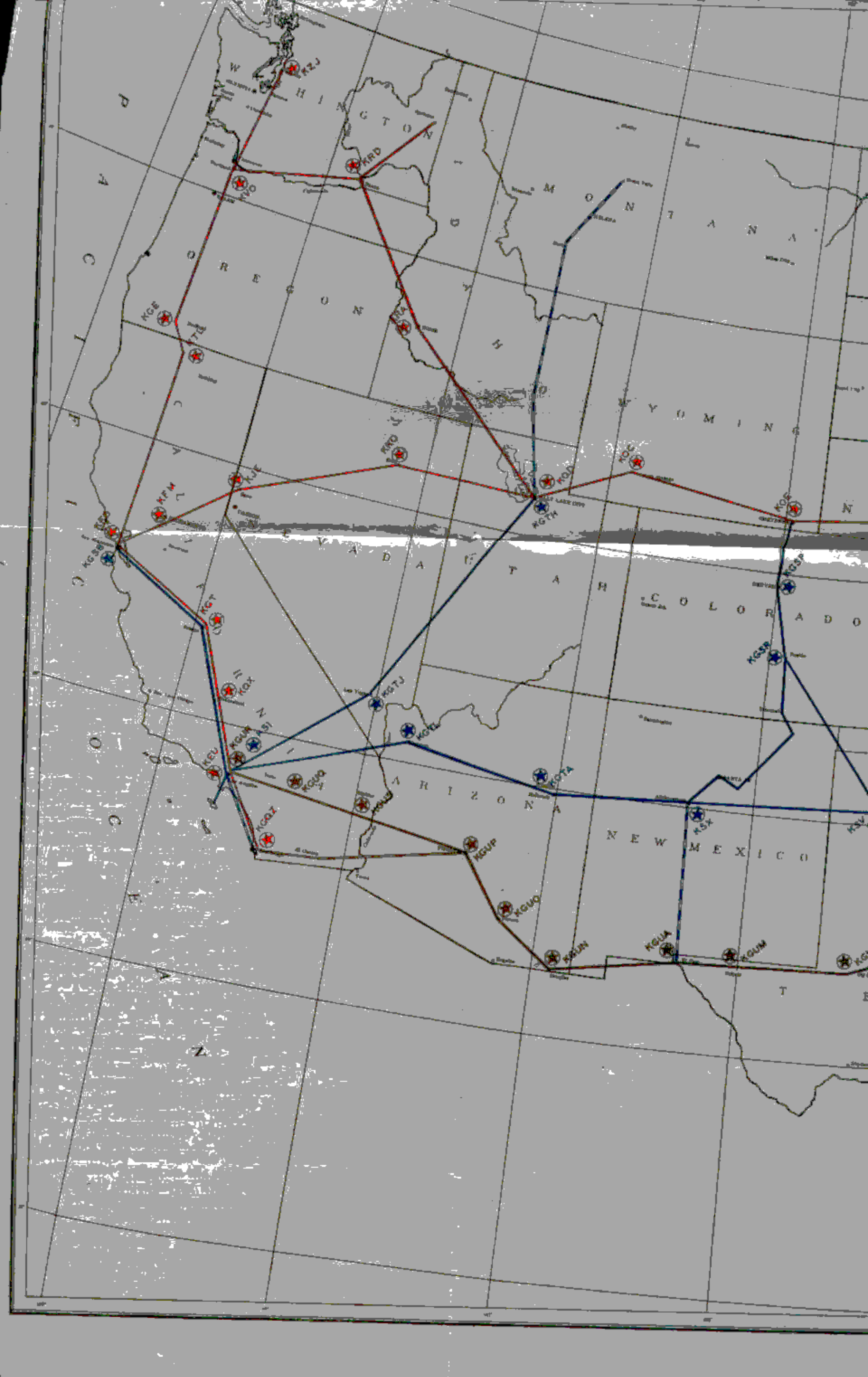
3,106 kilocycles: National calling and working frequency for all itinerant aircraft. It may also be assigned to transport aircraft in addition to the chain frequencies. Aircraft calling or working ground stations on this frequency will conduct a 2-way communication by utilizing the 3,106-kilocycle frequency for transmitting from aircraft to the ground and the 278-kilocycle frequency for receiving from the ground to aircraft.

5,525, 11,060, 16,580 kilocycles: Primarily for coastal stations and ships. May also be assigned to aircraft only for the purpose of calling a coastal station or ship when aircraft is in flight over the sea.

414, 457 kilocycles: Working frequencies for aircraft on sea flights desiring intermediate frequencies. Those desiring high frequencies may use the frequencies designated for maritime calling and working.

The frequencies used by aeronautical or aircraft stations on a chain or chains and the reserve list of other aviation frequencies appear in the bands above 1,500 kilocycles. The majority of these, however, are of the order of 3,000 kilocycles for night communication and 5,500 kilocycles for day operation.

There was on June 30, 1931, a total of 101 ground stations, either licensed or under construction, for aeronautical radio service on the five chains. In addition, many independently owned airport sta-


W A S H I N G T O N
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N E W M E X I C O
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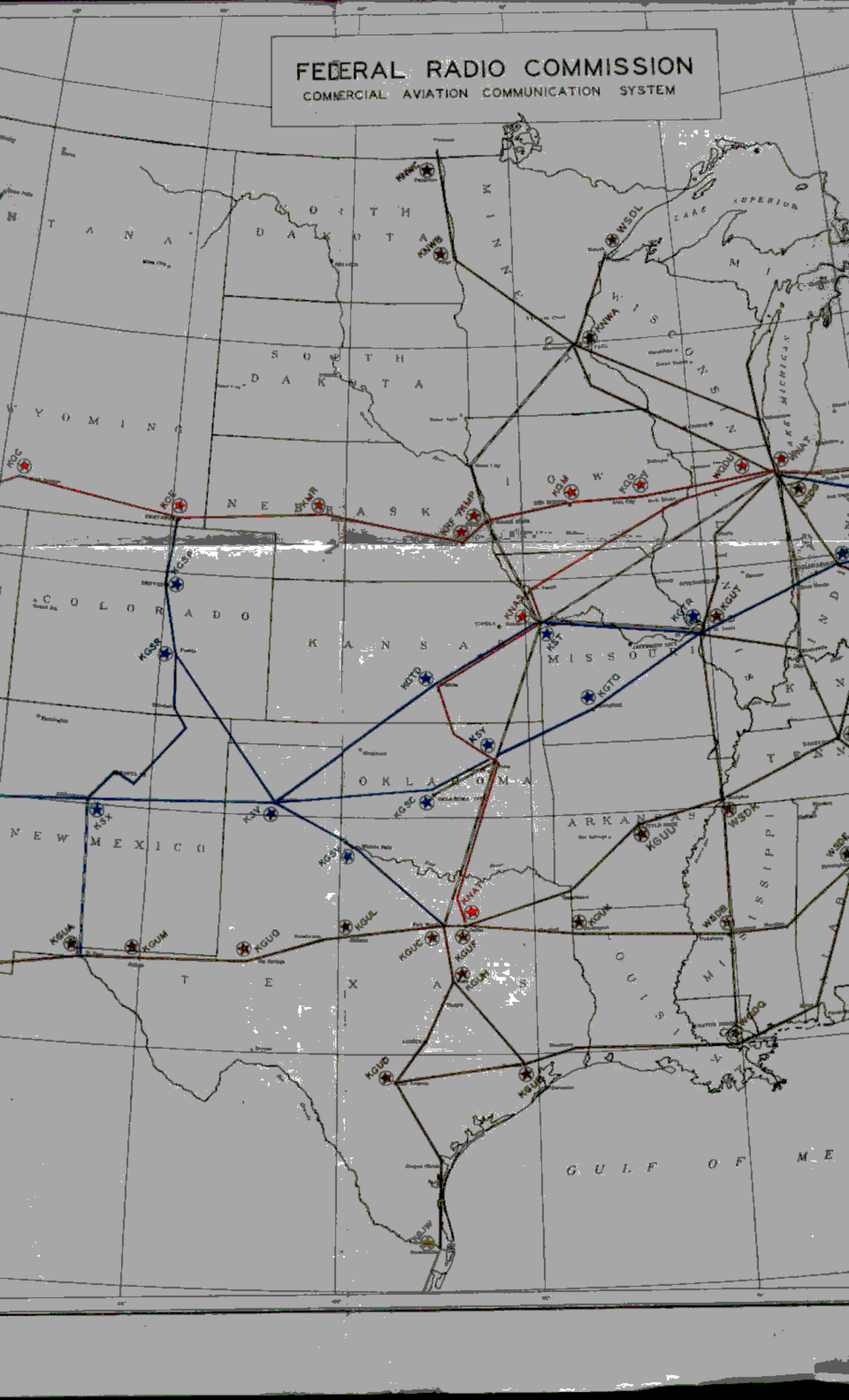
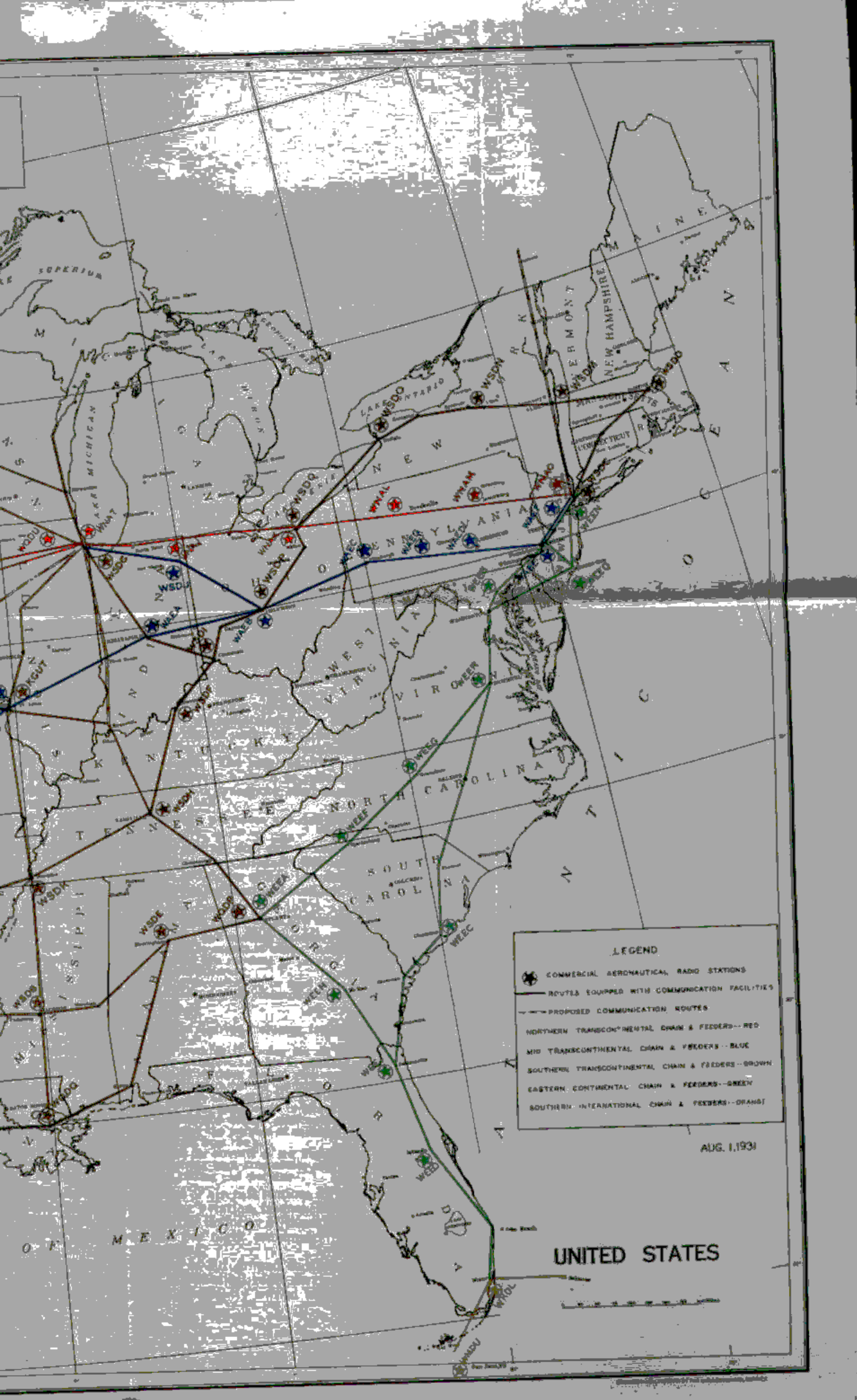
FEDERAL RADIO COMMISSION

COMMERCIAL AVIATION COMMUNICATION SYSTEM




LEGEND
COMMERCIAL AERONAUTICAL RADIO STATIONS
ROUTES EQUIPPED WITH COMMUNICATION FACILITIES
PROPOSED COMMUNICATION ROUTES
NORTHERN TRANSCONTINENTAL CHAIN & FEEDERS--RED
MID TRANSCONTINENTAL CHAIN & FEEDERS--BLUE
SOUTHERN TRANSCONTINENTAL CHAIN & FEEDERS--BROWN
EASTERN CONTINENTAL CHAIN & FEEDERS--GREEN
SOUTHERN INTERNATIONAL CHAIN & FEEDERS--ORANGE
AUG. 1,1931
UNITED STATES
LAKE SUPERIOR
LAKE MICHIGAN
LAKE ONTARIO
NEW YORK
NEW HAMPSHIRE
VERMONT
MASSACHUSETTS
CONNECTICUT
PENNSYLVANIA
WEST VIRGINIA
VIRGINIA
KENTUCKY
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
MEXICO

tions were in operation to provide radiocommunication between ground and itinerant aircraft at points where regular chain service is not in operation.

POLICE

The use of radio by police departments for transmission of orders from police headquarters to policemen in automobiles patrolling the streets has developed rapidly. The first radio station for the exclusive use of a city police department was established in Detroit in 1927. In April, 1930, the commission adopted the first organized plan (General Order 85) for the assignment of frequencies to municipal police in order to make possible an efficient service on the limited number of frequencies available. At that time 29 cities had stations in operation. On June 30, 1931, there were 62 separately licensed police radio stations. In addition a State police service is maintained in Michigan, Massachusetts, and Pennsylvania, the latter State carrying on only a point-to-point radiotelegraph communication service with State police barracks.

In the municipal police radio service, policemen patrol the streets in automobiles which are equipped with radio receivers permanently adjusted to the frequency of the transmitting station of that city. Orders are given in voice from a central point by a police officer, who dispatches the various cars to locations requiring police attention. There is consequently no delay in getting orders from headquarters to police in the vicinity of a crime or disorder. The frequencies used for the service are above 1,500 kilocycles, and the orders can not be heard on a radio-broadcast receiver and there is no interference to broadcast reception.

A number of city police departments have established a police service to serve an entire metropolitan area. Each of these cities entered into agreement with surrounding municipal and county governments under the provisions of which they agreed to furnish police service to all municipalities without discrimination, and the subscribing municipalities agreed, in turn, not to request independent broadcasting facilities. This agreement makes it possible to give a coordinated and efficient police service.

With only eight frequencies available for emergency police service it is obviously impracticable to authorize a different frequency for each municipality. The allocation plan, therefore, is based on a zone system of frequency assignment whereby all cities within the same zone are required to cooperate in the joint use of a common frequency. It is believed also that the zone system of allocation is to be preferred, because it permits the interception of emergency broadcast messages by all police forces within the area, thereby increasing the efficiency of the system in combating major crimes. The use of several units of low power instead of a single unit of higher power to cover a city has been encouraged as a means of avoiding interference and of giving better coverage of the city. This has been used in a few cities with good results.

An illustration of the joint use of one frequency is the Detroit area, in which there are located the two transmitters of the city of Detroit and transmitters operated by two neighboring cities, Grosse

Point and Highland Park. The actual operation in this area is conducted as follows: In each control room there is installed a monitor receiver, together with loud-speaker, tuned to the joint police frequency. If the frequency is in use by either of the other municipalities, the operator is aware of such fact and will not attempt to put his call through until the other city has signed off. If, however, he has an emergency message which can not be delayed, it is possible to gain the immediate use of the frequency by the exchange of signals over a private leased wire. In any event it takes but a few seconds to announce an alarm, and serious delay is not experienced.

The information transmitted over most police radio stations is obtained from two general sources:

(1) From citizens by means of the telephone or call boxes.

(2) From the precinct stations and the several divisions of the police department.

The radio-equipped patrol cars are, in general, arranged throughout the city by precincts and each regular police precinct is divided into what are termed "patrol districts." A radio car is assigned to each district and is constantly on watch while patrolling the district. When an emergency arises in the district, the car is immediately dispatched to the scene of trouble.

The patrol districts are chosen with the following points in mind:

(1) Density of population.

(2) Crime record of the territory considered.

(3) The traffic problem:

- (*a*) Density of traffic.
- (*b*) Congested points.
- (*c*) Possible obstructions, such as railroads, etc.

(4) Other police protection.

The radio cars are usually of two types, termed "scout cars" and "cruisers." The scout cars are light automobiles and are usually manned by two policemen. It is these cars that are assigned to the patrol districts. The cruisers are heavy, high-powered cars, and usually carry about four men. The cruisers are equipped with riot guns, tear-gas bombs, and are designed to handle the more serious crimes. A cruiser patrols through an entire precinct and covers territory which may also be covered by scout cars, so that during serious trouble the two policemen in a scout car are augmented by the crew in the cruiser.

The following method of handling a call is used by many police departments: A citizen calls the police department by telephone. This call comes direct to the telephone operator in the main dispatching room, who turns the information over to the police dispatcher. The dispatcher then determines the orders to be given and connects a microphone through to the radio station. He then gives his orders by talking into the microphone, and those orders are received by all automobiles in the streets, thus informing all cars of movements of any others. His orders are also heard by loud-speakers in various parts of his station and by means of receiving sets in other police stations of the city and adjacent communities. The call is sometimes repeated, either by the dispatcher or the radio operator, to insure that it is received.

The car upon receiving its orders immediately proceeds to the scene of the trouble. As soon as the patrol crew has completed its work, one member of the crew telephones back to the radio station, and the patrol car is then considered ready for new service. There is no provision for radio transmission from the automobile to the central station.

The following is a typical report taken from the log of a large city and representing one month's record of emergency broadcast messages:

Total messages broadcast	6,639
Total number of runs	4,079
Total minutes on runs	8,774
Total arrests	418
Average time on runs, in minutes	1.99
Recoveries:	
Taxicabs	3
Automobiles	10
Motor cycles	1
Lost children	4
Insane persons	1
Cash register	1
Confiscated:	
Guns	10
Knives	1

From the above it is noted that if the average time consumed in making one announcement is 30 seconds, an emergency message was transmitted on the average of once in every 13 minutes. It is of further interest to note that an average of one arrest was made during each successive period of 1 hour and 45 minutes.

Another large city reported only 3,001 messages broadcast during the same month. These are classified as follows:

Number of messages	Nature of transmission
955	Call your station; meet detectives.
411	Automobiles stolen.
342	Automobiles recovered.
318	Minor complaints.
103	Accidents.
91	Robberies.
77	Descriptions of persons wanted.
71	Pick up automobiles; persons wanted.
62	Fights.
28	Burglaries.
20	Assaults.
4	Murders.
1	Rape.

NOTE.—Other announcements related to bank box alarms, prowlers, drownings, mad dogs, false fire alarms, suspicious persons, shootings, etc.

The use of radio by State police departments is only in service in three States, and it has not yet been determined whether or not this use will be extended. This service is closely related to city service.

The engineering division is in close touch with the police departments operating radio service and will assist in developing it to the maximum efficiency.

Table XIII gives the cities and States authorized to operate police radio stations or which have stations under construction.

TABLE XIII.—*State and municipal police radio stations*

(a) LICENSED AND IN OPERATION

Call letter	Name	Call letter	Name
WPDO	City of Akron.	WPDE	City of Louisville.
WPDY	City of Atlanta.	WPDW	Metropolitan police, Washington, D. C.
KGPJ	City of Beaumont.	WRDS	State of Michigan.[1]
KSW	City of Berkeley.	WPDK	City of Milwaukee.
WMJ	City of Buffalo.	KGPB	City of Minneapolis police department.
KGOZ	City of Cedar Rapids.	WPY	City of New York police department.[2]
WPDV	City of Charlotte.	KGPI	City of Omaha, Nebr.
WPDC	City of Chicago police department.	WPDJ	City of Passaic, N. J.
WPDD	Do.	KGJX	Pasadena police department.
WPDB	Do.	WBA	Pennsylvania State police.[1]
WKDU	City of Cincinnati.	WBR	Do.[1]
WBBH	City of Cleveland.	WDX	Do.[1]
WMP	Commonwealth of Massachusetts, department of public safety, division of State police.[1]	WJL	Do.[1]
		WMB	Do.[1]
KVP	City of Dallas police and fire signal department.	WPDP	City of Philadelphia.
KGPN	City of Davenport.	WPDU	City of Pittsburgh.
WCK	Detroit police department.	WPDH	City of Richmond.
WPDX	Do.	WPDR	City of Rochester.
WPDF	City of Flint.	KGPC	City of St. Louis.
WPDI	Franklin County Board of County Commissioners.	WPDS	City of St. Paul, department of public safety.
WRDR	Township of Grosse Point.	KGPA	Seattle police department and Seattle fire department.
WMO	City of Highland Park.	KGPK	City of Sioux City.
WMDZ	City of Indianapolis.	WRDQ	City of Toledo.
KGPE	City of Kansas City.	WPDA	City of Tulare police department.
WPDL	City of Lansing.	KGPG	City of Vallejo.
KGPL	City of Los Angeles.	WPDG	City of Youngstown.

(b) CONSTRUCTION AUTHORIZED BUT NOT COMPLETED

WPDN	City of Auburn.	KGPH	County of Oklahoma.
WPDZ	City of Fort Wayne.	WGPP	City of Portland.
WPEB	City of Grand Rapids.	KGPM	City of San Jose.
WPDT	City of Kokomo.	WPEA	City of Syracuse.
WPEC	City of Memphis.	KGPO	City of Tulsa.

[1] State police. [2] Harbor police.

RADIO COMMUNICATIONS IN ALASKA

In the Territory of Alaska radio communication is used extensively by the fishing industry for communication between shore stations and fishing vessels and between canneries. These communications are coordinated by the Washington-Alaska Military Cable and Telegraph System of the Signal Corps, United States Army, which maintains radio communications within Alaska, and by means of radio and cable with the United States.

Most of the private radio operations are by radiotelegraph on frequencies below 550 kilocycles. Many of the stations operating on these frequencies have in the past used spark transmitters, and a large amount of interference resulted therefrom. In accordance with modern engineering practice and in order to reduce interference, General Order No. 79 prohibited the use of spark transmitters after June 1, 1931. All the stations now operating have complied with the order and have installed modern vacuum-tube transmitters.

A limited number of frequencies above 1,500 kilocycles are used by stations in Alaska both for telegraph and telephone. A small number of shore stations and ships have been equipped with low-power

radiotelephone transmitters. This permits direct voice communication between the superintendent of operations and the masters of the ships under his control.

BROADCAST PICK-UP SERVICE

Events of interest to broadcast listeners often occur at locations at which wire-line facilities are unavailable or unsuitable. In order to make it possible to broadcast such events directly, six frequencies, all above 1,500 kilocycles, were allocated for broadcast pick-up service. Two of these frequencies are assigned for the use of each group originating the broadcast program for the period of the broadcast only.

In general, a low-power transmitter operating on one of the frequencies is located at the point of origin of the program, which may be an airplane, a train, an automobile, etc., or the transmitter may be carried by an announcer. The description of the event or the program is transmitted by the small transmitter and is received by a receiving set located at the nearest point at which connection can be made to suitable telephone-wire lines. At that point the output of the receiving set is connected through suitable equipment to the wire lines and is distributed by the regular wire facilities to the broadcasting stations which transmit the program to the broadcast listener. The second frequency is used for a second transmitter, either at a second location to pick up additional descriptions or broadcasts, or is used as an "order circuit" to direct the broadcasting of the mobile station in order to fit it into other parts of a program.

Many interesting descriptions of events, such as sporting events (boat races, golf tournaments, etc.), take-off and landing of several international airplane flights, submarine rescue demonstrations, airplane events, and other events described from aircraft, etc., have been broadcast which otherwise would not have been available.

MOTION-PICTURE SERVICE

Many motion pictures or portions of motion pictures are produced at locations where wire lines are not available. Often large numbers of people are involved and units are distributed over wide areas. In order to provide communication between field production units, or between field units and headquarters where no other form of communication is available, two frequencies were allocated for use by the motion-picture industry. These frequencies provide two radiotelegraph channels or one radiotelephone channel.

Licenses for this class of station provide that the transmitter is to be used only upon specific authorization of the commission for the period of time actually required. This restriction was required because of the limited frequencies available and the possibilities of adjustments being required in order to avoid interference.

EXPERIMENTAL VISUAL BROADCASTING

There has been a large amount of public interest shown in the development of visual broadcasting (television) and its possibilities for public entertainment and use. The public interest has stimulated

the laboratories working in this field to increase their efforts to improve the art.

There has been in the past year very material improvement in the quality of the transmissions of visual broadcast stations and the detail of the image which is received. Many of the experimental transmissions consist of motion-picture films which provide ample opportunity for observation. However, there has been much development in the production of studio programs of public interest. The development of pick-up devices to include a complete scene and the production of plays especially for visual broadcasting purposes have received special attention. Several stations have coordinated the visual broadcasting with regular sound broadcasting.

The amount of detail which can be transmitted and received in an image is a function of the number of picture elements which are transmitted. The majority of the stations now operating in the visual broadcast bands between 2,000 and 3,000 kilocycles have standardized their transmissions for the present, and their images are made up of 60 lines per frame and 20 frames per second; but this has not been universally adopted.

In order to obtain greater detail in transmitted images, there have been developed methods of scanning which differ materially from the method used in the majority of visual broadcast stations. There has been no effort on the part of the commission to require any standard method of scanning or a standardization of the number of lines per frame or frames per second which are transmitted. The experimental visual broadcast stations have been given complete freedom in developing the art.

In order to obtain an image of great detail it appears to be necessary, using the present methods of radio technique, to transmit higher modulation frequencies, which in turn require a wider frequency band to accommodate the transmissions of this type of station. The present band widths permitted for visual broadcasting on frequencies between 2,000 and 3,000 kilocycles are 100 kilocycles wide, or ten times the band width required for a sound-broadcast station. Consensus of engineering opinion indicates that in order to transmit a picture having satisfactory detail the band width required will be many times that now available in this frequency range. The needs of other essential services for frequencies in this band appear to make it impossible to provide frequencies in this frequency range other than those now used for visual broadcasting.

The commission has authorized a number of laboratories to investigate the possibilities of transmission of images in the following bands of frequencies:

43,000–46,000 kilocycles
48,500–50,300 kilocycles
60,000–80,000 kilocycles

Preliminary reports indicate that these very high frequencies show great possibilities, and many transmissions are now being observed. It is, however, too early to form an opinion as to the suitability of these bands. In view of the possibility of visual broadcast requiring very wide frequency bands, no limitation has been put on the band width to be used in the very high frequencies. Licensees in these bands are authorized for the present to use as great a portion of the band as is necessary in order to transmit the best picture possible.

EXPERIMENTAL RELAY BROADCASTING

Most of the relay broadcast stations of the United States maintained regular programs on their authorized frequencies (above 6,000 kilocycles) and made observation of their reception in other countries. These stations provide programs which are of principal interest to those parts of the world in which there is no organized broadcasting in the broadcast bands below 1,500 kilocycles.

Certain of the relay broadcast stations are also used for transmitting programs of special interest to foreign countries, where they are received by specialized equipment and rebroadcast through the transmitting stations on regular broadcast frequencies. This use of relay broadcast channels provides one means of interchange of programs between nations.

An outstanding case of this use of international exchange of programs was in connection with the ceremonies incident to the deposition of the naval treaty at London on October 27, 1930. On this occasion the voices of the President of the United States, the Prime Minister of England, the Premier of Japan, and other prominent people were broadcast to the inhabitants of the North American Continent, Europe, Australia, and Japan. In connection with this program both relay broadcast stations and fixed point-to-point stations were used to provide the necessary connections.

There has been no material increase in the number of licensees for the experimental relay broadcast service. A number of licensees have been granted increased power in order to make possible a more satisfactory and reliable service.

GENERAL AND SPECIAL EXPERIMENTAL SERVICE

The following frequencies are now set aside for the use of stations conducting general radio research, and all or a limited number of them are assigned to general experimental service as required by the type of research being done:

Kilocycles:	Kilocycles:	Kilocycles:	Kilocycles:
1,604	8,050	26,000	60,000–400,000
2,898	12,850	27,100	401,000 and above
3,256	17,300	34,000	
4,795	23,100	41,000	
6,425	25,700	51,400	

Confidential reports of the work of these stations, which are filed quarterly show that the use of these frequencies has resulted in many advancements in radio engineering and the knowledge of radio transmission.

All radio research work, however, can not be done on these frequencies. To accommodate such research a class of license has been authorized for "special experimental stations." These licenses cover the operation of stations used for research in the radio art which requires the transmission of power on frequencies other than those set aside for general experimental service. Licenses of this class are issued for short periods of time and only after a satisfactory showing that the research to be conducted is very important to the development of radio transmission and that the general experimental frequencies are entirely unsuited for the research problem involved.

Since frequencies other than those set aside for general experimental stations are used by regular commercial services, use by special experimental stations is only authorized at such time and under condition that no interference will be caused to the regular established communications on those frequencies.

AMATEUR RADIO SERVICE

There were on June 30, 1931, approximately 22,739 amateur stations licensed. These stations operate on the frequencies allocated for this service by the international radio convention of Washington, 1927, the North American agreement of 1929, and under regulations imposed by the international convention and by General Order 84. Most amateur communications are carried on by radiotelegraph, but there is an increasing interest in radiotelephone transmissions, and portions of the amateur bands have been allocated for use by radiotelephone stations. There has been some activity in the investigation of the ultra-high frequencies above 28,000 kilocycles, but to date there are practically no amateurs consistently communicating on these frequencies, although many experiments are in progress.

A large number of the amateur stations have communicated with similar stations in practically all foreign countries, and such contacts have contributed to development of data concerning transmission effects on high frequencies.

Amateur stations cooperated with the Army, Navy, and Red Cross in handling of emergency traffic and by engaging in mobilization practice in connection therewith. A plan has been worked out by the Navy Department and the American Red Cross for the employment of the Naval Communication Reserve, of which many amateur operators are members, in times of emergency when the Red Cross functions to bring relief to distressed communities. This plan also provides for the use of amateur stations not affiliated with the Naval Reserve. The large number of amateurs that are members of the volunteer Naval Communication Reserve and the Army Amateur Reserve Corps are qualifying themselves for future service in times of national emergencies.

Since 1925 a Navy day receiving contest has been held for amateur operators, and interest has been continually increasing. On October 27, 1930, a message from the Secretary of the Navy to the radio amateurs of the United States was broadcast by radiotelegraph from the naval radio stations at Arlington, Va., and San Francisco, Calif., and from the naval reserve station at Hartford, Conn. This message was copied in full by operators of 285 amateur stations.

On March 16, 1931, 494 amateur stations were successful in copying a message from the Red Cross national chairman, which was addressed to all the chapters and representatives of the Red Cross throughout the United States and broadcast by radiotelegraph from the Army amateur net control station in Washington, D. C. Of the 494 amateurs who copied the message, 481 delivered it personally to the local Red Cross representative within 24 hours. The average time interval between the time the message left Washington and the time that the information was received by Red Cross representatives throughout the United States was 2 hours and 25 minutes.

Of the operators participating, 338 delivered the messages inside of 18 minutes. This was the first nation-wide mobilization of the amateur radio system for the Red Cross, and resulted in direct contact between these amateur operators and the nation-wide personnel of the American Red Cross, who will require, as they often have in the past, the services of these men to furnish rapid emergency communication in times of disaster when commercial facilities fail.

Immediately upon receiving word of the disastrous earthquake which destroyed the city of Managua, Nicaragua, operators of amateur radio stations throughout the United States, and particularly in Washington, D. C., proceeded to do all in their power to establish communication with the stricken area. From March 31 to April 12, 1931, a large number of messages of a personal nature were handled which could not be routed through Government or commercial stations, since those stations were overtaxed with official traffic.

Amateur operators also have maintained communication between various expeditions and their sponsors in the United States. Among these were the expedition to Africa which made motion pictures in connection with the production of Trader Horn, the all-American Malaysia expedition to Dutch Borneo, the first international highway exploring expedition in Mexico, the MacMillan Arctic expedition, and the Byrd Antarctic expedition.

Many of the amateur stations participated in competitive activities, arranged by their own organization. Some of these were as follows: 276 stations engaging in a message-handling contest resulted in the winning station exchanging messages with 305 amateur stations distributed throughout the United States and Canada (February 14 to 28). A radiophone versus radiotelegraph transcontinental relay contest, held on January 11, 18, and 25, resulted in the transmitting of a radiotelegraph message from the east to the west coast and the receipt of a reply in two minutes. An international relay contest, conducted from March 8 to 21, inclusive, culminated in 160 American amateur stations communicating with foreign amateur stations in five continents.

The amateurs as a class are continually endeavoring to improve their skill as operators and to so organize their activities that they will contribute to the development of the radio art, particularly in the study of high-frequency transmissions, and at the same time to equip themselves to render the maximum service to the United States in times of emergency.

INTERNATIONAL AND INTERDEPARTMENTAL RELATIONS SECTION

GERALD C. GROSS, Chief

INTERNATIONAL TECHNICAL CONSULTING COMMITTEE ON RADIO COMMUNICATIONS

The second meeting of the International Technical Consulting Committee on Radio Communications (C. C. I. R.) met at Copenhagen, Denmark, May 27 to June 8, 1931. The United States delegation, which was headed by the Hon. Wallace H. White, jr., included Dr. C. B. Jolliffe, chief engineer, and Mr. Gerald C. Gross, engineer, of the Federal Radio Commission. One member of the secretarial staff which accompanied the delegation was also from the Federal Radio Commission.

The preparatory work of the United States for this conference, which was done prior to the appointment of the official delegation on April 7, 1931, was organized by the Federal Radio Commission upon request of the Department of State. This preparatory work was done by a group of representatives from Government departments, commercial operating companies, and other interested organizations. The seven questions which were listed as unfinished by the first meeting of the C. C. I. R. and the questions which were subsequently added to the agenda were studied, and complete material was prepared and sent to the various administrations prior to the formation of the official delegation. This material was circulated to the various nations and published by the International Bureau in the documents of the conference. In many cases during the conference these documents formed a basis for the work and the final opinions which were issued.

At the time of the opening of the conference 25 questions were listed on the agenda for consideration. From the study of these questions, 20 opinions [1] were formulated and 14 new questions were designated for further study. The opinions which were formulated by the conference covered practically all technical phases of radio communication and served principally to define the present state of the radio art. They were in substantial agreement with the proposals of the United States on these questions, and there was no conflict with the position of the technical experts of the United States on the various matters discussed.

Many of the opinions adopted are in accordance with existing regulations of the Federal Radio Commission. Other recommendations which are applicable to the regulation of radio in the United States will be considered in formulating new regulations.

[1] A report of the meeting will be published by the Department of State. Copies of the opinions and new questions adopted may be obtained from the Federal Radio Commission.

The third meeting of the C. C. I. R. is to be held in Lisbon, Portugal, at a date to be fixed later by the International Radio Conference which will be held in Madrid, Spain, in 1932.

INTERNATIONAL RADIO CONFERENCE

The International Radio Conference, to revise the international radio convention signed at Washington in 1927, is to meet in Madrid, Spain, in the fall of 1932. The International Telegraph Conference, to revise the international telegraph convention and regulations, is to meet at the same time and place. It has been proposed that these two conferences be joined and that a joint radio and telegraph convention be formulated. The International Bureau of the Telegraph Union has asked for proposals for both of these conventions to be filed by August 1, 1931. The Federal Radio Commission has cooperated with the Department of State in the preparation of these proposals.

The study of the general regulations annexed to the international radio convention was organized by the commission at the request of the Department of State, and proposals for the revision of the regulations prepared. This work was done by a group of representatives of Government departments, commercial operating companies, and other interested organizations, which held frequent meetings on the subject.

The study of the revision of the convention and of the proposals concerning the amalgamation of the two conventions which was carried on by the State Department was participated in by members of the commission's staff. The proposals were tentatively completed before the delegation left to attend the second meeting of the International Technical Consulting Committee on Radio Communications at Copenhagen, but were held for final approval until the completion of that meeting.

The International Radio Conference will be one of the most important communication conferences yet held and involves many important considerations of governmental policy. Since changes in the regulations affect the regulations which may be promulgated by the United States, the Federal Radio Commission is vitally interested and will continue to be actively interested in all preparatory work for the conference.

INTERDEPARTMENTAL

The Interdepartment Radio Advisory Committee, which includes representatives from all Government organizations interested in radio communication, prepared a revision of previous Executive orders assigning frequencies to Government departments. This revision resulted in the issuance of Executive Order No. 5638, which lists the frequencies assigned to all Government fixed and land stations. Representatives of the Federal Radio Commission on this committee cooperated in the preparation of this revision, in particular with relation to coordination with the assignments made to commercial radio stations. This work resulted in a more effective use and closer coordination between the Government stations and new assignments to commercial radio stations, thus providing for more efficient and economical use of the radio spectrum.

REPORT OF THE GENERAL COUNSEL

THAD H. BROWN

I. INTRODUCTION

The legal division of the commission has been organized into three principal sections:

(1) The administrative section, which is subdivided into the application and form subsection and the complaint and investigation subsection. It has charge of all applications for facilities coming through the legal division and the preparation of all forms used by the commission. Complaints, except those of a technical nature, are referred to it for investigation and report to the commission.

(2) The hearing section, which conducts all hearings before the commission and the examiners. It is responsible for the preparation of the commission's case and to see that all facts are properly brought to the attention of the examiners for their decision.

(3) The research and drafting section, which prepares all legal opinions, rules and regulations of the commission, general orders, and has charge of the cases appealed to the appellate courts.

The work of the legal division is carried on by a general counsel and three assistants to the general counsel provided for by amendment of March 4, 1929, to the radio act, and six junior assistant attorneys. The plan of dividing the legal division into three sections, with an assistant to the general counsel in charge of each section, has proved very efficient and satisfactory.

THE GENERAL COUNSEL'S OFFICE

The general counsel has direct charge of all court matters of the commission, including briefs, record on appeal, as well as the presentation of matters in all courts. All correspondence, opinions, memoranda, and reports on applications are prepared for his signature and supervised by him. Direct contact with the commission is maintained at all times and legal advice or opinions are presented to the commission by the general counsel. It is his duty to handle interdepartmental affairs of a legal nature and to interview parties having matters pending before the commission and representatives of the public.

II. ADMINISTRATIVE SECTION

This section is divided into two main subdivisions, the first being application and form subsection, whose duties are to handle all applications coming before the commission and to draft all new forms for the use of the commission, and the second being complaint and investigation subsection, whose duties are to make a study of all

formal complaints, except those dealing with the technical operation of a station. This work is in charge of an attorney, who makes a careful investigation of all the facts surrounding the case and reports the same to the commission, who, in turn, determines whether the violating station shall be set down for hearing. If the commission deems it necessary, an investigator is sent into the field with a carefully prepared outline of the information required, and a thorough check is made of all the facts surrounding the case. In this way the commission is fully informed before a case is set down for hearing and a station cited to appear and defend its position.

1. The application and form subsection is responsible for the preparation and revision of forms of application and authorization and such other forms relating to the administrative or routine work of the commission as the legal division is called upon to prepare, revise, or approve. All applications for licenses and authorizations are referred to this subsection, where they are examined, and recommendation of the legal division with respect thereto is made. The number of applications that have been investigated and passed upon by this subsection during the past year is 5,679.

2. The complaint and investigation subsection of the legal division has investigated numerous complaints against station licensees for operating in violation of the rules and regulations of the commission. The diligence with which these investigations have been made has resulted in a greater respect by the station licensees for such regulations. It has been found that almost all stations are now willing to cooperate with the commission in correcting any error, with the result that the stations have improved their service to the public through improvements in their physical equipment by refusing to broadcast questionable programs and by generally raising their program standards.

3. During the fiscal year there were three criminal convictions secured for violations of the radio act of 1927:

(*a*) *United States v. Joseph Travers.*

The defendant, Joseph Travers, was indicted at the September term, 1930, of the United States District Court for the District of Massachusetts. The indictment in one count charged the defendant with operating radio transmitting apparatus without a license in that behalf granted, in violation of section 1 (d) and (e) of the radio act of 1927 (47 U. S. C. A. 81 (d) and (e)). The second count charged a violation of section 1 (b) of the radio act of 1927 (47 U. S. C. A. 81 (b)).

The defendant was tried, convicted, and sentenced to two years' imprisonment on each count, the sentences to run concurrently. These sentences were suspended and the defendant released on probation by the court.

(*b*) *United States v. Robert Gordon Duncan.*

The defendant, Robert Gordon Duncan, was indicted by the United States grand jury for the district of Oregon in June, 1930. The indictment contained five counts, charging the defendant with uttering obscene, indecent, and/or profane language by means of radio

communication in violation of section 29 of the radio act of 1927 (47 U. S. C. A. 109).

The defendant was tried and convicted in the United States District Court for the district of Oregon at Medford, Oreg., in October, 1930, on one of the five counts and acquitted as to the other four counts. The court sentenced the defendant to six months in jail and to pay a fine of $500.

The defendant appealed his conviction and sentence to the United States Circuit Court of Appeals for the Ninth Circuit. That court affirmed the conviction and sentence imposed by the lower court, holding that the language charged in the indictment was profane. (See Duncan *v.* United States, 48 Fed. (2d) 128.) The defendant then attempted to secure a review of the case by the Supreme Court of the United States. This the Supreme Court declined to do. (See Duncan *v.* United States, 75 L. ed. 876.)

(*c*) *United States v. Malcolm McMasters and Cecil Molyneaux.*

The defendants, Malcolm McMasters and Cecil Molyneaux, were indicted September 26, 1930, by the United States grand jury at Brooklyn in the eastern district of New York. This indictment contained three counts. The first count charged the defendants with operating radio transmitting apparatus without a license in that behalf granted, in violation of section 1 of the radio act of 1927 (47 U. S. C. A. 81). The second count charged the operation of radio transmitting apparatus without an operator's license, in violation of section 20 of the radio act of 1927 (47 U. S. C. A. 100). The third count charged the operation of radio transmitting apparatus without a license in that behalf granted, in violation of the provisions of the international radio telegraph convention of 1927 and specifically in violation of section 32 of the radio act of 1927 (47 U. S. C. A. 112).

An amateur radio-station license had been issued by the Federal Radio Commission to authorize the operation of an amateur radio station at the address where it was charged that the defendants carried on and conducted their illegal operations. The amateur in making application for a station license had described his apparatus as a transmitter having six vacuum tubes, employing a Heising modulation circuit and capable of transmitting continuous wave, and interrupted continuous wave telegraph, as well as being operated as a radiotelephone transmitter for the transmission of sound. The apparatus being used by the defendants, McMasters and Molyneaux, was a 1-tube radio transmitter and was not capable of being used as a radiotelephone transmitter for the transmission of sound.

The amateur-station license described the equipment, which was authorized to be used at the address where the defendants operated, as "vacuum-tube transmitter." The court held that this description was so general and so broad as to cover any vacuum-tube transmitter and that it did specifically cover, generally, the apparatus which was operated by the defendants. Because of this the court directed a verdict of "not guilty" as to counts 1 and 3 of the indictment.

The second count, which charged the operation of radio transmitting apparatus by the defendants without holding operators' licenses from the Secretary of Commerce authorizing them to operate such apparatus, went to the jury, which returned a verdict of "guilty" under count 2 of the indictment. The court sentenced the defendants to serve three years in the Federal penitentiary, but suspended the sentence against Malcolm McMasters and released him on probation.

This case has been appealed to, but not decided by, the United States Circuit Court of Appeals for the Second Circuit.

(*d*) Indictments for violations of the radio act of 1927 have been returned by United States grand juries in other cases which have yet to be tried. Four other defendants have been held under bond by United States commissioners pending action and possible indictments by United States grand juries. Numerous cases of alleged illegal operation of unlicensed radio stations have been reported and are being investigated, and evidence is being secured by the United States Department of Justice and by the legal division of the commission.

It has been found that most of the unlicensed stations being operated in the United States are operated as aids in the commission of other crimes. Among these crimes are violations of the national prohibition act, the Federal narcotic act, and the customs act. The radio division of the Department of Commerce, Department of Justice agents, and the United States Coast Guard have cooperated with the commission in locating unlicensed radio stations and in securing evidence against those engaged in such illegal operations.

Realizing the importance of enforcing strict adherence to the radio act, especially the criminal provisions thereof, the commission has authorized the designation of an assistant to the general counsel, cooperating with the Department of Justice and the radio division of the Department of Commerce, to assist United States attorneys in preparing and presenting evidence to grand juries, in drafting indictments, and in the prosecution of such cases.

III. HEARING AND RECORD SECTION

The hearing and record section has had a very strenuous year, due to the fact that there were a great number of cases pending at the beginning of the calendar, and for the further reason that General Order No. 93 of the commission went into effect on September 1, 1930, which was a new practice and procedure before the commission.

This General Order No. 93, which sets up the entire practice and procedure and manner of holding hearings before the commission, has worked very satisfactorily during its first year of existence, and it is believed that very few amendments or changes will be necessary to make this splendid order a more workable and satisfactory one.

Hearings were started on Tuesday, September 2, and at that time there were over 400 applications pending and set for hearing. This necessitated a tremendous amount of work in the matter of giving notices to all parties interested and the preparation of the docket. The following statistics will give some idea of the amount of work handled by the hearing and docket sections through the past year:

Month	Set for hearing	Answered and docketed	Defaults	Continued	Dismissed	Heard
September	120	94	26	2	1	65
October	234	85	1	3	2	79
November	71	28	0	1	0	22
December	101	22	0	2	0	20
January	99	32	5	1	1	27
February	83	21	1	4	1	15
March	85	27	1	2	3	21
April	110	43	1	3	2	37
May	88	38	0	6	2	30
June	75	45	1	4	1	39
Total	1,096	430	46	28	13	343

Number of cases reported by examiners 258
Number of cases heard, unreported by examiners 57
Number of commission decisions 212

There were set for hearing and docketed 1,096 applications of all kinds. The greater portion of these were applications for new facilities, but they also included all other types of applications and had to be given a hearing date and opportunity to the applicant to present his case. Of this number, 430 responded to the notice for hearing and requested that their applications be heard by the commission, in accordance with General Order No. 93. Of the 430 actually set down and placed on the permanent docket, there were 46 defaults, 28 applications continued, 13 dismissed, and 343 finally heard by examiners, with counsel from the legal division handling the commission's side of these cases.

Of the 343 cases heard throughout the past fiscal year the examiners have submitted reports on 258 and the commission has made its final decision and determination upon 212 applications. There are pending at this time 57 cases which have been heard and upon which the examiners have not made their reports.

In addition to the above work the hearing section has had charge of the taking of depositions in the field and the hearing of one case at Los Angeles, which took almost a month. A considerable portion of the time of the hearing section is devoted to the preparation of depositions and the actual taking of same in the field.

The hearing section is busy at all times in preparing the cases to be heard and is making an effort to be fully advised in each case before the same comes on for hearing, which involves an enormous amount of work, due to the fact that approximately 25 cases are set for hearing each week.

In addition to this a large portion of the time of the hearing section is devoted to the review of the examiners' reports to find any legal difficulties or technicalities. Also a considerable amount of the time of one of the members of the hearing section is taken with the drawing up of commission orders which are submitted to the applicant, showing the determination of the cases.

IV. RESEARCH AND DRAFTING SECTION

This section maintains a file of the "opinions of the general counsel," and drafts, correlates, and indexes all such new opinions. Under the direction of the commission it prepares all proposed

rules and regulations and general orders. It examines, from a legal point of view, the minutes of the commission. This section collects all available foreign laws and treaties, digests all court opinions pertaining to radio communication, and has charge of the library of the commission and keeping the same up to date. Briefs in all cases in which the commission is a party are prepared under the supervision of this section. It also prepares for commission consideration and action statements of fact, grounds for decision, and orders of the commission upon cases heard by examiners. During the past year 78 of these opinions were prepared by this section. Perhaps the major activity of this section is the conduct of litigated cases in which the commission is interested as a party. As this subject is not susceptible of summary treatment, it follows under separate title.

1. Litigation

Although a great majority of all cases reported as pending at the end of the fiscal year 1930 were decided or dismissed during the fiscal year just ended and a number of cases filed during that period were disposed of prior to June 30, 1931, there has been no appreciable reduction in the number of pending cases in which the commission is interested as a party.

Of the 31 cases pending June 30, 1930, 13 have been finally decided by the courts; opinions and interlocutory orders have been handed down in 7; 9 have been dismissed by the courts or by the complaining parties and 2 are still pending, although steps have been taken to dispose of them. In the 7 cases in which opinions and interlocutory orders have been rendered, jurisdiction has either been retained or the cases have been remanded to lower courts for further proceedings. These cases must therefore be classed as "pending," leaving a total of 9 cases still pending out of the 31 reported June 30, 1930.

During the fiscal year, 25 new cases were filed, and the commission appealed 1 case to the Court of Appeals of the District of Columbia from a decree of the Supreme Court of the District of Columbia granting a preliminary injunction. Of the 25 new cases filed, 2 have been finally decided by the courts; 10 have been dismissed by the courts or by the complaining parties prior to or following preliminary hearing, and 14 are still pending. The total number of cases pending on July 1, 1931, was therefore 22, as compared with 31 at the same time last year.

CASES FINALLY DECIDED DURING FISCAL YEAR

The 13 cases finally decided during the fiscal year were all decided by the Court of Appeals of the District of Columbia. A number of these were consolidated for hearing and argument, so that they were finally disposed of by nine opinions. In order of their decision, these cases were:

THE ANSLEY CASE

(Ansley *v.* Federal Radio Commission, 46 F. (2d) 600)

This case was an appeal from a decision and order of the commission denying an application for a construction permit. The

station sought to be constructed was an entirely new one, and in this respect the appeal presented a novel question. The commission's decision was based upon evidence adduced at the hearing, which, in the opinion of the commission, established: (1) That the proposed station would result in the creation of additional heterodyne interference with existing stations on the same frequency; (2) That the State of Texas already had more than its fair and equitable share of available broadcasting facilities according to population as prescribed by the Davis amendment; and (3) that neither the radio needs nor the economic support of Abilene, Tex., and vicinity justified the construction and operation of the station applied for.

In affirming the commission's decision the court of appeals held that on appeal from such an order the question presented is whether the commission's decision is manifestly against the evidence. The court found that the commission's findings were not so defective, and refused to pass upon a number of procedural questions, saying that they did not affect the substantial issues in the case.

THE HAVENS & MARTIN CASE

(Havens & Martin v. Federal Radio Commission, 45 F. (2d) 295)

This case involved a refusal by the commission to grant a construction permit which, in effect, would have authorized the increase in power of an existing station from 100 to 500 watts and a change in its assigned frequency. The commission based its decision upon: (1) The creation of additional interference, and (2) the fact that the State of Virginia already enjoyed more than a fair and equitable proportion of the facilities available to that zone; and the city of Richmond, in which the station was located, already enjoyed a full share of the radio facilities of the State.

The court of appeals, in affirming this decision, again applied the rule that commission findings after hearing should be sustained unless manifestly against the evidence. The court stated that a review of the record convinced it that the commission's findings were justified.

THE COURIER-JOURNAL CASE

(Courier-Journal Co. et al. v. Federal Radio Commission, 46 F. (2d) 614)

This case arose upon an appeal from an order of the commission which sought to change the frequency assignment of station WHAS, at Louisville, Ky., and a number of other stations so as to bring about a limited reallocation in the cleared-channel class. The commission orders extant at the time the appeal was perfected provided that the change in frequency assignment should be effective April 30, 1930, at 3 a. m., eastern standard time. No hearing was provided for prior to this date, but provision was made that any station dissatisfied with its new assignment might be heard on June 17, 1930, provided 20 days' notice of desire to be heard was given prior to that date.

The court reversed the commission and held that an order changing a broadcasting station's frequency, the change to become effective prior to the date of hearing therein provided for, was erroneous; that its effect was to deprive the station, without an opportunity to

be heard, of the frequency for which it was contending and which it had previously been allotted.

During the pendency of this appeal the commission made certain amendments to its orders designed to provide appellant and others similarly situated with prior notice and opportunity to be heard in opposition to the proposed change. The commission urged that these amendments had rendered the appeal moot, but the court held otherwise, and remanded the case to the commission with directions to permit appellant to use its then assigned frequency until such time as it might be determined, as a result of a hearing after due notice upon issues clearly defined, that such continued operation is not in the public interest, convenience, and necessity.

THE BRINKLEY CASE

(KFKB Broadcasting Assn., Inc., v. Federal Radio Commission, 47 F. (2d) 670)

This case arose upon an appeal from a decision and order of the commission denying an application for renewal of broadcasting station license filed by KFKB Broadcasting Association, Inc., owners and operators of station KFKB, at Milford, Kans. The commission designated this application for hearing pursuant to section 11 of the act and upon the theory that the burden was upon an applicant for station facilities to show that its continued operation would be in the public interest, convenience, and necessity.

At the hearing it was shown that the real owner of the station (Dr. J. R. Brinkley) had been using the station in connection with his medical practice and through the "medical question box" received inquiries at the station as to medical advice. Persons making inquiry in response to broadcasts were induced by means of the station to come to Brinkley's hospital for treatment or were referred by the same means to some member of Doctor Brinkley's pharmaceutical association who sold Brinkley's prescriptions, returning a part of the purchase price to Brinkley. Transcripts of the broadcasts showed that the medical advice given by means of the station was given without examination of the patients and was of doubtful value. The commission found that the station's operation had been in the private interest of Brinkley and not in the public interest; that the practices of the station, particularly that of the "medical question box" were inimical to public health and safety, and for that reason were not in the public interest.

In affirming this decision the court again applied the rule that the commission's findings, after hearing, will be sustained unless manifestly against the evidence. It was also held: (1) That the business of radio broadcasting is impressed with a public interest; (2) that the requirements of the act making a finding of public interest, convenience, or necessity a prerequisite to the renewal of a broadcasting license means that broadcasting should not be a mere adjunct of a particular business but should be of a public character; (3) that the burden is on an applicant to establish that a renewal of a radio broadcasting station license will be in the public interest, convenience, or necessity; (4) that the commission, in passing on applications for renewal of station license, must consider the character and quality

of service to be rendered; (5) that an applicant's past conduct is an important consideration in passing on an application to renew a broadcasting license, especially where the evidence clearly justifies the conclusion that the applicant's future conduct will not differ materially from that in the past; and (6) that the refusal of the commission to renew a broadcasting license on the ground that public interest, convenience, or necessity would not be served thereby does not constitute censorship within the meaning of section 29 of the radio act of 1927.

In passing on the question of censorship the court said:

> Appellant contends that the attitude of the commission amounts to a censorship of the station contrary to the provisions of section 29 of the radio act (47 U. S. C. A., sec. 109). This contention is without merit. There has been no attempt on the part of the commission to subject any part of appellant's broadcasting matter to scrutiny prior to its release. In considering the question whether the public interest, convenience, or necessity will be served by a renewal of appellant's license, the commission has merely exercised its undoubted right to take note of appellant's past conduct, which is not censorship.

THE MARQUETTE UNIVERSITY CASE

(Marquette University *v.* Federal Radio Commission, 46 F. (2d) 406)

This case involved a refusal by the commission to modify the license of station WHAD, owned and operated by Marquette University. The modification of license sought involved a change of frequency and additional hours of operation, the contention being made that the present assignment was not adequate for the educational and other needs of the licensee. In affirming this decision the court stated that only a question of fact was involved, that there was evidence to sustain the commission's decision, and that the court will hesitate to set aside a finding of the commission unless it is manifestly contrary to the evidence.

THE WCBS CASE

(General Broadcasting System, Inc., *v.* Federal Radio Commission, 47 F. (2d) 426)

This case grew out of a decision and order of the commission denying an application of the General Broadcasting System for renewal of station license. The appellant had previously been licensed to operate on the frequency 1,180 kilocycles, but applied for and received a modification of license which permitted it to use the frequency of 600 kilocycles on an experimental basis, the assignment to be subject to change if interference developed with other stations in the same geographical area. During this experimental operation protests were received from the stations in question, stating that destructive interference had resulted from the experimental assignment, whereupon the commission designated appellant's application for renewal of station license for hearing. As a result of the hearing held the commission found as a fact that destructive interference did exist which required the denial of appellant's application. In the order denying this application provision was made that appellant's station should be assigned to the frequency used by it before the experimental assignment.

In affirming this decision the court again applied the rule previously stated in the Ansley case with respect to the effect of the commission's findings based on evidence adduced at a hearing. The appellant also presented numerous procedural questions which the court declined to pass upon, saying that they did not affect the substantial issue in the case.

THE WESTINGHOUSE CASES

(Westinghouse Elec. & Mfg. Co. *v.* Federal Radio Commission, 47 F. (2d) 415)

Four separate appeals brought by the Westinghouse Electric & Manufacturing Company, owners and operators of station KYW, Chicago, Ill., were disposed of by the court with a single opinion.

The first of these cases arose out of the action of the commission in inserting a condition in a license issued to this station which provided "that the cleared channel or frequency 1,020 kilocycles has been allocated for use by stations in the second zone created by section 2 of the radio act of 1927, and this license is issued only for a temporary period of 90 days and will not be renewed, provided application is made for the use thereof by a proper applicant or applicants within said second zone above referred to." This condition was inserted in the license of appellant's station without prior notice and hearing.

The second and third of these cases presented substantially the same questions with respect to subsequent licenses granted and issued to appellant's station.

The fourth appeal arose out of the same action of the commission which gave rise to the appeal in the Courier-Journal case (46 F. (2d) 614). By that action and as a part of the limited reallocation of cleared-channel stations thereby attempted, it was proposed to change the frequency of appellant's station from 1,020 to 1,140 kilocycles, with no provision made for notice and hearing until after the date of the proposed change.

In reversing these cases the court held that the action of the commission in inserting the condition in appellant's licenses without prior notice and hearing, and in attempting to change its frequency assignment under the circumstances presented, was erroneous, and the cases were remanded with direction that the commission should renew appellant's license without the qualification in question until such time as it might be determined, as a result of hearing after due notice upon issues clearly defined, that such continued operation is not in the public interest, convenience, or necessity.

THE MILWAUKEE JOURNAL CASES

(Journal Company *v.* Federal Radio Commission, 48 F. (2d) 461)

Here again the court disposed of four separate appeals by a single opinion. The first of these appeals was taken before the amendment to section 16 of the radio act of 1927 by Public Law No. 494, approved July 1, 1930, and challenged the legality of the action of the commission in making certain changes in the power and assignments of other stations operating on a common frequency with that of ap-

pellant's station. The second of these appeals was also taken before the amendment of section 16 of the act but involved a denial by the commission of an application to use 5,000 watts power on the regional frequency 620 kilocycles for the purpose, as appellant alleged, of reestablishing appellant in the position occupied by it prior to the commission action involved in the first appeal.

The third and fourth of these appeals grew out of the action of the commission in renewing the station licenses of WLBZ, located at Bangor, Me., and WFLA–WSUN, located at Clearwater, Fla., to operate on the frequency 620 kilocycles, together with appellant's station. The effect of these grants complained of was to continue the conditions brought about by the action of the commission involved in the first appeal. These appeals were, however, taken subsequent to July 1, 1930, and were governed by the provisions of section 16 of the act as amended.

The court dismissed the first appeal on the ground that section 16 of the act as originally enacted did not provide for an appeal from a decision of the commission granting the application of another, even though the effect of such grant was to adversely affect the status of appellant's station.

The court reversed the commission in the other three cases, and in so doing held that the commission erred as a matter of law in increasing the power of the Maine station and shifting the assignments of the Florida stations without notice to appellant and an opportunity for it to be heard, and that the effect of such action, according to the proofs submitted, was to materially reduce the service area of appellant's station. The court pointed out in the course of its opinion that the purpose of the regulation provided for by the radio act was obviously to prevent chaos and to insure satisfactory service; that the installation and maintenance of broadcasting stations involve considerable expense; and that no station that has been operated in good faith should be subjected to a change of frequency or power or to a reduction of its normal and established service area except for compelling reasons.

The court remanded the last three cases to the commission, saying that appellant was entitled to some form of relief; that the court was reluctant to direct the particular form of such relief, but that the interests of justice would be subserved by affording appellant, after notice and opportunity to be heard, such relief as would measurably reestablish it in the position occupied by it prior to the acts complained of.

THE READING CASE

(Reading Broadcasting Co. *v.* Federal Radio Commission, 48 F. (2d) 458)

This case arose out of a decision and order of the commission's refusing an application of appellant for an increase in power and change in frequency assignment for its station, WRAW, located at Reading, Pa. The refusal of the commission to grant the application was based principally upon evidence and findings to the effect that the changes applied for would result in the creation of additional serious heterodyne interference not only with appellant's station but with other stations operating on the same frequency. The appellant

relied upon the fact that the second zone, in which the State of Pennsylvania is situated, is under quota in radio facilities as compared with other zones established by section 2 of the act, and upon the further fact that the State of Pennsylvania is similarly under quota as compared with the other States of the second zone, based upon the rule established by section 9 of the act, as amended by section 5 of the act of March 28, 1928 (the Davis amendment).

In affirming the commission's decision the court again refused to disturb the findings of the commission based upon evidence adduced at the hearing, saying that they were not manifestly against the evidence. The court also held that it would not be consistent with the legislative policy to equalize the comparative broadcasting facilities of the various States and zones by unnecessarily injuring stations already established and which are rendering valuable service to their natural service areas.

2. Cases in Which Opinions and Interlocutory Orders Were Handed Down During the Fiscal Year

A. IN THE SUPREME COURT OF THE UNITED STATES

(1) White v. Johnson, 75 L. ed. 137, and (2) American Bond & Mortgage Co. v. United States of America, 75 L. ed. 140

These cases, the manner in which they arose, and the questions certified to the Supreme Court of the United States in each were considered in the fourth annual report (pp. 48–50). In opinions reported as indicated above the Supreme Court of the United States on January 5, 1931, dismissed the certificates in each of these cases.

In the opinion of the court the principal question certified in each case was "so broad and indefinite as to admit of one answer under one set of circumstances and a different answer under another." The other questions certified were considered as contingent upon the first, and therefore not required to be answered.

Since the dismissal of these certificates the latter case has been argued in the United States Circuit Court of Appeals for the Seventh Circuit, where it is now pending decision by that court.[1]

B. IN THE COURT OF APPEALS OF THE DISTRICT OF COLUMBIA

THE STROMBERG-CARLSON CASE

(Saltzman et al. v. Stromberg-Carlson Telephone Mfg. Co., 46 F. (2d) 612)

This case arose upon an appeal by the commission from a decree of the Supreme Court of the District of Columbia granting a preliminary injunction. The action of the commission involved in this litigation was essentially the same as that involved in the Courier-Journal case (46 F. (2d) 614) and the fourth appeal perfected by the Westinghouse Electric & Manufacturing Company (47 F. (2d) 415). The commission sought to change the frequency assignment of station WHAM from 1,150 to 1,160 kilocycles and to assign station

[1] On July 9, 1931, the United States Circuit Court of Appeals for the Seventh Circuit handed down its opinion affirming the decree of the District Court for the Northern District of Illinois, Eastern Division.

KTNT, located at Muscatine, Iowa, to the frequency of 1,160 kilocycles for operation during daytime hours. Station WHAM had previously enjoyed the exclusive day and night time use of the frequency 1,150 kilocycles, and immediately upon the promulgation of the commission's orders seeking to bring about these changes as a part of its plan for a limited reallocation of the cleared-channel stations, filed a bill for injunctive relief in the Supreme Court of the District of Columbia. After the filing of this bill and before hearing on the application for preliminary injunction, the commission amended its orders so as to make the proposed changes conditional upon the result of the commission's decision, after prior notice and hearing. These amendments and the effect thereof were brought to the attention of the court by amendments and supplements to the bill and answer. Notwithstanding these amendments, the lower court granted a preliminary injunction, which in effect enjoined the commission from changing the frequency assignment of station WHAM without prior notice and hearing, or changing its assignment as the result of any hearing in which the station was required to show cause why a change should not be made.

In affirming the action of the lower court in granting the preliminary injunction, the court of appeals held that the commission's orders as originally enacted were void and that the amended orders, which required station WHAM to show cause why its frequency assignments should not be changed, did not afford it the sort of hearing provided by section 11 of the radio act.

The court remanded the case for further proceedings in conformity with its opinion, and although the commission's orders involved in this litigation have been repealed, the case has not as yet been finally disposed of.

THE SHORT-WAVE CASES

(Intercity Radio Telegraph Co. *v.* Federal Radio Commission and Three Other Cases, 46 F. (2d) 602)

This case involved four separate but interrelated appeals taken from various decisions and orders of the Federal Radio Commission which refused to authorize the issuance of certain construction permits and station licenses to appellants for point-to-point communication within the United States. The cases were consolidated by order of the court for argument and decision.

These appeals involved the conflicting claims of the several appellants for a limited number of available frequencies, there being two or more applications for each available frequency. At the time these cases came on for argument before the court of appeals there had been material changes in the status of certain of the companies involved, brought about by their bankruptcy and/or insolvency. Under the circumstances the court permitted, and gave consideration to, a stipulation of the parties reciting the facts concerning these changes. Upon a review of the record and the stipulation filed the court affirmed such of the commission grants as were not affected by the facts stipulated to by the parties and, while retaining jurisdiction of the cases, remanded them to the commission for appropriate proceedings and decisions, in view of the altered conditions. Since

the receipt of the order remanding these cases the commission has proceeded with the hearings necessary to such a decision. These, however, had not been completed on June 30, 1931.

3. Cases Dismissed During the Fiscal Year

A. CASES PENDING JULY 1, 1930

The following cases, which were reported as "pending" and in which the issues were stated in the fourth annual report, were dismissed during the fiscal year, as indicated:

(1) IN THE COURT OF APPEALS

No. 5204—Missouri Broadcasting Corporation and C. W. Benson *v.* Federal Radio Commission. (Dismissed by the court upon appellant's failure to deposit costs for printing record.)
No. 5207—American Fishermen's Protective Association *v.* Federal Radio Commission. (Dismissed on motion of appellant.)
No. 5208—J. E. Bennett Music Co. *v.* Federal Radio Commission. (Dismissed by court upon appellant's failure to file brief.)
No. 5227—Shortwave & Television Lab., Inc., *v.* Federal Radio Commission. (Dismissed by court upon appellant's failure to file brief.)
No. 5228—William B. Schaeffer (doing business as Schaeffer Radio Co.) *v.* Federal Radio Commission. (Dismissed by the court upon appellant's failure to deposit costs for printing record.)
No. 5256—Pere Marquette Railway Co. *v.* Federal Radio Commission. (Dismissed on motion of appellant.)
No. 5257—Ann Arbor Railroad Co. *v.* Federal Radio Commission. (Dismissed on motion of appellant.)

(2) IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF CONNECTICUT

No. 2064—Bridgeport Broadcasting Station, Inc., *v.* Federal Radio Commission. (Dismissed by court on petition of intervenor, General Broadcasting System, Inc.)

B. CASES FILED DURING THE FISCAL YEAR

The following cases, which were filed during the fiscal year, were dismissed prior to July 1, 1931, as indicated:

(1) IN THE COURT OF APPEALS OF THE DISTRICT OF COLUMBIA

No. 5281—WOBU, Inc., *v.* Federal Radio Commission. (Dismissed on motion of appellant.)
No. 5321—WDAY, Inc., *v.* Federal Radio Commission. (Dismissed by court upon failure of appellant to deposit costs for printing record.)
No. 5343—Journal Company *v.* Federal Radio Commission. (Dismissed on motion of appellant.)
No. 5399—Stuart Broadcasting Corp. *v.* Federal Radio Commission. (Dismissed on motion of appellant.)

(2) IN THE SUPREME COURT OF THE DISTRICT OF COLUMBIA

Equity No. 51372—Atlass Co., Inc., *v.* Charles McK. Saltzman et al. as the Federal Radio Commission

Plaintiff in this case, the owner and operator of station WBBM, at Chicago, Ill., brought suit against the commission and the individual members thereof to enjoin the continuance of the assignment of station WISJ, Madison, Wis., on the frequency 780 kilocycles.

The assignment complained of was made by the commission on an experimental basis. Plaintiff's bill alleged, among other things, that the action of the commission in making this experimental assignment without notice to it and an opportunity for hearing was contrary to the provisions of the radio act, and therefore void; and that such assignment had effectively reduced the normal and established service area of plaintiff's station by the creation of cross talk and other interference in and adjacent to the city of Madison, Wis.

On filing the bill a temporary restraining order was issued, but after hearing the court denied plaintiff's application for preliminary injunction. The bill was then dismissed upon motion of plaintiff.

Equity No. 52955—National Broadcasting Co., Inc., *v.* Federal Radio Commission et al.

Equity No. 52956—R. C. A. Communications, Inc., *v.* Federal Radio Commission et al.

Equity No. 52957—Radiomarine Corporation of America *v.* Federal Radio Commission et al.

Equity No. 52958—R. C. A.-Victor Co., Inc., *v.* Federal Radio Commission et al.

These were four separate but interrelated cases brought by subsidiaries of the Radio Corporation of America.

In an opinion reported as Lord, Receiver, *v.* R. C. A. (35 F.(2d) 962), the United States District Court for the District of Delaware granted a final injunction against the Radio Corporation of America enjoining the further enforcement of certain contracts for the sale of radio vacuum tubes for radio broadcast receiving sets on the ground that such contracts were violative of the provisions of section 3 of the Clayton Act. The Circuit Court of Appeals for the Third Circuit affirmed this decision in an opinion reported as R. C. A. *v.* Lord, Receiver, et al (28 F.(2d) 257, and on April 27, 1931, the Supreme Court of the United States denied a petition for certiorari filed by Radio Corporation of America (49 S. Ct. 83).

In view of the uncertainty as to the effect of this decision upon the status of Radio Corporation of America and its subsidiary companies and their eligibility to receive instruments of authorization in view of sections 13 and 15 of the radio act, the commission, on May 7, 1931, entered an order which provided:

That any renewal applications filed by R. C. A. or any of its so-called subsidiary companies which are now pending decision before the commission be designated for hearing, and if such applications request licenses which are necessary for the maintenance of the existing service, that until after the conduct of such hearing and the decision of the commission as a result thereof the existing licenses be extended upon a temporary basis to 8 a. m., July 15, 1931.

That such further renewal applications, if any, as come before the commission prior to its decision in these matters be treated in a similar manner.

That the hearing on these renewal applications should be held before the entire commission sitting en banc on Monday, June 15, 1931, at 10 a. m.

That such steps should be taken prior to the hearing date as will be necessary to insure that at least one renewal application of each of the above-named companies is designated for hearing on that date, and that if necessary to accomplish this result these companies should be directed by the commission to file applications for renewal forthwith and without regard to the expiration

date of the existing licenses or the requirements of General Order No. 99 with respect to filing applications for renewal of license.

That any applications other than applications for renewal of licenses or applications for instruments of authorizations necessary for the maintenance of an existing service now pending upon behalf of the above-named parties or hereinafter filed by them be held in abeyance and no decision made thereon until after the conduct of the hearing herein recommended and the rendition of a decision as a result thereof.

Pursuant to this action, the commission designated a number of applications of each of the above-named subsidiaries of Radio Corporation of America for hearing on June 15, 1931 (commission minute No. 374, June 8, 1931):

To determine whether or not said applicant is a company or corporation or any subsidiary thereof which has been finally adjudged guilty by a Federal Court of unlawfully monopolizing or attempting to monopolize radio communication, directly or indirectly, through the control of the manufacture or sale of radio apparatus, through exclusive traffic arrangements, or by any other means, or to have been using unfair methods of competition within the meaning of section 13 of the radio act of 1927.

To determine whether or not said applicant is eligible, under the terms of the radio act of 1927, to receive the instrument of authorization applied for.

To determine whether or not the radio act of 1927 prohibits the granting to said applicant of the instrument of authorization applied for.

On June 5 these cases were commenced to enjoin the commission from holding the hearings set for June 15 and/or from denying any applications filed by any of said companies by reason of the decree of the Delaware district court above referred to. The bills filed upon behalf of each of said companies were essentially similar and the legal questions presented thereby were identical.

Each of these bills alleged, in effect, that the decree of the Delaware court was not the kind of judgment referred to in sections 13 and 15 of the act, and that the provisions of said sections were therefore not applicable to any of the plaintiff companies; and further, that, if held to be applicable, such sections were unconstitutional as being violative of the due process clause of the fifth amendment and section 9 of article 1 of the Constitution of the United States. Facts were also alleged which were designed to show that plaintiffs had no adequate legal remedy and that the mere conduct of the hearing, and certainly the denial of plaintiffs' licenses pursuant thereto, would cause great and irreparable injury.

The plaintiffs filed motions for preliminary injunction and the commission filed motions to dismiss for want of equity in each of these cases. These motions in the several cases were consolidated for hearing and were submitted on the pleadings and supporting affidavits of the plaintiffs after extensive argument. After taking the matter under advisement the court denied the several motions for preliminary injunction, denied the motions to dismiss the bills, and retained jurisdiction of the cases to permit a supplementary showing at the election of the plaintiffs.

No supplementary showing was made. The hearing of June 15 was held as scheduled, and these bills were subsequently dismissed on motion of the plaintiffs.

4. Cases Pending at End of Fiscal Year

A. CASES PENDING JULY 1, 1930

The nine cases which were carried over from the fiscal year 1930 were all dealt with and the principal issues discussed in the fourth annual report. In so far as the developments in these cases have been important, they have again been considered here under the heading, Cases in Which Opinions and Interlocutory Orders Were Handed Down During the Fiscal Year (pp. 71 to 72, supra).

In the interest of brevity, no further reference to these cases will be made other than to identify them and to refer to their treatment in the fourth annual report.

(1) IN THE COURT OF APPEALS OF THE DISTRICT OF COLUMBIA

No. 4987—Intercity Radio Telegraph Co. *v.* Federal Radio Commission.
No. 4988—Wireless Telegraph & Communications Co. *v.* Federal Radio Commission.
No. 4990—R. C. A. Communications, Inc., *v.* Federal Radio Commission.
No. 4991—Mackay Radio & Telegraph Co. *v.* Federal Radio Commission.
(See Fourth Annual Report, pp. 42 and 43.)

(2) IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT

No. 4291—American Bond & Mortgage Co. and Trianon, Inc., *v.* United States of America.
No. 4119—Clinton R. White *v.* George E. Q. Johnson and H. D. Hayes.
(See Fourth Annual Report, pp. 48, 49, and 50.)

(3) IN THE SUPREME COURT OF THE DISTRICT OF COLUMBIA

Equity No. 51439—Baltimore Radio Show, Inc., *v.* Federal Radio Commission.
Equity No. 51325—Stromberg-Carlson Telephone Mfg. Co., a Corporation, *v.* Federal Radio Commission.
(See Fourth Annual Report, pp. 47 and 48.)

(4) IN THE DISTRICT COURT OF THE UNITED STATES FOR THE NORTHERN DISTRICT OF ILLINOIS, EASTERN DIVISION

Equity No. 9882—Agricultural Broadcasting Co. & Great Lakes Broadcasting Co. *v.* Federal Radio Commission et al.
(See Fourth Annual Report, p. 48.)

B. CASES FILED DURING THE FISCAL YEAR

The following summary will serve to briefly identify the cases filed during the fiscal year which were pending July 1, 1931, the principal issues involved, and their status:

(1) IN THE COURT OF APPEALS OF THE DISTRICT OF COLUMBIA

No. 5335—Fisher's Blend Station, Inc. (station KOMO), *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for construction permit. Appellant's station is now and has been assigned to operate on the frequency 920 kilocycles with 1-kilowatt power, hours of operation unlimited (a regional as-

signment). The application denied requested authority to construct a station to operate on the frequency 970 kilocycles with power of 5 kilowatts, hours of operation unlimited (a cleared-channel assignment). The commission denial was made after a full hearing which involved a competitive showing between appellant and station KJR, now utilizing the requested assignment. The questions presented are chiefly with respect to the correctness and propriety of the commission findings on the evidence presented. This appeal also involves a question of law, to wit, the right of appellant to appeal from a decision of the commission denying an application for construction permit in view of the provisions of section 16 of the act as amended by Public Law No. 494, approved July 1, 1930. The record has been printed, and appellant's briefs are due early in the fall term.

No. 5349—Rev. John W. Sproul *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for renewal of station license. The hearing on this application was heard together with certain other applications for the same facilities. The evidence adduced tended to establish disregard by the applicant of the rules and regulations of the commission, and a financial condition which, in the opinion of the commission, made operation in the public interest, convenience, and necessity an impossibility. Appellant filed a petition for and obtained an order of the court of appeals to proceed *forme pauperis*. Appellant's briefs are due early in the fall term.

No. 5378—Rines Hotel Co. *v.* Federal Radio Commission. (Dismissed on motion of appellant July 22, 1931.)

No. 5391—John R. Sylvester *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for construction permit to construct a new radio broadcasting station at Derry, Pa. The sole question presented is one of public interest, convenience, and necessity in view of the showing with respect to the service which the territory now enjoys and the probability of destructive interference to this and other stations in the event that the proposed station is constructed and placed in operation. The commission has filed the record, its statement of facts, grounds for decision, and order pursuant to section 16 of the act. The record has, however, as yet not been printed.

No. 5418—Keystone Broadcasting Corporation (station WCOD) and Norman R. Hoffman *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for construction permit. Authority is sought to increase the daytime power from 100 to 250 watts. Here again the sole question presented is one of public interest, convenience, and necessity in view of the showing with respect to the service which the territory now enjoys and the probability of destructive interference to this and other stations in the event that the proposed increase in power is authorized. The record in this case has been filed but not yet printed.

No. 5414—John H. Brahy (station WLBX) v. Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for renewal of station license. Acting under the provisions of section 11 of the act, the commission failed to find that public interest, convenience, and necessity would be served by granting the renewal application and designated the same for hearing. The showing made upon the hearing with respect to the past and probable future operation of the station was such that the commission was constrained to deny this application for renewal. The primary question presented is one of public interest, convenience, and necessity. This appeal also presents certain procedural questions, it being contended by the appellant that the action taken by the commission is in effect a revocation of license, which should have been commenced and prosecuted under section 14. The record in this case has been filed but not yet printed.

No. 5146—WHB Broadcasting Company v. Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for modification of station license. The station is now assigned daytime operation with 500 watts power. Authority was sought to increase the power output from 500 watts to 1 kilowatt. No other change in the assignment was involved. This appeal involves the issue of public interest, convenience, and necessity in view of the admittedly good service which the territory now receives, and in addition thereto involves a question of the interpretation and application of section 9 of the radio act of 1927 as amended by the act approved March 28, 1928 (Davis amendment). The record in this case has been filed but not yet printed.

No. 5417—Pioneer Broadcasting Company v. Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for a construction permit. Authority is sought to construct a new radio broadcasting station at Adamsburg, Pa., to operate, when constructed, on the regional frequency of 620 kilocycles with 100 watts power and daytime hours of operation. The issue presented is principally one of public interest, convenience, and necessity in view of the good radio broadcasting service now received by the locality in question from a number of stations, the questionable financial ability of the applicant to construct and operate the proposed station, and the assignment of a 100-watt station to a regional frequency. The record in this case has been filed but not yet printed.

No. 5418—Norman Baker (station KTNT) v. Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for renewal of station license. Upon examination of the application the commission was unable to determine that public interest, convenience, and necessity would be served by the grant thereof, and designated the same for hearing

pursuant to section 11 of the act. Upon the hearing evidence was adduced which tended to establish that the licensee of this station had utilized the same to make bitter attacks upon various individuals, companies, and associations with whom he had personal differences; that the station programs were composed largely of these attacks and direct selling and price quoting of licensee's merchandise, as well as the exploitation of the medical theories and practices of licensee and his cancer hospital. Upon this showing the commission denied the application for renewal on the authority of the Brinkley case (47 F. (2d) 670). The principal issue involved is that of public interest, convenience, and necessity in view of the character of the station's operation. A number of procedural questions are also presented by this appeal, as is also the question of whether or not the commission's refusal to grant an application for renewal, based upon the character of a station's past and probable future operation, constitutes censorship. The record has been filed but not yet printed.

No. 5422—W. E. Riker (station KFQU) *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for renewal of station license. The application was designated for hearing pursuant to the provisions of section 11 of the act. The evidence adduced at the hearing tended to establish that the applicant did not possess financial ability to maintain the proper operation of the station; that there had been repeated violations of the commission's rules and regulations with respect to maintenance of the assigned frequency; and that the service being rendered by the station was not such as to justify its continued operation. The principal question involved is one of public interest, convenience, and necessity in view of the facts developed at the hearing. Certain procedural questions are also presented, the contention of the appellant being that the commission should have proceeded against the station, if at all, under section 14 of the act. The record has been filed but not yet printed.

No. 5425—Woodmen of the World Life Insurance Co. (station WOW) *v.* Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for modification of station license. Appellant's station, located at Omaha, Nebr., operates on the frequency 590 kilocycles, with 1 kilowatt power, upon a time-sharing basis with station WCAJ of Lincoln, Nebr., owned and operated by Nebraska Wesleyan University. Station WOW uses six-sevenths of the time and station WCAJ uses one-seventh of the time on this frequency. By the application in question station WOW sought unlimited time on this frequency. The principal question involved is one of public interest, convenience, and necessity and of the correctness and propriety of the commission's findings on the evidence adduced at the hearing. The record in this case has been filed but not yet printed.

No. 5426—Kunsky-Trendle Broadcasting Corporation (station WXYZ) *v.* Federal Radio Commission[2]

[2] Dismissed on motion of appellant, July 17, 1931.

No. 5427—KFQW, Inc., v. Federal Radio Commission

This is an appeal from a decision and order of the commission denying an application for renewal of station license. The application was designated for hearing pursuant to section 11 of the act. The evidence adduced at the hearing tended to show that appellant lacked the financial ability to properly conduct and operate the station; that it had frequently violated the commission's rules and regulations, particularly those with respect to maintenance of the assigned frequency; that the character of the station's operation was not such as to justify its continuance. The principal question involved is one of public interest, convenience, and necessity in view of the record disclosures, although certain procedural questions are presented. The record in this case has been filed but not yet printed.

V. CONCLUSION

The principal developments of the fiscal year from the standpoint of the legal division can be said to consist of—

1. The court decisions heretofore summarized, clarifying and applying the provisions of the radio act of 1927, as amended, in criminal as well as civil cases.

2. A marked improvement in the manner in which cases before the commission are handled, due to—

(*a*) The creation of an examiners division, the members of which hear all but exceptional cases, relieving the commission of this burden.

(*b*) The adoption of a code of rules governing practice and procedure.

(*c*) The preparation by the commission of formal opinions in virtually all cases which go to hearing.

(*d*) The cooperation of parties having business before the commission and the more careful preparation of their cases.

3. Active complaint and investigation work, making possible the deletion of stations not performing a public service, and the prosecution of those violating the criminal provisions of the act.

4. The elimination of duplication of effort and a corresponding increase in opportunity for specialization within the division, brought about by the establishment of sections with clearly defined duties and responsibilities.

REPORT OF THE CHIEF EXAMINER

ELLIS A. YOST

Although the radio act of 1927 authorized the Federal Radio Commission to appoint examiners no such appointments were actually made prior to June 30, 1930, all hearings being conducted before one or more members of the commission. The steady growth of commission business made it apparent that the commission and the individual commissioners should be relieved of the duty of conducting hearings, and General Order No. 93, embodying rules of practice and procedure and providing for the conduct of hearings by examiners, was adopted on June 25, 1930, to become effective September 1, 1930. At the same time three new positions were created in the legal division—a chief examiner and two examiners, and subsequently, in February, 1931, provision was made for the appointment of an additional examiner.

On June 30, 1930, Ellis A. Yost was appointed chief examiner and Elmer W. Pratt, formerly an assistant counsel of the commission, was appointed an examiner. The appointments of Rosel H. Hyde and Ralph L. Walker, both formerly assistant counsel of the commission, on November 25, 1930, and February 2, 1931, respectively, completed the present complement of examiners.

On December 19, 1930, a separate examiners division was created, of which the chief examiner was made the head.

With few exceptions all hearings held since July 1, 1930, have been conducted by an examiner. Each case is made the subject of an examiner's report, containing findings of fact, conclusions, and recommendation as to the action which should be taken thereon by the commission. All parties to the hearing are afforded an opportunity to file exceptions to the examiner's report, and, in the discretion of the commission, present oral argument to the commission before a final decision is made.

During the fiscal year ending June 30, 1931, a total of 317 cases were heard by examiners. Of this number, 260 have been reported, leaving 57 unreported.

APPENDIX A

TEXT OF GENERAL ORDERS ADOPTED DURING THE YEAR ENDED JUNE 30, 1931

General Order No. 95

At a session of the Federal Radio Commission held at its offices in Washington, D. C., September 29, 1930, for the purpose of giving the Federal Radio Commission more accurate information concerning radio stations, for the prevention of violations of section 12 of the radio act of 1927, as amended, and further to give effect to other provisions of the law,

It is hereby ordered:

1. That all applications for consent to the assignment of a construction permit or license shall be made upon forms prescribed by the commission setting forth such facts as are necessary to show that the assignee is eligible and qualified to receive a construction permit or license, and that the continued operation of the station will be in the public interest. Where the assignment is voluntary the application shall be executed in duplicate by both assignor and assignee, and duplicate verified copies of the sale or lease contract shall be attached to such application and made a part thereof. Such contract shall provide that the assignee will have complete control of the station equipment and apparatus and of its operation, including unlimited supervision of programs to be broadcast from the station, and shall be subject only to the consent of the commission; where involuntary it shall be executed by the assignee and shall, in addition, set forth the nature of such involuntary assignment and a certified copy of the court order or legal instrument by which assignee has obtained such right.

2. That the insolvency of the licensee of any radio station shall be grounds for the revocation of the station license and/or the refusal of the renewal thereof. The appointment of receivers upon grounds of insolvency and preliminary adjudications of bankruptcy will be considered by the commission as prima facie proof of insolvency. Final adjudications will be accepted as conclusive.

3. That a violation of any of the provisions of this order will be deemed grounds for the revocation of station license, under section 14 of the radio act of 1927, as amended, or for denial of the application for renewal of the station license held by a licensee so violating any provision of this order.

4. That General Order No. 9 is repealed.

General Order No. 96

At a session of the Federal Radio Commission, held at its offices in Washington, D. C., on October 6, 1930, the commission adopted the following general order:

AUXILIARY BROADCASTING TRANSMITTERS

I

Upon a showing that a need exists therefor, a license may be issued upon application for an auxiliary transmitter in addition to the regular transmitter of a broadcasting station. Auxiliary transmitters are defined as transmitters maintained for the purpose of transmitting the regular program of the station only in case of failure of the main transmitter.

Auxiliary transmitters will be permitted to be installed only at the same location as the main transmitter, except that upon suitable showing of technical necessity therefor the commission may grant permission for other locations.

II

A licensed operator shall be in control whenever an auxiliary transmitter is placed in operation. The provisions of General Order 90 shall apply to licenses covering auxiliary transmitters.

All auxiliary transmitters shall be maintained so that they may be put into immediate operation at any time upon failure of the main transmitter or upon request of a duly authorized Government official.

All auxiliary transmitters shall be tested at least once each week to determine that they are in proper operating condition and that they are adjusted to the proper frequency. Such tests shall be conducted between 1 a. m. and 12 o'clock noon. A record of the time, conditions, and results of tests shall be kept in a special record available for inspection at any time.

All auxiliary transmitters shall be equipped with satisfactory frequency checking or control equipment which will enable the maintenance of the frequency emitted from the station within the limits prescribed by the regulations of the commission.

All auxiliary transmitters which may be licensed at geographical locations different from that of the main transmitters shall be equipped with a frequency-control device which will automatically hold the frequency within 500 cycles of the licensed frequency without any manual adjustment during operation or when preparing to place in operation.

III

All auxiliary transmitters licensed at the present time and not in compliance with the above sections shall be made to comply therewith by the end of the license period ending January 31, 1931, or the license will not be renewed at that time.

All regulations applying to changes in the main transmitter equipment shall also apply to auxiliary transmitters. All provisions of General Order No. 91 apply equally to auxiliary transmitters as to main transmitters.

IV

Where broadcasting stations have their transmitting equipment in duplicate and arranged for alternate operation, one such duplicate shall be considered as an auxiliary transmitter subject to the terms and conditions of this order: *Provided, however,* That duplicate transmitters for alternate operation may be licensed where the commission is satisfied that desirable experimental development work is being carried on. In this event the licensee shall file reports with the commission at the quarterly periods ending March 31, June 30, September 30, and December 31, setting forth the nature of the experiments conducted and the results thereof during the preceding period of three months. These reports shall be mailed in time to reach the commission within 15 days after the end of each quarter.

V

Within two days after each use of the auxiliary transmitter, except for testing, the radio supervisor shall be notified of the date, time, and power at which the auxiliary transmitter is operated and the reasons for each use.

GENERAL ORDER No. 97

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on October 6, 1930, the commission adopted the following general order:

It is hereby ordered:

SECTION I. That no radio broadcasting station will be licensed by the Federal Radio Commission to operate after January 31, 1931, with a greater power than can be satisfactorily delivered and maintained by the licensed transmitter with a percentage of modulation of over seventy-five per cent (75%) on peaks with not over ten per cent (10%) combined audio harmonics.

SEC. II. No radio broadcasting station license will be granted by the Federal Radio Commission authorizing the operation of any station after January 31, 1931, with a greater power than the maximum rated carrier power of the transmitter as determined by existing general orders of the Federal Radio Commission.

SEC. III. All radio broadcasting stations specifying or claiming operating constants that give greater carrier power than the maximum rated power of the transmitter as determined by existing general orders of the Federal Radio Commission shall submit data showing the antenna input power by direct measurement and oscillograms of the maximum satisfactory modulation to prove licensed power output and proper modulation.

SEC. IV. (a) The oscillograms required by Section III of this general order shall be taken while modulating the transmitter with a frequency of approximately 200 cycles at maximum licensed power and under normal operating conditions. Reference lines shall be run on the oscillograms as follows: (1) One line indicating carrier position, (2) one line for one hundred per cent (100%) negative modulation, and (3) one line for one hundred per cent (100%) positive modulation. These lines shall be one-half (½) inch or more apart. Such oscillograms may be taken with time delay relays so that one-third of the oscillogram shows no current through vibrator, one-third shows rectified carrier only, and one-third shows modulation.

(b) One overload oscillogram shall be taken with the 200-cycle tone input voltage twenty-five per cent (25%) greater than the input voltage necessary to produce the maximum satisfactory modulation which the licensee claims the transmitter is capable of producing.

(c) Complete data on a measuring of the antenna resistance shall be submitted to the commission for its approval, together with full operating constants of the transmitter while taking such oscillograms.

SEC. V. (a) The data required in Section IV shall be submitted and approved by the commission on or before January 31, 1931, or the licensed power will be reduced to conform to maximum rated carrier power of the transmitter as determined by existing general orders of the Federal Radio Commission.

(b) No changes shall be made in any radio broadcasting transmitter affecting the maximum rated carrier power thereof until such changes have been authorized by the commission.

GENERAL ORDER No. 98

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 27th day of October, 1930,

It is ordered:

That General Order No. 28, heretofore issued by the commission on April 20, 1928, be, and the same is hereby, amended to read as follows:

Under the radio law of 1928, approved by the President March 28, 1928, it is specified that "allocations shall be charged to the State, District, Territory, or possession wherein the studio is located and not where the transmitter is located."

In this particular it is ordered that no broadcasting station shall move its main studio outside of 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 said studio and securing written permission for such removal. Permission to move the main studio of a station from one location to another within a city or town is not required, but licensees shall notify the commission first of any such change.

The studio from which the majority of the local programs originate and from which a majority of station announcements are made of programs originating at remote points shall be considered the main studio.

This order shall not apply to purely secondary or auxiliary studios or remote-control apparatus.

This order shall be effective on the day first above written.

General Order No. 99

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 27th day of October, 1930,

It is ordered:

(1) That General Order No. 94 is hereby repealed.

(2) Upon proper application of any companies or agencies maintaining, or proposing to maintain, aeronautical stations, if the commission is satisfied that the particular applicant is qualified and that the issuance of the license or licenses in question would serve public interest, convenience, or necessity, frequencies will be designated solely for use by all of said stations which comprise a continuous series of stations, or chain, along a particular airway.

(3) In the interest of economy in the use of frequencies, to coordinate the radio facilities and secure the maximum flexibility, it is required that where the service provided by a chain is regularly used as distinguished from casual, incidental, or emergency use, the owners of the transport aircraft which use such chain or chains shall cooperate among themselves as to the operation, maintenance, and liability of the stations: *Provided, however*, That nothing herein shall impose upon the commission any authority or responsibility whatever with reference to the private business or transactions of any licensee. Aeronautical stations licensed pursuant to this plan are required to provide service, without discrimination, for all and any aircraft the owners of which enter into such cooperation. In addition, chain stations shall provide reasonable and fair service to itinerant aircraft upon the frequencies designated for that purpose.

(4) For the purpose of this order, two types of aircraft are defined:

a. Transport aircraft: Those commercially transporting persons and/or property and operating regularly on fixed routes

b. Itinerant aircraft: All those other than transport or Government aircraft.

(5) An aeronautical station shall be defined as one being capable of giving—

1. Ground-to-aircraft communication.

2. Point-to-point communication (provided frequencies have been designated for this service pursuant to paragraph *a* of section 9).

3. Distress, calling, and navigational service.

(6) All frequencies assigned for aviation purposes shall be designated in three classes, as follows:

a. Frequencies used by aeronautical or aircraft stations on a chain or chains for communication purposes either between aeronautical stations and aircraft or between aeronautical stations.

b. Frequencies used for distress, calling, and aids to navigation.

c. Other aviation frequencies.

(7) The distress, calling, and navigational frequencies and frequencies other than those permanently assigned to chains shall be as follows:

278 kilocycles. Airport frequency. Calling and working frequency from all ground stations to aircraft. Power not to exceed 15 watts. To be required for all ground stations after September 1, 1931.

333 kilocycles. International air calling frequency to be used only beyond the limits of the United States, and then only for communication between aircraft and foreign stations.

375 kilocycles. Radio compass.

500 kilocycles. International calling and distress frequency for ships and aircraft over the seas.

3,106 kilocycles. National calling and working frequency for all itinerant aircraft. It may also be assigned to transport aircraft in addition to the chain frequencies. Aircraft calling or working ground stations on this frequency will conduct a 2-way communication by utilizing the 3,106-kilocycle frequency for transmitting from aircraft to the ground and the 278-kilocycle frequency for receiving from the ground to aircraft.

5,525, 11,050, 16,580 kilocycles. Primarily for coastal stations and ships. May also be assigned to aircraft only for the purpose of calling a coastal station or ship when aircraft is in flight over the sea.

414, 457 kilocycles. Working frequencies for aircraft on sea flights desiring intermediate frequencies. Those desiring high frequencies may use the frequencies designated for maritime calling and working.

(8) The frequencies 12,180 and 12,210 kilocycles designated by the President as reserved for Government experimental stations, but available for assignment to commercial companies subject to recall by the Government upon six months' notice, are made available on such temporary basis for aeronautical point-to-point communications on chains during daylight hours only: *Provided, however*, That applicants desiring the use of such frequencies can show that such frequencies are necessary. Licensees are hereby notified that these frequencies may be recalled on or before July 1, 1931.

(9) Frequencies licensed for use by aeronautical stations shall not be used for point-to-point service except in conjunction with communication between aircraft and ground, and then only—

a. Where frequencies are allocated to a chain and cooperatively used, as described in paragraph 2, a point-to-point service will be licensed upon application for frequencies to be designated: *Provided*, That the use of such service shall be open to all of the cooperative participants upon an equal basis, and then only to the extent of the actual aviation needs of the users.

b. That at all times the licensee of point-to-point service shall be required to transmit, without charge or discrimination, all necessary messages in times of public emergency which involve the safety of life or property.

(10) In no event shall the use of any frequency authorized under the provisions of this order by a licensee extend to commercial correspondence or to paid or toll messages in the sense in which these terms are generally understood and accepted.

(11) The chains shall be established as indicated upon a map to be maintained by the commission, and this map shall show (1) the location of all aeronautical stations, (2) the frequencies allocated by the commission, and (3) as nearly as possible all proposed chains (following, connecting with or independent of existing chains). Copies of this map are available upon request.

(12) The chains shall be established as indicated upon this map in colored lines, the colors having the frequency designations as follows:

NORTHERN TRANSCONTINENTAL CHAIN AND FEEDERS (RED)

Mobile service—Available for aircraft and aeronautical stations

3,160 kilocycles. Unlimited hours.
3,166 kilocycles. Unlimited hours.
3,172 kilocycles. Unlimited hours.
3,178 kilocycles. Unlimited hours.
5,570 kilocycles. Day only.
5,660 kilocycles. Day only.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.

2,482 kilocycles. Unlimited hours.
2,506 kilocycles. Unlimited hours.
4,124 kilocycles. Unlimited hours.
6,215 kilocycles. Day only.
6,230 kilocycles. Day only.

MIDTRANSCONTINENTAL CHAIN AND FEEDERS (BLUE)

Mobile service—Available for aircraft and aeronautical stations

3,070 kilocycles. Unlimited hours. West of Kansas City, Kans.
3,076 kilocycles. Unlimited hours. West of Kansas City, Kans.
3,082 kilocycles. Unlimited hours. East of Kansas City, Kans.
3,088 kilocycles. Unlimited hours. East of Kansas City, Kans.
5,510 kilocycles. Day only. West of Kansas City, Kans.
5,540 kilocycles. Day only. East of Kansas City, Kans.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.

2,722 kilocycles. Unlimited hours.
2,734 kilocycles. Unlimited hours.
4,108 kilocycles. Unlimited hours.
6,350 kilocycles. Day only. West of Kansas City, Kans.
6,365 kilocycles. Day only. East of Kansas City, Kans.
6,380 kilocycles. Day only. Los Angeles to Salt Lake City to Great Falls.
8,015 kilocycles. Day only.
12,190 kilocycles. Day only.

SOUTHERN TRANSCONTINENTAL CHAIN AND FEEDERS (BROWN)

Mobile service—Available for aircraft and aeronautical stations

3,238 kilocycles. Unlimited hours. Must not interfere with Canadian services.
3,244 kilocycles. Unlimited hours. Must not interfere with Canadian services.
3,452 kilocycles. Unlimited hours. Not to be used west and north of Chicago, Ill.
3,460 kilocycles. Unlimited hours. Not to be used west and north of Chicago, Ill.
3,468 kilocycles. Unlimited hours. Not to be used west and north of Chicago, Ill.
3,484 kilocycles. Unlimited hours. Not to be used west and north of Chicago, Ill.
5,600 kilocycles. Day only.
5,630 kilocycles. Day only. For Canadian aeronautical services. May be assigned in southern United States, provided no interference is caused to Canadian communications.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.

2,326 kilocycles. Unlimited hours.
2,344 kilocycles. Unlimited hours.
4,140 kilocycles. Unlimited hours.
6,260 kilocycles. Day only.
6,275 kilocycles. Day only.
12,210 kilocycles. Day only.

ATLANTIC COASTAL CHAIN AND FEEDERS (ORANGE)

Mobile service—Available for aircraft and aeronautical stations

3,070 kilocycles. Unlimited hours.
3,076 kilocycles. Unlimited hours.
5,405 kilocycles. Day only—Miami, Fla., and Brownsville, Tex., and other stations south of these locations. Not available for aircraft.
5,690 kilocycles. Day only.
8,650 kilocycles. Unlimited hours. Available only for assignment to aircraft and to be used only when operating south of Miami, Fla., and Brownsville, Tex.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.

2,662 kilocycles. Unlimited hours; also available for mobile service.
4,164 kilocycles. Unlimited hours.
6,305 kilocycles. Day only.
6,320 kilocycles. Day only.
8,015 kilocycles. Day only.
12,210 kilocycles. Day only.

(13) In all cases herein where the word "day" occurs in connection with a specific frequency, such use of the word "day" shall be construed to mean that period of time included between two hours after local sunrise and two hours before local sunset. If, for any reason, it is impossible to shift from a day to a night frequency at the exact time required, such shift in frequency shall be made at the earliest possible moment, and with respect to any aircraft; under no circumstances shall the use of a day frequency be continued at night after

such aircraft has once landed at one of the regular airports along its route, following the time when such shift is required to be made.

(14) No aeronautical station will be licensed to use more than 1 kilowatt power on frequencies of 1,500 kilocycles and above.

(15) All aeronautical stations will maintain a watch on such frequencies and for such periods of time as may be designated.

(16) Licensees, both of aeronautical and aircraft stations, shall install equipment of such construction and efficiency as will assure the service which the station is intended to give.

(17) All licenses, whether aircraft or aeronautical, shall be posted at all times in a conspicuous place in the station so licensed. The license of every station operator shall be available for inspection at all times while on duty.

(18) This order is, and shall be, construed as a regulation of the commission, violation of which will be cause for revocation of license as provided by the act of 1927, as amended.

It is further ordered that all general orders or parts thereof and all rules and regulations in conflict herewith be, and the same are hereby, repealed.

This order shall be effective on the day first above written.

Amendment to General Order No. 99

January 19, 1931.

The commission amended General Order No. 99 as follows: Under "Mid-transcontinental Chain and Feeders (Blue)" change so as to read:

5,510 kilocycles. Day only. East of Kansas City, Kans.

5,540 kilocycles. Day only. West of Kansas City, Kans.

Amendment to General Order No. 99 as Amended

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 19th day of February, 1931,

The commission amended General Order No. 99 as follows:

1. With regard to the frequency 278 kilocycles, change section 7 to read as follows:

"278 kilocycles. Airport frequency. Calling and working frequency from all ground stations to aircraft. Power not to exceed 15 watts. To be required for all ground stations after September 1, 1931. Aeronautical stations licensed to use this frequency are required to provide service, without discrimination, for all and any aircraft."

2. By deleting that portion of section 12 which refers to "Atlantic Coastal Chain and Feeders (Orange)" and substituting therefor the following:

(a) Eastern Continental Chain and Feeders (Green) with routes to be indicated on map in conformity with section 12 of General Order No. 99, and frequency assignments as follows:

EASTERN CONTINENTAL CHAIN AND FEEDERS (GREEN)

Mobile service—Available for aircraft and aeronautical stations

3,070 kilocycles. Unlimited hours.

3,076 kilocycles. Unlimited hours.

5,690 kilocycles. Day only.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.

2,662 kilocycles. Unlimited hours.

4,164 kilocycles. Unlimited hours.

5,905 kilocycles. Day only.

6,320 kilocycles. Day only.

8,015 kilocycles. Day only.

(b) Southern International Chain and Feeders (Orange) with routes to be indicated on map in conformity with section 12 of General Order No. 99 and frequency assignments as follows:

SOUTHERN INTERNATIONAL CHAIN AND FEEDERS (ORANGE)

Mobile service—Available for aircraft and aeronautical stations

3,070 kilocycles. Unlimited hours.
3,076 kilocycles. Unlimited hours.
5,405 kilocycles. Day only—Miami, Fla., and Brownsville, Tex., and other stations south of these locations. Not available for aircraft.
5,690 kilocycles. Day only.
8,650 kilocycles. Unlimited hours. Available only for assignment to aircraft and to be used only when operating south of Miami, Fla., and Brownsville, Tex.

Fixed service

The primary use shall be for the relay of messages destined for or originating on aircraft and relating to the actual aviation needs of the users and on condition that no interference is caused to mobile services.
2,662 kilocycles. Unlimited hours; also available for mobile service.
4,164 kilocycles. Unlimited hours.
6,305 kilocycles. Day only.
6,520 kilocycles. Day only
8,015 kilocycles. Day only.

General Order No. 100

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 10th day of November, 1930, the commission adopted the following general order:

It is ordered:

1. That the term "marine relay service" shall be construed to mean a radiotelegraph communication service carried on between coastal stations communicating with one another for the relaying of or pertaining to maritime mobile communications.

2. Upon application and proper showing being made the commission may issue a license or other instrument of authorization for marine relay service:

(a) *To any coastal station* for the transmission of radio operating signals utilizing the calling or individual working frequencies licensed to such coastal station for mobile service. Radio operating signals are defined as a letter, figure, or combination of letters and figures, or both, designed to facilitate the conduct of communications; for example, the List of Abbreviations to be Used in Radio Transmissions, Appendix 1 to the General Regulations of the International Radio Convention.

(b) *To any Great Lakes coastal station* for the relaying of messages either destined to or originating at mobile stations on the Great Lakes: *Provided, however*, That such messages shall be relayed only upon the working frequencies licensed to such coastal station which are available for both fixed and mobile service under the provisions of the international radio convention.

(c) *To any other coastal station* for the relaying via another coastal station of messages destined to a mobile station: *Provided, however*, That such messages shall be relayed only upon the working frequencies licensed to such coastal station for mobile service: *And provided further*, That this service is not to be used for the normal routing of traffic, but only when, for any reason, the initial coastal station has been unable to communicate directly with such mobile station.

3. Licenses for marine relay service will authorize communication only between coastal stations located in the same geographical area. The areas to be designated are as follows:

a. Atlantic-Gulf area.
b. Great Lakes area.
c. Pacific area.

This order shall be effective the day first above written.

General Order No. 101

At a session of the Federal Radio Commission held in its offices in Washington, D. C., on the 14th day of November, 1930,

It is ordered:

That all existing licenses, except those for stations in Alaska, for the services specified below be, and the same are hereby, extended as follows:

(a) Until 3 o'clock a. m., eastern standard time, April 1, 1931:
Point-to-point.
Coastal.
Marine relay.
Ships above 1,500 kilocycles.
Aeronautical and aeronautical point-to-point.
Aircraft.

(b) Until 3 o'clock a. m., eastern standard time, May 1, 1931:
Police.
Fire.
Experimental visual broadcasting.
Experimental relay broadcasting.

It is further ordered:

That all licenses covering the operation of any radio station in Alaska, except broadcasting stations, which expire between the date of this order and June 1, 1931, are hereby extended until 3 o'clock a. m., eastern standard time, June 1, 1931.

This order, however, is subject to the conditions that it shall not be deemed or construed as a finding or decision by the commission, or as any evidence whatsoever, that the continued use or operation of any of said stations serve, or will serve, public interest, convenience, or necessity, or that public interest, convenience, or necessity would be served by the granting of any pending application for a renewal of any of said licenses; and any licensee subject to this order who continues to use or operate his station during the period covered by this order shall be deemed to have consented to said conditions. The commission reserves the right to change the frequency assignment of any station, the license of which is affected by this order, during the extension herein provided if, in the opinion of the commission, such change is advisable.

The provisions of General Order No. 89, requiring that applications for renewal of license be filed so as to be received at the offices of the supervisor of radio in charge of the district in which the station is located at least 30 days prior to the expiration date of the license sought to be renewed, shall be construed to apply to the extension dates hereinabove authorized.

The licenses for the following services are not affected by the terms of this order, and the expiration date shall be as specified in the existing license:
Geophysical.
General experimental.
Special experimental.
Temporary services.
Ships below 1,500 kilocycles.
Amateur.

This order shall be effective on the day first above written.

AMENDMENT TO GENERAL ORDER NO. 101

At a session of the Federal Radio Commission held in its offices in Washington, D. C., on the 26th day of February, 1931,

It is ordered:

That the following licenses heretofore extended by General Order No. 101, except those granted to Universal Wireless Communication Co. (Inc.) and the Intercity Radio Telegraph Co., covered by the commission's revocation order of January 29, 1931, be, and the same are hereby, further extended until 3 o'clock a. m., eastern standard time, October 1, 1931:
Point-to-point.
Coastal.
Marine relay.
Ships above 1,500 kilocycles.
Aeronautical and aeronautical point-to-point.[1]
Aircraft.
Police.

It is further ordered:

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[1] Exception is made (1) to those licenses authorizing the use of 12,180 kilocycles and 12,210 kilocycles; these shall expire at 3 o'clock a. m., eastern standard time, July 1, 1931; and (2) to those licenses issued to the Ford Motor Co. authorizing the use of the frequencies 290, 398, and 414 kilocycles, which shall expire on the date specified in the existing licenses.

That all applications for renewal of licenses for any of the above services shall be acknowledged by the secretary and retained in the files of the commission for subsequent action: *Provided, however,* That such applications that are allowed to remain in a delayed action status may be acted upon on or prior to the renewal date, in accordance with the rules and regulations in effect at the time of such action.

This order, however, is subject to the conditions that it shall not be deemed or construed as a finding or decision by the commission, or as any evidence whatsoever, that the continued use or operation of any of said stations serve, or will serve, public interest, convenience, or necessity beyond the express terms of this order, or that public interest, convenience, or necessity would be served by the granting of any pending application for a renewal of any of said licenses; and any licensee subject to this order who continues to use or operate his station during the period covered by this order shall be deemed to have consented to said conditions. The commission reserves the right to change the frequency assignment of any station, the license of which is affected by this order, during the extension herein, provided, if in the opinion of the commission, such change is advisable.

The provisions of General Order No. 89, requiring that applications for renewal of license be filed so as to be received at the offices of the supervisor of radio in charge of the district in which the station is located at least 30 days prior to the expiration date of the license sought to be renewed, shall be construed to apply to the extension date hereinabove authorized.

The licenses for the following services are not affected by this order, and the expiration date shall be as specified in General Order No. 101, as follows:

(*a*) Until 3 o'clock a. m., eastern standard time, May 1, 1931:

Fire.
Experimental visual broadcasting.
Experimental relay broadcasting.

(*b*) Until 3 o'clock a. m., eastern standard time, June 1, 1931:

All licenses covering the operation of any radio station in Alaska, except broadcasting stations, which expire between the date of this order and June 1, 1931.

(*c*) The expiration date of the following licenses shall be as specified in the existing license:

Geophysical.
General experimental.
Special experimental.
Temporary services.
Ships below 1,500 kilocycles.
Amateur.

This amendment to General Order No. 101 shall be effective on the day first above written.

General Order No. 102

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 8th day of January, 1931, the commission adopted the following general order:

Whereas under the unit and quota figures adopted by the commission the first and second zones are under quota and the remaining three zones are over quota;

And whereas there are a number of States that are over quota and a number of States that are under quota;

And whereas there is now pending before the commission a number of applications from under-quota States which, under the law, are entitled to their pro rata share of radio facilities:

Therefore, in order to bring about an equalization of these radio facilities among the States in the zones, the commission adopts the following with reference to applications:

1. Where a zone has already in use its pro rata share of facilities, the commission will not allocate any further radio facilities to that zone which would increase its quota.

2. Applications from under-quota States in zones which have already allocated to them their pro rata share of radio facilities should be for a facility already in use in that zone by an over-quota State.

3. Likewise, where a State is already over quota, the commission will not allocate any further radio facilities to that State which would increase its quota.

4. Applications from States which now have their quotas or from States which are over quota should be for facilities already in use in that State.

5. An applicant from an under-quota State in an under-quota zone may apply either for facilities in use in an over-quota State in that zone or an over-quota State in an over-quota zone.

The further questions of kilocycle and mileage separations should also be considered by an applicant in selecting the frequency to be applied for.

Since the commission has classified stations in accordance with power into three classes, namely, clear channel, regional, and local stations, and has allocated certain frequencies for the use of each of these three classes of stations, applications should be for frequencies set aside by the commission for the character of station applied for.

All applications now pending before the commission which have not been heard or designated for hearing by the commission may be amended by the applicants to conform to this order.

This order shall be effective on the day first above written.

Explanation of General Order No. 102

February 26, 1931.

General Order No. 102 of the Federal Radio Commission must be considered together with other general orders of the commission and its established policy. General Order No. 40 of this commission designates six frequencies for use by local stations and restricts the nighttime power of stations of these frequencies to a maximum of 100 watts. The same general order designates certain frequencies to be occupied by regional stations operating with powers of 250, 500, or 1,000 watts at night. General Order No. 40, therefore, would prohibit the operation of a station using more than 100 watts power on any of the six local frequencies. The established policy of the commission, based on what is believed to be sound engineering and economic principles, has been to authorize no 100-watt stations to operate at night on regional frequencies.

Applicants for construction permits for local stations (meaning stations operating with the power of 100 watts or less at night) are restricted to the six frequencies designated for that purpose by General Order No. 40 above referred to.

In the final analysis, and from a practical viewpoint, it appears that applications from States which have their quota, or more, of radio facilities assigned to them should, in general, be confined to facilities of a station, or stations, of the same class as that proposed to be constructed and/or operated by the applicant. That is, if the applicant applies for authority to construct or operate a local station in a State which has its quota, or more, the application should be to supplant a local station in that State. Applications for regional assignments should be made for the facilities of a regional station and applications for clear-channel assignments should be for the facilities of a clear-channel station.

In some cases, however, where facilities of one class can be installed without interference but the State and/or zone has its quota already assigned, then applications may be made for all or part of the facilities of any station of any class in that State or zone. In this case the applicant should specify the facility which he desires to have transferred.

General Order No. 103

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 20th day of January, 1931,

It is ordered:

The licenses of all broadcasting stations, with the following exceptions, are hereby extended subject to the terms and conditions provided in said licenses for the period beginning 3 a. m., eastern standard time, January 31, 1931, and ending 3 a. m., eastern standard time, April 30, 1931:

(A) WLBX, KFQU, WJBW, KTSA, WHK, WCGU, KFQW, KGEF, and KZM, which have been heretofore designated for hearing. The licenses for

these stations are hereby extended until decision of the commission as a result of the said hearings, but in no event later than 3 a. m., eastern standard time, March 31, 1931.

(B) KFXY, KGB, KWKH, WJAY, WRUF, WMRJ, WIBR, WJW, WALR, WWL, WHBC, WRBL, WGCM, KRLD, KONO, KFYO, KLRA, WLOE, and WMBC, which are pending investigation. The licenses for these stations are hereby extended until the completion of said investigation or until decision of the commission if, after a result of said investigation, the applications are designated for hearing, but in no event later than 3 a. m., eastern standard time, March 31, 1931.

(C) WBRE, WCLS, WELL, WEVD, WHEC-WABO, WKBO, WKBQ, WLTH, WMBJ, WMBQ, WWRL, KBPS, KFUL, KGAR, KGBZ, KMPC, KTNT, KTRH, WNJ, WAIU, and WREC-WOAN, which have been heard and are pending the decision of the commission. The licenses for these stations are hereby extended until decision of the commission, as a result of said hearings, and in no event later than 3 a. m., eastern standard time, April 30, 1931.

(D) WAWZ, WDRC, WKAQ, WOAX, WDBJ, WGAR, WHP, WACO, WDAG, KGCR, KFVD, KFXJ, KOL, KSEI, and KUJ, which have not filed applications for renewal of station licenses.

No authority herein contained shall be construed as a finding by the Federal Radio Commission that the operation of these stations is now or will be in the public interest beyond the dates specified in this order.

It is further ordered:

The operation of General Order No. 97 is hereby postponed to 3 a. m., eastern standard time, April 30, 1931.

This order shall be effective on the day first above written.

Amendment to General Order No. 103

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 30th day of January, 1931:

It is ordered:

That paragraph (D) of General Order No. 103, adopted on January 20, 1931, be, and the said paragraph is hereby, amended so as to exclude from the provisions thereof and to delete therefrom the following radio broadcasting stations, to wit:

WDRC, WKAQ, WOAX, WDBJ, WHP, WACO, WDAG, KGCR, KFVD, KOL, and KSEI.

This order shall be effective on the day first above written.

General Order No. 104

At a session of the Federal Radio Commission held at its offices in Washington, D. C., February 2, 1931,

It is ordered:

MARITIME STATIONS

1. All ship stations, coastal stations, and stations licensed for marine relay service shall maintain an accurate log of their operation on the international calling and distress frequency, 500 kilocycles (410 kilocycles on the Great Lakes), as follows:

(*a*) At stations where continuous watch is maintained, an entry shall be made at least every 15 minutes. At stations having limited hours of operation, similar entry shall be made during the time the station is active. All calls or answers made shall be entered, giving time and call letters of station worked. Stations may be designated by their call letters in all log entries.

(*b*) Entry shall be made of any unlawful interference from other stations.

(*c*) Distress calls and any unusual and special incidents shall be duly entered.

(*d*) Notations shall be made of any breakdowns of apparatus, failure of power supply, noises, or disturbances tending to delay traffic.

(e) When a change in the watch is made the operator relieved shall sign his name with the indication "off watch" and the relieving operator shall sign his name showing that he is "on watch."

(f) Each sheet of the log shall be numbered and dated. The time used for making an entry in the radio log shall be stated at the top of each sheet; i. e., Greenwich mean time, seventy-fifth meridian time, or whatever time is used, depending upon the location of the station.

2. In addition, ship stations shall show the following:

(a) Time of arrival at and departure from ports, giving names of each.

(b) Approximate position of vessel, showing miles and direction from some given point each day. Latitude and longitude may be used (noon position is preferred).

3. These logs shall be available to inspection by Government radio inspectors in the course of their official duties, and information therein contained shall be held confidential by said inspectors, except as may become necessary in the discharge of their official duties.

This order shall be effective on March 1, 1931.

GENERAL ORDER No. 105

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 12th day of February, 1931,

It is ordered:

SECTION 1. *The broadcasting day.*—That period of time between 6 o'clock a. m. and 12 o'clock midnight shall constitute a broadcasting day; the period between 6 o'clock a. m. and local sunset to be designated as daytime and that between local sunset and 12 o'clock midnight as nighttime. The monthly average sunset at all locations will be specified by the Federal Radio Commission, and the references herein made to times shall be taken as referring to local standard time unless otherwise ordered. In determining the quota value of a given assignment or in the computation of time division, the average time of local sunset shall be taken to be 6 o'clock p. m., and one hour of nighttime operation shall be considered as the equivalent of two hours of daytime operation.

SEC. 2. *The test or experimental period.*—That period of time between 12 o'clock midnight and 6 o'clock a. m. local time shall constitute the test or experimental period and may be used for this purpose by any regularly licensed broadcasting station on its assigned frequency and with its authorized power: *Provided, however,* That no interference is caused with other stations maintaining a regular operating schedule during all or any part of said time.

SEC. 3. *Unlimited time stations.*—All broadcasting stations now or hereinafter licensed to operate without limit as to time may operate on any schedule of hours that meets their requirements, whether during the broadcasting day or test or experimental period: *Provided, however,* That from and after the 1st day of May, 1931, no licenses authorizing unlimited hours of operation will be issued to broadcasting stations which are not on said date and do not continuously thereafter maintain a minimum regular operating schedule of 12 hours per broadcasting day, at least 3 hours of which shall be between 6 o'clock p. m. and 12 o'clock midnight local time. In all cases where the minimum regular operating schedule herein provided is not adhered to, such stations may, after hearing, be required to share time with other stations or be reduced to part-time stations.

SEC. 4. *Stations sharing time.*—(a) In all cases where broadcasting stations are licensed to share time they shall not operate simultaneously at any time, either day or night, unless specifically authorized to do so by the terms of their licenses.

(b) In all cases where broadcasting stations are licensed to share time and specified hours of operation are designated in the license, that schedule shall be adhered to until otherwise ordered by the commission or deviation therefrom is permitted pursuant to paragraph (d) of this section.

(c) In all cases where broadcasting stations are required to share time and the specific hours of operation are not designated in the license, the licensees of such stations shall endeavor to reach an agreement as to a definite schedule of periods of time to be used by each of them, and if successful each of said stations shall reduce said agreement to writing and file the same in triplicate with the commission with each application for renewal of license. If and when such written agreements are properly filed in conformity with this order, the file

mark of the commission shall be affixed thereto; one copy shall be retained by the commission, one copy shall be forwarded to the radio division of the Department of Commerce, and one copy shall be returned to the licensee of said station to be posted with its license and considered as a part thereof. If the license specifies a definite proportionate time division, the agreement shall maintain this proportion. In case no proportionate time division is specified, the stations will agree upon a division of time. Nothing contained in this order shall be construed as authorizing or permitting the simultaneous operation of such stations unless specifically authorized to do so by the terms of their licenses.

(*d*) In all cases enumerated in paragraphs (*b*) and (*c*) hereof, departure from the regular operating schedule will be permitted only in cases where an agreement to that effect is reduced to writing, signed by the stations affected thereby, and filed in triplicate with the commission prior to the time of said departure: *Provided, however*, That in cases where time is of the essence the actual departure in the operating schedule may, after appropriate notice to the commission and to the radio division of the Department of Commerce, precede the actual filing of the written agreement with the commission: *And provided further*, That nothing herein contained shall be taken as authorizing any simultaneous operation not specifically authorized in the licensees of the station affected.

(*e*) In all cases enumerated in paragraph (*c*) hereof where the station licensees are unable to reach an agreement as to a definite schedule of periods of time to be used by each of them, the commission shall be so notified by the filing of a statement to that effect with the application for renewal of license. Upon receipt of such statement the commission will designate the applications for hearing, and pending such hearing the operating schedule previously adhered to shall remain in full force and effect.

SEC. 5. *Limited time and day stations.*—(*a*) In all cases where a broadcasting station is licensed to operate limited time or during daytime it shall not operate simultaneously with any other station assigned to that frequency at any time unless specifically authorized to do so by the terms of its license.

(*b*) In all cases where a broadcasting station is licensed to operate with limited hours and required to cease operation at the time of sunset at some point within the United States, the license will provide the hour of the day during each month of the license period when said station shall cease operation.

(*c*) In all cases where limited-time stations are licensed to resume operation at the time the unlimited-time station on the same channel ceases operation, the licensee of said limited-time station shall file in triplicate with the commission a copy of its 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 one copy, forward one copy to the radio division of the Department of Commerce, and return one copy to the licensee of the limited-time station filing the same who shall cause it to be posted with and considered as a part of the station license. Departure from said operating schedule may be had only by compliance with the provisions of paragraph (*d*) of section 4 with respect to such departures by stations sharing time.

SEC. 6. *Reducing power at sunset.*—In all cases where a broadcasting station is licensed to operate with more power during daytime operation than for nighttime operation and the licensee is required to reduce the power of the station at the time of sunset, the license issued to said station will specify the hour of the day during each month of the license period at which said station is required to reduce its power.

SEC. 7. *Part-time stations.*—Any broadcasting station other than a day or a limited-time station, which is licensed to operate part time on a channel where the entire available broadcasting time (i. e., the broadcasting day) has not been designated for the use of any other station or stations, may operate temporarily and until the further order of the commission upon all or any part of the time not so designated: *Provided, however*, That where two or more part-time stations are eligible to operate on said undesignated time, they shall comply with the provisions of paragraph (*c*) of section 4 with respect to the regular operating schedule of stations sharing time.

SEC. 8. *Violations.*—(*a*) In all cases where a licensee is required by the terms of this order to file any document pertaining to its operating schedule at the time of its application for a license, the failure to file such a document shall

be considered as a defect in the application for license within the meaning of section 1 of subtitle B of Practice and Procedure Before the Federal Radio Commission adopted by General Order No. 93.

(*b*) In all cases where a station licensee is required to prepare and file a regular 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 and of this order.

(*c*) In all cases where the specific hours of operation are fixed in the license, any deviation or departure therefrom, except as herein authorized, shall be considered as a violation of a material term of the license and of this order.

(*d*) Unless specifically authorized to do so by the terms of their licenses, no stations operating on the same frequency assignments shall be permitted to operate simultaneously. Any unauthorized simultaneous operation shall be considered as a violation of a material term of the station license and of this order without regard to any understanding or agreement as between the stations affected thereby.

This order shall be effective on March 1, 1931.

Amendment to General Order No. 105

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 2d day of March, 1931,

It is ordered:

The effective date of General Order 105 is hereby postponed until 3 a. m., eastern standard time, April 30, 1931.

General Order No. 106

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on February 16, 1931,

It is ordered:

BROADCASTING STATIONS

That all broadcasting stations be, and they hereby are, required to maintain two logs, as follows:

1. *Program log.*—This log shall contain—

(*a*) An entry of all station and call announcements and the time made.

(*b*) An entry describing each program broadcast, with the time beginning and ending. If phonograph records or electrical transcriptions are used, that fact shall be noted, together with the announcement made thereof.

2. *Operating log.*—This log shall contain—

(*a*) An entry of the time the station's carrier wave goes on the air and the time the station's carrier wave is stopped.

(*b*) An entry of the time the program begins and ends.

(*c*) An entry of every interruption of the carrier wave, its cause and duration.

(*d*) An entry of each of the following shall be made every 30 minutes.

(1) Operating constants on last radio stage (total plate current and plate voltage); antenna current.

(2) Frequency check.

(3) Temperature of crystal chamber (if used).

These logs shall be kept by the person or persons competent to do so, having actual knowledge or information of the facts herein required, who shall sign the log when coming on duty and again when going off duty. The logs herein required shall be open to inspection at all reasonable times by Government radio inspectors and other persons authorized to do so by the Federal Radio Commission.

This order shall be effective on the 1st day of March, 1931.

AMENDMENT TO GENERAL ORDER No. 106

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 27th day of February, 1931,

It is ordered:

The effective date of General Order No. 106 is hereby postponed until 3 a. m., eastern standard time, April 30, 1931.

GENERAL ORDER No. 107

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 24th day of March, 1931.

It is ordered that General Order No. 87, as amended, be, and the same is hereby, repealed.

This order shall be effective on the date first above mentioned.

GENERAL ORDER No. 108

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on March 26, 1931,

It is ordered:

That General Order No. 97, adopted and promulgated by the Federal Radio Commission on October 6, 1930, be, and said general order is hereby, amended so as to read as follows:

Section I.

Section II.

Section V (*a*).

Change date from January 31, 1931, to April 30, 1931.

GENERAL ORDER No. 109

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on March 26, 1931,

It is ordered:

That General Order No. 108, adopted by the Federal Radio Commission on January 20, 1931, and General Order No. 103 as amended and promulgated by the Federal Radio Commission on January 30, 1931, be, and they are hereby, rescinded and repealed.

GENERAL ORDER No. 110

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 27th day of March, 1931,

It is ordered:

That General Order No. 101, as amended, be, and the same is hereby, repealed.

This order shall be effective at 3 a. m., eastern standard time, April 1, 1931.

GENERAL ORDER No. 111

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 20th day of April, 1931,

It is ordered:

That General Order No. 108 be, and the same is hereby, repealed;

That General Order No. 97, adopted and promulgated by the Federal Radio Commission October 6, 1930, be, and it is hereby, amended so as to read as follows:

"SECTION I. That no radio broadcasting station will be licensed by the Federal Radio Commission to operate after April 30, 1931, with a greater power

than can be satisfactorily delivered and maintained by the licensed transmitter with a percentage of modulation of over seventy-five per cent (75%) on peaks with not over ten per cent (10%) combined audio harmonics.

"SEC. II. No radio broadcasting station license will be granted by the Federal Radio Commission authorizing the operation of any station after April 30, 1931, with a greater power than the maximum rated carrier power of the transmitter as determined by existing general orders of the Federal Radio Commission.

"SEC. III. All radio broadcasting stations specifying or claiming operating constants that give greater carrier power than the maximum rated power of the transmitter as determined by existing general orders of the Federal Radio Commission shall submit data showing the antenna input power by direct measurement and oscillograms of the maximum satisfactory modulation to prove licensed power output and proper modulation.

"SEC. IV. (a) The oscillograms required by Section III of this general order shall be taken while modulating the transmitter with a frequency of approximately 200 cycles at maximum licensed power and under normal operating conditions. Reference lines shall be run on the oscillograms as follows: (1) One line indicating carrier positions, (2) one line for one hundred per cent (100%) negative modulation, and (3) one line for one hundred per cent (100%) positive modulation. These lines shall be one-half (½) inch or more apart. Such oscillograms may be taken with time delay relays so that one-third of the oscillograms shows no current through vibrator, one-third shows rectified carrier only, and one-third shows modulation.

"(b) One overload oscillogram shall be taken with the 200-cycle tone input voltage twenty-five per cent (25%) greater than the input voltage necessary to produce the maximum satisfactory modulation which the licensee claims the transmitter is capable of producing.

"(c) Complete data on a measuring of the antenna resistance shall be submitted to the commission for its approval, together with full operating constants of the transmitter while taking such oscillograms.

"SEC. V. (a) The data required in Section IV shall be submitted and approved by the commission on or before April 30, 1931, or the licensed power will be reduced to conform to maximum rated carrier power of the transmitter as determined by existing general orders of the Federal Radio Commission.

"(b) No changes shall be made in any radio broadcasting transmitter affecting the maximum rated carrier power thereof until such changes have been authorized by the commission."

GENERAL ORDER No. 112

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 4th day of May, 1931,

It is ordered:

That General Order No. 99 be, and it is hereby, amended in the following particulars:

The frequencies hereinafter mentioned are hereby added to those already assigned the Southern Transcontinental Chain and Feeders (Brown):

(a) Mobile service:

2,680 kilocycles. Unlimited hours. To be used west and north of Chicago, Ill.

5,875 kilocycles. Day only. To be used west and north of Chicago, Ill.

(b) Fixed service:

2,680 kilocycles. Unlimited hours. To be used west and north of Chicago, Ill.

GENERAL ORDER No. 113

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on May 11, 1931,

It is ordered:

I. All stations licensed under the radio act of 1927 shall keep the licensed operator or operators of the grade specified by the Secretary of Commerce

on duty during all periods of actual operation at the place where the radio transmitting apparatus is located: *Provided, however*, that in the case of a remotely controlled transmitter delivering power to the antenna not in excess of 1,000 watts, operating on frequencies other than those in the broadcast band (550 to 1,500 kilocycles, the commission may authorize such operator or operators to be on duty at the control station during all periods of operation of the station if and when

(1) The transmitter can be properly operated in accordance with the terms of the station's license; and

(2) The transmitter will be monitored from the control station with apparatus which will permit placing the transmitter in an inoperative condition in the event there is a deviation from the terms of the license, in which case the radiation of the transmitter shall be suspended immediately until corrective measures are effectively applied to place the transmitter in proper condition for operation in accordance with the terms of the station license; and

(3) The separation between the transmitter and the remote-control station does not exceed 5 miles by air-line distance; and

(4) The transmitter is so located or housed that it is not accessible to other than duly authorized persons.

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

III. The person manipulating the transmitting key of a manually operated radiotelegraph mobile or amateur transmitting station shall be a regularly licensed operator. The licensees of other stations which are operated under the constant supervision of duly licensed operators may permit any person or persons, whether licensed or not, to transmit by voice or otherwise, in accordance with the type or types of emissions specified by their respective licenses.

GENERAL ORDER No. 114

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on May 15, 1931,

It is ordered:

SECTION 1. Unless otherwise directed by the commission, all applications for renewal of license shall be filed so as to be received at the office of the supervisor of radio in charge of the district in which the station is located at least sixty (60) days prior to the expiration date of the license sought to be renewed. Where an applicant for renewal of license fails to meet these requirements and as a result thereof the commission fails to take action upon any such application before the expiration date of the license sought to be renewed, the licensee shall cease operating, in accordance with the terms of said license, and no temporary extension thereof will be granted pending decision of the commission on said delinquent application.

SEC. 2. In all cases where an application for renewal of license is regarded as essential to the proper conduct of a hearing or investigation by the commission and the commission as a result thereof specifically directs that the same be filed on or before a date certain, such application shall be filed so as to be received at the office of the supervisor of radio in charge of the district in which the station is located within the time specified by the commission. Upon the failure of any licensee to file an application within such time as the commission shall prescribe by specific direction or such extension thereof as the commission may grant upon proper showing, the commission shall proceed with the hearing upon the premise and assumption that said delinquent licensee does not desire or intend to make application for renewal of its existing license; said delinquent licensee shall be defaulted in the matter of said hearing and no renewal of license will be granted or issued to it.

SEC. 3. That General Order No. 39 be, and the same is hereby, repealed.

This order shall be effective on the day first above written.

General Order No. 115

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on May 25, 1931,

It is ordered:

That General Order No. 91 be, and the same is hereby, amended to read as follows:

Section 1. The maximum rated carrier power of all broadcast transmitters installed after this date shall be determined by the authorized power as given in Table I of this section. The maximum rated carrier power shall be determined as provided in section 2 of this general order.

Table I

Authorized power (watts)	Maximum rated carrier power allowed to be installed (watts)
(a)	
5 to 100	100
100 night and 250 day	250
(b)	
250 to 1,000	1,000
2,500 to 5,000	5,000
(c)	
The maximum rated carrier power of transmitters hereafter installed in stations with an authorized power of over 5,000 watts shall be not more than twice the authorized power.	

Applicants requesting power from 5 to 50 watts or from 250 to 500 watts, inclusive, may be allowed to install transmitters of the same maximum rated carrier power as the authorized power.

Sec. 2. The maximum rated carrier power of all broadcast transmitters shall be determined by the installed vacuum-tube capacity of the last radio stage (i. e., oscillator or radio-frequency power amplifier which supplies power to the antenna), depending on the system of modulation employed.

(a) The maximum rated carrier power of transmitters employing high-level modulation shall be considered the same as the total installed tube-power capacity of the last radio stage as determined by Table II.

(b) The maximum rated carrier power of transmitters employing low-level modulation shall be considered as one-fourth the total installed tube-power capacity of the last radio stage as determined by Table II.

(c) The maximum rated carrier power of transmitters employing grid bias modulation on the last radio stage shall be considered the same as the total installed tube-power capacity of the last radio stage as determined by Table III.

(d) If the methods of rating in paragraphs (a), (b), and (c) of this section do not give an even power rating, the nearest rating recognized in the commission's plan of allocation will be accepted.

(e) The power capacity of standard vacuum tubes commonly used in broadcast transmitters having a power rating of 50 watts and above as oscillators, class 3 or class C amplifiers, is fixed and approved as set out in Tables II and III, hereafter set out in this section. Any vacuum tube of a type number and power rating not listed in Tables II or III may be specified and accepted on an application to the commission, provided the manufacturer's complete maximum and normal operating constants as oscillator or class 8 or class C amplifier and for class of service for which vacuum tube is specified in the application and complete curves, which are considered necessary to determine the complete characteristics of the vacuum tube, are submitted to and approved by the commission.

TABLE II

Power rating (watts)	De Forest type No.	R. C. A.—radiotron type No.	Western Electric type No.
50	508-A	UV-208-A	211-D
	511	UV-211	211-E
	545	UV-845	242-A
			245-A
			262-A
75	552	UX-852	----------
	560	UX-860	----------
250	504	UV-204-A	212-D
	504-A	----------	----------
350	549	UV-849	----------
500	561	UV-861	270-A
1,000	----------	UV-851	----------
5,000	520-B	RCA-1652	228-A
	520-M	----------	----------
	521	----------	----------
10,000	507	UV-207	220-B
	548	UV-848	----------
	563	UV-863	----------
20,000	----------	UV-858	----------
35,000	----------	----------	232-A
100,000	----------	UV-862	----------

TABLE III

Power rating (watts)	De Forest type No.	R. C. A.—radiotron type No.	Western Electric type No.
50	----------	----------	270-A

SEC. 3. No licensee shall change the number of vacuum tubes or change to vacuum tubes of different power rating in the last radio stage, or change the system of modulation except upon authority from the commission.

SEC. 4. The operating carrier power of broadcast stations shall be determined from the antenna input power either (*a*) by direct measurement or (*b*) by indirect measurement by means of the plate input power of the last radio stage.

(*a*) The antenna input power determined by direct measurement is the square of the antenna current times the antenna resistance at the place where the current is measured and at the operating frequency. The direct measurement of the antenna input power will be accepted as operating power, 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.

Any licensee authorized by the commission to determine the operating power by direct measurement of antenna input power shall not make any changes in the antenna system except upon authority from the commission.

(*b*) The antenna input power shall be determined by indirect measurement from the plate input power of the last radio stage by multiplying plate voltage by the total plate current of the last radio stage and by the proper percentage given in Table IV, V, or VI, in accordance with the power and system of modulation used.

The operating power of transmitters employing high-level modulation shall be computed from the maximum rated carrier power of the transmitter as determined by section 2 of this order and the plate input power in accordance with Table IV.

TABLE IV

Maximum rated carrier power of transmitters as determined by section 2	The operating power shall be this per cent of the total plate input
Watts	*Per cent*
5-100	50
250-1,000	60
2,500-50,000	65

The operating power of transmitters employing low-level modulation shall be computed from the maximum percentage of satisfactory modulation and the total plate input power in accordance with Table V. No distinction will be recognized between transmitters of different powers.

TABLE V

Maximum percentage of satisfactory modulation	The operating power shall be this per cent of the total plate input
Per cent	*Per cent*
100-86	33⅓
85-75	40

The operating power of transmitters employing grid bias modulation in the last radio stage shall be computed from the maximum percentage of satisfactory modulation and the total plate input power in accordance with Table VI. No distinction will be recognized between transmitters of different powers.

TABLE VI

Maximum percentage of satisfactory modulation	The operating power shall be this per cent of the total plate input
Per cent	*Per cent*
100-86	22⅓
85-75	27

In computing the operating power of stations by indirect measurement, the above percentages shall apply in all cases and no distinction will be recognized due to the operating power being less than the maximum rated carrier power.

SEC. 5. The operating power of broadcast stations 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.

Any licensee authorized by the commission to determine the operating power from radiated power shall not make any changes in the antenna system except upon the authority from the commission.

SEC. 6. All broadcast stations shall be required to maintain their operating power in exact accordance with their licensed power at all times during the broadcast day, and no departure from the licensed power will be permitted in any case except upon specific authorization from the commission.

SEC. 7. Unless specifically authorized by the commission to do otherwise, all broadcast licensees shall compute their operating power by the antenna input indirect measurement, and any broadcast licensee which has at any time been authorized by the commission to compute its operating power by any other method (i. e., antenna input direct measurement or radiated power measurement) shall, upon making any change in its antenna system or in the antenna current measuring instruments, revert to the use of the antenna, input indirect measurement until further order of the commission.

SEC. 8. (a) All broadcast stations shall be equipped with indicating instruments of accepted accuracy to measure the antenna current, direct plate circuit voltage, and the direct plate circuit current on the last radio stage.

(b) These indicating instruments shall not be changed or replaced except upon authority from the commission.

This order shall be effective on the day first above written.

DEFINITION OF TECHNICAL TERMS USED IN GENERAL ORDER No. 115

The following definitions apply to the terms used in General Order No. 115, adopted May 25, 1931:

(1) *Authorized or licensed power:* The power assigned by the commission and specified in the instrument of authorization.

(2) *Maximum rated carrier power:* Determined by the design of the transmitter and orders of the commission and is independent of operating power, except that generally it is the greatest power at which the transmitter can be satisfactorily operated.

(3) *Operating power:* The power that is actually transmitted by the station. It must be determined by one of the several methods set out in General Order No. 115 and must agree with the authorized or licensed power.

(4) *Plate input power:* The product of the direct-plate voltage applied to the tubes in the last radio stage and the total direct-plate current of these tubes, measured under conditions of no modulation.

(5) *Radiated power:* The total power radiated from the antenna at all angles. In the absence of actual measurements, it is considered to be 50 per cent of the antenna input power for all computations.

(6) *Antenna input power or antenna power:* Product of the total antenna resistance and the square of the antenna current.

(7) *Last radio stage:* The oscillator or radio-frequency power amplifier stage which supplies the power to the antenna.

(8) *Modulation:* The superimposing of audio-frequency power on radio-frequency power resulting in the generation of side bands or varying the peak amplitude of the output current and voltage. May be accomplished by several methods.

(9) *System of modulation:* Determined by stage modulated, the method, and subsequent amplification.

(10) *Modulator:* The last audio-frequency amplifier stage which modulates a radio stage by plate modulation or otherwise.

(11) *Modulated stage:* The radio-frequency amplifier stage which is coupled to the modulator and is modulated by one of the several methods.

(12) *Percentage of modulation:* The ratio of the amplitude of the difference between the maximum or minimum rectified antenna current during modulation and the rectified carrier under conditions of no modulation to the rectified carrier under conditions of no modulation, multiplied by 100. If the positive and negative modulation are of different percentages, the one giving the lesser percentage is considered as determining.

(13) *Maximum percentage of satisfactory modulation:* Defined as the greatest percentage that may be obtained by supplying sound energy to the station microphone without over 10 per cent combined audio harmonics in the output being generated by the entire transmitter.

(14) *High-level modulation:* The plate circuit of the last radio stage is modulated.

(15) *Low-level modulation:* A stage before the last radio stage is modulated and the last stage operates only as a linear power amplifier.

(16) *Grid bias modulation in the last radio stage:* The grid bias voltage of the stage which supplies power to the antenna is controlled at audio frequency. If such modulation is employed in other than the last radio stage, it is low-level modulation.

(17) *Antenna resistance:* The total resistance of the antenna system at the operating frequency and at the place of measuring the antenna current.

(18) *Antenna current:* The radio-frequency current at the operating frequency under conditions of no modulation.

GENERAL ORDER No. 116

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 22d day of June, 1931,

It is ordered:

1. On and after the effective date of this order and until one year from said date, all radio broadcasting stations operating between 550 and 1,500 kilocycles shall maintain the assigned frequency between the limits of 500 cycles per second above to 500 cycles per second below the assigned frequency.

2. On and after one year from the effective date of this order, all radio broadcasting stations operating between 550 and 1,500 kilocycles shall maintain the assigned frequency between the limits of 50 cycles per second above to 50 cycles per second below the assigned frequency, and said stations are hereby required to make provision for the checking of the frequency of the emitted wave by means independent of the frequency control of the transmitter, said independent means having capability of the accuracy above mentioned.

3. On and after the effective date of this order the commission will authorize the installation of new transmitting equipment in broadcasting stations or changes in the frequency-control equipment at present licensed for operation only if such equipment is so designed that there is reasonable assurance that the transmitter is capable of maintaining the assigned frequency to the accuracy set forth in paragraph 2 above.

4. Each broadcasting station is hereby required to announce twice each day, at the beginning and end of its program, that it is broadcasting on a frequency of —— kilocycles, by authority of the Federal Radio Commission.

5. General Order No. 7 is hereby repealed.

6. This order shall be effective on the date first above written.

GENERAL ORDER No. 117

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 24th day of June, 1931,

It is ordered:

That General Orders Nos. 62, 88, and 88 as amended, be, and the same are hereby, repealed.

This order shall be effective on the date first above written.

GENERAL ORDER No. 118

At a session of the Federal Radio Commission held at its offices in Washington, D. C., on the 24th day of June, 1931,

It is ordered:

That General Order No. 90 be, and it is hereby, amended in the following particulars:

The frequency hereinafter mentioned is hereby added to those already assigned the Southern Transcontinental Chain and Feeders (Brown):

MOBILE SERVICE

Available for aircraft and aeronautical stations

4,915 kilocycles. Day only, for use only between Chicago, Ill.; Peoria, Ill.; Springfield, Ill.; and St. Louis, Mo.

○