THIRTEENTH ANNUAL REPORT

FEDERAL COMMUNICATIONS COMMISSION

FISCAL YEAR ENDED JUNE 30, 1947

(With Notation of Subsequent Important Developments)

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[As of October 1, 1947]

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(Term expires June 30, 1951)

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(Term expires June 30, 1953)

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(Term expires June 30, 1948)

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(Term expires June 30, 1950)

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(Term expires June 30, 1949)

ROBERT F. JONES
(Term expires June 30, 1954)

[1] Resigned as of Oct. 31, 1947.
[2] Designated Acting Chairman Nov. 3, 1947.

LETTER OF TRANSMITTAL

FEDERAL COMMUNICATIONS COMMISSION,
Washington 25, D. C., December 31, 1947.

To the Congress of the United States:

Pursuant to section 4 (k) of the Communications Act, there is submitted herewith the Thirteenth Annual Report of the Federal Communications Commission, covering the fiscal year 1947.

This report reflects the mounting volume of work and complexities involved in regulating postwar advances in the field of electrical communications. Electronic and other developments are so fast moving that situations and statistics as of June 30, 1947, have altered considerably in the ensuing 6 months. For that reason, there is included a summary of the more important of these subsequent events.

Respectfully,

PAUL A. WALKER, *Acting Chairman.*

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REPORT SUMMARY

1. HIGHLIGHTS OF THE FISCAL YEAR

2. SUBSEQUENT EVENTS

1. HIGHLIGHTS OF THE FISCAL YEAR

The fiscal year 1947 was notable for its domestic and international developments of vital concern to radio. Commission activities reflected an increasing demand for radio facilities of all types, and world conferences met in this country to modernize international radio regulations.

The Commission played an active role in preparing for and participating in the sessions of the International Telecommunications Conferences at Atlantic City, over which its Chairman presided. This meeting was called to rewrite prewar radio regulations in the light of subsequent events and the need for world agreement on allocations and standards of operation to insure the most economical and practical use of the limited radio frequencies.

As far as this country is concerned, the Commission had the task of regulating nearly 40 different radio services and seeking spectrum space for more. The number of outstanding radio authorizations of all kinds (stations and operators) rose to nearly 550,000.

Broadcast stations of 11 types reached a new peak of 3,551 authorized as compared with 2,439 the year previous. More than two-thirds of these were commercial standard (AM) and frequency modulation (FM) outlets.

While demand for AM stations continued to increase, engineering and other problems presented by congestion in that field required many applications to be set for hearing. In consequence, most of the 580 new AM grants were to small communities, many without previous local service. For the first time the number of licensed AM stations passed the one-thousandth mark and, on June 30 last, 1,795 AM stations had licenses or construction grants. A 12-week expediting procedure, which ended May 1, 1947 enabled the Commission to catch up with a backlog of AM applications.

FM showed its biggest and most material gain. Authorized stations doubled—from 456 to 918—and the number on the air increased from 55 to 238. This activity forecasts FM service to more than 500 communities and adjacent rural areas extending through all States except

Montana. There were six times as many FM applications for large-area coverage as for purely local service. Some interference to FM reception caused by operation on alternate channels was corrected by exchanging frequencies. Previously reserved FM channels were released as of July 1, 1947. Manfacturers reported an increasing production of sets capable of receiving FM. The first large-scale FM network operation started in March 1947.

Television broadcast authorizations also more than doubled—from 30 to 66. These stations proposed to serve 33 metropolitan areas and three individual cities. In March the Commission removed an uncertainty in the industry by deciding, after extensive hearing, that color television requires further experimentation before being given commercial status. Eighty-one experimental television stations are working on this and other improvements in television techniques and apparatus. Development of microwave relay systems and extension of coaxial cable lines hold prospect of regular television network operation. Sharing of television frequencies by other services was found impracticable and a new allocation plan was in preparation.

Facsimile broadcast continued on an experimental basis while industry resolves some differences of opinion on technical problems to enable standards to be set up for commercial operation.

Noncommercial educational station authorizations increased to 38, which is half again the number in 1946. State-wide educational networks were in prospect.

Thirty-seven international broadcast stations continued to be programmed and operated by the Department of State.

The increasing use of radio for other than broadcast purposes was evinced by the growth of 25 services devoted to safety of life and property and public and business benefit. The number of authorized stations in this category (exclusive of amateurs) increased to 37,137, which is almost double the 1946 total.

Aeronautical had the largest number—15,843; followed by 10,989 ship stations. Mobile and other experimental operations accounted for 3,450, not including 10 times that number of associated mobile units. A total of 4,130 authorizations were for police, fire, and forest protection.

One new service was established. In August 1946, the utility radio service became available to power, transit, and petroleum pipe-line operation, and by the close of the fiscal year numbered 1,136 stations. Railroads were utilizing 109 radio stations, chiefly in connection with terminal operation. One hundred and four geological stations participated in exploring for new sources of oil.

Frequencies were provided for operation of medical diathermy and industrial heating equipment which, otherwise, would interfere with radio communication. About 25,000 vehicles were testing mobile two-

way radiotelephone service for trucks, taxicabs, and other vehicles. Other proposed services contemplate radio systems for lumbering and other business enterprises, highway departments and, ultimately, for individual citizens.

Meanwhile, radio was employed to bring telephone service to isolated communites by spanning terrain or water where it is uneconomical or impossible to string wire lines. In some rural localities telephone messages were being "hitch-hiked" over electric power lines. Air lines were offering telegraph facilities or experimenting with two-way telephone service in flight, and telephone communication with moving trains was under way.

More telephones were installed in fiscal 1947 than in any previous 12 months. In March 1947 the Commission proposed to authorize the use of telephone recording devices under certain conditions, but final order was delayed pending working out technical details.

New and reestablished circuits brought to 63 the number of countries with which the United States has radiotelephone contact. Overseas radiotelephone rates were reduced in some instances. There was no major change in domestic interstate telephone rates.

The telephone and telegraph industries were developing microwave relay systems to supplant or replace wire circuits. Western Union was operating an experimental chain between New York and Philadelphia, and links with Pittsburgh and Washington were under construction. Western Union was also testing radio facsimile for telegram delivery.

In December 1946 the Commission granted Western Union a 9.1 percent rate increase over the temporary 10 percent increase authorized previously. At the same time inquiry was begun into Western Union's plans to close or reduce hours at about 1,000 public offices. A survey of overseas radiotelegraph rates was also under way. Nearly 700,000,000 words were handled by international telegraph (radio and cable) carriers in the calendar year 1946.

The year saw ship radar emerge from experimental to regular use. Other war developments were being adapted to peacetime pursuits.

Technical investigations by the Commission were directed to stratovision (television and FM relay broadcasts from planes), interference to radio reception from natural or man-made causes, use of low-power devices, testing of receivers and other equipment, and production of special apparatus to the inclusion of a model diathermy machine.

Field activities, in which about one-fourth of the Commission's total personnel of 1,328 were engaged, were largely devoted to engineering matters such as monitoring, investigation, inspection, and examination. One hundred and twenty-one illegal radio stations were located. The field staff also traced 6,843 sources of interference. In-

spection was made of 13,948 ship stations and 9,546 land stations. Examinations were given 80,395 applicants for operator licenses.

The ranks of licensed commercial radio operators increased to 325,000 and the amateur radio service grew to 80,000 licensed operators and 75,000 licensed stations. Amateurs had recovered practically all their prewar frequencies, with additions.

2. SUBSEQUENT EVENTS

Of world importance was the signing, on October 3, 1947, of a new treaty regulating all phases of international radiocommunication. Representatives of 78 nations in attendance at the International Telecommunications Conferences at Atlantic City (mentioned elsewhere in this report) affixed their signatures to this latest step toward world-wide cooperation in the communications field.

Of particular interest and concern to domestic broadcasting is a hearing, announced September 8, 1947, and scheduled for March 1, 1948, to determine whether broadcast stations should editorialize on matters of public interest and controversy and, if so, to what extent they are obligated to provide time for divergent opinion. This hearing was prompted by questions raised concerning policy laid down in the Mayflower decision of 1941 which, in effect, requires broadcast licensees to maintain a neutral attitude.

On August 11 the Commission, having received reports that some advertising arrangements had the effect of depriving licensees of direct control of programs, warned broadcasters generally against surrendering their responsibilities through time contracts.

Indications that some groups and individuals contemplated broadcast service over electric power lines caused the Commission, on July 28, to point out that this service was neither envisioned nor provided for in the broadcast picture and, hence, necessary action under its jurisdiction was being studied.

The Commission's economic study of standard broadcasting (noted under "Standard broadcast service") was made public on November 4.

Fall estimates by radio manufacturers indicated a total of 73,000,000 broadcast receiving sets in this country by the close of the calendar year 1947, or 12,000,000 more than at the start of the year. Of the anticipated new sets, nearly 2,600,000 would be FM and 300,000 television.

On July 30 United States international telegraph carriers were authorized to make a general increase in rates to meet a decline in net earnings. It was estimated that this would bring them $5,500,000 additional annual revenue on out-bound traffic. After public hearings, Western Union was permitted to eliminate the rate differential favoring United States Government telegrams, and priority on such tele-

grams was limited to full rate and serial messages for which the sender specifically requested priority.

Final report and order in the matter of radiotelegraph circuits between the United States and British points (Dockets 7094 and 7412) were issued December 5, effective January 10, 1948.

An order, adopted November 26, authorized the use of telephone recording devices, beginning January 15, 1948, in interstate and foreign message toll service, subject to automatic tone warning that such conversations are being recorded.

Radiotelephone service with certain moving trains was authorized August 15 and November 21. On September 25, highway telephone service was made available to radio-equipped vehicles between Boston and Washington. On the same day a new coaxial cable, capable of handling 1,500 simultaneous telephone calls, began operating between New York and Philadelphia. Interim arrangements between this country and Canada made it possible for automobiles equipped with transmitters to cross the border under seal, effective in September.

Widespread sale of surplus radar and other electronic equipment caused a warning to be issued on July 9 that purchasers must obtain authorization from the Commission before attempting to operate such apparatus. In early December the Commission advised on the use of radar and other radiocommunication equipment for school and other training purposes.

In September the Commission authorized emergency communication by amateurs and otherwise cooperated in communication relief in connection with the hurricane which swept portions of Florida and Louisiana. On December 3 the Commission proposed to extend to domestic amateur communication the existing international ban on the use of unauthorized codes and ciphers in overseas "ham" transmissions.

Simplification of forms and procedures continued. On October 23 the Commission announced adoption of new broadcast application forms. Seven unified and compacted forms will replace 20 different forms used for the services affected. Effective October 6, the Commission shortened the employee data form for annual reports by small broadcast stations. On August 1 it proposed revising the radio operator licensing procedure in the light of changed conditions in that field.

On August 7 the Commission extended to November 1, 1948, the term of all general mobile class 2 experimental licenses pending hearing looking towards the establishment of a mobile service. On August 26 it extended to May 1, 1948, the license term of all experimental class 2 ship radar stations. On September 19 it reinstated or extended all temporary limited second class radiotelephone operator licenses, but not beyond June 30, 1948.

The proposed citizens radio service moved a step nearer when the Commission, the same day, promulgated rules and regulations prescribing technical requirements and established a procedure for obtaining type approval for radio equipment to be so used.

To solve the problem of interference to commercial television (noted elsewhere in this report), the Commission on August 14 proposed to abolish sharing of such channels and assign television channel No. 1 to nongovernment fixed and mobile services. Hearing began November 17.

The Supreme Court on October 13 upheld the Commission's refusal to approve transfer of control of radio broadcast station WOV, New York City. (See "Litigation.")

Chairman Charles R. Denny resigned from the Commission as of October 31 to accept a post in private industry. On November 3 the President designated Commissioner Walker as Acting Chairman.

At the close of the calendar year the Commission had approximately 580,000 outstanding licenses and other authorizations in the radio field. This figure included 120,000 radio stations, of which number 4,000 were broadcast, 40,000 nonbroadcast, and 80,000 amateur. In addition, there were 340,000 commercial radio operators, 85,000 amateur operators, and 35,000 special aircraft authorizations.

CHAPTER I.—GENERAL

1. ADMINISTRATION
2. COMMISSIONERS
3. STAFF ORGANIZATION
4. PERSONNEL
5. APPROPRIATIONS
6. LEGISLATION
7. LITIGATION
8. STATISTICS
9. BOARD OF WAR COMMUNICATIONS

1. ADMINISTRATION

In regulating interstate and foreign communication by radio and wire under the provisions of the Communications Act of 1934, as amended, the Federal Communications Commission continued to function as a unit, directly supervising all activities, with delegations of responsibility to boards and committees of Commissioners, individual Commssioners, and the staff. All policy determinations were made by the Commission as a whole.

2. COMMISSIONERS

The President, on December 4, 1946, designated Acting Chairman Charles R. Denny as Chairman. On March 7, 1947, the President nominated Edward M. Webster to fill the unexpired term, ending June 30, 1949, of Paul A. Porter, resigned. Confirmed by the Senate on March 18, 1947, Commissioner Webster took office on April 10 following. Robert F. Jones was nominated on June 18 of the same year to succeed Commissioner Ray C. Wakefield for a seven-year term to expire June 30, 1954. Senate confirmation followed on July 11 and Commissioner Jones was sworn in September 5.

3. STAFF ORGANIZATION

The Commission operates with four departments—Engineering, Accounting, Law, and Secretary's Departments—augmented by five staff service units—an Executive Officer, a Rules Committee, a Budget and Planning Division, a Personnel Division, and an Office of Information. In general, each department is broken down into broadcast, common carrier, safety and special services and other comparable units to handle those respective phases of licensing and regulation.

Pursuant to the Administrative Procedure Act, the Commission on August 27, 1946, delegated to the Secretary, Chief Engineer, Chief Accountant, and General Counsel (individually and collectively) authority to act on all the matters previously delegated to an Administrative Board, along with other routine jurisdiction, effective September 11. At the same time, Boards of Commissioners were authorized to act in the absence of a quorum of the Commission. As of May 28, 1947, the Commission established an independent Hearing Division to carry out other provisions of the Administrative Procedure Act.

Reorganization of the Engineering Department, announced July 18, 1947, enabled that department to meet changed conditions and, at the same time, permitted utilizing the services of Assistant Chief Engineers for special assignments. Engineering branch chief positions were abolished. All common carrier radio services, in addition to international point-to-point services, were placed under the Radio Section of the Common Carrier Division. Certain treaty functions of the former International Division were transferred to the Frequency Service-Allocation Division. The Marine Division was renamed the Marine Radio and Safety Division. The Emergency and Miscellaneous Division became the Public Safety and Special Services Division, with sections devoted to public safety, land transportation, industrial, and experimental and miscellaneous. A new Radio Operator and Amateur Division was made responsible for all commercial and amateur radio operator matters as well as the proposed citizens radio service. Previously, on June 6, the Commission had created an Industrial Heating, Scientific, and Medical Services Section in the Engineering Department's Emergency and Miscellaneous Division.

On May 9, 1947, the position of Executive Officer was created for the purpose of reviewing the Commission's program and procedures with a view to recommending adjustments for more effective administration of the Communications Act in the public interest, at the least cost to the Government and with a minimum burden on industry; also to coordinate and direct planning, budget, and personnel activities.

4. PERSONNEL

At the close of the fiscal year, the Commission employed 1,328 persons. Of this number, 840 were in Washington and 488 in the field. Engineering Department personnel totaled 717, Accounting 161, Law 100, Secretary 248, and 102 others were engaged in administrative duties.

5. APPROPRIATIONS

Total appropriations received by the Commission for the fiscal year amounted to $6,236,900, including $25,000 for printing and binding.

6. LEGISLATION

There were no amendments to the Communications Act during the fiscal year. However, there was pending before Congress the White-Wolverton bill (S. 1333) to amend the act. This bill, which would make major changes affecting both the organization and functions of the Commission, required careful study and analysis. This included a detailed review of not only provisions of the bill itself, but also of similar bills previously introduced and of the legislative and judicial history of present law which would be affected. The Commission also had before it for consideration and comment a number of additional legislative proposals referred to it by Congress and other Government agencies which would either amend provisions of the Communications Act or would to some extent have a possible bearing upon the performance by the Commission of its functions. These proposals, too, received extensive study and analysis as a basis for appropriate comment.

7. LITIGATION

Twenty-two cases involving the Commission were in the courts during the fiscal year. Two of these were before the Supreme Court; 16 were before the Court of Appeals for the District of Columbia; and 4 were before various district courts.

In one of the Supreme Court cases the Commission's decision was affirmed and the other was pending. The Court of Appeals sustained the Commission's decision in one case; in another case the Commission's decision was sustained in part and reversed in part; one was dismissed by order of the court on motion by the Commission; five cases were dismissed by agreement of the parties, and eight were pending. Of the four cases before various district courts the Commission's position was sustained in two, one was dismissed on motion of the court, and one was pending.

The following cases were of particular interest:

WOKO, Inc. v. *Federal Communications Commission.*—This action involved an appeal by the licensee to set aside a Commission order denying renewal of WOKO's license. The Commission's decision was based on the licensee's failure to furnish true information concerning the ownership of 24 percent of the stock in the licensee corporation and its falsification of information submitted to the Commission concerning the ownership of such stock. The licensee's course of misrepresentation and concealment for a period of approximately 18 years evidenced to the Commission a lack of the qualifications required of a licensee to operate a broadcast station in the public interest. The Circuit Court of Appeals for the District of Columbia reversed the Commission primarily on the ground that such action, without a

consideration of other factors such as the need for the broadcast service and loss of invested capital which the licensee might incur, was beyond the scope of Commission authority. The Commission's petition for a writ of certiorari to review the lower court decision was granted by the Supreme Court on April 22, 1946 (*WOKO, Inc.* v. *Federal Communications Commission*, 153 F. 2d 623), and in December of 1946 the Supreme Court reversed the Court of Appeals and sustained the Commission's decision.

Murray and Meyer Mester v. *Federal Communications Commission.*—This case arose upon the application of Wodaam Corp., licensee of radio statio WOV, for permission to transfer control of the corporation to Murray and Meyer Mester. The application was designated for hearing to obtain, among other things, "full information with reference to the qualifications of the proposed transferees." Upon the basis of the hearing record, which included evidence that the proposed transferees had been involved in several actions by various regulatory bodies of the Federal Government for violations of Federal law in the conduct of their edible oil business and which reflected an extreme evasiveness and lack of candor in furnishing required information, the Commission found that it would not be in the public interest to approve the transfer of control. The proposed transferees appealed to the District Court for the Eastern District of New York and the matter was heard before a special three-judge court as provided in section 402 (a) of the Communications Act. The court granted the Commission's motion for summary judgment February 4, 1947 in an opinion which held that the Commission was authorized to make a full inquiry into the character of a proposed transferee, including involvement in civil litigation and his disposition to be truthful, and to refuse an application for transfer of control if in the light of such inquiry it appears that such transfer would not be in the public interest. (*Mester et al.* v. *United States*, 70 F. Supp. 118.) This decision was appealed to the Supreme Court May 27, 1947.

Churchill Tabernacle v. *Federal Communications Commission.*—This case involved the Commission's refusal to renew a radio station license until a contract between the licensee and Churchill Tabernacle was abrogated. This contract was entered into at the time the licensee acquired the station from Churchill Tabernacle. It provides for certain cash payments each week, reverter of the physical property, reverter of the station license and a reservation of 17½ hours of broadcast time every Sunday to Churchill Tabernacle for a period of 99 years. The Court affirmed the Commission decision with respect to the reverter of the license and the reservation of time, and reversed the Commission with respect to the weekly cash payments and the reverter of physical property. The case was remanded to the Commission to consider possibilities for modification of the agreement in a

manner which would be consistent with the Communications Act. (*Churchill Tabernacle* v. *Federal Communications Commission*, 160 F. 2d 244.)

Calumet Broadcasting Co. v. *Federal Communications Commission.*—This case arose upon the Commission's refusal to grant an application for a new radio station license when it found, after hearing, that the applicant was evasive and deceptive with respect to the company's financial arrangements. The Commission's decision was sustained by the Court of Appeals for the District of Columbia March 10, 1947. (*Calumet Broadcasting Co.* v. *Federal Communications Commission*, 160 F. 2d 285.)

Skywave cases.—These eight cases are discussed as a group since they are all appeals taken by the licensees of class I stations on clear channels who alleged that their stations would suffer daytime skywave interference by reason of the assignment of new stations operating daytime only on the same channel. In the first case it was also contended that the Commission's assignment of a station operating daytime only on the channel presently assigned to station WJR prior to the determination of the clear channel hearing was improper in that it prejudiced WJR's desire to apply for permission to operate with increased power. Oral arguments on three cases was held in which the Commission contended that under its existing Rules and Standards of Good Engineering Practice appellants were not entitled to protection against daytime skywave interference and had not been deprived of a right to hearing contrary to constitutional or any other legal requirements. All of these cases were pending in the United States Court of Appeals for the District of Columbia at the close of the fiscal year. (*Wilson, Inc.* v. *F. C. C.*, No. 9434, U. S. Ct. of Appeals, D. C.; *Courier Journal & Louisville Times Co., Inc.* v. *F. C. C.*, No. 9502, U. S. Ct. of Appeals, D. C.; *National Life and Accident Insurance Co.* v. *F. C. C.*, Nos. 9510 and 9511, U. S. Ct. of Appeals, D. C.; *WGN, Inc.* v. *F. C. C.*, No. 9497, U. S. Ct. of Appeals, D. C.; *Crosley Broadcasting Corp.* v. *F. C. C.*, No. 9501, U. S. Ct. of Appeals, D. C.; *WJR The Goodwill Station, Inc.* v. *F. C. C.*, Nos. 9495 and 9464, U. S. Ct. of Appeals, D. C.)

Hearst Radio, Inc. v. *F. C. C.*—This action involved a suit by Hearst Radio, Inc., licensee of radio station WBAL, in the District Court for the District of Columbia for a declaratory judgment to have certain allegedly libelous matter deleted from the Commission's report of March 7, 1946, entitled "Public Service Responsibility of Broadcast Licensees." Plaintiff requested a preliminary injunction pending a determination of this case, prohibiting the Commission from proceeding with the processing of Hearst's application for renewal of WBAL's license which had been set for consolidated hearing with a mutually exclusive application for the frequency upon which that

station has been licensed to operate. On February 19, 1947, the district court denied the Commission's motion to convene a three-judge court to hear the matter and granted the preliminary injunction sought by Hearst. On April 21, 1947, argument was held before the district court on a motion by the Commission to convene a three-judge court to hear the action or, in the alternative, to dismiss the action for want of jurisdiction. Court decision on these motions was pending on June 30, 1947.

8. STATISTICS

During the fiscal year the Commission received 114,437 applications of all types, not including 27,000 tariff filings and petitions and other papers relating to docket cases. In the same period it disposed of 126,588 applications. On June 30 a total of 6,105 applications were pending as compared with 18,256 on the same date the year previous.

By far the greater number of applications and actions concerned the safety and special radio services (including amateur), for which 106,641 applications were received, 118,311 were disposed of, and 3,595 pending. In the broadcast, 5,336 applications (1,268 for new stations) were received, 5,700 (including 1,619 for new stations) disposed of, and 2,209 (1,146 new stations) pending. In the common carrier field, 2,460 applications were received, 2,507 disposed of, and 301 pending.

Docket statistics show 892 cases designated for hearing, 891 disposed of, and 734 pending. Hearings completed during the year numbered 315.

Field engineering activities located 121 illegal radio operations, traced 6,843 sources of interference, inspected 23,494 ship and land radio stations, examined 80,395 applicants for operator licenses, and conducted technical studies of interference and other problems.

9. BOARD OF WAR COMMUNICATIONS

Having completed its task of coordinating the Nation's radio and wire facilities for war purposes, the Board of War Communications ceased operation on February 25, 1947, by Executive order of the President. At the same time, its few orders and instructions remaining in effect were canceled.

This board, which reported to the President, had no paid personnel or appropriations. The Chairman of the Federal Communications Commission served as its chairman. Approximately 100 different organizations representing Government, industry, labor, and civilian groups were on its various committees. Originally created as the Defense Communications Board on September 24, 1940, the board issued 37 orders in harnessing communciations to the war effort.

CHAPTER II.—RADIO FREQUENCIES

1. RADIO SPECTRUM
2. FREQUENCY SERVICE—ALLOCATIONS
3. GOVERNMENT FREQUENCIES
4. NONGOVERNMENT FREQUENCIES
5. INTERNATIONAL

1. RADIO SPECTRUM

The boundaries of the radio spectrum are determined by the progress of radio. Wartime development of new techniques and apparatus made it possible, in 1945, to raise the radio ceiling from about 300 megacycles to 30,000 megacycles (30,000,000 kilocycles). While all of the frequencies in the extended radio spectrum have present or potential value for communication purposes, the present "top" for practical commercial use is around 10,000 megacycles. In consequence, radio spectrum space is still quite limited.

2. FREQUENCY SERVICE—ALLOCATIONS

A major task of the Commission is to allocate frequencies to meet the increasing demand. There were 39 different radio services in 1947, and this number is growing. It would be wasteful and chaotic to operate one kind of a station on one frequency and another type of service on an adjoining frequency. Sharing of frequencies is often impractical. So, generally speaking, each service has a particular band in which to operate.

The spectrum space between 10 and 530 kilocycles is used largely by radiotelegraph stations and stations which serve as radio beacons for aircraft and ships. The section between 550 and 1600 kilocycles is the familiar broadcast band. Between 1,600 and 25,000 kilocycles are groups of frequencies employed for various experimental, developmental and other special services; and long-distance radiotelephone and radiotelegraph communication between various countries of the world, ships at sea, and planes in the air. Portions of the spectrum between 30 and 30,000 megacycles, besides providing for FM and television broadcasting, are divided between Government and non-Government fixed and mobile services for flexibility in making future frequency assignments.

3. GOVERNMENT FREQUENCIES

Radio stations operated by the Federal Government receive their frequency assignments by Executive order of the President upon the

advice of the Interdepartment Radio Advisory Committee, representing various Government departments and agencies including the Federal Communications Commission.

This committee approved 5,100 new regular assignments and 1,855 deletions of regular assignments in 1946, bringing the total number of assignments recommended by the committee since its establishment to 48,201. Outstanding regular assignments totaled 46,346.

During the year the committee approved 276 changes in assignments, 3,430 temporary assignments and 1,256 deletions of temporary assignments, which are not included in the above figures. A total of 12,466 applications and requests were processed. This work involved Commission personnel serving on the secretariat of the committee.

4. NONGOVERNMENT FREQUENCIES

In the matter of frequency service-allocations to nongovernment radio services, a number of proposed and final allocations were published by the Commission during the year. Some of these required the holding of hearings and oral arguments and, in some instances, informal engineering conferences preceded promulgation of the proposals.

Final service-allocations were made in the following fixed and mobile bands: 30 to 40, 42 to 44, 72 to 76, 152 to 162, and 920 to 960 megacycles. Final allocations were also made for the operation of industrial, scientific and medical devices on seven frequencies between 25 and 20,000 megacycles.

In May 1947, a hearing was held on proposed reallocation of frequencies between 960 and 1600 megacycles to provide adequate spectrum space for an integrated aeronautical navigational system.

5. INTERNATIONAL

Dividing the radio spectrum into bands of frequencies to accommodate the growing number of radio services is not only a difficult domestic problem, but it is also an international problem. Radio waves cross international borders and, therefore, there must be coordination and agreement on a world use.

When there is international agreement as to what the bands for the various services shall be, there must be a division of the assignments within those bands. For example, the bands set aside for radiotelephone and radiotelegraph must be shared by the stations of the United States with the stations of other countries. And the ship bands must be shared, and so must the aviation bands, and the international broadcast bands.

INTERNATIONAL TELECOMMUNICATIONS CONFERENCES

A forward step toward international agreement on such problem was undertaken by the International Telecommunications Conferences,

which opened at Atlantic City, N. J., on May 16, 1947. The United States, as one of the principal users of radio communications and as the host to the delegates from 78 nations attending the conferences, played a leading part in bringing about universal agreement on revisions to international communications regulations made necessary by radio's phenomenal developments.

Considerable time and effort was spent by the Commission in preparing for these conferences, which were called to rewrite the Madrid Convention of 1932 and the Cairo regulations of 1938. This mass of international law which regulates the use of communications on a global basis has largely been made obsolete by subsequent developments.

The Atlantic City session actually consisted of three conferences—the International Radio Conference, the International Telecommunications Conference (also called the Plenipotentiary Conference), and the International High Frequency Broadcast Conference. The Chairman of the Commission was chairman of the conferences, and other Commission representatives served as United States delegates and in other capacities.

The first session, that of the International Radio Conference, opened in May and its task was to completely revise the international technical regulations covering standards, licensing requirements and procedures, operating practices, call signals, matters relating to safety and distress, and a host of other detail.

The second session in chronological order was the Plenipotentiary Conference, which convened July 1. Its agenda called for revising the Madrid Convention, the basic treaty which lays down the principles on which the technical regulations are founded. The International High Frequency Broadcast Conference, the third session, was to consider the matters indicated in its title.

The United States frequency allocation proposal to the Atlantic City session was published in February. One subject which invited high priority at the conferences is high-frequency broadcasting. The number of HF broadcasting transmitters in the world has increased at an unforeseen rate since the Cairo conference. This increase, due to expanded wartime use of broadcasting, came at a time when other radio services also were expanding. The amount of frequency space allocated for this service in no way provided for the increased number of transmitters in use. As a result, numerous countries were operating these stations out of the high-frequency broadcast bands, with resultant interference to other services and other countries. The state of confusion was at its peak during the past fiscal year.

This one problem is enormous, entailing a complete revisal of the Cairo bands, the preparation of numerous plans concerning some type of sharing on a world scale, the establishment of minimum standards of good engineering practice for this service, and an enumeration of

the needs and desires of the nations of the world as regards high frequency broadcasting.

The Commission, together with representatives of the radio industry, the Department of State and other Government agencies concerned, was actively engaged in this work for the entire year. Many allocation plans were drawn up consisting of various methods of frequency time sharing based on such features as the best listening hours in the different countries, geographic separation of the transmitters, and the needs of the countries as evidenced by the number of existing transmitters. These plans had to be many and varied so as to fit into the bands allocated by the International Radio Administrative Conference, and to satisfy any compromise agreement among the nations involved. The bulk of this work formed the basis of recommendations of the United States delegation to the High Frequency Broadcasting Administrative Conference.

Of particular interest to common carriers was consideration at the Atlantic City sessions of matters having to do with priorities for Government international telephone and telegraph messages, provisions dealing with setting up international traffic accounts and settling balances, and tariff and rate aspects of radiotelegraph service with aircraft and ships at sea.

OTHER INTERNATIONAL CONFERENCES

The Commission participated in the Five-Power Telecommunications Conference in Moscow which exchanged ideas between Russia, the United Kingdom, China, France, and the United States preliminary to the Atlantic City sessions.

Commission representatives served as United States delegates and spokesmen to the first session of the Special Radio Technical Division of the Provisional International Civil Aviation Organization held in Montreal in October and November of 1946. This conference was called to consider international standardization of air navigational aids; the accomplishments consisted largely of adoption of functional requirements and technical standards for both equipment and operation. Frequency requirements for civil aviation were studied, and it appeared that the allocation table which the Commission was proposing at that time provided ample spectrum space to meet the requirements of international operations. The conference considered the method to be used in transmitting the statement of frequency needs of international civil aviation to the International Telecommunications Union. It was decided that PICAO should make known its frequency needs only through its member states, and not transmit this information directly to the ITU.

It was revealed that an agreement negotiated between the United States and the United Kingdom in February of 1946 relating to the

operation of distance indicator equipment had not been officially ratified by the United Kingdom. This agreement had provided for the interim use of the 200-megacycle British distance indicator at specified United States gateways until January 1, 1949. The agreement included the state objective of a development program for the 1000-megacycle distance measuring equipment to be participated in by both countries. Since the signing of the agreement, considerable progress has been made in this country in the development of this indicator, and such equipment is now being manufactured under commercial contract.

To clarify this situation, a meeting was held in Washington, April 24 to 29, 1947, attended by representatives of the United States and the United Kingdom and an observer from Canada, for the purpose of working out a mutually satisfactory arrangement for the temporary use of the 200 megacycle British distance indicator in the United States. The new agreement reaffirms the temporary nature of the 200-megacycle distance indicator and provides that it shall not be used in the United States or within interference range of the United States border after January 1, 1954, and that the United States and the United Kingdom are agreed on the use of the 100-megacycle band for the standardization of aeronautical distance indicating equipment.

An International Meeting on Marine Radio Aids to Navigation, likewise participated in by the Commision, was held in New York City and New London, Conn., from April 28 to May 9, 1947, to exchange views on navigational radio aid development and take steps looking toward their standardization throughout the world. Agreements were reached on requirements for radar and position fixing systems. This meeting also recommended very high frequencies for at least one two-way international circuit for radiotelephone communication between ships and for safety and distress purposes.

The Commision was also represented at the meeting of the Eighth Committee of Reporters of the International Telegraph Consulting Committee (CCIT) in London in November 1946, to discuss proposals for revising the International Telegraph Regulations (Cairo 1938) for submission at the International Telegraph Conference, scheduled for 1949.

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CHAPTER III.—RADIO BROADCAST SERVICES

1. BROADCAST STATIONS SOAR IN NUMBER
2. MULTIPLE OWNERSHIP
3. BLUE BOOK CHANGES
4. STANDARD BROADCAST SERVICE
5. FREQUENCY MODULATION (FM) BROADCAST SERVICE
6. TELEVISION BROADCAST SERVICE
7. INTERNATIONAL BROADCAST SERVICE
8. NONCOMMERCIAL EDUCATIONAL BROADCAST SERVICE
9. FACSIMILE BROADCAST SERVICE
10. REMOTE PICK-UP BROADCAST SERVICE
11. ST (STUDIO TRANSMITTER) BROADCAST SERVICE
12. DEVELOPMENTAL BROADCAST SERVICE
13. STATISTICS

1. BROADCAST STATIONS SOAR IN NUMBER

At the close of the fiscal year the number of authorized stations in the standard and nonstandard broadcast services had reached a new peak of 3,551 as compared with 2,439 the year previous. This despite the fact that 123 stations were deleted during the year. Most of the 1,112 stations added in these two general categories were commercial standard and FM (frequency modulation) broadcast stations.

The collective number of standard, FM and television stations slated to render commercial broadcast service increased about 60 percent from 1,701 in 1946 to 2,779 in 1947.

Though standard broadcast stations established a numerical record with 1,795 stations licensed or authorized as of June 30 last, FM grants had jumped to 918. It is noteworthy that new FM station authorizations for the year nearly equalled the number of AM grants.

Authorized commercial television stations increased from 30 to 66, and experimental television stations from 58 to 81. Noncommercial educational station authorizations rose from 24 to 38. International broadcast stations remained at 37.

In the nonstandard broadcast field as a whole there were 1,756 authorized stations of various types, an increase of 532 over the previous year. They were primarily for FM transmission.

2. MULTIPLE OWNERSHIP

Following oral argument in February 1947 on rules and regulations concerning multiple ownership of broadcast stations (Docket 8050), the Commission on April 11, 1947, decided that "public interest would not be served by adoption of an iron-clad rule defining the extent of overlap of service areas or the degree of common ownership, operation or control that would be deemed to be in contravention" to its rules covering standard broadcast, FM and television stations. The Commission announced that it will continue to decide each such case on its own merits.

The rule banning operation of more than one station of the same class in the same area by the same interest or group remained unchanged, also the maximum of six FM and five television stations which can be operated in the country as a whole.

3. BLUE BOOK CHANGES

Pursuant to suggestions made by interested parties, the Commission on July 2, 1946 announced several changes in the definitions of terms used in its report of March 7, 1946 entitled "Public Service Responsibility of Broadcast Licensees." These changes clarified the meaning of types of programs referred to in that so-called Blue Book.

4. STANDARD BROADCAST SERVICE

DEMAND FOR FACILITIES CONTINUES

The fiscal year saw a continued, and unprecedented, demand for standard broadcast facilities. Engineering considerations involved in these applications grow increasingly complex as more assignments are made and more applications are filed. The ingenuity of applicants and their engineers has been taxed to the utmost in their attempts to squeeze into the congested standard broadcast band. The Commission, on its part, has streamlined and expedited procedures in every way possible consistent with essential engineering, legal and other requirements to keep up with the requests for new or increased facilities.

LICENSED STATIONS PASS ONE-THOUSANDTH MARK

In line with the demand for standard broadcast facilities, the Commission made a record-breaking number of grants. New stations licensed during the fiscal year totaled 366. Only 29 were deleted. Thus, the number of licensed standard broadcast stations rose from 961 in June 1946 to 1,298 in June 1947. The one-thousandth license was issued to WIRA, Fort Pierce, Fla., on September 25, 1946.

However, construction permits outstanding at the close of the fiscal year numbered 497, which brought the total number of station grants at that time to 1,795, as compared with 1,215 in 1946. The net result was that nearly 600 new stations were authorized during fiscal 1947, or more than twice the number for the previous year. In addition, 666 applications for new stations were pending.

MORE SMALL LOCAL OUTLETS

Of significance in connection with standard broadcast station grants and applications is the fact that the smaller towns and communities have become increasingly interested in establishing small local outlets. In consequence, a large portion of the new stations are in towns with populations under 5,000.

DAYTIME STATIONS INCREASE

The Commission's rules have always provided for the operation of daytime stations and, from an engineering point of view, a large number of such assignments are still available. Applicants in the past, however, have felt that unlimited time operation was more economic and have accordingly not been particularly interested in daytime stations. But the greatly increased interference problems involved in nighttime operation have resulted in a trend which indicates willingness on the part of applicants to accept daytime facilities when nighttime operation is not feasible. So a large percentage of the new stations have been for day operation only.

TEMPORARY EXPEDITING PROCEDURE

During the 6-month period from July 1946 until December 1946 applications for new stations or major changes in existing facilities were being received at an average of about 140 per month and grants were being made at an average rate of about 50 per month.

In January 1947 the Commission announced the adoption of a temporary expediting procedure for processing an accumulation of complicated applications. It had become almost impossible to make detailed engineering analysis of this group because of the continuous filing of new applications and changes in those pending. It was finally decided that the only method by which these applications could be examined in detail was to provide for the so-called "freeze" period for a 12-week period ending May 1, during which no new applications or new amendments would be given consideration and time would thus be afforded to make up complicated channel studies showing inter-

relationship between stations and applicants on the same and adjacent channels. In setting up this procedure the Commission provided a means whereby the engineering consultants of broadcast applicants cooperated on channel studies reflecting the interference problems involved with their applications, after which it was possible for the Commission's engineers to prepare reports and make recommendations. Announcement of this policy resulted in a last-minute flood of applications which complicated the procedure. The rate at which applications were received rose from the December figure of 140 to 200 in January and reached a record high of 362 prior to the "freeze" period. The rate of filing of applications dropped to 60 during March and about 35 in April but was up approximately 60 for May and June. The peak in handling applications was reached in April, the last month of the freeze period, when a total of 180 applications were granted.

An all-time high of 1,227 applications pending was reached during February 1947 but, as a result of the processing procedure, was reduced to about 925 in April.

HEARINGS

From September 1946 to February 1947 between 35 to 70 applications were designated for hearing per month. Here again the peak during the temporary expediting procedure was reflected in the total of 220 designated for hearing during March and April.

Applications granted as a result of hearings remained at a fairly constant level of about 20 per month from September 1946 to June 1947. The level of applications in hearing remained at about 500 up until March 1947 and on June 30 had risen to about 600.

CLEAR CHANNEL STUDY

The clear channel hearing, begun in January 1946, was scheduled to resume in October 1947. The involved technical studies and other engineering work connected with the hearing were completed and it remained to make an analysis of the service and interference problems involved on the basis of the established standards.

Some of the determinations of interference and service requirements were incorporated as amendments to the Commission's Standards of Good Engineering Practice just before the temporary expediting procedure. Significant changes involve the adoption of new curves for estimating the nighttime propagation characteristics of radio waves in the standard broadcast band. These curves are based on the analysis of data accumulated over the past 10 years. They provide a more accurate way of determining service areas and interference. Other

changes include the adoption of less stringent standards with respect to interference from and between stations on adjacent channels.

NORTH AMERICAN REGIONAL BROADCASTING AGREEMENT

The North American Regional Broadcasting Agreement, which expired in March 1946, was superseded by a temporary arrangement among the signatory countries to continue certain revisions of the entire treaty until a new one could be effected. A conference of the signatories will commence work on drafting a new agreement. The Commission plans to incorporate these changes in its own standards as part of its proposal for revision of the treaty. If a decision in the clear channel hearing affects clear channel allocations such changes will have to be provided for in the new treaty.

GENERAL INTERFERENCE CONSIDERATION

In granting applications, particularly for nighttime operation, the Commission has inclined to authorize stations where little or no interference is occasioned to already existing stations even though the proposed station is subject to interference well over the recommended values of the allocation standards. The view is taken that as long as an applicant is aware of the restrictions that will be placed on his operation because of interference from existing stations, and can install a station without materially increasing interference to other stations, that service should be permitted if the applicant feels that it is feasible from an economic viewpoint.

SKYWAVE INTERFERENCE

A large percentage of daytime stations have been authorized to operate on clear channels. Heretofore the matter of daytime skywave interference has been of no particular significance in that there were so few daytime stations and they were generally so far removed from the dominant clear channel stations that no interference was involved. As a result of the large number of daytime stations now in operation, however, interference to the dominant stations during the so-called transition period from nighttime to daytime and from daytime to nighttime has become a problem necessitating consideration.

For the purpose of obtaining data on the subject, the Commission in June 1947 conducted a hearing in the matter of promulgating rules, regulations and standards concerning daytime skywave transmissions of standard broadcast stations (Docket 8333) which may necessitate further amendments and changes in the engineering standards to take

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care of interference of this nature. A decision with respect to recommended amendments had not been made at the close of the fiscal year.

ECONOMIC STUDY OF STANDARD BROADCASTING

The unprecedented increase in the number of standard broadcast stations caused the Commission in March 1947 to initiate an economic study of that field, which was still in progress at the close of the fiscal year. Its purpose is to provide the industry, licensees and applicants with economic information on postwar conditions. To this end, the report proposes to include consideration of changing conditions; the financial experience of all stations since 1939 as well as the financial experience of new stations; the possible "problem areas"; construction costs and operating expenses of new stations; the relation of broadcast advertising to the total volume of advertising; and, finally, industry trends which may affect the competitive position of broadcast and other media.

STANDARD BROADCAST FINANCIAL DATA

The following table shows comparative calendar 1945–46 financial and employee data for the standard broadcast industry as a whole:

Networks and standard stations	1945—10 networks, 901 stations	1946—8 networks, 1,025 stations	Percent increase or (decrease)
Investment in tangible broadcast property (as of Dec. 31):			
Cost to respondent	$88, 101, 940	$107, 790, 819	22.35
Depreciation to date under present owner	$46, 506, 921	$51, 365, 253	10.45
Depreciated cost	$41, 595, 019	$56, 425, 566	35.65
Revenues from sale of network time	$133, 973, 536	$134, 781, 108	.60
Revenues from sale of nonnetwork time	$176, 510, 510	$199, 297, 806	12.91
Commissions paid representatives, etc	$43, 923, 466	$45, 469, 650	3.52
Revenues from sale of talent, etc	$32, 777, 553	$33, 943, 507	3.56
Total broadcast revenues	$299, 338, 133	$322, 552, 771	7.76
Total broadcast expenses	$215, 753, 845	$246, 086, 525	14.06
Broadcast income [1]	$83, 584, 288	$76, 466, 246	(8.52)
Number of employees of networks and standard stations (as of Dec. 31)	37, 757	40, 026	6.01
Total compensation for the year	$116, 267, 274	$137, 720, 367	18.45

[1] Before Federal income taxes.

Because a substantial number of new stations in their early and less profitable months of operation are included in 1946, trends in the foregoing data may not correspond to the experience of "old" stations. For this reason, comparative data for the 2 years follow for identical stations, i. e., stations which were in operation in both years and which did not change their status during the period with respect to class, time, and whether or not affiliated with a network. The data are shown in terms of averages per station of broadcast revenues, expenses, and income for each class of station, excluding the Nation-wide networks and their 10 key stations.

Standard broadcast stations (*excluding 10 key stations of* Nation-wide networks)	1945	1946	Percent increase or (decrease)
Averages per station:			
Clear channel 50 kilowatts unlimited:			
Number of stations, 40.			
Total broadcast revenues	$1,238,880	$1,245,486	0.5
Total broadcast expenses	769,706	839,900	9.1
Broadcast income	469,174	405,587	(13.6)
Clear channel 50 kilowatt part time:			
Number of stations, 4.			
Total broadcast revenues	743,289	809,665	8.9
Total broadcast expenses	549,657	626,728	14.0
Broadcast income	193,632	182,937	(5.5)
Clear channel 5–20 kilowatts unlimited:			
Number of stations, 26.			
Total broadcast revenues	441,597	472,027	6.9
Total broadcast expenses	338,130	397,236	17.5
Broadcast income	103,468	74,791	(27.7)
Clear channel 5–20 kilowatts part time:			
Number of stations, 2.			
Total broadcast revenues	392,789	393,202	.1
Total broadcast expenses	282,722	314,552	11.3
Broadcast income	110,067	78,650	(28.5)
Regional unlimited:			
Number of stations, 278.			
Total broadcast revenues	332,820	354,678	6.6
Total broadcast expenses	223,924	251,502	12.3
Broadcast income	108,877	103,176	(5.2)
Regional part time:			
Number of stations, 47.			
Total broadcast revenues	179,890	191,641	6.5
Total broadcast expenses	139,843	156,424	11.9
Broadcast income	40,056	35,217	(12.1)
Local unlimited:			
Number of stations, 416.			
Total broadcast revenues	96,735	115,794	19.7
Total broadcast expenses	73,361	88,569	20.7
Broadcast income	23,374	27,225	16.5
Local part time:			
Number of stations, 18.			
Total broadcast revenues	55,404	72,106	30.2
Total broadcast expenses	45,013	56,658	25.9
Broadcast income	10,391	15,448	48.7
All stations:			
Number of stations, 831.			
Total broadcast revenues	249,114	268,584	7.8
Total broadcast expenses	171,482	195,179	13.8
Broadcast income	77,633	73,404	(5.5)

All broadcast income shown is before Federal income taxes.

The following table compares the 1945–46 broadcast revenues, expenses, and income of the four Nation-wide networks and their key stations:

4 Nation-wide networks and their 10 key stations	1945	1946	Percent increase or (decrease)
Total broadcast revenues	$85,151,875	$86,494,599	1.58
Total broadcast expenses	67,001,351	71,708,921	7.03
Broadcast income (before Federal income taxes)	18,150,524	14,785,678	(18.54)

The distribution of the 1946 broadcast revenues and broadcast income as between networks and stations is here shown:

Distribution of total broadcast revenues

	Amount	Percent
Networks, including 29 owned and operated stations	$101,968,989	31.6
Networks, including 10 key stations	88,010,128	27.3
19 other network owned and operated stations	13,958,861	4.3
996 other stations	220,583,782	68.4
801 stations serving as network outlets	189,236,437	58.7
195 stations not serving as network outlets	31,347,345	9.7
Total broadcast revenues	322,552,711	100.0

Distribution of broadcast Income (before Federal income taxes)

	Amount	Percent
Networks, including 29 owned and operated stations	$19,344,123	25.3
Networks, including 10 key stations	14,837,877	19.4
19 other network owned and operated stations	4,506,246	5.9
996 other stations	57,122,123	74.7
801 stations serving as network outlets	53,185,098	69.6
195 stations not serving as network outlets	3,937,025	5.1
Total broadcast income	76,466,246	100.0

5. FREQUENCY MODULATION (FM) BROADCAST SERVICE

GROWTH OF FM BROADCASTING

The fiscal year witnessed a tremendous spurt of activity in FM broadcasting, further demonstrating the important role this new and superior broadcast service is assuming in the postwar era.

The number of FM stations on the air rose from 55 on July 1, 1946, to 238 a year later. Total authorizations doubled—from 456 to 918, indicating that a thousand FM stations may soon be in operation. Those already authorized or applied for will provide FM program service to more than 500 communities and surrounding rural areas, including every State except Montana.

Although the workload in this field has increased proportionately, the Commission has endeavored to process FM applications as promptly as possible and otherwise assist in getting FM service established throughout the Nation. Under the Commission's conditional grant policy, FM stations can go on the air as quickly as they can get their transmitters up.

FM APPLICANTS

As of March 1, 1947, three-fourths of all FM applications were from standard broadcast interests, and one-third were from newspapers,

23 percent of which were in the standard broadcast field. These groups are in a position to support the new industry until it reaches profitability. Standard broadcasters have an advantage in being permitted, thus far, to transmit their programs over their FM facilities. Since FM channels can accommodate more stations than are available in the AM band—50 to 100 percent more per city—there is little danger of AM interests monopolizing FM, but certain regulations have been adopted to encourage new entries in the FM field.

FM CONSTRUCTION

Production of FM transmitting equipment increased rapidly during the year, but most FM stations on the air have not completed full construction and are employing low-powered equipment on a temporary basis. FM transmitters are generally built so that higher power amplifiers may be added as desired or as equipment becomes available. The Commission has encouraged interim operation with available equipment in order that FM service may be provided in as many areas as possible.

Because of the difficulty in getting equipment and due to other construction delays, several hundred requests for extension of construction time were granted. Many of these were in connection with modifications. Under Commission regulations, permits for all types of broadcast stations call for construction starting within 2 months and completion within 8 months. The Commission sent inquiries to FM permittees on their construction status, and has not granted the full extension of time requested in all cases.

FM FREQUENCIES, CHANNELS, AND STATIONS

FM broadcast is between 88 and 108 megacycles. FM standards adopted in 1945 provided for the assignment of alternate channels with a 400-kilocycle separation of stations in the same area. Separate blocks of frequencies were allocated for community (now class A) and metropolitan-rural (now class B) stations.

In June 1947 changes were made in the assignment of frequencies to provide for a class B station in every fourth instead of every other channel—in other words, for an 800-kilocycle instead of 400-kilocycle separation for stations in the same area. Class A and class B stations are now interspersed, and the former are allocated in the same manner as class B stations by interference contours rather than by mileage separation.

This revision was adopted after it was found that operation on alternate channels produced some interference in receivers then being produced. It was accomplished by trading channels within one area for those in other areas. No city lost channels, and some evincing need

actually gained. Transmitters in use required no change except readjustment and retuning.

The great bulk of FM applications thus far have been for the higher-powered class B stations which are designed to render service primarily to a metropolitan district or principal city and the surrounding rural area, or to a rural area removed from large centers of population. At the end of May 1947, applications for class B stations outnumbered those for class A by almost 6 to 1 (898 class B to 154 class A).

While linking of FM stations through rebroadcasts is not new, the first large scale regional operation was launched by the Continential Network on March 26, 1947. Its operation subsequently embraced 27 stations in the northeastern part of the country.

Following a hearing, the Commission in July 1946 reserved until June 30, 1947, every fifth channel in cities or areas which had been allocated five or more channels. In March 1947 this policy was extended to include 4 out of the 20 channels designed to serve communities and adjacent areas. This reservation plan was to permit latecomers to receive consideration with other applicants for channels in areas where the demand exceeds the supply.

FM RECEIVERS

FM receiver production in 1946 was limited, due principally to the large production of table model standard sets. As a result, only 181,000 FM receivers were manufactured during that calendar year, or 1.4 percent of the total of all sets made. During the first half of 1947, however, FM set production was intensified, and the industry estimated that approximately 2,000,000 would be manufactured in 1947. Indications were that FM would be included in nearly all future console models, as well as in an increasing proportion of table models.

It is important to the full development and utilization of FM broadcasting that receiving sets be available at the lowest possible cost. The appearance of reasonably priced combination AM-FM sets gives promise that the benefits of FM reception will soon be available in varied price brackets. Meanwhile, converters have appeared which make it possible for AM sets to receive FM programs.

Since FM service under the station allocation and assignment system depends, to a large extent, on the selectivity of FM receivers, the Commission is sample testing the latter as they are manufactured in order to have information on this subject.

6. TELEVISION BROADCAST SERVICE

TELEVISION STATIONS

Six television stations held licenses at the close of the fiscal year, with 60 construction permits outstanding and 9 applications pending.

In addition to the six licensees, six newly constructed stations were also furnishing program service. Thirty-three large metropolitan areas and three smaller cities either had or will have service from the television stations licensed or building. The Commission continued to relax its requirement of a minimum of 28 hours of program service by each station per week.

TELEVISION DEVELOPMENTS

Of interest to the industry was the expansion of the coaxial cable system, the development of microwave equipment for relay pick-up and studio-to-transmitter links, improvement in tubes, and the increasing number of technicians trained in television and related work. Television demonstrations during the year included its use as an instructional aid in schools and hospitals, televising pictures in art galleries, on-the-spot news shots, and large screen theater television.

TELEVISION RECEIVERS

During the war there were only about 10,000 television receivers on the market, about one-half of these being in the New York area. At the close of fiscal 1947 an estimated 50,000 sets were in the hands of the public, with the bulk in cities having television broadcast service. The television audience was estimated at 300,000. Receivers varied in price from about $250 for table models to $2,500 for the large floor models. Their viewing screens ranged from 5 to 24 inches in size.

COLOR TELEVISION HEARING

This proceeding arose from a petition of the Columbia Broadcasting System, filed September 27, 1946, seeking operation of its (Columbia's) particular color television system in the ultra-high frequencies of 480 to 920 megacycles, currently employed for television experimentation.

Hearing was held in Washington, New York, and Princeton, N. J., at intervals between December 9, 1946, and February 13, 1947. During its course, the Radio Corporation of America demonstrated another color television system still in the laboratory stage but for which it claimed certain advantages.

The CBS petition was denied on March 18. While recognizing the advances that have been made in color television development, the Commission concluded that further experimentation is needed. It was also of the opinion that there may be other systems which offer the possibility of cheaper receivers and use of narrower band widths.

Before a new system of television is established it must be given adequate field testing. There is a great difference between laboratory performance with trained personnel and home operation by the average citizen. Also, decision must be made on standards. Otherwise the public could not purchase receivers with any assurance that they

would be able to receive programs from all television stations, or that their sets would not become useless if the existing station should change any of the fundamentals. So, before approving proposed standards, the Commission must be satisfied not only that the system proposed will work but also that it is as good as can be expected within a reasonable time to come.

The method of transmitting color is only one of the many principles that must be fixed. Additional considerations cover number of lines, frame rate, type of sound system, etc. In all of these things the receiver must be constructed to "key" with the transmitter in order to receive the program. If at any time a broadcast company should change these standards, the receivers it previously served would become useless. Unlike the automobile or vacuum cleaner, which remains capable of operation long after a new model is brought out, a basic change in the television system would immediately render obsolete all receivers built for the old standards.

Because of these and other considerations, the Commission was of the view that the standards proposed by CBS should not be adopted. The evidence did not show that they represented the optimum performance which may be expected of a color television system within a reasonable time. In addition to the need for adequate field testing, the Commission judged Columbia's color system deficient in picture brightness, flicker, frame rate, color break-up, and receiver design. It also pointed out that, because of the nature of color television, there are not enough frequencies available in the 480 to 920 megacycle band for more than one color television system.

The Commission's decision served as a go-ahead signal for expansion of black and white television service on the basis of present rules and standards in the 13 channels between 44 and 216 megacycles now allocated for commercial television. This should encourage manufacturers of monochrome equipment to proceed at full pace and, at the same time, enable the public to buy receivers with confidence that they will continue to give service. Meanwhile, the door is left open for further color television experimentation and development.

TELEVISION FREQUENCY SHARING

The Commission's report of May 1945 on frequency allocations provided for sharing of 10 of the 13 television broadcasting channels between 44 and 216 megacycles with non-Government fixed and mobile services, and two others with Government services. This plan was adopted on the recommendation of the radio industry, as represented by the Radio Technical Planning Board, in the allocations hearings of 1944–45. Services to share with television included police control and relay circuits, point-to-point, marine control circuits, forestry fixed circuits, rural telephone, and railroad terminal and

yard operations. In addition, adjacent channel assignments went to such services as amateur, urban transit, and power and petroleum.

Subsequent experience indicated that this sharing is impractical. As more and more services moved into the space set aside for them, it became increasingly evident that interferences of many sorts would occur. The problems involved amateur interference to television receivers, harmonic interference to and from television stations, co-channel interference from sharing services, receiver interference due to receiver oscillation, etc.

On June 10 and 11, 1947, an informal conference discussed interference in connection with television sharing and allied problems. The Commission furnished evidence of the seriousness of the situation. Motion pictures were shown of the deterioration to the television picture under shared and adjacent channel operations, using such services as a mobile transmitter, diathermy machines, etc. The amateur interference and television harmonic interference to air navigation aids also received attention.

Industry representatives offered testimony, exhibits, and suggestions as to possible solutions. Several plans for reallocation of the spectrum portion in question were discussed but all had fundamental weaknesses. The conference ended with the conclusions that (1) interference to television was serious, and (2) channel sharing was impracticable. It was recommended that the Radio Technical Planning Board's television panel work jointly with the Commission's Engineering Department in preparing an allocation plan for later submission to the Commission.

EXPERIMENTAL TELEVISION SERVICE

Television experimentation and research was at an accelerated pace. This included work on propagation studies, development of transmitters, receivers, antennas, and allied equipment, new and simpler circuits, utilization of techniques developed during the war, such as pulse modulation, color transmission by various systems, stratovision (relay broadcast from planes), and the study of shadow and multipath effects. Interests involved in this work ranged from individual radio engineers to large manufacturing companies.

At the end of the fiscal year there were 64 experimental television stations licensed and 17 outstanding construction permits. Included in these figures were 53 relay stations used primarily as remote pick-up, studio-to-transmitter links, and multiple-hop relay transmitters.

TELEVISION REMOTE PICK-UP BROADCAST STATIONS

Progress in television has spelled the need for a system of relaying programs from remote points to the transmitter, and from the studio to the transmitter if the two were not at the same location. Wired services, if available, would result in a loss of picture definition since

they cannot pass the wide band of frequencies necessary in television. Consequently, the Commission tentatively set aside the frequencies of 1295 to 1425, 6875 to 7125, and 12,700 to 13,200 megacycles for such services. Subsequently, the aviation interests requested the use of the first-named band for air navigation aids.

Transmitters have been produced for use in the 7000-megacycle region using the klystron principle and are now available for relay work. At the end of the fiscal year there were 16 such stations operated by television broadcasters. Since the allocation of these frequencies is not final and since no rules or standards have as yet been adopted, these stations are experimental until such time as a regular service of this nature is authorized.

TELEVISION NETWORK OPERATION

One problem facing television is the lack of intercity relay facilities for network operation. In television, even more so than in standard and FM broadcast, there is urgent need for such a service for economic reasons. Ordinary wire services are not satisfactory; television relay requires a coaxial cable or a microwave system. The American Telephone & Telegraph Co. has a coaxial cable link operating experimentally between New York and Washington as part of a proposed national system.

Many broadcasters wanted to know when they could expect cable links to important sources of programs, such as New York and Hollywood. Others expressed dissatisfaction with proposed coaxial cable rates. Consequently, the Commission called an informal engineering conference on June 9, 1947, to enable common carriers to indicate when they would be able to supply coaxial cable or microwave relay service and television broadcasters and construction permit holders, on their part, to forecast the time they would desire network facilities.

Some broadcasters expressed a desire to build their own networks because of the unavailability of relay service or what they deemed to be excessive coaxial cable rates. The Philco Corp. had an experimental relay link between New York and Philadelphia. During the fiscal year, this company and the General Electric Co. obtained authority to operate other links between New York and Washington, and between New York and Schenectady. They propose to use ultra-high frequency transmitters, directional antennas, and several hops or relay points.

7. INTERNATIONAL BROADCAST SERVICE

The 37 international broadcast stations continued to be programmed and operated by the Office of International Information and Cultural Affairs of the Department of State. This control was limited by the Seventy-ninth Congress to provide in part that "funds herein appro-

priated shall not be used to purchase more than 75 per centum of the effective daily broadcasting time from any person or corporation holding an international shortwave broadcasting license from the Federal Communications Commission without the consent of such licensee * * *."

On the basis of this limitation, the World Wide Broadcasting Corp. operated two stations, WRUL and WRUW, on a private basis for about 3 hours per day. Program hours were slightly reduced on the 35 other stations operated by 7 broadcasting companies.

The shortage of frequencies continued to exist in this service, requiring continuation of broadcasting on frequencies formerly assigned to other services. However, many frequencies were returned to former users, notably the common carriers. This forced the use of frequencies not assigned to international broadcasting in this country yet permitted by the Cairo Conference of 1938.

Among the activities of this service were the broadcasting of meetings of the Security Council, the Economic and Social Council, the Atomic Energy Commission, and the Health Commission of the United Nations, broadcasts of the Armed Forces Radio Service and the Bikini bombing test, the inauguration of broadcasts to Soviet Russia via Munich relay stations, and the operation in regular service of two 200-kilowatt stations on the west coast. Many international programs were rebroadcast by several domestic standard broadcast stations.

8. NONCOMMERCIAL EDUCATIONAL BROADCAST SERVICE

Stations in this service are licensed primarily to school systems and universities for the purpose of providing educational programs to school systems, but are also used to furnish educational and entertainment programs to the public.

The 20 channels between 88 and 92 megacycles allocated for this service are a part of the FM broadcast band, and FM sets used by the public and by school systems will, therefore, receive both regular commercial FM and noncommercial educational FM broadcast. The rapid growth of commercial FM broadcasting should provide an impetus to the greater use of FM in serving the needs of education.

Eight noncommercial educational FM stations were in operation at the close of the year and construction permits for 30 additional stations were outstanding. In addition, seven applications were pending. Fifteen new stations were authorized during the year.

A number of State-wide FM educational networks were planned, including both Stated-owned and municipally-owned stations. Establishment of many educational FM stations has been delayed by lack of appropriations for actual construction.

9. FACSIMILE BROADCAST SERVICE

Printed matter and pictures may be received by using facsimile receivers and recorders within the service areas of facsimile broadcast stations, and equipment now developed permits excellent quality and speed of reproduction.

Since facsimile transmitters and receivers have a "lock-and-key" relationship, as in television, transmission standards must be established so that any receiver will operate from any station in its area. A number of industry meetings were held during the year, and in June 1947 the Radio Technical Planning Board submitted proposed standards to the Commission. These standards would provide for facsimile transmission by FM stations in the 88- to 108-megacycle band during hours not used for aural broadcasting. The Commission requested that further experimental operation and demonstrations be conducted, however, since there was a difference of opinion as to whether both 8.2″ and 4.1″ images should be provided with the same line rate of 105 lines per inch, and since only a limited amount of experimental operation had been conducted to determine public preference on this subject.

Pending the establishment of standards, facsimile broadcasting continued on an experimental basis. In addition to three prewar experimental facsimile stations operating in the 25-megacycle band formerly allocated to this service, several FM broadcast stations have from time to time experimented with facsimile. These transmissions have been correlated with facsimile receivers set up in various public places, and a considerable amount of interest has been evinced.

Provision has also been made for experimental facsimile operation in the 470 megacycle range but no activity therein has been indicated.

10. REMOTE PICK-UP BROADCAST SERVICE

Broadcast stations in this service are usually low-powered mobile units, used to provide a program circuit between points of temporary program origination and the main broadcast transmitter. For example, remote pick-up transmitters are often employed for reporting golf tournaments, auto and boat races, street broadcasts, and similar events. During the fiscal year 46 applications for new stations were granted, bringing the total number authorized to 583. Frequencies are allocated for these stations in several parts of the spectrum. These assignments are currently under revision as a part of the over-all allocation studies.

11. ST (STUDIO-TRANSMITTER) BROADCAST SERVICE

ST broadcast stations are required in some instances to provide program circuits between the studio and the transmitter of an FM broad-

cast station, since FM transmitters are sometimes located where telephone wires are not available or adequate for program transmission. ST stations are also authorized for use with international broadcast stations. The band of 940 to 952 megacycles is allocated for this purpose, and equipment is now under development. Until such equipment is available, a number of FM stations have been authorized to use temporary equipment on other frequencies. ST stations previously authorized in the 530-megacycle range are continuing to operate there pending their conversion to the new ST band.

12. DEVELOPMENTAL BROADCAST SERVICE

Development broadcast stations are authorized when experimentation with broadcast equipment requires radio transmission. These stations are also used in connection with the testing of antennas and in the conduct of radio propagation measurements and studies. Activity in this service fluctuates. There were 24 such stations at the close of the year.

13. STATISTICS

The following tabulation shows authorized stations (licensed or holding construction permits) by various classes in the broadcast service for the last 2 fiscal years:

	1946	1947	Increase
Standard (commercial)	1,215	1,795	580
FM (commercial)	456	918	[1] 462
FM (experimental)	1	0	(−1)
Television (commercial)	30	66	36
Television (experimental)	58	81	23
Noncommercial educational	24	38	14
International	37	37	0
Facsimile (experimental)	3	3	0
Remote pick-up (formerly relay)	573	583	10
Studio transmitter (ST)	7	5	(−2)
Developmental	34	24	(−10)
Class II (experimental)	1	1	0
Total	2,439	3,551	1,112

[1] Includes 260 conditional grants.

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CHAPTER IV.—SAFETY AND SPECIAL RADIO SERVICES

1. GENERAL
2. AERONAUTICAL RADIO SERVICES
3. MARINE RADIO SERVICES
4. EMERGENCY RADIO SERVICE
5. UTILITY RADIO SERVICE
6. RAILROAD RADIO SERVICE
7. MISCELLANEOUS RADIO SERVICES
8. EXPERIMENTAL RADIO SERVICES
9. STATISTICS

1. GENERAL

In addition to broadcast, radio is now used for an increasing number of other purposes. This is reflected in the safety and special services. The majority of stations in this category operate as direct and vital aids in safeguarding lives and property in conjunction with air, sea, and land transportation, and in police, fire, and forest protection. Other stations function in established or proposed services for industrial and general public benefit. Still others are concerned with the development of new equipment and new uses for radio.

One of the Commission's most challenging tasks is faced in finding spectrum space for new services as well as accommodating the expansion of existing services.

2. AERONAUTICAL RADIO SERVICES

The fiscal year witnessed the greatest annual increase in civilian aviation activities as far as the Commission is concerned. The total number of applications in the various types of aeronautical radio services increased from 11,672 in 1946 to 24,280 in 1947. Aircraft and ground radio stations together numbered 15,843.

This brought many new problems and, among other things, made necessary a complete revision of the Rules and Regulations Governing the Aeronautical Radio Services, effective May 1, 1947. An informal conference in this connection provided the first opportunity for a discussion of postwar civil aviation radio needs with a representative group of aviation interests.

Another major and continuing activity involves conferences with the International Civil Aviation Organization (ICAO). These have been directed toward the best utilization of frequencies, new aids to air

navigation, search and rescue, and radio equipment and licensing standards. This was a forward step in the direction of world agreement of frequencies, standardization of equipment, and uniform procedural practices.

AIRCRAFT RADIO

The largest increase in the aeronautical radio services was that of private aircraft. There were 14,627 authorized radio stations on planes at the close of the fiscal year as compared with 5,200 in 1946, and of the former 13,011 were private aircraft.

The growth of air traffic and associated communications created a need for additional spectrum space on the very high frequencies. This problem was referred to the Radio Technical Committee for Aeronautics. After numerous conferences, the RTCA recommended an allocation plan for the frequency band 108 to 132 megacycles which, after due consideration, was adopted by the Commission on October 25, 1946.

Much of the military surplus radio equipment was not applicable to civilian aviation. Consequently, it was necessary to assist the flying public in determining what apparatus would suit its needs. Study and tests indicated that no transmitters of this class, except that employing crystal frequency control, would meet requirements. In view of this, the Commission on April 28, 1947, announced a policy on non-crystal controlled equipment.

Purchasers of new aircraft with factory-installed radio equipment were formerly inconvenienced by delay in procuring a license from the Commission. To remedy this, the Commission on October 10, 1946, inaugurated a plan by which the manufacturers, dealers, or distributors of new radio-equipped aircraft could issue at the time and place of sale a 30-day special temporary authorization for flight use while a license was being obtained.

Methods of expediting action in aviation radio matters during 1947 included the simplification of procedures for obtaining aircraft operators' permits, easing the licensing procedure for scheduled aircraft equipment by reclassifying transmitters of the same type to permit interchange of equipment, and issuance of identical licenses to all aircraft operated by the same air line. This streamlining is largely responsible for the fact that only about 17 percent of all aviation applications now require attention at professional level. The remaining 83 percent can be processed by the clerical staff. This is in marked contrast to the situation at the beginning of the year when approximately 77 percent required detailed attention.

Expansion of air traffic in the international field caused the Commission to authorize blanket use by United States planes of frequen-

cies assigned to foreign aeronautical stations, if certain conditions are met.

Due to the shortage of available call letters, a plan was tentatively adopted on January 30, 1947, which, when necessary rule changes are made, will, among other things, no longer assign call letters from the international series to private aircraft stations; instead, they will be identified more simply and conveniently by the aircraft registration number.

For private communication between individuals aboard planes in flight and persons on the ground, the "public service" type of station has been provided to connect with the land-line telephone or telegraph system.

Public service aircraft stations on transport planes engaged in overseas flight have been authorized to operate on the frequencies available to ship-telephone and ship-telegraph stations. One air line is experimenting with two-way telephone service. Another is offering telegraph facilities. Since the first application in the air carrier public service was granted June 20, 1946, a score of stations have been licensed.

AERONAUTICAL LAND AND AERONAUTICAL FIXED RADIO STATIONS

These stations provide nongovernment ground-to-air and point-to-point communication relating solely to actual flight needs. Also, domestic scheduled air carriers are required to maintain two-way ground-to-aircraft radiotelephone communication at terminals and other points necessary to insure contact over the entire route. These are independent of radio facilities provided by Government agencies.

There were 1,435 aeronautical land and aeronautical fixed radio stations at the close of fiscal 1947, an increase of 524 since the same period in 1946.

Attention is being given to the frequencies employed for this type of service. It must resolve the "chain" versus the "area" concept of assignments, or perhaps a combination of both, as well as better utilization of frequency characteristics.

Conferences between Aeronautical Radio, Inc., and the Civil Aeronautics Administration resulted in agreement to dismiss the applications of the former (Docket 6988) for aeronautical ground radio facilities to serve overseas flights at New York City. This case raised the broad question of whether radio facilities at aviation gateways in this country employed for the operational control of aircraft on international flights should be operated privately or by the Government. The applications were granted in part subject to consideration of services with higher priority and without prejudice to future applications by nongovernment agencies for like facilities at other points.

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AIRDROME CONTROL RADIO STATIONS

As the name implies, these stations are concerned with regulating the movement of aircraft within the control area of the airport involved and in providing ground communication for final approach and landing. Since many aircraft may be in the air at various altitudes in approaching or leaving the airport from different directions, the process of directing each plane to a common landing point is essential to safeguarding life and property.

The frequency band 118.1 to 121.3 megacycles was made available for such stations. Since the CAA uses these frequencies for the same purpose, a plan of allocation and coordination was prepared and is now in effect.

At the close of the fiscal year 58 of these air traffic control stations held licenses. This compared with 45 stations for 1946.

AERONAUTICAL MOBILE UTILITY RADIO STATIONS

These are mobile stations used at airdromes for communicating with the control tower, ground vehicles and aircraft on the ground. They are necessary in insuring the safe, coordinated movement of surface vehicles on the field. The first application for this type of station was granted on February 26, 1947, and 18 stations were so licensed by the close of the fiscal year.

AERONAUTICAL NAVIGATION RADIO STATIONS

Operation of these stations involves the transmission of special radio signals to assist in determining aircraft position with particular reference to collision hazards. Included are radio beacons, radio direction finders, radio ranges, localizers, glide paths, markers, and ground control approach stations.

Although most such stations are operated by the Federal Government, the Commission had licensed 19 navigational nongovernment stations by the end of the fiscal year. These stations are installed at places not served by Government stations or airline flying schools. In 1947 the airlines had in operation two instructional "instrument landing systems" and one "ground controlled approach station". The latter is licensed experimentally to determine the most effective method of operation. However, the CAA has approved navigational use of this installation by airlines.

An immediate objective of American aviation is to provide safe and efficient air travel under all weather conditions. There is need for a standard integrated system of electronic aids to air navigation and traffic control. At the present time no single integrated system, either proposed or in development, is capable of fulfilling all of the required functions. In May 1947 the Commission held a public hearing on the question of revising the existing frequency service allocations to make

the entire band 960 to 1600 megacycles available to the aeronautical navigational service. This band is considered by aviational development agencies to be the most suitable for the purpose. Since it must ultimately be integrated into a world-wide system of frequency allocations, final decision awaited international coordination.

FLYING SCHOOL RADIO STATIONS

Due to the increased interest in aviation and since many veterans are taking flying instructions under the G. I. Bill of Rights, flying schools and soaring societies have multiplied since the close of the war. There were 15 licensed flying school radio stations in 1947 as compared with five the year previous.

FLIGHT TEST RADIO STATIONS

There is rapid development of aircraft and associated equipment which must be tested extensively under flight conditions to determine suitability for aviation needs. For final flight testing, communication with the ground is required to impart instructions and to log pertinent data. Frequencies have been provided for this purpose. Eighty-two such stations were licensed as of June 30, 1947.

3. MARINE RADIO SERVICES

FREQUENCY ASSIGNMENTS

The scarcity of radio channels is still a serious problem in the marine field which depends upon a variety of services utilizing radiotelephony and radiotelegraphy for communication between ships and between ship and shore stations.

It is becoming increasingly difficult to make coastal station frequency assignments which will permit interference-free contact with ships. Frequency allocation proposals of the United States to the International Telecommunications Conference may alleviate this situation somewhat, since they are designed to provide for a more effective utilization of maritime mobile frequencies through the use of exclusive bands. Supplemental proposals aim to more evenly distribute message traffic through the available frequency space between 2 and 25 megacycles.

Development of nine very high frequency channels in the 152 to 162 megacycle band is progressing, and it is believed that more extensive use of this band will relieve congestion between 2 to 3 megacycles where approximately 9,000 radiotelephone-equipped vessels now operate. A number of problems are involved in the full development of this band, such as determination of its functions, procedures to be used, and the most efficient frequency assignment plan consistent with the availability of equipment. Another problem is whether private or common

carrier operation is to be preferred. Many of these questions are raised in pending applications which were designated for a consolidated hearing, the outcome of which should provide the basis of future policy.

During the year an additional medium-high frequency used extensively in ship-to-shore radiotelephone service was also made available to ships operating in Alaskan waters for communication with coastal stations. This action benefited Alaskan fishing craft and the Army's Alaska Communication System.

NEW MARINE RADIO DEVICES

The Commission is continuing study of the value and application of new marine radio aids, particularly those developed during the war, to determine whether their use should be required in furthering safety of life and property. In this conection the Commission considers the technical characteristics and operational performance of equipment, its value to navigation, and the economic factors of installation, such as weighing costs against benefits.

One result of these studies was to remove ship radar from experimental to regularly established use. Indications are that considerable time has been saved in ship operation by the ability of radar-equipped vessels to navigate under conditions of low visibility. Six manufacturers were producing commercial type marine radar sets and approximately 200 licenses were granted to use such devices on shipboard.

A number of United States vessels employ special receiving equipment for loran (long-range aid to navigation). Also a war development, this system has its greatest value in accurately navigating vessels during overcast when celestial observations cannot be made. No transmitting equipment is needed on board ships for this purpose.

RADIO TECHNICAL COMMISSION FOR MARINE SERVICES

The Commission participated in the establishment of a Radio Technical Commission for Marine Services. Comprised of Government and industry representatives, this organization is an advisory body for coordinated study of problems covering all phases of marine communications and electronic navigation systems and to foster radio developments to meet marine operating requirements. During the fiscal year the RTCMS completed a study of modulation systems for very high frequency marine radiotelephony and recommended that FM be adopted for the maritime mobile service within the frequency range of 30 to 300 megacycles.

MARINE RADIO INTERFERENCE

Several cases of radio interference involving the marine services were investigated and appropriate steps were taken looking toward

their elimination. Examples are coastal stations transmitting on frequencies which interfere with broadcast reception due primarily to poorly designed receivers operating near the coastal station, as well as cases of unauthorized harmonic radiations of ship stations. The latter, which normally interfere with other communication services, is sometimes caused by faulty transmitting equipment and at other times is due to the close proximity of operation of the two services.

MARINE RADIO EQUIPMENT DEVELOPMENT

One improved commercial type of automatic alarm receiver designed for use on ocean vessels was being tested by the Commission. Devices of this nature are normally operated on cargo ships while the radio operators are off duty, for alerting the latter whenever distress signals are received.

Type approval was granted to one new ship radio receiver.

RADIO AID IN SEA DISASTERS

The year witnessed many instances in which aid was summoned by radio for vessels in distress. In addition, numerous urgent messages were sent relative to the safety of a vessel or persons on board. Among the cases in which radio was of direct importance in the saving of life and property were disasters involving the steamship *Oakey L. Alexander*, off Cape Elizabeth, Maine, on March 3, 1947, the steamship *Fort Dearborn*, in the West Pacific, on March 12, 1947, and the schooner *Catherine L. Brown*, off the Virginia Capes on February 27, 1947.

EXEMPTIONS

The Commission is empowered to exempt vessels from prescribed radio requirements under certain conditions. Many of these are small boats without adequate facilities for radiotelegraph installations. Applications for exemption during the year numbered 41, of which 35 were granted. This was 122 percent more than in 1946. Two area exemptions covered vessels of less than 100 gross tons navigating waters between Indian River Inlet, Del., and New York harbor, and betwen Naples, Fla., and New Orleans. Exemption previously granted all vessels up to and including 15 gross tons was renewed for 1 year.

WAIVERS

To facilitate the temporary use of cargo ships to carry passengers in the national interest, the Commission permitted portable in lieu of permanently installed motor lifeboat equipment in 119 instances for periods ranging from 30 to 90 days. Most of these covered single voyages when permanent equipment was not available. Authorizations of this kind represented a 240 percent increase over the year previous.

RULE CHANGES

Rules governing ship and coastal services were revised to more closely reflect peacetime needs and advancements in the radio art. The Commission abolished the requirements that ships carry emergency antennas but retained provision that ships have "safety links" to protect their main antennas. Another rule change permits ships auto-alarms to be connected to the emergency transmitter power supply, thus eliminating the need of a storage battery for this purpose.

Several rule sections were modified to implement the establishment of 8280 kilocycles as an interim long-range distress frequency pending adoption of a suitable international distress channel in the high frequency band. This should facilitate distant reception and increase the likelihood that signals from survival craft will be heard.

SHIP RADIO STATIONS

An all-time peak of 10,989 ship radio stations were licensed as of June 30, 1947, an increase of 37 percent over 1946. About one-fourth of this number fell within the "compulsory" classification (ships compelled by law to carry radio for safety purposes), and the remainder represented voluntary installations on yachts, fishing boats, tugs, towboats, dredges, etc. The number of vessels in the latter category, which normally employ radiotelephone, is increasing at an unprecedented rate.

Photostatic procedure was established for the expeditious handling of ship radiotelephone applications and licenses, resulting in substantial savings of clerical time and effort.

COASTAL RADIO STATIONS

Coastal stations are normally located near the sea, the Great Lakes or other waterways to communicate with ships. At the close of the fiscal year there were 47 such radiotelegraph stations, exclusive of those in Alaska. Forty-four of these rendered public service.

In addition, there were 38 coastal-harbor radiotelephone stations, exclusive of those in Alaska, of which number 33 offered public service. New coastal-harbor stations were established at The Dalles and Umatilla, Oreg., to augment service on the Columbia River. Experimental stations were authorized at Mobile and New York City to use very high frequencies. Very high frequency telephone service is also being developed for the Great Lakes. Four stations connecting with the public land lines communicate with ocean-going vessels.

MARINE RADIO RELAY SERVICE

Thirty-six of the coastal radiotelegraph stations engaged in public service were authorized to operate in the marine relay service, an increase of 25 percent over the preceding year. This point-to-point

type of radio service implements the coastal telegraph service by forwarding shore-to-ship messages from one coastal station to another such station better located with regard to the ship for which the message is intended.

ALASKAN POINT-TO-POINT AND COASTAL RADIO STATIONS

In Alaska, due to the scarcity of wire facilities, much of the communication between communities is carried on by radiotelephone and radiotelegraph. There were 403 point-to-point radio stations for this purpose at the close of the fiscal year, exclusive of Government stations. This is an increase of 16 percent over 1946. In addition, 232 coastal stations were authorized, an increase of 27 percent.

4. EMERGENCY RADIO SERVICE

This service embraces seven classes of stations operated by instrumentalities of Government to promote phases of public safety or welfare. In addition to four types of police radio operation, there are municipal fire, forestry, and special emergency stations.

The Commission's frequency allocations hearings developed considerable data concerning the operation of stations in this service. On the basis of this information, and in light of the technical advances in radio, it was necessary and desirable to undertake, with the cooperation of representatives of various classes of licensees, a proposed revision of the existing rules. This task was completed by the close of the fiscal year.

One of its major proposals is the establishment of a highway maintenance class of radio station for State and local governments. Other contemplated revisions would enable forestry radio stations to include essential conservation activities, and eliminate population requirements for eligibility of municipal fire radio stations.

Study of frequency allocations to the emergency service resulted in a reallocation of channels by blocks instead of on an interspersed basis. This will not only permit assignments by geological areas, but will mean a saving in spectrum space and economy in equipment costs.

POLICE RADIO STATIONS

The police radio service has four classes of stations—municipal, State, zone, and interzone. Municipal and State police radio stations employ voice transmission and, generally, are used in matters of immediate concern, such as dispatching patrol cars. Zone and interzone stations use radiotelegraphy and serve to join the various municipalities, counties and States into a single network for expediting reports of stolen automobiles and missing or wanted persons, and identification of suspected criminals.

The growth of the police radio service is indicated in the following tabulation for the past 3 years (as of June 30 respectively):

	1945	1946	1947
Municipal police	2,051	2,243	2,657
State	477	507	669
Zone	85	88	87
Interzone	30	30	29
Total	2,643	2,868	3,442

Due to the Commission's practice of listing all mobile units under a single license, the above figures do not represent the actual number of transmitters operated. The latter exceed 25,000.

Reallocation of frequencies to police stations in accordance with the new frequency allocation plan has been delayed by many technical, manufacturing, and economic considerations. Therefore, the Commission has permitted licensees until July 1, 1950, to make the necessary shifts. To reduce the expense involved, the Commission has authorized licensees in many instances to complete the conversion in stages. Under this plan, licensees install a portion of the new equipment but meanwhile continue to use their present apparatus.

Frequency allocation committees of the police communication organizations, the Radio Technical Planning Board and the Commission are cooperatively engaged in frequency studies. Problems concerning the use of adjacent channels on a 40-kilocycle spacing as well as the adoption of a 20-kilocycle channeling system in lieu of the present 40-kilocycle system are receiving like attention, to the inclusion of manufacturers.

In view of the limited number of frequencies available for police communications, it is necessary to insist on a high degree of technical performance to accommodate the increasing number of applicants. The Commission has proposed an amendment to its rules which would incorporate basic technical requirements.

There is also a complexity of engineering problems arising from applications which involve interference to established stations. The rules were revised to eliminate the requirement that specific authorizations be obtained by police licensees to operate mobile units other than official cars, or to render cooperative service to adjacent municipalities. This has lightened the burden of licensees and reduced Commission paper work.

MUNICIPAL FIRE RADIO STATIONS

Municipal fire radio stations furnish emergency and mobile communications to fire departments in the same manner that police radio stations serve police agencies. The number of fire stations doubled in

the past year, from 25 to 50, and include approximately 500 mobile units.

The comparatively small number of stations in this category is due to the fact that licenses have been normally issued only to municipalities serving areas containing a population in excess of 150,000 persons. The extensive interest shown by volunteer fire departments and smaller municipalities resulted in proposed amendments to the rules that would extend eligibility to fire departments in small communities.

FORESTRY RADIO STATIONS

Forestry radio station licenses are issued to governmental agencies responsible for the protection of forest areas, and to a few private organizations having that same objective.

The usual forestry communication system employs one or more land stations with portable stations installed in fire observation towers. It is not unusual to use aircraft equipped with mobile transmitters to drop men and material to combat the blaze. By means of lightweight pack sets, the fire fighters are able to communicate with the plane or a portable station set up nearby.

Although the number of these stations shows a decrease in the year from 1,018 to 638, this is not due to any actual reduction in the number of transmitters in use but to a new procedure which consolidates mobile and portable transmitters into a single license.

Representatives of State conservation agencies have requested that frequencies be made available for their use. Their activities include game law enforcement, protection of forests from insect pests and disease, reforestation, flood and erosion control, etc. Although not of the same emergency nature as police, fire, and forestry, conservation work is chiefly in remote areas where other methods of communication are not available. The Commission is, accordingly, proposing to make a limited number of forestry frequencies available to conservation agencies.

SPECIAL EMERGENCY RADIO STATIONS

The special emergency class of radio station is used for communication in emergencies jeopardizing life, public safety or important property, and for emergency transmission from one point to another where other communication facilities do not exist or are temporarily disrupted.

Until September 1946, when a utility radio service was created, most of the special emergency stations were used by the power industry. About 80 percent of them were transferred to that new service. In consequence, the number of special emergency stations decreased from 821 in 1946 to 127 in 1947.

The remaining emergency stations are licensed mainly to communication common carriers and are used to restore service when land line

failures occur. Some licenses are held by organized relief agencies, such as the American Red Cross, for communication in event of a major disaster. An example was in connection with the explosion and fires which devastated Texas City, Tex., in April 1947.

PROPOSED HIGHWAY MAINTENANCE RADIO STATIONS

During the year the Commission was petitioned by various State highway departments and highway organizations to establish a new class of station to provide for radiocommunication systems operated by highway departments.

Under existing rules, highway departments are eligible for the special emergency class of station but, like the power utilities, were hesitant about investing large sums of money in radio equipment which could be used only in emergencies involving the safety of life and property. The highway interests stressed that radio is also essential in dispatching emergency vehicles and work crews, and is needed by supervisors patrolling highways to report weather and road conditions.

In response to this appeal, the Commission has drafted proposed rules for projected highway maintenance stations which would be similar to State police stations. Until such time as this class of service is permitted, highway departments may operate class 2 experimental (highway maintenance) stations in the experimental radio service.

5. UTILITY RADIO SERVICE

This class of radio service provides radio communication for three general types of public utilities—power, transit, and petroleum pipe lines. The first named serves electric, gas, water, and steam utilities. The transit utility station is used by bus, street cars, subway and other passenger-transportation lines in metropolitan areas. Petroleum pipe line stations communicate with pipe line operators engaged in cross-country distribution of crude petroleum, petroleum products, and natural gas.

Established in August 1946, the utility radio service permits licensees to transmit messages relating not only to safety of life and property, but also those in connection with essential operations, such as dispatching of maintenance crews and trucks. The advantages of this type of service are commanding increasing attention from eligible utilities. As of June 1946 utilities were operating 600 special emergency stations. In the same period of 1947 there were 1,136 stations in the new utility radio service. Each of these stations may include from one to 150 transmitters.

The Commission during the past year devoted considerable attention to the allocation of channels to various industries requiring radio services. This study, still in process, is coordinated with panels of the Radio Technical Planning Board. The power and petroleum indus-

tries have collectively organized regional frequency coordinating committees throughout the United States to assist the Commission in allocating appropriate frequency assignments in critical areas.

6. RAILROAD RADIO SERVICE

Established in December 1945, this service adds to railroad safety and facilitates the movement of rolling stock with a resultant increase in efficiency and economy.

Railroads employ radio for several purposes. A train station provides communication between locomotive and caboose, from train to train, or from train to wayside station. A yard and terminal station expedites switching and "humping" operations. A utility station aids railroad operation and maintenance through contact with track patrols, road repair gangs, etc.

There still remains considerable work on the part of manufacturers to develop and produce equipment sturdy enough to withstand the rigors of railroad use. On the other hand, some railroad management considers railroad radio still in the developmental stage and its unwillingness or inability to make substantial installations denies manufacturers the incentive to go into quantity production for this type of equipment. This situation contributes to the continued expensiveness of stations on board trains where the cost is approximately four times that of a mobile station in other services.

On June 30 there were 109 railroad radio licensees, authorized to use some 900 transmitters.

A study has been conducted in collaboration with the Association of American Railroads looking to the preparation of a geographical frequency assignment plan for railroad use. This would insure economical utilization of available frequencies and limit interference by preventing duplication of assignments.

7. MISCELLANEOUS RADIO SERVICES

These services cover provisional, geological, motion picture, relay press, and mobile press radio stations. The two first named comprise the greater portion of licensees.

Provisional stations are authorized to transmit messages relative to safety of life and property, or other matters of public necessity in areas not served by other forms of communication. Geological stations are used extensively in oil and gas well-drilling operations and, in a more limited way, by construction and logging companies, irrigation projects and large-scale farming operations.

Due to the new policy of blanketing mobile and portable transmitters into a single license, the total number of stations in the miscellaneous services was reduced from 1,228 to 437 in the course of the

year, although there was a significant increase both in the number of licensees and transmitters.

Because of the interest shown by many types of industries, the Commission is considering a plan to reorganize and expand the provisional class station into a new service which is tentatively referred to as the industrial radiocommunication service. A number of frequency channels have been allocated for this purpose.

GEOLOGICAL RADIO STATIONS

This term applies to stations used in connection with investigating the earth's surface and underlying strata for new and needed oil deposits. Practically all of the 104 licensed geological stations, which represent more than 500 mobile units, are operated by oil and geophysical exploration companies.

Of low power, these stations transmit signals and impulses to seismic recording instruments from various pick-up points located at distances up to 15 miles from a centrally located recording truck or boat. They are also utilized for communication by crews at work in isolated areas. Many geological stations operate in the tidelands along the Gulf of Mexico, often miles offshore.

MOTION PICTURE RADIO STATIONS

Stations in this class provide communication for film crews on location in places where other facilities are not available, and aid in protecting life and property in that connection. Being mobile, they are particularly advantageous for coordinating and directing "mob" scenes and the activities of various units engaged in the actual filming.

Motion-picture stations were little used during the past year. However, correspondence and inquiries from the industry indicated that activities of this class of station will increase now that new and improved equipment has become available.

RELAY PRESS RADIO STATIONS

Newspapers and press associations use these stations to transmit messages from locations remote from wire facilities. A number of requests have been received for authority to permit installation of land stations at the newspaper's main office for the purpose of maintaining communication with reporters and other staff members at the scene of a news event or traveling in the vicinity. To obtain more information concerning this type of service, the Commission has authorized a number of class 2 experimental (relay press) stations to operate accordingly.

STATE GUARD RADIO STATIONS

At the request of the War Department, the Commission extended the licenses of 27 State guard radio stations until July 1, 1948, or until

such time as the National Guard reorganization is completed. These are a hold-over from the War Emergency Radio Service, an emergency defense set-up that was terminated in other respects at the close of the war.

8. EXPERIMENTAL RADIO SERVICES

GENERAL

The Communications Act requires the Commission to "study new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest."

In the past year the industry has been active in developing equipment and techniques looking toward new services and improvement of old services. The Commission kept abreast of and encouraged these developments through its experimental radio services.

Experimental radio stations fall into two broad classes. Class 1 stations are used in connection with research projects for the general advancement of radio. Such activities include development and testing of new or improved transmitter and receiver designs, antennas, and equipment components; field strength surveys; and radio propagation studies of various kinds. Class 2 stations are authorized for the initial development of a new radio service, or for the further development of an established service requiring new methods and materials. Stations in both classes are licensed to individuals or corporations desiring to follow a specific research or development program.

The experimental services are radio's proving ground. When sufficient information has been secured from an experimental operation, the project may be abandoned as impracticable or steps taken to place the service on a regular basis.

The most fundamental and far-reaching development in the field of electronics in the past few years is the extension of the usable radio frequency spectrum almost a hundredfold. Although there still is not enough spectrum space for all persons desiring to make use of radio, provision can be made to accommodate a great many more than heretofore.

Since knowledge of how to utilize the higher frequencies was applied almost entirely during the war years to development of military equipment, the past year witnessed new applications to commercial use as wartime equipment was redesigned for peacetime needs and materials for mass production became available.

In taking advantage of the added spectrum space, nearly all existing radio services have been expanded, as described elsewhere in this report, and a number of new devices and new radiocommunication services have been proposed for extensive experimental development

as a necessary preliminary to regular operation. Included in this list are radar stations, microwave relay chains, telecar service, a general mobile radio service, a group of industrial radio services, and a citizens radio service.

RADAR

One of the most revolutionary and valuable technical developments of the war is radar (radio direction and ranging). Due to changes in frequency allocations and the differing needs of commercial users, much of the military radar equipment is unsuitable for commercial use. So new equipment has been and is being developed to meet the demands of ship operators, commercial aviation, and geological exploration companies, although the total of peacetime uses so far developed is greatly outweighed by the number of military uses.

All signs point to rapid adoption of radar in transoceanic marine passenger service. For example, in one crossing of the Atlantic, the steamship *Queen Elizabeth* proceeded by radar for 720 miles through dense fog at full speed, thereby saving twice the cost of her radar set in a single day. In passenger service it appears that economic as well as safety factors may force general acceptance of radar navigation. In cargo service, adoption of radar navigation may not be so universal, particularly on smaller vessels where the first cost and maintenance charges are appreciable factors. The number of shipboard radar installations has increased approximately 1,000 percent during the past year.

Radar navigation for commercial aircraft operating in domestic service has little appeal due to the well-developed system of other aids already established, the high cost of the equipment, the special skills involved, and the decreased payload due to the very considerable weight of the installation. However, a large number of relatively lightweight radar altimeters and anticollision devices have been installed.

A number of other adaptations of radar techniques are in various stages of laboratory development, with coined names suggestive of the functions involved. Included are teleran, radiovision, navar, navaglobe, navaglide, and fathometer.

MICROWAVE RELAY

The field of point-to-point microwave transmission (frequencies on the order of 1000 megacycles and higher) showed great expansion during the year.

Studies made by the telephone companies and Western Union Telegraph Co. indicate that it may be practicable to replace, or at least parallel, heavily used long-distance wire circuits with chains of microwave relay stations spaced 30 to 50 miles apart. A single microwave system can be used to carry hundreds of telephone conversations and

telegraph messages simultaneously, or several high-fidelity FM and television programs for rebroadcast by local outlets. One of the factors weighing heavily in favor of the microwave circuits is their ability to transmit much wider bands of frequencies than can be accommodated by existing wire or cable facilities.

Many groups have evinced interest in microwave communication circuits. In addition to the present communications common carriers, and others proposing to enter into competition with them, interested parties include television and FM station licensees, the broadcast networks, the aviation, railroad, petroleum and power industries, and law enforcement agencies. Each group proposes a different method of allocating the available frequencies, and the number of requests for assignment in the microwave bands already indicates that expressed needs cannot be met in full. This situation raises many questions of policy which will take time to resolve, particularly since the full potentialities of the equipment now under development cannot be predicted with certainty. For example, sufficient information on costs of installation and maintenance of microwave relay chains versus similar costs for wire and cable lines is not yet available. This information is essential to proper rate-making.

The American Telephone & Telegraph Co. has allocated $7,000,000 for construction of a relay chain between New York and Chicago, and is currently installing a shorter experimental chain between New York and Boston.

Western Union Telegraph Co. has installed a relay chain between New York and Philadelphia which is now in service on an experimental basis. A new chain is being constructed by Western Union in the triangle formed by New York, Pittsburgh and Washington.

TELECAR SERVICE

Telecar is a mobile telegram pick-up and delivery service now under development by Western Union as part of its modernization program. The system consists of a fixed radio station at the central telegraph office (plans call for institution of the service in 64 cities) and a number of mobile units. When the main office receives a message destined to a point within the area served by a particular automobile, a picture of the message is transmitted to the car by radio facsimile methods. This facsimile message is then delivered by the "telecar" to the addressee. Looking further into the future, this system may be extended to intercity operation over the microwave relay chains so that a picture of any message may be sent to other cities and delivered in the original handwriting.

GENERAL MOBILE RADIO SERVICE

In its report on the allocation of frequencies in the extended radio spectrum, the Commission recognized the need for a radio service

to provide communication between vehicles and fixed points. Frequencies were, therefore, provided in the 30 to 44 megacycle band for stations serving vehicles operating over highways, and frequencies in the 152 to 162 megacycle band for urban stations serving taxicab operators, doctors' cars, delivery trucks, towing services, etc.

At the time these allocations were made certain questions of policy existed, including whether the service should be made available for common carrier operation, noncommon carrier operation, or both; and whether restrictions would be placed on the kind of communications to be handled, and the type of emission and amount of power used. Pending final determination of these and other problems, experimental authorizations for general mobile systems have been issued for the purpose of acquiring data on which to formulate rules for governing the service on a regular basis.

The service has grown rapidly from 279 authorizations in fiscal 1946 to more than 1,700 in June 1947. The latter permit operation of 22,000 radio-equipped vehicles. Its mushrooming has raised administrative, developmental, and regulatory problems, the solution of which has required careful study and coordination with licensees and manufacturers of equipment during the past year. Moreover, a frequency assignment plan in the 152 to 162 megacycle band was found necessary in order to promote an orderly experimental program affording all interested parties equal opportunity to explore their operational requirements. A temporary allocation plan provides for one pair of frequencies to taxicab operators; one pair to operators of miscellaneous vehicles, such as department stores, towing services, doctors' cars, etc.; three pairs to existing general communication common carriers; and one pair to applicants who are not existing communication common carriers but propose a common carrier type of communication service for specialized purposes.

Processing the many applications for mobile stations required determination of the eligibility of the wide variety of applicants to hold radio station authorizations and the capability of the proposed systems to meet the Commission's requirements. During the year the Commission also issued decisions relative to this service on petitions submitted by representatives of the intercity bus, taxicab, and trucking industries.

National Bus Communications, Inc., requested the Commission to make available a certain number of the frequencies allocated to the general mobile service for the exclusive use of the intercity bus industry, directly or through an organization formed for the purpose of rendering radio communication sevice exclusively to the bus industry. In its report granting this petition to a limited extent, the Commission announced that the intercity bus industry would not be required to obtain its mobile radio communications service from an existing gen-

eral communications common carrier or to share with others the frequencies assigned for use of the bus industry. However, a further hearing is to be held in order to determine the exact number of frequencies to be assigned to this use.

The Commission denied a petition by representatives of the taxicab industry requesting a 5-year experimental license period, and the assignment of at least four and preferably six channels to taxicab dispatching systems. In so doing, the Commission reiterated its recognition of the need for such a service and gave assurance that it would make every effort to establish one on a permanent basis at an early date. The Commission recognizes that at least two channels will be required. Whether additional channels can be assigned will depend upon other demands for urban mobile service, and no determination in this respect can be made until after a general hearing has been held to consider frequency and regulatory problems.

At the same time, the Commission advised the trucking industry that highway mobile experimental radiotelephone licenses could not be extended for 5 years. The Commission pointed out that it has heretofore announced that there will be a highway service and that a specific number of channels will be assigned for truck use pending a final determination of the best method of operation for this service. The Commission indicated that it could give the trucking interests no further assurance in this matter until a program of experimentation has been under way or at least a plan has been worked out for a Nation-wide coordinated use of the frequencies temporarily assigned for trucks.

In the latter part of the fiscal year it appeared that the development of the general mobile service had progressed to the extent that sufficient experimental data was available to serve as a basis for determining issues relating to the establishment of this type of operation on a regular basis. The Commission, therefore, scheduled a hearing on this matter for late 1947. Questionnaires designed to secure information which will be of assistance to the hearing were distributed to all general mobile licensees. These questionnaires will also serve to eliminate the need for licensees to prepare experimental reports in connection with applications for renewal of experimental licenses in this service.

INDUSTRIAL RADIO SERVICE

A service is being developed for limited use by agricultural, lumbering, manufacturing, merchandising, mining, petroleum, and other miscellaneous business enterprises for which special provision is not made elsewhere in the Commission's rules. The service is in the early experimental stage, and its final form has not yet been determined. The frequencies available for assignment have approximately line-

of-sight transmission characteristics in common with those very high frequency channels available for most of the other radio services being developed.

The need which this new service is designed to meet is illustrated in the communication requirements of the petroleum industry. In the case of this industry, oil and gas are frequently sought and found in areas remote from existing communications facilities. During the drilling operations it is essential that communication be established between the well site and the field headquarters in order to maintain proper supervision. Break-down of equipment, accidents, and other emergencies, such as a blow-out, fire, or explosion, not only present hazards to life and property, but also involve loss of productive time.

After a field is proven and steady production is begun, the need for communication facilities continues. The prompt and uninterrupted movement of equipment and supplies, transmission of operating instructions and reports, direction of well-servicing crews, repair crews, and other routine operations in the producing field are dependent upon the instant and reliable means of communication which radio affords when no other means is available.

In addition to portable "walkie-talkie" types of equipment, miscellaneous low-power devices using radio, and radio-equipped supervisor's cars and repair trucks operating in a mobile service, the industry can make good use of various types of fixed radio service installations wherever frequencies can be made available. Those which involve only line-of-sight distances are: radio control and repeater stations, generally used as mobile service auxiliaries to complete or extend the area of coverage of a mobile service radio system; radio telemetering stations, used to transmit data which is determined by mechanical or electrical means; fixed point-to-point radio communication circuits, used in conjunction with an established mobile service system; and fixed point-to-point radiocommunication circuits unassociated with a mobile service installation. The point-to-point circuits in general would be used for either radiotelephone or facsimile transmissions.

The existing classes of radio stations available for licensing by the petroleum industry and other industries meet only a small fraction of the total potential demand for radiocommunication facilities. It is the purpose of the proposed new service to fill the additional requirements as they occur.

INDUSTRIAL, SCIENTIFIC, AND MEDICAL RADIO SERVICE

Another result of the frequency allocation hearings was the promulgation of proposed rules and regulations to govern the use of radio equipment which, although not used for communications, is capable

of causing extensive interference to radio communication services. Of particular concern are diathermy and industrial heating units, and miscellaneous electronic devices.

Public hearings on these proposed regulations, participated in by medical, industrial, and other interested parties, were held in December 1946. The resultant rules were adopted May 8, 1947, and became effective June 30 following. These rules provide specific frequency bands in which such equipment may be operated and prescribe limits for radiation when used on other frequencies. Prior to the enactment of these regulations, diathermy and industrial heating apparatus had operated without specific limitation as to power or radiation and caused problems of interference to many established radio services.

The regulations also require submission of diathermy equipment for type approval by the Commission. As approval indicates that the Commission has found that operation would either take place within one of the frequency bands assigned to the service, or would be sufficiently shielded as to eliminate objectionable interference, such approved equipment is permitted to operate without a license. The regulations also provide for a period wherein equipment manufactured prior to the effective date of the regulations may be used without license if no interference is caused to existing services.

CITIZENS RADIO SERVICE

The frequency allocations hearings likewise proposed a citizens radio service, to which the frequencies 460 to 470 megacycles were allocated. The potentialities of this service are unlimited since possible uses range from small private communications systems to low powered control devices. These frequencies are peculiarly adapted to very small transmitters and receivers employing tubes and printed circuits similar to those used during the war in proximity fuzes for artillery shells.

During the year extensive studies of design problems were made by the Commission and resulted in June 1947 in proposed technical requirements and procedure for obtaining type approval equipment to be used in the contemplated service. This proposal will serve as a guide for prospective manufacturers of such equipment. The comments of the industry and interested parties will be received in the coming year and will form a basis for drafting acceptable standards and rules.

During fiscal 1947 this service was on an experimental basis and one of the principal problems was the development of suitable small transmitting units which could be safely placed in the hands of nontechnical persons yet come within the price range of those interested. Although such equipment was not available at the end of the fiscal year, except for experimental use, progress was noted in its development.

RURAL AND SHORT-DISTANCE TOLL RADIOTELEPHONE SERVICE

Rapid advancement is being made in using radio to bring telephone service to isolated places. Previously, it was often impossible, because of economic or technical reasons, to extend wire lines to remote hamlets. To fill this void, the Commission recognized a new type of radio service designated as the rural radiotelephone service. It finds its greatest application in connecting individual subscribers with a central telephone exchange, thus making it possible to link rural areas with the telephone system. A pioneer installation was that of the Mountain States Telephone and Telegraph Co. at Cheyenne Wells, Colo., to serve a group of isolated ranches. It is anticipated that substantially all such installations will be made by the telephone companies operating in the areas concerned.

Parallel with the rural radiotelephone service, the Commission has tentatively recognized a short-distance toll telephone service to connect isolated communities by radio in lieu of wire lines. As in the case of rural radiotelephone service, these facilities will normally be made available through existing telephone companies. Authorizations have been granted to the Southern California Telephone Co. to conduct experiments to determine the feasibility of establishing such service in Death Valley, Calif. While provisions were made to operate this service on the frequencies allocated to the general mobile service, recent tests indicate that the microwave frequencies may prove suitable. Accordingly, the Southern California Telephone Co. has installed a microwave system between Santa Catalina Island and Avalon, Calif.

These services are in addition to carrier-current systems in which the signal travels along rural power lines.

9. STATISTICS

Exclusive of the broadcast services and amateur and commercial operator licensing noted elsewhere in this report, the Commission received more than 55,000 applications and authorized more than 15,000 stations of various types during the fiscal year, bringing the total number of stations (with the exceptions noted) to over 37,000. A break-down of these stations follows:

Class of station	Applications	New stations	Total stations
Aircraft	22,047	9,426	14,627
Aviation ground	2,233	212	1,216
Ship	14,042	3,111	10,989
Police	3,733	574	3,442
Fire	119	25	50
Forestry	426	−380	638
Special emergency	441	−694	127
Experimental [1]	3,162	811	1,767
General mobile (experimental) [2]	3,255	1,265	1,683
Fixed public telephone [3]	143	0	23
Fixed public telegraph [3]	627	−4	50
Wire service extensions [4]	412		
Wire service reductions [4]	743		
Utility [5]	1,763	1,136	1,136
Railroad	193	−47	109
Coastal marine relay	274	13	131
Alaska coastal	408	49	232
Alaska fixed public	586	56	403
Geological	560	−381	104
Provisional	515	142	331
Miscellaneous	79	24	52
State guard	0	1	27
Total	55,761	15,337	37,137

[1] Separated under Common carrier and safety and special services Dec. 1, 1946. Of the figures shown above, 66 applications and 81 total stations are common carrier.
[2] Separated under Common carrier and safety and special services Dec. 1, 1946. Of the figures shown above 469 applications and 427 total stations are common carrier.
[3] Fixed public telephone and telegraph stations are now considered common carrier.
[4] Wire service extensions and reductions are now considered common carrier.
[5] New service originated August 1946.

— Indicates decrease.

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CHAPTER V—COMMON CARRIERS

1. TELEPHONE (WIRE AND RADIO)
2. TELEGRAPH (WIRE, CABLE, AND RADIO)

1. TELEPHONE (WIRE AND RADIO)

GENERAL

Besides expanding its regular facilities, the telephone industry manifested increasing interest and activity in radio developments and utilizations during fiscal 1947.

All-time highs were set in fiscal 1947 in the number of telephones in service and in telephone service revenues. However, the increase in operating revenues were more than offset by increased operating expenses, resulting in declines in net income. This led to telephone companies in most States applying to their local regulatory bodies for authority to increase rates for intrastate toll and exchange telephone service. Net income from interstate telephone service has suffered less decline than is reflected in intrastate results, and there have been no requests for increases in interstate rates.

More telephones were installed in fiscal 1947 than in any prior 12 months. More than 36 billion local and short-haul toll and 1.7 billion long-distance toll calls were handled by the Bell system. With increased traffic amounting to about 10 percent, the industry had to expand greatly its exchange and toll facilities. At the same time, it augmented private line, teletypewriter exchange, rural, and other land-line services.

The over-all telephone activity increase was reflected in established services employing or dealing with radio, such as international and ship-to-shore telephone and channel service for radio broadcast, and in new services involving microwave relay, television transmission by coaxial cable, and mobile telephone.

DOMESTIC TELEPHONE SERVICES

Construction of wire facilities.—Continued public demand for telephone service, together with overloaded facilities at the beginning of the fiscal year, resulted in a period of enormous construction activity. In addition to 20 applications on hand from the preceding year, the Commission received 305 new requests for wire line construction, acquisition, extension or leasing. Of this number, 309 were approved,

including 289 construction projects. A comparison of this authorized wire construction with that of the previous year follows:

Fiscal year	Projects	Cost	Cable-miles	Coaxial-miles	Open-wire-miles
1946	239	$78,896,450	3,193.8	16,580	12,261
1947	289	126,325,771	5,587.7	23,490	15,976

The Bell system added about 1,600,000 miles of toll message channels, which increased its previous total by 11.9 percent. Carrier systems continued to provide about 90 percent of the new channels. Coaxial cables are discussed elsewhere in this report.

Speed of toll service.—The Bell system was able to install new equipment and secure additional operators which reduced the average speed of service for completing toll-board calls to 2.3 minutes in March 1947, a decrease of 0.4 of a minute compared with the year previous.

Telephone recording devices.—On March 24, 1947, the Commission issued a final report on the use of recording devices in connection with interstate and foreign telephone service. It concluded that a real need exists for this adjunct but held that its use should be under conditions which will give adequate notice to parties that their conversation is being recorded. The Commission decided, among other things, that this should be accomplished by an automatic tone warning signal repeated at regular intervals during the conversation. However, it deferred issuance of a final order pending resolution of various engineering questions considered at an engineering conference on April 29.

Rural telephone service.—At the close of fiscal 1947, some 330,000 additional rural families were receiving telephone service. This increase was about three times that of any previous year. About 18,000 miles of pole line were constructed in rural areas. Also, some subscribers were receiving service over electric power lines or by means of radiotelephone.

Power line telephone service.—Initial installations were made of a new carrier system modified for short-haul toll operation. It was developed in connection with "hitch-hiking" telephone messages over rural electric power lines in some southern areas and has proved economical in cases where wire construction would otherwise be necessary. Known as the M1A in its modified form, five or six channels can ordinarily be operated on a power line.

Short distance radiotelephone service.—Telephone companies have shown an increasing interest in harnessing radio to expand short distance service. They were working toward the use of radio to bring

service to isolated ranches in the West, small rural communities at a distance from large cities, and as a replacement for wire lines where construction and maintenance costs are prohibitive. Preliminary studies indicate that, under geographical conditions favorable for wire lines. (See also "Rural and Short-distance Radio telephone Service".)

Coaxial cable service.—Coaxial cable installations are designed for radio broadcast and television transmission as well as for telephone and telegraph traffic. In the fall of 1946 rates were instituted by eight Bell telephone companies for the use of local channels in connection with television operation. Since then, extension of the coaxial cable system has taken on a new importance in the light of the need for intercity exchange of television programs. The American Telephone & Telegraph Co. continued to make its coaxial link between New York and Washington available without charge for television tests. This was the only section open for this purpose in fiscal 1947. However, a national coaxial system of 12,000 miles is expected to be in operation by 1950.

On June 2, the A. T. & T. filed coaxial cable rates for television service, but they were withdrawn for further study before they became operative.

Microwave relay service.—Microwave radio relay development (more fully described under "Experimental radio services") received considerable impetus through the grant of a construction permit to the American Telephone & Telegraph Co. for an experimental system to link New York and Chicago, and similar authorizations to the Raytheon Manufacturing Co. for connecting New York and Chicago, and Los Angeles and San Francisco. These are in addition to previous authorizations to the American Telephone & Telegraph Co. and the Western Union Telegraph Co. for systems between New York and Boston and a triangular system linking New York, Philadelphia, Washington, and Pittsburgh, respectively. The New York-Boston chain was expected to be in service in the fall of 1947, offering telephone, teletype, broadcast, and other communication services.

Mobile radiotelephone service.—Bell system and independent telephone companies are continuing experimental development of mobile radiotelephone service. The first urban mobile system went into operation in St. Louis on June 17, 1946, and at the end of fiscal 1947 commercial service was being afforded in 42 cities in 26 States, with prospect of 19 more cities being added at an early date.

The first highway mobile system started operation in the vicinity of Green Bay, Wis., on August 28, 1946. Highway service on a commercial basis is now available in 19 areas, and installations in 78 more are nearing completion. Plans call for such service along approximately 5,000 miles of the Nation's trunk highways.

The general mobile service is being extended to ships and aircraft operating in the vicinity of land service facilities. Various persons who never before rendered communication service for hire have also obtained experimental authorizations.

The rate of expansion of this service indicates that, within a few years, it will be possible to communicate with radio-equipped vehicles in many parts of the country. The present rates for urban and highway service vary from 30 to 40 cents for a three-minute call within a local telephone exchange area, with long distance calls charged for at the person-to-person daytime rate.

In view of the mounting demand for mobile service, the Commission ordered a public hearing for late 1947, to consider the establishment of this service on a regular basis. Problems to be considered were the types of mobile service which should be authorized, the frequencies which can be allocated for the service and the manner in which they can be apportioned among the different classes of users, the extent to which service shall be afforded by common carriers or private carriers, and other information necessary to drafting proposed rules and regulations. (Further reference to mobile service will be found under "Experimental radio services.")

Coastal and Alaskan services.—Coastal harbor, coastal telephone, and Alaskan radio communications services are discussed in the chapter on Safety and Special Services because of their relationship to radio aids to the safety of life and property. During the year public radiotelephone service was inaugurated between various coastal harbor stations and aircraft at rates generally the same as for coastal harbor communication with ships. In Alaska the communications picture is peculiar in that the nature of the terrain and population distribution make radio an almost exclusive medium for communication. Accordingly, virtually all the coastal and point-to-point services there furnish public service. Independent stations throughout the territory are interconnected in a network operated by the Alaska Communication System, an agency of the United States Army Signal Corps.

INTERNATIONAL RADIOTELEPHONE SERVICES

During the year radiotelephone service was reestablished with 16 countries to which it had been suspended during the war, and became available for the first time to four other countries. Some 90 overseas points in 63 foreign countries and United States possessions are now served by 6 companies in the United States and 3 in its Territories. One other company furnished an interisland service in Hawaii.

Overseas private line service.—Private line service was established for the first time to Norway, Puerto Rico, Spain, and Great Britain.

Overseas program transmission service.—This broadcast relay serv-

ice was reestablished to 9 countries, making a total of 54 to which such service is available.

RATES AND TARIFFS

During the fiscal year, overseas message toll telephone rates were reduced between the United States and five foreign countries. Rates for overseas private line telephone service were reduced between the United States and Great Britain, France, and Switzerland, as were program transmission rates from Hawaii to the United States.

There were no major changes in interstate telephone rates during the year.

Rate schedules.—Approximately 27,000 tariff publications were filed with the Commission. Of this total, 19,400 related to telephone and 7,800 to telegraph services. At the close of the year, 365 carriers had tariffs on file with the Commission.

Special permissions.—During the year, 276 applications for special permission to make tariff changes or to file new schedules with less than the required notice were received. Of these, 266 were granted, 8 denied, and 2 withdrawn.

Washington metropolitan area.—In early 1947 the Chesapeake & Potomac Telephone Cos. of Virginia and Baltimore City filed revised tariff schedules increasing the charges for certain interstate telephone calls between points in Virginia and Maryland within the Washington metropolitan area. The Commission suspended the proposed rates for a period of 3 months pending a hearing as to their lawfulness. The telephone companies have challenged the Commission's jurisdiction in this matter.

"Other line" charges.—Bell system companies continued to establish direct rates for interstate message telephone and telegraph traffic interchanged with independent companies on an "other line" charge basis. As of January 1, 1947, only 11 independent companies applied "other line" charges on 393 telephone and 454 telegraph routes.

COOPERATION WITH REGULATORY BODIES

Separation of property, revenues, and expenses.—The Commission cooperated with the National Association of Railroad and Utilities Commissioners in a review of procedures employed by Bell system companies to separate telephone property, revenues, and expenses among exchange and interstate and intrastate toll services. The study included an appraisal of the results developed by the procedure for the division of interstate message toll revenue and for the establishment of the level of intrastate earnings now under consideration by various State commissions. Data to be obtained by Bell system companies through incorporating revised procedures in their division of toll revenue contracts will be examined by the Commission in con-

nection with its general investigation of telephone separation methods (Docket 6328).

Bell system license contracts.—The Commission also cooperated with the NARUC in continued study of services performed by the American Telephone & Telegraph Co. associated companies for its long-lines department and of the methods employed in allocating the costs of furnishing those services.

State rate cases.—Under its policy of cooperation with State utility commissions in related regulatory problems, the Commission furnished information and other assistance in intrastate rate proceedings before those State bodies.

ACCOUNTING REGULATIONS

Uniform system of accounts.—In addition to issuing instructions and interpretations on specific problems submitted by individual companies, the Commission amended the uniform system of accounts for class A and class B telephone companies to provide, principally, (1) accounting for write-ups of plant and other plant adjustments not arising from acquisitions of plant and (2) accounting for capital surplus as distinguished from earned surplus. Further amendments are under consideration, particularly with respect to improved classification of income items which will tend to make the accounts more informative. Studies were continued to determine the extent to which the carriers were complying with the accounting regulations prescribed by the Commission.

Financing and refinancing.—Due to postwar construction, there was heavy issuance of new securities, both stocks and bonds, by telephone companies. Many of these issues gave rise to special accounting problems. Special studies of prospectus uses were made in collaboration with the Securities and Exchange Commission and the accounting data included therein were checked against data on file with the Commission. There was also increased activity in refunding of old issues of bonds. This activity required extensive research into (1) the reasons for refunding, (2) current interest rates, (3) the accounting for call premium, bond expense and bond discount, and (4) the most desirable method of disposing of unamortized bond discount.

Pensions and relief.—Increased wages and liberalization of pension benefits were responsible for pension costs of communication carriers being larger than ever before, reaching approximately $85,000,000 for the Bell system alone. Problems of pension accounting, therefore, became of greater significance, particularly in regard to (1) the propriety and reasonableness of pension costs, (2) the methods of determining the costs, and (3) the accounting for these costs. Continuing studies were pursued in regard to all companies, but an extended study was initiated with respect to Bell system actuarial methods. The

Commission granted Bell system companies' request for limited reporting of changes in their practices regarding payment of termination allowances to employees. Further consideration was given to the matter of additional lump-sum payments into the pension-trust funds of certain companies. Continued attention was given to charging current operating expenses with the cost of pensions based on service prior to the adoption of a pension plan. Other studies were made of data submitted by carriers regarding their pension plans. Another consideration was excluding from the current operating expenses of certain carriers all pension costs in excess of normal accruals on the full-service basis (that is, the respective annual amounts that would be paid into a pension-trust fund if the company had established such a fund during the employees' successive periods of service).

Preservation of records.—In cooperation with technical consultants, industry representatives and regulatory agencies, extensive inquiry was made into the feasibility of microfilming carriers' records. Tentative rules were prepared and submitted to interested parties for comment. Substantial progress was made toward attaining uniformity in rules governing preservation of records. Regulations were revised to relieve telephone companies of the burden of maintaining a prescribed index of records in certain instances.

New types of plant and services.—Special studies were initiated to ascertain the applicability of existing accounting rules to new services furnished by telephone companies, such as police and other emergency telephone services, commercial mobile radiotelephone services, and rural telephone services by radio or power-line carrier.

Restatement of plant on basis of original cost.—General agreement was reached with most Bell system companies on the nature of the original cost adjustments to be made with respect to acquisitions of plant made prior to the present system of accounts. Accordingly, these companies are completing restatement of plant accounts on an original cost basis and are disposing of the amounts set aside and recorded in the plant acquisition adjustment accounts either directly to surplus or through appropriate amortization over future periods. During the year adjustments made by telephone companies reduced the net book cost of plant through charges to income or surplus of over $19,000,000, thereby increasing the accumulated adjustments to over $35,000,000.

Original cost schedules in annual reports.—In order to furnish the Commission with systematic and periodic data, new schedules were designed and incorporated in the annual report (Form M) giving analyses of the carriers' accounting for plant acquisitions and adjustments therefor.

Continuing property records.—Accounting and engineering studies were continued jointly with State commissions and representatives of

the telephone industry with the view of developing continuing property record procedures that will (*a*) provide a continued and perpetual record of quantities and costs of plant as of a certain date and reflect changes subsequent to the date, (*b*) provide data for determination of original cost of plant retired, (*c*) serve as a basis of inventories with a minimum of field work and as a basis for summarized plant records, and (*d*) furnish pertinent data necessary for determining plant mortality, service lives, and depreciation charges. Emphasis was given to improving the accuracy of the estimated average unit costs used in retiring mass quantities of plant, thereby reducing to a minimum the distortion in plant accounts.

New plant accounting.—Telephone companies have developed procedures to account for new plant used in mobile radiotelephone service, rural radiotelephone service, and power-carrier service. These procedures, many of them preliminary and experimental in nature, will require further study to determine whether the new plant can be properly classified into present accounts and subaccounts or whether new accounting classifications must be provided.

Increase in depreciation charges.—The depreciation problem assumed far greater importance in the fiscal year than ever before. This was largely due to (1) the shortening of the life of present plant by improvements in the art of communication, and (2) the increased costs of construction. The depreciation expense for the Bell system companies alone aggregated $200,000,000 in 1946. In determining the reasonableness of rates for telephone service, depreciation plays an important part as an annual operating charge representing cost of plant expired in service, and as a deduction to an equitable degree from the cost of plant in service in determining the residual investment on which a fair return should be earned. The factors that produce annual depreciation expense also produce accrued depreciation. It is essential, therefore, that there be consistency in determining the two elements.

Depreciation methods.—Because of the vital importance of depreciation to the regulatory duties of the Commission, joint engineering and accounting studies continued in regard to changes in depreciation rates. Particular study was made of the methods applied by Bell system carriers in estimating the service lives, salvage factors and the resulting depreciation rates with respect to plant in service. Field studies were conducted in the offices of four of the principal Bell system companies to determine the reasonableness of increased rates for certain classes of plant.

Filing of depreciation data.—Revisions were made of the requirements that carriers report currently their proposed changes in de-

preciation rates. These revisions will require the submittal of more useful data to be used by the Commission in determining the reasonableness and justification of new rates, yet minimize reporting requirements regarding minor changes. Studies were continued in the matter of determining the degree of compliance of carriers with respect to their reporting proposed changes in depreciation rates, and in the reasonableness and propriety of such changes. The Commission rescinded a previous order requiring the larger carriers to segregate plant and related depreciation reserve accounts with respect to plant (constructed because of the program for national defense) classified as "emergency facilities."

STATISTICS

Annual reports containing financial and operating data were filed by 146 common carriers and 33 controlling companies. Among the common carriers reporting annually are 118 telephone, 12 wire-telegraph and ocean-cable, and 16 radiotelegraph carriers. A few important financial and operating items for the calendar year 1946, as compared with 1945, are shown in the following table:

Telephone carriers

Item	1945	1946	Percent increase or (decrease), 1946 over 1945
Investment in plant and equipment	$6,060,028,722	$6,684,830.044	10.31
Depreciation and amortization reserves	$2,167,674,373	$2,350,398,973	8.43
Net investment in plant and equipment	$3,892,354.349	$4,334,431.071	11.36
Local service revenues	$1,108,350,679	$1,237,229,168	11.63
Toll service revenues	$867,579,478	$899,828,351	3.72
Total operating revenues [1]	$2,075,410,511	$2,251,942,629	8.51
Operating expenses [1]	$1,380,348,934	$1,714,901,566	24.24
Taxes, including income and excess profits	$420,740,213	$273,262,223	(35.05)
Net operating income after all taxes	$274,321,589	$263,779,140	(3.84)
Net income	$190,157,344	$226,813,615	19.28
Dividends declared	$192,813,713	$198,831,671	3.12
Company telephones:			
Business	8,723,714	9,594,087	9.98
Residential	15,598,560	18,234,914	16.90
Average number of calls originating per month:			
Local [2]	3,405,052,934	4,012,545,963	17.84
Toll [2]	147,612,394	171,322,349	16.06
Number of employees at end of October	398,665	525,523	31.82
Male	109,778	160,695	46.38
Female	288,887	364,828	26.29
Total pay roll for the year	$936,689,151	$1,306,053,484	39.43

[1] Intercompany general service and license fees and rents, amounting to approximately $39,000,000 for 1946, and $37,000,000 for 1945 have not been eliminated.
[2] Partly estimated by reporting carriers.

2. TELEGRAPH (WIRE, CABLE, AND RADIO)

DOMESTIC SERVICE AND FACILITIES

Western Union modernization program.—Modernization of Western Union, which contemplates the construction of 2,700,000 channel-miles of telegraph microwave radio relay systems and the leasing of

approximately 1,000,000 telegraph channel miles from the Bell system, made substantial progress. Plans call for 26 large message centers equipped with reperforator-switching systems which ultimately will be connected by microwave radio relay systems supplemented by leased telegraph carrier bands. Relaying of messages through these centers will be largely automatic and is expected to result in improved terminal handling. Five such offices have been constructed and several more will be put into operation during fiscal 1948. The program calls for completion by 1949, but, due to delays in deliveries of some essential items, will probably be delayed until 1950.

In this connection, Western Union wires, poles, conduits, and cables along railroads will be sold to the railroads. Agreements have been reached with 8 railroads involving cash settlements of more than $2,000,000, and negotiations with 24 additional railroads are continuing.

Domestic radiotelegraph.—Western Union's experimental microwave chain between New York and Philadelphia has been operating regularly with telegraph traffic diverted from wire facilities. Similar equipment is being installed for use in its New York-Washington-Pittsburgh triangle.

Another Western Union experiment, being conducted in Baltimore, involves the delivery of telegrams by radio facsimile. The message is transmitted to an automobile cruising in the area and the driver makes delivery at the indicated address. The speed and efficiency obtained by this method has encouraged Western Union to plan extension of the idea to practically all principal cities.

Construction of wire facilities.—During the year, 76 applications and requests for wire telegraph certificates were filed. Four similar applications were carried over from the preceding year, making a total of 80. Seventy-seven authorizations were granted. They covered 502,619 telegraph channel miles and 2,422 telegraph wire miles at an estimated construction cost of $4,795,315 and annual rental of $713,799. These facilities will replace 272,648 miles of wire and 11,038 miles of poles originally costing $21,426,298.

Speed of service.—The quality of service rendered by Western Union deteriorated during the year. The time required to route messages through 25 message centers in principal cities averaged 11 minutes. This covers the interval from the time a message is received in a relay office to the time it is sent from that office. The monthly average varied from 9.8 to 12 minutes. The average time required by the Bell system to establish teletypewriter exchange connections between subscribers was 1.6 minutes.

Discontinuance, reduction, or impairment of service.—In December 1946 the Commission instituted an investigation and hearing of the

over-all plans of Western Union to curtail telegraph service through closure of company-operated offices and reduction of hours of other offices, the standards to be applied in carrying out such plans, and their effects on telegraph service. Western Union contemplated filing about 1,000 such applications during fiscal 1948 to effect economies in operation and because of technological improvement and normal post-war contraction. The matter was pending decision.

During the year, 682 requests for authority to close public telegraph offices or reduce hours of other offices were filed, in addition to 84 applications carried over from the preceding year. Of this number, 614 were granted. In most cases where the Commission authorized closure or reduction in hours of offices, alternate service was available to the communities affected.

RATES AND TARIFFS

Western Union rate increase.—The 1946 annual report referred to Commission proceedings which culminated in a 10-percent increase in domestic interstate telegraph rates, effective June 12, 1946, for a period of 1 year. Following further hearings, the Commission in October 1946 ordered Western Union to eliminate its so-called "exceptional" or "special" city-to-city and city-to-State rates as being unlawfully discriminatory, preferential, and advantageous. These rates were lower than Western Union's standard rates otherwise applicable. It was estimated that raising these rates to the standard rate level would produce $3,700,000 additional revenue from interstate service.

After public hearing on Western Union's "first supplemental petition" for a further increase in interstate message telegraph rates, the Commission on December 27, 1946, authorized replacement of the 10 percent flat increase, allowed by the Commission in June 1946 for a period of 1 year, with a 20 percent flat increase with no time limitation. The flat increase amounted to a 9.1 percent increase over the existing rate level, as against 15 percent requested by the company. It was estimated that the December action would produce additional annual interstate revenues of $8,500,000.

In its December report the Commission stated that rate increases are not the ultimate answer to Western Union's situation, and that further increases will worsen its competitive position in relation to the telephone companies and the air mail. Nevertheless, because of the immediate urgency of Western Union's financial situation, the Commission permitted the increase. Subsequently, and as part of the same proceeding, the Commission authorized the company to increase its "extra United States domestic" message rates (involving service to Canada, Newfoundland, Labrador, and St. Pierre-Miquelon) by 20 percent. It was estimated that these increases, with corresponding

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increases on south-bound traffic, would provide about $411,000 additional revenue to Western Union after divisions with foreign carriers.

Rate structure studies.—Studies were made of Western Union's domestic rate structure, having as objectives the equalization of charges for equal service and the supplying of the greatest amount of service at the lowest possible cost. In the present stage, attention is being directed primarily to devising a rate pattern which would provide, uniformly, like rates at like distances to replace the existing State-rate pattern in which rates for 10-word telegrams transmitted, say a thousand miles, range from as little as 72 cents to as much as $1.44. Competitive and other aspects of the problem have made necessary the statistical analysis by Western Union of several million messages in testing numerous distinct trial rate structures.

SUPERVISION OF ACCOUNTS (DOMESTIC AND INTERNATIONAL)

Depreciation.—Detailed analysis was continued of Western Union's depreciation practices which is of particular importance in view of prospective premature retirement of plant under its modernization program for which only partial depreciation has been provided. An independent study of the company's depreciation records was undertaken to determine the reasonableness of rates, the adequacy of reserve requirement, and the propriety of the methods employed. As a result, it will be possible to recommend (1) the adoption of depreciation rates more closely conforming to probable future experience of the company than provided for by rates now in effect, and (2) an adequate depreciation reserve reflecting actual depreciation existing in plant, also (3) to outline procedures whereby the company may improve upon its present depreciation practices. Studies of the depreciation rates of international telegraph common carriers continued.

Continuing property records.—Western Union has made substantial progress in establishing a continuing property record. Effort continues to obtain compliance from ocean cable and radiotelegraph carriers. Companies which do not have a continuing property record plan are required to submit bimonthly reports of progress in that direction.

Pension accounting.—Studies of carriers' pension plans continued, including actuarial methods used by RCA Communications, Inc., Radiomarine Corporation, and Mexican Telegraph. Further consideration was given to excluding from current operating expenses of Western Union all pension costs in excess of normal accruals on the full-service basis (that is, the respective annual amounts that would be paid into a pension trust if the company had maintained such a fund during employees' service).

Uniform system of accounts.—A list of retirement units for outside wire-telegraph and ocean-cable plant was added. It was designed to show what units would, upon retirement, be accounted for by depreciation rather than by direct charges to expenses. Supplemental instructions included accounting for revenues for transmissions at gateway and inland points. An amendment deleted "foreign-exchange differential" accounts and permitted carriers to make entries direct to income accounts for gains or losses arising from differences in rates of exchange.

Revision of annual reports.—Annual report Forms O and R were revised by deleting unnecessary schedules, adding new schedules, and consolidating several others, thereby resulting in shorter reports yet providing adequate information to the Commission.

Preservation of records.—Regulations governing preservation of records were modified to relieve carriers from preparing a prescribed index of records in certain instances. Progress was made in drafting revisions which will reflect modern methods of record keeping, such as machine bookkeeping and microfilming.

Reclassification of plant.—Western Union progressed in reclassifying its plant despite the fact that introduction of radio-relay plant created many new problems. The Commission approved the company's proposal to record the book cost of the new radio-relay plant in accordance with prescribed radiotelegraph plant classifications. Since 1938 adjustments have been made reducing Western Union's net book cost by approximately $77,000,000 (exclusive of about $43,000,000 pertaining to former Postal Telegraph plant). Plant of international carriers has been reclassified in accordance with the plant accounts prescribed in the new systems of accounts.

Original cost adjustments.—Further progress was made in restating the plant of international carriers on the basis of original cost. In the case of one carrier, adjustment required reduction in recorded book cost of over a million dollars, with a charge to surplus created as a result of reduction of capital.

LAND-LINE TELEGRAPH STATISTICS

Twenty-eight annual reports were filed by wire-telegraph, ocean-cable, and radiotelegraph carriers for the calendar year of 1946. Some selected financial and operating items compiled from Western Union reports for 1946, as compared with 1945, are shown in the table below. These figures relate to land-line operations of that carrier, inasmuch as the data applicable to its cable operations are included in the table pertaining to ocean-cable carriers shown in the "International" section of this chapter.

The Western Union Telegraph Co.[1]

Item	1945	1946	Percent increase or (decrease), 1946 over 1945
Investment in plant and equipment	$357, 783, 838	$361, 618, 200	1.07
Depreciation and amortization reserves	$157, 243, 013	$161, 825, 750	2.91
Net investment in plant and equipment	$200, 540, 825	$199, 792, 450	(.37)
Transmission revenues	$166, 544, 597	$160, 242, 193	(3.78)
Total operating revenues	$182, 047, 743	$175, 535, 860	(3.58)
Operating expenses, depreciation, and other operating revenue deductions	$174, 847, 497	$183, 365, 261	4.87
Net operating revenues	$7, 200, 246	[2] $7, 829, 401	(208.74)
Net income	[2] $7, 832, 903	[2] $10, 030, 010	
Dividends declared	$2, 432, 594		(100.00)
Revenue messages handled	245, 157, 962	221, 243, 091	(9.75)
Number of employees at end of October	63, 446	57, 644	(9.14)
Total pay roll for the year	$126, 662, 000	$137, 292, 715	8.39

[1] Represents data for land-line operations. Figures covering cable operations included in table on p. 68. Amount of dividends applicable to cable operations cannot be segregated. [2] Deficit.

INTERNATIONAL

SERVICE AND FACILITIES

General.—The Commission participated in the work of the Telecommunications Coordinating Committee, which is made up of representatives of Government departments and acts in an advisory capacity for coordinating United States policy in the field of international communications. The Commission likewise worked with the Interdepartmental Radio Advisory Committee which functions as a clearing house for Government frequency assignments.

Since the end of the war, all but 7 of the 100 frequency assignments borrowed by the Government for war purposes have been or are about to be reassigned to commercial carriers. This will help meet the demand for frequencies in the 2 to 20 megacycle range used for international communciations. In addition, approximately 150 new frequency assignements were made during the year. The major portion was within the presently authorized bands and represent an expansion of use of licensed channels resulting from improved operating techniques and equipment, thereby promoting more efficient use in the radio spectrum.

Radiotelegraph circuits.—Postwar expansion of international communication saw the establishment of direct radiotelegraph service with Athens, Greece; Geneva, Switzerland; and Nanking, China; and the reestablishment of prewar circuits with Saigon, French Indochina; Batavia, Java; Manila, Philippine Islands; and Shanghai, China.

On June 26, 1947, the Commission issued a proposed decision in Dockets 7094 and 7412 looking to authorization of only one direct radiotelegraph circuit with each of the following countries with which the United States does not now have direct circuits: Jamaica, Saudi Arabia, Palestine, and the Union of South Africa. It also proposed to discontinue one of the two direct radiotelegraph circuits operating between the United States and Australia, New Zea-

land, and India, respectively, and to license a single circuit with Greece. These proceedings grew out of provisions of the Bermuda telecommunications agreement mentioned in the 1946 annual report.

Review of radiotelegraph service.—On November 27, 1946, the Commission instituted a general investigation of radiotelegraph service between the United States and foreign points to determine whether the present disposition of radiotelegraph circuits and frequencies among the radiotelegraph carriers serves public interest. Hearing in this matter was scheduled for the fall.

International Telegraph Regulations.—The Commission, together with other interested Government agencies, undertook a thorough study of the International Telegraph Regulations in preparation for the forthcoming Paris administrative conference. Although the United States has not formally adhered to these regulations, they constitute basic tariff and operating rules under which nearly all international telegraph communications are carried on.

RATES AND TARIFFS

Rate increases.—Despite traffic volumes more than double those of previous years, mounting operating expenses and declining operating revenues in the later months of the calendar year 1946, due in part to rate decreases in May and June, produced an unhealthy financial condition in the international field. It was estimated on the basis of the latter months of 1946 and early 1947 that two international telegraph carriers, All America and Tropical Radio, would operate in the black to the extent of $750,000 in 1947, while other carriers would suffer substantial operating losses of $4,650,000. By order of March 12, 1947, the Commission instituted a general investigation, and public hearings were held in April and May at which the carriers urged substantial rate increases as a solution to their difficulties. Decision was pending at the close of the fiscal year.

Rate reductions.—International radio and cable carriers substantially reduced rates for message telegraph service from the Dutch East Indies, French Indochina, the United Kingdom and Ireland, China, Sweden, French Guiana, and Macao, to the United States and its possessions. Special reduced rates for official messages of the United Nations, International Bank for Reconstruction and Development and International Monetary Fund between the United States and most foreign countries were established by the carriers. The rates for such messages are generally one-half of the commercial rates.

STATISTICS

Cable and radiotelegraph carriers engaged in international traffic handled 697,449,196 paid words in the calendar year 1946. Outbound words totaled 342,975,144, in-bound 354,474,052. The extent of

this traffic with the principal countries is shown in the accompanying tabulation:

International telegraph (radio and cable) traffic, 1946

Country	Number of words	
	Out-bound from the United States	In-bound to the United States
Europe, Africa, and the Near East:		
Belgium	5, 284, 500	4, 634, 998
Denmark	2, 089, 382	1, 825, 262
Finland	727, 564	746, 381
France	21, 758, 801	21, 012, 136
Germany	6, 666, 010	21, 584, 940
Hungary	1, 293, 562	704, 186
Italy	11, 749, 097	9, 481, 245
Netherlands	5, 483, 924	5, 127, 945
Norway	3, 547, 898	2, 418, 601
Portugal	3, 139, 623	2, 463, 875
Spain	4, 513, 319	3, 463, 759
Sweden	7, 911, 114	7, 176, 416
Switzerland	8, 882, 531	6, 644, 078
Union of South Africa	4, 093, 661	4, 432, 267
U. S. S. R.	10. 752. 595	17, 028, 685
United Kingdom and Eire	69, 204, 606	66, 246, 149
All other countries	28, 375, 104	26, 292, 304
Total	195, 473, 291	201, 283, 227
West Indies, Central, North and South America:		
Argentina	12, 292, 138	11, 092, 593
Bolivia	922, 707	630, 576
Brazil	13, 690, 858	13, 318, 847
British West Indies	2, 580, 901	2, 299, 446
Canada	8, 490, 892	10, 750, 206
Central America	6, 496, 635	6, 249, 883
Chile	3, 518, 083	2. 846, 143
Colombia	5, 256, 708	4. 033, 229
Cuba	10, 835, 438	10, 621, 872
Dominican Republic	1, 059, 476	990, 056
Ecuador	1, 373, 078	1, 076, 835
Haiti	573, 823	539, 006
Mexico	4, 093, 905	2, 989, 876
Neth. West Indies	1, 006, 184	1, 223, 294
Peru	2, 574, 883	1, 885, 492
Puerto Rico	3, 111, 926	2, 937, 383
Uruguay	3, 163, 795	1, 826, 673
Venezuela	4, 944, 583	4, 713, 897
Virgin Islands	179, 404	156, 358
All other countries	949, 412	711, 798
Total	87, 113, 929	80, 893, 963
Asia and Oceania:		
Australia	5, 454, 364	5, 474, 286
China	15, 773, 549	13, 943, 862
Hawaii	13, 015, 443	10, 715, 783
India	5, 481, 372	5, 202, 767
Japan	2, 650, 680	8, 772, 456
Philippines	12, 476, 706	17, 498, 697
All other countries	4, 865, 701	7, 231, 989
Total	59, 717, 815	68, 839, 845
Miscellaneous	670, 109	3, 457, 017
Grand total	342, 975, 144	354, 474, 052

Selected financial and operating data compiled from annual reports filed by international telegraph (radio and cable) carriers for the calendar year 1946, as compared with 1945, appear in the following tables:

Radiotelegraph carriers

Item	1945	1946	Percent increase or (decrease), 1946 over 1945
Investment in plant and equipment (as of Dec. 31)	$28, 571, 927	$34, 015, 568	19. 05
Depreciation and amortization reserves	$16, 588, 106	$16, 676, 631	. 53
Net investment in plant and equipment	$11, 983, 821	$17, 338, 937	44. 69
Message and other transmission revenues	$20, 660, 835	$20, 501, 801	(. 29)
Total operating revenues	$22, 459, 735	$21, 775, 900	(3. 04)
Operating expenses, depreciation, and other operating revenue deductions	$15, 755, 732	$21, 550, 904	36. 78
Net operating revenues	$6, 704, 003	$224, 996	(96. 64)
Income and excess profits taxes	$6, 299, 881	$200, 454	(96. 82)
Net income	$2, 268, 174	$313, 034	(86. 20)
Dividends declared	$850, 000	$872, 000	2. 59
Revenue messages handled: [1]			
Domestic service classification [2]	75, 434	96, 871	28. 42
Foreign service classification [2]	9, 374, 597	10, 476, 469	11. 75
Marine	52, 795	629, 983	1, 093. 26
Number of employees at end of October	[3] 4, 662	5, 969	28. 04
Total pay roll for the year	$14, 216, 543	$17, 832, 605	25. 44

[1] Excludes domestic haul of foreign, insular, and marine messages to avoid duplication.
[2] International messages (primarily Canadian and Mexican) transmitted in accordance with carriers' rules governing domestic traffic are included under "Domestic service classification." Insular messages are included under "Foreign service classification."
[3] Represents number of employees at end of December.

Ocean cable carriers

[Including cable operations of the Western Union Telegraph Co.]

Item	1945	1946	Percent increase or (decrease), 1946 over 1945
Investment in plant and equipment (as of Dec. 31)	$108, 636, 285	$95, 129, 932	(12. 43)
Depreciation and amortization reserves	$69, 459, 405	$60, 078, 811	(13. 51)
Net investment in plant and equipment	$39, 176, 880	$35, 051, 121	(10. 53)
Transmission revenues:			
Domestic service classification	$825, 348	$844, 716	2. 35
Foreign service classification	$24, 358, 725	$20, 396, 545	(16. 27)
Total operating revenues	$26, 646, 572	$22, 691, 417	(14. 84)
Operating expenses, depreciation, and other operating revenue deductions	$19, 709, 666	$21, 366, 862	8. 41
Net operating revenues	$6, 936, 906	$1, 324, 555	(80. 91)
Income and excess profits taxes	$1, 486, 403	$344, 759	(76. 81)
Net income	$5, 523, 545	$522, 784	(90. 54)
Dividends declared	$20, 141	$2, 148, 066	10, 565. 14
Revenue messages handled:			
Domestic service classification	648, 310	696, 820	7. 48
Foreign service classification	9, 883, 006	10, 656, 424	7. 83
Number of employees at end of October	[1] 4, 962	5, 681	14. 49
Total pay roll for the year	$10, 983, 632	$12, 664, 251	15. 30

[1] Represents the number of employees at end of December.

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CHAPTER VI.—RADIO OPERATORS

1. COMMERCIAL RADIO OPERATORS
2. COMMERCIAL RADIO SERVICE

1. COMMERCIAL RADIO OPERATORS

The Commission is charged by Congress with regulation of all persons in the United States engaged in communication or transmission of energy by radio. As part of these duties, it has established six classes of commercial radio operator licenses and an "authorization" restricted to operation of aircraft radiotelephone equipment.

With the exception of restricted radiotelephone operator permits and aircraft authorizations, commercial radio operator licenses are issued only to applicants who successfully complete prescribed examinations.

Unless excepted by the Commission's rules, personnel who operate commercial radio stations must hold valid commercial radio operator licenses of the proper grades. The term "commercial radio operator", therefore, identifies the thousands of licensed radio operators employed by broadcast stations, coastal harbor stations, coastal radiotelephone and radiotelegraph stations, ship radiotelephone and radiotelegraph stations, railroad radio stations, state and municipal police radio stations, fire department radio stations, etc.

There has been a rapid postwar increase in the ranks of commercial radio operators. More than 325,000 persons held such licenses at the close of fiscal 1947.

The resumption of peacetime pursuits by veterans and civilians who, because of experience with radio before or during the war, desired to make it their career, presented a rehabilitation problem. The Commission cooperated in establishing in the United States Employment Service a clearing house to assist radio stations obtain licensed employable personnel. To cushion the transition from war to civilian pursuits, the Commission extended, by Orders 77–G and 77–H, its temporary modification of rules permitting renewal of outstanding commercial radio operator licenses without requiring applicants to show service under their licenses. The 128 series of Commission Orders was likewise extended by Orders 128–B and 128–C to permit renewal of expired commercial radio operator licenses valid on or subsequent to December 7, 1941, the holders of which were in the military services

or the merchant marine at some time during the terms of the licenses or who, because of civilian assignments outside the United States in connection with the war effort, were unable to file timely applications for renewal.

During the fiscal year the Commission issued approximately 54,000 new and 24,000 renewed commercial licenses in connection with expanding radio services.

To facilitate licensing of the many additional radio operators in the lower grades of licenses acceptable for minimum operator requirements at new stations, the Commission established an "authorization" valid for operation of aircraft radiotelephone equipment only, and relaxed its rules to allow restricted radiotelephone operator permits to be acquired through the mail as well as by personal appearance at Commission field offices. Authorizations to operate radiotelephone equipment on aircraft may be obtained either at a Commission office or from any CAA certified pilot examiner appointed as issuing agent by the Commission. This eliminates long and arduous journeys to designated examination points. Under the new procedure, these authorizations and permits are issued without written examination, thus further simplifying the procedure for obtaining them.

At the beginning of the year, the Commission considered requests from several standard broadcast stations for temporary continuance of the relaxed radio operator standards authorized under its Order No. 91–C and subsequently withdrawn by Order No. 91–D, effective August 1, 1946. These stations have since secured radiotelephone first class operators and prewar radio operator standards again prevail throughout this branch of the industry.

It became apparent during the year that the wartime relaxation of technical requirements for operators of radiotelegraph transmitters in aeronautical and aeronautical fixed stations was no longer desirable in view of the increased availability of properly qualified operators and the decline in use of radiotelegraphy at aeronautical stations. The Commission, therefore, on March 25, 1947, by its Order 102–A canceled its Order 102 which temporarily permitted the operation of telegraph transmitters at these stations by holders of radiotelephone operator licenses endorsed to show proficiency in transmitting and receiving International Morse Code at the rate of 16 code groups per minute.

To cope with shortage of ship radiotelegraph operators arising at several ports during the past year, the Commission authorized its engineers in charge in the affected districts to waive the 6 months' experience requirement for sole or chief radiotelegraph operators of cargo ships so that operators without the requisite experience might be assigned to vessels otherwise unable to sail for lack of qualified radio personnel.

The Commission, after considering a request to modify its Order 133 to permit specially trained unlicensed installation personnel to make antenna tuning and coupling adjustments to transmitters in mobile units, concluded that the public interest might be served if such adjustments were permitted. Accordingly, on April 25, 1947, it proposed an amendment to Order 133 to permit unlicensed persons to make the adjustments requested, but under certain specified conditions. A flood of protests resulted, which were under Commission study at the year's close.

Actions of the Commission with respect to commercial radio operators have been influenced by development of standardized radio equipment that has greatly simplified technical operation and, conversely, by new developments which have increased the complexity of other equipment, thus calling for greater knowledge and skill on the part of operators. In view of this, the Commission inaugurated broad studies of the entire radio field to determine and recommend changes in the present radio operator licensing system and related rules and examinations. The Commission prepared numerous proposals relating to commercial operators for consideration by the World Telecommunications Conferences. Whether an over-all revision of the licensing system results or gradual changes are inaugurated, it can be expected tem results or gradual changes are inaugurated, it can be expected matters will be brought abreast of the latest developments in the radio art.

2. AMATEUR RADIO SERVICE

The amateur radio service in which more than 75,000 amateur stations and more than 80,000 amateur radio operators are licensed is one of the oldest, largest, and most active radio services established by the Commission.

Through intercommunication between their stations, these self-styled "hams" conduct programs of experimentation and self-improvement while engaging in a fascinating hobby which has proved itself an asset to the national welfare. The amateur radio service has provided an invaluable reservoir of trained radio personnel in time of war, it has in many instances supplied the only means of communication when disaster has disrupted normal public and official facilities, and it has been the source of many outstanding advances in radio technique.

In furthering this important service, the Commission has, insofar as possible, assigned harmonically related groups of frequencies for the exclusive use of amateur radio stations and otherwise encouraged amateur activities.

Licensed amateur radio operators are United States citizens who have passed the required examination and were found to be otherwise quali-

fied. Operation of amateur radio stations and the conduct of amateur radio operators are required to be in accordance with prescribed rules.

The Commission during the past year, by its Orders 130–I, 130–J, 130–K, 130–L, 130–M, 130–N, and 130–O, continued its policy of assigning former amateur frequencies for use by amateurs as quickly as military relinquishment made them again available. Certain frequency band assignments were necessarily deleted or modified and others added to assure the most equitable and practical distribution among the amateur and other services. The Commission's monitoring stations maintained a close watch on amateur, as well as other frequencies, in order to observe any off-frequency operation or violations of applicable regulations. When such conditions were observed, the offending licensees were required to take corrective action without delay. In a few flagrant cases it was necessary to suspend the amateur's operator license and revoke his station license.

Resumption of postwar amateur radio activities was made easier by promulgation of Order 115–C, dated January 3, 1947, which extended and reinstated until 1948 all amateur operator licenses issued between December 7, 1938 and December 31, 1944, and provided that the terms of amateur station licenses affected by the order should run concurrently with such extended or reinstated operator licenses.

Renewal of outstanding amateur operator licenses was also facilitated when the Commission approved Orders 77–G and 77–H extending for additional periods, the last of which ends on June 30, 1948, the suspension of the terms of section 12.27 of its rules insofar as they require applicants for renewed amateur operator licenses to make a showing of use of the expiring license.

The Commission on July 11, 1946, adopted Order 132–A exempting amateur station licensees, who move their stations to a new permanent location within the same call area, from following the calling procedure referred to in section 12.93 [c] of the rules, as previously required by Order 132, pending modification of their station licenses.

The first full year of amateur operation since the end of the war saw a number of emergencies during which amateurs furnished communication facilities. The most notable of these was the Texas City, Tex., explosion and fire in April 1947. The Commission withdrew the amateur frequencies between 3860 and 3940 kilocycles and the frequency 7050 kilocycles from general use within the triangular area bounded by Beaumont, San Antonio and Corpus Christi, and assigned them for the exclusive use of amateur stations transmitting emergency traffic within the designated area pending reestablishment of regular communication services. Other emergencies caused by tornadoes, floods, and fires in various parts of the country saw amateurs fill the breach left by disrupted commercial communication lines.

Considerable interest in the use of narrow band FM has been indicated by amateurs. The rules do not authorize use of FM by amateur stations on frequencies below 27.160 megacycles. Special temporary authorizations permitting them to use narrow band FM in the lower frequency bands for periods not exceeding 90 days were approved in a number of instances where the applicants made a showing of a bona-fide program of experimentation and agreed to furnish the Commission with periodic reports of their observations. The resulting data has proved helpful in connection with laboratory and operating tests of narrow band FM by Commission engineers.

The Commission was engaged in a study of the amateur radio service throughout the year and is preparing recommended changes in the amateur rules and licensing procedures to bring them in line with recent technical developments and improved communication techniques.

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CHAPTER VII.—FIELD ENGINEERING AND MONITORING

1. FIELD ENGINEERING AND MONITORING DIVISION

1. FIELD ENGINEERING AND MONITORING DIVISION

Effective July 1, 1946, the Field Division and the Radio Intelligence Division were merged to form the Field Engineering and Monitoring Division. The reorganized division consists of four sections, namely, the Inspection and Operator Examination Section, the Monitoring Section, the Technical Operations Section, and the Administrative Section.

The field service is divided along two major lines, one having to do with enforcement activities, the other with monitoring. Enforcement duties include inspections, examinations, investigations, etc., and are carried on out of 23 district offices, 6 suboffices, and 4 ship offices. Ten primary monitoring stations and 12 secondary monitoring stations engage in frequency measurements, signal recordings, long-range direction finding, interference and general illegal-operation investigation. All field activities, both enforcement and monitoring, are under the general supervision of nine regional managers.

A total of 142 field cars, of which 54 are equipped with monitoring and direction finding apparatus, were used in connection with field work. They operated a total of 1,072,894 miles in fiscal 1947.

EXAMINATIONS AND INSPECTIONS

Radio operator waivers.—Effective May 15, 1947, engineers in charge of port offices were given authority to issue waivers of section 353 (b) of the Communications Act, thus permitting operators with less than 6 months' sea experience to sail on oceangoing vessels for one voyage in cases where more experienced operators could not be obtained. Placing such determination in the hands of field engineers in close touch with conditions existing at the several ports expedited handling of such applications. Up to June 30 a total of 73 waivers were issued.

Radio operator examinations.—New operator code examination tapes for field office use were designed in accordance with international regulations. Examinations were given 67,401 applicants for all classes of commercial licenses as compared to 69,706 in 1946. Applicants for amateur classes A and B radio operator licenses totalling

12,994 were examined as compared to 6,923 in 1946. Total operator examinations for 1947 were 80,395, an increase of 3,766 over 1946.

Broadcast station inspections.—From January 1 to June 30, 1947, initial inspections were made of 252 new broadcasting stations on equipment tests preliminary to commencement of program tests. Of the first 125 stations inspected, 22 were found to be "unsatisfactory," 13 "poor," 24 "fair," and the balance "satisfactory" or "excellent." These preliminary inspections are made to insure that all new stations have been completed in accordance with the terms of their authorizations and to prevent transmissions of poor technical quality.

Ship inspections.—For the purpose of concentrating on compulsory and passenger ship stations, there was a reduction in the frequency with which cargo ships were inspected. However, a total of 11,717 United States ships were inspected during fiscal 1947 as compared with 12,765 the year before. Inspections of all ship stations, both United States and foreign, increased to 13,948 in 1947 from 13,788 in 1946. The number of inspections of foreign ship stations increased 169 percent over 1946. Technical deficiencies of all kinds noted by these inspections totaled 9,230 for 1947 as compared with 8,769 for the year previous. In addition, 5,128 deficiencies were corrected during inspections as compared with 6,959 for 1946.

Inspection of other stations.—The number of inspections of stations other than broadcast and ship increased materially. Under revised inspectional instructions, hundreds of new stations as well as previously licensed stations which had not been visited during the war were inspected to assure that their operation conformed with the terms of their licenses and the Commission's regulations. A total of 9,294 land station inspections of all classes were made as compared to 7,017 during 1946. In the course of these inspections 2,706 technical deficiencies were found during 1947 as compared to 1,890 in 1946.

MONITORING

Frequency measurements.—Activities by the 22 primary and secondary monitoring stations were reorganized on a peacetime basis during the year with emphasis directed toward the solution of technical problems and the correction of technical deficiencies and discrepancies. Frequency measurements were extended for the first time with a high degree of accuracy. Particular attention was given to the operation of radio stations engaged in FM and television broadcasting. A number of the former, which were observed operating outside of tolerance, were assisted by field monitoring stations in getting back on their assigned frequency. Other new services received like attention with the result that frequency tolerances on the part of stations and services were exceedingly good. As a result of monitoring activities, 16,483 notices were served during the year compared with 2,104 in

1946. This total was made up of 4,885 violations of treaty, 5,393 violations of the Communications Act or Commission regulations, 1,031 frequency deviations, and 5,174 minor infractions.

Interference.—A marked rise was noted in the number of complaints of unidentified interference. This was due largely to the increase in the number of radio stations and services. Other interference complained of resulted from radiation produced as a by-product of the operation of industrial, scientific, and medical equipment. The use of long-range direction finders and mobile units proved successful in the identification and location of both classes of interference. Much of this interference was not disruptive to radio communication and, therefore, was classified as minor in nature. There were 5,731 minor interference cases reported during the year in addition to 1,112 cases of major consequence.

Illegal station operation.—The number of illegal radio stations located during the year totaled 121, which represents a slight increase over the 1946 figure of 117. A large percent of this unlawful operation was found to be carried on either by minors or misinformed persons without malicious intent. In many instances it was possible to work cooperative measures to terminate such unauthorized operation without the necessity of criminal prosecution. On the other hand, 12 cases were referred to the Department of Justice for prosecution either as a result of the seriousness of the case or where knowledge of the law was apparent and where the violation was willful.

Direction finding.—Direction finding activities in the monitoring field continue to be an important operation. The great majority of interference cases require the use of the Commission's direction finding network. Without long range direction finders operating as a coordinated unit by means of private line teletype and radio connections, the location of the source of thousands of cases of interference and their subsequent elimination would be impossible. Although less impressive numerically, the assistance rendered through direction finding services to the safety of life and property in the air and at sea is of inestimable value. During the fiscal year monitoring stations received 124 requests for direction finding assistance to lost planes, resulting in the furnishing of 64 "fixes." While this shows a decrease over the previous fiscal year, it is expected that during fiscal 1948 this figure will materially increase due mainly to the closing of the United States Coast Guard and United States Army direction finding networks.

TECHNICAL OPERATIONS

Equipment requirements.—Movement of radio services into the higher frequencies requires the Commission's engineering staff to keep pace in the development and procurement of equipment for monitoring and supervising this portion of the band. Extension of the range

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of frequency measuring equipment for primary stations was accomplished by the addition of a standard harmonic amplifier developed by A. K. Robinson of the Santa Ana monitoring station, and by certain modifications to the general radio type DS–1 heterodyne frequency meter. Additionally, a number of Hoffman meters were obtained for mobile use, which extends frequency measurements performed in the field into the very high-frequency ranges. Although procurement of new technical equipment has been difficult because of manufacturing delays, a considerable amount is either on order or has already been received. A number of new high frequency receivers are in operation at monitoring stations and in a limited number of field mobile units. To permit extending the signal and noise recording program, additional standard signal generators have been procured, also a limited number of needed field intensity sets. Frequency analysis spectroscopes designed by the Field and Laboratory Divisions have been distributed to all primary monitoring stations.

Field projects.—Forty-seven new field projects were assigned during the year. These included investigations of man-made noise in rural areas; studies of the nature, effect, and elimination of cross modulation interference from standard broadcast stations; design and construction of wide band radio frequency transformers for monitoring station antennas; design and construction of a fixed monopole type long range direction finder; field strength recording of very-high frequency transmissions; field intensity measurements of carrier-current systems; studies of blanketing interference from broadcast stations; field tests of auto alarms, and interference to television. A study of a variable side band frequency measuring system was completed by the Millis primary monitoring station. A new project involves a comprehensive survey of the functioning of directional antennas of standard broadcast stations.

CHAPTER VIII.—TECHNICAL STUDIES

1. TECHNICAL INFORMATION DIVISION
2. LABORATORY DIVISION

1. TECHNICAL INFORMATION DIVISION

In its eleventh year of operation, the Technical Information Division continued its primary long-term studies described in previous annual reports, and initiated new studies as the need for them was indicated.

It was represented at meetings of numerous groups interested in contemporary radio research problems. These included technical committees of the Institute of Radio Engineers, Radio Technical Planning Board, Aircraft Radio and Electronics Committee of the Aeronautical Board, Radio Technical Coordinating Committee on Reduction of Interference of the American Standards Association, and the joint committee of the Radio Manufacturers' Association and the Society of Automotive Engineers for the reduction of ignition interference from automobiles.

The Chief of the Technical Information Division serves as alternate for the Chief Engineer on the Executive Council of the Central Radio Propagation Laboratory (CRPL), through which research on wave propagation is coordinated among various Government agencies, and as second alternate for the Chairman of the Commission on the President's Scientific Research Board, to which several reports were furnished as requested on matters relating to developments in the national research program.

WAVE PROPAGATION

These studies are maintained for the determination of field intensities and of noise and interference to be expected in radio reception. The analyses are used in formulating engineering standards and regulations governing radio services. The data on which these studies are based are obtained principally from the following continuing projects, supplemented by information available from the industry and from other Government departments:

Sunspot Cycle.—Continuous automatic recording machines installed at the Commission's monitoring stations at Baltimore, Md.; Grand Island, Nebr.; Portland, Oreg.; and Powder Springs, Ga., are used

to make field intensity records of the signals of selected stations operating in the broadcast band. The recorder tapes are analyzed to obtain hourly median values of field intensity. Solar activity, which has a profound effect upon radio wave propagation, varies in unidentical cycles of approximately 11 years duration. Hence, this recording program must be continued over a long period of time. It was begun in 1938.

Skywave pulse transmissions.—Radio signals which travel from the transmitter to the receiver by way of the E or F layers of the ionosphere are characterized by multiple reflections of different relative amplitudes and phases, depending on the distance or range of reception. To determine action and effect, pulses transmitted by selected broadcast stations are received simultaneously on loran receivers at distances of 500 to 2,000 miles. The pulses appearing on the oscilloscopes of each receiver are photographed at equal intervals of time. The results are then analyzed to determine the signal intensities exceeded for various percentages of the time for the components arriving by way of one, two, three or more reflections or hops from the ionosphere. This information supplements that obtained from the sunspot cycle recording program.

Atmospheric noise.—Continuous field intensity recordings are made of atmospheric noise on at least one of the three frequencies of 200, 540 and 1,600 kilocycles at each of the Commission's four monitoring stations noted previously. This information, together with that received from other sources, is analyzed and correlated with thunderstorm data supplied by the United States Weather Bureau. Atmospheric noise maps are then prepared, showing the characteristic variations and trends with the time of day and as a percentage of the time for each frequency band. These maps are used in estimating the signal level required to provide an acceptable radio service in the presence of atmospheric noise and, hence, the service ranges that are possible in the absence of interference from other radio stations.

Results of studies from the foregoing three projects were used for the preparation of Commission exhibits and testimony at the clear channel hearing (Docket 6741) and in the hearing on daytime skywaves (Docket 8333). The studies are being extended to determine the effects on service should the power of clear channel stations be increased.

Very-high frequency recording.—Measurements of the field intensities of FM and television stations operating between 30 to 300 megacycles were continued to obtain data needed in the preparation of standards for predicting good service and objectionable interference ranges for these classes of stations. The locations and numbers of recorders varied from time to time. On the average at least six recorders were in operation, located at Laurel, Md.; Allegan, Mich.; Port-

land, Oreg.; Powder Springs, Ga.; San Leandro, Calif.; and a temporary recording site at Southampton, Pa. In addition, the RCA Laboratories cooperated in operating two recorders at Princeton, N. J.

With increasing sunspot activity during the year, it became apparent that long distance propagation via the F2 layer of the ionosphere was to be expected in the lower ultra-high frequency bands. Some recordings were obtained at eastern locations but, since reception occurred only at great distances, the Portland and San Leandro stations proved to be the most valuable for this purpose.

A study, based on selected measurements from the above project and on mobile field surveys, was introduced into the record of the engineering conference on the sharing of television channels by mobile services. A study was in progress to correlate available data on very-high frequency propagation for the purpose of arriving at coverage and interference standards for FM and television stations operating on frequencies between 30 and 300 megacycles.

Continuous recordings were made for a period of 5 months of field intensity on the frequency 700 megacycles from a test transmitter operated in the Chrysler Building in New York City by the Columbia Broadcasting System. Measurements were made by the Commission at Laurel and Southampton and by the RCA laboratories. The data formed the basis of an exhibit relating to probable service and interference ranges for the color television hearing (Docket 7896). Supplemented by information from other surveys and sources, it was valuable in assessing the accuracy and applicability of theoretical radio propagation formulas upon which previous allocation studies had been made.

SPECIAL STUDIES

A study to determine satisfactory levels of broadcast signals in the presence of atmospheric noise was completed, in cooperation with the industry, for the clear channel hearing. This involved subjective listening tests on some 2,000 persons in all walks of life.

A study was instituted to reclassify and to adopt rules for each class of radio frequency generator now operating under the low power rules, such as phonograph oscillators, remote control devices, and college and utility carrier systems. The rapid increase in the number of such devices since the war, and their more varied applications, have made such action necessary.

2. LABORATORY DIVISION

The Laboratory Division, created in March 1946, is engaged chiefly in studying and testing new types of radio apparatus requiring type approval by the Commission, and otherwise evolving means and methods of preventing interfering radiation.

INDUSTRIAL HEATING AND DIATHERMY

Its chief activity during 1947 was in establishing standards and procedures for reducing interference from diathermy and industrial heating equipment.

A first step consisted of gathering data as to the engineering specifications which could be met by the industries concerned and determining the amount of interference that could be tolerated by television and other affected services. The second phase was weighing the conflicting requirements of industry against the requirements of the communications services in order to effect a reasonable compromise.

In one instance the industry had proposed the joint use of frequencies by diathermy, industrial heating and radar. Field tests indicated that such operation would result in a hazardous condition, since the operation of diathermy and industrial heating equipment on the same frequency as radar equipment could blank certain sectors of the radarscope and thus endanger vessels and aircraft.

Considerable effort was also expended in establishing measurement standards for the field intensities radiated by diathermy and industrial heating equipment. The Laboratory Division was represented on two subcommittees of the American Institute of Electrical Engineers—one committee covering the general industrial heating field and the other committee studying methods for making field intensity measurements of the radiations of industrial heating apparatus. A symposium, to which representatives of the diathermy industry were invited, was conducted by the Laurel laboratory in June to acquaint the industry with the measurement methods used by the Commission.

A diathermy machine was constructed by laboratory engineers to demonstrate the feasibility of the proposed rules. The machine was tested for therapeutic effects by the American Medical Association and Council on Physical Medicine. It met the requirements of the latter and was well within the frequency and field intensity requirements of the proposed rules.

These efforts resulted in the final adoption of part 18 of the Commission's rules and regulations, effective June 30, 1947. The stimulus given the industrial heating industry by the war, together with the utilization of the higher frequency bands by FM and television broadcast and by police, radar and other safety services required such steps to protect these communication channels. The magnitude of the interference problem can be adjudged from the fact that at present more kilowatts of power are installed in industrial heating plants than in all communication industry installations.

It is realized that the present field intensities permitted in part 18 of the rules may cause some interference to television and other reception in certain restricted areas and that lower values of permissible field intensity may have to be established. It did not appear appro-

priate to recommend these lower values in fiscal 1947 since to have done so might have retarded the industrial heating and diathermy industries.

STRATOVISION

The Laboratory Division cooperated with the Westinghouse Electric & Manufacturing Co. in making certain measurements of the strength of signals received from aircraft flying at altitudes of 10,000 to 20,000 feet. Automatic recording equipment was set up at the Laurel laboratory and measurements made on a number of frequencies of the emissions received from radio equipment located in a plane on a number of flights over various terrain and at different altitudes.

The results indicated a method for serving much greater areas with television and FM broadcast, including the possibility of furnishing such services to wide rural areas. These stratovision tests also indicated a possible method of relaying television and other transmission over long distances without the necessity of a large number of repeater stations. It was recommended that the Commission investigate the possibilities of this method of transmission.

EQUIPMENT TESTING

Numerous pieces of apparatus were tested to determine whether they would meet existing Commission requirements or, if no particular requirements were specified, whether the equipment could be operated to serve the purpose for which it was intended without causing interference to other communications services. The following tabulation indicates some of these tests:

Three tests were made on broadcast frequency monitors. The equipment was found unsatisfactory on two tests, and in compliance on one.

Three modulation monitors were tested. One was found unsatisfactory and two were found in compliance (after certain minor changes were made in one instrument).

Tests were made on two types of altimeters proposed for licensing by the Commission. Both were found to require an extremely wide portion of the radio spectrum.

A war surplus type aircraft transmitter was tested and found not to have suitable frequency stability for employment in the commercial aviation service.

Tests were conducted on field intensity equipment being produced by one large manufacturer for the measurement of frequencies in the standard broadcast band. Certain errors were indicated in the measured values and the manufacturer was so advised. Subsequently, the manufacturer located faulty equipment in his calibration set-up and correction was made.

A consulting engineer making measurements in the FM broadcast

frequency band submitted a field intensity meter. Although the former had been calibrated by one of the major manufacturers of field intensity equipment, it did not agree with the equipment used at the laboratory. Subsequent tests by the manufacturer indicated difficulties in his calibration procedure and he recalled a number of instruments for recalibration.

TELEVISION

Certain data was obtained by the laboratory for the Commission's use in the color television hearing. Field and laboratory tests were conducted with regard to black and white television to determine the possibility of the shared use of frequencies by television and other services. Demonstrations were conducted for members of the Commission and movies were obtained of the interference produced by the sharing of television frequencies with other services.

FM BROADCASTING

Eight FM broadcast receivers were obtained from manufacturers to permit determination of their characteristics. Such information was needed to enable the Commission to space the stations in frequency and geographically so as to render required service and at the same time prevent interference to reception. Tests on these and other FM receivers are being continued to obtain data to permit the most effective use of the frequencies available for FM broadcasting. Several informal conferences were held with manufacturers and it is believed that certain improvements in receiver design will be made on their own initiative.

FIELD INTENSITY SURVEYS

A number of field intensity surveys were conducted, including surveys to determine the relative coverage obtained on the old and new FM bands and the amount of harmonic emission of existing frequency modulation and television broadcast stations.

IGNITION INTERFERENCE

In some areas considerable interference is suffered to the reception of television and FM broadcast signals by automobile ignition systems. A laboratory study was begun to determine the method of measuring interference levels, looking toward the establishment of standards regarding the maximum permissible interference radiation from such sources. It is hoped that sufficient information will be available during the coming year to permit protection of FM and television reception from this severe impairment.

PRODUCTION OF SPECIAL EQUIPMENT

The Laboratory Division constructed special spectroscopes for the Commission's monitoring stations to permit examination of the band

width (the amount of space taken on a receiver dial) of various transmitters. A device of this nature was severely needed because many stations now employ very complicated types of emission and the mere measurement of the unmodulated frequency would not tell the complete story of interference that would be caused to other stations. The spectroscope also permits the rapid measurement of frequency required in the case of certain stations operating for extremely short periods of time. This device has already resulted in adjustment of a number of FM broadcast transmitters to proper operating conditions.

LORAN NAVIGATION SYSTEM SHARING

A proposal was made to the Commission for shared use of the frequency employed by the loran navigational system by amateur radio stations. A laboratory study indicated that such operation would reduce the accuracy of loran. Since joint operation on these frequencies would impair the safety of life and property at sea, this proposal has been abandoned.

LOW POWER DEVICES

Tests were made of a proposed electric sign in which the gas supplying the illumination was excited with a radio frequency oscillator. The radiation from this sign was found to exceed the value permitted by the rules except when the device was provided with an enclosing screen. Without the screen the device was capable of interference to communications services over a wide band.

A radio-operated garage door, also submitted for test, was found to produce greater interference than is permitted by the rules.

A toy transmitter placed on the market during the Christmas season was tested and the field intensity was found to be within the requirements of the low-power rule.

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APPENDIX

1. FIELD OFFICES

The Commission's field offices are as follows:

ENGINEERING DEPARTMENT

Region	*Headquarters*
North Atlantic	506 Federal Bldg., New York 14, N. Y.
South Atlantic	411 Federal Annex, Atlanta 3, Ga.
Gulf States	332 U. S. Appraisers Bldg., Houston 11, Tex.
South Pacific	323–A Customhouse, San Francisco 26, Calif.
North Pacific	801 Federal Office Bldg., Seattle 4, Wash.
Central States	878 U. S. Courthouse Bldg., Chicago 4, Ill.
Great Lakes	1029 New Federal Bldg., Detroit 26, Mich.
Hawaiian	609 Stangenwald Bldg., Honolulu 1, T. H.
Alaskan	39 Federal Bldg., Anchorage, Alaska.

DISTRICT OFFICES

District	*Address*
1	1600 Customhouse, Boston 9, Mass.
2	748 Federal Bldg., New York 14, N. Y.
3	1005 U. S. Customhouse, Philadelphia 6, Pa.
4	508 Old Town Bank Bldg., Baltimore 2, Md.
5	402 New Post Office Bldg., Norfolk 10, Va.
6	411 Federal Annex, Atlanta 3, Ga. (Sub-office) 214–218 Post Office Bldg., Savannah, Ga.
7	312 Federal Bldg., Miami 1, Fla. (Sub-office) 409–410 Post Office Bldg., Tampa 2, Fla.
8	400 Audubon Bldg., New Orleans 10, La.
9	324 U. S. Appraisers Bldg., Houston 11, Tex. (Sub-office) 329 Post Office Bldg., Beaumont, Tex.
10	500 U. S. Terminal Annex Bldg., Dallas 2, Tex.
11	539 U. S. Post Office and Courthouse Bldg., Los Angeles 12, Calif. (Sub-office) 320 U. S. Customhouse, San Diego 1, Calif.
12	323–A Customhouse, San Francisco 26, Calif.
13	406 Central Bldg., Portland 5, Oreg.
14	801 Federal Office Bldg., Seattle 4, Wash.
15	521 Customhouse, Denver 2, Colo.
16	208 Uptown Post Office and Federal Courts Bldg., St. Paul 2, Minn.
17	838 U. S. Courthouse, Kansas City 6, Mo.
18	246 U. S. Courthouse, Chicago 4, Ill.
19	1029 New Federal Bank Bldg., Detroit 26, Mich. (Sub-office) 541 Old Post Office Bldg., Cleveland 14, Ohio.
20	328 Federal Bldg., Buffalo 3, N. Y.
21	609 Stangenwald Bldg., Honolulu 1, T. H.
22	322–323 Federal Bldg., San Juan 13, P. R.
23	7–8 Shattuck Bldg., Juneau, Alaska. (Sub-office) 39 Federal Bldg., Anchorage, Alaska.

PRIMARY MONITORING STATIONS

Allegan, Mich.
Grand Island, Nebr.
Kingsville, Tex.
Millis, Mass.
Santa Ana, Calif.
Laurel, Md.
San Leandro, Calif.
Portland, Oreg.
Powder Springs, Ga.
Honolulu, T. H.

SECONDARY MONITORING STATIONS

Searsport, Maine.
North Scituate, R. I.
Spokane, Wash.
Twin Falls, Idaho.
South Miami, Fla.
Minneapolis, Minn.
Lexington, Ky.
Broken Arrow, Okla.
Bay St. Louis, Miss.
Point Lena, Alaska.
Anchorage, Alaska.
San Juan, P. R.

COMMON CARRIER FIELD DIVISION

Atlanta, Ga.—515 First National Bank Bldg.
New York, N. Y.—604 90 Church St.
San Francisco, Calif.—810 West Coast Life Bldg.

ACCOUNTING DEPARTMENT FIELD OFFICES

Atlanta, Ga.—515 First National Bank Bldg.
New York, N Y—624 90 Church St
St Louis, Mo—Old Customhouse
San Francisco, Calif—316 Customhouse

LAW DEPARTMENT FIELD OFFICES

New York, N Y—90 Church St
San Francisco, Calif—231 Prague Bldg

2. PUBLICATIONS

Following is a list of Federal Communications Commission publications which may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., unless otherwise indicated:

Title	Price
Communications Act of 1934, with amendments and index, revised to June 14, 1945	$0.25
Federal Communications Commission reports (bound volumes of decisions and orders exclusive of annual reports):	
Volume 2—July 1935–June 1936	2.00
Volume 3—July 1936–February 1937	2.00
Volume 4—March 1937–November 15, 1937	1.50
Volume 5—November 16, 1937–June 30, 1938	1.50
Volume 6—July 1, 1938–February 28, 1939	1.50
Volume 7—March 1, 1939–February 29, 1940	1.50
Volume 8—March 1, 1940–August 1, 1941	1.50
Volume 9—August 1, 1941–March 31, 1943	1.25
Volume 10—April 1, 1943–June 30, 1945	2.00

Title	Price
Annual reports of the Commission:	
First Annual Report—Fiscal year 1935	$0.15
Third Annual Report—Fiscal year 1937	.30
Fifth Annual Report—Fiscal year 1939	.30
Twelfth Annual Report—Fiscal year 1946	.20
Thirteenth Annual Report—Fiscal year 1947	(2)
Statistics of the Communications Industry:	
For the year 1939	.25
For the year 1940	.20
For the year 1942	.35
For the year 1943	9.30
For the year 1944	.40
For the year 1945	.50
Report on Chain Broadcasting	.30
Report on Public Service Responsibility of Broadcast Licensees	.25
An ABC of the FCC	.05
Radio—A Public Primer	.10
Study Guide and Reference Material for Commercial Radio Operator Examinations	.15
Digest of Radio Regulations and Instructions for Restricted Radiotelephone Operators	.05
Standards of Good Engineering Practice:	
Concerning Standard Broadcast Stations, revised to June 1, 1944	.65
Concerning FM Broadcast Stations, revised to January 9, 1946	.10
Concerning Television Broadcast Stations, revised to December 19, 1945	.10
Rules and Regulations:	
Part 1, Organization and Practice and Procedure, revised to February 20, 1947	.30
Part 2, General Rules and Regulations, revised to December 19, 1944	.10
Part 3, Standard and High Frequency Broadcast Stations, revised to October 5, 1940	(2)
Part 4, Experimental and Auxiliary Broadcast Stations, effective September 10, 1946	(2)
Part 5, Experimental Radio Services, revised to October 28, 1943	(2)
Part 6, Fixed Public Radio Services, revised February 18, 1947	.05
Part 7, Coastal and Marine Relay Services, revised April 5, 1941	(2)
Part 8, Ship Service, revised to May 31, 1943	.15
Part 9, Aeronautical Services, revised to July 1, 1947	.10
Part 10, Emergency Radio Services, revised to October 16, 1944	(2)
Part 11, Miscellaneous Radio Services, effective January 1, 1939	.05
Part 12, Amateur Radio Service, revised to May 9, 1946	.10
Part 13, Commercial Radio Operators, revised to January 1, 1947	(2)
Part 14, Radio Stations in Alaska (other than Amateur and Broadcast), revised to April 2, 1942	.05
Part 15, Radio Stations in the War Emergency Radio Service, revised to April 2, 1942	.10
Part 16, Railroad Radio Service, revised to September 1, 1947	.05
Part 17, Utility Radio Service, effective September 12, 1946	(2)
Part 18, Industrial, Scientific and Medical Service, effective June 15, 1947	(2)

[1] In the process of printing—available at Government Printing Office at a later date.

[2] Obtainable temporarily from the Federal Communications Commission, Washington 25, D. C., without charge.

Title	Price
Rules and Regulations—Continued	
Part 31–32, Uniform System of Accounts for Class A and Class B Telephone Companies—Units of Property Class A and Class B Telephone Companies, revised to August 1, 1946	$0.30
Part 33, Uniform System of Accounts for Class C Telephone Companies, effective January 1, 1939	.15
Part 34, Uniform System of Accounts for Radiotelegraph Carriers, effective January 1, 1940	.25
Part 35, Uniform System of Accounts for Wire-Telegraph and Ocean-Cable Carriers, effective January 1, 1943	.35
Part 41, Telegraph and Telephone Franks, effective August 11, 1939	([2])
Part 42, Preservation of Records, revised to May 27, 1943	.10
Part 43, Filing of Information, Contracts, etc. of Telecommunications Carriers revised to September 29, 1943	.05
Part 51, Classification of Telephone Employees, effective July 25, 1944	.05
Part 52, Classification of Wire-Telegraph Employees, effective July 11, 1944	.05
Part 61, Construction, Filing and Posting of Schedules of Charges for Interstate and Foreign Communications Service, revised to August 1, 1946	.10
Part 62, Applications Under Section 212 of the Act to Hold Interlocking Directorates, revised to May 23, 1944	.05
Part 63, Extension of Lines and Discontinuance of Service by Carriers, revised to December 30, 1946	([2])
Part 64, Miscellaneous Rules Relating to Common Carriers, revised to September 19, 1946	([2])

[2] Obtainable temporarily from the Federal Communications Commission, Washington 25, D. C., without charge.

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