National Association of Broadcasters

ENGINEERING HANDBOOK

SEVENTH EDITION

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National Association of Broadcasters
Washington, DC

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Library of Congress Cataloging in Publication Data
Main entry under title:

National Association of Broadcasters Engineering Handbook.

Includes bibliographies and index.
1. Radio—Transmitters and transmission. 2. Radio stations—Design and construction. 3. Television—Transmitters and transmission. 4. Television stations—Design and construction. I. Crutchfield, E.B. II. National Association of Broadcasters.
TK6561.N3 1985 621.3841 85-3023

ISBN 0-89324-000-1

TO THE BROADCAST ENGINEER

"Broadcast quality" is a term in which our industry can take great pride. It has come to be almost a generic phrase for excellence in the communications field, a tribute to the skill, inventiveness and stringent adherence to sound engineering principles of our broadcast engineers. The result in the United States is the most superb, high quality system of free over-the-air broadcasting in the world—the model upon which other nations develop their communications system.

Technology continues to advance at an awesome pace. Technical regulations are being swept away. It is our challenge and our responsibility to maintain the superior quality of our system and to develop even further in an increasingly competitive marketplace.

This new edition of the *NAB Engineering Handbook* takes into account the technological and regulatory changes since the book's last revision in 1975. We hope that broadcast engineers will find it a valuable resource as they seek to maintain the high standards of performance which our audiences have come to expect.

Edward O. Fritts
President, National Association of Broadcasters

FOREWORD

With publication of this 7th Edition, we mark the fiftieth anniversary of NAB's first *Engineering Handbook*, published in 1935. Those years have seen tremendous growth in our industry and extensive change in our technology, reflected in the development of this book from the slim, 100-page First Edition.

When the First Edition went to press, AM radio was well established and directional antenna technology was developing; television and FM radio were still experimental, and the Communications Act of 1934 had just gone into effect, replacing the Federal Radio Commission with the Federal Communications Commission. For five decades, then, the FCC developed regulations in greater number and detail to guide development of a broadcasting system serving "the public interest, convenience, and necessity."

In the new era of deregulation and "unregulation," the Commission has recognized that the broadcast industry has matured and has scrapped its technical rules, finding them burdensome, outdated, and unnecessary. It left the broadcaster with considerable freedom, but greater responsibility, for what to do, and how to do it, to stay in compliance with overall requirements.

Technology and regulation have changed, and the nature of the *Handbook* must change as well. The emphasis of this edition is less on quoting rules and more on providing the broadcast engineer with a tool to ensure that the best engineering practices are the norm at every radio and television station—in other words, that the lofty standards inherent in the term "broadcast quality" are maintained. With deregulation, we no longer have precisely defined operating procedures and routines imposed on us and cannot be content with simply meeting FCC requirements. As broadcasters, we are clearly challenged to develop voluntary standards to hold on to this freedom and to use it to our advantage. This means applying our skills and imagination not only to maintain technical compliance but to do so in a way that will benefit our stations, our industry and, most important, our audiences.

A primary responsibility of the NAB Department of Science and Technology is to assist the broadcast industry by gathering and making readily available broadcast technical information related to interference control, spectrum efficiency, compatibility and technical quality. The 7th Edition of the *Handbook* represents an important part of that effort and we are indebted to the many companies, members and associate members and the literally hundreds of individuals whose efforts have made this book possible. We welcome your comments and suggestions to help us develop updates and future editions of the *NAB Engineering Handbook*.

Thomas B. Keller
Senior Vice President, Department of Science and Technology
National Association of Broadcasters

EDITOR'S NOTES

USING THE HANDBOOK

If you are not familiar with this edition, please take a few minutes to read the following notes.

Purpose

The *NAB Engineering Handbook* is a general reference for all engineers and technicians working in broadcast stations as well as those working in related or similar facilities such as production, closed-circuit, and cable studios, and for engineering consultants and equipment manufacturers.

The authors are experienced engineers, active in the fields on which they are writing. Each was asked to review theory, where applicable, but to emphasize practical information such as design approaches and criteria, applications, and techniques for system planning, installation, operation and maintenance. We have tried to avoid, on the one hand, the highly theoretical information found in design textbooks and, on the other hand, the very detailed instructions found in manuals supplied with equipment. Some things, such as towers and transmission lines, do not usually come with instruction manuals, and there we have tried to provide more details.

The *Handbook* is not a primer. Some understanding of electronics and general engineering principles is expected, but the level depends on the subject matter of the individual chapter.

Organization

The material in this Handbook is divided into 7 sections.

Section 1. Procedures and Practices: Working with the Federal Communications Commission, frequency coordination committees and consultants.

Section 2. Antennas and Towers: Radiating systems, transmission lines, measurements and towers.

Section 3. Transmitters: Transmitters, subcarriers, remote control and measurements.

Section 4. Program Transmission Facilities: Terrestrial and satellite systems and measurements.

Section 5. Production Facilities: Studio facilities, production equipment and systems.

Section 6. Remote Program Origination: Remote production equipment and pickup systems.

Section 7. Special Systems: Broadcast engineering and related items not covered in the above sections, including NTSC and other color systems, news room computers, ac power systems, and others.

The Table of Contents lists the main headings within each chapter to make it easier to find which chapter or chapters cover a particular subject. In coordinating the preparation and review of manuscripts, we have tried to avoid

duplication, but in some cases it is neither practical nor desirable to eliminate all overlap. A good example of this is in planning and coordinating auxiliary service frequency use; this increasingly important subject is addressed in several chapters.

Please take some time to browse through the Table of Contents and become familiar with its organization. Section and chapter titles may look familiar if you have an earlier edition of the *Handbook*. We have retained the previous general organization, but all material in this edition is completely new or has been updated.

Each page number includes the section and chapter numbers, and individual pages are numbered from the start of each section. For example, the Table of Contents shows Transmission Lines as the third chapter of Section 2, starting on the 33rd page of that section, or "2.3-33."

FCC Rules

As we go to press, the FCC is completing a major effort toward "technical deregulation." A number of requirements affecting operation and performance have been deleted completely. In some instances, an operating parameter is specified (*e.g.:* carrier frequency tolerance), but how the broadcaster monitors and maintains compliance is not specified.

We have tried to reflect changes in the Rules, not by citing Rules or FCC decisions, but rather by emphasizing what might be called "good engineering practice." Where a specific Rule is cited, it is because there is good reason to believe it will remain in effect. In any event, every broadcaster is responsible for knowing and maintaining compliance with all applicable FCC Rules and other regulations and laws.

Acknowledgements

Production of this edition of the *NAB Engineering Handbook* has taken almost two years and required the efforts of many people in the broadcasting industry and related fields. In addition to the individual authors, who are identified with their chapters, there were many others who spent considerable time assisting NAB staff with overall planning of this edition, reviewing manuscripts, offering suggestions and supplementary material. It is not possible to list everyone, but the following reflects the breadth of technical and editorial support NAB received.

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R. LaVerne Pointer
American Broadcasting Company, Inc.

William J. Wisniewski
Mutual Broadcasting System

And thanks to the many others who helped.

Norm Avery
WBZ

Oded Ben-Dov
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Delta Electronics, Inc.

Neil Braswell
Enterprise Electronics

John A. Carlton
Monaco Labs

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WJR-AM

John Serafin
American Broadcasting Company

Jerry Smith
Harris Corporation

Steven A. Smith
Broadcast Technology Consultants

Harris Sullivan
National Broadcasting Company, Inc.

Jim Tharp
KING Radio

E. M. Tingley
Electronic Industries Association

Theodore "Bud" Untiedt
American Broadcasting Company

Donald Voros
Harris Corporation

John Wang
Federal Communications Commission

Paul Wescott
Shively Labs

Editorial

Design and production were supervised by Teryn Wright. Text processing and telecommunications were supervised by assistant editor M. Elizabeth Andleman. JoAnn Pileggi was in charge of proofreading and authors' reviews. Their skills and extraordinary efforts made the expeditious delivery of this edition possible. The editor accepts full responsibility for editorial errors which may have slipped by; it was his decision that an up-to-date *Handbook,* in your hands, is more important than a perfect *Handbook* inching its way toward the press.

E. B. Crutchfield
Editor

NAB ENGINEERING HANDBOOK
Supplement to the 7th Edition

Introduction

As the 7th Edition of the Handbook was being prepared, the broadcast industry was in a period of rapid change in both technology and regulation. This situation was likely to continue for some time, and it was affecting planned contents of the Handbook.

The chapters supplied as part of the Supplement to the Handbook are, for the most part, those which contained important materials being affected by technical and regulatory changes. It was felt that the industry would be better served by publishing the main body of material, particularly in the basic areas of transmission, as soon as that was ready.

Now that these remaining chapters are completed, they should be placed in their appropriate sections. An up-dated Table of Contents is supplied, along with new Section dividers and a complete Index.

Acknowledgements

In addition to those persons whose help is acknowledged in the Editor's Notes, we would like to thank the following persons who helped with preparation of the Supplement.

David Chancey
Moseley Associates, Inc.

Bernie Dickens
CBS

John Fesler
ITC-3M

Don Himus
RCA Broadcast Systems Division

Michael Leader
Electro-Voice, Inc.

Bill Lorenz
Capitol Video Communications, Inc.

Mac McClanahan
Marti Electronics

John Phelan
Shure Brothers, Inc.

Ronald Rackley
duTreil Rackley

Karl Renwanz
WNEV-TV

Jack Williams
Pacific Recorders &
Engineering Equipment

Yoshi Yao
Panasonic

Fred Zimmerman
Moseley Associates, Inc.

Editorial

We were fortunate to have the high quality of design and production maintained by Teryn Wright. Assistant Editor for the Supplement was Janet Elliott who also coordinated communications and proofreading.

The Index was prepared by David Bialik, who also compiled the information in Chapter 1.6, Information Sources.

E. B. Crutchfield
Editor

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1.1

FCC Organization and Administrative Procedures

Ralph A. Haller
Chief, Technical & International Branch
*Federal Communications Commission**
Washington, DC

STATUTORY AUTHORITY

Congress, through adoption of the Communications Act of 1934 (the Act), created the Federal Communications Commission (FCC) as an independent regulatory agency. Section 1 of the Act specifies that the FCC was created:

> "For the purpose of regulation of interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges, for the purpose of the national defense, for the purpose of promoting safety of life and property through the use of wire and radio communication, and for the purpose of securing a more effective execution of this policy by centralizing authority heretofore granted by law to several agencies and by granting additional authority with respect to interstate and foreign commerce in wire and radio communication..."

*The opinions expressed in this chapter are those of the author and not necessarily those of the FCC.

THE "COMMISSION"

The "Commission" consists of five Commissioners appointed by the President, by and with the advice and consent of the Senate. The President designates one Commissioner as Chairman. Except for limited actions of delegated authority by the staff, the Commissioners personally consider each new rule or regulation and either adopt or reject it by vote in regularly scheduled public meetings.

FCC ORGANIZATION

The staff of the FCC performs day-to-day functions of the agency, including: 1) license and application processing, 2) drafting of rule making items, 3) enforcing rules and regulations, and 4) formulating policy. The staff is divided along functional lines into various offices and bureaus. Normally, broadcasters deal with the Mass Media Bureau (MMB) or the Field Operations Bureau (FOB); however, actions by other elements of the agency may directly affect broadcasters. The major organizational units, as shown in Fig. 1, are:

Office of the Managing Director (OMD):

The Managing Director serves as the chief operations and executive official, as supervised and directed by the Chairman. OMD recommends,

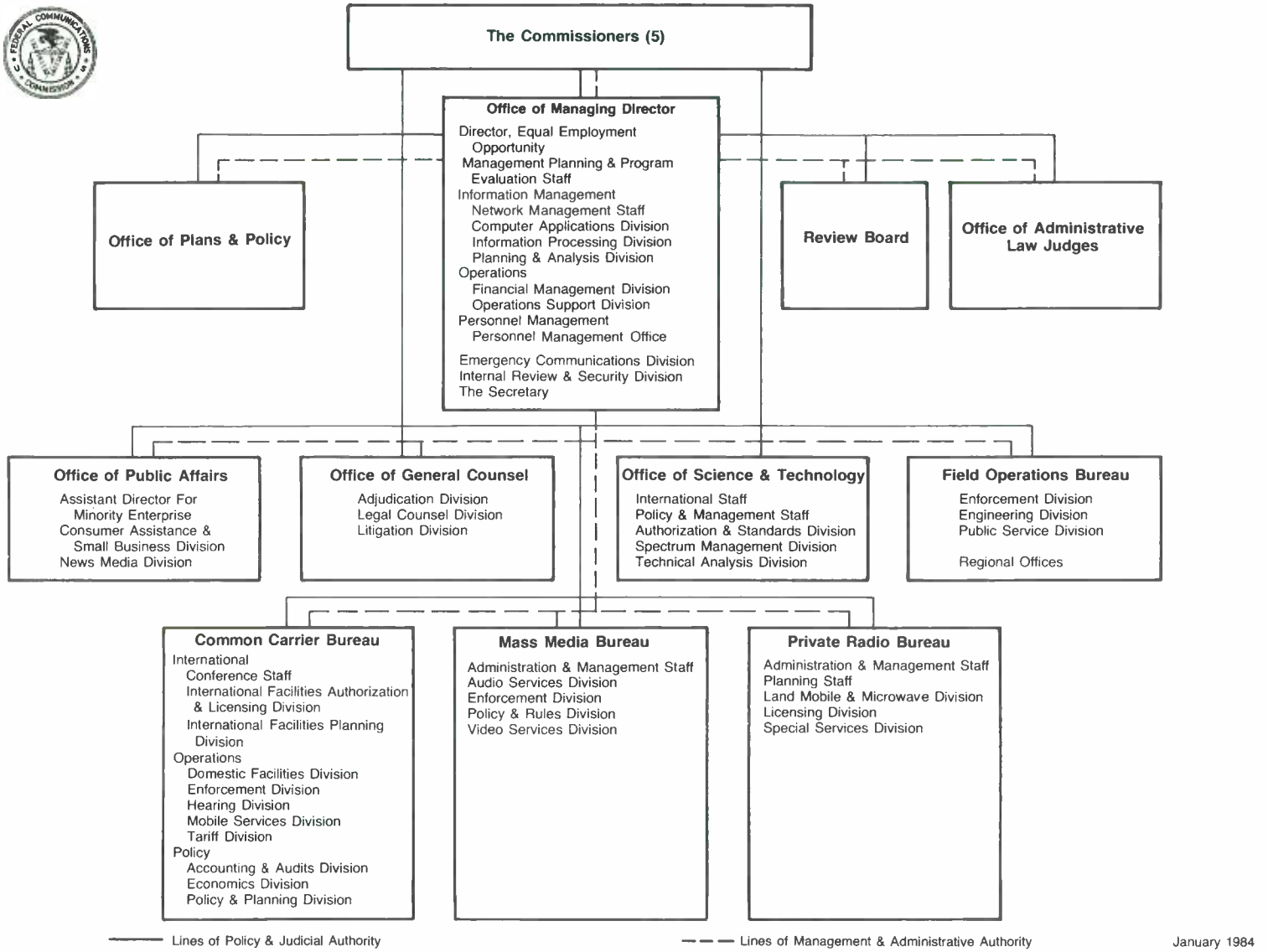


Fig. 1. Federal Communications Commission organization chart.

to the Chairman, program priorities, resources and position allocations, management and administrative policies. OMD operates the agency's personnel office. This Office, along with the Defense Commissioner, has responsibility for emergency communications policies.

Office of Public Affairs (OPA):

OPA functions as the FCC's primary point of contact with the public in dissemination of information about the Commission.

Office of Plans and Policy (OPP):

This Office makes recommendations to the Commission on development and implementation of communications policies.

Office of General Counsel (OGC):

The General Counsel advises the Commission in all matters of law and litigation, and interprets and implements statutes and treaties.

Office of Administrative Law Judges (ALJ):

The Law Judges have responsibility for hearing and conducting all adjudicatory cases designated for any evidentiary adjudicatory hearing other than those to be heard by the Commission en banc.

Office of Science and Technology (OST):

OST conducts scientific and technical studies related to communications and operates the FCC Laboratory in Columbia, Maryland. This Office has primary responsibility for overall spectrum management. The Chief Scientist administers the equipment authorization program (type acceptance, certification, etc.). Additionally, the Office issues authorizations for experimental communications work.

Review Board (RB):

The Review Board (three or more FCC personnel) is set up within the FCC to review decisions of Administrative Law Judges in all adjudicative proceedings, unless the Commission specifies otherwise.

Common Carrier Bureau (CCB):

CCB develops, recommends, and administers policies and programs for the regulation of services, facilities, rates and practices of entities (excluding maritime) which furnish communications services for hire.

Private Radio Bureau (PRB):

PRB develops, recommends, and administers policies and programs for development and regulation of the private radio services, such as those used by persons, businesses, state and local governments, and other organizations licensed to operate their own communications systems for their own use (not for hire).

Field Operations Bureau (FOB):

FOB operates the Commission's field offices, monitoring stations, and mobile monitoring vehicles. It administers the radio operator licensing programs, the field enforcement programs, and the field public service programs. The Bureau has responsibility for the nationwide program of lighting and marking of antenna structures.

Mass Media Bureau (MMB):

MMB develops, recommends, and administers policies and programs for development and regulation of the broadcastng and cable television industries. This includes auxiliary services such as translators, low power television, and operational circuits.

MASS MEDIA BUREAU ORGANIZATION

Because the Mass Media Bureau regulates broadcasting and cable television, most broadcast engineers will deal primarily with this Bureau. (Certainly, contact with the Field Operations Bureau can also be expected; see Section 1.2: "FCC Field Operations Bureau.") There are four major operational Divisions within MMB. Each Division has subdivisions, called Branches, to handle specific areas of regulation, enforcement, licensing, or policy development, as shown in Fig. 2.

Audio Services Division

Licensing, license modification, and license renewal of AM and FM broadcasting stations fall under the Audio Services Division. The Division also handles the aural auxiliary services, such as Broadcast Remote Pickup, Studio Transmitter Links, and FM Translators. Questions concerning pending applications, processing policies, and filing requirements should be directed to the appropriate branch as listed below. Also, requests for waivers of the Rules, requests to operate with parameters at variance (e.g., directional AM antenna out of tolerance), and other requests to operate inconsistently with the station's instru-

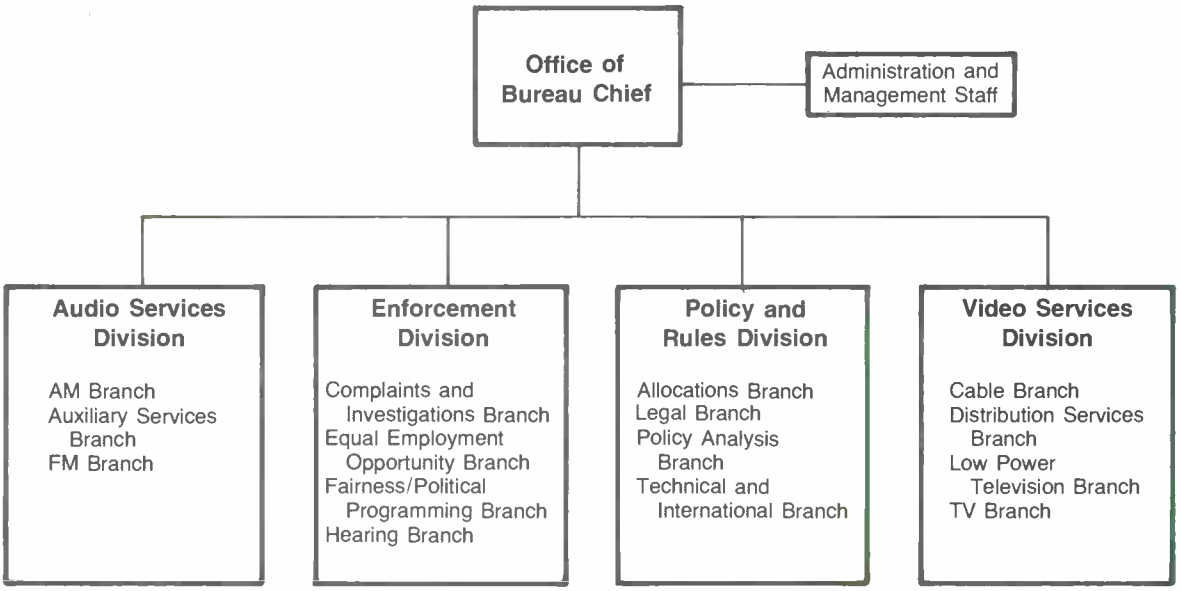


Fig. 2. Mass Media Bureau organization chart.

ment of authorization (license or construction permit) are handled by this Division. The Audio Services Division branches are:

AM Branch— AM Broadcast radio

FM Branch— FM Broadcast radio

Auxiliary Services Branch—Broadcast Remote Pickup, FM Boosters, and Translators, Aural STL

Video Services Division

Licensing, license modification, and license renewal of television stations are handled by the Video Services Division. In addition to over-the-air television, the Division's responsibilities include Low Power Television (LPTV), Direct Broadcast Satellite (DBS), Cable Television (CATV), Instructional Television Fixed Service (ITFS), and video auxiliary services. Questions concerning pending applications, processing policies, and filing requirements should be addressed to the appropriate branch as listed below. Also, requests for waivers of the Rules or for authority to operate inconsistently with the station's instrument of authorization (license or construction permit) are handled by this Division. The Video Services Division branches are:

Cable Television Branch— CATV, CARS Microwave

Distribution Service Branch — ITFS, TV-STL, DBS

Low Power Television Branch — LPTV and TV Translators

Television Branch— TV Broadcast

Enforcement Division

Although the Field Operations Bureau generally conducts station inspections and enforcement monitoring, their work normally concentrates on violations of the technical rules. Enforcement actions in other areas, such as equal employment opportunity or political broadcasting, are handled by the Enforcement Division in Washington, DC. This Division also works closely with FOB in enforcement of the technical regulations. Questions regarding enforcement matters should be addressed to the Enforcement Division. The Enforcement Division branches are:

Complaints and Investigations Branch — General

Equal Employment Opportunity Branch — EEO matters

Fairness/Political Broadcasting Branch — Fairness Doctrine, Political Broadcasts

Hearing Branch — Broadcast and CATV hearings

Policy and Rules Division

New broadcast and CATV rules and regulations generally are written in the Policy and Rules Division. The Division also regularly reviews the rules to eliminate unneeded ones or to modify those that have not kept pace with technology, policies, or legal decision. The Division also interprets broadcasting and CATV rules and regula-

tions. The Division can grant waivers of the Rules to permit experimentation with new technology on broadcast frequencies. The Policy and Rules Division also represents the United States at international forums. Rules and regulations can be classified as: frequency allocations related, legal, policy, or technical. The branches are accordingly aligned as:

Allocations Branch — Petitions for Rule Making to Amend the FM or TV Table of Allotments

Legal Branch — Legal rules such as ownership or community ascertainment

Policy Branch — Rules that are primarily policy decisions such as lottery procedures

Technical and International Branch — Technical rules, international representation, and AM and short wave station coordination internationally

THE LICENSING PROCESS

Any qualified citizen, firm, or group may apply to the Federal Communications Commission for authority to construct and operate an amplitude modulated (AM), frequency modulated (FM), or television (TV) broadcast station. More recent changes in the rules have permitted low power television (LPTV) and direct broadcast satellite (DBS) stations to be licensed. The FCC does not license cable television (CATV) systems; however, it does have rules and regulations governing CATV operation and some filings are required. The licensing procedures are outlined in Part 73 of the FCC Rules and Regulations. In general, applicants must satisfy the Commission that they are legally, technically, and financially qualified, and that operation of the proposed station would be in the public interest.

Types of Facilities

Applicants must propose specific station parameters to the Commission. In the case of AM broadcast, applicants generally conduct an interference study to assure that certain field strength contours of the planned station will not overlap existing stations. There are no preplanned AM broadcast assignments to cities or locations. Each application must be uniquely engineered to: 1) serve the community of interest, and 2) prevent interference. Use of a directional antenna will often be required to limit radiation in one or more directions. AM broadcast assignments are made at 10 kilohertz intervals, from 540 kilohertz to 1600 kilohertz, inclusive. Each channel has a designation of Class I, II, III, or IV (with additional subdivisions). The classes relate to coverage area ranging from Class I stations that serve only one locality. Power of AM broadcast stations varies from 250 watts to 50,000 watts.

Commercial FM and all TV applications differ from AM broadcast in that the Commission already has a Table of Allotments in these services. An application for a station in a city need not contain a mileage separation study if the city is listed in the Table of Allotment and no station currently operates on that channel. If no assignment exists in the table, then the applicant must first file a petition for rule making to have the proposed city added to the Table, based solely on specified mileage separations from other stations or assignments. If the proposal meets the Commission's criteria, the assignment will be added to the appropriate Table of Allotments and the application can then file for the station. Unfortunately, being successful in amending the Table does not guarantee being granted a station. Once the Table has been amended, other qualified applicants may also file for the station.

Commercial FM stations operate on channels spaced every 200 kilohertz, from 92.1 megahertz to 107.9 megahertz. Stations are classified as A, B1, B, C2, C1, and C, based on location in the country, channel, and power. Class A station operate between 100 watts and 3,000 watts, while class B stations may operate with up to 50,000 watts and class C stations are permitted 100,000 watts. Television stations have three categories: low VHF, high VHF, and UHF. Channels 2-6 are considered low VHF and 100,000 watts is authorized. High VHF stations operate on channels 7-13 and are permitted 316,000 watts. Finally, UHF television stations can radiate up to 5 million watts. The coverage areas of all television stations should be relatively equal with the above power levels. The power level differences in television relate to the more difficult propagation conditions at the higher frequencies.

Non-commercial FM (educational) stations have assignments between 88.1 megahertz and 91.9 megahertz. These stations may radiate up to 100,000 watts, but are allocated by actual predictions of service contour overlap rather than by the absolute mileage separations of commercial FM stations. LPTV stations are secondary to full service television stations. LPTV service contours may not overlap full service stations' contours and cause interference. Successful applicants for direct broadcast satellite transponders receive an exclusive right to use a particular DBS "slot" in space. Finally, licensees in the ITFS have exclusive use of a set of frequencies in a given community and may, to a limited extent, merge their facilities with common carrier operations in the Multipoint Distribution Service (MDS).

Applicants may represent themselves before the Commission in licensing matters; however, most applicants employ the services of communications attorneys and consulting engineers. By necessity, to prevent interference and assure license grants to qualified entities, the license process is complex. Professional advice can speed the process along and help prevent costly errors.

The First Step to a Broadcasting (AM, FM, or TV) License

Assuming that the engineering work has been done to determine that an AM or educational FM station can be designed and built in a community or that the FM or TV station can be designed and built in a community or that the FM or TV assignment is now contained in the appropriate Table of Allotments, the next step is to file for a construction permit (CP). Commercial applicants file on FCC Form 301, "Application for Authority to Construct a New Broadcast Station or Make Changes in an Existing Station." Educational station applicants use FCC Form 340 for the same purpose. The application for CP requests considerable information about the applicant(s) and the proposed facility. Commercial applicants must certify the financial ability to operate the station, without revenue, for three months after construction of the station.

If the Commission accepts the application for filing, a Public Notice will be released to inform interested parties of the action. At least 30 days after the release of the Public Notice will pass before the Commission again acts on the application. If no objections to the application are received and the Commission otherwise finds the applicant(s) qualified, a construction permit will be issued by the Mass Media Bureau under delegated authority. Again, the Commission issues a Public Notice and allows 30 days for interested parties to file for reconsideration of the grant. After grant of the CP, the applicant (now called a "permittee") should file for a call sign. Construction must be completed within 12 months for all classes of stations (except TV, which is 18 months) after the grant. Extensions of time may be requested for legitimate reasons.

Contested Applications

Not all applications for construction permits flow smoothly through the FCC. Often other parties will either file applications in competition with the original application or they will contest the application on some grounds. For example, an existing station licensee may disagree with the applicant's basic qualifications or intentions. Any of these protests will undoubtedly delay issuance of the CP, even if the applicant can resolve the conflicts outside the FCC forum. Absent any other method of resolution, the Commission will designate the application for a hearing.

Once designated for hearing, the applicant and other parties have 60 days to prepare their respective cases. The hearing will be conducted by an Administrative Law Judge (ALJ). The ALJ has authority to administer oaths, examine witnesses, and rule on the case based on the evidence presented. After the ALJ closes the record, an initial decision will be issued. The applicant, or any other interested party, may then file exceptions to the finding. The Commission or its Review Board may then hear oral arguments and adopt, modify, or reverse the ALJ's initial decision. If the decision was by the Review Board, the matter may be contested and the case taken to the Commission. Court appeals may be filed after the final decision by the Commissioners.

Station Construction and Equipment Testing

Construction should be exactly in accordance with the terms of the construction permit. If deviations must be made, then an amended FCC Form 301 must be filed. If the station cannot be constructed within the required time period, the permittee must file FCC Form 701 (Application for Additional Time to Construct a Radio Station). It is important to remember that filing of the form 301 or 701 does not guarantee that an extension of the CP will be granted.

Applying for the Station License

After the technical parameters of the station are in line, program testing may begin for non-directional AM and FM stations and TV stations. At this time, the permittee files for the station license on FCC form 302. AM and FM stations with directional antennas must apply for and secure authority from the FCC before beginning program testing. Stations operate in the program test mode until a license is received. Processing time varies, but the station license should arrive within a few months, assuming the FCC finds no problems with the form 302. The FCC may suspend the program test authority because of interference or other appropriate reasons.

License Renewal

Broadcast licenses have a life of 5 years for TV stations and 7 years for radio stations. Renewal is not automatic. Licensees file for license renewal on FCC form 303. If the licensee's record is good and if no one contests the renewal, the renewal process remains relatively simple. On the other hand, the renewal may be placed in hearing status for disposition if the licensee's per-

formance during the previous period is in question or if someone contests the renewal.

Sales and Transfers

If the holder of a construction permit or license desires to assign it to someone else, application is made on FCC Form 314 (Application for Consent to Assignment of Radio Broadcast Station Construction Permit or License). Should the permittee or licensee wish to transfer corporate control, FCC Form 315 (Application for Consent to Transfer Control of Corporation Holding Broadcast Station Construction Permit or License) is used. FCC Form 316 (Application for Assignment or Transfer-Short Form) may be used when the transfer or assignment involves no substantial change in interest.

Auxiliary and Translator Services

Broadcast station permit and license holders can apply for several types of auxiliary radio stations. For example, Aural Studio-Transmitter Links are available. Also, Broadcast Remote Pickup (two-way) stations can be used for program production communications or remote broadcasts.

FM licensees and other interested parties may operate FM Translators to fill in areas of the coverage pattern. Likewise, TV licensees and other interested parties may operate TV translators. Each application varies slightly. Details of these services are contained in Part 74 of the FCC Rules and Regulations.

DBS and LPTV

The application process for these services differs considerably from regular processing for broadcast stations. Unless an application for an LPTV station is not contested (which is very rare), the decision for the best qualified applicant is made by weighted lottery. Each applicant receives a weighting in the lottery based on factors such as minority ownership. DBS applicants apply to the Commission for a slot in space in the geostationary orbit. The construction permit can be retained only if a showing of due diligence has been shown in the construction of the facility. Final licensing comes after the station has been placed in operation.

THE FCC RULES AND REGULATIONS

Broadcasters should be familiar with the FCC Rules and Regulations. Every station should have at least one copy of the Rules. The Government Printing Office, not the FCC, sells the Rules through their local stores or by mail. New editions are printed yearly. This service provides no updates throughout the year as Rules are changed; however, the service is relatively inexpensive.

The following Rule Parts pertain to broadcasting and CATV:

Part 0: Commission Organization
Part 1: [FCC] Practice and Procedures
Part 2: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 17: Construction, Marking, and Lighting of Antenna Structures
Part 73: Radio Broadcast Stations
Part 74: Experimental, Auxiliary, and Special Broadcast and Other Program Distribution Services
Part 76: Cable Television Service
Part 78: Cable Television Relay Service

All of these Rule Parts can be obtained by purchasing two rules books. The FCC Rules are contained in the Code of Federal Regulations (CFR), Title 47. Parts 0-19 are contained in one book and Parts 70-79 are contained in another. The Government Printing Office, Washington, DC, 20402, phone (202) 738-3238, or your local GPO sales office, should be contacted directly to order the books.

One or more private publishers offer subscription services to the FCC Rules. Generally, these services are more costly, but regular updates of the Rules are provided to subscribers. Subscriptions can also be obtained to receive copies of daily releases from the FCC.

THE RULE MAKING PROCESS

The FCC, like all other federal government agencies, enacts new rules and regulations through the terms of the Administrative Procedures Act (APA). The APA specifies how rules may be proposed, adopted, and appealed. The APA assures that the public has input into the rule making process. Fig. 3 is a flow chart of the process and may be helpful in understanding the steps. Part 1 of the FCC Rules and Regulations provides detailed information on the FCC's general rules of practice and procedure.

Initiation of Actions

Rule making actions can be proposed by anyone through a petition for rule making. Such petitions bring the desires of individuals or groups to the attention of the Commission. The FCC will evaluate the petitions and either dismiss them for one of the reasons in Section 1.401 of the Rules or accept them for action. If accepted, a Public

Notice will be released giving a brief description of the details of the petition. Others may then submit comments in support of or against the petition.

Other rule makings may begin by direction of Congress, the President, or the courts. The FCC may also initiate rule makings on its own motion.

Early Options

Initiation actions are handled in one of four ways. A petition can be dismissed directly through a *Memorandum Opinion and Order* (MO&O). Minor rules changes can be made effective directly through a *Report and Order* (R&O). Generally, however, either a *Notice of Inquiry* (NOI) or *Notice of Proposed Rule Making* (NPRM) will be drafted by the staff. If enough information is at hand to draft the proposed rule changes, an NPRM will be issued without first gathering background material in an NOI. After adoption of an NPRM by vote of the Commissioners, the *ex parte* rules become effective (see section below). Because this inhibits direct contact between FCC staff and concerned parties, the NOI may be considered an essential first step in many matters. *Ex parte* does not apply at the NOI stage.

Comment periods are provided to allow interested parties to express their views. If, based on a review of the comments received, the Commission finds that an NOI should be terminated without further action, it will issue an MO&O stating the reasons for the termination. Otherwise, the matter will be considered for specific rule making in an NPRM. The MO&O is subject to a 30 day period in which parties may file petitions for reconsideration if they have good reason to believe the Commission acted incorrectly.

Notice of Proposed Rule Making

Most rule making items begin as a *Notice of Proposed Rule Making*. The staff prepares the NPRM for consideration by the five Commissioners. An NPRM normally presents the issues and alternatives, may ask specific questions to help finalize the matter, and sets forth proposed rules or rule amendments. An NPRM may address one or multiple topics.

Comments must be filed by the close of the comment period, usually 30 days. Reply comments may then be filed in response to comments, usually for a 15 day period. These two comment periods provide the Commission with a "written debate" of the issues.

The comments and reply comments received are reviewed and enter heavily into the Commission's final actions. However, a comment does not represent a vote for the proposed rules. The Commission must decide in each issue based on the public's interest, convenience, and necessity. Even if the majority of the comments oppose an item, the FCC can nevertheless adopt the proposal. The FCC can also schedule items for oral argument among the interested parties.

Filings should be clear, concise, and address the issues in the NPRM. Emotional responses or uninformed responses are of little value. Copies of the actual texts of the NPRM need to be studied before making comments. All NPRMs are published in the Federal Register and will be available at most larger libraries or law libraries.

The comments are reviewed by Commission staff at the Branch or Division levels. Recommendations are then passed to the Bureau level and ultimately to the Commissioners. The Commissioners will then approve, disapprove, or direct the staff to modify the recommendations.

The staff or the Commissioners may also decide that that record still does not support a decision, and a *Further Notice of Proposed Rule Making* (FNPRM) will be released. Like an NPRM, the comment periods apply. Once the record supports a final decision, the FCC will act by adoption of a *Report and Order*.

Report and Order

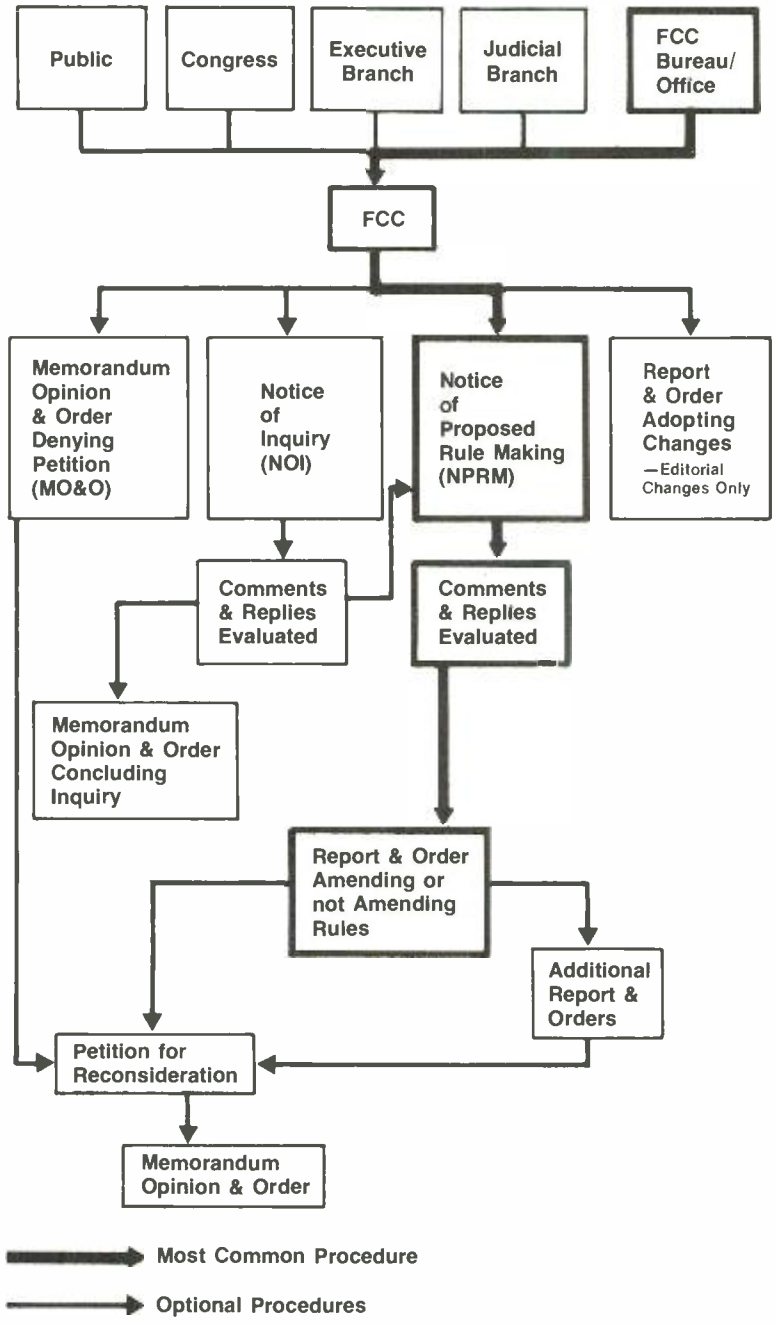
A *Report and Order* may be used to dismiss the proposals in the NPRM, adopt some of the proposals (possibly modified based on the comments), or adopt the rules as proposed. Rules will normally not become effective until 30 days after publication of the R&O in the Federal Register. The R&O constitutes the Commission's final action unless a petition for reconsideration is filed.

Petition for Reconsideration

Any interested person may petition for reconsideration of a final action. The petitions for reconsideration must be filed within 30 days of the date the R&O was published in the Federal Register. The Commission will act on a petition for reconsideration by *Memorandum Opinion and Order*. The initial decision may be modified or the petition may be denied in the MO&O.

Ex Parte Considerations

Most rule making proceedings become *ex parte* upon adoption of an NPRM and remain *ex parte* until 30 days after the Commission's final action (R&O or MO&O for reconsiderations). An *ex parte* contact is any written presentation made to FCC decision making personnel by another person, which is not served on all parties to the proceeding. It is also any oral presentation made to the FCC decision makers, without advance notice to the parties to the proceeding and op-



This brief account of how Rules are made at the FCC merely highlights the major components of the process. For details, contact the Dockets Branch.

This article was prepared with the assistance of staff members from several Bureaus and Offices, particularly Sharon Briley, Cable Television Bureau.

Steps:

1. Initiation of Action. Suggestions for changes to the FCC Rules and Regulations can come from sources outside of the Commission either by formal petition, legislation, court decision, or informal suggestion. In addition, a Bureau/Office within the FCC can initiate a Rule Making proceeding on its own.

2. Bureau/Office Evaluation. When a petition for Rule Making is received, it is sent to the appropriate Bureau(s)/Office(s) for evaluation. If a Bureau/Office decides a particular petition is meritorious, it can request that Dockets assign a Rule Making (RM) number to the petition. A similar request is made when a Bureau/Office decides to initiate a Rule Making procedure on its own. A weekly notice is issued listing all accepted petitions for Rule Making; the public has 30 days to submit comments. The Bureau/Office then has the option of generating an agenda item requesting one of four actions by the Commission. If an NOI or NPRM is issued, a Docket is instituted, and a Docket number is assigned.

3. Possible Commission Actions. Major changes to the Rules are presented to the public as either an NOI or NPRM. The Commission will issue an NOI when it is simply asking for information on a broad subject or trying to generate ideas on a given topic; an NPRM is issued when there is a specific change to the Rules being proposed. If an NOI is issued, it must be followed by either an NPRM or an MO&O concluding the inquiry.

4. Comments & Replies Evaluated. When an NOI or NPRM has been issued, the public is given the opportunity to comment initially, and then respond to the comments that are made. When the Commission does not receive sufficient comments to make a decision, a further NOI or NPRM may be issued, again calling for comments & replies. It may be determined that an oral argument before the Commission is needed to provide an opportunity for the public to testify before the Commission, as well as for the Bureau(s)/Office(s) to present diverse opinions concerning the proposed Rule change.

5. Report & Order Issued. A Report & Order is issued by the Commission stating the new or amended Rule, or stating that the Rules will not be changed. The proceeding may be terminated in whole or in part.

6. Additional Reports & Orders Issued. The Commission may issue additional Reports & Orders in the docket.

7. Reconsideration Given. Petitions for reconsideration may be filed by the public within 30 days; they are reviewed by the appropriate Bureau(s)/Office(s) and/or by the Commission.

8. Modifications Possible. As a result of its review of a petition for reconsideration, the Commission may issue a MO&O modifying its initial decision or denying the petition for reconsideration.

Fig. 3. How FCC rules are made.

portunity for them to be present. Certain proceedings are "restricted" and no *ex parte* contacts can be made. These would be, for example, contested applications for licenses. Most rule makings are "non-restricted" and do not involve competing claims to a valuable privilege.

Appeal to the Courts

Once the Commission has considered and reconsidered a matter, interested parties may appeal the decision to the federal courts. Ultimately, the Supreme Court could hear the case. Under current law, however, the Federal Communications Commission need not wait for the court decision before enacting the new rules and regulations. As long as the matter has been given full consideration under the Administrative Procedures Act, the FCC may place the new rule in effect until a court rules to the contrary or orders a "stay." The courts typically defer to the expertise of the Commission in technical matters and will often look more to assure that the APA was followed than to try to second-guess the Commission's decision.

FCC Telephone Directory
Functional Listing

(Please Note: Telephone numbers are subject to change.)

Subject	Telephone Number
—A—	
Access charge tariffs (CCB)	632-6387
Accounting systems (CC)	634-1861
Administrative Sanctions (FOB)	632-7354
Advisory Committees	
• Advisory Committee on Cable Single Leakage	632-2706 / 254-3420
• National Industry Advisory Committee	632-7232
• Radio Technical Commission for Marine Service	296-6610
Agriculture (including Crop Spraying, Bee Keeping, Farming, Ranching, Harvesting, Seeding, Livestock, Nurseries, Orchards) (PRB)	(717) 337-1212
Alien Restricted Permits (FOB)	632-7240
All-Channel TV Receivers (OGC)	632-6990
Allocation	
• Call Signs	634-1923
• Call Sign Block	653-8144
• Call Sign Policy	653-8144
• Charts and Tables (OST)	653-8162
• Frequency	
— Government (OST)	653-8137
— Non-Government (OST)	653-7434
— International (OST)	632-8144
Amateur applications/Licenses (PRB)	(717) 337-1212
Ambulance & Rescue Squads (PRB)	(717) 337-1212
Annual Report Form (CC)	632-7084
Annual Employment Report Form 395) (CCB)	632-7500
Annual Employment Report (395A) Cable TV Systems	632-7069
Antenna Structures & Towers— Includes Lighting and Marking (FOB)	632-7521
Application Status	
• Air to. Ground Public Correspondence	254-6810
• Amateur (PRB)	(717) 337-1212
• Aviation (PRB)	
— Aircraft	(717) 337-1212
— Aviation Ground	(717) 337-1511
• Business (PRB)	(717) 337-1511
• Cellular	632-6400
• Commercial Operator (FOB)	632-7240
• Common Carrier (Wire Line Facilities)	634-1800
• Digital Electronic Message Service —DEMS—(CCB)	634-1706
• Domestic Satellite	634-1624
• Mobile Services (CCB)	254-6810
• Microwave (CCB)	634-1706
• Multipoint Distribution Service— MDS—(CCB)	634-1706
• International (CCB)	632-7265
• Experiment (OST)	653-8137
• General Mobile (PRB)	(717) 337-1511
• Industrial (Includes Power, Petroleum, Manufacturers, Forest Products, Industrial Ratio Location, Motion Picture, Relay Press and Telephone Maintenance) (PRB)	(717) 337-1511
• Land Transportation (Includes Railroad, Taxicab, Auto Emergency, Motor Carrier—Interurban Passenger, Urban Property, Urban Passenger) (PRB)	(717) 337-1511
• Equipment Authorization	(301) 725-1585
• Telephone Equipment Registration (CCB)	634-1833
• Marine (PRB)	
— Ships	(717) 337-1212
— Marine Coast	(717) 337-1511
— Offshore Radio Telecommunications Service (CCB)	632-6400
— Rural Radio Service (CCB)	632-6400
• Microwave (Industrial) (PRB)	(717) 337-1421
— Public Safety (Includes Police, Fire, Local Government, Highway Maintenance, Forestry Conservation Special Emergency and State Guard) (PRB)	(717) 337-1511
— Radio, TV and Aux. Serv. (MM)	632-6634
Assignment of Microwave Common Carrier Licenses (CCB)	634-1706
Automobile Emergency (PRB)	(717) 337-1212
Aviation Services (PRB):	
• Applications/ Licenses	See "Application Status Aviation"
• Rules/Hearings	632-7175
—B—	
Bills (Legislative) (OGC)	632-6405
Broadcast, Inspection of Stations (FOB)	632-7014
Broadcast Services—(MMB)	
■ AM SERVICE	
• Engineering Rules:	
— Existing Stations	632-7010
— Minor Changes Applications	245-9570
— New Stations and major changes Applications	254-9570
— STL's; Remote Pickups, Intercity Relays	634-6307
• Non-Engineering Rules:	
— Advertising Questions/Comments	632-7551
— Application Forms	632-7272
— Assignment & Transfer Applications	254-9470
— Construction Permit Applications	254-9570
— Emergency Broadcast System	634-1600
— Political Programming/Fairness Doctrine	632-7586
— Programming Questions/Comments	632-7048

*Unless noted, all numbers are in Area Code 202, Washington, D.C., Area Code 717 refers to the Gettysburg, PA Office, Area Code 301 refers to the Laboratory in Laurel, MD.

—C—

Subject	Telephone Number
Community Antenna TV—SEE CABLE TV	
Complaints—	
• Broadcast (TV & Radio)	632-7048
— Advertising Questions	632-7551
— Political Broadcasting/Fairness Doctrine	632-7586
— Programming Questions/Religious Petitions	632-7048
• Cable Television (MMB)	632-7048
• Common Carrier—	
• Informal Complaints & Public Inquiries	632-7553
— Telephone	632-7553
— Telegraph/Telegram	632-7553
— Interconnect	634-1800
— Pole Attachments (CCB)	632-4890
— Rates	632-5550
• Interference to Radio & TV	
— Washington, D.C. Area	(301) 962-2728
— All Other Areas—Refer to local field installations listed in backs of telephone book	
Compliance—	
• Registration (MMB)	254-3407
• Common Carrier Accounting (CCB)	634-1861
• Experimental (OST)	653-8139
• Incidental and Restricted Radiation Devices (OST)	653-8247
• Land Mobile (PRB)	632-7125
• Aviation & Marine (PRB)	632-7197
• Personal & Amateur (PRB)	632-7197
Computing Device Emission Standards (Pt. 15) (OST)	653-8247
Conferences	
International—CCIR, WARC (OST)	653-8102
CCITT (CCB)	632-3214
Conflict of Interest Interpretations (OGC)	632-6990
Congressional and Public Affairs, Office of	254-7674
Consumer Assistance and Small Business	632-7000/632-7260
Control Devices (unlicensed) Part 15 (OST)	653-8247
Copy Contractor (Int'l Transcription Svs.)	296-7322
Cordless Telephone (Pt. 15)(OST)	653-8247
Court Cases (OGC)	632-7112
Coverage—Radio (OST)	653-8247
Curtailment of Service (Telephone or Telegraph) (CCB)	632-7553
Customer Owned Equipment—	
• Attach to Telephone (CCB)	634-1833
Customer Toll Dialing (CCB)	632-7553

—D—

Defense Activities (EBS)	632-7007
Depreciation Rules (CCB)	634-1861
Development Stations	
• Aviation or Marine (PRB)	(717) 337-1431
• Common Carrier (CCB)	634-1706
• Experimental (OST)	632-8139
Diathermy Approval (OST)	(301) 725-1585
Direct Broadcasting Satellites	632-9356/632-7792
Direct Distance Dialing (CCB)	632-5550
Discontinuances—Carrier Comm. Svcs. (CCB)	634-1800
Domestic Public (CCB)—	
• Auxiliary Test, Base, Control and Repeater Stations	632-6450
• Cellular Radio	632-6400
• Land Mobile Radio Service	632-6450
• Microwave	634-1706
• Rural Radio	632-6450

—E—

Eavesdropping (Electronic)(OGC)	632-6990
Electronic Switching (Telephone)(CCB)	634-1800
Emergency Broadcasting System (EBS)	634-1600
Emergency Medical Services (PRB)	337-1212
Employment	632-7106
Enforcement—Private Radio Bureau Forfeitures Show Cause Orders.	
• Revocations, Suspensions	632-7197
— Land Mobile (PRB)	632-7125
— Aviation & Marine	632-7197
— Personal & Amateur	632-7197
• Requests for Enforcements	
— Washington, D.C. Area (FOB)	(301) 962-2728
— All other areas—Refers to local field office (FOB)	
Engineering Surveys—Field Strength (OST)	632-7080
Environmental Law (NEPA)(OGC)	632-6990
Equipment Measurement Authorization (OST)	(301) 725-1585
Examinations—(FOB)	
• Washington, D.C. Area	(301) 926-2728
• Outside Washington, D.C.	632-7240
Ex Parte Rules (Interpretations of)(OGC)	632-6990

—F—

Facsimile—Wire (CCB)	634-1800
Fairness Doctrine	632-7586
FCC Rules (Legal Interpretations of)(OGC)	632-6990
Field Disturbance (Pt. 15)	653-8247
Field Offices	
• Common Carrier (CCB)	634-1861
• Field Operations Bureau (See Field Office Directory)	
• Field/Public Service Staff	634-1940
Financial Data—	
• Common Carrier (CCB)	632-7084
Fire (PRB)	(717) 337-1212
Foreign Attachments—	
• Telephone (CCB)	634-1833
• Interconnection (CCB)	634-1800
Forest Products (PRB)	(717) 337-1212
Forfeitures/Fines	
• Mobile Services (includes CB)	632-7197
• Collection of (OGC)	632-6444
Forms Distribution—	
• By form number only	632-7272
• General form request	632-7000
Franchising (CATV)	254-3407
Freedom of Information (OGC)	632-6990
Frequencies for—(Ask for which service and refer to that service)	
Frequency Allocations—	
• Government (OST)	653-8137
• Non-Government (OST)	653-8162
• Allocation Treaties Agreements and Arrangements (International)(OST)	653-8144
• Chart and Tables (OST)	653-8144
• Coordination/Spectrum	
• Government (OST)	632-7025
• Non-Government (OST)	632-7025
• International (OST)	653-8144
• Lists	
• Government (OST)	653-8162
• Non-Government (OST)	653-8162

Subject	Telephone Number
• Notification and Registration (OST)	653-8144
• Usage Data & Utilization (OST)	653-8162

—G—

Garage Door Openers—Licensed (PRB)	(717) 337-1212
Garage Door Openers—not licensed	653-8247
General Counsel (OGC)	632-7020
General Mobile Radio Service (PRB)	(717) 337-1212
Government—	
• Broadcasting, Frequency Coordination, List, Interference, Radio Stations, Telecommunications Committees (OST)	632-7025

—H—

Health Unit (FCC)	632-1618
Harrassing Telephone Calls (CCB)	632-7553
Hearing Calendar (OLJ)	632-7680
Highway Maintenance (PRB)	(717) 337-1212
Highway Patrol (PRB)	(717) 337-1212

—I—

Incidental Radiation Devices (Rules)(OST)	653-8247
Industrial Heating Equipment (OST)	653-8247
Information—General (OPA)	632-7000/632-7260
Information—Technical Research (OST)	632-7040
Infraction Reports—International (OST)	653-8144
Injunctions (OGC)	632-7112
Inspections (FOB)	632-7014
Integrated Data Processing (common carrier transmission of)(CCB)	632-5550
Interception of Radio Communications (OGC)	632-6990
Interconnection (CCB)	634-1800
Interference Complaints	
• Washington, D.C. Area (FOB)	(301) 962-2728
• All Others (Refer to local Field Office)	
• Requests for Monitoring (FOB)	632-6975
• Direction Finding Assistance (FOB)	632-6975
• Radio—Government (OST)	653-8137
• Radio—International (OST)	653-8144
• Research (OST)	632-7040
• Standards (OST)	632-7093
International—International Conferences (Future), CCIR	653-8108
Conferences (past)	632-7025
WARC (OST)	653-8102
Broadcasting	632-9660
• Conferences and Meetings (OST)	653-8102
• Frequency Allocations (OST)	632-7025
• Frequency Allocation Charts & Tables (OST)	632-7025
• Frequency Coordination (OST)	653-8144
• Frequency Lists, Notification & Registration (OST)	653-8144
• Interference (OST)	653-8144
• Permits to Operate in Canada	653-8144
• Radio Publications/Regulation (OST)	653-8144
• Satellites Systems Coordination	653-8153
• Telecommunications Convention/Union (OST)	653-8144
• Telegraph & Telephone Rates (CCB)	632-5550
• Treaties, Agreements & Arrangements (OST)	653-8144
Intrusion Alarms (OST)	653-8247

Subject	Telephone Number
Investigations—	
• Unlicensed Operations	
— Washington, D.C. Area (FOB)	(301) 962-2728
— All other areas refer to local Field Office (FOB)	
• Interference	
— Washington, D.C. Area (FOB)	(301) 962-2728
— All other areas refer to local Field Office (FOB)	
Ionosphere (OST)	632-7080
IRAC (Interdepartment Radio Advisory Committee) (OST)	632-7025
ISM (Industrial, Scientific & Medical Equipment) (OST)	653-8247

—L—

Land Mobile—	
• Common Carrier (CCB)	632-6450
• Other than CC (PRB)	(717) 337-1212
— Public Safety	(717) 337-1212
— Special Emergency	(717) 337-1212
— Business	(717) 337-1212
— Other Industrial	(717) 337-1212
— Land Transportation	(717) 337-1212
Land Mobile Frequency Assignment Techniques (PRB)	(717) 337-1411
Land Mobile Operational Review of Radio Systems	632-6497
Land Transportation (PRB)	(717) 337-1212
Law Suits Litigation (OGC)	632-7112
Leased Facilities (OGC)	632-7553
Library (FCC)(MD)	632-7100
Licenses—(See "Application Status" also)	
• Amateur (PRB)	(717) 337-1212
• Aviation (PRB)	(717) 337-1212
• Business (PRB)	(717) 337-1212
• Commercial Operator (FOB)	632-7240
• Common Carrier	
• Domestic Satellite	634-1624
— Mobile Services (CCB)	632-6400
— Cellular	632-6400
— Microwave (CCB)	634-1706
— Wireline (Authorization or Cert.)(CCB)	634-1800
— International & Satellite (CCB)	632-7265
• Experimental (OST)(PHS)	653-8137
• General Mobile (PRB)	(717) 337-1212
• Industrial (PRB)	(717) 337-1212
• Land Transportation (PRB)	(717)337-1212
• Marine (PRB)	(717) 337-1212
• Microwave (Industrial) (PRB)	(717) 337-1421
• 1st, 2nd, 3rd Class Operators (FOB)	632-7240
• Public Safety (PRB)	(717) 337-1212
• Radio & TV (See Broadcast Services)	
Lighting devices (RF) (Pt. 18)(OST)	653-8247
Local Government Radio (PRB)	(717) 337-1212
Local Television Transmission (CCB)	634-1706
Locator—Personnel	632-7106
Lotteries (OGC)	632-6990
Low Power Transmitters for operation without a license (OST)	653-8247
Low Power Television	
■ Engineering Rules	
• Existing Stations	632-7426
• New Stations/Major or Minor Change Applications	632-7426
■ Non-Engineering Rules	
• Application Processing	632-3894
• Existing Stations	632-3894

Subject	Telephone Number

—M—

Manufacturing (PRB) ..... (717) 337-1212
Marine Services (PRB)
- Applications/Licenses ..... (717) 337-1212
- Rules/Hearings 632-7175

Marketing Rules 632-7068
MD's Licensing 634-1706
Measurement for
- Type Acceptance ..... (301) 725-1585
- Type Approval ..... (301) 725-1585
- Certification ..... (301) 725-1585

Medical Equipment (including diathermy) (OST) 653-8247
Metered Service—Message Units (CCB) 632-7553
Microwave—
- Auxiliary—Common Carrier (CCB) 634-1706
- Auxiliary—Mass Media (MM) 634-6307
- Cable TV Relay Service (MM) 254-3420
- Closed Loop (CCB) 634-1706
- Data Base (OST) 653-8163
- Digital Electronic Message (CCB) 634-1706
- Monitoring Stations, Protection from Interference (FOB) 632-7593
- Multipoint Distribution (MDS)(CCB) 634-1706
- (PRB) operational review 632-6497
- Ovens (OST) (Pt. 18) 653-8247
- Radio Relay (CCB) 634-1706
- General/Operational 632-6497
- Satellite (OST) 653-8107
- TV—Pickup (CCB) 634-1706

Military Stations (OST) 653-8137
Mining (PRB) ..... (717) 337-1212
Mobile Telephone Services (CCB) 632-6450
Mobilization Planning (OST) 632-7025
Model Airplanes (PRB) ..... (717) 337-1212
Monitoring (FOB) 632-6975
- Monitoring Stations, Protection from Interference (FOB) 632-7593

Monitoring Telephone Svc. (CCB) 632-5550
Motor Carrier (PRB) ..... (717) 337-1212

—N—

National Environmental Policy Act (OCG) 632-6990
Navigation (Air or Water) (PRB) 632-7175
News Gathering and Publishing (PRB) ..... (717) 337-1212
Noise—Radio (OST) 632-7040

—O—

Obstruction Markings—Antenna (FOB) 632-7521
Offshore Radio Telecommunications Service (CCB) 632-6450
Off-the-Air Pickup (CCB) 634-1706
Off-Track Betting (OGC) 632-6990
One-Way Paging and Signaling (CCB) 632-6450
Operating Revenues—
- Int'l., Telephone & Telegraph (CCB) 632-7084

Operator Licenses (FOB)—
■ Commercial
- Administration & Suspension of 632-7240
- Examinations (1st, 2nd & 3rd Class)
  - — Washington, D.C. Area ..... (301) 962-2728
  - — All Other Areas 632-7240
- License Records (Commercial) 632-7240

Subject	Telephone Number

■ Restricted Radiotelephone Permit (FOB)
- U.S. Citizens—Wash., D.C. Area ..... (301) 962-2728
- U.S. Citizens—All Other Areas 632-7240
- Aliens—All Areas 632-7240

Oral Arguments (OMD) 632-7535
Original Plant Cost (Telephone & Telegraph) (CCB) 632-3772
Over-the-Horizon or Scatter Technique (OST) 632-7080

—P—

Paging—Common Carrier (CCB) 632-6450
Paging—One-Way (PRB) ..... (717) 337-1212
Pay Cable TV (CATV) 632-7480
Personnel—Employment (OMD) 632-7106
Personnel—Health Benefits Retirement, Employment Verification 632-6279
Personnel—Locator 632-7106
Petroleum Off-Shore Drilling (PRB) ..... (717) 337-1212
Physicians Radio—Private (PRB) ..... (717) 337-1212
Physicians Radio—Common Carrier (CCB) 632-6400
Point-to-Point Microwave—
- Common Carrier (CCB) 634-1706
- Private (PRB) ..... (717) 337-1212

Pole Attachments (CCB) 632-4890
Political Programming 632-7586
Power (Electric, Gas, Water) (PRB) ..... (717) 337-1212
Press Relations (OPA) 254-7674
Press (Relay) (PRB) ..... (717) 337-1212
Privacy Act—Procedures (OGC) 632-6990
Private Carriers Communications (PRB) ..... (717) 337-1212
Private Operational Fixed Services (PRB)
- Microwave Applications
  - — Technical Questions ..... (717) 337-1212
  - — Status of ..... (717) 337-1212

Private Wire Systems—Telephone & Telegraph (CCB) 634-1800
Procurement (OMD) 634-1528
Propagation—Radio Waves (OST) 653-8108
Property Records—Common Carrier (CCB) 634-1861
Public Information—
- Consumer Assistance ..... 632-3860 / 632-7000
- Press & News Media 254-7674

Public Reference Rooms—
- Mass Media (MMB) 632-7566
- Cable (MMB) 632-7076
- Carrier Reports (CCB) 632-7084
- Carrier Tariffs (CCB) 632-5550

Public Safety (PRB) ..... (717) 337-1212

—Q—

Quality Control—Common Carrier (CCB) 634-1800
Quality Control—Common Carrier (CCB) 632-7553

—R—

RACES (PRB) ..... (717) 337-1212
Radar—
- Intrusion Alarms (Unlicensed) (OST) 653-8247
- Aviation or Marine (PRB)
  - — Applications/Licenses ..... (717) 337-1212
  - — Rule Interpretations 632-7175

Radiation hazards (OST) 632-7074

Subject	Telephone Number
Radio Astronomy—	
• Frequencies (OST)	632-7025
• Technical (OST)	632-7040
Radio Broadcasting (See Broadcasting Services)	
Radio Complaints	632-7048
Radio Control Devices	
• Unlicensed (Pt. 15) (OST)	653-8247
• Unlicensed (Pt. 95) (OST)	653-6288
• (PRB)	632-4964
• Unlicensed (other Pts.) (PRB)	632-4964
• (OST)	653-8247
Radio Frequency Devices (OST)	653-8247
Radiograms (CCB)	632-7265
Radiolocation—Industrial (PRB)	(717) 337-1212
Radio Propagation (OST)	653-8108
Radiotelegraph—	
• Common Carrier (CCB)	632-7265
• Marine (PRB)	
— Applications/Licenses See "Application Status—Marine"	
• Operator License, Issuance of (FOB)	632-7240
Radiotelephone—	
• Aviation or Marine (PRB)	
— Applications/Licenses	(717) 337-1212
— Rule Interpretations	632-7175
• Common Carrier Services (CCB)	632-6450
• Equipment	(301) 725-1585
• Operator License Issuance of (FOB)	632-7240
• Permits, Restricted Radiotelephone (FOB)	632-7240
Railroad (PRB)	(717) 337-1212
Rate Base (International, Telegraph and Telephone) (CCB)	632-3772
Rate Level (International, Telegraph and Telephone) (CCB)	632-5550
Rate of Return (International, Telegraph and Telephone) (CCB)	632-3772
Rate Structure (International, Telegraph and Telephone) (CCB)	632-5550
Real Property (FOB Field Installations)	632-7593
Recording Telephone Conversations (CCB)	632-7553
Reduction of Carrier Service (CCB)	632-7876
Relay—Microwave (CCB)	634-1706
Relay Press (PRB)	(717) 337-1212
Religious Petition (RM 2493)	632-3860/632-7000
Rescue Squads (PRB)	(717) 337-1212
Research (Technical) (OST)	632-7040
Restricted Radiation Devices (OST)	653-8247
Retirements (Telephone Plants) (CCB)	634-1861
Rules and Regulations—	
• Aviation and Marine	632-7175
• Business	634-2443
• Industrial, Scientific and Medical (ISM) Equipment	653-8247
• Other Industrial	634-2443
• Land Transportation	634-2443
• Low Power Communication Devices (unlicensed) (Pt. 15) (OST)	653-8247
• Microwave (PRB)	634-2443
• Personal and Amateur	632-4964
• Public Safety	634-2443
Rules—Ship Earth Station	632-7175
• Interpretation of (Gen. Inquiries) (OGC)	632-6990
Rural Radio (CCB)	632-6400

—S—

Subject	Telephone Number
Safety—Sea (PRB)	632-7175
Safety Manager (OMD)	632-7541
Satellite—Sanction (FOB)	
• International Facilities (CCB)	632-7265
• Domestic Facilities (CCB)	634-1624
• International Coordination	653-8144
• Maritime (PRB)	632-7175
• Rates (CCB)	632-5550
• Systems (CCB)	634-1624
• Spread Spectrum (OST)	632-7073
• Coordination and Interference (OST)	653-8107
Scatter Technique—Technical (OST)	653-8108
Search & Rescue—Assistance for (FOB)	632-6975
Security Officer (OMD)	632-7143
Ship Inspections (FOB)	632-7014
Ship Licensing (PRB)	(717) 337-1212
Ship Rules/Exemptions	632-7175
Single Side Band—Standards (OST)	653-6288
Special Emergency or Industrial (PRB)	(717) 337-1212
Spectrum Allocation (See Allocation)	
Speed of Service—	
• Telephone or Telegraph (CCB)	634-1800
Split Channel Operations (CCB)	632-6400
Sports Blackout (MMB)	632-7048
Standards—Licensed Equipment (OST)	653-6288
State Guard (PRB)	(717) 337-1212
Statistics—	
• Common Carrier (CCB)	632-7084
Studio Transmitter Links—	
• Mass Media (MMB)	634-6307
• Common Carrier (CCB)	634-1706
Submarine Cable (CCB)	632-7265
Sunspot Cycle (OST)	632-7040

—T—

Subject	Telephone Number
Taping of Phone Calls (OGC)	632-6990
Tariff Schedules (International, Telegraph and Telephone) (CCB)	632-5550
Taxicab (PRB)	(717) 337-1212
Technical Research (OST)	632-7040
Telephone Equipment Interconnection (CCB)	634-1800
Telegraph Service (CCB)	632-7876
Telephone Lines (CCB)	634-1706
Telephone Telegraph Service Complaints (CCB)	632-7553
Telephone Telegraph Rates (CCB)	632-5550
Teleprinter (Telephone, Telegraph) (CCB)	634-1800
Teletypewriter Exchange Svs. (TWX) (CCB)	632-5550
Television Broadcasting (See Broadcast Services)	
Television Complaints—	
• Advertising Questions	632-7551
• Political Broadcasting Fairness Doctrine	632-7586
• Programming Questions	632-7048
• Religious Petitions	632-3860/632-7000
TELEX	
• International & Domestic (CCB)	632-7265
Tie-line—Telegraph Telephone (CCB)	632-5550
Toll Charges (CCB)	632-5550
Tort Claims (Legal) (OGC)	632-6990
Towers—Painting and Lighting of (FOB)	632-7521
Towing (PRB)	(717) 337-1212
Transfers—	
• Microwave Common Carrier License (CCB)	634-1706
Transit Systems (PRB)	(717) 337-1212
Transportation—Land (PRB)	(717) 337-1212

Subject	Telephone Number
Treaties—	
• Administrative Interpretation (OGC)	632-6990
• Frequency Allocation (OST)	632-8144
Treaty Library (OST)	653-8144
Troposphere (OST)	632-7040
• Interference to (Wash., D.C. Area) (FOB)	(301) 962-2728
— All other areas—Refer to Local Field Office (FOB)	
• Military (OST)	653-8157
• Pickup (Common Carrier) (CCB)	634-1706
TV (and Radio) Complaints—Other than Interference	632-3860
TV STL—	
• Mass Media (MMB)	634-6307
• Common Carrier (CCB)	634-1706
Type Acceptance (OST)	(301) 725-1585
Type Approval (OST)	(301) 725-1585

—U—

Ultrasonics Equipment (OST)	653-8247
Unlicensed Operators—	
• Investigation of (FOB)	632-6345
• Administrative Sanctions (FOB)	632-7240

—V—

Video Transmission—	
• Common Carrier (CCB)	634-1706
Violations Records (Ask what service and refer to that service)	
• FOB Violation Records (FOB)	632-7278

—W—

Walkie-Talkies (That may be operated without a license) (OST)	653-8247
Watch Officer (Monitoring) (Open 24 hrs. per day—7 days per week) (FOB)	632-6975
Wire Facilities (CCB)	634-1800
Wireless Microphones—	
• Non-licensed (OST)	653-8247
• Licensed (PRB)	(717) 337-1212
• Licensed (MMB)	632-7505
Wiretapping (OGC)	632-6990

—Y—

Yellow Page Advertising (CCB)	632-7553

1.2

FCC Field Operations Bureau

Ralph A. Haller
Chief, Technical & International Branch
*Federal Communications Commission**
Washington, DC

THE FIELD OPERATIONS BUREAU

The FCC's Field Operations Bureau operates a series of 25 field offices and 13 monitoring stations throughout the United States, including Alaska, Hawaii, and Puerto Rico. These offices and monitoring stations perform the day-to-day enforcement work of the Commission. Additionally, the offices provide a local contact point between the public, licensees, and the FCC.

FOB Headquarters (Washington, DC)

The headquarters of FOB is divided into 3 functional Divisions:

1) Engineering Division
2) Enforcement Division
3) Public Service Division

Although these divisions support the field installations and formulate policies, normally broadcasters will not deal directly with the headquarters Divisions. FOB headquarters Divisions should be considered as "second level" contacts as these offices are not intended for direct public contact. Nevertheless, knowledge of the headquarters functions may prove useful in specific instances.

*The opinions expressed in this chapter are those of the author and not necessarily those of the FCC.

Engineering Division

The Engineering Division serves the in-house engineering consulting function for FOB. The Engineering Division develops enforcement measuring procedures, designs and builds enforcement vehicles, and develops new enforcement tools such as direction finders. Questions concerning any of these areas may be directed to the Engineering Division.

Enforcement Division

The Enforcement Divison directs all field inspections, investigations, and monitoring (signal sampling) operations. This Division sets priorities for enforcement actions and administers the violations sanctions program. Inquiries concerning enforcement actions may be addressed to the Enforcement Division; however, such inquiries should begin with the local enforcement facility.

Public Service Division

The Public Service Division administers the Bureau's public service program. The program assists the public, licensees, and other government agencies with telecommunications-related matters. It also reports to the FCC, trends and problems learned of through public contact. The Division also provides information to people with interference problems, supervises the mailing out of forms and publications from field installations, and administers the radio operator examination program. This Division handles approvals for

tower construction and lighting. Questions in these areas may be addressed to the Public Service Division.

Field Facilities

Operationally, the field installations are divided into six regions, which cover large areas of the country. Although policies may vary slightly between regions, based on available resources, basic enforcement guidance flows from headquarters.

Regional Directors

Regional directors are located in Atlanta, Boston, Chicago, Kansas City, San Francisco, and Seattle. Their primary function is to support the operations of the field facilities under their control. The regional directors set regional priorities and provide a first-level supervisory function over local offices and monitoring stations. Again, like headquarters, the regional offices are primarily administrative and are not intended regularly to handle inquiries from licensees or the public. Generally, the regional offices should be contacted only if a problem cannot be resolved with the local office.

Field Offices

Most direct contact between broadcasters and the FCC enforcement team comes at the field office level. Each office is headed by an Engineer in Charge. Most offices also have public contact representatives, staff engineers (inspectors), and clerical personnel. These are multi-purpose offices which provide forms, technical assistance, rule interpretations, and radio operator testing. Broadcasters should make an effort to become acquainted with their local FCC office staff, as these offices can be of invaluable assistance. Offices are located in Anchorage, AK; Atlanta, GA; Baltimore, MD; Boston, MA; Buffalo, NY; Chicago, IL; Dallas, TX; Denver, CO; Detroit, MI; Honolulu, HI; Houston, TX; Kansas City, MO; Long Beach, CA; Miami, FL; New Orleans, LA: New York, NY; Norfolk, VA; Philadelphia, PA; Portland, OR; St. Paul, MN; San Diego, CA; San Francisco, CA; San Juan, PR; Seattle, WA; and Tampa, FL. In addition to inspecting FCC licensed stations, these offices solve interference problems, administer the Safety of Life at Sea Act, find and close down illegal stations, and investigate any use of radio energy that does not comply with the Rules and Regulations.

Monitoring Stations

Monitoring stations provide most of the functions of a field office in addition to sampling signals off-the-air. Because many signals cannot be heard beyond line-of-sight distances, these stations operate several monitoring vehicles that travel around the country and sample signals, especially in the VHF region and above. Monitoring stations are located in Allegan, MI; Anchorage, AK; Belfast, ME; Douglas, AZ; Ferndale, WA; Fort Lauderdale, FL; Grand Island, NE: Kingsville, TX; Laurel, MD; Livermore, CA; Powder Springs, GA; Sabana Seca, PR; and Waipahu, HI. Six of the stations also have special TV/FM/microwave enforcement vehicles, called Enforcement Monitoring Units (EMU), to handle most broadcast and microwave work. Although these units are not needed for AM stations, these stations will often be included in enforcement schedules for convenience. These monitoring stations and vehicles can analyze signals with amazing accuracy. Originally, monitoring stations were not intended for direct public contact. More recently, however, such contact has been welcomed as an added public service of the Commission.

THE INSPECTION

Perhaps the most feared activity of the FCC is the inspection program. Although this reaction is understandable, the inspection need not be cause for concern in well managed and operated stations. The FCC inspectors are engineering professionals, not policemen. As such, they will normally be very understanding of problems and often will be eager to offer advice. The inspections provide an opportunity for one-on-one exchanges with the FCC and should be viewed positively. The inspectors have no violation quotas to meet, so an inspection need not end with a violation notice.

Elements of an Inspection

Most inspections follow a similar pattern. The inspector will be primarily interested in the technical operation of the station. Although some attention may be paid to the required records, the majority of the time will be devoted to a review of technical parameters. In the case of AM directional antenna stations, the inspection will include visits to the monitoring points.

The following topic areas are included in inspections; however, a particular inspection need not cover all of the areas:

1. Station Documents and Records
2. Transmitter Operation
3. Studio and Control Point Operation
4. Tower and Antenna
5. Emergency Broadcast System Compliance
6. Remote Control Operation
7. Extension Metering

8. Tower Light Inspection Log
9. Other Logs, as may be required
10. Automatic Transmission System
11. Radio Operator Licenses
12. Directional AM Antenna Performance
13. Auxiliary Broadcast Stations
14. Signal Analysis

The FCC publishes checklists to assist broadcasters in checking their own operation. One checklist covers AM and FM stations, while a second checklist pertains to TV stations. FCC field offices can supply copies of one or both checklists to stations upon request.

After the inspection, the inspector will hold a review session with the chief operator and station licensee or general manager. All areas that need improvement will be discussed. Depending on the severity of a particular violation, FCC actions could range from simply a warning to a monetary forfeiture.

Notification of Violations

If violations were noted during the inspection, the inspector will return to the FCC office and mail a list of the violations to the station. Three levels of notices are provided, and a given inspection may result in issuance of one or more of these notices.

Advisory Notice (FCC Form 790)

Near violations will be brought to the attention of licensees in the form of an FCC Form 790. This level indicates that an observation in some area of the station operation has a high probability of becoming a violation if the problem is not corrected. No reply to the notice is required. (See Fig. 1)

Tier Two Violation (FCC Form 790)

Violations that have little probability of causing the station to interfere with other stations will be notified by the tier two advisory notice (FCC Form 790). Although no reply is required, licensees should immediately correct the discrepancies. Left unchecked, these violations could lead to more serious actions (See Fig. 1)

Tier One Violation (FCC Form 793)

Violations that involve safety of life or property, have a high potential to cause interference, or are of a serious nature for some other reason will be notified on FCC Form 793. This is an Offical Notice of Violation. Licensees must reply to such notices within 10 days of receipt. Failure to reply could result in a monetary forfeiture or ultimately in license revocation. Even if the response cannot be fully complete within the 10 days, as a minimum an extension of time must be requested. Violations in this category are serious and require immediate attention. Depending on the nature of the violation, whether it is a repeated or willful violation, and the licensee's response, additional sanctions could be imposed. (See Fig. 2)

Monetary Forfeitures

Serious violations can result in a forfeiture. In most cases, the local field office will issue the forfeiture; however, in a few cases, some forfeitures will be issued by the FCC in Washington, DC. Field issued forfeitures may not exceed $2,000. The field issued forfeitures may be for items related to safety, interference, tower lighting, or important administrative matters (like not having a licensed operator on duty). More serious violations may have forfeitures of up to $20,000 or more if repeated. These higher levels do require the approval by the Commissioners before being issued. Failure to pay a forfeiture may result in license revocation or criminal charges being filed by the US Attorney.

Criminal Penalties

Broadcasters normally will not be involved in violations so serious as to be handled as criminal violations. These types of violations often are, for example, by people operating unlicensed stations.

Appeals

As with any governmental enforcement actions, licensees have the opportunity throughout the sanction process to appeal the action. If the broadcaster feels that the sanction action is inappropriate or the amount of a monetary forfeiture should be reduced, the office issuing the sanction should be contacted. It may also be useful to obtain professional counsel.

OFF-THE-AIR MONITORING

Technical parameters of station operation may be monitored off-the-air. This occurs at the monitoring stations or in FCC enforcement vehicles. Licensees do not usually know about the Commission's monitoring until after-the-fact. Violations will be brought to a licensee's attention through an advisory notice, a tier two notice, or a tier one notice (see above).

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

NOTICE OF
RADIO STATION CONDITIONS

FREQUENCY	CALL SIGN	
EMISSION	DATE OBSERVED	TIME OBSERVED
LOCATION OF STATION OR NAME OF CRAFT	RADIO SERVICE OR CLASS OF STATION	

NO REPLY
IS NECESSARY

☐ Items are violations of the Commission's Rules detected during monitoring or an inspection. These items must be corrected promptly.

☐ Items identify unsatisfactory or marginal conditions noted during monitoring or an inspection. We suggest you correct these items to avoid violations or operating problems.

PARTICULARS:

FCC OFFICE ADDRESS	DATE SERVED	ISSUING OFFICER
		SUPERVISOR

CAUTION: Violations, if repeated or willful, may result in imposition of sanctions, including monetary fine, revocation or suspension of operating authority or prosecution. (See Sections 501, 502, 503, 312, and 303 (m) of the Communications Act of 1934, as amended and Section 1.89 of the Commission's Rules.) We are retaining a copy of this notice.

(All previous editions of this form are canceled.)

FCC Form 790
November 1978

Fig. 1. Sample FCC advisory notice.

United States of America
FEDERAL COMMUNICATIONS COMMISSION

OFFICIAL NOTICE OF VIOLATION

1. Name and Address of Licensee

WRITTEN REPLY REQUIRED IN DUPLICATE

(See Instructions and Privacy Act Notice on reverse side)

WARNING: Violations, if repeated or willful, as well as your failure to reply to this notice, may result either in the imposition of monetary forfeitures, the revocation of your station license or suspension of operator license. (See Sections 503, 312, and 303 (m) of the Communications Act of 1934, as amended and Section 1.89 of the Commission's Rules.)

2. FREQUENCY			3. Emission	
2a. Authorized	2b. Measured	2c. High/Low (Hertz)		
4. Location of Station or Name of Craft	5. Radio Service or Class of Station	6. Hour(s) of Violation (EST-GMT)	7. Date(s) of Violation	8. Call Sign

9. VIOLATION(S)

ISSUING OFFICER	SUPERVISOR - LOCATION	DATE MAILED/SERVED

The knowing and willful making of any false statement in reply to this NOTICE is punishable by fine or imprisonment under Title 18, United States Code, Section 1001.

(All previous editions of this form are canceled.)

(See Reverse Side)

FCC Form 793
April 1978

Fig. 2. Sample FCC office Notice of Violation.

TO THE LICENSEE:

The facts set forth herein indicate that you have violated the requirements of law or treaty. This Notice is issued in accordance with Section 1.89 of the Commission's Rules.

1. Within 10 days from receipt of this Notice, a written reply in DUPLICATE shall be addressed to "Federal Communications Commission" and SENT TO THE ADDRESS SHOWN ON THE FACE HEREOF AT THE TOP OF THE PAGE. DO NOT address your reply to an individual.

2. **MAKE CERTAIN THAT YOUR ANSWER:**
   a. Fully explains each violation.
   b. Specifically describes the action taken to correct and to prevent continuation or recurrence of each violation.
   c. Is identified as a reply to this Notice. Include the *call sign* of your station so that your answer may be properly associated with the station file.
   d. Does not refer to a reply to another notice, but is complete in itself.
   e. Is dated and is signed by the licensee or, if appropriate, an officer of the licensee.
   f. Includes all the information requested above in addition to any other information requested in Items 3 and 4, below.

3. **CHANGE OF ADDRESS:**
   If the address appearing in Block 1 on the face of this Notice is not your correct address for receipt of mail, include the correct address in your letter of reply to this Notice.

4. If an "X" appears in the box preceding any of the following instructions, comply with the instruction(s) so indicated and submit the information together with the above described letter.

☐ a. State the name of the person who operated the transmitter at the time of the violation. Does this person hold an operator license or permit issued by the Federal Communications Commission?

☐ b. A second copy of this Notice is enclosed for the operator to answer the following questions thereon. That copy must then be submitted with the letter of reply described in Item 2 above from the person addressed on the face of this notice. RETAIN THE ORIGINAL OF THIS NOTICE.

I, the undersigned, was the operator on duty at the time of the violation noted hereon, and hereby acknowledge this NOTICE. I hold FCC-issued Radio Operator (Not Station) License or Permit as follows (if none, so state): _____
Number (If unnumbered, so state): _____
Issuance date: _____ Birth date: _____
Name (print): _____
Address: _____
Signature: _____

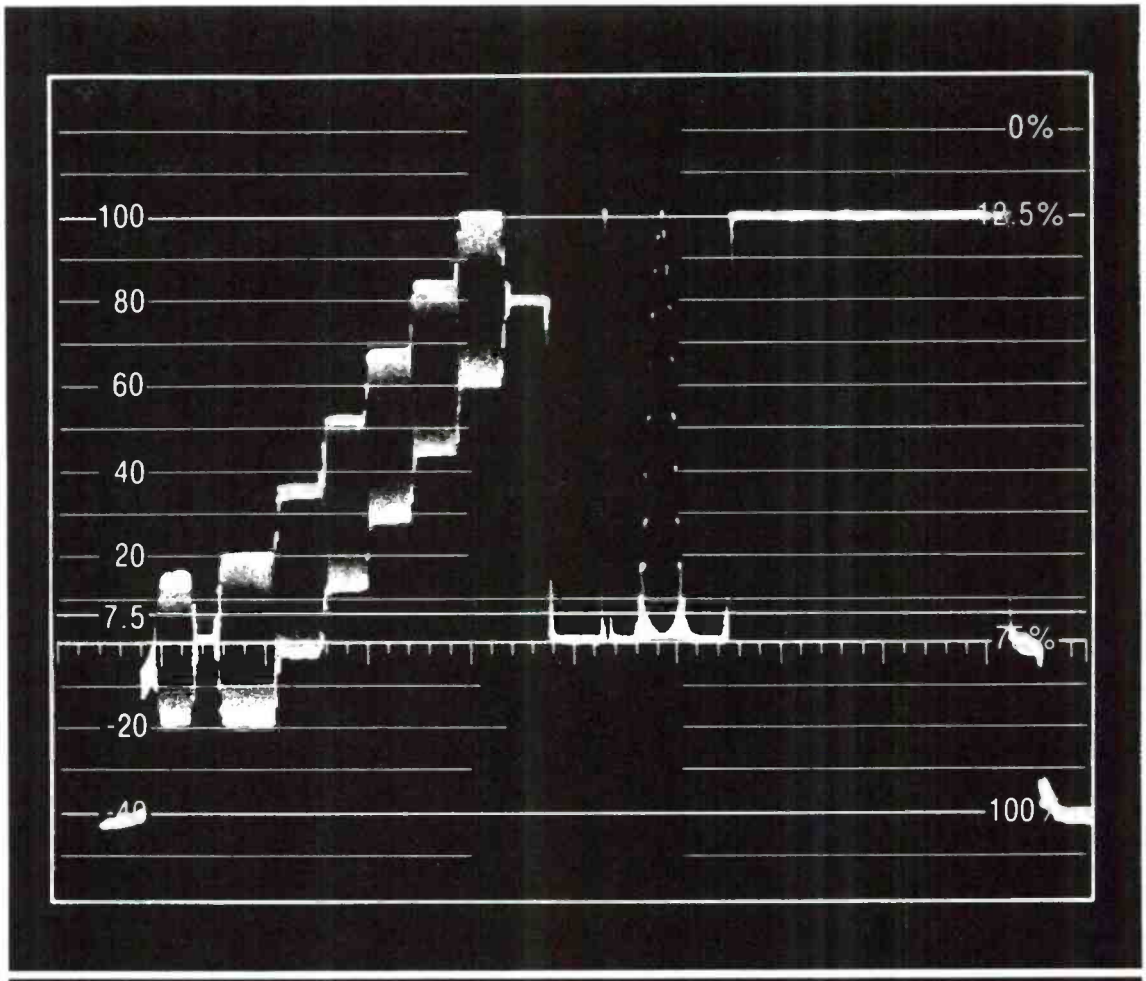
NOTICE REQUIRED BY THE PRIVACY ACT OF 1974, P.L. 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3):

The staff will use all relevant and material information before it, including the information disclosed in your reply, to determine what, if any, enforcement action is required to ensure current and future Rule compliance.

Willful or repeated violation or failure to reply may result in a monetary forfeiture or license revocation.

FCC Form 793
April 1978 (page 2)

Fig. 2. Sample FCC office Notice of Violation. (Cont.)



FEDERAL COMMUNICATIONS COMMISSION
FCC
USA

Provided by
Field Operations Bureau

TV Station Checklist

This **TV Station Checklist** is provided to assist broadcast engineers and other technical staff in maintaining compliance with FCC Rules and Regulations.

For additional copies, contact the nearest field office or the FCC, Field Operations Bureau, Washington, D.C. 20554.

Provided by
Field Operations Bureau

December 1984

Partial Index By Subject To Rules For TV Stations

Since rules are subject to periodic revisions, listings should be checked with recent rule changes as they occur. This is not a complete listing of all rules to which stations may be subject.

1. Station Document & Records

☐	License, Construction Permit, Renewal, Program test posted	**73.1230 [a]**
☐	Operator licenses posted	**73.1230 [b]**
☐	Operators properly licensed	**73.1860 [a]**
☐	Auxiliary, antenna authorization	**73.1230 [a]**
☐	Logs and Records available	**73.1225 [c]**
☐	Station available for FCC inspection	**73.1225 [a]**
☐	Logs relinquished to Commission on request	**73.1226 [a]**
☐	Chief operator designation	**73.1870 [b]**

2. New Station Notices To Be Filed

☐	Equipment test notice with Washington and EIC	**73.1610 [a]**
☐	Program test commencement notice with Washington	**73.1620 [a]**
☐	License application filed within 10 days	**73.1610 [a]**

3. Transmitter

☐	Transmitter type-accepted or approved, or as shown on license	**73.1665**
☐	Aural O.K. not more than 22% visual	**73.1560 [c] [2]**
☐	Visual operating power 80-110% of authorized	**73.1560 [c] [1]**
☐	Function of meters labeled	**73.688 [d]**
☐	Meters accurate	**73.1215 [f]**

☐	Means for measuring aural modulation	**73.688 [a]**
☐	(Meters) proper scale/range all powers	**73.1215**
☐	Interlock and safety provisions	**73.687 [d] [3]**
☐	Power adjustment capability	**73.687 [c] [3]**
☐	Efficiency O.K.	**Good engineering practice**
☐	Transmitter modifications approved	**73.1690 [b] [2]**
☐	Vestigial sideband filter if necessary	**73.687 [a] [3]**
☐	Harmonics suppressed at least 60 dB	**73.687 [i]**
☐	Carrier frequencies within tolerance	**73.1545 [c]**

4. Studio and Control Point

☐	Main studio location O.K. and licensed	**73.1125**
☐	Operator's primary duty is operation of transmitter	**73.1860 [d]**
☐	Equipment/wiring—good engineering practice	**73.687 [j]**
☐	Transmitter/Monitor visible to operator	**73.1860 [a]**
☐	EBS alarm visible or audible	**73.932 [a]**
☐	EBS check list immediately available	**73.908**

5. Tower and Antenna

☐	Tower location and height as licensed	**73.1690 [b] [3]**
☐	Correct color (TSA)	**17.23**
☐	Correct number of bands (TSA)	**17.23**
☐	Lighting agrees with license	**TSA**
☐	Top and flashing lights work or FAA notified	**17.48 [a]**
☐	Photocell and flashing mechanism	**TSA**
☐	Authority obtained for changes in antenna	**73.1690 [b] [3]**

6. Visual Signal Monitors

☐	Visual signal monitoring equipment installed and working	**73.691**

7. EBS

☐	Receiver decoder installed and working	**73.932 [a]**
☐	Weekly test transmission made unscheduled	**73.961 [c]**
☐	EBS tests received off-the-air	**73.932 [c]**
☐	EBS check list immediately available	**73.908**
☐	Equipment loan inventory installed and operational	**Terms of Contract**
☐	EBS tone encoder installed/working	**73.932 [b]**
☐	Correct station assignment monitored	**73.932 [a]**

8. Remote Control Operation

☐	Positive on/off	**73.1410 [a]**
☐	Transmitter secure	**73.1410 [b]**
☐	Operation discontinued if operation beyond station authorization not correctable	**73.1410 [e]**
☐	Remote equipment calibrated and tested as needed	**73.1410 [c]**
☐	Provisions for remote tower light check if not directly observed	**73.1410 [a]**
☐	Fail-safe for false activation	**73.1410 [d]**
☐	Remote control point(s) secure	**73.1410 [b]**

9. Extension Metering

☐	Transmitter accessible within 100 feet	**73,1550 [a] [2]**
☐	All required meters extended	**73.1550 [b]**
☐	Meters have standard scales	**73.1550 [a] [6]**
☐	Extension meters calibrated	**73.1550 [c]**
☐	Extension meters agree within 2%	**73.1550 [c] [3]**
☐	Extension meters operate continuously	**73.1550 [a] [5]**

10. Station Log

☐	Retained for 2 years	**73.1840 [a]**
☐	Signed by operators making entries	**73.1800 [a]**
☐	Reviewed and signed by designated chief operator	**73.1870 [c] [3]**
☐	Pages numbered and dated	**73.1800 [b]**
☐	Indicated advanced or nonadvanced times	**73.1800 [b]**
☐	Tower light failures	**73.1820 [a] [1] [i]**
☐	Data as specifically required by FCC	**73.1835**
☐	EBS tests transmitted and received	**73.961**
☐	Corrections made properly	**73.1800 [c]**
☐	Reason for EBS test failures	**73.932 [c]**

11. Public Inspection File

☐	Records at accessible location	**73.3526 [d]**
☐	Applications tendered (after May 13, 1965)	**73.3526 [a] [1]**
☐	Ownership reports filed (after May 13, 1965)	**73.3526 [a] [3]**

☐	Political time requests in public file	**73.3526 [a] [4]**
☐	Annual employment reports	**73.3526 [a] [5]**
☐	Public and Broadcasting Procedural Manual	**73.3526 [a] [6]**
☐	Letters from public as required	**73.3526 [a] [7]**
☐	Materials available for reproduction	**73.3526 [f]**
☐	Materials retained for proper period	**73.3526 [e]**
☐	Quarterly Issues/Programs List	**73.3526 [a] [8]**

12. Automatic Logging

Station Log

☐	Accurately calibrated, time, date and circuit functions	**73.1820 [b]**
☐	Autologger does not affect accuracy	**73.1820 [b] [1]**
☐	Equipment accurate	**73.1820 [b] [2]**
☐	Calibration of logger as needed	**73.1820 [b] [3]**
☐	Aural alarm circuit	**73.1820 [b] [4]**
☐	Parameters read continuously or at least once each 30 minutes	**73.1820 [b] [5]**
☐	Logger located in vicinity of operator	**73.1820 [b] [7]**
☐	Conforms with 73.1215 (arbitrary scales not authorized)	**73.1820 [b] [8]**
☐	No alterations after entry recorded	**73.1800 [d]**

13. Operator

☐	Chief operator employed	**73.1870 [b]**
☐	Licensed operator on duty	**73.1860 [a]**
☐	Operator properly instructed	**73.1860 [c]**

14. Other Operating Requirements

☐	Licensee conducted contest	**73.1216**
☐	Required station identification	**73.1201 [a]**
☐	Sponsors identified on air	**73.1212**
☐	Broadcast of telephone conversation	**73.1206**
☐	Rebroadcasting other stations	**73.1207**
☐	Delayed-recorded broadcast announced	**73.1208 [a]**
☐	No fraudulent billing	**73.1205**
☐	EEO compliance	**73.2080**
☐	Compliance with rules re: personal attacks and political editorials, broadcasts by candidates for public office	**73.1920, 73.1930 73.1940**
☐	Letters to Commission describing any emergency operation conducted by the station	**73.1250 [e]**
☐	Broadcast of Lottery Information	**73.1211**

15. Technical Signal Analysis

☐	Visual carrier frequency Nom. 1.25 MHz above lower bound	**73.682 [a] [2]**
☐	Visual carrier frequency tolerance within ± 1000 Hz	**73.668 [a]**
☐	Aural-Visual separation 4.5 MHz ± 1000 Hz	**73.668 [b]**
☐	Horizontal scan rate within tolerance	**73.682 [a] [6]**
☐	Vertical scan rate within tolerance	**73.682 [a] [6]**
☐	Chrominance frequency 3.579545 MHz ± 10 Hz	**73.682 [a] [5]**
☐	Blanking level 72.5-77.5%	**73.682 [a] [12]**
☐	Reference white level 10-15%	**73.682 [a] [13]**
☐	Setup interval 5-10 IRE units	**73.682 [a] [17]**
☐	Horizontal sync pulse width 4.4-5.1 us	**73.699**

☐	Front porch duration 1.3 us min.	**73.699**
☐	Sync to end-of-burst 7.9 us max.	**73.699**
☐	Sync to start of video 9.2 us min.	**73.699**
☐	Horizontal blanking interval 11.5 us max.	**73.699**
☐	Color burst length 8-11 cycles	**73.699**
☐	Color burst amplitude 90-110%	**73.699**
☐	Breezeway duration .4 us min.	**73.699**
☐	Pulse rise time .3 us max.	**73.699**
☐	Equalizing pulse width 2.5 us Nom. (45-50% H. sync)	**73.699**
☐	Serration width 3.8-5.1 us	**73.699**
☐	Blanking sync tip variation 5% max.	**73.682 [a] [16]**
☐	Teletext lines & levels	**73.682 [a] [24]**
☐	Vertical blanking interval 21 lines	**73.682 [a] [24]**
☐	Aural carrier modulation within limits	**73.1570 [b] [3]**
☐	Subcarrier modulation within limits	**73.1570 [b] [3]**

16. Auxiliary Broadcast Stations

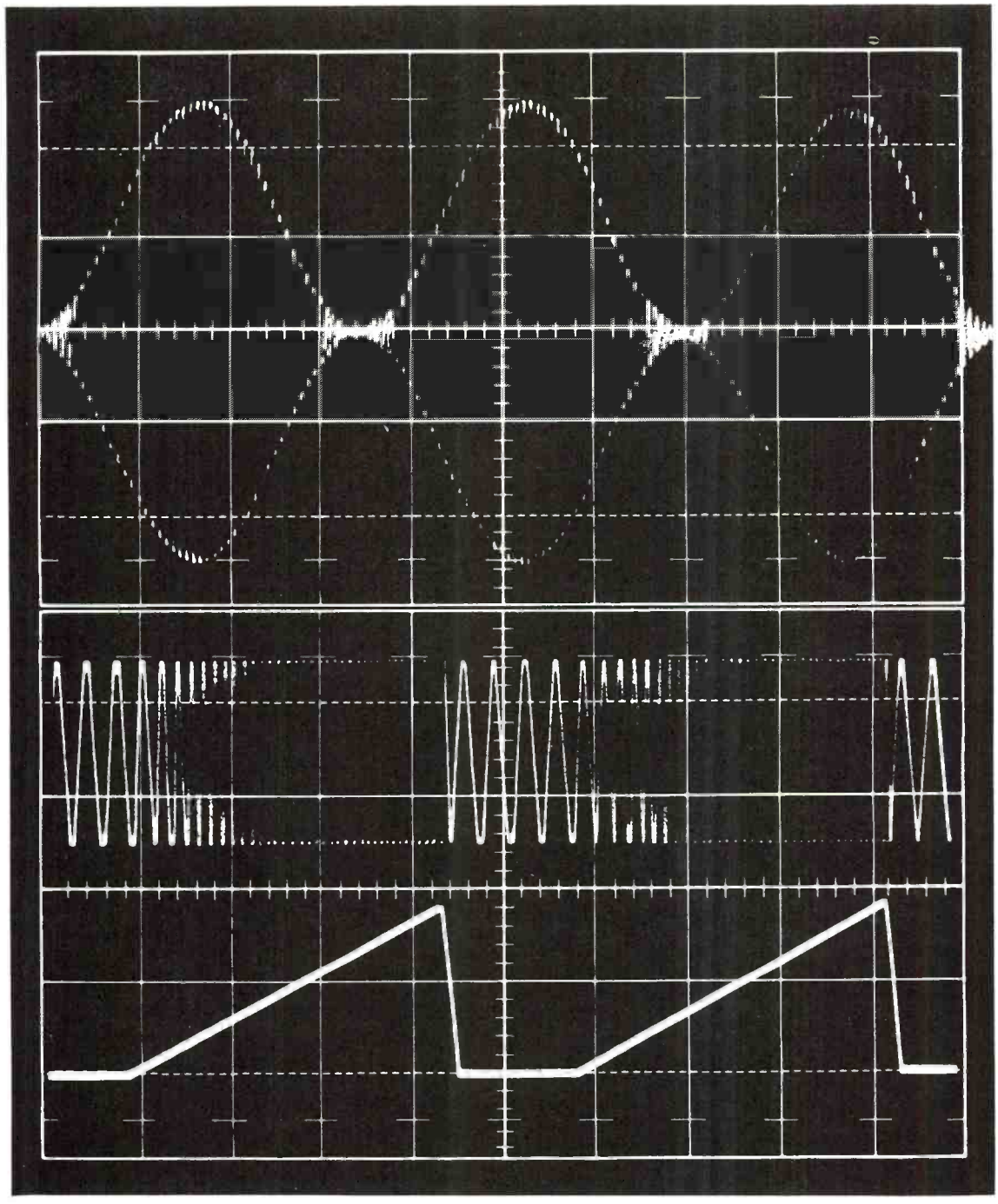
Remote Pickup Stations

☐	Operating power not in excess	**74.461**
☐	Frequency within tolerance	**74.464**
☐	License posted or attached to transmitter	**74.467 [a] or [b]**
☐	Operated under control of licensee	**74.18 [b]**
☐	Tower light entries required by Part 17	**74.30**
☐	Station identification given	**74.482**
☐	Repairs by qualified person	**74.18 [d]**

Remote Control Operation

☐	% modulation indicator or automatic modulation control	**74.434 [a] [1]**

☐	On/off control of RF stage	**74.434 [a] [2]**
☐	Protected against unauthorized operation	**74.434 [a] [3]**
	Aural Broadcasting Auxiliary Stations	
☐	Operating power not in excess	**74.534**
☐	Directional antenna required	**74.536**
☐	Frequency tolerance of .005% or for 18 GHz .003% maintained	**74.561**
☐	Station license posted	**74.564**
☐	Tower light records required by Part 17	**74.30**
☐	Station identification	**74.582**
	Remote Control Operation	
☐	RF or control activated device showing Tx is radiating	**74.533 [a] [2]**
☐	On/off control of RF stage	**74.533 [a] [3]**
☐	Protected against unauthorized operation	**74.533 [a] [4]**
	Unattended Operation	
☐	Notification to Commission 10 days prior to operation	**74.533 [b]**
☐	Protected against improper operation	**74.533 [b] [2]**
☐	Protected against unauthorized operation	**74.533 [b] [3]**
☐	Observations made at receiving end or operating position	**74.533 [b] [4]**



FEDERAL COMMUNICATIONS COMMISSION
FCC
USA

Provided by
Field Operations Bureau

AM & FM Broadcast Station Checklist

This **AM/FM Checklist** is provided to assist broadcast engineers and other technical staff in maintaining compliance with FCC Rules and Regulations.

For additional copies, contact the nearest field office or the FCC, Field Operations Bureau, Washington, D.C. 20554.

Provided by
Field Operations Bureau

December 1984

Partial Index By Subject To Rules For AM & FM Broadcast Stations

Since rules are subject to periodic revisions, listings should be checked with recent rule changes as they occur. This is not a complete listing of all rules to which stations may be subject.

TSA = Terms of Station Authorization
GEP = Good engineering practice

1. Station Document & Records	AM	FM
☐ License, CP, Renewal, Program test posted	73.1230 [a]	73.1230 [a]
☐ Operator licenses posted	73.1230 [b]	73.1230 [b]
☐ Alternate site, auxiliary antenna, PSRSA, PSSA, remote control (AM Directional) authority	73.1230 [a]	73.1230 [a]
☐ Designated chief operator agreement posted	73.1870 [a]	73.1870 [a]
☐ Contract chief operator agreement	73.1870 [b]	73.1870 [b]
☐ Antenna impedance measurement	73.1225 [c]	—
☐ Field strength measurement for directional systems	73.1225 [c]	—
☐ Contracts for brokers, etc.	73.1226 [c]	73.1226 [c]
☐ Logs and Records available	73.1225 [c]	73.1225 [c]
☐ Station available for FCC inspection	73.1225 [a]	73.1225 [a]
☐ Logs relinquished to Commission on request	73.1226 [a]	73.1226 [a]
☐ Common carrier SCA authorized	73.127 [b]	73.295 [b]

2. New Station Notices To Be Filed		
☐ Equipment test notice with Washington and EIC	73.1610 [a]	73.1610 [a]

☐	Program test authority advance notice with Washington or authorized for DA	73.1620 [a]	73.1620 [a]
☐	License application filed within 10 days	73.1610 [a]	73.1610 [a]

3. Transmitters

☐	Main transmitters acceptable	73.1665	73.1665
☐	Operating power correct	73.1560 [a]	73.1560 [b]
☐	Function of Meters labeled	73.58 [d]	73.258 [d]
☐	Meters accurate	73.1215 [f]	73.1215 [f]
☐	Meter(s) proper scale/range all powers	73.1215	73.1215
☐	Interlock and safety provisions	73.49	73.317 [b]
☐	Power adjustment capability	73.40 [a] [1]	73.317 [a] [8]
☐	Efficiency O.K.	GEP	GEP
☐	Transmitter efficiency factor available	—	73.267 [c] [3]
☐	Transmitter modifications approved	73.1690 [b]	73.1690 [b]
☐	Frequency in tolerance (AM—20 Hz, FM—2000 Hz)	73.1545 [a]	73.1545 [b]
☐	Modulation within tolerance (generally 85—100%)	73.1570 [b] [1]	73.1570 [b] [2]

4. Studio and Control Point

☐	Main studio location O.K. and licensed	73.1125	73.1125
☐	Operator's primary duty is operation of transmitter	73.1860 [d]	73.1860 [d]
☐	Equipment/wiring—good engineering practice	73.49	73.317 [c]
☐	Transmitter/control equipment visible to operator	73.1860 [b]	73.1860 [b]
☐	EBS alarm visible or audible	73.932 [a]	73.932 [a]
☐	EBS check lists immediately available	73.908	73.908
☐	Extension meters visible	73.1550 [a] [3]	73.1550 [a] [3]

☐	Operator can monitor/control SCA services	73.127 [e]	73.295 [e]

5. Tower and Antenna

☐	Authority obtained for change in radiating system	73.1690 [b] [3]	73.1690 [b] [3]
☐	Correct color (TSA—terms of station license)	17.23	17.23
☐	Correct number of bands (TSA)	17.23	17.23
☐	Lighting agrees with license	TSA	TSA
☐	Top and flashing lights work or FAA notified	17.48 [a]	17.48 [a]
☐	Photocell and flashing mechanism	TSA	TSA
☐	Radials protected and in good condition	73.189 [b] [4] & [5]	—
☐	Antenna & transmission line not exposed	73.49 [a]	—
☐	Base fence secure and grounded	73.49 [a] [8]	—
☐	Tuning house secure	73.49 [a] [8]	—
☐	Base ammeter 2% calibration to remote	73.57 [d] [3]	—
☐	Weeds cut in antenna area	GEP	—
☐	Satisfactory field strength at 1 mile	73.189 [b] [2]	—
☐	Spurious or harmonic emissions attenuated	73.44 [a]	73.317 [a]
☐	Base meters in range for all powers	73.58 [a]	—
☐	Remote antenna current pickup point located at, but below main meter	73.57 [b]	—
☐	Directional System Tolerances	73.62	—

6. Modulation Monitor

☐	Equipment for measuring modulation levels	73.58 [a]	73.258 [a]

7. EBS

☐	Receiver decoder installed and working	73.932 [a]	73.932 [a]
☐	Weekly test transmissions made unscheduled	73.961 [c]	73.961 [c]
☐	EBS tests being received	73.932 [c]	73.932 [c]
☐	Check list immediately available	73.908	73.908
☐	Equipment loan inventory O.K.	Terms of loan agreement	
☐	EBS tone encoder installed/working	73.932 [b]	73.932 [b]
☐	Monitoring correct station assignment	73.932 [a]	73.932 [a]

8. Remote Control Operation

☐	Positive on/off	73.1410 [a]	73.1410 [a]
☐	Transmitter secure	73.1410 [b]	73.1410 [b]
☐	Operation discontinued if operation beyond station authorization not correctable	73.1410 [e]	73.1410 [e]
☐	Remote equipment calibrated and tested as needed	73.1410 [c]	73.1410 [c]
☐	Remote control point(s) secure	73.1410 [b]	73.1410 [b]
☐	Fail safe for false activation	73.1410 [b]	73.1410 [d]
☐	Redundant control for automatic AM mode changes	73.1410 [a]	—
☐	Termination of remote control within three hours when required because of inaccurate readings	73.1410 [e]	73.1410 [e]
☐	Antenna monitor type approved for remote reading	73.53 [c] [9]	—
☐	Provisions for remote tower light check if not directly observed	73.1410 [a]	73.1410 [a]

9. Extension Metering

☐	Transmitter accessible within 100 feet	73.1550 [a] [2]	73.1550 [a] [2]
☐	All required meters extended	73.1550 [b]	73.1550 [b]
☐	Meters have correct scales	73.1550 [a] [6]	73.1550 [a] [6]

☐	Extension meters calibrated	73.1550 [c]	73.1550 [c]
☐	Extension meters agree within 2%	73.1550 [c] [3]	73.1550 [c] [3]
☐	Extension meters operate continuously	73.1550 [a] [5]	73.1550 [a] [5]

10. Station Log

☐	Logs retained for 2 years	73.1840 [a]	73.1840 [a]
☐	Signed by operator making entries	73.1800 [a]	73.1800 [a]
☐	AM DA field strength measurements	73.61 [a]	—
☐	Reviewed, signed and dated by designated chief	73.1870 [c] [3]	73.1870 [c] [3]
☐	Pages numbered and dated	73.1800 [b]	73.1800 [b]
☐	Indicated advanced or nonadvanced times	73.1800 [b]	73.1800 [b]
☐	Tower light observed failures	73.1820 [a] [1]	73.1820 [a] [1]
☐	Special technical data as required by FCC	73.1835	73.1835

AM Directional Antenna Stations Without Approved Sampling Systems

☐	Adjustments to transmitter parameters	73.1820 [a] [2] [i]	—
☐	Plate voltage and plate current	73.1820 [a] [2] [i]	—
☐	Antenna current or common point current	73.1820 [a] [2] [i] [B]	—
☐	Antenna monitor sample current, ratio or ratio deviation	73.1820 [a] [2]	—
☐	Phase indications	73.1820 [a] [2]	—
☐	Meter readings without modulation effects	73.1820 [a]	—
☐	No variation in readings for long periods	GEP	GEP
☐	Entries for commencement at each mode and at 3 hour intervals	73.1820 [a] [2]	—

☐	Efficiency factor derivation, Ep X Ip for indirect power	73.1820 [a] [2] [ii]	—
☐	EBS Tests transmitted and received	73.961 73.1820 [a] [1] [iv]	73.961 73.1820 [a] [1] [iv]
☐	Corrections made properly	73.1800 [c]	73.1800 [c]

11. Public Inspection File

☐	Records at accessible location	73.3526 [d]	73.3526 [d]
☐	Applications tendered after May 13, 1965	73.3526 [a] [1]	73.3526 [a] [1]
☐	Ownership reports filed after May 13, 1965	73.3526 [a] [3]	73.3626 [a] [3]
☐	Political use requests	73.3526 [a] [4]	73.3526 [a] [4]
☐	Annual employment reports	73.3526 [a] [5]	73.3526 [a] [5]
☐	Public and Broadcasting Procedural Manual	73.3526 [a] [6]	73.3526 [a] [6]
☐	Letters from public as required	73.3526 [a] [7]	73.3526 [a] [7]
☐	Issues/Programs list	73.3526 [a] [10]	73.3526 [a] [10]
☐	Materials available for reproduction	73.3526 [f]	73.3526 [f]
☐	Materials retained for proper period	73.3526 [e]	73.3526 [e]
☐	Donor announcement for non-commercial stations	73.3527 [a] [8]	73.3527 [a] [8]

12. Automatic Logging

Station Log

☐	Accurately calibrated, time, date and circuit functions	73.1820 [b]	—
☐	Autologger does not affect accuracy	73.1820 [b] [1]	—
☐	Equipment accuracy	73.1820 [b] [2]	—
☐	Calibration of logger as needed	73.1820 [b] [3]	—
☐	Aural alarm circuit	73.1820 [b] [4]	—

☐	Parameters read continuously or at least once each 30 minutes	73.1820 [b] [5]	—
☐	Logger located at control point	73.1820 [b] [6]	—
☐	Logger located in vicinity of operator	73.1820 [b] [7]	—
☐	Conforms with 73.1215 (arbitrary scales not authorized)	73.1820 [b] [8]	73.1820 [b] [8]
☐	No alterations after entry recorded	73.1800 [d]	73.1800 [d]

13. Radio Operator

☐	Chief operator employed or contracted	73.1870 [b]	73.1870 [b]
☐	Licensed operators on duty	73.1860 [a]	73.1860 [a]
☐	Operator properly instructed	73.1860 [c]	73.1860 [c]

14. Other Operating Requirements

☐	Required station identification	73.1201 [a]	73.1201 [a]
☐	Sponsors identified on air	73.1212	73.1212
☐	Presunrise authorized operation	73.99	—
☐	Time, power and modes of operation correct	73.1745	73.1745
☐	Broadcast of telephone conversation requirements	73.1206	73.1206
☐	Rebroadcasting other stations	73.1207	73.1207
☐	Delayed-recorded broadcast announced	73.1208 [a]	73.1208 [a]
☐	No fraudulent billing	73.1205	73.1205
☐	EEO Compliance	73.2080	73.2080
☐	Compliance with rules re: personal attacks and political editorials, broadcasts by candidates for public office	73.1920 73.1930 73.1940	73.1920 73.1930 73.1940
☐	Letter to Commission describing emergency operation	73.1250 [e]	73.1250 [e]

☐	Minimum Operating Schedule	73.1740	73.1740
☐	Licensee conducted contest	73.1216	73.1216
☐	Broadcast of Lottery Information	73.1211	73.1211

15. AM Measurements

		Required In Proof	Required Specifications
☐	Hum & noise referenced to 100% modulation at 400 Hz	—	73.40 [a] [6]

16. Directional Antenna System

		AM	FM
☐	Field strength measurements made as necessary	73.61	—
☐	Field strength meter available and working	73.61 [a] [1]	—
☐	Base current, sample loop current, phase angle agree with license	73.62	—
☐	Antenna monitor installed and working	73.69	—
☐	Field strength measured less than licensed maximum at monitoring points	TSA	—
☐	Monitor point satisfactory location and adequately described on license	GEP	—
☐	Antenna monitoring authorized type	73.69 [a]	—
☐	Approved sampling system O.K. if required	73.68	—

17. Stereo & SCA Operation

☐	Stereo pilot checked as necessary	—	73.297 [b]
☐	Stereo pilot injection 8 to 10%	—	73.322 [b]
☐	Stereo pilot frequency within 2 Hz	—	73.322 [b]
☐	Stereophonic subcarrier suppressed to less than 1% modulation of main carrier	—	73.322 [e]
☐	Subcarrier injections not excessive	—	73.319 [d]
☐	Subcarrier baseband within limits	—	73.319 [c]

18. Automatic Transmission Systems

☐	Authorization to use ATS	73.140 [c]	73.340 [c]
☐	ATS personnel licensee employees	73.146 [a]	73.346 [a]
☐	ATS personnel can perform monitoring & duties	73.146 [f]	73.346 [f]
☐	ATS personnel fully instructed on duties	73.146 [g]	73.346 [g]
☐	Tower lights checks either manual or automatic	73.146 [c] [3]	73.346 [c] [3]
☐	Only manual turn on used	73.140 [e]	73.340 [e]
	ATS control functions		
☐	Power adjust automatic	73.142 [b] [2]	73.342 [b] [2]
☐	Modulation adjust automatic	73.142 [b] [3]	73.342 [b] [3]
☐	Mode switching clock O.K. if needed	73.142 [d]	—
☐	Mode switching completely automatic	73.142 [d]	—
☐	Modulation control for SCA if used	—	73.342 [c]
☐	ATS auxiliary/alternate trans. O.K. if used	73.142 [g]	73.342 [g]
☐	Minimum modulation maintained	73.142 [b] [3]	73.342 [b] [3]
☐	Provision for indirect power function if used	—	73.342 [b] [1]
☐	ATS test system functioning	73.142 [i]	73.342 [i]
	ATS turn off and fail-safe functions		
☐	Over power uncorrected over 3 minutes	73.144 [a] [1]	73.344 [a] [1]
☐	Over modulation uncorrected over 3 minutes	73.144 [a] [2]	73.344 [a] [2]
☐	Clock for mode switching fails over 3 minutes	73.144 [a] [3]	—
☐	Loss of turn-on or turn-off control	73.144 [a] [4]	73.344 [a] [4]
☐	Loss of alarm device functioning	73.144 [a] [5]	73.344 [a] [5]
☐	Loss of alarm sampling circuits	73.144 [a] [6]	73.344 [a] [6]

ATS alarm functions

☐	Loss of signal (carrier or program) 3 minutes	73.146 [c] [1]	73.346 [c] [1]
☐	Power below 90% authorized over 3 minutes	73.146 [c] [2]	73.346 [c] [2]
☐	Tower lighting failure if alarms used	73.146 [c] [3]	73.346 [c] [3]

ATS monitoring and alarm points

☐	On/off controls functioning	73.146 [b] [1]	73.346 [b] [1]
☐	Off-air SCA program monitor for SCA	—	73.346 [b] [2]
☐	Off-air monitor	73.146 [b] [2]	73.346 [b] [2]
☐	Aural alarm signal functioning	73.146 [b] [3]	73.346 [b] [3]
☐	Point accessible & under licensee control	73.146 [a]	73.346 [a]
☐	Point controls protected from unauthorized operation	73.146 [a]	73.346 [a]
☐	EBS facilities provided as needed	73.146 [f]	73.346 [f]
☐	Licenses and ATS authorization posted	73.146 [h]	73.346 [h]

19. Auxiliary Broadcast Stations

Remote Pickup Stations

☐	License power not exceeded	74.461
☐	Frequency within tolerance	74.464
☐	License posted or attached to transmitter	74.467 [a] or [b]
☐	Operated under control of licensee	74.18 [b]
☐	Tower light records required by Part 17	74.30
☐	Station identification given	74.482
☐	Repairs by qualified person	74.18 [d]

Remote Control Operation

☐	% modulation indicator or automatic modulation control	73.434 [a] [1]
☐	On/off control of RF stage	74.434 [a] [2]

☐	Protected against unauthorized operation	74.434 [a] [3]
	Aural Broadcast Auxiliary Stations	
☐	Operating power not in excess	74.534
☐	Directional antenna required	74.536
☐	Frequency tolerance for offset operation	74.502 [a]
☐	Frequency tolerance of 0.005% or 0.003% for 18GHz maintained	74.561
☐	Station license posted	74.564
☐	Tower light records required by Part 17	74.30
☐	Station identification	74.582
	Remote Control Operation	
☐	Notification to Commission 10 days prior to operation	74.533 [a]
☐	RF or control activated device showing Tx is radiating	74.533 [a] [2]
☐	On/off control of RF stage	74.533 [a] [3]
☐	Protected against unauthorized operation	74.533 [a] [4]
	Unattended Operation	
☐	Notification to Commission 10 days prior to operation	74.533 [b]
☐	Protected against improper operation	74.533 [b] [2]
☐	Protected against unauthorized operation	74.533 [b] [3]
☐	Observations made at receiving end every day	74.533 [b] [4]

1.3

Frequency Coordination

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WHAT IS FREQUENCY COORDINATION?

The push to leave the studio to originate programs has been a part of broadcasting from the beginning. Now, with over 9000 radio and 1150 TV stations on the air, the demand for reliable ways to get news, sports, public affairs and entertainment programming from the field back to the studio has naturally increased. Part 74 of the FCC's Rules deals with segments of the spectrum that have been assigned to the Broadcast Auxiliary Service to accommodate this demand. Part 74 also covers other services outside the scope of this discussion such as FM and TV translators, ITFS, and experimental broadcast stations.

While the number of stations requiring support spectrum has grown tremendously since 1970, the amount of spectrum allocated for this support has stayed relatively constant. Broadcasters using Part 74 spectrum began to experience competition for the limited number of channels allocated. Interference from other broadcasters has gradually become a critical problem in many markets and there are no provisions for exclusive licensing in Part 74. Consequently, broadcast frequency coordination is necessary to facilitate the allocation of limited spectrum for a growing number of uses among a growing number of users.

SOME HISTORY OF BROADCAST COORDINATION

Formal coordination has existed for some time for major events such as political conventions and space launches. In the case of the political conventions, the three national television networks have rotated the chairmanship of an "ad hoc" group, known as the National Political Conventions Frequency Coordinating Committee. Washington, D.C. has had unique coordination problems along with a history of cooperative effort for pool feeds to cover the workings of our Federal Government. Such committee activity has traditionally arisen out of a need, mutually felt by broadcast engineers, to discuss concerns before they become problems. Among the oldest groups formed to deal with mutual operational problems, including coordination, were the Washington Executive Broadcast Engineers (WEBE) and the TV Broadcasters All-Industry Committee in the New York metropolitan area.

The first major region to form a committee to deal exclusively with Part 74 coordination was

Several people made important contributions to both the new field of Part 74 coordination and this chapter of the NAB Engineering Handbook. They are: Don Wilson, present Chairman of the Southern California Frequency Coordinating Committee, for work on aural STL standards proposed in this chapter. Robert Van Buhler, Chairman of the Arizona Frequency Coordinating Committee for his case study on the AFCC, and work on frequency coordinating data bases. Larry Will, New Jersey Public Television, for his assistance on the TV microwave portion of this chapter.

TABLE 1. 1976 FCC 450 Channel Plan Showing SCFCC Waiver Changes.

Channel Designation	Channel Bandwidth	Peak FM Deviation	Total No. of Channels	SCFCC Waiver No.of Chs.
N1	50 kHz	10 kHz	12	0
N2	25	5	24	60
R	50	10	10	14
S	100	35	2	0
P	10	1.5	8	8

Note that since the SCFCC plan allows for center channel use of the "split" N1 50 kHz channels, the maximum number of 25 kHz channels can jump from 24 to 60 since the center channel can be used when geographic separation and or terrain shielding permit.

Southern California. In 1976, the FCC revised Part 74, Subpart D of its Rules which deals with the Remote Pickup Service used by radio and television stations for dispatch, on-air remote pickup, cues and orders, communications, and transmitter telemetry. Recognizing the use of narrowband FM technology, the Commission reallocated the UHF (450 and 455 MHz) frequencies from wideband 100 kHz channels to smaller bandwidth 50 kHz, 25 kHz and 10 kHz channels. Under the FCC's 1976 changes, R and S channels were intended for program material, and cues and orders necessary to implement that programming. N1 and N2 channels were to be used for broadcast program material, cues and orders necessary to that material, and operational communications. Microwave path setup and dispatch functions fall under this last category. P channels may be used only for Operational Communications and telemetry.

In the last half of 1976 CBS called a series of meetings in markets where they owned stations to discuss these changes with their fellow broadcasters. Prior to the FCC's 1976 changes, there were only ten 100 kHz channels in each 1 MHz band segment, for a total of 20 channels. With their 1976 Rulemaking, the FCC created five separate channel groups for specific uses. Southern California, already the scene of heavy 450 MHz activity, was the only region at that time to formally organize a group that held regular meetings.

The Southern California Frequency Coordination Committee (SCFCC) held its first official meeting in November, 1976. By early 1977, it had gained appoval of its membership to request a waiver of the FCC Rules. This waiver request proposed further splitting of the N1 50 kHz channels and the S 100 kHz channels. In 1980 the FCC granted this waiver. It was implemented successfully, and has become the basis for similar plans in other markets.

The SCFCC has been holding monthly meetings for the region since 1976 and has broadened its scope to deal with congestion in the Aural STL (Studio Transmitter Link) service, wireless mikes and RF cuing systems, as well as in the microwave bands for TV STL, Inter City Relay (ICR), and Television Pickup (ENG).

Regions such as Northern California, Arizona, Dallas, and New York organized according to the needs of their licensees. For example, the Northern California Frequency Coordinating Committee, building on bylaws prototyped by the SCFCC, recently incorporated as a non-profit organization. The Arizona group not only coordinates the entire state, but is deeply involved with coordinators for non-broadcast VHF, UHF, and microwave services, including public safety.

Coordination activity spans many aspects of broadcasting. Some regions have not experienced congestion and interference with their own licensees, but have organized committees to deal with problems associated with broadcasters who enter their regions for temporary operation. After conducting a survey at the chapter level on how this problem is viewed locally, the Society of Broadcast Engineers has identified frequency coordination as a chapter project. The SBE National Frequency Coordinating Committee (NFCC) was formed to assist any chapters interested in this project. In addition, the SBE NFCC publishes a list of volunteer coordinators who are responsible for over 80 regions in 50 states, plus Puerto Rico.

If there is one adjective that can be used to describe the nature of effective broadcast coordination, that word is local. Electronic news gathering for both radio and television introduces many unknowns. Mobile paths cannot be predicted from day to day, or even hour to hour. Large scale news, public affairs, or sporting events may mean interference for everyone involved unless technical personnel familiar with a number of factors are consulted. Since many of these factors concern local propagation anomalies, terrain considerations, and user patterns, experience has proven that engineers who work

with these factors at the local level on a day-to-day basis are the best people to consult with and to ask for advice for successful operations.

TERRAIN CONSIDERATIONS

Southern California is an excellent example of a region where most of the key two-way communication and microwave sites are located on mountains in line-of-sight relationship. In addition, there are numerous hilltop and building top sites lying along the 140 mile path between Mount Wilson near Los Angeles and the Mexican Border in San Diego. While adjacent and cochannel signal strength attenuation due to geographical separation between transmitters and receivers, along with some terrain shielding, allows some reuse of channels, frequency reuse and sharing under such conditions are severely limited in broadcast VHF, UHF, and microwave services and public safety. Regions such as New York-New Jersey-Philadelphia and Washington-Baltimore have unusual problems because licensees in different markets are so physically close that line-of-sight conditions exist.

When users are planning formal coordination, the use of topographical maps and engineers who have experience with the region's sites is strongly recommended. The word "regional" takes into account terrain influences. It transcends market and political divisions since RF does not respect man-made divisions and boundaries.

USER DENSITY

In the Southern California region, it is possible to tune in almost 70 AM and FM stations. There is television activity on more than 20 VHF and UHF channels. A large percentage of these stations need spectrum for the "backstage" needs of broadcasting: communications which support the on-air effort in any way. They include studio-to-transmitter links (STL), transmitter-to-studio links (TSL), intercity relay (ICR), remote pickup (RPU) for television and radio broadcasts from the field, news dispatch, wireless microphone, and telemetry and control links.

In a growing list of markets throughout the country, the sheer number of licensees requiring "backstage" support spectrum exceeds the capacity of the available spectrum. Part 74 licenses are issued on a non-exclusive basis. New licensees have a responsibility not to cause harmful interference to existing users. Because of this fact, broadcasters have voluntarily engaged in various types of coordination activities as a matter of survival in the highly competitive marketplace.

PROPAGATION ANOMALIES

A number of factors can modify the expected line-of-sight characteristics of VHF and UHF aural and visual transmission. Many of these can be understood best if the radio waves so affected are compared to light waves. Radio waves sometimes bend around corners in a manner that can be compared to light travelling through the reflective surfaces of a periscope so the viewer can see around corners.

The three most common propagation anomalies are (1) ducting effects, (2) reflection due to thermal inversion layers, and (3) obstacle gain (sometimes referred to as knife edge refraction).

These anomalies can occur for seconds at a time, or may exist in a predictable manner for much longer periods. For instance, obstacle gain can be used in some cases to provide permanent and quite dependable links. In the Part 74 environment, these anomalies have to be recognized and taken into account to assure cochannel and adjacent channel users of adequate protection for both fixed and mobile links. Known anomalies in a region must be factored into any coordinated environment. As in the case of terrain, licensees should seek out engineers who have long-time experience in the region to be coordinated so anomalies that have been identified, and the paths they affect, can be taken into consideration.

THE ESSENCE OF THE BROADCAST COORDINATION PROCESS

The successful coordination efforts mounted so far are all founded on one essential: *licensee-to-licensee contact*. The coordination effort, however it is structured, acts to *facilitate* this contact. As of this writing, Part 74 of the FCC's Rules places the burden of preventing interference squarely on the licensee. Since broadcasting is highly competitive, no local committee should place itself in a position where it "assigns" spectrum.

Successful committees never act as policemen. This role is left for the FCC if all other means of settling disputes fails. However, committees can and do use neutral mediators to try to solve the inevitable problems and disputes that arise in a competitive world. Successful committees are built on trust. This trust can be destroyed easily if committee leadership steps over the line between facilitating coordination and enforcing coordination.

In addition to the reasons mentioned that might lead broadcasters to start coordination activity, one more must be added. Many broadcasters now travel outside their markets to cover news, sports,

or public affairs events. In 1983 the FCC revised Section 74.24 of the Rules to make it easier for broadcasters to cover such events. A footnote to this Rules change asked that regional coordinators make themselves known to the Commission. The SBE NFCC was first formed to compile a list of coordinators to go beyond the Commission's request. The SBE NFCC updates this listing several times a year.

In Reply Comments filed in 1984 with the FCC concerning recognition of Part 74 coordination and the growing trend to enhance spectrum use by splitting wideband channels for both aural and visual needs, the Society of Broadcast Engineers National Frequency Coordinating Committee outlined several possible levels of coordination activity. These levels would be keyed to the actual needs of the licensees in a region where coordination appears to be desirable. These levels recognize that, while some regions require formal committees, many really do not. These guidelines may serve to help licensees achieve the level of coordination appropriate for their region:

Level One

Broadcasters do not form a regional committee. If any individual broadcaster wishes to implement an activity that requires group agreement, it must make a proper showing that it has taken steps to secure such agreement. This protects other licensees from harmful interference and insures operations will not be hampered by the actions of any one licensee. This level is appropriate for regions that are seldom visited by outside licensees and are exposed to little risk of interference from such sources and each other.

Level Two

Broadcasters, either independently, or through the auspices of their local SBE chapter, appoint a Data Base Administrator/Coordinator who serves as the contact for local broadcasters and those from outside the region who wish to operate under the 30 day/720 hour rule (Section 74.24). If modifications such as split channel operation are desired by any entity or entities, individual licensees are still responsible to make a showing to the FCC that other licensees are aware of their intentions and safeguards for their protection are in place. The appointed Coordinator or Administrator serves as a focal point for these activities. This person does not come in direct contact with the FCC. The SBE will list such Coordinators or Administrators and circulate this information to the Industry. This will support the ongoing program that facilitates transient coordination, and makes it easier for broadcasters in the same region to make others aware of changes in fixed and mobile operations.

Level Three

Broadcasters in a region form a Committee. A Data Base Administrator is appointed. The Committee serves as a forum to allow the region's licensees to do planning necessary to implement various types of operating practices. The impetus to form the Committee comes from a market's response to present or predicted Part 74 spectrum shortages. The region's licensees should be willing to invest time, effort, and financial backing to support data base maintenance, and regular meetings. The Committee and Administrator serve as the focal point to coordinate Section 74.24 activity.

Level Four

This level is based on groups like the Southern California Frequency Coordinating Committee, Northern California Frequency Coordinating Committee, Arizona Frequency Coordinating Committee, and the Washington Executive Broadcast Engineers. The organization and support given to the Committee are typical of major market level activity, or regional activity that involves an entire state. The Committee has usually been established for at least two years. It has adopted formal Bylaws, holds elections for officers, and may be incorporated.

Other typical characteristics are that it has been able to hold regular meetings that draw good attendance, publishes a newsletter on a regular basis, routinely interacts with other spectrum users regarding cochannel and adjacent channel assignments, provide a high level of informed technical advice to its members, and has had some experience and success in arbitrating disputes between members. It has an up-to-date data base maintained by a Data Base Administrator.

Such Committees have been able to build a level of communication and trust to bring about cooperative innovations such as ENG control point intercommunication, and state-of-the art computerized data base management.

WHAT DOES IT TAKE TO BUILD A SUCCESSFUL COORDINATING COMMITTEE?

Does Your Region Need a Committee?

If your market is experiencing the growing pains associated with Part 74 spectrum congestion, you and your fellow broadcasters might wish to form a Committee. Your analysis of terrain, user density, and propagation anomalies will help you and your fellow licensees find the right approach. Remember: This question can only be answered by the broadcasters in your region. No

outside force can or should make this decision for you.

We can speak with some degree of confidence on the adverse affects that interference can have on the operation of licensees in an uncoordinated environment. Aside from frustration and embarrassment of blown live shots and disrupted STL's, there is a real economic impact of time spent tracking interference, and of the possibility of lost revenue if there is lost air time.

Some Notes of Caution

There may be several key legal issues to be addressed before you proceed. A frequency coordinating committee is a type of trade association. The Southern California group and others have received legal advice from some of their member-licensees in an effort to develop safeguards against inadvertent antitrust activity. There is always a risk that some type of trade association activity could be interpreted as *restraint of trade.*

The other key issue is that of *membership.* If your market is typical, not all broadcasters will step forward to participate in committee activity. Yet, since Part 74 spectrum access remains non-exclusive, all licensees have the same access rights. Your committee exists to protect interference-free access for as many licensees as possible. Again, as a trade association, you must make sure this precept is planted clearly in the minds of all who participate. Actions perceived as limiting or preventing anyone's access could be viewed as a form of restraint of trade.

The best way to assure this never happens is to conduct committee business in as open a manner as possible. The Southern California group found the best way to accomplish this was to publish a newsletter and send it monthly to every broadcast licensee in the entire region.

With over 250 licensees in over 10,000 square miles, this represents a sizeable monthly mailing burden. Yet, the SCFCC Newsletter goes to each and every licensee. While some have never been to a meeting, the newsletter serves as an acknowledgement of their membership.

It is important to inform licensees who do not attend meetings as well as those who do that *every* licensee has equal status, membership rights, (including voting), and equal spectrum access. Many misunderstandings can be avoided if this point is made early in the formative process and repeated often.

Regarding legal questions, the best general advice is for you to consult legal counsel before proceeding to form your committee to avoid any possible legal complications. As formation takes place, advise each licensee to check with their legal advisors as well.

How to Start

If you are attempting to form a regional committee, your first challenge is to call the region's licensees together for a general meeting. The purpose of this meeting will be to outline why you feel a committee is necessary for your region. Since you will be trying to get as many licensees to send engineering representatives to attend this meeting as possible, you should consider drafting a written letter of invitation to each licensee. The *Broadcasting Yearbook* is a readily available source for licensee information. You should at this point have some idea of the RF considerations that will shape your region and committee. Remember that political and physical boundaries will not necessarily agree with what you might recommend as a RF coordination region.

Writing the Letter

The letter should include your reasons for calling the meeting, and some discussion of the benefits of forming a committee. Depending on the market, you may wish to ask a manufacturer or vendor to send the letter out on their letterhead. This approach may help some people in the area view the meeting more objectively. At this stage, a lot depends on the basic relationships between licensees in your region. If there has been little contact in the past, anything that helps promote a productive meeting of all licensees will in turn help to build the level of trust necessary to start your committee.

What About Inviting Non-Broadcasters?

It is far better to invite participation of cable systems, manufacturers, two-way site managers, and entities such as CNN and Wold (if they operate in your region) than to leave them out. First, we share spectrum with several non-broadcast services. Second, you will need the cooperation and input from site managers and manufacturers to give your committee access to the right people to get perspectives on mutual problems and to come up with solutions. If there are coordinating groups for Amateur or Public Safety in your region, invite them to come to your meetings once you are organized.

Another Benefit of Committee Activity

One of the most important contributions frequency committee activity can make to active participants is serving as a common meeting ground. The trust and mutual respect that must be the foundation for group cooperation and decision making are built on the simple act of people getting to know each other. Some simple things to help this process along are using name tags dur-

ing early meetings, and starting a tradition of everyone standing up at the beginning of each meeting and introducing themselves.

Basics for Running Meetings

Provide a sign-up list that is passed around at the beginning of each meeting. You might want to have space on the sign-up list so people can indicate their Amateur Radio call sign. Many engineers who will attend are involved in this hobby. If you decide to publish a monthly newsletter (strongly recommended) the names of everyone attending meetings should be included. Your monthly newsletter may start out just as a meeting notice, and a recap of what happened at the last meeting. It should also contain an agenda for the coming meeting.

This is important for two reasons. First, it will help meeting attendance if people know that specific issues will be discussed. Second, many legal authorities believe trade association meetings should be run by sticking to an agenda as a further way of eliminating any hint of actions that might involve restraint of trade. Someone should be appointed to keep notes during each meeting for the same reason. These notes will be the basis for newsletter information. Since each meeting should have time set aside for everyone to give reports on their own RF systems (including any proposed changes), accurate notes become the vehicle for up-to-date information on what is happening in the market. Good, clear notes can also be important should the committee become involved in some legal action.

Parliamentary procedure as outlined in *Roberts Rules of Order* should be used to run your meetings. While many committees are ultimately able to run meetings with a high degree of informality, it is best to start off with a chairman or leader. Members should raise their hands to be recognized. A good chairman will make sure everyone is heard on every issue.

Your Mailing List

Your mailing list is an important part of your data base. As mentioned above, make sure you include all actual and potential licensees, even (and especially) if they do not attend meetings. Include cable operators, two-way site managers, consultants, dealers, manufacturers, and other nearby coordination groups. You should consider including group or headquarter engineering management for stations in your region. There is no such thing as too much written communication to your members concerning the activities of a coordinating committee.

Leadership

Your group should decide on a chairman and vice-chairman to run the meetings and provide liaison and leadership for your efforts. If politics are an integral part of your market's facts of life, it is best to get everyone's views (and fears) out in the open concerning committee leadership in the early stages of formation. Since this is rarely possible, you should be aware that these considerations can and do affect committee effectiveness.

Voting vs. Consensus

There are relatively few issues that require a formal vote. If this issue comes up, your committee will have to decide what weight to give each licensee's membership. The SCFCC and several other committees decided to give each license a vote for each band of operation for which it is duly licensed. A television station engagted in ENG plus two-way dispatch would therefore have two votes. A radio station with an aural STL and a 450 MHz RPU would also have two votes. Manufacturers, and others not holding licenses can join in discussion, but do not vote. If your committee is truly operating as a facilitator and a vehicle for information exchange, voting should not be a significant issue.

The issue of consensus is a vital one. Your committee may be deciding how to implement a 450 MHz split channel plan. If you cannot get agreement from all involved licensees to, for instance, split the Group S 100 kHz channels down to four 50 kHz Group R channels, this does not easily fall under the heading of majority rule. In fact, taking group action that might limit a station's ability to do certain types of operation might be viewed as restraint of trade. As in other committee matters that involve legal considerations, work slowly, and get informed legal opinions before taking action.

Conflict

For conflicts that cannot be solved on technical merits, you will have to be creative. Try to get impartial parties involved in mediation. Do not overlook the benefits of subcommittee meetings, working lunches and dinners, and other semi-social occasions where consensus might be sought. If all else fails, you may have to go back to the drawing board and try another approach.

Sometimes a tactic termed "enlightened peer pressure" is useful. If a majority in your committee discusses their views in front of the minority in a constructive, logical manner, breakthroughs can sometimes be made.

Committee Costs

Most committees get their early backing for postage, meeting places, and refreshments from some of the larger stations in a market. Once you are established, you may decide to collect dues, sell advertising in your monthly newsletter, or rotate financial responsibilities among members on a monthly basis. As in other areas, you will have to find what will work in your region.

Goals

Especially in the early stages of your committee, pick one goal and see it through. If TV ENG operation is the leading problem area in in your region, tackle it first. It does little good to work on things that are working well. The tough projects are where committee action will be most appreciated. Your goal is to establish a credible working group.

Meeting Dates

It may seem simplistic to mention such a trivial topic, but it is vital to set your next meeting date before each meeting adjourns. Never skip months in the early stages of formation. In fact, in those early days, you might find it advisable to set up weekly meetings. Try to identify a specific day of the week, and a specific week of each month for your meetings. After a period of time everyone will know that is when your meetings are scheduled. This will help meeting attendance.

COORDINATION CONSIDERATIONS FOR VARIOUS BROADCAST USES OF PART 74 SPECTRUM

Dispatch and Aural Remote Pickup

Channels for this purpose are currently available in a range from 26 MHz to 455 MHz (see accompanying Part 74 tabular listing of frequencies). Spectrum allocated for this purpose just above the standard broadcast band is slated for new AM stations and will become unavailable for Remote Pickup.

In major markets experiencing congestion, and in other markets where older equipment is still in service, 26 MHz operation for dispatch and even some types of remote pickup are still being done. Low power cuing systems for TV field operations sometimes appear in this band. Since it is near to present Citizen's Band channels, it is subject to interference from this service. Propagation conditions at 26 MHz include "skip" so it is common to experience interference in this band from hundreds, or thousands of miles away at certain times of the year.

VHF dispatch and aural remote pickup are more common throughout the country. With the advent of excellent commercial narrowband FM mobile tranceivers and remotely operated base stations on hills and mountains many radio and TV stations have used the Part 74 VHF channels reliably for years. Until recently, it appeared repeater operation at VHF would never happen under Part 74. However, with the development of Remote Pickup Amplitude Compandored Sideband (ACSB) technology, repeater operation at VHF has become feasible. ACSB transmission can be accomplished using 5 kHz channels that can be interleaved between existing VHF narrowband equipment that operates in 25 and 30 kHz channels. The FCC has now approved VHF repeater operation. It is likely that hybrid FM/ACSB systems will be common for stations with heavy current investments in FM equipment. Hand held ACSB portable radios are also available for VHF.

Frequency committees will face a challenge to implement split channel operation as ACSB becomes known as a reliable communications medium. The challenge will come from other services whose licensees may resent broadcasters' expanding use of VHF channels, and from Part 74 licensees who may not be aware of the benefits of ACSB technology.

Tests show ACSB can equal FM performance, and even exceed FM in situations where impulse noise is a consideration. Noise energy that can enter an ACSB radio receiver is limited since bandwidth is only 5 kHz, and compandoring techniques further reduce apparent impulse noise in the received signal. This technology shows great promise for gaining the greatest possible use and efficiency in the limited spectrum available to meet the operational needs of the broadcast industry.

Fig. 1. Mobile communications gear used on a typical KFWB news vehicle. (Photo courtesy KFWB Radio)

Committees will be confronted with a number of seemingly conflicting uses and users as they sort through years of accumulated problems in VHF bands. One guiding principal that has helped many committees is the order of priorities outlined by the FCC. The transmission of remote pickup program material for broadcast, either live or delayed, takes precedence over other permissible uses. There is no reason to believe that the existing order of priorities will change.

VHF and UHF remote pickup with usable audio frequency response to 15 kHz is available with a variety of equipment. In many regions, interference from adjacent channels licensed to other services makes such operation difficult. A strong adjacent channel signal can "capture" an FM receiver, pulling the discriminator away from the desired signal. As channel use builds in a region, broadband white noise rises, making life difficult for wideband receivers.

Some equipment marketed for broadcast use was not designed for today's levels of channel congestion and sometimes makes the problem appear worse than it really is. Sometimes adding cavity filters to receivers helps. Sometimes relocating the receiver and antenna to a "quiet" location is the answer.

With the advent of solid state finals in transmitters, the need for cavity filters on all transmitter outputs has increased. Odd order harmonic products are a characteristic of solid state finals. Older vacuum tube equipment produced even order products as a rule. Good engineering practice now dictates using cavity filters between the transmitter and antenna, especially at common sites.

In the case of repeaters, good practice indicates installing a ferrite circulator and an appropriate reject load to reduce the possibility of unwanted mixing. With repeater operation now possible on Part 74 VHF channels, and the already high level of VHF activity in a number of radio services, committees have a responsibility to make everyone aware of these considerations.

Broadband white noise at common sites is now being viewed as much of a culprit to degraded receiver performance as spurious emissions. As the number of transmitters at a site increases, the noise level at the site increases. This noise desensitizes all receivers at the site. If a user is operating a receiver at a common site used for high power paging transmitters that are on the air most of the time, the receiver may be trying to listen in a channel less than 1 MHz away from a 250 watt transmitter with a gain antenna. The resultant 1000 watts (ERP) can cause problems for even the best equipment. Committees can educate members on this subject as well.

Committees can educate members on the pitfalls of common sites, and work with site managers to let them know of licensee concerns. There is a trend in many markets toward reengineering common sites using transmitter and receiver combiners, and physical separation of transmit and receive antennas. These changes can improve the transmit and receive performance at most sites. Changes like this are expensive. A committee can educate users on the benefits of such projects, and help generate support to make them happen.

Many committees accomplish educational and informational goals by setting aside time during monthly meetings. They invite manufacturers and distributors to put on educational programs. These range from how to use a spectrum analyzer, to how to engineer a receiver or transmitter combiner.

The two blocks of UHF channels available to broadcast licensees are separated by 5 MHz. This is adequate for repeater operations, and many licensees in markets with hilly or mountainous terrain have employed this type of system to allow field units to communicate with the base no matter where they are. Repeater operation has the benefit of being truly wireless, since remote base systems usually depend on telephone company local channels for control and audio.

Unfortunately, repeater operation requires two channels. The high level of repeater use in Southern California was one of the driving forces that led the SCFCC to request a waiver from the FCC to split the 50 kHz Group N1 channels into more 25 kHz channels, and the two 100 kHz Group S channels into four 50 kHz R channels.

Spectrum efficiency in the UHF bands by splitting channels is becoming an accepted mode of operation in other markets. Since it is possible to derive audio response beyond 5 kHz from a 25 kHz narrowband FM channel, many radio stations who want better audio quality for news reports can get it without using a 50 kHz R channel, provided the receiver used is well into full quieting. Committees can work with their members to make sure everyone is using the least amount of bandwidth consistent with needs.

Similarly, a station engaged in voice dispatch does not need a 50 kHz N1 channel. A 25 kHz N2 channel is more than adequate for this use. Responsible committees can help assure that use is matched to bandwidth. Narrowband operation using 5 kHz channels is only possible in the Part 74 VHF channels with ACSB equipment. ACSB equipment for UHF is not available as of this writing. Manufacturers of VHF ACSB equipment now on the market say that it is being developed.

Committees can sometimes arrange sharing of channels between compatible users. This can even involve several licensees operating a community repeater system. This choice not only helps

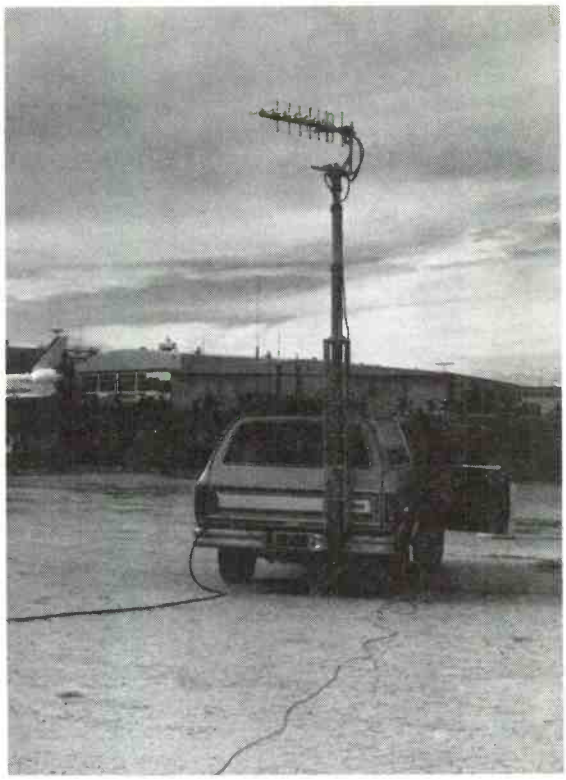

Fig. 2. The KFWB 4-wheel-drive mobile unit/repeater station features a verstile 40-foot pneumatic mast. (Photos taken by KFWB, Los Angeles. Supplied courtesy of *Broadcast Engineering* magazine.)

enhance spectrum efficiency, but may mean small stations can become part of a larger system they could not otherwise afford.

When new users are looking for Part 74 aural communications, there are some things a committee can do to ease the process along:

1. Make sure the potential user understands he must be a Part 73 licensee, or a Network (as defined in Part 74) to qualify for Part 74 channels.
2. Make sure he knows the committee really exists to help accommodate new users in bands already crowded—not to keep new users out.
3. Ask him to explain his needs during an open committee meeting, and publish what is said in the newsletter so everyone concerned can be aware of what is going on. It may be that someone at the meeting might make a suggestion to the potential user that could improve his system, or even accomodate his needs by some other means. For instance, cellular mobile telephones might be all someone needs to do ENG microwave setup if there are no dispatch channels left in a market.
4. The committee may "recommend" certain frequencies. At this point, it is up to the potential licensee to contact each co-channel and adjacent channel occupant and complete the transaction. It is NOT the responsibility of the committee to do this.
5. In the event the parties reach an impasse regarding an issue, the committee can and should act as a mediating force. Usually a compromise can be arranged.

In a congested RF environment, there is always the possibility of adjacent channel interference. Mobiles operating in the field can find themselves next to other mobiles transmitting on an adjacent channel. If this channel happens to be on the repeater output of the first station, the person in the mobile cannot communicate with its base while the other mobile has its transmitter on. If this is a chronic problem, one station may find it desirable to change frequencies. No amount of coordination will ever solve all of these problems.

There is at least one operating practice a committee can promote that will help: Make it a standard in the market for each licensee to use his appropriate station identification and unit designator call sign. Not only is this in compliance with FCC Rules, but call signs make it easier to track down interference problems that will inevitably arise.

AURAL STL CONSIDERATIONS

The FCC has now supplemented the existing 950 MHz Aural STL band with additional channels in the 18 GHz band. While of questionable value in markets that experience appreciable snowfall, this new band does offer the benefits that will come about from digital audio techniques impossible at 950 MHz because of limited bandwidth. This new band is viable according to a General Telephone paper presented during the 1984 NAB Convention for paths up to ten miles.

At this writing, the FCC has not decided what will happen with licensees in the 942-947 MHz "grandfathered" portion of the band. With new services such as AM stereo and enhanced services such as FM SCA, more and more stations will want to install their own wireless STL systems. This situation presents an ongoing problem for licensees and frequency committees alike.

In 1979 the SCFCC held a symposium for Aural STL licensees and equipment manufacturers in Los Angeles. Its purpose was to develop guidelines for the design, installation, and operation of Aural 950 MHz systems:

1. A list of stations using the band is required. The list should state the following items:
   A. Transmitter coordinates in degrees, minutes, and seconds

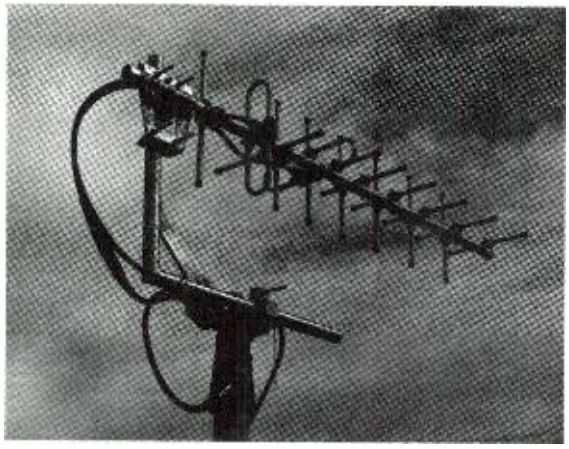

Fig. 3. Close-up of the cross-polarized yagi transmitting antenna used on the KFWB mobile unit/repeater station (Photos taken by KFWB, Los Angeles. Supplied courtesy of *Broadcast Engineering* magazine).

B. Receiver coordinates in degrees, minutes, and seconds
C. Frequencies used
D. System type (Composite, Dual, Mono)
E. Manufacturers and model numbers of receivers, transmitters, antennas, and feedline.
F. Transmitter antenna azimuth
G. Receiver antenna azimuth
H. Antenna polarization for each transmit link
I. Transmitter Power Output (TPO)
J. Effective Radiated Power (ERP) in dBm
K. Power available to the receiver in dBm
L. Path length

2. All systems should be designed with a known signal level at the receive site. The use of obstructed paths should be avoided since protection for stations attempting such paths is difficult to achieve.
3. Systems operating into the same site should, wherever possible, attempt to operate into the site at the same signal level.
4. Systems should be designed for an adequate but not excessive fade margin (approximately 30 dB in most cases). The transmitter power output should be reduced as much as possible to comply with this goal. It is recognized in some cases TPO will have to be raised for an increased fade margin to override interference.
5. Systems should be designed using antenna manufacturer's radiation pattern envelopes for their antennas at all points. All paths should be assumed to be line-of-sight in initial calculations.
6. Antenna beamwidth should be as narrow as possible. Six foot solid dishes are highly desirable. Although Paraflector (C) type antennas are acceptable for vertical polarization beam control, four foot dishes, miniflectors, and yagi antennas should be avoided.
7. Frequency tolerance for all systems should be .001%, not the presently allowable tolerance of .005% for monaural systems.
8. Dual systems should use the same polarization for each link to make channel reuse more possible for other paths. It is recognized that not all equipment is capable of accomplishing this as a goal. Stations should not arbitrarily change polarization without a thorough engineering study and necessary notification of co-channel and adjacent channel licensees.
9. There should be an external modulation limiting device ahead of all STL transmitters to limit transmitted bandwidth through the link since some STL transmitters do not incorporate internal limiting and can deviate beyond channel limits. The limiter should be frequency sensitive. If limiting cannot be installed, modulation levels should be reduced to prevent overdeviation. Cross polarization is NOT an acceptable means to accomplish this protection.
10. A bandpass filter and circulator should be used with any system likely to produce spurious emissions. This would include all transmitters operating at common radio sites, all varactor systems, and all transmitters combined into a common antenna. In the latter case, a hybrid alone is insufficient. There must be greater that 70 dB isolation, transmitter-to-transmitter. A table of proposed acceptable interference ratios was also discussed at the symposium and has been used as a guide in Southern California and several other regions:

There are non-RF alternatives available for STL systems. Laser links are feasible for very short distances where there is little likelihood of any interruption of the line-of-sight path.

Many stations still rely on program channels leased from their local telephone company. For short distances that do not involve very many telephone exchanges, this may still represent the best solution for some stations. This may be true especially in markets that have reached STL saturation.

Microwave STL's should be promoted for stations needing the extra quality and/or reliability these systems can provide if they are designed and coordinated properly. Licensees wishing to design new systems may balk at the rather strict design parameters outlined in this section. For instance,

TABLE 2. Interference Ratios Expressed in Decibels

	Co-Channel		Offset + or — 100-150 kHz		
	Composite Or Mono To Composite	Dual To Dual Or Composite Or Mono To Mono	Mono To Dual Or Dual To Mono	Composite To Dual	Dual To Composite
Current Equipment	55	45	40	50	55
Short Term Goal	50	40	35	45	50
Ultimate Goal	45	35	30	40	45

	Composite				Dual/Mono			
	350-400 kHz	500-700 kHz	1 MHz-3 MHz	3 MHz-10 MHz	200-300 kHz	500 kHz-1 MHz	1 MHz-3 MHz	3 MHz-10 MHz
Current Equipment	0	0	10	30	10	20	30	40
Short Term Goal	10	15	30	50	20	30	40	60
Ultimate Goal	25	40	60	80	40	50	60	80

six foot solid design parameters may be "overkill" for certain applications. Committees might remind their members that if the majority of the STL's in a market are engineered for efficient spectrum use, more users can be accommodated in the band, they will enjoy greater immunity from interference, and the reliability of their paths will be maximized.

TV MICROWAVE CONSIDERATIONS

Television has come to rely on either their own or common carrier microwave links to interconnect their studios with their transmitters and to facilitate live remote broadcasts. Rules governing links operated by broadcasters are found in Part 74 of the FCC Regulations and cover frequencies from 2, 7 and 13 GHz bands, and also shared frequencies in the 18, 21, 23, and 39 GHz bands.

Microwave transmissions can accommodate one or more subcarriers imbedded in the video signal to carry mono or stereo television sound, aural service for a co-owned AM or FM station, program cuing, telemetry, or a combination of these elements. In congested markets there is a trend to use the lowest possible subcarrier frequency combinations to keep occupied bandwidth as low as possible.

In major markets the number of stations engaged in field operations exceeds the number of available channels. While spectrum is available in the 2, 2.5, 7, 13, 18, 23 and GHz bands at this time, many stations and coordinating committees in these major markets have opted to make 2 GHz the primary band for ENG. However, this band will have some level of STL and ICR activity for the foreseeable future due to its long haul propagation characteristics.

The trend to using 2 GHz for ENG with its better propagation characteristics at 2 GHz as a choice over the other bands means stations have to install fewer ENG receive locations in their service area. Path lengths up to 50 miles can be operated reliably and under optimum conditions, including low humidity, path lengths up to 100 miles may be possible. Since it is not cost effective to equip a field truck and several ENG receive sites for multiple band operation, 2 GHz seems to have been the logical choice.

What this has meant in many markets is intense competition for the seven primary 2 GHz channels (1.9 through 2.1 GHz) and for the three channels at 2.4 GHz These are not available for broadcast use in some markets, and are shared

with other users in markets where they are available. This factor has contributed to the rise in frequency coordinating committee formation and activity.

Stations having 2 GHz STL's have been, for the most part, open to suggestions to relocate to 7 or 13 GHz in some cases for several reasons. First, they may themselves be involved in 2 GHz ENG. Second, a fixed link in this band has a high potential risk of interference from mobile operations. Since modern TV ENG portable equipment is frequency agile, and non-technical personnel are more involved in field operations, this is a very real risk.

Coordination for ENG is being done more and more on a "real time" basis. Coverage of breaking news cannot be planned. Coupled with the limited number of 2 GHz channels, the entire subject of 2 GHz band usage and will be a controversial topic in more and more markets.

The 1984 Olympics in Los Angeles proved to be a testing ground for ideas that have been proposed and tried in several markets. The 2 GHz Microwave Subcommittee formed under the auspices of the World Broadcasters RF Committee came up with a number of recommendations and set several goals. The broadcasters of Los Angeles followed many of these recommendations and met most of the goals. The Olympics stand as a very successful page in the history of broadcast frequency coordination. Coordination of ABC's 2 GHz operations in a band that already had more users than channels was the greatest challenge the broadcasters in the market had to face.

Suggested Operational Guidelines for TV ENG Operations

1. Form a Microwave Subcommittee. Compile a list of persons responsible for ENG technical and operational decisions at each station. This list should contain telephone numbers good 24 hours a day, should be circulated to all stations involved in ENG operations, and should be updated as needed.

Fig. 4. The KIRO-TV Chopper Seven helicopter is used for live news broadcasts and as a repeater station when needed for live ground shots. (Photos taken by KIRO-TV, Seattle, WA. Supplied courtesy of *Broadcast Engineering* magazine.)

2. The Microwave Subcommittee should be a forum to devise a Home Channel Plan for the region. The purpose of this plan is to give each user a primary channel for his operation. Alternate polarization is assigned to each channel. Split channel operation should be the long range goal for the market. Every user is furnished with a copy of this plan for reference.

3. As part of this plan, each user should set a goal to become frequency, polarization, and power agile.

4. Once the Home Channel Plan has been worked out, a method of coordinating this plan in real time is needed. WEBE in Washington pioneered a hard wired ring down network between ENG control points. The SCFCC expanded on this idea and put into operation an ACSB VHF community repeater with base stations located at the control point of each ENG licensee. This ACSB system was a key part of the coordination plan for the 1984 Olympics.

5. Each licensee should set a goal to equip his ENG operation at the following level:
   A. Mobile transmitters should be frequency agile.
   B. Each transmitter shall have continuously variable control of output power.
   C. Each mobile truck should ideally be equipped with an antenna with excellent sidelobe supression of the "Silhouette" (C) type.
   D. Each mobile truck should be capable of changing the polarity of their feed.
   E. Each truck should have a means of identifying its test bars, and ideally be able to identify its transmissions in the vertical interval. If this latter type of equipment is employed, the ID is viewed by unlocking the vertical hold control of a video monitor. (This signal must be stripped by a processing amplifier prior to on-air broadcast!)

6. Each licensee should refrain from using audio subcarriers higher than 4.8 MHz (For programs requiring dual subcarrier audio, success has been reported using 4.6 and 4.8 MHz subcarriers together.)

7. Truck crews are instructed to never light up until they receive permission from their control point, even on their home channel.

8. Truck crews should receive careful instruction on polarity settings, using only enough power for the path involved, and in the overall operational agreements with other stations engaged in ENG activity.
9. Stations should install antennas with maximum directivity at their receive locations. Preamplifiers, and channel filters that can be switched in and out of the signal path should be employed to take best advantage of the Home Channel Plan.
10. Stations normally stay on their home channel. They use the ENG control point communication system to request different channels for extra activity, to eliminate inevitable adjacent channel interference during some operations, or for paths that conflict on their home channel with Inter City Relay (ICR) links, or STL's. The request is made of the station who is assigned the desired channel as its Home Channel.

THE BENEFITS OF COORDINATION FOR MICROWAVE USERS

The 7 GHz Band

The 6.875 to 7.125 GHz band of ten channels is typically used for STL's and ICR's. Some use for remote pickup (RPU) has taken place and it has proven to be very satisfactory.

The bulk of all STL's throughout the country are in this band. There is some shared activity possible in this band with common carriers in the 6.425 and 6.525 GHz range.

The 13 GHz Band

The 12.7 to 13.25 GHz band with 44 channels (including offsets) is used also for ICR and STL activity. It is also being used more and more for low power "window" microwave to relay signals from isolated cameras in and out of the studio. (Fig. 1) This band is shared with the cable television relay service (CARS) and with private operational fixed service users on a co-equal basis. The chief liability of this band (and any microwave band at approximately 8 GHz or higher) is degradation due to rain and snow attenuation. Careful engineering is required to insure uninterrupted service, particularly for fixed links.

General Equipment Considerations

Visual microwave transmitter power in the broadcast auxiliary service runs from about 0.1 through a maximum of 20 watts. Antennas for fixed paths are generally parabolic, or in some extreme cases of the "horn" type to concentrate power at a distant receiver and to recover as much of the power as possible. The use of highly directional antennas is required in the ICR and STL service to permit geographic reuse of frequencies. Horizontal, vertical, or circular polarization is used to permit further reuse, and to eliminate ghosting interference from adjacent channels, particularly in RPU service. Circular polarization in particular is helpful in reducing ghosting on relays blocked by obstructions. These obstructions may cause polarity changes that negate benefits of simple vertical or horizontal polarization.

Temporary Operation for TV Microwave RPU

As in the aural services, temporary operation away from a station's service area without a special license is permitted for up to 720 hours or 30 days per year under Part 74.24 of the Rules. As mentioned earlier in this chapter, the Coordinator Listing compiled and maintained by the SBE can make coordination for this type of operation less painful. The coordination burden is still on the licensee who is visiting not to cause interference to the local stations. During this type of operation, the visitor uses his broadcast on-air call sign, not their Part 74 call sign. This rule is primarily designed to cover special events and should not be substituted for filing licenses. While coordinating committees do their best, for temporary operations, having a license insures co-equal status.

Microwave Licensing Considerations

Form 313 is used to apply. Instructions are included with blank forms. A license is always required for an STL or ICR, and implies careful engineering and coordination. The FCC currently issues a "one step" Construction Permit (CP) and license. Further information on the design of microwave links can be found in "Engineering Considerations for Microwave Communications" published by GTE Lenkurt, Incorporated, Copyright 1975.

The Benefits of Coordination for Microwave Licensees

As in the case of all Part 74 coordination, committees exist to help new and existing licensees share very limited amounts of spectrum. The move to frequency agility has made real time coordination possible for mobile operations. It mandates cooperation and sharing. In return, it allows licensees to operate their field ENG equipment and STL's with reduced risk of interference.

INTERFERENCE AND THE PART 74 LICENSEE

Interference to a Part 74 licensee's operations may come from almost any source of RF one cares to mention. Radiation from unshielded computer cables has interfered with wireless microphone operation, for instance. On channel interference from other broadcasters can be thought of as a problem that can be solved by additional attempts at coordination, followed, if necessary, by mediation by a neutral party.

Locating the source of spurious emissions can be a real challenge. The committee can offer some advice and support when a suspected case of interference from an out-of-channel source is reported. Quite often, other stations in the market can make spectrum analyzers available to eliminate the possibility of a mixing product that is actually generated in the front end of the receiver due to an overload condition. This type of problem is common for both voice and video equipment.

Older solid state receivers are sometimes quite prone to front end overload. When an overload-prone receiver is operating at a common site with an appreciable amount of adjacent channel activity, the receiver may be rendered useless. Filtering and attenuator pads can sometimes be suggested as cures. Video microwave receivers operating with preamplifiers can overload easily as a result of proper adjacent channel operation. In such cases, a suggestion to provide a bypass switch is in order.

Committees should encourage licensees to use call letters and unit identifiers for all voice transmissions. All video ENG trucks should be able to transmit bars with ID, and ideally should be able to place ID in the vertical interval as well for identification during program transmission.

Tracking unidentified interference is not unlike detective work. For video, tuning through the on-air signals may provide a clue. If bars with no ID are seen at an ENG receive location, triangulation may be possible if the interference can be seen by two other locations equipped with steerable dishes. Trucks have been identified by reading street signs that appear in shots. Talent on other stations can sometimes be a good means of identification.

Interference to aural links can be very challenging to trace. If call letters are not being used, anything heard then becomes a clue. If a street address is mentioned, a newsroom "criss-cross" telephone directory can be used to find a telephone number at or near the address. A call to the number identifying yourself, your reason for calling, and if a taxicab or delivery truck has been there (or will be there) often works wonders.

Land mobile transmitters are sometimes designed so the final has power applied to it at all times. Any instability in the final can start it oscillating. These transmitters can sometimes migrate through many megaHertz of spectrum, almost at random. When their exciters are keyed, they return to their proper channel. Sometimes only a spectrum analyzer and a lot of patience can trace this type of problem.

Inexpensive direction finding equipment is available for VHF and UHF tracking. Some units work with any hand-held portable. For unmodulated carriers and other types of interference that are present for long periods of time, direction finding can be a very effective (though time consuming and expensive) process.

If the licensee(s) involved, even with committee guidance, are unable to locate the interference, a call to the FCC may be in order. You will be asked for all pertinent information, such as time the interference occurs, its nature, duration, and any other details you might have learned. They generally will not take interference complaints unless you can supply this information. Remember that coordinating committees and their members are never to act as police in such matters.

Curing Interference

Dealing with the broad topic of interference cures is beyond the scope of this chapter. When committees are working to solve such problems, creativity is definitely an asset. For instance, in a case where an aural STL on an adjacent channel on a parallel path was causing interference, the cure that was tried and worked involved installing a larger dish at the transmitter. The dish was aimed slightly off azimuth from its receiver so that the receive site being interfered with appeared in a deep null of the interfering transmit antenna.

SETTING UP A COMMITTEE: A CASE STUDY

This chapter has outlined many topics Part 74 licensees should take into consideration in their day-to-day operations in coordinated and uncoordinated environments. At this point it might be useful to look at a case study of how one market dealt with its particular set of circumstances. The market selected for this analysis is Phoenix, Arizona.

Frequency coordinating in Arizona dates back to the early 1970's when the Society of Broadcast Engineers (SBE) began to keep track on a formal basis of Part 74 license assignments in the

Phoenix area. In the late 1970's, it became apparent that frequency coordination was more than a one man job.

Lists were being updated annually, but changes were occurring weekly. Within the Phoenix market, most broadcasters were making the transition to 950 MHz microwave Aural STL operation for obvious reasons. Soon, all the frequencies in the band were in use. Out of band channels were sought. It was clear channel sharing would be impossible without detailed and accurate information.

To add to the drama, new TV stations were coming on line in the market. They had needs for studio transmitter links (STL's); transmitter studio links (TSL's) for video relay and telemetry return; channels for electronic news gathering (ENG); plus Intercity Relay (ICR) links for network affiliates and cable companies.

The situation was complicated by the proximity of the Tucson market. Phoenix's South Mountain transmitter sites have a line of sight relationship to the primary TV transmission location of the Tucson market, Mt. Bigelow, located 100 miles Southeast. The potential for mutual interference was present.

These are the circumstances under which the Arizona Frequency Coordinating Committee was formed. Organization was provided for the committee by Chapter 9 of the SBE, and funding by the Arizona Broadcasters Association. The organizational structure was patterned after the Southern California Coordinating Committee.

Officer selection is based on function and availability, but Board nominations take geographic considerations into account to insure all areas of the state are represented, as well as all types of users. Board members from television, AM, FM, and cable, are nominated and elected on that basis.

The multi-market coordination process involves the use of two main coordination contacts working with a single database. For practical reasons, a separate coordinator exists for Tucson and Southerna Arizona, and one in Phoenix for Phoenix, Central, and Northern Arizona.

The philosophy governing the Coordinating Committee is one of *facilitating* coordination. It does not act as a consulting service. It does promote spectrum management and spectrum efficiency by fostering user-to-user dialogue, providing accurate record keeping, and insuring prompt dissemination of information.

The data is compiled in Phoenix on an Apple II Plus computer with dual disc drives, running a multisort database management system. This allows the integration of data for the extensive broadcast and cable use of the shared CARS band.

The coordinators rotate updated computer diskettes monthly, and share data by telephone weekly. Change in the diskettes are only made by the database manager. This is a designated duty of the Secretary-Treasurer of the AFCC. Focusing entry responsibility on one individual protects the database from the "too many cooks" syndrome.

Mailing and duplication costs are deferred by small classified ads in the AFCC Newsletter which is published monthly. We send copies of out newsletter to key personnel at the Federal Communications Commission as well as to all broadcasters and cable companies in Arizona. We also exchange newsletters with several other coordinating committees.

When asked for information, the AFCC manager gives the potential applicant data on other users of the frequency of interest. The party making the query is then expected to contact cochannel and adjacent channel users as appropriate to determine if specific objections to sharing exist. The database manager will point out possible problems, and may suggest an alternative frequency if the primary channel suggested cannot be coordinated. If the potential user is at a loss to determine a frequency that suits his needs and causes no interference, the database manager assists in selecting one.

Users of A, B, and D band microwave channels send a letter to the Committee informing it of their plans to use a specific frequency, with copies of the letter to all other users of the band in the region. The Committee publishes the data in the master list and the Newsletter. Specific objections are discussed by the users at the AFCC meeting, or on a one-on-one basis between users.

FCC releases and BROADCASTING magazine are scanned regularly to determine any new or potential licensees who may begin to operate in the state. The new broadcaster is sent a letter about the AFCC, and stressing the importance of frequency coordination. This letter also gives details on contacts to accomplish coordination.

All broadcasters and cablecasters in the state are updated on available coordination information on a monthly basis. Meetings are held ten times a year in Phoenix to provide a regular forum for the discussion of issues related to coordination and interference, or coordination problems that have arisen since the last meeting. The month of the NAB convention and December are the dark months for meetings.

Annual elections are held for the officers and the board. No limits to tenure of service are employed. In accordance with the bylaws, nominations are tendered at the November meeting and elections are held in January. With the concurence of a majority of the membership,

the Committee may comment to the FCC on matters directly or indirectly related to Part 74.

OPERATION GOLDEN RULE

The SBE National Coordinating Committee has an ongoing educational program on coordination named Operation Golden Rule. Its purpose is to make non-engineering broadcast management aware of the vital importance of coordination to their operations, and to promote the simple but effective idea that the original Golden Rule expresses the best ideals of coordination.

The theory behind this approach is simple. Since so many routine operations are now accomplished by non-technical personnel, and the usual top management at stations is non-technical, we must raise awareness concerning coordination, or our best technical efforts may be meaningless.

GOALS OF THE SBE NATIONAL FREQUENCY COORDINATING COMMITTEE

1. To identify persons willing to act as local data base administrators in light of the FCC's rewrite of Part 74.24 of the Rules. (The Commission requested persons wishing to act as coordinators make themselves known so licensees could utilize the 30 day/720 hour rule effectively, and operate without causing interference to licensees in the area they are visiting.)
2. To publish a listing of these individuals and circulate it widely throughout the Industry to supplement the FCC's stated goal under 74.24.
3. To facilitate exchange of ideas among regional coordinating bodies.
4. To ascertain problems pertaining to coordination and work to solve them.
5. To increase awareness in non-engineering management of the importance of frequency coordination as an essential "back stage" activity to all of broadcasting through an informational campaign, OPERATION GOLDEN RULE.

So far, the SBE NFCC has identified over 80 individuals throughout the 50 states, and Puerto Rico who have volunteered for this important work. It has worked with entities such as the National Political Frequency Coordinating Committee and the World Broadcasters RF Committee on various aspects of successful coordination for the political conventions and the Olympics. The NFCC has supplied Comments to the FCC on important Industry issues such as the microwave Docket where we helped make the case that the 2 and 7 GHz. TV ENG bands should not be opened to non-broadcast licensees and the channel splitting docket that we hope will allow more efficient use of the very limited number of voice channels in Part 74.

Through space in management oriented publications such as *Broadcasting*, appearances before Industry management groups, the GOLDEN RULE effort has helped promote cooperation at all levels within Part 74 activity.

The SBE considers frequency coordination to be a key Chapter activity in regions where no other body exists to facilitate licensee-to-licensee contact regarding Part 74.

MORE INFORMATION

For more information on Operation Golden Rule, an up to date list of coordinators, or additional questions on coordinating committees, contact the Society of Broadcast Engineers, P.O. Box 50844, Indianapolis, Indiana 46250.

CHAPTER 17
MINNEAPOLIS/ST. PAUL
SOCIETY OF BROADCAST ENGINEERS

RPU, STL, TSL AND OTHER AUXILIARY BROADCAST SERVICES FREQUENCY COORDINATION PROJECT REPORT FORM

Station Call or Corporate Name: _____
Street Address: _____
City: _____ State: _____ Zip: _____
Contact Person: _____ Title: _____
Phone Number: _____ Extension: _____

Please answer the following questions as accurately as possible. If you are unsure of some information, try to locate that information on your FCC Instrument of Authorization, or leave it blank. If you have more than one service to report, please photocopy this form as many times as you need, or call any member of the Committee for more.

1	TYPE OF SERVICE (Circle one): REMOTE PICKUP STUDIO-TRANSMITTER LINK TRANSMITTER-STUDIO LINK AUXILLIARY OTHER			
2	CALL SIGN OF SERVICE:			
3	OPERATING FREQUENCY:		FREQUENCY #2 (If so equipped):	
4	TYPE OF EMISSION:			
5	CONFIGURATION (Circle one): MONAURAL DUAL MONAURAL STEREO (Composite)			
6	TRANSMITTER OUTPUT POWER:		Circle one: WATTS dBm	
		TRANSMITTER		**RECEIVER**
7	LOCATION: North Latitude: West Longitude:	° ′ ″ ° ′ ″		° ′ ″ ° ′ ″
8	TYPE OF ANTENNA/dB GAIN/°AZIMUTH:			
9	POLARIZATION (Circle one):	Horizontal Veritcal CP		Horizontal Vertical CP
10	ANTENNA HEIGHT ABOVE GROUND:	feet		feet
11	GROUND HEIGHT ABOVE MEAN SEA LEVEL:	feet		feet

12 DESCRIBE ANY SPECIAL CONDITIONS OR ADDITIONAL INFORMATION:

Now just fold and mail! THANK YOU!

Form FCPR-1-83

Sample database questionnaire submitted by SBE Chapter 17.

ARIZONA FREQUENCY COORDINATING COMMITTEE
LISTING OF BROADCASTING/CABLE DATA BY FREQUENCY-D1
AS OF: JAN FEB MAR APR MAY JUN JLY SEP OCT NOV DEC 1984

FREQUENCY (MHZ)	FCC ID EMISSION	LICENSEE/ID FREQUENCY USE DATE E/U	RECEIVER COORDINATES REMARKS 1	TRANSMITTER COORDINATES REMARKS 2	D/ND AZIMUTH	POLAR POWER (W)	REC #
450.450	WBJ-981 100F3	KTSP-TV, CH 10, PHOENIX RPU-BASE STATION U 11/11/83	N 33 20 02 W 112 03 42	N 33 20 02 W 112 03 42	—ND— N/A	VERT. 75.0	145
450.450	WHE-761 25F3	KVOA-TV, CH 4, TUCSON AUTOMATIC RELAY STATION U 05/19/83	N 32 24 56 W 110 42 49	N 32 24 56 W 110 42 49	—N— N/A	VERT. 75.0	146
450.4875	WQA-984 16F3	KNIX-AM/FM, TEMPE AUTOMATIC RELAY STATION U 03/21/83	N 33 19 58 W 112 03 53	N 33 19 58 W 112 03 53	—ND— N/A	VERT. 90.0	147
450.500							148
450.5125	KIW-877 25F3	KGUN-TV, CH 9, TUCSON AUTOMATIC RELAY STATION U 05/19/83	N 32 12 48 W 111 00 20	N 32 12 48 W 111 00 20	—ND— N/A	VERT. 75.0	149
450.550	APPLIED	KDTU-TV, Ch 18, TUCSON AUTOMATIC RELAY STATION E 03/17/84					150
450.550	KON-241 50F3	KHYT-AM, TUCSON AUTOMATIC RELAY STATION U 05/19/83	N 32 10 46 W 110 54 55	N 32 10 46 W 110 54 55	—ND— N/A	VERT. 100.0	151
450.550	KBH-744 50F3	KOY-AM, PHOENIX AUTOMATIC RELAY STATION U 01/07/83	N 33 27 30 W 112 04 24	N 33 20 06 W 112 03 39	—ND— N/A	VERT. 75.0	152
450.5875	KIV-89 25F3	KGUN-TV, CH 9, TUCSON RPU-BASE STATION U 05/19/83	N 32 14 49 W 110 58 38	N 32 14 49 W 110 58 38	—ND— N/A	VERT. 25.0	153

Sample database printout for the 450 mHz band.

1.4

Consultant Services: When and How to Use Them

Alan E. Gearing, P.E.
John F. X. Browne, P.E.
Association of Federal Communications Consulting Engineers
Washington, DC

The dictionary defines a consultant as a person who gives expert or professional advice. Our complex, technologically oriented society has created the need for experts who advise on subjects requiring specialized knowledge and experience.

Broadcast applicants and licensees employ the services of consultants to assist with various aspects of the conduct of their business such as engineering, finance, legal, marketing, personnel, and programming areas. The need for these services may arise for many reasons including the unavailability of staff, the need for expertise not found in-house, or the need for additional manpower to ensure timely completion of a project. Broadcasters selecting technical consultants may be unfamiliar with the variety of services normally offered, or with the procedures for selecting and engaging such a consultant which are most likely to result in a successful relationship.

The extent of services offered by consultants ranges from evaluation and recommendation, to supervision of installation, to complete turnkey responsibilities. The types of consultants range from those handling transmission and general broadcast engineering matters to those specializing in narrowly defined areas. Examples of the latter include experts in broadcast building design and acoustics, tower design and maintenance, and telephone system planning.

The tables at the end of this chapter contain a partial listing of the types of services provided. Table 1 includes services applicable to all types of broadcast facilities. Services specific to AM broadcast stations are listed in Table 2, and Table 3 lists services mainly applicable to FM and TV broadcast stations.

Many consultants offer services of the types listed in the tables for other communications activities in which some broadcasters may also be involved, such as:

- Instructional Television Fixed Service Systems
- Multichannel Multipoint Distribution Sytems
- Satellite Up Link, Down Link, and Space Facilities
- Microwave Relay Systems
- Paging Systems
- Land Mobile Systems
- Cellular Radio Systems
- International Broadcast (Shortwave) Facilities
- Subcarrier Services
- LPTV and Translator Systems
- Remote Pickup and other Auxiliary Systems
- Fiber Optic Systems

Some of the activities engaged in by consultants may affect the public in matters of health, safety, and welfare. Therefore, various means have been used to provide some assurance to the public that practitioners have at least threshold qualifica-

tions. For example, the states and some professional organizations have established minimum qualifications for persons acting in certain professional capacities including the practice of engineering. All fifty states and the District of Columbia have engineering registration laws.

The practice of broadcast and telecommunications consulting engineering is, with few exceptions, a professional field in which most states require the practitioner to be registered as a Professional Engineer, or "PE". In most cases in fact, registration is required in order legally to represent oneself as a consulting *engineer* or as providing professional engineering services. At the present time the Federal Communications Commission does not require that filings submitted by applicants and licensees be prepared by a registered Professional Engineer.

Professional Engineers are registered or licensed through a process involving verification of educational credentials (e.g., a degree in engineering or related science), the attainment of specific engineering experience (usually a minimum of four years, post graduation) plus the passing of an examination gauging the applicant's mastery of engineering fundamentals and his or her specific field of engineering practice (usually a two-day, 16-hour written exam).

The services listed in the Tables at the end of this chapter include both those which fall within the realm of the Professional Engineer and those which may not require such certification. While the guidelines for selecting a consultant, contained in this chapter, refer to the Professional Engineer or consulting engineer, they can, and should, be used as a general guide in the selection of any type of consultant service.

Professional Engineers usually subscribe to a code-of-ethics such as those adopted by the National Society of Professional Engineers (NSPE) and the Association of Federal Communications Consulting Engineers (AFCCE). Many engineering societies representing the various engineering disciplines also support ethical codes for their members.

These codes require a standard of professional conduct which govern the consultant's activites and his relationship with clients in areas such as:

- Advertising
- Solicitation of clients
- Conflicts of interest
- Confidentiality of client activities
- Practice in field of expertise
- Use of the work of other engineers

Copies of these representative codes of ethics may be obtained free of charge from the:

National Society of Professional Engineers
2029 K Street, NW
Washington, D.C. 20006

and the:

Association of Federal Communications Consulting Engineers
P.O. Box 19333
20th St. Station
Washington, D.C. 20036

The selection of a consulting engineer does not have to be a confusing formal process. Initial contacts with prospective consulting engineers are often made by referral from communications attorneys or on the recommendations of other broadcasters. Additionally, "professional cards" in trade publications or referrals by engineering societies are sources of listings on professional practitioners.

When selecting a consulting engineer the broadcaster should discuss the following topics with the potential consultant:

- professional qualifications and registrations
- knowledge of FCC Rules and Regulations and international agreements
- expertise in the particular area of interest
- recent experience
- availability of professional staff, time and facilities
- estimated time for completion
- estimated fees or fee structure

Since individual requirements vary, the above list may not be all inclusive. As a general rule, the qualifying items may be considered to be listed in descending order of importance in the selection process. Selecting a consultant primarily on a "low bid" basis is usually not in the best interests of the broadcaster.

Once a consulting engineer has been selected for a specific project an agreement regarding the scope of work, timetables and fees is normally executed. In its simplest form this may merely be an exchange of informal letters; on complex projects, particularly those involving large scale construction, there may be a need for formalized contractual documents.

To assist the consulting engineer in the performance of his work, the client should provide any and all background material as well as earlier engineering documentation that may have been developed on the project. It is important that the client recognize that the use of such information is at the discretion of the consultant, and that a fee quoted on the basis of the validity and applicability of such data to a new project may have

to be adjusted if the data are found to be unsuitable or inaccurate. In some contexts, such as filings with the FCC, the consultant must attest to the accuracy of the data being presented and, therefore, he must have a high level of confidence in data which he did not personally generate in order to incorporate it. There may also be legal or ethical problems associated with incorporating the engineering work product of other engineers, especially that prepared by non-registered or unqualified practitioners.

Changes in technical details which may appear to be minor to the client often have major impact on the work completed by the consulting engineer. A transmitter site relocation of only a mile, for example, may involve recomputation of service areas, operating parameters, interference protections or separations, or aeronautical impact. For these reasons the client should attempt to finalize such details—with guidance from the consulting engineer—as early as possible, but especially before authorizing the completion of final reports or applications.

In many cases FCC applications must be filed before certain dates which are established by processing procedures or mandated in FCC docket actions. Since the preparation of these filings in a professional manner can require a rather lengthy time frame, the client should give the consulting engineer sufficient advance notice of such filing deadlines.

In the absence of formal arrangements to the contrary, consulting engineers do not generally assume the responsibility of monitoring FCC actions in behalf of present or former clients, to note activities (such as competitive filings, notices, or grants) which could have an impact on a client's existing or proposed facility. Such monitoring is often performed by the station's legal counsel and is also available directly from some of the computer database firms serving the broadcast industry. One way in which consulting engineers do provide such monitoring, relative to potential engineering impact, is through retainer agreements in which the client employs the consultant's services under an ongoing arrangement. The agreement usually specifies the level of services, such as FCC monitoring, that will be provided and the method of reporting to be used. In some cases, such agreements also specify that the consultant will make available a specified minimum amount of staff time which may be used over the course of the agreement to respond to the client's needs as they arise.

The client should have an understanding with the consultant regarding ownership of documentation produced by the consultant. It is common practice for the consulting engineer to retain all rights to files, drawings, reports, and other work products. The consultant grants to the client permission to use such data for specified FCC filings and for retention as part of the station's files. Normally, the data cannot be transferred to another party, or copied and used as part of another filing, or incorporated as part of a design for another project or facility without the express consent of all parties.

When a consulting engineer is engaged there should be a clear understanding between the parties as to the scope of work and responsibilities of each, particularly if the client (broadcaster) desires to perform part of the engineering work in-house or plans to employ other consultants for portions of the project. There is a great potential for both duplicative efforts and omissions in these arrangements when areas of responsibility are not clearly defined. While the initial objective may have been to minimize the consulting engineer's time (and fees) the result could very well be the opposite.

There are some consultants offering services which are oriented to field projects, such as equipment installation, construction, and measurements. These persons or firms operate as extensions of the broadcaster's staff and usually can bring a wealth of practical experience and additional manpower that the broadcaster may not have in-house. Professional engineering certifications may not be required for these services, but the possession of an appropriate FCC Commercial Operator's license may be required if transmitter related services are performed. Any measurements made by these consultants, which will ultimately be used in connection with FCC filings, should be collected, assembled, and presented (including certifications) in an acceptable form. Coordination of these activities with the station's consulting engineer may be desirable. References concerning the qualifications and capabilities of such consultants may be obtained form the station's consulting engineer or the other referral sources listed earlier.

CONSULTING SERVICES

The following tables show the types of technical consulting services available to broadcasters from various sources.

Table 1: Services Applicable to All Types of Broadcast Facilities

- Allocation studies to determine the feasibility of establishing new stations at specified communities.
- Allocation studies to determine the feasibility of improving existing facilities.

- Determination of appropriate areas where transmitting facilities may be located.
- Preparation of specifications for transmitting systems.
- Transmitter plant design and construction.
- Evaluation and recommendation of equipment for studios, newsrooms, remotes, automation.
- Studio design and construction including proper acoustics, sound proofing, lighting, heating and air conditioning.
- Design and installation of in-house telephone systems.
- Preparation of specifications for computer systems and their installation and maintenance.
- Antenna tower planning, including placement of antennas, intermodulation studies, and multicoupler and filter requirements to avoid interference.
- Tower design, erection, and maintenance.
- Structural analysis of towers and antennas.
- Design and installation of equipment for lightning protection.
- Evaluation of manufacturer's equipment bids.
- Electromagnetic interference studies to determine whether or not a proposed new or improved facility would cause interference to an existing station or to another proposed new or improved facility.
- Electromagnetic radiation hazard analyses.
- Environmental impact studies.
- Population and area service analyses.
- Determination of existing and proposed services in a particular area.
- Preparation of engineering portions of applications to the FCC for construction permits and licenses.
- Consideration of air hazard aspects, and preparation of notice to FAA, of proposed construction.
- Review of engineering proposals by other stations or applicants.
- Preparation of engineering in support of petitions to deny, or replies to petitions to deny.
- Provision of expert testimony in hearings or court proceedings.
- Field review of station facilities to determine compliance with FCC Rules, and to determine the general condition of station facilities.
- Measurement and adjustment of transmission systems to establish proper operation and compliance with FCC Rules.
- Appraisals of facilities for buyers, sellers, and brokers.
- Development of operational and monitoring procedures, including specification of test equipment.
- Analysis and design of special-purpose antennas, waveguides, transmission lines, cavity resonators, and other electromagnetic devices.
- Training of technical personnel.

Table 2: Services Applicable to AM Broadcast Stations

- Measurements of RF field strength relative to allocation matters.
- Design of directional antenna systems.
- Design of phasing and coupling equipment for directional antenna systems.
- Adjustment of directional antenna systems (proof of performance).
- Investigation of effects of reradiating obstacles (buildings, power lines, water towers, utility poles, irregular terrain, nearby antennas and arrays) upon antenna performance.
- Design of special filters or detuning networks which may be required.
- Investigation of electromagnetic effects of guy wires upon AM broadcast antennas and arrays.

Table 3: Services Applicable to FM and TV Broadcast Stations

- Study of feasibility of adding allotments to FCC Table of Allotments.
- Preparation of engineering support for petition for rulemaking.
- Review of engineering aspects of comments and providing engineering support for reply comments.
- Study of and recommendations for optimum height, power, location, and vertical and horizontal radiation pattern characteristics.
- Propagation studies, including use of alternate models and taking into account actual terrain features.
- Field strength and signal quality surveys of existing facilities.
- Prepartion of specifications for antenna systems including review of manufacturer's range tests results.
- Investigation of electromagnetic effects of support towers and guy wires upon TV and FM broadcast antenna.

1.5

Frequency Allocations for Broadcasting and the Broadcast Auxiliary Services

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INTRODUCTION

This chapter provides a summary and overview of frequency allocations available for AM, FM and TV broadcast services and the assorted radio services ("auxiliary" broadcast services) that support broadcasting operations. The study of frequency allocations should begin with an understanding of the decision-making process that results in a particular frequency band being allocated for a particular purpose. Such decisions are complex; they not only involve fundamental decisions as to *location* of the service in the frequency spectrum, but also decisions as to channelization, power and antenna limitations, and technical standards which define and prevent mutual interference. These decisions are different for each broadcasting service, a reflection of the fact that each service developed independently from the others and therefore each possesses unique service and interference objectives.

Rather than delve extensively into the history behind each broadcasting allocation, only the current state of frequency allocations is presented together with expectations for the future. We begin with a short discussion on the mechanisms of frequency allocations decisions.

HOW IS SPECTRUM ALLOCATED?

It is a fundamental characteristic of radio wave propagation that radio waves ignore political or geographic boundaries where such boundaries are encountered. Principally for this reason, the regulation, decision-making and consideration of matters concerning the radio frequency spectrum are *federal* rather than *local* interests. Radio waves frequently cross state lines. Regulation of the radio spectrum began within the U.S. Department of Commerce's Interstate Commerce Commission (ICC) in the early 1920s, the same government agency that later came to regulate interstate trucking and "common carriage". The ICC granted the first AM broadcasting licenses. By 1927, the number of AM stations had increased to 733 and over six million radio receivers had been manufactured. However, the specific choice of location, power, and operating frequency, had, until this time, been left largely to the discretion of the broadcaster. As a result, chaos generally prevailed and interference became widespread. The federal government, therefore, formed the Federal Radio Commission in 1927. This was replaced by the Federal Communications Commission (FCC), formed pursuant to the Communications Act of 1934. From then on, and continuing today, prospective broadcast licensees *apply* for and are *granted* a *license* to operate on a particular frequency with a particular power at a specified location. The FCC is said to *allocate* radio frequencies which it *licenses* for use on a non-interference basis by license applicants.

Radio waves also traverse *international* political and geographic boundaries. International fre-

quency allocations decisions are made by the International Telecommunications Union (ITU), an arm of the United Nations with headquarters in Geneva, Switzerland. The ITU, like the UN, is a consortium among governments whose purpose is to propose, develop, revise and administer worldwide frequency allocation plans. Cooperation among nations is essential if interference is to be avoided and use of the spectrum maximized. There are at present over 150 member nations of the ITU. The ITU divides the world into three Regions. Region 1 is Europe and Africa; Region 2 is North and South America; and Region 3 consists of Asia and Australia. Unlike the FCC, the ITU does not directly license prospective radio operators; however, it does keep a master register of radio stations worldwide. The agency responsible for this activity is a subsidiary of the ITU, the International Frequency Registration Board (IFRB). Periodically, the FCC notifies the IFRB of the new stations or modifications in existing stations it has licensed. Other ITU member countries perform the same task.

The process for making decisions on worldwide allocations for radio services is done through international conferences called World Administrative Radio Conferences, or WARCs. The WARCs entertain proposals from member countries for worldwide frequency allocations. Through a process of give and take, decisions are made to allocate spectrum. These conferences take place at roughly twenty year intervals; the last WARC took place in 1979, and considered over 15,000 individual proposals dealing with numerous aspects of world telecommunications. The ITU also convenes Regional Administrative Radio Conferences, or RARCs, that consider allocations for each of the three ITU regions, as well as lists of planned assignments and technical standards. Typically, a RARC will develop lists of planned and assigned radio stations as well as standardized technical interference criteria used to resolve disputes among nations and enable nations to license individual stations on a non-interference basis.

Technical input for WARCs and RARCs comes from the International Radio Consultative Committee (CCIR). The CCIR considers technical matters necessary to the transmission of information by radio wave. A sister technical committee, the CCITT, considers information transmission by wire.

The CCIR is an international committee operating under the aegis of the ITU. Every four years, the CCIR publishes a revised version of its "green books," collections of technical information which can be used to plan and implement systems of broadcast allocations. The CCIR conducts technical investigations into matters such as radio wave propagation, receiver criteria, and new communications technologies. United States input to the CCIR is administered through the Department of State, Office of International Communications Policy. Participation on CCIR committees is open to the public.

Decisions on allocations matters that are international in nature are made at WARCs with more specific technical parameters subsequently developed at RARCs. The WARC and RARC decisions, however, are left to individual nations to implement. In the U.S., the FCC and National Telecommunications and Information Administration (NTIA) are responsible for implementing international agreements to which the U.S. has assented. For the most part, international decisions only affect AM broadcasting. Since FM and TV propagation are limited to their immediate geographic areas, there is little need to seek international guidelines for FM and TV allocations, except in border areas. Still, international agreement on technical transmission standards is essential if world-wide free-flow of communications is to be guaranteed.

Radio frequency allocations occur as a result of a series of complex decisions. On the first, most basic level, large blocks of frequencies are allocated on a worldwide basis by the ITU WARC and RARC process. Exactly *which* blocks of frequencies are allocated to what particular services is determined by evaluating the many specific proposals submitted to the WARC for each frequency band. Technical input is garnered from propagation studies and engineering analysis conducted and submitted through the CCIR committee process. While blocks of frequencies are allocated worldwide, member nations retain flexibility to modify the allocation domestically so long as the nation is not in contravention with its international agreements. In the U.S., the FCC begins to implement the allocations in response to domestic needs and priorities. See Fig. 1 for a portrayal of the international allocations process.

The FCC does not need the ITU's blessing to allocate frequencies; it can also begin allocations proceedings on its own motion or in response to requests from the public, and, in fact, this is a task the Commission frequently performs. The FCC has wide latitude in specifying operational frequencies for the services it regulates. The agency can begin allocations proceedings on its own motion or in response to an industry petition for rule making. See Fig. 2 for the FCC's allocations process. The rulemaking procedure at the FCC is a complex subject in its own right. In brief, the Commission is under an obligation to provide an opportunity for the public to comment on its proposed rule changes *before* making the rule change. To do this, the FCC issues a *Notice of Proposed Rule Making* upon which members

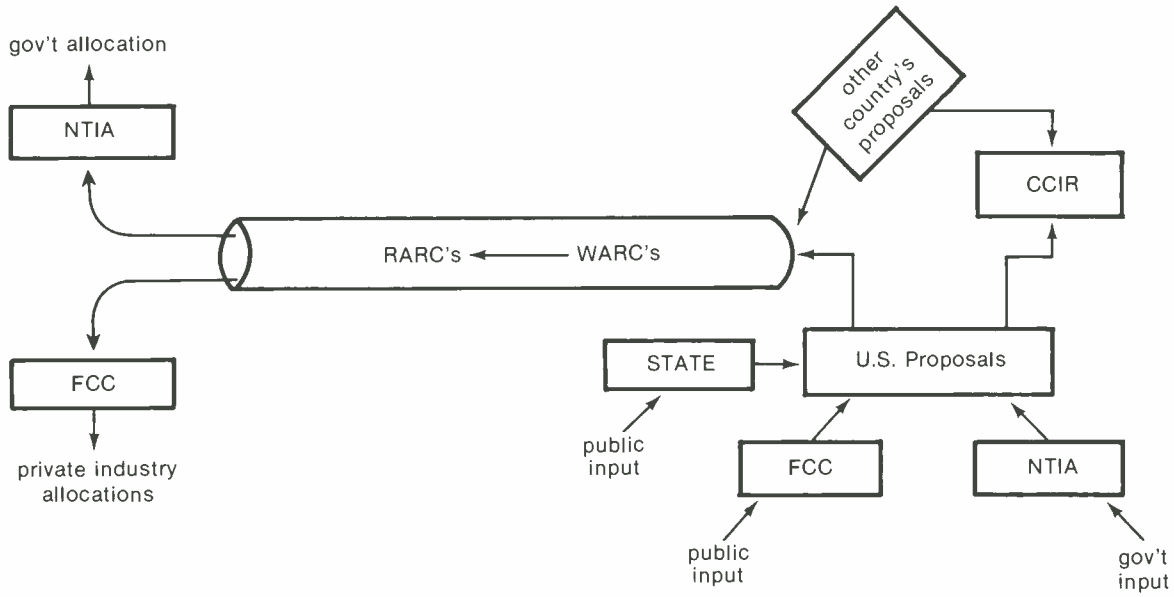


Fig. 1. The international allocations pipeline.

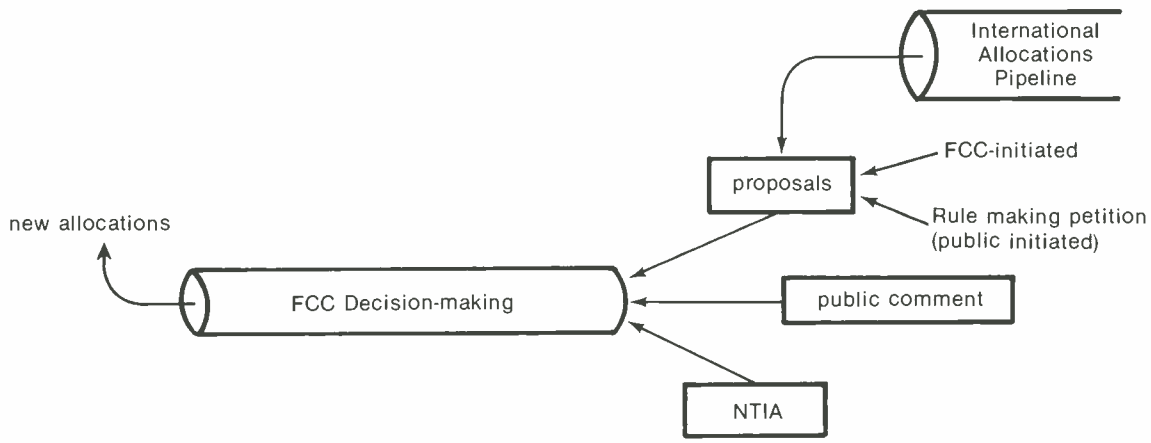


Fig. 2. The domestic allocations pipeline.

of the public can comment.There is also an opportunity for public commenters to reply to the comments of other parties. After the Commission receives comments on its *Notice*, it goes ahead and decides to either adopt its proposals or adopt slightly different proposals on the basis of the submitted comments. Sometimes the FCC's initial proposals are not adopted at all. The nature of the Commission's rule making process is described in greater detail on pages 1.1-7 to 1.1-10.

Many FCC proceedings are controversial in nature, allocations proceedings especially so. The reason is that a particular communications industry's livelihood depends in part on how much spectrum it is allocated. The FCC's allocations decisions frequently are political decisions where several industries in effect compete for a limited amount of spectrum. Or, if spectrum at a particular frequency band is relatively uncrowded, the FCC may propose to authorize sharing of this spectrum with other users. No communications

industry likes to share spectrum with a possibly dissimilar service because of the possibility of interference and the difficulty of coordinating frequency use. Because of these factors, FCC allocations proceedings consume a great deal of time and energy of the organizations, like NAB, and industries, like broadcasting, that participate in them.

From time to time there have been alternative methods proposed for allocating spectrum. These ideas usually envision the removal of the FCC as the arbiter of mutually exclusive requests for spectrum and, in its place, substituting marketplace forces where, it is contended, spectrum would be allocated to the most economically efficient user. The Commission's role would be reduced to a technical "traffic cop" of the airwaves. However intellectually appealing these ideas may be, there is considerable inertia in the present system which would have to be overcome if the current rule making procedure is to be changed.

AM BROADCASTING FREQUENCY ALLOCATIONS

It is ironic that the oldest form of broadcasting, Amplitude Modulation, remains, after many years, technologically so complex. Neither in FM or TV broadcasting do we find allocations criteria that are so complex; AM remains the most difficult allocations system to grasp quickly and easily.

The basic band plan is shown in Fig. 3. There are 107 channels each 10 kHz wide. Over 4800 commercial and non-commercial AM stations occupy these frequencies with primary powers ranging from 250 watts to 50 kilowatts. Half of all AM stations use multi-tower directional antennas to control radiation in certain directions, for the purpose of controlling interference and maximizing radio service. About half of all AM stations operate only during the day. At night, propagation considerations preclude many "daytimers" from operating fulltime on a non-interference basis under the FCC's current technical standards.

The details and methodology for allocating AM radio stations as well as basic design specifications for AM directional antennas is incorporated within FCC Rules, Parts 73.14 to 73.190, one of the largest sections of FCC Rules pertaining to broadcasting. A reader who is interested in further details of AM allocations criteria is referred to the relevant sections of the FCC's rules.

A brief allocations history of AM broadcasting may help to understand the current system. On April 16, 1960, the North American Regional Broadcast Agreement (NARBA) became effective in the United States. NARBA was an agreement among the U.S., Canada, Mexico, Cuba, the Bahamas, and certain other Caribbean countries. The NARBA was necessary principally because nighttime propagation on the AM broadcast band would cause interference to neighboring countries unless mutual allocations criteria and related technical standards were agreed upon and adhered to by parties to the agreement. In brief, NARBA provided for a partitioning of AM broadcast channels into three classes. The first of these are the so-called "clear" channels, on which a single high-power station was to enjoy primary access to its frequency. Clear channel stations provide service, both day and night, over wide areas, even the entire U.S. NARBA provided for 60 clear channels out of the 107 total available frequencies. Each NARBA country received a "priority" on certain clear channel frequencies. NARBA countries without a priority could still allocate radio stations provided that these stations protect the wide-area service of the dominant station in the country with NARBA priority. The clear channels were divided among the NARBA countries with the U.S. receiving a major portion of available priorities. A clear channel station operates with 50 kW night and day and is generally non-directional.

The second class of channels are the 41 regional channels. Unlike clear channels, there is no priority on any particular regional frequency; rather, all countries share these frequencies equally. The technical standards developed for regional channels allowed for (and depended upon) the design of directional antennas to protect existing stations operating on the band. Regional stations are presently limited to 5 kW day and night, often use directional antennas, and may operate daytime only. These stations may also operate with different powers day and night and perhaps with different antennas.

NG128: The AM carrier may be used to transmit subsidiary signals for utility board management and other purposes.

Note 1: 1605-1705 kHz is to become available for AM Broadcasting following completion of a 1986 and 1987 Regional Administrative Radio Conference ("RARC") as well as applicable FCC proceedings.

Note 2: Channel bandwidth is 10 kHz.

Fig. 3. AM broadcast frequency allocations: 535-1705 kHz.

The third class of channels are the six local channels. On these frequencies, nearly all stations are entitled to operate with a uniform 1000 watts daytime and 1000 watts at night with non-directional antennas.

A station that operates on a clear channel was considered a clear channel station if the station was accorded Class 1 or dominant status on its frequency. Similarly, regional stations operated on regional channels and local stations operate on local channels. Each class of station engenders its own particular set of allocations criteria and technical standards. Intermixture of station classes on the various frequencies was in general not permitted; there were, however, different *types* of operations on clear and regional channels, in particular: on the clear channels, daytime-only stations were permitted which did not cause daytime interference with the clear channel station on the frequency. Daytimers are permitted on the regional channels but are not found on local channels. And some clear channel frequencies have dual priorities and are therefore shared.

But NARBA is now obsolete; although many of the agreements continue to underlie the U.S. system of AM allocations. In 1981, a Region 2 RARC was held in Rio de Janeiro which developed a plan for further broadcasting use of the AM spectrum. The NARBA classification system was modified to allow any class of station to operate on any AM frequency and receive protection from interference. The proposed AM station need only comply with applicable interference protection criteria for its class of station.

Today, the clear channels are being broken down to permit the authorization of additional stations. Clear channel stations now are protected only for approximately 750 miles at night.

As of this writing, the AM band is scheduled to be "expanded" from 1605 to 1705 kHz. A RARC will convene in 1986 and again in 1988 to develop a plan for broadcasting use of this spectrum. This RARC will require a vast amount of necessary technical work. Much of this work is now being performed at the FCC.

FM BROADCASTING ALLOCATIONS

FM Broadcast Allocations are quite different from AM. It is much more a strictly domestic U.S. matter and less of an international matter; there have been no RARCs dedicated exclusively to FM matters. While U.S.-Canadian and U.S.-Mexican bilateral agreements remain necessary, they exist primarily to equitably allocate permissible FM broadcast locations on either side of the border and to agree on applicable transmission standards. Technical standards are also agreed upon in order to insure system compatibility.

The basic FM band plan is shown in Fig. 4. FM broadcasting uses frequencies from 88 MHz to 108 MHz. There are 100 available channels each 200 kHz wide. Most non-commercial broadcasting is concentrated at 88-92 MHz (20 channels) with the rest of the band used for commercial purposes.

Commercial FM allocations have recently undergone a significant change. In June 1983, the FCC terminated a lengthy Rule Making proceeding which modified the domestic allocations criteria for FM broadcasting. The title of this proceeding was BC Docket No. 80-90; "Modification of FM broadcast station rules to increase the availability of commercial FM assignments". Prior to Docket 80-90, the FCC authorized three classes of FM stations. Class A stations were designated to operate on 20 exclusive channels. They have a service radius of approximately 15 miles, operate with a maximum height-above-average-terrain (HAAT) of 300 feet, and use a maximum effective radiated power (ERP) of 3 kW. Class B or C stations operate on the remaining 60 channels. Whether a station is designated Class B or C depends on where in the U.S. it is located. Class B stations have approximate service areas of 40 miles and are located in FCC Zones I and I-A. Zone I is the northeast U.S. extending south to the Virginia-North Carolina border and west to the Mississippi River. Zone I-A is a portion of southern California, plus Puerto Rico and the Virgin Islands. Class B stations operate at a maximum ERP of 50 kW at 500 feet HAAT. Class C stations have the largest FM facilities authorized by the FCC and Class C stations can operate with up to 100 kW at 2000 feet

Allocations Notes:

NG 2: Facsimile stations may be authorized at 88-108 MHz.

NG 128: Permits use of FM baseband for subsidizing communications purposes.

NG 129: In Alaska, 88-100 MHz is also allocated to the fixed service on a secondary basis.

US 93: 108 MHz may be used for VOR test facilities on a non-interference basis to FM Broadcasting.

Fig. 4. FM broadcast frequency allocations: 88-108 MHz.

HAAT, for service areas of approximately 57 miles. Class C stations operate in FCC Zone II (the rest of the U.S. that is not Zone I or Zone I-A). FM stations that elect to operate at a HAAT above maximum are required to reduce their ERP to keep their designated coverage areas within the FCC's prescribed limits.

The use of FM channels is governed by the FM "Table of Assignments" found in Section 73.202 of the FCC's rules. The table lists all communities in which FM stations are operating, or may operate, and the channel on which they must transmit. The placement of FM radio stations is initially determined by applicable technical standards. For FM, these standards are the required minimum distance separations between, for example, two co-channel FM transmitter sites. First, second, and third adjacent channel mileage separations are also specified.

In 1983, however, much of the pre-existing FM allocations criteria such as station classes, permitted zones, and mileage separations were changed with the new rules adopted in Docket 80-90. Without changing the basic Table of Assignments concept, Docket 80-90 amended the Commission's rules to:

1. Allow Class A stations on Class B or C channels;
2. Create a new type of Class B FM station, Class B1. This class is allowed to operate in Zones I and I-A. With an expected service area of 28 miles, a permitted maximum ERP of 25 kW at 100 meters (328 feet HAAT); and
3. Create two new types of Class C stations, Class C1 and Class C2 to operate in Zone II. Class C1 stations have an expected service area of 45 miles with an authorized maximum ERP

Station Classes

Station Class	Maximum Facilities kW & m. (ft.)	Permitted Zone	Service Radius km. (mi.)	Field Strength mV/m (dBu)
A	3 & 100 (328)	1&2	24 (15)	1.0 (60)
B1	25 & 100 (328)	1	45 (28)	.7 (57)
B	50 & 150 (492)	1	64 (40)	.5 (54)
C2	50 & 150 (492)	2	52 (32)	1.0 (60)
C1	100 & 300 (984)	2	72 (45)	1.0 (60)
C	100 & 600 (1968)	2	92 (57)	1.0 (60)

MINIMUM DISTANCE SEPARATION REQUIREMENTS in kilometers (miles)

Relation	Co-channel	200 kHz	400/600 kHz	10.6/10.8 MHz
A to A	105 (65)	64 (40)	27 (17)	8 (5)
A to B1	138 (86)	88 (55)	48 (30)	16 (10)
A to B	163 (101)	105 (65)	69 (43)	16 (10)
A to C2	163 (101)	105 (65)	55 (34)	16 (10)
A to C1	196 (122)	129 (80)	74 (46)	32 (20)
A to C	222 (138)	169 (105)	105 (65)	32 (20)
B1 to B1	175 (109)	114 (71)	50 (31)	24 (15)
B1 to B	211 (131)	145 (90)	71 (44)	24 (15)
B1 to C2	200 (124)	134 (83)	56 (35)	24 (15)
B1 to C1	233 (145)	161 (100)	77 (48)	40 (25)
B1 to C	259 (161)	193 (120)	105 (65)	40 (25)
B to B	241 (105)	169 (105)	74 (46)	24 (15)
B to C2	241 (150)	169 (105)	74 (46)	24 (15)
B to C1	270 (168)	195 (121)	79 (49)	40 (25)
B to C	274 (170)	217 (135)	105 (65)	40 (25)
C2 to C2	190 (118)	130 (81)	58 (36)	24 (15)
C2 to C1	224 (139)	158 (98)	79 (49)	40 (25)
C2 to C	249 (155)	188 (117)	105 (65)	40 (25)
C1 to C1	245 (152)	177 (110)	82 (51)	48 (30)
C1 to C	270 (168)	209 (130)	105 (65)	48 (30)
C to C	290 (180)	241 (150)	105 (65)	48 (30)

Fig. 5. FM allocations technical standards.

of 100 kW at 300 meters (984 ft.) HAAT. The service area of a Class C2 station will be 32 miles with an authorized maximum power of 50 kW ERP at 150 meters (492 ft. HAAT). FM allocations standards are summarized in Fig. 5.

Further, Docket 80-90 provided that *existing* Class B or C FM stations *not* operating with maximum facilities will be required to upgrade their facilities within 3 years, (March 1, 1987) or be reclassified to a lower class based on their existing facilities.

After the FM allocations rules were changed in Docket 80-90, it was necessary for the Commission to establish procedures which would allow applicants for new FM stations to take advantage of the new rules. Since the FM Table of Assignments concept was preserved, any new FM allocations that became available through Docket 80-90's rule changes had to be incorporated in the FM Table. The Commission believed that a flood of such petitions to amend the Table would descend unless amending the Table could be done in an organized, step by step fashion. Accordingly, using the FCC's computer resources, the Commission elected to propose a mass modification of the FM Table, using expressions of interest in new radio stations it had solicited from interested parties several years earlier. Initially, approximately 700 locations were proposed. It is expected that the process of proposing new allocations, allowing for public comment, and, finally, accepting applications will continue for some time.

Further changes in FM allocations are not envisioned in the near future, at least until we see the result of Docket 80-90.

TELEVISION BROADCASTING ALLOCATIONS

There are several different bands used for broadcast television stations. The low-VHF band comprises TV channels 2 to 4 (54 MHz to 72 MHz) and channels 5 and 6 (76 MHz to 88 MHz). The high-VHF band comprises TV channels 7 through 13 (174 MHz to 216 MHz). The UHF band is comprised of TV channels 14 through 69 (470 MHz through 806 MHz). Technical standards for TV stations are given in Fig. 6. A diagram of frequency allocations is given in Fig. 7.

Like the case for FM broadcasting, full power TV allocations are governed by a Table of Frequency Assignments located in Part 73.606 of the FCC Rules. Requests for modification of the Table are made by petitioning the FCC; such requests must comply with applicable mileage separation criteria which serve to prevent mutual interference. Generally speaking, few, if any, VHF allotments are available. There are, however, a number of vacant UHF channels that remain scattered throughout the U.S. Low Power Television Stations (LPTV) are not allocated according to a predetermined table. Rather, these stations operate on a strictly secondary, non-interference basis with full power TV stations

Channel	Maximum Visual Effective Radiated Loss	Grade A (dBu)	Grade B (dBu)
2-6	20 dBk (100 kW)	68	47
7-13	25 dBk (316 kW)	71	56
14-69	37 dBk (5000 kW)*	74	64

* 30 dBk within 250 miles of the U.S./Canadian Border.

Basic Mileage Separations*

	— Co-Channel			
	Channels	Channels	Adj. Channel	
	2-13	14-69	2-13	14-64
Zone 1	170	155	60	55
Zone 2	190	175	60	55
Zone 3	220	205	60	55

* There are other "taboos" which may or may not preclude a particular television station from operating in a particular location. See FCC Sec. 73.698.

Fig. 6. Television broadcast allocations technical standards.

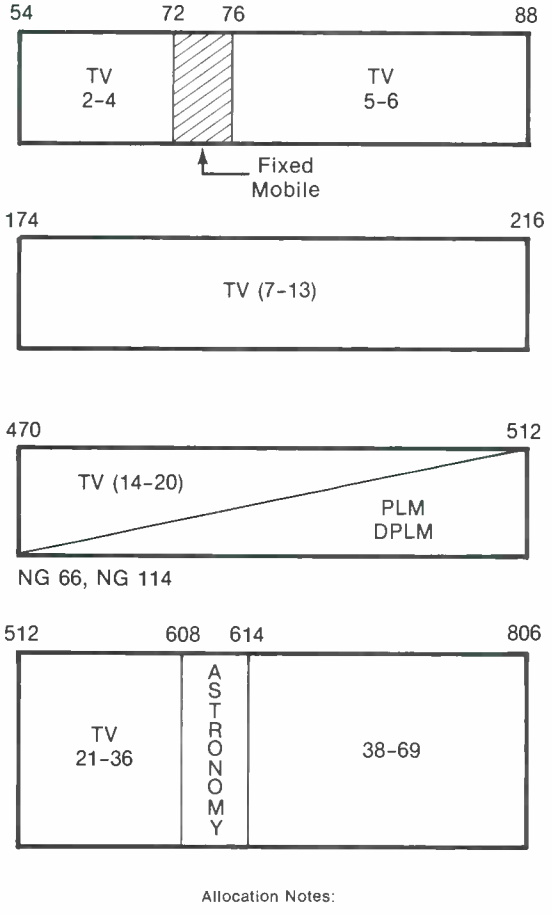


Fig. 7. Television broadcast frequency allocations.

wherever they can be located. Technical standards governing the establishment of LPTV stations are given in subpart G of part 74 of the FCC's Rules.

Aside from establishment of the LPTV service, there has been little change in the allocation of television broadcast stations over the past several years. The last major change was the reallocation of channels 70 through 83 from TV to the Land Mobile radio services in the early 1970s. At that time, sharing of UHF channels 14-20 with land mobile radio services became permitted in certain markets. Such efforts to achieve reallocation of UHF spectrum continue and must be studied carefully by broadcasters.

In August 1984, for example, the Los Angeles County Sheriff petitioned the FCC to reallocate channel 19 in Los Angeles for land mobile communications. Many studies have been conducted which portray the land mobile industry as one suffering from severe spectrum congestion and hence requiring additional spectrum. Public safety land mobile agencies claim that reallocation of additional spectrum would assist their communications capability to the extent of saving lives and property. On the other hand, a FCC Field Operations Bureau study, completed in the summer of 1984, indicates that many of the available land mobile channels in Los Angeles are lightly loaded, if they are used at all. And several organizational and technology implementation studies (the *Hatfield Reports*) have shown that the Los Angeles County Sheriff can meet his existing needs as well as plan for future growth by strategically employing modern narrowband (Amplitude Compandored Single Sideband or ACSB) communications systems. On still another hand, in 1983 the FCC completed a broad-based study evaluating land mobile's need for additional spectrum; this report concludes that additional spectrum is necessary by the year 1990 and that a likely source lies in the domain of UHF Television: generally the first place land mobile's industries look to expand their use of frequencies.

Even further, in June of 1985 the FCC proposed reallocation of certain UHF channels in eight of our largest markets. A technical advisory committee consisting of broadcast and land mobile representatives has been formed to address the complex technical questions.

In any event, the debate goes on and there will undoubtably be further studies and additional rhetoric. One indicator of the seriousness of this matter is that the Commission's *Notice of Proposed Rule Making* responding to the L.A. Sheriff's request for channel 19 spectrum in Los Angeles mysteriously raised the spectre of modifying the license of the channel 18 adjacent TV station, which, by operating at full power, might preclude the sheriff's use of channel 19. It will be interesting to see how TV-Land Mobile allocations in Los Angeles are changed, if they are at all, in the near future.

AUXILIARY BROADCAST SERVICES

Broadcasters use auxiliary broadcast services for a multitude of essential purposes. With recent deregulation, the number of potential uses is growing rapidly. Yet, while there has been steady growth in the number of AM, FM and TV stations, there has not been a corresponding growth in the allocated frequencies for auxiliary services; in many broadcast markets, these frequencies are congested and the prospect for further growth is unlikely, if not impossible; at least with current technical standards. Pressure from competing radio services, such as private, land mobile, government, cable and other services, makes it unlikely that, in the future, additional spectrum for auxiliary services will be allocated.

Still, in many small to medium markets, demand for auxiliary facilities is less and plenty of auxiliary spectrum is available for radio and TV broadcasters.

It is imperative that broadcasters make efficient use of the spectrum we have now. To do this, it is first necessary to understand what spectrum is allocated and available and how it is used; what portion of available spectrum is at present most controversial and why; the extent that cost efficient technology can alleviate existing spectrum shortages and assist broadcasters; and recent FCC rule changes of a procedural or policy nature that impact on auxiliary spectrum use.

Radio Broadcasting Auxiliary Allocations

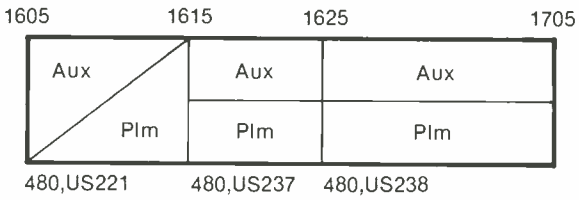
Radio stations use auxiliary broadcast facilities for studio-to-transmitter links (STLs), remote pickup units (RPUs) and on occasion, intercity relay links (ICRs). STLs carry the live on-the-air programming, remote metering, control telemetry, and any subsidiary communications from the studio location to the actual broadcast transmitting facility. STL stations are operational whenever the broadcast station is on the air, often for a full 24 hours. RPUs are mobile or portable facilities that are also used to transmit live on-the-air programming from a temporary remote location, such as a shopping center or football game, to the station's studio facilities for taping, for later rebroadcast, or for on-the-scene-reports incorporated into the actual on-going live broadcast. Radio stations typically have several RPUs that may be licensed to one or more frequencies. ICR stations are used to circumvent obstacles in an otherwise clear path from the studio to the transmitter. ICRs aid the broadcaster's capability to relay programming from studio location to transmitter site, even though the terrain and buildings in between do not allow a clear path. In these cases, the ICR generally is located on the highest point on the path between studio and transmitter. Typically, ICRs transmit on different frequencies than they receive; however, recently the Commission has authorized use of microwave "boosters" which receive and retransmit on the same frequency. Because STLs, RPUs and ICR stations frequently, if not always, carry live on-the-air programming, they must be protected from undesired interference from other telecommunications allocations which may be sharing their frequencies or operating in adjacent spectrum. Absent such protection, interference received by operating STL stations can impair programming intended for reception by the general public. Moreover, any interference or interruption to the STL transmission, or RPU or ICR transmission, can be immediately present on the actual broadcast and would therefore be present everywhere within the broadcast station's service area. In the case of STLs, proper operation is so critical to the technical integrity of the broadcast, that many stations purchase and erect hot stand-by STL stations which immediately begin transmitting (on the same frequency) if the main STL fails.

In November 1984, the FCC significantly revised its radio broadcast auxiliary frequency allocations to permit the *optional* use of narrow band technologies in the Broadcast Remote Pickup Service. The Commission's goal was to foster spectrum efficiency in a flexible manner; broadcasters and equipment manufacturers who wanted to operate narrowband equipment, the Commission believed, should not be precluded from doing so by rigid FCC rules.

In December 1984, the FCC allocated additional spectrum for radio STLs and ICRs. In brief, the new spectrum is expected to relieve much of the congestion at STL frequencies in many markets as well as provide for future growth. Additionally, spectrum at 18 GHz is now available for aural STL purposes.

Here is a brief summary of existing and new frequency allocations for radio broadcast auxiliary services.

1. ***1605-1705 kHz:*** There are three channels in the band available for mobile remote pickup broadcast stations: 1606, 1622 and 1646 kHz. At 1606 kHz, use is subject to the condition that no harmful interference is caused to the reception of AM stations operating on 1600 kHz. Maximum operating power for these frequencies, like other auxiliary bands, is limited to that power. The entire band, is subject to

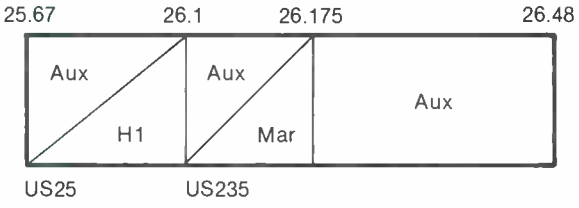


Allocation Notes:

480: Use of 1605-1705 kHz is subject to a 1986 and 1987 RARC (AM Broadcast Band Expansion.)
US221: Use of 1605-1615 kHz is limited to distribution of Traveler's Information stations ("TIS"), operating at 1610 kHz.
US237, US238: At 1615-1625 kHz, Radiolocation services are primary until the 1985 RARC.

Available Frequencies: 1606, 1622, and 1646 kHz, subject to operation on a non-interference basis with other services.
Bandwidth is 10 kHz.

Fig. 8. Radio broadcast auxiliary services: 1605-1705 kHz.



Allocation Notes:

US25: No interference to high-frequency broadcasting.
US235: These frequencies have yet to be implemented by the Maritime Mobile Services and their use may be modified by future RARCs.

Available Frequencies:
1. 25.87, 25.91, 25.95, 25.99, 26.03. Maximum bandwidth is 40 kHz.

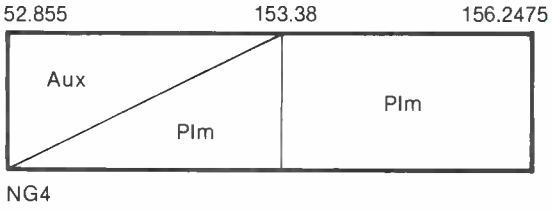
2. 26.07,26.09,26.11,26.13,26.15,26.17,26.21,26.23,26.25,26.27,26.29, 26.31,26.33,26.35,26.37,26.39,26.41,26.43,26.45, and 26.47 MHz.

Fig. 9. Radio broadcast auxiliary services: 25.67-26.48 MHz.

modification at a 1986 Regional Administrative Radio Conference (RARC), which will consider the establishment of technical standards for AM broadcasting at 1605-1705 kHz. Also, at 1610 kHz, many local government entities operate Travelers' Information Stations (TIS). See Fig. 8 for a summary.

2. ***25.67-26.48 MHz:*** There a total of 25 frequencies available in this band for use by remote pickup broadcast stations. All are subject to the condition that no interference is caused to high frequency broadcasting, primarily at night. Some of these frequencies are shared with the Maritime Mobile Services; but, as yet, this service has not been implemented. These frequencies are also subject to other fixed station uses which may be established at future RARCs. Bandwidth is 20 kHz except at 25.87-26.03 MHz were the allowable bandwidth is 40 kHz. See Fig. 9 for a summary of allocations at these frequencies.

3. ***153 and 161 MHz***: In November 1984, the FCC split available spectrum into 5 kHz segments beginning at 152.8575 MHz and ending at 153.362 MHz. These segments may be stacked to form a channel which may be assigned for use by broadcast remote pickup stations. Frequencies are allocated provided no interference is caused to other services. Also, many frequencies will not be licensed to network entities, and will not be authorized to new stations for use on board aircraft. Similarly, the frequencies at 160.8625-161.3975 MHz and 161.6275-161.7725 have been split into 5 kHz segments and are also available for stacking. The maximum authorized bandwidth is 30 kHz. The first set of frequencies are only



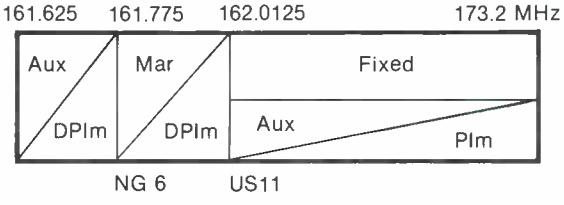
Allocation Note:

NG4: Limits available frequencies to 152.84—153.38 MHz

Available Frequencies:

152.8575—153.362 MHz. (at intervals of .005 MHz "stackable" to a maximum authorized bandwidth of 30 kHz.) Provided no interference is caused to PLM services; not licensed to network entities; and not licensed for use on aircraft.

Fig. 10. Radio broadcast auxiliary services: 152.855—156.2475.



Allocation Notes:

US11: Available Frequencies are limited to 166.25 and 170.15 MHz in certain areas.
NG 6: Some DPLM services may operate between 159.51 and 161.79 MHz, but cannot interfere with AUX services. New DPLM services will not be authorized.

Available Frequencies:

1. 161.6275—161.7725 MHz; (available at .005 MHz intervals "stackable" to a maximum authorized bandwidth of 30 kHz.) Not available to "network entities".

2. 160.8625—161.3975 MHz; (available only in Puerto Rico and the Virgin Islands. Available at .005 MHz intervals "stackable" to a maximum authorized bandwidth of 30 kHz.)

3. 166.25 and 170.15 MHz; see FCC Rules Sec. 74.402(e)(8). Maximum channel bandwidth is 25 kHz.

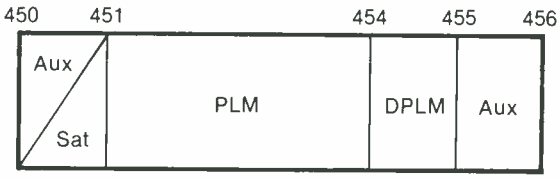
Fig. 11. Radio broadcast auxiliary services: 161.625—173.2 MHz.

available for assignment in Puerto Rico or the Virgin Islands, and may be shared with certain Land Mobile Services; the second set of frequencies are not available in Puerto Rico and the Virgin Islands, but may be shared in certain areas with Land Mobile radio services. See Figs. 10 and 11 for a summary of the band plan at these frequencies. Broadcasters contemplating operation in this band are urged to consult the latest FCC rules. This particular band seems to be susceptible to quick change in applicable regulations.

4. *450 MHz and 455 MHz*: Frequencies in the UHF band have also been split and are available for stacking. Operating frequencies occur every 5 kHz from 450.0275 MHz to 450.6225 MHz and from 455.0275 to 455.6225 MHz. Maximum authorized bandwidth is 50 kHz. However, some segments in this frequency band are partitioned into 25 kHz segments which also may be stacked to form a wider channel. These segments are shown in Fig. 12.
5. *942-952 MHz:* In the past, this spectrum has been quite controversial for radio broadcasters. Prior to November 1984, only half —947-952 MHz—was actually allocated for radio STLs on a primary basis. The lower half, 942-947 MHz, belonged to a land mobile reserve pool of frequencies that had yet to be implemented by that service.

In the early 1970s as part of a massive restructuring of radio spectrum to accommodate the long term needs of the land mobile services, available STL spectrum was halved from 942-952 MHz to 947-952 MHz. STLs that operated there at that time continue to do so today; they are permitted continued renewal of their licenses pending a decision as to their disposition through a future FCC Rule Making proceeding. That rule making proceeding began on June 23, 1982 when the FCC adopted *Notice of Proposed Rule Making* in General Docket No. 82-335. The Commission brought together a number of different proposals for the disposition of STLs operating below 947 MHz that had accumulated during the ten years or so since the band was halved. In 1976, NAB petitioned the FCC to reallocate 942-947 MHz for all STL stations on a primary basis. Another petition, filed by Moseley Associates, a manufacturer of STLs, proposed permitting broadcast STLs to operate on a secondary non-interfering basis within unassigned UHF television channels. Docket 82-335 also included a tentative decision in two previous FCC proposals (1) to allow STL stations to operate in the band 2150-2160 MHz; and (2) to allow STL stations to operate at 2110-2113 MHz. Both of these proposals envisioned sharing spectrum with other fixed users; the Commission suggested that the latter two of these proposals be abandoned, chiefly because spectrum congestion precluded extensive STL frequency/path availabilities.

But the essence of Docket 82-335 proposed to permit STLs to access spectrum at 2130-2150 MHz and 2180-2200 MHz. Broadcasters now operating STLs below 947 MHz would be required to move to the new frequencies within five years of the adoption of rules in this proceeding.



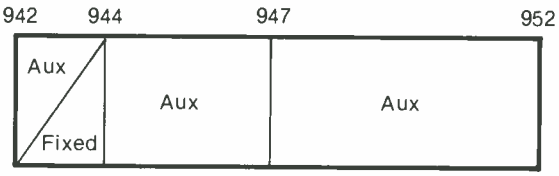
Allocation Notes:

668: 449.75—450.25 MHz may be used for the space operation service.
US87: 449.5—450.5 MHz may be used for "space telecommand" purposes by Govt.

Available Frequencies:

1. 450.0275—450.6225 MHz; 455.0275—455.6225 MHz. (at .005 MHz intervals; can be "stacked" to form channels up to 50 kHz wide)
2. 450.6375—450.8375 MHz; 455.6375—455.8375 MHz. (at .025 MHz intervals; can be "stacked" to form channels up to 50 kHz wide).
3. 450.900, 450.950; 455.900; and 455.950 MHz. 100 kHz maximum bandwidth.

Fig. 12. Radio broadcast auxiliary services: 450-456 MHz.



Allocation Notes:

1. Licensed STL's at 942-944 MHz may remain and are protected from interference STL's operating pursuant to special temporary authority must relocate within five years.

Available Frequencies:

1. 944-952 MHz at .5 MHz intervals subject to local frequency coordination.

Additional Notes:

1. The FCC is expected to begin in early 1985 a "spectrum efficiency proceeding" which may result in optional bandwidth reductions.
2. Additional STL frequencies at 2130-2150 MHz and 2180-2200 MHz may be available in congested areas.

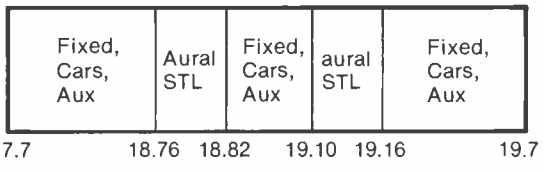
Fig. 13. Radio broadcast auxiliary services: 942-952 MHz.

In December 1984, the FCC resolved Docket 82-335 and reallocated an additional 3 MHz at 944-947 MHz for STL and ICR use on a primary, exclusive basis. Existing *licensed* STL facilities are entitled to remain where they are and will be protected from interference. STL

facilities operating pursuant to a Special Temporary Authority (STA) and *below* 944 MHz are required to change operating frequency to one that is above 944 MHz by November 1989. Further, an allocation at 2130-2150 MHz and 2180-2200 MHz will be available as an escape valve in the event of congestion at 944-952 MHz. See Fig. 13 for the current band plan.

On October 31, 1985, the Commission revised the channelization and bandwidth criteria of the aural STL band, 944-952 MHz (MM Docket No. 85-36). The new rules "split" the existing 500 kHz channels into 25 kHz "segments" which can be "stacked" to form channels of varying bandwidths. The Commission also adopted RF bandwidth "criteria" for aural STL operation: 300 kHz for FM stereo stations using subcarriers, 200 kHz for AM stations and the existing 500 kHz bandwidth as a "wideband" criterion.

6. ***18.76-19.160 GHz***: As a result of a recent FCC microwave utilization proceeding (Docket 82-334), some spectrum was allocated for Radio Fixed STLs and ICRs at 18 GHz. STLs may operate at 18.76-18.82 GHz and 19.10-19.160 GHz on 12 two-way channels, each 5 MHz wide. These frequencies are shared on a co-primary basis with stations in the point-to-point microwave services licensed under Parts 21, 78 and 94 of the Commission's Rules. Applicants may use either a two-way link or one frequency of a frequency pair for a one-way link, and may employ analog (FM) modulation or digital modulation, subject to a number of specific emissions limitations designed to help prevent adjacent channel interference. See Fig. 14 for a detailed band plan.



Television Use: Available bandwidths use 6 MHz, 10 MHz, 20 MHz, 40 MHz, and 80 MHz. Each bandwidth has its own channel plan. *See* Sec. 74.601(i) of the Commission's Rules.

Radio Use: STL's and other Fixed links are permitted at 18.76-18.82 GHz and 19.10-19.16 GHz width SMHz channels. *See* Sec. 74.502(b).

Note: *All* broadcast use of these frequencies is subject to the Frequency coordination requirements of FCC Rule Part 21.100(d).

Fig. 14. 17.7—19.7 GHz

Frequency Coordination at 18 GHz is subject to FCC Rule 21.100(d), a firmly rigorous coordination scheme. The reader is referred to this Rule if 18 GHz operation is contemplated.

7. ***23 GHz Operations.*** Although not strictly a "Broadcast Auxiliary" frequency band, 23 GHz is, nonetheless, available to broadcasters for STL intercity uses. Depending upon the rate of precipitation, the line-of-sight path lengths can be up to five miles or possibly more.

Further, 23 GHz is relatively uninhabited and there is almost no frequency coordination required. Eligible frequencies are 21.8-22.4 and 23.0-23.6 GHz. Applications and instructions are available from the FCC, Land Mobile and Microwave Division. Suitable equipment is available from popular microwave equipment manufacturers.

Auxiliary Broadcast Allocations: Television Broadcasting

Television broadcasters use auxiliary broadcast spectrum for many of the same reasons that radio broadcasters do. The most popular uses include television STLs and Electronic News Gathering (ENG). Additionally, television stations frequently employ intercity relay links when news events require mobile coverage. Typically, an ICR is located at a strategic high place within the station's city of license. Then, the mobile ENG equipment directs their transmissions to the relay point instead of the station itself. The relay station improves the station's capability to gather live news by extending the area within which ENG transmissions can be received.

On balance, the spectrum allocated for television auxiliary services is significantly more competitive than spectrum allocated for radio broadcasting services. Network entities often travel extensively and can compete with local broadcasters for available frequencies, resulting in an enhanced potential for spectrum congestion. Further, the variety of different activities that television broadcasters undertake usually requires more complex auxiliary systems than is the case in the radio industry. Also, most of the auxiliary spectrum allocated for television broadcasters is located above 1 GHz, popular spectrum used by private and common-carrier communications services.

There are three principal bands used for television broadcast auxiliary services: 1990-2500 MHz (the 2 GHz band), 6425-7125 MHz (the 7 GHz band), and 12.7-13.25 GHz (the 13 GHz band).

1. ***The 2 GHz Band:*** While the 2 GHz band extends from 1990-2500 MHz, only 1990-2110

and 2400-2500 MHz is available for television broadcasters who wish to own and operate their own auxiliary news gathering services. There are seven channels at 1990-2110 MHz. There are few potential interfering services that also operate at these frequencies. Recently, however, the Commission has proposed to allow Cable TV networks and certain cable systems to access 2 GHz channels. Unless mutual efforts to coordinate frequencies are successful, this "sharing" of spectrum, if adopted by the Commission, may lead to increased interference.

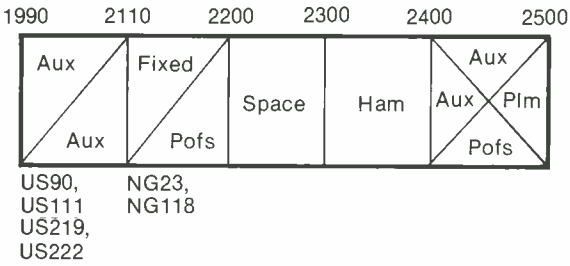
Other sources of interference include certain earth-to-space and space-to-earth transmissions on 2025-2110 MHz and at certain locations on 1990-2120 MHz. Also, there may be government-operated earth exploration satellite services at 2106.4 MHz. At certain geographical sites in the United States, space research radio services are authorized on a co-equal basis with auxiliary broadcasters at 2025-2035 MHz. Fortunately, all of these services operate on a non-interfering basis with television auxiliary broadcasters. There are three channels available at 2400-2500 MHz. One of these channels, the uppermost one (channel 10) is currently being sought for reallocation by a new radiodetermination satellite service, called *Geostar*, that would use channel 10 as part of a larger allocation for a satellite downlink in their system.

The 2 GHz band is used for both fixed STL uses and mobile ENG applications on a co-equal basis by television broadcasters. To date, local frequency coordinating committees have done an admirable job of ensuring that both these fixed and mobile users of 2 GHz coordinate their use of these frequencies. See Fig. 15 for a complete band plan.

On October 31, 1985, the Commission changed the channelization of the 2 GHz band. The existing 17 and 18 MHz "wideband" channels were "split" into 250 kHz "segments," which can be "stacked" to form channels of varying bandwidths. The Commission's rationale for this rule revision is to offer broadcasters "increased flexibility in system development and implementation."

Coupled with the proposals contained in Docket 82-334 (see below), microwave operations at 2 GHz may become significantly more complicated despite Commission assertions of "increased flexibility". We should find out in 1986 and 1987.

2. ***The 7 GHz Band:*** There are four channels available between 6425 and 6525 MHz and ten channels available between 6875 and 7125 MHz. Like the 2 GHz band, both fixed and



Allocation Notes:

US90: There may be earth-to-space and space-to-earth transmissions authorized on a non-interfering basis at 2025-2110 MHz.
US111: There may be government space research earth stations authorized on a non-interfering basis at certain locations at 1990-2120 MHz.
US219: There may be government earth exploration satellite services at 2106 MHz.
US222: At certain U.S. sites, certain space research radio services are authorized on a co-equal basis at 2025-2035 MHz.
NG118: TV translator relay stations may operate on a secondary basis at these frequencies.
US41: Government radio location service at 2450-2500 MHz can operate on a non-interference basis with non-government services.
752: All radio services must accept interference from industrial, scientific and medical equipment operating at 2450 MHz.

Available Frequencies:

1. 1990-2008, 2008-2025, 2025-2042, 2042-2059, 2059-2076, 2076-2093, and 2093-2110 MHz. Bandwidth is 17 MHz.

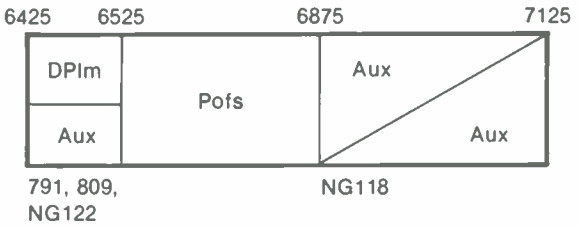
2. 2450-2467, 2467-2484, 2484-2500 MHz. Bandwidth is 17 MHz.

Notes:
1. Channels are split into 250 kHz segments, stackable into channels of wider bandwidths.
2. Docket 82-334 may alter various requirements for use of this band.

Fig. 15. Television broadcast auxiliary services: 1990-2500 MHz.

mobile operations are permitted on a co-equal basis. A standard satellite service time signal operates at 6427 MHz; and, occasionally, passive microwave sensor measurements are taken at 6425-7025 MHz. At 6425-6525 MHz, ENG stations operate on a secondary basis. Between 6875 and 7125, TV relay stations can operate on a secondary basis. These frequencies are primarily available for television broadcasters who wish to own and operate their own auxiliary services. There are other frequencies available for common carrier entities that wish to sell or lease their services to broadcasters. Although the communications provided by a broadcaster who owns his auxiliary service and the common carrier entity who leases or sells the same service are identical, they currently occupy different portions of the spectrum. See Fig. 16 for a complete band plan.

Like the 2 GHz band, in October 1985, the Commission changed the 7 GHz band channelization. Wideband channels were "split"



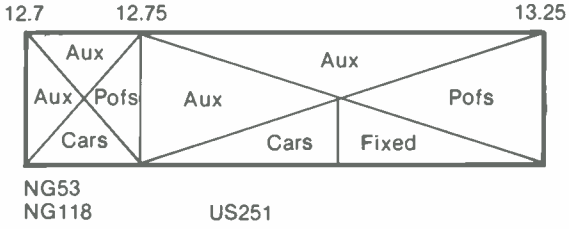
Allocation Notes:

791: 6426 MHz is a "standard" satellite service time signal.
809: "Passive" microwave sensor measurements at 6425-7025 MHz.
NG122: TV Pickup stations may operate at 6425-6525 MHz on a secondary basis.
NG118: TV translator relay stations may operate at 6875-7125 MHz on a secondary basis.

Available Frequencies:

1. 6425-6450, 6450-6475, 6475-6500, 6500-6525 MHz. Bandwidth is 25 MHz.
2. 6875-6900, 6900-6925, 6925-6950, 6950-6975, 6975-7000, 7000-7025, 7025-7050, 7050-7075, 7075-7100, and 7100-7125. Bandwidth is 25 MHz.
3. Channels are split into 250 kHz segments, stackable into channels of wider bandwidths.
4. Docket 82-334 may alter various requirements for use of this band.

Fig. 16. Television broadcast auxiliary service: 6425—7125 MHz



Allocation Notes:

NG53: TV pickup and CARS pickup are co-equal at 12.7-13.15 GHz. At 13.15 GHz, are co-equal and exclusive within 50 km of the top 100 markets.
NG118: TV translator relay stations may operate on a secondary basis.
US251: Space research at 12.75-13.25 GHz only at Goldstone, CA.

Available Frequencies:

1. 12700-12725, 12725-12750, 12750-12775, 12775-12800 12800-12825, 12825-12850, 12850-12875, 12875-12900 12900-12925, 12925-12950, 12950-12975, 12975-13000 13000-13025, 13025-13050, 13050-13075, 13075-13100 13100-13125, 13125-13150, 13150-13175, 13175-13200 13200-13225, 13225-13250 MHz.

2. 12.7125-12.7375, 12.7375-12.7625, 12.7625-12.7875, 12.7875-12.8125 12.8125-12.8375, 12.8375-12.8625, 12.8625-12.8875, 12.8875-12.9125 12.9125-12.9375, 12.9375-12.9625, 12.9625-12.9875, 12.9875-13.0125 13.0125-13.0375, 13.0375-13.0625, 13.0625-13.0875, 13.0875-13.1125 13.1125-13.1375, 13.1375-13.1625, 13.1625-13.1875, 13.1875-13.2125, 13.2125-13.2375 MHz.

Fig. 17. Radio broadcast auxiliary services: 12.7-13.25 GHz.

into 250 kHz "segments" which can be "stacked" to form channels of varying bandwidths. The proposals being considered in Docket 82-334 may significantly change the manner in which our industry uses this band (see below).

3. *The 13 GHz Band:* The 13 GHz band is without question becoming increasingly congested. In addition to television broadcasters, Cable Television Relay Systems (CARS) use these frequencies as do Private Operational Fixed Service users (POFS). Thirteen GHz can support both mobile and fixed operations; however, mobile ENG is nearly always operated on a secondary basis to fixed service users. This spectrum is also highly controversial—as explained in detail below. A current plan is shown in Fig. 17.

At 13 GHz:

- Private operational fixed service users displaced from 12 GHz may operate on the frequencies 12.7-13.20 GHz, on a co-primary basis with existing fixed users of that band,
- Mobile ENG units may operate on the secondary basis to fixed users on the frequencies 12.7-13.20 GHz, except that, on the frequencies 13.15-13.20 GHz, within 50 kilometers of the top 100 television markets, they are co-primary with CARS and ENG; and
- Mobile ENG units may operate on a co-primary basis with existing fixed users on the frequencies 13.20-13.25 GHz.

On November 27, 1985, the Commission released a *Second Notice of Proposed Rule Making* in Gen. Docket No. 82-334. The new proposal offers many of the same concepts used in the First *Notice*: minimum path length requirements, antenna performance standards, and further sharing of 2 GHz and 7 GHz by other users.

The Commission's new proposal would permit Cable TV Networks and local CATV operators to have "equal access" to the 2 and 7 GHz microwave bands, for *mobile use only*, such as ENG operations. Moreover, the Commission would impose *minimum path lengths and antenna sizes* for *new fixed* microwave links or major changes in existing links in areas where there is frequency congestion. Finally, the Commission has offered the use of the 6.4 GHz band, now used sparingly by common carriers, to broadcasters and others. Broadcasters currently have access to this band on a secondary basis, but its use must be formally coordinated which has proved to be time consuming. Use of 6.4 GHz would be limited to "portable" use only, rather than mobile or ENG use. Substantial lead time would be necessary before a broadcaster could use these frequencies.

The Commission will decide in 1986 whether or not to adopt its proposals.

Future Changes

The foremost pending proceeding is General Docket No. 82-334. This rulemaking began in early 1982, and seeks to establish a spectrum utilization policy for the fixed and mobile services use of certain bands between 947 MHz and 40 GHz. The proposals espoused by the FCC in the original *Notice of Proposed Rule Making* could, if implemented, have a disastrous effect on television broadcast auxiliary frequency use. In brief, the FCC proposed to displace present occupants of what is now the direct broadcast satellite (DBS) downlink band, 12.2-12.7 GHz, to bands that included those allotted for television broadcast auxiliary services (TV ENG and STL at 2, 7 and 13 GHz). Not only would sharing be permitted but, for the first time, the FCC would impose technical standards it believes would improve spectrum efficiency. These proposed standards include required minimum path lengths for transmission on each microwave band, minimum antenna suppression standards, a new channeling plan for the 2 GHz band and revised frequency coordination procedures.

In September 1983, the FCC adopted a favorable *First Report and Order* in Docket 82-334. The FCC, for the time being, preserved the integrity of 2 and 7 GHz, and allowed only limited sharing at 13 GHz and opened up the 18 GHz band to all. At that time, no action was taken on other technical proposals such as minimum path length requirements.

CONCLUSION

The figures contained in this chapter of the handbook present the broadcast auxiliary spectrum as presented by the FCC's *Second Report and Order* in General Docket No. 80-739: domestic implementation of the Final Acts of the 1979 World Administrative Radio Conference (1979 WARC) as modified by subsequent FCC orders.

If a given portion of spectrum is divided horizontally, the upper service is primary and the lower service is secondary. If, on the other hand, a portion of spectrum is divided diagonally, both services enjoy co-equal status. If an identical service appears twice in the same frequency portion, then, for this service, both fixed and mobile services are permitted.

Note the allocation footnotes for each spectrum portion. These are located in Section 2.100 to 2.108 of the Commission's Rules. Here are the relevant terms:

POFS = Private Operational Fixed Service
AUX = Auxiliary Broadcast Service
MAR = Maritime Mobile
PLM = Private Land Mobile
DPLM = Private Land Mobile (common-carrier)
HF = High frequency broadcasting
HAM = Amateur Radio
FIXED = Fixed microwave services (private or common carrier)
SAT = Satellite uplink or downlink.

1.6

Source Guide: Broadcast Standards and Information

INTRODUCTION

The purpose of this chapter is to provide an easily accessible guide to organizations whose activities affect the work of broadcast engineers. This includes government agencies, trade and professional associations, and private companies.

There is also a list of abbreviations and acronyms.

The information here has been compiled from various sources by David Bialik of NAB. Accuracy and currency cannot be guaranteed; please contact listed organizations directly for more information.

FEDERAL GOVERNMENT

Department of Agriculture

14th and Independence Avenue, S.W.
Washington, DC 20250
(202) 447-2791

The Department of Agriculture (USDA) Forest Service oversees the use of 190 million acres of land under the domain of the National Forest System. More often than not, the use of a mountain top transmitter site is controlled by the Forest Service. Land use permits are obtained from the Forest Supervisor for the particular forest of interest who has detailed policy directives for permissible uses and fee structures of forest land.

Department of Commerce

National Bureau of Standards

Gaithersburg, MD 20899
(202) 921-1000

The National Bureau of Standards of the Department of Commerce has been authorized by Congress to undertake the following functions: "The custody, maintenance, and development of the national standards of measurements and the provisions of means and methods for making measurements consistent with those standards, including the comparison of standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions, with the standards adopted or recognized by the Government."

Time and Frequency Division

The Time and Frequency Division, located in Boulder, Colorado, is that part of the National Bureau of Standards that carries out the above functions related to time and frequency. This division is responsible for distributing the standards and for finding new and improved methods of dissemination. The dissemination services for time and frequency are presently available from stations WWV and WWVB in Fort Collins, Colorado, and from WWVH in Kauai, Hawaii. In addition, services using network television and satellite signals are also available. Correspondence

pertaining to station operations may be addressed to:

Engineer-in-Charge
NBS Radio Stations WWV and WWVB
2000 East County Road 58
Fort Collins, CO 80524
(303) 484-2372

or,

Engineer-in-Charge
NBS Radio Station WWVH
P.O. Box 417
Kekaha, Kauai, HI 96752
(808) 335-4361

National Telecommunications and Information Administration

14th St. and Constitution Avenue N.W.
Washington, DC 20230
(202) 377-1551

The National Telecommunications and Information Administration develops telecommunications policy for the executive branch; manages federal use of radio spectrum; conducts technical research on radiowave transmissions and other aspects of telecommunications; serves as information source for federal and state agencies on the efficient use of telecommunications resources.

Department of the Interior

The Bureau of Land Management of the Department of Interior oversees the use of 360 million acres of "public domain" lands, those lands not under the domain of the USDA Forest Service. Broadcaster use of these lands for transmitter sites is coordinated by the State Director of the Bureau of Land Management.

Topographic Maps

Topographic maps usually used in prediction of coverage and other engineering studies requiring accurate information about the position and elevation of terrain features may be obtained from the U. S. Geological Survey (USGS), a bureau of the U. S. Department of the Interior. Standard topographic quadrangles on a scale of 1:24,000 (7.5 minutes) or 1:62,500 (15 minutes) are usually used, but other scale maps are available. To order free map indexes or to purchase maps, contact one of the following offices.

For areas east of the Mississippi River (including Minnesota, Puerto Rico, and the Virgin Islands:

Eastern Distribution Branch
U.S. Geological Survey
1200 S. Eads Street
Arlington, VA 22202

For areas west of the Mississippi River (including Alaska, Hawaii, Louisiana, Guam, and Samoa:

Western Distribution Branch
U.S. Geological Survey
Box 25286, Federal Center
Denver, CO 80225

Department of Labor

200 Constitution Ave., N.W.
Washington, DC 20210
(202) 523-6666

Broadcast engineers should be aware that two federal laws, the Fair Labor Standards Act and the Occupational Safety and Health Act, empower the Department of Labor (DOL) to regulate work place safety standards and wages and hours of employment of broadcast employees. Occupational safety standards are enforced by OSHA, the Occupational Safety and Health Administration of DOL, while the minimum wage and hours of employment are enforced by DOL's Wage and Hour Division.

Applicability of OSHA and Wage and Hour Division regulations depend upon many factors such as the station's geographic location, the number of station employees and the type of work they perform; so, broadcast engineers should consult their station's attorney to determine what regulations apply to them and how to abide by them.

Department of Transportation

Federal Aviation Administration

400 7th Street, S.W.
Washington, DC 20590
(202) 426-4000

When construction of a new broadcast tower, or a change in height of a existing tower, is proposed, the Federal Aviation Administration (FAA) becomes involved to study the potential impact that the proposed structure may have on navigable airspace. Broadcasters are required to notify the FAA of proposed new or modified tower structures. The FAA than applies its obstruction standards (Part 77 of the FAA Rules) to determine whether or not the tower constitutes a hazard to navigable airspace. Broadcasters may need to accommodate an adverse finding by the FAA with a modified tower location and or tower height. FAA clearance of a proposed tower specifies the lighting and marking requirement, which are then included on the FCC construction permit. See Part 17 of the FCC Rules and Section 2 of this *Handbook*.

Environmental Protection Agency

401 M Street, S.W.
Washington, DC 20460
(202) 382-2090

When broadcasters construct station facilities such as antenna towers or large satellite earth stations they should be aware that these activities may fall under the scope of the National Environmental Protection Act (NEPA). NEPA grants the Environmental Protection Agency (EPA) authority to regulate activities which may affect the "quality of the human environment." The FCC cooperates with EPA in enforcing provisions of NEPA that relate to telecommunication licensees.

The FCC monitors construction of telecommunications facilities and requires information about the operation of transmitters and other broadcast equipment. For example, the FCC, with the assistance of EPA, monitors the level of employee and general public exposure to nonionizing radiation emitted from the equipment. Generally, licensees who propose to construct such facilities must file studies of the potential environmental consequences with the FCC and may be required to take steps to minimize possible environmental hazards.

Federal Communications Commission

1919 M St. N.W.
Washington, DC 20554

For information on the Federal Communications Commission refer to chapters 1.1 and 1.2.

Every station should have an up-to-date copy of the FCC's broadcast rules. There are two ways to obtain them:

1. Order a set of the Code of Federal Regulations (CFR) issued annually by the U.S. Government Printing Office. Call them at (202) 783-3238 and order "47 CFR Parts 0-19" for the Tower Regulations in part 17 and "47 CFR Parts 70-79" for the Broadcast Rules Part 73 and Broadcast Auxiliary Rules Part 74.

The CFRs may also be ordered by writing the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

2. For a continuously updated subscription, call the Rules Service Company at (301) 424-9402. Parts 17,73 and 74 in loose-leaf (updated quarterly) form. Or write them at 7658 Standish Place, Suite 106, Rockville, MD 20855.

National Labor Relations Board

1717 Pennsylvania Avenue, N.W.
Washington, DC 20570
(202) 254-9044

Broadcast engineers should also be aware that the National Labor Relations Act (NRLA) protects the right of station employees to bargain collectively with management over the "terms and condition of employment." The National Labor Relations Board (NLRB), an independent federal agency, was established to enforce the right of workers to organize and engage in " concerted activity." As with the DOL regulations, the extent of these rights depends upon many factors such as the type and the number of employees involved.

STATE AND LOCAL GOVERNMENTS

A number of aspects of a broadcast engineer's job are affected or controlled by state or local governmental bodies. It is important for the engineer to have some familiarity with the laws, codes and zoning ordinances governing such matters as building construction, electrical wiring, and fire safety. Many such considerations are, or should be, obvious, but some are not and others are often overlooked. Furthermore, regulations may vary from one community to another, even within the same state or county.

While there are model national codes, these codes may or may not be adopted by a state or local government. If adopted, there may be some changes from the national model. The only way to determine definitely is to check with the local agency or agencies having jurisdiction over the matter in question. For more information on state or local regulations see the following:

The station's local lawyer,

The local business licensing office,

Building inspector, fire marshall,

A licensed local contractor who does the type of work in question.

TRADE ASSOCIATIONS

Association of Federal Communications Consulting Engineers (AFCCE)

The AFCCE is a professional association of communications engineers practicing before the Federal Communications Commission. Engineering for broadcast stations in the AM, FM and TV services, for microwave, cellular radio, and paging systems, and for satellite facilities are some of the areas in which AFCCE members offer their professional services. Full members of the AFCCE are registered Professional Engineers in the jurisdictions wherein they practice.

Association of Maximum Service Telecasters (MST)

1735 DeSales Street, N.W. Suite 400
Washington, DC 20036
(202) 347-5412

The purpose of MST is to assure the maintenance and development of an effective nationwide system of free over-the-air television based on local broadcast stations providing service of high technical quality. MST seeks to meet both present and future needs of developing an effective nationwide VHF and UHF system; to provide free over-the-air broadcasting; to develop local stations to reflect the needs and interests of local communities; to safeguard against broadcast of only a few purely national voices; to protect against interference and degradation of the public's broadcast service. MST develops and preserves opportunities for local stations to use new technologies.

Advanced Television Systems Committee (ATSC)

1771 N Street, N.W.
Washington, DC 20036
(202) 429-5345

The Advanced Television Systems Committee (ATSC) was established in 1983 to develop and coordinate voluntary national technical standards for advanced television systems, and to recommend to the U.S. Department of State positions for the United States within international standards organizations such as the International Radio Consultative Committee (CCIR).

The ATSC is composed of fifty member companies, all of which are major factors within the United States television industry. These members include broadcast networks and stations, cable television companies, program producers, professional and consumer equipment manufacturers, and satellite communications companies.

Electronic Industries Association (EIA)

2001 Eye Street, N.W.
Washington, DC 20006
(202) 457-4900

The Electronic Industries Association is a trade association representing the manufacturers of telecommunications, industrial and consumer equipment; components (parts, tubes and solid state products); equipment and systems for the government. Their engineering activity includes the publication of voluntary standards. Those of interest to broadcasters are TV test charts and standards covering transmitters, towers, microwave transmission systems and tape cartridges. The standards work is primarily done in the Broadcast Television Systems Committee and engineering committees of the Telecommunications Group: the catalog of standards and engineering publications may be obtained from:

Standards Sales Department
Electronic Industries Association
2001 Eye Street, N.W.
Washington, DC 20006
(202) 457-4966

A selection of EIA voluntary standards of interest to broadcast engineers is given below along with the date of acceptance or reaffirmation. Interested readers should contact EIA for a current listing and price list.

RS-189-A Encoded Color Bar Signal. 1976

RS-200-A Circular Waveguides. 1975

RS-211-D Processed Analog Disc Records and Reproducing Equipment. 1981

RS-215 Basic Requirements for Broadcast Microphone Cables. 1958

RS-219 Audio Facilities for Radio Broadcasting. 1959

RS-221-A Polarity or Phase of Microphones for Broadcasting, Recording and Sound Reinforcement. 1979

RS-222-C Structural Standards for Steel Antenna Towers and Antenna Supporting Structures. 1976

RS-224 Magnetic Recording Tapes. 1959

RS-225 Rigid Coaxial Transmission Lines. 1975

RS-232-C Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Exchange. 1981

RS-238-B Standards for Stylus Tips Used for Disc Phonograph Reproducing. 1981

RS-240 Electrical Performance Standards for Television Broadcast Transmitters, Channels 2-6, 7-13, 14-83. 1961

RS-250-B Electrical Performance Standards for Television Relay Facilities. 1977

RS-258 Semi-flexible Air Dielectric Coaxial Cables and Connectors. 1962

RS-261-B Rectangular Waveguides. 1979

RS-264 Magnetic Recording Tape Cartridge Dimensions. 1962

RS-288 Audio Magnetic Playback Characteristic at 7½ IPS. 1963

RS-295 Disc Recording Characteristic. 1973

RS-297-A Cable Connectors for Audio Facilities for Radio Broadcasting. 1970

RS-386 Recommended Measurement Method for Phonograph Rumble. 1978

RS-455 Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices. 1980

RS-462 Electrical Performance Standards for Television Broadcast Demodulators. 1979

TR-101-A Electrical Performance Standards for Standard Broadcast Transmitters. 1948

TR-107 Electrical Performance Standards for FM Broadcast Transmitters. 1949

TR-117 Antennas and Combinations of Antennas for FM Broadcasting Stations. 1949

National Association of Broadcasters (NAB)

1771 N Street, N. W.
Washington, DC 20036
(202) 429-5300

The NAB represents the broadcasting industry before Congress, the courts, regulatory agencies, at the White House and before the general public. They serve a membership of over 4,000 radio and 880 television stations including all the major networks.

The Science and Technology department provides technical support to other NAB departments, prepares engineering statements and presentations for comment on FCC-related issues, and provides technical services to members. Their services include the monthly *Engineering Report, Equipment Clearinghouse* which lists used equipment for sale, plus special engineering bulletins, studies, conferences and meetings. The department also participates in industry standards committee activities and conducts special projects and investigations.

NAB Direct Dial Reference List (All numbers are Area Code 202 except toll-free as noted)

Employment/Minority Services 429-5497
Government Relations 429-5301
Government Relations Hotline .(800) 424-8806
Legal 429-5430
Library and Information Center 429-5490
President's Office 429-5444
Radio 429-5420
Radio Membership 429-5400
Research and Planning 429-5380
Science and Technology 429-5346
TV/TV Membership 429-5362
Billing .....(800) 626-5542
Publications .....(800) 368-5644
Insurance Information .....(800) 368-5644

Engineering Publications of the National Association of Broadcasters

- *AM Technical Improvement Bibliography*
- *Earth Station Planning*
- *Broadcast Engineering Conference Proceedings* (Published annually at the Conference; current year and back issues for some years available.)
- *NAB Standard Magnetic Tape (Reel to Reel) Recordings and Reproductions*
- *NAB Standard Audio Cassette Recordings and Reproductions*
- *NAB Standard Cartridge Tape Recordings and Reproductions*
- *NAB Standard Disc Recordings and Reproductions*
- *NAB Test Record*
- *AM Ground Wave Field Strength vs Distance Graphs* (metric complete set)
- *AM Ground Wave Field Strength vs Distance* (metric graph paper)

National Cable Television Association (NCTA)

1724 Massachusetts Avenue N.W.
Washington, D.C. 20036
(202) 775-3550

The National Cable Television Association (NCTA) is the major trade association for the cable industry. They represent the cable television industry before Congress and Federal Agencies, in the courts and before state regulatory agencies. Members comprise over 400 cable operating companies and over 600 equipment manufacturers, programmers and service companies.

PROFESSIONAL ASSOCIATIONS

Institute of Electrical and Electronic Engineers (IEEE)

Broadcast Technology Society

Institute of Electrical and Electronic Engineers
345 East 47th Street
New York, NY 10017
(212) 705-7900

Members of the IEEE include engineers and scientists in electrical engineering, electronics, and allied fields as well as over 30,000 students. The IEEE holds numerous meetings and special technical conferences, conducts lecture courses at the local level on topics of current engineering and scientific interest, assists student groups, and awards medals, prizes, and scholarships for outstanding technical achievement. They also sup-

port the Engineering Societies' Library in New York City with other groups.

The boards include Awards, Educational Activities, Publications, Regional Activities, Technical Activities, U.S. Activities Board. Societies of interest to broadcasters include Acoustics, Speech and Signal Processing; Aerospace and Electronic Systems, Antennas and Propagation, Broadcast, Cable and Consumer Electronics, Circuits and Systems, Communications Computer Control Systems, Education, Electrical Insulation, Electromagnetic Compatibility; Electron Devices; Industrial Electronics; Instrumentation and Measurement, Microwave Theory and Techniques, Power Engineering, Professional Communications.

Publications of the IEEE include the *Proceedings*, monthly; *Spectrum*, monthly; *Directory*, annually; Standards, irregular; the Societies and Councils publish 42 journals, 8 magazines, and 125 conference proceedings.

IEEE publishes a number of voluntary standards and practices affecting broadcasting. A few of those are listed below. For a current listing and prices, contact IEEE.

152 Recommended Practice for Volume Measurements of Electrical Speech and Program Waves. 1971 (Ask about revision with PPM.)

153 Standard Definitions of Terms Relating to Television. 1979

202 Standards on Television: Methods of Measurement of Aspect Ratio and Geometric Distortion. 1972

205 Standards on Television: Measurement of Luminance Signal Levels. 1972

206 Standards on Television: Measurement of Differential Gain and Differential Phase. 1978

208 Standards on Video Techniques: Measurement of Resolution of Camera Systems, 1961. 1978

511 Standard on Video Signal Transmission: Measurement of Linear Waveform Distortion. 1979

Society of Broadcast Engineers, Inc. (SBE)

7002 Graham Rd., Suite 118
Indianapolis, IN 46220
(317) 842-0836

The Society of Broadcast Engineers, Inc. (SBE) encourages the professional development of its members who include broadcast engineers, students, and broadcast professionals in closely allied fields. It also provides information exchange.

The SBE administers a certification program, recognizing four levels of engineering achievement.

1. Broadcast Technologist
   This certification can be obtained in either two ways:
   By achieving a passing grade on the proficiency examination. There is no experience requirement to be eligible for the examination.
   By holders of a valid FCC First Class (not general) Operator license with either two years of continuous satisfactory service in broadcast engineering prior to the date of application, or a total of three out of last five years of satisfactory service in broadcasting.
2. Broadcast Engineer
   The candidate must have had five years of suitable experience in broadcast engineering, and achieve a passing grade on the proficiency examination.
3. Senior Broadcast Engineer
   The candidate must have had ten years of responsible experience in broadcast engineering, and achieve a passing grade on the proficiency examination.
4. Twenty Year Certification
   The candidate must have had twenty years of professional broadcast engineering experience. Also, the candidate must be recommended by a certified Senior Broadcast Engineer, have at least one additional reference from a certified Senior Broadcast Engineer, and a reference from at least one person who has supervised his or her work.

For more information on Certification you can write:

Certification Secretary
Society of Broadcast Engineers
P.O. Box 50844
Indianapolis, IN 46220
(317) 842-0836

For information on the SBE Frequency Coordination Program see section 1.3. of this *Handbook*.

Society of Motion Picture and Television Engineers (SMPTE)

826 Scarsdale Avenue,
Scarsdale, NY 10583
(914) 472-6606

The membership of SMPTE is comprised of professional engineers and technicians in motion pictures, television, and allied arts and sciences. The society advances engineering technology, disseminates scientific information, and sponsors lectures, exhibitions, and conferences to advance the theory and practice of engineering. They also develop standards for motion pictures, television, and optical and magnetic recording and sponsor standards promulgated by the American National

Standards Institute. For copies of SMPTE standards contact their standards subscription service.

SMPTE also makes available visual and sound test films for use as standardized measuring tools and organizes and sponsors technical courses at universities on such subjects as sound techniques, laboratory processing, and film handling for television station technicians. The society presents eight annual awards for outstanding contribution to motion pictures and television.

SMPTE Committees include: Audio Recording and Reproduction Technology; Educational, Industrial and Consumer Film Technology and Applications; Film Technology; Laboratory Services Technology; Theatrical Projection Technology and Applications; Video Recording and reproduction Technology. Publications of the society include the *Journal* and various standards, recommended practices and engineering guidelines.

RELATED ORGANIZATIONS

American National Standards Institute (ANSI)

655 15th Street, N.W., Suite 300
Washington, DC 20005
(202) 639-4090

Members include industrial firms, trade associations, technical societies, labor organizations, consumer organizations, and government agencies. ANSI serves as the clearinghouse for nationally-coordinated voluntary safety, engineering and industrial standards. The institute gives status as American National Standards to standards developed by agreement from all groups concerned, in such areas as: definitions, terminology, symbols and abbreviations; materials, performance characteristics, procedure and methods of rating, methods of testing and analysis; size, weight, volume, and rating; practice, safety, health, and building construction. They also provide information on foreign standards and represent United States' interests in international standardization work. The ANSI committee is Certification. The Councils are: Company Member, Consumer, Executive Standards, International Standards, Organizational Member. Publications of the institute are the *Reporter*, biweekly; *Standards Action*, biweekly; *Catalog of Standards*, published annually.

American Radio Relay League (ARRL)

225 Main Street
Newington, CT 06111
(203) 666-1541

Members are licensed amateur radio operators in the U.S. and Canada and others interested in amateur radio, communication, and experimentation. The league operates a nationwide message handling network, the National Traffic System, with members serving as official relay stations, observers, phone stations, emergency coordinators, experimental stations, and bulletin stations. They operate an experimental equipment laboratory and maintain the Museum of Amateur Radio. They also sponsor contests and present awards for operating proficiency. ARRL serves as secretariat for International Amateur Radio Union. Publications include *QST*, monthly and *Radio Amateur's Handbook*, annually as well as special booklets for beginners and others on antennas and mobile and radio fundamentals.

Association for Broadcast Engineering Standards (ABES)

2000 M St., N.W., Suite 600
Washington, DC 20036
(202) 331-0606

An independent, nongovermental, voluntary organization of licensees and permittees of U.S. radio broadcast stations "united to assist the appropriate government authorities and the industry in assuring optimum radio service for the people of the United States and to follow the intent of Congress in the Communications Act of 1934, as amended." Objectives include: "rejecting and opposing proposals which would decrease, impair, or destroy the radio service now available to the American people; and supporting the adoption of legislature and Federal Communications Commission policies that encourage sound technical standards upon which optimum radio service may be obtained." Analyzes proposed broadcast legislation, FCC proposals for rule making, and industry proposals filed with the FCC that will, directly or indirectly, affect the public interest in optimum radio service. The association formulates and conducts short and long range programs of technical research to assist governmental and industrial groups in maintaining sound technical standards.

Audio Engineering Society (AES)

60 East 42nd Street, Room 449,
New York, NY 10017
(212) 661-8528

Members include engineers, administrators, and technicians who design or operate recording and reproducing equipment for radio, television, motion picture and recording studios, or who produce, install, and operate disc, magnetic tape, and sound amplifying equipment; educators who use recording in teaching, or who teach acoustics, electronics, and other sciences basic to the record-

ing and reproducing of sound; administrators, sales engineers, and technicians in the sound industry and related fields.

Broadcast Education Association (BEA)

National Association of Broadcasters
1771 N Street, N.W.
Washington, DC 20036
(202) 429-5355

Primarily directed by those in the academic community, its orientation is toward exploring new trends, ideas, and opportunities in broadcasting. Publishes *Journal of Broadcasting and Electronic Media* and *Feedback*. They also administer the Patterson Radio Scholarship and the Harold E. Fellows Memorial Scholarship.

Illumination Engineering Society of North America (IES)

345 E. 47th St.
New York, NY 10017
(212) 705-7926

This is a technical society whose members include engineers, architects, designers, educators, students, contractors, distributors, utility personnel, scientists, and manufacturers dealing with the art or science of illumination. They provide assistance with technical problems, reference help, and speakers. They maintain liaison with schools and colleges and offer basic and advanced IES Lighting Courses through local sections and in cooperation with other organizations.

Underwriters Laboratories (UL)

333 Pfingsten Rd.
Northbrook, IL 60062
(312) 272-8800

A testing laboratory that maintains additional laboratories in Melville, NY, Santa Clara, CA, and Tampa, FL. "By scientific investigation, study, experiments and tests to determine the relation of various materials, devices, products, equipment, constructions, methods and systems to hazards appurtenant thereto or to the use thereof affecting life and property, and to ascertain, define and publish standards, classifications, and specifications for materials, devices, products, equipment, construction, methods, and systems affecting such hazards, and other information tending to reduce loss of life and property from such hazards."

BROADCAST ENGINEERING AND RELATED PERIODICALS

ABU (Asian Pacific Broadcast Union) Review

NHK Broadcasting Centre
2-2-1 Jinnan
Shibuyaku
Tokyo, Japan

Audio

1515 Broadway
New York, NY 10036

BM/E (Broadcast Management/Engineering)

295 Madison Avenue
New York, NY 10017
(212) 685-5320

BM/E's World Broadcast News

295 Madison Avenue
New York, NY 10017

Broadcast Engineering

P.O. Box 12901
Overland Park, KS 66212
(913) 888-4664

EBU (European Broadcast Union) Review

Brussels edition
European Broadcasting Union Technical Centre
Avenue Albert Lancaster 32
B-1180 Brussels, Belgium

Electronic Media

Crain Communications Inc.
740 North Rush Street
Chicago, Il 60611

Electronic News

Fairchild Publications
7 East 12th Street
New York, NY 10003

Proceedings of the IEEE

Institute of Electrical & Electronics Engineers
345 E. 47th Street
New York, NY 10017
(212) 705-7900

IEEE Transactions on Broadcasting

Institute of Electrical & Electronics Engineers
345 E. 47th Street
New York, NY 10017
(212) 705-7900

Journal Of The Audio Engineering Society

60 East 42nd Street
New York, NY 10165
(212) 661-2355

Microwaves and RF
10 Mullholland Drive
Hasbrouck Heights, NJ 07604
(201) 393-6000

Pro Sound News
220 Westbury Avenue
Carle Place, NY 11514

QST
225 Main Street
Newington, CT 06111

Radio-Electronics
200 Park Avenue South
New York, NY 10003
(212) 777-6400

Radio World
5827 Columbia Pike, Suite 310
Falls Church, VA 22041

Recording Engineer/Producer
Gallay Communications Inc.
1850 Whitley Suite 220
Hollywood, CA 90028

SMPTE Journal
Society of Motion Picture and Television Engineers
862 Scarsdale Avenue
Scarsdale, NY 10583

Studio Sound and Broadcast Engineering
Link House
Dingwall Avenue
Croydon CR9 2TA, Great Britain

Television Broadcast
Globecom Publishing Limited
4551 W. 107th Street, Suite 210
Overland Park, KS 66207

TV Digest
475 Fifth Avenue
New York, NY 10017
212-686-5410

TV/Broadcast Communications
4551 W. 107th Street, Suite 210
Overland Park, KS 66207
(913) 642-6611

Television Technology
5827 Columbia Pike, Suite 310
Falls Church, VA 22041
(703) 998-7600

Video Systems
P.O. Box 12901
Overland Park, KS 66212
(913) 888-4664

BROADCAST ABBREVIATION REFERENCE LIST

(Compiled by John Reiser, Mass Media Bureau, FCC.)

AA	Average Audience
ABES	Association for Broadcast Engineering Standards
ACC	Automatic Chrominance (or Contrast) Control
ACE	American Cinema Editors
ACSB	Amplitude Compandored Sideband
ACTS	All-Channel Television Society
ACTS	Association of Cable Television Suppliers
ACTVA	American Community TV Association
ACU	Antenna Coupling Unit
ADC	Analog-to-Digital Converter
ADS	Alpha Delta Sigma (Advertising Fraternity)
AER	Alpha Epislon Rho—College Broadcast Fraternity
AES	Audio Engineering Society
AF	Audio Frequency
AFC	Automatic Frequency Control
AFCCE	Association of Federal Communications Consulting Engineers
AFN	Armed Forces Network
AFRTS	American Forces Radio & Television Service
AFT	Automatic Fine Tuning
AFTRA	American Federation of Television & Radio Artists
AFTRCC	Aerospace Flight Test Radio Coordinating Council
AGC	Automatic Gain Control
AID	Arbitron Information on Demand
AIM	Accuracy in Media
AITS	Association of Independent Television Stations
ALC	Automatic Level Control
ALJ	Administrative Law Judge
ALPTVA	American Low Power TV Association
AMOL	Automated Measurement of Lineup
AMST	Association of Maximum Service Telecasters
ANSI	American National Standards Institute
AOR	All Over the Road (undefined program format)
AOR	Album Oriented Rock (program format)
APA	Administrative Procedures Act
APL	Average Picture Level
ARCH	Automatic Remote Cassette Handler

ASC	American Society of Cinematographers
ASCAP	American Society of Composers Authors and Publishers
ATFP	Alliance of Television & Film Producers
ATS	Applications Technology Satellite
ATS	Automatic Transmission System
ATSC	Advanced Television Systems Committee
ATU	Antenna Tuning Unit
AWG	American Wire Gauge
AWRT	American Women in Radio & Television
BBC	British Broadcasting Corporation
BEA	Broadcast Education Association
BET	Black Entertainment Television
BFM	Broadcast Financial Management Association
BIAC	Broadcast Interassociation Council
BIB	Board for International Broadcasting
BICIAP	Broadcasting Industry Council to Improve American Productivity
BMI	Broadcast Music Incorporated
BOC	Bell Operating Company
BRC	Broadcast Rating Council—See EMRC
C/CS	County Coverage Service
CAB	Canadian Association of Broadcasters
CAMS	Cable Audience Measurement Study
CARS	Community Antenna Relay Service
CATA	Community Antenna Television Association
CBA	Community Broadcasters Association
CBC	Canadian Broadcasting Corporation
CC	Closed-Captioned
CCB	FCC Common Carrier Bureau
CCD	Charge Coupled Device Camera
CCIR	International Radio Consultative Committee
CCSB	Clear Channel Broadcasting Service
CCTA	Canadian Cable Television Association
CCTV	Closed Circuit Television
CD	Compact Disk (Audio Recordings)
CE	Chief Engineer (Chief Station Operator)
CFR	Code of Federal Regulations
CHR	Contemporary Hit Radio (Format)
CHUT	Cable Households Using Television
CIRT	Mexican Association of Broadcasters
CLI	Cumulative Leakage Index
CODEC	Coder, Decoder (digital)
CONTAM	Committee on Nationwide Television Audience Measurement
CP	Construction Permit
CPB	Corporation for Public Broadcasting
CPCS	Common Program Control Station for EBS
CRT	Copyright Royalty Tribunal
CRT	Cathode Ray Tube (video monitor)
CRTC	Canadian Radio Television & Telecommunications Commission
CS	Close Shot (in video or film production)
CTAM	Cable Television Administration & Marketing Society
CTS	Communications Technology Satellite
CU	Close Up Shot (in video or film production)
CUB	Council for UHF Broadcasters
CUME	Cumulative Audience
CWA	Communications Workers of America
DA	Directional Antenna
DA	Distribution Amplifier
DAC	Digital-to-Audio Converter
DAF	Demographic Adjustment Factor
DATS	Digital Audio Transmission Service
DB	Delayed Broadcast
DBA	Daytime Broadcasters Association
DBS	Direct Broadcast Satellite
DBSA	Direct Broadcast Satellite Association
DMA	Designated Market Area
DRAW	Direct Read After Write (Optical Data Disk)
DTTR	Digital Television Tape Recorder
DVE	Digital Video Effects
EAN	Emergency Action Notification
EBR	Electron Beam Recording
EBS	Emergency Broadcast System
EBU	European Broadcasting Union
ECU	Extreme Close-up Shot (in video or film production)
EEPA	Electromagnatic Energy Policy Alliance
EFP	Electronic Field Production
EIA	Electronic Industries Association
EMP	Electro-Magnetic Pulse
EMRC	Electronic Media Rating Council
ENG	Electronic News Gathering
EPA	Environmental Protection Agency
EPM	Equipment Performance Measurements
ERP	Effective Radiated Power

ETV	Educational Television
FCBA	Federal Communications Bar Association
FCC	Federal Communications Commission
FDM	Frequency Division Multiplex
FEMA	Federal Emergency Management Agency
FET	Field Effect Transistor
FMX	FM Extended-Range Transmission System
FNG	Film News Gathering
FOB	FCC Field Operations Bureau
FOIA	Freedom of Information Act
FSK	Frequency Shift Keying
GAO	General Accounting Office
GPO	Government Printing Office
HAAT	Height Above Average Terrain
HASL	Height above Mean Sea Level
HDTV	High Definition Television
HID	High Intensity Discharger (for lighting lamps)
IAAB	Inter-American Association of Broadcasters
IATSE	International Alliance of Theatrical Stage Employees
IBA	Independent Broadcasting Authority
IBEW	International Brotherhood of Electrical Workers
IBS	Intercollegiate Broadcasting System
ICPM	Incidental Carrier Phase Modulation
ICR	Inter-City Relay Station
ICTV	Independent Community Television Alliance
ID	Station Identification
IEEE	Institute of Electrical and Electronics Engineers
IFB	Interruptable Feedback (Remote Pickup System)
IFRB	International Frequency Registration Board
IHF	Institute of High Fidelity
INTELSAT	International Telecommunications Satellite Organization
INTV	Association of Independent Television Stations
IPA	Intermediate Power Amplifier
IRAC	Interdepartmental Radio Advisory Committee
IRE	Institute of Radio Engineers (now IEEE)
IRTS	International Radio and Television Society
IRTV	International Radio & Television Foundation
ISDN	Integrated Services Digital Network
ITFS	Instructional Television Fixed Service
ITNA	Independent Television News Association
ITU	International Telecommunications Union
JCIC	Joint Council on Intersocietal Coordination
LED	Light Emitting Diode
LFCC	Local Frequency Coordinating Committee
LNA	Low Noise Amplifier
LPTV	Low Power Television
LS	Long Shot (in video or film production)
MAC	Multiplex Analog Component (TV Transmission)
MCR	Master Control Room
MTS	Multi-channel Television Sound
MCU	Medium Close-Up Shot (in video or film production)
MDS	Multipoint Distribution Service
MEOV	Maximum Expected Operating Value
MERPS	Multiple Event Record & Playback System
MLS	Medium Long Shot (in video or film production)
MMB	FCC Mass Media Bureau
MMDS	Multichannel-Multipoint Distribution Service
MNA	Multi-Network Area
MO&O	Memorandum Opinion and Order
MOP	Minute of Program
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MSO	Multiple System Operator (CATV)
MST	Association of Maximum Service Telecasters
MUSE	Multiple Sub-Nyquist Sampling Encoding (for TV)
NAB	National Association of Broadcasters
NABA	North American Broadcast Association
NABET	National Association of Broadcast Employees and Technicians
NABOB	National Association of Black-Owned Broadcasters
NABTS	North American Broadcast Teletext Standard
NAC	National Audience Composition
NAITPD	National Association of Independent TV Producers and Distributors
NAL	Notice of Apparent Liability
NAPTE	National Association of Television Program Executives
NAPTS	National Association of Public Television Stations

NARAS	National Academy of Recording Arts and Sciences
NARBA	North American Radio Broadcasting Agreement
NARTE	National Association of Radio & Television Engineers
NARUC	National Association of Regulatory Utility Commissioners
NASB	National Association of Spanish Broadcasters
NATAS	National Academy of Television Arts & Sciences
NBN	National Black Network
NCFM	Noncommercial FM
NCTA	National Cable Television Association
NEMO	Remote Broadcast—Not Emminating from Main Office
NHK	Japan Broadcasting Corporation
NIAC	National Industry Advisory Committee (EBS)
NILPTV	National Institute for Lower Power TV
NOI	Notice of Inquiry
NPACT	National Public Affairs Center for Television
NPR	National Public Radio
NPRM	Notice of Proposed Rule Making
NRB	National Religious Broadcasters
NTA	National Translator Association
NTIA	National Telecommunications and Information Administration
NTSC	National Television System Committee
OB	Outside Broadcast
OFS	Operational Fixed Service
OIRT	International Radio and Television Organization
OMD	FCC Office of Managing Director
OPP	FCC Office of Plans and Policy
OROM	Optical Read Only Memory (for data storage)
OSHA	Occupational Safety and Health Administration
OST	FCC Office of Science and Technology
PA	Power Amplifier
PAL	European Color Television System
PBS	Public Broadcasting Service
PCM	Pulse Code Modulation
PDM	Pulse Duration Modulation
PDT	Published Data Tapes
PLL	Phase Locked Loop
PLP	Presentation Level Protocol
PLT	Private Line Telecommunications Circuit
POV	Point of View (shot in video or film production)
PPM	Peak Program (level) Indicator
PRB	FCC Private Radio Bureau
PSA	Presunrise Service Authorization
PSK	Phase Shift Keying
PSRA	PreSunrise Authority
PSSA	Post Sunset Authority
PSSC	Public Service Satellite Consortium
PTAR	Prime Time Access Rule
PTV	Public Television
QPSK	Quadrature Phase Shift Keying
R&F	Reach & Frequency
RARC	Regional Administrative Radio Conference
RCC	Radio Common Carrier
RCL	Remote Control Location
RDD	Random Digital Dialing (for audience surveys)
RFA	Regulatory Flexibility Act
RFE	Radio Free Europe
RFI	Radio Frequency Interference
RFR	Radio Frequency Radiation
RGB	Red-Green-Blue Color Monitor Signal
RIAA	Recording Industry Association of America
RMS	Root Mean Square
RNA	Radio Network Association
RO	Receive-Only Earth Terminal
RP	Restricted Radiotelephone Operator Permit
RPU	Remote Pickup
RSS	Root Sum Square
RTNDA	Radio & Television News Directors Association
SAP	Second Audio Program on TV Subcarrier
SBE	Society of Broadcast Engineers
SCA	Subsidiary Communications Authority
SCPC	Single Channel per Carrier
SCTE	Society of Cable Television Engineers
SECAM	French and Russian Color Television System
SECC	State Emergency Communications Committee (for EBS)
SH	Specified Hours (Licensed hours of operation)
SIA	Storage Instantaneous Audimeter
SID	Source Identification Signal (in TV VBI)
SIU	Sets in Use
SMA	Special Market Area
SMATV	Satellite Master Antenna Television System
SMPTE	Society of Motion Picture and Television Engineers
SMSA	Standard Metropolitan Statistical Area
SNG	Satellite News Gathering

SOF	Sound on Film
SPACE	Society for Private & Commercial Earth Stations
STA	Special Temporary Authority
STC	Satellite Television Corp.
STL	Studio Transmitter Link
STV	Subscription Television
STVA	Subscription Television Association
SWARC	Satellite World Radio Conference
T/R	Transmit—Receive Earth Terminal
TARPAC	Television & Radio Political Action Committee
TARPEC	Television and Radio Political Education Committee
TASO	Television Allocations Study Organization
TBC	Time Base Corrector
THD	Total Harmonic Distortion
TIO	Television Information Office
TMC	Time Multiplex Component Video
TOC	Television Operator Council
TPO	Transmitter Power Output
TSL	Transmitter to Studio Link
TVB	Television Bureau of Advertising
TVI	Television Reception Interference
TVROTV	Receive-only Satellite Earth Terminal
UHF	Ultra High Frequency
USIA	United States Information Agency
VAR	Video to Audio Carrier Ratio
VBI	Vertical Blanking Interval
VBIC	Vertical Blanking Interval Code
VCR	Video Cassette Recorder
VHF	Very High Frequency
VIRS	Vertical Interval Reference Signal
VITC	Vertical Interval Time Code
VITS	Vertical Interval Television Signal
VOA	Voice of America
VSWR	Voltage Standing Wave Ratio
VTR	Video Tape Recorder
VU	Volume Unit (measurement of program level)
WARC	World Administrative Radio Conference
WHCAA	White House Communications Agency
WIC	Women in Cable
WICI	Women in Communications, Inc.
WPFC	World Press Freedom Committee
WST	World System Teletext