

THE INTERNATIONAL RADIO CONSULTATIVE COMMITTEE (CCIR)
ITS ROLE, FUNCTION AND INFLUENCE ON THE
DISTRIBUTION OF TIME AND FREQUENCY INFORMATION

Hugh S. Fosque
Chairman, U.S. CCIR Study Group 7
NASA Headquarters
Washington, D.C.

ABSTRACT

There are several organizations which play a role in the international coordination of frequency and time, and act to promote cooperation between nations in the standardization and regulation of frequency and time dissemination on a worldwide basis. Since dissemination methods depend predominantly on transmission of information by radio which does not recognize national boundaries, international organizations whose function is regulating the use of radio transmissions affect the way in which time and frequency information is promulgated between countries. The dominant international bodies dealing with radio transmission regulations are the International Telecommunications Union (ITU) and its advisory arm on technical matters, the International Radio Consultative Committee (CCIR). This paper will describe how the worldwide coordination of frequency and time is affected by the functions of the CCIR in its role of advising the ITU and the extent to which the workings of the CCIR influence frequency and time activities on a national and international basis.

INTRODUCTION

While not the only method, radio transmissions are the principal worldwide dissemination method used to coordinate time and frequency from one location to another. These transmissions transcend national borders and are regulated for the common good of all nations. The principal organizational body dealing with radio regulations is the International Telecommunications Union (ITU), which formulates and administers International Radio Regulations.

The ITU acts on technical matters principally on the advice of its technical advisor, the CCIR. Member nations provide information and advice directly to the ITU on non-technical matters and occasionally on technical issues when CCIR advice to the ITU is contrary to the national interest of a member country.

In order to understand the influence of the CCIR on these matters, it is necessary to review some of the history, background, and influence of its parent organization, the ITU.

THE ITU

The ITU was established in 1885 to provide coordination between countries for international telegraph communication. Today, the organization has about 153 member countries and concerns itself with radio as well as telegraph and telephone regulation. The ITU is affiliated with, but not a part of, the United Nations and maintains permanent offices and a staff of about 300 people in Geneva, Switzerland.

The ITU establishes agreements (regulations) at conferences participated in by its member countries. At about 20 year intervals, a "General World Administrative Radio Conference" (GWARC) is convened. At this meeting, all radio frequency allocation agreements between member nations are reviewed and updated. At more frequent intervals (5 years or so) limited "World Administrative Radio Conferences" (WARC's) are held which have authority only to suballocate the radio frequency spectrum already assigned at a GWARC to a particular service such as Space, Maritime Mobile, Aeronautical, or perhaps Space Broadcasting. The resulting allocation table from WARC meetings has treaty status between ITU member nations and in the U.S. must be ratified by the Senate and signed by the President prior to U.S. adherence to its provisions.

To perform its task of establishing worldwide standards and using these standards to effect regulation of the use of telecommunications between member nations, the ITU has three suborganizations to provide advice, new regulations, and information on current use of established telecommunication channels. These organizations are the International Telephone and Telegraph Consultative Committee (CCITT), the International Frequency Regulation Board (IFRB), and the International Radio Consultative Committee (CCIR). Figure 1 gives an organizational chart of the ITU

and indicates the general functions performed by each of these suborganizations.

THE CCIR

The CCIR provides the technical advice to the ITU on which the Radio Regulations are based. It has permanent offices and a small full-time staff located in Geneva. The CCIR accomplishes its work through international study groups whose meetings are usually held in Geneva. These study groups examine all technical aspects of radio frequency spectrum allocation and use; define technical problems which exist, or may arise, through the use of the radio frequency spectrum; and produce general technical recommendations to the ITU on how to allocate and regulate use of the radio frequency spectrum.

To accomplish CCIR work, international study group meetings are held. Attendees to these meetings are appointed by member countries. The chairmen of the various study groups for these meetings are internationally recognized experts and are elected to their offices at meetings of the CCIR, called Plenary Assemblies. At the Plenary meetings, the CCIR study groups sit as a body of the whole to ratify the work of the individual study groups prior to this advice being passed on to the ITU. The name and general scope of the activities of the CCIR study groups are given in Figure 2.

To see how the CCIR works, refer to Figure 3. Member countries prepare and submit draft papers to the study group meetings, these national proposals are merged into studies and recommendations agreed upon by the international study group as a whole, then papers are circulated to the member nations for further consideration. After two such iterations, the papers are forwarded to the Plenary Assembly meeting of the CCIR. At the Plenary meetings all study groups are represented and each paper is examined. This allows review of the impact of the papers of one study group on another and avoids unexpected interaction between the recommendations of one study group on the work of another group. The coordinated recommendations from the Plenary meetings of the CCIR are then forwarded to the ITU.

UNITED STATES CCIR ACTIVITIES

In the U.S., the State Department serves as the U.S. focal point for policy formulation and dissemination of information relating to both CCIR and ITU and acts as the Head of the U.S. delegation at CCIR international meetings. The U.S. has established a U.S. study group organization which parallels the international study group structure (see Figure 2). The chairmen of the U.S. study groups are appointed by and serve at the pleasure of the State Department.

To accomplish the work of the CCIR in the U.S., an advisory committee has been formed called the National Committee of the CCIR. This committee is chaired by a State Department representative with membership consisting of U.S. CCIR study group chairmen, frequency managers for government departments and agencies, and interested private organizations. This advisory group reviews all U.S. CCIR documents prior to transmission to the CCIR for international consideration, and coordinates activity among U.S. CCIR groups. Figure 4 shows a working schedule of a typical U.S. study group in preparation for the various international CCIR meetings.

CCIR STUDY GROUP 7

The study group which influences frequency and time activities, both nationally and internationally, is Study Group 7. Figure 5 gives the terms of reference of Study Group 7 and the current international radio frequency allocations for frequency and time dissemination. The existing membership of U.S. Study Group 7 indicating the broad interest in its activities is given in Figure 6.

The activities of U.S. CCIR Study Group 7 at this time are in preparation for the next international meeting in January 1978. Work to prepare for this meeting falls into the following general areas:

1. In 1971, the International CCIR Study Group 7 recommended a new system of Coordinated Universal Time (UTC) be adopted and broadcasted by the time and frequency broadcast stations. This system went into effect on January 1, 1972. The new system makes possible the broadcast of the second as determined from atomic frequency standards and at the same time provides information on the earth's rotation rate, UT-1. There is continued work to eliminate problems related to the new UTC

System. Consideration will be given to change should serious problems arise.

2. To preclude misunderstandings due to the language used in CCIR recommendations, Study Group 7 currently has a significant effort underway to define certain important terms in an unambiguous manner.
3. There is mutual interference between standard frequency and time broadcast stations on the 2.5, 5, 10, and 15 MHz frequencies. This problem is accentuated in certain areas such as in Europe, and does cause problems for reception in other parts of the world. Study Group 7 has an interim working party looking into ways to reduce this serious problem.
4. In the last 5 to 10 years, considerable effort has been made to characterize frequency and phase noise of oscillators. This work has been largely successful and, to a very great extent, results of this work have been adopted by a broad spectrum of users including manufacturers of various types of oscillators. It is important for the future that an international standard for characterizing frequency and phase noise be available. In its current activity CCIR Study Group 7 is attempting to define such an international standard.
5. Study Group 7 has continuing effort to study and promote regional synchronization techniques such as the use of TV and other localized emissions.
6. There is a growing need for worldwide synchronization of time to less than 100 nanoseconds. The Study Group is engaged in defining the requirements for and practicality of providing operational systems capable of meeting these needs. For example: In the 1971 Space WARC, Study Group 7 proposed an allocation for two types of time synchronization service using earth orbiting satellites. These proposals were successful and resulted in a standard frequency and time service allocation at 400.1 MHz for one way broadcasts and allocation of 4202 and 6427 MHz for a two-way synchronization system. In view of the fact that the upcoming GARC in 1979 may not be repeated for 20 years and in

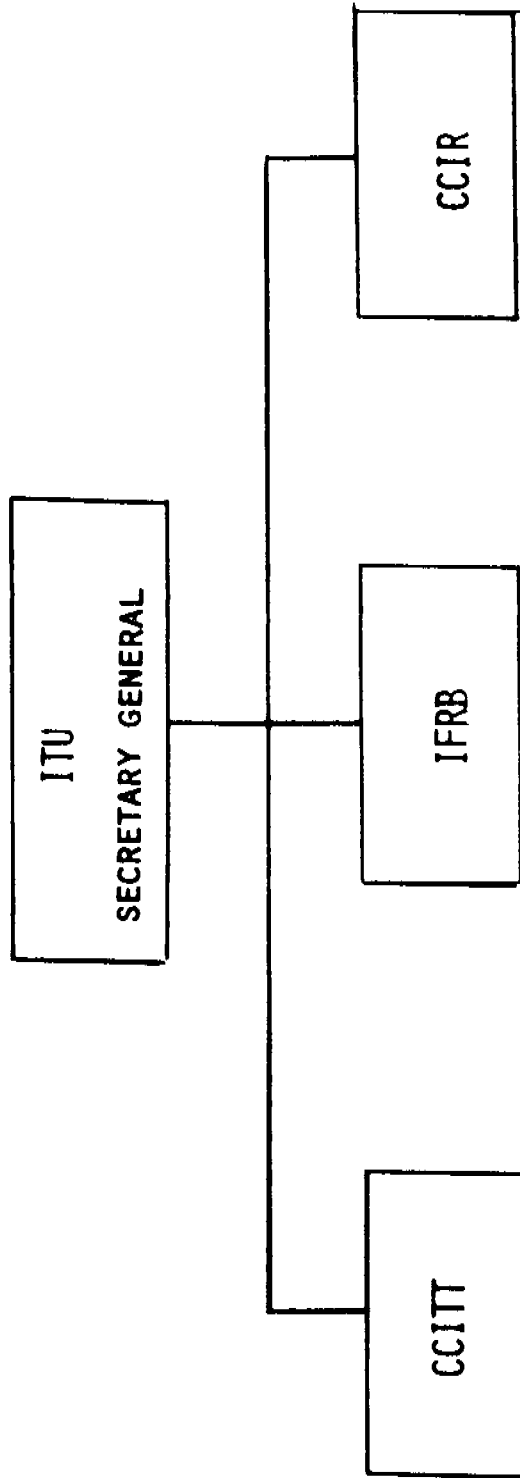
recognition of a need for future synchronization service to the 10 to 50 picosecond level, U.S. Study Group 7 is preparing a recommendation for a broadband frequency allocation in the 15-30 GHz band to allow for future satellite synchronization systems which can meet this need.

CONCLUSION

In summary, the current technology of time and frequency dissemination using radio has greatly improved our ability to transfer the information from place to place as required by most applications. Radio transfer methods have become so refined that it is now difficult to find a way to test the accuracy of radio dissemination. Methods which provided an alternate check means a few years ago, such as transportable atomic clocks, cannot today be depended upon to test satellite synchronization links to their full capability if the points to be synchronized are separated by 2000 miles or more, even when the clocks are carried from point to point by aircraft.

The future use of radio methods for time and frequency transfer will surely come into even greater use making the activities of the CCIR even more important to the interest of the time and frequency technologist and to the use of this technology for future system applications.

ITU ORGANIZATION



- TELEPHONE & TELEGRAPH
 - STANDARDS
 - TARIFFS
 - ETC.
- MAINTAINS FREQUENCY USAGE DATA
 - MEDIATES INTERFERENCE PROBLEMS
- RADIO
 - STANDARDS
 - FREQUENCY SHARING
 - INTERFERENCE
 - ETC.

Figure 1

CCIR STUDY GROUPS

<u>STUDY GROUP</u>	<u>SCOPE</u>
1	SPECTRUM UTILIZATION, MONITORING
2	SPACE RESEARCH AND RADIOASTRONOMY
3	FIXED SERVICE BELOW 30 MHz
4	FIXED SERVICE USING SATELLITES
5	PROPAGATION IN NON-IONIZED MEDIA
6	IONOSPHERIC PROPAGATION
7	STD-FREQUENCY AND TIME SERVICE
8	MOBILE SERVICES
9	FIXED SERVICE USING RADIO RELAY
10	SOUND BROADCASTING
11	TV BROADCASTING

Figure 2

HOW CCIR WORKS

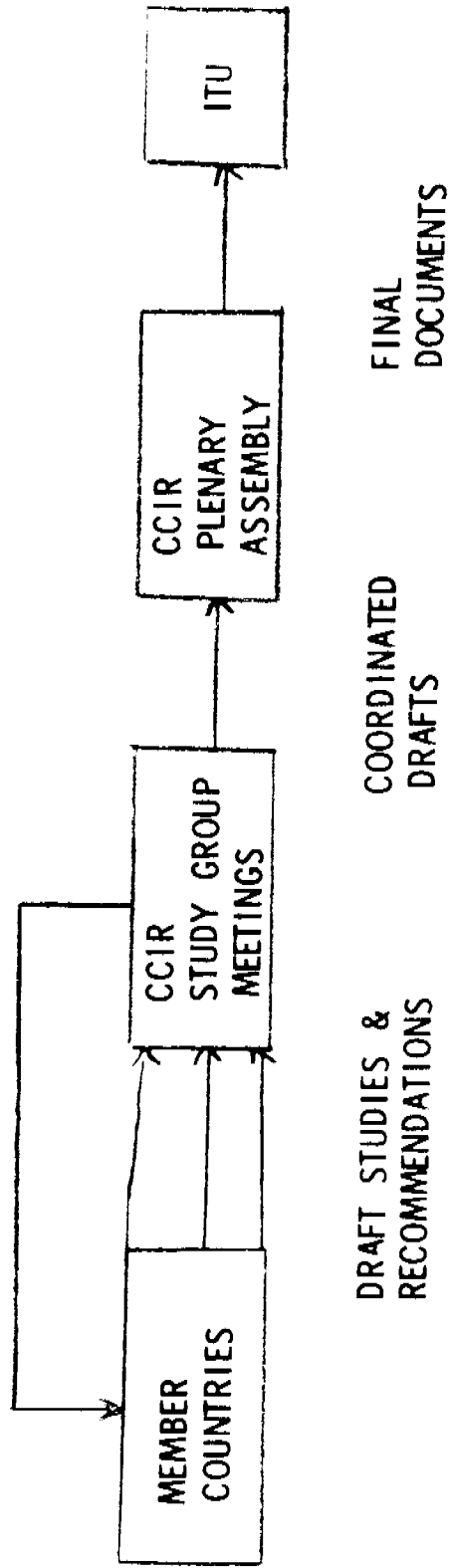


Figure 3

U. S. CCIR WORKING SCHEDULE

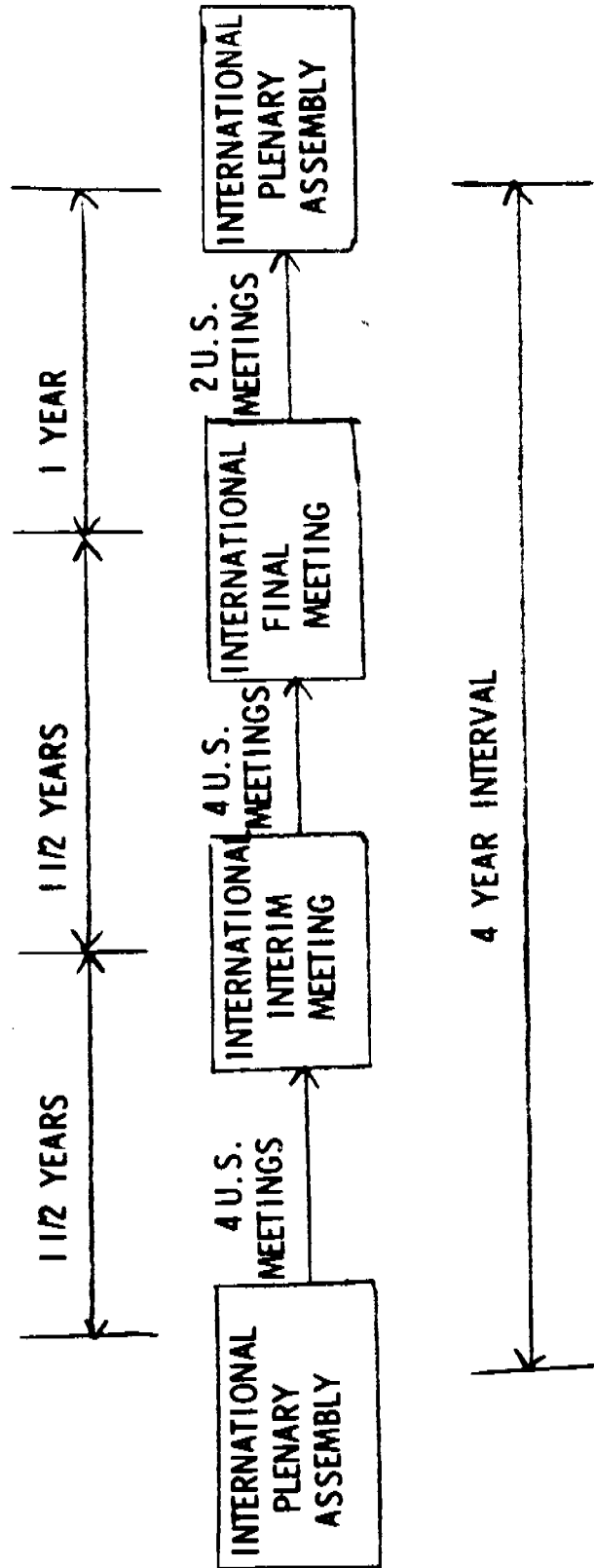


Figure 4

CCIR STUDY GROUP 7

- TERMS OF REFERENCE
 - COORDINATE WORLD-WIDE SERVICES OF STANDARD FREQUENCY & TIME SIGNAL EMISSION
 - STUDY TECHNICAL ASPECTS OF EMISSION & RECEPTION INCLUDING THE USE OF SATELLITE TECHNIQUES IN THESE SERVICES AND MEANS TO IMPROVE THE ACCURACY OF MEASUREMENT
- ALLOCATIONS FOR FREQUENCY & TIME
 - 20 KHZ \pm 0.05 KHZ
 - 20.0 MHZ \pm 10 KHZ
 - 2.5 MHZ \pm 5 KHZ
 - 25.0 MHZ \pm 10 KHZ
 - 5.0 MHZ \pm 5 KHZ
 - 400.1 MHZ \pm 25 KHZ (SPACE-TO-EARTH)
 - 10.0 MHZ \pm 5 KHZ
 - 4202 MHZ \pm 2 MHZ (SPACE-TO-EARTH)
 - 15.0 MHZ \pm 10 KHZ
 - 6427 MHZ \pm 2 MHZ (EARTH-TO-SPACE)

Figure 5

MEMBERSHIP U.S. CCIR STUDY GROUP - 7

- 45 MEMBERS
 - GOVT.
 - AIR FORCE ● NBS
 - ARMY ● NELC
 - COMMERCE DEPT. ● NRL
 - DCA ● OTP
 - DOT ● SAO
 - FAA ● STATE DEPT.
 - NASA ● USCG
 - NAVY ● USNO
 - PRIVATE CORP.
 - HUGHES ● JAMES MILLEN
 - NATIONAL SCIENTIFIC LABS
 - UNIVERSITY
 - MIT ● APL
 - INDIVIDUALS

Figure 6