

(November 11, 1926)

REQUIREMENTS OF CONSTANT FREQUENCY STATIONS.

A list of certain broadcasting stations designated as "constant frequency stations" is published monthly by the Bureau of Standards in the Radio Service Bulletin. Each of those stations employs a special device for maintaining its frequency close to the licensed value and by virtue of fulfilling certain additional conditions is of value to the public as a standard of frequency. This circular gives in detail the conditions to be fulfilled by a station in order that it may be considered for inclusion in the list of constant frequency stations. These requirements are stated as definitely as possible consistent with applicability to various kinds of transmitting stations. Stations meeting the requirements given herein and which are not now included in the list of standard frequency or constant frequency stations in the Radio Service Bulletin are invited to communicate with the Bureau of Standards. The letter should state in detail how these requirements are met in the construction and operation of the transmitting station.

(1) The Employment of a Special Device for Checking or Controlling the Frequency.— This may be a piezo oscillator, piezo resonator, automatic piezo control or a frequency indicator. A piezo oscillator is a simple electron tube generator comprising a coil of wire, a variable condenser, an electron tube, and a quartz plate so connected as to control the frequency of the current in the tube circuits in accordance with the frequency of mechanical vibration of the quartz plate. A piezo resonator similarly involves the use of a quartz plate but instead of acting as a generator, its operation depends upon power picked up from the transmitting set under measurement. Automatic piezo control is, as the name indicates, a method of automatically holding the frequency of the transmitting set at a constant value; in this method the output of a piezo oscillator is amplified by a power amplifier, the power amplifier in turn feeding into the antenna. A frequency indicator is a special type of frequency meter (wavemeter) so constructed as to give readings at only a single point or over a very narrow range of frequencies (not over 10 per cent); the usual frequency meter designed for measurements of frequencies over a wide range is not suitable for this purpose.

Specifications for the construction of a piezo oscillator and a frequency indicator are given respectively in Bureau of Standards Letter Circulars 180 and 186, entitled, "Specifications for portable piezo oscillator, Bureau of Standards Type N," and "Specifica-

1/ A monthly publication of the Department of Commerce obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C., for 25 cents per year.

tions for frequency indicator, Bureau of Standards Type B, for use in radio transmitting stations." Either Letter Circular may be obtained upon application to the Bureau of Standards.

(2) Agreement of Calibration of the Device for Frequency Regulation with the Frequency Standard of the Bureau of Standards.- This calibration is obtained by: (a) shipping the device (quartz plate or frequency indicator) to the Bureau of Standards; (b) use of the standard frequency signals transmitted monthly from the Bureau's laboratory; (c) calibration from some other agency which bases its standard upon the frequency standard of the Bureau.

The Bureau will adjust to the licensed frequency a quartz plate or a frequency indicator used as a standard in a transmitting station, upon request of the station owner. The fee for a Type B frequency indicator is \$5.00; for a quartz plate, the fee is \$20.00. Quartz plates when submitted must be operating at slightly less than the licensed frequency; it is preferable that they be cut to give a frequency approximately 1% below the licensed frequency; this will enable the Bureau to adjust to the exact frequency by reducing the thickness of the plate. The Bureau may refuse to undertake any work on a quartz plate which does not operate readily, or which is appreciably more than 1% below the station's licensed frequency. It is necessary that the quartz plate be sent to the Bureau mounted in the holder in which it is used.

A method by means of which stations may obtain their own calibration of a frequency indicator is found in the standard frequency signals of the Bureau of Standards, as explained in Bureau of Standards Letter Circular 171, obtainable by request. Schedules of these transmissions are published from time to time in newspapers and magazines and in the Radio Service Bulletin.

When the device used by the station for frequency control is of commercial manufacture and calibration the station owner should give the Bureau of Standards the name of the company or person manufacturing and calibrating the device, the date of purchase or calibration, and any further information as to the calibration, etc.

(3) Special Procedure in Checking the Station Frequency.- Except in the case of piezo control, there should be a regular check of the station frequency at time intervals of not less than 15 minutes and at somewhat more frequent intervals during the first half hour of operation. Detailed suggestions on the method of employing a piezo oscillator for this purpose are given in Bureau of Standards Letter Circular now in preparation, which may be obtained by request. If the station is equipped with automatic piezo control, precautions should be taken to ascertain that the piezo apparatus is functioning at all times. In the initial operation of the equipment, it is very desirable that some independent means of checking the frequency at intervals be provided. This is to overcome a possible difficulty from the piezo control shifting its frequency from one fixed value to another, a condition which may occur if the quartz plate used in the piezo oscillator has not been cut from the quartz crystal in exactly the proper manner. If the quartz plate is

mounted in such a manner that a variable pressure is obtained upon the electrodes, means should be provided for accurate and definite indication of the amount of pressure applied.

(4) General Features of the Transmitting Station.— Mechanical features of the installation, such as antenna and counterpoise, must be such as to insure permanence and rigidity. This is of special importance in case the means employed for power transfer to the antenna system are such that changing antenna characteristics will affect the frequency. The transmitting set must be of such a type that the generated frequency will not be appreciably affected by any ordinary changes in the antenna system.

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