

NOTE ON THE SYNCHRONIZATION OF BROADCAST STATIONS WJZ AND WBAL*

By

K. A. NORTON

(Bureau of Standards, Washington, D.C.)

The field intensities of the broadcast stations WJZ, Bound Brook, N.J., and WBAL, Baltimore, Md., were recorded continuously throughout a number of 24-hour periods in 1932 and 1933 at the Bureau of Standards receiving station at Meadows, Md., (latitude $38^{\circ}48'32''N$, longitude $76^{\circ}52'40''W$) near Washington, D.C. The method used for recording the field intensity is described elsewhere.¹ The two stations are synchronized on 760 kilocycles on alternate days during the daytime, and similarly at night. The synchronization is accomplished by means of an audio-frequency current transmitted to each station over a wire line and multiplied to the radio frequency of the station at the transmitter.

Fig. 1. illustrates the type of record obtained, showing that the fading is of a radically different character when the stations are synchronized than when not. On the lower record may be seen the comparatively steady ground wave from WJZ during the daytime, having the constant intensity of about 200 microvolts per meter. On the upper record, during the daytime, the two stations are synchronized but fading occurs. This fading is due to interference of the two ground waves, the intensities of which are about 200 and 600 microvolts per meter, so that the maxima and minima are 800 and 400 microvolts per meter, i.e., the sum and difference of the two fields.

Fig. 2 shows this same interference phenomenon for two hours during the daytime, with the recorder operating three times as fast for half the time in order to resolve the fading. It may be seen that the average period of the fading is about one minute; it was observed on a receiver with automatic volume control that this slow fading did not introduce any serious distortion into the received modulation where the ratio of the intensities of the two ground waves was three to one. It is believed that no serious distortion would be introduced into the received modulation by the synchronization fading in that part of the primary service area of the two stations where the ratio of the intensi-

* Decimal classification: R550. Original manuscript received by the Institute, April 16, 1934. Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

¹ RP597. K. A. Norton and S. E. Reymer, "A continuous recorder of radio field intensities," *Bur. Stan. Jour. Res.*, vol. 11, September, 1933.

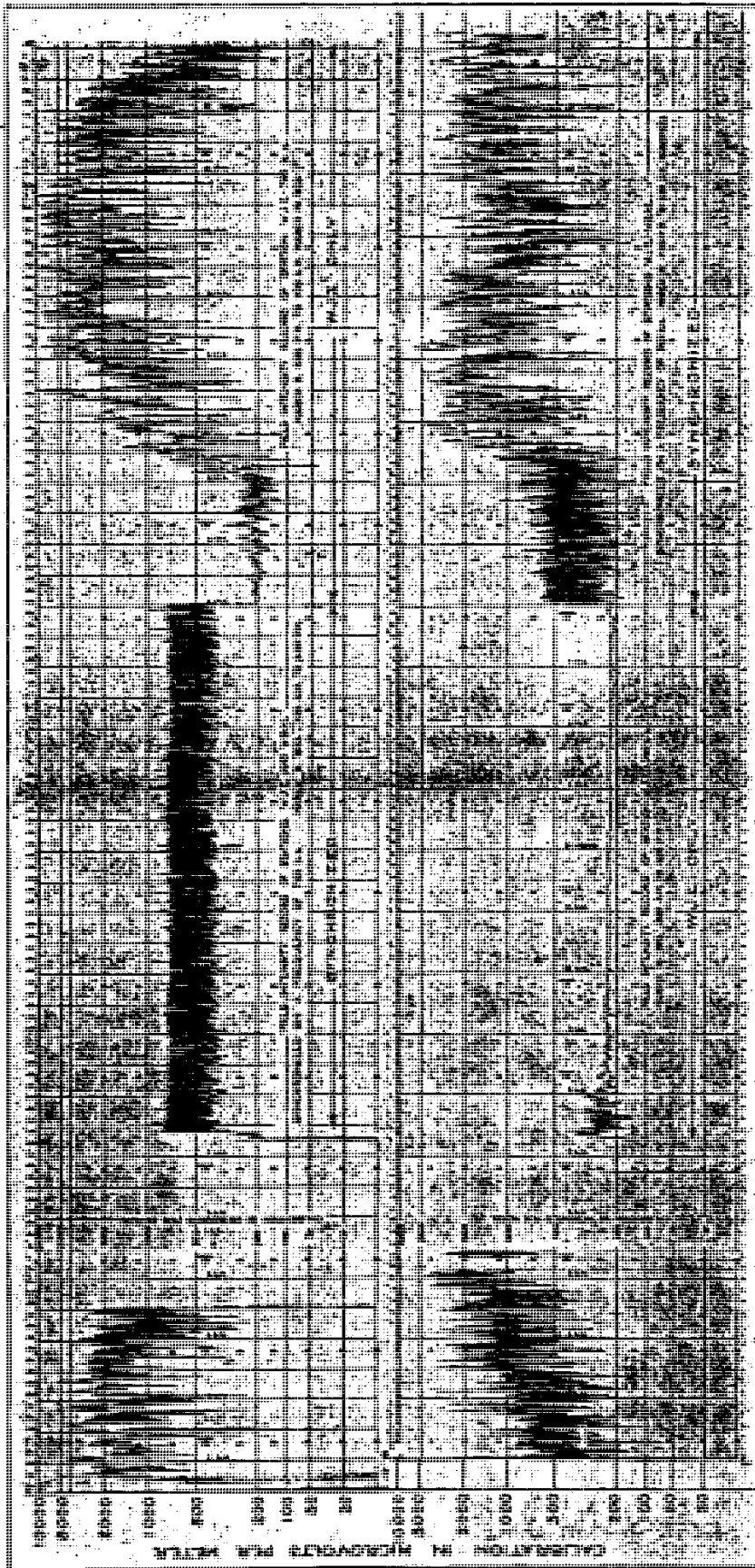


Fig. 1

ties
Fede
in th
is ne
ratio
auto

In
trates
when 1
tensiti
pared
period

² S

ties of their two ground waves is about two to one or greater. The Federal Radio Commission states² that a ratio of at least four to one in the intensities of the radio waves from two synchronized stations is necessary in order to prevent modulation distortion; this latter ratio is based on the average receiver in use; e.g., a receiver without automatic volume control.

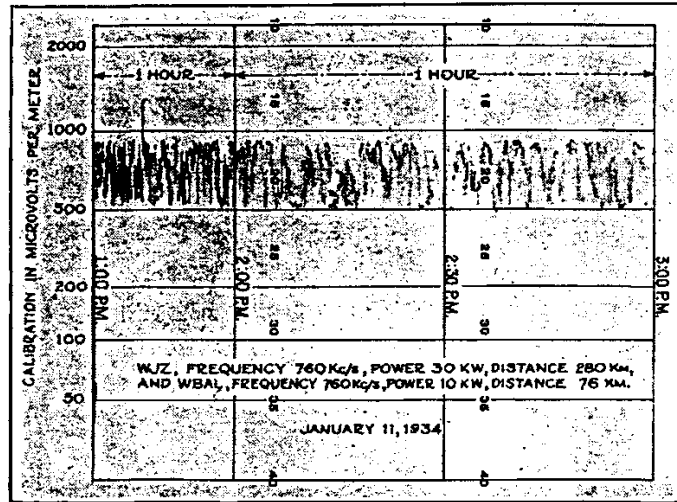


Fig. 2

In Fig. 1, the upper record is of WJZ alone after 4 P.M. and illustrates the type of fading observed for this frequency at this distance when the station operates alone. It may be seen that the peak field intensities reach 10 millivolts per meter. The fading here may be compared with the fading shown on the lower record for the same evening period when the two stations are synchronized.

² Seventh Annual Report of the Federal Radio Commission, page 20.

