BEFORE THE

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C.

In the Matter of AMENDMENT OF PART 3 (RADIO BROADCAST SERVICES) OF THE COMMISSION'S RULES AND REGULATIONS AND THE STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING STANDARD BROADCAST STATIONS	Docket No. 10604

REPORT AND ORDER

BY THE COMMISSION: COMMISSIONERS HENNOCK AND BARTLEY NOT PARTICIPATING.

1. The Commission has under consideration its Notice of Proposed Rule Making, issued on August 3, 1953, proposing to amend the Standards of Good Engineering Practice Concerning Standard Broadcast Stations by (1) deleting the map entitled "Ground Conductivity in the United States and Canada" designated as Figure 3; (2) substituting therefor a new map entitled "Estimated Effective Ground Conductivity in the United States" (Figures M3 [1] and R3); (3) deleting Table B in Section 4 and all references thereto; (4) deleting footnote 13 of Section 1; and (5) making certain editorial revisions to Sections 1 and 4. It is also proposed to amend Part 3 of Commission Rules and Regulations by the addition of Section 3.36, which provides for the issuance of special field test authorizations to operate transmitters for the taking of field intensity data.[2]

2. The comments filed favor adoption of the proposed amendments with some modifications. The recommended modifications are considered separately below.

3. The comments of Columbia Broadcasting System, Inc. were directed to footnote 15 of the proposed text, which states, "In all cases the effective field should be established from the dimensions of the radiating system." Columbia points out, and we agree, that this statement is inconsistent with other provisions of the Standards. Accordingly, we are deleting the footnote in question.

4. Radio Station KMA, Shenandoah, Iowa, filed a comment suggesting changes in conductivity value in an area north of Shenandoah. The Commission's proposed map indicates values 15 and 30 mmhos/m south and north, respectively, of Station KMA. KMA contends that the field intensity measurements filed with its comment show a value of 30 mmhos/m to exist to a point approximately 100 miles north of KMA, and that the line

[1] Because of its large size, Figure M3 is not to be a physical part of the Standards, but is to be published as a separate document and is available from the Superintendent of Documents, Washington, D.C. for the sum of $3.50.

[2] The Notice erroneously stated that changes were to be made in Section 2 of the Standards.

between 15 and 30 mmhos/m should be moved northward to that point. We have studied the data submitted and find it warrants moving the line about 20 miles northward but that beyond this distance, the conductivity tends to decrease. Accordingly, the map has been modified to show the higher value of conductivity north of KMA but only to the 20-mile extent indicated.

5. The Association of Federal Communications Consulting Engineers filed a comment setting forth several suggestions. First, it points out an error with respect to a corridor of low conductivity, extending through North Dakota. We have corrected the error by ascribing the value of 30 mmhos/m to the area in question.

6. The Association also calls attention to measurements made on a station at Sayre, Pennsylvania northward to Lake Ontario and to the apparent discrepancy between the results obtained and the conductivity value shown on the proposed map. The measurements show varying conductivity values over the three paths measured, with 2 mmhos/m as the most consistent value; with a minor exception, none of the various values indicated is as great as the 4 mmhos/m figure shown on the map. It is implicitly suggested that we have erred either in the assignment of the conductivity value to the area or in the delineation of the line of demarcation between the areas of 2 and 4 mmhos/m, which line is shown to be south of Sayre. We have studied the measurements referred to and the other measurements that originally led us to assign the 4 mmhos/m value to the area and to arrive at the line of demarcation. It is our conclusion that assignment of the 4 mmhos/m figure and retention of the present demarcation line is warranted by the preponderance of measurements pertaining to the area. In this connection, it is pointed out that the map does not purport to give precise values along particular paths and therefore, the narrow refinement sought is inappropriate.

7. The Association objects to the requirement in Section 3.36 as proposed that the test antenna resistance be measured and such measurements, together with log notations of the antenna power input, be submitted to the Commission. It is argued that the resistive component of the impedance of such antennas is usually so low as to make accurate measurement difficult or impossible; and that the resistance of the antennas has little direct relationship to the radiated field. As an alternative, the Association suggests that the rule be revised to require the maintenance of constant antenna current. We believe this suggestion to have merit. Accordingly, we have revised the proposed subparagraphs (a) (3) and (a) (7) to provide that the plate power of the final stage of the transmitter not exceed authorized power; that the antenna current be maintained constant for each phase of the test; and that certified copies of logs of the plate voltage and plate current of the final stages of the transmitter be submitted.

8. The Association's suggestion that the term "unattenuated field" appearing in subparagraph (2) (6) be replaced by "inverse distance field" to avoid any possibility of confusion, has been adopted.

9. We believe the Association's final recommendation that the map be held in abeyance until questions of "measuring techniques and acceptability of measurements are finally established," to be without merit. Assuming that new measuring techniques should be adopted, we cannot tell what effect, if any, such techniques would have upon the conductivity values shown on the map; further, reevaluation because of new techniques of the large amount of data upon which this map was based would take years to accomplish. In view of these considerations, the public interest clearly requires adoption of the subject map.

10. Certain changes not suggested by parties to this proceeding have also been made. Thus, we have noted an error in our placement of a portion of the line of demarcation between the areas of 4 and 2 mmhos/m in central Maryland, and are accordingly moving the line somewhat northward so as to include Baltimore and its environs in the area shown as having a conductivity value of 2 mmhos/m. Also, there has come to our attention field intensity measurement data which indicates that an area in south central Michigan is not accurately represented by the value of 8 mmhos/m shown by the proposed map; the map has therefore been revised to reflect the proper value for this area and to move the western line of demarcation. Finally, on the basis of certain field intesity measurements filed with the Commission, the area from east to central Utah, which is shown as having a value of 8 mmhos/m, is modified so that the value 15 mmhos/m is set out and slight changes are made in the lines of demarcation about the area.

11. One other point should be noted in connection with Section 3.36. Subparagraph (a) (1) provides that test authorizations will be granted only if no objectionable interference will result to other authorized radio operations. We believe it desirable to supplement this provision by precluding the use of power in excess of that necessary to carry out the desired tests; in this way, any possibility of interference is minimized.

12. We conclude that the proposed amendments to the Rules and Standards, as modified and set out in the attached Appendix, should be adopted.

13. Authority for the adoption of the amendments herein is contained in Sections 1, 4(i), 303(f), (h) and (r), and 307(b) of the Communications Act of 1934, as amended.

14. *It is ordered,* That effective April 5, 1954, the Standards of Good Engineering Practice Concerning Standard Broadcast Stations and Part 3 of the Commission's Rules and Regulations *are amended* as set forth in the attached Appendix.

Adopted February 24, 1954.

FEDERAL COMMUNICATIONS COMMISSION,

MARY JANE MORRIS, *Secretary.*

APPENDIX

I. A new Section is added to Part 3 (Radio Broadcast Services) of Commission Rules and Regulations as follows:

3.36 *Special Field Test Authorization.* (a) Upon a showing that a need exists, a special test authorization to operate a portable or regularly authorized transmitter may be issued to persons desiring to make field intensity surveys to determine values of soil conductivity, or other factors influencing radio wave propagation, in particular areas or paths for the period necessary to conduct the survey. Such authorizations may be granted upon the following conditions:

(1) No objectionable interference will result to the operation of other authorized radio services; in this connection, the power requested shall not exceed that necessary for the purposes of the test.

(2) Carrier will be unmodulated except for half-hourly voice identification.

(3) The plate power (E_P x I_P) of the final stage of the transmitter shall not exceed authorized test power and the antenna current shall be maintained at a constant value for each phase of the test.

(4) The test equipment shall not be permanently installed, unless such installation has been separately authorized. Mobile units shall not be deemed permanent installations.

(5) The equipment must be operated by or under the personal direction of either a licensed radiotelephone first-class or second-class operator.

(6) A report, under oath, containing the measurements, their analysis and other results of the survey shall be filed with the Commission within sixty (60) days from the termination of the test authorization. The measurements taken shall be sufficiently complete, in accordance with Section 2 of the Standards of Good Engineering Practice Concerning Standard Broadcast Stations, so as to permit a determination of the inverse distance field at 1 mile in pertinent directors.

(7) The plate voltage (E_P) and plate current (I_P) of the final stage of the transmitter shall be logged at half-hour intervals and at any time that such power is changed. Certified copies of such log notations shall be submitted to the Commission with the required report.

(8) Operation shall conform to the requirements of Part 3, Subpart G, of Commission's Rules and Regulations.

(b) The test equipment, installation and operation thereof need not comply with the requirements of Commission Rules and Standards except as specified in this Section; *Provided however,* That the equipment, installation and operation shall be consistent with good engineering principles and practices.

(c) No authorization shall be issued unless the applicant for such authorization is determined to be legally qualified. Requests for authorizations to operate a transmitter under this Section shall be made in writing, signed by the applicant under oath or affirmation (with no special form provided, however), and shall set forth the following information:

(1) Purpose, duration and need for the survey.

(2) Frequency, plate power and time of operation.

(3) A brief description of the test antenna system and its estimated effective field and its proposed location.

(4) In the case of a directional test antenna, an estimate of the maximum fields expected to be radiated in the direction of pertinent broadcast stations.

(5) In the case of a person who is not a licensee or permittee of this Commission the information required by Section II of FCC Form 301.

(d) The authorization may be modified or terminated by notification from the Commission if in its judgment such action will promote the public interest, convenience or necessity.

II. Annex 1 of Section 1 of the Standards of Good Engineering Practice Concerning Standard Broadcast Stations is amended to read as follows:

ANNEX 1

Groundwave Signals

A. Interference that may be caused by a proposed assignment or an existing assignment during day time should be determined, when possible, by measurements on the frequency involved or on another frequency over the same terrain and by means of the curves in Appendix I entitled "Ground Wave Field Intensity versus Distance."

E. Where a signal traverses a path over which different conductivities exist, the distance to a particular groundwave field intensity contour shall be determined by the use of the equivalent distance method. Reasonably accurate results may be expected in determining field intensities at a distance from the antenna by application of the equivalent distance method when the unattenuated field of the antenna, the various ground conductivities and the location of discontinuities are known. This method considers a wave to be propagated across a given conductivity according to the curve for a homogeneous earth of that conductivity. When the wave crosses from a region of one conductivity into a region of a second conductivity, the equivalent distance of the receiving point from the transmitter changes abruptly but the field intensity does not. From a point just inside the second region the transmitter appears to be at that distance where, on the curve for a homogeneous earth of the second conductivity, the field intensity equals the value that occurred just across the boundary in the first region. Thus the equivalent distance from the receiving point to the transmitter may be either greater or less than the actual distance. An imaginary transmitter is considered to exist at that equivalent distance. This technique is not intended to be used as a means of evaluating unattenuated field or ground conductivity by the analysis of measured data. The method to be employed for such determinations is set out in Section 2 of these Standards.

F. An example of the use of the equivalent distance method follows:

It is desired to determine the distance to the 0.5 mv/m and 0.025 mv/m contours of a station on a frequency of 1000 kc with an inverse distance field of 100 mv/m at one mile being radiated over a path having a conductivity of 10 mmhos/m for a distance of 15 miles, 5 mmhos/m for the next 20 miles and 15 mmhos/m thereafter. By the use of the appropriate curves in Appendix 1—Graph 12, it is seen that at a distance of 15 miles on the curve for 10 mmhos/m the field is 3.45 mv/m. The equivalent distance to this field intensity for a conductivity of 5 mmhos/m is 11 miles. Continuing on the propagation curve for the second conductivity, the 0.5 mv/m contour is encountered at a distance of 27.9 miles from the imaginary transmitter. Since the imaginary transmitter was 4 miles nearer (15=11 miles) to the 0.5 mv/m contour, the distance from the contour to the actual transmitter is 31.9 miles (27.9+4 miles). The distance to the 0.025 mv/m contour is determined by continuing on the propagation curve for the second conductivity to a distance of 31 miles (11+20 miles), at which point the field is read to be 0.39 mv/m. At this point the conductivity changes to 15 mmhos/m and from the curve relating to that conductivity, the equivalent distance is determined to be 58 miles—27 miles more distant than would obtain had a conductivity of 5 mmhos/m prevailed. Using the curve representing the conductivity of 15 mmhos/m the 0.025 mv/m contour is determined to be at an equivalent distance of 172 miles. Since the imaginary transmitter was considered to be 4 miles closer at the first boundary and 27 miles farther at the second boundary, the net effect is to consider the imaginary transmitter 23 miles (27−4 miles) more distant than the actual transmitter; thus the actual distance to the 0.025 mv/m contour is determined to be 149 miles (172−23 miles).

III. Section 4 of these Standards is amended by deleting paragraph I together with Table B and substituting therefor the following:

I. Figures M3 and R3 indicate effective conductivity values in the United States and are to be used for determining the extent of broadcast station coverage when adequate field intensity measurements over the path in question are not available. Since the values specified are only for general areas and since conductivity values over particular paths may vary widely from those shown, caution must be exercised in using the maps for selection of a satisfactory transmitter site. Where the submission of field intensity measurements is deemed necessary or advisable, the Commission, in its discretion, may require an applicant for now or changed broadcast facilities to submit such data in support of its application.

IV. Figure 3 is deleted from these Standards and Figures M3 and R3 substituted therefor. Figure M3 is substituted and incorporated into the Standards by reference. Figure R3 is attached.

FEDERAL COMMUNICATIONS COMMISSION.

B. In determining interference based upon field intensity measurements, it is necessary to do the following:

First, establish the outer boundary of the protected service area of the desired station in the direction of the station that may cause interference to it. Second, at this boundary, measure the interfering signal from the undesired station. The ratio of the desired to the undesired signal given in Table V should be applied to the measured signals and if the required ratio is observed, no objectionable interference is foreseen. When measurements of both the desired and undesired stations are made in one area to determine the point where objectionable interference from groundwave signals occur or to establish other pertinent contours, several measurements of each station shall be made within a few miles of this point or contour. The effective field of the antennas in the pertinent directions of the stations must be established and all measurements must be made in accordance with Section 2 (Field Intensity Measurements in Allocation).

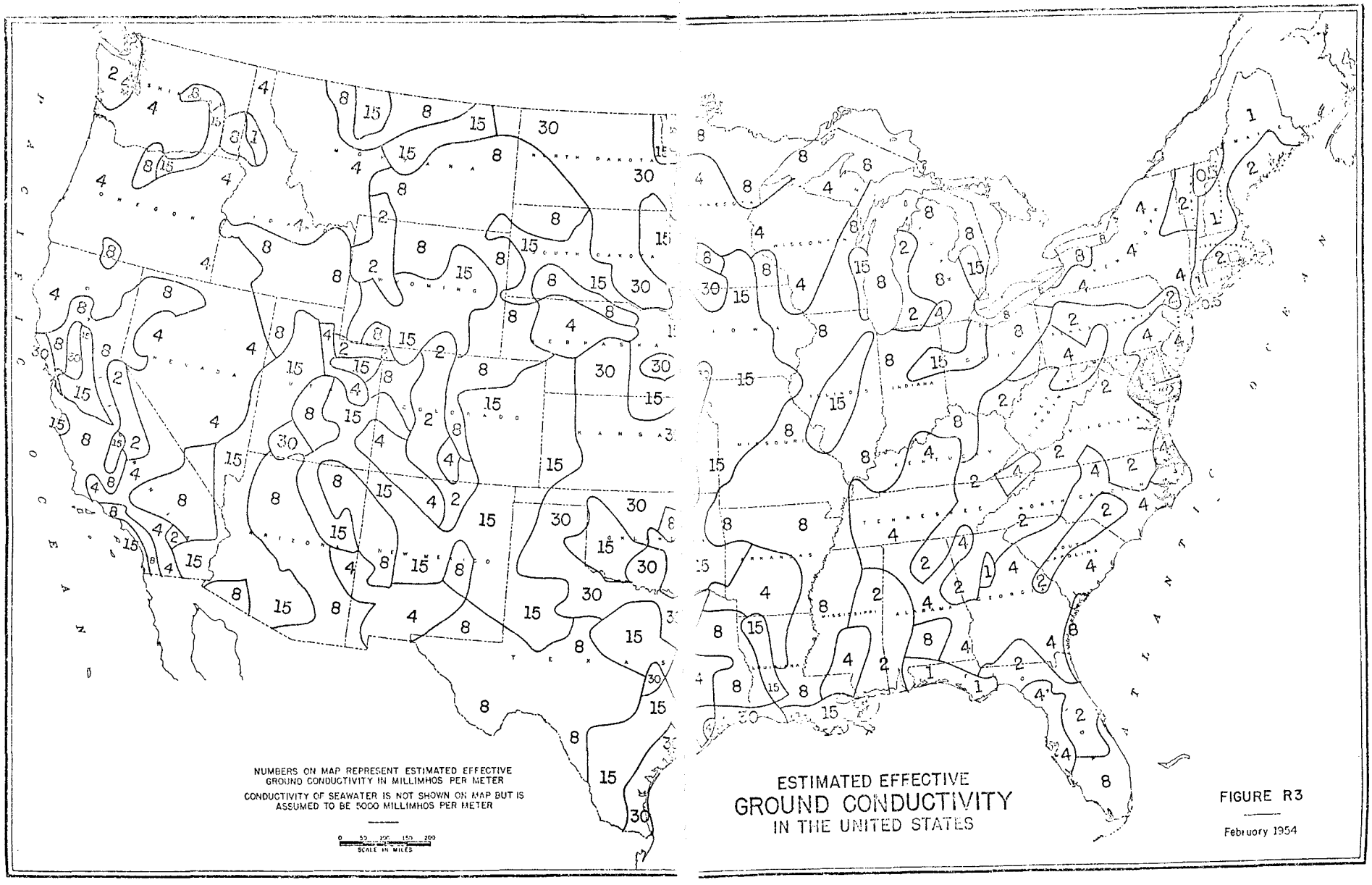
C. In all cases where measurements taken in accordance with the requirements are not available, the groundwave intensity must be determined by means of the pertinent map of ground conductivity and the groundwave curves of field intensity versus distance. The conductivity of a given terrain may be determined by measurements of any broadcast signal traversing the terrain involved. Figures M3 [13] and R3 show the conductivity throughout the United States by general areas of reasonably uniform conductivity. When it is clear that only one conductivity value is involved, Figure R3, which is a replica of Figure M3 and contained in these Standards, may be used; in all other situations Figure M3 must be employed. It is recognized that in areas of limited size or over a particular path, the conductivity may vary widely from the values given; therefore, these maps are to be used only when accurate and acceptable measurements have not been made. Figure 4 is a map of ground conductivity in Canada prepared by the Canadian Department of Transport. It is to be noted that at some locations there are differences in conductivity on eigher side of the border, which cannot be explained by geophysical cleavages. Pending adjustment of the maps for such inconsistencies, all variations at the border will be treated as real.

D. An example of determining interference by the curves in Appendix 1 follows:

It is desired to find whether objectionable interference exists between a 5 kw Class III station on 990 kc and a 1 kw Class III station on 1000 kc, the stations being separated by 130 miles; both stations use nondirectional antennas [14] having such height as to produce an effective field for 1 kw of 175 mv/m. The conductivity at each station and of the intervening terrain is determined as 6 mmhos/m. The protection to Class III stations during daytime is to the 500 uv/m contour. The distance to the 500 uv/m groundwave contour of the 1 kw station is determined by the use of the appropriate curve in Appendix 1—Graph 12. Since the curve is plotted for 100 mv/m at a mile, to find the distance to the 285 uv/m contour ($\frac{100 \times 500}{175} = 285$). From the appropriate curve, the estimated radius of the service area for the desired station is found to be 39.5 miles. Subtracting this distance from the distance between the two stations, leaves 90.5 miles for the interfering signal to travel. From the above curve it is found that the signal from the 5 kw station at this distance would be 158 uv/m. Since a one to one ratio applies for stations separated by 10 kc, the undesired signal at that point can have a value up to 500 uv/m without objectionable interference. If the undesired signal had been found to be greater than 500 uv/m, then objectionable interference would exist. For other channel separations, the appropriate ratio of desired to undesired signal should be used.

[13] Figure M3 which is incorporated in these Standards by reference, was derived by indicating ground conductivity values in the United States on the United States Albers equal area projection map (based on standard parallels 29½° and 45½°; North American datum; scale 1/2,500,000). Figure M3, consisting of two sections, an eastern and a western half, may be obtained from the Superintendent of Documents, Washington, D.C.

[14] See Annex II in case of use of directional antennas.


NUMBERS ON MAP REPRESENT ESTIMATED EFFECTIVE GROUND CONDUCTIVITY IN MILLIMHOS PER METER
CONDUCTIVITY OF SEAWATER IS NOT SHOWN ON MAP BUT IS ASSUMED TO BE 5000 MILLIMHOS PER METER
SCALE IN MILES
ESTIMATED EFFECTIVE
GROUND CONDUCTIVITY
IN THE UNITED STATES
FIGURE R3
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