

C.C.I.R.
XIIth Plenary Assembly
NEW DELHI, 1970

Doc. V/1006-E
13 October 1969
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STUDY GROUP V

The Drafting Committee, after examination of Doc. V/161(Rev.1) (draft Recommendation G.I.b(V)), presented by Study Group V, submits the following text to the Plenary Assembly for approval.

DRAFT

RECOMMENDATION ...*

GROUND-WAVE PROPAGATION CURVES
FOR FREQUENCIES BELOW 10 MHz

(Question 246)

(1951-1959-1963-1970)

The C.C.I.R.,

CONSIDERING

- (a) that ground-wave propagation curves for an extended range of frequencies are of continued importance for all types of radiocommunication, including navigational aids;
- (b) that such curves are needed for a range of conductivities if they are to apply to the varying conditions met with in practice along land paths,

RECOMMENDS

that the curves in the Annex be used for the determination of ground-wave field-strength at frequencies below 10 MHz under the conditions stated.

ANNEX

The attached curves apply to propagation at frequencies below 10 MHz.

The following points are to be especially noted with regard to them :

* This Recommendation replaces Recommendation 368.

1. they refer to a smooth homogeneous earth;
2. no account is taken of tropospheric effects at these frequencies;
3. the transmitter and receiver are both assumed to be on the ground. Height-gain effects can be of considerable importance in connection with navigational aids for high-flying aircraft, but it has been decided not to include them at the present time;
4. the curves refer to the following conditions:
 - they are calculated for the vertical component of electric field from the rigorous analysis of van der Pol and Bremmer;
 - the transmitter is an ideal Hertzian vertical electric dipole to which a vertical antenna shorter than one quarter wavelength is nearly equivalent;
 - the dipole moment is chosen so that the dipole would radiate 1 kW if the earth were a perfectly conducting infinite plane, under which conditions the radiation field at a distance of 1 km would be 3×10^5 $\mu\text{V/m}$;
 - the curves are drawn for distances measured around the curved surface of the earth;
 - the inverse-distance line shown in the Figures, to which the curves are asymptotic at short distances, passes through the field value of 3×10^5 $\mu\text{V/m}$ at a distance of 1 km;
5. the propagation loss defined in Recommendation 341 for ground-waves may be determined from the values of the field-strength in dB relative to 1 $\mu\text{V/m}$ given in the attached curves by the use of equation (19) of Report 112;
6. the curves should, in general, be used to determine field-strength, only when it is known that ionospheric reflections at the frequency under consideration will be negligible in amplitude - for example, propagation in daylight between 150 kHz and 2 MHz and for distances of less than about 2000 km. However, under conditions where the sky-wave is comparable with, or even greater than, the ground-wave, the curves are still applicable when the effect of the ground-wave can be separated from that of the sky-wave, by the use of pulse transmissions, as in some forms of direction-finding systems and navigational aids;
7. this Recommendation should continue in use until such time as any revision can be made in accordance with the suggestions made in Report ... (G.1.v(V)).

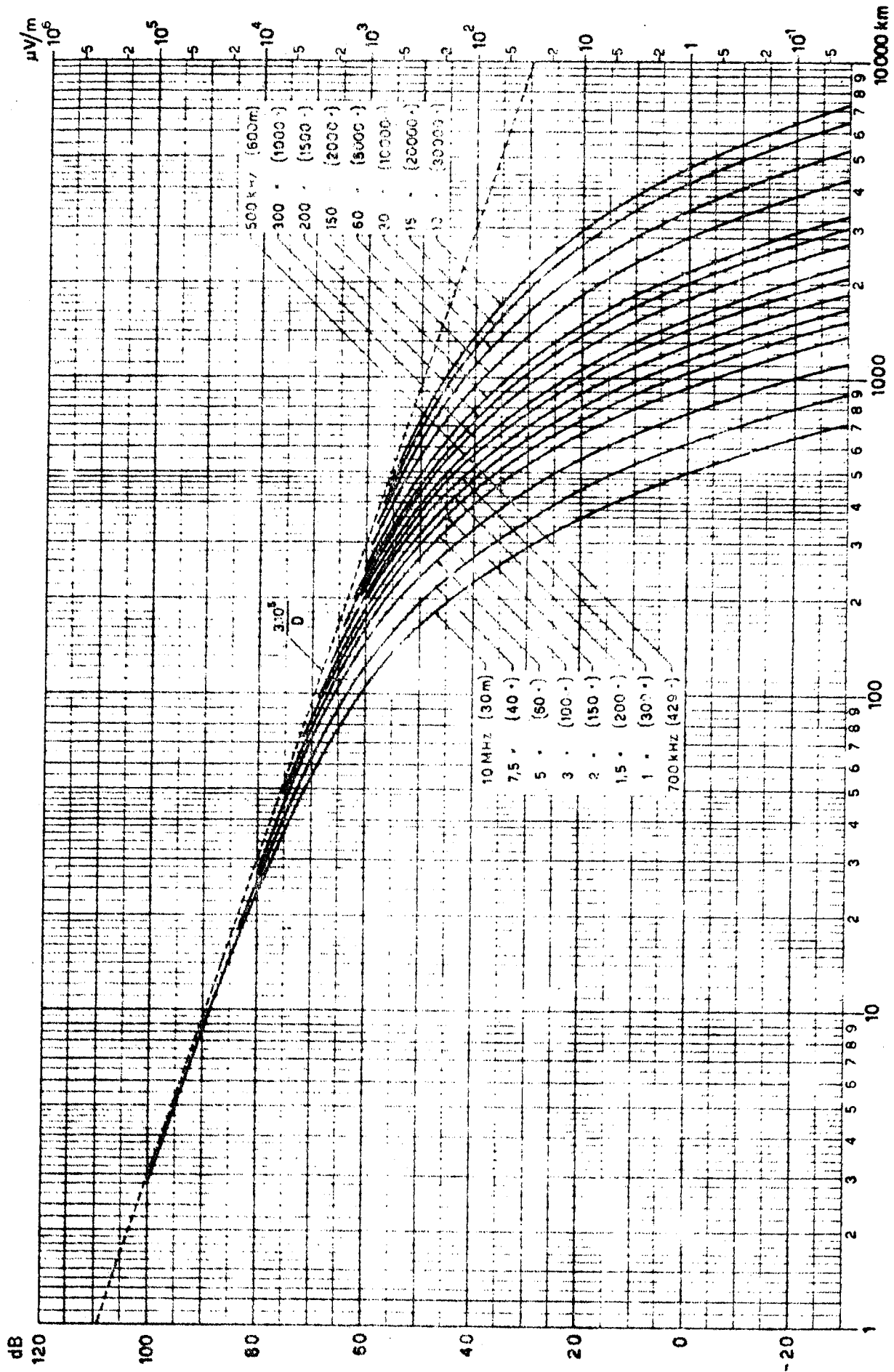


FIGURE 1

Ground-wave propagation curves; Sea, $\gamma = 4$ mho-m, $\epsilon = 80$

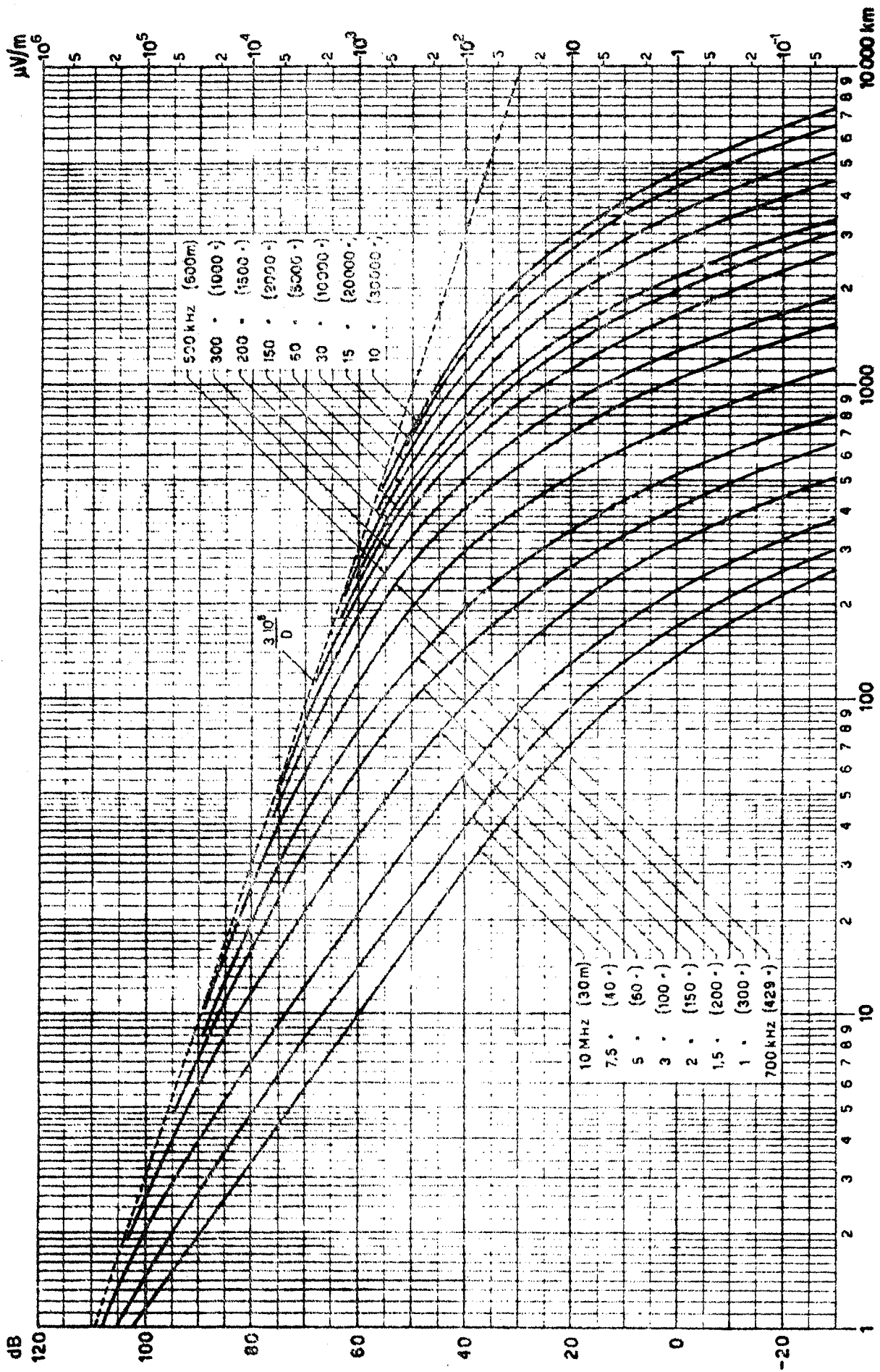


FIGURE 2

Ground-wave propagation curves: Earth, $\sigma = 3 \times 10^{-3}$ mho/m, $\epsilon = 4$

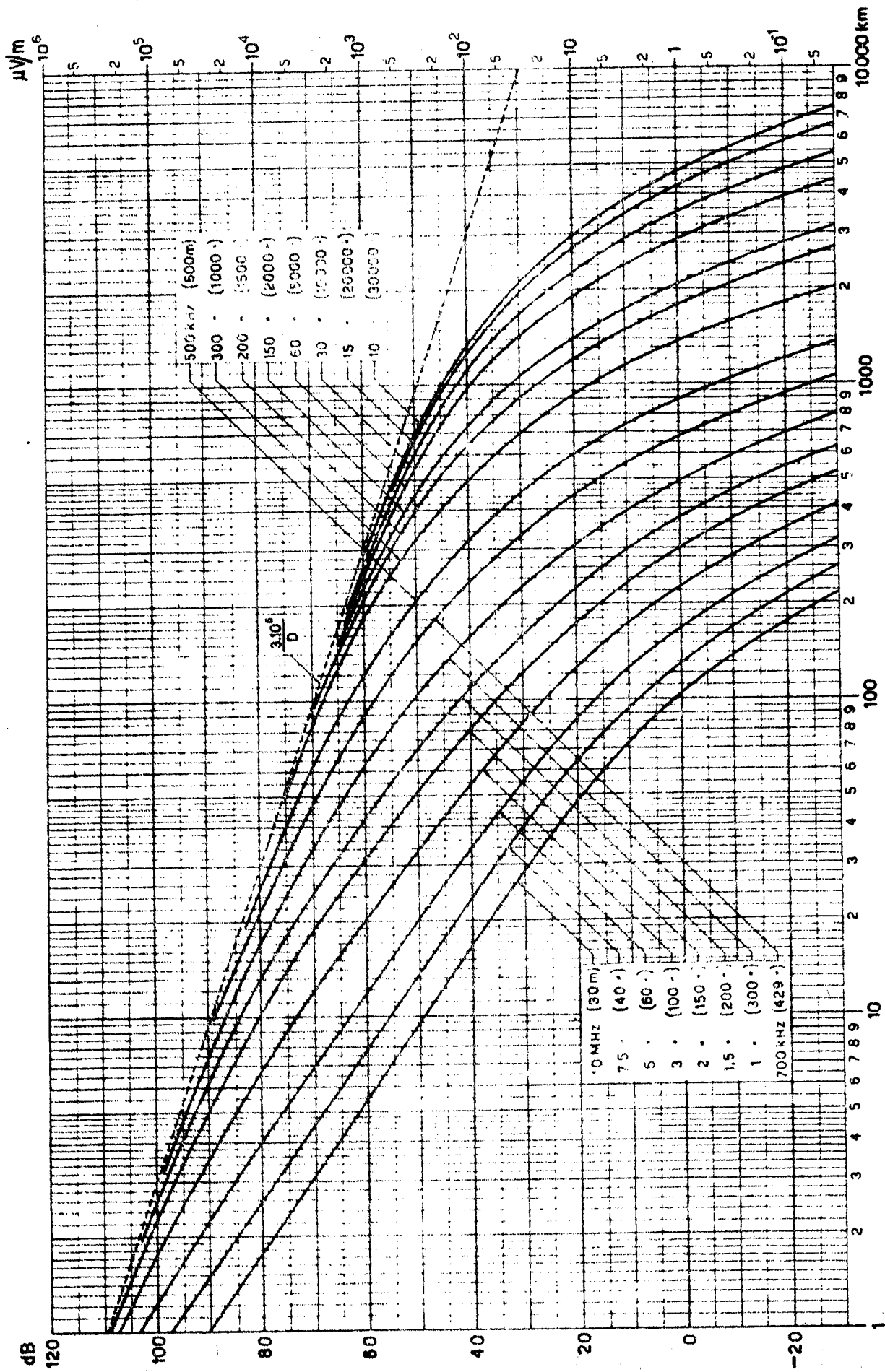


FIGURE 3
Ground-wave propagation curves; Earth, $\gamma = 10^{-3}$ mho m, $\epsilon = 4$

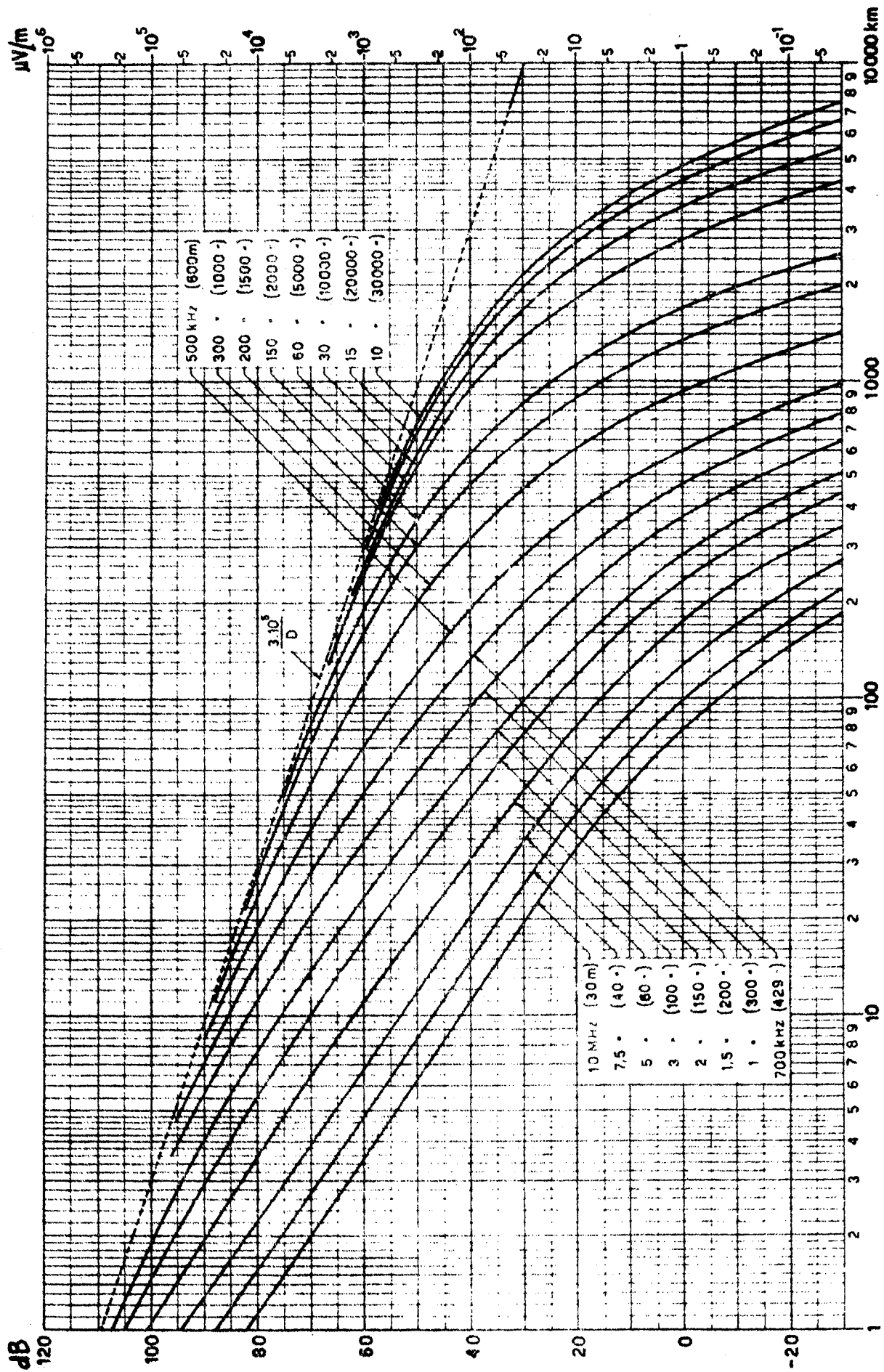


FIGURE 4
Ground-wave propagation curves: Earth, $\sigma = 3 \cdot 10^{-3}$ mho/m, $\epsilon = 4$

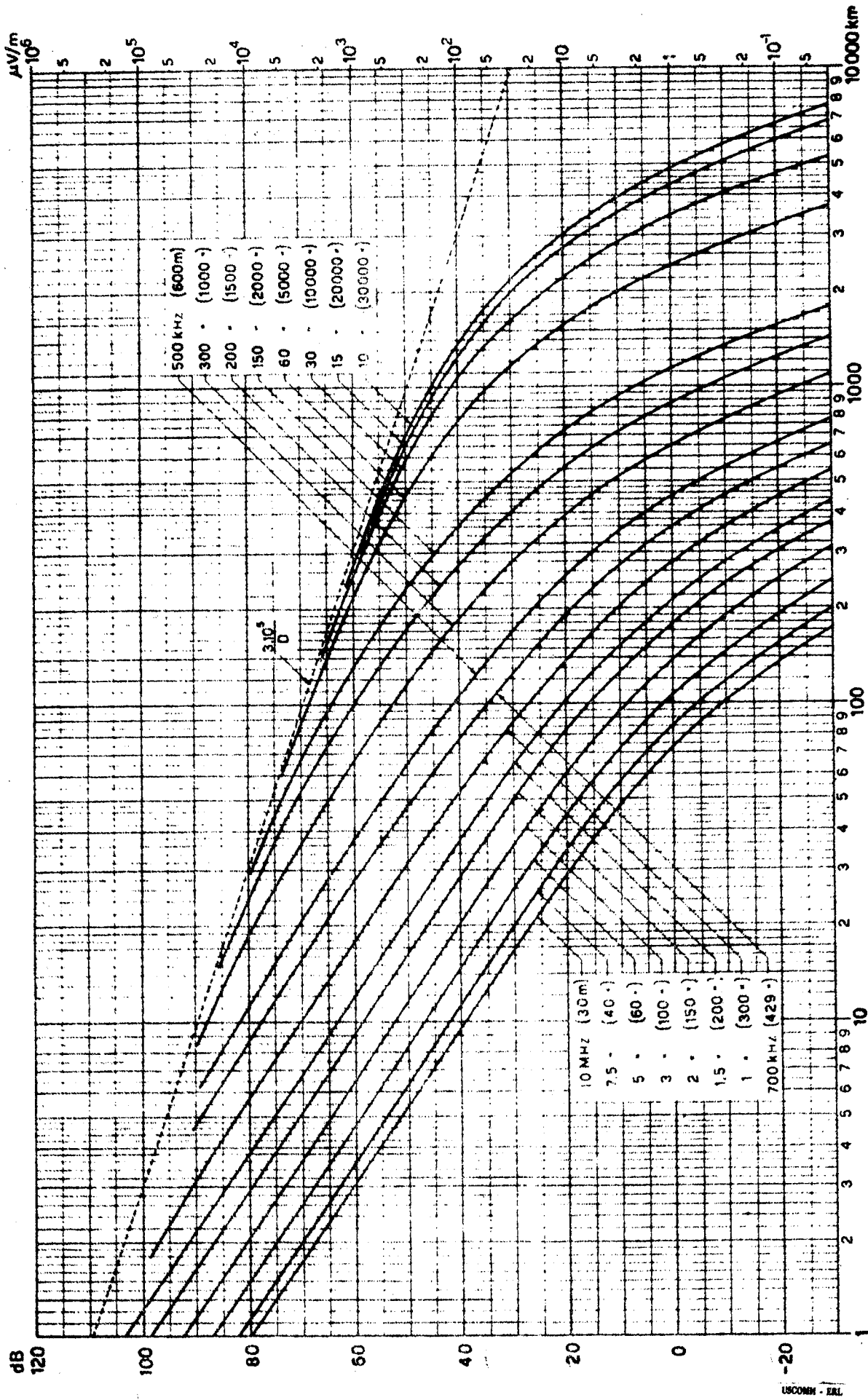


FIGURE 5
Ground-wave propagation curves; Earth, $\sigma = 10^{-3}$ mho/m, $\epsilon = 4$