RECOMMENDATION ITU-R P.529-2

PREDICTION METHODS FOR THE TERRESTRIAL LAND MOBILE SERVICE IN THE VHF AND UHF BANDS

(Question ITU-R 203/3)

(1978-1990-1995)

The ITU Radiocommunication Assembly,

considering

a) that there is a need to give guidance to engineers in the planning of land mobile radio services in the VHF and UHF bands,

recommends

1 that the methods given in Annex 1 be used to provide guidance on the prediction of point-to-area field strength for the land mobile service in the VHF and UHF bands.

ANNEX 1

1 Introduction

Propagation in the land mobile services is affected in varying degrees by topography, vegetation, man-made structures, ground constants, the troposphere and the ionosphere.

This Recommendation provides curves for predicting field strength under average conditions for three frequency ranges. It also provides analytical expressions which are valid for certain frequency ranges and conditions, and various correction factors which can be used to refine the average predictions.

The material in the Recommendation is statistical in nature and oriented towards application to planning and system design.

2 Propagation curves

Field strength curves for three frequency ranges, centred around 150, 450 and 900 MHz, are presented in this section. The VHF and UHF curves were derived from different sources and involved different underlying assumptions, so care must be exercised in their use to ensure that a particular set of curves matches the intended application. Information on corrections to these curves to take account of terrain cover is given in Recommendations ITU-R P.1058, ITU-R P.833 and ITU-R P.1146.

Generally, the effective antenna height of the base station intended to be used with Figs. 1 to 5 of this Recommendation is defined as the height of the antenna over the average level of the ground between distances of 3 and 15 km from the base station in the direction of the mobile station. This definition is based on the definition of transmitting antenna height given in Recommendation ITU-R P.370.

The antenna height of a mobile or portable station is taken as its height above ground.

2.1 VHF curves

Figures 1, 2 and 3 show propagation curves which are valid for frequencies approximately between 30 and 250 MHz; base station antenna heights, h_1, between 10 and 600 m; and mobile station antenna height, h_2, of 1.5 m. These curves are for rural areas over land. The field strength values should be reduced by 3 dB for suburban areas and by 5 dB for urban areas, with additional corrections for local terrain cover.

These curves have been derived from information in Recommendation ITU-R P.370, using the appropriate curves for Δh = 50 m, and including the corrections for lower antenna heights given in § 1.3.1 and 1.10.

FIGURE 1

Field strength (dB(μV/m)) for 1 kW e.r.p.

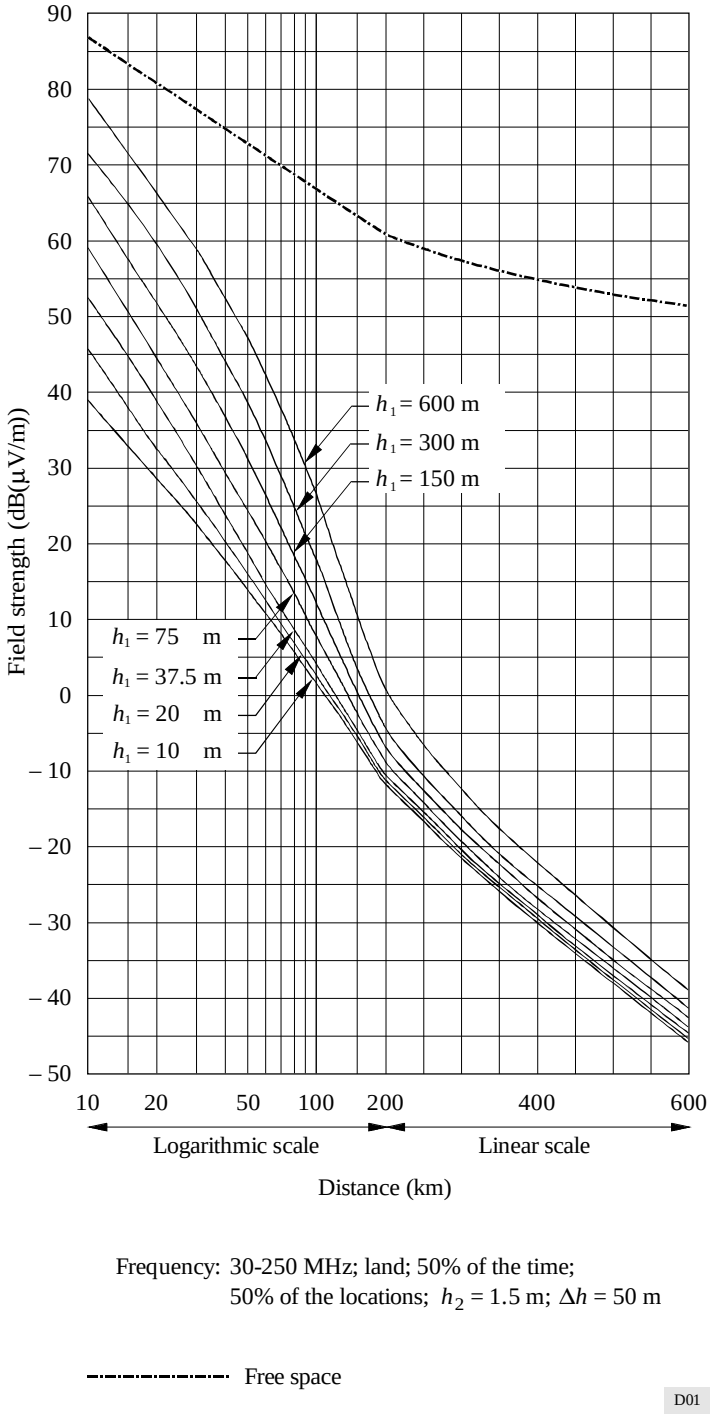


FIGURE 2

Field strength (dB(μV/m)) for 1 kW e.r.p.

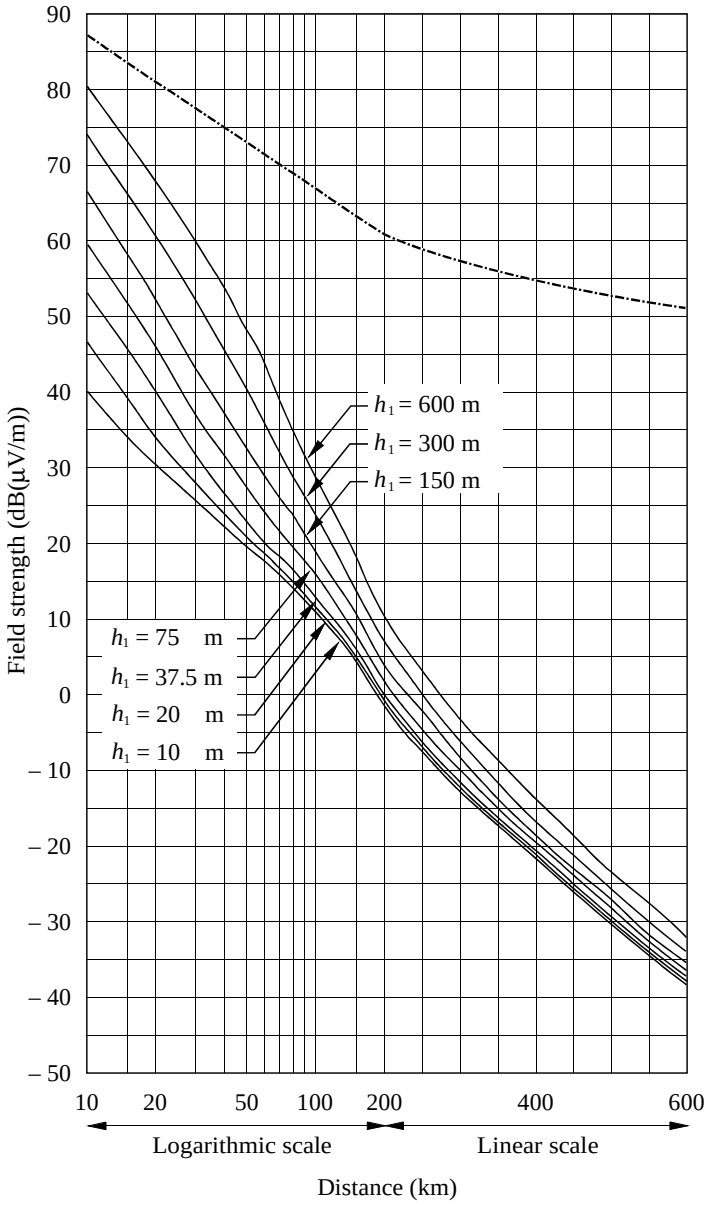
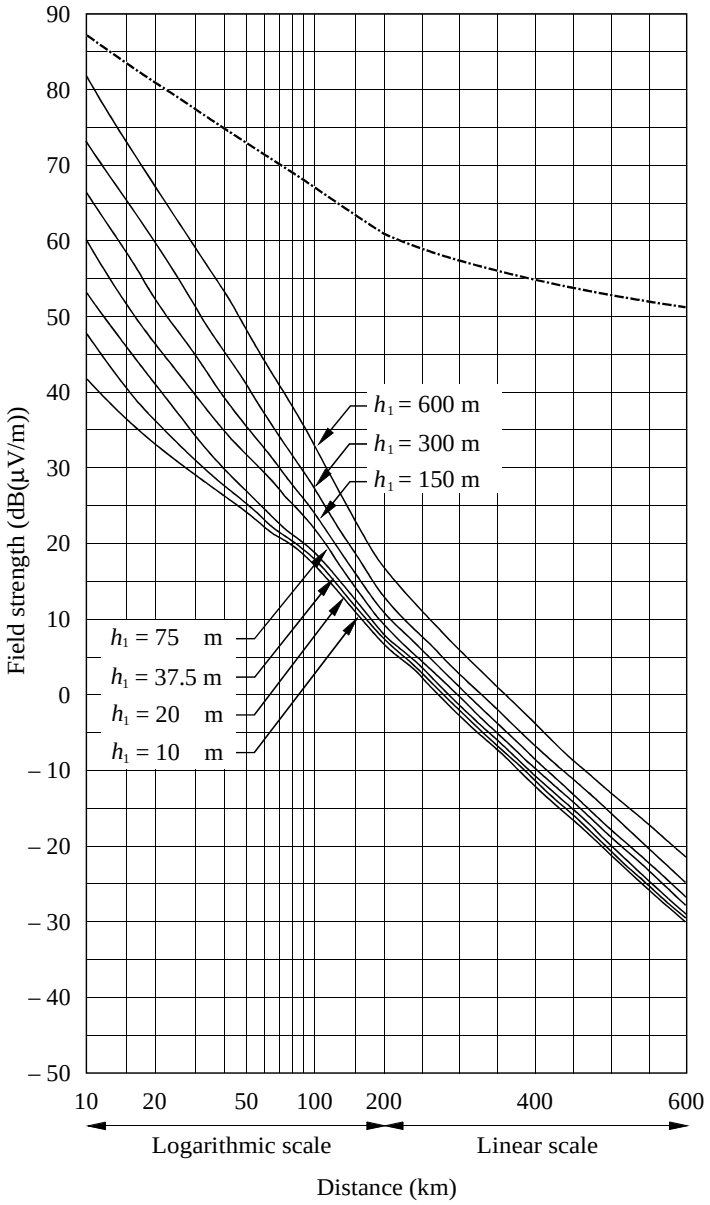


FIGURE 3

Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency: 30-250 MHz; land; 1% of the time;
50% of the locations; h_2 = 1.5 m; Δh = 50 m

Free space

D03

2.2 UHF curves

Figures 4 and 5 show curves for approximately 450 MHz and 900 MHz at mobile antenna heights of 1.5 m, base station heights between 30 and 1 000 m, 50% of the locations and 50% of the time. These particular curves were derived from measurements made in urban areas of Japan.

FIGURE 4

Field strength (dB(μV/m)) for 1 kW e.r.p.

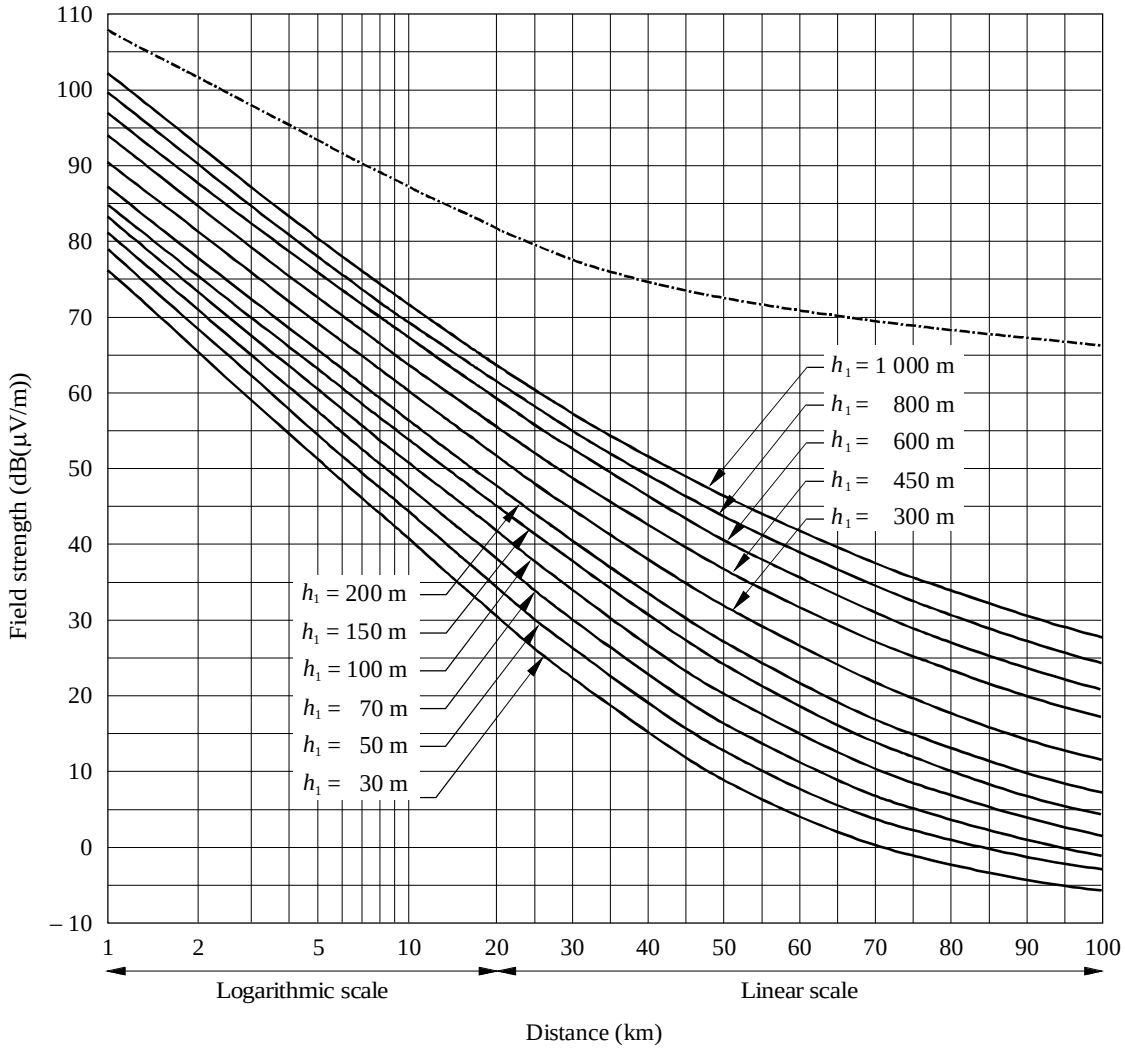
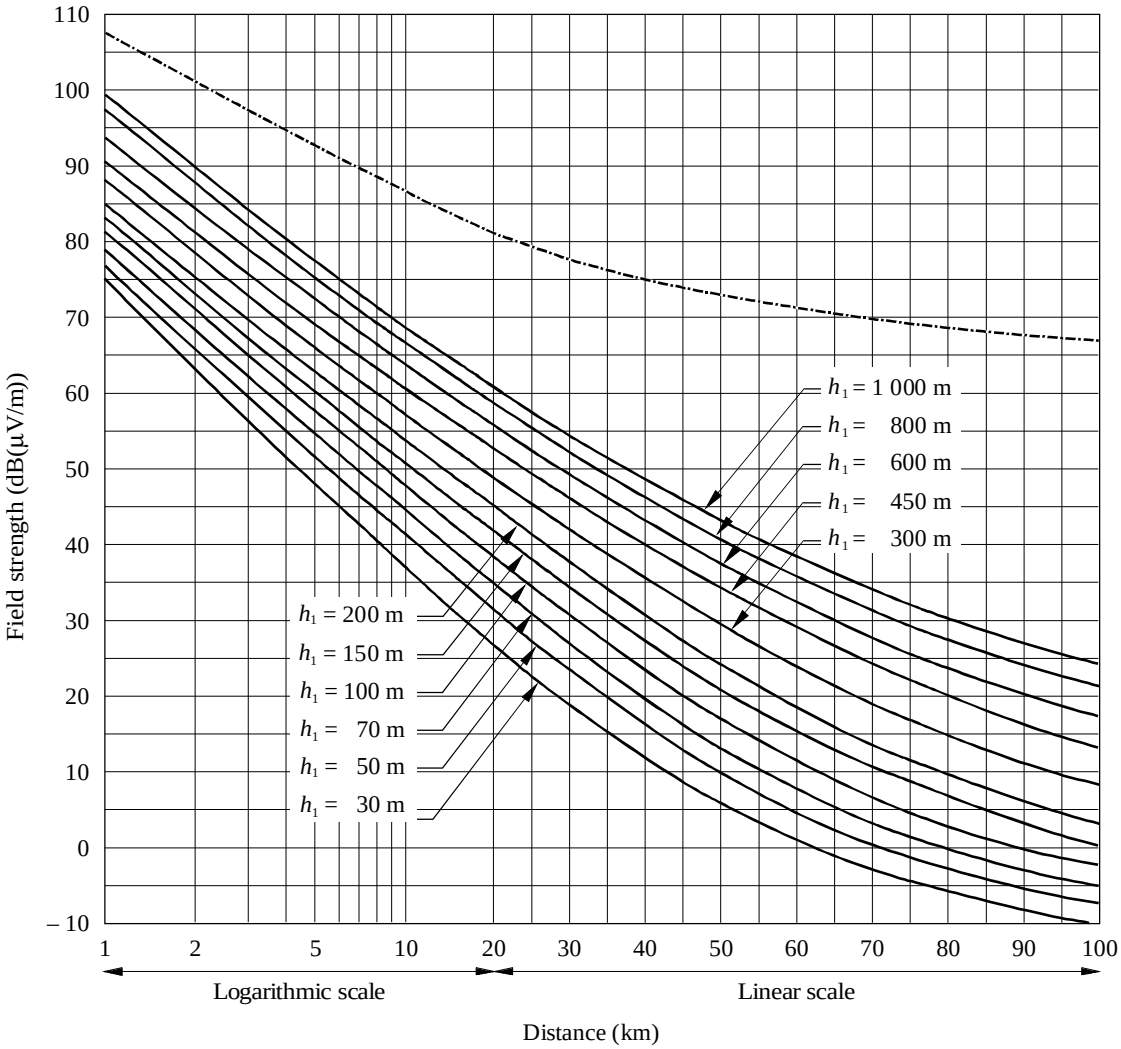


FIGURE 5

Field strength (dB(μV/m)) for 1 kW e.r.p.



Frequency ≈ 900 MHz; urban area; 50% of the time;
50% of the locations; h_2 = 1.5 m

Free space

D05

Information for small percentages of the time, appropriate for interference assessment, is given in Recommendation ITU-R P.370.

The Okumura-Hata equations which correspond to the curves of Figs. 4 and 5 are:

$$E = 65.55 - 6.16 \log f + 13.82 \log h_1 + a(h_2) - (44.9 - 6.55 \log h_1) \log R^b \quad (1)$$

where:

E: field strength for 1 kW e.r.p.

f: frequency (MHz)

h_1: base station effective antenna height in the range 30-200 m

h_2: mobile station antenna height in the range 1-10 m.

$a(h_2) = (1.1 \log f - 0.7)h_2 - (1.56 \log f - 0.8)$

$b = 1$ for $R \leq 20$ km

$b = 1 + (0.14 + 1.87 \times 10^{-4} \times f + 1.07 \times 10^{-3} h_1) \left(\log \frac{R}{20}\right)^{0.8}$ for 20 km $< R <$ 100 km.

Equation (1) is also valid for frequencies up to 2 GHz at ranges up to 20 km.