MOBILE TRAIN RADIO PROPAGATION STUDIES OVER WESTERN INDIA

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1.Introduction:

The tremendous growth of mobile radio requires the detailed knowledge of radio propagation characteristics and the effect of environment and terrain on wave propagation, (1-2). The design of future mobile communication systems for railways, transport operations etc. requires extensive experimental campaigns and comparisons of these investigations with different models.

2.Experimental details:

With the objective in view, field strength measurements were conducted in a moving train in western India in UHF band utilizing trackside microwave towers and base stations. The base stations utilised in this study are 1. Kurla (part of Mumbai) situated in a densely crowded urban area. 2. Kalyan base station located in a sub urban zone. The e.i. r.p. of both the stations are + 37 dBm and are separated by a distance of 36.6 kms. The carrier levels originally from these base stations were monitored inside the moving train.

3.Results and Discussion:

The observed carrier levels were converted into path loss values and were compared with prediction methods like Hata (3), Walfish - Berton (4), Ibrahim - parson(5) Uniform therory of diffraction (6), Egli (7), and Blanquist and Ladell (8). The main advantage of the comparison with various prediction methods whether empirical or semi empirical is possible extrapolation of these measurements to higher frequencies and different base stations antenna heights.

Figure I shows the comparison of path losses deduced from observations of Kurla base station with those predicted from Hata, Walfish - Bertoni, Ibrahim Parsons, UTD, Egli and Blomquist and Ladell. The base station Kurla is situated at a distance marked zero and the observed path losses plotted on the left side correspond to that of measurement conducted when the train was moving towards Kalyan side. The observed path loss increases steadily on either side and a maximum path loss of 145 db is seen at a distance of 6.5 kms. towards Kalyan side. Hata 's method overestimates the observed values till 6 km with a maximum deviation of 15db at 4 km on the Kalyan side. Ibrahim & Parsons, Egli's methods deviate and do not give good agreement. Walfish & Batoni's method gives very good agreement up to 5 km on the Kalyan side and therafter deviation increases. The agreement of UTD deduced path loss with observed values becomes better beyond 4 km onwards.

Figure II shows the comparison of observed path losses deduced from Kalyan base station with those predicted from different prediction methods. Here Hata's methods follows the trend of observed values reasonably on both sides. From 12 Km onwards agreement becomes very good on both sides. The deviation at these distances is confined between 3 to 4 dB. Egli's method also follows the trend on both the sides. Blanquist & Ladell 's method clearly underestimates on both sides by 15 to 20 dB.

4.Conclusion:

The field strength measurements were conducted in a moving train and the observed results were compared with different models. In the urban region, Hata's method gives better agreement beyond 5 km on Kalyan side and beyond 4 km on the other side. Walfish & Betoni 's method gives good agreement at closer distances. UTD gives reasonably good agreement at all distances and the deviation is slightly high at shorter distances. In the suburban region, both Hata's and Egli's methods follow the trend at all distances and Blomquist & Ladells'method underestimates the observed losses by large values.

5.References:

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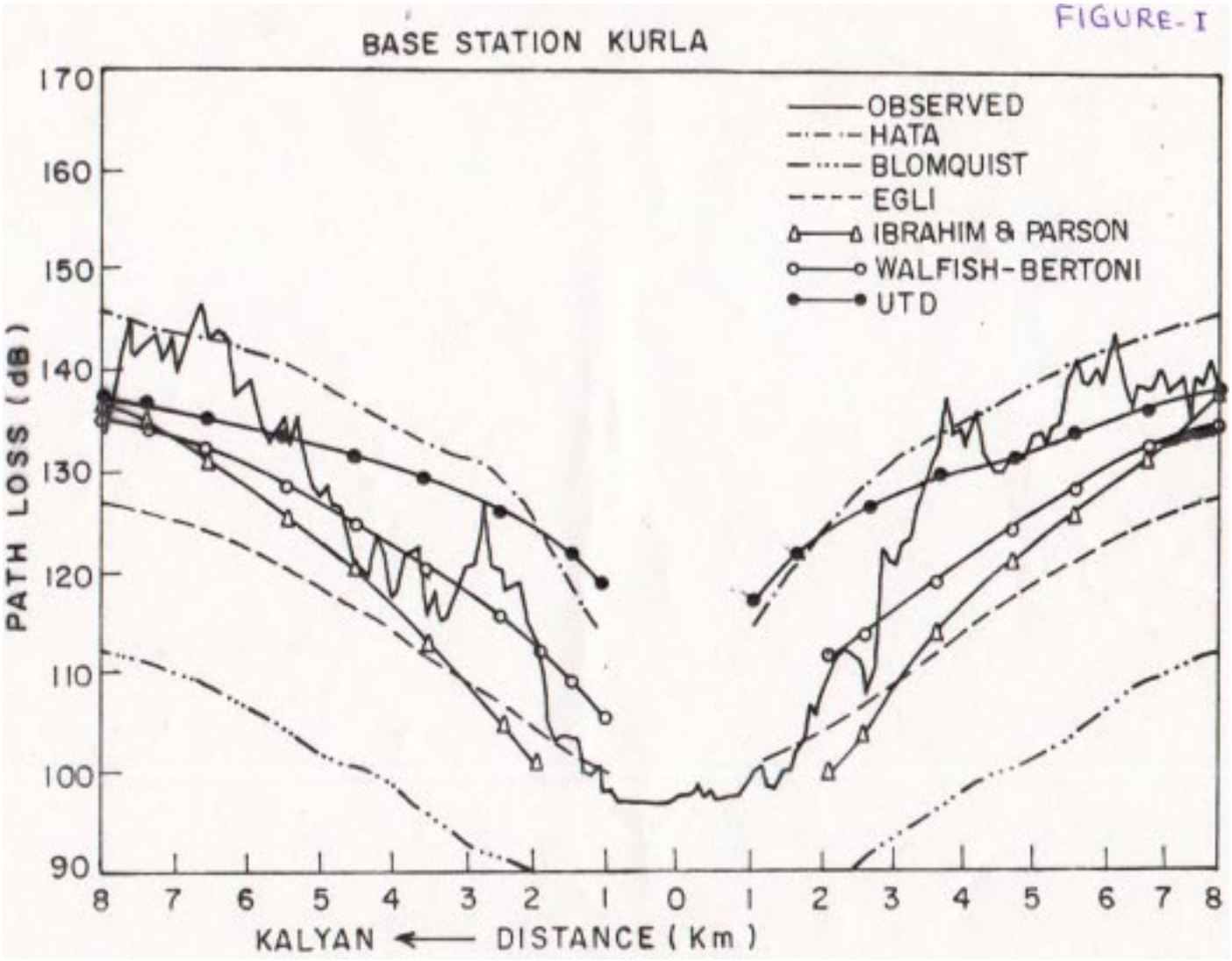
6.Figure Captions:

(i) Comparison observed and predicted path losses from various methods for Kurla base station (urban region)

(ii) Comparison of observed and predicted path losses from various methods from Kalyan base station. (sub-urban region).

Base Station Kurla

Figure I



Base Station Kalyan

Figure II