

Development of Method for Estimating Interference of Power Transmission Line with Terrestrial Digital Television Broadcasting Waves

Background

The method for estimating interference of overhead power transmission lines with terrestrial analog television broadcasting waves, established by CRIEPI almost 20 years ago, has been utilized for power companies to plan power transmission lines. As terrestrial digital broadcasting commenced in 2003, a new estimation method for digital broadcasting waves, quite different from analog ones regarding broadcasting scheme and radio frequencies, was required by power companies. This research was conducted at the request of the FEPC.

Objectives

To develop an evaluation method and a PC-based tool for estimating interference of overhead power transmission lines with terrestrial digital television broadcasting waves.

Principal Results

1. Development of estimation method for power transmission line interference

(1) Calculation method for received signal quality in digital broadcasting

While received signal quality is evaluated in terms of the averaged power attenuation and the desired-to-undesired power ratio for analog broadcasting, the digital broadcasting quality should be evaluated in terms of bit error ratio (BER). To achieve precise estimations, the following techniques have been employed for the calculation scheme as shown in Figure 1.

- (a) BER calculation: The transmitter block consists of OFDM (Orthogonal Frequency Division Multiplexing) signal composition, error correction, and so on based on the Japanese digital broadcasting standard. BER is calculated by using a computer simulation technique taking account of error correction, signal distortion, etc.
- (b) Calculation of scattered waves: A direct wave and scattered waves from power transmission lines are considered for each frequency component. The sag of a power transmission conductor and each conductor component of a tower are taken into account for the calculation of scattered waves. The measurement of received power can be also taken into account concerning environmental conditions influenced by existing buildings and terrain.

(2) Verification of the estimation method

By using experimental digital broadcasting waves, attenuations in the vicinity of power transmission lines were measured to verify the validity of the estimation method with satisfactory accuracy. The measured attenuation is around 3 dB, which is almost equivalent to the increase of BER by three figures and shows that interference area for digital broadcasting system will decrease compared to the analog one.

2. Development of estimation tool

A PC-based estimation tool has been developed with user-friendly functions for the input assistance for power transmission line specifications and for displaying calculated results graphically on a map as shown in Figure 2. The influence of buildings can be also estimated.

Future Developments

The developed estimation tool is applied not only to the power industry but also various construction-related sectors.

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Reference

A. Ohtsuka, K. Takeshita, Y. Serizawa and T. Yanagisawa, 2004, "A Method for Estimating Shielding and Scattering of Terrestrial Digital Broadcasting Waves by Overhead Power Transmission Lines", ITE Annual Convention, No. 16-7. (in Japanese)

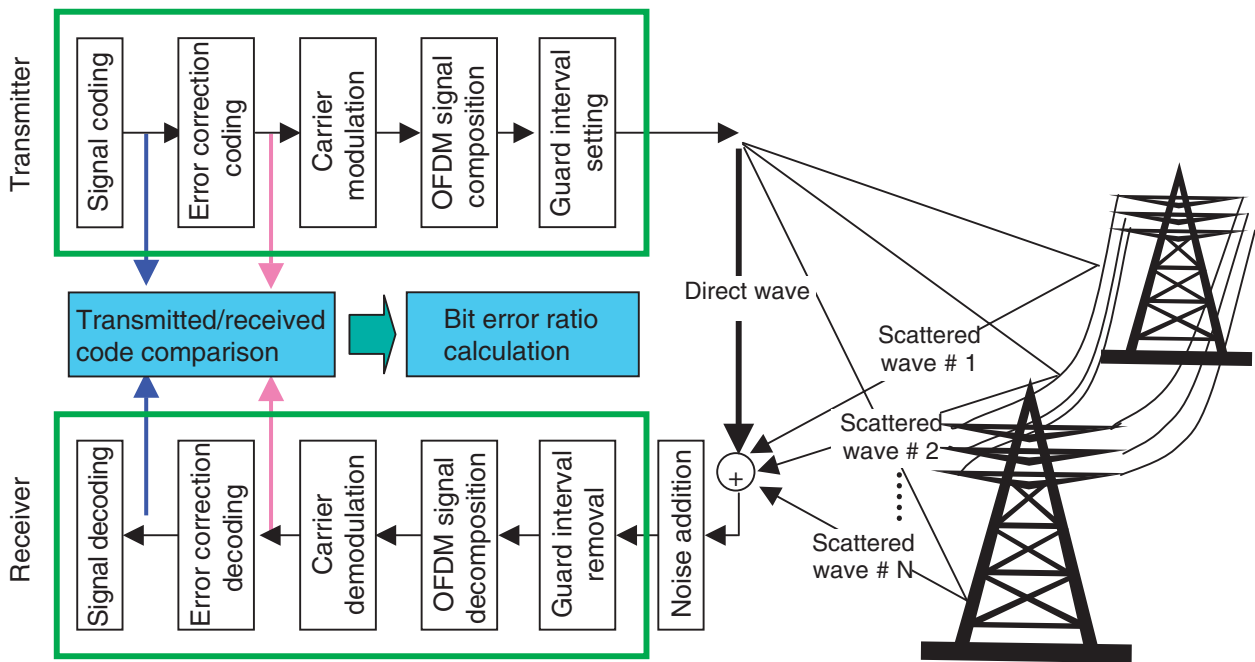


Fig.1 Schematic diagram of the estimation method.

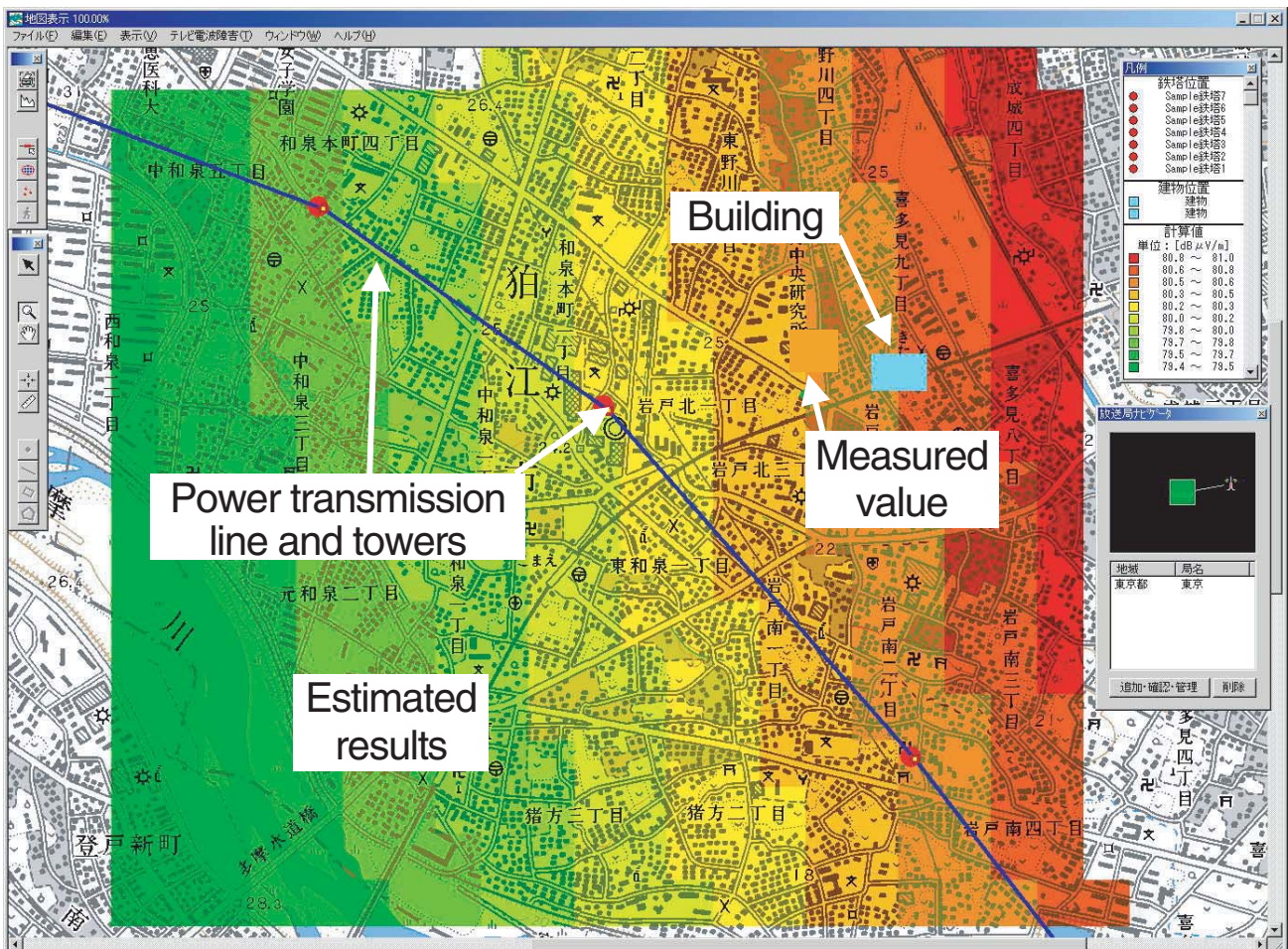


Fig.2 A result of estimation by the estimation tool.