A simple computer program for microwave radio link performance analysis

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Abstract

A simple computer program is developed for system power budget analysis of microwave radio links. As known, such an analysis is very important in radio link network planning and optimization of the existing transmission networks. The performance of the program developed in this study is tested by applying it to Adana region and by comparing with measurement results.

Key words: Radiocommunication, Microwave, System performance, Numerical simulation, Power budget, Computer program.

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I. INTRODUCTION

Microwave radio links are widely used in cellular communication networks in order to develop the transmission infrastructure between Base Transceiver Stations (BTS), Base Station Controllers (BSC) and Message Switching Centers (MSC). As known, in order to achieve a continuous and satisfactory transmission between the transmitters and receivers, the magnitude of the signal reaching the receiver should be above a certain threshold value. Therefore, it is important to analyze the system power budget for certain parts of a transmission network and investigate the effects that cause the changes in the radio link power level. Also, it is known that such analysis deals with fade margin together with losses due to the hardware components of the system and all effects causing propagation loss. This information is important for system planning studies; and may be required for installing a new system or for improving the capacity or performance of a present system.

There are many commercially available computer programs that can be used for system planning purposes. One of the most popular and well-known link design program is the one named “iQ-Link” [1] and the Company declares that more than 200000 existing microwave paths have been designed using this tool. It supports analysis in the full range of frequency bands from 2 to 60 GHz and can accomplish complex analysis algorithms and not easy to use. Also, it costs too much and some of the softwares having certain features are sold separately. Similarly, “Nokia NetAct Link Planner” [2], also offers efficient and flexible microwave link planning and, if the coordinates of near and far ends of the link are entered, it has the feature of checking LOS (Line of Sight) clearance. It is sold to GSM operators as a part of Nokia NetAct Planner Software Package. Another software also sold by Nokia is the one named “DrLink” [3] from which is known as digital radio link route design program. It is simple and easy to use; but, rain and fog loss calculation is not made properly because it uses average rain rate values to make estimations. “Ellipse Transmission Planning” [4], is another commercially available software which uses flexible propagation models based on ITU recommendations. It also has interface with standard Geographic Information Systems (GIS) like MapInfo or ArcView. “Quantum” [5] is a software used for both RF modeling and microwave link design purposes. TELSIM, which is one of the GSM operators in Turkey, uses this software and design engineers of the company claim that sometimes LOS tests give wrong results; therefore, it is suggested to make surveys in advance and check whether the LOS condition is satisfied.

In this work, a simple and user friendly computer program is developed to accomplish system power budget analysis which we named as “Microwave RL Tool”. The transmitter power output level, rain rate, fog density, distance, polarization type, antenna radius, temperature, foliage depth are the effects considered during the analysis. The main output of the investigation is the received power level, for different radio link types and environmental conditions that is calculated by the software. In order to analyze the performance of the computer program, the behavior of the transmitting system at three different frequencies (10.5 GHz, 23 GHz and 38 GHz) are examined in Adana Region under different atmospheric conditions. Measured and calculated values are compared, and the reasons of possible differences between them are investigated.