Aims and scope

RA$_3$DIO is a virtual reality simulation environment for the design, optimization and management of radio networks.

RA$_3$DIO lets you place antennas interactively in a 3-dimensional terrain. You can instantly visualize the radio wave propagation prediction.

RA$_3$DIO automatically suggests a placement of a smallest possible number of antennas that cover any given terrain.

RA$_3$DIO analyses your existing and new cellular radio networks (**2**). It computes co-channel interferences (**3**), and helps you to find an optimal frequency reuse plan.

RA$_3$DIO lets you optimize broadcasting and paging networks. It analyses delay spread areas and suggests different delays for the antennas in order to minimize these areas (**4**).

RA$_3$DIO manages all your antenna data in a common database. All of this (and more) is under easy visual control at your fingertips, with a single click for each feature.

RA$_3$DIO runs under Microsoft Windows NT and newer versions of Windows. It uses the ultimate in algorithms technology, to let you navigate in real-time in the virtual world of antennas on the terrain. It is designed according to the latest in software technology, to make extensions that you may need feasible and economic.

**xeraina**
Quality Algorithms

RA$_3$DIO

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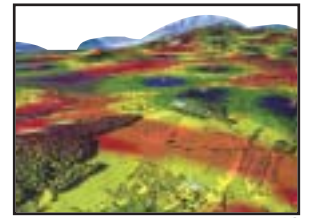
The system basics

RA$_3$DIO is truly a realtime system: Flying interactively over the terrain and observing radio signal strengths is done with high speed and realistic impression. Placing new antennas, changing their characteristics, or moving their position and of course removing them – all of this is reflected on the screen instantly.

This is made possible on one hand by several fast implementations of empirical electromagnetic wave propagation prediction models. These models are best suited for rural and suburban areas and carrier frequencies in the VHF and UHF range (20 MHz–40 GHz). The models take into account digital elevation data, land-usage data (**8**), and antenna characteristics. Antenna characteristics are given

through standard antenna parameters complemented with horizontal and vertical radiation patterns (**7**). RA$_3$DIO provides following prediction models: free space, CCIR-Hata, COST-Hata, modified Hata, Longley-Rice, and Walfish-Ikegami. All of these models can be combined with radio visibility and knife-edge diffraction computations (**6**). Visibility computations are necessary for cellular GSM and UMTS radio networks.

On the other hand, RA$_3$DIO is efficient due to its specific terrain data maintenance and visualization software architecture, designed to support the interactive exploration of arbitrarily large topographic scenes. Navigation is made simple with 3D coordinates in different coordinate systems and small scale maps, compass, and terrain-contour profile.

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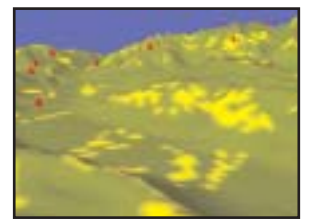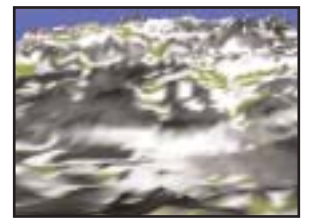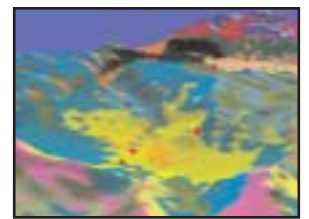
Terrain data

RA₃DIO accepts digital elevation data and land-usage data from free or commercial sources. The triangulated terrain model is produced with an additional stand-alone terrain data converter. Optional texture data mapped onto the terrain helps you find better your way in space (**1)**. Texture data is accepted from remote sensing satellites, aerial ortho-photos, or topographic pixel maps.

Antenna management

As you expect, RA₃DIO lets you keep track of your antennas with ease. It also helps you manage data from antennas in a standard database. In addition to the placement related data such as height, power, carrier frequency, it is of course easily possible to maintain other data, such as those specific for suppliers. The strict separation of terrain data and antenna data lets you easily integrate existing networks into RA₃DIO.

Placement optimization (optional)

The optimization component is a gem. It lets you cover any given terrain with a minimum number of antennas of given type (**5)**. RA₃DIO gives you the maximum freedom in interacting with the optimization. You can reach a partial conclusion on the basis of the optimization algorithm's suggestion, modify the placement in any way you like, and rerun the optimization for the terrain that remains to be covered. Any decision you make can be revoked at a later time. This gives you the full spectrum of possibilities, from fully automatic to totally manual placement. In particular, existing antennas are fully taken into account by the optimization software.

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RA₃DIO

Contacts

RA₃DIO is a professional tool for interactive and automatic antenna placement and radio wave propagation prediction. It is based on a research prototype supported by the Swiss National Science Foundation and the Swiss Federal Institute of Technology, Zurich (ETH). For any further information, please contact:

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