



A short list of supported features

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1 General Information

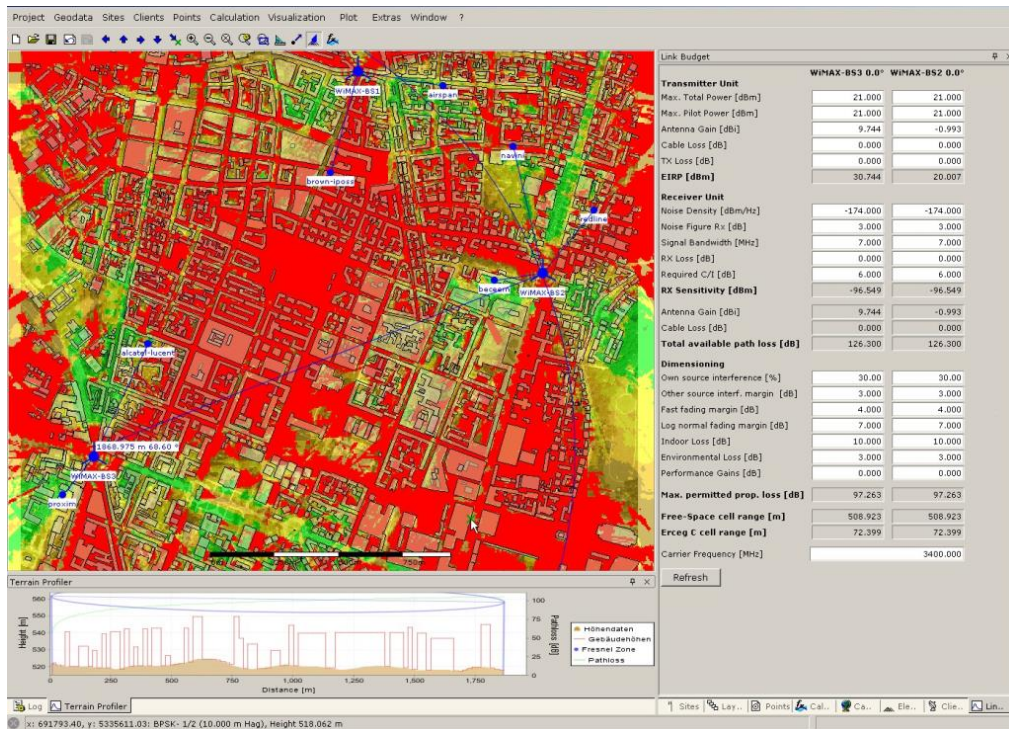


Fig. 1. Screenshot of WiMAP-4G. It is particularly designed to plan networks for broadband wireless access.

WiMAP-4G is the radio network planning software by brown-iposs. It is developed particularly for planning the air interface of wireless broadband access networks, e.g. based on WiMAX or WLAN standard.

WiMAP-4G is Java-based and able to run on every modern standard PC.

2 WiMAP-4G Editions

There are two editions of WiMAP-4G.

2.1 WiMAP-4G Community Edition (free of charge)

- Basic propagation models
- Comfortable project creation and handling
- Basic antenna patterns
- Basic visualisation features

The Community Edition offers almost all functionalities but with limitations. Such limitations are e.g. a maximum of 12 Sites in a single project and a maximum of 50 points of a category, limitations in displaying resolution or missing export features.

2.2 WiMAP-4G Professional Edition (purchasable)

- Additional import/export features
- Additional high-class propagation models
- High-definition visualisation
- Several available antenna patterns
- Unlimited number of sites and points supported

The Professional Edition will offer higher flexibility, more comfort and additional features to improve your productivity and successful planning.

3 New features in release 7.1

The focus of WiMAP-4G are several enhancements in using templates that can be used to create projects more easily. However, several detail enhancements have been implemented (references are pointing to chapters of WiMAP manual):

- Antenna Type – integrity of data checked when loading
- OSM Buildings – importing with customer settings
- OSM Buildings – accept/deny unknown class types (chapt 5.7.1 and 5.7.2)
- OSM Buildings – mapping same classes not to be allowed
- OSM Buildings – mapping building class to OSM building class as default
- OSM Buildings – offer partitioned download (chapt. 1.6)
- OSM Buildings – available loading from file for desired coordinate system
- Support calculation with building intersection for Erceg Model – only Professional Version (chapt. 11.3)
- Support calculation with building intersection for ITU-R P.1411-3 – only Professional Version (chapt. 11.3)
- Support CORLA calculation with geographic coordinate system – only Professional Version
- Elevation Model – available loading from file for desired coordinate system (chapt. 4.2.1)
- Site export (CSV) includes also technology information
- Replaced Java JRE with OpenJRE
- Supporting only edit and delete function for global database – only Professional Version (chapt. 1.7)
- Location Image – import for desired region (chapt. 4.4)
- Points – adjust "Capture Measurement Points"
- Points – Convert drawn points into points of desired point category
- Points – "Multiple Colour Assignment" with power level only for active objects
- Improved performance of Area Field Strength calculation
- Replaced default http link with https link to load elevation model (chapt. 1.6)
- Replaced default http link with https link to load OSM buildings (chapt. 1.6)

4 List of Features and Requirements

4.1 Operation Systems and System Requirements

WiMAP-4G supports Windows 7/8.1/10, 32-bit versions as well as 64-bit on any current (standard) PC hardware. In particular WiMAP-4G runs also on every current standard notebook. Since WiMAP-4G is Java-based other platforms may be supported on request.

4.2 Data Handling

4.2.1 Geographical Data

Geographical data is required for radio propagation prediction and to assign the calculation results to locations. Such data is provided typically as raster data (like formats as TIFF, GIF, JPG or PNG) or as vector-orientated data (DXF: AutoCAD, Autodesk). Also building data can be generated from vector-orientated data (2.5D - building data) and vice-versa building data can be used as maps.

Topographical data is required for every field strength prediction, mainly for detection of "line-of-sight" and for the calculation of reflections and shadows. This data is expected to be available in ASCII Grid-formats (ARCInfo, ESRI) or basic X-Y-Z lists.

WiMAP-4G supports UTM and WGS84-coordinates. Elevation data can be imported from free online sources within WiMAP-4G while initializing a project.

Building data is used by the high-precise propagation prediction model CORLA, which is based on a 3D-Ray-Tracing approach. Shadowing, reflections, and diffractions by buildings are explicitly taken into account here. The data is expected to be available as MIF-files (MapInfo). And building data also can be imported from online sources like Corine or OpenStreetMap™.

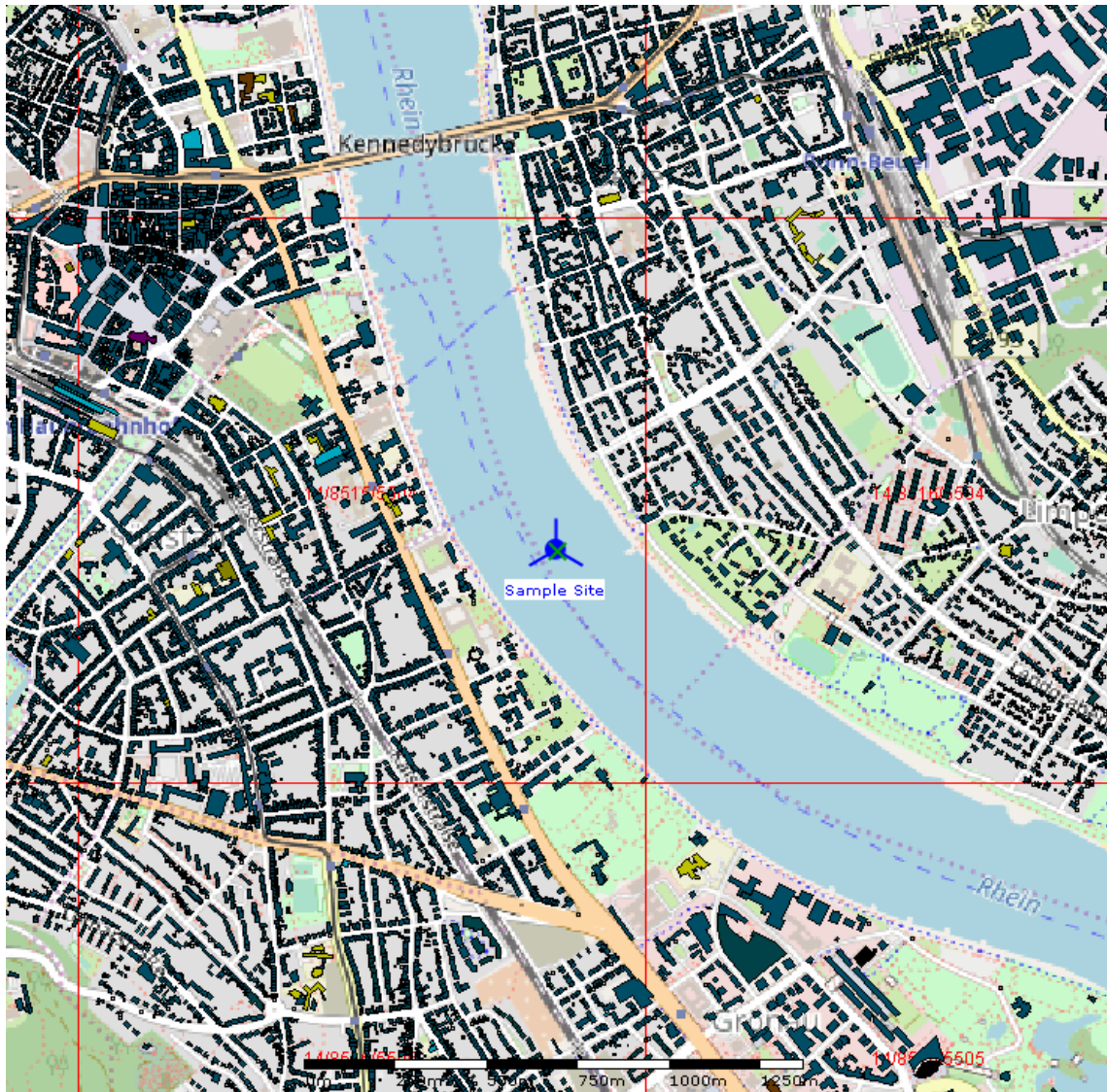
Building data also can be used by the propagation models FreeSpace, Erceg and ITU-R P.1411-3. These models can use building intersection for the area field strength calculations (WiMAP manual, chapter 11.3). This is only available in the Professional Version of WiMAP-4G.

4.2.2 OpenStreetMap™ Buildings – used defined

In the global settings WiMAP the user can define building/landusage classes by his own.

WiMAP already delivers a large amount of building types and their related heights. By default, all these building types are enabled. So, when loading building data by OpenStreetMap™ import (see manual chapter 5.7) WiMAP checks whether the building by OpenStreetMap™ contains information about its height. If so, this data will be used as building height. If the data contains no information about building height, WiMAP will check if there is a corresponding building type in the list. If the option "Fill missing height" is activated WiMAP will use the value for this building type defined here. If there is no corresponding building type the default height value will be used.

If the building data from OpenStreetMap™ contains no information about the building height and there is no building class defined in WiMAP, the building height will be set to 0 (zero), if option "Fill missing height" is NOT activated.



WiMAP-Project with OSM-building data

For further details see WiMAP-4G-Manual chapter 1.6 and 5.7.

4.2.3 Technologies and Hardware Types

WiMAP-4G supports the opportunity to edit and create own technologies. Variable channels can be attached to each technology.

Hardware types are used to define types of hardware for creating sites or clients in a project. Based on the technologies hardware types which include radio units and antennas can be created. It's also possible to add documents (e.g. antenna diagrams, technical information etc.) to this hardware types.

4.2.4 Site Data

Site data is required for every propagation prediction. It includes

- Location of sites (coordinates)
- Category
- Creatable from templates
- Hardware (including radio units and antennas)

The user can define site templates which are helpful especially in bigger projects so creating several sites in the project is much easier.

4.2.5 Additional losses/gains (e.g. cable loss) Radio Unit Data

Radio unit represents an antenna set which can be used for distributed antennas. The radio unit is assigned to a hardware which then can be assigned either a site or a client. The radio unit can have one or more antennas for representing MIMO-antennas.

4.2.6 Antenna Data

Antenna diagrams are required for every propagation prediction. WiMAP-4G interpolates a 3D-antenna diagram from its vertical and horizontal antenna diagram like they are typically provided by antennas' vendors. Data is expected to be in ASCII-format like the MSI-format (Planet). It is also possible to deal with several electrical tilt measurements for antenna diagrams in WiMAP-4G, the data itself can be edited within WiMAP-4G.

As Professional Edition user you can find prepared antenna diagram packages for WLAN and WiMAX in the download area.

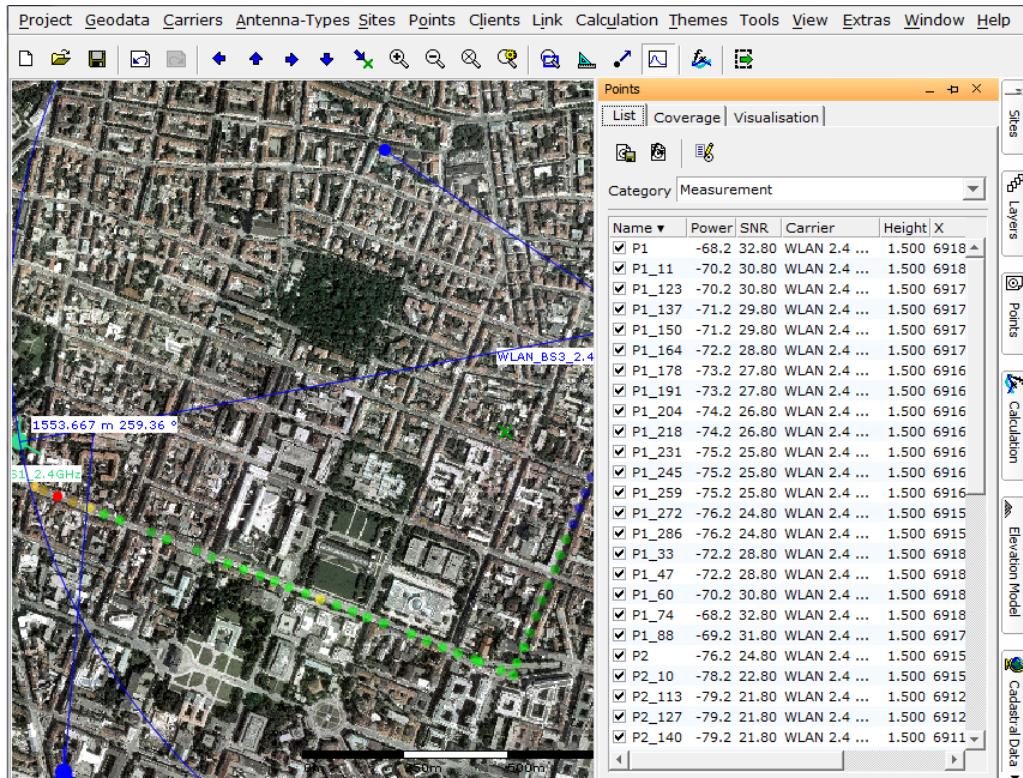
WiMAP-4G supports distributed antennas for multi-input multi-output (MIMO) technology, too. MIMO technology is used to enhance the performance of signal transmission. In practice the distributed antennas can interfere with each other although their signals are transmitted over different mediums.

4.2.7 Clients

For fixed-line substitution by wireless often outdoor antennas with significant antenna gains and high receiver heights are used. WiMAP-4G supports the planning of such scenario with the help of "clients". Apart from "points" these objects are bounded to a site and characterized by the channel. Clients use the same data structure as sites.

4.2.8 Measurement Data

Measurement data from different sources like e.g. tools for doing site-surveys can be imported and visualised in WiMAP-4G. By this feature measured and predicted power level results can be easily compared.



Measurement points can be

- imported and exported as csv-files (with tab delimiter)
- assigned to a channel (e.g. WLAN 2.4 GHz channel 1)
- visualised with colour table taken from channel
- visualised according to power level, data rate, C/I, field strength
- exported as KML-files (to Google Earth™ e.g.)
- edited with individual URLs which offer a direct link to any web-application
- imported from Spectrum Analyzer

4.2.9 Location Images

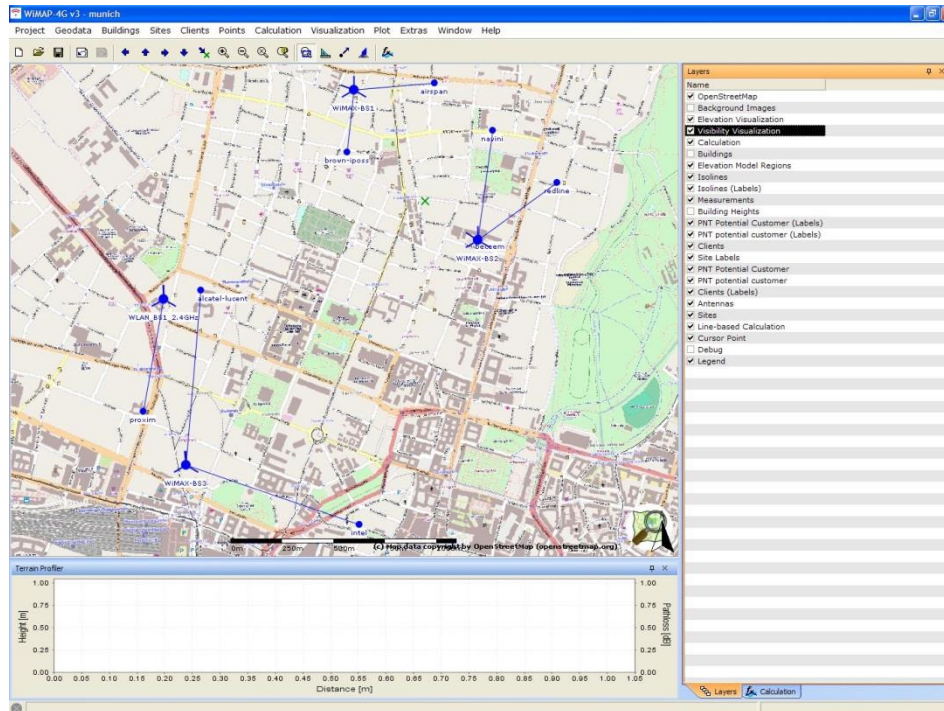
The location images are georeferenced images that contain coordinate information, can easily imported in WiMAP-4G and viewed. WiMAP-4G supports the import location images with JPEG-Format. It is possible to browse and to rotate through multiple images from one location while watching. Location images can be grouped into categories.

4.3 Geographic Operations - GIS Editor

Since WiMAP-4G is a visualisation tool the geographical presentation is the main interface to its user. Several typical GIS-features are available in WiMAP-4G, including:

- Selection of categories for display
- Site details
 - Antennas
 - Symbol, background
 - Name, identifier
 - Azimuths, sectors

- Height, clutter and other raster data
- Satellite photos and background maps (OpenStreetMap™)



- Calculation results
 - Power level
 - Field strength
 - Coverage, based on pre-defined carrier-based thresholds
 - Server levels, best-server
 - C/I representations
 - Sub Carrier Interference
- Orientation
 - Move up
 - Move down
 - Move to top
 - Move to bottom
 - Zoom in
 - Zoom out
 - Zooming by opening rectangular
- Set display properties
 - Define visual appearance
 - Set font, size and style for text
 - Save GIS display configurations
 - Save current display as a preference
- Tools
 - Distance and angle measurement-tool
 - Distance circle
 - Centre point of interest
 - Magnifier
- 3D-visualisation
 - Building data
 - Background maps and photos

- Calculation results (e.g. power level)

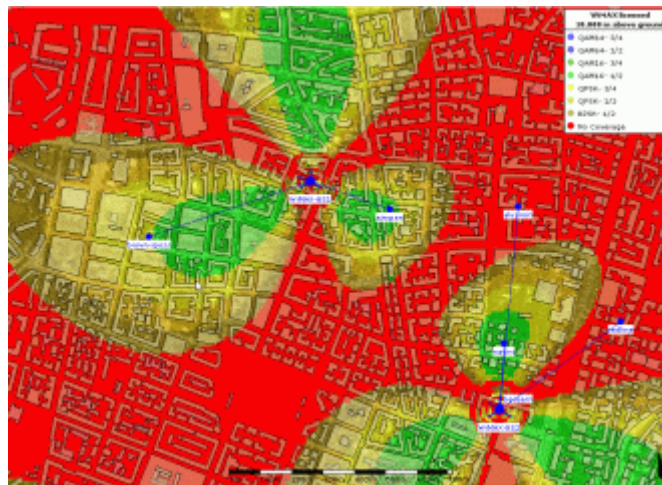
4.4 Radio Propagation Models

WiMAP-4G offers several radio propagation models.

4.4.1 Free-Space Propagation

The Free-Space-Propagation model is primarily based on the elevation model. Optionally it takes into account visibility restrictions regarding the elevation model and the building model. While this model is not well-suited for city centres and strongly cultured regions, it produces good results for suburban and rural regions. It can help you to identify critical regions where detailed measurements should be done. It is applicable for every frequency between 100 MHz and 11 GHz (and above).

4.4.2 Erceg Propagation

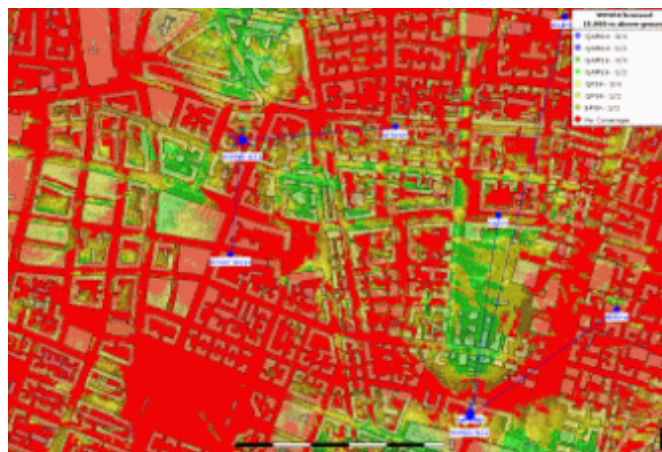


The IEEE 802.16.3c proposes this model developed by Victor Erceg for WiMAX planning. It is designed for suburban - urban areas and considers three Non-Line-of-Sight (NLoS)-scenarios - A, B and C.

- A - Hilly, medium to high vegetation
- B - Hilly, low vegetation or flat with medium to high vegetation
- C - Flat with little vegetation (also for urban areas)

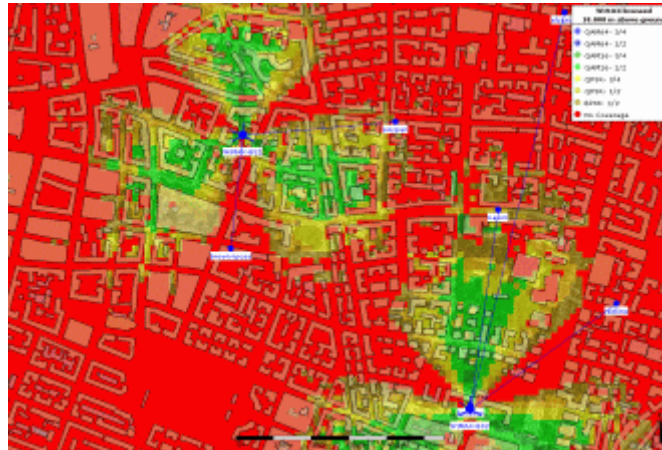
It is applicable for frequencies between 450 MHz up to 11 GHz, according to IEEE 802.16.3.c.

4.4.3 CORLA



CORLA - a Cube Oriented Ray Launching Algorithm - uses a discrete cube based representation of the supplied area that leads to a fast identification and processing of diffraction and reflection sources. Different antenna patterns, delay spread and building penetration are inherent features of the algorithm. It is applicable for every frequency between 100 MHz and 11 GHz (and above). CORLA is licensed by TNC (Telecommunication Network Consulting). Based on CORLA, TNC offers powerful decision support modules for UMTS network planning, like BTS_Opt. For more information visit www.telnetcon.com or contact info@telnetcon.de.

4.4.4 ITU-R P.1411-3



ITU-R P.1411-3 is a semi-empirical model based on COST 231 Walfish-Ikegami and enhanced by ITU-R. The model considers detailed input data like average height and separation of buildings, street data (width, direction), BS and MS antenna height, length of the path covered by buildings as well as distance from BS to MS. It is applicable for radio frequencies between 450 and 6000 MHz.

4.4.5 WinProp

WinProp is for propagation modeling in different scenarios (like rural, indoor and outdoor) with different model types of calculation. In this version, only click on Rural. There are four model types include:

- Dominant Path Model
- Okumura-Hata Model
- Empirical Two Ray Model
- Deterministic Two Ray Model

WiMAP uses the Dominant Path Model

4.5 Coverage Prediction

The following results can be visualised in WiMAP-4G with individual defined renderers:

- Best server
- Carrier to Interferer, identifying signals interfering with the serving signals
- Power level
- Field strength
- Modulation and coding schemes (e.g. QAM16 1/2)
- Coverage based on C/I and power receiving levels

4.6 Terrain Profiler

The terrain profiler is designed to support the analysis of point-to-point connections. It takes into account:

- Profile display
- Items to include in profile:
 - Terrain heights and building data
 - Radio path and first Fresnel zone
 - Transmitter and receiver heights
- Calculations to include in display:
 - Azimuth and distance
 - Starting and end points
 - Predicted path loss
- Draw line of profile on map
- Draw distance circle on map
- Site-to-point
 - Select antenna and cell on site
- Cell-to-Cell: model based on 1st cell, receive based on 2nd cell
 - Select start and end cells
 - Set transmit and receive heights based on antennas of the cells

4.7 Link Budget

Between each two points - practically between every transmitter and receiver - the link budget can be calculated, based on all typical RF parameters, including the channel bandwidth and minimum required C/I. Due to its integration with the link budget it is possible to calculate directly with the directed antenna gain of each antenna.

Based on the calculations the following results are available:

- EIRP as a result of transmitted power, antenna gains and losses
- Receiver sensitivity as a result of receiver's noise figure, thermal noise and channel bandwidth
- Total available path loss [dB] as a result of Tx EIRP and Rx sensitivity and antenna gains/losses
- Max. permitted propagation loss [dB] as a result of total available path loss and dimensioning figures
- Free-Space cell range (m)
- Erceg (A,B,C) cell range (m)

The required parameters are taken as long as possible from the antennas of interest. To support this, the link budget is connected with the terrain profiler mentioned above. Parameters from the antennas considered in the terrain profiler are used here, too.

4.8 Site-to-Site Prediction

The site-to-site prediction is a special case of the link-budget calculation. For any initial antenna (might be many) the power level to any other antenna of the same channel and within a suitable range is calculated and visualised as a coloured line, and are shown as tool tips.

4.9 KML-export

Calculation results can be directly exported as KML-files and visualised easily within Google Earth™ or Google Maps™.

5 About brown-iposs

Founded in 2006 brown-iposs possesses know-how of many years in the area of planning, optimizing, engineering, and operating mobile broadband networks. In-depth experience with carriers and providers gives a portfolio of consultancy, well-proven software and specially developed products. In its own WiFi-testing network bips.net new products, technologies, and services are evaluated permanently.

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