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## **Qosmotec Air Interface Simulator User Guide**

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## **Prerequisite skills**

For network professionals and system administrators, the following skills are assumed:

Proficiency with Windows-based applications

General knowledge about mobile networks and expert knowledge about high-frequency components such as cable attenuators

System administrators are also expected to be familiar with the network test processes and standards of the test labs in which AIS will be used.

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# 1 Introduction to AIS

## 1.1 About AIS

The Qosmotec Air Interface Simulator (AIS) is a tool, which simulates essential effects of signal propagation through open space, such as the free space path loss, slow or fast fading, on a mobile radio link between mobile terminals and the network infrastructure. As the name suggests, the tool shall be used in a laboratory environment to simulate aspects of the air interface that do not occur in cabled configurations, but which are of utmost importance for network or terminal validation. It is thus aimed at infrastructure or mobile equipment manufacturers or network operators that are performing end-to-end tests in a controlled laboratory environment. It can be applied to tests of network as well as terminal equipment.

To simulate the air interface, the AIS hardware uses signal attenuators that are regulated by computer to control the individual radio paths between base stations/sectors and mobile phones. AIS can provide up to 32full bandwidth GSM/GRPS or UMTS radio paths in one 19 inch metal enclosure.

A graphical user interface (GUI) enables testers to create configurations of base stations/sectors mobile phones, and other elements of a natural environment such as hills, tunnels, and buildings. In these configurations, the movement of mobile phones is tracked and the signal strength between mobile phones and base stations/sectors is adjusted accordingly. As a result, AIS can create realistic simulations of handover and fast fading situations. Because these configurations are computer-controlled they can be saved and reused and run automatically with minimal support from testers.

#### Note:

AIS creates the environmental conditions for handovers but it does not enforce handovers. That is the task of the mobile network.

AIS does not perform the test calls during which handovers are expected to occur. Testers perform handover tests either by controlling the mobile keypad manually, or by using an automatic callgenerator.

## 1.2 The AIS system components

The AIS system consist of the following hardware and software components:

The subrack

The attenuator modules

The AIS server

The AIS resource manager

The AIS switch matrix

AIS client

## 1.2.1 The Subrack

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The Qosmotec Air Interface Simulator consists of both hardware and software components. The hardware resides in a 19" metal case, termed *Subrack* fitting up to two drawers with connectors for four base stations and four mobile station antennae each. On the backside of the subrack, data network (fast Ethernet) connection and power supply (220 volts) are provided. Each mobile connector is internally linked to each base station connector via a separate semiconductor attenuator, which can be addressed and controlled individually. The network connection allows connecting remote terminals to the attenuator hardware and controlling the hardware via GUI clients



Air Interface Simulator Subrack

The AIS is equipped with an internal CPU. The CPU is a standard industrial PC-compatible microcontroller board with connectors for external data networks and a bus for internal access of the attenuator modules. The CPU runs the software that drives the attenuators and the server process, which provides a set of functions to operate the attenuators from remote clients.

## 1.2.2 The attenuator modules

The AIS hardware furthermore encloses a number of so called  $2x^2$  Attenuator Modules that each contain 4 semiconductor attenuators with a response time of 8  $\mu$ s.

Each attenuator module links 2 base stations with 2 mobiles, so that each mobile is connected via an individually controllable link to each base station. Four attenuator modules are cascaded into a basic 4x4 configuration, interconnecting 4 mobiles with 4 base stations.



Internal Architecture of the AIS Hardware

Each attenuator assembly contains either 16 GSM/GRPS attenuators or 16 UMTS attenuators. These 16 attenuators support 16 individually modulated radio paths.

For GSM/GRPS attenuators, the range of attenuation is 0 to 63 dB within a frequency range of 800-2000 MHz.

For UMTS attenuators, the range of attenuation is 0 to 95 dB within a frequency range of 1600-2500 MHz.

The attenuator modules are adjustable by software control in 1 dB steps. The response time of an attenuator is 8 micro-seconds.

The base configuration is 4x4 (4 mobiles and 4 base stations/sectors.). This is realized with one drawer put into a subrack.

Two 4x4 configurations can be externally connected by using cables to form a single 8x4 configuration (8 mobiles x 4 base stations/sectors or 4 mobiles x 8 base stations/sectors).

To create larger configurations of mobiles and base stations/sectors, the signal needs to be split. Splitter-combiner panels can be provided for this purpose.

There is an additional attenuation of the signal of 4 dB when a splittercombiner panel is used. For this reason, the largest configuration possible is 8x8. An 8x8 configuration for UMTS is shown in the following figure.



When two subracks are used, the server in one subrack acts as the master and the other server acts as the slave so that users of the AIS GUI see one system rather than two.

### 1.2.3 The AIS server

The AIS server is a software program that runs on the micro-controller inside the AIS subrack (see chapter "<u>The Subrack</u>")and calculates and controls the signal strength of the attenuators in a subrack. These calculations take into account the position of mobiles and base stations/sectors in the virtual landscapes created on the AIS clients.

## 1.2.4 The AIS resource manager

The AIS software provides a simple resource manager for multi-user access. The resource manager handles requests for mobile groups from users and it ensures that allocated mobile groups cannot be accessed or monitored by other users.

## 1.2.5 The AIS switch matrix

The AIS switch matrix is an optional component, that allows to connect more base stations to an AIS than actually usable due to the number of attenuators. With an m x n switch matrix, a subset of all m connected base stations is mapped to the n BTS input ports of the AIS subrack, that can be served by an AIS server.

The handling of the AIS switch matrix is done implicitly by the AIS server. The user clients will always be updated with the current information of the used subset of base stations that are made usable through the switch matrix.

## 1.2.6 AIS client

The AIS GUI is installed on a client which is linked to the AIS hardware using the fast Ethernet network in the test lab. A client is a standard PC running Windows 2000 or XP.

From the GUI, you can do the following:

Create virtual landscapes called sceneries populated with the base stations/sectors and mobiles connected to the AIS hardware.

Move the mobiles across a scenery and monitor the changes in attenuation between the mobiles and the base stations/sectors.

Display attenuation graphs from dial settings stored in a comma separated file.

More detailed information on these tasks is provided in the chapters <u>Getting started</u>, <u>Objects</u>, <u>Running Sceneries</u> and <u>Table file view</u>.

## 1.2.7 Data Storage

The sceneries and table files, that are executed with AIS, can be either stored in a local Access database file or in a central Oracle Database.

In case of a local data storage, the saved sceneries and table files cannot be shared among users working on different client PCs.

To save the data in a central database, that has to be delivered and installed separately by Qosmotec, the Oracle 9i Database Release 2 (9.2.0.1) Client for Windows 98/NT/2000/XP has to be installed on each client PC using AIS. For installation details refer to the readme file that is delivered with the installation version. The installation of the runtime version is sufficient to run AIS. If the Oracle Client CD that is delivered by Qosmotec is used for the installation, no configuration needs to be done after installation. Otherwise refer to Qosmotec support for configuration details.

To ensure stability of the Oracle client, it is recommended to install also the Oracle 9.2.0.6 Client Patch for Windows 98/NT/2000/XP after successful client installation. For installation details refer to the readme file, that is delivered with this patch.

## 2 Getting started

This chapter gives an overview how to start AIS and how to create and run sceneries.

It will be explained how to:

Install AIS

Open AIS

Log on to AIS

Work with frame windows

create and run sceneries

## 2.1 Install AIS

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The AIS server software and firmware is delivered by Qosmotec on a Compact Flash Card, that is ready to run when inserted into the AIS subrack. For this make sure, that the AIS subrack is switched off and insert the Compact Flash into the slot in the back of the subrack.

For installing the AIS Client Software, double click the setup.exe and follow the steps in the Install Shield Wizzard. If there is already an older version of AIS installed, it shall be removed before installing a newer version. For this, select Remove in the Program Maintenance Window and continue.

🙀 Air Interface Simulator - InstallShield Wizard 🔀 🔀				
Program Maint Modify, repair,	or remove the program.			
C Modify	Change which program features are installed. This option displays the Custom Selection dialog in which you can change the way features are installed.			
O Regair	Repair installation errors in the program. This option fixes missing or corrupt files, shortcuts, and registry entries.			
e <u>Remove</u>	Remove Air Interface Simulator from your computer.			
InstallShield	< <u>B</u> ack <u>N</u> ext > Cancel			

Removing AIS

**Note:** Removing AIS may delete all your sceneries, if you save them in the local database on your computer as well as all preconfigured access data to the AIS server. To prevent this, make a copy of your database file AIS.mdb and of the configuration files ais.ini and aisadmin.ini, that is located in your local installation directory, before removing the software.

After removing AIS from your client computer you have to start setup.exe again and follow the steps in the Install Shield Wizzard. Select Complete in the Setup Type window for a full installation.

🙀 Air Interface	Simulator - InstallShield Wizard	
Setup Type Choose the set	up type that best suits your needs.	
Please select a	setup type.	
	All program features will be installed. (Requires the most disk space.)	
Custom	Choose which program features you want installed and where they will be installed. Recommended for advanced users.	
InstallShield ———	< Back Next > Can	cel

Installing AIS

By default, AIS is installed with an empty local database and empty configuration files ais.ini and aisadmin.ini. If you use the database locally installed on your computer, you may replace the empty AIS.mdb file in the AIS installation directory with a copy of a database file containing entries from former AIS versions and the ais.ini and aisadmin.ini files with the backup copy containing your access configuration data.

## 2.2 Open AIS

To start the AIS Client on a Windows PC select

## Start -> Program Files -> Qosmotec -> AIS -> Air Interface Simulator

## 2.3 Logging on to AIS

Before working with AIS the user must check the <u>server connection settings</u> and log on to AIS.

## 2.3.1 Server connection settings

Fill in the IP-Address of the AIS-Server in the **IP-Address** input box in the server connection settings field of the **Connection settings - Login** dialog.

Fill in the port number of the AIS-Server in the **Port** input box in the server connection settings field of the **Connection settings - Login** dialog.

Fill in your user name in the **User name** input box in the login field of the **Connection settings - Login** dialog.

Fill in your password in the **Password** input box in the login field of the **Connection settings** - **Login** dialog.

Click "OK".

The settings can be saved under a name in the **Name** input box, that can be reused for later login. For that, select the name from the Name input box selection list.

Connection settings - Login	
Server         Image: 12/11000           Connection settings         Image: Port: 10 . 2 . 2 . 212 . 11000	OK Cancel <u>C</u> onnect now
Login User name: Tester 1 Password: *****	

The "Connection settings - Login" dialog.

# If you do not know the IP-address or the port number contact your local system administrator.

## 2.3.2 Disconnecting and Reconnecting

While running an AIS client, it is possible to disconnect and to reconnect to the AIS server by

pressing the Server Connection button. Description or by selecting Edit -> Disconnect from Server ... or Edit -> Connect to Server from the menu respectively.

It is advisable to disconnect from the server before disconnecting from the local area network, e.g. when running the AIS Client on a laptop, in order to free the license immediately.

Before reconnecting to an AIS Server, it is possible to modify the <u>server connection settings</u> and the login credentials by selecting **Edit -> Server setup ...** from the menu.

## 2.4 Frame windows

Once the user is logged on to AIS the following frame windows appear cascaded by default:

Scenery-Map view: The scenery-map view window displays the map and the BTS/Sector pane, the mobile group pane and the configuration pane



The scenery-map view window

<u>Attenuation-Matrix view</u> : The Attenuation-Matrix view window shows the current attenuation of a mobile group to each of the BTS/Sectors in the scenery.

Atten	uation-Matrix	k view	
	Sector-1	Sector-2	
MG-1	45	34	
MG-2	40	43	
MG-3	32	45	
MG-4	38	44	
I			

#### The Attenuation-Matrix view window

If the server calibration feature is activated and the <u>server is correctly calibrated</u>, the user can <u>switch between showing attenuations or Rx-Levels</u>. When switched to Rx Levels, the Attenuation-Matrix view is replaced by a <u>Rx Level Matrix view</u>.

<u>Scenery-Logging view</u>: This window shows changes and updates to the scenery, listed according to the time when they were put into effect.

Scenery-Logging view			
Time stamp	MG	BTS/Sector	text
14:31:57	-	BTS/Sect	Basestation position update
14:31:57	-	BTS/Sect	Basestation frequency update
14:31:57	-	BTS/Sect	Basestation position update
14:31:57	-	BTS/Sect	Basestation frequency update
14:31:57	-	BTS/Sect	Basestation position update
14:31:57	-	BTS/Sect	Basestation frequency update
14:31:57	-	-	Fast Fading area properties update
14:31:57	-	-	Trail properties update
14:31:57	-	-	Trail properties update
14:31:57	MG-1	-	MobileGroup position update
14:31:57	MG-2	-	MobileGroup position update
14:31:57	MG-1	-	x/y:1076/743 [1:48 - 4:42 - 2:47 dB]
14:31:57	MG-2	-	x/y:307/259 [1:49 - 4:46 - 2:39 dB]
14:31:57	MG-1	-	x/y:1076/743 [1:48 - 4:42 - 2:47 dB]
14:31:57	MG-2	-	x/y:307/259 [1:49 - 4:46 - 2:39 dB]
•			

The Scenery-Logging view window

<u>Table file view</u>: The table file view is an application of it's own within the AIS. It is used to set a user specified attenuation pattern of a mobile group to each of the BTS/Sectors in the table file at a user specified time.



The table file view window

The "Scenery-Map view" window is activated by default. The user may <u>arrange the windows</u> in any other mode.

## 2.4.1 Arrange windows

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Before the user starts working with sceneries he is advised to arrange the windows of the AIS GUI.

The user may now arrange the windows of the AIS GUI in one of the following ways:

Cascade: Select from the menu bar **Window**  $\rightarrow$  **Cascade**. In the cascade mode the windows appear one behind each other.



Windows arranged in the cascade mode

Tile: Select from the menu bar **Window**  $\rightarrow$  **Tile**. In the tile mode the windows are arranged quarterly. If the windows are arranged in the tile mode, the table file view window is visible.



Windows arranged in the tile mode

Auto arrange Windows (map left): Select from the menu bar **Window**→ **Auto arrange windows (map left)** or click on the **arrange frame windows (map left)** button in the tool bar



Windows auto arranged map left

Auto arrange Windows (map top): Select from the menu bar **Window**  $\rightarrow$  **Auto arrange** 

Windows (map top) or click on the arrange frame windows (map top) button in the tool bar.



Windows auto arranged map top

To bring a frame window to front and activate it select from the menu bar **Window** and the window you want to activate, e.g. **Window**  $\rightarrow$  **Scenery-Map view**.

## 2.5 Sceneries

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## 2.5.1 Create a new scenery

If a scenery is already opened in the AIS GUI and the user wants to create a new scenery Select from the menu bar File→New Scenery (AIS instance) or press Ctrl+N.

If no scenery is opened, the user may start to create a new secenery by placing objects on the map.

See also section "Example: Run AIS"

## 2.5.2 Open existing scenery

To open an existing scenery from the menu bar **File** $\rightarrow$ **Open Scenery** or press **Ctrl+O**.

The open scenery dialog appears.

mment			_	Cana
annone J				Lanc
xisting sceneries:				
Name	write protected	Comment		Delete
Testcase				
Testcase_2				

The Open scenery dialog

Select a scenery from database or type name of the scenery you want to open in the name field and click open.

If a scenery has been running for a while and the number of log entries exceeds 10.000, the user will be given the opportunity to load only the last 10.000 log entries to avoid long loading times. A pop up window prompts the user to decide whether to load only the last 10.000 log entries or not, before the user is able to work with the scenery.

AIS	
?	The number of log entries for this scenery is greater then 10000 (28173)! We recommend to load only the last 10000 entries. Do you want to load the last 10000 entries?
	Ja Nein
	The load log entries dialog

Note:

When a scenery is already open and you try to open another scenery, AIS will try to start another instance of AIS. You can only open as many sceneries as you own licenses.

### 2.5.3 Save scenery

To save a scenery select from the menu bar File→Save Scenery or press Ctrl+S.

If the scenery has been saved before, the current scenery will be overwritten.

If the scenery has not been saved yet, the **Save scenery** window appears. Fill in a name in the name input box and click **Save**. The user may also write a short comment about the scenery in the **comment** input box of the **Save scenery** window before saving.

All sceneries are saved in the database.

If a scenery shall be saved under a new name, select from the menu bar  $File \rightarrow Save$ Scenery As.... The Save scenery window appears. Fill in a name in the name input box and click Save.

manat			_	5.896
americ ]				Cance
xisting sceneries	c			
Name	write protected	Comment		Delete
Testcase			-	
Levease"s				

The save scenery dialog

## 2.5.4 Close scenery

To close a scenery select from the menu bar **File** $\rightarrow$ **Close Scenery**. The user is prompted to save the scenery before the scenery is closed, if any changes have not been saved yet.

## 2.5.5 Delete Scenery

There are the following possibilities to delete a scenery:

To delete an already open scenery, select File  $\rightarrow$  Delete current scenery from database from the menu bar.

It is also possible to delete a scenery from database via the **Open scenery** or the **Save scenery** dialog. Select a scenery from the database or type the name of the scenery you want to delete in the name field and click on the **Delete** button.

Name	write protected	Comment		Delete
festcase				
Testcase_2				
.1			1	

Database with stored AIS files

## 2.6 Example: Run AIS

It is a assumed that the user is logged on to AIS, the windows are already arranged and no scenery is running.

Activate the Scenery-Map view window.

Select a <u>BTS/Sector</u> from the BTS/Sector pane and place the BTS/Sector on the map either by drag and drop or select from the menu bar: **Objects**  $\rightarrow$  **Base station/Sector**  $\rightarrow$  **Add to map**.





Select a mobile group (MG) from the mobile group pane and place the mobile group on the map by drag and drop.

Add a new trail to map.

Either by selecting from the menu bar Objects  $\rightarrow$  Trail  $\rightarrow$  Add to map or click on the add

**new trail** button *in the tool bar.* 

Click with left mouse button at the position on the map, where you want the new trail to start. Click with left mouse button at the position on the map where you want the trail to end. To finish the trail, click right mouse button.



Scenery map with BTS/Sector, mobile group and Trail

Instead of a trail the user may also place a <u>random walk area</u> on the map.

### Connect the mobile group to trail

To connect a MG to a trail click on the MG with right mouse button and select **Connect to Trail/Random area** from the MG menu. A small square now appears on the peak of the cursor.



Move the cursor to the trail's <u>reference point</u> to which the selected MG shall be connected. When the reference point of the trail turns red, realease the left mouse button to connect MG to trail.

To run the scenario <u>allocate the mobile group</u> on server by selecting a MG and select **allocate on server** from the MG menu or select from the menu bar **Objects**  $\rightarrow$ 

Mobilegroup  $\rightarrow$  Allocate on server and click on the start the session button  $\square$  in tool bar.

## 3 Objects

## 3.1 Objects in general

The AIS software application offers several objects with which the user may work. These objects are the following:

**BTS/Sector** 

Mobile groups

<u>Trails</u>

Random walk areas

Shaded areas

Fast fading areas

All of these objects feature different attributes and functions which are explained in the chapters relating to the specific objects. The general handling that applies to all objects and is explained once in general for all objects.

#### **Reference Points**

Each object has a reference point (RP). The RP is shown as a small square within the object, e.g. in the middle of a BTS/Sector or at the beginning of a trail.



Reference point of a BTS/Sector

The user may decide whether the RPs of the objects in the scenery shall be shown or hidden. To show or hide the RPs in a scenery click on the **show/hide reference points** 

button B in the tool bar or select from the menu bar View  $\rightarrow$  Show/Hide reference points.

The object menu is accesable by clicking with the right mouse button on the object's RP.

#### Selection

There are the following possibilities to select an object:

Click on the RP of an object with the mouse.

BTS/Sectors and mobile groups may also be selected by clicking on them in either the BTS/Sector or mobile group pane .

If an object is selected, the configuration pane for the selected object appears below the mobile group pane.

#### Configuration

When the user changes the configuration of an object the changes are enabled by pressing "enter" or clicking anywhere on the map.

## 3.2 BTS/Sectors

A Base Transceiver Station (BTS/Sector) transmits radio signals to the mobile groups connected with the <u>AIS hardware</u>. The default radio propagation model set for a BTS/Sector channel is the free space path loss model, but it is possible to set user defined radio propagation models for a BTS/Sector. The frequency dependent signal loss according to this model in dB is indicated by contour lines around the BTS symbol.

A BTS/Sector can consist of several channels, that are individually connected to different

ports of the AIS Hardware. The channels of a BTS simulate different antennas of a Base Station transmitting radio signals to the mobile groups connected with the AIS hardware in the same way like a BTS/Sector with only a single channel.

In this section it is explained how to:

Add BTS/Sector to map

Reserve a BTS/Sector for exclusive usage

Configure BTS/Sector

**Delete BTS/Sector** 

## 3.2.1 Add BTS/Sector to map

Select a BTS/Sector from the BTS/Sector pane.

BTS/Sector	used by	blocked by	^
BTS/Sector 1	-		
BTS/Sector 2	Tester 1		
BTS/Sector 3	-		
BTS/Sector 4	-		
📀 BTS/Sector 5	Tester 2		
OBTS/Sector 6	Tester 2	Tester 2	~

The BTS/Sector pane

Place the BTS/Sector on the map either via drag and drop or select from the menu bar: **Objects > Base station/Sector > Add to map**.

All BTS/Sectors, that are added to your current scenery view are bold printed the BTS/Sector pane.

If the selected base station is not in use by any other user, the output radiation power of the BTS can be configured in the Radiation dialog, that pops up, when adding the base station to the map. The default value that is shown is read from the configuration, that is set in the <u>AIS Administration GUI</u>

Radiation Power
Channels :
Channel 1
Channel Radiation Power:
40
ОК

The Radiation Power dialog

The number of base stations, that are served by one server depends on the number of Switch Matrix Ports n, that are served by the AIS Server. If the number of base stations, that is added to the Scenery-Map View by all the users that are logged in to the AIS Server reaches the number of Switch Matrix ports, all other base stations become unavailable and will be greyed out in the BTS/Sector pane.

The names of all users, who have added a base station to the Scenery Map View are listed in the **used by** column of the BTS/Sector pane. By default, it shows the first user of the base station. All current users can be retrieved as a tooltip.



BTS in scenery map

To change the position of a BTS/Sector on the Map, either drag BTS/Sector to a new position or fill in new coordinates in the input boxes of the **Position** field of the configuration pane.

## 3.2.2 Exclusive BTS/Sector reservation

A user can reserve a BTS/Sector, that is not in use by any other tester, exclusively by selecting **Exclusive Reservation** from the BTS/Sector menu or selecting **Objects**  $\rightarrow$  **Base station/Sector**  $\rightarrow$  **Exclusive Reservation**.

BTS/Sector	used by	blocked by		^
BTS/Sector 1	-		- í	=
BTS/Sector 2	Tester 1			
BTS/Sector 3	Delete from map		ï	
😟 BTS/Sector 4	Evolutive Decorruption			
💿 BTS/Sector 5 🚽	Exclusive Reservation			
OBTS/Sector 6	Tester 2	Tester 2		~

Exclusive Reservation from the BTS/Sector menu

Base stations, that are reserved exclusively can only be added to the Scenery Map View by the user that has reserved it. They become unavailable and will be greyed out in the BTS/Sector pane for all other users. The name of the reserving user will be shown in the **blocked by** column of the BTS/Sector pane.

Exclusive Reservations will be kept up also when disconnecting from the AIS server and can be removed only by the user who has reserved it, or by an administrator.

## 3.2.3 Configure BTS/Sector

The user has the following possibilities to configure a BTS/Sector:

Add BTS Pattern files

Load BTS Pattern files to database

Select the BTS/Sector channel

Change the frequency

Assign BTS Pattern files to a BTS/Sector channel

Change the direction of the main beam

Configure the contour lines

#### 3.2.3.1 Add BTS Pattern files

A pattern file is a text file describing the change of attenuation according to the radiation pattern of an antenna. This file contains the changes in attenuation, when deviating from the main beam for x degrees for a full 360 scale pattern. AIS currently supports horizontal BTS Patterns.

To create a pattern file open any text file editor.

If a pattern file shall apply for a BTS or one BTS channel, it has to be of the following format:

Type **NAME** in in the first line. Enter a space character and type the name of the antenna pattern

Type **FREQUENCY** in the second line. Enter a space character and type in a value for the frequency of the antenna pattern in MHz.

Type **GAIN** in the third line. Enter a space character and type in a value in dBd.

Type **TILT** in the fourth line.

Type **COMMENT** in the fifth line.

Type **HORIZONTAL** in the sixth line. This parameter determines the number of deviations clockwise from the main fr with a user defined attenuation value beam for x degrees for a full 360 scale pattern.

Enter a space character and type in a the number of attenuation values for the antenna pattern.

Note! This value must be a nonnegative integer and not higher than 360.

e.g.: If the user set the number of deviations in the **HORIZONTAL** parameter, he must fill in no more and no less than 36 deviation values in degrees with a user defined attenuation. For example a value at every 10 degrees.

Type the degrees of deviation from the main beam and their attenuation value in dB in the lines below the HORIZONTAL parameter. Use the first column of each line for the deviation value and the second for it's attenuation.

The devation value must be a nonnegative integer.



After filling in all values for the horizontal level type VERTICAL and proceed just as with the horizontal.

Save file as .txt

Note! VERTICAL is NOT used but needs to be present.

#### 3.2.3.2 Load BTS Pattern file to database

The user has the possibility to import files describing the change of Attenuation according to the radiation pattern of an antenna, called **BTS Pattern Files**, to the database and assign them to a channel of a BTS/Sector.

To load a Pattern File to the database select **File**→**Import BTS Pattern File** from the menu bar.

The **Open BTS Pattern Files** file dialog appears. Unlike in the open scenery dialog only the file system of the users own computer is shown. Select the file you want to import to the database click **Open**.

Öffnen	()	<li></li>
Suchen in:	🔁 Pattern Files 💌 🗢 🗈 📸 📰 -	
<mark>III demo1</mark> III demo2 III demo3 III demo4		-
Dateiname: Dateityp:	demo1 Öffnen Abbrechen	
	5 Schreibgeschutzt offnen	11.

The Open Pattern File dialog

#### 3.2.3.3 Select the BTS/Sector channel

If a BTS/Sector on the server consists off several channels, that are indivindually connected to different ports, the user has to select a channel of the BTS/Sector he wants to configure.

To select the channel of a BTS/Sector, select a BTS/Sector and select a channel from the pick list in the **Channel** field in the configuration pane.

BTS/Sector: -		
Name:	BTS/Sector	-3
Position:		
X:	472	meter
Y:	843	meter
Channel: —		
Channel 1		•
Channel 1		
Channel 2		
Channel 2 Pattern File:	DEMO	•
Channel 2 Pattern File: Main Beam:	DEMO 0	▼ Deg.
Channel 2 Pattern File: Main Beam:	DEMO 0	▼ Deg.
Channel 2 Pattern File: Main Beam: Contour line Up to:	DEMO 0 es: 40	▼ Deg. dB
Channel 2 Pattern File: Main Beam: Contour line Up to: in steps:	DEMO 0 es: 40 5	Deg. dB dB

The configuration pane of a BTS/Sector

**Note!** Any changes concerning frequency, BTS pattern files, direction of the Main Beam and contour lines become only effective for the channel selected.

#### 3.2.3.4 Change Frequency

Select BTS/Sector channel.

Fill in a value between 800MHz and 2500MHz into the **Frequency** input box in the Channel field in the configuration pane.

- Channel:	
Channel 1	-
Frequency: 2150	MHz

The "Frequency" input box in the channel field in the configuration pane

## 3.2.3.5 Assign a BTS Pattern File to a BTS/Sector channel

To assign an **Antenna Pattern** from the database to a channel, select the channel, then select the **Antenna Pattern** from the pick list in the **Pattern File** box in the **Channel** field in the configuration pane.

- Channel:		
Channel 1		•
Frequency:	2150	MHz
Pattern File:	Omnidirectio	onal 🔽
Main Beam:	DEMO DEMO1	
Contour line	DEMO2	
Up to:	40	dB
in steps:	5	dB

The Pattern File Box of the Channel field in the configuration pane

#### 3.2.3.6 Change the direction of the main beam

To change the direction of the main beam of a BTS/Sector channel, select the channel, and fill in a value in the **Main Beam** input box and press **Enter**. The main beam will be turned clockwise for as many degrees as filled into the **Main Beam** input box. Zero degrees means north direction.

Channel:	
Channel 1	•
Frequency: 2150	MHz
Pattern File: DEMO	•
Main Beam: 💶	Deg.

The Main Beam input box in the channel field in the configuration pane

#### 3.2.3.7 Configure contour lines

Each BTS/Sector channel is surrounded by contour lines displaying the signal loss according to the frequency defined for the connected BTS/Sector channel. A Contour Line is a circle of equal attenuation level in the AIS GUI. The contour lines show different levels of equal attenuation up to an attenuation level of 95dB. The contour lines appear in steps up to the maximum contour line.

Contour lines are not intended to show the complete area covered by a base station/sector. Coverage continues beyond the outermost contour line.



The user may change the range and step width of the displayed contour lines.

To modify the range of the maximum attenuation level shown by the contour lines of a BTS/Sector channel, select the BTS/Sector channel and fill in a value between 0dB and 95 dB into the **up to** input box in the Channel field of the configuration pane.

To edit steps fill in a value between 1 and the maximum Contour Line into the **in steps** input box in the channel file of the configuration pane.

Channel:	
Channel 1	~
Frequency: 2150	MHz
Pattern File: Omnidirect	ional 💌
Main Beam: 0	Deg.
Contour lines:	
Up to: 40	dB
in steps: 5	dB

The channel field of the configuration pane of a BTS/Sector

The user can toggle between displaying the attenuation values that are set by the AIS server and the actual Rx Levels that are received by the connected mobiles on the contour lines. For this, select **View**  $\rightarrow$  **RxLevel Values** or **View**  $\rightarrow$  **Attenuation Values** respectively or
click the Att/RxLevel Button Hor from the Scenery Map toolbar.

In order to show the correct Rx Level values, it is necessary that the AIS server is correctly calibrated.

### 3.2.4 Remove BTS/Sector

There are the following possibilities to remove a BTS/Sector from the map

Select a BTS/Sector and select **Delete from map** from the BTS menu.

Select a BTS/Sector and select **Objects** → **Delete selected object** from the menu bar or press **del**.

Select a BTS/Sector and select **Objects**  $\rightarrow$  **Base station/sector**  $\rightarrow$  **Delete from map** from the Menu bar.

# 3.3 Mobile Groups

A mobile group (MG) is a set of mobiles that are connected to the same MG output ports of the <u>AIS hardware</u> and therefore receive identical RF signals from all connected <u>BTS</u>. They are thus located in the same place in the AIS scenery.

The available mobile groups are shown in the mobile group pane, which also shows connection status, running status and allocation status. Mobile groups, that are added to the current scenery view are bold printed in the MG pane.

Mobile group	connected	allocated by	running	
MG 1	-	Tester 1	-	
MG 2	-		-	
MG 3	-	Tester 2	-	
MG 4	-		-	
<	1111		[	>
	<b>T</b> I I			

The mobile group pane

To run a MG it needs to be <u>allocated</u>, meaning a certain user reserves it. Once the MG is reserved by a certain user it cannot be accessed by other users.

To run a MG it also needs to be <u>connected</u> to a <u>trail</u> or a <u>random walk area</u> It is possible to connect several MGs to the same Trail/Random walk area.

In this section it is explained how to:

Add mobile groups to the map

Allocate mobile groups

Connect mobile groups to a trail or a random walk area

Fix the attenuation value between a mobile group and a BTS/Sector

Delete mobile groups

### 3.3.1 Add MG to map

Select a mobile group from mobile group pane.

Place the mobile group on map by drag and drop.



Mobile group added to map

To change the position of a MG either drag the MG to a new position within the Map or fill in new coordinates in the input boxes of the **Position** field of the configuration pane.

– Mobilegroup:	
Name: MG-1	
Connected to:	
Position:	
×: 690	meter
Y: 643	meter

The Position fields of the mobile group configuration pane

# 3.3.2 Allocate MG on server

To allocate a MG, select the MG and select **Allocate on server** from the MG menu or select from the menu bar **Objects**  $\rightarrow$  **Mobilegroup**  $\rightarrow$  **allocate on server**. The allocating user is shown in the **allocated by** column of the mobile group pane. Allocated mobile groups are unavailable and therefore greyed out in the mobile group pane for other users.

To release a MG on the server select the MG and select **De-allocate on server** from the MG menu or select from the menu bar **Objects**  $\rightarrow$  **Mobilegroup**  $\rightarrow$  **De-allocate on server**.



Mobile group menu of an allocated mobile group

Mobile allocations can be cancelled by an AIS adminstrator.

# 3.3.3 Connect MG to Trail/Random walk area

To connect a MG to a <u>trail/random walk area</u>, select the MG and select **Connect to Trail/Random area** from the MG menu or select from the menu bar **Objects** $\rightarrow$ **Mobilegroup** $\rightarrow$ **Connect to Trail/Random area**. A small square now appears on the peak of the cursor.



Move the cursor to the Trail/Random area's <u>RP</u> to which the MG shall be connected. When the RP of the trail or the random walk area turns red, click left mouse button to connect the MG to the trail/random walk area.

You can also connect a MG to a trail/random walk area by dragging it directly from the MG pane onto a trail/random walk area's RP.

To disconnect a MG from a trail/random walk area, select **Disconnect from Trail/Random** walk area from MG menu.

The mobile group is disconnected but remains in it's current position until it is moved.

### 3.3.4 Locking Attenuations

The user has the possibility to fix the attenuation values between a Mobile Group and a BTS/Sector that is positioned in the scenery. In this case, the attenuation value will be set to the specified once and will not be modified by the AIS server according to the distance between Mobile Group and BTS/Sector channel.

The Locking Value can be set individually for each BTS/Sector channel in the configuration pane for a mobile group. It can be selected from the available attenuation range.

– Mobilegroup: —			
Name:	MG-1		
Connected to:	Trail - 1		
Position:			
X: 20	)0	meter	
Y: 11	98	meter	
BTS / Cha	Unlocke	ed/Locked	
Sector-1	Locked	to 10 dB	
Sector-2	Unlocke	d	
Sector-3	Unlocke	d	
Sector-4	Unlock	ed	
	Unlocke	ed	•
	Locked	to 0 dB	
	Locked	toldB toldB	
	Locked	to 3 dB	-

Locking Attenuation values

# 3.3.5 Remove MG

There are the following possibilities to remove a MG from the map:

Select a MG and select **Delete from map** from the MG menu.

Select a MG and select **Objects**  $\rightarrow$  **Delete selected object** from the menu bar or press **del**.

Select a MG and select **Objects**  $\rightarrow$  **Mobilegroup**  $\rightarrow$  **Delete from map** from the Menu bar.

# 3.4 Trails

A trail is an open route of linear segments in the AIS GUI, on which a MG may walk along forth and back once or several times.

In this section it will be explained how to:

Add a new trail to map

Configure trails

Delete trail

### 3.4.1 Add new trail to map

Either select from the menu bar Objects  $\rightarrow$  Trail  $\rightarrow$  Add to map or click on the add new trail button  $\checkmark$  in the tool bar with left mouse button.

Click with the left mouse button at the position on the map, where you want the new trail to start.

Click with the left mouse button at the position on the map, where you want the segment of the new trail to end. The minimum trail segment length is 10 meters.



To add further segments of the trail, click with the left mouse button at the position on the map where you the next segment to end, after finishing the segment before. This procedure can be repeated as often as required.



To finish a trail, click with the right mouse button anywhere in the map, after finishing the last

segment of the trail.

Note: Trails will be named only when they are finished.

### 3.4.2 Configure trails

The user has the following possibilities to configure a trail:

Change the position of a trail on the map

Specify the type of trail

Set a trail as roundtrip

Specify the velocity of the wohle trail and single segments

### 3.4.2.1 Change Position of a trail

To change the position of a trail on the map, select a trail. Hold left mouse button to drag the trail to a new position within the map.

To edit the positions of the segment points of a trail, fill in new coordinates for the segment points in the position field of the configuration pane.

Trait	
Name: Trai-1	
Closed: No	
Connected to: MG-1	-
Type:	
One way 💌 1	
Speed	
100 km/h Set for al	
No. Speed [km/h] 1 100	
Positions: Pt X[m] Y[m] 1 745 673	The position field of the configuration pane
2 205 1301	

The configuration pane of a trail

**NOTE:** To change the position of a trail, the trail must NOT be connected with any mobile groups!

### 3.4.2.2 Types of trails

42

To specify the type of a trail, select a type from the pick list in the type field in the configuration pane.

- Trail: ———			
Name	e: Trail -	1	
Closed	: No		
Connected to: MG-1			
Type:			
One way		<b>-</b> 1 🗄	
One way			
Return			
Cycle			
Cycle infinit	e		
100	km/h	Set for all	
No. Spe	eed [km/h	1	
1 100	)		

The pick list in the type field in the configuration pane of a trail

A trail can be specified as one of the following types:

One way: The MG walks the trail once from the start point to the end point

Return: The MG walks the trail once from the start point to the end point and returns

Cycle: The MG cycles around the trail for a certain number of times defined by the user. To define the number of cycles, fill in a value in the input box in the type field in the configuration pane.

Г Туре:	
Cycle	▼ 8 ÷

Input box in the type field in the configuration pane of trail to specify the number of cycles

Cycle infinite: The MG cycles around the trail continually until it is stopped by the user.

<u>Roundtrip</u>: A roundtrip is closed route on which a MG circles continually until it is stopped by the user.

### 3.4.2.3 Set trail as roundtrip

Select the Trail.

Select from the menu bar Objects  $\rightarrow$  Trail  $\rightarrow$  Set as roundtrip or select Set as roundtrip from the trail menu.



Trail menu

If a trail is set as a roundtrip, it is possible to choose the direction in which the MG circles around the Trail. To choose the direction, select **forward** or **backward** from the pick list in the type field in the configuration pane.

Туре:		
Cycle		▼ <u>1</u> →
Forward		•
Forward Backward		
100	km/h	Set for all

Type field of the configuration pane of a trail with direction pick list

To resolve a roundtrip select **Resolve roundtrip** from the trail menu or select from the menu bar **Objects**  $\rightarrow$ **Trail**  $\rightarrow$ **Resolve as roundtrip**.

#### 3.4.2.4 Specify velocity for whole trail and single segments

To specify the velocity for a trail, select a trail and fill in a value between 1km/h and 500km/h into the input box in the speed field in the configuration pane.

Speed	d:	
150	km/h	Set for all
No.	Speed [km/ł	1]
1	100	

The speed field in the configuration pane

To specify the velocity of a single segment of a trail, select a trail double click with left mouse button on the speed input box of the segment whose velocity shall be altered in the speed field of the configuration pane and fill in a value between 1km/h and 500km/h.

-Speed	<b>1</b> :		
100		km/h	Set for all
No.	Spe	eed [km/h	<u></u>
1	85		
2	50		
3	125	i i i i i i i i i i i i i i i i i i i	
4	100	)	
L			
L			
I			

The speed input boxes of the trail segments

### 3.4.3 Delete trail

There are the following possibilities to delete a Trail:

Select a trail and select **Delete from map** from the trail menu.

Select a trail and select **Objects**  $\rightarrow$  **Delete selected object** from the menu bar or press **del**.

Select a trail and select **Objects**  $\rightarrow$  **Trail**  $\rightarrow$  **Delete from map** from the menu bar.

# 3.5 Random Walk Area

A Random Walk Area (RWA) is a rectangular area, in which an AIS mobile group may move around on random paths and with random velocity continually until it is stopped by the user.

In this section it will be explained how to:

Add a Random Walk Area to map

Configure a Random Walk Area

Delete a Random Walk Area

### 3.5.1 Add random walk area to map

There are the following possibilities to add a RWA to the map:

Select Objects  $\rightarrow$  Random walk area  $\rightarrow$  Add to map from the menu bar.

Click on the **add new random area** button <sup>le</sup> in the tool bar.

After executing one of these procedures click on the map in the AIS GUI at the place where you want to locate the new RWA. Hold left mouse button and drag to set the size of the new RWA.



Random walk area in the scenery map

# 3.5.2 Configure random walk area

The user can configure the following parameters of the RWA:

Size and position of the RWA

The speed range within the MGs are walking through the RWA.

### 3.5.2.1 Size and position of a RWA

There are the following ways to alter the size and/or the position of a RWA:

Select a RWA and drag to the preferred size and/or the preferred position.

Select a RWA and click on one of the sides of the RWA with left mouse button. Hold the left mouse button and drag the side of the RWA to enlarge or to downsize the RWA.

Select a RWA and fill in new coordinates in any or all of the Left, Bottom, Right or Top input boxes in the configuration pane.

-Random Area:		
Name:	RndArea - 1	
Connected to:	•	•
Left	345	meter
Bottom:	605	meter
Right	956	meter
Top:	1513	meter
_Speed [km/	h]:	
From: 10 To: 100		

The configuration pane of RWA

# NOTE! To alter size and/or position of a RWA, the RWA must NOT be connected with any mobile groups!

#### 3.5.2.2 Speed range in a random walk area

To set the speed range for the mobile groups running through a RWA, mark the RWA and fill in any value between 1km/h and 500km/h in the "from" and "to" input boxes in the speed field of the configuration pane.

Speed [km/h]:	
From: 10	To: 125

The speed field of the configuration pane of a RWA

### NOTE! The minimum velocity must NOT exceed the maximum velocity!

### 3.5.3 Delete Random Walk Area

There are the following possibilities to delete a RWA:

Select a RWA and select **Delete from map** from the random area menu.

Select a RWA and select **Objects**  $\rightarrow$  **Delete selected object** from the menu bar or press **del**.

Select a RWA and select **Objects**  $\rightarrow$  **Random walk area**  $\rightarrow$  **Delete from map** from the menu bar.

# 3.6 Shaded area

A shaded area is a rectangular area in the AIS GUI, where the local attenuation is increased by a user specified amount, e.g. to simulate tunnels, bridges, or radio shades of buildings.

In this section it will be explained how to:

Add a shaded area to map

Configure a shaded area

Show or hide connection between shaded area and BTS/Sector channel

Delete shaded area

### 3.6.1 Add shaded area to map

There are the following possibilities to add a shaded area to the map:

Select **Objects**  $\rightarrow$  **Shaded** area  $\rightarrow$  **Add** to map from the menu bar.

Click on the **add new shaded area** button in the tool bar.

After executing one of these procedures click on the map in the AIS GUI at the place where you want to locate the new shaded area. Hold left mouse button and drag to define the size of the new shaded area.



A shaded area in the scenery map

### 3.6.2 Configure shaded area

The user can configure the following parameters of a shaded area:

Size and position

The additional attenuation within the area per BTS/Sector channel

#### 3.6.2.1 Size and position of a shaded area

There the following ways to alter the size and/or the position of a shaded area:

Select a shaded area and drag to the preferred size and/or the preferred position.

Select a shaded area and click on one of the sides of the shades area with left mouse button. Hold the left mouse button and drag the side of the shaded area to enlarge or to downsize shaded area.

Select shaded area and fill in new coordinates in any or all of the Left, Bottom, Right or Top input boxes in the configuration pane.

- Shaded Area: Name:	ShdArea -	1
Left	498	meter
Bottom	778	meter
Right	1051	meter
Top:	1260	meter
0 dB Set for all		
0	dB	Set for all
Secto	. 10 . 10	

The configuration pane of a shaded area

### 3.6.2.2 Set BTS/Sector-Attenuations

The user may set a single attenuation within a shaded area for all BTS/Sector channels in the scenery or set different attenuations for some or each of the BTS/Sector channels in the scenery.

To define a single attenuation for every BTS/Sector channel mark the shaded area and fill in a value between 0dB and 95dB in the input box in the BTS/Sector-Attenuations field in the configuration pane and click on the **set for all** button next to the input box.

BTS-/Sector-Attenuations:				
1E	dB	Set for all		
BTS	Atten	uation [dB]		
🔘 Secto	10			
🙆 Secto	10			
🙆 Secto	10			
🔘 Secto	10			

The BTS/Sector-Attenuations field in the configuration pane of a shaded area

To modify the attenuation of selected BTS/Sector channel: Select the shaded area, then double click on the attenuation column of the BTS/Sector channel whose attenuation you want to change in the BTS/Sector-Attenuations field in the configuration pane. Then type in a value between 0dB and 95dB and click with the left mouse button or press **enter**. The attenuation is indicated on blue lines, if this option is switched on.

BTS-/Sector-Attenuations:				
dB		Set for all		
BTS	Attenu	ation [dB]		
Secto	15			
🙆 Secto	25			
📀 Secto	10			
Secto	76			

The BTS/Sector-Attenuations field in the configuration pane of a shaded area

### 3.6.3 Show or hide connection between shaded area and BTS/Sector channel

The connection between shaded area and BTS/Sector channel is shown by the blue lines which indicate the attenuation



Connection between shaded area und BTS/Sectors

To show or hide the connection lines, click on the **show/hide connection shaded area** -BTS button in the tool bar, or select from the menu bar View→Show/Hide connection (Shaded area - BTS)

### 3.6.4 Delete shaded area

There are the following possibilities to delete a shaded area:

Select a shaded area and select **Delete from map** from the shaded area menu.

Select a shaded area and select **Objects** → **Delete selected object** from the menu bar or

press del.

Select a shaded area and select **Objects**  $\rightarrow$  **Shaded area**  $\rightarrow$  **Delete from map** from the menu bar.

# 3.7 Fast Fading Area

A fast fading area (FFA) is a rectangular area in the AIS GUI, where the local attenuation between MGs and BTS/Sectors is randomly varied over short distances, so that mobiles moving through such an area experience a profile dependent fast fading effect.

In this section it will be explained how to:

Add a new fast fading area to map

Configure a fast fading area

Show or hide connection between FFA and BTS/Sector channel

Delete fast fading area from map

### 3.7.1 Add new fast fading area to map

There are the following possibilities to add a FFA to the map:

Select **Objects**  $\rightarrow$  **Fast Fading area**  $\rightarrow$  **Add to map** from the menu bar.

Click on the **add new fast fading area** button in tool bar.

After executing one of these procedures click on the map in the AIS GUI at the place where you want to locate the new FFA. Hold left mouse button and drag to set the size of the new FFA.



Fast fading area in the scenery map

# 3.7.2 Configure fast fading area

The user can configure the following parameters of a FFA:

### Size and position

The Fast Fading profile separately for each BTS/Sector channel in the scenery

#### 3.7.2.1 Size and position of a fast fading area

There are two ways to alter size and/or position of a FFA:

Select a FFA and drag to the preferred size and/or the preferred position.

Select a FFA and click on one of the sides of the FFA with left mouse button. Hold the left mouse button and drag the side of the FFA to enlarge or to downsize the FFA.

Select a FFA and fill in new coordinates in any or all of the Left, Bottom, Right or Position input boxes in the configuration pane.

- Fast Fading Ar	ea:	
Name:	FFArea - 1	
Left	478	meter
Bottom:	783	meter
Right	1212	meter
Top:	1233	meter
BTS-/Sector	Fast Fading	Factor Set for all ng Type Fading Fading

The configuration pane of a fast fading area

### 3.7.2.2 Fast fading profiles

The user may specify a single fast fading profile for all BTS/Sector channels in the scenery or set different fast fading factors for some or each of the BTS/Sector channel in the scenery.

To set a fast fading profile for all BTS/Sector channels in the scenery: Select a fast fading area and select a fast fading profile from the selection in the **BTS/Sector-Fast Fading Factor** field of the configuration pane and click on the **Set for all** button next to the input box.

BIS-/Sector-Fast Fad	ng Fa	actor
No Fading	<b>•</b>	Set for all
No Fading Rayleigh Fading Rician Fading; K = 1 Rician Fading; K = 2 Rician Fading; K = 3 Rician Fading; K = 4 Rician Fading; K = 5		g Type

"BTS/Sector-Fast Fading Factor" field of the configuration pane

To set a fast fading profile for a selected BTS/Sector channel: Select the FFA, click on the **Fast Fading Type** column of the BTS/Sector channel whose fast fading profile shall be altered in the table in the **BTS/Sector-Fast Fading Factor** field of the configuration pane. A selection box appears. Select a fast fading profile from the pick list and click with the left mouse button or press **enter**.

BTS	Fast Fading Type
Sector-1	No Fading 📃
🞯 Sector-2	No Fading 📃 🔺
	Rayleigh Fading 🛛 🥅
	Rician Fading; K = 1
	Rician Fading; K = 2
	Rician Fading; K = 3 📃

Pick list in the "BTS/Sector-Fast Fading Factor" field of the configuration pane to set fast fading profile for a selected BTS/Sector channel

The user may choose one of the following fast fading profiles:

Rayleigh fading: The signal strength from the BTS to a mobile group moving within the area will be calculated from the free space path loss propagation model modified by a random value determined by the Rayleigh distribution

Rician fading from factor K=1 up to factor K=50: The signal strength from the BTS to a mobile group moving within the area will be calculated from the free space path loss propagation model modified by a random value determined by the Rician distribution with the corresponding K-factor.

No Fading: The signal strength from the BTS to a mobile group moving within the area will only be calculated by the free space path loss propagation model

It is possible to overlap fast fading areas. In this case, always the strongest fading profile applies. Rayleigh Fading is stronger than all Rician Fading profiles and lower K-factors are stronger than higher ones. The effect of nested fast fading areas is displayed.



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# 3.7.3 Show or hide connection between FFA and BTS/Sector channel

The connection between FFA and BTS/Sector channel is shown by the red lines which indicate the fast fading profile.



Connection between fast fading area and BTS/Sectors

To show or hide the connection lines between FFA and BTS/Sector channel, click on the

**show/hide connection FastFading area - BTS** button in the tool bar, or select from the menu bar **View Show/Hide connection (FastFading area - BTS)** 

### 3.7.4 Delete fast fading area from map

There are the following possibilities to delete a FFA:

Select a FFA and select **Delete from map** from the FFA menu.

Select a FFA and select **Objects**  $\rightarrow$  **Delete selected object** from the menu bar or press **del**.

Select a FFA and select **Objects**  $\rightarrow$  **Fast Fading area**  $\rightarrow$  **Delete from map** from the menu bar.

# 3.8 Indoor Area

A Indoor Area is a rectangular area in the AIS GUI, which represents a room / building equipped with a picocell. The reception level inside this area, called **Indoor Reception Level** in AIS, is assumed to be almost constant. So if mobiles move around in this room they will not change their reception level.

Outside the indoor area the signals of the picocell are received with an extra attenuation due to the walls of the building, called **Wall Attenuation** in AIS.

So if mobiles move outside the indoor area, their attenuation will be calculated as normal attenuation through distance and the wall attenuation.

The same happens if a BTS is placed outside an indoor area and mobiles move inside it. Thus their attenuation will also be calculated as normal attenuation through distance and wall attenuation. The following issues are explained in this section:

Add a new indoor area to map

Configure an indoor area

Show or hide connection between indoor area and BTS/Sector

Delete an indoor area from map

Indoor area use cases

### 3.8.1 Add indoor area to map

There are the following possibilities to add an indoor area to the map:

Select **Objects**  $\rightarrow$  **indoor area**  $\rightarrow$  **Add to map** from the menu bar.

Click on the **add new indoor area** button in the tool bar.

After executing one of these procedures click on the map in the AIS GUI at the place where you want to locate the new indoor area. Hold left mouse button and drag to define the size of the new indoor area.



### 3.8.2 Configure indoor area

The user can configure the following parameters of an indoor area:

Size and Position

The wall attenuation

The indoor reception level

#### 3.8.2.1 Size and position of an indoor area

There the following ways to alter the size and/or the position of an indoor area:

Select an indoor area and drag to the preferred size and/or the preferred position.

Select an indoor area and click on one of the sides of the shades area with left mouse button. Hold the left mouse button and drag the side of the indoor area to enlarge or to downsize indoor area. Select indoor area and fill in new coordinates in any or all of the Left, Bottom, Right or Top input boxes in the configuration pane.

Indees Areas		
Indoor Area:		
Name:	IndoorArea	-1
Left	493	meter
Bottom	530	meter
Dista	040	maker
Hight	848	meter
Top:	1078	meter
Wall Attenua	ation:	
0	dB S	et for all
1.		
BTS	Attenuatio	n [dB1
@BTS/	10	
80701	10	
@BIS7	10	
© BTS/	10	
BTS/	10	
- Indoor Bece	ntion Level	
madormeee	pion cover.	
0 0	dB S	et for all
	_	
BTS	Attenuatio	n [dB]
OBTS/	10	
MPTC/	10	
8013/	10	
@BTS/	10	
00 BTS/	10	
-		

The configuration pane of an indoor area

#### 3.8.2.2 Set wall attenuation

The user may set a single wall attenuation for an indoor area for all BTS/Sector channels in the scenery or set different wall attenuations for some or each of the BTS/Sector channels in the scenery.

To define a single attenuation for every BTS/Sector channel select the indoor area and fill in a value between 0dB and 95dB in the input box in the **Wall Attenuation** field in the configuration pane and click on the **Set for all** button next to the input box.

Wall Attenuation:			
15	dB	Set for all	
BTS	Attenu	uation [dB]	
<b>⊚</b> BTS	/ 10		
<b>⊚</b> BTS	/ 10		
💿 BTS	/ 10		
💿 BTS	/ 10		
,			

The Wall Attenuation field in the configuration pane of an indoor area

To modify the Wall attenuation of a selected BTS/Sector channel: Select the indoor area, then double click on the attenuation column of the BTS/Sector channel whose Wall attenuation you want to change in the **Wall Attenuation** field in the configuration pane. Then type in a value between 0dB and 95dB and click with the left mouse button or press **enter**. The attenuation is indicated on green lines, if this option is switched on.

-Wall Attenuation:			
0	c	IB	Set for all
BTS		Attenu	ation [dB]
<b>©</b> BT	S7	10	
🔞 ВТ	S7	10	
🛛 💿 ВТ	S7	15	
🛛 💿 ВТ	S7	10	
, ,			

The Wall Attenuation field in the configuration pane of an indoor area

#### 3.8.2.3 Set indoor reception level

The user may set a single indoor reception level for an indoor area for all BTS/Sector channels in the scenery or set different indoor reception level for some or each of the BTS/Sector channels in the scenery.

To define a single attenuation for every BTS/Sector channel select the indoor area and fill in a value between 0dB and 95dB in the input box in the **Indoor Reception Level** field in the configuration pane and click on the **Set for all** button next to the input box.

- Indoor Reception Level:				
	βB	Set for all		
BTS	Attenu	ation [dB]		
OBTS/	10			
<b>OBTS/</b>	10			
OBTS/	10			
OBTS/	10			

The Indoor Reception Level field in the configuration pane of an indoor area

To modify the indoor reception level of selected BTS/Sector channel: Select the indoor area, then double click on the attenuation column of the BTS/Sector channel whose indoor reception level you want to change in the **Indoor Reception Level** field in the configuration pane. Then type in a value between 0dB and 95dB and click with the left mouse button or press **enter**. The attenuation is indicated on green lines, if this option is switched on.

Indoor Reception Level:			
0	c	ΙB	Set for all
BTS		Attenu	ation [dB]
<u>о</u> в'	TS7	10	
💿 В'	TS7	10	
B 🔘 B	TS7	15	
⊚ B'	TS7	10	

The Indoor Reception Level field in the configuration pane of an indoor area

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### 3.8.3 Show or hide connection between indoor area and BTS/Sector channel

The connection between indoor area and the BTS/Sector channels is shown by the green lines which indicate the attenuation. The two values displayed beside the connection lines indicate the wall attenuation and the indoor reception level.



Connection between shaded area and BTS/Sector channels

To show or hide the connection lines, click on the show/hide connection Indoor area -

**BTS** button  $\checkmark$  in the tool bar, or select from the menu bar View  $\rightarrow$  Show/Hide connection (Indoor area - BTS).

### 3.8.4 Delete indoor area from map

There are the following possibilities to delete an indoor area:

Select an indoor area and select **Delete from map** from the indoor area menu.

Select an indoor area and select **Objects**  $\rightarrow$  **Delete selected object** from the menu bar or press **del**.

Select an indoor area and select **Objects**  $\rightarrow$  **Indoor Area**  $\rightarrow$  **Delete from map** from the menu bar.

### 3.8.5 Indoor area use cases

If a MG is inside an indoor area and a BTS/Sector is outside the indoor area (or vice versa), the between the MG and the BTS is the sum of all wall attenuations between MG and BTS/Sector plus the distance attenuation.



MG in indoor area and BTS/Sector outside. The attenuation is the sum of the wall attenuation plus the distance attenuation.

If a MG and a BTS/Sector are in the same indoor area, the attenuation between BTS/Sector and MG is the indoor reception level of the indoor area.



BTS/Sector and MG in the same indoor area

If several indoor areas overlay both the BTS/Sector and mobile, the highest indoor reception level (the lowest attenuation) applies.



BTS/Sector and MG overlayed by two different indoor areas

Wall attenuations of indoor areas that include neither the mobile nor the BTS/Sector are ignored, even if the indoor area is located in between the mobile and the BTS/Sector, because the signal finds its way around or over the indoor area.



An indoor area between BTS/Sector and mobile, including neither.

# 4 Running sceneries

This chapter gives a detailed overview how to run sceneries.

It will be explained here how to:

Prepare to run sceneries

Start sessions

View the attenuation data

Break sessions

Stop sessions

# 4.1 **Preparations**

To execute a scenario the following preconditions must be full filled:

The MGs that are to be started must be <u>connected</u> to a trail or a random walk area.

The MGs must be <u>allocated</u> on the server.

If the MGs are connected to a trail or a RWA and allocated on server the user may start the movement.

# 4.2 Start session

There are the following possibilities to start a session:

Click on the start the session button  $\blacksquare$  in tool bar or select Edit  $\rightarrow$  Start session (all

**mobile groups)** from the menu bar. This will automatically start every MG in the scenery that is connected to a trail/RWA and allocated on the server and currently not running. The start button in the tool bar is activated, if there is at least one MG in the scenery which is connected to a trail/RWA, allocated on the server and not running.

Start a single MG by selecting a MG and selecting **Start** from the MG menu or select **Objects**  $\rightarrow$  **Mobilegroup**  $\rightarrow$  **Start** from the menu bar. This will only start the selected MG to walk the trail/RWA it is connected to.



MG menu to start selected MG

# 4.3 Viewing the attenuation data

The user has the following possibilities to check the attenuation data while running a scenario:

Attenuation/RxLevel matrix view

Scenery-Logging view

Attenuation/RxLevel graph

# 4.3.1 Attenuation/RxLevel matrix view

The **Attenuation/RxLevel Matrix view** window displays the either attenuation or the received RxLevel of each MG in the scenery to all the BTS/Sectors in the scenery. The displayed values are calculated by the AIS-server. The data is recorded every second.



The attenuation data in the "Attenuation-Matrix view" window

The user can toggle between displaying the attenuation values that are set by the AIS server and the actual Rx Levels that are received by the connected mobiles. For this, select **View**  $\rightarrow$  **RxLevel Values** or **View**  $\rightarrow$  **Attenuation Values** respectively or click the Att/RxLevel

Button *from the Matrix view toolbar.* 

In order to show the correct Rx Level values, it is necessary that the AIS server is correctly calibrated.

**Note:** The Scenery Logging View as well as the Attenuation/RxLevel Matrix view only show the result of the free space path loss propagation model. For performance as well as for data storage reasons, fast fading values are not taken into consideration there.

# 4.3.2 Scenery-Logging view

The **Scenery-Logging view** window shows updates to the scenery, the attenuation of each MG in the scenery to all the BTS/Sectors in the scenery and the position of each mobile group.

The data is recorded every second.

Scenery-	-Loggin	g view		1
Time stamp	MG	BTS/Sector	text 🔺	]
12:15:45	-	BTS/Sector-2	Basestation position update	
12:15:45	-	BTS/Sector-2	Basestation frequency update	
12:15:45	-	BTS/Sector-1	Basestation position update	
12:15:45	-	BTS/Sector-1	Basestation frequency update	
12:15:45	-	BTS/Sector-3	Basestation position update	
12:15:45	-	BTS/Sector-3	Basestation frequency update	
12:15:45	-	BTS/Sector-4	Basestation position update	
12:15:45	-	BTS/Sector-4	Basestation frequency update	
12:15:45	-	-	Shaded area properties update	
12:15:45	-	-	Fast Fading area properties update	
12:15:45	MG-1	-	x/y:801/621 [2:48 - 1:49 - 3:40 - 4:52 dB]	Attenuation of the MG
12:15:45	MG-2	-	x/y:330/1268 [2:37 - 1:49 - 3:48 - 4:47 dB]	to each BTS/Sector in
12:15:45	MG-3	-	x/y:476/626 [2:45 - 1:50 - 3:45 - 4:52 dB]	the scenery in dB
12:15:45	MG-4	-	x/y:1039/1218 [2:48 - 1:40 - 3:40 - 4:47 dB] 🗾	J. A. Martin and A Martin and A. Martin and
12:15:45	MG-1	-	x/y:801/621 [2:48 - 1:49 - 3:40 - 4:52 dB]	
12:15:45	MG-2	-	x/y:330/1268 [2:37 - 1:49 - 3:48 - 4:47 dB] 👘	1
12:15:45	MG-3	-	x/y:476/626 [2:45 - 1:50 - 3:45 - 4:52 dB]	
12:15:45	MG-4	-	x/y:1039/1218 [2:48 - 1:40 - 3:40 - 4:47 dB]	.
12:15:45	MG-1	-	×/y:1968/452 [2:50 - 1:49 - 3:41 - 4:53 dB] 💌	]]
			MG in	1
		the ma	P	_

The "Scenery-Logging view" window

To delete log entries activate either the **Scenery-Logging view** window or the **Attenuation/RxLevel Matrix view** window and stop the scenario. Select **Edit** $\rightarrow$ **Textual Logging** $\rightarrow$ **Delete log entries** from the menu bar. This action cannot be undone.

Logging into the Scenery-Logging view can be disabled by selecting **Edit→Textual** Logging→Disable Logging from the menu bar.

**Note:** The Scenery Logging View as well as the Attenuation/RxLevel Matrix view only show the result of the free space path loss propagation model. For performance as well as for data storage reasons, fast fading values are not taken into consideration there.

# 4.3.3 Attenuation/RxLevel graph

The attenuation or the received RxLevel between a MG and the BTS/Sectors can also be shown in a graph. To show an attenuation graph select MG and select **Show Attenuation/RxLevel Graph** from the MG menu.

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The Attenuation Graph

This window shows a graph for each BTS in the Scenery Map view. The displayed time sector can be varied from 2 seconds to 1 hour by activating the respective **Time resolution** button from the toolbar or by selecting the time resolution from the **View -> Time period** menu.

The user can toggle between displaying the attenuation values that are set by the AIS server and the actual Rx Levels that are received by the connected mobiles. For this, select **View**  $\rightarrow$  **RxLevel Values** or **View**  $\rightarrow$  **Attenuation Values** respectively or click the Att/RxLevel

Button E from the graph view toolbar.

In order to show the correct Rx Level values, it is necessary that the AIS server is correctly calibrated.

The graph displays the settings on the AIS server per second. The visibility of fast fading effects in the graph can be switched on and off by activating / deactivating the **Fast Fading Effect** button or by selecting **View -> Show/Hide Fast Fading Component** from the menu.







Graph of fast fading with a time resolution of 2s

To switch to the following or preceding time sector, use the **scroll forward** in the **scroll backward** button from the toolbar.

Logging into the Attenuation/RxLevel graph can be disabled by selecting **Edit→Attenuation Graph Logging→Disable Logging** from the menu bar.

# 4.4 Break session

To interrupt a session, click on the **break the session** button  $\square$  in the tool bar or select **Edit** $\rightarrow$ **Break session (all mobile groups)** from the menu bar.

Click on the **break the session** button again to continue the movement. The MG will continue its movement from the point where it was interrupted.

# 4.5 Stop session

There are the following possibilities to stop a session:

Click on the **stop the session** button in tool bar or select **Edit**→**Stop session (all mobile groups)** from the menu bar. This will terminate the entire session at once. The **stop the session** button is activated, if at least one MG in the scenery is running.

Note! If the movement of an MG is stopped it cannot be restarted from the current position!
The user may also stop only a single MG by selecting the MG and selecting **Stop** from the MG menu. This only stop the selected MG whilst the other MGs in the scenery will continue to run the trails/RWAs they are connected to.



MG menu to stop selected MG

## 5 Dynamic Scenery View

If an AIS system is equipped with a m x n <u>switch matrix</u>, where m specifies the number of base stations, that can be connected to the AIS system and n specifies the number of BTS input ports into the AIS subrack, the Dynamic Scenery View is an optional feature, that allows to place more base stations on a scenery than BTS input ports are available. The AIS application automatically switches the strongest base stations to the subrack input ports.

Since it is not possible to switch one base station to different subrack input ports at the same time, the usage of base stations requires exclusivity regarding users testing on the same switch matrix. For mobile groups, that are used in this mode, the allocation concept is not enough. Additionally, base station input ports have to be reserved in order to guarantee the signal of the desired number of strongest base stations at any time.

The following chapters explains how to work with the Dynamic Scenery View, i.e.

How to switch to the Dynamic Scenery Mode

The switching exclusive reservation of base stations

The reservation of base station input ports

The differences in the <u>execution of sceneries in Dynamic Scenery Mode</u>, compared to the Normal Scenery Mode.

### 5.1 Dynamic Scenery Mode

In order to enter the dynamic scenery mode, select

#### File -> Switch to ... -> Dynamic Scenery Mode

from the Normal Scenery View menu.

To switch back to Normal Scenery Mode, select

#### File -> Switch to ... -> Normal Scenery Mode

from the Dynamic Scenery view menu.

Note: Open Sceneries have to be closed before leaving the respective mode.

#### 5.2 BTS port reservation

In Dynamic Scenery Mode, the tester can decide, how many of the AIS subrack BTS input ports shall be reserved for his test session. The number of desired input ports are exclusively reserved for this tester upon mobile allocation. When reserving a number of ports k, the AIS application always switches the k strongest Base Stations to the reserved ports. The signal of other base stations switched to other than the reserved input ports does not become visible for the selected mobile group.

To reserve a number of ports for one mobile group, select

#### Reserve and Allocate -> (k) Ports

from the mobile group menu. The number of reserved BTS input ports is displayed in the mobile group configuration pane.

Mobile	group connected allocated by running	
MG 1		
MG 2 MG 3	Start	
MG 4		
MG 5	Reserve and Allocate 🔹 🕨	2 Ports
MG 6	Delete from man	3 Ports
	Disconnect from Trail/Random walk area	4 Ports
	⊆onnect to Trail/Random area	Release Ports
	Show Attenuation Graph	



If ports are reserved by one user, the number of available ports that is free for other users decreases automatically. The number of public available ports is always indicated in the status bar of the AIS client GUI.

public available ports: 2	Tester 1@212/11000:0

Public available Ports decreased by 2

BTS port reservations can be cancelled by an AIS adminstrator.

#### 5.3 Switching exclusive BTS reservation

It is not possible to switch one BTS at the same time to more than one BTS input port on the AIS subrack. In order to gurantee, that a BTS is free for being switched on one of the reserved ports at the moment where it is one of the k strongest ones in the scenery, the usage of each BTS placed in the scenery must be exclusive regarding all the other users on the same switch matrix. For that reason,

base stations, that are placed on the scenery automatically become reserved switching exclusive. This exclusivity is displayed with the user name and the switch matrix number in the **switching exclusive** column of the BTS/Sector pane.

A switching exclusive BTS reservation can also be achieved without placing the BTS into the scenery by selecting **Exclusive Switch Reservation** from the BTS menu.

BTS/Sector	used by	blocked by	switching ex	clusive
BTS/Sector 1	-		Tester:0	
<sup>(2)</sup> BTS/Sector 2	-		Tester:0	
③BTS/Sector 3	-		Tester:0	
OBTS/Sector 4	-		Tester:0	
😟 BTS/Sector 5	-		Tester:0	
BTS/Sector 6	-		Tester : 0	
BTS/Sector 7	-		_	
OBTS/Sector 8	Delete	from map		
BTS/Sector 9	Exclusiv	/e Reservatio	n	
BTS/Sector 10	Exclusiv	ve Switch Res	ervation	
🞯 BTS/Sector 11 🛛	-		-	1
OBTS/Sector 12	-		-	

Explicit exclusive Switch Reservation in Dynamic Scenery Mode

If a base station is reserved switching exclusively, it automatically becomes unavailable for other users operating on the same switch matrix. Users working on other switch matrices still have full access to the base stations. On the other hand, base stations that are already in use cannot be reserved switching exclusively.

Switching exclusive reservations can be cancelled by an AIS adminstrator.

## 5.4 Running Sceneries in Dynamic Mode

Sceneries can be drawn with the same objects and

started in the same way as in Normal Scenery Mode. The only difference is only the signal of the k strongest base stations is actually seen by the mobile group in use. The base stations, that are currently switched to the reserved BTS input ports are marked with the testers name in the **used by** column of the BTS/Sector pane. All base stations placed in the scenery are visible in the <u>Attenuation / Rx-Level Matrix View</u> and in the <u>Attenuation / Rx-Level Graph View</u>, where those BTS that do not belong to the k strongest ones, are automatically set to maximum attenuation / minimum Rx-Level.



Running a scenery in Dynamic Scenery Mode with 2 reserved BTS ports

## 6 Table file view

The table file view is an application of its own within AIS. It shows the attenuation of MGs to BTS/Sectors at user specified time stamps according to a user created comma or semicolon separated value (csv) file.

Table files are useful to replay a recorded scenario from field measurements or to create an artificial RF-Scenario, that cannot be reproduced by placing base stations in the scenery window.

Table files may be saved in the filesystem of the user's computer or in the local database and are accesible in both without any impairment of serviceability.

In this section it will be explained how to:

Enter the table file mode

Create .csv table files

Import table files to database

Delete table files from database

#### Work with table files in the AIS

Run table files

### 6.1 Table File Mode

In order to enter the table file mode, select

#### File -> Switch to ... -> Table File Mode

from the Scenery View menu.

To switch back to Scenery Mode, select

#### File -> Switch to ... -> Scenery Mode

from the Table File menu.

Note: Open Sceneries or Table Files have to be closed before leaving the respective mode.

### 6.2 Creating .csv table files

Open Excel.

Specify the columns: The columns must be named as follows: Column A = t Column B = MG From column C on the columns must be named according to the BTS/Sectors in ascending order, e.g. BTS1; BTS2; BTS3;... The user may also leave out some BTS/Sectors as long as an ascending order is kept, e.g. BTS1; BTS3; BTS5;...

Fill the time stamps in ms in the of t column. The first time stamp must be t=0, the difference between two subsequent time stamps must be at least 1 ms.

Fill the number of MG ID in the MG column

Fill in a level of attenuation between 0dB and 95dB in each of the **BTS** columns for every time stamp. To keep the attenuation level for two or more time stamps fill in the same value at these time stamps.

Save file as .csv file.

	🕙 Datei Bearbeiten Ansicht Einfügen Format Extras Daten Eenster ?							
] 🗅	🗅 🖙 🖬 🚑 🎒 🗟 💖 🐰 🖻 🛍 🕬 - 🍓 Σ 🏂 🛃 🛍 📿 💥 Arial							
	A1 💌	<b>=</b> t						
	A	В	С	D	E	F		
1	t	MG	BTS1	BTS2	BTS3	BTS4		
2	0	1	10	11	12	13		
3	5	2	11	12	13	14		
4	1000	1	20	21	22	23		
5	1005	2	21	22	23	24		
6	2000	1	30	31	32	33		
7	2005	2	31	32	33	34		
8	3000	1	40	41	42	43		
9	3005	2	41	42	43	44		
10	4000	1	50	51	52	53		
11	4005	2	51	52	53	54		
12								

Example for a .csv table file in Excel

**Note:** Depending on the default language, Excel creates .csv files with commas or with semicolons as separator. Both is accepted by AIS, but no other separator can be used!

### 6.3 Import table files to database

To import a table file to the database switch to the table file mode.

Select from the menu bar File $\rightarrow$ Import table file into Database or press the import table

file button 🛄.

The open table file dialog appears. Unlike in the open scenery dialog only the file system of the users own computer is shown. Select table file and click open.

Öffnen			? ×
Suchen in:	Table_Files	- 🗢 🗈	e* 💷 •
testfile0	testfile12	🖏 testfile6	testfileh3g
testfile1	🐁 testfile13	🐁 testfile7	🚯 testfileh3g
testfile10	testfile2	🚯 testfile8	testfileh3g
testfile100	🖏 testfile3	🐁 testfile9	
testfile101	🐁 testfile4	🐁 testfileh3g	
testfile11	Testfile5	🐁 testfileh3g1	
<b></b>			<u> </u>
Dateiname:	sample		Öffnen
Dateityp:	CSV Files (*.csv)		Abbrechen

The open table file dialog

The **Import table file into database** dialog appears. Fill in a name under which the table file shall be displayed in the database in **Name** field of the Import table file into database dialog and click **Import**.

	o database	ort table file into
Import	10	Name: Testfile 10
Canaal		
Caricei		
		Evisting table files
	1	Name
Uelete		Testfile1
-		Testfile2
		Testfile3
		Testfile4
		Testfile5
		Testfile6
		Testfile7
		Testfile8
-		Testfile9
•		estfile8 estfile9

The Import table file into database

**Note!** If the user wants to import a table file whilst working with another table file, a pop up dialog appears asking whether to import the currently loaded table file. Click **Yes** to import the currently loaded table file.

### 6.4 Delete table files from database

The user has the following options to delete a table file from the database:

Select File -> Load table file to database from the menu bar or press the load table file

button . The **Load table file from database** dialog appears. Select the table file you want to delete in the list and click on the **Delete** button. A confirmation dialog appears. Click **Yes** to delete the table file from the database.

Select from the File >Import table file to database from the menu bar or press the import

table file button . Select a table file and click open. The **Import table file into database** dialog appears. Select the table file you want to delete in the list and click on the **Delete** button. A confirmation dialog appears. Click **Yes** to delete the table file from the database.

## 6.5 Working with table files in AIS

Open table file in the file system of the users computer or load a table file from database. To open a table file from the file system, select from the menu bar **File** $\rightarrow$ **Open Table File** 

**from Disk ...** or click on the **open table file** button in tool bar. The open table file dialog appears. Unlike in the open scenery dialog only the file system of the users own computer is shown. Select table file and click open.

Öffnen			<u>? ×</u>
Suchen in:	Table_Files	- 🗢 🖿 (	-
testfie0 testfie1 testfie10 testfie100 testfie101 testfie11	testfile12 testfile13 testfile2 testfile3 testfile4 testfile5	testfile6 testfile7 testfile8 testfile9 testfileh3g testfileh3g1	Ntestfileh3g Ntestfileh3g Lestfileh3g
•			Þ
Dateiname:	ample		Öffnen
Dateityp:	CSV Files (*.csv)	×	Abbrechen

The open table file dialog

To load a table file from database, select from the menu bar File→Open Table File from

**Database ...** or press the load table file button <sup>1</sup> The Load table file from database dialog appears. Select the table file and click Load.

Name: Testfile	1		Load
			Cancel
Existing table files			
Name			Delete
Testfile1			
Testfile2			
Testfile3			
Testfile4			
Testfile5			
Testfile6			
Testfile7			
Testfile8			
Testfile9		-	

The Load table file from database dialog

The user specified settings of the table file are displayed in table text pane below the tool bar.

🚟 Table f	ile view						1		
Repetitions	2		nfinite						
Time 0 ms 5 ms 1000 ms 1005 ms 2000 ms 2005 ms	MG 1 2 1 2 1 2	BTS/ 10 11 20 21 30 31	BTS/ 11 12 21 22 31 32	BTS/ 12 13 22 23 32 33	BT5/ 13 14 23 24 33 34		xt pane of the able file view		×
0.186828:	Table	e graph ane	1000	1	1500	2000	2500	3000	3500
MG-28888		000	1000	1	1500	2000	2500	3000	3500

The "Table file view" window

Below the table text pane there is a graphic view of the settings displayed in the table graph pane. One graph for each MG is displayed and one line for each BTS/Sector in the same color as in the scenery.



The table graph pane

The user can toggle between displaying the attenuation values that are set by the AIS server and the actual Rx Levels that are received by the connected mobiles in the graph. For this, select View 
Archiver Values or View 
Attenuation Values respectively or click the Att/RxLevel Button from the graph view toolbar. This does not apply for the table text pane, that only shows the attenuation values.

In order to show the correct Rx Level values, it is necessary that the AIS server is correctly calibrated.

**Note:** The Table file should describe a period of at least 1000 ms. The application works also with smaller time periods, but the displayed graphic in the table graph pane has a very bad resolution.

#### 6.6 Running table files

Specify the number of repetitions: Either select a number of repetitions from the selection box in the table file settings bar or in case the table file shall be repeated until it is stopped by the user tick infinite box in the table file settings bar.

Make sure that the involved MGs are not allocated on the scenery window. The MGs involved will be allocated at start time and remain allocated until the table file execution is stopped.



Start table file: Either click on the **Start** button  $\square$  in the tool bar or select **Edit**  $\rightarrow$  **Start table file** from the menu bar. Before the application starts a **please wait** info box appears. This box remains on the screen for the time it requires to transmit the table files data to the server, this might be a few moments.

As soon as the execution of the table file starts a black vertical bar is displayed, which indicates the current time of the log file.



View of a table file graph while running

Interrupt table file execution: Either click on the **Pause table file** button  $\square$  in the tool bar or select **Edit**  $\rightarrow$  **Pause table file** from the menu bar. To continue either click on the **Pause table file** button in the tool bar again or selecting **Edit**  $\rightarrow$  **Pause table file** from menu bar again.

When the user the restarts the table file the application will continue at the next time stamp in the table graph pane.

**Note:** A table file should not be stopped, when it is very close to the end of the execution (<200 ms). This confuses the message flow between client and server.

Stop table file. Either click on the **Stop** button  $\square$  in the tool bar or select **Edit**  $\rightarrow$  **StopTable File** from the menu bar. If the table file is stopped, it can only be restarted at the beginning.

## 7 Prediction Profile View

The Prediction Profile View is an application of its own within AIS. It enables the user to load predictions, that has been generated with a network planning tool and to simulate a movement within this prediction according to the calculated values.

In order to simulate a prediction in a given area with AIS, it is necessary to have prediction files containing only one Base Station for the whole area. It is not possible to simulate a prediction, that contains the signal of more than one Base Station. Thus, if for example 4 Base Stations are involved, AIS needs individual predictions for each single Base Station. With AIS it is possible to display views like maximum field strength or best serving base station.

In this section it will be explained how to:

Enter the Prediction Profile Mode

Import prediction profiles

Use a Base Station in Prediction Profile Mode

Select different views on the prediction

Run a simulation with AIS in the predicted environment

### 7.1 Prediction Profile Mode

In order to enter the Prediction Profile Mode, select

#### File -> Switch to ... -> Prediction Profile Mode

from the Scenery View menu.

To switch back to Scenery Mode, select

#### File -> Switch to ... -> Scenery Mode

from the Prediction Profile View menu.

Note: Open Sceneries have to be closed before leaving the respective mode.

### 7.2 Import Prediction Profiles

Prediction Profiles have to be saved in the local file system as .3ga files. One file must not contain the prediction of more than one Base Station in a given area.

To make a prediction profile available for AIS, it has to be imported into the AIS Database.

From the Prediction Profiles View menu select

#### File -> Import Prediction Profile Files into Database ...

Select all files of .3ga format for import from the file system and press the "Open" button. A progress bar indicates, how far the import of a Prediction Profile File has proceeded.

To delete Prediction Profile Files from the Database select

#### File -> Delete Prediction Profiles ...

Select the files you want to delete by name and press the "Delete" button.

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## 7.3 Assigning Prediction Profiles to Base Stations

To use a Prediction Profile for simulation, it must be assigned to a Base Station.

In Prediction Profile View, Base Stations cannot be dragged as in Scenery View. Their position within the simulated area is determined by the prediction profile. To use a Base Station for simulation, select **Use for predict simulation** from the Base Station Context Menu, that can be opened on right mouse click on the base station name in the BTS pane.

BTS/Sector	used by	blocked by
BTS/Sector 1	-	
OBTS/Sector 2	Exclusi	ve Reservation
BTS/Sector 3	Use for	r predict simulation
BTS/Sector 4	⊆hoose	e color

The BTS context menu in Prediction Profile Mode

If the Base Station is in use, it is printed in bold letters and the user name is indicated in the used by column.

The prediction profile that shall be assigned to the base station can now be selected from the BTS properties window.

**Note:** All Base Stations used in one simulation must have prediction profiles for the same area assigned. For this reason, only prediction profiles with matching dimensions are offered to the user as soon as there is a prediction profile assigned to one base station. The other ones are not offered in the selection list, though they are imported into the database. To make them visible again, all assignents need to be removed from all base stations in use.

The predicted environment will be displayed in the Prediction Profile view. A legend in the base station properties view displays, how to interpret the colours in terms of Rx-Levels. When dragging the mouse pointer over the predicted environment, the coordinates and the predicted field strength will be displayed for each position.



Prediction profile for one base station loaded into the Prediction Profile View

## 7.4 Changing Prediction Views

AIS offers several views on the predicted area.

By default, when selecting one base station in the BTS pane, the prediction for this single base station is displayed in the Prediction Profile View. Besides to that, the User can display the maximal field strength or the best server on the whole predicted area. To switch to these views select

#### View -> Display maximal field strength

or

#### View -> Display best serving base station

To facilitate distinguishing the base stations in the Best Serving Base Station View, the user has the possiblity to assign a colour of his choice to each base station over the BTS context menu.

BTS/Sector	used by blocked by	
BTS/Sector 1 BTS/Sector 2 BTS/Sector 3	Exclusive Reservation	ז
BTS/Sector 4	<u>C</u> hoose color	

Assigning a colour to a base station for Best Serving Base Station View

The area that is covered with maximum field strenght by a base station is displayed in the selected colour. The colour also applies to the Attenuation Graph View.



The Best Serving Base Station View and the Attenuation Graph with user specified colours

**Note:** AIS switches back automatically to the default view of one base station profile, if a base station is selected from the BTS pane.

## 7.5 Running a simulation

Prerequisite to run a simulation in Prediction Profile Mode, is, that at least one Prediction Profile is assigned to a base station. After that, that prediction is displayed in the Prediction Profile View, which can be used in the same way as the Scenery View:

All other objects except base stations can be placed anywhere in the simulated environment as described in the objects chapter. Simulations can be started as described in the chapter <u>Running Sceneries</u>.



A mobile group running on a trail in Prediction Profile Mode

**Note:** To receive the correct Rx Levels on the mobiles connected to AIS as they are displayed in the Prediction Profile View, it is necessary to <u>calibrate the server</u> by an AIS administrator before starting a simulation.

## 8 AIS Administration GUI

The Administration GUI displays the AIS setup and the licensed features and enables users with administrator rights to

- Configure the mobile groups and base stations,
- Administrate users of the AIS system and their access rights,
- Calibrate the AIS server according to HF measurements on the hardware.

## 8.1 Open Administration GUI

To start the Administration GUI select

#### Start -> Program Files -> Qosmotec -> AIS -> Air Interface Simulator Administration

The login dialog opens.

The mechanism to login to the AIS Administration GUI is identical with logging in to the AIS GUI.

### 8.2 AIS Setup Information

The Information tab of the AIS Administration GUI lists the following AIS setup information:

- The AIS server version,
- The number of concurrently usable GUI licenses on this AIS server,
- The number of base stations, that is served by this AIS server,
- The number of Switch Matrix ports, that is served by this AIS server (if switch matrix hardware is part of the system),
- The number of Mobile Group ports, that are served by this AIS server,
- The software features, that are licensed on this AIS server.

Note: It is not possible to edit anything in this tab!

🙀 User 🛛 🦚 BTS configuratio	m 🧕 Mobile configuration 🚯 Information	
GUI licenses:	1	
BTS connectors:	4	
Curitala estativ compostare:	1	
Switch matrix connectors.	4	
Mobile ports:	2	
Server version:	4.3.1	
Featurelist		
Features		Availability
<ul> <li>Topographic simulation</li> </ul>		feature available
× Multichannel		feature not available
🗸 Fast fading		feature available
<ul> <li>Scenery GUI</li> </ul>		feature available
LTS integration: scenery :	support	feature not available
🛛 🗙 LTS integration: tablefile s	upport	feature not available
× Inverse shaded areas		feature not available
🗸 Table files		feature available
× BTS pre-attenuation		feature not available
🗸 Trails		feature available
🗸 Random walk areas		feature available
<ul> <li>Shaded areas</li> </ul>		feature available
🛛 🗙 Horizontal antenna patteri	าร	feature not available
🛛 🗙 Vertical antenna patterns		feature not available
× Indoor areas		feature not available
<ul> <li>Rx level calibration</li> </ul>		feature available
X Dynamic switch sceneries		feature not available
× Dynamic switch tablefiles		feature not available
× Extended BTS properties		feature not available
🗙 Multi BTS usage		feature not available
1		

The Information tab of the AIS Administrator GUI

## 8.3 Mobile Configuration

The Mobile Configuration tab of the AIS Administration GUI lists all mobile groups, that are served by this AIS server.

A user with administrator rights is allowed to change the name of the mobile group.

Changes on the mobile group names must be confirmed by pressing the Apply-Button. The user will be prompted for saving changes, if he leaves this tab or closes the AIS Administration GUI.

**Note:** A normal user is only allowed to read the settings, but not to change mobile group names.

🙀 User   🚓 BTS co	nfiguration 🧕 I	Mobile configuration	1 Information
<u>N</u> umber of mobiles Name of <u>m</u> obile:	4 MG-1		
Properties of mobiles			
Mobile number		Name	
1		MG-1	
2		MG-2	
3		MG-3	
4		MG-4	
			Annly

The Mobile Configuration tab of the AIS Administrator GUI

### 8.4 Base Station Configuration

The BTS Configuration tab of the AIS Administration GUI lists all base stations and their properties, that are served by this AIS server.

A user with administrator rights is allowed to change the name of the base station, the frequency, the radiation power and the electrical pre-attenuation (attenuation value, that is added automatically and reduces the variable attenuation range).

An administrator can also allow, that several channels of the same base station can be connected to different base station ports of the AIS hardware. This can be realized by selecting one base station, activating the "Allow multichannel" field and clicking the up-button in to "Number of channels" field. This accumulates the AIS base stations ports to one BTS (see column "Used ports"). The number of channels per BTS can be reduced by clicking the down-button in the "Number of channels" field.

**Note:** Increasing the number of channels for one BTS decreases the number of individual base stations.

Any change must be confirmed by pressing the Apply-Button. The user will be prompted for saving changes, if he leaves this tab or closes the AIS Administration GUI.

Note: A normal user is only allowed to read the settings, but not to change the properties.

User 🗱 BTS configur	ration 🔌 Mobile configu	uration 🚺 Information			llow multichappel
Base station:	BTS/Sector 1				
Number of channels:	Channel 1				
Erequency [MHz]:	2150				
<u>R</u> adiation power [dBm]:	200				
Pre-Attenuation [dB]:	0				
<u>J</u> nits BTS id	Used ports	Numbers of channels	Unit type	Name	
1	1, 2, 3	3	logical	BTS/Sector 1	
			-		
2	4	1	unique	BTS/Sector 2	
2 3	4 5	1 1	unique unique	BTS/Sector 2 BTS/Sector 3	
2 3 4	4 5 6	1 1 1	unique unique unique	BTS/Sector 2 BTS/Sector 3 BTS/Sector 4	
2 3 4	4 5 6	1 1 1	unique unique unique	BTS/Sector 2 BTS/Sector 3 BTS/Sector 4	
2 3 4	4 5 6	1 1 1	unique unique unique	BTS/Sector 2 BTS/Sector 3 BTS/Sector 4	, 1 1

The Base Station Configuration tab of the AIS Administration GUI

If there is one AIS Port, where no base station is connected to, it is not necessary to delete the base station in the Admin GUI. It can simply be set to inactive by unselecting the "Running" checkbox next to the base station name. An inactive base station port is indicated as greyed out, italic name in the BTS pane of AIS and cannot be used in a scenery.

BTS/Sector	used by	blocked by
🞯 BTS/Sector 1	-	
BTS/Sector 2	-	
BTS/Sector 3	-	
BTS/Sector 4	-	
•		Þ

BTS pane with BTS/Sector 1 set to inactive

#### 8.5 User Administration

The User tab of the AIS Administration GUI lists all users and their execution rights, that are allowed to log in into the AIS server

A user with administrator rights is allowed to add or remove users or to change the execution rights (Admin/Normal) of existing users

Any change must be confirmed by pressing the Apply-Button. The user will be prompted for saving changes, if he leaves this tab or closes the AIS Administration GUI.

Note: A normal user is only allowed to read the settings, but not to change the properties.



User Jassword:				
User name	Full name	User type admin normal normal		
Add <u>R</u> emove		Apply		

The User tab of the AIS Administration GUI

### 8.6 Server Calibration

The AIS Server can be calibrated over the AIS Administration GUI. For that, the output power of the Base Station needs to be measured as well as the power level, that is received by the mobile groups.

The AIS Server calibration is necessary for getting the correct values when toggling between Attenuation and RxLevel values in the Scenery view.

The calibration can be started by selecting **Tools -> Calibrate** ... or by pressing the

calibration button

**Note:** Starting a calibration will disconnect all users from the AIS server and stop all running tests!

The calibration algorithm itsself depends on the setup of the AIS system. The basic idea is to measure the BTS output power and to measure the received Rx Level for each mobile group. If the AIS is equipped with a <u>digital switch matrix</u>, each base station needs to be switched to each port of the switch matrix.

For each base station that can be used by the AIS server, the radiation power level needs to be measured. This output power needs to be entered in the AIS calibration setup wizzard.

AIS calibration setup			
	Step 1		1 of 16 basestations
	Basestation 1 — Measure BTS Po	ower and enter the v	<b>value.</b> dBm
	<u>C</u> ancel		<u>N</u> ext >>

Entering the BTS radiation power for calibration

If the AIS system is equipped with a digital switch matrix, for each base station and each switch matrix port that is served by the AIS server, the reception power level on mobile group 1 needs to be measured. This reception level needs to be entered in the AIS calibration setup wizzard. If there is no switch matrix, the signal level needs to be entered only once.

AIS calibration setup			
	Step 1		1 of 16 basestations
M	Array (1 of 4) Measure signal value	evel at mobile group	<b>o 1 and enter the</b> dBm
	<u>C</u> ancel		<u>N</u> ext >>

Entering Reception Power per switch matrix port for BTS 1 and MG 1

Finally, the reception power level for every other mobile group needs to be measured when base station 1 is switched on each switch matrix port. The reception level needs to be entered in the AIS calibration setup wizzard. If there is no switch matrix, the signal level on mobile group side needs to be measured for each mobile group to each base station instead.

AIS calibration setup		
	Step 2	2 of 6 mobile groups
	Array (1 of 4) Measure signallevel at mobile group value -49	<b>o 2 and enter the</b> dBm
	Cancel	<u>N</u> ext >>

Entering Reception Power per switch matrix port for BTS 1 and all other Mobile groups

Press the Calibrate Button that appears, when you have reached the last switch matrix port on the last mobile group.

## 9 Trouble Shooting

This chapter summarizes typical errors or and explains reasons or potential error sources.

When an error occurs or you do not now how to handle the tool, try to solve your problems first with readint the following sections. If you do not succeed with the hints given here or any other problem occurs, that is not described, please write a detailled bug report to support@qosmotec.com.

### 9.1 No Login to AIS possible

#### Problem:

The client GUI cannot connect to the AIS server. After some seconds the following error message appears



No Connection to AIS Server

#### Check the following:

- Is the AIS subrack reachable over the network? Try to ping it!

- Check the server connection settings in the login dialog
- Check the firewall on your client PC.

- Contact your system administrator to check the running processes and the configuration on the AIS subrack.

### 9.2 Wrong User Name or Password

#### Problem:

The client GUI cannot connect to the AIS server with username/password error. The following error message appears



Invalid user name or password

#### Check the following:

- Have user name and password been correctly typed into the login dialog?

- Is the keyboard switched to captital letters, when typing the password?

- Contact your system administrator to check, if the user/password is added on the AIS subrack.

### 9.3 No Free Licenses

#### Problem:

The client GUI cannot connect to the AIS server due to missing licenses. The following error message appears



Number of available licenses exceeded

#### Check the following:

- Who has logged in to the AIS server? The number of floating GUI licenses cannot be

exceeded.

- Check on your own computer, if still other client GUIs are open.

- Check also, if nobody is connected to the AIS server with an AIS Administration GUI. This also requires one floating license.

- Only in case, that the current license users cannot be found, the AIS HW may be restarted.

**NOTE:** All other connected users will be automatically disconnected and their tests will be interrupted in this case !!!

### 9.4 Cannot allocate mobile group

A mobile group cannot be <u>allocated</u>. When selecting **Allocate on server** from the MG menu, the following error message appears

Allocatio	n Status 🛛 🗙	J
<b>i</b>	The requested Mobile Group is already allocated by another user.	
	OK	

Mobile Group allocation failure

#### Check the following:

- Who has the requested mobile group currently in use? The resource manager does not allow concurrent usage of mobile groups.

- Check on your own computer, you have allocated the mobile group in another open GUI.

- Check also, if in use by a running table file. For executing <u>table files</u>, the mobile groups are automatically allocated by AIS.

- Only in case, that the current user of a mobile group cannot be found, the AIS HW may be restarted.

**NOTE:** All other connected users will be automatically disconnected and their tests will be interrupted in this case !!!

### 9.5 Cannot move a mobile group on the scenery window

#### Problem:

A mobile group cannot be moved with the mouse on the scenery window

#### Check the following:

- Is the mobile group <u>connected to a trail or random walk area</u>? In this case, it must be disconnected, before it can be moved.

## 9.6 Cannot Edit Trail / Random Walk Area Properties

### Problem:

The properties of a trail or random walk area cannot be edited.

### Check the following:

- Can you see the properties pane of the trail or random walk area? If the <u>reference points</u> of several objects are placed over each other, you have to click with several mouse clicks to change the visibility of the configuration panes.

- Is any mobile group connected to or running on the trail or random walk area? The properties can only be edited, if the object is free.

- Have you clicked "Enter" or anywhere into the scenery window to apply the change? This must be done to activate the setting.

## 9.7 No attenuation shown in the attenuation matrix

#### Problem:

A mobile group is positioned on the scenery window, but there is no attenuation value displayed in the <u>attenuation matrix view</u>.

#### Check the following:

- Is the mobile group <u>allocated</u>? Attenuation values are only set for mobile groups reserved for the specific user.

- Is a BTS/Sector positioned on the scenery window? Attenuations are calculated according to the distance between mobile group and BTS/Sector.

## 9.8 Start button does not become active

#### Problem:

You want to start a mobile group on a trail or random walk area, but the global start button is inactive

#### Check the following:

- Is the mobile group <u>allocated</u>? Only mobile groups, reserved by the user, can be started.

- Is the mobile group <u>connected</u> to the trail or random walk area? May be, the mobile group icon simply overlaps with the <u>reference point</u> of the object. If you can still move the mobile group with the mouse, it is not connected to any trail or random walk area.

- If a mobile group can be started, the <u>"Start" entry in the mobile group menu</u> becomes active, so that it can also be started from there.

## 9.9 Mobile Group does not move on start

#### Problem:

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You press the global start button, but your mobile group does not start to move.

#### Check the following:

- Is the global start button active because another mobile group was ready for start? Check, if another mobile group started to move.

- Is the mobile group <u>allocated</u>? Only mobile groups, reserved by the user, can be started.

- Is the mobile group <u>connected</u> to the trail or random walk area? May be, the mobile group icon simply overlaps with the <u>reference point</u> of the object. If you can still move the mobile group with the mouse, it is not connected to any trail or random walk area.

- If a mobile group can be started, the <u>"Start" entry in the mobile group menu</u> becomes active, so that it can also be started from there.

## 9.10 Attenuation values do not change during movement

#### Problem:

The mobile group moves on a trail or random walk area, but the attenuation values in the attenuation matrix view do not change.

#### Check the following:

- Is the attenuation between mobile group and BTS/Sector <u>locked to a specific value</u>? In this case the locking value remains, independent from the distance.

- Is the mobile group moving in a big distance from the BTS/Sector? The attenuation in dB is a logarithmic value. In close distance to the BTS/Sector the 1dB steps are significantly smaller than in large distance.

### 9.11 Cannot see fast fading area graph

#### Problem:

A mobile group has moved through a fast fading area, but the attenuation graph view does not show fluctuating values.

#### Check the following:

- Is the <u>Fast Fading Effect button</u> activated? If this button is inactive, only the distance dependent attenuation values are displayed in the attenuation graph.

- Has the mobile already left the fast fading area? The fast fading values are only updated, if the area is completely passed, or if the mobile group has changed its direction within the area when moving through a random walk area.

- Is the correct time window displayed? Depending on the selected <u>time resolution</u>, it might be necessary to scroll through the attenuation graph window to see the correct time window, when the mobile group has passed the fast fading area.

## 9.12 Cannot Open Table File

#### Problem:

A table file cannot be opened in the AIS table file view.

#### Check the following:

- Does it have the right format? Are all values separated by commas or semicolons? If the separator is not correct, the following error message appears:



Wrong separator in table file

- Does it use an invalid Mobile Group? If a mobile group outside the available range (e.g. MG 5 for a 4x4 specification) is specified, the following error message appears:



Mobile Group specified in table file does not exist

- Does it use an invalid BTS/Sector? If a BTS/Sector outside the available range (e.g. BTS/Sector 5 for a 4x4 specification) is specified, the following error message appears:



BTS/Sector specified in table file does not exist

- Is a BTS/Sector used twice? A BTS/Sector must only appear in one column. If the same one is reused, the following error message appears:



The same BTS/Sector used mulitple times

- Does the table file start with time stamp 0? If not, the following error message appears:



Wrong time stamp in table file

- Are the time stamps sorted in ascending order? Is there a minimum time gap of 1 ms between the specified time stamps in the table file? You cannot specify two lines with the same time stamp, even not for different mobile groups. If not, the following error message appears:



Time stamps not sorted correctly in table file

## 9.13 Bad resolution of table file graph

#### Problem:

When a table file is loaded, the graph, that displays the attenuations consists of very thick lines and seems to have a bad resolution.

#### Check the following:

- Is the time period, described in the table file less than 1000 ms? In this case, it is simply a problem of the representation in the table graph pane. This does not affect the application at all.

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### \_ '' -

"added to map" column 25 "blocked by" column 27 "used by" column 25

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