

5.4 Transmitter to Receiver Path

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Introduction

3 elements form the path between the VLR and the VLT or the ILR and ILT as illustrated in Figure 148.

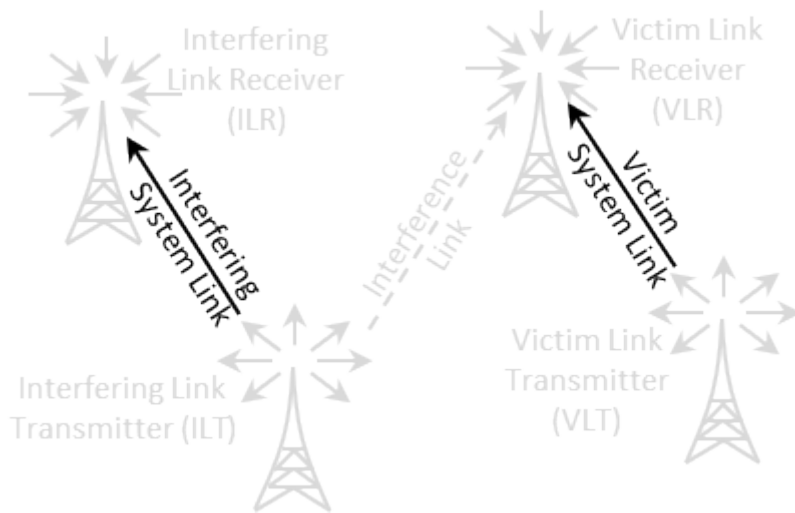


Figure 148: Transmitter to Receiver Path illustration

Relative location	
☐ Correlated distance (origin = Victim/Interfering transmitter)	
Delta X	[Constant(0.0)] Distribution km
Delta Y	[Constant(0.0)] Distribution km
Path azimuth	[UniformDistri...] Distribution deg
Path distance factor [Uniform Polar...]	Distribution
☐ Use a polygon	
Shape of the polygon	Hexagon
Turn ccw	[Constant(0.0)] Distribution degree

Coverage Radius	
Library	[Icons]
Name	User-defined radius
Description	User-defined radius
Coverage Radius	0.1 km

Local Environments	
Receiver	100% Outdoor
Transmitter	100% Outdoor

Propagation Model	
Library	[Icons]
Name	Extended Hata
Description	
☒ Variations	
General environment	Urban
Propagation environment	Above roof
Wall loss (indoor indoor)	5.0 dB
Wall loss std. dev. (indoor indoor)	10.0 dB
Loss between adjacent floor	18.3 dB
Empirical parameters	0.46
Size of the room	4.0 m
Height of each floor	3.0 m

Figure 149: Transmitter to Receiver Path GUI

5.4.1 Relative location

- When the Correlated distance option is checked, the positions of the receiver and transmitter are geographically fixed with respect to each other (e.g. co-located or constantly spaced base stations). The transmitter is considered a reference centre.
- When the correlated distance is unchecked, the receiver is randomly moving around the transmitter. There are 2 primary options to define type of mutual placement of VLR with respect to VLT.

See ANNEX 12: for further details on the algorithm and conventions.

Relative location ?

☐ Correlated distance (origin = Victim/Interfering transmitter)

Delta X

[Constant(0.0)]

Distribution

km

Delta Y

[Constant(0.0)]

Distribution

km

Path azimuth

[UniformDistri...]

Distribution

deg

Path distance factor [Uniform Polar...]

Distribution

☐ Use a polygon

Shape of the polygon

Octagon

Turn ccw

[Constant(0.0)]

Distribution

degree

Figure 150: Relative location panel

Table 15: Relative location GUI

Description	Symbol	Type	Unit	Comments
Correlation distance	-	Boolean	-	When checked, the only the Delta X and Y are editable.

Delta X	X	Distribution	Km	Horizontal distance between the transmitter and receiver. It can be used to shift horizontally the distributed receivers.
Delta Y	Y	Distribution	Km	Vertical distance between the transmitter and receiver. It can be used to shift vertically the distributed receivers.
Path azimuth	-	Distribution	Degree	Horizontal angle for the location of the Rx respect to the Tx. If constant, the Rx's location will be on a straight line. If not, the location of the Rx will be on an angular area. (See Annex A12.3)
Path distance factor	-	Distribution	-	Distance factor to describe path length between the Tx and the Rx. If the path factor is constant, the Rx will be located on a circle around the Tx. (See Annex A12.2)
Use of polygon	-	Boolean	-	When this is checked, you can select other shape of deployment than the default circle
Shape of the polygon	-	Boolean	-	You can select between hexagon (6 sides), heptagon (7 sides), Octagon (8 sides), Pentagon (5 sides), Rectangle (4 sides) and Triangle (3 sides)
Turn CCW	-	Distribution	Degree	Allows to rotate counter clock wise the selected polygon

5.4.2 Coverage radius

A coverage radius is calculated for both the victim link and the interfering link. It is the R_{max}^{VLT} for the victim link (VLR-VLT) and the R_{max}^{ILT} for the interfering link (ILR-ILT) (see Annex A13.1). The receivers will be randomly deployed within the area centred on the transmitter and delimited by the coverage radius if the non-correlated option is selected.

Three different modes are available for calculating the maximum radius .

- **User-defined radius** allows directly entering the maximum radius (See Annex A13.1.1);

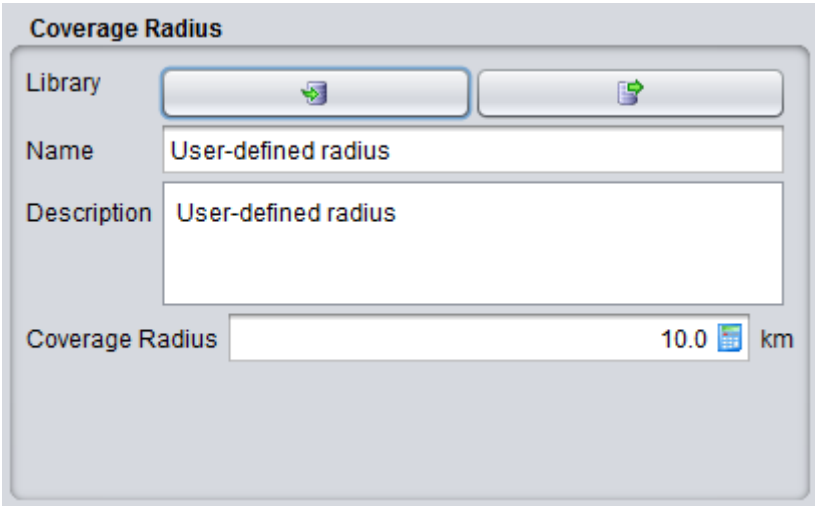


Figure 151: User-defined coverage radius dialog box

Table 16: Description on User-defined coverage radius

Description	Symbol	Type	Unit	Comments
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Coverage radius	$R_{\max}$	Scalar	km	The coverage radius defines the coverage of the system, i.e. the maximum distance between an ILT and a ILR or between a VLT and a VLR. The origin point of the coverage radius is logically the VLT or the ILT.
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- The **noise-limited network** option will calculate the coverage radius based on the formula for noise-limited network. If this option is chosen, a set of input boxes will appear below allowing the user to enter specific parameters required for this calculation. In this case it is considered that the coverage of the transmitter is limited only by propagation losses and other elements in the link budget, with received signal operating at the sensitivity limit. The details of the calculation are given in Annex A13.1.2.

Coverage Radius

Library

Name

Noise Limited

Description

The coverage of the transmitter is limited only by propagation losses and other elements of link budget, with received signal operating at the very sensitivity limit.

Ref. antenna height (Rx)

0.0

m

Ref. antenna height (Tx)

0.0

m

Ref. frequency (Tx)

0.0

MHz

Ref. power (Tx)

0.0

dBm

Minimum distance

0.0

km

Maximum distance

0.0

km

Availability

0.0

%

Fading Std. Dev.

0.0

dB

Figure 152: Noise limited network coverage radius dialog box

The coverage radius in the noise-limited network is defined by the parameters of Table 17. Note that the input parameters for the Noise-limited network interface are set to zero by default in order to independently define the radius from some parameters set elsewhere in the link.

Table 17: Description of the Noise limited network coverage radius user interface

Description	Symbol	Type	Unit	Comments
Reference antenna height (receiver):	h^0	Scalar	m	The height used for coverage radius calculations. If a distribution is used to define the real height, the coverage radius would be different in each trial, here the value may be fixed.
Reference antenna height (transmitter):	h^0	Scalar	m	The height used for coverage radius calculations.
Reference frequency	fVLR	Scalar	MHz	
Reference power	PVLT	Scalar	dBm	
Minimum distance			km	
Maximum distance			km	
Availability			%	
Fading standard deviation			dB	
Reference percentage of time			%	

Traffic-limited network option will calculate the coverage radius, based on the formula for traffic-limited network. If this option is chosen, a set of input boxes will appear below allowing user to enter specific parameters required for this calculation (See Annex A13.1.3).

Coverage Radius

Library

Name

Traffic Limited

Description

number of frequency channels that a radio system provides, the number of MS per frequency channel provided by a radio system and the size of a group of frequency channels (frequency cluster).

Density

0.0

1/km²

Number of channels

0

Number of users per channel

0

Frequency cluster

0

Figure 153: Traffic limited network coverage radius dialog box

Table 18: Description of the traffic limited network coverage radius user interface

Description	Symbol	Type	Unit	Comments
Density		Scalar	1/km ²	Maximum number of active transmitters per km2
Number of channels		Scalar		Number of frequency channels of the system
Number of users per channel		Scalar		Number of MS per frequency channel
Frequency cluster		Scalar		Size of a group of frequency channels. See Figure 180 for illustrative details.

The consistency of this parameter should be verified against the sensitivity, so that if a receiver is placed at given distance (e.g. at the maximum coverage radius) the received power is higher than the sensitivity for a reasonable percentage of occurrences (availability).

5.4.3 Local environment

The percentage of transceivers being indoor and outdoor can be selected thanks to this panel. It will work in combination with the chosen propagation model that you will select. By default the transmitter and receiver are located outdoor. For each elements of the link, it is possible to add  or remove  a probability of indoor.

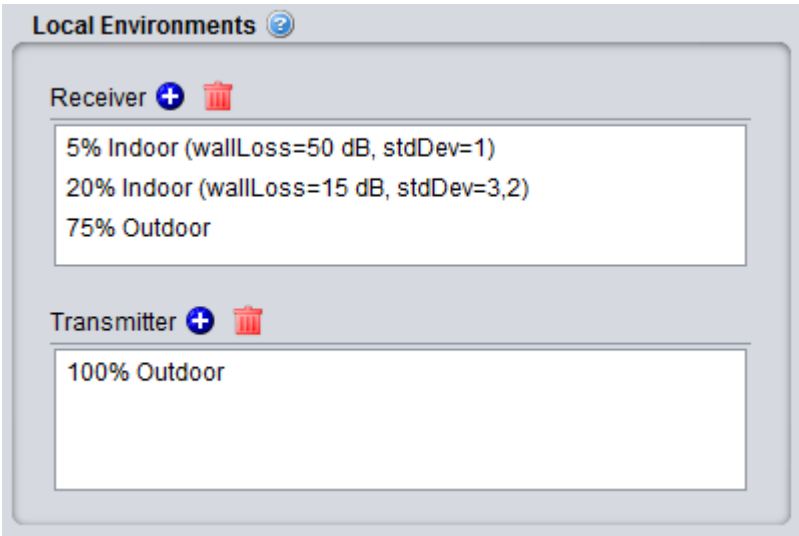


Figure 154: Example of setting up the

outdoor/indoor ratio

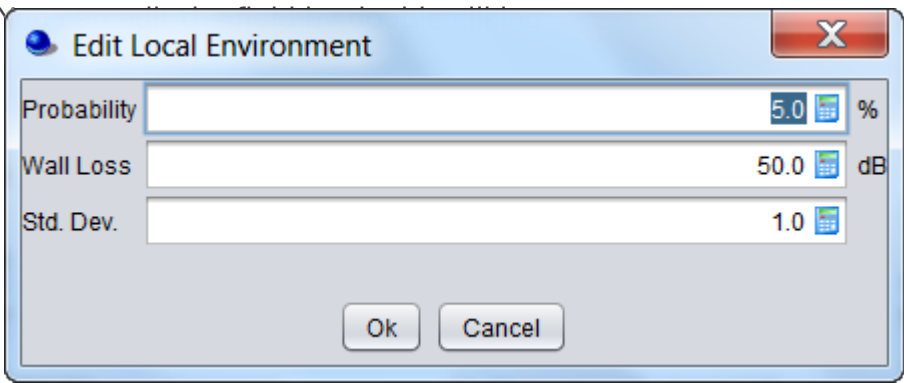


Figure 155: Graphical interface

to edit the probability, wall loss and associated standard deviation

Table 19: Local environment and wall loss

Description	Symbol	Type	Unit	Comments
Local environment: Receiver	Indoor/ outdoor	-	-	Environment of the receiver antenna: outdoor, indoor It is used for both VLR and ILR.
Local environment: Transmitter	Indoor/ outdoor	-	-	Environment of the transmitter antenna: outdoor, indoor It is used for both VLT and ILT.
Probability	-	Scalar	%	Probability that a Tx or Rx is located indoors or outdoors.
Wall loss	or	Scalar	dB	Attenuation of external walls separating indoor and outdoor propagation environments. This parameter is associated to the selected propagation model.
Std. dev.	or	Scalar	dB	Wall loss standard deviation (indoor - outdoor) Wall loss standard deviation associated to the selected propagation model.

Note that when opening a workspace created prior to SEAMCAT version 5, all settings are mapped to the current SEAMCAT version running on your machine. As the parameter local environment didn't exist before version 5, a warning may appear indicating that "local environments are skipped for multiple interfering links". This means that SEAMCAT was not able to automatically set the parameters of the local environments (most likely due to a scenario with multiple interferers). Therefore, there is a need to edit the local environment manually.

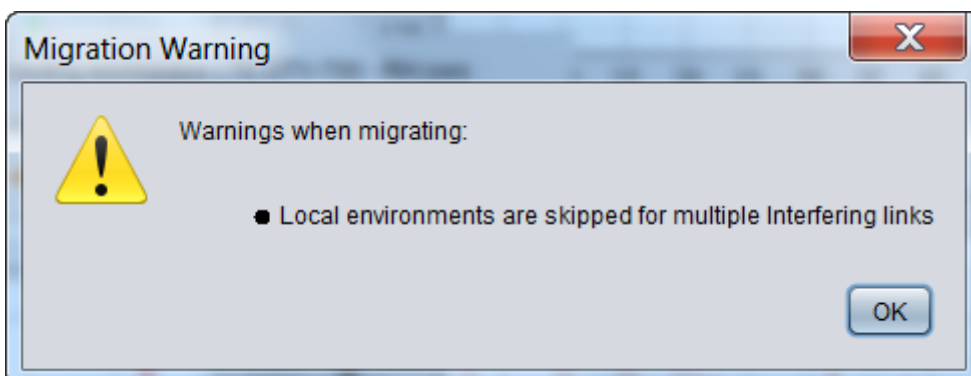


Figure 156: Migration warning on the local environment

5.4.4 Propagation Model

A suitable propagation model can be selected to be applied when calculating signal loss along the path between transmitters and receivers. Further information on propagation models are presented in detail in ANNEX 17.