WinProp V14

- Modifications and Improvements of Software Modules
- Content of new Updates
- History of Changes

Definitions:

Month Day, Year

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Bugfix**
A bug (error) in the software was corrected.
Different prediction results might occur between new and former release.

☐ **Code-Modification**
A modification of the source code was made which should lead to no effect. This message is only for information if the software shows a different/wrong behavior. The user should not see this modification and the software should be identical to the former release.

☐ **Modification**
A modification of a sub-routine was made because of new scientific results.
Different prediction results might occur between new and former release.

☐ **Extension**
Extension of the software by adding new features. This allows additional control or additional processing of predictions. If the new features are not enabled in the dialog, the new version of the software will lead to the same prediction results as the former version.

☐ **New Release**
New version was released.

December 12, 2016

ProMan	**CoMan**	**StreetM.**		**Aircom**		**PRO-R**	**PRO-I**		**NET-O**	**NET-T**	**NET-G**		**DPM**		**MCS**
WallMan	**CompoM.**	**MobileM.**		**Forsk**		**PRO-U**	**PRO-T**		**NET-L**	**NET-D**	**NET-E**		**IRT**		**FUS**
AMan	**OptMan**	**MIMO M.**		**MASC**		**PRO-C**	**PRO-V**		**NET-C**	**NET-B**			**SRT**		**COV**

- **New V14 released**
  WinProp V14 released including HWU licensing.

November 04, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **AMan MASC: Export of 3D antenna pattern in msi format**
  AMan allows to compute the resulting 3D antenna pattern in case the multiple antennas are radiating in parallel, or the antenna is mounted in front of a wall, on a mast etc.. As input for the simulations the patterns for the individual antennas need to be provided in the WinProp *.apb format (3D antenna pattern binary), but the conversion of *.msi files (common antenna pattern format including horizonal and vertical patterns, i.e. 2x2D pattern, e.g. used by Kathrein and many radio planning tools) is also feasible in AMan. So far the *.msi export function in AMan was not working, which is required if the customers want to further process the antenna patterns computed in AMan outside of WinProp. This bug is fixed now.

October 18, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban IRT Prediction in ProMan: Crash if tile/segment size too small**
  When using the urban IRT prediction in ProMan a crash occurred if the tile/segment size was defined too small. This problem is fixed now. In the V13 version up to 65535 tiles (segments) per wall (wedge) are supported.

September 15, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMOMan		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

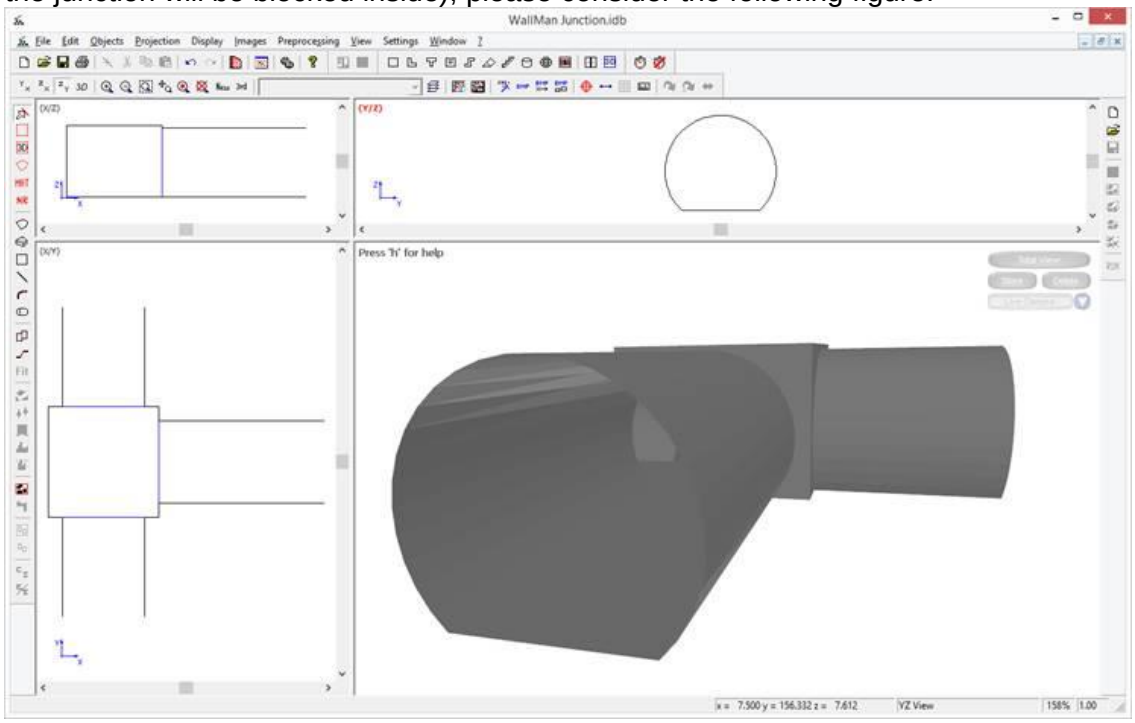
- **MIMOMan: Problem for defined route along not computed pixels**
  The prediction results computed with the ray-optical models can be post-processed within MIMOMan for superposing the Rx antenna pattern along a defined route or trajectory. In case the route was defined along not computed pixels the post-processing in MIMOMan was not possible. This problem is fixed now.

August 08, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	**TuMan**	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ TuMan: Correct definition of tunnel junctions

For the correct definition of junctions for tunnels with circular cross sections it is required to switch before the junction from the circular cross section to a larger rectangular cross section (otherwise there will be either gaps in the tunnel geometry or the junction will be blocked inside), please consider the following figure:



July 15, 2016

ProMan	CoMan	StreetMan		Aircom		**PRO-R**	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ ProMan/WallMan: Extended converters for topographical maps

For the conversion of topographical maps there are various converters included in WinProp (both in WallMan and ProMan). In the HGT format the US agency USGS offers various maps for download. So far only the 3arc-sec resolution data has been supported and now the converter has been extended for the 1arc-sec resolution data. The DEM format provides the topo information in column vectors with variable length, which is considered now, so far only DEM files with constant length were supported.

June 28, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	**PRO-V**		NET-C	NET-B			SRT		COV

☐ **ProMan: Consideration of atmospheric absorption effects**

For the application of the sophisticated WinProp wave propagation models for higher frequency bands the models have been extended to consider atmospheric absorption effects like the oxygen absorption at 60 GHz. For this purpose the specific attenuation in dB/m for different frequencies can be defined and is then considered depending on the path length.

June 26, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	**PRO-V**		NET-C	NET-B			SRT		COV

☐ **ProMan: Display of results for different time steps in time-variant projects**

In the previous version there were some limitations regarding the visualization of the results of the different time steps. In point mode all the time-variant prediction points were shown at time 0.000s (where only the first point should appear). Furthermore the time step information was missing for the correct display of the computed rays (e.g. in case of moving Tx all the displayed rays start at the Tx location at time 0.000s. Now the time-variant results are correctly displayed including the computed rays, both for the area mode and the point mode.

June 17, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Urban IRT: Problem for vertical plane post-processing with KE model**

The prediction results computed with the ray-optical urban IRT model can be post-processed with the knife-edge (KE) diffraction model evaluating the vertical plane including Tx and Rx. For some specific Tx and Rx constellations problems were observed which result in duplicated LOS rays or crash of the propagation computation. Both problems are fixed now.

June 06, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMOMan		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **DPM: Now available also for leaky feeder cables**

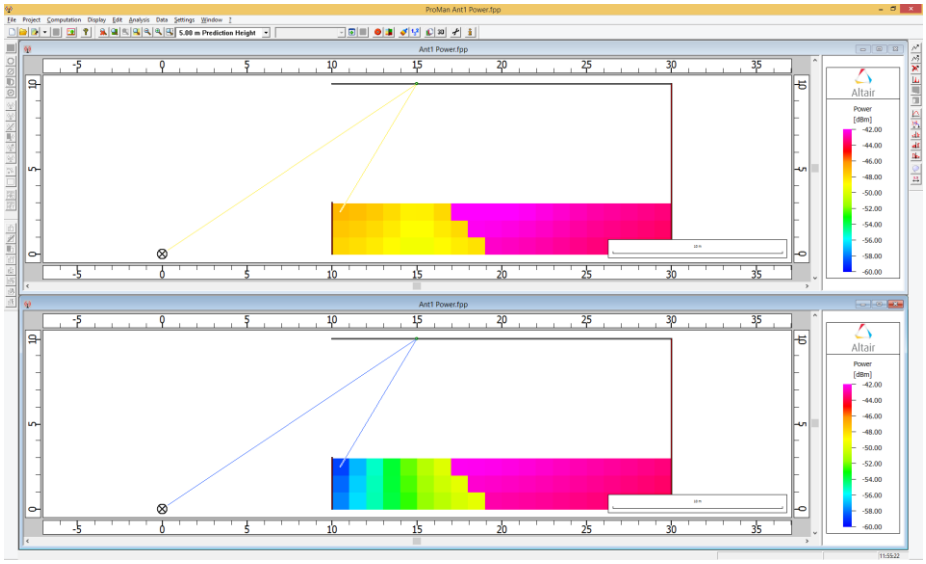
The dominant path model (DPM) determines the best propagation path connecting transmitter and receiver under consideration of the specific environment (e.g. walls and their properties in an indoor scenario). Besides omni and sector Tx antennas also leaky feeder cables can be deployed in the ProMan tool. Now the DPM model can be also used for the coverage predictions in case of leaky feeder cables.

May 18, 2016

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

☐ **IRT/SRT Scattering in ProMan: Correct angular dependency**

The IRT and SRT propagation models allow to consider also the scattering on walls. In case the scattering direction is getting further out of the reflection direction the contribution of the scattered ray shall be further reduced. This impact is now correctly considered (see lower result in the figure below), while in the previous version the scattered contribution was too high (see upper part of the figure below).



April 29, 2016

ProMan	CoMan	StreetMan		Aircom		**PRO-R**	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMOMan		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **DPM: Path determination for definable frequency**

The dominant path model determines the propagation path connecting transmitter and receiver under consideration of transmissions through walls. For higher frequencies typically the transmission loss increases, which prefers then rather diffracted paths with lower number of wall transmissions. Due to this behaviour the dominant paths were depending on the defined frequency, which made it difficult to compare the coverage situation for different frequencies. In order to avoid such problems it is now possible to define a frequency for the determination of the dominant paths, which can then be used for the coverage prediction at different frequencies.

October 16, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMOMan		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

☐ **Material catalogue extended for higher frequencies up to 75 GHz**

The WinProp material catalogue has been extended to include the electrical properties for typical construction materials now for frequencies up to 75 GHz. Besides this frequency band also the bands 450 MHz, 900 MHz, 1.5 GHz, 1.8 GHz, 2 GHz, 3.5 GHz, 5 GHz, 15 GHz, 30 GHz, and 60 GHz are considered.

The material catalogue can be loaded in WallMan and used for the definition of the wall properties which are then considered when using the wave propagation models in ProMan.

September 29, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	**MIMOMan**		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **MIMO Channel Capacity: Correct computation in case of water filling**
  The water filling algorithm assigns individual Tx power values to the different antenna elements of a MIMO transmitter according to the channel properties in order to maximize the MIMO channel capacity. For the computation of the Tx power values using the water filling algorithm there was an error leading to wrong MIMO channel capacities (lower than for the equal power case). This problem is fixed now.

August 13, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban DPM: Shadowing due to buildings missing if Rx height > Tx height**
  For the fast computation with the dominant path model from a certain distance on the buildings are considered via a pixel data matrix. For the case Rx height above Tx height this matrix was only considering the buildings above Tx height, i.e. buildings below were missing (no shadowing behind these buildings). This problem is fixed now.

May 08, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Components: Crash in case rad. cables are used**
  In case radiating cables were defined when using the components module (e.g. connected between a splitter and a terminator) the ProMan tool partly crashed after performing the coverage prediction..
  This problem is fixed and now also the definition of radiating cables when using the components module is feasible.

April 24, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Components: Wrong loss in case Tx power defined in Watt**
  In case the power for the carrier assignment was defined in Watt when using the components module the resulting Tx power at Tx antenna level might be wrong due to wrong calculation of the losses, which occur due to the installation (e.g. cables, splitter, ...) between the transmitter/transceiver and the Tx antenna.
  This problem is fixed now and the resulting losses due to the installation of the components are correctly considered for the computation of the Tx power at Tx antenna level (in both cases, i.e. independent if in the carrier assignment the power was defined in Watt or dBm).

February 26, 2015

ProMan	CoMan	StreetMan		Aircom		**PRO-R**	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Rural DPM: No results in case no clutter losses shall be considered**

In case no clutter losses shall be considered, the computation with the rural DPM did not save the results. This problem is fixed now.

February 19, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	PRO-V		NET-C	NET-B			SRT		COV

☐ **CNP DPM: Indoor transmission loss partly missing for outdoor Tx**

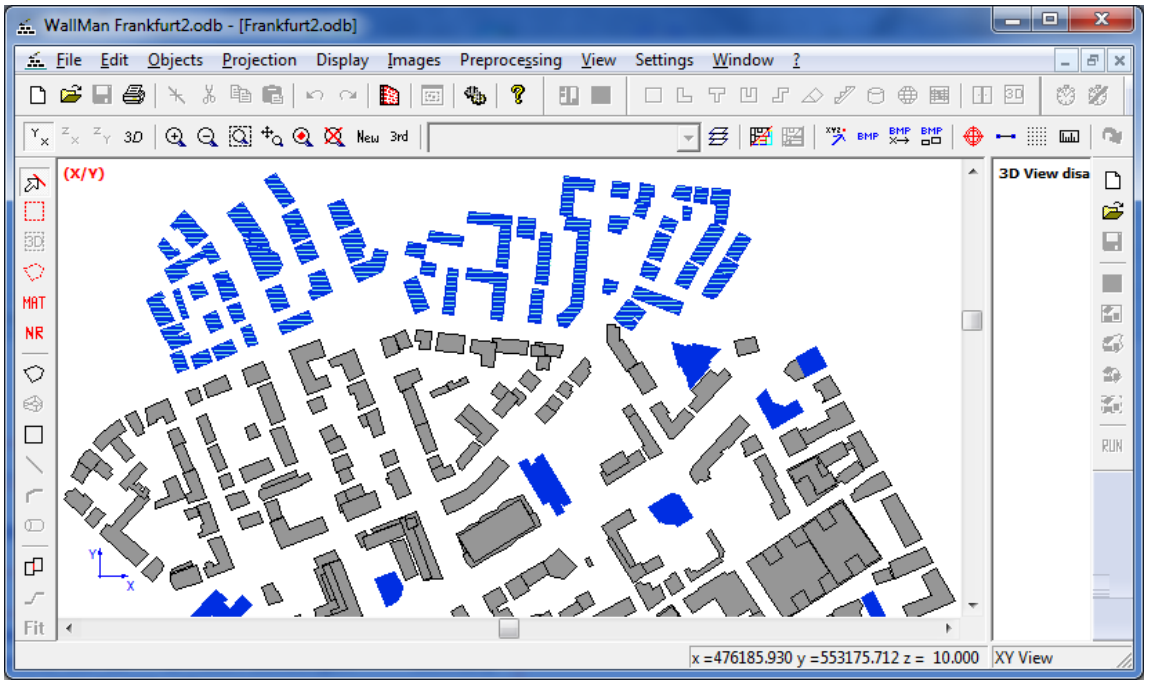
For the computation of the coverage inside CNP buildings (urban) the indoor transmission loss was partly missing in case of outdoor Tx. This problem is fixed now.

February 17, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	PRO-V		NET-C	NET-B			SRT		COV

☐ **Combined Urban & Indoor Scenarios: Creation of interior walls**

For urban buildings the feature Create Interior allows the automatic generation of indoor floor levels and indoor vertical walls based on the urban polygonal cylinder describing the building. This feature has been extended for the parallel creation of indoor walls for multiple buildings.

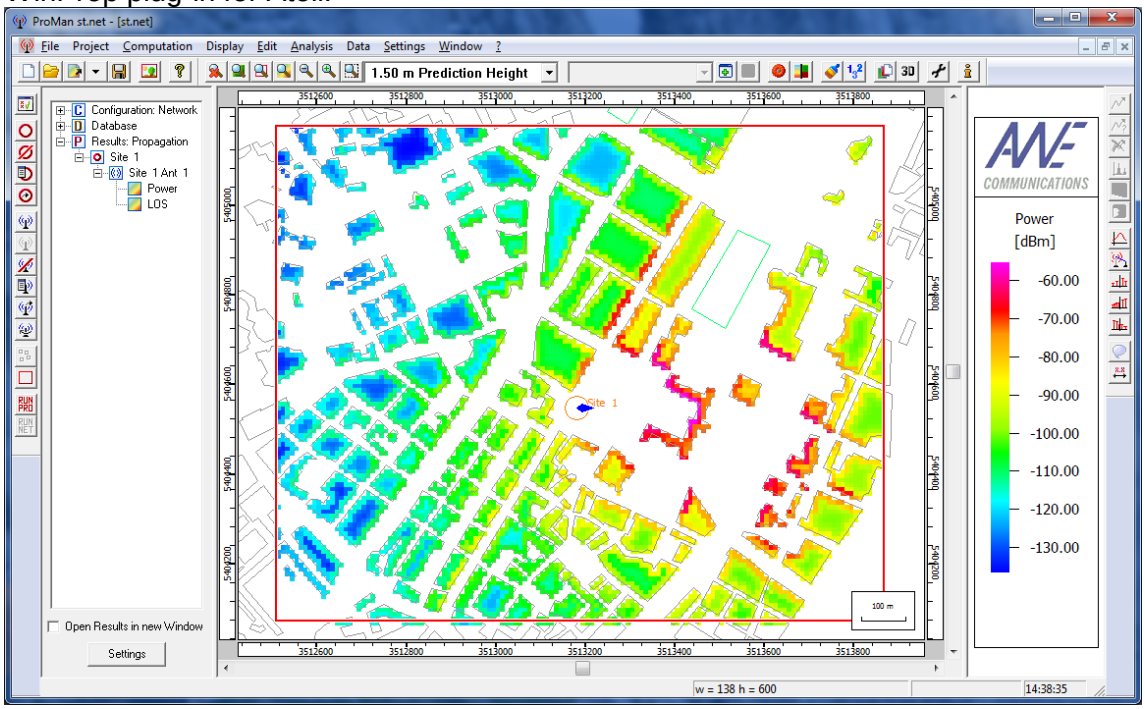


February 04, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		**Forsk**		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Urban Scenarios: Computation of indoor coverage only

For urban scenarios the indoor coverage can be computed with various indoor penetration models. An additional option allows now to compute (display) only the indoor coverage, i.e. inside the buildings. This extension is available in ProMan and the WinProp plug-in for Atoll.



January 30, 2015

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Indoor IRT: Correct angle calculation for empirical diffraction loss model

When using the indoor IRT propagation model together with the empirical interaction loss model the diffraction loss is computed based on the projected angle of incidence and the projected angle of diffraction with respect to the illuminated wall forming the wedge. Now it is ensured that the two angles are always referring to the same (illuminated) wall, which provides the correct angles for the diffraction loss calculation. As the angles are calculated partly in the preprocessing the preprocessing in WallMan needs to be computed again.

December 16, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Urban DPM: Error in case of outdoor Tx located in indoor pixel

For the computation of the urban coverage for an outdoor Tx which is located close to a building and therefore the Tx falls into an indoor pixel partly an error occurred. This problem has been fixed.

December 05, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Indoor Leaky Feeder: Propagation exponents for LOS and NLOS**
  For the computation of the indoor coverage by leaky feeders propagation exponents for LOS and NLOS can be defined. The defined exponents are considered in the prediction, but have not been read correctly when opening the project again. This problem has been fixed now.

November 28, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	PRO-V		NET-C	NET-B			SRT		COV

- **CNP DPM: Too high signal levels for coverage inside CNP buildings**
  For the computation of the coverage inside CNP buildings (urban) partly too high signal levels were computed in case of topography consideration. This problem is fixed now.

November 11, 2014

ProMan	CoMan	StreetMan		Aircom		**PRO-R**	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Rural DPM: Prediction areas larger than 100km by 100km possible**
  Prediction areas larger than 100km by 100km were so far not possible with the rural DPM model independent of the defined prediction resolution. This problem is fixed and now prediction areas larger than 100km by 100km can be computed also with the rural DPM model.

October 21, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban IRT preprocessing in WallMan: Shadowing due to topography partly missing if box is empty (no buildings)**
  In order to accelerate the computation the area is divided in mutliple boxes, so that first is checked which boxes are passed by the investigated ray. In case of an empty box, i.e. box has no buildings at all, the topography for this box was also not considered, i.e. the possible shadowing due to the topography in this box was missing. This problem is fixed now.

October 08, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban IRT Preprocessing: Separate spheric zone value for pixel visibilities**
  The urban IRT model is based on a single preprocessing in the WallMan tool. In this preprocessing the visibilities between tiles (from the building walls), segments (from the building wedges), and pixel are determined. In order to limit the computational

effort for very large urban scenarios the spheric zone can be activated as preprocessing option, so that only visibilites up to a certain distance range are determined. Now a separate spheric zone value for the pixel visibilities has been introduced, so for the single interactions (reflection and diffraction) a larger distance value can be used than for the higher order interactions which are based on the visibilities between tiles and segments.
For the determination of the visible elements (tiles, segments, and pixels) from the Tx antenna in ProMan there is no limitation regarding the distance, i.e. no spheric zone applied.

September 26, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Urban IRT: Problem when Tx and Rx positions are identical

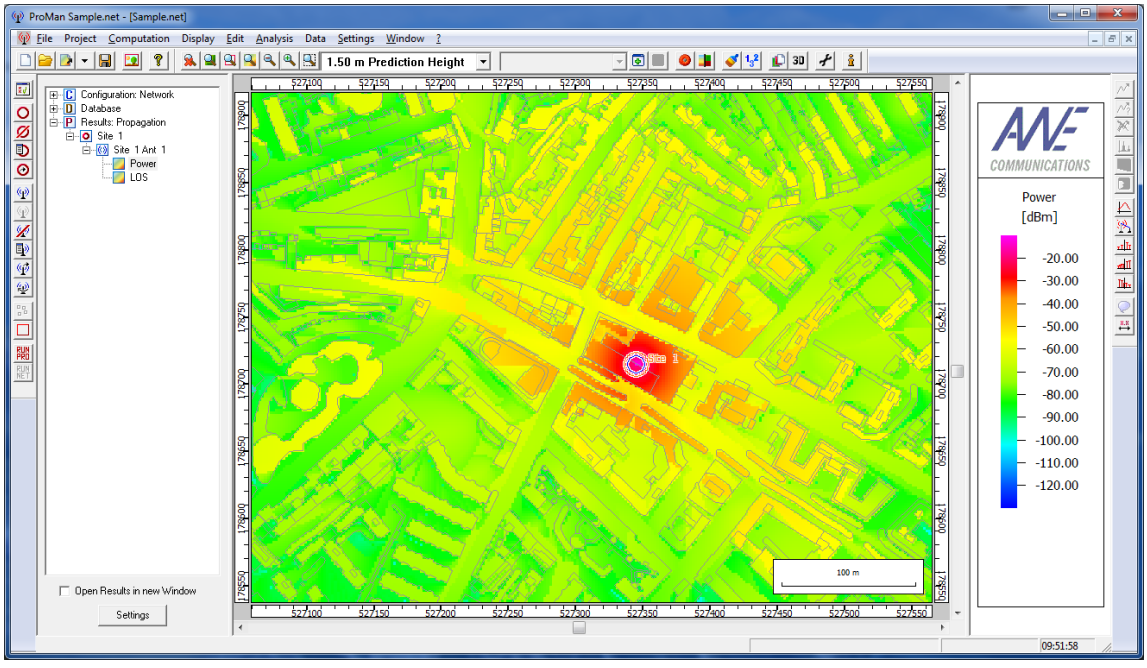
In case of identical Tx and Rx positions so far the direct ray was predicted which led to problems when computing and saving the prediction results (due to path length 0 the signal levels can not be correctly computed in this case). This problem is solved now. If Tx and Rx positions are identical the direct ray is no longer computed, but all other rays with at least one interaction. So the correct radio channel is now also available in this case.

September 12, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Urban DPM in ProMan: Prediction on building rooftops

The urban DPM model was extended by an additional "indoor" model, which allows to predict the signal levels on the defined height above the building rooftops (instead of the indoor penetration) in addition to the outdoor prediction at the defined height.



September 3, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	PRO-V		NET-C	NET-B			SRT		COV

- **Save urban building database with bitmap and imported indoor building (CNP) in WallMan: Walls of indoor CNP building not considered**
  If the urban building database was saved with a bitmap and an imported indoor building (CNP) the walls of the CNP building were not considered during the coverage prediction. This problem is fixed now.

August 7, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban preprocessing in WallMan: Error if topo data not available for full preprocessing area**
  If the topo data is not available for the full preprocessing area an error message is displayed, but afterwards a crash occurred. This problem is fixed now.

July 28, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

- **Indoor scenarios in ProMan: Unlimited number of prediction points**
  For indoor scenarios individual prediction or receiver points can be specified either by defining the corresponding locations directly with coordinates or by importing the points from an ASCII file. So far only a max. number of about 300 prediction points can be handled in a project, for more prediction points an error occurred. This has been improved now, so that there is no fix limit anymore, i.e. the number of prediction points is only limited by the available RAM.

July 21, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

- **Indoor scenarios in ProMan: Import of text file with prediction points**
  For indoor scenarios individual prediction or receiver points can be specified either by defining the corresponding locations directly with coordinates or by importing the points from an ASCII file. In the previous version a crash occurred at the import of prediction points which is solved now.
  Individual prediction points are not supported by all wave propagation models. Therefore this option may be not available, depending on the selected prediction model.

June 16, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban IRT: Error when loading str file if empirical interaction model and transmission matrix output are activated**
  The str file computed with the urban IRT cannot be loaded in ProMan (error message) if the empirical interaction model and/or the KE post-processing model are active and the output of the transmission matrix is activated. In order to avoid this problem the transmission matrix output is automatically disabled when the empirical interaction model and/or the KE post-processing model are active. Generally the transmission matrix can be only computed using the physical interaction model and not using the empirical interaction model nor the knife edge diffraction model in the vertical plane.

May 28, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

- **IRT/SRT Scattering in ProMan: Correct angular dependency in emp. model**
  The IRT and SRT propagation models allow to consider also the scattering on walls. When using the empirical model for the computation of the scattering loss now the correct angular dependency is considered, i.e. the same angular dependency as for the Fresnel/UTD model.

May 15, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

- **Indoor SRT Scattering in ProMan: Wrong rays**
  When using the indoor SRT propagation model it is also possible to consider the scattering on walls. Partly wrong scattered rays were computed which penetrate walls instead of scatter the impinging rays. This problem is fixed now.

May 13, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **Urban IRT in ProMan: Crash for computation of angular or delay spread**
  When using the urban IRT in ProMan a crash occurred if the computation of the angular spread and/or delay spread was activated. This problem is fixed now.

May 13, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

- **Indoor IRT/SRT Calibration in ProMan: Crash for Apply Calibrated Materials**
  When using the indoor IRT/SRT propagation models it is also possible to calibrate the material properties. After the calibration the materials can be applied to the given building database. When using this button a crash occured. This problem is fixed now.

April 28, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Urban IRT Preprocessing in WallMan: Crash if tile/segment size too small**
When using the urban IRT preprocessing in WallMan a crash occurred if the tile/segment size was defined too small. This problem is fixed now. In the V13 version up to 65535 tiles (segments) per wall (wedge) are supported.

April 8, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Indoor IRT in ProMan: Different results for Fresnel/UTD dep. on outputs**
When using the indoor IRT propagation model together with the Fresnel coefficients for transmission/reflection and the UTD for diffraction the map of the computed signal level results changed if further outputs (e.g. angular spread, transmission matrix) were activated. This problem is fixed now.

March 31, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

☐ **Indoor SRT in ProMan: Coherent superposition for empirical interact. model**
For the coherent superposition of the rays computed with the indoor SRT using the empirical interaction model the phase of the individual rays was not correctly considered. This problem is fixed now.

March 25, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	PRO-V		NET-C	NET-B			SRT		COV

☐ **DPM in ProMan: Not computed areas for Tx in CNP building**
In case the Tx is defined in a CNP building it occurred that part of the indoor areas and the urban outdoor area was not computed (if the outer walls of the CNP building are in NLOS to the Tx). This problem is solved now and the DPM computes the full outdoor and indoor simulation areas also for the case Tx inside CNP building.

March 21, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		**NET-O**	**NET-T**	NET-G		DPM		**MCS**
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		**NET-L**	NET-D	NET-E		IRT		**FUS**
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		**NET-C**	NET-B			SRT		**COV**

☐ **Throughput per cell in Monte Carlo simulation report**
The throughput per cell results derived by the Monte Carlo network planning simulation and given in the corresponding report were summed up so far, i.e. the throughput of the following cells included also the throughput of the previous cells. Now the throughput per cell results derived by the Monte Carlo are reported correctly.

March 19, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		**NET-O**	**NET-T**	NET-G		DPM		**MCS**
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		**NET-L**	NET-D	NET-E		IRT		**FUS**
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		**NET-C**	NET-B			SRT		**COV**

☐ **Acceleration of network planning**

The transmission modes were always analyzed (computation of the performance of each mode) even if no results were selected. This analysis is now skipped if the user does not want to get the results related to the transmission modes.

☐ **Output of ASCII results of network planning**

The results in the network planning were always written only in binary data format - even if the user selected the additional output in ASCII format. Now the result files are written additionally in ASCII format.

March 17, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Urban Preprocessing in WallMan: Crash directly after start**

Due to a problem in the initialization the urban preprocessing in WallMan produced partly a crash directly after the start of the preprocessing. This problem is fixed now.

March 14, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Indoor IRT in ProMan: No diffraction at convex wedges**

The indoor IRT model computed so far diffracted rays at convex wedges which were formed by two neighbouring walls, i.e. the walls were partly penetrated by a diffraction. This problem is fixed now.

March 14, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Indoor IRT in ProMan: Prediction of LOS and OLOS**

The indoor IRT model predicted so far always OLOS even if there is LOS between Tx and Rx. This problem is fixed now.

March 12, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	**OptMan**	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Optimization of Antenna Adjustment and Additional Target Result Maps**

The simulation time of the antenna adjustment module could be decreased. Propagation prediction reruns only for adaptable antennas now.
For LTE network planning projects additional result maps (RSRP, RSRQ) can be selected as optimization target.

March 12, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Urban IRT in ProMan: Different Tx topo height for computation and str file**
In case the Tx is defined on a building the absolute Tx height in the str file was based on the topo height plus relative Tx height, while in the computation the topo height of the building plus the relative Tx height is considered. The approach used in the computation is now also considered for the absolute Tx height in the str file.

March 11, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		**NET-O**	**NET-T**	**NET-G**		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		**NET-L**	**NET-D**	**NET-E**		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		**NET-C**	**NET-B**			SRT		COV

☐ **ASCII Output of Network Planning Results**
The additional output of network planning results in ASCII files did not work. This bug is fixed now.

March 11, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ **Urban IRT in ProMan: No further rays computed if free space loss reached**
In case an omni antenna is defined with a max. gain larger 0 dB it happened that in the LOS area only the direct ray is computed, despite the option "Cancel determination of further rays if free space loss is reached" was disabled. This bug is fixed now.

March 10, 2014

ProMan	CoMan	StreetMan		Aircom		**PRO-R**	**PRO-I**		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	**PRO-T**		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	**PRO-V**		NET-C	NET-B			**SRT**		COV

☐ **Network projects in ProMan: Frequency used for propagation models**
Instead of the frequency of the carrier assigned to a cell transmitter, always the frequency of the first carrier in the list of carriers was used for the computation of the propagation (RUN PRO). This bug was not in releases prior to V13.
Propagation projects (i.e. without definition of air interface) did not have this problem. Only network projects (with air interface specification).

March 06, 2014

ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		**NET-O**	**NET-T**	NET-G		DPM		**MCS**
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		**NET-L**	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		**NET-C**	NET-B			SRT		COV

☐ **Further results for Monte Carlo Simulator: Number of Mobile Stations**
In the network planning with the Monte Carlo Simulator further results (maps) can be generated with the number of users (mobile stations) generated during the Monte Carlo Simulation.

January 10, 2014

ProMan	CoMan	StreetM.		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoM.	MobileM.		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO M.		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

- **New V13 released**
  WinProp V13 released.

New Modules of V13

- **CompoMan: Editor for the Components in Indoor Radio Network Installation**
  The components required for the installation of the indoor radio network (e.g. cables, antennas, splitters, combiners, attenuators, amplifiers, etc.) can now be easily defined in a new editor. For each component the specific properties for different frequency bands can be defined).

- **OptMan: Tool for the Optimization of the Tx Antennas in the Radio Network**
  OptMan is introduced to optimize network installations designed with WinProp.
  Existing radio networks, containing transmitters with directional (sector) antennas, can be optimized regarding azimuth and tilt orientation of the sector antennas considering predefined evaluation criteria.
  Beyond this optimization of the Tx antenna orientations, OptMan is able to assist during the planning process of new radio networks by extracting a subset of predefined possible Tx antennas required to fulfill a user defined set of thresholds for the coverage performance of the radio network.

- **ProMan: Indoor Network Projects: Components used for the installation**
  Graphical editor to draw the installation maps in indoor scenarios. Based on the components ((cables, splitters, amplifiers, etc) in the plans the radiated power at the antenna location is determined automatically.
  Signal level plans for the installed components are computed automatically and can be printed/exported.
  Reports as well as lists with mounted components can be generated.

- **ProMan: Network Planning: Consideration of Traffic**
  Two simulators for the consideration of traffic in wireless networks are now available. Different applications and their individual transmission modes can be defined and are assigned based on clutter maps. Extension of the software by adding new features. This allows additional control or additional processing of predictions. If the new features are not enabled in the dialog, the new version of the software will lead to the same prediction results as the former version.

Differences to WInProp V12.3

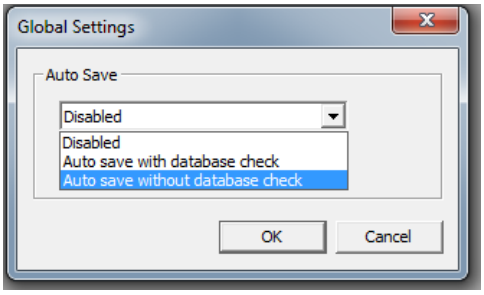
ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	**PRO-T**		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		**PRO-C**	**PRO-V**		NET-C	NET-B			SRT		COV

- **Simplification of Urban Building Databases**
  Crash of the WallMan tool occurred during the simplification of urban buildings. Therefore it was not possible to simplify the buildings automatically. This problem is fixed now.

- **Numerical Problems with Subdivisions in Indoor Building Databases**
  Numerical problems occurred during insertion of subdivisions in single wall view. Therefore it was not always possible to create subdivisions. This problem is fixed now.

- **Distance between wall and surface prediction plane**
  The prediction on surfaces of indoor walls was changed. Now the prediction plane is no longer located directly on the wall element, but on separate prediction planes before and behind the wall. The distance between the wall element and the surface prediction planes has to be specified in WallMan either during enabling the surface prediction option or via Objects menu.

- **Optimization of Auto Save**
  The auto save option, which offers the possibility to automatically backup databases, was extended in order to save the databases without database check. Saving the databases without check is much faster and therefore recommended for auto save.



ProMan	CoMan	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

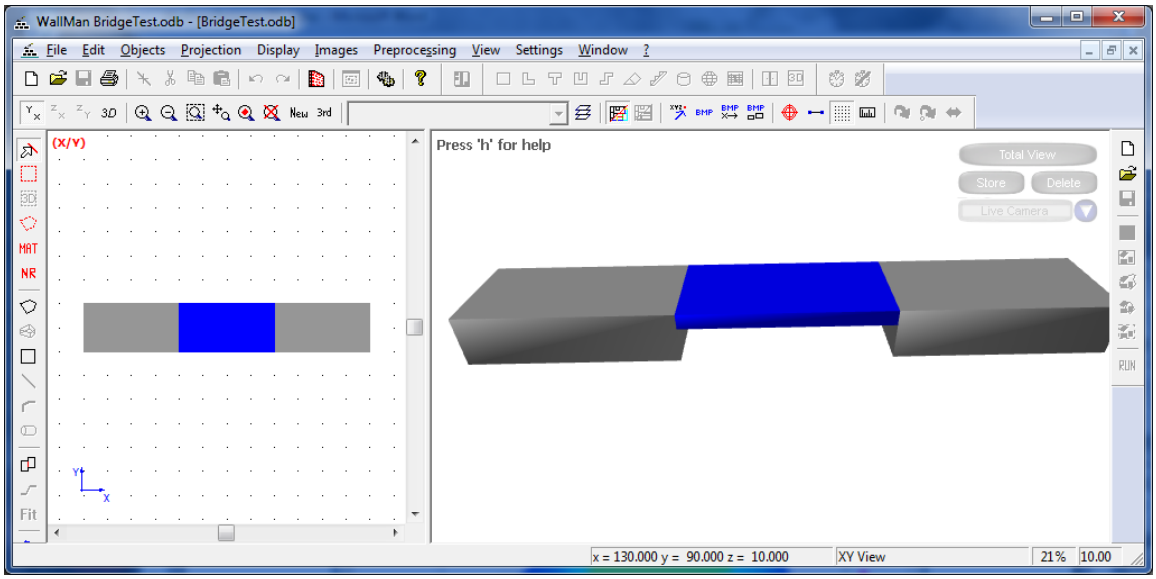
- **New method to extrapolate 3D pattern from horizontal & vertical patterns**
  A new algorithm for the extrapolation of 3D antenna radiation patterns based on the given horizontal and vertical patterns of the antenna has been implemented in AMan. In this exponential method the horizontal diagram is corrected according to the difference between the front-to-back ratio at elevation angle 0° and the front-to-back ratio at the elevation angle theta. This exponential interpolation provides accurate predictions especially for antennas with electrical downtilt.

ProMan	**CoMan**	StreetMan		Aircom		PRO-R	PRO-I		NET-O	NET-T	NET-G		**DPM**		MCS
WallMan	CompoMan	MobileMan		Forsk		**PRO-U**	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

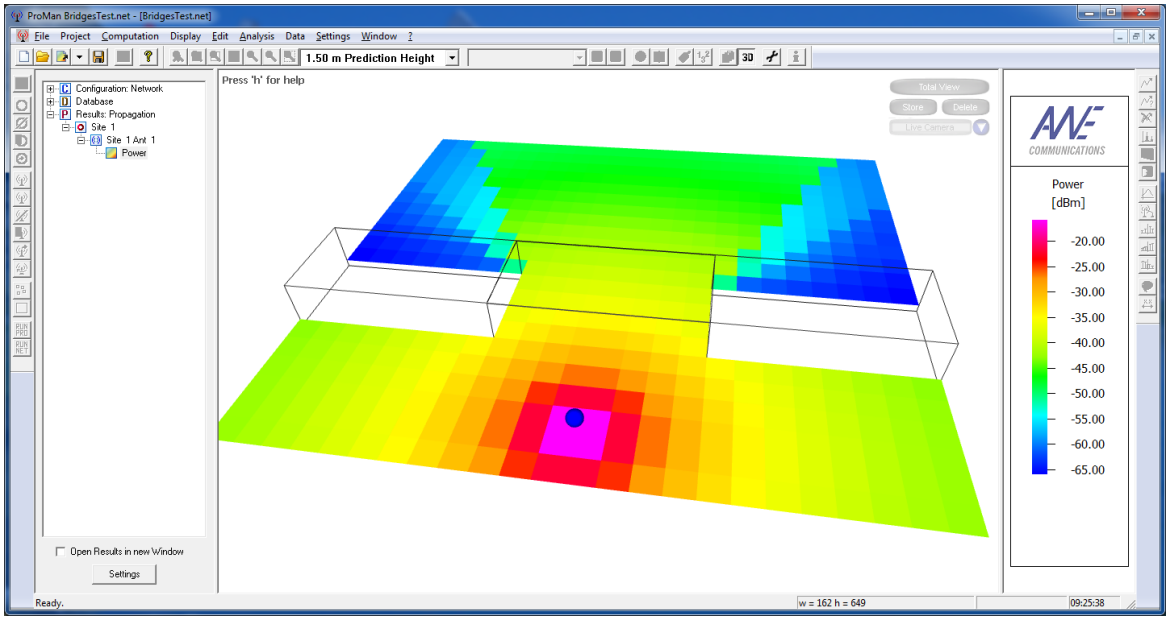
☐ Consideration of Bridges in Urban Scenarios

The WinProp urban propagation models (DPM, IRT) have been extended to consider complex 3D objects like bridges (so far all buildings have been polygonal cylinders).

The new objects can be defined in WallMan like the well known polygonal cylinders. By selecting the object type "Horizontal Plates" the object is considered as horizontal object in an urban environment which has a certain thickness, but does not reach the ground (e.g. the blue object in the following figure). By using such objects bridges or balconies can be defined.



The new objects are considered in ProMan when using the urban propagation models (DPM, IRT). Accordingly the opening under the bridge is considered for the wave propagation. Furthermore the predictions are performed also in the area below the bridge.

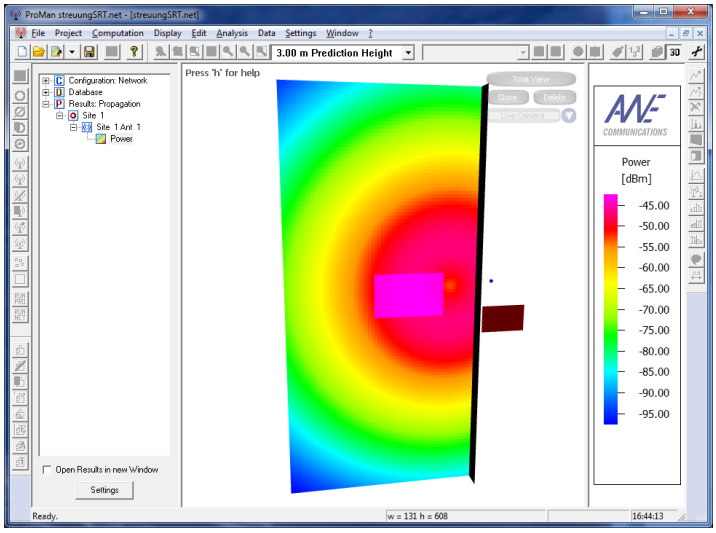


ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		IRT		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			**SRT**		COV

☐ Scattering for Indoor SRT

The WinProp SRT model has been extended to consider the scattering on building walls and other objects. For this purpose the scattering can be activated in the model settings by enabling the option 'Consider additionally rays with scattering'.

As the scattering increases the overall number of rays significantly, there is a limitation of one scattering per ray. The single scattering is considered as separate ray only, i.e. not considered in combination with other interactions (transmission, reflection and diffraction). Furthermore the scattering properties of the corresponding materials need to be defined (in WallMan and/or ProMan).

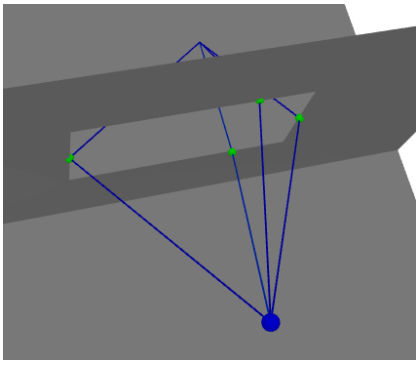


Both the empirical and the deterministic (physical) interaction models are supported. In the empirical interaction model the scattering loss defines the additional loss (for a ray 30° out of the reflection direction). The scattering loss is added to the reflection loss. The defined scattering loss is applied if the angle difference between reflected and scattered ray is 30°. In case of 0° angular difference no additional scattering loss is applied. Generally the scattering loss is increasing with increasing angular difference. In the deterministic model the polarimetric scattering matrix S_vv, S_vh, S_hv, S_hh is defined and considered for the field strength computation. For the scattering in the SRT model tiles with sizes as defined in the dialog are considered. The scattered contribution is weighted with the size of the scattering area (tile) with a reference size of 100 sqm. Accordingly the resulting scattered power from the whole object is for large distances independent of the tile size. For small distances there is an impact due to the modified scattering angles which depend on the size of the tile.

ProMan	CoMan	StreetMan		Aircom		PRO-R	**PRO-I**		NET-O	NET-T	NET-G		DPM		MCS
WallMan	CompoMan	MobileMan		Forsk		PRO-U	PRO-T		NET-L	NET-D	NET-E		**IRT**		FUS
AMan	OptMan	MIMO Man		MASC		PRO-C	PRO-V		NET-C	NET-B			SRT		COV

☐ Consideration of diffractions at wedges from holes in the indoor IRT model

The wedges generated by holes (as subdivisions in walls) are now considered for the computation of diffractions in the indoor IRT propagation model (see the following figure). This includes modifications in the preprocessing (WallMan) and prediction (ProMan).



ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X						

☐ Consideration of Rx antenna gain in lower hemisphere for indoor models

The indoor models have been extended to consider an Rx antenna gain (e.g. - 20 dBi) for rays reaching the Rx antenna from the lower hemisphere.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X						

☐ Output of transmission matrix in the urban IRT model

The urban IRT model was extended by the output of the transmission matrix and the corresponding vector of the electrical field strength. This information for each ray is only available, if the ray tracing model is selected in combination with the Fresnel (reflection, transmission) and GTD/UTD (diffraction) model for the calculation of the rays. The transmission matrix is always optional, whereas the channel impulse data is always written, if the output of propagation paths is selected.

☐ Predictions on building rooftops for the urban DPM model

The urban DPM model was extended by an additional "indoor" model, which allows to predict the signal levels on the building rooftops (instead of the indoor penetration) in addition to the outdoor prediction at the defined height.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X						

☐ Gradient for Coupling Loss (Radiating Cable)

The coupling loss can be reduced by defining a (positive) coupling loss gradient. If the coupling loss at the begin of the cable is 10 dB for example and the coupling loss gradient is 2 dB/100m then the coupling loss at the end of a 100 meter long cable is 8 dB. Along the cable there is a linear decrease of the coupling loss.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
				X	X	

☐ Option to consider the defined floors for CNP prediction with DPM model

The height levels considered in the DPM model have an impact on the wave propagation result, e.g. on the outdoor prediction result in case of a scenario with multiple CNP buildings and an indoor transmitter. If only the defined Tx and Rx height levels (both for outdoor and indoor) are considered the outdoor DPM result might vary with the defined CNP indoor prediction height. Optionally it is now possible to consider all defined floors in the DPM model which increases the computation time, but generates reproducible outdoor results (independent of the defined CNP indoor prediction height).

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
			X			

☐ Indoor projects with time variant objects

CoMan offers the possibility to simulate time variant indoor projects now. Supported are time variant database vector objects defined in WallMan as well as time variant transceiver nodes.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X	X					

☐ **Adjustment of database geometry during conversion**

The geometry of converted topography and clutter pixel databases (e.g. lower left & upper right corner, resolution) can be adjusted right after the conversion now.

☐ **Extension of GeoTIFF topography converter**

The GeoTIFF topography database converter was extended to support further database sub formats. Now it is possible to import GeoTIFF files with topography values stored as integer and floating point numbers.

☐ **Modification of pixel databases**

Several functionalities for pixel matrices (prediction results, topography and clutter maps) have been introduced in ProMan. Now it is possible to extract sub areas of pixel databases via Edit menu (Edit -> Modify Geometry of Area -> Extract Data) and to change the resolution of the maps (Edit -> Modify Geometry of Area -> Change Resolution). Besides this, values at the edge of the map can be copied automatically to fill the gap between the edge of the map and the corresponding database boundary. This is especially useful, if a topography database needs to be extended and no additional data is available for example.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X						

☐ **Display of database boundaries**

The (rectangular) boundaries of prediction results (matrices) can be displayed optionally in ProMan. This offers the possibility to easily determine the extension of the result matrix even if pixels at the border are not computed.
The new option can be enabled via the 'Options' button on the Layout page of the Display Settings dialog.

ProMan	WallMan	AMan	CoMan	API	Atoll	Aircom
X			X	X	X	X

☐ **Cancel a prediction with the Dominant Path Prediction Model**

If the user cancelled a computation with the DPM during the initialization of the DPM main matrix, the software could crash during "free memory" because not all elements of the DPM main matrix have been initialized correctly. After code modification the user can cancel the prediction during the initialization phase without any problems.

☐ **Impact of the Prediction Area on the results of the DPM in rural scenarios**

The corners of the prediction area influence the result of the DPM propagation model. To reduce this effect, the lower left corner of the area is now moved (area is slightly extended) to make sure that the transmitter is exactly in the center of a prediction pixel

☐ **Determination of resolution (in meter) in case of geo databases**

In case of geodetic databases the tool has to determine the size of a pixel (in meter). In former versions the resolution depended also on the prediction area. This is now changed and the resolution (in meter) is directly computed based on the resolution defined by the user (in degree).