This document will comment on different aspects regarding the simulation of activity factors. It is intended to provide a basis for further discussions, how Seamcat might be improved in the future. It is based on the current Seamcat 4.0.0.

Current situation

The simulation of interferer's activity factors is possible using modes „uniform density" or „closest interferer", available at tab „Interfering Link/Transmitter to Victim Link Receiver Path". Then, the parameters to define the density become available, i.e. in detail:

- $dens_{it}^{active}$: Density of Tx – given in 1/km²
- p_{it}^{tx} : Probability of transmission – which is the activity factor, as it is used e.g. for many SRDs
- $activity_{it}(time)$: Activity – given in 1/h, maybe seen as a kind of daily activity function; a strict separation from the meaning of the Probability of transmission is essential; not of interest within this document
- Time – useful in connection to the activity parameter above, i.e. to be seen as a given hour in a day; not of interest within this document
- d_0 : Protection distance – defines a minimum „free space" around the victim receiver, i.e. an area, in which no interferer will be placed

The number of active transmitters is given separately, as well as the Path azimuth distribution. The placement of the interfering Tx is done in an area, which is defined by a path azimuth parameter only, i.e. which is mainly circular around a given point, by default around the Victim Link Receiver. According to the manual, the simulation radius is calculated as follows:

$$R_{simu}=\sqrt{n^{active}/\pi * dens_{it}^{active}} \quad \text{, with} \quad dens_{it}^{active}=dens_{it} * p_{it}^{tx} * activity_{it}(time) \quad ,$$

and in the presence of a protection distance the calculation is:

$$R_{simu}=\sqrt{n^{active}/\pi * dens_{it}^{active}+d_0^2} \quad .$$

The effects of this calculation scheme are twofold:

- On one hand, when looking at the scenario, one will see active transmitters only, i.e. only those transmitters, which are actively transmitting and which might (depending on other settings) add a portion to the interference the victim receiver will face.
- On the other hand, one will notice different pictures in terms of the simulation radius, when changing e.g. the number of active transmitters n^{active} or the probability of transmission p_{it}^{tx} .

With respect to Short Range Devices (SRD), there is one more issue. To calculate the interference caused by these devices it might be useful to have fixed scenarios, i.e. the placement should not be restricted to circular patterns, maybe fixed distances between several SRDs or between SRDs and the victim receiver will be necessary. Therefore, the placement should be done using the mode „none". But in this case an activity factor is not accessible at tab „Interfering Link/Transmitter to Victim Link Receiver Path". The following workaround is helpful here.

Workaround

Using mode „none" for the placement of the interfering links (tab „Interfering Link/Transmitter to Victim Link Receiver Path"), a simple workaround to deal with an activity factor is the use of the power emission characteristics of the interfering transmitters (tab „Interfering Link/Transmitter"). One can define a „user defined stair", in this way setting a kind of activity factor. For definition of a transmission power of 10 dBm and an activity factor of 1 % the file could look like this:

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-100.0      0.99
10.0        1.0
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The transmitter will use a transmission power of 10 dBm only with a probability of 1 %, with a probability of 99 % a transmission power of -100 dBm will be used, i.e. the transmitter will be switched off. The result is an activity factor of 1 %. This workaround leads to the following facts:

- When looking at the scenario, the settings are always identical, independent from the currently used activity factor or the number of active devices. The placement of the interferers can be set using many more options then in the above mentioned case.
- One has to notice that (in contrast to the case mentioned above) *not* all visible transmitters will transmit. According to the activity factor their might be only a few or even no transmitter, which are transmitting in a given event. Therefore, for proper statistics, *much more events have to be calculated* than in the above mentioned case!

Open point

The workaround works well for different settings. But there is one issue, which sometimes makes the things more complex than necessary. This issue is the protection distance.

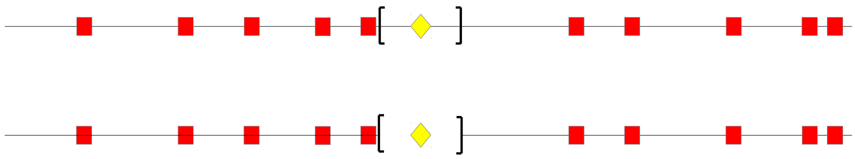
As mentioned above, when using a density to define the placement of the interfering transmitters, one of the parameters is the protection distance. The calculation engine will test, if a generated transmitter is located inside the protection distance. If so, this transmitter is cancelled and a new one is generated.

In mode „none“, the protection distance is not available anymore. But why? There is no need for restrictions.

>> **Proposal**: The parameter protection distance (d_0) should be available in any case, i.e. for any possible placement option for the interfering transmitters relative to the victim receiver.

The calculation engine can be used as usual – a transmitter is generated and after that a test is done, whether this transmitter is located inside the protection distance. If so, the transmitter is cancelled and a new one is generated. The only tricky issue is to make sure that – according to the placement settings – there is a possibility at all that a transmitter can be placed outside the protection distance. This issue is not relevant to the density case, because the protection distance is included in the simulation radius calculation. But it seems to be a simple test, a simple message might inform the user about the incoherent settings.

A protection distance, which is always available, would prevent the user from the need to split a set of interferers, e.g. it will be possible to have interferers placed along a line together with the victim receiver. Up to now, such a scenario would lead to two separate parts of that line, when there is a need for a protection distance.



The picture illustrates this scenario. The upper line represents a placement of interferers as one group, including a protection distance. The lower line represents the need for a separation of the group onto two lines, as it is without the availability of a protection distance parameter.