

3.3 Calculating the iRSS

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3.3.0 Objective

In this section, you will learn how to ...



Define Interefering link transmitter (It)

- Tx power
- Antenna characteristics
- Set the emission bandwidth



Position the VLR vs It (i.e. Victim link vs Interfering link)



Calculate the iRSS



Relation between Emission bandwidth, reference bandwidth and VLR

3.3.1 Interfering Links

The characteristics of the interfering system summarised in Table 7 should be entered into the SEAMCAT simulation scenario. For this example only one interfering link will be simulated.

Table 7: Characteristics of the interfering link pair of transmitter and receiver

Parameters	Value	Units
Operating frequency	1000	MHz
Transmitter power	33	dBm
Emission bandwidth	200	kHz
Reference bandwidth	200	kHz
Tx antenna type	Omni directional	
Tx antenna gain	11	dBi
Tx antenna height	30	m

3.3.2 System to be an interferer

Contrary to the victim link, it is possible to set more than one interfering link in your simulation. A given simulation workspace must contain at least one interfering link.

First edit the technical characteristics of the system(s) that will be used as interferer(s). It is possible to generate many links with the same system or with different systems. Figure 84 presents an example with 3 interfering links having each a different technical characteristic.

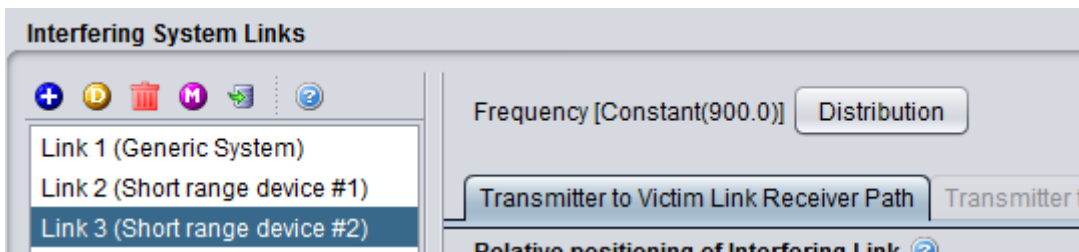


Figure 84: Example of generating multiple Interfering links

The frequency of 1000 MHz will be finally set at the “scenario” tab level (#1).

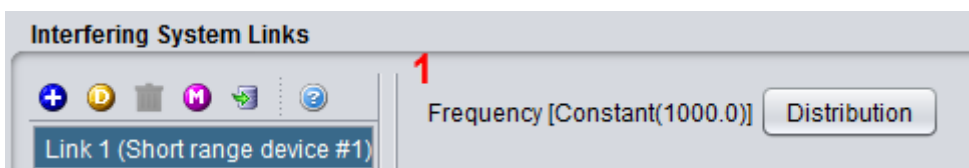


Figure 85: Setting up the operating frequency of the interfering link

3.3.3 Transmitter

Set now the victim link transmitter by selecting the transmitter tab:

- the Interfering link transmitter uses a Power of 33 dBm; (#1 of Figure 86)
- the Interfering link transmitter uses an omni-directional antenna of 11 dBi gain; (#2)
- the Interfering link transmitter uses an antenna height of 30m; (#3)
- the Interfering link transmitter uses an emission bandwidth of 200 kHz and a reference bandwidth Bref = 200 kHz. (#4)

The emission bandwidth of 200 kHz is defined through the emission mask (see Figure 86). This interfering link transmitter emission mask is defined in dBc. Then, enter an attenuation given in a reference bandwidth, the corresponding power is derived using the following equation:

$$P(\text{dBm}/\text{Bref}) = P_e(\text{dBm}) + \text{Att}(\text{dBc}/\text{Bref}) \quad (\text{Eq.18})$$

Where P_e is the power of the Interfering link transmitter within the emission bandwidth (also known as the in-band power). The sign of $\text{Att}(\text{dBc}/\text{Bref})$ is explained in section A7.5. Then, in this example, within the emission bandwidth (200kHz- offset between -0.1 MHz and 0.1 MHz), the power is 33 dBm, if the reference bandwidth is supposed to be equal to the emission bandwidth then $\text{Att} = 0 \text{ dBc}/\text{Bref}$, this gives:

$$33 (\text{dBm}/200\text{kHz}) = 33 + 0(\text{dBc}/\text{Bref})$$

The attenuation in dBc should be taken equal to 0 dBc/200 kHz (the link between the mask given in a reference bandwidth and the mask defined in 1 MHz is explained in ANNEX 6:).

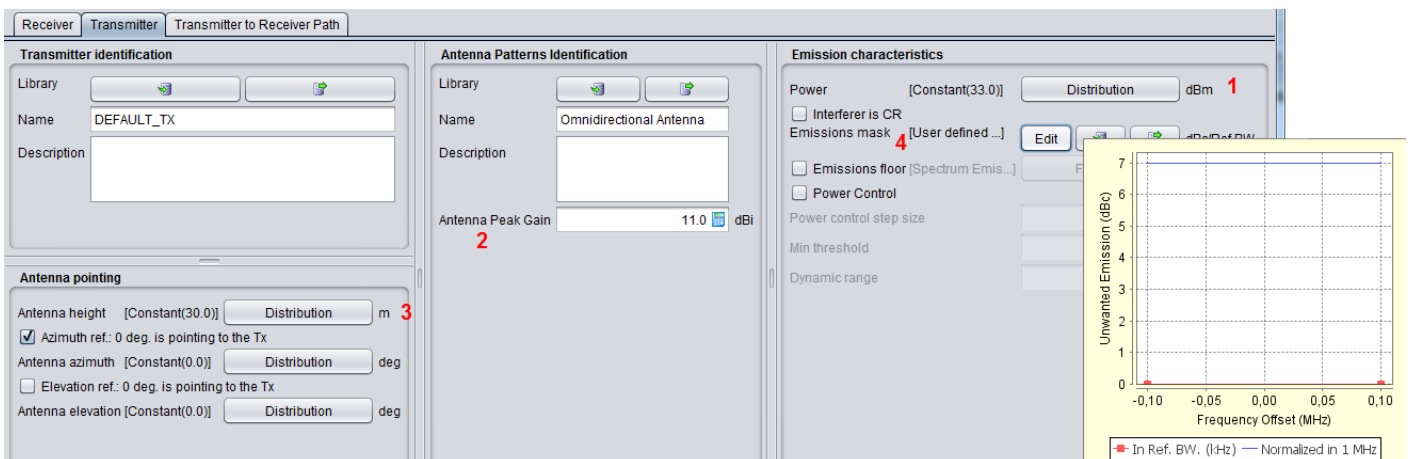


Figure 86: Setting up the interfering link transmitter

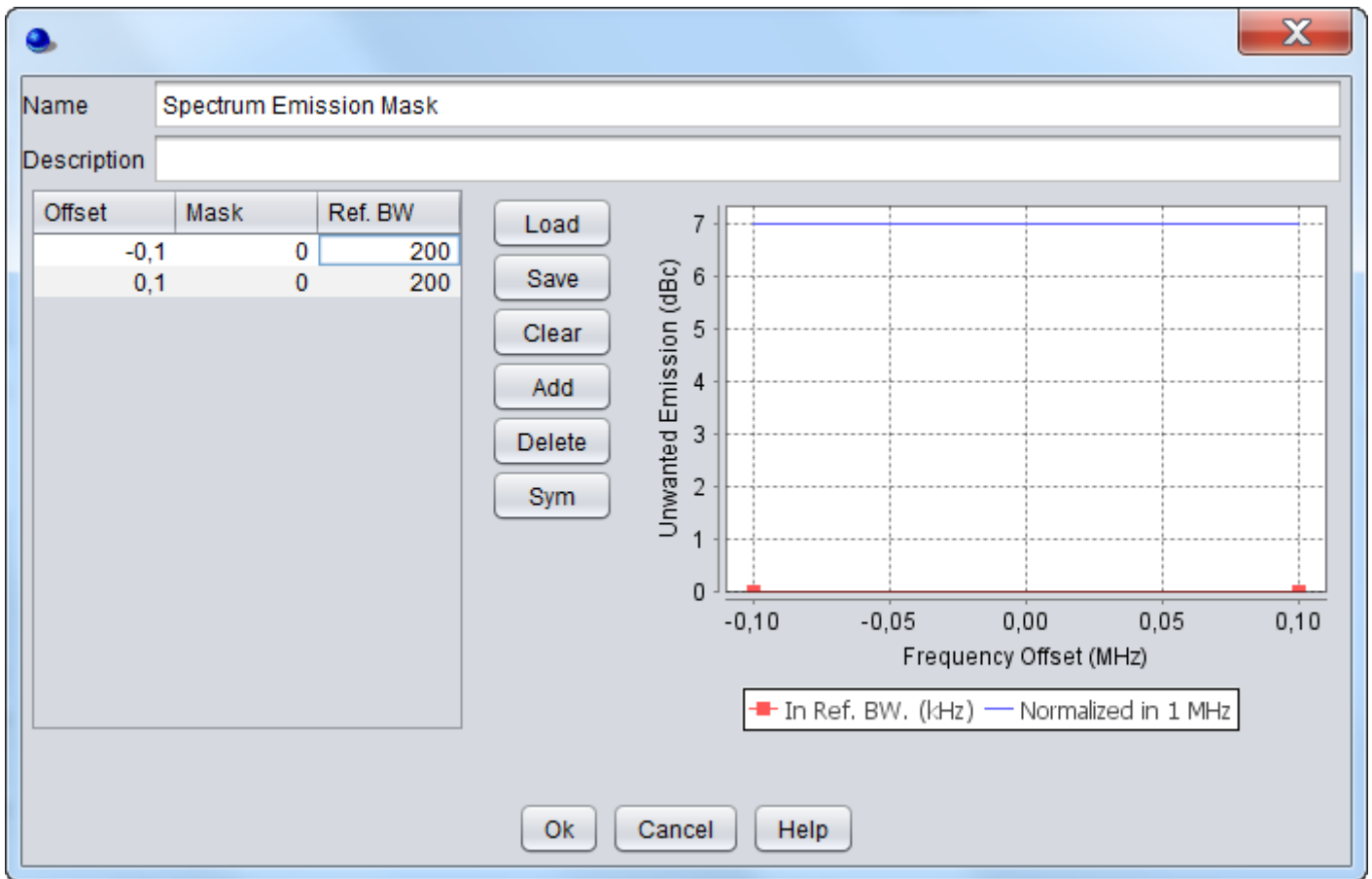


Figure 87: Spectrum emission mask settings

3.3.4 Receiver

For this exercise, the Power Control is not activated, therefore there is no need to fill in any information about the Interfering link receiver.

3.3.5 Positioning of the ILT vs ILR

Positioning of the ILT vs ILR is similar to positioning VLT vs VLR as described in Section 3.2.5.

This is required when the power control in the interfering link is simulated. It is also important to set it in case the geometry of the scenario is dependant on the position of the ILR (for instance ILR being at the center of the ILT distribution, or the victim link being fixed with respect to the ILR).

3.3.6 Positioning of the VLR vs ILT

SEAMCAT allows defining the relative location between the Victim link receiver and the Interfering link transmitter as illustrated in Figure 88. The input parameters are detailed in section 10.3, and the algorithms are detailed in ANNEX 13:

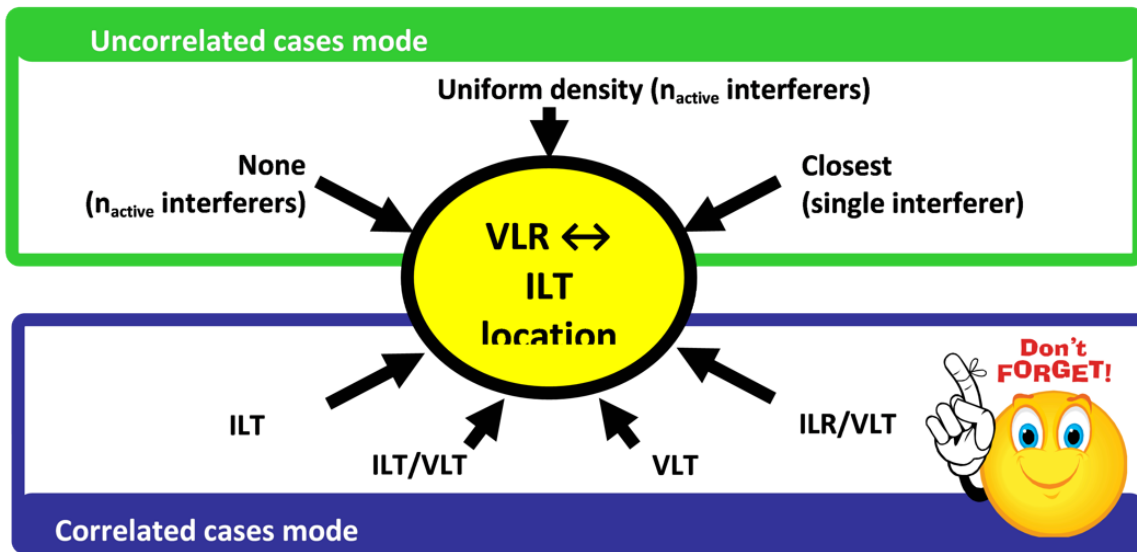


Figure 88: Summary of the VLR \leftrightarrow ILT location capability in SEAMCAT

In this exercise, the distance between the Interfering link transmitter and the Victim link receiver as shown in Figure 89 is fixed by using the correlated distance as illustrated by Figure 90.

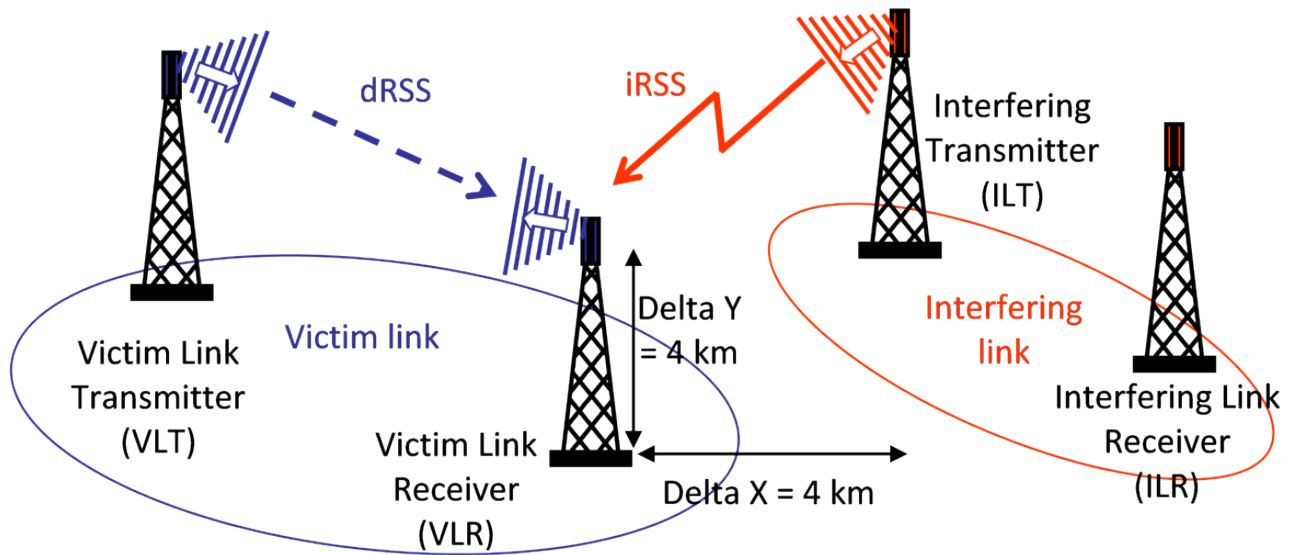


Figure 89: Distance between the Interfering link transmitter and the Victim link receiver

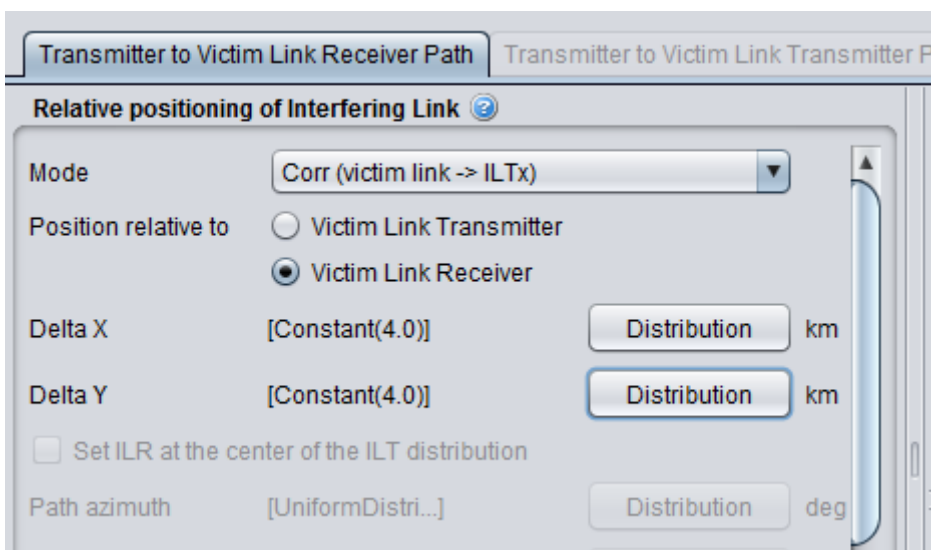


Figure 90: Example of setting up the distance between the Interfering link transmitter and the Victim link receiver in SEAMCAT. Here the ILT is positioned relative to the VLR

3.3.7 Calculating the iRSS by hand

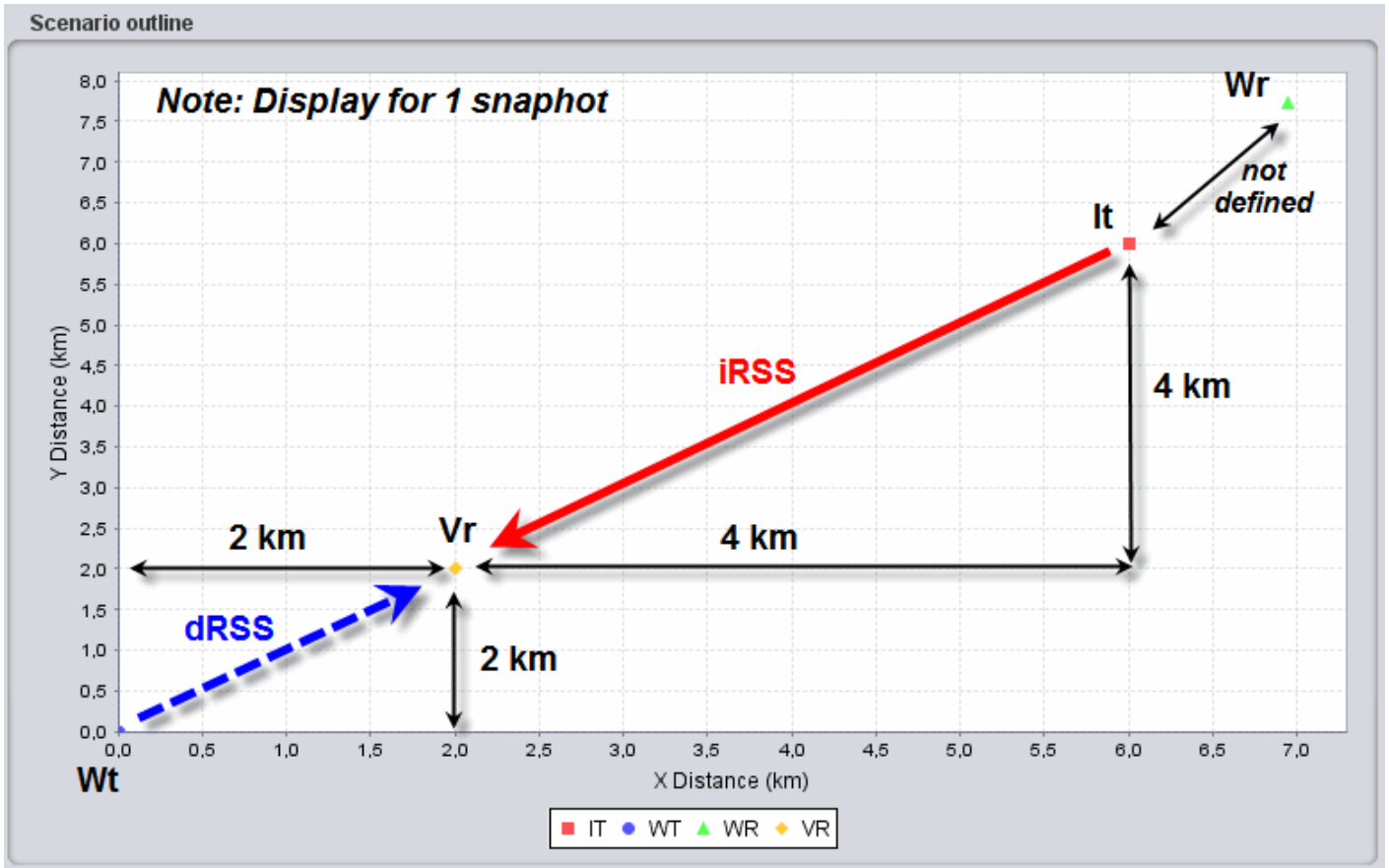


Figure 91: Illustration of SEAMCAT display (only 1 snapshot) of the various pair of transmitter and receiver and the dRSS and iRSS relationship

The attenuation between the Interfering link transmitter and the Victim link receiver is simulated by using the free space model (Variation should be disabled). When the simulation is finished, SEAMCAT presents the positioning of the various pairs of transmitters and receivers as shown in Figure 91(only one snapshot is illustrated).

Using these assumptions, it is possible to derive the interfering power received by the Victim link receiver iRSS:

(Eq.19)

$$iRSS = P_e + G_e + G_r - L$$

$$\text{iRSS} = 33(\text{dBm}) + 11 + 9 - (32.5 + 10\log(32) + 20\log(1000))$$

$$\text{iRSS} = -54.5\text{dBm}$$

3.3.8 Emission, reference, VLR bandwidth relationship and bandwidth correction factor

The proposed exercise considers the case where the VLR bandwidth is the same as the emission bandwidth and the reference bandwidth.

This section aims at illustrating the interaction between the emission bandwidth (It_{BW}), reference bandwidth (B_{ref}), VLR bandwidth (VLR_{BW}) and any bandwidth correction factor. This section provides examples where these values are different and its' effect on the iRSS calculation.

Relationship between Emission bandwidth and Reference bandwidth

For a fixed $VLR_{BW} = 200$ kHz, and fixed $It_{BW} = 200$ kHz, the attenuation $Att(dBc/B_{ref})$ will be different depending on the values of the B_{ref} in order to achieve the same interference power level.

Case 1, $It_{BW} > B_{ref}$:

$B_{ref} = 100$ kHz, with $Att = -3$ dBc/ B_{ref} , $iRSS = -54.49$ dBm;

As mentioned in Section A7.5 on p.287, if the reference bandwidth is lower than the emission bandwidth then the attenuation must be defined with negative sign;

Case 2, $It_{BW} = B_{ref}$:

Bref = 200 kHz, with Att = 0 dBc/Bref, iRSS = -54.49 dBm;

If the reference bandwidth is equal to the emission bandwidth then the attenuation should be set as zero.

Case 3, $I_{t_{BW}} < B_{ref}$:

Bref = 400 kHz, with Att = 3 dBc/Bref, iRSS = -54.49 dBm;

If the reference bandwidth is larger than the emission bandwidth then the attenuation must be defined with positive sign.

Please note that, it is best practice and recommended that the user set the reference bandwidth as the same value as the bandwidth of the emission mask, to avoid any unexpected scaling effect.

Relationship between Emission bandwidth and Victim link receiver bandwidth

For a fixed Bref = 200 kHz and a fixed $I_{t_{BW}} = 200$ kHz, depending on the size of the VLR_{BW} a bandwidth correction factor is applied or not. Calculations presented here are mainly illustration of effect or relation between emission Bw nad VLR Bw in the co-frequency case.

Case 4, $I_{t_{BW}} = VLR_{BW}$:

$VLR_{BW} = 200$ kHz, iRSS = -54.49 dBm;

Case 5, $I_{t_{BW}} > VLR_{BW}$:

$VLR_{BW} = 100 \text{ kHz}$, $iRSS = -57.5 \text{ dBm}$;

As shown in ANNEX 22: on p. 422, when the $It_{BW} > VLR_{BW}$, the interfering power in the VLR is reduced due a bandwidth correction factor automatically applied in SEAMCAT. As a results, the $iRSS$ value decreases compare to a case where $It_{BW} = VLR_{BW}$.

Case 6, $It_{BW} < VLR_{BW}$: Case of ILT Spectrum emission mask when the Tx spectrum is sharply reduced outside its reference bandwidth

$VLR_{BW} = 400 \text{ kHz}$, $iRSS = -54.49 \text{ dBm}$;

As illustrated in ANNEX 22:, when the $It_{BW} < VLR_{BW}$, there is no bandwidth correction factor applied to the interfering emitted power since the all the energy is “seen” by the VLR. Therefore the $iRSS$ is equal to the case where $It_{BW} = VLR_{BW}$. Note also that since the emission bandwidth of the interferer is smaller than the victim, SEAMCAT will complain that the spectrum emission mask of the interferer is not defined with the range of the victim bandwidth, therefore you need to increase the out of band emission.

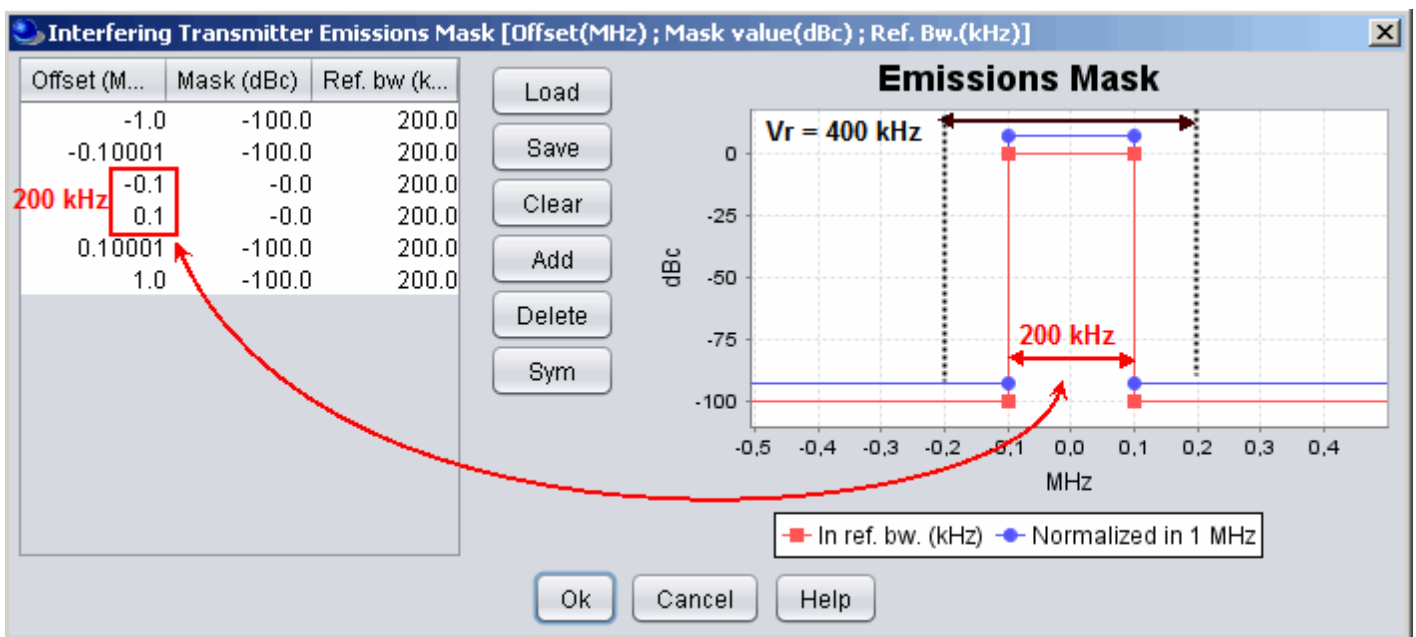


Figure 92: Illustration of the emission spectrum mask with respect to the VLR bandwidth in case 6

Case 7: $It_{BW} < VLR_{BW}$: Case of ILT Spectrum emission mask when the Tx spectrum have sloped characteristics outside its reference bandwidth

This is the same as case 6 ($VLR = 400 \text{ kHz}$ and $Bref = 200 \text{ kHz}$) except that the spectrum emission mask (emission bandwidth 200 kHz) has slopes on both sides (Figure 93) which generates higher

interference compared to the case 6 and the $iRSS = -53.44$ dBm

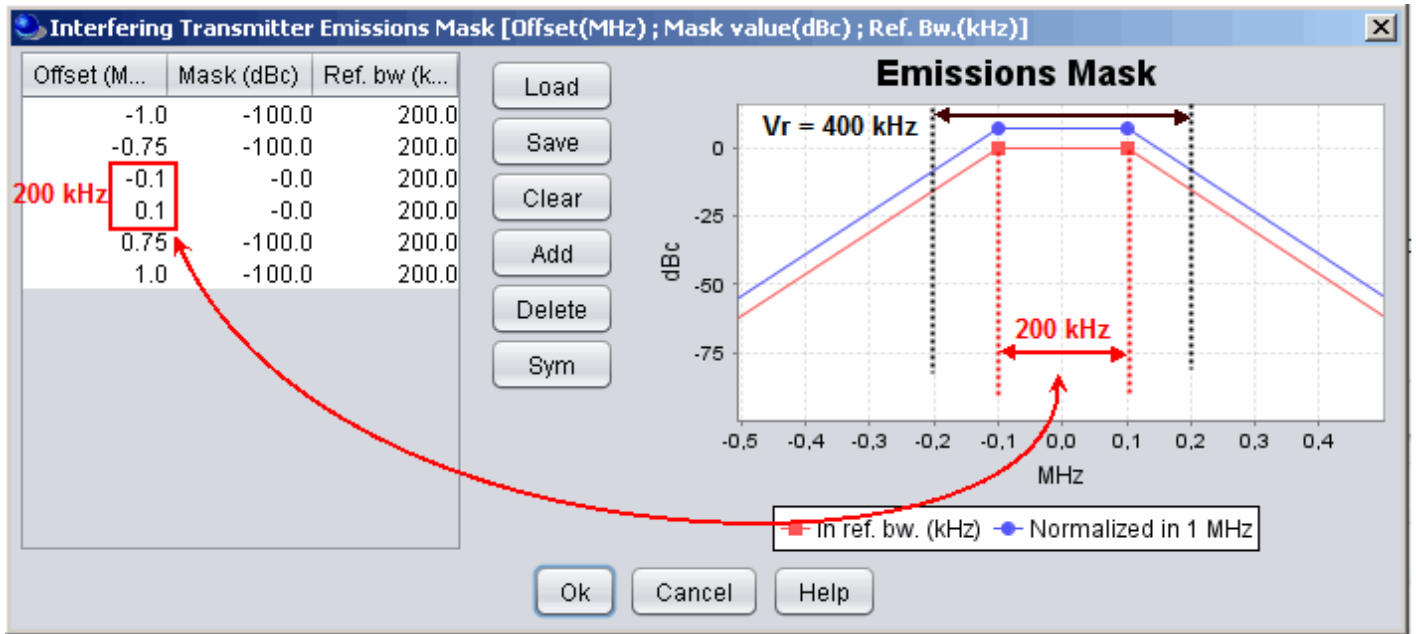


Figure 93: Illustration of case 7 and the “extra” interfering energy to the VLR due to the slope in the emission mask