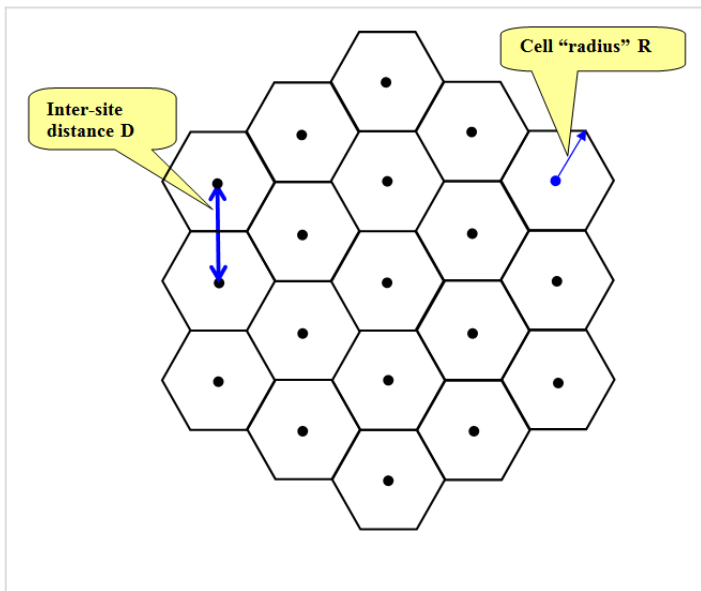


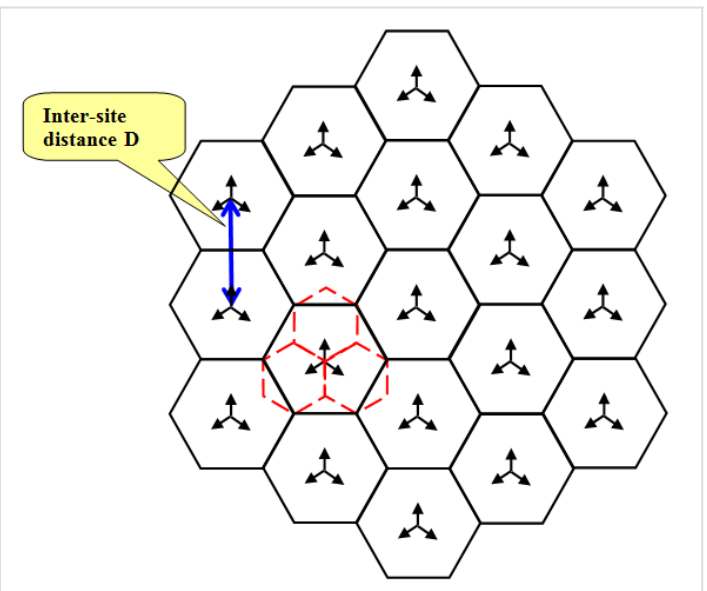
# 7.5.1 System

Initially macro-cellular environment was implemented in SEAMCAT, but with time more flexibility was given to the tool to reproduce various topology options in cellular network (Figure 176). Cell sites are laid out in a hexagonal grid. Sites with omni-directional antennas are placed in the middle of the cells as depicted in Figure 172 and sites with tri-sector antennas are placed at the edge of the cells, where each site covers three cells. Figure 173 shows one of these cell sites (small hexagons in dashed lines) and that the arrows demonstrate the antenna orientation of each cell. The BS to BS distance (also referred as inter-site distance in the literature) is  $D$ . The cell radius  $R$  is equal to  $D/\sqrt{3}$  in the omni-antenna case and is equal to  $D/3$  in the tri-sector antenna case. Both suburban scenario and urban scenario can be modeled with this cell configuration. The scenarios differ only in propagation conditions and in the cell radius.

A wrap around cluster is used to reduce the number of cells required in the simulations and consequently to enable faster simulation run times. The number of cell sites in the cluster is assumed to be 19 (19 cells in the case of omnia-antenna and 57 cells in the case of tri-sector antenna), which appears to be appropriate for SEAMCAT simulation (see Section 7.6.3 for further details on wrap-around technique).

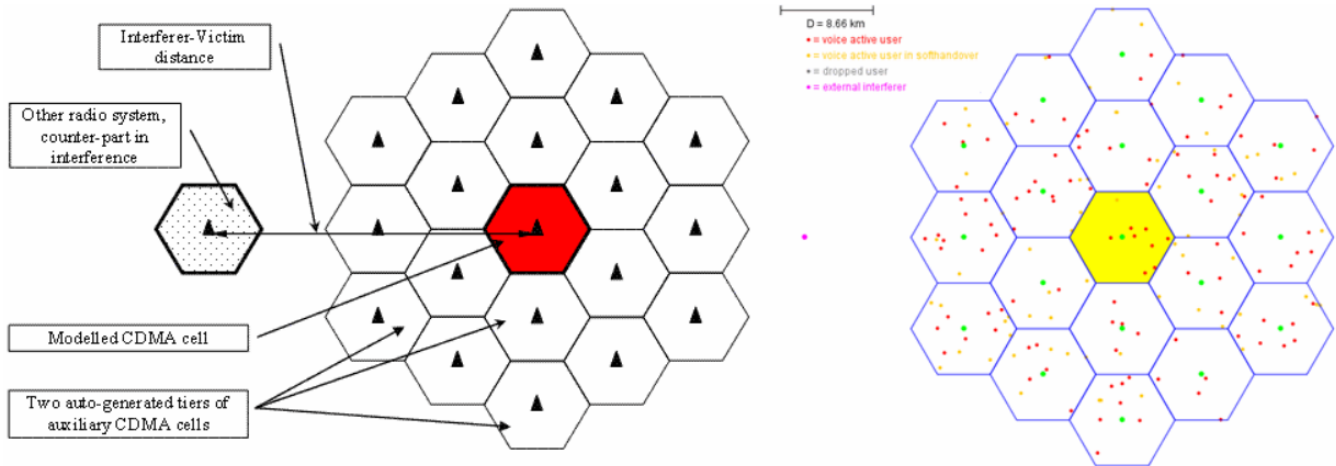


**Figure 172: Macro-Cellular CDMA Network Deployment with Omni Antenna**



**Figure 173: Macro-Cellular CDMA Network Deployment with Tri-Sector Antenna**

Therefore SEAMCAT supplements a single considered CDMA / OFDMA cell with its Base Station (BS) two tiers of virtual cells to form a 19 cell (57 cell for tri-sector deployment) cluster, which is then populated with a certain number of mobile stations (MS) and a power control algorithm is then applied for balancing overall system, see Figure below:

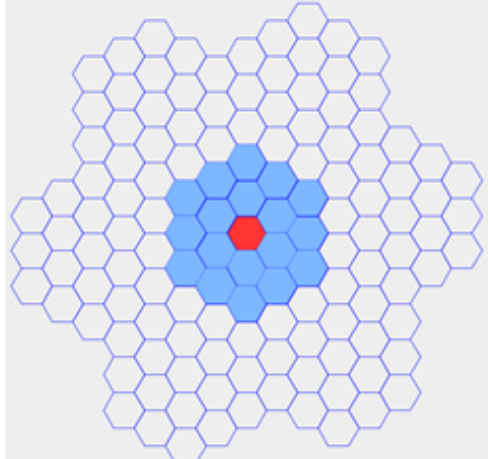
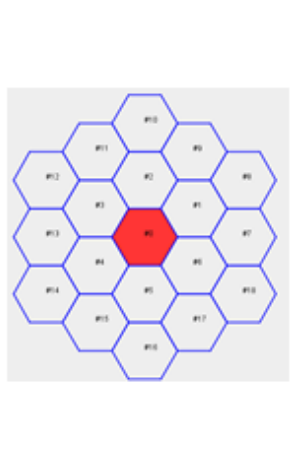


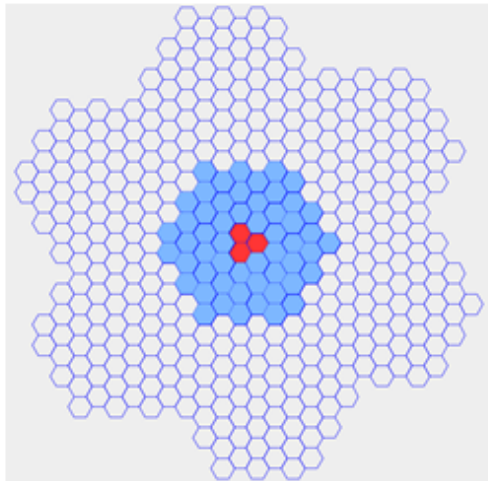
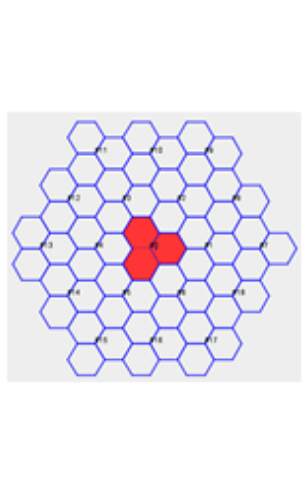
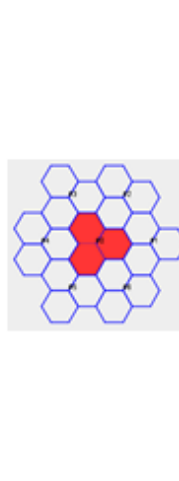

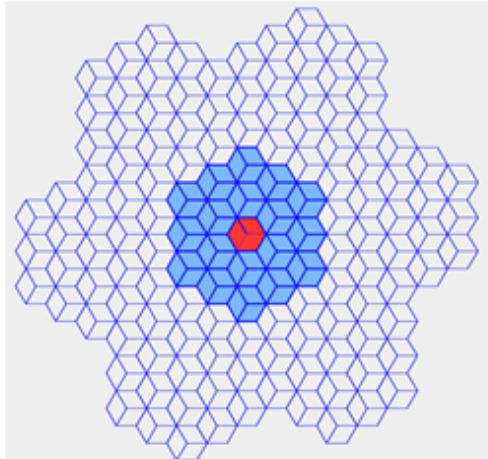
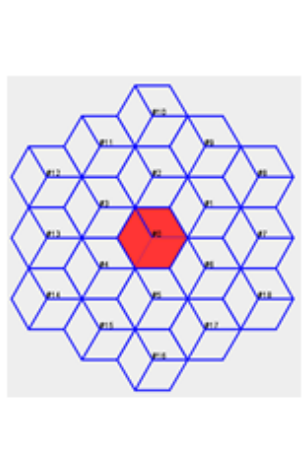
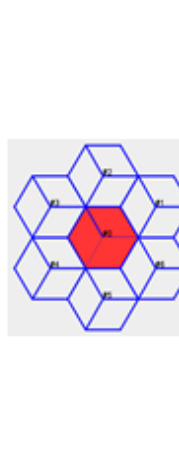



**Figure 174: 19 cells omni setup**

CDMA and OFDMA module shares common platform like the positioning of the cellular layout. The cellular topology in SEAMCAT is composed of the “Cell layout” and the “Cell radius” as shown in Figure 176.

In the “Cell Layout” you can select 2 tiers, 1 tier or single cell layout. In addition, you can select between Omni directional (single sector), tri-Sector (3GPP) and tri-Sector (3GPP2).

The “Cell Radius” (km) is the size of the cell and defines also the BS to BS distance (i.e. inter-site distance).

Sector configuration	2-tiers (with wrap-around)	2-tiers (without wrap-around)	1-tier	Single cell
Omni				
Tri-sector 3GPP				
Tri-sector 3GPP2				

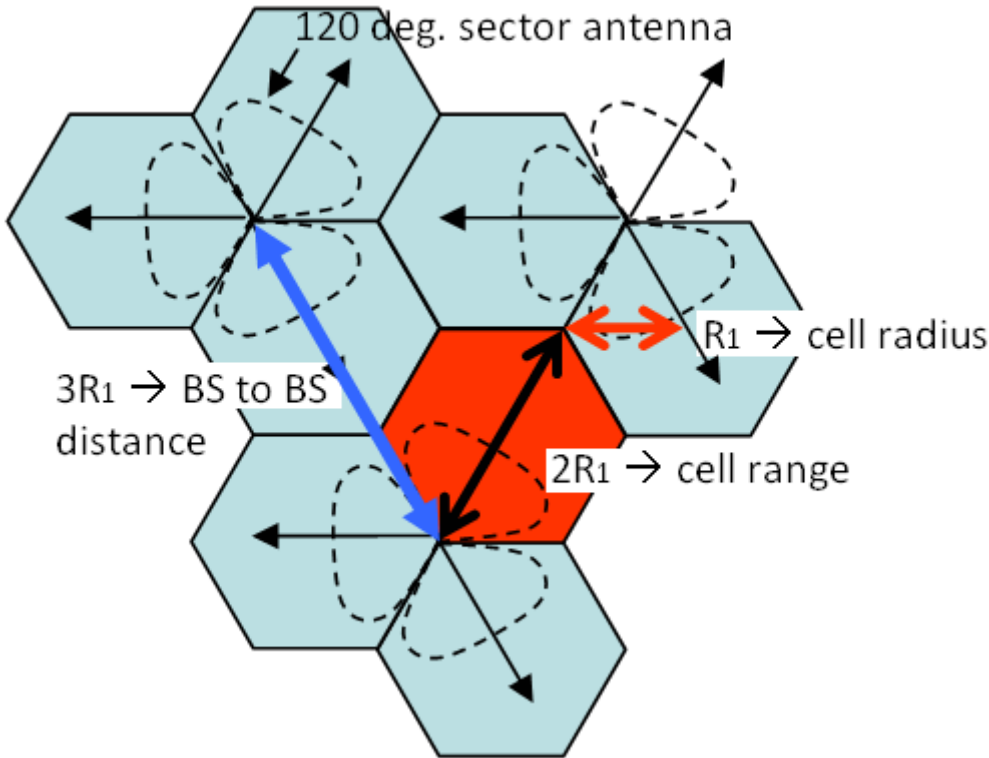
**Figure 176: Overview of the topology options in cellular network**

Two types of hexagonal grids are used to represent cellular layout, there is the 3GPP (<http://www.3gpp.org/>) and the 3GPP2 (<http://www.3gpp2.org/>). The differences are illustrated in Figure 177 (3GPP) and in Figure 178 (3GPP2). The fundamental principal of the two approaches is

that they share the same commonality for the BS to BS. Based on this same value, it is possible to extract the relationship of the cell range and cell radius between the two approaches.

Within the CEPT work, it is more common to use the 3GPP hexagonal grid, ECC Report 82 [6] and ECC Report 96 [7].

Figure 177 presents an example of the 3GPP approach:



**Figure 177: 3GPP illustration of the Cell Radius, Cell Range and BS to BS distance**

where:	$\text{Cell Radius} = R_1$ $\text{Cell Range} = 2R_1$ $\text{BS to BS distance} = 3R_1$	(Eq.31)
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What is important is that the BS to BS station distance be the same between the 3GPP and the 3GPP2 approach, i.e. where  $3R_1 = 2h$  which is equivalent to  $R = \sqrt{3} R_1$ .

From there it is possible to extract the cell radius in SEAMCAT.

**Table 21: Example of the distances relationship between 3GPP and SEAMCAT**

	Urban Case	Rural Case
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SEAMCAT cell radius (R)=	433 m	4330 m
SEAMCAT cell range (h)=	375 m	3750 m
Distance BS to BS ( $2h = 3 R_1$ ) =	750 m	7500 m
3GPP cell range ( $2R_1$ ) =	500 m	5000 m
3GPP cell radius ( $R_1$ ) =	250 m	2500 m

In summary, according to Figure 179 below, the Table 22 shows the current different definitions for sector, cell and radii:

**Table 22: Different definitions for sector, cell and radii**

<b>Parameter</b>	<b>3GPP TR 36.942</b>	<b>ECC Report 252 and others</b>	<b>Recommendation ITU-R M.2101 Report ITU-R M.2292</b>
<b>Sector</b>	1 hexagon	1 hexagon	1 hexagon
<b>Cell</b>	3 hexagon	3 hexagon	1 hexagon
<b>Cell radius</b>	X	X	$Y = 2*X$
<b>Cell range</b>	$Y = 2*X$	$Y = 2*X$	Not defined
<b>BS to BS distance</b>	$Z = 3*X$	$Z = 3*X$	$Z = 3*X$

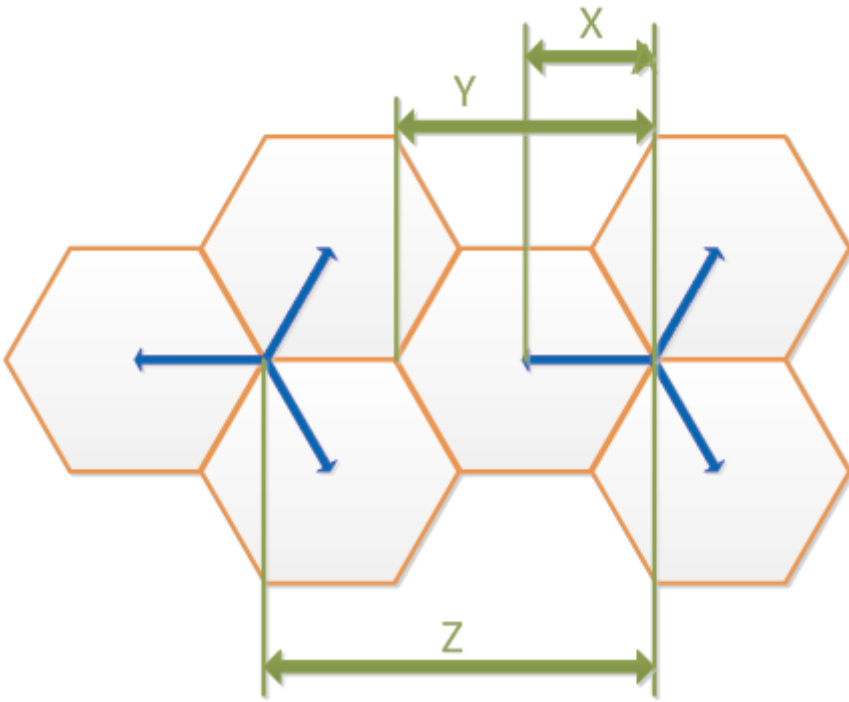


Figure 179: Different definitions for sector, cell and radii

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