Static Users Submenu

Until now the user has already set the Manhattan Environment, the Topology Parameters, the User Parameters and the group coordinates. At this case, all UEs are assumed to be static and are placed at the same spot. The "Static Users submenu" (Figure 1) gives the user the possibility to watch some graphics (results) with the selected topology and parameters.

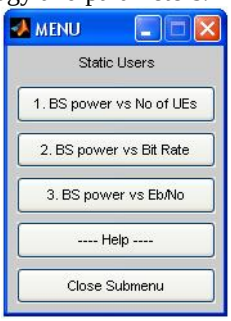

Figure 1: Static Users Submenu

BS power vs No of UEs

By clicking the first button of the "Static Users submenu" (Figure 1), the user can examine how the BS total power changes with the number of UEs. Three new figures appear. The first, called "Manhattan Grid Environment", presents the topology and the point where the group has been placed.

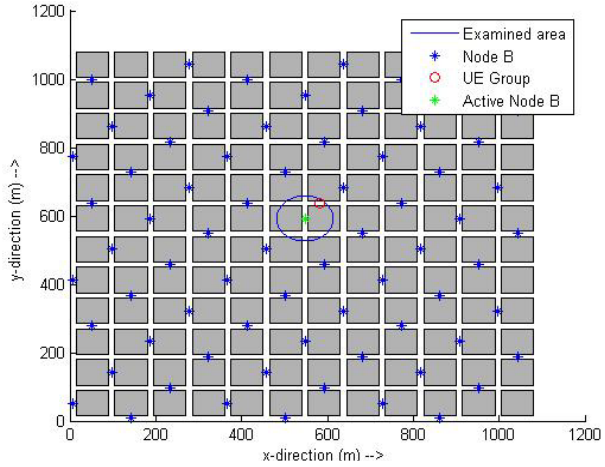

Figure 2: Manhattan Grid Environment (Node Bs, UE Group and Active Node B)

The above figure appears every time a button from the "Static Users Submenu" is clicked, so we won't go over it again.

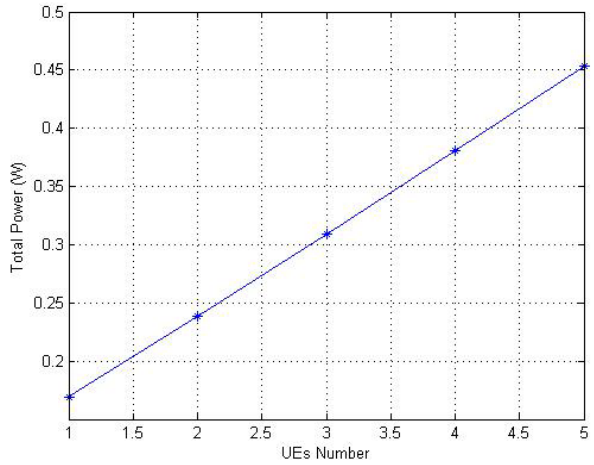

Figure 3: BS total transmission power vs No of UEs

The second figure (Figure 3), called "BS total transmission power vs No of UEs", examines how the total transmission power of the active Node B changes with the number of UEs. The user has already specified the total number of UEs. This figure shows how the total transmission power of the active

Node B changes, while the number of UEs at the group increases by 1 (from one UE to total UE number). The x-axis of the figure shows the number of UEs (max=total UE number), while the y-axis shows the corresponding total transmission power of the active Node B in Watts.
The third figure, called "Parameters And Results Display", is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections. Substantially, it is a centralized representation of the above two figures.

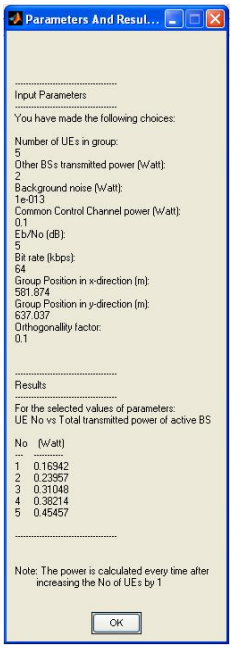

Figure 4: Parameters And Results Display

The above figure appears every time a button from the "Static Users Submenu" is clicked, having however different results, so we won't go over it again.

BS power vs Bit Rate

By clicking the second button of the "Static Users submenu" (Figure 1), the user can examine how the BS total power changes with different Bit Rates. Three new figures appear. The first, called "Manhattan Grid Environment", presents the topology and the point where the group has been placed (same as Figure 2).

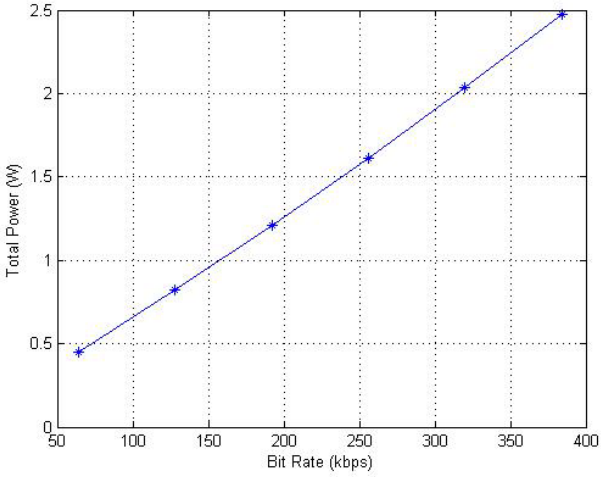

Figure 5: BS total transmission power vs Bit Rate for n UEs

The second figure (Figure 5), called "BS total transmission power vs Bit Rate for n UEs", examines how the total transmission power of the active Node B changes with different Bit Rates. The program assumes that all the UEs have the same Bit Rate demand. This figure shows how the total transmission power of the active Node B changes, while the Bit Rate takes the value 64, 128, 192, 256, 320, 384 Kbps. The x-axis of the figure shows the Bit Rate in Kbps, while the y-axis shows the corresponding total transmission power of the active Node B in Watts.

The third figure, called “Parameters And Results Display”, is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections (same as Figure 4).

BS power vs Eb/No

By clicking the third button of the Static Users submenu (Figure 1), the user can examine how the BS total power changes with different Eb/No. Three new figures appear. The first, called “Manhattan Grid Environment”, presents the topology and the point where the group has been placed (same as Figure 2). The second figure (Figure 6), called “BS total transmission power vs Eb/No for n UEs”, examines how the total transmission power of the active Node B changes with different Eb/No. The program assumes that all the UEs experience the same Eb/No. This figure shows how the total transmission power of the active Node B changes, while Eb/No takes the value 3, 4, 5, 5.5, 6, 6.5, 7, 8 dB. The x-axis of the figure shows the Eb/No in dB, while the y-axis shows the corresponding total transmission power of the active Node B in Watts.
The third figure, called “Parameters And Results Display”, is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections (same as Figure 4).

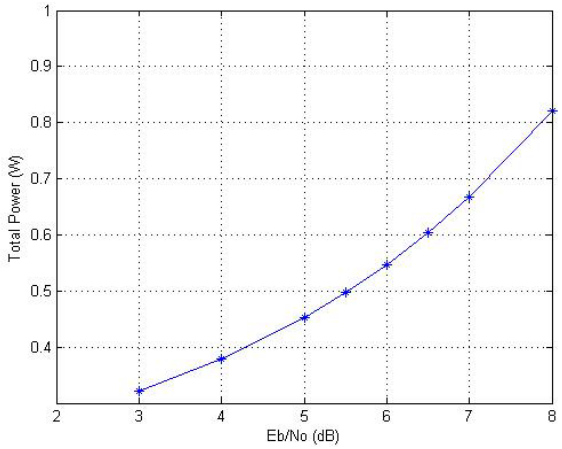

Figure 6: BS total transmission power vs Eb/No for n UEs

Help (Adobe Acrobat required)

Clicking this button opens this manual.

Close Submenu

Clicking this button closes the “Static Users submenu” and returns to “UE Topology submenu”.

Figures and Results Explanation*

The program calculates the Node B’s total transmission power, when a number of n MBMS users who are residing in the above mentioned Node B use DCH. In that case the Node B’s total transmission power is calculated as follows:

$$P_T = \frac{P_P + \sum_{i=1}^{n} \frac{(P_N + x_i)}{\frac{W}{(E_b/N_o)_i R_{b,i}} + p} L_{p,i}}{1 - \sum_{i=1}^{n} \frac{p}{\frac{W}{(E_b/N_o)_i R_{b,i}} + p}} \qquad \textbf{Eq. 1}$$

* Footnote: The following results have been calculated assuming: *n*=5, *Pp*=0.1W, *p*=0.1, *Pn*=1e-13W, *Eb/No*=5dB, *Rb*=64Kbps, *W*=3.84Mcps, *Group x-coordinate*=581.87m, *Group x-coordinate*=637.04m.

where P_T is the total transmission power for all the DCH users in the cell, P_P is the power devoted to common control channels, $L_{p,i}$ refers to the path loss for user *i*, $R_{b,i}$ the bit rate for user *i*, *W* the bandwidth, P_N the background noise, *p* the orthogonality factor and $(E_b/N_o)_i$ is the signal energy per bit divided by noise spectral density. Parameter x_i is the intercell interference observed by user *i* given as a function of the transmitted power by the neighbouring cells P_{Tj}, *j*=1,…K and the path loss from this user to the *j*th cell L_{ij}. More specifically:

$$x_i = \sum_{j=1}^{K} \frac{P_{Tj}}{L_{ij}} \qquad \textbf{Eq. 2}$$

From the above equations it is observed that Node B's transmission power, for the PTP case, increases when the distance between the Node B and the UEs increases. The same occurs when the bit rate of the MBMS service increases. Objective of present program is to simulate a Microcell environment (Manhattan grid environment) taking into consideration moving and non moving users. Using Eq. 1 the program calculates the transmitted power from the Node Bs that serve a number of MBMS users. By changing one of the user Parameters in Eq. 1 we examine how the total transmission power of the examined Node B changes. In the Static Users case (all UEs static and at the same point) user can examine three different cases:

- Total transmission power of the examined Node B vs number of UEs (all other parameters constant)
- Total transmission power of the examined Node B vs Bit Rate (for n users and all other parameters constant)
- Total transmission power of the examined Node B vs Eb/No (for n users and all other parameters constant)

BS power vs No of UEs

The first figure (Figure 2), called "Manhattan Grid Environment", presents the topology and the point where the group of UEs has been placed. Substantially, it is a graphic representation of the topology the user has created, consequently, it is not essential to be further analyzed.
The second figure (Figure 3), called "BS total transmission power vs No of UEs", examines how the total transmission power of the active Node B changes with the number of UEs. The user has already specified the total number of UEs. This figure shows how the total transmission power of the active Node B changes, while the number of UEs at the group increases by 1 (from 1 UE to total UE number). Substantially, it is graphic representation of the total transmission power calculated by Eq. 1, where the number of users *n* takes the value from 1 to the number of UEs specified by the user. As expected, the total transmission power of the Examined Node B increases when the number of UEs increases. Referring to (Figure 3), the Examined Node B total transmission power was calculated:

- For 1 user, BS total transmission power = 0.1694 Watt,
- For 2 users, BS total transmission power = 0.2396 Watt,
- For 3 users, BS total transmission power = 0.3105 Watt,
- For 4 users, BS total transmission power = 0.3821 Watt,
- For 5 users, BS total transmission power = 0.4546 Watt.

It is worth mentioning that the above values may change if one of the parameters in Eq. 1 changes (see the Footnote at page 3). However, in order to change one of the parameters the user has to return to a previous submenu ("Manhattan Environment Simulation menu" or "UEs Topology submenu").
The third figure (Figure 4), called "Parameters And Results Display", is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections.

BS power vs Bit Rate

The first figure (Figure 2), called "Manhattan Grid Environment", is a graphic representation of the topology the user has created.
The second figure (Figure 5), called "BS total transmission power vs Bit Rate for n UEs", examines how the total transmission power of the active Node B changes with the Bit Rate. This figure shows how the total transmission power of the active Node B changes, while the Bit Rate takes the value 64, 128, 192, 256, 320, 384 Kbps. Substantially, it is graphic representation of the total transmission power

calculated by Eq. 1, where the Bit Rate takes these values. As expected, the total transmission power of the Examined Node B increases when the Bit rate demand increases. Referring to (Figure 5), the Examined Node B total transmission power was calculated:

- For 64 Kbps bit rate, BS total transmission power = 0.4546 Watt,
- For 128 Kbps bit rate, BS total transmission power = 0.8248 Watt,
- For 192 Kbps bit rate, BS total transmission power = 1.2116 Watt,
- For 256 Kbps bit rate, BS total transmission power = 1.6163 Watt,
- For 320 Kbps bit rate, BS total transmission power = 2.0400 Watt,
- For 384 Kbps bit rate, BS total transmission power = 2.4842 Watt.

It is worth mentioning that the above values may change if one of the parameters in Eq. 1 changes (see the Footnote at page 3). However, in order to change one of the parameters the user has to return to a previous submenu ("Manhattan Environment Simulation menu" or "UEs Topology submenu").
The third figure (same as Figure 4), called "Parameters And Results Display", is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections.

BS power vs Eb/No

The first figure (Figure 2), called "Manhattan Grid Environment", is a graphic representation of the topology the user has created.
The second figure (Figure 6), called "BS total transmission power vs Eb/No for n UEs", examines how the total transmission power of the active Node B changes with the Eb/No. This figure shows how the total transmission power of the active Node B changes, while Eb/No takes the value 3, 4, 5, 5.5, 6, 6.5, 7, 8 dB. Substantially, it is graphic representation of the total transmission power calculated by Eq. 1, where the Eb/No takes these values. As expected, the total transmission power of the Examined Node B increases when the Eb/No increases. Referring to (Figure 6), the Examined Node B total transmission power was calculated:

- For 3 dB Eb/No, BS total transmission power = 0.3220 Watt,
- For 4 dB Eb/No, BS total transmission power = 0.3804 Watt,
- For 5 dB Eb/No, BS total transmission power = 0.4546 Watt,
- For 5.5 dB Eb/No BS total transmission power = 0.4989 Watt,
- For 6 dB Eb/No, BS total transmission power = 0.5489 Watt,
- For 6.5 dB Eb/No BS total transmission power = 0.6053 Watt,
- For 7 dB Eb/No BS total transmission power = 0.6691 Watt,
- For 8 dB Eb/No BS total transmission power = 0.8230 Watt.

It is worth mentioning that the above values may change if one of the parameters in Eq. 1 changes (see the Footnote at page 3). However, in order to change one of the parameters the user has to return to a previous submenu ("Manhattan Environment Simulation menu" or "UEs Topology submenu").
The third figure (same as Figure 4), called "Parameters And Results Display", is a message box that shows the values of all parameters that the user has selected and the results derived from the above selections.