EVEN TIGHTER TCH REUSE & HOT SPOT MICRO CELLS

Apply an even tighter TCH reuse in the macro cell network to make micro cell carriers available. In this step random frequency hopping, quality based power control and DTX (both uplink and downlink) are prerequisites. The Multiple Reuse Pattern (MRP) is used. In MRP the frequency band used for the TCH carriers are divided into groups, see Figure 12-9. The first group may keep the 8-9 frequency reuse and the last groups a 3-6 frequency reuse. Table 12-3 gives an example with 31 carriers for the macro cells. These carriers are divided into four groups of unique carriers. Group A contains 12 carriers for BCCH only, group B contains 8 carriers for TCH only, group C contains 7 carriers for TCH only, group D contains 4 carriers for TCH only. The equivalent reuse is (12 + 8 + 7 + 4)/4 = 7.75. The TCH reuse is (8 + 7 + 4)/4 = 6.3.

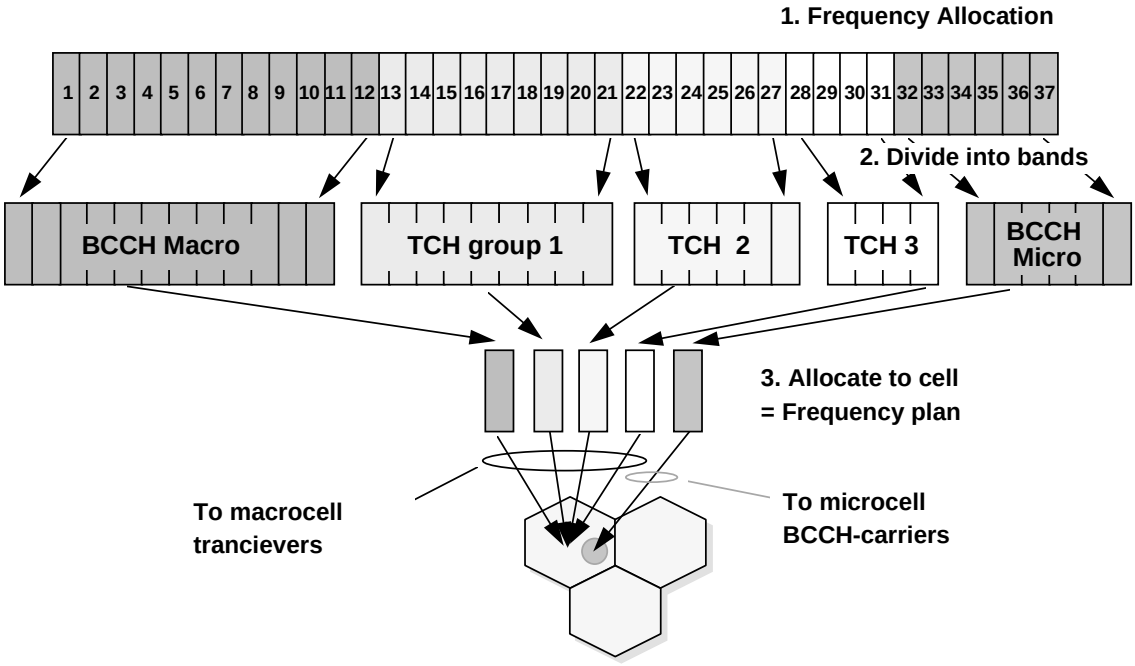

Figure 12-9. Building up a Multiple Reuse Pattern - MRP

Table 12-3. Example of Multiple Reuse Pattern, MRP.

TRX/cell	MRP (A/B/C/D)	TCH reuse	Equivalent reuse
1	12	-	12
2	12/8	8	10
3	12/8/7	7.5	9
4	12/8/7/4	6.3	7.75

The BCCH reuse is conservative. Keep the old frequency plan for BCCH if it is optimized.

The TCH frequency planning is aggressive. The TCH is more robust and power control and DTX is used. A TCH reuse down to 6 or even lower is possible with 3 or more carriers per cell.

It should be possible to double the capacity using this method compared with the original macro cell network using a 12 frequency reuse. The reuse is tighter and tighter for every TRX that is added. The last TRX is not only giving more interference, but also gives us a new carrier to hop on. There will be an interference diversity gain associated with the extra TRX. This will compensate the increased interference.

A contiguous micro cell network is not needed at once. A hot spot micro cell network is more feasible in the early phases. Carriers can be borrowed from the macro cell network and reused in the micro cell network, but a separate band of 2 - 3 carriers is the recommended solution.

EVEN TIGHTER TCH REUSE & CONTIGUOUS MICRO CELLS

An allocation of 5 to 8 carriers is normally sufficient as a micro cell BCCH allocation for a contiguous network. This micro cell network can use 2 TRXs/cell since the TCH carrier can use synthesized frequency hopping with a large number of frequencies in the hopping sequence, avoiding only the strongest BCCH neighbors.

FREQUENCY PLANNING

Frequency planning is a function of bandwidth, current site-to-site distance, frequency reuse and wanted capacity.

There are two different methods for frequency planning for micro- and indoor cells. You can either use separate parts of the frequency band or you can borrow frequencies.

SEPARATE FREQUENCY BAND

This method will give trunking losses, but can be used for big networks with many micro cells. If the operator has a very high number of frequencies (10 MHz) available for his system this is a good method. In this solution it is recommended to use hierarchical cell structures with one layer for macro cells and another layer for micro cells. Fast moving traffic can be handled by the macro cell layer. Since the two cell layers use different frequency bands, interference between macro and micro cells is not a problem.

FREQUENCY BORROWING

If the operator has a small frequency band (less than 6 MHz) frequency borrowing is recommended. This method can be used if there are not too many micro cells. The result depends on the locations and sizes of the micro cells. The macro cells will provide the coverage and the micro or indoor cells will provide the hot spot capacity. Great care must be taken when allocating the frequencies to the micro cells. Co-channel interference must be predicted and verified. When it becomes impossible to borrow frequencies there is a need for a change to using the first method, a separate frequency band.

FREQUENCY HOPPING

Since the number of TRXs in a micro cell will generally be low, baseband hopping will not be efficient. Synthesizer hopping must be used to gain from the frequency diversity.