Presently, cellular network users are not only those which generate mostly downlink (DL) traffic (web browsing, downloading) but also combination of users generating symmetric (both uplink (UL) and downlink) traffic (social networking, gaming) and users generating uplink traffic (IoT devices).

In such a heterogeneous environment, it is highly possible that a user equipment (UE) or a device will receive signals from different base stations (including Macro cell and small cells) and will have an option to connect with one of them.

For a device, a base station which is good in terms of downlink connection, may not be good for uplink connection. This phenomena is termed as UL/DL imbalance.

The concept that a device gets connected to two different cells in downlink and uplink respectively, is called as downlink/uplink decoupling (DUDe).

Table 1: Simulation Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro cell and small cell DL transmit power</td>
<td>40, 20 dBm</td>
</tr>
<tr>
<td>Maximum UE transmit power</td>
<td>23 dB</td>
</tr>
<tr>
<td>Number of resource blocks</td>
<td>10</td>
</tr>
<tr>
<td>Macro cell and small cell power control parameters</td>
<td>0.7, 0.7</td>
</tr>
<tr>
<td>Macro cell coverage radius</td>
<td>1 KM</td>
</tr>
<tr>
<td>Small cell coverage radius</td>
<td>0.035 KM</td>
</tr>
<tr>
<td>Number of small cells</td>
<td>8</td>
</tr>
<tr>
<td>Scheduling Algorithm</td>
<td>Round Robin</td>
</tr>
</tbody>
</table>

From Equation (1) and (2), it can be written that:

\[
\frac{\text{SINR}_M}{\text{SINR}_S} = \frac{\left(\frac{d_M}{d_S}\right)^{10(1-\alpha)}}{L} \times \text{SINR}_M
\]

We can say that, in order to achieve same uplink SINR, required transmit power is more in coupled connection in comparison to decoupled connection.

Conclusion

In this work, new handover schemes are proposed and analyzed for DUDe systems which were not existing in legacy coupled systems.

Results are confirming that DUDe is a better option to increase the efficiency of LTE HetNets.

Acknowledgement

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