Figures for Chapter 10

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<table>
<thead>
<tr>
<th>$X_1, X_2$</th>
<th>Hartley</th>
<th>Colpitts</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_3$</td>
<td></td>
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</table>

![Hartley Circuit](image)

![Colpitts Circuit](image)

![Clapp Circuit](image)
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<table>
<thead>
<tr>
<th>Transmission line</th>
<th>Electrical length, deg.</th>
<th>Width, mil</th>
<th>Length, mil</th>
</tr>
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<tbody>
<tr>
<td>TL1</td>
<td>80</td>
<td>74</td>
<td>141</td>
</tr>
<tr>
<td>TL2</td>
<td>48.5</td>
<td>74</td>
<td>86</td>
</tr>
<tr>
<td>TL3</td>
<td>67</td>
<td>74</td>
<td>118</td>
</tr>
<tr>
<td>TL4</td>
<td>66</td>
<td>74</td>
<td>116</td>
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</table>
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(b) LO signal

(c) Down- and upconverted spectral products
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<table>
<thead>
<tr>
<th>Mixer type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active (vs. passive)</td>
<td>• Conversion gain&lt;br&gt;• Better linearity&lt;br&gt;• Lower LO power&lt;br&gt;• Simpler to implement</td>
<td>• Typically higher noise figure&lt;br&gt;• Less-predictable performance&lt;br&gt;• Limited to lower frequencies</td>
</tr>
<tr>
<td>Unbalanced (active)</td>
<td>• Lowest noise figure&lt;br&gt;• All ports single-ended</td>
<td>• Poor port-to-port isolation&lt;br&gt;• Poor linearity&lt;br&gt;• Difficult to implement</td>
</tr>
<tr>
<td>Single-balanced (active)</td>
<td>• LO-to-RF isolation&lt;br&gt;• RF-to-IF isolation&lt;br&gt;• Best linearity&lt;br&gt;• Good noise figure</td>
<td>• Differential IF output&lt;br&gt;• LO-to-IF feed-through</td>
</tr>
<tr>
<td>Double-balanced (active)</td>
<td>• LO-to-RF, LO-to-IF and RF-to-IF isolation&lt;br&gt;• Good spurious product rejection&lt;br&gt;• Good linearity&lt;br&gt;• Simple to implement</td>
<td>• High noise figure&lt;br&gt;• High power consumption</td>
</tr>
</tbody>
</table>
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