Carrier Aggregation

Introduction

Since 2010, the roll-out of commercial LTE networks has proceeded at a phenomenal rate.

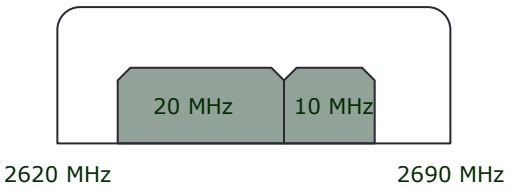
- This has been accompanied by the prevalence of Category 4 (150 Mbps) LTE terminals, capable of fully utilising 20 MHz LTE bandwidths.
- The lack of support by networks for uplink 64-QAM and downlink 4-layer spatial multiplexing has precluded the release of Category 5 (300 Mbps) LTE terminals.

The competition between network operators for spectrum allocated by regulators has left many with an assortment of band segments, some as little as 5 MHz.

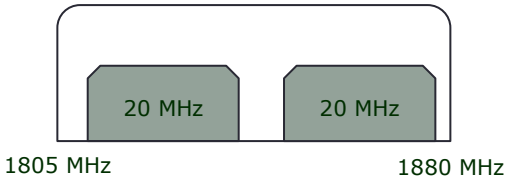
Carrier Aggregation is a Rel. 10 feature that is allowing operators to pool together spectrum from multiple bands and enables terminal manufacturers to provide consumers with devices that surpass the performance of Rel. 8 / Rel. 9 terminals.

The types of Carrier Aggregation are;

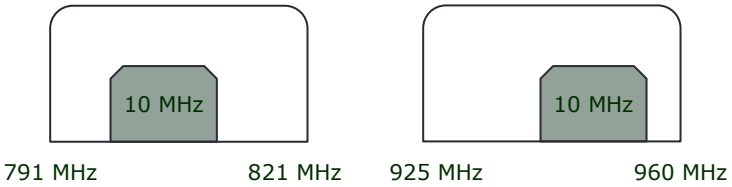
- Intra-band (contiguous)
  - Band VII



- Intra-band (non-contiguous)
  - Band III



- Inter-band
  - Bands XX + VIII



Proposed Testing

IoTAS consider relative throughput testing of the Device Under Test (DUT) against a commercial reference device to be the most effective way of assessing a DUT's carrier aggregation performance in a live network environment. At times IoTAS may benchmark multiple DUT and reference devices. Testing can be done for either UDP or FTP over TCP, using IoTAS servers with sufficient bandwidth to support the higher data rates involved with carrier aggregation.

Both the DUT and reference device shall support the carrier aggregation band combinations used by the tested networks as per 3GPP TS 36.104.

Testing shall be conducted so as to cover:

- Static and dynamic
- Close proximity to eNodeB's and at the periphery of CA coverage
- Sequential throughput testing and concurrent throughput testing (in which DUT and reference device(s) are in contention with one another for radio resources.

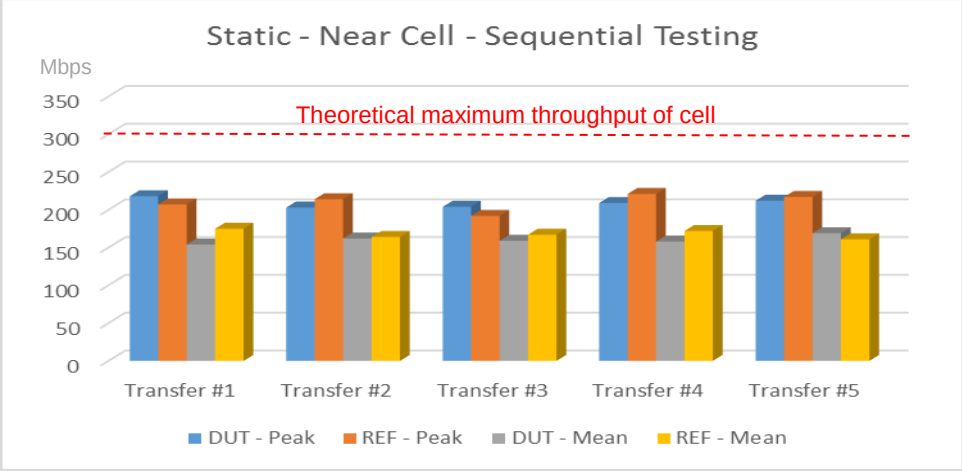
Test Metrics

The following data shall be obtained for each tested scenario:

- Known cell capacity
  - This is determined by the aggregated bandwidth of a cell and its MIMO capabilities
  - Drive routes shall be selected so that the aggregated bandwidth is consistent for all of the cells involved
- Throughput
  - Mean and Peak rates
  - UDP packet loss rate
- Proportion of time spent with multiple carrier components configured
  - Assignment of additional carrier components can depend on measurements by UE and potentially by extension on its RF performance.

Test Reporting

The peak and mean transfer rates for both the DUT and reference device(s) shall be presented for each scenario using column charts as illustrated below:



The report shall include individual throughput rates for both devices in tabular form and the details of all cells used throughout testing.