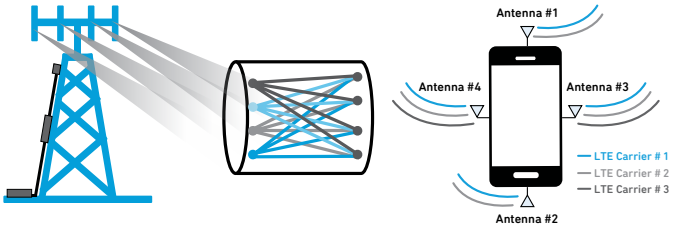
Carrier Aggregation

What's New in Mobile CA?

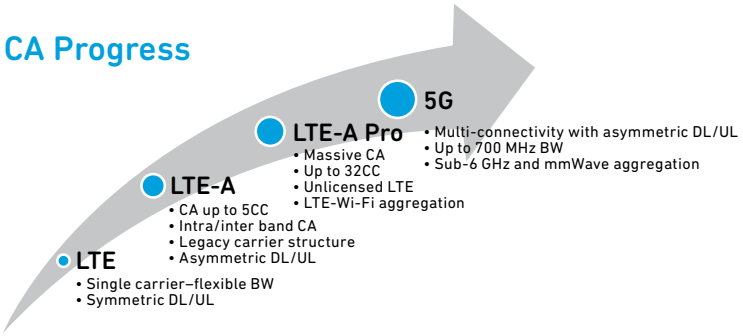
Increasing bandwidths using CA is one technique to achieve higher data rates. Another option is to upgrade the modulation to 256 QAM and increase the number of spatial streams using MIMO (multiple input multiple output). The most common approach to achieving 1 Gbps data rates, as we move to 5G, is a combination of both.

3 Downlink CA with 4x4 MIMO



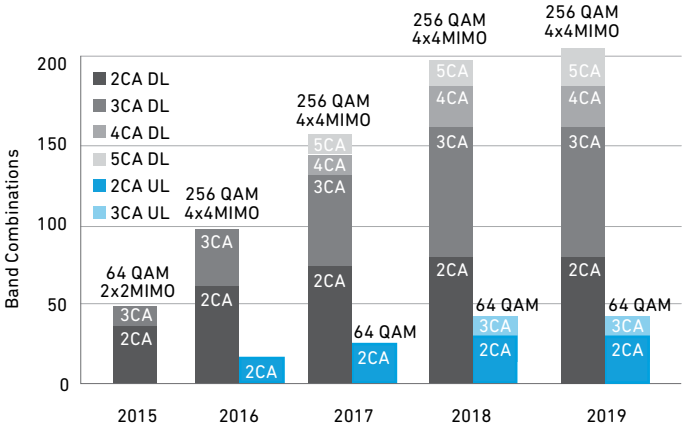
- Requires four unique data streams transmitted from a minimum of four unique antennas at the base station
- Needs four unique, corresponding receiver chains in the mobile device
- Data rates increase by a factor of two for each component carriers (CC) it is applied compared to 2x2 MIMO
- Using 256 QAM, 4x4 DL MIMO applied to just two out of the three CCs will achieve 1Gbps

CA Progress

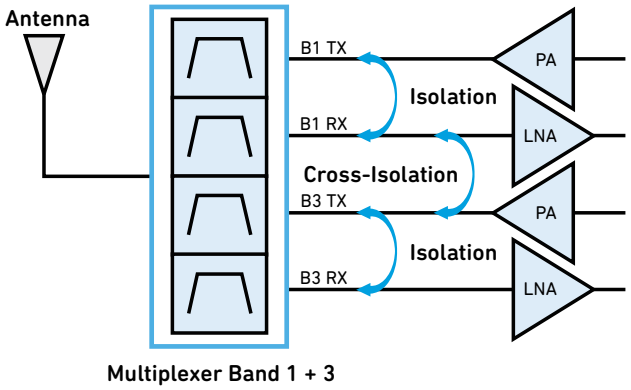


To further increase consumer data throughput, operators have implemented CA on DL and UL. 3GPP has started 5G studies and work items to develop the 5G new radio specification (5G NR) for both NSA and SA operation. Initial 5G operator releases will be NSA in the sub-6 GHz area. Up to 400 MHz of instantaneous bandwidth can be achieved at sub-6 GHz, using four 100 MHz channels.

Evolution of LTE Carrier Aggregation (Year Over Year)



CA Requires Multiplexers with High Isolation Between Tx and Rx Ports - Example Band 1 + 3



Multiplexer Band 1 + 3

Enabling CA requires simultaneous communication on multiple CCs. In some cases the RF front end must support multiple transmit and/or receive paths between the antenna(s) and transceiver. Isolation of these paths requires multiplexed RF filters or physically separated antennas. Achieving cross-isolation calls for matched filters that attenuate the out-of-band signals to avoid loading the other aggregated bands. In addition, each filter must have low insertion loss to minimize transmit power consumption and optimize phone receiver sensitivity.

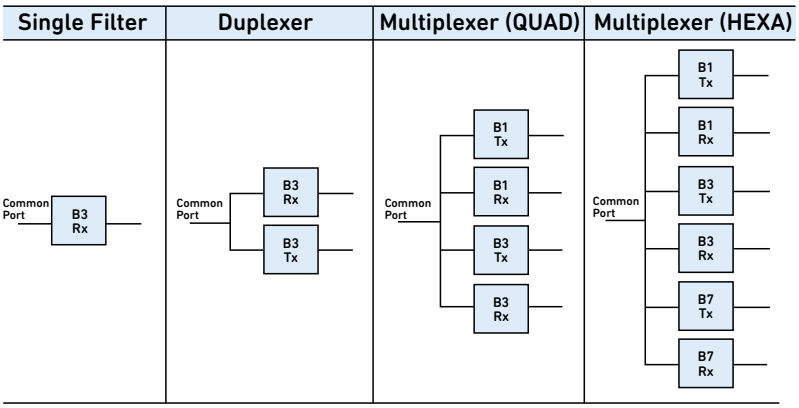
qorvo®

all around you

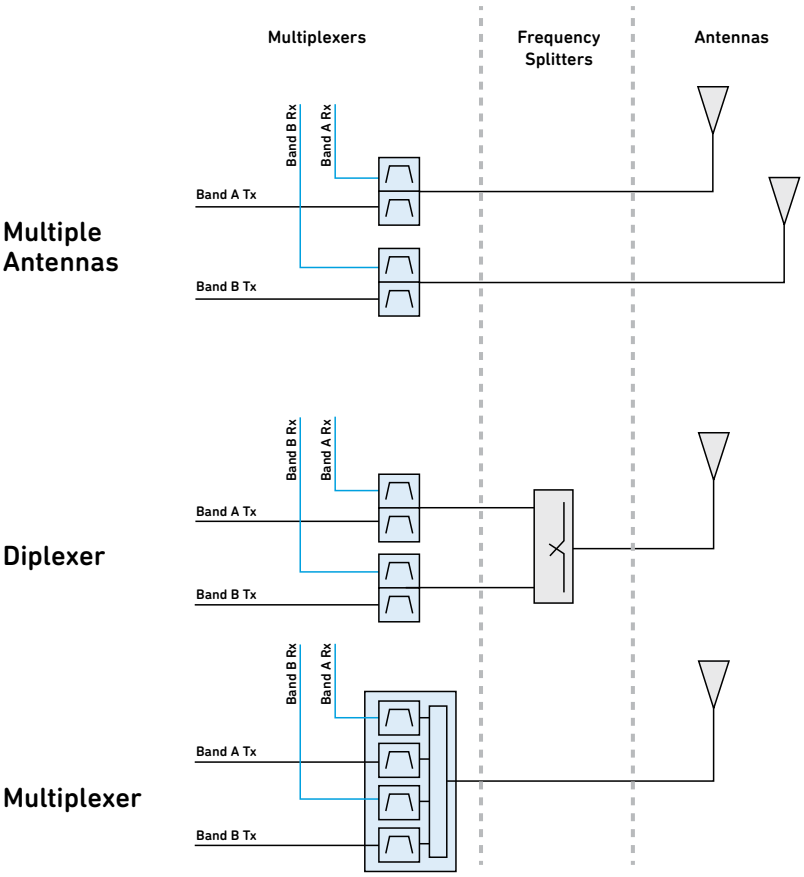
Downlink CA

3DL and 4DL CA solutions can be implemented in multiple ways depending on the band combinations and associated challenges. Multiple antennas may solve some challenges, but more complex filters are often required. Cascaded diplexers, triplexers, quadplexers and even higher-order multiplexers, such as hexaplexers and septaplexers, are being employed to solve system-level problems.

Single Filters, Duplexers and Multiplexers



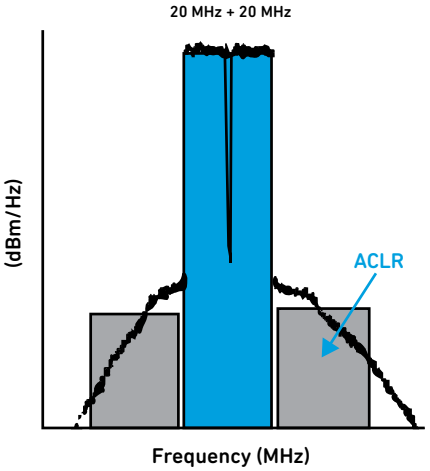
3 Front End Architectural Approaches Supporting CA



Uplink CA

ULCA improves the user experience by enabling new trends in social video and gaming. ULCA combines two or more LTE CCs transmitted from a single user device, increasing the speed a user can upload content.

Channel Bandwidth and ACLR



Intra-band ULCA uses wider bandwidth signals than other LTE cases. These signals require power amplifiers designed with wider bandwidth and higher linearity (ACLR, SEM and EVM). Similarly, envelope tracking converters require wider bandwidth capabilities.

Some intra-band ULCA combinations require high linearity switches to ensure low IMD products. An example is B1/B3 ULCA where the IMD3 products can desense B1 RX and GPS signals.

www.qorvo.com/ca
info-mobile@qorvo.com