

# MIMO: An Overview

Wireless systems using MIMO represent an economical way to increase user capacity, range and throughput in a variety of environments

**M**ultiple-Input Multiple-Output (MIMO) is an antenna technology – sometimes called smart antenna technology – that is used both in transmission and receiver

equipment for wireless radio communication. MIMO uses multiple antennas to send multiple parallel signals (from transmitter).

MIMO has been variously defined as two or more unique radio signals, in the same radio channel, where each signal carries different digital information and/or two or more radio signals which use beam-forming, receive combining, and spatial multiplexing.

MIMO was first standardized in 3GPP Release 6 (Rel-6), and was further developed in Rel-7 with spatial multiplexing for HSPA+ using Double Transmit Adaptive Array (D-TxAA). With MIMO, the use of multiple antennas at both transmitter and receiver allows:

- Substantial increase in peak data rates
- Significantly higher spectrum efficiency, especially in low-interference environments
- Increased system capacity (number of users)

Based on simulation results presented in the report, MIMO Transmission Schemes for LTE and HSPA Networks, it was shown that the relatively simple MIMO transmission scheme based on 2X2 closed-loop SM, at low user equipment (UE) speeds, can increase by 20 percent the downlink (DL) sector spectral efficiency relative to a single antenna transmission, as well as increase the cell edge efficiency by approximately 35 percent. More advanced antenna configurations can provide

benefits that are significant for users that are receiving a strong signal as well as cell edge users.

The 3GPP Rel-9 LTE specifications, completed in March 2010, included some of the most advanced forms of MIMO of any standard in the industry. 3GPP has since included even more advanced MIMO enhancements for LTE-Advanced.

## UMTS and LTE

Operators believe that, notwithstanding the basic differences in the physical layers used by UMTS and LTE, the benefits envisioned from MIMO in LTE can also be obtained from MIMO in UMTS systems, starting in Release 7 (HSPA+). By deploying MIMO with HSPA+, an operator's throughput speeds may double.

MIMO can be used to advance such applications as:

- Streaming video, music
- Video surveillance
- Voice over Internet Protocol (VoIP)
- Video conferencing
- Interactive gaming
- Mobile TV

Wireless network operators see a need for MIMO due to its many advantages. Wireless systems using MIMO represent an economical way to increase user capacity, range and throughput in a variety of environments, most notably those which are enclosed and having low radio interference such as small and/or isolated cells.

## Source:

4G Americas, 2011  
4gamericas.org