

Efficient pilot transmission schemes for multi-antenna communication systems are described. In general, MISO receivers prefer a pilot transmitted in one spatial direction, and MIMO receivers typically require a pilot transmitted in different spatial directions. In one pilot transmission scheme, a first set of  $T$  scaled pilot symbols is generated with a first training vector and transmitted (e.g., continuously) from  $T$  transmit antennas, where  $T > 1$ . If MIMO receiver(s) are to be supported by the system, then at least  $T-1$  additional sets of  $T$  scaled pilot symbols are generated with at least  $T-1$  additional training vectors and transmitted from the  $T$  transmit antennas. The training vectors are for different (e.g., orthogonal) spatial directions. Each MISO receiver can estimate its MISO channel based on the first set of scaled pilot symbols. Each MIMO receiver can estimate its MIMO channel based on the first and additional sets of scaled pilot symbols.