LTE control patents

Control patents

- Control patents are mostly used
    - to prepare concepts
    - to search classes, and
    - to verify the search strategy
- Control patents are found by running a query with narrow keywords, and in this process litigation's and file wrappers are also looked at.

S.No	Patent/Publication No.	Title	Abstract
1	US7295624	Wireless system with hybrid automatic retransmission request in interference-limited communications	A wireless receiver for receiving signals from an interference-limited transmitter in an interference-limited system comprising at least one transmit antenna, wherein the signals comprise a plurality of symbols. The receiver comprises a plurality of receive antennas and collection circuitry for collecting a plurality of signal samples with at least one symbol and interference effects. The receiver also comprises suppression circuitry, accumulation circuitry, circuitry for providing estimates of a group of bits, error detection circuitry and circuitry for requesting the transmitter to transmit a retransmission of a packet in response to detecting an error.
2	US6873606	Rate adaptive transmission scheme for MIMO systems	A rate adaptive transmission scheme for MIMO systems, which can transmit a variable number of data symbol streams, provide transmit diversity for each data symbol stream, and fully utilize the total transmit power of the system and the full power of each antenna. In one method, at least one data symbol stream is received for transmission from a plurality of antennas. Each data symbol stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream. The scaled data symbol stream(s) are multiplied with a transmit basis matrix to provide a plurality of transmit symbol streams for the plurality of antennas. The transmit basis matrix (e.g., a Walsh-Hadamard matrix or a DFT matrix) is defined such that each data symbol stream is transmitted from all antennas and each transmit symbol stream is transmitted at (or near) the full power for the associated antenna.
3	US7233625	Preamble design for multiple input--multiple output (MIMO), orthogonal frequency division multiplexing (OFDM) system	One or more preambles are inserted into frames of Orthogonal Frequency Multiplexing (OFDM)-Multiple Input, Multiple Output (MIMO) signals. The preamble is received by the antennas of a receiver, decoded and compared to known values to provide synchronization, framing, channels estimation, offsets and other corrections to the transmitted signal.
4	US7248559	Scattered pilot pattern and channel estimation method for MIMO-OFDM systems	A method and apparatus are provided for reducing the number of pilot symbols within a MIMO-OFDM communication system, and for improving channel estimation within such a system. For each transmitting antenna in an OFDM transmitter, pilot symbols are encoded so as to be unique to the transmitting antenna. The encoded pilot symbols are then inserted into an OFDM frame to form a diamond lattice, the diamond lattices for the different transmitting antennae using the same frequencies but being offset from each other by a single symbol in the time domain. At the OFDM receiver, a channel response is estimated for a symbol central to each diamond of the diamond lattice using a two-dimensional interpolation. The estimated channel responses are smoothed in the frequency domain. The channel responses of remaining symbols are then estimated by interpolation in the frequency domain.
5	US7548506	System access and synchronization methods for MIMO OFDM communications systems and physical layer packet and preamble design	A method and apparatus are provided for performing acquisition, synchronization and cell selection within an MIMO-OFDM communication system. A coarse synchronization is performed to determine a searching window. A fine synchronization is then performed by measuring correlations between subsets of signal samples, whose first signal sample lies within the searching window, and known values. The correlations are performed in the frequency domain of the received signal. In a multiple-output OFDM system, each antenna of the OFDM transmitter has a unique known value. The known value is transmitted as pairs of consecutive pilot symbols, each pair of pilot symbols being transmitted at the same subset of sub-carrier frequencies within the OFDM frame.
6	US7120395	MIMO communications	The present invention allows a wireless communication system, such as a base station, to select N antennas from an associated group of M antennas for transmitting multiple streams of data to a given user. Based on the channel conditions between the M antennas of the wireless communication system and the multiple antennas at the receiver, the N antennas to use for transmission are selected to enhance channel capacity, signal-to-noise ratios, or a combination thereof. The channel conditions are measured at the receiver, and may be sent back to the wireless communication system for processing or may be processed at the receiver, wherein instructions are transmitted back to the wireless communication system to control antenna selection.
7	US7283499	Simplified practical rank and mechanism, and associated method, to adapt MIMO modulation in a multi-carrier system with feedback	A method of adapting transmission parameters in a multicarrier communication system having multiple transmit antennas and/or multiple receive antennas, whereby a statistical parameter of a wideband channel is computed, one type of matrix modulation scheme is selected to be used for a given multicarrier modulation symbol, one type of signal constellation is selected to be used for a given multicarrier modulation symbol, and one concatenated channel coding rate is selected to be used for a given multicarrier modulation symbol. Multicarrier modulation symbols are then transmitted using the selected matrix modulation scheme, signal constellation, and concatenated channel coding rate.
8	US7194040	Beam-steering and beam-forming for wideband MIMO/MISO systems	Techniques to perform beam-steering and beam-forming to transmit data on a single eigenmode in a wideband multiple-input channel. In one method, a steering vector is obtained for each of a number of subbands. Depending on how the steering vectors are defined, beam-steering or beam-forming can be achieved for each subband. The total transmit power is allocated to the subbands based on a particular power allocation

			scheme (e.g., full channel inversion, selective channel inversion, water-filling, or uniform). A scaling value is then obtained for each subband based on its allocated transmit power. Data to be transmitted is coded and modulated to provide modulation symbols. The modulation symbols to be transmitted on each subband are scaled with the subband?s scaling value and further preconditioned with the subband?s steering vector. A stream of preconditioned symbols is then formed for each transmit antenna.
9	US7336727	Generalized m-rank beamformers for MIMO systems using successive quantization	The telecommunications system described herein implements a multi-rank beamformer for use in wireless systems equipped with multiple transmit and multiple receive antennas. The multi-rank beamformer uses finite-rate feedback of channel conditions to achieves close to theoretical performance indicated by the water-filling algorithm, while avoiding the computational complexity associated with space time codes. In addition, the multi-rank beamforming system described herein improves on the performance of unit rank beamforming methods by maintaining the gains over space time codes over a broader range of transmission rate
10	US7702029	MIMO precoding enabling spatial multiplexing, power allocation and adaptive modulation and coding	In a closed-loop wireless communication system, a codebook-based feedback mechanism is provided to enable non-unitary precoding for multi-stream transmission, where in each stream is optimized with suitable transmission power allocation and AMC. The codebook-based feedback mechanism uses a precoding codebook having a power allocation matrix which is constrained to specify that beamforming always applies full power to a predetermined beam. With this constraint, a one-bit power allocation feedback index may be used to switch between beamforming and spatial multiplexing.
11	US20080247479	Pilot Scheme For A Mimo Communication System	The present invention employs a pilot scheme for frequency division multiple access (FDM) communication systems, such as single carrier FDM communication systems. A given transmit time interval will include numerous traffic symbols and two or more short pilot symbols, which are spaced apart from one another by at least one traffic symbol and will have a Fourier transform length that is less than the Fourier transform length of any given traffic symbol. Multiple transmitters will generate pilot information and modulate the pilot information onto sub-carriers of the short pilot symbols in an orthogonal manner. Each transmitter may use different sub-carriers within the time and frequency domain, which is encompassed by the short pilot symbols within the transmit time interval. Alternatively, each transmitter may uniquely encode the pilot information using a unique code division multiplexed code and modulate the encoded pilot information onto common sub-carriers of the short pilot symbols.
12	US7630356	Methods for supporting MIMO transmission in OFDM applications	Aspects of the present invention provide MAC enhancements to support the PHY features of a MIMO-OFDMA framework. The MAC enhancements involve DL burst assignment to support adaptive MIMO transmission, UL burst assignment to support adaptive MIMO transmission, fast feedback channel operation to support wireless terminal dynamic feedback of MIMO mode selection, for example space time transmit diversity (STTD) or spatial multiplexing (SM), and/or permutation mode selection, for example diversity or adjacent subcarrier mode, dynamic CQICH allocation and de-allocation and the use of CQICH_ID for DL burst allocation. One or more of these enhancements is included in a given implementation. Methods are also provided for implementing the MAC enhancements.
13	US20080165875	Multi-user MIMO-SDMA for finite rate feedback systems	A multi-user MIMO downlink beamforming system with limited feedback is provided to enable preceding for multi-stream transmission, where a channel codeword (u.sub.i) and one or more channel quality indicator values (CQI.sub.A, CQI.sub.B) are computed at the user equipment on the basis of maximizing a predetermined SINR performance metric (.rho..sub.i) which estimates the receive signal-to-noise-ratio (SINR) at the user equipment . The computed codeword (u.sub.i) and CQI values (or differential values related thereto) are quantized and fed back to help the base station which applies a correction to the appropriate CQI value in the course of designing the transmit beamforming vectors w and determining the appropriate modulation and coding level to be used for downlink data transmission.
14	US20100142455	Systems and methods for uplink power control	A method for uplink power control is described. A user equipment (UE) power class may be determined. An uplink multiple access scheme may also be determined. The maximum transmission power for the UE may further be determined according to the determined uplink multiple access scheme and the UE power class.
15	US20040082356	MIMO WLAN system	A multiple-access MIMO WLAN system that employs MIMO, OFDM, and TDD. The system uses a channel structure with a number of configurable transport channels, supports multiple rates and transmission modes, which are configurable based on channel conditions and user terminal capabilities, employs a pilot structure with several types of pilot (e.g., beacon, MIMO, steered reference, and carrier pilots) for different functions, implements rate, timing, and power control loops for proper system operation, and employs random access for system access by the user terminals, fast acknowledgment, and quick resource assignments. Calibration may be performed to account for differences in the frequency responses of transmit/receive chains at the access point and user terminals. The spatial processing may then be simplified by taking advantage of the reciprocal nature of the downlink and uplink and the calibration.
16	US20090046800	Feedback and rate adaptation for MIMO transmission in a Time Division Duplexed (TDD) communication system	Techniques for sending a MIMO transmission in a wireless communication system are described. In one design, a transmitter sends a first reference signal to a receiver. The receiver selects a precoding matrix based on the first reference signal and in accordance with a selection criterion. The receiver estimates noise and interference at the receiver and determines channel quality indicator (CQI) or modulation and coding scheme (MCS) information based on the precoding matrix and the estimated noise and interference. The receiver sends the CQI or MCS information and a second reference signal to the transmitter. The transmitter selects the precoding matrix based on the second reference signal and in accordance with the same selection criterion used by the receiver. The transmitter then sends a MIMO transmission to the receiver based on the CQI or MCS information obtained from the receiver and the precoding matrix selected by the transmitter.

17	US20080188259	CQI reporting for MIMO transmissionin a wireless communication system	Techniques for determining and reporting channel quality indicator (CQI) information are described. A user equipment (UE) may determine a transmit power per channelization code, P.sub.OVSF, based on the available transmit power and a designated number of channelization codes, e.g., by uniformly distributing the available transmit power across all transport blocks and all of the designated number of channelization codes. The UE may estimate SINRs of multiple transport blocks based on P.sub.OVSF, determine CQI indices for the transport blocks based on the SINRs, and send the CQI indices to a Node B. The Node B may send multiple transport blocks to the UE based on the CQI indices. The Node B may send the transport blocks (i) with the designated number of channelization codes at P.sub.OVSF or (ii) with a second number of channelization codes at P.sub.OVSF, with the transport block sizes being scaled based on the designated and second numbers of channelization codes.
18	US20090086849	Method and apparatus of improved circular buffer rate matching for turbo-coded MIMO-OFDM wireless systems	Methods and apparatus for determining the starting points of redundancy version transmissions in a circular rate matching operation. At least one block of information bits to be transmitted are encoded to generate a plurality of coded bits, which are then segmented into a plurality of sub-blocks of coded bits. Each of the sub-blocks of coded bits is interleaved by using a certain interleaver. The interleaved coded bits of the plurality of sub-blocks are collected and filled into a circular buffer having a plurality of redundancy versions in the circular buffer, with each redundancy version corresponding to a starting bit index in the circular buffer. For each transmission, a subset of bits are selected from the circular buffer by selecting a redundancy version from among the plurality of redundancy version. The selected subset of bits are modulated by using a certain modulation scheme, and are transmitted via at least one antenna. The redundancy versions of the circular being determined such that in at least one pair of redundancy versions, the number of bits between the starting point of a first redundancy version and the starting point of a second redundancy version is not divisible by at least one modulation order.
19	US20060045169	Coded-bit scrambling for multi-stream communication in a mimo channel	In one embodiment, a multi-input/multi-output system includes a receiver , processor, coded bit scrambler, coded bit descrambler , and transmitter . The receiver generates demodulated symbol streams corresponding to a received signal. The processor generates coded bit sequences from source bit streams when operating in a transmit mode and bit log-likelihood ratio sequences from the information bit streams when operating in a receive mode. The coded bit scrambler scrambles the coded bit sequences to generate scrambled bit streams when in the transmit mode. The coded bit descrambler descrambles the log-likelihood ratio sequences by a real-valued descrambling sequence when operating in the receive mode, and also removes the effect of a scrambling sequence. The transmitter generates a transmit signal corresponding to the scrambled bit streams.
20	US20070105503	Systems and methods for reducing uplink resources to provide channel performance feedback for adjustment of downlink MIMO channel data rates	Systems and methods for improving the performance of a MIMO wireless communication system by reducing the amount of uplink resources that are needed to provide channel performance feedback for the adjustment of data rates on the downlink MIMO channels. In one embodiment, a method comprises encoding each of a set of data streams according to corresponding data rates, permuting the data streams on a set of MIMO channels according to a full permutation of combinations, transmitting the permuted data streams, receiving the permuted data streams, decoding and determining an SNR for each of the data streams, computing a condensed SNR metric for the set of data streams, providing the condensed metric as feedback, determining a set of individual SNR metrics for the data streams based on the condensed SNR metric, and adjusting the data rates at which the data streams are encoded based on the individual SNR metrics.

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