is transmitted at a selected one of a second plurality of data rates. For each of the data rates, another modulation scheme is used.

An equally proposed demodulator is suited for demodulating modulated signals originating from the proposed modulator. Such a demodulator comprises therefore demodulating means for demodulating received signals with a demodulation scheme corresponding to the selected modulation scheme, and processing means for processing the demodulated signals for regaining the original signals before modulation. The processing depends on the set of values of the at least one modulation parameter of the selected modulation scheme used for modulation. A method for demodulating signals comprises corresponding steps.

Further proposed is a device comprising the proposed modulator and/or the proposed demodulator and a wireless communications network comprising at least one such device.

The invention proceeds from the idea that a single modulation scheme can be employed for transmitting signals with different bit rates. This is achieved according to the invention by applying on the one hand a first set of the values of at least one parameter of a selected modulation scheme on signals that are to be modulated, and on the other hand a second set of these values. If both sets comprise different numbers of values of said at least one parameter, different entities of a packet can be modulated with different bit rates without requiring a guard time between the different entities for switching the modulation scheme and without requiring a re-synchronization. If the modulation scheme and the two sets of values of modulation parameters are selected suitably, the signals modulated with the set comprising less values can then be demodulated for example by demodulators not supporting a demodulation of signals modulated with a larger set of values. Since the invention moreover results only in a small increase of complexity in a modulator, demodulator, device or communications system, it can further be realized at low costs.

Preferred embodiments of the invention become apparent from the dependent claims.

The first set of values of the at least one modulation parameters preferably comprises all values of the at least one modulation parameter of the selected modulation scheme. This enables a maximum bit rate for the signals modulated with the first set of values. Alternatively, the first set of values can comprise only a subset of all values of the at least one modulation parameter, as long as it is ensured that the first set comprises more values than the second set of values.

The invention can be employed in particular, though not exclusively, for short-range radio links, like Bluetooth™.

In a preferred embodiment of the invention, a packet can consist of an entity with synchronization information and/or an entity with payload data. It is proposed that the payload data is modulated with the first set of the selected modulation scheme, in order to enable a higher data rate for transmission. At the same time it is proposed to modulate the synchronization information with the second set of values, resulting in a second reduced transmission rate, in order to allow also devices not supporting a demodulation of signals transmitted with the higher data rate to demodulate at least the synchronization part of a packet.

In case the invention is employed for a system employing a structure of packets similar to the Bluetooth™ system, it is proposed that the access code entity and, if present, the header entity of each packet are modulated with a reduced modulation scheme, while the payload entity, if present, is modulated with the first set of the values of modulation parameters of the selected modulation scheme. A possibility to demodulate in addition to the access entity also the header entity of each packet can be of interest for receiving devices, since the header entity indicates for example the length of the respective packet.

In a further preferred embodiment of the invention, the selected modulation scheme is a π/4-DQPSK modulation scheme (Differential Quadrature Phase Shift Keying), which employs +135°, +45°, −45° and −135° phase changes for modulation. If all phase changes are allowed, i.e. if the entire set of this modulation scheme is employed, a higher data rate is achieved than e.g. with the GFSK modulation scheme (Gaussian Frequency Shift Keying) employed according to the current Bluetooth™ specification. The second set of values when using this scheme used for modulating the access code and the header could then include e.g. only ±45° phase changes. This subset leads to the same data rate for the access code and the header of a packet. In the whole, the medium gross data rate is thus higher than with the GFSK modulation scheme of the Bluetooth™ specification.

Preferably, a π/4-DQPSK modulation scheme employs a raised cosine filter for pulse shaping with a roll-off factor of 0.8. This ensures that signals modulated with the reduced modulation scheme using only phase changes of ±45° can be demodulated with current Bluetooth™ devices. It is to be noted, though, that the selection of +450 phase changes for a reduced modulation scheme, as well as the use of a raised cosine filter with a roll-off factor of 0.8 are only to be understood as example which can be varied in any suitable way.

In a π/4-DQPSK modulation scheme, for each phase change a set of two bits is mapped to one of the four available phase changes. In order to restrict the changes to only two possible phase changes, one bit of each pair of bits can be frozen to either '0' or '1'. Thus, only one of the two bit of each set of bits influences the mapping, leading to a reduced mapping to only two of four available phase changes. With such an approach, a gross data rate of up to 2 Mbit/s, corresponding to a symbol rate of 1 Ms/s, and a maximum user data rate of 1.4 Mbit/s can be achieved for connections employing the currently defined Bluetooth™ payload types. The maximum user data rate is twice that of the current Bluetooth™ user data rate.

Instead of a π/4-DQPSK modulation scheme also other modulation schemes can be employed. In particular, more complex modulation schemes than QPSK can be selected. An 8PSK modulation scheme would be suited for instance for a payload modulation in some cases which require a high speed transmission speed but only a short transmission distance. In a Bluetooth™ system, for instance, the access code and the header can then be modulated in a similar manner as proposed for DQPSK, thus a synchronization of current devices to transmitted packets remains possible. With more complex modulation schemes, even higher gross medium data rates than 2 Mbit/s can be achieved easily.

A control signal can be employed for selecting the beginning of the payload and thus for switching from using only a subset of the modulation scheme to using the whole modulation scheme.

In another embodiment of the invention, fixed values are added already in the baseband to the signals which are to be modulated with the first set of values. More specifically, bits of '0' and/or '1' are added in the baseband to the regular bits. Then, the required change between a modulation with the second set of values and a modulation with the first set of values is achieved automatically in the modulator.

Preferably, the modulation is based on a lookup table, according to which signals that are to be transmitted are