Claims

1. A system comprising at least a transmitting device acting as master and a receiving device acting as slave, each ~~device~~ comprising a time reference and ~~being~~ arranged for transmitting and receiving radio signals that include a plurality of chirps, wherein each chirp is limited in time between an initial instant, at which the signal has an initial instantaneous frequency and a final instant at which the signal has a final instantaneous frequency, said initial and final instants and said initial and final frequencies being determined by the time reference, said devices having a ranging mode, in which a ranging request is transmitted from the transmitting device to the receiving device, and wherein the receiving device is arranged for receiving the ranging request and for determining the time and frequency shifts of the time reference of the receiving device with respect to the time reference of the transmitting device, based on the time and frequency of chirps contained in the ranging request, wherein the receiving device is arranged for transmitting back a ranging response that contains chirps that are aligned in time and frequency with the time reference of the transmitting device, and wherein the system includes a third device comprising a radio receiving unit compatible with those of the transmitting device and of the receiving device, the third device being arranged for receiving the signal exchanged from said transmitting device and said receiving device and for determining a range to the transmitting device or to the receiving device passively.

2. The system of the previous claim, wherein the third device is further arranged for estimating a range to the receiving device based on the time and frequency of chirps contained in the ranging response, wherein the ranging response is separated from the ranging request by a delay whose length is determined by a secret shared by the transmitting device and the receiving device.

3. The system of one of claims 1 or 2, further comprising a plurality of receiving devices having a common time reference arranged for receiving the ranging request, and for determining a plurality of time offsets dependent on the range between the transmitting device and each receiving device, and a

computing means, arranged for determining the position of the transmitting device based on said time offsets.

4. The system of one of claims 1 or 2, comprising a plurality of transmitting devices having a common time reference arranged for transmitting said ranging requests, and a receiving device, arranged for arranged for receiving the ranging requests and for a plurality of time offsets dependent on the range between the receiving device and each transmitting device, and for determining the position of the receiving device based on said time offsets.

5. The system of any one of ~~the previous~~ claims 2-4, having a open ranging mode in which the delay of the ranging reply is predetermined.

6. The system of any one of the previous claims, wherein each chirp is limited in time between an initial instant, at which the signal has an initial instantaneous frequency and an initial phase; and a final instant at which the signal has a final instantaneous frequencyand a final phase, the phase of the signal being essentially continuous.

7. The system of any one of the previous claims, wherein the ranging request comprises a series of identical chirps, and the receiving device is arranged for performing a dechirp operation, in which each received chirp is multiplied by a locally-generated conjugate chirp, and a FFT is executed on the result, whereupon the peak of the FFT is an indication of the time shift between the received chirps and the locally generated ones.

8. The system of the previous claim, wherein the receiving device is arranged for performing an adjusted dechirp, in which a different locally-generated chirp is used at each received chirp in order to adjust for the timing and frequency shifts.

9. The system of any one of ~~the previous~~ claims 2-8, wherein the ranging response comprises a series of identical chirps that are synthesized in the receiving device applying different parameters to each chirp, such that they

are aligned in time and frequency with the time reference of the transmitting device.

10. The system of any one of the previous claims, wherein the receiving and/or the transmitting devices are arranged to perform several ranging measures and for combining them based on the associated signal strength.

11. The system of any one of the previous claims, wherein the frequency and/or the bandwidth and/or the spreading factor of the radio signals is adapted based on the channel state.

12. The system of any one of the previous claims, wherein the receiving device is arranged to compensate a range estimate affected by multipath by applying a compensation curve.

13. The system of the previous claim, arranged to execute automatic calibration of the compensation curve, in which the rate of change of the estimated range is used as an indication of the true range.

14. The system of any one of the previous claims, further arranged to computed an obstruction indication based on the range estimate and the received signal strength.

15. The system of any one of the previous claims, wherein the transmitting device and the receiving device have a communication mode that allows them to exchange digital data by chirp-modulated radio signals.