CLAIMS

1. A communication system comprising:

   one or more base stations;

   a plurality of remotely located terminal units;

   the base stations and the remotely located units comprising means for transmitting and receiving data over communication links;

   the communication links being operative between any combination of one or more base stations and zero or more terminal units;

   a communication manager that is configured to define and manage said communication links;

   characterised in that

   the communication manager comprises means for adjusting the latency of any communication link, such that the data transfer rate and latency is guaranteed for at least one of the communication links; and

   the communication system further comprises means for increasing the number of communication links without impacting the data transfer rate, latency guarantee or spectral efficiency of the communication links.

2. A communications system according to claim 1, in which the communication links are further adjustable by the communications manager, the communications manager comprising means for further adjusting one, more or all of:

   a. the data rate of each of the one or more communication links;

   b. the frequency bands utilized by each of the one or more communication links;

   c. the channel within the frequency bands used by each of the one or more communication links;

   d. the communication error resilience by each of the one or more communication links, the error resilience being governed by

      i. a predetermined coding scheme; and/or

ii. the use of a duplicate frequency mode;

e. the number of terminal units communicating per base station;

f. the type and characteristics of each communication link;

g. the roaming method of terminal units changing between base stations;

h. the back up channel(s) to switch to in the event of a DFS (radar interference) event;

i. the monitoring and logging of radio performance;

j. the tile frequency and time characteristics;

k. which tiles are used for pilot signals;

l. the length of time before any one or more of the above parameters are changed.

3. The communications system of claim 1 or 2 wherein the communications manager is further provided with means for allocating frequency and time slot tiles for the communications link based on the requirements of the communications system, whilst maintaining the desired latency.

4. The communication system of any preceding claim, wherein the one or more communication links is/are comprised of:

one or more low bandwidth communication links configured for communication between any combination of one or more base stations and zero or more terminal units ; and

one or more high bandwidth communication links configured for communication between any combination of one or more base stations and zero or more terminal units .

5. The communication system of claim 4, wherein the one or more low bandwidth communication links is/are configured for communication within a predetermined latency range.

6. The communication system of claim 4 or 5, wherein the one or more high bandwidth communication links is configured for communication within a variable latency range.

7. The communication system of any one of claims 4 to 6, wherein the number of the one or more low bandwidth communication links and the one or more high bandwidth communication links can be adjusted during a start-up process of the one or more base stations.

8. The communication system of any one of claims 4 to 7, wherein the number of the one or more low bandwidth communication links and the number of the one or more high bandwidth communication links can be adjusted in real-time or near real-time to respond to requirements for communication between the at least one base station and the plurality of terminal units.

9. The communication system of any one of claims 4 to 8, wherein a data packet sent by a terminal unit of the one or more terminal units through the one or more low bandwidth communication links is transmitted at least twice, as a first data burst and a second data burst.

10. The communication system of claim 9, wherein the first data burst and the second data burst occupy one or more different frequencies.

11. The communication system of any preceding claim, the system being further provided with means of power control, the terminal unit setting the power at which it transmits depending on the strength of the signal received from the base station.

12. The communication system of any preceding claim, the system being further provided with means for synchronising the communications, said means comprising fixed time frequency synchronisation.

13. The communications system according to any one of claims 3 to 12 wherein the allocation of the frequency and time slot tiles can be changed dynamically during operation.

14. The communications system of any one of claims 3 to 12 in which the communications manager may allocate frequency and time slot tiles and other configuration data to the terminal units and base stations over a fixed or wireless out of band connection.

15. The communication system of any preceding claim, wherein the latency of the one or more communication links can be adjusted by adjusting one of at least one parameter associated with the one or more communication links, including frequency usage, tile characteristics, multiplexing/de-multiplexing techniques, timing and code usage.

16. The communication system of any one of claims 2 to 15, wherein the tile characteristics, such as the number and placement of pilots, can be configured by the communication manager.

17. The communication system of any preceding claim, wherein the communication system comprises one or more communication managers.

18. The communication system of any preceding claim, wherein the one or more communication links are utilized as emergency communication links.

19. The communication system of any preceding claim, wherein retransmission of existing data to the one or more terminal units continues until there is new data to be sent.

20. The communication system of any preceding claim, wherein the one or more communication links include at least one contention-free communication link and zero or more contended communication links.

21. The communication system of any preceding claim, wherein the transmission of data to the one or more terminal units is utilized for maintenance and troubleshooting.

22. The communication system of any preceding claim, wherein dynamic frequency hopping techniques are utilized in optimising the communication links characteristics.

23. The communication system of any preceding claim, wherein dynamic frequency selection techniques are utilized by the one or more base stations and are handled by one or more dedicated radio frequency chains.

24. The communication system of any preceding claim, wherein dynamic frequency selection techniques are utilized for radar detection and avoidance.

25. The communication system of any preceding claim using broadband coordinated multiple access schemes for command and control of material handling equipment.

26. The communication system of claim 25, wherein the material handling equipment includes one or more autonomous guided vehicles in a warehouse, which may incorporate one or more of the one or more terminal units .

27. The communication system of claim any preceding claim, wherein frequency pairs symmetric about a centre frequency are allocated to the same terminal unit so that any energy leakage from +f into –f and vice versa occurs at the location of the terminal unit such that less unwanted interference occurs compared to allocating +f and –f to different

terminal units.

28. The communication system of claim 27, wherein the terminal units may be at different distances from the same base station, with the result that a leaked signal into –f from a terminal unit close to the base station could interfere strongly with the actual –f signal from a terminal unit far from the base station (similarly for leakage into f).

29. The communication system of any preceding claim where the radio is implemented as a peripheral to a computer.

30. A communication system or method as hereinbefore described with reference to the accompanying diagrammatic drawings.

CLAIMS

1. A communication system comprising:

one or more base stations;

a plurality of remotely located terminal units;

the base stations and the remotely located terminal units comprising means for transmitting and receiving data over communication links;

a communication manager that is configured to define and manage said communication links;

characterised in that

the communication links comprise one or more low bandwidth communication links configured for communication between one or more base stations and one or more terminal units, and one or more high bandwidth communication links configured for communication between one or more base stations and one or more terminal units;

the terminal units are allocated information which is stored on the terminal units, the information including a time slot to use for a low bandwidth communication link;

the communication manager comprises means for adjusting the latency of any communication link, such that the data transfer rate and latency is guaranteed for at least one of the communication links; and

the communication system further comprises means for increasing the number of communication links without impacting the data transfer rate, latency guarantee or spectral efficiency of the communication links.

2. A communications system according to claim 1, in which the communication links are further adjustable by the communications manager, the communications manager comprising means for further adjusting one, more or all of:

   a. the data rate of each of the one or more communication links;

   b. the frequency bands utilized by each of the one or more communication links;

c. the channel within the frequency bands used by each of the one or more communication links;

d. the communication error resilience by each of the one or more communication links, the error resilience being governed by

i. a predetermined coding scheme; and/or

ii. the use of a duplicate frequency mode;

e. the number of terminal units communicating per base station;

f. the type and characteristics of each communication link;

g. the roaming method of terminal units changing between base stations;

h. the back up channel(s) to switch to in the event of a DFS (radar interference) event;

i. the monitoring and logging of radio performance;

j. the tile frequency and time characteristics;

k. which tiles are used for pilot signals;

l. the length of time before any one or more of the above parameters are changed.

3. The communications system of claim 1 or 2 wherein the communications manager is further provided with means for allocating frequency and time slot tiles for the communications link based on the requirements of the communications system, whilst maintaining the desired latency.

4. The communication system of any preceding claim, wherein the information stored on the terminal units includes a low bandwidth communication link number identifying one or more of a multi frame offset, the time slot and a tile offset to use for the low bandwidth communication link.

5. The communication system of any preceding claim, wherein the one or more low bandwidth communication links is/are configured for communication within a predetermined latency range.

6. The communication system of any preceding claim, wherein the one or more high bandwidth communication links is configured for communication within a variable latency range.

7. The communication system of any preceding claim, wherein the number of the one or more low bandwidth communication links and the one or more high bandwidth communication links can be adjusted during a start-up process of the one or more base stations.

8. The communication system of any preceding claim, wherein the number of the one or more low bandwidth communication links and the number of the one or more high bandwidth communication links can be adjusted in real-time or near real-time to respond to requirements for communication between the at least one base station and the plurality of terminal units.

9. The communication system of any preceding claim, wherein a data packet sent by a terminal unit of the one or more terminal units through the one or more low bandwidth communication links is transmitted at least twice, as a first data burst and a second data burst.

10. The communication system of claim 9, wherein the first data burst and the second data burst occupy one or more different frequencies.

11. The communication system of any preceding claim, the system being further provided with means of power control, the terminal unit setting the power at which it transmits depending on the strength of the signal received from the base station.

12. The communication system of any preceding claim, the system being further provided with means for synchronising the communications, said means comprising fixed time frequency synchronisation.

13. The communications system according to any one of claims 3 to 12 wherein the allocation of the frequency and time slot tiles can be changed dynamically during operation.

14. The communications system of any one of claims 3 to 12 in which the communications manager may allocate frequency and time slot tiles and other configuration data to the terminal units and base stations over a fixed or wireless out of band connection.

15. The communication system of any preceding claim, wherein the latency of the one or

more communication links can be adjusted by adjusting one of at least one parameter associated with the one or more communication links, including frequency usage, tile characteristics, multiplexing/de-multiplexing techniques, timing and code usage.

16. The communication system of any one of claims 2 to 15, wherein the tile characteristics, such as the number and placement of pilots, can be configured by the communication manager.

17. The communication system of any preceding claim, wherein the communication system comprises one or more communication managers.

18. The communication system of any preceding claim, wherein the one or more communication links are utilized as emergency communication links.

19. The communication system of any preceding claim, wherein retransmission of existing data to the one or more terminal units continues until there is new data to be sent.

20. The communication system of any preceding claim, wherein the one or more communication links include at least one contention-free communication link and zero or more contended communication links.

21. The communication system of any preceding claim, wherein the transmission of data to the one or more terminal units is utilized for maintenance and troubleshooting.

22. The communication system of any preceding claim, wherein dynamic frequency hopping techniques are utilized in optimising the communication links characteristics.

23. The communication system of any preceding claim, wherein dynamic frequency selection techniques are utilized by the one or more base stations and are handled by one or more dedicated radio frequency chains.

24. The communication system of any preceding claim, wherein dynamic frequency selection techniques are utilized for radar detection and avoidance.

25. The communication system of any preceding claim using broadband coordinated multiple access schemes for command and control of material handling equipment.

26. The communication system of claim 25, wherein the material handling equipment includes one or more autonomous guided vehicles in a warehouse, which may incorporate one or more of the one or more terminal units .

27. The communication system of claim any preceding claim, wherein frequency pairs

symmetric about a centre frequency are allocated to the same terminal unit so that any energy leakage from +f into –f and vice versa occurs at the location of the terminal unit such that less unwanted interference occurs compared to allocating +f and –f to different terminal units.

28. The communication system of claim 27, wherein the terminal units may be at different distances from the same base station, with the result that a leaked signal into –f from a terminal unit close to the base station could interfere strongly with the actual –f signal from a terminal unit far from the base station (similarly for leakage into f).

29. The communication system of any preceding claim where the radio is implemented as a peripheral to a computer.