CLAIMS

What is claimed is:

1. A method, comprising,

processing, by a user equipment, a group of N modulation symbols in Spreading Factor (SF) pathways in parallel for uplink transmission, wherein N and SF are integers and SF is equal to a number of elements in a spreading code, comprising:

multiplying, by the user equipment, the N modulated symbols in each of the SF pathways with a unique element of the spreading code and outputting N symbols in each of the SF pathways; and

performing, by the user equipment, a cyclically shifting to the output N modulation symbols in each of the SF pathways, wherein each SF pathway is using a particular shift from a series of SF cyclic shifts, and wherein the series of cyclic shifts is according ~~within the group according~~ to a cell-specific shift pattern~~; and~~

~~applying a spreading code to the group of symbols~~.

2. The method according to claim 1,

in which ~~the spreading code is characterized by a spreading factor (SF), there are N symbols or bits in the group, and each of~~ said SF and N are characterized by integers greater than one and N is greater than SF;

and in which the cell-specific shift pattern comprises a total of at least SF cyclic shifts ~~of the symbols or bits~~.

3. The method according to claim 2, in which:

the spreading code is a block spreading code that is specific to an apparatus in the cell;

said group comprises time domain modulation symbols within a discrete Fourier Transformation spread orthogonal frequency division multiple access symbol (DFT-S-OFDMA); and

said time domain modulation symbols are shifted cyclically relative one to other.

4. The method according to claim 3, wherein the cyclically shifting is made before a fast Fourier transform.

5. The method according to claim 3 wherein cyclically shifting is done in a frequency domain after a fast Fourier transform.

6. The method according to claim 1,

in which the group of modulation symbols comprise indications for acknowledgement, negative acknowledgement and discontinuous transmission of a physical downlink shared channel;

and the method further comprises transmitting the generated orthogonal frequency division multiple access symbols in a physical uplink control channel.

7. The method according to claim 1, in which the cell-specific shift pattern is based on at least one of a cell index, a system frame number, and a system slot number.

8. The method according to claim 1, the method further comprising:

upon attaching to a new cell after a handover, automatically replacing the cell-specific shift pattern with a new shift pattern that is specific to the new cell.

9. The method according to any one of claims 1-8, wherein the steps may be configured and stored on a computer-readable medium and may be executed by at least one processor. ~~performed by at least one computer program code embodied on at least one memory and executed by at least one processor~~.

10. An apparatus, comprising:

at least one processor configured to; ~~and~~

~~at least one memory including computer program code, where the at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus to at least:~~

process a group of N modulation symbols in Spreading Factor (SF) pathways in parallel for uplink transmission, wherein N and SF are integers and SF is equal to a number of elements in a spreading code, comprising:

multiply the N modulated symbols in each of the SF pathways with a unique element of the spreading code and outputting N symbols in each of the SF pathways; and

perform a cyclic~~ally~~ shift~~ing~~ to the output N modulation symbols in each of the SF pathways, wherein each SF pathway is using a particular shift from a series of SF cyclic shifts, and wherein the series of cyclic shifts is according~~within the group according~~ to a cell-specific shift pattern~~; and~~

~~applying a spreading code to the group of symbols~~;

and a memory coupled to the processor~~.~~

11. The apparatus according to claim 10,

in which ~~the spreading code is characterized by a spreading factor (SF), there are N symbols or bits in the group, and each of~~ said SF and N are characterized by integers greater than one and N is greater than SF;

and in which the cell-specific shift pattern comprises a total of at least SF cyclic shifts ~~of the symbols or bits~~.

12. The apparatus according to claim 11, in which:

the spreading code is a block spreading code that is specific to the apparatus in the cell; and

said group comprises time domain modulation symbols within a discrete Fourier Transformation spread orthogonal frequency division multiple access symbol (DFT-S-OFDMA); and

in which the at least one processor~~memory including the computer program code~~ is configured~~, with the at least one processor to cause the apparatus~~ to cyclically shift said time domain modulation symbols relative one to other.

13. The apparatus according to claim 12, wherein the cyclically shifting is made before a fast Fourier transform.

14. The apparatus according to claim 12, wherein cyclically shifting is done in a frequency domain after a fast Fourier transform.

15. The apparatus according to claim 10,

in which the group of modulation symbols comprise indications for acknowledgement, negative acknowledgement and discontinuous transmission of a physical downlink shared channel;

and in which the at least one processor is configured ~~memory including the computer program code is configured, with the at least one processor to cause the apparatus~~ to transmit the generated orthogonal frequency division multiple access symbols in a physical uplink control channel.

16. The apparatus according to claim 10, in which the cell-specific shift pattern is based on at least one of a cell index, a system frame number, and a system slot number.

17. The apparatus according to claim 10, wherein the at least one processor ~~memory including the computer program code~~ is configured~~, with the at least one processor to cause the apparatus~~, upon attaching to a new cell after a handover, to automatically replace the cell-specific shift pattern with a new shift pattern that is specific to the new cell.

18. The apparatus according to claim 17, in which cyclically shifting the frequency response is before applying the spreading code and is done via a Fourier transform.

19. An apparatus comprising:

a means for processing a group of N modulation symbols in Spreading Factor (SF) pathways in parallel for uplink transmission, wherein N and SF are integers and SF is equal to a number of elements in a spreading code, comprising:

a means for multiplying the N modulated symbols in each of the SF pathways with a unique element of the spreading code and outputting N symbols in each of the SF pathways; and

and a means for performing a cyclically shifting to the output N modulation symbols in each of the SF pathways, wherein each SF pathway is using a particular shift from a series of SF cyclic shifts, and wherein the series of cyclic shifts is according within the group according to a cell-specific shift pattern; and

means for applying a spreading code to the group of symbols.

20. The apparatus according to claim 19, wherein the means for processing, means for performing cyclically shifting, and the means for applying a spreading code steps may be configured and stored on a computer-readable medium and may be executed by a at least one processor.comprise at least one computer program code embodied on at least one memory and executed by at least one processor.