

CLAIMS:

1. A wireless device configured to communicate with a Radio Access Network (RAN) node, the wireless device comprising:

a processor; and,

a memory that stores processor-executable instructions, wherein the processor interfaces with the memory to execute the processor-executable instructions, whereby the wireless device is operable to:

attempt a system access using an Extended Coverage Random Access Channel (EC-RACH) by transmitting, to the RAN node, a system access message on the EC-RACH using repeated Extended Synchronization Access Bursts (ESABs), wherein each ESAB is extended over 2 timeslots on the EC-RACH, and wherein each ESAB comprises 140 synchronization bits, 102 encrypted data bits, 3 tail bits, and 68 guard symbols.

2. The wireless device of claim 1, wherein each ESAB has the 102 encrypted data bits coded according to an 11-bit RACH coding scheme which utilizes 11 payload bits and 6 parity bits to which a rate 1/6 tail biting convolutional coding is applied, resulting in the 102 encrypted data bits after channel coding.

3. The wireless device of claim 2, wherein the rate 1/6 tail biting convolutional coding utilizes the following polynomials:

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G7 = 1 + D + D2 + D3 + D6;$$

$$G5 = 1 + D + D4 + D6;$$

$$G6 = 1 + D + D2 + D3 + D4 + D6; \text{ and}$$

$$G6 = 1 + D + D2 + D3 + D4 + D6.$$

4. The wireless device of claim 1, wherein the transmitting of the system access message on the EC-RACH is performed when the EC-RACH is in a 2 timeslot (2TS) and coverage class 5 (CC5) operation and involves transmitting 22 repeated ESABs over three consecutive 51-Multi-Frames (MFs) for a total of 66 repeated ESABs.

5. A method implemented by a wireless device configured to communicate with a Radio Access Network (RAN) node, the method comprising:

attempting a system access using an Extended Coverage Random Access Channel (EC-RACH) by transmitting, to the RAN node, a system access message on the EC-RACH using repeated Extended Synchronization Access Bursts (ESABs), wherein each ESAB is extended over 2 timeslots on the EC-RACH, and wherein each ESAB comprises 140 synchronization bits, 102 encrypted data bits, 3 tail bits, and 68 guard symbols.

6. The method of claim 5, wherein each ESAB has the 102 encrypted data bits coded according to an 11-bit RACH coding scheme which utilizes 11 payload bits and 6 parity bits to which a rate 1/6 tail biting convolutional coding is applied, resulting in the 102 encrypted data bits after channel coding.

7. The method of claim 6, wherein the rate 1/6 tail biting convolutional coding utilizes the following polynomials:

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G7 = 1 + D + D2 + D3 + D6;$$

$$G5 = 1 + D + D4 + D6;$$

$$G6 = 1 + D + D2 + D3 + D4 + D6; \text{ and}$$

$$G6 = 1 + D + D2 + D3 + D4 + D6.$$

8. The method of claim 5, wherein the transmitting of the system access message on the EC-RACH is performed when the EC-RACH is in a 2 timeslot (2TS) and coverage class 5 (CC5) operation and involves transmitting 22 repeated ESABs over three consecutive 51-Multi-Frames (MFs) for a total of 66 repeated ESABs.

9. A Radio Access Network (RAN) node configured to interact with a wireless device, the RAN node comprising:

a transceiver;

a processor; and,

a memory that stores processor-executable instructions, wherein the processor interfaces with the memory to execute the processor-executable instructions to:

receive, from the wireless device via the transceiver, a system access message on an Extended Coverage Random Access Channel (EC-RACH), wherein the system access message comprises repeated Extended Synchronization Access Bursts (ESABs), wherein each ESAB is extended over 2 timeslots on the EC-RACH, and wherein each ESAB comprises 140 synchronization bits, 102 encrypted data bits, 3 tail bits, and 68 guard symbols.

10. The RAN node of claim 9, wherein each ESAB has the 102 encrypted data bits coded according to an 11-bit RACH coding scheme which utilized 11 payload bits and 6 parity bits to which a rate 1/6 tail biting convolutional coding was applied, resulting in the 102 encrypted data bits after channel coding.

11. The RAN node of claim 10, wherein the rate 1/6 tail biting convolutional coding utilized the following polynomials:

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G7 = 1 + D + D2 + D3 + D6;$$

$$G5 = 1 + D + D4 + D6;$$

$$G6 = 1 + D + D2 + D3 + D4 + D6; \text{ and}$$

$$G6 = 1 + D + D2 + D3 + D4 + D6.$$

12. The RAN node of claim 9, wherein the receiving of the system access message on the EC-RACH is done when the EC-RACH is in a 2 timeslot (2TS) and coverage class 5 (CC5) operation and involves receiving 22 repeated ESABs over three consecutive 51-Multi-Frames (MFs) for a total of 66 repeated ESABs.

13. A method implemented by a Radio Access Network (RAN) node configured to interact with a wireless device, the method comprising:

receiving, from the wireless device, a system access message on an Extended Coverage Random Access Channel (EC-RACH), wherein the system access message comprises repeated Extended Synchronization Access Bursts (ESABs), wherein each ESAB is extended over 2 timeslots on the EC-RACH, and wherein each ESAB comprises 140 synchronization bits, 102 encrypted data bits, 3 tail bits, and 68 guard symbols.

14. The method of claim 13, wherein each ESAB has the 102 encrypted data bits coded according to an 11-bit RACH coding scheme which utilized 11 payload bits and 6 parity bits to which a rate 1/6 tail biting convolutional coding was applied, resulting in the 102 encrypted data bits after channel coding.

15. The method of claim 14, wherein the rate 1/6 tail biting convolutional coding utilized the following polynomials:

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G4 = 1 + D2 + D3 + D5 + D6;$$

$$G7 = 1 + D + D2 + D3 + D6;$$

$$G5 = 1 + D + D4 + D6;$$

$$G6 = 1 + D + D2 + D3 + D4 + D6; \text{ and}$$

$$G6 = 1 + D + D2 + D3 + D4 + D6.$$

16. The method of claim 13, wherein the receiving of the system access message on the EC-RACH is done when the EC-RACH is in a 2 timeslot (2TS) and coverage class 5 (CC5) operation and involves receiving 22 repeated ESABs over three consecutive 51-Multi-Frames (MFs) for a total of 66 repeated ESABs.