METHODS AND APPARATUS FOR DETERMINING DEVICE-TO-DEVICE TRANSMISSION PATTERNS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/034,025 filed on August 6, 2014, U.S. Provisional Patent Application No. 62/054,809 filed on September 24, 2014, and U.S. Provisional Patent Application No. 62/075,604 filed on November 5, 2014, the contents of which are hereby incorporated by reference herein.

BACKGROUND

[0002] Long Term Evolution (LTE) communication is becoming more widespread as the technology matures and is starting to be used in new areas. Recently, public safety officials (e.g. police, firefighters, paramedics) have shown growing interests in using LTE as their main communication tool. However, current versions of LTE however only work under network coverage, which may be a limitation for many public safety situations.

SUMMARY

[0003] In an embodiment, a method for a first wireless transmit/receive unit (WTRU) to perform device-to-device (D2D) communication directly with a second WTRU, the method comprising: determining, outside of network coverage, a base pattern to use for the D2D communication based on at least a transmission configuration, wherein the base pattern is selected from a base pattern family comprising one or more base patterns having a pre-defined duration and one or more transmission opportunities, and wherein the base pattern family is defined by a number of the one or more transmission opportunities; and transmitting one or more data packets to the second WTRU in the one or more transmission opportunities of the selected base pattern.

In another embodiment, a wireless transmit/receive unit (WTRU) for performing device-to-device (D2D) communication directly with another WTRU, the WTRU comprising: a processor; and an antenna operatively coupled to the processor; the processor configured to determine, outside of

network coverage, a base pattern to use for the D2D communication based on at least a transmission configuration, wherein the base pattern is selected from a base pattern family comprising one or more base patterns having a pre-defined duration and one or more transmission opportunities, and wherein the base pattern family is defined by a number of the one or more transmission opportunities; and the processor and the antenna configured to transmit one or more data packets to the second WTRU in the one or more transmission opportunities of the selected base pattern.

CLAIMS

1. A method for a first wireless transmit/receive unit (WTRU) to perform device-to-device (D2D) communication directly with a second WTRU, the method comprising:

determining, outside of network coverage, a base pattern to use for the D2D communication based on at least a transmission configuration, wherein the base pattern is selected from a base pattern family comprising one or more base patterns having a pre-defined duration and one or more transmission opportunities, and wherein the base pattern family is defined by a number of the one or more transmission opportunities; and

transmitting one or more data packets to the second WTRU in the one or more transmission opportunities of the selected base pattern.

2. The method of claim 1, wherein the determining the base pattern comprises:

determining a number of buffered data packets to be transmitted;

estimating a number of transmission opportunities required to transmit the buffered data packets in an upcoming scheduling period; and

choosing an available base pattern with a number of available transmission opportunities corresponding to the required number of transmission opportunities.

3. The method of claim 1, wherein the determining the base pattern comprises:

determining whether the D2D communication is of a unicast, multicast, or broadcast nature; and

if the D2D communication is of a unicast nature with feedback, choosing an available base pattern with a number of available transmission opportunities that allow for feedback transmissions from the second WTRU.

4. The method of claim 1, wherein the determining the base pattern comprises:

determining whether the D2D communication is of a unicast, multicast, or broadcast nature; and

choosing an available base pattern from a predefined set of base pattern families corresponding to the determined nature of D2D communication.

5. The method of claim 1, wherein the determining the base pattern comprises:

choosing an available base pattern such that interference with base patterns of one or more adjacent WTRUs is minimized.

6. The method of claim 1, wherein the determining the base pattern comprises:

determining the required number of transmissions in an upcoming scheduling period for the D2D communication, wherein the required number of transmissions is dependent on traffic type of the D2D communication; and

choosing an available base pattern with a number of available transmission opportunities corresponding to the required number of transmissions.

7. The method of claim 1, wherein the base pattern is selected from the base pattern family based on a random selection.

8. The method of claim 1, wherein the base pattern is selected from the base pattern family using one or more identifiers.

9. The method of claim 1, wherein the base pattern is selected from the base pattern family based on a pseudo-random generator initialized with an identifier.

10. A wireless transmit/receive unit (WTRU) for performing device-to-device (D2D) communication directly with another WTRU, the WTRU comprising:

a processor; and

an antenna operatively coupled to the processor;

the processor configured to determine, outside of network coverage, a base pattern to use for the D2D communication based on at least a transmission configuration, wherein the base pattern is selected from a base pattern family comprising one or more base patterns having a pre-defined duration and one or more transmission opportunities, and wherein the base pattern family is defined by a number of the one or more transmission opportunities; and

the processor and the antenna configured to transmit one or more data packets to the second WTRU in the one or more transmission opportunities of the selected base pattern.

11. The WTRU of claim 10, wherein the processor is further configured to:

determine a number of buffered data packets to be transmitted;

estimate a number of transmission opportunities required to transmit the buffered data packets in an upcoming scheduling period; and

choose an available base pattern with a number of available transmission opportunities corresponding to the required number of transmission opportunities.

12. The WTRU of claim 10, wherein the processor is further configured to:

determine whether the D2D communication is of a unicast, multicast, or broadcast nature; and

if the D2D communication is of a unicast nature, choose an available base pattern with a number of available transmission opportunities that allow for feedback transmissions from the second WTRU.

13. The WTRU of claim 10, wherein the processor is further configured to:

choose an available base pattern such that interference with base patterns of one or more adjacent WTRUs is minimized.

14. The WTRU of claim 10, wherein the processor is further configured to:

determine the required number of transmissions in an upcoming scheduling period for the D2D communication, wherein the required number of transmissions is dependent on traffic type of the D2D communication; and

choose an available base pattern with a number of available transmission opportunities corresponding to the required number of transmissions.

15. The WTRU of claim 10, wherein the processor is further configured to:

determine whether the D2D communication is of a unicast, multicast, or broadcast nature; and

choose an available base pattern from a predefined set of base pattern families corresponding to the determined nature of D2D communication.

16. The WTRU of claim 10, wherein the processor is further configured to select the base pattern from the base pattern family based on a random selection.

17. The WTRU of claim 10, wherein the processor is further configured to select the base pattern from the base pattern family using on one or more identifiers.

18. The WTRU of claim 11, wherein the processor is further configured to select the base pattern from the base pattern family based on a pseudo-random generator initialized with an identifier.