

Claims

1. A method for wireless network operation, comprising:
(a) successively transmitting a communication frame at a defined interval during a first period of time;

5 (b) after the first period of time, ceasing transmission of the communication frame for a second period of time; and

(c) after the second period of time, repeating operations (a), (b) and (c).

2. The method for wireless network operation as recited in claim 1, wherein the defined interval between successive communication frame transmissions is set within a range
10 extending from 6 milliseconds to 19 milliseconds.

3. The method for wireless network operation as recited in claim 1, wherein the first period of time has a duration of 1 second.

4. The method for wireless network operation as recited in claim 1, wherein the second period of time has a duration within a range extending from 1 second to 255 seconds.

15 5. The method for wireless network operation as recited in claim 1, wherein the communication frame is a medium access control (MAC) frame of an IEEE 802.15.4 communication protocol.

6. The method for wireless network operation as recited in claim 5, wherein the MAC frame is formatted as a beacon frame, and wherein the beacon frame includes a payload
20 portion that is formatted in accordance with a distributed access management protocol separate from the IEEE 802.15.4 communication protocol.

7. The method for wireless network operation as recited in claim 5, wherein the MAC frame is formatted as a broadcast network discovery (BND) frame, and wherein the BND frame includes a payload portion that is formatted in accordance with a distributed access
25 management protocol separate from the IEEE 802.15.4 communication protocol.

8. The method for wireless network operation as recited in claim 1, further comprising:

operating a network device to receive and process the communication frame; and

operating the network device to respond to the communication frame by sending a
30 request to join a network to a device from which the communication frame was transmitted.

9. The method for wireless network operation as recited in claim 8, further comprising:

operating the device from which the communication frame was transmitted to either allow the network device to join the network or to deny the network device from joining the network.

10. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a frame transmission type, and

defining a payload portion of the MAC frame in accordance with a payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type;

operating the sending device to transmit the generated MAC frame over the wireless network;

operating a receiving device to receive the MAC frame over the wireless network;

operating the receiving device to recognize the MAC frame as the indicated frame transmission type; and

operating the receiving device to process the payload portion of the MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type.

11. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein each of the sending and receiving devices is compliant with both an IEEE 802.15.4 standard and the distributed asset management protocol, wherein non-payload portions of the MAC frame are defined to be processed by wireless communication devices that are compliant with the IEEE 802.15.4 standard, and wherein payload portions of the MAC frame are defined to be processed by wireless communication devices that are compliant with the distributed asset management protocol.

12. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame transmission type is one of a beacon frame, a broadcast network discovery frame, a data frame, a command frame, and an acknowledgement frame.

13. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame

transmission type is a beacon frame, and wherein the payload specification of the distributed asset management protocol corresponding to the beacon frame includes,

an identification of a device type of the sending device,

an identification of a type of data included within a data portion of the payload of the

5 beacon frame,

an identification of an alternate channel to be used for subsequent communication,

a specification of a beacon interval duration of the sending device,

a specification of an association timeout duration for the receiving device,

a specification of a response interval duration for the receiving device,

10 a specification of a length of data included within the data portion of the payload of the beacon frame,

the data portion of the payload of the beacon frame, and

a specification of cyclic redundancy data associated with the payload of the beacon frame.

15 14. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 13, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

20 15. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 13, wherein the type of data included within the data portion of the payload of the beacon frame includes one or more of device date and time, device identification, device location, device velocity, and device differential global positioning system correction.

25 16. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 13, wherein the beacon interval duration of the sending device is an integer value in seconds between successive beacon periods, wherein each beacon period is a duration of time during which MAC frames of the beacon frame type are successively transmitted at a set interval.

30 17. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 16, wherein the beacon interval duration is within a range extending from 1 second to 255 seconds, and wherein the beacon period duration is 1 second, and wherein the set interval is within a range extending from 6 milliseconds to 19 milliseconds.

18. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 16, wherein the association timeout duration for the receiving device is a number of beacon intervals that should pass without communication before the receiving device disassociates from the wireless network of the sending device.

19. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 16, wherein the response interval duration for the receiving device is a maximum number of beacon intervals that are allowed to pass before the receiving device should communicate its status to the sending device.

20. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame transmission type is a broadcast network discovery frame, and wherein the payload specification of the distributed asset management protocol corresponding to the broadcast network discovery frame includes,

- an identification of a device type of the sending device,
- an identification of a message type as the broadcast network discovery frame,
- an identification of an alternate channel to be used for subsequent communication,
- a specification of a broadcast interval duration of the sending device,
- a specification of a response interval duration for the receiving device,
- an identification of data types included within the data portion of the payload of the broadcast network discovery frame,
- the data portion of the payload of the broadcast network discovery frame, and
- a specification of cyclic redundancy data associated with the payload of the broadcast network discovery frame.

21. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 20, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

22. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 20, wherein the broadcast interval duration of the sending device is an integer value in seconds between successive broadcast periods, wherein each broadcast period is a duration of time during which MAC

frames of the broadcast network discovery frame type are successively transmitted at a set interval.

23. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 22, wherein the broadcast interval duration is within a range extending from 1 second to 255 seconds, and wherein the broadcast period duration is 1 second, and wherein the set interval is within a range extending from 6 milliseconds to 19 milliseconds.

24. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 22, wherein the response interval duration for the receiving device is a maximum number of broadcast intervals that are allowed to pass before the receiving device should communicate its status to the sending device.

25. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 20, wherein the type of data included within the data portion of the payload of the broadcast network discovery frame includes one or more of device date and time, device identification, device location, device velocity, and device differential global positioning system correction.

26. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame transmission type is a command frame, and wherein the payload specification of the distributed asset management protocol corresponding to the command frame includes,

an identification of a device type of the sending device,

an identification of a message type as the command frame,

a specification of a length of data included within the data portion of the payload of the command frame,

an identification of a type of command communicated in the command frame,

the data portion of the payload of the command frame, and

a specification of cyclic redundancy data associated with the payload of the command frame.

27. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 26, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

28. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame transmission type is a data frame, and wherein the payload specification of the distributed asset management protocol corresponding to the data frame includes,

5 an identification of a device type of the sending device,
 an identification of a message type as the data frame,
 a specification of a length of data included within the data portion of the payload of the data frame,
 an identification of a packet type associated with the data included within the data
10 portion of the payload of the data frame,
 the data portion of the payload of the data frame, and
 a specification of cyclic redundancy data associated with the payload of the data frame.

29. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 28, wherein the device type
15 of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

30. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 28, wherein the identification of the packet type includes identification of the data included within the data
20 portion of the payload of the data frame as either stored data or real-time data.

31. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 10, wherein the frame transmission type is an acknowledgement frame, and wherein the payload specification of the distributed asset management protocol corresponding to the acknowledgement frame includes,

25 an identification of a device type of the sending device,
 an identification of a message type as the acknowledgement frame,
 a specification of a length of the acknowledgement frame,
 a specification of an acknowledgement value as either successful acknowledgement or failed acknowledgement,

30 an identification of a sequence number of a communication that is acknowledged by the acknowledgement frame,

 an identification of a packet identifier that is acknowledged by the acknowledgement frame in the case of a successful acknowledgement, or an identification of an error type in the case of a failed acknowledgement,

a specification of a ready state of the sending device,
a specification of an incrementing counter value indicating a sequence of processed commands,

a specification of a sleep timer value used by the sending device,
5 an identification of a current network channel used by the sending device for communication over the wireless network, and

a specification of cyclic redundancy data associated with the payload of the acknowledgement frame.

32. The method for communicating data over the wireless network in accordance
10 with the distributed asset management protocol as recited in claim 31, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

33. The method for communicating data over the wireless network in accordance
with the distributed asset management protocol as recited in claim 31, wherein the
15 specification of the ready state of the sending device is zero if the sending device is ready to receive more data, and wherein the specification of the ready state of the sending device is a number of seconds greater than zero to be delayed before the sending device is ready to receive more data.

34. A device defined to communicate data over a wireless network in accordance
20 with a distributed asset management protocol, comprising:

a wireless transceiver; and

a processor defined to operate in conjunction with the wireless transceiver to transmit and receive wireless communications in accordance with the distributed asset management protocol,

25 wherein the processor includes a transmission module defined to generate a medium access control (MAC) frame to be transmitted over the wireless network,

wherein generating the MAC frame includes setting a frame control field of the MAC frame to indicate a frame transmission type, and defining a payload portion of the MAC frame in accordance with a payload specification of the distributed asset management protocol
30 corresponding to the indicated frame transmission type, and

wherein the transmission module is defined to direct the wireless transceiver to transmit the generated MAC frame over the wireless network,

wherein the processor also includes a reception module defined to process MAC frames received through the wireless transceiver from the wireless network,

wherein the reception module is defined to recognize the frame transmission type of the received MAC frame, and process the payload portion of the received MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the recognized frame transmission type.

5 35. The device defined to communicate data over the wireless network in accordance with the distributed asset management protocol as recited in claim 34, wherein the device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

10 36. The device defined to communicate data over the wireless network in accordance with the distributed asset management protocol as recited in claim 34, wherein the processor and wireless transceiver are defined to be compliant with both an IEEE 802.15.4 standard and the distributed asset management protocol, wherein non-payload portions of the MAC frame are defined to be processed by wireless communication devices that are compliant with the IEEE 802.15.4 standard, and wherein payload portions of the MAC frame are defined
15 to be processed by wireless communication devices that are compliant with the distributed asset management protocol.

20 37. The device defined to communicate data over the wireless network in accordance with the distributed asset management protocol as recited in claim 34, wherein the frame transmission type is one of a beacon frame, a broadcast network discovery frame, a data frame, a command frame, and an acknowledgement frame.

Claims

1. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a beacon frame transmission type, and

defining a payload portion of the MAC frame to include,

an identification of a device type of the sending device,

an identification of a type of data included within a data portion of the payload of the beacon frame,

an identification of an alternate channel to be used for subsequent communication,

a specification of a beacon interval duration of the sending device,

a specification of an association timeout duration for the receiving device,

a specification of a response interval duration for the receiving device,

a specification of a length of data included within the data portion of the payload of the beacon frame,

the data portion of the payload of the beacon frame, and

a specification of cyclic redundancy data associated with the payload of the beacon frame;

operating the sending device to transmit the generated MAC frame over the wireless network;

operating a receiving device to receive the MAC frame over the wireless network;

operating the receiving device to recognize the MAC frame as the indicated frame transmission type; and

operating the receiving device to process the payload portion of the MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type.

2. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 1, wherein each of the sending and receiving devices is compliant with both an IEEE 802.15.4 standard and the distributed asset management protocol, wherein non-payload portions of the MAC frame are defined to be processed by wireless communication devices that are compliant with the IEEE 802.15.4 standard, and wherein payload portions of the MAC frame are defined to be processed by wireless communication devices that are compliant with the distributed asset management protocol.

3. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 1, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

4. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 1, wherein the type of data included within the data portion of the payload of the beacon frame includes one or more of

device date and time, device identification, device location, device velocity, and device differential global positioning system correction.

5. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 1, wherein the beacon interval duration of the sending device is an integer value in seconds between successive beacon periods, wherein each beacon period is a duration of time during which MAC frames of the beacon frame type are successively transmitted at a set interval.

6. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 5, wherein the beacon interval duration is within a range extending from 1 second to 255 seconds, and wherein the beacon period duration is 1 second, and wherein the set interval is within a range extending from 6 milliseconds to 19 milliseconds.

7. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 5, wherein the association timeout duration for the receiving device is a number of beacon intervals that should pass without communication before the receiving device disassociates from the wireless network of the sending device.

8. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 5, wherein the response interval

duration for the receiving device is a maximum number of beacon intervals that are allowed to pass before the receiving device should communicate its status to the sending device.

9. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a broadcast network discovery frame transmission type, and

defining a payload portion of the MAC frame to include,

an identification of a device type of the sending device,

an identification of a message type as the broadcast network discovery frame,

an identification of an alternate channel to be used for subsequent communication,

a specification of a broadcast interval duration of the sending device,

a specification of a response interval duration for the receiving device,

an identification of data types included within the data portion of the payload of the broadcast network discovery frame,

the data portion of the payload of the broadcast network discovery frame, and

a specification of cyclic redundancy data associated with the payload of the broadcast network discovery frame;

operating the sending device to transmit the generated MAC frame over the wireless network;

operating a receiving device to receive the MAC frame over the wireless network;

operating the receiving device to recognize the MAC frame as the indicated frame transmission type; and

operating the receiving device to process the payload portion of the MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type.

10. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 9, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

11. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 9, wherein the broadcast interval duration of the sending device is an integer value in seconds between successive broadcast periods, wherein each broadcast period is a duration of time during which MAC frames of the broadcast network discovery frame type are successively transmitted at a set interval.

12. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 11, wherein the broadcast interval duration is within a range extending from 1 second to 255 seconds, and wherein the broadcast period duration is 1 second, and wherein the set interval is within a range extending from 6 milliseconds to 19 milliseconds.

13. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 11, wherein the response interval duration for the receiving device is a maximum number of broadcast intervals that are allowed to pass before the receiving device should communicate its status to the sending device.

14. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 9, wherein the type of data included within the data portion of the payload of the broadcast network discovery frame includes one or more of device date and time, device identification, device location, device velocity, and device differential global positioning system correction.

15. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a command frame transmission type, and

defining a payload portion of the MAC frame to include,

an identification of a device type of the sending device,

an identification of a message type as the command frame,

a specification of a length of data included within the data portion of the payload of the command frame,

an identification of a type of command communicated in the command frame,

the data portion of the payload of the command frame, and

a specification of cyclic redundancy data associated with the payload of the command frame;

operating the sending device to transmit the generated MAC frame over the wireless network;

operating a receiving device to receive the MAC frame over the wireless network;

operating the receiving device to recognize the MAC frame as the indicated frame transmission type; and

operating the receiving device to process the payload portion of the MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type.

16. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 15, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

17. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a data frame transmission type, and

defining a payload portion of the MAC frame to include,
an identification of a device type of the sending device,
an identification of a message type as the data frame,
a specification of a length of data included within the data portion of the payload
of the data frame,

an identification of a packet type associated with the data included within the data
portion of the payload of the data frame,

the data portion of the payload of the data frame, and

a specification of cyclic redundancy data associated with the payload of the data
frame;

operating the sending device to transmit the generated MAC frame over the wireless
network;

operating a receiving device to receive the MAC frame over the wireless network;

operating the receiving device to recognize the MAC frame as the indicated frame
transmission type; and

operating the receiving device to process the payload portion of the MAC frame in
accordance with the payload specification of the distributed asset management protocol
corresponding to the indicated frame transmission type.

18. The method for communicating data over the wireless network in accordance with
the distributed asset management protocol as recited in claim 17, wherein the device type of the
sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a
tag device.

19. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 17, wherein the identification of the packet type includes identification of the data included within the data portion of the payload of the data frame as either stored data or real-time data.

20. A method for communicating data over a wireless network in accordance with a distributed asset management protocol, comprising:

operating a sending device to generate a medium access control (MAC) frame to be transmitted over the wireless network, wherein generating the MAC frame includes,

setting a frame control field of the MAC frame to indicate a acknowledgement frame transmission type, and

defining a payload portion of the MAC frame to include,

an identification of a device type of the sending device,

an identification of a message type as the acknowledgement frame,

a specification of a length of the acknowledgement frame,

a specification of an acknowledgement value as either successful acknowledgement or failed acknowledgement,

an identification of a sequence number of a communication that is acknowledged by the acknowledgement frame,

an identification of a packet identifier that is acknowledged by the acknowledgement frame in the case of a successful acknowledgement, or an identification of an error type in the case of a failed acknowledgement,

a specification of a ready state of the sending device,
a specification of a incrementing counter value indicating a sequence of processed commands,
a specification of a sleep timer value used by the sending device,
an identification of a current network channel used by the sending device for communication over the wireless network, and
a specification of cyclic redundancy data associated with the payload of the acknowledgement frame;
operating the sending device to transmit the generated MAC frame over the wireless network;
operating a receiving device to receive the MAC frame over the wireless network;
operating the receiving device to recognize the MAC frame as the indicated frame transmission type; and
operating the receiving device to process the payload portion of the MAC frame in accordance with the payload specification of the distributed asset management protocol corresponding to the indicated frame transmission type.

21. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 20, wherein the device type of the sending device is one of a fixed reader device, a mobile reader device, a handheld device, and a tag device.

22. The method for communicating data over the wireless network in accordance with the distributed asset management protocol as recited in claim 20, wherein the specification of the ready state of the sending device is zero if the sending device is ready to receive more data, and wherein the specification of the ready state of the sending device is a number of seconds greater than zero to be delayed before the sending device is ready to receive more data.