

## CLAIMS

1. An apparatus for wireless communication, comprising:  
a processor;  
memory in electronic communication with the processor; and  
instructions stored in the memory and operable, when executed by the processor,  
to cause the apparatus to:  
  - power on, according to a duty cycle, a wakeup radio of the apparatus to receive a wakeup signal physical layer conversion protocol (PLCP) protocol data unit (PPDU), the duty cycle comprising periodic transmission times during which an access point (AP) transmits the wakeup signal PPDU, the wakeup signal PPDU comprising a preamble and a wakeup message, the preamble comprising a first portion and a second portion, the wakeup message comprising a plurality of station identifiers arranged in ascending order according to a wakeup frequency associated with each station identifier of the plurality of station identifiers;
  - receive, at the powered-on wakeup radio of the apparatus, the first portion of the preamble of the wakeup signal PPDU and the second portion of the preamble of the wakeup signal PPDU from the AP, the first portion having a first bandwidth and the second portion having a second bandwidth narrower than the first bandwidth, the second portion of the preamble being a preamble to the wakeup message of the wakeup signal PPDU;
  - receive, from the AP at the powered-on wakeup radio of the apparatus, the wakeup message of the wakeup signal PPDU, the wakeup message having the second bandwidth narrower than the first bandwidth and following the received second portion of the preamble;
  - identify, in the received wakeup message, an indication of a station identifier from the plurality of station identifiers arranged in ascending order according to the wakeup frequency, the station identifier associated with the apparatus to be activated by the wakeup message; and
  - power on a primary radio of the apparatus based at least in part on receiving the wakeup message at the powered-on wakeup radio and identifying the

station identifier.

2. The apparatus of claim 1, wherein the instructions to receive the wakeup message are executable by the processor to cause the apparatus to:

listen for the wakeup message after a predetermined interval following the received first portion of the preamble.

3. The apparatus of claim 2, wherein the predetermined interval comprises a gap, or a dummy block, or a combination thereof.

4. The apparatus of claim 1, wherein the second bandwidth of the wakeup signal PPDU is less than or equal to 5 MHz.

5. The apparatus of claim 1, wherein the wakeup message comprises an identifier bitmap, or a bloom filter indication, or a combination thereof, for one or more stations to be activated.

6. The apparatus of claim 1, wherein the wakeup message comprises a frame control field, or a sender address field, or a timing synchronization function (TSF) field, or a paged device identifier field, or a service set identifier (SSID) hash field, or a control message field, or a combination thereof.

7. The apparatus of claim 1, wherein the instructions are further executable by the processor to cause the apparatus to:

receive a frame control field in the wakeup message; and

identify a presence of one or more fields of the wakeup message based at least in part on the received frame control field.

8. The apparatus of claim 7, wherein the one or more fields of the frame control field comprise a version field, or a length field, or a paging field, or a control field, or a service set identifier (SSID) field, or a broadcast field, or a combination thereof.

9. The apparatus of claim 1, wherein the instructions are further executable by the processor to cause the apparatus to:

monitor for a service set identifier (SSID) hash field in the wakeup message for an

identifier of a station.

10. The apparatus of claim 1, wherein the instructions are further executable by the processor to cause the apparatus to:

identify a jitter pattern to be used by the AP to transmit the wakeup message;  
listen, using the powered-on wakeup radio, for the wakeup message during a plurality of wakeup listening periods based at least in part on the identified jitter pattern; and  
receive the wakeup message during at least one of the plurality of wakeup listening periods.

11. The apparatus of claim 10, wherein the instructions are further executable by the processor to identify the jitter pattern by being executable by the processor to cause the apparatus to receive an indication of the jitter pattern from the AP during association.

12. The apparatus of claim 10, wherein the jitter pattern modifies time intervals between the plurality of wakeup listening periods.

13. The apparatus of claim 1, wherein the instructions are further executable by the processor to cause the apparatus to:

determine a rotating identifier associated with the AP based at least in part on a received identifier key;  
receive a sender identifier in the received wakeup message;  
compare the sender identifier with the determined rotating identifier; and  
power on a second radio of the apparatus based at least in part on the comparison.

14. The apparatus of claim 13, wherein the instructions are further executable by the processor to determine the rotating identifier by being executable by the processor to cause the apparatus to calculate the rotating identifier using:

an inner hash function, or an outer hash function, or a combination thereof; and  
a time value, or a sequence number value, or a combination thereof.

15. The apparatus of claim 13, wherein the instructions are further executable by the processor to cause the apparatus to:

associate with the AP, wherein the received identifier key is received from the AP

during association.

16. The apparatus of claim 1, wherein the first portion of the preamble comprises a legacy short training (L-STF) field, a legacy long training (L-LTF) field, and a legacy signal (L-SIG) field.

17. An apparatus for wireless communication, in a system comprising:  
a processor;  
memory in electronic communication with the processor; and  
instructions stored in the memory and operable, when executed by the processor,  
to cause the apparatus to:

identify a plurality of wakeup transmission periods corresponding to a duty cycle for a station to be powered on to receive wakeup signal physical layer conversion protocol (PLCP) protocol data unit (PPDUs), the duty cycle comprising periodic transmission times during which an access point (AP) transmits the wakeup signal PPDUs, each of the wakeup signal PPDUs comprising a preamble and a wakeup message, the preamble comprising a first portion and a second portion;

identify two or more stations to be activated by the AP;

transmit, to a wakeup radio of the station during a wakeup transmission period of the plurality of wakeup transmission periods, the first portion of the preamble of the wakeup signal PPDU and the second portion of the preamble of the wakeup signal PPDU, the first portion having a first bandwidth and the second portion having a second bandwidth narrower than the first bandwidth, the second portion of the preamble being a preamble to the wakeup message of the wakeup signal PPDU; and

transmit, during the wakeup transmission period, the wakeup message of the wakeup signal PPDU to the wakeup radio of the station, the wakeup message having a second bandwidth narrower than the first bandwidth and following the transmitted second portion of the preamble, the wakeup message comprising an indication of a plurality of station identifiers associated with the identified two or more stations to be activated by the wakeup message transmitted by the AP, the plurality of station identifiers arranged in ascending order according to a wakeup frequency associated with each station of the two or more stations.

18. The apparatus of claim 17, wherein the instructions are further executable by the processor to cause the apparatus to:

wait a predetermined interval after transmitting the first portion of the preamble to transmit the wakeup message.

19. The apparatus of claim 17, wherein the instructions are further executable by the processor to cause the apparatus to:

transmit one or more dummy symbols between the first portion of the preamble and the second portion of the preamble.

20. The apparatus of claim 17, wherein:

a predetermined interval comprises a gap, or a dummy block, or a combination thereof; and

the second bandwidth of the wakeup signal PPDU is less than or equal to 5 MHz.

21. The apparatus of claim 17, wherein the instructions are further executable by the processor to cause the apparatus to:

transmit a frame control field in the wakeup message to indicate a presence of one or more fields of the wakeup message.

22. The apparatus of claim 17, wherein the instructions are further executable by the processor to cause the apparatus to:

identify a jitter pattern for the plurality of wakeup transmission periods; and

transmit, during at least one of the plurality of wakeup transmission periods, the wakeup message to the wakeup radio of the station based at least in part on the jitter pattern.

23. The apparatus of claim 22, wherein the instructions are further executable by the processor to cause the apparatus to transmit an indication of the jitter pattern to the station during association.

24. The apparatus of claim 17, wherein the instructions are further executable by the processor to cause the apparatus to:

transmit an identifier key to the station;

determine a rotating identifier based at least in part on the identifier key; and

transmit a sender identifier in the wakeup message, the sender identifier corresponding to the determined rotating identifier.

25. The apparatus of claim 24, wherein the instructions are further executable by the processor to cause the apparatus to:

associate with the station, wherein the identifier key is transmitted to the station during association.

26. A method for wireless communication at a station, comprising:

powering on, according to a duty cycle, a wakeup radio of the station to receive a wakeup signal physical layer conversion protocol (PLCP) protocol data unit (PPDU), the duty cycle comprising periodic transmission times during which an access point (AP) transmits the wakeup signal PPDU, the wakeup signal PPDU comprising a preamble and a wakeup message, the preamble comprising a first portion and a second portion, the wakeup message comprising a plurality of station identifiers arranged in ascending order according to a wakeup frequency associated with each station identifier of the plurality of station identifiers;

receiving, at the powered-on wakeup radio of the station, the first portion of the preamble of the wakeup signal PPDU and the second portion of the preamble of the wakeup signal PPDU from the AP, the first portion having a first bandwidth and the second portion having a second bandwidth narrower than the first bandwidth, the second portion of the preamble being a preamble to the wakeup message of the wakeup signal PPDU;

receiving, from the AP at the powered-on wakeup radio of the station, the wakeup message of the wakeup signal PPDU, the wakeup message having the second bandwidth narrower than the first bandwidth and following the received second portion of the preamble;

identifying, in the received wakeup message, an indication of a station identifier from the plurality of station identifiers arranged in ascending order according to the wakeup frequency, the station identifier corresponding to the station to be activated by the wakeup message; and

powering on a primary radio of the station based at least in part on receiving the wakeup message at the powered-on wakeup radio and identifying the station identifier.

27. A method for wireless communication at an access point (AP),

comprising:

identifying a plurality of wakeup transmission periods corresponding to a duty cycle for a station to be powered on to receive wakeup signal physical layer conversion protocol (PLCP) protocol data unit (PPDUs), the duty cycle comprising periodic transmission times during which the AP transmits the wakeup signal PPDUs, each of the wakeup signal PPDUs comprising a preamble and a wakeup message, the preamble comprising a first portion and a second portion

identifying two or more stations to be activated by the AP;

transmitting, to a wakeup radio of the station during a wakeup transmission period of the plurality of wakeup transmission periods, the first portion of the preamble of the wakeup signal PPDU and the second portion of the preamble of the wakeup signal PPDU, the first portion having a first bandwidth and the second portion having a second bandwidth narrower than the first bandwidth, the second portion of the preamble being a preamble to the wakeup message of the wakeup signal PPDU; and

transmitting, during the wakeup transmission period, the wakeup message of the wakeup signal PPDU to the wakeup radio of the station, the wakeup message having a second bandwidth narrower than the first bandwidth and following the transmitted second portion of the preamble, the wakeup message comprising an indication of a plurality of station identifiers, the plurality of station identifiers corresponding to the two or more stations to be activated by the wakeup message transmitted by the AP, the plurality of station identifiers arranged in ascending order according to a wakeup frequency associated with each station of the two or more stations.