

CLAIMS

1. A method for wireless communications, comprising:
performing a clear channel assessment (CCA) at a base station to determine availability of an unlicensed spectrum;
transmitting, by the base station, a first waveform having a subframe to a set of user equipments (UEs) over the unlicensed spectrum when a determination is made that the unlicensed spectrum is available, wherein the subframe comprises a first component configured to be readable by a WiFi device and a second component configured to be readable by a cellular device; and
receiving responsive to the first waveform, a second waveform, from one or more of the set of UEs, each second waveform being received over the unlicensed spectrum and being configured to indicate that the respective UE has channel access over the unlicensed spectrum to receive data from the base station.
2. The method of claim 1, further comprising:
transmitting data to the one or more of the set of UEs over the unlicensed spectrum.
3. The method of claim 2, further comprising:
transmitting one or both of a synchronization waveform and a training waveform to the one or more of the set of UEs over the unlicensed spectrum.

4. The method of claim 1, wherein:
the first component is configured to cause WiFi devices to avoid accessing the available unlicensed spectrum; and
the second component is configured to indicate a time period during which the base station has channel access over the unlicensed spectrum.
5. The method of claim 1, wherein the cellular device comprises an LTE device operating in an unlicensed spectrum.
6. The method of claim 1, wherein the same first component of the subframe is used by each base station in an operator deployment.
7. The method of claim 1, wherein a different second component of the subframe is used by each base station in an operator deployment.
8. The method of claim 1, wherein the first component of the subframe comprises a physical layer convergence procedure (PLCP) header and a WiFi-readable data field.
9. The method of claim 1, wherein the first waveform is configured to indicate a first time period and a second time period during which the base station has channel access over an unlicensed spectrum.
10. The method of claim 9, wherein:
performing a CCA comprises performing the CCA during a subframe;
the first time period indicates that the base station has channel access over the unlicensed spectrum until the end of the subframe or until a time during a next subframe; and

the second time period indicates that the base station has channel access over the unlicensed spectrum for a specified period of time after the subframe or after a time during a next subframe.

11. The method of claim 1, wherein:

the subframe is transmitted using a single radio access technology.

12. A base station for wireless communications, comprising:

a processor;

memory in electronic communication with the processor;
and

instructions stored in the memory, the instructions being executable by the processor to:

perform a clear channel assessment (CCA) to determine availability of an unlicensed spectrum;

transmit a first waveform having a subframe to a set of user equipments (UEs) over the unlicensed spectrum when a determination is made that the unlicensed spectrum is available, wherein the subframe comprises a first component configured to be readable by a WiFi device and a second component configured to be readable by a cellular device; and

receive responsive to the first waveform, a second waveform, from one or more of the set of UEs, each second waveform being received over the unlicensed spectrum and being configured to indicate that the respective UE has channel access over the unlicensed spectrum to receive data from the base station.

13. The base station of claim 12, wherein the instructions are executable by the processor to:

transmit data to the one or more of the set of UEs over the unlicensed spectrum.

14. The base station of claim 13, wherein the instructions are executable by the processor to:

transmit one or both of a synchronization waveform and a training waveform to the one or more of the set of UEs over the unlicensed spectrum.

15. The base station of claim 12, wherein the cellular device comprises an LTE device operating in an unlicensed spectrum.

16. The base station of claim 12, wherein the same first component of the subframe is used by each base station in an operator deployment.

17. The base station of claim 12, wherein a different second component of the subframe is used by each base station in an operator deployment.

18. The base station of claim 12, wherein the first component of the subframe comprises a physical layer convergence procedure (PLCP) header and a WiFi-readable data field.

19. The base station of claim 12, wherein the first waveform is configured to indicate a first time period and a second time period during which the base station has channel access over an unlicensed spectrum.

20. The base station of claim 19, wherein:

the instructions executable by the processor to perform a CCA comprise instructions executable by the processor to perform the CCA during a subframe;

the first time period indicates that the base station has channel access over the unlicensed spectrum until the end of the subframe or until a time during a next subframe; and

the second time period indicates that the base station has channel access over the unlicensed spectrum for a specified period of time after the subframe or after a time during a next subframe.

- 21.** A method for wireless communications, comprising:
 receiving at a user equipment (UE) a first waveform
 having a subframe, wherein the subframe comprises a
 first component configured to be readable by a WiFi
 device and a second component configured to be read-
 able by a cellular device;
 performing responsive to the first waveform, a clear
 channel assessment (CCA) to determine availability of
 an unlicensed spectrum for the UE; and
 transmitting a second waveform and a third waveform
 over the unlicensed spectrum when a determination is
 made that the unlicensed spectrum is available, the
 second waveform being configured to indicate to
 nearby WiFi devices that a base station has channel
 access over the unlicensed spectrum and the third
 waveform being configured to provide information to
 the base station for data transmissions to the UE.
- 22.** The method of claim **21**, further comprising:
 identifying one of a set of second waveform slots; and
 transmitting the second waveform during the identified
 second waveform slot.
- 23.** The method of claim **22**, wherein the identifying
 comprises identifying the second waveform slot to stagger
 the second waveform slot relative to a second waveform slot
 identified by another UE in a same operator deployment.
- 24.** The method of claim **21**, wherein transmitting the
 third waveform comprises transmitting reference symbols
 for one or both of channel estimation and channel synchro-
 nization.
- 25.** A user equipment (UE) for wireless communications,
 comprising:
 a processor;
 memory in electronic communication with the processor;
 and

instructions stored in the memory, the instructions being executable by the processor to:

receive a first waveform having a subframe, wherein the subframe comprises a first component configured to be readable by a WiFi device and a second component configured to be readable by a cellular device;

perform responsive to the first waveform, a clear channel assessment (CCA) to determine availability of an unlicensed spectrum for the UE; and

transmit a second waveform and a third waveform over the unlicensed spectrum when a determination is made that the unlicensed spectrum is available, the second waveform being configured to indicate to nearby WiFi devices that a base station has channel access over the unlicensed spectrum and the third waveform being configured to provide information to the base station for data transmissions to the UE.

26. The UE of claim **25**, wherein the instructions executable by the processor to transmit the third waveform include instructions executable by the processor to transmit reference symbols for one or both of channel estimation and channel synchronization.

27. The UE of claim **25**, wherein the instructions are executable by the processor to:

identify one of a set of second waveform slots; and

transmit the second waveform during the identified second waveform slot.

28. The UE of claim **27**, wherein the instructions executable by the processor to identify one of a set of second waveform slots include instructions executable by the processor to identify the second waveform slot to stagger the second waveform slot relative to a second waveform slot identified by another UE in a same operator deployment.