CLAIMS

1. A method for wireless communications by a base station (BS), comprising: generating a primary synchronization signal (PSS) utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and transmitting the PSS and a secondary synchronization signal (SSS) to a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth.

2. The method of claim 1, wherein the at least one sequence comprises a base sequence and wherein the base sequence comprises a Zadoff-Chu sequence of size 11 with root index 5.

3. The method of claim 1, wherein the at least one sequence is selected from a set of candidate base sequences corresponding to a set of optimized PSS candidates.

4. The method of claim 3, wherein the set of optimized PSS candidates are evaluated using an optimization procedure involving a sliding autocorrelation function of candidate sequences for a given binary code cover.

5. The method of claim 1, wherein the at least one sequence comprises a pair of sequences.

6. The method of claim 5, wherein the pair of sequences comprises one of orthogonal sequences or quasi-orthogonal sequences.

7. The method of claim 5, further comprising: determining the pair of sequences based, at least in part, on an interpolation of Zadoff-Chu sequences.

8. The method of claim 1, wherein the PSS and SSS is based on a short Zadoff-Chu sequence.

9. The method of claim 1, wherein transmitting the PSS and SSS comprises: transmitting the PSS and SSS in adjacent subframes in the frame.

10. The method of claim 1, wherein the number of symbols are mapped to resource elements that have a same subcarrier spacing as resource elements used to communicate with a second type of UE that communicates on the wider system bandwidth.

11. The method of claim 10, wherein the PSS and SSS are transmitted using resource elements of the one or more subframes not used for communicating with the second type of UE.

12. The method of claim 1, wherein the SSS is used to convey a cell identification (cell ID) and additional system information.

13. The method of claim 12, wherein the additional system information comprises at least a subframe ID.

14. The method of claim 1, further comprising: generating the SSS based on quasi-orthogonal sequences.

15. A method for wireless communications by a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth, comprising: detecting, within the one or more narrowband regions of the wider system bandwidth, a primary synchronization signal (PSS) generated utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and performing an initial time and frequency acquisition based on the detected PSS.

16. The method of claim 15, wherein the at least one sequence comprises a base sequence and wherein the base sequence comprises a Zadoff-Chu sequence of size 11 with root index 5.

17. The method of claim 15, wherein performing the initial time and frequency acquisition involves a sliding auto-correlation procedure of the PSS in the time domain.

18. The method of claim 17, wherein the sliding auto-correlation procedure involves performing symbol-wise correlation between adjacent and non-adjacent PSS symbols.

19. The method of claim 15, wherein: detection of the PSS is performed based on PSS re-transmissions over a plurality of subframes.

20. The method of claim 19, wherein the detection of the PSS involves coherent accumulation of PSS re-transmissions.

21. The method of claim 15, wherein the initial time and frequency acquisition are performed in the time domain.

22. The method of claim 15, wherein performing the initial time acquisition comprises: performing a coarse and fine symbol boundary estimation for the PSS.

23. The method of claim 22, wherein performing the initial frequency acquisition comprises: performing a fractional frequency offset correction, from the PSS, based on autocorrelation in time domain of the time-synchronized PSS to find a fractional carrier frequency offset (CFO); and performing an integer frequency offset correction, from the PSS, based a cross correlation between the PSS and a replica of the received signal in the time domain, to find an integer CFO of the PSS.

24. The method of claim 15, wherein the number of symbols are mapped to resource elements that have a same subcarrier spacing as resource elements used to communicate with a second type of UE that communicates on the wider system bandwidth.

25. The method of claim 24, wherein the PSS is received using resource elements of the one or more subframes not used for communicating with the second type of UE.

26. The method of claim 15, wherein the PSS is based on a short Zadoff-Chu sequence.

27. The method of claim 15, further comprising: detecting, within the one or more narrowband regions, a secondary synchronization signal (SSS); and refining the initial time and frequency acquisition based, at least in part, on the detected SSS.

28. The method of claim 27, wherein the PSS and SSS are received on adjacent subframes of the frame.

29. The method of claim 27, further comprising: determining, from the SSS, a cell identification (cell ID) and additional system information.

30. The method of claim 29, wherein the additional system information comprises at least a subframe ID.

31. An apparatus for wireless communications by a base station (BS), comprising: means for generating a primary synchronization signal (PSS) utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and means transmitting the PSS and a secondary synchronization signal (SSS) to a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth.

32. An apparatus for wireless communications by a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth, comprising: means for detecting, within the one or more narrowband regions of the wider system bandwidth, a primary synchronization signal (PSS) generated utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and means for performing an initial time and frequency acquisition based on the detected PSS.

33. An apparatus for wireless communication by base station (BS), comprising: at least one processor configured to: generate a primary synchronization signal (PSS) utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and transmit the PSS and a secondary synchronization signal (SSS) to a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth; and a memory coupled to the at least one processor.

34. An apparatus for wireless communications by a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth, comprising: at least one processor configured to: detect, within the one or more narrowband regions of the wider system bandwidth, a primary synchronization signal (PSS) generated utilizing a binary

code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and perform an initial time and frequency acquisition based on the detected PSS and a memory coupled to the at least one processor.

35. A computer readable medium for wireless communication by a base station (BS) having instructions stored thereon for: generating a primary synchronization signal (PSS) utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and transmitting the PSS and a secondary synchronization signal (SSS) to a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth.

36. A computer readable medium for wireless communication by a first type of user equipment (UE) that communicates on one or more narrowband regions of a wider system bandwidth, having instructions stored thereon for: detecting, within the one or more narrowband regions of the wider system bandwidth, a primary synchronization signal (PSS) generated utilizing a binary code cover and at least one sequence applied to a number of symbols within one or more subframes of a frame, wherein the binary code cover comprises a length=11 symbol sequence of [1 1 1 1 −1 −1 1 1 1 −1 1]; and performing an initial time and frequency acquisition based on the detected PSS.