CLAIMS

~~**WHAT IS CLAIMED IS:**~~

1. A method (1000) for assisting a position determination of a user equipment~~ (~~, UE (120) communicating over a shared communication medium in unlicensed spectrum~~,~~ (344), comprising:

receiving~~,~~ (1002), at the UE~~,~~ (120), positioning assistance data, the positioning assistance data comprising a plurality of positioning reference signal~~ (~~, PRS~~)~~, configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;

measuring~~,~~ (1004), by the UE (120) at a first positioning occasion of the common set of positioning occasions, a first PRS from a first evolved NodeB~~ (~~, eNB (110B) for a first secondary cell of the plurality of secondary cells, wherein the first eNB transmits the first PRS on the shared communication medium, and wherein the first PRS is configured according to a first PRS configuration of the plurality of PRS configurations;

measuring~~,~~ (1006), by the UE (120) at a second positioning occasion of the common set of positioning occasions, a second PRS from a second eNB (110C) for a second secondary cell of the plurality of secondary cells, wherein the second eNB transmits the second PRS on the shared communication medium, and wherein the second PRS is configured according to a second PRS configuration of the plurality of PRS configurations; and

sending~~,~~ (1008), by the UE~~,~~ (120), the measurement of the first PRS, the measurement of the second PRS, an identification of the first PRS configuration, and an identification of the second PRS configuration to a location server~~.~~ (170).

2. The method (1000) of claim 1, wherein the UE (120) measures PRS for the plurality of secondary cells based on the positioning assistance data comprising the plurality of PRS configurations.

3. The method (1000) of claim 1, ~~wherein only one eNB for the plurality of secondary cells transmits a PRS during a given positioning occasion.~~further comprising:

~~4. The method of claim 1, wherein the location server determines the position of the UE based at least in part on the measurement of the first PRS, the measurement of the second PRS, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB, and a location of the second eNB.~~

~~5. The method of claim 1, wherein:~~

~~the first eNB transmits the first PRS on the shared communication medium upon winning access to the shared communication medium, and~~

~~the second eNB transmits the second PRS on the shared communication medium upon winning access to the shared communication medium.~~

~~6. The method of claim 1, further comprising:~~

measuring, by the UE (120) at a third positioning occasion of the common set of positioning occasions, a third PRS from a third eNB (110D) for a third secondary cell of the plurality of secondary cells, wherein the third eNB transmits the third PRS on the shared communication medium, and wherein the third PRS is configured according to a third PRS configuration of the plurality of PRS configurations; and

sending, by the UE~~,~~ (120), the measurement of the third PRS and an identification of the third PRS configuration to the location server~~.~~ (170).

~~7. The method of claim 1, wherein the UE sends the measurement of the first PRS and the measurement of the second PRS to the location server based on an accuracy of the measurement of the first PRS and an accuracy of the measurement of the second PRS being above a threshold.~~

~~8. The method of claim 1, wherein the measurement of the first PRS and the measurement of the second PRS are measurements of a reference signal time difference (RSTD) for Observed Time Of Arrival (OTDOA) positioning for a Long Term Evolution (LTE) wireless access.~~

~~9. The method of claim 1, wherein the first eNB and the second eNB are the same eNB and the first secondary cell and the second secondary cell are different cells of the same eNB.~~

~~10~~4. A method (1100) at a location server (170) for determining a position of a user equipment (UE) communicating over a shared communication medium in unlicensed spectrum, comprising:

sending~~,~~ (1102), by the location server~~,~~ (170), positioning assistance data to the UE~~,~~ (120), the positioning assistance data comprising a plurality of positioning reference signal ~~(~~, PRS~~)~~, configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, wherein the plurality of secondary cells are in contention for the common set of positioning occasions;

receiving~~,~~ (1104), at the location server (170) from the UE~~,~~ (120), a first measurement of a first PRS for a first PRS configuration of the plurality of PRS configurations, a second measurement of a second PRS for a second PRS configuration of the plurality of PRS configurations, an identification of the first PRS configuration, and an identification of the second PRS configuration, wherein the first PRS is transmitted by a first evolved NodeB ~~(~~, eNB, (110B) for a first secondary cell of the plurality of secondary cells at a first positioning occasion of the common set of positioning occasions, and wherein the second PRS is transmitted by a second eNB (110C) for a second secondary cell of the plurality of secondary cells at a second positioning occasion of the common set of positioning occasions; and

determining~~,~~ (1106), by the location server~~,~~ (170), the position of the UE (120) based at least in part on the first measurement, the second measurement, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB and a location of the second eNB.

~~11~~5. The method (1100) of claim ~~10~~4, further comprising:

receiving, by the location server (170) from the first eNB~~,~~ (110B), the first PRS configuration of the plurality of PRS configurations; and

receiving, by the location server (170) from the second eNB~~,~~ (110C), the second PRS configuration of the plurality of PRS configurations.

~~12~~6. The method (1100) of claim ~~10, wherein an eNB for only one of the plurality of secondary cells transmits a PRS during a given positioning occasion of the common set of positioning occasions.~~

~~13. The method of claim 10, wherein:~~

~~the first eNB transmits the first PRS on the shared communication medium upon winning access to the shared communication medium, and~~

~~the second eNB transmits the second PRS on the shared communication medium upon winning access to the shared communication medium.~~

~~14. The method of claim 10~~4, further comprising:

receiving, at the location server (170) from the UE~~,~~ (120), a third measurement of a third PRS for a third PRS configuration of the plurality of PRS configurations and an identification of the third PRS configuration, wherein the third PRS is transmitted by a third eNB (110D) for a third secondary cell of the plurality of secondary cells at a third positioning occasion of the common set of positioning occasions.

~~15~~7. The method (1100) of claim ~~14~~6, further comprising:

determining, by the location server~~,~~ (170), the position of the UE (120) based at least in part on the third measurement, the identification of the third PRS configuration, and a location of the third eNB.

~~16~~8. The method (1000, 1100) of claim ~~10, wherein the UE sends the first measurement of the first PRS and the second measurement of the second PRS to the location server based on an accuracy of the first measurement of the first PRS and an accuracy of the second measurement of the second PRS being above a threshold.~~

~~17. The method of claim 10~~1 or 4, wherein the first measurement of the first PRS and the second measurement of the second PRS are measurements of a reference signal time difference ~~(~~, RSTD~~)~~, for Observed Time Of Arrival ~~(~~, OTDOA~~)~~, positioning for a Long Term Evolution ~~(~~, LTE~~)~~, wireless access.

~~18. The method of claim 10, wherein the first eNB and the second eNB are the same eNB and the first secondary cell and the second secondary cell are different cells of the same eNB.~~

~~19. An apparatus~~9. A user equipment, UE (120), for assisting a position determination of ~~a user equipment (~~the UE (120) communicating over a shared communication medium in unlicensed spectrum~~,~~ (344), comprising:

~~a transceiver of the UE configured to:~~

~~receive~~means for receiving positioning assistance data, the positioning assistance data comprising a plurality of positioning reference signal ~~(~~, PRS~~)~~, configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions; ~~and~~

~~at least one processor of the UE configured to:~~

~~measure~~means for measuring, at a first positioning occasion of the common set of positioning occasions, a first PRS from a first evolved NodeB ~~(~~, eNB, (110B) for a first secondary cell of the plurality of secondary cells, wherein the first eNB transmits the first PRS on the shared communication medium, and wherein the first PRS is configured according to a first PRS configuration of the plurality of PRS configurations;

~~measure~~means for measuring, at a second positioning occasion of the common set of positioning occasions, a second PRS from a second eNB (110C) for a second secondary cell of the plurality of secondary cells, wherein the second eNB transmits the second PRS on the shared communication medium, and wherein the second PRS is configured according to a second PRS configuration of the plurality of PRS configurations; and

~~cause the transceiver to send~~means for sending the measurement of the first PRS, the measurement of the second PRS, an identification of the first PRS configuration, and an identification of the second PRS configuration to a location server~~.~~ (170).

~~20~~10. The ~~apparatus~~UE (120) of claim ~~19~~9, wherein the UE ~~measures~~(120) is adapted to measure PRS for the plurality of secondary cells based on the positioning assistance data comprising the plurality of PRS configurations.

~~21~~11. The ~~apparatus~~UE (120) of claim ~~19~~9, wherein ~~only one eNB for the plurality of secondary cells transmits a PRS during a given positioning occasion.~~

~~22. The apparatus of claim 19, wherein the location server determines the position of the UE based at least in part on the measurement of the first PRS, the measurement of the second PRS, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB, and a location of the second eNB.~~

~~23. The apparatus of claim 19, wherein:~~

~~the first eNB transmits the first PRS on the shared communication medium upon winning access to the shared communication medium, and~~

~~the second eNB transmits the second PRS on the shared communication medium upon winning access to the shared communication medium.~~

~~24. The apparatus of claim 19, wherein the at least one processor is further configured to:~~

~~measure, at a third positioning occasion of the common set of positioning occasions, a third PRS from a third eNB for a third secondary cell of the plurality of secondary cells, wherein the third eNB transmits the third PRS on the shared communication medium, and wherein the third PRS~~the UE (120) is ~~configured according to a third PRS configuration of the plurality of PRS configurations; and~~

~~cause the transceiver~~adapted to send the measurement of the ~~third PRS to the location server.~~

~~25. The apparatus of claim 19, wherein the UE sends the measurement of the~~ first PRS and the measurement of the second PRS to the location server based on an accuracy of the measurement of the first PRS and an accuracy of the measurement of the second PRS being above a threshold.

~~26~~12. The ~~apparatus~~UE (120) of claim ~~19~~9, wherein the measurement of the first PRS and the measurement of the second PRS are measurements of a reference signal time difference ~~(,~~ RSTD~~),~~ for Observed Time Of Arrival ~~(,~~ OTDOA~~),~~ positioning for a Long Term Evolution ~~(,~~ LTE~~),~~ wireless access.

~~27. The apparatus of claim 19, wherein the first eNB and the second eNB are the same eNB and the first secondary cell and the second secondary cell are different cells of the same eNB.~~

~~28. An apparatus~~13. A location server (170) for determining a position of a user equipment~~ (~~, UE (120) communicating over a shared communication medium in unlicensed spectrum~~, (344),~~ comprising:

~~a communication device of a location server configured to:~~

~~send~~ means for sending positioning assistance data to the UE~~,~~ (120), the positioning assistance data comprising a plurality of positioning reference signal~~ (~~, PRS~~),~~ configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;~~ and~~

~~receive~~means for receiving, from the UE~~,~~ (120), a first measurement of a first PRS for a first PRS configuration of the plurality of PRS configurations, a second measurement of a second PRS for a second PRS configuration of the plurality of PRS configurations, an identification of the first PRS configuration, and an identification of the second PRS configuration, wherein the first PRS is transmitted by a first evolved NodeB~~ (~~, eNB (110B) for a first secondary cell of the plurality of secondary cells at a first positioning occasion of the common set of positioning occasions, and wherein the second PRS is transmitted by a second eNB (110C) for a second secondary cell of the plurality of secondary cells at a second positioning occasion of the common set of positioning occasions; and

~~at least one processor of the location server configured to:~~

~~determine the position of the UE based at least in part on the first measurement, the second measurement, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB, and a location of the second eNB.~~

~~29. The apparatus of claim 28, wherein the communication device is further configured to:~~

~~receive, from the first eNB, the first PRS configuration of the plurality of PRS configurations; and~~

~~receive, from the second eNB, the second PRS configuration of the plurality of PRS configurations.~~

30. The apparatus of claim 28, wherein an eNB for only one of the plurality of secondary cells transmits a PRS during a given positioning occasion of the common set of positioning occasions.

31. The apparatus of claim 28, wherein:

the first eNB transmits the first PRS on the shared communication medium upon winning access to the shared communication medium, and

the second eNB transmits the second PRS on the shared communication medium upon winning access to the shared communication medium.

32. The apparatus of claim 28, wherein the communication device is further configured to:

receive, from the UE, a third measurement of a third PRS for a third PRS configuration of the plurality of PRS configurations and an identification of the third PRS configuration, wherein the third PRS is transmitted by a third eNB for a third secondary cell of the plurality of secondary cells at a third positioning occasion of the common set of positioning occasions.

33. The apparatus of claim 32, wherein the at least one processor is further configured to:

determine the position of the UE based at least in part on the third measurement, the identification of the third PRS configuration, and a location of the third eNB.

34. The apparatus of claim 28, wherein the UE sends the first measurement of the first PRS and the second measurement of the second PRS to the location server based on an accuracy of the first measurement of the first PRS and an accuracy of the second measurement of the second PRS being above a threshold.

35. The apparatus of claim 28, wherein the first measurement of the first PRS and the second measurement of the second PRS are measurements of a reference signal time difference (RSTD) for Observed Time Of Arrival (OTDOA) positioning for a Long Term Evolution (LTE) wireless access.

~~36. The apparatus of claim 28, wherein the first eNB and the second eNB are the same eNB and the first secondary cell and the second secondary cell are different cells of the same eNB.~~

~~37. A user equipment (UE) apparatus for assisting a position determination of a UE communicating over a shared communication medium in unlicensed spectrum, comprising:~~

~~means for receiving positioning assistance data, the positioning assistance data comprising a plurality of positioning reference signal (PRS) configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;~~

~~means for measuring, at a first positioning occasion of the common set of positioning occasions, a first PRS from a first evolved NodeB (eNB) for a first secondary cell of the plurality of secondary cells, wherein the first eNB transmits the first PRS on the shared communication medium, and wherein the first PRS is configured according to a first PRS configuration of the plurality of PRS configurations;~~

~~means for measuring, at a second positioning occasion of the common set of positioning occasions, a second PRS from a second eNB for a second secondary cell of the plurality of secondary cells, wherein the second eNB transmits the second PRS on the shared communication medium, and wherein the second PRS is configured according to a second PRS configuration of the plurality of PRS configurations; and~~

~~means for sending the measurement of the first PRS, the measurement of the second PRS, an identification of the first PRS configuration, and an identification of the second PRS configuration to a location server.~~

~~38. A location server apparatus for determining a position of a user equipment (UE) communicating over a shared communication medium in unlicensed spectrum, comprising:~~

~~means for sending positioning assistance data to the UE, the positioning assistance data comprising a plurality of positioning reference signal (PRS) configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each~~

~~PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;~~

~~means for receiving, from the UE, a first measurement of a first PRS for a first PRS configuration of the plurality of PRS configurations, a second measurement of a second PRS for a second PRS configuration of the plurality of PRS configurations, an identification of the first PRS configuration, and an identification of the second PRS configuration, wherein the first PRS is transmitted by a first evolved NodeB (eNB) for a first secondary cell of the plurality of secondary cells at a first positioning occasion of the common set of positioning occasions, and wherein the second PRS is transmitted by a second eNB for a second secondary cell of the plurality of secondary cells at a second positioning occasion of the common set of positioning occasions; and~~

means for determining the position of the UE (120) based at least in part on the first measurement, the second measurement, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB, and a location of the second eNB.

14. The location server (170) of claim 13, wherein the first measurement of the first PRS and the second measurement of the second PRS are measurements of a reference signal time difference, RSTD, for Observed Time Of Arrival, OTDOA, positioning for a Long Term Evolution, LTE, wireless access.

~~39~~15. A non-transitory computer-readable medium storing computer-executable instructions for assisting a position determination of a user equipment ~~(~~, UE (120) communicating over a shared communication medium in unlicensed spectrum~~,~~ which, when executed by the UE, cause the UE to carry out a method in accordance with any of claims 1 to 3 or computer-executable instructions ~~comprising:~~for determining a position of said UE (120) which, when executed by a location server, cause the location server to carry out a method in accordance with any of claims 4 to 8.

~~at least one instruction instructing the UE to receive positioning assistance data, the positioning assistance data comprising a plurality of positioning reference signal (PRS) configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS~~

configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;

at least one instruction instructing the UE to measure, at a first positioning occasion of the common set of positioning occasions, a first PRS from a first evolved NodeB (eNB) for a first secondary cell of the plurality of secondary cells, wherein the first eNB transmits the first PRS on the shared communication medium, and wherein the first PRS is configured according to a first PRS configuration of the plurality of PRS configurations;

at least one instruction instructing the UE to measure, at a second positioning occasion of the common set of positioning occasions, a second PRS from a second eNB for a second secondary cell of the plurality of secondary cells, wherein the second eNB transmits the second PRS on the shared communication medium, and wherein the second PRS is configured according to a second PRS configuration of the plurality of PRS configurations; and

at least one instruction instructing the UE to send the measurement of the first PRS, the measurement of the second PRS, an identification of the first PRS configuration, and an identification of the second PRS configuration to a location server.

40. A non-transitory computer-readable medium storing computer-executable instructions for determining a position of a user equipment (UE) communicating over a shared communication medium in unlicensed spectrum, the computer-executable instructions comprising:

at least one instruction instructing a location server to send positioning assistance data to the UE, the positioning assistance data comprising a plurality of positioning reference signal (PRS) configurations for a plurality of secondary cells having overlapping coverage areas, each of the plurality of secondary cells having a different PRS configuration of the plurality of PRS configurations, wherein each PRS configuration of the plurality of PRS configurations includes a common set of positioning occasions, and wherein the plurality of secondary cells are in contention for the common set of positioning occasions;

at least one instruction instructing the location server to receive, from the UE, a first measurement of a first PRS for a first PRS configuration of the plurality of PRS configurations, a second measurement of a second PRS for a second PRS configuration of the plurality of PRS configurations, an identification of the first PRS configuration, and an identification of the second PRS configuration, wherein the first PRS is transmitted by a first

evolved NodeB (eNB) for a first secondary cell of the plurality of secondary cells at a first positioning occasion of the common set of positioning occasions, and wherein the second PRS is transmitted by a second eNB for a second secondary cell of the plurality of secondary cells at a second positioning occasion of the common set of positioning occasions; and

at least one instruction instructing the location server to determine the position of the UE based at least in part on the first measurement, the second measurement, the identification of the first PRS configuration, the identification of the second PRS configuration, a location of the first eNB, and a location of the second eNB.