

-40-

CLAIMS

What is claimed is:

1. A method of performing location determination by a user equipment (UE), the method comprising:
 - receiving Vehicle-to-Everything (V2X) information from an entity in a wireless network that provides V2X services, the V2X services comprising services for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N) or a combination thereof, wherein the V2X information comprises information from which an approximate location of the UE may be determined;
 - transmitting the V2X information to a location server to obtain positioning assistance data from the location server;
 - receiving positioning assistance data from the location server in response to the V2X information, the positioning assistance data comprising position information, identification, and Positioning Reference Signal (PRS) information for neighbor base stations;
 - receiving PRS signals from the neighbor base stations; and
 - performing position determination for the UE using the PRS signals.
2. The method of claim 1, wherein the V2X information is an identity and a location of the entity in the wireless network that provides V2X services.
3. The method of claim 1, wherein the V2X information is an identity of the entity in the wireless network that provides V2X services, wherein the location server uses the identity to obtain a location of the entity.
4. The method of claim 1, wherein the entity in the wireless network that provides V2X services is a road side unit.
5. The method of claim 1, wherein the V2X information is transmitted to the location server in a Provide Capability Message.

-41-

6. The method of claim 1, wherein the V2X information is transmitted to the location server in addition to or instead of a serving base station.

7. The method of claim 1, further comprising receiving PRS signals from the entity or a different entity in the wireless network that provides V2X services, wherein performing position determination for the UE using the PRS signals comprises using the PRS signals from the neighbor base stations and the entity or the different entity in the wireless network that provides V2X services.

8. The method of claim 7, wherein the positioning assistance data from the location server further comprises identification of and PRS information for the entity or the different entity in the wireless network that provides V2X services.

9. A user equipment (UE) that performs location determination, the UE comprising:

a wireless transceiver configured to wirelessly communicate with entities in a first wireless network that provides V2X services comprising services for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N), or a combination thereof and configured to wirelessly communicate with base stations in a second wireless network; and

at least one processor coupled to the wireless transceiver and configured to receive with the wireless transceiver Vehicle-to-Everything (V2X) information from an entity in the wireless network that provides V2X services, wherein the V2X information comprises information from which an approximate location of the UE may be determined, transmit with the wireless transceiver the V2X information to a location server to obtain positioning assistance data from the location server, receive with the wireless transceiver positioning assistance data from the location server in response to the V2X information, the positioning assistance data comprising position information, identification, and Positioning Reference Signal (PRS) information for neighbor base stations, receive PRS signals from the neighbor base stations with the wireless transceiver, and perform position determination for the UE using the PRS signals.

-42-

10. The UE of claim 9, wherein the V2X information is an identity of the entity in the wireless network that provides V2X services.

11. The UE of claim 9, wherein the entity in the wireless network that provides V2X services is a road side unit.

12. The UE of claim 9, wherein the V2X information is transmitted to the location server in a Provide Capability Message.

13. The UE of claim 9, wherein the V2X information is transmitted to the location server in addition to or instead of a serving base station.

14. The UE of claim 9, wherein the at least one processor is further configured to receive PRS signals from the entity or a different entity in the wireless network that provides V2X services, wherein performing position determination for the UE using the PRS signals comprises using the PRS signals from the neighbor base stations and the entity or the different entity in the wireless network that provides V2X services.

15. A method of performing location determination for a user equipment (UE), the method comprising:

receiving Vehicle-to-Everything (V2X) information from the UE to obtain positioning assistance data, the V2X information is for an entity in a wireless network that provides V2X services to the UE, the V2X services comprising services for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N), or a combination thereof, wherein the V2X information comprises information from which an approximate location of the UE may be determined;

determining a coarse position of the UE using the V2X information;

generating the positioning assistance data using the coarse position of the UE;

and

transmitting the positioning assistance data to the UE, the positioning assistance data comprising position information, identification, and Positioning Reference Signal (PRS) information for neighbor base stations.

16. The method of claim 15, wherein the V2X information is an identity of the entity in the wireless network that provides V2X services.

17. The method of claim 15, wherein the entity in the wireless network that provides V2X services is a road side unit.

18. The method of claim 15, wherein determining the coarse position of the UE using the V2X information comprises:

- obtaining a static location of the entity in the wireless network that provides V2X services from a V2X application server; and
- estimating the coarse position using the static location of the entity.

19. The method of claim 15, further comprising receiving a serving base station identity from the UE to obtain positioning assistance data, wherein generating the positioning assistance data further uses the serving base station identity.

20. The method of claim 15, wherein the V2X information is received from the UE in a Provide Capability Message.

21. The method of claim 15, wherein the positioning assistance data further comprises identification of an entity in the wireless network that transmits PRS signals and PRS information for PRS signals transmitted by the entity in the wireless network that transmits PRS signals.

22. A location server for location determination for a user equipment (UE), the location server comprising:

- an external interface configured to wirelessly communicate with the UE in a wireless network; and
- at least one processor coupled to the external interface and configured to receive with the external interface Vehicle-to-Everything (V2X) information from the UE to obtain positioning assistance data, the V2X information is for an entity in a wireless network that provides V2X services to the UE, the V2X services comprising services

-44-

for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N), or a combination thereof, wherein the V2X information comprises information from which an approximate location of the UE may be determined, determine a coarse position of the UE using the V2X information, generate the positioning assistance data using the coarse position of the UE, and transmit with the external interface the positioning assistance data to the UE, the positioning assistance data comprising position information, identification, and Positioning Reference Signal (PRS) information for neighbor base stations.

23. The location server of claim 22, wherein the V2X information is an identity of the entity in the wireless network that provides V2X services.

24. The location server of claim 22, wherein the entity in the wireless network that provides V2X services is a road side unit.

25. The location server of claim 22, wherein the at least one processor is configured to determine the coarse position of the UE using the V2X information by being configured to obtain a static location of the entity in the wireless network that provides V2X services from a V2X application server, and estimate the coarse position using the static location of the entity.

26. The location server of claim 22, wherein the at least one processor is further configured to receive a serving base station identity from the UE to obtain positioning assistance data, wherein generating the positioning assistance data further uses the serving base station identity.

27. The location server of claim 22, wherein the V2X information is received from the UE in a Provide Capability Message.

28. The location server of claim 22, wherein the positioning assistance data comprises identification of an entity in the wireless network that transmits PRS signals and PRS information for PRS signals transmitted by the entity in the wireless network that transmits PRS signals.

29. A method of performing location determination of a user equipment (UE), the method comprising:

transmitting to a UE Vehicle-to-Everything (V2X) information from an entity in a wireless network that provides V2X services to the UE, the V2X services comprising services for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N), or a combination thereof, wherein the V2X information comprises information from which an approximate location of the UE may be determined; and

transmitting a Positioning Reference Signal (PRS) from the entity to the UE for position determination for the UE using the PRS signals.

30. The method of claim 29, wherein the V2X information is an identity of the entity in the wireless network that provides V2X services.

31. The method of claim 29, wherein the entity in the wireless network that provides V2X services is a road side unit and the PRS signals are periodically transmitted.

32. The method of claim 29, wherein the entity in the wireless network is a non-stationary entity, the method further comprising determining when the entity will be stationary for a predetermined amount of time, wherein the PRS signals are transmitted while the entity is stationary.

33. The method of claim 29, wherein the entity in the wireless network is a non-stationary entity, wherein the PRS signals are transmitted along with a speed and trajectory of the entity.

34. The method of claim 29, wherein the PRS signals are transmitted to the UE with short range wireless signals.

35. A Vehicle-to-Everything (V2X) entity for providing V2X services to a user equipment (UE), the V2X entity comprising:

-46-

a wireless transceiver configured to wirelessly communicate with the UE in a wireless network to provide V2X services comprising services for at least one of Vehicle-to-Vehicle (V2V), Vehicle-to-Pedestrian (V2P), Vehicle-to-Infrastructure (V2I), Vehicle-to-Network (V2N), or a combination thereof; and

at least one processor coupled to the wireless transceiver and configured to transmit with the wireless transceiver V2X information comprising information from which an approximate location of the UE may be determined, and transmit with the wireless transceiver a Positioning Reference Signal (PRS) to the UE for position determination for the UE using the PRS signals.

36. The V2X entity of claim 35, wherein the V2X information is an identity of the V2X entity and the V2X entity is a road side unit.