CLAIMS

~~What is claimed is:~~

1. ~~——~~ A method of ~~determining a~~periodic location ~~of~~determination on a mobile device, comprising:

setting a location determination timer; transitioning a GNSS receiver to a low-powered state; transitioning a wide area network (WAN) wireless modem, on the mobile device, to a low power ~~state;~~

modem state, wherein the low power modem state comprises powering down the WAN wireless modem; in response to expiration of a ~~first timer and expiration of a second~~paging slot timer, transitioning the WAN wireless modem ~~out of the low power~~to a powered state;

~~checking for a WAN page;~~

~~determining the location of the mobile device;~~

~~storing~~ in response to expiration of the location ~~of the mobile device in memory~~determination timer during the low power modem state, in absence of a pending application related request for position update, and subsequent expiration of the paging slot timer: transitioning the GNSS receiver to a powered state; measuring GNSS signal information; and

~~returning~~ transitioning the GNSS receiver into the low-powered state; and transitioning the WAN wireless modem to the low power modem state.

2. ~~——~~The method of ~~Claim 1, wherein the first timer is a paging slot timer.~~

~~3. The method of Claim 1, wherein the second timer is a location determination timer.~~

~~4. The method of Claim~~claim 1, wherein a period of the ~~first~~paging slot timer is shorter than a period of the ~~second~~location determination timer.

~~5. ——~~3. The method of ~~Claim~~claim 1, further comprising: receiving, at the mobile device, a base station almanac~~.~~; and determining, using the base station almanac, a GNSS-based location of the mobile device.

4. The method of claim 1, further comprising: receiving, at the mobile device, long-term orbital predictions; and determining a GNSS-based location of the mobile device using the long-term orbital predictions.

5. The method of claim 4, wherein the long-term orbital predictions comprise long-term orbital predictions effective for a week.

6. ~~The method of Claim~~claim 1, further comprising~~: receiving, at the mobile device, GNSS assistance.~~

~~7. The method of Claim 6, wherein the GNSS assistance comprises GNSS assistance effective for at least one day.~~

~~8. The method of Claim 1, wherein~~ determining ~~the~~a GNSS-based location of the mobile device ~~comprises~~comprising: acquiring a WAN frequency reference; estimating GNSS time; and determining GNSS pseudoranges.

~~9.~~ 7. The method of ~~Claim~~claim 1, ~~wherein~~further comprising determining ~~the~~a GNSS-based location of the mobile device ~~comprises~~comprising: determining an uncertainty associated with the stored GNSS-based location; comparing the determined uncertainty with a predetermined uncertainty threshold; and, responsive to the determined uncertainty exceeding the predetermined uncertainty threshold, determining an updated location of the mobile device.

~~10.~~ 8. The method of ~~Claim~~claim 1, further comprising:
~~transitioning the WAN wireless modem out of the low power state;~~
receiving a location request for the mobile device~~;~~ while the WAN wireless modem is in a powered state; and
providing ~~the~~a stored GNSS-based location of the mobile device.

~~11.~~ 9. The method of ~~Claim 10~~claim 8, wherein receiving the location request comprises receiving a location request from an application on the mobile device.

~~12.~~ 10. The method of ~~Claim 10~~claim 8, wherein receiving the location request comprises receiving a message from an application server requesting the location of the mobile device.

11. The method of periodic location determination of a mobile device of claim 1, further comprising: in response to expiration of the location determination timer while the WAN wireless modem is in a high power state, determining a GNSS-based location.

~~13.~~ 12. A mobile device for ~~determining a~~ periodic location determination, comprising:
a memory;
a global navigation satellite system (GNSS) receiver; a wide area network (WAN) wireless modem; and
one or more processing units coupled to the memory and the WAN wireless modem, wherein the one or more processing units are configured to:
set a location determination timer; transition the ~~WAN wireless modem~~GNSS receiver to a low ~~power-~~powered state;
~~in response to expiration of a first timer and expiration of a second timer,~~ transition the WAN wireless modem ~~out of the low power state;~~
~~check for a WAN page;~~
~~determine the location of the mobile device;~~
~~store the location of the mobile device in the memory; and~~
~~return~~to a low power modem state, wherein the low power modem state comprises powering down the WAN wireless modem; in response to expiration of a paging slot timer, transitioning the WAN wireless modem to ~~the low power state.~~

~~14. The mobile device of Claim 13, wherein:~~a powered state; in response to expiration of the location determination timer during the low power modem state, in absence of a pending application related request for position update, and subsequent expiration of the paging slot timer: transition the ~~first timer is a paging slot timer.~~

GNSS receiver to a powered state; measure GNSS signal information; and transition the GNSS receiver into the low-powered state; and transition the WAN wireless modem to the low power modem state.

~~15.~~ 13. The mobile device of ~~Claim 13, wherein: the second timer is a location determination timer.~~

~~16. The mobile device of Claim 13~~claim 12, wherein: a period of the ~~first~~paging slot timer is shorter than a period of the ~~second~~location determination timer.

~~17.~~ 14. The mobile device of ~~Claim 13~~claim 12, wherein the one or more processing units are further configured to: receive, at the mobile device, a base station almanac~~.~~; and determine, using the base station almanac, a GNSS-based location of the mobile device.

~~18.~~ 15. The mobile device of ~~Claim 13~~claim 12, wherein the one or more processing units are further configured to: receive, at the mobile device, long term orbital predictions; and determine a GNSS ~~assistance.~~-based location of the mobile device based upon the long-term orbital predictions.

~~19.~~ 16. The mobile device of ~~Claim 18~~claim 15, wherein the ~~GNSS assistance comprises GNSS assistance~~long-term orbital predictions comprise long term orbital predictions effective for ~~at least one day.~~a week.

~~20.~~ 17. The mobile device of ~~Claim 13~~claim 12, wherein the one or more processing units are further configured to determine ~~the~~a GNSS-based location of the mobile device ~~comprise~~, comprising: the one or more processing units configured to: acquire a WAN frequency reference; estimate GNSS time; and determine GNSS pseudoranges.

~~21.~~ 18. The mobile device of ~~Claim 13~~claim 12, wherein the one or more processing units ~~configured to determine the location of the mobile device comprise: one or more processing~~

~~units~~are further configured to determine a GNSS-based location of the mobile device, comprising the one or more processing units configured to: determine an uncertainty associated with the stored GNSS-based location; compare the determined uncertainty with a predetermined uncertainty threshold; and, responsive to the determined uncertainty exceeding the predetermined uncertainty threshold, determine an updated location of the mobile device.

~~22.~~ 19. The mobile device of ~~Claim 13~~claim 12, wherein the one or more processing units are further configured to:

~~transition the WAN wireless modem out of the low power state;~~

receive a location request for the mobile device~~;~~ while the WAN wireless modem is in a powered state; and

provide ~~the~~a stored GNSS-based location of the mobile device.

~~23.~~ 20. The mobile device of ~~Claim 22~~claim 19, wherein the one or more processing units configured to receive the location request comprise: one or more processing units configured to receive a location request from an application on the mobile device.

~~24.~~ 21. The mobile device of ~~Claim 22~~claim 19, wherein the one or more processing units configured to receive the location request comprise: one or more processing units configured to receive a message from an application server requesting the location of the mobile device.

22. The mobile device for periodic location determination of claim 12, wherein the processor is further configured to: in response to expiration of the location determination timer while the WAN wireless modem is in a high power state, determine a GNSS-based location.

~~25.~~ 23. A non-transitory computer-readable medium, having stored thereon computer-readable instructions to cause a processor to:

set a location determination timer; transition a GNSS receiver to a low-powered state; transition a wide area network (WAN) wireless modem, on a mobile device, to a low power ~~state;~~ modem power state, wherein the low power modem state comprises powering down a WAN wireless modem; in response to expiration of a ~~first timer and~~ paging slot timer, transitioning the

WAN wireless modem to a powered state; in response to expiration of ~~a second timer, transition the WAN wireless modem out of the low power state;~~

~~check for a WAN page;~~

~~determine a location of the mobile device;~~

~~store~~ the location determination timer during the low power modem state, in absence of a pending application related request for position update, and subsequent expiration of the ~~mobile device in memory~~paging slot timer: transition the GNSS receiver to a powered state; measure GNSS signal information; and

~~return~~ transition the GNSS receiver into the low-powered state; and transition the WAN wireless modem to the low power modem state.

~~26.~~ 24. The non-transitory computer-readable medium of ~~Claim 25, wherein the~~ claim 23, wherein a period of the ~~first~~paging slot timer is shorter than a ~~paging slot~~period of the location determination timer.

~~27.~~ 25. A mobile device for ~~determining a~~periodic location determination, comprising:

means for setting a location determination timer; means for transitioning a GNSS receiver to a low-powered state; means for transitioning a wide area network (WAN) wireless modem, on the mobile device, to a low power modem state~~;~~

, wherein the low power modem state comprises powering down the WAN wireless modem;

means for, in response to expiration of a paging slot timer, transitioning the WAN wireless modem ~~out of the low power state in response to expiration of a first timer and expiration of a second timer;~~

to a powered state; means for ~~checking~~, in response to expiration of the location determination timer during the low power modem state, in absence of a pending application related request for ~~a WAN page;~~

position update, and subsequent expiration of the paging slot timer: means for ~~determining the location of the mobile device;~~

transitioning the GNSS receiver to a powered state; means for ~~storing the location of the mobile device in memory~~measuring GNSS signal information; and

means for ~~returning~~transitioning the GNSS receiver into the low-powered state; and means for transitioning the WAN wireless modem to the low power modem state.

~~28.~~ 26. The mobile device of ~~Claim 27, wherein the wherein the first timer is a paging slot timer.~~

~~29. The mobile device of Claim 27, wherein the second timer is a location determination timer.~~

~~30. The mobile device of Claim 27~~claim 25, wherein a period of the ~~first~~paging slot timer is shorter than a period of the ~~second~~location determination timer.