

In a first aspect, the present disclosure provides wireless communication method, comprising: determining, by a wireless communication device, Small Data Transmission (SDT) information; and performing, by the wireless communication device with a network, SDT procedure using the SDT information.

In a second aspect, the present disclosure provides a wireless communication device, comprising: at least one processor configured to: determine Small Data Transmission (SDT) information; and perform, with a network, SDT procedure using the SDT information.

In some arrangements, User Equipment (UE) performs a method including determining Small Data Transmission (SDT) information and performing, with a network, SDT procedure using the SDT information.

In other arrangements, a BS performs a method including determining SDT information and performing, with a UE, SDT procedure using the SDT information.

In other ~~embodiments~~examples, a wireless communications apparatus comprising a processor and a memory, wherein the processor is configured to read code from the memory and implement a method including determining SDT information and performing, with a network, SDT procedure using the SDT information.

In other ~~embodiments~~examples, a computer program product comprising a computer-readable program medium code stored thereupon, the code, when executed by a processor, causing the processor to implement a method including determining SDT information and performing, with a network, SDT procedure using the SDT information.

The above and other aspects and their implementations are described in greater detail in the drawings, the descriptions, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Various example embodiments of the present solution are described in detail below with reference to the following figures or drawings. The drawings are provided for purposes of illustration only and merely depict example embodiments of the present solution to facilitate the reader's understanding of the present solution. Therefore, the drawings should not be considered limiting of the breadth, scope, or applicability of the present solution. It should be noted that for clarity and ease of illustration, these drawings are not necessarily drawn to scale.

CLAIMS

1. A wireless communication method, comprising:

determining, by a wireless communication device, Small Data Transmission (SDT) information; and

performing, by the wireless communication device with a network, SDT procedure using the SDT information.

~~2. The method of claim 1, wherein~~

~~the SDT information comprises SDT Configured Grant (CG) configuration;~~

~~determining the SDT information comprises one of:~~

~~determining validity of the SDT CG configuration using a timer, wherein the SDT CG configuration is released in response to determining that the timer has expired; or~~

~~determining validity of the SDT CG configuration using a counter threshold, wherein the SDT CG configuration is released in response to determining that a number of skipped CG occasions reaches the counter.~~

32. The wireless communication method of claim 1, wherein

the SDT information comprises SDT Configured Grant (CG) configuration; and

~~determining the SDT information~~the wireless communication method comprises:

receiving, from the network, Time Alignment (TA) information;

in response to receiving the TA information, initiating, by the wireless communication device, a timer; and

in response to determining that the timer has expired, releasing ~~or suspending~~, by the wireless communication device, ~~the SDT CG configuration~~ resources.

43. The wireless communication method of claim 1, wherein

the SDT information comprises SDT Configured Grant (CG) configuration; and

~~determining the SDT information during performing the SDT procedure~~the wireless communication method comprises:

receiving, from the network, Time Alignment (TA) information; and

in response to receiving the TA information and determining that the TA information is maintained:

applying the TA information; and
starting or restarting a timer.

~~5. The method of claim 4, wherein during performing the SDT procedure, the method further comprises in response to determining that the timer has expired, at least one of:~~

~~—— releasing the SDT CG configuration, and setting the wireless communication device to a Radio Resource Control (RRC) Idle state;~~

~~—— releasing the SDT CG configuration, and initiating RRC re-establishment procedure or RRC resume procedure; or~~

~~—— suspending the SDT CG configuration, and initiating a Random Access (RA) procedure in which uplink synchronization is obtained in a RRC Inactive state.~~

~~6. The method of claim 4, further comprising:~~

~~—— in response to determining that the SDT procedure ends and that the wireless communication device enters into a Radio Resource Control (RRC) Inactive state, maintaining, by the wireless communication device, the timer; and~~

~~—— in response to determining that the timer has expired, releasing or suspending, by the wireless communication device, the SDT CG configuration.~~

74. The wireless communication method of claim 1, wherein

the SDT information comprises SDT Random Access Channel (RACH) configuration; and

~~determining the SDT information~~the wireless communication method comprises ~~one of:~~

receiving, from the network, Time Alignment (TA) information with the SDT RACH configuration; ~~or~~

~~—— setting the TA parameters to default TA information.~~

85. The wireless communication method of claim 1, wherein the SDT information comprises SDT Random Access Channel (RACH) configuration, and ~~determining the SDT information~~the wireless communication method comprises:

in initiating the SDT procedure, applying first Time Alignment (TA) information and initiating a timer;

during performing the SDT procedure, in response to determining that the timer ~~has expired~~is not running:

~~setting the wireless communication device to a Radio Resource Control (RRC)-Idle state;~~

~~initiating RRC re-establishment procedure or RRC resume procedure; or~~

initiating a Random Access (RA) procedure in which uplink synchronization is obtained in a RRC-Inactive state; and

in response to determining that the SDT procedure ends and that the wireless communication device enters into a Radio Resource Control (RRC)-Inactive state, terminating the timer;

wherein the timer is reinitiated in response to receiving any TA information.

96. The wireless communication method of claim 1, wherein

the SDT information comprises SDT Configured Grant (CG) configuration and SDT Random Access Channel (RACH) configuration;

using the SDT RACH configuration for the SDT procedure in response to determining that using the SDT CG configuration has failed.

107. The wireless communication method of claim 96, wherein a first timer corresponds to the SDT CG configuration, and a second timer corresponds to the SDT RACH configuration; and ~~determining the SDT information~~the wireless communication method further comprises:

in response to determining that the first timer ~~or the second timer~~ has expired, release ~~or suspend the SDT CG configuration resources~~;

in response to initiating the SDT procedure using the SDT RACH configuration and receiving from the network, Time Alignment (TA) information:

apply the TA information;

stop the first timer; and

~~one of:~~

starting the second timer; ~~or~~

~~—— in response to determining that the first timer is present, starting the first timer; and in response to determining that the first timer is absent, starting the second timer;~~
~~or~~

~~—— in response to determining that the first timer is present, starting a longer one of the first timer or the second timer; and in response to determining that the first timer is absent, starting the second timer; or~~

~~—— in response to determining that the first timer is present, starting a shorter one of the first timer or the second timer; and in response to determining that the first timer is absent, starting the second timer;~~

in response to determining that another cell of the network has been selected:

stopping the first timer or the second timer; and

releasing or suspending the SDT CG configurations; and

in response to determining that the SDT procedure has ended and the wireless communication device is set to a Radio Resource Control (RRC)-Inactive state:

maintaining the first timer or the second timer upon determining that CG resources are valid; and

stopping the first timer or the second timer upon determining that the CG resources are invalid.

~~11. The method of claim 10, wherein in response to initiating the SDT procedure using the SDT RACH configuration and receiving from the network, the TA information, determining the SDT information further comprises resuming the SDT CG configuration and the first timer, wherein the SDT CG configuration is suspended.~~

~~12. The method of claim 1, wherein~~

~~—— the SDT information comprises a plurality of Configured Grant (CG) resources;~~

~~—— each of the plurality of CG resources is associated with one of a plurality of Synchronization Signal Blocks (SSBs) according to:~~

~~—— a position of each of the plurality of CG resources on a list; or~~

~~—— an SSB index configured for each of the plurality of CG resources.~~

13. The method of claim 1, wherein

- ~~the SDT information comprises a plurality of Configured Grant (CG) occasions;~~
- ~~each of the plurality of CG occasions is associated with one of a plurality of Synchronization Signal Blocks (SSBs) according to a position of each of the plurality of CG occasions in time and one of:~~
- ~~a position of each of the plurality of SSBs on a list of SSBs actually transmitted by the network; or~~
- ~~a position of each of the plurality of SSBs on a list of SSB indexes.~~

14. The method of claim 1, wherein

- ~~the SDT information comprises a counter for beam failure instances and a timer associated with the counter; and~~
- ~~configuring the SDT information comprises determining, by the wireless communication device during performing the SDT procedure, that beam failure has occurred in response to determining that the counter for the beam failure instances exceeds a threshold before the timer expires.~~

15. The method of claim 1, wherein

- ~~the SDT information comprises SDT Configured Grant (CG) configuration; and~~
- ~~determining the SDT information comprises in response to determining beam failure, at least one of:~~
- ~~releasing the SDT CG configuration and setting the wireless communication device to a Radio Resource Control (RRC) Idle state;~~
- ~~releasing the SDT CG configuration, and initiating RRC re-establishment procedure;~~
- ~~releasing the SDT CG configuration, and initiating RRC resume procedure; or~~
- ~~suspending the SDT CG configuration, and initiating a Random Access (RA) procedure in which beam is recover in a RRC Inactive state.~~

16. The method of claim 1, wherein

~~the SDT information comprises an association between SDT Random Access Channel (RACH) resources and Synchronization Signal Blocks (SSBs);~~

~~determining the SDT information comprises selecting, by the wireless communication device, one of the SSBs in a Random Access (RA) procedure during SDT procedure using the association.~~

17. The method of claim 1, wherein

~~the SDT information comprises out-of-synchronization indications;~~

~~determining the SDT information comprises:~~

~~starting a timer in response to receiving a number of the out-of-synchronization indications; and~~

~~in response to determining that a number of the in-synchronization indications received is lower than a threshold when the timer expires, determining that Radio Link Failure (RLF) has occurred.~~

18. The method of claim 17, wherein determining the SDT information further comprises initiating an SDT timer in response to initiating an SDT request, wherein the out-of-synchronization indications are received outside of any time interval in which the SDT timer is running.

198. The wireless communication method of claim 1, ~~determining the SDT information comprises~~comprising determining, during performing the SDT procedure, that Radio Link Failure (RLF) has occurred in response to determining ~~one or more~~at least one of:

~~an expiration of a radio problem timer; or~~

a Random Access (RA) procedure failure, or

a Radio Link Control (RLC) failure.

209. The wireless communication method of claim 198, ~~wherein determining the SDT information comprises~~comprising:

in response to determining that the RLF has occurred during performing the SDT procedure,
~~at least one of:~~

~~in response to determining that RLF has occurred is outside of any time interval in which the SDT timer is running, releasing SDT Configured Grant (CG) configuration, and setting the wireless communication device to a Radio Resource Control (RRC) Idle state;~~

~~in response to determining that RLF has occurred is outside of any time interval in which the SDT timer is running, releasing the SDT CG configuration, and initiating RRC re-establishment procedure;~~

releasing the SDT CG configuration, and setting the wireless communication device to the RRC-Idle state;~~or~~

~~releasing the SDT CG configuration, and initiating RRC re-establishment procedure.~~

21. The method of claim 1, wherein determining the SDT information further comprises

~~—initiating an SDT timer in response to initiating an SDT request; and~~

~~in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

~~in response to determining that cell reselection has occurred while the SDT timer is running, setting the wireless communication device to a Radio Resource Control (RRC) Idle state;; and~~

~~in response to determining that the cell reselection has occurred outside of any time interval in which the SDT timer is running, releasing SDT Configured Grant (CG) configuration, and initiating RRC re-establishment procedure.~~

22. The method of claim 1, wherein determining the SDT information further comprises

~~—initiating an SDT timer in response to initiating an SDT request; and~~

~~in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

~~in response to determining that cell reselection has occurred while the SDT timer is running, setting the wireless communication device to a Radio Resource Control (RRC) Idle state; and~~

~~in response to determining that the cell reselection has occurred outside of any time interval in which the SDT timer is running, releasing SDT Configured Grant (CG) configuration, and initiating a new SDT request to a target cell of the network.~~

23. The method of claim 1, wherein determining the SDT information further comprises:

~~— initiating an SDT timer in response to initiating an SDT request; and~~

~~in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

~~in response to determining that cell reselection has occurred while the SDT timer is running, releasing SDT Configured Grant (CG) configuration, and setting the wireless communication device to a Radio Resource Control (RRC) Idle state; and~~

~~in response to determining that the cell reselection has occurred outside of any time interval in which the SDT timer is running, suspending the SDT CG configuration and initiating a new SDT request to a target cell of the network.~~

2410. The wireless communication method of claim 1, ~~wherein determining the SDT information further comprises comprising~~ in response to determining that the cell-reselection has occurred during performing the SDT procedure:

releasing SDT Configured Grant (CG) configuration; and

setting the wireless communication device to a Radio Resource Control (RRC)-Idle state.

~~25. The method of claim 1, wherein determining the SDT information further comprises in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

~~— releasing SDT Configured Grant (CG) configuration; and~~

~~— initiating Radio Resource Control (RRC) re-establishment procedure.~~

~~26. The method of claim 1, wherein determining the SDT information further comprises in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

~~— releasing SDT Configured Grant (CG) configuration; and~~

~~initiating a new SDT request to a target cell of the network.~~

~~27. The method of claim 1, wherein determining the SDT information further comprises in response to determining that the cell reselection has occurred during performing the SDT procedure:~~

- ~~——suspending the SDT Configured Grant (CG) configuration; and~~
- ~~——initiating a new SDT request to a target cell of the network.~~

~~28. A wireless communication apparatus comprising at least one processor and a memory, wherein the at least one processor is configured to read code from the memory and implement the method recited in claim 1.~~

~~29. A computer program product comprising a computer readable program medium code stored thereupon, the code, when executed by at least one processor, causing the at least one processor to implement the method recited in claim 1.~~

~~30. A wireless communication method, comprising:~~

- ~~——determining, by a network, Small Data Transmission (SDT) information; and~~
- ~~——performing, by the network with a wireless communication device, SDT procedure using the Small Data Transmission (SDT).~~

~~31. A wireless communication apparatus comprising at least one processor and a memory, wherein the at least one processor is configured to read code from the memory and implement the method recited in claim 30.~~

~~32. A computer program product comprising a computer readable program medium code stored thereupon, the code, when executed by at least one processor, causing the at least one processor to implement the method recited in claim 30.~~

11. A wireless communication device, comprising:

at least one processor configured to:

- determine Small Data Transmission (SDT) information; and

perform, with a network, SDT procedure using the SDT information.

12. The wireless communication device of claim 11, wherein
the SDT information comprises SDT Configured Grant (CG) configuration; and
the at least one processor is configured to:
receive, from the network, Time Alignment (TA) information;
in response to receiving the TA information, initiate, by the wireless communication
device, a timer; and
in response to determining that the timer has expired, release SDT CG resources.

13. The wireless communication device of claim 11, wherein
the SDT information comprises SDT Configured Grant (CG) configuration; and
the at least one processor is configured to:
receive, from the network, Time Alignment (TA) information; and
in response to receiving the TA information and determining that the TA
information is maintained:
apply the TA information; and
start or restart a timer.

14. The wireless communication device of claim 11, wherein
the SDT information comprises SDT Random Access Channel (RACH) configuration; and
the at least one processor is configured to:
receive, from the network, Time Alignment (TA) information with the SDT RACH
configuration.

15. The wireless communication device of claim 11, wherein the SDT information comprises
SDT Random Access Channel (RACH) configuration, and the at least one processor is configured
to:
in initiating the SDT procedure, apply first Time Alignment (TA) information and initiating
a timer;
during performing the SDT procedure, in response to determining that the timer is not

running:

initiate a Random Access (RA) procedure in which uplink synchronization is obtained in a RRC-Inactive state; and

in response to determining that the SDT procedure ends and that the wireless communication device enters into a Radio Resource Control (RRC)-Inactive state, terminate the timer,

wherein the timer is reinitiated in response to receiving any TA information.